



1.0 Introduction

The TEOM 1405-F Monitor is a “gravimetric” instrument that draws ambient air through a sample filter at constant flow rate, continuously weighing the filter and calculates the near real-time mass concentration of the collected particulate matter. The FDMS unit automatically generates mass concentration measurement that account for both non-volatile and volatile PM components. The FDMS unit constantly samples ambient air and uses a switching valve to change the path of the sample flow and automatically compensates for the semi-volatile fraction of the sample. Every six minutes the switching valve alternates the sample flows between base and reference sample periods. During the base period, sample is collected normally and the base mass concentration is determined. During the reference period, the flow is diverted through a chilled filter to remove and retain the non-volatile and volatile PM. Based upon mass concentration (MC) measurements obtained during the base and reference periods, the FDMS system updates a one-hour average every six minutes.

2.0 Applicability and Use

- To obtain timely data for the purpose of air quality assessment
- air quality trend reporting
- meet the requirements for inclusion of data in provincial and national air quality databases
- A continuous method of monitoring sulphur dioxide concentrations in ambient air

This method is capable of measurement updates at a rate of once every six minutes. This method captures and records PM readings every six minutes, and these readings are compiled in to one hour averages.

2.1 Range

This method is applicable to the measurement of PM concentrations in ambient air in the range of $5.0 \mu\text{g}/\text{m}^3$ to several g/m^3 .

This method adheres to the requirements of the current Air Monitoring Directive (AMD) drafted by Alberta Environment in 1989. In some cases the limits and specifications exceed the requirements of the current AMD and subsequent amendments. It should be considered that the current and any future amendments or drafts of the AMD will be used as the benchmark for requirements and criteria for ambient air monitoring practices conducted in the Province of Alberta.



3.0 Additional References

- Alberta Air Monitoring Directive 1989
- 2006 Amendment to the 1989 Alberta Air Monitoring Directive

4.0 Precision and Accuracy

The measurement precision is generally considered to be the “repeatability of the measurement”. Precision of the data output by the analyzer is established by the manufacturer, but confirmed during daily data review and bi-monthly audits.

The accuracy of the analyzer is generally considered the “deviation from true”. This means how close it is to what it should be.

The accuracy and precision of the analyzer are specified by the manufacturer in the instrument manual.

4.1 Reporting Detection Limits

The TEOM 1405F particulate monitor used in this method is a commercially available monitor. The measurement range is selectable. The typical range selection used in Alberta for ambient air monitoring is -50 ug/m^3 to 450 ug/m^3 .

Data generated from these analyzers are reported to the nearest 0.1 ug/m^3 .

5.0 Setup and Operation

All the installation requirements are specified by the manufacturer in the installation procedures of the manual. General requirements listed below must also be followed.

- A data acquisition system will be connected to the analyzer to record the signal output from the analyzer. For connection to record analog voltage signals, the system will be set to match the voltage range of the analyzer output. Generally this is 10V full scale.
- The monitoring station temperature will be controlled within the range of 20 to 25°C.
- Necessary channels must be put into “Maintenance” before calibration/maintenance starts.



6.0 Calibration and Audit Procedure

The TEOM 1405F has several internal operational parameters. The critical parameters are identified in the manual and are to be checked at regular intervals as indicated by the manual. The 1405F audit procedures are highly automated in this instrument, and for purposes of ease of use and to avoid mistakes, it is recommended to use the “wizards” in the instrument to perform audits and calibrations. The wizards are highly intuitive and user friendly with excellent step by step instructions, and circumvents the need to write a separate procedure for audit and calibration. It is important to follow the audit procedures in the order presented below of logistical reasons. For example, if the leak check does not pass, the flow audit cannot be done until the leak is resolved.

It is important to note that “audit” implies checking and measuring the parameter of interest. “Calibrate” implies adjustment if out of tolerance. Therefore an audit is always done first to determine if a given operational parameter is within tolerance, then an adjustment is made if necessary.

The frequencies of some checks in this SOP exceed the requirements of the operational manual. See the table below for audit parameters and frequencies.

Operational Parameter	SOP Frequency	Manual Frequency
Leak Check	2x/month	Monthly
Ambient Temperature Audit	Monthly	Monthly
Ambient Pressure Audit	Monthly	Monthly
Flow Audit	Monthly	monthly
Mass Transducer Constant) Audit	Every 6 months	annually

6.1 Leak Check Procedure

Put the TEOM 1405F logger channel in to maintenance mode. Initiate the “leak check wizard” in the TEOM, see manual page 3-4. Follow the instructions in the “leak check wizard”. Record results on spreadsheet. If the leak check does not pass initiate trouble shooting procedures.

6.2 Ambient Temperature Audit Procedure

Put the TEOM 1405F logger channel in to maintenance mode. See manual page 5-39. Record results on spreadsheet. If the temperature audit does not pass then adjust as per the instructions in the manual on page 5-42.



6.3 Ambient Pressure Audit Procedure

Put the TEOM 1405F logger channel in to maintenance mode. See manual page 5-39. Record results on spreadsheet. If the pressure audit does not pass then adjust as per the instructions in the manual on page 5-43.

6.4 Flow Audit Procedure

Put the logger channel in to maintenance mode. Initiate the “flow audit wizard” in the TEOM, see manual page 5-44. Follow the instructions in the “flow audit wizard”. Note that either the “direct flow device” or “FTS System” options can be used depending on the users’ level of familiarity and experience. Record results on spreadsheet. If the flow does not pass initiate trouble shooting procedures. A flow calibration may be required depending on the cause of the failure. If a calibration of the flows is required then adjust the flows as per page 5-48 of the manual.

6.5 Mass Transducer Constant Audit Procedure

Put the TEOM 1405F logger channel in to maintenance mode. See manual page 5-63. Record results on spreadsheet. If the Ko constant audit does not pass then contact the manufacturer as per the instructions in the manual. It is important to note that the mass transducer audit filter is NOT used for more than ten audits, as the audit filter will load up with enough particulate over the course of ten audits to significantly change the mass of the audit filter. Following each use of this filter a black line is placed on the outside of the case of the audit filter to record usage. After the tenth use it is discarded.

7.0 Quality Control Requirements

On a daily basis data is reviewed to verify validity and proper performance. If data appears suspect, then a technician is dispatched to perform a full audit of the TEOM unit. The audits as per section 6 of this SOP are used to verify validity of the data, or, in the event of a catastrophic failure data will be invalidated back to the last point in time where data was known to be valid.

In addition, flow audit devices are verified on an annual basis, and the ambient temperature and pressure audit devices are verified every six months.

8.0 Data Calculation and Reporting

See TEOM 1405F manual pages 1-6 to 1-11.

8.2 Reporting

Critical internal operating parameters of the TEOM 1405F are to be recorded in the calibration/audit spreadsheet. This includes:



- Date of the audit/calibration
- Leak check readings and results
- Ambient temperature and ambient pressure audit/calibration readings and results
- Flow audit/calibration readings and results
- Mass transducer audit/calibration readings and results
- Calibration equipment information and last verification dates