Medical Gas Cylinder and Bulk Tank Storage

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This monograph summarizes storage requirements for medical gas cylinders, including bulk tank storage, in health care occupancies. Decision points for various storage requirements are based on the total volume of gas in stored cylinders.

1 Definitions

1.1 Cylinder capacity is approximately as follows:

- E cylinder: 23 cubic feet
- G cylinder: 254 cubic feet
- H cylinder: 337 cubic feet

1.2 Medical gas cylinders are considered to be “in use” if they are:

- Actually being used by a patient.
- Secured to equipment (e.g., a crash cart, wheelchair, single E cylinder two-wheel cart, or gurney) so as to be ready for immediate use.
- Placed in a patient room for immediate patient use.

Note: Cylinders that are in use are excluded from the total volume of gas considered for storage determination.

Regulatory Requirements

As of June 2012, both the Joint Commission and the Centers for Medicare and Medicaid Services (CMS) require compliance with the 1999 edition of NFPA 99: Standard for Health Care Facilities because this is the edition cited by NFPA 101-2000: Life Safety Code®, which is the edition of that code CMS requires hospitals to follow.

It is anticipated that both organizations will adopt the 2012 edition of NFPA 99, now titled Health Care Facilities Code. Therefore, this monograph references NFPA 99-2012 for medical gas cylinder storage requirements.

Relevant information can be found in NFPA 99-2012 as follows:

- Storage of 300 cubic feet or less of gas: 11.3.3–11.3.3.2
- Storage of between 300 and 3,000 cubic feet of gas: 11.3.2–11.3.2.3
- Storage of more than 3,000 cubic feet of gas: 11.3.1, 5.1.3.3.2–5.1.3.3.3
- Storage of cylinders and containers: 11.6.5
- Mechanical ventilation: 9.3.7
- Transfilling cylinders: 11.5.2.2–11.5.2.3

The full text of NFPA 99-2012 should be consulted for complete details.
2 General Storage Requirements for All Medical Gas Cylinders

2.1 All medical gas cylinders (including E cylinders) must be physically supported, either in a stand or rack or chained or strapped to the wall. This requirement is intended to prevent mechanical hazards caused by a sudden release of gas if a tank falls over.

2.2 Oxidizing gases such as oxygen, nitrous oxide, and nitrogen must not be stored with flammable gases.

2.3 Medical gas cylinders should not be stored near radiators, steam pipes, heat ducts, or other sources of heat.

2.4 Full cylinders must be segregated from empty cylinders. The Joint Commission defines segregation as storage in separate racks. Empty cylinders must be marked to avoid confusion, which is typically done by labeling the racks “Empty” and “Full.”

3 Requirements for Cylinder Storage of Less Than 300 Cubic Feet of Gas

3.1 Cylinders with contents totaling less than 300 cubic feet of gas per smoke compartment (22,500 sq. ft. maximum) are not required to be stored in enclosures of any type.

3.2 Both the Joint Commission and CMS permit storage of up to 300 cubic feet of gas (12 E cylinders) per smoke compartment without any specific protection or room requirements. Tanks may be kept in an area open to the corridor, but may not obstruct the corridor. The number of 12 E cylinders allowed to be stored is based on full tanks; empty tanks (as well as tanks that are in use) do not count toward the total.

3.3 All full cylinders totaling up to 300 cubic feet may be stored in one rack. It is not necessary that they be distributed throughout the smoke compartment.

3.4 Wooden racks are permitted for storage of up to 300 cubic feet of gas.

3.5 If stored inside a room, the local authority having jurisdiction (AHJ) may enforce the requirements of 4.1 and 4.2, below.
4 Requirements for Cylinder Storage of 300–3,000 Cubic Feet of Gas

4.1 Cylinder storage must be located either outdoors in a lockable enclosure or indoors in a lockable enclosed space constructed of non-combustible or limited-combustible materials.

4.2 In such a room, oxidizing gases must be separated from combustible materials in one of the following ways:

- Locate gases at least 20 feet from combustible materials in non-sprinklered areas
- Locate gases at least 5 feet from combustible materials in a room that is fully sprinklered
- Contain gases in a flammable cabinet with a fire resistance rating of at least 30 minutes.

4.3 Cylinders stored outside must be protected as follows:

- From the ground beneath to prevent rusting
- From accumulation of snow and ice during the winter
- From exposure to direct sunlight during the summer

5 Requirements for Cylinder Storage of More Than 3,000 Cubic Feet of Gas

5.1 All Locations

5.1.1 The storage requirements for cylinders totaling more than 3,000 cubic feet apply to single-tank storage as well as rooms containing gas manifolds and associated piping.

5.1.2 The storage location must be lockable.

5.1.3 Chains, racks, and stands for medical gas cylinders must be constructed of non-combustible or limited-combustible materials.

5.2 Indoor Locations

5.2.1 Indoor locations for cylinder storage must have walls, floors, ceilings, and doors constructed with at least a one-hour fire resistance rating.
5.2.2 Full or empty cylinders may be stored in the same location as their respective central supply system. They may NOT be stored in enclosures that contain medical air compressor sources, medical vacuum supply systems, or waste anesthetic gas disposal (WAGD) systems.

5.2.3 Electrical requirements
- Any electrical devices such as switches or outlets in rooms where medical gas is stored must be located at least 5 feet off the finished floor. An alternative is to have the light switch outside the room and no electrical outlets inside.
- All electrical service must be compliant with NFPA 70: National Electrical Code® for ordinary locations.
- Electrical power must be part of the essential electrical system.
- In locations where only oxygen and/or nitrogen is stored, the wiring and electrical equipment is not required to be explosion-proof.

5.2.4 Heating of the enclosure, if necessary, must be via indirect means. In other words, the source of the heat must be outside the enclosure, with only warm air, steam, hot water, etc. passing into the enclosure.

5.2.5 Ventilation requirements
- The area must be equipped with dedicated mechanical ventilation that draws air from within one foot of the floor and operates continuously.
- A source of makeup air must be provided. This ventilation system must not be connected with other facility ventilation systems.
- The power supply for the ventilation system must be part of the essential electrical system.

5.3 Outdoor Locations

5.3.1 Outdoor locations for cylinder storage must be enclosed with a wall or fencing made of non-combustible materials.

5.3.2 Outdoor storage locations that are surrounded by solid walls must have protected ventilation openings at the base of each
wall, unless that wall is shared with another enclosure or building.

5.3.3 Cylinders stored outside must be protected as follows:
- From the ground beneath to prevent rusting
- From accumulation of snow and ice during the winter
- From exposure to direct sunlight during the summer

6 **Signage Requirements for Cylinder Storage**

Signs must be posted on each door or gate of a gas cylinder storage room or enclosure. The signs must be readable from a distance of 5 feet and must include the following language:

**CAUTION**

**OXIDIZING GAS(ES) STORED WITHIN**

**NO SMOKING**

7 **Requirements for Transfilling Liquid Oxygen**

7.1 Transfer of any gases from one cylinder to another in patient care areas of health care facilities is prohibited.

7.2 Transfilling of liquid oxygen must be performed in an area that is:

- Mechanically ventilated
- Sprinklered
- Ceramic- or concrete-floored
- Separated with at least one-hour construction from any patient care area

8 **Requirements for Outdoor Bulk Tank Storage**

8.1 Bulk storage tanks and associated systems are considered critical components of the piped medical gas system.
8.2 Tanks must be installed as follows:

- Above ground and not on roofs
- Away from electrical services or power lines
- 10 feet clear of vehicles and sidewalks
- At least 50 feet from wood-framed buildings

8.3 Tanks must have permanent signage that states:

OXYGEN

NO SMOKING

NO OPEN FLAMES

8.4 Access to tanks should be controlled or locked.