AGENDA

NFPA Technical Committee on Animal Housing Facilities (ASF-AAA)
NFPA 150 Second Draft Meeting (A2024)

October 10 and October 12, 2023
10 a.m. – 1 p.m. (EDT)

Web/Teleconference
To join the meeting, please contact eliolin@nfpa.org

1. **Call to order.** R. Husted.
2. **Introductions.** See committee roster attached.
3. **Chair report.** R. Husted.
4. **Staff liaison report.** J. Sisco.
5. **Previous meeting minutes.** September 14, 2022, Web/Teleconference. See attached.
6. **NFPA 150 Second Draft.**
   a. **Public Comments.** See attached.
   b. **Task group report(s).**
      i. **Agricultural Fire Safety**. S.Learned. See attached.
      ii. **Medical Gas Supply**. K.Weniger. See attached.
   c. **Presentation(s).**
   d. **Committee Inputs.** See attached.
7. **Other Business.**
8. **Future meetings.**
9. **Adjournment.**

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09/20/2023
Tracy L. Vecchiarelli

Animal Housing Facilities

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MINUTES

NFPA Technical Committee on Animal Housing Facilities (ASF-AAA)
NFPA 150 First Draft Meeting (A2024)

September 14, 2022
11:00 a.m. – 4:00 p.m. (ET)

Web Teleconference

1. **Call to order.** R. Husted, chair, called the meeting to order at 11:00 am on September 14th.
2. **Introductions.** Attendees introduced themselves and identified their affiliation.
3. **Chair report.** R. Husted welcomed attendees and provided an overview of the meeting.
4. **Staff liaison report.** T. Vecchiarelli provided an overview of the standards development process and the revision cycle schedule.
5. **Previous meeting minutes.** The minutes from August 19, 2020 were approved without revision.
6. **2022 Fire Protection Research Foundation Report.** The Fires in Animal Housing Facilities report was reviewed and discussed. The committee extends their thanks to FPRF and to the panel who worked on the report. The committee used the report during the review of some of the public inputs and creation of first revisions.
7. **NFPA 150 First Draft.**
   a. **Review of Public Inputs.** The Technical Committee reviewed the Public Inputs and developed First Revisions and Committee Inputs as necessary. These will be available in the First Draft Report at www.nfpa.org/150.
   b. **Task group report.** The following task groups provided their reports and recommendations.
      i. **Checklist Task Group**. A. Black. The task group provided a report, and a first revision was created based on their work.
   c. **New task groups.** The following task groups were appointed to work subsequent to the meeting:
      i. **Agricultural fire safety**. TG Chair: S. Learned. Members: C. Aler, M. Spencer, M. Keenan, R. Neiderheiser, J. Lewis, J. Reetz, P. Haas, K. Weniger. The task group is assigned to review the code requirements within the agricultural chapter to further examine the benefits of passive vs. active fire protection methods and systems. The task group should discuss new technologies available, hazards certain systems might present to the animals, water supply, construction requirements, and which class the

requirements should apply to. The task group should submit public comments by May 31, 2023.

ii. **Medical Gas Supply**. TG Chair: K. Weniger. Members: S. Learned, J. Call, R. Neiderheiser, C. Aler, A. Black. The task group is assigned to develop language for medical gas in veterinary facilities. The task group should consider the current scope of NFPA 99. The task group should submit public comments by May 31, 2023.

d. **Additional Items.**

i. **S. Learned.** The TC reviewed three topics from S. Learned and created various CIs.

ii. **M. Keenan.** The TC reviewed a document from M. Kennen and created a CI.

8. **Other Business.** The committee thanked past chair A. Gulati for his service and welcomed new chair R. Husted.

9. **Future meetings.** The next committee meeting will be in late summer/early fall of 2023. A meeting notification will be posted at www.nfpa.org/150next when the meeting is scheduled. It was suggested that the next meeting be held in Atlanta.

10. **Adjournment.** The meeting was adjourned at 4:00pm on September 14th.

Attendees

✓	**Husted, Rebecca**	Chair	Technical Large Animal Emergency
	Adams, Melanie	Principal	Miami-Dade Fire Rescue Department
✓	**Aler, Clay**	Principal	Koffel Associates, Inc.
	Bahra, Nandeep	Principal	Smithsonian Institution
✓	**Black, Art**	Principal	Carmel Fire Protection Associates
✓	**Boucher, John**	Principal	Harvard School of Public Health
	Cohen, Hal	Principal	HCC & Associates, Inc.
	Dorko, Christopher	Principal	Berkley Life Sciences, LLC
	Dvorscak, Michelle	Principal	Lake County Sheriff's Department
✓	**Gulati, Ajay**	Principal	Self Employed
✓	**Haas, Paul**	Principal	All Fire Solutions Inc.
	Hoberg, Shelena	Principal	
✓	**Jones, Dena**	Principal	Animal Welfare Institute
✓	**Keenan, Michael**	Principal	Arthur J. Gallagher & Co.
✓	**Learned, Scott**	Principal	Design Learned Inc.
✓	**Lewis, James**	Principal	National Fire Sprinkler Association
✓	**Loftus, Jim**	Principal	Automatic Fire Alarm Association, Inc.

✓	**McBride, Jeffery**	Principal	EBL Engineers, LLC
✓	**McKeon, Thomas**	Principal	Dual North America
✓	**Meerschaert, Gary**	Principal	City of St. Francis
✓	**Morrison, Brian**	Principal	Centerville-Osterville-Marstons Mills Fire
✓	**Neiderheiser, Rita**	Principal	United Assn. of Journeymen & Apprentices
	Raisi, Kameron	Principal	KCI Technologies
	Reiswig, Rodger	Principal	National Electrical Manufacturers
	Rieck, Brian	Principal	National Pork Producers Council
	Roberts, Selwyn	Principal	National Institute of Health (NIH)
✓	**Ryan, Amy**	Principal	Chubb Limited
✓	**Scibetta, Joe**	Principal	BuildingReports
✓	**Spencer, Matthew**	Principal	US Poultry and Egg Association
✓	**Wright, Thomas**	Principal	Wright Fire Consulting, Inc.
	Wynnyczuk, Peter	Principal	Xtralis
	Aikens, Kenton	Alternate	Automatic Fire Alarm Association, Inc.
✓	**Call, James**	Alternate	Smithsonian Institution
	Formica, Michael	Alternate	National Pork Producers Council
✓	**Fox, Donii**	Alternate	Berkley Life Sciences
	Geiser, Dennis	Alternate	University Of Tennessee
	Krieger, Mark	Alternate	Chubb
✓	**Larose, Jake**	Alternate	Arthur J. Gallagher & Co.
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✓	**Reetz, Jeffrey**	Alternate	Fire and Risk Alliance, LLC
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✓	**Weniger, Kristin**	Alternate	Koffel Associates, Inc.
✓	**Vecchiarelli, Tracy**	Staff Liaison	National Fire Protection Association

Total number in attendance: 26

Public Comment No. 1-NFPA 150-2023 [New Section after 17.3.5.1]

TITLE OF NEW CONTENT

17.3.5.1 Automatic Fire Sprinklers

Class A Facilities meeting or exceeding the US Environmental Protection Agency animal size threshold of a Medium Concentrated Animal Feeding Operation shall be required to provide automatic fire sprinklers in accordance with Section 9.2.

Statement of Problem and Substantiation for Public Comment

Acting on its fire protection expertise and authority over animal housing facilities code, the NFPA 150 technical committee determined that the following animal housing facilities should be protected by automatic fire sprinkler systems:

- Short-term medical care facilities for all types of animals
- Facilities for horses
- Research, lab, and science facilities for all types of animals
- Exhibition facilities for all types of animals
- General boarding and care facilities for all types of animals

A reasonable exception to this long list of protected animal housing are emergency facilities used to save the lives of animals in danger in other places.

As fire protection experts and the authorities on this code, we should provide consistent requirements and bring agricultural facilities code into alignment with every other code for protecting permanent animal housing.

Related Item

• Public Input No. 7

Submitter Information Verification

Submitter Full Name: Rita Neiderheiser
Organization: Ua Sprinkler Fitters Lu 669
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 31 11:57:04 EDT 2023
Committee: ASF-AAA

NFPA 150 – Agriculture Fire Prevention Task Group

Final Edits- Annex Notes (5/16/2023)

The task group is assigned to review the code requirements within the agricultural chapter to further examine the benefits of passive vs. active fire protection methods and systems. The task group should discuss new technologies available, hazards certain systems might present to the animals, water supply, construction requirements, and which class the requirements should apply to.

4.2.2 Appropriateness of Safeguards.

Every facility shall be provided with means of egress and other fire and life safety safeguards of the kinds, numbers, locations, and capacities appropriate to the individual facility, with due regard to the following:

(1) Character of the occupancy, including fire load
(2) Characteristics and capabilities of both human and animal occupants and their responses to fire protection safeguards
(3) Number of animals and persons exposed
(4) Fire protection available
(5) Height, size, and type of construction of the facility
(6) Other factors necessary to provide animal and human occupants with a reasonable degree of safety
(7) Other factors necessary to protect the facility and contents from unacceptable damage
(8) Available water supplies
(9) Alternate non-combustible and limited-combustible construction techniques and materials

9.12.1.3 [Relocate to new 9.3.4 under heading "Carbon Monoxide Detection"]

For animal housing facilities with fuel-burning appliances or equipment, carbon monoxide detection shall be installed in accordance with NFPA 72.

17.2 Means of Egress Requirements.

17.2.1 General.

Each required means of egress shall be in accordance with Section 17.2 and the applicable sections of Chapter 8.

17.2.1.2

Where compliance with 17.2 and applicable sections of Chapter 8 cannot be met in Limited Access Structures or portion of a structure, Emergency Access openings shall be permitted in accordance with 17.2.2.5. and 17.2.2.6.

17.2.2 Arrangement of Means of Egress.

17.2.2.1

The maximum travel distance to an exit shall not exceed 300 ft (91 m).

17.2.2.2

Where the calculated human occupant load is less than 30, the common path of travel shall not exceed 100 ft (30 m).

17.2.2.3

Dead-end corridors shall not exceed 50 ft (15 m).

17.2.2.4

The common path of travel shall not exceed 75 ft (22.8 m).

17.2.2.5

One story structures shall have finished ground level doors or emergency access openings in accordance with 17.2.2.6 on at least two sides of the structure. Travel distance from any point within the building to an emergency access opening shall not exceed 125 ft. (38m).

17.2.2.6*

Emergency access openings shall consist of a window, panel or similar opening that complies with the following

(1) The opening shall have dimensions not less than 32 in (81 cm) width and 32 in (81 cm) in height and shall be unobstructed to allow for ventilation and rescue from the exterior
(2) The bottom of the opening shall not be more than 44 in (1120mm) above the floor
(3) The opening shall be readily identifiable from both the exterior and the interior
(4) Signage on the occupied side that clearly indicates “Emergency Exit Only”
(5) Glazing with a minimum size of 9 in. x 9 in. centered on the door leaf
(6) Single latch releasing mechanism on the occupied side not more than 60” above floor elevation
(7) The opening shall be openable from the exterior and interior

A.17.2.2.6

It is not the intent that emergency access opening be readily openable from the exterior by the public but that they be openable with normal firefighting equipment

17.3.4.5 Detection

17.3.4.5.1*

An automatic detection system shall be installed in accordance with Section 9.3 in hazardous areas including, but not limited to, the following:

(1) Laundry areas
(2) Electrical rooms
(3) Kitchens
(4) Utility rooms
(5) Power washing rooms
(6) Storage areas greater than 50 ft^2 (4.7 m^2) or containing flammable and combustible liquids

A.17.3.4.5.1

Detection should be located in all animal areas for the earliest warning. Section 17.3.4.5.1 is a minimum coverage.

17.3.4.5.2

Areas with dusty, dirty animal environments shall employ aspirating air sampling detectors.

[NEW] A.17.3.4.6

Poultry farms should have CO and temperature monitoring regardless of installed equipment.

NFPA 150 – Medical Gas Task Group

Final Edits- Annex Notes (5/15/2023)

Final Edits- KW Editorial Responses (9/14/2023)

C. Scott Learned, 3/20/23

K. Weniger, 4/25/2023

K. Weniger, 4/27/2023

Chapter 3 – New Definitions

(add the following new definitions. Insert in Section 3.3 Alphabetically- if approved)

3.3.2.2 Animal Patient*. [insert under definition for Animal]*

Any animal that is present in any animal care Category that is being treated for any medical, wellness, injury, or behavioral condition.

3.3.5 Animal Patient*. [insert pointer after definition for Animal Housing Facility Categories]*

See 3.3.2.2

3.3.XXX Patient Care Space*. [insert after definition for Occupancy]*

Any space within a veterinary, shelter medicine, animal health, animal transport, animal laboratory, animal research or other animal care facilities wherein animals are intended to be examined, treated, studied, or procedures performed on.

3.3.XXX Medical Gas 1 Space *[insert after definition for Mechanical Utility Room]*

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors.

3.3.XXX Medical Gas 2 Space

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors.

3.3.XXX Waste Anesthetic Gas Disposal (WAGD) *[insert after definition for Tack]*

Waste anesthetic gas disposal (WAGD) sources also known as veterinary scavenger systems, are exhaust systems specifically designed to remove exhalation and waste anesthetic gases to the outdoors.

Chapters 11 through 18 (except 14 Reserved) – application

(modify the following existing sections)

11.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

12.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

13.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

15.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

16.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

17.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

18.1.2 General.

The requirements in Chapters 1 and Chapter 4 through Chapter 10 shall apply.

[NEW] Chapter 5* – Medical Gas Systems

A.5 Chapter 5 is intended to provide medical gas guidance for facilities providing animal housing and care including but not limited to veterinary clinics, laboratories, shelters, etc. This chapter is intended to be used in lieu of NFPA 99 which is only applicable to human healthcare occupants.

5.1 Medical Gas 1 and Medical Gas 2 Piped Gas and Vacuum Systems.

5.1.1*Applicability.

A.5.1.1

NFPA 99excludes veterinary care except for hyperbaric chambers. This exclusion created a lack of guidance for medical gas use in veterinary settings. Chapter 5 of this Code addresses that void.

5.1.1.1

Chapter 5 shall apply to veterinary, shelter medicine, animal health, animal transport, animal laboratory, animal research or other animal care facilities that require Medical Gas 1 and Medical Gas 2 systems.

5.1.1.2

Medical Gas 1 and Medical Gas 2 piped gas or piped vacuum system requirements shall be applied where any of the following criteria is met:

(1) General anesthesia or deep sedation 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.
(3) The facility piped gas or piped vacuum systems are intended for Medical Gas 1 and Medical Gas 2 patient care space.

5.1.1.3*

Where the terms medical gas or medical support gas occur, the provisions shall apply to all piped systems for oxygen, nitrous oxide, medical air, instrument air, and mixtures thereof as well as vacuum and waste anesthetic has disposal (WAGD) systems. Wherever the name of a specific gas service occurs, the provision shall apply only to that gas.

A.5.1.1.3

Veterinary systems typically utilize cart-mounted isofluorane anesthesia and have only a limited number of gas services. These requirements do not restrict the distribution of other inert gases through piping systems.

5.1.1.4

An existing system that is not in strict compliance with the provisions of this chapter shall be permitted to be continued in use if the authority having jurisdiction has determined that such use does not constitute a distinct hazard to life.

5.1.2 Medical Gas 1 and Medical Gas 2 Sources.

5.1.2.1 Central Supply System Operations.

5.1.2.1.1

The use of adapters or conversion fittings to adapt one gas-specific fitting to another shall be prohibited.

5.1.2.1.2

No flammable materials, cylinders containing flammable gases, or containers containing flammable liquids shall be stored in rooms with gas cylinders.

5.1.2.1.3

Cylinders without correct markings or whose markings and gas-specific fittings do not match shall not be used.

5.1.2.1.4

Cryogenic liquid storage units intended to supply gas to the facility shall not be used to trans fill other liquid storage vessels.

5.1.2.1.5

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.

5.1.2.1.6

Cylinders containing compressed gases and containers for volatile liquids shall be kept away from radiators, steam piping, and like sources of heat.

5.1.2.1.7

When cylinder valve protection caps are supplied, they shall be secured tightly in place unless the cylinder is connected for use.

5.1.2.1.8

Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 125°F (52°C).

5.1.2.2*Central Supply System Locations.

A.5.1.2.2

The bulk supply system should be installed on a site that has been prepared to meet the requirements of NFPA 55 or CGA G-8.1, Standard for Nitrous Oxide Systems at Customer Sites. A storage unit(s), reserve, pressure regulation, and a signal actuating switch(es) are components of the supply system. Shutoff valves, piping from the site, and electric wiring from a signal switch(es) to the master signal panels are components of the piping system.

The bulk supply system is normally installed on the site by the owner of this equipment. The owner or the organization responsible for the operation and maintenance of the bulk supply system is responsible for ensuring that all components of the supply system — main supply, reserve supply, supply system signal-

actuating switch(es), and delivery pressure regulation equipment — function properly before the system is put in service.

In the locating of central supply systems, consideration should be given to ensuring the resilience of the facility under reasonably anticipated adverse conditions. Examples have included the following:

(1) Flooding of systems located in basements from extraordinary weather, water main breaks, and sprinkler head failures
(2) Seismic events that rendered the supply system inoperative
(3) Degradation of the quality of air at the intake due to a nearby fire and chemical release
(4) Electrical problems, including failure of motor control centers and failure of switchgear to properly connect

Many of these risks can be ameliorated by care when siting the central supply systems and their utility connections.

5.1.2.2.1 General.

Central supply systems shall be located to meet the criteria in 5.1.2.2.1 through 5.1.2.2.1.5.

5.1.2.2.1.1

Any of the following systems shall be permitted to be located together in the same outdoor enclosure:

(1) Manifolds for gas cylinders
(2) Manifolds for cryogenic liquid containers
(3) Bulk cryogenic liquid systems

5.1.2.2.1.2

Any of the following systems shall be permitted to be located together in the same indoor enclosure:

(1) Manifolds for gas cylinders
(2) Manifolds for cryogenic liquid containers
(3) In-building emergency reserves

5.1.2.2.1.3

Any of the following systems shall be permitted to be located together in the same room:

(1) Medical air compressor supply sources
(2) Medical–surgical vacuum sources
(3) Waste anesthetic gas disposal (WAGD) sources
(4) Any other compressor, vacuum pump, or electrically powered machinery
(5) Veterinary anesthesia cart bottled isoflurane or other cart mounted anesthetic
(6) Veterinary anesthesia cart bottled oxygen

5.1.2.2.1.4

Indoor storage locations for oxygen and other gases shall not communicate with the following:

(1) Areas involved in critical patient care
(2) Anesthetizing locations where moderate sedation, deep sedation, or general anesthesia is administered

(3) Locations storing flammables
(4) Rooms containing open electrical contacts or transformers
(5) Storage tanks for flammable or combustible liquids
(6) Engines
(7) Kitchens
(8) Areas with open flames

5.1.2.2.1.5

Central supply systems for oxygen with a total capacity connected and in storage of 566,335 L (20,000 ft3) or more outside of the facility at standard temperature and pressure (STP) shall comply with NFPA 55, Compressed Gases and Cryogenic Fluids Code.

5.1.2.2.2*Design and Construction.

Locations for central supply systems and the storage of positive-pressure gases shall meet the following requirements:

(1) They shall be constructed with access to move cylinders, equipment, and so forth, in and out of the location on hand trucks.
(2) They shall be provided with lockable doors or gates or otherwise able to be secured.
(3) If outdoors, they shall be provided with an enclosure (wall or fencing) constructed of noncombustible materials with a minimum of two entry/exits.
(4) If outdoors, bulk cryogenic liquid systems shall be provided with a minimum of two entry/exits.
(5) If indoors, they shall have interior finishes of noncombustible or limited-combustible materials.
(6) *If indoors, the room shall be separated from the rest of the building by walls and floors having a one-hour fire resistance rating with doors and other opening protectives having a 3⁄4-hour fire protection rating.
(7) They shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.
(8) *They shall be supplied with electrical power from an emergency generator or enough Uninterruptable Power Supply (UPS) to carry the load until the generator power is fully functioning or orderly transfer to anesthesia cart mounted medical gas.
(9) They shall have racks, shelves, and supports, where provided, constructed of noncombustible materials or limited-combustible materials.
(10) They shall protect electrical devices from physical damage.
(11) They shall allow access by delivery vehicles and management of cylinders (e.g., proximity to loading docks, access to elevators, and passage of cylinders through public areas).
(12) They shall be designed to meet the operational requirements of 5.1.2.2 regarding room temperature.

A.5.1.2.2.2

Electric wiring and equipment are not required to be explosion proof.

5.1.2.2.3 Ventilation.

5.1.2.2.3.1 Ventilation for Indoor Locations.

Medical gas storage and transfilling room ventilation shall be provided with adequate ventilation based on the stored gases in accordance with this section.

5.1.2.2.3.2 Natural Ventilation.

5.1.2.2.3.2.1

Natural ventilation shall consist of two nonclosable louvered openings, each having an aggregate free opening area of at least 24 in^2 per 1000 ft^3 (155 cm^2 per 35 L) of the fluid designed to be stored in the space and in no case less than 72 in^2 (465 cm^2).

5.1.2.2.3.2.2

One opening shall be located within 1 ft (30 cm) of the floor, and one shall be located within 1 ft (30 cm) of the ceiling.

5.1.2.2.3.3 Mechanical Ventilation.

5.1.2.2.3.3.1

Mechanical exhaust to maintain a negative pressure in the space shall be provided continuously, unless an alternative design is approved by the authority having jurisdiction.

5.1.2.2.3.3.2

Mechanical exhaust shall be at a rate of 1 cfm of airflow for each 5 ft^3 (1 L/sec per 300 L of fluid) designed to be stored in the space and not less than 50 cfm (24 L/sec) nor more than 500 cfm (235 L/sec).

5.1.2.2.3.3.3

Mechanical exhaust inlets shall be unobstructed and shall draw air from within 1 ft (300 mm) of the floor and adjacent to the cylinder or containers.

5.1.2.2.3.3.4

Dedicated exhaust systems shall not be required, provided that the system does not connect to spaces that contain combustible or flammable materials.

5.1.2.2.3.3.5

The exhaust duct material shall be noncombustible.

5.1.2.2.3.3.6

A means of make-up air shall be provided according to one of the following:

(1) Air shall be permitted via noncombustible ductwork to be transferred from adjacent spaces, from outside the building, or from spaces that do not contain combustible or flammable materials.
(2) Air shall be permitted to be transferred from a corridor under the door up to the greater of 50 cfm (24 L/sec) or 15 percent of the room exhaust.
(3) Supply air shall be permitted to be provided from any building ventilation system that does not contain flammable or combustible vapors.

5.1.2.2.3.4 Venting of Relief Valves.

Indoor supply systems shall have all relief valves vented.

5.1.2.2.3.5 Ventilation for Motor-Driven Equipment.

The following source locations shall be adequately ventilated to pre-vent accumulation of heat:

(1) Medical air sources
(2) Medical–surgical vacuum sources
(3) Waste anesthetic gas disposal (WAGD) sources

5.1.2.2.3.6 Ventilation for Outdoor Locations.

Ventilation for outdoor locations shall comply with all the following:

(1) Outdoor locations surrounded by impermeable walls, except fire barrier walls, shall have protected ventilation openings located at the base of each wall to allow free circulation of air within the enclosure.
(2) Walls that are shared with other enclosures or with buildings shall be permitted to not have openings.
(3) The fire barrier wall shall not have openings or penetrations, except conduit or piping shall be permitted, provided that the penetration is protected with a firestop system in accordance with the building code.

5.1.2.2.4 Storage of Unconnected Gas Cylinders

5.1.2.2.4.1

Full or empty medical gas cylinders, when not connected, shall be stored in accordance with this section and shall be permitted to be in the same rooms or enclosures as their respective central supply systems.

5.1.2.2.4.2

Storage of volumes between 300 ft^3 (8,495 L) and 3000 ft^3 (84,950 L) must be stored in locations that are outdoors or in an interior enclosure of noncombustible or limited combustible construction. Indoor locations must include the following:

(1) Restriction of oxidizing gases from being stored with any flammable gas, liquid, or vapor.
(2) Separation of oxidizing gases from combustibles or flammables by a minimum distance of 20 ft (6.1 m) or a distance of 5 ft (1.5 m) where the entire storage location is sprinklered or a gas cabinet.
(3) Regulation of temperatures.
(4) Appropriate restraints and cylinder valve protection caps.
(5) Smoking, open flames, electric heating elements, prohibited from location and within 20 ft (6.1 m) outside location.

5.1.2.3 Central Supply Systems.

5.1.2.3.1 General.

Central supply systems shall be obtained from a supplier or manufacturer familiar with their proper construction and use and installed in accordance with the manufacturer's instructions.

5.1.2.3.2 Permitted Locations for Medical Gases.

Central supply systems and medical gas outlets for oxygen, medical air, nitrous oxide, carbon dioxide, and all other patient medical gases shall be piped only into areas where the gases will be used under the direction of licensed veterinary medical professionals.

5.1.2.3.3* 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 350 psi (2413 kPa), inter-connecting 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 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 as per the manufacturer's requirements.

A.5.1.2.3.3

Components include, but are not limited to, containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment, including hose. Easily ignitable materials should be avoided.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air will burn violently in pure oxygen at normal pressure and explosively in pressurized oxygen. Also, many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Metals for containers and piping have to be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions can call for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials can be ignited by friction at a valve seat or stem packing or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.

5.1.2.3.4 Final Line Pressure Regulators.

5.1.2.3.4.1

All positive pressure supply systems shall be provided with duplex line pressure regulators piped in parallel with the following characteristics:

(1) They shall be provided with isolation valves on the source side of each regulator.
(2) They shall be provided with isolation or check valves on the patient side of each regulator.
(3) A pressure indicator(s) shall be located downstream (patient or use side) of each regulator or immediately down-stream of the isolating valves for the regulators.
(4) They shall be piped to allow either regulator to be serviced without interrupting supply.
(5) Each regulator shall be sized for 100 percent of the peak calculated demand.
(6) They shall be constructed of materials deemed suitable by the manufacturer.

5.1.2.3.4.2

Central supply systems for positive pressure gases shall include one or more relief valves, all meeting the following requirements:

(1) They shall be located between each final line regulator and the source valve.
(2) They shall have a relief setting that is 50 percent above the normal system operating pressure.

5.1.2.4 Emergency Plan:

The facility staff shall develop their emergency plan to address the loss of piped medical gas and the loss of medical–surgical vacuum.

5.1.3 Valves.

5.1.3.1 General.

5.1.3.1.1 Gas and Vacuum Shutoff Valves.

Shutoff valves shall be provided to isolate sections or portions of the piped distribution system for maintenance, repair, or planned future expansion need and to facilitate periodic testing.

5.1.3.1.2 Labeling.

All valves shall be labeled as to gas supplied and the area(s) controlled.

5.1.4*Station Outlets/Inlets.

A.5.1.4

Station outlets and inlets should be located at an appropriate height above the floor to prevent physical damage to equipment attached to the outlet. The minimum number of outlets and inlets for each system should be based on the applicable FGI guidelines.

5.1.4.1

Each station outlet/inlet for medical gases or vacuums shall be gas-specific, whether the outlet/inlet is threaded or is a noninterchangeable quick coupler.

5.1.4.2

Each outlet/inlet shall be legibly identified.

5.1.4.3

Station outlets/inlets shall be permitted to be recessed or otherwise protected from damage.

5.1.4.4

When multiple wall outlets/inlets are installed, they shall be spaced to allow the simultaneous use of adjacent outlets/inlets with any of the various types of therapy equipment.

5.1.4.5

Station outlets in systems having nonstandard operating pressures shall meet the following additional requirements:

(1) They shall be gas-specific
(2) They shall be pressure-specific where a single gas is piped at more than one operating pressure [e.g., a station outlet for oxygen at 80 psi (550 kPa) shall not accept an adapter for oxygen at 50 psi (345 kPa)].
(3) If operated at a pressure in excess of 80 psi (550 kPa), they shall be either D.I.S.S. connectors or comply with 5.1.4.5(4).
(4) If operated at a gauge pressure between 200 psi and 300 psi (1380 kPa and2070 kPa), the station outlet shall be designed so as to prevent the removal of the adapter until the pressure has been relieved to prevent the adapter injuring the user or others when removed from the outlet.

5.1.4.6

WAGD networks shall provide a WAGD inlet in all locations where halogenated anesthetic gas is intended to be administered.

5.1.4.6.1

Station inlets for WAGD service shall have the following additional characteristics:

(1) They shall not be interchangeable with any other systems, including medical–surgical vacuum.
(2) Components necessary for the maintenance of WAGD specificity shall be legibly marked to identify them as components of a WAGD inlet.
(3) They shall be of a type appropriate for the flow and vacuum level required by the facility's gas anesthetic machines.
(4) They shall be located to avoid physical damage to the inlet.

5.1.5 Medical Gas 1 and Medical Gas 2 Warning Systems.

5.1.5.1 General.

All master, area, and local alarm systems used for medical gas and vacuum systems shall include the following:

(1) Separate visual indicators for each condition monitored, except as permitted for local alarms that are displayed on master alarm panels
(2) Means to indicate a lamp or LED failure and audible failure
(3) Visual and audible indication that the communication with an alarm-initiating device is disconnected
(4) Labeling of each indicator, indicating the condition monitored
(5) Labeling of each alarm panel for its area of surveillance
(6) Reinitiation of the audible signal if another alarm condition occurs while the audible alarm is silenced
(7) Power for master, area alarms, sensors, and switches from the emergency power system.
(8) Communication devices that do not use electrical wiring for signal transmission will be supervised such that failure of communication shall initiate an alarm.

5.1.5.2 Master Alarms.

A master alarm system shall be provided to monitor the operation and condition of the source of supply and the pressure in the main lines of each medical gas and vacuum piping system.

5.1.5.2.1

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

(1) Alarm indication when the pressure in the main line of each separate medical gas system increases 20 percent or decreases 20 percent from the normal operating pressure
(2) Alarm indication when the medical–surgical vacuum pressure in the main line of each vacuum system drops to or below 12 in. (300 mm) gauge HgV
(3) WAGD low alarm when the WAGD vacuum level or flow is below effective operating limits

5.1.6 Medical Gas 1 and Medical Gas 2 Distribution.

5.1.6.1 Piping Materials for Field Installed Positive Pressure Medical Gas Systems.

5.1.6.1.1

Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service by the manufacturer prior to installation in accordance with the mandatory requirements of CGA G-4.1, Cleaning Equipment for Oxygen Service, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

5.1.6.1.2

Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation.

5.1.6.1.3

Fittings, valves, and other components shall be delivered sealed and labeled and kept sealed until prepared for installation.

5.1.6.1.4*

Tubes shall be hard-drawn seamless copper in accordance with ASTM B 819, Standard Specification for Seamless Copper Tube for Medical Gas Systems, medical gas tube, Type L, except Type K shall be used where operating pressures are above a gauge pressure of 185 psi (1275 kPa) and the pipe sizes are larger than NPS 3 (3 1⁄8 in. O.D.)(DN80).

A.5.1.6.1.4

Operation of piped medical gas systems at gauge pressures in excess of 185 psi (1275 kPA) involves certain restrictions because of the limitations in materials.

5.1.6.1.5

ASTM B819, Standard Specification for Seamless Copper Tube for Medical Gas Systems, medical gas tube shall be identified by the manufacturer's markings "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue (Type L) or green (Type K).

5.1.6.1.6

The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of 5.1.6.1.1.

5.1.6.2 Piping Materials for Field Installed Medical–Surgical Vacuum and WAGD Systems.

5.1.6.2.1 Tubes for Vacuum.

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

(1) Hard-drawn seamless copper tube in accordance with the following:
   (a) ASTM B 88, Standard Specification for Seamless Copper Water Tube, copper tube (Type K, Type L, or Type M)
   (b) ASTM B 280, Standard Specification for Seamless Copper Tubing for Air Conditioning and Refrigeration Field Service, copper ACR tube
   (c) ASTM B 819, 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 A 269 TP304L or 316L, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
(b) ASTM A 312 TP304L or 316L, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
(c) A312 TP 304L/316L, Sch. 5S pipe, and A403WP304L/316L, Sch. 5S fittings

5.1.6.3 Prohibited Joints.

The following joints shall be prohibited throughout medical gas and vacuum distribution pipe-line systems:

(1) Flared and compression-type connections, including connections to station outlets and inlets, alarm devices, and other components
(2) Other straight-threaded connections, including unions
(3) Pipe-crimping tools used to permanently stop the flow of medical gas and vacuum piping
(4) Removable and nonremovable push-fit fittings that employ a quick assembly push fit connector

5.1.6.4 Installation of Piping and Equipment.

5.1.6.4.1 Pipe Sizing.

5.1.6.4.1.1

Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures.

5.1.6.4.1.2

Mains and branches in medical gas piping systems shall be not less than NPS 1⁄2(5⁄8 in. O.D.) (DN15) size.

5.1.6.4.1.3

Mains and branches in medical–surgical vacuum systems shall be not less than NPS 3⁄4 (7⁄8 in. O.D.) (DN20) size.

5.1.6.4.1.4

Drops to individual station outlets and inlets shall be not less than NPS 1⁄2 (5⁄8 in. O.D.) (DN15) size.

5.1.6.4.1.5

Runouts to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to be NPS 1⁄4 (3⁄8 in. O.D.) (DN8) size.

5.1.6.4.2 Protection of Piping.

Piping shall be protected against freezing, corrosion, and physical damage.

5.1.6.4.2.1

Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be protected.

5.1.6.4.2.2

Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

5.1.6.4.3 Location of Piping.

5.1.6.4.3.1

Piping risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

5.1.6.4.3.2

Piping shall not be installed in kitchens, elevator shafts, elevator machine rooms, areas with open flames, and areas prohibited under NFPA70.

5.1.6.4.4 Pipe Support.

5.1.6.4.4.1

Piping shall be supported from the building structure.

5.1.6.4.4.2

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.

5.1.6.4.4.3

Supports for copper tube shall be sized for copper tube.

5.1.6.4.4.4

In potentially damp locations, copper tube hangers or supports that are in contact with the tube shall be plastic-coated or otherwise be electrically insulated from the tube by a material that will not absorb moisture.

5.1.6.4.4.5

Maximum support spacing shall be in accordance with Table 5.1.10.11.4.5 (change to Table 5.1.6.4.4.5 throughout).

Table 5.1.10.11.4.5 Maximum Pipe Support Spacing

Pipe Size	Hanger Spacing	
	mm	ft
DN8 (NPS ¼) (⅜ in. O.D.)	1520	5
DN10 (NPS ⅜) (½ in. O.D.)	1830	6
DN15 (NPS ½) (⅝ in. O.D.)	1830	6
DN20 (NPS ¾) (⅞ in. O.D.)	2130	7
DN25 (NPS 1) (1⅛ in. O.D.)	2440	8
DN32 (NPS 1¼) (1⅜ in. O.D.)	2740	9
DN40 (NPS 1½) (1⅝ in. O.D.) and larger	3050	10
Vertical risers, all sizes, every floor, but not to exceed	4570	15

5.1.6.4.4.6

Where required, medical gas and vacuum piping shall be seismically restrained against earthquakes in accordance with the applicable building code.

5.1.6.4.5 Prohibited System Interconnections.

5.1.6.4.5.1

Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing, or any other reason, except as permitted by 5.1.6.4.5.2.

5.1.6.4.5.2

Medical gas and vacuum systems with the same contents shall be permitted to be interconnected with an in-line valve installed between the systems.

5.1.6.4.5.3

Leak testing shall be accomplished by separately charging and testing each individual piping system.

5.1.6.4.6 Manufacturer's Instructions.

5.1.6.4.6.1

The installation of individual components shall be made in accordance with the instructions of the manufacturer.

5.1.6.4.6.2

Manufacturer's instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper operation, testing, and maintenance of the medical gas and vacuum systems.

5.1.6.4.6.3

Copies of the manufacturer's instructions shall be left with the system owner.

5.1.6.4.7 Qualification of Installers.

5.1.6.4.7.1

The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in performing such installations, including all personnel who actually install the piping system.

5.1.6.4.7.2

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, Professional Qualification Standard for Medical Gas Systems Installers.

5.1.7* Labeling, Identification, and Operating Pressure.

Color and pressure requirements shall be in accordance with Table 5.1.11 (Change to Table 5.1.7 throughout).

A.5.1.7

It is recommended that the facility's normal operating pressure of nitrous oxide be initially set and continually maintained at least 5 psig (34.5 kPag) below the normal operating pressures of the oxygen and medical air.

5.1.7.1 Pipe Labeling.

5.1.7.1.1

Piping shall be labeled by stenciling or adhesive markers that identify the medical gas, WAGD piping, or the vacuum system and include the following:

(1) Name of the gas or vacuum system or the chemical symbol per Table 5.1.11
(2) Gas or vacuum system color code per Table 5.1.11

5.1.7.1.2

Pipe labels shall be located as follows:

(1) At intervals of not more than 20 ft (6.1 m)
(2) At least once in or above every room
(3) On both sides of walls or partitions penetrated by the piping
(4) At least once in every story height traversed by risers

5.1.7.1.3

Medical gas piping shall not be painted.

5.1.7.2 Shutoff Valves.

5.1.7.2.1

Shutoff valves shall be identified with the following:

(1) Name or chemical symbol for the specific medical gas or vacuum system
(2) Room or areas served
(3) Caution to not close or open the valve except in emergency

Table 5.1.11 Standard Designation Colors and Operating Pressures for Gas and Vacuum Systems

Gas Service	Abbreviated Name	Colors (Background/ Text)	Standard Gauge Pressure	
			kPa	psi
Medical air	Med air	Yellow/black	345–380	50–55
Carbon dioxide	CO_2	Gray/black or gray/white	345–380	50–55
Helium	He	Brown/white	345–380	50–55
Nitrogen	N_2	Black/white	1100–1275	160–185
Nitrous oxide	N_2O	Blue/white	345–380	50–55
Oxygen	O_2	Green/white or white/green	345–380	50–55
Oxygen/carbon dioxide mixtures	$O_2/CO_2 n\%$ (n = % of CO_2)	Green/white	345–380	50–55
Medical–surgical vacuum	Med vac	White/black	380 mm to 760 mm (15 in. to 30 in.) HgV	
Waste anesthetic gas disposal	WAGD	Violet/white	Varies with system type	
Other mixtures	Gas A%/Gas B%	Colors as above Major gas for background/minor gas for text	None	
Nonmedical air (Category 3 gas-powered device)		Yellow and white diagonal stripe/black	None	
Nonmedical and Category 3 vacuum		White and black diagonal stripe/black boxed	None	
Laboratory air		Yellow and white checkerboard/black	None	
Laboratory vacuum		White and black checkerboard/black boxed	None	
Instrument air		Red/white	1100–1275	160–185

5.1.7.3 Station Outlets and Inlets.

5.1.7.3.1

Station outlets and inlets shall be identified as to the name or chemical symbol for the specific medical gas or vacuum provided.

5.1.7.3.2

Where medical gas systems operate at pressures other than the standard gauge pressure of 50 psi to 55 psi (345 kPa to 380 kPa) or a gauge pressure of 160 psi to 185 psi (1100 kPa to 1275 kPa) for nitrogen, the station outlet identification shall include the nonstandard operating pressure in addition to the name of the gas.

5.1.7.4 Alarm Panels.

5.1.7.4.1

Labeling of alarm panels for each indicator shall indicate the condition monitored and its area of surveillance.

5.1.8* Performance Criteria and Testing — Medical Gas 1 and Medical Gas 2 (Gases, Medical–Surgical Vacuum, and WAGD).

A.5.1.8

All testing should be completed before putting a new piping system, or an addition to an existing system, into service. Test procedures and the results of all tests should be made part of the permanent records of the facility of which the piping system forms a part. They should show the room and area designations, dates of the tests, and names(s) of the person(s) conducting the tests.

5.1.8.1 General.

5.1.8.1.1

Inspection and testing shall be performed on all new piped gas systems, additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that all applicable provisions of this document have been adhered to and system integrity has been achieved or maintained.

5.1.8.1.2

Inspection and testing shall include all components of the system, or portions thereof, including, but not limited to, gas bulk source(s); manifolds; compressed air source systems (e.g., compressors, dryers, filters, regulators); source alarms and monitoring safeguards; master alarms; pipelines; isolation valves; area alarms; zone valves; and station inlets (vacuum) and outlets (pressure gases).

5.1.8.1.3

All systems that are breached and components that are subject to additions, renovations, or replacement (e.g., new gas sources: bulk, manifolds, compressors, dryers, alarms) shall be inspected and tested.

5.1.8.1.4

Systems shall be deemed breached at the point of pipeline intrusion by physical separation or by system component removal, replacement, or addition.

5.1.8.1.5

Breached portions of the systems subject to inspection and testing shall be confined to only the specific altered zone and components in the immediate zone or area that is located upstream for vacuum systems and downstream for pressure gases at the point or area of intrusion.

5.1.8.1.6

The inspection and testing reports shall be submit-ted directly to the party that contracted for the testing, who shall submit the report through channels to the responsible facility authority and any others that are required.

5.1.8.1.7

Reports shall contain detailed listings of all findings and results.

5.1.8.2 Installer-Performed Tests.

5.1.8.2.1 General.

5.1.8.2.1.1

The tests required by 5.1.8.2 shall be performed and documented by the installer prior to the tests listed in 5.1.8.3.

5.1.8.2.1.2

The test gas shall be oil-free, dry nitrogen NF (National Formulary).

5.1.8.2.1.3

Where manufactured assemblies are to be installed, the tests required by 5.1.8.2 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) At all station outlets/inlets on installed manufactured assemblies supplied through copper tubing

5.1.8.2.2 Initial Piping Blowdown.

Piping in medical gas 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, source equipment).

5.1.8.2.3 Initial Pressure Test.

5.1.8.2.3.1

Each section of the piping in medical gas and vacuum systems shall be pressure tested.

5.1.8.2.3.2

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, line pressure relief valves)

5.1.8.2.3.3

The source shutoff valve shall remain closed during the tests.

5.1.8.2.3.4

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 150 psi (1035 kPa).

5.1.8.2.3.5

Leaks, if any, shall be located, repaired (if permitted), replaced (if required), and retested.

5.1.8.2.4 Initial Cross-Connection Test.

It shall be determined that no cross-connections exist between the various medical gas and vacuum piping systems.

5.1.8.2.4.1

All piping systems shall be reduced to atmospheric pressure.

5.1.8.2.4.2

Sources of test gas shall be disconnected from all piping systems, except for the one system being tested.

5.1.8.2.4.3

The system under test shall be charged with oil-free, dry nitrogen NF to a gauge pressure of 345 kPa (50 psi).

5.1.8.2.4.4

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 being dispensed only from the piping system being tested.

5.1.8.2.5 Initial Piping Purge Test.

The outlets in each medical gas piping system shall be purged to remove any particulate matter from the distribution piping.

5.1.8.2.5.1

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.

5.1.8.2.5.2

The purging shall be started at the closest outlet/inlet to the zone valve and continue to the furthest outlet/inlet within the zone.

5.1.8.2.6 Standing Pressure Test for Positive Pressure Medical Gas Piping.

After successful completion of the initial pressure tests, medical gas distribution piping shall be subject to a standing pressure test.

5.1.8.2.6.1

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, hose).

5.1.8.2.6.2

The source valve shall be closed during this test.

5.1.8.2.6.3

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

5.1.8.2.6.4

Test pressures shall be 20 percent above the normal system operating line pressure.

5.1.8.2.6.5*

At the conclusion of the tests, there shall be no change in the test pressure except that attributed to specific changes in ambient temperature.

A.5.1.8.2.6.5

See A.5.1.8.2.7.5

5.1.8.2.6.6

Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and retested.

5.1.8.2.7 Standing Vacuum Test for Vacuum Piping.

After successful completion of the initial pressure tests, vacuum distribution piping shall be subjected to a standing vacuum test.

5.1.8.2.7.1

Tests shall be conducted after installation of all components of the vacuum system.

5.1.8.2.7.2

The piping systems shall be subjected to a 24-hourstanding vacuum test.

5.1.8.2.7.3

Test pressure shall be between 12 in. (300 mm) HgV and full vacuum.

5.1.8.2.7.4

During the test, the source of test vacuum shall be disconnected from the piping system.

5.1.8.2.7.5*

At the conclusion of the test, there shall be no change in the vacuum other than that attributed to changes of ambient temperature.

A.5.1.8.2.7.5

The effect of temperature changes on the vacuum of a confined gas is based on the Ideal Gas Law. The final absolute vacuum (V2a) equals the initial absolute vacuum (V1a) times the final absolute temperature (T2a), di-vided by the initial absolute temperature (T1a).

Absolute vacuum is the absolute zero pressure 101 kPa(30 inHg) less the vacuum reading below atmospheric. See Table A.5.1.12.2.6.5 for the absolute atmospheric pressures for elevations at and above sea level.

Absolute temperature K (°R) is the temperature gauge reading °C (°F) plus the absolute zero temperature 273°C(460°F).

Examples of vacuum test data at sea level in SI and IP units follow.

The initial test vacuum is 54 kPa or 16 inHg at 18°C (65°F). A temperature increase to 27°C (80°F) will cause the test vacuum to decrease to 52.5 kPa (15.6 inHg).

For SI units:

V1g = 54 kPa, T1g = 18°C, T2g = 27°C

V1a = 101 – 54 = +47 kPaV

T1a = 18 + 273 = 291K

T2a = 27 + 273 = 300K

V2a = 47 × 300/291 = +48.5 kPaV

V2g = 101 – 48.5 = 52.5 kPa

For IP units:

V1g = 16 inHg, T1g = 65°F, T2g = 80°F

V1a = 30 – 16 = +14 inHgV

T1a = 65 + 460 = 525°R

T2a = 80 + 460 = 540°R

V2a = 14 × 540/525 = +14.4 inHgV

V2g = 30 – 14.4 = 15.6 inHg

Table A.5.1.12.2.6.5 Pressure Corrections for Elevation

Elevation	Absolute Atmospheric Pressure			
(ft)	kPa	psia	mmHg	inHg
0	101.33	14.70	760.0	29.92
500	99.49	14.43	746.3	29.38
1000	97.63	14.16	733.0	28.86
1500	95.91	13.91	719.6	28.33
2000	94.19	13.66	706.6	27.82
2500	92.46	13.41	693.9	27.32
3000	90.81	13.17	681.2	26.82
3500	89.15	12.93	668.8	26.33
4000	87.49	12.69	656.3	25.84
4500	85.91	12.46	644.4	25.37
5000	84.33	12.23	632.5	24.90

5.1.8.2.7.7

Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and retested.

5.1.8.3 System Verification.

5.1.8.3.1 General.

5.1.8.3.1.1

Verification tests shall be performed only after all tests required in 5.1.8.2, Installer Performed Tests, have been completed.

5.1.8.3.1.2

The test gas shall be oil-free, dry nitrogen NF or the system gas where permitted.

5.1.8.3.1.3

Testing shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum pipeline testing and meeting the requirements of ASSE 6030, Professional Qualifications Standard for Medical Gas Systems Verifiers.

5.1.8.3.1.4

Testing shall be performed by a party other than the installing contractor.

5.1.8.3.2 Alarm Test.

5.1.8.3.2.1 General.

(A) All warning systems for each medical gas and vacuum system(s) shall be tested to ensure that all components function properly prior to placing the system in service.
(B) Permanent records of these tests shall be maintained.
(C) Warning systems that are part of an addition to an existing piping system shall be tested prior to the connection of the new piping to the existing system.

5.1.8.3.2.2 Master Alarms.

(A) The master alarm system tests shall be performed foreach of the medical gas and vacuum piping systems.
(B) Permanent records of these tests shall be maintained.
(C) The audible and noncancelable visual signals shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.
(D) The operation of all master alarm signals referenced in 5.1.5.2.1 shall be verified.

5.1.8.3.3 Piping Purge Test.

In order to remove any traces of particulate matter deposited in the pipelines as a result of construction, a heavy, intermittent purging of the pipeline shall be done.

5.1.8.3.3.1

The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates of at least 8 SCFM (225 Nl/min) shall be put on each outlet.

5.1.8.3.3.2

After the 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.

5.1.8.3.3.3

In order to avoid possible damage to the outlet and its components, this test shall not be conducted using any implement other than the proper adapter.

5.1.8.3.4 Medical Air Compressor Systems.

(A) Tests of the medical air compressor system shall include the purity test for air quality, and the test of the alarm sensors after calibration and setup per the manufacturer's instructions, as well as lead-lag controls.
(B) Tests shall be conducted at the sample port of the medical air system.
(C) The operation of the system control sensors, such as dewpoint, air temperature, and all other air quality monitoring sensors and controls, shall be checked for proper operation and function before the system is put into service.
(D) The quality of medical air as delivered by the compressor air supply shall be verified after installation of new components prior to use by veterinary patients.
(E) The air quality tests shall be conducted after the medical air source system has been operating normally but with the source valve closed under a simulated load for an elapsed time of at least 12 hours.

5.1.8.3.5 Medical–Surgical Vacuum Systems.

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

5.1.9*Medical Gas 1 and Medical Gas 2 Operation and Management.

A.5.1.9

All cylinders containing compressed gases, such as anesthetic gases, oxygen, or other gases used for medicinal purposes, whether these gases are flammable or not, should comply with the specifications and be maintained in accordance with regulations of the U.S. Department of Transportation.

Cylinder and container temperatures greater than 125°F (52°C) can result in excessive pressure increase. Pressure relief devices are sensitive to temperature and pressure. When relief devices actuate, contents are discharged.

5.1.9.1 Special Precautions—Patient Gas, Vacuum, WAGD, and Medical Support Gas Systems.

5.1.9.1.1*

Piping systems shall not be used for the distribution of flammable anesthetic gases.

A.5.1.9.1.1

Piping systems for the distribution of flammable gases (e.g., hydrogen, acetylene, natural gas) are outside the scope of this chapter.

5.1.9.1.2

Piping systems shall not be used as a grounding electrode.

5.1.9.1.3*

Liquid or debris shall not be introduced into the medical–surgical vacuum or WAGD systems for disposal.

A.5.1.9.1.3

Vacuum systems from station inlets to the exhaust discharge should be considered contaminated unless prove otherwise. Methods exist to disinfect the system or portions thereof.

Clogging of regulators, for example, with lint, debris, or dried body fluids, reduces vacuum system performance

5.1.9.1.4*

The medical–surgical vacuum and WAGD systems shall not be used for nonmedical applications.

A.5.1.9.1.4

Other examples of prohibited use of medical surgical vacuum would be scope cleaning, decontamination, and laser plume.

5.1.9.2 Maintenance of Medical Gas, Vacuum, WAGD, and Medical Support Gas Systems.

5.1.9.2.1*General.

Animal care facilities with installed medical gas, vacuum, WAGD, or medical support gas systems, or combinations thereof, shall develop and document periodic maintenance programs for these systems and their subcomponents as appropriate to the equipment installed.

A.5.1.9.2.1

The facility should retain a written or an electronic copy of all findings and any corrections performed.

5.1.9.3 Medical Gas and Vacuum Systems Information and Warning Signs.

5.1.9.3.1

The gas content of medical gas and vacuum piping systems shall be labeled in accordance with 5.1.7.1.

5.1.9.3.2

Labels for shutoff valves shall be in accordance with 5.1.7.2 and updated when modifications are made changing the areas served.

5.1.9.3.3

Station inlets and outlets shall be identified in accordance with 5.1.7.3.

5.1.9.4 Medical Gas and Vacuum Systems Maintenance and Record Keeping.

5.1.9.4.1

Permanent records of all tests required shall be maintained in the organization's files.

5.1.9.4.2

Central supply systems for nonflammable medical gases shall conform to the following:

(1) They shall be inspected annually.
(2) They shall be maintained by a qualified representative of the equipment owner.
(3) A record of the annual inspection shall be available for review by the authority having jurisdiction.

5.1.9.4.3

Whenever modifications are made that breach the pipeline, the installer and verification tests specified in this Code shall be conducted on the downstream portions of the medical gas piping system.

5.1.9.4.4

Audible and visual alarm indicators shall meet the following requirements:

(1) They shall be periodically tested to determine that they are functioning properly.
(2) Records of the test shall be maintained until the next test is performed.

References in Mandatory Sections:

2.3.XX ASSE Publications.

American Society of Sanitary Engineering, 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448.

ASSE 6010, *Professional Qualifications Standard for Medical Gas Systems Installers*, 2021.

ASSE 6030, *Professional Qualifications Standard for Medical Gas Systems Verifiers*, 2021.

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, 2022.

ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2022a. ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2022.

ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2020.

ASTM B819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems*, 2019.

2.3.XX CGA Publications.

Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-2923.

CGA G-4.1, *Cleaning Equipment for Oxygen Service*, 2018.

2.3.XX MSS Publications.

Manufacturer's Standardization Society (MSS) of the Valve and Fittings Industry, 127 Park Street NE, Vienna, VA 22180-4602.

MSS SP-58, *Pipe Hangers and Supports — Materials, Design, Manufacture, Selection, Application, and Installation*, 2018.

ANNEX References

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2023 edition.

2.3.10 CGA Publications.

Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-2923.

CGA G-8.1, *Standard for Nitrous Oxide Systems at Customer Sites*, 2013.

Committee Input No. 4-NFPA 150-2022 [Section No. 1.3.1]

1.3.1*

This *Code* shall apply to animal housing facilities that are subject to local, state, or federal licensing or permitting requirements, including, but not limited to, the following:

(1) Animal hospitals and veterinary facilities

(2) Barns and stables

(3) Laboratories

(4) Animal shelters and adoption centers including intake facilities and animal control

(5) Zoos, special amusement parks, and traveling exhibitions

(6) General board and care facilities including daycare, training, breeding and grooming

(7) Agricultural facilities

(8) Emergency facilities

(9) Animal sanctuaries and long term animal rehabilitation facilities

(10) Animal transportation and transportation holding facilities

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 15:05:24 EDT 2022

Committee Statement

Committee Statement: More examples are needed to define and explain the intent behind these categories so they are not excluded. This may be better in an annex note or explained further in the definitions or Ch 6 sections.

Response Message: CI-4-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 5-NFPA 150-2022 [Section No. 1.3.3]

1.3.3*

This *Code* shall also apply to existing facilities where any one of the following conditions applies:

(1) A change of use or occupancy classification occurs where animals are introduced.

(2) A change is made in the category or quantity of the animals housed.

(3) A facility undergoes rehabilitation that is classified by Chapter 43 of NFPA *101* as a modification, reconstruction, addition, or change of use or occupancy classification.

(4) A building or structure with an animal housing facility is relocated.

(5) A building with an animal housing facility is considered damaged, unsafe, or a fire hazard.

(6) A property line that affects compliance with any provision of this *Code* is created or relocated.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 15:12:56 EDT 2022

Committee Statement

Committee Statement: When a change to the quantity of animals occurs, the code requirements should be reviewed. Increasing the number of animals may impact the required safety features.

Response Message: CI-5-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 12-NFPA 150-2022 [Section No. 3.3.5.1]

3.3.5.1– * Category 1 — Animal Health Care.

Animal housing facilities used for short-term care, maintenance, or medical attention of animals.

A.3.3.5.1 Examples include veterinary hospitals, veterinary clinics, portions of zoos and animal shelters that include clinics and veterinary services.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:12:00 EDT 2022

Committee Statement

Committee Statement: More examples are needed to help users of the code. These examples need to be coordinated with the examples in the annex of Ch 6.

Response Message: CI-12-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 13-NFPA 150-2022 [Section No. 3.3.5.9]

3.3.5.9– * Category 5 — Exhibition/Public Viewing.

Facilities that allow public access for the purpose of exhibition or public viewing of animals.

A.3.3.5.9 Examples include circuses, traveling animal exhibits, animal transportation, and public portions of zoos.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:13:46 EDT 2022

Committee Statement

Committee Statement: More examples are needed to help users of the code. These examples need to be coordinated with the examples in the annex of Ch 6.

Response Message: CI-13-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 14-NFPA 150-2022 [Section No. 3.3.5.12]

3.3.5.12– * _ Category 6 — General Board and Care.

Facilities used for temporary or permanent housing of animals used for providing a service or participating in a sport or for the purposes of providing general board and care.

A.3.3.5.12 Examples include animal shelters and adoption centers, companion animal intake and animal control facilities, animal kennels and boarding facilities, breeding facilities, animal daycare and training facilities, companion animal grooming facilities, animal sanctuaries and rehabilitation facilities, and animal transportation holding facilities.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:20:56 EDT 2022

Committee Statement

Committee Statement: More examples are needed to help users of the code. These examples need to be coordinated with the examples in the annex of Ch 6.

Response Message: CI-14-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 16-NFPA 150-2022 [New Section after 7.8.2]

7.9 Medical Gas

Medical gas installations shall comply with NFPA 99.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:26:39 EDT 2022

Committee Statement

Committee Statement: Medical gas requirements create a conflict since NFPA 99 specifically excludes veterinary facilities in the scope. Careful review should be given to determine what standard is appropriate for reference and where this requirement should go- Ch 7 or Ch 9. A task group was developed to look closer at medical gas requirements.

Response Message: CI-16-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 15-NFPA 150-2022 [Section No. 8.2.1.1]

8.2.1.1 Minimum Width of Doors.

The clear width of any door opening in a means of egress shall not be less than the following:

(1) ~~32 in~~ 36 in . (815 mm)

(2) * One-and-one-half times the largest average width of the following:

(3) Largest animal using the door

(4) Any associated equipment necessary for egress

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:24:54 EDT 2022

Committee Statement

Committee Statement: Consideration should be given to egress of large animals in crates. Typical large dog crates do not fit through a 32" clear width. Clarity is needed to determine if the clear width of 36" is truly required or if a door leaf of 36" is required.

Response Message: CI-15-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 3-NFPA 150-2022 [Section No. 9.14]

9.14 Utilities.

9.14.1

Equipment using fuel gas and related gas piping shall be in accordance with NFPA 54 or NFPA 58. *(See Chapter 69 of NFPA 1 for LP-Gas fuel supply and storage installations.)* [**1:**11.4]

9.14.2 Ventilation Requirements.

Ventilation shall be provided in accordance with ASHRAE 62.1, Ventilation and Acceptable Indoor Air Quality.

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 15:02:34 EDT 2022

Committee Statement

Committee Statement: Ventilation can impact fire protection and health/safety of animal/human occupants. ASHRAE 62.1 contains guidance for ventilation. Further information is required to determine if requiring compliance with this document is required or appropriate.

Response Message: CI-3-NFPA 150-2022

Ballot Results

This item has not been balloted

Committee Input No. 17-NFPA 150-2022 [Section No. 17.2]

17.2 Means of Egress Requirements.

17.2.1* General.

17.2.1.1 Each required means of egress shall be in accordance with Section 17.2 and the applicable sections of Chapter 8.

17.2. 1. 2 Where compliance with 17.2 and applicable sections of Chapter 8 cannot be met in Limited Access Structures or portion of a structure, Emergency Access openings shall be permitted in accordance with 17.2.2.5. and 17.2.2.6.

17.2.2 * Arrangement of Means of Egress.

17.2.2.1

The maximum travel distance to an exit shall not exceed 300 ft (91 m).

17.2.2.2

Where the calculated human occupant load is less than 30, the common path of travel shall not exceed 100 ft (30 m).

17.2.2.3

Dead-end corridors shall not exceed 50 ft (15 m).

17.2.2.4

The common path of travel shall not exceed 75 ft (22.8 m).

17.2.2.5 One story structures shall have finished ground level doors or emergency access openings in accordance with 17.2.2.6 on two sides of the structure spaced not more than 125 ft. (38m) on the exterior walls

17.2.2.6* Emergency access openings shall consist of a window, panel or similar opening that complies with the following:

(1) The opening shall have dimensions not less than 32 in (81 cm) width and 32 in (81 cm) in height and shall be unobstructed to allow for ventilation and rescue from the exterior

(2) The bottom of the opening shall not be more than 44 in (1120mm) above the floor

(3) The opening shall be readily identifiable from both the exterior and the interior

(4) Signage on the occupied side that clearly indicates “Emergency Exit Only”

(5) Glazing with a minimum size of 9 in. x 9 in. centered on the door leaf

(6) Single latch releasing mechanism on the occupied side not more than 60” above floor elevation

(7) The opening shall be openable from the exterior and interior

A.17.2.2.6 It is not the intent that emergency access opening be readily openable from the exterior by the public but that they be openable with normal firefighting equipment

Submitter Information Verification

Committee: ASF-AAA

Submittal Date: Wed Sep 14 17:30:31 EDT 2022

Committee Statement

Committee Statement: The purpose of this proposed language is to allow for greater use of Emergency Access Openings in animal agriculture buildings to provide a greater number and availability of emergency egress options. The proposed language is similar to the language in NFPA 101 emergency access openings. Further research is required to evaluate how this change will impact the design and safety of agricultural facilities.

Response Message: CI-17-NFPA 150-2022

Ballot Results

This item has not been balloted