

MSHA Course of Instruction Certified Person; Maintenance and Calibration - CPDM

New Dust Rule Outline

- New Dust Rule Overview
- Person Certified in Sampling with CPDM Overview
- Person Certified in Maintenance and Calibration of CPDM Overview

Duties – Certified Person; Sampling - CPDM

- Program the CPDM for compliance sampling
- Ensure the miner(s) being sampled are properly wearing the CPDM at all times
- Monitor concentrations and status conditions at mid-shift or more frequently
 - Assure sampling device is in correct location
 - Assure CPDM is operating properly
 - Assure work environment remains in compliance with applicable standard
- Transmit compliance samples to MSHA electronically within 24 hours of the end of each sampling shift
 - Also note any samples that were not taken on a normal work shift

Duties – Certified Person; Sampling - CPDM

(Continued)

- Shall provide each part 90 miner a paper record of the sample run within an hour after the start of the miner's next work shift
- Must check CPDM within 3 hours before the sampling shift to assure operational readiness
 - If not in proper working order, arrange for or conduct appropriate procedures to put CPDM into working condition
 - *In the event that a unit were to fail the preoperational check during the pre-shift warm-up period, the operator would either use another CPDM for sampling, or notify the District Manager orally and in writing that sampling will not occur because a CPDM is not available
 - Checks Includes:
 - Required cleaning
 - Installation of a new filter

* Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete

Duties – Certified Person; Sampling - CPDM

(Continued)

- Except for Part 90 Miners, within 12 hours of the end of a sampling shift post the dust data card with the mine ID number, shift length, location sampled, equivalent concentration reported, and status conditions encountered (if any are recorded by the CPDM)
 - Do not post dust data card for part 90
- Dust data card posted must remain posted until an MSHA report covering these respirable dust samples is received*
- The MSHA report must be kept posted for at least 31 days
- Ensure that the data transmitted to MSHA is kept for at least 12 months*

* Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete

Duties – Certified Person; Sampling - CPDM

(Continued)

- Upon request from the District Manager (DM), the operator must submit the date and time any sampling required by the rule is scheduled to start. This information must be submitted at least 48 hours before the scheduled sampling*
- Regarding the transmission of samples by the certified person to MSHA, all samples collected are to fulfill regulatory requirements unless the sample has been identified in writing to the District Manager prior to the sampling shift as a sample to be used for some other purpose

* Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete

Duties – Certified Person; Sampling



Not permitted to perform calibrations
(is allowed to perform flow audit, not flow calibration)



Not permitted to open CPDM case



.msha file must not be altered in any way and shall be maintained for at least 12 months



Certification in sampling with the CPDM is required in order to collect samples with CPDM

Duties – Certified Person; Maintenance and Calibration - CPDM

(Continued)

- Performs maintenance and calibrations as recommended by the manufacturer
- Permitted to open CPDM case for maintenance



NOT permitted to perform sampling with the CPDM

Duties – 30 CFR

- To be certified in sampling or maintenance and calibration, you must complete the MSHA course of instruction and pass the exam for the respective certification
- Persons certified in sampling or maintenance and calibration must be recertified every 3 years by passing a MSHA examination
- MSHA may revoke the certification if there is a failure to properly carry out the required sampling procedures
- Both Sampling and Maintenance and Calibration certified persons may clean the CPDM including the flow line, grit pot, and mass transducer

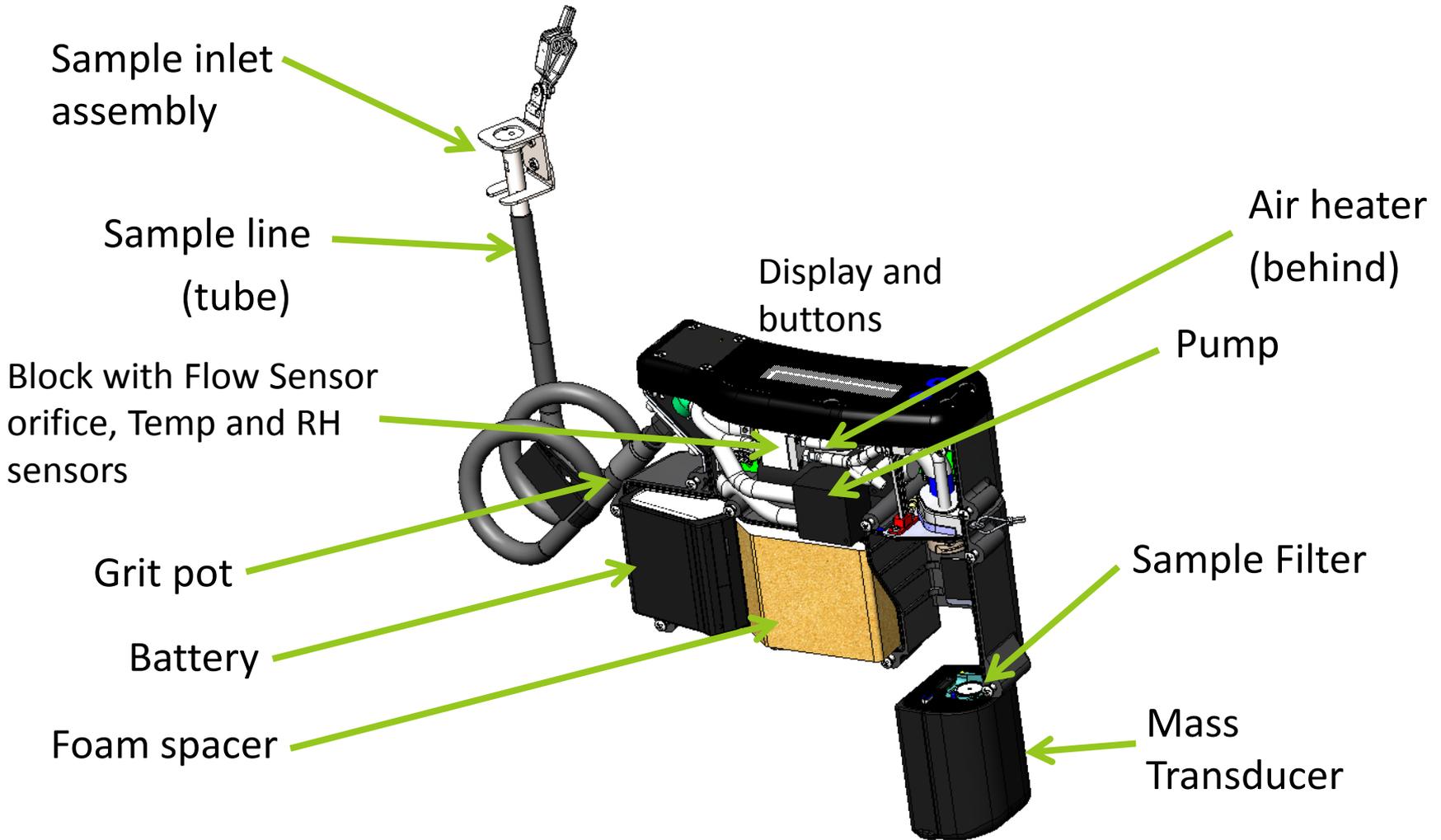


This course DOES NOT certify for sampling using the Coal Mine Dust Personal Sampling Unit (CMDPSU)

Maintenance Outline

- PDM3700 Overview
- PDM3700 Features
- Charging
- Status Codes
- Troubleshooting
- Cleaning and Changing Filters
- Cleaning the Cyclone and Inlet Tubing
- Items to Remember

Main System Components



Purpose

- The CPDM unit is a device designed to provide a continuous readout of respirable coal mine dust concentrations during the work shift
- Only current approved CPDM unit is the PDM3700



General Information

- Provides near real-time analysis
 - Last 15-minute average for short term (second) samples
 - Last 30-minute average for full-shift samples
- Digital readout
 - Flow control system maintains operating flow at 2.2 lpm and total filter loading to 6 inches Hg (Uses Higgins Dewell instead of 10-mm Dohr-Oliver dust cyclone)
- Weighs approximately 4.4 lbs
- Stores sample data for future download and analysis
- Includes label certifying approval from MSHA/NIOSH

PDM Unit and Computer Connections

- Connect PDM unit to charging unit



- Connect charging unit to serial port on computer with RS232 Cable or via a RS232/USB adapter



Charging PDM Unit

Charger Lights

■ Red

- Solid: Charging
- Flashing: Problem with charger or connection

■ Green

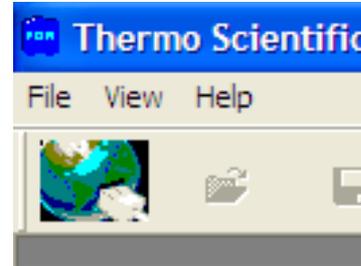
- Solid: Fully charged
- Flashing: 80% charged minimum



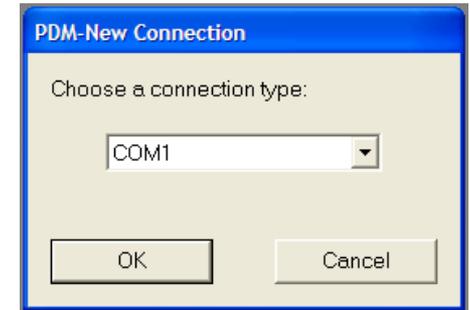
- ⚠ Keep PDM unit on charge when not in use. If PDM unit is not used within 3 months, run down PDM unit and recharge. Do not charge in environment below 32°F (0°C)

Opening WinPDM

- Use of WinPDM software requires Windows operating system



- Click button on top left corner of screen



- Choose connection type COM1 and click "OK"



Information to Get Started

2 Buttons

A is the “wake up” button
(blank screen)

B is the “scroll” button



Warm-up Time

- PDM unit will automatically start a warm-up period for 35 minutes prior to ANY sampling type's start time
- During warm-up period, the PDM will display the time remaining until sampling starts

Blinking "S"

(Upper Right Corner)



Status Condition Encountered



Status Screen

- Indicates a status condition encountered
- "S" remains for sample duration
- "S" restarts blinking if new status condition is logged

View Status Codes

Press **A** and **B** together

(A) RESET SAMPLE 2
(B) MORE OPTIONS...



Press **B** until you see

(A) VIEW STATUS
(B) MORE OPTIONS...



Press **A** to view status

PDM3700 Firmware Status Codes

Status Code	Description
TE not detected	Mass transducer not detected
High filter load	Differential pressure approaching maximum
Flow out of range	Flow rate is out of allowable range
Mass offset error	The PDM3700 has gained or lost too much mass over a short period of time
CPU fault	A CPU fault was detected
Power low	Power remaining in the battery has reached a critically low level
TE Frequency	The TEOM frequency is out of range
CPDM CPU reset	The PDM3700's CPU was reset
Power low shutdown	The PDM3700 was shutdown due to insufficient power
TE Temp out of range	The difference between the mass transducer and the setpoint is greater than 1°C
Sample Start Time Missed	The programmed sample start time was missed

Troubleshooting

(Diagnostic Failure during Warm-Up Period)

- View cause of failure
 - Press  and  together
 - Press  twice to scroll until “View Failures” option is displayed
 - Press  to view failures
- Flashing “DIAGNOSTIC FAILURE” will stop if condition causing failure is corrected before end of warm-up period



PDM MUST NOT be operated in an area of the mine where permissible electrical equipment is required, if the case is cracked, screw are missing or the MSHA approval label is missing or illegible

View Failures

Press **A** and **B** together

(A) RESET SAMPLE 2
(B) MORE OPTIONS...



Press **B** until you see



Press **A** to view failures

Troubleshooting

(Diagnostic Failure at end of Warm-Up Period)

- Sample run will not start
- Identify diagnostic failure
 - Press **A** to wake up
 - Press **B** to scroll and identify diagnostic failure
- Attach PDM unit to charger and start WinPDM program
- Start “Instrument Diagnostics”
 - First series of tests with pump and heaters off
 - Second series of tests with pump and heaters on

Troubleshooting

(Diagnostic Failures along with WinPDM Instrument Diagnostics)

PDM3700 Diagnostic Failure	WinPDM Instrument Diagnostics
AIR TEMP FAILURE	AIR TEMP
AMBIENT PRES FAILURE	AMBIENT PRES
AMBIENT TEMP FAILURE	AMBIENT TEMP
CLOCK FAILURE	CLOCK
DIFFERENTIAL PRESSURE	DIFFERENTIAL PRESSURE
FREQUENCY FAILURE	FREQUENCY
NO MASS TRANSDUCER	NO MASS TRANSDUCER
RH SENSOR FAILURE	RH SENSOR
RH TEMP FAILURE	RH TEMP
TE TEMP FAILURE	TE TEMP
FLOW RATE FAILURE	FLOW RATE (VOLTS)
TILT Z FAILURE	TILT Z DUTY CYCLE

Troubleshooting

(Diagnostic Failure at end of Warm-Up Period)

- Be sure to consult the manual on proper solution to the diagnostic failure
- Diagnostic failures that are the result of a digital board problem must be returned to the manufacturer for repair

Maintenance and Calibration

Daily

- Charge the internal battery pack assembly before each use, or as necessary
- Clean the grit pot after each use, or as necessary
- Clean the mass transducer and sample lines after each use, or as necessary
- Replace the TEOM filter after each use, or as necessary



These maintenance procedures can be conducted by either a person certified in sampling or a person certified in maintenance and calibration

Maintenance and Calibration

(continued)

Monthly

- Perform a flow audit once per month, or as necessary
- Clean the cyclone and inlet tubing once per month, or as necessary



The flow audit may be performed by either a person certified in sampling or a person certified in maintenance and calibration. The cleaning of the cyclone and inlet tubing may ONLY be performed by a person certified in maintenance and calibration

Maintenance and Calibration

(continued)

Annual

- K0 audit once a year, or as necessary
- Tilt audit once a year, or as necessary



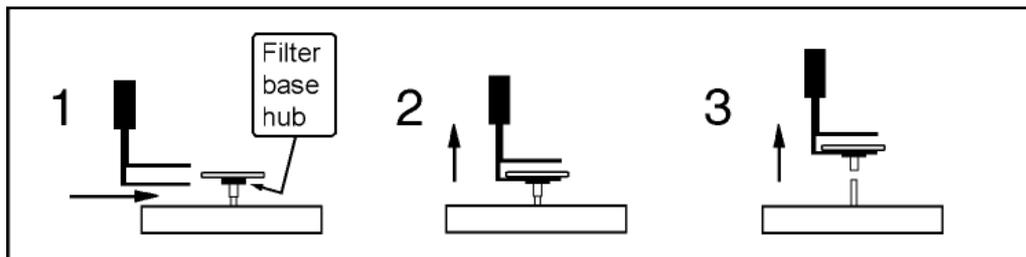
These audits must be conducted by a person certified in maintenance and calibration

Changing Filters

(Removal)

1. Locate the TE handle on the left side of the PDM3700 and slide the handle all the way to the right to unlock the mass transducer and then pull the mass transducer out of the unit.
2. Carefully insert the lower fork of the filter exchange tool into the filter change notch so that the filter disk is between the lower fork and the upper tab of the filter exchange tool. The tines of the lower fork should straddle the hub of the filter base.
3. Gently pull straight up from the tapered element (TE) lifting the filter from the TE.

Do not twist or tilt the filter exchange tool from side-to-side while removing the filter from the TE. This will damage the TE.



Filter change notch



Changing Filters

(Installation)

1. Clean the exchange tool with canned air or a clean cloth. Use it pick up a new TEOM filter from the box of filters, so that the filter disk lies between the fork and the upper tab of the tool, and the hub of the filter lies between the tines of the fork. Do not touch the filter with your fingers.
2. Lightly place the hub of the filter onto the tip of the tapered element, then slide the tool toward the notch and remove.
3. Turn the tool upside down, place the bottom of the spring loaded filter exchange tool on top of the filter and apply downward pressure until the filter tool stops. Lift the tool and rotate the mass transducer 90° and press down repeating this process a total of 4 times*.
4. Install the mass transducer back into the PDM3700 unit.



Cleaning PDM Unit

- The manufacturer requires the use of standard commercial canned air for cleaning a PDM
 - If using anything else, ensure the air is purified and free of any oil mist, such as compressor generated
- Isopropyl alcohol is suggested when cleaning anything that requires an alcohol swab

Cleaning PDM Unit

(Continued)

Remove

- Mass transducer
- TEOM filter
- Grit pot

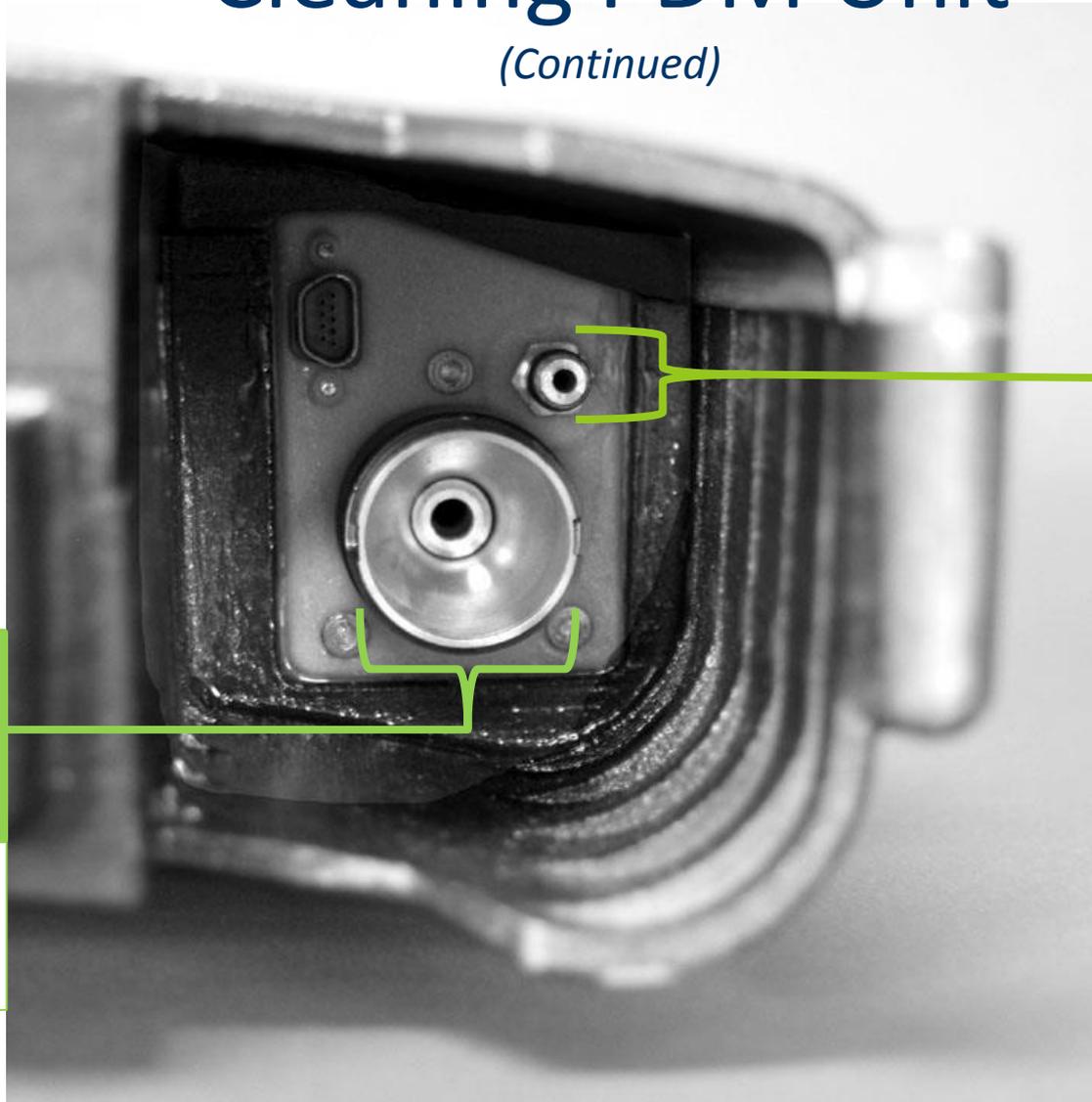


Spray compressed (canned) air inside (daily):

- Grit pot
- Sample inlet
- Plastic outlet (opposite direction from orifice)
- Housing of mass transducer, but not the connecting port
- Bell where mass transducer is installed (bell-shaped inlet)

Cleaning PDM Unit

(Continued)



Bell-shaped inlet

OK TO
SPRAY

Filter loading pressure sensor

DO NOT
SPRAY

This will damage the sensor and disable PDM

Cleaning CPDM Unit

(Continued)

Wipe with alcohol:

- Mass transducer
- Bell-shaped inlet
- Grit pot



Manufacturer requires that components listed above be cleaned daily or after each use

Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

(Daily)

1. Disconnect the sample line from the inlet assembly (inlet bracket).
2. Remove the mass transducer from the PDM3700 unit and remove the TEOM filter from the mass transducer.
3. Use canned air then an alcohol swab to clean all surfaces of the mass transducer.
4. Use canned air and an alcohol swab to clean the bell-shaped inlet inside the PDM3700 unit and then direct a stream of air through the bell-shaped inlet.

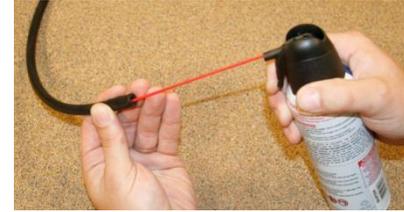
Disconnect
here



Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

(continued)
(Daily)

5. Direct a stream of air through the end of the sample line removed from the sample inlet assembly (inlet bracket) and through the sample inlet on the sample inlet assembly (bracket).



a



b



c



d



e

- Disassembly of the sample inlet assembly
 - a. Loosen screws on rear of bracket
 - b. Open sample inlet assembly bracket
 - c. Slide out sample inlet assembly
 - d. Remove sample inlet cap using tool provided
 - e. Clean sample inlet

Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

(continued)
(Daily)

6. Install a new TEOM filter onto the mass transducer and install the mass transducer into the PDM3700 unit. Reassemble the sample inlet assembly*.
7. Install the sample line onto the base of the sample inlet assembly (sample inlet).

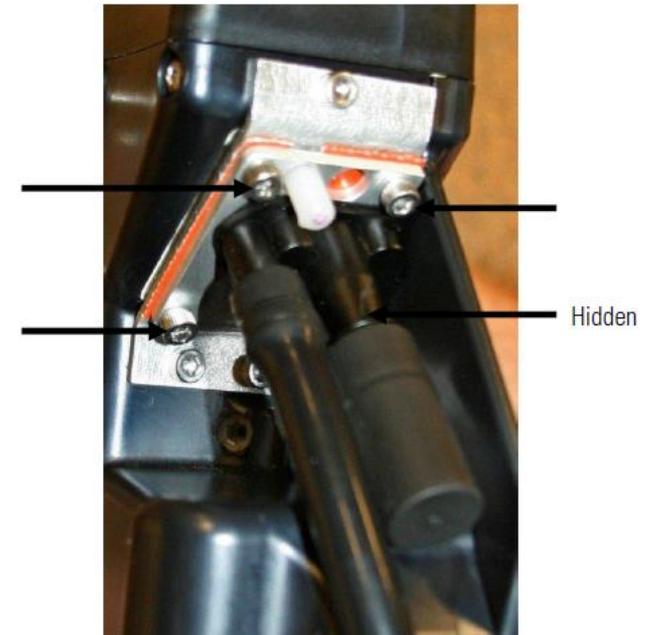


Make sure to inspect the O-ring in the top of inlet for damage

Cleaning the Cyclone and Inlet Tubing

(Monthly)

1. Remove the mass transducer from the PDM3700 unit.
2. Disconnect the sample line from the sample inlet assembly (inlet bracket).
3. Remove the grit pot from the PDM3700 unit and ensure that the grit pot and its plastic outlet are clean.
4. Locate the top cyclone plate on the right-hand side of the PDM3700 unit and use a 7/64-inch hex wrench to remove the four hex screws from the top cyclone plate.



Cleaning the Cyclone and Inlet Tubing

(Continued)
(Monthly)

5. Remove the top cyclone plate from the cyclone inlet assembly. Clean the cyclone inlet with an alcohol swab then direct a stream of air into the inlet.
6. Locate the red cyclone inlet assembly plate gasket (between the top cyclone plate and the cyclone inlet assembly).



Cleaning the Cyclone and Inlet Tubing

(Continued)
(Monthly)

7. Check the red cyclone inlet assembly plate gasket for signs of wear or damage, and replace the gasket, if necessary.
8. Using the small flat-head screwdriver, remove the four screws that secure the top cyclone plate to the inlet tubing.
9. Using an alcohol swab, clean the top cyclone plate.
10. Check the inlet tubing gasket for signs of wear or damage, and replace the gasket, if necessary. Using canned air, direct a stream of air up through the inlet tubing.



Step 10: Inspecting the Inlet tubing gasket



Step 10: Cleaning inlet tubing with canned air

Cleaning the Cyclone and Inlet Tubing

(Continued)

(Monthly)

11. Using an alcohol swab, clean the end of the inlet tubing.
12. Install the inlet tubing gasket onto the end of the inlet tubing.
13. Install the top cyclone plate onto the end of the inlet tubing.
14. Install the top cyclone plate onto the cyclone inlet assembly.
15. Install the sample line onto the sample inlet assembly (inlet bracket).
16. Install the grit pot.
17. Install the mass transducer into the PDM3700 unit.
18. Perform a sample path (sample line) leak check.

Items to Remember

- **Use appropriate software**

WinPDM 7.2 (or higher) software should be installed on the computer. Version 7.1 (or higher) firmware should be installed on the PDM unit. All computer versions (Software or Firmware) should be the most up-to-date, only the manufacturer can install or upgrade the firmware

- **Wipe down connectors**

Always wipe down the connectors on the PDM unit and charging bracket to obtain a good connection. Using an alcohol swab is recommended

Items to Remember

(Continued)

- **Install mass transducer properly**

Firmly press the mass transducer into the unit while securing the latch and then check to make sure the mass transducer does not slide out of the PDM unit

- **Program accurate computer information**

Make sure your computer's date and time are accurate when using WinPDM. The PDM unit uses this information. This is important when there are time zone changes and daylight saving time changes

Items to Remember

(Continued)

- **Running a Manual Start**

(Instead of programming by computer)

- **PDM unit remembers last programmed information**

This can affect information such as time, temperature, etc. If information needs changed, program the PDM unit to run a sample ahead of time

- **Locked PDM unit screen**

Connect the PDM unit to charger and computer, and run the WinPDM software to unlock the PDM unit

Items to Remember

(Continued)

- If inlet is immersed in water
 - Remove and empty the mass transducer of water immediately. Reinstall mass transducer
 - Run clean water through the PDM unit as soon as possible (Do not immerse the PDM unit into water). Running clean water through the inlet may not be possible when in a mine
 - Empty the mass transducer once again and reinstall
 - Next, let the PDM unit run for a long time (many hours) to work the water through and dry the PDM unit (the unit may run while on the charging unit)



As soon as possible use canned air to spray out the mass transducer and sample path

Items to Remember

(Continued)

- PDM Serial Number will be displayed on the top display panel by pressing the  button while the PDM is charging
- Mass Transducer has a separate Serial Number

PDM Flow Audit, Leak Check, and Calibration

Outline

- Flow Audit
- Sample Path Leak Check
- Case Leak Check
- Calibration

Flow Audit

(Monthly)

- Flow Audits are to be performed once a month or as necessary
- Verifies the flow rate is within the accepted range
 - $2.2 \pm 2.5\%$ (2.145 – 2.255) lpm (Manufacturer's specification)
- 30 CFR Part 74 requires that a CPDM's flow rate be within 5% of the calibrated flow for 95% of samples up to 12 hours in duration

Flow Audit

(Continued)

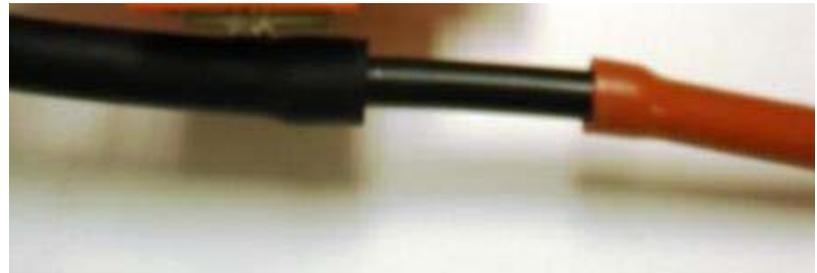
(Monthly)

- Materials needed for Flow Audit
 - Flow meter
 - Flow audit inlet tubing adapter (if necessary)

Flow Audit Steps

(Monthly)

1. Disconnect the sample line from the sample inlet assembly (inlet bracket).
2. Install one end of the tubing adapter (if necessary to connect) into the sample line from the inlet assembly (bracket) and the other end of the tubing adapter into the tubing that is attached to the flow meter.



3. Connect the PDM3700 unit to the charger and make sure the charger is connected to your PC.
4. Open the WinPDM software and connect to the instrument.

Flow Audit Steps

(Continued)

(Monthly)

5. Start a primary sample run on the PDM3700 unit.
6. Wait 10 minutes to allow the flow rate to stabilize, then check the flow rate readings on the flow meter.
7. Ensure that this value matches the 2.2 lpm flow rate set point for the PDM3700 unit. If the flow meter reading is within your acceptance criteria end the sample run, remove the tubing adapter and reinstall the sample line. If the flow meter is not within your acceptance criteria, a flow calibration must be performed.



If flow is outside acceptable range, a person certified in maintenance and calibration should perform a flow calibration

Leak Checks

- Tool/materials needed for this procedure include:
 - Leak check adapter (leak check suction cup)
 - Inlet plug
- Two types of leak checks:
 - Sample Path
 - Case
- Leak checking must be performed periodically and anytime the PDM case is opened for maintenance. Other examples include:
 - Cleaning the cyclone and inlet tubing
 - Performing a flow calibration
- The sample path leak check must be performed before the case leak check is performed

Leak Check Steps

1. Disconnect the sample line from the sample inlet assembly (inlet bracket).
2. Connect the PDM3700 unit to its charger and start the WinPDM software.
3. When in the PDM - COM1 screen, select the "Leak Check"* button to display the Leak Check Routines screen.



*Manual being revised

Leak Check Steps

(Continued)

4. A sample path leak check must be performed before a case leak check can be performed. Select the Leak Check Sample Path Routine and follow the instructions on the screen. Remove the sample line from the sample inlet assembly (inlet adapter) and plug using the insert inlet plug.

When the process is complete, a leak check passed or failed message is displayed on the screen. If the leak check fails, refer to the Troubleshooting section for information about leak failures.

5. After the sample path leak check passes, select the “Leak Check Case” button. A Warning/Confirmation screen will display with a “Place the inlet adapter in the inlet” message. Install the inlet adapter (case leak check suction cup) into the sample line. Select “OK.”



Step 4: Inlet plug inserted into the sample line.



Step 5: Inlet adapter inserted into the sample line.

Leak Check Steps

(Continued)

6. Another Warning/Confirmation screen will display with a “Attach the inlet adapter to the PDM” message. Install the suction cup side of the housing leak check suction cup onto the battery compartment vent that is located below the communication connections on the PDM3700. Select the “OK” button.



Step 6: Inlet adapter attached to the battery compartment vent.

Leak Check Steps

(Continued)

7. The Calibrate/Audit screen will display with a “Performing case check” message. The PDM3700 unit will perform the case leak check and display a pass or fail message on the Calibrate/Audit screen (Figure 5–46).
8. If the leak check passes, remove the case leak check suction cup from the battery compartment vent and remove the case leak check suction cup from the sample line. Return to normal operation. If the leak check fails, refer to the Troubleshooting section.

Sample Path Leak Check Troubleshooting

- The most common sources of a leaking sample path, in order of most likely to cause leaks:

1



- 1 Grit Pot – Not seated, needs lubricated (grease), torn or punctured.

2



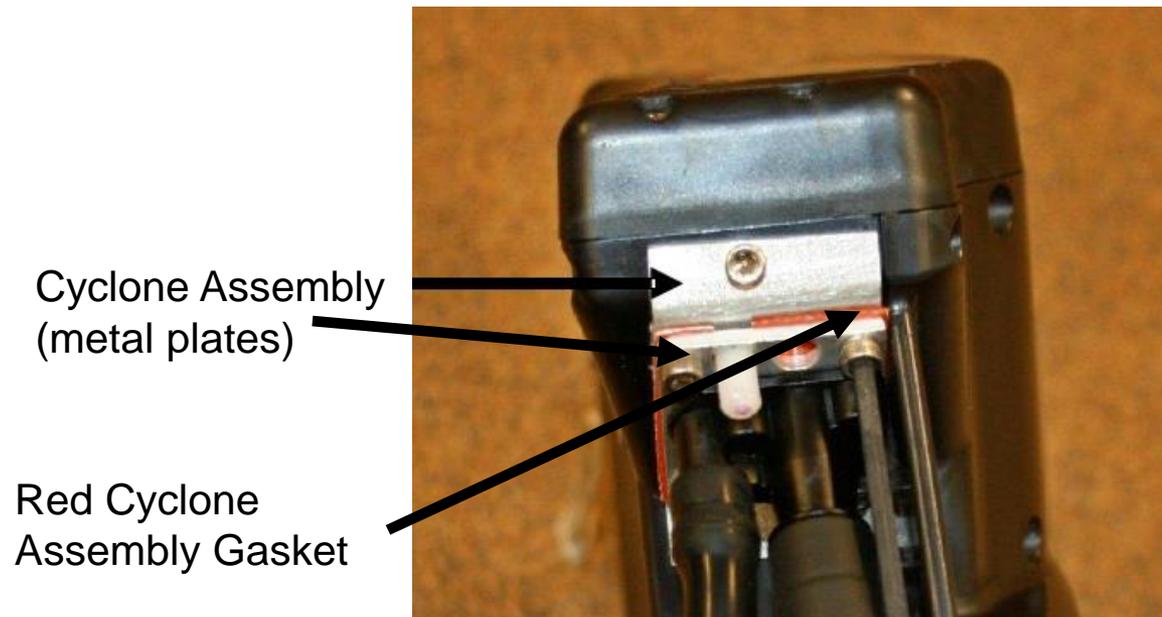
- 2 Mass transducer O-rings –Needs lubricated (grease), torn, or damaged.

Note: Use silicone compound for lubrication

Sample Path Leak Check Troubleshooting

(Continued)

- 3 Red Cyclone Assembly Gasket (Cyclone Gasket) – Screws not tight, gasket damaged, metal plates damaged.



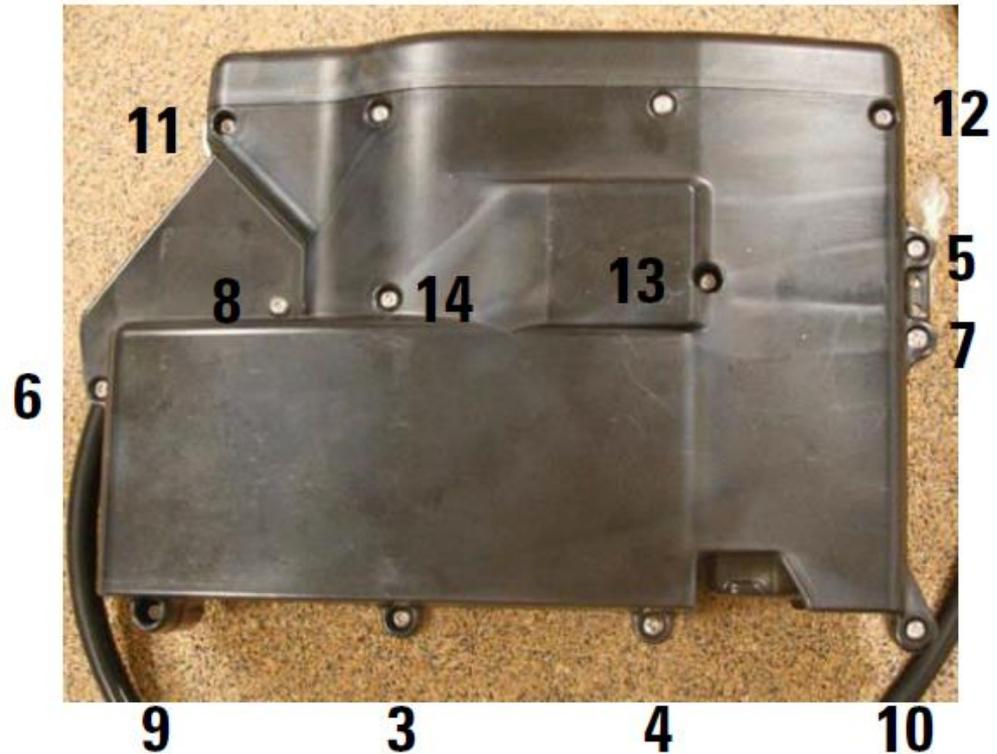
Case Leak Check Troubleshooting

(Continued)

- The most common sources of a leaking battery compartment, in order of most likely to cause a leak:

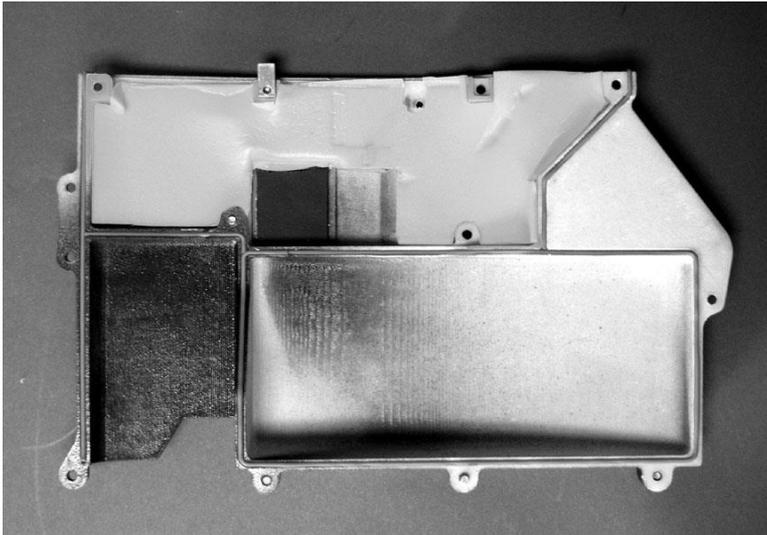
1

Screws – Missing or not tightened to 6 in.-lbs per sequence shown



Case Leak Check Troubleshooting

(Continued)



2

Front Cover Panel (Front Cover) – cracked or damaged front cover panel (cover), cover gasket (o-ring gasket) missing/damaged

Flow Calibration

- Tool/materials needed for this procedure:
 - Flow meter
 - Tubing adapter (if necessary)
 - Flow meter tubing (if necessary)
 - Flow calibration kit (59-010019)
 - Black (0.033-inch) orifice
 - Red (0.028-inch) orifice
- Flow calibration must be conducted if the flow audit fails
- Sample path leak check must be performed prior to a flow calibration

Flow Calibration Steps

1. Install a new TEOM filter.
2. Disconnect the sample line from the sample inlet assembly (inlet bracket).
3. Perform a sample path leak check (leak check of the sample line).
4. Connect the PDM3700 unit to its charger and start the WinPDM software.
5. When in the PDM - COM1 screen, select the “Flow Calibrations” button to display the Flow Calibration screen.



Flow Calibration Steps

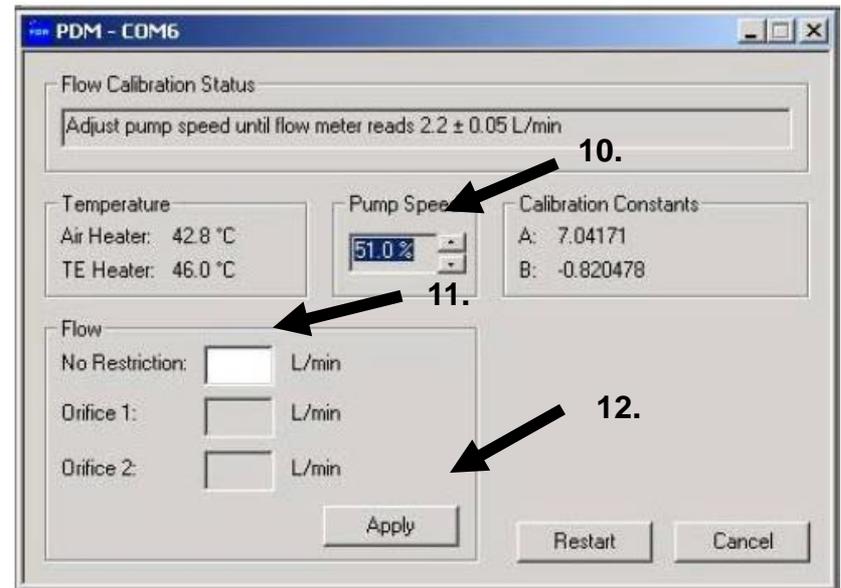
(Continued)

6. In the Flow Calibration screen, the Air Heater and TE Heater must stabilize before a flow calibration can be performed. A Warning/Confirmation screen displays the “Connect flow meter to sample tube inlet” message when the flow calibration can begin.
7. Install the tubing adapter (if necessary to connect) into the sample line.
8. Install the other end of the tubing adapter (if necessary to connect) into the tubing that is attached to the flow meter (if necessary to connect).
9. Select the OK button. The Flow Calibration screen will display with the “Pump Speed” box active.

Flow Calibration Steps

(Continued)

10. Increase or decrease the flow rate reading on the flow meter by clicking on the small arrows (black triangles) located to the right of the “Pump Speed” box. Adjust pump speed until the flow meter reads 2.2 lpm.
11. When the flow rate reading on the flow meter matches 2.2 lpm, record the flow rate reading (from the flow meter) into the “No Restriction” (lpm) white box. Wait 2-3 minutes to ensure the flow meter is stable.
12. Select the “Apply” button. The PDM3700 unit will begin the flow calibration routine and will display a “Please wait, gathering data” message on the Flow Calibration screen.



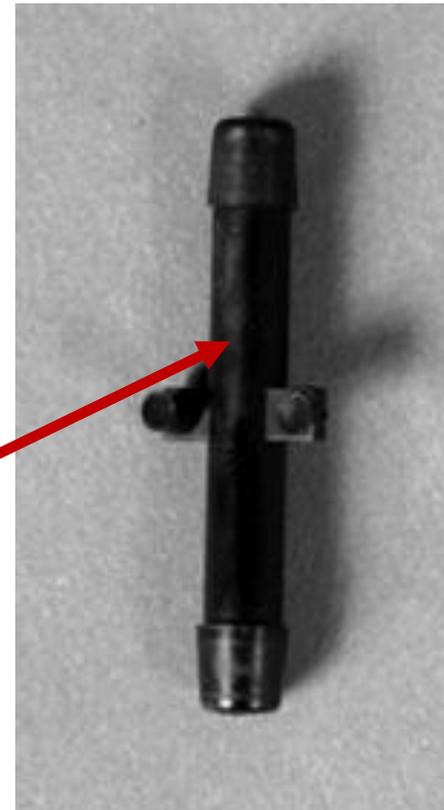
Flow Calibration Steps

(Continued)

13. A warning/confirmation will display “Attach black orifice inline between flow meter and sample tube”*
14. Remove the tubing adapter (if necessary to connect) from the sample line.

Note: The pump speed is not adjusted after step 10; which is before attaching orifices

Orifice



*Manual needs revised

Flow Calibration Steps

(Continued)

15. Locate the black (0.033-inch)* orifice. Install one end of the orifice into the sample line then install the other end into the tubing that is attached to the flow meter.



Step 15: Sample line connected to the flow meter via the orifice.

*Manual needs revised

Flow Calibration Steps

(Continued)

16. When in the Warning/Confirmation screen with an “Attach orifice” message, select the “OK” button. The Flow Calibration screen will display with the Pump Speed white box active.
17. Do Not adjust the pump speed. Enter the Orifice 1 flow rate from the flow meter (typically 2.0 lpm).
18. Select the “Apply” button. The PDM3700 unit will continue the flow calibration routine and will display a “Please wait, gathering data” message on the Calibrate/Audit screen.

Flow Calibration Steps

(Continued)

19. A Warning/Confirmation screen will display with a “Attach red orifice inline between flow meter and sample tube”* message.
20. Remove the black* orifice from the sample line and flow meter tubing.
21. Install the red* orifice into the sample line then install the other end of the orifice into the flow meter tubing (tubing that is attached to the flow meter).
22. When in the Warning/Confirmation screen with an “Attach red* orifice to the inlet” message, select the “OK” button. The Flow Calibration screen will display with the Pump Speed white box active.
23. Do Not adjust the pump speed. Enter the Orifice 2 flow rate from the flow meter (typically 1.8 lpm).
24. Select the “Apply” button. The PDM3700 unit will continue the flow calibration routine and will display a “Please wait, gathering data” message on the Flow Calibration screen.

*Manual needs revised

Flow Calibration Steps

(Continued)

25. The PDM3700 unit will perform the remainder of the flow calibration routine and display a “Flow calibration complete” message on the Flow Calibration screen.
26. Select the “Yes” button to accept the new flow values or the “No” button to keep the old values. Press the “Restart” button to perform a new calibration or the “Cancel” button to exit.
27. Remove the red* orifice from the sample line and flow meter tubing.
28. Install the sample line onto the sample inlet assembly (inlet bracket).

NOTE: MSHA recommends conducting another flow audit to verify the flow calibration.

*Manual needs revised

PDM K0 Audit and Tilt Audit

K0 Audit

- K0 number is the calibration constant
- The K0 Number must be audited once per year or as necessary
- Always use a new filter when doing a K0 Audit
- Make sure the PDM is upright during the audit



PDM in upright position

Tools and Materials for K0 Audit

- K0 Audit kit (tweezers, weights)
- Alcohol swab
- Small flat head screwdriver
- 7/64 Hex wrench

K0 Audit Steps

(Annually)

1. Connect the PDM3700 unit to its charger and start the WinPDM software.
2. When in the PDM - COM1 screen, select the “K0 Audit” button to display the K0 Audit screen.

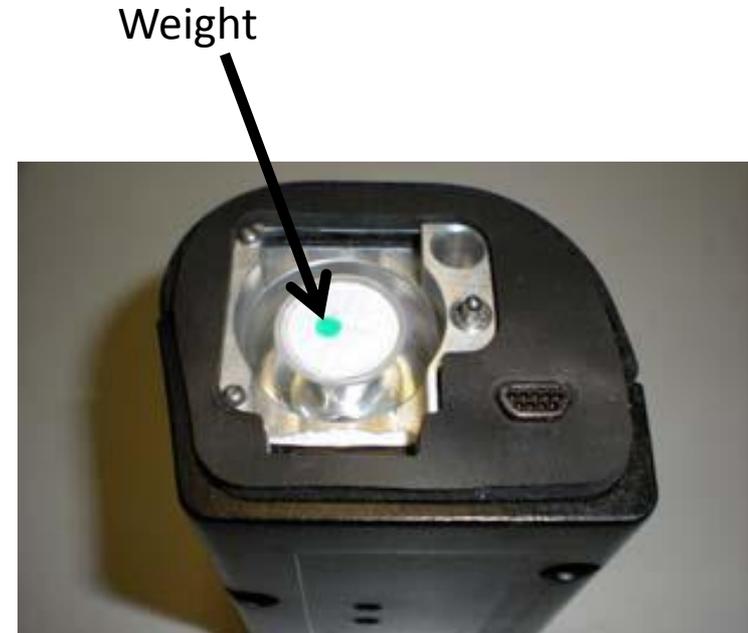


2.

KO Audit Steps

(Continued)
(Annually)

3. The instrument could take up to 45 minutes to stabilize the TE frequency.
4. When stable, the computer will prompt to add the first weight to the filter.



Step 4: Mass transducer removed with weight placed on the filter.

Before adding any weights, make sure the tweezers and screwdriver are clean and use the alcohol swab to clean the weights.

K0 Audit Steps

(Continued)

(Annually)

5. The computer will prompt to add three* more weights. Place the weights consecutively as shown below.



* Manual being revised

K0 Audit Steps

(Continued)
(Annually)

6. After the final weight has been added, a % error will be displayed.

The screenshot displays the 'PDM - COM1' software interface. The main window shows the 'K0 Audit Status' as 'Audit passed'. Below this, there are sections for 'Temperature & Frequency Stabilization' and 'Measurements'. The 'Results' section shows 'Stored K0: 14779', 'Calculated K0: 15535', and '% Error: 5.117'. A smaller 'K0 Audit' dialog box is overlaid on the bottom right, displaying an information icon, the text 'K0 audit passed', 'Stored value: 14779', 'Calculated value: 15535', and '% Error: 5.117', with an 'OK' button.

Temperature & Frequency Stabilization		
Current Temperature:	Mass Transducer: 49.860 °C	Air Heater: 46.814 °C
Temperature Goal:	49.8 to 50.2 °C	46.5 to 47.5 °C
Current Frequency:	292.924103 Hz	
Avg Rate of Change:	0.40 mHz/min	
Avg Rate of Change Goal:	0 ±1.00 mHz/min	

Measurements		
Frequency (Hz)	K0	% Difference
F0 295.816528		
F1 295.085910	15531	-0.023
F2 294.363520	15562	0.174
F3 293.640139	15527	-0.052
F4 292.923960	15519	-0.098

Results	
Stored K0:	14779
Calculated K0:	15535
% Error:	5.117
% Error Goal:	-10 to 10%

Plus or minus 10% is the maximum percent error of the K0 number that is allowed for a K0 audit to be successful

K0 Audit

(Continued)

(Annually)

- Note the mass transducer has a separate serial number that should be recorded along with the date when the last K0 audit was performed. The mass transducer must have a K0 audit performed annually as recommended by the manufacturer to be used for collecting respirable coal mine dust samples

Tilt Sensor Audit

The tilt sensor must be audited once per year or as necessary.

Tilt Sensor Audit Steps

(Annually)

1. Connect the PDM3700 unit to its charger and start the WinPDM software.
2. When in the PDM - COM1 screen, select the "Tilt Audit" button to display the Tilt Audit screen.



Tilt Sensor Audit Steps

(Continued)

(Annually)

3. The instrument could take up to 45 minutes to stabilize the TE frequency.
4. When stable, the computer will prompt to position the instrument upright as shown (Display facing up).



Tilt Sensor Audit Steps

(Continued)

(Annually)

5. When prompted, position the instrument on the right side (mass transducer) as shown. When prompted position the PDM on the battery connector side.*



Step 5: Right Side



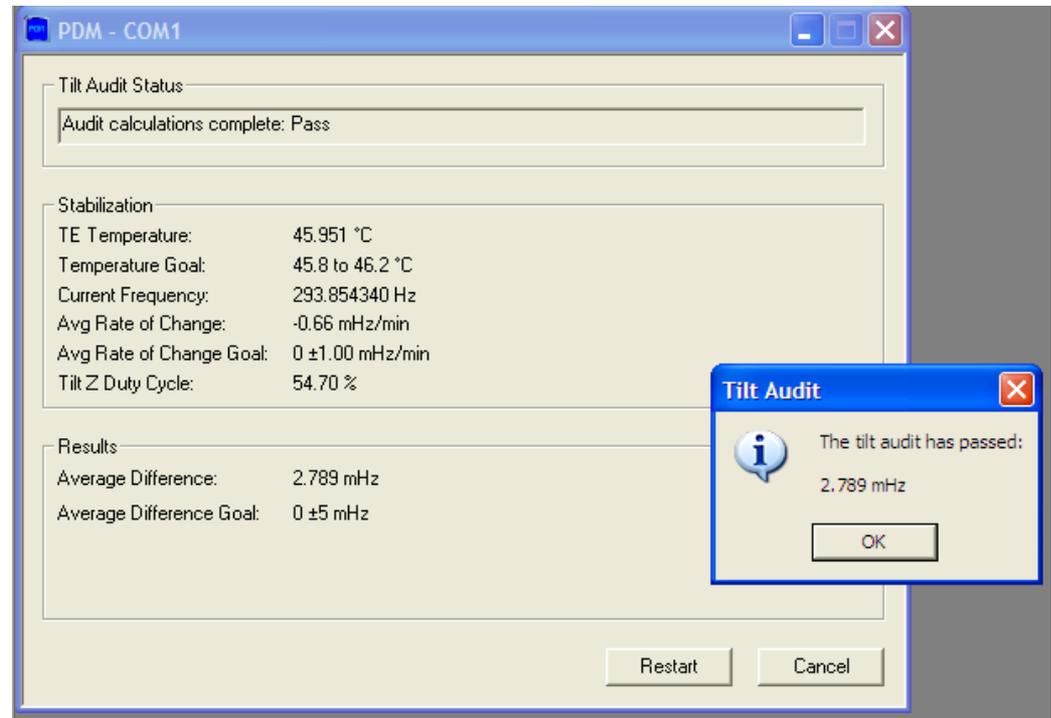
Battery Side

*Manual needs revised

Tilt Sensor Audit Steps

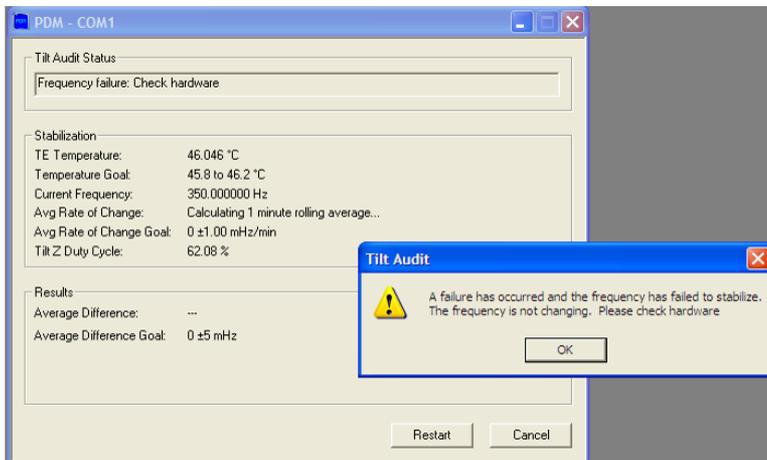
(Continued)

6. When complete, the computer will indicate a pass or fail status.



Tilt Sensor Audit Steps

(Continued)



If the Tilt Audit fails make sure the PDM is held stable and make sure there was a filter installed in the mass transducer.

PDM Periodic Maintenance and Related Tasks

Periodic Maintenance and Related Tasks

- In addition to regularly scheduled maintenance, the unit may require other maintenance, including:
 - Replacing the battery pack
 - Replacing the Pump
 - Lubricating Mass Transducer O-Rings
 - Flow Calibration (Previously covered in PDM Flow Audit, Leak Check, and Calibration section)

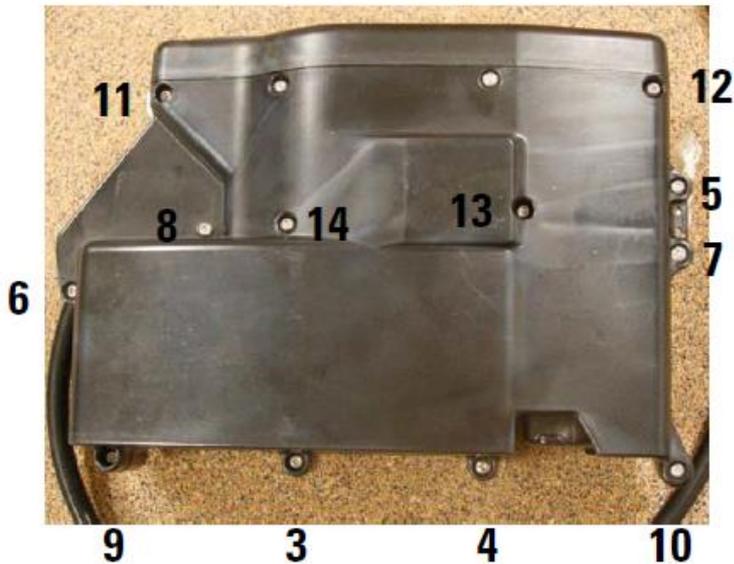
Opening PDM3700 Case and Removing the Front Cover Panel of the PDM Case

Some of the maintenance procedures require the user to open the case and remove the front cover panel of the PDM case.

1. Remove the mass transducer from the PDM3700 unit and place it on a flat surface so that the front is accessible.
2. Using the Phillips screwdriver, remove the screw from location 12 first(next slide). Next, in order, remove screws from locations 14, 13, 11, and 10. Finally, remove the remaining screws in any order of preference except locations 1 and 2 which should be removed last.
3. Remove front cover panel of PDM case (cover panel).

Opening PDM3700 Case and Removing the Front Cover Panel of the PDM Case

(Continued)



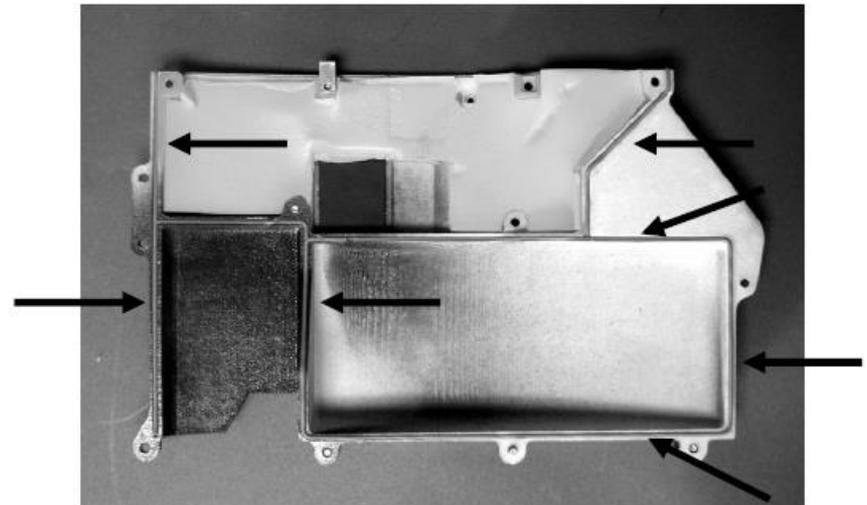
Front Cover Panel Screws



Top Display Screws

Installing the Front Cover Panel of the PDM Case

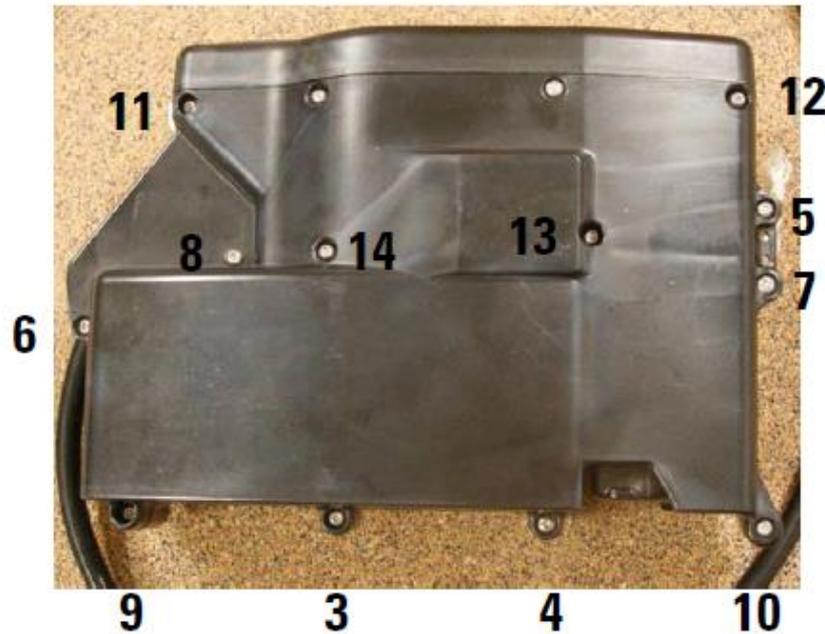
1. Inspect the gasket and sealing surface to ensure they are clean and free of defects. Replace the gasket, if necessary. Install the gasket.
2. Install the front cover onto the PDM3700 case. Ensure that the two screw holes on the top of the front panel are aligned with the screw holes on the top of the PDM3700.
3. Verify that the cover gasket seats properly in place.



Cover gasket checkpoints

Installing the Front Cover Panel of the PDM Case

(Continued)

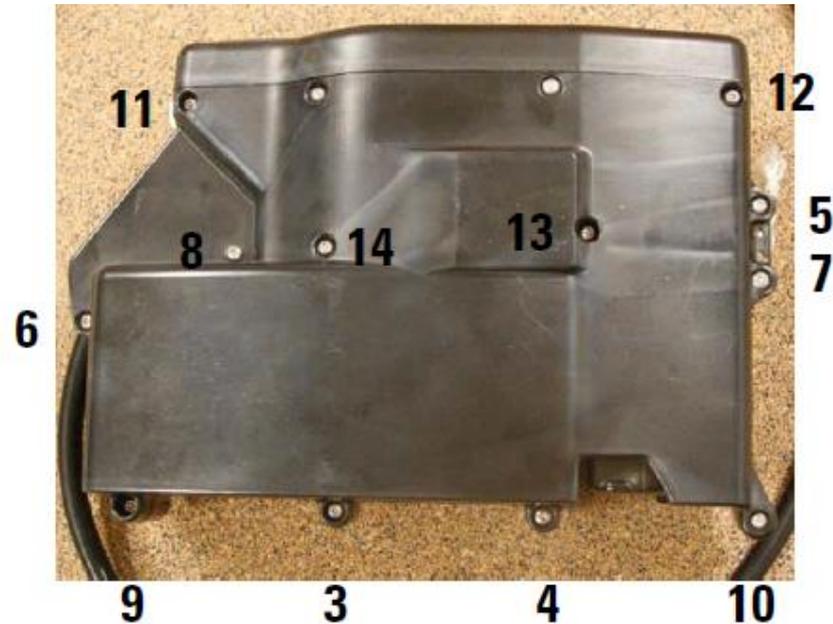


4. Install the screws in locations 1 and 2 until seated (Figure 5–40). Press down on back of cover, aligning holes 3 and 4. Put a screw into either location 3 or 4 and tighten lightly. Then torque the screws to 6-in. lbs, respectively on location 1 and 2.

Installing the Front Cover Panel of PDM Case

(Continued)

6. Install the remaining screws into the front cover panel (front panel) to get them started in numerical order (a cross-pattern) as shown. Then, tighten until seated in numerical order (a cross-pattern) as shown. Finally, torque the screws to 6-in. lbs in numerical order (a cross-pattern) as shown.
7. Perform a sample path and case leak check*.



*Manual needs revised

Replacing the Battery Pack

1. Remove the front cover panel (PDM3700 cover plate) (Opening PDM3700 Case and Removing the Front Cover Panel of the PDM Case).
2. Locate the battery pack assembly in the bottom of the unit.
3. Carefully remove the battery pack “A” from the PDM3700 unit. Press the small tab on the wire connection to disconnect the battery wires.
4. Inspect the battery pack and the PDM3700 unit's case for damage.
5. Install a new battery pack assembly into the PDM3700 unit.
6. Check mass transducer O-rings and lubricate them if necessary (refer to Lubricating the Mass Transducer O-Rings).

Replacing the Battery Pack

(Continued)

7. Install the front cover panel (PDM3700 cover plate) (refer to Installing the Front Cover Panel of the PDM Case).
8. Install the mass transducer into the PDM3700 unit.
9. Press the “A” (“WAKE UP”) button on the top panel of the PDM3700 unit to ensure that the display screen appears.
10. If the display screen does not appear, open the case and double-check the battery connections. Reassemble the case, and press the “A” (“WAKE UP”) button again. If the display screen does not appear, contact Thermo Fisher Scientific.
11. Properly dispose of the used PDM3700 battery packs. Recycling is the preferred method of disposal. Contact Thermo Fisher Scientific for further information. Do not dispose of the battery packs in fire or heat.
12. Perform a sample path leak check and a case leak check.

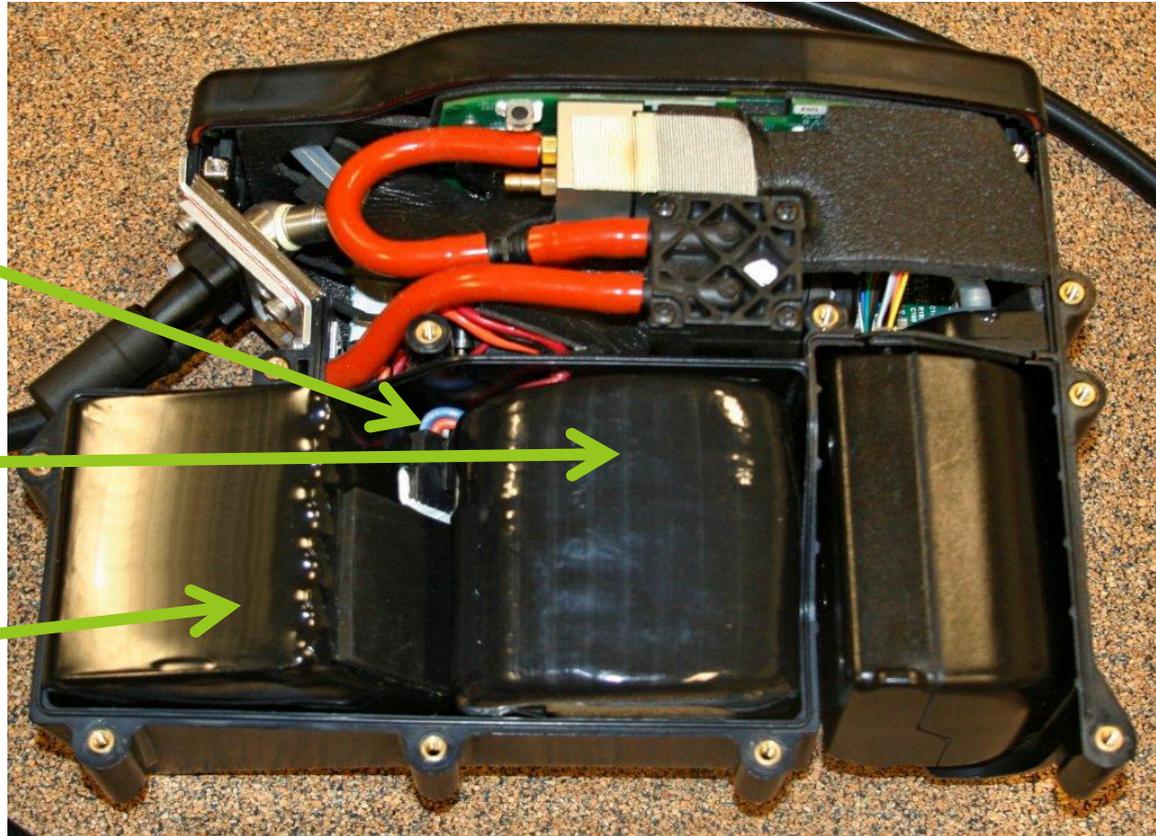
Replacing the Battery Pack

(Continued)

Wire
Connector
(Step 3)

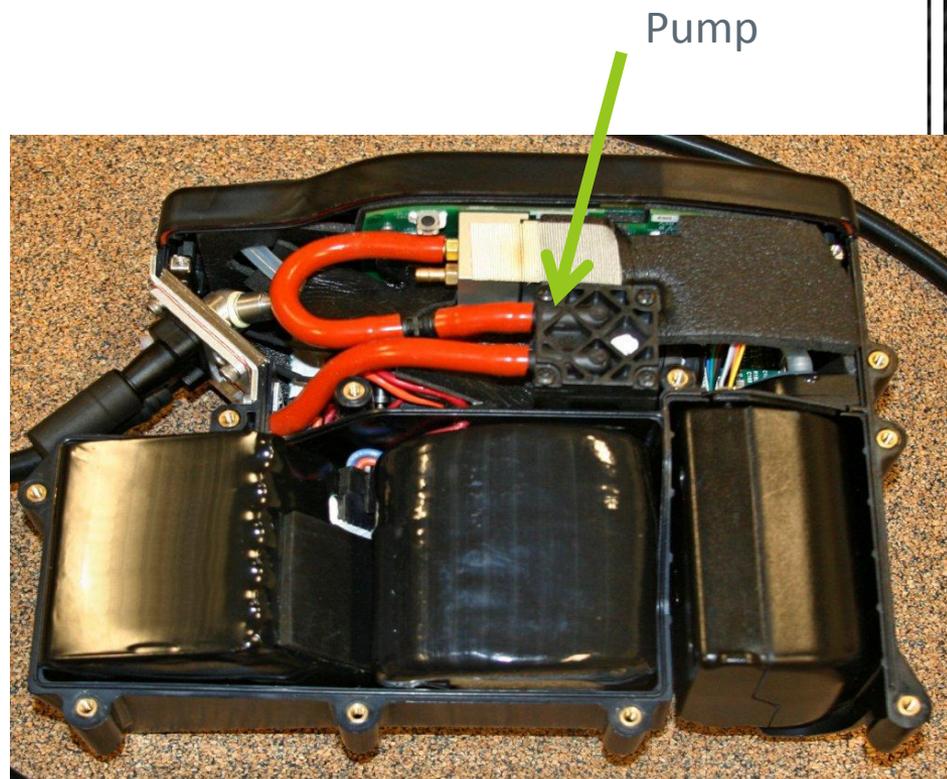
Foam Spacer

Battery Pack
(Step 2)



Replacing the Pump

Contact Thermo Fisher Scientific if the pump needs replaced.



Lubricating Mass Transducer O-Rings

1. Remove the front cover panel (PDM3700 cover plate) (refer to “Opening PDM3700 Case and Removing the Front Cover Panel of the PDM Case”).
2. Locate the mass transducer chamber of the PDM3700 and the two O-rings in the top of the chamber.
3. Using the cotton swab, apply the silicone compound to the O-rings.
4. Install the front cover panel (refer to “Installing the Front Cover Panel of PDM Case”) and perform a sample path and case leak check*.



*Manual needs revised

MSHA Website

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