Instruction Manual

Model AD Aerosol Diluters

QVA Test Solutions

1281 Colony Drive
New Bern, NC 28562
PH: 919.567.3208
www.qvats.com

Introduction

This manual describes the operation of the Model AD 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.

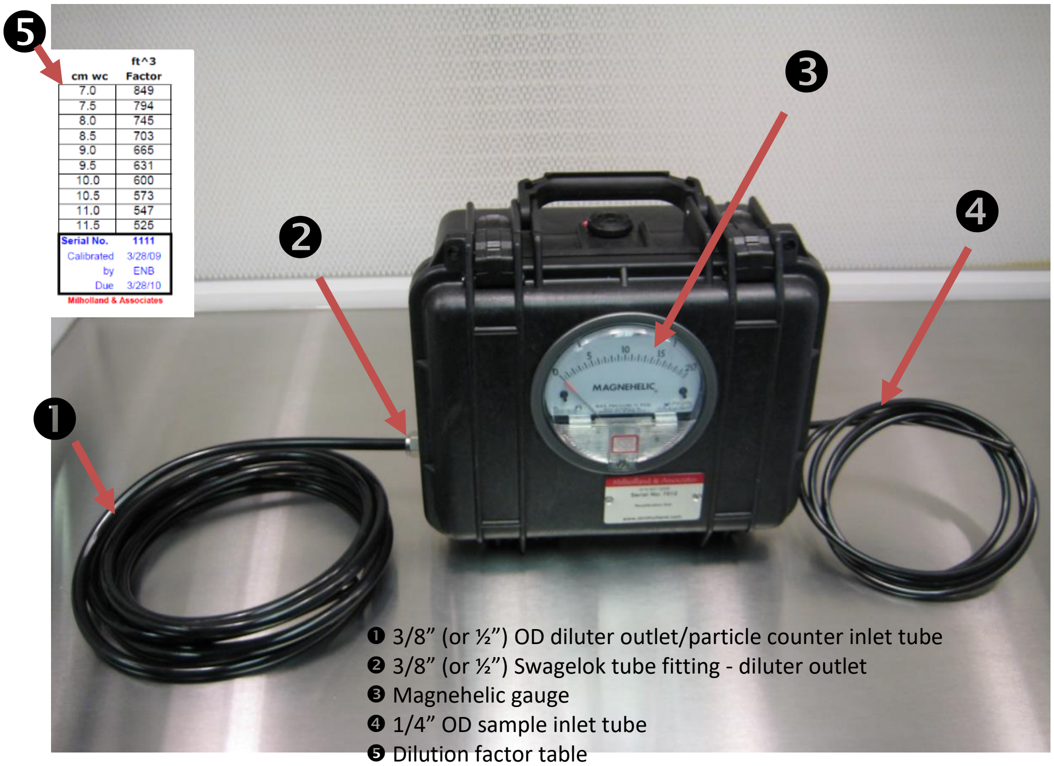
The Model AD aerosol diluters are instruments to be used in conjunction with particle counting systems when the aerosol concentration of 0.1µm → 1.0µm particles to be measured exceeds the maximum concentration limit of the particle counter. Please contact your particle counter manufacturer to determine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

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 factor 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 dilution factor is determined by matching the capillary differential pressure readout on the Magnehelic gauge to the attached dilution factor table.

Overview



cm wc	ft^3 Factor
7.0	849
7.5	794
8.0	745
8.5	703
9.0	665
9.5	631
10.0	600
10.5	573
11.0	547
11.5	525
Serial No.	1111
Calibrated	3/28/09
by	ENB
Due	3/28/10

Milholland & Associates

❶ 3/8" (or ½") OD diluter outlet/particle counter inlet tube
❷ 3/8" (or ½") Swagelok tube fitting - diluter outlet
❸ Magnehelic gauge
❹ 1/4" OD sample inlet tube
❺ Dilution factor table

Operation

1. Place the diluter on a flat level surface and remove the dust cap from the ¼" OD sample line and remove any caps/plugs from the 3/8" (or ½") outlet of the diluter. At this point both the inlet and outlet of the diluter should be open to atmosphere.
2. Prior to connecting the 3/8" (or ½") OD outlet tube to the particle counter and before placing the ¼" OD sample tube at the measurement location, check the Magnehelic gauge to ensure that the reading is ZERO. It is good practice to place the ¼" OD sample tube in close proximity to the 3/8" (or ½") outlet of the diluter when verifying a ZERO reading.

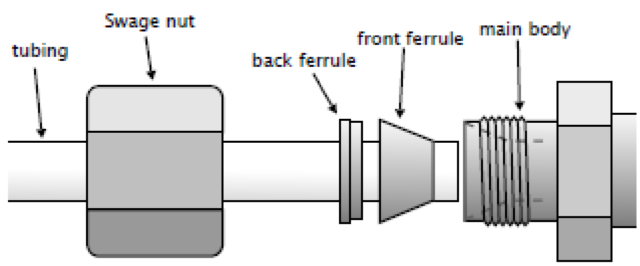
NOTE: If a reading other than ZERO is obtained, it is likely that the inlet and outlet of the diluter are at different pressures or the unit requires service. NEVER make a zero adjustment to the Magnehelic gauge by turning the adjustment screw. This will invalidate the diluter's calibration and the unit will need to be serviced and recalibrated.

1281 Colony Drive
New Bern, NC 28562 USA
PH: 919.567.3208
www.qvats.com

3. After verifying a ZERO gauge reading, attach the 3/8” (or ½”) OD sample tube (Bev-A-Line XX or Hytrel tubing recommended) of the diluter to the inlet of a 1.0 cfm (28.3 lpm) particle counter.

Note: Particle counters with flow rates other than 1.0 cfm (28.3 lpm) may require a custom diluter.

4. Attach the other end of the 3/8” (or ½”) OD tube to the diluter outlet using the supplied nylon ferrules and Swagelok tube fittings. Ensure the nylon ferrules are oriented as shown in the figure below. Improper installation of the ferrules could potentially result in a leak that would impact the particle counter readings.



NOTE: Nylon ferrules only need to be tightened a little past finger tight (about 1/4 of a turn). Use caution, over tightening can damage the ferrule set.

5. Place the ¼” OD sample inlet tube into the air stream to be sampled.
6. Set the 1.0 cfm (28.3 lpm) particle counter to sample for 20 seconds (corresponding volume 0.33 ft^3), 30 seconds (corresponding volume 0.5 ft^3) or 60 seconds (corresponding volume 1.0 ft^3).

Note: The ¼” diluter inlet tubing will need to be purged of air before a representative sample can be obtained. It is recommended that a minimum sample of 20 seconds be taken and discarded immediately before the actual sample is taken. For example, take two consecutive (particle counter continues sampling without stopping) 30 second samples and discard the first sample.

7. From the table attached to the diluter, find the “dilution factor” that corresponds to the Magnehelic gauge reading.
8. When the counter stops, adjust the counts to read particles per cubic foot. 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.
9. To determine the aerosol concentration, multiply the counts per cubic foot by the dilution factor obtained using the table attached to the diluter.

1281 Colony Drive
New Bern, NC 28562 USA
PH: 919.567.3208
www.qvats.com

Example:

1. The particle counter having a sample rate of 1.0 cfm is set up to take two consecutive 30 second samples.
2. The diluter is attached and the sampling is started on the particle counter.
3. The first 30 second sample is discarded since this was obtained while the sample tubing was being purged. The second sample will be used to determine the upstream concentration.
4. The particle counter display reads 4,000 particles (30 seconds / 0.5 cubic feet) on the 2nd or representative sample.
5. Normalize 4,000 particles per 0.5 cubic foot of air (4000/0.5 = 8,000 particle per cubic foot of air.
6. The diluter's Magnehelic gauge reads 14 cm wc during the sample. From the attached chart, 14 cm wc. corresponds to a dilution factor of 600 at 1.0 cfm.
7. Multiply 8,000 particles /cu. ft. x 600 = 4,800,000 particles per cubic foot.

Therefore, you were able to measure the true concentration of an aerosol as 4.8 million particles / ft^3 with a counter that can only accurately measure up to 50,000 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 and sample tubing 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 generator. The readings should be repeatable.

2. For accurate data, the reading on most 1.0 cfm particle counters should not exceed 80,000 particles per minute in the most sensitive channel. (This is 40,000 counts in 30 seconds or 8,000 counts in six seconds, etc.) Concentrations greater than this may result in coincidence counting and thus an under estimation of the true aerosol concentration. Additional dilution of the aerosol will be required for extremely high aerosol concentrations.

3. The added resistance of the diluter may result in a reduced sample flow to the particle counter. This will not significantly affect the calculation of the aerosol concentration. The concentration is based entirely on the capillary sample air volume which is a direct function of the pressure across the capillary tube. However for maximum particle counter accuracy, you should adjust the flow of the particle counter to 1.0 cfm with the diluter attached to the sample tubing. The counter was calibrated at this flow. Remember to readjust the counter flow rate after removing the diluter. Without the diluter, one must sample at a rate of 1.0 cubic feet of air per minute for accurate data.

4. 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, 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.

5. The 2 meter sample tube (1/4” OD) must remain intact. Extending the tube could lead to a reduction in particle transport efficiency through means such as particle diffusion and sedimentation. It is ok to reduce the length of the ¼” OD sample tubing as this will reduce the particle loss during transport and also decrease the time needed to purge the sample tubing.

6. 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.