



Measurement
Canada

An Agency of
Industry Canada

Mesures
Canada

Un organisme
d'Industrie Canada

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 1 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

GS-ENG-09-01.1

Procedures for the Calibration, Certification and Use of Gas Measuring Apparatus

Working Level Bell Provers Pursuant to the Requirements of GS-ENG-09-01

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

Canada

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 2 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

TABLE OF CONTENTS

1.0 Scope.....	6
2.0 References	6
3.0 Definitions	6
4.0 Safety.....	8
4.1 Scope.....	8
4.2 Requirements	8
4.3 Hazards	9
4.4 Safe Operating Procedures	9
5.0 Procedures for Assessing Administrative Requirements.....	9
5.1 Scope.....	9
5.2 The Designating Authority: Refer to section 4.5.1 of the Requirements	9
5.3 Owner	100
5.4 Statement of intended use	122
6.0 Procedures for Assessing Metrological Requirements.....	12
6.1 General	122
6.1.1 Scope	122
6.1.2 Worksheet Package	12
6.1.3 Calibration Reference Standards.....	133
6.2 Procedures for Assessing Environmental Requirements.....	133
6.2.1 Temperature.....	133
6.2.1.1 Scope	133
6.2.1.2 General	133
6.2.1.3 Apparatus	133
6.2.1.5 Remarks	133
6.3 Prover Oil	144
6.3.1 Scope	144
6.3.2 General	144
6.3.3 Apparatus.....	144
6.3.4 Procedure.....	144
6.3.5 Remarks	144
6.4 Mechanical Requirements	155
6.4.1 Bell Component Installation.....	15
6.4.1.1 Scope	155
6.4.1.2 General	155
6.4.1.3 Apparatus	15
6.4.1.4 Procedure	155
6.4.1.5 Remarks	155
6.4.2 Cycloid Counterweight Arm Position.....	155
6.4.2.1 Scope	155
6.4.2.2 General	166
6.4.2.3 Apparatus	166

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 3 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.2.4 Procedure	166
6.4.2.5 Remarks	166
6.4.3 Bell Roller Guide Clearances	166
6.4.3.1 Scope	166
6.4.3.2 General	166
6.4.3.3 Apparatus	166
6.4.3.4 Procedure	166
6.4.3.5 Remarks	177
6.4.4 Prover Oil Level	177
6.4.4.1 Scope	177
6.4.4.2 General	177
6.4.4.3 Apparatus	177
6.4.4.4 Procedure	177
6.4.4.5 Remarks	188
6.4.5 Bell Balance	188
6.4.5.1 Scope	188
6.4.5.2 General	188
6.4.5.3 Apparatus	188
6.4.5.4 Procedure	188
6.4.5.5 Remarks	188
6.4.6 Bell Reference Pressure	19
6.4.6.1 Scope	19
6.4.6.2 General	19
6.4.6.3 Apparatus	19
6.4.6.4 Procedure	19
6.4.6.5 Remarks	19
6.4.7 Bell Static Pressure	19
6.4.7.1 Scope	19
6.4.7.2 General	19
6.4.7.3 Apparatus	20
6.4.7.4 Procedure	20
6.4.7.5 Remarks	20
6.4.8 Bell Dynamic Pressure	20
6.4.8.1 Scope	20
6.4.8.2 General	20
6.4.8.3 Apparatus	20
6.4.8.4 Procedure	20
6.4.8.5 Remarks	21
6.4.9 Leak Tests	21
6.4.9.1 System Leak Tests	21
6.4.9.1.1 Scope	21
6.4.9.1.2 General	21
6.4.9.1.3 Apparatus	21

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 4 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.9.1.4 Procedure	21
6.4.9.1.5 Remarks	21
6.4.9.2 Operational Leak Tests	222
6.4.9.2.1 Scope	222
6.4.9.2.2 General	222
6.4.9.2.3 Apparatus	222
6.4.9.2.4 Procedure	222
6.4.9.2.5 Remarks	222
6.4.10 Flow Rate Tests	222
6.4.10.1 Scope	222
6.4.10.2 General	233
6.4.10.3 Apparatus	233
6.4.10.4 Procedure	233
6.4.10.5 Remarks	244
6.4.11 Register Verification	255
6.4.11.1 Scope	255
6.4.11.2 General	255
6.4.11.3 Apparatus	255
6.4.11.4 Procedure	255
6.4.11.5 Remarks	255
6.5 Meter Classifications and Transfer Meters	255
6.5.1 Meter Classes and Classifications	255
6.5.1.1 Scope	255
6.5.1.2 General	266
6.5.1.3 Apparatus	266
6.5.1.4 Procedure	266
6.5.1.5 Remarks	266
6.6 Volume Correlations	266
6.6.1 Correlations	266
6.6.1.1 Scope	266
6.6.1.2 General	266
6.6.1.3 Apparatus	266
6.6.1.4 Procedure	277
6.6.1.5 Remarks	277
6.6.2 Maximum Error Detection	277
6.6.2.1 Scope	277
6.6.2.2 General	277
6.6.2.3 Apparatus	277
6.6.2.4 Procedure	288
6.6.2.5 Remarks	288
6.6.3 Additional Modes of Operation	288
6.6.3.1 Temperature Differential Mode Correlations	288
6.6.3.1.1 Scope	288

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 5 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.6.3.1.2 General	288
6.6.3.1.3 Apparatus	288
6.6.3.1.4 Procedure	29
6.6.3.1.5 Remarks	29
6.6.3.2 Temperature Converting Mode	300
6.6.3.2.1 Scope	300
6.6.3.2.2 General	300
6.6.3.2.3 Apparatus	300
6.6.3.2.4 Procedure	300
6.6.3.2.5 Remarks	311
7.0 Procedures for Assessing Technical Requirements	322
7.1 Use Requirements	322
7.1.1 Scope	322
7.1.2 General	322
7.1.3 Apparatus	322
7.1.4 Procedure	322
7.1.5 Remarks	322

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 6 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

1.0 Scope

This document is intended to provide support for certification and recertification of gas measuring apparatus - working level bell provers to the requirements of GS-ENG-09-01 (interim requirements). Detailed descriptions and explanations, as well as test procedures related to specific requirements are provided. Worksheets associated with test procedures and requirements are appended to this document.

2.0 References

- 1) Electricity and Gas Inspection Act. 1980-81-82-83, c.87, s.1.
- 2) Electricity and Gas Inspection Regulations. SOR/86-131.
- 3) Canada Labour Code Part II (Human Resources Development Canada, January 2008.
- 4) Statistical Sampling Plans for the Verification and Reverification of Electricity and Gas Meters (LMB-EG-04, section 3.0 and 4.0, Consumer and Corporate Affairs Canada, Legal Metrology Branch 1986).
- 5) Requirements for the Calibration, Certification and Use of Gas Measuring Apparatus - Working Level Bell Provers GS-ENG-09-01, Measurement Canada.
- 6) Worksheets for the Calibration, Certification and Use of Working Level Gas Measuring Apparatus - Working Level Bell Provers GS-ENG-01.1 Annex, Measurement Canada, [date TBD].

3.0 Definitions

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.

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 Designating Authority proving system certificate.

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

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 7 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

High load rate The term used to describe the flow rate corresponding to 145 c 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.

Low load rate The term used to describe the flow rate corresponding to 45 c 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 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 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 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.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 8 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

Transfer meter A non-converting meter supplied by the owner for the purposes of volume correlations on the gas measuring.

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.

X-bar The arithmetic mean of the end results considered.

4.0 Safety

4.1 Scope

The purpose of this section is to describe the safety requirements and hazards when performing certification testing and use of Gas Measuring Apparatus - working level bell provers as related to Requirements GS-ENG-09-01.

4.2 Requirements

The Designating Authority and the Technical Evaluator shall have sufficient knowledge and experience to test and operate gas measuring apparatus pursuant to the specification. Inspectors will be deemed qualified if they have sufficient knowledge, training and experience with various models and types of gas measuring apparatus - bell provers and the metrological theories to perform that duty safely and properly.

A qualified Designating Authority or the Technical Evaluator is required to be aware of the following safety documents:

- 4.2.1 Canada Labour Code Part II
- 4.2.2 Regulations respecting Occupational Safety and Health made under Part II of the Canada Labour Code.
- 4.2.3 Safety and Health Committees and representatives= regulations and procedures.
- 4.2.4 Treasury Board Manuals that outline the National Joint Council Agreements as related to Health and Safety. (Personnel Management Manual Vol. 12).
- 4.2.5 Departmental Policies.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 9 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

4.2.6 Safety Policies at the site of the gas measuring apparatus inspection, which includes Provincial and local Occupational Safety and Health Committee policies.

4.2.7 Workplace Hazardous Material Information System (WHIMS).

4.2.8 CSA, UL or Special Inspection Certification of electrical equipment.

4.3 Hazards

4.3.1 The Designating Authority inspector must be aware of the potential hazards associated with live electrical circuits, the WHIMS data information pertaining to the prover oil and the restrictive work area to which bell provers are often located.

4.4 Safe Operating Procedures

4.4.1 The inspector shall wear Omega rated safety boots and safety glasses while performing inspections of the gas measuring apparatus - bell provers.

4.4.2 The inspector shall wear an approved hard hat as required by the working environment.

4.4.3 The inspector must be aware of the prover oil flash point, while performing any electrical work.

4.4.4 The inspector must obey all on-site safety requirements of the owner of the device(s).

5.0 Procedures for Assessing Administrative Requirements

5.1 Scope

Section 5.0 outlines the roles and responsibilities related to the administration and the application of the Requirements GS-ENG-09-01.

5.2 The Designating Authority: Refer to section 4.5.1 of the Requirements

The Designating Authority shall be responsible for:

5.2.1 Making available the Requirement GS-ENG-09-01, these procedures and worksheets, upon request.

5.2.2 Making available the certification request form (IC3296, reproduced in the Annex to this procedure) and accepting the completed request.

5.2.3 Assigning the gas measuring apparatus certification testing to be carried out by the Technical Evaluator.

5.2.4 Ensuring that all required pre-testing has been performed by the owner of the gas measuring apparatus. This should be established by examining all the required worksheets and test results.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 10 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

- 5.2.5 Being assured by the owner that the gas measuring apparatus will meet the requirement of the Specifications before commencing certification testing.
Distributing a copy of the completed package (owner=s documents, completed worksheets, all printouts of data from gas measuring apparatus and a summary report) to the applicable Designating Authority and to the owner of the gas measuring apparatus. One copy will be retained by the Technical Evaluator.
- 5.2.6 Reviewing, by the Designating Authority, documentation, and any recommendations for certification or recertification of the gas measuring apparatus by the inspector. If the Designating Authority requires clarification of the test data or with the recommendation, consultation with the local inspector, Program Development or Engineering/Laboratory Divisions of Measurement Canada will be required.
- 5.2.7 Providing all documentation and test results to satisfy the conditions set out in the requirement GS-ENG-09-01, a certificate of calibration will be generated and issued by the respective Regional Director, Measurement Canada. One copy of the certificate will be forwarded to the owner of the gas measuring apparatus, and the copy to the local Measurement Canada office that performed the certification testing.
- 5.2.8 Conducting all certification tests and procedures pursuant to the requirement GS-ENG-09-01 and this document by a local Measurement Canada Inspector designated under the *Electricity and Gas Inspection Act*.
- 5.2.9 Ensuring that all measuring apparatus and test equipment used pursuant to specification requirement GS-ENG-09-01 and this document for the purposes of determining error, possess a valid certificate of calibration issued by a recognized calibration facility. The local inspector performing the certification testing is responsible for ensuring that all measuring apparatus and test equipment possess valid certificates of calibration, if required.
- 5.3 Owner:** Refer to section 4.5.2 of the Requirements
- The owner shall be responsible for:
- 5.3.1 Obtaining and forwarding a completed device certification request (IC3296, reproduced in the Annex/appendix of this procedure) to the local Measurement Canada office.
- 5.3.2 Ensuring that the gas measuring apparatus is compliant with all the requirements as stated in section 4.5.2 of the Requirements GS-ENG-09-01. All required information must be provided to Measurement Canada.
- 5.3.3 Ensuring that all setups, pre-testing, calibration, and troubleshooting is performed prior to the request for certification of a gas measuring apparatus.
- 5.3.4 Providing to Measurement Canada, completed worksheets providing objective evidence that all Requirements section are met, prior to any certification tests performed by Measurement Canada inspectors.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 11 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

- 5.3.5 Ensuring that the scope of certification of any gas measuring apparatus is limited to those meter types identified on the statement of intended use. It is the responsibility of the owner of the gas measuring apparatus to inform the local office of Measurement Canada if the apparatus will be required to perform verification tests beyond the scope of its certification. Measurement Canada will determine what, if any, additional certification tests are required to be performed prior to the scope of the gas measuring apparatus certification may be expanded. If required, Measurement Canada will perform the additional certification tests, prior to the issuance of a revised certificate in accordance with the Requirement GS-ENG-09-01.
- 5.3.6 Ensuring that all certificates and certification worksheets are retained for the period of certification of the gas measuring apparatus. Requirement GS-ENG-09-01 must be readily available whenever the apparatus is being used for verification testing during the course of its certification period.
- 5.3.7 Maintaining the certified apparatus in good repair and operating order, both electrically and mechanically.
- 5.3.8 Maintaining a log book for the gas measuring apparatus. Details of all certification, calibration, correlation, maintenance and repairs must be documented in the log book. The log book must be made available to Measurement Canada upon request.
- 5.3.9 Informing the local office of Measurement Canada, in writing, immediately after any repairs or adjustment are performed. This will include all minor repairs that could affect the settings that were established while performing the certification tests. Measurement Canada will determine if any additional certification tests are required as a result of the repairs or adjustments. This decision may be made by the local office of Measurement Canada, in consultation with the Designating Authority and/or Engineering/Laboratory Division, if required.
- 5.3.10 Informing the local office of Measurement Canada, in writing, prior to any modification or relocation of the gas measuring apparatus. This will include relocation to a different area on the premises or to another premise. This includes any major repairs or replacement of parts. Measurement Canada will evaluate the extent that the modification, the potential affect(s) upon the certification of the gas measuring apparatus and the extent to which additional certification tests must be performed. This decision is made by the local office of Measurement Canada, in consultation with the Designating Authority and/or Engineering/Laboratory Division. Measurement Canada may limit the scope of certification of a certified gas measuring apparatus before allowing the owner to proceed with the stated modification.
- 5.3.11 Providing transfer meters of sufficient stability and repeatability to perform all tests required by this Specification. Any testing required to guarantee this requirement being met is to be performed by the owner.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 12 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

- 5.3.12 A complete set of operating instructions for the apparatus to be certified must be made available to the Technical Evaluator prior to certification testing. These instructions must be of sufficient detail to allow the inspector to be familiar with the operation of the apparatus.
- 5.3.13 Providing a suitable leak test apparatus for use to determine the leak test detection capabilities of the gas measuring apparatus. The owner shall provide the necessary calculations referenced to the local volumetric standard or other certified standards to prove the owner supplied leak test apparatus meets the specified requirements.

5.4 Statement of intended use: Refer to section 4.6 of the Requirements

A statement of intended use must accompany the certification request form listed in section 4.6.2 of the requirements. The documentation requirements are listed in section 4.6. of GS-ENG-09-01.

6.0 Procedures for Assessing Metrological Requirements

6.1 General

6.1.1 Scope

To ensure that all metrological requirements described in requirement GS-ENG-09-01 are in compliance prior to the commencement of the certification testing.

6.1.2 Worksheet Package

The first step in the certification testing process is to produce a complete set of worksheets for each gas measuring apparatus to be tested. The worksheet set is reproduced in the annex of these procedures. Following are specific instructions for completing the forms:

- 6.1.2.1 Each worksheet is identified with two headers. The top header identifies the document, the revision date and the numbered header for each sheet. This header aids in locating and using the correct sheet for the testing being completed.
- 6.1.2.2 The second header is used to customize the worksheet package to the gas measuring apparatus being tested. The second header must be completed for each sheet as testing proceeds. This header allows for the use of multiple pages of the same worksheet as will be required to document the same test for different meter types. For example, section 5.3.8, the worksheet for flow testing contains sufficient area for one (1) meter type. If twelve (12) different meter types are to be tested, eleven (11) additional copies of that worksheet must be produced for inclusion in the package. The completed original and additional sheets are placed in the package and numbered, showing the worksheet page and total number of pages in that section. Using the example above, the pages would show 1 of 12, 2 of 12, and 3 of 12 etc.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 13 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.1.3 Calibration Reference Standards

All reference Standards used in the certification of gas measuring apparatus must be certified by an approved laboratory. Included in the worksheet package are sections that require this information.

6.2 Procedures for Assessing Environmental Requirements

6.2.1 Temperature

6.2.1.1 Scope

The purpose of this procedure is to ensure that the ambient temperature surrounding the gas measuring apparatus is within the requirement set out in the specification. This procedure relates to section 6.1.5 of the Requirements.

6.2.1.2 General

This procedure involves measuring the ambient temperatures surrounding the gas measuring apparatus.

6.2.1.3 Apparatus

Certified thermometer

6.2.1.4 Procedure

- a) The thermometer and/or sensor shall be placed at the same height from the floor as a meter under normal test conditions and within three (3) linear feet of the gas measuring apparatus. Care should be taken to insulate the thermometer probe against effects of sudden temperature shifts.
- b) Read and record the ambient and meter proving air temperature once every thirty (30) minutes for a period of four (4) hours (Worksheet section 4.1.1).

6.2.1.5 Remarks

- a) The procedure may be repeated during the course of the certification testing if it appears that the temperature is fluctuating to the extent that it may be outside the specified limits.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 14 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

b) If more than one (1) gas measuring apparatus is requested for certification testing, within the same proving room; the temperature testing procedure must be completed for each gas measuring apparatus for which certification testing has been requested.

c) The temperature test must be completed only once, regardless of the number of meter proving methods requested by the owner.

6.3 Prover Oil

6.3.1 Scope

The purpose of this procedure is to ensure that the prover oil meets the requirements. This procedure relates to section 6.1.4 of the Requirement GS-ENG-09-01.

6.3.2 General

This procedure requires that a copy of the test results of the prover oil be verified by the inspector.

6.3.3 Apparatus

<i>Property</i>	<i>ASTM Test Method Specifications</i>
Viscosity	D 445
Relative Density	D 1298

6.3.4 Procedure

The inspector verifies, and attaches a copy of, either the laboratory report showing the test results for viscosity and relative density or the owner's report of test results. A laboratory supplying the test results shall be approved to conduct this type of testing and shall have used the ASTM methods listed in the Requirements. (Worksheet section 5.2).

6.3.5 Remarks

A laboratory test is not required on the prover oil if the oil is new and the supplier has supplied a report on the product showing the required information. The owner shall retain all records with regards to the testing and certification of prover oil. The records shall be retained for a period of 6 years.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 15 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4 Mechanical Requirements

6.4.1 Bell Component Installation

6.4.1.1 Scope

The purpose of this procedure is to ensure that all components operate in the same plane of motion throughout the bell=s intended range of operation. This procedure relates to section 5.3.1 of the requirements.

6.4.1.2 General

This procedure involves checking the installation of the components of the gas measuring apparatus.

6.4.1.3 Apparatus

- a) Level
- b) Plumb bob

6.4.1.4 Procedure

- a) Using the level, check all components listed in the Requirements section 5.3.1.
- b) Record the results of each component. (Worksheet section 5.3.1).

6.4.1.5 Remarks

None

6.4.2 Cycloid Counterweight Arm Position

6.4.2.1 Scope

This procedure is not part of the Requirements but is shown in these procedures as an aid to the owner in obtaining the correct set-up of a bell proving system.

The purpose of this procedure is to ensure that the cycloid counterweight arm is positioned to maintain a constant pressure of 2.0 inches water column in the bell throughout the travel of the bell.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 16 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.2.2 General

This procedure involves ensuring that the cycloid counterweight arm is correctly attached to the main shaft.

6.4.2.3 Apparatus

- a) Wrenches and/or allen wrenches

6.4.2.4 Procedure

- a) With the bell positioned at its highest point of travel (ie start) adjust the cycloid arm such that the weight is the greatest distance from the bell tank.

6.4.2.5 Remarks

Fine adjustments of the cycloid arm position may be necessary when performing the bell balance tests.

6.4.3 Bell Roller Guide Clearances

6.4.3.1 Scope

This procedure relates and is not part of the Requirements but is shown in these procedures as an aid to the owner in obtaining the correct set-up of a bell proving system. The purpose of this procedure is to ensure that adequate clearance exists between the guide rollers and the guide rods.

6.4.3.2 General

This procedure involves checking the clearance between the guide rollers and the guide rods as the bell descends.

6.4.3.3 Apparatus

- a) Mag flashlight
- b) Wrenches or plyers

6.4.3.4 Procedure

- a) Begin with bell fully raised to the start position.
- b) Slowly lower the bell into the tank while observing the clearance of both the bottom and top rollers.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 17 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

- c) If all rollers are clear during decent of the bell into the tank, the setting is correct.
- d) If contact between the rollers and the guide rods exists, the added contact friction must not cause the requirements of GS-ENG-09-01 sections 5.3.5 and 5.3.6 to be exceeded.

6.4.3.5 Remarks

- a) If the contact friction causes the requirements of GS-ENG-09-01 sections 5.3.5 and 5.3.6 to be exceeded, it may be necessary to remove and machine additional clearance with the rollers. Reinstall rollers and retest to specification tolerances.
- b) The bell must be on the same plane as the tank and supports, otherwise the bell will be crooked in the tank as it submerges.

6.4.4 Prover Oil Level

6.4.4.1 Scope

The purpose of this procedure is to determine the level of the prover oil and record for use on the certificate. This procedure relates to section 5.3.2 of the Requirements.

6.4.4.2 General

This procedure involves measuring the level of the prover oil with the bell in both the raised and lowered position.

6.4.4.3 Apparatus

- a) Straight edge
- b) Machinist ruler or measuring tape

6.4.4.4 Procedure

- a) Chose a reference point on tank (example - top lip of tank) and record. (Worksheet section 5.3.2).
- b) Completely lower bell and open to atmosphere. Measure and record distance from reference point to the tank oil level. Raise bell to start point, and with bell closed to atmosphere, measure and record distance to oil level. The bottom guide rollers and bottom guide roller assemblies shall remain totally submerged in the prover oil at this point. Also, prover oil level must be sufficient to maintain seal.
- c) Completely lower bell, keep closed to atmosphere and measure and record distance to oil level. The top guide rollers and roller assemblies shall not be in the prover oil and the prover oil shall be retained in the prover's outer tank.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 18 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.4.5 Remarks

- a) The prover oil level must be checked on regular intervals to ensure compliance with the specified level on the certificate.
- b) The tank reference point must be a horizontal fixed surface.

6.4.5 Bell Balance

6.4.5.1 Scope

The purpose of this procedure is to ensure that the gas measuring apparatus is correctly balanced. This procedure relates to section 5.3.3 of the Requirements.

6.4.5.2 General

This procedure involves checking that the bell is balanced at all points of travel.

6.4.5.3 Apparatus

- a) Additional counterweights
- b) Wrenches and plyers

6.4.5.4 Procedure

- a) Raise bell to start point of proving cycle and allow a minimum drain time of five minutes.
- b) Add weight to main counter weight until bell pressure has been reduced to 0.0 inches water column.
- c) Open bell to atmosphere.
- d) The bell must remain stationary.
- e) The bell is then manually moved to points equalling 20, 40, 60 80, 100 percent of the intended range of travel.
- f) Bell must remain stationary at all points. Record results. (Worksheet section 5.3.3).

6.4.5.5 Remarks

- a) If the bell does not remain stationary, it may be necessary to adjust the position of the cycloid arm.
- b) The bell must pass the balance test before proceeding to the bell sensitivity test.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 19 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.6 Bell Reference Pressure

6.4.6.1 Scope

The purpose of this procedure is to check the bell pressure. This procedure relates to section 5.3.4 of the Requirements.

6.4.6.2 General

This procedure involves checking the bell pressure to ensure that it is set at 2.0 \pm 0.02 inches water column.

6.4.6.3 Apparatus

- a) Certified pressure gauge.
- b) Certified inches water column pressure gauge.

6.4.6.4 Procedure

- a) Place bell within range of travel.
- b) Adjust counterweight to achieve a bell pressure of 2.0 \pm 0.02 inches water column.
- c) Record results. (Worksheet section 5.3.4).

6.4.6.5 Remarks

- a) The bell reference pressure is set to 2.0 inches water column \pm 0.02 with reference to the bell prover's normal cycle of operation and oil drain tim.
- b) If small additional weights are added to the main counter weight or to the top of the bell, they should be adequately secured to prevent loss.

6.4.7 Bell Static Pressure

6.4.7.1 Scope

The purpose of this procedure is to check the bell static pressure. This procedure relates to section 5.3.5 of the Requirements.

6.4.7.2 General

This procedure involves checking the bell static pressure throughout the travel of the bell.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 20 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.7.3 Apparatus

- a) Certified pressure gauge
- b) Certified inches water column pressure gauge.

6.4.7.4 Procedure

- a) Raise bell to start point of proving cycle and measure bell pressure. The drain time should be representative of the bell prover normal operation. Record results. (Worksheet section 5.3.5).
- b) Reposition bell to points equal to 20, 40, 60, 80 and 100 and measure bell pressure. Record results.

6.4.7.5 Remarks

- a) Allow the bell to fully stabilize before taking static pressure readings.
- b) Variation in static pressures may be the result of chain binding, contaminated main bearings, improper cycloid arm positioning and/or excessive roller to guide rod friction.

6.4.8 Bell Dynamic Pressure

6.4.8.1 Scope

The purpose of this procedure is to check that pressure in the bell is maintained throughout the travel of the bell. This procedure relates to section 5.3.6 of the Requirements.

6.4.8.2 General

This procedure involves checking the bell pressure at various points as the bell travels through its proving range.

6.4.8.3 Apparatus

- a) Certified pressure gauge
- b) Certified inches water column differential pressure gauge.

6.4.8.4 Procedure

- a) Raise bell to start point of proving cycle. The drain time should be representative of the normal bell prover operation.
- b) Allow bell to begin its descent at a rate not exceeding 8.0 inches per minute.
- c) Read and record the bell pressure at 20, 40, 60, 80 and 100 per cent of the intended range of the bell. (Worksheet section 5.3.6).
- d) Results must be 2.00 \pm 0.02 inches water column at each point.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 21 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.8.5 Remarks

- a) Pressure variations during testing may be the result of chain binding, contaminated main bearings, improper cycloid arm positioning and/or excessive roller to guide rod friction.

6.4.9 Leak Tests

6.4.9.1 System Leak Tests

6.4.9.1.1 Scope

The purpose of this procedure is to ensure that no leaks exist in the gas measuring apparatus and associated piping. This procedure relates to section 5.3.7.1 of the Requirements.

6.4.9.1.2 General

This procedure involves checking the gas measuring apparatus and associated piping for leaks.

6.4.9.1.3 Apparatus

- a) Certified inches water column pressure gauge.

6.4.9.1.4 Procedure

- a) Mount meter in gas measuring apparatus.
- b) Seal outlet of meter.
- c) Apply suitable pressure to the system and valve in.
- d) Record starting reading. (Worksheet section 5.3.7.1).
- e) Allow test to operate for minimum of ten (10) minutes.
- f) Record and compare final reading.

6.4.9.1.5 Remarks

- a) This procedure assumes that the ambient temperature remains stable. If ambient temperature shifts during the test, this effect may have to be brought into the calculation.
- b) Additional stabilization time may be suggested by the manufacturer prior to commencement of the test period.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 22 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.9.2 Operational Leak Tests

6.4.9.2.1 Scope

The purpose of this procedure is to ensure that the leak detection mode of the gas measuring apparatus is able to detect leaks accurately and repeatedly. This procedure relates to section 5.3.7.2 of the Requirements.

6.4.9.2.2 General

This procedure involves the introduction of a controlled leak into the system to determine if the gas measuring apparatus can meet the Requirements GS-ENG-09-01.

6.4.9.2.3 Apparatus

- a) Leak test apparatus (supplied by owner) capable of producing a leak of 0.25 cubic feet per hour or less.

6.4.9.2.4 Procedure

- a) Connect owner supplied apparatus to local volumetric standard.
- b) Verify that leak is equivalent to 0.25 cubic feet per hour, as referenced to 2.0 inches water column on the local volumetric standard.
- c) Mount apparatus on gas measuring apparatus and operate system.
- d) Determine the leak test time set on the gas measuring apparatus.
- e) Commence the leak test detection system.
- f) Repeat test procedure three (3) six (6) times.
- g) Record the set leak test time of the gas measuring apparatus on the worksheet. (Worksheet section 5.3.7.2).

6.4.9.2.5 Remarks

- a) The length of time taken by the gas measuring apparatus to detect the required leak is set by the owner.
- b) The minimum time required to consistently detect the specified leak rate shall be recorded.
- c) The bell prover controller shall be set for the specified leak test time duration.
- d) The operational leak test must be completed once regardless of the number of meter proving methods requested by the owner.

6.4.10 Flow Rate Tests

6.4.10.1 Scope

The purpose of this procedure is to ensure that the gas measuring apparatus is capable of accurately setting the flow rates of all meters in the statement of intended use. This

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 23 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

procedure relates to section 5.3.8 of the Requirements.

6.4.10.2 General

This procedure involves checking high and low flow rates using individual meters of each type.

6.4.10.3 Apparatus

- a) Stopwatch
- b) Calculator
- c) Transfer meters or stable temperature compensated meters of known error.

6.4.10.4 Procedure

- a) Mount meter in gas measuring apparatus.
- b) Operate prover to determine error of meter.
- c) Record error. (Worksheet section 5.3.8).
- d) Note starting position of dial test hand.
- e) Initiate test sequence, starting stopwatch as initial flow rate begins.
- f) Repeat three (3) times if fixed flow rate caps, six (6) if adjustable rate caps are used.
- g) Record all volumes and associated times.
- h) Initiate test sequence, starting stopwatch as second flow rate begins.
- i) Repeat three (3) times if fixed flow rate caps, six (6) if adjustable rate caps are used.
- j) Record all volumes and associated times.
- k) Calculate flow rates using following formula:

$$\text{Measured Flow} = \frac{\text{Volume} \times (1 - \text{error}) \times 3600}{\text{Time (sec onds)}}$$

- l) Compare flow rates determined by testing to the nominal flow rates for the type of meter being tested using the following formula:

$$\text{Percent Variance (PV)} = \frac{\text{Measured Flow} - \text{Target Flow}}{\text{Target Flow}} \times 100\%$$

- m) Record percent variance. Calculated PV must be less than 5.0%.
- n) Repeat procedure for all meter types listed in statement of intended use.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 24 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.10.5 Remarks

- a) The flow rate tests must be completed once regardless of the number of meter proving methods requested by the owner.

An example calculation for a standard transfer meter and a stable T.C. meter of known error follows:

Example using a standard meter:

Transfer meter error = + 0.2 %

Time = 52.0 seconds

Measured Volume = 1.0 cubic feet

Nominal low load flow = 73 cubic feet per hour

$$\text{Measured FlowRate} = \frac{1.0 \times (1 + (+0.002)) \times 3600}{52.0}$$

$$= 69.36 \text{ cubic feet per hour}$$

$$PV = \frac{69.36 - 73.0}{73.0} \times 100$$

$$= -4.97 \%$$

Example using a stable T.C. meter of known error:

Temperature Compensated meter known error = + 0.2 % T.C.

Test Time = 53.0 seconds

Measured Meter Volume = 1.0 cubic feet

Nominal low load flow = 73.0 cubic feet per hour

Air Temperature (GMA) = 72.0 ° F

$$\text{Measured Flow Rate} = \frac{1.0 \times \left[\frac{Tb + 460}{Tc + 460} \right] \times (1 + (+0.002)) \times 3600}{53.0}$$

$$= 69.63 \text{ cubic feet per hour}$$

$$PV = \frac{69.63 - 73.0}{73.0} \times 100$$

$$= -4.62 \%$$

Where *Tb* is the GMA air temperature and *Tc* is the base temperature.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 25 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.4.11 Register Verification

6.4.11.1 Scope

The purpose of this procedure is to ensure that, if so equipped, the gas measuring apparatus is capable of accurately determining if a problem exists with the meter register. This procedure relates to section 5.3.9 of the Requirements.

6.4.11.2 General

This procedure involves the use of intentionally mismatched registers to check the ability of the gas measuring apparatus to identify a problem.

6.4.11.3 Apparatus

- One metric and/or one imperial transfer meter or meter of known accuracy, as identified within the statement of intended use (as applicable).
- Various ratio of registers for the selected metric and imperial meter from the statement of intended use (as applicable).

6.4.11.4 Procedure

- Choose a meter and install a register which does not match. For example, a metric reading register on an imperial reading meter.
- Mount meter in gas measuring apparatus.
- Operate prover.
- Record success of gas measuring apparatus to identify problem (Worksheet section 5.3.9).

6.4.11.5 Remarks

This test is only when the unit is equipped with this feature.

6.5 Meter Classifications and Transfer Meters

6.5.1 Meter Classes and Classifications

6.5.1.1 Scope

The purpose of this procedure is to describe the methodology used in grouping meter types into classes and classifications. This procedure relates to section 5.4.1 of the Requirements.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 26 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.5.1.2 General

This procedure involves the grouping of meter types shown on the owner's statement of intended use into classes and classifications as applicable, for use in correlation of a gas measuring apparatus.

6.5.1.3 Apparatus

- a) Calculator

6.5.1.4 Procedure

- a) Meter types on the owner's statement of intended use are grouped together using the following attributes:
 - 1 same manufacturer (classification only)
 - 2 same meter class (i.e. 200 class)
 - 3 same units of measure
- b) The owner chooses the meter from each group that is to be used as the representative transfer meter (Worksheet section 5.4.1, 5.4.2, 5.4.3).

6.5.1.5 Remarks

The owner is responsible for ensuring that the transfer meters chosen are of sufficient repeatability for the certification testing procedures.

6.6 Volume Correlations

6.6.1 Correlations

6.6.1.1 Scope

This procedure relates to section 5.5.3 of the Requirements. The purpose of this procedure is to describe the procedures concerning the correlation to the local volumetric standard.

6.6.1.2 General

This procedure involves performing volume correlation, comparing the results obtained on the gas measuring apparatus undergoing test to the local volumetric standard.

6.6.1.3 Apparatus

- a) Transfer Meters
- b) Calculator

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 27 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.6.1.4 Procedure

- a) Using the local volumetric standard, perform six (6) tests at both the low load rate and the high load rate.
- b) Determine X bar for each load rate.
- c) Determine local volumetric standard flow rate of low and high load rate.
- d) Record results (Worksheet section 5.5.1).
- e) Using gas measuring apparatus, perform six (6) tests at both the low load rate and the high load rate.
- f) Determine gas measuring apparatus flow rate of low and high load rate.
- g) Record results (Worksheet section 5.5.1).
- h) The flow rates as determined on the local volumetric standard and the gas measuring apparatus must meet the requirements shown in sections 5.4.2 items 6 and 7 of the requirements.
- i) Results of gas measuring apparatus must be within $\pm 0.2\%$ of local volumetric standard.
- j) Repeat test procedure for all other transfer meters to be tested.

6.6.1.5 Remarks

Transfer meters must be acclimatized for a minimum of four (4) hours in the proving room prior to testing. The complete testing of a transfer meter must be performed on the same day. If time does not allow for both, testing must be delayed until the next day.

6.6.2 Maximum Error Detection

6.6.2.1 Scope

The purpose of this procedure is to describe the procedures concerning the correlation to the local volumetric standard using transfer meters calibrated as specified in requirements clause 5.5.4.1 a) and b). This procedure relates to section 5.5.4 of the Requirements.

6.6.2.2 General

This procedure involves performing volume correlation, comparing the results obtained on the gas measuring apparatus undergoing test to the local volumetric standard on transfer meters that are calibrated to have high errors.

6.6.2.3 Apparatus

- a) Transfer meters
- b) Calculator

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 28 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.6.2.4 Procedure

- a) The owner may either supply six transfer meters calibrated to the high errors shown in the Specification, or may choose to utilize a smaller number of meters and recalibrate to meet the required errors.
- b) Using the local volumetric standard, perform six (6) tests at the high load rate.
- c) Determine X bar for the high load rate.
- d) Using gas measuring apparatus, perform six (6) tests at the high load rate.
- e) Observe gas measuring apparatus flow rate of high load rate.
- f) Record results (Worksheet section 5.5.2).
- g) The flow rates as determined on the local volumetric standard and the gas measuring apparatus must meet the requirements shown in section 5.4.2 items .6 and .7 of the requirements.
- h) Results of gas measuring apparatus must be within $\pm 0.2\%$ of local volumetric standard.
- i) Repeat test procedure for all other transfer meters to be tested.

6.6.2.5 Remarks

The complete testing of a transfer meter must be performed on the same day. If time does not allow for both, testing must be delayed until the next day.

6.6.3 Additional Modes of Operation

6.6.3.1 Temperature Differential Mode Correlations

6.6.3.1.1 Scope

The purpose of this procedure is to describe the procedures utilized in testing other modes of operation as required to comply with the owner statement of intended use. This procedure relates to section 5.5.5 of the requirements.

6.6.3.1.2 General

This procedure involves the testing of the temperature differential portion of the prover operation. This portion of the program makes an adjustment to the output of the gas measuring apparatus which is based on the difference between the bell air temperature and the meter air temperature.

6.6.3.1.3 Apparatus

- a) Certified thermometer
- b) Water bath

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 29 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

6.6.3.1.4 Procedure

- Using the local volumetric standard, perform six (6) tests at the high load flow rate.
- Record results, calculate X bar. (We have no worksheet for this section) (Worksheet 5.5.3.1).
- Immerse either the bell outlet air temperature sensor or the meter outlet air temperature sensor of the gas measuring apparatus in the water bath. The water bath must be a minimal 2° C ± 1.0° C different than the other measured temperature.
- Set gas measuring apparatus on temperature differential mode.
- Perform six (6) tests at high load rate. Record errors.
- Record meter outlet temperature for all runs. (We have not worksheet for this section) (Worksheet section 5.5.3.1).
- Determine X bar for the high load rate.
- Record results. (We have no worksheet for this section).
- Calculate correction applied by the gas measuring apparatus to the error reading using the bell outlet temperature and the meter inlet outlet air temperature. Formula for calculation is as follows:

$$PC = \frac{(Tb + 273.15) - (Ts + 273.15)}{(Ts + 273.15)} \times 100$$

Where *Tb* is the bell outlet air temperature and *Ts* is the meter inlet air temperature.

- Compare results using the following formula:

$$RXm = PC + TXm$$

Where Rxm is the indicated X bar for the high load error determined on the gas measuring apparatus and Txm is the true X bar value as determined on the local volumetric standard.

- Results of above calculation must be within ± 0.3 % of each other.
- Record results. (We have no worksheet for this section) (Need to draft something similar to section 10.1 of 1992 draft worksheet procedure).

6.6.3.1.5 Remarks

None

Sample of Calculations for Percent Corrections

With the measuring apparatus set in the **temperature differential correcting mode**, the correcting circuit or mechanism of the measuring apparatus is to correct its output display to reflect the differential temperature between the bell outlet air and meter outlet air.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 30 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

The percent correction may be calculated as follows:

$$PC = \frac{(T_b + 273.15) - (T_s + 273.15)}{(T_s + 273.15)} \times 100 \%$$

where T_b is the bell outlet air temperature and T_s is the temperature at which meter outlet air probe is being held.

The expected indicated error of the measuring apparatus output display is the sum of any corrections applied by the measuring apparatus plus the true error of any meter as determined on the reference standard.

Example: Expected Error Indication is $RX_m = PC + TX_m$

6.6.3.2 Temperature Converting Mode

6.6.3.2.1 Scope

The purpose of this procedure is to describe the procedures utilized in testing other modes of operation. This procedure relates to section 5.5.5.2 of the Requirements.

6.6.3.2.2 General

This portion of the program makes an adjustment to the output of the gas measuring apparatus which corrects the output display to reflect measured volumes to a base temperature from the actual measured temperature.

6.6.3.2.3 Apparatus

- a) Certified thermometer

6.6.3.2.4 Procedure

- a) Using the local volumetric standard, perform six (6) tests at the high load rate.
- b) Record results, calculate X bar (Worksheet section 5.5.3.2).
- c) Set gas measuring apparatus on temperature converting mode.
- d) Perform six (6) tests at high load rate and record results (Worksheet section 5.5.3.2).
- e) Record meter outlet temperature for all runs.
- f) Calculate correction applied by the gas measuring apparatus to the error reading using the meter outlet temperature and the chosen base temperature. Formula for calculation is as follows:

$$PC = \frac{(T_m + 273.15) - (T_c + 273.15)}{(T_c + 273.15)} \times 100$$

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 31 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

Where T_m is the meter inlet outlet air temperature and T_c is the base temperature to which the gas measuring apparatus is adjusted in the temperature converting mode.

- g) Apply the calculated temperature correction factor (PC) to each meter run performed on the gas measuring apparatus. Record corrected values on worksheets.
- h) Determine X-bar for the high load rate.
- i) Record results (Worksheet section 4.5.3.21).
- j) The flow rates as determined on the local volumetric standard and the gas measuring apparatus must meet the requirements shown in section 5.4.2 items .6 and .7 of the specification.
- k) Compare results using the following formula:

$$RX_m = PC + TX_m$$

Where Rx_m is the indicated X bar for the high load error determined on the gas measuring apparatus and Tx_m is the true X bar value as determined on the local volumetric standard.

- l) Results of above calculation must be within $\pm 0.3\%$ of each other.
- m) Record results (Worksheet section 5.5.3.2).

6.6.3.2.5 Remarks

None.

Procedures

Category: GAS	Document: GS-ENG-09-01.1	Page: 32 of 32
Document(s):	Distribution Date: June 30, 2010	Effective Date: June 30, 2010
	Supersedes:	

7.0 Procedures for Assessing Technical Requirements

7.1 Use Requirements

7.1.1 Scope

The purpose of this section is to provide a formal method of auditing the user requirements of the Requirements. This procedure relates to section 6.1 of the Requirements.

7.1.2 General

This procedure is simply the completion of a checklist verifying that the inspector has observed the record of the required procedures.

7.1.3 Apparatus

7.1.3.1 Gas measuring apparatus log book.

7.1.4 Procedure

7.1.4.1 Use checklist to verify that all user requirements are being met.

7.1.4.2 Record findings. (Worksheet section 6.1).

7.1.5 Remarks

None.