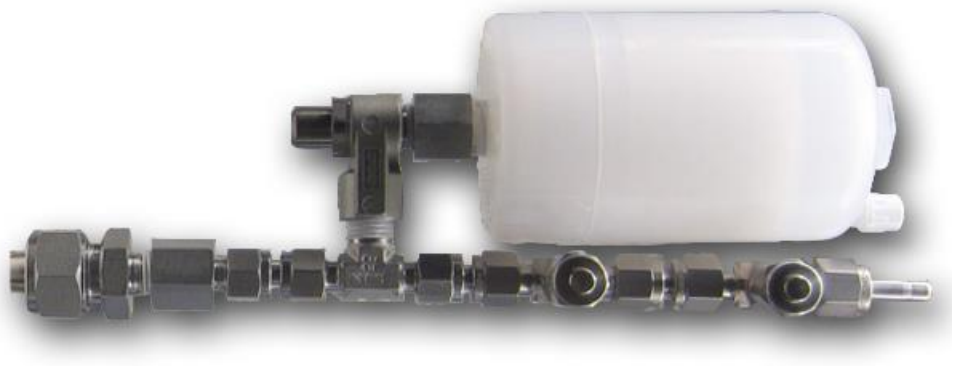
Instruction Manual

Model HHAD
Aerosol Diluters



Introduction

This manual describes the operation of the Model HHAD style aerosol diluters. Please note that this manual gives a general overview of the units and that some features of custom aerosol diluters may not be covered. All units are inspected prior to shipping. Please visually inspect each unit after receiving to ensure that the unit was not damaged during transport. Please immediately contact QVA Test Solutions if any defects are noted or if you have questions about the aerosol diluters. The diluters require no maintenance and contain no serviceable or adjustable parts. Any attempt to repair or make adjustments to components of the unit will likely result in compromising the diluter's accuracy.

The Model HHAD aerosol diluters are instruments to be used in conjunction with particle counting systems when the aerosol concentration of 0.1µm → 1.0µm (recommended) particles to be measured exceeds the maximum concentration limit of the particle counter. Please contact your particle counter manufacturer to determine the concentration limits of your specific instrument.

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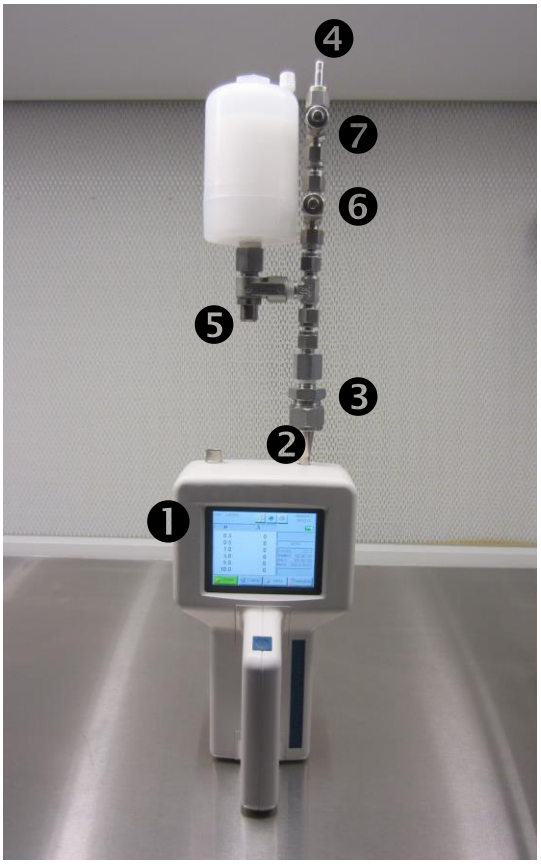
Principle of Measurement

The aerosol diluter delivers a small volume of unfiltered sample through a capillary while supplying clean dilution makeup air to satisfy the volumetric flow requirements of the particle counter. The undiluted sample flow is determined by monitoring the differential pressure across the capillary tube when the particle counter is in operation. All units are calibrated by the manufacturer. Calibration of flow is performed using HEPA filtered air and NIST traceable standards. Each unit possesses its own unique calibration curve.

The dilution ratio for the particular setup is determined by taking the ratio of the particle counter's total flow to the total flow through the capillary during the sampling period. The HHAD style diluters have single point dilution ratios based on the specified flow rate (typically 0.1 cfm (2.83 lpm)) of the particle counter that will be used with the diluter.

Overview



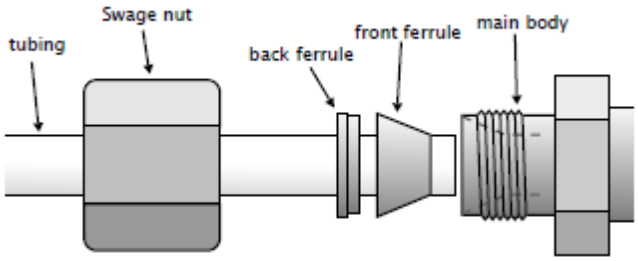
❶ Particle Counter
❷ Isokinetic probe/diluter outlet adaptor fitting
❸ Diluter outlet
❹ Diluter inlet
❺Flow control valve (DO NOT ADJUST)
❻ Downstream (-) differential pressure port (only used with custom diluters)
❼Upstream (+) differential pressure port to ambient (only used with custom diluters)

Operation

1. Place the diluter on the isokinetic probe of the 0.1 cfm (2.83 lpm) handheld particle counter. The diluter may require a custom adapter for your unit.

Note: The diluter is calibrated based on a flow rate of 0.1 cfm (2.83 lpm). Particle counters with flow rates other than 0.1 cfm (2.83 lpm) or counters that will not adjust to maintain 0.1 cfm (2.83 lpm) may require a custom diluter.

2. Tighten the adaptor fitting to the isokinetic inlet probe of the handheld particle counter according to the specifics below.



For nylon ferrules, fully insert the tube into the fitting and rotate the nut finger-tight. Tighten the nut an additional approximately 1/8 turn past finger tight.

For metal ferrules, fully insert the tube into the fitting and rotate the nut finger-tight. Mark the nut at the 6 o'clock position. While holding the fitting body, tighten the nut one and one quarter turns to the 9 o'clock position.

CAUTION: It is critical that the custom adapter is properly mated to the isokinetic probe. Contact QVA Test Solutions for information on compression fitting specs for your specific setup.

NOTE: Improper installation or alteration of the fittings could potentially result in a leak that would impact the particle counter readings.

3. Set the 0.1 cfm (2.83 lpm) particle counter to sample for 20 seconds (corresponding volume 0.033 ft^3), 30 seconds (corresponding volume 0.05 ft^3) or 60 seconds (corresponding volume 0.1 ft^3).

NOTE: It is good practice to set a delay (>10 seconds) on the particle counter prior to taking sample counts. The delay will allow the sample lines to purge and the particle counter pump to reach its optimal state.

4. When the counter stops, adjust the counts to read particles per 0.1 cubic feet. That is, if a 20 second count was taken, multiply the displayed reading by 3. If a 30 second count was taken, multiply the displayed reading by 2.

5. To determine the aerosol concentration, multiply the counts per 0.1 cubic feet by the dilution ratio specified for on your diluter.

Example:

1. The particle counter having a sample rate of 0.1 cfm is set up to take 30 second samples.
2. The diluter is attached and the particle counter is started.
3. The particle counter display reads 4,000 particles after 30 seconds (0.05 cubic feet)
4. The diluter has a dilution ratio of 80:1 at 0.1 cfm
5. Determine the number of particles that would be obtained in a 1 minute sample or 0.1 cubic feet of sampled air with the diluter attached. (4,000 x 2) = 8,000 particles per 0.1 cubic feet.
6. Multiply the number of particles obtained above (8,000) by the dilution ratio (80) to get the calculated upstream particles per 0.1 cubic feet of air.
   (8000 x 80) = 640,000 particles per 0.1 cubic feet
7. If working in units of particles per cubic foot of air, multiply the above value by 10. 640,000 x 10 = 6,400,000 particles per cubic foot.

Therefore, you were able to measure the true concentration of an aerosol as 6.4 million particles / ft^3 with a counter that can only accurately measure up to 2.0 million particles / ft^3.

NOTES:

1. It is good practice to take several readings, discard the initial reading, and average the remaining. Air inside the diluter is purged by the initial sample and may thus result in an inaccurate particle count. Multiple samples will provide the operator information on the stability and consistency of the aerosol generation source. The readings should be repeatable.

2. For accurate data, the reading on a number of 0.1 cfm particle counters should not exceed 1 million particles per minute in the most sensitive channel. (That is 500,000 counts in 30 seconds or 100,000 counts in six seconds, etc.) Concentrations greater than this may result in coincidence counting and thus an under estimation of the true aerosol concentration. The upper concentration limits of each particle counter can vary. Please contact your particle counter manufacturer or refer to instrument literature to determine the upper concentration limits of the particle counter.

   NOTE: In some instances, the upper concentration limits of particle counters may be grossly overstated for real-life applications. One should never operate at the upper limits of the particle counter without considering potential errors in count readings.

3. The diluter must be recalibrated at least annually, and possibly more often if used in extreme conditions. There are no electronic or moving parts, however, filter loading, an accumulation of particulate on the walls of the capillary or a partial restriction of the capillary by lint or fiber may result in erroneous data.

4. The diluter is a rugged instrument designed for field use. However, it should be handled as a test instrument. Avoid dropping or extreme shock. Use the vinyl tubing caps when the instrument is not being used to prevent gross contamination of the device.