

NFPA[®]

51

**Standard for the
Design and Installation
of Oxygen–Fuel Gas Systems
for Welding, Cutting, and
Allied Processes**

2018



IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA STANDARDS

NFPA® codes, standards, recommended practices, and guides (“NFPA Standards”), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that NFPA Standards may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any Tentative Interim Amendment and any Errata then in effect.

In order to determine whether an NFPA Standard has been amended through the issuance of Tentative Interim Amendments or corrected by Errata, visit the “Codes & Standards” section on NFPA’s website. There, the document information pages located at the “List of NFPA Codes & Standards” provide up-to-date, document-specific information including any issued Tentative Interim Amendments and Errata.

To view the document information page for a specific Standard, go to <http://www.nfpa.org/docinfo> to choose from the list of NFPA Standards or use the search feature to select the NFPA Standard number (e.g., NFPA 101). The document information page includes postings of all existing Tentative Interim Amendments and Errata. It also includes the option to register for an “Alert” feature to receive an automatic email notification when new updates and other information are posted regarding the document.

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards (“the ANSI Patent Policy”), and hereby gives the following notice pursuant to that policy:

NOTICE: The user’s attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term “adoption by reference” means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

Copyright © 2016 National Fire Protection Association®. All Rights Reserved.

NFPA® 51

Standard for the

Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes

2018 Edition

This edition of NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, was prepared by the Technical Committee on Industrial and Medical Gases. It was issued by the Standards Council on July 22, 2016, with an effective date of August 11, 2016, and supersedes all previous editions.

This edition of NFPA 51 was approved as an American National Standard on August 11, 2016, 2016.

Origin and Development of NFPA 51

NFPA standards for the construction, installation, and use of acetylene gas machines and for the storage of calcium carbide date from 1900. The first edition of NFPA 51 was adopted in 1925.

Subsequent editions of NFPA 51 were dated 1927, 1936, 1942, 1944, 1946, 1951, 1953, 1957, 1958, 1960, 1961, 1964, 1969, 1973, 1974, 1977, 1983, 1987, and 1992. In June 1966, responsibility for NFPA 51 was reassigned from the Committee on Gases and its Sectional Committee on Industrial Gases to the Committee on Industrial and Medical Gases.

The 1997 edition was revised editorially to make the standard easier to use, understand, and enforce.

The 2002 edition of NFPA 51 contained relatively few changes. The most significant changes were clarification of the size of small systems to which the standard would not apply and the requirements for leak testing piping systems. In addition, the document was revised to conform to the 2002 edition of *Manual of Style for NFPA Technical Committee Documents*, including reordering of the chapters and adoption of SI units as primary units.

The changes to the 2007 edition of NFPA 51 were as follows:

- (1) Use of standard NFPA text for retroactivity and equivalency
- (2) Changes in Chapters 4 through 9 to be consistent with the 2005 edition of NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*, particularly the storage amounts
- (3) Adoption of definitions of *fuel gas*, *limited combustible*, and *noncombustible material* that are consistent with the subject matter of the document
- (4) Elimination of several terms that could not be enforced

The 2013 edition was reorganized to coordinate maximum allowable quantities (MAQs) and building controls as used in NFPA 55, *Compressed Gases and Cryogenic Fluids Code*; NFPA 1, *Fire Code*; NFPA 5000®, *Building Construction and Safety Code*®; and NFPA 400, *Hazardous Materials Code*; with updates to Chapter 4 and the definitions in Chapter 3. Allowable pressures and other requirements for oxygen manifolds were updated and clarified. New protocols for mobile acetylene trailer systems (MATS) were added to coordinate with NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*.

The 2018 edition primarily updates information extracted from and references to NFPA 55, ensuring consistency between the two documents.

Technical Committee on Industrial and Medical Gases

Rob Early, *Chair*
Praxair, NY [M]

John J. Anicello, Airgas Inc., WA [M]
William H. Barlen, Barlen and Associates, Inc., NJ [SE]
Rodney L. Barnes, U.S. Department of Energy, TN [U]
Denise Beach, FM Global, MA [I]
Erik W. Christiansen, Exponent, Inc., CA [SE]
Michael Ciotti, Linde North America, NJ [M]
Julie V. Cordero, Sandia National Laboratories, NM [U]
David J. De Fina, Sterigenics International, Inc., IL [IM]
Kenneth Fegley, Air Products and Chemicals, Inc., PA [IM]
Alejandro Gonzalez, Kryogenifex, FL [M]
Martin T. Gresho, FP2 Fire, Inc., CO [SE]
Gerald T. Hayes, Air Liquide America, AZ [IM]
 Rep. Compressed Gas Association
Anthony J. Lachawiec, Jr., Intel Corporation, OR [M]
Frank A. Licari, U.S. Department of Transportation, VA [E]

Eugene Y. Ngai, Chemically Speaking LLC, NJ [SE]
Robert R. Nii, CH2M-WG Idaho, LLC, ID [U]
Richard P. Palluzi, Richard Palluzi LLC, NJ [SE]
Diana C. Parks, State of Alaska Department of Public Safety, AK [E]
Carl H. Rivkin, National Renewable Energy Laboratory, CO [U]
David A. Rohrig, Pacific Northwest National Laboratory, WA [U]
Jerrold Sameth, Compressed Gas Association, Inc., NJ [IM]
 Rep. Compressed Gas Association
William J. Satterfield, III, Hydrogen Safety, LLC/Rode & Associates, LLC, RI [SE]
Michael W. St. Clair, Ostrander, OH [U]
 Rep. NFPA Industrial Fire Protection Section
Randolph Viscomi, ARC Specialty Products Corporation, NJ [IM]
Jonathan C. Willard, Acute Medical Gas Services, NH [SE]
Edgar Wolff-Klammer, UL LLC, IL [RT]

Alternates

Joseph M. Bablo, UL LLC, IL [RT]
 (Alt. to Edgar Wolff-Klammer)
Richard A. Craig, Compressed Gas Association, VA [IM]
 (Alt. to Gerald T. Hayes)
David J. Farese, Air Products and Chemicals, Inc., PA [IM]
 (Alt. to Kenneth Fegley)
Rick Ginn, Praxair Inc., OH [M]
 (Alt. to Rob Early)
Scott M. Heyworth, FP2Fire, Inc., FL [SE]
 (Alt. to Martin T. Gresho)
Stuart J. Muller, Matheson, MA [IM]
 Rep. Compressed Gas Association
 (Alt. to Jerrold Sameth)

Charles B. Henrici, Elk Grove Village, IL [SE]
 (Member Emeritus)

Susan Bershad, NFPA Staff Liaison

Brian D. Musch, Sterigenics U.S., LLC, IL [IM]
 (Alt. to David J. De Fina)
Michael G. Pirrello, Airgas, PA [M]
 (Alt. to John J. Anicello)
Scott E. Swanson, Intel Corporation, OR [M]
 (Alt. to Anthony J. Lachawiec, Jr.)
Robert W. Whittlesey, Exponent, Inc., CA [SE]
 (Alt. to Erik W. Christiansen)

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the storage, transfer, and use of industrial gases. Included are the storage and handling of such gases in their gaseous or liquid phases; the installation of associated storage, piping, and distribution equipment; and operating practices. The Committee also has a technical responsibility for contributions in the same areas for medical gases and clean rooms. The Committee shall coordinate the material on gaseous and liquid hydrogen storage and use with the Hydrogen Technology Committee.

Contents

Chapter 1 Administration	51- 4	6.3 Installation.	51- 11
1.1 Scope.	51- 4	6.4 Cleaning.	51- 11
1.2 Purpose.	51- 4	6.5 Testing.	51- 12
1.3 Retroactivity.	51- 4	6.6 Painting and Signs.	51- 12
1.4 Equivalency.	51- 4		
1.5 Fuel Gases in the Liquid Phase.	51- 5	Chapter 7 Protective Equipment, Hose, and	
1.6 Operations and Fire Prevention Practices.	51- 5	Regulators	51- 12
1.7 Material–Oxygen Compatibility.	51- 5	7.1 General.	51- 12
1.8 Cylinders and Containers.	51- 5	7.2 Pressure Relief for Piping Systems.	51- 12
1.9 Units and Formulas.	51- 5	7.3 Piping Protective Equipment.	51- 13
		7.4 Station Outlet Protective Equipment.	51- 13
Chapter 2 Referenced Publications	51- 5	7.5 Hose and Hose Connections.	51- 13
2.1 General.	51- 5	7.6 Pressure-Reducing Regulators.	51- 13
2.2 NFPA Publications.	51- 5		
2.3 Other Publications.	51- 5	Chapter 8 Acetylene Generators	51- 13
2.4 References for Extracts in Mandatory Sections. ...	51- 6	8.1 Listing and Marking.	51- 13
		8.2 Rating and Pressure Limitations.	51- 13
Chapter 3 Definitions	51- 6	8.3 Location.	51- 14
3.1 General.	51- 6	8.4 Stationary Acetylene Generators (Automatic and	
3.2 NFPA Official Definitions.	51- 6	Nonautomatic).	51- 14
3.3 General Definitions.	51- 6	8.5 Outside Generator Houses and Inside Generator	
		Rooms for Stationary Acetylene Generators.	51- 15
Chapter 4 Cylinders and Containers	51- 7		
4.1 Fabrication and Marking.	51- 7	Chapter 9 Calcium Carbide Storage	51- 15
4.2 Cylinder Storage and Use — General.	51- 7	9.1 Packaging.	51- 15
4.3 Fuel Gas Cylinder Storage.	51- 8	9.2 Storage in Buildings.	51- 15
4.4 Oxygen Cylinder Storage.	51- 9	9.3 Storage Outside Buildings.	51- 15
4.5 Gas Cabinets.	51- 9		
4.6 Exhausted Enclosures.	51- 9	Chapter 10 Mobile Acetylene Trailer Systems	51- 15
4.7 Gas Rooms.	51- 9	10.1 General Provisions.	51- 15
		10.2 Discharge Stations at Consumer Sites.	51- 15
Chapter 5 Manifolding of Cylinders	51- 9	10.3 Indoor Discharge Stations.	51- 16
5.1 Fuel Gas Manifolds.	51- 9	10.4 Instructions.	51- 16
5.2 High-Pressure Oxygen Manifolds.	51- 9	10.5 Fire Protection.	51- 16
5.3 Low-Pressure Oxygen Manifolds.	51- 10		
5.4 Portable Outlet Headers.	51- 10	Annex A Explanatory Material	51- 18
Chapter 6 Piping Systems	51- 11	Annex B Informational References	51- 19
6.1 Materials and Design.	51- 11		
6.2 Piping Joints.	51- 11	Index	51- 21

NFPA 51

Standard for the

Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes

2018 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Standards." They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the "List of NFPA Codes & Standards" at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex B. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex B.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard applies to the following:

- (1) Design and installation of oxygen-fuel gas welding and cutting systems and allied processes (see 3.3.2), except for systems meeting the criteria in 1.1.5
- (2) Utilization of gaseous fuels generated from flammable liquids under pressure where such fuels are used with oxygen
- (3) Storage on the site of a welding and cutting system installation of the following:
 - (a) Gases to be used with such systems where more than one cylinder each of oxygen and fuel gas are stored

in any single storage area [includes storage of more than one cylinder each in any single storage area even though all such stored cylinders may be intended for use in systems of the kind described in 1.1.1(1)]

- (b) Calcium carbide

1.1.2 Unless specifically indicated otherwise, the term *welding and cutting systems* shall be considered to include *allied processes* in this standard.

1.1.3 Where only a portion of a fuel gas system is to be used for welding, cutting, or allied processes, only that portion of the system need comply with this standard.

1.1.4 Where only a portion of an oxygen system is to be used with fuel gas for welding, cutting, or allied processes, only that portion of the system need comply with this standard.

1.1.5 This standard shall not apply to the following:

- (1)* Systems consisting of a single cylinder not exceeding 120 ft³ (3.4 m³) of oxygen and a single cylinder not exceeding 120 ft³ (3.4 m³) of fuel gas used for welding and cutting
- (2) Systems in which fuel gases are not to be used with oxygen, as described in NFPA 54 and NFPA 58
- (3) The manufacture of gases and the filling of cylinders
- (4) Storage of empty cylinders
- (5) Compressed air-fuel gas systems

1.2 **Purpose.** The purpose of this standard is to reduce the risk of fires and explosions in oxygen-fuel gas cutting and welding systems.

1.3 **Retroactivity.** The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.3.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.3.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.3.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction and only where it is clearly evident that a reasonable degree of safety is provided.

1.4 **Equivalency.** Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Fuel Gases in the Liquid Phase.

1.5.1 The use of liquid acetylene shall be prohibited.

1.5.2 Fuel gases in the liquid phase shall not be piped into any building except as permitted in the following:

- (1) Buildings used exclusively to house equipment for vaporization, pressure reduction, or gas mixing
- (2) Buildings or separate fire divisions of buildings used exclusively for research and experimental laboratories

1.6 Operations and Fire Prevention Practices.

1.6.1 Operating safe practices shall be in accordance with ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*.

1.6.2 Fire prevention practices in relation to cutting and welding shall be in accordance with NFPA 51B.

1.7* Material–Oxygen Compatibility. Oxygen system components, including, but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment, including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components might be exposed in the containment and use of oxygen. Easily ignitable materials shall not be used unless they are parts of equipment or systems that are approved, listed, or proved suitable by tests or by past experience.

1.8 Cylinders and Containers. The terms *cylinder* and *container* are used interchangeably in this standard and include any portable vessel used to supply a fuel gas or oxygen.

1.9 Units and Formulas.

1.9.1 The units of measure in this standard are presented first in U.S. customary units (inch-pound units), followed by International System (SI) units in parentheses.

1.9.2 Either system of units shall be acceptable for satisfying the requirements in this standard.

1.9.3 Users of this standard shall apply one system of units consistently and shall not alternate between units.

1.9.4 The values presented for measurements in this standard are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

1.9.5 Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2013 edition.
NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2014 edition.

NFPA 54, *National Fuel Gas Code*, 2015 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 101®, *Life Safety Code®*, 2015 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2013 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2015 edition.

2.3 Other Publications.

2.3.1 ASME Publications. ASME International, Two Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping*, 2014.

Boiler and Pressure Vessel Code, 2015.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2014.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2015.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2012.

2.3.3 AWS Publications. American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672.

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, 2012.

2.3.4 CGA Publications. Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-1788.

CGA C-7, *Guide to the Classification and Labeling of Compressed Gases*, 10th edition, 2014.

CGA E-1, *Standard for Rubber Welding Hose and Hose Connections for Gas Welding, Cutting, and Allied Processes*, 2009.

CGA E-3, *Low Pressure Pipeline Station Outlet/Regulator Inlet Connection Standard*, 2008.

CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*, 2011.

CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections*, 2013.

2.3.5 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 723, *Tests for Surface Burning Characteristics of Building Materials*, 2008, revised 2013.

2.3.6 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 400, *Hazardous Materials Code*, 2016 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Acetylene.

3.3.1.1 Low-Pressure Acetylene. Acetylene at a pressure not exceeding 1 psig (gauge pressure of 6.9 kPa).

3.3.1.2 Medium-Pressure Acetylene. Acetylene at pressures exceeding 1 psig (gauge pressure of 6.9 kPa) but not exceeding 15 psig (gauge pressure of 103 kPa).

3.3.2 Allied Processes. Those processes using oxygen-fuel gas mixtures for operations such as scarfing, heat treating, heating, or thermal spraying.

3.3.3 Backflow Check Valve. A device designed to allow flow in only one direction.

3.3.4 Building Code. The building or construction code adopted by the jurisdiction. [55, 2016]

3.3.5 Control Area. A building or portion of a building or outdoor area within which hazardous materials are allowed to be stored, dispensed, used, or handled in quantities not exceeding the MAQ. [400, 2016]

3.3.6 Cylinder. A pressure vessel designed for absolute pressures higher than 40 psi (276 kPa) and having a circular cross-section. It does not include a portable tank, multiunit tank car tank, cargo tank, or tank car. [55, 2016]

3.3.7 Cylinder Storage. Cylinders of compressed gas standing by on the site (not those in use or attached ready for use).

3.3.8* DOT. U.S. Department of Transportation.

3.3.9* Exhausted Enclosure. An appliance or piece of equipment that consists of a top, a back, and two sides that provides a means of local exhaust for capturing gases, fumes, vapors, and mists. [55, 2016]

3.3.10* Fast-Acting Fire Detection System. A detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

3.3.11 Fire Code. The fire prevention code adopted by the jurisdiction. [55, 2016]

3.3.12 Fuel Gas. Acetylene; hydrogen; natural gas; LP-Gas; propylene; methylacetylene-propadiene, stabilized gas mixtures; and other liquefied and nonliquefied flammable gases that are stable because of their composition or because of the conditions of storage and utilization stipulated in this standard.

3.3.13* Gas Cabinet. A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. [55, 2016]

3.3.14 Gas Room. A separately ventilated, fully enclosed room in which only compressed gases, cryogenic fluids, associated equipment, and supplies are stored or used. [55, 2016]

3.3.15 Limited-Combustible Material. Refers to a building construction material not complying with the definition of *noncombustible* that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) when tested in accordance with NFPA 259 and includes either (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of $\frac{1}{8}$ in. (3.2 mm) that has a flame spread index not greater than 50, or (2) materials, in the form and thickness used having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Tests for Surface Burning Characteristics of Building Materials*.

3.3.16* Liquefied Petroleum Gas (LP-Gas). Any material having a vapor pressure not exceeding that allowed for commercial propane that is composed predominantly of the following hydrocarbons, either by themselves (except propylene) or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes. [58, 2017]

3.3.17 Machine. A device in which one or more torches using fuel gas and oxygen are incorporated.

3.3.18 Manifold. An assembly of pipe and fittings for connecting two or more cylinders for the purpose of supplying gas to a piping system or directly to a consuming device.

3.3.18.1 High-Pressure Oxygen Manifold. A manifold connecting oxygen containers having a DOT service pressure exceeding 350 psig (gauge pressure of 2.4 MPa).

3.3.18.2* Low-Pressure Oxygen Manifold. A manifold connecting oxygen containers having a DOT service pressure not exceeding 350 psig (gauge pressure of 2.4 MPa).

3.3.19 Maximum Allowable Quantity per Control Area (MAQ). A threshold quantity of hazardous material in a specific hazard class that once exceeded requires the application of additional administrative procedures, construction features, or engineering controls. [55, 2016]

3.3.20* Mobile Acetylene Trailer System (MATS). A manifolded group of cylinders held together as a unit on a transport vehicle for the purpose of containing and transporting large quantities of acetylene.

3.3.20.1 MATS Building. A single-story detached building, without an attic, basement, crawl space, or false ceiling, used for acetylene trailer(s) or MATS operations located indoors with the balance of the building used exclusively for acetylene operations, including storage and use of hazardous materials.

3.3.20.2 MATS Fire Area. The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the MATS source valve for the MATS being discharged.

3.3.20.3 MATS Source Valve. A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user's supply line.

3.3.21 Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. Materials that are reported as passing ASTM E136 are considered noncombustible materials.

3.3.22* P_F Device. A wet or dry device (or assembly of devices) in a fuel gas line designed to perform the following three functions: (1) prevent backflow of oxygen into the fuel gas supply system; (2) prevent the passage of flame into the fuel gas supply system (flashback); (3) prevent the development of a fuel gas–oxygen mixture at sufficient pressure so that its ignition would achieve combustion pressures that could cause failure to perform functions (1) and (2). This device is given the diagram symbol P_F.

3.3.23 Pipe. A pressure-tight cylinder used to convey a fluid or to transmit fluid pressure. [ASME B31.3:300.2]

3.3.24* Piping. Assemblies of piping components used to convey, distribute, mix, separate, discharge, meter, control, or snub fluid flows. Piping also includes pipe-supporting elements, but does not include support structures, such as building frames, bents, foundations, or any other equipment excluded from this standard. [ASME B31.3:300.2]

3.3.25 Piping Components. Mechanical elements suitable for joining or assembly into pressure-tight fluid-containing piping systems. Components include pipe, tubing, fittings, flanges, gaskets, bolting, valves, and devices such as expansion joints, flexible joints, pressure hoses, traps, strainers, in-line portions of instruments, and separators. [ASME B31.3:300.2]

3.3.26 Piping System. Interconnected piping subject to the same set or sets of design conditions. [ASME B31.3:300.2]

3.3.27* Portable Outlet Header. An assembly of piping and fittings, used for station outlet purposes, that is connected to the permanent piping of an oxygen–fuel gas system by means of hose or other nonrigid conductors.

3.3.28* Pressure-Relief Device. A device designed to open to prevent a rise of internal fluid pressure in excess of a specified value due to exposure to emergency or abnormal conditions.

3.3.29* Protection Level. A tier of building safety that exceeds the construction requirements for control areas to accommodate quantities of hazardous materials in excess of those permitted using the control area concept. [55, 2016]

3.3.30 Psia. Pounds per square inch absolute.

3.3.31 Psig. Pounds per square inch gauge.

3.3.32 Station Outlet. Point at which gas is withdrawn from the permanent piping or portable outlet headers.

3.3.33 TC. Transport Canada.

Chapter 4 Cylinders and Containers

4.1 Fabrication and Marking.

4.1.1 Cylinders shall be designed, fabricated, tested, and marked (stamped) in accordance with regulations of the U.S. Department of Transportation (DOT), Transport Canada (TC), or the Rules for the Construction of Unfired Pressure Vessels, Section VIII, of ASME *Boiler and Pressure Vessel Code*.

4.1.2 Cylinders shall be equipped with connections complying with the American-Canadian Standard CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections*.

4.1.3 For the primary identification of cylinder, container, or manifold gas supply unit content, each cylinder, container, or unit shall be legibly marked with the name of the gas in accordance with CGA C-7, *Guide to Classification and Labeling of Compressed Gases*. These markings shall not be cut into the metal of the cylinder.

4.2* Cylinder Storage and Use — General.

4.2.1 Cylinders permitted inside buildings shall be stored at least 20 ft (6.1 m) from flammable and combustible liquids and easily ignited forms of materials, such as wood, paper, oil, and grease, and where they will not be exposed to excessive rise in temperature, physical damage, or tampering by unauthorized persons.

4.2.2* Where control areas are utilized, the maximum allowable quantities of fuel gas or oxidizing gas in storage and use in control areas shall be in accordance with Table 4.2.2.

4.2.2.1 Control areas shall be constructed in accordance with the building code.

Table 4.2.2 Maximum Allowable Quantity (MAQ) of Hazardous Materials per Control Area

Material	Class	High Hazard Protection Level	Storage		Use — Closed Systems		Use — Open Systems
			Liquid Gallons (lb)	Gas ^a scf (lb)	Liquid Gallons (lb)	Gas ^a scf (lb)	Liquid Gallons (lb)
Cryogenic fluid	Flammable	2	45 ^{b, c}	NA	45 ^{b, c}	NA	45 ^{b, c}
	Oxidizing	3	45 ^{d, e}	NA	45 ^{d, e}	NA	45 ^{d, e}
Flammable, gas ^f	Gaseous	2	NA	1000 ^{d, e}	NA	1000 ^{d, e}	NA
	Liquefied	2	NA	(150) ^{d, e}	NA	(150) ^{d, e}	NA
	Liquefied petroleum (LP)	2	NA	(300) ^{g, h, i}	NA	(300) ^g	NA
Oxidizing gas	Gaseous	3	NA	1500 ^{d, e}	NA	1500 ^{d, e}	NA
	Liquefied	3	NA	(150) ^{d, e}	NA	(150) ^{d, e}	NA
Unstable (reactive) gas	2	3	NA	750 ^{d, e}	NA	750 ^{d, e}	NA
	1	NA	NA	NL	NA	NL	NA

NA: Not applicable within the context of NFPA 51 (refer to the applicable building or fire code for additional information on these materials).

NL: Not limited in quantity.

Notes:

(1) For use of control areas, see the building code.

(2) Table values in parentheses or brackets correspond to the unit name in parentheses or brackets at the top of the column.

(3) The aggregate quantity in use and storage is not permitted to exceed the quantity listed for storage. In addition, quantities in specific occupancies are not permitted to exceed the limits in the building code.

^aMeasured at normal temperature and pressure (NTP), 70°F (21°C) and 14.7 psi (101.3 kPa).

^bNone allowed in unsprinklered buildings unless stored or used in gas rooms or in approved gas cabinets or exhausted enclosures, as specified in NFPA 55.

^cWith pressure-relief devices for stationary or portable containers vented directly outdoors or to an exhaust hood.

^dQuantities are permitted to be increased 100 percent where stored or used in approved cabinets, gas cabinets, exhausted enclosures, or gas rooms, as appropriate for the material stored. Where Footnote e also applies, the increase for both circumstances is permitted to be applied accumulatively.

^eMaximum quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with NFPA 13. Where Footnote d also applies, the increase for both circumstances is permitted to be applied accumulatively.

^fFlammable gases in the fuel tanks of mobile equipment or vehicles are permitted to exceed the MAQ where the equipment is stored and operated in accordance with the fire code.

^gSee NFPA 58 for additional requirements for liquefied petroleum gas (LP-Gas).

^hAdditional storage locations are required to be separated by a minimum of 300 ft (92 m).

ⁱIn mercantile occupancies, storage of LP-Gas is limited to a maximum of 200 lb (91 kg) in nominal 1 lb (0.45 kg) LP-Gas containers.

4.2.3 Where the aggregate quantity of fuel gas or oxidizing gas in storage and use in an indoor control area exceeds those shown in Table 4.2.2, the area shall meet the requirements for Protection Levels 2 or 3 in accordance with the building code for the protection level specified.

4.3 Fuel Gas Cylinder Storage.

4.3.1 Fuel gas cylinders in storage shall be separated from oxygen cylinders or combustible materials in storage or use by a minimum distance of 20 ft (6.1 m) or by a barrier of noncombustible material at least 5 ft (1.5 m) high having a fire-resistive rating of at least ½ hour.

4.3.2 The barrier shall interrupt the line of sight between the fuel gas cylinders and the oxygen cylinders.

4.3.3 The storage or use of a single cylinder of fuel gas and a single cylinder of oxygen and located on a cart shall be allowed without requiring the cylinders to be separated in accordance with 4.3.1 and 4.3.2 or with 4.4.3 when the cylinders are connected to regulators, ready for service, and equipped with

apparatus designed for cutting or welding, and the following conditions are met:

- (1) Carts shall be kept away from the cutting or welding operations or separated by fire-resistant shields.
- (2) Cylinders shall be secured to the cart to resist movement.
- (3) Carts shall be an approved type and designed to secure and move the cylinders attached.
- (4) Cylinder valves not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while the cylinders are in service.
- (5) Cylinder valve outlet connections shall be in accordance with 4.1.2.
- (6) Cylinder valves shall be closed when work is finished.
- (7) Cylinder valves shall be closed before moving the cart.

4.3.4 When approved by the AHJ, designated storage areas separated by a minimum distance of 100 ft (30.5 m) shall be permitted to be used in lieu of control areas for the storage of fuel gases.

4.3.4.1 In buildings protected by an automatic sprinkler system and water supply designed in accordance with NFPA 13 for an Ordinary Hazard Group 2 or more hazardous occupancy, where the occupancy other than the cylinder storage is not more hazardous than Ordinary Hazard as defined in NFPA 13, the distance between designated storage areas shall be permitted to be reduced to 50 ft (15.2 m).

4.3.4.2 If the occupancy in such protected buildings between the designated storage areas is free of combustible material, the distance shall be permitted to be reduced to 25 ft (7.6 m).

4.4 Oxygen Cylinder Storage.

4.4.1 Oxygen cylinders shall not be stored in inside acetylene generator rooms.

4.4.2 Oxygen cylinders stored in outside generator houses shall be separated from the generator or carbide storage rooms by a full-height partition of noncombustible material having a fire resistance rating of at least 1 hour.

4.4.2.1 This partition shall be without openings and shall be gastight.

4.4.3 Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 ft (6.1 m) or by a barrier of noncombustible material at least 5 ft (1.5 m) high having a fire resistance rating of at least ½ hour.

4.4.3.1 The barrier shall interrupt all lines of sight between oxygen cylinders and fuel gas cylinders located within 20 ft (6.1 m) of each other.

4.5 Gas Cabinets. Where a gas cabinet is required, is used to provide separation of gas hazards, or is used to increase the control area limits specified by Table 4.2.2, the gas cabinet shall be in accordance with the requirements of 4.5.1 through 4.5.4.

4.5.1 Construction. [55:6.17.1]

4.5.1.1 Materials of Construction. The gas cabinet shall be constructed of not less than 0.097 in. (2.46 mm) (12 gauge) steel. [55:6.17.1.1]

4.5.1.2 Access to Controls. The gas cabinet shall be provided with self-closing limited access ports or noncombustible windows to give access to equipment controls. [55:6.17.1.2]

4.5.1.3 Self-Closing Doors. The gas cabinet shall be provided with self-closing doors. [55:6.17.1.3]

4.5.2 Ventilation Requirements. [55:6.17.2]

4.5.2.1 The gas cabinet shall be provided with an exhaust ventilation system designed to operate at a negative pressure relative to the surrounding area. [55:6.17.2.1]

4.5.3 Quantity Limits. Gas cabinets shall contain not more than three cylinders, containers, or tanks. [55:6.17.4]

4.5.4 Separation of Incompatibles. Incompatible gases shall be stored or used within separate gas cabinets.

4.6 Exhausted Enclosures. [55:6.18]

4.6.1 Ventilation Requirements. Where an exhausted enclosure is required or used to increase the threshold quantity for a gas requiring special provisions, the exhausted enclosure shall be provided with an exhaust ventilation system designed to

operate at a negative pressure in relationship to the surrounding area. [55:6.18.1]

4.6.2 Fire Protection. Exhausted enclosures shall be internally sprinklered. [55:6.18.1.3]

4.6.3 Separation. Incompatible gases shall be stored or used within separate exhausted enclosures.

4.7 Gas Rooms. When a gas room is used to increase the threshold quantity for a gas requiring special provisions or where otherwise required by the material or application specific requirements of Chapters 7 through 16 [of NFPA 55], the room shall meet the requirements of 4.7.1 through 4.7.5. [55:6.4]

4.7.1 Pressure Control. Gas rooms shall operate at a negative pressure in relationship to the surrounding area. [55:6.4.1]

4.7.2 Exhaust Ventilation. Gas rooms shall be provided with an exhaust ventilation system. [55:6.4.2]

4.7.3 Construction. Gas rooms shall be constructed in accordance with the building code. [55:6.4.3]

4.7.4 Separation. Gas rooms shall be separated from other occupancies by a minimum of 1-hour fire resistance. [55:6.4.4]

4.7.5 Limitation on Contents. The function of compressed gas rooms shall be limited to storage and use of compressed gases and associated equipment and supplies. [55:6.4.5]

Chapter 5 Manifolding of Cylinders

5.1 Fuel Gas Manifolds.

5.1.1 Manifolds shall be listed or approved either separately for each component part or as an assembled unit.

5.1.2* Fuel gas cylinders connected to one manifold inside a building shall be limited to a total gas capacity of 3000 ft³ (85 m³) of acetylene or nonliquefied gas or a total water capacity of 735 lb (334 kg) for LP-Gas or methylacetylene-propadiene, stabilized (MPS).

5.1.2.1 More than one such manifold with connected cylinders shall be permitted to be located in the same room, provided the manifolds are at least 50 ft (15.2 m) apart or are separated by a barrier of noncombustible material at least 5 ft (1.5 m) high having a fire resistance rating of at least ½ hour.

5.1.2.2 Fuel gas cylinders connected to one manifold having a total gas capacity exceeding 3000 ft³ (85 m³) of acetylene or nonliquefied gas or a total water capacity of 735 lb (334 kg) for LP-Gas or MPS shall be located outdoors or in a separate building or room constructed in accordance with 8.5.1.6 and 8.5.1.7.

5.1.3 High-pressure fuel gas manifolds shall be provided with listed pressure-regulating devices.

5.2 High-Pressure Oxygen Manifolds.

5.2.1 High-pressure oxygen manifolds shall be used with cylinders having a DOT service pressure above 350 psig (2.4 MPa).

5.2.2 Manifolds shall be listed or approved either separately for each component part or as an assembled unit.

5.2.3 Oxygen manifolds shall not be located in an acetylene generator room.

5.2.4 Oxygen manifolds shall be separated from fuel gas cylinders or combustible materials (especially oil or grease) in the same room by a minimum distance of 20 ft (6.1 m) or by a barrier of noncombustible material at least 5 ft (1.5 m) high having a fire resistance rating of at least ½ hour.

5.2.5 Oxygen cylinders connected to one manifold shall be limited to a total gas capacity of 6500 ft³ (184 m³).

5.2.5.1 Two such manifolds with connected cylinders shall be permitted to be located in the same room, provided the building is protected throughout with an approved automatic sprinkler system designed in accordance with NFPA 13 furnishing a sprinkler discharge density of at least 0.25 gpm/ft² (10.2 mm/min) over a minimum operating area of at least 3000 ft² (279 m²) with sprinklers located not more than 20 ft (6.1 m) above the floor where the manifolds are located.

5.2.6 An oxygen manifold to which cylinders having an aggregate capacity of more than 6500 ft³ (184 m³) of oxygen are connected shall be located in accordance with one of the following:

- (1) They shall be located outdoors.
- (2) They shall be located in a separate building constructed of noncombustible or limited-combustible materials.
- (3) If located inside a building having occupancy other than that directly associated with the production of acetylene, the storage of calcium carbide, or the storage and manifold of fuel gases used in welding and cutting, the manifold shall be in one of the following:
 - (a) A separate room constructed of noncombustible or limited-combustible materials having a fire resistance rating of at least ½ hour
 - (b) An area with no combustible materials within 20 ft (6.1 m) of the manifold.

5.2.7 An oxygen manifold or oxygen bulk supply system that has storage capacity of more than 20,000 ft³ (565 m³) of oxygen [measured at 70°F (21.1°C) and pressure of 14.7 psia (gauge pressure of 101 kPa)], including unconnected reserves on hand at the site, shall comply with the provisions of NFPA 55.

5.2.8 High-pressure oxygen manifolds shall be provided with listed pressure-regulating devices.

5.3 Low-Pressure Oxygen Manifolds. Low-pressure oxygen manifolds shall be used with cylinders having a DOT service pressure not exceeding 350 psig (gauge pressure of 2.4 MPa).

5.3.1 Manifolds shall be constructed of materials suitable for use with oxygen at a pressure of 350 psig (gauge pressure of 2.4 MPa). They shall have a minimum bursting pressure of 1400 psig (gauge pressure of 9.6 MPa) and shall be protected by a pressure-relief device set to relieve at a maximum pressure of 700 psig (gauge pressure of 4.8 MPa).

5.3.2 Hose and hose connections shall only be used downstream at pressure regulators and shall comply with Section 7.5.

5.3.2.1 Hose conforming with CGA E-1, *Standard for Rubber Welding Hose and Hose Connections for Gas Welding, Cutting, and Allied Processes*, as required by Section 7.5 shall have a maximum working pressure of 200 psig (gauge pressure of 1.4 MPa) and a minimum bursting pressure of 800 psig (gauge pressure of 55 MPa).

5.3.2.2 Listed or approved pressure-relief devices shall be installed downstream of the manifold regulator discharge in accordance with Section 7.2.

5.3.3 The assembled manifold, including cylinder leads, shall be tested and proven gastight at a pressure of 525 psig (gauge pressure of 3.6 MPa). The material used for testing oxygen manifolds shall be oil-free and nonflammable.

5.3.4 The location of manifolds shall comply with 5.2.3, 5.2.6, 5.3.4.1, and 5.3.4.2.

5.3.4.1 Except as provided in 5.3.4.2, oxygen cylinders connected to one manifold shall be limited to a total gas capacity of 12,000 ft³ (340 m³).

5.3.4.1.1 More than one such manifold with connected cylinders shall be permitted to be located in the same room, provided the manifolds are at least 50 ft (15.2 m) apart.

5.3.4.2 An oxygen manifold connected to cylinders having an aggregate capacity of more than 12,000 ft³ (340 m³) of oxygen shall be located according to one of the following:

- (1) They shall be located outdoors.
- (2) They shall be located in a separate building constructed of noncombustible or limited-combustible materials.
- (3) If located inside a building having occupancy other than that directly associated with the production of acetylene, the storage of calcium carbide, or the storage and manifold of gases used in welding and cutting, the manifold shall be in one of the following:
 - (a) A separate room constructed of noncombustible or limited-combustible materials having a fire resistance rating of at least ½ hour
 - (b) An area with no combustible materials within 20 ft (6.1 m) of the manifold.

5.3.5 The following sign shall be conspicuously posted at each manifold:

LOW-PRESSURE MANIFOLD —
DO NOT CONNECT
HIGH-PRESSURE CYLINDERS.
MAXIMUM PRESSURE — 350 PSIG.

5.4 Portable Outlet Headers.

5.4.1 Portable outlet headers shall not be used indoors except for temporary service where the conditions preclude a direct supply from station outlets located on the piping system.

5.4.2 Each outlet on the piping system from which oxygen or fuel gas is withdrawn to supply a portable outlet header shall be equipped with a readily accessible shutoff valve.

5.4.3 Hose and hose connections used for connecting the portable outlet header to the piping system shall comply with Section 7.5.

5.4.4 Master shutoff valves for both oxygen and fuel gas shall be provided at the entry end of the portable outlet header.

5.4.5 The high-pressure supply systems for both oxygen and fuel gas serving portable outlet headers shall be provided with listed and labeled or approved pressure-regulating devices.

5.4.5.1 If a station outlet is equipped with a detachable regulator, the outlet of the portable header shall terminate in a union

connection that complies with CGA E-3, *Low Pressure Pipeline Station Outlet/Regulator Inlet Connection Standard*.

5.4.6 Each station outlet on portable outlet headers shall be provided with a valve assembly that includes a detachable outlet dust cap, chained or otherwise attached to the body of the valve.

5.4.7 Materials and fabrication procedures for portable outlet headers shall comply with Sections 6.1, 6.2, and 6.3.

5.4.8 Portable outlet headers shall be provided with frames that will support the equipment securely in the correct operating position and protect the headers from damage during handling and operation.

Chapter 6 Piping Systems

6.1 Materials and Design.

6.1.1 General.

6.1.1.1 Piping and fittings shall comply with ASME B31.3, *Process Piping*, insofar as it does not conflict with Section 6.1 and except as follows:

- (1) Pipe shall be at least Schedule 40, and fittings shall be at least standard weight in sizes up to and including 6 in. nominal.
- (2) Copper tubing shall be Type K or L, in accordance with ASTM B88, *Standard Specification for Seamless Copper Water Tube*.

6.1.1.2 Piping shall be steel, brass, or copper pipe or seamless copper, brass, or stainless steel tubing, except as provided in 6.1.2 and 6.1.3.

6.1.2 Oxygen Piping Systems.

6.1.2.1* Materials for fabrication, installation, cleaning, and testing of piping systems shall be selected in accordance with sound engineering practice.

6.1.2.2 Hose connections and hose complying with Section 7.5 shall be permitted to be used to connect the outlet of a manifold pressure regulator to piping, in accordance with the following:

- (1) Maximum delivery pressure of the regulator is 200 psig (gauge pressure of 1.4 MPa) or less.
- (2) The length of the hose does not exceed 5 ft (1.5 m).

6.1.2.2.1 The hose shall have a minimum bursting pressure of 800 psig (gauge pressure of 5.52 MPa).

6.1.2.3 When oxygen is supplied to a service piping system from a low-pressure oxygen manifold without an intervening pressure-regulating device, the piping system shall have a minimum design pressure of 350 psig (gauge pressure of 2.41 MPa). A pressure-regulating device shall be used at each station outlet where the connected equipment is intended for use at pressure less than 350 psig (gauge pressure of 2.41 MPa).

6.1.3 Piping for Acetylene and Methylacetylene-Propadiene, Stabilized.

6.1.3.1 Piping shall be steel.

6.1.3.2 Unalloyed copper shall not be used except in listed equipment.

6.1.3.3* Except in cylinder manifolds, acetylene shall not be piped or utilized at a pressure in excess of 15 psig (gauge pressure of 103 kPa) or 30 psia (absolute pressure of 206 kPa). This provision shall not apply to the storage of acetylene in cylinders manufactured to DOT specifications.

6.2 Piping Joints. (Also see 6.1.2 for oxygen piping.)

6.2.1 Joints in steel piping shall be welded, threaded, or flanged. Fittings, such as ell, tees, couplings, and unions, shall be permitted to be rolled, forged, or cast steel, malleable iron, or nodular iron. Gray or white cast-iron fittings shall be prohibited.

6.2.2 Joints in brass or copper pipe shall be welded, brazed, threaded, or flanged. If of the socket type, they shall be brazed with silver-brazing alloy or similar high-melting-point filler metal.

6.2.3 Joints in seamless copper, brass, or stainless steel tubing shall be listed or approved gas tubing fittings, or the joints shall be brazed. If of the socket type, they shall be brazed with silver-brazing alloy or similar high-melting-point filler metal.

6.2.4 Tapered threaded connections in oxygen pipe shall be tinned or made up with polytetrafluoroethylene (such as Teflon®) tape or other thread sealants suitable for oxygen service. Sealants shall be applied to the externally threaded portion only.

6.3 Installation. (Also see 6.1.2 for oxygen piping.)

6.3.1 Piping shall be run as directly as practical and protected against corrosion and physical damage, and allowance shall be made for expansion, contraction, jarring, and vibration. Piping under buildings or foundations shall be prohibited or provided with a vented casing or located in a well-ventilated tunnel.

6.3.2 Oxygen piping shall be permitted to be placed in the same tunnel, trench, or duct with fuel gas pipelines, provided there is good natural or mechanical ventilation and there is no contact with oil.

6.3.3 Low points in piping and equipment where moisture can collect shall be drained into drip pots constructed so as to permit pumping or draining out the condensate at necessary intervals. Drain valves having outlets normally closed with screw caps or plugs shall be installed for this purpose. Open-end valves or petcocks shall not be used, except that in drips located outdoors and underground and not readily accessible, valves shall be permitted to be used at outlets if they are equipped with means to secure them in the closed position. Pipes leading to the surface of the ground shall be cased or jacketed where necessary to prevent loosening or breaking.

6.3.4 Readily accessible gas valves shall be provided to shut off the gas supply to buildings in cases of emergency. A shutoff valve shall be installed in the discharge from the generator, gas holder, manifold, or other source of supply.

6.4* Cleaning. (Also see 6.1.2 for oxygen piping.)

6.4.1* Fittings and lengths of pipe shall be examined internally *before assembly* and, if necessary, freed of scale or dirt. Oxygen piping and fittings shall be washed out with a solution that will remove grease and dirt but that will not react with oxygen.

6.4.2 Piping shall be thoroughly blown out after assembly to remove foreign materials. For oxygen piping, oil-free air or oil-free nitrogen shall be used. For other piping, air or inert gas shall be permitted to be used.

6.5 Testing. (Also see 6.1.2 for oxygen piping.)

6.5.1 Piping systems shall be tested and proved gastight and leak free in accordance with ASME B31.3, *Process Piping*.

6.5.2 Where combustible gas lines or other parts of equipment are being purged of air or gas, sources of ignition shall not be permitted near uncapped openings.

6.6 Painting and Signs.

6.6.1* Underground pipe and tubing and outdoor ferrous pipe and tubing shall be covered or painted with a material for protection against corrosion.

6.6.2 Station outlets shall be marked to indicate the name of the gas in the connected pipe.

6.6.3 Signs clearly establishing the location and identity of section shutoff valves shall be provided.

Chapter 7 Protective Equipment, Hose, and Regulators

7.1 General.

7.1.1 Equipment shall be installed only for the service for which it is intended and as recommended by the manufacturer.

7.1.2 Where piping systems or portions of systems supply only consuming devices in which no internal mixing of fuel gas with oxygen is possible within the consuming device, the system or portion of system need not comply with 7.3.1, 7.3.3, 7.3.6, 7.3.7, 7.3.8, 7.3.9, 7.4.1, or 7.4.2.

7.2 Pressure Relief for Piping Systems.

7.2.1 Listed or approved pressure-relief devices, illustrated in Figure 7.2.1, shall be installed in fuel gas piping if the maximum design pressure of the piping or the system components can be exceeded.

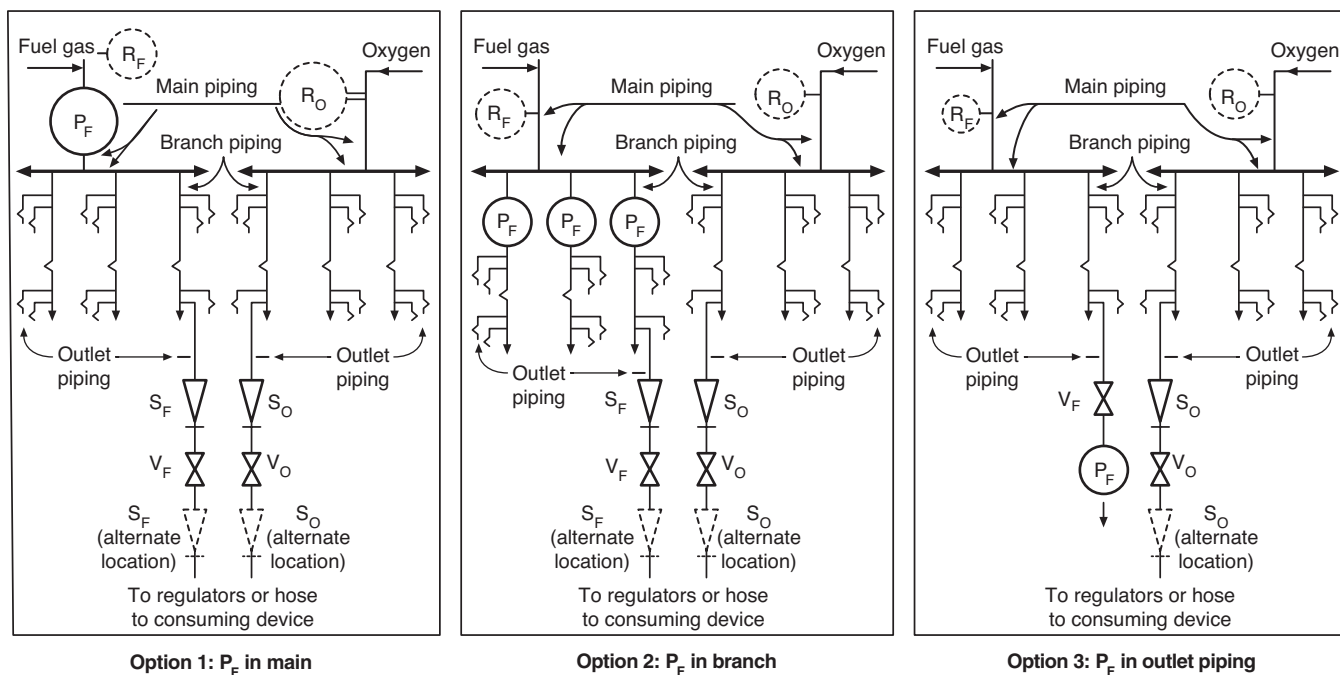
7.2.1.1 These devices shall be set to discharge at not more than the maximum design pressure of the piping or system components and to a safe location.

7.2.1.2 In systems as shown in Figure 7.2.1, Option 1 only, pressure-relief devices included as part of P_F devices shall be permitted to fulfill this provision.

7.2.2 Listed or approved pressure-relief devices shall be installed in oxygen piping if the maximum design pressure of the piping or the system components can be exceeded.

7.2.2.1 These devices shall be set to discharge at not more than the maximum design pressure of the piping or system components and to a safe location.

7.2.2.2 Pressure-relief devices in pressure regulators in the system shall not be used to fulfill this provision.



Legend:

P_F = Protective equipment in fuel gas piping	S_F = Backflow check valve
V_F = Fuel gas station outlet valve	S_O = Backflow check valve
V_O = Oxygen station outlet valve	R_O = Pressure-relief device (oxygen)
	P_F = Pressure-relief device (fuel gas)

FIGURE 7.2.1 Schematic Arrangements of Piping and Station Outlet Protective Equipment. (See Sections 7.2, 7.3, and 7.4.)

7.3 Piping Protective Equipment. (See Figure 7.2.1.)

7.3.1 The fuel gas and oxygen piping systems shall incorporate the protective equipment shown in Figure 7.2.1, Option 1, 2, or 3.

7.3.1.1 When only a portion of a fuel gas system is to be used with oxygen, only that portion shall comply with 7.3.1.

7.3.2 Portable outlet headers for fuel gas service shall be provided with a listed or approved P_F device installed at the inlet and preceding the station outlets, unless a P_F device is installed at each outlet.

7.3.3 Listed or approved protective equipment (designated P_F) shall be installed in the fuel gas piping.

7.3.4* The P_F device shall be located in the main supply line, as in Figure 7.2.1, Option 1; or at the head of each branch line, as in Figure 7.2.1, Option 2; or at each location where fuel gas is withdrawn, as in Figure 7.2.1, Option 3.

7.3.4.1 In all cases, except as covered in 7.1.2, fuel gas serving an oxygen-fuel gas device shall flow through a P_F device.

7.3.4.2 When a P_F device is located at a fuel gas station outlet, the only other device required is a shutoff valve, V_F (see Figure 7.2.1, Option 3).

7.3.4.3 Where branch lines are of 2 in. pipe size or larger, a P_F device shall be located as shown in either Option 2 or Option 3 of Figure 7.2.1

7.3.5 When a P_F device is located as shown in Figure 7.2.1, Options 1 and 2, backflow protection of the fuel gas supply also shall be provided at the station outlet by a listed or approved device that will prevent oxygen from flowing into the fuel gas system.

7.3.6 In a P_F device, the pressure-relief device shall be located on the downstream side of the backflow and flashback protection devices.

7.3.6.1 The vent from the pressure-relief device shall be at least as large as the relief device outlet and shall be installed without low points that can collect moisture.

7.3.6.2 If low points are unavoidable, drip pots with drains closed with screw plugs or caps shall be installed at the low points.

7.3.6.3 The vent terminus shall not endanger personnel or property through gas discharge, shall be located away from ignition sources, shall terminate in a hood or bend, and shall discharge outdoors at a safe location.

7.3.7 If pipeline protective equipment incorporates a liquid, the liquid level shall be maintained, and an antifreeze shall be permitted to be used to prevent freezing.

7.3.8 Fuel gas for use with equipment not requiring oxygen shall be withdrawn upstream of the piping protective devices.

7.3.9 Where a compressor or booster pump is used in a fuel gas system requiring oxygen and where this fuel gas is withdrawn from a source that also supplies a system not requiring oxygen, the latter system shall incorporate a check valve to prevent possible backflow.

7.4 Station Outlet Protective Equipment.

7.4.1 A listed or approved shutoff valve shall be installed at each outlet and located on the upstream side of other station outlet equipment except as provided in 7.4.2.

7.4.2 A listed or approved backflow check valve shall be installed at each station outlet, including those on portable outlet headers, either upstream or downstream of the shutoff valve, V_F or V_O .

7.4.2.1 When a P_F device is located at the station outlet as shown in Figure 7.2.1, Option 3, an additional check valve is not required in the fuel gas line.

7.4.3 If the station outlet is equipped with a detachable regulator, the outlet shall terminate in a union connection that complies with CGA E-3, *Low Pressure Pipeline Station Outlet/Regulator Inlet Connection Standard*.

7.4.4 If the station outlet is connected directly to a hose, the outlet shall terminate in a union connection complying with CGA E-1, *Standard for Rubber Welding Hose and Hose Connections for Gas Welding, Cutting, and Allied Processes*.

7.4.5 Station outlets shall be permitted to terminate in pipe threads to which permanent connections are to be made, such as to a machine.

7.4.6 Station outlets shall be equipped with a detachable outlet dust cap that shall be secured in place except when a hose, a regulator, or piping is attached.

7.4.7 Where station outlets are equipped with backflow and flashback protective devices, four torches shall be permitted to be supplied from one station outlet through rigid piping, provided each outlet from such piping is equipped with a shutoff valve and provided the fuel gas capacity of any one torch does not exceed 15 ft³ (0.43 m³) per hour of acetylene, LP-Gas, or MPS; or 50 ft³ (1.4 m³) per hour of natural gas, methane, or hydrogen. This provision shall not apply to machines.

7.5 Hose and Hose Connections. Hose and hose connections for oxygen and fuel gas service, including hose used to connect portable outlet headers to piping systems, shall comply with CGA E-1, *Standard for Rubber Welding Hose and Hose Connections for Gas Welding, Cutting, and Allied Processes*.

7.6 Pressure-Reducing Regulators. Regulators or automatic reducing valves shall be used only for the gas for which they are intended.

Chapter 8 Acetylene Generators

8.1 Listing and Marking. Generators shall be listed; shall be of the carbide-to-water type; and shall be plainly marked with the following:

- (1) The rate in cubic feet of acetylene per hour for which they are designed
- (2) The amount or weight and size of carbide necessary for a single charge
- (3) The manufacturer's name and address
- (4) The type or model designation

8.2 Rating and Pressure Limitations.

8.2.1 The total hourly output of a generator shall not exceed the rate for which it is marked.

8.2.2 Acetylene shall not be generated at a pressure in excess of 15 psig (gauge pressure of 103 kPa).

8.2.3 Nonautomatic generators shall not be used for generating acetylene at pressures exceeding 1 psig (gauge pressure of 6.9 kPa). Water overflows shall be visible.

8.3 Location. Stationary generators shall be located in outside generator houses or inside generator rooms complying with Section 8.5.

8.4 Stationary Acetylene Generators (Automatic and Nonautomatic).

8.4.1 Installation.

8.4.1.1 Generators shall be installed on a level foundation so that no excessive strain will be placed on the generator or its connections.

8.4.1.2 The area around the generator shall be adequate for operation, maintenance, adjustment, and charging.

8.4.1.3 Generators shall be protected against freezing. The use of salt or other corrosive chemical to prevent freezing shall be prohibited.

8.4.1.4 Except where generators are provided with an adequate overflow or automatic water shutoff to prevent overfilling of the generator, the water supply pipe shall terminate not less than 2 in. (50 mm) above the opening used for filling so that the water can be observed as it enters the generator.

8.4.1.5 Pressure-relief valves for generating chambers shall be set to open at a pressure not in excess of 15 psig (gauge pressure of 103 kPa).

8.4.1.5.1 Pressure-relief valves for hydraulic back-pressure valves shall be set to open at a pressure not in excess of 20 psig (gauge pressure of 138 kPa).

8.4.1.6 Generators shall not be fitted with continuous drain connections leading to sewers but shall discharge through an open connection into a vented outdoor residue settling pit that, if approved, shall be permitted to have a clear water connection to the sewer.

8.4.1.6.1 Ventilation shall permit dissolved acetylene gas to dissipate.

8.4.2 Stationary Generator Vent Pipes. Equipment shall be installed with sufficient clearance for operation and maintenance.

8.4.2.1 Each generator shall be provided with a vent pipe of Schedule 40 galvanized iron or steel. Outside buildings, vent pipes larger than 4 in. (10.2 cm) in diameter shall be not less than 14 gauge galvanized tubing or sheet steel.

8.4.2.2 The vent pipe shall be rigidly installed without traps so that any condensation will drain back to the generator.

8.4.2.2.1 Means shall be provided to prevent accumulation of condensate in the vent pipes.

8.4.2.3 The vent pipe shall be full size to the termination point outside the building and shall terminate in a hood or bend.

8.4.2.3.1 The hood or bend shall be located at least 12 ft (3.7 m) above the ground, at least 3 ft (0.9 m) from combusti-

ble construction, and 5 ft (1.5 m) from building openings and sources of ignition.

8.4.2.3.2 The hood or bend shall be constructed so that it will not be obstructed by rain, snow, ice, insects, or birds.

8.4.2.3.3 Vent pipes shall not be interconnected but shall lead separately to the outside.

8.4.3 Acetylene Gas Holders.

8.4.3.1* Gas holders shall be constructed using the gasometer principle.

8.4.3.1.1 The gas bell shall move freely, shall be guided, and shall have a clearance of at least 2 in. (50 mm) from the shell.

8.4.3.2 Gas holders shall be permitted to be located outdoors, in the generator room, or in a connecting room complying with the provisions for generator rooms. (See Section 8.5.)

8.4.3.3 Where not located within a heated building, gas holders shall be protected against freezing.

8.4.3.4 To prevent collapse of the gas bell due to a vacuum caused by a compressor or booster pump, a compressor or booster cutoff shall be provided at a point 12 in. (305 mm) or more above the landing point of the bell.

8.4.3.5 An automatic device shall be installed on the gas holder to stop the generation of gas before the holder bell reaches the upper limit of its travel.

8.4.3.6 The gas capacity of a gas holder, connected to a single generator, shall be not less than one-third the hourly rated capacity of the generator.

8.4.3.7 If acetylene is used from the gas holder without increase in pressure at some points but with increase in pressure by a compressor or booster pump at other points, piping protective devices shall be installed in each supply line. The low-pressure protective device shall be located between the gas holder and the shop piping, and the medium-pressure protective device shall be located between the compressor or booster pump and the shop piping. (See Figure 8.4.3.7.)

8.4.4 Acetylene Compressor and Booster Pump Equipment.

8.4.4.1 Compressors and booster pumps shall be listed or approved.

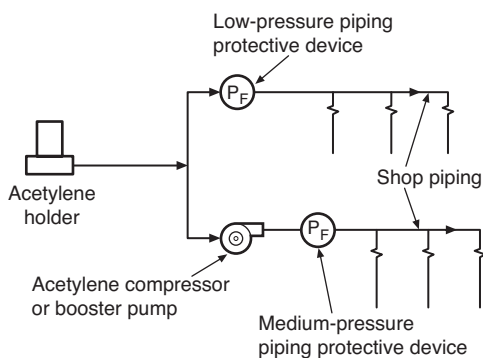


FIGURE 8.4.3.7 Protective Devices for Gas Holders, Compressors, and Booster Pumps.

8.4.4.2 Wiring and electrical equipment in compressor or booster pump rooms or enclosures shall conform to the provisions of Article 501 of *NFPA 70* for Class I, Division 2 or Class I, Zone 2 locations.

8.4.4.3 Compressor or booster pumps shall be provided with pressure-relief valves that will relieve pressure exceeding 15 psig (gauge pressure of 103 kPa) by venting the gas to a safe outdoor location as provided in 8.4.2.3 or by returning the gas to the inlet side or to the gas supply source.

8.4.4.4 Compressors or booster pumps cooled by water recirculation shall be provided with interlocks to shut down the compressors or pumps in the event of cooling water supply failure.

8.4.4.5 Compressor or booster discharge outlets shall be provided with piping protective equipment. (See Section 7.3.)

8.4.4.6 Compressors and booster pump equipment shall be located in well-ventilated areas away from open flames, electrical or mechanical sparks, or other ignition sources.

8.5* Outside Generator Houses and Inside Generator Rooms for Stationary Acetylene Generators.

8.5.1 Construction.

8.5.1.1 Openings in any outside generator house shall not be located within 5 ft (1.5 m) of any opening in another building.

8.5.1.2 Walls, floors, and roofs of outside generator houses shall be constructed of noncombustible or limited-combustible materials.

8.5.1.3 Means of egress shall comply with high hazard occupancy requirements in *NFPA 101*.

8.5.1.4 Buildings in which acetylene generators are located shall not exceed one story in height, except that generators shall be permitted to be installed on the top floor or roof of a multi- or single-story building.

8.5.1.5 Generators installed inside buildings in which calcium carbide is used in amounts exceeding the maximum allowable quantity per control area shall be in rooms constructed to meet Protection Level 2 requirements.

8.5.1.6 Calcium carbide exceeding 600 lb (273 kg) but not exceeding 5000 lb (2273 kg) shall be stored under one of the following conditions:

- (1) In accordance with 8.5.1.7
- (2) In an inside generator room or an outside generator house
- (3) In a separate room in a one-story building that can contain other occupancies but without cellar or basement beneath the carbide storage section; such rooms shall be constructed in accordance with 8.5.1.6 and 8.5.1.7 and shall be used for no other purpose.

8.5.1.7 Explosion control shall be in accordance with *NFPA 5000* for high hazard Level 2 contents.

8.5.2 Ventilation. Ventilation shall be in accordance with Section 6.16 of *NFPA 55*.

8.5.3 Heating Systems, Electrical Equipment, and Sources of Ignition.

8.5.3.1 Heating shall be by steam, hot water, or other indirect means.

8.5.3.1.1 Heating by flames or fires shall be prohibited in outside generator houses, in inside generator rooms, and in any enclosure communicating with them.

8.5.3.2 Electrical equipment and wiring in outside generator houses or inside generator rooms shall conform to the provisions of Article 501 of *NFPA 70* for Class I, Division 2 or Class I, Zone 2 locations.

8.5.3.3 Sources of ignition shall be prohibited in outside generator houses or inside generator rooms.

Chapter 9 Calcium Carbide Storage

9.1 Packaging.

9.1.1 Calcium carbide shall be stored in packages meeting DOT or TC regulations.

9.1.2 Packages containing calcium carbide shall be conspicuously marked "Calcium Carbide — Dangerous If Not Kept Dry" or with equivalent warning.

9.2 Storage in Buildings.

9.2.1 Storage of calcium carbide inside buildings in aggregate quantities exceeding the maximum allowable quantity per control area for Class 2 water-reactive solids in accordance with *NFPA 5000* shall be in buildings, rooms, or areas constructed and protected in accordance with *NFPA 5000* for high hazard Level 3 contents.

9.2.2 Calcium carbide in sealed packages, except as provided for in Section 9.3, shall be permitted to be stored inside buildings or in the same room with fuel gas cylinders provided the aggregate quantities do not exceed the maximum quantities set forth in 9.2.1, 4.3.1, and 4.3.2.

9.3 Storage Outside Buildings.

9.3.1 Calcium carbide in unopened containers in good condition (watertight and airtight) shall be permitted to be stored outdoors.

9.3.2 Containers shall be stored horizontally in single or double rows. The bottom tier of each row shall be placed on wooden planking or equivalent so that the containers will not come in contact with the ground or ground water.

9.3.3 Storage areas shall be at least 10 ft (3 m) from lines of adjoining property that can be built upon.

Chapter 10 Mobile Acetylene Trailer Systems

10.1 General Provisions. The mobile acetylene trailer system and discharging of the trailer system shall comply with CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*.

10.2 Discharge Stations at Consumer Sites.

10.2.1 The discharge station site shall be outdoors or in a separate building used for that purpose exclusively. The site shall be such that the trailer and associated equipment shall not be beneath or exposed to failure of electric power lines, flammable or combustible liquid lines, or flammable gas lines.

10.2.2 Minimum distances from the trailer, the trailer discharge connection, or a building housing the trailer to exposures shall be as shown in Table 10.2.2.

10.2.3 The site shall be located so as to be readily accessible and to provide adequate space for trailer positioning.

10.2.4 The site shall be posted “Acetylene — Flammable Gas — No Smoking — No Open Flames” or equivalent.

10.2.5 The mobile acetylene trailer system shall be electrically bonded and grounded.

10.2.6 Acetylene meters, where utilized, shall be a type recommended by the meter manufacturer for acetylene service and shall operate at pressures not to exceed 15 psig (gauge pressure of 103 kPa).

10.2.7 Where protective walls or roofs are provided on outdoor installations, they shall be constructed of noncombustible (*see 3.3.21*) or limited-combustible materials (*see 3.3.15*).

10.2.8 Electrical equipment within 15 ft (4.6 m) of outdoor installations shall be in accordance with Article 501 of *NFPA 70* for Class I, Division 2 or Class I, Zone 2 locations.

10.3 Indoor Discharge Stations.

10.3.1 Separate buildings housing mobile acetylene trailer systems shall be constructed of noncombustible or limited-combustible materials.

10.3.1.1 Heating, if provided, shall be by steam, hot water, or other indirect means.

10.3.2 Adequate ventilation to the outdoors shall be provided. Inlet openings shall be located near the floor in exterior walls only.

10.3.2.1 Outlet openings shall be located at the high point of the room in exterior walls or roof.

10.3.2.2 Inlet and outlet openings shall each have a minimum total area of 1 ft²/1000 ft³ (0.1 m²/28.3 m³) of room volume.

10.3.3 Explosion venting shall be provided in exterior walls or roof only.

10.3.3.1 The venting area shall be equal to not less than 1 ft²/50 ft³ (0.1 m²/1.4 m³) of room volume.

10.3.3.2 Vents shall be permitted to consist of any one or any combination of the following, designed to relieve at a maximum pressure of 25 lb/ft² (1.2 kPa): walls of light material; lightly fastened hatch covers; lightly fastened, outward-opening swinging doors in exterior walls; and lightly fastened walls or roof.

10.3.4 Electrical equipment shall be in accordance with Article 501 of *NFPA 70* for Class I, Division 2 or Class I, Zone 2 locations.

10.3.5 There shall be no sources of ignition, such as from open flames, electrical equipment, or heating equipment, in the indoor discharge station.

10.4 Instructions.

10.4.1 For installations requiring any equipment operation by the user, legible instructions shall be posted and maintained at the discharge station.

10.4.2 A trained person shall be in attendance while the mobile acetylene trailer is being connected to or disconnected from the discharge station piping and during any manual valve operations.

10.5* Fire Protection.

10.5.1* Areas devoted to discharging mobile acetylene trailer systems shall be provided with fire hoses or fixed water spray systems.

10.5.1.1 At least one dry chemical portable fire extinguisher with a rating of 10-A:60-B:C shall be provided.

10.5.2 Fire protection equipment shall be conspicuously located and posted so that it is visible and accessible in an emergency. Fire hoses and fixed water spray system control valves shall be located so that they can be operated from outdoors.

10.5.3 Exits and fire protection equipment shall not be blocked or obstructed in any manner.

10.5.4 MATS General.

10.5.4.1 Mobile acetylene trailer system (MATS) fire areas used for discharging operations shall be separated from each other by not less than 30 ft (9.1 m) or by fire barriers or fire walls.

10.5.4.1.1 Where fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire-resistive construction and shall separate individual fire areas by line of sight.

10.5.4.1.2 Where fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of *NFPA 55* the fire barriers shall be full-height walls without openings extending from the foundation to the roof and constructed of not less than 2-hour fire-resistive construction.

10.5.4.1.3 Where MATS are installed indoors in a MATS building, fire walls, fire barriers, or 2-hour fire-rated exterior walls shall be permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.

Table 10.2.2 Separation Distances from Trailer Discharge Connection or Building Housing Trailer to Exposures

Exposure	Separation Distance	
	ft	m
Property line	25	7.6
Buildings constructed of combustible materials	50	15.2
Buildings constructed of noncombustible or limited-combustible materials	15	4.6
Bulk oxygen systems	50	15.2
All classes of flammable and combustible liquid storage aboveground	50	15.2
All classes of flammable and combustible liquid belowground		
Tank	20	6.1
Vent or fill opening of tank	25	7.6
Other flammable gas storage	50	15.2

10.5.4.1.4 An electrical grounding system for the acetylene piping shall be provided in accordance with *NFPA 70*.

10.5.4.1.5 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.5.5 MATS Discharging Stations.

10.5.5.1 MATS discharging stations, including the mobile acetylene trailer, shall be located a minimum distance of:

- (1) Not less than 25 ft (7.6 m) from property lines
- (2) Not less than 50 feet (15.2 m) from buildings of combustible construction
- (3) Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the discharging of the mobile acetylene trailer
- (4) Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines
- (5) Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, oxidizing materials, or flammable gases other than acetylene
- (6) Not less than 50 ft (15.2 m) from air intakes

10.5.5.1.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.5.5.1.2* Flexible transfer hoses used for discharging of MATS shall have a minimum burst pressure of 10,000 psig (gauge pressure of 69,000 kPa).

10.5.5.1.3 The discharge site shall be posted with a sign with the following or equivalent wording:

ACETYLENE — FLAMMABLE GAS — NO SMOKING — NO
OPEN FLAMES

10.5.6 MATS Discharge Stations.

10.5.6.1 Flexible transfer hoses used on manifolds for withdrawal of acetylene shall be pressure rated as follows:

- (1)* For pressures greater than 15 psig (gauge pressure of 103 kPa), hoses shall have a minimum burst pressure of 10,000 psig (gauge pressure of 69,000 kPa).
- (2) For pressures of 15 psig (gauge pressure of 103 kPa) or less, hoses shall be rated for a minimum working pressure of 125 psig (gauge pressure of 860 kPa) and a minimum burst pressure of 500 psig (gauge pressure of 3450 kPa).

10.5.6.2 Signs. MATS areas shall be posted with a sign declaring the following or equivalent prohibition:

WARNING: NO OPEN FLAMES
SMOKING STRICTLY PROHIBITED

10.5.7 Metering. Acetylene meters, where used, shall be designed for acetylene service and shall not be operated at a pressure exceeding 15 psig (gauge pressure of 103 kPa).

10.5.8 Fire Protection.

10.5.8.1 MATS. Fire protection requirements for MATS shall apply to charging or discharging stations located indoors or outdoors. [55:15.3.9.1]

10.5.8.1.1* An automatic deluge sprinkler system shall be provided for MATS fire areas used as indoor and outdoor charging and discharging stations. [55:15.3.9.1.1]

10.5.8.1.2* Automatic deluge sprinkler systems shall be designed in accordance with the requirements of NFPA 13 using Extra Hazard Group 1 with a minimum design area of 2500 ft² for the entire MATS fire area. [55:15.3.9.1.2]

10.5.8.1.3 The automatic deluge system shall be able to be activated automatically by a fast-acting fire detection system and also by at least one manual pull station in an accessible location at a minimum of 25 ft (7.6 m) from the MATS fire area. [55:15.3.9.1.3]

10.5.8.1.3.1* The manual pull station shall be distinctive from the standard fire alarm system manual pull system stations if provided. [55:15.3.9.1.3.1]

(A) The manual pull station shall be identified as being for the MATS deluge system and marked with a sign stating as such. [55:15.3.9.1.3.1(A)]

(B) The manual pull station shall be positioned for use in an emergency. [55:15.3.9.1.3.1(B)]

10.5.8.1.3.2 Fire protection equipment and manual pull boxes serving the MATS fire protection system shall not be blocked or obstructed. [55:15.3.9.1.3.2]

10.5.8.1.4 Existing acetylene charging and discharging stations shall be protected by an automatic deluge sprinkler system in accordance with 10.5.8.1 not later than January 1, 2015. (See also Section 1.4.) [55:15.3.9.1.4]

10.5.8.1.4.1 The requirements of 10.5.8.1.1, 10.5.8.1.2, and 10.5.8.1.3, shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this code, providing the MATS fire area is protected with an automatic sprinkler or deluge system with a minimum design density of not less than 0.25 gpm/ft² (10.1 L/min). [55:15.3.9.1.4.1]

10.5.8.1.5 At least one listed portable fire extinguisher rated in accordance with NFPA 10 at not less than 20 B:C shall be mounted on the mobile acetylene trailer and at least one 2A:20B:C extinguisher shall be in an accessible location. [55:15.3.9.1.5]

10.5.8.2 Indoor Areas. Buildings or portions thereof, other than MATS, required to comply with protection level controls shall be protected by an approved automatic sprinkler system in accordance with Section 6.10 of NFPA 55. [55:15.3.9.2]

10.5.8.2.1* Automatic sprinkler systems shall be prohibited in rooms or areas used exclusively for the following:

- (1) Calcium carbide storage
- (2) Calcium carbide transfer operations
- (3) Acetylene generation

[55:15.3.9.2.1]

10.5.8.2.1.1 In areas where automatic sprinklers are otherwise required but prohibited by 10.5.8.2.1, the following additional requirements shall apply:

- (1) An approved automatic fire detection system shall be installed, or
- (2) An alternative automatic fire extinguishing system shall be installed

[55:15.3.9.2.1.1]

10.5.8.2.2 Fire protection equipment shall be identified and located so that it is readily visible and accessible in an emergency. [55:15.3.9.2.2]

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.5(1) For information on safety in welding and cutting, see ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*.

A.1.7 Compatibility involves both combustibility and ease of ignition. Materials that burn in air will burn violently in pure oxygen at normal pressure and explosively in pressurized oxygen. Also, many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Metals for containers and piping must be selected carefully, depending on service conditions. The various steels are acceptable for many applications, but some service conditions can call for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials can be ignited by friction at a valve seat or stem packing or by adiabatic compression produced when oxygen at high pressure is introduced rapidly into a system initially at low pressure.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designa-

ted agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.8 DOT. Prior to April 1, 1967, DOT regulations and specifications referenced in this standard were promulgated by the Interstate Commerce Commission (ICC).

A.3.3.9 Exhausted Enclosure. Such enclosures include laboratory hoods, exhaust fume hoods, and similar appliances and equipment used to retain and exhaust locally the gases, fumes, vapors, and mists that could be released. Rooms or areas provided with general ventilation, in and of themselves, are not exhausted enclosures. [55, 2016]

A.3.3.10 Fast-Acting Fire Detection System. Examples for outdoor installations are optical ultraviolet/infrared (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations, examples include high sensitivity smoke detection (HSSD), optical (UV/IR), or other early detection systems.

A.3.3.13 Gas Cabinet. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are permitted to be included as part of a gas cabinet. [55, 2016]

A.3.3.16 Liquefied Petroleum Gas (LP-Gas). In the pure state, propylene [Chemical Abstract Service Registration Number (CAS) 105-07-01] has a vapor pressure of 132.8 psig (gauge pressure of 915.72 kPa) at 70°F (21.1°C). The vapor pressure of commercial propane (CAS 74-98-6) at 70°F (21.1°C) is 124 psig (gauge pressure of 855 kPa). Although commercial propane can contain a minor concentration of propylene as an impurity, propylene in the pure state does not meet the definition of LP-Gas. Propylene in the pure state is commonly used as a fuel gas. [58:A.3.3.43]

A.3.3.18.2 Low-Pressure Oxygen Manifold. Low-pressure gas manifolds are commonly used to connect pressurized low-pressure cylinders (DOT 4L liquid cylinders) that contain liquid oxygen (LOX). The operating pressure for portable cryogenic liquid containers can vary, with pressures ranging from tens of pounds per square inch gauge to pressures as high as 350 psig (gauge pressure of 2.4 MPa), depending on the design of the container and its integral pressure relief valve.

A.3.3.20 Mobile Acetylene Trailer System (MATS). This system includes the mobile acetylene trailer, pressure regulator(s), flash arresters, protective devices, meter (optional), and interconnecting piping. The system terminates at the point where acetylene at service pressure enters the user's piping system.

A.3.3.22 P_F Device. A wet P_F device is commonly known as a *hydraulic seal*, a *hydraulic valve*, or a *hydraulic back-pressure valve*.

A.3.3.24 Piping. The piping includes some or all of the following:

- (1) Main piping — piping leading directly from the gas supply source to branch or outlet piping
- (2) Branch piping — piping leading from the main piping to outlet piping
- (3) Outlet piping — piping leading to station outlets, either from branch piping or directly from main piping

A.3.3.27 Portable Outlet Header. These devices are commonly used at piers and dry docks in shipyards where the permanent piping system station outlets cannot be located close enough to the work to provide a direct supply.

A.3.3.28 Pressure-Relief Device. It can be of the spring-loaded, weight-loaded, or rupture-disc type.

A.3.3.29 Protection Level. NFPA uses the concept of protection levels in a manner that is analogous to Group H occupancies in other model codes. Although NFPA 1 and *NFPA 5000* do not have unique occupancy classifications for occupancies containing hazardous materials, Protection Levels 1 to 5 in NFPA codes and standards reflect increased building safety requirements that are applicable to occupancies containing hazardous materials, which generally correlate to the Group H, Division 1 to 5 occupancy classifications in other codes. [55, 2016]

A.4.2 Storage of cylinders of dissolved acetylene with the valve end up minimizes the possibility of liquid solvent being discharged.

A.4.2.2 Table 4.2.2 is a partial extract of Table 6.3.1.1 found in NFPA 55 which limits the materials to the hazards categories found in fuel gas applications. Stabilized acetylene, a common fuel gas, is classified as both a flammable (nonliquefied) gas and a Class 2 unstable reactive gas. Stabilized mixtures of methylacetylene and propadiene, which are commonly referred to as MPS, are also in use.

A.5.1.2 A water capacity of 735 lb (334 kg) is equivalent to about 309 lb (140 kg) of propane, 368 lb (167 kg) of MPS, or 375 lb (170 kg) of butane.

A.6.1.2.1 For information on materials, fabrication, installation, cleaning, and testing of piping systems for oxygen service, see CGA G-4.4, *Oxygen Pipeline and Piping Systems*.

A.6.1.3.3 The pressure limit of 30 psia (absolute pressure of 206 kPa) is intended to prevent unsafe use of acetylene in pressurized environments such as caissons, underground excavations, or tunnel construction.

A.6.4 Also see CGA G-4.1, *Cleaning Equipment for Oxygen Service*.

A.6.4.1 Hot water solutions of caustic soda or trisodium phosphate are effective cleaning agents for this purpose.

A.6.6.1 For information on marking of aboveground piping systems, see ANSI A13.1, *Scheme for the Identification of Piping Systems*.

A.7.3.4 The options for the location of a P_F device will depend on the size and complexity of the piping.

A.8.4.3.1 A gasometer is an apparatus that displaces water by the generation of acetylene gas into a gastight holder or container.

A.8.5 In this section, the word *building* means a building having occupancy other than that directly associated with the production of acetylene, the storage of calcium carbide, or the storage and manifolding of gases used in welding and cutting.

A.10.5 The major fire hazard on a mobile acetylene trailer system is that of acetylene gas escaping from equipment, piping, or cylinder fittings. The gas might or might not ignite. In either case, every attempt consistent with personnel safety is normally made to shut off or remove the source of escaping gas. Fire normally is not extinguished in any other way, but some fires in leaking acetylene have been extinguished with hose water or hand extinguishers when the source of escaping fuel was small enough so that it did not present a reignition hazard, or the source was removed safely and promptly to a safe location. When a fire has exposed acetylene cylinders, the cylinders have been kept cool by application of water to protect the cylinders and prevent undue release of acetylene through the cylinder fusible plug devices.

A.10.5.1 Combination stream fire hose nozzles of the solid-to-spray pattern are recommended for use in these areas.

For information on portable fire extinguishers, see NFPA 10.

A.10.5.5.1.2 A 10,000 psig (gauge pressure of 69,000 kPa) burst pressure for discharging lines has been used to withstand a decomposition reaction of acetylene in the discharge line.

A.10.5.6.1(1) A 10,000 psig (gauge pressure of 69,000 kPa) burst pressure for discharging lines has been used to withstand a decomposition reaction of acetylene in the discharge line.

A.10.5.8.1.1 The system should be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire and not as a means to extinguish the fire. To extinguish a gas fire, the flow of gas must be shut off at the source. [55:A.15.3.9.1.1]

A.10.5.8.1.2 For additional information on mobile acetylene trailer systems, see CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*. [55:A.15.3.9.1.2]

A.10.5.8.1.3.1 The sign may read: ACETYLENE TRAILER WATER DELUGE SYSTEM or similar wording to identify the pull/activation station is specifically for MATS. [55:A.15.3.9.1.3.1]

A.10.5.8.2.1 Dry sand is typically located in areas where calcium carbide is stored or used. A 30 gal (114 L) container with scoop is used to isolate the calcium carbide from the atmosphere in the event of fire. [55:A.15.3.9.2.1]

Annex B Informational References

B.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

B.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2015 edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2013 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 5000[®], *Building Construction and Safety Code*[®], 2015 edition.

B.1.2 Other Publications.

B.1.2.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI A13.1, *Scheme for the Identification of Piping Systems*, 2007, reaffirmed 2013.

B.1.2.2 AWS Publications. American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672.

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, 2012.

B.1.2.3 CGA Publications. Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-1788.

CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*, 2011.

CGA G-4.1, *Cleaning Equipment for Oxygen Service*, 2009.

CGA G-4.4, *Oxygen Pipeline and Piping Systems*, 2012.

B.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2017 edition.

B.3 References for Extracts in Informational Sections.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.