

**COMMON BREATHING AIR QUALITY STANDARDS FOR SCBA AND AIRLINES**

| LIMITING CHARACTERISTICS   | CGA GRADE D <sup>a</sup><br>(2004)                | CGA GRADE E <sup>b</sup><br>(2004)<br>Includes<br>SCUBA Diving | OSHA <sup>c</sup> 1910.134<br>(2006)           | ANSI Z88.2 <sup>d</sup><br>(1992)                | NFPA 1404 <sup>e</sup><br>(2006)        | NFPA 1500 <sup>f</sup><br>(2007)         | NFPA 1852 <sup>g</sup><br>(2002)          | NFPA 1989 <sup>h</sup><br>(2003)     |
|--|---|--|--|--|---|--|---|--------------------------------------|
| Carbon Dioxide - ppm v/v   | 1000 <sup>(1)</sup>                               | 1000   | 1000   | 1000   | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | 1000                                      | 1000                                 |
| Carbon Monoxide - ppm v/v  | 10 <sup>(1)(2)</sup>                              | 10   | 10   | 10   | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | 10  | 10                                   |
| Dew Point (°F) / Water - ppm v/v                                 | (3)   | (3)  | ≤.50 / ≤63 <sup>(4)</sup>                      | ≤.65 / ≤25 <sup>(5)</sup>                        | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | ≤.63 / ≤24                                | ≤.63 / ≤24                           |
| Odor   | (7)   | (7)  | no noticeable odor                             | (7)  | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | (7)                                       | (7)                                  |
| Oil (condensed) - mg/m <sup>3</sup> at NTP & Particulates        | 5 <sup>(8)</sup><br>NA                            | 5 <sup>(8)</sup><br>NA   | 5<br>NA  | 5<br>NA  | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | 5<br>5                                    | 5<br>5                               |
| Percent Oxygen, balance is predominantly nitrogen <sup>(9)</sup> | atm<br>19.5 - 23.5                                | atm<br>20 - 22   | atm<br>19.5 - 23.5                             | atm<br>19.5 - 23.5                               | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | atm<br>19.5 - 23.5                        | atm<br>19.5 - 23.5                   |
| Total Hydrocarbon Content (as methane) - ppm v/v                 | NA  | 25   | NA   | NA   | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | NA  | 25                                   |
| Sampling Frequency   | per supplier / customer agreement<br>[Sec. 3.3.2] |  | not specified<br>[Sec. (I)(7)] <sup>(10)</sup> | not specified<br>[Sec. 10.5.4.3] <sup>(11)</sup> | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | reference to<br>NFPA 1500<br>[Sec. 7.3.2] | at least quarterly<br>[Sec. 5.1.1.1] |
| Sampling Location  |   | samples shall be representative of the air supply [Sec. 4.2]   | not specified                                  | <sup>(12)</sup><br>[Sec. 10.5.4.3]               | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | reference to<br>NFPA 1500<br>[Sec. 7.3.2] | <sup>(13)</sup><br>[Sec. 5.2.1]      |
| Testing  |   | tested by supplier or laboratory<br>[Sec. 3.4.1]               | reference to<br>CGA [Sec. (I)(1)(i)]           | <sup>(14)</sup><br>not specified                 | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | reference to<br>NFPA 1500<br>[Sec. 7.3.2] | lab required<br>[Sec. 5.1.1.1]       |
| Accreditation / Certification                                    |   | not required   | not required                                   | not required                                     | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | not required                              | required<br>[Sec. 4.1.1]             |
| Breathing Air Quality  |   | specified in Table 1   | reference to<br>1989 CGA<br>[Sec. (I)(1)(ii)]  | reference to<br>1989 CGA<br>[Sec. 10.5.1]        | reference to<br>NFPA 1500<br>[Sec. 9.1] | reference to<br>NFPA 1989<br>[Sec. 7.10] | reference to<br>NFPA 1500<br>[Sec. 7.3.2] | specified in<br>Sec. 5.3             |

NA = "indicates no maximum limiting characteristic. The absence of a listed quality verification level does not imply that the limiting characteristic is or is not present, but merely indicates that the test is not required for compliance with the characteristics specification." CGA 2004

Comparison of Respiratory Protection standards prepared by Air Quality Laboratories, Inc. as a guideline document only. Not intended to replace the official standards.

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| OTHER RESPIRATORY PROTECTION PROGRAM REQUIREMENTS | CGA GRADE D <sup>a</sup> (2004) | CGA GRADE E <sup>b</sup> (2004) Includes SCUBA Diving | OSHA <sup>c</sup> 1910.134 (2006)      | ANSI Z89.2 <sup>d</sup> (1992)      | NFPA 1404 <sup>e</sup> (2006)        | NFPA 1500 <sup>f</sup> (2007)       | NFPA 1852 <sup>g</sup> (2002)          | NFPA 1989 <sup>h</sup> (2003) |
|---|---------------------------------|---|--|-------------------------------------|--------------------------------------|-------------------------------------|--|-------------------------------|
|   |                                 |   |  |                                     |                                      |                                     |  |                               |
| Written Program                                   | not specified                   | not specified   | required [Sec. (c)]                    | required [Sec. 4]                   | required [Sec. 1.2.1 & 5.1.1]        | required [Sec. 7.9.1]               | required [Sec. 4.2.1]                  | not specified                 |
| Written SOPs                                      | not specified                   | not specified   | required [Sec. (c)]                    | required [Sec. 6]                   | required [Sec. 5.1.3]                | required [Sec. 7.9.2]               | required [Sec. 4.2.1]                  | not specified                 |
| Medical Evaluation / Certification                | not specified                   | not specified   | Initially then as necessary [Sec. (e)] | referred to ANSI Z89.6 [Sec. 4.5.3] | Initially then annually [Sec. 6.1.5] | annually [Sec. 10.2.2]              | not specified                          | not specified                 |
| Facepiece Fit Testing                             | not specified                   | not specified   | Initially then annually [Sec. (f)]     | annually [Sec. 9.1.4]               | Initially then annually [Sec. 6.1.4] | Initially then annually [Sec. 7.12] | not specified                          | not specified                 |
| Respiratory Protection Training                   | not specified                   | not specified   | Initially then annually [Sec. (k)(5)]  | Initially then annually [Sec. 8.2]  | Initially then annually [Sec. 5.2.6] | Reference to NFPA 1404 [Sec. 5.3.5] | not specified                          | not specified                 |
| Respirator Selection                              | not specified                   | not specified   | required [Sec. (d)]                    | required [Sec. 7]                   | required [Sec. 4.2.1 & 4.3]          | required [Sec. 7.9.1]               | required [Sec. 5]                      | not specified                 |
| Respirator Cleaning / Storage                     | not specified                   | not specified   | required [Sec. (h)(1) & (h)(2)]        | required [Sec. 10.1 & 10.4]         | required [Sec. 4.1.4 & 8.1.3]        | required [Sec. 7.9.1 & 7.9.6]       | required [Sec. 6]                      | not specified                 |
| Respirator Inspection                             | not specified                   | not specified   | required [Sec. (h)(3)]                 | required [Sec. 10.2]                | required [Sec. 7 & 8.1.2]            | required [Sec. 7.9.1]               | required [Sec. 7.2]                    | not specified                 |
| Respirator Maintenance                            | not specified                   | not specified   | repairs [Sec. (h)]                     | required [Sec. 10.3]                | required [Sec. 8]                    | required [Sec. 7.9.1]               | required [Sec. 7]                      | not specified                 |
| Cylinder Hydrostatic Testing                      | reference to DOT [Sec. 6.1.1]   | reference to DOT [Sec. (l)(4)(i)]                     | reference to DOT [Sec. (l)(4)(i)]      | reference to DOT [Sec. 10.5.4.1]    | reference to NFPA 1500 [Sec. 7]      | required [Sec. 7.14.2]              | reference to DOT [Sec. 7.3.5 & 7.12.4] | not specified                 |
| Recordkeeping                                     | not specified                   | not specified   | required [Sec. (m)]                    | required [Sec. 4.5.1 & 5.3]         | required [Sec. 6.1.2]                | required [Sec. 4.6.5]               | required [Sec. 4.4.1]                  | not specified                 |
| Reference to NFPA 1989                            | not specified                   | not specified   | not specified                          | not specified                       | not specified                        | [Sec. 7.10]                         | not specified                          | ---                           |

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- a) Compressed Gas Association, Inc., CGA G-7.1-2004, Commodity Specification for Air  
CGA G-7 (Compressed Air for Human Respiration) specifies Grade D as the minimum grade for routine use in self-contained or supplied-air protective breathing equipment as used in general industry and firefighting.
  - b) Compressed Gas Association, Inc., CGA G-7.1-2004, Commodity Specification for Air  
CGA G-7 (Compressed Air for Human Respiration) specifies Grade E as the minimum grade to be used for SCUBA diving to 130 feet.
  - c) Occupational Safety & Health Administration, OSHA 29 CFR 1910.134 (8/24/06), Respiratory Protection
  - d) American National Standards Institute, ANSI Z88.2 (1992), Respiratory Protection
  - e) National Fire Protection Association, NFPA 1404 (2006), Fire Service Respiratory Protection Training
  - f) National Fire Protection Association, NFPA 1500 (2007), Fire Department Occupational Safety & Health Program
  - g) National Fire Protection Association, NFPA 1852 (2002), Selection, Care, and Maintenance of Open-Circuit SCBA
  - h) National Fire Protection Association, NFPA 1989 (2003), Breathing Air Quality for Fire and Emergency Services
- (1) Not required for synthesized air when oxygen component was produced by air liquefaction & meets USP specification.
  - (2) Not required for synthesized air when nitrogen component was previously analyzed & meets NF specification.
  - (3) The water content of compressed air may vary with the intended use from saturated to very dry. For breathing air use in conjunction with SCBA in extreme cold where moisture can condense and freeze causing the breathing apparatus to malfunction, a dew point not to exceed -65 °F (24 ppm v/v) or 10 degrees Fahrenheit lower than the coldest temperature expected in the area is required.
  - (4) Employers shall ensure that cylinders of purchased breathing air have a certificate of analysis from the supplier that the air meets the requirements for Grade D breathing air and the moisture content in the cylinder does not exceed a dew point of -50 °F 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 below the ambient temperature.
  - (5) The driest air obtainable (dew point of -100 °F or lower) should be used for recharging SCBA cylinders to be used in environments with ambient temperatures below -25 °F.
  - (6) Or 10 °F lower than the coldest temperature expected in the area.
  - (7) Specific measurement of odor in gaseous air is impractical. Air may have a slight odor but the presence of a pronounced odor should render the air unsatisfactory.
  - (8) Not required for synthesized air whose oxygen and nitrogen components are produced by air liquefaction.
  - (9) The term "atm" (atmospheric) denotes the oxygen and nitrogen content normally present in atmospheric air; the numerical values denote the oxygen limits for synthesized air.

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- (10) "The employer must ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm. Methods for ensuring that the carbon monoxide level does not exceed 10 ppm include the placement of the air intake for the compressor in an area to be free from contaminants, frequent or continuous monitoring of the breathing air supply, the use of carbon monoxide filters, or the use of high temperature alarms or shut off devices where necessary. "
- "If only a high temperature alarm is used then the breathing air must be tested for the presence of carbon monoxide at intervals sufficient to ensure that carbon monoxide levels do not exceed 10 ppm. "
- "The frequency of monitoring will depend on the breathing air system in place in the facility, adherence to required maintenance procedures, and the location of the air intake for the compressor. For example, keeping in mind that a given measurement represents only that instant in time and must be representative of long-term air quality, periodic monitoring may be appropriate in situations where the compressor is well maintained and the air intake for the compressor is located in an area free from contaminants. In contrast, continuous monitoring would be warranted for older compressors where oil blow-by is more likely due to piston ring and cylinder wear....or the maintenance history is not known." OSHA Instruction & Inspection Guidelines CPL2-0.120 9/25/98
- (11) Prior to initial use and to ensure a continued high-quality air supply samples should be collected on a periodic basis, as directed by the program administrator.
- (12) To account for any distribution system contamination input, a representative sample should be taken at the distribution supply points.
- (13) A sample of breathing air obtained directly from the point of transfer from the filling system to the SCBA cylinders.
- (14) Table 3 & Table 4 differentiate between analysis guidance for purchased breathing air and a compressed source. No reference is made to "laboratory testing".

This AQL breathing air quality summary information is not intended to replace the actual referenced documents. For more detailed information and for exact wording refer to the original standards. Copies of the standards can be obtained from the appropriate organization. Questions regarding the summary information may be addressed to Air Quality Laboratories (AQL).