

## Summary of Air Specifications

## Commonly Used Air Specifications for SCBA or airline respirators

STANDARD ANALYTES	CGA '04 Grade D	NFPA '08 1989	OSHA '03 1910.134
Carbon dioxide, ppm	1000 <sup>(1)</sup>	1000	1000
Carbon monoxide, ppm	10 <sup>(1)</sup>	5	10
Odor	No Pronounced Odor		
Oil (condensed) (mg/m3 at NTP)	5 <sup>(1)</sup>	2	5
% Oxygen, balance predominantly N <sub>2</sub>	19.5-23.5	19.5-23.5	19.5-23.5
Total volatile hydrocarbons, ppm (as methane)		25 <sup>(1)</sup>	
Water, ppm v/v	24	24	63 <sup>(1)</sup>
Water, dew point °F at 1 atm abs	-65	-65	-50 <sup>(1)</sup>
Sampling Frequency	Per Agreement	At Least Quarterly	Per Resp. Prot. Plan
Accredited Lab Analysis	Not Required	Required	Not Required

Revised in  
2008

## Commonly Used Air Specifications for Diving

STANDARD ANALYTES	CGA '04 Grade E	OSHA '03 Com. Diving	CSA '00 Z180.1	O <sub>2</sub> Compatible Air		O <sub>2</sub> Enriched
				ANDI	IANTD	PADI
Carbon dioxide, ppm	1000	1000	500	500	1000	1000
Carbon monoxide, ppm	10	20	5	2	2	10
Halogenated solvents, ppm			5			
Odor	----- No Pronounced Odor			----- No Pronounced Odor-----		
Oil (condensed) (mg/m3 at NTP)	5	5	1	0.1	0.1	0.1
% Oxygen, balance predominantly N <sub>2</sub>	20-22	19.5-23.5	20-22	20-22	20-22	20-40
Particle size, > 2µm diameter				none		
Total volatile hydrocarbons, ppm (as methane)	25		5	25	25	25
Methane, ppm			10			
Water, ppm v/v	<sup>(1)</sup>		27 <sup>(1)</sup>	128		
Water, dew point °F at 1 atm abs	<sup>(1)</sup>		-63 <sup>(1)</sup>	-40°		
Sampling Frequency	Per Agreement	At Least Semi-Annual	At Least Quarterly	Quarterly	Quarterly	Quarterly
Accredited Lab Analysis	Not Required	Not Required	Required	Recommended	Not Stated	??

## Notes

<sup>(1)</sup> For additional notes, refer to specification notes on following pages. Specification notes are summaries, for complete details, refer to original source document which can be obtained on the websites noted.

American Nitrox Divers Int'l., [www.andihw.com](http://www.andihw.com)  
 Compressed Gas Assn., [www.cganet.com](http://www.cganet.com)  
 National Fire Protection Assn., [www.nfpa.org](http://www.nfpa.org)  
 Occupational Safety & Health Assn., [www.osha.gov](http://www.osha.gov)  
 Undersea Breathing Systems, [www.dnax.com](http://www.dnax.com)

Canadian Standards Assn., [www.csa.ca](http://www.csa.ca)  
 Int'l. Assn. of Nitrox & Technical Divers, Inc., [www.iantd.com](http://www.iantd.com)  
 Nat'l. Assn. of Underwater Instructors, [www.naui.com](http://www.naui.com)  
 Professional Assn. of Diving Instructors, [www.padi.com](http://www.padi.com)



**COMPRESSED GAS ASSN, CGA G-7.1–2004, Commodity Specification for Air**[www.cganet.com](http://www.cganet.com)**Air Quality Grade Levels and Typical Users** (Page 3, Table 2)

Gr A for industrial compressed non-breathing air

Gr D for OSHA breathing air

Gr J for specialty grade air, analytical applications

Gr L SCBA air (only specifies water and odor)

Gr E for SCUBA air

Gr N for Medical air USP (typically synthesized air)

The appropriate requirements for SCBA are Gr D with CGA Note 6 requirements for moisture. Note 3 states that water content of compressed air can vary with intended use. For use with SCBA in extreme cold temperatures, dew point should not exceed -65°F (24 ppm) or 10 degrees Fahrenheit lower than the coldest temperature expected.

Fire departments who have Underwater Rescue Teams frequently specify compliance with Gr D and Gr E.

**Synthetic Breathing Air** For users who purchase air from vendors (typically who synthesize air by blending oxygen and nitrogen) the quality verification systems that may be used can be summed up by stating that whatever is agreed upon between the supplier and the customer is acceptable. Production qualification tests may be performed by the supplier or by a laboratory agreed upon between the supplier and the customer (CGA Page 1, Sec. 3.1). Analytes such as carbon dioxide, carbon monoxide and oil do not need to be tested in synthesized air (CGA Page 3, Table 2 Notes)

**NATIONAL FIRE PROTECTION ASSOCIATION, NFPA 1989, 2008 Edition**[www.nfpa.org](http://www.nfpa.org)**Air Quality Requirements** (5.6)

Limit for carbon monoxide lowered from 10 ppm to 5 ppm and Condensed Hydrocarbons (Oil Mist & Particulates) from 5 mg/m<sup>3</sup> to 2 mg/m<sup>3</sup>. Nitrogen percentage must be between 75-81%. Total non-methane volatile organic compounds limited to 25 ppm. Previously methane was included in this limit. Odor must not be pronounced or unusual.

**Testing**

Quarterly testing by an accredited laboratory, with records maintained by the organization (5.1).

Samples shall be taken before and after any maintenance that is performed that could affect air quality. (5.2)

Samples are to be taken from the compressor after purification. (5.5)

Remote fill or sampling port is acceptable if unable to take inside containment fill station. (5.5)

Minimum of 500 liters for oil and particulate test. (6.4.5)

**Contaminated Air** (5.4)

If a sample fails, compressor will be removed from service, cause determined, corrective action taken, retest must be in compliance before compressor is put back into service.

**Synthetic Breathing Air** (Sec. 5.3)

Organization shall document whether air is normal atmospheric or synthetic. In addition to quarterly testing, each and every cylinder of synthetic breathing air shall be tested. Testing shall occur when the organization takes delivery of a cylinder of synthetic air from a supplier. Air samples should be tested to verify oxygen content is between 19.5% and 23.5% by volume.

**Laboratory Test Methods** (Sec. 6.0)

Minimum accuracy and minimum detection limit is established for each analyte to be tested. Suggested analytical procedures updated, see Appendices A6.1.2 through A6.6.2. Detector tubes are no longer a suggested analytical method for water; however, they are not disallowed.

For more detailed information, see Helpful Technical Info on Trace's website: [www.AirCheckLab.com](http://www.AirCheckLab.com).

**OSHA, 1910.134, Respiratory Protection, 1998 Edition**[www.osha.gov](http://www.osha.gov)**Respiratory protection program** (Sec. c)

Requires employer to develop and implement a written respiratory protection program with required work site-specific procedures and elements for required respirator use (c). Should include procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators (vi). A sample program "Small Entity Compliance Guide" is available at Helpful Technical Info on Trace's website: [www.AirCheckLab.com](http://www.AirCheckLab.com).

**Breathing air quality and use** (Sec. i)

Mandates compliance with Type 1-Grade D breathing air described in ANSI/Compressed Gas Assn. Commodity Specification for Air, G-7.1-1989 (1)(ii).

**Air Cylinders**

Cylinders used to supply breathing air to respirators must be tested and maintained according to DOT (49 CFR part 173 & part 178) (4). Cylinders of purchased breathing air must have a certificate of analysis from supplier that air meets Grade D specs (4) (ii).

Moisture content in cylinder must not exceed a dew point of -50°F (63 ppm) at 1 atmosphere pressure (4)(iii).



**OSHA, continued****Compressors**

Employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to (5) prevent entry of contaminated air into air supply system (i), minimize moisture content so that dew point at 1 atmosphere pressure is 10° below the ambient temperature (intended for airline respirator not SCBA) (ii), ensure breathing air quality by having suitable in-line air-purifying sorbent beds and filters which are maintained according to manufacturer instructions (iii), have a tag on compressor containing the most recent change date and the signature of the person authorized by the employer to perform the change. (i)(6) For compressors that are not oil-lubricated, ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm. (i)(7) For oil-lubricated compressors, use a high-temperature or carbon monoxide alarm or both. If only a high-temperature alarm used, monitor sufficiently to prevent carbon monoxide from exceeding 10 ppm. (i)(8)

OSHA does not state a frequency of testing. “OSHA believes that it is essential for the employer to ensure that excessive carbon monoxide is not in the compressed breathing air supplied to the respirators...requirement can be met by ... continuous carbon monoxide alarms, carbon monoxide filters, proper air intake location... frequent monitoring of air quality, or the use of high-temperature alarms and automatic shut off devices.” (Pg 1256, Federal Register).

**OSHA, 1910.156, Fire Brigades**, same as OSHA 1910.134.

**OSHA, 1910.430, Sub Part T, Commercial Diving, 2003**

**CSA-Z180.1-00, 2001 Edition, National Standard of Canada,  
Compressed Breathing Air and Systems**

[www.csa.ca](http://www.csa.ca)

**Air Quality Program Requirements**

Samples shall be analyzed according to Table 1 (15.3) by an accredited laboratory (A12.2 (j)). CSA's definition for accredited laboratory is a lab having a certificate of accreditation meeting the requirements of ISO/IEC Guide 25 for the collection and analysis outlined in their standard (page 2).

Samples should be taken at least semiannually (15.2.2), after noncompliance (15.1.7), and after maintenance and repairs (15.2.3).

**European Standard EN 12021**

[www.bcas.org.uk](http://www.bcas.org.uk)

**Air Quality Program requirements**

BS 4275:1997 “Guide to implementing an effective respiratory protective device programme” was withdrawn in 2005 and replaced with BS EN 529:2005 Respiratory protective devices. Recommendations for selection, use, care and maintenance. Unlike 4275, 529 does not identify an air quality specification. It does reference EN 12021 in the Annex. (BCAS Fact Sheet No. 304 is available at Helpful Technical Info on Trace's website: [www.AirCheckLab.com](http://www.AirCheckLab.com).)

EN 12021 limits oxygen (20-21%), carbon monoxide (15 ppm), carbon dioxide (500 ppm), lubricants (0.5 mg/m<sup>3</sup>), no significant odor or taste. Water (no free liquid), dewpoint sufficiently low to prevent condensation and freezing. Specific limits are set for compressor by pressure (40-200 bar; 50 mg/m<sup>3</sup>, (>200 bar; 35 mg/m<sup>3</sup>), and compressor for filling 200 bar or 300 bar cylinders; water should not exceed 25 mg/m<sup>3</sup>.

**TEXAS COMMISSION ON FIRE PROTECTION, 2005 Edition (Chapter 435)**

[www.tcfp.state.tx.us](http://www.tcfp.state.tx.us)

**Air Quality Program requirements**

Applies to any Texas fire dept. who has at least 1 paid person.

Develop an air quality program that complies with NFPA 1989 Standard on Breathing Air Quality for Fire and Emergency Services Respiratory Protection, 2003 edition (435.3). Maintain records for no less than three years. It is anticipated that the Commission will adopt 2008 edition later this year.

**PADI** (Professional Association of Diving Instructors) requires Dive Retailers to comply with CGA Grade E and quarterly testing of their compressed breathing air. For a complete copy of the PADI Enriched Oxygen guidelines, see Product No. 70167 PADI Enriched Air Operations and Resource Guide © 1995. This guideline outlines the parameters to test for when an enriched air sample is provided for analysis. The oxygen must be within ±1% of the intended oxygen percentage. [www.padi.com](http://www.padi.com)

**ANDI** (American Nitrox Divers International) requires compliance to a modified Grade E & quarterly testing. [www.andihq.com](http://www.andihq.com)

**IANTD** (International Assn. of Nitrox & Technical Divers, Inc.) requires compliance to a modified Grade E. [www.iantd.com](http://www.iantd.com)

**NAUI** (National Association of Underwater Instructors) Code of Ethics commitment to quarterly testing according to modified E or Grade E (as appropriate). [www.naui.com](http://www.naui.com)





### Information on Oxygen Enriched Air Analyses

We receive frequent requests for CGA Grade J analyses. Refer to the Air Specifications on the reverse side for a complete list of testing specifications. Typical use for Grade J air is listed by the Compressed Gas Association as Specialty Grade Air and Analytical Applications. It does not list it for oxygen enriched air for diving nor was it intended for that purpose. **It is a physical impossibility for a dive shop using an air compressor to meet the carbon dioxide levels of 0.5 ppm. Grade J also does not have a limit for condensed hydrocarbons (oil) which is of extreme concern for those producing oxygen enriched air.** Grade J is an expensive analysis that is not applicable for use without severe modifications. Organizations such as American Nitrox Divers International (ANDI) and International Association of Nitrox & Technical Divers, Inc. (IANTD) modified the CGA Grade E specification for use with oxygen enriched air. Trace currently provides analyses according to these two different specifications. If you require a different specification, please fax the requirements and we will be glad to provide a price quote.

Oxygen Compatible I (same as IANTD) is a modification of CGA Grade E requirements which reduces the levels of carbon monoxide to 2 ppm and condensed hydrocarbons to .1 mg/m<sup>3</sup>. Other analytes remain the same as stated in CGA Grade E. If you are taking 1 sample for certification of both your Grade E and Oxygen Compatible air, there is no additional cost. If you are submitting two separate samples; one for Grade E and one for an Oxygen Compatible system, the cost will be for two samples at your routine price.

Oxygen Compatible A (same as ANDI) is a modification of CGA Grade E requirements which reduces the levels of carbon monoxide to 2 ppm and condensed hydrocarbons to .1 mg/m<sup>3</sup>. It also requires moisture analysis at ≤128 ppm and particle size not to exceed 2µm (microns) diameter. Other analytes remain the same as stated in CGA Grade E. If you are taking 1 sample for certification of both your Grade E and Oxygen Compatible air, there is an additional cost of \$20 to your routine analysis cost. This covers the additional moisture and particle size analyses. If you are submitting two separate samples; one for Grade E and one for an Oxygen Compatible system, the cost will be for two samples (routine cost x 2 + \$20 for the Oxygen Compatible system. You must notify Trace that you will be using this specification to receive the appropriate sample containers.

If you have further questions regarding air specifications, please feel free to call us.

