AIR SPECIFICATIONS

AirCheck✔Notes™

TECHNICAL BULLETIN NO. 9401A (rev. 01.99)

Commonly Used Air Specifications for SCBA or airline respirators

LIMITING CHARACTERISTICS	CGA, Grade D (1997)	NFPA 1500 (1997)	NFPA 1404 (1996)	TX Comm (1992)	OSHA 1910.134 ('98)
Percent O_2 Balance Predominantly N_2	atm/ 19.5 - 23.5 (5)	atm/ 19.5 - 23.5(5)	atm/ 19.5 -23.5(5)	atm/ 19.5 -23.5(5)	atm/ 19.5 – 23.5(5)
Water, ppm (v/v) (3)	(3)	≤24	≤63	≤24	≤63(7)
Dew Point, °F (3)	(3)	≤-65	≤-50	≤-65	≤-50(7)
Condensed Hydrocarbons & Particulates, mg/m³ at NTP	5 (4)	5 (4) 5	5 (4)	5 (4) 5	5
Carbon Monoxide, ppm	10	10		10	10
Odor (6)	(6)	(6)	(6)	(6)	(6)
Carbon Dioxide, ppm	1000	1000	1000	1000	1000
Total Hydrocarbon Content (as methane), ppm					
Solid Particles, >2µm diameter					
Sampling Frequency	Per agreement (Between Vendor/Supplier)	At Least Quarterly	At Least Quarterly	Semi-Annual (Qtrly Recommended)	(8)
Laboratory Analysis/ Accredited Laboratory	Supplier or Lab Not Req.	Required by Ref 1404	Re-quired	Re-quired	Same as CGA

Commonly Used Air Specifications for Diving

LIMITING CHARACTERISTICS	CGA, Grade E (1997)	NITROX ANDI ('94)	NITROX IANTD ('98)	NITROX UBS ('97)	CGA, Grade J (1997)
Percent O_2 Balance Predominantly N_2	atm/ 20-22 (2)	atm / 20-22	atm/ 20-22	atm/ 20-40	atm/ 19.5-23.5
Water, ppm (v/v) (3)	(3)	128		63	1
Dew Point, °F (3)	(3)	-40°		-50°	-104
Condensed Hydrocarbons & Particulates, mg/m³ at NTP	5 (4)	.1	.1	5	
Carbon Monoxide, ppm	10	2	2	10	1
Odor (6)	(6)	(6)	(6)	(6)	(6)
Carbon Dioxide, ppm	1000	500	1000	1000	0.5
Total Hydrocarbon Content (as methane), ppm	25	25	25	25	0.5
Solid Particles, >2µm diameter		None			
Halogenated Solvents, ppm					0.1
Nitrogen dioxide, ppm					0.1
Nitrous oxide, ppm					0.1
Sulfur dioxide, ppm					0.1
Sampling Frequency	Per agreement (Between Vendor/Supplier)	Quarterly	Not stated	Quarterly	Per agreement (Between Vendor/Supplier)
Laboratory Analysis/ Accredited Laboratory	Supplier or Lab Not Req.	Recommended	Not stated	Recommended	Supplier or Lab Not Req.

NOT USED FOR DIVING

Notes

(1) Not required for synthesized air when oxygen produced by air liquefaction & meets USP specification.

(2) Not required for synthesized air when nitrogen previously analyzed & meets National Formulary specification.

(3) The water content may vary depending on the 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.

(4) Not required for synthesized air whose oxygen & nitrogen components are produced by air liquefaction.

(5) The term "atm" (atmospheric) denotes the oxygen content normally present in atmospheric air; the numerical values denote the oxygen limits for synthesized air.

(6) Measurement of odor is impractical. Air may have a slight odor but a pronounced odor renders the air unsatisfactory.

(7) Employers shall ensure that cylinders of purchased air have a certificate of analysis from the supplier that air meets Grade D breathing air. Moisture content does not exceed a dew point of -50°F (63 ppm) at 1 atmosphere pressure. The employer shall ensure that compressors used to supply breathing air to respirators minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees Fahrenheit below the ambient temperature.

(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 o high-temperature alarms and automatic shut off devices." Pg 1256, Federal Register.

COMPRESSED GAS ASSN, *CGA G-7.1–1997, Commodity Specification for Air*

(Page 3) Table 2 describes typical users and appropriate air quality grade levels. It lists Gr A for industrial compressed air (non-breathing air but inappropriate for instrument air since it does not limit condensed hydrocarbons (oil)), Gr L for SCBA air (does not include complete requirements for safe air), Gr D for OSHA breathing air, Gr E for SCUBA, Gr J for specialty grade air, analytical applications, and N for Medical/USP air (some of the Gr J & N limiting characteristics can only be met by synthesized air.) ***(Page 2)*** Table 1 has dropped Grades K, G, and M. Gr L only requires testing of dew point/water, odor, and oxygen. The limit (which is also referenced as Note 3 has been changed to the stricter -65°F/24ppm (same as NFPA 1500) or 10°F lower than the coldest expected temperature. For fire department use, the appropriate requirements are Gr D with Note 3 requirements for moisture. Fire departments who have Underwater Rescue Teams frequently specify compliance with Gr D and Gr E. In the '97 revision, Gr E carbon dioxide limits have been raised from 500 ppm to 1000 ppm. Gr E includes an additional limit for total hydrocarbon content (as methane) to 25 ppm and specifies 20-22% oxygen. The standard still does not address sampling frequency for users who have their own air compressor. For users who purchase air from vendors (typically who synthesize air by blending oxygen and nitrogen) there are several quality verification systems that may be used which can best be summed up by stating that whatever is agreed upon between the supplier and the customer is acceptable. ***(Page 1, Sec. 3.1)*** Production qualification tests may be performed by the supplier or by a laboratory agreed upon between the supplier and the customer.

NATIONAL FIRE PROTECTION ASSOCIATION, *NFPA 1500, 1997 Edition*

(Sec. 5-3.1) A fire dept. is to adopt and maintain a respiratory protection program that includes the assurance of air quality testing. ***(Sec. 5-3.1.1)*** The respiratory protection program shall meet the requirements of NFPA 1404 which includes among other things the use of an accredited laboratory. ***(Sec. 5-3.2)*** Dept. will have written standard operating procedures (SOP). **(Sec. 5-*3.6)*** A minimum air quality of ANSI/CGA G-7.1, Grade D, a dew point level of -65°F (24 ppm) or dryer, and a maximum particulate level of 5 mg/m^3. ***(Sec. 5-3.7)*** WHEN AIR IS PURCHASED IN A VENDOR SUPPLIED SCBA CYLINDER, the fire dept. shall require the vendor to provide documentation that a sample of air obtained directly at the point of transfer from the vendor's filling system to the SCBA has been tested at least quarterly and meets Grade D as stated in Sec. 5-3.6. ***(Sec. 5-3.7.1)*** WHEN THE FIRE DEPT. MANUFACTURERS ITS OWN BREATHING AIR, the dept. shall be required to provide documentation that a sample of the breathing air obtained directly from the point of transfer from the filling system to the SCBA cylinders has been tested at least quarterly as stated in Sec. 5-3.6.

NATIONAL FIRE PROTECTION ASSOCIATION, *NFPA 1404, 1996 Edition*

(Sec. 7-1.1) Air for SCBA taken from production of compressor and storage system shall meet the testing and quality requirements of CGA G–7.1 with a minimum quality of Grade D and a maximum dewpoint level of -50°F (63 ppm) or 10°F lower than the coldest temperature expected in the area(refers to 1989 version) ***(Sec. 7-1.2)*** IF AIR IS PURCHASED IN A VENDOR SUPPLIED CYLINDER, the fire dept. will require the vendor to provide certification and documentation that air has been tested by an accredited laboratory and meets Grade D requirements as stated earlier. IF FIRE DEPT. MAKES ITS OWN BREATHING AIR OR TRANSFERS PURCHASED AIR FROM VENDOR CYLINDERS into other storage cylinders, dept. shall test at least quarterly by accredited laboratory. ***(Sec. 7-1.3)*** Maintain records for each air quality test. If air does not meet Grade D requirements, use of system shall be discontinued until repairs are made and verified by air quality tests. ***(Sec. 7-1.4)*** ANY AIR CYLINDERS CONTAINING AIR SUSPECTED OF NOT MEETING AIR STANDARDS SHALL BE EMPTIED AND PURGED.

TEXAS COMMISSION ON FIRE PROTECTION, *(Fire Fighter Safety, Chapter 435)* applies to any Texas fire dept. who has at least 1 paid person. ***(4)*** Ensure that compressed breathing air from any source, including but not limited to transferred air from vendor cylinders to other cylinders, fire dept. air compressors, cascade systems and private sources, that is used to fill the cylinders of a SCBA complies with the minimum standards of the National Fire Protection Association for air quality testing of compressed breathing air and identified in NFPA 1500, 1992 edition. ***(5)*** Ensure that at least every six months, samples of the air used to fill

the cylinders of SCBA are tested by a testing laboratory which currently holds accreditation to test breathing air from a nationally recognized accrediting organization. Air samples shall be taken directly from the point where SCBA cylinders are connected for filling. If a fill station has more than one port where a SCBA cylinder can be attached and if only one sample is taken from the fill station, then the sample shall be taken from the port that ensures that all components of the fill station are tested. It is "recommended" that the air used to fill cylinders of SCBA be tested at least every 3 months.

OSHA, 1910.134, Respiratory Protection, revised 1/8/98, effective 4/8/98,

Section (c) Respiratory protection program, requires the employer to develop and implement a written respiratory protection program with required work site-specific procedures and elements for required respirator use. ***(c)(vi)*** Among other things, the plan should include procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators. A sample program is available from OSHA's Office of Publications, ask for "Small Entity Compliance Guide." For a copy, call 202-693-1888.

Section (i) Breathing air quality and use (1)(ii) mandates compliance with Type 1-Grade D breathing air described in ANSI/Compressed Gas Assn. Commodity Specification for Air, G–7.1–1989. ***(Section i (4)) (i)*** CYLINDERS used to supply breathing air to respirators are tested and maintained according to DOT (49 CFR part 173 & part 178). ***(i)(4)(ii)*** CYLINDERS of purchased breathing air must have a certificate of analysis from the supplier that air meets Grade D specifications. ***(i)(4)(iii)*** The moisture content in the CYLINDER does not exceed a dew point of -50°F at 1 atmosphere pressure. (i)(5) The employer shall ensure that COMPRESSORS used to supply breathing air to respirators are constructed and situated so as to: ***(i)(5)(i)*** prevent entry of contaminated air into the air supply system ***(i)(5)(ii)*** Minimize moisture content so that the dew point at 1 atmosphere pressure is 10°F below the ambient temperature. This is intended for airline respirator use not for high pressure filling of SCBA's. ***(i)(5)(iii)*** Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds & filters shall be maintained and replaced/refurbished according to manufacturer's instructions. ***(i)(5)(iv)*** Have a tag on the 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)*** Breathing air couplings are incompatible with outlets for nonrespirable work site air or other gas systems.

NOTE: The new OSHA revision references the 1989 version of CGA air specifications. The CGA standard was revised in 1997; however not published and released until May of 1998. In the past whenever CGA has updated this standard, OSHA Directorate of Compliance Programs has issued letters of interpretation that required employers to use the updated air specifications.

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

OSHA, 1910.430, Commercial Diving, has not been updated recently. Mandates that air shall not contain levels greater than 20 ppm of carbon monoxide (Note: precedence is to use current CGA standard see Note above), 1000 ppm of carbon dioxide, 5 mg/m^3 of oil mist, a noxious or pronounced odor, and semi-annual testing.

ANDI (American Nitrox Divers International) requires compliance to a modified Grade E shown in chart & quarterly testing.

IANTD (International Association of Nitrox & Technical Divers, Inc.) requires compliance to a modified Grade E shown in chart.

NAUI (National Association of Underwater Instructors) Code of Ethics commitment to quarterly testing according to modified E or Grade E (as appropriate).

PADI (Professional Association of Diving Instructors) requires compliance to Grade E, 1997 and quarterly testing.

UBS-DNAX (Undersea Breathing Systems, Inc.) requires quarterly testing and compliance with Grade E and modified Grade E as shown above.

For a complete copy of the CGA specifications, contact the CGA at 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202, 703-412-0900. The OSHA Federal Register, 29 CFR PARTS 1910 and 1926, Respiratory Protection can be obtained free of charge on the internet at www.osha.gov. Copies of NFPA 1404 and 1500 are available for purchase from the National Fire Protection Association at 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101, Order Desk Phone 800-344-3555. The Texas Commission on Fire Protection can be reached at PO Box 2286, Austin, TX 78768-2286, 512-918-7100.

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^3. 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 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^3. It also requires moisture analysis at $\leq$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 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 specifcations, please feel free to call us.