PROPOSED rules and regulations on

N.J.A.C. 12:134

COMPRESSED, LIQUEFIED AND CRYOGENIC GASES.

STATE OF NEW JERSEY.
DEPARTMENT OF LABOR AND INDUSTRY.
Bureau of Engineering and Safety. (Division of Labor.)
Trenton, New Jersey

December 31, 1970

This draft is proposed N.J.A.C. 12:134, Compressed, Liquefied and Cryogenic Gases dated April 1, 1970, as modified by the First Revision dated December 4, 1970. This First Revision is based upon recommendations of the New Jersey State Industrial Safety Committee. This proposal also incorporates a new style and format now required by the Division of Administrative Procedures.

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FOREWORD

This is a new Chapter of Title 12 of the New Jersey Administrative Code to establish reasonable standards of safety for the manufacture, storage, handling or charging of compressed, liquefied or cryogenic gases.

The rapid developments in the technology of the use of low temperature gases and the increasing application of the common compressed gases in industry makes it apparent that safeguards in industrial use should be provided. Within the last few years the State has experienced serious fires, explosions and accidents involving these gases that has resulted in fatalities, serious injuries, and property damage so that it is appropriate that a regulation be drafted on this subject.

This Chapter is promulgated by the Commissioner of Labor and Industry of the State of New Jersey, under authority vested in him by Section 9 of the Worker Health and Safety Act, P.L. 1965, Chapter 154; N.J.S.A. 34:6A, as follows:

> The commissioner shall make and promulgate rules and regulations reasonably necessary to implement the purposes of this act. Such rules and regulations shall have the force and effect of law and shall be enforced in the manner provided in this act.....

This same statute provides authority for the commissioner to grant exceptions from the requirements of this Chapter in accordance with Section 23, as follows:

> The commissioner shall have the power and authority to grant exceptions from the literal requirements of rules and regulations promulgated under this act. Such exception shall be granted in any particular case only where it is clearly evident that it is necessary to prevent undue hardship or where existing conditions prevent compliance. In no case shall any exception be granted unless in the opinion of the commissioner reasonable protection of the health and safety of workers and the public will be maintained hereby. An application for an exception shall be filed in writing with the commissioner, setting forth specifically the requirements of the rules and regulations from which an exception is desired and the reason why enforcement of the applicable provisions of the rules and regulations is unreasonable. The commissioner shall grant or deny the exception within 30 days from the date of receipt by him of the application. The commissioner shall maintain a record of all exceptions granted and shall make such record reasonably available for public examination and shall mail a copy of all rulings granting exceptions to the members of the board.

It is important to note that in some cases approval of more than one State Agency could be a requirement.

Under Title 34, Chapter 7 of the Revised Statutes, originally enacted in 1935, construction of containers (pressure vessels) is regulated by the New Jersey Board of Boiler, Refrigeration and Pressure Vessels rules. This Board operates as part of the Mechanical Inspection Bureau in the Division of Labor Standards, Department of Labor and Industry. Nothing contained in this Chapter is intended to be in conflict with or less restrictive than the current rules promulgated by the Board and approved by the Commissioner.

Prior to promulgation this Chapter was submitted to the New Jersey State Industrial Safety Committee, Public Hearing, and the New Jersey Industrial Safety Board in accordance with the requirements of the Worker Health and Safety Act.

All standards and publications, other than Chapters 110 through 210 of Title 12, N.J.A.C. referenced in this Chapter, are available for inspection or purchase in accordance with Appendix A. Chapters of Title 12, N.J.A.C. are available in accordance with the back cover of this publication.

SUBCHAPTER 1
GENERAL PROVISIONS

12:134-1.1 TITLE AND CITATION.

This regulation shall be known and may be cited as Chapter 134, Compressed, Liquefied, and Cryogenic Gases of Title 12, N.J.A.C.

12:134-1.2 PURPOSE.

The purpose of this Chapter is to provide reasonable standards for the manufacture, storage, handling, charging and use of compressed, liquefied or cryogenic gases for the protection of the health and safety of all employees.

12:134-1.3 SCOPE.

1.3.1 This Chapter shall apply to all compressed, liquefied or cryogenic gases in places of employment included in the Worker Health and Safety Act, P.L. 1965, Chapter 154, N.J.S.A., except as provided in 1.3.1 (a) through (d), and as provided in 1.3.2.

(a) Section 1, 2, and 8 shall apply to the storage and handling of any compressed, liquefied or cryogenic gas in cylinders.

(b) Section 9 shall apply to any compressed, liquefied or cryogenic gas, except 9.1 shall apply only to cryogenic gases and anhydrous ammonia.

(c) Sections 1 through 7 shall apply to the storage, handling, charging and use of oxygen, hydrogen, ammonia or acetylene, as applicable.

(d) Section 7 shall apply to the manufacture of acetylene.

1.3.2 This Chapter shall not apply to:

(a) Compressed air systems used other than for charging portable containers.

(b) Liquefied petroleum gas.

(c) Transportation of compressed gases.

(d) The manufacture of oxygen, hydrogen or anhydrous ammonia.

(e) Refrigeration plants where ammonia is used solely as a refrigerant.

(f) Fuel gases and oxygen used for welding and cutting within the scope of Chapter 160, Welding and Cutting of Title 12, N.J.A.C.

12:134-1.4 EFFECTIVE DATE.

This Chapter shall take effect on April 1, 1971.

12:134-1.5 VALIDITY.

1.5.1 Nothing in this Chapter shall be construed to prevent the enforcement of other Chapters of Title 12, N.J.A.C., which prescribe more restrictive requirements.

1.5.2 Should any section, paragraph, sentence, or work of this Chapter be declared for any reason to be invalid such decision shall not affect the remaining portions of this Chapter.

12:134-1.6 EXISTING INSTALLATIONS.

1.6.1 Installations within the scope of this Chapter which were installed on or before the effective date of this Chapter may be continued in service unless the continued operation of such equipment, and installations constitute a serious and substantial threat to the health and safety of employees.

1.6.2 Maintenance of existing equipment shall be in accordance with this Chapter. Such equipment as may be replaced shall be replaced with equipment in accordance with this Chapter.

12:134-1.7 COMPLIANCE.

1.7.1 All equipment subject to this Chapter shall be maintained in a safe operating condition and shall conform to this Chapter.

1.7.2 Only a qualified person shall install, remove, connect, disconnect, fill, refill, deliver or permit to be delivered or use in any manner any gas container or system.

1.7.3 Only a qualified person shall operate a compressed, liquefied, or cryogenic gas system.

12:134-1.8 APPROVAL.

1.8.1 Each gas system or gas charging plant shall be approved.

1.8.2 Valves, safety relief devices, gauges, regulators and other accessories shall be approved for the gas service in which it will be used.

12:134-1.9 PLAN FILING.

1.9.1 Plan filings for compressed, liquefied or cryogenic gas projects shall be in accordance with Chapter 110, Plan Filing of Title 12, N.J.A.C., except as provided in 1.9.2.

1.9.2 Plan filings shall be required for any charging plant, and all gas systems except as provided in 1.9.3 through 1.9.6.

1.9.3 Plan filing shall not be required for oxygen systems with an aggregate storage capacity of:

(a) 13,000 cubic feet of gaseous oxygen NTP or less.

(b) 100 gallons of liquid oxygen or less.

1.9.4 Plan filing shall not be required for hydrogen systems with an aggregate storage capacity of:

(a) 3,000 cubic feet of gaseous hydrogen or less.

(b) 39.63 gallons of liquid hydrogen or less.

1.9.5 Plan filing shall not be required for ammonia systems with an aggregate storage capacity of 200 gallons or less.

1.9.6 Plan filing shall not be required for acetylene systems with an aggregate storage capacity of 3,000 cubic feet of acetylene or less.

SUBCHAPTER 2
DEFINITIONS

Accessories. All devices in a system such as excess flow valves, container valves, regulators, and safety relief devices.

Acetylene. A colorless, flammable, highly reactive, hydrocarbon gas slightly lighter than air.

Acetylene operations. Includes acetylene generation, storage, purification, compression, cylinder filling, cylinder storage, or calcium carbide storage.

Addition. A physical enlargement of an existing building or structure, service system or safety provision.

Alteration. A physical rearrangement of the whole or its parts of an existing gas facility.

Ammonia. When used in this Chapter means anhydrous ammonia.

Anhydrous ammonia. A compound formed by a combination of two gaseous elements, nitrogen and hydrogen, in the proportion of one part of nitrogen to three parts hydrogen by volume.

ANSI. American National Standards Institute, 1430 Broadway, New York, New York, 10018.

API. American Petroleum Institute, 1271 Avenue of the Americas, New York, New York, 10020.

Approved. Acceptable to the Commissioner. Devices having been tested and accepted for a specific purpose by a nationally recognized testing agency may be deemed to be acceptable.

ASME. American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017.

ASTM. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa., 19103.

Building. A structure enclosed within exterior walls or fire walls built, erected and framed of component structural parts designed for the housing, shelter, enclosure and support of individuals, anamals or property of any kind.

Bureau. Bureau of Engineering and Safety, Division of Labor Standards, Department of Labor and Industry, State of New Jersey.

Cf. Cubic feet measured at 14.7 psig and 70° F.

Charging and filling. Are used interchangeably and have the same meaning.

Charging plant. A room or building in which compressed gas containers are charged. Such a plant usually includes facilities for the bulk storage of cryogenic fluids, and other flammable or nonflammable gases.

Combustible liquid. A liquid having a flash point at or above 140° F. and below 200° F.

Commissioner. Commissioner of Labor and Industry or his authorized representative.

Compressed gas. Any mixture or material having in the container either an absolute pressure exceeding 40 pounds per square inch at 70° F., or an absolute pressure exceeding 104 pounds per square inch at 130° F., or both; or any liquid flammable material having a Reid vapor pressure exceeding 40 pounds per square inch absolute at 100° F.

Container. Any vessel, such as a tank or sphere, other than a portable container or cylinder, used for the storage, handling or transportation of gases.

Cryogenic gas. A gas liquefied by ultra low temperatures usually from minus 150° F., to almost absolute zero (-459° F.).

Cubic feet NTP. Cubic feet measured at 14.7 psig and 70° F.

Cylinder. A portable cylindrical container for gases under pressure constructed in accordance with USDOT Regulations - 1970.

Department. Department of Labor and Industry.

Design pressure. Maximum allowable working pressure.

Employee. Any person engaged in service to an employer for wages, salary or other compensation.

Employer. Any person or corporation, partnership, individual proprietorship, joint venture, firm, company or legal entity who engages the services of an employee and who pays his wages, salary, or other compensation; and any person exercising supervision of employees on an employer's behalf.

Filled by volume. The net amount of a gas in the vessel determined by volume.

Filled by weight. The net amount of a gas in the vessel determined by weight.

Filling density. The percent ratio of weight of the gas to the weight of water the vessel will hold at 60° F.

Fire resistant foundation. Foundations made of monolithic concrete or steel embedded in concrete or other coverings having a fire resistance rating of at least 2 hours.

Flammable liquid. A liqud having a flash point below 140° F. and having a vapor pressure not exceeding 40 pounds per square inch absolute at 100° F.

Gallon. A U.S. gallon or 231 cubic inches.

Gases. When not otherwise identified shall mean compressed, liquefied or cryogenic gases.

Hydrogen. An element which exists as a flammable, colorless, odorless, tasteless and non-toxic gas at atmospheric temperature and pressure, or as a liquid.

Hydrostatic relief device. An automatic pressure activated valve for liquid service characterized by throttle or slow weep opening.

ICC cylinder. See "Cylinder".

Liquefied gas. A gas which under the charged pressure, is partially liquid at a temperature of 70° F.

Liquid converter. A supply unit that stores product as a liquid and discharges it for utilization by heating to a gas.

Liquefied hydrogen. Hydrogen refrigerated by ultra low temperature usually from minus 150° F. to almost absolute zero (-459° F.) which transforms it to the liquid phase.

Liquid oxygen. Oxygen refrigerated to a temperature between -297.4 F., and -361.1 F., at a pressure of one atmosphere which transforms it to the liquid phase.

Mechanical Inspection Bureau. New Jersey Department of Labor and Industry, Mechanical Inspection Bureau, John Fitch Plaza, Box 1503, Trenton, New Jersey, 08625.

Nationally recognized testing agency. A laboratory, such as the Underwriters' Laboratories, Inc., U.S. Bureau of Mines, Factory Mutual Laboratories or American Gas Association Laboratories.

NFPA. National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 02110.

N.J.A.C. New Jersey Administrative Code.

Outdoors. Locations outside of any building or structure and locations under a noncombustible weather shelter or canopy not enclosed on more than two sides.

Owner. Person possessing equitable title shall mean that person, corporation, partnership, individual, proprietorship, joint venture, firm, company or other legal entity that has actual control over the premises used in whole or in part as a place of employment.

Owner of equipment. Person possessing legal title over equipment, leased, rented or loaned to an employer.

Oxygen. An element which exists as a nonflammable colorless, odorless, tasteless gas at atmospheric temperature and pressure.

Permanent storage. Fixed containers used as stationary storage mounted on a permanent foundation.

Place of employment. Any building or other premises occupied by an employer in or about which an employee customarily is suffered or permitted to work.

Plan filing. Delivery in person or by mail of applications, project data form, fee; and when required, drawings and other related data to the offices of the Bureau of Engineering and Safety for approval and deposit in its record.

Portable bank. A group of USDOT cylinders manifolded and secured so that they can be easily transported.

Portable container. A portable cylinder constructed in accordance with the USDOT Regulations - 1970.

Property line. The line of adjoining property or the nearest side of any public way.

Public way. A thoroughfare designated for public use by lawful procedure.

Qualified person. A person selected and directed by an employer to perform a specific task or duty involving gases, who has the degree of competence to accomplish the work in a safe manner.

Reid vapor pressure. The pressure measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method), ASTM D-323-1958.

Saddle. The part of the supporting structure upon which a horizontally installed container rests and which may be a steel member between the container and foundation.

Safety relief device. An automatic spring loaded or equivalent type pressure activated device for gas or vapor service characterized by pop action upon opening.

Separate building. A detached non-communicating building used exclusively to house gases covered by the scope of this Chapter.

Separate room. A separate enclosed area which is part of, or attached to another building and is used exclusively for gases covered by the scope of this Chapter.

Structure. An assembly of materials forming a construction for occupancy or use including among others, buildings, stadiums, gospel and circus tents, reviewing stands, platforms, stagings, observation towers, radio towers, storage tanks, trestles, piers, wharves, open sheds, coal bins, shelters, fences, and display signs.

System. An assembly of equipment consisting of but not limited to container, vaporizer, safety devices, charging, loading and unloading equipment, pumps, compressors, mixing equipment and connecting piping.

Tank. A container of more than 1,000 pounds water capacity (nominal) used for the storage, transportation or utilization of gases.

Transport. A tank truck, tank trailer, tube trailer or tank semi-trailer that transports gas.

USDOT. United States Department of Transportation, Hazardous Materials Regulations Board, Washington, D. C., 20590.

USDOT Regulations. Code of Federal Regulations, Title 49, Parts 171-190, Hazardous Material Regulations.

Vaporizer. A device to convert liquid to the gaseous state.

3.5.2 Insulation casings on liquid oxygen containers shall be equipped with suitable safety relief devices.

3.5.3 Safety relief devices and vent piping shall be so designed and located that moisture cannot collect and freeze to interfere with proper operation of the device.

3.5.4 The discharge of all safety relief devices shall be directed to a safe location away from service or operating personnel.

3.5.5 All lines, vessels, and equipment in which liquid oxygen may be trapped between closed valves shall be protected by hydrostatic or pressure relief devices or both.

12:134-3.6 PIPING, TUBING AND FITTINGS.

3.6.1 Gaseous Oxygen:

(a) Piping, tubing and fittings shall be suitable for oxygen service and for the pressures and temperatures involved.

(b) Gaseous oxygen piping shall be steel, wrought iron, brass or copper pipe or seamless copper, brass or stainless steel tubing.

(c) Piping, tubing and fittings shall conform to Petroleum Refinery Piping, ANSI B31.3-1966.

3.6.2 Liquid Oxygen:

(a) Piping or tubing for operating temperatures below -20 F. shall be fabricated of materials meeting the impact test requirements of Par. UG-84 of Unfired Pressure Vessel Code, ASME-1968 when tested at the minimum operating temperature to which the piping may be subjected in service.

(b) Metals used in liquid oxygen equipment shall possess satisfactory physical properties at extremely low operating temperatures.

(c) The following metals are acceptable for service with liquid oxygen: stainless steel - series 18-8, copper, bronze, brass, Monel, aluminum and Everdur. Some materials suitable for low temperature piping are austentic chromium - nickel alloy steels, and (in the wrought condition) copper, copper-silicon alloys, aluminum, some brasses and bronzes.

(d) Non-metals shall be compatible with liquid oxygen, including among others Teflon, Kel-F, asbestos and other fluorocarbons.

3.6.3 Gaskets may be made of Goetz-type aluminum, asbestos, or other approved materials.

3.6.4 Thread lubricants shall be fluorocarbon type, oxyseal, fluorolubes, or other approved compounds.

12:134-3.7 EQUIPMENT ASSEMBLY.

3.7.1 Equipment making up a bulk oxygen system shall be cleaned to remove oil, grease or other oxidizable materials before placing the system in service.

3.7.2 Joints in piping and tubing shall be brazed, welded, flanged, threaded or compression fittings. Gaskets or thread sealants shall be suitable for oxygen service.

3.7.3 Storage containers, piping at storage locations, piping to the point of use, valves, regulating equipment, and other accessories shall be protected against physical damage and against tampering.

3.7.4 Any enclosure containing control or operating equipment shall be adequately vented.

12-134-3.8 ELECTRICAL EQUIPMENT.

3.8.1 Electrical wiring and equipment shall comply with Chapter 162, Electrical Installations of Title 12, N.J.A.C.

3.8.2 The oxygen storage area shall be provided with adequate lighting.

12:134-3.9 LIQUID OXYGEN VAPORIZER.

3.9.1 The vaporizer shall be anchored and its connecting piping shall be sufficiently flexible to provide for the effect of expansion and contraction due to temperature changes and other movements.

3.9.2 The vaporizer and its piping shall be adequately protected with safety relief devices.

3.9.3 Heat used in an oxygen vaporizer shall be supplied indirectly by steam, air, water, or water solutions which do not react with oxygen.

3.9.4 If electric heaters are used to provide the primary source of heat, the vaporizing system shall be electrically grounded.

3.9.5 The vaporizing system shall be equipped with a device to prevent liquid carry-over.

12:134-3.10 INSTALLATION OF SYSTEM.

3.10.1 Gaseous oxygen systems of more than 13,000 cubic feet of oxygen NTP shall not be permitted inside buildings unless located in a special room having a fire resistance rating of not less than one hour, that is adequately vented, and used exclusively for the purpose.

3.10.2 The storage of liquid oxygen inside an occupied building shall not be permitted. Liquid oxygen shall be stored outdoors or in a separate oxygen building approved for the purpose and having no other occupancy. The total volume of storage in a separate oxygen building shall not exceed 100 gallons of liquid oxygen or 13,000 cubic feet of oxygen NTP.

3.10.3 Oxygen systems shall not be exposed by electrical power lines.

3.10.4 A storage system shall be located so that it is readily accessible to transports at ground level and to authorized personnel.

3.10.5 Oxygen systems on ground lower than any adjacent flammable or combustible liquid storage shall be provided with dikes, diversion curbs, or grading to prevent accumulation of liquids under the oxygen system.

3.10.6 A noncombustible surface shall be provided for any area where the leakage of liquid oxygen could fall during the operation of the system. Asphaltic or bituminous paving shall be considered combustible for the purposes of this requirement.

3.10.7 The container storage area shall be:

(a) Enclosed with an industrial type manproof fence at least 6 feet high, or

(b) Within an approved fenced plant area.

3.10.8 The fence covered in 3.10.7(a) shall be provided with at least two egress gates remotely located from each other when the travel distance exceeds 20 feet, except when the travel distance is 20 feet or less only one exit shall be required.

3.10.9 Substantial bumper guards shall be provided to protect the system from vehicle damage, when fenced in accordance with 3.10.7(b).

3.10.10 The minimum distance from the bulk oxygen system to an exposure shall be in accordance with Table 3.10.10.

TABLE 3.10.10
DISTANCE FROM OXYGEN STORAGE TO EXPOSURES

TYPE OF EXPOSURE	OXYGEN STORAGE CAPACITY	
	UNDER 1,000 GALLONS OR 115,000 CF	1,000 GALLONS OR 115,000 CF AND OVER
	Feet	Feet
A. Fire Resistive Building or Fire Wall Having Fire Resistance Rating Not Less Than 2 Hours	5	25
B. Buildings of Construction Other Than "A" Above	25	50
C. Wall Openings, Air Compressor Intakes, Inlets for Air Conditioning or Ventilating Equipment	25	50
D. Sources of Ignition	25	50
E. Concentration of Flammable and Combustible Liquids	50	100
F. Distance Between Oxygen Containers	5	5
G. Concentration of Flammable Gases	50	100
H. Concentration of Combustible Solids	50	100
I. Concentrations of People (offices, lunchrooms, and similar locations where people may congregate)	25	50
J. Property Lines	25	75

3.10.11 When the required distance from an oxygen system to an exposure cannot be obtained under Table 3.10.10, the Bureau may approve a lesser distance if some other approved means of protection, such as water spray protection, insulation, burying, mounding, fire walls, or dikings, is provided for the system and reasonable protection for the health and safety of the employee is maintained.

3.10.12 Liquid oxygen systems exceeding 3,000 gallons individual or aggregate liquid capacity or oxygen systems that present a serious exposure hazard shall be protected by one or more of the following: distances at least 50 percent greater than Table 3.10.10, water spray protection, insulation, burying, mounding, fire walls or diking.

12:134-3.11 TRANSPORT STORAGE.

3.11.1 Transports used with permanently installed containers shall be parked on a firm level roadway with steel or concrete pads of adequate size to accomodate the pony wheels.

3.11.2 Substantial bumper stops shall be provided for rear wheel of transports, and between transports and permanent storage to protect storage from vehicle damage.

3.11.3 Each transport used as part of a system shall be adequately secured to prevent movement.

3.11.4 The transport shall not be parked on a public way when conducting unloading or loading operations.

3.11.5 Transports shall have a minimum separation of 3 feet from the permanent storage system, fence, and other transports.

3.11.6 The transport storage shall be:

(1) Enclosed with an industrial type manproof fence at least six feet high with at least two egress gates remotely located from each other, or

(2) Within an approved fenced area.

3.11.7 The fence covered in 3.11.6(a) shall be provided with at least two egress gates remotely located from each other when the travel distance exceeds 20 feet, except when the travel distance is 20 feet or less, only one exit shall be required.

3.11.8 Transports shall be located with respect to adjacent exposures in accordance with Table 3.10.10.

12:134-3.12 TESTING.

3.12.1 After installation and before placing in service, the oxygen system shall be tested and proved gas tight at the maximum operating pressure. The testing mediums shall be oil free and nonflammable.

3.12.2 Safety relief devices on containers, other than USDOT containers, shall be visually examined at least once each year and shall be shop tested at least every five years.

3.12.3 All safety relief devices on oxygen systems, not covered by 3.12.2 or on USDOT containers, shall be tested at least once each year.

SUBCHAPTER 4
HYDROGEN SYSTEMS

12:134-4.1 SCOPE OF SECTION 4.

This Section 4 shall apply to gaseous and liquefied hydrogen systems.

12:134-4.2 CONTAINER CONSTRUCTION.

4.2.1 Hydrogen containers, other than USDOT containers, shall be designed, constructed, and tested in accordance with the appropriate requirements of the Unfired Pressure Vessel Code, ASME-1968. Vessels shall be stamped "National Board" or "New Jersey Standard" and shall comply with Chapters 90 through 99, Rules and Regulations of the Mechanical Inspection Bureau of Title 12, N.J.A.C.

4.2.2 Portable containers shall be designed, constructed, tested and maintained in accordance with USDOT regulations-1970.

4.2.3 Containers designed for liquefied hydrogen shall not be used for other liquids.

4.2.4 Liquefied hydrogen shall not be handled in glass dewars.

4.2.5 Liquefied hydrogen containers shall be of double wall construction with an insulation space between the two walls.

12:134-4.3 MARKING.

4.3.1 The bulk gaseous storage area shall be permanently and prominently placarded to indicate: "HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES".

4.3.2 The bulk liquefied hydrogen storage area shall be permanently and prominently placarded to indicate "LIQUID HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES".

4.3.3 Each portable container shall be identified by labeling or stencilling the common name of contents on cylinder, owner of cylinder and supplier of gas.

4.3.4 Each gaseous hydrogen container shall be legibly marked to indicate HYDROGEN - FLAMMABLE GAS".

4.3.5 Each liquefied hydrogen container shall be legibly marked to indicate "LIQUID HYDROGEN - FLAMMBLE GAS".

4.3.6 Each location where cylinders are stored in quantity shall be prominently posted with a sign reading: "NO SMOKING - NO OPEN FLAMES".

12:134-4.4 FOUNDATIONS AND SUPPORTS.

4.4.1 Permanently installed containers shall be provided with substantial noncombustible supports securely anchored on firm monolithic masonry foundations.

4.4.2 Steel supports for hydrogen containers shall have a protective covering having a fire resistance rating of not less than 2 hours.

12:134-4.5 SAFETY RELIEF DEVICES.

4.5.1 Hydrogen containers shall be equipped with safety relief devices as required by the Unfired Pressure Vessel Code - 1968 or USDOT Regulations - 1970, as applicable.

4.5.2 Safety relief devices shall be arranged to discharge unobstructed to the outdoors and in such a manner as to prevent impingement of escaping liquid or gas upon the container, adjacent structures or personnel. This shall not apply to USDOT containers having an internal volume at 2.0 cubic feet or less.

4.5.3 Safety relief devices and vent piping shall be designed and located so that moisture cannot collect and freeze to interfere with proper operation of the device.

4.5.4 Rain caps shall protect the discharge of all relief vents. Provision shall be made for draining condensate. Such draining channels shall not permit impingement on the container.

4.5.5 The discharge vents of a relief valve shall be adequately supported.

4.5.6 All lines, vessels, and equipment in which liquid hydrogen may be trapped between closed valves shall be protected by hydrostatic or pressure relief devices or both.

12:134-4.6 PIPING, TUBING AND FITTINGS.

4.6.1 Piping, tubing and fittings shall be suitable for hydrogen service and for the pressures and temperatures involved. Cast iron pipe and fittings shall not be used.

4.6.2 Liquefied hydrogen piping or gas piping -20°F or below shall conform to Petroleum Refinery Piping, ANSI B31.3-1966 or Refrigeration Piping ANSI B31.5-1966 and Addenda ANSI B31.5a-1968.

4.6.3 Joints in piping and tubing shall be made by welding or brazing, or by use of flanged, threaded, socket or compression fittings. Gaskets and thread sealants shall be suitable for hydrogen service.

4.6.4 Piping systems when exposed to temperature fluctuations of ambient to liquid hydrogen temperatures shall be designed to compensate for thermal expansion and contraction.

4.6.5 Means shall be provided to minimize exposure of personnel to liquefied hydrogen piping operating at low temperatures and to prevent air condensate from contacting piping, structural members and surfaces not suitable for cryogenic temperatures. Only these insulating materials which are rated non-burning shall be used, or other protective means used to protect personnel. The insulation shall be designed to have a vapor-tight seal in the outer covering to prevent the condensation of air and subsequent oxygen enrichment within the insulation. The insulation material and outside shield shall also be of adequate design to prevent attrition of the insulation due to normal operating conditions.

4.6.6 Uninsulated piping and equipment, which operate at liquefied hydrogen temperatures, shall not be installed above asphalt surfaces or other combustible material.

12:134-4.7 EQUIPMENT ASSEMBLY.

4.7.1 Valves, gauges, regulators and other accessories shall be suitable for the hydrogen service and for the pressures and temperatures involved.

4.7.2 Storage containers, piping, valves, regulating equipment and other accessories shall be readily accessible and shall be protected against physical damage and tampering.

4.7.3 A shutoff valve shall be located in the liquid withdrawal lines as close to the container as practical. On containers of 2,000 gallons capacity or over, this shutoff valve shall be of the remote control type with no connections, flanges or other accessories (other than a welded manual shutoff valve) allowed in the piping between the shutoff valve and its connection to the inner containers.

4.7.4 Cabinets or housings containing hydrogen control or operating equipment shall be ventilated to prevent any accumulation of hydrogen gas.

12:134-4.8 ELECTRICAL EQUIPMENT.

4.8.1 All Systems:

(a) Electrical wiring and equipment shall comply with Chapter 162, Electrical Installations of Title 12, N.J.A.C.

(b) The hydrogen storage area shall be provided with adequate lighting.

4.8.2 Gaseous Hydrogen Systems:

(a) Electrical wiring and equipment within 15 feet of gaseous hydrogen storage and unloading areas shall be designed for Class 1, Group B, Division 2 locations.

4.8.3 Liquefied Hydrogen Systems:

(a) Electrical wiring and equipment located within 5 feet of a point where connections are regularly made and disconnected shall be designed for Class 1, Group B, Division 1 locations.

(b) Except as provided in 4.8.3(a), electrical wiring and equipment located within 25 feet of a point where connections are regularly made and disconnected or within 25 feet of a liquid hydrogen container shall be designed for Class 1, Group B, Division 2 locations.

(c) When equipment listed for Class 1, Group B atmospheres is not commercially available, the equipment may: be purged or ventilated in accordance with Purged Enclosures for Electrical Equipment in Hazardous Locations, NFPA No. 496-1967; or be intrinsically safe; or be listed for Class 1, Group C atmospheres.

(d) Sections 4.8.3(a) and (b) shall not apply to electrical equipment which is installed on transports or tank cars from which the storage container is filled.

12:134-4.9 INSTALLATION OF GASEOUS HYDROGEN SYSTEMS.

4.9.1 Any Gaseous Systems:

(a) Hydrogen systems shall be located outside buildings, except a system may be installed inside buildings when permitted by the Bureau.

(b) A hydrogen system shall be located so that it is readily accessible to transport at ground level and to authorized personnel.

(c) Hydrogen systems shall not be exposed by electrical power lines.

(d) When locating hydrogen containers near aboveground flammable or combustible liquid storage or liquid oxygen storage, consideration shall be given to relocating the hydrogen container on ground higher than flammable liquid storage or liquid oxygen storage.

(e) Hydrogen containers on ground lower than adjacent flammable or combustible liquid storage or liquid oxygen storage, shall be provided with dikes, diversion curbs, or grading to prevent accumulation of liquids under the hydrogen container.

(f) The container storage area shall be fenced, in accordance with 3.10.7. Egress from the fenced area shall be provided in accordance with 3.10.8.

(g) Substantial bumper guards shall be provided to protect the system from vehicle damage, when fenced in accordance with 4.9.1(f)(2).

(h) The hydrogen storage area and the transport unloading apron shall be paved with the noncombustible material.

(i) If protective walls are provided around the storage area, they shall have a fire resistance rating of not less than 2 hours.

(j) The transfer of hydrogen, except for process operations, from one container to another shall be performed outdoors.

4.9.2 Distance from System to Exposure:

(a) The minimum distance from the gaseous hydrogen storage located outdoors, in a separate building or in a special room to an exposure shall be in accordance with Table 4.9.2(a).

TABLE 4.9.2(a)
DISTANCE FROM GASEOUS HYDROGEN STORAGE TO EXPOSURES

TYPE OF OUTDOOR EXPOSURE	GASEOUS HYDROGEN STORAGE CAPACITY		
	401 to 3,000 CF	3,000 to 15,000 CF	Over 15,000 CF
	Feet	Feet	Feet
A. Fire Resistive Building or Fire Wall Having Fire Resistive Rating Not Less Than 2 Hours	5	15	25
B. Buildings of Construction Other Than "A" Above	10	25	50
C. Wall Openings, Air Compressor Intakes, Inlets for Air Conditioning or Ventilating Equipment	50	50	50
D. Sources of Ignition	25	25	50
E. Concentration of Flammable and Combustible Liquids	25	50	100
F. Between Gaseous Hydrogen Containers	5	5	5
G. Concentration of Other Flammable Gases	50	50	100
H. Concentration of Oxygen Storage and Other Oxidizers	50	50	50
I. Concentration of Combustible Solids	50	50	100
J. Concentrations of People (offices, lunchrooms, and similar locations where people may congregate)	25	50	50
K. Property Lines	25	25	75

(b) When the required distance from an gaseous hydrogen system to an exposure cannot be obtained under Table 4.9.2(a), the Bureau may approve a lesser distance if some other approved means of protection, such as water spray protection, insulation, burying, mounding, or fire walls is provided for the system and reasonable protection for the health and safety of the employee is maintained.

(c) Gaseous hydrogen systems that present a serious exposure hazard shall be protected by one or more of the following; distances at least 50 percent greater than Table 4.9.2(a), water spray protection, insulation, burying, mounding, or fire walls.

4.9.3 In Buildings Other Than Special Rooms or Separate Buildings:

(a) The volume of gaseous hydrogen in buildings other than special rooms or separate buildings shall be less than 3,000 CF.

(b) A minimum of 6 air changes an hour shall be provided. Inlet openings shall be located near the floor in exterior wall only. Outlet openings shall be located at the high point of the room in exterior walls or roof. Inlet and outlet openings shall each have a minimum total area of 1 square foot per 1000 cubic foot of room volume. Discharge from outlet openings shall be directed or conducted to a safe location.

(c) The system shall be at least 25 feet from flammable liquids and combustible material.

(d) The system shall be at least 25 feet from ordinary electrical equipment and other sources of ignition.

(e) The system shall be at least 25 feet from concentrations of people.

(f) The system shall be at least 50 feet from intakes of ventilation or air conditioning equipmentand air compressors.

(g) The system shall be 50 feet from flammable gases or oxidizing gases.

(h) The system shall be protected against physical damage due to falling objects or working activity in the area.

(i) Containers shall be firmly secured and stored in an upright position.

(j) Piping in plant shall be protected by spring loaded relief valves set to discharge at approximately 1-1/2 times the line pressure. The discharge shall terminate in a safe outside location.

4.9.4 In Special Rooms:

(a) The volume of gaseous hydrogen in special rooms shall not exceed 6,000 CF.

(b) The floor, walls and ceiling of a special room shall have a fire resistance rating of not less than 2 hours. Walls or partitions shall be continuous from floor to ceiling and shall be securely anchored. At least one wall shall be an exterior wall. Openings to other parts of the building shall not be permitted. Windows and doors shall be in exterior walls and shall be readily accessible in case of emergency.

(c) Ventilation shall be in accordance with 4.9.3(b).

(d) Explosion venting shall be provided in exterior walls or roof only. The venting area shall be equal to not less than 1 square foot per 30 cubic feet of room volume and may consist of any one or any combination of the following:

(1) Walls of light, noncombustible material, such as single thickness, single strength glass.

(2) Lightly fastened hatch covers.

(3) Lightly fastened swinging doors in exterior walls opening outward, or

(4) Lightly fastened walls or roof designed to relieve at a maximum pressure of 25 lb. per square foot or 5 lbs. per square foot in excess of the maximum expected wind pressure, which ever is greater.

(e) There shall be no sources of ignition from open flames, electrical equipment or heating equipment.

(f) Electrical equipment shall be designed for Class 1, Division 2 locations.

(g) Heating, if provided, shall be by steam, hot water or indirect means.

4.9.5 In Separate Buildings:

(a) The volume of gaseous hydrogen in separate buildings shall not exceed 15,000 CF.

(b) Buildings shall have a fire resistance rating of not less than 2 hours.

(c) Windows and doors shall be located for easy means of egress in case of emergency.

(d) Ventilation, explosion venting, ignition sources, electrical equipment, and heat shall comply with 4.9.3(c) through 4.9.3(g) respectively.

4.9.6 Transport Storage:

(a) Transports used with permanently installed containers shall comply with 3.11.1 through 3.11.7.

(b) Transports shall be located with respect to adjacent exposures in accordance with Table 4.9.2(a).

12:134-4.10 INSTALLATION OF LIQUEFIED HYDROGEN SYSTEMS.

4.10.1 Any Liquefied System:

(a) Liquefied hydrogen systems shall be located outside of buildings.

(b) Liquefied hydrogen systems shall comply with 4.9.1(b) through 4.9.1(j).

(c) Liquefied Hydrogen Vaporizers:

(1) The vaporizer shall be anchored and its connecting piping shall be sufficiently flexible to provide for the effect of expansion and contraction due to temperature changes.

(2) The vaporizer and its piping shall be adequately protected on the hydrogen and heating media sections with safety relief devices.

(3) Heat used in a liquefied hydrogen vaporizer shall be indirectly supplied utilizing media, such as air, steam, water, or water solutions.

(4) A low-temperature shutoff switch shall be provided in the vaporizer discharge piping to prevent flow of liquid hydrogen in the event of the loss of the heat source.

4.10.2 Distance From System to Exposure:

(a) The minimum distance from the liquefied hydrogen system located outdoors to an exposure shall be in accordance with Table 4.10.2(a).

TABLE 4.10.2(a)
DISTANCE FROM LIQUEFIED HYDROGEN STORAGE TO EXPOSURE

		LIQUEFIED HYDROGEN STORAGE CAPACITY		
		39.63 to 3,500 GALLONS	3,501 to 15,000 GALLONS	15,001 to 30,000 GALLONS
		Feet	Feet	Feet
A.	Fire Resistive Building or Fire Wall Having Fire Resistance Rating Not Less Than 2 Hours	25	50	75
B.	Buildings of Construction Other Than "A" Above	50	75	100
C.	Wall Openings, Air Compressor Intakes, Inlets for Air Conditioning or Ventilating Equipment	75	75	100
D.	Sources of Ignition	50	50	50
E.	Concentration of Flammable and Combustible Liquids	50	75	100
F.	Between Liquefied Hydrogen Containers	10	10	10
G.	Concentration of Other Flammable Gases	50	75	100
H.	Concentration of Oxygen and Other Oxidizers	100	100	100
I.	Concentration of Combustible Solids	50	75	100
J.	Concentrations of People (offices, lunchrooms, and similar locations where people may congregate)	75	75	100
K.	Property Lines	50	75	100

(b) When the required distance from a liquefied hydrogen system to an exposure cannot be obtained under Table 4.10.2(a), the Bureau may approve a lesser distance if some other approved means of protection, such as water spray protection, insulation, burying, mounding, fire walls or diking is provided for the system and reasonable protection for the health and safety of the employee is maintained.

(c) Liquefied hydrogen systems that present a serious exposure hazard shall be protected by one or more of the following; distances at least 50 percent greater than Table 4.10.2(a), water spray protection, insulation, burying, mounding, fire walls or diking.

4.10.3 Transport Storage:

(a) Transports used with permanently installed containers shall comply with 3.11.1 through 3.11.7.

(b) Transports shall be located with respect to adjacent exposures in accordance with Table 4.10.2(a).

12:134-4.11 TESTING.

4.11.1 After installation and before being placed in service, the gaseous or liquefied hydrogen system shall be tested and proved gas tight at the maximum operating pressure.

4.11.2 All safety relief devices on containers, other than USDOT containers, shall be visually examined at least once each year and shall be shop tested at least once every five years.

4.11.3 All safety relief devices on hydrogen systems not covered by 4.11.2 or on USDOT containers, shall be tested at least once each year.

SUBCHAPTER 5
ANHYDROUS AMMONIA SYSTEMS

12:134-5.1 SCOPE OF SECTION 5.

This Section 5 shall apply to anhydrous ammonia systems.

12:134-5.2 NONREFRIGERATED CONTAINERS.

5.2.1 Ammonia containers, other than USDOT containers, shall be designed, constructed and tested in accordance with the appropriate requirements of the Unfired Pressure Vessel Code, ASME - 1968. Vessels shall be stamped "National Board" or "New Jersey Standard" and shall comply with Chapters 90 through 99, Rules and Regulations of the Mechanical Inspection Bureau of Title 12, N.J.A.C.

5.2.2 Containers, other than USDOT containers and refrigerated containers, shall have a design pressure of at least 250 psig.

5.2.3 Containers used with systems covered in 5.18 shall be designed, constructed, tested and maintained in accordance with the USDOT Regulations - 1970.

5.2.4 Aboveground uninsulated containers shall be provided with a light reflective surface, which shall be maintained in good condition.

12:134-5.3 MARKING.

5.3.1 The bulk ammonia storage area shall be permanently and prominently placarded to indicate "CAUTION - ANHYDROUS AMMONIA".

5.3.2 Each portable container shall be identified by labeling or stencilling the common name of contents of cylinder, owner of cylinder and supplier of gas.

5.3.3 Each anhydrous ammonia container shall be legibly marked to indicate "ANHYDROUS AMMONIA".

5.3.4 System nameplates on nonrefrigerated containers when required shall be permanently attached to the system so as to be readily accessible for inspection and shall include markings as prescribed in 5.3.5.

5.3.5 Each refrigerated and nonrefrigerated container shall be marked in accordance with Storage and Handling of Anhydrous Ammonia, ANSI K61.1-1971.

5.3.6 All main operating valves on permanently installed containers over 3,000 gallons water capacity shall be identified to show whether the valve is in liquid or vapor service. The legend LIQUID (or LIQUID VALVE), VAPOR (or VAPOR VALVE), as appropriate, shall be placed on or within 12 inches of the valve by means of a stencil, tag or decal.

12:134-5.4 FOUNDATIONS AND SUPPORTS.

5.4.1 Permanently installed containers shall be provided with substantial noncombustible supports securely anchored on firm monolithic masonry foundations.

5.4.2 Steel supports for ammonia containers shall have a protective covering having a fire resistance rating of not less than 2 hours except as provided in 5.16.4(b).

12:134-5.5 SAFETY RELIEF DEVICES.

5.5.1 Every container used in nonrefrigerated systems shall be provided with one or more safety relief valves of the spring loaded or equivalent type. The discharge from safety relief valves shall be vented away from the container upward and unobstructed to the atmosphere. All relief valve discharge openings shall have suitable raincaps that will permit free discharge of the vapor and prevent the entrance of water. Provision shall be made for draining condensate which may accumulate.

5.5.2 The minimum required rate of discharge of each safety relief device in cubic feet per minute of air at 120 percent of the maximum permitted start to discharge pressure shall be in accordance with Table 5.5.2.

Table 5.5.2

SURFACE AREA Sq. Ft.	FLOW RATE AIR Cfm	SURFACE AREA Sq. Ft.	FLOW RATE AIR Cfm
20	258	340	2,640
25	310	350	2,700
30	360	360	2,760
35	408	370	2,830
40	455	380	2,890
45	501	390	2,950
50	547	400	3,010
55	591	450	3,320
60	635	500	3,620
65	678	550	3,910
70	720	600	4,200
75	762	650	4,480
80	804	700	4,760
85	845	750	5,040
90	885	800	5,300
95	925	850	5,590
100	965	900	5,850
105	1,010	950	6,120
110	1,050	1,000	6,380
115	1,090	1,050	6,640
120	1,120	1,100	6,900
125	1,160	1,150	7,160
130	1,200	1,200	7,410
135	1,240	1,250	7,660
140	1,280	1,300	7,910
145	1,310	1,350	8,160
150	1,350	1,400	8,410
155	1,390	1,450	8,650
160	1,420	1,500	8,900
165	1,460	1,550	9,140
170	1,500	1,600	9,380
175	1,530	1,650	9,620
180	1,570	1,700	9,860
185	1,600	1,750	10,090
190	1,640	1,800	10,330
195	1,670	1,850	10,560
200	1,710	1,900	10,800
210	1,780	1,950	11,030
220	1,850	2,000	11,260
230	1,920	2,050	11,490
240	1,980	2,100	11,720
250	2,050	2,150	11,950
260	2,120	2,200	12,180
270	2,180	2,250	12,400
280	2,250	2,300	12,630
290	2,320	2,350	12,850
300	2,380	2,400	13,080
310	2,450	2,450	13,300
320	2,510	2,500	13,520
330	2,570		

Notes to Table

1. Surface Area = Total Outside Surface Area of Container in Square Feet. When the Surface Area is not stamped on the name plate or when the marking is not legible the area can be calculated by using one of the following formulas:

   a. Cylindrical container with hemispherical heads
      Area = overall length in feet times outside diameter in feet times 3.1416.

   b. Cylindrical container with other than hemispherical heads
      Area = (overall length in feet plus 0.3 outside diameter in feet) times outside diameter in feet times 3.1416.

   c. Spherical container
      Area = outside diameter in feet squared times 3.1416.

2. Flow Rate = CFM Air = cubic feet per minute of air required at standard conditions, 60 F and atmospheric pressure (14.7 psia).

3. The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than 2,500 sq. ft., the required flow rate can be calculated using the formula, Flow Rate CFM Air = 22.11 A 0.82, where A = outside surface area of the container in square feet.

5.5.3 Container safety relief valves shall be set to start-to-discharge as in accordance with Table 5.5.3 with relation to the design pressure of the container.

TABLE 5.5.3

CONTAINERS	MINIMUM Percent	MAXIMUM Percent
ASME Code; Par. U-68, U-69-1949 and earlier editions	110	125(1)
ASME Code; Par. U-200, U-201-1949 edition.	95	100(1)
ASME Code; 1950, 1952, 1956, 1959, 1962, 1965 and 1968 editions	95	100(1)
API-ASME Code; All editions.	95	100(1)
U. S. Coast Guard.	95	100
USDOT.	As required by USDOT Regulations	

Note to Table

1. Manufacturers of safety relief valves are allowed a plus tolerance not exceeding 10 percent of the set pressure on the valve.

5.5.4 Safety relief devices used in nonrefrigerated systems shall be constructed to discharge at not less than the rates required in 5.5.2 before the pressure is in excess of 120 percent of the maximum permitted start-to-discharge pressure setting of the device.

5.5.5 Safety relief valves shall be so arranged that the possibility of tampering will be minimized. If the pressure setting adjustment is external, the relief valves shall be provided with means for sealing the adjustment.

5.5.6 Shut-off valves shall not be installed between the safety relief valves and the container; except that a shut-off valve may be used where the arrangement of this valve is such as always to afford full required capacity flow through the relief valves.

5.5.7 Safety relief valves shall have direct communication with the vapor space of the container.

5.5.8 Each container safety relief valve used with nonrefrigerated systems shall be plainly and permanently marked with the symbol "NH_3" or "AA:, with the pressure in pounds per square inch gauge at which the valve is set to start-to-discharge; with the actual rate of discharge of the valve at its full open position in cubic feet per minute of air at 60 F. and atmospheric pressure; and with the manufacturer's name and catalog number.

5.5.9 The flow capacity of the relief valve shall not be restricted by any connection to it on either the upstream or downstream side.

5.5.10 A hydrostatic relief valve shall be installed between each pair of valves in the liquid ammonia piping or hose where liquid may be trapped and shall be vented away from container personnel and buildings and unobstructed to the atmosphere. The start-to-discharge pressure of such relief valves shall not be less than 350 psig nor in excess of 400 psig.

5.5.11 The manufacturer or supplier of a safety relief device manifold shall publish complete date showing the flow rating through the combined assembly of the manifold with safety relief valves installed. The manifold flow rating shall be determined by testing the manifold with all but one valve discharging. If one or more openings have restrictions not present in the remaining openings, the restricted opening or openings of those having the lowest flow shall be used to establish the flow rate marked on the manifold nameplate. The marking shall be similar to that required in 5.5.8 for individual valves.

5.5.12 All lines, vessels, and equipment in which liquefied ammonia may be trapped between closed valves shall be protected by hydrostatic or pressure relief devices or both.

12:134-5.6 PIPING, TUBING AND FITTINGS.

5.6.1 All piping, tubing and fittings shall be made of material suitable for anhydrous ammonia service.

5.6.2 All refrigerated piping shall conform to Refrigeration Piping ANSI B31.5 - 1966 and Addenda ANSI B31.5a - 1968, as it applies to ammonia.

5.6.3 Piping used on nonrefrigerated systems shall be at least Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal of Welded and Seamless Steel Pipe, ASTM A 53-1969. Such pipe shall be at least schedule 40 when joints are welded, or welded and flanged. Such pipe shall be at least Schedule 80 when joints are threaded. Threaded connections shall not be back-welded. Brass, copper, or galvanized steel pipe shall not be used.

5.6.4 Tubing made of brass, copper or other material subjected to attack by ammonia shall not be used.

5.6.5 Cast iron fittings shall not be used but this shall not prohibit the use of fittings made specifically for ammonia service of mallable, nodular or high strength gray iron meeting Malleable Iron Castings, ASTM A 47-1968; Ductile Iron for Pressure Containing Castings for Use at Elevated Temperatures ASTM A 395-1968; or Class B or C of Gray Iron Castings for Valves, Flanges and Pipe Fittings, ASTM A 126-1966.

5.6.6 Joint compounds shall be resistant to ammonia.

12:134-5.7 HOSE SPECIFICATIONS.

5.7.1 Hose used in ammonia service shall conform to Specifications for Anhydrous Ammonia Hose, AA1-RMA No. M-5-1967.

5.7.2 Hose subject to container pressure shall be designed for a minimum working pressure of 350 psig and a minimum burst pressure of 1750 psig. Hose assemblies, when made up, shall be capable of withstanding a test pressure of 500 psig.

5.7.3 Hose and hose connections located on the low pressure side of flow control or pressure reducing valves shall be designed for a bursting pressure of not less than five times the pressure setting of the safety relief devices protecting that portion of the system but not less than 125 psig. All connections shall be so designed and constructed that there will be no leakage when connected.

5.7.4 Wet hose shall be equipped with approved shut-off valves at discharge end. Provision shall be made to prevent excessive pressure in hose.

5.7.5 On all hose one-half inch O.D. and larger, used for the transfer of anhydrous ammonia liquid or vapor, there shall be etched, cast, or impressed at five-foot intervals the following information:

"ANHYDROUS AMMONIA"
XXX psig (maximum working pressure)
MANUFACTURER'S NAME AND TRADEMARK
YEAR OF MANUFACTURE

5.7.6 In lieu of 5.7.5 the same information may be contained on a nameplate permanently attached to the hose.

12:134-5.8 CONTAINER ACCESSORIES.

5.8.1 All accessories shall be designed for not less than the maximum working pressure of the portion of the system on which they are installed. All accessories shall be fabricated from materials suitable for anhydrous ammonia service.

5.8.2 All connections to containers except safety relief devices, gauging devices, or those fitted with a No. 54 drill size orifice shall have shut-off valves located as close to the container as practicable.

5.8.3 Excess flow valves shall close automatically at the rated flows of vapor or liquid as specified by the manufacturer. The connections and line including valves and fittings being protected by an excess flow valve shall have a greater capacity than the rated flow of the excess flow valve so that the valve will close in case of failure of the line or fittings.

5.8.4 Liquid level gauging devices that require bleeding of the product to the atmosphere and which are so constructed that outward flow will not exceed that passed by a No. 54 drill size opening need not be equipped with excess flow valves.

5.8.5 Openings from container or through fittings attached directly on container to which pressure gauge connections are made need not be equipped with excess flow valves if such openings are not larger than No. 54 drill size.

5.8.6 Excess flow and back pressure check valves shall be located inside of the container or at a point outside as close as practicable to where the line enters the container. In the latter case installation shall be made in such manner that any undue strain beyond the excess flow or back pressure check valve will not cause breakage between the container and the valve.

5.8.7 Excess flow valves shall be designed with a bypass, not to exceed a No. 60 drill size opening to allow equalization of pressures.

5.8.8 All excess flow valves shall be plainly and permanently marked with the name or trade-mark of the manufacturer, the catalog number, and rated capacity.

12:134-5.9 CHARGING OF CONTAINERS.

5.9.1 The filling densities for containers that are not refrigerated shall not exceed that indicated in Table 5.9.1.

TABLE 5.9.1

TYPE OF CONTAINER	PERCENT BY WEIGHT	PERCENT BY VOLUME
Aboveground - Uninsulated	56	82
Aboveground - Uninsulated	--	87.5
Aboveground - Insulated	57	83.5
Underground - Uninsulated	58	85
USDOT	In accordance with USDOT Regulation	

5.9.2 Aboveground uninsulated containers may be charged to 87.5 percent by volume provided the temperature of the anhydrous ammonia being charged is determined to be not lower than 30 F. or provided the charging of the container is stopped at the first indication of frost or ice formation on its outside surface and is not resumed until such frost or ice has disappeared.

5.9.3 Any container, including USDOT cargo and portable tanks, shipped under USDOT jurisdiction shall be filled according to the requirements of the USDOT Regulations - 1970.

12:134-5.10 TRANSFER OF LIQUID

5.10.1 Anhydrous ammonia shall always be at a temperature suitable for the container.

5.10.2 A qualified person shall be continuously in the vicinity of the operation during such time as ammonia is being transferred.

5.10.3 Containers shall be gauged and charged only in the open atmosphere or in buildings or areas approved for the purpose.

5.10.4 Pumps shall be designed for at least 250 psig working pressure.

5.10.5 Positive displacement pumps shall have installed, off the discharge port, a constant differential relief valve discharging into the suction port of the pump through a line of sufficient size to carry the full capacity of the pump at relief valve setting, which setting and installation shall be according to pump manufacturer's recommendations.

5.10.6 On the discharge side of the positive displacement pump, before the relief valve line, there shall be installed a pressure gauge graduated from 0 to 400 psi. Such pressure gauges shall be vented at the back.

5.10.7 Plant piping shall contain shut-off valves located as close as practical to pump connections.

5.10.8 Compressors shall be designed for at least 250 psig working pressure.

5.10.9 Plant piping shall contain shut-off valves located as close as practical to compressor connections.

5.10.10 A safety relief valve large enough to discharge the full capacity of the compressor shall be connected to the discharge before any shut-off valve.

5.10.11 Compressors shall have pressure gauges at suction and discharge graduated to at least one and one-half times the maximum pressure that can be developed.

5.10.12 Adequate means, such as a drainable liquid trap, shall be provided on the compressor suction to minimize the entry of liquid into the compressor.

5.10.13 Where necessary to prevent contamination, an oil separator shall be provided on the discharge side of the compressor.

5.10.14 Relief valve vents shall be piped outdoors to a safe location.

5.10.15 Loading and unloading systems shall be protected by suitable devices to prevent emptying of the storage container or the container being loaded or unloaded in the event of severance of the hose. Backflow check valves or properly sized excess flow valves shall be installed where necessary to provide such protection. In the event that such valves are not practical, remotely operated shutoff valves shall be installed.

5.10.16 Containers in LP-Gas service shall not be used for anhydrous ammonia service or containers in anhydrous ammonia service or containers in anhydrous ammonia service shall not be used for LP-Gas service, unless the materials of construction of the container and the design pressure of the vessel is satisfactory for the service.

12:134-5.11 TANK CAR UNLOADING.

5.11.1 Provisions for unloading tank cars shall conform to the applicable parts of the USDOT Regulations - 1970.

5.11.2 Tank car unloading shall comply with 3.11.1 through 3.11.6.

5.11.3 Caution signs shall be so placed on the track or car as to give necessary warning to persons approaching car from open end or ends of siding and shall be left up until after car is unloaded and disconnected from discharge connections. Signs shall be of metal or other suitable material, at least 12 by 15 inches in size and bear the words "STOP", - Tank Car Connected" or "STOP - Men at Work" the word, "STOP", being in letters at least 4 inches high and other words in letters at least 2 inches high. The letters shall be white on a blue background.

5.11.4 The track of a tank car siding shall be substantially level.

5.11.5 Brakes shall be set and wheels blocked on all cars being unloaded.

5.11.6 Tank cars of anhydrous ammonia shall be unloaded only through a permanently installed unloading station to a permanently located bulk storage system. Anhydrous ammonia shall not be unloaded directly from a tank car into other transports or other portable containers.

12:134-5.12 TRANSPORT UNLOADING.

5.12.1 A qualified person shall be in attendance while the transfer operation is in progress.

5.12.2 Transport unloading shall comply with 3.11.1 through 3.11.6.

5.12.3 No ammonia in either gaseous or liquid phase shall be vented to the atmosphere at the unloading site, except as provided in 5.13.3 or when disconnecting transfer hose.

5.12.4 Transports for anhydrous ammonia shall be unloaded only through a permanently installed unloading station to a permanently located bulk system. Anhydrous ammonia shall not be unloaded directly from a transport into other transports or other portable containers.

12:134-5.13 LIQUID LEVEL GAUGING DEVICE.

5.13.1 Each container except those filled by weight shall be equipped with an approved liquid level gauging device and a fixed tube liquid level gauge. A thermometer well shall be provided in all containers not utilizing a fixed liquid level gauging device.

5.13.2 All gauging devices shall be arranged so that the maximum liquid level to which the container is filled is readily determined.

5.13.3 Gauge devices that require bleeding of the product to the atmosphere such as the rotary tube, fixed tube, and slip tube device shall be designed so that the maximum opening of the bleed valve is not larger than No. 54 drill size unless provided with an excess flow valve.

5.13.4 Gauging devices shall have a design pressure equal to or greater than the design pressure of the container on which they are installed.

5.13.5 Fixed tube liquid level gauges shall be designed and installed to indicate that level at which the container is filled to 85 percent of its water capacity in gallons.

5.13.6 Gauge glasses of the tube type shall not be used. Armoured, high pressure gauge glasses of the columnar type shall be permitted. These gauge glasses shall be equipped with shutoff valves having metallic hand wheels, and excess flow valves.

12:134-5.14 ELECTRICAL EQUIPMENT.

5.14.1 Electrical wiring and equipment shall comply with Chapter 162, Electrical Installations of Title 12, N.J.A.C.

5.14.2 Electrical equipment and wiring for use in ammonia installations shall be Class I, Division 1, within 10 feet of any container charging or transfer of ammonia.

5.14.3 Where a concentration of ammonia can occur, only through failure or accidental rupture of a hose, pipe or vessel, the Class I, Division 2 electrical equipment shall be used within 25 feet of the source of vapor liberation.

5.14.4 The ammonia storage area shall be provided with adequate lighting.

12:134-5.15 INSTALLATION OF CONTAINERS

5.15.1 Containers shall be located outside buildings except as provided in 5.18.2(c) and (d).

5.15.2 Permanent storage containers shall be located at least 50 feet from a dug well or other sources of potable water supply, unless the container is a part of a water treatment installation.

5.15.3 Permanent storage containers shall be located outside densely populated areas.

5.15.4 Permanent storage systems shall comply with 3.10.3, 3.10.4, 3.10.5, 3.10.7, 3.10.8 and 3.10.9.

5.15.5 Container locations shall comply with Table 5.15.5.

TABLE 5.15.5
DISTANCE FROM AMMONIA STORAGE TO EXPOSURES

TYPE OF OUTDOOR EXPOSURES	AMMONIA STORAGE CAPACITY			
	100 to 2,000 GALLONS	2,0001 to 30,000 GALLONS	30,001 to 100,000 GALLONS	OVER 100,000 GALLONS
	Feet	Feet	Feet	Feet
A. Fire Resistive Building or Fire Wall Having Fire Resistance Rating Not Less Than 2 hours	5	25	50	100
B. Buildings of Construction Other Than "A" Above	20	50	75	150
C. Wall Openings, Air Compressor Intakes, Inlets for Air Conditioning or Ventilating Equipment	50	50	75	100
D. Sources of Ignition	25	50	75	100
E. Concentration of Flammable and Combustible Liquids	25	50	75	100
F. Between Ammonia Containers	5	5	1/4 of sum of diameters of adjacent containers	
G. Concentration of Flammable Gases	25	50	75	100
H. Concentration of Oxygen and Other Oxidizers	25	50	75	100
I. Concentration of Combustible Solids	25	50	75	100
J. Concentrations of People (Offices, lunchrooms and similar locations where people may congregate)	100	150	250	300
K. Property Lines	25	75	150	300

5.15.6 When the required distance from an ammonia system to an exposure cannot be obtained under Table 5.15.5, the Bureau may approve a lesser distance if some other approved means of protection, suchas water spray protection, insulation, burying, mounding, fire walls or diking is provided for the system and reasonable protection for the health and safety of the employee is maintained.

5.15.7 Ammonia systems that present a serious exposure hazard shall be protected by one or more of the following: distances at least 50 percent greater than Table 5.15.5, water spray protection, insulation, burying, mounding, fire walls or diking.

12:134-5.16 STATIONARY, NONREFRIGERATED STORAGE SYSTEMS.

5.16.1 Application: Sections 5.2 through 5.15 shall apply to stationary, nonrefrigerated storage systems, except as otherwise provided in 5.16.

5.16.2 Safety Relief Devices:

(a) On underground nonrefrigerated installations where there is a probability of the manhole or housing becoming flooded, the discharge from vent lines shall be located at least seven feet above the container or above the roof of any adjacent buildings. All manholes or housing shall be provided with ventilated louvres or their equivalent, the area of such openings equalling or exceeding combined discharge areas of safety relief valves and vent lines which discharge their content into the manhole housing.

(b) Vent stacks, when required, shall not be restricted or of smaller diameter than the relief valve outlet connection.

(c) When a common vent stack is used, the capacity of the stack shall equal the sum of the capacities of the individual discharge lines from each relief valve.

(d) Secure anchorage or adequate pier height shall be provided against container flotation wherever sufficiently high flood water might occur.

5.16.3 Container Accessories.

(a) Each filling connection shall be provided with a combination back-pressure valve and excess flow valve; one double or two single back-pressure check valves; or a positive shut-off valve in conjunction with either an internal excess flow valve or an internal back-pressure check valve.

(b) All liquid and vapor connections to containers except safety relief connections and liquid level gauging and pressure gauge connections provided with orifices not larger than No. 54 drill size as required in 5.3.6(d) and 5.3.6(e) shall be equipped with excess flow valves or equivalent safety devices.

(c) Each storage container shall be provided with a pressure gauge graduated from 0 to 400 psi. Gauges shall be designated for use in ammonia service.

(d) All containers shall be equipped with a vapor return valve.

(e) Valves, regulators, gauges and other accessories shall be protected against tampering and physical damage. Such accessories shall also be protected during transit of containers.

(f) All connections to underground containers shall be located within a dome, housing or manhole and with access thereto by means of a substantial cover.

5.16.4 Installation:

(a) Permanently installed aboveground containers shall comply with 5.4, except as provided in 5.16.4(b).

(b) Containers of 100 gallons water capacity or less may be installed with nonfire resistive ferrous metal supports if mounted on monolithic concrete pads or footings, and if the distance from the outside bottom of the container shell to grade does not exceed 24 inches.

(c) Horizontal aboveground containers shall be so mounted on foundations as to permit expansion and contraction. Every container shall be supported to prevent the concentration of excessive loads on the supporting portion of the shell. Every container shall be mounted so that the container will not turn on its axis. That portion of the container in contact with foundations or saddles shall be protected against corrosion.

(d) Containers installed underground shall be so placed that the top of container is below the frost line and in no case less than 2 feet below the surface of the ground. To prevent floating, containers shall be securely anchored or weighted.

(e) Underground containers shall be set on a firm foundation (firm earth may be used) and surrounded with earth or sand well tamped in place. The container, prior to being placed underground, shall be given a corrosion resistant protective coating approved for the purpose. The container thus coated shall be so lowered into place as to prevent abrasion or other damage to the container.

(f) Where containers are reinstalled underground, the corrosion resistant coating shall be put in good condition. Where containers are reinstalled aboveground, safety devices or gauging devices shall comply with 5.5 or 5.13 respectively for above ground containers.

12:134-5.17 REFRIGERATED STORAGE SYSTEMS.

5.17.1 Application: Sections 5.2 through 5.15 shall apply to refrigerated storage systems except as otherwise provided in 5.17.

5.17.2 Containers:

(a) Containers shall be designed for the storage pressures at the temperatures which may be encountered.

(b) The design temperature shall be the minimum temperature to which the container will be refrigerated.

(c) Containers with a design pressure exceeding 15 psig shall be constructed in accordance with 5.2 and the materials shall be selected from those listed in Design and Construction of Large, Welded, Low-Pressure Storage Tanks, API No. 620 - 1966.

(d) Containers with a design pressure of 15 psig and less shall be constructed in accordance with the applicable requirements of Large, Welded, Low-Pressure Storage Tanks, API No. 620 - 1966, including its Appendix R.

(e) When austenitic steels or non-ferrous materials are used, the Unfired Pressure Vessel Code, ASME - 1968 shall be used as a guide in the selection of materials for use at the design temperature.

(f) The filling density for refrigerated storage containers shall be such that the container will not be liquid full at a liquid temperature corresponding to the vapor pressure at the start-to-discharge pressure setting of the safety relief valve.

5.17.3 Safety Relief Devices:

(a) Safety relief valves shall be set to start-to-discharge at a pressure not in excess of the design pressure of the container and shall have a total relieving capacity sufficient to prevent a maximum pressure in the container of more than 120 percent of the design pressure.

(b) The total relieving capacity shall be the larger requirement of 5.17.3(b)(1) or 5.17.3(b)(2).

(1) Possible refrigeration system upset such as a) cooling water failure, b) power failure, c) instrument air or instrument failure, d) mechanical failure of any equipment, e) excessive pumping rates, and f) changing atmospheric conditions.

(2) Either one of the following formulas for fire exposure:

[a] for valve manufacturers who use weight of vapors to be relieved as basis for classifying valves:

$$W = \frac{34{,}500\ F\ A^{0.82}}{L} \quad \text{or}$$

[b] for valve manufacturers that classify valves on the basis of air flow:

$$Qa = \frac{633{,}000\ F\ A^{0.82}\ \sqrt{\frac{ZT}{M}}}{LC}$$

Where W = weight of vapors to be relieved in pounds per hour at relieving conditions;

Qa = air flow in cubic feet per minute at standard conditions (60 F and 14.7 psi);

F = fireproofing credit. Use F = 1.0 except when an approved fireproofing material of recommended thickness is used, then use F = 0.2;

A = total surface area in square feet up to 25 feet above grade or to the equator of a sphere, whichever is greater;

Z = compressibility factor of ammonia at relieving conditions (if not known, use Z = 1.0);

T = temperature in degrees R (460 + temperature in degrees F of gas at relieving conditions);

M = molecular weight = 17 for ammonia;

L = latent heat of ammonia at relieving conditions;

C = constant based on relation of specific heats. C may be obtained from Table 5.17.3(b)(2)[b].

Table 5.17.3(b)(2)[b]

K	C	K	C	K	C
1.00	315	1.26	343	1.52	366
1.02	318	1.28	345	1.54	368
1.04	320	1.30	347	1.56	369
1.06	322	1.32	349	1.58	371
1.08	324	1.34	351	1.60	372
1.10	327	1.36	352	1.62	374
1.12	329	1.38	354	1.64	376
1.14	331	1.40	356	1.66	377
1.16	333	1.42	358	1.68	379
1.18	335	1.44	359	1.70	380
1.20	337	1.46	361	2.00	400
1.22	339	1.48	363	2.20	412
1.24	341	1.50	364		

Notes to Table

Where $K = \frac{Cp}{Cv}$ at atmospheric conditions

Cp= Specific heat of vapor at constant pressure

Cv= Specific heat of vapor at constant volume

If K is not known, use C = 315.

(c) If vent lines are installed to conduct the vapors from the relief valves, the back pressure under full relieving conditions shall not exceed 50 percent of the start-to-discharge pressure for pressure balanced valves or 10 percent of the start-to-discharge pressure for conventional valves. The vent lines shall be installed to prevent accumulation of liquid in the lines.

(d) The valve or valve installation shall provide weather protection.

(e) Atmospheric storage shall be provided with vacuum breakers. Ammonia gas may be used to provide a pad.

5.17.4 Container Accessories:

(a) Each connection except safety relief connections, liquid level gauging and pressure gauge connections provided with orifices not larger than No. 54 drill size shall be equipped with internal safety shut-off devices in conjunction with a positive shut-off valve.

(b) Each fill connection shall have a check valve or equivalent automatic safety device in conjunction with a positive shut-off valve.

(c) Accessories shall be protected against tampering and physical damage.

5.17.5 Installation:

(a) Permanently installed containers shall comply with 5.4.

(b) Adequate protection against flotation or other water damage shall be provided whereveflood water might occur.

(c) Containers for product storage at less than 32°F. shall be supported in such a way, or heat shall be applied, to prevent the effects of freezing and consequent frost heaving.

(d) Protection shall be provided against damage from vehicles.

5.17.6 Refrigeration Equipment:

(a) The total refrigeration load shall be computed as the sum of the following:

(1) Load imposed by heat flow into the container caused by the temperature differential between design ambient temperature and storage temperature.

(2) Load imposed by heat flow into the container caused by maximum sun radiation.

(3) Maximum load imposed by filling the container with ammonia warmer than the design storage temperature.

(b) More than one storage container may be handled by the same refrigeration system.

(c) A minimum of two compressors shall be provided either of which shall be of sufficient size to handle the loads listed in 5.17.6(a)(1) and 5.17.6(a)(2). When more than two compressors are provided, minimum standby equipment equal to the largest normally operating equipment shall be installed. Compressors required for 5.17.6(a)(3) may be used as standby equipment for compressors required in 5.17.6 (a)(1) and 5.17.6(a)(2).

(d) Compressors shall be sized to operate with a suction pressure at least 10 percent below the minimum setting of the safety valves on the storage container and shall withstand a suction pressure at least equal to 120 percent of the design pressure of the container.

(e) Each compressor shall have its individual driving unit.

(f) An emergency source of power of sufficient capacity to handle the loads listed in 5.17.6(a)(1) and 5.17.6 (a)(2) shall be provided unless facilities are available to safely dispose of vented vapors while the refrigeration system is not operating.

(g) The refrigeration system shall be arranged with suitable controls to govern the compressor operation in accordance with the load as evidenced by the pressure in the container.

(h) An emergency alarm system shall be installed to function in the event the pressure in the container approaches the maximum allowable operating pressure.

(i) An emergency alarm and shut-off shall be located in the container system to respond the excess discharge pressure caused by failure of the cooling medium.

(j) All automatic controls shall be installed in a manner to preclude operation of alternate compressors unless the controls will function with the alternate compressors.

(k) An entrainment separator of suitable size and design pressure shall be installed in the compressor suction line of lubricated compression. The separator shall be equipped with a drain and gauging device.

(l) An oil separator of suitable size shall be installed in the compressor discharge line. It shall be designed for at least 250 psig and shall be equipped with a gauging device and drain valve.

(m) The condenser system may be cooled by air or water or both. The condenser shall be designed for at least 250 psig. Provisions shall be made for purging non-condensibles either manually or automatically.

(n) A receiver shall be provided with a liquid level control to discharge the liquid ammonia storage. The receiver shall be designed for at least 250 psig and be equipped with the necessary connections, safety valves and gauging device.

(o) Refrigerated containers and pipe lines which are insulated shall be covered with a material of suitable quality and thickness for temperature encountered. Insulation shall be suitably supported and protected against the weather. Weatherproofing shall be of a type which will not support flame propagation.

12:134-5.18 USDOT CYLINDER SYSTEMS.

5.18.1 Safety Relief Devices:

(a) Cylinders shall be provided with a safety relief device, when required by the USDOT Regulations - 1970.

(b) Cylinders containing less than 165 lbs. of anhydrous ammonia shall not be required to be equipped with a safety relief device.

5.18.2 Installation:

(a) Cylinders in use or stored for use outside buildings shall comply with 5.15.6.

(b) Cylinders stored or in use outdoors shall be protected from sources of heat.

(c) The total quantity of ammonia in USDOT containers installed indoors shall not exceed six 150 lb. cylinders.

(d) Cylinders in use or stored for use indoors shall be in a room or building approved for the purpose.

(e) The discharge from safety relief valves shall be vented away from the container upward and obstructed to the atmosphere.

(f) Indoor storage areas shall be ventilated.

(g) Indoor storage areas shall comply with 9.1.2.

12:134-5.19 TRANSPORT STORAGE.

5.19.1 Transports used with permanently installed containers shall comply with 3.11.1 through 3.11.7.

5.19.2 Transports shall be located with respect to adjacent exposures in accordance with Table 5.15.6.

12:134-5.20 TESTING.

5.20.1 After installation and before being placed in service, the ammonia system shall be tested and proven gas tight at the maximum operating pressure.

5.20.2 All safety relief devices on containers, other than USDOT containers, shall be visually examined at least once each year and shall be shop tested at least once every five years.

5.20.3 All safety relief devices on ammonia systems, not covered by 5.20.2 or on USDOT containers, shall be tested at least once each year.

SUBCHAPTER 6
CHARGING PLANTS OTHER THAN ACETYLENE

12:134-6.1 SCOPE OF SECTION 6

This Section 6 applies to the charging of compressed liquefied or cryogenic gases, except acetylene.

12:134-6.2 CHARGING PLANT LOCATION.

6.2.1 The charging plant shall be located in industrial or agricultural areas or their equivalent.

6.2.2 Charging plants shall be located at least 50 feet from other buildings, property lines, and combustible materials.

6.2.3 The charging plant shall be located so that it is readily accessible to transports at ground level and to authorized personnel.

6.2.4 The container charging plant shall be fenced in accordance with 3.10.7. Egress from fenced area shall be provided in accordance with 3.10.8.

12:134-6.3 CONSTRUCTION OF CHARGING PLANT.

6.3.1 The building or room devoted to charging of containers shall be a one story building without basement.

6.3.2 The floor, walls, ceiling and roof of a room or building used for the charging or storing of compressed gases shall be of noncombustible construction having a fire resistance rating of not less than 2 hours.

6.3.3 Explosion venting designed to relieve at a maximum pressure of 25 pounds per square foot shall be provided for flammable gases in the exterior walls or in roof of room or building where flammable gases are charged. The venting area shall be equal to not less than one square foot per 50 cubic feet of room volume.

6.3.4 Egress doors shall be located as to be readily accessible in case of emergency and shall open outward.

12:134-6.4 HEATING OF CHARGING PLANT.

6.4.1 No open flames shall be allowed where oxidizing or flammable gases are handled.

6.4.2 Boilers, open flames, or equipment capable of creating sparks shall be located in a separate room or building not communicable to areas handling flammable or oxidizing gases.

12:134-6.5 VENTILATION IN CHARGING PLANT.

6.5.1 At least 12 air changes per hour shall be provided in any container charging area.

6.5.2 Local ventilation shall be provided at the charging spot so that:

(a) Hydrogen atmospheres do not exceed 25 percent of the lower flammable limit.

(b) Ammonia atmospheres do not exceed the values of Chapter 131, Threshold Limit Values of Title 12, N.J.A.C.

(c) Oxygen atmospheres do not exceed 21.9 percent by volume or go below 16.5 percent by volume.

12:134-6.6 ELECTRICAL EQUIPMENT.

6.6.1 Electrical equipment in rooms charging gases shall comply with 3.8, 4.8, or 5.14, as applicable.

12:134-6.7 CHARGING USDOT CYLINDERS.

6.7.1 Cylinders for compressed, liquefied and cryogenic gases shall be charged in accordance with the USDOT Regulations - 1970.

6.7.2 No cylinders shall be charged that have not been re-tested or requalified in accordance with the USDOT Regulations - 1970.

6.7.3 Safety devices on cylinder valves shall not be tampered with.

6.7.4 Cylinders shall not be converted from one gas service to another.

6.7.5 Flammable and oxidizing gases shall not be charged simultaneously in the same room.

6.7.6 Cylinders and cylinder valves of oxygen gases shall be kept free of oil and grease.

6.7.7 Instructions for filling portable containers shall be available in the container charging area.

12:134-6.8 USDOT CYLINDERS ON DOCKS.

6.8.1 A storage dock for flammable gases shall be separated from a charging room for oxidizing and other non-flammable gases by an unpierced noncombustible wall having a fire resistance rating of not less than 2 hours or by a distance of 25 feet.

6.8.2 Flammable gas cylinders shall be separated from non-flammable gas cylinder storage areas on docks by noncombustible construction having a fire resistance rating of not less than 1/2 hour or a distance of 20 feet.

6.8.3 Trucks with flammable gas loads shall not be parked adjacent to oxygen storage.

12:134-6.9 STORAGE AND HANDLING OF USDOT CYLINDERS.

6.9.1 The storage and handling of USDOT cylinders at charging plants shall comply with Section 8.

6.9.2 The cylinder storage shall be located at least 50 feet from the property lines, combustible materials, and buildings, except the charging building.

12:134-6.10 FIRE PROTECTION.

6.10.1 Fire protection shall be provided in accordance with 9.2.

6.10.2 Where plant buildings are widely separated, an audible alarm shall be provided for summoning plant personnel in an emergency.

SUBCHAPTER 7
ACETYLENE CHARGING PLANTS AND ACETYLENE SYSTEMS

12:134-7.1 SCOPE OF SECTION 7.

This Section 7 shall apply to acetylene charging plants and acetylene systems.

12:134-7.2 CHARGING PLANT.

The acetylene charging plant shall comply with 6.2 through 6.6.

12:134-7.3 ACETYLENE GENERATORS.

7.3.1 Acetylene generators shall be designed in accordance with 3.6.1 and 3.6.2 of Chapter 160, Welding and Cutting of Title 12, N.J.A.C.

7.3.2 Generators shall be installed in accordance with 3.6.3 and 3.6.4-1 of Chapter 160, Welding and Cutting of Title 12, N.J.A.C.

7.3.3 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 (except flame arrestors) and in such a manner that condensation cannot accumulate in the vent piping.

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

7.3.5 The relief vent piping shall be carried full size and shall terminate in a direction away from the building at a point located at least 3 feet outside the building, 12 feet above ground, and 25 feet from sources of ignition and combustible materials. The outlets of relief vent piping shall be constructed or guarded to prevent obstruction by rain, snow, ice, insects or birds.

7.3.6 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.

12:134-7.4 ACETYLENE GAS HOLDERS, PURIFIERS, AND DRIERS.

7.4.1 Gas holders may be located outdoors or inside of buildings.

7.4.2 The gas holder shall be located at least 50 feet from a place of public occupancy and any flammable liquid or flammable gas storage, and at least 25 feet from any source of ignition.

7.4.3 Indoor gas holders shall be located in a room complying with 7.6. This room may house other acetylene equipment.

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

7.4.5 The gas holder shall not be exposed to electric power lines, flammable liquid lines or flammable gas lines.

7.4.6 The gas holder shall be conspicuously marked: ACETYLENE-FLAMMABLE GAS - DANGER - KEEP FIRE AND OPEN FLAMES AWAY, or with an equivalent wording.

7.4.7 Purifiers and driers shall be designed to prevent excessive pressure within the equipment, or be provided with suitable pressure relief devices.

7.4.8 Purifiers and driers shall be provided with inlet and outlet shut-off valves so located that they can be closed in an emergency.

12:134-7.5 ACETYLENE COMPRESSORS.

7.5.1 The inlet and outlet piping of each compressor shall be provided with readily accessible shut-off valves that can be closed in an emergency.

7.5.2 The drain lines from oil separators and condensate traps shall be piped outdoors to a safe location away from any source of ignition.

7.5.3 Relief-valve vent piping shall be carried full size and terminated in a direction away from the building at a point located at least 3 feet outside the building, 12 feet above the ground, and 25 feet from sources of ignition and combustible materials. The outlets of relief vent piping shall be constructed or guarded to prevent obstruction by rain, snow, ice, insects, or birds.

7.5.4 The suction line of 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 no less than one inch of water column above atmospheric pressure. No valve shall be installed between the compressor and the pressure switch or equivalent device.

7.5.5 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.

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

7.5.7 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.

7.5.8 A pressure gauge shall be provided on the discharge pipin following each stage of compression.

7.5.9 A safety relief device shall be provided on the discharge piping following each stage of compression. There shall be no shut-off valve between the relief device and the compressor piping.

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

7.5.11 Compressors shall be plainly marked with their capacities pressure ratings, the manufacturer's name and address and the model or serial numbers. The capacity and operating pressure of the compressor shall not exceed the rating for which it was designed.

12:134-7.6 OUTSIDE GENERATOR HOUSES AND INSIDE GENERATOR ROOMS.

7.6.1 Outside generator houses and inside generator rooms shall comply with 3.6.6 of Chapter 160, Welding and Cutting of Title 12, N.J.A.C.

12:134-7.7 CALCIUM CARBIDE STORAGE AND RESIDUE DISPOSAL.

7.7.1 Calcium carbide storage shall comply with 3.7.1, 3.7.2 or 3.7.3 of Chapter 160, Welding and Cutting of Title 12, N.J.A.C., as applicable.

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

7.7.3 No water, steam, or condensate lines shall be permitted in rooms or buildings devoted exclusively to calcium carbide storage.

7.7.4 Acetylene generators shall not be fitted with continuous drain connections leading to sewers.

7.7.5 Calcium carbide residue shall be discharged into outdoor open sump pits or other ventilated receptacles. Such receptacles shall not discharge to public sewers.

7.7.6 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 25 feet from sources of ignition.

7.7.7 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.

12:134-7.8 ACETYLENE PIPING, VALVES, AND FITTINGS

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

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

7.8.3 Copper alloys containing more than 65 percent copper shall not be used where they may be exposed to acetylene, unless such alloys have been found to be safe in the specific application by test.

7.8.4 Piping and fittings for acetylene at 15 psig or less shall be steel, wrought iron, malleable iron or copper alloys.

7.8.5 For nominal pipe size 6 inches and less, pipe for acetylene at 15 psig or less shall be at least Schedule 40, and all pipe fittings shall have a minimum working pressure of 125 psig.

7.8.6 Piping and fittings for acetylene exceeding 15 psig shall be steel, wrought iron, malleable iron or copper alloys.

7.8.7 All pipe of nominal size 3/4 inch or less for acetylene exceeding 15 psig shall be at least Schedule 80.

7.8.8 All pipe of nominal sizes 1 inch to 1-1/2 inches inclusive for acetylene exceeding 15 psig shall be at least Schedule 160.

7.8.9 All pipe fittings for acetylene exceeding 15 psig shall have a minimum working pressure of 3,000 psig.

7.8.10 Pressure gauge Bourdon tubes shall be steel, but may be copper alloys when complying with 7.8.3.

7.8.11 Piping, excluding relief valves, pressure gauges, diaphragm valves, and regulators for acetylene exceeding 15 psig shall be hydrostatically tested at 4500 psig.

7.8.12 Cylinder charging leads shall have a minimum burst rating of 6,000 psig and shall be constructed of metallic or non-metallic materials suitable for use in acetylene service.

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

7.8.14 A check valve shall be installed in the pipe to each cylinder charging manifold or in each cylinder charging lead.

7.8.15 Each cylinder charging manifold shall be provided with a pressure gauge located downstream of the shut-off valve.

7.8.16 Each cylinder charging manifolds shall be arranged so that excessive strain on the cylinder charging leads is prevented.

7.8.17 All acetylene piping shall be leak tested at 150 percent of the maximum operating pressure.

12:134-7.9 CHARGING ACETYLENE CYLINDERS.

7.9.1 Acetylene cylinders shall be designed, tested, charged, and maintained in accordance with the USDOT Regulations - 1970.

7.9.2 Each cylinder of acetylene shall be identified by labeling or stencilling the common name of contents on cylinder, owner of the cylinder and supplied of gas.

7.9.3 Acetylene cylinders shall be charged in accordance with 6.7.

12:134-7.10 ACETYLENE CYLINDERS ON DOCKS.

7.10.1 Acetylene cylinders on docks shall be stored or handled in accordance with 6.8.

12:134-7.11 STORAGE AND HANDLING OF ACETYLENE CYLINDERS.

7.11.1 The storage and handling of acetylene cylinders at acetylene charging plants shall comply with 6.8.

7.11.2 The storage location for acetylene cylinders and other flammable gas cylinders shall be separated from aboveground acetone storage tanks in excess of 55 gallons by at least 25 feet.

12:134-7.12 FIRE PROTECTION.

7.12.1 Fire protection shall be provided in accordance with 6.10.

7.12.2 The plant areas devoted to calcium carbide storage and handling and to acetylene generation shall be provided with an adequate supply of dry sand and dry chemical, or carbon dioxide portable fire extinguishers.

7.12.3 Each location where cylinders are stored in quantity shall be prominently posted with a sign reading: "NO SMOKING - NO OPEN FLAMES".

7.12.4 Plant areas devoted to acetylene storage, purification, compression cylinder storage and cylinder charging, acetone storage and usage, and other areas in which calcium carbide is not present shall be provided with fire hoses, water sprinkler systems, or fire extinguishers of dry chemical or carbon dioxide types.

SUBCHAPTER 8
SAFETY PROCEDURES FOR CYLINDERS

12:134-8.1 SCOPE OF SECTION 8.

This Section 8 shall apply to safe procedures for the storage and handling of cylinders for any compressed, liquefied or cryogenic gas.

12:134-8.2 USDOT CYLINDERS: GENERAL.

8.2.1 A cylinder shall not be used for any purpose other than its intended purpose of holding the gas.

8.2.2 Cylinders shall be stored, used, or transported valve end up.

8.2.3 Cylinders shall be set in an upright position and located or secured so that they cannot be knocked over.

8.2.4 All cylinders shall have a valve protection cap or collar. Where caps are used, they shall be kept on cylinders at all times except when the cylinder is actually being used.

8.2.5 Cylinders shall not be buried.

12:134-8.3 STORAGE OF USDOT CYLINDERS.

8.3.1 Oxygen cylinders stored for use or connected for use shall conform to Section 3.

8.3.2 Hydrogen cylinders stored for use or connected for use shall conform to Section 4.

8.3.3 Ammonia cylinders stored for use or connected for use shall conform to Section 5.

8.3.4 Acetylene cylinders stored for use or connected for use shall conform to Chapter 160, Welding and Cutting of Title 12, N.J.A.C.

8.3.5 Cylinders may be stored in the open but in such cases shall be protected against effects of weather and from dampness of the ground to prevent rusting.

8.3.6 Inside storage locations shall be dry, cool, well ventilated and free from sources of ignition, heat and combustible material.

8.3.7 Cylinders shall not be stored near elevators, gangways or in location where heavy objects might strike or fall upon them.

8.3.8 Cylinders shall be protected from moving vehicles.

8.3.9 Cylinders shall not be stored near flammable substances, combustible material and similar substances, or near unprotected electrical connections, gas flame or other sources of ignition.

8.3.10 Cylinders shall be protected against tampering by unauthorized individuals.

8.3.11 Cylinders containing the same gas shall be grouped in an orderly manner. Cylinders containing different gases shall not be intermingled.

8.3.12 Each location where cylinders are stored in quantity shall be prominently posted with the name of the gas to be stored. Flammable gas areas shall be posted: NAME OF GAS, FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES.

12:134-8.4 MOVING USDOT CYLINDERS.

8.4.1 When transporting cylinders by crane or derrick, a cradle, boat or suitable platform shall be used. Slings or electric magnets shall not be used for this purpose.

8.4.2 Cylinders shall be moved by hand truck with the cylinder chained to truck. Cylinders may also be moved by tilting or rolling them on their bottom edges. Dragging and sliding shall be avoided. Cylinders shall not be dropped or struck or permitted to strike each other violently.

8.4.3 Valve protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under valves or valve protection caps to pry cylinders loose when frozen to the ground or otherwise fixed. Warm (not boiling) water shall be used. Before raising cylinders provided with valve protection caps from a horizontal position, the cap shall be properly in place, the cap shall be turned clockwise hand tight, then the cylinder shall be raised by grasping the cap.

8.4.4 Cylinder valves shall be closed before moving cylinders.

8.4.5 Unless cylinders are secured on a special truck, regulators shall be removed and valve protection caps shall be put in place before cylinders are moved.

8.4.6 Cylinders shall never be used as rollers or supports, whether full or empty.

8.4.7 Safety relief devices shall not be tampered with.

8.4.8 Cylinder valves and pressure regulators shall be protected against tampering when installed for use.

12:134-8.5 UTILIZING USDOT CYLINDER CONTENT.

8.5.1 Cylinder valves shall be opened slowly. Wrenches shall not be used on cylinder valve handles.

8.5.2 Before attaching cylinders to any other connection, it shall be determined that threads are mates.

8.5.3 A cylinder's content shall not be used for purposes other than those intended by the supplier.

8.5.4 Cylinder valves shall be closed when the gas is not being used.

8.5.5 Cylinders shall not be placed where they might become part of an electrical circuit. Contact with third rails, trolley wires and similar electrically charged equipment shall be avoided.

12:134-8.6 WELDING ON USDOT CYLINDERS.

8.6.1 An arc shall not be struck on any gas cylinder. If an arc is accidently struck on a cylinder, the cylinder shall be tagged as damaged.

8.6.2 Welding shall not be permitted on compressed gas cylinders except when permitted by the USDOT Regulations - 1970.

12:134-8.7 EMPTY USDOT CYLINDERS.

8.7.1 Empty cylinders shall have their valves closed. Cylinders designed for valve protection caps shall have their caps in place.

8.7.2 Empty cylinders shall be marked "EMPTY" or "MT".

8.7.3 Empty cylinders of one gas shall be segregated from cylinders of other gases.

8.7.4 Empty cylinders shall be returned promptly to the supplier.

12:134-8.8 USDOT CYLINDER RETEST.

8.8.1 Cylinders requiring a retest shall be stored in separate areas and marked to indicate that a retest is required.

8.8.2 Cylinders which have been in a fire shall be removed from service until properly heat treated and retested.

8.8.3 Original markings and retest dates stamped on cylinders shall not be obliterated.

SUBCHAPTER 9
PERSONAL PROTECTION, FIRE PROTECTION, AND PROCEDURES

12:134-9.1 PERSONAL PROTECTION.

9.1.1 Cryogenic Gases Other Than Ammonia:

(a) Personnel engaged in the handling or transfer of cryogenic gases shall wear:

(1) Approved goggles or face shield.

(2) Leather or asbestos gloves of the gauntlet type.

(3) Approved clothing for the gas handled.

(b) A safety shower or hose bib shall be available in areas where cryogenic gases are charged or stored.

9.1.2 Anhydrous Ammonia:

(a) Personnel required to handle ammonia shall be trained in safe operating practices and the proper action to take in the event of emergencies. Personnel shall be instructed to use the equipment listed in 9.1.2 in the event of an emergency.

(b) If a leak occurs in an ammonia system, the personnel trained for and designated to act in such emergencies shall:

(1) Shut off the appropriate valves.

(2) Put on a suitable gas mask.

(3) Wear gauntlet type plastic or rubber gloves and wear plastic or rubber suits in heavily contaminated atmospheres.

(4) See that persons not required to deal with an emergency are evacuated from the contaminated area.

(c) All storage systems shall have on hand, as a minimum, the following equipment for emergency and rescue purposes:

(1) One full face respirator approved by the U.S. Bureau of Mines.

Note: An ammonia canister is effective for short periods of time in light concentrations of ammonia vapor, generally 15 minutes in concentrations of 3% and will not protect breathing in heavier concentrations. If ammonia vapors are detected when mask is in use, the concentration is too high for safety. The life of a canister in service is controlled by the percentage of vapors to which it is exposed. Canisters must not be opened until ready for use and should be discarded after use. Unopened canisters may be guaranteed for as long as three years. All should be dated when received because of this limited life. In addition to this protection, an independently supplied air mask of the type used by fire departments may be used for severe emergencies.

(2) One pair of protective gloves, impervious to ammonia.

(3) One pair of protective boots, impervious to ammonia.

(4) One protective slicker and/or protective pants and jacket, impervious to ammonia.

(5) Easily accessible shower.

(6) Tight fitting non-vented goggles and one full face shield.

(7) When additional personnel may be exposed, additional equipment shall be provided.

9.1.3 Compressed, and Liquefied Gases Other than Ammonia:

(a) Personal protection for all compressed and liquefied gases other than ammonia shall be provided in accordance with the manufacturer's recommendations. Special precautions shall be exercised for these gases that are toxic and hazardous to health.

12:134-9.2 FIRE PROTECTION.

9.2.1 A fire lane shall be provided to and around a gas system or a charging plant.

9.2.2 Water shall be available in adequate volume and pressure for fire protection, cooling of container surfaces and for dissipation of gases.

9.2.3 A yard system of fire hydrants and fire hose shall be provided for permanently installed gas systems or charging plants. Fire hydrants shall not be located more than 300 feet from such systems or plants.

9.2.4 Portable fire extinguishers with a minimum rating of 12-B-C shall be available at flammable gas systems or flammable gas charging plants. Ratings shall be in accordance with Portable Fire Extinguishers, NFPA No. 10 - 1969.

9.2.5 Personnel shall be trained in handling fire emergencies at gases system.

9.2.6 All gas equipment in a gas system or charging plant shall be bonded and connected to a ground.

9.2.7 The name, address, and emergency telephone number of the owner of the equipment and gas supplier shall be posted at the site.

12:134-9.3 OPERATIONS.

9.3.1 Operating personnel of the user shall be instructed by the supplier in operating, maintenance and emergency shut-down procedures.

9.3.2 Installations which require any operation of the equipment by the user shall be provided with legible operating and emergency shut-down instructions. The user shall contact the supplier for instructions.

9.3.3 All equipment such as valves, switches, or pumps shall be identified and tagged.

9.3.4 A qualified person shall be in attendance at all times while a transport is being unloaded.

9.3.5 All personnel working with compressed, liquefied or cryogenic gases shall be familiar with the following within the scope of their work assignment.

(a) Nature and properties of gases in both liquid and gaseous phases.

(b) Approved materials compatible with individual gases.

(c) Proper equipment and operation.

(d) Use and care of protective clothing.

(e) Safety, self-aid and first-aid instructions.

9.3.6 Persons leaving liquid oxygen storage or handling areas shall ensure that no oxygen remains absorbed in clothing before smoking or approaching sources of ignition.

9.3.7 Care shall be taken to prevent the accumulation of moisture in equipment such as lines, valves, traps to avoid freezing and plugging and subsequent pressure rupture.

12:134-9.4 MAINTENANCE PROCEDURES.

9.4.1 Weeds or other combustibles shall not be permitted within 25 feet of any gas system or charging plant.

9.4.2 Containers, piping and equipment used in any system shall be kept clean and free of grease and oil.

9.4.3 A qualified person shall make periodic inspections to insure good housekeeping practices.

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

APPENDIX A

AVAILABILITY OF REFERENCED STANDARDS AND PUBLICATIONS

A.1 AVAILABILITY FOR INSPECTION.

A copy of each of the standards and publications referenced in this Chapter is on file and may be inspected at the following office of the Bureau of Engineering and Safety between the hours of 9:00 A.M. and 4:00 P.M. on normal working days:

State of New Jersey
Department of Labor and Industry
Bureau of Engineering and Safety, Room 1103
Trenton, New Jersey

A.2 AVAILABILITY BY PURCHASE.

Copies of the referenced standards and publications may be purchased from the organizations listed below. The abbreviations preceding these standards and publication have the following meaning and are the organizations issuing the standards and publications listed.

AAI-RMA	Agricultural Nitrogen Institute 703 DuPont Building 22 South Second Street Memphis, Tenn. 38103
ANSI	American National Standards Institute 1430 Broadway New York, New York 10018
API	American Petroleum Institute 1271 Avenue of Americas New York, New York 10020
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, New York 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pa. 19103
NFPA	National Fire Protection Association 60 Batterymarch Street Boston, Mass. 02110
NJAC	New Jersey Administrative Code Division of Administrative Procedure Department of State 10 North Stockton Street Trenton, New Jersey 08608

USDOT United States Department of Transportation
Hazardous Materials Regulations Board
Publications available from Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20204

No. and Edition	Title	Price/Copy
AAI-RMA No. M-5-1967	Specification for Anhydrous Ammonia Hose	Not Known
ANSI B31.3-1966	Petroleum Refinery Piping	$ 5.00
ANSI B31.5-1966	Refrigeration Piping	4.00
ANSI B31.5a-1968	Addenda to ANSI B31.5-1966	0.50
ANSI K61.1-1966	Storage and Handling of Anhydrous Ammonia	1.00
API No. 620-1963	Design and Construction of Large, Welded, Low Pressure Storage Tanks	3.00
ASME-1968	Unfired Pressure Vessel Code	16.50
ASTM A 47-1968	Malleable Iron Castings	1.50
ASTM A 53-1969	Welded and Seamless Steel Pipe	1.50
ASTM A 126-1966	Gray Iron Castings for Valves, Flanges and Pipe Fittings	1.50
ASTM A 395	Ductile Iron for Pressure Containing Castings for Use at Elevated Temperatures	1.50
ASTM D 323-1958	Vapor Pressure of Petroleum Products (Reid Method)	1.50
NFPA No. 10-1969	Portable Fire Extinguishers	1.00
NFPA No. 496-1967	Purged Enclosures for Electrical Equipment in Hazardous Locations	0.50
N.J.A.C. 12-90 thru 99	Rules and Regulations of Mechanical Inspection Bureau	No Charge
USDOT-1970	Code of Federal Regulations, Title 49, Parts 171-190, Hazardous Materials Regulations	3.75