1313.0 Central Supply Systems.

1313.1 General. Central supply systems and medical gas outlets for oxygen, medical air, nitrous oxide, carbon dioxide, and other patient medical gases shall be piped into areas where the gases will be used under the direction of licensed medical professionals for purposes congruent with the following:

(1) Direct respiration by patients.
(2) Clinical application of the gas to a patient.
(3) Medical device applications directly related to respiration.
(4) Power for medical devices used directly on patients.
(5) Calibration of medical devices used in accordance with Section 1313.1(1) through Section 1313.1(4). [NFPA 99:5.1.3.5.2]

1313.1.1 Materials. Materials used in central supply systems shall comply with the following requirements:

(1) In those portions of systems intended to handle oxygen at gauge pressures that exceed 350 poundsforce per square inch (psi) (2413kPa), the interconnecting hose shall contain no polymeric materials.
(2) In those portions of systems intended to handle oxygen or nitrous oxide material, construction shall be compatible with oxygen under the temperatures and pressures to which the components are capable of being exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases, or mixtures containing more than 23.5 percent oxygen. [NFPA 99:5.1.3.5.4 – 5.1.3.5.4(2), 5.3.6.21.8 – 5.3.6.21.8(2)]

1313.1.2 Pressure-Relief Valve Requirements. Pressure-relief valves shall be installed in accordance with Section 1316.2. Each central supply system shall have a pressure-relief valve set at 50 percent above normal line pressure, installed downstream of the pressure regulator and upstream of the shutoff valve. This pressure-relief valve shall be
permitted to be set at a higher pressure, provided another pressure-relief valve set at 50 percent above normal line pressure is installed in the main supply line.

1314.0 Medical Air Systems.

1314.1 Medical Air Compressors. Medical air compressors shall be installed in a well-lit, ventilated, and clean location and shall be accessible. The location shall be provided with drainage facilities in accordance with this code. The medical air compressor area shall be located separately from medical gas cylinder system sources, and shall be readily accessible for maintenance.

1314.1.1 Capacity. 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 less than two compressors. [NFPA 99:5.1.3.6.3.10(B)]

1314.1.2 Required Components. Medical air compressor systems shall consist of the components listed in Section 1314.1.2.1 or Section 1314.1.2.2.

1314.1.2.1 Category 1 and 2 Systems. Category 1 and Category 2 medical air compressor systems shall consist of the following:

1. Components shall be arranged to permit service and a continuous supply of medical air in the event of a single fault failure. Component arrangement shall be permitted to vary in accordance with the technology(ies) employed, provided an equal level of operating redundancy and medical air quality is maintained. [NFPA 99:5.1.3.6.3.10(A)]

2. An automatic means to prevent backflow from on-cycle compressors through off-cycle compressors. [NFPA 99:5.1.3.6.3.2(2)]

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. [NFPA 99:5.1.3.6.3.2(3)]

4. Intake filter-mufflers of the dry type. [NFPA 99:5.1.3.6.3.2(4)]

5. Pressure relief valves set at 50 percent above line pressure. [NFPA 99:5.1.3.6.3.2(5)]

6. Piping and components between the compressor and the source shutoff valve that do not contribute to contaminant levels. [NFPA 99:5.1.3.6.3.2(6)]
(7) Materials and devices used between the medical air intake and the medical air source valve shall be permitted to be of a design or construction appropriate for the service as determined by the manufacturer. [NFPA 99:5.1.3.6.3.2(7)]

**1314.1.2.2 Category 3 Systems.** Category 3 medical air compressor systems shall consist of the following:

1. Disconnect switches.
4. One or more compressors.
5. For single, duplex, or multiple compressor systems, means for activation and deactivation of each individual compressor.
6. Where multiple compressors are used, manual or automatic means to alternate individual compressors.
7. Where multiple compressors are used, manual or automatic means to activate the additional unit(s) where the in-service unit(s) are incapable of maintaining the required pressure.
8. Intake filter-mufflers of the dry type.
9. Receivers with a manual or automatic drain.
10. Shutoff valves.
11. Compressor discharge check valves (for multiple compressors).
12. Air dryers that maintain not less than 40 percent relative humidity at operating pressure and temperature.
13. In-line final particulate or coalescing filters rated at 0.01 micron (0.01 µm), with filter status indicator to ensure the delivery of compressed air with a maximum allowable 0.05 ppm liquid oil.
14. Pressure regulators.
15. Pressure-relief valve.
16. Pressure indicator.
17. Moisture indicator. [NFPA 99:5.3.7.6.1]

**1314.1.3 Air Sources.** Air sources for medical air compressors shall comply with Section 1314.1.3.1 or Section 1314.1.3.2.
1314.1.3.1 Category 1 and 2 Systems. The medical air compressors shall draw their air from a source of clean air. [NFPA 99:5.1.3.6.3.12(A)] Where an air source equal to or better than outside air is available, it shall be permitted to be used for the medical air compressors in accordance 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 99:5.1.3.6.3.12(E)]

1314.1.3.2 Category 3 Systems. Air sources for a compressor(s) located inside a building shall comply with the following provisions:

1. Be located within a space where no chemicalbased materials are stored or used.
2. Be located in a space that is not used for patient medical treatment.
3. Not be taken from a room or space in which there is an open or semi-open discharge from a medical vacuum or scavenging system. [NFPA 99:5.3.7.6.5.1]

Air sources for a compressor(s) located outside the building shall be drawn from locations where no contamination from medical vacuum or scavenging system discharges or particulate matter is anticipated. [NFPA 99:5.3.7.6.5.2]

1314.1.4 Air Intakes. Compressor intake piping shall be constructed in accordance with Section 1308.5. [NFPA 99:5.1.3.6.3.12(F)]

1314.1.4.1 Location. Compressor air intakes shall be located as follows:

1. Not less than 25 feet (7620 mm) from ventilating system exhausts, fuel storage vents, combustion vents, plumbing vents, medical vacuum and WAGD discharges, or areas that are capable of collecting vehicular exhausts or other noxious fumes. [NFPA 99:5.1.3.6.3.12(B)]
2. Not less than 20 feet (6096 mm) above ground level. [NFPA 99:5.1.3.6.3.12(C)]
3. Not less than 10 feet (3048 mm) from a door, window, or opening in the building. [NFPA 99:5.1.3.6.3.12(D)]
1314.1.4.2 Separate Compressors. 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 backpressure in accordance with the manufacturer’s instructions.
2. Each compressor is capable of being isolated by manual or check valve, blind flange, or tube cap to prevent open inlet piping where the compressor(s) is removed for service from the consequent backflow of room air into the other compressor(s). [NFPA 99:5.1.3.6.3.12(G)]

1314.1.4.3 Screening. The end of the intake shall be turned down and screened or otherwise protected against the entry of vermin, debris, or precipitation by screening fabricated or composed of a non-corroding material. [NFPA 99:5.1.3.6.3.12(H)]

1314.2 Medical Air Receivers. Receivers for medical air shall meet the following requirements [NFPA 99:5.1.3.6.3.6]:

1. Be made of corrosion-resistant materials or otherwise be made corrosion resistant. [NFPA 99:5.1.3.6.3.6(1)]
2. Comply with Section VIII of the ASME Boiler and Pressure Vessel Code. [NFPA 99:5.1.3.6.3.6(2), 5.3.7.6.2.2]
3. Be equipped with a pressure-relief valve, automatic drain, manual drain, sight glass, and pressure indicator. [NFPA 99:5.1.3.6.3.6(3)]
4. Be of a capacity sufficient to prevent the compressor from short cycling. [NFPA 99:5.1.3.6.3.6(4), 5.3.7.6.2.1]

1314.2.1 Valves. Medical air receivers shall be provided with approved valves to allow the flow of compressed air to enter and exit out of separate receiver ports during normal operation and allow the receiver to be bypassed during service without shutting down the supply of medical air. [NFPA 99:5.1.3.6.3.10(D)]

1315.0 Medical Vacuum System.

1315.1 General. The vacuum plant shall be installed in a well-lit, ventilated, and clean location with accessibility. The location shall be provided with drainage facilities in accordance with this
The vacuum plant, where installed as a source, shall be located separately from other medical vacuum system sources, and shall be readily accessible for maintenance.

1315.2 Medical-Surgical Vacuum Sources. Medicalsurgical vacuum sources shall consist of the following:

1. Two or more vacuum pumps sufficient to serve the peak calculated demand with the largest single vacuum pump out of service.
2. An automatic means to prevent backflow from oncycle vacuum pumps through off-cycle vacuum pumps.
3. A shutoff valve or other isolation means to isolate each vacuum pump from the centrally piped system and other vacuum pumps for maintenance or repair without loss of vacuum in the system.
4. A vacuum receiver.
5. Piping between the vacuum pump(s), discharge(s), receiver(s), and the vacuum source shutoff valve shall be in accordance with Section 1308.5, except that brass, galvanized, or black steel pipe shall be permitted to be used in accordance with the manufacturer’s instructions.
6. Materials and devices used between the medical vacuum exhaust and the medical vacuum source shall be permitted to be of a design or construction appropriate for the service, as determined by the manufacturer’s instructions. [NFPA 99:5.1.3.7.1.2]

1315.3 Vacuum Pumps. Additional pumps shall automatically activate when the pump(s) in operation is incapable of maintaining the required vacuum. [NFPA 99:5.1.3.7.6.1]

Automatic or manual alternation of pumps shall allow division of operating time. Where automatic alternation of pumps is not provided, the facility staff shall arrange a schedule for manual alternation. [NFPA 99:5.1.3.7.6.2] 1315.4 Vacuum Receivers. Receivers for vacuum shall meet the following requirements:

1. Be made of materials approved by the manufacturer.
2. Comply with Section VIII of the ASME Boiler and Pressure Vessel Code.
3. Withstand a gauge pressure of 60 psi (414 kPa) and 30 inch gauge HgV (102 kPa).
4. Be equipped with a manual drain.
5. Be of a capacity based on the technology of the pumps. [NFPA 99:5.1.3.7.3]
1315.5 Vacuum Source Exhausts. Medical-surgical vacuum pumps shall exhaust in a manner and location that will minimize the hazards of noise and contamination to the facility and its environment. [NFPA 99:5.1.3.7.7.1]

1315.5.1 Location. The exhaust shall be located as follows:

(1) Outdoors.
(2) Not less than 10 feet (3048 mm) from a door, window, air intake, or other openings in buildings or places of public assembly.
(3) At a level different from air intakes.
(4) Where prevailing winds, adjacent buildings, topography, or other influences that will not divert the exhaust into occupied areas or prevent dispersion of the exhaust. [NFPA 99:5.1.3.7.7.2]

1315.5.2 Screening. The end of the exhaust shall be turned down and screened or otherwise be protected against the entry of vermin, debris, or precipitation by screening fabricated or composed of a noncorroding material. [NFPA 99:5.1.3.7.7.3]

1315.5.3 Dips and Loops. The exhaust shall be free of dips and loops that are capable of trapping condensate or oil, or provided with a drip leg and valved drain at the bottom of the low point. [NFPA 99:5.1.3.7.7.4]

1315.5.4 Multiple Pumps. Vacuum exhausts from multiple pumps shall be permitted to be joined together to one common exhaust where in accordance with the following [NFPA 99:5.1.3.7.7.5]:

(1) The common exhaust is sized to minimize backpressure in accordance with the pump manufacturer’s instructions. [NFPA 99:5.1.3.7.7.5(1), 5.3.8.3.11(7)]
(2) Each pump shall be isolated by manual or check valve, blind flange, or tube cap to prevent open exhaust piping where the pump(s) is removed for service and consequent flow of exhaust air into the room. [NFPA 99:5.1.3.7.7.5(2), 5.3.8.3.11(8)]

1316.0 Pressure-Regulating Equipment.

1316.1 Where Required. Pressure-regulating equipment shall be installed in the supply main upstream of the final line-pressure valve. Where multiple piping systems for the same gas at different operating pressures are required, separate pressure-regulating equipment, relief valves, and source shutoff valves shall be provided for each pressure.
1316.2 Pressure-Relief Valves. Pressure-relief valves shall close automatically where excess pressure has been released.

1316.2.1 Venting. Pressure-relief valves set at 50 percent shall be vented to the outside from gas systems, except medical air, or where the total capacity of the supply system is in excess of 3000 cubic feet (84.95 m³) of gas.

1316.2.2 Design. Pressure-relief valves shall be brass, bronze, or stainless steel and designed for the gas service. [NFPA 99:5.3.6.21.6]

1316.2.3 Isolation. A pressure-relief valve shall not be isolated from its intended use by a valve.

1316.3 Pressure Gauges. Pressure and vacuum indicators shall be readable from a standing position. Pressure and vacuum indicators shall be provided at the following locations:

1. Adjacent to the alarm-initiating device for source mainline pressure and vacuum alarms in the master alarm system.
2. At or in area alarm panels to indicate the pressure, vacuum, or both at the alarm activating device for each system that is monitored by the panel.
3. On the station outlet or inlet side of zone valves. [NFPA 99:5.1.8.2.1, 5.1.8.2.2]

1317.0 Station Outlets and Inlets

1317.1 General. Station outlets and inlets shall be installed in strict accordance with the manufacturer’s installation instructions. Each station outlet and inlet for medical gases and medical vacuums shall be gas-specific. [NFPA 99:5.1.5.1, 5.3.6.17.1]

1317.2 Required Valves. Each station outlet shall consist of a primary and secondary valve (or assembly). [NFPA 99:5.1.5.2, 5.3.6.17.2] Each station inlet shall consist of a primary valve (or assembly). [NFPA 99:5.1.5.3]

1317.2.1 Secondary Valve. The secondary valve (or assembly) shall close automatically to stop the flow of medical gas (or medical vacuum, where provided) where the primary valve (or assembly) is removed. [NFPA 99:5.1.5.4, 5.3.6.17.3]

1317.3 Post Installation. After installation of the piping, but before installation of the station outlets and inlets and other medical gas and medical gas system components (e.g., pressure-actuating switches for alarms, manifolds, pressure gauges, or pressure relief valves), the line shall be blown clear by means of oil-free, dry nitrogen NF.
1317.4 **Identification.** Station outlets and inlets shall be identified as to the name or chemical symbol for the specific medical gas or medical vacuum provided. [NFPA 99:5.1.11.3.1]

1318.0 **Warning Systems.**

1318.1 **Category 1 and 2 Systems.** Master, area, and local alarm systems used for medical gas and medical 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. Visual indicators that remain in alarm until the situation that has caused the alarm is resolved.
3. A cancelable audible indication of each alarm condition that produces a sound level of not less than 80 decibels at 3 feet (914 mm).
4. A means to visually identify a lamp or LED failure.
5. Visual and audible indication that the communication with an alarm initiating device is disconnected.
6. Labeling of each indicator, indicating the condition monitored.
7. Labeling of each alarm panel for its area of surveillance.
8. Reinitiation of the audible signal where another alarm condition occurs while the audible alarm is silenced.
9. Power for master, area alarms, sensors, and switches from the life safety branch of the emergency electrical system as described in NFPA 99.
10. Power for local alarms, dew point sensors, and carbon monoxide sensors permitted to be from the same essential electrical branch as is used to power the air compressor system.
11. Where used for communications, wiring from switches or sensors that is supervised or protected as required by NFPA 70 for life safety and critical branch circuits in which protection is one of the following types:
   a. Conduit
   b. Free air
   c. Wire
   d. Cable tray
   e. Raceways
(12) Communication devices that do not use electrical wiring for signal transmission shall be supervised such that failure of communication shall initiate an alarm.

(13) Assurance by the responsible authority of the facility that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date.

(14) Provisions for automatic restart after a power loss of 10 seconds (e.g., during generator startup) without giving false signals or requiring manual reset.

(15) Alarm switches, sensors, or both installed so as to be removable. [NFPA 99:5.1.9.1]

1318.2 Category 3 Systems. Warning systems for medical gas systems (oxygen and nitrous oxide) in Category 3 facilities shall include the following:

(1) Alarms for the following:
   (a) Oxygen main line pressure low or high.
   (b) Oxygen changeover to secondary bank or about to change over (where automatic).
   (c) Nitrous oxide main line pressure low or high.
   (d) Nitrous oxide changeover to secondary bank or about to changeover (where automatic).

(2) Warning systems shall have not less than one single alarm panel in each treatment facility served by the medical gas source equipment.

(3) Alarm panels shall be located in an area of continuous surveillance while the facility is in operation.

(4) Pressure switches, sensors, or both that monitor main line pressure shall be mounted at the source equipment with pressure alarm indicators (lamp or LED) at the alarm panel.

(5) Audible and non-cancelable alarm visual signals shall indicate where the pressure in the main line increases or decreases 20 percent from the normal operating pressure.

(6) Visual indications shall remain until the situation that caused the alarm is resolved.

(7) Pressure switches, sensors, or both shall be installed downstream of emergency shutoff valves, and other shutoff valves in the system, and shall cause an alarm for the medical gas where the pressure decreases or increases 20 percent from the normal operating pressure.
(8) A cancelable audible indication of each alarm condition that produces a sound at the alarm panel shall reinitiate the audible signal where another alarm condition occurs while the audible signal is silenced. [NFPA 99:5.3.6.22]

1318.3 Components. Functioning of alarm components shall be verified in accordance with the testing and monitoring requirements of the manufacturer and the Authority Having Jurisdiction.

Part IV – Testing, Inspection, and Certification.

1319.0 Testing and Inspection.

1319.1 Where Required. Inspection and testing shall be performed on components, or portions thereof, of new piped medical gas or vacuum systems, additions, renovations, temporary installations, or repaired systems in accordance with Section 1319.2 through Section 1319.12.2, and certified in accordance with Section 1320.0.

1319.2 Breached Systems. Systems that are breached and components that are subject to additions, renovations, or replacement shall be inspected and tested. Systems shall be deemed breached at the point of pipeline intrusion by physical separation or by system component removal, replacement, or addition. Breached portions of the systems subject to inspection and testing shall be confined to the specific altered zone and components in the immediate zone or area that is located upstream for medical vacuum systems and downstream for pressure gases at the point or area of intrusion. [NFPA 99:5.1.12.1.3 – 5.1.12.1.5]

1319.3 Reports. Inspection and testing reports shall be submitted directly to the party that contracted for the testing, who shall submit the report through channels to the responsible facility authority and others that are required. Reports shall contain detailed listings of findings and results. [NFPA 99:5.1.12.1.6, 5.1.12.1.7]

1319.4 Initial Piping Blow Down. Piping in medical gas and medical vacuum distribution systems shall be blown clear by means of oil-free, dry nitrogen NF after installation of the distribution piping, and before installation of station outlet and inlet rough-in assemblies and other system components. [NFPA 99:5.1.12.2.2, 5.3.6.23.2.2]

1319.5 Initial Pressure Tests – Medical Gas and Medical Vacuum Systems. Each section of the piping in medical gas and medical vacuum systems shall be pressure tested by a party qualified in accordance with Section 1306.1, and using oil-free, dry nitrogen NF. [NFPA
Initial pressure tests shall be conducted in accordance with the following:

(1) After blow down of the distribution piping.
(2) After installation of station outlet and inlet rough-in assemblies. Test caps shall be permitted to be used.
(3) Prior to the installation of components of the distribution piping system that would be damaged by the test pressure. [NFPA 99:5.1.12.2.3.2, 5.3.6.23.2.3(B)]

**1319.5.1 Shutoff Valve.** The source shutoff valve for the piping system shall remain closed during tests. [NFPA 99:5.1.12.2.3.3, 5.3.6.23.2.3(C)]

**1319.5.2 Required Test Pressure.** The test pressure for pressure medical gases and medical vacuum systems shall be one and one-half times the system working pressure, and not less than a gauge pressure of 150 psi (1034 kPa). [NFPA 99:5.1.12.2.3.4, 5.3.6.23.2.3(D)] The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia. [NFPA 99:5.1.12.2.3.5, 5.3.6.23.2.3(E)]

**1319.5.3 Leaks.** Leaks shall be located, repaired (where permitted), replaced (where required), and retested. [NFPA 99:5.1.12.2.3.6, 5.3.6.23.2.3(F)]

**1319.6 Cross-Connection Tests – Medical Gas and Medical Vacuum Systems.** A party qualified in accordance with Section 1306.1 shall determine that no crossconnections exist between medical gas and medical vacuum piping systems. [NFPA 99:5.1.12.2.4, 5.3.6.23.2.4]

**1319.6.1 Atmospheric Pressure.** Piping systems shall be reduced to atmospheric pressure. [NFPA 99:5.1.12.2.4.1, 5.3.6.23.2.4(A)]

**1319.6.2 Sources of Test Gas.** Sources of test gas shall be disconnected from piping systems except for the one system being tested. [NFPA 99:5.1.12.2.4.2, 5.3.6.23.2.4(D)]

**1319.6.3 System to be Charged.** The system under test shall be charged with oil-free, dry nitrogen NF to a gauge pressure of 50 psi (345 kPa). [NFPA 99:5.1.12.2.4.3, 5.3.6.23.2.4(C), 5.3.6.23.2.4(E)]

**1319.6.4 Check Outlets and Inlets.** After the installation of the individual faceplates with approved adapters matching outlet and inlet labels, each individual outlet and inlet (in each installed medical gas and medical vacuum piping system) shall be checked to
determine that the test gas is being dispensed from the piping system being tested. [NFPA 99:5.1.12.2.4.4, 5.3.6.23.2.4(F)]

**1319.6.5 Repeat Test.** The cross-connection test shall be repeated for each installed medical gas and medical vacuum piping system. [NFPA 99:5.1.12.2.4.5, 5.3.6.23.2.4(G)]

**1319.6.6 Identification of System.** The proper labeling and identification of system outlets and inlets shall be confirmed during these tests. [NFPA 99:5.1.12.2.4.6, 5.3.6.23.2.4(H)]

**1319.7 Standing Pressure Tests – Medical Gas Piping Systems.** After successful completion of the initial pressure tests in accordance with Section 1319.5, medical gas distribution piping shall be subjected to a standing pressure test by a party qualified in accordance with Section 1306.1. [NFPA 99:5.1.12.2.6, 5.3.6.23.2.6]

**1319.7.1 Time Frame for Testing.** Tests shall be conducted after the final installation of station outlet valve bodies, face plates, and other distribution system components. [NFPA 99:5.1.12.2.6.1, 5.3.6.23.2.6(A)]

**1319.7.2 Source Valve.** The source valve shall be closed during testing. [NFPA 99:5.1.12.2.6.2, 5.3.6.23.2.6(B)]

**1319.7.3 Length of Testing.** The piping systems shall be subjected to a 24 hour standing pressure test using oil-free, dry nitrogen NF. [NFPA 99:5.1.12.2.6.3, 5.3.6.23.2.6(C)]

**1319.7.4 Test Pressure.** Test pressures shall be 20 percent above the normal system operating line pressure. [NFPA 99:5.1.12.2.6.4, 5.3.6.23.2.6(D)]

**1319.7.5 Conclusion of Test.** At the conclusion of the tests, there shall not be a change in the test pressure except that attributed to changes in ambient temperature. [NFPA 99:5.1.12.2.6.5] For Category 3 systems, there shall not be a change in the test pressure that exceeds a gauge pressure of 5 psi (34 kPa). [NFPA 99:5.3.6.23.2.6(E)]

**1319.7.6 Leaks.** Leaks shall be located, repaired (where permitted), or replaced (where required), and retested. [NFPA 99:5.1.12.2.6.6, 5.3.6.23.2.6(F)]

**1319.7.7 Proof of Testing.** The 24 hour standing pressure test shall be witnessed by the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1319.12. [NFPA 99:5.1.12.2.6.7]
1319.8 Standing Pressure Tests – Medical Vacuum Piping Systems. After successful completion of the initial pressure tests under Section 1319.5, medical vacuum distribution piping shall be subjected to a standing vacuum test. [NFPA 99:5.1.12.2.7]

1319.8.1 Timeframe for Testing. Tests shall be conducted after installation of all components of the medical vacuum system. [NFPA 99:5.1.12.2.7.1]

1319.8.2 Length of Testing. The piping systems shall be subjected to a 24 hour standing vacuum test. [NFPA 99:5.1.12.2.7.2]

1319.8.3 Test Pressure. Test pressure shall be between 12 inch gauge HgV (41 kPa) and full vacuum. [NFPA 99:5.1.12.2.7.3]

1319.8.4 Disconnection of Testing Source. During the test, the source of test vacuum shall be disconnected from the piping system. [NFPA 99:5.1.12.2.7.4]

1319.8.5 Conclusion of Test. At the conclusion of the test, there shall not be a change in the vacuum except that attributed to changes in ambient temperature. [NFPA 99:5.1.12.2.7.5]

1319.8.6 Leaks. Leaks shall be located, repaired (where permitted), or replaced (where required), and retested. [NFPA 99:5.1.12.2.7.7]

1319.8.7 Proof of Testing. The 24 hour standing pressure test of the medical vacuum system shall be witnessed by the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1319.12. [NFPA 99:5.1.12.2.7.6]

1319.9 Purge Tests. The outlets in each medical gas piping system shall be purged by a party qualified in accordance with Section 1306.1, using oil-free, dry nitrogen NF to remove particulate matter from the piping. [NFPA 99:5.1.12.2.5, 5.3.6.23.2.5]

1319.9.1 Procedure. 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. [NFPA 99:5.1.12.2.5.1, 5.3.6.23.2.5(B)]

1319.9.2 Location. Purging shall start at the closest outlet or inlet to the zone valve and continue to the furthest outlet or inlet within the zone. [NFPA 99:5.1.12.2.5.2]

Exception: For Category 3 medical gas piping systems, purging shall start at the furthest outlet in the system and proceed toward the source equipment. [NFPA 99:5.3.6.23.2.5(C)]
1319.10 Operational Pressure Test. Operational pressure tests shall be performed at each station outlet and inlet or terminal where the user makes connections and disconnections. [NFPA 99:5.1.12.3.10]

1319.10.1 Test Gas. Tests shall be performed with the gas of system designation or the operating vacuum. [NFPA 99:5.1.12.3.10.1]

1319.10.2 Medical Gas Outlets. Gas outlets with a gauge pressure of 50 psi (345 kPa), including, but not limited to, oxygen, nitrous oxide, medical air, and carbon dioxide, shall deliver 3.5 standard cubic feet per minute (SCFM) (100 SLPM) with a pressure drop of not more than 5 psi (34 kPa) and static pressure of 50 psi (345 kPa) to 55 psi (379 kPa). [NFPA 99:5.1.12.3.10.2]

1319.10.3 Medical-Surgical Vacuum Inlets. Medical-surgical vacuum inlets shall draw 3 SCFM (85 Nl/min) without reducing the vacuum pressure below 12 inch mercury gauge (HgV) (41 kPa) at any adjacent station inlet. [NFPA 99:5.1.12.3.10.4]

1319.10.4 Oxygen and Medical Air Outlets. Oxygen and medical air outlets serving critical care areas shall allow a transient flow rate of 6 SCFM (170 SLPM) for 3 seconds. [NFPA 99:5.1.12.3.10.5]

1319.11 Medical Gas Concentration Test. After purging each system in accordance with Section 1319.9, the following shall be performed:

(1) Each pressure gas source and outlet shall be analyzed for concentration of gas, by volume.

(2) Analysis shall be conducted with instruments designed to measure the specific gas dispensed.

(3) Allowable concentrations shall be as indicated in Table 1319.11. [NFPA 99:5.1.12.3.11]

<table>
<thead>
<tr>
<th>MEDICAL GAS</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>&gt;99% oxygen</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>&gt;99% nitrous oxide</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>&lt;1% oxygen or &gt;99% nitrogen</td>
</tr>
<tr>
<td>Medical air</td>
<td>19.5% - 23.5% oxygen</td>
</tr>
<tr>
<td>Other gases</td>
<td>As specified by +/-1%, unless otherwise specified</td>
</tr>
</tbody>
</table>

1319.12 System
**Verification.** Verification tests shall be performed after tests in accordance with Section 1319.5 through Section 1319.11 have been completed. [NFPA 99:5.1.12.3.1.1, 5.3.6.23.3.1(C)]

**1319.12.1 Test Gas.** The test gas shall be oil-free, dry nitrogen NF or the system gas where permitted. [NFPA 99:5.1.12.3.1.2, 5.3.6.23.3.1(D)]

**1319.12.2 Approved Tester.** Verification testing shall be conducted by a party technically competent and experienced in the field of medical gas and medical vacuum pipeline testing and meeting the requirements of ASSE 6030. [NFPA 99:5.1.12.3.1.3, 5.3.6.23.3.1(A)] Testing shall be performed by a party other than the installing contractor, the system supplier, or the system manufacturer. [NFPA 99:5.1.12.3.1.4, 5.3.6.23.3.1(B)]
Where systems have not been installed by in-house personnel, testing shall be permitted by personnel of that organization who meet the requirements of this section. [NFPA 99:5.1.12.3.1.5]

**1320.0 System Certification.**

**1320.1 Certification.** Prior to a medical gas or medical vacuum system being placed in service, such system shall be certified in accordance with Section 1320.2.

**1320.2 Certification Tests.** Certification tests, verified and attested to by the certification agency, shall include the following:

1. Verifying in accordance with the installation requirements.
2. Testing and checking for leakage, correct zoning, and identification of control valves.
3. Checking for identification and labeling of pipelines, station outlets, and control valves.
4. Testing for cross-connection, flow rate, system pressure drop, and system performance.
5. Functional testing of pressure relief valves and safety valves.
6. Functional testing of sources of supply.
7. Functional testing of alarm systems, including accuracy of system components.
8. Purge flushing of system and filling with specific source gases.
10. Testing for specific gas identity at each station outlet.
1320.3 Report Items. A report that includes the specific items addressed in Section 1320.2, and other information required by this chapter, shall be delivered to the Authority Having Jurisdiction prior to acceptance of the system.