

# Pressure, Vacuum, and Cryogenic Systems: Oxygen Requirements

Department: Chemical and General Safety

Program: Pressure, Vacuum, and Cryogenic Systems

Owner: Program Manager

Authority: ES&H Manual, Chapter 14, Pressure, Vacuum, and Cryogenic Systems<sup>1</sup>

All pressure systems must be in conformance with the requirements of Chapter 14, and this exhibit provides the additional required information specific to oxygen systems. If you need further clarification on the unique characteristics of this type of system or the specific codes, regulations, and standards, please contact the program manager.

## **Unique Characteristics**

Oxygen system design, installation, use, and maintenance require the highest level of attention to safety considerations and materials compatibility to minimize the ever-present danger of combustion.

- Oxygen undergoes adiabatic compression when the pressure in the system is increased. This can result in extremely high temperatures in a localized area; these temperatures can exceed the auto-ignition temperature of certain soft goods or metal particles in the system, resulting in a very hot fire within the gas system.
- The installation of and any repair or maintenance on oxygen systems requires the highest level of attention to cleanliness. Impurities such as oils or grease can react violently with pure oxygen, creating conditions for fire.

## **Required Regulations, Codes, and Standards**

In addition to those listed in Section 3, “Standards”, of Chapter 14, the following regulations, codes, and standards apply.

*Note Use the most current edition unless otherwise indicated.*<sup>2</sup>

### **American Society of Mechanical Engineers (ASME) Standards**

- ASME B31.3-2002, “Process Piping”
- ASME B16 series, “Standards of Pipes and Fittings”

### **National Fire Protection Association (NFPA) Standards**

- NFPA 51, “Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes”

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1 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 14, “Pressure, Cryogenic, and Vacuum Systems”, [http://www-group.slac.stanford.edu/esh/hazardous\\_activities/pressure/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_activities/pressure/policies.htm)

2 See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

## Pressure, Vacuum, and Cryogenic Systems: Oxygen Requirements

- NFPA 53, “Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres”
- NFPA 55, “Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks”

### **California Fire Code**

- Chapter 30, “Compressed Gases”
- Chapter 27, “Hazardous Materials – General Provisions”

### **California Mechanical Code**

- Chapter 14, “Process Piping”

### **ASTM Standards**

- ASTM G-88, “Standard Guide for Designing Systems for Oxygen Service”
- ASTM G-93, “Standard Practice for Cleaning Methods for Material and Equipment Use in Oxygen-Enriched Environments”
- ASTM G-128, “Standard Guide for Control of Hazards and Risks in Oxygen Enriched Systems”

### **Compressed Gas Association (CGA) Standards and Publications**

- CGA G-4, “Oxygen”
- CGA G-4.1, “Cleaning Equipment for Oxygen Service”

### ***Related Documents***

- Hazardous Materials: Oxygen Safe Handling Guideline (SLAC-I-730-0A09T-011)<sup>3</sup>
- Hazardous Materials: Personal Protective Equipment Requirements (SLAC-I-730-0A09S-017)<sup>4</sup>
- Pressure, Vacuum, and Cryogenic Systems: Codes, Regulations, and Standards List (SLAC-I-730-0A21V-001)<sup>5</sup>

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3 <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatGuideOxygen.pdf>

4 <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatReqPPE.pdf>

5 <http://www-group.slac.stanford.edu/esh/eshmanual/references/pressureListStandards.pdf>