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JAN 2019

LUNCH & LEARN



OXYGEN CYLINDER

USE & STORAGE



Presented by **Lauzon Life Safety Consulting**

Presenter

Bill Lauzon



2011-present

1973-2006



2006-2011

DHS-DQA

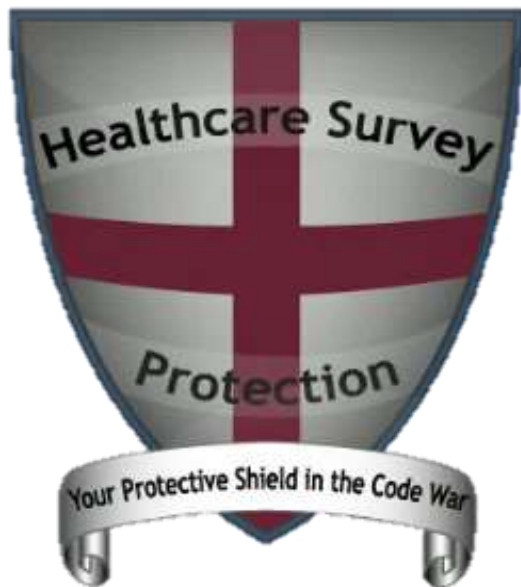
Lauzon Life
Safety Consulting

“Facility Engineer”

Tomah – Fargo- Madison
Kenosha - Racine



6 Years – Statewide Consultant
Lauzon Life Safety Consulting



3 Years - Director of Environment of
Care at combined rehab hospital,
CBRF, RCC, and school

Presenter

Heather Lauzon Werner



Owner

Lauzon Life Safety
Consulting, LLC

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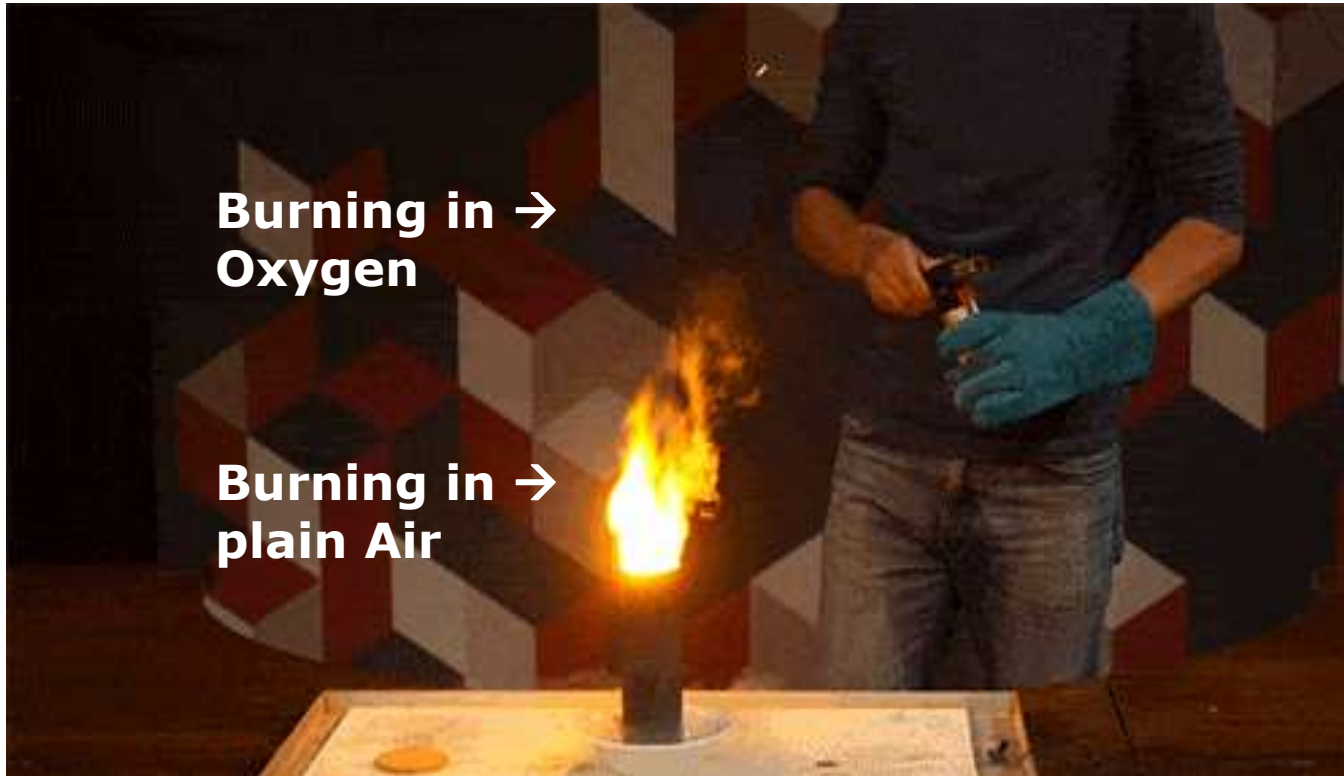
Two Main Safety Hazards with Oxygen

(1). Energy from compressed gas

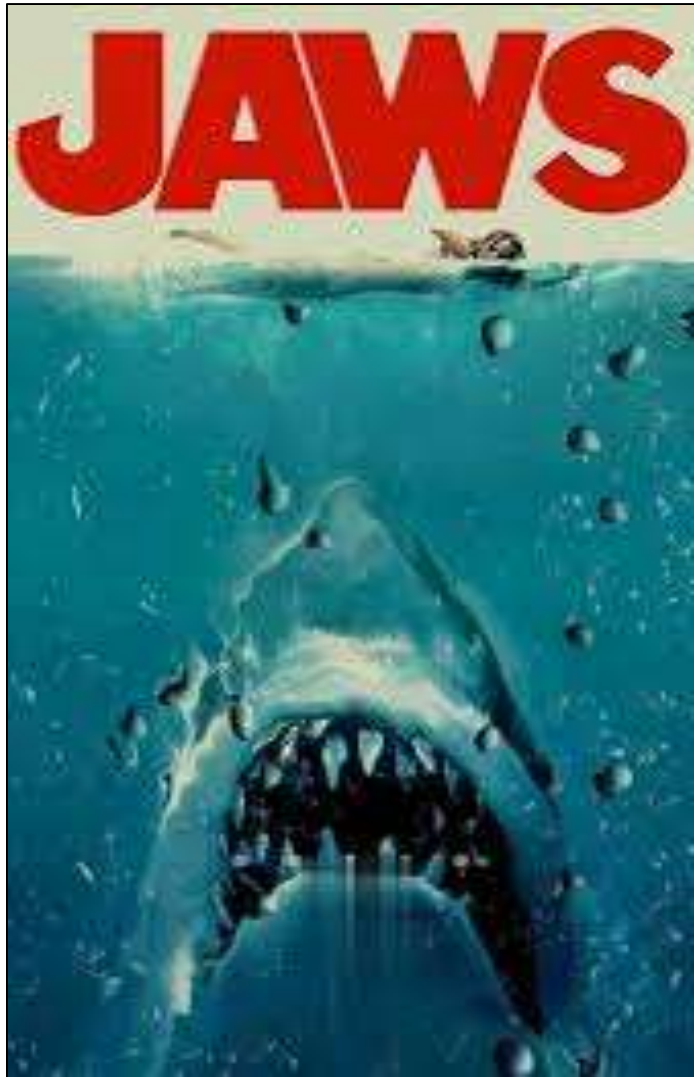


Two Main Safety Hazards with Oxygen

(2). Enhanced combustion



(1). Energy from compressed gas



Do you
remember ...
how the 'Jaws'
Shark was
finally killed?

Think Back



... the boat was adrift in the water



Brody was inside the cabin



The shark pushed himself in



Brody picked up a floating air tank



And flung it into the shark's mouth



The shark backed off ...



... but made another attack run



So Brody climbed the mast



and prepared for another attack



Shark made another run with the air tank stuck in its mouth



Brody took aim



And the shark was blown up!



And Brody screamed with joy !



Could You Really Kill 'Jaws' with a Scuba Tank and a Rifle?

In 2005, the television series MythBusters tested the results by firing a rifle into a SCUBA tank.



Could You Really Kill 'Jaws' with a Scuba Tank and a Rifle?

The result was not a fireball explosion, but the compressed air rushing from the bullet might have torn a hole in the shark's body, effectively killing it.



Could You Really Kill 'Jaws' with a Scuba Tank and a Rifle?



So, YES you could !

How HAZARDOUS can a Toppled Tank be?

There's enough energy in a compressed air scuba tank to **BUST** through a concrete block wall



Incidentally . . .

In the book Brody killed the shark with a harpoon
(but that wasn't exciting enough for Spielberg)



Two Main Safety Hazards with Oxygen

(1). Energy from compressed gas



Two Main Safety Hazards with Oxygen

(2). Enhanced combustion

**Now let's look at the
fire hazard side**

**Burning in →
plain Air**

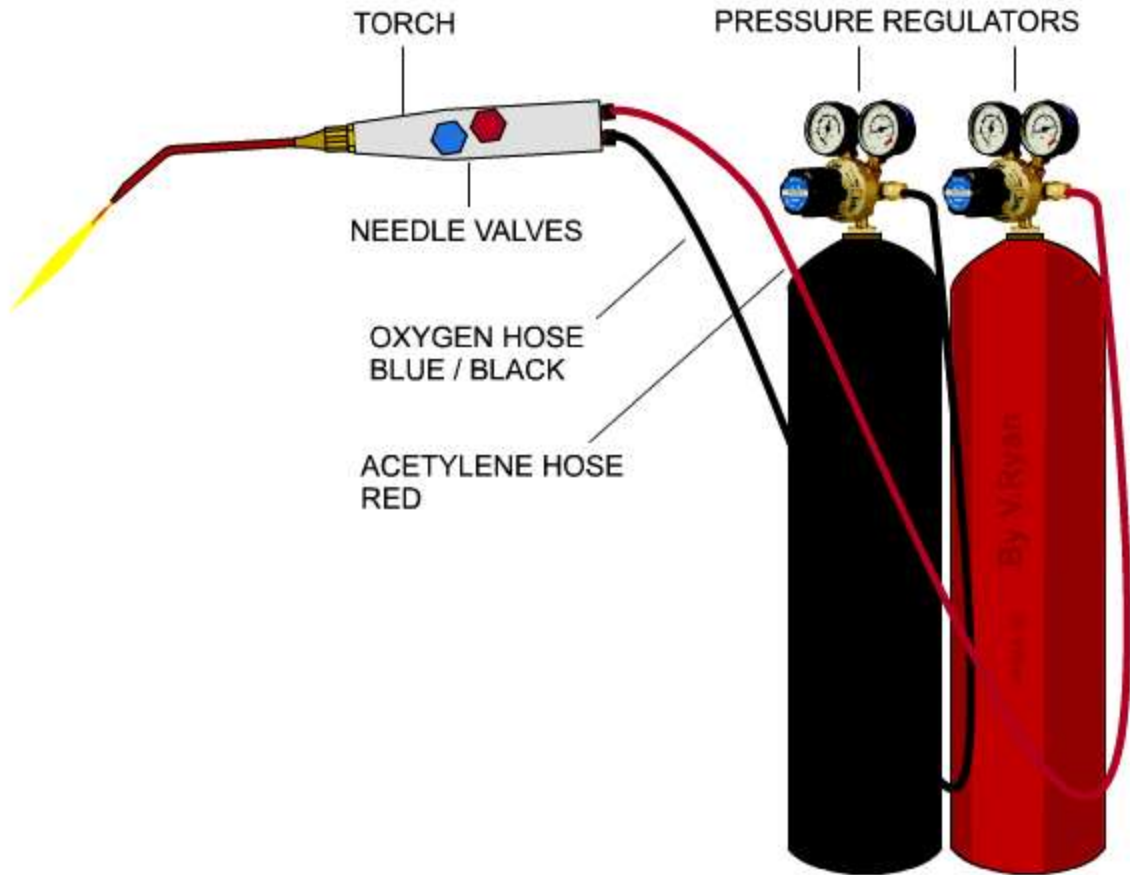


(2). Enhanced Combustion



Acetylene by itself
does a great job
heating things

(2). Enhanced Combustion



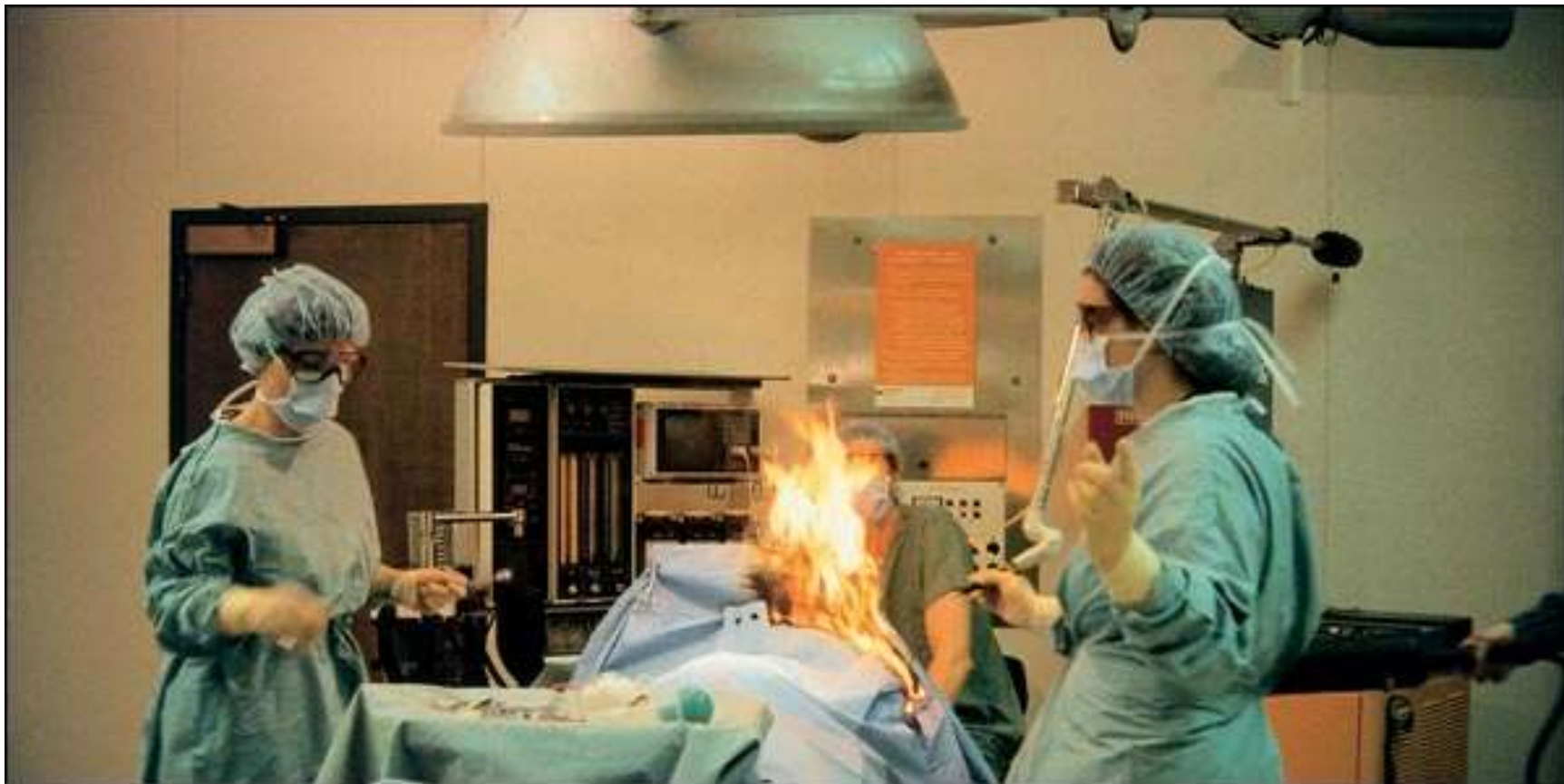
But add
Oxygen and it
becomes
POWERFUL

(2). Enhanced Combustion



Cutting metal made easy

(2). Enhanced Combustion



Oxygen can Accentuate Fires !

Two Main Safety Hazards with Oxygen

(1). Energy from compressed gas



(2). Enhanced combustion




How do the Codes provide SAFEGUARDS?

Safety Codes on Oxygen

1. Follow CMS Memo S&C 07-10

→ Q&A on small quantities of O₂ cylinders
(will cover later with cylinders)

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop S2-12-25
Baltimore, Maryland 21244-1850

 **CMS**
CENTERS for MEDICARE & MEDICAID SERVICES

Center for Medicaid and State Operations/Survey and Certification Group

Ref: S&C-07-10

DATE: January 12, 2007

TO: State Survey Agency Directors
State Fire Authorities

FROM: Director
Survey and Certification Group

SUBJECT: Multiple Providers - Hospitals, Ambulatory Surgical Centers, Nursing Homes, Religious Non-Medical Health Care Institutions, Programs of All-Inclusive Care for the Elderly (PACE) Facilities, Critical Access Hospitals, Intermediate Care Facilities for the Mentally Retarded - Medical Gas Storage and Usage Considerations

Memorandum Summary

- Up to 300 cubic feet of nonflammable medical gas may be accessible as operational supply rather than storage, when properly secured.
- An individual container of medical gas placed in a patient room for "as needed" (but regular) individual use is not required to be stored in an enclosure, when properly secured.

The purpose of this memorandum is to answer questions regarding storage requirements for small quantities of medical gas and what is considered when determining if a medical gas container is "in use." These issues are not addressed by the 1999 edition of NFPA 99 Health Care Facilities but information on these issues can be found in the 2005 edition of NFPA 99 Health Care Facilities at 9.4.3.

Q1. Can up to 300 cu ft of nonflammable medical gas (12 E sized cylinders) associated with patient care be located outside of an enclosure at locations open to the corridor in a healthcare facility?

A1. Yes, up to 300 cu ft of nonflammable medical gas can be located outside of an enclosure (per smoke compartment) at locations open to the corridor such as at a nurse's station or in a corridor of a healthcare facility.

Safety Codes on Oxygen

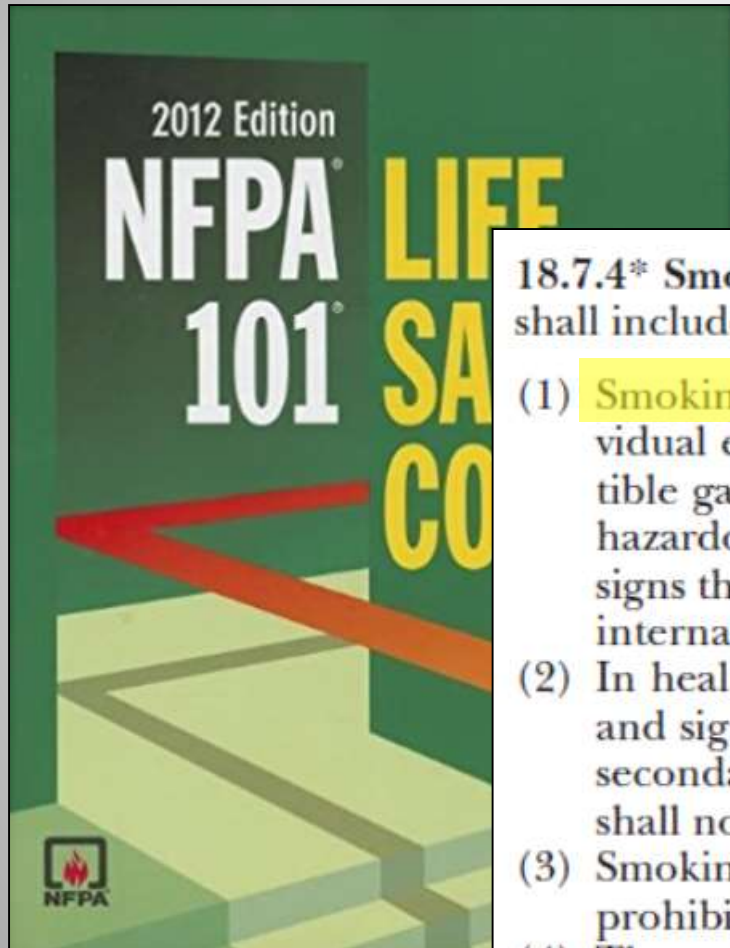
1. Follow CMS Memo S&C 07-10

→ Q&A on small quantities of O₂ cylinders
(will cover with cylinders)

2. LSC-2012: 18/19.7.4 – Smoking

→ “Oxygen” is used only once in the LSC

2. NFPA 101-2012 – Life Safety Code



18.7.4* **Smoking.** Smoking regulations shall be adopted and shall include not less than the following provisions:

- (1) Smoking shall be prohibited in any room, ward, or individual enclosed space where flammable liquids, combustible gases, or oxygen is used or stored and in any other hazardous location, and such areas shall be posted with signs that read NO SMOKING or shall be posted with the international symbol for no smoking.
- (2) In health care occupancies where smoking is prohibited and signs are prominently placed at all major entrances, secondary signs with language that prohibits smoking shall not be required.
- (3) Smoking by patients classified as not responsible shall be prohibited.
- (4) The requirement of 18.7.4(3) shall not apply where the patient is under direct supervision.

Safety Codes on Oxygen

1. Follow CMS Memo S&C 07-10

→ Q&A on safety of O2 cylinders (ers)

2. LSC-2012: 18/19.3.2.4

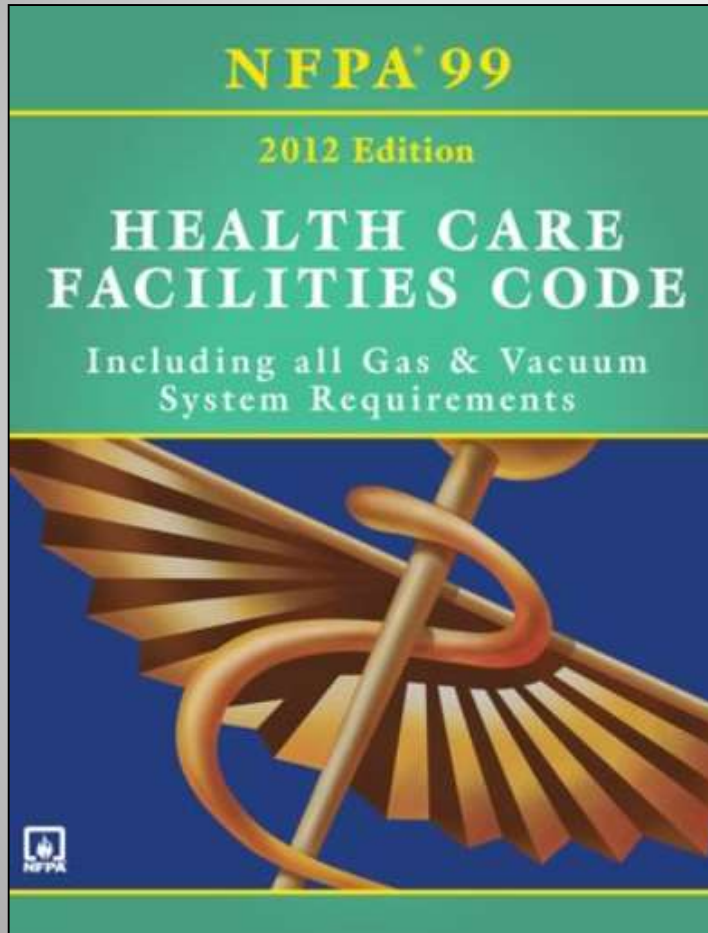
→ "Oxygen" presence in the LSC



3. LSC-2012: 18/19.3.2.4 – Medical Gas

→ Follow NFPA 99-2012

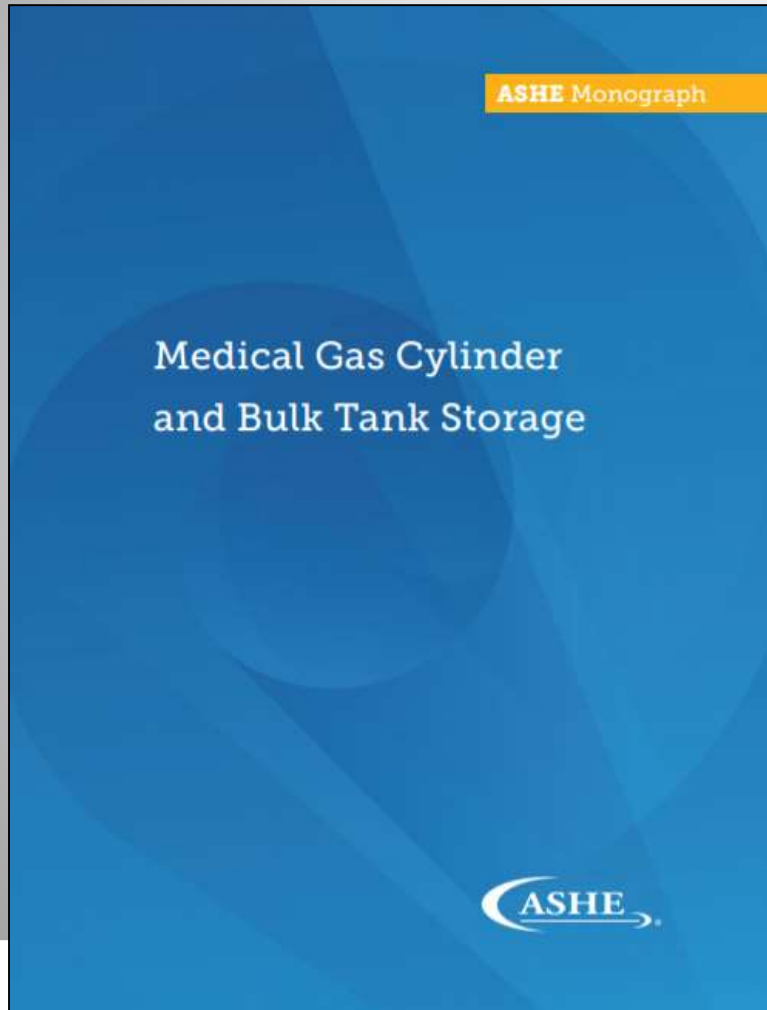
3. NFPA 99-2012 – Healthcare Facilities Code



Chapter 5:
Medical Gases
(piped sys)

Chapter 11:
Gas Equipment
(cylinders)

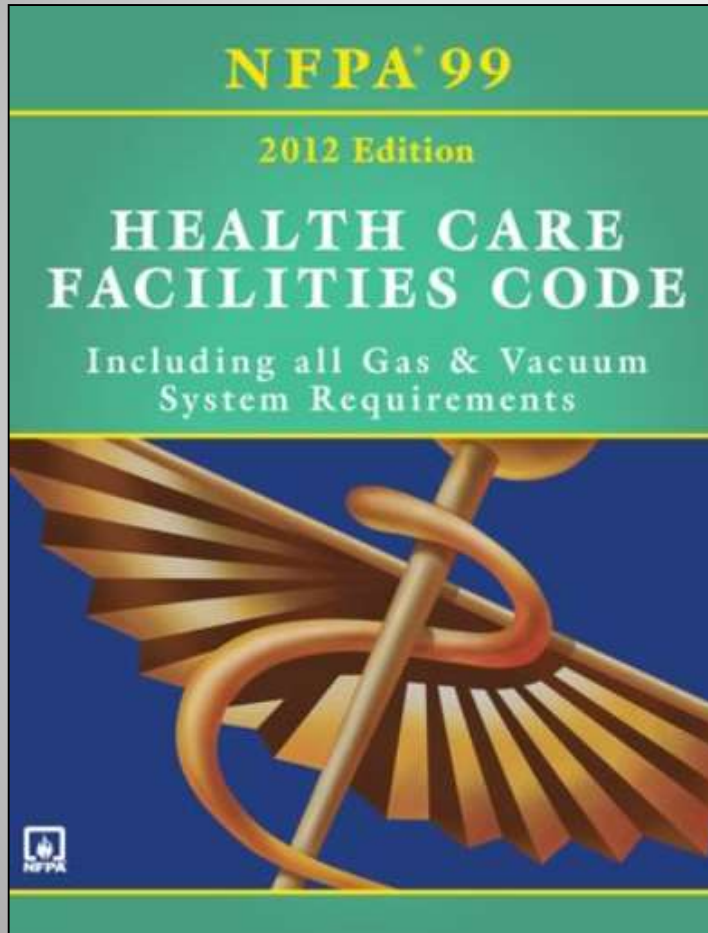
3. NFPA 99-2012 – Healthcare Facilities Code



ASHE's 2012 Monograph

Summary of NFPA 99-2012 Cylinder Requirements

3. NFPA 99-2012 – Healthcare Facilities Code

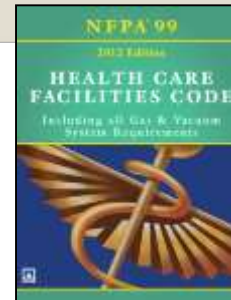


11.6 General Management Program on Cylinders

Required for **ALL**
healthcare facilities that
use medical gas
cylinders

1. Two Main Safety Hazards with Oxygen
2. Applicable Codes
3. Cylinder Management Policy

11.6 Management Program



11.6 Operation and Management of Cylinders.

11.6.1 Administration. Administrative authorities of health care organizations shall provide policies and procedures for safe practices.

11.6.1.1 Purchase specifications shall include the following:

- (1) Specifications for cylinders
- (2) Marking of cylinders, regulators, and valves
- (3) Proper connections on the cylinders supplied to the facility

11.6.1.2 Training procedures shall include the following:

- (1) Maintenance programs in accordance with the manufacturer's recommendations for the piped gas system
- (2) Use and transport of equipment and the proper handling of cylinders, containers, hand trucks, supports, and valve protection caps
- (3) Verification of gas content and mechanical connection specificity of each cylinder or container prior to placing it into service



Must have

Policies

for Safe Practice

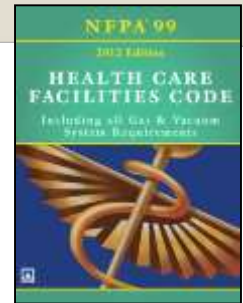
- Purchase Specs on cylinder marking & connections

- Training on

- Piped Gas Sys
- Use & Transport
- Verifications prior to use



11.6 Management Program



11.6.1.3 Policies for enforcement shall include the following:

- (1) Regulations for the storage and handling of cylinders and containers of oxygen and nitrous oxide

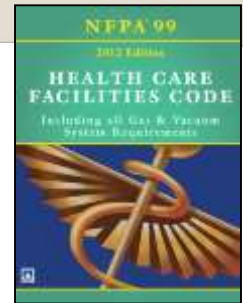
Policies must Include

(1).Rules for Storage





11.6 Management Program



11.6.1.3 Policies for enforcement shall include the following:

- (2) Prompt evaluation of all signal warnings and all necessary measures taken to re-establish the proper functions of the medical gas and vacuum systems

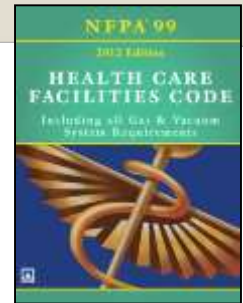
Policies must Include

(2). Prompt Eval of Warnings





11.6 Management Program



11.6.1.3 Policies for enforcement shall include the following:

(3) Organizational capability and resources to cope with a complete loss of any medical gas or vacuum system

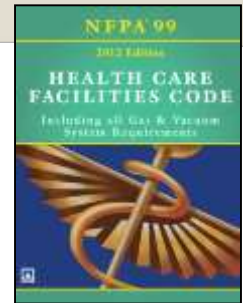
Policies must Include

(3).Response to Full Loss of gas





11.6 Management Program



11.6.1.3 Policies for enforcement shall include the following:

(4) Successful completion of all tests required in 5.1.12.3 prior to the use of any medical gas or vacuum piping system for patient care

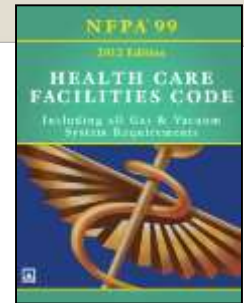
Policies must Include

(4).Installation Testing





11.6 Management Program



11.6.1.3 Policies for enforcement shall include the following:

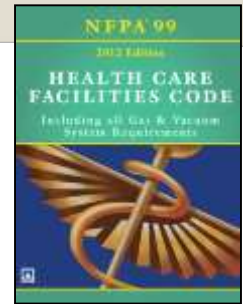
Policies must Include

(5) Locations intended for the delivery vehicle delivering cryogenic liquid to bulk cryogenic liquid systems to remain open and not be used for any other purpose (e.g., vehicle parking, storage of trash containers)

(5).Delivery Access



11.6 Management Program



11.6.2 Special Precautions for Handling Oxygen Cylinders and Manifolds. Handling of oxygen cylinders and manifolds shall be based on CGA G-4, *Oxygen*.

- Follow CGA G-4



Industry

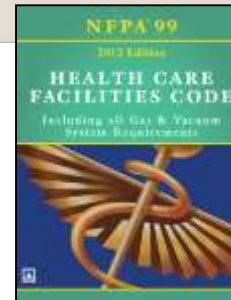
"Standards of Practice"

Referenced by NFPA, OSHA

A collage of various CGA publications. Visible titles include "CGA G-1—2009 ACETYLENE TWELFTH EDITION", "CGA P-1: SAFE HANDLING OF COMPRESSED GASES", "CGA G-7—2004 GUIDE TO PREPARATION OF PRECAUTIONARY LABELING AND MARKING", and "CGA G-4.4: Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems". The CGA logo is also visible at the bottom of the collage. A note at the bottom right of the collage reads "Note: This is not the actual book cover".

63 on-line pages of publications

11.6 Management Program



11.6.2.1 Oxygen cylinders, containers, and associated equipment shall be protected from contact with oil or grease by means of the following specific precautions:

- (1) Oil, grease, or readily flammable materials shall not be permitted to come in contact with oxygen cylinders, valves, pressure reducing regulators, gauges, or fittings.
- (2) Pressure reducing regulators, fittings, or gauges shall not be lubricated with oil or any other flammable substance.
- (3) Oxygen cylinders or apparatus shall not be handled with oily or greasy hands, gloves, or rags.

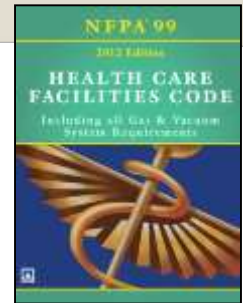
- Grease/Oil Precautions

Oxygen under pressure and hydrocarbons (oil and grease) can react violently, resulting in explosions, fire, and injury to personnel and damage to property. Even a small amount of hydrocarbon can be hazardous in the presence of high oxygen concentrations.



Example of oil in contact with oxygen under pressure. This worker, employed by a construction contractor in Nigeria, had oil on his left hand while adjusting the pressure on an oxygen regulator. There was an oxygen leak at the hose clamp.

11.6 Management Program



11.6.2.2 Equipment associated with oxygen shall be protected from contamination by means of the following specific precautions:

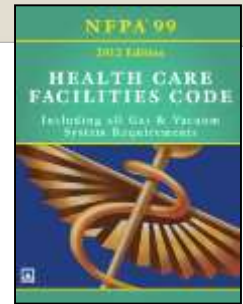
- (1) Particles of dust and dirt shall be cleared from cylinder valve openings by slightly opening and closing the valve before applying any fitting to the cylinder valve.
- (2) The high pressure valve on the oxygen cylinder shall be opened slowly before bringing the apparatus to the patient or the patient to the apparatus.
- (3) An oxygen cylinder shall not be draped with any materials such as hospital gowns, masks, or caps.
- (4) Cylinder-valve protection caps, where provided, shall be kept in place and be hand-tightened, except when cylinders are in use or connected for use.
- (5) Valves shall be closed on all empty cylinders in storage.

Contamination Precautions

- Open/Close prior to attaching
- Open/Close prior to patient use
- Nothing on tank
- Valves closed & capped when not in use



11.6 Management Program



11.6.2.3 Cylinders shall be protected from damage by means of the following specific procedures:

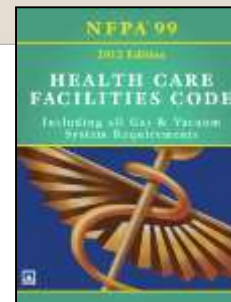
- (1) Oxygen cylinders shall be protected from abnormal mechanical shock, which is liable to damage the cylinder, valve, or safety device.
- (2) Oxygen cylinders shall not be stored near elevators or gangways or in locations where heavy moving objects will strike them or fall on them.
- (3) Cylinders shall be protected from tampering by unauthorized individuals.
- (4) Cylinders or cylinder valves shall not be repaired, painted, or altered.
- (5) Safety relief devices in valves or cylinders shall not be tampered with.
- (6) Valve outlets clogged with ice shall be thawed with warm — not boiling — water.

Damage Precautions

- (1). No Shock
- (2). Avoid Knocking Over
- (3). No Tampering
- (4-5). No Altering
- (6). Thaw w/warm water



11.6 Management Program



11.6.2.3 Cylinders shall be protected from damage by means of the following specific procedures:

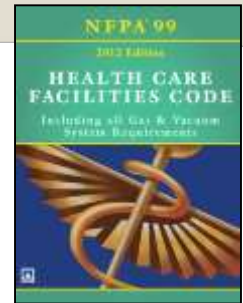
- (7) A torch flame shall not be permitted, under any circumstances, to come in contact with a cylinder, cylinder valve, or safety device.
- (8) Sparks and flame shall be kept away from cylinders.
- (9) Even if they are considered to be empty, cylinders shall not be used as rollers, supports, or for any purpose other than that for which the supplier intended them.
- (10) Large cylinders (exceeding size E) and containers larger than 45 kg (100 lb) weight shall be transported on a proper hand truck or cart complying with 11.4.3.1.

Damage Precautions

- (7).No Torch
- (8).No Flame or Spark
- (9).No Alt. Use
- (10).Transport large tanks with cart



11.6 Management Program



11.6.2.3 Cylinders shall be protected from damage by means of the following specific procedures:

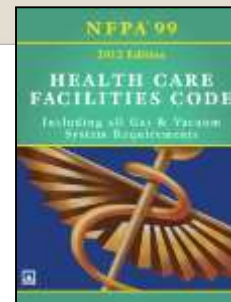
- (11) Freestanding cylinders shall be properly chained or supported in a proper cylinder stand or cart.
- (12) Cylinders shall not be supported by radiators, steam pipes, or heat ducts.

Damage Precautions

- (11). **Always support**
- (12). **Don't chain to heating devices**



11.6 Management Program



11.6.2.4 Cylinders and their contents shall be handled with care, which shall include the following specific procedures:

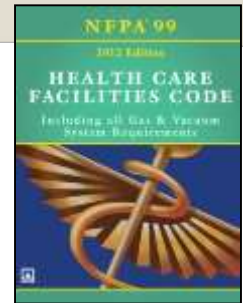
- (1) Oxygen fittings, valves, pressure reducing regulators, or gauges shall not be used for any service other than that of oxygen.
- (2) Gases of any type shall not be mixed in an oxygen cylinder or any other cylinder.
- (3) Oxygen shall always be dispensed from a cylinder through a pressure reducing regulator.
- (4) The cylinder valve shall be opened slowly, with the face of the indicator on the pressure reducing regulator pointed away from all persons.
- (5) Oxygen shall be referred to by its proper name, *oxygen*, not air, and liquid oxygen shall be referred to by its proper name, not liquid air.
- (6) Oxygen shall not be used as a substitute for compressed air.

Handling Precautions

- (1).Use O₂ only for O₂
- (2).Don't mix gases
- (3).Use Regulator
- (4).Valve pointed away
- (5).Use correct terms
- (6).Don't substitute O₂ for air



11.6 Management Program



11.6.2.4 Cylinders and their contents shall be handled with care, which shall include the following specific procedures:

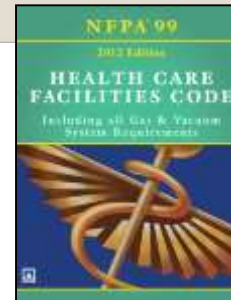
- (7) The markings stamped on cylinders shall not be tampered with, because it is against federal statutes to change these markings.
- (8) Markings used for the identification of contents of cylinders shall not be defaced or removed, including decals, tags, and stenciled marks, except those labels/tags used for indicating cylinder status (e.g., full, in use, empty).
- (9) The owner of the cylinder shall be notified if any condition has occurred that might allow any foreign substance to enter a cylinder or valve, giving details and the cylinder number.
- (10) Neither cylinders nor containers shall be placed in the proximity of radiators, steam pipes, heat ducts, or other sources of heat.
- (11) Very cold cylinders or containers shall be handled with care to avoid injury.

Handling Precautions

- (7).Don't change stamps
- (8).Don't change ID
- (9).Notify tank owner if contaminated
- (10).Don't store near heaters
- (11).Handle with care if very cold



11.6 Management Program



11.6.2.5 Oxygen equipment that is defective shall not be used until one of the following tasks has been performed:

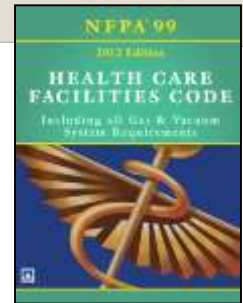
- (1) It has been repaired by competent in-house personnel.
- (2) It has been repaired by the manufacturer or his or her authorized agent.
- (3) It has been replaced.

11.6.2.6 Pressure reducing regulators that are in need of repair or cylinders having valves that do not operate properly shall not be used.

Defective Equip
Precautions



11.6 Management Program



11.6.3 Special Precautions for Making Cylinder and Container Connections.

11.6.3.1 Cylinder valves shall be opened and connected in accordance with the following procedure:

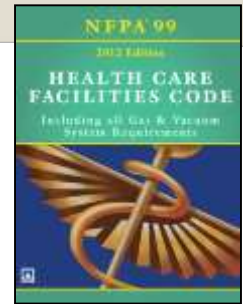
- (1) Make certain that apparatus and cylinder valve connections and cylinder wrenches are free of foreign materials.

Cylinder Connection Precautions

(Refer to full list)



11.6 Management Program

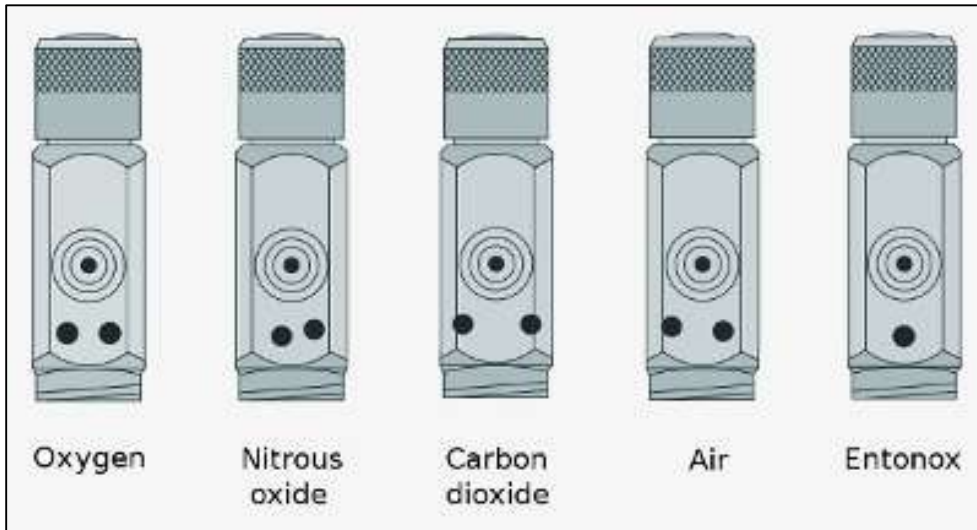


11.6.4 Special Precautions for the Care of Safety Mechanisms.

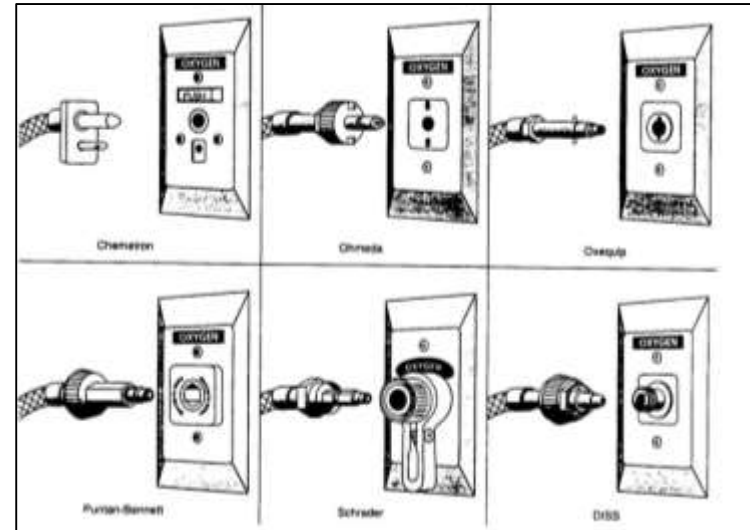
11.6.4.1 Personnel using cylinders and containers and other equipment covered in this chapter shall be familiar with the CGA Pin-Index Safety System and the CGA Diameter-Index Safety System, which are both designed to prevent utilization of the wrong gas.

11.6.4.2 Safety relief mechanisms, noninterchangeable connectors, and other safety features shall not be removed, altered, or replaced.

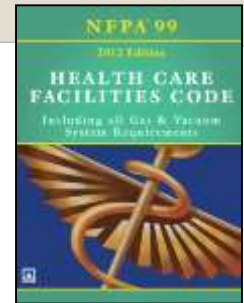
Safety Device Precautions



Pin-Index Safety Sys



Diameter-Index Safety Sys



11.6 Management Program

Most importantly ...

Storage Precautions

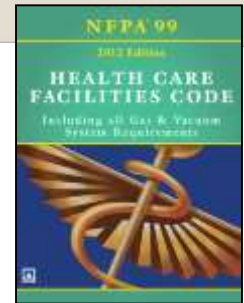
11.6.5 Special Precautions — Storage of Cylinders and Containers.
11.6.5.1 Storage shall be planned so that cylinders can be used in the order in which they are received from the supplier.

- Use in-order



First In ...

First Out



11.6 Management Program

Most importantly ...

Storage Precautions

11.6.5.2 If empty and full cylinders are stored within the same enclosure, empty cylinders shall be segregated from full cylinders.

11.6.5.3 Empty cylinders shall be marked to avoid confusion and delay if a full cylinder is needed in a rapid manner.

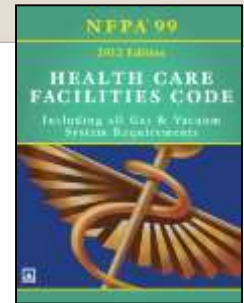
- Separate empty & full

- Mark empties



← Keep Apart →





11.6 Management Program

Most importantly ...

Storage Precautions

11.6.5.2.1 When the facility employs cylinders with integral pressure gauge, it shall establish the threshold pressure at which a cylinder is considered empty.

- **Set empty pressure threshold**



Define: How Much PSI is empty?



Hint: It's NOT zero

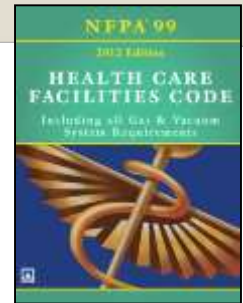
11.6 Management Program

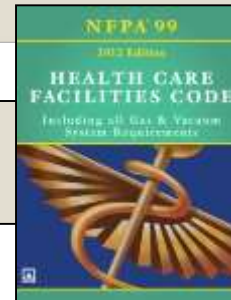
Most importantly ...

Storage Precautions

CMS thought these were so important that it created a special “K-Tag” for them

CMS K923 Tag: “Storage is planned so cylinders are used in order of which they are received from the supplier ... When facility employs cylinders with integral pressure gauge, a threshold pressure considered empty is established”





All Facilities Must have these Policies

Cylinder POLICY contains:

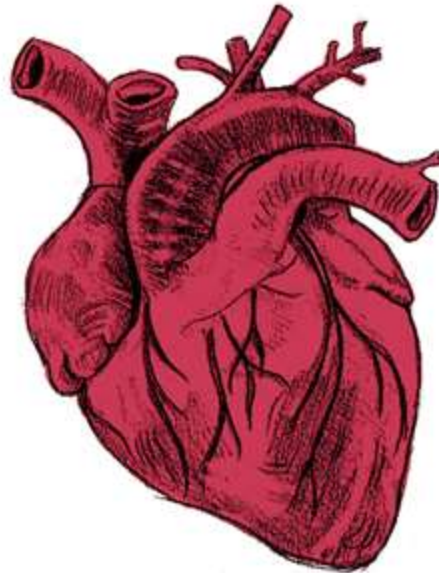
1. Storage
2. Evaluation of Warnings
3. Response to Gas Loss
4. Installation Testing
5. Access to Delivery site

6. Precautions

- Grease/Oil
- Contamination
- Damage
- Handling
- Defective Equip
- Cylinder Connections
- Safety Mechanism
- Storage



Now Let's Get to the **HEART** of the Matter



4 Primary uses of O₂ Cylinders

All Hospitals & Nursing Homes



(1) Stand alone cylinders



Large Nursing Homes

(2) Liquid O₂ cylinders

Small Hospitals



(3) Manifold for a piped oxygen system



Large Hospitals

(4) Bulk oxygen tanks

4 Primary uses of O2 Cylinders

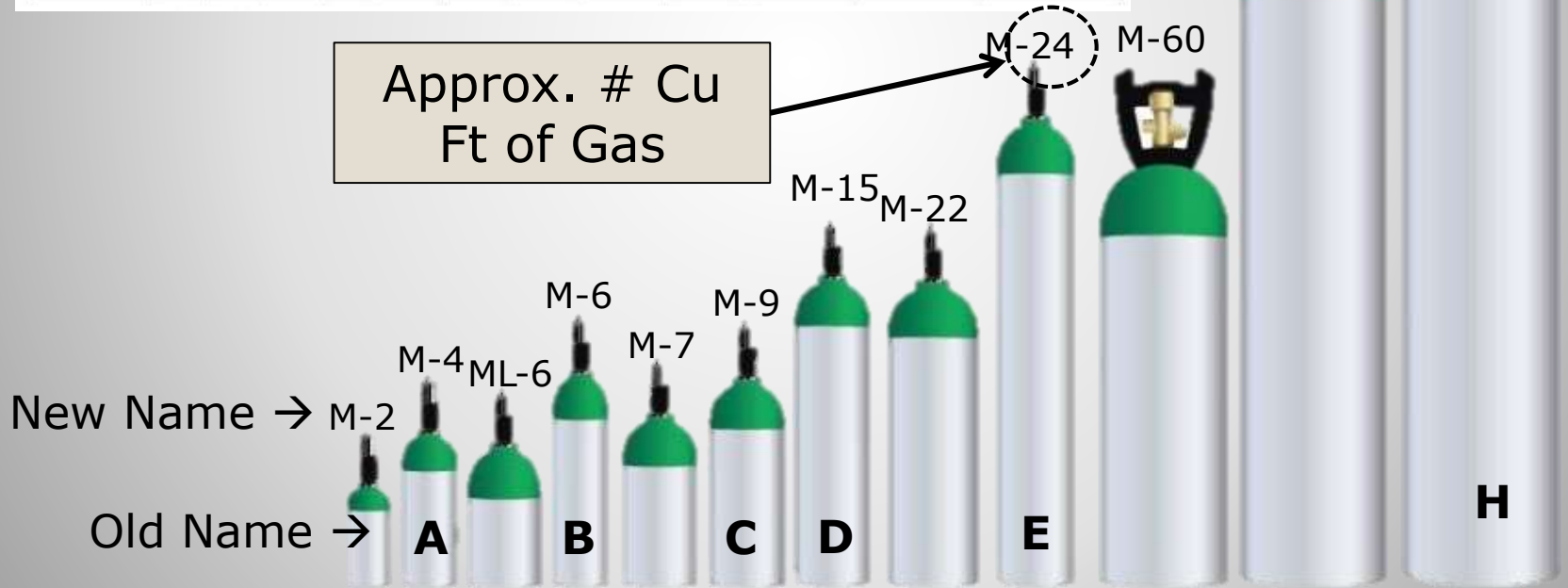
(1) Stand alone cylinders



Cylinder Size Designations

Older Name	A	B	C	D	JD	E	H					
Newer Name	M-2	M-4	ML-6	M-6	M-7	M-9	M-15	M-22	M-24	M-60	M/MM/M122	M250
Diameter (in.)	2.5	3.2	4.3	3.2	4.3	4.3	4.3	5.3	4.3	7.3	8	9
Height (in.)	5.3	8.5	7.6	11.5	9.1	11	16.5	16.5	25.5	23	36	52
Empty Weight (lb)	0.7	1.6	2.8	2.2	3.3	3.7	5.3	8	7.9	22.3	39.5	114
Capacity (L) at 2,200psi	42	113	165	164	198	255	425	640	680	1738	3455	7080
Transport Method	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Wheelchair Bag or Cart	Not Portable	Not Portable	Not Portable
Regulator Type	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 540	CGA 540	CGA 540

Approx. # Cu Ft of Gas



(1) Stand alone cylinders

Four Levels of Use

NOT clearly defined in the 1999 NFPA 99

Much better in 2012 NFPA 99

1-In Use (no limit)

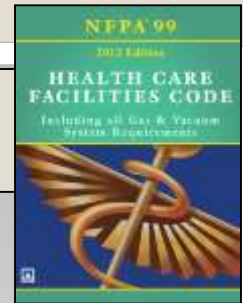
2-Operational Reserve (max 12 E)

3-Unit Supply (max 120 E)

4-Main Storage (max 800 E)

Rated Walls are Required

(1) Stand alone cylinders



Level 1 – In Use (NFPA 99-2012, 11.3.3)



- PRN physician order
- Doesn't need to be in-use (but immediately available to pt)
- No Limit on amount
- No Room Requirements
- Must Protect from falling
- Must not block egress paths
- Not applicable to Liq O2



(1) Stand alone cylinders

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop S2-12-25
Baltimore, Maryland 21244-1850



Center for Medicaid and State Operations/Survey and Certification Group

Ref: S&C-07-10

DATE: January 12, 2007

TO: State Survey Agency Directors

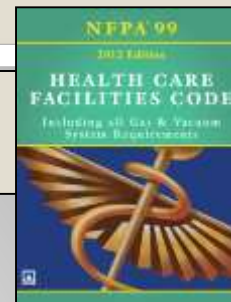
CMS Memo S&C 07-10

Q2. When medical gases are used by patients on a “PRN” basis does the container have to be stored in an approved gas storage room when not being used?

Memorandum Summary

A2. The term “PRN” means “as needed.” An individual cylinder placed in a patient room for immediate use by a patient is not required to be stored in an enclosure and is considered in use. It should be secured to prevent tipping or damage to the cylinder. If the resident does not need the use of oxygen for an extended period of time, such as several days, then the medical gas container should be removed from the room and properly secured in an approved storage room.

corridor of a healthcare facility.



(1) Stand alone cylinders

Level 2 - Operational Reserve

(NFPA 99-2012, 11.3.3)

- Back-Up for In-Use (DO NOT call Storage)
- Can be in open corridor or nrs sta
- Can be in any unrated room
- Must not obstruct egress width
- Must be properly secured
- Limit of 300 CuFt per smoke compartment (~12 E-size cylinders)



E: 12 x 25 CuFt = 300 CuFt

(1) Stand alone cylinders

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop S2-12-25
Baltimore, Maryland 21244-1850



Center for Medicaid and State Operations/Survey and Certification Group

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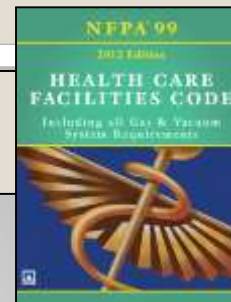
Q1. Can up to 300 cu ft of nonflammable medical gas (12 E sized cylinders) associated with patient care be located outside of an enclosure at locations open to the corridor in a healthcare facility?

- Up to 300 cubic feet of nonflammable medical gas may be accessible as operational supply rather than storage, when properly secured.

A1. Yes, up to 300 cu ft of nonflammable medical gas can be located outside of an enclosure (per smoke compartment) at locations open to the corridor such as at a nurse's station or in a corridor of a healthcare facility.

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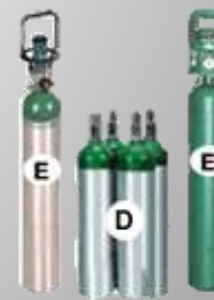
(1) Stand alone cylinders



Level 3: Unit Supply

(NFPA 99-2012, 11.3.2)

- To Replenish Operational Reserve (is **NOT** storage)
- >300 CuFt but $\leq 3,000$ CuFt
(>12 but <120 E-size cylinders)
- Non-Rated Enclosure (Must be Lockable)
- No Ventilation needed
- Combustible materials must be >5' from cylinders of oxygen, unless the tanks are in a rated metal cabinet
- Separate Empty & Full cylinders



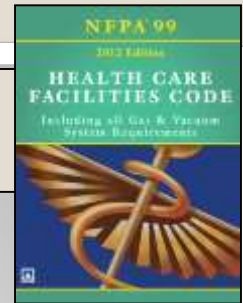
Level 3: Unit Supply

Beware: Many architectural firms will automatically fire rate all walls that have “Oxygen” associated with it, regardless of the quantity of cylinders



If MORE than 120, you need to have rated walls & door

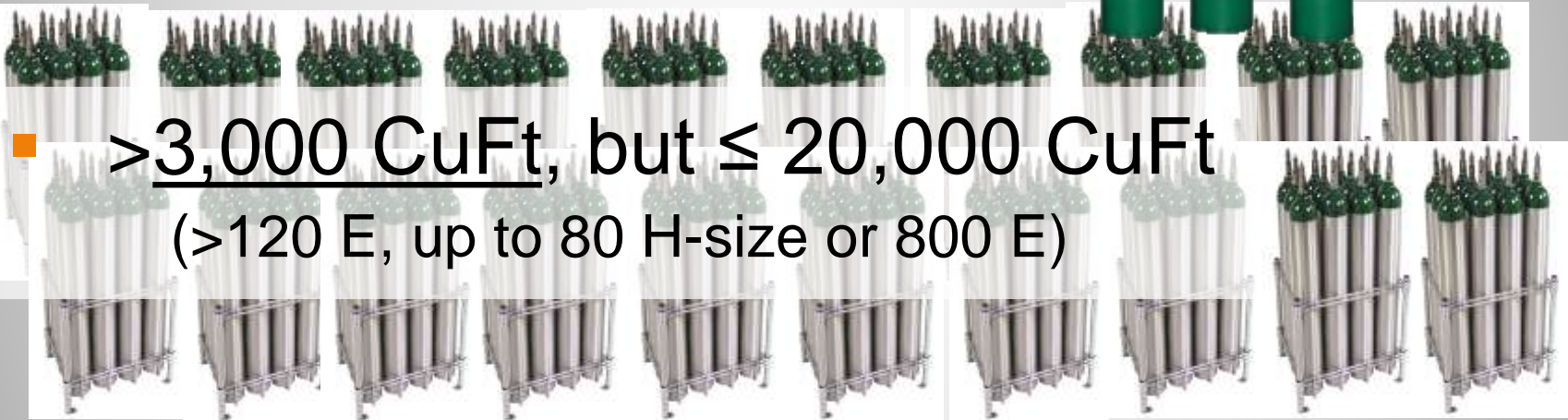
If you rate room un-necessarily, you will be required to forever maintain walls as rated and to annually inspect the door (& be subject to citations) !



(1) Stand alone cylinders

Level 4: Main Storage

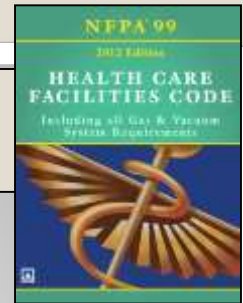
(NFPA 99-2012, 11.3)



- >3,000 CuFt, but ≤ 20,000 CuFt
(>120 E, up to 80 H-size or 800 E)

- Storage shall comply with 5.1.3.3.2 (enclosure) & 5.1.3.3.3 (ventilation)

(1) Stand alone cylinders



Level 4: Main Storage

(NFPA 99-2012, 11.3 → 5.1.3.3.2 & .3)

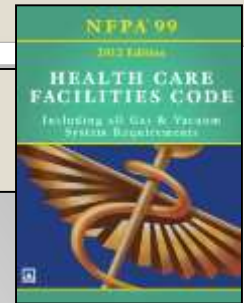
5.1.3.3.2* Design and Construction. Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

- (1) They shall be constructed with access to move cylinders, equipment, and so forth, in and out of the location on hand trucks complying with 11.4.3.1.1.
- (2) They shall be secured with lockable doors or gates or otherwise secured.
- (3) If outdoors, they shall be provided with an enclosure (wall or fencing) constructed of noncombustible materials with a minimum of two entry/exits.

Enclosure

5.1.3.3.2

1. Access to Move Equipment
2. Lockable
3. Outdoor: Non-combustible enclosure; 2 exits



(1) Stand alone cylinders

Level 4: Main Storage

5.1.3.3.2* Design and Construction. Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

- (4) If indoors, they shall be constructed and use interior finishes of noncombustible or limited-combustible materials such that all walls, floors, ceilings, and doors are of a minimum 1-hour fire resistance rating.

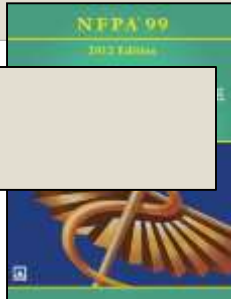
We'll cover **rated** wall & door after the material on oxygen cylinders

Enclosure

5.1.3.3.2

4. Indoor:

- Non-combustible enclosure;
- 1-hr rating



(1) Stand alone cylinders

Level 4: Main Storage

Enclosure

- (5)*They shall be compliant with *NFPA 70, National Electrical Code*, for ordinary locations.
- (6) They shall be heated by indirect means (e.g., steam, hot water) if heat is required.

- 5. NEC compliant
- 6. Indirect heat



NEW

← CMS Compliance
Wis Compliance →

EXISTING

Follow edition in effect
when constructed



(1) Stand alone cylinders

Level 4: Main Storage

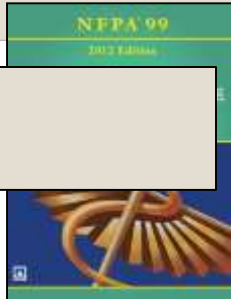
Enclosure

(7) They shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.

7. Cylinder secured



Remember the POWER of the PRESSURE



(1) Stand alone cylinders

Level 4: Main Storage

Enclosure

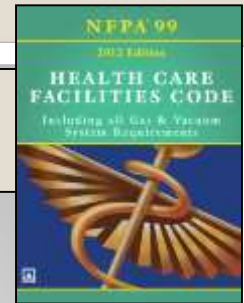
- (8)*They shall be supplied with electrical power compliant with the requirements for essential electrical systems as described in Chapter 6.
- (9) They shall have racks, shelves, and supports, where provided, constructed of noncombustible materials or limited-combustible materials.
- (10) They shall protect electrical devices from physical damage.

- 8. On emerg power
- 9. Non-combustible storage
- 10. Electrical protected from damage



↑
5' above
floor





(1) Stand alone cylinders

PRECAUTIONARY SIGNS

(NFPA 99-2012, 11.3.4.2)

- Prescribed words:

CAUTION:
OXIDIZING GAS(ES) STORED WITHIN
NO SMOKING

- At entrance of rooms that store oxidizing gases
- Readable from 5'
- “NO SMOKING” posted Where O₂ is used

LSC 19.7.4* Smoking (2) In health care occupancies where smoking is prohibited and signs are prominently placed at all major entrances, secondary signs with language that prohibits smoking shall not be required.

(1) Stand alone cylinders

Summary



Four Levels of Use & Requirements

1-In Use (no limit)

2-Operational Reserve (max 12 E)

3-Unit Supply (max 120 E)

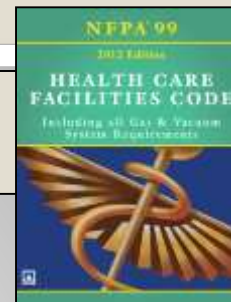
4-Main Storage (max 800 E)

Rated Walls are Required

4 Primary uses of O₂ Cylinders

(2) Liquid O₂ cylinders

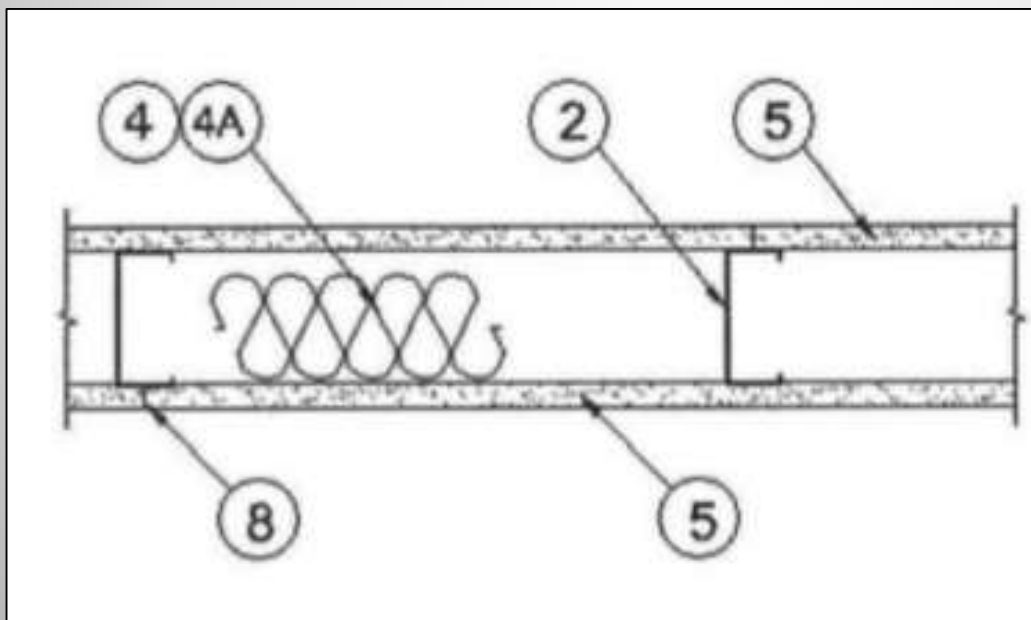




(2) Liquid O2 cylinders

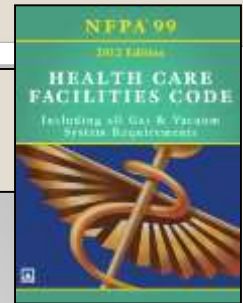
Storage or Transfer (NFPA 99-2012, 11.5.2.3)

- 1-hour Rated enclosure (45 min door & frame)



(2) Liquid O2 cylinders

Storage or Transfer (NFPA 99-2012, 11.5.2.3)



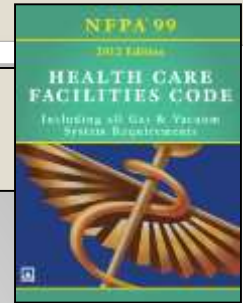
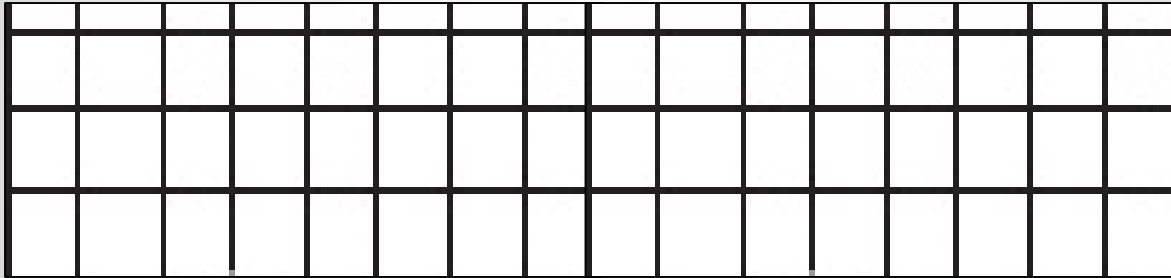
- If Pt Room, must be separated by 1-hr assembly & max 31.6 gal (NFPA 99-2012, 11.7.4)



(2) Liquid O2 cylinders

Storage or Transfer (NFPA 99-2012, 11.5.2.3)

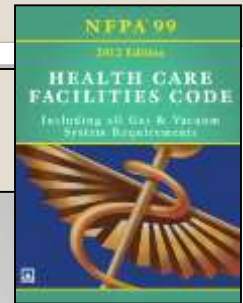
- Ceramic or Concrete flooring

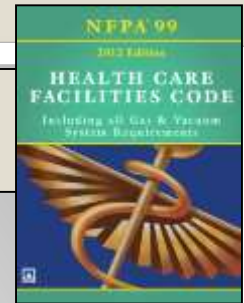


(2) Liquid O2 cylinders

Storage or Transfer (NFPA 99-2012, 11.5.2.3)

- Mechanically ventilated
- Sprinkler protected (may need to upgrade density to ordinary, per NFPA 13, 21.11)
- Electrical fixtures (>60" Above Floor)





(2) Liquid O2 cylinders

Storage or Transfer (NFPA 99-2012, 11.5.2.3)

- Posted Signage that transfilling is occurring & smoking is not permitted (no exception for smoke-free)
- Transfer with door closed
- Continuing Educ of Staff



(2) Liquid O2 cylinders

Summary

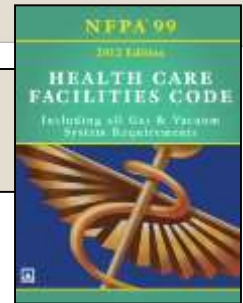
- 1-hour rated enclosure
- Ceramic/concrete flooring
- Mechanically ventilated
- Sprinkler protected
- Electrical fixtures (>60" Above Floor)
- Required Signage
- Transfer with door closed
- Max 31.6 gal (NFPA 99-2012, 11.7.4)
- If Pt Room must be separated by 1-hr assembly



4 Primary uses of O₂ Cylinders

(3) Manifold for a piped oxygen system





(3) Manifold for piped oxygen

Follow Chapter 5 for Piped Sys

5.1.3.5.10.1 The manifolds in this category shall be located in accordance with 5.1.3.3.1 and shall meet the following:

- (1) If located outdoors, they shall be installed in an enclosure used only for this purpose and sited to comply with minimum distance requirements in NFPA 55.
- (2) If located indoors, they shall be installed within a room used only for enclosure of such manifolds.

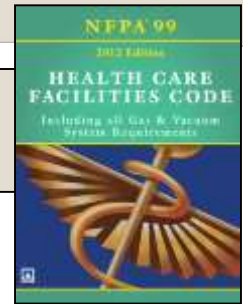
5.1.3.5.10.1

Enclosure

Exclusive use of space for manifold

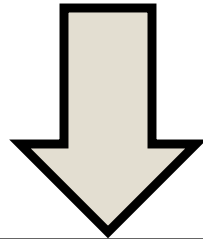


(3) Manifold for piped oxygen



5.1.3.5.10.1 The manifolds in this category shall be located in accordance with 5.1.3.3.1 and shall meet the following:

5.1.3.5.10.2 The manifold locations for this category shall be constructed in accordance with 5.1.3.3.2.

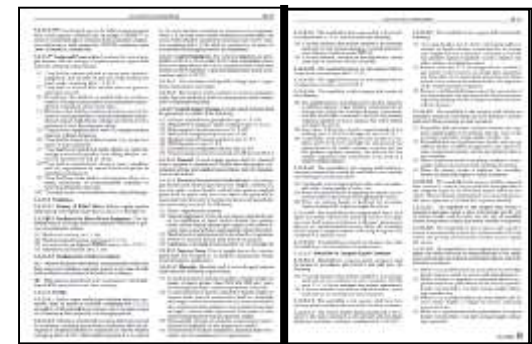


5.1.3.3.2* Design and Construction. Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

- (1) They shall be constructed with access to move cylinders, equipment, and so forth, in and out of the location on hand trucks complying with 11.4.3.1.1.
- (2) They shall be secured with lockable doors or gates or otherwise secured.
- (3) If outdoors, they shall be provided with an enclosure (wall or fencing) constructed of noncombustible materials with a minimum of two entry/exits.
- (4) If indoors, they shall be constructed and use interior finishes of noncombustible or limited-combustible materi-

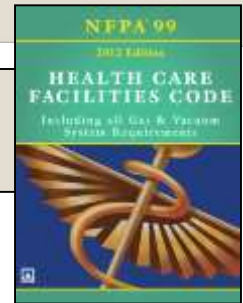
Enclosure

Space
Constructed per
5.1.3.3.2



Must flip to another page

(3) Manifold for piped oxygen



5.1.3.3.2* Design and Construction. Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

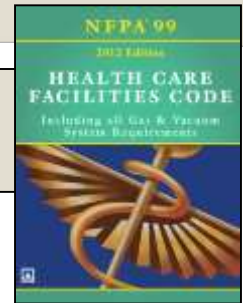
- (1) They shall be constructed with access to move cylinders, equipment, and so forth, in and out of the location on hand trucks complying with 11.4.3.1.1.
- (2) They shall be secured with lockable doors or gates or otherwise secured.

Enclosure

1. Access to Move Equipment
2. Lockable



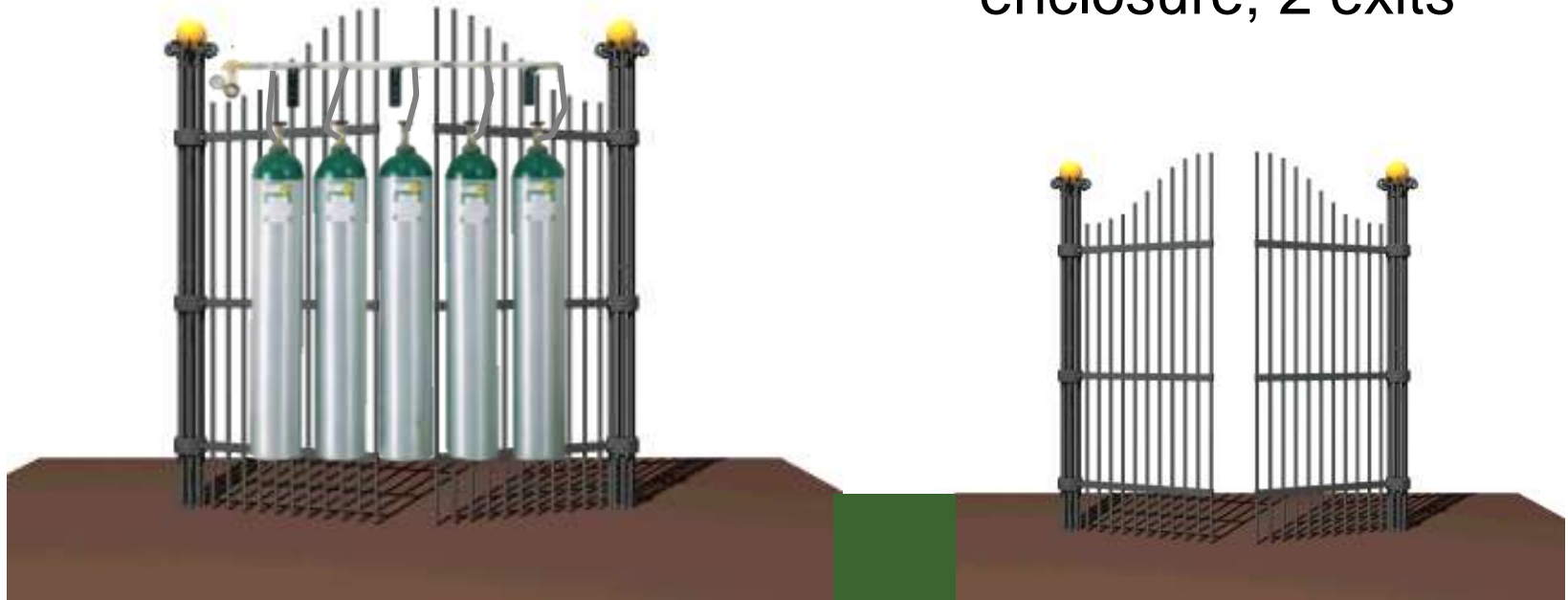
(3) Manifold for piped oxygen



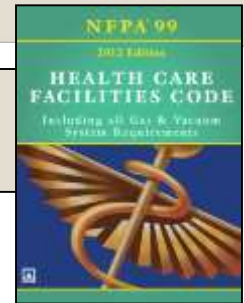
(3) If outdoors, they shall be provided with an enclosure (wall or fencing) constructed of noncombustible materials with a minimum of two entry/exits.

Enclosure

3. Outdoor: Non-combustible enclosure; 2 exits



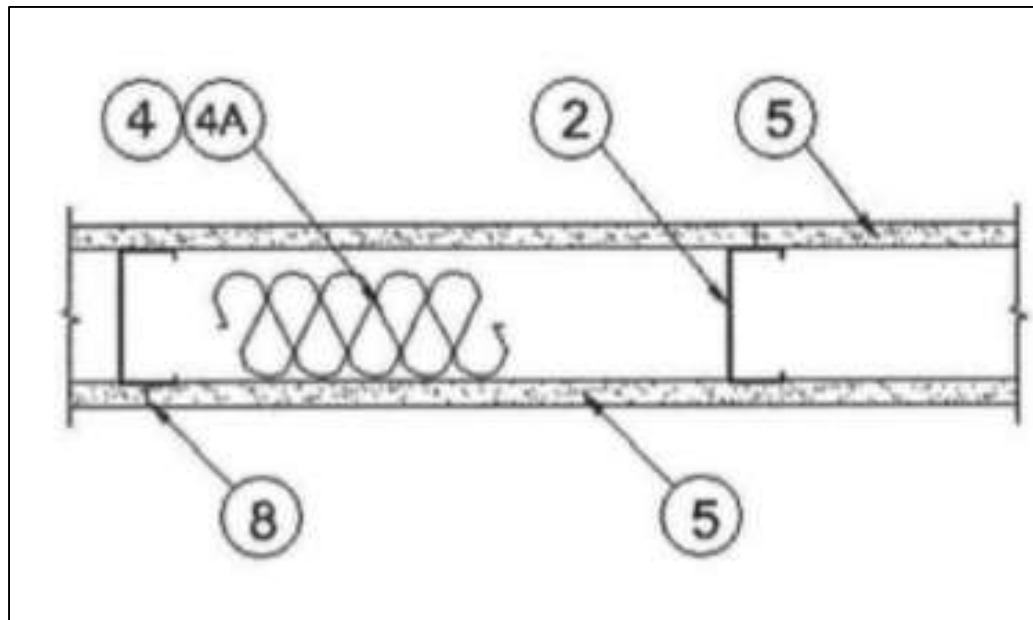
(3) Manifold for piped oxygen



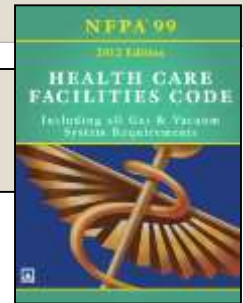
(4) If indoors, they shall be constructed and use interior finishes of noncombustible or limited-combustible materials such that all walls, floors, ceilings, and doors are of a minimum 1-hour fire resistance rating.

Enclosure

4. Indoor: Non-combustible enclosure; 1-hr rating



(3) Manifold for piped oxygen



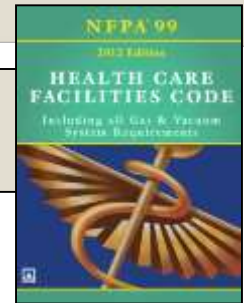
Enclosure

5. NEC compliant
6. Indirect heat
7. Secure Cylinder
8. On emerg power
9. Non-combustible means of storage
10. Electrical protected from physical damage

- (5)*They shall be compliant with *NFPA 70, National Electrical Code*, for ordinary locations.
- (6) They shall be heated by indirect means (e.g., steam, hot water) if heat is required.
- (7) They shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.
- (8)*They shall be supplied with electrical power compliant with the requirements for essential electrical systems as described in Chapter 6.
- (9) They shall have racks, shelves, and supports, where provided, constructed of noncombustible materials or limited-combustible materials.
- (10) They shall protect electrical devices from physical damage.



(3) Manifold for piped oxygen

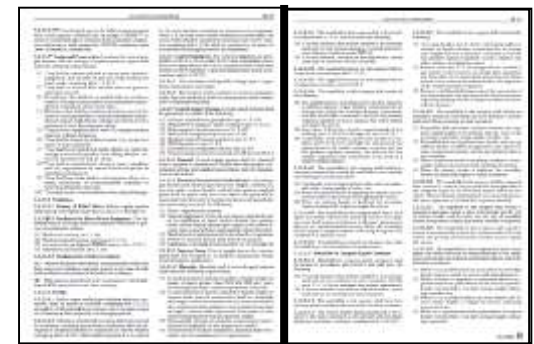


5.1.3.5.10.3

Ventilation

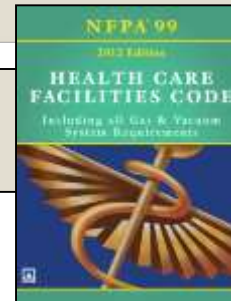
per 5.1.3.3.3

5.1.3.5.10.3 The manifold locations for this category shall be ventilated in accordance with 5.1.3.3.3.



Must flip to another page

(3) Manifold for piped oxygen



5.1.3.3.3 Ventilation.

5.1.3.3.3.1 Venting of Relief Valves. Indoor supply systems shall have all relief valves vented per 5.1.3.5.6.1(4) through (9).

5.1.3.3.3.2 Ventilation for Motor-Driven Equipment. The following source locations shall be adequately ventilated to prevent accumulation of heat:

- (1) Medical air sources (*see 5.1.3.6*)
- (2) Medical-surgical vacuum sources (*see 5.1.3.7*)
- (3) Waste anesthetic gas disposal (WAGD) sources (*see 5.1.3.8.1*)
- (4) Instrument air sources (*see 5.1.3.9*)

5.1.3.3.3.3 Ventilation for Outdoor Locations.

(A) Outdoor locations surrounded by impermeable walls shall have protected ventilation openings located at the base of each wall to allow free circulation of air within the enclosure.

(B) Walls that are shared with other enclosures or with buildings shall be permitted to not have openings.

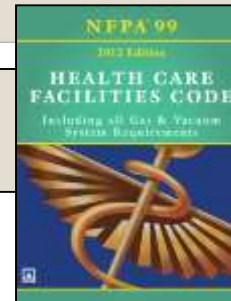
Ventilation

In/Outdoor Different

INDOOR

1. Relief Valve Venting (*see 5.1.3.5.6*)
2. Motors Venting (NOT for O₂)

(3) Manifold for piped oxygen



5.1.3.3.3 Ventilation.

5.1.3.3.3.1 Venting of Relief Valves. Indoor supply systems shall have all relief valves vented per 5.1.3.5.6.1(4) through (9).

5.1.3.3.3.2 Ventilation for Motor-Driven Equipment. The following source locations shall be adequately ventilated to prevent accumulation of heat:

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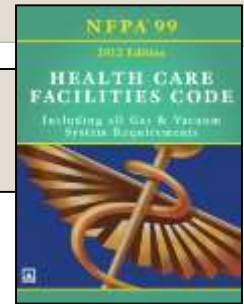
(B) Walls that are shared with other enclosures or with buildings shall be permitted to not have openings.

Ventilation

In/Outdoor Different

OUTDOOR

1. If walls: Low louver on each
2. Except shared walls



(3) Manifold for piped oxygen

5.1.3.5.10* Manifolds for Gas Cylinders Without Reserve Supply.

5.1.3.5.10.4 The manifolds in this category shall consist of the following:

- (1) Two equal headers in accordance with 5.1.3.5.9, each with a sufficient number of gas cylinder connections for an average day's supply, but not fewer than two connections, and with the headers connected to the final line pressure regulator assembly in such a manner that either header can supply the system

10.4 Manifold

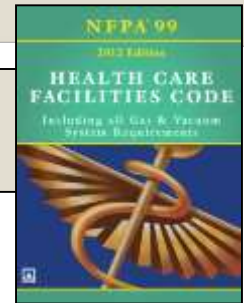
1. Duplicate headers; each sized for 1 day supply; Min 2 tanks

**#1
Primary**



**#2
Reserve**

(3) Manifold for piped oxygen

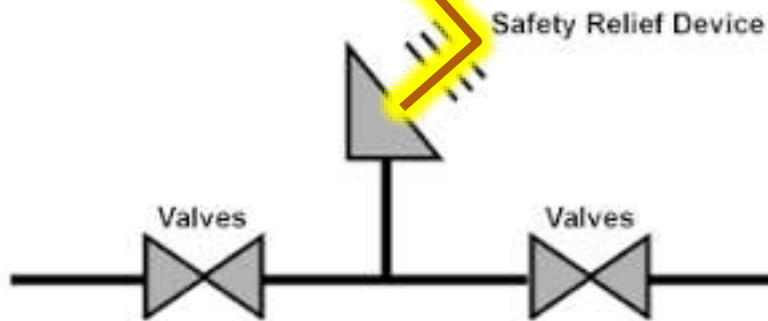


5.1.3.5.10.4 The manifolds in this category shall consist of the following:

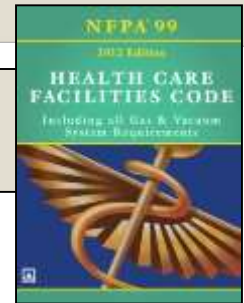
- (2) Vent valves, if fitted on a header, vented outside of the building per 5.1.3.5.6.1(5) through (9) and 5.1.3.5.6.2
- (3) Intermediate relief valve(s), piped to the outside in accordance with 5.1.3.5.6.1(5) through (9), that protects the piping between the header pressure regulator and the line pressure regulator assembly, and protects the line pressure regulators from overpressure in the event of a header regulator failure

10.4 Manifold

- 2. Valves vented to outside enclosure
- 3. Intermediate relief valves vented outside



(3) Manifold for piped oxygen



5.1.3.5.10.5 The manifolds in this category shall include an automatic means of alternating the two headers to accomplish the following in normal operation:

- (1) One header is the primary and the other is the secondary, with either being capable of either role.
- (2) When the primary header is supplying the system, the secondary header is prevented from supplying the system.
- (3) When the primary header is depleted, the secondary header automatically begins to supply the system.

10.5 **Manifold**
Auto header
alternation between
primary & secondary

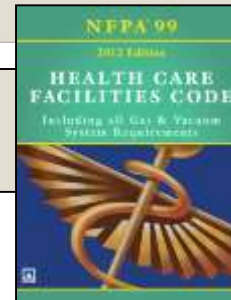


#1
Primary
Reserve



#2
Reserve
Primary

(3) Manifold for piped oxygen



10.6 Manifold

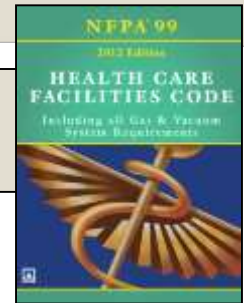
Local visible status signal; signals master alarm panel of switch-over

5.1.3.5.10.6 The manifolds in this category shall have a local signal that visibly indicates the operating status of the equipment and shall activate an indicator at all master alarm panels when or at a predetermined set point before the secondary header begins to supply the system, indicating changeover has occurred or is about to occur.



Local Visual Signal -----> Master Panel Alarm

(3) Manifold for piped oxygen



5.1.3.5.11* Manifolds for Cryogenic Liquid Containers.

5.1.3.5.11.1 Manifolds for cryogenic liquid containers shall be located in accordance with 5.1.3.3.1 and shall meet the following:

- (1) If located outdoors, they shall be installed in an enclosure used only for the enclosure of such containers. *[See Figure A.5.1.3.5.12(a) for minimum citing distance requirements.]*
- (2) If located indoors, they shall be installed within a room used only for the enclosure of such containers.

5.1.3.5.11.2 The manifolds in this category shall have their primary and secondary headers located in the same enclosure.

5.1.3.5.11.3 The reserve header shall be permitted to be located in the same enclosure as the primary and secondary headers or in another enclosure compliant with 5.1.3.5.11.1.

5.1.3.5.11.4 The manifolds in this category shall consist of the following:

- (1) Two equal headers per 5.1.3.5.9, each having sufficient number of liquid container connections for an average day's supply, and with the headers connected to the final line pressure regulator assembly in such a manner that either header can supply the system

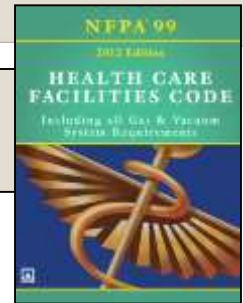
11 Manifold (If Cryogenic)

Many requirements

See full 5.1.3.5.11

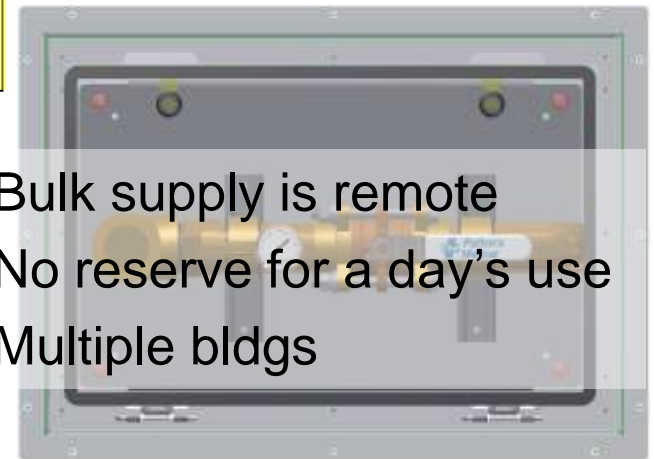


(3) Manifold for piped oxygen



13 Emerg Connection

Connection for temp supply for emergency or maintenance:



- 1- Bulk supply is remote
- 2- No reserve for a day's use
- 3- Multiple bldgs

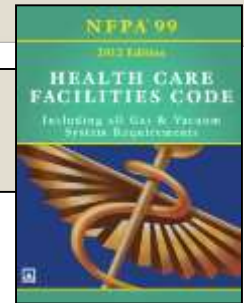
5.1.3.5.13* Emergency Oxygen Supply Connection (EOSC).
Emergency oxygen supply connections (EOSCs) shall be installed to allow connection of a temporary auxiliary source of supply for emergency or maintenance situations where any of the following conditions exist:

- (1) The bulk cryogenic liquid central supply system is outside of and remote from the building that the oxygen supply serves.
- (2) There is no connected oxygen reserve sufficient for an average day's supply within the building. (see 5.1.3.5.14 for requirements for such reserves).
- (3) Multiple freestanding buildings are served from a single oxygen source such that damage to the interconnecting oxygen line could result in one or more buildings losing oxygen supply, in which case each building is required to be provided with a separate emergency connection.

HIGH RISK SITUATIONS

High Severity
High Possibility

(3) Manifold for piped oxygen

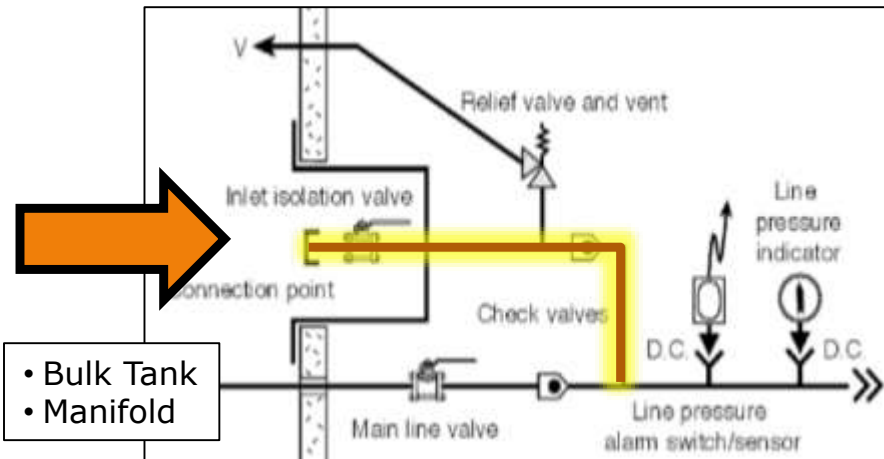


5.1.3.5.13.1 EOSCs shall be located as follows:

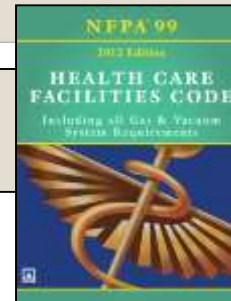
- (1) Located on the exterior of the building being served in a location accessible by emergency supply vehicles at all times in all weather conditions
- (2) Connected to the main supply line immediately downstream of the main shutoff valve

13.1 Emerg Connection

- (1) Bldg Exterior;
access at all times
- (2) Downstream of
Main Shutoff Valve



(3) Manifold for piped oxygen



5.1.3.5.13.2 EOSCs shall consist of the following:

- (1) Physical protection to prevent unauthorized tampering
- (2) Female DN (NPS) inlet for connection of the emergency oxygen source that is sized for 100 percent of the system demand at the emergency source gas pressure
- (3) Manual shutoff valve to isolate the EOSC when not in use
- (4) Two check valves, one downstream of the EOSC and one downstream of the main line shutoff valve, with both upstream from the tee connection for the two pipelines
- (5) Relief valve sized to protect the downstream piping system and related equipment from exposure to pressures in excess of 50 percent higher than normal line pressure
- (6) Any valves necessary to allow connection of an emergency supply of oxygen and isolation of the piping to the normal source of supply
- (7) Minimum of 1 m (3 ft) of clearance around the EOSC for connection of temporary auxiliary source

13.2 Emerg Connection

- (1) Physical protection
- (2) Female inlet
- (3) Manual iso valve
- (4) Two check valves
- (5) Relief valve
- (6) Added valves
- (7) 3' Clearance

(3) Manifold for a piped oxygen system

Summary

- Located inside or outside
- Lockable & Enclosed (1hr if inside)
- On Emerg Power
- Ventilation/Louvers
- Min Two Manifolds
- Auto Switch-Over
- Emerg Connection



4 Primary uses of O₂ Cylinders

(4) Bulk Oxygen Tanks



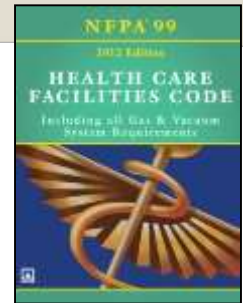
Bulk Oxygen Leaks Have Occurred

Brazed Joint Failure; 8000 gal spill



University of Alabama Hospital
Jan 2004

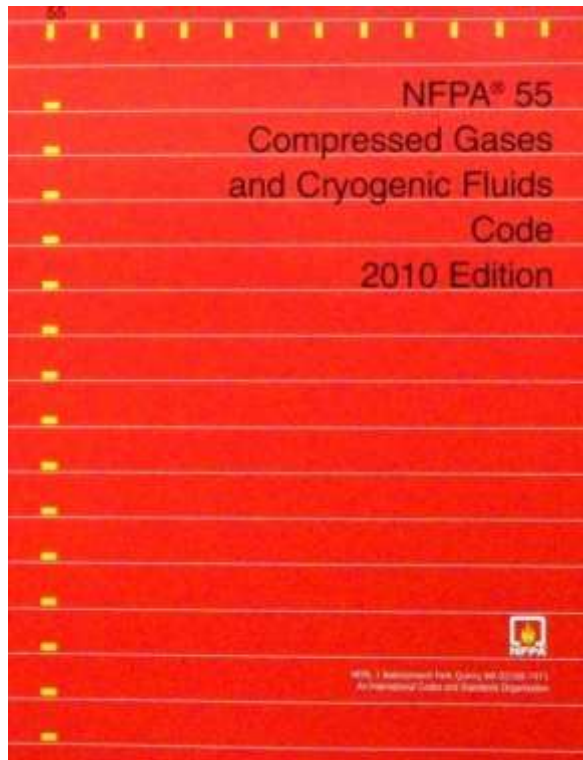
(4) Bulk Oxygen Tanks



5.1.3.5.12* Bulk Cryogenic Liquid Systems.

5.1.3.5.12.1 Bulk cryogenic liquid storage systems shall be in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

Follow **NFPA 55**
2010 edition



Chapter 9 Bulk Oxygen Systems

Chapter 9 is shorter than
NFPA 99 on Oxygen

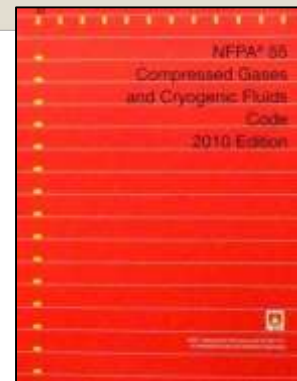
Primary Topics:

- Clearances
- Piping
- Equipment

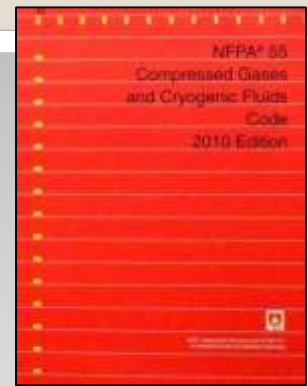
Exposure Table 9.3.2 (Clearances)

Distance (See 9.3.2)

Type of Exposure	ft
(1) Buildings of Type I and II construction as defined by the building code	1
(2) Buildings of Type III, IV, or V construction as defined by the building code	50
(3) Wall openings as measured from high-pressure gas or liquefied gas regulators, pressure relief devices, vaporizers, manifolds, and interconnected piping	10
(4) Property lines	5
(5) Public sidewalks	10
(6) Public assembly	50
(7) Areas occupied by nonambulatory patients as measured from the primary pressure relief device discharge vent and from filling and vent connections	50
(8) Parked vehicles	10
(9) Exterior walls that encroach on the container to form a court with three or more sides	See 8.13.2.7.
(10) All classes of flammable and combustible liquids above ground (See 9.3.2.2.)	
(a) 0 gal to 1000 gal (0 to 3785 L)	25
(b) Over 1000 gal (3785 L)	50
(11) All classes of flammable and combustible liquids in belowground tanks or vaults	
(a) Horizontal distance from oxygen storage container to tank or vault	15
(b) Horizontal distance from oxygen storage container to filling and vent connections or other openings to tank or vault	25
(12) Flammable gases aboveground	
(a) Liquefied hydrogen (any quantity)	75
(b) Other liquefied gas, 0 gal to 1000 gal (0 L to 3785 L)	25
(c) Other liquefied gas, over 1000 gal (3785 L)	50
(d) Nonliquefied or dissolved gases, 0 scf to 25,000 scf (0 m ³ to 708 m ³)	25
(e) Nonliquefied or dissolved gases, over 25,000 scf (708 m ³)	50
(13) Rapidly burning solids, including, but not limited to, excelsior, paper, or combustible waste	50
(14) Slowly burning solids, including, but not limited to, heavy timber or coal	25
(15) Inlets to underground sewer or drainage systems from liquid delivery connections, pressure relief device outlets, mobile supply equipment, and liquid withdrawal connections	8
(16) Areas below connections where liquid can fall during loading or unloading operations and system operation from combustible surfaces, including, but not limited to, asphalt or bitumastic paving and expansion joint fillers (See 9.3.2.3.)	3
(17) Encroachment by overhead utilities	
(a) Horizontal distance from the vertical plane below the nearest overhead wire of an electric trolley, train, or bus line	50
(b) Horizontal distance from the vertical plane below the nearest overhead electrical wire other than those noted in (a)	5
(c) Piping containing other hazardous materials	15



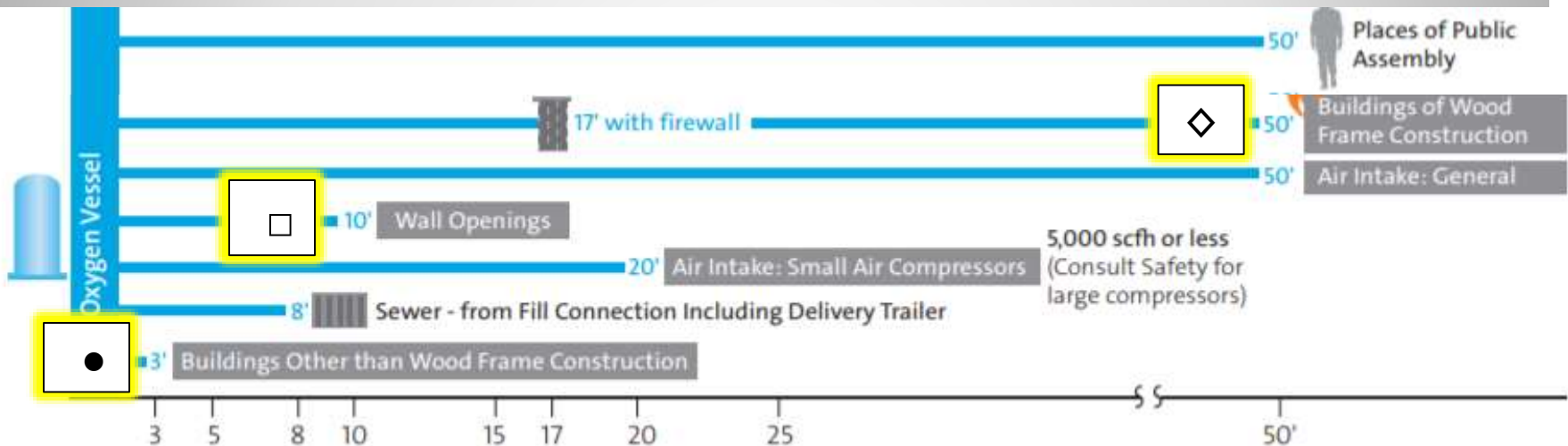
9.3.2.1* The distances shown in items 2, 4, 5, 8, and 10 through 14 of Table 9.3.2 shall not apply where a fire barrier wall having a minimum fire resistance of 2 hours interrupts the line of sight between uninsulated portions of the bulk storage system and the exposure.



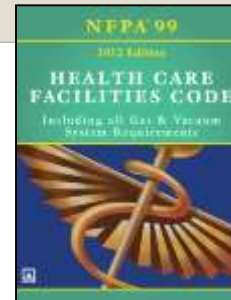
(4) Bulk Oxygen Tanks

Min. Clearances to Structures

(Bar Chart format)



- ◇ 50' - Wood Structures
- 10' - Windows & Doors
- 3' - Non-Wood Structures



(4) Bulk Oxygen Tanks

5.1.3.5.12.2 Bulk cryogenic liquid systems shall have the following protections:

- (2) Meet the requirements of 5.1.3.3.2(1)
- (3) Meet the requirements of 5.1.3.3.2(8)
- (4) Meet the requirements of 5.1.3.3.2(10)



5.1.3.3.2* **Design and Construction.** Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

(1) They shall be constructed with access to move cylinders, equipment, and so forth, in and out of the location on hand trucks complying with 11.4.3.1.1.

(8)*They shall be supplied with electrical power compliant with the requirements for essential electrical systems as described in Chapter 6.

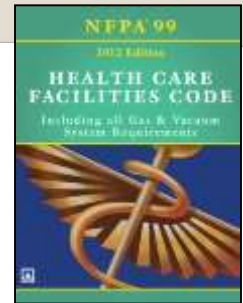
(10) They shall protect electrical devices from physical damage.

2.(2)-(4) **Enclosure**
per 5.1.3.3.2

(same as manifold requirements on slides 74-78)

1. Accessible to Move Equipment
8. On emerg power
10. Electrical protected from damage

(4) Bulk Oxygen Tanks



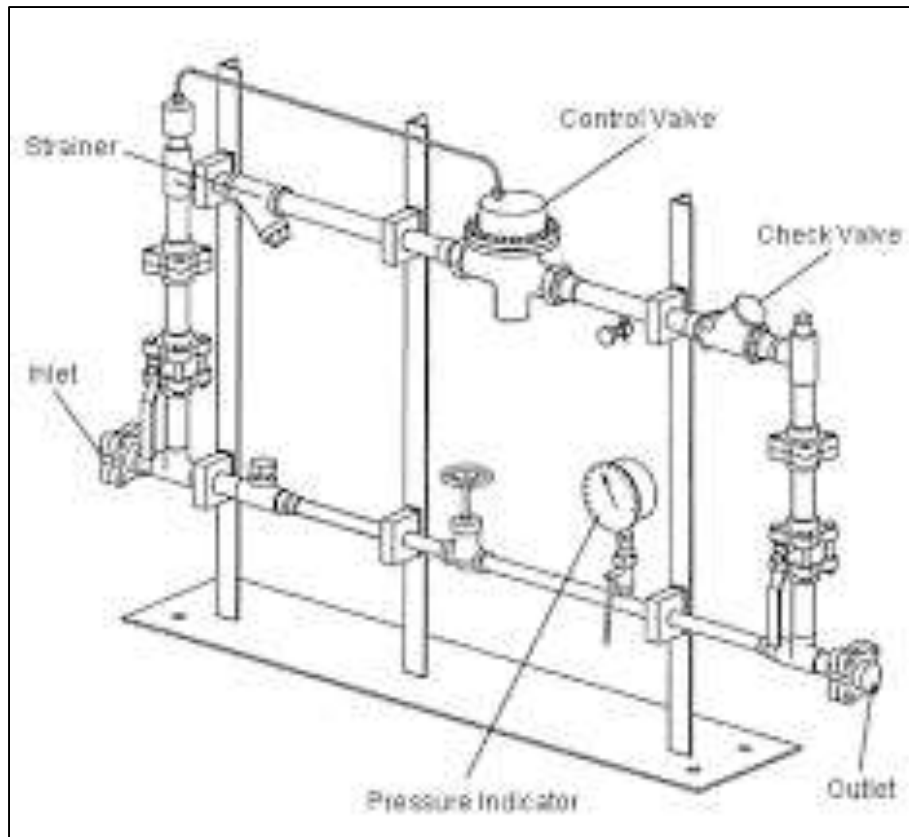
5.1.3.5.12.2 Bulk cryogenic liquid systems shall have the following protections:

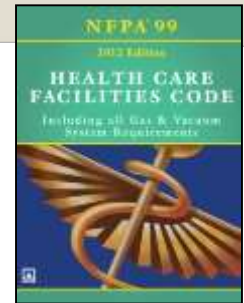
(5) Be installed meeting the requirements in 5.1.10.1 through 5.1.10.4.7

2.(5) Piping

Per 5.1.10

(see extensive piping requirements)





(4) Bulk Oxygen Tanks

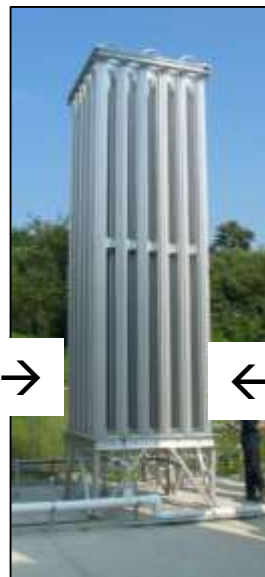
5.1.3.5.12.2 Bulk cryogenic liquid systems shall have the following protections:

(6) Have a minimum work space clearance of 3 ft (1 m) around the storage container, vaporizer(s), and the cabinet opening or front side of the pressure regulating manifold for system maintenance and operation

2.(6) **Clearance**
Min 3' around tanks, vaporizer & manifold



Vaporizer



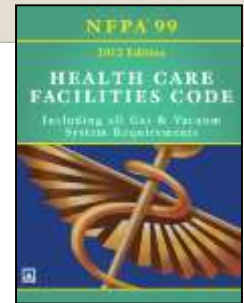
Reserve



Manifold



(4) Bulk Oxygen Tanks



5.1.3.5.12.3 Bulk cryogenic liquid sources shall include automatic means to provide the following functions:

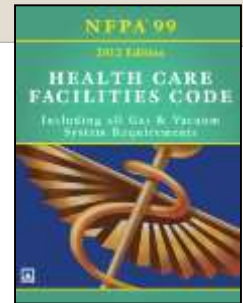
- (1) When the main supply is supplying the system, the reserve supply shall be prevented from supplying the system until the main supply is reduced to a level at or below the reserve activation pressure.
- (2) When the main supply cannot supply the system, the reserve supply shall automatically begin to supply the system.
- (3) Where there is more than one main supply vessel, the system shall operate as described in 5.1.3.5.11 for primary, secondary, and reserve operation.
- (4) Where there are two or more cryogenic vessels, they shall be permitted to alternate (e.g., on a timed basis) in the roles of primary, secondary, and reserve, provided that an operating cascade (primary–secondary–reserve) as required in 5.1.3.5.11.4 is maintained at all times.
- (5) Where a cryogenic vessel is used as the reserve, the reserve vessel shall include a means to conserve the gas produced by evaporation of the cryogenic liquid in the reserve vessel and to discharge the gas into the line upstream of the final line regulator assembly as required by 5.1.3.5.11.6.

3.(1-5) Auto Controls

Main to Reserve Switch-over Rules

- (1) Switch to Reserve based on pressure
- (2) Auto Switch-Over
- (3,4) If 2 Main Tanks
- (5) Method to conserve gas if on Reserve

(4) Bulk Oxygen Tanks



5.1.3.5.12.4* The bulk systems shall have a local signal that visibly indicates the operating status of the equipment and an indicator at all master alarms under the following conditions:

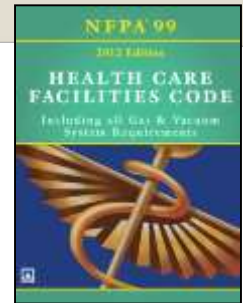
- (1) When or at a predetermined set point before the main supply reaches an average day's supply, indicating low contents
- (2) When or at a predetermined set point before the reserve supply begins to supply the system, indicating reserve is in use
- (3) When or at a predetermined set point before the reserve supply contents fall to one day's average supply, indicating reserve low
- (4) If the reserve is a cryogenic vessel, when or at a predetermined set point before the reserve internal pressure falls too low for the reserve to operate properly, indicating reserve failure
- (5) Where there is more than one main supply vessel, when or at a predetermined set point before the secondary vessel begins to supply the system, indicating changeover

4.(1-5) Signals

Local & Master Alarm Conditions

- (1) Low Main
- (2) Reserve in use
- (3) Low Reserve (1d)
- (4) Reserve Failure
- (5) Secondary in use

(4) Bulk Oxygen Tanks



13 Emerg Connection

Connection for temp supply for emergency or maintenance, if:

- 1- Bulk supply is remote
- 2- No reserve for a day's use
- 3- Multiple bldgs

5.1.3.5.13* Emergency Oxygen Supply Connection (EOSC). Emergency oxygen supply connections (EOSCs) shall be installed to allow connection of a temporary auxiliary source of supply for emergency or maintenance situations where any of the following conditions exist:

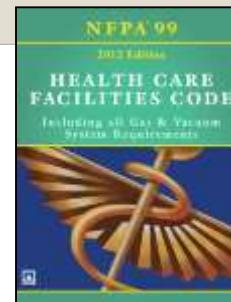
- (1) The bulk cryogenic liquid central supply system is outside of and remote from the building that the oxygen supply serves.
- (2) There is no connected oxygen reserve sufficient for an average day's supply within the building. *(see 5.1.3.5.14 for requirements for such reserves).*
- (3) Multiple freestanding buildings are served from a single oxygen source such that damage to the interconnecting oxygen line could result in one or more buildings losing oxygen supply, in which case each building is required to be provided with a separate emergency connection.

Refer to slides 103-105 at Manifold Sys for EOSC Requirements



Fig. 1 Potential for trapping liquid between valves.

(7) Bulk Oxygen Tanks



11.5.2.1 Qualification and Training of Personnel.

11.5.2.1.5 If a bulk cryogenic system is present, the supplier shall provide annual training on its operation.

Annual Training



- By Supplier
- For Facility Med Gas Maintenance



Summary

> 20,000 cf

- Follow NFPA 55
- Exterior Located
- Secured & Separated
- Concrete Pad under tank & delivery apron
- Loading location always available
- Min Separation Distances to cars, sidewalks, buildings, etc.



RATED WALL Requirements

REQUIRED AT:

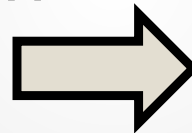
- >3,000 CuFt Cylinder Storage (>120 E tanks)
- Manifold Rooms
- Liquid Oxygen Storage

Rated Walls must comply with these elements:

1. Proper Wall Construction
2. Drywall Seams & Screws
3. Holes & Patches in wall
4. Top of Wall joint
5. Side-Wall joints
6. Fire-Stopped Penetrations

1. Build per the Listed Design

Follow the design
rules
EXACTLY



Save the Design Documents to defend construction when future inspectors question it

UL ONLINE CERTIFICATIONS DIRECTORY

Design No. U465
BXUV.U465
Fire Resistance Ratings - ANSI/UL 263

Page Notation

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Listed or Classified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered as Classified, Listed, or Recognized.

Fire Resistance Ratings - ANSI/UL 263

See General Information for Fire Resistance Ratings - ANSI/UL 263

Design No. U465
December 16, 2011
Nonbearing Wall Rating - 1 HR.

1. Floor and Ceiling Beams - (Not shown) - Channel shaped beams, 3-1/2 in. deep (min), 1-1/4 in. legs, formed from min. No. 25 MSK galv. steel, attached to floor and ceiling with fasteners spaced 24 in. OC max.

1A. Framing Members* - Floor and Ceiling Beams - (Not shown) - As an alternate to Item 1 - Channel shaped, min 3-1/2 in. deep, attached to floor and ceiling with fasteners 24 in. OC max.

ALLSTEEL & GYPSUM PRODUCTS INC - Type SUPREME Framing System

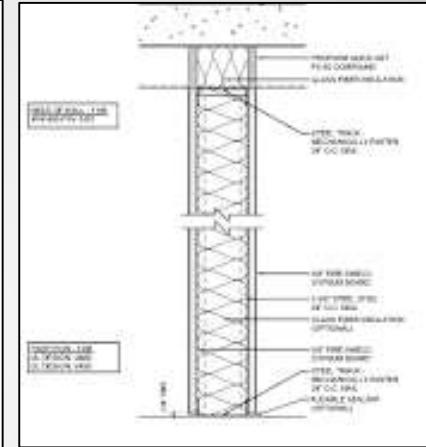
CONSOLIDATED FABRICATORS CORP.
BUILDING PRODUCTS DIV - Type SUPREME Framing System

QUAIL RUN BUILDING MATERIALS INC - Type SUPREME Framing System

1. Have proper thickness of drywall, block, etc..

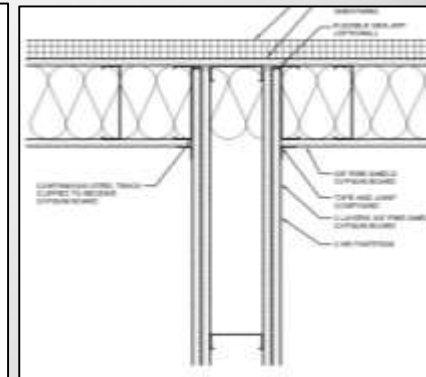
1-hr Rating

- Two 1/2" layers on both sides
- One 5/8" on both sides
- 3" Clay Tile + 5/8" both sides
- 4" Block
- 2-3/4" Concrete



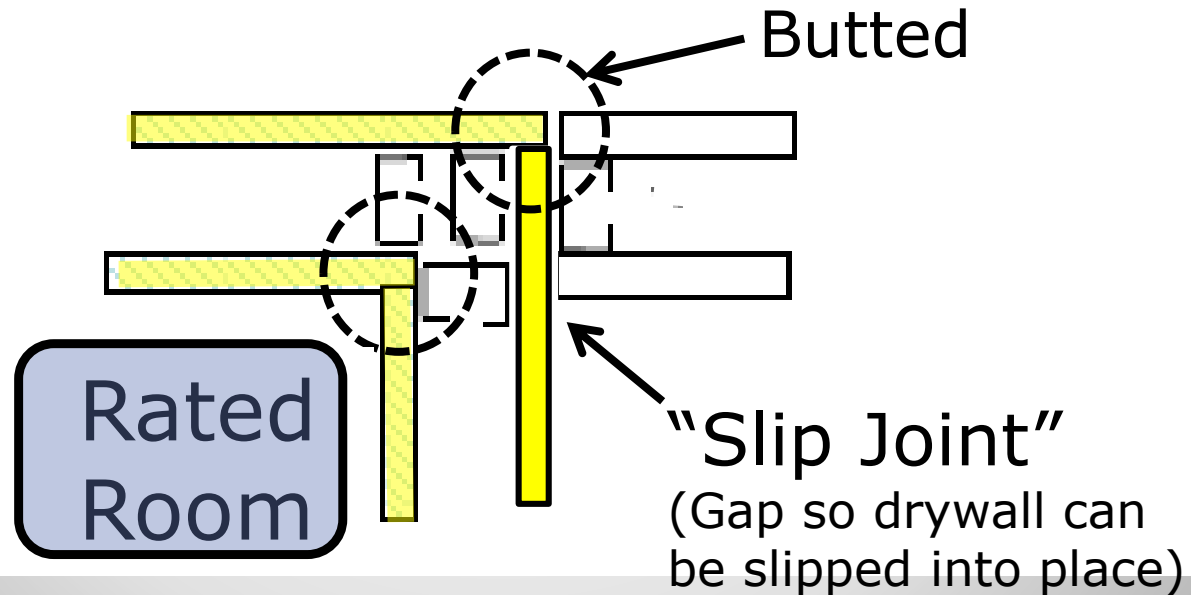
2-hr Rating

- Two 5/8" layers on both sides
- 6" Clay Tile + 5/8" both sides
- 8" Block
- 4" Concrete



1. Edge must **butt against** another rated wall edge

Drywall on rated walls must be continuous, even around corners & intersections



2. Seam Taping & Screw Covering

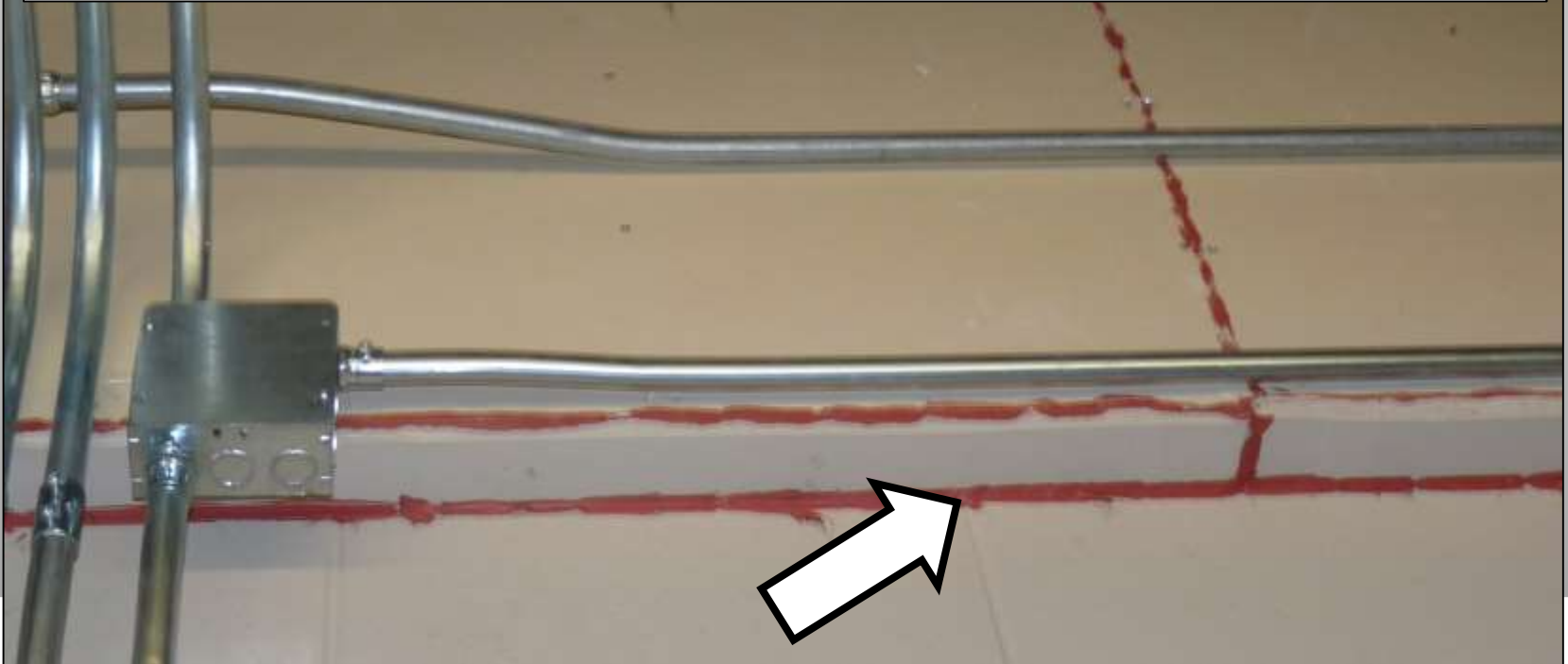
- Must have two layers of joint compound on tape seams and screws (unless listing document authorizes otherwise)

Should not be able to see tape or screws



2. Seam Taping & Screw Covering

Fire stop is **NOT** normally accepted by inspectors as a joint seal unless have written documentation from listing agency



3. Drywall Patches

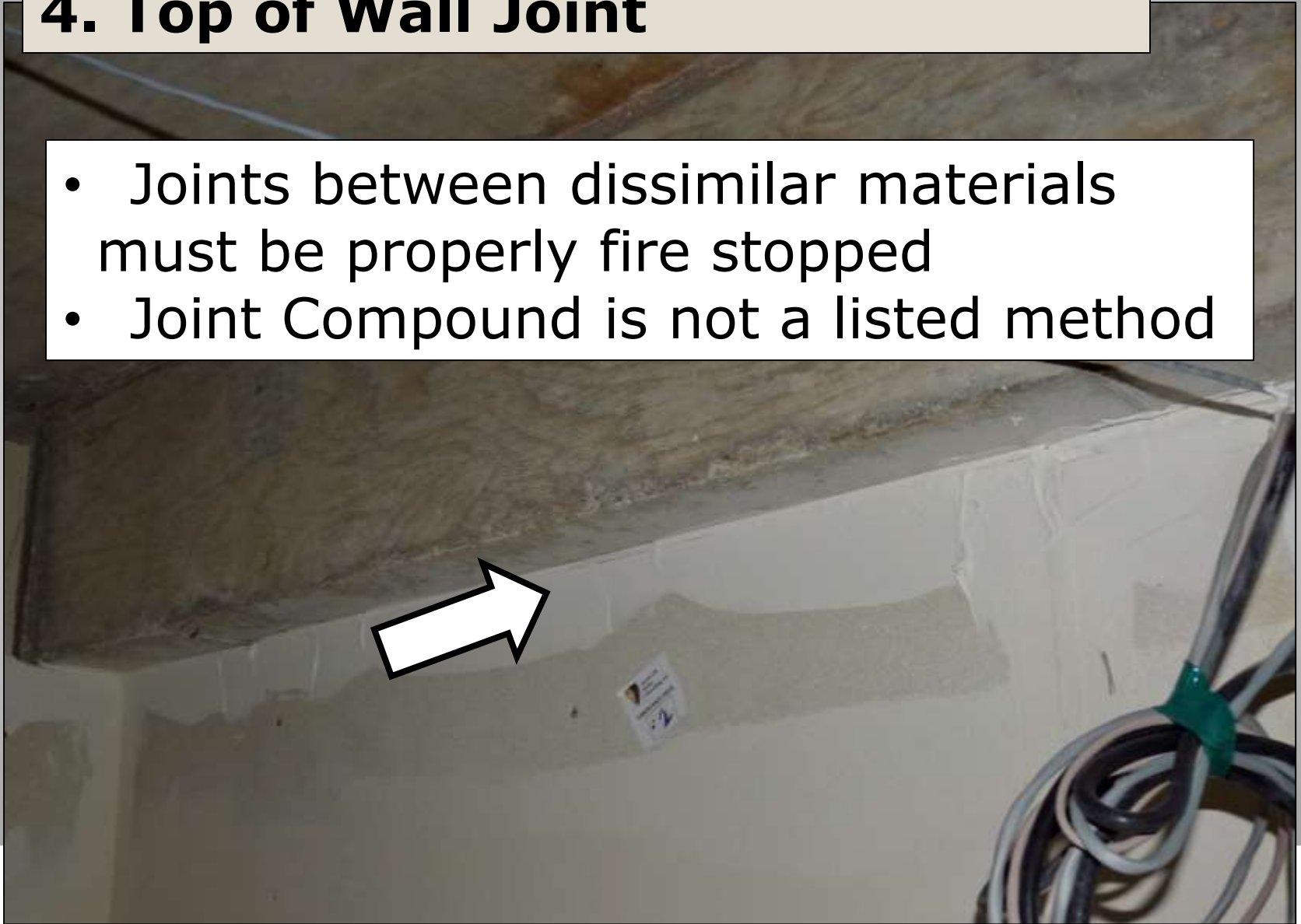
Drywall patches – Not recognized by codes or listing standards, so always a risk of citation

1. Drywall wide enough to span at least 2 studs
2. Screw into a stud, not drywall
3. Tape edges with paper tape & compound
4. Cover screws with compound
5. Fire stop only penetrations



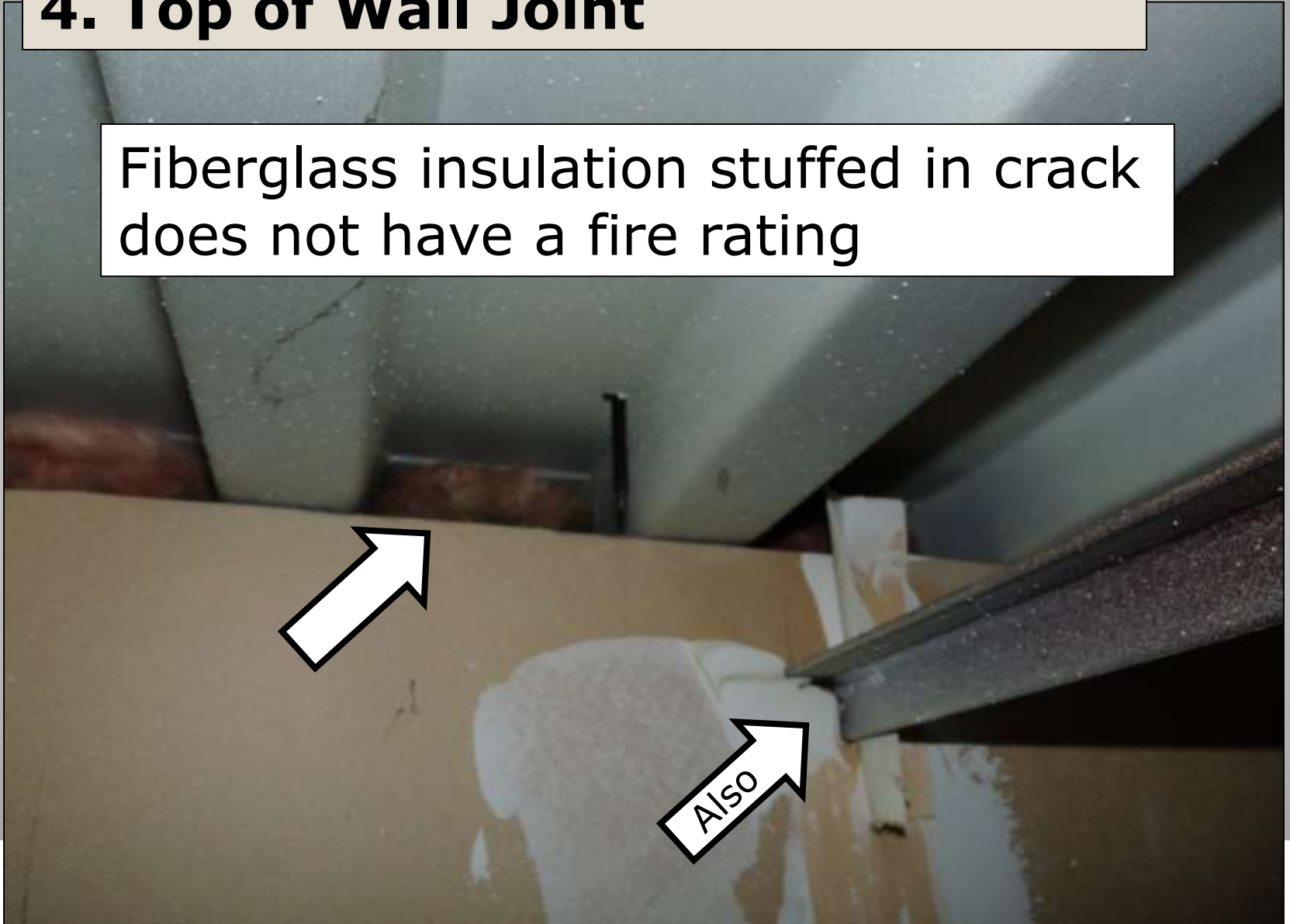
4. Top of Wall Joint

- Joints between dissimilar materials must be properly fire stopped
- Joint Compound is not a listed method



4. Top of Wall Joint

Fiberglass insulation stuffed in crack does not have a fire rating



5. Side-Wall Joint

Always must be properly fire stopped where rated wall butts another wall made with different materials



6. Fire Stop

10 Fire Stop Tips

1- Follow **EXACTLY** the UL Design Instructions

2- Ducts & Multiple Penetrations typically **REQUIRE FRAMING** around the penetrations

3- **JOINT COMPOUND** is NOT a fire stop sealant!

4- Walls Must be Sealed on **BOTH** sides (but confirm UL Design)

5- Floors are typically Sealed on the **TOP** side (but confirm UL Design)

6- **DO NOT MIX** fire stop products in the same penetrations ... voids all



6. Fire Stop

10 Fire Stop Tips

7- **TOO MUCH SEALANT** on the outside is an indication of poor installation

8- On Drywall, Seals are typically the **SAME THICKNESS** as the drywall (but confirm UL Design)

9- **LABEL** every fire stop

10- Keep **COPIES** of all UL Designs Used in Bldg

RATED DOOR Requirements

REQUIRED AT:

- >3,000 CuFt Cylinder Storage (>120 E tanks)
- Manifold Rooms
- Liquid Oxygen Storage

FIRE LABELS



- Provides visible proof that the components are the same as those that were tested by independent laboratories for use on fire-rated doors
- Labeled door assemblies are only valid when **all** required components are installed and function properly
- Both Door & Frame must be labeled

FIRE LABELS

BEWARE of “official” looking labels like this



NOT independently tested to meet NFPA 80 requirements

NEVER MODIFY a listed door or frame



Including:

- Changing Closer
- Changing Latch
- Installing Mag Lock
- Installing Elec Strike
- Screwed Signs

- Changing Hinges
- Adding Deadbolts
- Adding Combo
- Adding Auto Open
- Make-shift Repairs

Door Coordinator (NFPA 80-2010)

6.4.1.2.1 Where there is an astragal or projecting latch bolt that **prevents the inactive door from closing** and latching before the active door closes and latches, a coordinating device shall be used.



Kick Plates (NFPA 80-2010)

6.4.5.1 Factory-installed protection plates shall be installed in accordance with the listing of the door.

6.4.5.2 Field-installed protection plates shall be labeled and installed in accordance with their listing.

6.4.5.3 Labeling shall not be required where the top of the protection plate is not more than 16 in. (406 mm) above the bottom of the door. Note: Refer to LSC Occupancy Chapters for the 48" height rules.

Astragals (NFPA 80-2010)

6.4.7.1 Doors swinging in pairs, where located within a means of egress, shall not be equipped with astragals that inhibit the free use of either leaf.

6.4.7.2 Pairs of doors that require astragals shall have at least one attached in place to **project approximately 3/4"** or as otherwise indicated in the individual published listings.

Positive Latching (NFPA 80-2010)

6.4.1.4 All closing mechanisms shall be **adjusted** to overcome the resistance of the latch mechanism so that **positive latching** is achieved on each door operation.



ANNUAL INSPECTION (NFPA 80-2010)

All rated doors must be inspected **ANNUALLY**

- (1) No open holes or breaks in surfaces of the door or frame
- (2) Glazing is intact & securely fastened in place, if so equipped
- (3) Door assembly in working order; no visible signs of damage
- (4) No parts are missing or broken
- (5) Door clearances do not exceed clearances 1/8"
- (6) Closer is operational so the active door completely closes
- (7) If coordinator, inactive leaf closes before active leaf
- (8) Latch operates and secures the door when it is closed
- (9) Interfering hardware not installed on the door or frame
- (10) No field modifications that void the label.
- (11) Gaskets and edge seals are inspected to verify their presence and integrity

OXYGEN CYLINDER USE & STORAGE

SUMMARY

1. Two Main Safety Hazards with Oxygen
2. Applicable Codes
3. Cylinder Management Policy
4. Stand-Alone Cylinders
5. Liquid Oxygen Cylinders
6. Manifold Cylinders
7. Bulk Oxygen Tanks
8. Rated Walls
9. Rated Doors



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