MAINTENANCE, CALIBRATION, AND REPAIR OF THE TEOM

Purpose

This Meteorology and Air Quality Group (MAQ) procedure describes the maintenance and repair of the Tapered Element Oscillating Microbalance (TEOM).

Scope

This procedure applies to the individuals assigned to maintain, calibrate, and repair the TEOM.

In this procedure

Signatures

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04/14/06

General information about this procedure

Attachments

This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Review	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	6/2/00	New document.
1	10/21/03	Changed annual cleaning frequency, revised flow auditing chapter, rearranged chapters on leak checking and flow auditing, and added block on mass transducer calibration verification.
2	04/14/06	Quick-change revision to convert HCP to HR and remove steps on upgraded mass controllers.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- Anyone repairing, calibrating or maintaining TEOMs

Personnel previously trained to revision 1 do not require retraining to this revision.

Annual retraining is required and will be by read training.

Training method

The training method for this procedure is **mentored** training by a previously-trained individual and is documented in accordance with the procedure for training (MAQ-024).

Prerequisites

In addition to training to this procedure, the following training is also required prior to performing this procedure:

- First Aid and Cardiopulmonary Resuscitation (CPR)
- MAQ-011, “Logbook Use and Control”
- MAQ-233, “Operation of the TEOM Air Sampling System”
- Rupprecht and Patashnick Operating Manual for TEOM

Periodically review the field safety information in the New Employee Handbook (see MAQ-032).

General information, continued

Definitions specific to this procedure

TEOM: Tapered Element Oscillating Microbalance. This instrument draws ambient air through a filter that is continuously weighed, giving real-time mass concentrations.

References

The following documents are referenced in this procedure:

- MAQ-011, "Logbook Use and Control"
- MAQ-024, "Personnel Training"
- MAQ-032, "Orienting New Employees"
- MAQ-233, "Operation of the TEOM Air Sampling System"

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Cleaning the PM-10 inlet

When to clean the PM-10 inlet

Clean the inlet annually or when stored mass concentration values become erratic or appear inconsistent with weather conditions or other TEOMs.

Materials needed

Collect the materials listed below:

- General purpose cleaner
- Cotton swabs
- Small soft-bristle brush
- Paper towels
- Silicone-based stopcock grease
- Small phillips screwdriver

Steps to clean the PM-10 inlet

To clean the inlet, perform the following steps:

Step	Action
1	Lift off the PM-10 inlet.
3	Unscrew the top acceleration assembly from the bottom collector assembly.
4	Mark the top plate deflector cone and lower plate with a pencil to facilitate proper orientation during reassembly.
5	Remove the four pan head screws from the top plate and lift off the top plate.
6	Lift the insect screen off the lower plate rain deflector and brush off. Replace.
7	Clean the top plate deflector cone and internal wall surface of the acceleration asembly with a general purpose cleaner and paper towels.
8	Clean the acceleration nozzle with a cleaner-dampened cotton swab.
9	Inspect the large diameter impactor nozzle O-ring for wear. Replace if necessary, or using a light coating of silicone grease, apply a thin film on the O-ring and a thin film on the aluminum threads of the acceleration assembly.
10	Align the top plate markings with the lower plate markings. Replace the four screws.

Steps continued on next page.

Cleaning the PM-10 inlet, continued

Step	Action
11	On the lower collector assembly, use the cleaner and paper towels and/or cotton swabs to clean the collector assembly walls and three vent tubes and the bottom side of the collector assembly, and the weep hole in the collector plate.
12	Remove the rain jar and clean. Before replacing, apply a thin coat of silicone grease to the cork gasket on the cap.
13	Inspect the 2 O-rings on the lower assembly. Replace if necessary. Coat lightly with silicone grease.
14	Reassemble the top and bottom assemblies. Hand tighten.
15	Replace the PM-10 inlet.

Replacing the large bypass in-line filter

Large bypass in-line filter

Replace every 6 months during heavy use or when visibly dark or discolored due to particulate buildup. Replacing these filters immediately following an exchange of a TEOM filter allows the change to be carried out during the one-half hour flow and temperature stabilization period following the instrument reset (see MAQ-233 chapter *Filter exchange*).

Remove the existing filters with the quick-disconnect fittings and replace with the new.

System leak test and flow audit

Purpose of leak testing

It is necessary to leak test the TEOM to ensure no air enters the system downstream from the sample, thus reducing the volume of air that goes through the filter.

When to perform leak test

Perform the leak test at least annually, when leaks are suspected during flow rate malfunctions, or when suggested by the troubleshooting guide in the operation manual.

Steps to leak test the TEOM

To test the TEOM for leaks, perform the following steps:

Step	Action
1	Remove the filter cartridge (see MAQ-233 chapter *Filter exchange*). This will prevent accidental damage occurring to the sample filter cartridge when exposed to the high pressure drop that the leak test creates.
2	On Main Screen, press the up/down arrows to display both the Main Flow and the Auxiliary Flow.
3	Turn off the pump so there is no flow and record the readings for Main and Auxiliary Flows. These are the "zero flow offset" readings.
4	Turn on the pump.
5	Remove the size-selective inlet from the flow splitter and replace it with the Flow Audit Adapter. Close the valve on the Flow Audit Adapter.
6	Observe the reading for Main Flow. Subtract the "zero flow offset" number for the Main Flow from step 3. The result of this subtraction should be less than 2% of the maximum flow (0.1 L/min).
7	Similarly, observe the reading for Auxiliary Flow. Subtract the "zero flow offset" number for the Main Flow from step 3. The result of this subtraction should be less than 2% of the maximum flow (0.4 L/min).
8	If the leak test indicates a problem, check hose fittings and other critical locations in the flow system for leaks.

Steps to flow audit

To audit the flow, perform the following steps:

System leak test and flow audit, continued

Step	Action
1	Attach the Dry Cal calibrator to the nozzle on the flow audit adaptor.
2	Turn on the Dry Cal calibrator. Press and hold the "read" button: total flow rate should be ±10% of 16.7 (15.0 to 18.4) lpm. If not, see troubleshooting guide.
3	Disconnect bypass line, plug splitter with Swagelock cap, and read Dry Cal for main flow rate: should be ±10% of 3.0 (2.7 to 3.3) lpm. If not, see the manual Section 8.2 or 8.4.
4	Remove the flow audit adapter from the flow splitter and replace the sample inlet on the flow splitter.
5	Replace the filter cartridge (see MAQ-233 chapter *Filter exchange*).
6	Record data in TEOM Logbook (kept at each TEOM location).

Mass transducer calibration verification

Annually or as time allows, perform a verification of the mass transducer calibration constant that R & P provides with the unit. For the steps to do this, refer to Section 8.5 of the Operators Manual.

These steps verify that the transducer assembly is performing the proper weight analysis based on the oscillation frequency and that it is based on accurate computations from the recorded frequency of a calibration filter with a known weight.

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted **annually** as records to the records coordinator:

- entries in the TEOM Logbook (made according to MAQ-011)

HAZARD REVIEW FOR MAINTENANCE, CALIBRATION, AND REPAIR OF THE TEOM

Work tasks/Steps	**Hazards, Concerns, and Potential accidents; Likelihood/ Severity**	**Controls, Preventive Measures** *(e.g., safety equipment, administrative controls, etc.)*	**Hazard Level** *from IMP 300-00-00 Hazard Grading Matrix*
Steps for maintenance and repair of the TEOM.	Abrasions/Scrapes Occasional/Negligible = Minimal	Use caution and never get in a hurry.	Low
Same as above	Strains from carrying the CPU. Occasional/Moderate = Low	Use a cart to push the CPU around when practical.	Low

Wastes or residual materials resulting from process

None

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible.