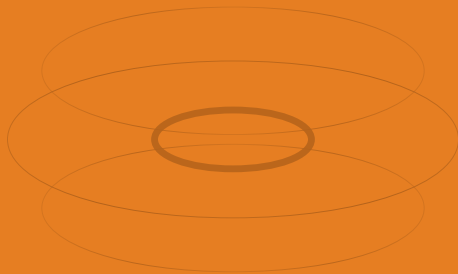


OWNER

Gas Chromatograph Calibration and Verification

Procedure



Document No.: [REDACTED] MEA-PRC-002

Rev. A, Issued for Review

Date: September 29, 2026

Project: [REDACTED] [REDACTED]



TORUS

[REDACTED] [REDACTED], [REDACTED] County, [REDACTED]

NOTICE

This document was prepared by TORUS for the use of the client named on the cover, under the terms of the agreement between TORUS and the client. It reflects the information available and the scope agreed at the date of issue. Information supplied by the client or by vendors has been used as received unless this document states that it was checked. Codes, site data and vendor information change over time, and conclusions may need to be revisited when they do. A document that is not issued for construction, or that is not sealed where a seal is required, shall not be used for construction. Use of this document by anyone other than the client is at that party's own risk.



ISSUE SUMMARY AND APPROVAL

This page records each issue of MEA-PRC-002. The preparer, reviewer and approver sign for each revision.

Rev.	Date	Issue purpose	Description
A	2026-09-29	Issued for Review	First issue

Contributors

Rev.	Discipline	Prepared by	Reviewed by	Approved by
A	Measurement			

C O N T E N T S

1. INTRODUCTION 1

1.1. PURPOSE AND SCOPE.....1

1.2. REFERENCES 1

1.3. RESPONSIBILITIES 1

2. CALIBRATION STANDARD AND FREQUENCY 2

2.1. CALIBRATION STANDARD 2

2.2. FREQUENCY.....2

3. PROCEDURE.....4

3.1. MANUAL OR WITNESSED CALIBRATION 4

3.2. ACTIONS WHEN THE CHROMATOGRAPH IS OUT OF TOLERANCE 4

4. ACCEPTANCE AND RECORDS 5

4.1. CALIBRATION ACCEPTANCE CRITERIA 5

4.2. VERIFICATION ACCEPTANCE CRITERIA 5

4.3. RECORDS 6

F I G U R E S A N D T A B L E S

Table 2-1: Calibration Standard, Nominal Composition 2

Table 2-2: Calibration and Verification Frequency 3

Table 4-1: Calibration Acceptance Criteria 5

Table 4-2: Verification Acceptance Criteria 5

1. INTRODUCTION

1.1. PURPOSE AND SCOPE

This procedure sets out how the Owner's measurement technicians will calibrate and verify the custody gas chromatograph AE/AT-141 and how they will act when it is out of tolerance. The chromatograph performs a C6+ heating value analysis to GPA 2261 on gas drawn through sample probe SP-141. Its composition sets the heating value of every unit of energy delivered and, through the compressibility calculation, part of the delivered volume, so its calibration is as important to custody as the meters themselves.

The procedure covers the calibration standard, the calibration and verification frequencies, the response factor and total checks, the monthly comparison with the composite sample taken by SMP-146, and the composition fallback that flow computer FQI-110 uses while the chromatograph is unavailable. It does not cover the moisture, H₂S and oxygen analyzers, which are validated with portable certified standards under the vendor's instructions.

1.2. REFERENCES

1. GPA 2261, Analysis for Natural Gas and Related Gaseous Mixtures by Gas Chromatography.
2. GPA 2198, Selection, Preparation, Validation, Care and Storage of Natural Gas and Natural Gas Liquids Reference Standard Blends.
3. GPA 2166, Obtaining Natural Gas Samples for Analysis by Gas Chromatography.
4. GPA 2286, Method for the Extended Analysis for Natural Gas and Similar Gaseous Mixtures by Temperature Program Gas Chromatography.
5. GPA 2145 and GPA 2172, physical constants and calculation of heating value.
6. API MPMS Chapters 14.1 and 14.5.
7. MEA-RPT-001, Measurement System Design Basis and Philosophy.
8. MEA-CAL-002, Measurement Uncertainty Analysis.
9. MEA-DS-003, Gas Chromatograph; MEA-DS-007, Composite Sampler.
10. MEA-PRC-004, Measurement Data, Audit Trail and Event Log Management.

1.3. RESPONSIBILITIES

The Owner's measurement technician performs calibrations and verifications and prepares the records. Gas control is told before any manual calibration because the chromatograph is taken off the process stream. The receiving pipeline operator is told before each witnessed calibration and before any change of calibration standard, and may witness either (HOLD H-01).

2. CALIBRATION STANDARD AND FREQUENCY

2.1. CALIBRATION STANDARD

The chromatograph is calibrated with a single-level standard whose composition is close to the pipeline gas. A standard close to the sample keeps the response factors in the range where the detector is linear, which removes most of the linearity error that a distant standard would add (MEA-CAL-002). Table 2-1 gives the nominal composition and the certified uncertainty expected of a gravimetric blend.

Table 2-1: Calibration Standard, Nominal Composition

Component	Nominal (mol %)	Certified relative uncertainty, $k = 2$ (typical)
Methane	88.72 (balance)	0.1 %
Ethane	6.00	0.5 %
Propane	2.20	0.5 %
i-Butane	0.40	1 %
n-Butane	0.40	1 %
neo-Pentane	0.10	1 %
i-Pentane	0.10	1 %
n-Pentane	0.10	1 %
n-Hexane	0.08	2 %
Nitrogen	1.20	0.5 %
Carbon dioxide	0.70	1 %

The standard shall be prepared gravimetrically, traceable to national standards, and supplied with a certificate that states the uncertainty of each component. Its hydrocarbon dew point shall be at least 20 °F below the lowest temperature at which it will be stored, and it is kept in a heated blanket at 70 to 120 °F so that no heavy component condenses in the cylinder. A new cylinder is rolled or heated for 4 hours before first use, and a cylinder is not used below 10 % of its fill pressure, where the composition can shift. A second, independently prepared verification standard of similar composition is kept for the checks in Table 2-2.

2.2. FREQUENCY

Table 2-2 sets the default frequencies. The Interconnect Agreement and the receiving pipeline operator's measurement requirements may change them (HOLD H-01, HOLD H-13).

Table 2-2: Calibration and Verification Frequency

Activity	Default frequency
Automatic calibration with the standard in Table 2-1	Daily, at a fixed time away from the contract-hour rollover
Automatic verification, standard analyzed as an unknown, 3 runs	Weekly
Verification with the independent standard	Monthly
Composite sample from SMP-146 analyzed by an accredited laboratory to GPA 2261 and GPA 2286, compared with the flow-weighted GC average	Monthly
Full performance check: repeatability, linearity with a second standard, retention times and valve timing	Annually, and after any column, valve or detector maintenance



3. PROCEDURE

3.1. MANUAL OR WITNESSED CALIBRATION

The automatic daily calibration follows the same sequence under the chromatograph controller. A manual or witnessed calibration proceeds as follows:

1. Notify gas control, and the receiving pipeline operator where the calibration is witnessed.
2. Set FQI-110 to hold the last good hourly composition, so that custody quantities are not calculated from calibration runs.
3. Check the helium carrier supply pressure and cylinder contents, and the calibration standard pressure and heating blanket.
4. Purge the calibration standard line with at least 10 line volumes.
5. **WITNESS POINT.** Run at least 3 consecutive analyses of the standard. Discard the first if the stream-switching purge was incomplete.
6. Compare the new response factors with the previous ones against the limits in Table 4-1.
7. If the calibration is accepted, store the new factors. The chromatograph controller and FQI-110 record the event with the old and new factors.
8. Run the verification standard as an unknown at least once and record the result.
9. Return the chromatograph to the process stream. Confirm that the next two process analyses have unnormalized totals within limits, then release FQI-110 to live composition.

3.2. ACTIONS WHEN THE CHROMATOGRAPH IS OUT OF TOLERANCE

When the chromatograph fails a calibration, fails a verification or is out of service, FQI-110 protects the custody quantities by falling back through the composition hierarchy set in MEA-RPT-001:

1. FQI-110 automatically uses the last good hourly composition and flags the affected hours.
2. After 24 hours (default, HOLD H-01) the technician enters a fixed composition taken from the latest composite analysis.
3. After repair and a successful calibration, the affected period is reviewed. If the last good or fixed composition differs from the post-repair composition by more than 0.2 % in heating value, the period is corrected under the Interconnect Agreement using the composite sample or a spot sample.
4. **HOLD POINT.** Corrections to custody quantities are agreed with the receiving pipeline operator and processed under MEA-PRC-004.

Every event, entry and correction is recorded with the user, the time and the reason.

4. ACCEPTANCE AND RECORDS

4.1. CALIBRATION ACCEPTANCE CRITERIA

Table 4-1 gives the limits that a calibration shall meet before its response factors are accepted. The response factor limits are tighter for the major components because they carry most of the heating value and compressibility.

Table 4-1: Calibration Acceptance Criteria

Check	Limit	Action if exceeded
Response factor change against the previous calibration	± 2 % each component; ± 1 % for methane, ethane, propane, nitrogen and carbon dioxide	Reject the calibration, keep the previous factors, alarm and investigate
Response factor change against the factory baseline	± 10 %	Column or detector maintenance
Unnormalized total of the calibration runs	99.5 % to 100.5 %	Reject the calibration
Repeatability of 3 consecutive calibration runs	Within the GPA 2261 repeatability limit for each component	Reject, repeat once, then maintenance
Heating value of the calibration runs against the certificate	± 0.5 Btu/scf (0.05 %)	Reject
Retention time drift	Within the vendor window	Adjust timing, witnessed where required

4.2. VERIFICATION ACCEPTANCE CRITERIA

Table 4-2 gives the limits for the verification checks and for the unnormalized total of each process analysis.

Table 4-2: Verification Acceptance Criteria

Check	Limit
Verification standard analyzed as an unknown, each component against the certificate	Within the combined certificate uncertainty and GPA 2261 reproducibility
Verification standard heating value against the certificate	± 1.0 Btu/scf (0.1 %)
Unnormalized total of each process analysis	98.5 % to 101.5 % (alarm); outside this range the analysis is invalid
Composite laboratory heating value against the flow-weighted monthly GC value	± 2.0 Btu/scf (0.2 %); beyond this, investigate the chromatograph, the sampler and sample handling

4.3. RECORDS

The records of this procedure are the calibration reports (factors, runs and limits), the verification reports, the certificates of the standards (kept for the life of each cylinder plus the record retention period), the composite laboratory reports and comparison worksheets, the maintenance records, and the FQI-110 composition source flags. They are retained under ME-PRC-004.

