

## Air Grade D and E Testing Requirements

The question is, "What are the testing requirements for:

1. Breathing Air Grade D (from compressor)
2. Breathing Air Grade D (by reconstitution)
3. Breathing Air Grade E

The testing requirements are specified in 29 CFR 1910.134 (i) (see below). The OSHA regulations specify the CGA document, "Commodity Specification for Air" G-7.1 (1989). CGA G-7.1 has been updated and the current version is 2004.

CGA G-7.1 gives additional details about approved testing methods and procedures for testing synthetic air. To summarize, if the Oxygen and Nitrogen (used to make the Grade D Air) were produced by air liquefaction and meet USP/NF specifications, the following tests are not required: Carbon Dioxide, Carbon Monoxide and Oil.

### For air compressed from the atmosphere:

	Grade D	Grade E
Carbon Dioxide	1000 ppm	1000 ppm
Carbon Monoxide	10 ppm	10 ppm
Odor	None Detected	None Detected
Condensed Oil	5 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>
Oxygen	19.5% – 23.5%	20% - 22%
Total Hydrocarbons (as CH <sub>4</sub> )	-	25 ppm

### For blended air from liquid Oxygen, USP and liquid Nitrogen, NF from air liquifaction:

	Grade D	Grade E
Carbon Dioxide	-	-
Carbon Monoxide	-	-
Odor	None Detected	None Detected
Condensed Oil	-	-
Oxygen	19.5% – 23.5%	20% - 22%
Total Hydrocarbons (as CH <sub>4</sub> )	-	25 ppm

Another CGA document, "Compressed Air for Human Respiration", G-7, implies that each cylinder of synthetic air should be individually tested for Oxygen content.

We strongly recommend that you follow the following minimum procedure when testing breathing air for oxygen content:

1. Follow analyzer manufacturers' specifications for zeroing, calibrating and operating the instrument.
2. Individually sample each cylinder for Oxygen content.
3. Introduce nitrogen into the analyzer before each cylinder is tested to assure the detector cell is purged of the prior sample. Allow the instrument reading to fall below 15%. If the sample Air cylinder valve is blocked/closed, this step helps assure that the tester will not pass a cylinder with the bad valve.

Please contact me with any additional questions.

Thanks,  
Tom Badstubner  
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From 29 CFR 1910.134...

(i) Breathing air quality and use. This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

(ii) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

(A) Oxygen content (v/v) of 19.5-23.5%;

(B) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

(C) Carbon monoxide (CO) content of 10 ppm or less;

(D) Carbon dioxide content of 1,000 ppm or less; and

<<< TLB Comment - Hydrocarbons, Carbon Monoxide and Carbon Dioxide are not required according to CGA G-7.1 2004 if using Oxygen, USP and Nitrogen, NF from air liquifaction >>>

(E) Lack of noticeable odor.

(2) The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

(3) The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

(4) The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

(i) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

(ii) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

(iii) The moisture content in the cylinder does not exceed a dew point of -50 F (-45.6 C) at 1 atmosphere pressure.

<<< TLB Comment - -50F dewpoint = 67 ppm v/v >>>

<<< TLB Comment - For SCBAs the CGA specification for moisture is 24 ppm v/v (CGA G-7.1 2004)>>>

(5) The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

(i) Prevent entry of contaminated air into the air-supply system;

(ii) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 C) below the ambient temperature;

(iii) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(iv) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

(6) For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

(7) For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are

used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

(9) The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.