

HANFORD MISSION SUPPORT CONTRACT

Supplied Breathing Air Systems

MSC-PRAC-30515

Revision 0

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Topic: Safety and Health

Supplied Breathing Air Systems

PURPOSE This practice identifies a key aspect of the Mission Support Alliance (MSA) Safety and Health (S&H) industrial hygiene (IH) program, and provides requirements for the use and maintenance of supplied breathing air systems for air line respirators. This practice supplements [MSC-PRAC-30510](#), *Respiratory Protection*.

SCOPE This practice includes the following major sections:

- General Requirements
- Breathing Air Sample Analysis
- Design Specifications
- Compressors
- Bottle Carts

Requirements for safe use of self-contained breathing apparatus are covered by practice [MSC-PRAC-30510](#), and are not within the scope of this practice.

The requirements of this practice are consistent with the requirements published in the Hanford Mission Support Contract (MSC) Safety and Health virtual manual.

APPLICATION This practice applies to MSA construction personnel.

GENERAL REQUIREMENTS Records generated during the performance of this activity are to be included in the Construction Work Package and will be managed in accordance with [MSC-PRAC-30374](#), *Construction Work Package* and [MSC-PRAC-30376](#), *Construction Document Control*.

Breathing air systems and supplied air respirators are used to minimize/eliminate personal exposure to airborne toxic/potentially toxic materials when engineering and administrative controls are insufficient to preclude exposure or are not feasible, or when other types of respiratory protection are not suitable.

Although this practice is primarily focused on portable supplied air systems, it may be applied to fixed supplied air systems. Prior to the design or modification of fixed supplied air systems, engineering and Safety and Health is contacted for interpretation of American National Standards Institute (ANSI) and American Society of Mechanical Engineers (ASME) standards.

Supplied Breathing Air Systems

Breathing air system components are selected to ensure compliance with [42 Code of Federal Regulations \(CFR\) 84](#). This requirement includes using manufacturer's National Institute of Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA)-approved piping assemblies and connectors.

Design and maintenance of supplied air systems ensure that the quality and quantity of breathing air delivered to the air line meet the requirements in [29 CFR 1910.134](#) and ANSI Z88.2, *American National Standard for Respiratory Protection (1992)*.

Air delivered by supplied breathing air systems meets at least Grade D quality, as specified in the most current edition of the Compressed Gas Association's (CGA) "Commodity Specification for Air" (G-7.1).

Breathing air system components are never used for nonbreathing air purposes. Breathing air system components are identified, marked, and controlled to prevent cross-contamination with other systems. Only Schraeder connectors are to be used for breathing air system connection.

NOTE: *Breathing air couplings (Schraeder) are not compatible with outlets for nonrespirable air or other gas systems.*

Supplied air respirators are:

- Used in adequately ventilated areas containing at least 19.5 percent oxygen, unless equipped with escape provisions.
- Not used in areas where concentrations of contaminant(s) are unknown or immediately dangerous to life or health unless equipped with escape provision.
- Selected, issued, and maintained in accordance with practice [MSC-PRAC-30510](#).

Breathing air system components are stored when not in use to ensure that exposure to chemical contaminants, biological contaminants, and agents that degrade or damage the components are minimized.

Supplied air respirators are used in accordance with applicable NIOSH/MSHA approvals and limitations (such as maximum allowable hose length).

Supplied Breathing Air Systems

Special handling, donning/doffing, and other activities associated with breathing air systems in hazardous locations (that are not commonly covered in training courses) are specified in prejob planning documents (refer to [MSC-PRAC-30462](#), *Prejob Safety Planning*).

Trained and qualified employees tend supplied breathing air systems at all times when in use.

Breathing air containers are marked in accordance with CGA C4-1990.

NOTE: *Use only breathing air bottles:*

with a date of origin 1985 or newer, and

that are medium blue in color, with “Breathing Air” stenciled on the bottle in white lettering.

Air hoses, manifolds, and major breathing air system components are identified and marked at conspicuous locations to indicate their use.

Additional identification of components, through a numbering system, may be used to help track individual components and to assist in-line tracing during system setup. Any numbering system may be used that provides unique numbers for each component.

Employees are familiar with the markings for breathing air equipment and aware of the segregation of breathing air and nonbreathing air equipment.

Breathing air components are kept free from sources of corrosion, chemical or physical degradation, and from chemical, radiological, or biological contamination.

Low-pressure alarms systems are functional and set at a level so users can safely evacuate the work environment.

NOTE: *Remote alarms may be required when the air source/primary alarm is not audible in the work environment and/or the attendant cannot warn users in a timely manner to effect safe evacuation.*

Breathing air piping/hoses are capped or covered with plastic that is secured with tape when not in use.

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Manifolds and other small components are secured in plastic bags. These bags are marked indicating their contents.

During the progress of the work, if any employee has to utilize an escape source (for example, bottle or hose), all workers shall exit the work area immediately and notify supervision.

Air hoses are left connected to the manifold until all workers are out of the work area. Air lines are disconnected **only at the person**, never at the manifold, when exiting the work area.

During summer and winter weather, breathing air hoses are protected as much as possible from ambient temperature extremes.

Hoses are stored out of direct sunlight when not in use.

Portable breathing air components are stored in a secure area when not in use. Facilities used for positive respirator control may be used for storage of portable breathing- air components provided that respirators are physically segregated from these components.

Prior to re-use, portable breathing air components are inspected for physical damage, degradation, and any surface contamination. Faded or degraded markings are repaired prior to re-use.

BREATHING AIR SAMPLE ANALYSIS

Supplied breathing air systems (except those using only compressed air cylinders) are sampled and meet Grade D quality and ANSI Z88.2 as follows:

- Within 6 months before use
- Following a system failure
- Following maintenance

During collection of breathing air samples, a compressor is operated in the same manner that it will be used during normal operations.

An Industrial Hygiene Chain of Custody and Laboratory Request, form [A-6004-314](#), is used to track the sample from collection through analysis/results reporting.

Breathing air samples are tested by a qualified analyst using protocols (including equipment calibration) in accordance with ANSI and CGA.

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BOTTLE CARTS

Bottle carts are operated in accordance with the general instructions in *Bottle Cart-Air Job Aid*, ([A-6004-341](#)) and unit-specific instructions must be attached to the bottle cart.

FORMS

Industrial Hygiene Chain of Custody and Laboratory Request, [A-6004-314](#)
Bottle Cart-Air Job Aid, ([A-6004-341](#))

RECORDS IDENTIFICATION

Records Capture Table

Name of Document	Submittal Responsibility	Retention Responsibility
<i>Industrial Hygiene Chain of Custody and Laboratory Request</i> , A-6004-314	Construction Supervisor/Superintendent	Project Document Control
<i>Bottle Cart-Air Job Aid</i> , (A-6004-341)	Employee	Project Document Control

REFERENCES

[29 CFR 1910.134](#), *Personal Protective Equipment*
[42 Code of Federal Regulations \(CFR\) 84](#), *Public Health*

ANSI Z88.2, *American National Standard for Respiratory Protection* (1992).

[MSC-PRAC-30374](#), *Construction Work Package*
[MSC-PRAC-30376](#), *Construction Document Control*
[MSC-PRAC-30510](#), *Respiratory Protection*

APPENDICES

[Appendix A](#), *General Guidelines for Design of Breathing Air Systems*

Supplied Breathing Air Systems

Appendix A General Guidelines for Design of Breathing Air Systems

These guidelines are to be considered for design of breathing air systems but are advisory only.

DESIGN SPECIFICATIONS

Breathing air systems are designed in accordance with the engineering and safety standards noted above.

The design of compressor-supplied breathing air systems and selection of the breathing air supply is dependent upon many factors including:

- The location and type of respirator that are used at each manifold
- The number of active manifold outlet connections to be in use at any one time
- The location of the compressor
- The location of the compressor's fresh air intake

Air supply piping provides design flow rates at the maximum anticipated design capacity requirements, with design pressure and temperatures maintained at the respirators.

Pressure

The design pressure for breathing air distribution piping is 860 kPa gage (125 psig) maximum and 420 kPa gage (60 psig) minimum. The piping and manifold stations are sized to provide 240 kPa to 345 kPa gage (35–50 psig) at respirators with a tight fitting face piece, and 420 kPa to 620 kPa gage (35–90 psig) to a loose fitting hood or helmet. For design calculations, assume the maximum length of air hose recommended by NIOSH/MSHA is used, with a pressure drop of 170 kPa gage (25 psig) for the hose and fittings.

Flow Rate

Compressor-supplied breathing air systems are designed to provide a minimum flow rate of 113 L/min at 240 kPa gage (4 scfm at 35 psig) for constant flow face-piece respirators and 170 L/min at 240 kPa gage (6 scfm at 35 psig) for loose fitting hoods and helmets. Demand type systems are capable of delivering not less than 113 L/min (4 scfm) and not more than 425 L/min (15 scfm).

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Capacity	The design capacity for breathing air supply piping is equal to the maximum number of outlets anticipated to be in use at one time multiplied by 425 L/min (15 scfm).
Components	<p>Pipe joint sealant and lubricant for threaded piping joints are of a nontoxic type.</p> <p>Quick-disconnect Schraeder check units are used for the air hose connection. Use only those quick-disconnect Schraeder assemblies approved for use by the respirator manufacturer.</p>
Pressure Reducing Station	<p>When the operating pressure of the breathing air supply is greater than 860 kPa gage (125 psig), a pressure reducing station is installed in the supply header. The pressure reducing station components include:</p> <ul style="list-style-type: none">• A pressure-reducing valve (PRV) set to provide 860 kPa gage (125 psig) outlet pressure.• Bypass piping around the PRV with a globe valve for manual pressure regulation.• A pressure gauge with a 0 to 1400 kPa (0–200 psig) scale, installed downstream of the PRV bypass piping.• A safety relief valve (SRV) installed downstream of the PRV bypass piping.
Manifold Station	<p>The breathing air manifold is the termination point for the breathing air supply piping. The manifold includes:</p> <ul style="list-style-type: none">• A filter rated to remove 99.99998 percent of all liquid and solid particles 0.03 micrometer or larger. The filter is drainable for removal of trapped fluids.• A pressure regulator with 0 to 860 kPa (0–125 psig) range and a gauge with a scale of 0 to 1050 kPa (0–150 psig). The pressure regulator is installed downstream from the filter.• Quick-disconnect Schraeder check units for the air hose connection.

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Pipe Installation

Piping is flushed after fabrication and prior to leak testing.

Piping may be flushed with a diluted solution of Turco Plaudit (Ethoxylated Alcohol, CAS 26027-38-3) prior to a final water flush. The diluted solution consists of 11 parts water to 1 part Turco Plaudit. (9 percent solution.)

NOTE: *Turco Plaudit solutions exceeding 10 percent are considered a regulated waste under Washington State regulations.*

Flush with water until the effluent is clean and contains no visible particulate matter; the duration of the flush is not less than 1 minute. Flushing velocity is at least 1.5 meters per second (5 feet per second). Drain all piping at flush completion. When leak testing is not performed immediately after flushing, dry the piping by blowing dry oil-free air through the lines for a period of not less than 15 minutes. Seal the lines after drying until leak testing is performed.

Hydrostatically test the piping in accordance with the design code. Drain all piping if it is not cleaned immediately, and dry the piping by blowing dry oil-free air through the lines for a period of not less than 15 minutes. Seal the lines after drying until cleaning is performed.

COMPRESSORS

Compressors and compressed breathing systems are properly installed, tested, and maintained to ensure the proper use of these systems in accordance with the manufacturer's operating instructions.

Compressors are designed and positioned to avoid intake of contaminated air. For all compressors, including portable types, the air intake location is carefully selected and evaluated to ensure continued quality of air supply to the compressor.

Compressor systems are equipped as necessary with a suitable in-line air-purifying sorbent bed and filter to further ensure breathing air quality. Periodic maintenance and replacement/refurbishment of compressor and associated air-purifying/filter media is performed by trained personnel, following manufacturer's recommendations and instructions.