

# CHAPTER 13

## HEALTH CARE FACILITIES AND MEDICAL GAS AND VACUUM SYSTEMS

### Part I – Special Requirements for Health Care Facilities.

#### 1301.0 Application.

**1301.1** Construction and equipment requirements shall be applied only to new construction and new equipment, except as modified in individual chapters. Only the altered, renovated, or modernized portion of an existing system or individual component shall be required to meet the installation and equipment requirements stated in this standard. If the alteration, renovation, or modernization adversely impacts existing performance requirements of a system or component, additional upgrading shall be required. [NFPA 99: 1.3.2]

**1301.2** This chapter applies to the special fixtures and systems in health care facilities and to the special plumbing requirements for such facilities. Other plumbing in such facilities shall comply with other applicable sections of this code.

**1301.3** This chapter shall not apply to breathing air replenishment (BAR) systems.

#### 1302.0 Medical Gas and Vacuum Piping Systems – Installation Requirements.

The installation of medical gas and vacuum piping systems shall be in accordance with the requirements of this chapter and/or the appropriate standards adopted by the Authority Having Jurisdiction. For additional standards see Table 14-1.

**1302.1** The installation of individual components shall be made in accordance with the instructions of the manufacturer. Such 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. Copies of the manufacturer's instructions shall be left with the system owner. [NFPA 99: 5.1.10.6.9.1, 5.1.10.6.9.2, 5.1.10.6.9.3]

**1302.2** The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in making such installations. Installers of medical gas and vacuum systems shall meet the requirements of ANSI/ASSE Standard 6010, *Professional Qualification Standard for Medical Gas and Vacuum System Installers*. [NFPA 99: 5.1.10.6.11.1, 5.1.10.6.11.2]

**1302.3** Brazing shall be performed by individuals who are qualified under the provisions of Section 1311.6. [NFPA 99: 5.1.10.6.11.3]

**1302.4** Prior to any installation work, the installer of medical gas and vacuum piping shall provide and maintain documentation on the job site for the qualification of brazing procedures and individual brazers that is required under Section 1311.6. [NFPA 99: 5.1.10.6.11.4]

#### 1303.0 Protrusions from Walls.

**1303.1** Drinking fountain control valves shall be flush-mounted or fully recessed when installed in corridors or other areas where patients may be transported on a gurney, bed, or wheelchair.

**1303.2** 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. [NFPA 99: 5.1.10.6.2.1]

#### 1304.0 Psychiatric Patient Rooms.

Piping and drain traps in psychiatric patient rooms shall be concealed. Fixtures and fittings shall be resistant to vandalism. [NFPA 101]

#### 1305.0 Locations for Ice Storage.

Ice makers or ice storage containers shall be located in nursing stations or similarly supervised areas to minimize potential contamination. [See NFPA 101]

#### 1306.0 Sterilizers.

**1306.1 General.** The requirements of this section apply to sterilizers and bedpan steamers. Such equipment shall be installed in accordance with this code and the manufacturer's installation instructions.

#### 1306.2 Indirect Waste Connections.

Waste drainage from sterilizers and bedpan steamers shall be connected to the sanitary drainage system through an airgap in accordance with this chapter and Chapter 8. The size of indirect waste piping shall not be less than the size of the drain connection on the fixture. Each such indirect waste pipe shall not exceed fifteen (15) feet (4,572 mm) in length and shall be separately piped to a receptor. Such receptors shall be located in the same room as the equipment served. Except for bedpan steamers, such indirect waste pipes shall not require traps. A trap having a

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ventilated, and clean location and shall be accessible. The location shall be provided with drainage facilities. The medical air compressor area shall be located separately from medical gas cylinder system sources, and shall be readily accessible for maintenance.

**1325.1** Medical air compressors shall be sufficient to serve the peak calculated demand with the largest single compressor out of service. In no case shall there be fewer than 2 (two) compressors. [NFPA 99: 5.1.3.5.11.2]

Medical air compressor systems shall consist of the following:

- (1) Components complying with NFPA 99: 5.1.3.5.4 through NFPA 99: 5.1.3.5.10, arranged per NFPA 99: 5.1.3.5.11.
- (2) An automatic means to prevent backflow from all on-cycle compressors through all off-cycle compressors.
- (3) A manual shutoff valve to isolate each compressor from the centrally piped system and from other compressors for maintenance or repair without loss of pressure in the system.
- (4) Intake filter-mufflers of the dry type.
- (5) Pressure relief valves set at 50 percent above line pressure.
- (6) Piping between the compressor and the source shutoff valve compatible with oxygen that does not contribute to contaminant levels. [NFPA 99: 5.1.3.5.3.2]
- (7) Except as defined in NFPA 99: 5.1.3.5.3.2(1) through NFPA 99: 5.1.3.5.3.2(6), materials and devices used between the medical air intake and the medical air source valve shall be permitted to be of any design or construction appropriate for the service, as determined by the manufacturer. [NFPA 99: 5.1.3.5.3.2]

**1325.2** The medical air compressors shall draw their air from a source of clean air located where no contamination is anticipated from engine exhausts, fuel storage vents, medical-surgical vacuum system discharges, particulate matter, or odor of any type. [NFPA 99: 5.1.3.5.13.1]

**1325.3** Compressor intake piping shall be hard-drawn seamless copper, and one of the following:

- (1) ASTM B 819, Standard Specification for Seamless Copper Tube for medical Gas Systems, medical gas tube.
- (2) ASTM B 88, Standard Specification for Seamless Copper Water Tube, water tube (Type K or L).
- (3) ASTM B 280, Standard Specification for Seamless Copper Tubing for Air Conditioning and

Refrigeration Field Service, 280ACR tube. [NFPA 99: 5.1.3.5.13.4]

The compressor air intake shall be located outdoors above roof level, at a minimum distance of 10 feet (3,050 mm) from any door, window, exhaust, other intake, or opening in the building and a minimum distance of 6,100 mm (20 feet) above the ground. [NFPA 99: 5.1.3.5.13.2]

If an air source equal to or better than outside air (e.g., air already filtered for use in operating room ventilating systems) is available, it shall be permitted to be used for the medical air compressors with the following provisions:

- (1) This alternate source of supply air shall be available on a continuous 24-hours-per-day, 7-days-per-week basis.
- (2) Ventilating systems having fans with motors or drive belts located in the air stream shall not be used as a source of medical air intake. [NFPA 99: 5.1.3.5.13.3]

Air intakes for separate compressors shall be permitted to be joined together to one common intake where the following conditions are met:

- (1) The common intake is sized to minimize back pressure in accordance with the manufacturer’s recommendations
- (2) Each compressor can be isolated by manual or check valve, blind flange, or tube cap to prevent open inlet piping when compressors are removed from service and consequent backflow of room air into the other compressor(s). [NFPA 99: 5.1.3.5.13.5]

**1325.3.1** Each medical air compressor shall have an isolation valve installed so that shutting off or failure of the largest unit will not affect the operation of the other unit(s).

**1325.4** Drains shall be installed on dryers, aftercoolers, separators, and receivers.

**1325.5** Medical air receivers shall be provided with proper valves to allow the flow of compressed air to enter and exit out of separator receive ports during normal operation and allow the receiver to be bypassed during service, without shutting down the medical air system. [NFPA 99: 5.1.3.5.11.4]

**1325.6 Medical Air Receivers.** Receivers for medical air shall meet the following requirements:

- (1) Be made of corrosion-resistant materials or otherwise be made corrosion resistant.
- (2) Comply with Section VIII, Unfired Pressure Vessels, of the *ASME Boiler and Pressure Vessel Code*.
- (3) Be equipped with a pressure-relief valve, automatic drain, manual drain, sight glass,









of Level 1 systems with the following exceptions:

- (1) Medical air compressor and accessories shall be permitted to be simplex. The facility shall develop their emergency plan to deal with the loss of medical air. [NFPA 99 5.2.3.5]
- (2) Medical vacuum and waste anesthetic gas disposal systems shall be permitted to be simplex. The facility staff shall develop their emergency plan to deal with the loss of medical vacuum. [NFPA 99 5.2.3.6, 5.2.3.7]
- (3) Warning system shall be permitted to be a single alarm panel located in an area of continuous surveillance while the facility is in operation. Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel. [NFPA 99 5.2.9]

#### **Part IV – Level 3 Piped Gas and Vacuum Systems.**

##### **1330.0 Level 3 Piped Gas and Vacuum Systems**

**1330.1** Medical gas supply systems (oxygen and nitrous oxide) shall meet the requirements of Level 2 gas systems. [NFPA 99 5.3.1.2]

**1330.2** Piped gas systems (compressed air or nitrogen) shall be cylinder systems or air compressor systems that include filters, receivers, dryers, regulators, relief valves, valves, and indicators. [NFPA 99 5.3.3.5]

**1330.3** Piped vacuum systems shall include pump(s) suited for dry service or for wet service with a liquid/air separator. [NFPA 99 5.3.3.6]

**1330.4** Where central supply systems are remote from the facility use points, emergency shut off valves shall be located within the facility. [NFPA 99 5.3.4]

**1330.5** Warning systems shall be provided for medical gas systems and shall include an alarm panel located in an area of continuous surveillance while the facility is in operation to monitor main line pressure and changeover. [NFPA 99 5.3.9]

**1330.6** Piping for systems shall be ASTM B819 cleaned copper for medical gas systems, ASTM B 819 cleaned copper or B 88 copper for piped gas systems, and ASTM B819 cleaned copper, ASTM B88 copper , or PVC Schedule 40 minimum for piped vacuum systems. [NFPA 99 5.3.10]

**1330.7** Labels shall be provided for piping, valves, and outlets/inlets. [NFPA 99 5.3.11]

**1330.8** Inspection and testing shall be performed on all new gas and vacuum systems, additions, renovations, temporary installations, or repaired systems. [NFPA 99 5.3.12]

- (1) Initial tests shall include blow down, pressure and leak, cross connection, piping purge, and standing pressure.
- (2) Verification tests shall be performed by a party meeting the requirements of ASSE 6030 and shall include standing pressure, standing vacuum, cross connection, warning, piping purge, piping particulate, piping purity, final tie-in, operational pressure, gas concentration, labeling, and source equipment.



**TABLE 13-2**  
**Minimum Flow Rates**

Oxygen	.71 CFM per outlet <sup>1</sup> (20 LPM)
Nitrous Oxide	.71 CFM per outlet <sup>1</sup> (20 LPM)
Medical Compressed Air	.71 CFM per outlet <sup>1</sup> (20 LPM)
Nitrogen	15 CFM (0.42 m <sup>3</sup> /min.) free air per outlet
Vacuum	1 SCFM (0.03 sm <sup>3</sup> /min.) per inlet <sup>2</sup>
Carbon Dioxide	.71 CFM per outlet <sup>1</sup> (20 LPM)
Helium	.71 CFM per outlet (20 LPM)

<sup>1</sup> Any room designed for a permanently located respiratory ventilator or anesthesia machine shall have an outlet capable of a flow rate of 180 LPM (6.36 CFM) at the station outlet.

<sup>2</sup> For testing and certification purposes, individual station inlets shall be capable of a flow rate of 3 SCFM, while maintaining a system pressure of not less than 12 inches (305 mm) at the nearest adjacent vacuum inlet.

**TABLE 13-3**  
**Minimum Outlets/Inlets per Station**

Location Level 1	Oxygen	Medical Vacuum	Medical Air	Nitrous Oxide	Nitrogen	Helium	Carbon Dioxide
Patient rooms for medical/surgical, obstetrics, and pediatrics	1/bed	1/bed	1/bed	—	—	—	—
Examination/treatment for nursing units	1/bed	1/bed	—	—	—	—	—
Intensive care (all)	2/bed	3/bed	2/bed	—	—	—	—
Newborn Intensive Care	2/bed	2/bed	2/bed	—	—	—	—
Nursery <sup>1</sup>	1/8 beds	1/8 beds	1/8 beds	—	—	—	—
General operating rooms	2/room	4/room <sup>4</sup>	2/room	1/room	1/room	—	—
PACU recovery rooms	1/bed	3/bed	1/bed	—	—	—	—
Cystoscopic and invasive special procedures	2/room	3/room <sup>4</sup>	2/room	—	—	—	—
Labor/delivery recovery rooms <sup>2</sup>	2/bed 2/room	2/bed 3/room <sup>4</sup>	1/bed 1/room	— —	— —	— —	— —
Labor rooms	1/bed	1/bed	1/bed	—	—	—	—
First aid and emergency treatment <sup>3</sup>	1/bed	1/bed <sup>4</sup>	1/bed	—	—	—	—
Autopsy	—	1/station	1/station	—	—	—	—
Anesthesia workroom	1/station	—	1/station	—	—	—	—

<sup>1</sup> Includes pediatric nursery.

<sup>2</sup> Includes obstetric recovery.

<sup>3</sup> Emergency trauma rooms used for surgical procedures shall be classified as general operating rooms.

<sup>4</sup> Vacuum inlets required are in addition to any inlets used as part of a scavenging system for removal of anesthetizing gases.

**TABLE 13-4**  
**System Sizing – Flow Requirements for Station Inlet/Outlet<sup>1</sup>**

Number of Inlet/Outlet Terminal Units per Facility	Diversity Percentage of Average Flow per Inlet/Outlet Terminal Units	Minimum Permissible System Flow <sup>2</sup>	
		SCFM (liters/minute) All Pressurized Medical Gas Systems	Vacuum Systems
1–10	100%	Actual Demand	See
11–25	75%	7.0 (200)	Table
26–50	50%	13.1 (375)	13-5
51–100	50%	17.5 (500)	

<sup>1</sup> Flow rates of station inlets/outlets per Table 13-2.

<sup>2</sup> The minimum system flow is the average inlet/outlet flow times the number of station inlets/outlets times the diversity percentage.

**TABLE 13-5**  
**Outlet Rating for Vacuum Piping Systems**

Location of Medical-Surgical Vacuum Outlets	Free-Air Allowance, Expressed as CFM (LPM) at 1 Atmosphere		Zone Allowances Corridors-Risers Main Supply Line-Valves	
	Per Room	Per Outlet	Simultaneous Usage, Factor Percent	Air to Be Transported CFM (LPM)*
Operating Rooms				
Major "A"(Radical, Open Heart)	3.5 (99.1)	–	100	3.5 (99.1)
(Organ Transplant)	3.5 (99.1)	–	100	3.5 (99.1)
(Radical Thoracic)	3.5 (99.1)	–	100	3.5 (99.1)
Major "B"(All Other Major ORs)	2.0 (56.6)	–	100	2.0 (56.6)
Minor	1.0 (28.3)	–	100	1.0 (28.3)
Delivery Rooms	1.0 (28.3)	–	100	1.0 (28.3)
Recovery Rooms (Post-Anesthesia) and Intensive Care Units (a minimum of 2 outlets per bed in each such department)				
1st outlet at each bed	–	3.0 (85.0)	50	1.5 (42.5)
2nd outlet at each bed	–	1.0 (28.3)	50	0.5 (14.2)
3rd outlet at each bed	–	1.0 (28.3)	10	0.1 (2.8)
All others at each bed	–	1.0 (28.3)	10	0.1 (2.8)
Emergency Rooms	–	1.0 (28.3)	100	1.0 (28.3)
Patient Rooms				
Surgical	–	1.0 (28.3)	50	0.5 (14.2)
Medical	–	1.0 (28.3)	10	0.1 (2.8)
Nurseries	–	1.0 (28.3)	10	0.1 (2.8)
Treatment and Examining Rooms	–	0.5 (14.2)	10	0.05 (1.4)
Autopsy Area	–	2.0 (56.6)	20	0.4 (11.3)
Inhalation Therapy, Central Supply and Instructional Areas	–	1.0 (28.3)	10	0.1 (2.8)

\*Free air at 1 atmosphere



