

CHAPTER 40

OXIDIZERS, OXIDIZING GASES AND OXIDIZING CRYOGENIC FLUIDS

SECTION 4001 GENERAL

4001.1 Scope. The storage and use of oxidizing materials shall be in accordance with this chapter and Chapter 27. Oxidizing gases shall also comply with Chapter 30. Oxidizing *cryogenic fluids* shall also comply with Chapter 32.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 2703.11.
2. Bulk oxygen systems at industrial and institutional consumer sites shall be in accordance with NFPA 55.
3. Liquid oxygen stored or used in home health care in Group I-1, I-4 and R occupancies in accordance with Section 4006.

4001.2 Permits. Permits shall be required as set forth in Section 105.6.

SECTION 4002 DEFINITIONS

4002.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used 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, that has a storage capacity of more than 20,000 cubic feet (566 m³) of oxygen at *normal temperature and pressure (NTP)* including unconnected reserves on hand at the site. The bulk oxygen system terminates at the point where oxygen at service pressure first enters the supply line. The oxygen containers can be stationary or movable, and the oxygen can be stored as a gas or liquid.

LIQUID OXYGEN AMBULATORY CONTAINER. A container used for liquid oxygen not exceeding 0.396 gallons (1.5 liters) specifically designed for use as a medical device as defined by 21 USC Chapter 9 that is intended for portable therapeutic use and to be filled from its companion base unit (a liquid oxygen home care container).

LIQUID OXYGEN HOME CARE CONTAINER. A container used for liquid oxygen not exceeding 15.8 gallons (60 liters) specifically designed for use as a medical device as defined by 21 USC Chapter 9 that is intended to deliver gaseous oxygen for therapeutic use in a home environment.

OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and, if heated or contaminated, can result in vigorous self-sustained decomposition.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Additionally, the oxidizer causes a severe increase in the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes in contact.

Class 2. An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes in contact.

Class 1. An oxidizer that does not moderately increase the burning rate of combustible materials.

OXIDIZING CRYOGENIC FLUID. An oxidizing gas in the cryogenic state.

OXIDIZING GAS. A gas that can support and accelerate combustion of other materials more than air does.

SECTION 4003 GENERAL REQUIREMENTS

4003.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of oxidizing materials in amounts not exceeding the *maximum allowable quantity per control area* indicated in Section 2703.1 shall be in accordance with Sections 2701, 2703, 4001 and 4003. Oxidizing gases shall also comply with Chapter 30.

4003.1.1 Special limitations for indoor storage and use by occupancy. The indoor storage and use of oxidizing materials shall be in accordance with Sections 4003.1.1.1 through 4003.1.1.3.

4003.1.1.1 Class 4 liquid and solid oxidizers. The storage and use of Class 4 liquid and solid oxidizers shall comply with Sections 4003.1.1.1.1 through 4003.1.1.1.4.

4003.1.1.1.1 Group A, E, I or U occupancies. In Group A, E, I or U occupancies, any amount of Class 4 liquid and solid oxidizers shall be stored in accordance with the following:

1. Class 4 liquid and solid oxidizers shall be stored in hazardous materials storage cabinets complying with Section 2703.8.7.
2. The hazardous materials storage cabinets shall not contain other storage.

4003.1.1.1.2 Group R occupancies. Class 4 liquid and solid oxidizers shall not be stored or used within Group R occupancies.

4003.1.1.1.3 Offices and retail sales areas. Class 4 liquid and solid oxidizers shall not be stored or used in offices or retail sales areas of Group B, F, M or S occupancies.

4003.1.1.1.4 Classrooms. In classrooms of Group B, F or M occupancies, any amount of Class 4 liquid and solid oxidizers shall be stored in accordance with the following:

1. Class 4 liquid and solid oxidizers shall be stored in hazardous materials storage cabinets complying with Section 2703.8.7.
2. Hazardous materials storage cabinets shall not contain other storage.

4003.1.1.2 Class 3 liquid and solid oxidizers. A maximum of 200 pounds (91 kg) of solid or 20 gallons (76 L) of liquid Class 3 oxidizer is allowed in Group I occupancies when such materials are necessary for maintenance purposes or operation of equipment. The oxidizers shall be stored in *approved* containers and in an *approved* manner.

4003.1.1.3 Oxidizing gases. Except for cylinders of nonliquefied *compressed gases* not exceeding a capacity of 250 cubic feet (7 m³) or liquefied *compressed gases* not exceeding a capacity of 46 pounds (21 kg) each used for maintenance purposes, patient care or operation of equipment, oxidizing gases shall not be stored or used in Group A, E, I or R occupancies or in offices in Group B occupancies.

The aggregate quantities of gases used for maintenance purposes and operation of equipment shall not exceed the *maximum allowable quantity per control area* listed in Table 2703.1.1(1).

Medical gas systems and medical gas supply cylinders shall also be in accordance with Section 3006.

4003.1.2 Emergency shutoff. *Compressed gas* systems conveying oxidizing gases shall be provided with *approved* manual or automatic emergency shutoff valves that can be activated at each point of use and at each source.

4003.1.2.1 Shutoff at source. A manual or automatic fail-safe emergency shutoff valve shall be installed on supply piping at the cylinder or bulk source. Manual or automatic cylinder valves are allowed to be used as the required emergency shutoff valve when the source of supply is limited to unmanifolded cylinder sources.

4003.1.2.2 Shutoff at point of use. A manual or automatic emergency shutoff valve shall be installed on the supply piping at the point of use or at a point where the equipment using the gas is connected to the supply system.

4003.1.3 Ignition source control. Ignition sources in areas containing oxidizing gases shall be controlled in accordance with Section 2703.7.

4003.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of oxidizing materials in amounts exceeding the *maximum allowable quantity per*

control area indicated in Section 2703.1 shall be in accordance with Chapter 27 and this chapter.

**SECTION 4004
STORAGE**

4004.1 Indoor storage. Indoor storage of oxidizing materials in amounts exceeding the *maximum allowable quantity per control area* indicated in Table 2703.1.1(1) shall be in accordance with Sections 2701, 2703 and 2704 and this chapter.

4004.1.1 Detached storage. Storage of liquid and solid oxidizers shall be in detached buildings when required by Section 2703.8.2.

4004.1.2 Distance from detached storage buildings to exposures. In addition to the requirements of the *International Building Code*, detached storage buildings shall be located in accordance with Table 4004.1.2.

**TABLE 4004.1.2
OXIDIZER LIQUIDS AND SOLIDS—DISTANCE FROM DETACHED BUILDINGS AND OUTDOOR STORAGE AREAS TO EXPOSURES**

OXIDIZER CLASS	WEIGHT (pounds)	MINIMUM DISTANCE TO BUILDINGS, LOT LINES, PUBLIC STREETS, PUBLIC ALLEYS, PUBLIC WAYS OR MEANS OF EGRESS (feet)
1	Note a	Not Required
2	Note a	35
3	Note a	50
4	Over 10 to 100	75
	101 to 500	100
	501 to 1,000	125
	1,001 to 3,000	200
	3,001 to 5,000	300
	5,001 to 10,000	400
	Over 10,000	As required by the fire code official

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

- a. Any quantity over the amount required for detached storage in accordance with Section 2703.8.2, or over the outdoor maximum allowable quantity for outdoor control areas.

4004.1.3 Explosion control. Indoor storage rooms, areas and buildings containing Class 4 liquid or solid oxidizers shall be provided with explosion control in accordance with Section 911.

4004.1.4 Automatic sprinkler system. The *automatic sprinkler system* shall be designed in accordance with NFPA 430.

4004.1.5 Liquid-tight floor. In addition to Section 2704.12, floors of storage areas for liquid and solid oxidizers shall be of liquid-tight construction.

4004.1.6 Smoke detection. An *approved* supervised smoke detection system in accordance with Section 907 shall be

installed in liquid and solid oxidizer storage areas. Activation of the smoke detection system shall sound a local alarm.

Exception: Detached storage buildings protected by an *approved* automatic fire-extinguishing system.

4004.1.7 Storage conditions. The maximum quantity of oxidizers per building in detached storage buildings shall not exceed those quantities set forth in Tables 4004.1.7(1) through 4004.1.7(4).

The storage configuration for liquid and solid oxidizers shall be as set forth in Tables 4004.1.7(1) through 4004.1.7(4).

Class 2 oxidizers shall not be stored in *basements* except when such storage is in stationary tanks.

Class 3 and 4 oxidizers in amounts exceeding the *maximum allowable quantity per control area* set forth in Section 2703.1 shall be stored on the ground floor only.

**TABLE 4004.1.7(1)
STORAGE OF CLASS 1 OXIDIZER LIQUIDS AND SOLIDS IN COMBUSTIBLE CONTAINERS^a**

STORAGE CONFIGURATION	LIMITS (feet)
Piles	
Maximum length	No Limit
Maximum width	50
Maximum height	20
Minimum distance to next pile	3
Minimum distance to walls	2
Maximum quantity per pile	No Limit
Maximum quantity per building	No Limit

For SI: 1 foot = 304.8 mm.

a. Storage in noncombustible containers or in bulk in detached storage buildings is not limited as to quantity or arrangement.

**TABLE 4004.1.7(2)
STORAGE OF CLASS 2 OXIDIZER LIQUIDS AND SOLIDS^{a,b}**

STORAGE CONFIGURATION	LIMITS		
	Segregated storage	Cutoff storage rooms ^c	Detached building
Piles			
Maximum width	16 feet	25 feet	25 feet
Maximum height	10 feet	12 feet	12 feet
Minimum distance to next pile	Note d	Note d	Note d
Minimum distance to walls	2 feet	2 feet	2 feet
Maximum quantity per pile	20 tons	50 tons	200 tons
Maximum quantity per building	200 tons	500 tons	No Limit

For SI: 1 foot = 304.8 mm, 1 ton = 0.907185 metric ton.

- a. Storage in noncombustible containers is not limited as to quantity or arrangement, except that piles shall be at least 2 feet from walls in sprinklered buildings and 4 feet from walls in nonsprinklered buildings; the distance between piles shall not be less than the pile height.
- b. Quantity limits shall be reduced by 50 percent in buildings or portions of buildings used for retail sales.
- c. Cutoff storage rooms shall be separated from the remainder of the building by 2-hour fire barriers.
- d. Aisle width shall not be less than the pile height.

**TABLE 4004.1.7(3)
STORAGE OF CLASS 3 OXIDIZER LIQUIDS AND SOLIDS^{a,b}**

STORAGE CONFIGURATION	LIMITS		
	Segregated storage	Cutoff storage rooms ^c	Detached building
Piles			
Maximum width	12 feet	16 feet	20 feet
Maximum height	8 feet	10 feet	10 feet
Minimum distance to next pile	Note d	Note d	Note d
Minimum distance to walls	4 feet	4 feet	4 feet
Maximum quantity per pile	20 tons	30 tons	150 tons
Maximum quantity per building	100 tons	500 tons	No Limit

For SI: 1 foot = 304.8 mm, 1 ton = 0.907185 metric ton.

- a. Storage in noncombustible containers is not limited as to quantity or arrangement, except that piles shall be at least 2 feet from walls in sprinklered buildings and 4 feet from walls in nonsprinklered buildings; the distance between piles shall not be less than the pile height.
- b. Quantity limits shall be reduced by 50 percent in buildings or portions of buildings used for retail sales.
- c. Cutoff storage rooms shall be separated from the remainder of the building by 2-hour fire barriers.
- d. Aisle width shall not be less than the pile height.

**TABLE 4004.1.7(4)
STORAGE OF CLASS 4 OXIDIZER LIQUIDS AND SOLIDS**

STORAGE CONFIGURATION	LIMITS (feet)
Piles	
Maximum length	10
Maximum width	4
Maximum height	8
Minimum distance to next pile	8
Maximum quantity per building	No Limit

For SI: 1 foot = 304.8 mm.

4004.1.8 Separation of Class 4 oxidizers from other materials. In addition to the requirements in Section 2703.9.8, Class 4 oxidizer liquids and solids shall be separated from other hazardous materials by not less than a 1-hour *fire barrier* or stored in hazardous materials storage cabinets.

Detached storage buildings for Class 4 oxidizer liquids and solids shall be located a minimum of 50 feet (15 240 mm) from other hazardous materials storage.

4004.1.9 Contamination. Liquid and solid oxidizers shall not be stored on or against combustible surfaces. Liquid and solid oxidizers shall be stored in a manner to prevent contamination.

4004.2 Outdoor storage. Outdoor storage of oxidizing materials in amounts exceeding the *maximum allowable quantities per control area* set forth in Table 2703.1.1(3) shall be in accordance with Sections 2701, 2703, 2704 and this chapter. Oxidizing gases shall also comply with Chapter 30.

4004.2.1 Distance from storage to exposures for liquid and solid oxidizers. Outdoor storage areas for liquid and solid oxidizers shall be located in accordance with Table 4004.1.2.

4004.2.2 Distance from storage to exposures for oxidizing gases. Outdoor storage areas for oxidizing gases shall be located in accordance with Table 4004.2.2.

4004.2.2.1 Oxidizing cryogenic fluids. Outdoor storage areas for oxidizing *cryogenic fluids* shall be located in accordance with Chapter 32.

4004.2.3 Storage configuration for liquid and solid oxidizers. Storage configuration for liquid and solid oxidizers shall be in accordance with Tables 4004.1.7(1) through 4004.1.7(4).

4004.2.4 Storage configuration for oxidizing gases. Storage configuration for oxidizing gases shall be in accordance with Table 4004.2.2.

4. Requirements for handling containers in accordance with Section 4006.3.5.
5. Safeguards for refilling containers in accordance with Section 4006.3.6.
6. Signage requirements in accordance with Section 4006.6.

4006.3 Liquid oxygen home care containers. Containers of liquid oxygen in home health care shall be in accordance with Sections 4006.3.1 through 4006.3.6.

4006.3.1 Maximum individual container capacity. Liquid oxygen home care containers shall not exceed an individual capacity of 15.8 gallons (60 L) in Group I-1, I-4 and R occupancies. Liquid oxygen ambulatory containers are allowed in Group I-1, I-4 and R occupancies. Containers of liquid oxygen in home health care shall also be stored, used and filled in accordance with Sections 4006, 3203.1 and 3203.2.

4006.3.2 Manufacturer’s instructions and labeling. Containers shall be stored, used and operated in accordance with the manufacturer’s instructions and labeling.

4006.3.3 Locating containers. Containers shall not be located in areas where:

1. They can be overturned due to operation of a door;
2. They are in the direct path of egress;
3. They are subject to falling objects;
4. They can become part of an electrical circuit; or
5. Open flames and high-temperature devices can cause a hazard.

4006.3.4 Restraining containers. Liquid oxygen home care containers shall be restrained while in storage or use to prevent falling caused by contact, vibration or seismic activity. Containers shall be restrained by one of the following methods:

1. Restraining containers to a fixed object with one or more restraints.
2. Restraining containers within a framework, stand or assembly designed to secure the container.
3. Restraining containers by locating a container against two points of contact such as the walls of a corner of a

**SECTION 4005
USE**

4005.1 Scope. The use of oxidizers in amounts exceeding the *maximum allowable quantity per control area* indicated in Table 2703.1.1(1) or 2703.1.1(3) shall be in accordance with Sections 2701, 2703, 2705 and this chapter. Oxidizing gases shall also comply with Chapter 30.

**SECTION 4006
LIQUID OXYGEN IN HOME HEALTH CARE**

4006.1 General. The storage and use of liquid oxygen (LOX) in home health care in Group I-1, I-4 and R occupancies shall comply with Sections 4006.2 through 4006.6, or shall be stored and used accordance with Chapter 27.

4006.2 Information and instructions to be provided. The seller of liquid oxygen shall provide the user with information in written form that includes, but is not limited to, the following:

1. Manufacturer’s instructions and labeling for safe storage and use of the containers.
2. Locating containers away from ignition sources, *exits*, electrical hazards and high temperature devices in accordance with Section 4006.3.3.
3. Restraint of containers to prevent falling in accordance with Section 4006.3.4.

**TABLE 4004.2.2
OXIDIZER GASES—DISTANCE FROM STORAGE TO EXPOSURES^a**

QUANTITY OF GAS STORED (cubic feet at NTP)	DISTANCE TO A BUILDING NOT ASSOCIATED WITH THE MANUFACTURE OR DISTRIBUTION OF OXIDIZING GASES OR PUBLIC WAY OR LOT LINE THAT CAN BE BUILT UPON (feet)	DISTANCE BETWEEN STORAGE AREAS (feet)
0 - 50,000	5	5
50,001 - 100,000	10	10
100,001	15	10

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m³.

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

room or a wall and a secure furnishing or object such as a desk.

4006.3.5 Container handling. Containers shall be handled by use of a cart or hand truck designed for such use.

Exceptions:

1. Liquid oxygen home care containers equipped with a roller base.
2. Liquid oxygen ambulatory containers are allowed to be hand carried.

4006.3.6 Filling of containers. The filling of containers shall be in accordance with Sections 4006.3.6.1 through 4006.3.6.3.

4006.3.6.1 Filling location. Liquid oxygen home care containers and ambulatory containers shall be filled outdoors.

Exception: Liquid oxygen ambulatory containers are allowed to be filled indoors where the supply container is specifically designed for filling such containers and written instructions are provided by the container manufacturer.

4006.3.6.2 Incompatible surfaces. A drip pan compatible with liquid oxygen shall be provided under home care container fill and vent connections during the filling process in order to protect against liquid oxygen spillage from coming into contact with combustible surfaces, including asphalt.

4006.3.6.3 Open flames and high-temperature devices. The use of open flames and high-temperature devices shall be in accordance with Section 2703.7.2.

4006.4 Maximum aggregate quantity. The maximum aggregate quantity of liquid oxygen allowed in storage and in use in each *dwelling unit* shall be 31.6 gallons (120 L).

Exceptions:

1. The maximum aggregate quantity of liquid oxygen allowed in Group I-4 occupancies shall be limited by the maximum allowable quantity set forth in Table 2703.1.1(1).
2. Where individual sleeping rooms are separated from the remainder of the *dwelling unit* by *fire barriers* constructed in accordance with Section 707 of the *International Building Code*, and *horizontal assemblies* constructed in accordance with Section 712 of the *International Building Code*, or both, having a minimum *fire-resistance rating* of 1 hour, the maximum aggregate quantity per *dwelling unit* shall be increased to allow a maximum of 31.6 gallons (120 L) of liquid oxygen per sleeping room.

4006.5 Smoking prohibited. Smoking shall be prohibited in rooms or areas where liquid oxygen is in use.

4006.6 Signs. Warning signs for occupancies using home health care liquid oxygen shall be in accordance with Sections 4006.6.1 and 4006.6.2.

4006.6.1 No smoking sign. A sign stating “OXYGEN—NO SMOKING” shall be posted in each room or area where liquid oxygen containers are stored, used or filled.

4006.6.2 Premises signage. Where required by the *fire code official*, each *dwelling unit* or *sleeping unit* shall have an *approved* sign indicating that the unit contains liquid oxygen home care containers.

4006.7 Fire department notification. Where required by the *fire code official*, the liquid oxygen seller shall notify the fire department of the locations of liquid oxygen home care containers.

