Enclosed is the agenda for the NFPA 99 First Draft meeting of the Technical Committee on Piping Systems, which will be held on **Wednesday, August 22, and Thursday, August 23, 2012 at the Sheraton Suites San Diego at Symphony Hall**. Please review the attached comments in advance, and if you have alternate suggestions, please come prepared with proposed language and respective substantiation.

If you have any questions prior to the meeting, please do not hesitate to contact me at: Phone: (617) 984-7470  
Email: jhart@nfpa.org

For administrative questions, please contact Elena Carroll at (617) 984-7952.

I look forward to working with everyone.
AGENDA

Wednesday, August 22, 2012 + Thursday, August 23, 2012

1. Call to Order – 8:00 am (8/22)

2. Introductions and Attendance

3. Chairman Comments

4. Approval of Previous Meeting Minutes

5. Staff Liaison Presentation on NFPA’s new Revision Process and A2014 Cycle

6. Review of Correlating Committee Minutes

7. Task Group Reports
   • Definitions
   • New/Existing Facility Requirements
   • Category 3 and 4

8. Preparation of the First Draft
   • Review Public Input
   • Create First Revisions

9. New Business

10. Discuss dates for the TC Second Draft Meeting

11. Adjournment – (8/23)
Special Notice on Meeting Procedures from Staff Liaison and Chair:

It is expected that all committee members have read the Public Input prior to the meeting and that the members come with proposed actions ready. It is not helpful or a good use of time when TC members are reading the public input for the first time during the meeting. All discussion must start with a motion.

The workflow of the meeting will be to start by moving quickly through public input that is easiest and put the tougher ones to the side. The tougher ones will then be categorized and assigned to task groups who will work together Wednesday afternoon and possibly evening if needed. The TC will then reconvene Thursday morning and resolve those tougher public inputs.
Technical Committee on Piping Systems  
(HEA-PIP)  
NFPA 99 First Draft Meeting (Annual 2014)  
Wednesday, August 22, 2012 + Thursday, August 23, 2012  
Sheraton Suites San Diego at Symphony Hall  
701 A Street, San Diego, California 92101

Key Dates for the Annual 2014 Revision Cycle

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Public Input Closing Date</td>
<td>June 22, 2012</td>
</tr>
<tr>
<td><strong>Final Date for First Draft Meeting</strong></td>
<td>August 31, 2012</td>
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<tr>
<td>Ballots Mailed to TC before</td>
<td>October 12, 2012</td>
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<td><strong>Ballots Returned By</strong></td>
<td>November 2, 2011</td>
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<tr>
<td>Correlating Committee First Draft Meeting</td>
<td>December 11, 2012</td>
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<tr>
<td><strong>Final First Draft Posted</strong></td>
<td>February 22, 2013</td>
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<tr>
<td>Public Comment Closing Date</td>
<td>May 3, 2013</td>
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<td><strong>Final Date for Second Draft Meeting</strong></td>
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<td>November 8, 2013</td>
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<td>Final Second Draft Posted</td>
<td>January 3, 2014</td>
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<td>Closing Date for Notice of Intent to Make a Motion (NITMAM)</td>
<td>February 7, 2014</td>
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<td><strong>Issuance of Consent Document (No NITMAMs)</strong></td>
<td>May 9, 2014</td>
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<tr>
<td>NFPA Annual Meeting (Las Vegas)</td>
<td>June 2014</td>
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<tr>
<td><strong>Issuance of Document with NITMAM</strong></td>
<td>August 12-14, 2014</td>
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Technical Committee deadlines are in **bold**.
Staff Liaison Notice

Note from the Staff Liaison

Dear Technical Committee Members:

We are very pleased that you will be participating in the processing of the 2015 Edition of NFPA 99, Health Care Facilities Code. Development of this document would not be possible without the participation of volunteers like you.

Meeting Preparation

Committee members are strongly encouraged to review the published comments prior to the meeting and to be prepared to act on each item.

Handout materials should be submitted to the chair and staff liaison at least seven days prior to the meeting.

Only one posting of the Public Input will be made; it will be arranged in section/order and will be pre-numbered. This will be posted to the NFPA 99 Document Information page (www.nfpa.org/99) under the “Next Edition” tab. If you have trouble accessing the website please contact Elena Carroll at ecarroll@nfpa.org.

Mandatory Materials:
- Last edition of the standard
- Meeting agenda
- Public Input
- Committee Officers' Guide (Chairs)
- Roberts’ Rules of Order (Chairs; An abbreviated version may be found in the Committee Officer’s Guide)

Optional Materials:
- NFPA Annual Directory
- NFPA Manual of Style
Regulations and Guiding Documents

All committee members are expected to behave in accordance with the Guide for the Conduct of Participants in the NFPA Codes and Standards Development Process.

All actions during and following the committee meetings will be governed in accordance with the NFPA Regulations Governing Committee Projects. Failure to comply with these regulations could result in challenges to the standards-making process. A successful challenge on procedural grounds could prevent or delay publication of the document.

The style of the document must comply with the Manual of Style for NFPA Technical Committee Documents.
## Distribution by %

### Piping Systems

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<th>Name</th>
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<td>Airgas, Inc.</td>
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<td>IM</td>
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<td>Allied Hospital Systems</td>
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<td>J. Richard Wagner</td>
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<td>Plumbing Industry Training Center</td>
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Voting Number 1: Percent 4%
Voting Number 2: Percent 8%
Voting Number 3: Percent 13%
Voting Number 4: Percent 17%
Voting Number 5: Percent 17%
Voting Number 6: Percent 29%
Voting Number 7: Percent 29%
## Distribution by %

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<td>Carolinas HealthCare System</td>
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<td>US Army Corps of Engineers</td>
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**Voting Number**  6  **Percent**  25%

**Total Voting Number**  24
## Address List No Phone

### Piping Systems

#### Health Care Facilities

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<tr>
<td>James K. Lathrop</td>
<td>Chair</td>
<td>SE</td>
<td>Koffel Associates, Inc. 81 Pennsylvania Avenue Niantic, CT 06357</td>
</tr>
<tr>
<td>Mark W. Allen</td>
<td>Principal</td>
<td>M</td>
<td>Beacon Medaes 1800 Overview Drive Rock hill, SC 29730-7463 Alternate: Mark T. Franklin</td>
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<td>Grant A. Anderson</td>
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<td>Bard, Rao &amp; Athanas Consulting Engineers, LLC 9 Stagecoach Road Boxford, MA 01921</td>
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<td>Steven J. Barker</td>
<td>Principal</td>
<td>C</td>
<td>University of Arizona COM/Department of Anesthesiology 1501 North Campbell Avenue PO Box 245114 Tucson, AZ 85724-5114 American Society of Anesthesiologists Alternate: Robert G. Loeb</td>
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<tr>
<td>Chad E. Beebe</td>
<td>Principal</td>
<td>U</td>
<td>ASHE - AHA PO Box 5756 Lacey, WA 98509-5756 American Society for Healthcare Engineering</td>
</tr>
<tr>
<td>David L. Brittain</td>
<td>Principal</td>
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<td>ProVac 8012 Glendevan Street, NW Massillon, OH 44646-9017</td>
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<td>Dana A. Colombo</td>
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<td>PIPE/National ITC Corporation 2540 Severn Avenue Metairie, LA 70002 Alternate: Michael T. Massey</td>
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<tr>
<td>Keith Ferrari</td>
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<td>M</td>
<td>Praxair, Inc. 3101-124 Stonybrook Drive Raleigh, NC 27604 Compressed Gas Association Alternate: Gary L. Bean</td>
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<td>William C. Fettes</td>
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<td>Airgas, Inc. 11523 Knox Street Overland Park, KS 66210 Alternate: Barry E. Brown</td>
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<tr>
<td>Michael Frankel</td>
<td>Principal</td>
<td>SE</td>
<td>Utility Systems Consultants 10860 Royal Caribbean Circle Boynton Beach, FL 33437-4219 American Society of Plumbing Engineers</td>
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<td>Ed Golla</td>
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<td>RT</td>
<td>TRI/Air Testing 1607 North Cuernavaca Drive, Suite 500 Austin, TX 78733-1600</td>
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<td>Anthony Lowe</td>
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<td>Allied Hospital Systems, Allied Air Compressor, Inc. 512-A Crain Highway North, Glen Burnie, MD 21061</td>
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<td>Edward J. Lyczko</td>
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<td>The Cleveland Clinic 19680 Puritas Avenue, Cleveland, OH 44135</td>
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<td>Gary L. Bean</td>
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<td>Air Products &amp; Chemicals, Inc. 2920-A Horizon Park Drive Suwanee, GA 30024</td>
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<td>James L. Lucas</td>
<td>Principal</td>
<td>Tri-Tech Medical Inc. 35401 Avon Commerce Parkway Avon, OH 44011-1374</td>
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<td>Medical Engineering Services, Inc. 40836 Oak Bucket Lane Leesburg, VA 20175-8814</td>
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<td>Ronald M. Smidt</td>
<td>Principal</td>
<td>Carolinas HealthCare System PO Box 901 Troutman, NC 28166 NFPA Health Care Section</td>
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<td>J. Richard Wagner</td>
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<td>J. Richard Wagner, PE, LLC 207 Locknell Road Timonium, MD 21093-3323 Mechanical Contractors Association of America, Inc.</td>
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<td>Wayne T. Wozniak</td>
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<td>American Dental Association 211 East Chicago Avenue Chicago, IL 60103 American Dental Association Alternate: P. L. Fan</td>
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*HEA-PIP* indicates Health Care Facilities Piping Systems.
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<tr>
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<td>Alternate</td>
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<td>Steven J. Barker</td>
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<tr>
<td>Jonathan Hart</td>
<td>Staff Liaison</td>
<td>3/1/2012</td>
<td>National Fire Protection Association</td>
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Attendees:

David Mohile
Mark Allen
Grant Anderson
Gary Bean
Barry Brown
David Eastman
Jan Ehrenwerth
Keith Ferrari
William Fettes
Michael Frankel
Ed Golla
James Lucas
Edward Lyczko
Jeffery McBride
Jerry McManus
Thomas Mraulak
Olen Pruitt
Daniel Shoemaker
Ronald Smidt
Christopher Swayze
Russell Thomason
Richard Wagner
Jonathan Willard
Richard Bielen
Jonathan Levin

Guest:
Dana Colombo
Chad Beebe
Robert Sutter

1. Chairman Dave Mohile called the meeting to order at 8:00 AM. He stated we have public comments to review for this meeting.

2. Richard Bielen gave the staff report. He reviewed the dates of the cycle and the actions the committee can take at the ROC meeting.
3. The minutes of the previous ROP meeting were approved.

4. The committee then acted on the public and committee Comments. See the ROC for the official action on the proposals.

5. There was no old business.

6. There was no new business.

7. Next meeting. TBD.

8. Meeting adjourned at 5:00 pm.
99- Log #322a HEA-PIP


Recommendation: Utilize a common chapter format for all chapters that use the risk assessment approach contained in Chapter 4. While it might be desirable to have Category 1 as the .1 Section of each Chapter this may not be practical. Therefore, an alternative approach would be to have the .1 Section address Applicability, the .2 Section address other issues such as Nature of Hazards, the .3 Section be Category 1, the .4 Section be Category 2, the .5 Section be Category 3.

Within each chapter it would also be good to follow a similar format for the categories addressed. For example, sprinkler requirements are found in 7.3.1.2.1.7 for EF’s but in 7.3.1.2.3.9 (within Environmental Requirements) for TR’s. A common format for each chapter would make the document more user friendly. A common format within each chapter would make it easier to determine the differences between the requirements for different categories of each system.

99- Log #26 HEA-PIP

NOTE: This proposal appeared as Comment 99-33 (Log #83) which was held from the A11 ROC on Proposal N/A.

Submitter: Keith Ferrari, Praxair

Recommendation: Revise text to read as follows:

3.3.19 Bulk System. An assembly of equipment, such as storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds, and interconnecting piping, that terminates at the source valve of oxygen or 1452 kg (3200 lb) of nitrous oxide including unconnected reserves on the site. (PIP)

Substantiation: Specific definitions for Bulk Oxygen and Bulk Nitrous are in 3.3.19.1 & 3.3.19.2.

99- Log #235 HEA-PIP

Submitter: Mark T. Franklin, Sherman Engineering Company

Recommendation: Revise to read:

3.3.84 Instrument Air. For the purposes of this code, instrument air is air intended for the powering of medical devices unrelated to human respiration (e.g., surgical tools, ceiling arms). Medical air and instrument air are distinct systems for mutually exclusive applications. Instrument air is a medical support gas that falls. Instrument air similar to Nitrogen gas are medical support gases used for the same purpose and may be connected together on the same piping system and not considered as a cross-connection but both or either used shall fall under the general requirements for medical gases. (PIP) When a Nitrogen system are connected to an operating instrument air system, the outlets shall be labeled accordingly, i.e., Nitrogen/instrument air. Either IA or N2 outlets may be used.

Substantiation: The N2 or IA gas used for this application is appropriate using either or a mixture of both. To allow the hospital community to incorporate the two into one "support gas" will allow existing hospitals a way to switch to a lower cost gas without any detrimental effect to the patient.
3.3.84 Instrument Air. For the purposes of this code, instrument air is air intended for the powering of medical devices unrelated to human respiration (e.g., surgical tools, ceiling arms). Medical air is a medical support gas that falls under the general requirements for medical gases. Medical air and instrument air are distinct systems for mutually exclusive applications. Instrument air is a medical support gas that falls under the general requirements for medical gases. (PIP)

Substantiation: This Public Input simplifies the definition of Instrument Air, since the definition of the umbrella term, Medical Support Gas includes the proper uses of Instrument Air. This simplification reduces any confusion and conflict. This Public Input is associated with Public Inputs defining Medical Support Gas and Nonmedical Compressed Air. These Public Inputs work well together to clarify that there are two separate systems of non-respired gas systems used in healthcare. One, (Medical Support Gas, which includes Instrument Air) is a system used directly in patient care, where the gas is in intimate contact with patients in an invasive setting, or has the potential to contaminate sterile product.

The other non-respired gas (Nonmedical Compressed Air) is a system used to support equipment in a healthcare facility, and can be used for raising or lowering booms, surgical tables, sterilizer doors, cart wash leveling ramps, etc. as well as regular facility maintenance.

Instrument Air requires brazed pipe with alarms, zone valve boxes, testing, and a redundant source capable of very dry, very clean gas. Not all "medical support applications" require this level of system. The distinction should be made based on whether or not the gas is in direct contact with patients in an invasive setting. These coordinated proposals make that distinction.

Instrument Air has much higher level of cleanliness than Medical Air (IA filtered to 98 percent efficiency at 0.01 micron, MA allows for 98 percent efficiency at 1 micron; IA required to be free of hydrocarbon vapors, MA allows for 25 ppm of gaseous hydrocarbons; IA dew point -40 °F, MA dew point of +32°F, MA). It is ironic that NFPA 99 currently prohibits the relatively dirty Medical Air system from providing mechanical function to an equipment boom, while at the same time prevents the much cleaner Instrument Air system from being used for respiration.

As the linking tool is not working for me, this is related to Public Inputs 394, 396, 397, and 398.
Submitter: Marcelo M. Hirschler, GBH International

Recommendation: Revise text to read:

3.3.96* Limited-Combustible (Material). See 4.4.1.2. Refers to a building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 9144 kJ/kg (3500 Btu/lb), where tested in accordance with NFPA 259, Standard Test Method for Potential Heat of Building Materials, and includes either of the following: (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 7/8 in. (3.2 mm) that has a flame spread index not greater than 50; or (2) materials, in the form and thickness used, having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion, when tested in accordance with ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials. [2012 (PIP)]

Substantiation: This change puts NFPA 99 in line with what was done for NFPA 101 (and many other documents) in the 2012 cycle. NFPA requirements are that definitions cannot contain requirements and the definitions of noncombustible and limited combustible contain requirements. Therefore this public input proposes to put simply a placeholder in chapter 3 (definitions) and place the requirements into Chapter 4 (fundamentals), just as was done in NFPA 101 and 5000. The proposed language is identical to the language in NFPA 101. If the technical committee wishes it can simply extract the language from NFPA 101. The corresponding sections are: 3.3.96 would be extracted from 3.3.169.2, 3.3.123 would be extracted from 3.3.169.4, 4.4.1 would be extracted from 4.6.13 and 4.4.2 would be extracted from 4.6.14.
3.3.109 Medical Support Gas. Nitrogen or Instrument Air, Carbon Dioxide, or Instrument Air used for any medical support purpose (e.g., to remove excess moisture from instruments before further processing, or to operate medical–surgical tools, air-driven booms, pendants, or similar applications) and, if appropriate to the procedures, used in laboratories and are not where the gas has the possibility of patient contact in an invasive procedure, or where the gas has the potential to contaminate sterile items. Medical support gas may be used, but it's use is not mandatory in laboratories and for non-patient contact applications in direct support of medical procedures (e.g. equipment booms, pendants, patient surgical tables). Medical support gasses shall not be respired as part of any treatment. Medical Support Gas shall not be used for general facility needs. Medical support gas falls under the general requirements for medical gases. (PIP)

Substantiation: This adds Carbon Dioxide to the list of Medical Support Gasses. This has been used for years without direction from NFPA 99. The Standard of Care has been to treat it like Nitrogen. This formalizes that practice.

This Public Input is associated with Public Inputs defining Instrument Air and Non Medical Compressed Air. These Public Inputs work well together to clarify that there are two separate systems of non-respired gas systems used in healthcare. One, (Medical Support Gas) is a system used directly in patient care, where the gas is in intimate contact with patients in an invasive setting, or has the potential to contaminate sterile product. This includes gasses used to drive tools where the exhaust is very near to an open surgical site, provide an inert gas field around a surgical site, used directly to dry body tissue, for insufflation, or to force dry medical devices.

The other is a system used to support the medical equipment in a healthcare facility, and can be used for raising or lowering booms, surgical tables, sterilizer doors, cart wash leveling ramps, etc. This equipment can all be considered “any medical support applications”, but the system of gasses involved only provide a mechanical function, not requiring intimate exposure with human beings in an invasive environment.

Any Medical Support Gas requires brazed pipe with alarms, zone valve boxes, testing, and a redundant source capable of very dry, very clean gas. Not all “medical support applications” require this level of system. The distinction should be made based on whether or not the gas is in direct contact with patients in an invasive setting. These coordinated proposals make that distinction.

This Public Input ALLOWS for a Medical Support Gas to be used in a limited applications directly supporting the medical program, but does not REQUIRE this system where the redundancy, alarms, etc of this system are not needed.

This Public input clarifies that a Medical Support Gas can not be used for general facility use.

As the linking tool is not working for me, this is related to Public inputs 395, 396, 397, and 398
5.1.1.3 Wherever the term medical–surgical vacuum occurs, the provisions shall apply to systems for piped medical–surgical patient vacuum and piped waste anesthetic gas disposal (WAGD). Wherever the name of a specific vacuum service occurs, the provision shall apply only to that vacuum service.

Substantiation: The original text does not make sense. How do you differentiate medical-surgical vacuum system from medical - surgical vacuum system? The intent is clear, but every time we use the word medical-surgical vacuum system and do not intend for the WAGD to be included on the item, based on this code section it would include WAGD.

We need to have a term that means both Patient vacuum system and waste anesthetic gas disposal, then when we have code items only for patient vacuum systems or WAGD, it is clear.

5.1.1.3 Wherever the term medical–surgical vacuum occurs system occurs, the provisions shall apply to systems for piped medical–surgical vacuum and piped waste anesthetic gas disposal (WAGD). Wherever the name of a specific vacuum service occurs, the provision shall apply only to that vacuum service.

Substantiation: It is not possible to distinguish when the term "medical-surgical vacuum" is intended to include WAGD because the same term is used for vacuum only and vacuum with WAGD. It appears that when the term "medical-surgical vacuum system" is used it refers to both vacuum and WAGD throughout section 5.

(2) Manifolds for gas cylinders with reserve supply

Substantiation: Editorial - no need for wording since with reserve was removed in 2012.
99- Log #114 HEA-PIP (5.1.3.3.1.2(1))

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
(1) Manifolds for gas cylinders without reserve supply (see 5.1.3.5.10)
Substantiation: Editorial - no need for wording since with reserve was removed in 2012.

99- Log #104 HEA-PIP (5.1.3.3.1.2(2) and (3))

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
(2) Manifolds for gas cylinders with reserve supply
(3) Manifolds for cryogenic liquid containers (see 5.1.3.5.12)
Substantiation: This section should have been removed from the list when the entire section on Manifolds for gas cylinders with reserve supply was deleted in the 2012 edition. (Editorial).

99- Log #106 HEA-PIP (5.1.3.3.1.5)

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Delete the following:
5.1.3.3.1.5 Locations shall be chosen to allow access by delivery vehicles and management of cylinders (e.g., proximity to loading docks, access to elevators, and passage of cylinders through public areas).
Substantiation: Relocate section to 5.1.3.3.2.
This section fits better under Design and Construction list of requirements. (Editorial).

99- Log #107 HEA-PIP (5.1.3.3.1.7)

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
5.1.3.3.1.7 Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 54°F 52°C (125°F 125°F).
Substantiation: 125 degrees is the recommended high storage temp for cylinders. (CGA). Also, this will be harmonized with sections: 5.1.3.3.1.8, 9.3.7.7, 9.3.7.8 and A.5.1.14 which all reference 125 degrees. (Editorial).
Revise to read:

5.1.3.3.1.8 Central supply systems for nitrous oxide and carbon dioxide using cylinders or portable containers shall be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer, but shall never be lower than -29°C (-7°F) or greater than 51.6°C (125°F).

Substantiation: Temperature vs flow data was not provided when this change was adopted in the 2012 edition of NFPA 99. To date, temperature vs flow data is not available. This change will increase patient safety by lowering the likelihood of a gas supply issue.

This is not original material; its reference/source is as follows: NFPA 99, 2005 edition

Add a new section to read:

(11) They shall allow access by delivery vehicles and management of cylinders (e.g., proximity to loading docks, access to elevators, and passage of cylinders through public areas).

Relocate 5.1.3.3.1.5 to this section (Editorial).

If indoors, they shall be constructed and use interior finishes of noncombustible or limited-combustible materials such that all walls, floors, ceilings, and doors are of a minimum 1-hour fire resistance rating, when tested in accordance with ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

This public input is basically editorial, but it is necessary to ensure that no alternate tests are used to determine the fire resistance rating. It is possible to use various non standard tests and get fire resistance ratings but then the safety desired by the code would not necessarily be achieved.

(A) Outdoor locations surrounded by impermeable walls shall have protected ventilation openings located at the base of each wall to allow free circulation of air within the enclosure.

(C) The fire barrier wall shall not have openings or penetrations, except conduit or piping shall be permitted provided that the penetration is protected with a firestop system in accordance with the building code.

Substantiation: Fire walls can not have “open” penetrations per the NFPA 55, 2010 edition section 8.7.2.1.1.1 This will harmonize with the Compressed GAs and Cryogenic Fluids Code.
Add a new section to read:

Medical Gases in the form of cylinders, containers and Bulk Vessels come with a Certificate of Analysis for the gases delivered. The gases then run through a network of components (Manifolds, vaporizers, pigtails, ...) with no on-line monitoring of the purity of these gases. Periodic gas sampling should/could be done at a sample port, similar to the medical air system (medical gas manufactured on site) to check that the gases being delivered to the patients from the central supply meets the medical air quality needed for patient care.

Add a new section to read:

5.1.3.5.7 Auxiliary inlets. All source systems shall be provided with an auxiliary inlet / outlet connection point of the same size as the main line which shall be located immediately on the patient side of the source valve.

5.1.3.5.7.1 The connection consists of a tee, valve and a removable plug or cap.

5.1.3.5.7.2 The auxiliary connection valve shall be normally closed and secured.

5.1.3.5.7.3 On oxygen systems furnished with an emergency oxygen supply connection (EOSC), the EOSC shall be considered to fulfill this requirement.

The addition of an auxiliary connection would simplify: 1. source changeouts 2. major source service 3. connection of an emergency supply in event of source failure.

Revise to read:

5.1.3.5.10* Manifolds for Gas Cylinders Without Reserve Supply

Editorial - no need for wording since with reserve was removed in 2012.

There is a common misconception that the EOSC can be utilized for Emergency Preparedness and is a viable way to feed the health care facility in the event of an unplanned loss of the oxygen supply system. In reality bulk gas suppliers are not able to provide a temporary oxygen supply trailer as quickly as would be needed for this type of event. There usually needs to be another interim measure for dealing with the loss of oxygen (i.e. high pressure cylinders back feeding critical care areas). Most bulk suppliers will not guarantee they will be able to respond quickly in an emergency event. This nomenclature leads facility managers to assume that the EOSC is the best option for dealing with an emergency situation, but in fact it is not.
5.1.3.5.14 In-Building Emergency Reserves (IBERs)

5.1.3.5.14.1 In-building emergency reserves (IBERs) shall not be ......... ..

5.1.3.5.14.2 When a reserve an IBER is provided inside the building as a substitute for the EOSC .. .. .. ... .. ... .... .. .. .

5.1.3.5.14.3 In-building emergency reserves (IBERs) shall consist of ........... .......... .

5.1.3.5.14.4 In-building emergency reserves (IBERs) shall include a ............ ..... ..... .

5.1.3.5.14.5 In-building emergency reserves (IBERs) shall have a ...... ............. ..... ..... .

Substantiation: To add IBER in Chapter 5. The term IBER is used in Chapter 14 to indicate in-building emergency reserve, similar to EOSC for emergency oxygen supply connection in Chapters 5 and 14.

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In-building emergency reserves shall have a local signal that visibly indicates the operating status of the equipment and an alarm at all master alarms when or just before the reserve begins to serve the system.

Substantiation: I recently had a customer whose facility was cited by their state authority for not having their in building emergency reserve system alarm at the Master Alarm panels. Their in building emergency reserve system is not a system that automatically feeds the system. It is a system that is manually operated when the gas emergency plan is activated. For automatically operating in building emergency reserves the low line pressure alarm should be adequate notice for operation of the system.

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5.1.3.5.15 Oxygen Concentrator Sources.

5.1.3.5.15.1 Oxygen concentrator systems used as sources shall comply to ISO 10083 "Oxygen concentrator supply systems for use with medical gas pipeline systems"

Substantiation: Central oxygen concentrator sources are still rare in U.S. healthcare but are increasingly common internationally. It is appropriate that the standard give some guidance for a safe installation. At this time I do not believe it appropriate for NFPA to attempt to write a standard, so I propose to reference the most widely used international standard.
(2) It shall
Cylinders shall meet the requirements of medical air USP.
(3) Medical air supplied from compressors using ambient source air shall be tested at initial installation and quarterly to meet the specifications of USP medical air (CGA grade N)
(4) It shall have no detectable liquid hydrocarbons.

Renumber remainder of section

Substantiation: USP medical air is / or has been typically accepted as CGA grade N. The limiting CO2 is 500ppm for CGA grade N (USP medical air). The local ambient air supply globally is increasing. The average CO2 level is somewhere around 350 ppm. There are days in the large cities where the ambient level is over 600ppm. I was unable to find the history behind why 500 ppm was chosen. The USP / FDA / and CGA are all involved as are the DOT and NFPA. I would suggest that if we leave the limit at 500 ppm CO2 we will start to see failure to meet the standard. It would be expensive to add air treatment packages and monitoring to compressor systems to meet the 500ppm CO2. An alternative would be to include a definition of medical air from compressors using ambient air and have the limits listed in a table. Also note that 5.1.3.6.14 does not agree with 5.1.3.6.1 as there is no requirement to monitor for CO2, nitric oxide, nitrogen dioxide, sulfer dioxide, etc...only CO, and dewpoint.

5.1.3.6.2* Uses of Medical Air. Medical air sources shall be connected to the medical air distribution system only and shall be used only for air in the application of human respiration and calibration of medical devices for respiratory application and cleaning of endoscopes.

Substantiation: Instrument air is often not available, and if available it is at an unacceptably high pressure. Compressed air is not clean enough.

Medical Air compressor systems shall preclude the condensation of water vapor in the piping distribution system by the selection of the air drying equipment.

Substantiation: Relocated 5.1.3.6.3.3 to this section. (editorial).
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99- Log #111 HEA-PIP
(5.1.3.6.3.9) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Delete the following text:
5.1.3.6.3.9* Medical Air Local Alarm. A local alarm complying with 5.1.9.5 shall be provided for the medical air-
compressor source:
Substantiation: Relocate 5.1.3.6.3.9 (and annex) to 5.1.3.6.3.13 Operating Alarms and Local Signals. (Editorial).

99- Log #117 HEA-PIP
(5.1.3.6.3.12(F)) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
(F) Compressor intake piping shall be permitted to be made of materials and use a jointing technique as permitted
under 5.1.10.2 and 5.1.10.3.
Substantiation: I believe this was a error on the original print (2012 edition). There was no referenced jointing
technique as listed in 5.1.3.6.3.12. 5.1.10.3 references the joining technique needed for this section.

99- Log #112 HEA-PIP
(5.1.3.6.3.13) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
Medical air systems shall be monitored for conditions that can affect air quality during use or in the event of failure,
based on the type of compressor(s) used in the system.

A local alarm complying with 5.1.9.5 shall be provided for the medical air compressor source.
Substantiation: Relocated 5.1.3.6.3.9 to this section. (Editorial).

99- Log #122 HEA-PIP
(5.1.3.7.4) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Delete the following text:
5.1.3.7.4 Vacuum Local Alarm. A local alarm complying with 5.1.9.5 shall be provided for the vacuum source.
Substantiation: This section is redundant with 5.1.3.7.8.

99- Log #123 HEA-PIP
(5.1.3.7.7.x (New )) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Add a new section to read:
Vacuum exhaust piping shall be permitted to be made of materials and use a jointing technique as permitted
under 5.1.10.2 and 5.1.10.3
Substantiation: 2012 Log CP2 99-219 inadvertently took out the exhaust piping section. the NFPA 99, 2012 does not
have a section for exhaust piping materials or joining techniques (The NFPA 99, 2005 edition section "5.1.3.6.7.4 The
exhaust shall be piped of materials approved for medical-surgical vacuum piping under 5.1.10.2."
99- Log #124 HEA-PIP (5.1.3.7.7.2(2)) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise text to read:
(2) At least 9.05 m (25 ft) from any door, window, air intake, or other openings in buildings or places of public assembly

Substantiation: The FGI 2.1-8.4.4.2 2010 edition requires 25 ft for exhausts from windows, doors, air intakes, ... The Medical Air intake was corrected in 2012 edition, but the vacuum exhaust was not.

99- Log #331 HEA-PIP (5.1.3.7.6 (New)) Final Action:

Submitter: Anthony Lowe, Allied Air Compressor, Inc.
Recommendation: Add a new section to read:
5.1.3.7.7.6 The exhaust shall be piped of materials approved for medical-surgical vacuum piping under 5.1.10.2.

Substantiation: Would clarify the type of materials to be used for vacuum exhaust. Under the current code there is no defined material to be used on vacuum exhaust piping.

This section was removed from the current edition. Since the code has a defined vacuum exhaust section the material used should be shown.

99- Log #125 HEA-PIP (5.1.3.8.3) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Delete the following text:
5.1.3.8.3 WAGD Connections to Vacuum Piping. If WAGD is joined to vacuum piping, it shall be connected at a minimum distance of 1.5 m (5 ft) from any vacuum inlet.

Substantiation: Relocate to 5.1.5.16 (editorial)

99- Log #142 HEA-PIP (5.1.4.3(1) and 5.1.4.3(5)) Final Action:

Submitter: Jim Lucas, Tri-Tech Medical Inc.
Recommendation: Revise to read:
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 without cutting or brazing.

Substantiation: Inclusion of the word "ball" restricts/limits technology. There are other types of valve designs that can meet all five of the requirements for medical valves but are currently denies to the market.

Inclusion of the phrase "consists of three pieces" restricts/limits technology. There are other types of valve designs that can meet all five of the requirements for medical valves but are currently denies to the market.
99- Log #141 HEA-PIP
(5.1.4.3.2)

Submitter: Jim Lucas, Tri-Tech Medical Inc.
Recommendation: Revise to read:
5.1.4.3.2 Valves for vacuum or WAGD service shall be permitted to be ball per 5.1.4.3 or butterfly type and shall not be required to be cleaned for oxygen service.
Substantiation: Inclusion of the word "ball" restricts/limits technology. There are other types of valve designs that can meet all five of the requirements for medical valves but are currently denied to the market.

99- Log #127 HEA-PIP
(5.1.4.4.1)

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
5.1.4.4.1 The source valve shall be located in the immediate vicinity of the source equipment, except as allowed by 5.1.3.4.
Substantiation: Editorial.

99- Log #128 HEA-PIP
(5.1.4.5)

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read:
A shutoff valve shall be provided in the main supply line inside of the building(s) being served, except where one or more of the following conditions exist:
Substantiation: When there are multiple free standing buildings being served by one central supply source, there will be more than one main valve.

99- Log #35 HEA-PIP
(5.1.4.8(4) (New))

Submitter: Mike Lemanek, Certech
Recommendation: Add a new subsection to read:
(4) The zone valve shall be placed to allow someone to to shut off the flow of gas without being directly exposed to the fire and any products of combustion.
Substantiation: This language is from the code handbook. The current language and exhibit 5.22(a) leaves a person exposed to products of combustion.
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.

**Recommendation:** Revise text to read:

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.

**Substantiation:** The proposed deleted phrase is in conflict with the definition of an Anesthetizing Location in 3.3.9. There is no such thing as an anesthetizing location of moderate or deep sedation. An anesthetizing location is by definition limited to general anesthesia.

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**Valves for Future Connections shall be included as part of the piping design of all medical gas and installed in the riser line to be used for future changes and additions to the piping systems. The valve size shall be the same as the riser and shall be replaced with a new valve in the event the first valve is used during any piping change.**

**Recommendation:** Valves for Future Connections shall be included as part of the piping design of all medical gas and installed in the riser line to be used for future changes and additions to the piping systems. The valve size shall be the same as the riser and shall be replaced with a new valve in the event the first valve is used during any piping change.

**Substantiation:** Medical gas piping changes are inevitable in every hospital or medical care facility. The cost of shutting down the medical gas is expensive and increases risk becoming dangerous to patients. The medical gas industry has been brilliant in developing a means of performing live tie-ins to complete the necessary changes such as “Smart Tap” and others. By including future valves as mandatory in the design code, and having facilities use these valves will reduce this risk and maintain the integrity of our medical gas piping.

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**Station outlets/inlets shall be installed where they are visible and accessible at all times. Station outlets/inlets shall not be installed behind normally open or normally closed doors or otherwise hidden from plain view.**

**Recommendation:** Station outlets/inlets shall be installed where they are visible and accessible at all times. Station outlets/inlets shall not be installed behind normally open or normally closed doors or otherwise hidden from plain view.

**Substantiation:** Recently there have been hospitals “Temporarily” building rooms with in rooms where walls are going up over existing walls that have medical gas outlets/inlets on them. The temporary installations are lasting for months, sometimes yrs. This seems to be a less expensive way of using an area without having to demo the area and perform shutdowns.

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**If joined to the vacuum piping, it shall be connected at a minimum distance of 1.5 m (5 ft) from any vacuum inlet.**

**Recommendation:** If joined to the vacuum piping, it shall be connected at a minimum distance of 1.5 m (5 ft) from any vacuum inlet.

**Substantiation:** Relocated 5.1.3.8.3 (Editorial)
99- Log #155 HEA-PIP (5.1.6.8) Final Action:

Submitter: Mark W. Allen, Beacon Medaes
Recommendation: Revise to read:
  5.1.6.8 Station outlets installed in Manufactured assemblies connected to the pipeline by brazing shall have station outlets/inlets that comply with 5.1.5 in all respects.
Substantiation: More clear wording. Not all manufactured assemblies contain outlets.

99- Log #353 HEA-PIP (5.1.6.10 (New)) Final Action:

Submitter: Rachael Stephenson, Flower Mound, TX
Recommendation: Add a new section to read:
  5.1.6.10 For manufactured assemblies employing flexible hose or tubing, the manufacturer shall provide documentation of the recommended inspection and preventative maintenance including frequency of such activities.
Substantiation: Flexible hose may wear or be damaged overtime. The manufacturer should specify the minimum frequency of inspections for this component. This is equivalent to the requirements in the international standard BS EN ISO 11197:2009.

99- Log #130 HEA-PIP (5.1.8.1.7) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Delete the following text:
  5.1.6.1.7 The rated accuracy of indicators used for testing shall be 1 percent (full scale) or better at the point of reading.
Substantiation: Relocate to 5.1.12 This has nothing to do with the pipeline indicators and more to do with testing equipment in 5.1.12.

99- Log #328 HEA-PIP (5.1.9.1 and 5.1.9.4.1) Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Throughout the document Emergency Electrical System should be changed to Essential Electrical Systems (EES) or Emergency Power Supply (EPS) whichever is applicable.
Specifically: 5.1.9.1, 5.1.9.4.1, 7.3.1.2.1.5, 7.3.1.2.3.8, 14.2.5.1.6, 14.2.5.4.3, chapter 1 and annexes.
Substantiation: The term Emergency Electrical System is used in chapters outside of chapter 6 where EES and EPS are very clearly defined (Essential Electrical Systems (EES) and Emergency Power Supply (EPS)), but not emergency electrical systems is not a defined system anywhere in the book. I believe in some chapters (outside of chapter 6) where emergency electrical system is used, the intent of the chapter was for an essential electrical system or an emergency power supply. It is confusing when you read a chapter, outside of chapter 6, that requires an emergency electrical system, when the intent was an essential electrical system or emergency power supply.
This should be an editorial change.
5.1.9.2.1 The master alarm system shall consist of two or more alarm panels located in at least two separate locations, as follows:

(1) One master alarm panel shall be located in the office or work space of the on-site individual responsible for the maintenance of the medical gas and vacuum piping systems when staffed 24 hours a day.

(2) In order to ensure continuous surveillance of the medical gas and vacuum systems while the facility is in operation, the second one or more master alarm panels shall be located in an area of continuous observation (e.g., the telephone switchboard, security office, or other continuously staffed location).

(3) It is permitted for the individuals responsible for the medical gas and vacuum systems to automatically be notified by phone, pager, or other means in addition to the warning systems above.

Substantiation: The Joint Commission has charged many hospitals this year with relocating one of the existing master panels to the maintenance office. This change will eliminate locating a master alarm panel in an office that is typically locked at night, where it cannot be responded to or silenced.

The maintenance/engineering department is a non-revenue producer that is often moved in some facilities requiring the relocation of all their alarms. The ability to contact these individuals automatically wherever they may be by phone or pager can improve response times to emergency situations.
(2)* Anesthetizing locations where moderate sedation, deep sedation, or general anesthesia is administered shall have the sensors installed either on the source side of any of the individual room zone valve box assemblies or on the patient or use side of each of the individual zone valve box assemblies.

Substantiation: The proposed deleted phrase, "where moderate sedation, deep sedation... is administered" is in conflict with, and "or general anesthesia" is redundant to the definition of an Anesthetizing Location in 3.3.9. There is no such thing as an anesthetizing location where moderate sedation or deep sedation is administered. An anesthetizing location is by definition limited to general anesthesia.

The use of bending shall only be used on overhead main or branch piping and is only meant to be used when the building structure has odd angles.

Bending shall be performed using proper tools and methods to allow for a smooth transition without kinks or damage to the wall of the piping or tubing.

Machine, manual benders, or the heating of the tubing while under nitrogen purge shall be acceptable methods.

Substantiation: Certain offsets in medical gas and vacuum piping are necessary due to structural reasons. Bending of medical gas and vacuum copper piping should be allowable when the degree of bend is less than what is available from fitting manufacturers. A bend should be allowed if the degree of bend is 22° or less.

 Tubes shall be hard-drawn seamless copper in accordance with ASTM B 819, Standard Specification for Seamless Copper Tube for Medical Gas Systems, medical gas tube, Type L, except Type K shall ACR B 819 OXY/MED (Type L ACR is rated for 743 psi, and well within the 1.5 times testing pressure. The brazed fittings are rated the same as the pipe). Type K may be used where operating pressures are above a gauge pressure of 1275 kPa (185 psi) and the pipe sizes are larger than DN80 [NPS 3 (3 1⁄8 in. O.D.)] but not required.

Substantiation: Type L or Type K on a Nitrogen system. Typically we will use Type K for this higher pressure pipe, thus that's how I responded. However type L ACR B 819 OXY/MED pipe is actually an acceptable system. In my systems we call for all pressure pipe and vacuum systems to use Type L ACR OXY/MED B 819 pipe. In some cases we call for Nitrogen or High Pressure Oxygen to use Type K of the same, however Type L ACR is rated for 743 psi, and Type L is 741 psi, well within the 1.5 times testing pressure. The brazed fittings are rated the same as the pipe. So you actually can use the Type L for Nitrogen, even though industry standard is to use Type K.

These pressures are based on the system temperature of 100 - 150 degrees F.
5.1.10.1.7 Witnessing of Installer Performed Test. Witnessing of installer performed test shall be witnessed by the authority having jurisdiction and signed off by both the installing contractor and the AHJ before proceeding to the next testing procedure. The authority having jurisdiction shall be certified in medical gas inspections per the ASSE 6020 standards, follow the standards outlined in this code, and shall follow inspection procedures outlined in the ASSE 6000.

**Substantiation:** Not all AHJ's are medical gas certified, or know what they are looking at half the time. In order to provide a more code compliant installation, we feel the inspector shall be ASSE 6020 certified, and witness to all the installing contractors installers performed test. Many times blockages will get by the installers performed test, and sometimes get past the verifiers performed task. As an inspector we should be making sure that the installing contractor has actually performed his/her required test. This would help eliminate many issues we see after the fact. By giving the medical gas inspector some added verbiage in this code section, it will help to provide some much needed support for their inspections.

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

1. Hard-drawn seamless copper tube:
   (b) ASTM B 280, *Standard Specifications for Seamless Copper Tubing for Air Conditioning and Refrigeration Field Service*, copper ACR tube.
   (c) ASTM B 819, *Standard Specification for Seamless Copper Tube for Medical Gas Systems*, copper medical gas tubing (Type K or L).

2. Stainless steel tube.
   (a) ASTM A 269 TP304L or 316L *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*.
   (b) ASTM A 312 TP304L or 316L *Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes*.
   (c) A312 TP 304L/316L Sch. 5S pipe and A403 WP304L/316L Sch. 5S fittings.

**Substantiation:** There is no material/s indicated for the stainless steel piping vacuum system. This would create acceptable material/s for stainless steel vacuum piping.
Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. The cutting wheels on tubing cutters shall be free from grease, oil, or other lubricant not suitable for oxygen service. The cut ends of the tube shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube.

When required, exterior deburring (manual filing) of piping for proper insertion into fittings shall be performed by inserting a clean white, lint-free cloth or line-size cap into the pipe paying close attention to sealing off as much area as possible. When the beveling process is completed, the cloth or cap shall be removed carefully so as to keep any filing materials from entering the cleaned pipe end. A clean white, lint-free cloth will then be saturated with a Tri-Sodium Phosphate (TSP) solution and the end wiped clean after which close inspection shall be made to ensure no debris is present.

When piping is cut from random lengths provided by the manufacturer, ends shall be sealed after cutting to prevent debris or other contaminants from entering the pipe. No nitrogen purge for either resultant lengths of pipe is required.

There are no procedures for the outside of the piping/tubing when cutting. When a tubing cutter is used, especially on large diameter pipe, the cutter forms a ridge that must be reduced or eliminated in order for proper insertion into fittings as the tolerances do not allow the ridge to properly seat into the bottom of the fitting/s. New Sections 5.1.10.4.2.4 and 5.1.10.4.2.5 will create a procedure to rectify that.

During and after installation brazing, openings in the piping system shall be kept sealed, other than the purge gas openings, to maintain a nitrogen atmosphere within the piping to prevent debris or other contaminants from entering the system.

Locally, "maintain a nitrogen atmosphere" has been interpreted to mean a nitrogen pressure charge. A pressurized nitrogen charge is not the intent.

After the joint has cooled, the purge discharge opening shall be sealed to prevent contamination of the inside of the tube and maintain a non-pressurized nitrogen atmosphere within the piping system.
99- Log #133 HEA-PIP
(5.1.10.8(1))

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise text to read:
(1) They shall be limited to connections for pressure and vacuum indicators, alarm devices, gas specific demand check valves, and source equipment on the source side of the source valve.

Substantiation: 2012 edition required oxygen check valves to have brazed extensions. The only check valve that can be thread on the pipeline is the gas specific demand check valve for sensors.

99- Log #23 HEA-PIP
(5.1.10.10.11)

Final Action:

NOTE: This proposal appeared as Comment 99-177 (Log #2) which was held from the A11 ROC on Proposal 99-295.
Submitter: Robert Sewell, Plumbers & Steamfitters Local 159
Recommendation: Add text to read as follows:
The installation of medical gas equipment such as but not limited to medical gas compressors, air dryers, vacuum pumps, headwalls, columns, ceiling columns, ceiling hung pendants, movable tract systems, and so forth, shall be installed by qualified, competent, technicians who meet the requirements of ASSE 6010 Professional Qualification Standard for Medical Gas Systems Installers.

Substantiation: In Contra Costa County, these items are being installed by persons who are not trained in the handling, installation and inspection of this equipment. To prevent equipment from being installed that may be contaminated, I believe that any and all persons who install medical gas equipment must meet the requirements of ASSE 6010.

99- Log #352 HEA-PIP
(5.1.10.11.6.1)

Final Action:

Submitter: Rachael Stephenson, Flower Mound, TX
Recommendation: Add new text to read:
5.1.10.11.6.1 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. Where flexible hose is used as part of a manufactured assembly, it shall be permitted to penetrate or be concealed in walls, floors, ceilings, or partitions and shall be as follows:
(1) Shall be connected to building pipeline no farther than 10 feet from the manufacturer assembly
(2) Meet the requirements of 5.1.6.10
(3) Accessible by removal of a panel, door, or cover

Substantiation: This is a clarification for application of this requirement to manufactured assemblies. Allowing connection of flexible hose from manufactured assemblies within the walls or ceiling allows manufactured assemblies to be maintained rather than fully removed for flexible hose servicing.
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**Submitter:** Anthony Lowe, Allied Air Compressor, Inc.  
**Recommendation:** Add new text to read:

5.1.10.11.7.1 Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing, or any other reason. Two or more medical gas or vacuum piping systems of the same medical gas can be allowed to be interconnected by automatic or manual means. Each Source shall be capable of supplying the entire facility. The sizing shall be confirmed by the authority having jurisdiction.

**Substantiation:** Modernization of hospitals often included a 2nd tower which included a 2nd medical air or medical vacuum system were both systems are large enough to supply the complete facility. Two facilities have this set up and have requested to install interconnecting piping so each system can back up the other in the event of a total system failure. One facility would like to install an electronic normally closed actuating ball valve with transducer(s) on each side of the valve to automatically open the valve when pressure falls below a giving set point. The transducer(s) would obviously require demand checks.

This would allow the facility to focus on the total failure and not have to focus on the medical gas or medical vacuum. We feel this exceeds the current 99 Code requirements but said section reads that two systems can not be interconnected for any reason.

**Submitter:** David McGunigale, Baltimore Washington Medical Center  
**Recommendation:** Add an Exception to read:

Exception: Piped medical gas systems with the same medical gas content may be interconnected when a normally closed valve is installed between the systems and the systems are allowed to operate independently as designed except when the failure or shutdown of either system mandates the use of the normally closed valve to protect the patient population.

Note: Each system must be designed and installed to handle the entire load of the facility when the normally closed valve is open.

**Substantiation:** Redundancy - our facility has 2 independent med air systems serving 2 patient towers. Due to an electrical outage on the emergency branch feeding one of the med air systems, we had a critical care unit without med air for about 50 minutes. If the type of normally closed valve had been installed between the 2 systems, we would have minimized the risk to our patients while the system was shut down.

**Submitter:** Keith Ferrari, Praxair, Inc.  
**Recommendation:** Revise title to read:

5.1.11* Labeling, Identification, and Identification Operating Pressure. Color and pressure requirements shall be in accordance with Table 5.1.11.

**Substantiation:** Rename of section to be consistent with the information described in the 5.1.11 Pressure is listed in the section, but not in the heading.
Report on Proposals – June 2014

99- Log #135 HEA-PIP
(5.11.2.6.x (New))

Final Action:

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Add a new section to read:
The zone valve(s) shall be labeled in substance as follows:
Zone Valve for the (gas/vacuum name) Serving (name of the area/rooms served by the particular valve)
Substantiation: Zone valves are the only valve not listed in this section on labeling.

99- Log #30 HEA-PIP
(5.11.3(1))

NOTE: This proposal appeared as Comment 99-180 (Log #106) which was held from the A11 ROC on Proposal 99-500.
Submitter: Jim Lucas, Tri-Tech Medical Inc.
Recommendation: Add new text to read as follows:
5.11.3(1) Where the outlet is downstream of a flow control device the station outlet identification shall include a warning not to use the outlet for ventilating patients...
5.11.3(2) No other flow control device (such as a flowmeter) shall be attached to the station outlet.
Substantiation: Sleep labs are being built with outlets downstream of flow control devices using standard labeling (i.e., Oxygen).

99- Log #136 HEA-PIP
(5.11.4)

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise to read as follows:
5.11.4 Alarm Panels. Labeling of alarm panels shall comply with the requirements of 5.1.9.1(6) and (7) for each indicator, indicating the condition monitored and for its area of surveillance.
Substantiation: Replaced reference of 5.1.9.1(6) and (7) with section wording for clarity.

99- Log #131 HEA-PIP
(5.12.1.1.x (New))

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Add a new section to read:
The rated accuracy of indicators used for testing shall be 1 percent (full scale) or better at the point of reading.
Substantiation: Relocated 5.1.8.1.7 (Editorial).
Submitter: John C. Gregory, HDR Architects Inc.

Recommendation: Revise text to read:

5.1.12.2.1.1 The tests required by 5.1.12.2 shall be performed and documented by the installer prior, and witnessed by an ASSE 6020 certified inspector prior to the tests listed in 5.1.12.3.

Substantiation: NFPA identifies the certification levels for the installing contractor, the verifier and the maintenance worker for the medical gas systems, but the medical gas inspector certified to the ASSE 6020 standards is not mentioned anywhere. I believe there should be some description either under the AHJ description or it’s own which identifies what they shall perform and how.

Submitter: George L. Scott, Scott Associates LLC

Recommendation: Revise text to read:

5.1.12.3.7.1 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 Nl/min (3.5 SCFM).

Substantiation: By allowing flow rates greater than 100 L/min the total amount of particulate matter deposited on the filter element can increase, possibly exceeding the permissible level in 5.1.12.3.7.3. Same erroneous result can occur by allowing the total volume of gas to exceed 1,000 L. As the flow increases, the gas velocity increases and the aerosolized particulate matter in the piping system can increase, thus depositing more particulate matter on the filter element.

Two tests performed on the same outlet using different rates of flow (1 at 100 L/min and 1 at >100L/min) could produce different results, perhaps causing the higher flow rate to exceed the total allowable particulate matter per unit of volume - 1mg/M3.

Submitter: Mike Lemanek, Certech

Recommendation: Delete the following text:

5.1.12.3.8.1 These tests shall be performed with oil-free, dry nitrogen NF or the system gas.

5.1.12.3.8.2 The outlet most remote from the source shall be tested for total non-methane hydrocarbons and compared to the source gas.

5.1.12.3.8.3 If the system gas is used as the source gas, it shall be tested at the source equipment.

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

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

Substantiation: Eliminate expensive and time consuming test.
Odor. All positive pressure gas outlets, except nitrous oxide, shall be tested for odor. No appreciable odor shall be discernible. At an outlet flow of approximately 10 SLPM, deflect a portion of the gas stream toward the nose and sniff. Do not direct the outlet gas stream toward the face.

Odor is presently not required during the verification process, but is seen too frequently when tubing plugs are brazed into the piping system during installation, causing an offensive odor. Gas odor is at times missed resulting in costly opening of walls, etc. and sometimes causing delayed clinical unit openings to remove the piping sections involved. Occasionally the problem is not noted until patient use, resulting in costly clinical unit(s) unplanned shutdowns.

The odor test should be performed with source gas, because the source gas itself is occasionally the cause of the odor. The new section methodology is similar to the USP test required on some medical gases.

Although odor can be subjective between individuals, a “discernible odor” would be caught by the vast majority of verifiers.

Perhaps a clarification in the Appendix would be helpful explaining the difference between breathing the gas under test and just sniffing it for odor.
(a) Purity - Percent Concentration
(b) Permanent Particulates & Contaminants
(c) Odor & Moisture

There is a continual need for human diligence in the establishment and maintenance of safe practices for respiratory therapy. It is essential for personnel having responsibility for respiratory therapy to establish and enforce appropriate safety programs.

The supply of gas that comes from the manufacturer or distributor should be accompanied with a Certificate of Analysis. Additional impurities can enter the pipeline over time from wear and tear on the pipeline, temperature changes that affect the pipeline, moisture buildup, maintenance work on the pipeline and components, etc. The purity of the gas does not end at the supply source. The pipeline network runs throughout the facility. There are numerous articles written about pipeline contamination (i.e. ECRI).

1. ECRI recommend random testing of selected outlets for purity and contaminant testing.
2. Routinely inspect and maintain medical gas and vacuum systems. Schedules and procedures are described in our IMP Procedure in Health Devices 23 (1-2).
3. Use filters on medical gas outlets only as a temporary measure to protect patients and devices against particles, bacteria, or liquid water found in the system. Develop a schedule of filter inspection and replacement and a plan to correct the source of contamination in a medical gas system as soon as possible. Note that filters will not remove water vapor or other gases, which can damage some medical devices. Water found in the system is a serious problem requiring immediate action to eliminate its cause and limit the extent and impact of the contamination.

Eichhorn JH, Bancroft ML, Laasbert LH, du Moulin GC, Saubermann AJ. Medical gases and water were sampled and tested for purity prior to the opening of a 176-bed addition to a 450-bed general hospital. Contamination was found. In delivered oxygen, compressed air, and nitrous oxide, this consisted of a volatile hydrocarbon at an initial concentration of 10 parts per million and a dust of fine gray particulate matter. In water from new taps bacterial contamination with as many 400,000 organisms per 100 ml was present. All these contaminants were considered potential hazards to patient safety. Studies were done to help delineate the nature and origin of these contaminants. Each contaminant was eventually largely eliminated by purging the respective pipeline systems with continuous flows. Planners, builders, and responsible medical personnel must be aware of the potential such hazards in a new hospital building.

3. Contamination of piped medical gas supply with water.

Abstract
The failure of anesthetic equipment as a result of maintenance is extremely rare. The ingress of water into the flowmeters of an anesthetic machine from the piped medical air supply is reported and is possibly unique. The piped medical air supply was open to the atmosphere during maintenance. Water condensed in the gas pipeline and this was not noticed during subsequent testing. Water was seen leaking from the orthopadic air tools used for surgery but was assumed to be from the autoclaving process. Later the same day, when medical air from the piped source was used as part of the gas mixture for a general anesthetic, water was seen filling the barrel of the flowmeter air control valve. This could have had far-reaching and dangerous consequences for the patient, which were fortunately averted.

(Published Online August 16, 2006)

4. Medicine

Journal of Clinical Monitoring and Computing Volume 11, Number 1, 73-76, DOI: 10.1007/BF01627427

Medical gas contamination: An unrecognized patient danger
Dr. Moss, of Verona, NY, has been very active with and is a consultant to the New Jersey State Society of Anesthesiologists. He is an APSR Director and also Chairman of the APSF Subcommittee on Medical Gas and Vacuum
This is not original material; its reference/source is as follows:
NFPA
Mark W. Allen, Beacon Medaes

Recommendation: Revise and add new sections to read:

5.1.13.1 Applicability

Support gases are any gases which 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 Sources

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).

5.1.13.2.1 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)

5.1.13.2.2 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 5.1.3.3.2
(3) For air-cooled equipment, in a room designed to maintain the ambient temperature range as recommended by the equipment manufacturer

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

(1) a gauge 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

5.1.13.2.4 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

5.1.13.2.5 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).

5.1.13.2.6 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.

5.1.13.2.5.7 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.

5.1.13.2.5.8* 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.

5.1.13.2.5.9 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 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.

5.1.13.2.5.10 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

5.1.13.2.5.11 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.

5.1.13.2.5.12 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

5.1.13.9.10.2 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 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

5.1.13.2.5.13 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.

Substantiation: 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).

99- Log #159 HEA-PIP

(5.1.13.4.1)

Submitter: Mark W. Allen, Beacon Medaes

Recommendation: Revise to read:

5.1.13.4.1 Requirements for nitrogen support gas outlets shall be in accordance with 5.1.5.1, 5.1.5.2, 5.1.5.4 through 5.1.5.8, 5.1.5.11, and 5.1.5.13 through 5.1.5.15.

Substantiation: These requirements are not unique for nitrogen.

99- Log #158 HEA-PIP

(5.1.13.8)

Submitter: Mark W. Allen, Beacon Medaes

Recommendation: Revise to read:

5.1.13.8 Distribution.

Requirements for support gas piping distribution shall be in accordance with 5.1.10.4, 5.1.10.3, 5.1.10.4, 5.1.10.4.1 through 5.1.10.4.6, 5.1.10.93.8, 5.1.10.9(1), 5.1.10.9(2), 4.3.13 through 5.1.10.9(3), and 5.1.10.11.

Substantiation:

99- Log #279 HEA-PIP

(5.1.14.2.2.5(1))

Submitter: David A. Dagenais, Wentworth-Douglas Hospital

Recommendation: Revise text to read:

(1) Training and certification Training program through the health care facility by which such persons are employed to work with specific equipment as installed in that facility

Substantiation: These systems have been maintained for several years by trained individuals within the healthcare origination. to use the term certification required the hospital to become a certifying body and well beyond a well developed training program.
99- Log #330 HEA-PIP  
(5.1.14.2.2.5(3))  
Final Action:

Submitter: Anthony Lowe, Allied Air Compressor, Inc.  
Recommendation: Delete the following text:  
(3) Credentialing to the requirements of ASSE 6030, Professional Qualification Standard for Medical Gas Systems— 
Verifiers  
Substantiation: The ASSE 6030 Standard does not include knowledge of manufactured equipment. If the ASSE 6030 can perform maintenance so can the ASSE 6005, ASSE 6010, ASSE 6020, ASSE 6050.  
Just because a person has knowledge with medical gas systems does not constitute knowledge of the actual equipment to perform routine maintenance.  
The current standard allows ALL ASSE 6030 credentialed person(s) to perform maintenance. Maintenance performed by untrained person(s) can be detrimental to the performance of the equipment being serviced.  
This is not original material; its reference/source is as follows:

99- Log #95 HEA-PIP  
(5.1.14.2.3.1(i))  
Final Action:

Submitter: James Bell, Intermountain Health Care  
Recommendation: Revise text to read:  
(i) Air purity, medical air supplied from compressors shall be verified to meet 5.1.3.6.1 by quarterly sampling using an AIHA or equivalent testing service unless continuous monitoring with alarms is installed.  
Substantiation: There is no requirement to test the medical air from compressors to meet 5.1.3.6.1 and it is not clear what (i) air purity means. OSHA standards and US Navy standards for breathing air require biannual sampling of the air provided by compressors I would suggest that medical air should be held to a higher or equal standard as occupational breathing air. See 14.2.8.6.1*

99- Log #160 HEA-PIP  
(5.1.15)  
Final Action:

Submitter: Mark W. Allen, Beacon Medaes  
Recommendation: Delete as shown:  
5.1.15*—Category 1 Maintenance. Facilities shall have a routine maintenance program for their piped medical gas and vacuum systems:  
Substantiation: This section is redundant to 5.1.14.
NOTE: This proposal appeared as Comment 99-146 (Log #94) which was held from the A11 ROC on Proposal 99-171.

Submitter: Keith Ferrari, Praxair

Recommendation:  Revise text to read as follows:

5.2.3.4 Central Supply Systems. Level 2 systems shall comply with 5.1.3.4, except as follows:
(1) Manifolds for Cryogenic Liquid Containers shall be permitted to have a primary supply and reserve supply.
(2) The facility staff shall develop their emergency plan to deal with the loss of medical gases.

Substantiation: The increased usage of micro bulks and mini bulks, supplies between 5000 cu ft and 20,000 cu ft of gas, in the healthcare industry have caused confusion as to their proper installation. Most installers will follow 5.1.3.4.12 for Manifolds for Cryogenic Liquid Containers, but some installations are being designed to 5.1.3.4.13 Bulk Cryogenic Liquid Systems because the word Bulk is used in the term "Micro Bulk".

By NFPA 99 -section 3.3.19.2 oxygen definition, a supply of oxygen more than 20,000 cu ft is considered a bulk supply. The supply of gas 20,000 cu ft or less is not a bulk supply and should be installed in accordance with 5.1.3.4.12. This may not be practical in the case of a micro bulk. In accordance with 5.1.3.4.12, there needs to be two equal headers. This means that the facility either will have to install two micro bulks and a reserve or have enough supply of gas (cylinders or containers) on the secondary side to equal the primary supply. By adding another micro bulk, this additional supply would in most cases increase the total supply to over 20,000 Cu ft thus requiring the installation to follow NFPA 55 code.

Most of the micro or mini bulk installation are supplying level II facilities (clinics, same days under general anesthesia, emergency care, etc.). In the NFPA 99 Level II sections 5.2.3.5, 5.2.3.6, & 5.2.3.7, there are exceptions for the Medical Air Supply Systems, Medical Surgical Vacuum Systems and WAGD central supply systems. I believe that Cryogenic Liquid Containers can be designed with a Primary supply and reserve supply for level II facilities without lowering patient safety standards. The facility will still need to develop an emergency plan that addresses the loss of medical gases.

Submitter: Keith Ferrari, Praxair, Inc.

Recommendation: Renumber all of section 5.3.7 to 8.3.7.

Substantiation: Gas-Powered Systems are not part of the scope of Chapter 5. The Gas-powered systems in Chapter 5 catagory 3 are plumbing systems. Chapter 5 includes medical gases, support gases, medical -surgical vacuum. Chapter 8 scope includes plumbing systems (non medical gas). The entire section should be moved to Chapter 8 and the TC for chapter 8 needs to review these sections.

Submitter: Keith Ferrari, Praxair, Inc.

Recommendation: Renumber all of section 5.3.8 to 8.3.8.

Substantiation: Vacuum and Scavenging Systems are not part of the scope of Chapter 5. The Vacuum and Scavenging systems in Chapter 5 catagory 3 are plumbing systems. Chapter 5 includes medical gases, support gases, medical -surgical vacuum. Chapter 8 scope includes plumbing systems (non medical - surgical vacuum). The entire section should be moved to Chapter 8 and the TC for chapter 8 needs to review these sections. As with my submittal on Gas Powered Systems, this section needs to either move to Chapter 8 or be defined as a Medical-Surgical Vacuum System Cat. 3 and defined with specific details. NFPA 99, 2012 seems to include wet, dry and other types of vacuum systems in Cat 3 vacuum. Also, the term "scavenging" as used in this section seems to conflict with Chapter 9 use of the term "scavenging" systems.
99- Log #138 HEA-PIP  Final Action:
(Table A.5.1.9.2)

Submitter: Keith Ferrari, Praxair, Inc.
Recommendation: Revise table as follows:

INSERT Table A.5.1.9.2 HERE

Substantiation: Updated table (editorial).

99- Log #36 HEA-PIP  Final Action:
(A.5.1.14.1.4)

Submitter: Mike Lemanek, Certech
Recommendation: Revise text to read:
A.5.1.14.1.4 Other examples of prohibited use of medical–surgical vacuum would be scope cleaning, decontamination, and laser plume.
Substantiation: Trying to enforce this prohibition during verification is futile.
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<th>Alarm Condition</th>
<th>Manifold for Gas Cylinders Without Reserve (5.1.3.5.10)</th>
<th>Manifold for Cryogenic Liquid Cylinders with Reserve (5.1.3.5.11)</th>
<th>Cryogenic Bulk with Cryogenic Reserve (5.1.3.5.12)</th>
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<th>Medical Air Proportioning System (5.1.3.6.3.15)</th>
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<th>Instrument Air Compressors (5.1.3.9)</th>
<th>Medical–Surgical Vacuum Pumps (5.1.3.7)</th>
<th>WAGD Producers (5.1.3.28)</th>
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