NFPA® 51A

Standard for Acetylene Cylinder Charging Plants

2012 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

2012 Edition

This edition of NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*, was prepared by the Technical Committee on Industrial and Medical Gases, and acted on by NFPA at its June Association Technical Meeting held June 12–15, 2011, in Boston, MA. It was issued by the Standards Council on August 11, 2011, with an effective date of August 31, 2011, and supersedes all previous editions.

This edition of NFPA 51A was approved as an American National Standard on August 31, 2011.

Origin and Development of NFPA 51A

Although acetylene cylinder charging plants have been built and operated for several decades, only a limited number of concerns were involved at first, since the plants possessed a high degree of design and operating capability. Fire experience was good, and there was no need for national standard guidance.

In the 1960s, a number of other firms entered the industry, and the need for a national standard became evident. Work on this standard was initiated, and its subsequent promulgation was 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.

NFPA 51A 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 to bring the standard into compliance with the 2000 edition of the *Manual of Style for NFPA Technical Committee Documents*.

The 2006 edition of NFPA 51A was completely revised to make it conform with the 2004 edition of the *Manual of Style for NFPA Technical Committee Documents*. The order of Chapters 2 through 12 was changed. In addition, several definitions were changed to make them consistent with other NFPA documents. Other changes were made throughout the document to increase clarity of the text and ease of use.

The 2012 edition includes new requirements for mobile acetylene trailer systems (MATS) filling and discharging stations and fire protection for such systems. Fires involving MATS at user sites during unloading operations were the subject of a special investigation report (SIR 09/01, PB2009-917002) by the National Transportation Safety Board (NTSB). The Technical Committee on Industrial and Medical Gases considered the NTSB findings and developed requirements for MATS location, equipment, posted warnings, and fire protection. In addition, specific separation distances between high pressure acetylene drain lines and exposures have been added to Chapter 8.

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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.

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Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

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. 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 10, *Standard for Portable Fire Extinguishers,* 2010 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2010 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2012 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* 2010 edition.

NFPA 70®, National Electrical Code®, 2011 edition.

NFPA 72®, National Fire Alarm and Signaling Code, 2010 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2008 edition.

NFPA 400, *Hazardous Materials Code,* 2010 edition.

NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations,* 2011 edition.

2.3 Other Publications.

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

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

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

ASME B31.3, *Process Piping,* 2008.

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

ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* 2010.

ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* 2009.

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

Uniform Mechanical Code, 2009.

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

UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008.

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 1, *Fire Code*, 2012 edition.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2007 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2010 edition.

NFPA 400, *Hazardous Materials Code*, 2010 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2012 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 gauge pressures exceeding 1 psi (6.9 kPa) but not exceeding 15 psi (103 kPa). [**51,** 2007]

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 Building Code. The building or construction code adopted by the jurisdiction. [**55,** 2010]

3.3.5* 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,** 2012]

3.3.6 Fixed Natural Ventilation. The movement of air into and out of a space through permanent openings that are arranged in such a way that the required ventilation cannot be reduced by operating windows, doors, louvers, or similar devices.

3.3.7 High Hazard Contents. High hazard contents include materials defined as hazardous materials in NFPA 400, *Hazardous Materials Code*, whether stored, used, or handled.

3.3.7.1* ***High Hazard Level 2 Contents.*** High hazard Level 2 contents include materials that present a deflagration hazard or a hazard from accelerated burning, including but not limited to: 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 kPa); combustible dusts stored, used, or generated in a manner creating a severe fire or explosion hazard; flammable gases and flammable cryogenic liquids; Class I organic peroxides; 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 kPa); nondetonable pyrophoric materials; Class 3 nondetonable unstable (reactive) materials; and Class 3 water-reactive materials [**1,** 2012]

3.3.7.2 ***High Hazard Level 3 Contents.*** High hazard Level 3 contents include materials that readily support combustion or present a physical hazard including, but not limited to, Level 2 and Level 3 aerosols; 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 kPa); consumer fireworks 1.4G; flammable solids, other than dusts classified as high hazard Level 2, stored, used, or generated in a manner creating a high fire hazard; Class II and Class III organic peroxides; Class 2 solid or liquid oxidizers; 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 kPa);

oxidizing gases and oxidizing cryogenic liquids; Class 2 unstable (reactive) materials; and Class 2 water-reactive materials [**1,** 2012]

3.3.7.3 ***High Hazard Level 4 Contents.*** High hazard Level 4 contents include materials that are acute health hazards including, but not limited to, corrosives; highly toxic materials; and toxic materials [**1,** 2012]

3.3.8 Material.

3.3.8.1* ***Limited-Combustible (Material).*** Refers to a building construction material not complying with the definition of noncombustible material 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, *Standard Test Method for Potential Heat of Building Materials*, and includes either of the following: (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of ⅛ in. (3.2 mm) that has a flame spread index not greater than 50; and (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 E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*.

3.3.8.2 ***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 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, are considered noncombustible materials.

3.3.9* 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,** 2007]

3.3.10 Normal Temperature and Pressure (NTP). A temperature of 70°F (21°C) at an absolute pressure of 14.7 psi (101.3 kPa). [**55,** 2010]

3.3.11* 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. [**5000,** 2012]

3.3.12* Secondary Containment. That level of containment that is external to and separate from primary containment. [**400,** 2010]

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 where protection level controls are provided shall be located in accordance with the requirements of the building 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 is 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. Where mixed-occupancy buildings are to be separated by the use of occupancy separations, fire-resistive separations shall be provided in accordance with the building 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, *Compressed Gases and Cryogenic Fluids Code*.

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, *Compressed Gases and Cryogenic Fluids Code*.

4.3.3 Exits shall be provided for areas with protection level controls in accordance with the building code.

4.4 Ventilation. Rooms housing acetylene operations shall be provided with mechanical exhaust or fixed natural ventilation that ventilates the space at a rate of not less than 1 $ft^3/min/ft^2$ (0.03 $m^3/min/0.09\ m^2$) of floor area over the area of storage or use.

4.4.1 Rooms or areas where gases other than acetylene are stored or used shall be ventilated in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

4.4.2 Calcium carbide storage rooms shall be in accordance with 5.2.7.

4.4.3 Continuous Operation. Where mechanical exhaust systems are provided, the systems shall operate continuously unless an alternative design is approved by the authority having jurisdiction.

4.4.3.1 Reduction in Ventilation. Mechanical exhaust ventilation shall be permitted to be reduced below 1 $ft^3/min/ft^2$ (0.03 $m^3/min/0.09\ m^2$), 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.

4.4.4 Shutoff Controls. Where powered exhaust ventilation is provided, a manual shutoff switch shall be provided outside the room in a position adjacent to the principal access door to the room or in an approved location.

4.4.4.1 The switch shall be of the break-glass or equivalent type and shall be labeled as follows:

WARNING:
VENTILATION SYSTEM EMERGENCY SHUTOFF

4.4.5 Inlets to the Exhaust System. Inlets to exhaust systems serving rooms used for acetylene operations shall be located within 12 in. (304.8 mm) of the highest point in the room.

4.4.6 Recirculation of Exhaust. Exhaust ventilation shall not be recirculated within the room or building.

4.4.7 Ventilation Discharge. The point of termination for the exhaust ventilation system discharge shall be a minimum of 50 ft (15 m) from air intakes to building ventilation systems, air-conditioning equipment, and air compressors.

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

4.5.1 Gas detection systems shall not be required for structures equipped with fixed natural ventilation and constructed as weather protection in accordance with the requirements of NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

4.5.2 System Design.

4.5.2.1 The flammable gas detection system shall be listed or approved for use with acetylene and any other flammable gases used in the room.

4.5.2.2 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).

4.5.2.2.1 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 the operations room
(2) Activation of the mechanical ventilation system where reduced mechanical ventilation is provided to increase the ventilation to a rate not less than 1 $ft^3/min/ft^2$ (0.03 $m^3/min/0.09\ m^2$)
(3) Shutdown of the gas generation system when the concentration of flammable gas equals or exceeds 50 percent of the LFL

4.5.2.2.2 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 type or the hot water type.

4.6.1.1* Electric heaters listed for installation in hazardous locations shall be allowed to be used in operating areas regulated by 4.7.2 where installed and used in accordance with the manufacturer's instructions and the listing.

4.6.2 Boilers, water heaters, and other heating equipment containing one or more of the following potential hazards shall be located in a separate building or room not directly communicating with areas devoted to acetylene operations:

(1) Open flames
(2) Release of sparks or spark generation during operation
(3) Exposed surface temperatures exceeding the lowest autoignition temperature of any of the materials present

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 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
[*list 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 or in containers approved by the authority having jurisdiction.

5.1.2 Containers for calcium carbide shall be marked with 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 can 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 can 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 the building code.

5.2.7.1 Rooms or areas where the quantity of calcium carbide exceeds the maximum allowable quantity (MAQ) per control area shall be provided with protection level 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 in 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 Where 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 IAPMO *Uniform Mechanical Code* for product-conveying ducts.

6.3.2.4.2 Vent pipes terminating outside the building shall be in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

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.

6.3.2.6.1* here multiple pressure relief devices are connected to a common vent line or manifold, the cross-sectional area of the common vent line or manifold shall not be less than the aggregate cross-sectional venting area of the individual pressure relief devices 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 where 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* Where 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. Where 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 Where discharging to sumps, pits, or other receptacles, the point of discharge shall be located outdoors not less than 25 ft (7.6 m) from sources of ignition and the line of adjoining property that can be built upon.

6.5.1.2.1 The minimum required distances shall not apply where fire barriers without openings or penetrations having a minimum fire resistive rating of 2 hours interrupt the line of sight between the storage and the exposure.

6.5.1.2.2 The configuration of the fire barriers shall be designed to allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

6.5.1.3 Collection in containment tanks shall be allowed indoors where 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 IAPMO *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 and Low and Medium Pressure Purifiers and Driers

7.1* Location of Gasholder. Gasholders shall be permitted to be located outdoors or inside 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 can 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 and Medium Pressure Purifiers and Driers. Purifiers and driers shall have inlet and outlet shutoff valves located and arranged so that they can be closed in an emergency.

7.4* Drain Lines from Low and Medium Pressure Acetylene Systems. Drain lines from low and medium pressure [15 psi (103 kPa) and lower] acetylene systems 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.

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 systems, oil separators, condensate traps, and driers shall be piped outdoors to a location that meets the following criteria:

(1) Not less than 25 feet (7.6 m) from building openings
(2) Not less than 25 feet (7.6 m) from sources of ignition
(3) Not less than 10 feet (3 m) from combustible material
(4) Not less than 50 feet (15.2 m) from air intakes

8.1.1.1.1.1 The minimum required distances shall not apply when fire barriers without openings or penetrations having a minimum fire resistive rating of 2 hours interrupt the line of sight between the drain line discharge and the exposure. The configuration of the fire barriers shall be designed to allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

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 Pressure Relief Device Vent Pipes. Vent pipes 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 Pipes. Vent pipes 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* Where provided, valves installed between the compressor and the pressure switch or device shall be equipped with positive lock-open devices to ensure that the valves are 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 Pipe of nominal size 6 in. (152 mm) and less 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 Pipe of nominal size 1 in. (25 mm) and less shall be not less than Schedule 80.

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

9.3.4 Pipe fittings shall have a minimum working pressure of a gauge pressure of 3000 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 4500 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 blow-down valve.

10.1.1.1* Either the blow-down valve shall be arranged to vent the manifold to the outdoors in accordance with 6.3.2.4.2, or the discharge shall be returned to a low or medium pressure acetylene system with the pressure rating and capacity to contain both the maximum pressure and the volume released from the manifold.

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

10.1.2.1 Check valves shall not be required on charging leads used to charge individual cylinders on mobile acetylene trailer systems equipped with manifold systems that serve multiple containers.

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 when the leads are connected for charging or transportation.

10.1.6 Acetylene cylinders that have provisions for caps shall not be required to have caps in place when they are 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.

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.

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

10.5 Cylinder Storage.

10.5.1 Charged cylinders shall be stored outside the charging room or outdoors in accordance with the requirements of NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

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 (MATS).

10.6.1 MATS Filling Stations.

10.6.1.1 Location. The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

(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 filling or discharging of the mobile acetylene trailer
(4) Not less than 25 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, flammable gases or oxidizing materials
(6) Not less than 50 ft (15.2 m) from air intakes

10.6.1.1.1 The minimum required distances, except for air intake openings, shall not apply where 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.

10.6.1.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water runoff.

10.6.1.3 Protection from vehicular damage shall be provided in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

10.6.1.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst gauge pressure of 10,000 psi (69,000 kPa).

10.6.1.5 The charging site shall be posted with a sign with the following or equivalent wording:

ACETYLENE — FLAMMABLE GAS
NO SMOKING — NO OPEN FLAMES

10.6.1.6 Electrical equipment shall be in accordance with *NFPA 70, National Electrical Code*.

10.6.1.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with *NFPA 70, National Electrical Code*.

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

10.6.2 MATS Discharge Stations.

10.6.2.1 The MATS discharge station shall be in accordance with 10.6.1 except that 10.6.1.2 shall not apply.

10.6.2.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed a gauge pressure of 15 psi (103 kPa).

10.6.2.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:

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

10.6.3 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.

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: NO OPEN FLAMES
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 level controls 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 Where 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).

11.2.1.3* Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants, a fire sprinkler system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, Extra Hazard Group 1 shall be installed in the areas occupied by trailers in charging or discharging stations.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, at not less than 20 B:C shall be mounted on each trailer.

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, *Compressed Gases and Cryogenic Fluids Code*.

11.2.4* Employee Alarm System. Where required by government regulations, an employee alarm system shall be provided to allow warning for necessary emergency action as called for in the emergency action plan required by 11.2.3, or for reaction time for safe egress of employees from the workplace or the immediate work area, or both. [**55:**6.7]

11.2.5 Where provided, employee alarm systems shall comply with *NFPA 72, National Fire Alarm and Signaling Code*.

Chapter 12 General Provisions

12.1 Alloys.

12.1.1 Unalloyed copper, silver, or mercury shall not be used where it can 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 can be exposed to acetylene, unless such alloys have been found, by experience or by test, to be compatible in the specific application.

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, manufacturer's name and address, and 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 generators 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.3.3.1 Acetylene. When compressed and packaged into cylinders, acetylene is dissolved in a solvent, typically acetone or dimethylformamide (DMF). The solvent is absorbed into a porous material that fills the inside of an acetylene cylinder. This method of packaging is unique to acetylene, and the U.S. Department of Transportation prohibits the use of acetylene cylinders for any other gases.

A.3.3.5 Control Area. The maximum allowable quantities (MAQs) per control area and the detached building threshold levels are applied based on evaluation of the applicable physical or health hazards of the material being classified. The MAQs and the detached building threshold quantity for each hazard class are found in NFPA 55, *Compressed Gases and Cryogenic Fluids Code*. The MAQ and the detached building threshold levels might also be specified by the applicable building code or fire prevention code adopted by local, state, or federal regulations.

A.3.3.7.1 High Hazard Level 2 Contents. When acetylene is produced in a gaseous undissolved, or unstabilized, state, it is classified as a nonliquefied flammable, unstable reactive Class 3 (nondetonable) gas in accordance with the requirements of NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*.

Acetylene is stabilized when it is packaged for shipment or storage by dissolving the gas in a solvent authorized by the U.S. Department of Transportation and the resultant solution being absorbed into a porous filler material that fills the inside of the acetylene cylinder. Stabilized acetylene is classified as a nonliquefied flammable gas and a Class 2 unstable reactive gas.

In either case, acetylene is a flammable gas. In the unstabilized state, it is classified as a flammable, unstable reactive Class 3 (nondetonable) gas. In the stabilized state, it is classified as a flammable, unstable reactive Class 2 gas. Users should be aware that once the gas has been removed from the container, it is no longer in the stabilized state and each use should be evaluated. The most common use of acetylene is as a fuel gas where it is consumed immediately after being discharged from the cylinder. In cases where the gas is piped to remote use points and utilized in process operations, gas pressure at the point of use as well as the quantity to be employed should be considered.

A.3.3.8.1 Limited-Combustible (Material). Material subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition is considered combustible. See NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, and NFPA 220, *Standard on Types of Building Construction*. [**5000,** 2012]

Where the term *limited-combustible* is used in this standard, it is also intended to include the term *noncombustible*.

A.3.3.9 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.3.3.11 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, *Fire Code*, and *NFPA 5000, Building Construction and Safety Code*, do not have unique occupancy classifications for occupancies containing hazardous materials, Protection Level 1 through Protection Level 5 in NFPA codes and standards reflect increased building safety requirements that are applicable to occupancies containing hazardous materials, which generally correlate to Group H, Division 1 through Division 5, occupancy classifications in other codes. [**5000,** 2012]

In NFPA model codes and standards, where the quantity of hazardous materials in a control area exceeds the MAQ per control area, protection level controls are required. Unlike the approach used by other model codes where the occupancy reverts to Group H, the occupancy of the area remains classified based on its use as determined by the building code, and protection level controls suitable for the types of materials (high hazard contents) contained are required. Such controls might include a reduction in the allowable heights and areas; degree of fire-resistive construction; exiting; and the application of construction, engineering, and administrative controls applicable to the materials contained.

Refer to the definitions of *high hazard contents* in 3.3.7.1 through 3.3.7.3 and the related annex material in A.3.3.7.1 for additional information regarding the application of protection levels based on the hazard classification of materials.

A.3.3.12 Secondary Containment. Examples of secondary containment include dikes, curbing, remote impoundment, and double-walled tanks. [**400,** 2010]

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 provided that they are in accord with the applicable restrictions of the building code.

A.4.3.2 See NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, for guidance in the construction techniques.

A.4.5 A listing standard for gas detection and sensing systems is published by Underwriters Laboratories as ANSI/UL 2075, *Standard for Safety Gas and Vapor Detectors and Sensors*.

A.4.6.1.1 The autoignition temperature for acetylene as listed in NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, is 581°F (305°C). Acetylene is the only material currently listed as being in Group A. Electrical equipment is required to comply with the requirements of *NFPA 70, National Electrical Code*, based on class and group designations determined by conditions as well as the material present.

ANSI/UL 823,*Standard for Electric Heaters for Use in Hazardous (Classified) Locations*, is a consensus-based standard that covers explosionproof, dust ignition–proof, and dusttight portable and fixed electric heaters for installation and use in hazardous (classified) locations, Class I, Divisions 1 and 2, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class II, Division 2, Groups F and G; and Class III, Divisions 1 and 2, in accordance with *NFPA 70, National Electrical Code*.

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.6.3.2.6.1 The aggregate cross-sectional area of the connected pressure relief devices is the sum of the cross-sectional areas for each of the individual relief devices connected to the manifold.

A.6.5.1 Although users might 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 because 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, *Handling Acetylene Cylinders in Fires*.

A.7.4 Refer to Figure A.7.4 for an example of a drain arrangement.

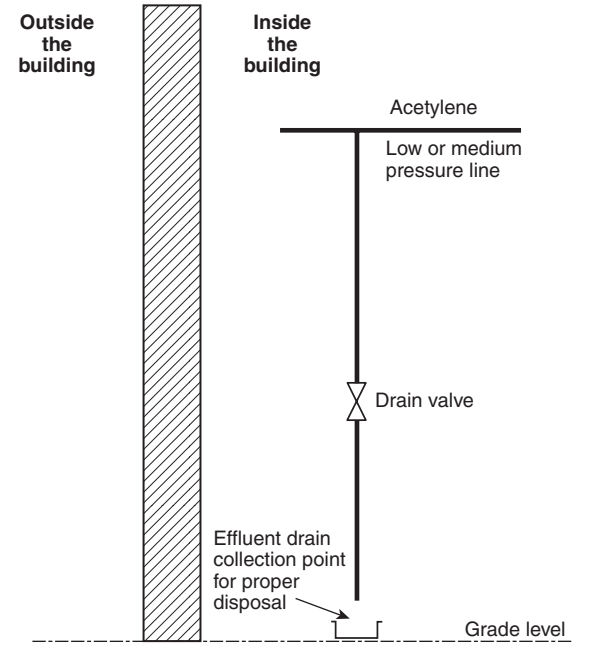

FIGURE A.7.4 Typical Drain Arrangement for Low or Medium Pressure Acetylene.

A.8.1.1.1.1 Drains lines are designed to drain condensate or other fluids; they are not "vent" lines used to vent or exhaust gases from the system. Drain lines should be piped to the outside of the building to avoid potential evolution of vapors that have been entrained into a liquid discharge. The location and collection of liquid drainage are determined by environmental considerations and the nature of the discharge.

Additional safeguards might be required when high pressure acetylene is vented. Protection against the potential ignition of vented gases due to a static electric discharge should be considered. For further information, see NFPA 77, *Recommended Practice on Static Electricity*. The use of rapid-opening valves in drain lines should be avoided so that unintended ignition does not occur.

A.8.1.1.1.2 Refer to Figure A.8.1.1.1.2 for an example of a valve arrangement.

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 because of the potential for adiabatic compression, which can lead to explosive decomposition.

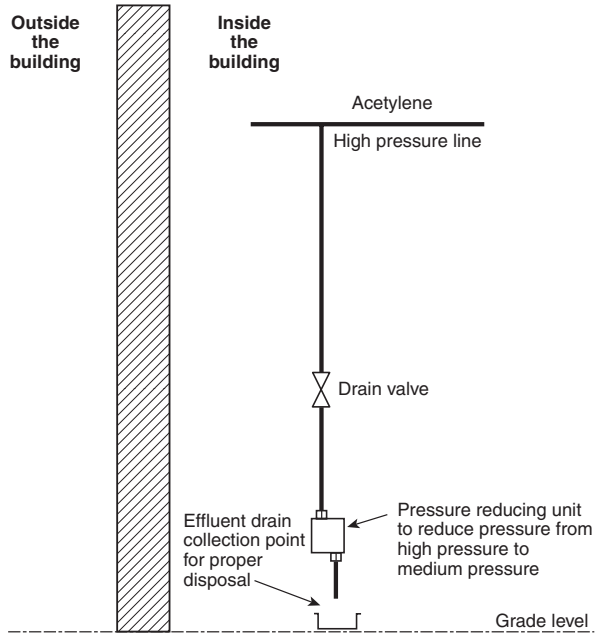

FIGURE A.8.1.1.1.2 Typical Drain Arrangement for High Pressure Acetylene.

A.8.2.5 Refer to Figure A.8.2.5 for an example of pressure relief vent piping.

A.10.1 Refer to Figure A.10.1 for a graphic representation of the various requirements found in Section 10.1.

A.10.1.1.1 Additional safeguards might be required when high pressure acetylene is vented. Protection against the potential ignition of vented gases due to a static electric discharge should be considered. For further information, see NFPA 77, *Recommended Practice on Static Electricity*. The use of rapid opening valves in vent lines should be avoided so that unintended ignition does not occur.

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

A.10.6.2.3(1) A 10,000 psi (~69,000 kPa) burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.

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

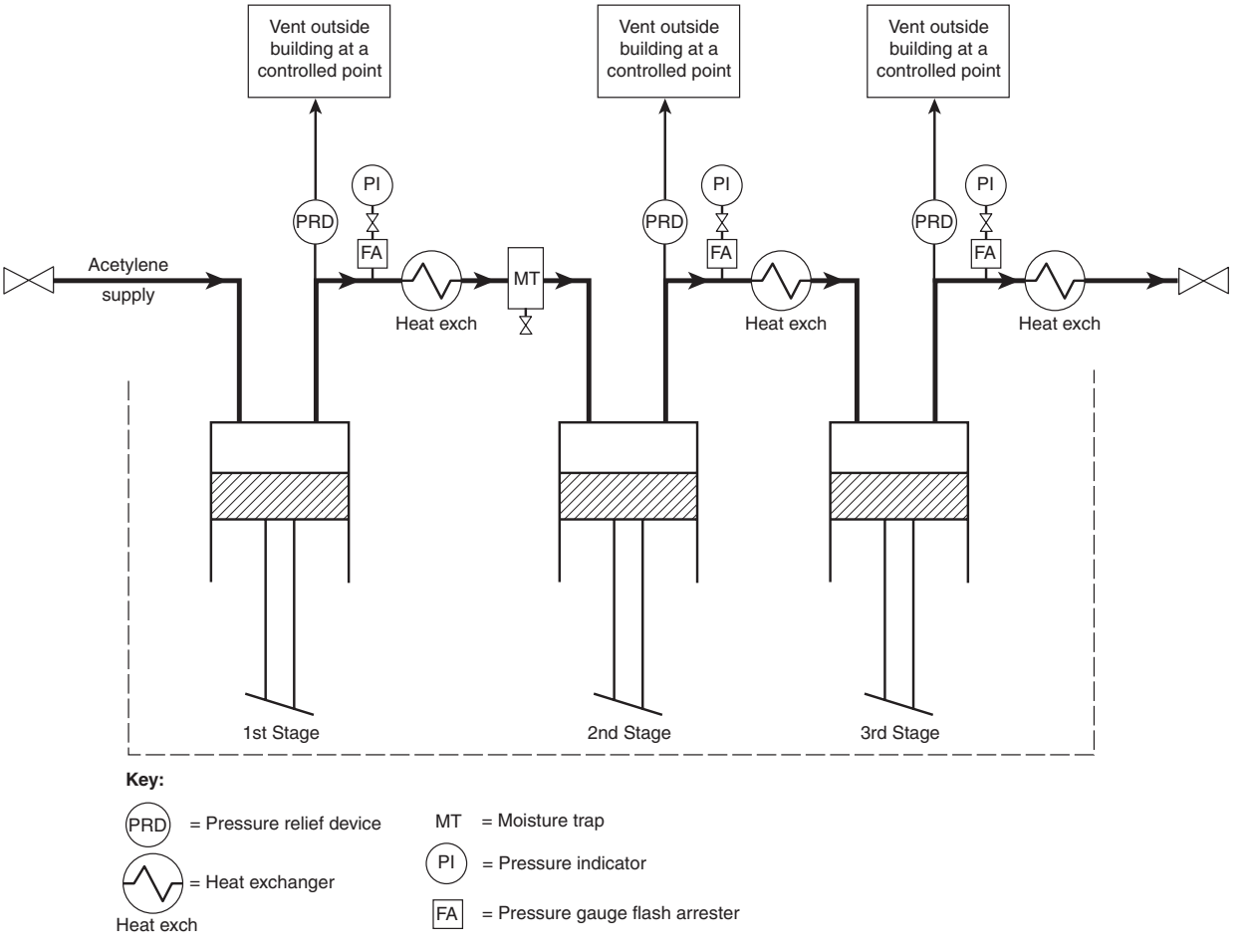

FIGURE A.8.2.5 Typical Pressure Relief Vent Piping Arrangement.

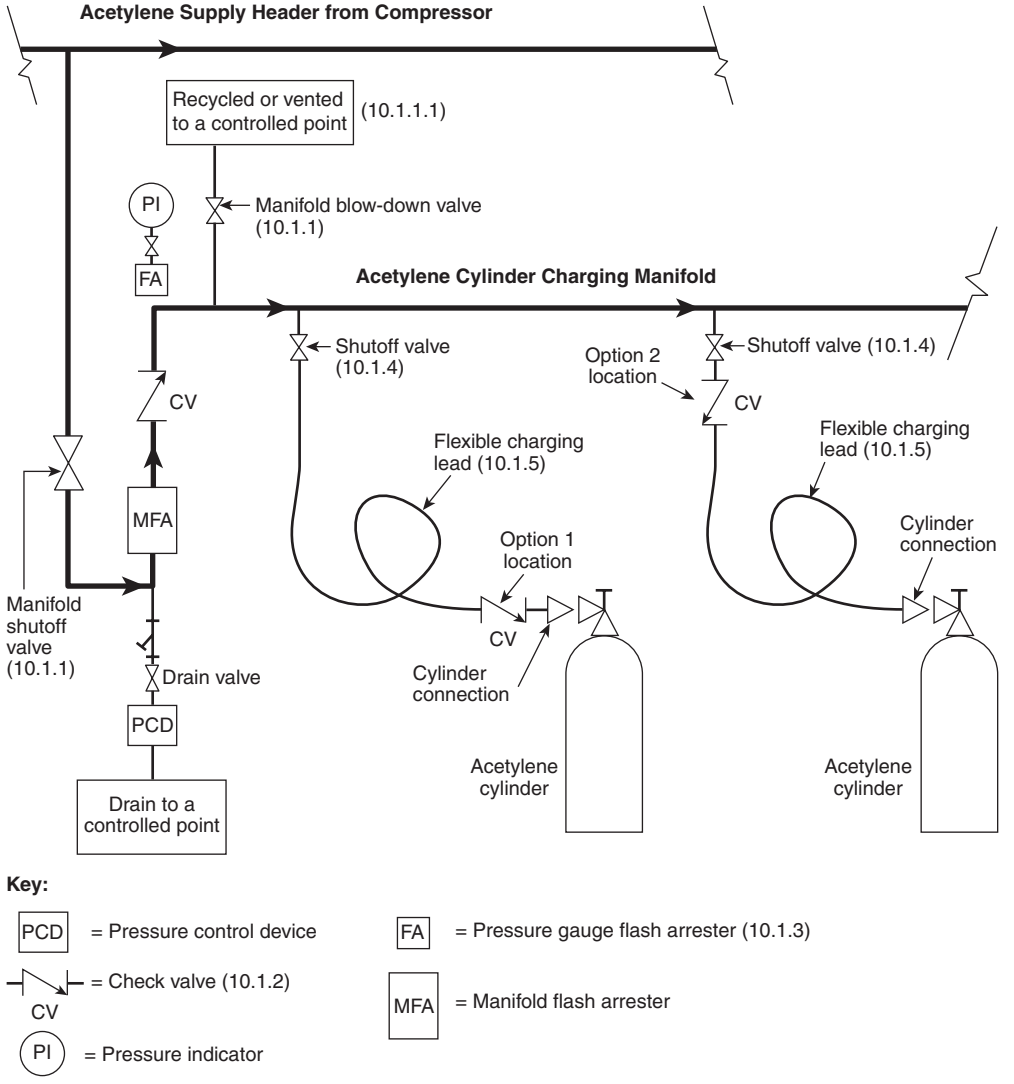

FIGURE A.10.1 Example Acetylene Cylinder Charging Manifold.

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.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

A.11.2.4 Under the requirements of 29 CFR 1910.38 established by OSHA regulations, employers must establish an employee alarm system that complies with 29 CFR 1910.165. The requirements of 29 CFR 1910.165 for the employee alarm system include, but are not limited to, systems that are capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace. Tactile devices may be used to alert those employees who would not otherwise be able to recognize the audible or visual alarm. The alarm system can be electrically powered or powered by pneumatic or other means. State, local, or other governmental regulations might also establish requirements for employee alarm systems. [**55:** A.6.7]

Annex B Informational References

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

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*, 2012 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2012 edition.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2007 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2010 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, 2007 edition.

NFPA 70®, *National Electrical Code®*, 2011 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2007 edition.

NFPA 220, *Standard on Types of Building Construction*, 2012 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2008 edition.

NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2008 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2012 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2012 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 G-1.6, *Recommended Practices for Mobile Acetylene Trailer Systems*, 2008.

CGA G-1.7, *Standard for Storage and Handling of Calcium Carbide in Containers*, 2005.

CGA Safety Bulletin SB-4, *Handling Acetylene Cylinders in Fires*, 2005.

B.1.2.2 UL Publications. Underwriters Laboratories Inc., 333 Pfingston Rd., Northbrook, IL 60062-2096

ANSI/UL 823, *Standard for Electric Heaters for Use in Hazardous (Classified) Locations*, 2006, revised 2007.

ANSI/UL 2075, *Standard for Safety Gas and Vapor Detectors and Sensors*, 2004, revised 2007.

B.1.2.3 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.38, "Emergency Action Plans."

Title 29, Code of Federal Regulations, Part 1910.165, "Employee Alarm Systems."

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.

CGA G-1, *Acetylene*, 2009.

CGA G-1.8, *Guidelines for the Operation and Closure of Lime Ponds*, 2008.

B.3 References for Extracts in Informational Sections.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2010 edition.

NFPA 400, *Hazardous Materials Code*, 2010 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2012 edition.

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