

AQM 65 and Dust Monitor Filter Changes

Filters are an important part of AQM 65 and Dust Monitor systems. The following standard user replaceable filters are used in Aeroqual products:

AQM 65

- Disposable 5 µm PTFE filter (Gas Inlet) (**Aeroqual part number AQM R12**)
- If a Particle Monitor (nephelometer) or Particle Profiler (OPC) is installed, Disposable Purge and Sample filters (**Aeroqual Part numbers R31 or R32**)

Dust Sentry

- Disposable Sample and Purge Filters (**Aeroqual part number DS R31**)

Dust Profiler

- Disposable Sample and Purge Filters (**Aeroqual part number DS R32**)

An optional 47mm filter and holder is available to be used as an external filter on the AQM 65 gas inlet, or as a sample collection filter in a Dust Sentry. This is covered later in this technical note.



Figure 1. Standard Filters for Aeroqual instruments

Filters protect gas sensors, pumps and particle engines from exposure to excessive amounts of particles, which can lead to damage and poor performance. Filters have a finite lifetime and must be replaced regularly for AQM and Dust Monitors to operate correctly. Examples of dirty filters are shown in Figure 2. The lifetime varies based on 2 factors:

1. **Local conditions: how dirty is the monitoring site?**
Environmental factors, such as local PM concentration and sources greatly affect filter life, as these high concentrations will load a filter quickly.
2. **What are the data quality goals of your project?**
For highest quality data, consider changing your filters more frequently. This reduces the chance of filters becoming clogged or dirty, and affecting data.



Figure 2. Examples of Dirty Particle Monitor filters, compared to a clean filter on the left.

The following table can be used as a guide for developing your filter change procedure. The Gas inlet filter should always be changed before attempting a calibration. Compared to the operational cost of missed calibration or poor quality data, filter changes are cheap insurance, and will reduce overall maintenance and operation costs for your instrument. **Note: You can never change a filter too often. If in doubt, change it out!**

Environment	Highest Data Quality			Medium Data Quality			Reduced Data Quality		
	Clean	Moderate	Dirty	Clean	Moderate	Dirty	Clean	Moderate	Dirty
Change Gas Inlet Filter (weeks)	3	2	1	4	3	2	5	4	3
Gas Filters needed per year of operation	17	26	52	13	17	26	10	13	17
Change Dust Monitor Filters (months)	3	2	1	4	3	2	5	4	3
Dust monitor Filters needed per year of operation	4	6	12	3	4	6	2	3	4

Clean $PM_{10} < 50 \mu g m^{-3}$ (24hr Average)
 Moderate $PM_{10} 50 - 100 \mu g m^{-3}$ (24hr Average)
 Dirty $PM_{10} > 100 \mu g m^{-3}$ (24hr Average)

Effects of insufficient filter changes

AQM 65

The AQM 65 has a disposable 5 μm PTFE filter on the gas sample inlet, designed to protect the gas sample manifold tubing and sensor modules from excessive contamination. The entire filter replacement procedure can be carried out in less than 30 seconds.

Insufficient inlet filter changes affect AQM 65 performance. A clogged or PM laden filter restricts flow through the gas sampling system. Each gas module must have a correct flow rate through it in order for the module to operate correctly. A restricted flow rate causes a loss of sensitivity to ambient concentrations and will cause unusual response to calibration gas.

If an inlet filter becomes clogged or PM laden, then the PM trapped on the filter, in certain conditions, can 'absorb' or 'scrub' the gases (especially O_3) in sample air and cause a loss of sensitivity and low readings.

PM Monitors

All PM monitors (Dust Sentry and Dust Profiler) and AQM 65 fitted with either Particle Monitor or Profiler modules have a set of two filters, one for sample and one for purge (Figure 1). The sample filter protects the sample pump from the PM laden sample air. The purge filter cleans purge air during the automatic zero.

If the sample and purge filters in Dust Monitors (including in the AQM 65) are not changed at appropriate intervals, the filters can become overly laden (saturated) with PM. When the instrument runs its regular auto zero check, purge air is passed through the purge filter, and through the optics of the engine, to check the zero of the engine. If there is excessive PM in the purge filter, this can contaminate the purge airstream. This causes the H0 value, which controls the zero of the module, to be set too high and causes negative PM readings.

The H0 value can be used to track the loading of PM on the sample and purge filters. You can track the H0 value using a chart in advanced charts on Aeroqual Cloud, or from the diagnostics of the instrument, available in Aeroqual Cloud and Aeroqual Connect (Figure 3). In the figure, the H0 value rises, to peak on November 23. The high H0 value causes negative PM values on the same day. The filters were changed shortly after,

and the PM_{2.5} readings return to normal. Note that the H0 value slowly begins to rise after this point as the filters start becoming dirty again.

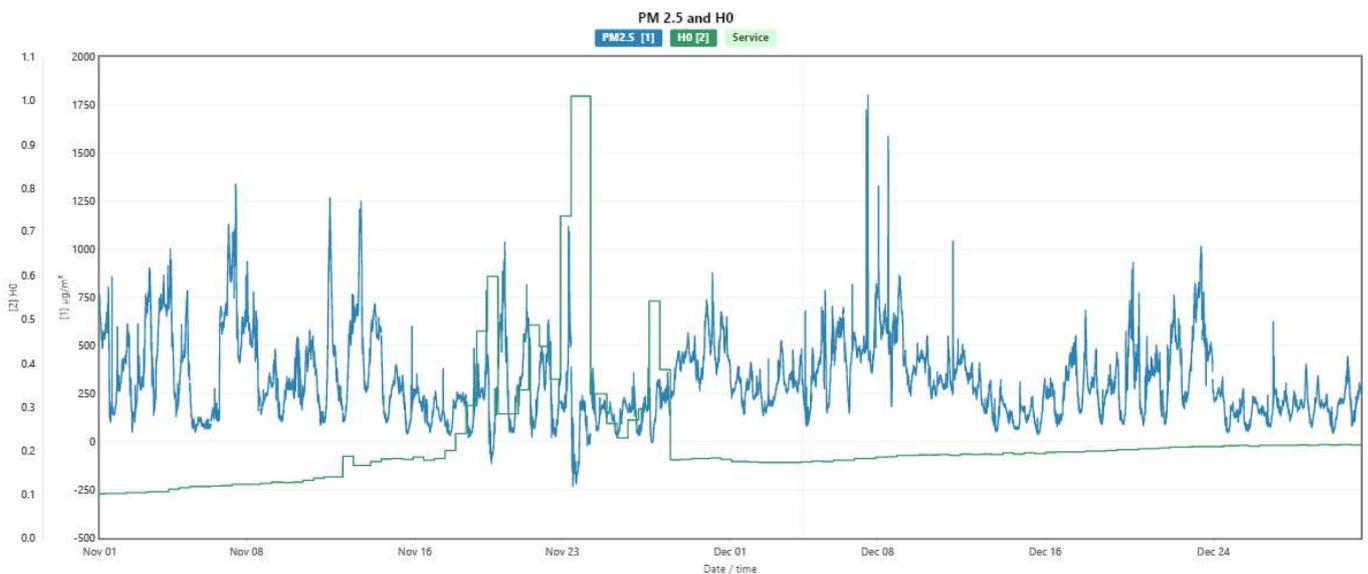


Figure 3 PM_{2.5} and H0 for tracking filter loading.

Option: 47mm filter and holder

Aeroqual offers a 47mm filter holder (Figure 4) (**Aeroqual part numbers AQM R47 for AQM 65 and DS R47 for Dust Monitors**) and 47mm filter membranes (**Aeroqual part numbers AQM R30 and DS R30**). 47mm filters are a default industry standard used worldwide in many instruments, including particle monitors and gas analysers. In AQM 65 systems, this filter can be added to the gas inlet to protect the gas modules and sample lines from excessive amounts of particles. This filter is larger making it a good option for:

- Protecting against excessive amounts of particles in environments with high PM concentration
- Extending filter change intervals in remote sites



Figure 4. 47mm filter holder

The 47mm filter can also be added to Dust Sentry and Dust Profiler instruments. This filter can be used for:

- Further analysis of PM composition, such as source apportionment or testing for a specific compound, such as lead or arsenic

If a filter is being used for further analysis, it is important to use the correct filter material. Commonly, 2 types are used, Quartz and Teflon.

- Quartz filters are best suited to gravimetric and analysis using acid digestion. They are unsuitable for analysis which is sensitive to Quartz.
- Teflon (PTFE) filters are suitable for all analysis types, including XRF, and ICP-MS.
- Consult with your laboratory service provider to decide which filter type is best for your project.

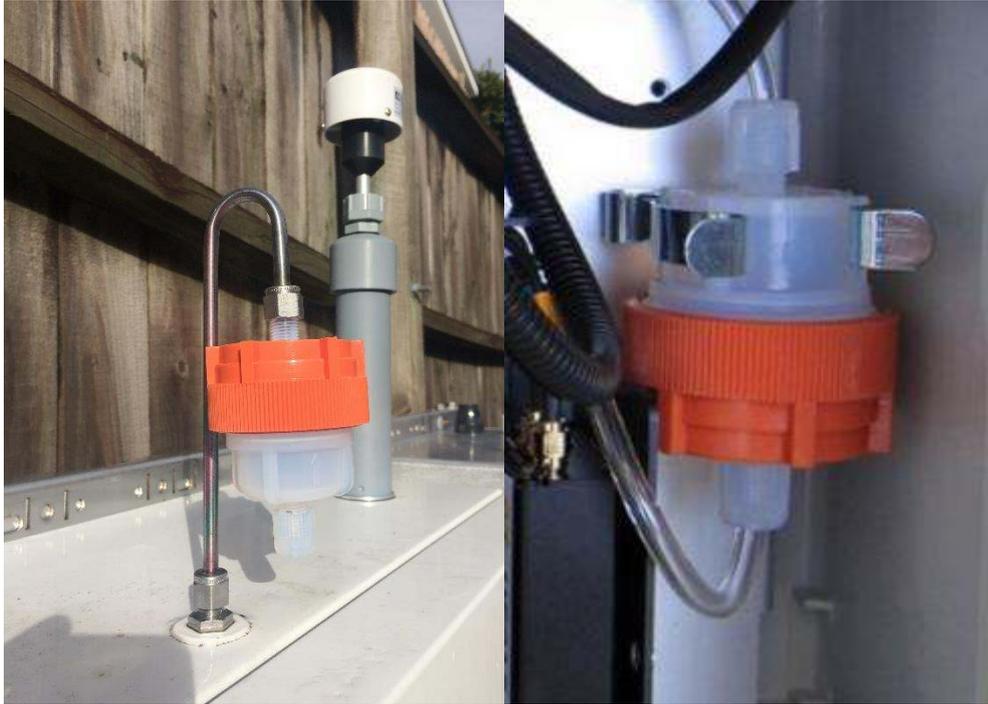


Figure 5. 47mm filter installed on an AQM65 gas inlet (left) and internally in a Dust Sentry (right)