

**To Be Rescinded**

1301:7-7-27 Compressed gases.

(A) Section FM-2701.0 General

(1) FM-2701.1 Scope: The provisions of this rule, the building code, ANSI K61.1, NFPA 50, 50A and 99 listed in rule 1301:7-7-44 of the Administrative Code shall apply to the storage, use and handling of compressed gases in addition to the requirements of rule 1301:7-7-23 of the Administrative Code.

(2) F-2701.2 Approval required: Approval shall be required for the storage, handling or use at normal temperature and pressure of more than 750 cubic feet (21 m<sup>3</sup>) of flammable or oxidizing compressed gas; 30 gallons (114) of liquefied flammable gas; 810 cubic feet (23m<sup>3</sup>) of corrosive gas; 6,000 cubic feet (168 m<sup>3</sup>) of nonflammable compressed gas; 15 gallons (57L) of liquefied oxidizing gas, and any quantity of highly toxic, or toxic, pyrophoric, irritant, sensitizer or other health- hazard compressed gas.

(3) F-2701.3 Use group classification: Occupancies in which compressed gases exceeding the allowable exempt amounts per control area indicated in Tables F-2701.3(2), F-2701.3(3), F-2701.3(4) and F-2701.3(5) are stored, handled or used shall be classified in accordance with Table F-2701.3(1).

Table F-2701.3(1)  
Compressed gas occupancy classifications

Compressed gas	Use Group
All flammable gases	H-2
Highly toxic and toxic, corrosive, irritant, sensitizer, and other health-hazard gases	H-4
Oxidizing gases	H-2
Pyrophoric (nondetonatable) gases	H-2
Pyrophoric (detonatable) gases	H-1
Unstable (reactive) class 4, class 3 detonatable gases	H-1
Unstable (reactive) nondetonatable gases	H-2
Unstable (reactive) class 2 gases	H-3
Nonflammable gases not included in any classification above	Use group it most closely resembles

Table F-2701.3(2)  
 Highly toxic, toxic, corrosive, irritant, sensitizer, and other health-hazard compressed gases  
 exempt amounts for storage <sup>a,d</sup>  
 (maximum quantities per control area)

Condition	Exempt amounts [measured at normal temperature condition and pressure (cubic feet)] <sup>e</sup>	
	Highly toxic	Toxic, corrosive, irritant, sensitizer, other health hazard
Inside storage Unprotected by sprinklers, gas cabinets, exhausted Enclosures or separate gas storage rooms	0	810 <sup>b</sup>
Within gas cabinets or exhausted Enclosures in an unsprinklered Structure or separate gas storage rooms	20	1,620
In sprinklered structures, not within gas cabinets, exhausted enclosures or separate gas storage rooms	20	1,620 <sup>c</sup>
In sprinklered structures, within gas Cabinets, exhausted enclosures or separate gas storagerooms	40	3,240
Outside storage	20	1,620

Note a. Except for lecture halls occupied for educational purposes and laboratories and classrooms in occupancies in Use Group B, highly toxic or toxic compressed gases shall not be permitted in occupancies in Use Groups A, B, E, I, M and R.

Note b. A single cylinder containing 150 pounds or less of anhydrous ammonia in a single control area shall be considered an exempt quantity.

Note c. Two cylinders, each containing 150 pounds or less of anhydrous ammonia in a single control area shall be considered an exempt quantity.

Note d. The maximum quantities apply independently to each material.

Note e. 1 cubic foot = 0.028 m<sup>3</sup>, 1 pound = 0.454 kg.

Table F-2701.3(3)  
 Flammable, oxidizing, pyrophoric, and unstable (reactive) compressed gases  
 Exempt amounts for storage<sup>a,b</sup>  
 (Maximum quantities per control area)

Condition	Exempt amounts at normal temperature and pressure in cubic feet or (gallons) <sup>b</sup>							
	Flammable		Unstable (reactive) class 2	Unstable (reactive) class 3	Unstable (reactive) class 4	Pyrophoric	Oxidizing	
	Gaseous	Liquefied					Gaseous	Liquefied
<b>Inside storage</b>								
Unprotected by sprinklers, gas cabinets, exhausted enclosures, or separate gas storage rooms	750	(30)	250	50	0	0	1,500	(15)
Within gas cabinets or exhausted enclosures in an unsprinklered structure or separate gas storage rooms	1,500	(60)	500	100	0	0	3,000	(30)
In sprinklered structures, not within gas cabinets, exhausted enclosures, or separate gas storage rooms	1,500	(60)	500	100	10	50	3,000	(30)
In sprinklered structures, within gas cabinets, exhausted enclosures, or separate gas storage rooms	3,000	(120)	1,000	200	20	100	6,000	(60)
<b>Outside storage</b>	1,500	(60)	500	100	10	50	3,000	(30)

Note a. The maximum quantities apply independently to each material and hazard class.

Note b. 1 cubic foot = 0.028 m<sup>3</sup>, 1 gallon = 3.785 L.

Table F-2701.3(4)  
 Flammable, oxidizing, pyrophoric and unstable (reactive) compressed gases  
 Exempt amounts for use and handling<sup>a</sup>  
 (maximum quantities per control area)

Condition	Exempt amounts at normal temperature and pressure in cubic feet or (gallons) <sup>b</sup>							
	Flammable		Unstable (reactive) class 2	Unstable (reactive) class 3	Unstable (reactive) class 4	Pyrophoric	Oxidizing	
	Gaseous	Liquefied					Gaseous	Liquefied
Unprotected by sprinklers, gas cabinets, exhausted enclosures, or separate gas storage rooms	750	(30)	250	10	0	0	1,500	(15)
Within gas cabinets or exhausted enclosures in an unsprinklered structure or separate gas storage rooms	1,500	(60)	500	20	4	0	3,000	(30)
In sprinklered structures, not within gas cabinets, exhausted enclosures or separate gas storage rooms	1,500	(60)	500	20	4	10	3,000	(30)
In sprinklered structures, within gas cabinets, exhausted enclosures, or separate gas storage rooms	3,000	(120)	1,000	40	8	20	6,000	(60)

Note a. The maximum quantities apply independently to each material and hazard class.

Note b. The aggregate quantity in use and storage shall not exceed the exempt amount per control area indicated in table F-2701.3(3).

Note c. 1 cubic foot = 0.028 m<sup>3</sup>; 1 gallon = 3.785L.

Table F-2701.3(5)  
Highly toxic, corrosive, irritant, sensitizer and other health-hazard compressed gases  
exempt amounts for use and handling<sup>b,d</sup>  
(maximum quantities per control area)

Condition	Exempt amounts <sup>c</sup> (measured at normal temperature and pressure in cubic feet) <sup>d</sup>	
	Highly toxic	Corrosive, irritant, sensitizer, toxic, other health hazard
Unprotected by sprinklers, gas cabinets, exhausted Enclosures, or separate gas storage rooms	0	<del>810</del> 810 <sup>d</sup>
Within gas cabinets or exhausted enclosures in an unsprinklered structure or separate gas storage rooms	20 <sup>a</sup>	<del>1,620</del> 1,620 <sup>d</sup>
In sprinklered structures, not within gas cabinets, exhausted enclosures, or separate gas storage rooms	0	<del>1,620</del> 1,620 <sup>d</sup>
In sprinklered structures, within gas cabinets, Exhausted enclosures, or separate gas storage rooms	20 <sup>a</sup>	<del>3,240</del> 3,240 <sup>d</sup>

Note a. Applicable where dispensed or used in approved gas cabinets or exhausted enclosures in accordance with section F-2705.0.

Note b. The maximum quantities apply independently to each material.

Note c. The aggregate quantity in use and storage shall not exceed the exempt amount per control area indicated in table F-2701.3(2).

NOTE d. A SINGLE CYLINDER CONTAINING 150 POUNDS OR LESS OF ANHYDROUS AMMONIA IN A SINGLE CONTROL AREA SHALL BE CONSIDERED AN EXEMPT QUANTITY.

Note ~~d~~ e. 1 cubic foot = 0.028m<sup>3</sup>.

Table F-2701.4  
Outside storage requirements for compressed gas cylinders and tanks

Gas hazard classification	Maximum number of containers per pile	Maximum pile size (cubic feet) <sup>l</sup>	Minimum distance between piles (feet)	Minimum distance from interior lot lines (feet) <sup>h,j</sup>	Minimum distance from other hazardous materials (feet) <sup>h,j</sup>	Minimum distance to buildings (feet) <sup>h,l</sup>	Minimum distance to public way or exit discharge (feet) <sup>h,l</sup>	Minimum distance from exterior wall (feet) <sup>h,l</sup>
Corrosive	Not limited	Not limited	0	25	0	0	25	25
Flammable	Not limited	Not limited	0	25 <sup>b</sup>	0	0	25 <sup>b</sup>	25 <sup>b,c</sup>
Irritant, sensitizer, other health hazard	Not limited	Not limited	0	25	0	0	25	25
Highly toxic	Not limited	Not limited	0	50 <sup>d,e</sup>	0	50 <sup>d,e,h</sup>	50 <sup>d,e,f</sup>	50 <sup>d,e</sup>
Nonflammable	Not limited	Not limited	0	5 <sup>b</sup>	0	0	5 <sup>b</sup>	5 <sup>b,c</sup>
Oxidizer	Not limited	Not limited	0	5	0	0	5	5 <sup>c</sup>
Pyrophoric	4000	15	50	25	20	25	0	0
Toxic	Not limited	Not limited	0	5	0	0	0	50 <sup>e,h</sup>
Unstable (reactive) <sup>i</sup>								
Class 1 and 2	Not limited	1000	Note k	25	0	0	25	25
Class 3 and 4	Not limited	500	Note k	0	0	25	25	25

Note a. The separation distance shall not apply where a 2-hour separation wall extending not less than 30 inches above and to the side of the storage area is provided.

Note b. The separation distances shall not apply where the minimum distance limitations are provided in accordance with the standards listed in Chapter 44.

Note c. Distance is from unprotected exterior wall openings.

Note d. The separation wall in Note a shall interrupt the line of sight between the storage and the exposure. The protective structure shall be at least 5 feet from any exposures and have not more than two sides at approximately 90-degree directions, except for a third diagonal section permitted at the vertex.

Note e. Other than buildings occupied for the storage or production of these materials.

Note f. Distance also applies to exit discharges.

Note g. The storage area shall not be located within 75 feet of any air intake, except that for buildings occupied for the production and storage of such materials, the storage area shall not be located within 50 feet of any air intake.

Note h. Openings into buildings other than piping shall not be permitted above the height of the top of the shielding structure or located within 25 feet horizontally from the storage area whether or not shielded by a protective structure.

Note i. Unstable (reactive) gases capable of detonation shall be stored in accordance with Chapter 30.

Note j. For storage regulations pertaining to incompatible hazardous materials, see Section F-2309.0.

Note k. One-half the height of the pile or 10 feet (whichever is greater).

Note l. 1 foot = 304.8 mm; 1 cubic foot = 0.028 m<sup>3</sup>.

(B) Section FM-2702.0 Definitions

FM-2702.1 General: The following words and terms shall, for the purposes of this rule and as stated elsewhere in this code, have the meanings shown herein.

**Bulk oxygen system:** An assembly of equipment, such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds and interconnecting piping, with a storage capacity at normal temperature and pressure of the following:

1. More than 13,000 cubic feet (364 m<sup>3</sup>) of oxygen connected in service or ready for service.
2. More than 25,000 cubic feet (700 m<sup>3</sup>) of oxygen, including unconnected reserve at the site.

The bulk oxygen system terminates at the point where oxygen at the service pressure first enters the supply line. The oxygen is stored as liquid or gas in either stationary or portable containers.

**Ceiling limit:** The maximum concentration of an air-borne contaminant to which a person is permitted to be exposed under OSHA regulations. The permitted ceiling limits shall be in accordance with DOL 29 CFR; Part 1910.1000 listed in rule 1301:7-7-44 of the Administrative Code.

**Compressed gas:** A gas or mixture of gases as contained having an absolute pressure exceeding 40 psi at 70 degrees F. (276 kPa at 21 degrees C.) or, regardless of the pressure at 70 degrees F. (21 degrees C.), having an absolute pressure exceeding 140 psi at 130 degrees F. (965 kPa at 54 degrees C.); or any liquid material having a vapor pressure exceeding 40 psi absolute at 100 degrees F. (276 kPa at 38 degrees C.) as determined by ASTM D323 listed in rule 1301:7-7-44 of the Administrative Code.

**Continuous gas detection system:** a gas detection system where the analytical instrument is maintained in continuous operation and sampling is performed without interruption and in which analysis is performed on a cyclical basis at intervals not exceeding 30 minutes.

**Excess flow valve:** A valve inserted into a compressed gas cylinder, portable or stationary tank designed to positively shut off the flow of gas in the event the predetermined flow from the cylinder

or tank is exceeded.

**Flammable anesthetic:** A compressed gas which is flammable and administered as an anesthetic, such as: cyclopropane, divinyl ether, ethyl chloride, diethyl ether and ethylene.

**Flammable compressed gas:** A compressed gas which forms a flammable mixture when 13 percent or less (by volume) is mixed with air or a compressed gas with a flammable range with air that is wider than 12 percent, regardless of the lower limitation. These limitations shall be determined at atmospheric temperature and pressure.

**Gaseous hydrogen system:** A facility in which the hydrogen is delivered, stored and discharged in the gaseous form to consumer piping. The system includes stationary or movable containers, pressure regulators, safety relief devices, manifolds, interconnecting piping and controls. The system terminates at the point where hydrogen at service pressure enters the consumer's distribution piping.

**Immediately dangerous to life and health (IDLH):** A concentration of air-borne contaminant, normally expressed in parts per million (ppm) or milligrams per cubic meter, which represents the maximum level from which an occupant is capable of escaping within 30 minutes without any escape-impairing symptoms or irreversible health effects.

**Nesting:** A method of securing flat-bottomed compressed gas cylinders upright in a tight mass utilizing a contiguous three-point contact system whereby all cylinders located within a group have a minimum of three points of contact with other cylinders, walls or bracing.

**Nonflammable medical gas:** A compressed gas which is nonflammable and utilized for therapeutic purposes, such as oxygen and nitrous oxide.

**Normal temperature pressure (NTP):** Standard NTP is considered a temperature of 70 degrees F. (21 degrees C.) and a pressure of 1 atmosphere (14.7 psig).

**Permissible exposure limit (PEL):** The maximum permitted 8-hour time weighted average concentration of an airborne contaminant. The maximum permitted time weighted average exposures shall be in accordance with DOL 29 CFR; Part 1910.1000 listed in rule 1301:7-7-44 of the Administrative Code.

**Piped distribution system:** A central supply system with control equipment and a system of piping extending to the station outlet valves where nonflammable medical gases are utilized.

**Reduced flow valve:** A valve equipped with a restricted flow orifice and inserted into a compressed gas cylinder, portable or stationary tank designed to reduce the maximum flow from the valve under full flow conditions. The maximum flow rate from the valve when fully open is determined with the valve allowed to flow to atmosphere with no other piping or fittings attached.



Separate gas storage room: A separate enclosed area which is part of a structure and utilized for the storage or use of highly toxic or toxic compressed gases.

Station outlet: The point at which gas is withdrawn from the service piping system.

(C) Section FM-2703.0 Storage and use

(1) FM-2703.1 General: All storage and use areas of any quantity shall comply with paragraphs (C)(2)(FM-2703.2) through ~~(C)(11)(FM-2703.11)~~ (C)(6)(FM-2703.6) of this rule.

(2) FM-2703.2 Storage containers: Cylinders and pressure vessels shall be designed, constructed, tested and maintained in accordance with ANSI K61.1, DOTn 49 CFR, NFPA 50, 50A or 99 listed in rule 1301:7-7-44 of the Administrative Code.

(3) FM-2703.3 Marking: Each cylinder, pressure vessel or group of containers shall be identified with the name of the contained gas in accordance with DOTn 49 CFR listed in rule 1301:7-7-44 of the Administrative Code.

(4) F-2703.4 Storage and use of cylinders: All compressed gas cylinders in storage or service shall be secured to prevent falling or being knocked over.

Exceptions

(a) Compressed gas cylinders in the process of examination, servicing and refilling are not required to be secured.

(b) At locations where cylinders are frequently moved, such as cylinder filling plants, securing of cylinders by nesting shall be permitted.

(5) F-2703.5 Hazardous gases: Compressed gas cylinders in transit, other than lecture bottles and cylinders with less than 1 gallon (4 L) capacity, shall have valve protection caps or valve protection devices attached. Cylinders containing highly toxic or toxic compressed gases shall have a gas-tight valve outlet cap or valve plug attached.

(6) FM-2703.6 Nonflammable gases: Nonflammable compressed gases, which are not otherwise classified as physical hazard or health-hazard gases, shall be stored and used in accordance with sections FM-2701.0 through FM-2703.0 of this rule.

(D) Section FM-2704.0 Highly toxic and toxic compressed gases

(1) FM-2704.1 General: The provisions of this section and the applicable provisions of sections FM-2701.0 through FM-2703.0 shall apply to all new and existing buildings and outside areas occupied for the storage, dispensing and use of highly toxic and toxic compressed gases exceeding the exempt



amounts per control area indicated in Tables F-2701.3(2) and F-2701.3(5) unless otherwise specified. The provisions of this section shall not apply to existing structures occupied for the storage of toxic compressed gases not constituting a distinct hazard to life or property.

(a) F-2704.1.1 Breathing apparatus: Where highly toxic or toxic compressed gases are stored, dispensed or used, a minimum of two self-contained breathing apparatus shall be provided. Personnel shall be trained in self-contained breathing apparatus operating procedures. The breathing apparatus shall be compatible with the gases stored and used. The breathing apparatus shall be stored near the immediate area of storage, dispensing or use in a location providing safety to the users of the apparatus. A safe area is a location that will not be immediately affected by the release of highly toxic or toxic compressed gases in the area of concern. Where self-contained breathing apparatus alone provides inadequate protection due to the nature of gases present, other approved protective equipment shall be provided.

(b) F-2704.1.2 Gas cabinets: Gas cabinets, where provided, shall be:

(i) Operated at negative pressure relative to the surrounding area;

(ii) Provided with self-closing limited access ports or noncombustible windows to provide access to equipment controls. The average velocity of ventilation at the face of access ports or windows shall not be less than 200 feet per minute (1 m/s) with a minimum of 150 feet per minute (0.75 m/s) at any point of the access port or window;

(iii) Operated so the exhaust ventilation is directed to a treatment system;

(iv) Provided with self-closing doors;

(v) Constructed of not less than a 0.1046-inch (no. 12 gage) steel; and

(vi) Shall not contain more than three cylinders unless the cylinders have a net capacity of 1 pound (0.45 kg) or less in which case the maximum number of cylinders shall be limited to 100.

(c) F-2704.1.3 Exhausted enclosures: Exhausted enclosures, where provided, shall be:

(i) Constructed of approved noncombustible material and shall consist of a top, back and two sides; and

(ii) Operated so the exhaust ventilation is directed to a treatment system.

(d) F-2704.1.4 Treatment systems: Treatment systems, where provided to process the accidental release of gas, shall be in accordance with paragraphs (D)(1)(d)(i)(F-2704.1.4.1) through (D)(1)(d)(v)(F-2704.1.4.5) of this rule.

(i) F-2704.1.4.1 Treatment system processing: Treatment systems shall process all exhaust ventilation discharged from gas cabinets, exhausted enclosures and separate gas storage rooms.

Exception: Treatment systems are not required for toxic gases where:

(a) Approved containment devices capable of fully containing a release are available at an approved location on site;

(b) Trained personnel are available at an approved location on site; and

(c) Such containment devices are capable of being transported to the leaking cylinder, portable tank or stationary tank.

(ii) F-2704.1.4.2 Treatment system design: Treatment systems shall be capable of diluting, adsorbing, absorbing, containing, neutralizing, burning or otherwise processing the entire contents of the largest single tank or cylinder of gas. Where a total containment system is utilized, the system shall be designed to process the maximum anticipated pressure of release to the system when the system reaches equilibrium.

(iii) F-2704.1.4.3 Treatment system performance: Treatment systems shall be designed to reduce the maximum allowable discharge concentration of the gas to one-half IDLH at the point of discharge to the atmosphere. Where more than one gas is emitted to the treatment system, the treatment system shall be designed to process the worst-case release based on the release rate, quantity and IDLH for all gases.

(iv) F-2704.1.4.4 Stationary tanks: Stationary tanks shall indicate the maximum rate of release for the contained gas based on any valves or fittings inserted directly into the tank. Where multiple valves or fittings are provided, the maximum flow rate of release for the valve or fitting with the highest flow rate shall be indicated. Where liquefied gases are in contact with any valve or fitting, the liquid flow rate shall be utilized for computation purposes. All flow rates indicated on the label shall be converted to cubic feet per minute of gas at a normal temperature and pressure.

(v) F-2704.1.4.5 Portable tanks and cylinders: The maximum flow rate of release for portable tanks and cylinders shall be calculated based on the total release from the cylinder or tank within the time indicated in table FM-2704.1.4. Where portable tanks or cylinders are equipped with approved excess flow or reduced flow valves, the worst-case release shall be determined by the maximum achievable flow from the valve in accordance with the valve manufacturer or the gas supplier. Reduced flow and excess flow valves shall be permanently marked by the manufacturer to indicate the maximum design flow rate. Such markings shall indicate the flow rate for air under normal temperature and pressure.

Table FM-2704.1.4  
Rate of release for cylinders and portable tanks

Container	Nonliquefied (minutes)	Liquefied (minutes)
Cylinders	5	30
Portable tanks	40	240

(e) F-2704.1.5 Emergency power: Emergency power, independent of the public supply, shall be provided where any of the following systems are required:

- (i) Exhaust ventilation, including the power supply for treatment systems.
- (ii) Detection systems.
- (iii) Emergency alarm systems.
- (iv) Temperature control systems.

Emergency power for mechanical ventilation, treatment systems and temperature control systems shall not be required where a fail-safe engineered system is installed.

(f) F-2704.1.6 Monitor control equipment: Monitor control equipment shall be provided in accordance with ~~Section~~ PARAGRAPH F-2316.1. Additionally, excess flow control shall be provided for stationary tanks piped for filling or dispensing.

(g) F-2704.1.7 Piping and controls: In addition to the requirements of paragraph F-2313.3, piping and controls on stationary tanks shall comply with the following:

- (i) Pressure relief devices shall be vented to a treatment system designed in accordance with paragraph F-2704.1.4 of this rule.
- (ii) Filling or dispensing connections, where provided, shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system designed in accordance with paragraph F-2704.1.4 of this rule.
- (iii) Stationary tanks shall be provided with a means of excess flow control on all tank inlet or outlet connections.

## Exceptions:

- (a) Inlet connections designed to preclude backflow.
- (b) Pressure relief devices.
- (h) FM-2704.1.8 Seismic protection: Stationary tanks and associated piping systems shall be structurally braced in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code.
- (2) FM-2704.2 Inside storage: The inside storage of highly toxic and toxic compressed gases exceeding the exempt amounts per control area indicated in table F-2701.3(2) shall comply with paragraphs (D)(2)(a)(F-2704.2.1) through ~~(D)(2)(f)(FM 2704.2.6)~~ and ~~(B)(4)(FM 2704.4)~~ (D)(2)(h)(FM-2704.2.8) of this rule.
- (a) F-2704.2.1 Gas cabinets: Gas cabinets, where provided, shall be in accordance with paragraph F-2704.1.2.
- (b) F-2704.2.2 Exhausted enclosures: Exhausted enclosures, where provided, shall be in accordance with paragraph F-2704.1.3.
- (c) F-2704.2.3 Separate gas storage rooms: Separate gas storage rooms, where provided, shall be:
- (i) Operated at a negative pressure relative to the surrounding area.
  - (ii) Operated so the exhausted ventilation is directed to a treatment system.
  - (iii) Provided with self-closing doors.
- (d) F-2704.2.4 Sprinkler system: Gas cabinets and exhausted enclosures for the storage of cylinders shall be internally sprinklered. Fire suppression systems other than water shall not be permitted.
- (e) FM-2704.2.5 Exhaust ventilation: Exhaust ventilation shall be provided for the indoor storage in accordance with paragraphs ~~(D)(2)(b)(i)(F 2704.2.2.1)~~ through paragraph ~~(D)(2)(b)(iv)(F-2704.2.2.4)~~ (D)(1)(b)(F-2704.1.2), (D)(1)(c)(F-2701.1.3), (D)(2)(c)(F-2704.2.3) AND (D)(2)(f)(F-2704.2.6) of this rule.
- (f) F-2704.2.6 Ventilated area: Storage of cylinders shall be located within ventilated gas cabinets, exhausted enclosures or a ventilated separate gas storage room. Storage of portable and stationary tanks shall be located within a gas storage ventilated room without other occupancies. Where gas cabinets are provided, the room or area in which the cabinets are located shall have independent exhaust ventilation.

(g) F-2704.2.7 Gas detection: A continuous gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit. The detection system shall initiate a local alarm and transmit a signal to a constantly attended control station. The alarm shall be both visual and audible and designed to provide warning both inside and outside of the storage area. The gas detection system shall also be capable of monitoring for gas at or below one-half the IDLH limit at the point of discharge from the treatment system to the atmosphere.

#### Exceptions

(i) Signal transmission to a constantly attended control station is not required where not more than one-cylinder is stored.

(ii) A continuous gas detection system shall not be required for toxic gases where the physiological warning properties for the gas are at a level below the permissible exposure limit (PEL) for the gas.

(h) FM-2704.2.8 Automatic fire detection: An approved automatic fire detection system shall be installed throughout structures where highly toxic compressed gases are stored indoors in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code. Activation of the detection system shall sound a local alarm. Where an approved automatic fire suppression system is provided and supervised by an approved central station or remote station in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code, automatic fire detection is only required in the storage area.

(3) FM-2704.3 Outside storage: Outside storage of highly toxic and toxic compressed gases shall comply with paragraphs (D)(3)(2)(FM-2704.3.1) through (D)(3)(d)(FM-2704.3.4) of this rule.

(a) F-2704.3.1 Security: Storage areas shall be secured against unauthorized entry.

(b) F-2704.3.2 Gas cabinets for leaking cylinders and tanks: A minimum of one gas cabinet or exhausted enclosure shall be provided for the handling of leaking cylinders and tanks exceeding the allowable exempt amounts indicated in table F-2701.3(2). The cabinet or enclosure shall be located within or adjacent to exterior storage areas. A cabinet or exhausted enclosure shall not be required for leaking cylinders where all cylinders and tanks are stored within gas cabinets or exhausted enclosures.

(c) F-2704.3.3 Local exhaust for leaking portable tanks: A means of local exhaust shall be provided to capture leaks from portable tanks. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the tank. The local exhaust shall be connected to treatment systems complying with ~~section~~ PARAGRAPH (D)(1)(d)(F-2704.1.4) OF THIS RULE. The local exhaust system shall be provided within or immediately adjacent to exterior storage areas. A local exhaust shall not be required where a treatment system is not required in accordance with paragraph (D)(1)(d)(F-2704.1.4) OF THIS RULE.

(d) FM-2704.3.4 Weather protection: Weather protection shall comply with paragraph (N)(11)(F-2314.11) of rule 1301:7-7-23 of the Administrative Code and the following:

(i) Portable tanks and cylinders stored outside of structures shall be provided with weather protection.

(ii) Where weather protection over the exterior storage area is attached to the structure, an approved automatic sprinkler system shall be provided for the storage of highly toxic or toxic flammable compressed gases.

(4) FM-2704.4 Inside dispensing and use: The inside dispensing and use of highly toxic or toxic compressed gases exceeding the exempt amounts per control area indicated in table F-2701.3(5) shall comply with paragraphs ~~F-2704.4.1~~ (D)(4)(a)(F-2704.4.1) through ~~F-2704.4.7~~ (D)(4)(G)(F-2704.4.7) OF THIS RULE.

(a) F-2704.4.1 Ventilated area: Cylinders shall be located within ventilated gas cabinets, exhausted enclosures or separate gas storage rooms. Portable or stationary tanks shall be located within a ventilated separate gas storage room or placed within an exhausted enclosure.

(b) FM-2704.4.2 Gas cabinets or exhausted enclosures: Gas cabinets or exhausted enclosures, where provided, shall comply with paragraph ~~F-2704.1.2~~ (D)(1)(b)(F-2704.1.2) or paragraph ~~F-2704.1.3~~ (D)(1)(c)(F-2704.1.3) OF THIS RULE and shall be internally sprinklered.

(c) FM-2704.4.3 Separate gas storage rooms: Separate gas storage rooms, where provided, shall comply with paragraph ~~F-2704.2.3~~ (D)(2)(c)(F-2704.2.3) OF THIS RULE.

(d) FM-2704.4.4 Treatment systems: Treatment systems shall be provided in accordance with paragraph ~~F-2704.1.4~~ (D)(1)(d)(F-2704.1.4) OF THIS RULE, except where cylinders of toxic gases are provided with detection systems which activate controls to close automatically a fail-safe valve immediately adjacent to the cylinder valve. The fail-safe valve shall close when gas is detected at the permissible exposure limit by a gas detection system monitoring the exhaust system at the point of discharge from the gas cabinet, exhausted enclosure or separate gas storage room.

(e) FM-2704.4.5 Gas detection: Gas detection shall be provided in accordance with paragraph ~~F-2704.2.7~~ (D)(2)(g)(F-2704.2.7) OF THIS RULE. Activation of the monitoring system shall automatically close the shutoff valve on all highly toxic or toxic gas supply lines relating to the system monitored. Automatic shutdown shall not be required for reactors utilized for the production of highly toxic or toxic gases where such reactors are:

(i) Operated at pressures less than 15 psig (103 kPa);

(ii) Constantly attended; and

(iii) Provided with readily accessible emergency shutoff valves.

(f) FM-2704.4.6 Automatic fire detection: An approved automatic fire detection system shall be provided throughout structures where highly toxic gases are used and dispensed in accordance with paragraph ~~F-2704.2.8~~ (D)(2)(h)(FM-2704.2.8) OF THIS RULE. Where an approved automatic fire suppression system is provided and supervised by an approved central station or remote station in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code, automatic fire detection shall only be required in the dispensing and use area.

(g) FM-2704.4.7 Process equipment: The effluent from process equipment containing highly toxic or toxic gases shall not be discharged to the atmosphere, unless the effluent has been processed through a treatment system in accordance with paragraph ~~F-2704.1.4~~ (D)(1)(d)(FM-2704.1.4) OF THIS RULE.

(5) FM-2704.5 Outside dispensing and use: The outside dispensing and use of highly toxic or toxic compressed gases exceeding the exempt amount indicated in table F-2701.3(2) shall comply with paragraphs ~~F-2704.5.1~~ (D)(5)(a)(FM-2704.5.1) through ~~F-2704.5.3~~ (D)(5)(c)(FM-2704.5.3) OF THIS RULE.

(a) FM-2704.5.1 Gas cabinets or local exhaust: Where cylinders or portable containers are utilized outside, gas cabinets or a locally exhausted enclosure shall be provided. Gas cabinets or exhausted enclosures, where provided, shall comply with paragraph ~~F-2704.1.2~~ (D)(1)(b)(F-2704.1.2) or paragraph ~~F-2704.1.3~~ (D)(1)(c)(F-2704.1.3) OF THIS RULE, except where cylinders of toxic gases are provided with detection systems which activate controls to automatically close a fail-safe valve immediately adjacent to the cylinder valve. The fail-safe valve shall close when gas is detected at the permissible exposure limit by a gas detection system monitoring the exhaust system at the point of discharge from the gas cabinet or exhausted enclosures.

(b) FM-2704.5.2 Gas detection: Gas detection shall be provided in accordance with paragraph ~~F-2704.2.7~~ (D)(2)(g)(F-2704.2.7) OF THIS RULE. Activation of the monitoring system shall automatically close the shutoff valve on all highly toxic or toxic gas supply lines relating to the system monitored. Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic gases where such reactors are:

(i) Operated at pressure less than 15 psig (103 kPa);

(ii) Constantly attended; and

(iii) Provided with readily accessible emergency shutoff valves.

(c) F-2704.5.3 Sprinkler system: Gas cabinets and exhausted enclosures shall be internally sprinklered.



(E) Section FM-2705.0 Flammable compressed gases

(1) FM-2705.1 General: The storage and use of flammable gases in any quantity shall comply with paragraphs ~~SECTIONS F-2701.0 (A) (FM-2701.0)~~ through F-2703.0 ~~(C) (FM-2703.0)~~ and with paragraphs ~~F-2705.2 (E)(2)(FM-2705.2)~~ and ~~F-2705.3 (E)(3)(FM-2705.3)~~ OF THIS RULE.

(2) FM-2705.2 Gaseous hydrogen systems: Gaseous hydrogen systems shall be installed and maintained in accordance with NFPA 50A listed in rule 1301:7-7-44 of the Administrative Code.

(3) FM-2705.3 Explosion control: In other than existing buildings and rooms occupied for the storage of flammable gases, flammable gases stored in rooms outside of gas cabinets or exhausted enclosures shall be provided with explosion venting or explosion suppression in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code.

(F) Section FM-2706.0 Medical gases

(1) FM-2706.1 General: Medical gases in any quantity shall be stored and used in accordance with paragraphs ~~F-2701.0 (A) (FM-2701.0)~~ through ~~F-2703.0 (C) (FM-2703.0)~~ and paragraphs ~~F-2706.2 (F)(2)(F-2706.2)~~ and ~~F-2706.3 (F)(3)(FM-2706.3)~~ OF THIS RULE.

(2) F-2706.2 Cylinder systems for medical gases: Cylinders containing flammable anesthetics and nonflammable medical gases in hospitals and similar facilities shall be stored and handled in a safe manner relative to persons and property.

(3) FM-2706.3 Piped distribution system for medical gases: Piping systems shall not distribute flammable medical gases in any hospital or similar facility. Piped distribution systems handling nonflammable medical gases in hospitals and similar facilities shall be installed and utilized in accordance with NFPA 99 listed in rule 1301:7-7-44 of the Administrative Code.

(G) Section FM-2707.0 Oxidizing compressed gases

(1) FM-2707.1 General: Oxidizing gases in any quantity shall be stored and used in accordance with paragraphs ~~F-2701.0 (A) (FM-2701.0)~~ through ~~F-2703.0 (C) (FM-2703.0)~~ and paragraph ~~F-2707.2 (G)(2)(FM-2707.2)~~.

(2) FM-2707.2 Bulk oxygen systems: Bulk oxygen systems located at industrial and institutional consumer sites shall be installed and maintained in accordance with NFPA 50 listed in rule 1301:7-7-44 of the Administrative Code.

(H) Section FM-2708.0 Corrosive compressed gases

(1) FM-2708.1 General: Corrosive gases in any quantity shall be stored and used in accordance with

paragraphs ~~F-2701.0 (A) (FM-2701.0)~~ through ~~F-2703.0 (C) (FM-2703.0)~~ and paragraph ~~F-2708.2 (H)(2)(FM-2708.2)~~ OF THIS RULE.

(2) FM-2708.2 Anhydrous ammonia: Anhydrous ammonia shall be stored and handled in accordance with ANSI K61.1 listed in rule 1301:7-7-44 of the Administrative Code.

(I) Section FM-2709.0 Pyrophoric compressed gases

(1) FM-2709.1 Inside storage, dispensing and use: Inside storage, dispensing and use of pyrophoric gases exceeding the exempt amounts per control area indicated in tables F-2701.3(3) and F-2701.3(4) shall comply with the applicable provisions of paragraphs ~~F-2701.0 (A) (FM-2701.0)~~ through ~~F-2703.0 (C) (FM-2703.0)~~ and paragraphs ~~F-2709.1.1 (I)(1)(a)(FM-2709.1.1)~~ through ~~F-2709.1.4 (I)(1)(d)(FM-2709.1.4)~~ OF THIS RULE.

(a) FM-2709.1.1 Construction: Structures and rooms occupied for the storage of use group H-1 pyrophoric gases shall be of noncombustible construction. Structures and rooms occupied for the storage of use group H-2 pyrophoric gases shall have floors of noncombustible construction, and walls and ceilings with an interior finish having a flame spread rating of 25 or less when tested in accordance with ASTM E84 listed in rule 1301:7-7-44 of the Administrative Code. The requirement for noncombustible floor construction shall not apply to existing structures or rooms occupied for the storage of use group H-2 pyrophoric gases, provided that the interior floor finish has a flame spread rating of 25 or less when tested in accordance with ASTM E84 listed in rule 1301:7-7-44 of the Administrative Code.

(b) F-2709.1.2 Nondetonatable pyrophoric gases: Indoor storage for nondetonatable pyrophoric gases in quantities greater than 2,000 cubic feet (56 m<sup>3</sup>) shall be in detached structures except in existing structures occupied for the storage of use group H-2 pyrophoric gases. Pyrophoric gases in indoor storage shall be arranged in accordance with table F-2709.1.3.

(c) F-2709.1.3 Detonatable pyrophoric gases: Structures occupied for the storage of detonatable pyrophoric gases shall be constructed as a barricade and designed to contain the worst-case release of the contents from the largest container based on the trinitrotoluene (TNT) equivalency for the material. Pyrophoric gases in indoor storage shall be arranged in accordance with table F-2709.1.3.

Table F-2709.1.3  
Inside storage of pyrophoric gases

Maximum number of containers per pile	Maximum volume per pile (cubic feet) <sup>a,b</sup>	Distance between piles (feet) <sup>b</sup>
6	1,200	5

Note a. Volume (cubic feet) at normal temperature and pressure.

Note b. 1 foot = 304.8 mm; 1 cubic foot = 0.028 m<sup>3</sup>.

(d) FM-2709.1.4 Separation: Where storage is not contained in approved hazardous materials storage cabinets constructed in accordance with paragraph ~~F-2306.1~~ (F)(1)(FM-2306.1), indoor storage of pyrophoric gases shall comply with paragraph ~~F-2309.1~~ (I)(1)(FM-2309.1) and shall be isolated from incompatible hazardous materials by fire separation assemblies having a fire resistance rating of not less than 1 hour with openings protected in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code.

(2) FM-2709.2 Outside storage: Outside storage of pyrophoric gases shall comply with table F-2701.4. Where weather protection is provided, the outside storage of pyrophoric gases shall comply with paragraph ~~F-2314.11~~ (N)(11)F-2314.11). Where weather protection over the outside storage areas is attached to the structure, an approved automatic sprinkler system shall be provided for the storage of pyrophoric gases.

(J) Section FM-2710.0 Unstable (reactive) compressed gases

(1) F-2710.1 Inside storage: Inside storage of unstable (reactive) gases exceeding the exempt amounts per control area indicated in table F-2701.3(3) shall comply with the applicable provisions of PARAGRAPHS sections ~~F-2701.0~~ (A) (FM-2701.0) through ~~F-2703.0~~ (C) (FM-2703.0) and paragraphs ~~F-2710.1.1~~ (J)(1)(a)(FM-2710.1.1) through ~~F-2710.1.4~~ (J)(1)(d)(FM-2710.1.4) OF THIS RULE.

(a) FM-2710.1.1 Construction: Structures or rooms occupied for the storage of class 3 or 4 unstable (reactive) gases shall be of noncombustible construction. Class 3 or 4 gases shall not be stored in basements or space below grade.

Exception: The interior finish of walls, floors and ceilings in existing structures or rooms occupied for the storage of use group H-2 unstable (reactive) gases shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84 listed in rule 1301:7-7-44 of the Administrative Code.

(b) F-2710.1.2 Detached storage: In other than existing structures or areas occupied for the storage of class 2 unstable (reactive) gases, storage of unstable (reactive) gases in quantities exceeding the quantity listed in table F-2710.1.2 shall be in a detached storage structure of noncombustible construction occupied exclusively for such storage or in an exterior storage area.

Table F-2710.1.2  
Unstable (reactive) gases  
quantities requiring detached storage

Class	Gases (cubic feet) <sup>a</sup>
4	Exempt amounts indicated in table F-2701.3(3)
3	2,000
2	10,000

Note a. 1 cubic foot = 0.028 m<sup>3</sup>.

(c) F-2710.1.3 Insulated roofs: In other than existing structures or rooms occupied for the storage of class 2 unstable (reactive) gases, roofs of storage rooms and structures shall be insulated to maintain the permissible temperature range of the gases stored.

(d) FM-2710.1.4 Smoke and heat venting: Storage areas of class 3 or 4 unstable (reactive) gases shall be provided with a means to vent smoke and heat in a fire or other emergency in accordance with the building code listed in rule 1301:7-7-44 of the Administrative Code for a class V hazard classification.

(e) F-2710.1.5 Storage arrangement: In other than those stored in approved tanks, unstable (reactive) gases in any quantity shall be separated into piles not exceeding 500 cubic feet (14 m<sup>3</sup>). Aisle widths shall not be less than the height of the piles or 4 feet (1219 mm), whichever is greater.

(2) F-2710.2 Outside storage: Outside storage of unstable (reactive) gases shall comply with table F-2701.4.

Effective date: January 3, 2000

  
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Certification

\_\_\_\_\_ November 17, 1999

Date

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Statutory authority: RC §3737.22 and §3737.82  
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Certification

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Date

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