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Report of the Committee on

Health Care Facilities

Technical Correlating Committee (HEA-AAC)

John P. Swope, Chair
Derwood, MD [SE]

Constance Bobik, B&K Fire Safety Equipment Inc., FL [IM]
Jay Crowley, U.S. Department of Health/Human Services, MD [E]
Marvin J. Fischer, Jamesburg, NJ [U]
Thomas W. Gardner, Gage-Babcock & Associates, VA [U]
Stanley Kahn, Tri-City Electric Company, Inc., CA [IM]
William E. Koffel, Koffel Associates, Inc., MD [SE]
Thomas A. Salamone, Health Care and Life Safety Concepts, NY [I]
Rep. Kemper Insurance Companies

Alternates

Sharon M. Stone, Koffel Associates, Inc, MD [SE]
(Alt to W. E. Koffel)

Committee Scope: This Committee shall have primary responsibility for documents which contain criteria for safeguarding patients and health care personnel in the delivery of health care services within health care facilities: a) from fire, explosion, electrical and related hazards resulting either from the use of anesthetic agents, medical gas equipment, electrical apparatus and high frequency electricity, or from internal or external incidents that disrupt normal patient care; b) from fire and explosion hazards associated with laboratory practices; c) in connection with the use of hyperbaric and hypobaric facilities for medical purposes; d) through performance, maintenance and testing criteria for electrical systems, both normal and essential; and e) through performance, maintenance and testing and installation criteria: 1) for vacuum systems for medical or surgical purposes, and 2) for medical gas systems.

Technical Committee on

Administration (HEA-ADM)
(Chapters 1, 2, and 4)

Michael Crowley, Chair
The RA Group, Inc., TX [SE]

James S. Davidson, Jr., Davidson Associates, DE [SE]
August F. DiManno, Jr., Fireman’s Fund Insurance Company, NY [I]
William C. McPeck, State of Maine Employee Health & Safety, ME [E]
Thomas A. Salamone, Health Care and Life Safety Concepts, NY [I]
Rep. Kemper Insurance Companies

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents on the scope, application, and intended use of documents under the Health Care Facilities Project, as well as definitions not assigned to other committees in the Health Care Facilities Project.

Technical Committee on

Electrical Equipment (HEA-ELE)
(Chapter 7 [new Chapter 8] and Chapter 9 [new Chapter 10])

Lawrence S. Sandler, Chair
V. A. Medical Center, CA [U]

Saul Aronow, Waban, MA [SE]
Robert A. Carlson, Hubbell Inc., CT [M]
Yadin David, Texas Childrens Hospital, TX [U]
Albert G. Garlatti, Intertek Testing Services NA Inc., MN [RT]
Alan Lipschultz, Christiana Care-Health Services, DE [SE]
Rep. Association for the Advancement of Medical Instrumentation

James A. Meyer, Pettis Memorial VA Hospital, CA [C]

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Rep. American Society of Anesthesiologists
Joseph P. Murnane, Underwriters Laboratories Inc., NV [RT]
Mike Velvikis, High Voltage Maintenance Corporation, WI [IM]
Robert F. Willey, III, Siemens Medical Systems, Inc., NJ [M]
Rep. Health Industry Manufacturers Association

Alternates

Dale Woodin, American Society for Healthcare Engineering, IL [U]
(Alt to T. Peglow)

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the maintenance, performance and testing of equipment for the purpose of safeguarding patients and staff within patient care areas of health care facilities from the hazards of fire, explosion, electricity, nonionizing radiation, heat and electrical interference.

Technical Committee on

Electrical Systems (HEA-ELS)
(Chapter 3)

Hugh O. Nash, Jr., Chair
Nash Lajesty Burch, LLC, TN [SE]

Robert A. Carlson, Hubbell Inc., CT [M]
Rep. National Electrical Manufacturers Association

 Alternates

Lawrence A. Bey, Onan Corporation, MN [M]
Douglas S. Erickson, American Society for Healthcare Engineers, VI [U]
James Meade, Newcomb & Boyd Engineers, GA [SE]
Herbert Daugherty, Middlesex County Utilities Authority, NJ [U]
Rep. Electrical Systems Association

Alternates

Lawrence A. Bey, Onan Corporation, MN [M]
Douglas S. Erickson, American Society for Healthcare Engineers, VI [U]
James Meade, Newcomb & Boyd Engineers, GA [SE]
Herbert Daugherty, Middlesex County Utilities Authority, NJ [U]
Rep. Electrical Systems Association

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering performance, maintenance and testing of electrical systems for the purpose of safeguarding patients, staff and visitors within health care facilities.

Technical Committee on

Gas Delivery Equipment (HEA-GAS)
(Chapter 2 [definitions] Chapter 8, 13 [moving some items to Chapter 13] and 21)

Gerald L. Wolf, Chair
SUNY/HCBS, Brooklyn, NY [C]
Rep. American Society of Anesthesiologists

Alternates

M. Lee Bancroft, Beth Israel Deaconess Medical Center, MA [U]
Jay Crowley, U.S. Department of Health and Human Services, MD [E]
Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the performance, maintenance and testing of patient-related gas equipment for the purpose of safeguarding patients and staff within health care facilities.

Technical Committee on Health Care Emergency Preparedness and Disaster Planning (HEA-HCE) (Chapters 2 and 11)

Russell Phillips, Chair

Pete Brewster, US Dept. of Veterans Affairs-EMSHG, IN [U]

Steve Ennis, The Reciprocal Group, VA [I]

Curt Fogel, Valera Insurance, Inc., ND [I]

Joseph J. Gulinello, Integrated Security Solutions, NJ [SE]

John P. Jarrett, New Paltz Nursing Home, NY [U]

Rep. NFPA Health Care Section

Yvonne M. Keafer, Sedgwick James of PA, Inc., PA [I]

James C. Kendig, Jr., Health First, FL [U]

James W. Kerr, M. R. Inc., MD [SE]

David J. Kitchin, Milcare, AZ [M]

William C. McPeck, State of Maine Employee Health & Safety, ME [E]

Thom A. Salamone, Health Care and Life Safety Concepts, NY [I]

Rep. Kemper Insurance Companies

W. Thomas Schipper, Kaiser Foundation Hospitals, CA [U]


Michael L. Siniscalchi, Windsor Locks Fire Department, CT [E]

Gregory E. Siple, Loss Prevention Services, Inc., CA [SE]

Robert J. Stone, Acordia of Cincinnati, Inc., OH [I]

Clevis T. Svetlik, New Paltz Nursing Home, NY [U]

Rep. NFPA Health Care Section

Ronald W. Woodfin, TetraTek, Inc., TX [SE]

Alternates

A. Richard Fasano, Russell Phillips & Associates Inc., CA [SE]

(Alt. to R. Phillips)

Susan B. McLaughlin, SBE Consulting Limited, IL [U]

(Alt. to W. T. Schipper)

Richard C. Ryan, TetraTek, Inc., TN [SE]

(Alt. to R. W. Woodfin)

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the performance, maintenance and testing of patient-related gas equipment for the purpose of safeguarding patients and staff within health care facilities.

Technical Committee on Hyperbaric and Hypobaric Facilities (HEA-HYP) (Chapter 19 and NFPA 99B)

Wilbur T. Workman, Chair
Workman Hyperbaric Services, Inc., TX [SE]

Peter Atkinson, Hyperbaric Technical & Nurses Associates Inc., Australia [U]

Harold D. Beeson, NASA Johnson Space Center, NM [RT]

Dave DeAngelis, U.S. Navy - Naval Facilities ESCECD, VA [E]

William H. L. Dornette, Kensington, MD [SE]

Christy Foreman, U.S. Department of Health & Human Service, MD [E]

William C. Gearhart, University of Pennsylvania, PA [U]

W. T. Gurnee, Oxy Heal Group, CA. [M]

Robert W. Hamilton, Hamilton Research Limited, NY [M]

Eric P. Kindwall, Medical College of Wisconsin, WI [U]

Carolyn Land, Curative Health Services, AZ [U]

Rep. Baromedical Nurses Association

Michael D. Martin, Ford Motor Company, MI [U]

Barry Newton, Wandall Hull & Associates, NM [SE]

Stephen D. Reimers, Reimers Systems Inc., VA [M]

Thomas A. Salamone, Health Care and Life Safety Concepts, NY [I]

Rep. Kemper Insurance Companies

Robert F. Schumacher, Nth Systems Inc., NC, [M]

J. Ronald Sechrist, Gechrist Industries, CA [M]

Paul J. Sheffield, International ATMO, Inc., TX [U]

John Steven Wood, Hyperbaric Oxygen, Inc., TX [SE]

Alternates

Greg Godfrey, Sechrist Industries, Inc., CA [M]

(Alt. to J. R. Sechrist)

Robert B. Sheffield, Wound Care Group, TX [U]

(Alt. to P. J. Sheffield)

Ellen C. Smithline, Baystate Medical Center, MA [C]

(Alt. to C. Land)

Joanna H. Weitershausen, U.S. Department of Health & Human Services, MD [E]

(Alt. to C. Foreman)

Harry T. Whelan, Medical College of Wisconsin, WI [U]

(Alt. to E. P. Kindwall)

Larry L. Wischhofer, Reimers Systems Inc., WA [M]

(Alt. to S. D. Reimers)

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the construction, installation, testing, performance and maintenance of hyperbaric and hypobaric facilities for safeguarding staff and occupants of chambers.

Technical Committee on Laboratories (HEA-LAB) (Chapters 2, 10, and 13)

Susan B. McLaughlin, Chair
SBE Consulting, Limited, IL [U]


James F. Barth, FIREPRO, Inc., MA [SE]

John Francis Capron, III, The Cleveland Clinic Foundation, OH [U]

Ulrich M. Lindner, Earl Walls Associates, CA [SE]

John P. McCabe, National Institutes of Health, MD [E]

Thomas A. Salamone, Health Care and Life Safety Concepts, NY [I]

Rep. Kemper Insurance Companies

Josephine Simmons, U.S. The Health Care Financing Administration, MD [E]

James O. Wear, U.S. Department of Veterans Admin. Medical Center, AR [U]

Rep. NFPA Health Care Section

Alternates

Carol Jacobson, Ohio State Univ. Medical Center, OH [U]

(Alt. to S. B. McLaughlin)

Judith A. Yost, U.S. Department of Health and Human Services, MD [E]

(Alt. to J. Simmons)

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the construction, installation, testing, performance and maintenance of hyperbaric and hypobaric facilities for safeguarding staff and occupants of chambers.
Technical Committee on Piping Systems (HEA-PIP)

(Chapter 2 [definitions] and Chapter 4)

Douglas S. Erickson, Chair
American Society for Healthcare Engr

Mark W. Allen, Beacon Medical, NC [M]
M. Lee Bancroft, Beth Israel Deaconess Medical Center, MA [U]
David L. Brittain, PROVAC, OH [M]
Sidney L. Cavanaugh, United Association of Journeymen/Apprentices of Plumbing/Pipe Fitters, CA, [L]
James S. Davidson, Jr., Davidson Associates, DE [SE]
Sharon Day, Pittsboro, NC [SE]
Peter Esherick, Patient Instrumentation Corporation, PA [RT]
P. L. Fan, American Dental Association, IL [U]
Michael Frankel, P. L. Fan,

Rep. Compressed Gas Association

David Eric Lees, Georgetown University Medical Ctr., DC [C]

Richard L. Miller, Medical Gas Technology Inc., SC [RT]

David B. Mohile, Medical Engr Services, Inc., VA [RT]

Thomas J. Mraulak, Metropolitan Detroit Plumbing Ind. Training Ctr., MI [L]

Fred C. Quarnstrom, Seattle, WA [U]

Ron Ridenaun, National ITC Corporation, CA [L]

E. Daniel Shoemaker, MDS Matrix, AZ [M]

Ronald M. Smidt, Carolinas HealthCare System, NC [U]

Edward R. Stevenson, LMC Property Engineers, MA [I]

J. Richard Wagner, Poole & Kent Company, MD [IM]

Craig B. Williams, Hill-Rom, IL [M]

Alternates

Dale J. Dumbleton, National ITC Corporation, LA [L]

David D. Eastman, Metro Detroit Plumbing Industry Training Center, MI [L]

David Esherick, Patient Instrumentation Corporation, PA [RT]

Robert A. Ferdig, Nellcor/Puritan-Bennett Corporation, KS [M]

Christopher R. Gossett, Squire-Cogswell Company, IL [M]

Michael J. Lynam, Porter Instrument Company, Inc., PA [M]

James A. Meyer, Petts Memorial VA Hospital, CA [C]

Sharon Stanford, American Dental Association, IL [U]

Christopher P. Swayze, The Sherman Engineering Company, PA [M]

Dale Woodin, American Society for Healthcare Engineering, IL [U]

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the performance, maintenance, installation, and testing of medical and dental related gas piping systems and medical and dental related vacuum piping systems.

Staff Liaison: Craig H. Kampmier

These lists represent the membership at the time each Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the front of this book.

The Report of the Committee on Health Care Facilities is presenting two Reports for adoption, as follows:

The Reports were prepared by the:

- Technical Correlating Committee on Health Care Facilities (HEA-ACC)
- Technical Committee on Administration (HEA-ADM)
- Technical Committee on Electrical Equipment (HEA-ELE)
- Technical Committee on Electrical Systems (HEA-ELS)
- Technical Committee on Gas Delivery Equipment (HEA-GAS)
- Technical Committee on Health Care Emergency Preparedness and Disaster Planning (HEA-HCE)
- Technical Committee on Hyperbaric and Hypobaric Facilities (HEA-HYP)
- Technical Committee on Laboratories (HEA-LAB)
- Technical Committee on Piping Systems (HEA-PIP)


This Report has been submitted to letter ballot of the individual Technical Committees. The results of the balloting, after circulation of any negative votes, can be found in the report.

This Report has also been submitted to letter ballot of the Technical Correlating Committee on Health Care Facilities, which consists of 10 voting members; of whom 9 voted affirmatively and 1 ballot was not returned (Crowley).


This Report on Comments has been submitted to letter ballot of the Technical Committee on Hyperbaric and Hypobaric Facilities, which consists of 10 voting members; of whom 9 voted affirmatively, and 2 ballots were not returned (Crowley, Gardner).
NFPA 99 technical committees are involved in the review. A correlating committee task group will provide a preliminary report to the Correlating Committee in Fall 2002.

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 999

RECOMMENDATION: Add after first sentence, a new sentence: This scope also applies to veterinary facilities.

SUBSTANTIATION: We must also guard the health care personnel who are giving care to animals. In NFPA 99 12-4.1.1.1 and in TCC scope of HEA-AC they refer to safe guarding health care personnel from "...fire... and related hazards associated with the administration of inhalation anesthetics."

COMMITTEE ACTION: Accept in Principle.

Add text to read as follows:

1.1.1. This scope also applies to veterinary facilities, for the protection of staff from hazards associated with piped gas and vacuum systems.

COMMITTEE STATEMENT: The Committee sees the need for a minimum level of safety for veterinary facility staff working with piped gas and vacuum systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

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NFPA 99 technical committees are involved in the review. A correlating committee task group will provide a preliminary report to the Correlating Committee in Fall 2002.

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 999

RECOMMENDATION: Add after first sentence, a new sentence: This scope also applies to veterinary facilities.

SUBSTANTIATION: We must also guard the health care personnel who are giving care to animals. In NFPA 99 12-4.1.1.1 and in TCC scope of HEA-AC they refer to safe guarding health care personnel from "...fire... and related hazards associated with the administration of inhalation anesthetics."

COMMITTEE ACTION: Accept in Principle.

Add text to read as follows:

1.1.1. This scope also applies to veterinary facilities, for the protection of staff from hazards associated with piped gas and vacuum systems.

COMMITTEE STATEMENT: The Committee sees the need for a minimum level of safety for veterinary facility staff working with piped gas and vacuum systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson
99-6 - (1-1.4.1(c)): Reject
TCC NOTE: See Technical Correlating Committee Note on Comment 99-5 (Log #2).
SUBMITTER: Burton R. Klein, Burton Klein Associates
COMMENT ON PROPOSAL NO: 999
RECOMMENDATION: Revise (c) to read: "Requirements for fire protection signaling systems.
COMMITTEE ACTION: Reject.
SUBSTANTIATION: Section 1.1.4.1 is titled ‘Areas not covered.’ wording includes requirements.
COMMITTEE STATEMENT: Submitter was not specific on where the paragraph should be located pursuant to NFPA Regulations Governing Committee Projects, Section 4-4.5.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 4
NOT RETURNED: 1 Davidson

99-7 - (1-1.5): Accept
TCC NOTE: See Technical Correlating Committee Note on Comment 99-9 (Log #92).
SUBMITTER: Technical Committee on Administration
COMMENT ON PROPOSAL NO: 999
RECOMMENDATION: Add the following paragraph to 1.1.5:
COMMITTEE ACTION: Accept.
SUBSTANTIATION: move sentence "Although it deals with... materials." to Appendix A or Annex A in new format.
COMMITTEE STATEMENT: Proposal 99-22 did not propose any language, therefore the only option available to the Technical Committee was to reject. Section 4-3.5.1 last sentence gives direction on how to process the proposals with missing information or no recommendation.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-8 - (1-1.11.1(c)): Accept
SUBMITTER: Burton R. Klein, Burton Klein Associates
COMMENT ON PROPOSAL NO: 999
RECOMMENDATION: Move sentence "Although it deals with... materials." to Appendix A or Annex A in new format.
COMMITTEE ACTION: Accept.
COMMITTEE STATEMENT: The term is considered for its application in an oxygen enriched atmosphere [OEA], and not for its mobility or response inhibiting characteristics.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 4
NOT RETURNED: 1 Davidson
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99-12 - (2-2): Reject
SUBMITTER: Peter Esherick, Patient Instrumentation Corp.
COMMENT ON PROPOSAL NO: 99-16
RECOMMENDATION: Accept the proposal as written.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The scope of this committee pertains to gas delivery equipment, and therefore inhalation agents. Focusing on other agents would be a significant change in scope.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 10
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
ABSTENTION: 1
NOT RETURNED: 1 Crowley
EXPLANATION OF ABSTENTION:
BRANCROFT: Have not been able to follow committee process secondary to extensive hospitalization.

99-15 - (2-2): Accept
SUBMITTER: Corky J. Bishop, Medical Gas Management, Inc.
COMMENT ON PROPOSAL NO: 99-29
RECOMMENDATION: Revise text to read as follows: "Patient Care Area (b) Critical Care Areas. Critical care areas are those special care units, intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, postanesthesia recovery rooms, emergency departments, and similar areas in which patients are intended to be subjected to invasive procedures and connected to line-operated, patient-care-related electrical appliances."
SUBSTANTIATION: Postanesthesia recovery rooms and emergency rooms were added in the 1999 edition. The Technical Correlating Committee has directed the term emergency department be used.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-16 - (2-2): Reject
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-22
RECOMMENDATION: The Technical Correlating Committee directs that the committee action be changed to Accept In Principle pursuant to the action on 99-20 (Log #CP710).
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: Proposal 99-22 did not propose any language, therefore the only option available to the Technical Committee was to reject. Section 4:3.5.1, last sentence gives direction on how to process the proposals with missing information or no recommendation.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-14 - (2-2): Accept
SUBMITTER: Peter Esherick, Patient Instrumentation Corp.
COMMENT ON PROPOSAL NO: 99-24
RECOMMENDATION: Modify text as follows:
<5 mg/m³ at normal atmospheric pressure of particulate at 1 micron size or greater.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
EXPLANATION OF NEGATIVE:
DAVIDSON: Increasing the allowable level of particulate matter in a drug delivery system in order to make the particulate test easy for the system verifier is the wrong reason to change the standard. The present standard allows an almost zero level of particulate matter. This is a safe level especially when compared to the FDA's 1978 Good Manufacturing Practices Regulations (cGMP) and 1996 Quality System Regulations for drug delivery systems, and Federal Regulations 21 CFR 210 & 211 and 21 CFR 820 which allows for no contamination of the drug product in the drug delivery system. The NFPA should not be specifying particulate contamination levels for drug delivery systems, especially if the only reason is to make the test easy for the verifier.

99-17 - (2-2): Accept
SUBMITTER: Technical Committee on Administration
COMMENT ON PROPOSAL NO: 99-14
RECOMMENDATION: Revise text to read as follows:
Health Care Facilities. Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory health care centers, whether permanent or movable. (ADM)
SUBSTANTIATION: Editorial parallelism.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 4
NOT RETURNED: 1 Davidson
For the purpose... Delete Note per Manual

A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of patients that (1) provides, on an outpatient basis, treatment for four or more inpatients.

Free Standing Birthing Center. A facility in which low-risk births are expected following normal, uncomplicated pregnancies, and in which professional midwifery care is provided to women during pregnancy, birth, and postpartum.

Hospital Facilities used to provide services or treatment simultaneously to four or more patients that (1) provides, on an outpatient basis, treatment for emergency rooms of departments... to be consistent with current nomenclature.

For the purpose... Delete Note per Manual

Paragraph 3: "Note: For the purpose..." Delete Note per Manual of Style.

The Technical Correlating Committee refers paragraph 2 to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

The Technical Correlating Committee refers paragraph 3 to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee that the Technical Committee review two definitions for stylistic continuity or parallelism. In the first paragraph, "Hospital Facility" delete "facility." In the second paragraph, "Ambulatory Health Care", insert the word "Center" after "Ambulatory Health Care."

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

REVISE TEXT TO READ AS FOLLOWS:

Ambulatory Health Care Center. A building or portion thereof used to provide services or treatment simultaneously to four or more patients that (1) provides, on an outpatient basis, treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; or (2) provides, on an outpatient basis, anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others. Free Standing Birthing Center. A facility in which low-risk births are expected following normal, uncomplicated pregnancies, and in which professional midwifery care is provided to women during pregnancy, birth, and postpartum.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Administration for review and comment.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: See Committee Action on Proposal 99-23 (Chapter 3).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NOT RETURNED: 1 Davidson

The Technical Correlating Committee refers this proposal to the Technical Committee on Electrical Equipment for review and comment.

SUBSTANTIATION: Revise definitions pursuant to MOS requirements for clarity and format.

Appliances: Utilization equipment, generally other than industrial, normally built in standardized sizes or types that is installed or connected as a unit to perform one or more functions, such as clothes washing, air conditioning, food mixing, deep freezing, etc.
Critical Care Area: STET.

Direct Electrical Pathway to the Heart.* An externalized conductive pathway, insulated except at its ends, one end of which is in direct contact with heart muscle while the other is in body and is accessible for inadvertent or intentional contact with grounded objects or energized, ground-referenced sources. (EE)

Physiologically there is more than one heart muscle, and this accurately reflects the intent and meaning desired by the TCC.

Double-Insulated Appliances, Appliances having an insulation system comprising both basic insulation necessary for the functioning of the appliance and for basic protection against electric shock and supplemental insulation. The supplemental insulation is independent insulation provided in addition to the basic insulation to ensure protection against electric shock in case of failure of the basic insulation. (EE)

Revise to read as follows:

Double-Insulated Appliances.* Appliances where the primary means of protection against electrical shock is not grounding. The primary means is by the use of combinations of insulation and separation spacings in accordance with an approved standard. Any Double-insulated and appliances can be identified by a symbol consisting of a square within a square or wording such as "double-insulated" marked on the appliance. Appliance packaging and documents may also provide identification. Although double-insulated appliances do not require a third wire or pin, some double-insulated appliances have a third conductor or pin solely for purposes of electromagnetic compatibility (EMC).

Electrode. An electrically conductive connection to a patient.

Some electrodes of interest are: (EE)

- Active Electrode. An electrode intended to generate a surgical or physiological effect at its point of application to the patient. (EE)
- Bipolar Electrode. An electrode consisting of adjacent contacts (e.g., the two legs of a forceps) such that the current passes between the pair of contacts generating the surgical intended effect. (EE)
- Dispersive Electrode. An electrode intended to complete the electrical path between patient and appliance and at which no surgical effect is intended. It is often called the "indifferent electrode," the "return electrode," the "patient plate," or the "neutral electrode." (EE)
- Change as follows:
  - Dispersive Electrode. An electrode, intended to complete the electrical path between patient and appliance and at which no surgical effect is intended. This electrode is often called the "the grounding electrode," "indifference electrode," the "return electrode," the "patient plate," or the "neutral electrode."
- Equipment Grounding Bus. A grounding terminal bus in the feeder circuit of the branch circuit distribution panel that serves a particular area. (EE)
- Exposed Conductive Surfaces. Those surfaces that are capable of carrying electric current and that are unprotected, uninsulated, unenclosed, or unguarded, permitting personal contact. (EE)
- Failure.* An incident that increases the hazard to personnel or to other accessible parts of an appliance. (EE)
- Leakage Current. Any current, including capacitive coupled current, not intended to be applied to a patient, that is conveyed from exposed metal parts of an appliance to ground or to other accessible parts of an appliance, (EE)
- Patient Area. Any portion of a health care facility wherein patients are intended to be examined or treated.

(a)* General Care Areas.

- Patient bedrooms, examining rooms, treatment rooms, clinics, and similar areas in which it is intended that the patient will come in contact with ordinary appliances such as a nurse-call system, electric beds, examining lamps, telephones, and entertainment devices.

(b)* Critical Care Areas.

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Critical care areas are Those special care units in which patients are intended to be subjected to invasive procedures and connected to line-operated, patient-care-related electrical appliances. Accept deletion of hyphens.

Move this to Annex A:

Examples of critical care areas include intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, postanesthesia recovery rooms, and emergency rooms. (EE)

Patient Care Related Electrical Appliance. An electrical appliance that is intended to be used for diagnostic, therapeutic, or monitoring purposes in a patient care vicinity. (EE) Accept delete hyphens.

Patient Vicinity. A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the bed, chair, table, treadmill, or other device that supports the patient during examination and treatment. A patient care vicinity extends vertically to 2.3 m (7 ft 6 in.) above the floor. (EE)

Patient Procedure Room. A jack or terminal that serves as the collection point for redundant grounding of electric appliances serving a patient care vicinity or for grounding other items in order to eliminate electromagnetic interference problems. (EE)

Patient Lead.* Any deliberate electrical connection that can carry current between an appliance and a patient. It is not intended to include adventitious or casual contacts such as a plug button, bed sururface, lamp, hand-held appliance, etc. and so forth. Some examples include a grounding plug, a grounding plug cap, a grounding plug cap receptacle, a patient ground plate, or a patient ground pin used for purposes of electro-magnetic compatibility (EMC).

Plug (Attachment Plug, Cap). A device that, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle. (EE)

Reactance. The component of impedance contributed by inductance or capacitance. The unit of reactance is the ohm. (EE)

Reference Grounding Point. A terminal bus that is the equipment grounding bus, or an extension of the equipment grounding bus, and is a convenient collection point for installed grounding wires or other bonding wires where used. (EE)

STET (Surgical Effect at the Tissue). The surgical effect at its point of application to the patient. (EE)

STET (Surgical Effect at the Tissue). The surgical effect at its point of application to the patient. (EE)

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means with light to see, i.e. the removal of a corn and not the retraction of an instrument from a body cavity.)

**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept in Part.

Revise "...shall be provided in each operating room anesthetizing location and procedure room." to read as follows: "...shall be provided in each anesthetizing location."

**COMMITTEE STATEMENT:** The term procedure room is too broad and will potentially include rooms that are not intended to have any patient lights.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 17

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 11

NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickley, Vernon

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**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 10

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 7

NEGATIVE: 1

ABSTENTION: 1

NOT RETURNED: 1 Crowley

**EXPLANATION OF NEGATIVE:**

DAVID: "Proceduralist" is not a familiar term for health care workers. "A person conducting the procedure" is familiar.

**EXPLANATION OF ABSTENTION:**

BRANCROFT: Have not been able to follow committee process secondary to extensive hospitalization.

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**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 10

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 8

NOT RETURNED: 2 Carlson, Willey
COMMITTEE ACTION:

Note: Supporting Material is available for review at NFPA panel could extract the pertinent requirements of UL-1436, and As an alternative, and similar to other areas within NFPA 99, the periodic calibration is taken care of by the requirements of the standard.

Simply, by requiring a listed tension tester, the accuracy as well as the reasoning that required the listed devices mentioned above. Therefore, changing NFPA 99 to require a listed tester to be used when making the tension measurement will be in agreement with the requirement that the listed devices mentioned above. That is, there is nothing prohibiting requiring a listed product. Simply by requiring a listed tension tester, the accuracy as well as the periodic calibration is taken care of by the requirements of the standard.

As an alternative, and similar to other areas within NFPA 99, the panel could extract the pertinent requirements of UL-1436, and simply require the instrument used to make the measurement, exhibit those characteristics. Note: Supporting Material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Due to the variability caused by the position of the receptacles to be tested and the operator of the test device, the committee can find no advantage which would assure that accurate and repeatable measurements are made by using a listed test device. There is no substantiation that existing methods of compliance are any less accurate. There is no substantiation that a need exists for listed test devices; hence the committee is considering eliminating the testing requirement for the next cycle of this document.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 10
NEGATIVE: 7
NOT RETURNED: 0

EXPLANATION OF NEGATIVE:

MURNANE: This is response to Comments 99-29 (Log #1) and 99-30 (Log #115) which address the same issue (i.e. receptacle ground tension requirement, Proposal 99-41). Proposal 99-41 should be accepted.

As long as there is a requirement in NFPA 99 to perform a test there is a presumption that there is a need for such test. The users of NFPA 99 read that they need to perform this test and, if acceptable, continue to rely on the integrity of the receptacle grounding connection. The most reliable test equipment available should be used in view of the consequences of not having an adequate ground. When the test requirement was put into NFPA 99 the Standard UL1436 did not exist nor did test equipment such as the Leviton unit. All meeting attendees agreed that this tester was preferable to the spring based one that was present for comparison purposes which was considered representative of these types. It was also agreed that accurate and repeatable measurements were desirable. The objection raised was that measurements would vary if the tester probe was removed at different angles. While this is true it is the same as any incorrect use of a piece of test equipment. That is any test equipment needs to be used properly to reduce the risk of incorrect and/or variable results. The listed testers come with directions for use which, if followed, would reduce these risks. Also these units can be calibrated and records kept. Although the committee is considering eliminating the testing requirement, for the time being there is still a test requirement that users of the standard will rely upon as the means to determine receptacle grounding reliability.
(Log #139) Committee: HEA-ELS

99-32 - (3-4.1.1.1(i)): Accept in Part

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION ON PROPOSAL NO: 99-44
RECOMMENDATION: The Technical Correlating Committee directs the following revised sentence be inserted under Committee Action:

"... vacuum pumps, pressure maintenance (jockey or make-up) pump(s) for water based fire protection systems, generator fuel pumps, jockey pumps, or other generator accessories." Substantiation: Wording was inadvertently omitted in the committee action on the proposal.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept in Part.

Delete "or make-up" in the Technical Correlating Committee recommendation.

"... vacuum pumps, pressure maintenance (jockey) pump(s) for water based fire protection systems, generator fuel pumps, jockey pumps, or other generator accessories." Substantiation: Wording was inadvertently omitted in the committee action on the proposal.

COMMITTEE STATEMENT: The term "make-up" is redundant and confusing.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 11
NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickley, Vernon

(See Committee Statement on Comment 99-33 (Log #140)).

COMMITTEE ACTION: Accept.

Current 99-47 (Log #118) to read as follows:

(b) Within a hospital building, Section 4.4.2.2.3(i) allows "additional" loads on the critical branch, and Section 4.4.2.2.3(j) allows "other equipment" on the equipment system in order to provide limited flexibility to a facility to add one or two loads not otherwise listed in Sections 4.4.2.2.3(a)-(h), or 4.4.2.2.3.4, or 4.4.2.2.3.5(a)-(i) to a critical branch panel or an equipment system panel. This allowance is to prevent the need for an additional panel to serve a smaller number of selected circuits in a particular area. These sections are not intended to allow large blocks of loads not listed in these sections to be on the Critical Branch or Equipment System. The intent of the Division of the Essential System loads into Systems and Branches is to ensure maximum reliability of service to loads considered essential. Every additional load placed onto a system somewhat increases the probability of a failure on the system that threatens the integrity of service to the balance of loads served by the system. Therefore, while "additional" loads and "other equipment" may be placed onto the critical branch and equipment system in very limited situations, where a facility wants to put large blocks or loads not listed in 4.4.2.2.3(a)-(h), or 4.4.2.2.3.4, or 4.4.2.2.3.5(a)-(i) onto the generating equipment, the facility may do so, but only by designating these large blocks of load as "optional loads" and by complying with Section 4.4.1.1.8.3.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 11
NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickley, Vernon

(See Committee Statement on Comment 99-33 (Log #140)).

COMMITTEE ACTION: Accept.

Current 99-47 (Log #118) to read as follows:

(b) Optional loads shall be permitted to be served by the essential electrical system generating equipment, not permitted in 3-4.2 to be on the essential electrical system. Optional loads shall be served by their own transfer switch(es) such that these loads (1) shall not be transferred onto the generating equipment if the transfer will overload the generating equipment, and (2) shall be shed upon a generating equipment overload. Use of the generating equipment to serve optional loads. It shall not constitute "other purposes" as described in 3-4.1.1.5(a).

Revise Proposal 99-47 (Log #118) to read as follows:

(b) Optional loads shall be permitted to be served by the essential electrical system generating equipment, not permitted in 3-4.2 to be on the essential electrical system. Optional loads shall be served by their own transfer switch(es) means such that these loads (1) shall not be transferred onto the generating equipment if the transfer will overload the generating equipment, and (2) shall be shed upon a generating equipment overload. Use of the generating equipment to serve optional loads. It shall not constitute "other purposes" as described in 4.4.1.1.5(a) and therefore shall not require multiple generator sets.

Add a new Annex A to read as follows:

A 4.4.2.2.8.3 The intent of this section is:

(a) Contiguous or same site non-hospital buildings may be served by the generating equipment. However, such loads must not compromise the integrity of the system serving the hospital. Thus, any such contiguous or same site non-hospital buildings may be served by the generating equipment only if the transfer means operates in accordance with this Section

(See Committee Statement on Comment 99-35 (Log #140)).

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 11
NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickley, Vernon

(See Committee Statement on Comment 99-35 (Log #140)).
99-36 - (3-4.2.2.2(c)(8a)): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-57

RECOMMENDATION: The Technical Correlating Committee directs that this proposal be returned to committee to clarify their action and rationale.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Acceptor.

Proposal 99-57 (Log #305) has been revised as follows:

We have Accepted in Principle 99-57. Committee action under 4-4-2.2.2.3(h) item 1: General care beds shall have at least one duplex receptacle per patient bedroom, and task illumination as required by the governing body of the health care facility.

COMMITTEE STATEMENT: The revised text accomplishes the submittor’s original intent.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 11
NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickleley, Vernon

99-37 - (3-4.2.2.3(e)(c)).: Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-59

RECOMMENDATION: The Technical Correlating Committee directs that this proposal be returned to committee in consideration of Log #203, the Committee Statement for Log #304 needs clarification.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

The committee accepts the direction from the Technical Correlating Committee. The committee reconsidered their action, and retains their action of reject.

COMMITTEE STATEMENT: The committee rejects Proposal 99-59 (Log #304) because the exception for facilities with two services is needed, especially for facilities with electric heat. In addition, 3-3.2.1.1 (referring to two services) still exists, but now appears as 3-4.1.1.1. The erroneous reference was corrected by the Committee’s Action on Proposal 99-61 (Log #CP203).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 11
NOT RETURNED: 6 Carlson, Crawford, Lobnitz, Longhitano, Stickleley, Vernon

99-38 - (Chapter 4): Reject

SUBMITTER: Stinson Batchelor, Batchelor & Kimball Inc.

COMMENT ON PROPOSAL NO: 99-113

RECOMMENDATION: Expand and include data in Appendix C (Relating to Chapter 4) directly into Chapter 4 text. Clearly state recommended delivery quantities of each gas on a per outlet/inlet basis, along with a minimum and maximum recommended pressure at outlets/inlets and in the distribution piping system.

SUBSTANTIATION: Without above proposed information, much of which is now in the appendices, designing piping systems in accordance with ‘currently accepted practices’ has no real reference. At the very minimum the appendices must be maintained in NFPA 99.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-151 (Log #25).

99-39 - (4.1.1): Accept in Principle

TCC NOTE: See Technical Correlating Committee Note on Comment 99-3 (Log #32).

SUBMITTER: David Mohile, Medical Engineering Services, Inc.

COMMENT ON PROPOSAL NO: 99-69

RECOMMENDATION: This proposal was to add veterinary facilities under the scope of HCA-PIP. The rejection by the ADM and TCC continues along long established lines that veterinary facilities are outside the scope of the Health Care Facilities scope.

SUBSTANTIATION: Support in favor of this log comes not only from the verifiers of medical gas systems, but also from the manufacturers of the medical gas equipment used in veterinary facilities. A comment was recently made that no problems have been reported.

Is it going to be necessary to have a death or serious injury reported from improperly installed nonflammable gas systems before action is taken? Can we not be proactive for a change? Many of the changes in NFPA are promulgated to prevent deaths and/or injuries.

If HCA-PIP is not the place for this coverage, would the TCC consider making recommendations up the line to have veterinary facilities covered under portion of NFPA, perhaps outside of Health Care facilities requirements?

COMMITTEE ACTION: Accept in Principle. See the Committee Action on 99-201 (Log #9).

COMMITTEE STATEMENT: This comment should be forwarded to the Technical Committee on Administration and the Technical Correlating Committee.

The Technical Committee on Piping unanimously voted to support the substantiation of Proposal 99-69 and Comment 99-79 (Log #71).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

DAVIDSON: The safety and health of veterinary facility employee is regulated by OSHA and the building, mechanical, plumbing and electrical codes of the jurisdictions the facilities are located in. Additionally the gas flows and vacuum requirements for these facilities are much greater than required for humans, depending on the type of animals and procedures performed at each facility. It is not NFPA’s role to determine the gas flows and vacuum demands, pipe sizing and equipment requirements for these facilities.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The figures were revised and moved to the Annex.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

VOTE ON COMMITTEE ACTION: 99-41 - (4-3.1.1.2): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-77

RECOMMENDATION: The Technical Correlating Committee directs the Committee to review the Committee Statement and recommends revising it to "submitter did not submit text."

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

VOTE ON COMMITTEE ACTION: 99-42 - (4-3.1.1.2(a)11g): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-80

RECOMMENDATION: The Technical Correlating Committee directs the Committee to substantiate the Committee Statement.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

See Substantiation on 99-14 (Log #59).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

VOTE ON COMMITTEE ACTION: 99-44 - (4-3.1.1.2(a)11g): Reject

SUBMITTER: Corky J. Bishop, Medical Gas Management, Inc.

COMMENT ON PROPOSAL NO: 99-80

RECOMMENDATION: Insert the wording: "In outdoor locations, cylinders shall be protected from direct sun and accumulations of ice or snow."

SUBSTANTIATION: This is supported by the existing wording in 4-3.5.2.2(b)/3 for cylinders in storage. Including it here will protect cylinders connected to the manifold as well. This paragraph is located at 4-5.1.1.2(e)1f in the committee response to Proposal 99-71.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The existing guidance (see 4-3.1.1.2(a)6 and 99-48 (Log #17)) to maintain cylinder temperatures above -7°C (20°F) and below 54.4°C (130°F) is considered adequate for the user to determine whether additional protection (e.g. of the nature described in this proposal) is necessary. It is unnecessarily restrictive to require all users, whatever their local climate or circumstance, to protect cylinders in this manner.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: 99-45 - (4-3.1.1.2(a)11): Accept

SUBMITTER: Mark Allen, Beacon Medical Products

COMMENT ON PROPOSAL NO: 99-85

RECOMMENDATION: Reconsider the rejection of this signage.

SUBSTANTIATION: The action taken in Log 148 leaves the labeling of these doors substantially unchanged from current wording. This means that the additional hazard of asphyxiation remains unaddressed. I submit (courtesy of BOC Gases), a safety video which vividly depicts this problem and substantiates the concern.

NOTE: Supporting Material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

VOTE ON COMMITTEE ACTION: 99-46 - (4-3.1.1.2(a)11): Accept

SUBMITTER: David Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-85

RECOMMENDATION: Accept this proposal as written.

SUBSTANTIATION: The submitter raises a valid issue here. I feel as if his proposed wording would make the rooms that contain medical gas supply systems safer for the employees maintaining the system.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

VOTE ON COMMITTEE ACTION: 99-47 - (4-3.1.1.2(a)11): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-85

RECOMMENDATION: The Technical Correlating Committee directs the Committee Action be changed to Accept In Principle. The Committee Statement must provide justification for its actions.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-48 - (4-3.1.1.2(b)) Accept in Principle

SUBMITTER: Dennis Huffman, Western Enterprises

COMMENT ON PROPOSAL NO: 99-48

RECOMMENDATION: Revise text as follows:

4.3.1.2(a)(7). Central supply systems for nitrous oxide and carbon dioxide shall be prevented from reaching temperatures lower than the manufacturer’s recommendations, but should never be lower than \(-7^\circ\text{C}(20^\circ\text{F})\) at \(0^\circ\text{F} \) or greater than \(-18^\circ\text{C}(0^\circ\text{F})\) or \(-25^\circ\text{C}(32^\circ\text{F})\).

SUBSTANTIATION: Carbon dioxide is only at a pressure of 250 psig at \(0^\circ\text{F}\) and nitrous oxide is only at 300 psig at \(0^\circ\text{F}\). These pressures may be inadequate to ensure proper manifold function. The specification should limit the temperature, to the values set by the manufacturer. Since each system is different, the manufacturer’s limits should supersede the limits listed in this specification. By changing the temperature limit to \(-7^\circ\text{C}(20^\circ\text{F})\) the \(\text{CO}_2\) cylinder pressure will be about 420 psig and \(\text{N}_2\text{O}\) will be about 400 psig. This temperature limit allows the cylinder pressure to be about half of what it is at \(70^\circ\text{F}\), which should allow sufficient pressure to the various manifold systems.

The vaporization rate of the cylinders is reduced as the ambient temperature drops, thereby reducing the available flow out each cylinder. To help limit the effects of the drop in available flow, the temperature limit on carbon dioxide and nitrous oxide should be about \(-5^\circ\text{C}(23^\circ\text{F})\).

Note: Supporting material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept in Principle.

REVISE TO READ AS FOLLOWS:

4.3.1.2(a)(7). Central supply systems for nitrous oxide and carbon dioxide shall be prevented from reaching temperatures lower than the manifold manufacturer’s recommendations, but shall never be lower than \(-7^\circ\text{C}(20^\circ\text{F})\) \(-25^\circ\text{C}(32^\circ\text{F})\) or greater than \(-18^\circ\text{C}(0^\circ\text{F})\) or \(-25^\circ\text{C}(32^\circ\text{F})\).

COMMITTEE STATEMENT: The word manifold was added to distinguish between the manifold, cylinder, or gas manufacturer.

The \(54^\circ\text{C}\) was added to ensure the central supply system did not exceed temperatures already mandated by the standard.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-49 - (4-3.1.1.2(b)): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-49

RECOMMENDATION: The Technical Correlating Committee directs the Committee to review the Committee Statement for rejection. The Committee’s rationale should be more specific regarding the requirements of NFPA 50.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

Proposal 99-90 will be referred to the Technical Committee responsible for NFPA 50. 20,000 t\(^3\) s is from Section 1-3, Definitions, of NFPA 50.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-50 - (4-3.1.1.3 (New)): Hold

SUBMITTER: Robert Sutter, BOC Gases

COMMENT ON PROPOSAL NO: 99-71

RECOMMENDATION: New text to read as follows:

Vaporizers. Vaporizers which are provided to convert cryogenic liquid to the gaseous state shall be ambient heat transfer units so that the flow from the vaporizer is unaffected by the loss of power. Exception: Use of powered vaporizers is permitted provided that:

a. Reserve ambient vaporizers are provided and are piped to the source of supply in such a manner as to be unaffected by a freeze up or flow stoppage from the powered vaporizer. The reserve vaporizer shall be capable of vaporizing at least one day’s average supply.

b. Medical gas is available from a non-cryogenic source capable of providing at least one day’s average supply.

SUBSTANTIATION: At the present time there is no requirement for back up vaporization when powered vaporizers such as hot water, steam or electric is being used. A loss of the source heat, water, steam or electric would allow cryogenic fluids to enter medical piping system. This requirement would allow the use of powered vaporizer system while insuring a continuous supply of gaseous product to the medical facility.

COMMITTEE ACTION: Hold.

COMMITTEE STATEMENT: The submitter is adding new material that has not had public review and would need further study. Section 4-4.6.2.2 of the Regulations Governing Committee Projects will allow the committee to hold. This comment will also be submitted to the Technical Committee responsible for NFPA 50 for feedback and to see whether it applies to bulk oxygen sites or not.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-51 - (4-3.1.1.3 (New)): Hold

SUBMITTER: Robert Sutter, BOC Gases

COMMENT ON PROPOSAL NO: 99-71

RECOMMENDATION: New text to read as follows:

Vaporizers. Vaporizers shall be sized to provide adequate capacity under all conditions. Winter temperature extremes, structures that obstruct air circulation and sunlight shall be considered by the agency rating and selecting the vaporizers.

SUBSTANTIATION: At the present time there is no requirement for the proper sizing of vaporizers. An ambient air vaporizer has to be properly sized for the application and environment in which it is being used. Improperly sized vaporizers will accumulate large quantities of low temperature ice, which has lead to equipment damage and equipment failure. Improperly sized vaporizers will also allow low temperature gas to enter the medical gas piping. Vaporizers which have air circulation and sunlight restrictions will not perform as well as the same identical vaporizers that do not have these restrictions.

COMMITTEE ACTION: Hold.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-50 (Log #117).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-52 - (4-3.1.1.3 (New)): Hold

SUBMITTER: Robert Sutter, BOC Gases

COMMENT ON PROPOSAL NO: 99-71

RECOMMENDATION: Add text to read as follows:

Vaporizers. Vaporizers shall be installed in such a manner which permits the switching of units to allow deicing. Switching valves shall:
a. Not be a solenoid if the valve is so located as to stop the flow of gas to the facility.
b. If powered, have the ability to be manually operated.
c. Not stop the flow of gas to the facility during switching.

**SUBSTANTIATION:** Vaporizers that convert cryogenic medical product into gaseous medical product operate in the -250°F to -280°F range. Under these conditions moisture in the air will condense and freeze on the piping. This ice will continue to grow until the outer layer of the ice reaches the dew point. This growth of ice has lead to equipment and pad failures. Due to the continuous use of medical gases at medical facilities a typical vaporizer will never be able to shed all of its ice. The installation of a switching system will allow a vaporizer to shed its ice load.

a. Solenoids should never be installed in a switching system if they can stop the flow of medical gas into the facility. Even fail open solenoids have failed in the closed position and these cannot be detected until the system switches and product fails to flow in to the medical facility.

b. A switching system can be manual or automatic. An automatic system is better for larger medical facilities. When an automatic system is used the timing of the vaporizer system can be set to minimize the growth of mature or hard ice. The best valve for a switching system is a three-way divertor ball valve. These valves have actuators placed on the top which can easily be removed or made to operate in a manual mode.

c. No switching system should be configured so that the flow of medical gas can be stopped. Some common installation designs place globe valves in front and back of vaporizers. In order to switch this type of system a valve must be opened and a valve must be closed. Doing this procedure improperly could lead to the system being shut down.

**COMMITTEE ACTION:** Hold.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-50 (Log #117).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

- **AFFIRMATIVE:** 21
- **NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMENT ON PROPOSAL NO:** 99-71

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

- **AFFIRMATIVE:** 21
- **NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMENT ON PROPOSAL NO:** 99-94

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

- **AFFIRMATIVE:** 21
- **NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker
I would like to propose that the wording for this paragraph be as follows:

"1. It is imperative that the information contained in references, such as those listed below, be taken into account by qualified technical personnel when designing, fabricating, and assembling high-pressure oxygen systems. Manufacturers are involved in evaluating the overall suitability of materials and components for oxygen service. Consultation with the gas supplier or other qualified professionals can be helpful to understand the circumstances that cause oxygen to react with its surroundings.

2. Nonmetallic materials have successfully demonstrated a superior capability of maintaining leak-free systems and, as a result, enhancing safety. However, the use of plastics, elastomers, and lubricants should be avoided, where practicable, or else minimized in high-pressure systems.

3. Where it is not practicable to avoid the use of plastics, elastomers, or lubricants (in high pressure breathing oxygen systems), the following is strongly recommended:
   - Minimize surface area exposed to the gas and make sure the nonmetallic material is well encased by ignition-resisting metal (heat sink) to help dissipate heat generated by adiabatic compression or other phenomenon and to quench, contain, or otherwise avoid burning propagation. Avoid placement of nonmetals in the direct path of the oxygen flow.
   - Minimize heat of compression by design. Avoid rapid pressurization, dead-ended obstructions, and constrictions.
   - Review assemblies where rapid pressurization is possibly in use. Where the behavior of the components under consideration is unproven or not well known, an appropriate adiabatic compression test can be used to evaluate their suitability for such a condition.
   - Avoid the use of materials that can generate particulate by aging or abrasion. The system should be free of thin-walled components, sharp feathered edges, leaks, incompatible materials, and contamination."


I would like to talk briefly about the problems we see with the proposed 4-3.1.1.3(a), as written in the November 2001 NOP. The substantiation states that "a substantial problem has been reported with 1. Flexible cylinder pigtails lined with Teflon." I take issue with the statement "a substantial problem". Our experience does not show this. However, we realize that there are reasons not to use Teflon lined pigtails in oxygen service. However, Log #223, the proposed 99-97 (4-3.1.1.3(d)) states that interior Teflon coated stainless steel braided flexible connectors shall not be used, so this covers the specific number one in 4-3.1.1.3(a).

The substantiation also says "a substantial problem has been reported with 2. Check valves with soft (polymeric) seats at Victor take issue that there has been a "substantial problem" with check valves with polymeric seats. We have not seen this. This is the main provision of this proposed paragraph that we take issue with. As written, the proposed paragraph is stating in reality that polymeric materials cannot be used in high pressure oxygen systems. There are no polymeric materials, to our knowledge, that have a resistance to combustion not lower than Red Brass. Adherence to the proposed paragraph will require cylinder valve manufacturers to remove polymeric materials from cylinder valves, and use metal to metal seats. Regulator manufacturers will have to remove polymeric materials from regulator seats, and attempt to use metal to metal seats. As a regulator manufacturer, I can tell you that we do not believe satisfactory regulator performance can be achieved by using metal to metal seats. We feel that polymeric materials, when used correctly, can be used in high pressure oxygen systems with safety and acceptable performance.

Although we take issue with the statement that "a substantial problem has been reported with aluminum regulators", we have no issue with the third provision of the substantiation, the recommendation that aluminum regulators not be used. We propose, however, that the paragraph would be better served to state that regulators, valves, and other like components should pass applicable industry tests for oxygen compatibility before being used in high pressure oxygen systems.

Victor Equipment Company urges you not to word the new paragraph in such a way that polymeric materials are not allowed in high pressure oxygen systems. Polymeric materials, when used in properly designed systems and components, have been used for years with success in these systems. There are no materials that can replace these materials, and offer the user the advantages the polymeric materials offer. ASTM, CGA, and UL standards and guides all state that polymers can be used in properly designed systems for high pressure oxygen systems. If you leave the proposed paragraph as stated, you will be stating a NFPA position that polymeric materials not be used in high pressure oxygen systems. This will result in an unacceptable requirement for regulator and valve manufacturers.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The information as presented is not in its mandatory language. Also the information can be found in CGA TB-12-1999.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
COMMITTEE ACTION: Accept in Principle.

Revise text as follows:

a. Portions of systems intended to handle oxygen at pressures greater than 2,070 kPa (300 psig) shall contain no polymeric materials be constructed of materials having adequate compatibility with the oxygen under the temperatures and pressures to which the components may be exposed. Components include but are not limited to containers, valves, valve seats, lubricants, fittings and gaskets.

COMMITTEE STATEMENT: Hoses containing polymeric material have exhibited hazards. See Committee Action taken on Comment 99-59 (Log #12).

ASTM STP 1197 has been deleted as a reference as it is not relevant to the current discussion. The action on Comment 99-57 (Log #11) allows the use of polymeric material on certain components. By contrast, hoses are not allowed to use polymeric materials for oxygen systems with pressures exceeding 2070 kPa (300 psig).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
The use of adapters or conversion fittings to adapt pursuant to the intent of the Manual of Style. Accept in Principle pursuant to NFPA Regulations Governing:

99-103

COMMENT ON PROPOSAL NO: 99-99
RECOMMENDATION: Accept this proposal as written.
SUBSTANTIATION: It would seem to me that a manufacturer rep. would know where the problems lie with their equipment. Committee should reconsider its action here.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: See Committee Statement on Comment 99-61 (Log #82).
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-62 - (4-3.1.1.5): Reject
SUBMITTER: David Esherick, Patient Instrumentation Corp.
COMMITTEE STATEMENT:

This is a direction from the Technical Committee: HEA-PIP
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-65 - (4-3.1.1.5): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMITTEE STATEMENT:

SUBMITTER: Dennis Huffman, Western Enterprises
COMMITTEE STATEMENT:

Number of Committee Members Eligible to Vote: 24
Vote on Committee Action:
Affirmative: 21
Not Returned: 3 Bancroft, Lynam, Shoemaker

99-64 - (4-3.1.1.6, 4-3.1.1.5 (b) 3):
TCC NOTE: The Technical Committee’s action is changed to Accept in Principle pursuant to NFPA Regulations Governing Committee Projects 4-4.7.1, and deletes the word “approximately” as found in the revised text, and inserts the word “nominal”, pursuant to the intent of the Manual of Style.
SUBMITTER: Dennis Huffman, Western Enterprises
COMMITTEE STATEMENT:

RECOMMENDATION: Revise text as follows:
A pressure relief valve shall be provided after the connection of the reserve header and before the final line pressure regulating assembly. This relief valve shall be set approximately 50 percent above the maximum expected inlet pressure at or below the relief pressure for the cryogenic liquid cylinders.
SUBSTANTIATION: All of the other relief valves required are set to protect downstream equipment. Setting the relief valve at or below the vessel pressure would indicate that it is being used to protect the vessel not the downstream equipment. The relief valve requirements for the vessel are specified per DOT/CGA requirements and should be adequate for medical installations.
There are currently two popular pressure ranges available, vessels with 255 psig relief valves and ones with 350 psig relief valves. The manufacturer of a system may have designed it so that it can be used with both types of cylinders. With this change, designing a system that would allow either type cylinder would not be possible. Furthermore, if someone connected a 350 psig vessel on a 255 psig system, it would pop the relief valve open. We have received some feedback indicating that a facility can’t always guarantee that they will get a specific type (235 psig or 350 psig) of vessel.
The pressure-building regulator is adjustable and each vessel usually is set a little different. If the set pressure of the system relief is below the vessel relief, there is a chance that normal system pressure will open the system relief valve. This also reduces the available pressure range for the economizer circuit. The economizer circuit is supposed to open and allow gas into the system before the relief valve on the vessel opens. Since the economist will have to open at a lower pressure and each pressure building regulator is set differently, it is possible that gas may bleed through the economizer circuit when it shouldn’t.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-99

COMMENT ON PROPOSAL NO: 99-115
RECOMMENDATION: Revise text as follows:
e. A cylinder lead for each cylinder shall be provided with end fittings complying with CGA pamphlet V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, (ANSI B57.1) Such fittings shall be permanently attached to the cylinder lead. The use of adapters or conversion fittings to adapt one gas specific fitting to another is prohibited.
SUBSTANTIATION: Making the end connections permanent does not protect against tampering. If someone is willing to demand a cylinder lead to change the gas fittings, they are certainly able to create and replace an existing lead with one that has the incorrect fittings permanently attached. The specification requires that the leads be gas specific at both ends and precludes the use of adapters. Nothing else is required.
If someone tampers with a lead, they are already violating the specification requirements. In order to provide the safety that the proposal desires, every component in the piping system will have to be made with permanent connections. It isn’t practical to make every joint in the entire system permanent. The original proposal also limits the type of products that can be used, without providing any quantifiable increase in safety.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: Cylinder lead ends shall be permanently installed to prevent possible conversion in the field.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-61 - (Log #82)
COMMITTEE STATEMENT:

SUBMITTER: Dennis Huffman, Western Enterprises
COMMITTEE STATEMENT:

COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-66 - (4-3.1.1.8(c), 4-3.1.1.3 (a)3.a): Accept
SUBMITTER: Dennis Huffman, Western Enterprises
COMMITTEE STATEMENT:

RECOMMENDATION: Revise text as follows:
4-3.1.1.3 (a)3.a. be provided with duplex final line regulators, installed in parallel with isolation valves before each regulator and an isolation valve or check valve after each regulator permitting service to either regulator without interruption of supply (ADJUST FIGURES). Each sleeve should be provided with a pressure gauge. A pressure gauge or indicator shall monitor the duplex final line regulator pressure. The gauge(s) or indicator(s) may either be located after each regulator, or be located immediately downstream of the isolation valves or check valves isolating the duplex line regulators.
SUBSTANTIATION: Proposal 99-119 was to require gauges in areas that may require adjustment. The committee’s change was to add a gauge after each duplex line regulator. In order to properly set a regulator you need to be able to create a flow of gas. This means that the regulator being adjusted needs to be the service regulator when it is being set. Therefore, the gauge on the backup regulator provides little or no benefit and should be made optional at most.
The specification should also permit the usage of digital displays (indicators) in place of gauges. The objective is to provide information on the pressure in the headers; therefore, the specification should permit all acceptable technologies.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
99-70 - (Figure 4-3.1.1.9): Reject
SUBMITTER: Peter Esherick, Patient Instrumentation Corp.
COMMENT ON PROPOSAL NO: 99-127
RECOMMENDATION: Accept proposal as written.
SUBSTANTIATION: Refer to Committee Statement: "The continuous monitoring of CO is necessary for patient safety." If in over 16 years of testing many medical air systems we have never found more than 1 or 2 ppm of CO where as USP limits are 10 ppm-where is the problem of patient safety?
CO monitors are expensive, must be calibrated regularly and require alarms that incur an extra cost to test.

99-71 - (Figure 4-3.1.1.9): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-126
RECOMMENDATION: The Technical Correlating Committee directs this proposal be returned to Committee.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-69 - (Log #31)
COMMITTEE: HEA-PIP

99-72 - (Figure 4-3.1.1.9, 4.3.1.1.9 (ii)): Reject
SUBMITTER: Mark Allen, Beacon Medical Products
COMMENT ON PROPOSAL NO: 99-127, 99-138, 99-139
RECOMMENDATION: Delete the requirement for continuous CO monitoring and move to an annual test.
SUBSTANTIATION: Carbon Monoxide Monitoring is problematic in several respects:
1. The level being monitored is that set by USP (10 ppm). There is no available research which indicates this is a particular health hazard, or to express it more bluntly that there is risk to patients at 11 ppm which does not exist at 10 ppm. Home monitors for CO,

99-67 - (4-3.1.1.8(e), 4-3.1.1.6 (c) 4-3.1.1.3 (a)6.g.ii): Accept in Principle
SUBMITTER: Dennis Huffman, Western Enterprises
COMMENT ON PROPOSAL NO: 99-119
RECOMMENDATION: Revise text as follows:
  e. ii. A pressure regulator to reduce the pressure to an intermediate pressure under 300 psig. A gauge in this area is optional, and an intermediate gauge.
SUBSTANTIATION: While I can appreciate the desire to make this gauge mandatory, it may cause more harm than good. If a gauge is located in this area it is more likely that inexperienced personnel may tamper/modify factory settings. Since pressure in this area may change during normal operation, an unknowledgeable user may misinterpret the information and adjust settings when the manifold is actually working properly. Furthermore, a qualified repair/maintenance person will have the equipment to service the system, including a test gauge assembly.
COMMITTEE ACTION: Accept in Principle.

99-68 - (4-3.1.1.8(e), figure 4-3.1.1.5, 4-3.1.3(a)6.e): Accept in Principle
SUBMITTER: Dennis Huffman, Western Enterprises
COMMENT ON PROPOSAL NO: 99-119
RECOMMENDATION: Revise text as follows:
  e. a pressure gauge or display indicating header contents.
SUBSTANTIATION: The specification should permit the usage of digital displays (indicators) in place of gauges. The objective is to provide information on the pressure in the headers; therefore, the specification should permit all acceptable technologies.
COMMITTEE ACTION: Accept in Principle.

99-69 - (4-3.1.1.9): Reject
SUBMITTER: David Esherick, Patient Instrumentation Corp.
COMMENT ON PROPOSAL NO: 99-127
RECOMMENDATION: Accept this proposal as written.
SUBSTANTIATION: Why are we mandating a technology with frequent maintenance requirements? What are the benefits if any of this technology? Why are we looking for something which isn't there.
COMMITTEE ACTION: Reject,
COMMITTEE STATEMENT: CO is a known contaminant with severe, acute effects that could harm patient health and could be drawn into the medical air inlet and should be monitored continuously.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
NEGATIVE: 20
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
EXPLANATION OF NEGATIVE: ERICKSON: I agree with the submitters of these comments that the issue of CO has not been proven to be a prominent health hazard at the levels we specify in our documents. As a result of Mark Allen’s comment the TC went even further and is now specifying the CO monitors be tested and calibrated annually or as required by the manufacturer (CC10). The TC Comment on Log #31 is inadequate to justify the need for this test, test equipment and the continued monitoring for CO. It appears as if the submitters did a better job of justifying why not to continuously monitor for CO than the TC did in justifying the existing requirement.

99-70 - (4-3.1.1.9): Reject
SUBMITTER: Peter Esherick, Patient Instrumentation Corp.
COMMENT ON PROPOSAL NO: 99-127
RECOMMENDATION: Accept proposal as written.
SUBSTANTIATION: Refer to Committee Statement: "The continuous monitoring of CO is necessary for patient safety." If in over 16 years of testing many medical air systems we have never found more than 1 or 2 ppm of CO where as USP limits are 10 ppm-where is the problem of patient safety? CO monitors are expensive, must be calibrated regularly and require alarms that incur an extra cost to test.
clearly intended for protection against long term exposure, do not register until above 20 ppm.

2. The original intent of the monitor was:
   A. To determine if the intake was placed in such a location as to ingest large amounts of engine exhaust, etc. The monitor, at least when new, does this well. This has been attested by the readings exhibited in the factory or on a trade show floor when forklifts are operating. However, it is unusual for the monitor to trip over the 10 ppm reading even at such times. There are also undeniably cases where the CO Monitor has detected an incorrect intake location. CO’s efficacy as an indicator gas is undeniable, but the level is highly problematic. EPA reports there are cities where ambient CO levels can exceed 10 ppm for periods of time. For any such sites, the monitor is a simple nuisance and has lost any relevance in detecting a bad air intake location.

B. To provide an early warning in the event of a lubricated compressor burning its oil. This application has become largely irrelevant as these compressors have disappeared from medical air service. Nevertheless, this function can be argued to still have some relevance in oil free style compressors.

3. The normal method of monitoring for CO is sensor know as a "fuel cell", which has an effective life of two years. At the end of this time, the fuel cell must be replaced or the monitor ceases to operate. In addition, all CO monitors require calibration (most at least an annual calibration). Beacon Medical is the largest single supplier of medical air systems in the United States, so it would follow that Beacon should also be a large supplier of replacement sensors and calibration kits. Without revealing confidential data, I would like to point out that in 2000, approximately 2% of Beacon’s eligible customers (i.e., those with monitors over 2 years of age) purchased replacement CO sensors. This would imply that as many as 98% of the monitors installed since 1993 are now inaccurate or inoperative. But ignorance must be bliss, because equally few customers bought calibration kits. I believe other manufacturers would report very similar results.

Testing CO levels is very valid and should continue. It is especially valid at startup, when a bad intake location can be identified and corrected, and it is valid on an occasional basis to ensure conditions have not changed. I do not support nor propose elimination of CO testing, but rather would prefer to see a periodic test substituted for a continuous monitor. This is supported by our experience with these monitors and the consequent conclusion that (1) periodic testing is equally valid, (2) periodic testing is more likely to be done and will give no false reading, and (3) CO level needs to be interpreted. A level above 10 ppm is not alone a sufficient cause for action. The hazard represented by CO level is relative to the ambient conditions, which a simple line monitor does not evaluate.

The monitor may have some additional justification on oil free compressors. Even this is problematic in light of the experience in the field, since if the sensors are not renewed, this function is lost at the same time the compressor is most likely to exhibit the problem. Nevertheless, retaining the CO monitor on oil free compressors may be defensible as an additional, type specific precaution.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-69 (Log #31).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
   NEGATIVE: 1

EXPLANATION OF NEGATIVE: ERICKSON: See my explanation of Negative on Comment 99-69 (Log #31)

AFFIRMATIVE: David Esherick, Patient Instrumentation Corp.
   RECOMMENDATION: Accept in Principle.

COMMITTEE STATEMENT: The modification was made to include all medical equipment dealing with patient respiratory equipment.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
   NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT: Medical air systems upstream of the source valve are not cleaned for oxygen service. Opening the inlet pipe to atmosphere would void the oxygen cleanliness.
COMMITTEE STATEMENT: The existing alarm point is satisfactory for the new requirement as defined in Proposal 99-134 (Log #281) and does not exclude any technology. Existing set points adequately handle the degradation of the dryer. NFPA 99 is a minimum standard and lower set points are acceptable. Daily monitoring of existing system performance adequately handles the degradation of the dryer.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

EXPLANATION OF NEGATIVE: ERICKSON: See my explanation of Negative on Comment 99-69 (Log #31)

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: See Committee Statement on Comment 99-69 (Log #31).
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
NEGATIVE: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:
ERICKSON: See my explanation of Negative on Comment 99-69 (Log #31)

COMMITTEE STATEMENT: The level that is in the standard is 10 ppm. This level is necessary for patient safety.

COMMITTEE STATEMENT: The C.O. monitor shall be tested and calibrated annually or more often if recommended by the manufacturer.

COMMITTEE STATEMENT: This change meets the submitter's intent and coordinates with other portions of the standard.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

EXPLANATION OF NEGATIVE: ERICKSON: See my explanation of Negative on Comment 99-69 (Log #31)

COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: The manufacturer's recommendation requires semiannual testing of the C.O. monitor and replacement of the pod every two years. Less than 2 percent of their customers have such pods. This relates to 98 percent of his customers with a false sense of security with a piece of equipment that NFPA requires to maintain a continuous monitoring.

COMMITTEE STATEMENT: The committee's action has been to reject all three of these logs on the basis that the continued monitoring of carbon monoxide is necessary for patient safety.

COMMITTEE STATEMENT: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 4
NOT RETURNED: 1 Davidson

COMMITTEE ACTION: Reject.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
COMMITTEE STATEMENT:

The Technical Correlating Committee on Health Care Facilities directs the Technical Committee to clarify which items were not accepted by the Technical Committee. The Committee Statement is not explicit, with specific information related to the submitter’s recommendation.

SUBSTANTIATION:

This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION:

Accept.

COMMITTEE STATEMENT:
The Committee deleted the word "Scotchbrite" as this is a proprietary product.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-93 - (4-3.1.2.8(b)(7)): Accept

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-185

RECOMMENDATION: Delete the added text: "Horizontal rerouts from all mains and branches shall be taken off above the centerline of the pipe and the vertical or at an angle of not more than 45° from the horizontal."

SUBSTANTIATION: A. See my explanation of my negative vote.

B. If we clean the medical gas pipelines as now mandated or to the suggested new limits, there will be no foreign matter within the piping systems that could cause an adverse effect on the overall performance of the system’s operation.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The requirement adds enhanced safety and it minimizes the transmission of foreign matter downstream towards the outlets.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-94 - (4-3.1.2.8(b)(7)): Accept in Principle

SUBMITTER: Fritz Koppenberger, Environmental Testing Services Inc.

COMMENT ON PROPOSAL NO: 99-185

RECOMMENDATION: Revise 4-3.1.2.8(b)7 Exception, as follows: Exception: A final connection to an existing pipeline shall be permitted to be made without the use of a nitrogen purge. After final connection, the affected downstream portions of the existing pipeline shall be tested in accordance with 4-3.4.1.3(i) and shall also be tested for particulate matter in accordance with the piping purge test 4-5.4.1.3(e), using the gas of system designation.

SUBSTANTIATION: I support the committee’s decision to accept this proposal in principle. The removal of the test to check gas concentrations downstream of the tie-in is my concern. It would be irresponsible to suggest that we not check gas concentrations downstream after a tie-in, even though it is implied in other areas of the standard. Consider, for example, an existing system where several different piped gases must be rerouted and then tied back into themselves, affecting only the piping. Deleting the text as suggested implies that existing outlets downstream need not be tested for gas concentration, only particulate matter. A cross connection in the system would not be discovered in this case.

COMMITTEE ACTION: Accept in Principle.

Revise to read as follows:

Exception: A final connection to an existing pipeline shall be permitted to be made without the use of a nitrogen purge. After final connection, the affected downstream portions of the existing pipeline shall be tested in accordance with 4-3.4.1.3(i) and shall also be tested for particulate matter in accordance with the piping purge test 4-5.4.1.3(e), using the gas of system designation.

COMMITTEE STATEMENT: The wording includes the appropriate testing for particulates and concentration that appear in Sections 4-3.4.1.3(e) and (f).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-95 - (4-3.1.2.9(i)): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-190

RECOMMENDATION: Revise 4-3.1.2.9(i) Exception, as follows:

Exception: The purity test follows in Paragraph 4-3.4.1.3(i).

Particulate shall be tested by intermittent purging into a clean, white cloth at source gas pressure. Following this test a filter test as described in 4-3.4.1.3(e) shall be performed to verify the cleanliness of the pipeline.

COMMITTEE ACTION: Accept in Principle.

Revise to read as follows:

Exception: The purity test follows in Paragraph 4-3.4.1.3(i).

Particulate shall be tested by intermittent purging into a clean, white cloth at source gas pressure. Following this test a filter test as described in 4-3.4.1.3(e) shall be performed to verify the cleanliness of the pipeline.

COMMITTEE STATEMENT: The wording includes the appropriate testing for particulates and concentration that appear in Sections 4-3.4.1.3(e) and (f).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

200
SUBMITTER: Corky J. Bishop, Medical Gas Management, Inc.

COMMENT ON PROPOSAL NO: 99-190

RECOMMENDATION: Reject this proposal.

SUBSTANTIATION: The submitter is trying to fix a "problem" that is not a problem. In my many years I have learned that "if it ain't broke don't fix it." If the committee accepts this proposal they will be trying to fix something which is not broken.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-95 (Log #45).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

(End of Log #76)

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-191

RECOMMENDATION: Delete the new text.

SUBSTANTIATION: Problem is that we should not be referencing standards just because they are new. NFPA 99 has sufficient requirements for brazer qualification.

I fully agree with the other negatives.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The ASSE 6000 covers all installation requirements, not just brazing. The reference is not to a new standard but to a set of certification requirements that are mandatory to medical gas system installations. There are many other standards referenced in NFPA 99 that belong to other standards writing organizations.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20

NEGATIVE: 4

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: DAVIDSON: See my Explanation of Negative on Comment 99-98 (Log #44).

ESHERICK: See my Explanation of Negative on Comment 99-237 (Log #50).

COMMENT ON AFFIRMATIVE: WAGNER: Subsequent changes to ANSI/ASSE Standard 6010 (or any other referenced standard) do not automatically affect the current issue of NFPA 99. The referenced standards in Chapter 21 include issue dates to indicate which edition of the standard is being referenced. If ASSE subsequently revises ANSI/ASSE Standard 6010, those changes will not be part of NFPA 99 until there is a proposal to update the referenced edition of 6010 during the next revision cycle of NFPA 99.
The installation shall be made by qualified, competent technicians experienced in making such installation and meeting the requirements of ANSI/ASSE Series 6000, Standard 6010.

**SUBSTANTIATION:** The substantiation of Proposal 99-191 (Log #190) is based on the fact that because a certification now exists it should be written into the standard. This implies that the standard was lacking and now that a certification exists the standard can now be made complete. The burden of proof must be substantiated by performance. Are there documented cases where the actions of a non-ASSE certified installer have led to patient harm or a medical incident? If not, it is purely speculative that ASSE certification should be the sole criteria for determining if an installer is competent. "The installation shall be made by qualified, competent technicians experienced in making such installations". This statement stands on its own as a requirement. Giving one organization as being the only measure of competency is short sighted and creates a closed market. Time and time again, lack of competition has led to increased fees and prevented, not enhanced, improvement. With accepting this proposal, this committee moves from a technical standards committee to a regulatory body mandating what skills and knowledge are acceptable and rejecting all others. This committee should readress this issue and confine its activities to setting the technical standards, not controlling the market.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-99 (Log #75).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF NEGATIVE:**

**DAVIDSON:** See my Explanation of Negative on Comment 99-98 (Log #44).

**WAGNER:** ANSI/ASSE Standard 6010 provides a means of determining if installers are qualified and competent by their knowledge of NFPA 99 medical gas and vacuum systems. If there is another standard that equally addresses this issue, it can be added to NFPA 99.

In the case of qualification of brazers and brazing procedures, NFPA 99 references ASME and AWS procedures, both of which are considered to be acceptable.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-99 (Log #75).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 19

**NEGATIVE:** 5

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF NEGATIVE:**

**DAVIDSON:** See my Explanation of Negative on Comment 99-98 (Log #44).

**WAGNER:** ANSI/ASSE Standard 6010 provides a means of determining if installers are qualified and competent by their knowledge of NFPA 99 medical gas and vacuum systems. If there is another standard that equally addresses this issue, it can be added to NFPA 99.

In the case of qualification of brazers and brazing procedures, NFPA 99 references ASME and AWS procedures, both of which are considered to be acceptable.
prevention installers trained. Why not their medical gas system installers?
And please note that the NFPA has for years been in the business of specifying the professional qualifications of Fire Fighters (NFPA 1001), Airport Fire Fighter (1003), Fire Fighter Medical Technicians (1004), etc. All we are doing here is standardizing the training of the personnel who will install vital life support systems. We specify what the systems shall consist of. Why not go further and mandate training of the installers?
For the record, I am an instructor of this program for which I receive fees. I am also a verifier who has extensive experience with installations of medical gas systems around the country and have seen what is done by personnel who do not have proper training.
And while completion of this 32 hour course is not a guarantee that all problems with installations will be eliminated, it is a giant step in the right direction.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:**

**COMMITTEE STATEMENT:**

**SUBSTANTIATION:**

**RECOMMENDATION:**

**COMMENT ON PROPOSAL NO:** 99-195

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<td>COMMITTEE ACTION:</td>
<td>Accept.</td>
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<td>VOTE ON COMMITTEE ACTION:</td>
<td>AFFIRMATIVE: 21</td>
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<td>3 Bancroft, Lynam, Shoemaker</td>
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**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 21

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMITTEE ACTION:** Reject.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 1

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMITTEE ACTION:** Reject.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 1

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

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**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 21

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker
seals were recommended. The substantiation given by the TC is flawed in many areas, such as:

1. Vacuum piping can be a permanent part of the facility but so are many other systems that need constant inspection and repair. We install HVAC systems in the same chases and ceiling spaces that the vacuum tube is installed, pneumatic tube systems, fire fighting and safety system cabling, etc. Just because this is a “permanent” installation doesn’t mean that materials other than copper tubing should be eliminated from being an acceptable material.

2. The statement that to permit the use of a mechanical joint other than a brazed joint would depart from the proven safety history is pure nonsense. How can a manufacturer prove something will work if it is never permitted in the first place? The technology has been proven in other applications and it does have a long history of safety, why are we going to outlaw it for vacuum systems?

3. The statement that the technology requires training by the manufacturer therefore it should not be allowed is a very weak argument by a TC. If this were the case then we would never have a system installed in a health care facility as they all require trained installers. If the ASSE 6000 certification passes, the training for the installation of all acceptable methodologies would need to be included.

4. The statement that permitting other than brazed joints will make NFPA 99 a performance based standard with regard to vacuum systems is another weak statement made by a TC. Look at the direction NFPA is going with regard to performance-based standards in the Life Safety Code, Building Code, etc. The whole movement in NFPA is toward performance-based standards and we should not be fighting that movement. If the authorities having jurisdiction need to make the evaluation on a case by case basis based on the material and location of installation, that is nothing new and is consistent with the entire NFPA family of codes and standards.

5. The last statement made in the substantiation about the standardization of material will make the system installation safer, stronger, cleaner is not backed up with any references to inappropriate installed systems, historical data, facts, etc., it is all conjecture at this point. To further this argument the last line talks about confusion of installing a positive pressure line with soft solder because the installer was confused. Isn’t this why we are certifying installers, inspectors, and verifiers?

To only allow brazed copper as the material of choice for vacuum systems is limiting without any real good explanation. Grooved pipe system are routinely used in medical facilities for sprinkler water line, to infer that only brazed copper will perform under fire conditions is not funded by the committee by any real empirical research. The committee represents the health care industry, which it serves, alternatives when they will perform for the stated function.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 1

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**ABSTENTION:** 4

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF ABSTENTION:** ERIKSON: See my explanation of abstention on Comment 99-108 (Log #27).

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-108 (Log #27).
By using copper tube and brazing the joints, we make the vacuum system at least as positive as gas systems.

NOTE: Supporting material is available for review at NFPA headquarters.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The Technical Committee rejected this proposal. I object to this change and request that the committee accept the material as written.

SUBSTANTIATION: The use of new materials and alternate installation methods represents competition and therefore offers the potential for keeping the cost of medical gas system installations reasonable. If the proposal establishes adequate technical substantiation as to the reliability and durability of the product, then this committee has a duty to only reject the proposal if this substantiation is not thorough or convincing or if contradictory evidence exists. In the absence of these elements the committee should allow the introduction of this product/method and let the user decide what is appropriate for their facility.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-108 (Log #27).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION:

ABSTENTION: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Reverse the actions.

RECOMMENDATION: Reverse the actions.

SUBSTANTIATION: Having no interest in this matter other than the good name of the committee, which I believe has been disgraced first by its inaction on 99-211 (Log #32) and second by so inadequate a substantiation in it’s final rejection, I wish to challenge the actions on these two proposals, requesting the committee reconsider their actions on both these submissions [99-211 (Log #32) and 99-213 (Log #80)].

The proposal in 99-211 (Log #32) was submitted in good faith to the committee, including presentations and the providing of considerable subsequent information by the submitter to deal with committee questions. Nevertheless, the proposal was held for “further study” from the 1999 cycle. Regrettably, and for a variety of reasons good and bad, the “further study” was not carried out. The later submission 99-213 (Log #80) is advanced as substantiation for rejecting this submission.

The sum effect of 99-213 (Log #80) is to eliminate the use of any material for vacuum piping other than copper tube, brazed as for pressure gases. This was verbally argued as desirable on the grounds of patient safety in addition to the substantiation in the original submission. However, there are inconsistencies in the arguments advanced:

The proposed change eliminates the use of galvanized, stainless or other piping materials previously allowed. This prohibition is argued on (a) economic grounds and (b) as desirable to harmonize vacuum and pressure gas requirements and (c) on the grounds of theoretical hazard of loss of vacuum under certain fire conditions.

With respect to the economic arguments advanced as (a) above, the Technical Committee is not charged with making economic decisions for the user. On cost grounds alone it cannot disallow materials which have served to general satisfaction and/or are known to be otherwise satisfactory for the service. The user is entitled to make their own decisions on economic grounds as they wish. In any event if this assertion is true and given the state of the industry today, the Committee need never fear that any but copper will be used!

With respect to the argument advanced as (b) above, there is no compulsion arising from safety hazards to harmonize these requirements. Harmonization is a voluntary effort aimed at making the standard easier to use, not at changing technical requirements. That desirable harmonization between vacuum and pressure has been admirably handled in 99-145.

With respect to the argument advanced as (c) above, i.e., that a localized fire could result in vacuum pipeline separation and therefore could endanger patients. Such a fire, hot enough to melt 95-S solder (450°F) must be assumed to exist in such a way as to melt the joint(s) of the vacuum pipeline and cause separation but not cause evacuation of the facility (e.g., procedures continue in other parts of the facility). Admitting this possibility (albeit highly unlikely) paradoxically leads to an entirely opposite conclusion. If we accept that this hazard is sufficiently real to make so dramatic a material change, then it is copper than should be precluded, as copper to copper is the least fire resistant jointing method.

We declare that substantial evidence does not warrant removal of other joints. Galvanized or stainless pipe joints are threaded or welded - a far more fire resistant jointing method than even brazing. The coupling systems envisioned under 99-211 (Log #32) will not separate under any fire scenario as limited as that envisioned above, which is demonstrated by actual testing (as shown in the original submission). Any leakage which might exist in such a coupling were the elastomeric seal to be entirely burnt or

99-114 - (4-3.2.2.2): Accept

SUBMITTER: Technical Committee on Piping Systems

RECOMMENDATION: Remove the words “soldered or”.

SUBSTANTIATION: This was inadvertently left in and should have been deleted.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT: See Committee Statement on Comment 99-108 (Log #27).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION:

ABSTENTION: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: See Committee Statement on Comment 99-108 (Log #27).

RECOMMENDATION: Accept Proposal 99-211 (Log #32) as submitted by Mr. Sellers.

The Technical Committee rejected this proposal. I object to this change and request that the committee accept the material as written.

SUBSTANTIATION: The committee did the industry a disfavor currently allowed. Galvanized or stainless pipe joints are threaded or welded - a far more fire resistant jointing method than even brazing. The coupling systems envisioned under 99-211 (Log #32) will not separate under any fire scenario as limited as that envisioned above, which is demonstrated by actual testing (as shown in the original submission). Any leakage which might exist in such a coupling were the elastomeric seal to be entirely burnt or
melted away is certainly minimal enough to be discounted in the near-disaster scenario envisioned.

In short, no irrefutable argument has been advanced to justify the change implied in the committee action on 99-213 (Log #80). If 99-213 (Log #80) cannot stand scrutiny, then 99-211 (Log #32) cannot be rejected, especially so in light of the voluminous data supplied by Victaulic with their submission in 1997. It is inappropriate for the committee to reject this submission without at least refuting the data submitted, and at best disrespectful to do so on so flimsy a substantiation.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Medical vacuum piping networks are part of vital, life saving systems essential to patient safety and care. Vacuum piping networks are a permanent part of the facility, often remaining in service over the lifetime of the facility, and are often located in inaccessible areas. Vacuum piping networks pass degrading materials and must remain leak-free over the service life. Specifications for materials, installation, and testing for medical gas and vacuum piping networks have been identical in this standard, including the use of brazed joints. To permit the use of mechanical joints, for which there is no standard, would depart from the proven safety history of brazed joints.

NFPA 99 has developed extensive requirements for brazing, performance, brazer certification, and testing to assure the successful performance of brazed joints.

Flush seal gaskets suitable for vacuum service and press fit fittings are proprietary products of specific manufacturers. There are no established criteria for their successful use in medical vacuum network piping systems. Both technologies require training by the manufacturer for their proper application and installation. Neither technology solves a problem that is created by the use of brazed copper joints. Permitting other than brazed copper joints will make NFPA 99 performance-based with regards to medical vacuum piping and will make the AHJ responsible for its successful operation.

Ductile iron components used on copper piping networks are dissimilar metals, which are not permitted in this standard.

The second proposal was rejected because the standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
ABSTENTION: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION:
ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

COMMITTEE STATEMENT: The need for nitrogen purging is to eliminate copper oxides from forming on the interior of the vacuum tubing during brazing. A large vacuum system brazed without a nitrogen purge could accumulate as much as a trash bag full of copper oxides. Requiring a nitrogen purge eliminates this problem and the cost of the nitrogen purge is less than a penny per foot of pipe run.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
ABSTENTION: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION:
ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
ABSTENTION: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION:
ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: Although no specific recommendation was provided, see the substantiation for Comment 99-113 (Log #84).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
COMMITTEE STATEMENT: The standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
ABSTENTION: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION: ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

RECOMMENDATION: The Technical Correlating Committee directs the Committee to review the Committee Statement and provide a more explicit explanation to their action.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: This was due to Manual of Style formatting as mandated by Proposal 99-7 (Log #CP700).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION: ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

COMMITTEE STATEMENT: The standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
ABSTENTION: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF ABSTENTION: ERICKSON: See my explanation of abstention on Comment 99-108 (Log #27).

COMMITTEE STATEMENT: The standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

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COMMITTEE STATEMENT: The standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.
EXPLANATION OF NEGATIVE:

DAVIDSON: There is no valid argument in favor of allowing the supplier to verify and test equipment that is supplied by the supplier. In most cases the equipment is sold to the contractor who installs the equipment and who contracts with the verifier (supplier of the equipment) to verify the equipment and related piping system. The committee’s justification statement is “it is beyond the scope of the committee to define the business relationship between individual entities. Safety and integrity of medical gas systems/equipment are not necessarily compromised by a qualified verifier who also sells equipment.” It is absurd to think that a supplier of equipment worth tens of thousands of dollars who is hired as the equipment/system verifier by the contractor who installed the system/equipment, the same contractor will not get paid until the system/equipment has been approved by the verifier does not lead to a serious conflict of interest. Therefore, the supplier/verifier will not get paid until the system is certified by the supplier/verifier. What conflict of interest?

ESHERICK: See my Explanation of Negative on Comment 99-148 (Log #163) and Comment 99-142 (Log #98).

(Comment #159)

Committee: HÉA-PIP

99-126 - (4-3.4.1.1): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

RECOMMENDATION: Accept the proposal as written.

SUBSTANTIATION: I cannot agree with the committee statement, which is true in 1999 edition. The proposal is to change that so there can no longer be a conflict of interest, expressed or implied. See CSA CAN 3-305.4-M85 Clause 4.2.2(e) which says: “The testing agency shall provide a written agreement to...”

(e) refrain from certifying any medical gas system in which the testing agency or any affiliated company(ses) has any material interest, so long as such a certification is intended to be the certification required by clause 11 of CSA Standard Z 305.1.”

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-124 (Log #30).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

DAVIDSON: See my Explanation of Negative on Comment 99-124 (Log #30).

ESHERICK: See my Explanation of Negative on Comment 99-148 (Log #163) and Comment 99-142 (Log #98).

(Comment #159)

Committee: HÉA-PIP

99-128 - (4-3.4.1.1, 4.3.4.1.3): Reject

SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: In the various committee actions on this proposal and in the past, there is a logical inconsistency which this committee must resolve, and now is the ideal time. On the one hand, in 4-3.4.1.3 Paragraph 2 the installer has been prohibited from performing their own verifications. This is justified irregardless of competence or lack thereof, but on the basis of averting a conflict of interest. On the other, the hospital is permitted to verify for themselves, assuming adequate competence (4-3.4.1.3 paragraph 3), and without consideration of conflict of interest. Now Log 82 presents a third case, which would permit the verifier to supply equipment, or conversely, allow the supplier to verify their own equipment. The submitter’s argument regarding conflict of interest is rejected. In three substantially similar cases, conflicted and irreconcilable actions have been taken. I argue for neither side per se, but rather argue that the standard must be consistent in its treatment of all parties.

SUBSTANTIATION: Reducing this issue to its simplest form, All must be trusted or none can be. The Committee cannot in all conscience assert that a verifier or a hospital staffer has some exclusive claim to virtue which is not shared by an installer, or that conflict of interest can be submerged by a “competent” individual, or therefore the installers are by definition incompetent - “for the purposes of this standard”.

Regrettably, there is more than adequate evidence to support the proposition that a system of checks and balances is desirable. As there were cases of installers shorthanging the certification, there are cases of verifiers selling questionable necessary equipment under the at least implicit threat of non-certification, and there are cases where the verifier feels financial pressure to turn a “Nelson’s Eye” to a “minor little infraction” as assurance toward securing the next sale. The more reliant the verifier on equipment sales for their livelihood, the greater the pressure. There is no statement more true or more damning than “most verifiers would go out of business if they lost their equipment sales.”

On the other hand, whatever is said for the verifier is equally true for the installer. It is patent nonsense to assert that installers will universally ignore their own self respect - not to mention their own considerable liabilities - just to cheat the owner with a crooked certification. There are installers who qualifications exceed those of the verifiers they are forced to hire, and as the installers have been working with the ASSE 6000 series qualifications standard for a longer time, the numbers of “qualified” installers is growing rapidly.

It is every bit as absurd to assert that hospital personnel, properly qualified or not, have no motive for cutting corners, just as no one could assume that they all would.

99-127 - (4-3.4.1.1): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee directs that the Committee Action be revised to read as Accept In Principle.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
All must be trusted or none can be. The committee must decide which principle they wish to uphold and carry it entirely through the document with appropriate forethought.

If all are to be trusted, in 4-3.4.1.3 second paragraph, strike "such testing shall be performed by a party other than the installing contractor."

If none are to be trusted (i.e., the trend toward a system of checks and balances is to be continued) add to 4-3.4.1.1 a new paragraph: "Conflict of Interest. In order to prevent conflict of interest in the supply, installation and verification of medical gas and vacuum systems, the following limitations shall be observed:

a. The Equipment Manufacturer, Manufacturer’s agent or Distributor(s), Installing contractor, Verifier and Facility shall each be independent, having no ownership interests in others.

b. Acting in one of the listed capacities shall preclude the same entity (person or company) from acting in any other of these capacities on the same project."

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: There was no specific wording presented for making changes. The committee rejected this comment based on section 4-3.5.1 of the Regulations Governing Committee Projects.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 4
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ALLEN: I do not feel that the fundamental issue at stake here has been addressed.

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NFPA 99 — November 2001 ROC — Copyright 2001, NFPA

SUBSTANTIATION: Why must we continue to look for a needle in a haystack? If the hydrocarbons as methane and halogenated hydrocarbons are not in medical gas systems how are we lowering safety standards by not checking for?

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: There are three grounds on which this test is being retained:

First, evidence has been presented which argues these tests have revealed installation problems concerning improper use of hydrocarbons and halogenated cleaning solvents used to clean pipelines.

Second, the risk of these compounds remaining in the pipeline is real and the elimination of them is one of the primary goals of the installations and maintenance specified in this chapter. The simple fact remains we have no other test which even circumstantially will check for the presence of these compounds.

Third, because the installer knows someone is coming to check for these compounds, and is going to be doing a test with these kinds of sensitivity, which will naturally tend to impose a discipline and vigilance on the process which otherwise would never exist. It is axiomatic (witness ISO 9000) that what is important should be tested, and what is tested will be done. If the installer knows there is little or no risk in ignoring the cleaning and good practice requirements, then the likelihood of them not complying is consequently enhanced.

The committee also asserts that the ASSE 6030 credentialed verifier shall be conversant with the various methods used to differentiate one gas from another and detect trace gaseous contamination which is important for trouble shooting and the elimination of hazards. Removal of this test has the undesirable consequence of removing a whole category of knowledge that ought to be a primary qualification of a professional verifier.

Eliminating either of these tests in favor of a single test (such as the Flame Ionization Detector (Comment 99-165 (Log #79)), would be technology restrictive and would exclude other apparently successful methods now in use.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19
NEGATIVE: 2
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ERICKSON: While the substantiation that these hydrocarbons are occasionally found in the pipeline, the statistics don’t prove the need for this test on all newly installed or renovated systems. If there is a doubt in the mind of the verifier that the proper installation was not made or if in the review of the installer’s methods and techniques show a potential for the gaseous hydrocarbons then the verifier should perform this test. The evidence given by the TC members against performing this test and the evidence presented in the TC meetings was not sufficient enough for me to continue to support performing this test on all new installations or system modifications. Once again it is up to the TC to prove that a test is necessary as a minimum requirement.

The statement in the committee substantiation that “removal of this test has the undesirable consequence of removing a whole category of knowledge that ought to be a primary qualification of a professional verifier” is not relevant to the argument as to whether or not this test needs to be accomplished as a minimum requirement. If the verifiers want to continue to be trained in how to perform this test then ASSE 6000 will make it a requirement of certification.

ESHERICK: See my Explanation of Negative on Comment 99-141 (Log #07).

COMMENT ON AFFIRMATIVE:

STEVENSON: I wish to speak in support of the committee action to reject this proposal.

The Liberty Mutual Industrial Hygiene Laboratory performed 1,432 hydrocarbon and halogen tests in the past year at 471 facilities using the piping purity test. From this data, we conclude:

1. We and several verifiers testify that these tests do work as they are currently specified and with it they have found cases of valve contamination and improper use of hydrocarbon and chlorinated hydrocarbons used in pipelines.

2. Halogen and hydrocarbon failures don’t always happen at a high failure rate, but when they happen they do point to problems.

We had 14 failures in the piping purity test last year within the range of 1.6 ppm to 7.5 ppm. These failures can have variable results, where some of the outlets pass and some fail and the measured levels go down after extensive purging only to increase again when the purging stops and liquid solvent remaining in the pipe or valve again evaporates. They also occur for other reasons as mistakes are made during installation.
3. Halogen and Hydrocarbon failures also happen at much higher concentrations, 3 cases of which involved expensive liability claims and litigation for the hospital as well as the loss of use of the piped gas system for extended times. This year we tested a line which had 5,000 ppm hydrocarbons.

4. The problems that have been identified on site have involved solvents such as trichloroethylene or mineral spirits used to clean out valves or regulators used in the pipeline.

5. If carefully done, these tests work and can successfully detect problems with contamination that are known to occur in the industry.

6. The FDA Fresh Air 2000 document specifically supports such testing as required Current Good Manufacturing Practice.

7. Other known cases have occurred where solvents in the high pressure side of the oxygen lines have caused both severe bodily injury and property damage. If the committee wanted to assure a test to detect these problems as well before they cause harm to patients, an additional Halogen and Hydrocarbon test should be added to the Medical Gas Concentration Tests 4.3.4.1.3(i).

COMMITTEE STATEMENT:

COMMITTEE ACTION:

99-252 Accept proposal as written.

hydrocarbons as methane were well within the criteria for Federal

where in no halogenated hydrocarbons ever found and

as evidenced by over 17 years experience as Independent Testers

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:

Comment 99-131 (Log #25).

This proposal does not lower the safety level

See Committee Statement on Proposal 99-231 (Log #27).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on

Comment 99-133 (Log #25).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ERICKSON: See my Explanation of Negative on Comment 99-131 (Log #25).

ESHERICK: See my Explanation of Negative on Comment 99-141 (Log #97).

COMMITTEE STATEMENT:

COMMITTEE ACTION:

99-134 - (4-3.4.1.3): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-232

RECOMMENDATION: Accept the proposal as written.

SUBSTANTIATION: See comment on Proposal 99-231.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on

Comment 99-131 (Log #25).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ERICKSON: See my Explanation of Negative on Comment 99-131 (Log #25).

ESHERICK: See my Explanation of Negative on Comment 99-141 (Log #97).

COMMITTEE STATEMENT:

COMMITTEE ACTION:

99-135 - (4-3.4.1.3): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

COMMENT ON PROPOSAL NO: 99-233

RECOMMENDATION: Do not accept this proposal.

SUBSTANTIATION: I agree with all negative explanations. Furthermore, if the Technical Committee wants to have the verifier "certified" - they should look at our Northern Neighbor - Canada. They have had such since September 1985: CAN3-Z305.4-95 "Qualification Requirements for Agencies Testing Non-flammable Medical Gas Piping Systems".

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: ASSE 6030 is based on the specific requirements of NFPA 99 with regard to the verification of medical gas and vacuum systems. In addition, it sets a benchmark for test equipment and procedures. ASSE 6000 provides guidelines which improve the installation, reliability and safety of medical gas systems and therefore needs to be referenced in NFPA 99.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20

NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Comment 99-237 (Log #50).

COMMITTEE STATEMENT:

COMMITTEE ACTION:

99-136 - (4-3.4.1.3): Reject

SUBMITTER: David Mohile, Medical Engineering Services, Inc.

COMMENT ON PROPOSAL NO: 99-238

RECOMMENDATION: We wish to continue to support the requirement that the Verifier shall not have any ties whatsoever to the equipment supplier, installer or manufacturer.

SUBSTANTIATION: None given.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on

Comment 99-124 (Log #30).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

DAVIDSON: The Verifier shall not have any ties whatsoever to the equipment supplier, installer and/or manufacturer. For objective test, the testing agency should not have provided equipment, devices or labor for the system being installed or tested. The testing agency shall not have a financial interest in the result of the testing, if a financial interest is present then the testing agency has a serious conflict of interest. It is absurd to think that a supplier of equipment worth tens of thousands of dollars who is hired as the equipment/system verifier by the contractor who installed the system/equipment, the same contractor will not get
paid until the system/equipment has been approved by the verifier
does not lead to a serious conflict of interest. Therefore, the
supplier/verifier will not get paid for the equipment until the
system is certified by the supplier/verifier. What conflict of
interest?
ESHERICK: See my Explanation of Negative on Comment 99-148
(Log #165) and Comment 99-142 (Log #98).

RECOMMENDATION: We wish to speak in the affirmative
regarding this proposal.

Several comments were offered in the negative for this proposal
and we would like to offer the following.
The ANSI/ASSE 6000 Standard 6030 is a level of knowledge for
the Verifiers. This has nothing to do with the medical gas pipeline
installer’s requirements which is covered in Standard 6010. (Please
see our comments on 99-218 (Log #190). Therefore, those
comments offered which referenced the installer portion of NFPA
are incorrectly located in this Log.

And the issue of ASSE being a non-consensus organization has
also been addressed in 99-218 (Log 190).

SUBSTANTIATION: The lengthy discussion of Professional
Engineering does not belong in this document. Buried within
these paragraphs is a statement that the NFPA is trying to
subvert the individual State Registration Board of Professional
Engineers’ ability to certify a medical gas system in order to
safeguard life, health and property. I was not aware that any State
Registration board is certifying anyone to specifically certify
medical gas systems.

Merely because an engineer has obtained the P.E. designation
does not make him or her a specialist in medical gas pipeline
systems. Nor does it make him or her a specialist in aircraft design
or any other specialty. While I generally respect someone who has
the patience to go through engineering school, graduate, and pass
the P.E. examination, this does not make that engineer a specialist
in medical gas pipeline systems. The ANSI/ASSE 6030 is a
compilation of the specialized knowledge necessary to permit
someone to adequately verify a medical gas pipeline system. Any
P.E. that I know that wants to work in a specific field usually
obtains additional training and experience in that field from a
variety of sources and then works within that field.

Also as a point of information, the term used in the Standard is
Verification, not Certification.

COMMITTEE ACTION: Accept,

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 19
NEGATIVE: 2
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:
DAVIDSON: The requirements for the medical gas system and
equipment "certifier" should be defined within NFPA 99, Chapter
4, not through a third party standards making body.

ESHERICK: See my Explanation of Negative on Comment 99-237
(Log #50).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on
Comment 99-131 (Log #25).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 19
NEGATIVE: 2
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:
DAVIDSON: The NFPA has in the past been very careful not to
endorse the products or services of any company and organizations
and been very careful to keep a neutral viewpoint in developing the
codes. Historically, the NFPA has deferred this type of regulation
to the Authority Having Jurisdiction. The committee's justification
statement says that ASSE 6000 series standards provides guidelines
which improve the installation, reliability and safety of medical gas
systems and needs to be referenced in NFPA 99, if so this standard
can be referenced in Chapter 21 "Referenced Standards" of NFPA
99. It is my belief that the present wording in NFPA 99 is adequate.
Presently, NFPA does not require certifiers of automatic fire
sprinkler systems to be trained by a NFPA specified standard and
sprinkler systems are a vital life safety system. Additionally, NFPA
does not specify the training required for the "certifiers" of the
emergency power systems in NFPA 110 "Standard for Emergency
and Standby Power Systems" Emergency Generators which power
the life safety critical circuits of a health care facility. It is my belief
that the inclusion of ASSE 6000 series document into the
NFPA 99 restricts trade of companies who are qualified, but not to
ASSE 6000 series document, from working in healthcare facilities
and does not provide any greater benefits than the present wording
of NFPA 99.

ESHERICK: See my Explanation of Negative on Comment 99-237
(Log #50).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on
Comment 99-135 (Log #49).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 19
NEGATIVE: 2
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:
DAVIDSON: The NFPA has in the past been very careful not to
endorse the products or services of any company and organizations
and been very careful to keep a neutral viewpoint in developing the
codes. Historically, the NFPA has deferred this type of regulation
to the Authority Having Jurisdiction. The committee's justification
statement says that ASSE 6000 series standards provides guidelines
which improve the installation, reliability and safety of medical gas
systems and needs to be referenced in NFPA 99, if so this standard
can be referenced in Chapter 21 "Referenced Standards" of NFPA
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Presently, NFPA does not require certifiers of automatic fire
sprinkler systems to be trained by a NFPA specified standard and
sprinkler systems are a vital life safety system. Additionally, NFPA
does not specify the training required for the "certifiers" of the
emergency power systems in NFPA 110 "Standard for Emergency
and Standby Power Systems" Emergency Generators which power
the life safety critical circuits of a health care facility. It is my belief
that the inclusion of ASSE 6000 series document into the
NFPA 99 restricts trade of companies who are qualified, but not to
ASSE 6000 series document, from working in healthcare facilities
and does not provide any greater benefits than the present wording
of NFPA 99.

ESHERICK: See my Explanation of Negative on Comment 99-237
(Log #50).
Further requirements are not required. NFPA requirements are sufficient already.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

COMMITTEE STATEMENT: See Committee Statement on Comment 99-124 (Log #30).

RECOMMENDATION: Delete the following text to the first paragraph, second sentence of the proposal: "The test gas shall be oil-free dry nitrogen or the gas of system designation."

This also should apply to Paragraphs 4-3.4.1.3(a1), (c1), (d2), and paragraph two of (e). The wording should be kept as originally stated in NFPA 99C, 1999 Edition 4-3.4.1.3, the first paragraph, second sentence.

SUBSTANTIATION: I am in opposition to the committee’s decision to accept this proposal. The rationale of eliminating nitrogen as a test gas as a means of cost savings to hospitals is flawed at best and possibly dangerous. The introduction of oxygen under pressure into an untested piping system brings into play four hazardous possibilities:

1. The introduction of oxygen under pressure in the presence of an unknown hydrocarbon could generate enough heat to exceed the flash point of that hydrocarbon.

2. In the presence of oxygen some VOCs (volatile organic compounds) can become corrosive.

3. Some VOCs will readily undergo oxidation in the presence of oxygen making their detection difficult if not impossible with some analyzers. For this reason, nitrogen is almost universally used as a carrier gas for calibration standards containing hydrocarbons. The statement "the final result of such testing will be the same regardless of which gas is used" is false.

4. Using the hospital system as the source of test gas risks contaminating the existing hospital system if the new piping is contaminated.

ETS, Inc. this year has already found one hospital piping system contaminated with 280 PPM of total hydrocarbons from use of an unauthorized piping sealant. I know of no industry or agency involved with compressed gas that would use or advocate use of oxygen as a purge or test gas to verify an oxygen-clean system.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: ASSE 6030 is based on the specific requirements of NFPA 99 with regard to the verification of medical gas and vacuum systems. In addition, it sets a benchmark for test equipment and procedures. ASSE 6000 provides guidelines which improve the installation, reliability and safety of medical gas systems and therefore needs to be referenced in NFPA 99.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 1 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: STEVENSON: I wish to speak in opposition of the committee action to reject this proposal. All 4-3.4.1.3 tests should remain in Nitrogen NF, except for the exception listed for "small projects affecting a limited number of areas where the use of nitrogen is impractical." Nitrogen NF is readily available in cleaned tanks. Conversations with the Texas Department of Health, Louisiana District FDA and FDA Center for Drug Evaluation and Research indicate Nitrogen NF would be easily available to either a licensed plumber or a plumber with a Medical Gas Endorsement from the State Board of Plumbing Examiners. Moreover, testing in Nitrogen NF avoids possible fire problems if oxygen is introduced to an unknown hydrocarbon that could be in the line and avoids allowing extensive cross connection, outlet flow and piping purge tests with nitrous oxide.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: ASSE 6030 is based on the specific requirements of NFPA 99 with regard to the verification of medical gas and vacuum systems. In addition, it sets a benchmark for test equipment and procedures. ASSE 6000 provides guidelines which improve the installation, reliability and safety of medical gas systems and therefore needs to be referenced in NFPA 99.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 19 NEGATIVE: 2 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of service provides a true independent check. Accordingly, the introduction of oxygen under pressure is not necessary.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-237 (Log #50).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 0 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of services provides a true independent check.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-139 (Log #74).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 0 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of services provides a true independent check.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-237 (Log #50).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 0 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of services provides a true independent check.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-237 (Log #50).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 0 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of services provides a true independent check.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-237 (Log #50).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20 NEGATIVE: 0 NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE: ESHERICK: Separation of services provides a true independent check.

(Warning: oxygen under pressure can increase the flash point of hydrocarbon vapors and this increase can lead to failure of the test.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-237 (Log #50).
The test gas shall be oil-free dry nitrogen or the gas of system follows: (Log #97).

**EXPLANATION OF NEGATIVE:**

**NOT RETURNED:** 3 Bancroft, Lynam, Shoemaker

**NEGATIVE:** 1

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 1

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**JOINING ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 1

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**EXPLANATION OF NEGATIVE:**

**ESHERICK:** See my Explanation of Negative on Comment 99-141 (Log #97).

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The odor and hydrocarbon residue caused by the melted plastic can not be removed by purging, and the piping must be replaced. This problem is discovered during the nitrogen testing, protecting the hospital. The use of nitrogen as a test gas is a benefit to both the installer and to the hospital. By adopting this proposal, you are suggesting that we build what is essentially a critical medical system and attach it to the hospital before testing it. Many times, a complex shutdown must occur to attach the new piping components. What will happen when the system fails a purity test after it is tied in to the hospital? It will probably have to be removed and tested with nitrogen (as is currently practiced). In addition, the cross connection test is essentially performed twice as the standard is currently written. Once with nitrogen, and once when the presence of source gas is confirmed. Adoption of this proposal will lead to laziness or complacency among some individuals and the number of cross connection tests will be reduced to one, seriously increasing the odds that a cross connection will be missed.

**COMMITTEE ACTION:**

**Reject.**

**COMMITTEE STATEMENT:**

See Committee Statement on Comment 99-144 (Log #103).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 1

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**EXPLANATION OF NEGATIVE:**

**STEVenson:** I wish to speak in opposition of the committee action to reject this proposal.

See my comment on 99-144 (Log #105).

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This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects. The use of a source gas, if approved by the authority having jurisdiction, is appropriate. See Section 4-3.4.1.3, Exception.

**COMMENT ON PROPOSAL NO:** 99-238

**RECOMMENDATION:** The Technical Correlating Committee directs the Committee to review and revise Committee Statement to respond to the submitter’s substantiation and provide reasons to answer why.

**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** See Committee Statement on Comment 99-124 (Log #30).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 1

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**EXPLANATION OF NEGATIVE:**

**ESHERICK:** A conflict of interest arises if the verifier is the supplier- he could look the other way.

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The use of nitrogen to perform flow and purity tests, the plumber gets a piece of paper that says his pipe was clean before he attached it to the hospital, protecting him from an existing problem.

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COMMITTEE ACTION: Accept in Principle in Part.

Revise as follows:

Insert new text before Cross-Connection Test as (a) and bump existing sections down one letter, making Cross-Connection Test (b), etc.

(a) Standing Pressure Test. Piping systems shall be subjected to a 10 minute standing pressure test at operating line pressure. The test gas shall be oil-free, dry nitrogen (see Section 2-2 Definitions).

1. After the piping system is filled with test gas, the supply valve, the zone valve, and all outlets shall be closed. The piping system shall remain leak-free for 10 minutes.

2. Leaks, if any, shall be located, repaired, and retested in accordance with 4-3.4.1.2(e).

COMMITTEE STATEMENT: Changing the word “standing” to “pipe” and bumping existing sections down one letter, making Cross-Connection Test (b), etc. is more correct. The test gas of oil free, dry nitrogen (see Section 2-2 Definitions).

affirmative: 20

negative: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: Properly purged pipe lines will assure no particulate matter is present. When weighing clean filters show no increase in weight.

COMMENT ON AFFIRMATIVE:

STEVENVON: I wish to speak in opposition of the committee action to increase the allowable particulate level from the present 0.1 milligram/m³.

The Liberty Mutual Industrial Hygiene Laboratory performed 1,354 particulate tests in the post year at 471 facilities. From this data, we conclude:

1. Taken in a careful manner, the existing particulate test reliably detects particulates in medical gas installations prior to their use. It is an objective, reproducible measurement whereby different people doing the same test in different parts of the country can have a reasonable expectation that they will detect the same amounts of material if it is present.

2. Particulate failures don't happen all the time, but at the current level of 0.1 milligram/m³, the failure rate for our tests were 2.65%. That means that we found 36 failures occurring in the piping particulate test we did this year.

3. The existing 0.1 milligram/m³ limit more closely matches the appropriate health limits for most of the contaminants the particulates are actually made of and you could expect to find within the assembled pipeline. The makeup of what the particulates are made of is listed below, along with the corresponding concentration limits for health affects:

   - Contaminant
   - Health Limit (mg/m³)
   - Arsenic
   - 0.01
   - Beryllium
   - 0.0002
   - Borates
   - 1.0
   - Cadmium
   - 0.002
   - Calcium
   - 2.0
   - Chromium III
   - 0.5
   - Chromium VI
   - 0.01
   - Copper
   - 0.2
   - Iron
   - 5.0
   - Manganese
   - 0.2
   - Nickel
   - 0.1
   - Tin
   - 2.0
   - Oil Mist
   - 0.2
   - Phosphorus
   - 0.1
   - Fluorides
   - 2.5

Although this test is in nitrogen which is not delivered to patients, this is the only objective test of the pipeline particulate cleanliness prior to filling it with the system gas and readied for patient use. Therefore, the test is for the cleanliness of the pipeline installation, not of the nitrogen gas.

Although these tests discussed above are piping purity, when particulate tests are actually done with the system gas, we find an even greater percent of particulate failure when the test is done using oxygen, air or nitrous oxide in the lines. We cannot say if these pipes were dirty to begin with or if these gases react with material in the lines to create or loosen scale off the pipes, creating more particulates. If it is true that reactive gases such as oxygen and air create or loosen scale creating more particulate, the committee should consider instituting an additional particulate test within the existing Medical Gas Concentration Tests 4-3.4.1.3(e).
Substantiation: It is difficult if not impossible to accurately weigh 0.1 mg in the field and even if samples are returned to the lab it is difficult to prevent contamination and get accurate results. If it were necessary to measure this small amount then these difficulties might be worthwhile, but this small amount is below what most experts in the field would believe is necessary. The amount allowed in divers breathing air is 5 mg per m³. This is 50 times the amount in this specification and is allowed on a continuous basis. I believe an amount of 1.0 mg is more realistic, with any more being an indication of a poor installation job.

Committee Action: Accept.

Committee Statement: See Committee Statement on Comment 99-156 (Log #95).

Number of Committee Members Eligible to Vote: 24

Vote on Committee Action: AFFIRMATIVE: 19
NEGATIVE: 2

Not returned: 3 Bancroft, Lynam, Shoemaker

Explanation of Negative:

Esherick: The committee is looking for very tiny "straws" that do not exist in a properly purged pipeline. When our filters remain white after 35 cu. ft., we never find any weight difference.

Highlights:

- The filter shall accrue no more than 0.1 mg of matter from any outlet.
- If you start with a clean white 0.45 micron filter and run a measured amount of gas through it and filter is as clean after as before there is no reason to weigh this.
- Not all contaminants are visible on a white filter test. Weighing the filter has found pipeline contamination which was not visible on the filter. Weighing provides quantifiable results.
COMMITTEE STATEMENT: See Committee Statement on Comment 99-156 (Log #95).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Comment 99-156 (Log #95), Comment 99-154 (Log #63) and Comment 99-132 (Log #23).

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: Testing 25 percent of the zones will provide verification of the quality of the installation of the medical gas pipeline.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-131 (Log #25).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Comment 99-131 (Log #25), Comment 99-132 (Log #23).

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: See my comment on 99-131 (Log #25).

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gaseous hydrocarbons, if at all present at one time, are gone from the purging.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-131 (Log #25).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19
NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ERICSON: See my Explanation of Negative on Comment 99-131 (Log #25).

ESHERICK: See my Explanation of Negative on Comment 99-131 (Log #25).

______

99-164 - (4-3.4.1.3(f)): Accept in Principle

SUBMITTER: Edward D. Golla, Texas Research Environmental

COMMENT ON PROPOSAL NO: 99-231

RECOMMENDATION: Keep the reference to Total Hydrocarbons, but change Dew Point in Table 4-3.4.1.3(f) to Moisture Content and set the value to 50 ppm.

SUBSTANTIATION: The problem is that the current value of a maximum Dew point variation of 5°C @ 50 psig is undefined. This spec. can mean anything from a few ppb to hundreds of ppm depending on the water content of the Nitrogen used in the test. The test should use a defined amount of water and I believe from past experience that 50 ppm would indicate a system that is completely dry for all practical purposes. The use of ppm instead of a Dew point eliminates any question that might result from pressure variations in different systems.

COMMITTEE ACTION: Accept in Principle.

Revised to read as follows:

"Keep the reference to Total Hydrocarbons, but change Dew Point in Table 4-3.4.1.3(f) to Moisture Content and set the value to 500 ppm (+12°C @ 50 psig)."

COMMITTEE STATEMENT: An actual moisture level is more definitive as opposed to a differential test. Measurement of moisture level in ppm is independent of pipeline pressure.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Comment 99-131 (Log #25).

______

99-165 - (4-3.4.1.3(f)): Reject

SUBMITTER: Edward D. Golla, Texas Research Environmental

COMMENT ON PROPOSAL NO: 99-231

RECOMMENDATION: Delete the reference to Halogenated Hydrocarbons in Table 4-3.4.1.3(f).

SUBSTANTIATION: Eliminate an unnecessary and costly test. Halogenated Hydrocarbons are hydrocarbons and they will be picked up with a Flame Ionization Detector. Even those with the lowest FID response (CCl4, etc.), have a response greater than 50% of the response of methane on a ppm basis, therefore, it would be impossible to pass a 1 ppm Total Hydrocarbon test and fail a 2 ppm Halogenated Hydrocarbon test. This is true of a FID, but is not true if you are using an Infrared Instrument. In the case of IR, you would have to do a separate test for Halogenated Hydrocarbons.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-165 (Log #79).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 19
NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ERICSON: See my Explanation of Negative on Comment 99-131 (Log #25).

ESHERICK: See my Explanation of Negative on Comment 99-131 (Log #25).

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99-166 - (4-3.4.1.3(f)): Reject

SUBMITTER: Fritz Koppenberger, Environmental Testing Services Inc.

COMMENT ON PROPOSAL NO: 99-263

RECOMMENDATION: Delete test as follows: "The test shall be performed with the use of gas of system oil free dry nitrogen."

SUBSTANTIATION: I am in opposition to the committee’s decision to accept this proposal. There are many reasons to not use source gas as the test gas, including the safety of the verifier. Please refer to my comments on Proposal 99-236.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The use of gas of systems at low pressure has been acceptable in the past without incident. This would not impinge on the validity of the gas purity test.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

STEVenson: All 4-3.4.1.3 tests should remain in Nitrogen NF, except for the exception listed for "small projects affecting a limited number of areas where the use of nitrogen is impractical."

Nitrogen NF is readily available in cleaned tanks. Conversations with the Texas Department of Health, Louisiana District FDA and FDA Center for Drug Evaluation and Research indicate Nitrogen NF would be easily available to either a licensed plumber or a plumber with a Medical Gas Endorsement from the State Board of Plumbing Examiners. Moreover, testing in Nitrogen NF avoids possible fire problems if oxygen is introduced to an unknown hydrocarbon that could be in the line and avoids allowing extensive cross connection, outlet flow and piping purge tests with nitrous oxide.

______

99-167 - (4-3.4.1.3(f)): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-252

RECOMMENDATION: The Technical Correlating Committee directs the Committee to review and reflect the submitter’s substantiation in the Committee Statement, providing explicit reasons explaining why.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: See Committee Statement on Comment 99-162 (Log #48).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Comment 99-131 (Log #25).

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99-168 - (4-3.4.1.3(k)): Accept

SUBMITTER: Fritz Koppenberger, Environmental Testing Services Inc.

COMMENT ON PROPOSAL NO: 99-263

RECOMMENDATION: I support the Committee’s action in rejecting the proposal to add piping to the requirements of label checking by the Verifier.

SUBSTANTIATION: If the proposed wording were added to the Standard, the Verifier would be responsible for checking every label on the tubing, including tubing that is installed behind permanent ceilings in OR’s, in enclosed pipe chases, installed in headwalls, etc.

This would mean that the installing contractor would have to hire the Verifier to come to the job site for additional visits during construction to verify the label installation. In the case of headwalls and ceiling booms it would mean that the contractor
would have to take these devices apart for the Verifier to check for the presence of labels. And on larger projects where the pipeline is installed in phases it would mean many extra visits to the jobsite. This would add considerably to the cost of a project.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

**AFFIRMATIVE:** 20

**NEGATIVE:** 4

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

DAVIDSON: The verifier should check the labeling of the medical gas system piping, not every foot of medical system piping, but at least 25 percent of the piping on a random basis as a spot check of the installing contractor. From experience in the field as an expert witness in medical gas system mishaps, labeling of medical gas system piping has led to mishaps and fatalities, usually linked to modifications of medical gas systems at a date after original system installation.

COMMITTEE STATEMENT:

See the Committee Action taken on Comment 99-188 (Log #CC6).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

**AFFIRMATIVE:** 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT:

See Committee Action on Proposal 99-213 (Pg 715). See Committee Action on Proposal 99-200 (Log #957) and Proposal 99-266 (Log #101) as the actions on these proposals accomplished the submitter’s intent.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

**AFFIRMATIVE:** 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT:

See Committee Action on Proposal 99-213 (Pg 715). See Committee Action on Proposal 99-200 (Log #957) and Proposal 99-266 (Log #101) as the actions on these proposals accomplished the submitter’s intent.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

**AFFIRMATIVE:** 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT:

See Committee Action on Proposal 99-213 (Pg 715). See Committee Action on Proposal 99-200 (Log #957) and Proposal 99-266 (Log #101) as the actions on these proposals accomplished the submitter’s intent.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

**AFFIRMATIVE:** 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
network piping systems. Both technologies require training by the manufacturer for their proper application and installation. Neither technology solves a problem that is created by the use of brazed copper joints. Permitting other than brazed copper joints will make NFPA 99 performance-based with regards to medical vacuum piping and will make the AHJ responsible for its successful operation.

Ductile iron components used on copper piping networks are dissimilar metals, which are not permitted in this standard.

The second proposal was rejected because the standardization of materials will be safer, stronger, cleaner and may prevent confusion and mistakes by inadvertently soldering a positive pressure gas line.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 24

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 20

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF NEGATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

**EXPLANATION OF AFFIRMATIVE:**

**COMMITTEE ACTION:** Accept.
Additionally, the definition of Branch (lateral) Lines on Page No. 3 in the "New" Chapter 5 section sent in the package for the ROC Ballot is "Those sections or portions of the piping system that serve a room or group of rooms on the same story of a facility. On piping system, "There appears to be a conflict with the wording of Item No. 4. To eliminate conflicting wording add after the word "or" the following "below the finished floor level but within the floor slab."

RECOMMENDATION: The committee should reconsider and accept this proposal.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NEGATIVE: 2

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:

QUARNSTROM: The comment submitted to the Committee to reconsider proposal 99-288 which the Committee already discussed and rejected in the ballot on ROP. In the submission for reconsideration, no new information was included to support the need to change the current document by adding a new section 4-5.1.2.10(b)(12). The current document provides requirements that are adequate and no information has been provided by the submitter to show inadequacy of the current requirements.

FRAN: The comment submitted to the Committee to reconsider proposal 99-288 which the Committee already discussed and rejected in the ballot on ROP. In the submission for reconsideration, no new information was included to support the need to change the current document by adding a new section 4-5.1.2.10(b)(12). The current document provides requirements that are adequate and no information has been provided by the submitter to show inadequacy of the current requirements.

99-177 - (4-5.1.2.10(b)(12)): Accept

COMMITTEE STATEMENT: Accept.

COMMITTEE ACTION: Accept.

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-179 - (4-6): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The Technical Committee on Piping is going to extract 4-6.2.2 the language of 4-6.2.2 and insert it into Chapter 11, Laboratories.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-180 - (4-6): Accept in Part

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept in Part.

COMMITTEE STATEMENT: The requirements of 4-6.2.2 should be kept with the laboratory piped gas system requirements because it deals with the connection of laboratory systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NOT RETURNED: 1 Linder

99-181 - (4-6.1.2.3): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee directs that this proposal be returned to Committee. The committee's action was not clear. Are paragraph headers being revised, or text and substantiation being revised, or are the requirements of paragraph 4-5.4.1.3 being deleted?

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The paragraphs are being relocated to conform to the new format of Chapter 5.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-179 - (4-6): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The Technical Committee on Piping is going to extract 4-6.2.2 the language of 4-6.2.2 and insert it into Chapter 11, Laboratories.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-179 - (4-6): Accept

SUBMITTER: Technical Correlating Committee on Health Care Facilities

RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The Technical Committee on Piping is going to extract 4-6.2.2 the language of 4-6.2.2 and insert it into Chapter 11, Laboratories.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
99-182 - (4-6.2.3): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-309
RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 7
NOT RETURNED: 1 Linder

99-183 - (4-6.2.3 (New)): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-310
RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-184 - (4-6.2.3 (New)): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-310
RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 7
NOT RETURNED: 1 Linder

99-185 - (4-6.4.3 (New)): Accept
SUBMITTER: Technical Correlating Committee on Health Care Facilities
COMMENT ON PROPOSAL NO: 99-311
RECOMMENDATION: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
compressor is operating or a cylinder header is in use or a flag. A visible indication of the operating status of applications. (PIP)

Air and instrument air are distinct systems for mutually exclusive human respiration (eg. Surgical tools, ceiling arms, etc.) Medical air is air intended for the powering of medical devices unrelated to Instrument Air. (PIP)

to power such devices as hand pieces, syringes, and cleaning compressed air or nitrogen at <1100 kPa (<160 psi) gage pressure. A Level 3 source system that delivers Gas Powered Source System.

A normal source of oxygen disconnected. Connection to supply oxygen to a building which has had it's containers, pressure regulators, pressure relief devices, vaporizers, equipment that automatically supplies the system in the event of supply becomes exhausted. (PIP)

equipment that automatically supplies the system when the primary supply becomes exhausted. (PIP)

Where provided, that portion of the source supply. (PIP)

Where provided, that portion of the source. (PIP)

A Level 3 gas distribution system comprised of component parts including but not limited to cylinders, manifolds, air compressor, motor, receivers, controls, filters, dryers, valves and piping that delivers compressed air or nitrogen at pressures less than 1100 kPa (less than 160 psi) gage] to power devices (e.g. hand pieces, syringes, cleaning devices) as a power source. (PIP)

Level 1 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the piped medical gas and vacuum system would place patients in imminent danger of morbidity or mortality. (PIP)

Level 2 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the piped medical gas and vacuum system would place patients at manageable risk of morbidity or mortality. (PIP)

Level 3 Piped Gas Systems. Systems serving occupancies where interruption of the piped medical gas would terminate procedures but would not place patients at risk of morbidity or mortality. (PIP)

Level 3 Piped Vacuum Systems. A Level 3 vacuum distribution system that can be either a wet system, designed to remove liquids air/gas or solids from the treated area or a dry system designed to trap liquid and solids before the service inlet and to accommodate air/gas only through the service inlet. (PIP)

Supply Source.

Primary Supply. That portion of the source equipment that actually supplies the system. (PIP)

Secondary Supply. Where provided, that portion of the source equipment that automatically supplies the system when the primary supply becomes exhausted. (PIP)

Reserve Supply. Where provided, that portion of the source equipment that automatically supplies the system in the event of failure of the primary and secondary operating supply. (PIP)

Main Lines. The piping that connects the source (pumps, receivers etc.) to the risers or branches or both. (PIP)

Risers. The vertical pipes connecting the system main line(s) with the branch lines on the various levels of the facility. (PIP)

Branch (Lateral) Lines. Those sections or portions of the piping system that serve a room or group of rooms on the same story of a facility. (PIP)

Remote. A Level 3 source of supply which is accessed by exiting the single or multiple treatment facility. (PIP)

SCFM. Standard cubic feet per minute.
Scavenging. An alternate term for WAGD often applied in Level 3. (PIP)

Semi-permanent Connection. A non interchangeable connection, usually a D.I.S.S. connector which is the termination of the pipeline and that is intended only to be detached only for service. It is not the point at which the user makes connections or disconnections. (PIP)

Service Inlet. The pneumatic terminus of a Level 3 piped vacuum system. (PIP)

Service Outlet. The pneumatic terminus of a piped gas system for other than critical, continuous duty, nonflammable medical life support type gases such as oxygen, nitrous oxide or medical air. (PIP)

Single Treatment Facility. A diagnostic or treatment complex under a single management comprising a number of use points, but confined to a single contiguous group of use points (i.e. does not involve widely separated locations or separate distinct practices). (PIP)

Multiple Treatment Facility. A diagnostic or treatment complex under a single management comprising a number of single treatment facilities, which can be accessed one from the other without exiting the facility (i.e. does not involve widely separated locations or separate distinct practices).

Station Inlet. An inlet point in a piped medical/surgical vacuum distribution system at which the user makes connections and disconnections. (PIP)

Station Outlet. An outlet point in a piped medical gas distribution system at which the user makes connections and disconnections. (PIP)

Surface-Mounted Medical Gas Rail. A surface-mounted gas delivery system intended to provide ready access for two or more gases through a common delivery system to provide multiple gas station outlet locations within a single patient room or critical care area. (PIP)

Use Point. A location with any number of station outlets and inlets arranged for access by a practitioner during treatment of a patient. (PIP)

Utility Center (J Box). A type of terminal enclosure for utilities (e.g., gas power, vacuum, water, electrical power, etc.) used in office-based occupancies. (PIP)

WAGD Interface. A device provided on the anesthesia gas machine that connects the WAGD network to the patient breathing circuit. (PIP)

Waste Anesthetic Gas Disposal (WAGD). The process of capturing and carrying away gases vented from the patient breathing circuit during the normal operation of gas anesthesia or analgesia equipment. (PIP)

Chapter 5

5.1 Level I Piped Gas and Vacuum Systems

5.1.1 Applicability

5.1.1.1 These requirements apply to health care facilities requiring Level 1 systems as referenced in Chapters 13 through 21.

5.1.1.2 Wherever the terms medical gas or vacuum occur, the provisions shall apply to all piped systems for oxygen, nitrous oxide, medical air, carbon dioxide, helium, nitrogen, medical/surgical vacuum, waste anesthetic gas disposal, and mixtures thereof. Wherever the name of a specific gas or vacuum service occurs, the provision applies only to that gas.

5.1.1.3 An existing system that is not in strict compliance with the provisions of this standard shall be permitted to be continued in use as long as the authority having jurisdiction has determined that such use does not constitute a distinct hazard to life.

5.1.2 Nature of Hazards of Gas and Vacuum Systems. Potential fire and explosion hazards associated with medical gas central piping systems and medical-surgical vacuum systems shall be considered in the design, installation, testing, operation and maintenance of these systems.

5.1.3 Level I Sources

5.1.3.1 Central Supply System Identification and Labeling

5.1.3.1.1 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.

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

5.1.3.1.3 Contents of cylinders and containers shall be verified prior to use.

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

5.1.3.1.5 Locations containing medical gases other than oxygen and medical air shall have their door(s) labeled substantially as follows: CAUTION Medical Gases No Smoking or Open Flame Room May Have Insufficient Oxygen Open Door and Allow Room to Ventilate before Entering

5.1.3.1.6 Locations containing central supply systems or cylinders containing only oxygen or medical air shall have their door(s) labeled as follows: CAUTION Medical Gases NO Smoking or Open Flame

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 Cylinders and containers shall be handled in strict accordance with 5.1.13.

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

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

5.1.3.2.5 Wooden racks for cylinder storage shall be permitted.

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 not in use shall have their valve protection caps secured tightly in place.

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

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

5.1.3.3 Central Supply System Locations

5.1.3.3.1 Central Supply Systems shall be located to meet the following criteria:

5.1.3.3.1.1 Any of the following systems shall be permitted to be located together in the same outdoor enclosure:

(1) Manifolds for gas cylinders without reserve supply. (See 5.1.5.4.9.)
(2) Manifolds for gas cylinders with reserve supply
(3) Manifolds for Cryogenic Liquid Cylinders. (See 5.1.3.4.10.)
(4) Bulk Cryogenic Liquid Systems. (See 5.1.3.4.11.)
5.1.3.3.1.2 Any of the following systems shall be permitted to be located together in the same indoor enclosure:
(1) Manifolds for Gas Cylinders without Reserve Supply. (See 5.1.3.4.9.)
(2) Manifolds for Gas Cylinders with Reserve Supply
(3) Manifolds for oxy-hydrogen liquid cylinders. (See 5.1.3.4.10.)
(4) In-building emergency reserves. (See 5.1.3.4.13.)
(5) Instrument air standby headers. (See 5.1.3.8.4.)

5.1.3.3.1.3 Any of the following systems shall be permitted to be located together in the same room:
(1) Medical air compressor supply sources. (See 5.1.3.5.3.)
(2) Medical/surgical vacuum sources. (See 5.1.3.6.)
(3) Waste anaesthetic gas disposal (WAGD) sources (see 5.1.3.7)
(4) Instrument air sources. (See 5.1.3.8.)

5.1.3.3.1.4 Any system listed under 5.1.3.3.1 shall not be located in the same room with any system listed under 5.1.3.3.1.1 or 5.1.3.3.1.2, except medical air or instrument air reserve headers complying with 5.1.3.4.13.

5.1.3.3.1.5 Locations shall be chosen to permit access by delivery vehicles and maintenance of cylinders (e.g., proximity to loading docks, access to elevators, passage of cylinders through public areas).

5.1.3.3.1.6 Indoor locations for oxygen, nitrous oxide, and mixtures of these gases shall not communicate with the following:
(1) Areas involved in critical patient care
(2) Anesthetizing locations
(3) Locations storing flammables
(4) Rooms containing open electrical contacts or transformers
(5) Storage tanks for flammable or combustible liquids
(6) Engines
(7) Kitchens
(8) Areas with open flames

5.1.3.3.1.7 Cylinders in use and in storage shall be prevented from reaching temperatures in excess of 54°C (130°F).

5.1.3.3.1.8 Central supply systems for nitrous oxide and carbon dioxide shall be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer, but shall never be lower than –7°C (20°F) or greater than 54°C (130°F).

5.1.3.3.1.9 Central supply systems for oxygen with a total capacity connected and in storage of 566.335 L (20,000 ft3) or more at Standard Temperature and Pressure (STP) shall comply with NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.

5.1.3.3.1.10 Central supply systems for nitrous oxide with a total capacity connected and in storage of 1,451 kg (3,200 lbs) or more shall comply with CGA G8.1, Standard for the Installation of Nitrous Oxide Systems at Consumer Sites.

5.1.3.3.2 Design and Construction. Locations for central supply systems and the storage of medical gases shall meet the following requirements:
(1) Be constructed with access to move cylinders, equipment, etc., in and out of the location.
(2) Be secured with lockable doors or gates or otherwise secured.
(3) If outdoors, be provided with an enclosure (wall or fencing) constructed of non-combustible materials.
(4) If indoors, be constructed and using interior finishes of non-combustible or limited combustible materials such that all walls, floors, ceilings and doors are of a minimum one-hour fire resistance rating.
(5) Be compliant with NFPA 70, National Electrical Code for ordinary locations, with electrical devices located at or above 1,520 mm (5 ft) above finished floor to avoid physical damage.
(6) Be heated by indirect means (e.g., steam, hot water) if heat is required.
(7) Be provided with racks, chains, or other fastenings to individually secure all cylinders, whether connected, unconnected, full, or empty, from falling.
(8) Be supplied with electrical power compliant with the requirements for Essential Electrical Systems as described in Chapter 4 of this document.
(9) Have racks, shelves, and supports, where provided, constructed of non-combustible materials or limited combustible materials.

5.1.3.3.3 Ventilation
5.1.3.3.3.1 Ventilation of Locations for Manifolds. Locations containing central supply systems or used for storing medical gas containers shall be ventilated to prevent the accumulation of medical gases from leaks and operation of cylinder or manifold overpressure safety devices as follows:
(1) Indoor supply systems shall have all relief valves vented per 5.1.3.4.5.1 (5) through (9).
(2) Where the total volume of medical gases connected and in storage is greater than 84,950 L (3,000 ft3) at STP, indoor supply locations shall be provided with dedicated mechanical ventilation systems that draw air from within 300 mm (1 ft) of the floor and operate continuously.
(3) The power supply for mechanical ventilation fans shall conform to the requirements of an essential electrical system as described in Chapter 4 of this document.
(4) Where the total volume of medical gases connected and in storage is less than 84,950 L (3,000 ft³) at STP or the only compressed gas in the room is medical air, natural ventilation shall be permitted to be employed.
(5) Where natural ventilation is permitted, it shall consist of two louvered openings, each having a minimum free area of 46,500 mm² (72 in²), with one located within 300 mm (1 ft) of the floor and one located within 300 mm (1 ft) of the ceiling.
(6) Louvered natural ventilation openings shall not be located in an exit access corridor.
(7) Mechanical ventilation shall be provided if the requirements of 5.1.3.3.3.1 (6) cannot be met.

5.1.3.3.3.2 Ventilation for Motor Driven Equipment. The following source locations shall be adequately ventilated to prevent accumulation of heat:
(1) Medical Air Sources. (See 5.1.3.5)
(2) Medical/Surgical vacuum Sources. (See 5.1.3.6)
(3) Waste Anesthetic Gas Disposal (WAGD) Sources. (See 5.1.3.7)
(4) Instrument Air Sources. (See 5.1.3.8)

5.1.3.3.3.3 Ventilation for Outdoor Locations. 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.

5.1.3.3.4 Storage
5.1.3.3.4.1 Full or empty medical gas cylinders when not connected shall be stored in locations complying with 5.1.3.3.2 through 5.1.3.3.5 and shall be permitted to be in the same room or enclosures as their respective central supply systems.

5.1.3.3.4.2 Central Supply Systems. (see Fig A.5.1.3.4) Central supply systems shall be permitted to consist of the following:
(1) Cylinder manifolds for gas cylinders per 5.1.3.4.9
(2) Manifolds for cryogenic liquid cylinders per 5.1.3.4.10
(3) Bulk cryogenic liquid systems per 5.1.3.5.1
(4) Medical air compressor systems per 5.1.3.5.2
(5) Medical/Surgical vacuum producers per 5.1.3.6
(6) WAGD producers per 5.1.3.7
(7) Instrument Air compressor systems per 5.1.3.8.

5.1.3.3.4.3 Central supply systems shall be obtained from and installed in accordance with the instructions of a supplier familiar with their proper construction and use.

5.1.3.3.4.4 Central supply systems for oxygen, medical air, nitrous oxide, carbon dioxide, nitrogen and all other medical gases shall not be piped to, or used for, any purpose except patient care applications.

5.1.3.3.4.5 Materials used in central supply systems shall meet the following requirements:
(1) In those portions of systems intended to handle oxygen at pressures greater than 2070 kPa (300 psi) gage, be made of materials having a resistance to combustion not lower than that of red brass in ASTM STP 1197 and contain no polymeric materials.
(2) In those portions of systems intended to handle oxygen or nitrous oxide at pressures less than 2070 kPa (300 psi) gage, be constructed of materials that are compatible with oxygen under the following conditions and pressures to which the components may be exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases or mixtures containing more than 23.5 percent oxygen.

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(3) If potentially exposed to cryogenic temperatures, be designed for low temperature service.
(4) If intended for outdoor installation, be listed and approved for outdoor use.

5.1.3.4.4 Regulators

5.1.3.4.4.1 All positive pressure central supply systems shall be provided with duplex final line pressure regulators, installed in parallel with isolation valves before each regulator and an isolation or check valve after each regulator permitting service to either regulator without interruption of supply.

5.1.3.4.4.2 The pressure indicator(s) shall be located downstream of each regulator or immediately downstream of the isolating valves for the regulators.

5.1.3.4.5 Relief Valves

5.1.3.4.5.1 All positive pressure central supply systems shall be provided with at least one relief valve that meets the following requirements:
(1) Is of brass, bronze, or stainless steel construction
(2) Is designed for the gas service
(3) Is located between the final line regulator outlet valve and the source valve.
(4) Is set at 50 percent above the normal system operating pressure. (See Table 5.1.11.)
(5) Is vented to the outside of the building, except that relief valves for air systems having less than 84,900 L (3,000 ft³) at STP shall be permitted to be diffused locally.
(6) Is connected, when vented outside, to a vent line sized at least at the full size of the relief valve outlet.
(7) Where multiple relief valves discharge into a common vent line, have a cross-sectional internal area of the common line that equals or exceeds the aggregate internal discharge areas of all of the relief valves served.
(8) When vented outside, discharges in areas away from flammable materials and not where a passerby may be endangered by the discharge.
(9) When vented outside, is turned down and screened at the discharge end to prevent the entry of water or vermin.

5.1.3.4.5.2 When vented outside, materials for relief valve vent lines shall comply with 5.1.10.1.

5.1.3.4.6 Multiple Pressures. Where a single central supply system supplies two piped distribution networks operating at different pressures, each piped distribution network shall be separately provided with all elements in 5.1.3.4.

5.1.3.4.7 Local Signals

5.1.3.4.7.1 The following systems shall have local signals located at the source equipment:
(1) Manifolds for gas cylinders without reserve supply (see 5.1.3.4.9)
(2) Manifolds for gas cylinders with reserve supply
(3) Manifolds for cryogenic liquid cylinders. (See 5.1.3.4.10.)
(4) Bulk cryogenic liquid systems (See 5.1.3.4.11.)
(5) In-building emergency reserves (See 5.1.3.4.13.)
(6) Instrument air headers. (See 5.1.3.8.4.)

5.1.3.4.7.2 The local signals shall meet the following requirements:
(1) Provide visual indication only.
(2) Be labeled for the service and condition being monitored.
(3) If used outdoors, be listed and approved for outdoor use.

5.1.3.4.8 Headers. [See Figure A-5.1.3.4.8] In central supply systems using cylinders containing either gas or liquid, each header shall include the following:
(1) Cylinder connections in the number required for the header’s application.
(2) A cylinder lead for each cylinder constructed of materials complying with 5.1.3.4.3 and provided with end fittings permanently attached to the cylinder lead complying with CGA Paragraph V-1, Standard for Compressed Gas Cylinder Valve Outlet and Fitting Connections, (ANSI B57. 1).
(3) A filter of a material complying with 5.1.3.4.3 to prevent the intrusion of debris into the manifold controls.
(4) A header shutoff valve downstream of the nearest cylinder connection, but upstream of the point at which the header connects to the central supply system.
(5) A pressure indicator indicating header contents.

5.1.3.4.9 Manifolds for Gas Cylinders without Reserve Supply (See Figure A-5.1.3.4.9.)

5.1.3.4.9.1 The manifolds in this category shall be located in accordance with 5.1.3.3.1 and the following:
(1) If located outdoors, be installed in an enclosure used only for this purpose and sited to comply with minimum distance requirements in Table A-2.2 in NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.
(2) If located indoors, be installed within a room used only for this purpose.

5.1.3.4.9.2 The manifold locations in this category shall be constructed in accordance with 5.1.3.3.2.

5.1.3.4.9.3 The manifolds locations in this category shall be ventilated in accordance with 5.1.3.3.3.

5.1.3.4.9.4 The manifolds in this category shall consist of the following:
(1) Two equal headers in accordance with 5.1.3.4.8, with each having a sufficient number of gas cylinder connections for an average day’s supply but not fewer than two connections, and with the headers connected to the final line pressure regulator assembly in such a manner that either header may supply the system.
(2) An intermediate relief valve(s), piped to the outside in accordance with 5.1.3.4.5.1(5-9), that protects the piping between the header pressure regulator and the line pressure regulator assembly, and protects the line pressure regulators from over pressure in the event of a header regulator failure.

5.1.3.4.9.5 The manifolds in this category shall include an automatic means of alternating the two headers to accomplish the following in normal operation:
(1) One header is the primary and the other is the secondary, with either being capable of either role.
(2) When the primary header is supplying the system, the secondary header is prevented from supplying the system.
(3) When the primary header is depleted, the secondary header shall automatically begin to supply the system.

5.1.3.4.9.6 The manifolds in this category shall actuate a local signal and shall activate an indicator at all master alarm panels when or at a predetermined set point before the secondary header begins to supply the system, indicating changeover has occurred or is about to occur.

5.1.3.4.9.7 If manifolds in this category are located outdoors, they shall be listed and approved for outdoor use.

5.1.3.4.10 Manifolds for Cryogenic Liquid Cylinders (see Figure A-5.1.3.4.10).

5.1.3.4.10.1 The manifolds in this category shall be located in accordance with 5.1.3.3.1 and the following:
(1) If located outdoors, be installed in an enclosure used only for this purpose and sited to comply with minimum distance requirements in Table A-2.2 in NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.
(2) If located indoors, be installed within a room used only for this purpose.

5.1.3.4.10.2 The manifolds in this category shall have their primary and secondary headers located in the same enclosure.

5.1.3.4.10.3 The reserve header shall be permitted to be located in the same enclosure as the primary and secondary headers or in another enclosure compliant with 5.1.3.4.10.1.
5.1.3.4.10.4 The manifolds in this category shall consist of the following:
(1) Two equal headers per 5.1.3.4.8 each having sufficient number of liquid cylinder connections for an average day’s supply but not fewer than two connections, and with the headers connected to the final line pressure regulator assembly in such a manner that either header may supply the system.
(2)* A reserve header per 5.1.3.4.8 having sufficient number of gas cylinder connections for an average day’s supply but not fewer than three connections, and connected downstream of the primary/secondary headers and upstream of the final line pressure regulators.
(3) A pressure relief valve set at or below the relief pressure for the cryogenic liquid cylinders and installed downstream of the connection of the reserve header and upstream of the final line pressure regulating assembly.

5.1.3.4.10.5 The manifolds in this category shall include an automatic means of controlling the three headers to accomplish the following during normal operation:
(1) One cryogenic liquid header is the primary and the other is the secondary, with either being capable of either role.
(2) When the primary header is supplying the system, the secondary header is prevented from supplying the system.
(3) When the primary header is depleted, the secondary header automatically begins to supply the system.

5.1.3.4.10.6 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. This mechanism shall discharge the conserved gas into the system upstream of the final line regulator assembly.

5.1.3.4.10.7 The manifolds in this category 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.

5.1.3.4.10.8 The manifolds in this category shall include a means to automatically activate the Reserve Header if for any reason the primary and secondary headers cannot supply the system.

5.1.3.4.10.9 The manifolds 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 secondary header begins to supply the system, indicating changeover.
(2) When or at a predetermined set point before the reserve header begins to supply the system, indicating reserve is in use.
(3) When or at a predetermined set point before the reserve header contents fall to one day’s average supply, indicating reserve low.

5.1.3.4.11 Bulk Cryogenic Liquid Systems (See Figure A-5.1.3.4.11.)

5.1.3.4.11.1 Bulk Cryogenic Liquid Systems shall be located outdoors as follows:
(1) In an enclosure located to comply with minimum distance requirements in Table A-2.2 in NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.
(2) In an enclosure constructed per 5.1.3.3.2(1) through (3) and (5), (8), (9).
(3) In an enclosure ventilated per 5.1.3.3.3.
(4) In compliance with CGA, Guidelines for Medical Gas Installations at Consumer Sites.

5.1.3.4.11.2 Bulk cryogenic liquid systems shall be sited as follows:
(1) The supply system shall be anchored firmly to a poured concrete pad, appropriate for the weight, surface loading and complying with local seismic requirements.
(2) The site shall be completely enclosed as per 5.1.3.2.8(3) with the poured concrete pad (equipment pad) completely filling the enclosed space.
(3)* The location intended for the delivery vehicle (the vehicle pad) shall comply with NFPA 50.
(4) The location intended for the delivery vehicle connection shall be concrete.
(5) Drainage from the equipment pad and vehicle pad shall be away from any building, parked vehicles, or other potential sources of ignition.
(6) No drain shall be located within the pad or closer than 2450 mm (8 ft) from the edge of the pad.

5.1.3.4.11.3 Bulk cryogenic liquid sources shall consist of the following:
(1) One or more main supply vessel(s), whose capacity shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the emergency plan.
(2) A contents gauge on each of the main vessel(s).
(3) 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.

5.1.3.4.11.4 Bulk cryogenic liquid sources shall include a reserve supply, including either or both of the following:
(1) A second cryogenic liquid vessel, including an actuating switch/sensor monitoring internal pressure, a contents gauge, and a check valve to prevent backflow into the reserve system.
(2) A cylinder header per 5.1.3.4.8 having sufficient gas cylinder connections for an average day’s supply but not fewer than three and including a contents pressure switch.

5.1.3.4.11.5 Bulk cryogenic liquid sources shall operate so as to provide the following functions:
(1) When the main supply is supplying the system, the reserve supply shall be prevented from supplying the system until the main supply fails or is depleted, at which point the reserve supply shall automatically begin to supply the system.
(2) Where there is more than one main supply vessel, the system shall operate as described in 5.1.3.4.10 for primary/secondary reserve operation.
(3) Two or more cryogenic vessels shall be permitted to alternate (e.g. on a timed basis) in the roles of primary, secondary and reserve, providing an operating cascade (primary-secondary-reserve) as required in 5.1.3.4.10.4 is maintained at all times.
(4) In the case of a cryogenic vessel used as the reserve, the reserve vessel shall include a means to conserve the gas produced by evaporation of the cryogenic liquid in the reserve vessel and to discharge the gas into the line upstream of the final line regulator assembly as required in 5.1.3.4.10.6.

5.1.3.4.11.6 The bulk systems shall actuate a local signal and an alarm at the required master alarms under the following conditions:
(1) When or at a predetermined set point before the main supply reaches an average day’s supply, indicating low contents.
(2) When or at a predetermined set point before the reserve supply begins to supply the system, indicating reserve is in use.
(3) When or at a predetermined set point before the reserve supply contents fall to one day’s average supply, indicating reserve low.
(4) 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.
(5) Where there is more than one main supply vessel, when or at a predetermined set point before the secondary vessel begins to supply the system, indicating changeover.

5.1.3.4.12 Emergency Oxygen Supply Connection (EOSC) (See Figure A-5.1.3.4.12.) EOSC(s) shall be installed to permit connection of a temporary auxiliary source of supply for emergency or maintenance situations under the following conditions:
(1) Where the bulk cryogenic liquid central supply system is outside of and remote from the building which the oxygen supply serves.
(2) Where there is not in the building a connected oxygen reserve sufficient for an average day’s supply. (See 5.1.3.4.13 for requirements for such reserves.)
(3) Where multiple freestanding buildings are served from a single oxygen source such that damage to the interconnecting oxygen line could result in one or more buildings losing oxygen supply.
(4) In this situation, each building shall be provided with a separate emergency connection.

5.1.3.4.12.1 EOSCs shall be located as follows:
(1) On the exterior of the building served in a location accessible by emergency supply vehicles at all times in all weather conditions.
(2) Be connected to the main supply line immediately downstream of the main shutoff valve.
5.1.3.4.12.2 EOSCs shall consist of the following:
(1) Physical protection to prevent unauthorized tampering
(2) A female DN (NPS) inlet for connection of the emergency oxygen source that is sized for 100 percent of the system demand at the emergency source gas pressure.
(3) A manual shutoff valve to isolate the EOSC when not in use.
(4) Two check valves, one downstream of the EOSC and one downstream of the main line shutoff valve, with both upstream from the tee connection for the two pipelines.
(5) A relief valve sized to protect the downstream piping system and related equipment from exposure to pressures in excess of 50 percent higher than normal line pressure.
(6) Any valves necessary to allow connection of an emergency supply of oxygen and isolation of the piping to the normal source of supply.

5.1.3.4.13 In-Building Emergency Reserves
5.1.3.4.13.1 In building emergency reserves shall not be used as substitutes for bulk gas reserves as required in 5.1.3.4.11.4.
5.1.3.4.13.2 If a reserve is provided inside the building as a substitute for the Emergency Oxygen Supply Connection, it shall be located in accordance with 5.1.3.3 as follows:
(1) In a room or enclosure constructed per 5.1.3.3.2.
(2) In a room or enclosure ventilated per 5.1.3.3.3.
(3) In a room or enclosure constructed per 5.1.3.3.2.
(4) A manifold for gas cylinders complying with 5.1.3.4.8 with sufficient cylinder connections to provide for at least an average days supply.

5.1.3.4.13.5 In-building emergency reserves shall include a check valve in the main line placed on the distribution system side of the ordinary source’s main line valve to prevent flow of gas from the Emergency Reserve to the ordinary source.
5.1.3.4.13.6 In-building emergency reserves shall actuate a local signal and at all master alarms when or just before it begins to serve the system.

5.1.3.5 Level 1 Medical Air Supply Systems
5.1.3.5.1 * Quality of Medical Air. Medical air shall comply with the following:
(1) Is supplied from cylinders, bulk containers, medical air compressor sources, or has been reconstituted from oxygen USP and oil free, dry Nitrogen NF.
(2) Meets the requirements of Medical Air USP.
(3) Has no detectable liquid hydrocarbons.
(4) Has less than 25 ppm gaseous hydrocarbons.
(5) Has equal to or less than 5 milligrams/cubic meter of permanent particulates sized 1 micron or larger in the air at normal atmospheric pressure.

5.1.3.5.2 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.

5.1.3.5.3 Medical Air Compressor Sources. (See Figure A-5.1.3.5)
5.1.3.5.3.1 Medical air compressor systems shall be located per 5.1.3.5 as follows:
(1) Indoors in a dedicated mechanical equipment area, adequately ventilated and with any required utilities (e.g., electricity, drains, lighting, etc)
(2) In a room constructed per 5.1.3.3.2.
(3) In a room ventilated per 5.1.3.3.2.
(4) For air-cooled equipment, in a room designed to maintain the ambient temperature range as recommended by the manufacturer.

5.1.3.5.3.2 Medical air compressor systems shall consist of the following:
(1) Components complying with 5.1.3.5.4 through 5.1.3.5.10 arranged per 5.1.3.5.11
(2) An automatic means to prevent backflow from all on-cycle compressors through all off-cycle compressors
(3) A manual shutoff valve to isolate each compressor from the centrally piped system and from other compressors for maintenance or repair without loss of pressure in the system.
(4) Intake filter-muffler(s) of the dry type.
(5) Pressure relief valve(s) set at 50 percent above line pressure.
(6) Piping between the compressor and the source shutoff valve shall be compatible with oxygen, not contribute to contaminant levels and be cleaned for oxygen use.

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

5.1.3.5.4 Compressors for Medical Air
5.1.3.5.4.1 Compressors for medical air shall be designed to prevent the introduction of contaminants or liquid into the pipeline by either of the following methods:
(1) Elimination of oil anywhere in the compressor (e.g., liquid ring and permanently sealed bearing compressors).
(2) A* separation of the oil-containing section from the compression chamber by at least two seals creating an area open to atmosphere that allows the following:
   a. direct and unobstructed visual inspection of the interconnecting shaft through vent and inspection openings no smaller than 1.5 shaft diameters in size.
   b. the facility operators to confirm proper seal operation by direct visual inspection through the above shaft opening, without disassembly of the compressor (e.g., extended head compressors with an atmospheric vent between the compression chamber and the crankcase).

5.1.3.5.4.2 For liquid ring compressors, service water and seal water of a quality recommended by the compressor manufacturer shall be used.

5.1.3.5.4.3 Compressors shall be permitted to be constructed of ferrous and/or non-ferrous materials.

5.1.3.5.4.4 Anti-vibration mountings shall be installed for compressors as required by equipment dynamics or location and in accordance with the manufacturer’s recommendations.

5.1.3.5.4.5 Flexible connectors shall connect the air compressors with their intake and outlet piping.

5.1.3.5.5 Aftercoolers. Aftercoolers, where required, shall be provided with individual condensate traps. The receiver shall not be used as an aftercooler or aftercooler trap.

5.1.3.5.5.1 Aftercoolers shall be permitted to be constructed of ferrous and/or non-ferrous materials.

5.1.3.5.5.2 Anti-vibration mountings shall be installed for aftercoolers as required by equipment dynamics or location and in accordance with the manufacturer’s recommendations.

5.1.3.5.6 Medical Air Receivers. Receivers for medical air shall meet the following requirements:
(1) Be made of corrosion resistant materials or otherwise made corrosion resistant.
(2) Comply with Section VIII, Unfired Pressure Vessels, of the ASME Boiler and Pressure Vessel Code
(3) Be equipped with a pressure relief valve, automatic drain, manual drain, sight glass, and pressure indicator.
(4) Be of a capacity sufficient to prevent the compressors from short-cycling.

5.1.3.5.7 Medical Air Dryers. Medical air dryers shall meet the following requirements:
(1) Be designed to provide air at a maximum dew point which is below the frost point (6°C (32°F)) at any level of demand.
(2) Be sized for 100 percent of the system peak calculated demand at design conditions.
(3) Be permitted to be constructed of ferrous and/or non-ferrous materials.
(4) Be provided with anti-vibration mountings installed as required by equipment dynamics or location and in accordance with the manufacturer’s recommendations.
5.1.3.5.8 Medical Air Filters. Medical air filters shall meet the following requirements:
(1) Be appropriate for the intake air conditions.
(2) Be located upstream of the final line regulators.
(3) Be sized for 100 percent of the system peak calculated demand at design conditions and shall be rated for a minimum of 98 percent efficiency at 1 micron or greater.
(4) Be equipped with a continuous visual indicator showing the status of the filter element life.
(5) Be permitted to be constructed of ferrous and/or non-ferrous materials.

5.1.3.5.8.1 Compressors complying with 5.1.3.5.4.1(2) shall be provided with:
(1) Coalescing filters with element change indicators.
(2) Charcoal absorbers with colormetric hydrocarbon indicators.

5.1.3.5.9 Medical Air Regulators. Medical air regulators shall meet the following requirements:
(1) Be sized for 100 percent of the system peak calculated demand at design condition.
(2) Be permitted to be constructed of ferrous and/or non-ferrous materials.
(3) Be equipped with a pressure indicator indicating delivery pressure.

5.1.3.5.10 Medical Air Local Alarm. A local alarm complying with 5.1.9.4 shall be provided for the medical air compressor source.

5.1.3.5.11 Piping Arrangement and Redundancies

5.1.3.5.11.1 Component arrangement shall be as follows:
(1) Components shall be arranged to permit service and a continuous supply of Medical Air in the event of a single fault failure.
(2) Component arrangement shall be permitted to vary as required by the technology(ies) employed, provided an equal level of operating redundancy and Medical Air quality is maintained.

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

5.1.3.5.11.3 When aftercoolers are provided, they shall be sufficient to serve the peak calculated demand with the largest single aftercooler out of service and provided with valves adequate to remove them from the system without shutting down supply of medical air.

5.1.3.5.11.4 Medical air receiver(s) shall be provided with a three-valve bypass to permit service to the receiver without shutting down the medical air system.

5.1.3.5.11.5 Dryers, filters, and regulators shall be at least duplexed with each component sized to serve the peak calculated demand with the largest of each component out of service.

5.1.3.5.11.6 (see Figure A-5.1.3.5.11.6) Dryers, filters, and regulators shall be provided with manual valves upstream and manual valves or check valves downstream to allow service to the components without shutting down the system as follows:
(1) Installed for each component, upstream and downstream of each component allowing each to be individually isolated, or
(2) Installed upstream and downstream of components in series so as to create redundant parallel branches of components.

5.1.3.5.11.7 Three way, indexed to flow, full port valves shall be permitted to be used to isolate each branch or component for the purposes of 5.1.3.5.11.6.

5.1.3.5.11.8 Under normal operation, only one aftercooler shall be open to airflow with the other aftercooler valved off.

5.1.3.5.11.9 Under normal operation, only one dryer-filter(s)-regulator sequence shall be open to airflow with the other sequence valved off.

5.1.3.5.11.10 If the relief valve required in 5.1.3.5.3.2(5) and 5.1.3.5.6(3) is installed in parallel sequence:
(1) Be appropriate for the intake air conditions.
(2) Be located upstream of the final line regulators.
(3) Be sized for 100 percent of the system peak calculated demand at design conditions and shall be rated for a minimum of 98 percent efficiency at 1 micron or greater.
(4) Be equipped with a continuous visual indicator showing the status of the filter element life.
(5) Be permitted to be constructed of ferrous and/or non-ferrous materials.

5.1.3.5.11.11 A DN8 (NPS 1/4) valved sample port shall be located upstream of the final line pressure regulators, Dew Point Monitor, and Carbon Monoxide Monitor and upstream of the source shutoff valve to allow for sampling of the medical air.

5.1.3.5.11.12 Medical air source systems shall be provided with a source valve per 5.1.4.4.

5.1.3.5.11.13 Where medical air piping systems at different operating pressures are required, the piping shall separate after the filters, but shall be provided with separate line regulators, dew point monitors, relief valves, and source shutoff valves.

5.1.3.5.12 Electrical Power and Control

5.1.3.5.12.1 Additional compressor(s) shall automatically activate when the compressor(s) in operation is(are) incapable of maintaining the required pressure.

5.1.3.5.12.2 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.

5.1.3.5.12.3 Each compressor motor shall be provided with electrical components including but not limited to the following:
(1) A dedicated disconnect switch installed in the electrical circuit ahead of each motor starter.
(2) Motor starting device.
(3) Overload protection.
(4) Where compressor systems having two or more compressors employ a control transformer or other voltage control power device, at least two such devices shall be installed.

5.1.3.5.12.4 Where compressor systems having two or more compressors employ a control transformer or other voltage control power device, at least two such devices shall be installed.

5.1.3.5.13 Compressor Intake.

5.1.3.5.13.1 The Medical Air compressors shall draw their air from a source of clean air located where no contamination is anticipated from engine exhausts, fuel storage vents, Medical/Surgical vacuum system discharges, particulate matter, odor of any type.

5.1.3.5.13.2 The compressor air intake shall be located outdoors above roof level, at a minimum distance of 3050 mm (10 ft) from any door, window, exhaust, other intake, or opening in the building and a minimum distance of 6100 mm (20 ft) above the ground.

5.1.3.5.13.3 If an air source equal to or better than outside air (e.g., air already filtered for use in operating room ventilating systems) is available, it shall be permitted to be used for the medical air compressors provided:
(1) This alternate source of supply air shall be available on a continuous 24-hour-per-day, 7-day-per-week basis.
(2) Ventilating systems having fans with motors or drive belts located in the air stream shall not be used as a source of medical air intake.

5.1.3.5.13.4 Compressor intake piping shall be of materials approved for vacuum piping under 5.1.10.2.1 that will not add contaminants in the form of particulate matter, odor, or other gases.

5.1.3.5.13.5 Air intakes for separate compressors shall be permitted to be joined together to one common intake if the following conditions are met:
(1) The common intake is sized to minimize back pressure in accordance with the manufacturer's recommendations.
(2) Each compressor can be isolated by manual or check valve, blind flange, or tube cap to prevent open inlet piping when compressor(s) are removed for service and consequent backflow of room air into the other compressor(s).
5.1.3.5.14 Operating Alarms and Local Signals. Medical Air systems shall be monitored for conditions that may affect air quality during use or in the event of failure, based on the type of compressor(s) used in the system.

5.1.3.5.14.1 Where liquid ring air compressors, compressors having water-cooled heads, or water cooled aftercoolers are used, air receivers shall be equipped with a high water level sensor that shuts down the compressor system and activates a local alarm indicator. [See 5.1.9.4.3 (7)]

5.1.3.5.14.2 Where liquid ring compressors are used, each compressor shall have a liquid level sensor in each air/water separator which, when the liquid level is above the design level, shuts down its compressor and activates a local alarm indicator. [See 5.1.9.4.3(8)]

5.1.3.5.14.3 Where non-liquid ring compressors compliant with 5.1.3.5.4.1 (1) are used, the air temperature at the immediate outlet of each compressor cylinder shall be monitored by a high temperature sensor that shuts down that compressor and activates a local alarm indicator. [See 5.1.9.4.3(9)] The temperature setting shall be as recommended by the compressor manufacturer.

5.1.3.5.14.4 Where compressors compliant with 5.1.3.5.4.1 (2) are used, the following requirements shall apply:
   1. The air temperature at the immediate outlet of each compressor cylinder shall be monitored by a high temperature sensor that shuts down that compressor and activates a local alarm indicator. [See 5.1.9.4.3(9)] The temperature setting shall be as recommended by the compressor manufacturer.
   2. Coalescing filters with element change indicator shall be provided.
   3. Charcoal filters with colorimetric hydrocarbon indicator shall be provided.
   4. Liquid hydrocarbons shall be monitored on a continuous basis by pigment indicator or other type of instrument permanently installed downstream of each compressor and shall be inspected and documented daily.
   5. Gaseous hydrocarbons shall be monitored on a quarterly basis.

5.1.3.5.14.5 When the backup or lag compressor is running, a local alarm shall activate. [See 5.1.9.4.3(1)]

5.1.3.5.15 Medical Air Quality Monitoring. Medical air quality shall be monitored downstream of the Medical Air regulators and upstream of the piping system as follows:
   1. Dew point shall be monitored and shall activate a local alarm and all master alarms when the dew point at system pressure exceeds +4°C (+39°F).
   2. Carbon monoxide shall be monitored and shall activate a local alarm when the CO level exceeds 10 ppm.

5.1.3.5.16 Medical/Surgical Vacuum Supply Systems

5.1.3.6.1 Medical/Surgical Vacuum Sources. (See Fig. A-5.1.3.6.)

5.1.3.6.1.1 Medical/surgical vacuum sources shall be located per 5.1.3.5 as follows:
   1. Indoors in a dedicated mechanical equipment area, adequately ventilated and with any required utilities.
   2. In a room constructed per 5.1.3.3.2.
   3. In a room ventilated per 5.1.3.3.3.
   4. For air-cooled equipment, in a room designed to maintain the ambient temperature range as recommended by the equipment manufacturer.

5.1.3.6.1.2 Medical/surgical vacuum sources shall consist of the following:
   1. Two or more vacuum pumps sufficient to serve the peak calculated demand with the largest single vacuum pump out of service.
   2. An automatic means to prevent backflow from any on-cycle vacuum pumps through any off-cycle vacuum pumps.
   3. A shut-off valve or other isolation means to isolate each vacuum pump from the centrally piped system and other vacuum pumps for maintenance or repair without loss of vacuum in the system.
   4. A vacuum receiver.
   5. Piping between the vacuum pump and the source shutoff valve complying with 5.1.10.2, except that stainless steel shall be permitted to be used as a piping material.

5.1.3.6.2 Vacuum Pumps

5.1.3.6.2.1 Vacuum pumps shall be permitted to be made of ferrous and/or non-ferrous materials.

5.1.3.6.2.2 Anti-vibration mountings shall be installed for vacuum pumps as required by equipment dynamics or location and in accordance with the manufacturer’s recommendations.

5.1.3.6.2.3 Flexible connectors shall connect the vacuum pumps with their intake and outlet piping.

5.1.3.6.2.4 For liquid ring vacuum pumps, seal water shall be of a quality recommended by the vacuum pump manufacturer.

5.1.3.6.3 Vacuum Receivers. Receivers for vacuum shall meet the following requirements:
   1. Be made of ferrous and/or non-ferrous materials.
   2. Comply with Section VIII, Unfired Pressure Vessels, of the ASME Boiler and Pressure Vessel Code.
   3. Be capable of withstanding 415 kPa (60 psi) gage pressure and 760 mm (29.9 in) HgV vacuum.
   4. Be equipped with a manual drain.
   5. Be of a capacity based on the technology of the pumps.

5.1.3.6.4 Vacuum Local Alarm. A local alarm complying with 5.1.9.4 shall be provided for the vacuum source.

5.1.3.6.5 Piping Arrangement and Redundancies.

5.1.3.6.5.1 Piping arrangement shall be as follows:
   1. Piping shall be arranged to permit service and a continuous supply of Medical/Surgical Vacuum in the event of a single fault failure.
   2. Piping arrangement shall be permitted to vary based on the technology(ies) employed, provided an equal level of operating redundancy is maintained.

5.1.3.6.5.2 The Medical/Surgical Vacuum receiver(s) shall be serviceable without shutting down the Medical/Surgical Vacuum system by either of the following methods:
   1. By providing an isolation valve where the receiver is tee'd into the main line.
   2. By piping the receiver at the end of a valved isolation line.

5.1.3.6.5.3 Medical /Surgical Vacuum source systems shall be provided with a source shutoff valve per 5.1.4.4.

5.1.3.6.6 Electrical Power and Control

5.1.3.6.6.1 Additional pumps shall automatically activate when the pump(s) in operation is(are) incapable of adequately maintaining the required vacuum.

5.1.3.6.6.2 Automatic or manual alternation of pumps shall allow division of operating time. If automatic alternation of pumps is not provided, the facility staff shall arrange a schedule for manual alternation.

5.1.3.6.6.3 Each pump motor shall be provided with electrical components including but not limited to the following:
   1. A dedicated disconnect switch installed in the electrical circuit ahead of each motor starter.
   2. Motor starting device.
   3. Overload protection.
   4. Where pump systems having two or more pumps employ a control transformer or other voltage control power device, at least two such devices are required.
   5. Control circuits arranged in such a manner that the shutdown of one pump does not interrupt the operation of another pump.

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

5.1.3.6.6.5 Emergency electrical service for the pumps shall conform to the requirements of the essential electrical system as described in Chapter 4 of this document.
5.1.3.6.7 Medical/Surgical Vacuum Source Exhaust

5.1.3.6.7.1 The Medical/surgical vacuum pumps shall exhaust in a manner and location that will minimize the hazards of noise and contamination to the facility and it’s environment.

5.1.3.6.7.2 The exhaust shall be located as follows:
(1) Outdoors.
(2) At least 3050 mm (10 feet) from any door, window, air intake, or other openings in buildings.
(3) At a level different from air intakes.
(4) Where prevailing winds, adjacent buildings, topography or other influences that would not divert the exhaust into occupied areas or prevent dispersion of the exhaust.

5.1.3.6.7.3 The end of the exhaust shall be turned down and screened or otherwise be protected against the entry of vermin, debris or precipitation by screening fabricated or composed of a non-corroding material.

5.1.3.6.7.4 The exhaust shall be piped of materials approved for medical/surgical Vacuum piping under 5.1.10.2.

5.1.3.6.7.5 The exhaust shall be free of dips and loops that might trap condensate or oil. Where such low points are unavoidable, a drip leg and drained valve shall be installed.

5.1.3.6.7.6 Vacuum exhausts from multiple pumps shall be permitted to be joined together in a common exhaust if the following conditions are met:
(1) The common exhaust is sized to minimize back pressure in accordance with the pump manufacturer’s recommendations.
(2) Each pump can be isolated by manual or check valve, blind flange, or tube cap to prevent open exhaust piping when pump(s) are removed for service and consequent flow of exhaust air into the room.

5.1.3.6.8 Operating Alarms. Medical/surgical vacuum systems shall activate a local alarm when the backup or lag pump is running per 5.1.9.4.

5.1.3.7 Waste Anesthetic Gas Disposal (WAGD)

5.1.3.7.1 Sources. *WAGD sources shall be chosen in consultation with the medical staff having knowledge of the requirements to determine the type of system, number and placement of terminals and other required safety and operating devices.

5.1.3.7.1.1 WAGD shall be permitted to be produced by a dedicated producer, through the Medical/Surgical vacuum source or by venturi.

5.1.3.7.1.2 If WAGD is produced by the medical/surgical vacuum source, the following shall apply:
(1) The medical/surgical vacuum source shall comply with 5.1.3.6.
(2) Flammable anesthetics or other flammable vapors shall be diluted below the lower flammable limit prior to disposal into the Medical/Surgical Vacuum system.
(3) The medical/surgical vacuum source shall be sized to accommodate the additional volume.

5.1.3.7.1.3 If WAGD is produced by a dedicated WAGD producer, the following shall apply:
(1) The WAGD source shall be located in accordance with 5.1.3.3.
(2) The WAGD source shall be indoors in a dedicated mechanical equipment area with any required utilities.
(3) The WAGD source shall be in a room constructed per 5.1.3.3.2.
(4) The WAGD source shall be ventilated per 5.1.3.3.3.2.
(5) For air-cooled equipment, the WAGD source shall be located to maintain the ambient temperature range as recommended by the manufacturer.
(6) For liquid ring pumps in WAGD service, seal water shall be of a quality as recommended by the pump manufacturer.

5.1.3.7.1.4 The WAGD source shall consist of the following:
(1) Two or more WAGD producers sufficient to serve the peak calculated demand with the largest single WAGD producer out of service.
(2) An automatic means to prevent backflow from any on-cycle WAGD producers through any off-cycle WAGD producers.
(3) A shutoff valve to isolate each WAGD producer from the centrally piped system and other WAGD producers for maintenance or repair without loss of Medical/Surgical Vacuum in the system.
(4) Piping between the WAGD producers and the source shutoff valve compliant with 5.1.10.2, except that stainless steel shall be permitted to be used as a piping material.
(5) Anti-vibration mountings shall be installed for WAGD producers as required by equipment dynamics or location and in accordance with the manufacturer’s recommendations.
(6) Flexible connectors interconnecting the producers with their intake and outlet piping as required by equipment dynamics or location, in accordance with the WAGD producer manufacturer’s recommendations.

5.1.3.7.1.6 If WAGD is produced by a venturi, the following shall apply:
(1) The venturi shall not be user adjustable (i.e., shall require the use of special tools).
(2) The venturi shall be driven using inert gas, instrument air or other dedicated air source.
(3) Medical air shall not be used to power the venturi.

5.1.3.7.2 Dedicated WAGD Producers. Dedicated WAGD producers shall be designed of materials and using lubricants where needed that are inert in the presence of oxygen, nitrous oxide and halogenated anesthetics.

5.1.3.7.3 WAGD Alarms. When the WAGD system is served by a central source(s), a local alarm complying with 5.1.9.4 shall be provided for the WAGD source.

5.1.3.7.4 Emergency electrical service for the producers shall allow division of operating time. If automatic alternation of producers is not provided, the facility staff shall arrange a schedule for manual alternation.

5.1.3.7.4.3 Each producer motor shall be provided with electrical components including but not limited to the following:
(1) A dedicated disconnect switch installed in the electrical circuit ahead of each motor starter.
(2) Motor starting device.
(3) Overload protection.
(4) Where WAGD systems having two or more producers employ a control transformer or other voltage control power device, at least two such devices.
(5) Control circuits arranged in such a manner that the shutdown of one producer does not interrupt the operation of another producer.

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

5.1.3.7.4.5 Emergency electrical service for the producers shall conform to the requirements of the essential electrical system as described in Chapter 4 of this document.

5.1.3.7.5 WAGD Exhaust. The WAGD pumps shall exhaust in compliance with 5.1.3.6.7.

5.1.3.8 Instrument Air Supply Systems
5.1.3.8.1 Instrument air shall be of a quality which:
(1) complies with Instrument Air in ANSI/ISA S7.0.01 1996.
(2) is filtered to 0.01 microns.
(3) is free of liquids (e.g. Water, hydrocarbons, solvents, etc.)
(4) is free of hydrocarbon vapors.
(5) is dry to a dew point of –40°C.

5.1.3.8.2 General (See Fig. A-5.1.3.8).

5.1.3.8.2.1 Instrument air shall be permitted to be used for any medical support purpose, (e.g. to operate tools, air driven booms, pendants or similar applications) and (if appropriate to the procedures) to be used in laboratories.

5.1.3.8.2.2 Instrument air supply systems shall be located per 5.1.3.5 as follows:
(1) Indoors in a dedicated mechanical equipment area, adequately ventilated and with any required utilities.
(2) In a room constructed per 5.1.3.3.2.
(3) In a room ventilated per 5.1.3.3.2.
(4) For air-cooled equipment, in a room designed to maintain the ambient temperature range as recommended by the equipment manufacturer.

5.1.3.8.2.3 Instrument Air systems shall be prohibited:
(1) from being interconnected with medical air systems.
(2) from being used for any purpose where the air will be intentionally respired by patients or staff.

5.1.3.8.3 Instrument Air Source

5.1.3.8.3.1 Instrument air sources shall produce air at not less than 1,380 kPa gage (200 psi) gage output pressure.

5.1.3.8.3.2 Instrument air sources shall provide air meeting the definition of “Instrument Air” in Chapter 3.

5.1.3.8.3.3 Instrument air sources shall be permitted to include at least two compressors or one compressor and a standby header complying with 5.1.3.8.4.

5.1.3.8.3.4 Instrument air sources shall comply with 5.1.3.5.5 with exceptions as specified in 5.1.3.8.

5.1.3.8.4 Instrument Air Compressors. Instrument air compressors shall be permitted to be of any type capable of not less than 1,380 kPa gage (200 psi) gage output pressure and of providing air meeting the definition of instrument air in Chapter 3.

5.1.3.8.5 Instrument Air Standby Headers

5.1.3.8.5.1 Where instrument air systems are provided with a standby header, the header shall meet the following requirements:
(1) Comply with 5.1.3.4.8, except that the number of attached cylinders shall be sufficient for one hour normal operation.
(2) Use connectors as for Medical Air in CGA Pamphlet V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, (ANSI B57. 1).
(3) Enter the system upstream of the final line regulators. (see Fig. A-5.1.3.8).
(4) Automatically serve the system in the event of a failure of the compressor.

5.1.3.8.6 Intake Air. *Intake air for instrument air compressors shall be permitted to be drawn from the equipment source location.

5.1.3.8.7 Instrument Air Filters

5.1.3.8.7.1 Instrument air sources shall be filtered with activated carbon filters that meet the following requirements:
(1) Be located upstream of the final line filters.
(2) Be sized for 100 percent of the system peak calculated demand at design conditions.
(3) Be permitted to be constructed of ferrous and/or non-ferrous materials.

5.1.3.8.7.2 Final line filters shall meet the following requirements:
(1) Be located upstream of the final line regulators and downstream of the carbon filters.
(2) Be sized for 100 percent of the system peak calculated demand at design conditions.
(3) Be rated for a minimum of 98 percent efficiency at 0.01 micron.

5.1.3.8.7.3 Filters combining the function of 5.1.3.8.6.1 and 5.1.3.8.6.2 shall be permitted to be used.

5.1.3.8.8 Instrument Air Accessories. Accessories used for instrument air sources shall comply with:
(1) 5.1.3.5.5 for aftercoolers.
(2) 5.1.3.5.6 for air receivers.
(3) 5.1.3.5.7 for air dryers.
(4) 5.1.3.5.9 for air regulators.

5.1.3.8.9 Instrument Air Piping Arrangement and Redundancies. Instrument air sources shall comply with 5.1.3.5.11 except for the following:
(1) Systems employing a standby header shall be permitted to have simplex aftercoolers and dryers.
(2) Standby headers, where provided, shall be isolated from the compressor by a check valve to prevent back flow through the compressor.

5.1.3.8.10 Instrument Air Monitoring and Alarms

5.1.3.8.10.1 Instrument air sources shall include the following alarms:
(1) A local alarm that activates when or just before the backup compressor (if provided) activates, indicating that the lag compressor is in operation.
(2) A local alarm and alarms at all master alarm panels that activates when the dew point at system pressure exceeds -30°C (-22°F), indicating High Dew Point.

5.1.3.8.10.2 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) an alarm that activates when or just before the reserve begins to supply the system, indicating Reserve in Use.
(2) an alarm that activates when or just before the reserve falls below an average hours supply, indicating Reserve Low.

5.1.4 Valves (See Fig. A-5.1.4.)

5.1.4.1 Gas and Vacuum Shutoff Valves. Shutoff valves shall be provided to isolate sections or portions of the piping system for maintenance, repair, or planned future expansion need, and to facilitate periodic testing.

5.1.4.2 Accessibility. All valves except valves in zone valve box assemblies shall be located in secured areas such as locked piped chases, or be locked or latched in their operating position, and be labeled as to gas supplied and the area(s) controlled.

5.1.4.2.1 Shutoff valves accessible to other than authorized personnel shall be installed in valve boxes with frangible or removable windows large enough to permit manual operation of valves.

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

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

5.1.4.3 Valve Types. New or replacement shutoff valves shall be as follows:
(1) quarter turn, full ported, ball type.
(2) of brass or bronze construction.
(3) have extensions for brazing.
(4) have a handle indicating open or closed.
(5) consist of three-pieces permitting inline serviceability.

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

5.1.4.3.2 Valves for vacuum or WAGD service shall:
(1) be permitted to be ball or butterfly type.
(2) not be required to be cleaned for oxygen service.
5.1.4.4 Source Valve. A shutoff valve shall be placed at the immediate connection of each source system to the distribution piping to permit the entire source, including all accessory devices (such as air dryers, final line regulators, etc.), to be isolated from the facility.

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

5.1.4.4.2 The source valve shall be labeled in accordance with 5.1.11.2.

5.1.4.5 Main Line Valve. A shutoff valve shall be provided in the main supply line inside of the building when the source shutoff valve is not accessible from within the building.

5.1.4.5.1 The main line valve shall be located to permit access by authorized personnel only (e.g., by locating above a ceiling or behind a locked access door).

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, enclosure, or where the main line first enters the building.

5.1.4.5.3 The main line valve shall be labeled in accordance with 5.1.11.2.

5.1.4.5.4 A main line valve shall not be required where the source shutoff valve is accessible from within 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.

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

5.1.4.6.2 The riser valve shall be labeled in accordance with 5.1.11.2.

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.

5.1.4.7.1 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.

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

5.1.4.7.3 Service valves shall be located as follows:
   (1) behind a locked access door, or
   (2) locked open above a ceiling, or
   (3) locked open in a secure area.

5.1.4.7.4 Service valves shall be labeled in accordance with 5.1.11.2.

5.1.4.7.5 Sensors for area alarm panels as required in 5.1.9.3.4 shall be permitted to be placed in any relationship to service valves (if installed).

5.1.4.8 Zone Valve. 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.

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

5.1.4.8.2 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.

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

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

5.1.4.8.5 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 Zone valve boxes shall not be located in closed or locked rooms, areas or closets.

5.1.4.8.7 A zone valve shall be located immediately outside each vital life-support, critical care, and anesthetizing location in each medical gas and/or vacuum line, and located so as to be readily accessible in an emergency.

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

5.1.4.8.7.2 These 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.

5.1.4.8.8 Zone valves shall be labeled in accordance with 5.1.11.2.

5.1.4.9 In-Line Valves. Optional in-line valves shall be permitted to be installed to isolate or shut off piping for servicing of individual rooms or areas.

5.1.4.9.1 In-line shutoff valves intended for use to isolate piping for maintenance or modification shall be located in a restricted area, be locked or latched open, and be identified in accordance with 5.1.11.2.

5.1.4.9.2 Sensors for area alarm panels as required in 5.1.9.3.4 shall be permitted to be placed in any relationship to in-line valves (if installed).

5.1.4.10 Valves for Future Connections. Shutoff valves provided for the connection of future piping shall be located in a restricted area, be locked or latched closed, and be identified in accordance with 5.1.11.2.

5.1.4.10.1 Future connection valves shall be labeled as to gas content.

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

5.1.5 Station Outlet/Inlets

5.1.5.1 Each station outlet/inlet for medical gases or vacuum, whether threaded or non-interchangeable quick-coupler shall be gas specific.

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

5.1.5.3 Each station inlet shall consist of a primary valve (or assembly) only.

5.1.5.4 The secondary valve (or unit) shall close automatically to stop the flow of medical gas or vacuum when the primary valve (or unit) is removed.

5.1.5.5* Each outlet/inlet shall be legibly identified in accordance with 5.1.11.3.

5.1.5.6 Threaded outlets/inlets shall be non-interchangeable connections complying with CGA Pamphlet V-5, Diameter-Index Safety System — Non-Interchangeable Low Pressure Connections for Medical Gas Applications.

5.1.5.7 Each station outlet/inlet, including those mounted in columns, hose reels, ceiling tracks, or other special installations, shall be designed so that parts or components that are required to be gas-specific for compliance with 5.1.5.1 and 5.1.5.9 cannot be interchanged between station outlet/inlet for different gases.

5.1.5.8 The use of common parts in outlets/inlets, such as springs, O-rings, fasteners, seals, and shutoff poppets, shall be permitted.

5.1.5.9 Components of a vacuum station inlet necessary for the maintenance of vacuum specificity shall be legibly marked to identify them as components or parts of a vacuum or suction system.
5.1.5.10 Components of inlets not specific to vacuum shall not be required to be marked.

5.1.5.11 Factory installed tubes on station outlets extending no further than 205mm (8 in.) from the body of the terminal shall be not less than DN8 (NPS 1/4) (3/8 in. O.D.) size, with 8 mm (0.3 in.) minimum inside diameter.

5.1.5.12 Factory installed tubes on station outlets extending no further than 205mm (8 in.) from the body of the terminal shall be not less than DN10 (NPS 3/8) (1/2 in. O.D.) size, with 10 mm (0.4 in.) minimum inside diameter.

5.1.5.13 Station outlets/inlets shall be permitted to be recessed or otherwise protected from damage.

5.1.5.14 When multiple wall outlets/inlets are installed, they shall be spaced to permit the simultaneous use of adjacent outlets/inlets with any of the various types of therapy equipment.

5.1.5.15 Station Outlets in systems in systems having non-standard operating pressures shall meet the following additional requirements:
- Be gas specific.
- Be pressure specific where a single gas is piped at more than one operating pressure, e.g., a station outlet for oxygen, 550 kPa (80 psi) shall not accept an adapter for oxygen, 545 kPa (50 psi).
- If operated at a pressure in excess of 550 kPa (80 psi), be either DISS or comply with (4) below.
- If operated at a pressure between 1380 kPa (200 psi) gage and 2070 kPa (300 psi) gage, the station outlet shall be so designed as to prevent the removal of the adapter until the pressure has been relieved, to prevent the adapter injuring the user or others when removed from the outlet.

5.1.6 Manufactured Assemblies (Fig. A-5.1.6)

5.1.6.1 Manufactured Assemblies shall be pre-tested by the manufacturer prior to arrival at the installation site as follows:
- Initial blowdown test per 5.1.12.2.2.
- Initial pressure test 5.1.12.2.3.
- Piping purge test per 5.1.12.2.5.
- Standing pressure test per 5.1.12.2.6 or 5.1.12.2.7 except as permitted under 5.1.6.2.

5.1.6.2 The standing pressure test under 5.1.6.1 (4) shall be permitted to be performed by any testing method that will assure a pressure decay of less than 1 percent in 24 hours.

5.1.6.3 The manufacturer of the assembly shall provide documentation certifying the performance and successful completion of the tests required in 5.1.6.1.

5.1.6.4 Manufactured Assemblies employing flexible hoses shall use hoses and flexible connectors with a minimum burst pressure of 6805 kPa (1000 psi) gage.

5.1.6.5 Manufactured Assemblies shall have a flame spread rating of not greater than 200 when tested in accordance with NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials.

5.1.6.6 Manufactured Assemblies employing flexible hoses or tubing shall be attached to the pipelines using station outlets (inlets).

5.1.6.7 Manufactured assemblies employing hoses or flexible connectors, where the station outlet (inlet) attached to the piping is not fully and immediately accessible (i.e., cannot be manipulated without the removal of panels, doors, etc.), shall have station outlets (inlets) with the following additional characteristics:
- Be DISS connectors.
- Be permitted to omit the secondary check required in 5.1.5.2.
- Be provided with a second terminal at which the user connects and disconnects complying with 5.1.5 except 5.1.5.2.

5.1.6.8 Manufactured Assemblies connected to the pipeline by brazing shall have station outlets (inlets) which comply with 5.1.5 in all respects.

5.1.6.9 The installation of Manufactured Assemblies shall be tested in accordance with 5.1.12.

5.1.7 Surface Mounted Medical Gas Rails (MGR)

5.1.7.1 MGR Assemblies shall be permitted to be installed where multiple use of medical gases and vacuum at a single patient location are required or anticipated.

5.1.7.2 MGR assemblies shall be entirely visible in the room, not passing into or through walls, partitions, etc.

5.1.7.3 MGR assemblies shall be made of materials with a melting point at least 538°C (1000°F).

5.1.7.4 MGR Assemblies shall be cleaned per 5.1.10.1.1.

5.1.7.5 Station outlets or inlets shall not be placed on the ends of MGR assemblies.

5.1.7.6 Openings for station outlets/inlets in the MGR shall be gas specific.

5.1.7.7 Openings in the MGR not occupied by station outlets/inlets (e.g., for future use) shall be capped or plugged so that a special tool is required for removal. (e.g., cannot be removed by a wrench, pliers, screwdriver or other common tools).

5.1.7.8 MGR Assemblies shall connect to the pipeline through fittings which are brazed to the pipeline.

5.1.7.9 * Where the pipeline and the MGR assembly are of dissimilar metals, the connections shall be plated or otherwise protected from interaction between the metals.

5.1.7.10 The installation of the MGR shall be tested in accordance with 5.1.12 and 5.1.13.

5.1.8 Pressure and Vacuum Indicators

5.1.8.1 General

5.1.8.1.1 Pressure indicators and manometers for medical gas piping systems shall be cleaned for oxygen service.

5.1.8.1.2 Gauges shall comply with ANSI/ASME B-40.1, Gauges, Pressure Indicating Dial-Type, Elastic Elements.

5.1.8.1.3 The scale range of positive pressure analog indicators shall be such that the normal reading falls within the middle 50 percent of the scale.

5.1.8.1.4 The scale range of digital indicators shall be not more than two times the working pressure of the piping system.

5.1.8.1.5 The scale range of vacuum indicators shall be 0-760 mm (0–29.9 in.) gage HgV, except that indicators with a “normal range” display shall indicate “normal” only above 300 mm (12 in.) gage HgV.

5.1.8.1.6 Indicators adjacent to master alarm actuators and area alarms shall be labeled to identify the name of or chemical symbol for the particular piping system that they monitor.

5.1.8.1.7 The rated accuracy of indicators used for testing shall be one percent (full scale) or better at the point of reading.

5.1.8.2 Locations

5.1.8.2.1 Pressure and vacuum indicators shall be readable from a standing position.

5.1.8.2.2 Pressure/vacuum indicators shall be provided at the following locations, as a minimum:
- Adjacent to the alarm initiating device for source main line pressure and vacuum alarms in the master alarm system.
- At or in area alarm panels to indicate the pressure/vacuum at the alarm activating device for each system that is monitored by the panel.
- On the station outlet/station inlet side of zone valves.

5.1.9 Level 1 Warning Systems (See Fig. A-5.1.4.)
5.1.9.1 General. All master, area and local alarm systems used for medical gas and vacuum systems shall include the following:

(1) Separate visual indicators for each condition monitored, except as permitted in 5.1.9.4.2 for local alarms that are displayed on master alarm panels.

(2) Visual indicators that remain in alarm until the situation which has caused the alarm is resolved.

(3) A cancelable audible indication of each alarm condition that produces a sound with a minimum level of 80 dBA at 920 mm (36 in.) from the source of the alarm.

(4) A means to visually indicate a lamp or LED failure.

(5) Visual and audible indication that the wiring to an alarm initiating device is disconnected.

(6) Labeling of each indicator, indicating the condition monitored.

(7) Labeling of each alarm panel for its area of surveillance.

(8) Re-initiation of the audible signal if another alarm condition occurs while the audible alarm is silenced.

(9) Power from the safety branch of the emergency electrical system as described in Chapter 4, Electrical Systems.

(10) Wiring from switches or sensors that is supervised or protected as required by Section 517-3(c)(5) of NFPA 70, National Electrical Code, for emergency system circuits.

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

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

5.1.9.2 Master Alarms. (See Table A-5.1.9.2.) A master alarm system shall be provided to monitor the operation and condition of the source of supply, the reserve source (if any), and the pressure in the main lines of each medical gas and vacuum piping system.

5.1.9.2.1 The master alarm system shall consist of two or more alarm panels located in at least two separate locations:

(1) One master alarm panel shall be located in the office or work space of the individual responsible for the maintenance of the medical gas and vacuum piping systems.

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

5.1.9.2.2 A centralized computer (e.g., a building management system) shall be permitted to be substituted for any of the panels required in 5.1.9.2.1, but shall be permitted to be used to supplement the medical gas and vacuum alarm systems.

5.1.9.2.3 The master alarm panels required in 5.1.9.2.1 shall connect directly to the alarm initiating devices that they monitor.

(a) Master alarm signals shall not be relayed from one master alarm panel to another.

(b) Where multi-pole alarm relays are used to isolate the alarm initiating signals to master alarm panels, the control power source for the relays shall be independent of any of the master alarm panels.

5.1.9.2.4 Master alarm panels for medical gas and vacuum systems shall each include the following signals:

(1) An alarm indication when, or just before, changeover occurs in a medical gas system that is supplied by a manifold or other alternating-type bulk system that has as a part of its normal operation a changeover from one portion of the operating supply to another.

(2) An alarm indication for a bulk cryogenic liquid system when the main supply reaches an average days supply, indicating low contents.

(3) An alarm indication when, or just before, the changeover to the reserve supply occurs in a medical gas system that consists of one or more units that continuously supply the piping system while another unit remains as the reserve supply and operates only in the case of an emergency.

(4) Where a cryogenic liquid storage unit is used as a reserve for a bulk supply system, an alarm indication when the contents of the reserve is reduced to one average day's supply.

(5) Where a cryogenic liquid storage unit is used as a reserve for a bulk supply system, an alarm indication when the gas pressure available in the reserve unit is below that required for the medical gas system to function.

(6) An alarm indication when the pressure in the main line of each separate medical gas system increases 20 percent or decreases 20 percent from the normal operating pressure.

(7) An alarm indication when the medical/surgical vacuum pressures in the main line of each vacuum system drops to or below 300 mm (12 in.) gage HgV.

(8) An alarm indication(s) from the local alarm panel(s) as described in 5.1.9.4.2 to indicate when one or more of the conditions being monitored at a site is in alarm.

(9) A medical air dew point high alarm from each compressor site to indicate when the line pressure dew point is greater than +4°C (+39°F).

(10) A WAGD low alarm when the WAGD vacuum level or flow is below effective operating limits.

(11) An instrument air dew point high alarm from each compressor site to indicate when the line pressure dew point is greater than -30°C (-22°F).

5.1.9.2.5 The alarm indications required in 5.1.9.4.3 (5) and (6) shall originate from sensors installed in the main lines immediately downstream (on the facility side) of the source valves. Where it is necessary to install a main line valve in addition to a source valve (see 5.1.4.5 and 5.1.4.5.4), the sensors shall be located downstream (on the facility side) of the main valve.

5.1.9.3 Area Alarms. (See Table A-5.1.9.3.) Area alarm panels shall be provided to monitor all medical gas, Medical/Surgical vacuum and piped WAGD systems supplying anesthetizing locations, and other vital life support and critical areas such as post anesthesia recovery, intensive care units, emergency departments, etc.

5.1.9.3.1 Area alarms shall be located at a nurse’s station or other location that will provide for continuous responsible surveillance.

5.1.9.3.2 Area alarm panels for medical gas systems shall indicate if the pressure in the lines in the area being monitored increases or decreases by 20 percent from the normal line pressure.

5.1.9.3.3 Area alarm panels for medical/surgical vacuum systems shall indicate if the vacuum in the area drops to or below 300 mm (12 in.) gage HgV.

5.1.9.3.4 Sensors for area alarms shall be located as follows:

(a) Vital life support and critical areas shall have the alarm sensors installed on the outlet side of any of the individual zone valve box assemblies.

(b) Areas for anesthetizing gas delivery shall have the sensors installed on the source side of any of the individual zone valve box assemblies, so that shutting down one or more of the anesthetizing area zone valves will not cause an alarm.

(c) The placement of the sensors shall not be affected by valves located in areas accessible to authorized personnel only, such as service valves (see 5.1.4.7) or in-line valves (see 5.1.4.9).

5.1.9.4 Local Alarms. (See Table 5.1.9.4.) Local alarms shall be installed to monitor the function of the air compressor system(s) medical/surgical vacuum pump system(s), WAGD systems and instrument air systems.
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5.1.10.1 Piping Materials for Field Installed Positive Pressure Medical Gas Systems

5.1.10.1.1 Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service by the manufacturer prior to installation in accordance with CGA G 4.1 Cleaning Equipment for Oxygen Service.

5.1.10.1.2 Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation.

5.1.10.1.3 Fittings, valves and other components shall be delivered sealed, labeled and kept sealed until prepared for installation.

5.1.10.1.4 Tubes shall be hard drawn seamless copper ASTM B 819 medical gas tube, Type L, except that where operating pressures are above 1275 kPa (185 psi) gage, Type K shall be used for sizes larger than DN80 (NPS 3) (3-1/8 in. O.D.).

5.1.10.1.5 ASTM B 819 medical gas tube shall be identified by the manufacturer’s markings “OXY”, “MED”, “OXY/MED”, “OXY/ACR”, or “ACR/MED” in blue (Type L) or green (Type K).

5.1.10.1.6 The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of 5.1.10.1.1.

5.1.10.2 Piping Materials for Field Installed Medical/Surgical Vacuum Systems

5.1.10.2.1 Vacuum tubes shall be hard drawn seamless copper, either ASTM B 819 medical gas tube, ASTM B 88 water tube (Type K, L, or M), or ASTM B 280 ACR tube.

5.1.10.3 Fittings

5.1.10.3.1 Turns, offsets, and other changes in direction in medical gas and vacuum piping shall be made with brazed wrought copper capillary fittings complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Fittings, or brazing fittings complying with MSS SP-75, Brazed Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings.

5.1.10.3.2 Cast copper alloy fittings shall not be permitted.

5.1.10.3.3 Branch connections in vacuum piping systems shall be permitted to be made using mechanically formed, drilled and extruded tee-branch connections that are formed in accordance with the tool manufacturer’s instructions, and brazed.

5.1.10.4 Threaded Joints. Threaded joints in medical gas and vacuum distribution piping shall be:

(a) limited to connections to pressure/vacuum indicators, alarm devices, and source equipment.

(b) tapered pipe threads complying with ANSI B1.20.1, Pipe Threads, General Purpose.

(c) 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.

5.1.10.5 Brazed Joints

5.1.10.5.1 General Requirements

5.1.10.5.1.1 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.

5.1.10.5.1.2 Brazed tube joints shall be the socket type.

5.1.10.5.1.3 Filler metals shall bond with and be metallurgically compatible with the base metals being joined.

5.1.10.5.1.4 Filler metals shall comply with ANSI/AWS A 5.8, Specification for Brazing Filler Metal.

5.1.10.5.1.5 Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorous-silver brazing filler metal (BCuF series) without flux.

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

5.1.10.5.2 Cutting Tube Ends

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

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

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

5.1.10.5.3 Cleaning Joints for Brazing

5.1.10.5.3.1 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.

5.1.10.5.3.2 The exterior surfaces of tube ends shall be cleaned prior to brazing to remove any surface oxides.

5.1.10.5.3.3 When cleaning the exterior surfaces of tube ends, no matter shall be permitted to enter the tube.
5.1.10.5.3.4 If the interior surfaces of fitting sockets become contaminated prior to brazing, they shall be re-cleaned for oxygen in accordance with 5.1.10.5.3.10 and be cleaned for brazing with a clean, oil-free wire brush.

5.1.10.5.3.5 Non-abrasive pads (such as Scotchbrite™) shall be used to clean the exterior surfaces of tube ends.

5.1.10.5.3.6 The use of steel wool or sand cloth shall be prohibited.

5.1.10.5.3.7 The cleaning process shall not result in grooving of the surfaces to be joined.

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

5.1.10.5.3.9 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.

5.1.10.5.3.10 The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but become contaminated prior to being installed, shall be permitted to be re-cleaned on-site by the installer by thoroughly scrubbing the interior surfaces with a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate 450 g to 11 liters (1 lb to 3 gal) of potable water and thoroughly rinsing them with clean, hot potable water.

5.1.10.5.3.11 Other aqueous cleaning solutions shall be permitted to be used for on-site re-cleaning permitted in 5.1.10.5.3.10 provided that they are as recommended in CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, and are listed in CGA Pamphlet O2-DIR, Directory of Cleaning Agents for Oxygen Service.

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

5.1.10.5.3.13 Joints shall be brazed within one hour after the surfaces are cleaned for brazing.

5.1.10.5.4 Brazing Dissimilar Metals

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

5.1.10.5.4.2 Surfaces shall be cleaned for brazing in accordance with 5.1.10.5.3.3.

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

5.1.10.5.4.4 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.

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

5.1.10.5.4.6 On joints DN20 (NPS 3/4) (7/8 in. O.D.) size and smaller, flux-coated brazing rods shall be permitted to be used in lieu of applying flux to the surfaces being joined.

5.1.10.5.5 Nitrogen Purge

5.1.10.5.5.1 While being brazed, joints shall be continuously purged with oil free, dry Nitrogen NF to prevent the formation of copper oxide on the inside surfaces of the joint.

5.1.10.5.5.2 The source of the purge gas shall be monitored and the installer shall be audibly alerted when the source content is low.

5.1.10.5.5.3 The purge gas flow rate shall not produce a positive pressure in the piping system.

5.1.10.5.5.4 The purge gas flow rate shall be controlled by the use of a pressure regulator and flow meter or combination thereof.

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

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

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

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

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

5.1.10.5.5.10 The final connection of new piping to an existing, in-use pipeline shall be permitted to be made without the use of a nitrogen purge.

5.1.10.5.5.11 After a final connection in a positive pressure medical gas pipeline is made without a nitrogen purge, an outlet in the immediate downstream zone of the affected portion(s) of both the new and existing in-use piping shall be tested in accordance with 5.1.13.3.9 Final Tie-in Test.

5.1.10.5.6 Assembly and Heating Joints

5.1.10.5.6.1 Tube ends shall be inserted fully into the socket of the fitting.

5.1.10.5.6.2 Where flux is permitted, the joint shall be heated slowly until the flux has liquefied.

5.1.10.5.6.3 After flux is 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.

5.1.10.5.6.4 Techniques for heating the joint, applying the brazing filler metal, and making horizontal, vertical, and large-diameter joints shall be as stated in sections on “Applying Heat and Brazing” and “Horizontal and Vertical Joints” in Chapter VII - “Brazed Joints” in the CDA Copper Tube Handbook.

5.1.10.5.7 Inspection of Brazed Joints

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

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

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

5.1.10.5.7.4 Joints exhibiting the following conditions shall not be permitted:

   (1) Flux or flux residue (when flux or flux coated BAg series rods are used with dissimilar metals).
   (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 braze filler metal.
   (7) Failure of the joint to hold the test pressure under the installer performed initial pressure test (5.1.12.2.5) and standing pressure test (5.1.12.2.6 or 5.1.12.2.7).

5.1.10.5.7.5 Brazed joints that are identified as defective under 5.1.10.5.7.4, conditions (2) or (5) shall be replaced.

5.1.10.5.7.6 Brazed joints that are identified as defective under 5.1.10.5.7.4, conditions (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.

5.1.10.5.8 Special Fittings. The following special fittings shall be permitted to be used in lieu of brazed joints:
(1) memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.
(2) listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint.
(3) dielectric fittings where required by the manufacturer of special medical equipment to electrically isolate the equipment from the piping distribution system.

5.1.10.5.9 Prohibited Joints. The following joints shall be prohibited throughout medical gas and vacuum distribution pipeline systems:

(1) flared and compression-type connections, including connections to station outlets and inlets, alarm devices, and other components.
(2) other straight-threaded connections, including unions.

5.1.10.6 Installation of Piping and Equipment

5.1.10.6.1 Pipe Sizing

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

5.1.10.6.1.2 Mains and branches in medical gas piping systems shall be not less than DN15 (NPS 1/2) (5/8 in. O.D.) size.

5.1.10.6.1.3 Mains and branches in medical-surgical vacuum systems shall be not less than DN20 (NPS 3/4) (7/8 in. O.D.) size.

5.1.10.6.1.4 Drops to individual station outlets and inlets shall be not less than DN15 (NPS 1/2) (5/8 in. O.D.) size.

5.1.10.6.1.5 Runouts to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to be DN8 (NPS 1/4) (3/8 in. O.D.) size.

5.1.10.6.2 Protection of Piping. Piping shall be protected against freezing, corrosion, and physical damage.

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

5.1.10.6.2.2 Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

5.1.10.6.3 Location of Piping

5.1.10.6.3.1 Piping risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

5.1.10.6.3.2 Piping shall not be installed in kitchens, electrical switchgear rooms, elevator shafts, and areas with open flames.

5.1.10.6.3.3 Medical gas piping shall be permitted to be installed in the same service trench or tunnel with fuel gas lines, fuel oil lines, electrical lines, steam lines, and similar utilities provided that the space is ventilated (naturally or mechanically) and the ambient temperature around the medical gas piping is limited to 54°C (130°F) maximum.

5.1.10.6.3.4 Medical gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

5.1.10.6.4 Pipe Support

5.1.10.6.4.1 Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports - Selection and Application.

5.1.10.6.4.2 Hangers and supports shall comply with MSS Standard Practice SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.

5.1.10.6.4.3 Hangers for copper tube shall have a copper finish and be sized for copper tube.

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

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

5.1.10.6.5 Underground Piping Outside of Buildings

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

5.1.10.6.5.2 Underground piping shall be installed in a continuous enclosure to protect the pipe during backfilling.

5.1.10.6.5.3 The continuous enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing.

5.1.10.6.5.4 Buried piping that will be subject to surface loads shall be buried at a depth that will protect the piping and its enclosure from excessive stresses.

5.1.10.6.5.5 The minimum backfilled cover above the top of the enclosure for buried piping outside of buildings shall be 900 mm (36 in.), except that the minimum cover shall be permitted to be reduced to 450 mm (18 in.) where physical damage is otherwise prevented.

5.1.10.6.5.6 Trenches shall be excavated so that the pipe enclosure has firm, substantially continuous bearing on the bottom of the trench.

5.1.10.6.5.7 Backfill shall be clean and compacted so as to protect and uniformly support the pipe enclosure.

5.1.10.6.5.8 A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name.

5.1.10.6.5.9 A continuous warning means shall also be provided above the pipeline at approximately one-half the depth of bury.

5.1.10.6.5.10 Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be scaled to prevent the entrance of ground water into the building.

5.1.10.6.6 Branch Takeoffs. Runouts from horizontal piping shall be taken off above the centerline of the main or branch pipe and rise vertically or at an angle of not less than 45 degrees from vertical.

5.1.10.6.7 Hose and Flexible Connectors

5.1.10.6.7.1 Hose and flexible connectors, both metallic and non-metallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions.

5.1.10.6.7.2 Flexible connectors, metallic or non-metallic, shall have a minimum burst pressure of 6895 kPa (1000 psi) gage.

5.1.10.6.8 Prohibited System Interconnections

5.1.10.6.8.1 Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing or any other reason.

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

5.1.10.6.5.3 The continuous enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing.

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5.1.10.6.8 Prohibited System Interconnections

5.1.10.6.8.1 Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing or any other reason.
5.1.10.6.8.2 Leak testing shall be accomplished by separately charging and testing each individual piping system.

5.1.10.6.9 Manufacturer’s Instructions

5.1.10.6.9.1 The installation of individual components shall be made in accordance with the instructions of the manufacturer.

5.1.10.6.9.2 Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper operation, testing, and maintenance of the medical gas and vacuum systems.

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

5.1.10.6.10 Changes in System Use

5.1.10.6.10.1 Where a positive pressure medical gas piping distribution system originally used or constructed for the use at one pressure and for one gas is converted for operation at another pressure or for another gas, all provisions of 5.1.10 shall apply as if the system were new.

5.1.10.6.10.2 A vacuum system shall not be permitted to be converted for use as a gas system.

5.1.10.6.11 Qualification of Installers

5.1.10.6.11.1 The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in making such installations.

5.1.10.6.11.2 Installers of medical gas and vacuum systems shall meet the requirements of ANSI/ASSE Standard 6010 - Professional Qualification Standard for Medical Gas and Vacuum System Installers.

5.1.10.6.11.3 Brazing shall be performed by individuals who are qualified under the provisions of 5.1.10.6.12.

5.1.10.6.11.4 Prior to any installation work, the installer of medical gas and vacuum piping shall provide and maintain documentation on the job site for the qualification of brazing procedures and individual brazers that is required under 5.1.10.6.12.

5.1.10.6.11.5 Health care organization personnel shall be permitted to install piping systems if all of the requirements of 5.1.10.6.11 are met during the installation.

5.1.10.6.12 Qualification of Brazing Procedures and Brazing

5.1.10.6.12.1 Brazing procedures and brazer performance for the installation of medical gas and vacuum piping shall be qualified in accordance with either Section IX, Welding and Brazing Qualifications, of the ASME Boiler and Pressure Vessel Code, or AWS B2.1, Standard for Brazing Procedure and Performance Qualifications, both as modified below.

5.1.10.6.12.2 Brazers shall be qualified by visual examination of the test coupon followed by sectioning.

5.1.10.6.12.3 The Brazing Procedure Specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

5.1.10.6.12.4 The Brazing Procedure Specification and the Record of Brazer Performance Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate during brazing of coupon, and the absence of internal oxidation in the completed coupon.

5.1.10.6.12.5 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 standard.

2. The employer obtains a copy of both the Brazing Procedure Specification and the supporting qualification records 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.

5.1.10.6.12.6 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 or an equivalent procedure that the new employer uses.

2. 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.

5.1.10.6.12.7 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.

5.1.11 Labeling and Identification

5.1.11.1 Pipe Labeling

5.1.11.1.1 Piping shall be labeled by stenciling or adhesive markers that identify the medical gas or vacuum system.

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

5.1.11.1.3 Where positive pressure gas piping systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or 1275 kPa (185 psi) gage for nitrogen, the pipe labels shall include the nonstandard operating pressure in addition to the name of the gas.

5.1.11.1.4 Pipe labels shall be located as follows:

1. At intervals of not more than 6100 mm (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 traversed by risers.

5.1.11.2 Shutoff Valves

5.1.11.2.1 Shutoff valves shall be identified as follows:

1. The name or chemical symbol for the specific medical gas or vacuum system.

2. The room or areas served.

3. A caution to not close or open the valve except in emergency.

5.1.11.2.2 Where positive pressure gas piping systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or 1100 to 1275 kPa (160 to 185 psi) gage for nitrogen or instrument air, the valve identification shall also include the nonstandard operating pressure.

5.1.11.2.3 Source valves shall be labeled in substance as follows: SOURCE VALVE FOR THE (SOURCE NAME).

5.1.11.2.4 Main line valves shall be labeled in substance as follows: MAIN LINE VALVE FOR THE (GAS/VACUUM NAME) SERVING THE (NAME OF THE BUILDING).

5.1.11.2.5 Riser valve(s) shall be labeled in substance as follows: RISER FOR THE (GAS/VACUUM NAME) SERVING (NAME OF THE AREA/BUILDING SERVED BY THE PARTICULAR RISER).

5.1.11.2.6 Service valve(s) shall be labeled in substance as follows: SERVICE VALVE FOR THE (GAS/VACUUM NAME) SERVING (NAME OF THE AREA/BUILDING SERVED BY THE PARTICULAR VALVE).

5.1.11.3 Station Outlets and Inlets

5.1.11.3.1 Station outlets and inlets shall be identified as to the name or chemical symbol for the specific medical gas or vacuum provided.

5.1.11.3.2 Where medical gas systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or 1100 to 1275 kPa (185 psi) gage for nitrogen, the station outlet identification shall include the nonstandard operating pressure in addition to the name of the gas.

5.1.11.4 Alarm Panels

Labeling of alarm panels shall comply with the requirements of 5.1.9.1 (6) and (7).
## Table 5.1.11 Standard Designation Colors and Operating Pressures for Gas and Vacuum Systems

<table>
<thead>
<tr>
<th>Gas Service</th>
<th>Abbreviated Name</th>
<th>Colors (Background/Text)</th>
<th>Standard Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Air</td>
<td>Yellow/Black</td>
<td>345-380 kPa (50-55 psi) gage</td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>CO₂</td>
<td>Grey/Black or Grey/White</td>
<td>345-380 kPa (50-55 psi) gage</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
<td>Brown/White</td>
<td>345-380 kPa (50-55 psi) gage</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N₂</td>
<td>Black/White</td>
<td>1100-1275 kPa (160-185 psi) gage</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>N₂O</td>
<td>Blue/White</td>
<td>345-380 kPa (50-55 psi) gage</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O₂</td>
<td>Green/White or White/Green</td>
<td>345-380 kPa (50-55 psi) gage</td>
</tr>
<tr>
<td>Oxygen/Carbon Dioxide Mixtures</td>
<td>O₂/CO₂ n%</td>
<td>Green/White</td>
<td>345-380 kPa (50-55 psi) gage</td>
</tr>
<tr>
<td>Medical-Surgical Vacuum</td>
<td></td>
<td>White/Black</td>
<td>380 mm to 760 mm (15 in. to 30 in.) HgV</td>
</tr>
<tr>
<td>Waste Anaesthetic Gas Disposal</td>
<td>WAGD</td>
<td>Violet/White</td>
<td>Varies with system type</td>
</tr>
<tr>
<td>Other Mixtures</td>
<td>Gas A % /Gas B%</td>
<td>Colors as above</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major gas for background/Minor gas for text</td>
<td></td>
</tr>
<tr>
<td>Non-Medical Air (Level 3 Gas Powered Device) Air</td>
<td>Yellow &amp; White Diagonal Stripe/Black</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Non-Medical and Level 3 Vacuum</td>
<td></td>
<td>White &amp; Black Diagonal Stripe/Black Boxed</td>
<td>None</td>
</tr>
<tr>
<td>Laboratory Air</td>
<td></td>
<td>Yellow and White Checkerboard/Black</td>
<td>None</td>
</tr>
<tr>
<td>Laboratory Vacuum</td>
<td></td>
<td>White and Black Checkerboard/Black Boxed</td>
<td>None</td>
</tr>
<tr>
<td>Instrument Air</td>
<td>Red/White</td>
<td>1100-1275 kPa (160-185 psi) gage</td>
<td></td>
</tr>
</tbody>
</table>
5.1.12 Performance Criteria and Testing--Level 1 (Gases, Medical/Surgical Vacuum, and WAGD)

5.1.12.1 General

5.1.12.1.1 Inspection and testing shall be performed on all new piped gas systems, additions, renovations, temporary installations, or repaired systems, to assure the facility, by a documented procedure, that all applicable provisions of this document have been adhered to and system integrity has been achieved or maintained.

5.1.12.1.2 Inspection and testing shall include all components of the system or portions thereof including, but not limited to, gas bulk source(s), manifolds, compressed air source systems (e.g., compressors, dryers, filters, regulators), source alarms and monitoring safeguards, master alarms, pipelines, isolation valves, area alarms, zone valves, and station inlets (vacuum) and outlets (pressure gases).

5.1.12.1.3 All systems that are breached and components that are subject to additions, renovations, or replacement (e.g., new gas sources-bulk, manifolds, compressors, dryers, alarms) shall be inspected and tested.

5.1.12.1.4 Systems shall be deemed breached at the point of pipeline intrusion by physical separation or by system component removal, replacement, or addition.

5.1.12.1.5 Breached portions of the systems subject to inspection and testing shall be confined to only the specific altered zone and components in the immediate zone or area that is located upstream for vacuum systems and downstream for pressure gases at the point or area of intrusion.

5.1.12.1.6 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.

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

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

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

5.1.12.2 Initial Blow Down. Piping in medical gas and vacuum distribution systems shall be blown clear by means of oil free, dry Nitrogen NF as follows:

(1) Before installation of station outlets/inlets rough-in assemblies. Test caps shall be permitted to be used.

(2) Prior to 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, manufactured assemblies with flexible hoses, hoses, etc.)

5.1.12.2.1 General

5.1.12.2.1.1 The tests required by this section shall be performed and documented by the installer prior to the tests listed in 5.1.12.3, System Verification.

5.1.12.2.1.2 The test gas shall be oil free, dry Nitrogen NF.

5.1.12.2.1.3 Where manufactured assemblies are to be installed, the tests required under this section shall be performed:

(1) After completion of the distribution piping but before the standing pressure test.

(2) Prior to installation of manufactured assemblies supplied through flexible hoses or flexible tubing.

(3) At all station outlets/inlets on installed manufactured assemblies supplied through copper tubing.

5.1.12.2.2 Initial Blow Down. Piping in medical gas and vacuum distribution systems shall be blown clear by means of oil free, dry Nitrogen NF as follows:

(1) After installation of the distribution piping

(2) Before installation of station outlets/inlets rough-in assemblies. Test caps shall be permitted to be used.

5.1.12.2.3 Initial Pressure Test

5.1.12.2.3.1 Each section of the piping in medical gas and vacuum systems shall be pressure tested.

5.1.12.2.3.2 Initial pressure tests shall be conducted as follows:

(1) After installation of station outlets/inlets rough-in assemblies. Test caps shall be permitted to be used.

(2) Prior to 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, manufactured assemblies with flexible hoses, hoses, etc.)

5.1.12.2.3.3 The source shutoff valve shall remain closed during these tests.

5.1.12.2.3.4 The test pressure for pressure gases shall be 1.5 times the system working pressure but not less than 1035 kPa (150 psi) gage.

5.1.12.2.3.5 The test pressure for vacuum shall be not less than 415 kPa (60 psi) gage.

5.1.12.2.3.6 The test pressure shall be maintained until each joint has been examined for leakage by means of soap water or other equally effective means of leak detection that is safe for use with oxygen.

5.1.12.2.3.7 Leaks, if any, shall be located, repaired (if permitted), replaced (if required), and re-tested.

5.1.12.2.4 Cross-Connection Test. It shall be determined that no cross connections exist between the various medical gas and vacuum piping systems.

5.1.12.2.4.1 All piping systems shall be reduced to atmospheric pressure.

5.1.12.2.4.2 Sources of test gas shall be disconnected from all piping systems except for the one system being tested.

5.1.12.2.4.3 The system under test shall be charged with oil free, dry Nitrogen NF to 345 kPa (50 psi) gage.

5.1.12.2.4.4 After the installation of the individual faceplates, with appropriate adapters matching outlet/inlet labels each individual outlet/inlet in each installed medical gas and vacuum piping system shall be checked to determine that the test gas is being dispensed only from the piping system being tested.

5.1.12.2.4.5 The cross-connection test referenced in 5.1.12.2.4 shall be repeated for each installed medical gas and vacuum piping system.
5.1.12.2.4.6 The proper labeling and identification of system outlets/inlets shall be confirmed during these tests.

5.1.12.2.5 Piping Purge Test. The outlets in each medical gas piping system shall be purged to remove any particulate matter from the distribution piping.

5.1.12.2.5.1 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.

5.1.12.2.5.2 This purging shall be started at the furthest point from the zone valve.

5.1.12.2.6 Standing Pressure Test for Positive Pressure Medical Gas Piping. After successful completion of the initial pressure tests under 5.1.12.2.3 medical gas distribution piping shall be subject to a standing pressure test.

5.1.12.2.6.1 Tests shall be conducted after the final installation of station outlet valve bodies, face plates, and other distribution system components (e.g. pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, hoses, etc.)

5.1.12.2.6.2 The source valve shall be closed during this test.

5.1.12.2.6.3 The piping systems shall be subjected to a 24-hour standing pressure test using oil free, dry Nitrogen NF.

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

5.1.12.2.6.5 At the conclusion of the tests, there shall be no change in the test pressure other than that attributed to changes of ambient temperature, as permitted under 5.1.12.2.7.6.

5.1.12.2.6.6 Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and re-tested.

5.1.12.2.7 Standing Pressure Test for Vacuum Systems. After successful completion of the initial pressure tests under 5.1.12.2.3, vacuum distribution piping shall be subjected to a standing vacuum test.

5.1.12.2.7.1 Tests shall be conducted after installation of all components of the vacuum system.

5.1.12.2.7.2 The piping systems shall be subjected to a 24-hour standing vacuum test.

5.1.12.2.7.3 Test pressure shall be not less than 300 mm (12 in.) gage HgV.

5.1.12.2.7.4 During the test, the source of test vacuum shall be disconnected from the piping system.

5.1.12.2.7.5 At the conclusion of the test, there shall be no change in the vacuum other than that attributed to changes of ambient temperature, as permitted under 5.1.12.2.7.6.

5.1.12.2.7.6 Test vacuum changes due to expansion or contraction shall be permitted to be determined by means of the following pressure - temperature relationship:

\[(a) \quad \text{the calculated final absolute pressure equals the initial absolute pressure times the final absolute temperature, divided by the initial absolute temperature.}\]

\[(b) \quad \text{absolute pressure is the gage pressure reading plus 101.4 kPa (14.7 psi).}\]

\[(c) \quad \text{absolute temperature is the temperature reading plus 238°F (460°C).}\]

\[(d) \quad \text{the final allowable gage pressure reading equals the final allowable absolute pressure minus 101.4 kPa (14.7 psi) gage.}\]

5.1.12.2.7.7 Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and re-tested.

5.1.12.3 System Verification

5.1.12.3.1 General

5.1.12.3.1.1 Verification tests shall be performed only after all tests required in 5.1.12.2 Installer Performed Tests have been completed.

5.1.12.3.1.2 The test gas shall be oil free, dry Nitrogen NF or the system gas where permitted.

5.1.12.3.1.3 Testing shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum pipeline testing and meeting the requirements of ANSI/ASSE Standard 6030, Medical Gas Verifiers Professional Qualifications Standard.

5.1.12.3.1.4 Testing shall be performed by a party other than the installing contractor.

5.1.12.3.1.5 When systems have been installed by in-house personnel, testing shall be permitted by personnel of that organization who meet the requirements of 5.1.12.3.1.3.

5.1.12.3.1.6 All tests required under 5.1.12.3 shall be performed after installation of any manufactured assemblies supplied through flexible hoses or tubing.

5.1.12.3.1.7 Where there are multiple possible connection points for terminals, each possible position shall be tested independently.

5.1.12.3.1.8 Where permitted by the authority having jurisdiction, for small projects affecting a limited number of areas where the use of nitrogen is impractical, the source gas shall be permitted to be used for the following tests:

(1) Standing pressure (5.1.12.3.2)

(2) Cross-Connection (5.1.12.3.3)

(3) Alarms (5.1.12.3.4)

(4) Piping Purge (5.1.12.3.6)

(5) Piping Particulates (5.1.12.3.7)

(6) Piping Purity (5.1.12.3.8)

(7) Operational Pressure (5.1.12.3.10)

5.1.12.3.2 Standing Pressure Test. Piping systems shall be subjected to a ten minute standing pressure test at operating line pressure using the following procedure:

(1) After the system is filled with nitrogen or source gas, the source valve and all zone valves shall be closed.

(2) The piping system shall show no decrease in pressure after ten minutes.

(3) Any leaks found shall be located, repaired and re-tested per 5.1.12.2.6.

5.1.12.3.3 Cross-Connection Test. After closing of walls and completion of requirements of 5.1.12.2, Installer Performed Tests, it shall be determined that no cross-connection of piping systems exists by either of the following methods:

5.1.12.3.3.1 Individual Pressurization

(1) All medical gas and vacuum piping systems shall be reduced to atmospheric pressure.

(2) All sources of test gas from all of the medical gas and vacuum systems, with the exception of the one system to be checked, shall be disconnected.

(3) The system being checked shall be pressurized to 345 kPa (50 psi) gage.

(4) With adapters matching outlet labels, each individual station outlet/inlet of all medical gas and vacuum systems installed shall be checked to determine that test gas is being dispensed only from the outlets/inlets of the piping system being tested.

(5) The source of test gas shall be disconnected and the system tested reduced to atmospheric pressure.

(6) Proceed to test each additional piping system until all medical gas and vacuum piping systems are free of cross-connections.

5.1.12.3.3.2 Pressure Differential

(1) The pressure in all medical gas systems shall be reduced to atmospheric.

(2) The test gas pressure in all medical gas piping systems shall be increased to the values indicated Table 5.1.12.3.3.3 simultaneously maintaining these nominal pressures throughout the test.

(3) Systems with nonstandard operating pressures shall be tested at a pressure at least 70 kPa (10 psi) gage higher or lower than any other system being tested.

(4) Any vacuum systems shall be in operation so that these vacuum systems are tested at the same time the medical gas systems are tested.

(5) Following the adjustment of pressures in accordance with 5.1.12.3.3.2 (2) and (3), each station outlet for each medical gas system shall be tested using the gas-specific connection for each
system with test gauge attached to verify that the correct test pressure/vacuum is present at each outlet/inlet of each system as listed in Table 5.1.12.3.3.2.

(6) Each test gauge used in performing this test shall be calibrated with the pressure indicator used for the line pressure regulator used to provide the source pressure.

(7) 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 Table 5.1.12.3.3.2 for the system being tested.

<table>
<thead>
<tr>
<th>Medical Gas</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen/Instrument Air</td>
<td>140 kPa (20 psi) gage</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>275 kPa (40 psi) gage</td>
</tr>
<tr>
<td>Oxygen</td>
<td>345 kPa (50 psi) gage</td>
</tr>
<tr>
<td>Medical Air</td>
<td>415 kPa (60 psi) gage</td>
</tr>
<tr>
<td>Vacuum</td>
<td>510 mm (20 in.) gage HgV</td>
</tr>
<tr>
<td>WAGD</td>
<td>380 mm (15 in.) gage HgV</td>
</tr>
<tr>
<td>Systems at nonstandard pressures</td>
<td>70 kPa (10 psi) gage greater or less than any other system</td>
</tr>
</tbody>
</table>

5.1.12.3.4 Valve Test. Valves installed in each medical gas and vacuum piping system shall be tested to verify proper operation and rooms or areas of control.

5.1.12.3.4.1 Records shall be made listing the rooms or areas controlled by each valve for each gas.

5.1.12.3.4.2 The information shall be utilized to assist and verify the proper labeling of the valves.

5.1.12.3.5 Alarm Test

5.1.12.3.5.1 General

(a) All warning systems for each medical gas and vacuum system(s) shall be tested to ensure that all components function properly prior to placing the system in service.

(b) Permanent records of these tests shall be maintained.

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

(d) Tests of warning systems for new installations (initial tests) shall be performed after the cross-connection testing (5.1.12.3.3), but before purging the piping (5.1.12.3.6) and performing the remaining verification tests (5.1.12.3.7 through 5.1.12.3.14).

(e) Initial tests of warning systems that can be included in an addition or extension to an existing piping system shall be completed before connection of the addition to the existing system.

(f) Test gases for the initial tests shall be oil free, dry Nitrogen NF, the gas of system designation, or operating vacuum.

5.1.12.3.5.2 Master Alarms

(a) The master alarm system tests shall be performed for each of the medical gas and vacuum piping systems.

(b) Permanent records of these tests shall be maintained with those required under 5.1.12.1.7.

(c) The audible and non-cancelable visual signals of 5.1.9.1 shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.

(d) The operation of all master alarm signals referenced in 5.1.9.2.4 shall be verified.

5.1.12.3.5.3 Area Alarms. The warning signals for all medical gas piping systems supplying anesthetizing locations and other vital life-support and critical care areas, such as post-anesthesia recovery, intensive care units, coronary care units, emergency suites and operating rooms shall be verified to verify an alarm condition if the pressure in the piping system increases or decreases 20 percent from the normal operating pressure for positive pressure gases, or when the vacuum system(s) drop below 300 mm (12 in.) gage HgV.

5.1.12.3.6 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 the pipeline shall be done.

5.1.12.3.6.1 The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates of at least 225 NL/min (8 SCFM) shall be put on each outlet.

5.1.12.3.6.2 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.

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

5.1.12.3.7 Piping Purity Test. For each positive-pressure gas system, the cleanliness of the piping system shall be verified.

(a) 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).

(b) Twenty-five percent of the zones shall be tested at the outlet most remote from the source.

(c) The filter shall accrue no more than .001 gram (1 mg) of matter from any outlet tested.

(d) If any outlet fails this test, the most remote outlet in every zone shall be tested.

(e) The test shall be performed with the use of oil free, dry Nitrogen NF.

5.1.12.3.8 Piping Purity Test. For each positive-pressure system, the purity of the piping system shall be verified.

(a) These tests shall be performed with oil free, dry Nitrogen NF or the gas of system designation.

(b) The tests shall be for total hydrocarbons (as methane), and halogenated hydrocarbons, and compared with the source gas.

(c) This test shall be performed at the outlet most remote from the source.

(d) The difference between the two tests shall in no case exceed:

<table>
<thead>
<tr>
<th>Total Hydrocarbons</th>
<th>1 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halogenated Hydrocarbons</td>
<td>2 ppm</td>
</tr>
</tbody>
</table>

(e) A test for dew point shall be conducted at the outlet most remote from the source and the dew point shall not exceed 500 ppm (12°C).

5.1.12.3.9 Final Tie In Test

5.1.12.3.9.1 Prior to the connection of any work or any extension or addition to an existing piping system, the tests in 5.1.12.3.1 through 5.1.12.3.8 shall be successfully performed on the new work.

5.1.12.3.9.2 Each joint in the final connection between the new work and the existing system shall be leak-tested with the gas of system designation at the normal operating pressure by means of soapy water or other means safe for use with oxygen.

5.1.12.3.9.3 For pressure gases, immediately after the 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 of intrusion shall be purged per 5.1.12.3.6.

5.1.12.3.9.4 Before the new work is used for patient care, positive pressure gases shall be tested for operational pressure, and gas concentration in accordance with 5.1.12.3.10 and 5.1.12.3.11.

5.1.12.3.9.5 Permanent records of these tests shall be maintained in accordance with 5.1.12.7.1.

5.1.12.3.10 Operational Pressure Test. Operational pressure tests shall be performed at each station outlet/inlet or terminal where the user makes connections and disconnections.

5.1.12.3.10.1 Tests shall be performed with oil free, dry Nitrogen NF, the gas of system designation, or the operating vacuum.

5.1.12.3.10.2 All 345 kPa (50 psi) gage gas outlets including, but not limited to oxygen, nitrous oxide, medical air, and carbon dioxide, shall deliver 100 Nl/min (3.5 SCFM) with a pressure drop of no more than 35 kPa (5 psi) gage, and static pressure of 345-380 kPa (50-55 psi) gage.

5.1.12.3.10.3 Nitrogen outlets shall deliver 140 NL/min (5.0 SCFM) with a pressure drop of no more than 35 kPa (5 psi) gage and static pressure of 1275 kPa (185 psi) gage.
5.1.12.3.10.4 Medical/surgical vacuum inlets shall draw 85 Nl/min (3 SCFM) without reducing the vacuum pressure below 300 mm (12 in) gage HgV at any adjacent station inlet.

5.1.12.3.10.5 Oxygen and air outlets serving critical care areas shall permit a transient flow rate of 170 Nl/min (6 SCFM) for 3 seconds.

5.1.12.3.11 Medical Gas Concentration Test. After purging each system with the gas of system designation, the following shall be performed:

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

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

(3) Allowable concentrations shall be as indicated in Table 5.1.12.3.11.

<table>
<thead>
<tr>
<th>Table 5.1.12.3.11 Gas Concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Gas</td>
</tr>
<tr>
<td>Oxygen</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
</tr>
<tr>
<td>Nitrogen</td>
</tr>
<tr>
<td>Medical Air</td>
</tr>
<tr>
<td>Other Gases</td>
</tr>
</tbody>
</table>

5.1.12.3.12 Medical Air Purity Test (Compressor System).

<table>
<thead>
<tr>
<th>Table 5.1.12.3.12 Contaminant Parameters for Medical Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>Dew Point</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>Gaseous Hydrocarbons</td>
</tr>
<tr>
<td>Halogenated Hydrocarbons</td>
</tr>
</tbody>
</table>

5.1.12.3.12.1 The medical air source shall be analyzed for concentration of contaminants by volume prior to the source valve being opened.

5.1.12.3.12.2 Sample(s) shall be taken for the air system test at the system sample port.

5.1.12.3.12.3 The test results shall not exceed the parameters in Table 5.1.12.3.12.

5.1.12.3.13 Labeling. The presence and correctness of labeling required by this standard for all components (e.g., station outlets/inlets, shutoff valves, and alarm panels) shall be verified.

5.1.12.3.14 Source Equipment Verification

5.1.12.3.14.1 General. Source equipment verification shall be performed following the installation of the interconnecting pipelines, accessories, and source equipment.

5.1.12.3.14.2 Gas Supply Sources

(a) The system apparatus shall be tested for proper function, including the changeover from primary to secondary supply (with its changeover signal) and the operation of the reserve (with its reserve in use signal), before the system is put into service.

(b) If the system has an actuating switch and signal to monitor the contents of the reserve, its function shall be tested before the system is put into service.

(c) If the system has an actuating switch and signal to monitor the pressure of the reserve unit, its function shall be tested before the system is put into service.

(d) Testing of the bulk supply signal and the master signal panel installations shall be arranged with the owner or the organization responsible for the operation and maintenance of the supply system for the testing of the bulk supply signals to ensure proper identification and activation of the master signal panels to be sure the facility can monitor the status of that supply system.

(e) The tests required in 5.1.12.3.14.2 (d) shall also be conducted when the storage units are changed or replaced.

5.1.12.3.14.3 Medical Air Compressor Systems

(a) Tests of the medical air compressor system shall include the purity test for air quality, and the test of the alarm sensors after calibration and setup per the manufacturer’s instructions, as well as lead-lag controls.

(b) Tests shall be conducted at the sample point of the medical air system.

(c) The operation of the system control sensors, such as dew point, air temperature, and all other air-quality monitoring sensors and controls, shall be checked for proper operation and function before the system is put into service.

(d) The quality of medical air as delivered by the compressor air supply shall be verified after installation of new components prior to use by patients.

(e) The air quality tests in 5.1.12.3.14.3 (d) shall be performed after a minimum of 24 hours of operation in accordance with 5.1.12.3.14.3 (f) of the machinery.

(f) A demand of approximately 25 percent of the rated compressor capacity shall be created to cause the compressors to cycle on and off continuously and the dryers to operate for the 24-hour period.

5.1.12.3.14.4 Medical/Surgical Vacuum Systems. The proper functioning of the medical/surgical vacuum source system(s) shall be tested before it is put into service.

5.1.13 Level 1 Operation and Management

5.1.13.1 Administration. Administrative authorities of health care organizations shall provide policies and procedures for safe practices.

5.1.13.1.1 Purchase specifications shall include:

(1) specifications for cylinders,

(2) marking of cylinders, regulators, and valves,

(3) proper connection of cylinders supplied to the facility,

5.1.13.1.2 Training procedures shall include:

(1) Maintenance programs in accordance with the manufacturers’ recommendations for the piped gas system.

(2) Use and transport of equipment and the proper handling of cylinders, containers, hand trucks, supports, and valve protection caps.

(3) Proper uses of the medical/surgical vacuum system in order to eliminate practices that reduce the system’s effectiveness, such as leaving suction tips and catheters open when not actually aspirating, and using equipment arrangements that are improperly trapped or are untrapped.

5.1.13.1.3 Policies for enforcement shall include:

(1) Regulations for the storage and handling of cylinders and containers of oxygen and nitrous oxide.

(2) Regulations for the safe handling of oxygen and nitrous oxide in anesthetizing locations.

(3) All signal warnings are promptly evaluated and all necessary measures are taken to re-establish the proper functions of the medical gas and vacuum systems.

(4) The organization has the capability and resources to cope with a complete loss of any medical gas or vacuum system.

(5) Prior to the use of any medical gas or vacuum piping system for patient care all tests required in 5.1.12.3.14 have been successfully conducted.

5.1.13.2* Special Precautions for Handling Oxygen Cylinders and Manifolds. Handling of oxygen cylinders and manifolds shall be based on CGA Pamphlet G-4, Oxygen.

5.1.13.2.1 Oxygen cylinders, containers and associated equipment shall be protected from contact with oil or grease. Specific precautions shall include:

(1) Oil, grease, or readily flammable materials shall never be permitted to come in contact with oxygen cylinders, valves, regulators, gauges, or fittings.

(2) Regulators, fittings, or gauges shall never be lubricated with oil or any other flammable substance.

(3) Oxygen cylinders or apparatus shall never be handled with oily or greasy hands, gloves, or rags.
5.1.13.2.2 Equipment associated with oxygen shall be protected from contamination. Specific precautions shall include:
1. Particles of dust and dirt shall be cleared from cylinder valve openings by slightly opening and closing the valve before applying any fitting to the cylinder.
2. The high-pressure valve on the oxygen cylinder shall be opened before bringing the apparatus to the patient or the patient to the apparatus.
3. An oxygen cylinder shall never be draped with any materials such as hospital gowns, masks, or caps.
4. Cylinder-valve protection caps, where provided, shall be kept in place and be hand tightened, except when cylinders are in use or connected for use.
5. Valves shall be closed on all empty cylinders in storage.

5.1.13.2.5 Cylinders shall be protected from damage. Specific procedures shall include:
1. Oxygen cylinders shall be protected from abnormal mechanical shock, which is liable to damage the cylinder, valve, or safety device.
2. Oxygen cylinders shall not be stored near elevators, gangways, or in locations where heavy moving objects will strike them or fall on them.
3. Cylinders shall be protected from the tampering of unauthorized individuals.
4. Cylinders or cylinder valves shall not be repaired, painted, or altered.
5. Safety relief devices in valves or cylinders shall never be tampered with.
6. Valve outlets clogged with ice shall be thawed with warm — not boiling — water.
7. A torch flame shall never be permitted under any circumstances to come in contact with cylinder valves or safety devices.
8. Sparks and flame shall be kept away from cylinders.
9. Even if they are considered to be empty, cylinders shall never be used as rollers, supports, or for any purpose other than that for which the supplier intended them.
10. When small-size (A, B, D, or E) cylinders are in use, they shall be attached to a cylinder stand or to therapy apparatus of sufficient size to render the entire assembly stable.
11. Large cylinders (exceeding size E) and containers larger than 45 kg (100 lb) weight shall be transported on a proper hand truck or cart complying with 8-5.2.
12. Freestanding cylinders shall be properly chained or supported in a proper cylinder stand or cart.
13. Cylinders shall not be chained to portable or movable apparatus such as beds and oxygen tents.
14. Cylinders shall not be supported by radiators, steam pipes, or heat ducts.

5.1.13.2.4 Cylinders and their contents shall be handled with care. Specific procedures shall include:
1. Oxygen fittings, valves, regulators, or gauges shall never be used for any service other than that of oxygen.
2. Gases of any type shall never be mixed in an oxygen cylinder or any other cylinder.
3. Oxygen shall always be dispensed from a cylinder through a pressure regulator.
4. The cylinder valve shall be opened slowly, with the face of the indicator on the regulator pointed away from all persons.
5. Oxygen shall be referred to by its proper name, oxygen, not air and liquid oxygen referred to by its proper name, not liquid air.
6. Oxygen shall never be used as a substitute for compressed air.
7. The markings stamped on cylinders shall not be tampered with because it is against federal statutes to change these markings without written authority from the Bureau of Explosives.
8. Markings used for the identification of contents of cylinders shall not be defaced or removed, including decals, tags, stenciled marks, and upper half of shipping tag.
9. The owner of the cylinder shall be notified if any condition has occurred that might permit any foreign substance to enter a cylinder or valve, giving details and cylinder number.
10. Neither cylinders nor containers shall be placed in proximity of radiators, steam pipes, heat ducts, or other sources of heat.
11. Very cold cylinders or containers shall be handled with care to avoid injury.

5.1.13.2.5 When individual small-size (A, B, D, or E) cylinders are used in association with patient care, the cylinders shall be permitted to be placed and stored in open areas throughout the patient care area.

5.1.13.2.6 Oxygen equipment that is defective shall not be used until either:
1. it has been repaired by competent in-house personnel,
2. it has been repaired by the manufacturer or his or her authorized agent,
3. it has been replaced.

5.1.13.2.7 Regulators that are in need of repair or cylinders having valves that do not operate properly shall never be used.

5.1.13.3 Special Precautions for Making Cylinder and Container Connections

5.1.13.3.1* Wrenches and tools used to connect respiratory therapy equipment shall not be required to be non-sparking.

5.1.13.3.2 Cylinder valves shall be opened and connected in accordance with the following procedure:
1. Make certain that apparatus and cylinder valve connections and cylinder wrenches are free of foreign materials.
2. Turn the cylinder valve outlet away from personnel. Stand to the side — not in front and not in back. Before connecting the apparatus to cylinder valve, momentarily open cylinder valve to eliminate dust.
3. Make connection of apparatus to cylinder valve. Tighten connection nut securely with a wrench.
4. Release the low-pressure adjustment screw of the regulator completely.
5. Slowly open cylinder valve to full open position.
6. Slowly turn in the low-pressure adjustment screw on the regulator until the proper working pressure is obtained.
7. Open the valve to the utilization apparatus.

5.1.13.3.3. Connections for containers shall be made in accordance with the container manufacturer’s operating instructions.

5.1.13.4 Special Precautions for the Care of Safety Mechanisms

5.1.13.4.1 Personnel using cylinders and containers and other equipment covered in this chapter shall be familiar with the Pin-index Safety System (see Chapter 9) and the Diameter-Index Safety System (see Chapter 9), both are designed to prevent utilization of the wrong gas.

5.1.13.4.2 Safety relief mechanisms, non-interchangeable connectors, and other safety features shall not be removed, altered, or replaced.

5.1.13.5 Special Precautions - Storage of Cylinders and Containers

5.1.13.5.1 Storage shall be planned so that cylinders can be used in the order in which they are received from the supplier.

5.1.13.5.2 If stored within the same enclosure, empty cylinders shall be segregated from full cylinders.

5.1.13.5.3 Empty cylinders shall be marked to avoid confusion and delay if a full cylinder is needed in a rapid manner.

5.1.13.5.4 Cylinders stored in the open shall be protected as follows:
1. against extremes of weather and from the ground beneath to prevent rusting,
2. during winter, against accumulations of ice or snow,
3. in summer, screened against continuous exposure to direct rays of the sun in those localities where extreme temperatures prevail.

5.1.13.5.5 No cylinders containing oxygen or nitrous oxide, other than those connected to anesthetic apparatus, shall be kept or stored in anesthetizing locations.

5.1.13.6 Special Precautions – Piped Patient Gas/Vacuum Systems

5.1.13.6.1* Piping systems shall not be used for the distribution of flammable anesthetic gases.

5.1.13.6.2 Nonflammable medical gas systems used to supply gases for respiratory therapy shall be installed in accordance with 5.1.11 through 5.1.11 of this chapter.

5.1.13.6.3 Piping systems for gases shall not be used as a grounding electrode.
5.1.13.6.4 Liquid or debris shall not be introduced into the medical-surgical vacuum system for disposal.

5.1.13.6.5 The medical-surgical vacuum system shall not be used for vacuum steam condensate return or other non-medical or non-surgical applications.

5.1.13.7 Gas/Vacuum Systems Information and Warning Signs

5.1.13.7.1 The gas content of medical gas and vacuum piping systems shall be labeled in accordance with 5.1.11.1.

5.1.13.7.2 Labels for shutoff valves shall be:
(1) in accordance 5.1.11.2,
(2) updated when modifications are made changing the areas served.

5.1.13.8 Gas/Vacuum Systems Maintenance and Record Keeping

5.1.13.8.1 Permanent records of all tests required by 5.1.11.3.1 through 5.1.11.3.14 shall be maintained in the organization's files.

5.1.13.8.2 A periodic testing procedure for nonflammable medical gas/vacuum and related alarm systems shall be implemented.

5.1.13.8.3 Whenever modifications are made or maintenance is performed that breaches the system the verification tests specified in 5.1.11.3 shall be conducted on the downstream portions of the medical gas piping system.

5.1.13.8.4 A maintenance program shall be established for the following:
(1) the medical air compressor supply system in accordance with the manufacturers’ recommendations,
(2) the facility shall establish a testing and calibration procedure which assures Carbon Monoxide monitors are calibrated at least annually or more often if recommended by the manufacturer,
(3) both the medical/surgical vacuum piping system and to the secondary equipment attached to medical/surgical vacuum station inlets to ensure the continued good performance of the entire medical/surgical vacuum system,
(4) the WAGD system to assure performance.

5.1.13.8.5* Audible and visual alarm indicators shall:
(1) shall be periodically tested to determine that they are functioning properly,
(2) shall have the records of the test maintained until the next test is performed.

5.1.13.8.6* Medical/surgical vacuum station inlet terminal performance, as required in 5.1.11.3.10.4, shall be tested as follows:
(1) on a regular preventive maintenance schedule as determined by the facility maintenance staff,
(2) based on flow of free air (NI/min or SCFM) into a station inlet while simultaneously checking the vacuum level.

5.2 Level 2 Piped Gas and Vacuum Systems

5.2.1 Applicability. These requirements shall apply to health care facilities which qualify for Level 2 systems as referenced in Chapters 13 through 21.

5.2.2 Nature of Hazards of Gas and Vacuum Systems

5.2.3 Level 2 Sources

5.2.3.1 Central Supply System Identification and Labeling. Level 2 Facilities shall comply with 5.1.3.1.

5.2.3.2 Central Supply Operations. Level 2 Facilities shall comply with 5.1.3.2.

5.2.3.3 Central Supply System Locations. Level 2 Facilities shall comply with 5.1.3.3.

5.2.3.4 Central Supply Systems. Level 2 Facilities shall comply with 5.1.3.4.

5.2.3.5 Level 2 Medical Air Supply Systems. Level 2 Facilities shall comply with 5.1.3.5, except as follows:
(a) Medical air compressors, dryers, aftercoolers, filters and regulators shall be permitted to be simplex.
(b) The facility staff shall develop their emergency plan to deal with the loss of medical air.

5.2.3.6 Level 2 Medical/Surgical Vacuum. Level 2 Facilities shall comply with 5.1.3.6, except as follows:
(a) Medical/surgical vacuum systems shall be permitted to be simplex.
(b) The facility staff shall develop their emergency plan to deal with the loss of medical/surgical vacuum.

5.2.3.7 Level 2 Waste Anesthetic Gas Disposal (WAGD). Level 2 Facilities shall comply with 5.1.3.7, except as follows:
(a) Medical WAGD pumps shall be permitted to be simplex.
(b) The facility staff shall develop their emergency plan to deal with the loss WAGD.

5.2.3.8 Instrument Air Supply Systems. Level 2 Facilities shall comply with 5.1.3.8.

5.2.4 Valves. Level 2 Facilities shall comply with 5.1.4.

5.2.5 Station Outlets/Inlets. Level 2 Facilities shall comply with 5.1.5.

5.2.6 Manufactured Assemblies. Level 2 Facilities shall comply with 5.1.6.

5.2.7 Surface Mounted Medical Gas Rails. Level 2 Facilities shall comply with 5.1.7.

5.2.8 Pressure and Vacuum Indicators. Level 2 Facilities shall comply with 5.1.8.

5.2.9 Warning Systems (Level 2). Warning systems in Level 2 facilities shall provide the master, area, and local alarm functions of a Level 1 facility as required in 5.1.8, except as follows:
(a) Warning systems shall be permitted to be a single alarm panel.
(b) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
(c) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.

5.2.10 Level 2 Distribution. Level 2 Facilities shall comply with 5.1.10.

5.2.11 Labeling and Identification. Level 2 Facilities shall comply with 5.1.11.

5.2.12 Performance Criteria and Testing - Level 2 (Gas, Medical/Surgical Vacuum, and WAGD). Level 2 Facilities shall comply with 5.1.12.

5.2.13 Level 2 Operation and Management. Level 2 Facilities shall comply with 5.1.13.

5.3 Level 3 Piped Gas and Vacuum Systems

5.3.1 Applicability

5.3.1.1 These requirements apply to health care facilities which qualify to install Level 3 systems as referenced in Chapters 13 through 21.

5.3.1.2 Wherever the term “medical gas” occurs, the provisions shall apply to all piped systems for oxygen and nitrous oxide.

5.3.1.3 Wherever the term “vacuum” occurs the provisions shall apply to all piped systems for vacuum.

5.3.1.4 An existing Level 3 system that is not in strict compliance with the provisions of this standard shall be permitted to be continued 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 medical gas systems and vacuum systems shall be considered in the design, installation, testing, operation and maintenance of these systems.

5.3.3 Level 3 Sources
5.3.3.1 **Medical Gas Supply System Identification and Labeling**

5.3.3.1.1 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.

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

5.3.3.1.3 Contents of cylinders and containers shall be verified prior to use.

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

5.3.3.1.5 Locations containing medical gases other than Oxygen shall have their door(s) labeled substantially as follows:

   CAUTION: Medical Gases
   No Smoking or Open Flame
   Room May Have Insufficient Oxygen
   Open Door and Allow Room to Ventilate before Entering

5.3.3.1.6 Locations containing only oxygen shall have their door(s) labeled as follows:

   CAUTION: Medical Gases
   NO Smoking or Open Flame

5.3.3.2 **Supply System Operations**

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

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

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

5.3.3.2.4 Wooden racks for cylinder storage shall be permitted.

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

5.3.3.2.6 Cylinders not in use shall have their valve protection caps secured tightly in place.

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

5.3.3.2.8 Cryogenic liquid storage units intended to supply gas to the facility shall not be used to transfer liquid storage vessels.

5.3.3.2.9 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.

5.3.3.2.10 Cylinders containing compressed gases and containers for volatile liquids shall be kept away from radiators, steam piping, and like sources of heat.

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

5.3.3.2.12 Containers shall not be stored in a tightly closed space such as a closet.

5.3.3.3 **Source Systems-Level 3**

5.3.3.3.1 Cylinders in service and in storage shall be individually secured and located to prevent falling or being knocked over.

5.3.3.3.2 **Locations for Medical Gas Supply Systems**

5.3.3.3.2.1 Medical Gas Supply systems shall be permitted to be located indoors or outdoors.

5.3.3.3.2.2 Air compressors and vacuum pumps shall be located separately from other medical gas systems or cylinder storage enclosures.

5.3.3.3.2.3 Locations for supply systems shall not be used for storage purposes other than for containers of nonflammable gases except that storage of full or empty containers shall be permitted.

5.3.3.3.2.4 Other nonflammable medical gas supply systems or storage locations shall be permitted to be in the same location with oxygen or nitrous oxide or both provided adequate ventilation to prevent the development of oxygen deficient atmospheres in the event of functioning of cylinder or manifold pressure-relief devices is provided.

5.3.3.3.2.5 Enclosures shall not be located in close proximity to open electrical conductors and transformers.

5.3.3.3.2.6 Enclosures shall not be located adjacent to storage tanks for flammable or combustible liquids.

5.3.3.3.3 **Indoor locations**

5.3.3.3.3.1 Enclosures for medical gases shall serve no other purpose.

5.3.3.3.3.2 Enclosures shall be constructed of an assembly of building materials with a fire resistive rating of at least 1 hour.

5.3.3.3.3.3 Enclosures shall not communicate directly with anesthetizing or storage locations for flammable anesthetizing agents.

5.3.3.3.3.4 Other nonflammable (inert) medical gases shall be permitted to be stored in the enclosure.

5.3.3.3.3.5 Flammable gases shall not be stored with oxidizing agents.

5.3.3.3.3.6 Storage of full and/or empty cylinders is permitted in the same enclosure.

5.3.3.3.4 **Outdoor Locations**

5.3.3.3.4.1 Storage facilities that are adjacent to a building wall shall be located such that the distance to any window of the adjacent building is greater than 7620 mm (25 ft.).

5.3.3.3.5 **Doors and Gates**. Enclosures for medical gas supply systems shall be provided with doors or gates.

5.3.3.3.5.1 If the enclosure is outside and/or remote from the single treatment facility, it shall be kept locked.

5.3.3.3.5.2 If the storage area is within the single treatment facility (i.e., is not remote), it shall be permitted to be locked.

5.3.3.3.6 **Ventilation**. Enclosures for medical gas systems (e.g., oxygen and nitrous oxide) shall be ventilated.

5.3.3.3.6.1 Where the total volume of Level 3 medical gases (e.g., oxygen and nitrous oxide) connected and in storage is greater than 84,950 L (3,000 ft3) at STP, indoor supply locations shall be provided with dedicated mechanical ventilation systems that draw air from within 300 mm (1 ft) of the floor and operate continuously.

5.3.3.3.6.2 The power supply for mechanical ventilation fans shall conform to the requirements of an essential electrical system as described in Chapter 4 of this document.

5.3.3.3.6.3 Where the total volume of Level 3 medical gases (e.g., oxygen and nitrous oxide) connected and in storage is less than 84,950 L (3,000 ft3) at STP, natural ventilation shall be permitted to be employed.

5.3.3.3.6.4 Where natural ventilation is permitted, it shall consist of two louvered openings, each having a minimum free area of 46,500 mm² (72 in²), with one located within 300 mm (1 ft) of the floor and one located within 300 mm (1 ft) of the ceiling.

5.3.3.3.6.5 Louvered natural ventilation openings shall not be located in an exit access corridor.
5.3.3.6.6 Mechanical ventilation shall be provided if the requirements of 5.3.3.6.5 cannot be met.

5.3.3.6.7 Heating (where required) shall be by steam, hot water, or other indirect means.

5.3.3.6.8 Where enclosures (interior or exterior) for medical gas supply systems are located near sources of heat, such as furnaces, incinerators, or boiler rooms, they shall be of construction that protects cylinders from reaching temperatures 54°C (130°F).

5.3.3.7 Locations for Air Compressors and Vacuum Pumps

5.3.3.7.1 Air compressors and vacuum pumps shall be installed in a designated mechanical equipment area, ventilated and with required utilities. (e.g. electricity, drains, lighting, etc.)

5.3.3.4 Medical Gas Supply Systems-Level 3

5.3.3.4.1 Mechanical means shall be provided to ensure the connection of cylinders containing the correct gas to the piping system.

5.3.3.4.1.1 Cylinder valve outlets for nonflammable gases and gas mixtures for medical purposes shall comply with CGA Pamphlet V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1; CSA B96).

5.3.3.4.1.2 Threaded connections between the regulators and the piping system shall comply with CGA Pamphlet V-5, Diameter-Index Safety System.

5.3.3.4.2 Level 3 Medical Gas Supply Systems shall include the following components:

5.3.3.4.2.1 A shutoff valve or check valve installed downstream of each pressure regulator.

5.3.3.4.2.2 A pressure relief valve set at 50 percent above normal line pressure installed downstream of the shutoff valve or check valve required in 5.3.3.4.2.1.

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

5.3.3.4.3 Flexible connectors of other than all-metal construction used to connect outlets of pressure regulators to fixed piping shall not exceed 1520 mm (5 ft) in length and shall not penetrate walls, floors, ceilings, or partitions.

5.3.3.4.3.1 Flexible connectors shall comply with the provisions of 5.3.3.4.1.2.

5.3.3.4.3.2 Flexible connectors shall have a pressure rating of at least 6895 kPa (1000 psig) gage.

5.3.3.4.4 Supply systems supplying only a single treatment facility shall contain the following:

5.3.3.4.4.1 Two banks of cylinders each containing the greater of either at least an average day's supply or:
(1) When storage is not remote, two cylinders of oxygen and one cylinder of nitrous oxide (if used).
(2) When storage is Remote, two cylinders of oxygen and two cylinders of nitrous oxide (if used).

5.3.3.4.4.2 The cylinders for each gas service shall be manifolded so that the cylinders can alternate supply the piping system.

5.3.3.4.4.3 When the primary bank is unable to supply the system, the secondary bank shall be capable of being switched to supply the system.

5.3.3.4.4.4 When storage is not remote, either manual or automatic switchover shall be permitted to be used.

5.3.3.4.4.5 When the supply system is remote, automatic switchover shall be provided.

5.3.3.4.5 Supply systems supplying multiple treatment facilities shall contain the following:

5.3.3.4.5.1 Two banks of cylinders each containing at least the greater of an average day's supply or two cylinders of oxygen and two cylinders of nitrous oxide (if used).

5.3.3.4.5.2 The cylinders for each gas service shall be manifolded so that the cylinders can alternately supply the piping system.

5.3.3.4.5.3 When the primary bank is unable to supply the system, the secondary bank shall automatically operate to supply the piping system.

5.3.3.5 Level 3 Gas Powered Devices Supply Systems

5.3.3.5.1 Level 3 Gas Powered Devices Supply Systems shall be used where compressed air is required to drive dynamic devices used for patient treatment.

5.3.3.5.1.1 A Gas Powered Devices Supply System 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.

5.3.3.5.2 Level 3 Gas Powered Devices Supply Systems shall be obtained from and be installed under the supervision of a manufacturer(s) or supplier(s) familiar with proper practices for its construction and use.

5.3.3.5.3 Level 3 Gas Powered Devices 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 multi-compressor systems, a 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) Shutoff valves.
(9) Air dryer(s) that maintain 40 percent relative humidity at operating pressure and temperature.
(10) In-line final particulate filters rated at 5 microns, 98 percent efficiency, with filter status indicator to ensure the delivery of compressed air with a maximum allowable 0.05 ppm liquid oil.
(11) In-line final particulate filters rated at 5 microns, 98 percent efficiency, with filter status indicator to ensure the delivery of compressed air with a maximum allowable 0.05 ppm liquid oil.
(12) Pressure regulator(s).
(13) In-line filters.
(14) Pressure relief valve.
(15) Pressure indicator.
(16) Moisture indicator.
(17) Oil indicator.
(18) A reserve for cylinders shall be permitted to be used to supplement or act as a reserve for the compressor source.

5.3.3.5.4 Receiver

5.3.3.5.4.1 Receiver(s) shall have the capacity to prevent short cycling of the compressor(s).

5.3.3.5.4.2 Receiver(s) shall comply with Section VIII, Unfired Pressure Vessels, of the ASME Boiler and Pressure Vessel Code.

5.3.3.5.5 Moisture Indicator

5.3.3.5.5.1 The Moisture Indicator shall be located in the active air stream prior to or after the receiver and upstream of any system pressure regulators.

5.3.3.5.5.2 The Moisture Indicator shall indicate (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.
5.3.9 Level 3 Warning Systems

(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) this additional vent shall be permitted to be connected to the plumbing system vents.

(5) both vents shall extend vertically to not less than six inches above the top of the holding tank before turning horizontal.

(6) 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).

(7) The trap seal shall be not less than 100 mm (4 in.) deep.

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

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

5.3.3.6.3.3 Where the drainage is at a positive pressure from an air/waste separator on the discharge side of the vacuum source:

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

(2) the trap vent shall extend vertically to not less than six inches above the top of the separator before turning horizontal.

(3) 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).

(4) the vent shall be the full size of the trap and drain.

(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.

5.3.3.6.4 Exhausts.

5.3.3.6.4.1 The gas discharge from a Level 3 vacuum source shall be piped to the outside.

5.3.3.6.4.2 The discharge point shall be chosen to minimize the hazards of noise.

5.3.3.6.4.3 The discharge point shall be located remote from any door, window or other opening in the building.

5.3.3.6.4.4 The discharge point shall be located at a different level than air intakes.

5.3.3.6.4.5 The discharge point shall not be located where effected by prevailing winds, adjacent buildings, topography or other obstacles to the rapid dispersion of the exhaust gases.

5.3.3.6.4.6 The discharge point shall be protected against the entry of insects, vermin, debris, and precipitation.

5.3.3.6.4.7 The discharge piping shall be sized to prevent back pressure greater than the pump manufacturer’s recommendations.

5.3.3.6.4.8 Where multiple pumps discharge through a common pipe, each pump shall be fitted with a check valve, a manual isolation valve or arranged to permit capping the individual pump exhausts when a pump is removed for service.

5.3.3.6.4.9 Where multiple pumps discharge through a common pipe, piping shall be arranged following the pump manufacturer’s recommendations.

5.3.4 Level 3 Valves (Reserved)

5.3.5 Service Inlets and Outlets

5.3.5.1 The service outlet for Level 3 Gas Powered Devices shall not be interchangeable with a medical air station outlet.

5.3.5.2 The service Inlet for Level 3 Vacuum shall be permitted to be either a shutoff valve with a threaded female pipe connector or a quick connect fitting with a single check valve.

5.3.6 Level 3 Manufactured Assemblies (reserved)

5.3.7 Level 3 Surface Mounted Medical Gas Rails (reserved)

5.3.8 Level 3 Pressure and Vacuum Indicators (reserved)

5.3.9 Level 3 Warning Systems
5.3.9.1 Warning systems for medical gases (e.g. oxygen and nitrous oxide) in Level 3 facilities shall provide the alarm functions of a Level 1 facility as required in 5.1.9, except as follows:

(a) Area and local alarms shall not be required.
(b) Warning systems shall be permitted to have a single alarm panel.
(c) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
(d) Pressure switches/sensors that monitor main line pressure shall be mounted at the source equipment with a pressure indicator at the alarm panel.
(e) Changeover alarms to suit the arrangement of the source equipment shall be provided.

5.3.9.2 Systems for gases such as compressed air or nitrogen used to power devices, as well as Level 3 vacuum systems, shall not be required to have warning systems.

5.3.10 Level 3 Distribution

5.3.10.1 Piping Materials for Field-Installed Level 3 Positive-Pressure Gas Systems

5.3.10.1.1 Piping for Medical Gases. Piping for Level 3 positive-pressure nonflammable medical gases (e.g. oxygen and nitrous oxide) shall meet the following requirements:

5.3.10.1.1.1 Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service by the manufacturer prior to installation in accordance with CGA 4.1 Cleaning Equipment for Oxygen Service.

5.3.10.1.1.2 Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation.

5.3.10.1.1.3 Fittings, valves, and other components shall be delivered sealed and labeled by the manufacturer and kept sealed until prepared for installation.

5.3.10.1.1.4 Tubes shall be hard drawn seamless copper ASTM B 819 medical gas tube, Type L or K.

5.3.10.1.1.5 ASTM B 819 medical gas tube shall be identified by the manufacturer's markings “OXY”, “MED”, “OXY/MED”, “OXY/ACR” or “ACR/MED” in blue (Type L) or green (Type K).

5.3.10.1.2 Piping for Level 3 Gas-Powered Devices. Tubes shall be hard drawn seamless copper; either ASTM B 819 medical gas tube (Type K or L), ASTM B 88 water tube (Type K or L), or ASTM B 285 ACR tube (O.D. size), except that tube installed underground or within floor slabs shall be permitted to be soft annealed temper.

5.3.10.2 Piping Materials for Field-Installed Level 3 Vacuum Systems

5.3.10.2.1 In copper piping systems, the tubes shall be hard drawn seamless copper; either ASTM B 819 medical gas tube (Type K or L), ASTM B 88 water tube (Type K, L, or M), or ASTM B 280 ACR tube (O.D. size).

5.3.10.2.2 Copper tube installed underground or within floor slabs shall be permitted to be soft annealed temper.

5.3.10.2.3 In plastic piping systems, the pipe shall be polyvinylchloride (PVC) plastic, schedule 40 minimum.

5.3.10.3 Fittings

5.3.10.3.1 Turns, offsets, and other changes in direction in medical gas piping, copper level 3 vacuum piping and piping for gas-powered devices shall be made with brazed wrought copper capillary fittings complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Fittings, or brazing fittings complying with MSS SP-73, Brazed Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings.

5.3.10.3.2 Cast copper alloy fittings shall not be used where joints are brazed.

5.3.10.3.3 Branch connections in copper vacuum piping systems shall be permitted to be made using mechanically-formed, drilled, and extruded tee-branch connections that are formed in accordance with the tool manufacturer's instructions, and brazed.

5.3.10.3.4 Turns, offsets, and other changes in direction in plastic Level 3 vacuum piping shall be made with solvent-cemented PVC plastic pressure fittings, schedule 40 minimum.

5.3.10.4 Threaded Joints. Threaded joints in Level 3 gas and vacuum distribution piping shall be:

(a) limited to connections to pressure/vacuum indicators, alarm devices, and source equipment
(b) tapered pipe threads complying with ANSI B1.20.1, Pipe Threads, General Purpose
(c) made up with polytetraflouroethylene (such as Teflon™) tape or other thread sealant recommended for oxygen service, with the sealant applied to the male threads only.

5.3.10.5 Soldered Joints. Soldered joints in copper Level 3 vacuum piping shall be made in accordance with ASTM B 828, 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% lead by volume.

5.3.10.6 Solvent-Cemented Joints. Solvent-cemented joints in plastic Level 3 vacuum piping shall be in accordance with ASTM D 2855, Practice for Making Solvent-Cemented Joints in PolyVinyl Chloride (PVC) Pipe and Fittings.

5.3.10.7 Brazed Joints

5.3.10.7.1 General Requirements

5.3.10.7.1.1 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.

5.3.10.7.1.2 Brazed tube joints shall be the socket type.

5.3.10.7.1.3 Filler metals shall bond with and be metallurgically compatible with the base metals being joined.

5.3.10.7.1.4 Filler metals shall comply with ANSI/AWS A 5.8, Specification for Brazing Filler Metal.

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

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

5.3.10.7.2 Cutting Tube Ends

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

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

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

5.3.10.7.3 Cleaning Joints for Brazing

5.3.10.7.3.1 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.

5.3.10.7.3.2 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.

5.3.10.7.3.3 If the interior surfaces of fitting sockets that were cleaned for oxygen become contaminated prior to brazing, they shall be re-cleaned for oxygen in accordance with 5.3.10.7.3.9 and be cleaned for brazing with a clean, oil-free wire brush.
5.3.10.7.3.4 Non-abrasive pads (such as Scotchbrite™) shall be used to clean the exterior surfaces of tube ends.

5.3.10.7.3.5 The use of steel wool or sand cloth shall be prohibited.

5.3.10.7.3.6 The cleaning process shall not result in grooving of the surfaces to be joined.

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

5.3.10.7.3.8 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 (if so required) and that they are free of obstructions or debris.

5.3.10.7.3.9 The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but become contaminated prior to being installed, shall be permitted to be re-cleaned on-site by the installer by thoroughly scrubbing the interior surfaces with a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate, mixed 450 g to 11 liters (1 lb to 3 gal) of potable water and thoroughly rinsing them with clean, hot potable water.

5.3.10.7.3.10 Other aqueous cleaning solutions shall be permitted to be used for on-site re-cleaning permitted in 5.3.10.7.3.9 provided that they are as recommended in CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, and are listed in CGA Pamphlet O2-DIR, Directory of Cleaning Agents for Oxygen Service.

5.3.10.7.3.11 Material that has become contaminated internally and is not clean for oxygen service (if so required) shall not be installed.

5.3.10.7.3.12 Joints shall be brazed within one hour after the surfaces are cleaned for brazing.

5.3.10.7.4 Brazing Dissimilar Metals

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

5.3.10.7.4.2 Surfaces shall be cleaned for brazing in accordance with 5.3.10.7.3.

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

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

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

5.3.10.7.4.6 On joints DN20 (NPS 3/4) (7/8 in. O.D.) size and smaller, flux-coated brazing rods shall be permitted to be used in lieu of applying flux to the surfaces being joined.

5.3.10.7.5 Nitrogen Purge

5.3.10.7.5.1 While being brazed, joints shall be continuously purged with oil free, dry Nitrogen NF to prevent the formation of copper oxide on the inside surfaces of the joint.

5.3.10.7.5.2 The source of the purge gas shall be monitored and the installer shall be audibly alerted when the content is low.

5.3.10.7.5.3 The purge gas flow rate shall not produce a positive pressure in the piping system.

5.3.10.7.5.4 The purge gas flow rate shall be controlled by the use of a pressure regulator and flow meter, or combination thereof.

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

5.3.10.7.5.6 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.

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

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

5.3.10.7.5.9 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.

5.3.10.7.5.10 The final connection of new piping to an existing in-use pipeline shall be permitted to be made without the use of a nitrogen purge.

5.3.10.7.5.11 After a final connection in a Level 3 positive-pressure gas pipeline is made without a nitrogen purge, an outlet in the immediate downstream zone of the affected portion(s) of both the new and existing in-use piping shall be tested in accordance with 5.3.12.5-9 Final Tie-in Test.

5.3.10.7.6 Assembling and Heating Joints

5.3.10.7.6.1 Tube ends shall be inserted fully into the socket of the fitting.

5.3.10.7.6.2 Where flux is permitted, the joint shall be heated slowly until the flux has liquefied.

5.3.10.7.6.3 After flux is 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.

5.3.10.7.6.4 Techniques for heating the joint, applying the brazing filler metal, and making horizontal, vertical, and large-diameter joints shall be as stated in sections on “Applying Heat and Brazing” and “Horizontal and Vertical Joints” in Chapter VII - “Brazed Joints” in the CDA Copper Tube Handbook.

5.3.10.7.7 Inspection of Brazed or Soldered Joints

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

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

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

5.3.10.7.7.4 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.

(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 braze or solder filler metal.

(7) Failure of the joint to hold the test pressure or vacuum under the installer-performed initial pressure or vacuum test (5.3.12.2.5 or 5.3.12.2.24) and standing pressure or vacuum test (5.3.12.2.7 or 5.3.12.2.8).

5.3.10.7.7.5 Joints that are identified as defective under 5.3.10.7.7.4, conditions (2) or (5) shall be replaced.

5.3.10.7.7.6 Joints that are found to be defective under 5.3.10.7.7.4, conditions (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.

5.3.10.8 Special Joints

5.3.10.8.1 The following joints shall be prohibited throughout Level 3 medical gas (e.g. oxygen and nitrous oxide) pipeline systems:
5.3.10.10 Installation of Level 3 Piping and Equipment

5.3.10.10.1 Qualification of Installers

5.3.10.10.1.1 The installation of Level 3 gas and vacuum systems shall be made by qualified, competent technicians who are experienced in making such installations.

5.3.10.10.1.2 The installers of Level 3 medical gas systems (e.g., oxygen and nitrous oxide) shall be qualified under the requirements of ASSE 6010 - Medical Gas Systems Installers Professional Qualifications Standard.

5.3.10.10.1.3 Brazing shall be performed by individuals who are qualified under the provisions of 5.3.10.10.15.

5.3.10.10.1.4 Prior to any installation work involving brazing, the installer of Level 3 medical gas piping shall provide documentation for the qualification of brazing procedures and individual brazers that is required under 5.3.10.10.15.

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

5.3.10.10.3 Minimum Pipe Sizes

5.3.10.10.3.1 Mains, branches, and drops to individual service outlets in Level 3 oxygen piping systems shall be not less than DN10 (NPS 3/8) (1/2 in. O.D.) size.

5.3.10.10.3.2 Mains, branches, and drops to individual service outlets and inlets in the following piping systems shall be not less than DN8 (NPS 1/4) (3/8 in. O.D.) size:
   (1) Level 3 medical gases other than oxygen (e.g., nitrous oxide)
   (2) gas-powered devices
   (3) Level 3 vacuum

5.3.10.10.3.3 Runouts to alarm panels and connecting tubing for pressure/vacuum indicators and alarm devices shall be permitted to be DN8 (NPS 1/4) (3/8 in. O.D.) size.

5.3.10.10.4 Protection of Piping. Piping shall be protected against freezing, corrosion, and physical damage.

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

5.3.10.10.4.2 Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

5.3.10.10.5 Location of Piping. Piping for Level 3 medical gases, Level 3 gas-powered devices, and Level 3 vacuum systems shall be located as follows:

5.3.10.10.5.1 Piping shall be installed overhead wherever possible.

5.3.10.10.5.2 Piping shall not be installed in electrical switchgear rooms, elevator shafts, and areas having open flames.

5.3.10.10.5.3 Medical gas piping (e.g., oxygen and nitrous oxide) shall not be located where subject to contact with oil.

5.3.10.10.6 Pipe Support

5.3.10.10.6.1 Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports - Selection and Application.

5.3.10.10.8.2 Flared and compression connections shall be permitted in piping for Level 3 gas-powered devices and Level 3 vacuum in junction boxes, and where exposed at station outlets/inlets and source equipment.

5.3.10.9 Special Fittings. The following special fittings shall be permitted to be used in lieu of brazed joints:
   (1) memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.
   (2) listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and scaling integrity of a brazed joint.

5.3.10.10.8 Hangers and supports shall comply with MSS Standard Practice SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.

5.3.10.10.6.2 Hangers and supports shall be sized for copper tube and have a copper finish.

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

5.3.10.10.6.5 Maximum support spacing for copper tubing shall be in accordance with Table 5.3.10.10.6.5.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hanger Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN8 (NPS 1/4)</td>
<td>1920 mm (5 ft)</td>
</tr>
<tr>
<td>DN10 (NPS 3/8)</td>
<td>1830 mm (6 ft)</td>
</tr>
<tr>
<td>DN15 (NPS 1/2)</td>
<td>1830 mm (6 ft)</td>
</tr>
<tr>
<td>DN20 (NPS 3/4)</td>
<td>2130 mm (7 ft)</td>
</tr>
<tr>
<td>DN25 (NPS 1)</td>
<td>2440 mm (8 ft)</td>
</tr>
<tr>
<td>DN32 (NPS 1-1/4)</td>
<td>2740 mm (9 ft)</td>
</tr>
<tr>
<td>DN40 (NPS 1-1/2)</td>
<td>3050 mm (10 ft)</td>
</tr>
<tr>
<td>Vertical risers, all sizes</td>
<td>Every floor, but not to exceed 4570 mm (15 ft)</td>
</tr>
</tbody>
</table>

5.3.10.10.6.6 PVC plastic piping for Level 3 vacuum systems shall be supported at a maximum spacing of 1220 mm (4 ft), except that vertical piping shall be supported at every floor and with mid-story guides.

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

5.3.10.10.7 Piping Within Floor Slabs and Underground Within Buildings. The following conditions shall be permitted only when piping must be installed within a floor slab or underground within a building in order to reach the service outlets or inlets served.

5.3.10.10.7.1 Tubes shall be permitted to be annealed soft temper seamless copper tube up to DN10 (NPS 3/8) (1/2 in. O.D.) maximum size.

5.3.10.10.7.2 Tubes shall have been cleaned for oxygen service in accordance with CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service.

5.3.10.10.7.3 The tube(s) shall be installed in one (or more) continuous conduits that are of sufficient size to permit subsequent installation, removal, and replacement of the gas and/or vacuum lines.

5.3.10.10.7.4 Each tube pulled into the conduit shall be a continuous length having no joints within the conduit.

5.3.10.10.8 Underground Piping Outside of Buildings

5.3.10.10.8.1 Underground piping outside of buildings shall be installed below the local level of frost penetration.

5.3.10.10.8.2 Underground piping shall be installed in a continuous enclosure to protect the pipe during backfilling.

5.3.10.10.8.3 The continuous enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing.
5.3.10.10.14.4 Underground piping that will be subject to surface loads shall be buried at a depth that will protect the piping and its enclosure from excessive stresses.

5.3.10.10.8.5 The minimum backfilled cover above the top of the enclosure for underground piping outside of buildings shall be 920 mm (36 in.), except that the minimum cover shall be permitted to be reduced to 460 mm (18 in.) where the pipeline is not subject to physical damage.

5.3.10.10.6 Trenches shall be excavated so that the pipe enclosure has firm, substantially continuous bearing on the bottom of the trench.

5.3.10.10.8.7 Backfill shall be clean and compacted so as to protect and uniformly support the pipe enclosure.

5.3.10.10.8.8 A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name.

5.3.10.10.8.9 A continuous warning means shall also be provided above the pipeline enclosure at approximately one-half the depth of bury.

5.3.10.10.8.10 Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water into the building.

5.3.10.10.9 Branch Takeoffs. Runouts from horizontal piping shall be taken off above the centerline of the main or branch pipe and rise vertically or at an angle of not less than 45 degrees from vertical.

5.3.10.10 Special Requirements for Level 3 Vacuum Piping

5.3.10.10.1 Horizontal piping in Level 3 vacuum systems shall be sloped a minimum of 7 mm per 3050 mm (1/4 in. per 10 ft) toward the vacuum source equipment.

5.3.10.10.2 Horizontal piping shall include no sags or low points that will permit fluids or debris to accumulate.

5.3.10.10.3 Accessible clean outs shall be provided where necessary to clear the piping of obstructions.

5.3.10.11 Hoses and Flexible Connectors

5.3.10.11.1 Hose and flexible connectors, both metallic and non-metallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions.

5.3.10.11.2 Flexible connectors, metallic or non-metallic, shall have a minimum burst pressure of 6895 kPa (1000 psi) gage.

5.3.10.12 Prohibited System Interconnections

5.3.10.12.1 Two or more piping systems for medical gases, gas-powered devices, and Level 3 vacuum shall not be interconnected for testing or any other reason.

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

5.3.10.13 System Manufacturer's Instructions

5.3.10.13.1 The installation of individual components shall be made in accordance with the instructions of the system manufacturer.

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

5.3.10.13.3 Copies of system manufacturer's instructions shall be left with the system owner.

5.3.10.14 Changes in System Use

5.3.10.14.1 Where a Level 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 of 5.3.10 shall apply as if the system were new.

5.3.10.14.2 Piping for Level 3 gas-powered devices or Level 3 vacuum shall not be permitted to be converted for use as a medical gas piping system (e.g. oxygen or nitrous oxide).

5.3.10.15 Qualification of Brazing Procedures and Brazing

5.3.10.15.1 Brazing procedures and brazar performance for the installation of Level 3 brazed piping shall be qualified as the same as for Level 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 Qualifications, both as modified below.

5.3.10.15.2 Brazers shall be qualified by visual examination of the test coupon followed by sectioning.

5.3.10.15.3 The Brazing Procedure Specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

5.3.10.15.4 The Brazing Procedure Specification and the Record of Brazar Performance Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate during brazing of coupon, and the absence of internal oxidation in the completed coupon.

5.3.10.15.5 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 meets the requirements of this standard.

2. The employer obtains a copy of both the Brazing Procedure Specification and the supporting qualification records 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 brazar following each Brazing Procedure Specification used.

5.3.10.15.6 An employer shall be permitted to accept Brazar Qualification Records of a previous employer under the following conditions:

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

2. The new employer obtains a copy of the record of Brazar Performance Qualification tests from the previous employer and signs and dates these records, thereby accepting responsibility for the qualifications performed by the previous employer.

5.3.10.15.7 Performance qualifications of brazars 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.

5.3.11 Labeling and Identification

5.3.11.1 Pipe Labeling

5.3.11.1.1 Piping 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 the chemical symbol.

5.3.11.1.3 Where positive pressure gas piping systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or to 1275 kPa (160 to 185 psi) gage for nitrogen, the pipe labels shall 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 6100 mm (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 traversed by risers

5.3.11.2 Shutoff Valves

5.3.11.2.1 Shutoff valves shall be identified as to the following:

1. The name or chemical symbol for the specific system

2. The name of the room(s) or area(s) served.

3. A caution to not close (or open) the valve except in an emergency.
5.3.12.2 Where positive pressure gas systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or to 1275 kPa (160 to 185 psi) gage for nitrogen, the valve identification shall also include the nonstandard operating pressure.

5.3.13 Service Outlets and Inlets

5.3.13.1 Service outlets and inlets shall be identified as to the name or chemical symbol for the specific gas or vacuum provided.

5.3.13.2 Where positive pressure gas systems operate at pressures other than the standard 345 to 380 kPa (50 to 55 psi) gage or to 1275 kPa (160 to 185 psi) gage for nitrogen, the station outlet identification shall include the nonstandard operating pressure.

5.3.12 Performance Criteria and Testing—Level 3 (Medical Gas, Gas-Powered Devices, Vacuum)

5.3.12.1 General

5.3.12.1.1 Inspection and testing shall be performed on all new piped gas systems, additions, renovations, temporary installations, or repaired systems, to assure the facility, by a documented procedure, that all applicable provisions of this document have been adhered to and system integrity has been achieved or maintained.

5.3.12.1.2 Inspection and testing shall include all components of the system or portions thereof including, but not limited to, medical gas source(s), compressed air source systems (e.g., compressors, dryers, filters, regulators), alarms and monitoring safeguards, pipelines, isolation valves, and service outlets and inlets.

5.3.12.1.3 All systems that are breached and components that are subjected to additions, renovations, or replacement (e.g., new medical gas sources, compressors, dryers, alarms) shall be inspected and tested.

5.3.12.1.4 Systems shall be deemed breached at the point of pipeline intrusion by physical separation or by system component removal, replacement, or addition.

5.3.12.1.5 Breached portions of the systems subject to inspection and testing shall be confined to only the specific altered zone and components in the immediate zone or area that is located upstream for vacuum systems and downstream for pressure gases at the point or area of intrusion.

5.3.12.1.6 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.

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

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

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

5.3.12.1.10 Before piping systems are initially put into use, the Level 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/vacuum. See 5.3.12.1.11.

5.3.12.1.11 Acceptance of the Verifier’s reports required under 5.3.12.3.1 under 5.3.12.5 5-System Verification shall be permitted to satisfy the requirements of 5.3.12.1.10.

5.3.12.2 Initial Tests

5.3.12.2.1 General

5.3.12.2.1.1 The tests required by this section shall be performed prior to the tests listed in 5.3.12.3 System Verification by one or more of the following:

(1) the installer.

(2) a representative of the system supplier.

5.3.12.2.1.2 The test gas for positive-pressure gas systems shall be oil free, dry Nitrogen NF.

5.3.12.2.1.3 Where manufactured assemblies are to be installed, the tests required under 5.3.12.2 shall be performed:

(1) After completion of the distribution piping

(2) Prior to installation or connection of manufactured assemblies supplied through flexible hoses or flexible tubing

(3) At all station outlets/inlets on manufactured assemblies supplied through copper tubing

5.3.12.2.2 Initial Blow Down. Piping in Level 3 positive-pressure gas distribution systems shall be blown clear by means of oil free, dry Nitrogen NF as follows:

(1) After installation of the distribution piping

(2) Before installation of station outlets and other system component (e.g., pressure alarm devices, pressure indicators, pressure relief valves, manifolds, source equipment).

5.3.12.2.3 Initial Pressure Test for Positive-Pressure Gas Systems and Copper Level 3 Vacuum Piping

5.3.12.2.3.1 Each section of the piping in Level 3 positive-pressure gas piping systems and copper Level 3 vacuum systems shall be pressure tested using oil free, dry Nitrogen NF.

5.3.12.2.3.2 Initial pressure tests shall be conducted as follows:

(1) After installation of station outlets/inlets rough-in assemblies. Test caps shall be permitted to be used.

(2) 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).

5.3.12.2.3.3 Where Level 3 vacuum piping systems include plastic piping, they shall be inspected to assure that there are no visible cross-connections to positive-pressure gas piping systems prior to applying test pressures to the positive-pressure systems.

5.3.12.2.3.4 The source shutoff valves for all piping systems shall remain closed during these tests.

5.3.12.2.3.5 The test pressure for positive-pressure gas piping shall be 1.5 times the system working pressure but not less than 1035 kPa (150 psi) gage.

5.3.12.2.3.6 The test pressure for copper Level 3 vacuum piping shall be 165 kPa (15 psi) gage.

5.3.12.2.3.7 The test pressure shall be maintained until each joint has been examined for leakage by means of soapy water or other equally effective means of leak detection.

5.3.12.2.3.8 Leaks, if any, shall be located, replaced (if permitted) or repaired (if required) and retested.

5.3.12.2.4 Initial Leak Tests - PVC Level 3 Vacuum Piping. Plastic Level 3 vacuum piping shall be leak-tested under vacuum conditions.

5.3.12.2.4.1 Plastic Level 3 vacuum piping shall not be tested with compressed gas.

5.3.12.2.4.2 Leak tests shall be conducted after installation of station inlets.

5.3.12.2.4.3 The piping being tested shall be subjected to a vacuum of not less than 485 mm (19 in.) gage HgV, using either the vacuum source equipment or a vacuum test pump.

5.3.12.2.4.4 The test vacuum shall be maintained until each joint has been examined for leakage.

5.3.12.2.5 Initial Cross-Connection Test. The installer shall determine that no cross connections exist between the various Level 3 gas and vacuum piping systems.

5.3.12.2.5.1 All level 3 gas and vacuum piping systems shall be at atmospheric pressure.

5.1.12.2.5.2 Face plates for outlets/inlets shall be installed.
5.3.12.5.3 Level 3 vacuum piping systems shall be subjected to a vacuum of not less than 485 mm (19 in.) gage HgV, using either the vacuum source equipment or a test pump.

5.3.12.5.4 Each individual system gas outlet and vacuum inlet in each piping system shall be checked to determine that the vacuum is present only at the inlets for the vacuum system being tested.

5.3.12.5.5 The vacuum piping system shall be relieved to atmospheric pressure.

5.3.12.5.6 The test gas for all positive-pressure gas piping systems shall be oil free, dry Nitrogen NF.

5.3.12.5.7 Sources of test gas and vacuum shall be disconnected from all piping systems except for the one system being tested.

5.3.12.5.8 The positive-pressure gas system being tested shall be pressurized to 345 kPa (50 psi) gage with oil free, dry Nitrogen NF.

5.3.12.5.9 Each individual system gas outlet and vacuum inlet in each piped piping system shall be checked to determine that the test gas is being dispensed only from the outlets in the piping system being tested.

5.3.12.5.10 The cross-connection test shall be repeated for each installed positive-pressure gas piping system.

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

5.3.12.6 Initial Piping Purge Test. The outlets in each Level 3 positive-pressure gas piping system shall be purged to remove any particulate matter from the distribution piping.

5.3.12.6.1 The test gas shall be oil free, dry Nitrogen NF.

5.3.12.6.2 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.

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

5.3.12.7 Initial Standing Pressure Test for Positive Pressure Gas Piping. After successful completion of the initial pressure tests under 5.3.12.2.3, Level 3 positive-pressure gas distribution piping shall be subjected to a standing pressure test.

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

5.3.12.7.2 The source valve shall be closed during this test.

5.3.12.7.3 The piping systems shall be subjected to a 24-hour standing pressure test using oil free, dry Nitrogen NF.

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

5.3.12.7.5 At the conclusion of the tests, there shall be no change in the test pressure greater than 35 kPa (5 psi) gage.

5.3.12.7.6 Leaks, if any, shall be located, repaired (if permitted), replaced (if required) and retested.

5.3.12.8 Initial Standing Vacuum Test for Vacuum Systems. Level 3 vacuum systems, with either plastic or copper piping, shall be subjected to a standing vacuum test.

5.3.12.8.1 The piping system shall be subjected to a vacuum of not less than 485 mm (19 in.) gage HgV gage for 24 hours, using either the vacuum source equipment or a test source.

5.3.12.8.2 During the test, the source of test vacuum shall be disconnected from the piping system.

5.3.12.8.3 At the conclusion of the test, the vacuum shall not have reduced to less than the 300 mm (12 in.) HgV.

5.3.12.8.4 Leaks, if any, shall be located, repaired (if permitted), replaced (if required) and retested.

5.3.12.3 System Verification

5.3.12.3.1 General

5.3.12.3.1.1 Verification tests shall be performed only after all tests required in 5.3.12.2, Initial Tests have been completed.

5.3.12.3.1.2 The test gas shall be oil free, dry Nitrogen NF or the system gas where permitted.

5.3.12.3.1.3 Testing shall be conducted by a party technically competent and experienced in the field of Level 3 gas and vacuum system verification and meeting the requirements of ANSI/ASSE Standard 6030, Medical Gas Verifiers Professional Qualifications Standard.

5.3.12.3.1.4 Testing shall be performed by a party other than the installing contractor.

5.3.12.3.1.5 All tests required under 5.3.12.3 shall be performed after installation of any manufactured assemblies supplied through flexible hoses or tubing.

5.3.12.3.1.6 Where manufactured assemblies include multiple possible connection points for terminals, each possible position shall be tested independently.

5.3.12.3.1.7 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 (5.3.12.3.2)

(2) Cross-Connection (5.3.12.3.4)

(3) Warning Systems (5.3.12.3.5)

(4) Piping Purge (5.3.12.3.6)

(5) Piping Particulates (5.3.12.3.7)

(6) Piping Purity (5.3.12.3.8)

(7) Operational Pressure (5.3.12.3.10)

5.3.12.3.1.8 All verification test results shall be reported as required in 5.3.12.1.

5.3.12.3.2 Verifier Standing Pressure Test. Each positive-pressure gas piping system shall be subjected to a ten 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 and any zone valves shall be closed.

(2) The piping system downstream of the valves shall show no decrease in pressure after ten minutes.

(3) Any leaks found shall be located, repaired (if permitted), replaced (if required) and retested.

5.3.12.3.3 Verifier Standing Vacuum Test. Each Level 3 vacuum piping system shall be subjected to a ten 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 ten minutes.

(3) Leaks, if any, shall be located, repaired (if permitted), replaced (if required) and retested.

5.3.12.3.4 Verifier Cross-Connection Test. After closing of walls and completion of the requirements of 5.3.12.2, Installer-Performed Tests, it shall be determined that no cross-connections of the piping systems exist by the following method:

(1) Shut off the source of test gas for all positive-pressure gas piping systems and reduce them to atmospheric pressure.

(2) Operate Level 3 vacuum systems at the normal system vacuum, using the source equipment.

(3) Each positive-pressure gas outlet and Level 3 vacuum inlet shall be tested with appropriate adapters to verify that vacuum is present only at the vacuum inlets in the system being tested and not at any positive-pressure gas outlets.

(4) Shut down the vacuum source equipment and slowly break the vacuum in the Level 3 vacuum piping system, increasing its pressure to atmospheric.

(5) Using oil free, dry Nitrogen NF or the system gas, pressurize one of the positive-pressure gas piping systems to 345 kPa (50 psi) gage.

(6) Test each positive-pressure gas outlet and Level 3 vacuum inlet using appropriate adapters to verify that the test gas pressure is present only at the outlets in the piping system being tested.
5.3.12.3.5 Verifier Level 3 Warning System Tests

5.3.12.3.5.1 All warning systems required by 5.3.9 shall be tested to ensure that all components function correctly prior to placing the system into service.

5.3.12.3.5.2 Permanent records of these tests shall be maintained.

5.3.12.3.5.3 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.

5.3.12.3.5.4 Tests of warning systems for new installations (initial tests) shall be performed after the verifier's cross-connection testing (5.3.12.3.4), but before purging the piping (5.3.12.3.6) and performing the remaining verification tests (5.3.12.3.7 through 5.3.12.3.13).

5.3.12.3.5.5 Test gases for the initial tests shall be either oil free, dry Nitrogen NF, the gas of system designation, or the operating vacuum source.

5.3.12.3.5.6 The audible and non-cancellable alarm signals in each single treatment facility shall be checked to verify that they are in a location that will be continuously attended while the facility is in operation.

5.3.12.3.5.7 The operation of the Level 3 line pressure alarms required by 5.3.9.1(d) shall be verified.

5.3.12.3.5.8 Audible and non-cancellable visual signals in each single treatment facility shall indicate if the pressure in the main line being monitored increases or decreases 20 percent from the normal operating pressure.

5.3.12.3.5.9 The operation of the Level 3 changeover alarms required by 5.3.9.1(e) shall be verified.

5.3.12.3.5.10 Audible and non-cancellable visual signals shall indicate whenever automatic changeover occurs or is about to occur.

5.3.12.3.5.11 Where Level 3 gas and vacuum systems include other alarm features that are not mandatory under 5.3.9, they shall be functionally tested in accordance with their intended purpose and the equipment manufacturer’s recommendations.

5.3.12.3.6 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 medical gas piping system (e.g., oxygen and nitrous oxide) where the user makes connections and disconnections.

5.3.12.3.6.1 The appropriate adapter shall be obtained from the facility or manufacturer, and high purge rates of at least 230 Nl/min (8 SCFM) shall be put on each outlet.

5.3.12.3.6.2 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.

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

5.3.12.3.7 Verifier Piping Particulate Test. The cleanliness of the piping in each medical gas (e.g., oxygen and nitrous oxide) system shall be verified as follows:

(a) The test shall be performed using oil free, dry Nitrogen NF or the system gas.

(b) 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).

(c) Each zone shall be tested at the outlet most remote from the source.

(d) The filter shall accrue no more than .001 gram (1 mg) of matter from any outlet tested.

5.3.12.3.8 Verifier Piping Purity Test. For each medical gas (e.g., oxygen and nitrous oxide) system, the purity of the piping system shall be verified as follows:

(a) These tests shall be performed with oil free, dry Nitrogen NF or the system gas.

(b) The tests shall be for total hydrocarbons (as methane) and halogenated hydrocarbons, and compared with the source gas.

(c) This test shall be performed at the outlet most remote from the source.

(d) The difference between the two tests shall in no case exceed:

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hydrocarbons (ppm)</td>
<td>1</td>
</tr>
<tr>
<td>Halogenated Hydrocarbons</td>
<td>2</td>
</tr>
<tr>
<td>Dew Point (°C)</td>
<td>12</td>
</tr>
</tbody>
</table>

5.3.12.3.9 Verifier Final Tie-in Test

5.3.12.3.9.1 Prior to the connection of any new piping to its source of supply, including extensions or additions to an existing piping system, the verification tests in 5.3.12.3.1 through 5.3.12.3.8 shall be successfully performed on the new work.

5.3.12.3.9.2 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 by means of soapy water or other means effective for use with oxygen.

5.3.12.3.9.3 For positive-pressure gases, immediately after the 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 5.3.12.3.6.

5.3.12.3.9.4 Before the new work is used for patient care, the following tests shall be performed for all medical gas (e.g., oxygen and nitrous oxide) systems:

1. Operational pressure (5.3.12.3.10).

2. Gas concentration (5.3.12.3.11).

5.3.12.3.9.5 Permanent records of these tests shall be maintained in accordance with 5.3.12.8.1.

5.3.12.3.10 Verifier Operational Pressure Test. Operational pressure tests shall be performed at each station outlet in Level 3 medical gas piping systems (e.g., oxygen and nitrous oxide) where the user makes connections and disconnections.

5.3.12.3.10.1 Tests shall be performed using either oil free, dry Nitrogen NF or the gas of system designation.

5.3.12.3.10.2 Medical gas outlets (e.g., oxygen and nitrous oxide) shall deliver 100 Nl/min (3.5 SCFM) with a pressure drop of no more than 35 kPa (5 psi) gage, and static pressure of 343-380 kPa (50-55 psi) gage.

5.3.12.3.11 Verifier Gas Concentration Test. After purging each piping system with the gas of system designation, the following shall be performed:

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

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

3. Allowable concentrations shall be as follows:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

5.3.12.3.12 Labeling. The presence and correctness of labeling required by this standard for all components (e.g., station outlets/inlets, shutoff valves, and alarm panels) shall be verified.

5.3.12.3.13 Source Equipment Verification

5.3.12.3.13.1 General. Source equipment verification shall be performed following the installation of the interconnecting pipelines, accessories, and source equipment.

5.3.12.3.13.2 Use of Source Equipment for Pipeline Verification Tests. Where the source equipment and system gas or vacuum is used for verification testing of the distribution piping, the source equipment shall be verified prior to verification of the distribution piping.
5.3.12.3.13.3 Level 3 Source Equipment for Positive-Pressure Gases

5.3.12.3.13.4 Level 3 Vacuum Source Equipment. The functioning of the Level 3 vacuum source system(s) shall be tested and verified before it is put into service.

5.3.13 Level 3 Operation and Management

5.3.13.1 Administration. Administrative authorities of health care organizations shall provide policies and procedures for safe practices.

5.3.13.1.1 Purchase specifications shall include:
(1) specifications for cylinders.
(2) marking of cylinders, regulators, and valves.
(3) proper connection of cylinders supplied to the facility.

5.3.13.1.2 Training procedures shall include:
(1) Maintenance programs in accordance with the manufacturers' recommendations for the piped gas system.
(2) Use and transport of equipment and the proper handling of cylinders, containers, hand trucks, supports, and valve protection caps.
(3) Proper uses of the Medical/Surgical vacuum system in order to eliminate practices that reduce the system's effectiveness, such as leaving suction tips and catheters open when not actually aspirating, and using equipment arrangements that are improperly trapped or are untrapped.

5.3.13.1.3 Policies for enforcement shall include:
(1) Regulations for the storage and handling of cylinders and containers of oxygen and nitrous oxide.
(2) Regulations for the safe handling of oxygen and nitrous oxide in anesthetizing locations.
(3) All signal warnings are promptly evaluated and all necessary measures are taken to reestablish the proper functions of the medical gas system.
(4) The organization has the capability and resources to cope with a complete loss of any medical gas system.
(5) Prior to the use of any medical gas piping system for patient care all tests required in 5.3.11 have been successfully conducted.

5.3.13.2 Special Precautions for Handling Oxygen Cylinders and Manifolds. Handling of oxygen cylinders and manifolds shall be based on C&G Pamphlet G-4, Oxygen.

5.3.13.2.1 Oxygen cylinders, containers, and associated equipment shall be protected from contact with oil or grease. Specific precautions shall include:
(1) Oil, grease, or readily flammable materials shall never be permitted to come in contact with oxygen cylinders, valves, regulators, gauges, or fittings.
(2) Regulators, fittings, or gauges shall never be lubricated with oil or any other flammable substance.
(3) Oxygen cylinders or apparatus shall never be handled with oily or greasy hands, gloves, or rags.

5.3.13.2.2 Equipment associated with Oxygen shall be protected from contamination. Specific precautions shall include:
(1) Particles of dust and dirt shall be cleared from cylinder valve openings by slightly opening and closing the valve before applying any fitting to the cylinder.
(2) The high-pressure valve on the oxygen cylinder shall be opened before bringing the apparatus to the patient or the patient to the apparatus.
(3) An oxygen cylinder shall never be draped with any materials such as hospital gowns, masks, or caps.
(4) Cylinder-valve protection caps, where provided, shall be kept in place and be hand tightened, except when cylinders are in use or connected for use.
(5) Valves shall be closed on all empty cylinders in storage.

5.3.13.2.3 Cylinders shall be protected from damage. Specific procedures shall include:
(1) Oxygen cylinders shall be protected from abnormal mechanical shock, which is liable to damage the cylinder, valve, or safety device.
(2) Oxygen cylinders shall not be stored near elevators, gangways, or in locations where heavy moving objects will strike them or fall on them.
(3) Cylinders shall be protected from the tampering of unauthorized individuals.

5.3.13.3.2 Valve outlets clogged with ice shall be thawed with warm — not boiling — water.

5.3.13.3.4 A torch flame shall never be permitted under any circumstances to come in contact with cylinder valves or safety devices.

5.3.13.3.5 Sparks and flame shall be kept away from cylinders.

5.3.13.3.6 Even if they are considered to be empty, cylinders shall never be used as rollers, supports, or for any purpose other than that for which the supplier intended them.

5.3.13.3.7 When small-size (A, B, D, or E) cylinders are in use, they shall be attached to a cylinder stand or to therapy apparatus of sufficient size to render the entire assembly stable.

5.3.13.3.8 Large cylinders (exceeding size E) and containers larger than 45 kg (100 lb) weight shall be transported on a proper hand truck or cart complying with Chapter 9.

5.3.13.3.9 Freestanding cylinders shall be properly chained or supported in a proper cylinder stand or cart.

5.3.13.3.10 Cylinders shall not be chained to portable or movable apparatus such as beds and oxygen tents.

5.3.13.3.11 Cylinders shall not be supported by radiators, steam pipes, or heat ducts.

5.3.13.3.12 Cylinders and their contents shall be handled with care. Specific procedures shall include:
(1) Oxygen fittings, valves, regulators, or gauges shall never be used for any service other than that of oxygen.
(2) Gases of any type shall never be mixed in an oxygen cylinder or any other cylinder.
(3) Oxygen shall always be dispensed from a cylinder through a pressure regulator.
(4) The cylinder valve shall be opened slowly, with the face of the gauge on the regulator pointed away from all persons.
(5) Oxygen shall be referred to by its proper name, oxygen, not air and liquid oxygen referred to by its proper name, not liquid air.
(6) Oxygen shall never be used as a substitute for compressed air.
(7) The markings stamped on cylinders shall not be tampered with because it is against federal statutes to change these markings without written authority from the Bureau of Explosives.

5.3.13.3.13 Markings used for the identification of contents of cylinders shall not be defaced or removed, including decals, tags, stenciled marks, and upper half of shipping tag.

5.3.13.3.14 The owner of the cylinder shall be notified if any condition has occurred that might permit any foreign substance to enter a cylinder or valve, giving details and cylinder number.

5.3.13.3.15 Neither cylinders nor containers shall be placed in proximity of radiators, steam pipes, heat ducts, or other sources of heat.

5.3.13.3.16 Very cold cylinders or containers shall be handled with care to avoid injury.

5.3.13.3.17 When individual small-size (A, B, D, or E) cylinders are used in association with patient care, the cylinders shall be permitted to be placed and stored in open areas throughout the patient care area.

5.3.13.3.18 Oxygen equipment that is defective shall not be used until:
(1) it has been repaired by competent in-house personnel,
(2) it has repaired by the manufacturer or his or her authorized agent,
(3) it has been replaced.

5.3.13.3.19 Regulators that are in need of repair or cylinders having valves that do not operate properly shall never be used.

5.3.13.3.20 Special Precautions for Making Cylinder and Container Connections

5.3.13.3.21* Wrenches and tools used to connect equipment shall be manufactured of material of adequate strength.

5.3.13.3.22* Cylinder valves shall be opened and connected in accordance with the following procedure:
(1) Make certain that apparatus and cylinder valve connections and cylinder wrenches are free of foreign materials.
(2) Turn the cylinder valve outwards from personnel. Stand to the side — not in front and not in back. Before connecting the apparatus to cylinder valve, momentarily open cylinder valve to eliminate dust,

5.3.13.3.23* Cylinders or cylinder valves shall not be repaired, painted, or altered.

5.3.13.3.24* Safety relief devices in valves or cylinders shall never be tampered with.

5.3.13.3.25* Valve outlets clogged with ice shall be thawed with warm — not boiling — water.

5.3.13.3.26* A torch flame shall never be permitted under any circumstances to come in contact with cylinder valves or safety devices.

5.3.13.3.27* Sparks and flame shall be kept away from cylinders.

5.3.13.3.28* Even if they are considered to be empty, cylinders shall never be used as rollers, supports, or for any purpose other than that for which the supplier intended them.

5.3.13.3.29* When small-size (A, B, D, or E) cylinders are in use, they shall be attached to a cylinder stand or to therapy apparatus of sufficient size to render the entire assembly stable.

5.3.13.3.30* Freestanding cylinders shall be properly chained or supported in a proper cylinder stand or cart.

5.3.13.3.31* Cylinders shall not be chained to portable or movable apparatus such as beds and oxygen tents.

5.3.13.3.32* Cylinders shall not be supported by radiators, steam pipes, or heat ducts.

5.3.13.3.33 Special Precautions for Making Cylinder and Container Connections

5.3.13.3.34* Wrenches and tools used to connect equipment shall be manufactured of material of adequate strength.

5.3.13.3.35* Cylinder valves shall be opened and connected in accordance with the following procedure:
(1) Make certain that apparatus and cylinder valve connections and cylinder wrenches are free of foreign materials.
(2) Turn the cylinder valve outwards from personnel. Stand to the side — not in front and not in back. Before connecting the apparatus to cylinder valve, momentarily open cylinder valve to eliminate dust,

5.3.13.3.36* Cylinders or cylinder valves shall not be repaired, painted, or altered.

5.3.13.3.37* Safety relief devices in valves or cylinders shall never be tampered with.

5.3.13.3.38* Valve outlets clogged with ice shall be thawed with warm — not boiling — water.

5.3.13.3.39* A torch flame shall never be permitted under any circumstances to come in contact with cylinder valves or safety devices.

5.3.13.3.40* Sparks and flame shall be kept away from cylinders.

5.3.13.3.41* Even if they are considered to be empty, cylinders shall never be used as rollers, supports, or for any purpose other than that for which the supplier intended them.

5.3.13.3.42* When small-size (A, B, D, or E) cylinders are in use, they shall be attached to a cylinder stand or to therapy apparatus of sufficient size to render the entire assembly stable.

5.3.13.3.43* Freestanding cylinders shall be properly chained or supported in a proper cylinder stand or cart.

5.3.13.3.44* Cylinders shall not be chained to portable or movable apparatus such as beds and oxygen tents.

5.3.13.3.45* Cylinders shall not be supported by radiators, steam pipes, or heat ducts.
(3) Make connection of apparatus to cylinder valve. Tighten connection nut securely with a wrench.
(4) Release the low-pressure adjustment screw of the regulator completely,
(5) Slowly open cylinder valve to full open position,
(6) Slowly turn in the low-pressure adjustment screw on the regulator until the proper working pressure is obtained, and
(7) Open the valve to the utilization apparatus.

5.3.13.3 Connections for containers shall be made in accordance with the container manufacturer’s operating instructions.

5.3.13.4 Special Precautions for the Care of Safety Mechanisms

5.3.13.4.1 Personnel using cylinders and containers and other equipment covered in this chapter shall be familiar with the Pin-Index Safety System (see Chapter 9) and the Diameter-Index Safety System (see Chapter 9), both are designed to prevent utilization of the wrong gas.

5.3.13.4.2 Safety relief mechanisms, non-interchangeable connectors, and other safety features shall not be removed or altered.

5.3.13.5 Special Precautions – Storage of Cylinders and Containers

5.3.13.5.1 Storage shall be planned so that cylinders can be used in the order in which they are received from the supplier.

5.3.13.5.2 If stored within the same enclosure, empty cylinders shall be segregated from full cylinders.

5.3.13.5.3 Empty cylinders shall be marked to avoid confusion and delay if a full cylinder is needed in a rapid manner.

5.3.13.5.4 Cylinders stored in the open shall be protected as follows:
(1) against extremes of weather and from the ground beneath to prevent rusting,
(2) during winter, against accumulations of ice or snow,
(3) in summer, screened against continuous exposure to direct rays of the sun in those localities where extreme temperatures prevail.

5.3.13.6 Special Precautions – Piped Patient Gas/Vacuum Systems

5.3.13.6.1* Piping systems shall not be used for the distribution of flammable anesthetic gases.

5.3.13.6.2 Piping systems for gases shall not be used as a grounding electrode.

5.3.13.6.3 The vacuum system shall not be used for vacuum steam condensate return or other non-medical applications.

5.3.13.7 Gas/Vacuum Systems Information and Warning Signs

5.3.13.7.1 The gas content of medical gas piping systems shall be labelled according to 5.3.11.1.

5.3.13.8* Gas/Vacuum Systems Maintenance and Record Keeping

5.3.13.8.1 Permanent records of all tests required by 5.3 shall be maintained in the organization’s files.

5.3.13.8.2 A periodic testing procedure for nonflammable medical gas/vacuum and related alarm systems shall be implemented.

5.3.13.8.3 Whenever modifications are made or maintenance is performed that breaches the system the tests specified in 5.3.12 shall be conducted on the downstream portions of the medical gas piping system.

5.3.13.8.4 A maintenance program shall be established for the following:
(1) the medical air compressor supply system in accordance with the manufacturers’ recommendations,
(2) the vacuum source and accessories in accordance with the manufacturers’ recommendations,
(3) * both the vacuum piping system and to the secondary equipment attached to vacuum station inlets to ensure the continued good performance of the entire vacuum system,
(4) the scavenger system to assure performance.

5.3.13.8.5* Audible and visual alarm indicator(s):
(a) shall be periodically tested to determine that they are functioning properly,
(b) shall have the records of the test maintained until the next test is performed.

Annex Materials

A.5.1.2 Nature of Hazards of Gas and Vacuum Systems

Gas Systems. Oxygen and nitrous oxide, the gases normally used for relative analgesia and as components of general anesthesia, are strong oxidizing gases and individually or as a mixture support combustion quite readily.

Inhalation gases or vapors introduce fire, chemical, mechanical, and electrical hazards that are all interrelated. Any mixture of inhalation gases will support combustion. In an oxygen-enriched atmosphere, materials that are flammable and combustible in air ignite more easily and burn more vigorously. Combustible materials that could be found near patients who are to receive respiratory therapy include hair oils, oil-based lubricants, skin lotions, facial tissues, clothing, bed linen, tent canopies, rubber and plastic articles, gas supply and suction tubing, ether, alcohols, and acetone.

A particular hazard exists when oxygen or nitrous oxide equipment becomes contaminated with oil, grease, or other combustible materials. Such contaminants will ignite readily and burn more rapidly in the presence of high oxygen concentrations and make it easier to ignite less combustible materials with which they come in contact.

Any mixture of breathing gases used in respiratory therapy will support combustion. In an oxygen-enriched atmosphere, materials that are combustible and flammable in air ignite more easily and burn more vigorously. Materials not normally considered to be combustible may be so in an oxygen-enriched atmosphere.

An oxygen-enriched atmosphere normally exists in an oxygen tent, croup tent, incubator, and similar devices when supplemental oxygen is being employed in them. These devices are designed to maintain a concentration of oxygen higher than that found in the atmosphere.

A hazard exists if either oxygen or nitrous oxide leaks into a closed space, creating an oxygen-enriched atmosphere.

Oxygen-enriched atmospheres can exist in the immediate vicinity of all oxygen administration equipment. (See definition of Site of Intentional Expulsion).

The transfer of liquid oxygen from one container to another container can create an oxygen-enriched atmosphere within the vicinity of the containers.

If oxygen is supplied by a container that stores the oxygen as a liquid, there will be a small amount of oxygen vented into the vicinity of the container after a period of nonuse of the equipment. Larger amounts of oxygen will be vented if the container is accidentally tipped over or placed on its side. This venting may create an oxygen-enriched atmosphere if the container is stored in a confined space.

A hazard exists if improper components are employed to connect equipment containing pressurized oxygen or nitrous oxide during respiratory therapy administration.

The occurrence of a fire requires the presence of combustible or flammable materials, an atmosphere of oxygen or other oxidizing agents, and a source of ignition. Combustible materials can be unavoidably present when oxygen is being administered, but flammable liquids and gases and ignition sources are avoidable.

Sources of ignition include not only the usual ones in ordinary atmospheres, but others that become significant hazards in oxygen-enriched atmospheres such as the following:
(a) Open flames, burning tobacco, and electric radiant heaters are sources of ignition.
(b) The discharge of a cardiac defibrillator can serve as a source of ignition.
(c) Arcing and excessive temperatures in electrical equipment are sources of ignition. Electrically powered oxygen apparatus and
Mechanical Hazards during Respiratory Therapy Administration.

Cylinders and containers can be heavy and bulky and can cause personal injury or property damage (including to the cylinder or container) if improperly handled. In cold climates, cylinders or containers stored outdoors or in unheated ventilated rooms can become extremely cold. A hazardous situation could develop if these cylinders or containers are heated

Improper maintenance, handling, or assembly of equipment can result in personal injury, property damage, or fire.

A hazardous condition exists if cylinders or containers are improperly located so that they can become overheated or tipped over. If a container is tipped over or placed on its side, liquid oxygen could be spilled. The liquid can cause frostbite on contact with skin.

A hazardous condition exists if there is improper labeling of cylinders or containers or inattention to the manufacturer’s label or instructions.

A hazardous condition exists if care is not exercised in making slip-on and other interchangeable connections when setting up equipment.

Safety features, including relief devices, valves, and connections, are provided in equipment and gas supply systems. Altering or circumventing these safety features by means of adapters creates a hazardous condition.

Extreme danger to life and property can result when compressed gases are mixed or transferred from one cylinder to another. A hazardous condition exists if devices, such as fixed or adjustable orifices and metering valves, are directly connected to cylinders or systems without a pressure-reducing regulator.

Hazardous conditions are created when pressure-reducing regulators or gauges are defective.

Manufactured Assemblies. Specific hazards associated with manufactured assemblies are the same as those listed above as well as additional hazards resulting from improper assembly, separation and leakage resulting from hidden semipermanent connections, improper connection resulting in cross connection, and blockage and flow problems resulting from damage to hoses, etc.

A.5.1.3.3 The bulk supply system should be installed on a site that has been prepared to meet the requirements of NFPA 30, Standard for Bulk Oxygen Systems at Consumer Sites, or CGA Pamphlet G-8.1, Standard for the Installation of Nitrous Oxide Systems at Consumer Sites. Storage unit(s), reserve, pressure regulation, and signal actuating switch(es) are components of the supply system. Shut-off valves, piping from the site, and electric wiring from a signal switch(es) to the master signal panel are components of the piping system. The bulk supply system is normally installed on the site by the owner of this equipment. It is the responsibility of the owner or the organization responsible for the operation and maintenance of the bulk supply system to ensure that all components of the supply system — main supply, reserve supply, supply system signal actuating switch(es), and delivery pressure regulation equipment — function properly before the system is put in service.
Either of two valve types: a ball valve or a check valve.

A union or other means to disassemble components. (Note: These are not illustrated in every location where they may be required.)

A pressure regulator.

A switch or sensor connected to the alarm panel(s).

Either of two valve types: a ball valve or a check valve.

A demand check to allow disconnection of the device without shutting down of the system.

A quarter turn ball valve. The type shown is used for ease of recognition, but other configurations may be permissible.

Items shown in dashed format indicate alternative arrangements or components required only conditionally.

A high-pressure valve. The technology of the valve is not specified.

A pressure indicator. A gauge type is shown, but other types may be permitted.

A relief valve vent piped to outside.

A relief valve.

A liquid vessel for containing cryogenic liquified gas.

A filter.

A vaporizer for converting cryogenic liquified gas from liquid to gas state.

The point at which the diagram transitions to the next portion of the system.

The wall of the source enclosure.

A check valve. The valve flows in the direction of the point.

A "pigtail" for connecting cylinders to the header. May be rigid or flexible, depending on the gas and pressure.

Figure A.5.1.3  Legend for the Typical Drawings
A four-valve bypass arrangement is illustrated. Three-way valves are permitted in lieu of the four valves shown.

Figure A.5.1.3.4 Typical Arrangement for Line Controls at Pressure Sources
A.5.1.3.4.2 Prohibited uses of medical gases include fueling torches, blowing down or driving any equipment such as lab equipment, endoscopy or other scopes, or any other purposes. Also prohibited is using the oxygen or medical air to raise, lower, or otherwise operate booms or other devices in ORs or other areas.

A.5.1.3.4.3 Components include but are not limited to containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hoses. Easily ignitable materials should be avoided.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air will burn violently in pure oxygen at normal pressure and explosively in pressurized oxygen. Also, many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Metals for containers and piping must be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions can call for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion. Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials can be ignited by friction at a valve seat or stem packing or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.

A.5.1.3.4.8 (See Figures A.5.1.3.4.8 Part 1 and Figure A.5.1.3.4.8 Part 2 on pages 263-264.)

A.5.1.3.4.8 (1) The appropriate number of cylinders should be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the emergency plan.

A.5.1.3.4.9 (See Figure A.5.1.3.4.9 on page 265.)

A.5.1.3.4.10 (See Figure A.5.1.3.4.10 on page 266.)

A.5.1.3.4.11 For bulk oxygen systems, see NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites. (See Figure A.5.1.3.4.11 on page 267.)

A.5.1.3.4.12 Consideration should be given to the consequences of a large spillage of liquid on the vehicle pad in terms of where the liquid would run and where the very cold gas would travel as it boiled off the liquid.

A.5.1.3.4.12 (See Figure A.5.1.3.4.12 on page 268.)

A.5.1.3.5 Medical Air. Air supplied from on-site compressor and associated air treatment systems (as opposed to medical air USP supplied in cylinders) that complies with the specified limits is considered medical air. Hydrocarbon carryover from the compressor into the pipeline distribution system could be detrimental to the safety of the end user and to the integrity of the piping system. Mixing of air and oxygen is a common clinical practice, and the hazards of fire are increased if the air is contaminated. Compliance with these limits is thus considered important to fire and patient safety. The quality of local ambient air should be determined prior to its selection for compressors and air treatment equipment. (See Figure A.5.1.3.5 on page 269.)

A.5.1.3.5.1 Supply systems for medical air using compressors draw air of the best available quality from a source of clean local ambient air, add no contaminants in the form of particulate matter, odor, or other gases, dry, filter, regulate and supply that air only via the Medical Air piping distribution system for use exclusively in the application of human respiration.

A.5.1.3.5.2 It is the intent that the medical air piping distribution system support only the intended need for breathable air for such items as IPPB and long-term respiratory assistance needs, anesthesia machines, and so forth. The system is not intended to be used to provide engineering, maintenance, and equipment needs for general hospital support use. It is the intent that the life safety nature of the medical air be protected by a system dedicated solely for its specific use.

As a compressed air supply source, a medical air compressor should not be used to supply air for other purposes because such use could increase service interruptions, reduce service life, and introduce additional opportunities for contamination.

A.5.1.3.5.4 Examples of 5.1.3.5.4.1 (1) are liquid ring and permanently sealed bearing compressors. An example of 5.1.3.5.4.1 (2) is an extended head compressor with an atmospheric vent between the compression chamber and the crankcase.

A.5.1.3.5.10 Other functions can be added at the request of the facility, such as low water pressure, etc.

A.5.1.3.5.11.6 The two configurations are equally acceptable. The components may be arranged in two parallel branches of components as follows:

(1) Individual components consisting of a tee + inlet valve - dryer - outlet valve + tee + inlet valve - filter - outlet valve + tee + inlet valve - regulator - outlet valve + tee

(2) Grouped components consisting of a tee + inlet valve - dryer - filter - regulator - outlet valve + tee. (See Figure A.5.1.3.5.11.6 on page 270.)

A.5.1.3.5.15 The utilization of an air-treatment system is the joint responsibility of the system designer, hospital clinical and engineering staffs, and the authority having jurisdiction. Different types of compressors have characteristics that affect the selection of the type of air-treatment system. Some air-treatment systems impose an additional load upon the compressors that must be accounted for in the sizing of the system (usable capacity). The compressor duty cycle must be chosen in accordance with the manufacturer’s recommendation.

The type of air compressor and air condition at the intake will govern the type of filter provided for the air compressor supply system. All filters should be examined quarterly for the presence of liquids or excessive particulates and replaced according to the manufacturer’s instructions.

One method for a decision on the quality of the medical air is the following:

(1) Test at the intake and at the sample connection valve.

(2) If the two purities agree within the limits of accuracy of the test, the compressor system can be accepted.

(3) If the air is found to exceed the values for Medical Compressed Air in 5.1.3.5.1, the facility can elect to install purification apparatus for the contaminants in question.

A.5.1.3.6 (See Figure A.5.1.3.6 on page 271.)

A.5.1.3.7 A functioning WAGD system will permit the facility to comply with occupational safety requirements by preventing the accumulation of waste anesthetic gases in the work environment. WAGD using an HVAC (heating, ventilation, and air conditioning) system are not within the scope of this chapter.

Flammable and nonflammable gases are known to be incompatible with some seals and piping used in medical-surgical vacuum systems. If waste anesthetic gas disposal is to be included as part of the medical-surgical vacuum system, it should be recognized that this activity might cause deterioration of the vacuum system. The station inlet performance tests outlined in 5.1.12.3.10 are extremely important in maintaining the integrity of the medical-surgical vacuum system, and they should be made at more frequent intervals if waste anesthetic gas disposal is included in the vacuum system.

A.5.1.3.7.1 WAGD Interface. Interfaces are provided with overpressure, underpressure, overflow, and underflow compensation to ensure the breathing circuit is isolated from the WAGD system.

A.5.1.3.8 (See Figure A.5.1.3.8 on page 272.)

A.5.1.3.8.5 Drawing intake air from outside in compliance with 5.1.3.5.13 is recommended.

A.5.1.4 (See Figure A.5.1.4 on page 273.)

A.5.1.5 Station outlets/inlets should be located at an appropriate height above the floor to prevent physical damage to equipment attached to the outlet.

A.5.1.6 Manufactured Assembly. Examples are headwalls, columns, ceiling columns, ceiling hung pendants, movable track systems, and so on. (See Figure A.5.1.6 on page 274.)
Figure A.5.1.3.4.8 Part 1 Header for Gas in Cylinders
Connection to the gas outlet connection is illustrated. If the liquid outlet connection were used, an external vaporizer may be required.

Figure A.5.1.3.4.8 Part 2 Header for Cryogenic Gas in Containers
Changeover Alarm Switch/Sensor Automating Control(s)

Intermediate Relief Valve

Primary/Secondary Headers

Final Line Controls 5.1.3.4

Header 5.1.3.4.8

Figure A.5.1.3.4.9 Manifold for Gas Cylinders
Figure A.5.1.3.4.10 Typical Source of Supply for Cryogenic Gas in Containers
Final Line Controls 5.1.3.4

Reserve in Use Alarm Switch/Sensor

Intermediate Relief Valve

Check Valve

Main Vaporizer

Main Contents Indicator and Switch/Sensor

Reserve Tank Pressure Switch/Sensor

Reserve Contents Indicator and Switch/Sensor

Reserve Vaporizer

Economizer

Two possible choices of reserves are illustrated. Both are not required.

Figure A.5.1.3.4.11 Typical Source of Supply for Cryogenic Gas in Bulk
Note: If the relief valve on the emergency oxygen connection is moved to downstream from the check valve in the emergency oxygen line, connect it to the system with a demand check fitting.

Figure A.5.1.3.4.12 Emergency Oxygen Supply Connection
Figure A.5.1.3.5  Elements of a Typical Duplex Medical Aire Compressor Source System (Level 1 Gas Systems)

Legend
- Ball Valve
- Check Valve
- Pressure Indicator
- Demand Check
- Pressure Relief Valve
- Filter with Change Indicator
- A Compressor that adds no oil to the Air

Note 1: See also Figure A.5.1.3.5.11.6 for arrangement of control components.

Note 2: Unions or other disconnect means may be required for maintenance and/or replacement of each component.
Figure A.5.1.3.5.11.6  Alternate Valving Sequences for Line Controls in Medical Air
Figure A.5.1.3.6 Elements of a Typical Duplex Vacuum Source System (Level 1 Vacuum Systems)
Figure A.5.1.3.8 Elements of Typical Instrument Air Source
Note: Single service valves are shown, but multiple zones may branch off a single service valve.

Note: Area alarms are required in critical care locations (examples include intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, postanesthesia recovery rooms, and emergency rooms) and anesthetizing locations (examples include operating rooms, delivery rooms). Refer to definitions for these areas.

Figure A.5.1.4 Arrangement of Pipeline Components
Figure A.5.1.6 Terminals in Manufactured Assemblies
A.5.1.7 Surface-Mounted Medical Gas Rail Systems. It is the intent that surface-mounted medical gas rail systems would be permitted in individual patient rooms but would not be allowed to go directly through room walls to adjacent patient rooms. However, it is the intent to allow surface-mounted medical gas rails to be used in a given critical care area where there can be a partition separating certain patient care functions, essentially leaving the system within the given critical care area as an example. Two adjacent patient rooms outside of a critical care unit would not be permitted to have a surface-mounted medical gas rail interconnecting between the two rooms through the wall. However, in a nursery where there might be one or two segregated areas for isolation, a medical gas rail system supplying more than one isolation room, but within the nursery area, would be permitted to be interconnected with the nursery system.

A.5.1.7.9 Typical plating would be nickel plating over copper or brass per Federal Specification QQ-N280, Class I, Type 7.

A.5.1.9.2 See Table A.5.1.9.2 on next page.

A.5.1.9.3

<table>
<thead>
<tr>
<th>Alarm Condition</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Line pressure (for each gas piped to the area)</td>
<td>5.1.9.3, 5.1.9.3.1, 5.1.9.3.2, 5.1.9.3.4</td>
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<tr>
<td>Low line pressure (for each gas piped to the area)</td>
<td>5.1.9.3, 5.1.9.3.1, 5.1.9.3.2, 5.1.9.3.4</td>
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<tr>
<td>Low medical/surgical vacuum (if piped to the area)</td>
<td>5.1.9.3, 5.1.9.3.1, 5.1.9.3.2, 5.1.9.3.4</td>
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<tr>
<td>Low WAGD vacuum (if piped to the area)</td>
<td>5.1.9.3, 5.1.9.3.1, 5.1.9.3.2, 5.1.9.3.4</td>
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</tbody>
</table>

A.5.1.10.5.5 The intent is to provide an oxygen-free atmosphere within the tubing and to prevent the formation of copper oxide scale during brazing. This is accomplished by filling the piping with a low-volume flow of low-pressure inert gas.

A.5.1.12.3.2 This is the final pressure test of the completely installed system and is intended to locate any leaks that would be more likely to occur at lower pressure, for example, leaks in stand outlet valve seals.

A.5.3.3.5 Level 3 Compressed Air System. The system does not produce air to meet the medical requirements of medical air and is not intended to be used for air life support devices.

A.5.3.3.4 Remote. A gas storage system can be remote from the single treatment facility, but all use points must be contiguous within the facility. [See Figure A.5.3.3.4(b).] Figure A.5.3.3.4(b) Examples of treatment facilities.

A.5.3.3.4 Single Treatment Facility. The definition of single treatment facility was established to take into consideration principally single-level installations or those of a practice that could be two-level, but are reached by open stairs within the confines of the single treatment facility.

A.5.3.5 Utility Center (j box). Typically includes electrical receptacle(s), compressed air, nitrogen, vacuum, and water.

A.5.3.6 Vacuum System — Level 3. The system is not intended for Level 1 vacuum applications. A wet piping system is designed to accommodate liquid, air-gas, and solids through the service inlet. A dry piping system is designed to accommodate air-gas only through the service inlet. [Liquid(s) and solid(s) are trapped before entering the service inlet.]

A.5.1.14 Safe Practice for Cylinders Containing Compressed Gases. Specifications for Cylinders. All cylinders containing compressed gases, such as anesthetic gases, oxygen, or other gases used for medicinal purposes, whether these gases are flammable or not, should comply with the specifications and be maintained in accordance with regulations of the U.S. Department of Transportation.

Cylinder and container temperatures greater than 125°F (52°C) can result in excessive pressure increase. Pressure-relief devices are sensitive to temperature and pressure. When relief devices actuate, contents are discharged.
### Table A.5.1.9.2 Requirements for Level 1 Master Alarms

<table>
<thead>
<tr>
<th>Alarm Condition</th>
<th>Manifold for Gas Cylinders w/o Reserve (5.1.3.4.9)</th>
<th>Manifold for Cryogenic Liquid Cylinders w/ Reserve (5.1.3.4.10)</th>
<th>Cryogenic Bulk w/Cryogenic Reserve (5.1.3.4.11)</th>
<th>Cryogenic Bulk w/Cylinder Reserve (5.1.3.4.11)</th>
<th>Medical Air Compressors (5.1.3.5)</th>
<th>Instrument Air Compressors (5.1.3.8)</th>
<th>Medical Surgical Vacuum Pumps (5.1.3.6)</th>
<th>WAGD Procedures (5.1.3.7)</th>
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<tbody>
<tr>
<td>Nitrogen main line pressure high</td>
<td>5.1.9.2.4(6)</td>
<td>5.1.9.2.4(6)</td>
<td>5.1.9.2.4(6)</td>
<td>5.1.9.2.4(6)</td>
<td>5.1.9.2.4(6)</td>
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A-5.1.3.2 Handling of Gas Containers. The precautions outlined in CGA Pamphlet P-1, Safe Handling of Compressed Gases, and Pamphlet P-2, Characteristics and Safe Handling of Medical Gases, should be observed. (See Appendix B.) These publications cover such items as moving and storage of cylinders, labeling, withdrawing of cylinder contents, and handling of leaking cylinders. Cryogenic fluids are to be used only in containers designed for the purpose, such as a double-walled thermos bottle. Caps are to be replaced promptly after each use to prevent the solidification of atmospheric water vapor in the pouring neck, which otherwise could convert a safe cylinder into a potential bomb.

Protective clothing and eye shields should be used to prevent burns from issuing gases or spilled liquids. Effects of flammable and oxidizing properties are intense and demand special fire protection measures and handling. Inadvertent saturation of clothing by oxygen or spills on asphalt flooring, for example, require prompt and accurate corrective measures. Ample ventilation is needed to prevent hazardous concentrations, for example, of nitrogen, which could cause asphyxiation. For routine cooling operations, liquid air or oxygen should never be used as substitutes for liquid nitrogen.

A-5.1.3.3.2 Electric wiring and equipment in storage rooms for oxygen and nitrous oxide are not required to be explosion proof.

A-5.1.1.2 These requirements do not restrict the distribution of other inert gases through piping systems.

A-5.1.9.4 Activation of any of the warning signals should immediately be reported to the department of the facility responsible for the medical gas piping system involved. If the medical gas is supplied from a bulk supply system, the owner or the organization responsible for the operation and maintenance of that system, usually the supplier, should also be notified. As much detail as possible should be provided.

A-5.1.12 All testing should be completed before putting a new piping system, or an addition to an existing system, into service. Test procedures and the results of all tests should be made part of the permanent records of the facility of which the piping system forms a part. They should show the room and area designations, dates of the tests, and name(s) of persons conducting the tests.

A-5.1.1 Section 5.1 covers requirements for Level 1 piped gas and vacuum systems; Section 5.2 covers Level 2 piped gas and vacuum systems; Section 5.3 covers Level 3 piped gas and vacuum systems. Laboratory systems are no longer (2002) covered by Chapter 5.

A-5.1.15.7.4 Vacuum systems from station inlets to the exhaust discharge should be considered contaminated unless proven otherwise. Methods exist to disinfect the system or portions thereof. Clogging of regulators, for example, with lint, debris, or dried body fluids, reduces vacuum system performance.

A-5.1.15.7.6 The test can be conducted using (1) a rotometer or other flow-measuring device and (2) a vacuum gauge, both devices being fitted with the appropriate station inlet connector. The test procedure will be to measure the flow with the station inlet wide open while simultaneously measuring the vacuum level at an adjacent wall station inlet or other station inlet on the same branch line. It is recognized that this criterion might not be met by some existing systems. It is the responsibility of facility personnel, based on past experience and use, to determine the acceptable alternate performance criterion for their system(s).

A-5.1.15.7.4 Suction collection bottles that are used as part of patient treatment equipment should be equipped with an overflow shutoff device to prevent carryover of fluids into equipment of the piping system. It is recommended that a separate vacuum trap with shutoff be used between the suction collection bottle and the vacuum system station inlet.

A-5.3.3.2 When the storage-supply enclosure is remote from the single treatment facility, it should be locked for security reasons to prevent tampering. Access should be only via authorized staff or fire department. When the enclosure is within the single treatment facility, it is left to the discretion of the single treatment facility management as to whether greater benefit is achieved by immediate access or by security. An enclosure with direct access from a public hallway should be locked. If the door to the enclosure opens onto an exit access corridor, see 4-5.1.1.2.

A-5.3.3.5 Level 3 compressed air and nitrogen gas systems are used primarily to drive gas-powered power devices. Similar applications are in podiatry and plastic surgery. Examples of these are air used to drive turbine-powered drills and air used to dry teeth and gums. Some dental hand pieces have an internal self-contained air return system, while other hand pieces discharge air into the atmosphere. Some discharge a mixture of air and water. Nitrogen is often piped as an alternate or reserve supply to the compressor system. The application of dental compressed air is not used for life-support purposes such as respirators, IPPB machines, analgesia, anesthesia, and so forth. Air discharged into the oral cavity is incidental and not a primary source of air to sustain life. However, if there is a coincident use of dental air for providing respiratory support, the requirements of dental air will be superseded by those of the respiratory support, and the compressed air system must provide the higher medical compressed air as defined in Chapter 2. This could affect the selection of a compressor.

A dental compressed air system should not be used to provide power for an air-powered evacuation system without specific attention paid to the discharge of the evacuated gases and liquids. An open discharge of evacuated gases into the general environment of an operator could compromise the quality of breathing air in the treatment facility. Air discharge should be vented to the outside of the building through a dedicated vent. An air power evacuation system might require significant quantities of air to operate. Manufacturers’ recommendations should be followed regarding proper sizing of the air compressor(s).

A-5.3.3.2 Compressed-air quality can be compromised and expected life of system components can be shortened if an undersized system is installed. Manufacturers’ recommendations should be followed regarding proper sizing of the air compressor(s).

A-5.3.3.5 The environmental air source for the compressor inlet should take into consideration possible contamination by particulates, concentrations of biological waste contaminants, ozone from nearby brush-type electric motors, and exhaust fumes from engines. Air taken from an outside atmosphere could cause harmful condensation problems in the compressor. Long runs of inlet tube should also be avoided as it will degrade compressor performance. The compressor manufacturer’s recommendations should be followed regarding appropriate pipe size to prevent possible degradation of system performance.

A dental air compressor and dental vacuum system can be in the same equipment room as long as the inlet for the dental air compressor does not draw air from a room or space containing an open discharge for the dental vacuum system. Atmospheric air in an operatory can have traces of mercury vapor and other contaminants. A compressor inlet location that would draw its supply directly from an operatory should be avoided.

A-5.3.3.5 A color dew point monitor downstream of the receiver indicating the quality of air coming into the receiver is desirable. A color dew point monitor in the main treatment facility is appropriate to help the staff promptly identify when the system is being degraded with air of dew point higher than is acceptable. The design of the color monitor should be such that the normal tolerance of variations will limit the maximum moisture at 39°F at 100 psig (9.9°C at 690 kPa) at activation.

A-5.3.3.5 If nitrogen is used as a backup supply to a compressed gas system, the nitrogen operating pressure should be regulated so as not to exceed the operating pressure of the Level III compressed air system.

A-5.3.3.5.8 The ft³ (or m³) of stored nitrogen gas is not restricted.
A-5.3.3.4.2 If the supply system is within the confines of a single treatment facility, a simple manual transfer is permissible. Only high/low pressure alarms are required. The gases are to be manifolded so a quick manual transfer is possible without life-threatening consequences. However, if the supply system is remote, a prompt transfer of gases becomes more difficult. It could require transcending one or more flights of stairs and/or going to a remote location on the same floor. Under these situations an automatic system is required.

A-5.3.3.5.3 The installation of a supply serving more than one single treatment facility creates by its very nature a remote location relative to the other facility. Because more than one practice could be involved, the transfer of oxygen and nitrous oxide gases is to be automatically achieved.

A-5.3.10.10.2 One of the major concerns is the cross-connection of piping systems of different gases. The problem of cross-connection of oxygen and other gases such as nitrous oxide, air, and nitrogen can readily be recognized/prevented by the use of different sizes of tubing. It is recommended that piping and manifolds for oxygen service be of a different size than the piping intended for other gas services. The piping for other than oxygen can be of a smaller size. Generally, oxygen is installed in 1/2 in. O.D. tube size and other gases with 3/8 in. O.D. tube size.

A-5.3.10.7.5 The intent is to provide an oxygen-free atmosphere within the tubing and to prevent the formation of copper oxide scale during brazing. This is accomplished by filling the piping with a low-volume flow of low-pressure inert gas.

A-5.3.4 Should a fire occur at night or when the facility is not in use, fire fighters should not be confronted with a potential pressurized gas source that could feed the fire and cause extensive damage and risk of life. Good economics also dictate that when the system is not in use, the leakage of gas through hoses, couplings, etc., can be minimized if the system is shut off and portable equipment disconnected.

A-5.3.5 Service outlets can be recessed or otherwise protected from damage.

A-5.3.3.6.3 Improper design will permit gas pressure to build up in the ventilation system and might blow the trap liquid seals.

A-5.3.3.6.4.8 Care should be taken to ensure the dual exhaust systems do not develop excessive back pressure when using a common exhaust line.

A-5.3.5.2 This will ensure that the required pressure and flow meet the secondary equipment manufacturer’s requirements.

A.5.3 Level 3 Vacuum System. The system is not intended for Level 1 medical/surgical vacuum applications. A Level 3 wet piping system is designed to accommodate liquid, air-gas, and solids through the service inlet. A Level 3 dry piping system is designed to accommodate air-gas only through the service inlet, with liquids and solids being trapped before entering the system.

Note:
This belongs as an appendix item for the Occupancy Chapters where the 5,000 ft³ limit now resides.

It is the intent to provide a simple, safe piping system for small facilities. Although the number of use points could be considered, it was felt that actual gas use is a more accurate indicator of complexity. Applications involving a storage in excess of 5000 ft³ (85 m³) would have a complexity warranting installation in accordance with the provisions of Level I patient gas distribution systems.

Although the principal intent is to provide simple installations for single treatment facilities, numerous applications exist where a remote use point creates essentially a second treatment facility or where the supply system might be shared by another health care professional such as another dentist, podiatrist, oral surgeon, or general medicine practitioner. The addition of another treatment facility requires incremental safety precautions. A maximum of two single treatment facilities also approximates the limit with which a 3000 ft³ (85 m³) supply system can provide [5000 ft³ (143 m³) when liquid oxygen is used].

It is acknowledged that older user analgesia equipment has offered a nitrous oxide lockout device that requires a minimum of 3 L/min oxygen flow. However, a reasonable percentage of older equipment without this safety feature is in daily use. The storage and piping system is based upon the potential use, either initially or subsequently, of one of the older style analgesia equipment in one of the single treatment facilities.

The quantity of 3000 ft³ (85 m³), or 5000 ft³ (143 m³) if liquid oxygen storage, is to be taken as the total combined storage of gases if there is more than one supply system in the single treatment facility.

C-5 Additional Information on Chapter 5.

C-5.1 Initial Testing of Nonflammable Medical Piped Gas Systems (Level 1 Systems).

Note: Numbers in brackets refer to paragraphs in Chapter 5 of text.

C-5.1.1 [5.3.4.5.1] The pressure relief valve, set at 50 percent above normal line pressure, should be tested to assure proper function prior to use of the system for patient care.

C-5.1.2 [5.3.5.2] The proper functioning of the safety valve, automatic drain, pressure gauge, and high-water-level sensor should be verified before the system is put into service.

C-5.1.3 [5.3.9.1.4] Changeover Warning Signal — 5.1.3.4.9, 5.1.3.4.10, and 5.1.3.4.11.

(1) Start a flow of gas from an outlet of the piping system.

(2) Close the shutoff valve or cylinder valves on the primary supply of the manifold (Figure 5.1.3.4.8), or the primary unit of the alternating bulk supply to simulate its depletion (Figure 5.1.3.4.11). Changeover should be made to the secondary supply or the alternate bulk unit.

(3) Check main-line pressure gauge to ensure maintenance of the desired pressure.

(4) Check signal panels for activation of the proper changeover signal.

(5) Silence the audible signal; visual signal should remain.

(6) Open the valves closed in Step 2. Close the valve on the secondary supply or alternate bulk unit. When changeover back to original primary supply has occurred, reopen the valve. This will reinstate system to its original status.

(7) Check signal panels for deactivation of warning signals.

(8) Stop flow of gas from the piping system.

C-5.1.4 [5.3.9.2.4] Reserve-In-Use Warning Signal — 5.1.3.4.9, 5.1.3.4.10, and 5.1.3.4.11.

(1) Start a flow of gas from the piping system.

(2) Close the proper shutoff valves to simulate depletion of the operating supply. Reserve should begin to supply the piping system.

(3) Check the main-line pressure gauge. Pressure should remain at the desired level.

(4) Check the master signal panels to determine that the reserve-in-use signals have been activated.

(5) Silence the audible signal. Visual signal should remain.

(6) Open the shutoff valves closed in Step 2.

(7) Check master signal panels for deactivation of the warning signals.

(8) Stop the flow of gas from the piping system.

C-5.1.5 [5.3.9.2.4] Reserve Supply Low — 5.1.3.4.10, 5.1.3.4.11, 5.1.3.4.13, and 5.1.3.8.2.3.

1. Start a flow of gas from the piping system.

2. Close all operating supply shutoff valves (to use pressure from the reserve).

3. Close the reserve supply shutoff valve or, if necessary, the reserve cylinder valves, depending on the exact location of the actuating switch (to reduce pressure on the actuating switch, simulating loss of supply).

4. Open the operating supply valves closed in Step 2 (so that only the "reserve low" signal should be activated).

5. Check the master signal panels for activation of the proper signal.


7. Open reserve supply valve or cylinder valves closed in Step 3.

8. Check master signal panels for deactivation of the warning signals.

9. Stop flow of gas from the piping system.

Note: On Liquid Bulk Reserves.

A type of reserve requires an actuating switch on the contents gauge and another actuating switch for the gas pressure being maintained in the reserve unit. Reduced contents or gas pressure in the reserve unit would indicate less than a day’s supply in reserve.
Simulation of these conditions requires the assistance of the owner or the organization responsible for the operation and maintenance of the supply system as it will vary for different styles of storage units.

C-5.2.7 [5.1.9.2.4] High or Low Pressure in Piping System. Initial test of the area alarms covered in 5.1.9.3 can be done at the same time.

(1) Increase the pressure in the piping system to the high-pressure signal point (20 percent above normal pressure).

(2) Check all master signal panels (and area signals) to ensure that the properly labeled warning signal is activated; also check main-line pressure gauge and area gauges to ensure their function.

(3) Silence the audible signal. Visual signal should remain.

(4) Reduce piping system pressure to the normal. A flow from the system is required to lower the pressure and permit readjustment of the line regulator.

(5) Check all signal panels for deactivation of the signals.

(6) Close main-line shutoff valve.

(7) Continue the flow from the system until pressure is reduced to the low-pressure signal point (20 percent below normal).

(8) Check all panel signals for activation of the properly labeled warning signal; also check main-line gauge and area pressure gauges to ensure their function.

(9) Silence the audible signal. Visual signal should remain.

(10) Open main-line shutoff valve.

(11) Check main-line gauge for proper line pressure.

(12) Check all signal panels for deactivation of warning signals.

C-5.1.7 [5.1.9.3] This signal should be initially tested at the time the tests of C-5.1.6 are performed.

C-5.2 Retesting and Maintenance of Nonflammable Medical Piped Gas Systems (Level 1 Systems).

NOTE: Numbers in brackets refer to paragraphs in Chapter 4 of text.

C-5.2.1 [5.1.3.4.9] These systems should be checked daily to assure that proper pressure is maintained and that the changeover signal has not malfunctioned. Periodic retesting of the routine changeover signal is not necessary as it will normally be activated on a regular basis.

C-5.2.2 [5.1.3.4.10] These systems should be checked daily to assure that proper pressure is maintained and that the changeover signal has not malfunctioned. Periodic retesting of the routine changeover signal is not required. Annual retesting of the operation of the reserve and activation of the reserve-in-use signal should be performed.

C-5.2.3 [5.1.3.4.10] If the system has an actuating switch and signal to monitor the contents of the reserve, it should be retested annually.

C-5.2.4 [5.1.3.4.11] Maintenance and periodic testing of the bulk system is the responsibility of the owner or the organization responsible for the operation and maintenance of that system.

The staff of the facility should check the supply system daily to ensure that medical gas is ordered when the contents gauge drops to the reorder level designated by the supplier. Piping system pressure gauges and other gauges designated by the supplier should be checked regularly, and gradual variation, either increases or decreases, from the normal range should be reported to the supplier. These variations might indicate the need for corrective action.

Periodic testing of the master signal panel system, other than the routine changeover signal, should be performed. Request assistance from the supplier or detailed instruction if readjustment of bulk supply controls is necessary to complete these tests.

C-5.2.5 [5.1.8.8] The main-line pressure gauge should be checked daily to ensure the continued presence of the desired pressure. Variation, either increases or decreases, should be investigated and corrected.

C-5.2.6 [5.1.3.5.13] Quarterly rechecking of the location of the air intake should be made to ensure that it continues to be a satisfactory source for medical compressed air.

C-5.2.7 [5.1.3.5.14] Proper functioning of the pressure gauge and high-water-level sensor should be checked at least annually. Check the receiver drain daily to determine if an excessive quantity of condensed water has accumulated in the receiver.

C-5.2.8 [5.1.3.5] An important item required for operation of any medical compressed air supply system is a comprehensive preventive maintenance program. Worn parts on reciprocating compressors can cause high discharge temperatures resulting in an increase of contaminants in the discharge gas. Adsorber beds, if not changed at specified time intervals, can become saturated and lose their effectiveness. It is important that all components of the system be maintained in accordance with the manufacturers’ recommendations. It is important that any instrumentation, including analytical equipment, be calibrated routinely and maintained in operating order. Proper functioning of the dew point sensor should be checked at least annually.

C-5.2.9 [5.1.9] When test buttons are provided with signal panels, activation of the audible and visual signals should be performed on a regular basis (monthly).

C-5.2.10 [5.1.9.2.4] Changeover Warning Signals As these are routine signals that are activated and deactivated at frequent intervals, there is no need for retesting UNLESS they fail. If the reserve-in-use signal is activated because both units of the operating supply are depleted without the prior activation of the changeover signal, it should be repaired and retested.

C-5.2.11 [5.1.9.2.4] Reserve-In-Use Warning Signal All components of this warning signal system should be retested annually in accordance with Steps 2 through 7 of the procedure given in C-5.1.4. Audible and visual signals should be tested periodically during the year (monthly).

C-5.2.12 [5.1.9.2.4] Reserve Supply Low (Down to an average one-day supply) High-Pressure Cylinder or Liquid Reserve. All components of these signal warning systems should be retested annually in accordance with Steps 2 through 7 of the procedure given in C-5.1.5. If test buttons are provided, audible and visual signals should be periodically tested throughout the year (monthly).

C-5.2.13 [5.1.9.2.4] The medical compressed air system alarms in 5.1.3.5.14 should be checked at least annually.

C-5.2.14 [5.1.8.8 (1)] This pressure gauge should be checked on a daily basis to ensure proper piping system pressure. A change, increase or decrease, if noted, can give evidence that maintenance is required on the line pressure regulator and could thus avoid a problem.

C-5.2.15 [5.1.9] Annual retesting of all components of warning systems, if it can be done without changing piping system line pressure, should be performed.

C-5.2.16 [5.1.9] If test buttons are provided, the retesting of audible and visual alarm indicators should be performed monthly.

C-5.2.17 [5.1.4] Shutoff valves should be periodically checked for external leakage by means of a test solution or other equally effective means of leak detection safe for use with oxygen.

C-5.2.18 [5.1.5] Station outlets should be periodically checked for leakage and flow. Instructions of the manufacturer should be followed in making this examination.

C-5.7 Oxygen Service Related Documents.

The following publications may be used for technical reference:


ASTM G93, Practice for Cleaning Methods for Material and Equipment Used in Oxygen-Enriched Environments.


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
COMMENT ON AFFIRMATIVE:

ERICKSON: I want everyone to know how long and hard the Manual of Style Task Group worked on this task. The original task group was made up of Dick Wagner, David Mohile, Daniel Shoemaker, Mark Allen and myself. Along the way we included Dale Dumbleton and Michael Frankel to assist us in reviewing the document. NFPA staff, at times as many as three, were also at our meetings and involved with the review of proposed material. If I had to calculate the professional hours and fees associated with this volunteer effort it would be in the hundreds of thousands of dollars not counting the out of pocket expenses to attend the MOS meetings. The NFPA and the using public needs to extend a huge thanks to the volunteers who made this happen. It was a monumental undertaking that has produced a much more user friendly document, the goal of the NFPA. For those of you familiar with the older version of Chapter 4 when you read the new Chapter 5 it is going to be totally different in appearance and format. In our efforts to comply with the NFPA’s Manual of Style the entire chapter needed to be reformatted and paragraphs broken down into individual requirements. The MOS task group did its absolute best at only making style changes and not to modify the text so that the requirements changed in meaning. In some cases this was very challenging and needed the consensus of the task group to make it happen.

In closing, I especially want to thank the three people that without their dedication and countless hours of work this task would never have happened: Dick Wagner, Mark Allen, and David Mohile.

ESHERICK: I agree with the new Chapter 5 as long as the committee’s and my comments are incorporated therein.

AFFIRMATIVE: 8
COMMITTEE STATEMENT: Accept in Principle.

COMMITTEE ACTION: Accept in Principle.

99-324
SUBMITTER: Technical Committee on Laboratories

99-190 - (8-3.11.1, 8-3.11.2): Accept
COMMITTEE STATEMENT: Accept in Principle.

COMMITTEE ACTION: Accept in Principle.

99-191 - (8-3.11.3): Accept in Principle
SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-324
RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee for further consideration. The Technical Committee Statement did not address the submitter’s substantiation.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept in Principle.

EXPLANATION OF ABSTENTION:
BRANCROFT: Have not been able to follow committee process secondary to extensive hospitalization.

AFFIRMATIVE: 8
COMMITTEE STATEMENT: The Committee’s Action addresses the submitter’s substantiated concerns.

COMMITTEE ACTION: Accept.

99-188 - (5-2.4.4.5): Accept
COMMITTEE STATEMENT: Accept.

COMMITTEE ACTION: Accept.

99-189 - (8-3.1.1): Accept
COMMITTEE STATEMENT: Accept.

COMMITTEE ACTION: Accept.

99-188 - (8-3.1.11.1, 8-3.1.11.2): Accept
COMMITTEE STATEMENT: Accept.

COMMITTEE ACTION: Accept.

99-320
SUBMITTER: Technical Committee on Laboratories

COMMENT ON PROPOSAL NO: 99-320
RECOMMENDATION: Revise the technical committee’s actions in Proposal #99-320 (Log #CFP02):
- Storage for nonflammable gases equal to or greater than 85 m³ (3000 ft³), uncompressed, shall comply with 4-3.1.1.2 and 4-3.5.2.2.
- 8.4.2 8.3.1.11.2 Storage for nonflammable gases greater than 8.5 m³ (300 ft³) but less than 85 m³ (3000 ft³), uncompressed, to read as follows:
  - Storage for nonflammable gases equal to or greater than 85 m³ (3000 ft³), uncompressed, shall comply with 4-3.1.1.2 and 4-3.5.2.2.
- 8.4.2 8.3.1.11.2 Storage for nonflammable gases greater than 8.5 m³ (300 ft³), but less than 85 m³ (3000 ft³), uncompressed, compressed.

SUBSTANTIATION: The committee reconsidered the use of commonly used compressed gas industry designations.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 10
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
ABSTENTION: 1
NOT RETURNED: 1 Crowley

EXPLANATION OF ABSTENTION:
LIPSCHULTZ: Please enter a comment for next cycle that new proposing committee members be placed on a list to ensure these individuals are aware of the rules.

AFFIRMATIVE: 8
COMMITTEE STATEMENT: The Committee’s Action addresses the submitter’s substantiated concerns.

COMMITTEE ACTION: Accept.

99-188 - (8-3.1.11.1, 8-3.1.11.2): Accept
COMMITTEE STATEMENT: Accept.

COMMITTEE ACTION: Accept.

99-324
SUBMITTER: Technical Committee on Laboratories

COMMENT ON PROPOSAL NO: 99-324
RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee for further consideration. The Technical Committee Statement did not address the submitter’s substantiation.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept in Principle.

EXPLANATION OF ABSTENTION:
BRANCROFT: Have not been able to follow committee process secondary to extensive hospitalization.

AFFIRMATIVE: 8
COMMITTEE STATEMENT: The Committee’s Action addresses the submitter’s substantiated concerns.

COMMITTEE ACTION: Accept.
NOTE: Since the ballot on this Comment did not confirm the Committee Action, the comment is being rejected.

NOTE:  Since the ballot on this Comment did not confirm the Committee Action, the comment is being rejected.

NOTE: Since the ballot on this Comment did not confirm the Committee Action, the comment is being rejected.

NOTE: Since the ballot on this Comment did not confirm the Committee Action, the comment is being rejected.
Flammable and combustible liquids shall be stored, handled, and used in accordance with NFPA 30, with care and with knowledge of their hazardous properties, both individually and in combination with other materials with which they can come in contact. A.10.7.1 The storage, handling, and use of flammable liquids should be with care and with knowledge of their hazardous properties, both individually and in combination with other materials with which they can come in contact.

**RECOMMENDATION:** NFPA 99 should be referencing the standard that has the scope and responsibility for flammable and combustible liquids. The last sentence is appendix material and should be moved to the appendix to comply with the manual of style.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** Storage of flammable and combustible liquids is addressed in paragraph 10.7.2. The committee's intent is that 10.7.1 provides an overall mandate for staff knowledge to ensure safe handling.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 8

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 7

**NOT RETURNED:** 1 Linder

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**SUBMISSION:**

A.10.7.1 The storage, handling, and use of flammable liquids should be with care and with knowledge of their hazardous properties, both individually and in combination with other materials with which they can come in contact.

**RECOMMENDATION:** Reconsider the original proposal and accept.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** We do not agree with the committee statement on the rejection of this proposal. The scope of NFPA 30 does not discriminate on the amount of flammable liquid. Also we do not believe that the technical committee has the authority to change requirements that another standard, in this case 30, has control of. NFPA 30 in 4.4.3.5 does not permit any quantity in any occupancy. Our concern is that in any occupancy, even industrial (a low life safety hazard occupancy) they are not permitted to store Class 1 liquids but a health care facility (a high life safety hazard occupancy) can. This does not make sense. NFPA 99 should have to follow the same rules as other occupancies and comply with the scopes of those codes and standards that have control of particular hazards.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 8

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 7

**NOT RETURNED:** 1 Linder

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**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** The existing restrictions concerning Class I liquids in 10-7.2.1 limits the quantities of Class I liquids in hospital laboratories, and fire protection requirements are provided for within chapter 10 and in NFPA 101.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 8

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 7

**NOT RETURNED:** 1 Linder

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**SUBMISSION:**

A.10.7.1 The storage, handling, and use of flammable liquids should be with care and with knowledge of their hazardous properties, both individually and in combination with other materials with which they can come in contact.

**RECOMMENDATION:** Reconsider the original proposal and accept.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** We do not agree with the committee statement on the rejection of this proposal. The scope of NFPA 30 does not discriminate on the amount of flammable liquid. Also we do not believe that the technical committee has the authority to change requirements that another standard, in this case 30, has control of. NFPA 30 in 4.4.3.5 does not permit any quantity in any occupancy. Our concern is that in any occupancy, even industrial (a low life safety hazard occupancy) they are not permitted to store Class 1 liquids but a health care facility (a high life safety hazard occupancy) can. This does not make sense. NFPA 99 should have to follow the same rules as other occupancies and comply with the scopes of those codes and standards that have control of particular hazards.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 8

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 7

**NOT RETURNED:** 1 Linder
Projects.

with 3-4.2 and 3-4.3 of the Regulations Governing Committee Correlating Committee on Health Care Facilities in accordance for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 19

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 10

NOT RETURNED: 9 Gulnicello, Jarrett, Phillips, Salamone, Sinsigalll, Spahr, Stone, Svetlik, Woodfin

COMMITTEE STATEMENT: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories:

99-209 - (13-3.4): Reject

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMITTEE: HEA-ADM

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT: The Technical Correlating Committee directs that this proposal be returned to Committee; the action and accomplishment are not clear.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The Committee accepts the Technical Committee on Administration by the Technical Correlating Committee’s direction to review and comment. The Committee Accepted in Principle Proposal 99-350 (Log #CP710). Providing written definitions achieves the intent of Proposal 99-350 (Log #F925) in principle.

Proposal 99-20 (Log #CP710) was referred to the Technical Committee on Administration by the Technical Correlating Committee on Health Care Facilities, as the Technical Committee on Administration is responsible for definitions.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE: HEA-ADM

COMMITTEE STATEMENT: The Technical Correlating Committee refers this proposal to the Technical Committee on Laboratories for review, comment and correlation with the Technical Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: 12.3.4.1(b) and (c) apply only in the situations where patients are served by the system. These sections are not specific to laboratories for that reason.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NOT RETURNED: 1 Linder
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Statement on 99-206 (Log #182a).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NOT RETURNED: 1 Linder

COMMEE STATEMENT:

COMMITTEE ACTION:

Projects.

Chapter 15 Veterinary Facilities

RECOMMENDATION:

AFFIRMATIVE: 10

ABSTENTION: 1

NOT RETURNED: 1 Crowley

EXPLANATION OF ABSTENTION:

BRANCROFT: Have not been able to follow committee process secondary to extensive hospitalization.

99- 215 - (13-4 New) : Accept

COMMENT ON PROPOSAL NO: 99-355

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: Reconsider and accept proposal 99-355.

AFFIRMATIVE: 8

NOT RETURNED: 1 Linder

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

SUBSTANTIATION:

This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

COMMITTEE STATEMENT:

Committee: HEA-PIP

Projects.

Chapter 15 Veterinary Facilities

RECOMMENDATION: It was the action of the Technical Correlating Committee to accept the Technical Committee's action and further propose that the Technical Committee consider that 13-2.1 be revised to read: "Laboratory Responsibilities. The governing boards ..."

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NOT RETURNED: 1 Linder


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
Comment 99-3 (Log #32).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 

COMMITTEE ACTION: 

The medical missions of health care and veterinary facilities, while 

Comment 99-3 (Log #32). The new chapter is created to separate 

in response to the modifications made to the scope by accepting 

Comment 99-3 (Log #32) . The new chapter is created to separate 

the medical missions of health care and veterinary facilities, while 

protecting their respective staffs.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 5

VOTE ON COMMITTEE ACTION: 

AFFIRMATIVE: 4 

NOT RETURNED: 1 Davidson

99-217 - (15-3.4.8 and 15-3.4.9): Accept 

SUBMITTER: Technical Correlating Committee on Health Care Facilities 

COMMENT ON PROPOSAL NO: 99-358 

RECOMMENDATION: The Technical Correlating Committee 

refers this proposal to the Technical Committee on Laboratories 

for review, comment and correlation with the Technical 

Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical 

Correlating Committee on Health Care Facilities in accordance 

with 3-4.2 and 3-4.3 of the Regulations Governing Committee 

Projects.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION: 

AFFIRMATIVE: 21 

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

99-221 - (17-3.4): Reject 

SUBMITTER: Technical Correlating Committee on Health Care Facilities 

COMMENT ON PROPOSAL NO: 99-361 

RECOMMENDATION: The Technical Correlating Committee 

refers this proposal to the Technical Committee on Laboratories 

for review, comment and correlation with the Technical 

Committee on Piping Systems.

SUBSTANTIATION: This is a direction from the Technical 

Correlating Committee on Health Care Facilities in accordance 

with 3-4.2 and 3-4.3 of the Regulations Governing Committee 

Projects.

COMMITTEE ACTION: Reject. 

COMMITTEE STATEMENT: See Committee Statement on 99-206 

(Log #182a). 

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 8

VOTE ON COMMITTEE ACTION: 

AFFIRMATIVE: 7 

NOT RETURNED: 1 Linder 

99-222 - (17-3.4.2): Accept 

SUBMITTER: Technical Correlating Committee on Health Care Facilities 

COMMENT ON PROPOSAL NO: 99-362 

RECOMMENDATION: The Technical Correlating Committee 

directs the Committee to review the Committee Statement. The 

Committee Statement does not address the submitter’s 

substatiation.

SUBSTANTIATION: This is a direction from the Technical 

Correlating Committee on Health Care Facilities in accordance 

with 3-4.2 and 3-4.3 of the Regulations Governing Committee 

Projects.

COMMITTEE ACTION: Accept. 

COMMITTEE STATEMENT: The statement being proposed to be 

revised no longer exists. 

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24 

VOTE ON COMMITTEE ACTION: 

AFFIRMATIVE: 21

NOT RETURNED: 3 Bancroft, Lynam, Shoemaker
The intent of "See also A-19.3.2.2" is unclear. The meaning is unclear whether it pertains to the paragraphs 19-3.2.2 and 19-3.5.1.1. There is a directive to relocate the Correlating Committee that this proposal be returned to committee to clarify their intentions. The strike through and underscore in 19-2.5.3 should have been more explicit, making it consistent with the reorientation of the paragraph.

**RECOMMENDATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** Revised to eliminate the list and clarify intent.

**REFERENCE:** A-19.3.2.4 clarifies the committee's original intent.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE | 16 |
| NOT RETURNED | 3 Beeson, Newton, Sheffield |

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**SUBMISSION:**

99-228 - (Chapter 19): Accept

**SUBMITTER:** Technical Correlating Committee on Health Care Facilities

**COMMENT ON PROPOSAL NO:** 99-369

**RECOMMENDATION:** It was the action of the Technical Correlating Committee that this proposal be editorially corrected. In new paragraph 19.2.4.1.3.3 delete the word "A", beginning the sentence with "Breathing."

**SUBSTANTIATION:** A breathing apparatus shall function at all pressures, source so as to prevent excessive current draw on the system during operation, but who could become so involved in an emergency. The purpose of this chapter is to set forth minimum safeguards for the protection of patients or other subjects of, and personnel administering, hyperbaric therapy and experimental procedures. Its purpose is also to offer some guidance for rescue personnel who are not ordinarily involved in hyperbaric chamber operation, but who could become so involved in an emergency. As follows:

- Add an asterisk as indicated in the ROP, and an appendix note A-19.3.2.4

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE | 16 |
| NOT RETURNED | 3 Beeson, Newton, Sheffield |

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**SUBMISSION:**

99-227 - (Chapter 19): Accept

**SUBMITTER:** Technical Correlating Committee on Health Care Facilities

**COMMENT ON PROPOSAL NO:** 99-372

**RECOMMENDATION:**

- It was the action of the Technical Correlating Committee that this proposal be returned to committee for editorial correction. Rewrite existing paragraph 19.1.1.1 to succinctly convey the Technical Committee's intended message.

**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:**

99-227 - (Chapter 19): Accept

**SUBMITTER:** Technical Correlating Committee on Health Care Facilities

**COMMENT ON PROPOSAL NO:** 99-372

**RECOMMENDATION:**

- It was the action of the Technical Correlating Committee that this proposal be returned to committee for editorial correction. Rewrite existing paragraph 19.1.1.1 to succinctly convey the Technical Committee's intended message.

**SUBSTANTIATION:** This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

**COMMITTEE ACTION:** Accept.

**COMMITTEE STATEMENT:**

- Add an asterisk as indicated in the ROP, and an appendix note A-19.3.2.4

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE | 16 |
| NOT RETURNED | 3 Beeson, Newton, Sheffield |

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**SUBMISSION:**

99-228 - (Chapter 19): Accept

**SUBMITTER:** Technical Correlating Committee on Health Care Facilities

**COMMENT ON PROPOSAL NO:** 99-369

**RECOMMENDATION:** It was the action of the Technical Correlating Committee that this proposal be editorially corrected. In new paragraph 19.2.4.1.3.3 delete the word "A", beginning the sentence with "Breathing."

**SUBSTANTIATION:** A breathing apparatus shall function at all pressures, source so as to prevent excessive current draw on the system during operation, but who could become so involved in an emergency.
procedures. Its purpose is also to offer some guidance for rescue personnel who are not ordinarily involved in hyperbaric chamber operation, but who could become so involved in an emergency. 19-1.1.2 Requirements cited in this section are minimum ones. Discretion on the part of chamber operators and others might dictate the establishment of more stringent regulations.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**
- **AFFIRMATIVE:** 16
- **NOT RETURNED:** 3 Beeson, Newton, Sheffield

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**COMMITTEE ACTION:**
- **AFFIRMATIVE:** 16
- **NOT RETURNED:** 3 Beeson, Newton, Sheffield

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**COMMITTEE STATEMENT:** 1. The committee reconsidered the Proposal 99-382 (Log #299).

The proposed value was modified to reflect current design and operating standards in both Class A and Class B chambers.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**
- **AFFIRMATIVE:** 16
- **NOT RETURNED:** 3 Beeson, Newton, Sheffield

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**COMMITTEE STATEMENT:** 1. The committee rejected the correlating committee’s direction to develop language for the implementation of the submitter’s procedures.

2. The procedures listed in the submission are addressed in the following sections: 19-3.1.5.4; 19-3.1.5.1; 19-2.9.1; 19-2.7.4.1; 19-3.1.5.6; 19-3.1.5.1, 19-2.8.5; 19-2.8.5; 19-2.2.1; 19-2.4.1.1; 19-2.1.1; 19-2.7.3.10; 19-2.7.3.2; and 19-2.7.6.1.

3. Compliance with these sections does not eliminate the need for a deluge system. The only documented Class A Chamber fire in a United States health care facility with known survivors was extinguished by a deluge system activated by staff outside of the chamber.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 19

**VOTE ON COMMITTEE ACTION:**
- **AFFIRMATIVE:** 16
- **NOT RETURNED:** 3 Beeson, Newton, Sheffield

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**COMMITTEE STATEMENT:** It was the action of the Technical Correlating Committee that this proposal be returned to committee for reconsideration. For Committee Statement No. 2, address the substantiation made by the submitter.
SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

Revise the Action and Recommendation of 99-385 (Log #121):

(1) Revise 19-2.5.1.1 to read:
"A fire suppression system consisting of an independently supplied and operating handline system and deluge system shall be installed in all Class A chambers."

(2) Revise 19-2.5.1.2 to read:
"Design of the fire suppression system shall be such that failure of components or water supply in either the handline system or deluge system will not render the other system inoperative. The handline and deluge systems shall be permitted to be supplied from a common water source only if one or both of them contains a holding tank of sufficient size to meet the requirement of this standard without refilling."

(3) Revise last sentence of 19-2.5.3.4 to read:
"The system shall be capable of supplying a minimum of 5 gpm (18.8 L/min) simultaneously to each of any two of the handlines at the maximum chamber pressure for a period of not less than four minutes."

As follows:
1. Change the Committee Action of 99-385 (Log #121) from Reject to Accept in Principle in Part.
2. Item No. 1: (The action was to Accept in Principle and referred to 99-384 (Log #278). The committee is further modifying the text of 99-384 as follows: ) "A fire suppression system consisting of an independently supplied and operating handline system and deluge type water spray systems shall be installed in all Class A chambers.
3. Item No. 2: Reject the submitter’s proposed text revision.
4. Item No. 3: Accept the proposed revision of 19-2.5.3.4 to read:
"The system shall be capable of supplying a minimum of 5 gpm (18.8 L/min) simultaneously to each of any two of the handlines at the maximum chamber pressure for a period of not less than four minutes.

COMMITTEE STATEMENT: 1. The committee reconsidered 99-385 (Log #121)
2. Item No. 1: Was addressed by 99-384 [Log #278] (Add the word “system” following the word “handline.” Revise text as follows): "A fire suppression system consisting of an independently supplied and operating handline system and deluge system shall be installed in all Class A chambers.) as noted in the substantiation; however, during the reconsideration of the committee’s action on 99-385, the committee provided further editorial clarification.
3. Item No. 2: The existing requirement conveys the committee’s intentions. The requirements for independence for deluge and handlines, 19-2.5.1.1 and 19-2.5.1.2 are considered to provide an acceptable level of safety.
4. Item No. 3: During reconsideration the committee reversed the earlier decision and accepts the revision of the last sentence of 19-2.1.3.4.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 19
VOTE ON COMMITTEE ACTION:
Affirmative: 16
Not returned: 3 Beeson, Newton, Sheffield

COMMITTEE STATEMENT: 1. Editorial replacing should with shall.
2. Located requirement under appropriate heading.

COMMITTEE ACTION: Accept.

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-391
RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee for reconsideration. The Committee Statement should qualify their action since they believe that there is no specific substantiation that there is a problem.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

1. The committee reconsidered Proposal 99-391 (Log #205) and the basis for the Committee Action.
2. Replace the committee statement:
"The existing text is acceptable.” as follows:
"The current design, capabilities, and actual testing experience in the hyperbaric industry has proven existing standards to be acceptable.

COMMITTEE STATEMENT: NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 19
VOTE ON COMMITTEE ACTION:
Affirmative: 16
Not returned: 3 Beeson, Newton, Sheffield

COMMITTEE STATEMENT: 1. Editorial replacing should with shall.
2. Located requirement under appropriate heading.

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-390
RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee for reconsideration. The Committee Statement should cite specific paragraphs.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The committee reconsidered Proposal 99-100 (Log #319).

COMMITTEE STATEMENT: NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 19
VOTE ON COMMITTEE ACTION:
Affirmative: 16
Not returned: 3 Beeson, Newton, Sheffield

COMMITTEE STATEMENT: 1. Editorial replacing should with shall.
2. Located requirement under appropriate heading.

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-404
RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee
Informatory Publications:

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 4
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

EXPLANATION OF NEGATIVE:
ESHERICK: The comments to Proposal 191 and 234 are valid. Putting ANSI/ASSE Series 6000 into NFPA 99 is beyond the scope of NFPA 99.

COMMITTEE ACTION: Reject.

Note: Proposal 99-411 was rejected. This action on the Technical Correlating Committee’s comment clarifies the Technical Committee’s substantiation for rejection.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 19

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 10
NOT RETURNED: 9 Galinello, Jarrett, Phillips, Salamone, Sinsgalli, Spahr, Stone, Svetlik, Woodfin

RECOMMENDATION: Accept.

SUBMITTER: Technical Correlating Committee on Health Care Facilities

COMMENT ON PROPOSAL NO: 99-416

RECOMMENDATION: It was the action of the Technical Correlating Committee that this proposal be returned to committee for a more expansive substantiation and definitive action, or update the appendix information.

SUBSTANTIATION: This is a direction from the Technical Correlating Committee on Health Care Facilities in accordance with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The definition in Chapter 2 with 3-4.2 and 3-4.3 of the Regulations Governing Committee Projects.

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COMMITTEE STATEMENT: This information is over 20 years old and contains many inaccuracies. Some of the information is over 36 years old. As an instance, the lead and lag vacuum settings are too low for today's machinery. There are many technical documents used by professional designers that have much more up to date information and are relied upon. Although a notation at the beginning of this section indicates that it has not been updated since its initial publication in 1980, it is still used in many cases. We need to take this information out of NFPA 99.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker

SUBMITTER: Burton R. Klein, Burton Klein Associates
COMMENT ON PROPOSAL NO: 99-416
RECOMMENDATION: Reconsider and accept proposal 99-416.
SUBSTANTIATION:
1. Reasons provided in T/C substantiation are not related to issue raised in proposal.
2. Reasons listed in substantiation of proposal 99-416 are still considered valid.
COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: This information is over 20 years old and contains many inaccuracies. Some of the information is over 36 years old. As an instance, the lead and lag vacuum settings are too low for today's machinery. There are many technical documents used by professional designers that have much more up to date information and are relied upon.
Although a notation at the beginning of this section indicates that it has not been updated since its initial publication in 1980, it is still used in many cases. We need to take this information out of NFPA 99.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 24
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NOT RETURNED: 3 Bancroft, Lynam, Shoemaker