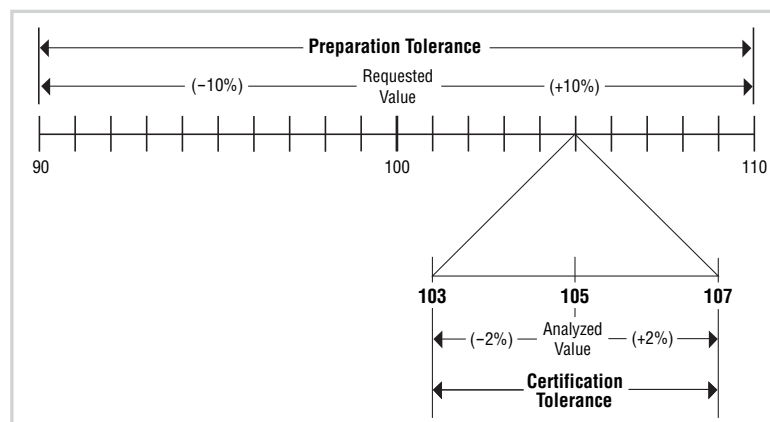


Gas Mixtures

Mix Grade	Concentration	Blend tolerances	Analytical tolerances	Note: Analytical tolerances for H ₂ S and NO ₂ mixtures are always +/-2% for all concentrations.
EPA Protocol	<2ppm 2ppm - 10ppm >10ppm	Inquire +/- 1ppm +/- 5%	+/- 2% +/- 2% +/- 1%	
Traceability	<2ppm 2ppm - 10ppm >10ppm	Inquire +/- 1ppm +/- 5%	+/- 1% +/- 2% +/- 1%	
Primary	<50ppm 50ppm - 0.99% 1.0 - 1.99% 2.0 - 50%	Inquire +/- 5% +/- 1% +/- 1%	Inquire +/- 1% +/- 1% +/- 0.02% absolute	
Precision Blend	All	"zero"	+/- 1% or +/- 2%	
Certified Batch analysis: order quantities of 6 or more cylinders	<5ppm 5ppm - 49ppm 50ppm - 0.99% 1.0 - 50%	Inquire +/- 20% +/- 10% +/- 5%	Inquire +/- 5% +/- 2% +/- 2%	
Unanalyzed	All	+/- 20%	N/A	



All of Airgas' six mixture grades have two tolerances—preparation and certification. This graph shows how the two interrelate. For example, a certified mix ordered at 100 ppm is prepared between 90 ppm and 110 ppm (the preparation tolerance). Assume the mix, when made, reads 105 ppm. When analyzed in the lab, it may actually be between 103 ppm and 107 ppm (the analytical tolerance).

For most applications, the certification tolerance is of greater importance than the preparation tolerance because it represents the range in which the true or actual concentration may be in relation to the analyzed concentration. For some applications, such as those that require an upper or lower range of concentration that cannot be exceeded, the preparation tolerance becomes equally if not more important.

Traceability in Calibration Gas Mixtures

Airgas offers three grades of calibration gas mixtures with established and defined traceability to NIST or to an equivalent national measurement institute. Each traceable mixture is accompanied by full documentation in the form of a Certificate of Analysis (COA), designed in compliance with customer, regulatory, and ISO 17025 guidelines.

Traceability is defined as *"the property of the result of measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties."* A requirement for ISO 9001:2000 programs, ISO 17025 compliant programs, emissions monitoring and reportable environmental testing is that the instrument calibration process maintain traceability to a national primary reference material.

Calibration gas mixture compositional traceability is assured through two methods:

- 1) Analytical traceability using Reference Materials from a national measurement institute (usually NIST) to calibrate the measurement system through a rigorous process to determine the concentrations of mixture components of interest, or
- 2) Process traceability to the international unit of mass (Kg) through comprehensive manufacturing and quality programs, using high precision, high sensitivity weighing systems for component additions. The resultant mixtures are analyzed versus Laboratory Primary Standards of known composition and uncertainty.

Typically, the process-based traceability is used when Reference Materials are unavailable from NIST or other national measurement institutes for the component(s) or concentration(s) of interest. Blends produced gravimetrically, using scales extensively calibrated with NIST certified weights, are considered traceable and have known uncertainty in their composition.

The majority of traceable products supplied by Airgas are certified to an overall analytical or process uncertainty not to exceed +/- 1%.