Committee Input No. 318-NFPA 99-2012 [ Global Input ]

Move all references to non-mandatory guidelines from within the body of the Code to the Annex. Ensure that all references in Chapter 2 of the code are used in the standard, if they are not then the reference should be removed.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Aug 27 10:02:14 PDT 2012

Committee Statement and Meeting Notes

Committee Statement: This is being submitted as a CI so that each committee will have time to evaluate and review their referenced documents.
CI-318-NFPA 99-2012
Committee Input No. 339-NFPA 99-2012 [ Global Input ]

Replace all instance of

"of the applicable building code; NFPA 101, Life Safety Code; or fire code acceptable to the authority having jurisdiction." with "of the applicable code."

Sections, 5.1.10.11.4.6, 5.3.3, 15.2, 15.7.1.1, 15.7.2.1, 15.7.3.1, 15.7.4.1, 15.9.2.2, 15.11.1, 15.13.3.10.3,

Add a new definition

3.3.X Applicable Code.

The building code, fire code, or NFPA 101, Life Safety Code, adopted by the jurisdiction or NFPA 101, Life Safety Code, where no such code has been adopted by the jurisdiction.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Aug 27 14:03:00 PDT 2012

Committee Statement and Meeting Notes

Committee Statement: This has been submitted as a CI to simplify the code. The reason this was not done as a First Revision is so that other technical committees have an opportunity to see how this might affect their sections that contain the same language.

CI-339-
NFPA 99-
2012
Committee Input No. 328-NFPA 99-2012 [ New Section after 4.3 ]

4.4 Medical Equipment Categories.
4.4.1 Electrical Equipment.
4.4.2 Gas Equipment.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Aug 27 11:27:26 PDT 2012

Committee Statement and Meeting Notes

The MED committee has added unique risk categories for those types of equipment. The FUN TC opens this Committee input to provide a place to open up discussion with the MED committee as to why there needs to be different risk categories for their Chapters. The FUN TC believes that all categories should be based on what is currently in Chapter 4, but if it can be shown that these chapters require unique categories then there needs to be something in Chapter 4 to reflect this. A task group will be set up with members from FUN and MED to address this.

Committee Input No. 297-NFPA 99-2012 [ New Section after 5.1.1.1 ]
5.1.1.1 Applicability Matrix.

The application of requirements in this chapter shall be based on the category of system as determined in Chapter 4 and as defined in Table 5.0.1.

Table 5.1.1.1 Applicability Matrix

<table>
<thead>
<tr>
<th>Category as Determined from Chapter 4</th>
<th>Additional Considerations</th>
<th>Category to Apply from Chapter 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>None</td>
<td>Category 1</td>
</tr>
<tr>
<td>Category 2</td>
<td>None</td>
<td>Category 2</td>
</tr>
<tr>
<td>Category 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) Will provide higher than minimal levels of sedation.</td>
<td>Category 2</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) The loss of the system can result in minor injury or patient discomfort.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) The facility is intended to perform other than elective procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) The facility will only perform minimal, moderate, or no sedation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) The loss of the system can result in, at worst case, patient discomfort.</td>
<td>Category 3</td>
</tr>
<tr>
<td></td>
<td>AND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) The facility is intended only to do elective surgery or no surgery.</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Thu Aug 23 15:52:18 PDT 2012

Committee Statement and Meeting Notes

Committee Statement:

This Committee Input has been put forward as a means to better identify what facilities or systems are appropriate to be designed to the different Category requirements. This change will require some systems that would have been designed to Category 3 requirements in the 2012 edition to be designed to Category 2. Public Comment is sought on this change to the Category applications.

CI-297-NFPA 99-2012

Committee Notes:
Committee Input No. 363-NFPA 99-2012 [ Section No. 5.1.3.2 ]

5.1.3.2 Central Supply System Operations.

5.1.3.2.1
The use of adapters or conversion fittings to adapt one gas-specific fitting to another shall be prohibited.

5.1.3.2.2
Rooms containing cylinders or containers shall be secured with lockable doors or gates or otherwise secured.

5.1.3.2.3
Cylinders and containers shall be handled in strict accordance with 11.6.2.

5.1.3.2.4
Only gas cylinders, containers, reusable shipping containers, and their accessories shall be permitted to be stored in rooms containing central supply systems or gas cylinders.

5.1.3.2.5
No flammable materials, cylinders containing flammable gases, or containers containing flammable liquids shall be stored in rooms with gas cylinders.

5.1.3.2.6
If cylinders are wrapped when received, the wrappers shall be removed prior to storage.

5.1.3.2.7
Cylinders without correct markings or whose markings and gas-specific fittings do not match shall not be used.

5.1.3.2.8
Cryogenic liquid storage units intended to supply gas to the facility shall not be used to transfill other liquid storage vessels.

5.1.3.2.9
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.

5.1.3.2.10
Rooms containing cylinders or containers shall be heated by indirect means (e.g.,
Rooms containing cylinders or containers shall be heated by indirect means (e.g., steam, hot water) if heat is required.

5.1.3.2.11

Rooms containing cylinders shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.

5.1.3.2.12

Cylinders and containers shall be kept away from radiators, steam piping, and like sources of heat.

5.1.3.2.13

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

5.1.3.2.14

Containers shall not be stored in a tightly closed space.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Thu Aug 30 07:46:08 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Editorial clean up, clarifying the use of the terms cylinders and containers and repeating some of the operating type issues that are in 5.1.3.3.2

CI-363-NFPA 99-2012

Committee Input No. 305-NFPA 99-2012 [ New Section after 5.1.3.5.11.9 ]

5.1.3.5.12 Micro Bulk or Small Bulk Cryogenic Liquid Systems.

5.1.3.5.12.1

Micro bulk cryogenic liquid systems shall have the following protections:

1. If located indoors, be installed within a room used only for this purpose

2. If located outdoors, oxygen systems sited to comply with minimum distance requirements in NFPA 55, Compressed Gases and Cryogenic Fluids Code

3. If located outdoors, nitrogen systems sited to comply with minimum distance requirements in CGA P-18, Standard for Bulk Inert Gas Systems at Consumer Sites

4. Compliant with CGA M-1, Guide for Medical Gas Installations at Consumer Sites

5. Location in an enclosure constructed in accordance with 5.1.3.3.2(1) through 5.1.3.3.2(3) and 5.1.3.3.2(5), 5.1.3.3.2(8), and 5.1.3.3.2(9)

6. Location in an enclosure ventilated in accordance with 5.1.3.3.3
(7) Design such that the items noted in 5.1.3.4.13.2 and items located in the trailer unloading area are readily visible to delivery personal during filling operations.

(8) Protection against overpressurization of the pressure vessel during filling operations.

(9) Does not have a bottom fill valve.

(10) Installation in accordance with 5.1.10.1 through 5.1.10.5.7.

(11) Installation by personnel qualified to meet CGA M-1, *Guide for Medical Gas Installations at Consumer Sites*, or ASSE 6015 *Professional Qualifications Standards for Bulk Medical Gas Systems Installers*.

(12) Installation in compliance with Food and Drug Administration (FDA) Current Good Manufacturing Practices as found in 21 CFR 210 and 21 CFR 211.

5.1.3.5.12.2

A micro bulk cryogenic liquid system with a primary and secondary supply shall have headers located in the same enclosure.

5.1.3.5.12.3

A micro bulk cryogenic liquid system with a reserve header shall be permitted to be located in the same enclosure as the primary and secondary headers or in another enclosure compliant with 5.1.3.4.12.1.

5.1.3.5.12.4

A micro bulk cryogenic liquid system shall consist of the following:

(1) Two equal headers each having sufficient capacity for an average day’s supply, with either being capable of either role, consisting of one primary supply and one secondary supply and with the headers connected to the final line pressure regulator assembly in such a manner that either header can supply the system and a reserve header, in accordance with 5.1.3.4.9 having sufficient number of gas cylinder connections for an average day’s supply, but not fewer than three, and connected downstream of the primary/secondary headers and upstream of the final line pressure regulators.

(2) One micro bulk cryogenic liquid main header, having sufficient capacity for an average day’s supply, one secondary supply consisting of a micro bulk cryogenic liquid, liquid containers, or high pressure cylinders and having sufficient capacity for an average day’s supply, and a reserve header, in accordance with 5.1.3.4.9 having sufficient number of gas cylinder connections for an average day’s supply, but not fewer than three, and connected downstream of the primary/secondary headers and upstream of the final line pressure regulators.

(3) One micro bulk cryogenic liquid main header, having sufficient capacity for an average day’s supply, one reserve header consisting of either a micro bulk cryogenic liquid supply or high pressure cylinders in accordance with 5.1.3.4.9 connections for an average day’s supply and connected downstream of the primary/secondary headers and upstream of the final line pressure regulators.

5.1.3.5.12.5

The micro bulk cryogenic system shall include the following:

(1) When the primary or main header is supplying the system, the secondary and reserve header is prevented from supplying the system.

(2) When the primary or main header is depleted, the roles of primary or main, secondary (when installed), and reserve will alternate and provide an operating cascade (primary–
(3) Capacity determined after consideration of the customer usage requirements, delivery schedules, proximity of the facility to alternate supplies, and the emergency plan.

(4) Where there are two or more micro bulk cryogenic liquid vessels of equal capacity, they are permitted to alternate in the roles of primary and secondary.

(5) A reserve supply sized for greater than an average day’s supply, with the appropriate size of vessel or number of cylinders being determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility’s emergency plan.

(6) At least two main vessel relief valves and rupture discs installed downstream of a three-way (three-port) valve.

(7) A check valve located in the primary supply piping upstream of the intersection with a secondary supply or reserve supply.

(8) A contents gauge on each of the main vessel(s).

(9) A pressure relief installed downstream of the connection of the reserve header and upstream of the final line pressure regulating assembly and set at 50 percent above the nominal inlet pressure.

(10) The manifolds in this category shall be equipped with a means to conserve the gas produced by evaporation of the cryogenic liquid in the secondary header (when so provided). This mechanism shall discharge the conserved gas into the system upstream of the final line regulator assembly.

(11) The manifolds for two equal headers shall include a manual or automatic means to place either header into the role as primary header and the other in the role of secondary header (when so provided).

(12) The manifolds for main supply with a secondary supply (when so provided) headers shall include a manual or automatic means to place the secondary header into the role as primary header during the filling of the main supply.

(13) The manifolds shall include a means to automatically activate the reserve header if for any reason the primary and secondary (when so provided) headers cannot supply the system.

(14) Permanent anchors holding the components to the pad or flooring in accordance with the design requirements.

5.1.3.5.12.6
The micro bulk cryogenic system in this category shall actuate a local signal and shall activate an indicator at all master alarms under the following conditions:

(1) When or at a predetermined set point before the main or primary supply reaches an average day’s supply, indicating low contents

(2) If the secondary supply is a cryogenic vessel, when or at a predetermined set point before the secondary supply reaches an average day’s supply, indicating low contents

(3) If the reserve supply is a cryogenic vessel, when or at a predetermined set point before the reserve supply reaches an average day’s supply, indicating low contents

(4) Where there is more than one main supply vessel, or at a predetermined set point before the secondary supply begins to supply the system, indicating changeover

(5) When or at a predetermined set point before the reserve supply begins to supply the system, indicating reserve is in use
(6) When or at a predetermined set point before the reserve supply contents fall to one day's average supply, indicating reserve low

(7) If the reserve is a cryogenic vessel, when or at a predetermined set point before the reserve internal pressure falls too low for the reserve to operate properly, indicating reserve failure

3.3.XX Micro Bulk Cryogenic System

An assembly of equipment, a container that is permanently installed through anchoring to a foundation, pressure regulators, pressure relief devices, vaporizers, manifolds, and interconnecting piping is designed to be filled at the health care facility with a cryogenic gas, that has a storage capacity of more than 566 m³ (20,000 ft³ (scf)) of oxygen, including unconnected reserves on hand at the site, and that terminates at the source valve.

5.1.3.5.13(1)

Where the bulk cryogenic liquid central supply system or microbulk cryogenic liquid system is outside of and remote from the building that the oxygen supply serves

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Thu Aug 23 17:39:22 PDT 2012

Committee Statement and Meeting Notes

Committee Statement: This section is proposed as a CI to put requirements on systems that are currently being installed.

CI-305-NFPA 99-2012

Committee Notes:

Date Submitted By
Aug 30, 2012 Hart

These are proposed new sections with the exception of the last paragraph. Although they're scattered, this seems a good way to keep the idea together in 1 CI.

Committee Input No. 364-NFPA 99-2012 [ Section No. 5.1.4 ]

5.1.4* Valves.

5.1.4.1 Gas

1 General.

5.1.4.1.1 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.

5.1.4.2 Accessibility 1.2 Security

All valves, except valves in zone valve box assemblies, shall be located in secured areas such as locked piped chases, or be locked or secured by any of the following means:

(1) Located in secured areas

(2) Locked or latched in their operating position

(3) Located above ceilings, but remaining accessible and not obstructed

5.1.4.1.3 Labeling. All valves shall be labeled as to gas supplied and the area(s) controlled, in accordance with 5.1.11.2.

5.1.4.2.1 Shutoff valves accessible to other than authorized personnel

1.4 Accessibility

Zone valves shall be installed in valve boxes with frangible or removable windows large enough to allow manual operation of valves.

5.1.4.2.1.5

Shutoff valves for use in certain areas, such as psychiatric or pediatric areas, shall be permitted to be secured with the approval of the authority having jurisdiction to prevent inappropriate access.

5.1.4.2.3 1.6 Flammable Gases

Valves for nonflammable medical gases shall not be installed in the same zone valve box assembly with flammable gases.

5.1.4.3 Valve 1.7 Valve Types

New or replacement shutoff valves shall be as follows:

(1) They shall be of the quarter turn, full ported, ball type.

(2) They shall be of brass or bronze construction.

(3) They shall have extensions for brazing.

(4) They shall have a handle indicating open or closed.

(5) They shall consist of three pieces permitting in-line serviceability.

5.1.4.3 1.4 8 Cleaning

Valves for positive pressure gases shall be cleaned for oxygen service by the manufacturer.

5.1.4.3.2 1.9 Vacuum or WAGD Valves

Valves for vacuum or WAGD service shall be permitted to be ball or butterfly type and shall not be required to be cleaned for oxygen service.

5.1.4.4 Source 2 Source Valve

5.1.4.2.1

A shutoff valve shall be placed at the immediate connection of each source system to the piped distribution system to allow the entire source, including all accessory devices (e.g., air dryers, final line regulators), to be isolated from the facility.

5.1.4.2.4 2

The source valve shall be located in the immediate vicinity of the source equipment.

5.1.4.103
4.2 The source valve shall be labeled in accordance with 3.2. Main Line Valve.

5.1.4.5.2 The main line valve shall be located on the facility side of the source valve and outside of the source room, the enclosure, or where the main line first enters the building.

5.1.4.6 Riser Valve.

Each riser supplied from the main line shall be provided with a shutoff valve in the riser adjacent to the main line.

5.1.5. Service Valves.

Riser valves shall be permitted to be located above ceilings, but shall remain accessible and not be obstructed.
5.1.4.7 Service Valves

Service valves shall be installed to allow servicing or modification of lateral branch piping from a main or riser without shutting down the entire main, riser, or facility. 5.1.4.

7 5 1

Only one service valve shall be required for each branch off of a riser, regardless of how many zone valve boxes are installed on that lateral. 5.1.4.

7 5 2

Service valves shall be placed in the branch piping prior to any zone valve box assembly on that branch. 5.1.4.

6 Zone Valves.

Service valves shall be located in any one of the following areas:

(1) Behind a locked access door
(2) Locked open above a ceiling
(3) Locked open in a secure area

5.1.4.

7.4

Service valves shall be labeled in accordance with 5.1.11.2.

5.1.4.8 Zone Valves.

6.1

All station outlets/inlets shall be supplied through a zone valve as follows:

(1) The zone valve shall be placed such that a wall intervenes between the valve and outlets/inlets that it controls.

(2) The zone valve shall serve only outlets/inlets located on that same story.
(4) The zone valve shall serve only outlets/inlets located on that same story.

(3) The zone valve shall not be located in a room with station outlets/inlets that it controls.

5.1.4.

8

6.

2

Zone valves shall be readily operable from a standing position in the corridor on the same floor they serve.

5.1.4.

8

6.

3

Zone valves shall be so arranged that shutting off the supply of medical gas or vacuum to one zone will not affect the supply of medical gas or vacuum to another zone or the rest of the system.

5.1.4.

8

6.

4

A pressure/vacuum indicator shall be provided on the station outlet/inlet side of each zone valve.

5.1.4.

8

6.

5

Zone valve boxes shall be installed where they are visible and accessible at all times.

5.1.4.

8

6.

6

Zone valve boxes shall not be installed behind normally open or normally closed doors or otherwise hidden from plain view.

5.1.4.

8

6.

6

Zone valve boxes shall not be located in closed or locked rooms, areas, or closets.
A zone valve shall be located immediately outside each vital life-support area, critical care area, and anesthetizing location of moderate sedation, deep sedation, or general anesthesia, in each medical gas or vacuum line, or both, and located so as to be readily accessible in an emergency.

All gas delivery columns, hose reels, control panels, pendants, booms, or other special installations shall be located downstream of the zone valve.

Zone valves shall be so arranged that shutting off the supply of gas to any one operating room or anesthetizing location will not affect the others.

In-line shutoff valves shall be located in a restricted area.

They shall be locked or latched open.

They shall be identified in accordance with Section 5.1.11.2.

In-line shutoff valves intended for use to isolate piping for maintenance or modification shall meet the following requirements:

1. They shall be located in a restricted area.
2. They shall be locked or latched open.
3. They shall be identified in accordance with Section 5.1.11.2.

Shutoff valves provided for the connection of future piping shall meet the following requirements:

They shall be located in a restricted area.

They shall be locked or latched closed.

They shall be identified in accordance with Section 5.1.
4. Future connection valves shall be labeled as to gas content.

5.1.4.

8.2. Downstream piping shall be closed with a brazed cap with tubing allowance for cutting and rebrazing.

5.1.4.

9 In-Line Check Valves.

New or replacement check valves shall be as follows:

(1) They shall be of brass or bronze construction.
(2) They shall have brazed extensions.
(3) They shall have in-line serviceability.
(4) They shall not have threaded connections.
(5) They shall have threaded purge points of \( \frac{1}{8} \) in. NPT.
Sections

5.1.13 Support Gases

5.1

5.1.13.1 Applicability.

5.1.13.1.1 Support gases are any gases that are used primarily for powering equipment used in patient care procedures (typical support gases are nitrogen and instrument air). Support gas applications require delivery at pressures, cleanliness, or purities specific to their intended function(s) (e.g., to operate medical-surgical tools). Support gases shall be permitted to be piped into areas intended for any medical support purpose and, if appropriate to the procedures, to be piped into laboratories.

5.1.13.2 Support gases sources shall be permitted to be used for many general utility uses (e.g., to remove excess moisture from instruments before further processing, or to operate gas-driven booms, boom brakes, pendants, or similar applications). Requirements for general utility systems will be found in Chapter 9).

5.1.13.3 Nature of Hazards Support Gas System.

5.1.13.3.1 Support gases may be supplied from the same sources as patient care gases. Where this is done, they shall be treated as the patient care gas and not as a support gas (refer to 5.1.1 to 5.1.12 and 5.1.14).

5.1.13.4 Sources

5.1.13.4.1 Requirements for support gas sources shall be in accordance with the following:
(1) Paragraphs 5.1.3.1 through 5.1.3.5 for nitrogen

(2) Paragraph 5.1.3.9 for instrument air

Sources for support gases delivered from cylinders shall comply with 5.1.3.3 through 5.1.3.5.10.

5.1.13.3.3
Sources for support gases delivered from containers shall comply with 5.1.3.3 through 5.1.3.5.11 except 5.1.3.5.10.

5.1.13.3.4
Sources for support gases delivered from bulk sources shall comply with 5.1.3.3 through 5.1.3.5.11 except 5.1.3.5.10.

5.1.13.3.5 Instrument Air Supply Systems

5.1.13.3.5.1
Quality of Instrument Air. The quality of instrument air shall be as follows:

(1) Compliant with instrument air section in ANSI/ISA S-7.0.01, Quality Standard for Instrument Air

(2) Filtered to 0.01 micron

(3) Free of liquids (e.g., water, hydrocarbons, solvents)

(4) Free of hydrocarbon vapors

(5) Dry to a dew point of °40°C (°40°F)

5.1.13.3.5.2
Instrument air supply systems shall be located per 5.1.3.3 as follows:

(1) Indoors, in a dedicated mechanical equipment area that is adequately ventilated and with any required utilities

(2) In a room ventilated per 5.1.3.3.3.2

(3) For air-cooled equipment, in a room designed to maintain the ambient temperature range as recommended by the equipment manufacturer

5.1.13.3.5.3
Instrument Air Sources shall provide air with the following characteristics:

(1) a guage pressure not less than a 1380 kPa (200 psi) at the compressor.
(2) meeting the definition of instrument air in 5.1.13.2.5.1.

5.1.13.3.5.4 Instrument air sources shall be of any of the following formats:

(1) at least two compressors

(2) one compressor and a standby header complying with 5.1.3.5.8.

5.1.13.3.5.5 Instrument air sources shall include the components specified in 5.1.3.6.3.2 (Components), 5.1.3.6.3.5 (Aftercoolers), 5.1.3.6.3.6 (Receivers), 5.1.3.6.3.7 (except (1)) (Dryers).

5.1.13.3.5.6 Instrument air compressors shall be permitted to be of any type capable of not less than a gauge pressure of 1380 kPa (200 psi) output pressure and of providing air meeting the definition of instrument air in 5.1.13.2.5.1.

5.1.13.3.5.7 Instrument Air Standby Headers.
Where instrument air systems are provided with a standby header, the header shall meet the following requirements:

(1) It shall comply with 5.1.3.5.9, except that the number of attached cylinders shall be sufficient for 1 hour normal operation.

(2) It shall use connectors as for medical air in CGAV-1, Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1).

(3) It shall enter the system upstream (source side) of the final line filters. (See Figure A.5.1.3.9.)

(4) It shall automatically serve the system in the event of a failure of the compressor.

5.1.13.3.5.8* Intake Air.
Intake air for instrument air compressors shall be permitted to be drawn from the outside, from ducted air, or from the equipment location.

5.1.13.3.5.9 Instrument Air Filters.
Instrument air sources shall be provided with filtration sized for 100 percent of the system peak calculated demand at design conditions and with the following elements and characteristics:

(1) activated carbon filters located upstream (source side) of the final line filters.

(2) line filters located upstream (source side) of the final line regulators and
(2) Line filters located upstream (source side) of the final line regulators and
downstream of the carbon filters rated for a minimum of 98 percent efficiency at 0.01
micron.

(3) Equipped with a continuous visual indicator showing the status of the line filter
element life.

(4) Constructed of materials deemed suitable by the manufacturer.

(5) Filters combining the functions in (1) to (4) in a single unit shall be permitted to be
used.

5.1.13.3.5.10 Instrument Air Accessories.
Accessories used for instrument air sources shall comply with the following
subparagraphs:

(1) 5.1.3.6.3.5 for aftercoolers

(2) 5.1.3.6.3.6 for air receivers

(3) 5.1.3.6.3.7 for air dryers

(4) 5.1.3.5.9 for air regulators

5.1.13.3.5.11 Instrument Air Piping Arrangement and Redundancies.
Instrument air sources shall comply with 5.1.3.6.3.10, except for the following:

(1) Systems employing a standby header shall be permitted to have simplex
aftercoolers and dryers.

(2) Systems employing a standby header shall not require a three-valve receiver
bypass.

(3) Standby headers, where provided, shall be isolated from the compressor by a
check valve to prevent backflow through the compressor.

5.1.13.3.5.12 Instrument Air Monitoring and Alarms.
Instrument air sources shall include the following alarms:

(1) Local alarm that activates when or just before the backup compressor (if
provided) activates, indicating that the lag compressor is in operation and that must
be manually reset

(2) Local alarm and alarms at all master alarm panels that activate when the dew
point at system pressure exceeds ?30°C (?22°F), indicating high dew point

5.1.3.9.10.2 For sources with standby headers, the following additional conditions
shall activate a local alarm at the compressor site, a local signal at the header
location, and alarms at all master alarm panels:

(1) Alarm that activates when or just before the main compressor begins to supply the system.
(1) Alarm that activates when or just before the reserve begins to supply the system, indicating reserve in use.

(2) Alarm that activates when or just before the reserve falls below an average hour’s supply, indicating reserve low.

5.1.13.3.5.13 Electrical Power and Control.
Power and control for instrument air sources shall have the following characteristics:

(1) Each compressor motor shall be provided with electrical components including, but not limited to, the following:

(a) Dedicated disconnect switch installed in the electrical circuit ahead of each motor starter

(b) Motor starting device

(c) Overload protection

(d) Where compressor systems having two or more compressors employ a control transformer or other voltage control power device, installation of at least two such devices

(e) Control circuits arranged in such a manner that the shutdown of one compressor does not interrupt the operation of another compressor

(f) Automatic restart function such that the compressor(s) will restart after power interruption without manual intervention.

(2) Electrical installation and wiring shall conform to the requirements of NFPA 70, National Electrical Code.

(3) Emergency electrical service for the compressors shall conform to the requirements of the essential electrical system as described in Chapter 6.

(4) When multiple compressors are used, an additional compressor(s) shall automatically activate when the compressor(s) in operation is incapable of maintaining the required pressure.

(5) When multiple compressors are used, automatic or manual alternation of compressors shall allow division of operating time. If automatic alternation of compressors is not provided, the facility staff shall arrange a schedule for manual alternation.

Delete 5.1.3.9

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Thu Aug 23 10:20:13 PDT 2012

Committee Statement and Meeting Notes

The Committee agrees in principle with the idea of this proposal. It is being submitted as a CI to solicit comments from the public and also to give the TC time for any needed editorial revisions. This reorganization advances the original intent of creating a separate set of requirements for support gases to recognize their less critical nature. It also attempts to identify them more clearly and to separate them from utility systems (Chapter 9).

CI-285-NFPA 99-2012

Public Input No. 176-NFPA 99-2012 [Sections 5.1.13.1, 5.1.13.2]

Committee Input No. 298-NFPA 99-2012 [Section No. 5.3]

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5.3 * Category 3 Piped Gas and Vacuum Systems.

5.3.1 Applicability.

5.3.1.1 These requirements shall apply to health care facilities that qualify to install Category 3 systems as defined in Chapter 4.

5.3.1.1.1 Subsection 5.3.2 through 5.3.12.3 and 5.3.12.5 shall apply to new health care facilities or facilities making changes that alter the piping.

5.3.1.2 Paragraph 5.3.12.2 and 5.3.13.4 shall apply to existing health care facilities.

5.3.1.3 Paragraph 5.3.12.1, 5.3.3.2, 5.3.12.1, and 5.3.13.3 shall apply to new and existing health care facilities.

5.3.1.4 A single Category 3 medical gas source system shall not supply more than two adjoining single treatment facilities.

5.3.1.2 Category 3 medical gas systems shall only use oxygen and nitrous oxide.

5.3.1.3 Category 3 gas-powered device supply systems shall use compressed air and nitrogen.

5.3.1.4 Category 3 vacuum and scavenging systems shall be of either the wet or dry type.

5.3.1.5 Deep sedation and general anesthesia shall not be permitted to be administered when using a Category 3 medical gas system.

5.3.1.6 An existing Category 3 system that is not in strict compliance with the requirements...
An existing Category 3 system that is not in strict compliance with the requirements of this code shall be permitted to continue in use as long as the authority having jurisdiction has determined that such use does not constitute a distinct hazard to life.

5.3.2 Nature of Hazards of Gas and Vacuum Systems.

Potential fire and explosion hazards associated with Category 3 gas and vacuum systems shall be considered in the design, installation, testing, operation, and maintenance of the systems.

5.3.3 Seismic Restraint.

Where required, Category 3 gas and vacuum equipment and piping shall be seismically restrained against earthquakes in accordance with the applicable building code.

5.3.4 Protection Against Cross-Connections.

All connections within Category 3 medical gas (oxygen and nitrous oxide) shall be gas-specific to prevent cross-connections with other piping systems, including vacuum, water, and drive gas.

5.3.5 Systems with Nonstandard Operating Pressures.

Station outlets and piped outlets for Category 3 medical gas and gas-powered dispensing devices having nonstandard operating pressures shall comply with the following additional requirements:

1. Be gas-specific.
2. Be pressure-specific where a single gas is piped at more than one operating pressure.
3. Be a D.I.S.S. connection if operated at a gauge pressure in excess of 560 kPa (80 psi).
4. Be designed to prevent the removal of the adapter until the pressure has been relieved, if operated at a gauge pressure between 1380 kPa and 2070 kPa (200 psi and 300 psi).

5.3.6 Category 3 Medical Gas Supply Systems (Oxygen and Nitrous Oxide).

5.3.6.1 Installer Qualifications.

5.3.6.1.1 Installers of Category 3 medical gas sources (i.e., oxygen and nitrous oxide) where the total of all gases in cylinders or containers, except nitrogen, connected and in storage at one time does not exceed 85 m$^3$ (3000 ft$^3$) at standard temperature and pressure (STP), or 142 m$^3$ (5000 ft$^3$) (STP) if oxygen is stored in a DOT Specification 4L (cryogenic liquid) container shall be certified in accordance with ASSE 6010, Professional Qualification Standard for Medical Gas Systems Installers.

5.3.6.1.2 Installers of Category 3 medical gas sources (i.e., oxygen and nitrous oxide) where the total of all gases exceeds the limits specified in 5.3.6.1.1, shall be qualified in accordance with CGA M-1, Guide for Medical Gas Installations at Consumer Sites.

5.3.6.1.3 The installers of Category 3 medical gas piped distribution systems (i.e., oxygen and nitrous oxide), regardless of source equipment size, shall be certified in accordance with ASSE 6010, Professional Qualification Standard for Medical Gas Systems Installers.
5.3.6.1.4
Installers of medical gas (i.e., oxygen and nitrous oxide) shall not use their certification to oversee installation by non-certified personnel.

5.3.6.2 Category 3 Medical Gas Distribution Piping (Oxygen and Nitrous Oxide)

5.3.6.2.1
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, Not Less Than Type L.

5.3.6.2.2
Tubes, valves, fittings, station outlets, and other piping components shall have been cleaned for oxygen by the manufacturer prior to installation in accordance with 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.

5.3.6.2.3
Joints for tubes, turns, offsets, and other changes in direction shall be made with brazed wrought copper capillary fittings complying with one of the following:

1. ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
2. ANSI/ASME B16.50, Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
3. ASME B16.22, with socket depths equal to or greater than brazed joint pressure fittings in accordance with ANSI/ASME B16.50

5.3.6.2.4
Cast copper alloy fittings shall not be used with field-brazed joints.

5.3.6.2.5
Threaded joints in Category 3 medical gas systems (oxygen and nitrous oxide) shall comply with the following:

1. They shall be limited to connections to pressure indicators, alarm devices, and source equipment.
2. They shall have tapered threads complying with ASME B1.20.1, Pipe Threads, General Purpose, Inch.
3. They shall be made up with polytetrafluoroethylene (such as Teflon™) tape or other thread sealant recommended for oxygen service, with the sealant applied to the male threads only.

5.3.6.2.6
The following joints shall be prohibited in Category 3 medical gas piping (oxygen and nitrous oxide):
(1) Flared and compression connections, including connections to station outlets, alarm devices, and other components

(2) Push-lock connections

(3) Straight-threaded connections, including unions

5.3.6.2.7
Special-purpose fittings permitted in Category 1 medical gas piping systems shall be permitted to be used in Category 3 medical gas piping systems.

5.3.6.3 Qualification of Brazing Procedures and Brazing.

5.3.6.3.1
Brazing procedures and brazer performance for the installation of Category 3 medical gas piping shall meet the same qualifications as Category 1 piping in accordance with either Section IX, “Welding and Brazing Qualifications,” of the ASME ‘Boiler and Pressure Vessel Code,’ or AWS B2.2- Standard for Brazing Procedure and Performance Qualification, both as modified by 5.3.6.3.2 through 5.3.6.3.7.

5.3.6.3.2
Brazers shall be qualified by visual examination of the test coupons followed by sectioning.

5.3.6.3.3
The brazing procedure specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

5.3.6.3.4
The brazing procedure qualification record and the record of brazer performance qualification shall document the filler metal used, cleaning, joint clearance, overlap, internal-purge gas, and flow rate during brazing of the coupon, and absence of internal oxidation in the completed coupon.

5.3.6.3.5
Brazing procedures qualified by a technically competent group or agency shall be permitted under the following conditions:

(1) The brazing procedure specification and the procedure qualification record meet the requirements of this code.

(2) The employer obtains a copy of both the brazing procedure specification and the supporting qualification record from the group or agency and signs and dates these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.

(3) The employer qualifies at least one brazer following each brazing procedure specification used.

5.3.6.3.6
An employer shall be permitted to accept brazer qualification records of a previous employer under the following conditions:

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

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

5.3.6.3.7
Performance qualifications of brazers shall remain in effect indefinitely, unless the brazer does not braze with the qualified procedure for a period exceeding 6 months or there is a specific reason to question the ability of the brazer.

5.3.6.4  Brazed Joints.

5.3.6.4.1
Brazed tube joints shall be of the socket type.

5.3.6.4.2
Brazed joints shall be made using a brazing alloy that exhibits a melting temperature in excess of 538°C (1000°F) to retain the integrity of the piping system in the event of fire exposure.

5.3.6.4.3
Filler metals shall bond with, and be metallurgically compatible with, the base metal being joined.

5.3.6.4.4
Filler metals shall comply with ANSI/AWS A5.8, Specification for Filler Metals for Brazing and Braze Welding.

5.3.6.4.5
Copper-to-copper joints shall be brazed using a copper–phosphorus or copper–phosphorus–silver brazing filler metal (BCuP series) without flux.

5.3.6.4.6
Joints to be brazed in place shall be accessible for necessary preparation, assembly, heating, filler application, cooling, cleaning, and inspection.

5.3.6.5  Cutting Tube Ends.

5.3.6.5.1
Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube.

5.3.6.5.2
The cutting wheels on tubing cutters shall be free from grease, oil, or other lubricant not recommended for oxygen service.

5.3.6.5.3
The cut ends of the tube shall be rolled smooth or deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube.

5.3.6.6  Cleaning Joints for Brazing.

5.3.6.6.1
The interior surfaces of tubes, fittings, and other components that are cleaned for oxygen service shall be stored and handled to avoid contamination prior to assembly and brazing.

5.3.6.6.2
The exterior surfaces of tube ends shall be cleaned prior to brazing to remove any oxides and surface dirt and to roughen the surfaces to prepare them for brazing.

5.3.6.6.3
Nonabrasive pads shall be used to clean the exterior surfaces of tube ends.
5.3.6.6.4—
The use of steel wool, sand cloth, or wire brushes shall be prohibited.

5.3.6.6.5—
The cleaning process shall not result in grooving the surfaces to be joined.

5.3.6.6.6—
After being abraded, the surfaces shall be wiped using a clean, lint-free white cloth.

5.3.6.6.7—
Tubes, fittings, valves, and other components shall be visually examined internally before being joined to verify that they have not become contaminated for oxygen service and that they are free of obstructions or debris.

5.3.6.6.8—
Material that has become contaminated internally and is not clean for oxygen service shall not be installed.

5.3.6.6.9—
Joints shall be brazed within 8 hours after being cleaned for brazing.

5.3.6.7—Brazing Dissimilar Metals—

5.3.6.7.1—
Flux shall only be used when brazing dissimilar metals, such as copper and bronze or brass, using a silver brazing filler metal (BAg series).

5.3.6.7.2—
Cast metals shall not be field-brazed.

5.3.6.7.3—
Surfaces shall be cleaned for brazing in accordance with 5.3.6.6.

5.3.6.7.4—
Flux shall be applied sparingly to minimize contamination of the inside of the tube with flux.

5.3.6.7.5—
The flux shall be applied and worked over the cleaned surfaces to be brazed using a stiff bristle brush to ensure complete coverage and wetting of the surfaces with flux.

5.3.6.7.6—
Where possible, short sections of copper tube shall be brazed onto the non-copper component, and the interior of the subassembly shall be cleaned of flux prior to installation in the system.

5.3.6.7.7—
On joints DN20 (NPS 3/4 in. O.D.) size and smaller, flux-coated brazing rods shall be permitted to be used in lieu of applying flux to the surfaces to be joined.

5.3.6.8—Nitrogen Purge—

5.3.6.8.1—
While being brazed, joints shall be continuously purged with oil-free, dry nitrogen NF to prevent the formation of copper oxide on the inside surface of the joint.

5.3.6.8.2—
The source of the nitrogen purge gas shall be monitored, and the installer shall be audibly alerted when the content is low.

5.3.6.8.3—
The nitrogen purge gas flow rate shall not be high enough to produce a positive pressure in the piping system.

5.3.6.8.4—
5.3.6.8.4
The nitrogen purge gas flow shall be controlled by the use of both a pressure regulator and a flowmeter, or a combination thereof.

5.3.6.8.5
Pressure regulators alone shall not be used to control nitrogen purge gas flow rates.

5.3.6.8.6
During and after installation, openings in the piping system shall be kept capped or plugged to maintain a nitrogen atmosphere within the piping and to prevent debris or other contaminants from entering the system.

5.3.6.8.7
While a joint is being brazed, a discharge opening shall be provided on the opposite side of the joint from where the nitrogen purge gas is being introduced.

5.3.6.8.8
The flow of nitrogen purge gas shall be maintained until the joint is cool to the touch.

5.3.6.8.9
After the joint has cooled, the purge discharge opening shall be plugged or capped to prevent contamination of the inside of the tube and maintain the nitrogen atmosphere within the piping system.

5.3.6.9 Assembling and Heating Brazed Joints.

5.3.6.9.1
Tube ends shall be inserted either fully into the depth of the fitting socket or to a mechanically limited depth that is not less than the minimum cup depth (overlap) specified in ANSI/ASME B16.50, Standard Specification for Wrought Copper and Copper Alloy Brazed-Joint Pressure Fittings.

5.3.6.9.2
Where flux is permitted, joints shall be heated slowly until the flux has liquefied.

5.3.6.9.3
After flux has liquefied, or where flux is not permitted to be used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint.

5.3.6.9.4
Techniques for heating joints, applying the brazing filler metal, and making the horizontal, vertical, and large-diameter joints shall be as described in sections on applying heat and brazing horizontal and vertical joints in Chapter VII, “Brazed Joints,” in the CDA Copper Tube Handbook.

5.3.6.10 Inspection of Brazed Joints.

5.3.6.10.1
After brazing, the outside of all joints shall be cleaned by washing with water and a wire brush to remove any residue and allow clear visual inspection of the joint.

5.3.6.10.2
Where flux has been used, the wash water shall be hot.

5.3.6.10.3
Each joint shall be visually inspected after cleaning the outside surfaces.

5.3.6.10.4
Joints exhibiting the following conditions shall not be permitted:

1. Flux or flux residue (when flux or flux-coated BAg rods are used with dissimilar metals)
2. Base metal melting or erosion
(2) Base metal melting or erosion
(3) Unmelted filler metal
(4) Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
(5) Cracks in the tube or component
(6) Cracks in the filler metal
(7) Failure of the joint to hold the test pressure under the installer-performed initial pressure test (see 5.3.6.23.2.3) and standing pressure test (see 5.3.6.23.2.6)

5.3.6.10.5—
Joints that are identified as defective under conditions specified in 5.3.6.10.4 (2) or (5) shall be replaced.

5.3.6.10.6—
Joints that are found to be defective under conditions specified in 5.3.6.10.4 (1), (3), (4), (6), or (7) shall be permitted to be repaired, except that no joint shall be reheated more than once before being replaced.

5.3.6.11—Installation of Category 3 Medical Gas Piping (Oxygen and Nitrous Oxide).

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

5.3.6.11.2—Minimum Pipe Sizes.
The minimum sizes of Category 3 oxygen and nitrous oxide piping shall be as follows:

(1) Category 3 oxygen piping systems shall be not less than DN10 (NPS 3/8 - in.) (4 3/4 - in. O.D.) size.
(2) Category 3 nitrous oxide piping systems shall be not less than DN8 (NPS 1/2 - in.) (3 3/4 - in. O.D.) size.

5.3.6.11.3—Location of Piping.
Oxygen and nitrous oxide piping shall not be located where subject to contact with oil.

5.3.6.11.4—Protection of Piping.

5.3.6.11.4.1—
Piping shall be protected against freezing, corrosion, and physical damage.

5.3.6.11.4.2—
Piping exposed in corridors and other locations where subject to physical damage from the movement of carts, stretchers, beds, portable equipment, or vehicles shall be protected.

5.3.6.12—Pipe Support.

5.3.6.12.1—
Piping shall be supported from the building structure.
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.

5.3.6.12.3
Hangers and supports for copper tube shall be sized for copper tube.

5.3.6.12.4
In potentially damp locations, copper tube hangers and supports that are in contact with the tube shall be plastic-coated or otherwise electrically insulated from the tube.

5.3.6.12.5
The maximum support spacing for copper tube shall be in accordance with Table 5.3.6.12.5.

Table 5.3.6.12.5 Maximum Copper Tube Support Spacing

<table>
<thead>
<tr>
<th>Hanger Spacing</th>
<th>Pipe Size</th>
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<th>ft</th>
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<td></td>
</tr>
<tr>
<td>1830</td>
<td>DN10 (NPS 3/8) (1/2 in. O.D.)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1830</td>
<td>DN15 (NPS 1) (5/8 in. O.D.)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2130</td>
<td>DN20 (NPS 3/4) (1 in. O.D.)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>2440</td>
<td>DN25 (NPS 1 1/4) (1 1/8 in. O.D.)</td>
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<td></td>
</tr>
<tr>
<td>2740</td>
<td>DN32 (NPS 1 1/2) (1 3/8 in. O.D.) and larger</td>
<td>9</td>
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<tr>
<td>3050</td>
<td>Vertical risers, all sizes, every floor, but not to exceed 4570</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

5.3.6.13 Underground Piping Outside of Buildings

5.3.6.13.1
Buried piping outside of buildings shall be installed below the local level of frost penetration.

5.3.6.13.2
The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

5.3.6.13.3
If the underground piping is protected by a conduit, cover, or other enclosure, the following requirements shall be met:

1. Access during construction shall be provided at the joints for visual inspection and leak testing.

2. The conduit, cover, or enclosure shall be self-draining and not retain groundwater in prolonged contact with copper tubing.

5.3.6.13.4
Buried piping that will be subject to surface loads shall be buried at a depth that will protect the piping or its enclosure, or both, from excessive stresses.

5.3.6.13.5
The minimum backfill cover above the top of the piping or its enclosure shall be 900 mm (36 in.); except that the minimum cover shall be permitted to be reduced to 450 mm (18 in.) where there is no potential for damage from surface loads or surface conditions.

5.3.6.13.6
Trenches shall be excavated so that the piping or its enclosure has firm, substantially continuous bearing on the bottom of the trench.
Backfill shall be clean, free from material that can damage the pipe, and compacted.

5.3.6.13.8—
A continuous warning tape or marker shall be placed immediately above the piping or its enclosure to clearly identify the pipeline by specific name.

5.3.6.13.9—
A continuous warning means shall also be placed above the pipeline at approximately one-half the depth of burial.

5.3.6.13.10—
Where buried piping is extended into a building through a wall sleeve, the outdoor end of the sleeve shall be sealed watertight to prevent the entrance of groundwater into the building.

5.3.6.14—Underground Piping Within Buildings—

5.3.6.14.1—
The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.

5.3.6.14.2—
If the underground piping is protected by a conduit, cover, or other enclosure, access shall be provided at the joints during construction for visual inspection and leak testing.

5.3.6.14.3—
The piping shall be backfilled with clean sand or gravel.

5.3.6.15—Piping Within Floor Slabs Prohibited—

Category 3 medical gas piping (oxygen and nitrous oxide) shall not be installed within floor slabs.

5.3.6.16—Hose and Flexible Connectors—

5.3.6.16.1—
Hose and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions.

5.3.6.16.2—
Hose and flexible connectors, metallic or nonmetallic, shall have a minimum burst gauge pressure of 6895 kPa (1000 psi).

5.3.6.16.3—
Medical gas hose and flexible connectors shall be oxygen compatible.

5.3.6.16.4—
Hose and flexible connectors shall be clearly identified as to the gas content.

5.3.6.16.5—
Hose and flexible connectors for Category 3 medical gases (oxygen and nitrous oxide) shall be gas-specific and not be permitted to conduct any other gas, gas mixture, or liquid.

5.3.6.17 *—Category 3 Medical Gas Station Outlets (Oxygen and Nitrous Oxide)—

5.3.6.17.1 *—
Each station outlet for Category 3 medical gases shall be gas-specific, whether the outlet connection is threaded or is a noninterchangeable quick coupler.

5.3.6.17.2—
Each station outlet shall consist of a primary and secondary valve (or assembly).
Each station outlet shall consist of a primary and secondary valve (or assembly).

5.3.6.17.3
Each secondary valve (or assembly) shall close automatically to stop the flow of gas when the primary valve (or assembly) is removed.

5.3.6.18  Piped Outlets for Connection to Category 3 Medical Gas Dispensing Devices.

5.3.6.18.1
Piped outlets for connection to Category 3 medical gas dispensing devices shall be gas-specific.

5.3.6.18.2
Piped outlets shall include a check valve and be capped until connected to the gas dispensing device.

5.3.6.18.3
Where piped outlets are connected to gas dispensing devices by flexible tubing, the tubing shall have a minimum burst gauge pressure of 6895 kPa (1000 psi) and be rated for oxygen use.

5.3.6.18.4
All connections between piped outlets and gas-dispensing devices shall be gas-specific to prevent cross-connections.

5.3.6.19  Emergency Shutoff Valves.

5.3.6.19.1
Where a central Category 3 medical gas (oxygen and nitrous oxide) supply is remote from a single treatment facility, the main supply line shall be provided with an emergency shutoff valve so located in the single treatment facility as to be accessible from all use-point locations in an emergency.

5.3.6.19.2
Where a central Category 3 medical gas (oxygen and nitrous oxide) supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve so located in the treatment facility as to be accessible from all use-point locations in an emergency.

5.3.6.19.3
Emergency shutoff valves shall be labeled to indicate the gas controlled and shall shut off only the gas to the treatment facility that they serve.

5.3.6.19.4
A remotely activated shutoff valve at a supply manifold shall not be used for emergency shutoff. For clinical purposes, such a remote valve actuator shall not fail-closed in the event of a loss of electric power. Where remote actuators are the type that fail-open, it shall be mandatory that cylinder shutoff valves be closed whenever the system is not in use.

5.3.6.20  Locations of Medical Gas Source Equipment (Oxygen and Nitrous Oxide).

5.3.6.20.1
Gas storage locations in facilities with Category 3 medical gas systems with a total of all gases in cylinders or containers, except nitrogen, connected and in storage at one time that does not exceed 85 m³ (3000 ft³) at standard temperature and pressure (STP), or 142 m³ (5000 ft³) (STP) if oxygen is stored in a DOT Specification 4L (cryogenic liquid) container shall comply with 5.3.6.20.3 through 5.3.6.20.12.

5.3.6.20.2
Gas storage locations in facilities with Category 3 medical gas systems with a total
Gas storage locations in facilities with Category 3 medical gas systems with a total of all gases in cylinders or containers exceeding quantities listed in 5.3.6.20.1 shall comply with 5.1.3.3:

5.3.6.20.3—
Enclosures shall serve no purpose other than to contain the medical gas source equipment (oxygen and nitrous oxide), except that nitrogen source equipment in 5.3.7.7 and compressed air cylinders in 5.3.7.6 shall be permitted in the enclosure.

5.3.6.20.4—
Storage of full or empty gas cylinders, or both, shall be permitted in the same enclosure.

5.3.6.20.5—
Air compressors, vacuum pumps, and other equipment shall not be located in enclosures for medical gas cylinders (oxygen and nitrous oxide source equipment).

5.3.6.20.6—
If enclosures are outdoors or remote from the treatment facilities that they serve, they shall be kept locked.

5.3.6.20.7—
Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 54°C (130°F). Nitrous oxide cylinders shall be prevented from reaching temperatures lower than −7°C (20°F).

5.3.6.20.8—
Only gas cylinders, reusable shipping containers, and their accessories shall be permitted to be stored in rooms containing central supply systems or gas cylinders.

5.3.6.20.9—
No flammable materials, cylinders containing flammable gases, or containers containing flammable liquids shall be stored in rooms with gas cylinders.

5.3.6.20.10—
Indoor enclosures shall not communicate directly with medical gas (oxygen and nitrous oxide) use points or storage locations for oxidizers.

5.3.6.20.11—
Outdoor enclosures that are adjacent to a building wall shall be located such that the distance to any window or door of the adjacent building is greater than 3.05 m (10 ft).

5.3.6.20.12—
Enclosures for Category 3 medical gas source equipment shall be provided with doors or gates.

5.3.6.21—Category 3 Medical Gas Source Equipment (Oxygen and Nitrous Oxide).

5.3.6.21.1—
Mechanical means shall be provided to ensure that the medical gas source equipment is connected to the correct medical gas distribution piping system.

5.3.6.21.2—
Cylinder valve outlets for oxygen and nitrous oxide shall comply with CGA V-1, Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections.

5.3.6.21.3—
Threaded connections to manifolds shall comply with CGA V-5, Diameter-Index Safety System (Noninterchangeable Low-Pressure Connections for Medical Gas Applications).
5.3.6.21.4—
A check valve shall be provided downstream of each pressure regulator.

5.3.6.21.5—
A pressure relief valve set at 50 percent above the normal line pressure shall be located downstream of the check valve in 5.3.6.21.4.

5.3.6.21.6—
Pressure relief valves shall be brass, bronze, or stainless steel and designed for oxygen service.

5.3.6.21.7—
Hose and flexible connectors shall have a gauge pressure rating not less than 6895 kPa (1000 psi).

5.3.6.21.8—
Materials used in central supply systems shall meet the following requirements:

1. In those portions of systems intended to handle oxygen at gauge pressures equal to or greater than 2413 kPa (350 psi), interconnecting hose shall contain no polymeric materials.

2. In those portions of systems intended to handle oxygen or nitrous oxide material, construction shall be compatible with oxygen under the temperatures and pressures to which the components can be exposed.

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

4. If intended for outdoor installation, materials shall be installed per the manufacturer's requirements.

5.3.6.21.9—
Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52 m (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

5.3.6.21.10—
Medical gas source equipment that serves one or two treatment facilities shall include two banks of one or more cylinders of oxygen and (if used) two banks of one or more cylinders of nitrous oxide, each bank containing at least an average day's supply.

5.3.6.21.11—
The two banks of each medical gas source shall be manifolded so that either bank can supply its distribution piping system.

5.3.6.21.12—
Where the source equipment is remote from a single treatment facility and an "in use" bank is unable to supply the system, the manifold shall automatically switch to the secondary bank.

5.3.6.21.13—
Where the source equipment serves multiple treatment facilities and an "in use" bank is unable to supply the system, the manifold shall automatically switch to the secondary bank.

5.3.6.21.14—
Where the source equipment is not remote and is accessible from a single treatment facility served and an “in use” bank is unable to supply the system, the manifold shall be manually (or automatically) switched to the secondary bank.

5.3.6.22—Category 3 Warning Systems.

5.3.6.22.1—
Warning systems for medical gas systems (oxygen and nitrous oxide) in Category 3 facilities shall provide the following alarms:

1. Oxygen main line pressure low
2. Oxygen main line pressure high
3. Oxygen changeover to secondary bank or about to changeover (if automatic)
4. Nitrous oxide main line pressure low
5. Nitrous oxide main line pressure high
6. Nitrous oxide changeover to secondary bank or about to changeover (if automatic)

5.3.6.22.2—
Warning systems shall have at least one single alarm panel in each treatment facility served by the medical gas source equipment.

5.3.6.22.3—
Alarm panels shall be located in an area of continuous surveillance while the facility is in operation.

5.3.6.22.4—
Pressure switches/sensors that monitor main line pressure shall be mounted at the source equipment with pressure alarm indicators (lamp or LED) at the alarm panel.

5.3.6.22.5—
Audible and noncancelable alarm visual signals shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.

5.3.6.22.6—
Visual indications shall remain until the situation that caused the alarm is resolved.

5.3.6.22.7—
Pressure switches/sensors shall be installed downstream of any emergency shutoff valves and any other shutoff valves in the system and shall cause an alarm for the medical gas if the pressure decreases or increases 20 percent from the normal operating pressure.

5.3.6.22.8—
A cancelable audible indication of each alarm condition that produces a sound at the alarm panel shall reinitiate the audible signal if another alarm condition occurs while the audible signal is silenced.

5.3.6.23—Performance Criteria and Testing — Category 3 Medical Gases (Oxygen and Nitrous Oxide).

5.3.6.23.1—General—

5.3.6.23.1.1—
Inspection and testing shall be performed on all new piped medical gas systems (oxygen and nitrous oxide), additions, renovations, temporary installations, or repaired systems to ensure, by a documented procedure, that all applicable
provisions of this code have been adhered to and system integrity has been achieved or maintained:

5.3.6.23.1.2—

The 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 authority and any others that are required.

5.3.6.23.1.3—

Reports shall contain detailed listings of all findings and results.

5.3.6.23.1.4—

The responsible facility authority shall review the inspection and testing records prior to the use of any systems to ensure that all findings and results of the inspection and testing have been successfully completed.

5.3.6.23.1.5—

All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

5.3.6.23.1.6—

The responsible facility authority shall review the inspection and testing records prior to the use of all systems to ensure that all findings and results of the inspection and testing have been successfully completed.

5.3.6.23.2—Initial Tests for Category 3 Medical Gases (Oxygen and Nitrous Oxide).

5.3.6.23.2.1—General.

(A)—

The initial tests required by 5.3.6.23.2 shall be performed prior to the verification tests listed in 5.3.6.23.3 by one or more of the following, who shall be qualified under ASSE 6010, Professional Qualification Standard for Medical Gas Systems Installers:

1. Installer
2. Representative of the system supplier
3. Representative of the system manufacturer
4. Medical gas systems verifier qualified under 5.3.6.23.3.1(A)

(B)—

The test gas for medical gas systems shall be oil-free, dry nitrogen NF.

(C)—

Where manufactured assemblies are to be installed, the tests required under 5.3.6.23.2 shall be performed as follows:

1. After completion of the distribution piping
2. Prior to installation or connection of manufactured assemblies having internal flexible hose or flexible tubing
3. At all station outlets on manufactured assemblies supplied through copper tubing
(D)—
Where plastic vacuum and scavenging piping systems are installed, they shall be
visually inspected for cross-connections to positive pressure systems prior to
applying positive test pressures to the copper piping systems.

5.3.6.23.2.2 Initial Piping Blow-Down.—
Piping in Category 3 medical gas distribution systems shall be blown clear by a
means of oil-free, dry nitrogen NF after installation of the distribution piping but
before installation of station outlets and other system components (i.e., pressure
alarm devices, pressure indicators, pressure relief valves, manifolds, source
equipment).

5.3.6.23.2.3 Initial Pressure Test.—

(A)—
Each section of the piping in Category 3 medical gas piping systems shall be
pressure tested by a party qualified under 5.3.6.23.2.1(A), using oil-free, dry
nitrogen NF.

(B)—
Initial pressure tests shall be conducted as follows:

1. After blow down of the distribution piping
2. After installation of station outlets/inlets rough-in assemblies, with test caps
   permitted to be used
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

(C)—
The source shutoff valves for the piping systems shall remain closed during the
tests.

(D)—
The test pressure for medical gas piping shall be 1.5 times the system working
pressure but not less than a gauge pressure of 1035 kPa (150 psi).

(E) —
The test pressure shall be maintained until each joint has been examined for
leakage by means of a leak detectant that is safe for use with oxygen and does not
contain ammonia.

(F)—
Leaks, if any, shall be located, repaired (if permitted), or replaced (if required) by the
installer and retested.

5.3.6.23.2.4 Initial Cross-Connection Test.—
A party qualified under 5.3.6.23.2.1(A) shall determine that no cross-connections
exist between the various medical gas piping systems (oxygen and nitrous oxide):

(A)—
The Category 3 medical gas piping systems shall be at atmospheric pressure.

(B)—
Faceplates for gas outlets shall be installed.

(C)—
The test gas for medical gas piping systems shall be oil-free, dry nitrogen NF.
The test gas for medical gas piping systems shall be oil-free, dry nitrogen NF:

(D)—
The source of test gas shall be connected only to the medical gas piping system being tested:

(E)—
The medical gas system being tested shall be pressurized to a gauge pressure of 345 kPa (50 psi):

(F)—
Each individual system gas outlet in each installed medical gas piping system (oxygen and nitrous oxide) shall be checked to determine that the test gas is being dispensed only from the outlets in the medical gas piping system being tested:

(G)—
The cross-connection test shall be repeated for each installed medical gas piping system:

(H)—
The proper labeling and identification of system outlets shall be confirmed during the tests:

5.3.6.23.2.5 Initial Piping Purge Test—
The outlets in each Category 3 medical gas piping system shall be purged by a party qualified under 5.3.6.23.2.1(A) to remove any particulate matter from the distribution piping:

(A)—
The test gas shall be oil-free, dry nitrogen NF:

(B)—
Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth:

(C)—
The purging shall be started at the furthest outlet in the system and proceed toward the source equipment:

5.3.6.23.2.6 Initial Standing Pressure Test—
After successful completion of the initial pressure tests under 5.3.6.23.2.3, Category 3 medical gas distribution piping shall be subjected to a standing pressure test by a party qualified under 5.3.6.23.2.1(A):

(A)—
Tests shall be conducted after the installation of station outlet valve bodies and faceplates and other distribution system components (e.g., pressure alarm devices, pressure indicators, and line pressure relief valves):

(B)—
The source valve shall be closed during the test:

(C)—
The piping systems shall be subjected to a 24-hour standing pressure test using oil-free, dry nitrogen NF:

(D)—
Test pressures shall be 20 percent above the normal system operating line pressure:

(E)—
At the conclusion of the tests, there shall be no change in the test pressure greater than a gauge pressure of 35 kPa (5 psi):
Leaks, if any, shall be located, repaired (if permitted), or replaced (if required) by the installer and retested.

5.3.6.23.3 System Verification for Category 3 Medical Gases (Oxygen and Nitrous Oxide).

5.3.6.23.3.1 General.

(A) Verification tests shall be conducted on Category 3 medical gases (oxygen and nitrous oxide) by a party technically competent and experienced in the field of medical gas and vacuum system verification and meeting the requirements of ASSE 6030, Professional Qualification Standard for Medical Gas Systems Verifiers.

(B) Verification testing shall be performed by a party other than the installing contractor, the system supplier, or the system manufacturer.

(C) Verification tests shall be performed only after all tests required in 5.3.6.23.2 have been successfully completed on the medical gas piping systems.

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

(E) All verification tests required under 5.3.6.23.3 shall be performed after installation of any manufactured assemblies having internal hose or tubing.

(F) Where manufactured assemblies with internal tubing or hose include multiple possible connection points for terminals, each possible connection point shall be tested independently.

(G) For small projects affecting a limited number of areas, where the use of nitrogen is impractical, the system gas shall be permitted to be used for the following tests:

1. Standing pressure (see 5.3.6.23.3.3)
2. Cross-connection by individual pressurization (see 5.3.6.23.3.4)
3. Cross-connection by pressure differential (see 5.3.6.23.3.5)
4. Warning system (see 5.3.6.23.3.6)
5. Piping purge (see 5.3.6.23.3.7)
6. Piping particulate (see 5.3.6.23.3.8)
7. Piping purity (see 5.3.6.23.3.9)
8. Operational pressure (see 5.3.6.23.3.10)

(H) All verification test results shall be reported as required in 5.3.6.23.3.1.

5.3.6.23.3.2 Source Equipment Verification.

(A) General: Source equipment verification for Category 3 medical gases (oxygen and nitrous oxide) shall be performed following the installation of the interconnecting...
(B) —

Use of Source Equipment for Pipeline Verification Tests. Where the source equipment and system gas is permitted to be used for verification testing of the distribution piping, the source equipment shall be verified prior to verification of the distribution piping:

(C) —

Automatic Changeover. Where medical gas sources include automatic changeover to a secondary bank, the system apparatus shall be tested for proper function, including the changeover from primary to secondary supply (with its changeover alarm signal), before the source equipment is put into service.

5.3.6.23.3.3 Verifier Standing Pressure Test.

Category 3 medical gas piping systems (oxygen and nitrous oxide) shall be subjected to a 10-minute standing pressure test at operating line pressure using the following procedures:

(1) The system source shutoff valve shall be closed, unless it is being used as the test gas.

(2) After the system is filled with oil-free, dry nitrogen NF or the system gas, the test source valve shall be closed.

(3) The piping system downstream of the valve shall show no decrease in pressure after 10 minutes.

(4) Any leaks shall be located by the installer, repaired by the installer (if permitted), replaced by the installer (if required), and retested by the verifier.

5.3.6.23.3.4 Verifier Cross-Connection Test by Individual Pressurization.

After closing of walls and completion of the requirements of 5.3.6.23.2, it shall be determined that no cross-connections exist between the Category 3 medical gas systems (oxygen and nitrous oxide) by either use of the following individual pressurization methods or by the pressure differential method in 5.3.6.23.3.5:

(1) Reduce the pressure in all Category 3 medical gas systems to atmospheric.

(2) Pressurize one of the Category 3 medical gas piping systems to a gauge pressure of 345 kPa (50 psi) using oil-free, dry nitrogen NF or the system gas.

(3) Test each medical gas outlet using appropriate adapters to verify that the test gas pressure is present only at the outlets in the Category 3 medical gas piping system being tested.

(4) After it has been verified that a Category 3 medical gas piping system is free of cross-connections, disconnect the source of test gas and reduce the piping to atmospheric pressure.

(5) Proceed to test each Category 3 medical gas piping system until each is verified to be free of cross-connections.

5.3.6.23.3.5 Verifier Cross-Connection Test by Pressure Differential.

After closing of walls and completion of the requirements of 5.3.6.23.2, it shall be
determined that no cross-connections exist between the Category 3 medical gas systems (oxygen and nitrous oxide) by either use of the pressure differential method in 5.3.6.23.3.5(A) through 5.3.6.23.3.5(F) or by the individual pressurization method in 5.3.6.23.3.4:

(A)—
The pressure in all Category 3 medical gas systems shall be reduced to atmospheric.

(B)—
The test gas shall be oil-free, dry nitrogen NF or the system gas.

(C)—
The test gas pressures shall be gauge pressures of 345 kPa (50 psi) for oxygen and 275 kPa (40 psi) for nitrous oxide, with simultaneous maintenance of these nominal pressures throughout the test.

(D)—
Following the adjustment of system pressures in accordance with 5.3.6.23.3.5(C), each station outlet for each medical gas system shall be tested using the gas-specific connection for each system with a test gauge attached to verify that the correct test pressure is present at each outlet of each system.

(E)—
Each test gauge used in performing the test shall be calibrated with the pressure indicators for the line pressure regulators that provide the test pressures.

(F)—
Each station outlet shall be identified by label (and color marking, if used), and the pressure indicated on the test gauge shall be that listed in 5.3.6.23.3.5(C) for the system being tested.

5.3.6.23.3.6  Verifier Warning System Tests.

(A)—
All warning systems that are installed for Category 3 medical gases (oxygen and nitrous oxide) shall be verified to ensure that all components function correctly prior to placing the system into service.

(B)—
Permanent records of the tests shall be maintained.

(C)—
Warning systems that are part of an addition to an existing piping system shall be tested prior to connection of the new piping to the existing system.

(D)—
Tests of warning systems for new installations shall be performed after the verifier's cross-connection testing (see 5.3.6.23.3.4 or 5.3.6.23.3.5), but before purging the piping (see 5.3.6.23.3.7) and performing the remaining verification tests. (See 5.3.6.23.3.8 through 5.3.6.23.3.10.)

(E)—
Test gases shall be either oil-free, dry nitrogen NF or the system gas.

(F)—
The audible and noncancelable alarm signals in each treatment facility shall be checked to verify that they are in a location that will be continuously attended while the facility is in operation.

(G)—
The operation of the Category 3 medical gas line pressure alarms required by 5.3.6.22.1 shall be verified.
The operation of the Category 3 changeover alarms, if provided under 5.3.6.22.1, shall be verified.

If automatic changeover is provided under 5.3.6.21.12 or 5.3.6.21.13, audible and noncancelable visual signals shall indicate whenever automatic changeover occurs or is about to occur.

Where Category 3 medical gas systems (oxygen and nitrous oxide) include other alarm features that are not mandatory in 5.3.6.21, they shall be functionally tested in accordance with their intended purpose and the equipment manufacturer's recommendations.

5.3.6.23.3.7 Verifier 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 each Category 3 medical gas (oxygen and nitrous oxide) pipeline shall be performed.

The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates shall be put on each outlet.

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.

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

5.3.6.23.3.8 Verifier Piping Particulate Test.

The cleanliness of the piping in each Category 3 medical gas system (oxygen and nitrous oxide) shall be verified as follows:

1. The test shall be performed using oil-free, dry nitrogen NF or the system gas.
2. A minimum of 1000 L (35 ft³) of gas shall be filtered through a clean, white 0.45 micron filter at a minimum flow rate of 100 SLPM (3.5 SCFM).
3. Each zone shall be tested at the outlet most remote from the source.
4. The filter shall accrue no more than 0.001 g (1 mg) of matter from any outlet tested.

5.3.6.23.3.9 Verifier Piping Purity Test.

For each Category 3 medical gas system (oxygen and nitrous oxide), the purity of the piping system shall be verified as follows:

1. The tests shall be performed with oil-free, dry nitrogen NF or the system gas.
2. The outlet most remote from the source shall be tested for total non-methane hydrocarbons and compared to the source gas.
(3) If the system gas is used as the source gas, it shall be tested at the source equipment.

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

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

(6) The moisture concentration of the outlet test shall not exceed 500 ppm or an equivalent pressure dew point of -12°C (10°F) at a gauge pressure of 345 kPa (50 psi):

5.3.6.23.3.10 Verifier Operational Pressure Test.—

(A) Operational pressure tests shall be performed at each station outlet in Category 3 medical gas piping systems (oxygen and nitrous oxide) where the user makes connections and disconnections.

(B) Tests shall be performed using either oil-free, dry nitrogen NF or the system gas.

(C) Medical gas outlets (oxygen and nitrous oxide) shall deliver 50 SLPM (1.8 SCFM) with a pressure drop of not more than 35 kPa (5 psi) from a gauge pressure of 345 kPa to 380 kPa (50 psi to 55 psi).

5.3.6.23.3.11* Verifier Gas Concentration Test.—

After purging each Category 3 medical gas piping system with the gas of system designation, the following shall be performed:

(1) Each medical gas outlet (oxygen and nitrous oxide) shall be analyzed for concentration of gas by volume.

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

(3) Allowable concentrations shall be as follows:

   (4) Oxygen ≥99 percent oxygen

   (5) Nitrous oxide ≥99 percent nitrous oxide

5.3.6.23.3.12 Verifier Final Tie-In Test.—

(A) Prior to the connection of any new piping in extensions or additions to an existing piping system, the final tests in 5.3.6.23.3 shall be successfully performed on the new work.

(B) Each joint in the final connection between the new work and the existing system shall be leak-tested with the gas of system designation at the normal operating pressure by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.
Vacuum joints shall be tested using an ultrasonic leak detector or other means that allow detection of leaks in an active vacuum system.

Immediately after a final connection is made and leak-tested, the specific altered zone and components in the immediate zone or area that is downstream from the point or area of intrusion shall be purged per 5.3.6.23.3.7.

5.3.6.23.3.13 Verification of Labeling.

The labeling and identification of source equipment, shutoff valves, alarm panels, and station outlets for Category 3 medical gas systems (oxygen and nitrous oxide) shall be verified.

5.3.7 Category 3 Gas-Powered Device Supply Systems (Compressed Air and Nitrogen).

5.3.7.1 General Requirements.

5.3.7.1.1 Category 3 gas-powered device supply systems shall be used to drive dynamic devices, to dry surfaces for patient treatment, to drive vacuum turbines, and to remove excess moisture from instruments before further processing and for other general compressed gas uses in Category 3 facilities.

5.3.7.1.2 Category 3 gas-powered device supply systems shall be permitted to be used to supply power to gas-driven devices for scavenging, but only where the exhaust of the scavenging device is a closed vent to the outside of the building.

5.3.7.1.3 Category 3 gas-powered device supply systems shall be furnished by the equipment manufacturer(s) or supplier(s), who shall be familiar with the proper application of the equipment and shall supervise its installation.

5.3.7.1.4 Installers of Category 3 gas-powered device supply systems shall be experienced in the installation and testing of such systems and the requirements of this code.

5.3.7.2 Piping for Gas-Powered Devices.

5.3.7.2.1 Tubes.

5.3.7.2.1.1 Tubes shall be in accordance with one of the following:

1. ASTM B 819, Standard Specification for Seamless Copper Tube for Medical Gas Systems, medical gas tube, not less than Type L
2. ASTM B 88, Standard Specification for Seamless Copper Water Tube, water tube, not less than Type L
3. ASTM B 280, Standard Specification for Seamless Copper Tubing for Air Conditioning and Refrigeration Field Service, ACR tube (O.D. size)

5.3.7.2.1.2 Tubing shall be hard temper or annealed (soft temper).

5.3.7.2.2 Fittings.

Fittings for Category 3 gas-powered device supply piping shall be one of the
following:

(1) Brazed-or-soldered fittings complying with ASME B16.22, Wrought Copper and Copper-Alloy Solder-Joint Pressure Fittings

(2) Brazed fittings complying with ASME B16.50, Wrought Copper and Copper-Alloy Braze-Joint Pressure Fittings

(3) Brazed fittings complying with ASME B16.22, with socket depths equal to or greater than braze-joint pressure fittings in compliance with ANSI/ASME B16.50.

(4) Flared fittings complying with ASME B16.26, Cast Copper-Alloy Fittings for Flared Copper-Tubes

(5) Compression fittings (¾ in. maximum size)

(6) Special-purpose fittings permitted for Category 1 medical gas piping

5.3.7.2.3 Joints.

5.3.7.2.3.1 Joints for Category 3 gas-powered-device supply piping shall be of the brazed, soldered, threaded, flared, or compression type.

5.3.7.2.3.2 Where joints are brazed, they shall comply with the requirements for Category 3 medical gas piping in 5.3.6.1 through 5.3.6.10.

5.3.7.2.3.3 Soldered joints in Category 3 gas-powered supply piping shall be made in accordance with ASTM B 828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings, using a “lead-free” solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B 32, Standard Specification for Solder Metal.

5.3.7.3 Installation of Gas-Powered Device Piping.

5.3.7.3.1 Pipe Sizing.

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

5.3.7.3.2 Protection of Piping.

Piping shall be protected in accordance with 5.3.6.11.

5.3.7.3.3 Pipe Support.

Pipe support shall be in accordance with 5.3.6.12.

5.3.7.3.4 Underground Piping Outside of Buildings.

Buried piping outside of buildings shall be in accordance with 5.3.6.13.

5.3.7.3.5 Underground Piping Within Buildings.

Underground piping within buildings shall be in accordance with 5.3.6.14.

5.3.7.3.6 Piping Within Floor Slabs.

5.3.7.3.6.1 Category 3 gas-powered device piping (compressed air and nitrogen) that is installed within floor slabs shall be enclosed in a conduit, in flexible plastic tubing, or by other means to prevent contact between the copper tubing and concrete.

5.3.7.3.6.2 During construction, access shall be provided at any joints for visual inspection and
During construction, access shall be provided at any joints for visual inspection and leak testing.

5.3.7.4 Valves in Gas-Powered Device Piping.
Shutoff valves shall be permitted to be installed in Category 3 gas-powered device piping.

5.3.7.5 Location of Gas-Powered Device Source Equipment.

5.3.7.5.1 Source equipment for Category 3 gas-powered devices shall be one or more of the following:

(1) One or more air compressors
(2) One or more air compressors with compressed air cylinders
(3) Nitrogen cylinders

5.3.7.5.2 Air compressors for Category 3 gas-powered devices shall be installed in a designated mechanical equipment area, heated and ventilated in accordance with 5.1.3.3.2 and 5.1.3.3.3, and have required utilities (e.g., electrical power, drains, lighting).

5.3.7.5.3 Where nitrogen or compressed air in cylinders is used, the cylinders shall be permitted to be located in a compressor equipment room.

5.3.7.5.4 Nitrogen and compressed air cylinders shall be permitted to be located in enclosures for Category 3 medical gases (oxygen and nitrous oxide).

5.3.7.6 Air Compressor Source Equipment.

5.3.7.6.1 General.
Category 3 compressed air compressor supply systems shall include the following:

(1) Disconnect switch(es)
(2) Motor-starting device(s)
(3) Motor overload protection device(s)
(4) One or more compressors
(5) For single-, duplex-, or multiple-compressor systems, means for activation/deactivation of each individual compressor
(6) When multiple-compressors are used, manual or automatic means to alternate individual compressors
(7) When multiple-compressors are used, manual or automatic means to activate the additional unit(s) should the in-service unit(s) be incapable of maintaining adequate pressure
(8) Intake filter–muffler(s) of the dry type
(9) Receiver(s) with a manual or automatic drain
(10) Shutoff valves
(11) Compressor discharge check valve(s) (for multiple compressors)
11. Compressor discharge check valve(s) (for multiple compressors)

12. Air dryer(s) that maintains a minimum of 40 percent relative humidity at operating pressure and temperature.

13. In-line final particulate/coalescing filters rated at 0.01 micron, with filter status indicator to ensure the delivery of compressed air with a maximum allowable 0.05 ppm liquid oil.

14. Pressure regulator(s)

15. Pressure relief valve

16. Pressure indicator

17. Moisture indicator

5.3.7.6.2 Receiver(s).

5.3.7.6.2.1 The receiver(s) shall have the capacity to prevent short cycling of the compressor(s).

5.3.7.6.2.2 The receiver(s) shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessel Code.

5.3.7.6.3 Moisture Indicator.

5.3.7.6.3.1 The moisture indicator shall be located in the active airstream prior to, or after, the receiver and upstream of any system pressure regulators.

5.3.7.6.3.2 The moisture indicator shall indicate (e.g., by color change, digital readout, or other method understood by the user) when the relative humidity of the compressed air exceeds 40 percent at line pressure and temperature.

5.3.7.6.4 Pressure Relief Valve Discharge.

Pressure relief valves for compressed air systems having less than 84,950 L (3000 ft³) at STP shall be permitted to discharge locally indoors in a safe manner that will not restrict the flow.

5.3.7.6.5 Source of Compressor Intake Air.

5.3.7.6.5.1 Air sources for a compressor(s) located inside the building shall meet the following requirements:

(1) They shall be located within a space where no chemical-based materials are stored or used.

(2) They shall be located in a space that is not used for patient medical treatment.

(3) They shall not be taken from a room or space in which there is an open or semi-open discharge from a Category 3 vacuum or scavenging system.

5.3.7.6.5.2 Air sources for a compressor(s) located outside the building shall be drawn from locations where no contamination from vacuum or scavenging system discharges or particulate matter is anticipated.
5.3.7.7—Compressed Air Cylinder Source Equipment—

5.3.7.7.1—
Compressed air cylinders shall be permitted to be installed in enclosures for Category 3 medical gases (oxygen and nitrous oxide) as described in 5.3.6.20.2—or in a mechanical room.

5.3.7.7.2—
Compressed air cylinder source equipment shall include the following:

1. One or more cylinders of compressed air, each providing at least an average day’s supply
2. Manifold if primary and secondary cylinders are provided
3. Line pressure regulating valve
4. Check valve downstream from the pressure regulating valve
5. Pressure relief valve set at 50 percent above the normal line pressure and located downstream from the check valve specified in 5.3.7.7.2 (4)

5.3.7.7.3—
Mechanical means shall be provided to ensure that the compressed air cylinder gas source equipment is connected to the correct gas distribution piping system.

5.3.7.7.4—
Threaded connections to manifolds shall comply with CGA V-5,’ Diameter-Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications).

5.3.7.7.5—
Flexible connectors shall have a gauge pressure rating not less than 6895 kPa (1000 psi).

5.3.7.7.6—
Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52 m (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

5.3.7.7.7—
Pressure relief valves for compressed air cylinder systems having less than 84,950 L (3000 ft^3) at STP shall be permitted to discharge locally indoors in a safe manner that will not restrict the flow.

5.3.7.8—Nitrogen Source Equipment—

5.3.7.8.1—
Nitrogen source equipment shall be permitted to be installed in enclosures for Category 3 medical gases (oxygen and nitrous oxide) as described in 5.3.6.20.2—or in a mechanical room.

5.3.7.8.2—
Nitrogen source equipment shall include the following:

1. One or more cylinders of nitrogen NF, each providing at least an average day’s supply
2. Manifold, if primary and secondary cylinders are provided
Manifold, if primary and secondary cylinders are provided

(3) Line-pressure regulating valve

(4) Check valve downstream from the pressure regulating valve

(5) A pressure relief valve set at 50 percent above the normal line pressure and located downstream from the check valve specified in 5.3.7.8.2 (4)

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

5.3.7.8.3—
Mechanical means shall be provided to ensure that the nitrogen gas source equipment is connected to the correct gas distribution piping system.

5.3.7.8.4—
Cylinder valve outlets for nitrogen shall comply with CGA V-1, Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections.

5.3.7.8.5—
Threaded connections to manifolds shall comply with CGA V-5, Diameter-Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications).

5.3.7.8.6—
Flexible connectors shall have a gauge pressure rating not less than 6895 kPa (1000 psi).

5.3.7.8.7—
Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52 m (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

5.3.8—Category 3 Vacuum and Scavenging Systems.

5.3.8.1—General Requirements.

5.3.8.1.1—
Category 3 vacuum and scavenging systems shall be furnished by an equipment manufacturer(s) or a supplier(s) who is familiar with the proper application of the equipment and shall be installed under their supervision.

5.3.8.1.2—
Installers of Category 3 vacuum and scavenging systems shall be experienced in the installation and testing of such systems and the requirements of this code.

5.3.8.1.3—
Any water supply and drain piping associated with vacuum or scavenging source equipment shall comply with the locally adopted plumbing code.

5.3.8.2—Piping for Vacuum and Scavenging Systems.

5.3.8.2.1—
Piping for Category 3 vacuum and scavenging systems shall be copper, PVC plastic, or CPVC plastic.

5.3.8.2.2—
Copper piping shall comply with the requirements for Category 3 gas-powered supply piping as follows:

(1) Copper tubing shall be in accordance with 5.3.7.2.1.
Copper tubing shall be in accordance with 5.3.7.2.1.

Copper fittings shall be in accordance with 5.3.7.2.2.

Joints in copper tubing shall be in accordance with 5.3.7.2.3.

5.3.8.2.3—
PVC plastic piping shall be in accordance with the following:

1. PVC plastic pipe shall be Schedule 40 or Schedule 80, complying with ASTM D 1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.


5.3.8.2.4—
CPVC plastic piping shall be iron pipe size (IPS) or copper tube size (CTS) in accordance with the following:

1. CPVC IPS plastic pipe shall be Schedule 40 or Schedule 80, complying with ASTM F 441, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.


4. Solvent cement for joints in CPVC plastic piping shall comply with ASTM F 493, Solvent Cements for CPVC Pipe and Fittings.

5.3.8.3—Installation of Vacuum and Scavenging Piping—
5.3.8.3.1—Pipe Sizing—
Piping systems shall be designed and sized to draw the required flow rates at the utilization vacuums.

5.3.8.3.2—Protection of Piping—
Piping shall be protected in accordance with 5.3.6.11.

5.3.8.3.3—Copper Pipe Support—
Pipe support for copper piping shall be in accordance with 5.3.6.12.

5.3.6.3.4 Plastic Pipe Support.

The maximum support spacing for plastic pipe shall be in accordance with Table 5.3.6.3.4.

Table 5.3.6.3.4 Maximum Plastic Pipe Support Spacing

<table>
<thead>
<tr>
<th>Hanger Spacing</th>
<th>Pipe Size</th>
<th>mm ft</th>
<th>DN15 (NPS 1/2) (5/8 in. O.D.)</th>
<th>1220 4.00 DN20 (NPS 3/4) (1 1/8 in. O.D.)</th>
<th>1320 4.33 DN32 (NPS 1) (1 1/8 in. O.D.)</th>
<th>1320 4.33 DN40 (NPS 1 1/4) (2 1/4 in. O.D.)</th>
<th>1420 4.66 DN50 (NPS 1 1/2) (2 1/2 in. O.D.)</th>
<th>1520 5.00 DN65 (NPS 2) (2 5/8 in. O.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1220 4.00 DN20 (NPS 3/4) (1 1/8 in. O.D.)</td>
<td>1320 4.33 DN32 (NPS 1) (1 1/8 in. O.D.)</td>
<td>1320 4.33 DN40 (NPS 1 1/4) (2 1/4 in. O.D.)</td>
<td>1420 4.66 DN50 (NPS 1 1/2) (2 1/2 in. O.D.)</td>
<td>1520 5.00 DN65 (NPS 2) (2 5/8 in. O.D.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.3.8.3.5 Underground Piping Outside of Buildings.

Buried piping outside of buildings shall be in accordance with 5.3.6.13.

5.3.8.3.6 Underground Piping Within Buildings.

Underground piping within buildings shall be in accordance with 5.3.6.14.

5.3.8.3.7 Piping Within Floor Slabs.

5.3.8.3.7.1 Copper Category 3 vacuum and scavenging piping that is installed within floor slabs shall be enclosed in a conduit, flexible plastic tubing, or other means to prevent contact between the copper tubing and concrete.

5.3.8.3.7.2 Plastic Category 3 vacuum and scavenging piping shall be permitted to contact concrete.

5.3.8.3.7.3 During construction, access shall be provided at all joints for visual inspection and leak testing.

5.3.8.3.7.4 Care shall be taken to protect plastic piping from damage from vibrators while wet concrete is being consolidated.

5.3.8.3.8 Valves in Vacuum and Scavenging Systems.

Shutoff valves shall be permitted to be installed in Category 3 vacuum and scavenging piping.

5.3.8.3.9 Category 3 Vacuum and Scavenging Source Equipment.

5.3.8.3.9.1 Category 3 vacuum sources shall include the following:

1. Vacuum pump or pumps suited for wet or dry service as intended in the system design.
2. If intended for wet service, properly vented liquid/air separator.

5.3.8.3.9.2 Category 3 vacuum and scavenging source equipment shall be obtained from, and be installed under the supervision of, the manufacturer(s) or supplier(s) who is familiar with its installation, operation, and use.

5.3.8.3.10 Drainage from Vacuum Equipment.

None of the requirements of 5.3.8.3.10.1 through 5.3.8.3.10.6 for drainage in...
None of the requirements of 5.3.8.3.10.1 through 5.3.8.3.10.6 for drainage in Category 3 vacuum systems shall supersede provisions of the local plumbing code.

5.3.8.3.10.1—

Liquids drained from a Category 3 vacuum source shall discharge indirectly to a sanitary drainage system through an approved air gap to a trapped and vented drain.

5.3.8.3.10.2—

The clear air gap between a vacuum drain outlet, or indirect drain pipe, and the flood category rim of an indirect waste receptor, or other point of disposal, shall be not less than twice the diameter of the effective opening of the drain served, but not less than 25.4 mm (1 in.), unless the local plumbing code requires a larger air gap.

5.3.8.3.10.3—

Where the drainage is from a waste holding tank on the suction side of the vacuum source, the following requirements shall be met:

1. A check valve shall be installed in the drain line from the holding tank between the tank and any vent lines.
2. The trap in the building drainage system shall be the deep-seal type that is conventionally vented within the plumbing system.
3. An additional vent shall be installed between the holding tank drain check valve and the drain trap, on the inlet side of the trap, to close and seal the check valve while the holding tank is operating under vacuum and collecting waste.
4. The additional vent described in 5.3.8.3.10.3 (3) shall be permitted to be connected to the plumbing system vents, unless a drain pump system with a positive pressure discharge is installed, in which case 5.3.8.3.10.4 shall apply.
5. Both of the vents in 5.3.8.3.10.3 (3) and (4) shall extend vertically to not less than 152 mm (6 in.) above the top of the holding tank before turning horizontal.
6. Outdoor vents shall be protected against the entry of insects, vermin, debris, and precipitation.
7. The trap and drain branch shall be not less than two pipe sizes larger than the waste pipe from the separator, but not less than DN50 (NPS 2).
8. The trap seal shall be not less than 100 mm (4 in.) deep.
9. The vent for the vacuum check valve shall be not less than the size of the check valve.
10. The vent for the trap shall be not less than one-half the size of the trap and drain branch.

5.3.8.3.10.4*—

Where the drainage is from a waste holding tank on the suction side of the vacuum source and a positive discharge pump drain system is in place, the following requirements shall be met:

1. The pump shall drain indirectly to the plumbing system through an air gap equal to the diameter of the discharge pipe but not less than 25.4 mm (1 in.) above the rim.
2. A check valve shall be installed in the drain line from the holding tank to the
(2) A check valve shall be installed in the drain line from the holding tank to the drain.

(3) The trap in the building drainage system shall be the deep-seal type that is conventionally vented within the plumbing system.

(4) The trap and drain branch shall be not less than two pipe sizes larger than the waste pipe from the separator, but not less than DN40 (NPS 1\(\frac{1}{4}\) or 2 - ).

(5) The trap seal shall be at least two times the exhaust back pressure in the separator but not less than 100 mm (4 in.) deep.

5.3.8.3.10.5—
Where the drainage is at a positive pressure from an air/waste separator on the discharge side of the vacuum source, the following requirements shall be met:

(1) Where there is a positive pressure discharge from a vacuum pump, it shall be required to drain through an air/waste separator.

(2) Discharge shall be either of the following:

(3) Direct into a trap in the building drainage system that is the deep-seal type and is conventionally vented within the plumbing system

(4) Indirect to the plumbing system through an air gap equal to the diameter of the discharge pipe, but not less than 25.4 mm (1 in.) above the rim

(5) The trap vent shall extend vertically to not less than 152 mm (6 in.) above the top of the separator before turning horizontal.

(6) Outdoor vents shall be protected against the entry of insects, vermin, debris, and precipitation.

(7) The trap and drain branch shall be two pipe sizes larger than the waste pipe from the separator, but not less than DN40 (NPS 1\(\frac{1}{4}\) or 2 - ).

(8) The air/waste separator vent shall be the full size of the separator vent connection.

(9) The separator vent shall be separate from the building vent piping.

5.3.8.3.10.6—
The indirect drainage from vacuum equipment shall discharge to the sanitary drainage system through an approved air gap without causing overflow or splatter on building surfaces.

5.3.8.3.11—Vacuum Exhaust—
The exhaust from Category 3 vacuum and scavenging sources shall comply with the following:

(1) The exhaust shall be piped to the outside through a separate vent system.

(2) The exhaust point shall be chosen to minimize the hazards of noise.

(3) The exhaust point shall be remote from any door, window, or other opening into
(3) The exhaust point shall be remote from any door, window, or other opening into the building.

(4) The exhaust point shall be located at a different elevation than air intakes.

(5) The exhaust point shall not be located where affected by prevailing winds, adjacent buildings, topography, or other obstacles to the rapid dispersion of the exhaust gases.

(6) The exhaust point shall be protected against the entry of insects, vermin, debris, and precipitation.

(7) The exhaust piping shall be sized to prevent back-pressure greater than the pump manufacturer's recommendations.

(8) Where multiple pumps exhaust through a common pipe, each pump shall be fitted with a check valve or a manual isolation valve or shall be arranged to allow capping the individual pump exhausts when a pump is removed for service.

(9) Where multiple pumps exhaust through a common pipe, piping shall be arranged following the pump manufacturer's recommendations.


5.3.9.1 General.

5.3.9.1.1 Inspection and testing shall be performed on all new piped Category 3 gas-powered device supply systems (compressed air and nitrogen), Category 3 vacuum systems, Category 3 scavenging systems, and their 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.

5.3.9.1.2 The 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 authority and any others that are required.

5.3.9.1.3 Reports shall contain detailed listings of all findings and results.

5.3.9.1.4 The responsible facility authority shall review the inspection and test records prior to the use of any systems to ensure that all findings and results of the inspections and tests have been successfully completed.

5.3.9.1.5 All documentation pertaining to inspections and testing shall be maintained on-site within the facility.

5.3.9.1.6 Before piping systems are initially put into use, the Category 3 health-care facility authority shall be responsible for ascertaining that the gas/vacuum delivered at each outlet/inlet is that shown on the outlet/inlet label and that the proper connecting fittings are installed for the specific gas or vacuum.

5.3.9.2 Initial Testing of Category 3 Gas-Powered Device Supply Systems, Category 3 Vacuum Systems, and Category 3 Scavenging Systems.

5.3.9.2.1 General.
5.3.9.2.1.1
The initial tests required by 5.3.9.2 shall be performed prior to the final tests required by 5.3.9.3.

5.3.9.2.1.2
Initial tests shall be conducted by one or more of the following, who shall be experienced in the installation, operation, and testing of Category 3 gas-powered device supply systems, vacuum systems, and scavenging systems:

1. Installer
2. Representative of the system supplier
3. Representative of the system manufacturer
4. Medical gas system's verifier qualified under 5.3.6.23.3.1(A)

5.3.9.2.1.3
The test gas for Category 3 gas-powered device supply systems shall be oil-free, dry nitrogen NF or the system gas.

5.3.9.2.1.4
Where manufactured assemblies are to be installed, the initial tests required under 5.3.9.2 shall be performed as follows:

1. After completion of the distribution piping
2. Prior to installation or connection of manufactured assemblies having internal tubing or hose.
3. At all outlets and inlets on manufactured assemblies having internal copper tubing

5.3.9.2.2 Blow Down.
Piping in Category 3 gas-powered device supply systems shall be blown clear using oil-free, dry nitrogen NF as follows:

1. After installation of the distribution piping
2. After installation of outlet shutoff valves
3. Before connection to the use points
4. Before installation of system components (e.g., pressure indicators, pressure relief valves, manifolds, source equipment)

5.3.9.2.3 Initial Pressure Test for Copper Piping Systems.

5.3.9.2.3.1
Each section of the piping in Category 3 gas-powered device supply systems, copper vacuum systems, and copper scavenging systems shall be pressure tested using oil-free, dry nitrogen NF or the system gas.

5.3.9.2.3.2
Initial pressure tests shall be conducted as follows:

1. After blow down of the distribution piping
2. After installation of outlet and inlet shutoff valves, station outlets and inlets
3. Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum indicators, line pressure relief valves)

5.3.9.2.3.3
The source shutoff valves for the piping systems shall remain closed during the tests, unless being used for the pressure test gas.

5.3.9.2.3.4
The test pressure shall be 1.5 times the system working pressure but not less than a gauge pressure of 1035 kPa (150 psi).

5.3.9.2.3.5
The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.

5.3.9.2.3.6
Leaks, if any, shall be located, repaired (if permitted) or replaced (if required) by the installer, and retested.

5.3.9.2.4  Initial Leak Test for Category 3 Plastic Vacuum and Scavenging Piping Systems.

5.3.9.2.4.1
Each section of the piping in Category 3 vacuum and scavenging systems with plastic piping shall be leak tested using a test vacuum or the vacuum source equipment.

5.3.9.2.4.2
If installed, the vacuum source shutoff valves for the piping systems shall remain closed during the tests, unless being used for the leak test vacuum source.

5.3.9.2.4.3
The leak test vacuum shall be a minimum of 300 mm (12 in.) HgV.

5.3.9.2.4.4
The test vacuum 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.

5.3.9.2.4.5
Leaks, if any, shall be located, repaired or replaced (if required) by the installer, and retested.

5.3.9.2.5  Initial Cross-Connection Test for Copper Piping Systems.

5.3.9.2.5.1
Tests shall be conducted to determine that no cross-connections exist between the Category 3 gas-powered device supply piping systems (compressed air and nitrogen), Category 3 copper vacuum piping systems, and Category 3 copper scavenging piping systems.

5.3.9.2.5.2
The piping systems shall be at atmospheric pressure.
5.3.9.2.5.3
The test gas shall be oil-free, dry nitrogen NF or compressed air.

5.3.9.2.5.4
The source of test gas shall be connected only to the piping system being tested.

5.3.9.2.5.5
The piping system being tested shall be pressurized to a gauge pressure of 345 kPa (50 psi).

5.3.9.2.5.6
The individual system gas-outlet and vacuum-inlet in each installed gas-powered device and copper vacuum or copper scavenging piping system shall be checked to determine that the test gas pressure is present only at the piping system being tested.

5.3.9.2.5.7
The cross-connection test shall be repeated for each installed Category 3 piping system for gas-powered devices and for vacuum and scavenging with copper piping.

5.3.9.2.5.8
The proper labeling and identification of system outlets/inlets shall be confirmed during the tests.

5.3.9.2.6 Initial Cross-Connection Test for Category 3 Plastic Vacuum and Scavenging Piping Systems.

5.3.9.2.6.1
Tests shall be conducted to determine that no cross-connections exist between any Category 3 plastic vacuum piping systems or Category 3 plastic scavenging piping systems and any Category 3 gas-powered device supply systems.

5.3.9.2.6.2
The vacuum source shutoff valves for the vacuum piping systems shall remain closed during the tests, unless they are being used for the cross-connection test vacuum source.

5.3.9.2.6.3
The cross-connection test vacuum shall be a minimum of 300 mm (12 in.) HgV.

5.3.9.2.6.4
The source of test vacuum shall be connected only to the vacuum piping system being tested.

5.3.9.2.6.5
The individual gas-powered device system gas outlets and vacuum/scavenging system inlets shall be checked to determine that the test vacuum is only present at the vacuum/scavenging piping system being tested.

5.3.9.2.6.6
The cross-connection tests shall be repeated for each installed vacuum and scavenging system with plastic piping.

5.3.9.2.6.7
The proper labeling and identification of system outlets/inlets shall be confirmed during the tests.

5.3.9.2.7 Initial Piping Purge Test for Gas-Powered Device Systems.

5.3.9.2.7.1
The outlets in each Category 3 gas-powered device supply piping system shall be purged to remove any particulate matter from the distribution piping.

5.3.9.2.7.2
The test gas shall be oil-free, dry nitrogen NF or the system gas:

5.3.9.2.7.3

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:

5.3.9.2.7.4

The purging shall be started at the furthest outlet in the system and proceed towards the source equipment:

5.3.9.2.8 Initial Standing Pressure Test for Gas-Powered Device Systems Piping:

After successful completion of the initial pressure tests under 5.3.9.2.3, Category 3 gas-powered device distribution piping shall be subjected to a standing pressure test:

5.3.9.2.8.1

Tests shall be conducted after the installation of outlet valves and other distribution system components (e.g., pressure indicators and line pressure relief valves):

5.3.9.2.8.2

The source valve shall be closed unless the source gas is being used for the test:

5.3.9.2.8.3

The piping systems shall be subjected to a 24-hour standing pressure test using oil-free, dry nitrogen NF or the system gas:

5.3.9.2.8.4

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

5.3.9.2.8.5

At the conclusion of the tests, there shall be no change in the test pressure greater than a gauge pressure of 35 kPa (5 psi):

5.3.9.2.8.6

Leaks, if any, shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested:

5.3.9.3 Final Testing of Category 3 Gas-Powered Device Supply Systems, Vacuum Systems, and Scavenging Systems:

5.3.9.3.1 General:

5.3.9.3.1.1 Final testing of gas-powered device systems, vacuum systems, and scavenging systems shall be performed only after all initial tests required by 5.3.9.2 have been performed.

5.3.9.3.1.2

The final tests required by 5.3.9.3.2 through 5.3.9.3.6 shall be performed by one or more of the following, who shall be experienced with the installation, operation, and testing of Category 3 gas-powered device supply systems, vacuum systems, and scavenging systems:

(1) Installer

(2) Representative of the system supplier

(3) Representative of the system manufacturer

(4) Medical-gas-systems-verifier-qualified-under 5.3.6.23.3.1(A)
5.3.9.3.1.3
The test gas shall be oil-free, dry nitrogen NF or the system gas or vacuum.

5.3.9.3.2 Final Standing Pressure Test (Category 3 Gas-Powered Devices).
Each gas-powered device piping system shall be subjected to a 10-minute standing pressure test at operating line pressure using the following procedures:

1. After the system is filled with oil-free, dry nitrogen NF or the system gas, the source valve shall be closed.
2. The piping system downstream of the valve shall show no decrease in pressure after 10 minutes.
3. Any leaks found shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested.

5.3.9.3.3 Final Standing Vacuum Test (Category 3 Vacuum and Scavenging Systems).
Each Category 3 vacuum and scavenging piping system shall be subjected to a 10-minute standing vacuum test at operating line vacuum using the following procedures:

1. After the system has stabilized at the operating line vacuum, the source valve and any zone valves shall be closed.
2. The piping system upstream of the valves shall show no decrease in vacuum after 10 minutes.
3. Leaks, if any, shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested.

5.3.9.3.4 Final Cross-Connection Test (Category 3 Gas-Powered Devices and Vacuum and Scavenging Systems).
After closing of walls and completion of the requirements of 5.3.9.2, it shall be determined that no cross-connections exist between the piping systems for Category 3 gas-powered devices and vacuum and scavenging systems using the following method:

1. Test each piping system independently, starting with the vacuum and scavenging systems first, and check that the test vacuum is present only at inlets of the system being tested.
2. Reduce all piping systems to atmospheric pressure.
3. Operate the Category 3 vacuum or scavenging system being tested at the normal system vacuum, using the source equipment.
4. Test each Category 3 gas-powered device gas outlet and vacuum or scavenging inlet using appropriate adapters to verify that vacuum is present only at the vacuum inlets in the system being tested, and not at any gas-powered device gas outlets or inlets of other vacuum or scavenging systems.
5. Shut down the vacuum source equipment and slowly break the vacuum in the
(5) Shut down the vacuum source equipment and slowly break the vacuum in the vacuum piping system, increasing its pressure to atmospheric.

(6) Test each Category 3 vacuum and scavenging system until all are determined to be free of cross-connections.

(7) Using oil-free, dry nitrogen NF or the system gas, pressurize the gas-powered device piping system to a gauge pressure of 345 kPa (50 psi).

(8) Test each gas-powered device gas outlet using appropriate adapters to verify that the test gas pressure is present only at the outlets in the gas-powered device system being tested.

(9) After it has been determined that a gas-powered device piping system is free of cross-connections, disconnect the source of test gas and reduce the piping to atmospheric pressure.

(10) Proceed to test each gas-powered device piping system until all are determined to be free of cross-connections.

5.3.9.3.5 Final Piping Purge Test (Category 3 Gas-Powered Devices).

In order to remove any traces of particulate matter deposited in the pipelines as a result of construction, a heavy, intermittent purging of each gas-powered device pipeline shall be done:

5.3.9.3.5.1 The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates shall be put on each outlet.

5.3.9.3.5.2 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.

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

5.3.9.3.6 Final Tie-In Test (Category 3 Gas-Powered Devices and Vacuum and Scavenging Systems).

5.3.9.3.6.1 Prior to the connection of any new piping in extensions or additions to an existing piping system, the final tests in 5.3.9.3 shall be successfully performed on the new work.

5.3.9.3.6.2 Each joint in the final connection between the new work and the existing system shall be leak-tested, with the gas of system designation or vacuum at the normal operating pressure or vacuum, by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.

5.3.9.3.7 Source Equipment Testing (Category 3 Gas-Powered Devices and Vacuum and Scavenging Systems).

5.3.9.3.7.1 General.
Source equipment checks for Category 3 gas-powered devices and vacuum and scavenging systems shall be performed following the installation of the interconnecting pipelines, accessories, and source equipment:

5.3.9.3.7.2 Use of Source Equipment for Distribution Piping Tests.
Where the source equipment and system gas or vacuum is used for testing of the distribution piping, the source equipment shall be checked out and placed in operation prior to testing the distribution piping.

5.3.9.3.7.3 Compliance with Manufacturer’s Instructions.
The source equipment for a Category 3 gas-powered device system(s), vacuum system(s), and scavenging system(s) shall be checked out and placed in operation according to the manufacturer’s instructions.

5.3.10 Compressed Gas Cylinders and Containers.

5.3.10.1 Only cylinders and containers constructed, tested, and maintained in accordance with U.S. Department of Transportation specifications and regulations shall be permitted to be used.

5.3.10.2 Cylinder contents shall be identified by attached labels or stencils naming the contents in accordance with CGA C-7, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers.

5.3.10.3 The contents of cylinders and containers shall be verified prior to use.

5.3.10.4 Labels shall not be defaced, altered, or removed, and connecting fittings shall not be modified.

5.3.11 Labeling and Identification.

5.3.11.1 Pipe Labeling.

5.3.11.1.1 Piping, both exposed and concealed, shall be labeled by stenciling or adhesive markers that identify the system.

5.3.11.1.2 Pipe labels shall show the name of the gas/vacuum system or its chemical symbol.

5.3.11.1.3 Where positive pressure gas piping systems operate at nonstandard pressures, the pipe labels shall also include the nonstandard operating pressure in addition to the name or symbol of the gas.

5.3.11.1.4 Pipe labels shall be located as follows:

1. At intervals of not more than 6.1 m (20 ft)
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 on risers

5.3.11.2 Identification of Shutoff Valves.
Shutoff valves shall be identified with the following information:
(1) Name or chemical symbol for the specific system

(2) Name of the room(s) or area(s) served

(3) Caution to not close (or open) the valve except in an emergency

5.3.11.3 Identification of Outlets and Inlets.
Outlets and inlets shall be identified as to the name or chemical symbol for the specific gas, vacuum, or scavenging provided.

5.3.12 System Use and Instructions.

5.3.12.1 Prohibited System Interconnections.

5.3.12.1.1 Two or more systems for Category 3 medical gas, gas-powered device gas, or vacuum and scavenging shall not be interconnected for testing or any other reason.

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

5.3.12.2 Changes in System Use.

5.3.12.2.1 Where a Category 3 positive pressure gas piping distribution system originally used or constructed for use at one pressure, or for one gas, is converted for operation at another pressure, or for another gas, all provisions and requirements of Section 5.3 shall apply.

5.3.12.2.2 Piping for Category 3 gas-powered devices or Category 3 vacuum shall not be permitted to be converted for use as a Category 3 medical gas piping system for oxygen or nitrous oxide.

5.3.12.3 System and Equipment Manufacturer’s Instructions.

5.3.12.3.1 The installation of individual components shall be made in accordance with the system or equipment manufacturer’s instructions.

5.3.12.3.2 Such instructions shall include directions and information deemed necessary by the manufacturer for attaining proper operation, testing, and maintenance of the system.

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

5.3.13 Operation and Management of Category 3 Systems.

5.3.13.1 Precautions for handling cylinders shall be in accordance with Chapter 11.

5.3.13.2 Special Precautions for the Use of Category 3 Gas and Vacuum Piping Systems.

5.3.13.2.1 Category 3 gas-piping systems shall not be used for the distribution of flammable anesthetic gases.

5.3.13.2.2 Piping systems for Category 3 gases shall not be used as grounding electrodes.
Category 3 vacuum piping shall not be used for vacuum steam condensate return or other nonmedical vacuum applications.

5.3.13.2.4
Every Category 3 facility shall establish a procedure for manually turning off the gas supply at the cylinder valves at the end of each work day.

5.3.13.2.5
Emergency shutoff valves or remote actuators shall not be used to turn off the gas supply at the end of the work day.

5.3.13.3 Category 3 Gas and Vacuum Systems Identification and Warning Signs.
The labeling and identification of Category 3 gas and vacuum systems shall comply with the requirements of 5.3.11.

5.3.13.4 Category 3 Gas and Vacuum Systems Maintenance and Record Keeping.

5.3.13.4.1
Permanent records of all tests required by Section 5.3 shall be maintained on site in the organization’s files.

5.3.13.4.2
A periodic testing procedure for Category 3 gas and vacuum systems and related alarm systems shall be implemented.

5.3.13.4.3
Whenever modifications are made that breach the pipeline, any necessary installer and verification test specified in 5.3.9 shall be conducted on the downstream portions of the medical gas piping system.

5.3.13.4.4
A maintenance program shall be established for the following:

1. Relief valves in accordance with applicable codes or manufacturer’s recommendation
2. Drive gas supply system in accordance with manufacturer’s recommendations
3. Vacuum source equipment and accessories in accordance with manufacturer’s recommendations
4. Vacuum piping system and the secondary equipment attached to vacuum station inlets to ensure the continued good performance of the entire vacuum system
5. Scavenging systems to ensure performance

5.3.13.4.5
An audible and visual alarm indicator(s) shall meet the following requirements:

1. It shall be periodically tested to determine that it is functioning properly.
2. The records of the test shall be maintained until the next test is performed.

Revise per the attached Document.
Committee Statement and Meeting Notes

This committee input does not look to add or get rid of any of the previous requirements for Category 3 systems. The term "dental" was added to drive gas and vacuum have been introduced to more accurately describe the applications which the Category 3 systems are designed for. It also makes Section 5.3 parallel to with 5.1 and 5.2. The TC is looking for public comment on this topic.

Committee Input No. 77-NFPA 99-2012 [Section No. 8.3.4]

8.3.4 Water Conditioning.

Water shall be treated or heated to control pathogens in the water in accordance with ASHRAE 188, Prevention of Legionellosis Associated with Building Water Systems.

Committee Statement and Meeting Notes

This provides a direction the user of the standard. It is being submitted as a CI to ensure that the document is published for public use.
5.3 Category 3 Piped Gas and Vacuum Systems.
5.3.1* Applicability. These requirements shall apply to health care facilities that qualify for Category 3 systems as referenced in Chapter 4.

5.3.1.1 These requirements shall apply to health care facilities that qualify to install Category 3 systems as defined in Chapter 4.

5.3.1.1.1 The following sections of this chapter apply to the operation, management, and maintenance of the medical gas and vacuum systems in existing Category 3 health care facilities: 5.3.1.5, 5.3.1.6, 5.3.2, 5.3.6.19.4, 5.3.6.20.3, 5.3.6.20.4, 5.3.6.20.5, 5.3.6.20.6, 5.3.6.20.7, 5.3.6.20.8, 5.3.6.20.9, 5.3.6.21.14, 5.3.6.23.1.5, 5.3.10, 5.3.12.1.1, 5.3.13 (I need to update sections based on the info below)

5.3.1.2 Where the terms medical gas occur, the provisions shall apply to all piped systems for oxygen, nitrous oxide, medical air, carbon dioxide, helium, air, and mixtures thereof. Wherever the name of a specific gas service occurs, the provision shall apply only to that gas.

5.3.1.3 Where the terms medical support gas occurs, the provisions shall apply to all piped systems for nitrogen and dental drive gas. Wherever the name of a specific gas service occurs, the provision shall apply only to that gas.

5.3.1.3 Wherever the term vacuum occurs, the provisions shall apply to all piped systems systems for medical–surgical vacuum, waste anesthetic gas disposal (WAGD), and dental vacuum. Wherever the name of a specific vacuum service occurs, the provision shall apply only to that vacuum service.
5.3.1.4 An existing system that is not in strict compliance with the requirements of this code shall be permitted to continue in use as long as the authority having jurisdiction has determined that such use does not constitute a distinct hazard to life.

5.3.2 Nature of Hazards of Gas and Vacuum Systems. Category 3 systems shall comply with 5.2.2

5.3.3 Sources. Category 3 systems shall comply with 5.2.3, except as included in 5.3.3.1 – 5.3.3.(X)

5.3.3.1 Central Supply System Identification and Labeling. Category 3 systems shall comply with 5.2.3.1.

5.3.3.2 Central Supply Operations. Category 3 systems shall comply with 5.2.3.2.

5.3.3.3 Central Supply System Locations. Category 3 systems shall comply with 5.2.3.3.

5.3.3.3.1 Ventilation for motor-driven equipment, including dental drive gas sources (see 5.3.3.6.1) and dental vacuum sources (see 5.3.3.7.1), shall comply with 5.2.3.3.

5.3.3.3.2 Enclosures shall serve no purpose other than to contain the medical gas source equipment, except that nitrogen source equipment and dental drive gas cylinders in 5.3.7.6 shall be permitted in the enclosure.

5.3.3.3.3 Dental drive gas compressors, dental vacuum pumps, and other equipment shall not be located in enclosures for medical gas cylinders.

5.3.3.3.4 Dental drive gas compressors shall be installed in a designated mechanical equipment area, heated and ventilated in accordance with 5.2.3.3. and have required utilities (e.g., electrical power, drains, lighting).
5.3.3.3.5 Where nitrogen or dental drive gas in cylinders is used, the cylinders shall be permitted to be located in a dental drive gas compressor equipment room.
5.3.3.3.6 Nitrogen and dental drive gas cylinders shall be permitted to be located in enclosures for medical gases.

5.3.3.4 Central Supply Systems. Category 3 systems, including dental drive gas sources (see 5.3.3.10) and dental vacuum sources (see 5.3.3.11), shall comply with 5.2.3.4. except as follows
(1) Central supply system’s final line regulators shall be permitted to be simplex.
(2) Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52m (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.
(3) When storage is not remote, supply systems supplying only a single treatment facility shall contain a minimum of two banks of cylinders each containing a minimum of an average day’s supply.
   *(Add annex explaining that one cylinder per side is okay if that is the average days supply).*
(4) Pressure relief valve discharge that will not create a probable hazard shall be permitted to exhaust inside the manifold room.

5.3.3.5 Category 3 Medical Air Supply Systems. Category 3 Medical Air Supply Systems, if used, shall comply with 5.2.3.5
5.3.3.6 Dental drive gas Supply Systems shall comply with 5.3.3.6.1 or 5.3.3.6.2
5.3.3.6.1 Dental drive gas Compressor Supply Systems.
5.3.3.6.1.1 General. Category 3 dental drive gas compressor supply systems shall include the following:

1. Disconnect switch(es)
2. Motor-starting device(s)
3. Motor overload protection device(s)
4. One or more compressors
5. For single, duplex, or multiple compressor systems, means for activation/de-activation of each individual compressor
6. When multiple compressors are used, manual or automatic means to alternate individual compressors
7. When multiple compressors are used, manual or automatic means to activate the additional unit(s) should the in-service unit(s) be incapable of maintaining adequate pressure
8. Intake filter–muffler(s) of the dry type
9. Receiver(s) with a manual or automatic drain
10. Shutoff valves
11. Compressor discharge check valve(s) (for multiple compressors)
12. Air dryer(s) that maintains a minimum of 40 percent relative humidity at operating pressure and temperature
13. In-line final particulate/coalescing filters rated at 0.01 micron, with filter status indicator to ensure the delivery of dental drive gas with a maximum allowable 0.05 ppm liquid oil
14. Pressure regulator(s)
15. Pressure relief valve
16. Pressure indicator
17. Moisture indicator
**5.3.3.6.1.2 Receiver(s).** Receivers shall have the following:
(1) The capacity to prevent short cycling of the compressor(s).
(2) Comply with Section VIII, “Unfired Pressure Vessels,” of the ASME *Boiler and Pressure Vessel Code*.

**5.3.3.6.1.3* Moisture Indicator.** Moisture indicators shall have the following:
(1) Be located in the active airstream prior to, or after, the receiver and upstream of any system pressure regulators.
(2) Indicate (e.g., by color change, digital readout, or other method understood by the user) when the relative humidity of the dental drive gas exceeds 40 percent at line pressure and temperature.

**5.3.3.6.1.4 Pressure Relief Valve Discharge.** Pressure relief valves for dental drive gas systems having less than 84,950 L (3000 ft³) at STP shall be permitted to discharge locally indoors in a safe manner that will not restrict the flow.

**5.3.3.6.1.5* Source of Dental drive gas Compressor Intake.** Dental drive gas sources for a compressor(s) shall meet the following requirements:
(1) If the intake is located inside of the building, it shall be located within a space where no chemical based materials are stored or used.
(2) If the intake is located inside of the building, it shall be located in a space that is not used for patient medical treatment.
(3) If the intake is located inside of the building, it shall not be taken from a room or space in which there is an open
or semi-open discharge from a Category 3 vacuum system.

(4) If the intake is located outside of the building, it shall be drawn from locations where no contamination from vacuum exhaust discharges or particulate matter is anticipated.

5.3.3.6.2 Dental drive gas Cylinder Supply Systems.

5.3.3.6.2.1 Quality of Dental drive gas Cylinder. Dental drive gas cylinders shall meet or exceed the quality grade requirements of industrial air. (Annex - CGA Grade A).

5.3.3.6.2.2 Dental drive gas cylinders shall be permitted to be installed in enclosures for Category 3 medical gases (oxygen and nitrous oxide) or in a mechanical room.

5.3.3.6.2.3 Dental drive gas cylinder source equipment shall include the following:

(1) One or more cylinders of dental drive gas, each providing at least an average day’s supply
(2) A Manifold if primary and secondary cylinders are provided
(3) Line pressure regulating valve
(4) Check valve downstream from the pressure regulating valve
(5) Pressure relief valve set at 50 percent above the normal line pressure and located downstream from the check valve.

5.3.3.6.2.4 Mechanical means shall be provided to ensure that the dental drive gas cylinder gas source equipment is connected to the correct gas distribution piping system.

5.3.3.6.2.5 Threaded connections to manifolds shall comply with CGA V-5, Diameter-Index Safety System
Flexible connectors shall have a gauge pressure rating not less than 6895 kPa (1000 psi).

Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52m(5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

Pressure relief valves for dental drive gas cylinder systems having less than 84,950 L (3000 ft3) at STP shall be permitted to discharge locally indoors in a safe manner that will not restrict the flow.

**Category 3 Instrument Air Supply System.** Category 3 Instrument Air Supply System, if used, shall comply with 5.2.3.8.

**Nitrogen Supply System.** Nitrogen source equipment shall be permitted to be installed in enclosures for Category 3 medical gases (oxygen and nitrous oxide) or in a mechanical room.

Nitrogen source equipment shall include the following:

1. One or more cylinders of nitrogen NF, each providing at least an average day’s supply
2. Manifold, if primary and secondary cylinders are provided
3. Line pressure regulating valve
4. Check valve downstream from the pressure regulating valve
5. A pressure relief valve set at 50 percent above the normal line pressure and located downstream from the check valve
(6) Pressure relief valve discharge piped to outdoors at a point that will not create a probable hazard and that is turned down to prevent the entry of rain or snow.

5.3.7.8.2 Flexible connectors of other than all-metal construction that connect manifolds to the gas distribution piping shall not exceed 1.52m (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

5.3.3.8 Medical–Surgical Vacuum. Category 3 Medical-Surgical Vacuum Systems, if used, shall comply with 5.2.3.5.

5.3.3.9 Dental Vacuum Supply Systems.

5.3.3.9.1* Category 3 Dental Vacuum Supply Systems.

5.3.3.9.1.1 Category 3 vacuum sources shall include the following:

(1) Vacuum pump or pumps suited for wet or dry service as intended in the system design
(2) If intended for wet service, properly vented liquid/air separator

5.3.3.9.1.2 Category 3 vacuum source equipment shall be obtained from, and be installed under the supervision of, the manufacturer(s) or supplier(s) who is familiar with its installation, operation, and use.

5.3.3.9.1.3 Drainage from Vacuum Equipment.

Drainage from vacuum equipment shall include the following:

(1) Liquids drained from a Category 3 vacuum source shall discharge indirectly to a sanitary drainage system through an approved air gap to a trapped and vented drain.
(2) The clear air gap between a vacuum drain outlet, or indirect drain pipe, and the flood category rim of an indirect waste receptor, or other point of disposal, shall be
not less than twice the diameter of the effective opening of
the drain served, but not less than 25.4 mm (1 in.), unless
the local plumbing code requires a larger air gap.

(3) Where the drainage is from a waste holding tank on
the suction side of the vacuum source, the following
requirements shall be met:

(A) A check valve shall be installed in the drain line
from the holding tank between the tank and any vent
lines.
(B) The trap in the building drainage system shall be
the deep-seal type that is conventionally vented within
the plumbing system.
(C) An additional vent shall be installed between the
holding tank drain check valve and the drain trap, on
the inlet side of the trap, to close and seal the check
valve while the holding tank is operating under
vacuum and collecting waste.
(D) The additional vent described in 5.3.8.3.10.3(3)
shall be permitted to be connected to the plumbing
system vents, unless a drain pump system with a
positive pressure discharge is installed, in which case
5.3.8.3.10.4 shall apply.
(E) Both of the vents in 5.3.8.3.10.3(3) and (4) shall
extend vertically to not less than 152mm(6 in.) above
the top of the holding tank before turning horizontal.
(F) Outdoor vents shall be protected against the entry
of insects, vermin, debris, and precipitation.
(G) The trap and drain branch shall be not less than
two pipe sizes larger than the waste pipe from the
separator, but not less than DN50 (NPS 2).
(H) The trap seal shall be not less than 100 mm (4 in.) deep.

(I) The vent for the vacuum check valve shall be not less than the size of the check valve.

(J) The vent for the trap shall be not less than one-half the size of the trap and drain branch.

(4)* Where the drainage is from a waste holding tank on the suction side of the vacuum source and a positive discharge pump drain system is in place, the following requirements shall be met:
(A) The pump shall drain indirectly to the plumbing system through an air gap equal to the diameter of the discharge pipe but not less than 25.4 mm (1 in.) above the rim.
(B) A check valve shall be installed in the drain line from the holding tank to the drain.
(C) The trap in the building drainage system shall be the deep seal type that is conventionally vented within the plumbing system.
(D) The trap and drain branch shall be not less than two pipe sizes larger than the waste pipe from the separator, but not less than DN40 (NPS 1 1/2).
(E) The trap seal shall be at least two times the exhaust back pressure in the separator but not less than 100 mm (4 in.) deep.

(5) Where the drainage is at a positive pressure from an air/waste separator on the discharge side of the vacuum source, the following requirements shall be met:
(A) Where there is a positive pressure discharge from a vacuum pump, it shall be required to drain through an air/waste separator.
(B) Discharge shall be either of the following:
(i) Direct into a trap in the building drainage system that is
the deep-seal type and is conventionally vented within the
plumbing system.
(ii) Indirect to the plumbing system through an air gap
equal to the diameter of the discharge pipe, but not less
than 25.4 mm (1 in.) above the rim.
(C) The trap vent shall extend vertically to not less than
152mm (6 in.) above the top of the separator before
turning horizontal.
(D) Outdoor vents shall be protected against the entry of
insects, vermin, debris, and precipitation.
(E) The trap and drain branch shall be two pipe sizes
larger than the waste pipe from the separator, but not less
than DN40 (NPS 11/2).
(F) The air/waste separator vent shall be the full size of
the separator vent connection.
(G) The separator vent shall be separate from the building
vent piping.
(6) The indirect drainage from vacuum equipment shall
discharge to the sanitary drainage system through an
approved air gap without causing overflow or splatter on
building surfaces.
(A) None of the requirements within this chapter for
drainage in Category 3 dental vacuum systems shall
supersede provisions of the local plumbing code.

5.3.3.9.1.4. Vacuum Exhaust. The exhaust from
Category 3 vacuum sources shall comply with the
following:
(1) The exhaust shall be piped to the outside through a
separate vent system.
(2) The exhaust point shall be chosen to minimize the hazards of noise.
(3) The exhaust point shall be remote from any door, window, or other opening into the building.
(4) The exhaust point shall be located at a different elevation than air intakes.
(5) The exhaust point shall not be located where affected by prevailing winds, adjacent buildings, topography, or other obstacles to the rapid dispersion of the exhaust gases.
(6) The exhaust point shall be protected against the entry of insects, vermin, debris, and precipitation.
(7) The exhaust piping shall be sized to prevent back pressure greater than the pump manufacturer’s recommendations.
(8)*Where multiple pumps exhaust through a common pipe, each pump shall be fitted with a check valve or a manual isolation valve or shall be arranged to allow capping the individual pump exhausts when a pump is removed for service.
(9) Where multiple pumps exhaust through a common pipe, piping shall be arranged following the pump manufacturer’s recommendations.

5.3.3.8 WAGD. Category 3 systems shall comply with 5.2.3.7.

5.3.4 Valves. Category 3 systems shall comply with 5.2.4., except as follows:

5.3.4.1 Emergency Shutoff Valves.
(1) Where a central Category 3 medical gas (oxygen and nitrous oxide) supply is remote from a single treatment
facility, the main supply line shall be provided with an emergency shutoff valve so located in the single treatment facility as to be accessible from all use-point locations in an emergency.

(2) Where a central Category 3 medical gas (oxygen and nitrous oxide) supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve so located in the treatment facility as to be accessible from all use-point locations in an emergency.

(3) Emergency shutoff valves shall be labeled to indicate the gas controlled and shall shut off only the gas to the treatment facility that they serve.

(4) A remotely activated shutoff valve at a supply manifold shall not be used for emergency shutoff. For clinical purposes, such a remote valve actuator shall not fail-closed in the event of a loss of electric power. Where remote actuators are the type that fail-open, it shall be mandatory that cylinder shutoff valves be closed whenever the system is not in use.

5.3.5 Station Outlets and Inlets. Category 3 systems shall comply with 5.2.5.

5.3.6 Manufactured Assemblies. Category 3 systems shall comply with 5.2.6.

5.3.7 Surface-Mounted Medical Gas Rails. Category 3 systems shall comply with 5.2.7.

5.3.8 Pressure and Vacuum Indicators. Category 3 systems shall comply with 5.2.8.

5.3.9 Category 3 Warning Systems. Category 3 warning systems shall comply with 5.2.9, except as follows:

(1) Warning systems shall be permitted to be a single alarm panel.
(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.
(4) Warning systems for medical gas systems shall provide the following alarms:
   (1) Oxygen main line pressure low
   (2) Oxygen main line pressure high
   (3) Oxygen changeover to secondary bank or about to changeover (if automatic)
   (4) Nitrous oxide main line pressure low
   (5) Nitrous oxide main line pressure high
   (6) Nitrous oxide changeover to secondary bank or about to changeover (if automatic)
(7) Audible and noncancelable alarm visual signals shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.
(8) Visual indications shall remain until the situation that caused the alarm is resolved.
(9) Pressure switches/sensors shall be installed downstream of any emergency shutoff valves and any other shutoff valves in the system and shall cause an alarm for the medical gas if the pressure decreases or increases 20 percent from the normal operating pressure.
(10) A cancelable audible indication of each alarm condition that produces a sound at the alarm panel shall reinitiate the audible signal if another alarm condition occurs while the audible signal is silenced.

5.3.10 Distribution. Category 3 systems shall comply with 5.2.10, except as follows:
(1) Dental drive gas and Dental Vacuum shall comply with 5.2.10.2.1, except the tubing shall be permitted to be annealed (soft temper).

(2) Dental Vacuum tubing shall be permitted to be:
   (1) PVC plastic pipe shall be Schedule 40 or Schedule 80, complying with ASTM D 1785, *Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.*
   (4) CPVC IPS plastic pipe shall be Schedule 40 or Schedule 80, complying with ASTM F 441, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.*
   (5) CPVC IPS plastic fittings shall be Schedule 40 or Schedule 80 to match the pipe, complying with ASTM F 438, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chlorinated) (CPVC) Plastic Pipe Fittings, Schedule 40,* or ASTM F 439, *Standard Specification for Chlorinated Poly...
(Vinyl Chlorinated) (CPVC) Plastic Pipe Fittings, Schedule 80.

(6) CPVC CTS plastic pipe and fittings 1/2 in. through 2 in. size shall be SDR 11, complying with ASTM D 2846, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.

(7) Solvent cement for joints in CPVC plastic piping shall comply with ASTM F 493, Solvent Cements for CPVC Pipe and Fittings.

(3) Dental drive gas and Dental Vacuum fittings shall be permitted to be:
   (A) Soldered complying with ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
   (B) Flared fittings complying with ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes
   (C) Compression fittings (3/4 in. maximum size)

(4) Soldered joints in Category 3 dental drive gas supply piping shall be made in accordance with ASTM B 828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings, using a “lead-free” solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B 32, Standard Specification for Solder Metal.

(5) Where required for gas and vacuum equipment and piping shall be seismically restrained against earthquakes in accordance with the applicable building code.

(6) Gas and Vacuum Piping systems shall be designed and sized to deliver the required flow rates at the utilized pressures.
5.3.10.1 Installation of Vacuum Piping.

5.3.10.1.1 Pipe Sizing. Piping systems shall be designed and sized to draw the required flow rates at the utilization vacuums.

5.3.10.1.2 Protection of Piping. Piping shall be protected in accordance with 5.3.6.11.4.

5.3.10.1.3 Copper Pipe Support. Pipe support for copper piping shall be in accordance table 5.3.6.12.5

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hanger Spacing</th>
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</thead>
<tbody>
<tr>
<td>DN8 (NPS ½&quot;) (3/8 in. O.D.)</td>
<td>1520 mm 5 ft</td>
</tr>
<tr>
<td>DN10 (NPS ¾&quot;) (½ in. O.D.)</td>
<td>1830 mm 6 ft</td>
</tr>
<tr>
<td>DN15 (NPS 1&quot;) (¾ in. O.D.)</td>
<td>1830 mm 6 ft</td>
</tr>
<tr>
<td>DN20 (NPS 1½&quot;) (7/8 in. O.D.)</td>
<td>2190 mm 7 ft</td>
</tr>
<tr>
<td>DN25 (NPS 2&quot;) (1¼ in. O.D.)</td>
<td>2440 mm 8 ft</td>
</tr>
<tr>
<td>DN32 (NPS 2½&quot;) (1⅜ in. O.D.)</td>
<td>2740 mm 9 ft</td>
</tr>
<tr>
<td>DN40 (NPS 3&quot;) (1½ in. O.D.)</td>
<td>3050 mm 10 ft</td>
</tr>
<tr>
<td>and larger</td>
<td>4570 mm 15 ft</td>
</tr>
<tr>
<td>Vertical risers, all sizes, every floor, but not to exceed</td>
<td>4570 mm 15 ft</td>
</tr>
</tbody>
</table>

5.3.10.1.4 Plastic Pipe Support. The maximum support spacing for plastic pipe shall be in accordance with Table 5.3.8.3.4.
5.3.10.1.5 Underground Piping Outside of Buildings.
Buried piping outside of buildings shall be in accordance with 5.1.10.11.5

5.3.10.1.6 Underground Piping Within Buildings.
Underground piping within buildings shall be in accordance with:
(1) The installation procedure for underground piping shall prevent physical damage to the piping while being backfilled.
(2) If the underground piping is protected by a conduit, cover, or other enclosure, access shall be provided at the joints during construction for visual inspection and leak testing.

5.3.10.1.7 Piping Within Floor Slabs.
5.3.10.1.7.1 Copper Category 3 vacuum piping that is installed within floor slabs shall be enclosed in a conduit, flexible plastic tubing, or other means to prevent contact between the copper tubing and concrete.
5.3.10.1.7.2 Plastic Category 3 vacuum piping shall be permitted to contact concrete.
5.3.10.1.7.3 During construction, access shall be provided at all joints for visual inspection and leak testing.
5.3.10.1.7.4 Care shall be taken to protect plastic piping from damage from vibrators while wet concrete is being consolidated.

5.3.10.1.8 **Valves in Vacuum Systems.** Shutoff valves shall be permitted to be installed in Category 3 vacuum piping.

5.3.11 **Labeling, Pressure and Identification.** Category 3 systems shall comply with 5.2.11.

5.3.12 **Performance Criteria and Testing.** Category 3 systems for medical gas, medical support gas, medical surgical vacuum, WAGD, dental drive gas and dental vacuum shall comply with 5.2.12, except as follows:

5.3.12.1 **General.**

5.3.12.1.1 The initial tests required by 5.3.12.1 shall be performed prior to the final tests required by 5.3.13.2.

5.3.12.1.2 Initial tests shall be conducted by one or more of the following, who shall be experienced in the installation, operation, and testing of Category 3 medical support gas, vacuum, WAGD, dental drive gas and dental vacuum supply systems:

(1) Installer

(2) Representative of the system supplier

(3) Representative of the system manufacturer

(4) Medical gas system’s verifier qualified under 5.3.6.23.3.1(A)

5.3.12.2.1.3 The test gas for Category 3 copper piping supply systems shall be oil-free, dry nitrogen NF or the system gas.
5.3.12.2.1.4 Where manufactured assemblies are to be installed, the initial tests required under 5.3.9.2 shall be performed as follows:
(1) After completion of the distribution piping
(2) Prior to installation or connection of manufactured assemblies having internal tubing or hose.
(3) At all outlets and inlets on manufactured assemblies having internal copper tubing

5.3.12.2 Category 3 Dental Vacuum Supply Systems

5.3.12.2.1 Blow Down. Piping in Category 3 copper piping supply systems shall be blown clear using oil-free, dry nitrogen NF as follows:
(1) After installation of the distribution piping
(2) After installation of outlet shutoff valves
(3) Before connection to the use points
(4) Before installation of system components (e.g., pressure indicators, pressure relief valves, manifolds, source equipment)

5.3.12.2.2 Initial Pressure Test for Copper Piping Systems.

5.3.12.2.3 Each section of the piping in Category 3 gas powered device supply systems, copper vacuum systems, shall be pressure tested using oil-free, dry nitrogen NF or the system gas.

5.3.12.2.4 Initial pressure tests shall be conducted as follows:
(1) After blow down of the distribution piping
(2) After installation of outlet and inlet shutoff valves station outlets and inlets
(3) Prior to the installation of components of the distribution piping system that would be damaged by the
test pressure (e.g., pressure/vacuum indicators, line pressure relief valves)
(4) The source shutoff valves for the piping systems shall remain closed during the tests, unless being used for the pressure test gas.
(5) The test pressure shall be 1.5 times the system working pressure but not less than a gauge pressure of 1035 kPa (150 psi).
(6) 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.
(7) Leaks, if any, shall be located, repaired (if permitted) or replaced (if required) by the installer, and retested.

5.3.12.2.5 Initial Leak Test for Plastic Vacuum Piping Systems.
(1) Each section of the piping in Category 3 vacuum systems with plastic piping shall be leak tested using a test vacuum or the vacuum source equipment.
(2) If installed, the vacuum source shutoff valves for the piping systems shall remain closed during the tests, unless being used for the leak test vacuum source.
(3) The leak test vacuum shall be a minimum of 300 mm (12 in.) HgV.
(4) The test vacuum 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.
(5) Leaks, if any, shall be located, repaired or replaced (if required) by the installer, and retested.
5.3.12.2.6 Initial Cross-Connection Test for Copper Piping Systems.
(1) Tests shall be conducted to determine that no cross-connections exist between the Category 3 copper piping systems, Category 3 copper vacuum piping systems.
(2) The piping systems shall be at atmospheric pressure.
(3) The test gas shall be oil-free, dry nitrogen NF or dental drive gas.
(4) The source of test gas shall be connected only to the piping system being tested.
(5) The piping system being tested shall be pressurized to a gauge pressure of 345 kPa (50 psi).
(6) The individual system gas outlet and vacuum inlet in each installed gas-powered device and copper vacuum or copper piping system shall be checked to determine that the test gas pressure is present only at the piping system being tested.
(7) The cross-connection test shall be repeated for each installed Category 3 piping system for gas-powered devices and for vacuum with copper piping.
(8) The proper labeling and identification of system outlets/inlets shall be confirmed during the tests.

5.3.12.2.7 Initial Cross-Connection Test for Plastic Vacuum Piping Systems
(1) Tests shall be conducted to determine that no cross connections exist between any Category 3 plastic vacuum piping systems or Category 3 copper piping systems
(2) The vacuum source shutoff valves for the vacuum piping systems shall remain closed during the tests, unless they are being used for the cross-connection test vacuum source.
3. The cross-connection test vacuum shall be a minimum of 300 mm (12 in.) HgV.
4. The source of test vacuum shall be connected only to the vacuum piping system being tested.
5. The individual gas-powered device system gas outlets and vacuum system inlets shall be checked to determine that the test vacuum is only present at the vacuum piping system being tested.
6. The cross-connection tests shall be repeated for each installed vacuum system with plastic piping.
7. The proper labeling and identification of system outlets/inlets shall be confirmed during the tests.

5.3.12.2.8 Initial Piping Purge Test for Dental drive gas and Nitrogen Supply Systems.

1. The outlets in each Category 3 dental drive gas and nitrogen supply piping system shall be purged to remove any particulate matter from the distribution piping.
2. The test gas shall be oil-free, dry nitrogen NF or the system gas.
3. 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.
4. The purging shall be started at the furthest outlet in the system and proceed towards the source equipment.

5.3.12.2.9 Initial Standing Pressure Test for Dental drive gas and Nitrogen Supply Systems. After successful completion of the initial pressure tests under 5.3.9.2.3, Category 3 gas-powered device distribution piping shall be subjected to a standing pressure test.
(1) Tests shall be conducted after the installation of outlet valves and other distribution system components (e.g., pressure indicators and line pressure relief valves).
(2) The source valve shall be closed unless the source gas is being used for the test.
(3) The piping systems shall be subjected to a 24-hour standing pressure test using oil-free, dry nitrogen NF or the system gas.
(4) Test pressures shall be 20 percent above the normal system operating line pressure.
(5) At the conclusion of the tests, there shall be no change in the test pressure greater than a gauge pressure of 35 kPa (5 psi).
(6) Leaks, if any, shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested.

(1) Final testing of gas-powered device systems, vacuum systems shall be performed only after all initial tests required by 5.3.9.2 have been performed.
(2) The final tests required by 5.3.9.3.2 through 5.3.9.3.6 shall be performed by one or more of the following, who shall be experienced with the installation, operation, and testing of Category 3 gas-powered device supply systems, vacuum systems:
(A) Installer
(B) Representative of the system supplier
(C) Representative of the system manufacturer
(D) Medical gas systems verifier qualified under 5.3.6.23.3.1(A)
(3) The test gas shall be oil-free, dry nitrogen NF or the system gas or vacuum.

5.3.12.2.11 Final Standing Pressure Test (Category 3 Dental drive gas and Nitrogen). Each gas-powered device piping system shall be subjected to a 10-minute standing pressure test at operating line pressure using the following procedures:
(1) After the system is filled with oil-free, dry nitrogen NF or the system gas, the source valve shall be closed.
(2) The piping system downstream of the valve shall show no decrease in pressure after 10 minutes.
(3) Any leaks found shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested.

5.3.12.2.12 Final Standing Vacuum Test (Category 3 Vacuum Systems). Each Category 3 vacuum piping system shall be subjected to a 10-minute standing vacuum test at operating line vacuum using the following procedures:
(1) After the system has stabilized at the operating line vacuum, the source valve and any zone valves shall be closed.
(2) The piping system upstream of the valves shall show no decrease in vacuum after 10 minutes.
(3) Leaks, if any, shall be located, repaired (unless prohibited) or replaced (if required) by the installer, and retested.

5.3.12.2.13 Final Cross-Connection Test (Category 3 Dental drive gas, Nitrogen and Vacuum Systems).
After closing of walls and completion of the requirements of 5.3.9.2, it shall be determined that no cross-connections exist between the piping systems for Category 3 gas-powered devices and vacuum systems using the following method:
(1) Test each piping system independently, starting with the vacuum systems first, and check that the test vacuum is present only at inlets of the system being tested.
(2) Reduce all piping systems to atmospheric pressure.
(3) Operate the Category 3 vacuum system being tested at the normal system vacuum, using the source equipment.
(4) Test each gas outlet and vacuum inlet using appropriate adapters to verify that vacuum is present only at the vacuum inlets in the system being tested, and not at any gas outlets or vacuum inlets.
(5) Shut down the vacuum source equipment and slowly break the vacuum in the vacuum piping system, increasing its pressure to atmospheric.
(6) Test each Category 3 vacuum system until all are determined to be free of cross-connections.
(7) Using oil-free, dry nitrogen NF or the system gas, pressurize the gas piping system to a gauge pressure of 345 kPa (50 psi).
(8) Test each gas-powered device gas outlet using appropriate adapters to verify that the test gas pressure is present only at the outlets in the gas-powered device system being tested.
(9) After it has been determined that a gas-powered device piping system is free of cross-connections,
disconnect the source of test gas and reduce the piping to atmospheric pressure.

(10) Proceed to test each gas-powered device piping system until all are determined to be free of cross-connections.

5.3.12.2.14 Final Piping Purge Test (Category 3 Dental drive gas and Nitrogen). In order to remove any traces of particulate matter deposited in the pipelines as a result of construction, a heavy, intermittent purging of each gas-powered device pipeline shall be done.

(1) The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates shall be put on each outlet.

(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.

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

5.3.12.2.15 Final Tie-In Test (Category 3 Dental drive gas, Nitrogen and Vacuum Systems).

(1) Prior to the connection of any new piping in extensions or additions to an existing piping system, the final tests in 5.3.9.3 shall be successfully performed on the new work.

(2) Each joint in the final connection between the new work and the existing system shall be leak-tested, with the gas of system designation or vacuum at the normal operating pressure or vacuum, by means of a leak detectant that is safe for use with oxygen and does not contain ammonia.
(3) For gas piping, immediately after a final connection is made and leak-tested, the specific altered zone and components in the immediate zone or area that is downstream from the point or area of intrusion shall be purged per 5.3.9.3.5.

5.3.12.2.16 Source Equipment Testing (Category 3 Dental drive gas, Nitrogen and Vacuum Systems).

(1) General. Source equipment checks for shall be performed following the installation of the interconnecting pipelines, accessories, and source equipment.

(2) Use of Source Equipment for Distribution Piping Tests. Where the source equipment and system gas or vacuum is used for testing of the distribution piping, the source equipment shall be checked out and placed in operation prior to testing the distribution piping.

(3) Compliance with Manufacturer’s Instructions. The source equipment shall be checked out and placed in operation according to the manufacturer’s instructions.

5.3.13 Reserved

5.3.14 Operation and Management. Category 3 systems shall comply with 5.2.13.

5.3.15* Maintenance. Category 3 systems shall comply with 5.2.14.