NFPA No.

51A

ACETYLENE CYLINDER CHARGING PLANTS 1974

NATIONAL FIRE PROTECTION ASSOCIATION

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Standard for

Acetylene Cylinder Charging Plants

NFPA No. 51A — 1974

1974 Edition of No. 51A

This is the third edition of this standard and was adopted at the NFPA Annual Meeting on May 23, 1974. It supersedes the 1973 edition.

Origin and Development of No. 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 by, and its subsequent promulgation materially assisted by, a Committee of the Compressed Gas Association, Inc., which submitted a text to the NFPA Committee on Industrial and Medical Gases.

This standard was adopted as a tentative standard in 1970. Amended editions were adopted in 1971 and 1973.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

Interpretation Procedure of the Committee on Industrial and Medical Gases

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA. 02210.

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Standard for

Acetylene Cylinder Charging Plants

NFPA No. 51A — 1974

1. INTRODUCTION

1.1 Purpose

This Standard is intended to 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.

1.2 Scope

1.2.1 This Standard applies to plants which 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.

1.2.2 The authority having jurisdiction may authorize the continued use of an existing plant which is not in strict compliance with the provisions of this Standard where such continued use will not constitute a distinct hazard to life or nearby property.

1.2.3 This Standard does not apply to plants which only produce and compress acetylene for chemical operations, or to plants which only produce and compress acetylene below 15 psig. (Refer to NFPA No. 51 for acetylene generating plants where the acetylene is used with oxygen for welding, cutting, heating, and heat-treating operations.)

1.3 Definitions

1.3.1 For the purposes of this Standard the following definitions shall apply:

ACETYLENE OPERATIONS — includes acetylene generation, storage, purification, compression, cylinder filling, cylinder storage and calcium carbide storage.

NONCOMBUSTIBLE — a type of building construction as defined in NFPA No. 220, i.e., "Construction in which the walls, partitions and structural members are of noncombustible construction not qualifying as Fire Resistive Construction."

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.

PSIG — pressure in pounds per square inch gage.

UNPIERCED WALL — a wall which may have pipes or conduits passing through it or windows, glazed with safety glass or wired glass, set in it; but such openings must be sealed to prevent the flow of air between adjacent rooms.

2. PLANT LOCATION, ARRANGEMENT, CONSTRUCTION AND UTILITIES

2.1 Location

2.1.1 Portions of plants housing acetylene charging and acetylene cylinder storage operations shall be located at least 50 feet from public right-of-way and from lines of adjoining property that may be built upon. A lesser distance is acceptable if suitable fire barriers are provided.

2.1.2 If plants are located in heavily populated or congested areas, the authority having jurisdiction shall determine appropriate distance requirements, barriers or other protective measures.

2.2 Arrangement

2.2.1 Portions of plants housing acetylene operations may be used for charging of other gases provided that oxidizing gas operations are located at least 20 feet from flammable gas operations. However, charging of oxidizing gas cylinders or storage of such filled cylinders may be separated from charging or storage of flammable gas cylinders by a masonry wall at least 5 feet high having a fire-resistance rating of at least 1 hour. For purposes of this Standard, air is not considered as an oxidizing gas.

2.2.2 Portions of plants housing acetylene operations shall be separated by unpierced walls from other portions of the plant which do not meet the provisions of this standard applicable to acetylene operations. In existing plants only, walls of rooms housing activities associated with the acetylene operations, such as locker rooms, offices and maintenance rooms, are permitted to be pierced with doorways if these are provided with self-closing doors. If either the construction or the occupancy of the nonacetylene operation portions of the plant are combustible, the common wall shall be of fire resistive construction having a fire resistance of at least one hour (see NFPA No. 220, Standard Types of Building Construction).

2.2.3 Acetylene cylinder charging plants constructed subsequent to May 19, 1971 shall have neither floors above or basements beneath the cylinder charging area. Floors above or basements beneath cylinder charging areas in plants constructed prior to May 19, 1971 shall not be used.

2.2.4 The property on which the plant and carbide-residue pond are located shall be suitably posted or fenced, or guarded to discourage the entrance of unauthorized persons.

2.3 Construction

2.3.1 Walls, partitions, and roofs of buildings in which acetylene operations are conducted shall be of noncombustible construction except as noted in 2.2.2.

2.3.2 Buildings or rooms housing acetylene operations, excluding calcium carbide storage rooms, shall be of explosion damage limiting construction and shall have an explosion venting area of not less than one square foot per 50 cubic feet of room volume. (*See NFPA No. 68, Guide for Explosion Venting.*)

2.3.3 Exits shall be provided in accordance with NFPA No. 101, Safety to Life Code. Areas housing acetylene operations shall be considered as "high hazard industrial occupancies" in the application of NFPA No. 101.

2.4 Ventilation

2.4.1 Rooms housing acetylene operations, excluding calcium carbide storage rooms (see 3.2.7), shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of ceiling area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building. Inlet openings shall be located near the floor. Outlet openings shall be located at the high point of the room. Provision shall be made for introduction of make-up air in such a manner as not to short circuit the ventilation. If operations involving heavier-than-air flammable gases are conducted in a room housing acetylene operations, special consideration shall be given to ventilation at the operation involving heavier-than-air gases.

2.5 Heating

2.5.1 Heating equipment shall be of the steam or hot water types.

2.5.2 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.

2.5.3 Buildings or rooms devoted to acetylene operations, excluding calcium carbide storage rooms and cylinder storage areas, shall be maintained at a temperature above 40°F during time of operation.

2.6 Electrical Equipment

2.6.1 Rooms containing electrical equipment and wiring not conforming with 2.6.2 shall be separated from acetylene operations by an unpierced wall. In existing plants only, walls of rooms housing activities associated with the acetylene operations, such as locker rooms, offices and maintenance rooms, are permitted to be pierced with doorways if these are provided with self-closing doors.

2.6.2 Electrical equipment and wiring in rooms housing acetylene operations, except rooms used exclusively for calcium carbide storage, shall conform to the National Electrical Code (NFPA No. 70), Article 501, for Class I, Division 2 locations. Class I, Groups C or D electrical equipment may be installed if located more than 5 feet from charging openings of generator hoppers, acetylene manifolds, liquid seals, and drain line outlets. If operations involving hydrogen are conducted in a room housing acetylene operations, special consideration shall be given to electrical equipment at these operations.

2.6.3 A readily accessible emergency electrical shutdown switch shall be provided.

3. CALCIUM CARBIDE

3.1 Drums and Containers

3.1.1 Calcium carbide shall be stored in metal containers of sufficient strength to ensure handling without rupture. The containers shall be constructed so as to be watertight under normal handling conditions.

3.1.2 Containers for calcium carbide shall be conspicuously marked CALCIUM CARBIDE — DANGEROUS IF NOT KEPT DRY, or equivalent wording.

3.2 Storage Areas

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

3.2.2 Each area of the plant in which calcium carbide is handled, stored, or used shall be conspicuously posted with notices reading: CALCIUM CARBIDE — DANGEROUS IF NOT KEPT DRY — KEEP WATER AND FLAMES AWAY or an equivalent wording.

3.2.3 Calcium carbide storage areas shall be arranged so that any defective container can be removed within a reasonable period of time.

3.2.4 Calcium carbide containers shall be supported in a suitable manner so that the container will not come in contact with the ground or with ground water.

3.2.5 Calcium carbide storage shall be located at least 10 feet from any line of adjoining property that may be built upon.

3.2.6 Exposed water, steam, or condensate lines shall not be permitted in rooms or buildings devoted exclusively to calcium carbide storage in drums. Unopened bulk carbide containers which have accumulations of ice and snow are permitted to be stored in such rooms or buildings.

3.2.7 Storage of calcium carbide inside buildings shall be in a dry, waterproof and well-ventilated location.

4. ACETYLENE GENERATORS AND CALCIUM CARBIDE RESIDUE

4.1 Design

4.1.1 This section is not intended to govern the design of acetylene generators because of the many variable and complex design features of different types of generators. Generators shall be designed by competent experienced persons familiar with the chemical and physical properties of acetylene and calcium carbide and with the fundamentals of pressure-vessel design.

4.2 Installation

4.2.1 Acetylene generators shall be installed within a room or building not exceeding a height of one story, except that a two-story building is permissible provided that the second story is used only for charging the generators with calcium carbide. Outdoor installations are permitted when protected from rain and freezing.

4.2.2 The foundation under a generator shall be so arranged that the generator will be level and no excessive strain will be placed on the generator or its connections.

4.2.3 If water is supplied to the generator through a continuous connection, means shall be provided on the generator to prevent over-filling. Such a connection shall also be equipped with means to prevent the backflow of acetylene from the generator into the water supply.

4.3 Venting of Generator

4.3.1 Each generator shall be provided with adequate pressure relief devices to prevent pressures in excess of the allowable pressure rating of the generator. The relief vent piping shall be substantially installed without traps and in such a manner that condensation will not accumulate in the vent piping.

4.3.2 The maximum permissible generating pressure is 15 psig. The maximum pressure setting of the generator pressure relief devices shall be 18 psig.

4.3.3 The vent pipes shall be full size to the termination point outside of the building and shall terminate in a hood or bend directed to a safe location. The hoods or bends shall be located at least 12 feet above the ground, at least 3 feet from combustible construction and as far as practicable from building openings and sources of ignition. The hood or bend shall be constructed so that it will not be obstructed by rain, snow, ice, insects, or birds.

4.3.4 Generator chamber relief pipes shall not be interconnected but shall be led separately to the outdoors. This requirement does not prohibit connecting two relief device vents protecting the same section of a generator from connecting to a common vent.

4.4 Operating Instructions

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

4.5 Calcium Carbide Residue Disposal

4.5.1 Acetylene generators shall not be fitted with continuous drain connections leading to sewers. Calcium carbide residue shall be discharged into outdoor open sump pits or other ventilated receptacles. Such receptacles may have a clear-water connection to public sewers if such disposal means is approved by local authorities.

4.5.2 The point of discharge of calcium carbide residue from acetylene generators into sump pits and other receptacles shall be located outdoors or in well-ventilated areas and at least 15 feet from sources of ignition and the line of adjoining property which may be built upon.

4.5.3 All calcium carbide residue pits and ponds shall be within an area fenced or posted around their perimeters with conspicuous signs reading: NO TRESPASSING — NO SMOKING OR OPEN FLAMES or equivalent wording.

5. ACETYLENE GASHOLDERS, PURIFIERS, AND LOW PRESSURE DRIERS

5.1 Location of Gasholder

5.1.1 Gasholders may be located outdoors or inside of buildings.

5.1.2 The gasholder shall be located at least 50 feet from concentrations of people and any flammable liquid or flammable gas storage, and at least 25 feet from any source of ignition, line of adjoining property which may be built upon, or public way.

5.1.3 Indoor gasholders shall be located in a room which complies with the requirements of Chapter 2 of this Standard. This room may house other acetylene equipment.

5.2 Installation of Gasholder

5.2.1 The gasholder shall be equipped with inlet and outlet shutoff valves located so that they can be closed readily in an emergency.

5.2.2 The gasholder shall not be exposed to electric power lines, flammable liquid lines or flammable gas lines.

5.2.3 Weeds and grass within 25 feet of the gasholder shall be kept cut and cuttings removed. Combustible material shall not be permitted within 25 feet of the gasholder.

5.2.4 The gasholder shall be conspicuously marked: ACETYLENE — FLAMMABLE GAS — DANGER — KEEP FIRE AND OPEN FLAMES AWAY, or with an equivalent wording.

5.3 Low Pressure Purifiers and Driers

5.3.1 Purifiers and driers shall be provided with inlet and outlet shutoff valves so located that they can be closed in an emergency.

6. ACETYLENE COMPRESSORS AND HIGH PRESSURE DRIERS

6.1 Installation

6.1.1 The inlet and outlet piping of each compressor shall be provided with readily accessible shutoff valves that can be closed in an emergency.

6.1.2 Drain lines from high pressure (above 15 psig) oil separators, condensate traps and driers shall be piped outdoors to a safe location away from any source of ignition and combustible material. Drain lines from medium pressure (15 psig and lower) systems where the effluent water is visible to the operator from the drain valve location, are permitted to be piped to an indoor drain.

6.1.3 The relief valve vent pipes shall be full size to the termination point outside of the building and shall terminate in a hood or bend directed to a safe location. The hoods or bends shall be located at least 12 feet above the ground, at least 3 feet from combustible construction and as far as practicable from building openings and sources of ignition. The hood or bend shall be constructed so that it will not be obstructed by rain, snow, ice or birds.

6.1.4 The suction line to the compressor shall be provided with a pressure switch or equivalent device capable of shutting down the compressor when the suction pressure falls below a pressure not less than one inch of water column above atmospheric pressure. A shutoff valve shall not be installed between the compressor and the pressure switch or equivalent device.

6.1.5 The discharge line from the compressor shall be provided with a pressure switch to shut down the compressor when the discharge pressure reaches the maximum permissible operating pressure of the system, but in no case more than 400 psig. Any valve installed between the compressor and the pressure switch shall be provided with a positive lock-open device.

6.2 Design

6.2.1 Compressors shall be specifically designed and constructed for acetylene service.

6.2.2 Compressors shall be constructed so that the acetylene is cooled during and after each stage of compression. When water is used, the flow of water from the cooling jackets and inter-coolers shall be visible to the operator.

6.2.3 A pressure gage shall be provided on the discharge piping following each stage of compression and a temperature indicator shall be provided on the final discharge piping.

6.2.4 A safety relief device shall be provided on the discharge piping following each stage of compression. There shall be no shutoff valve between the relief device and the compressor piping.

6.2.5 Transmission belts when used in compressor rooms shall be provided with static eliminators or be of the static-conducting type.

7. ACETYLENE PIPING

7.1 General

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

7.1.2 Acetylene piping shall be braced and supported to avoid excessive strains and vibrations.

7.1.3 Pipe and fittings shall conform to the requirements of 10.1.1, 10.1.2, and 10.1.3.

7.2 Piping for Pressure Not Exceeding 15 Psig

7.2.1 Piping and fittings shall be steel, wrought iron, malleable iron or copper alloys meeting the requirements of 10.1.2.

7.2.2 For nominal pipe size 6 inches and less, all pipe shall be a minimum of Schedule 40, and all pipe fittings shall have a minimum rating of 125 psig.

7.2.3 Piping shall be gas leak tested to at least 150 percent of the maximum operating pressure using inert gas or air as the test medium.

7.3 Piping for Pressure Exceeding 15 Psig

7.3.1 Piping shall be steel or wrought iron, and fittings shall be steel, malleable iron, ductile iron, or copper alloys meeting the requirements of 10.1.2.

7.3.2 All pipe of nominal size 1 inch and less shall be at least Schedule 80.

7.3.3 All pipe of nominal sizes 1¼ inches and 1½ inches shall be at least Schedule 160.

7.3.4 All pipe fittings shall have a minimum working pressure of 3,000 psig.

7.3.5 Pressure gage Bourdon tubes shall preferably be steel but may be copper alloys meeting the requirements of 10.1.2.

7.3.6 Piping shall be hydrostatically tested at 4,500 psig. Relief valves, pressure gages, diaphragm valves, regulators and flash arresters are exempted from this provision.

7.4 Cylinder Charging Leads

7.4.1 Cylinder charging leads shall have a minimum burst rating of 10,000 psig and shall be constructed of metallic or nonmetallic materials suitable for use in acetylene service.

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*Available from the American National Standards Institute, Inc., 1430 Broadway, New York, N. Y. 10018.

8. ACETYLENE CYLINDER CHARGING MANIFOLDS AND ACETONING EQUIPMENT

8.1 General

8.1.1 Each cylinder charging manifold shall be provided with a shutoff valve and a blow-down valve vented to the outdoors or to the low pressure system.

8.1.2 A check valve shall be installed in the pipe line at each cylinder charging manifold or in each cylinder charging lead.

8.1.3 Each cylinder charging manifold shall be provided with a pressure gage located downstream of the shutoff valve.

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

8.1.5 Cylinder charging manifolds shall be arranged so that excessive stress in the cylinder charging leads is prevented.

8.1.6 Acetylene cylinders which have provision for caps need not have caps in place when in the acetylene cylinder charging plant.

8.2 Acetoning Equipment

8.2.1 Acetone storage containers shall be constructed and installed in accordance with NFPA No. 30, Flammable and Combustible Liquids Code. Aboveground acetone storage containers in excess of one 55-gallon drum shall be located at least 25 feet from the storage of acetylene cylinders and other flammable gas cylinders.

8.3 Cylinder Cooling Systems

8.3.1 Acetylene cylinders connected to charging manifolds shall be cooled by water spray applied from a manually activated spray nozzle system, when needed for removing heat of solution of acetylene, as determined by ambient temperature and cylinder charging rate.

8.4 Cylinder Storage

8.4.1 Charged cylinders shall be preferably stored outside the charging room. If stored in the charging room, they shall be located as far as practicable from the charging manifolds.

9. FIRE PREVENTION AND PROTECTION

The major fire hazard in the acetylene plant is that of acetylene gas escaping from equipment, piping or cylinder fittings. The gas may or may 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 some fires in 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 reignition hazard, or the source was removed safely and promptly to a safe location. When a fire has exposed acetylene cylinders, the cylinders have been kept cool by application of water to protect the cylinders and prevent undue release of acetylene through the cylinder safety devices.

9.1 Fire Prevention

9.1.1 Acetylene cylinder shipping and receiving docks and plant entrances shall be posted with a readily visible sign reading: "SMOKING STRICTLY PROHIBITED" or equivalent wording.

9.1.2 Self-closing metal waste receptacles shall be provided for greasy, oily rags and similar waste materials.

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

9.2 Fire Protection

9.2.1 Plant areas devoted to acetylene compression, purification, acetylene cylinder charging, acetylene cylinder storage and other areas housing acetylene operations (but where calcium carbide is not stored), shall be protected by one or more 1½-inch hose stations equipped with an adequate length of hose. Hoses shall be equipped with combination spray and solid stream nozzles.

9.2.2 The need for automatic water spray system protection for acetylene cylinder charging manifolds shall be determined by an analysis of local conditions of hazard within the plant, exposure to other properties, water supplies, the probable effectiveness of plant fire brigades, and the time of response and probable effectiveness of fire departments. Where automatic water spray systems are installed, NFPA No. 15, Standard for Water Spray Fixed Systems for Fire Protection, shall be used as a guide. Automatic actuation may be by means of fusible links. Water coverage shall be not less than 0.25 gpm per square foot of floor area directly wetted by the system. An