

NFPA 99-Proposed 2012 Edition

Standard for Health Care Facilities

TIA Log No. 1032

Reference: Chapter 9 (New)

Comment Closing Date: July 20, 2011

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1. Add a new Chapter 9 to read as follows:

Chapter 9 Heating, Ventilation, and Air Conditioning (HVAC)

9.1 Applicability.

9.1.1 This chapter shall apply to construction of new health care facilities, except as noted in 9.1.2 and 9.1.3.

9.1.2 This chapter shall also apply to the altered, renovated, or modernized portions of existing systems or individual components.

9.1.3 Existing construction or equipment shall be permitted to be continued in use when such use does not constitute a distinct hazard to life.

9.1.4 Definitions.

9.1.4.1 Ventilation. The mechanical or natural movement of air.

9.2* System Category Criteria. The health care facility's governing body that has the responsibility for the building system components as identified in this chapter shall designate, in accordance with the function of each space, building system categories in accordance with Sections 4.1 and 4.2.

9.2.1* The category of risk applied to each HVAC system serving a space shall be independent of the category of risk applied to other systems serving that same space.

9.3 General.

9.3.1 Heating, Cooling, Ventilating, and Process Systems.

9.3.1.1 Heating, cooling, ventilating, and process systems serving spaces or providing health care functions covered by this code or listed within ASHRAE 170 shall be provided in accordance with ASHRAE 170.

9.3.1.2 Laboratories shall comply with NFPA 45.

9.3.2 Energy Conservation. Heating, cooling, and ventilating systems serving spaces or providing health care functions covered by this code shall comply with ASHRAE 90.1 or another locally adopted energy code.

9.3.3 Commissioning.

9.3.3.1 Heating, cooling, ventilating, and process systems serving spaces or providing health care functions covered by this code shall be commissioned in accordance with ASHRAE 90.1.

9.3.3.2 Commissioning shall follow ASHRAE Guidelines 0 and 1 or any other publically reviewed document acceptable to the authority having jurisdiction.

9.3.4 Piping. Heating, cooling, ventilating, and process systems serving spaces or providing health care functions covered by this code shall utilize piping systems complying with ASME standards.

9.3.5 Ductwork. Heating, cooling, ventilating, and process systems serving spaces or providing health care functions covered by this code shall utilize ductwork systems complying with SMACNA standards.

9.3.6 Acoustics. Heating, cooling, ventilating, and process systems serving spaces or providing health care functions covered by this code shall not exceed noise criteria for specific spaces as listed in the ASHRAE handbook.

9.3.7 Medical Gas Storage or Transfilling.

9.3.7.1 All gases, other than medical gases, shall be provided with ventilation per NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

9.3.7.2 Outdoor storage/installations for medical gases and cryogenic fluids shall be provided with ventilation per NFPA 55, *Compressed Gases and Cryogenic Fluids Code*.

9.3.7.3* Medical gases and cryogenic fluids that are in use per Chapter 11 shall not require special ventilation.

9.3.7.4 Transfilling area shall be provided with ventilation in accordance with NFPA 55.

9.3.7.5 Indoor storage or manifold areas and storage or manifold buildings for medical gases and cryogenic fluids shall be provided with natural ventilation or mechanical exhaust ventilation in accordance with 9.3.7.5.1 through 9.3.7.8.

9.3.7.5.1* For the purposes of this section, the volume of fluid (gas and liquid) to be used in determining the ventilation requirements shall be the volume of the stored fluid when expanded to standard temperature and pressure (STP) of either the largest single vessel in the enclosed space or of the entire volume of the connected vessels that are on a common manifold in the enclosed space, whichever is larger.

9.3.7.5.2 Natural Ventilation.

9.3.7.5.2.1 Natural ventilation shall consist of two nonclosable louvered openings, each having an aggregate free opening area of at least 155 cm²/35 L (24 in.²/1000 ft³) of the fluid designed to be stored in the space and in no case less than 465 cm² (72 in.²).

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

9.3.7.5.2.3 The openings shall be located to ensure cross ventilation.

9.3.7.5.2.4 Natural ventilation openings shall be directly to the outside atmosphere without ductwork.

9.3.7.5.2.5 Mechanical ventilation shall be provided if natural ventilation requirements cannot be met.

9.3.7.5.3 Mechanical Ventilation.

9.3.7.5.3.1 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.

9.3.7.5.3.2 Mechanical exhaust shall be at a rate of 1 L/sec of airflow for each 300 L (1 cfm per 5 ft³ of fluid) designed to be stored in the space and not less than 24 L/sec (50 cfm) nor more than 235 L/sec (500 cfm).

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

9.3.7.5.3.4 Mechanical exhaust air fans shall be supplied with electrical power from the essential electrical system.

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

9.3.7.5.3.6 The exhaust duct material shall be noncombustible.

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

(1) Air shall be permitted to be transferred from adjacent spaces, or from outside the building, or that do not contain combustible or flammable materials via noncombustible ductwork.

(2) Air shall be permitted to be transferred from a corridor under the door up to the greater of 24 L/sec (50 cfm) or 15 percent of the room exhaust in accordance with NFPA 90A.

(3) Supply air shall be permitted to be provided from any building ventilation system that does not contain flammable or combustible vapors.

9.3.7.6 Discharge from the natural and mechanical ventilation systems shall be sited by a minimum separation distance in accordance with NFPA 55.

9.3.7.7 A storage room shall maintain a temperature not greater than 52°C (125°F).

9.3.7.8 A transfer or manifold room shall maintain a temperature not greater than 52°C (125°F) and not less than -7°C (20°F).

9.3.8 Waste Gas.

9.3.8.1 Removal of excess anesthetic gases from the anesthesia circuit shall be accomplished by waste anesthetic gas disposal (WAGD), as described in Chapter 5, or by an active or passive scavenging ventilation system.

9.3.8.1.1 Active Systems. A dedicated exhaust system with an exhaust fan shall be provided to interconnect all of the anesthesia gas circuits to provide sufficient airflow and negative pressure in the gas disposal tubing so that cross contamination does not occur in the other circuits connected to the system.

9.3.8.1.2 Passive Systems.

9.3.8.1.2.1 A dedicated exhaust system with an exhaust fan shall be provided to exhaust snorkels at all of the anesthesia gas circuits to provide sufficient airflow to capture the gases, vapors, and particles expelled from the gas disposal tubing.

9.3.8.1.2.2 The snorkel shall include a minimum 25.4-mm (1-in.) diameter tubing connected to the exhaust system.

9.3.8.2 All the exhausted air shall be vented to the external atmosphere.

9.3.8.3 The excess anesthetic gases shall be deposited into the exhaust stream either at the exhaust grille or further downstream in the exhaust duct.

9.3.9 Medical Plume Evacuation. Plumes from medical procedures including the use of lasers shall be captured by one of the following methods:

(1) Direct connection to a unfiltered dedicated exhaust system that discharges outside the building

(2) HEPA filtering and direct connection to a return or exhaust duct

(3) Chemical and thermal sterilization and return to the space

9.3.10 Emergency Power System Room.

9.3.10.1 Heating, cooling, and ventilating of the emergency power system shall be in accordance with NFPA 110.

9.3.10.2 Maintenance of Temperature. The EPS shall be heated as necessary to maintain the water jacket temperature determined by the EPS manufacturer for cold start and load acceptance for the type of EPSS. [110:5.3.1]

9.3.10.3 Heating, Cooling, and Ventilating.

9.3.10.3.1* With the EPS running at rated load, ventilation airflow shall be provided to limit the maximum air temperature in the EPS room to the maximum ambient air temperature required by the EPS manufacturer. [110:7.7.1]

- 9.3.10.3.1.1** Consideration shall be given to all the heat rejected to the EPS equipment room by the energy converter, uninsulated or insulated exhaust pipes, and other heat-producing equipment. [110:7.7.1.1]
- 9.3.10.3.2** Air shall be supplied to the EPS equipment for combustion. [110:7.7.2]
- 9.3.10.3.2.1** For EPS supplying Level 1 EPSS, ventilation air shall be supplied directly from a source outside of the building by an exterior wall opening or from a source outside the building by a 2-hour fire-rated air transfer system. [110:7.7.2.1]
- 9.3.10.3.2.2** For EPS supplying Level 1 EPSS, discharge air shall be directed outside of the building by an exterior wall opening or to an exterior opening by a 2-hour fire-rated air transfer system. [110:7.7.2.2]
- 9.3.10.3.2.3** Fire dampers, shutters, or other self-closing devices shall not be permitted in ventilation openings or ductwork for supply or return/discharge air to EPS equipment for Level 1 EPSS. [110:7.7.2.3]
- 9.3.10.3.3** Ventilation air supply shall be from outdoors or from a source outside of the building by an exterior wall opening or from a source outside the building by a 2-hour fire-rated air transfer system. [110:7.7.3]
- 9.3.10.3.4** Ventilation air shall be provided to supply and discharge cooling air for radiator cooling of the EPS when running at rated load. [110:7.7.4]
- 9.3.10.3.4.1** Ventilation air supply and discharge for radiator cooled EPS shall have a maximum static restriction of 125 Pa (0.5 in.) of water column in the discharge duct at the radiator outlet. [110:7.7.4.1]
- 9.3.10.3.4.2** Radiator air discharge shall be ducted outdoors or to an exterior opening by a 2-hour fire rated air transfer switch. [110:7.7.4.2]
- 9.3.10.3.5** Motor operated dampers, when used, shall be spring-operated to open and motor-closed. Fire dampers, shutters, or other self-closing devices shall not be permitted in ventilation openings or ductwork for supply or return/discharge air to EPS equipment for Level 1 EPSS. [110:7.7.5]
- 9.3.10.3.6** The ambient air temperature in the EPS equipment room or outdoor housing containing Level 1 rotating equipment shall be not less than 4.5°C (40°F). [110:7.7.6]
- 9.3.10.3.7** Units housed outdoors shall be heated as specified in 5.3.3 of NFPA 110, *Standard for Emergency and Standby Power Systems*. [110:7.7.7]
- 9.3.10.3.8** Design of the HVAC system for the EPS equipment room shall include provision for factors including, but not limited to, the following:
- (1) Heat
 - (2) Cold
 - (3) Dust
 - (4) Snow and ice accumulations around housings
 - (5) Louvers
 - (6) Remote radiator fans
 - (7) Prevailing winds blowing against radiator fan discharge air [110:7.7.8]
- 9.3.11 Ventilation During Construction.** Ventilation during construction shall be in accordance with *AIA Guidelines for the Design and Construction of Health Care Facilities*.

A.9.2 Table A.9.2 represents a typical analysis for a health care facility. The governing body, or its designate, should complete a system analysis based on its functional program. A table similar to Table A.9.2 can be developed to transfer information from the governing body to designers or authorities having jurisdiction, or both.

Table A.9.2 Category Designation by Function — Heating

Function	Category			
	Heating	Cooling	Ventilating	Process
Airborne infection isolation room	2	2	2	NA
Ambulance garage	NA	NA	3	NA
Biomedical waste holding	2	3	2	2
Bone marrow transplants	2	2	1	NA
Burn patient care rooms	2	2	2	NA
Business office/administration	4	4	4	4
Central sterile room	3	2	2	2
Class A surgical procedures	3	3	2	3
Class B surgical procedures	2	2	2	2
Class C surgical procedures	1	1	1	1
Critical care rooms (Category 1 room)	2	2	2	2
Emergency department trauma room	2	2	2	2
Intensive care	2	2	2	2

Medical-gas storage room	2	2	2	NA
Medical records	4	4	4	4
Morgue	3	3	2	NA
Occupation therapy	4	4	4	4
Oxygen transfilling	2	2	2	NA
PACU	2	2	2	2
Patient education	4	4	4	4
Pharmacy	2	2	2	2
Physical therapy	4	4	4	4
Protective environment room	2	2	2	NA
Radiology	2	2	2	2
Speech therapy	4	4	4	4
Waiting rooms	4	4	4	4

NA: Not applicable

Note: This is a sample table. The numbers represented in this table might not be consistent with the health care facility scenario.

A.9.2.1 There are no interdependencies for each type of system (e.g., medical gas, electrical, potable water, nonpotable water, nonmedical compressed air, plumbing). A risk assessment of each system should be conducted to evaluate the risk to the patient, staff, and visitors. It is possible when applying this section to identify multiple categories of systems serving a single patient. For example see Table A.9.2 and A.4.1.

A.9.3.7.3 Paragraph 9.3.7.3 only covers fluids that are stored in enclosed spaces.

A.9.3.7.5.1 Table A.9.3.7.5.1 shows the cylinder volumes and weights of typical medical gas cylinders.

Table A.9.3.7.5.1 Typical Medical Gas Cylinders' Volume and Weight of Available Contents

[All Volumes at 21.1°C (70°F) and 101.325 kPa (14.696 psi)]

Cylinder Style and Dimensions	Nominal Volume L (in. ³)	Contents	Name of Gas							
			Air	Carbon Dioxide	Helium	Nitrogen	Nitrous Oxide	Oxygen	Mixtures of Oxygen Helium CO ₂	
B 8.89 × 33 cm (3 × 1/2 in. O.D. × 13 in.)	1.43 (87)	kPa (psig)		5778 (838)				13100 (1900)		
		L (ft ³)		370 (13)				200 (7)		
		Kg (lb-oz)		0.68 (1-8)				—		
D 10.8 × 43 cm (4 1/2 in. O.D. × 17 in.)	2.88 (176)	kPa (psig)	13100 (1900)	5778 (838)	11032 (1600)	13100 (1900)	5137 (745)	13100 (1900)	*	*
		L (ft ³)	375 (13)	940 (33)	300 (11)	370 (13)	940 (33)	400 (14)	300 (11)	400 (14)
		Kg (lb-oz)	—	1.73 (3-13)	—	—	1.73 (3-13)	—	*	*
E 10.8 × 66 cm (4 × 1/4 in. O.D. × 26 in.)	4.80 (293)	kPa (psig)	13100 (1900)	5778 (838)	11032 (1600)	13100 (1900)	5137 (745)	13100 (1900)	*	*
		L (ft ³)	625 (22)	1590 (56)	500 (18)	610 (22)	1590 (56)	660 (23)	500 (18)	660 (23)
		kg (lb-oz)	—	2.92 (6-7)	—	—	2.92 (6-7)	—	*	*
M 17.8 × 109 cm (7 in. O.D. × 43 in.)	21.9 (1337)	kPa (psig)	13100 (1900)	5778 (838)	11032 (1600)	15169 (2200)	5137 (745)	15169 (2200)	*	*
		L (ft ³)	2850 (101)	7570 (267)	2260 (80)	3200 (113)	7570 (267)	3450 (122)	2260 (80)	3000 (106)
		Kg (lb-oz)	—	13.9 (30-10)	—	—	13.9 (30-10)	—	*	*
G 21.6 × 130 cm (8 1/2 in. O.D. × 51 in.)	38.8 (2370)	kPa (psig)	13100 (1900)	5778 (838)	11032 (1600)	15169 (2200)	5137 (745)	15169 (2200)	*	*
		L (ft ³)	5050 (178)	12300 (434)	4000 (141)	5000 (176)	13800 (487)	6000 (211)	4000 (141)	5330 (188)
		Kg (lb-oz)	—	22.7 (50-0)	—	—	25.4 (56-0)	—	*	*
H or K 23.5 × 130 cm	43.6 (2660)	kPa (psig)	15169 (2200)	5778 (838)	15169 (2200)	15169 (2200)	5137 (745)	15169† (2200†)	*	*
		L	6550	15840	6000	6400	15800	6900	6000	15840

(9 ¹ / ₄ in. O.D. × 51 in.)	(ft ³)	(231)	(559)	(212)	(226)	(558)	(244)	(212)	(559)
	Kg (lb-oz)	—	29.1 (64)	—	—	29.1 (64)		*	*

Notes: These are computed contents based on nominal cylinder volumes and rounded to no greater variance than ±1%.

* The pressure and weight of mixed gases will vary according to the composition of the mixture.

[†]275 ft³/7800 L cylinders at 2490 psig are available upon request.

Source: *Compressed Gas Association, Inc.*

A.9.3.10.3.1 During operation, EPS and related equipment reject considerable heat that needs to be removed by proper ventilation or air-cooling. In some cases, outdoor installations rely on natural air circulation, but enclosed installations need properly sized, properly positioned ventilation facilities, to prevent recirculation of cooling air. The optimum position of air-supply louvers and radiator air discharge is on opposite walls, both to the outdoors. [110: A.7.7.1]

Submitter’s Substantiation: Chapter 9, Heating, was returned to the committee at the Association Technical Meeting in June 2011. As a result, there was several ventilation requirements that were deleted but existed in the 2005 edition and are considered necessary by the committee. The requirements for ventilation of rooms transferring or transfilling cylinders and containers with oxygen and smoke removal of windowless anesthetizing rooms needs to be added back into the code to make the document more complete. In addition there are other new ventilation requirements that should also be added back into the code and they include system category criteria, generator ventilation, energy conservation, acoustics, commissioning, waste gas, medical plume evacuation and ventilation during construction. It was stated at the Association Technical Meeting, and agreed upon, that in the event of Chapter 9 being returned, the committee would process a TIA to bring back the necessary language that the committee felt was not controversial and would make the document a more useable code.

Emergency Nature: It is important to process the following TIA immediately to correct an omission as NFPA 99 will be incomplete without the requirements for ventilation and HVAC systems in a health care facility. Health care facilities depend on the requirements of NFPA 99 for the various systems such as electrical, medical gas and vacuum, security systems and information systems but the code will be incomplete if the ventilation requirements do not exist, thus leaving the users and designers without any specific guidance. In addition, there were existing requirements that were moved to the proposed new Heating chapter but were eliminated when the chapter was returned to the committee. The elimination of these requirements has left a gap in the standard for the ventilation of rooms used to transfill and transfer oxygen into cylinders and containers. This TIA will correct a situation that has an adverse impact on the safety of patients and staff in health care facilities as well as an adverse impact on the adoption of the code.

Anyone may submit a comment by the closing date indicated above. To submit a comment (on company letterhead), please identify the number of the TIA and forward to the [Secretary, Standards Council](#), 1 Batterymarch Park, Quincy, MA 02169-7471.