

Discussion Topics in Respiratory Protection

Compressed-Air Sources for Airline Respirators: Supplied-Air Respirators

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Over the past year I have been contacted multiple times by individuals seeking information on compressed-air sources for airline respirators. In order to stay focused on compressed breathing air, compressed oxygen and synthetic air systems are not addressed in this discussion topic. I am most familiar with the United States OSHA/NIOSH regulations, which do not regulate the complete system. NIOSH certifies the supplied-air respirator from the connection to the compressed breathing air source specifying the required pressure for operation of each approved device. OSHA and NIOSH require CGA, Grade D quality compressed breathing air and OSHA provides detailed requirements for breathing compressors:

"Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications of Grade D breathing air."

OSHA also requires unique couplings to be used with compressed-air pipelines as well as proper labeling and testing of breathing gas containers. ANSI Z88.2 (1992) requires Grade D quality compressed breathing air, similar labeling and testing requirements for breathing gas containers, unique airline couplings, and a dew point value lower than the lowest ambient temperature to which any part of the system will be exposed:

"A compressor shall be constructed so as to avoid entry of contaminated air. For all air compressors, including portable types, the air intake location shall be carefully selected, and monitored closely to ensure continued quality of air supply to the compressor. The system shall be equipped as necessary with a suitable in-line air-purifying sorbent bed and filter to further assure breathing air quality. Maintenance and replacement/refurbishment of compressor and associated air-purifying/filter media shall be performed periodically, by trained personnel following the manufacturer's recommendations and instructions."

ANSI Z88.2 also states that acceptance breathing air testing shall be performed as specified for the compressor as part of the ongoing periodic air-sampling program. There are no requirements for a high-temperature shutoff device or continuous monitoring for carbon monoxide.

United States regulations and standards are lacking requirements or specifications that would completely address various compressed breathing air sources. The regulations and standards I

have summarized previously do not describe or provide examples of a complete compressed breathing air system.

The current Canadian Standards Association (CSA) Standard for Compressed Breathing Air Systems (CAN3-Z180.1-M94, update expected late 1997), provides detailed information addressing the complete system. I have used the CSA information to answer questions on pipeline details, fabrication, and provide an example of a typical compressed breathing air purification train.

From my brief overview on this subject, what information do you feel is needed in national standards and related reference material to adequately address the correct design, installation and safe operation of compressed air sources for supplied airline respirators?

- Should there be specific examples of complete compressed breathing air systems? Do we need continuous monitoring of temperature and carbon monoxide?
- How should air quality be measured and at what frequency?
- What examples are available of systems that consistently produce compressed breathing air in compliance with OSHA and NIOSH regulations (e.g., compressor intakes are situated to avoid ingesting contaminated air)?
- What type of distribution piping should be used and how should it be assembled?
- When using cylinders of compressed breathing air, how should they be configured and what requirements should be placed on the pressure reducers, valves, and alarms in these systems?
- There are incidents where deaths have resulted from inhalation of inert gas such as nitrogen when the air cylinders are accidentally filled with inert gas. Should the oxygen content be verified for each air cylinder before use? What other controls should be considered?
- Should the oxygen content be monitored for all breathing air sources prior to entry into a confined space or an IDLH atmosphere?
- Can direct-readout carbon monoxide monitors be used routinely in an operating system? Is it just a case of maintenance for routine use?
- The Grade D air is the lowest grade breathing air listed in the CGA 7.1 standard. There are no monitoring requirements for many air contaminants for Grade D air. Should a higher grade breathing air such as Grade J be used as the minimum acceptable air quality?
- Should the type of oxygen monitor be specified (e.g., detector tube for non-IDLH and cosensor IDLH detectors)?
- Are high-temperature shutoff switches required for oil-lubricated compressors?
- Are there any documented accidents with oil-lubricated compressors which resulted in the production of carbon monoxide due to decomposition of the oil within the compressor?
- What operational/incident/accident experience is available to document problems with compressed air sources? Please provide specific details with references if possible.
- How should water content of the compressed air be addressed (e.g., CGA, G7.1, NFPA1981) and what experience and documentation is available to support the current recommendations?
- Are receivers necessary to provide backup air, should a compressor fail?
- What requirements, if any, should be placed on ambient air blower and pumps (e.g., carbon vane pumps)? Should the intake air be monitored for toxic airborne substances?
- What concerns do you have about compressed breathing air systems that you feel need to be addressed?