Public Comment No. 13-NFPA 99-2022 [Global Input]

[See attached "NFPA 99 CCN_12"]

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_12.pdf	NFPA 99 CCN_12	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 12 appeared in the First Draft Report on First Revision No. 1088.

In 5.4.4, 5.4.5.2, 5.4.6.9.1.3, 5.4.6.9.1.4, consider replacing "suitable" with enforceable language; relocating 5.4.5.2(5), 5.4.6.2(1), and 5.4.6.8 to Annex A (mandatory requirement to consider something does not require anything tangible); break multiple requirements of 5.4.6.9.1.3 into a list; in A.5.4.6.9.1.3, replace "Keep Cool" valves with generic description; clarify in 5.4.6.10(3) how insulation is a test criterion; clarify in 5.4.6.10(4) what is meant by "other criteria as determined by the application" via annex note. Review the redundant use of the terms "hazards" and "they shall be" or "they shall have" as the terms are used in the prior parent language.

Related Item

- FR-1088

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 09:20:46 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 99-2022
Statement: The revisions respond to CCN-12 and incorporate the suggested revisions.

Correlating Committee Note No. 12-NFPA 99-2022 [New Section after 5.3]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:47:57 EST 2022

Committee Statement

Committee Statement: In 5.4.4, 5.4.5.2, 5.4.6.9.1.3, 5.4.6.9.1.4, consider replacing "suitable" with enforceable language; relocating 5.4.5.2(5), 5.4.6.2(1), and 5.4.6.8 to Annex A (mandatory requirement to consider something does not require anything tangible); break multiple requirements of 5.4.6.9.1.3 into a list; in A.5.4.6.9.1.3, replace "Keep Cool" valves with generic description; clarify in 5.4.6.10(3) how insulation is a test criterion; clarify in 5.4.6.10(4) what is meant by "other criteria as determined by the application" via annex note. Review the redundant use of the terms "hazards" and "they shall be" or "they shall have" as the terms are used in the prior parent language.

First Revision No. 1088-NFPA 99-2021 [New Section after 5.3]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad

Reiswig, Rodger

Rosenbaum, Eric R.

Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 50-NFPA 99-2022 [Global Input]

5.1.3.3.1.5

Indoor locations for oxygen, nitrous oxide, and mixtures of these gases shall not communicate with the following:

(1) (1) Areas involved in critical patient care

(2) (2) Anesthetizing locations ~~wheremoderatesedation, deep sedation, or general anesthesia is administered~~

(3) (3) Locations storing flammables

(4) (4) Rooms containing open electrical contacts or transformers

(5) (5) Storage tanks for flammable or combustible liquids

(6) (6) Engines

(7) (7) Kitchens

(8) (8) Areas with open flames

5.1.4.6.2

A zone valve in each medical gas or vacuum line shall be provided for each Category 1 space and Anesthetizing location, ~~for moderate sedation, deep sedation, or general anesthesia specific for the occupancy,~~ and shall be located as follows:

(1) (1) They are installed immediately outside the area controlled.

(2) (2) They are installed where they are visible and accessible at all times.

5.1.9.4 * Area Alarms.

Area alarm panels shall be provided to monitor all medical gas, medical–surgical vacuum, and piped WAGD systems supplying the following:

(1) (1) Anesthetizing location ~~where moderate sedation, deep sedation, or general anesthesia is administered~~

(2) (2)*Category 1 space

5.1.9.4.4 *

Alarm sensors for area alarms shall be located as follows:

(1) (1)*Category 1 spaces, other than anesthetizing location addressed in 5.1.9.4.4(2), shall have the alarm sensors installed on the patient or use side of each of the individual zone valve box assemblies.

(2) (2)* Anesthetizing location ~~where moderate sedation, deep sedation, or general anesthesia is administered~~shall have the sensors installed either on the source side of each of the individual room zone valve box assemblies or on the patient or use side of each of the

individual zone valve box assemblies.

Statement of Problem and Substantiation for Public Comment

(Task group on “Anesthetizing Locations”)
1.3.4.2 Requires that “the health care facility’s governing body to designate all anesthetizing locations.” However, there is no definition in the code of what constitutes an anesthetizing location. Prior editions of code have shown an evolution of the term. Initially in 1996 it was defined in terms of the use of flammable anesthetics (GAS) (which have subsequently fallen out of common use). In 2012 the term was redefined as “any area of a facility that has been designated to be used for the administration of general anesthesia (MED). In 2015 and forward the term was eliminated, presumably because it was eliminated from the MED subsection of the code.

All of the occurrences of “anesthetizing location” in chapter 5 are phrased “anesthetizing location for moderate sedation, deep sedation, or general anesthesia.” This appears in 5.1.3.3.1.5, 5.1.4.6.2, 5.1.9.4 and 5.1.9.4.4. There are also instances of the phrase in 16.14.3.1, 16.14.3.2, A.5.1.4, A5.1.9.4.4(2) and A.6.3.2.9.3.4 where there is no further suggestion as to what constitutes an “anesthetizing location.”

It is the opinion of the task group that the phrase requires a definition to provide guidance to health care facilities who are required to designate these areas. Defining the term broadly, as “any location where moderate sedation, deep sedation, or general anesthesia is intended to be administered” and removing the newly redundant language from chapter 5, will not substantively change the intent of the already existing code, but will improve clarity.
It is our anticipation that there may be a desire to address specific details of this definition or other related areas (e.g. should moderate sedation locations be included in the definition, should all of the subsections in chapter 5 that refer to anesthetizing locations include moderate sedation areas). Once this definition exists, it will be easier to address these discussions using the usual workflow.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 49-NFPA 99-2022 [New Section after 3.3.4]	Removes redundant language

Related Item

- Public Input No. 279-NFPA 99-2021

Submitter Information Verification

Submitter Full Name: David Lyons
Organization: University of Rochester
Affiliation: American Society of Anesthesiologists
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 07 10:20:35 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-964-NFPA 99-2022

Statement: The revision removes redundant language based on the addition of the definition of 'anesthetizing location'. The revisions to 5.1.3.3.1.5, 5.1.9.4, and 5.1.9.4.4 suggested by PC-50 are incorporated by SR-964, 965, and 966. No revision to 5.1.4.6.2 because the language provided in PC-50 was from the previous code edition and not the first draft, which was revised.

Public Comment No. 49-NFPA 99-2022 [New Section after 3.3.4]

3.3.x Anesthetizing locations .

As used in this code, applies to any location where moderate sedation, deep sedation, or general anesthesia is intended to be administered.

Statement of Problem and Substantiation for Public Comment

(Task group on “Anesthetizing Locations”)
1.3.4.2 Requires that “the health care facility’s governing body to designate all anesthetizing locations.” However, there is no definition in the code of what constitutes an anesthetizing location. Prior editions of code have shown an evolution of the term. Initially in 1996 it was defined in terms of the use of flammable anesthetics (GAS) (which have subsequently fallen out of common use). In 2012 the term was redefined as “any area of a facility that has been designated to be used for the administration of general anesthesia (MED). In 2015 and forward the term was eliminated, presumably because it was eliminated from the MED subsection of the code.

All of the occurrences of “anesthetizing location” in chapter 5 are phrased “anesthetizing location for moderate sedation, deep sedation, or general anesthesia.” This appears in 5.1.3.3.1.5, 5.1.4.6.2, 5.1.9.4 and 5.1.9.4.4. There are also instances of the phrase in 16.14.3.1, 16.14.3.2, A.5.1.4, A5.1.9.4.4(2) and A.6.3.2.9.3.4 where there is no further suggestion as to what constitutes an “anesthetizing location.”

It is the opinion of the task group that the phrase requires a definition to provide guidance to health care facilities who are required to designate these areas. Defining the term broadly, as “any location where moderate sedation, deep sedation, or general anesthesia is intended to be administered” and removing the newly redundant language from chapter 5, will not substantively change the intent of the already existing code, but will improve clarity.
It is our anticipation that there may be a desire to address specific details of this definition or other related areas (e.g. should moderate sedation locations be included in the definition, should all of the subsections in chapter 5 that refer to anesthetizing locations include moderate sedation areas). Once this definition exists, it will be easier to address these discussions using the usual workflow.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 50-NFPA 99-2022 [Global Input]	
Public Comment No. 51-NFPA 99-2022 [Section No. 1.3.4.2]	

Related Item

- Public Input No. 279-NFPA 99-2021

Submitter Information Verification

Submitter Full Name: David Lyons
Organization: University of Rochester
Affiliation: American Society of Anesthesiologists
Street Address:
City:

State:
Zip:
Submittal Date: Sat May 07 09:43:33 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-963-NFPA 99-2022

Statement: The revision was developed by a task group on anesthetizing locations. 1.3.4.2 requires that “the health care facility’s governing body to designate all anesthetizing locations.” However, there is no definition in the code of what constitutes an anesthetizing location. Prior editions of code have shown an evolution of the term. Initially in 1996 it was defined in terms of the use of flammable anesthetics (GAS) (which have subsequently fallen out of common use). In 2012 the term was redefined as “any area of a facility that has been designated to be used for the administration of general anesthesia (MED). In 2015 and forward the term was eliminated, presumably because it was eliminated from the MED subsection of the code.

All of the occurrences of “anesthetizing location” in chapter 5 are phrased “anesthetizing location for moderate sedation, deep sedation, or general anesthesia.” This appears in 5.1.3.3.1.5, 5.1.4.6.2, 5.1.9.4 and 5.1.9.4.4. There are also instances of the phrase in 16.14.3.1, 16.14.3.2, A.5.1.4, A5.1.9.4.4(2) and A.6.3.2.9.3.4 where there is no further suggestion as to what constitutes an “anesthetizing location.”

The phrase requires a definition to provide guidance to health care facilities who are required to designate these areas. Defining the term broadly, as “any location where moderate sedation, deep sedation, or general anesthesia is intended to be administered” and removing the newly redundant language from chapter 5, will not substantively change the intent of the already existing code, but will improve clarity.

Public Comment No. 81-NFPA 99-2022 [New Section after 3.3.6]

Anesthetizing Location. Any area of a facility that has been designated to be used for the administration of deep sedation or general anesthesia.

Statement of Problem and Substantiation for Public Comment

Add this definition back in. It was removed after the 2012 edition - however is used throughout the publication. Without a clear definition - it is left to someone's opinion to determine what it means. 1.3.4.2 as an example.

Related Item

- n/a

Submitter Information Verification

Submitter Full Name: Michael Civitello
Organization: Porter Instrument
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 25 15:14:51 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The committee desired to retain moderate sedation since the definition is intended to define location, which was added based on PC-49.

Public Comment No. 31-NFPA 99-2022 [Section No. 3.3.20]

3.3.20* Central Supply System.

The complete source of supply for a medical gas or vacuum system or a medical support gas system. (PIP)

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_34.pdf	NFPA 99 CCN_34	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 34 appeared in the First Draft Report on First Revision No. 1015.

Reconsider the action on FR-1015, which deletes the definition of 'Category 3 Vacuum System', as 5.3.3.7 contains requirements for these systems.

Related Item

- FR-1015

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 11:56:57 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution: The definition was replaced by 3.3.39 Dental Vacuum/Scavenging Systems. The code already defines Categories 1 through 4 in Chapter 4. A definition of Category 3 vacuum systems is not required. The definition, which was deleted, conflicts with 5.1.3.3.

Correlating Committee Note No. 34-NFPA 99-2022 [Section No. 3.3.20]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:26:55 EST 2022

Committee Statement

Committee Statement: Reconsider the action on FR-1015, which deletes the definition of 'Category 3 Vacuum System', as 5.3.3.7 contains requirements for these systems.

First Revision No. 1015-NFPA 99-2021 [Section No. 3.3.20]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]

3.3.103.1 Manufactured Rough-In Assembly

A factory-assembled product designed for aesthetics or convenience that contains only the secondary valves of medical gas or vacuum outlets, piping, or other devices related to medical gases.

Statement of Problem and Substantiation for Public Comment

A trend exists within the healthcare construction industry to incorporate off-site manufacturing in multiple forms. The result is that portions of work are being completed off-site to be delivered and installed in various stages of completion. One common example is a frame that has station outlet/inlet rough-in assemblies as well as portions of the distribution piping assembly. These assemblies do not fit within the traditional definition of a manufactured assembly as they do not contain complete medical gas or vacuum outlets and therefore some tests required of manufactured assemblies in section 5.1.6.1 are not applicable. This addition seeks to clarify the differences in form and testing requirements.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 91-NFPA 99-2022 [Section No. A.5.1.12.2.2]	
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 91-NFPA 99-2022 [Section No. A.5.1.12.2.2]	

Related Item

• Public Input No. 228 • Public Input No. 227 • Public Input No. 234

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 09:04:57 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Accepted
Resolution:	SR-967-NFPA 99-2022
Statement:	A trend exists within the healthcare construction industry to incorporate off-site manufacturing in multiple forms. The result is that portions of work are being completed off-site to be delivered and installed in various stages of completion. One common example is a frame that has station outlet/inlet rough-in assemblies as well as portions of the distribution piping assembly. These assemblies do not fit within the traditional definition of a manufactured assembly as they do not contain complete medical gas or vacuum outlets and therefore some tests required of manufactured assemblies in section 5.1.6.1 are not applicable. This addition seeks to clarify the differences in form and testing requirements.

Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]

3.3.103* Manufactured Assembly.

A factory-assembled product designed for aesthetics or convenience that contains medical gas or vacuum outlets which are complete with secondary and primary valves , piping, or other devices related to medical gases. (PIP)

Statement of Problem and Substantiation for Public Comment

A trend exists within the healthcare construction industry to incorporate off-site manufacturing in multiple forms. The result is that portions of work are being completed off-site to be delivered and installed in various stages of completion. One common example is a frame that has station outlet/inlet rough-in assemblies as well as portions of the distribution piping assembly. These assemblies do not fit within the traditional definition of a manufactured assembly as they do not contain complete medical gas or vacuum outlets and therefore some tests required of manufactured assemblies in section 5.1.6.1 are not applicable. This addition seeks to clarify the differences in form and testing requirements.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 91-NFPA 99-2022 [Section No. A.5.1.12.2.2]	

Related Item

• Public Input No. 228 • Public Input No. 227 • Public Input No. 234

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 08:59:13 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-968-NFPA 99-2022

Statement: A trend exists within the healthcare construction industry to incorporate off-site manufacturing in multiple forms. The result is that portions of work are being completed off-site to be delivered and installed in various stages of completion. One common example is a frame that has station outlet/inlet rough-in assemblies as well as portions of the distribution piping assembly. These assemblies do not fit within the traditional definition of a manufactured assembly as they do not contain complete medical gas or vacuum outlets and therefore some tests required of manufactured assemblies in section 5.1.6.1 are not applicable. This addition seeks to clarify the differences in form and testing requirements.

Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]

5.1.1.2

Category 1 piped gas or piped vacuum system requirements shall be applied where any of the following criteria is met:

(1) General anesthesia, as defined in 3.3.67.1, or deep sedation, as defined in 3.3.67.2, is performed.

(2) The loss of the piped gas or piped vacuum systems is likely to cause major injury or death of patients, staff, or visitors.

-

Statement of Problem and Substantiation for Public Comment

Regarding CI 1117: Task Group on Categories recommends no such action.

In the specific case of medical gases, the risks to staff and visitors are generally encompassed by the general considerations for safety and fire planning. Therefore these are all Chapter 4 considerations.

Risks to patients include those general considerations but are also determined by the state of the individual patient. The ability of a patient to survive a specific loss of medical gas or vacuum is determined by their physical condition at presentation, the medical procedure in process, and their state of consciousness (see ASA Physical Status Evaluation). For the determination of Category with medical gas systems specifically, the depth of anesthesia acts both as a direct determinant and a reasonable proxy.

While the Chapter 4 Category decision making process may encompass this, there is no uniform guide to what will factor, at what weighting, in the Chapter 4 decision. Therefore there is no assurance that this will be considered or that it will be understood as having the central significance that it does in the design of medical gases.

Where the significance of depth of anesthesia is understood in the Chapter 4 decision process, the inclusion of these requirements aligns with and reinforces that decision. Where the significance of depth of anesthesia is not understood, inclusion here ensures the specific risks are not overlooked.

See please Report of the Task Group, Chapter 15.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	

Related Item

• CI 1117

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization:
Affiliation: Task Group on Categories
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 25 06:14:31 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The public comment makes no revision.

Public Comment No. 74-NFPA 99-2022 [Section No. 5.1.1.6]

5.1.1.6

The following sections of this chapter shall apply to the operation, management, and maintenance of Category 1 medical gas and vacuum systems in both new and existing facilities:

(1) 5.1.2

(2) 5.1.3.1

(3) 5.1.3.2

(4) 5.1.3.3. ~~1.5~~

(5) ~~5.1.3.3.~~ 4

(6) 5.1.3.6.2

(7) 5.1.3.6.3.10(A)(2)

(8) 5.1.3.7.6(A)(2)

(9) 5.1.3.8.4.1(2)

(10) 5.1.14

Statement of Problem and Substantiation for Public Comment

We can not apply new requirements for locations of central supply systems to existing systems. This needs to be removed from this list.

Related Item

• FR 1020

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:54:37 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1049-NFPA 99-2022

Statement:	It might not be practical to apply new requirements for locations of central supply systems to existing systems. The revision removes the reference to 5.1.3.3.1.5 from the list of requirements that are applicable to existing facilities.

Public Comment No. 8-NFPA 99-2022 [Section No. 5.1.1.6]

5.1.1.6

The following sections of this chapter shall apply to the operation, management, and maintenance of Category 1 medical gas and vacuum systems in both new and existing facilities:

(1) 5.1.2

(2) 5.1.3.1

(3) 5.1.3.2

(4) 5.1.3.3.1.5

(5) 5.1.3.3.4

(6) 5.1.3.6.2

(7) 5.1.3.6.3.10(A)(2)

(8) 5.1.3.7.6(A)(2)

(9) 5.1.3.8.4.1(2)

(10) 5.1.14

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_5.pdf	NFPA 99 CCN_5	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 5 appeared in the First Draft Report on First Revision No. 1020.

Consider the negative votes of Beebe, Crowley, and Smidt. Insufficient substantiation has been provided for a new, retroactive requirement on existing installations.

Related Item

• FR-1020

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 06:50:08 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-1049-NFPA 99-2022
Statement:	It might not be practical to apply new requirements for locations of central supply systems to existing systems. The revision removes the reference to 5.1.3.3.1.5 from the list of requirements that are applicable to existing facilities.

Correlating Committee Note No. 5-NFPA 99-2022 [Section No. 5.1.1.5]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:32:29 EST 2022

Committee Statement

Committee Statement: Consider the negative votes of Beebe, Crowley, and Smidt. Insufficient substantiation has been provided for a new, retroactive requirement on existing installations.

First Revision No. 1020-NFPA 99-2021 [Section No. 5.1.1.5]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

First Revision No. 1020-NFPA 99-2021 [Section No. 5.1.1.5]

5.1.1.6

The following sections of this chapter shall apply to the operation, management, and maintenance of Category 1 medical gas and vacuum systems in both new and existing facilities:

(1) 5.1.2
(2) 5.1.3.1
(3) 5.1.3.2
(4) 5.1.3.3.1.5
(5) 5.1.3.3.4
(6) 5.1.3.6.2
(7) 5.1.3.6.3.10(A)(2)
(8) 5.1.3.7.6(A)(2)
(9) 5.1.3.8.4.1(2)
(10) 5.1.14

Submitter Information Verification

Committee: HEA-PIP
Submittal Date: Tue Aug 03 14:56:15 EDT 2021

Committee Statement and Meeting Notes

Committee Statement: The location requirements of 5.1.3.3.1.5 are meant to keep these systems and their locations protected from fire and other various hazards that could exist in the facility. These should be mandated in existing facilities in addition to new ones.

Response Message: FR-1020-NFPA 99-2021

Public Input No. 344-NFPA 99-2021 [Section No. 5.1.1.5]

Ballot Results

✔ **This item has passed ballot**

30 Eligible Voters
4 Not Returned
23 Affirmative All
0 Affirmative with Comments
3 Negative with Comments
0 Abstention

Not Returned

Colombo, Dana A.

Fasel, Mark

Franklin, Mark T.

Fuchs, Andrew

Affirmative All

Allen, Mark W.

Anderson, Grant A.

Braidich, David

Carter, Mark David

Currence, Gary

Dodson, Marc

Ferrari, Keith

Gagné, Neil

Golla, Ed

Hamilton, Scott

Lathrop, James K.

Litvin, Edward A.

Lucas, James L.

Lyczko, Edward J.

Lyons, David C.

Martin, Bret M.

McBride, Jeffery F.

Miller, Douglas

Scarlett, Kevin A.

Shapiro, Elizabeth A. "Betsy"

Shoemaker, E. Daniel

Volz, Allan D.

Willard, Jonathan C.

Negative with Comment

Beebe, Chad E.

This should not make this requirement retroactive. There was no evidence provided that the hazard was so high that all existing health care facilities need to be modified.

Crowley, Michael A.

This should not be a retroactive requirement. Existing installation can be addressed by the AHJ.

Smidt, Ronald M.

Not sure we want this section to be retroactive, will require building plan changes that may be tough to comply with.

Editorial Comment

Click here

Public Comment No. 54-NFPA 99-2022 [Section No. 5.1.3.1.8 [Excluding any Sub-Sections]]

* Source locations containing positive pressure gases other than oxygen and medical air shall be provided with signage ~~located~~ centered at 151 cm (59") +/- 10 cm (4") AFF and immediately on or ~~immediately~~ adjacent to the door ~~that is~~ so as to be visible upon entering the space as follows:

Positive Pressure Gases

NO Smoking or Open Flame

Room May Have Insufficient Oxygen

Open Door and Allow Room to Ventilate Before Entering

Add Annex:

Basri, A. and Sulaiman, S., June 2017, *"USE OF EYE LEVEL HEIGHT TO DETERMINE SIGNAGE HEIGHT IN PUBLIC HOSPITAL"* , Department of Industrial Design, Faculty of Design & Architecture, Universiti Putra Malaysia, Malaysia frsb.upm.edu.my/upload/dokumen/20171108145605paper_5.pdf

Statement of Problem and Substantiation for Public Comment

As written, the provision would allow for narrow signage mounted to the door frame above the door. It is clear the such is not the intent, so more specific language is required.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 55-NFPA 99-2022 [Section No. 5.1.3.1.9 [Excluding any Sub-Sections]]	

Related Item

- FR1021

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 13 14:40:05 EDT 2022

Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution: The proposed concept might have merit, however there is concern with using criteria from a standard from outside the U.S. The proposed language appears to be overly prescriptive to sign location.

Public Comment No. 55-NFPA 99-2022 [Section No. 5.1.3.1.9 [Excluding any Sub-Sections]]

* Source locations containing

~~only oxygen or~~
positive pressure gases other than oxygen and medical air shall be provided with signage

~~located~~
centered at 151 cm (59") +/- 10 cm (4") AFF and immediately on or

~~immediately~~
adjacent to the door

~~that is~~
so as to be visible upon entering the space as follows:

Medical Gases

NO Smoking or Open Flame

Add Annex:

A 5.1.3.1.9. Approximate eye level. Refer to A 5.1.3.1.8

Statement of Problem and Substantiation for Public Comment

As written, the provision would allow for narrow signage mounted to the door frame above the door. It is clear the such is not the intent, so more specific language is required.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 54-NFPA 99-2022 [Section No. 5.1.3.1.8 [Excluding any Sub-Sections]]	same

Related Item

• FR1027

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 13 14:53:14 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected
Resolution:	The proposed concept might have merit, however there is concern with using criteria from a standard from outside the U.S. The proposed language appears to be overly prescriptive to sign location.

Public Comment No. 69-NFPA 99-2022 [Sections 5.1.3.3.1.6, 5.1.3.3.1.7, 5.1.3.3.1.8, 5.1.3.3.1.9...]

Sections 5.1.3.3.1.6, 5.1.3.3.1.7, 5.1.3.3.1.8, 5.1.3.3.1.9, 5.1.3.3.1.10

5.1.3.3.1.6

Cryogenic fluid central supply systems for oxygen shall comply with ~~NFPA 55~~ this section .

5.1.3.3.1.7

Bulk nitrous oxide central supply systems shall comply with ~~NFPA 55 and~~ this section and with the mandatory requirements of CGA G-8.1, *Standard for Nitrous Oxide Systems at Customer Sites*.

5.1.3.3.1.8

Central supply systems for carbon dioxide using permanently installed containers with product capacities greater than 454 kg (1000 lb) shall comply with ~~NFPA 55 and~~ this section and with the mandatory requirements of CGA G-6.1, *Standard for Insulated Liquid Carbon Dioxide Systems at Consumer Sites*.

5.1.3.3.1.9

Central supply systems for carbon dioxide using permanently installed containers with product capacities of 454 kg (1000 lb) or less shall comply with ~~NFPA 55 and~~ this section and with the mandatory requirements of CGA G-6.5, *Standard for Small Stationary Insulated Carbon Dioxide Supply Systems*.

5.1.3.3.1.10*

Cryogenic fluid central supply systems for inert gases shall comply with ~~NFPA 55 and~~ this section and with the mandatory requirements of CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites*.

Statement of Problem and Substantiation for Public Comment

References that compliance with NFPA 55 conflicts with NFPA 99. To comply with all of NFPA 55 would require facilities to comply with every chapter of NFPA 55 including chapter 5 and 6 that limits the use and storage of oxygen. NFPA 55 Chapter 17 is specific to cryogenic systems in health care facilities but the first requirement is in the chapter is to follow chapters 1-16.

Related Item

• PI-69

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:08:49 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected
Resolution:	Deleting the references to NFPA 55 might have unintended consequences. It would also lead to the loss of general requirements that are addressed in NFPA 55. These provisions are intended to apply to bulk systems and sources up to the source valve and not to the use of oxygen or cylinder storage.

Public Comment No. 43-NFPA 99-2022 [New Section after 5.1.3.3.2]

5.1.3.3.2 Design and Construction

5.1.3.3.2.1 Medical gas and vacuum systems shall be designed by a party technically competent and experienced in the field of medical gas and vacuum system design and meeting the requirements of ASSE 6060, Professional Qualification Standard for Medical Gas System Designers.

Statement of Problem and Substantiation for Public Comment

ASSE 6060 is a new ANSI published professional qualification standard that establishes minimum criteria for designers of medical gas systems. Certification to the standard requires 40 hours of training and successfully passing a rigorous, third party administered exam. Addition of this requirement in NFPA 99 will ensure minimum proficiency requirements for medical gas systems designers while providing a quick method for AHJs to confirm system designer qualifications. The proposal intends to supplement local regulations and not to circumvent requirements for PE approval. The purpose of this public comment is to include renovation of existing medical gas systems rather than just new systems and also to correct the title of the standard.

Related Item

• PI 350-NFPA 99-2021 Section 5.1.3.3.2

Submitter Information Verification

Submitter Full Name: Ramiro Mata
Organization: American Society Of Plumbing Engineers
Street Address:
City:
State:
Zip:
Submittal Date: Mon Apr 04 11:30:48 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: Insufficient substantiation has been provided to mandate certification per ASSE 6060.

Public Comment No. 79-NFPA 99-2022 [Section No. 5.1.3.3.2]

5.1.3.3.2* Design and Construction.

5.1.3.3.2.1

New medical gas and vacuum systems shall be designed by of:

(a) a party technically competent and experienced in the field of medical gas and vacuum system design and meeting the requirements of ASSE 6060, Professional Qualification Standard for Medical Gas System Design Engineers.

(b) a party deemed technically competent through other qualification(s) deemed sufficient to the Governing Body of the Healthcare Facility and the Authority Having Jurisdiction.

5.1.3.3.2.2

Locations for central supply systems other than cryogenic fluid central supply systems and motor-driven equipment and locations for 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 the requirements of 11.4.3.1.1.

(2) They shall be provided with lockable doors or gates or otherwise able to be secured.

(3) If outdoors, they shall be well drained and provided with an enclosure (e.g., wall or fencing) constructed of noncombustible materials.

(4) If outdoors, cylinders and containers shall be protected from prolonged contact with soil.

(5) If indoors, they shall have interior finishes of noncombustible or limited-combustible materials.

(6)* If indoors, rooms containing oxygen, nitrous oxide, or other oxidizers shall be separated from the rest of the building by walls and floors having a 1-hour fire resistance rating with doors and other opening protectives having a ¾-hour fire protection rating.

(7)* They shall comply with *NFPA 70* for ordinary locations.

(8)* Fuel-fired equipment shall not be located in the room.

(9) If they require heat, the maximum allowable temperature of the in-room heating element shall be 130°C (266°F).

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

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

(12) They shall have racks, shelves, and supports, where provided, constructed of noncombustible materials or limited-combustible materials.

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

(14)* They shall allow access by delivery vehicles and management of cylinders.

(15) They shall be designed to meet the operational requirements of 5.1.3.2 regarding room temperature.

(16) If containing positive pressure gases other than oxygen and medical air, they shall be equipped with oxygen depletion monitors with alarm indicators at the entrance(s) that will indicate ambient oxygen levels in the room below 19.5 percent.

5.1.3.3.2.~~2~~ – 3

Locations for motor-driven central supply systems shall meet the following requirements:

(1) They shall be constructed with access to move equipment and so forth in and out of the location as necessary.

(2) They shall be provided with lockable doors or gates or otherwise able to be secured.

(3) They shall comply with *NFPA 70* for ordinary locations.

(4) The maximum allowable temperature of the room shall be in accordance with the manufacturer's recommendations.

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

5.1.3.3.2.~~3~~ 4

Design and construction of locations for cryogenic fluid central supply systems shall comply with 5.1.3.10.

5.1.3.3.2.4

Total quantities of gases in any location, including gas connected to central supply systems and in storage, shall be limited in accordance with Table 5.1.3.3.2.4(a) and Table 5.1.3.3.2.4(b).

Table 5.1.3.3.2.4(a) Storage Quantities for Medical Gas and Cryogenic Fluid Central Supply Systems for Medical Gases in Each Location

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP			
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]
Sum of all gases[f]			No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)
Carbon dioxide	Liquefied compressed gas in cylinders	n, i, a	No limit	84 m^3 (3,000 ft^3) (e.g., 5 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 17 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 35 “H” cylinders)[g]
	Refrigerated liquid in containers	n, i, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)
Helium	Compressed gas in cylinders	n, i, a	No limit	84 m^3 (3,000 ft^3) (e.g., 14 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 47 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 94 “H” cylinders)[g]
	Cryogenic fluid in containers	n, i, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Oxygen	Compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 12 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 40 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 81 “H” cylinders)[g]
	Cryogenic fluid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Medical air	Cylinder	None	No limit	Not limited in quantity		

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP			
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]
Nitrogen	Compressed gas in cylinders	n, i, a	No limit	Not limited in quantity		
	Cryogenic fluid in containers	n, i, a, c	No limit	Not limited in quantity		
Nitrous oxide	Liquified compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 5 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 17 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 35 “H” cylinders)[g]
	Refrigerated liquid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Other	Cylinder	Various	See NFPA 55.			

Note: See Table 5.1.3.3.2.4(b) for number of permitted locations and derating factors.

[a]Hazard classifications are as follows:

n = nonflammable

i = inert

a = asphyxiant

c = cryogen when liquid

x = oxidizer

[b]Outdoor enclosure constructed and ventilated in accordance with this code and NFPA 55.

[c]See 5.1.3.3.2 and Section 11.3.

[d]Indoor structure constructed in accordance with 5.1.3.3.2 and ventilated in accordance with 9.3.6.

[e]Indoor structure constructed in accordance with 5.1.3.3.2, ventilated in accordance with 9.3.6, and sprinklered in accordance with NFPA 13.

[f]The maximum allowable quantity of medical gases within a single location is limited both by the total quantity of gas and type of gas. The allowable storage quantity is also limited by the gas type, as listed, and the sum is the maximum aggregate quantity of gases of all species. For example: In an indoor medical gas manifold room, provided with ventilation in accordance with 9.3.2 and sprinklered in accordance with NFPA 13, it would be permissible to store eight “H” size cylinders [126,406 m^3 (4,464 ft^3)] of nitrous oxide, two 160 L (9,722 ft^3) containers, and 23 “H” size cylinders [162,171 m^3 (5,727 ft^3)] of oxygen for a total quantity of 563,873 m^3 (19,913 ft^3) gas equivalent. In this example, cylinders or containers of the same capacity (Standard Cubic Feet of medical gas) (like for like) can be exchanged freely, but additional cylinders or containers of a larger capacity would increase the room’s total contents of medical gas above

the allowed 566 m^3 (20,000 ft^3) of medical gas and could not be stored in this room.

[g]These are the limits for indoor storage. See NFPA 55 for outdoor storage limits.

Table 5.1.3.3.2.4(b) Number and Derating Factors of Gas Storage Locations by Floor

Floor	Maximum Allowable Quantity (%)*	Number of Locations Permitted	Fire Rating (hr)
Above grade			
>9	5	1	2
7–9	5	2	2
4–6	25	2	2
3	50	2	1
2	75	3	1
1 (on grade)	100	4	1
Below grade			
1	100	3	1
2	50	2	1
Lower than 2	NP	NP	NA

NP: Not permitted. NA: Not applicable.

*See Table 5.1.3.3.2.4(b).

Statement of Problem and Substantiation for Public Comment

The Committee required alternate qualification and the chance to review the ASSE 6000.

The Standard was furnished to the Committee courtesy of the ASSE. The course and the qualifying credentialling examination are now available, and additional organizations are known to be preparing to offer these as well.

The proposed additional wording provides for continued use of the same essential qualification which is common today.

Related Item

• PI 350

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 25 10:55:08 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-1051-NFPA 99-2022
Statement:	The revision responds to PC-79, the substantiation for which follows: The Committee required alternate qualification and the chance to review the ASSE 6000. The Standard was furnished to the Committee courtesy of the ASSE. The course and the qualifying credentialing examination are now available, and additional organizations are known to be preparing to offer these as well. The proposed additional wording provides for continued use of the same essential qualification which is common today.

Public Comment No. 73-NFPA 99-2022 [Section No. 5.1.3.3.2.1]

5.1.3.3.2.1

Locations for central supply systems other than cryogenic fluid central supply systems and motor-driven equipment and locations for 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 the requirements of 11.4.3.1.1.

(2) They shall be provided with lockable doors or gates or otherwise able to be secured.

(3) If outdoors, they shall be well drained and provided with an enclosure (e.g., wall or fencing) constructed of noncombustible materials.

(4) If outdoors, cylinders and containers shall be protected from prolonged contact with soil.

(5) If indoors, they shall have interior finishes of noncombustible or limited-combustible materials.

(6)* If indoors, rooms containing oxygen, nitrous oxide, or other oxidizers shall be separated from the rest of the building by walls and floors having a 1-hour fire resistance rating with doors and other opening protectives having a ¾-hour fire protection rating.

(7)* They shall comply with *NFPA 70* for ordinary locations.

(8)* Fuel-fired equipment shall not be located in the room.

(9) If they require heat, the maximum allowable temperature of the in-room heating element shall be 130°C (266°F).

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

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

(12) They shall have racks, shelves, and supports, where provided, constructed of noncombustible materials or limited-combustible materials.

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

(14)* They shall allow access by delivery vehicles and management of cylinders.

(15) They shall be designed to meet the operational requirements of 5.1.3.2 regarding room temperature.

(16) ~~If containing positive pressure gases other than oxygen and medical air, they shall be equipped with oxygen depletion monitors with alarm indicators at the entrance(s) that will indicate ambient oxygen levels in the room below 19.5 percent.~~

Statement of Problem and Substantiation for Public Comment

No data or justification was submitted to make this change in the first draft, only an anecdotal comment about "several accidents have occurred in the past". The committee needs to provide better evidence that a problem exists before changing the code and adding unnecessary expenses. In addition, why would an outdoor location require a depletion monitor? I would like to see more research showing how this could be a problem.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 99-NFPA 99-2022 [Section No. 2.2]	

Related Item

- PI-1039

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:46:02 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Accepted
Resolution: SR-1052-NFPA 99-2022
Statement: No data or justification was submitted to make this change in the first draft, only an anecdotal comment about "several accidents have occurred in the past". Insufficient evidence exists to indicate that a problem exists warranting a change to the code and adding expenses. The reasons an outdoor location would require a depletion monitor are unclear. More research showing how this could be a problem would be needed to include this requirement.

Public Comment No. 10-NFPA 99-2022 [Section No. 5.1.3.3.2.4]

5.1.3.3.2.4

Total quantities of gases in any location, including gas connected to central supply systems and in storage, shall be limited in accordance with Table 5.1.3.3.2.4(a) and Table 5.1.3.3.2.4(b).

Table 5.1.3.3.2.4(a) Storage Quantities for Medical Gas and Cryogenic Fluid Central Supply Systems for Medical Gases in Each Location

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP			
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]
Sum of all gases[f]			No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)
Carbon dioxide	Liquefied compressed gas in cylinders	n, i, a	No limit	84 m^3 (3,000 ft^3) (e.g., 5 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 17 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 35 “H” cylinders)[g]
	Refrigerated liquid in containers	n, i, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)
Helium	Compressed gas in cylinders	n, i, a	No limit	84 m^3 (3,000 ft^3) (e.g., 14 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 47 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 94 “H” cylinders)[g]
	Cryogenic fluid in containers	n, i, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Oxygen	Compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 12 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 40 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 81 “H” cylinders)[g]
	Cryogenic fluid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Medical air	Cylinder	None	No limit	Not limited in quantity		
Nitrogen	Compressed gas in cylinders	n, i, a	No limit	Not limited in quantity		

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP			
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]
	Cryogenic fluid in containers	n, i, a, c	No limit	Not limited in quantity		
Nitrous oxide	Liquified compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 5 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 17 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 35 “H” cylinders)[g]
	Refrigerated liquid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Other	Cylinder	Various	See NFPA 55.			

Note: See Table 5.1.3.3.2.4(b) for number of permitted locations and derating factors.

[a]Hazard classifications are as follows:

n = nonflammable

i = inert

a = asphyxiant

c = cryogen when liquid

x = oxidizer

[b]Outdoor enclosure constructed and ventilated in accordance with this code and NFPA 55.

[c]See 5.1.3.3.2 and Section 11.3.

[d]Indoor structure constructed in accordance with 5.1.3.3.2 and ventilated in accordance with 9.3.6.

[e]Indoor structure constructed in accordance with 5.1.3.3.2, ventilated in accordance with 9.3.6, and sprinklered in accordance with NFPA 13.

[f]The maximum allowable quantity of medical gases within a single location is limited both by the total quantity of gas and type of gas. The allowable storage quantity is also limited by the gas type, as listed, and the sum is the maximum aggregate quantity of gases of all species. For example: In an indoor medical gas manifold room, provided with ventilation in accordance with 9.3.2 and sprinklered in accordance with NFPA 13, it would be permissible to store eight “H” size cylinders [126,406 m^3 (4,464 ft^3)] of nitrous oxide, two 160 L (9,722 ft^3) containers, and 23 “H” size cylinders [162,171 m^3 (5,727 ft^3)] of oxygen for a total quantity of 563,873 m^3 (19,913 ft^3) gas equivalent. In this example, cylinders or containers of the same capacity (Standard Cubic Feet of medical gas) (like for like) can be exchanged freely, but additional cylinders or containers of a larger capacity would increase the room’s total contents of medical gas above the allowed 566 m^3 (20,000 ft^3) of medical gas and could not be stored in this room.

[g]These are the limits for indoor storage. See NFPA 55 for outdoor storage limits.

Table 5.1.3.3.2.4(b) Number and Derating Factors of Gas Storage Locations by Floor

Floor	Maximum Allowable Quantity (%)*	Number of Locations Permitted	Fire Rating (hr)
Above grade			
>9	5	1	2
7–9	5	2	2
4–6	25	2	2
3	50	2	1
2	75	3	1
1 (on grade)	100	4	1
Below grade			
1	100	3	1
2	50	2	1
Lower than 2	NP	NP	NA

NP: Not permitted. NA: Not applicable.

*See Table 5.1.3.3.2.4(b).

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_9.pdf	NFPA 99 CCN_9	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 9 appeared in the First Draft Report.

Consider the negative votes of Beebe, Crowley, and Smidt and review for potential correlation issues with NFPA 55.

Related Item

• FR-1040

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 08:55:49 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Rejected but see related SR

Action:

Resolution: SR-1053-NFPA 99-2022

Statement: The committee considered all of the information and determined that the presentation could be greatly simplified, duplication removed, and clarification provided. The revised text resolves these concerns. Requirements are provided for maximum quantities of medical gases used for central supply systems in a health care facility.

Public Comment No. 45-NFPA 99-2022 [Section No. 5.1.3.3.2.4]

~~**5.1.3.3.2.4** –~~

~~Total quantities of gases in any location, including gas connected to central supply systems and in storage, shall be limited in accordance with Table 5.1.3.3.2.4(a) and Table 5.1.3.3.2.4(b) .~~

~~Table 5.1.3.3.2.4(a) Storage Quantities for Medical Gas and Cryogenic Fluid Central Supply Systems for Medical Gases in Each Location~~

~~Gas Package Forms Hazard Class and Description [a] Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP Outdoor Enclosure [b] Indoor Medical Gas Storage Areas [c] Indoor Gas Room [d] Indoor Gas Room, Sprinklered [e] Sum of all gases [f] No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) Carbon dioxide Liquefied compressed gas in cylinders n, i, a No limit 84 m^3 (3,000 ft^3)~~

~~(e.g., 5 "H" cylinders) 283 m^3 (10,000 ft^3)~~

~~(e.g., 17 "H" cylinders) 566 m^3 (20,000 ft^3)~~

~~(e.g., 35 "H" cylinders) [g] Refrigerated liquid in containers n, i, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) Helium Compressed gas in cylinders n, i, a No limit 84 m^3 (3,000 ft^3)~~

~~(e.g., 14 "H" cylinders) 283 m^3 (10,000 ft^3)~~

~~(e.g., 47 "H" cylinders) 566 m^3 (20,000 ft^3)~~

~~(e.g., 94 "H" cylinders) [g] Cryogenic fluid in containers n, i, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Oxygen Compressed gas in cylinders n, x, a No limit 84 m^3 (3,000 ft^3)~~

~~(e.g., 12 "H" cylinders) 283 m^3 (10,000 ft^3)~~

~~(e.g., 40 "H" cylinders) 566 m^3 (20,000 ft^3)~~

~~(e.g., 81 "H" cylinders) [g] Cryogenic fluid in containers n, x, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Medical air Cylinder None No limit Not limited in quantity Nitrogen Compressed gas in cylinders n, i, a No limit Not limited in quantity Cryogenic fluid in containers n, i, a, c No limit Not limited in quantity Nitrous oxide Liquified compressed gas in cylinders n, x, a No limit 84 m^3 (3,000 ft^3)~~

~~(e.g., 5 "H" cylinders) 283 m^3 (10,000 ft^3)~~

~~(e.g., 17 "H" cylinders) 566 m^3 (20,000 ft^3)~~

~~(e.g., 35 "H" cylinders) [g] Refrigerated liquid in containers n, x, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Other Cylinder Various See NFPA~~

~~55.~~

~~Note: See Table 5.1.3.3.2.4(b) for number of permitted locations and derating factors.~~

~~a~~ ~~Hazard classifications are as follows:~~

~~n = nonflammable~~

~~i = inert~~

~~a = asphyxiant~~

~~c = cryogen when liquid~~

~~x = oxidizer~~

~~b~~ ~~Outdoor enclosure constructed and ventilated in accordance with this code and NFPA 55.~~

~~c~~ ~~See 5.1.3.3.2 and Section 11.3.~~

~~d~~ ~~Indoor structure constructed in accordance with 5.1.3.3.2 and ventilated in accordance with 9.3.6.~~

~~e~~ ~~Indoor structure constructed in accordance with 5.1.3.3.2, ventilated in accordance with 9.3.6, and sprinklered in accordance with NFPA 13.~~

~~f~~ ~~The maximum allowable quantity of medical gases within a single location is limited both by the total quantity of gas and type of gas. The allowable storage quantity is also limited by the gas type, as listed, and the sum is the maximum aggregate quantity of gases of all species. For example: In an indoor medical gas manifold room, provided with ventilation in accordance with 9.3.2 and sprinklered in accordance with NFPA 13, it would be permissible to store eight "H" size cylinders [126,406 m~~ ~~3~~ ~~(4,464 ft~~ ~~3~~ ~~)] of nitrous oxide, two 160 L (9,722 ft~~ ~~3~~ ~~) containers, and 23 "H" size cylinders [162,171 m~~ ~~3~~ ~~(5,727 ft~~ ~~3~~ ~~)] of oxygen for a total quantity of 563,873 m~~ ~~3~~ ~~(19,913 ft~~ ~~3~~ ~~) gas equivalent. In this example, cylinders or containers of the same capacity (Standard Cubic Feet of medical gas) (like for like) can be exchanged freely, but additional cylinders or containers of a larger capacity would increase the room's total contents of medical gas above the allowed 566 m~~ ~~3~~ ~~(20,000 ft~~ ~~3~~ ~~) of medical gas and could not be stored in this room.~~

~~g~~ ~~These are the limits for indoor storage. See NFPA 55 for outdoor storage limits.~~

~~Table 5.1.3.3.2.4(b) Number and Derating Factors of Gas Storage Locations by Floor~~

~~Floor Maximum Allowable Quantity (%)* Number of Locations Permitted Fire Rating (hr) Above grade >9 5 1 2 7–9 5 2 2 4–6 25 2 2 3 50 2 1 2 75 3 1 1 (on grade) 100 4 1 Below grade 1 100 3 1 2 50 2 1 Lower than 2 NP NP NA~~

~~NP: Not permitted. NA: Not applicable.~~

~~*See Table 5.1.3.3.2.4(b).~~

Statement of Problem and Substantiation for Public Comment

There was no technical justification to start including MAQ's in NFPA 99. For years NFPA 99 has had no restrictions in hospitals when it comes to use and storage of medical gases on upper floors and there has never been an issue. The committee shouldn't be developing code for problems that don't exist and didn't support the necessary evidence to make the change. Furthermore, the way this is section is written will put any hospital over 5 stories in height out of business. Adding any MAQ's to this code should not be rushed, at most a task group or research project should be done to determine the potential hazard and then the committee can respond appropriately.

Related Item

- PI-69

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Apr 18 22:06:34 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1053-NFPA 99-2022
Statement: The committee considered all of the information and determined that the presentation could be greatly simplified, duplication removed, and clarification provided. The revised text resolves these concerns. Requirements are provided for maximum quantities of medical gases used for central supply systems in a health care facility.

Public Comment No. 5-NFPA 99-2022 [Section No. 5.1.3.3.2.4]

5.1.3.3.2.4

Total quantities of gases in any location, including gas connected to central supply systems and in storage, shall be limited in accordance with Table 5.1.3.3.2.4(a) ~~and~~ .

5.1.3.3.2.5

The limits for the maximum allowable quantitites listed in Table 5.1.3.3.2.4 ~~(b).~~ are permitted to be exceeded through a documented risk assessment.

A.5.1.3.3.2.5

The documented risk assessment should consider clinical needs, emergency needs for proper patient care, the hazards with storing larger quantities of gases, and any mitigation requirements for patient, personnel, and visitor safety. This should be done for each location independently as these conditions may change due to factors like which floor is the gas being stored or how many smoke compartments there are in the area.

Table 5.1.3.3.2.4(a) Storage Quantities for Medical Gas and Cryogenic Fluid Central Supply Systems for Medical Gases in Each Location

~~566 m 3 (20,000 ft 3) 566 m 3 (20,000 ft 3) g~~

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP				
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]	
Sum of all oxidizing gases[f]			No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)	
Carbon dioxide	Liquefied compressed gas in cylinders	n, i, a	No limit	~~84 m 3 (3,000 ft 3)~~ ~~(e.g., 5 "H" cylinders)~~	~~283 m 3 (10,000 ft 3)~~ ~~(e.g., 17 "H" cylinders)~~	~~566 m 3 (20,000 ft 3)~~ ~~(e.g., 35 "H" cylinders) g~~	Not limited in quantity
	Refrigerated liquid in containers	n, i, a, c	No limit	~~84 m 3 (3,000 ft 3)~~	~~283 m 3 (10,000 ft 3)~~	Not limited in quantity	Not limited in quantity
Helium	Compressed gas in cylinders	n, i, a	No limit	~~84 m 3 (3,000 ft 3)~~ ~~(e.g., 14 "H" cylinders)~~	~~283 m 3 (10,000 ft 3)~~ ~~(e.g., 47 "H" cylinders)~~	~~566 m 3 (20,000 ft 3)~~ ~~(e.g., 94 "H" cylinders) g~~	Not limited in quantity
	Cryogenic fluid in containers	n, i, a, c	No limit	~~84 m 3 (3,000 ft 3)~~	~~283 m 3 (10,000 ft 3)~~	Not limited in quantity	Not limited in quantity
Oxygen	Compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 12	283 m^3 (10,000 ft^3) (e.g., 40	566 m^3 (20,000 ft^3) (e.g., 81 "H"	

Gas	Package Forms	Hazard Class and Description[a]	Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP			
			Outdoor Enclosure[b]	Indoor Medical Gas Storage Areas[c]	Indoor Gas Room[d]	Indoor Gas Room, Sprinklered[e]
				“H” cylinders)	“H” cylinders)	cylinders)[g]
	Cryogenic fluid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Medical air~~Cylinder~~	Compressed gas in cylinders	None	No limit	Not limited in quantity		
Nitrogen	Compressed gas in cylinders	n, i, a	No limit	Not limited in quantity		
	Cryogenic fluid in containers	n, i, a, c	No limit	Not limited in quantity		
Nitrous oxide	Liquified compressed gas in cylinders	n, x, a	No limit	84 m^3 (3,000 ft^3) (e.g., 5 “H” cylinders)	283 m^3 (10,000 ft^3) (e.g., 17 “H” cylinders)	566 m^3 (20,000 ft^3) (e.g., 35 “H” cylinders)[g]
	Refrigerated liquid in containers	n, x, a, c	No limit	84 m^3 (3,000 ft^3)	283 m^3 (10,000 ft^3)	566 m^3 (20,000 ft^3)[g]
Other Non-Medical Gases	Cylinder	Various	~~See~~ Shall be in accordance with NFPA 55.			

~~Note: See Table 5.1.3.3.2.4(b) for number of permitted locations and derating factors~~
Add Nitric Oxide to table - Compressed gas in cylinders - n, x, a - No Limit - 3,000 cu. ft. - 10,000 cu. ft. - 20,000 cu. ft .

[a] Hazard classifications are as follows:

n = nonflammable

i = inert

a = asphyxiant

c = cryogen when liquid

x = oxidizer

[b] Outdoor enclosure constructed and ventilated in accordance with this code and NFPA 55.

[c] See 5.1.3.3.2 and Section 11.3.

[d] Indoor structure constructed in accordance with 5.1.3.3.2 and ventilated in accordance with 9.3.6.

e Indoor structure constructed in accordance with 5.1.3.3.2, ventilated in accordance with 9.3.6, and sprinklered in accordance with NFPA 13.

(f) The maximum allowable quantity of oxidizing medical gases within a single location is limited both by the total quantity of oxidizing gas

~~and type of gas~~

.

~~The allowable storage quantity is also limited by the gas type, as listed, and the sum is the maximum aggregate quantity of gases of all species. For example: In an indoor medical gas manifold room, provided with ventilation in accordance with 9.3.2 and sprinklered in accordance with NFPA 13, it would be permissible to store eight "H" size cylinders [126,406 m^3 (4,464 ft^3)] of nitrous oxide, two 160 L (9,722 ft^3) containers, and 23 "H" size cylinders [162,171 m^3 (5,727 ft^3)] of oxygen for a total quantity of 563,873 m^3 (19,913 ft^3) gas equivalent. In this example, cylinders or containers of the same capacity (Standard Cubic Feet of medical gas) (like for like) can be exchanged freely, but additional cylinders or containers of a larger capacity would increase the room's total contents of medical gas above the allowed 566 m^3 (20,000 ft^3) of medical gas and could not be stored in this room.~~

g ~~These are the limits for indoor storage. See NFPA 55 for outdoor storage limits.~~

~~Table 5.1.3.3.2.4(b) Number and Derating Factors of Gas Storage Locations by Floor~~

~~Floor Maximum Allowable Quantity (%)* Number of Locations Permitted Fire Rating (hr) Above grade >9 5 1 2 7–9 5 2 2 4–6 25 2 2 3 50 2 1 2 75 3 1 1 (on grade) 100 4 1 Below grade 1 100 3 1 2 50 2 1 Lower than 2 NP NP NA~~

~~NP: Not permitted. NA: Not applicable.~~

~~*See Table 5.1.3.3.2.4(b).~~

Statement of Problem and Substantiation for Public Comment

Adjusted Table (a) to address inert gases being limited. They are not limited in NFPA 55, which is where this table originated. The table has been amended to be consistent with NFPA 55. The table was also updated to only reflect oxidizing gases having a "sum" limitation.

Table (b) was deleted since there has been no technical information provided to justify the derating limits for upper levels within the hospital. Limiting the quantities on upper floors would potentially limit the availability;ity of these life saving gases for patients in an emergency. Therefore, it is recommended that a task group be formed to research appropriate derating factors that could be applied to the health care setting without compromising patient safety.

Related Item

• FR-1040

Submitter Information Verification

Submitter Full Name: Jonathan Willard
Organization: Acute Medical Gas Services
Street Address:
City:
State:
Zip:
Submittal Date: Mon Mar 14 16:29:33 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-1053-NFPA 99-2022

Statement: The committee considered all of the information and determined that the presentation could be greatly simplified, duplication removed, and clarification provided. The revised text resolves these concerns. Requirements are provided for maximum quantities of medical gases used for central supply systems in a health care facility.

Public Comment No. 72-NFPA 99-2022 [Section No. 5.1.3.3.2.4]

5.1.3.3.2.4

Total quantities of gases in any location, including gas connected to central supply systems and in storage, shall be limited in accordance with Table 5.1.3.3.2.4(a) and Table 5.1.3.3.2.4(b).

Table 5.1.3.3.2.4(a) Storage Quantities for Medical Gas and Cryogenic Fluid Central Supply Systems for Medical Gases in Each Location

Gas Package Forms Hazard Class and Description [a] Maximum Allowable Quantity, Connected and in Storage, Gas Equivalent at STP Outdoor Enclosure [b] Indoor Medical Gas Storage Areas [c] Indoor Gas Room [d] Indoor Gas Room, Sprinklered [e] Sum of all gases [f] No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) Carbon dioxide Liquefied compressed gas in cylinders n, i, a No limit 84 m^3 (3,000 ft^3)

(e.g., 5 “H” cylinders) 283 m^3 (10,000 ft^3)

(e.g., 17 “H” cylinders) 566 m^3 (20,000 ft^3)

(e.g., 35 “H” cylinders) [g] Refrigerated liquid in containers n, i, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) Helium Compressed gas in cylinders n, i, a No limit 84 m^3 (3,000 ft^3)

(e.g., 14 “H” cylinders) 283 m^3 (10,000 ft^3)

(e.g., 47 “H” cylinders) 566 m^3 (20,000 ft^3)

(e.g., 94 “H” cylinders) [g] Cryogenic fluid in containers n, i, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Oxygen Compressed gas in cylinders n, x, a No limit 84 m^3 (3,000 ft^3)

(e.g., 12 “H” cylinders) 283 m^3 (10,000 ft^3)

(e.g., 40 “H” cylinders) 566 m^3 (20,000 ft^3)

(e.g., 81 “H” cylinders) [g] Cryogenic fluid in containers n, x, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Medical air Cylinder None No limit Not limited in quantity Nitrogen Compressed gas in cylinders n, i, a No limit Not limited in quantity Cryogenic fluid in containers n, i, a, c No limit Not limited in quantity Nitrous oxide Liquified compressed gas in cylinders n, x, a No limit 84 m^3 (3,000 ft^3)

(e.g., 5 “H” cylinders) 283 m^3 (10,000 ft^3)

(e.g., 17 “H” cylinders) 566 m^3 (20,000 ft^3)

(e.g., 35 “H” cylinders) [g] Refrigerated liquid in containers n, x, a, c No limit 84 m^3 (3,000 ft^3) 283 m^3 (10,000 ft^3) 566 m^3 (20,000 ft^3) [g] Other Cylinder Various See NFPA 55.

Note: See Table 5.1.3.3.2.4(b) for number of permitted locations and derating factors.

[a] Hazard classifications are as follows:

n = nonflammable

i = inert

~~a = asphyxiant~~

~~c = cryogen when liquid~~

~~x = oxidizer~~

~~b Outdoor enclosure constructed and ventilated in accordance with this code and NFPA 55.~~

~~c See 5.1.3.3.2 and Section 11.3.~~

~~d Indoor structure constructed in accordance with 5.1.3.3.2 and ventilated in accordance with 9.3.6.~~

~~e Indoor structure constructed in accordance with 5.1.3.3.2, ventilated in accordance with 9.3.6, and sprinklered in accordance with NFPA 13.~~

~~f The maximum allowable quantity of medical gases within a single location is limited both by the total quantity of gas and type of gas. The allowable storage quantity is also limited by the gas type, as listed, and the sum is the maximum aggregate quantity of gases of all species. For example: In an indoor medical gas manifold room, provided with ventilation in accordance with 9.3.2 and sprinklered in accordance with NFPA 13, it would be permissible to store eight "H" size cylinders [126,406 m^3 (4,464 ft^3)] of nitrous oxide, two 160 L (9,722 ft^3) containers, and 23 "H" size cylinders [162,171 m^3 (5,727 ft^3)] of oxygen for a total quantity of 563,873 m^3 (19,913 ft^3) gas equivalent. In this example, cylinders or containers of the same capacity (Standard Cubic Feet of medical gas) (like for like) can be exchanged freely, but additional cylinders or containers of a larger capacity would increase the room's total contents of medical gas above the allowed 566 m^3 (20,000 ft^3) of medical gas and could not be stored in this room.~~

~~g These are the limits for indoor storage. See NFPA 55 for outdoor storage limits.~~

~~Table 5.1.3.3.2.4(b) Number and Derating Factors of Gas Storage Locations by Floor~~

~~Floor Maximum Allowable Quantity (%)* Number of Locations Permitted Fire Rating (hr) Above grade >9 5 1 2 7–9 5 2 2 4–6 25 2 2 3 50 2 1 2 75 3 1 1 (on grade) 100 4 1 Below grade 1 100 3 1 2 50 2 1 Lower than 2 NP NP NA~~

~~NP: Not permitted. NA: Not applicable.~~

~~*See Table 5.1.3.3.2.4(b).~~

~~being used for medical purposes shall not be limited in health care occupancies.~~

Statement of Problem and Substantiation for Public Comment

This ensures that the gases are being used for medical purposes and that the building that they are being used in is a Health Care Occupancy as defined by NFPA 101 i.e. requiring sprinklering, compartmentation and other life safety features that will reduce the hazard associated with using medical gases.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 99-NFPA 99-2022 [Section No. 2.2]	

Related Item

• PI-69

Submitter Information Verification

Submitter Full Name: Chad Beebe

Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:31:47 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution: It is appropriate to specify limits on gases used with medical gas systems. See SR-1053 for revised maximum allowable quantities.

Public Comment No. 11-NFPA 99-2022 [Section No. 5.1.3.5.4]

5.1.3.5.4* Materials.

Materials used in central supply systems shall meet the following requirements:

(1) In those portions of systems intended to handle oxygen at gauge pressures greater than 3000 kPa (435 psi), interconnecting hose shall contain no polymeric materials.

(2) In those portions of systems intended to handle oxygen or nitrous oxide at gauge pressures of less than 3000 kPa (435 psi), material, construction shall be compatible with oxygen under the temperatures and pressures to which the components can be exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases, or mixtures containing more than 23.5 percent oxygen.

(3) If potentially exposed to cryogenic temperatures, materials shall be designed for low temperature service.

(4) If intended for outdoor installation, materials shall be installed in accordance with the manufacturer's requirements.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_10.pdf	NFPA 99 CCN_10	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 10 appeared in the First Draft Report on First Revision No. 1042.

Review 5.1.3.5.4.(2) for placement of "material" and editorially relocate or delete as appropriate.

Related Item

• FR-1042

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 08:59:52 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-973-NFPA 99-2022
Statement: The revision responds to CCN-10 and deletes 'material' as suggested.

Correlating Committee Note No. 10-NFPA 99-2022 [Section No. 5.1.3.5.4]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:45:26 EST 2022

Committee Statement

Committee Statement: Review 5.1.3.5.4(2) for placement of "material" and editorially relocate or delete as appropriate.

First Revision No. 1042-NFPA 99-2021 [Section No. 5.1.3.5.4]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 97-NFPA 99-2022 [Sections 5.1.3.5.12.1, 5.1.3.5.12.2]

Sections 5.1.3.5.12.1, 5.1.3.5.12.2

5.1.3.5.12.1

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

(3) Minimum of 1 m (3 ft) of clearance around the EOSC for connection of temporary auxiliary source

5.1.3.5.12.

~~2~~

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 and other components necessary to allow testing, maintenance, and 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~~

(8) * Four alarm connection points installed to both master alarm panels to allow the temporary supply to be monitored while in use

(9) Labeled as “Emergency Oxygen Supply Connection”.

Statement of Problem and Substantiation for Public Comment

During the Covid-19 Pandemic when surges in oxygen demand were at their highest levels, the Emergency Oxygen Supply Connections (EOSC) was the most depended upon Oxygen System auxiliary connection to add vital supplemental oxygen. This critical auxiliary connection allows for supplemental oxygen supplies such as portable oxygen bulk tank system trailers, temporary skid mounted bulk oxygen tanks systems, temporary microbulk oxygen supplies systems, portable liquid container systems, high pressure cylinder systems, to be connected into the Medical Oxygen Piped Utility System and support and enhance the patient respiratory treatment needs of the Facility. The

EOSC is a vital part of the Medical Oxygen Utility System and the design, location, testing and maintenance of this auxiliary supply connection are important parts of the EOSC.
Testing and maintenance conducted on the EOSC needs to be conducted to keep the EOSC operating as needed when used. With most industry design configurations of the EOSC units, testing and maintenance can be a challenge. It is recommended that the Facility works with their Bulk Gas Supplier when testing and conducting maintenance on the EOSC. Any newly installed EOSC should take into consideration a means to test and maintain the EOSC. This will require additional components and designs of te EOSC.

Related Item

• EOSC Task group and 1st Revision 1044

Submitter Information Verification

Submitter Full Name: Keith Ferrari
Organization: Linde/Praxair
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 13:44:25 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but held
Resolution: The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 64-NFPA 99-2022 [Section No. 5.1.3.5.14]

5.1.3.5.14 *

Auxiliary Connections.

~~All medical gas and vacuum systems shall be provided with~~

~~an auxiliary connection located on the patient side of the source valve~~

a point of access for connection of a temporary or supplemental source of supply.

~~**5.1.3.5.14.1** –~~

~~The~~

~~auxiliary~~

~~connection shall include the following:~~

~~(1) located in the main line, patient side of the source valve, in a location determined to be suitable by the Responsible Facility Authority;~~

~~(2) of the same size as the main line~~

~~**5.1.3.5.14.2** –~~

~~The auxiliary connection shall~~

~~, but need not be larger than DN 54 NPS 2"(2 1/8" OD);~~

~~(3) consist of a tee, valve~~

~~and removable plugged or capped connection point ;~~

~~(4) the valve and connection point shall be labelled (5 . 1.11);~~

~~(5) the valve shall be secured (5 .1. 4.1.2).~~

~~A 5.1. 3.5.14~~

~~.3~~

~~The location of~~

~~(insert illustration)~~

~~The preferred location for the auxiliary connection~~

~~shall~~

~~should consider how it will be used~~

~~**5.1.3.5.14.4** –~~

~~The valve shall be secured in accordance with 5.1.4.1.2 .~~

~~in event of need, including space for or access to the temporary source, access to electrical power and alarm connections.~~

~~Similar auxiliary connections (tee, valve and plug or cap) may also be useful in other locations the Responsible Facility Authority determines appropriate for operating or supplementing their systems during maintenance, construction or emergencies (e.g. at zone valves in high dependency areas). They are generally superior to "backfeeding" through outlets or gauge ports, which may be the only other option.~~

Additional Proposed Changes

File Name	Description	Approved
aux_connection_v2.png	illustration for annex	

Statement of Problem and Substantiation for Public Comment

This is the conclusion of the Auxiliary Connections Task Group, reconciling proposals for PI 184, PI 261 and PI 354 with FR 1044

Related Item

- FR 1044

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: Task Group on Auxiliary Connections
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 19 10:29:15 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 99-2022
Statement: The revisions were developed by a task group on auxiliary connections in response to PI-184, PI-261, PI-354, and FR-1044.

Public Comment No. 70-NFPA 99-2022 [Section No. 5.1.3.6.3.14(B)]

(B) Location.

The medical air proportioning system shall be located per 5.1.3.3 as follows:

(1) The medical air proportioning system's supply of oxygen USP and nitrogen NF shall be located per 5.1.3.3~~- and NFPA 55, as applicable~~ .

(2) The mixing device and controls, analyzers, and receivers shall be located indoors within a room or area per 5.1.3.3.1.

(3) The indoor location shall include atmospheric monitoring for oxygen concentration.

(4) The indoor location shall be constructed with all required utilities (e.g., electricity, drains, lighting) per *NFPA 5000*.

(5) The indoor location shall be ventilated and heated per Chapter 9 and the manufacturer's recommendations.

Statement of Problem and Substantiation for Public Comment

There is no need to reference NFPA 55 here and bring in industrial gases since this section is only about medical gases. The subjective terminology "as applicable" should be avoided within the reference because AHJ's won't know what is applicable and what is not applicable.

Related Item

• PI-69

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:19:53 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution: The submitter's concerns have been addressed by other revisions related to references to NFPA 55.

Public Comment No. 12-NFPA 99-2022 [Section No. 5.1.3.8.1.2]

5.1.3.8.1.2

If WAGD is produced by the medical–surgical vacuum source, the following shall apply:

(1) The medical–surgical vacuum source shall comply with 5.1.3.7.

(2) The total concentration of oxygen shall be maintained below 23.6 percentunless one of the following conditions is met:

(a) The vacuum pump complies with 5.1.3.8.2.1.

(b) The combined medical–surgical vacuum/WAGD system is monitored for oxygen and an alarm will initiate at all master alarm panels if the oxygen concentration exceeds 23.6 percent.

(3) The medical–surgical vacuum source shall be sized to accommodate the additional volume.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_11.pdf	NFPA 99 CCN_11	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 11 appeared in the First Draft Report on First Revision No. 1029, and is also related to Public Input No. 1029.

Consider the negative vote of Currence re. need for revisions to 5.1.9 for master alarms.

Related Item

• FR-1029 • PI-358

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 09:05:24 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-979-NFPA 99-2022

Statement: Thee is no definition for "Supply Unit". The Code uses the term Supply Source for each "unit" and Central Supply System for the collection of Supply Sources and controls that comprise the entire plant. It is desirable to use consistent language. The revision also responds to CCN-11 and incorporates the suggested change via the new item (16).

Correlating Committee Note No. 11-NFPA 99-2022 [Section No. 5.1.3.8.1.2]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:46:41 EST 2022

Committee Statement

Committee Statement: Consider the negative vote of Currence re. need for revisions to 5.1.9 for master alarms.

First Revision No. 1029-NFPA 99-2021 [Section No. 5.1.3.8.1.2]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

First Revision No. 1029-NFPA 99-2021 [Section No. 5.1.3.8.1.2]

5.1.3.8.1.2

If WAGD is produced by the medical–surgical vacuum source, the following shall apply:

(1) The medical–surgical vacuum source shall comply with 5.1.3.7.

(2) The total concentration of oxygen shall be maintained below 23.6 percent~~, or the vacuum pump shall comply with 5.1.3.8.2.1 .~~ unless one of the following conditions is met:

(a) The vacuum pump complies with 5.1.3.8.2.1 .

(b) The combined medical–surgical vacuum/WAGD system is monitored for oxygen and an alarm will initiate at all master alarm panels if the oxygen concentration exceeds 23.6 percent.

(3) The medical–surgical vacuum source shall be sized to accommodate the additional volume.

Submitter Information Verification

Committee: HEA-PIP
Submittal Date: Wed Aug 04 13:29:52 EDT 2021

Committee Statement and Meeting Notes

Committee Statement: The revision clarifies that monitoring of the system is an acceptable means to mitigate the issue addressed in the code.
Response Message: FR-1029-NFPA 99-2021

Public Input No. 358-NFPA 99-2021 [Section No. 5.1.3.8.1.2]

Ballot Results

This item has passed ballot

30 Eligible Voters
4 Not Returned
25 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Colombo, Dana A.

Fasel, Mark

Franklin, Mark T.

Fuchs, Andrew

Affirmative All

Allen, Mark W.

Anderson, Grant A.

Beebe, Chad E.

Braidich, David

Carter, Mark David

Crowley, Michael A.

Dodson, Marc

Ferrari, Keith

Gagné, Neil

Golla, Ed

Hamilton, Scott

Lathrop, James K.

Litvin, Edward A.

Lucas, James L.

Lyczko, Edward J.

Lyons, David C.

Martin, Bret M.

McBride, Jeffery F.

Miller, Douglas

Scarlett, Kevin A.

Shapiro, Elizabeth A. "Betsy"

Shoemaker, E. Daniel

Smidt, Ronald M.

Volz, Allan D.

Willard, Jonathan C.

Negative with Comment

Currence, Gary

1.Need to add a section in 5.1.9 to cover the now required master alarm. 2. To my knowledge, the technology does not exist to monitor this required alarm. Some facilities use larger rotary screw vacuum pumps(50+ horsepower). This change could put a large engineering and finical burden on them. Rotary screw vacuums, to my knowledge, do not have a history of fire incidents when used in Med/WAGD combo systems. This input could limit the type of vacuum producer that could be used.

Editorial Comment

Click here

Public Comment No. 46-NFPA 99-2022 [Section No. 5.1.3.8.5]

5.1.3.8.5 WAGD Exhaust.

WAGD producers shall exhaust in compliance with 5.1.3.7.7unless otherwise permitted by one of the following:

(1) Producers under 1 hp and venturi producers shall be permitted to exhaust individually in a manner that will allow for dispersion of the exhaust gases and not allow the exhaust gas to reenter the building through openable windows, nearby intakes, or other openings.

(2) Anesthetic gas ~~recovery (AGR) systems~~ recovery and anesthetic gas destruction systems shall be permitted to be installed in the WAGD exhaust piping as long as bypassing ~~the AGR systems is~~ the system is allowed where required.

Statement of Problem and Substantiation for Public Comment

Anesthetic gas destruction systems are an alternate and often superior technology for mitigating the environmental effects of inhaled anesthetics. Described systems use phocataylic processes to render these chemicals environmentally inert and can eliminate nitrous oxide in addition to volatile anesthetics. This proposal supplements the original first draft proposal to include destruction systems in addition to recovery / sequestration systems.

This revision is also requested for 15.1.3.8.5 which is identical to 5.1.3.8.5

Related Item

• Clarification to FR1046

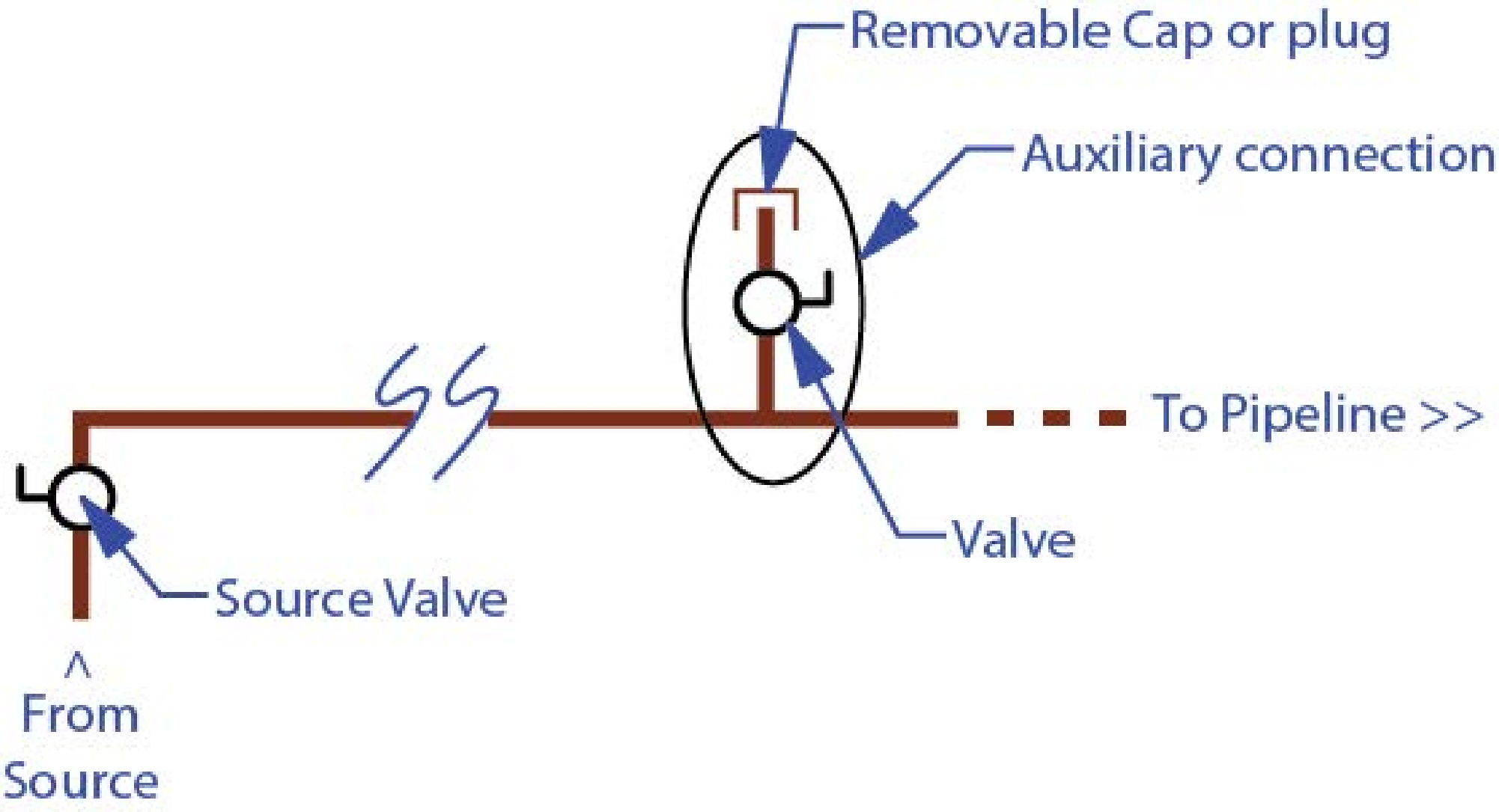
Submitter Information Verification

Submitter Full Name:	David Lyons
Organization:	University of Rochester - Department of Anesthesiology and Perioperative Medicine
Affiliation:	American Society of Anesthesiologists
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Apr 25 09:48:26 EDT 2022
Committee:	HEA-PIP

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-975-NFPA 99-2022
Statement:	Anesthetic gas destruction systems are an alternate and often superior technology for mitigating the environmental effects of inhaled anesthetics. Described systems use phocataylic processes to render these chemicals environmentally inert and can eliminate nitrous oxide in addition to volatile anesthetics. This proposal supplements the

original first draft proposal to include destruction systems in addition to recovery / sequestration systems. The revision also incorporates the recommendation of PC-58.


Removable Cap or plug
Auxiliary connection
To Pipeline >>
Valve
Source Valve
From Source

Public Comment No. 58-NFPA 99-2022 [Section No. 5.1.3.8.5]

5.1.3.8.5 WAGD Exhaust.

WAGD producers shall exhaust in compliance with 5.1.3.7.~~7~~ 7 unless otherwise permitted by one of the following:

(1) Producers under 1 hp and venturi producers shall be permitted to exhaust individually in a manner that will allow for dispersion of the exhaust gases and not allow the exhaust gas to reenter the building through openable windows, nearby intakes, or other openings.

(2) Anesthetic gas recovery (AGR) systems shall be permitted to be installed in the WAGD exhaust piping ~~as long as bypassing the AGR systems is allowed where~~ provided the AGR system can be bypassed without compromising the flow of exhaust when required.

Statement of Problem and Substantiation for Public Comment

The language as written did not make it clear that the exhaust needs to be maintained in a safe condition in bypass. Proposed language is intended to clarify.

Related Item

• FR1045

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: Beaconmedaes
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 08:47:43 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-975-NFPA 99-2022
Statement: Anesthetic gas destruction systems are an alternate and often superior technology for mitigating the environmental effects of inhaled anesthetics. Described systems use phocataylic processes to render these chemicals environmentally inert and can eliminate nitrous oxide in addition to volatile anesthetics. This proposal supplements the original first draft proposal to include destruction systems in addition to recovery / sequestration systems. The revision also incorporates the recommendation of PC-58.

Public Comment No. 56-NFPA 99-2022 [Section No. 5.1.3.9.1.13]

5.1.3.9.1.13

The oxygen concentrator supply ~~unit~~ source shall be provided with an oxygen concentration monitor with the following characteristics:

(1) The monitor shall be capable of monitoring 99 percent oxygen concentration with 1 percent accuracy.

(2) The monitor shall continuously display the oxygen concentration and shall activate local alarm and master alarms in accordance with 5.1.3.9.5 when a concentration lower than 91 percent is observed.

(3) The monitor shall continuously display the oxygen concentration.

(4) It shall be permitted to insert the monitor into the pipeline without a demand check.

Statement of Problem and Substantiation for Public Comment

There is no definition for a "supply unit". The code uses the term "supply source" for the individual "units" and the term "central supply system" for the collection of supply sources and controls making up the total plant. It is important to use these terms for consistency.

Related Item

• FR1030

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 08:29:34 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Accepted
Resolution: SR-976-NFPA 99-2022
Statement: There is no definition for a "supply unit". The code uses the term "supply source" for the individual "units" and the term "central supply system" for the collection of supply sources and controls making up the total plant. It is important to use these terms for consistency.

Public Comment No. 57-NFPA 99-2022 [Section No. 5.1.3.9.3]

5.1.3.9.3 Arrangement and Redundancies.

An oxygen central supply system using a concentrator(s) shall be permitted to consist of two or three supply sources, as follows:

(1) If two supply sources are provided, the following shall apply:

(2) One source shall be an oxygen concentrator supply

~~unit~~

(a) source .

(b) The second source shall be a cylinder header complying with 5.1.3.5.9 with sufficient cylinder connections for one average day's supply.

(c) Containers shall not be used as a supply source.

(3) If three supply sources are provided, the following shall apply:

(a) Each source shall be capable of independently supplying the full system demand in the event of the unavailability of one or both of the other sources.

(b) Each source shall be permitted to be either of the following:

(4) An oxygen concentrator supply

~~unit~~

i. source complying with 5.1.3.9.1

ii. A cylinder header complying with 5.1.3.5.9 with sufficient cylinder connections for one average day's supply

(c) Containers shall not be used as a supply source.

(5) Use of oxygen concentrator supply systems as all three sources shall only be permitted after a documented risk analysis by the governing authority of the health care facility indicating an understanding of the inherent risks and defining how those risks shall be mitigated.

(6) An isolation valve and automatic check valve shall be provided to isolate each of the three sources from the others and from the pipeline. The valves in 5.1.3.5.9(4), 5.1.3.5.9(6), 5.1.3.9.1.11, and 5.1.3.9.1.12 shall be permitted to be used for this purpose.

(7) Each of the three supply sources shall be provided with a pressure relief valve complying with 5.1.3.5.6 on the source side of its respective isolating valve.

(8) The three supply sources shall join to the pipeline systems through control arrangements with at least the following characteristics:

(a) Able to maintain stable pressures within the limits of Table 5.1.11

(b) Able to flow 100 percent of the peak calculated demand

(c) Redundant, such that each component of the control mechanism can be isolated for service or replacement while maintaining normal operation

(d) The cascade of sources described in 5.1.3.9.4

(e) Protected against overpressure *(see 5.1.3.5.6)*

(9) A pressure relief valve shall be provided in the common line between the sources and the line pressure controls.

(10) A source valve in accordance with 5.1.4.2 shall be provided on the patient side of the line pressure controls.

(11) A gauge and switch or sensor shall be located between the three sources and the line pressure controls to monitor the pressure feeding the line pressure controls.

(12) An oxygen concentration monitor, sampling the gas on the patient side of the line pressure controls and on the source side of the source valve, shall be provided with the following characteristics:

(a) The monitor shall be capable of monitoring 99 percent oxygen concentration with ±1.0 percent accuracy.

(b) The monitor shall be attached to the pipeline through a demand check in accordance with 5.1.8.2.3.

(c) The monitor shall continuously display the oxygen concentration and shall activate the local alarm and master alarms when an oxygen concentration lower than 91 percent is observed.

(13) A DN8 (NPS ¼) valved sample port shall be provided on the patient side of the line pressure controls and source side of the source valve for sampling the oxygen.

(14) An auxiliary source connection complying with 5.1.4.10 shall be provided.

(15) Electrical installation and wiring shall conform to the requirements of *NFPA 70*.

(16) Emergency electrical service for all components of the oxygen supply system shall conform to the requirements of the essential electrical system as described in Chapter 6.

Statement of Problem and Substantiation for Public Comment

There is no definition for a "supply unit". The code uses the term "supply source" for the individual "units" and the term "central supply system" for the collection of supply sources and controls making up the total plant. It is important to use these terms for consistency.

Related Item

• FR1030

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 08:39:28 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Accepted
Resolution: SR-977-NFPA 99-2022
Statement: There is no definition for a "supply unit". The code uses the term "supply source" for the individual "units" and the term "central supply system" for the collection of supply sources and controls making up the total plant. It is important to use these terms for consistency.

Public Comment No. 71-NFPA 99-2022 [Section No. 5.1.3.10.1.2]

5.1.3.10.1.2 Applicability.

~~**(B)** –~~

(A) _

~~The source valve shall be the line separating the applicability between NFPA 55 and this code. [**55:** 17.1.2.1]~~

Cryogenic fluid central supply system installations up to, but not including, the source valve shall be covered by

~~NFPA 55. [**55:** 17.1.2.2]~~

this code

(

~~C~~

B) _

The source valve and all downstream piping and components, including wiring to storage system alarms, shall be covered by this code. [**55:** 17.1.2.3]

Statement of Problem and Substantiation for Public Comment

Eliminate (A) which really doesn't make any sense and difficult to interpret.

Eliminate the reference to NFPA 55. It's not appropriate to apply all of NFPA 55 to cryogenic systems in health care facilities.

Related Item

• pi-69

Submitter Information Verification

Submitter Full Name: Chad Beebe
Organization: ASHE-AHA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 11:25:55 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The submitter's concerns have been addressed by other revisions related to references to NFPA 55.

Public Comment No. 68-NFPA 99-2022 [Section No. 5.1.4.6.2]

5.1.4.6.2*

A zone valve in each medical gas ~~or~~ and vacuum line shall be provided for each Category 1 space and be located as follows:

(1) ~~They~~ Where no general anesthesia, deep sedation, or moderate sedation to patients is administered, t hey shall be installed immediately outside the area or zone being controlled.

(2) ~~They shall be installed where they are visible and accessible at all times.~~

(3) Where general anesthesia, deep sedation, or moderate sedation to patients is administered, they shall be installed outside each room.

(4) They shall be installed where they are visible and accessible at all times.

Statement of Problem and Substantiation for Public Comment

This section was modified during the 1st draft by this submitter. After reviewing the text, it seemed that this section still could be interpreted as needing a zone valve for the zone/area AND a zone valve outside each room. To better explain the intent of a zone valve placement for a Cat 1 space when Anesthesia/Sedation is administered and when Anesthesia/Sedation is not administered in a Cat 1 space, the edited text is submitted for review and approval.

Related Item

• First Revision No. 1090 (PI 379)

Submitter Information Verification

Submitter Full Name: Keith Ferrari
Organization: Linde
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 23 12:58:54 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-978-NFPA 99-2022
Statement: This section was modified during the 1st draft. After reviewing the text, it seemed that this section still could be interpreted as needing a zone valve for the zone/area AND a zone valve outside each room. The revision better explains the intent of a zone valve placement for a Cat 1 space when Anesthesia/Sedation is administered and when Anesthesia/Sedation is not administered in a Cat 1 space. The former item (2) is deleted because it is addressed in the preceding paragraph.

Public Comment No. 65-NFPA 99-2022 [Section No. 5.1.4.10 [Excluding any Sub-Sections]]

All ~~cryogenic fluid~~ central supply systems shall be provided with an auxiliary source connection ~~point of the same size as the main line~~ , which shall be located ~~immediately~~ on the patient side of the source valve.

(1) Auxiliary connection size shall be no more than 2" pipe size.

(2) Connected to the main line.

(3) Shall be located on the patient side of the source valve, or on the side of the building it serves.

(4) Connection located in an area where a portable medical gas source can be located on a temporary basis.

(5) Location of temporary source equipment shall meet the same distance requirements (intake and exhaust) as the source being served.

(6) Provide emergency power connection for temporary source equipment.

(7) Provide same required signals back to the master alarm panel for monitoring during the duration portable unit is being used.

Statement of Problem and Substantiation for Public Comment

This did not remove the cryogenic limitation. It also is not practical to provide auxiliary connection of same size as the main, as the portable units being provided usually come with a 1-1/2" - 2" connection. So to provide a 6" vacuum or a 4" med air connection, you will still be connected using at most a 2" line. a 2" line serving a med air or med vac system will work more along the lines as maintaining system long enough for other system to be placed into service, which could be a day or two. I have seen this work on a level 1 trauma center with 435 beds, 6" med vac system for couple of days with no issue. I don't mind leaving the Tee with a valve and capped end as currently shown, but do not limit future possibilities as we have done for other items in the code. Also if the room where the equipment has had a fire or another failure, having a similar connection much like an EOSC supports the Oxygen, this connection becomes of no use.

Related Item

• PI #261 and PI #354

Submitter Information Verification

Submitter Full Name: John Gregory
Organization: WSP USA
Affiliation: P.I.P.E. Med Gas Committee of Arizona
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 19 18:23:07 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-974-NFPA 99-2022
Statement:	The revisions were developed by a task group on auxiliary connections in response to PI-184, PI-261, PI-354, and FR-1044.

Public Comment No. 66-NFPA 99-2022 [Section No. 5.1.4.10.1]

5.1.4.10.1

The connection shall consist of ~~a tee~~ 2" type L copper pipe , a lockable valve, and a removable ~~plug or~~ cap. The cap shall be of the removavle type that meets the requirements of pipe and fitting material.

Statement of Problem and Substantiation for Public Comment

we do not want the caps or plugs to be to easily removable as it could be knocked off and contaminate the end of the pipe we are trying to maintain a cleanliness level. If there are more than one manufacturer or type of fitting similar to a shark bite, which can be removed with a special tool. That is the type of cap I believe we should e using to maintain cleanliness.

Related Item

• PI #261 and PI# 354

Submitter Information Verification

Submitter Full Name: John Gregory
Organization: WSP USA
Affiliation: P.I.P.E. Med Gas Committee Arizona
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 19 18:46:47 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 99-2022
Statement: The revisions were developed by a task group on auxiliary connections in response to PI-184, PI-261, PI-354, and FR-1044.

Public Comment No. 82-NFPA 99-2022 [Section No. 5.1.5.16 [Excluding any Sub-Sections]]

WAGD networks shall provide a WAGD inlet in all locations where nitrous oxide or halogenated anesthetic gas is intended to be administered for deep sedation or general anesthesia .

Statement of Problem and Substantiation for Public Comment

Medical facilities have expanded the use of nitrous oxide and oxygen to procedural areas where it is being used for minimal sedation and pain management. These locations do not commonly have WAGD inlets. Nitrous oxide can safely and effectively be scavenged through a vacuum inlet (and has been for decades). It is the facilities responsibility to ensure that the vacuum system itself meets the "vacuum" requirements set forth within NFPA. The facilities also have strict guidelines on who can perform what levels / types of sedation - and in what locations. Having or not having a WAGD inlet does not present a safety benefit or risk in these scenarios. A WAGD inlet and VAC inlet both go to the same source.

The current NFPA language has resulted in hospitals spending tens of thousands of dollars (and disruption) to add WAGD inlets - or they have ceased in use of nitrous oxide and oxygen for these applications - reducing access to improved care for patients. ASHE is also specifically targeting hospitals and looking for those that are using nitrous oxide and do not have a WAGD inlet. Hospitals are being threatened with "non-compliance" and told they will lose their accreditation.

Prior editions of NFPA 99 included language regarding different levels of treatment areas within the same facility. This language was removed - and now when 5.1.5.16 is reviewed it is "all-encompassing" versus - how is it being used, where is it being used, and the risk level associated to the patient and staff (which when used for minimal to moderate sedation - is little to no risk).

It is also written within Chapter 15 - that WAGD inlets are not required when nitrous oxide is used for minimal to moderate sedation. Although 15 is "dental" - the use of scavenging and WAGD terms should be used similarly. 15.3.3.6.1.1 and 15.4.3.3.4.1.

Related Item

• 21-NFPA 99 - 2020

Submitter Information Verification

Submitter Full Name: Michael Civitello
Organization: Porter Instrument
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 25 16:00:25 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution:	The proposed change would create inconsistencies in the code. Resolution of those inconsistencies would be considered new business at the second draft stage.

Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]

5.1.6.1.1

Manufactured assemblies shall be pretested by the manufacturer prior to arrival at the installation site in accordance with the following:

(1) Standing pressure test per 5.1.12.2.6 or 5.1.12.2.7, except as permitted under 5.1.6.2

(2) Operational pressure test per 5.1.12.4.10, except tat the test gas is permitted to be in accordance with the manufacturer's process requirements

Statement of Problem and Substantiation for Public Comment

These are the current requirements, items 4 and 5, under 5.1.6.1. I'm attempting to clarify that they are only able to be completed on assemblies that have the medical gas or vacuum outlet front bodies installed.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	

Related Item

• Public Input No. 234 • Public Input No. 227 • Public Input No. 228

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 09:38:15 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-969-NFPA 99-2022

Statement: These are the current requirements, items 4 and 5, under 5.1.6.1. The revision clarifies that they are only able to be completed on assemblies that have the medical gas or vacuum outlet front bodies installed.

Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]

5.1.6.1

Manufactured assemblies and rough-in assemblies shall be pretested by the manufacturer prior to arrival at the installation site in accordance with the following:

(1) Initial blowdown test per 5.1.12.2.2

(2) Initial pressure test per 5.1.12.2.3

(3) Piping purge test per 5.1.12.2.5

(4) ~~Standing pressure test per 5.1.12.2.6 or 5.1.12.2.7 , except as permitted under 5.1.6.2~~

(5) ~~Operational pressure test per 5.1.12.4.10 , except that the test gas is permitted to be in accordance with the manufacturer's process requirements~~

Statement of Problem and Substantiation for Public Comment

Since the manufactured rough-in assemblies include only the station outlet/inlet secondary valves (back bodies), and do not include the primary valves (front bodies), then the standing pressure test per 5.1.12.2.6 and operational pressure test per 5.1.12.4.10 are unable to be completed at the factory.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 88-NFPA 99-2022 [New Section after 5.1.6.1]	
Public Comment No. 91-NFPA 99-2022 [Section No. A.5.1.12.2.2]	

Related Item

• Public Input No. 234 • Public Input No. 227 • Public Input No. 228

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 09:34:28 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-970-NFPA 99-2022
Statement:	Since the manufactured rough-in assemblies include only the station outlet/inlet secondary valves (back bodies), and do not include the primary valves (front bodies), then the standing pressure test per 5.1.12.2.6 and operational pressure test per 5.1.12.4.10 are unable to be completed at the factory.

Public Comment No. 59-NFPA 99-2022 [Section No. 5.1.9.2.4]

5.1.9.2.4

Master alarm panels for medical gas and vacuum systems shall each include the following signals:

(1) Alarm indication when or just before changeover occurs in a medical gas system that is supplied by a manifold or other alternating-type bulk system that has, as a part of its normal operation, a changeover from one portion of the operating supply to another

(2) Alarm indication for a cryogenic fluid central supply system when the main supply reaches one average day's supply, indicating low contents

(3) Alarm indication when or just before changeover to the reserve supply occurs in a medical gas system that consists of one or more units that continuously supply the piping system while another unit remains as the reserve supply and operates only in an emergency

(4) Alarm indication for cylinder reserve pressure low when the content of a cylinder reserve header is reduced below one average day's supply

(5) For cryogenic fluid central supply systems, alarm indication when or at a predetermined set point before the reserve supply contents fall to one average day's supply, indicating low reserve

(6) Where a cryogenic liquid storage unit is used as a reserve for a cryogenic fluid central supply system, alarm indication when the gas pressure available in the reserve unit is below that required for the medical gas system to function

(7) Alarm indication when the pressure in the main line of each separate medical gas system increases 20 percent from the normal operating pressure

(8) Alarm indication when the pressure in the main line of each separate medical gas system decreases 20 percent from the normal operating pressure

(9) Alarm indication when the medical–surgical vacuum pressure in the main line of each vacuum system drops to or below 300 mm (12 in.) gauge HgV

(10) Single alarm indication from the local alarm panel(s) as described in 5.1.3.6.3.12 and 5.1.9.5.3 to indicate when one or more of the conditions being monitored at a site is in alarm

(11) Medical air dew point high alarm from each compressor site to indicate when the line pressure dew point is greater than +2°C (+35°F)

(12) WAGD low alarm when the WAGD vacuum level or flow is below effective operating limits

(13) Instrument air dew point high alarm from each compressor site to indicate when the line pressure dew point is greater than −30°C (−22°F)

(14) Alarm indication if the primary or reserve production stops on a proportioning system

(15) When oxygen is supplied from an oxygen central supply system using concentrators *(see 5.1.3.9)*, the following signals:

(16) For each concentrator

~~unit used~~

(a) supply source used in the oxygen central supply system, alarm indication that oxygen concentration from that oxygen concentrator

~~unit~~

(a) supply source is below 91 percent

(b) For each oxygen concentrator

~~unit~~

(a) supply source used in the oxygen central supply system, alarm indication that the isolating valve for that oxygen concentrator

~~unit~~

(a) supply source is closed and the

~~unit is~~

(a) supply source is isolated

(b) For each cylinder header used as a source, alarm indication that the header is in use

(c) For each cylinder header used as a source, alarm indication that the cylinder contents are below one average day's supply

(d) If the supply source in use changes because of a failure to appropriately supply the system, alarm indication that an unexpected oxygen supply change has occurred

(e) Alarm indication that the pressure in the common line on the source side of the line pressure controls is low

(f) Alarm indication that the oxygen concentration from the central supply system is below 91 percent

Statement of Problem and Substantiation for Public Comment

Thee is no definition for "Supply Unit". The Code uses the term Supply Source for each "unit" and Central Supply System for the collection of Supply Sources and controls that comprise the entire plant. It is desirable to use consistent language.

Related Item

• FR 1035

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 09:16:45 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-979-NFPA 99-2022
Statement: Thee is no definition for "Supply Unit". The Code uses the term Supply Source for each "unit" and Central Supply System for the collection of Supply Sources and controls that comprise the entire plant. It is desirable to use consistent language. The revision also responds to CCN-11 and incorporates the suggested change via the new item (16).

Public Comment No. 60-NFPA 99-2022 [Section No. 5.1.9.4.4]

5.1.9.4.4*

Alarm sensors for area alarms shall be located as follows:

(1)* Category 1 spaces, other than anesthetizing locations addressed in 5.1.9.4.4(2), shall have the alarm sensors installed on the patient or use side ~~of each of the~~ of the individual zone ~~valve box assemblies~~ valves .

(2)* Anesthetizing locations which are intended as parts of a single suite and where where moderate sedation, deep sedation, or general anesthesia is administered shall be permitted to have the sensors installed in either of the following locations:

(3) On the source side of

~~any one~~

(a) all individual room zone

~~valve box assembly and~~

(a) valves on the same branch line

~~feeding the zone~~

(a)

(b) On the patient or use side of each of the individual zone

~~valve box assemblies~~

(a) valves

Annex A 5.1.9.4.4

Examples of an anesthetising suite might include a group of operating rooms, endoscopy rooms, imaging rooms, etc. They will typically be adjacent to one another or close together, under a common supervisor and intended for the same or similar medical procedures.

See also Fig A 5.1.4

Statement of Problem and Substantiation for Public Comment

1. The zone valve box as such is irrelevant to this requirement, and as sensors are often placed in the boxes themselves, the language is also potentially restrictive.
2. The intent of (2) which is the grouping of anesthetising locations into anesthetising suites for efficient alarming, is explicitly mentioned. Additional clarification is added to the annex.
3. The word "any one" in 2 (a) seems to imply one must make a choice between the valves in the suite, which is not the case. It has been replaced with "all" and unnecessary language removed.

Related Item

• FR1091

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: Beaconmedaes

Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 09:27:30 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-966-NFPA 99-2022

Statement: This revision meets the intent of locating alarm sensors for groups of rooms and individual areas without confusing the concept of anesthetizing suites with that of health care suites in NFPA 101. The revision also removes redundant language based on the addition of the definition of 'anesthetizing location'.

Public Comment No. 61-NFPA 99-2022 [Section No. 5.1.10.2.1]

5.1.10.2.1 Tubes for Vacuum and ~~WAGD.~~ WAGD at vacuums >125 mmHgV (5 inHgV)

Piping for vacuum and WAGD systems **at vacuums >125 mmHgV (5 inHgV)** shall be constructed of any of the following:

(1) Hard-drawn seamless copper tube in accordance with the following:

(2) ASTM B88, *Standard Specification for Seamless Copper Water Tube* , copper tube (Type K, Type L, or Type M)

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , copper ACR tube

(4) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems* , copper medical gas tubing (Type K or Type L)

(5) Stainless steel tube in accordance with the following:

(6) ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service,* TP304L or 316L

(7) ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes,* TP304L or 316L

(8) A312 TP 304L/316L, Sch. 5S pipe, and A403 WP304L/316L, Sch. 5S fittings

(9) CMT meeting the requirements of 5.1.10.1.4(2)

Statement of Problem and Substantiation for Public Comment

This addition is necessary to preserve the current allowance for other materials in low vacuum WAGD service (see 5.1.10.2.3 (2))

Related Item

• FR 1105

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: BeaconMedaes
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 14 09:42:15 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Accepted

Action:

Resolution: SR-980-NFPA 99-2022

Statement: This addition is necessary to preserve the current allowance for other materials in low vacuum WAGD service (see 5.1.10.2.3 (2))

Public Comment No. 9-NFPA 99-2022 [Section No. 5.1.10.2.3]

5.1.10.2.3 Piping Materials for Field-Installed WAGD.

Piping for WAGD systems shall be ~~permitted to be~~ constructed of ~~any~~ one of the following:

(1) Any materials complying with 5.1.10.2.1

(2) Any noncorroding tube suitable to the vacuum level

(3) For systems operated at no greater than 130 mm (5 in.) HgV, ductwork

5.1.10.2.3.1

WAGD system piping that is joined to the vacuum piping shall be connected at a minimum distance of 1.5 m (5 ft) from any vacuum inlet.

5.1.10.2.3.2*

Systems complying with 5.1.10.2.3.1 shall be labeled as indicated in 5.1.11 for both WAGD and vacuum.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_7.pdf	NFPA 99_CCN_7	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 7 appeared in the First Draft Report on First Revision Nos. 1105 and 1106, and is also related to Public Input No. 175.

Consider the negative vote of Currence re formatting of mandatory requirement. Consider revising 5.1.10.2.3 to read, "Piping for WAGD systems shall be constructed of the following:..."

Related Item

• PI-175 • FR-1105 • FR-1106

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 08:32:30 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-981-NFPA 99-2022

Statement: The revision responds to CCN-7 and incorporates the suggested change and also further clarifies the requirement.

Correlating Committee Note No. 7-NFPA 99-2022 [Section No. 5.1.10.2.3]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:36:48 EST 2022

Committee Statement

Committee Statement: Consider the negative vote of Currence re. formatting of mandatory requirement. Consider revising 5.1.10.2.3 to read, "Piping for WAGD systems shall be constructed of one of the following: ..."

First Revision No. 1106-NFPA 99-2021 [Section No. 5.1.10.2.3]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

First Revision No. 1106-NFPA 99-2021 [Section No. 5.1.10.2.3]

5.1.10.2.3 ~~WAGD System~~ Piping Materials for Field-Installed WAGD .

Piping for WAGD systems shall be ~~piped as follows~~ permitted to be constructed of any of the following :

(1) ~~Using~~ Any materials ~~compliant~~ complying with 5.1.10.2.1 ~~or 5.1.10.2.2~~

(2) Any noncorroding tube suitable to the vacuum level

(3) ~~In~~ For systems operated ~~under~~ at no greater than 130 mm (5 in.) HgV, ~~maximum vacuum only, using any noncorroding tube or~~ ductwork

5.1.10.2.3.1

~~If joined to the vacuum piping,~~ WAGD system piping that is joined to the vacuum piping shall be connected at a minimum distance of 1.5 m (5 ft) from any vacuum inlet.

5.1.10.2.3.2*

Systems ~~meeting~~ complying with 5.1.10.2.3.1 shall be labeled as indicated in 5.1.11 for both WAGD and vacuum.

Submitter Information Verification

Committee: HEA-PIP
Submittal Date: Fri Aug 06 18:59:13 EDT 2021

Committee Statement and Meeting Notes

Committee Statement: The revision responds to PI-175. See also FR-1105.
Response Message: FR-1106-NFPA 99-2021

Ballot Results

✔ **This item has passed ballot**

30 Eligible Voters
4 Not Returned
25 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Colombo, Dana A.

Fasel, Mark

Franklin, Mark T.

Fuchs, Andrew

Affirmative All

Allen, Mark W.

Anderson, Grant A.

Beebe, Chad E.

Braidich, David

Carter, Mark David

Crowley, Michael A.

Dodson, Marc

Ferrari, Keith

Gagné, Neil

Golla, Ed

Hamilton, Scott

Lathrop, James K.

Litvin, Edward A.

Lucas, James L.

Lyczko, Edward J.

Lyons, David C.

Martin, Bret M.

McBride, Jeffery F.

Miller, Douglas

Scarlett, Kevin A.

Shapiro, Elizabeth A. "Betsy"

Shoemaker, E. Daniel

Smidt, Ronald M.

Volz, Allan D.

Willard, Jonathan C.

Negative with Comment

Currence, Gary

The wording "permitted to be constructed of" means that you can use any of the following. It does not mean you MUST use only the following. The language should read "Piping for WAGD systems shall be constructed of one of the following:". (2) allows the use of PVC at elevated vacuum levels. Noncorroding tube is to be used only when not exceeding 5"hg.

Editorial Comment

Click here

First Revision No. 1105-NFPA 99-2021 [Section No. 5.1.10.2.1]

5.1.10.2.1 Tubes for Vacuum and WAGD .

Piping for vacuum and WAGD systems shall be constructed of any of the following:

(1) Hard-drawn seamless copper tube in accordance with the following:

(a) ASTM B88, *Standard Specification for Seamless Copper Water Tube*, copper tube (Type K, Type L, or Type M)

(b) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, copper ACR tube

(c) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems*, copper medical gas tubing (Type K or Type L)

(2) Stainless steel tube in accordance with the following:

(a) ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service,* TP304L or 316L

(b) ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes,* TP304L or 316L

(c) A312 TP 304L/316L, Sch. 5S pipe, and A403 WP304L/316L, Sch. 5S fittings

(3) CMT meeting the requirements of 5.1.10.1.4(2)

Submitter Information Verification

Committee: HEA-PIP
Submittal Date: Fri Aug 06 18:54:47 EDT 2021

Committee Statement and Meeting Notes

Committee Statement: The revision responds to PI-175. See also FR-1106.
Response Message: FR-1105-NFPA 99-2021

Committee Notes:

Date	Submitted By	
Aug 19, 2021	Barbosa	No changes to sublist items.

Public Input No. 175-NFPA 99-2021 [Section No. 5.1.10.2.3]

Ballot Results

✔ **This item has passed ballot**

30 Eligible Voters
4 Not Returned
25 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Colombo, Dana A.

Fasel, Mark

Franklin, Mark T.

Fuchs, Andrew

Affirmative All

Allen, Mark W.

Anderson, Grant A.

Beebe, Chad E.

Braidich, David

Carter, Mark David

Crowley, Michael A.

Dodson, Marc

Ferrari, Keith

Gagné, Neil

Golla, Ed

Hamilton, Scott

Lathrop, James K.

Litvin, Edward A.

Lucas, James L.

Lyczko, Edward J.

Lyons, David C.

Martin, Bret M.

McBride, Jeffery F.

Miller, Douglas

Scarlett, Kevin A.

Shapiro, Elizabeth A. "Betsy"

Shoemaker, E. Daniel

Smidt, Ronald M.

Volz, Allan D.

Willard, Jonathan C.

Negative with Comment

Currence, Gary

This section is not meant to apply to WAGD piping. 5.1.10.2.3 dictates WAGD piping. This change would prevent the use of duct work or non-corroding tube in low vacuum level WAGD systems.

Public Comment No. 107-NFPA 99-2022 [Section No. 5.1.10.11.6.1]

5.1.10.11.6.1

Metallic and nonmetallic hose and flexible connectors shall be no longer than necessary and not penetrate or be concealed in walls, floors, ceilings, or partitions.

5.1.10.11.6.1.1 Connections that are part of a manufactured assembly shall be permitted to be concealed above a ceiling in accordance with 5.1.6.8 where access is provided to the ceiling space for inspection and maintenance.

Statement of Problem and Substantiation for Public Comment

As noted in the PI 386, the code is not clear regarding manufactured assemblies that come with connections located above a ceiling. In a recent project, the AHJ argued that these connections were not permitted based on this code section. Adding this new section with reference back to 5.6.8.1 will clarify the requirement.

Related Item

• PI-386

Submitter Information Verification

Submitter Full Name: James Peterkin
Organization: TLC Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 19:42:22 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1056-NFPA 99-2022
Statement: The revision responds to PC-107, the substantiation for which follows:

As noted in the PI 386, the code is not clear regarding manufactured assemblies that come with connections located above a ceiling. In a recent project, the AHJ argued that these connections were not permitted based on this code section. Adding this new section with reference back to 5.6.8.1 will clarify the requirement.

Public Comment No. 15-NFPA 99-2022 [Section No. 5.1.10.11.11.6]

5.1.10.11.11.6

An employer shall be permitted to accept the brazer qualification records of a previous employer under the following conditions:

(1) The brazer has been qualified following the same or an equivalent procedure that the new employer uses.

(2) The new employer obtains a copy of the brazer performance qualification ~~tests records~~ test records from the previous employer and signs and dates these records, thereby accepting responsibility for the qualifications performed by the previous employer.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_6.pdf	NFPA 99 CCN_6	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 6 appeared in the First Draft Report on First Revision No. 1053.

In 5.1.10.11.11.6(2), consider editorially revising "qualification tests records" to "qualification test records."

Related Item

• FR-1053

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 09:44:24 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Accepted
Resolution: SR-984-NFPA 99-2022
Statement: The revision responds to CCN-6 and incorporates the suggested change.

Correlating Committee Note No. 6-NFPA 99-2022 [Section No. 5.1.10.11]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Thu Jan 20 15:35:12 EST 2022

Committee Statement

Committee Statement: In 5.1.10.11.11.6(2), consider editorially revising "qualification tests records" to "qualification test records."

First Revision No. 1053-NFPA 99-2021 [Section No. 5.1.10.11]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 92-NFPA 99-2022 [Sections 5.1.12.2.3.3, 5.1.12.2.3.4]

Sections 5.1.12.2.3.3, 5.1.12.2.3.4

5.1.12.2.3.3

~~The~~ ~~source~~ ~~shutoff valve shall remain closed during the tests specified in~~ ~~5.1.12.2.3~~ ~~.~~ When the test pressures reach the levels identified in 5.1.12.2.3.4, the test gas suppling the piped distribution areas being tested, shall be valved off and remained closed for the duration of the initial pressure test.

5.1.12.2.3.4

The test pressure for pressure gases and vacuum systems shall be 1.5 times the system operating pressure but not less than a gauge pressure of

~~1035 kPa~~

1035 kPa (

~~150 psi~~

150 psi).

Statement of Problem and Substantiation for Public Comment

The word “SOURCE” is used throughout the Installer and Verifier testing sections of 5.1.12.2 and 5.1.12.4. But the meaning of this term is not the same for these sections. First you have the defined source supply such as the Bulk Oxygen Central Supply, MA Compressor Central Supply, and MV Pump Central Supply and each of these supply systems also has a defined “Source Valve” located at the Central Supply location. Next you have the test gas used to supply the pressures needed for conducting the tests. This test gas can be either the Nitrogen NF, or in some cases the gas from the central supply systems. But in both case of the test gas used (ether the test gas N2 NF or the gas from the central supply system), the source valve for the test gas is not referring to the NFPA 99 defined source valve near the central supply systems (refer to note 1), the valve to be closed is the valve for the test gas supply for the area(s) being tested and not the entire MGVS. This shutoff valve will either be the valve for the test gas N2 NF supplied to the testing zone, or the isolation valve (inline valve or zone valve) for the central supply system gas supplied to the testing zone. The word “source” in these sections is being misapplied, in some cases, for these tests. Over the years and editions of NFPA 99 (56F, 565,…), the term “source” was used throughout the standard/code and when the term “source valve” was defined in NFPA 99, a check of the various locations this term was used was not conducted. This is the cause of some confusion over this term in the sections listed.
NOTE (1): With one exception -- If the testing is conducted on an entire new facility and the testing requires the entire MGVS supplies shut off.

Also, move section and numbers for 5.1.12.2.3.4 above 5.1.12.2.3.3 section for better sequence of events order. Pressure the system, then shut of test supply.

Related Item

• 1st Revision 1058 & 1102

Submitter Information Verification

Submitter Full Name: Keith Ferrari

Organization:	Linde/Praxair
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri May 27 13:07:21 EDT 2022
Committee:	HEA-PIP

Committee Statement

Committee Action:	Rejected but held
Resolution:	The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 93-NFPA 99-2022 [Sections 5.1.12.2.6.2, 5.1.12.2.6.3, 5.1.12.2.6.4]

Sections 5.1.12.2.6.2, 5.1.12.2.6.3, 5.1.12.2.6.4

5.1.12.2.6 Standing Pressure Test for Positive Pressure Medical Gas Piping .

~~2~~

5.1.12.2.6.2 ~~The~~ ~~source~~ ~~valve shall be closed during this test.~~ When the test pressures reach the levels identified in 5.1.12.2.6.4, the test gas supplying the piped distribution areas being tested, shall be valved off and remained closed for the duration of the 24-hour standing pressure test.

5.1.12.2.6.3

The piping systems shall be subjected to a 24-hour standing pressure test using oil-free, dry nitrogen NF.

5.1.12.2.6.4

Test pressures shall be

~~20 percent~~

20 percent above the normal system operating line pressure.

Statement of Problem and Substantiation for Public Comment

The word “SOURCE” is used throughout the Installer and Verifier testing sections of 5.1.12.2 and 5.1.12.4. But the meaning of this term is not the same for these sections. First you have the defined source supply such as the Bulk Oxygen Central Supply, MA Compressor Central Supply, and MV Pump Central Supply and each of these supply systems also has a defined “Source Valve” located at the Central Supply location. Next you have the test gas used to supply the pressures needed for conducting the tests. This test gas can be either the Nitrogen NF, or in some cases the gas from the central supply systems. But in both case of the test gas used (ether the test gas N2 NF or the gas from the central supply system), the source valve for the test gas is not referring to the NFPA 99 defined source valve near the central supply systems (refer to note 1), the valve to be closed is the valve for the test gas supply for the area(s) being tested and not the entire MGVS. This shutoff valve will either be the valve for the test gas N2 NF supplied to the testing zone, or the isolation valve (inline valve or zone valve) for the central supply system gas supplied to the testing zone. The word “source” in these sections is being misapplied, in some cases, for these tests. Over the years and editions of NFPA 99 (56F, 565,…), the term “source” was used throughout the standard/code and when the term “source valve” was defined in NFPA 99, a check of the various locations this term was used was not conducted. This is the cause of some confusion over this term in the sections listed.
NOTE (1): With one exception -- If the testing is conducted on an entire new facility and the testing requires the entire MGVS supplies shut off.

Also, move section and numbers for 5.1.12.2.6.2, 5.1.12.2.6.3, 5.1.12.2.6.4 section for better sequence of events order. Pressure the system, shut if test supply, run 24 hrs. (5.1.12.2.6.4, then 5.1.12.2.6.2, then 5.1.12.2.6.3)

Related Item

• 1st Revision 1058 & 1102

Submitter Information Verification

Submitter Full Name: Keith Ferrari
Organization: Linde/Praxair
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 13:12:11 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but held
Resolution: The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 94-NFPA 99-2022 [Section No. 5.1.12.4.2]

5.1.12.4.2* Standing Pressure Test.

Piping systems shall be subjected to a 10-minute standing pressure test at operating line pressure using the following procedure:
(1) ~~After the system is filled with nitrogen or~~ ~~source~~ ~~gas, the~~ ~~source~~ ~~valve and all zone valves shall be closed.~~ When the test pressures reach the levels identified in 5.1.12.4.2, the test gas supplying the piped distribution areas being tested shall be valved off, and all zone valves in the area closed, and all valves remain closed for the duration of the 10-min standing pressure test.

(1) The piping system shall show no decrease in pressure after 10 minutes.

(2) Any leaks found shall be located, repaired, and retested per 5.1.12.2.6.

Statement of Problem and Substantiation for Public Comment

The word “SOURCE” is used throughout the Installer and Verifier testing sections of 5.1.12.2 and 5.1.12.4. But the meaning of this term is not the same for these sections. First you have the defined source supply such as the Bulk Oxygen Central Supply, MA Compressor Central Supply, and MV Pump Central Supply and each of these supply systems also has a defined “Source Valve” located at the Central Supply location. Next you have the test gas used to supply the pressures needed for conducting the tests. This test gas can be either the Nitrogen NF, or in some cases the gas from the central supply systems. But in both case of the test gas used (ether the test gas N2 NF or the gas from the central supply system), the source valve for the test gas is not referring to the NFPA 99 defined source valve near the central supply systems (refer to note 1), the valve to be closed is the valve for the test gas supply for the area(s) being tested and not the entire MGVS. This shutoff valve will either be the valve for the test gas N2 NF supplied to the testing zone, or the isolation valve (inline valve or zone valve) for the central supply system gas supplied to the testing zone. The word “source” in these sections is being misapplied, in some cases, for these tests. Over the years and editions of NFPA 99 (56F, 565,…), the term “source” was used throughout the standard/code and when the term “source valve” was defined in NFPA 99, a check of the various locations this term was used was not conducted. This is the cause of some confusion over this term in the sections listed.
NOTE (1): With one exception -- If the testing is conducted on an entire new facility and the testing requires the entire MGVS supplies shut off.

Related Item

• 1st Revision 1058 & 1102

Submitter Information Verification

Submitter Full Name: Keith Ferrari
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Street Address:
City:
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Zip:
Submittal Date: Fri May 27 13:27:40 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected but held
Resolution:	The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 95-NFPA 99-2022 [Section No. 5.1.12.4.3.1]

5.1.12.4.3.1 Individual Pressurization Method.

(A)

All medical gas and vacuum piping

~~systems~~

system ~~s~~ areas being tested shall be reduced to atmospheric pressure.

~~(B)~~

~~All sources of test gas from all of the medical gas and vacuum systems, with the exception of the one system to be checked, shall be disconnected.~~

(C)

~~The~~

The individual medical gas system being checked shall be pressurized with the test gas to a gauge pressure of 345 kPa (50 psi).

(X) The medical vacuum system being checked shall be pressurized with medical vacuum to a gauge pressure of

~~345 kPa (50 psi~~

510 mm (20 in. HgV or greater).

(X) The WAGD being checked shall be pressurized with WAGD vacuum to a gauge pressure meeting the designed WAGD mm (HgV) levels.

(D)

With adapters matching outlet labels, each individual station outlet/inlet of all medical gas and vacuum systems installed shall be checked to determine that test gas is being dispensed only from the outlets/inlets of the piping system being tested.

(E)

The source of test gas shall be disconnected, and the system tested reduced to atmospheric pressure.

(F)

Proceed to test each additional piping system until the cross-connection test for all medical gas and vacuum piping systems is completed . ~~are free of cross~~

~~connections~~ .

Statement of Problem and Substantiation for Public Comment

The word “SOURCE” is used throughout the Installer and Verifier testing sections of 5.1.12.2 and 5.1.12.4. But the meaning of this term is not the same for these sections. First you have the defined

source supply such as the Bulk Oxygen Central Supply, MA Compressor Central Supply, and MV Pump Central Supply and each of these supply systems also has a defined “Source Valve” located at the Central Supply location. Next you have the test gas used to supply the pressures needed for conducting the tests. This test gas can be either the Nitrogen NF, or in some cases the gas from the central supply systems. But in both case of the test gas used (ether the test gas N2 NF or the gas from the central supply system), the source valve for the test gas is not referring to the NFPA 99 defined source valve near the central supply systems (refer to note 1), the valve to be closed is the valve for the test gas supply for the area(s) being tested and not the entire MGVS. This shutoff valve will either be the valve for the test gas N2 NF supplied to the testing zone, or the isolation valve (inline valve or zone valve) for the central supply system gas supplied to the testing zone. The word “source” in these sections is being misapplied, in some cases, for these tests. Over the years and editions of NFPA 99 (56F, 565,…), the term “source” was used throughout the standard/code and when the term “source valve” was defined in NFPA 99, a check of the various locations this term was used was not conducted. This is the cause of some confusion over this term in the sections listed.
NOTE (1): With one exception -- If the testing is conducted on an entire new facility and the testing requires the entire MGVS supplies shut off.

Related Item

• 1st Revision 108 & 1102

Submitter Information Verification

Submitter Full Name: Keith Ferrari
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Street Address:
City:
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Submittal Date: Fri May 27 13:31:11 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but held

Resolution: The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 96-NFPA 99-2022 [Section No. 5.1.12.4.8]

5.1.12.4.8* Verifier Piping Purity Test.

For each medical gas system, the purity of the piping system shall be verified in accordance with 5.1.12.4.8.

5.1.12.4.8.1

–

These tests shall be performed with oil-free, dry nitrogen NF or the system gas.

5.1.12.4.8.2

–

~~The outlet most remote from the~~ source ~~shall be tested for total nonmethane hydrocarbons and halogenated hydrocarbons and compared to the~~ source ~~gas.~~

A comparison test for total nonmethane hydrocarbons and halogenated hydrocarbons shall be conducted between the test gas source supply and the outlet, in the testing area, most remote from the test gas supply.

5.1.12.4.8.3

–

If the central supply system gas is used as the ~~source~~ test gas, ~~it~~ the system gas shall be tested at the central supply source location. ~~equipment~~ .

5.1.12.4.8.

~~4~~

X If a test cylinder/container of oil-free, dry nitrogen NF is used as the test gas, the Nitrogen NF gas shall be tested at the portable cylinder/container supply location.

5.1.12.4.8.4 The difference between the two tests shall in no case exceed 5 ppm of total non-methane hydrocarbons.

5.1.12.4.8.5

–

The difference between the two tests shall in no case exceed 5 ppm halogenated hydrocarbons.

5.1.12.4.8.6

–

The moisture concentration of the outlet test shall not exceed 500 ppm or an equivalent pressure dew point of -12°C (10°F) at a gauge pressure of

~~345 kPa~~

345 kPa (

~~50 psi~~

50 psi).

Statement of Problem and Substantiation for Public Comment

The word “SOURCE” is used throughout the Installer and Verifier testing sections of 5.1.12.2 and 5.1.12.4. But the meaning of this term is not the same for these sections. First you have the defined source supply such as the Bulk Oxygen Central Supply, MA Compressor Central Supply, and MV Pump Central Supply and each of these supply systems also has a defined “Source Valve” located at the Central Supply location. Next you have the test gas used to supply the pressures needed for conducting the tests. This test gas can be either the Nitrogen NF, or in some cases the gas from the central supply systems. But in both case of the test gas used (ether the test gas N2 NF or the gas from the central supply system), the source valve for the test gas is not referring to the NFPA 99 defined source valve near the central supply systems (refer to note 1), the valve to be closed is the valve for the test gas supply for the area(s) being tested and not the entire MGVS. This shutoff valve will either be the valve for the test gas N2 NF supplied to the testing zone, or the isolation valve (inline valve or zone valve) for the central supply system gas supplied to the testing zone. The word “source” in these sections is being misapplied, in some cases, for these tests. Over the years and editions of NFPA 99 (56F, 565,…), the term “source” was used throughout the standard/code and when the term “source valve” was defined in NFPA 99, a check of the various locations this term was used was not conducted. This is the cause of some confusion over this term in the sections listed.
NOTE (1): With one exception -- If the testing is conducted on an entire new facility and the testing requires the entire MGVS supplies shut off.
Confirmation request: Is the moisture test a comparison test or not between the test gas source supply and remote outlet? As listed in the code today it is NOT a comparison test, so I did not adjust any of the wording or section 5.1.12.4.8.6.

Related Item

• 1st Revision 1058 & 1102

Submitter Information Verification

Submitter Full Name: Keith Ferrari
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Street Address:
City:
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Submittal Date: Fri May 27 13:36:04 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but held
Resolution: The proposed revision is considered new material and will be held for the next revision cycle.

Public Comment No. 62-NFPA 99-2022 [Section No. 5.1.12.4.14.6]

5.1.12.4.14.6 Medical–Surgical Vacuum Systems.

The proper functioning of the medical–surgical vacuum source system(s) shall be tested before it is put into service.

Add new:

* 5.1.12.4.15 Emergency Oxygen Connection

5.1.12.4.15.1 A newly installed Emergency Oxygen Connection shall be tested as follows:

(1) include EOSC piping in all installer tests (5.1.12.2);

(2) confirm presence of physical protection by visual inspection (5.1.3.5.13.2 (1));

(3) confirm size(es) of inlet connection(s) (5.1.3.5.13.2 (2));

(4) confirm presence and operation of isolation valve (5.1.3.5.13.2 (3));

(5) confirm patentcy of the EOSC piping by pressurizing the EOSC connection and feeding the system through the inlet connection;

(6) confirm operation of the two EOSC check valves by pressurization at the EOSC and pressurization at the Central Supply System. Ensure the check valves operate as required. (5.1.3.5.13.2 (4));

(7) confirm the relief valve is appropriate for the pressure of the system by visual inspection of the valve labelling. (5.1.3.5.13.2 (5));

(8) confirm the four (4) alarm connection points are connected to the master alarms and will operate signals on those alarms (5.1.3.5.13.2 (8)).

5.1.12.4.15.2 These tests may be conducted with Nitrogen NF or with Oxygen

* Annex 5.1.12. 4.15

These tests are intended to confirm that the EOSC is ready for use should it ever be required. 5.1.12.4.15.1 (1) is also added to ensure that the check valves required for the EOSC does not prevent installer testing of the sections of the piping between the check valves and the EOSC or the remote Central Supply System and the EOSC Check valve.

The Initial Piping Blowdown and Initial Pressure Test will be complicated by the presence of the required check valves in the piping. It will be necessary to connect the nitrogen to the EOSC itself and at the Central Supply System location to properly complete these operations.

Testing patentcy of the piping and operation of the check valves will require gas to flow from the Central Supply System to the pipeline, and from the EOSC to the pipeline, but NOT from the EOSC to the Central Supply System or from the Central Supply System and out the EOSC.

As the four alarm connections may not be active at the masters, it may be necessary to adjust alarm settings in accordance with manufacturer's instructions to perform this test.

Statement of Problem and Substantiation for Public Comment

The Committee objected to the original PI due to lack of specifics for this test. These are provided here.
In addition, it is proposed that the requirements be placed in 5.1.12.4.15 to properly fall under Verifier testing.

5.1.12.4.15.1 (1) is specifically added to ensure that the check valves required for the EOSC does not prevent installer testing of the sections of the piping between the check valves and the EOSC or the remote Central Supply System and the EOSC Check valve.

Related Item

• PI 187

Submitter Information Verification

Submitter Full Name: Mark Allen
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Zip:
Submittal Date: Sun May 15 08:38:22 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but held

Resolution: The proposed revision contains requirements deemed to be new material. The comment will be held for the next revision cycle. Consider locating the new material in 5.1.12.4.4.

Public Comment No. 86-NFPA 99-2022 [New Section after 5.1.14.1.2]

5.1.14.1 Responsible Facility Authority

MGVS SURGE PLANNING TABLE Questions & Answers

Additional Proposed Changes

File Name	Description	Approved
MGVS_Surge_Needs_-_Planning_Questions_DRAFT_10.xlsx	MGVS SURGE PLANNING TABLE (Q & A)	

Statement of Problem and Substantiation for Public Comment

Problem to resolve: PI-270 addressed the needs for:
"During Covid-19, hospitals, engineers, contractors, and suppliers had a difficult time understanding the impact to the existing medical gas & vacuum systems limitations and solutions needed to support patient care, especially the oxygen system. The public input is an attempt to put in some language, recommendations and links to assist Hospitals and their Risk Assessment and Emergency Management teams."

Based on submitted PI-270, the NFPA PIP requested a task group be assembled and work on a detailed submittal to support PI-270. During the process of working on PI-270, the task group concluded that the best way to support PI-270 was to put the information into a Table format. Due to and volume of material, an ANNEX entry did not seem possible. The task group suggests that the MGVS Surge Planning Table (60 questions and answers) be considered for the NFPA 99 2024 Handbook and be referenced to material for 5.1.14.1 Responsible Facility Authority. The Task group included 13 NFPA PIP committee members that met weekly for 10 weeks to develop the attached table.

Related Item

• Public Input No. 270-NFPA 99-2021 [New Section after 5.1.14.2.2 }

Submitter Information Verification

Submitter Full Name: Keith Ferrari
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City:
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Submittal Date: Fri May 27 09:11:04 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected

Resolution:	The committee recommends that NFPA incorporate the material in this PC in the next edition of the NFPA 99 Handbook.

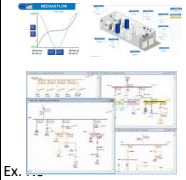
The table below will be submitted for consideration into the NFPA 99, 2024 MGVS Handbook referencing section 5.1.14.1 (RFA)

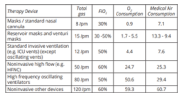
The resource table below is intended to provide guidance for the Responsible Facility Authority (RFA), or other healthcare Facility representatives, on how to enhance the Facility's Medical Gas & Vacuum Systems (MGVS) capacities in response to a surge in patient MGV treatment demand. The table includes a list of Medical Gas & Vacuum System (MGVS) discovery questions, example answers, and the intent or explanation of the questions. The questions are intended to assist the Health Care Facility with expediting strategies and solutions (reduce delays) for managing MGVS surge capacity. The questions are targeted for first contact MGVS questions ONLY.
The table includes examples of initial questions that the RFA should be prepared to answer when initially contacting their primary MGVS points of contact, such as an A/E firm or MGVS Design Company for calculating capacity demands and designing supplemental MGVS options, Medical Gas Supplier for maximizing the current MGS supply and adding additional supplies, MGVS Equipment Supplier for maximizing the current Med Air & Med Vac supply and supplying additional MGVS distribution equipment, MGVS Installer for installing additional MGVS supplies/distribution systems, AHJ for project authorization, permits and mitigation guidance (waivers/exceptions/interim measures), MGVS Verifiers for consulting, testing, documenting and expert MGVS advice. (NOTE: The questions are not an exhaustive list of MGVS questions. There will be additional MGVS questions and Non MGVS questions that will need to be answered as MGSV support solutions are being discussed, decided and implemented).

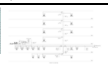
Responsible Facility Authority: " Due to an increase in patient Medical Gas and Vacuum (MGV) therapy treatments & care, we need assistance with our MGV System(s) to support this surging demand. What strategies, options and solutions are available?"

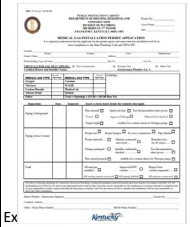
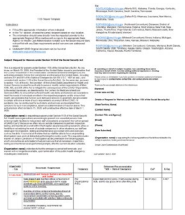
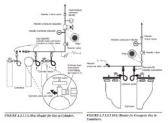
MGVS SURGE PLANNING QUESTIONS	EXAMPLE	QUESTION INTENT/EXPLANATION OF REQUEST
What type of concerns or challenges is the Facility having with the MGVS? Has the Facility's MGVS, or components of the MGVS, started to under perform or stop functioning?	Ex. low line pressures, Heavy ice on outside ambient vaporizers, frozen regulators, MA compressors & MV pump failures, alarms activating.	In the lead up to reaching the point where demand exceeds supply, lots of things may be happening. Line pressure is decreasing in heavier usage areas, master alarms, area and/or local alarms are activating, abnormal icing is occurring on vaporizers and regulator control stations, reserve or back up supplies are being brought on-line, cylinder change outs are occurring more frequently, liquid bulk tank deliveries are occurring more frequently, etc. As the demand gets very close to the available rated capacity of the MGVS, the system pressure and flows are dropping - at first locally and then by overall system degrees that can be sensed by the warning systems. And despite all the redundancies and safety measures in MGVS, the COVID-19 pandemic pushed many systems to their limits and often overwhelmed them. Due to the infrequency of respiratory pandemics, most medical gas systems were not designed to handle a respiratory virus outbreak. Life supporting medical gases are of vital importance in healthcare Facility settings. An interruption or disruption in flow of a Facility's MGVS is a crisis that can quickly spiral into a potential detrimental situation for patients who require Medical Gases & Vacuum. Before pushing the limits or operating outside of the rated capacity of the MGVS, the Facility's primary MGVS contacts should be consulted to determine what impact additional loads will have on the essential MGVS or parts and components of the MGVS.
How has the change in MGVS usage caused a surge demand on the system(s)?	ex. Due to the increase in patient admissions, the Facility has added 12 High Flow ventilators in the 2nd Flr. SDU (Step Down Unit) Acute Patient Care area, added 24 O2 'Y' connectors on 3rd Flr. Non-acute Patient West Wing, the estimated added demand will be 10,000-15,000 SCF O2 per day .	A basic understanding of what is causing the increase in MGVS usage is vital to deciding what the next course of action will be. The first tasks the Facility needs to do is figure out how much of an impact these usage demands will make to the MGVS rated capacity. The items the Facility needs to keep track of in order to obtain this sort of information is called baseline measures. In other words, the baseline is the standard against which you will measure all subsequent implemented changes impacting the MGVS. You can look at what the Facility typical or standard capacity demands have been prior to the surge increases, and use these numbers as a baseline. We call them baselines because they're usually shown as lines in graph form to easily show changes over time. To plan effective solutions, the Facility has to know what their MGVS Capacity Rating are, what the baseline (typical) demand capacity are, and how much of an effect any additional changes (beyond typical) to the MGVS are having. Recording baseline measures, which the Facility can then compare with whatever the surge demand numbers are, will help the Facility figure out an effective plans of action. Before adding additional MGVS loads (loads greater than typical loads) to the system or areas of the Facility, the Facility needs to collect MGVS data for evaluation of the current, the surge and (estimated) future MGVS capacity demands. Each patient care zone using the MGVS needs calculated for maximum available capacity under typical system use and under non-standard uses (high flow). This documentation should include items such as: additional patient MGV therapy equipment, 'Y' connectors (NOTE: for acute patient care - not recommended) added to existing MGV terminals to service more than one patient, alternate care sites on campus such as tents, modular buildings/rooms, surge buildings, etc. that needs to utilizing the MGVS. The Facility needs to know the required MGV flows, pressures, durations, operations, and number of items being used for patient care therapy and maintenance, and the locations where the additional work load will be added to the MGVS, to determine if added demands and equipment will meet patient treatment needs, allow the proper operation of the MGVS attached patient therapy equipment, and not exceed MGVS capacity designs. Evaluating this information, the Facility can measure the impact to their existing MGVS and calculate if additional MGVS supplemental supplies and any adjustments to the existing MGVS can improve the performance and meet or exceed the Facility's MGVS capacity demands.
Are MGVS master and/or area alarms activated? If so, which ones and which locations?	 ex. Yes, which one(s)?	Throughout the piped medical gas & vacuum systems, both the source equipment and the gas flowing in the pipelines are monitored with Master, Area and Local alarms. Activation of an alarm condition allows the Facility staff to be notified before a source of supply is depleted or a supply system stops to function. Being able to identify which medical gas & vacuum system has an alarm condition and what that alarm abnormality is, will allow a quicker response to pin point a solution(s). During surge activity, it s critical that all MGVS alarms are being monitored on a daily basis to react quickly to changing destabilizing conditions and to maintain optimal MGVS performance. A Master Alarm is a warning system that monitors the operation and condition of the source of supply, the reserve source (if any), and the pressure in the main lines of each medical gas and vacuum piping system. The master alarm is the alarm used to indicate the condition of the sources of supply (in some cases remote sources). Master alarms are found at locations that are attended whenever the building is occupied and where they can be seen by staff who will act to correct any failures. Area Alarm is a warning system within an area of use that provides continuous visible and audible surveillance of Category 1 and Category 2 medical gas and vacuum systems. Alarm conditions examples: Liquid Level Low, Reserve In Use, Reserve Low, Changeover, Line pressure High, Line pressure low, dew point high, local alarm, etc.
Are Medical Air Compressor, Medical Vacuum Pump, … local alarms activating? Which alarm conditions are activating?	Ex. Yes - Vac Reserve  mp in use. Yes - 5 - Ward D (Low vacuum)	Local alarms are intended to provide audible and visual warnings that the source components such as Medical Air Compressors and Medical-Surgical Vacuum Pumps are operating in an unusual manner or malfunction in. Activation of an alarm condition allows the Facility staff to be notified before a source of supply is depleted or a supply system stops to function. Local alarms also trigger a signal to the master alarms panels. During surge activity, it s critical that all MGVS alarms are being monitored on a daily basis to react quickly to changing destabilizing conditions and to maintain optimal MGVS performance. Local Alarm condition examples: Low Capacity, Thermal Shutdown, High Water Separator, High Water in Receiver, Reserve in Use, Reserve Low, CO High, etc.

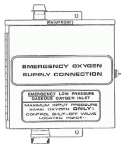
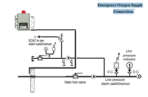
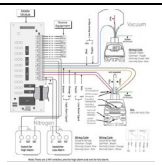
Is the AHJ (Fire Marshall, Dept of Health, …) aware of the Facility's current patient MGV treatment surge? Who is the AHJ that the Facility's has been speaking with and what is the AHJ's contact information? Does the Facility have an assigned MGVS Responsible Facility Authority (RFA) person? Who is the Facility's MGVS Responsible Facility Authority (RFA) and what is RFA's contact information?	ex. James Jones - Fire Marshal (000) 123-4567, Ex. Sally Smith - RFA (Assoc. Dir of Engineering at Facility) (000) 987-6543	The authority having jurisdiction (AHJ) plays a crucial role in ensuring fire/life safety in buildings, and it's essential that Responsible Facility Authority (RFA) understand what the AHJ is and the role it plays throughout the life of a building. The AHJ help with carrying out the "policy" (adopted code) for the jurisdiction. The AHJ is usually involved in the plan review process. The AHJ is the best person to ask to learn which edition and what, if any, local amendments (or waivers/exceptions/interim measures) are in effect for the jurisdiction. For construction projects, a construction permit will typically be needed.. That permit triggers a number of actions. One of these is the plan review process. The AHJ is there to review the building plans and specifications. The AHJ is evaluating compliance for the project where it will be sited. Once the permit has been obtained, the plan review process is finished, and construction begins, the AHJ is may conduct specific inspections as the project progresses. If the AHJ is asked to conduct a certificate-of-occupancy final inspection and no permit was issued, there was no previous plan review, and there were no in-progress inspections, then there is a good chance that no certificate of occupancy will be issued. The Responsible Facility Authority (RFA) is responsible for implementation of the piped medical gas and vacuum system requirements in NFPA 99. The RFA will be solely responsible for keeping all the documentation, issuing Facility permit-to-work on a medical gas & vacuum systems, and be able to advise on the code issues regarding risk assessments related to categories of patient care and all content in the NFPA 99 sections 5.1 through 5.3 regarding medical gas and vacuum systems code. The RFA will be the primary Facility contact to coordinate plans with vendors and contractors to perform site work for the supplemental MGV supply equipment., including MGVS shutdowns and installation coordination.
  What is the Facility's current MGVS main line pressure reading(s)? What is the Facility's MGVS source supply gauges reading(s)?	Ex. Main Line: O2 - 45 psig, .. Source Supply: Main O2 Tank: 50 Inches, 180 psig, Res O2 Tank 35 inches, 160 psig, O2 Reserve in Use: 90 psig, MA Compressor = 100 psig Compressors , Medical Vacuum Pump = 19 inches working line, …	The purpose, of the main line pressure gauges and source gauges, is to provide information regarding the status of a MGVS delivery pressure(s). If the line pressure is lower or higher than the standard operating line pressure, the reading on the main line gauge will help identify possible causes of abnormalities with the supply or pipeline distribution systems. Compare the typical day to day readings with the current surge readings. What is the change (delta) between typical readings and surge readings (ex. +/- > 5 psig, =/- > 10 psig, etc.) This change in main line pressure is one of the variables included in troubleshooting solutions for the Healthcare Facility (Assuming the pressure gauge device is accurate and correctly functioning). Abnormal Low or high line pressure readings can be contributed to a number of reasons, such as heavy usages caused by added MGV therapy equipment, if someone closed the source or main valves, cut the main line pipe, there are clogged pipelines, source supplies failing or overtaxed, regulator controls are frozen or failing, temperature fluctuations with the medical gases or area where the gases are being transport through, outlets stuck open, back feed valves left open, leaks in the MGVS pipeline, …). As needed, inspect and document the gauges readings daily during surge activities: Primary Supply (contents), Secondary Supply and/or Reserve supply, Reserve in Use, Reserve Change Over, Reserve Supply (HP Cylinders), Medical Air Compressors and Medical Vacuum Pumps, Line Pressure High, Line Pressure Low, …).
  What are the Facility's current MGVS line pressure readings in the patient care zones/areas?	ex. Higher: 60 psig, 65 psig, … Lower: 50 psig, 45 psig, 40 psig, …Yes - 2nd Flr.. ICU = 42 psig MA, Ex. O2: 44 psig, MA: 48 psig, MV: 19", N2O: 52 psig, N2: 180 psig	The purpose of area/zone line pressure gauge(s) is to provide information regarding the status of a supply system delivery pressures within the area/zone being monitored. List the area/zone readings (psig), location of zones (floors/wings), and description of zones/areas (ICU, NICU, ER, OR, etc.), then compare typical day to day readings with the current surge readings. What is the change (delta) between typical readings and surge readings (ex. +/- > 5 psig, +/- > 10 psig, etc.). If the line pressure is lower or higher than the standard operating line pressure, the reading on the area/zone line gauge will help identify possible causes of abnormalities with the supply or pipeline distribution systems. The most common causes of pressure fluctuations in zones and areas is an increase in patient MGV therapy being used with high flows, using "Y" connectors to service additional patent beds, exceeding rated pipeline distribution capacity.
Can current photos of the Facility's Cryogenic Fluid Central Supply System, Manifold System, Medical Air Compressor System, Medical Vacuum Pump System Central Supply System(s) be sent?	   Ex. Yes	Photo's of the current conditions of the Facility's MGVS, with additional supportive data about the MGVS, allows for a better examination by the OEM or other Facility primary contacts. The MGVS Manufacturers/Suppliers, with other support data, should be able to critically review the photos to identify areas of concern with the MGVS and start to develop solutions to mitigate against MGVS low performance. The Oxygen Supplier will have oxygen delivery records and/or telemetry units installed on the bulk oxygen supply system that can be used to review the Facility's oxygen demand past and current levels. For Oxygen Supply system that are leased to the Facility by the Oxygen supplier, the Oxygen Supplier will have records of the type of equipment installed at the Facility (Model, size, design and operation details - Tanks, Vaporizers, Control Cabinet, Interconnecting piping sizes, alarm signal settings, etc.). For customer owned Oxygen Supply Systems, the Facility will need to supply Model, size, design and operation details - Tanks, Vaporizers, Control Cabinet, Interconnecting piping sizes, alarm signal settings, etc. Current site photo(s) of the complete Bulk Cryogenic Fluid Medical Gas System should include the Primary & Reserve Tanks, Vaporizer (s), Control Cabinet / Regulator station, Interconnecting pipeline, the piping entering and exiting the control cabinet, and a photo of the source valve. Current site photo of complete MA & MV system(s) should include the Compressors/pumps, receiver, dryers, filtration system, regulator system, etc. Manifold system photos should include the control cabinet/regulator station, number of cylinders/containers on each header bar, the source/main valve, indoor or outdoor location of Manifold system, if indoor show all applicable safety controls such as ventilation locations, sprinklers, room air monitors, exits/entrances, and any other equipment or gases stored in the room. If outdoors, include entire site photo and surrounding area photos.
Does the Facility's oxygen vaporizer(s) have excessive or abnormal ice or frost buildup? Is the Facility's regulator controls station icing or frosting up? Can photos the current view of vaporizers and regulator control panels be sent?	  Ex. Yes or No	With excessive Vaporizer icing there can be possible low temperature product supplied to pipeline. By design, the ambient vaporizers will accumulate a small amount of ice at the inlet, while delivering gas near ambient temperatures on the outlet. However, when flows significantly exceed design rates, the ice further accumulates on the vaporizer fins, resulting in less surface area for heat exchange. This drives the delivered oxygen temperatures lower to the point where frost and condensation form on the hospital line, posing risks to the safe operation of the hospital oxygen equipment. The Medical Gas Supplier will assist the Facility with a maintenance program to deice the vaporizers and may adjust switching vaporizer duty schedules, of in the absence of switching vaporizers, install additional vaporizers to assist with the added surge demands. If the bulk oxygen supply vaporizers are icing up, this can drive the delivered oxygen temperatures lower to the point where frost and condensation form on the hospital line, posing risks to the safe operation of the oxygen regulator controls station equipment. The primary vaporizer should evaporate liquid at such a rate as to maintain the flow delivery potential of the control panel. However, maintaining maximum efficiency is dependent on frequent ice removal, using water or steam. Unfortunately, not all plant has been fitted with adequately sized vaporizers, limiting the flow potential of the control panel. Some systems are fitted with an automatic switching (changeover), using electrically powered motorized valves. The changeover time cycle is set by the gas supplier and is typically 8 to 12 hours. Although this lessens the risk of excessive, uncontrolled icing, regular observation of the vaporizer performance should be carried out. Manual changeover systems require more diligent attention, particularly under high flow conditions. When more oxygen is flowing through a manifold than the manifold has been designed for, there will be external frosting of the components in the manifold. The external frosting does not indicate that the inside of the pipe is frosted – for example oxygen is a dry gas – but the external frosting and freezing can cause the manifold to malfunction.
Has maintenance been conducted on the Facility's MGV equipment due to the MG surge demand?	Ex. No 	The MGVS needs to run at or close to peak performance during times of surge demand. To mitigate decreases in MGVS performance during high system usage periods, increased frequencies of maintenance care needs to be performed such as: Deicing ambient vaporizers, increasing ambient vaporizer switching periods, adjusted regulator settings, monitoring medical gas line pressures and temperatures, monitor source supply conditions, check any cylinder "pigtail" hose connection conditions, monitor source supply shutoff valves conditions, monitor zone valves, monitor master, area & local alarm panels, monitor electrical and other utility supply to MGV source equipment, monitor outlet/inlet performance/leaks, increased product delivery orders, added addition supplemental MG supplies to the MGS to support high usage periods, …

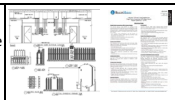
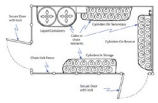
Has the Facility made any adjustments to the existing MGVS, such as adjusting the MGVS working line pressure(s)?	 Ex. I want to increase the line pressure from 50 to 60 psig to compensate for any MGVS wide pressure drops that may cause the MG therapy from operating.	Some MG therapy equipment during start up operations requires a minimum of 45 psig and maximum of 65 psig to operate safely. If MGVS low pressure is occurring within the hospital, increasing the main line pressure to > 55 PSIG will require a risk analysis to identify what MGVS components and patient therapy equipment attached to the MGVS will be impacted and what steps are required to increase the main line pressure. If a zone is being considered to be back feed through an outlet, depending on the model and type of the outlet, age of the outlet, OEM of the outlet, and design of the outlet, there may be limits on what the outlet can handle and how long the added pressure/flow will last,...always check with the OEM of the medical gas outlets to find out if back feeding through the outlets is possible. Note that when pressure is increased for the entire MGVS or an isolated zone, the pressure increase will equalize and spread out to the entire pipeline connected zone and terminals. This increase in pressure can affect the performance and operation of outlets, gauges, alarms, ... and could interrupt MG therapy patient treatments (fluctuation of flow/pressure disruption, percentage concentrations of mixed gases treatments, ...). The Medical Gas Supplier can work with the Facility to maximize the operation and capacity of the on site medical gas source of supply for example by increasing the frequency of deliveries to site, deicing and switching vaporizers (if installed) then increasing the timing of switching controls, adjusting source supply controls, adjusting working line pressure, etc. The Facility and Clinical staff should work on economizing the MGV demands in non essential zones or operations. If the current on site supply and increased deliveries of supply can not meet the Facility needs, added supplemental MGV supplies can be temporary installed utilizing the (oxygen) EOSC and other MGV supplies can utilize the auxiliary supply connection, also additional vaporizers can be added, additional control cabinets can be added, inhouse supplemental MGV stations can be coordinated with Facility Management and Clinical Staff.
Can the Facility's existing MGVS meet the surge demand? Or does the Facility need additional MGV source(s) of supply and/or modifications to the piped distribution system?	Ex. Yes for now, but it is estimated that the MGV Surge activity will continue for at least a month and increase in daily usage and exceed our existing MGVS capacities.	The Facility needs to know the rated capacity of their MGVS, track the current MGV demand volumes, and measure the demand vs available capacity. Knowing when the Facility MGV usage levels are trending outside the MGSV rating capacity, and when to activate additional supplemental resources and/or surge operational plans, will mitigate crisis management activities related to the MGVS.
Has MGVS flow capability assessment by load testing or flow analysis software (simulation modeling) been conducted?	 Ex.	The intention is to determine through physical testing or simulation modeling what flowrate & working pressure could be expected with the MGVS, when a surge in demand occurs, and know what the realistic assessment of capacity limitations are in the areas tested. Using known variable (flowrate, working pressures, quantities of equipment that will be run simultaneously, duration of demands, existing pipeline dimeter sizes and linear feet of piping in the tested area, ...), testing can be conducted, documented and estimates can be determined on the impact to identify areas which could prove problematic and require permanent reinforcement of the existing MGVS. Pressure drop in the MGVS is the limiting factor for flow rate to remain within operating parameters. For each load test proposed, a documented risk assessment will need to be conducted. Physical load testing involves working on a live system supporting patients and these tests must maintain patient safety. The downside of physical testing is that it only validates the individual tested area and does not accurately consider what is happening in adjacent areas and how it may impact the zone tested. Engineering flow capability assessment (simulation modeling) can compliment physical testing results and forecasts. The applicability of formulas used with flow analysis software have been tested in different conditions. It has been found that some of the formulas present more accurate results with the measured values under a certain range of conditions than others. So, the user should be careful when selecting the flow analysis simulation modeling to apply.
What is the calculated total capacity of the existing MGV source of supplies? What are the ratings of the existing MGVS including the minimum and maximum capacity ratings and duration of demand impacts on the ratings. What is the calculated maximum capacity of the exiting pipeline distribution network?	Ex. O2: Prim Tank 3000G (345,000 net capacity), Vaporizer: ...	The existing MGVS available capacity can be calculated when tracking usage demand vs MGVS rated and designed capacity. When the MGVS was originally designed, the source equipment installed and the piped distribution system were sized and calculated to produce a MGVS that would meet the healthcare Facility patient care needs. Modifications over the years would impact the original installation numbers and need to be taken into consideration. The owner of the leased cryogenic fluid central supply system should be able to provide rating capacities for all their equipment (Tanks, Vaporizers, Control Cabinets). The OEM of the MA Compressors, MV Pumps, MG manifolds and components of these systems (Dryers, Filters, Regulators, ...) should be able to supply capacity ratings for their supplied equipment. The capacity of the internal MGV piping system within the Facility can also be exceeded. An example of that is a drop in pressure from the MG manifold to various zones downstream in the hospital MG piping system, where the manifold can be delivering 55 or 60 psig of MG, but downstream zones can be measuring lower pressure (for example 45 psig or even lower) because of the limited capacity of the MG piping system which was only designed to support a significantly lower flow of MG. Design engineers should be able to calculate the capacity of the piped MGV Distribution systems.
What is the Facility's current daily total MGVS demand usage? What percentage of the Facility's existing daily MGVS maximum capacity is in use? What are the peak MGV demand usage numbers and durations? What is a typical total daily MGV demand usage before the surge and what is it now?	Ex. Total Capacity: O2 = 40,000 SCF/day, O2 = 98%, Peak: O2 = 3,200 SCF/HR for < 1 hr., Typical Capacity demand: O2 = 28,000 SCF/day	Tracking the Facility's current volume usage and demand patterns of medical gas and vacuum is critical to assess the potential constraints with the MGVS. Volume level tracking can help determine if the gas usages fall within the acceptable rating capacities of the Facility's MGVS. The existing MGVS available capacity can be calculated when tracking usage demand vs MGVS rated and designed capacity.
Are the Facility's current MGVS demand levels expected to continue to surge, level off or decrease? If so, when and how long?	Ex. Surge, 4 weeks.	The Clinical Staff, Facility Staff and the Governing Body of the Facility should be collaborating on current and forecasted patient care needs including the MGSV impact. This team should share information on Facility patient care utilization of MGVS, maximum available flow capacities of patient care areas, and limitations of potential usage of the MGVS with Clinical Lead colleagues (who will be responsible for connection of high flow medical equipment). Ensure that the Clinical Staff, Facility Staff and RFA communicate with each other before any equipment is connected to the MGVS. Surge demands of 2x, 3x, and more than standard MGVS capacity require a surge plan to keep the Facility MGVS running at peak performance.
What is the Facility's calculated, expected or estimated future additional MGVS demands due to the surge in MGVS demands? What is the calculated MGV demand per bed needed? What is the calculated or estimated total MGVS capacity needed?	Ex. 32 SCFH, (Bed's x 32 SCFH X 100% factor), Est. total demand needed: 150,000 - 300,000 SCF/month (Current system rated to 100,000 SCF/month) = require additional 50,000 - 200,000 SCF/month.	For projecting, estimating & forecasting future MGVS usage demands, utilize consumption tracking and assessment tools (Refer to the links section below). Document the designed rated capacity for each zone under standard conditions and the expected future maximum MGV demand for each zone/area. In addition to locations that plan to increase MGV flow and duration at patient beds, include all high flow MG equipment expected to be added and any additional patient beds that will be piped for MGV patient treatment. Tracking of daily Facility consumption and modeling scenarios can help with planning for production, maintenance, applying surge plans, cylinder numbers needed, refill frequency (liquid oxygen), management how to best maximize the use of the MGVS.

What is the maximum number of ventilators (MG therapy equipment) that can be in use on the Facility's patient floor(s) or wing(s) served by the MGVS? What diversity factor should be applied?	 Ex. 2nd Flr.. 3/4" and 100 LF will allow ICU: Device Capacity High O2 Flow (40 LPM) = 17	During MGVS Surge activity, with the exception of hyperbaric use, the largest individual bed consumer of MG is typically ventilator equipment being used for patient care. And when the usage demand exceeds the rated capacity of the MGVS, end result is a MGVS being overtaxed. Ventilation equipment for patient treatments can include classic ventilators, CPAP, BIPAP, Oxygen tents, Hoods, and Oscillating ventilators. If you start by reading specifications on ventilators, it is very easy to be confused by the numbers you read. Numbers as large as 180 lpm to 200 lpm are typically listed as "peak flow". No patient can absorb this amount of gas, so where does it go? The confusion comes from the fact that this is a rate, not a volume. A ventilator can be set to fill the patient's lungs at various speeds, and that is what this number reflects. This is therefore not a consumption concern (gas used over time) but a flow rate concern (how fast the gas must move from the outlet into the ventilator). For sizing, it is unrealistic to simply apply a worst case 180 lpm or 200 lpm number. If the information is available from the manufacturers of the equipment, estimates for Gas Consumption by device should be used. If the required information for Gas Consumption by device is not available, an estimate of 45 lpm per moderate acuity patient, at a 50% FiO2 seems to be a consensus value being used by the healthcare industry. This means 28 lpm (1 scfm) of air and 16.5 lpm (0.58 scfm) per patient for oxygen. These numbers are appropriate for source sizing and main line sizing, where demand averaging will occur. However, they should NOT be used for pipe sizing in zones, as it is entirely possible to have whole units with the sickest patients and the heaviest demand concentrated in a single zone. Having MG demand loads beyond the capacity of the existing pipeline causes excessive pressure drops. The limiting factor of how many ventilators and other breathing assist devices can be placed on a patient unit/wing is the pipe size and length, source supply capacity & source supply components rated capacity.
What is the calculated MGV source of supply needed for a new or temporary installation? Will the MGV supply be a Surge, Primary, Temporary, Permanent type of supply? What is the calculated pipe size needed for a new or temporary piped distribution installation?	Ex. O2: 150,000 SCF/month (additional 208 SCFH needed)	To figure out what capacity of MGV source of supply is needed, a few items need to be addressed. What is the Facility's typical or average day (or monthly) MGV usage demand (load) - Using this information, calculate (with the Facility's gas or equipment supplier) what capacity of supply is needed and compare it with the Facility's current MGV source of supply. Is the current source of supply undersized, or does the supply have room for expanded use. Are the components of the source of supply rated to meet the typical use demands or are they undersized, from this information, the additional current and estimated future usage demands can be calculated into the overall MGVS needed usage demands and decisions can be made to upgrading or expanding the current source of supply or if adding an independent supplemental source of supply will be needed. Then decisions regarding what type of construction project this will be, such as permanent, temporary, surge supply, primary supply, location of additional supply, local AHJ and regulatory compliance, etc. When the source of supply is calculated and the Facility demands are calculated, a look at the existing piped distribution network can be critically reviewed. The MGV piped distribution system capacity usage and line pressure loss can be reviewed and the maximum usage demand they area can handle can determined. The pipe sizing charts that are available for MGVS can be used to determine if the existing piped distribution system is undersized or adequate for the typical Facility demand usage and if there is available capacity for additional MGV demand usage. The original designed and installed MGVS is frequently found to be significantly different from what the MGVS design looks like today. If every addition or change were properly sized and documented, flow capability of any area could be reasonably assumed. But since this is not typically the case, it is important to identify any bottlenecks in the system (e.g. use of smaller than needed pipe diameters), and determine options (risk assessment, consultation with MGVS experts such as Engineers, Designers, Suppliers, Contractors, AHJ and Facility Clinical and Facility Staff) for additional usage demands, such as loop, ring, dual pipeline or cross over installations and increasing pipe diameters (if possible). (Refer to the link section below).
Does the Facility have defined requirements and tasks for MGVS surge operations? Have these operations and tasks been documented, defined, explained and conducted with the Facility's Management Staff & Clinical Staff?	 Ex. Yes or No	To address the ability to evaluate and care for an increased volume of patients that exceed normal operating capacity, and the ability to manage patients requiring highly specialized medical gas treatments and care, a MGVS Surge Response Plan should be in place and contain protocols for dealing with maintaining peak performance of the MGVS. The main elements of the plan should include Risk Assessment and Hazards Operations, Emergency Planning, Communication Plan, Policies and Procedures , and Training and Testing. Areas covered within this plan should include, and not limited to, Supplemental MGV supply options, MGVS failures and abnormal line pressure, Medical Gas & Vacuum Systems - Description of equipment and operations, Hazards & Risks associated with MGV use in the hospital setting, Ordering Medical Gas & Vacuum Supplies and Inventory Control, Storage of Medical Gas Cylinders/Containers, Contingency Capacity Plan for indoor & outdoor locations where MGVS supplemental supply will be installed or stored, Handling of Medical Gas Cylinders/Containers, Use of Medical Gas Cylinders, Ordering of Medical Gases for the MGS, Administering Medical Gases and the impact of High Flow Therapy Equipment on the MGVS, Medical Oxygen, Medical Air, Medical Vacuum , Medical N2O, Medical N2, Instrument Air, WAGD, Other Medical Gases, Cryogenic Liquids, Contingency Capacity locations where MGV will be provided for patient care, the RFA & the Medical Gas Committee, Roles and Responsibilities, Clinical & Facility Staff Training. Indicators and Trigger Points should be part of the Policies and Procedures: Indicators including measurements, predictions or events that represent changes in demand or resource availability suggesting transition to contingency capacity. Triggers include decision points along continuum of care indicating transition to surge or crisis capacity.
Does the Facility have any onsite MGV surge supply equipment that can be used?	 Ex. MGV Surge Planning List	Surge portable supplies may include one or more cylinders/containers on a cylinder/container cart connected with regulator(s) and hoses, connected to medical equipment, back-feed ports or terminal unit(s). Ambient Atmospheric or Oxygen Monitors, Portable automatic/semi-automatic manifold system can also be used as a temporary supply during area isolation and back deed operations. Portable manifolds system can be used to reduce the risk of low pressure in high risk zones. Portable/temporary suction pumps, portable/temporary Med Air Compressor units, Emergency Back-Up Oxygen System (Regulator stations, Vaporizers, Interconnection connections) tied into the EOSC.
Are Installation, Operations, Monitoring and Maintenance procedures in place for supplemental MGVS Surge Equipment?	 Ex. Yes or No	The RFA along with the Facility's Medical Gas Committee needs to ensure the MGVS Surge Response Plan includes MGSV installation, operations, monitoring and maintenance procedures that address both technical and clinical responses to MGVS surge situations. Consider producing and distributing Action Cards for use by the Clinical Staff and Facility Staff. Sections should include topics such as emergency isolation of the MGVS supply in a zone or hospital wide, back feeding of a MGVS supply, responses to MGVS alarms, capacity limitations of the MGVS, and use of MGVS terminal units.

Where can adjustments to the existing MGV system be done to compensate for added demand within the maximum delivery rates and duration periods? Where can expansion, such as patient beds with high flow MGVS therapy be added to the MGVS and within the limited resources of Facility and Clinical staff during Surge operations? What areas of the MGVS can handle additional capacity loads? How can the MGVS loads be managed?	Ex. 12 additional patient beds in the 2nd flr ICU will be added, high flow MG therapy equipment on to 3rd flr non-acute patient wing area will be added and this wing will be converted to an acute treatment area,	Ways to support added usage demand for the existing MGVS include: 1.**MGVS Utility Load Management** is the process of balancing the supply of MGVS or controlling the MGV load. In short, MGVS Utility Load Management helps reduce demand for MGV during peak usage times. The MGVS Load Management process requires data including the number and locations of patient utilization the MGVS, Number and type of MGV therapy equipment attached to the MGVS, essential and nonessential locations where MGVS is piped, average load performance tracking per bed/area/zone, Load Capacity forecasting, etc. Load management, when done properly, is non-invasive, and imposes no hardship on the patient. Determining the existing load and calculating the new load should not be a wild guess. Loadings beyond the capacity of the existing pipework, will cause excessive pressure drops. Load management planning may begin by building sophisticated models (Engineering modeling testing and flow analysis software) to describe the physical properties of the MGVS piped distribution network (i.e. Equipment operation and limitations, source supply and distribution system rated capacities, load variation & behavior scenarios, and other characteristics of the MGVS). The analysis may include scenarios that account for respiratory type Pandemics, Hurricanes, Flooding and similar disasters. 2. **Increase preventive care maintenance** to keep the MGVS up to peak performance. When preparing or during surging demand usage, tasks such as daily monitoring and deicing the Bulk Cryogenic Fluid Supply System Ambient Vaporizers, increasing switching ambient vaporizer time schedules, requesting additional deliveries from MG Suppliers, monitoring and adjusting, as needed, MA & MV system lead-lag operational time schedules, adjusting working line pressures for source equipment and line control regulator stations, inspections and repairs of MGVS distribution equipment for leaks and operation, activating all surge operational plans related to medical gas and vacuum systems with the same contents and working line pressure interconnected with an in-line valve installed between the systems that allows for additional MGVS capacity support. 3. **Engineering design, capacity rating, and engineering modeling testing with flow analysis** of the MGVS, to identify areas that cannot meet the calculated additional MGVS demands at the patient beds (after MGVS load management & maintenance management options have been exhausted). These areas may need supplemental MGVS options (Cylinders, concentrators, portable vacuum pumps, portable compressors, added pipelines, increased working lone pressures, expanded pipeline capacity (larger dimeter pipelines or added loop designs), additional central supply resources such as surge tanks, cylinders/containers, added MA compressors, added MV pumps, additional MGVS pipeline equipment, other MGV distribution options). Clinical expectation will need to be taken into account when estimating future demands and adding supplemental MGVS resources. (Refer to links section below).
Does the Facility have current and up to date as-built drawings of the MGVS?	  Ex. Yes or No (partial?)	Drawings and engineered calculations of the MGVS showing pipeline locations, pipeline sizes, pipeline distances, valve controls, flows, pressures, and minimum and maximum capacity ratings are required that accurately reflect the current medical gas and vacuum system. Having current and up to date as-builts allows for planning and quick response to surge activities and allows for "Flow/Pressure Capacity Demand & Surge Modeling" scenarios - "What if?". Keeping track of daily Facility MGV consumption and modeling scenarios can help with planning for production and maintenance, cylinder numbers needed, refill frequency (liquid oxygen).
Does the Facility have any same medical gas pipeline crossover connections between MGV source supplies and/or piping sections that can be operated during surge demands?	Ex. Yes, The MA USP supply have 4 separate MA USP Supply sources feeding various locations inside the hospital. A crossover pipeline connects them all together with manual valve controls and they can be opened as needed.	Exiting loop, ring or crossover pipeline connections can be activated during MGVS surge demands to compensate for low working line pressure. Installation of a of local loop system will lower pressure drops to most remote terminal units. It is essential that a risk assessment and full consultation with clinical colleagues takes place. Using a zero diversity factor for pipe sizing or general pipe size increases everywhere is probably not the best solution, and it is only the technical ability of the RFA (MGVS) or the AE (MGVS) to explain the technical and financial implications of any design above and beyond Code recommendations that will result in the most practicable solution.
What type of MGV work will be conducted? Will the work be for a New Permanent System, Temporary System, or Modify/Repair Existing System?	Ex. Temporary System	Each type of installation will need defined and each will have some variances on how the installation is required to be conducted. New permanent systems (New Bulk O2 System, New MA Compressor System,...) vs Temporary Systems (Duplex MA Compressor Systems on skids, Surge MG Tanks,...) vs Modified existing systems (Add additional Vaporizer, Add simplex MA compressor, Add simplex vacuum pump,...).
What supplemental MGV product of supply will be installed on site?	Ex. Bulk Oxygen Supply	The product type is critical to know. Permits and licenses are required to distribute USP/NF gases for patient care. Medical Gases can be used under the direction of licensed medical professionals for purposes for direct respiration by patients & medical device applications directly related to patient respiration. Construction Permits may be required to install a supplemental MGV Source Supply. The AHJ and local ordinances may have regulations restricting certain size and/or types of outdoor storage containers or equipment.
Are there drawings and specification available for the supplemental MGVS project? Is there a defined scope of construction work?	 Ex. No, No, Temporary	The scope of work defines details of what the Facility needs to do and what the Facility's suppliers need to do, what deliverables are expected, what tasks should be done to support the deliverables, what's the timetable for the work, what party should be responsible for what work, what criteria will be used to decide the quality of the end results and more. the distinction between " temporary " and " permanent " may be a feature of the product design. Temporary products might be easily removed and relocated, or permanent products might be designed to be permanently supported to ground or structure. The difference between a temporary and permanent building doesn't always come down to physical attributes but rather business objectives, available resource and sometimes personal preference.
Are there MGV construction plans and documents completed and sufficient clarity? Are detailed MGV Floor Plans including?	Ex. No 	The MGVS construction plans and documents should indicate the location, access, nature and extent of the work proposed and show in detail compliance with the applicable codes, standards and amendments. The MGVS Floor Plans should include Patient Room Details, Written Scope of work, and Equipment Data Sheets.
If there are no construction plans and documents, how can the Facility try to minimize risk during a MGVS project?	Ex. Conduct a Risk Assessment and gathering of as much information about the project as possible.	During unexpected Surge activities, there may not be time to develop formal construction plan and documents. Without drawings and specifications, the Facility needs information that "proves" this installation, equipment and folks installing the systems will put in a "safe for patient use" systems. If this occurs, then collecting as much detailed information as possible such as: site survey reports, site sketches, OEM shop drawings, OEM equipment specifications, site photos, and requiring NFPA 99 compliant equipment and materials, as well as proof of credentials from installers and suppliers will help minimize risk during a MGVS project. A risk analysis will need conducted to support where is the supplemental MGV supply is going to be located, and equipment manufacturers will need to supply equipment shop drawings & equipment specification documenting proof of compliance with NFPA 99 or similar codes/regulations.

Does the Facility have or need construction permits for the supplemental MGVS installation? Have permit-to-work been setup for the project?	 Ex	Construction Permits may be required to install a supplemental MGV Source Supply. To apply for a construction permit the Facility, GC or A/E, or other special trades can apply with the local construction permit office. The local permit office issues permits for all new construction projects. Before building permits can be issued for plumbing, electrical and mechanical work, the contractor must be registered with the permit office. Contractors typically show proof of their state licensing for mechanical, plumbing, electrical, ... work. The Facility's Responsible Facility Authority (RFA) will be responsible and will issue the permit-to-work. The Responsible Facility Authority of the health care Facility shall develop, maintain, and manage a permit-to-work system ensuring uninterrupted quality, quantity, and continuity of supply during all piped medical gas and vacuum system maintenance, repair, or construction work. The RFA's plan shall include processes to assure at least the following: (1) The affected medical staff and Facility administration is appropriately in communication prior to any work on piped medical gas and vacuum systems (2) Alternative supply or adjustments in patient care arrangements are in place prior to system interruption, including monitoring, as appropriate, of the work being performed and the alternate arrangements in use (3) All work on piped medical gas and vacuum systems is performed by competent individuals holding appropriate qualifications for the work (4) Procedures for shutdown and restoration of medical gases are described, communicated, and observed by all persons working on or with the systems (5) Safety procedures are in place and are observed for all persons involved in working on the systems (6) This code is observed in the execution of maintenance, repair, or construction procedures (7) The affected portions of the systems are correctly tested and demonstrated to be acceptable for patient use.
Who is supplying, installing, verifying and will be maintaining the supplemental MGV supply, and what are their credentials (FDA - cGMP compliant, NFPA 99 compliant, ASSE 6015, M-1, 6035, ASSE 6010, 6030, 6040,...)?	 Ex. Joe's Gas Co Installers, and Jim's Verification Co.	The Cryogenic Fluid Central Supply System product needs to be installed and verified by a qualified personnel with CGA M-1, ASSE 6015 and ASSE 6035 credentials . The MGV Distribution installation requires a ASSE 6010 qualified installer and ASSE 6030 Verifier. Confirm that the companies involved with a installation of a MGVS surge supply are qualified and credentialed to supply and install the MGVS. Also, when the MGVS Supplemental Supply system is installed and running, it is critical to identify who will be monitoring and maintaining this supply during operations. This person(s) shall need to be trained, experienced and knowledgeable of the Facility's MGVS Surge Plans Operations and Communications. The Cryogenic Fluid Central Supply System product needs to be installed and verified by a qualified personnel with CGA M-1, ASSE 6015 and ASSE 6035 credentials . The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in performing such installations. Installers of medical gas and vacuum piped distribution systems, all appurtenant piping supporting pump and compressor source systems, and appurtenant piping supporting source gas manifold systems not including permanently installed bulk source systems, shall be certified in accordance with ASSE 6010, MGV Distribution installation requires a ASSE 6010 qualified installer and ASSE 6030 Verifier.
Does the supplemental MGV supply installation comply with NFPA 99 code? If no, are waivers/exceptions/interim measures documented and approved by the AHJ to support the exceptions to the code? Is the Facility requesting approval to use a waiver?	 Ex. YES - CMT waiver.	In certain applications, the inability to use alternate equipment, materials or procedures may be considered an unreasonable hardship as the installation using alternative measures may be more efficient and economical. Organizations such as CMS can issue categorical waivers and local AHJs such as the Fire Marshal's office can allow categorical waivers that are based on support documentation proved to be safe and sound to be used for healthcare facilities. Important notice to facilities using waivers: If AHJ's do not receive the waiver(s) information at the start of their inspection, the waiver(s) will not be accepted and applied to the project. Categorical Waiver Process Steps: 1. Providers and suppliers that want to utilize a categorical waiver must formally elect and document their decision. 2. At the survey entrance conference, a provider/supplier that has elected to use a categorical waiver must provide the survey team with their documented decision and verification of compliance with all applicable provisions. 3. It is not acceptable for a Facility to notify surveyors of the election to use a categorical waiver after the survey team has issued a citation. 4. The survey team will call their supervisor and review the documentation decision to use the categorical waiver and confirm the Facility is compliant. 5. This will confirm a minimum level of protection is afforded to protect the health and safety of patients and residents, as required by regulation.
If this project will be for a temporary installation, what is the estimated length of time the supply will be on site?	Ex. 8 weeks estimated.	Remember that a temporary installation is different from a permanent installation because it has an expiration date; in other words, there are time constraints on the use of temporary installations. In some cases, temporary installations must be removed after completion of the purpose for which it was installed, such as for construction or repair purposes. In others cases, there is a specific time limit for the use of a temporary installation. Temporary installations are acceptable only if the AHJ approves them based on the conditions of use, estimated timeframe and any special requirements of the location. Temporary installations have their own additional hazards that a permanent installation may not have, such as exposed pipeline and wires that could cause tripping hazards, limited automated alarm conditions, hazards around the temporary installation if exception to some safety distances, and other hazards. Most of these hazards are reduced through a risk assessment and good housekeeping, which is an essential part of ensuring temporary installations are safe. Determining the exact or estimated length of time a temporary supply is needed can be challenging. A initial risk assessment and a scheduled periodic risk assessment after the temporary installation is installed should be conducted to confirm the safety and compliant conditions around the temporary installation still apply and if any adjustments are needed. If a temporary installation is deemed to be needed for an extending period of time, consideration should be made to upgrade the existing system to eliminate the risks associated with the temporary installations, especially in the cases where exceptions/waivers/interim measures were granted and have exceeded their limited timeframe.
Can portable emergency MG supplies be connected (back feed) in to the MGVS for critical care zones/areas that are vulnerable to interruption? How?	 Ex. Yes, through zone valve back feed ports.	Back feeding medical gas systems can be used to provide the functionality to a zone during maintenance, repairs, construction and as a supplemental supply during MGV surge demands. A well-planned and documented procedure is required and recommended by the ASSE 6000 series. Connection into a medical gas terminal unit will depend on the type of outlets installed. Some outlets are designed to only allow flow in one direction, some other outlets caution against back feeding through the outlets (check with the outlet OEM on any non standard operation the Facility wants to perform using the outlets). Make sure to identify suitable locations where back feeding supplies will be stationed safely. The FRA shall be responsible for the overall implementation process for the Back feed operations. Back feeding Supplies may include independent/portable feed with cylinder, regulators and carts, portable suction units, etc.
 Does the Facility have existing Floor Level auxiliary medical gas connections or Back Feed connections?	 Ex. Yes - 2nd flr ICU area Medical Gas Room has an in building header set up that a Portable 4 HP O2 cylinder Header/Regulator/Hose system can be attached.	The Facility should indicate on their As-built drawings all locations that have auxiliary MGV connection available and a list of the type and quantities of "backup/supplemental" medical gas supply that are available to attach to the Floor Level auxiliary medical gas connections. The details of these backup/supplemental MGV supply connections should include the pipe size (diameter), the linear ft, and material of the existing pipeline distribution system in the are. Also the Facility will need to document the current MGV demand of this zone/area and how much capacity (if any) is available before the supplemental medical gas supply is added. During Surge activities, the use of Supplemental medical gas may allow the main medical gas supply to build pressure back up (balance) during surge activity. These auxiliary connection shall be of the same size as the main line, consist of a tee, valve, and removable plugged or capped connection point, The auxiliary connection valve shall be secured.

If the Facility does not have floor level auxiliary medical gas connections, where will the Zone (floor level) auxiliary medical gas connection(s) be installed? What is the size of the existing pipeline where these auxiliary connection are to be installed?	Ex. 2nd Flr.. ICU zone and SICU, 1 " branch lines. 3/4"- 120 LF - Type K B819 Cu, Current Zone Demand: 500 LPM - Max Potential based on capacity design 660 LPM (160 LPM capacity still available)	If the Facility does not have floor level auxiliary backup/supplemental MGV supply connections available and will be installing these connections to the MGSV, the first requirement is to identify the locations where these types of connections will best support the MGVS performance. During the risk assessment process, zones/areas of the Facility that are considered essential, have critical care MGV therapy applications, and potentially can have usage demands exceeding the design capacity at elevated flows, should be identified and evaluated to confirm a supplemental supply attached to the MGVS would allow additional support to the MGVS performance in this area/zone. To install new floor level auxiliary medical gas connections onto the existing pipeline network will require a shutdown of the pipeline affected area where the new auxiliary medical gas connections will be installed. These auxiliary connection shall be of the same size as the main line, consist of a tee, valve, and removable plugged or capped connection point, The auxiliary connection valve shall be secured.
 Is an EOSC installed, functional (tested) and available to be used to connect a supplemental Oxygen supply? Does the EOSC area have EOSC alarm contacts installed? Can current photos be sent of the Facility's EOSC(s) location(s)? What are the dimensions of access under current conditions, dimensions of or near the EOSC area that can be used to station a temporary oxygen supply.	   ex. One EOSC is installed, tested and available for hook up for supplemental oxygen supply. NO alarm contacts available, 30' x 30' available for site work, temp supply stationing, access by tractor trailer is available.	During the Covid-19 Pandemic when surges in oxygen demand were at their highest levels, the Emergency Oxygen Supply Connections (EOSC) was the most depended upon Oxygen System auxiliary connection to add vital supplemental oxygen. This critical auxiliary connection allows for supplemental oxygen supplies such as portable oxygen bulk tank system trailers, temporary skid mounted bulk oxygen tanks systems, temporary microbulk oxygen supplies systems, portable liquid container systems, high pressure cylinder systems, to be connected into the Medical Oxygen Piped Utility System and support and enhance the patient respiratory treatment needs of the Facility. The EOSC is a vital part of the Medical Oxygen Utility System and the design, location, testing and maintenance of this auxiliary supply connection are important parts of the EOSC. The design of the EOSC shall include an external weather-tight lockable enclosure that will physically protect and prevent unauthorized tampering and labeled as “Emergency Oxygen Supply Connection”. EOSCs shall consist of a minimum of the following items: 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, manual shutoff valve to isolate the EOSC when not in use, 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, 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, any valves and other components that necessary to allow testing ,maintenance and connection of the emergency supply of oxygen and isolation of the piping to the normal source of supply, four alarm connection points installed to both master alarm panels to allow the temporary supply to be monitored while in use. The EOSC(s) shall be located on the exterior of the building being served in a location accessible by oxygen supply vehicles at all times, have a minimum of 3 ft of clearance around the EOSC for connection of temporary auxiliary source and be connected to the main supply line immediately downstream of the main shutoff valve. The site where the Supplemental Oxygen Supply will be stationed outdoors shall meet the requirements for outdoor storage as defined in NFPA 99 & NFPA 55, as applicable. This means that 24/7 street access to the temporary oxygen supply is required, the site shall meet all hazardous site safety distances, the site shall have all the requires system protections (temporary fencing or equivalent, temporary vehicular protections (Jersey Barriers), properly engineered concrete surfaces or equivalent, labels and signage, security measures, etc.) and comply with all local regulatory requirements. Testing and maintenance conducted on the EOSC needs to be conducted to keep the EOSC operating as needed when used. With most industry design configurations of the EOSC units, testing and maintenance can be a challenge. It is recommended that the Facility works with their Bulk Gas Supplier when testing and conducting maintenance on the EOSC. Any newly installed EOSC should take into consideration a means to test and maintain the EOSC. This will require as design similar to the attached pictured example.
Will the project installation be connecting to a "live" MGV system, can there be a shutdown, will the installation be for an independent MGVS system from the exiting MGVS? Are future valves already installed and can be used to extend the area/zone pipelines without a shutdown?	Ex. No, No, Yes, No	The crucial step in a planned shutdown is the management of uninterrupted MGV supply to patient care areas. Management of planned shutdown of MGV pipeline system require thorough investigation and planning to successfully complete the work without disrupting Facility MGVS operations. Planning Minimizes Risks – communication and collaboration are paramount. There is no margin for error as Facilities rely on the MGVS for patient care and treatment. A planned shutdown of the MGVS involves three stages: the project scope and planning prior to shutdown, the actual shutdown and work needed (braze in valves, add outlets, ...) on the MGVS, and the verification of the system before and after shutdown is brought back on line. The key to minimizing downtime and risks to patients throughout the process is effective communication, preparation, and coordination between Facility & Clinical Staff affected by the shutdown and the contractors involved in the project. (Refer to the links section below for additional information on MGVS shutdowns). Adding additional pipelines, valves and outlets to an existing system when future valves already are installed in the area of installation or installing an independent MGVS distribution system may not require a shutdown of the existing MGVS, if future valves (or similar tie in valves) are not available and an independent system is not an option, a shutdown may be required.
Are there MGV alarms signals contacts available for the surge/primary MGV Supply to be connected to the Facility's MGV Master Alarm panels? Does the master alarm panels have extra contact points that can be used to connect the supplemental MGV supply alarm signals?	 Ex. Yes, Yes	A new permanent or temporary supply installations will need alarm monitoring. This may be achieved by installing additional alarm panels or connecting to existing alarms panels that have available alarm contact points. The same is true for area and local alarms.
What size (i.e.. Gallons) of supplemental oxygen is the Facility planning to install? Has the local AHJ signed off on the supplemental supply design, scope of work and installation? Will the supplemental MGV supply be a surge supply system or a primary supply system?	 Ex. 1500G Oxygen Surge Tank, Ex. Surge supply to back up primary supply during excessive O2 demands.	After a supplemental supply of MG and the location where the supply will be staged have been decided by the MG supplier and Facility, there are some jurisdictions that have additional regulations limiting or additional permitting for the location, size, architectural design, environmental impact, and noise of an outdoor MG central supply. (ex. Fire Department permits Section FC105.6 of the NYC Fire Code (FC) requires a Fire Department permit to store, handle or use of medical oxygen in quantities exceeding: a. Compressed gaseous oxygen (O2) - 504 SCF; b. Cryogenic liquefied oxygen (LO2):• 10 gallons indoors• 50 gallons outdoors). The AHJ will be able to identify these additional regulations and assist on any exceptions/waivers/interim measures that may be necessary to proceed with the installation. (Refer to link section below). Installing a primary supply will require a full compliment of redundancies as defined in NFPA 99. A surge supply system acts as a backup supply or emergency supply to support the Primary supply during high volume demands and becomes part of the Primary supply redundancies system. If the main supply system (Primary and Reserve) can not keep up with the surge demand and working line pressure starts to decrease, the surge supply will activate and supplement the main supply until the main supply is able to reestablish the primary supply role.

Has the Facility selected a site where a supplemental supply can be set up and connected to the existing MGS? Has a site survey been conducted by the MG Supplier and Health Care Facility at the location of where the supplemental Bulk MG Supply will be installed and filled?	 Ex. Yes, Yes, Yes	For outdoor supplemental MG supplies installations a scope sheet with NFPA 55 siting list needs to be completed, documented and available for review (or have AHJ approved mitigation steps been put in place). The access to the supplemental Bulk MG Supply delivery area needs evaluated and confirmed by the Medical Bulk Gas Supplier and Health Care Facility to be acceptable. For example, 24/7 street access to the temporary oxygen supply, all hazardous site safety distances met, all the requires system protections are met (temporary fencing or equivalent, temporary vehicular protections (Jersey Barriers), properly engineered concrete surfaces or equivalent, labels and signage, security measures, etc.) and the site complies with all local regulatory requirements.
If the onsite Cryogenic Fluid Central Supply System is customer owned (not leased), what are the rated capacity of the Facility's Tank(s), Vaporizer(s), Control Cabinet(s), Distribution System?	Ex. Main Tank: 6000G (677,700 SCF), Res Tank: 1500G (175,000 SCF), Main Vaporizer: 8 hr.: 7500 SCFH , Continuous: 2500 SCFH, Control Cabinet 10,000 SCFH, Total Distribution System: 1,000,000 SCF/month	Cryogenic Fluid Central Supply Systems that are leased by a Facility can contact their gas supplier to obtain rate capacity information. When the Facility owns their own Cryogenic Fluid Central Supply Systems, the Facility, not the gas supplier, is required to have this information when they purchased the systems. That information can be requested from the OEM of the Vessels, Vaporizers, Regulator Control Panels, and the Original Design Engineer.
Is the medical gas manifold system supplied with HP Cylinders and/or LC Containers ? How many Medical Gas LC containers or Medical Gas HP cylinders are attached to each header?	 Ex. 5 HP cylinder per header	Knowing the current quantities and volumes of medical gas cylinders or liquid containers attached to the Facility's manifold system and comparing this source of supply with the Facility's current and projected medical gas supply needs will assist with deciding if additional deliveries, added cylinders/containers, or adding a larger source of supply is necessary to manage the volume of medical gas needed for patient care.
If the Medical Gas LC or HP Manifold system is installed indoors: Is there any other medical gases stored in the room and if so, what is the total volume of medical gas stored in the room? What are the dimensions of the room? How much space is available to add additional supplies?	 Ex. 20 oom, 1 hr. Fire resistance rated, Sprinklered, Mech Ventilation (500 SCFH), Total MG Volume Stored and in service = 17,000 SCF	Finding a suitable site to add additional MGV supplies is critical during surge planning. Indoor MG storage rooms are limited by the Maximum Allowable Qualities for gas storage and NFPA 99 & NFPA 55 codes. If a medical gas storage room with all the required NFPA 99 requirements for a gas storage room (ventilation, sprinklered, fire rated room, ...) for example has a total of three Liquid containers (160 L) of oxygen, this equal approximately a net capacity of 12,000 SCF. Depending on the size of the room and calculations for ventilations and negative pressure, approx. two more O2 LC's or 8,000 SCF of stored oxygen can be placed into the medical gas room. Other consideration are Ambient Air or Low Oxygen Percentage (<19.5% O2) content alarms/monitors installed that monitoring medical gas rooms that contain Nitrogen, Helium, Carbon Dioxide, Nitrous Oxide,... If leaks or Liquid Containers off gassing occurs and the room ventilation is not adequate or not working properly, the gas(es) will act as a simple diluent and reduce the oxygen concentration in the room below acceptable breathing levels and possibly causing asphyxiation to employees enter the room. Breathing an oxygen deficient atmosphere can have serious and immediate effects, including unconsciousness after only one or two breaths. The exposed person has no warning and cannot sense that the oxygen level is too low.
If the Medical Gas LC or HP Manifold System is installed outdoors: What are the dimensions of the storage area? What is the total volume of medical gas stored in the outdoor enclosure? How much space is available to add additional supplies?	 Ex. 20' x 10'	The limitations for indoor medical gas storage and outdoor medical gas storage are quite different. Outdoor storage is unlimited with the proper controls, safe guards and proper siting from hazards. Without adding additional site work such as concrete pads, fencing, vehicular protections, lighting etc. if the existing outdoor storage locations for medical gases is large enough and has space for additional medical gas supplies, adding additional medical gas supplies may be an easy and economical process.
What is the make, model, design, rated capacity and manufacturer or supplier name of the Medical Air Compressor or Medical Vacuum Pump Source equipment?	  Ex. MA Compressor Intake: 2 " Cu, 100 LF, roof of boiler room.	Knowing the Facility's current MA compressor or MV Pump design, model, HP, location and other key information, will assist in a possible solution such as adding additional compressors or pumps, adding supplemental parts to a MA or MV system, or adding a separate MA or MV system. Always work with the Facility's equipment vendor to decide on a plan to modify the Facility's MA or MV source equipment. The Manufacturer of the equipment should be able to discuss with the Facility any options that are available with their company built equipment. Additional support data that is helpful to know is the model, serial number, and year built, horse power, design (Simplex, duplex, triplex, quadruplex, etc.) capacity (SCFM per compressor), Type of MA dryer(s), MA Intake size or MV Exhaust size and length and location.
If the Facility decides to use a supplemental O2 concentrator during surge demand activity, what are important considerations to consider?	 Yes - supplement my existing oxygen supply system,	Oxygen concentrators are intended to produce Oxygen 93 USP while the Oxygen in containers or high pressure cylinders will usually be Oxygen USP. A concentrator will be specified at a concentration between the allowed 90 - 96% which defines the maximum supply flow. If overdrawn, a concentrator would produce a concentration below the required minimum of 90%. The Code requires the concentrator source be automatically valved out of service if the concentration falls below 91%. Therefore, exceeding the design output of the concentrator is not possible without special controls. Concentrators require an air source, and the air source(s) will generate heat like any air compressor. In addition, the concentrator will vent oxygen-depleted air. The Code requires adequate ventilation to remove this heat which should also be designed to refresh the room air. The Code also requires the temperature of compressor/concentrator rooms be maintained within the manufacturer's stipulated range, which may require supplemental cooling. All Central Supply Systems require power from the essential electrical system. Mixing Oxygen 93 USP and Oxygen USP in the pipeline may be problematic in some jurisdictions since there is no pharmacopeia monograph to address Oxygen between 96% and 99%. For the above reasons, use of concentrators as surge supplies requires careful consideration.
Does the Facility have a safe site location, access and space for the construction needs required for the supplemental MGV supply?	 Ex. Y	Construction sites can be dangerous places, and only authorized personnel should be allowed access. It is critical that planning for MGVS projects during Surge conditions includes a focus on location, access and spaces for construction needs. Some of the dangers to non-authorized construction personnel can include, falling materials or tools, falling into trenches, falling from height, being struck by moving vehicles, being cut by sharp objects, coming into contact with electricity or hazardous materials, and dust, noise and vibration. Construction sites can also be vulnerable to vandalism, theft, arson, protests, and so on. Construction sites present a challenge in terms of securing access as, their nature and layout is subject to frequent change, access is required by a large number of contractors, suppliers, consultants and so on, construction site access is often in highly-populated areas with limited parking and space. There can be time pressures to complete the work quickly or work during off hours. When a supplemental surge MGVS project needs to be expedited, all these factors and concerns need to be incorporated into the decisions for where the best site location can be for the contractors.

Does the Facility have (essential) electrical power supply/capacity for additional MA Compressor, MV Pump & IA Compressors units and Alarms? Does the Facility have ventilation and other utilities needed for MGSV support?	Ex. Yes	The additional electrical power needed for the temporary supplemental equipment during MGV surge operations will need to be calculated and determined if this additional power is able to be connected to the EES (Essential Electrical System has the capability of restoring and sustaining a supply of electrical energy to specified loads in the event of a loss of the normal supply of energy) or a separate generator is required? Any other utilities (water , sewer, HVAC, …) required for the supplemental MGVS will need to be sized and determined if this additional utility needs are able to be connected to the existing utilities or if independent support utilities are required.
Does the Facility need a piped distribution system installed?	Ex. Yes, 1 1/2" main 120 LF, (2) 1" branch lines 100 LF, (12) 3/4" drops, Yes - copy of calculations and design available.	When an independent MGVS, from the existing MGVS, has been decided to be used within a Healthcare Facility the design and installation will follow the same steps as a new MGVS installed. For the sizing of the MGVS, data related to the number of patient care beds, number of outlets, location of the valves, and sources, location of piping routes, placement of alarms, estimated usage at each outlet/bed, will assist in sizing the source equipment and pipeline distribution system.
How many additional beds and what will be the MGV total capacity demand needed for the piped MGV system? Is the Facility adding MGV outlets/beds to the existing MGV supply system or installing an independent MGV supply system?	Ex. 50 beds/outlets approx. 3100 SCFH total capacity needed. Adding beds/outlets to existing MGV system. 100% cat 1 space, Acute = Covid Positive patients, High Flow Ventilators to be used.	Knowing the outlet and bed counts, the type of patient MGV therapy equipment expected at the beds, the MGV therapy equipment and the MGV requirements for the equipment that will be attached to the bed's outlet, if the MGVS demand will be added to the existing or if the MGV demand will be for an independent system, and the estimated total MGV capacity expected will allow MGVS engineers, MG suppliers, and MGVS equipment suppliers to put together options to support the MGVS needs for the Facility.
Will outdoor MGV piping distribution be piped underground, above ground or both? Will the indoor piping in patient or employee areas require ceiling tiles removed?	  Ex. Above ground	Whether the Facility will be installing underground piping or above ground piping for a MGVS surge project, each will have their challenges. Prior to any digging, it is crucial that all known ground utilities locations and other Facility buried pipes, conduit, equipment or other have been identified and labeled, so when digging starts for the MGSV there are no unexpected work stoppages. **Underground MG pipe installation** requires buried piping outside of buildings follow the NFPA 99 section " Underground Piping Outside of Buildings". The depth of buried pipe depends on such factors as the climatic conditions of the region, the type of traffic anticipated, and the routing of the piping. Underground medical gas piping is vulnerable to damage by lightning strikes, ground fault conditions, and soil corrosion. Electrical continuity between underground medical gas piping and aboveground piping, or between same-trench piping or between underground piping and other metal structures, should be avoided to prevent cathodic protection problems. Due to the possibility of leaks and the risk of enriched atmosphere, it is preferable to have no flanged or threaded connections on the underground pipeline. Pipe trenches should be backfilled with clean earth that is free from large stones, boulders, construction debris, or other materials that could damage or break the piping or cause corrosion. Bulldozers, graders, and the like can be used to complete backfill to grade. Fill needs to be compacted. Suitable precautions must be taken to ensure permanent stability for the pipes in the trench and the ground above the pipes. Different soil types have differing properties, and they require different construction techniques to ensure optimum performance. Selection and depositing of backfill materials should be done with special reference to the future safety of the pipes. **Aboveground MG pipe installation** that is installed in an outdoor exposed location is subject to the rigors of the surrounding environment. It can be damaged by the movement of vehicles or other equipment, and such damage generally results in gouging, deflecting or flattening of the pipe surfaces. If an above-ground installation must be located in a region of high traffic or excessive mechanical abuse (along a roadway, etc.), the pipe requires extra protection. It may be protected by building a berm or by encasing the pipe where damage is most likely. Other devices may be used, as appropriate to the situation. Other consideration would be to have minimum support heights above ground and roof surfaces, such as piping installed outdoors shall be elevated not less than 3-1/2 inches above ground and where installed across roof surfaces, shall be elevated not less than 3-1/2 inches above the roof surface. Using the 3-1/2" above ground, roof surfaces, and outdoor concrete/asphalt surfaces should foster greater consistency in installations and enforcement. Piping installed above ground, outdoors, and installed across the surface of roofs shall be securely supported and located where it will be protected from physical damage. Trip hazards should not be created and by placing piping alongside a building wall or other vertical surface will help mitigate this type of hazard. Piping/wires/conduits crossing over roads or areas where vehicles travel will require vehicle rated drive over plates. **Indoor Above Ceiling Piping:** The construction team prior to work beginning in any space in a Health Care Facility, should conduct a preliminary inspection of the areas where the construction will take place. This team includes members from both the Health Care Facility and Contractor. An Infection Control Risk Assessment (ICRA) should be created and serve to identify the potential risks and the preventative measures to be taken during the construction activities in order to reduce risk exposure. An Interim Life Safety Measures Assessment (ILSM) should be performed on any system or element that could create a life safety code deficiency. This includes specifics about impairment of access and egress, fire detection and alarm systems, etc. A Patient Impact Risk Assessment (PIRA) should also be performed to identify risk and ways to mitigate risk to any patients who may become affected due to the construction, whether it be from noise, vibration, dust and more. The contractor should ensure compliance with each of these. Both the ICRA standards and Interim Life Safety Measures should be posted throughout the Facility, so staff can refer to them as needed.
Can flex hosing, corrugated medical tubing (CMT), other approved materials for the distribution system be used? Is a Waiver needed?	 Ex. Type K Cu ASTM B819 or CMT, waiver needed for CMT.	During the COVID-19 years where surge demands of oxygen were running high, CMS put out a waiver (Refer to links section below) allowing CMT to be installed for MGVS. (Note that CMT is an approved tubing material listed in the NFPA 99 2021 edition. CMS adopted and evaluates facilities under the NFPA 99, 2012 edition). There was also other AHJ who allowed one time exceptions or waivers on types of locations where MGVS were in use (Alternate care sites, Cafeterias, Lobbies, outdoor tents, etc.), types of installation procedures (Brazing, Threading connections, flex hoses, quick connections, etc.), non standard designs (inline regulator stations, multiple splitters of feed lines, back feeding equipment monitored in patient rooms, etc.). When time is of the essence, and that time is asap, coming up with a solutions for designing, and installing a MGVS quickly and safely, requires knowing all the available options including all waivers/exceptions and interim measure that can assist in putting a safe, reliable, and code compliant plan together.

If the existing MGVS pipeline diameters can not be increase inside the Facility, can a loop, ring or cross over pipeline connections system be installed for the individual medical gas and vacuum pipelines?	Ex. Yes	If a Facility has area/zone/dept where replacing the existing MGVS distribution piping with larger diameter piping is unable to be done due to technical or financial reasons, a solution may be to install a loop, ring or cross over designed piping system in the zone/area/dept to mitigate against surge demand causing low working line pressures. Most MGVS are radial feeds, with one-way piping branches feeding out from the MGVS Sources in all directions. Often, the piping starts out in larger size and the diameter of the piping is reduced near the end of the lines (Use point areas). With MGVS, having proper pressure is important. Critical MGV therapy equipment or MG tools receiving low pressure due to excessive pressure loss in MGVS piping will cause problems, and a common way to solve this is to boost the MGVS discharge pressure to compensate. Boosting the pressure raises the pressure at the critical use areas, but also all the other non critical areas in the Facility. Looping the piping has two effects, it equalizes the pressure drop because now the critical use area has at least two more diverse parallel paths to receive MGV. And having a loop typically means the piping is the same size throughout the loop, rather than reducing the size near the end. Having a parallel path is very effective in reducing the pressure loss. Because the pressure loss in piping varies with the square of the internal velocity, best case would have one half the flow in each line, which would result in one quarter the pressure loss. Further to this, if pipe size is increased, there is a significant increase in internal area of the pipe, which also reduces internal velocity. For example, use of 3-in. pipe rather than 2-in. would reduce the pressure loss by a factor of eight. Similar pipe size comparisons exist for other size upgrades. For this reason, where practical, it is always good to consider looping the Facility's piping, and using multiple loops of well sized piping is the best of all. Remember this can only be done with the same medical gas product and working line pressures. Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing, or any other reason, except that medical gas and vacuum systems with the same contents shall be permitted to be interconnected with an in-line valve installed between the systems. NO CROSS CONNECTIONS OF DISSIMILAR MEDICAL GAS LINES ALLOWED!
Does the Facility need to install (temporary) alarm(s), valves, outlet/inlets, etc.?	Ex. Yes, Yes, Yes 	If the initial thought is to add additional patient beds, the MGV Equipment Supplier and MGVS installer will need to know the quantities of MGVS equipment needed. It is vital that the type of medical gas outlet/inlet connection is specified to match with the MGV equipment that will be connected to the outlets/inlets.
If the Facility will be installing equipment, in which patient care locations, and what type and quantities of equipment does the Facility need?	 Ex. 24 O2 outlets (DISS), 48 Vacuum inlets (DISS), 2 O2 3/4" valves, 2 MV 1" valves, 2 Area Alarm panels (O2, MV)	Refer to the FGI Guideline for Design and Construction of Hospitals' table for Station Outlets for Oxygen, Vacuum (Suction), Medical Air in Hospitals to estimate outlet counts and defining patient care locations. As important is the Facility defining the patient care space as Cat 1 space, Cat 2 space, Cat 3 space, Cat 4 space and identifying where Minimal Sedation, Moderate Sedation, Deep Sedation, General Anesthesia will be administered or not. The Facility should list what type of patient care, such as Adult, Neonatal, Acute, Covid positive will be using the MGV outlets. The Facility should have a list of the MGV therapy equipment that will be connected to the MGV outlets (Ventilators, High Flow, Pediatric Flow Meters, …). Other items that will help in deciding MGV equipment needs are how many alarm conditions will need monitored? Does the existing alarm panels have any extra modules that can be used for temporary alarm connections? And matching the Facility's existing outlets connection indexes is critical and required to ensure the Facility's MGVS equipment they are using with their current outlets will connect to any new outlet they install. The manufacturer's name is useful but secondary. Specifying the indexing is how the Facility will ensure compatibility. Outlets types are either Pin index, DISS, Latch, Geometric, Ring, or Other.
Can the MGVS in a "shuttered" hospital or areas within the existing hospital that were not in use be started back up and used for patient care?	 Ex. YES, 5 yrs., No	Reopening a closed ("shuttered") hospital to expand surge capacity in an emergency requires significant planning. A shuttered hospital is a hospital that has been closed and is no longer in active or in daily use. These types of facilities may be reopened in times of crisis to care for the homeless, injured, or sick, esp. after a mass casualty incident. Prior to Opening the Facility (MGVS): The MGVS in a shuttered healthcare Facility would need to be inspected. If the MGVS was properly decommissioned, the process of reusing the MGVS is less involved. For MGVS where the decommissioning process was not conducted, testing, inspection, and repairs may be a lengthy process. If it is feasible to use the centralized medical gas system, have a credentialed medical gas system verifier (locate at www.mgpho.org) test the system and oversee needed repair activities. Medical Gas System Verifier: The medical gas verifier will need to complete a checklist of discover questions that will include questions such as: Is there an existing MGVS in the Facility?, Was the MGVS decommissioned properly?, Are there MGVS As-Built Drawings? Are there history records of inspections/maintenance/repairs, Are the MGVS Source Supplies still located on site? Are the MGVS Sources of Supply functional?, During decommissioning were the pipeline capped and sealed? If there was a bulk oxygen tank, was it removed and who was the MG Supplier?, When was MGVS last used?, What is the name(s) of the MGVS equipment manufacturer(s) (Source equipment, Alarms, Valves, Outlets,)? What are the Medical Gas Outlets description/model/type to coordinate with any MGV equipment that is being planned to be attached to outlets?, After a thorough checklist of discovery questions have been answered, the medical gas system verifier needs to inspect and test the existing installed medical gas system in the proposed surge Facility. This inspection and testing will exceed the verification testing described in NFPA 99 System Inspection under the Verification Testing section. A complete check will also require physically looking at the MGV Piped Distribution System and Supply Sources based on all relative sections of NFPA 99 (Central Supply Identification and labeling, Central Supply System Operations, Central Supply Locations, Control Equipment, Central Supply Systems, Valves, Station Outlets/Inlets, Manufactured Assemblies, Surface mounted medical gas rails, Pressure & Vacuum Indicators, Warning Systems (Alarms), Distribution system including Piping materials, Joints, Fittings, Pipe sizing, Installation, Protection of piping, Location of piping, Pipe Supports, Underground piping outside of building, Hose & Flexible connectors, Labeling, and MG Storage locations. In addition to the typical verification testing that includes functional and purity testing, also the additional testing should be conducted - pipe blowdown and purging testing, pressure testing, cross-connection test, leak testing. The inspection and testing should include 100% of the medical gas system components (Source, Alarms, Valves, Outlets, etc.) and MGVS pipelines to determine if the MGVS is usable or if cleaning and repairs are needed. If the MGVS will be reactivated, the Facility will need to arrange for Advance Contracts or Formal Arrangements from the Medical Gas Supplier (s), and identification of providers for Medical Gas System Verifier and Medical Gas System Equipment & Parts Supplier. Ongoing Operations (MGVS): Once needed staffing, equipment, and supplies are in place, and the Facility plans to accept patients, efforts will be needed to maintain fully MGVS operational status. The MGVS operations activities will begin on opening day and continue until the Facility is closed. Retain at least one facilities staff person on-site to conduct any needed Facility MGVS repairs, maintenance and to Monitor levels medical gasses, and other supplies, and reorder as needed. Closure Description (MGVS): Shutdown of the surge Facility will require removal of MGVS equipment and termination of on-going contracts or arrangements. Once all patients are discharged or transported back to another hospital for continued care, and no on-going surge capacity is needed, the Facility's MGVS can be closed down. Restoring Facility to Pre-surge Use Condition (MGVS): If the MGVS was used, have the MGVS verifier conduct system close-down (Decommissioning) procedures to preserve system integrity for future use.

The Facility wants to setup an alternate care site with MGVS installed? What is needed?	Ex. Tents set up on campus to treat patients.	Any hospital, public health organiation or other party that erects an ACS that will utilize a MGVS for purposes of the treating patients during an emergency response (surge activities) is typically required to notify their local AHJ. Initial information that the AHJ may request may include information on the size and location of the ACS, the expected occupant load, how space heating is being provided, and the nature and extent of flammable and combustible gases, liquids and materials to be stored, usage or handling of liquids and materials, design of the structure, any waiver/exception/interim emergency procedures and Interim Life Safety Measures for temporary use of hospital tent / temporary structures or location. Similarly to the ACS, if the Facility seeks to convert all or a portion of an existing building for use as a temporary medical Facility or patient treatment area, the AHJ should be notified. Additional information related to MGVS that may be requested includes: means of egress, fire protection systems and equipment, interior furnishings and maintenance of required fire-rated construction (oxygen compatible enclosures and materials), emergency planning and preparedness, hazardous materials, ACS placement, staffing, utilities to be used (heating, ventilation, air conditioning and refrigeration (HVACR) systems; plumbing systems including water, waste and piped MGVS and the electrical systems both normal power and the essential electrical system, building automation and control systems, information technology and communications systems, pneumatic tube systems, fire alarm and fire suppression systems, and the clinical technology systems and equipment. Crucial asset measures needed for site selection, the orientation of ACS, integration of vehicle access, control points, physical barriers, landscaping, parking, and protection of utilities to mitigate threats. Fire Department (AHJ) permits, construction permits, Indoor medical gas manifolds, Indoor medical gas quantities, outdoor medical gas quantities, medical gas storage, MG manifold electrical components, MGVS piping/hosing, Hot work (burn & work permits), MGVS shutoff valves, MGVS outlets, MGVS alarms, testing, maintenance, training, signage, medical gas supplier delivery areas and access approvals, construction workers credentials and access approvals, security, communication.
How are supplemental MG cylinders secured, handled and stored?		During surge activities, the Facility's medical gas storage rooms are typically filled to capacity with in-use or reserve medical gas supplies. When an Alternate Care Site (ACS) has been set up, designated temporary medical gas storage location are often not part of the original design. When a Facility needs "extra" medical gas storage during times of surge demands, or when an ACS that will use MGV is set up, designated medical gas storage areas need to be established. These "temporary" medical gas storage sites will need to follow the same requirements as permanent medical gas storage areas. The only notable exceptions would be the local AHJ approvals for waivers/exceptions/interim measures directed at the medical gas storage site(s). Safe handling & storage information can be found in NFPA 99 chapters 5 & 11, CGA, and most gas suppliers and medical gas manifold suppliers have free safety pamphlets and videos that are available to the public. (Refer to the links section below).

HELPFUL LINKS

AARC: www.aarc.org/additional-ventilators-may-pose-risk-to-hospital-gas-systems/

AIA: www.aia.org/pages/6280670-covid-19-resources-for-architects

APSF: https://www.apsf.org/article/shutdown-of-gas-supply-system-need-not-be-danger/

AHRQ: www.ahrq.gov/sites/default/files/wysiwyg/research/shuttered/shuttools.pdf

ASHE: www.ashe.org/COVID19resources, www.ashe.org/medical-air-and-oxygen-capacity-assessment-tool, www.ashe.org/system/files/media/file/2020/04/MedGasSizing-updated.pdf, www.ashe.org/system/files/media/file/2020/04/KP-NFSKaiserFSPDE-MedicalAirandOxygenCapacitypub20200329.pdf

ASSE: https://www.asse-plumbing.org/asse/personnel-certification/6000

CGA: www.cganet.com/resources/cga-covid-19-toolkit/, CGA M-28 GUIDELINE FOR ASSESSMENT OF HEALTH CARE Facility MEDICAL OXYGEN SYSTEMS, https://www.cganet.com/cylinder-and-equipment-safety/, https://www.cganet.com/medical-oxygen-safety-supply/

CMS: Approved1135Waivers: www.cms.gov/files/document/covid19-emergencydeclaration-health-care-providers-fact-sheet.pdf , https://www.cms.gov/files/document/covid-1135-waiver-application-quick-start-guide.pdf

FDA: www.fda.gov/media/136830/download, https://www.fda.gov/media/70973/download?msclkid=54612a95d16011ec95f6041f56ae8991, https://www.fda.gov/regulatory-information/search-fda-guidance-documents/policy-temporary-use-portable-cryogenic-containers-not-compliance-21-cfr-21194e1-oxygen-and-nitrogen

FGI: https://fgiguidelines.org/beyond-fundamentals/beyond-fundamentals-library/

MGPHO: www.mgpho.org/ Video - Impact on Covid 19 Medical Gas Systems

NFPA: www.nfpa.org/-/media/Files/White%20papers/NFPA550WhitePaper.pdf, www.nfpa.org/~/media/4B6B534171E04E369864672EBB319C4F.pdf, https://www.nfpa.org/-/media/Files/White-papers/TemporaryComplianceOptionsHCWhitePaper.ashx

NYC GOV: www1.nyc.gov/assets/fdny/downloads/pdf/codes/Emergency-Tents-and-Other-Temporary-Medical-Facilities-COVID-19.pdf

TJC: www.jcrinc.com/-/media/jcr/jcr-documents/products/consulting/covid-recovery-services/max-medical-gas-ec-news.pdf

US Army COE: www.usace.army.mil/coronavirus/, https://www.usace.army.mil/Coronavirus/Alternate-Care-Sites/Acute-Containerized-Shell-Only/

The U.S. Department of Health and Human Services (HHS): phe.gov/Preparedness/COVID19/Documents/COVID19%20Healthcare%20Planning%20Checklist.pdf.7

Kaiser Permanente: Edward (Sandy) Renshaw, P.E. Medical Air and Oxygen Capacity, Kaiser Permanente National Facilities Service Facilities Strategy Planning & Design, https://drive.google.com/file/d/19MCipjp7g0C2MGPi9fXIBV2zsi7M5E-G/view

BeaconMedaes: https://www.ashe.org/system/files/media/file/2020/04/MedGasSizing-updated.pdf, “Handle and Connect Medical Gas Cylinders Safely” video https://www.youtube.com/watch?v=MYzdOYztDxw, **Linde:** https://www.lindeus.com/resource-library/sds, Oxygen Safety video https://www.youtube.com/watch?v=6vvLkrRhTbY **Air Products**: https://www.airproducts.com/company/sustainability/safetygrams **Cleveland Clinic:** https://consultqd.clevelandclinic.org/how-we-created-a-hospital-fr-covid-19-patients-in-less-than-a-month/amp/ **Holy Name Medical Center:** www.holyname.org/help/covid19-construction.aspx

Public Comment No. 63-NFPA 99-2022 [Section No. 5.1.14.3.5]

5.1.14.3.5*

When clinical spaces are converted to nonclinical spaces, medical gas inlets and outlets that are not accessible for maintenance and testing shall be either removed or decommissioned.

5.1.14.3.6*

Access to Cylinder and Container manifolds and Cryogenic Fluid Central Supply systems, as well as protection of those systems in the event of adverse events (e.g. weather events, flooding, etc) shall be considered in operational planning.

Annex

A 5.1.14.3.6

Ensuring access to outdoor central supply systems and proper operation of those systems both day to day and in the event of adverse events (e.g. snow, ice, flooding) is essential to effective operation of the systems. Examples of elements the operational plan should include are designating and enforcing restrictions on parking, ensuring access to the fill connection for the tanker truck, spill control, maintenance of the pathway for cylinder and container carts, preventing accumulations of detritus in the enclosure and the like.

Examples of elements that might need consideration in planning for adverse events might include snow and ice accumulation, flooding of the pathways to the Central Supply Systems and the like

Statement of Problem and Substantiation for Public Comment

See PI 164.
The Committee correctly noted this proposal was an operational matter and did not belong with the construction of the enclosures. This comment attempts to observe the original intent, but to move the material to the appropriate section and to add additional annex material to explain the requirement.

Related Item

• PI 164

Submitter Information Verification

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Submittal Date: Mon May 16 10:16:28 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-1057-NFPA 99-2022

Statement: The revision responds to PC-63. The revision observes the original intent, but moves explanatory material to the appropriate annex section and adds additional annex language to explain the requirement.

Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]

5.2.1.2

Category 2 piped gas or piped vacuum system requirements shall be permitted when all of the following criteria are met:

(1) Only moderate sedation (as defined in 3.3.67.3), minimal sedation (as defined in 3.3.67.4), or no sedation is performed. Deep sedation and general anesthesia shall not be permitted.

(2) The loss of the piped gas or piped vacuum systems is likely to cause minor injury to patients, staff, or visitors.

(3) The facility piped gas or piped vacuum systems are intended for Category 2 patient care space per 3.3.140.2.

Statement of Problem and Substantiation for Public Comment

Regarding CI 1118: Task Group on Categories recommends no such action.

In the specific case of medical gases, the risks to staff and visitors are generally encompassed by the general considerations for safety and fire planning. Therefore these are all Chapter 4 considerations.

Risks to patients include those general considerations but are also determined by the state of the individual patient. The ability of a patient to survive a specific loss of medical gas or vacuum is determined by their physical condition at presentation, the medical procedure in process, and their state of consciousness (see ASA Physical Status Evaluation). For the determination of Category with medical gas systems specifically, the depth of anesthesia acts both as a direct determinant and a reasonable proxy.

While the Chapter 4 Category decision making process may encompass this, there is no uniform guide to what will factor, at what weighting, in the Chapter 4 decision. Therefore there is no assurance that this will be considered or that it will be understood as having the central significance that it does in the design of medical gases.

Where the significance of depth of anesthesia is understood in the Chapter 4 decision process, the inclusion of these requirements aligns with and reinforces that decision. Where the significance of depth of anesthesia is not understood, inclusion here ensures the specific risks are not overlooked.

See please Report of the Task Group, Chapter 15.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	

Related Item

• CI 1118

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Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The public comment makes no revision.

Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]

5.3.1.2

Category 3 piped gas and vacuum systems shall be permitted when all of the following criteria are met:

(1) Only minimal sedation, as defined in 3.3.67.4, or no sedation is performed. Deep sedation, moderate sedation, and general anesthesia are not performed.

(2) The loss of the piped gas and vacuum systems is not likely to cause injury to patients, staff, or visitors but can cause discomfort.

(3) The facility piped gas and vacuum systems are intended for Category 3 patient care rooms in accordance with 3.3.140.3.

Statement of Problem and Substantiation for Public Comment

Regarding CI 1119: Task Group on Categories recommends no such action.

In the specific case of medical gases, the risks to staff and visitors are generally encompassed by the general considerations for safety and fire planning. Therefore these are all Chapter 4 considerations.

Risks to patients include those general considerations but are also determined by the state of the individual patient. The ability of a patient to survive a specific loss of medical gas or vacuum is determined by their physical condition at presentation, the medical procedure in process, and their state of consciousness (see ASA Physical Status Evaluation). For the determination of Category with medical gas systems specifically, the depth of anesthesia acts both as a direct determinant and a reasonable proxy.

While the Chapter 4 Category decision making process may encompass this, there is no uniform guide to what will factor, at what weighting, in the Chapter 4 decision. Therefore there is no assurance that this will be considered or that it will be understood as having the central significance that it does in the design of medical gases.

Where the significance of depth of anesthesia is understood in the Chapter 4 decision process, the inclusion of these requirements aligns with and reinforces that decision. Where the significance of depth of anesthesia is not understood, inclusion here ensures the specific risks are not overlooked.

See please Report of the Task Group, Chapter 15.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 78-NFPA 99-2022 [Chapter 15]	

Related Item

• CI1119

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Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The public comment makes no revision.

Public Comment No. 78-NFPA 99-2022 [Chapter 15]

Chapter 15 – Dental Gas and Vacuum Systems

15.1 – Applicability.

This chapter shall apply to dental health care facilities that qualify to install dental gas and vacuum piping systems.

15.1.1 –

Category 1 dental piped gas and piped vacuum system requirements shall be applied in facilities where general anesthesia and deep sedation is performed, as defined in 3.3.67.1 and 3.3.67.2 .

15.1.2 –

Category 2 dental piped gas and piped vacuum system requirements shall be applied in facilities where only moderate and minimal sedation is performed, as defined in 3.3.67.3 and 3.3.67.4 .

15.1.3 –

Category 3 dental piped gas and piped vacuum system requirements shall be applied in facilities where minimal or no sedation is performed, as defined in 3.3.67.4 .

15.1.4 –

A single facility shall be permitted to include dental gas and vacuum systems for more than one category of dental piped gas and vacuum systems.

15.1.5 –

An existing system that is not in strict compliance with the provisions of this code shall be permitted to continue in use unless the authority having jurisdiction has determined that such use constitutes a distinct hazard to life.

15.1.6 –

This chapter shall apply to new health care facilities as specified by Section 1.3 unless otherwise specified by 15.1.7 , 15.1.8 , or 15.1.9 .

15.1.7 –

The requirements for Category 1 dental gas and vacuum systems for the operation, management, and maintenance of gas and vacuum piping systems shall apply to both new and existing facilities within the scope of this chapter and in accordance with 5.1.1.6 .

15.1.8 –

The following sections of this chapter shall apply to the operation, management, and maintenance of Category 2 dental gas and vacuum systems in both new and existing facilities:

(1) 15.1.5

(2) Section 15.2

(3) 15.4.2.4.3

(4) 15.4.2.4.6

(5) 15.4.2.4.12

(6) 15.4.2.5.14

(7) 15.4.2.6.4

(8) 15.4.9

15.1.9 –

The following sections of this chapter shall apply to the operation, management, and maintenance of Category 3 dental gas and vacuum systems in both new and existing facilities:

(1) 15.1.5

(2) Section 15.2

(3) 15.5.8

15.1.10 –

Where the term *responsible facility authority* is used, that entity shall follow the requirements of 5.1.14.1 .

15.2 – Nature of Hazards of Gas and Vacuum Systems.

Potential fire and explosion hazards associated with positive-pressure dental gas systems and vacuum systems shall be considered in the design, installation, testing, operation, and maintenance of these systems.

15.3 – Category 1 Dental Gas and Vacuum Systems.

15.3.1 – General.

Facilities that perform deep sedation and general anesthesia associated with dental treatment shall meet the requirements for Category 1 dental gas and vacuum systems.

15.3.2 – Category 1 Medical Gas Systems (Dental).

15.3.2.1 – Medical Gas and Vacuum Sources.

15.3.2.1.1 – Central Supply System Identification and Labeling.

Category 1 systems shall comply with 5.1.3.1 .

15.3.2.1.2 – Central Supply Operations.

Category 1 systems shall comply with 5.1.3.2 .

15.3.2.1.3 – Central Supply System Locations.

Category 1 systems shall comply with 5.1.3.3 .

15.3.2.1.4 – Central Supply Systems.

Category 1 systems shall comply with 5.1.3.5 .

15.3.2.1.5 – Medical Air Supply Systems.

Category 1 systems shall comply with 5.1.3.6 , except as follows:

(1) Medical air compressors, dryers, aftercoolers, filters, and regulators shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of medical air.

15.3.2.1.6 –

Oxygen supply systems using concentrators shall be permitted to consist of two sources, one of which shall be a cylinder header with sufficient cylinder connections for an average day's supply.

15.3.2.1.7 – Dental–Surgical Vacuum Systems.

Category 1 systems shall comply with 5.1.3.7 , except as follows:

(1) Dental–surgical vacuum systems shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of dental–surgical vacuum.

15.3.2.1.8 – WAGD Systems.

Category 1 systems shall comply with 5.1.3.8 , except as follows:

(1) Medical WAGD pumps shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of WAGD.

15.3.2.2 – Valves.

Category 1 systems shall comply with 5.1.4 .

15.3.2.3 – Station Outlets and Inlets.

Category 1 systems shall comply with 5.1.5 .

15.3.2.4 – Manufactured Assemblies.

Category 1 systems shall comply with 5.1.6 .

15.3.2.5 – Surface-Mounted Medical Gas Rails.

Category 1 systems shall comply with 5.1.7 .

15.3.2.6 – Pressure and Vacuum Indicators.

Category 1 systems shall comply with 5.1.8 .

15.3.2.7 – Warning Systems.

Warning systems associated with Category 1 systems shall provide the master, area, and local alarm functions of a Category 1 system as required in 5.1.9 , except as follows:

(1) Warning systems shall be permitted to be a single alarm panel.

(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.

(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.

15.3.2.8 – Medical Gas Distribution.

Category 1 systems shall comply with 5.1.10 .

15.3.2.9 – Labeling and Identification.

Category 1 systems shall comply with 5.1.11 .

15.3.2.10 – Performance Criteria and Testing (Medical Gas, Medical–Surgical Vacuum, and WAGD).

Category 1 systems shall comply with 5.1.12 .

15.3.2.11 – Support Gases.

Category 1 systems shall comply with 5.1.13 except as follows:

(1) Nitrogen source equipment shall be permitted to be installed in enclosures for Category 3 medical gases or in a mechanical room.

(2) Nitrogen source equipment shall include the following:

(3) One or more cylinders of nitrogen NF, sufficient for at least one average day's supply

(4) A manifold, if primary and secondary cylinders are provided

(5) A line pressure regulating valve

(6) A check valve downstream from the pressure regulating valve

(7) A pressure relief valve set at 50 percent above the normal line pressure and located downstream from the check valve

(8) A pressure relief valve discharge piped to the outdoors at a point that will not create a probable hazard and that is turned down to prevent the entry of rain or snow

15.3.2.12 – Medical Gas and Vacuum Operation and Management.

Category 1 systems shall comply with 5.1.14 .

15.3.3 – Category 1 Dental Air and Vacuum Piping Systems.

15.3.3.1 – General.

15.3.3.1.1 –

Dental vacuum systems shall include dental vacuum and nitrous oxide scavenging.

15.3.3.2 – Equipment Locations for Dental Air and Vacuum Systems.

15.3.3.2.1 – General.

Any of the following systems shall be permitted to be located together in the same room:

(1) Medical air compressor supply sources

(2) Dental air compressor sources and reserve headers

(3) Dental-surgical vacuum sources

(4) Dental vacuum sources

(5) WAGD sources

(6) Any other compressor, vacuum pump, or electrically powered machinery

15.3.3.2.2 – Cylinders and Containers.

Cylinders and containers for gases shall be handled in accordance with Chapter 11 .

15.3.3.2.3 – Ventilation.

The following source locations for motor-driven equipment shall be adequately ventilated to prevent accumulation of heat:

(1) Medical air sources

(2) Instrument air sources

(3) Dental compressed air sources

(4) Dental-surgical vacuum sources

(5) Dental vacuum sources

(6) WAGD sources

15.3.3.3 – Dental Gas and Vacuum Source Equipment.

15.3.3.3.1 – General.

15.3.3.3.1.1 –

The capacity of source equipment shall be based on the design requirements for the facility, including the number of gas outlets, vacuum inlets, and other connections, and their individual capacities.

15.3.3.3.1.2 –

The system design requirements shall be included in the data used for testing and verifying the operation of the gas and vacuum piping systems.

15.3.3.4 * – Dental Air.

15.3.3.4.1 – General.

15.3.3.4.1.1 –

Dental air use shall comply with the following requirements:

(1) Dental air shall be used for driving dental tools.

(2) Dental air shall be permitted to be used to supply air-driven equipment.

(3) Dental compressed air shall not be permitted to be used for respiration.

15.3.3.4.1.2 –

Dental air outlets shall not be interchangeable with any other gas outlets.

15.3.3.4.2 – Dental Air Compressor Units.

15.3.3.4.2.1 –

Dental air compressor units shall include dental air compressors, vibration isolation, air receivers, coalescent air filters, adsorption dryers, exhaust silencer/filters, moisture indicators, and service access manifolds, electrical disconnects, motor wiring, and controls.

15.3.3.4.2.2 –

Air compressors shall be scroll dental, reciprocating dental, or the oil-free dental types.

15.3.3.4.2.3 –

Dental air sources for compressors located inside the building shall meet the following requirements:

(1) Sources shall be located in a space where no chemical-based materials are stored or used.

(2) Sources shall be located in a space that is not used for patient treatment or dental procedures.

(3) Sources shall not be taken from a room or space in which there is an open or semi-open discharge from a dental vacuum or dental scavenging system.

(4) When the compressor is located in a room with an open or semi-open discharge from a dental vacuum or dental scavenging system, the air shall be drawn from a remote location such as the building return air system.

15.3.3.5 * – Dental Vacuum.

15.3.3.5.1 – General.

15.3.3.5.1.1 –

Dental vacuum shall be used for oral evacuation and nitrous oxide scavenging.

15.3.3.5.1.2 –

Dental vacuum inlets shall not be interchangeable with any other vacuum inlets, including dental-surgical vacuum.

15.3.3.5.2 – Dental Vacuum Units.

15.3.3.5.2.1 –

Dental vacuum units shall include dental vacuum pumps, vibration isolation, separation tanks, vacuum inlet, vacuum exhaust, condensate drain, motor wiring, and controls.

15.3.3.5.2.2 –

Dental vacuum pumps shall be dental dry vacuum or dental liquid (wet) ring pumps. Pumps shall be oil-free or oil-lubricated, and suitable for nitrous oxide scavenging.

15.3.3.5.2.3 –

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

15.3.3.5.2.4 –

Dental vacuum system piping shall comply with all of the following:

(1) Horizontal piping in dental vacuum systems shall be sloped a minimum of 7 mm per 3.05 m (**1** ⁄ **4** in. per 10 ft) toward the vacuum source equipment.

(2) Horizontal piping shall include no sags or low points that would permit fluid or debris to accumulate in the piping.

(3) Voids in the vacuum piping shall be avoided to prevent buildup and obstructions.

(4) Accessible cleanouts shall be permitted to be installed in the vertical downflow pipe to clear obstructions, where necessary.

(5) Dental vacuum cleanouts shall not to be installed on horizontal piping.

(6) Dental vacuum inlets shall be capable of 283 L/min (10 SCFM) or greater flow capacity.

15.3.3.6 – Nitrous Oxide Scavenging.

15.3.3.6.1 – General.

15.3.3.6.1.1 –

The use of scavenging shall be limited to portions of dental facilities where moderate or minimal sedation is administered. WAGD shall be provided where the dental treatment involves general anesthesia or deep sedation.

15.3.3.6.1.2 –

Active nitrous oxide scavenging shall include the use of a nasal mask on the patient. The nasal mask shall be connected to a scavenging inlet in the dental vacuum system through a flow-limiting adapter.

15.3.3.6.1.3 –

Nitrous oxide scavenging inlets shall not be interchangeable with any other vacuum inlets, including medical-surgical vacuum, dental vacuum, and WAGD.

15.3.3.6.2 – Connection to Dental Vacuum.

Scavenging connections to the dental vacuum system shall be a direct high-volume evacuation (HVE) connection to a high-volume vacuum port with a capacity of 45 L/min (1.6 cfm).

15.3.3.7 – Piping for Dental Air and Vacuum Systems.

15.3.3.7.1 – General.

15.3.3.7.1.1 –

Piping for dental compressed air systems shall comply with 15.3.3.7.2 .

15.3.3.7.1.2 –

Piping for dental vacuum systems and scavenging systems shall comply with 15.3.3.7.3 .

15.3.3.7.2 – Piping for Dental Air Systems.

15.3.3.7.2.1 – General.

Pipe, fittings, and joints in piping for dental compressed air systems shall be in accordance with 15.3.3.7.2.2 through 15.3.3.7.2.5 .

15.3.3.7.2.2 – Pipe.

Piping materials for dental air systems shall comply with one of the following:

(1) ASTM B88, *Standard Specification for Seamless Copper Water Tube,* Type L or K

(2) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , ACR tube (O.D. size)

(4) ASTM B103/B103M, *Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar* , listed corrugated medical tubing (CMT) fabricated from copper alloy No. 51000 strip, as follows:

(5) Having a design margin of 3.5

(6) Externally coated with a nonmetallic sheath marked with the manufacturer's marking

(7) Listing includes testing to demonstrate that CMT systems can be consistently gas-purged with results equivalent to comparable medical gas copper tubing

15.3.3.7.2.3 –

Copper tube shall be hard temper or annealed (soft temper).

15.3.3.7.2.4 – Fittings.

Fittings for dental air piping systems shall be permitted to be any of the following acceptable joining methods:

(1) Brazed or soldered fittingscomplying with ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings complying with ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings complying with ASME B16.22, with socket depths equal to or greater than braze-joint pressure fittingscomplying with ANSI/ASME B16.50

(4) Flared fittings complying with ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** ⁄ **4** in. maximum size)

(6) Axially swaged fittings complying with 5.1.10.7

15.3.3.7.2.5 – Joints.

Joints for piping under 15.3.3.7.2 shall comply with the following:

(1) Joints shall be brazed, soldered, threaded, flared, or the compression type.

(2) Where joints are brazed, they shall comply with the requirements of 15.4.6 .

(3) Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a "lead-free" solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.3.3.7.3 – Piping for Dental Vacuum Systems and Scavenging Systems.

15.3.3.7.3.1 – General.

Piping for dental vacuum systems and scavenging systems shall be copper, PVC plastic, or CPVC plastic.

15.3.3.7.3.2 – Copper Piping.

Copper piping under 15.3.3.7.3 shall be in accordance with 15.3.3.7.3.2(A) through 15.3.3.7.3.2(D) .

(A) – Copper Tube.

Copper tubing shall comply with the following:

(1) ASTM B88, *Standard Specification for Seamless Copper Water Tube,* Type L or K

(2) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , ACR tube (O.D. size)

(B) –

Copper tube shall be hard temper or annealed (soft temper).

(C) – Copper Fittings.

Copper fittings shall comply with the following:

(1) Brazed or soldered fittings conforming to ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings conforming to ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings conforming to ASME B16.22 with socket depths equal to or greater than braze-joint pressure fittings conforming to ANSI/ASME B16.50

(4) Flared fittings conforming to ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** ⁄ **4** in. maximum size)

(D) – Joints for Copper Piping.

Joints in copper tubing shall be in accordance with the following:

(1) Joints shall be brazed, soldered, threaded, flared, or the compression type.

(2) Where joints are brazed, they shall comply with the requirements of 15.4.6 .

(3) Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a “lead-free” solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.3.3.7.3.3 – PVC Plastic Piping.

PVC plastic piping under 15.3.3.7.3 shall be in accordance with the following:

(1) PVC plastic pipe shall be Schedule 40 or Schedule 80, conforming to ASTM D1785, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120* .

(2) PVC plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, conforming to ASTM D2466, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40* , or ASTM D2467, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80* .

(3) Joints in PVC plastic piping shall be solvent-cemented in accordance with ASTM D2672, *Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement* .

15.3.3.7.3.4 – CPVC Plastic Piping.

CPVC plastic piping under 15.3.3.7.3 shall be in accordance with the following:

(1) CPVC IPS plastic pipe shall be Schedule 40 or Schedule 80, conforming to ASTM F441/F441M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80* .

(2) CPVC IPS plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, conforming to ASTM F438, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40* , or ASTM F439, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80* .

(3) CPVC CTS plastic pipe and fittings 1/2 in. through 2 in. size shall be SDR 11, conforming to ASTM D2846/D2846M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems* .

(4) Solvent cement for joints in CPVC plastic piping shall comply with ASTM F493, *Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride)(CPVC) Plastic Pipe and Fittings* .

15.3.3.7.3.5 – Piping Within Floor Slabs Prohibited.

Dental gas and vacuum piping shall not be installed within floor slabs.

15.3.3.8 – Dental Air and Vacuum Systems Testing.

15.3.3.8.1 – General.

15.3.3.8.1.1 –

Inspection and testing shall be performed on all new piped dental gas and vacuum systems, additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that the following have been completed:

(1) All applicable provisions of this code have been adhered to.

(2) System integrity has been achieved or maintained.

(3) Piping systems are ready for testing and verification.

(4) Piping systems are performing in accordance with their design requirements.

15.3.3.8.1.2 –

The inspection and testing reports shall be submitted directly to the party that contracted for the testing, who shall submit the reports through channels to the responsible facility authority and any others that are required.

15.3.3.8.1.3 –

Reports shall contain detailed listings of all findings and results.

15.3.3.8.1.4 –

The responsible facility authority shall review the inspection and testing records prior to the use of any systems to ensure that all findings and results of the inspection and testing have been successfully completed before use.

15.3.3.8.1.5 –

All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

15.3.3.8.2 – Category 1 Dental Air and Vacuum Systems.

15.3.3.8.2.1 –

All Category 1 dental air and vacuum piping systems indicated in 15.3.3 shall be initially tested in accordance with 15.3.3.8.3 .

15.3.3.8.2.2 –

Dental air, vacuum, and scavenging systems shall be final tested in accordance with 15.3.3.8.3.5 and 15.3.3.8.3.6 .

15.3.3.8.3 – Initial Testing of Piping Systems.

15.3.3.8.3.1 – General.

(A) –

Where plastic vacuum and plastic scavenging piping systems are installed, they shall be visually inspected for cross-connections to oxygen and nitrous oxide systems before applying positive test pressures to the copper piping systems.

(B) –

During the process of initial testing, the identification and labeling of the dental gas and vacuum piping shall be checked.

15.3.3.8.3.2 – Initial Cross-Connection Test for Plastic Vacuum and Plastic Scavenging Piping Systems.

(A) –

Plastic piping shall be tested before copper piping.

(B) –

Tests shall be conducted to determine that no cross-connections exist between any plastic vacuum piping systems or plastic scavenging piping systems and any copper piping systems.

(C) –

The vacuum or scavenging source shutoff valves for the vacuum or scavenging piping systems shall remain closed during the tests, unless they are being used for the cross-connection test vacuum source.

(D) –

The cross-connection test vacuum shall be a minimum of 300 mm (12 in.) HgV.

(E) –

The source of test vacuum shall be connected only to the vacuum or scavenging piping system being tested.

(F) –

All individual gas system outlets and vacuum or scavenging system inlets shall be checked to determine that the test vacuum is only present in the vacuum or scavenging piping system being tested.

~~**(G)** –~~

~~The cross-connection tests shall be repeated for each installed vacuum and scavenging system with plastic piping.~~

~~**(H)** –~~

~~Any cross-connections shall be removed and the associated piping repaired and leak tested.~~

~~**(I)** –~~

~~The proper labeling and identification of system outlets/inlets shall be confirmed during the initial tests.~~

~~**15.3.3.8.3.3** – Initial Pressure Test.~~

~~**(A)** –~~

~~Each section of the piping in dental air systems and copper vacuum systems shall be pressure tested. Plastic vacuum and plastic scavenging piping shall not be pressure tested.~~

~~**(B)** –~~

~~Initial pressure tests shall be conducted as follows:~~

(1) ~~After installation of station outlet/inlet rough-in assemblies~~

(2) ~~Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, and line pressure relief valves)~~

~~**(C)** –~~

~~The source shutoff valve shall remain closed during the pressure tests.~~

~~**(D)** –~~

~~The test pressure for dental air piping and copper vacuum piping shall be 1.5 times the system operating pressure but not less than a gauge pressure of 1035 kPa (150 psi).~~

~~**(E)** –~~

~~The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.~~

~~**(F)** –~~

~~Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.~~

~~**15.3.3.8.3.4** – Initial Piping Purge Test.~~

~~**(A)** –~~

~~The outlets in each dental air piping system shall be purged to remove any particulate matter from the distribution piping.~~

~~**(B)** –~~

~~Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth.~~

~~**(C)** –~~

~~The purging shall be started at the closest outlet to the piping shutoff valve and continue to the furthest outlet from the shutoff valve.~~

~~**15.3.3.8.3.5** – Standing Pressure Test for Dental Air and Copper Vacuum Piping.~~

~~**(A)** –~~

~~After successful completion of the initial pressure tests in 15.4.8.1 , the dental air systems and copper vacuum systems shall be subject to a standing pressure test.~~

(B) –

Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, and hoses).

(C) –

The source valve shall be closed during this test.

(D) –

The piping systems shall be subjected to 24-hour standing pressure tests using oil-free, dry nitrogen NF.

(E) –

Test pressures shall be 20 percent above the normal system operating line pressure.

(F) –

At the conclusion of the tests, there shall be no change in the test pressure, except that attributed to specific changes in ambient temperature.

(G) –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. The piping shall be repurged if necessary.

15.3.3.8.3.6 – Standing Vacuum Test for Plastic Vacuum Piping.

(A) –

After successful completion of the initial pressure tests in 15.4.8.1 , vacuum distribution piping, including scavenging, shall be subjected to a standing vacuum test.

(B) –

Tests shall be conducted after installation and connection of all components of the vacuum system.

(C) –

The piping systems shall be subjected to a 24-hour standing vacuum test.

(D) –

Test pressure shall be between 300 mm (12 in.) HgV and full vacuum.

(E) –

During the test, the source of test vacuum shall be disconnected from the piping system.

(F) –

At the conclusion of the test, there shall be no change in the vacuum pressure other than that attributed to changes of ambient temperature.

(G) –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.3.3.8.4 – Operation and Management.

15.3.3.8.4.1 – System Shutdowns.

(A) –

Gas and vacuum piping systems shall be shut down at the end of each workday.

(B) –

Emergency shutoff valves or remote actuators shall not be used for daily shutdown of the systems. Cylinder gas valves shall be used for daily shutdowns.

15.3.3.8.4.2 – Prohibited Interconnections.

Two or more piping systems for different gases or different vacuums shall not be interconnected for testing or any other reason.

15.3.3.8.4.3 – Manufacturer's Instructions.

(A) –

Piping system components shall be installed, adjusted, operated, and maintained in accordance with the manufacturer's instructions.

(B) –

Copies of the manufacturer's instructions shall be provided to the facility and maintained at the facility.

15.3.3.8.4.4 – Maintenance.

(A) –

Gas and vacuum system equipment shall be maintained by a qualified person.

(B) –

Every facility shall establish a procedure for manually turning off the gas supply at the cylinder valves of Category 2 dental gas and vacuum systems at the end of each day.

15.3.3.8.5 – Periodic Testing.

Station outlets for oxygen and nitrous oxide shall be tested for flow and pressure on an approved schedule.

15.4 – Category 2 Dental Gas and Vacuum Systems.

15.4.1 – General.

15.4.1.1 –

Category 2 dental gas and vacuum system shall be limited to facilities that, at most, provide moderate and minimal sedation.

15.4.1.2 –

The medical gases shall be limited to oxygen and nitrous oxide.

15.4.1.3 –

Dental air shall be provided from a dental air source system.

15.4.1.4 –

The vacuum systems shall be dental vacuum and nitrous oxide scavenging.

15.4.1.5 –

All connections within Category 2 medical gas (oxygen and nitrous oxide) shall be gas-specific to prevent cross-connections with other piping systems, including vacuum, water, and dental air.

15.4.1.6 –

Station outlets and piped outlets for Category 2 medical gas and dental air having nonstandard operating pressures shall comply with the following additional requirements:

(1) Be gas-specific.

(2) Be pressure-specific where a single gas is piped at more than one operating pressure.

(3) Be a D.I.S.S connection if operated at a gauge pressure in excess of 550 kPa (80 psi).

(4) Be designed to prevent the removal of the adapter until the pressure has been relieved, if operated at a gauge pressure between 1380 kPa and 2070 kPa (200 psi and 300 psi).

15.4.1.7 –

Requirements for Category 2 dental gas and vacuum systems relating to the operation, management, and maintenance of oxygen and nitrous oxide piping systems shall apply both new and existing facilities as specified in 15.1.8 .

15.4.2 – Medical Gas Systems (Oxygen and Nitrous Oxide).

15.4.2.1 – Installer Qualifications (Oxygen and Nitrous Oxide).

15.4.2.1.1 –

Installers of medical gas systems shall be certified in accordance with ASSE 6010, *Professional Qualifications Standard for Medical Gas Systems Installers* , regardless of the capacity of the source equipment.

15.4.2.1.2 –

Installers of medical gas systems shall not use their certification to oversee installation by noncertified personnel.

15.4.2.1.3 –

Brazing of medical gas piping systems shall be performed by individuals who are qualified in accordance with 15.4.6.1 .

15.4.2.1.4 –

Prior to any installation work involving brazing, the installer of the medical gas piping systems shall provide documentation required by 15.4.6.1 for the qualifications of the brazing procedures and individual brazers.

15.4.2.2 – Central Supply System Identification and Labeling (Oxygen and Nitrous Oxide).

15.4.2.2.1 –

Cylinders, containers, and tanks shall be designed, fabricated, tested, and marked (stamped) in accordance with regulations of DOT, Transport Canada (TC) *Transportation of Dangerous Goods Regulations* , or the ASME *Boiler and Pressure Vessel Code* , "Rules for the Construction of Unfired Pressure Vessels," Section VIII. [**55:** 7.1.5.1]

15.4.2.2.2 –

Cylinder contents shall be identified by attached labels or stencils naming the contents in accordance with the mandatory requirements of CGA C-7, *Guide to Classification and Labeling of Compressed Gases* .

15.4.2.2.3 –

Liquid containers shall have additional product identification visible from all directions with a minimum of 51 mm (2 in.) high letters such as a 360-degree wraparound tape for medical liquid containers.

15.4.2.2.4 –

Cryogenic liquid containers shall be provided with gas-specific outlet connections in accordance with the mandatory requirements of CGA V-5, *Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)* , or CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections* .

15.4.2.2.5 –

Cylinder and cryogenic liquid container outlet connections shall be affixed in such a manner as to be integral to the valve(s), unremovable with ordinary tools, or so designed as to render the attachment point unusable when removed.

15.4.2.2.6 –

The contents of cylinders and cryogenic liquid containers shall be verified prior to use.

15.4.2.2.7 –

Labels shall not be defaced, altered, or removed, and connecting fittings shall not be modified.

15.4.2.2.8 –

Locations containing positive-pressure gases other than oxygen and medical air shall have their door(s) labeled as follows:

- **Positive-Pressure Gases**

NO Smoking or Open Flame

Room May Have Insufficient Oxygen

Open Door and Allow Room to Ventilate Before Entering

15.4.2.2.9 –

Locations containing central supply systems or cylinders containing only oxygen or medical air shall have their door(s) labeled as follows:

- **Medical Gases**

NO Smoking or Open Flame

15.4.2.3 – Central Supply System Operations (Oxygen and Nitrous Oxide).

15.4.2.3.1 –

The use of adapters or conversion fittings to adapt one gas-specific fitting to another shall be prohibited.

15.4.2.3.2 –

Cylinders and containers shall be handled in strict accordance with 11.6.2 .

15.4.2.3.3 –

Only gas cylinders, reusable shipping containers, and their accessories shall be permitted to be stored in rooms containing central supply systems or gas cylinders.

15.4.2.3.4 –

No flammable materials, cylinders containing flammable gases, or containers containing flammable liquids shall be stored in rooms with gas cylinders.

15.4.2.3.5 –

If cylinders are wrapped when received, the wrappers shall be removed prior to storage.

15.4.2.3.6 –

Cylinders without correct markings or whose markings and gas-specific fittings do not match shall not be used.

15.4.2.3.7 –

Cryogenic liquid storage units intended to supply gas to the facility shall not be used to transfill other liquid storage vessels.

15.4.2.3.8 –

Care shall be exercised when handling cylinders that have been exposed to freezing temperatures or containers that contain cryogenic liquids to prevent injury to the skin.

15.4.2.3.9 –

Cylinders containing compressed gases and containers for volatile liquids shall be kept away from radiators, steam piping, and like sources of heat.

15.4.2.3.10 –

Where cylinder valve protection caps are supplied, they shall be secured tightly in place unless the cylinder is connected for use.

15.4.2.3.11 –

Containers shall not be stored in a tightly closed space.

15.4.2.3.12 –

Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 52°C (125°F).

15.4.2.3.13 –

Central supply systems for nitrous oxide and carbon dioxide using cylinders or portable containers shall be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer but shall never be lower than −7°C (20°F) or greater than 52°C (125°F).

15.4.2.4 – Locations of Medical Gas Source Equipment (Oxygen and Nitrous Oxide).

15.4.2.4.1 –

Gas storage locations in facilities with Category 2 medical gas systems with a total of all gases in cylinders or containers, except nitrogen, connected and in storage at one time that does not exceed 85 m^3 (3000 ft^3) at standard temperature and pressure (STP), or 142 m^3 (5000 ft^3) (STP) if oxygen is stored in a DOT specification 4 L (cryogenic liquid) container shall comply with 15.4.2.4.3 through 15.4.2.4.12 .

15.4.2.4.2 * –

Gas storage locations in facilities with Category 2 medical gas systems with a total of all gases in cylinders or containers exceeding quantities listed in 15.4.2.4.1 shall comply with 5.1.3.3 .

15.4.2.4.3 –

Enclosures shall serve no purpose other than to contain the medical gas source equipment (oxygen and nitrous oxide), except that nitrogen source equipment and compressed air cylinders shall be permitted in the enclosure.

15.4.2.4.4 –

Natural or mechanical ventilation for oxygen and nitrous oxide manifold locations shall be in accordance with 9.3.6.5 .

15.4.2.4.5 –

Storage of full or empty gas cylinders, or both, shall be permitted in the same enclosure.

15.4.2.4.6 –

Air compressors, vacuum pumps, and other equipment shall not be located in enclosures for medical gas cylinders (oxygen and nitrous oxide source equipment).

15.4.2.4.7 * –

If enclosures are outdoors or remote from the treatment facilities that they serve, they shall be kept locked.

15.4.2.4.8 –

Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 52°C (125°F). Nitrous oxide cylinders shall be prevented from reaching temperatures lower than −7°C (20°F).

15.4.2.4.9 –

Indoor enclosures shall not communicate directly with medical gas (oxygen and nitrous oxide) use points or storage locations for flammable materials or gases.

15.4.2.4.10 –

Outdoor enclosures that are adjacent to a building wall shall be located such that the distance to any window or door of the adjacent building is greater than 3.05 m (10 ft).

15.4.2.4.11 –

Enclosures for medical gas (oxygen and nitrous oxide) source equipment shall be provided with doors or gates.

15.4.2.4.12 –

Cylinders in service or in storage shall be individually secured and located to prevent falling or being knocked over.

15.4.2.4.13 –

Locations containing positive pressure gases or cylinders containing oxygen, nitrous oxide, or both shall be separated from the rest of the building by walls and floors having a 1-hour fire resistance rating with doors and other opening projective having a **3/4** -hour fire protection rating.

15.4.2.4.14 –

Locations containing positive pressure gasses or cylinders containing positive pressure gases shall be ventilated in accordance with 9.3.6.5 .

15.4.2.4.15 –

Locations containing positive pressure gasses or cylinders containing positive pressure gases shall be provided with an automatic fire sprinkler in accordance with the following:

(1) Where the automatic sprinkler is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system.

(2) Where the automatic sprinkler is installed in a building without an automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system if the following conditions are met:

(3) The plumbing system is capable of simultaneously supplying the domestic and sprinkler waterflow demands.

(4) The automatic sprinkler is a dedicated line branched from the main domestic water supply line, immediately after the main shutoff valve for the dental facility, with appropriate backflow protection in accordance with local plumbing codes.

15.4.2.5 – Medical Gas Source Equipment (Oxygen and Nitrous Oxide).

15.4.2.5.1 –

Mechanical means shall be provided to ensure that the medical gas source equipment is connected to the correct medical gas distribution piping system.

15.4.2.5.2 –

Cylinder valve outlets for oxygen and nitrous oxide shall comply with CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections* .

15.4.2.5.3 –

Threaded connections to manifolds shall comply with CGA V-5, *Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)* .

15.4.2.5.4 –

A check valve shall be provided downstream of each pressure regulator.

15.4.2.5.5 –

A pressure relief valve set at 50 percent above the normal line pressure shall be located downstream of the check valve in 15.4.2.5.4 .

15.4.2.5.6 –

Pressure relief valves shall be brass, bronze, or stainless steel and designed for oxygen service.

15.4.2.5.7 –

Hose and flexible connectors shall have a gauge pressure rating not less than 6895 kPa (1000 psi).

15.4.2.5.8 –

Materials used in central supply systems shall meet the following requirements:

(1) In those portions of systems intended to handle oxygen at gauge pressures greater than 3000 kPa (435 psi), interconnecting hose shall contain no polymeric materials.

(2) In those portions of systems intended to handle oxygen or nitrous oxide material, construction shall be compatible with oxygen under the temperatures and pressures to which the components can be exposed.

(3) If potentially exposed to cryogenic temperatures, materials shall be designed for low temperature service.

(4) If intended for outdoor installation, materials shall be installed in accordance with the manufacturer's requirements.

15.4.2.5.9 –

Nonmetallic hoses and flexible connectors shall not exceed 1.52 m (5 ft) in length and shall not be concealed or penetrate walls, floors, ceilings, or partitions.

15.4.2.5.9.1 –

Source equipment shall not be connected to the piping system through flexible connectors.

15.4.2.5.10 –

Medical gas source equipment that serves one or two treatment facilities shall include two banks of one or more cylinders of oxygen and (if used) two banks of one or more cylinders of nitrous oxygen, each bank containing at least one average day's supply.

15.4.2.5.11 –

The two banks of each medical gas source shall be manifolded so that either bank can supply its distribution piping system.

15.4.2.5.12 –

Where the source equipment is remote from a single treatment facility and an in use bank is unable to supply the system, the manifold shall automatically switch to the secondary bank.

15.4.2.5.13 –

Where the source equipment serves multiple treatment facilities and an in use bank is unable to supply the system, the manifold shall automatically switch to the secondary bank.

15.4.2.5.14 –

Where the source equipment is not remote and is accessible from a single treatment facility served and an in use bank is unable to supply the system, the manifold shall be manually or automatically switched to the secondary bank.

15.4.2.6 – Emergency Shutoff Valves (Oxygen and Nitrous Oxide).

15.4.2.6.1 * –

All Category 2 medical gas systems shall have an emergency shutoff valve accessible from all use-point locations in an emergency.

15.4.2.6.2 –

Where a central medical gas supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve located in that treatment facility accessible from all use-point locations in an emergency.

15.4.2.6.3 –

Each emergency shutoff valve shall be labeled to indicate the gas it controls and shut off only the gas to the treatment facility that it serves.

15.4.2.6.4 –

A remotely activated shutoff valve at a gas supply manifold shall not be used for emergency shutoff.

15.4.2.6.4.1 –

For clinical purposes, a remote valve actuator shall not fail-close in the event of loss of electric power.

15.4.2.6.4.2 –

Where remote actuators are the type that fail-open, it shall be mandatory that cylinder shutoff valves be closed whenever the system is not in use.

15.4.2.6.4.3 –

Emergency shutoff valves shall be located to meet the following requirements:

(1) They shall be readily operable from a standing position.

(2) They shall be installed where visible and accessible at all times.

(3) They shall not be installed where they can be hidden from plain view, such as behind normally open or normally closed doors.

(4) They shall be installed in the egress pathway near the exit of the treatment area that will be used in an emergency.

(5) They shall not be installed in rooms, areas, or closets that can be closed or locked.

15.4.2.7 – Station Outlets and Risers (Oxygen and Nitrous Oxide).

15.4.2.7.1 –

Each gas outlet shall be gas-specific.

15.4.2.7.2 –

Gas outlets shall consist of a primary and a secondary valve or assembly.

15.4.2.7.3 –

Each gas outlet shall be legibly identified.

15.4.2.7.4 –

Threaded outlets shall be noninterchangeable connections complying with the mandatory requirements of CGA V-5, *Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)* .

15.4.2.7.5 –

Factory-installed copper inlet tubes on station outlets extending no further than 205 mm (8 in.) from the body of the terminal shall be not less than DN8 (NPS **1**⁄**4**) (**3**⁄**8** in. O.D.) size, with 8 mm (0.3 in.) minimum inside diameter.

15.4.2.8 – Manufactured Assemblies (Oxygen and Nitrous Oxide).

Category 2 systems shall comply with 5.1.6 .

15.4.2.9 – Pressure and Vacuum Indicators (Oxygen and Nitrous Oxide).

Category 2 systems shall comply with 5.1.8 .

15.4.2.10 – Warning Systems (Oxygen and Nitrous Oxide).

Category 2 warning systems shall comply with 5.2.9 , except as follows:

(1) Warning systems shall be permitted to be a single alarm panel.

(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.

(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.

(4) Warning systems for medical gas systems shall provide the following alarms:

(5) Oxygen main line pressure low

(6) Oxygen main line pressure high

(7) Oxygen changeover to secondary bank or about to changeover (if automatic)

(8) Nitrous oxide main line pressure low

(9) Nitrous oxide main line pressure high

(10) Nitrous oxide changeover to secondary bank or about to changeover (if automatic)

(11) Audible and noncancelable alarm visual signals shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.

(12) Visual indications shall remain until the situation that caused the alarm is resolved.

(13) Pressure switches/sensors shall be installed downstream of any emergency shutoff valves and any other shutoff valves in the system and shall cause an alarm for the medical gas if the pressure decreases or increases 20 percent from the normal operating pressure.

(14) A cancelable audible indication of each alarm condition that produces a sound at the alarm panel shall reinitiate the audible signal if another alarm condition occurs while the audible signal is silenced.

15.4.2.11 – Labeling and Identification.

Category 2 systems shall comply with 5.1.11 .

15.4.3 – Category 2 Dental Air and Vacuum Piping Systems.

15.4.3.1 – General.

Dental vacuum systems shall include dental vacuum and nitrous oxide scavenging.

15.4.3.2 – Equipment Locations for Dental Air and Vacuum Systems.

15.4.3.2.1 – General.

Any of the following systems shall be permitted to be located together in the same room:

(1) Dental air compressor sources and reserve headers

(2) Dental-surgical vacuum sources

(3) Dental vacuum sources

(4) Any other compressor, vacuum pump, or electrically powered machinery

15.4.3.2.2 – Cylinders and Containers.

Cylinders and containers for gases shall be handled in accordance with Chapter 11 .

15.4.3.2.3 – Ventilation for Motor-Driven Equipment.

The following source locations shall be adequately ventilated to prevent accumulation of heat:

(1) Medical air sources

(2) Instrument air sources

(3) Dental compressed air sources

(4) Dental-surgical vacuum sources

(5) Dental vacuum sources

(6) WAGD sources

15.4.3.3 – Dental Gas and Vacuum Source Equipment.

15.4.3.3.1 – General.

15.4.3.3.1.1 –

The capacity of source equipment shall be based on the design requirements for the facility, including the number of gas outlets, vacuum inlets, and other connections, and their individual capacities.

15.4.3.3.1.2 –

The system design requirements shall be included in the data used for testing and verifying the operation of the gas and vacuum piping systems.

15.4.3.3.2 – Dental Air.

15.4.3.3.2.1 – General.

(A) –

Dental air use shall comply with the following requirements:

(1) Dental air shall be used for driving dental tools.

(2) Dental air shall be permitted to be used to supply air-driven equipment.

(3) Dental compressed air shall not be permitted to be used for respiration.

(B) –

Dental air outlets shall not be interchangeable with any other gas outlets, including oxygen, nitrous oxide, medical air, instrument air, and nitrogen.

15.4.3.3.2.2 – Dental Air Compressor Units.

(A) –

Dental air compressor units shall include dental air compressors, vibration isolation, air receivers, coalescent air filters, adsorption dryers, exhaust silencer/filters, moisture indicators, service access manifolds, electrical disconnects, motor wiring, and controls.

(B) –

Air compressors shall be scroll dental, reciprocating dental, or the oil-free dental types.

(C) –

Dental air sources for compressors located inside the building shall meet the following requirements:

(1) Sources shall be located in a space where no chemical-based materials are stored or used.

(2) Sources shall be located in a space that is not used for patient treatment or dental procedures.

(3) Sources shall not be taken from a room or space in which there is an open or semi-open discharge from a dental vacuum or dental scavenging system.

(4) When the compressor is located in a room with an open or semi-open discharge from a dental vacuum or dental scavenging system, the air shall be drawn from a remote location such as the building return air system.

15.4.3.3.3 – Dental Vacuum.

15.4.3.3.3.1 – General.

(A) –

Dental vacuum shall be used for oral evacuation and nitrous oxide scavenging.

(B) –

Dental vacuum inlets shall not be interchangeable with any other vacuum inlets, including dental-surgical vacuum.

15.4.3.3.3.2 – Dental Vacuum Units.

(A) –

Dental vacuum units shall include dental vacuum pumps, vibration isolation, separation tanks, vacuum inlet, vacuum exhaust, condensate drain, motor wiring, and controls.

(B) –

Dental vacuum pumps shall be dental dry vacuum or dental liquid (wet) ring pumps. Pumps shall be oil-free or oil-lubricated and suitable for nitrous oxide scavenging.

(C) –

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

(D) –

Dental vacuum system piping shall comply with all of the following:

(1) Horizontal piping in dental vacuum systems shall be sloped a minimum of 7 mm per 3.05 m (**1** ⁄ **4** in. per 10 ft) toward the vacuum source equipment.

(2) Horizontal piping shall include no sags or low points that would permit fluid or debris to accumulate in the piping.

(3) Voids in the vacuum piping shall be avoided to prevent buildup and obstructions.

(4) Accessible clean outs shall be permitted to be installed in the vertical downflow pipe to clear obstructions, where necessary.

(5) Dental vacuum clean outs shall not to be installed on horizontal piping.

(6) Dental vacuum inlets shall be capable of 283 L/min (10 SCFM) or greater flow capacity.

15.4.3.3.4 – Nitrous Oxide Scavenging.

15.4.3.3.4.1 – General.

(A) –

The use of scavenging shall be limited to portions of dental facilities where moderate or minimal sedation is administered.

(B) –

Active nitrous oxide scavenging shall include the use of a nasal mask on the patient. The nasal mask shall be connected to a scavenging inlet in the dental vacuum system through a flow-limiting adapter.

(C) –

Nitrous oxide scavenging inlets shall not be interchangeable with any other vacuum inlets, including medical-surgical vacuum, dental vacuum, and WAGD.

15.4.3.3.4.2 – Connection to Dental Vacuum.

Scavenging connections to the dental vacuum system shall be a direct high-volume evacuation (HVE) connection to a high-volume vacuum port with a capacity of 45 L/min (1.6 cfm).

15.4.3.4 – Category 2 Warning Systems (Oxygen and Nitrous Oxide).

15.4.3.4.1 – General.

15.4.3.4.1.1 –

The warning systems in Category 2 dental gas and vacuum systems shall comply with applicable requirements of 5.2.9 and 15.4.3.4.2 through 15.4.3.4.4 .

15.4.3.4.1.2 –

The master, area, and local alarm functions shall be permitted to be provided by a single alarm panel, as indicated in 5.2.9 .

15.4.3.4.2 – Master Alarm Panels.

15.4.3.4.2.1 –

A master alarm panel shall be located in the facility at a point of continuous surveillance when the facility is in operation.

15.4.3.4.2.2 –

The master alarm panel shall indicate the following:

(1) Oxygen supply pressure ±20 percent from normal

(2) Nitrous oxide supply pressure ±20 percent from normal

(3) Changeover of oxygen supply source

(4) Changeover of nitrous oxide supply source

15.4.3.4.3 – Area Alarm Panels.

15.4.3.4.3.1 –

An area alarm panel shall be centrally located where two or more treatment areas are supplied from the same zoned dental gas and vacuum piping.

15.4.3.4.3.2 –

Area alarm panels shall indicate the following:

(1) Oxygen supply pressure ±20 percent from normal

(2) Nitrous oxide supply pressure ±20 percent from normal

15.4.3.4.4 – Local Alarms.

15.4.3.4.4.1 –

Local alarms shall be located in source equipment control panels or separate control panels in the equipment rooms for source equipment.

15.4.4 – Piping for Category 2 Medical Gas, Dental Air, and Vacuum Systems.

15.4.4.1 – General.

15.4.4.1.1 –

Piping for the following systems shall comply with 15.4.4.2 :

(1) Oxygen

(2) Nitrous oxide

15.4.4.1.2 –

Piping for dental air systems shall comply with 15.4.4.3 .

15.4.4.1.3 –

Piping for dental vacuum systems and scavenging systems shall comply with 15.4.4.4 .

15.4.4.2 – Piping for Oxygen and Nitrous Oxide Systems.

15.4.4.2.1 – Cleaning for Oxygen Service.

For oxygen and nitrous oxide, the pipe, fittings, valves, gas/vacuum outlets/inlets, and other piping components shall be cleaned for oxygen by the manufacturer prior to installation in accordance with CGA G-4.1, *Cleaning Equipment for Oxygen Service* . Fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

15.4.4.2.2 – Pipe.

Piping materials for oxygen and nitrous oxide shall be one of the following:

(1) Hard-drawn seamless copper in accordance with ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* medical gas tube, Type L or Type K

(2) Listed corrugated medical tubing (CMT) fabricated from copper alloy No. 51000 strip, meeting ASTM B103/B103M, *Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar* , as follows:

(3) Having a design margin of 3.5

(4) Externally coated with a nonmetallic sheath marked with the manufacturer's marking

(5) Listing includes testing to demonstrate that CMT systems can be consistently gas-purged with results equivalent to comparable medical gas copper tubing

15.4.4.2.2.1 –

CMT shall have a flame spread index of 25 or less and a smoke developed index of 50 or less as determined by ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials* .

15.4.4.2.2.2 –

CMT shall be identified by the manufacturer as suitable for oxygen service at a minimum of every 0.92 m (3 ft).

15.4.4.2.3 – Fittings.

15.4.4.2.3.1 –

Fittings shall be brazed, memory metal, or axially swaged.

15.4.4.2.3.2 –

Brazed fittings shall be the wrought copper capillary type complying with the following:

(1) ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) ASME B16.22 with socket depths equal to or greater than brazed joint pressure fittings in accordance with ANSI/ASME B16.50

15.4.4.2.3.3 –

Cast copper alloy fittings shall not be used with field-brazed joints.

15.4.4.2.3.4 –

Memory metal fittings shall be rated for not less than 538°C (1000°F) and 2070 kPa (300 psi) and shall be installed by qualified technicians in accordance with the manufacturer's instructions.

15.4.4.2.3.5 –

Axially swaged couplings shall include metal-to-metal seats, shall be rated for not less than 538°C (1000°F) and 2070 kPa (300 psi), and shall provide permanent, nonseparable joints. Fittings shall be installed by qualified technicians in accordance with the manufacturer's instructions.

15.4.4.2.4 – Joints.

15.4.4.2.4.1 – Brazed.

Brazing of copper joints shall be in accordance with 15.4.6 .

15.4.4.2.4.2 – Threaded.

Threaded joints shall be limited to connections to pressure indicators, alarm devices, and source equipment and shall comply with the following:

(1) Threads shall be tapered complying with ASME B1.20.1, *Pipe Threads, General Purpose, Inch* .

(2) Threads shall be made up with polytetrafluoroethylene (PTFE) tape or other thread sealant recommended for oxygen service, with the sealant applied to the male threads only.

15.4.4.2.4.3 – Prohibited Joints.

The following joints shall be prohibited under 15.4.4.2.4 :

(1) Flared and compression connections, including connections to station outlets, alarm devices, and other components

(2) Push-lock connections

(3) Straight-threaded connections, including unions

(4) Pipe crimping tools used to permanently stop the flow of medical gas and vacuum piping

15.4.4.3 – Piping for Dental Air Systems.

15.4.4.3.1 – General.

Pipe, fittings, and joints in piping for dental compressed air systems shall be in accordance with 15.4.4.3.2 through 15.4.4.3.4 .

15.4.4.3.2 – Pipe.

Piping materials for dental air systems shall comply with one of the following:

(1) ASTM B88, *Standard Specification for Seamless Copper Water Tube,* Type L or K

(2) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , ACR tube (O.D. size)

(4) ASTM B103/B103M, *Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar* , listed corrugated medical tubing (CMT) fabricated from copper alloy No. 51000 strip, as follows:

(5) Having a design margin of 3.5

(6) Externally coated with a nonmetallic sheath marked with the manufacturer's marking

(7) Listing includes testing to demonstrate that CMT systems can be consistently gas purged with results equivalent to comparable medical gas copper tubing

15.4.4.3.2.1 –

Copper tube shall be hard temper or annealed (soft temper).

15.4.4.3.3 – Fittings.

Fittings for dental air piping systems shall be permitted to be any of the following acceptable joining methods:

(1) Brazed or soldered fittings complying with ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings complying with ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings complying with ASME B16.22, with socket depths equal to or greater than braze-joint pressure fittings complying with ANSI/ASME B16.50

(4) Flared fittings complying with ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** /**4** in. maximum size)

(6) Axially swaged fittings complying with 15.4.4.2.3.5

15.4.4.3.4 – Joints.

Joints for piping under 15.4.4.3 shall comply with 15.4.4.3.4.1 through 15.4.4.3.4.3 .

15.4.4.3.4.1 –

Joints shall be brazed, soldered, threaded, flared, or the compression type.

15.4.4.3.4.2 –

Where joints are brazed, they shall comply with the requirements of 15.4.6 .

15.4.4.3.4.3 –

Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a "lead-free" solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.4.4.4 – Piping for Dental Vacuum Systems and Scavenging Systems.

15.4.4.4.1 – General.

Piping for dental vacuum systems and scavenging systems shall be copper, PVC plastic, or CPVC plastic.

15.4.4.4.2 – Copper Piping.

Copper piping under 15.4.4.4 shall be in accordance with 15.4.4.4.2.1 through 15.4.4.4.2.3 .

15.4.4.4.2.1 – Copper Tube.

Copper tubing shall be hard temper or annealed (soft temper) and shall comply with the following:

(1) ASTM B88, *Standard Specification for Seamless Copper Water Tube,* Type L or K

(2) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service,* ACR tube (O.D. size)

15.4.4.4.2.2 – Copper Fittings.

Copper fittings shall comply with the following:

(1) Brazed or soldered fittings conforming to ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings conforming to ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings conforming to ASME B16.22 with socket depths equal to or greater than braze-joint pressure fittings conforming to ANSI/ASME B16.50

(4) Flared fittings conforming to ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** ⁄ **4** in. maximum size)

15.4.4.4.2.3 – Joints for Copper Piping.

Joints in copper tubing shall be in accordance with the following:

(1) Joints shall be brazed, soldered, threaded, flared, or the compression type.

(2) Where joints are brazed, they shall comply with the requirements of 15.4.6 .

(3) Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a "lead-free" solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.4.4.4.3 – PVC Plastic Piping.

PVC plastic piping under 15.4.4.4 shall be in accordance with the following:

(1) PVC plastic pipe shall be Schedule 40 or Schedule 80, conforming to ASTM D1785, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120* .

(2) PVC plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, conforming to ASTM D2466, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40* , or ASTM D2467, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80* .

(3) Joints in PVC plastic piping shall be solvent-cemented in accordance with ASTM D2672, *Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement* .

15.4.4.4.4 – CPVC Plastic Piping.

CPVC plastic piping under 15.4.4.4 shall be in accordance with the following:

(1) CPVC IPS plastic pipe shall be Schedule 40 or Schedule 80, conforming to ASTM F441/F441M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80* .

(2) CPVC IPS plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, conforming to ASTM F438, *Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40* , or ASTM F439, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80* .

(3) CPVC CTS plastic pipe and fittings 1/2 in. through 2 in. size shall be SDR 11, conforming to ASTM D2846/D2846M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems* .

(4) Solvent cement for joints in CPVC plastic piping shall comply with ASTM F493, *Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings* .

15.4.4.5 – Piping for Nitrogen.

Nitrogen piping in dental facilities shall comply with 15.4.4.2 , including cleaning for oxygen service.

15.4.5 – Installation of Medical Gas, Dental Air, and Vacuum Piping.

15.4.5.1 – General.

15.4.5.1.1 –

Gas and vacuum piping systems shall be as listed in Section 15.4 .

15.4.5.1.2 –

Piping materials shall be as listed in 15.4.4 .

15.4.5.2 – Pipe Sizing.

Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures.

15.4.5.3 – Minimum Pipe Sizes.

The minimum size of the following piping shall be as follows:

(1) Category 2 oxygen piping shall be not less than DN10 (NPS 3/8 in.) (1/2 in. O.D.) size.

(2) Category 2 nitrous oxide piping shall be not less than DN8 (NPS 1/4 in.) (3/8 in. O.D.) size.

(3) Category 2 oxygen piping shall be at least 1 size larger than piping for nitrous oxide.

15.4.5.4 – Location of Piping.

Piping shall not be located where subject to contact with oil.

15.4.5.5 – Protection of Piping.

15.4.5.5.1 –

Piping shall be protected against freezing, corrosion, and physical damage.

15.4.5.5.2 –

Piping exposed in corridors and other locations where subject to physical damage from the movement of equipment shall be protected.

15.4.5.6 – Pipe Support.

15.4.5.6.1 –

Piping shall be supported from the building structure.

15.4.5.6.2 –

Hangers and supports shall comply with and be installed in accordance with MSS SP-58, *Pipe Hangers and Supports — Materials, Design, Manufacture, Selection, Application, and Installation* .

15.4.5.6.3 –

Hangers and supports shall be sized for the tube or pipe being supported.

15.4.5.6.4 –

In potentially damp locations, copper tube hangers and supports that are in contact with the tube shall be plastic-coated or otherwise electrically insulated from the tube.

15.4.5.6.5 –

The maximum support spacing for copper tube shall be in accordance with Table 15.4.5.6.5 .

Table 15.4.5.6.5 Maximum Copper Tube Support Spacing

- Hanger Spacing Pipe Size mm ft DN8 (NPS $\frac{1}{4}$) ($\frac{3}{8}$ in. O.D.) 1520 5 DN10 (NPS $\frac{3}{8}$) ($\frac{1}{2}$ in. O.D.) 1830 6 DN15 (NPS $\frac{1}{2}$) ($\frac{5}{8}$ in. O.D.) 1830 6 DN20 (NPS $\frac{3}{4}$) ($\frac{7}{8}$ in. O.D.) 2130 7 DN25 (NPS 1) (1 $\frac{1}{8}$ in. O.D.) 2440 8 DN32 (NPS 1 $\frac{1}{4}$) (1 $\frac{3}{8}$ in. O.D.) 2740 9 DN40 (NPS 1 $\frac{1}{2}$) (1 $\frac{5}{8}$ in. O.D.) and larger 3050 10 Vertical risers, all sizes, every floor, but not to exceed 4570 15

15.4.5.6.6 –

The maximum support spacing for plastic pipe shall be in accordance with Table 15.4.5.6.6 .

Table 15.4.5.6.6 Maximum Plastic Pipe Support Spacing

- Hanger Spacing Pipe Size mm ft DN15 (NPS $\frac{1}{2}$) ($\frac{5}{8}$ in. O.D.) 1220 4 DN20 (NPS $\frac{3}{4}$) ($\frac{7}{8}$ in. O.D.) 1220 4 DN25 (NPS 1) (1 $\frac{1}{8}$ in. O.D.) 1320 4.33 DN32 (NPS 1 $\frac{1}{4}$) (1 $\frac{3}{8}$ in. O.D.) 1320 4.33 DN40 (NPS 1 $\frac{1}{2}$) (1 $\frac{5}{8}$ in. O.D.) 1420 4.66 DN50 (NPS 2) (2 $\frac{3}{8}$ in. O.D.) 1420 4.66 DN65 (NPS 2 $\frac{1}{2}$) (2 $\frac{7}{8}$ in. O.D.) and larger 1520 5 Vertical risers, all sizes, every floor, but not to exceed 3040 10

15.4.5.7 – Underground Piping Outside of Buildings.

15.4.5.7.1 –

Buried piping outside of buildings shall be installed below the local level of frost penetration.

15.4.5.7.2 –

The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

15.4.5.7.3 –

If the underground piping is protected by a conduit, cover, or other enclosure, the following requirements shall be met:

(1) Access during construction shall be provided at the joints for visual inspection and leak testing.

(2) The conduit, cover, or enclosure shall be self-draining and not retain groundwater in prolonged contact with copper tubing.

15.4.5.7.4 –

Buried piping that is subject to surface loads shall be buried at a depth that will protect the piping, its enclosure, or both, from excessive stresses.

15.4.5.7.5 –

The minimum backfill cover above the top of the piping or its enclosure shall be 900 mm (36 in.), except that the minimum cover shall be permitted to be reduced to 450 mm (18 in.) where there is no potential for damage from surface loads or surface conditions.

15.4.5.7.6 –

Trenches shall be excavated so that the piping or its enclosure has firm, substantially continuous bearing on the bottom of the trench.

15.4.5.7.7 –

Backfill shall be clean, free from material that can damage the pipe, and compacted.

15.4.5.7.8 –

A continuous warning tape or marker shall be placed immediately above the piping or its enclosure to clearly identify the pipeline by specific name.

15.4.5.7.9 –

A continuous warning means shall also be placed above the pipeline at approximately one-half the depth of burial.

15.4.5.7.10 –

Where buried piping is extended into a building through a wall sleeve, the outdoor end of the sleeve shall be sealed watertight to prevent the entrance of groundwater into the building.

15.4.5.8 – Underground Piping Within Buildings.

15.4.5.8.1 –

The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

15.4.5.8.2 –

If the underground piping is protected by a conduit, cover, or other enclosure, access shall be provided at the joints during construction for visual inspection and leak testing.

15.4.5.8.3 –

The piping shall be backfilled with clean sand or gravel.

15.4.5.9 – Piping Within Floor Slabs Prohibited.

Dental gas and vacuum piping shall not be installed within floor slabs.

15.4.5.10 – Hose and Flexible Connectors.

15.4.5.10.1 –

Hose and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions.

15.4.5.10.2 –

Hose and flexible connectors, metallic or nonmetallic, shall have a minimum burst gauge pressure of 6895 kPa (1000 psi).

15.4.5.10.3 –

Medical gas hose and flexible connectors shall be oxygen compatible.

15.4.5.10.4 –

Hose and flexible connectors shall be clearly identified as to the gas content.

15.4.5.10.5 –

Hose and flexible connectors for dental medical gases shall be gas-specific and not be permitted to conduct any other gas, gas mixture, or liquid.

15.4.6 – Brazing Copper Tubing.

15.4.6.1 – Qualification of Brazing Procedures and Brazers.

15.4.6.1.1 –

Brazing procedures and brazer performance for the installation of dental piping shall be in accordance with either Section IX, "Welding and Brazing Qualifications," of the ASME *Boiler and Pressure Vessel Code,* or AWS B2.2/B2.2M, *Specification for Brazing Procedure and Performance Qualification* , both as modified by 15.4.6 .

15.4.6.1.2 –

Brazers shall be qualified by visual examination of the test coupons followed by sectioning.

15.4.6.1.3 –

The brazing procedure specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

15.4.6.1.4 –

The brazing procedure qualification record and the record of brazer performance qualification shall document the filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate during brazing of the coupon, and the absence of internal oxidation in the completed coupon.

15.4.6.1.5 –

Brazing procedures qualified by a technically competent group or agency shall be permitted under the following conditions:

(1) The brazing procedure specification and the procedure qualification record meet the requirements of this code.

(2) The employer obtains a copy of both the brazing procedure specification and the supporting qualification record from the group or agency and signs and dates these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.

(3) The employer qualifies at least one brazer following each brazing procedure specification used.

15.4.6.1.6 –

An employer shall be permitted to accept brazer qualification records of a previous employer under the following conditions:

(1) The brazer has been qualified following the same procedure that the new employer uses or an equivalent procedure.

(2) The new employer obtains a copy of the record of brazer performance qualification tests from the previous employer and signs and dates these records, thereby accepting responsibility for the qualifications performed by the previous employer.

15.4.6.1.7 –

Performance qualifications of brazers shall remain in effect indefinitely, unless the brazer does not braze with the qualified procedure for a period exceeding 6 months or there is a specific reason to question the ability of the brazer.

15.4.6.2 – Brazed Joints.

15.4.6.2.1 –

Brazed tube joints shall be of the socket type.

15.4.6.2.2 –

Brazed joints shall be made using a brazing alloy that exhibits a melting temperature in excess of 538°C (1000°F) to retain the integrity of the piping system in the event of fire exposure.

15.4.6.2.3 –

Filler metals shall bond with and be metallurgically compatible with the base metal being joined.

15.4.6.2.4 –

Filler metals shall comply with ANSI/AWS A5.8M/A5.8, *Specification for Filler Metals for Brazing and Braze Welding* .

15.4.6.2.5 –

Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorus-silver brazing filler metal (i.e., BCuP series) without flux.

15.4.6.2.6 –

Joints to be brazed in place shall be accessible for necessary preparation, assembly, heating, filler application, cooling, cleaning, and inspection.

15.4.6.3 – Cutting Tube Ends.

15.4.6.3.1 –

Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube.

15.4.6.3.2 –

The cutting wheels on tubing cutters shall be free from grease, oil, or other lubricants not recommended for oxygen service.

15.4.6.3.3 –

The cut ends of the tube shall be rolled smooth or deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube.

15.4.6.4 – Cleaning Joints for Brazing.

15.4.6.4.1 –

The interior surfaces of tubes, fittings, and other components that are cleaned for oxygen service shall be stored and handled to avoid contamination prior to assembly and brazing.

15.4.6.4.2 –

The exterior surfaces of tube ends shall be cleaned prior to brazing to remove any oxides and surface dirt and to roughen the surfaces to prepare them for brazing.

15.4.6.4.3 –

Nonabrasive pads shall be used to clean the exterior surfaces of tube ends.

15.4.6.4.4 –

The use of steel wool, sand cloth, or wire brushes shall be prohibited.

15.4.6.4.5 –

The cleaning process shall not result in grooving the surfaces to be joined.

15.4.6.4.6 –

After being abraded, the surfaces shall be wiped using a clean, lint-free white cloth.

15.4.6.4.7 –

Tubes, fittings, valves, and other components shall be visually examined internally before being joined to verify that they have not become contaminated for oxygen service and that they are free of obstructions or debris.

15.4.6.4.8 –

Material that has become contaminated internally and is not clean for oxygen service shall not be installed.

15.4.6.4.9 –

Joints shall be brazed within 8 hours after being cleaned for brazing.

15.4.6.5 – Brazing Dissimilar Metals.

15.4.6.5.1 –

Flux shall only be used when brazing dissimilar metals, such as copper and bronze or brass, using a silver brazing filler metal (i.e., BAg series).

15.4.6.5.2 –

Cast metals shall not be field brazed.

15.4.6.5.3 –

Surfaces shall be cleaned for brazing in accordance with 15.4.6.4 .

15.4.6.5.4 –

Flux shall be applied sparingly to minimize contamination of the inside of the tube with flux.

15.4.6.5.5 –

The flux shall be applied and worked over the cleaned surfaces to be brazed using a stiff bristle brush to ensure complete coverage and wetting of the surfaces with flux.

15.4.6.5.6 –

Where possible, short sections of copper tube shall be brazed onto the noncopper component, and the interior of the subassembly shall be cleaned of flux prior to installation in the piping system.

15.4.6.5.7 –

On joints DN20 (NPS $\frac{3}{4}$) ($\frac{7}{8}$ in. O.D.) size and smaller, flux-coated brazing rods shall be permitted to be used in lieu of applying flux to the surfaces to be joined.

15.4.6.6 – Nitrogen Purge.

15.4.6.6.1 –

While being brazed, joints shall be continuously purged with oil-free, dry nitrogen NF to prevent the formation of copper oxide on the inside surface of the joint.

15.4.6.6.2 –

The source of the nitrogen purge gas shall be monitored, and the installer shall be audibly alerted when the content is low.

15.4.6.6.3 –

The nitrogen purge gas flow rate shall not be high enough to produce a positive pressure in the piping system.

15.4.6.6.4 –

The nitrogen purge gas flow shall be controlled by the use of both a pressure regulator and a flowmeter or a combination thereof.

15.4.6.6.5 –

Pressure regulators alone shall not be used to control nitrogen purge gas flow rates.

15.4.6.6.6 –

During and after installation, openings in the piping system shall be kept capped or plugged to maintain a nitrogen atmosphere within the piping and to prevent debris or other contaminants from entering the system.

15.4.6.6.7 –

While a joint is being brazed, a discharge opening shall be provided on the opposite side of the joint from where the nitrogen purge gas is being introduced.

15.4.6.6.8 –

The flow of nitrogen purge gas shall be maintained until the joint is cool to the touch.

15.4.6.6.9 –

After the joint has cooled, the purge discharge opening shall be plugged or capped to prevent contamination of the inside of the tube and maintain the nitrogen atmosphere within the piping system.

15.4.6.7 – Assembling and Heating Brazed Joints.

15.4.6.7.1 –

Tube ends shall be inserted either fully into the depth of the fitting socket or to a mechanically limited depth that is not less than the minimum cup depth (i.e., overlap) specified in ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings* .

15.4.6.7.2 –

Where flux is permitted, joints shall be heated slowly until the flux has liquefied.

15.4.6.7.3 –

After flux has liquefied, or where flux is not permitted to be used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint.

15.4.6.7.4 –

Techniques for heating joints, applying the brazing filler metal, and making the horizontal, vertical, and large-diameter joints shall be as described in sections on applying heat and brazing horizontal and vertical joints in Chapter VIII, “Brazed Joints,” in the CDA *Copper Tube Handbook* .

15.4.6.8 – Inspection of Brazed Joints.

15.4.6.8.1 –

After brazing, the outside of all joints shall be cleaned by washing with water and a wire brush to remove any residue and allow clear visual inspection of the joint.

15.4.6.8.2 –

Where flux has been used, the wash water shall be hot.

15.4.6.8.3 –

Each joint shall be visually inspected after cleaning the outside surfaces.

15.4.6.8.4 –

Joints exhibiting the following conditions shall not be permitted:

(1) Flux or flux residue (where flux or flux-coated BAg rods are used with dissimilar metals)

(2) Base metal melting or erosion

(3) Unmelted filler metal

(4) Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube

(5) Cracks in the tube or component

(6) Cracks in the filler metal

(7) Failure of the joint to hold the test pressure under the installer-performed initial pressure test *(see 15.4.7.4.4)* and standing pressure test *(see 15.4.7.4.6)*

15.4.6.8.5 –

Joints that are identified as defective under conditions specified in 15.4.6.8.4(2) or 15.4.6.8.4(5) shall be replaced.

15.4.6.8.6 –

Joints that are found to be defective under conditions specified in 15.4.6.8.4(1) , 15.4.6.8.4(3) , 15.4.6.8.4(4) , 15.4.6.8.4(6) , or 15.4.6.8.4(7) shall be permitted to be repaired, except that no joint shall be reheated more than once before being replaced.

15.4.7 – Performance Criteria and Testing (Oxygen and Nitrous Oxide).

15.4.7.1 – Testing and Verification.

15.4.7.1.1 – General.

15.4.7.1.1.1 –

Inspection and testing shall be performed on all new piped oxygen and nitrous oxide systems, additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that the following have been completed:

(1) All applicable provisions of this code have been adhered to.

(2) System integrity has been achieved or maintained.

(3) Piping systems are ready for testing and verification.

(4) Piping systems are performing in accordance with their design requirements.

15.4.7.1.1.2 –

The inspection and testing reports shall be submitted directly to the party that contracted for the testing, who shall submit the reports through channels to the responsible facility authority and any others that are required.

15.4.7.1.1.3 –

Reports shall contain detailed listings of all findings and results.

15.4.7.1.1.4 –

The responsible facility authority shall review the inspection and testing records prior to the use of any systems to ensure that all findings and results of the inspection and testing have been successfully completed before use.

15.4.7.1.1.5 –

All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

15.4.7.2 – Required Testing and Verification.

15.4.7.2.1 – Category 2 Medical Gas Systems (Oxygen and Nitrous Oxide).

All Category 2 oxygen and nitrous oxide piping systems indicated in 15.4.2 shall be initially tested in accordance with 15.4.7.4 .

15.4.7.2.2 –

The oxygen and nitrous oxide piping systems shall be verified in accordance with 15.4.7.5 .

15.4.7.3 – Qualification of System Testers and Verifiers (Oxygen and Nitrous Oxide).

15.4.7.3.1 –

Individuals who perform the initial and final tests of the oxygen and nitrous oxide piping systems shall be certified to ASSE 6010, *Professional Qualifications Standard for Medical Gas Systems Installers* , or verifiers who comply with 15.4.7.3.2 .

15.4.7.3.2 –

Individuals who verify the oxygen and nitrous oxide piping systems shall be certified to ASSE 6030, *Professional Qualifications Standard for Medical Gas Systems Verifiers* .

15.4.7.4 – Initial Testing of Piping Systems (Oxygen and Nitrous Oxide).

15.4.7.4.1 – General.

15.4.7.4.1.1 –

The initial tests required by 15.4.7.4 shall be performed prior to either the final tests or the verification tests listed in 15.4.7.5 .

15.4.7.4.1.2 –

The test gas for gas piping systems shall be oil-free, dry nitrogen NF.

15.4.7.4.1.3 –

Where manufactured assemblies are to be installed, the initial tests required by 15.4.7.4 shall be performed as follows:

(1) After completion of the distribution piping but before the standing pressure test

(2) Prior to installation of manufactured assemblies supplied through flexible hose or flexible tubing

(3) For all station outlets/inlets on installed manufactured assemblies supplied through copper tubing

15.4.7.4.1.4 –

Where plastic vacuum and plastic scavenging piping systems are installed, they shall be visually inspected for cross-connections to positive-pressure systems before applying positive test pressures to the copper piping systems.

15.4.7.4.1.5 –

Where brazed joints in copper tubing are found to be defective, they shall be repaired if permitted by 15.4.6.8.6 or replaced if required by 15.4.6.8.5 , and retested. The piping shall be repurged if necessary.

15.4.7.4.1.6 –

During the process of initial testing, the identification and labeling of the medical gas and vacuum piping shall be checked.

15.4.7.4.2 – Initial Piping Blowdown (Oxygen and Nitrous Oxide).

Piping in dental air and vacuum distribution systems shall be blown clear by means of oil-free, dry nitrogen NF after installation of the distribution piping but before installation of station outlet/inlet rough-in assemblies and other system components (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, pressure relief valves, manifolds, and source equipment).

15.4.7.4.3 – Initial Cross-Connection Test for Copper Piping Systems.

15.4.7.4.3.1 –

Copper piping shall not be tested before any plastic piping.

15.4.7.4.3.2 –

It shall be determined that no cross-connections exist between the various medical gas and vacuum piping systems.

15.4.7.4.3.3 –

All piping systems shall be reduced to atmospheric pressure.

15.4.7.4.3.4 –

Sources of test gas shall be disconnected from all piping systems except for the one system being tested.

15.4.7.4.3.5 –

The system under test shall be charged with oil-free, dry nitrogen NF to a gauge pressure of 345 kPa (50 psi).

15.4.7.4.3.6 –

After the installation of the individual faceplates with appropriate adapters matching outlet/inlet labels, each individual outlet/inlet in each installed medical gas and vacuum piping system shall be checked to determine that the test gas is dispensed only from the piping system tested.

15.4.7.4.3.7 –

The initial cross-connection test in 15.4.7.4.3 shall be repeated for each installed medical gas and vacuum piping system with copper piping.

15.4.7.4.3.8 –

Any cross-connections shall be removed and the associated piping repaired and leak tested.

15.4.7.4.3.9 –

The proper labeling and identification of system outlets/inlets shall be confirmed during these tests.

15.4.7.4.4 – Initial Pressure Test.

15.4.7.4.4.1 –

Each section of the piping in positive-pressure gas systems and copper vacuum systems shall be pressure tested. Plastic vacuum and plastic scavenging piping shall not be pressure tested.

15.4.7.4.4.2 –

Initial pressure tests shall be conducted as follows:

(1) After blowdown of the distribution piping

(2) After installation of station outlet/inlet rough-in assemblies

(3) Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, and line pressure relief valves)

15.4.7.4.4.3 –

The source shutoff valve shall remain closed during the pressure tests.

15.4.7.4.4.4 –

The test pressure for oxygen and nitrous oxide piping shall be 1.5 times the system operating pressure but not less than a gauge pressure of 1035 kPa (150 psi).

15.4.7.4.4.5 * –

The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.

15.4.7.4.4.6 –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.4.7.4.5 – Initial Piping Purge Test.

15.4.7.4.5.1 –

The outlets in each oxygen and nitrous oxide piping system shall be purged to remove any particulate matter from the distribution piping.

15.4.7.4.5.2 –

Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth.

15.4.7.4.5.3 –

The purging shall be started at the closest outlet to the piping shutoff valve and continue to the furthest outlet from the shutoff valve.

15.4.7.4.6 – Standing Pressure Test for Oxygen and Nitrous Oxide Piping.

15.4.7.4.6.1 –

After successful completion of the initial pressure tests in 15.4.7.4.4 , the gas distribution piping shall be subject to a standing pressure test.

15.4.7.4.6.2 –

Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, and hoses).

15.4.7.4.6.3 –

The source valve shall be closed during this test.

15.4.7.4.6.4 –

The piping systems shall be subjected to 24-hour standing pressure tests using oil-free, dry nitrogen NF.

15.4.7.4.6.5 –

Test pressures shall be 20 percent above the normal system operating line pressure.

15.4.7.4.6.6 –

At the conclusion of the tests, there shall be no change in the test pressure except that attributed to specific changes in ambient temperature.

15.4.7.4.6.7 –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. The piping shall be repurged if necessary.

15.4.7.4.6.8 –

The 24-hour standing pressure tests shall be witnessed by the authority having jurisdiction or its designee. A form indicating that these tests have been performed and witnessed shall be provided to the verifier at the start of the verification tests in 15.4.7.5 .

15.4.7.5 – Verification of Piping Systems (Oxygen and Nitrous Oxide).

15.4.7.5.1 – General.

15.4.7.5.1.1 –

The oxygen and nitrous oxide piping systems requiring initial testing and verification shall be as indicated in 15.4.7.2 for the different dental facilities.

15.4.7.5.1.2 –

Required verification of oxygen and nitrous oxide piping systems shall be performed only after all initial tests required in 15.4.7.4 have been completed.

15.4.7.5.1.3 –

The test gas shall be oil-free, dry nitrogen NF or the system gas or vacuum where permitted.

15.4.7.5.1.4 –

Verification shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum piping system testing and certified for ASSE 6030, *Professional Qualifications Standard for Medical Gas Systems Verifiers* .

15.4.7.5.1.5 –

Verification shall be performed by a party other than the installing contractor.

15.4.7.5.1.6 –

All required verification tests shall be performed after installation of any manufactured assemblies supplied through tubing or flexible hose.

15.4.7.5.1.7 –

Where there are multiple possible connection points for terminals, each possible position shall be tested independently.

15.4.7.5.1.8 –

Where brazed joints in copper tubing are found to be defective, they shall be repaired if permitted by 15.4.6.8.6 or replaced if required by 15.4.6.8.5 , and retested. The piping shall be repurged if necessary.

15.4.7.5.1.9 –

During the process of verification, the presence and proper labeling of source equipment, station outlets/inlets, zone valve boxes, shutoff valves, and alarms shall be checked.

15.4.7.5.2 – Verifier Standing Pressure Test.

Oxygen and nitrous oxide piping systems requiring verification shall be subjected to a 10-minute standing pressure test at operating line pressure using the following procedure:

(1) After the system is filled with nitrogen or the source gas, the source valve shall be closed.

(2) The piping system shall show no decrease in pressure after not less than 10 minutes.

(3) Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.4.7.5.3 – Verifier Cross-Connection Test.

The piping systems shall be tested for cross-connections between the systems using the following procedure:

(1) All medical gas and vacuum piping systems shall be reduced to atmospheric pressure.

(2) All sources of test gas for all of the gas and vacuum systems, with the exception of the one system to be checked, shall be disconnected.

(3) The system being checked shall be pressurized to a gauge pressure of 345 kPa (50 psi).

(4) With adapters matching outlet labels, each individual station outlet/inlet of all medical gas and vacuum systems installed shall be checked to determine that test gas is dispensed only from the outlets/inlets of the piping system being tested.

(5) The source of test gas shall be disconnected, and the system that was tested reduced to atmospheric pressure.

(6) Each additional piping system shall be tested until all gas and vacuum piping systems requiring verification are free of cross-connections.

(7) Any cross-connections shall be removed and the associated piping repaired and tested for leaks.

15.4.7.5.4 – Verifier Piping Purge Test.

15.4.7.5.4.1 –

To remove any traces of particulate matter deposited in the oxygen and nitrous oxide piping during construction, a heavy, intermittent purging of the piping shall be done.

15.4.7.5.4.2 –

The appropriate adapter shall be obtained and high purge rates of at least 225 Nl/min (8 SCFM) shall be put on each outlet.

15.4.7.5.4.3 –

After each purge is started, it shall be rapidly interrupted several times until the purge produces no discoloration in a white cloth loosely held over the adapter during the purge.

15.4.7.5.4.4 –

To avoid possible damage to the outlet and its components, this test shall not be conducted using any implement other than the proper adapter.

15.4.7.5.4.5 –

No pronounced or objectionable odor shall be discernible from any positive pressure outlet.

15.4.7.5.5 – Verifier Piping Particulate Test.

15.4.7.5.5.1 –

For each oxygen and nitrous oxide system, the cleanliness of the piping system shall be verified.

15.4.7.5.5.2 –

The test shall be performed with the use of oil-free, dry nitrogen NF.

15.4.7.5.5.3 –

A minimum of 1000 L (35 ft^3) of gas shall be filtered through a clean, white 0.45 micron filter at a minimum flow rate of 100 Nl/min (3.5 SCFM).

15.4.7.5.5.4 –

Twenty five percent of the zones shall be tested at the outlet most remote from the source.

15.4.7.5.5.5 –

The filter shall accrue no more than 0.001 g (1 mg) of matter from any outlet tested.

15.4.7.5.5.6 –

If any outlet fails this test, the most remote outlet in every zone shall be tested.

15.4.7.5.6 – Verifier Piping Purity Test.

15.4.7.5.6.1 –

For each oxygen and nitrous oxide system, the purity of the piping system shall be verified in accordance with 15.4.7.5.6 .

15.4.7.5.6.2 –

These tests shall be performed with oil-free, dry nitrogen NF or the system gas.

15.4.7.5.6.3 –

The outlet most remote from the source shall be tested for total nonmethane hydrocarbons and compared to the test of the source gas.

15.4.7.5.6.4 –

If the system gas is used as the source gas, it shall be tested at the source equipment.

15.4.7.5.6.5 –

The difference between the two tests shall in no case exceed 5 ppm of total nonmethane hydrocarbons.

15.4.7.5.6.6 –

The difference between the two tests shall in no case exceed 5 ppm of halogenated hydrocarbons.

15.4.7.5.6.7 –

The moisture concentration of the outlet test shall not exceed 500 ppm or an equivalent pressure dew point of −12°C (10°F) at a gauge pressure of 345 kPa (50 psi).

15.4.7.5.7 – Verifier Final Tie-in Test.

15.4.7.5.7.1 –

Prior to the connection of any work or any extension or addition to an existing piping system, the verification tests in 15.4.7.5 shall be successfully performed on the new work.

15.4.7.5.7.2 –

Each joint in the final connection between the new work and the existing system shall be leak-tested with the gas of system designation at the normal operating pressure by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.

15.4.7.5.7.3 –

For oxygen and nitrous oxide, immediately after the final brazed connection is made and leak-tested, an outlet in the new piping and an outlet in the existing piping that are immediately downstream from the point or area of intrusion shall be purged in accordance with the applicable requirements of 15.4.7.5.4 .

15.4.7.5.7.4 –

Before the new work is used for patient care, oxygen and nitrous oxide shall be tested for operational pressure and gas concentration in accordance with 15.4.7.5.8 and 15.4.7.5.9 .

15.4.7.5.7.5 –

Permanent records of these tests shall be maintained.

15.4.7.5.8 – Verifier Operational Pressure Test.

15.4.7.5.8.1 –

Operational pressure tests shall be performed at each station outlet or terminal where the user makes connections and disconnections.

15.4.7.5.8.2 –

Tests shall be performed with the gas of system designation.

15.4.7.5.8.3 –

All medical gas outlets with a gauge pressure of 345 kPa (50 psi), including oxygen and nitrous oxide, shall deliver 50 SLPM (1.8 SCFM) with a pressure drop of not more than 35 kPa (5 psi) and static pressure of 345 kPa to 380 kPa (50 psi to 55 psi).

15.4.7.5.9 – Verifier Gas Concentration Test.

After purging each system with the gas of system designation, the following shall be performed:

(1) Each pressure gas source and outlet shall be analyzed for concentration of gas, by volume.

(2) Analysis shall be conducted with instruments designed to measure the specific gas dispensed.

(3) Allowable concentrations shall be as follows:

(4) Oxygen ≥99 percent

(5) Nitrous oxide ≥99 percent

(6) Other gases ±1 percent unless otherwise specified

15.4.8 – Performance Criteria and Testing (Dental Air and Vacuum).

15.4.8.1 – Dental Air and Vacuum Systems Testing.

15.4.8.1.1 – General.

15.4.8.1.1.1 –

Inspection and testing shall be performed on all new piped dental gas and vacuum systems, additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that the following have been completed:

(1) All applicable provisions of this code have been adhered to.

(2) System integrity has been achieved or maintained.

(3) Piping systems are ready for testing and verification.

(4) Piping systems are performing in accordance with their design requirements.

15.4.8.1.1.2 –

The inspection and testing reports shall be submitted directly to the party that contracted for the testing, who shall submit the reports through channels to the responsible facility authority and any others that are required.

15.4.8.1.1.3 –

Reports shall contain detailed listings of all findings and results.

15.4.8.1.1.4 –

The responsible facility authority shall review the inspection and testing records prior to the use of any systems to ensure that all findings and results of the inspection and testing have been successfully completed before use.

15.4.8.1.1.5 –

All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

15.4.8.1.2 – Category 2 Dental Air and Vacuum Systems.

15.4.8.1.2.1 –

All Category 2 dental air and vacuum piping systems indicated in 15.4.3 shall be initially tested in accordance with 15.4.8.1 .

15.4.8.1.2.2 –

Dental air, vacuum, and scavenging systems shall be final tested in accordance with 15.4.8.1.7 and 15.4.8.1.8 .

15.4.8.1.3 – Initial Testing of Piping Systems.

15.4.8.1.3.1 – General.

(A) –

Where plastic vacuum and plastic scavenging piping systems are installed, they shall be visually inspected for cross-connections to oxygen and nitrous oxide systems before applying positive test pressures to the copper piping systems.

(B) –

During the process of initial testing, the identification and labeling of the dental gas and vacuum piping shall be checked.

15.4.8.1.4 – Initial Cross-Connection Test for Plastic Vacuum and Plastic Scavenging Piping Systems.

15.4.8.1.4.1 –

Plastic piping shall be tested before copper piping.

15.4.8.1.4.2 –

Tests shall be conducted to determine that no cross-connections exist between any plastic vacuum piping systems or plastic scavenging piping systems and any copper piping systems.

15.4.8.1.4.3 –

The vacuum or scavenging source shutoff valves for the vacuum or scavenging piping systems shall remain closed during the tests, unless they are being used for the cross-connection test vacuum source.

15.4.8.1.4.4 –

The cross-connection test vacuum shall be a minimum of 300 mm (12 in.) HgV.

15.4.8.1.4.5 –

The source of test vacuum shall be connected only to the vacuum or scavenging piping system being tested.

15.4.8.1.4.6 –

All individual gas system outlets and vacuum or scavenging system inlets shall be checked to determine that the test vacuum is only present in the vacuum or scavenging piping system being tested.

15.4.8.1.4.7 –

The cross-connection tests shall be repeated for each installed vacuum and scavenging system with plastic piping.

15.4.8.1.4.8 –

Any cross-connections shall be removed and the associated piping repaired and leak tested.

15.4.8.1.4.9 –

The proper labeling and identification of system outlets/inlets shall be confirmed during the initial tests.

15.4.8.1.5 – Initial Pressure Test.

15.4.8.1.5.1 –

Each section of the piping in dental air systems and copper vacuum systems shall be pressure tested. Plastic vacuum and plastic scavenging piping shall not be pressure tested.

15.4.8.1.5.2 –

Initial pressure tests shall be conducted as follows:

(1) After installation of station outlet/inlet rough-in assemblies

(2) Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, and line pressure relief valves)

15.4.8.1.5.3 –

The source shutoff valve shall remain closed during the pressure tests.

15.4.8.1.5.4 –

The test pressure for dental air piping and copper vacuum piping shall be 1.5 times the system operating pressure but not less than a gauge pressure of 1035 kPa (150 psi).

15.4.8.1.5.5 –

The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.

15.4.8.1.5.6 –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.4.8.1.6 – Initial Piping Purge Test.

15.4.8.1.6.1 –

The outlets in each dental air piping system shall be purged to remove any particulate matter from the distribution piping.

15.4.8.1.6.2 –

Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth.

15.4.8.1.6.3 –

The purging shall be started at the closest outlet to the piping shutoff valve and continue to the furthest outlet from the shutoff valve.

15.4.8.1.7 – Standing Pressure Test for Dental Air and Copper Vacuum Piping.

15.4.8.1.7.1 –

After successful completion of the initial pressure tests in 15.4.8.1 , the dental air systems and copper vacuum systems shall be subject to a standing pressure test.

15.4.8.1.7.2 –

Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, and hoses).

15.4.8.1.7.3 –

The source valve shall be closed during this test.

15.4.8.1.7.4 –

The piping systems shall be subjected to 24-hour standing pressure tests using oil-free, dry nitrogen NF.

15.4.8.1.7.5 –

Test pressures shall be 20 percent above the normal system operating line pressure.

15.4.8.1.7.6 –

At the conclusion of the tests, there shall be no change in the test pressure, except that attributed to specific changes in ambient temperature.

15.4.8.1.7.7 –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. The piping shall be repurged if necessary.

15.4.8.1.8 – Standing Vacuum Test for Plastic Vacuum Piping.

15.4.8.1.8.1 –

After successful completion of the initial pressure tests in 15.4.8.1 , vacuum distribution piping, including scavenging, shall be subjected to a standing vacuum test.

15.4.8.1.8.2 –

Tests shall be conducted after installation and connection of all components of the vacuum system.

15.4.8.1.8.3 –

The piping systems shall be subjected to a 24-hour standing vacuum test.

15.4.8.1.8.4 –

Test pressure shall be between 300 mm (12 in.) HgV and full vacuum.

15.4.8.1.8.5 –

During the test, the source of test vacuum shall be disconnected from the piping system.

15.4.8.1.8.6 –

At the conclusion of the test, there shall be no change in the vacuum pressure other than that attributed to changes of ambient temperature.

15.4.8.1.8.7 –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.4.9 – Operation and Management.

15.4.9.1 – System Shutdowns.

~~**15.4.9.1.1** –~~

~~Gas and vacuum piping systems shall be shut down at the end of each workday.~~

~~**15.4.9.1.2** –~~

~~Emergency shutoff valves or remote actuators shall not be used for daily shutdown of the systems. Cylinder gas valves shall be used for daily shutdowns.~~

~~**15.4.9.2** – Prohibited Interconnections.~~

~~Two or more piping systems for different gases or different vacuums shall not be interconnected for testing or any other reason.~~

~~**15.4.9.3** – Manufacturer's Instructions.~~

~~**15.4.9.3.1** –~~

~~Piping system components shall be installed, adjusted, operated, and maintained in accordance with the manufacturer's instructions.~~

~~**15.4.9.3.2** –~~

~~Copies of the manufacturer's instructions shall be provided to the facility and maintained at the facility.~~

~~**15.4.9.4** – Maintenance.~~

~~**15.4.9.4.1** –~~

~~Gas and vacuum system equipment shall be maintained by a qualified person.~~

~~**15.4.9.4.2** –~~

~~Every facility shall establish a procedure for manually turning off the gas supply at the cylinder valves of Category 2 dental gas and vacuum systems at the end of each day.~~

~~**15.4.9.5** – Periodic Testing.~~

~~**15.4.9.5.1** –~~

~~Station outlets for oxygen and nitrous oxide shall be tested for flow and pressure on an approved schedule.~~

~~**15.5** – Category 3 Dental Gas and Vacuum Systems.~~

~~**15.5.1** – General.~~

~~**15.5.1.1** –~~

~~Category 3 dental gas and vacuum systems shall be limited to facilities that perform minimal or no sedation.~~

~~**15.5.1.2** –~~

~~There shall be no medical gases.~~

~~**15.5.1.3** –~~

~~Dental air shall be provided from a dental air source system.~~

~~**15.5.1.4** –~~

~~The vacuum system shall be dental vacuum.~~

~~**15.5.2** – Category 3 Dental Air and Vacuum Piping Systems.~~

~~Dental vacuum systems shall include dental vacuum and nitrous oxide scavenging.~~

~~**15.5.3** – Equipment Locations for Dental Air and Vacuum Systems.~~

15.5.3.1 – General.

Any of the following systems shall be permitted to be located together in the same room:

(1) Dental air compressor sources and reserve headers

(2) Dental vacuum sources

(3) Any other compressor, vacuum pump, or electrically powered machinery

15.5.3.2 – Cylinders and Containers.

Cylinders and containers for gases shall be handled in accordance with Chapter 11 .

15.5.3.3 – Ventilation for Motor-Driven Equipment.

The following source locations shall be adequately ventilated to prevent accumulation of heat:

(1) Dental compressed air sources

(2) Dental vacuum sources

15.5.4 – Dental Gas and Vacuum Source Equipment.

15.5.4.1 – General.

15.5.4.1.1 –

The capacity of source equipment shall be based on the design requirements for the facility, including the number of gas outlets, vacuum inlets, and other connections, and their individual capacities.

15.5.4.1.2 –

The system design requirements shall be included in the data used for testing and verifying the operation of the gas and vacuum piping systems.

15.5.4.2 – Dental Air.

15.5.4.2.1 – General.

15.5.4.2.1.1 –

Dental air use shall comply with the following requirements:

(1) Dental air shall be used for driving dental tools.

(2) Dental air shall be permitted to be used to supply air-driven equipment.

(3) Dental compressed air shall not be permitted to be used for respiration.

15.5.4.2.1.2 –

Dental air outlets shall not be interchangeable with any other gas outlets, including oxygen, nitrous oxide, medical air, instrument air, and nitrogen.

15.5.4.2.2 – Dental Air Compressor Units.

15.5.4.2.2.1 –

Dental air compressor units shall include dental air compressors, vibration isolation, air receivers, coalescent air filters, adsorption dryers, exhaust silencer/filters, moisture indicators, and service access manifolds, electrical disconnects, motor wiring, and controls.

15.5.4.2.2.2 –

Air compressors shall be scroll dental, reciprocating dental, or the oil-free dental types.

15.5.4.2.2.3 –

Dental air sources for compressors located inside the building shall meet the following requirements:

(1) Sources shall be located in a space where no chemical-based materials are stored or used.

(2) Sources shall be located in a space that is not used for patient treatment or dental procedures.

(3) Sources shall not be taken from a room or space in which there is an open or semi-open discharge from a dental vacuum or dental scavenging system.

(4) When the compressor is located in a room with an open or semi-open discharge from a dental vacuum or dental scavenging system, the air shall be drawn from a remote location such as the building return air system.

15.5.4.3 – Dental Vacuum.

15.5.4.3.1 – General.

15.5.4.3.1.1 –

Dental vacuum shall be used for oral evacuation and nitrous oxide scavenging.

15.5.4.3.1.2 –

Dental vacuum inlets shall not be interchangeable with any other vacuum inlets, including dental-surgical vacuum.

15.5.4.3.2 – Dental Vacuum Units.

15.5.4.3.2.1 –

Dental vacuum units shall include dental vacuum pumps, vibration isolation, separation tanks, vacuum inlet, vacuum exhaust, condensate drain, motor wiring, and controls.

15.5.4.3.2.2 –

Dental vacuum pumps shall be dental dry vacuum or dental liquid (wet) ring pumps. Pumps shall be oil-free or oil-lubricated and suitable for nitrous oxide scavenging.

15.5.4.3.2.3 –

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

15.5.4.3.2.4 –

Dental vacuum system piping shall comply with all of the following:

(1) Horizontal piping in dental vacuum systems shall be sloped a minimum of 7 mm per 3.05 m (**1** ⁄ **4** in. per 10 ft) toward the vacuum source equipment.

(2) Horizontal piping shall include no sags or low points that would permit fluid or debris to accumulate in the piping.

(3) Voids in the vacuum piping shall be avoided to prevent buildup and obstructions.

(4) Accessible clean outs shall be permitted to be installed in the vertical downflow pipe to clear obstructions, where necessary.

(5) Dental vacuum clean outs shall not to be installed on horizontal piping.

(6) Dental vacuum inlets shall be capable of 283 L/min (10 SCFM) or greater flow capacity.

15.5.5 – Piping for Category 3 Dental Gas and Vacuum Systems.

15.5.5.1 – General.

15.5.5.1.1 –

Piping for dental air systems shall comply with 15.5.5.2 .

15.5.5.1.2 –

Piping for dental vacuum systems and scavenging systems shall comply with 15.5.5.3 .

15.5.5.2 – Piping for Dental Air Systems.

15.5.5.2.1 – General.

Pipe, fittings, and joints in piping for dental compressed air systems shall be in accordance with 15.5.5.2.2 through 15.5.5.2.4 .

15.5.5.2.2 – Pipe.

Piping materials for dental air systems shall comply with one of the following:

(1) ASTM B88, *Standard Specification for Seamless Copper Water Tube,* Type L or K

(2) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems,* Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , ACR tube (O.D. size)

(4) ASTM B103/B103M, *Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar* , listed corrugated medical tubing (CMT) fabricated from copper alloy No. 51000 strip, as follows:

(5) Having a design margin of 3.5

(6) Externally coated with a nonmetallic sheath marked with the manufacturer's marking

(7) Listing includes testing to demonstrate that CMT systems can be consistently gas purged with results equivalent to comparable medical gas copper tubing

15.5.5.2.2.1 –

Copper tube shall be hard temper or annealed (soft temper).

15.5.5.2.3 – Fittings.

Fittings for dental air piping systems shall be permitted to be any of the following acceptable joining methods:

(1) Brazed or soldered fittings complying with ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings complying with ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings complying with ASME B16.22, with socket depths equal to or greater than braze-joint pressure fittings complying with ANSI/ASME B16.50

(4) Flared fittings complying with ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** /**4** in. maximum size)

(6) Axially swaged fittings complying with 5.1.10.7

15.5.5.2.4 – Joints.

Joints for piping under 15.5.5.2 shall comply with the following:

(1) Joints shall be brazed, soldered, threaded, flared, or the compression type.

(2) Where joints are brazed, they shall comply with the requirements of 15.4.6 .

(3) Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a "lead-free" solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.5.5.3 – Piping for Dental Vacuum Systems and Scavenging Systems.

15.5.5.3.1 – General.

Piping for dental vacuum systems and scavenging systems shall be copper, PVC plastic, or CPVC plastic.

15.5.5.3.2 – Copper Piping.

Copper piping under 15.5.5.3 shall be in accordance with 15.5.5.3.2.1 through 15.5.5.3.2.3 .

15.5.5.3.2.1 – Copper Tube.

(A) –

Copper tubing shall comply with the following:

(1) ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems* , Type L or K

(2) ASTM B88, *Standard Specification for Seamless Copper Water Tube* , Type L or K

(3) ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service* , ACR tube (O.D. size)

(B) –

Copper tube shall be hard temper or annealed (soft temper).

15.5.5.3.2.2 – Copper Fittings.

Copper fittings shall comply with the following:

(1) Brazed or soldered fittings conforming to ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

(2) Brazed fittings conforming to ANSI/ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings*

(3) Brazed fittings conforming to ASME B16.22 with socket depths equal to or greater than braze-joint pressure fittings conforming to ANSI/ASME B16.50

(4) Flared fittings conforming to ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

(5) Compression fittings (**3** /**4** -in. maximum size)

15.5.5.3.2.3 – Joints for Copper Piping.

Joints in copper tubing shall be in accordance with the following:

(1) Joints shall be brazed, soldered, threaded, flared, or the compression type.

(2) Where joints are brazed, they shall comply with the requirements of 15.4.6 .

(3) Soldered joints shall be made in accordance with ASTM B828, *Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings* , using a "lead-free" solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B32, *Standard Specification for Solder Metal* .

15.5.5.3.3 – PVC Plastic Piping.

PVC plastic piping for dental vacuum systems and scavenging systems shall be in accordance with the following:

(1) PVC plastic pipe shall be Schedule 40 or Schedule 80 and comply with ASTM D1785, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120* .

(2) PVC plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe and comply with ASTM D2466, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40* ; ASTM D2467, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80* ; or ASTM D2665, *Standard Specifications for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings* .

(3) Joints in PVC plastic piping shall be solvent cemented in accordance with ASTM D2672, *Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement* .

15.5.5.3.4 – CPVC Plastic Piping.

CPVC plastic piping under 15.5.5.3 shall be in accordance with the following:

(1) CPVC IPS plastic pipe shall be Schedule 40 or Schedule 80, conforming to ASTM F441/F441M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80* .

(2) CPVC IPS plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, conforming to ASTM F438, *Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40* , or ASTM F439, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80* .

(3) CPVC CTS plastic pipe and fittings **1** ⁄ **2** in. through 2 in. size shall be SDR 11, conforming to ASTM D2846/D2846M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems* .

(4) Solvent cement for joints in CPVC plastic piping shall comply with ASTM F493, *Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings* .

15.5.6 – Installation of Dental Air and Vacuum Piping.

15.5.6.1 – General.

15.5.6.1.1 –

Dental air and vacuum piping systems shall be as listed in 15.5.2 .

15.5.6.1.2 –

Piping materials shall be as listed in 15.5.5 .

15.5.6.2 – Pipe Sizing.

Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures.

15.5.6.3 – Protection of Piping.

15.5.6.3.1 –

Piping shall be protected against freezing, corrosion, and physical damage.

15.5.6.3.2 –

Piping exposed in corridors and other locations where subject to physical damage from the movement of equipment shall be protected.

15.5.6.4 – Pipe Support.

15.5.6.4.1 –

Piping shall be supported from the building structure.

15.5.6.4.2 –

Hangers and supports shall comply with and be installed in accordance with MSS SP-58, *Pipe Hangers and Supports — Materials, Design, Manufacture, Selection, Application, and Installation* .

15.5.6.4.3 –

Hangers and supports shall be sized for the tube or pipe being supported.

15.5.6.4.4 –

The maximum support spacing for copper tube shall be in accordance with Table 15.5.6.4.4 .

Table 15.5.6.4.4 Maximum Copper Tube Support Spacing

- Hanger Spacing Pipe Size mm ft DN8 (NPS 1/4) (3/8 in. O.D.) 1520 5 DN10 (NPS 3/8) (1/2 in. O.D.) 1830 6 DN15 (NPS 1/2) (5/8 in. O.D.) 1830 6 DN20 (NPS 3/4) (7/8 in. O.D.) 2130 7 DN25 (NPS 1) (1 1/8 in. O.D.) 2440 8 DN32 (NPS 1 1/4) (1 3/8 in. O.D.) 2740 9 DN40 (NPS 1 1/2) (1 5/8 in. O.D.) and larger 3050 10 Vertical risers, all sizes, every floor, but not to exceed 4570 15

15.5.6.4.5 –

The maximum support spacing for plastic pipe shall be in accordance with Table 15.5.6.4.5 .

Table 15.5.6.4.5 Maximum Plastic Pipe Support Spacing

- Hanger Spacing Pipe Size mm ft DN15 (NPS 1/2) (5/8 in. O.D.) 1220 4 DN20 (NPS 3/4) (7/8 in. O.D.) 1220 4 DN25 (NPS 1) (1 1/8 in. O.D.) 1320 4.33 DN32 (NPS 1 1/4) (1 3/8 in. O.D.) 1320 4.33 DN40 (NPS 1 1/2) (1 5/8 in. O.D.) 1420 4.66 DN50 (NPS 2) (2 3/8 in. O.D.) 1420 4.66 DN65 (NPS 2 1/2) (2 7/8 in. O.D.) and larger 1520 5 Vertical risers, all sizes, every floor, but not to exceed 3040 10

15.5.6.5 – Underground Piping Outside of Buildings.

15.5.6.5.1 –

Buried piping outside of buildings shall be installed below the local level of frost penetration.

15.5.6.5.2 –

The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

15.5.6.5.3 –

If the underground piping is protected by a conduit, cover, or other enclosure, the following requirements shall be met:

(1) Access during construction shall be provided at the joints for visual inspection and leak testing.

(2) The conduit, cover, or enclosure shall be self-draining and not retain groundwater in prolonged contact with copper tubing.

15.5.6.5.4 –

Buried piping that is subject to surface loads shall be buried at a depth that will protect the piping, its enclosure, or both, from excessive stresses.

15.5.6.5.5 –

The minimum backfill cover above the top of the piping or its enclosure shall be 900 mm (36 in.), except that the minimum cover shall be permitted to be reduced to 450 mm (18 in.) where there is no potential for damage from surface loads or surface conditions.

15.5.6.5.6 –

Trenches shall be excavated so that the piping or its enclosure has firm, substantially continuous bearing on the bottom of the trench.

15.5.6.5.7 –

Backfill shall be clean, free from material that can damage the pipe, and compacted.

15.5.6.5.8 –

A continuous warning tape or marker shall be placed immediately above the piping or its enclosure to clearly identify the pipeline by specific name.

15.5.6.5.9 –

A continuous warning means shall also be placed above the pipeline at approximately one-half the depth of burial.

15.5.6.5.10 –

Where buried piping is extended into a building through a wall sleeve, the outdoor end of the sleeve shall be sealed watertight to prevent the entrance of groundwater into the building.

15.5.6.6 – Underground Piping Within Buildings.

15.5.6.6.1 –

The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

15.5.6.6.2 –

The piping shall be backfilled with clean sand or gravel.

15.5.6.7 – Piping Within Floor Slabs Prohibited.

Dental gas and vacuum piping shall not be installed within floor slabs.

15.5.7 – Performance Criteria and Testing (Dental Air and Vacuum).

15.5.7.1 – Dental Air and Vacuum Systems Testing.

15.5.7.1.1 – General.

15.5.7.1.1.1 –

Inspection and testing shall be performed on all new piped dental gas and vacuum systems, additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that the following have been completed:

(1) All applicable provisions of this code have been adhered to.

(2) System integrity has been achieved or maintained.

(3) Piping systems are ready for testing and verification.

(4) Piping systems are performing in accordance with their design requirements.

15.5.7.1.1.2 –

The inspection and testing reports shall be submitted directly to the party that contracted for the testing, who shall submit the reports through channels to the responsible facility authority and any others that are required.

15.5.7.1.1.3 –

Reports shall contain detailed listings of all findings and results.

15.5.7.1.1.4 –

The responsible facility authority shall review the inspection and testing records prior to the use of any systems to ensure that all findings and results of the inspection and testing have been successfully completed before use.

15.5.7.1.1.5 –

All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

15.5.7.1.2 – Required Testing.

15.5.7.1.2.1 – Category 3 Dental Air and Vacuum Systems.

(A) –

All Category 3 dental gas and vacuum piping systems indicated in 15.5.2 shall be initially tested in accordance with 15.5.7.1.3 .

(B) –

Dental air, vacuum, and scavenging systems shall be final tested in accordance with 15.5.7.1.3.4 and 15.5.7.1.3.5 .

~~**15.5.7.1.3** – Initial Testing of Piping Systems.~~

~~**15.5.7.1.3.1** – General.~~

~~**(A)** –~~

~~Where plastic vacuum and plastic scavenging piping systems are installed, they shall be visually inspected for cross-connections to oxygen and nitrous oxide systems before applying positive test pressures to the copper piping systems.~~

~~**(B)** –~~

~~During the process of initial testing, the identification and labeling of the dental gas and vacuum piping shall be checked.~~

~~**15.5.7.1.3.2** – Initial Pressure Test.~~

~~**(A)** –~~

~~Each section of the piping in dental air systems and copper vacuum systems shall be pressure tested. Plastic vacuum and plastic scavenging piping shall not be pressure tested.~~

~~**(B)** –~~

~~Initial pressure tests shall be conducted as follows:~~

(1) ~~After installation of station outlet/inlet rough-in assemblies~~

(2) ~~Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, and line pressure relief valves)~~

~~**(C)** –~~

~~The source shutoff valve shall remain closed during the pressure tests.~~

~~**(D)** –~~

~~The test pressure for dental air piping and copper vacuum piping shall be 1.5 times the system operating pressure but not less than a gauge pressure of 1035 kPa (150 psi).~~

~~**(E)** –~~

~~The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.~~

~~**(F)** –~~

~~Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.~~

~~**15.5.7.1.3.3** – Initial Piping Purge Test.~~

~~**(A)** –~~

~~The outlets in each dental air piping system shall be purged to remove any particulate matter from the distribution piping.~~

~~**(B)** –~~

~~Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth.~~

~~**(C)** –~~

~~The purging shall be started at the closest outlet to the piping shutoff valve and continue to the furthest outlet from the shutoff valve.~~

~~**15.5.7.1.3.4** – Standing Pressure Test for Dental Air and Copper Vacuum Piping.~~

(A) –

After successful completion of the initial pressure tests in 15.5.7.1.3.2 , the dental air systems and copper vacuum systems shall be subject to a standing pressure test.

(B) –

Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, and hoses).

(C) –

The source valve shall be closed during this test.

(D) –

The piping systems shall be subjected to 24-hour standing pressure tests using oil-free, dry nitrogen NF.

(E) –

Test pressures shall be 20 percent above the normal system operating line pressure.

(F) –

At the conclusion of the tests, there shall be no change in the test pressure except that attributed to specific changes in ambient temperature.

(G) –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. The piping shall be repurged if necessary.

15.5.7.1.3.5 – Standing Vacuum Test for Plastic Vacuum Piping.

(A) –

After successful completion of the initial pressure tests in 15.5.7.1.3.2 , vacuum distribution piping, including scavenging, shall be subjected to a standing vacuum test.

(B) –

Tests shall be conducted after installation and connection of all components of the vacuum system.

(C) –

The piping systems shall be subjected to a 24-hour standing vacuum test.

(D) –

Test pressure shall be between 300 mm (12 in.) HgV and full vacuum.

(E) –

During the test, the source of test vacuum shall be disconnected from the piping system.

(F) –

At the conclusion of the test, there shall be no change in the vacuum pressure other than that attributed to changes of ambient temperature.

(G) –

Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested.

15.5.8 – Operation and Management.

15.5.8.1 – System Shutdowns.

Gas and vacuum piping systems shall be shut down at the end of each workday.

15.5.8.2 – Manufacturer's Instructions.

~~**15.5.8.2.1** –~~

~~Piping system components shall be installed, adjusted, operated, and maintained in accordance with the manufacturer's instructions.~~

~~**15.5.8.2.2** –~~

~~Copies of the manufacturer's instructions shall be provided to the facility and maintained at the facility.~~

~~**15.5.8.3** – Maintenance.~~

~~Dental air and vacuum system equipment shall be maintained by a qualified representative of the equipment manufacturer.~~

Replace entire chapter with attached.

Additional Proposed Changes

File Name	Description	Approved
Categories_TF_report_final.docx	Report of the Task Group	
anesthesia_use_guidelines.pdf	Anesthesia Use Guidelines	
ASA_Physical_Status_and_M_and_M_2016.pdf	ASA Physical Status Evaluation	
continuum-of-depth-of-sedation-definition-of-general-anesthesia-and-levels-of-sedation-analgesia.pdf	Continuum of Sedation	
Validation_of_the_European_Society_of_Cardiology_a.pdf	Validation from Cardilology	

Statement of Problem and Substantiation for Public Comment

Justification:
The Task Group explored the root causes of the proposals which originally raised the issues (2019 PC 139, 2021 PI 272, 280, 281, 282, 284, 285, 286, 287, 290) and considered the original reasons for setting out the chapter as was done for 2018. It was evident that the intent of the change in 2018 had not been completely realized, and that intent has been summarized and clarified in the form of the Table proposed for Annex A 15.1.1.1.

It is essential to note that there are two determinations needed for use of Chapter 15. First is determination of eligibility: Can you qualify as a Dental facility or not? This would be a decision determined by the expected patient population. Patients with significantly adverse presentations, under the kinds of "threat to life" emergency conditions expected in a medical setting or expected to undergo complex surgical procedures would not be treated in a facility which would qualify for consideration under Chapter 15. When a facility is intending to perform work or treat patients outside of the normal limits of a dental facility for which Chapter 15 is intended, they belong firmly in Chapter 5. This determination would be expected from the "Governing Body" and AHJ, hopefully using the principles set out in Chapter 4 (4.2).

However, once qualified as a Chapter 15 Dental facility, one can also apply depth of anesthesia as the most relevant criteria to divide into Categories. As with Chapter 5, the Chapter 4 Category decision process may encompass this. If so, these requirements will simply align with and reinforce that decision. Where the Chapter 4 Category decision process does not consider or appropriately assess the importance of depth of anesthesia in risk assessment, or where no Chapter 4 process is conducted at all (regrettably not unusual in the Dental world) inclusion here ensures the risks are not overlooked. Annex A 15.1.1.1 produces the essential guidance to applying the risk assessments essential to these determinations.

One of the essential causes of difficulties discovered was the original use of references to Chapter 5. In the proposal, these have been taken into the Chapter 15 text entire, so as to completely disconnect Chapters 5 and 15, and complete the work as intended in 2018. Note that all the changes proposed for Chapter 5 in this cycle have been assumed to apply in Chapter 15 as well, and are therefore incorporated.

There remain issues, as the Task Group appreciates. However, to correct these, changes in substance would be required which would not be appropriate at this point in the revision cycle as they would not receive appropriate public review. Therefore, new language is confined to 15.1.1.1. Beyond that, the proposal is primarily intended to be editorial, preserving the original requirement insofar as possible and the original language wherever possible, only modifying the few places where “Dental" needed to be inserted or the language modified to read correctly.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	
Public Comment No. 75-NFPA 99-2022 [Section No. 5.1.1.2]	
Public Comment No. 76-NFPA 99-2022 [Section No. 5.2.1.2]	
Public Comment No. 77-NFPA 99-2022 [Section No. 5.3.1.2]	

Related Item

• FR 1116 • FR 1020

Submitter Information Verification

Submitter Full Name: Mark Allen
Organization: Self
Affiliation: Task Group on Categories
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 25 06:30:55 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1127-NFPA 99-2022
Statement: The Ch. 15 Task Group explored the root causes of the proposals which originally raised the issues (2019 PC 139, 2021 PI 272, 280, 281, 282, 284, 285, 286, 287, 290) and considered the original reasons for setting out the chapter as was done for 2018. It was evident that the intent of the change in 2018 had not been completely realized, and that intent has been summarized and clarified in the form of the Table proposed for Annex A 15.1.1.1.

It is essential to note that there are two determinations needed for use of Chapter 15. First is determination of eligibility: Can you qualify as a Dental facility or not? This would be a decision determined by the expected patient population. Patients with significantly

adverse presentations, under the kinds of "threat to life" emergency conditions expected in a medical setting or expected to undergo complex surgical procedures would not be treated in a facility which would qualify for consideration under Chapter 15. When a facility is intending to perform work or treat patients outside of the normal limits of a dental facility for which Chapter 15 is intended, they belong firmly in Chapter 5. This determination would be expected from the "Governing Body" and AHJ, hopefully using the principles set out in Chapter 4 (4.2).

However, once qualified as a Chapter 15 Dental facility, one can also apply depth of anesthesia as the most relevant criteria to divide into Categories. As with Chapter 5, the Chapter 4 Category decision process may encompass this. If so, these requirements will simply align with and reinforce that decision. Where the Chapter 4 Category decision process does not consider or appropriately assess the importance of depth of anesthesia in risk assessment, or where no Chapter 4 process is conducted at all (regrettably not unusual in the Dental world) inclusion here ensures the risks are not overlooked. Annex A 15.1.1.1 produces the essential guidance to applying the risk assessments essential to these determinations.

One of the essential causes of difficulties discovered was the original use of references to Chapter 5. In the proposal, these have been taken into the Chapter 15 text entire, so as to completely disconnect Chapters 5 and 15, and complete the work as intended in 2018. Note that all the changes proposed for Chapter 5 in this cycle have been assumed to apply in Chapter 15 as well, and are therefore incorporated.

There remain issues, as the Task Group appreciates. However, to correct these, changes in substance would be required which would not be appropriate at this point in the revision cycle as they would not receive appropriate public review. Therefore, new language is confined to 15.1.1.1. Beyond that, the proposal is primarily intended to be editorial, preserving the original requirement insofar as possible and the original language wherever possible, only modifying the few places where “Dental" needed to be inserted or the language modified to read correctly.

Public Comment No. 32-NFPA 99-2022 [Section No. 15.3.3.4.2.3]

15.3.3.4.2.3

Dental air sources for compressors located inside the building shall meet the following requirements:

(1) Sources shall be located in a space where no chemical-based materials are stored or used.

(2) Sources shall be located in a space that is not used for patient treatment or dental procedures.

(3) Sources shall not be taken from a room or space in which there is an open or semi-open discharge from a dental vacuum or dental scavenging system.

(4) When the compressor is located in a room with an open or semi-open discharge from a dental vacuum or dental scavenging system, the air shall be drawn from a remote location such as the building return air system.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_35.pdf	NFPA 99 CCN_35	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 35 appeared in the First Draft Report on First Revision No. 1061.

Consider reviewing the redundant use of the phrase "sources shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1061

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:00:27 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1058-NFPA 99-2022
Statement: The revision responds to CCN-35 and incorporates the suggested changes.

Correlating Committee Note No. 35-NFPA 99-2022 [New Section after 15.3.3.4.2.2]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:31:31 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "sources shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1061-NFPA 99-2021 [New Section after 15.3.3.4.2.2]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 33-NFPA 99-2022 [Section No. 15.3.3.5.2.3]

15.3.3.5.2.3

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_36.pdf	NFPA 99 CCN_36	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 36 appeared in the First Draft Report on First Revision No. 1076.

Consider reviewing the redundant use of the phrase "It shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1076

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:03:42 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1059-NFPA 99-2022
Statement: The revision responds to CCN-36 and incorporates the suggested changes.

Correlating Committee Note No. 36-NFPA 99-2022 [New Section after 15.3.3.5.2.2]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:33:29 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "It shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1076-NFPA 99-2021 [New Section after 15.3.3.5.2.2]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 14-NFPA 99-2022 [Section No. 15.4.2.4.15]

15.4.2.4.15

Locations containing positive pressure gasses or cylinders containing positive pressure gases shall be provided with an automatic fire sprinkler in accordance with the following:

(1) Where the automatic sprinkler is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system.

(2) Where the automatic sprinkler is installed in a building without an automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system if the following conditions are met:

(a) The plumbing system is capable of simultaneously supplying the domestic and sprinkler waterflow demands.

(b) The automatic sprinkler is a dedicated line branched from the main domestic water supply line, immediately after the main shutoff valve for the dental facility, with appropriate backflow protection in accordance with local plumbing codes.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_13.pdf	NFPA 99 CCN_13	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 13 appeared in the First Draft Report on First Revisions No. 1067.

Consider the ballot comments re. correlation with Ch. 5; review 15.4.2.4.15 for potential correlation issues with NFPA 13, NFPA 101, and NFPA 5000.

Related Item

• FR-1067

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 09:39:21 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1060-NFPA 99-2022

Statement:	The revision responds to CCN-13 by referencing NFPA 13 directly.

Public Comment No. 34-NFPA 99-2022 [Section No. 15.4.2.6.4.3]

15.4.2.6.4.3

Emergency shutoff valves shall be located to meet the following requirements:

(1) They shall be readily operable from a standing position.

(2) They shall be installed where visible and accessible at all times.

(3) They shall not be installed where they can be hidden from plain view, such as behind normally open or normally closed doors.

(4) They shall be installed in the egress pathway near the exit of the treatment area that will be used in an emergency.

(5) They shall not be installed in rooms, areas, or closets that can be closed or locked.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_37.pdf	NFPA 99 CCN_37	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 37 appeared in the First Draft Report on First Revision No. 1079.

Consider reviewing the redundant use of the phrase "they shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1079

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:06:42 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1061-NFPA 99-2022
Statement: The revision responds to CCN 34 and incorporates the suggested changes.

Correlating Committee Note No. 37-NFPA 99-2022 [Section No. 15.4.2.6]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:34:40 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "they shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1079-NFPA 99-2021 [Section No. 15.4.2.6]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 35-NFPA 99-2022 [Section No. 15.4.3.3.2.2]

15.4.3.3.2.2 Dental Air Compressor Units.

(A)

Dental air compressor units shall include dental air compressors, vibration isolation, air receivers, coalescent air filters, adsorption dryers, exhaust silencer/filters, moisture indicators, service access manifolds, electrical disconnects, motor wiring, and controls.

(B)

Air compressors shall be scroll dental, reciprocating dental, or the oil-free dental types.

(C)

Dental air sources for compressors located inside the building shall meet the following requirements:

(1) Sources shall be located in a space where no chemical-based materials are stored or used.

(2) Sources shall be located in a space that is not used for patient treatment or dental procedures.

(3) Sources shall not be taken from a room or space in which there is an open or semi-open discharge from a dental vacuum or dental scavenging system.

(4) When the compressor is located in a room with an open or semi-open discharge from a dental vacuum or dental scavenging system, the air shall be drawn from a remote location such as the building return air system.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_38.pdf	NFPA 99 CCN_38	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 38 appeared in the First Draft Report on First Revision No. 1108.

Consider reviewing the redundant use of the phrase "sources shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1108

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:

Submittal Date: Fri Mar 18 12:09:19 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1064-NFPA 99-2022
Statement: The revision responds to CCN-38 and incorporates the suggested changes.

Correlating Committee Note No. 38-NFPA 99-2022 [New Section after 15.4.3.3.2.2(B)]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:35:32 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "sources shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1108-NFPA 99-2021 [New Section after 15.4.3.3.2.2(B)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 36-NFPA 99-2022 [Section No. 15.4.3.3.3.2]

15.4.3.3.3.2 Dental Vacuum Units.

(A)

Dental vacuum units shall include dental vacuum pumps, vibration isolation, separation tanks, vacuum inlet, vacuum exhaust, condensate drain, motor wiring, and controls.

(B)

Dental vacuum pumps shall be dental dry vacuum or dental liquid (wet) ring pumps. Pumps shall be oil-free or oil-lubricated and suitable for nitrous oxide scavenging.

(C)

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

(D)

Dental vacuum system piping shall comply with all of the following:

(1) Horizontal piping in dental vacuum systems shall be sloped a minimum of 7 mm per 3.05 m (¼ in. per 10 ft) toward the vacuum source equipment.

(2) Horizontal piping shall include no sags or low points that would permit fluid or debris to accumulate in the piping.

(3) Voids in the vacuum piping shall be avoided to prevent buildup and obstructions.

(4) Accessible clean outs shall be permitted to be installed in the vertical downflow pipe to clear obstructions, where necessary.

(5) Dental vacuum clean outs shall not to be installed on horizontal piping.

(6) Dental vacuum inlets shall be capable of 283 L/min (10 SCFM) or greater flow capacity.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_39.pdf	NFPA 99 CCN_39	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 39 appeared in the First Draft Report on First Revision No. 1109.

Consider reviewing the redundant use of the phrase "it shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1109

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:11:38 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1068-NFPA 99-2022
Statement: The revision responds to CCN-39 and incorporates the suggested changes.

Correlating Committee Note No. 39-NFPA 99-2022 [New Section after 15.4.3.3.3.2(B)]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:36:21 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "it shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1109-NFPA 99-2021 [New Section after 15.4.3.3.3.2(B)]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 67-NFPA 99-2022 [Section No. 15.4.5.3]

15.4.5.3 Minimum Pipe Sizes.

The minimum size of the following piping shall be as follows:

(1) Category 2 oxygen piping shall be not less than DN10 (NPS ⅜ in.) (½ in. O.D.) size.

(2) Category 2 nitrous oxide piping shall be not less than DN8 (NPS ¼ in.) (⅜ in. O.D.) size.

(3) ~~Category 2 oxygen piping shall be at least 1 size larger than piping for nitrous oxide.~~

(4)

Statement of Problem and Substantiation for Public Comment

The requirement of having different pipe sizes for nitrous oxide and oxygen is unnecessary when a system is properly installed by an ASSE 6010 certified medical gas installation professional, tested, inspected, and verified as presently required by the code. Mandating that the oxygen line be one pipe size larger than the nitrous oxide could lead to additional cost of construction and provide a false sense of security against cross connections.

The code already requires that all medical gas piping in dental category 2 facilities to be installed by ASSE 6010 Medical Gas Installers. This same requirement is true for all other piped medical gas systems. There is not a “dental” 6010 or a different training requirement, meaning all installers are required to have the same training and certification. Certified 6010 installers are required to complete a cross connection test prior to a system verification. A system verification is also required to be completed, by an ASSSE 6030 verifier, which includes a cross connection test. Requiring two different pipe sizes for different gasses is assuming that the medical gas installer has ignored the 6010-training requirement, ignored the cross-connection test, ignored the verification and associated cross connection test but has decided to follow the requirement of two different pipe sizes.

In the past the reasoning for adding the different pipe sizes requirement was to prevent cross connections between gasses, as cross connections are “the number one problem found”. By that reasoning if this requirement is to remain in the code it should apply to all medical gas systems including those found in Chapter 5. As a standard that has been established as the minimum requirements for the safe installation of medical gasses, mandating two different pipe sizes falls outside of that scope and should be removed. The code already clearly states that installers must be ASSE 6010 certified and it is the responsibility of the AHJ to enforce all installations are code compliant. This includes the requirement for cross connection testing and verification.

Related Item

•

Submitter Information Verification

Submitter Full Name: Mathis Carlson
Organization: Meditrac
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 21 09:28:35 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action:	Rejected
Resolution:	The specified pipe size needs to be retained in the code to ensure proper installation.

Public Comment No. 37-NFPA 99-2022 [Section No. 15.5.4.2.1.1]

15.5.4.2.1.1

Dental air use shall comply with the following requirements:

(1) Dental air shall be used for driving dental tools.

(2) Dental air shall be permitted to be used to supply air-driven equipment.

(3) Dental compressed air shall not be permitted to be used for respiration.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_40.pdf	NFPA 99 CCN_40	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 40 appeared in the First Draft Report on First Revision No. 1100.

Consider reviewing the redundant use of the phrase "dental air shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1100

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:14:20 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1070-NFPA 99-2022
Statement: The revision responds to CCN-40 and incorporates the suggested changes.

Correlating Committee Note No. 40-NFPA 99-2022 [Section No. 15.5.4.2.1.1]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:38:03 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "dental air shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1100-NFPA 99-2021 [Section No. 15.5.4.2.1.1]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 38-NFPA 99-2022 [Section No. 15.5.4.3.2.3]

15.5.4.3.2.3

Dental vacuum exhaust shall comply with one of the following requirements:

(1) It shall be exhausted to the outdoors in accordance with the manufacturer's recommendations.

(2) It shall be filtered and diffused locally with a ULPA filter element capable of retaining 99.99 percent of particulates.

(3) If used for nitrous oxide scavenging, it shall discharge outdoors.

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_41.pdf	NFPA 99 CCN_41	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 41 appeared in the First Draft Report on First Revision No. 1114.

Consider reviewing the redundant use of the phrase "it shall" in the list items as the terms are used in the parent text prior to the list.

Related Item

• FR-1114

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 12:16:33 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1072-NFPA 99-2022
Statement: The revision responds to CCN-41 and incorporates the suggested revisions.

Correlating Committee Note No. 41-NFPA 99-2022 [New Section after 15.5.4.3.2.2]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Mon Jan 24 16:38:57 EST 2022

Committee Statement

Committee Statement: Consider reviewing the redundant use of the phrase "it shall" in the list items as the terms are used in the parent text prior to the list.

First Revision No. 1114-NFPA 99-2021 [New Section after 15.5.4.3.2.2]

Ballot Results

This item has passed ballot

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 27-NFPA 99-2022 [Section No. A.5.1.3.10]

A.5.1.3.10

For bulk oxygen systems, see NFPA 55. Figure A.5.1.3.10(a) illustrates the separation distances between bulk oxygen systems and exposures. Figure A.5.1.3.10(b) illustrates two possible choices of oxygen reserves. Both are not required.

Figure A.5.1.3.10(a) Distances Between Bulk Oxygen Systems and Exposures. [55:Figure A.9.3.2]

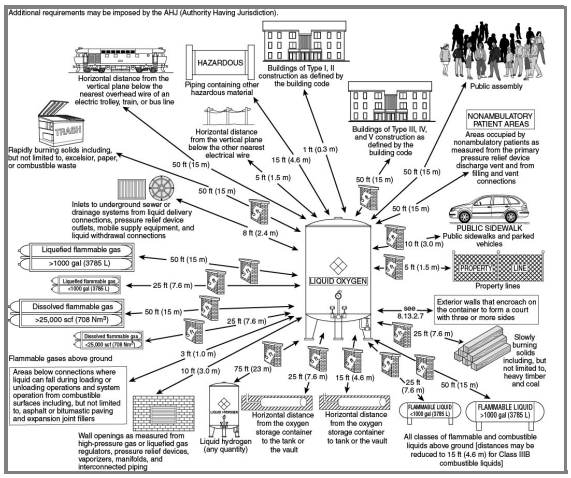
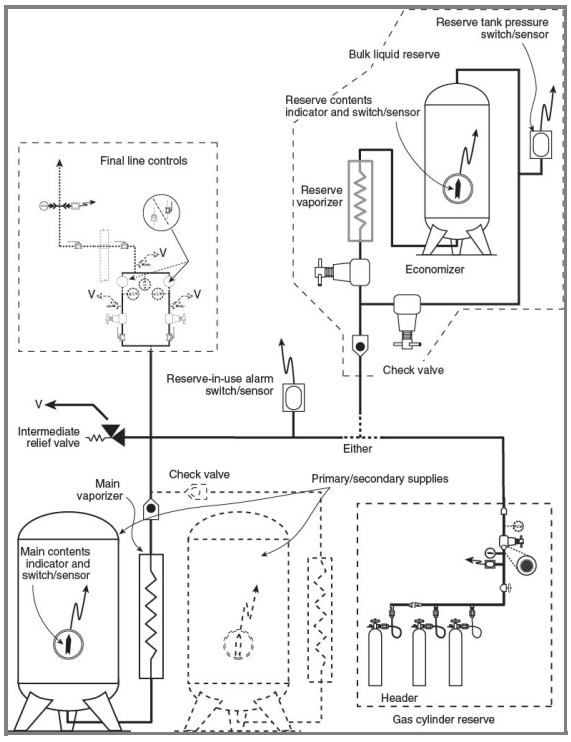


Figure A.5.1.3.10(b) Typical Source of Supply for Cryogenic Gas in Bulk.



Additional Proposed Changes

File Name	Description	Approved

NFPA_99_CCN_30.pdf NFPA 99 CCN_30

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 30 appeared in the First Draft Report on First Revision No. 1089.

Clarify the phrase, "Both are not required," which could be interpreted to mean, "Neither is required," or "Compliance with both is not required."

Related Item

• FR-1089

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 11:28:51 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-994-NFPA 99-2022
Statement: The revision responds to CCN-30 and clarifies the committee's intent.

Correlating Committee Note No. 30-NFPA 99-2022 [Section No. A.5.1.3.10]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Fri Jan 21 12:17:13 EST 2022

Committee Statement

Committee Statement: Clarify the phrase, "Both are not required," which could be interpreted to mean, "Neither is required," or "Compliance with both is not required."

First Revision No. 1089-NFPA 99-2021 [Section No. A.5.1.3.10]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert

Versteeg, Joseph H.

Public Comment No. 28-NFPA 99-2022 [Section No. A.5.1.9.2]

A.5.1.9.2

See Table A.5.1.9.2.

Table A.5.1.9.2 Requirements for Category 1 Master Alarms for Gas and Vacuum Systems

Alarm Condition	Manifold for Gas Cylinders (5.1.3.9.1)	Manifold for Cryogenic Liquid Cylinders with Reserve (5.1.3.10)	Cryogenic Bulk with Cryogenic Reserve (5.1.3.5.13)	Cryogenic Bulk with Cylinder Reserve (5.1.3.5.15)	Medical Air Proportioning System (5.1.3.6.3.13)	Medi Comp (5.1
Nitrogen main line pressure high	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Nitrogen main line pressure low	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Nitrogen changeover to secondary supply	5.1.3.9.1.6 5.1.9.2.4(1)	5.1.3.5.12.9(1), 5.1.9.2.4(1)	5.1.3.10.12(5)			
Nitrogen main supply less than 1 day (low contents)			5.1.9.2.4(2), 5.1.3.10.12(1)	5.1.9.2.4(2), 5.1.3.10.12(1)		
Nitrogen reserve in use		5.1.3.5.12.9(3), 5.1.9.2.4(3)	5.1.9.2.4(3), 5.1.3.10.12(2)	5.1.9.2.4(3), 5.1.3.10.12(2)		
Nitrogen reserve supply less than 1 day (low contents)		5.1.9.2.4(4), 5.1.3.5.12.9(4)	5.1.9.2.4(5), 5.1.3.10.12(3)	5.1.9.2.4(4), 5.1.3.10.12(3)		
Nitrogen reserve pressure low (not functional)			5.1.9.2.4(6), 5.1.3.10.12(4)			
Carbon dioxide main line pressure high	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Carbon dioxide main line pressure low	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Carbon dioxide changeover to secondary supply	5.1.3.9.1.6 5.1.9.2.4(1)	5.1.3.5.12.9(1), 5.1.9.2.4(1)				
Carbon dioxide main supply less than 1 day (low contents)			5.1.9.2.4(2), 5.1.3.10.12(1)	5.1.9.2.4(2), 5.1.3.10.12(1)		
Carbon dioxide reserve in use		5.1.3.5.12.9(3), 5.1.9.2.4(3)	5.1.9.2.4(3), 5.1.3.10.12(2)	5.1.9.2.4(3), 5.1.3.10.12(2)		
Carbon dioxide reserve supply less than 1 day (low contents)		5.1.3.5.12.9(4)	5.1.9.2.4(5),	5.1.9.2.4(5),		

Alarm Condition	Manifold for Gas Cylinders (5.1.3.9.1)	Manifold for Cryogenic Liquid Cylinders with Reserve (5.1.3.10)	Cryogenic Bulk with Cryogenic Reserve (5.1.3.5.13)	Cryogenic Bulk with Cylinder Reserve (5.1.3.5.15)	Medical Air Proportioning System (5.1.3.6.3.13)	Medi Comp (5.1
			5.1.3.10.12(3)	5.1.3.10.12(3)		
Carbon dioxide reserve pressure low (not functional)			5.1.9.2.4(6), 5.1.3.10.12(4)			
Medical air main line pressure high	5.1.9.2.4(7)					5.1.9.2
Medical air main line pressure low	5.1.9.2.4(7)					5.1.9.2
Medical air changeover to secondary supply	5.1.3.9.1.6 5.1.9.2.4(1)					
Medical air dew point high						5.1.3.6 5.1.9.2
Medical air production stop					5.1.9.2.4(13)	
Oxygen main line pressure high	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Oxygen main line pressure low	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Oxygen changeover to secondary supply	5.1.3.9.1.6 5.1.9.2.4(1)	5.1.3.5.12.9 (1) 5.1.9.2.4(1)				
Oxygen main supply less than 1 day (low contents)			5.1.9.2.4(2), 5.1.3.10.12(1)	5.1.9.2.4(2), 5.1.3.10.12(1)		
Oxygen reserve in use		5.1.3.5.12.9(3) 5.1.9.2.4(3) 5.1.9.2.4(5)	5.1.9.2.4(3), 5.1.3.10.12(2)	5.1.9.2.4(3), 5.1.3.10.12(2)		
Oxygen reserve supply less than 1 day (low contents)			5.1.3.10.12(3)	5.1.3.10.12(3)		
Oxygen reserve pressure low (not functional)			5.1.9.2.4(6), 5.1.3.10.12(4)			
Nitrous oxide main line pressure high	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		

Alarm Condition	Manifold for Gas Cylinders (5.1.3.9.1)	Manifold for Cryogenic Liquid Cylinders with Reserve (5.1.3.10)	Cryogenic Bulk with Cryogenic Reserve (5.1.3.5.13)	Cryogenic Bulk with Cylinder Reserve (5.1.3.5.15)	Medical Air Proportioning System (5.1.3.6.3.13)	Medi Comp (5.1
Nitrous oxide main line pressure low	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)	5.1.9.2.4(7)		
Nitrous oxide changeover to secondary supply	5.1.3.9.1.6 5.1.9.2.4(1)	5.1.3.5.12.9(1) 5.1.9.2.4(1)				
Nitrous oxide main supply less than 1 day (low contents)			5.1.9.2.4(2), 5.1.3.10.12(1)	5.1.9.2.4(2), 5.1.3.10.12(1)		
Nitrous oxide reserve in use		5.1.9.2.4(3), 5.1.3.5.12.9(3)	5.1.9.2.4(3), 5.1.3.10.12(2)	5.1.9.2.4(3), 5.1.3.10.12(2)		
Nitrous oxide reserve supply less than 1 day (low contents)		5.1.3.5.12.9(4)	5.1.9.2.4(5), 5.1.3.10.12(3)	5.1.9.2.4(5), 5.1.3.10.12(3)		
Nitrous oxide reserve pressure low (not functional)			5.1.9.2.4(6), 5.1.3.10.12(4)			
Medical–surgical main line vacuum low						
WAGD main line vacuum low						
Local alarm					5.1.9.2.4(9), 5.1.9.5.2, 5.1.3.6.3.14(C)(9)	5.1.3.6 5.1.9.2 5.1.9.5
Instrument air main line pressure high						
Instrument air main line pressure low						
Instrument air dew point high						
Instrument air cylinder reserve in use (if provided)						
Instrument air cylinder reserve less than 1-hour supply						
Oxygen concentrator low						

Alarm Condition	Manifold for Gas Cylinders (5.1.3.9.1)	Manifold for Cryogenic Liquid Cylinders with Reserve (5.1.3.10)	Cryogenic Bulk with Cryogenic Reserve (5.1.3.5.13)	Cryogenic Bulk with Cylinder Reserve (5.1.3.5.15)	Medical Air Proportioning System (5.1.3.6.3.13)	Medi Comp (5.1
concentration						
Oxygen concentrator offline						
Oxygen reserve in use						
Oxygen reserve supply less than 1 day (low contents)						
Oxygen main line low concentration						
Oxygen main line high concentration						
Oxygen main line pressure high						
Oxygen main line pressure low						
Oxygen change of source						
Oxygen concentrator internal pressure low						
Oxygen concentrator local alarm						

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_CCN_31.pdf	NFPA 99 CCN_31	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 31 appeared in the First Draft Report on First Revision No. 1128.

Review Table A.5.1.9.2 for needed corrections to references.

Related Item

• FR-1128

Submitter Information Verification

Submitter Full Name: CC on HEA-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 18 11:31:22 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-995-NFPA 99-2022
Statement: The revision deletes the table in response to CCN-31. A task group is being appointed to update the table for the next edition of the code.

Correlating Committee Note No. 31-NFPA 99-2022 [Section No. A.5.1.9.2]

Submitter Information Verification

Committee: HEA-AAC
Submittal Date: Fri Jan 21 12:19:16 EST 2022

Committee Statement

Committee Statement: Review Table A.5.1.9.2 for needed corrections to references.

First Revision No. 1128-NFPA 99-2021 [Section No. A.5.1.9.2]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
4 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Ashby, H. Shane
Brooks, Bruce D.
Dagenais, David A.
Hijazi, Robert

Affirmative All

Beebe, Chad E.
Burrill, Gordon D.
Ferrari, Keith
Finnegan, Daniel P.
Gagnon, Robert M.
Galloway, Ronald E.
Gilyeat, Sharon S.
Kennedy, Chad
Reiswig, Rodger
Rosenbaum, Eric R.
Sontag, Robert
Versteeg, Joseph H.

Public Comment No. 89-NFPA 99-2022 [New Section after A.5.1.12.1.3]

A.5.1.12.1.4

Examples of an addition to systems addressed by 5.1.12.1.4 include, but are not limited to, connecting to an existing station outlet/inlet via a hose assembly with the intent of adding a new station outlet/inlet to permanently relocate the user connection point.

Statement of Problem and Substantiation for Public Comment

Modular Services has received requests to provide facelift products for small renovation projects which are to include new gas outlets. The new gas outlets would be connected to the existing gas outlets via hose assemblies. We are seeking clarification that this type of addition to the piping infrastructure is intended to be inspected and tested.

Related Item

• Public Input No. 231

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 09:54:32 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision implies the hose connection described would be approved.

Public Comment No. 91-NFPA 99-2022 [Section No. A.5.1.12.2.2]

A.5.1.12.2.2

Examples of system components addressed by 5.1.12.2.2 include, but are not limited to, pressure/vacuum alarm devices, pressure/vacuum indicators, pressure relief valves, manifolds, source equipment, manufactured assemblies, and manufactured rough-in assemblies.

Statement of Problem and Substantiation for Public Comment

Adding "manufactured rough-in assemblies" here in case the related public comments are approved.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 84-NFPA 99-2022 [Section No. 3.3.103]	
Public Comment No. 85-NFPA 99-2022 [New Section after 3.3.103]	
Public Comment No. 87-NFPA 99-2022 [Section No. 5.1.6.1]	

Related Item

- Public Input No. 232

Submitter Information Verification

Submitter Full Name: Travis Webb
Organization: Modular Services Company
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 10:04:06 EDT 2022
Committee: HEA-PIP

Committee Statement

Committee Action: Accepted
Resolution: SR-971-NFPA 99-2022
Statement: The revision adds "manufactured rough-in assemblies" per the new definition.