TECHNICAL NOTE:

Calibration gas, regulators, fittings and tubing

This technical note provides general information regarding appropriate equipment for calibrating the AQM60. The guide covers the equipment used if calibration is performed using the dilution method with the AirCal1000, or if using the direct method where gas is delivered without dilution. This document is not a comprehensive guide to purchasing calibration gas, equipment or fittings, and the reader is advised to consult their local supplier for advice on purchasing appropriate and safe gases and fittings.

Calibration gases

There are several considerations to be made when selecting gases for span concentration of the AQM60. The first is which gas composition to purchase and at what concentration. The gas balance or carrier (usually Air or Nitrogen) must also be considered and also the size of the gas cylinder. The gases for performing calibration using the direct method are different from those used to perform calibration using the dilution method. The gas concentrations listed in the table below are optimised for use with the Aeroqual AirCal1000 gas dilution calibrator. **NOTE: THE AIRCAL1000 CAN NOT SUPPORT CALIBRATION OF CO2.**

Gas composition

AQM Gas module	O3	NO2	NOx	CO	SO2	PID	CO2	H2S
Gas type used for calibration	O3	NO2	NO or NO2	CO	SO2	Isobutylene	CO2	H2S
Gas module measurement range	0 to 0.150 ppm	0 to 0.2 ppm	0 to 0.5 ppm	0 to 25 ppm	0 to 10 ppm	0 to 20 ppm	0 to 2000 ppm	0 to 5 ppm
Recommended span calibration concentration	0.08 to 0.150 ppm	0.05 to 0.100 ppm	0.1 to 0.2 ppm	5 to 15 ppm	1 to 3 ppm	5 to 15 ppm	500 to 1500 ppm	0.5 to 1.5 ppm
Recommended cylinder concentrations if using the dilution method (gas can be in a balance of Air or N2)		**20 (10, 100)**	**20 (10, 100)**	**1000 (500,5000)**	**100 (50,500)**	**1000 (500,5000)**	**10% (not available For AirCal1000)**	**100 (50,500)**
Recommended cylinder concentrations if using the direct method (gas must be in a balance of Air)		0.100 ppm	0.100 ppm	10 ppm	2 ppm	10 ppm	1000 ppm (0.1 %)	0.5 ppm

Cylinder concentrations in ppm shown in green are the ideal concentrations. The minimum and maximum recommended concentrations are given brackets underneath.

Note: If you are calibrating using the direct method, you will also need to purchase a cylinder of certified zero air in order to perform a zero (baseline) calibration. You will also need to humidify the gas if using the direct method, see the calibration section in the User Guide for how to humidify calibration gas. If you purchase the AirCal1000, you will perform a zero alibration with the built in zero air generator without the need for additional humidification.

Gas cylinder size/volume

There are many cylinder sizes available from small portable
cylinders through to larger cylinders. Both the small and large gas cylinders can be used to calibrate the AQM60. The smaller cylinders are more convenient especially for field calibrations, the larger cylinders will last longer but will be more difficult to transport to the site where the AQM is installed and these issues should be considered when selecting a cylinder size.

It is important to understand how long your gas cylinder will last so that you can plan your gas cylinder purchases. To plan your purchases you must understand

1) what volume of gas your cylinder holds,
2) how much gas you will use per calibration,
3) the frequency of calibrations.
4) the number of AQM60 stations requiring calibration
5) the expiry date of the calibration gas (different gases have different expiry dates)

A few considerations:

Smaller gases cylinder, such as the 6D size from CalGaz , hold approximately 100 liters of calibration gas. As a general rule (a conservative estimate) you will use approximately 1 to 2 litres of gas per AQM60 gas module when performing a calibration if using the dilution method. You will use 15 to 30 litres per calibration if using the direct method. Depending on what calibration frequency you decide upon, you can then calculate how long the cylinder will last.

The three images below demonstrate a small portable gas cylinder (size 6D) from CalGaz, and a large and medium size cylinder from AirLiquide. All sizes are suitable for use with the Aeroqual Aircal1000 and AQM60, the decision as to which size is best to use is based upon the considerations discussed above.



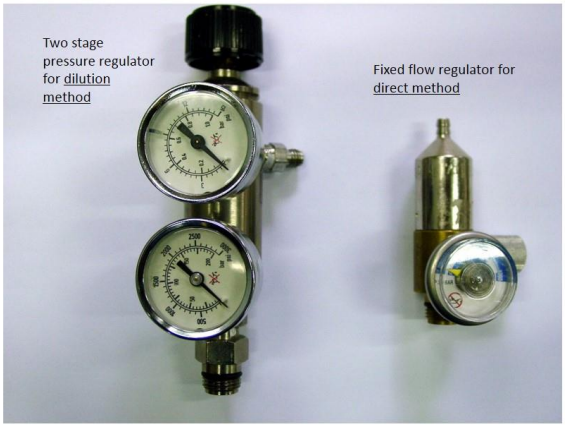
Gas regulators

If you are calibrating using the direct method you will need to purchase a fixed flow regulator. The flow rate should exceed the inlet flow rate of your AQM60. The recommended fixed flow rate is 1.0 LPM. Note: If using the direct method you also need to perform a zero calibration using a cylinder of certified clean air. Also, gas delivered directly from a cylinder will be very dry (0% RH) and will need to be humidified. See the calibration section in the AQM60 user guide on how to humidify calibration gas.

If you are calibrating using the dilution method you will need to purchase a two stage pressure regulator. The maximum pressure of the second stage should be no more than 100 PSI.

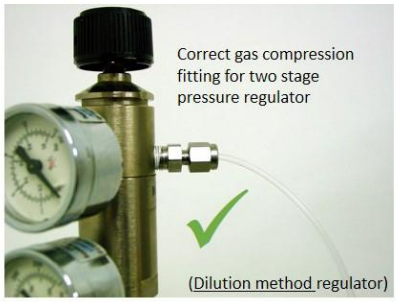
Your gas cylinder supplier should be able to recommend or supply either a suitable fixed flow regulator or a two stage regulator depending on your needs. The same regulator may not be able to be used for all gases because of incompatibilities between the material of the regulator and the gas, make sure you check the regulator/gas compatibility with your regulator supplier.

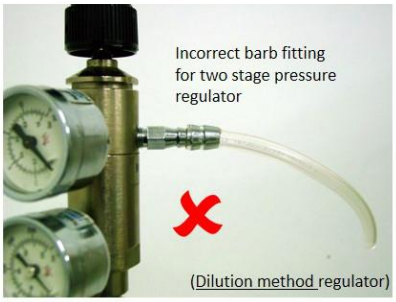
Aeroqual can supply the AirLiquide series 1001 two stage regulator with all of the appropriate fittings already attached. Please ask Aeroqual to supply.

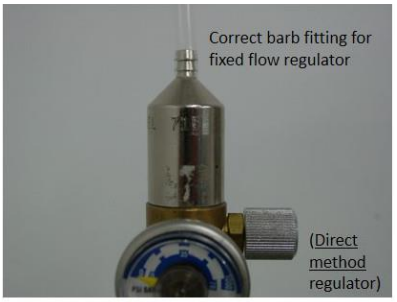


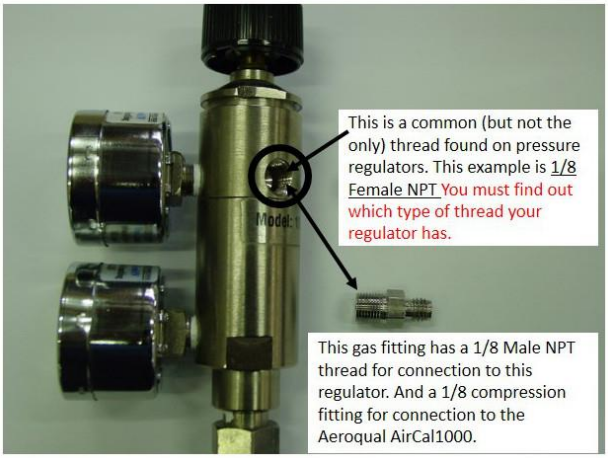
Regulator gas fittings: Barb vs Compression fitting

It is also important to make sure you have the correct gas outlet fitting on the regulator. A barb fitting is **not** suitable for use with the pressure regulator (dilution calibration method). For this you will need to purchase a gas compression fitting like that shown in the images below. A barb fitting is acceptable if the fixed flow regulator (direct calibration method) is being used. Your regulator supplier may or may not be able to supply a suitable fitting.









There are a number of possible thread types found on pressure regulators, but two common threads you will find on the outlet port of a pressure regulator are: ¼ Female NPT or 1/8 Female NPT.

YOUR REGULATOR MAY HAVE A DIFFERENT FITTING, YOU MUST CHECK WITH YOUR REGULATOR SUPPLIER TO MAKE SURE YOU HAVE A COMPATABLE FITTING.

Recommended fittings and tubing:
The Aeroqual AirCal1000 gas inlet ports are stainless steel 1/8" compression fittings. Aeroqual recommends using 1/8" OD PTFE tubing for calibration gas which requires 1/8" compression fittings to connect the AirCal1000 to the pressure regulator. The fitting on the AirCal1000 comes with the appropriate compression fitting, but you must complete the connection to the gas regulator.

If your pressure regulator has a 1/8" Female NPT thread you should purchase part number **SS-200-1-2** from Swagelok This is fitting 1 in the above image.

If your pressure regulator has a ¼" Female NPT thread you should purchase part number **SS-200-1-4** from Swagelok This is fitting 2 in the above image.

See the following video for WHEN and HOW to apply PTFE tape.
http://norcal.swagelok.com/blog/bid/88017/Skill-Applying-PTFE-tape-to-tapered-pipe-threads