



1 CFM HIGH PRESSURE DIFFUSER OPERATION PROCEDURE

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AIR PARTICULATE MONITORING WITH THE EMTEK, LLC 1 CFM HIGH PRESSURE DIFFUSER

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PURPOSE

To describe the procedure for monitoring the particulate load in compressed air and gas systems with the aid of the One (1) Cubic Foot per Minute (1 CFM) High Pressure Diffuser (HPD) from EMTEK, LLC.

PRINCIPLE

The EMTEK 1 CFM HPD is a accessory that can be used in conjunction with most 1 CFM (28.3 LPM) Laser Particulate Counters (LPC's) that permits direct particle sampling of pressurized air, nitrogen, and inert, dry, non-toxic gases. During testing, the HPD's internal 1 CFM orifice and diffuser configuration reduces the air flow from pressurized systems ranging from 15 psi up to 125 PSI to approximately ambient conditions, to allow for a 1 CFM sample rate required by 1 CFM particle counters, without over pressurizing the particle counter and allowing it to operate within its calibrated parameters.

The EMTEK, LLC HPD is designed to operate with 1 CFM particle counters for measurement of 0.3 micron and larger particles to allow for sampling at the use point under full system pressures from 15 to 125 psi. If the system pressure is greater than 125 a regulator or valve can be placed at the use point to bring the pressure down to the operative range of the HPD. If the system pressure is lower than 15 psi environmental air and associated particulate matter may be drawn into the HPD through the vent holes and as such will not give an allow for an accurate assessment of the system being tested.

SCOPE

This SOP covers the following:

1. Control Count Test
2. Set-Up and Testing
3. Cleaning and Storage

RESPONSIBILITIES

It is the responsibility of all personnel performing air particulate monitoring with the aid of the EMTEK 1 CFM HPD to be trained and proficient with this procedure.

MATERIALS

- EMTEK 1 CFM High Pressure Diffuser, Model No. EMT.HPD1, or EMTEK.HPD1
- 1 CFM Laser Particulate Counter
- 0.750" Inch Sanitary Fitting, Gasket (e.g., Teflon, or platinum cured silicon are preferable gasket materials), and Sanitary Clamp (for connection to the air/gas System) Other fitting configurations may be used if required to attach the HPD securely to the system test point.
- 0.188" or 0.375" ID Low or Non-Particulate Generating Tubing (e.g., Hytrel Tubing with EVA Liner, for connection to the particle counter)
- Gloves: Clean, Non-Particulate Shedding (e.g., Latex, or Nitrile)
- Particulate free, non-residue forming disinfectant (e.g., 70% sterile filtered alcohol, IPA, or EtOH) and/or de-ionized water.
- Non-particulate shedding wipes (e.g., Gamma Wipes)
- Low profile (thin) 11/32" and 5/8" open end wrenches
- Control Count Filter Assembly (e.g., 0.2 Micron Capsule or Canister Type Filter with appropriate pressure rating and fittings for attachment to pressurized air or gas system pressure)

PRE USE VISUAL/SAFTEY INSPECTION

To assure appropriate operation and safe use of the EMTEK HPD, prior to each days use, sampling personnel should inspect the unit for any obvious physical defect. This inspection shall include but not be limited to the following:

- A visual check of the sanitary connection and gasket to assure it is not visibly damaged in a way that would keep it from sealing appropriately (tears in the gasket, etc.).
- A visual check to ensure that the HPD is free of occlusions to assure proper sample flow.
- A manual check to ensure that the 3 pieces of the HPD are securely assembled and tightened.

If any maintenance need be performed, contact appropriate service or repair personnel.



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IMPORTANT SAFETY PRECAUTIONS!!

Operation and testing of high pressure air and gas systems has inherent risks, which can lead to injury and death. Follow all safety procedures and precautions as specified in your companies, or site guidelines, procedures, or other applicable documents. Additionally, to minimize the chance of injury when using the EMTEK 1 CFM HPD:

- Assure that the 3 pieces of the HPD are properly assembled and the fittings are tightened prior to each use.
- Assure that the sanitary fitting is properly connected to the air/gas system prior to activating the sample location.
- Do not use the EMTEK 1 CFM HPD on systems/drops pressurized to greater than 125 psi without additional regulation of the use/test point to bring the drop pressure below 125 psi.
- Do not perform direct testing of pure, or high percentage oxygen systems.
- Wear appropriate Personal Protective Equipment (PPE) including safety glasses and/or face shield to avoid injury to eyes.
- Again, follow all applicable company, or site specific safety precautions for operation and testing of the pressurized air/gas system.

PROCEDURE

1. Control Count Test

Control Count Testing is performed to verify the HPD and tubing are virtually particulate free. It is ideal to perform Control Count Testing Prior to each days testing, after cleaning of the HPD, or if the HPD and/or associated sample tubing are suspect of harboring particulates. The Control Count Test is performed as follows:

- 1.1 Attach the Control Count Filter assembly to a closed compressed air or gas drop with appropriate fitting(s).
- 1.2 Attach the inlet end of the HPD, with the sanitary connector, to the control count filter with appropriate fitting(s).
- 1.3 Attach the outlet end of the HPD, with the barbed connector, to the sample tubing to the LPC sensor inlet with appropriate tubing and ensure the LPC is set to a sample rate of 1 CFM (or 28.3 LPM).

- 1.4 Open the system pressure feeding the Control Count Filter assembly and adjust the pressure to 20-30 PSI,
- 1.5 Begin sampling with the LPC, following applicable LPC operation procedures, and take five (5) one-minute sample counts.
- 1.6 Turn off the LPC and close the system valve feeding the Control Count Filter.
- 1.7 Two consecutive counts of ≤ 10 particles should be obtained as the result for particles ≥ 0.5 microns and or ≤ 40 particles as the result for particles ≥ 0.3 microns for an acceptable Total Control Count Test.
- 1.8 If acceptable results are obtained, the HPD/tubing assembly is acceptable for testing.
- 1.9 If acceptable results are not obtained, the HPD or tubing may be contaminated and may be shedding particles. Try the following steps to address the particulate counts.
 - 1.9.1 Purge the HPD and tubing assembly for a period of time to see if the counts fall within an acceptable range.
 - 1.9.2 Obtain new clean tubing and repeat the Control Count Test.
 - 1.9.3 If results are still not acceptable, clean the HPD (per Section 4) and repeat the Control Count Test.
 - 1.9.4 If a particle counter malfunction is suspected, perform a control count test directly on the LPC. Refer to the site specific procedure or operator manual for this test, or to troubleshoot the equipment. Or, obtain another particle counter and repeat the Control Count Test.
- 1.10 Record the diffuser serial number or equipment number, analyst initials and date sampled on Control Count printout from the LPC.
- 1.11 Retain the result of the Total Particulate Control Count with the sampling data of the day.
- 1.12 Repeat the Total Particulate Control Count as needed when performing sampling on multiple sites. High particulate counts can cause the diffuser to become soiled and shed particles.

2. Set Up and Testing

Caution: Ear protection may be required.

2.1 Check the system, or test point pressure is within the range of the HPD (15-125 psi). Document the drop pressure on the LPC print out if applicable.

2.1.1 If the pressure of the drop exceeds the range of the HPD, regulate the drop pressure before testing so that it remains within the usable range of the HPD.

2.1.2 If no pressure gauge is attached to the drop, contact the appropriate personnel (e.g., facilities, maintenance) to determine the maximum pressure of the drop.

2.2 Attach the inlet side of the HPD, the sanitary fitting, to the air/gas system using a sanitary gasket and clamp. Or, if the drop does not have matching sanitary fitting, use appropriate attachment means (e.g., sanitary barb adapter, sanitary reducer/enlarger, etc.) to securely attach the diffuser to the test point.

2.3 Attach the barbed end of the diffuser to the particle counter using either 0.188" or 0.375" Non-Particulate Generating Tubing.

2.3 Initiate Sampling of the System Test Point

Note: Operate the 1 CFM LPC and test the system as described in site specific standard operating procedures, users manual, and/or other applicable guidelines.

2.4.2 Ensure the LPC sample rate is set to 1 CFM, or 28.3 LPM.

2.4.3 Initiate air or gas flow from the test point (i.e., open the appropriate valve or regulator).

2.4.4 Begin the sampling cycle of the LPC and take the required number of samples (e.g., five (5) one-minute samples).

Note: The first 1-minute count of each set should be performed as a purge to clear particulates that may have been generated during HPD assembly transport, or set up.

2.4.5 When the required number of samples have been taken, stop the LPC and close the test point valve or regulator.

2.4 Remove the HPD from the test point.

- 2.4 Repeat steps 2.1 through 2.5 for each test point to be sampled.
- 2.4 Report test results per applicable site procedures.
3. **Cleaning, Storage and Transport**
Particles will not be "generated" by the diffuser, but the diffuser can become contaminated with particles from transport, handling, storage and use. If following control count testing the diffuser is found to be contributing to particle counts, clean it by following the procedure below. This procedure may be used as well for preventive maintenance.
- 3.1 Disassemble the diffuser.
- 3.1.1 Don a pair of clean gloves
- 3.1.2 Unthread the sanitary fitting end from the outer diffuser tube using a 5/8" wrench.
- 3.1.3 Unthread the barbed end from the outer diffuser tube using a 11/32" wrench.
- 3.1.4 Remove and inspect the O-rings to assure that they are not visibly damaged in a way that would keep it from sealing appropriately (nicks, cuts, pinching, etc.). Replace after cleaning if required, or if desired as part of a preventive maintenance program.
- 3.2 While wearing clean gloves, clean the interior and exterior surfaces of the diffuser using a particle free, non-residue forming disinfectant (e.g., 70% sterile filtered alcohol), or filtered de-ionized water and a non-particulate shedding wipe and or swabs.
- NOTE: For additional control, these operations may be performed in a Laminar Airflow Hood or Safety Cabinet.
- NOTE: An ultrasonic water bath may also be used to clean the surfaces of the diffuser.

3.3 Re-Assemble the HPD

3.3.1 Don a new pair of clean gloves

3.3.2 Assure that the following parts of the diffuser are present as described below.

- Sanitary end fitting
- Diffuser Tube
- Barbed end fitting
- Two O-Rings

3.3.3 Insert the O-rings into the channels of the vented and non-vented ends of the diffuser.

3.3.4 Thread the sanitary end fitting into the non-vented end of the diffuser tube and tighten using a 5/8" wrench. Assure that the O-ring is properly seated in the O-ring channel as you tighten the sanitary end fitting.

3.3.5 Thread the barbed end fitting into the vented end of the diffuser tube and tighten using a 11/32" wrench. Assure that the O-ring is properly seated in the O-ring channel as you tighten the barbed end fitting.

3.3.6 Once both ends are threaded onto the diffuser, use appropriate wrenches at each end at the same time to completely tighten the sanitary and barbed end fittings.

NOTE: Be careful not to over tighten to avoid damage to the threads.

3.3.7 Verify the status of the HPD after assembly by performing a Control Count Test per Section 1

3.4 Store the HPD (and sample tubing) in dry location in a clean non-particle shedding bag or case to minimize particulate contamination.

3.5 Transport the HPD (and sample tubing) and sample tubing between test locations in a clean non-particle shedding bag or case to minimize particulate contamination.