NFPA 51A

Standard for Acetylene Cylinder Charging Plants

2006 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA 51A

Standard for

Acetylene Cylinder Charging Plants

2006 Edition

This edition of NFPA 51A, *Standard for Acetylene Cylinder Charging Plants,* was prepared by the Technical Committee on Industrial and Medical Gases. It was issued by the Standards Council on January 27, 2006, with an effective date of February 16, 2006, and supersedes all previous editions.

This edition of NFPA 51A was approved as an American National Standard on February 16, 2006.

Origin and Development of NFPA 51A

Although acetylene cylinder charging plants have been built and operated for several decades, a limited number of concerns were involved and these possessed a high degree of design and operating capability. As a result, fire experience was good and there was no need for national standard guidance.

In recent years, a number of other firms have entered this industry and the need for a national standard became evident. Work on this standard was initiated and its subsequent promulgation materially assisted by a committee of the Compressed Gas Association, Inc., which submitted a text to the NFPA Technical Committee on Industrial and Medical Gases.

This standard was adopted as a tentative standard in 1970. Amended editions were adopted in 1971, 1973, 1974, 1979, 1984, 1989, and 1996.

The 2001 edition contained editorial changes made to conform to the *Manual of Style for NFPA Technical Committee Documents.*

The 2006 edition of NFPA 51A has been completely revised to make it conform with the current edition of the *Manual of Style for NFPA Technical Committee Documents.* The order of Chapters 2 through 12 has been changed. In addition, several definitions have been changed so that they are consistent with other NFPA documents. There have also been changes made throughout the document to increase clarity of the text and ease of use.

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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.

Contents

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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. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. 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. This standard shall apply to plants that are engaged in the generation and compression of acetylene and in the charging of acetylene cylinders, either as their sole operation or in conjunction with facilities for charging other compressed gas cylinders.

1.2 Purpose. This standard shall provide safety requirements for the design, construction, and installation of acetylene cylinder charging plants in order to provide safeguards for the protection of the plant, its employees, and the public.

1.3* Application. This standard shall not apply to plants that only produce and compress acetylene for chemical operations or to plants that only produce and compress acetylene below a gauge pressure of 15 psi (103 kPa).

1.4 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.

1.4.1 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.

1.4.2 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.

1.4.3 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.

1.5 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.

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

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

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 1, *Uniform Fire Code™*, 2006 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2002 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2003 edition.

NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks,* 2005 edition.

NFPA 70, *National Electrical Code®,* 2005 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2003 edition.

NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations,* 2006 edition.

NFPA 5000®, *Building Construction and Safety Code®,* 2006 edition.

2.3 Other Publications.

2.3.1 ANSI Publication. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI A13.1, *Scheme for Identification of Piping Systems*, 1996.

2.3.2 ASME Publication. American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping*, 2002 edition.

2.3.3 ASTM Publication. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 136, *Standard Method of Test for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2000 edition.

2.3.4 IAPMO Publication. International Association of Plumbing and Mechanical Officials, 5001 E. Philadelphia Street, Ontario, CA 91761.

2003 Uniform Mechanical Code.

2.3.5 Other Publication.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Uniform Fire Code™,* 2006 edition.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes,* 2002 edition.

NFPA 5000®, Building Construction and Safety Code®, 2006 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* 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.

3.2.4 Shall. Indicates a mandatory requirement.

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

3.2.6 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Acetylene.

3.3.1.1 ***High Pressure Acetylene.*** Acetylene at pressures exceeding a gauge pressure of 15 psi (103 kPa), but not exceeding a gauge pressure of 400 psi (2760 kPa).

3.3.1.2 ***Low Pressure Acetylene.*** Acetylene at a pressure not exceeding a gauge pressure of 1 psi (6.9 kPa).

3.3.1.3 ***Medium Pressure Acetylene.*** Acetylene at pressures exceeding 1 psi (6.9 kPa) but not exceeding 15 psi (103 kPa). [**51,** 2002]

3.3.2 Acetylene Operations. Operations that include acetylene generation, storage, purification, compression, cylinder filling, cylinder storage, and calcium carbide storage.

3.3.3 Acetylene Plant. A facility engaged in the generation and compression of acetylene and in the filling of acetylene cylinders either as its sole operation or in conjunction with facilities for filling other compressed gas cylinders.

3.3.4 Control Area. A building or portion of a building within which hazardous materials are allowed to be stored, dispensed, used, or handled in quantities not exceeding the maximum allowable quantities (MAQ). [***5000,*** 2006]

3.3.5 High Hazard Contents. High hazard contents include materials defined as hazardous materials in NFPA 1, whether stored, used or handled. [**1,** 2006]

3.3.5.1 ***High Hazard Contents, Level 2.*** High hazard Level 2 contents include materials that present a deflagration hazard or a hazard from accelerated burning including, but not limited to, the following: (1) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103.3 kPa) (2) Combustible dusts stored, used, or generated in a manner creating a severe fire or explosion hazard (3) Flammable gases and flammable cryogenic liquids (4) Class I organic peroxides (5) Class 3 solid or liquid oxidizers that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103.3 kPa) (6) Nondetonable pyrophoric materials (7) Class 3 nondetonable unstable (reactive) materials (8) Class 3 water-reactive materials [**1**, 2006]

3.3.5.2 ***High Hazard Contents, Level 3.*** High hazard Level 3 contents include materials that readily support combustion or present a physical hazard including, but not limited to, the following: (1) Level 2 and Level 3 aerosols (2) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103.4 kPa) (3) Classification 1.4G consumer fireworks (4) Flammable solids, other than dusts classified as high hazard Level 2, stored, used, or generated in a manner creating a high fire hazard (5) Class II and Class III organic peroxides (6) Class 2 solid or liquid oxidizers (7) Class 3 solid or liquid oxidizers that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103.4 kPa) (8) Oxidizing gases and oxidizing cryogenic liquids (9) Class 2 unstable (reactive) materials (10) Class 2 water-reactive materials [**1**, 2006]

3.3.5.3 ***High Hazard Contents, Level 4.*** High hazard Level 4 contents include materials that are acute health hazards including, but not limited to, the following: (1) Corrosives (2) Highly toxic materials (3) Toxic materials [**1**, 2006]

3.3.6 Material.

3.3.6.1 ***Limited-Combustible (Material).*** Refers to a building construction material not complying with the definition of noncombustible material *(see 3.3.340.11 of NFPA 5000)* that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), where tested in accordance with NFPA 259 and includes (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 0.125 in. (3.2 mm) that has a flame spread index not greater than 50; and (2) materials, in

the form and thickness used, other than as described in (1), 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. [***5000,*** 2006]

3.3.6.2 ***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 E 136, *Standard Method of Test for Behavior of Materials in a Vertical Tube Furnace at 750°C*, are considered noncombustible materials. [***5000***, 2006]

3.3.7* Mobile Acetylene Trailer System. 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. [**51,** 2002]

3.3.8 Normal Temperature and Pressure (NTP). A temperature of 21.1°C (70°F) and a pressure of 1 atmosphere [101.3 kPa (14.7 psia)]. [***5000,*** 2006]

3.3.9 Protection Levels. Construction-related controls specified for buildings, and portions thereof, where high hazard contents are stored, used, or handled in quantities greater than the maximum allowable quantity per control area as specified in *NFPA 5000*. The requirements for construction vary with the type of hazardous materials employed.

3.3.10 Protection Level 2. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 2 contents permitted in control areas shall comply with applicable regulations for Protection Level 2, as set forth in *NFPA 5000*. [***5000,*** 2006]

3.3.11 Protection Level 3. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 3 contents permitted in control areas shall comply with applicable regulations for Protection Level 3, as set forth in *NFPA 5000*. [***5000,*** 2006]

3.3.12 Protection Level 4. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 4 contents permitted in control areas shall comply with applicable regulations for Protection Level 4, as set forth in *NFPA 5000*. [***5000,*** 2006]

3.3.13 Unpierced Wall. A wall that is allowed to have pipes or conduits passing through it, or unopenable windows, glazed with safety glass or wired glass, set in it, but such openings are sealed to prevent the flow of air between adjacent rooms.

Chapter 4 Plant Location, Arrangement, Construction, and Utilities

4.1 Location. Portions of plants housing acetylene generation and charging and acetylene cylinder storage operations classified as Protection Level 2, 3, or 4 shall be located in accordance with the requirements of *NFPA 5000, Building Construction and Safety Code*.

4.2 Arrangement.

4.2.1 Multiple-Occupancy Buildings.

4.2.1.1* Portions of plants housing multiple occupancies that include acetylene operations shall be permitted to be used for charging of other gases provided that oxidizing gas operations are located at least 20 ft (6 m) from flammable gas operations.

4.2.1.2 The 20 ft (6 m) separation distance shall not be required to be met if charging of oxidizing gas cylinders or storage of such filled cylinders are separated from charging or storage of flammable gas cylinders by a masonry wall at least 5 ft (1.5 m) high having a fire resistance rating of at least 1 hour.

4.2.2 Separated Occupancy. When mixed-occupancy buildings are to be separated by the use of occupancy separations, fire-resistive separations shall be provided in accordance with *NFPA 5000, Building Construction and Safety Code*.

4.2.3* Single-Story Buildings. Acetylene cylinder charging plants shall be limited to single-story buildings without basements or crawl spaces.

4.2.4 Security. Storage, use, and handling areas shall be secured against unauthorized entry in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*.

4.3 Construction.

4.3.1 Buildings where acetylene operations are conducted shall be constructed of noncombustible or limited-combustible materials.

4.3.2* Buildings or rooms housing acetylene operations, excluding calcium carbide storage rooms, shall be provided with explosion control in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*.

4.3.3 Exits shall be provided in accordance with *NFPA 5000, Building Construction and Safety Code*, as required for Protection Level 2, 3, or 4 occupancies as applicable.

4.4 Ventilation. Rooms housing acetylene operations, excluding calcium carbide storage rooms *(see 5.2.7)*, shall be ventilated in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*.

4.4.1 Reduction in Ventilation. Mechanical ventilation shall be permitted to be reduced below 1 $ft^3/min \cdot ft^2$ (0.03 $m^3/min \cdot 0.09\ m^2$), provided that full ventilation is automatically restored when the acetylene concentration exceeds 25 percent of the lower flammable limit (LFL) when measured by a gas detection system in accordance with Section 4.5.

4.5 Gas Detection System. Rooms in which acetylene operations are conducted shall be provided with an approved flammable gas detection system.

4.5.1 System Design.

4.5.1.1 Listed System Required. The flammable gas detection system shall be listed for use with acetylene and any other flammable gases used in the room.

4.5.1.2 Operation. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the LFL for the gas or mixtures present at the anticipated normal temperature and pressure (NTP).

4.5.1.2.1 Activation of Gas Detection System. Activation of the gas detection system shall result in the following:

(1) Initiation of distinct audible and visual alarm signals both inside and outside of the operations room
(2) Activation of the mechanical ventilation system when reduced mechanical ventilation is provided to increase the ventilation to a rate not less than 1 $ft^3/min \cdot ft^2$ (0.03 $m^3/min \cdot 0.09\ m^2$)
(3) Shutdown of the gas generation system when the concentration of flammable gas equals or exceeds 50 percent of the LFL

4.5.1.2.2 Failure of Gas Detection System. Failure of the gas detection system shall result in activation of the mechanical ventilation system, cessation of acetylene generation, and the sounding of a trouble signal in an approved location.

4.6 Heating.

4.6.1 Heating equipment in operating areas shall be of either the steam or hot water type.

4.6.2 Boilers, water heaters, and other heating equipment employing flames or capable of creating sparks shall be located in a separate building or room not directly communicating with areas devoted to acetylene operations.

4.6.3 Buildings or rooms used for acetylene operations, excluding calcium carbide storage rooms and cylinder storage areas, shall be maintained at a temperature above 40°F (4.4°C) during time of operation.

4.7 Electrical Equipment.

4.7.1 Rooms containing electrical equipment and wiring not conforming with 4.7.2 shall be separated from acetylene operations by an unpierced wall.

4.7.2 Electrical equipment and wiring in rooms housing acetylene operations, except rooms used exclusively for calcium carbide storage, shall conform to NFPA 70, *National Electrical Code*, Article 501, for Class I, Division 2 locations.

4.7.3 An emergency electrical shutoff switch shall be provided to shut off acetylene compressors and generators.

4.7.3.1 A shutoff switch shall be located at each exterior exit door, horizontal exit door, and door to exit enclosures from the fill plant.

4.7.3.2 Each exit door provided with a shutoff switch shall be marked with a sign indicating the location of the shutoff switch.

4.7.3.3 When the shutoff switch is located on the outside of the door, the inside of the door shall be marked with a sign to indicate that the switch is located outside the room served.

4.7.3.4 The signage shall indicate the following:

WARNING: Generator and Compressor (other equipment as necessary) Emergency Shutoff Switch (indicate whether switch is located inside room or outside room at exit)

Chapter 5 Calcium Carbide

5.1 Drums and Containers.

5.1.1 Calcium carbide shall be stored in packages meeting U.S. Department of Transportation or Transport Canada regulations.

5.1.2 Containers for calcium carbide shall be marked using the following or equivalent wording:

WARNING: CALCIUM CARBIDE — DANGEROUS IF NOT KEPT DRY

5.2 Storage Areas.

5.2.1 Calcium carbide storage areas shall not be used for the storage of flammable materials or flammable compressed gases.

5.2.2 Each area of the plant where calcium carbide is handled, stored, or used shall be posted with notices using the following or equivalent wording:

WARNING: CALCIUM CARBIDE — DANGEROUS IF NOT KEPT DRY — KEEP WATER AND FLAMES AWAY

5.2.3 Calcium carbide storage areas shall be arranged so that defective containers are able to be removed promptly.

5.2.4 Calcium carbide containers shall be supported so that those portions of the containers containing calcium carbide will not come in contact with the ground or with groundwater.

5.2.4.1 Locations subject to flooding shall be provided with a means to protect the containers from exposure to water.

5.2.4.2 Protection from the ground shall be provided by one or more of the following:

(1) Concrete or asphalt paved storage pads
(2) Dry, well-drained ground protected with timbers, pallets, or gravel arranged to elevate the containers above expected surface water

5.2.5 Calcium carbide storage shall be located not less than 10 ft (3 m) from any line of adjoining property that is able to be built upon.

5.2.6 Exposed water, steam, or condensate lines shall not be permitted in rooms or buildings devoted exclusively to calcium carbide storage in drums.

5.2.6.1 Unopened bulk calcium carbide containers that have accumulations of ice and snow shall be permitted to be stored in such rooms or buildings.

5.2.7 Calcium carbide storage buildings shall be constructed in accordance with *NFPA 5000, Building Construction and Safety Code*.

5.2.7.1 Rooms or areas where the quantity of calcium carbide exceeds the maximum allowable quantity per control area shall be provided with Protection Level 3 and 4 controls.

5.3 Handling. Locations where calcium carbide is transferred from transport containers to generator hopper loading carts or systems shall be protected from rain.

Chapter 6 Acetylene Generators and Calcium Carbide Residue

6.1* Design. Acetylene generators shall be designed by competent, experienced persons knowledgeable of the chemical and physical properties of acetylene and calcium carbide and the fundamentals of pressure-vessel design.

6.2 Installation.

6.2.1 Acetylene generators shall be installed within a room or building not exceeding one story in height.

6.2.2 The installation of acetylene generators in two-story buildings or rooms with mezzanines shall be permitted provided that the second story or mezzanine is used only for charging the generators with calcium carbide.

6.2.3 Outdoor installations shall be permitted where generators are protected from rain, freezing, and groundwater.

6.2.4 The foundation under a generator shall be constructed so that the generator will be level and piping shall be supported and arranged so that excessive strain is not placed on the generator or the piping connections.

6.2.5 When water is supplied to the generator through a piped connection, means shall be provided to prevent overfilling of the generator.

6.2.6 Generators served by a connected water supply system shall be equipped with a means to prevent the backflow of acetylene from the generator into the water supply.

6.2.7 Piping used to transport calcium carbide residue from acetylene generators shall be equipped with a means to prevent backflow of residue into the generators during periods when the generators are not in operation.

6.3 Venting of Generator.

6.3.1 Operating Pressure. The maximum permissible generating pressure shall be a gauge pressure of 15 psi (103 kPa).

6.3.1.1 Pressure Relief Devices. Each generator shall be provided with one or more pressure relief devices.

6.3.1.1.1 The pressure relief device(s) shall prevent pressure from exceeding the allowable pressure rating of the generator due to chemical reaction or thermal exposure.

6.3.1.1.2 The maximum setting of the generator pressure relief device(s) shall be a gauge pressure of 18 psi (124 kPa).

6.3.2 Vent Pipes.

6.3.2.1 The vent pipes shall be sized so that the pressure relief device served is allowed to operate at its full design flow.

6.3.2.2 The relief vent piping shall be installed without traps and in such a manner that condensation does not accumulate in the vent piping.

6.3.2.3 Vent pipes shall be constructed so that obstructions are not caused by rain, snow, ice, insects, or wildlife.

6.3.2.4 Vent pipes shall terminate in an exhaust hood or at a point outside the building.

6.3.2.4.1 The termination point for exhaust ducts serving vent pipes located in a hood shall be located in accordance with the *Uniform Mechanical Code* for product-conveying duct.

6.3.2.4.2 Vent pipes terminating outside the building shall be in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks.*

6.3.2.5 Generator chamber relief pipes shall not be interconnected but shall lead separately to the outdoors.

6.3.2.6 The use of multiple pressure relief devices serving the same section of a gas generator shall be allowed, provided that the aggregate cross-sectional venting area of the individual pressure relief devices is not less than the cross-sectional area of the common vent line to which they are connected.

6.4 Operating Instructions.

6.4.1 Generator operating instructions shall be displayed in a conspicuous place near the generator or otherwise be kept convenient for ready reference by the operator.

6.4.2 Operating instructions shall include procedures for operation as well as shutdown procedures that are to be taken in the event of an emergency.

6.5 Calcium Carbide Residue Disposal.

6.5.1* The discharge of calcium carbide residue from acetylene generators shall be by one or more of the following means:

(1) Discharge to a public sewer when approved by the authority having jurisdiction
(2) Discharge to the outdoors into an open sump or pit
(3) Discharge into ventilated containment tanks

6.5.1.1* When discharging to a public sewer drain, a system shall be in place to ensure that all calcium carbide is reacted and that no free acetylene is available to create hazardous atmospheres in sewer lines. Direct connection of acetylene generators to the public sewer shall not be allowed. When discharge to the public sewer is allowed under 6.5.1(1), connections from acetylene generators shall be constructed to provide an air gap between the point of discharge from the drain of the generator and the point of entry to the sewer.

6.5.1.1.1 Calcium carbide residue shall be discharged into outdoor open sump pits or other ventilated receptacles.

6.5.1.1.2 Such receptacles shall be permitted to have clear water connections to public sewers if such disposal means is approved by the authority having jurisdiction.

6.5.1.2 When discharging to sumps, pits, or other receptacles, the point of discharge shall be located outdoors not less than 15 ft (4.5 m) from sources of ignition and the line of adjoining property that is able to be built upon.

6.5.1.3 Collection in containment tanks shall be allowed indoors when the tanks are equipped with an exhaust system that transports vapors to a point outside the building in which the tanks are located.

6.5.1.4 Exhaust collection systems shall be in accordance with the *Uniform Mechanical Code*, and the duct serving such systems shall be classified as product-conveying duct.

6.5.1.5 Containment tanks installed outdoors shall not be required to be equipped with an exhaust system.

6.5.2 Calcium carbide residue pits and ponds shall be within a fenced area or posted around their perimeters with signs declaring the following or equivalent warning:

WARNING: NO TRESPASSING — NO SMOKING — NO OPEN FLAMES

Chapter 7 Acetylene Gasholders, Purifiers, and Low Pressure Driers

7.1* Location of Gasholder. Gasholders shall be permitted to be located outdoors or inside of buildings.

7.1.1 Outdoors. The gasholder shall be located at least 50 ft (15 m) from places of public assembly and any flammable liquid or flammable gas storage and at least 25 ft (7.6 m) from

any source of ignition, line of adjoining property that is able to be built upon, or public way.

7.1.2 Indoors.

7.1.2.1 Indoor gasholders shall be located in a room that complies with the requirements of Chapter 4 of this standard.

7.1.2.2 This room shall be permitted to house other acetylene equipment.

7.2 Installation of Gasholder.

7.2.1 The gasholder shall be equipped with inlet and outlet shutoff valves located and arranged so that they are able to be closed in an emergency.

7.2.2* The gasholder shall not be located beneath or in a location where it is exposed to the failure of electric power lines, piping containing all classes of flammable or combustible liquids, or piping containing other flammable gases.

7.2.3 Weeds and grass within 25 ft (7.6 m) of the gasholder shall be kept cut, and the cuttings shall be removed.

7.2.4 Combustible material shall not be permitted within 25 ft (7.6 m) of the gasholder.

7.2.5 The gasholder shall be marked as follows:

WARNING: ACETYLENE — FLAMMABLE GAS — DANGER — KEEP FIRE AND OPEN FLAMES AWAY

7.3* Low Pressure Purifiers and Driers. Purifiers and driers shall have inlet and outlet shutoff valves located and arranged so that they are able to be closed in an emergency.

Chapter 8 Acetylene Compressors and High Pressure Driers

8.1 Installation.

8.1.1 Drain Lines, Vents, and Equipment.

8.1.1.1 Drain Lines from High Pressure Acetylene Systems.

8.1.1.1.1 Drain lines from high pressure [pressure above 15 psi (103 kPa)] acetylene oil separators, condensate traps, and driers shall be piped outdoors to a location away from any sources of ignition and combustible material.

8.1.1.1.2 Drain lines from high pressure acetylene systems where source pressures have been reduced to medium gauge pressure [15 psi (103 kPa) and lower] shall be permitted to be piped to an indoor drain where the effluent water drained from the system is visible to the operator from the drain valve location.

8.1.1.2 Drain Lines from Medium Pressure Acetylene Systems. Drain lines from medium gauge pressure [15 psi (103 kPa) and lower] acetylene shall be permitted to be piped to an indoor drain where the effluent water drained from the system is visible to the operator from the drain valve location.

8.1.1.3 Pressure Relief Device Vent Lines. Vent lines serving equipment provided with pressure relief devices shall be in accordance with 6.3.2.

8.1.2 Compressors.

8.1.2.1 Inlet and Outlet Piping Control Valves. The inlet and outlet piping of compressors shall be provided with shutoff valves located and arranged so that they are able to be closed in an emergency.

8.1.2.2 Pressure Relief Device Vent Lines. Vent lines serving pressure relief valves shall be in accordance with 6.3.2.

8.1.2.3 Automatic Shutdown.

8.1.2.3.1 Inlet Lines.

8.1.2.3.1.1 Pressure Switches. The suction line to the compressor shall be provided with a pressure switch or device capable of automatically shutting down the compressor when the suction pressure falls below a pressure not less than 1 in. of water column (0.25 kPa) above atmospheric pressure.

8.1.2.3.1.2 Isolation of Pressure Switches. Shutoff valves shall not be installed on the inlet or suction line between the compressor and the pressure switch or device.

8.1.2.3.2 Discharge Lines.

8.1.2.3.2.1 The discharge line from the compressor shall be provided with a pressure switch or device to automatically shut down the compressor when the discharge pressure reaches the maximum allowable operating gauge pressure of the system or 400 psi (2800 kPa), whichever is less.

8.1.2.3.2.2* When provided, valves installed between the compressor and the pressure switch or device shall be equipped with positive lock-open devices to ensure that the valve(s) is maintained in a locked open position when the compressor is in operation.

8.1.2.3.2.3 Such lock-open devices shall be visible to the operator.

8.2 Compressor Design.

8.2.1 Compressors shall be designed and constructed for acetylene service.

8.2.2 Compressors shall be constructed so that the acetylene is cooled during and after each stage of compression.

8.2.3 Where compressors use water as a cooling medium, the flow of water from the cooling jackets and intercoolers shall be visible to the operator.

8.2.4 Pressure and Temperature Indicators.

8.2.4.1 Pressure Gauges. A pressure gauge shall be provided on the discharge piping following each stage of compression.

8.2.4.2 Temperature Indicators. A temperature indicator shall be provided on the final discharge piping at the point where the gas at service pressure exits the compressor.

8.2.5 A pressure relief device shall be provided on the discharge piping following each stage of compression.

8.2.5.1 The pressure relief device in the final compression stage shall be set at a gauge pressure not greater than 450 psi (3100 kPa).

8.2.5.2 Shutoff valves shall not be allowed between pressure relief devices and the compressor piping.

8.2.6 Transmission belts, where used in compressor rooms, shall be provided with static eliminators or be of the static-conducting type.

Chapter 9 Acetylene Piping

9.1 General. Piping systems shall be designed, fabricated, tested, and maintained in accordance with ASME B31.3, *Process Piping*.

9.1.1 Acetylene piping shall be identified in accordance with ANSI A13.1, *Scheme for Identification of Piping Systems*.

9.1.2 Acetylene piping shall be braced and supported for the coincident internal or external pressure, temperature, vibration, or other structural loads expected under service conditions.

9.1.3 Pipe fittings shall conform to the requirements of Section 12.1.

9.2 Piping for Pressure Not Exceeding a Gauge Pressure of 15 psi (103 kPa).

9.2.1 Piping and fittings shall be steel, wrought iron, malleable iron, or copper alloys meeting the requirements of 12.1.2.

9.2.2 For pipe of nominal size 6 in. and less (≤152 mm), all pipe shall be a minimum of Schedule 40, and all pipe fittings shall have a minimum rating of a gauge pressure of 125 psi (861 kPa).

9.2.3 Piping shall be pneumatically tested at 110 percent of the maximum design pressure using inert gas or air as the test medium.

9.2.3.1 Hydrostatic testing shall be allowed in lieu of pneumatic testing.

9.2.3.2 When piping is tested hydraulically, the test pressure shall be not less than 150 percent of the design pressure.

9.3 Piping for Pressure Exceeding a Gauge Pressure of 15 psi (103 kPa).

9.3.1 Piping shall be steel or wrought iron, and fittings shall be steel, malleable iron, ductile iron, or copper alloys meeting the requirements of 12.1.2.

9.3.2 All pipe of nominal size 1 in. and less (≤25 mm) shall be not less than Schedule 80.

9.3.3 All pipe of nominal sizes 1¼ in. (32 mm) and 1½ in. (38 mm) shall be not less than Schedule 160.

9.3.4 All pipe fittings shall have a minimum working pressure of a gauge pressure of 3,000 psi (20,684 kPa).

9.3.5 Bourdon tubes of pressure gauges shall be steel or copper alloys meeting the requirements of 12.1.2.

9.3.6 Pressure gauges shall be protected by a device that stops a detonation flame and limits the rise in pressure on the pressure gauge side to prevent Bourdon tube deformation.

9.3.7 Piping shall be hydrostatically tested at a gauge pressure of not less than 4,500 psi (31,026 kPa).

9.3.8 Pressure relief valves, pressure gauges, diaphragm valves, regulators, and flash arresters shall not be required to be hydrostatically tested.

9.4 Cylinder Charging Leads. Cylinder charging leads shall have a burst pressure rating of a gauge pressure not less than 10,000 psi (68,948 kPa) and shall be constructed of metallic or nonmetallic materials compatible for use in acetylene service.

Chapter 10 Acetylene Cylinder Charging Manifolds, Solvent Equipment, and Mobile Acetylene Trailer Systems

10.1 General.

10.1.1 Cylinder charging manifolds shall be provided with a shutoff valve and a blowdown valve vented to the outdoors or to the low pressure system.

10.1.2 A check valve shall be installed in the pipeline at each cylinder charging manifold and in each cylinder charging lead.

10.1.3 Pressure gauges shall be protected by a device that stops a detonation flame and limits the rise in pressure to prevent Bourdon tube deformation.

10.1.4 Each cylinder charging manifold outlet shall be provided with a shutoff valve.

10.1.5 Cylinder charging manifolds shall be arranged so that stress in the cylinder charging leads is limited to prevent failure.

10.1.6 Acetylene cylinders that have provisions for caps shall not be required to have caps in place when in the acetylene cylinder charging plant.

10.2 Solvent Equipment.

10.2.1 Solvent storage containers shall be constructed and installed in accordance with NFPA 30, *Flammable and Combustible Liquids Code*.

10.2.2 Aboveground solvent storage containers in excess of one 55 gal (208 L) drum allowed for use shall be located at least 25 ft (7.6 m) from the storage of acetylene cylinders and other flammable gas cylinders.

10.2.3 Solvent containers in use shall be provided with secondary containment.

10.3 Charging Procedures.

10.3.1 To prevent liquefaction (condensation) of acetylene, its pressure shall not exceed the values for the corresponding acetylene temperatures shown in Table 10.3.1.

Table 10.3.1 Maximum Acetylene Pressure According to Acetylene Temperature

Temperature		Gauge Pressure	
°F	°C	psi	kPa
–5	–20.5	200	1400
0	–17.8	220	1500
10	–12.2	260	1800
20	–6.7	305	2100
30	–1.1	360	2500
≥37	≥2.8	400	2800

10.3.2 Valves for charging cylinders shall be operated in such a sequence that the cylinder valves are opened first at the start of charging operations and closed last at the end of charging operations.

10.4 Cylinder Cooling Systems. Acetylene cylinders connected to charging manifolds shall have provisions for cooling by water spray applied from a manually activated spray nozzle

system, where needed for removing the heat of solution of acetylene, as determined by ambient temperature and cylinder charging rate.

10.5 Cylinder Storage.

10.5.1 Charged cylinders shall be stored outside the charging room or out of doors in accordance with the requirements of NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks.*

10.5.2 Acetylene cylinders located in the charging room awaiting transportation shall be located not less than 15 ft (4.6 m) from the acetylene charging manifolds.

10.6* Mobile Acetylene Trailer Systems. (Reserved)

Chapter 11 Fire Prevention and Protection

11.1* Fire Prevention.

11.1.1 Signs. Acetylene cylinder shipping and receiving docks and plant entrances shall be posted with a sign declaring the following or equivalent prohibition:

WARNING: SMOKING STRICTLY PROHIBITED

11.1.2 Combustible Waste. Self-closing metal waste receptacles shall be provided for greasy, oily rags and waste materials.

11.1.3 Fire Protection Equipment. Fire protection equipment shall not be blocked or obstructed.

11.2 Fire Protection.

11.2.1 Buildings or portions thereof required to comply with Protection Levels 1 through 4 shall be protected by an approved automatic sprinkler system complying with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

11.2.1.1* Automatic sprinkler systems shall be prohibited in rooms or areas used exclusively for calcium carbide storage or transfer operations or acetylene generation areas.

11.2.1.2 When sprinkler protection is provided, the area in which flammable compressed gases are stored or used shall be protected with a sprinkler system designed to be not less than that required by NFPA 13, *Standard for the Installation of Sprinkler Systems*, for Extra Hazard Group 1 with a minimum design area of 2500 ft^2 (232.26 m^2).

11.2.2 Fire protection equipment shall be identified and located so that it is readily visible and accessible in an emergency.

11.2.3 An emergency plan shall be provided in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks.*

11.2.4 Emergency alarms shall be provided in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks.*

Chapter 12 General Provisions

12.1 Alloys.

12.1.1 Unalloyed copper, silver, or mercury shall not be used where they are able to be exposed to acetylene or to liquids containing acetylene in solution.

12.1.2 Copper alloys containing more than 65 percent copper shall not be used where they are able to be exposed to acetylene, unless such alloys have been found to be compatible in the specific application by experience or by test.

12.2 Equipment and Piping.

12.2.1 Equipment and piping (generators, compressors, and manifolds) employed in acetylene operations shall be electrically continuous and bonded to any grounding electrode, in accordance with NFPA 70, *National Electrical Code.*

12.2.2 Generators, compressors, and pressure relief devices shall be marked with their capacities, pressure ratings, the manufacturer's name and address, and the model or serial numbers.

12.2.3 The capacity and operating pressure of this equipment shall not exceed the rating for which it is designed.

12.3 Powered Industrial Trucks. Powered industrial trucks shall be in accordance with NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations.*

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.1.3 Refer to NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, for acetylene generating plants where the acetylene is used with oxygen for welding, cutting, heating, and heat-treating operations.

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 designated 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.3.2.3 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.3.3.7 Mobile Acetylene Trailer System. 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.4.2.1.1 For purposes of this standard, air is not an oxidizing gas.

A.4.2.3 Equipment (industrial) platforms or mezzanines are frequently constructed and placed within generator rooms as a means to access and service hoppers used to gravity feed calcium carbide. The construction of mezzanines and the limits on their size, numbers, and openness are regulated by the building code. Rooms containing mezzanines or industrial platforms do not require that the building be classified as more than one story providing that they are in accord with the applicable restrictions of the building code.

A.4.3.2 See NFPA 68, *Guide for Venting of Deflagrations*, for guidance in the construction techniques.

A.6.1 This section does not govern the design of acetylene generators because of the variable and complex design features of different types of generators.

A.6.5.1 Although users may be allowed to discharge generator waste to the public sewer in some cases, such discharge must be carefully controlled and designed to eliminate the potential to generate acetylene in the sewer system. Most modern plants collect generator waste in collection tanks that are open to the atmosphere and where the waste can be further utilized as a by-product of the production.

A.6.5.1.1 Direct connections are connections where the discharge piping is hard piped or connected to the drain system without gaps in the piping system or openings where either trace amounts of acetylene can be entrained into the sewer system or unreacted calcium carbide can react with water in the sewer system with no ability to vent the gas formed.

A.7.1 Gasholders are intermediate vessels used to collect gas as it is generated to allow the compressor to operate on a duty cycle based on the rate of gas generation. The gasholder provides a means to collect a variable volume of gas within predefined limits. The gasholder acts as a buffer that provides a reservoir of gas to the compressor when activated. Such a buffer is needed as the rate of gas generation varies, and the rate of production is less consistent than the rate of consumption of the compressor. The compressor draws gas from the reservoir as gas is being compressed. When the gas capacity in the gasholder drops to a predetermined limit, the compressor is automatically shut down to avoid creating suction on the gas generator, which could lead to the entrainment of air. When sufficient gas has been generated and collected in the gasholder, the compressor is reactivated and the compression cycle is repeated.

A.7.2.2 See NFPA 30, *Flammable and Combustible Liquids Code.*

A.7.3 See CGA G-1.7, *Standard for Storage and Handling of Calcium Carbide in Containers,* and CGA Safety Bulletin SB-4-1997, *Handling Acetylene Cylinders in Fires.*

A.8.1.2.3.2.2 Devices or housings placed over the valve, such as clamshells that are released through the use of a lock and key, provide a visible means to ensure that the valve is set in the open position. The use of rapid opening valves, such as quarter-turn ball valves, is not recommended due to the potential for adiabatic compression, which can lead to explosive decomposition.

A.10.6 For information on mobile acetylene trailer systems, see CGA Pamphlet G-1.6, *Recommended Practices for Mobile Acetylene Trailer Systems.*

A.11.1 The major fire hazard in an acetylene plant 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 is not normally extinguished in any other way, but fires due to leaking acetylene or acetone 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 re-ignition hazard, or the source was removed to an isolated location. When a fire has exposed acetylene cylinders, the cylinders have been kept cool by application of water to protect them and prevent undue release of acetylene through the cylinder safety devices.

A.11.2.1.1 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.

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 30, *Flammable and Combustible Liquids Code*, 2003 edition.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2002 edition.

NFPA 68, *Guide for Venting of Deflagrations*, 2002 edition.

B.1.2 Other Publications.

B.1.2.1 CGA Publications. Compressed Gas Association, 4221 Walney Road, Fifth Floor, Chantilly, VA 20151-2923.

CGA Pamphlet G-1.6, *Recommended Practices for Mobile Acetylene Trailer Systems*, 2001.

CGA Pamphlet G-1.7, *Standard for Storage and Handling of Calcium Carbide in Containers,* 1995.

CGA Safety Bulletin SB-4, *Handling Acetylene Cylinders in Fires*, 1997.

B.2 Informational References.

CGA Pamphlet G-1, *Acetylene*, 2001.

CGA G-1.8, *Guidelines for the Operation and Closure of Lime Ponds,* 1999.

B.3 References for Extracts in Informational Sections. (Reserved)

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