



Standard Guide for Control of Hazards and Risks in Oxygen Enriched Systems¹

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1. Scope

1.1 This guide covers an overview of the work of ASTM Committee G04 on Compatibility and Sensitivity of Materials in Oxygen-Enriched Atmospheres. It is a starting point for those asking the question: “What are the risks associated with my use of oxygen?” This guide is an introduction to the unique concerns that must be addressed in the handling of oxygen. The principal hazard is the prospect of ignition with resultant fire, explosion, or both. All fluid systems require design considerations, such as adequate strength, corrosion resistance, fatigue resistance, and pressure safety relief. In addition to these design considerations, one must also consider the ignition mechanisms that are specific to an oxygen-enriched system. This guide outlines these ignition mechanisms and the approach to reducing the risks.

1.2 This guide also lists several of the recognized causes of oxygen system fires and describes the methods available to prevent them. Sources of information about the oxygen hazard and its control are listed and summarized. The principal focus is on Guides G63, G88, Practice G93, and Guide G94. Useful documentation from other resources and literature is also cited.

NOTE 1—This guide is an outgrowth of an earlier (1988) Committee G04 videotape adjunct entitled *Oxygen Safety* and a related paper by Koch² that focused on the recognized ignition source of adiabatic compression as one of the more significant but often overlooked causes of oxygen fires. This guide recapitulates and updates material in the videotape and paper.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific precautionary statements see Sections 8 and 11.

NOTE 2—ASTM takes no position respecting the validity of any evaluation methods asserted in connection with any item mentioned in this guide. Users of this guide are expressly advised that determination of the validity of any such evaluation methods and data and the risk of use of such evaluation methods and data are entirely their own responsibility.

2. Referenced Documents

2.1 ASTM Standards:³

- D2512 Test Method for Compatibility of Materials with Liquid Oxygen (Impact Sensitivity Threshold and Pass-Fail Techniques)
- D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
- D4809 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
- G63 Guide for Evaluating Nonmetallic Materials for Oxygen Service
- G72 Test Method for Autogenous Ignition Temperature of Liquids and Solids in a High-Pressure Oxygen-Enriched Environment
- G74 Test Method for Ignition Sensitivity of Nonmetallic Materials and Components by Gaseous Fluid Impact
- G86 Test Method for Determining Ignition Sensitivity of Materials to Mechanical Impact in Ambient Liquid Oxygen and Pressurized Liquid and Gaseous Oxygen Environments
- G88 Guide for Designing Systems for Oxygen Service
- G93 Practice for Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen-Enriched Environments
- G94 Guide for Evaluating Metals for Oxygen Service
- G124 Test Method for Determining the Combustion Behavior of Metallic Materials in Oxygen-Enriched Atmospheres

¹ This guide is under the jurisdiction of ASTM Committee G04 on Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres and is the direct responsibility of Subcommittee G04.02 on Recommended Practices.

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² Koch, U. H., “Oxygen System Safety,” *Flammability and Sensitivity of Materials In Oxygen-Enriched Atmospheres*, Vol 6, ASTM STP 1197, ASTM, 1993, pp. 349–359.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.