Report of the Committee on
Health Care Facilities

Technical Correlating Committee (HEA-AAC)

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

Constance Bobik, B&E 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]
Rep. American Health Care Association
Stanley Kahn, Tri-City Electric Company, Inc., CA [IM]
Rep. National Electrical Contractors Association
William E. Koffel, Jr., Koffel Associates, Inc., MD [SE]
D. A. McWhinnie, Jr., Mechanical Dynamics Associates, IL [SE]
Thomas A. Salamone, Health Care and Life Safety Concepts, NY [I]
Rep. Kemper Insurance Companies
Steven Werner, Marsh USA, Inc., WI [I]
Mayer D. Zimmerman, U.S. Department of Health and Human Services, MD [E]

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 RJA Group, Inc., TX [SE]

Thomas Bulow, Tucson, AZ [U]
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
U.S. Department of Veterans Affairs, CA [U]

Saul Aronow, Waban, MA [SE]
Yadin David, Texas Childrens Hospital, TX [U]
Albert G. Garlatti, Intertek Testing Services NA Inc., MN [RT]
Alan Lipschultz, Christiana Health Care Services, DE [SE]
Rep. Association for the Advancement of Medical Instrumentation
James A. Meyer, Petris Memorial VA Hospital, CA [C]
Rep. American Society of Anesthesiologists
Joseph P. Murnane, Underwriters Laboratories Inc., NY [RT]
Timothy Peglow, La Porte Hospital, IN [U]
Rep. American Society for Healthcare Engineers
Mike Velvikis, High Voltage Maintenance Corporation, WI [IM]

Robert F. Willey, III, Siemens Medical Systems, Inc., NJ [M]
Rep. Health Industry Manufacturers Association

Alternates
George Mills, MM EC, Limited, IL [U]
(Alt. to T. Peglow)
Robert A. Carlson, Hubbell Inc., CT [M]
(Voting Alt. to NEMA Rep.)

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 Lipsy Burch, LLC, TN [SE]

Dan Chisholm, Motor and Generator Institute, Inc., FL [IM]
Herbert Daugherty, Middlesex County Utilities Authority, NJ [U]
Albert G. Garlatti, Intertek Testing Services NA Inc., MN [RT]
James W. Hillebrand, Byron Electric Company, KY [IM]
Rep. National Electrical Contractors Association
James R. Iverson, Kanon Corporation, MN [M]
Edward A. Lobnitz, Tilden Lobnitz & Cooper Inc., FL [SE]
Alfred J. Longhitano, Gage-Babcock & Associates Inc., NY [U]
Rep. American Health Care Association
Joseph P. Murnane, Underwriters Laboratories Inc., NY [RT]
David K. Norton, U.S. Department of Veterans Affairs, DC [E]
Ronald M. Smith, Carolinas HealthCare System, NC [U]
Rep. American Society for Healthcare Engineers
Howard Stickley, U.S. Army Corps of Engineers, DC [U]
Raymond J. Swisher, Naval Healthcare Support Office, VA [U]
Mike Velvikis, High Voltage Maintenance Corporation, WI [IM]
Walter N. Vernon, IV, Mazzetti & Associates Inc., CA [SE]

Alternates
Lawrence A. Bey, Onan Corporation, MN [M]
(Alt. to J. R. Iverson)
Robert A. Carlson, Hubbell Inc., CT [M]
(Voting Alt. to NEMA Rep.)
Douglas S. Erickson, American Society for Healthcare Engineers, VI [U]
(Alt. to R. M. Smith)
James Meade, US Army Corps of Engineers, MD [U]
(Alt. to H. Stickley)
Jeffrey L. Steplowski, U.S. Department of Veterans Affairs (183A), DC [E]
(Alt. to D. K. Norton)

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
M. Lee Bancroft, Beth Israel Deaconess Medical Center, MA [U]
Jay Crowley, U.S. Department of Health/Human Services, MD [E]
Yadin David, Texas Childrens Hospital, TX [U]
Gordon Earhart, HSB Professional & Loss Control, TN [I]
Rep. Compressed Gas Association

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Alan Lipschultz, Christiana Health Care Services, DE [SE]
Rep. Association for the Advancement of Medical Instrumentation

George Mills, MM EC, Limited, IL [U]

Dwight R. (Dak) Quarelles, Institute of Exercise & Environmental Medicine, TX [U]

Jay R. Sommers, Kimberly-Clark Corporation, GA [M]

John P. Swope, Derwood, MD [SE]
Rep. NFPA Health Care Section

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents on the performance, and maintenance criteria for safeguarding patients and health care personnel from fire, explosion, electrical, and related hazards in anesthetizing locations involving the administration of both flammable and nonflammable anesthetics, including equipment and facilities ancillary thereto; and 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

Steve Ennis, The Reciprocal Group, VA [I]

Curt Fogel, Vaxler 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, Health First, FL [U]

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

David J. Kitchin, Milicare, AZ [M]

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

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

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

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

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

Clevis T. Svetlik, Marsh USA, Inc., OH [I]

Steven Vargo, Barton Bay Medical Center, NJ [U]

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

Alternates

A. Richard Fasano, Russell Phillips & Associates Inc., CA [SE]
(Alt. to R. Phillips)

Susan B. McLoughlin, IBM 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 of health care facilities under disaster conditions.

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, DC [E]

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

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

W. T. Garnée, Oxy Heal Group, CA [M]

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

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

Carolyn C. Latty, Currative Health Services, AZ [U]
Rep. Baromedical Nurses Association

Richard A. Leland, Environmental Tectonics Corporation, PA [M]

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

Dennis J. Murray, KMS-Medical Gas Systems Consultants Limited, MI [U]
Rep. American Society for Healthcare Engineers

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

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

Alternates

Greg Godfrey, Sechrist Industries, Inc., CA [M]
(Alt. to J. R. Sechrist)

George Mills, MM EC, Limited, IL [U]
(Alt. to D. J. Murray)

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. Wischhoffer, 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. McLoughlin, Chair
IBM 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/Fire Prevention Section, MD [E]

Susan Y. Nickasch, Neenah, WI [SE]
Rep. American Society for Clinical Laboratory Science

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

Robert A. Guy, Earl Walls Associates, CA [SE]
(Alt. to U. M. Lindner)

Carol Jacobson, Ohio State Univ. Medical Center, OH [U]
(Alt. to S. B. McLoughlin)

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 maintenance of equipment and environment for the purpose of safeguarding patients, visitors and staff within laboratories in health care facilities.
Technical Committee on

Piping Systems (HEA-PIP)
(Chapter 2 [definitions] and Chapter 4)

Douglas S. Erickson, Chair
American Society for Healthcare Engr, VI [U]

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 Fitting (UA), CA, [L]
James S. Davidson, Jr., Davidson Associates, DE [SÈ]
Sharon Day, Pittsboro, NC [SE]

Rep. EnviroGuard
Peter Esherick, Patient Instrumentation Corporation, PA [RT]
P. L. Fan, American Dental Association, IL [U]
Michael Frankel, American Dental Association, IL [U]

Rep. American Society of Plumbing Engineers
Rep. Compressed Gas Association
Henri R. Kaht, Squire-Cogswell Company, IL [M]
David Eric Lees, Georgetown University Medical Ctr., DC [C]

Rep. American Society of Anesthesiologists
Richard L. Miller, Medical Gas Technology Inc., SC [RT]
David B. Mohile, Medical Engr Services, Inc., VA [RT]

Rep. American Society of Sanitary Engineering
Ron Ridinour, National ITC Corporation, CA [L]

Rep. Piping Industry Progress and Education
E. Daniel Shoemaker, Apollo Dental Products, AZ [M]
Ronald M. Smidt, Carolinas HealthCare System, NC [U]

Rep. NFPA Health Care Section
Edward K. Stevenson, LMG Property Engineers, MA [I]

Rep. The Alliance of American Insurers
J. Richard Wagner, Poole & Kent Company, MD [IM]

Rep. Mechanical Contractors Association of America, Inc.
Craig B. Williams, MEDAES Inc., GA [M]
F. David Wyrick, Sr., Cambiare Limited, NC [M]

Rep. International Analgesia Society

Alternates

Dale J. Dumbleton, National ITC Corporation, LA [L]
(Alt. to R. Ridinour)
David D. Eastman, Metro Detroit Plumbing Industry Training Center, MI [L]
(Alt. to T. J. Mraulak)
David Esherick, Patient Instrumentation Corporation, PA [RT]
(Alt. to P. Esherick)
Robert A. Ferdig, Nellcor/Puritan-Bennett Corporation, KS [M]
(Alt. to R. E. Hoffman)
Christopher R. Gossett, Squire-Cogswell Company, IL [M]
(Alt. to H. R. Kaht)
Michael J. Lynam, Porter Instrument Company, Inc., PA [M]
(Alt. to F. David Wyrick, Sr.)
James A. Meyer, Pettis Memorial VA Hospital, CA [C]
(Alt. to H. R. Kaht)

Alternates

George Mills, MM EC, Limited, IL [U]
(Alt. to D. S. Erickson)
Sharon Stanford, American Dental Association, IL [U]
(Alt. to P. L. Fan)
Christopher P. Swayne, The Sherman Engineering Company, PA [M]
(Alt. to M. W. Allen)

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-AAC)
• 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)


NFPA 99 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.

NFPA 99 has also been submitted to letter ballot of the Technical Correlating Committee on Health Care Facilities, which consists of 11 voting members; of whom 8 voted affirmatively and 3 ballots were not returned (Crowley, Gardner, Swope).


NFPA 99B has been submitted to letter ballot of the Technical Committee on Hyperbaric and Hypobaric Facilities, which consists of 20 voting members. The results of the balloting, after circulation of any negative votes, can be found in the report.

NFPA 99B has also been submitted to letter ballot of the Technical Correlating Committee on Health Care Facilities, which consists of 11 voting members; of whom 8 voted affirmatively and 3 ballots were not returned (Crowley, Gardner, Swope).
99-1 - (Entire Document): Accept

SUBMITTER: Technical Committee on Administration

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 5
NOT RETURNED: 1 McPeck

99-2 - (Entire Document): Accept

SUBMITTER: Technical Committee on Electrical Equipment

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
NOT RETURNED: 3 Bancroft, Mills, Swope

99-3 - (Entire Document): Accept

SUBMITTER: Technical Committee on Electrical Systems

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-4 - (Entire Document): Accept

SUBMITTER: Technical Committee on Gas Delivery Equipment

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
NOT RETURNED: 3 Bancroft, Mills, Swope

99-5 - (Entire Document): Accept

SUBMITTER: Technical Committee on Health Care Emergency Preparedness and Disaster Planning

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinnigalli, Woodfin

99-6 - (Entire Document): Accept

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 7
NOT RETURNED: 2 Nickasch, Simmons
SECTION 1.1 SCOPE

1.1.1 The scope of this document is to establish criteria to minimize the hazards of fire and explosions in laboratories, as defined in Chapter 3.

1.1.2 Chapter 10 Manufacturer Requirements covers the performance, maintenance, and testing, with regard to safety, required of manufacturers of equipment used within health care facilities.

1.1.3 Chapter 11 Laboratories establishes criteria to minimize the hazards of fire and explosions in laboratories, as defined in Chapter 3.

1.1.4 Chapter 12 Health Care Emergency Preparedness establishes minimum criteria for health care facility emergency preparedness management in the development of a program for effective disaster preparedness, mitigation, response, and recovery.

1.1.5 Chapter 15 addresses safety requirements of hospitals.

1.1.6 Chapter 14 “Other” Health Care Facilities addresses safety requirements for facilities, or portions thereof, that provide services to human beings.

1.1.7 Chapter 7 Materials covers the hazards associated with the use of flammable and combustible materials used within health care facilities.

1.1.8 Chapter 8 Electrical Equipment covers the performance, maintenance, and testing of electrical equipment used within health care facilities.

1.1.9 Chapter 9 Gas Equipment covers the performance, maintenance, and testing of gas equipment used within health care facilities.

1.1.10 Chapter 10 Manufacturer Requirements covers the performance, maintenance, and testing, with regard to safety, required of manufacturers of equipment used within health care facilities.

1.1.11 Chapter 11 Laboratories establishes criteria to minimize the hazards of fire and explosions in laboratories, as defined in Chapter 3.

1.1.12 Chapter 12 Health Care Emergency Preparedness establishes minimum criteria for health care facility emergency preparedness management in the development of a program for effective disaster preparedness, mitigation, response, and recovery.

1.1.13 Chapter 15 addresses safety requirements of hospitals.

1.1.14 Chapter 14 “Other” Health Care Facilities addresses safety requirements for facilities, or portions thereof, that provide diagnostic and treatment services to patients in health care facilities.

1.1.15 Areas Not Addressed. As defined in Chapter 3:
1.1.16 Reserved.
1.1.17 Chapter 17 addresses safety requirements of nursing homes.
1.1.18 Chapter 18 covers safety requirements of limited care facilities.
1.1.19* Chapter 19 Electrical and Gas Equipment for Home Care addresses the requirements for the selection and installation of electrical and gas equipment used for home care medical treatment.
1.1.20* Chapter 20 Hyperbaric Facilities covers the recognition of and protection against hazards of an electrical, explosive, or implosive nature, as well as fire hazards associated with hyperbaric chambers and associated facilities that are used, or intended to be used, for medical applications and experimental procedures at pressures from 0 psig to 100 psig (14.7 psi to 114.7 psi) (0 to 690 kPa gauge).
1.2 Chapter 21 Freestanding Birthing Centers addresses the requirements for the safe use of electrical and gas equipment, and for electrical, gas, and vacuum systems used for the delivery and care of infants in freestanding birthing centers.

SECTION 1.2 PURPOSE
1.2.1 The purpose of this standard is to provide minimum requirements for the performance, maintenance, testing, and safe practices for facilities, material, equipment, and appliances, including other hazards associated with the primary hazards.

SECTION 1.3 APPLICATION
1.3.1 This document shall apply to all health care facilities.
1.3.2 Construction and equipment requirements shall be applied only to new construction and new equipment, except as modified in individual chapters. Only the altered, renovated, or modernized portion of an existing system or individual component shall be required to meet the installation and equipment requirements stated in this standard. If the alteration, renovation, or modernization adversely impacts existing performance requirements of a system or component, additional upgrading shall be required.
1.3.3 Chapters 13 through 19 specify the conditions under which the requirements of Chapters 4 through 12 shall apply in Chapters 13 through 19.
1.3.4 This document is intended for use by those persons involved in the design, construction, inspection, and operation of health care facilities and in the design, manufacture, and testing of appliances and equipment used in patient care areas of health care facilities.
Nonflammable piped medical gases covered by this document include, but are not limited to, oxygen, nitrogen, nitrous oxide, medical air, carbon dioxide, and helium.

SECTION 1.4 EQUIVALENCY
1.4.1 The authority having jurisdiction for the enforcement of this document shall be permitted to grant exceptions to its requirements.
1.4.2 Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety to those prescribed by this standard.

Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.
The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

SECTION 1.5 UNITS AND FORMULAS
1.5.1* Primary units will be trade units, secondary will be the conversion. While it is common practice for medical appliances to have metric units on their dials, gauges, and controls, many components of systems within the scope of this document, which are manufactured and used in the U.S., employ nonmetric dimensions. Since these dimensions (such as nominal pipe sizes) are not established by the National Fire Protection Association, the now Technical Correlating Committee on Health Care Facilities cannot independently change them. Accordingly, this document uses dimensions that are presently in common use by the building trades in the U.S. Conversion factors to metric units are included in C-4.5.
A.1.5.1 Trade units vary from SI to English units depending on the equipment devices or material.

SECTION 1.6 CODE ADOPTION REQUIREMENTS
1.6.1 The effective date of application of any provision of this document is not determined by the National Fire Protection Association. All questions related to applicability shall be directed to the authority having jurisdiction.
1.6.2* This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority.
A.1.6.2.1 The following sample ordinance is provided to assist a jurisdiction in the adoption of this code and is not part of this code.

** Ordinance No. _____

An ordinance of the [jurisdiction] adopting the [year] edition of NFPA [document number], [complete document title] documents listed in Chapter 2 of that code; prescribing regulations governing conditions hazardous to life and property from fire or explosion; providing for the issuance of permits and collection of fees; regulating Ordinance No. of the [jurisdiction] and all other ordinances and parts of ordinances in conflict therewith; providing a penalty; providing a severability clause; and providing for publication; and providing an effective date.

BE IT ORDAINED BY THE [governing body] OF THE [jurisdiction].

SECTION 1.1 That the [complete document title] and documents adopted by Chapter 2, three (3) copies of which are on file and are open to inspection by the public in the office of the [jurisdiction’s keeper of records] of the [jurisdiction], are hereby adopted and incorporated into this ordinance as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling within the limits of the [jurisdiction]. The same are hereby adopted as the code of the [jurisdiction] for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion and providing for issuance of permits and collection of fees.

SECTION 2 Any person who shall violate any provision of this code or standard hereby adopted or fail to comply therewith; or who shall fail to or cease to comply with any order made thereunder; or who shall violate any order or permit issued thereunder; or who shall fail to follow any order made thereunder; or who shall violate or fail to comply with any order as affirmed or modified or by or by a court of competent jurisdiction, within the time fixed herein, shall severally for each and every such violation and noncompliance, respectively, be guilty of a misdemeanor, punishable by a fine of not less than $5 or by imprisonment for not less than ___ days or more than ___ days or by both such fine and imprisonment.

The imposition of one penalty for any violation shall not excuse the violation or permit it to continue; and all such persons shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified the application of the above penalty shall not be held to prevent the enforced removal of prohibited conditions. Each day that prohibited conditions are maintained shall constitute a separate offense.

SECTION 3 Additions, insertions, and changes — that the [year] edition of NFPA [document number], [complete document title] is amended and changed in the following respects:

List Amendments

SECTION 4 That ordinance No. _____ of [jurisdiction] entitled [fill in the title of the ordinance or ordinances in effect] at the present time and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

SECTION 5 That if any section, subsection, clause, or phrase of this ordinance is, for any reason, held to be invalid or unconstitutional, such decision shall not affect the validity or constitutionality of the remaining portions of this ordinance. The [governing body] hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase hereof, notwithstanding the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

SECTION 6 That the [jurisdiction’s keeper of records] is hereby ordered and directed to cause this ordinance to be published.

[NOTE: An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.]

SECTION 7 That this ordinance and the rules, regulations, provisions, requirements, orders, and matters established and adopted hereby shall take effect and be in full force and effect [time period] from and after the date of its final passage and adoption.

SUBSTANTIATION: Chapter 1 was revised to conform to the new Manual of Style.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6
VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 5
NOT RETURNED: 1 McPeck

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VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinigallia, Woodfin

99-13 - (2-2 Alarm System Level III): Accept
SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.
RECOMMENDATION: Definition for Alarm System Level III should be 2
SUBSTANTIATION: Level 3 is the correct use and Roman numerals is incorrect. The use of “medical air” is confusing since no manufacturer of Level 3 has a medical air alarm and is not normally used in Level 3. This adds more confusion for inspectors and builders. They are thinking the Level 3 air compressor is medical and wanting a Level 1 or 2 installation. Medical air is not for powering devices such as handpieces.
COMMITTEE ACTION: Accept.

Also delete the word “and”.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-14 - (2-2 Ambulatory Health Care, Free Standing Birthing Center, Hospital Facility, Hyperbaric, Hypobaric, Limited Care Facility):
TCC NOTE: It was the action of 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.”

SUBMITTER: Technical Committee on Administration
RECOMMENDATION: Reorganize and revise the following definitions of Healthcare Facilities: Ambulatory Health Care, Free Standing Birthing Center, Hospital Facility, Hyperbaric, Hypobaric, Limited Care Facility, Medical/Dental Office, and Nursing Home, as follows:
Ambulatory Health Care: 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.
Hospital Facility: A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients.
Hyperbaric Facility, building or structure used to house chambers and all auxiliary service equipment for medical applications and procedures at pressures above normal atmospheric pressures.
Hypobaric Facility, building or structure used to house chambers and all auxiliary service equipment for medical applications and procedures at pressures below atmospheric pressures.
Limited Care Facility: A building or portion of a building used on a 24-hour basis for the housing of four or more persons who are incapable of self-preservation due to age; physical limitations due to accident or illness; or limitations such as mental retardation/developmental disability, mental illness, or chemical dependency.
Medical/Dental Office: A building or part thereof in which the following occur:
(1) Examinations and minor treatments/procedures are performed under the continuous supervision of a medical/dental professional.

(Feedback #CP3)
COMMITTEE: HEA-ADM
AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinigallia, Woodfin

99-10 - (1-1 Scope): Reject
TCC NOTE: The Technical Correlating Committee supports the Technical Committee’s action by reaffirming the Technical Correlating Committee’s previous position that free-standing veterinary facilities are outside the scope of the Health Care Facilities Project.
SUBMITTER: Peter Estreicher, Patient Instrumentation Corp.
RECOMMENDATION: Add new sentence after first sentence: “The scope also applies to veterinary facilities.”
SUBSTANTIATION: (1) Problem is that we should not only take care of ill human beings, but also ill animals-many of whom are loved by their owners as much or more than they love their fellow human beings.
In addition, we must be looking out for the fire and health safety of the people who are treating the animals. This is also in first paragraph of 12-4.1.1.1 “…health care personnel from fire, explosion, electrical, and related hazards associated with the administration of inhalation anesthetics.”
(2) Note that the “Scope” of the HEA-AAC Technical Correlating Committee has responsibility for documents “…which contain criteria for safeguarding patients and health care personnel…”.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee’s interpretation is that the committee scope is limited to services for human beings. The submitter should propose that veterinary facilities be addressed in NFPA 5000, NFPA Building Code, or in the Mechanical and Plumbing Code. In addition no loss history or data has been submitted to substantiate the proposed change or a problem in these facilities.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 5
NOT RETURNED: 1 McPeck

99-11 - (1-3): Accept
SUBMITTER: David B. Mohle, Medical Engineering Services, Inc.
RECOMMENDATION: Add wording for new paragraph as follows:
“Nonflammable piped medical gases covered by this document include, but are not limited to, oxygen, nitrogen, nitrous oxide, medical air, carbon dioxide, and helium.”
SUBSTANTIATION: In the 1996 edition of this standard the above list was a note at the very beginning of the chapter. However, part of the editing of the 1999 edition of the standard was to move all notes to the appendix and this list of gases never made it. It is important to list the gases that we are dealing with. Also, by adding the word “piped” we reinforce the negative wording in 4-1.3 which states that portable compressed gas systems are not covered.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 4
NEGATIVE: 1
NOT RETURNED: 1 McPeck

EXPLANATION OF NEGATIVE:
BULOW: Piped systems are noted in A-4-1 of the 1999 edition of NFPA 99. Levels 1 and 2 are covered adequately in A-4-2.2 referring back to Sections 4-3 and 4-4. Piped and portable appear to be adequately and clearly defined. If this recommendation goes forward, then all hospital utility systems should be so noted.

(Feedback #CP407)
COMMITTEE: HEA-HCE
AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinigallia, Woodfin

99-12 - (2-2): Accept
SUBMITTER: Technical Committee on Health Care Emergency Preparedness and Disaster Planning
RECOMMENDATION: Delete “(From NFPA 1600, Recommended Practice for Disaster Management)” from Incident Command System (ICS).
SUBSTANTIATION: The text in NFPA 99 and in NFPA 1600 are no longer identical.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18
(2) Only sedation or local anesthesia is involved and treatment or procedures do not render the patient incapable of self-preservation under emergency conditions.

(3) Overnight stays for patients or 24-hour operation are not provided.

Nursing Home. A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person.

SUBSTANTIATION: Conforms to the Manual of Style.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 5

NOT RETURNED: 1 McPeck

99-17 - (2-2 Anesthetic): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

RECOMMENDATION: Delete text as follows:

"Anesthetic. As used in this standard, applies to any inhalation agent used to produce relative analgesia or general anesthesia."

SUBSTANTIATION: There are other types of anesthetizing agents commonly used for general anesthesia. One example: sodium pentothal. There are others.

COMMITTEE STATEMENT: The requirements of the standard are based on inhalation anesthetics. The proposal would greatly expand where the requirements would be applied. The submitter did not substantiate how the proposed change would be applied or why.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Mills, Swope

EXPLANATION OF NEGATIVE:

DAVID: Reject: Non-inhalation agent does not present specific hazard subjected to the scope of this standard.

99-16 - (2-2 Anesthetizing Location): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

RECOMMENDATION: Add to the definition of Anesthetizing Location: "Any area of a facility that has been designated to be used for the administration of nonflammable, intravenous, and/or other types of anesthetic agents in the course of examination or treatment..."

SUBSTANTIATION: More and more procedures, such as endoscopy, tooth extraction, and others use intravenous or other means of introducing anesthesia that would render the patient comatose and thus be incapable of protecting themselves in an emergency situation.

COMMITTEE ACTION: Reject.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NEGATIVE: 1

NOT RETURNED: 3 Bancroft, Mills, Swope

EXPLANATION OF NEGATIVE:

DAVID: Reject: The appropriate monitoring of sedated patient is not regulated by this standard, but rather the conditions that may lead to fire and/or explosion.

99-18 - (2-2 Clinic): Accept

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

RECOMMENDATION: This definition should be deleted totally.

COMMITTEE STATEMENT: This adds more confusion to non-hospital Level 3. This is a duplicate of "Anesthetizing Location" as a definition.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 4

NEGATIVE: 1

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

WYRICK: This is most confusing because some non-hospital based facilities are called clinics. There are Dental Clinics, Medical Clinics, and Out Patient Surgery Clinics that may or may not be viewed as what they really are or should be identified. The definition does not appear in the NFPA 99C document. To add to the confusion, we still do not have a definition for Anesthesia. If the inspector uses Life Support 101, it will become more confusing and has happened just last week in Tennessee. A dental office was required to be Level 1 because of the difference in definitions. What should be followed: Clinic, Ambulatory Health Care Facility or Office Practice, Medical or Dental? Do we change all Medical or Dental facilities if they have more than 4 treatment rooms.

Can they treat wheel chair patients, blind patients and some children? Clinic and Ambulatory Facilities need to be revised and explained with a better definition. All of these should be corrected in NFPA 101.

99-19 - (2-2 Clinic): Accept

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Use the "preferred definitions" from the Glossary of Terms. 1. Combustible. Capable of undergoing combustion. 2. Combustible Liquid. A liquid having a flash point at or above 37.8°C [100°F]. Combustible liquids shall be subdivided as follows: (a) Class II liquids shall include those having flash points at or above 37.8°C [100°F] and below 60°C [140°F]. (b) Class IIIA liquids shall include those having flash points at or above 60°C [140°F] and below 93°C [200°F].
3. Flammable. A combustible that is capable of easily being ignited and rapidly consumed by fire. Flammables may be solids, liquids, or gases exhibiting these qualities.

4. Flammable Liquid. A liquid that has a closed-cup flash point that is below 37.8 °C [100 °F] and a maximum vapor pressure of 2068 mm Hg [40 psi] at 37.8 °C [100 °F].

5. Laboratory Work Area. A room or space for testing, analysis, research, instruction, or similar activities that involve the use of chemicals. This work area may or may not be enclosed.

**COMMITTEE ACTION:** While accepting the preferred definition for “combustible liquid” in the new glossary of terms/definitions, the committee desires this definition to also appear in Appendix C-10.2.1 where a definition presently exists.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 9

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 7 |
| NOT RETURNED: 2 NicKasch, Simmons |

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**COMMITTEE STATEMENT:**

Include clear definitions of Levels 1, 2, 3, and 4 facilities at the beginning of the report. Index should include reference to these definitions.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The 5 mg/m³ standard is inappropriate for action to be taken. The 5 mg/m³ is too high given the filtration systems required by this code for new installations and the documented performance of existing systems, which can easily achieve 1.0 mg/m³. We have over 15 years of installations and the documented performance of existing systems, and it is extremely rare for an existing system to have more than 1.0 mg/m³. The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.

**SUBSTANTIATION:**

The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.

**COMMITTEE STATEMENT:**

The committee feels that it’s equal to or less than the 5 mg/m³.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

Editorial.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 6

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 5 |
| NOT RETURNED: 1 McPeck |

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**COMMITTEE STATEMENT:**

The submitted proposal to the Technical Committee on Administration for review and comment.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The standard now allows only 5 mg, no less or no more.

**COMMITTEE ACTION:**

Accept in Principle.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The committee feels that it’s equal to or less than the 5 mg/m³.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

| AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

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**COMMITTEE STATEMENT:**

The particulate weight in this definition is <1 mg/m³ at normal atmospheric pressure...”.
EXPLANATION OF NEGATIVE:

ESHERRICK: See Committee Action on Proposal 99-23 (Log #333) [2-2 Office Practice, Medical/Dental]
Modify text as follows:
“5 mg/m³ at normal atmospheric pressure of particulate at 1 micron size or greater.”

99-25 - (2-2 Office Practice, Medical/Dental): Reject
SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.
RECOMMENDATION: Revise as follows:
"Office Practice, Medical/Dental": change to “Medical Facility” as a definition and “Dental Facility” as a definition.

SUBSTANTIATION: As a definition, it would be easier to find in Chapter 2. Many of the facilities are called clinics, offices, and outpatient surgery clinics (oral surgery or plastic surgery). This has been misunderstood by many inspectors and resulted in Level 1 or 2 requirements. This becomes so expensive many of these offices forgo piping of gases and use portable devices.

COMMITTEE STATEMENT: The submitter did not recommend specific wording.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
WYRICK: My mistake, I should have given again the definition. Delete “Office Practice, Medical/Dental” and enter 2 new definitions.

Dental Care Facility. A health care facility where patients are seen on an ambulatory basis and treated for dental procedures.

Treatment or surgery may involve anesthesia or conscious sedation. For purposes of this standard, facilities that retain patients for more than 12 hours post procedure shall not be considered a dental care facility or Level 3 facility.

Medical Care Facility. A health care facility where patients are seen on an ambulatory basis and tested for minor medical procedures. Treatment or surgery may involve anesthesia or conscious sedation. For purposes of this standard, facilities that retain patients for more than 12 hours post procedure should not be considered a medical care facility or Level 3 facility.

Committee: HEA-ELS
99-26 - (2-2 Reference Grounding Point): Accept
SUBMITTER: Hugh Nash, Nash Lipsy Burch, LLC
RECOMMENDATION: Change the definition of “Reference Grounding Point” to read as follows:
“The ground bus of the panelboard or isolated power system panel supplying the patient care area.”

SUBSTANTIATION: The NEC wording given above is simpler and more straightforward. Moreover, an “extension of the equipment grounding bus” is not permitted by the NEC.

COMMITTEE ACTION: Accept.
COMMITTEE STATEMENT: The committee agrees with the recommendation. However, the committee disagrees with sentence number two of the submitter’s substantiation because an extension is permitted under certain circumstances.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-27 - (2-2 Station Inlet): Accept
SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.
RECOMMENDATION: Delete the words “Typical.”

SUBSTANTIATION: Type is no longer used in Chapters 2 or 4. There is no mention of types or levels in “Station Outlet.” They should be the same.

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 22
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-28 - (2-2 Various definitions): Accept
SUBMITTER: Technical Committee on Electrical Systems
RECOMMENDATION: 1. Change the following definitions to the NFPA preferred definitions as follows:

Ambulatory. The current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Automatic. Providing a function without the necessity of human intervention.

Emergency System. A system of circuits and equipment intended to supply alternate power to a limited number of prescribed functions vital to the protection of life and safety.

Equipment System. A system of feeders and branch circuits arranged for delayed, automatic, or manual connection the alternate power source and that serves primarily 3-phase power equipment.

Feeder. All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.

Ground-Fault Circuit-Interrupter (GFCI). A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

Total Hazard Current. The hazard current of a given isolated system with all devices, including the line isolation monitor, connected.

Do not accept the preferred definitions for the following five words/phrases:

Hazard Current
Isolation Transformer
Life Safety Branch
Selected Receptacles
Task Illumination

which should defer to the NFPA 99 definition for Chapter 2 purposes.

SUBSTANTIATION: The terms were modified to conform to the preferred definitions for the glossary of terms.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 17
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-29 - (2-2 Various Definitions, 4-4, 12-3-4, Chapter 13, 16-3-4, 17-3-4):
TCC NOTE: The Technical Correlating Committee directs that the recommended text be reconsidered by the applicable Technical Committee and consider the following recommendations:

Paragraph 2: “....emergency rooms departments....” to be consistent with current nomenclature.

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

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

SUBMITTER: Technical Committee on Piping Systems
RECOMMENDATION: Revise text as follows:
1. In 2-2, delete the following terms and associated definitions:

Ambulatory Health Care Center
Clinic
Office Practice, Medical/Dental

621
12-3.4.5. If installed, laboratory vacuum systems shall conform to Level 4 vacuum systems of Chapter 4.

6. Insert new Chapter 13 to read as follows:

Chapter 13 ‘Other’ Health Care Facilities

13-1 General.

13-1.1 Scope. This chapter addresses safety requirements for facilities, or portions thereof, that provide diagnostic and treatment services to patients in health care facilities other than hospitals, nursing homes, limited care facilities, or hyperbaric facilities as defined in Chapter 2.

13-2 General Responsibilities.

13-2.1 Laboratories. The governing boards of these facilities shall have the responsibility of protecting the facilities (for patient care and clinical investigation) and the personnel employed therein.

13-3 General Requirements.

13-3.1 (Reserved)

13-3.2 (Reserved)

13-3.3 Electrical System Requirements.

13-3.3.1 Normal Electrical Distribution System. (Reserved)

13-3.3.2 Essential Electrical Distribution System. The essential electrical distribution system shall conform to a Type 3 system as described in Chapter 3.

13-3.3.2.1 If electrical life support equipment is required, the essential electrical distribution system shall conform to a Type 1 system as described in Chapter 3.

13-3.3.2.2 If critical care areas are present, the essential electrical distribution system shall conform to a Type 1 system as described in Chapter 3.

13-3.4 Gas and Vacuum System Requirements.

13-3.4.1 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4.

13-3.4.2 If installed where the patient population is not on critical life support equipment, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.

13-3.4.3 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient vacuum system shall conform to Level 1 piped vacuum systems of Chapter 4.

13-3.4.4 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient vacuum system shall conform to Level 2 piped vacuum systems of Chapter 4.

13-3.4.5 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

13-3.4.6 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

13-3.4.7 If installed, patient WAGD systems shall conform to Level 1 WAGD systems of Chapter 4. [NOTE: a public comment is being prepared to revise this paragraph to correlate with Proposal 99-218 (Log #179).]

13-3.4.8 If installed, laboratory gas systems shall conform to Level 4 vacuum systems of Chapter 4.

13-3.5 Environmental Systems. (Reserved)

13-3.6 Material Requirements. (Reserved)

13-3.7 Electrical Equipment Requirements.

13-3.7.1 Patient Care Areas. If critical care areas are present, electrical appliances shall conform to Chapter 7.

13-3.7.2 Laboratories. Equipment shall conform to 7-5.2.2 and 7-6.

13-3.8 Gas Equipment Requirements.

13-3.8.1 Patient. Gas equipment shall conform to the patient equipment requirements in Chapter 8.

13-3.9 (Reserved)

13-3.10 (Reserved)

13-3.11 Facilities covered by this chapter shall comply with the provisions of Chapter 11 for disaster planning, as appropriate.


8. Delete text of existing Chapter 14, and have Chapter 14 indicated as "(Reserved)."

9. Delete text of existing Chapter 15, and have Chapter 15 indicated as "(Reserved)."

10. Revise 16-3.4 to read as follows:

16-3.4 Gas and Vacuum System Requirements.
16-3.4.1 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4. A single alarm panel, as described in 4-3.1.2.1(b), shall be mounted in an area of continuous surveillance while the facility is in operation.

Exception: For facilities that do not provide mechanical ventilation or assisted mechanical ventilation,
(a) Medical air compressors shall be permitted to be simplex.
(b) Dental, after cooler, filters, and regulators, as listed in 4-3.1.2.1(c)1a, shall be permitted to be simplex.
(c) If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient vacuum systems shall conform to Level 1 piped vacuum systems of Chapter 4.

16-3.4.2 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.

16-3.4.3 If installed where the patient population is not on critical life support equipment, the patient gas system shall conform to Level 3 piped gas systems of Chapter 4.

16-3.4.4 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient vacuum systems shall conform to Level 1 piped vacuum systems of Chapter 4.

16-3.4.5 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient vacuum system shall conform to Level 2 piped vacuum systems of Chapter 4.

16-3.4.6 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

16-3.4.7 If installed, patient WAGD systems shall conform to Level 1 WAGD systems in Chapter 4. [NOTE: a public comment is being prepared to revise this paragraph to correlate with Proposal 99-218 (Log #179).]

16-3.4.8 Laboratory Gas Systems. (Reserved)

16-3.4.9 Laboratory Vacuum Systems. (Reserved)

11. Revise 17-3.4 to read as follows:

17-3.4 Gas and Vacuum System Requirements.

17-3.4.1 If installed, patient gas systems shall conform to Level 3 gas systems of Chapter 4.

Exception: For systems with compressed gases totaling more than 8000 cu ft (230 m3), the source supply shall comply with a Level 1 gas system of Chapter 4.

17-3.4.2 If installed, patient vacuum systems shall conform to Level 3 vacuum systems of Chapter 4.

17-3.4.3 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4.

17-3.4.4 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.

17-3.4.5 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient vacuum system shall conform to Level 2 piped vacuum systems of Chapter 4.

17-3.4.6 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

17-3.4.7 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4.

17-3.4.8 Laboratory Gas Systems. (Reserved)

17-3.4.9 Laboratory Vacuum Systems. (Reserved)

11. Revise 17-3.4 to read as follows:

17-3.4 Gas and Vacuum System Requirements.

17-3.4.1 If installed, patient gas systems shall conform to Level 3 gas systems of Chapter 4.

Exception: For systems with compressed gases totaling more than 8000 cu ft (230 m3), the source supply shall comply with a Level 1 gas system of Chapter 4.

17-3.4.2 If installed, patient vacuum systems shall conform to Level 3 vacuum systems of Chapter 4.

17-3.4.3 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4.

17-3.4.4 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.

17-3.4.6 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

17-3.4.8 Laboratory Gas Systems. (Reserved)

17-3.4.9 Laboratory Vacuum Systems. (Reserved)

11. Revise 17-3.4 to read as follows:

17-3.4 Gas and Vacuum System Requirements.

17-3.4.1 If installed, patient gas systems shall conform to Level 3 gas systems of Chapter 4.

Exception: For systems with compressed gases totaling more than 8000 cu ft (230 m3), the source supply shall comply with a Level 1 gas system of Chapter 4.

17-3.4.2 If installed, patient vacuum systems shall conform to Level 3 vacuum systems of Chapter 4.

17-3.4.3 If installed where patients are provided mechanical ventilation or assisted mechanical ventilation, patient gas systems shall conform to Level 1 piped gas systems of Chapter 4.

17-3.4.4 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.

17-3.4.6 If installed where the patient population is not on critical life support equipment, the patient vacuum system shall conform to Level 3 piped vacuum systems of Chapter 4.

17-3.4.8 Laboratory Gas Systems. (Reserved)

17-3.4.9 Laboratory Vacuum Systems. (Reserved)

11. Revise 17-3.4 to read as follows:

17-3.4 Gas and Vacuum System Requirements.

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17-3.4.4 If installed where patients due to medical, surgical, or diagnostic intervention are dependent on the piped vacuum system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.
Chapter 3 Electrical Systems

4.1 General.

4.1.1 Wiring and installation requirements on equipment shall be in accordance with NFPA 70, National Electrical Code.

4.1.2 Requirements for illumination and identification of means of egress in health care shall be in accordance with NFPA 101, Life Safety Code.

4.1.3 The alternate source of emergency power for illumination and identification of means of egress shall be from the essential electrical system.

4.1.4 Requirements for the installation of stationary engines and gas turbines shall be in accordance with NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

4.2 Nature of Hazards.

4.2.2 Shock.

4.2.2.1 General.

4.2.2.2 Control. Control of electric shock hazard requires the limitation of electric current that might flow in an electric circuit involving the patient's body and is accomplished through a variety of alternative approaches.

4.2.3 Thermal. (Reserved)

4.2.4 Interruption of Power.

4.2.4.1 General. Medical and nursing sciences are becoming progressively more dependent on electrical apparatus for the preservation of life of hospitalized patients. For example, year by year more cardiac operations are performed, in some of which the patient's life depends on artificial circulation of the blood. In other operations, life is sustained by means of electrical impulses that stimulate and regulate heart action. In still others, suction developed by electrical means is routinely relied on to remove body fluids and mucus that might otherwise cause suffocation. In another sense, lighting is needed in strategic areas in order that precise procedures can be carried out, and power is needed to safeguard such vital services as refrigerated stores held in tissue, bone, and blood banks.

4.2.4.2 Control. Interruption of normal electrical service in health care facilities can be caused by catastrophes such as storms, floods, fires, earthquakes, or explosions; by failures of the systems supplying electrical power; or by incidents within the facility. For all such situations, electrical systems should be planned to limit internal disruption and to provide for continuity of vital services at all times. Outages might be corrected in seconds or might require hours for correction. This indicates that the system or protection needs to be designed to cope with the longest probable outage.

4.2.4.3 Selecting. Selecting vital areas and functions considered to be essential, designing safeguards to ensure continuity in these circuits, and containing the electrical and mechanical components of such essential services so that they will work when called on are complex problems that warrant standardized guidance for regulating agencies, governing boards, and administrators of health care facilities and architects and engineers concerned with their construction. Such guidance is offered in this chapter.

4.2.4.4 Designing. This chapter is predicated on the basic principle of achieving dependability. It is intended to recognize the different degrees of reliability that can result from varying approaches to electrical design. Therefore, its requirements have been developed to allow the designer the flexibility needed to achieve a reliable electrical system.

4.2.4.5 Maintenance. Interruption of the supply of electric power in a facility can be a hazard. Implementation of the requirements of this chapter serves to maintain the required level of continuity and quality of electrical power for patient care electrical appliances.
4.3.2.2.2 Grounding requirements shall comply the following:

(a) Grounding Circuitry Integrity. Grounding circuits and conductors in patient care areas shall be installed in such a way that the continuity of other parts of those circuits cannot be interrupted nor the resistance raised above an acceptable level by the installation, removal, or replacement of any installed equipment, including power receptacles.

(b) * Reliability of Grounding. Where used, the reliability of installed grounding circuits to a power receptacle in all patient care areas shall be at least equivalent to that provided by an electrically continuous copper conductor of appropriate ampacity run from the receptacle to a grounding bus in the distribution panel. The grounding conductor shall conform to NFPA 70, National Electrical Code.

(c) Separate Grounding Conductor. When existing construction does not use a separate grounding conductor the continued use of the system shall be permitted to be used provided it meets the performance requirements in 4.3.3.2, Grounding System in Patient Care Areas.

(d) Metal Receptacle Boxes. Where metal receptacle boxes are used, the performance of the connection between the receptacle grounding terminal and the metal box shall be equivalent to the performance provided by copper wire no smaller than No. 12 AWG.

4.3.2.2.3* Grounding Interconnects. In patient care areas supplied by the normal distribution system and any branch of the essential electrical system, the grounding system of the normal distribution system and that of the essential electrical system shall be interconnected.

4.3.2.2.4 Circuit Protection.

4.3.2.2.4.1* The main and downstream ground-fault protective devices (where required) shall be coordinated as required in 4.3.2.5.

4.3.2.2.4.2* If used, ground-fault circuit interrupters (GFCIs) shall be approved for the purpose.

4.3.2.2.5 Wiring in Anesthetizing Locations.

4.3.2.2.5.1* Wiring. Installed wiring shall be in metal raceway or shall be in accordance with NFPA 70, National Electrical Code, Sections 517-60 through 517-63.

4.3.2.2.5.2 Raceway. Such distribution systems shall be run in metal raceways along with a green grounding wire sized no smaller than the energized conductors.

4.3.2.2.5.3 Grounding to Raceways. Each device connected to the distribution system shall be effectively grounded to the metal raceway at the device.

4.3.2.2.5.4 Installation. Methods of installation shall be in accordance with Articles 250 and 517 of NFPA 70, National Electrical Code.

4.3.2.2.5.5 Battery-Powered Emergency Lighting Units. One or more battery-powered emergency lighting units shall be provided in accordance with NFPA 70, National Electrical Code, Section 700-12(e).

4.3.2.2.5.6 Other Services Receptacles. Receptacles provided for other services having different voltages, frequencies, or types on the same premises shall be of such design that attachment plugs and receptacles cannot be connected to circuits of a different voltage, frequency, or type, but shall be interchangeable within each classification and rating required for two-wire, 125-V, single-phase ac service.

4.3.2.2.6* Special Grounding.

4.3.2.2.6.1 Use of Quiet Grounds. A quiet ground, if used, shall not defeat the purposes of the safety features of the grounding systems detailed herein.

4.3.2.2.6.2 Patient Equipment Grounding Point. A patient equipment grounding point comprising one or more grounding terminals or jacks shall be permitted in an accessible location in the patient care vicinity.

4.3.2.2.6.3* Special Grounding in Patient Care Areas. In addition to the grounding required to meet the performance requirements of 4.3.2.2.6, additional grounding shall be permitted where special circumstances so dictate.

4.3.2.2.7 Wet Locations.

4.3.2.2.7.1* Wet location patient care areas shall be provided with special protection against electric shock. This special protection shall be provided as follows:

(a) A power distribution system that inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply;

(b) A power distribution system in which the power supply is interrupted if the ground-fault current does, in fact, exceed a value of 6 mA.

4.3.2.2.7.2 Patient beds, toilets, bidets, and wash basins shall not be required to be considered wet locations.
4.3.2.2.7.3 In existing construction, the requirements of 2.3.2.2.6.1 are not required when written inspection procedure, acceptable to the authority having jurisdiction, is continuously enforced by a designated individual at the hospital, to indicate that equipment-grounding conductors for 120-V, single-phase, 15- and 20-A receptacles, equipment connected by cord and plug, and fixed electrical equipment are installed, maintained in accordance with NFPA 70, National Electrical Code, and applicable performance requirements of this chapter. The procedure shall include electrical continuity tests of all required equipment, grounding conductors, and their connections. These tests shall be conducted as follows.

Fixed receptacles, equipment connected by cord and plug, and fixed electrical equipment shall be tested as follows:

(a) When first installed
(b) Where there is evidence of damage
(c) After any repairs, or
(d) At intervals not exceeding 6 months

4.3.2.2.7.4 The use of an isolated power system (IPS) shall be permitted as a protective means capable of limiting ground fault current without power interruption. When installed, such a power system shall conform to the requirements of 4.3.2.2.

4.3.2.2.7.5 Where power interruption under first fault condition (line-to-ground fault) is tolerable, the use of a ground-fault circuit interrupter (GFCI) shall be permitted as the protective means, monitors the actual ground fault current and interrupts the power when that current exceeds 6 mA.

4.3.2.2.8 Isolated Power. An isolated power system shall not be required to be installed in any patient care area except as specified in 4.3.2.2.6. The system shall be permitted to be installed, however, and, when installed, shall conform to the performance requirements specified in 5-3.2.2.

4.3.2.3 Laboratories. Power outlets shall be installed in accordance with NCCS Standard ASI-5, Power Requirements for Clinical Laboratory Instruments and for Laboratory Power Sources. Outlets with two or four receptacles, or an equivalent power strip, shall be installed every 0.5 to 1.0 m (1.6 to 3.3 ft) in instrument usage areas, and either installation is to be at least 8 cm (3.15 in.) above the countertop.

4.3.2.4 Other Nonpatient Areas. (Reserved)

4.3.2.5 Ground-Fault Protection. When ground-fault protection is provided for operation of the service or feeder disconnecting means, an additional step of ground-fault protection shall be provided in the next level of feeder downstream toward the load. Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the downstream device and not the upstream device shall open for downstream ground faults. The additional step of ground-fault protection shall not be required where the service or feeder disconnecting means does not serve patient care areas or equipment intended to support life, such as clinical air compressors and vacuum pumps. When equipment-ground-fault protection is first installed, each level shall be performance tested to ensure compliance with 2the above.

4.3.2.6* Isolated Power Systems.

4.3.2.6.1 Isolation Transformer.

4.3.2.6.1.1 The isolation transformer shall be approved for the purpose.

4.3.2.6.1.2 The primary winding shall be connected to a power source so that it is not energized with more than 600 V (nominal). The neutral of the primary winding shall be grounded in an approved manner. If an electrostatic shield is present, it shall be connected to the reference grounding point.

4.3.2.6.1.3 Wiring of isolated power systems shall be in accordance with Section 517-72 of NFPA 70, National Electrical Code.

4.3.2.6.2 Impedance of Isolated Wiring.

4.3.2.6.2.1* The impedance (capacitive and resistive) to ground of either conductor of an isolated system shall exceed 200,000 ohms when installed. The installation at this point shall include receptacles but is not required to include lighting fixtures or components of fixtures. This value shall be determined by energizing the system and connecting a low-impedance ac milliammeter (0 to 1 mA scale) between the reference grounding point and either conductor in sequence. This test shall be performed with the line isolation monitor (see 4.3.2.2.3) connected, provided the connection between the line isolation monitor and the reference grounding point is open at the time of the test. After the test is made, the milliammeter shall be removed and the ground-fault connection to the line isolation monitor shall be restored. When the installation is completed, including permanently connected fixtures, the reading of the meter on the line isolation monitor, which corresponds to the unloaded line condition, shall be made. This meter reading shall be recorded as a reference for subsequent line-impedance evaluation.

This test shall be conducted with no phase conductors grounded.

4.3.2.6.2.2 An approved capacitance suppressor shall be permitted to be used to improve the impedance of the permanently installed isolated system; however, the resistive impedance to ground of each isolated conductor shall exceed 6.6 ohms connected to the balanced differential input of the monitor, with NCCLS Standard ASI-5, when that current exceeds 6 mA.

4.3.2.6.3 Line Isolation Monitor.

4.3.2.6.3.1* In addition to the usual control and protective devices, each isolated power system shall be provided with an approved continually operating line isolation monitor that indicates possible leakage or fault currents from either isolated conductor to ground.

4.3.2.6.3.2 The monitor shall be designed such that a green signal lamp, connected to the green test switch, remains unlighted when power is disconnected from the patient care area (connection of the suppression equipment), capacitance suppressors are installed so as to prevent inadvertent disconnection during normal use.

4.3.2.6.3.3 The line isolation monitor shall either have sufficient internal impedance such that, when properly connected to the isolated system, the maximum internal current that will flow through the line isolation monitor, when any point of the isolated system is grounded, shall be 1 mA, or it shall be permitted to be of the low-impedance type such that the current through the line isolation monitor, when any point of the isolated system is grounded, will not exceed twice the alarm threshold value for a period not exceeding 5 min.

4.3.2.6.3.4 An ammeter connected to indicate the total hazard current of the system (contribution of the fault hazard current plus monitor hazard current) shall be mounted in a plainly visible place on the line isolation monitor with the “alarm on” (total hazard current = 5.0 mA) at the upper high limit of the scale. It is desirable to locate the ammeter such that it is conspicuously visible to persons in the anesthetizing location.

4.3.2.6.3.5 Means shall be provided for shutting off the audible alarm while leaving the red warning lamp activated. When the fault is corrected and the green signal lamp is reactivated, the audible alarm shall reset automatically, or an audible or distinctive visual signal shall indicate that the audible alarm is silenced.

4.3.2.6.3.6 A reliable test switch shall be mounted on the line isolation monitor to test its capability to operate (i.e., cause the alarms to operate and the meter to indicate in the “alarm on” zone). This switch shall transfer the grounding connection of the line isolation monitor from the reference grounding point to a test impedance arrangement connected across the isolated line; the test impedance(s) shall be of the appropriate magnitude to produce a meter reading corresponding to the rated total hazard current at the nominal line voltage, or to a lesser alarm hazard current if the line isolation monitor is so rated. The operation of this switch shall be tested by disconnecting the grounding connection of the line isolation monitor to the reference grounding point before transferring this grounding connection to the test impedance(s), so that making this test will not add to the hazard of a system in actual use, nor will the test include the effect of stray impedances in the line-impedance system. The test switch shall be of a self-restoring type.

4.3.2.6.3.7 The line isolation monitor shall not generate energy of sufficient amplitude or frequency, as measured by a physiological monitor with a gain of at least 10 4 with a source impedance of 1000 ohms connected to the balanced differential input of the monitor,
to create interference or artifact on human physiological signals. The output voltage from the amplifier shall not exceed 30 mV when the gain is 10^4. The 1000 ohms impedance shall be connected to the ends of typical unsheathed electrode leads which are a normal part of the cable assembly furnished with physiological monitors. A 60-Hz notch filter shall be used to reduce ambient interference as is typical in physiological monitor design.

4.3.2.6.4 Identification of Conductors for Isolated (Ungrounded) Systems. The isolated conductors shall be identified in accordance with Section 517-160(a)(5) of NFPA 70, National Electrical Code.

4.3.3 Performance Criteria and Testing.

4.3.3.1 Grounding System in Patient Care Areas.

4.3.3.1.1* Grounding System Testing. The effectiveness of the grounding system shall be determined by voltage measurements and impedance measurements.

4.3.3.1.1.1 For new Construction, the effectiveness of the grounding system shall be evaluated before acceptance.

4.3.3.1.1.2 Small, wall-mounted conductive surfaces, not likely to become energized, such as surface-mounted towel and soap dispensers, mirrors, and so forth, shall not be required to be intentionally grounded or tested.

4.3.3.1.1.3 Large, metal conductive surfaces not likely to become energized, such as windows, door frames, and drains, shall not be required to be intentionally grounded or periodically tested.

4.3.3.1.1.4* Whenever the electrical system has been altered or replaced, that portion of the system shall be tested.

4.3.3.1.2 Reference Point. The voltage and impedance measurements shall be taken with respect to a reference point. The reference point shall be one of the following:

(a) A reference grounding point (see Chapter 2, Definitions)

(b) A grounding point, in or near the room under test, that is electrically remote from receptacles, for example, an all-metal cold-water pipe

(c) The grounding contact of a receptacle that is powered from a different branch circuit from the receptacle under test

4.3.3.1.3* Voltage Measurements. The voltage measurements shall be made under no-fault conditions between a reference point and exposed fixed electrical equipment with conductive surfaces in a patient care vicinity. The voltage measurements shall be made with an accuracy of ±20 percent. Voltage measurements for faceplates of wiring devices shall not be required.

4.3.3.1.4* Impedance Measurements. The impedance measurement shall be made with an accuracy of ±20 percent. For new construction, the impedance measurement shall be made between the reference point and the grounding contact of 10 percent of all receptacles in each patient care vicinity. The impedance measurement shall be the ratio of voltage developed (either 60 Hz or dc) between the point under test and the reference point to the current applied between these two points.

4.3.3.1.5 Test Equipment. Electrical safety test instruments shall be tested periodically, but not less than annually, for acceptable performance.

4.3.3.1.5.1 Voltage measurements specified in 4.3.3.2.3 shall be made with an instrument having an input resistance of 1000 ohms ±10 percent at frequencies of 1000 Hz or less.

4.3.3.1.5.2 The voltage across the terminals (or between any terminal and ground) of resistance-measuring instruments used in occupied patient care areas shall not exceed 500 mV rms or 1.4 dc or peak to peak.

4.3.3.1.6 Criteria for Acceptability for New Construction.

4.3.3.1.6.1 Voltage limit shall be 20 mV.

4.3.3.1.6.2 Impedance limit shall be 0.2 ohms. For quiet ground systems, and 0.1 ohms for all others.

4.3.3.2 Receptacle Testing in Patient Care Areas.

4.3.3.2.1 The physical integrity of each receptacle shall be confirmed by visual inspection.

4.3.3.2.2 The continuity of the grounding circuit in each electrical receptacle shall be verified.

4.3.3.2.3 Correct polarity of the hot and neutral connections in each electrical receptacle shall be confirmed.

4.3.3.2.4 The retention force of the grounding blade of each electrical receptacle (except locking-type receptacles) shall be not less than 115 g (4 oz).

4.3.3.3 Isolated Power Systems.

4.3.3.3.1 Patient Care Areas. If installed, the isolated power system shall be tested in accordance with 3.3.3.4.2.

4.3.3.3.2 Line Isolation Monitor Tests.

4.3.3.3.2.1 The LIM circuit shall be tested after installation, and prior to being placed in service, by successively grounding each line of the energized distribution system through a resistor of 200 × V ohms, where V = measured line voltage. The visual and audible alarms [see 3.2.2.3(b)] shall be activated.

4.3.3.3.2.2 The LIM circuit shall be tested at intervals of not more than 1 month by actuating the LIM test switch [see 3.2.2.3(b)]. For a LIM circuit with automated self-test and self-calibration capabilities, this test shall be performed at intervals of not more than 12 months. Activation of the test switch shall activate both visual and audible alarm indicators.

4.3.3.3.2.3 After any repair or renovation to an electrical distribution system and at intervals of not more than 6 months, the LIM circuit shall be tested in accordance with paragraph (a) above and only when the circuit is not otherwise in use. For a LIM circuit with automated self-test and self-calibration capabilities, this test shall be performed at intervals of not more than 12 months.

4.3.4* Administration of Electrical System.

4.3.4.1 Maintenance and Testing of Electrical System.

4.3.4.1.1* Design Considerations.

(a) Abnormal voltages such as single phasing of three-phase utilization equipment, switching and/or lightning surges, voltage reductions, and so forth

(b) Capability of achieving the fastest possible restoration of any given circuit(s) after clearing a fault

(c) Effects of future changes, such as increased loading and/or supply capacity

(d) Stability and power capability of the prime mover during and after abnormal conditions

(e) Sequence reconnection of loads to avoid large current inrushes that trip overcurrent devices or overload the generator(s)
4.4.1.1.10 Capacity and Rating. The generator set(s) shall have sufficient capacity and proper rating to meet the maximum actual load of the essential system(s) at any one time.

4.4.1.1.11 Load Pickup. The generator set(s) shall have sufficient capacity to pick up the load and meet the minimum frequency and voltage stability requirements of the emergency system within 10 seconds after loss of normal power. [110: 3-4.1]

4.4.1.1.12 Maintenance of Temperature. Provisions shall be made to maintain the generator room at not less than 50°F (10°C) or the engine water-jacket temperature at not less than 90°F (32°C). [110: 3-3.1, 5-7.6]

4.4.1.1.13 Ventilating Air. Provision shall be made to provide adequate air for cooling and to replenish engine combustion air. [110: 5-7.2, 5-7.4]

4.4.1.1.14 Cranking Batteries. Internal combustion engine cranking batteries shall be in accordance with the battery requirements of NFPA 110, Standard for Emergency and Standby Power Systems.

4.4.1.1.15 Compressed Air Starting Devices. Internal combustion engine air starting devices shall have sufficient capacity to supply five 10-second cranking attempts, with not more than a 10-second rest between attempts, with the compressor not operating.

4.4.1.1.16 Fuel Supply. The fuel supply for the generator set shall comply with 4.1.1 and 4.4.2 of NFPA 110, Standard for Emergency and Standby Power Systems.

4.4.1.1.17 Requirements for Safety Devices. [110: 3-5.5.2]

(a) Internal Combustion Engines. Internal combustion engines serving generator sets shall be equipped with the following:

1. A sensor device plus visual warning device to indicate a water-jacket temperature below those required in 4.4.1.1.9

2. Sensor devices plus visual prealarm warning device to indicate the following:
   a. High engine temperature (above manufacturer’s recommended safe operating temperature range)
   b. Low lubricating oil pressure (below manufacturer’s recommended safe operating range)
   c. Low water coolant level

3. An automatic engine shutdown device plus visual device to indicate that a shutdown took place due to the following:
   a. Overcrank (failed to start)
   b. Overspeed
   c. Low lubricating oil pressure
   d. Excessive engine temperature

4. A common audible alarm device to warn that any one or more of the prealarm or alarm conditions exist

(b) Other Types of Prime Movers. Prime movers, other than internal combustion engines, serving generator sets shall have appropriate safety devices plus visual and audible alarms to warn of alarm or approaching alarm conditions.

(c) Liquid Fuel Supplies. Liquid fuel supplies for emergency or auxiliary power sources shall be equipped with a sensor device to warn that the main fuel tank contains less than a 4-hour operating supply.

4.4.1.1.18 Alarm Annunciator. A remote annunciator, storage battery powered, shall be provided to operate outside of the generating room in a location readily observed by operating personnel at a regular work station (see NFPA 70, National Electrical Code, Section 700-12.)

The annunciator shall indicate alarm conditions of the emergency or auxiliary power source as follows:

(a) Individual visual signals shall indicate the following:
   1. When the emergency or auxiliary power source is operating to supply power to load
   2. When the battery charger is malfunctioning

(b) Individual visual signals plus a common audible signal to warn of an engine-generator alarm condition shall indicate the following:
   1. Low lubricating oil pressure
   2. Low water temperature (below those required in 4.4.1.1.9)
3. Excessive water temperature
4. Low fuel — when the main fuel storage tank contains less than a 4-hour operating supply
5. Overcrank (failed to start)
6. Overspeed

Where a regular work station will be unattended periodically, an audible and visual derangement signal, appropriately labeled, shall be established at a continuously monitored location. This derangement signal shall activate when any of the conditions in 4.4.1.15(a) and (b) occur, but need not display these conditions individually. [110: 4-5.5.2]

4.4.1.2 Battery. Battery systems shall meet all requirements of Article 700 of NFPA 70, National Electrical Code.

4.4.2* Distribution (Type I EES).

4.4.2.1 General Requirements.

4.4.2.1.1 Electrical characteristics of the transfer switches shall be suitable for the operation of all functions and equipment they are intended to supply. [110: 4-1.1]

4.4.2.1.2 Switch Rating. The rating of the transfer switches shall be adequate for switching all classes of loads to be served and for withstanding the effects of available fault currents without contact welding. [110: 4-2.1]

4.4.2.1.3 Automatic Transfer Switch Classification. Each automatic transfer switch shall be approved for emergency electrical service (see NFPA 70, National Electrical Code, Section 700-3) as a complete assembly.

4.4.2.1.4 Automatic Transfer Switch Features. [110: 4-2.4]

(a) General. Automatic transfer switches shall be electrically operated and mechanically held. The transfer switch shall transfer and retransfer the load automatically.

Exception: It shall be permitted to program the transfer switch (1) for a manually initiated retransfer to the normal source, or (2) for an automatic intentional “off” delay, or (3) for an in-phase monitor delay or similar automatic delay method, so as to provide for a planned momentary interruption of the load. If used, this arrangement shall be provided with a bypass feature to permit automatic retransfer in the event that the alternate source fails and the normal source is available.

(b) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design of transfer switches to prevent the unintended interconnection of the normal and alternate sources of power, or of any two separate sources of power.

(c) Voltage Sensing. Voltage sensing devices shall be provided to monitor all ungrounded lines of the normal source of power.

(d) Time Delay on Starting of Alternate Power Source. A time delay device shall be provided to delay starting of the alternate source generator. The timer is intended to prevent nuisance starting of the alternate source generator with subsequent load transfer in the event of harmless momentary power dips and interruptions of the normal source. The time range shall be short enough so that the generator can start and be on the line within 10 seconds of the onset of failure.

(e) Time Delay on Transfer to Alternate Power. An adjustable time delay device shall be provided for those transfer switches requiring “delayed-automatic” operation. The time delay shall commence when proper alternate source voltage and frequency are achieved. The delay device shall prevent transfer to the alternate power source until after expiration of the preset delay.

(f) Time Delay on Retransfer to Normal Power. An adjustable timer with a bypass shall be provided to delay retransfer from the alternate source of power to the normal. This timer will permit the normal source to stabilize before retransfer to the load and help to avoid unnecessary power interruptions. The bypass shall operate similarly to the bypass in 4.4.2.1.4(a).

(g) Test Switch. A test switch shall be provided on each automatic transfer switch that will simulate a normal power source failure to the switch.

(h) Indication of Switch Position. Two pilot lights, properly identified, shall be provided to indicate the transfer switch position.

(i) Manual Control of Switch. A means for the safe manual operation of the automatic transfer switch shall be provided.

(j) Time Delay on Engine Shutdown. A time delay of 5 minutes minimum to allow engine cooldown shall be provided for unloaded running of the alternate power source generator set prior to shutdown.

Exception: Time delay need not be provided on small (15 kW or less) aircooled prime movers or if included with the engine control panel. [110: 4-2.4.8]

(k) Motor Load Transfer. Provisions shall be included to reduce excessive currents resulting from motor load transfers if such currents can damage essential electrical system equipment or cause nuisance tripping of essential electrical system overcurrent protective devices. [110: 4-2.4.12]

4.4.2.1.5 Nonautomatic Transfer Device Classification.

Nonautomatic transfer devices shall be approved for emergency electrical service (see NFPA 70, National Electrical Code, Section 700-3).

4.4.2.1.6 Nonautomatic Transfer Device Features. [110: 4-2.5]

(a) General. Switching devices shall be mechanically held. Operation shall be by direct manual or electrical remote manual control. Electrically operated switches shall derive their control power from the source to which the load is being transferred. A means for safe manual operation shall be provided.

(b) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design in order to prevent the unintended interconnection of the normal and alternate sources of power, or of any two separate sources of power.

(c) Indication of Switch Position. Pilot lights, properly identified, shall be provided to indicate the switch position.

4.4.2.1.7 Bypass-Isolation Switches. [110: 4-4.1] Bypass-isolation switches shall be permitted for bypassing and isolating the transfer switch. If installed, they shall be in accordance with all of the following:

(a) Bypass-Isolation Switch Rating. The bypass-isolation switch shall have a continuous current rating and withstand current rating compatible with that of the associated transfer switch.

(b) Bypass-Isolation Switch Classification. Each bypass-isolation switch shall be listed for emergency electrical service as a completely factory-assembled and tested apparatus. (See NFPA 70, National Electrical Code, Section 700-3.)

(c) Operation. With the transfer switch isolated or disconnected and both means shall be provided so the bypass-isolation switch can function as an independent nonautomatic transfer switch and allow the load to be connected to either power source. Reconnection of the transfer switch shall be possible with a load interruption no greater than the maximum time, in seconds, by the type of essential electrical system.

4.4.2.2 Specific Requirements.

4.4.2.2.1* General.

A.4.4.2.2.1 Type I essential electrical systems are comprised of two separate systems capable of supplying a limited amount of lighting and power service, which is considered essential for life safety and effective facility operation during the time the normal electrical service is interrupted for any reason. These two systems are the emergency system and the equipment system.

A.4.4.2.2.1.1 The emergency system shall be limited to circuits essential to life safety and critical patient care and are designated the life safety branch and the critical branch.

A.4.4.2.2.1.2 The equipment system shall supply major electrical equipment necessary for patient care and basic Type I operation.

A.4.4.2.2.1.3 Both systems shall be arranged for connection, within time limits specified in this chapter, to an alternate source of power following a loss of the normal source.

A.4.4.2.2.1.4 The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each
branch of the emergency system and each equipment system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW).

4.4.2.2.2 Emergency System.

4.4.2.2.2.1 General. Those functions of patient care depending on lighting or appliances that shall be permitted to be connected to the emergency system are divided into two mandatory branches, described in 4.4.2.2.2(b) and (c).

(All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance. (1106-5-12.5)

4.4.2.2.2.2 Life Safety Branch. The life safety branch of the emergency system shall supply power for the following lighting, receptacles, and equipment:

(a) Illumination of means of egress as required in NFPA 101® Life Safety Code®
(b) Exit signs and exit direction signs required in NFPA 101, Life Safety Code
(c) Alarm and alerting systems including the following:
   1. fire alarms and
   2. alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 4, "Gas and Vacuum Systems"
(d)* Hospital communication systems, where used for issuing instruction during emergency conditions
(e) Task illumination, battery charger for emergency battery-powered lighting unit(s), and selected receptacles at the generator set location
(f) Elevator cab lighting, control, communication, and signal systems
(g) Automatically operated doors used for building egress.
(h) The auxiliary functions of fire alarm combination systems complying with NFPA 72, National Fire Alarm Code.

No function other than those listed above in items 1 through 7 shall be connected to the life safety branch.

4.4.2.2.2.3* Critical Branch. The critical branch shall be permitted to be subdivided into two or more branches. The critical branch of the emergency system shall supply power for task illumination, fixed equipment, selected receptacles, and selected power circuits serving the following areas and functions related to patient care.

(a) Critical care areas that utilize anesthetizing gases, task illumination, selected receptacles, and fixed equipment
(b) The isolated power systems in special environments
(c) Task illumination and selected receptacles in the following:
   1. Patient care areas including infant nurseries, selected acute nursing areas, psychiatric bed areas (omit receptacles), and ward treatment rooms
   2. Medication preparation areas
   3. Pharmacy dispensing areas
   4. Nurses’ stations (unless adequately lighted by corridor luminaires)
(d) Additional specialized patient care task illumination and receptacles, where needed
(e) Nurse call systems
(f) Blood, bone, and tissue banks
(g)* Telephone equipment rooms and closets
(h) Task illumination, selected receptacles, and selected power circuits for the following areas:
   1. General care beds shall have at least one duplex receptacle per patient bedroom
   2. Angiographic labs

3. Cardiac catheterization labs
4. Coronary care units
5. Hemodialysis rooms or areas
6. Emergency room treatment areas (selected)
7. Human physiology labs
8. Intensive care units
9. Postoperative recovery rooms (selected)

(i) Additional task illumination, receptacles, and selected power circuits needed for effective facility operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch.

4.4.2.2.3 Equipment System.

4.4.2.2.3.1 General. The equipment system shall be connected to equipment described in (c) through (e).

4.4.2.2.3.2 Connection to Alternate Power Source. The equipment system shall be installed and connected to the alternate power source, such that equipment described in 4.4.2.2.3.4 is automatically restored to operation at appropriate time lag intervals following the energizing of the emergency system. Its arrangement shall also provide for the subsequent connection of equipment described in 4.4.2.2.3.5 by either delayed-automatic or manual operation.

4.4.2.2.3.3 AC Equipment for Nondelayed Automatic Connection. Generators accessories, including but not limited to, the transfer fuel pump, electrically operated louvers, and other generator accessories essential for generator operation, shall be arranged for automatic connection to the alternate power source.

4.4.2.2.3.4* Equipment for Delayed-Automatic Connection. The following equipment shall be arranged for delayed-automatic connection to the alternate power source:

(a) Central suction systems serving medical and surgical functions, including controls. It shall be permitted to place such suction systems on the critical branch.
(b) Sump pumps and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms
(c) Compressed air systems serving medical and surgical functions, including controls. It shall be permitted to place such air systems on the critical branch.
(d) Smoke control and stair pressurization systems
(e) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood

4.4.2.2.3.5 Equipment for Delayed-Automatic or Manual Connection. The following equipment shall be arranged for either delayed-automatic or manual connection to the alternate power source [also see A-3-4.2.2.3(d)]:

(a) Heating equipment to provide heating for operating, delivery, labor, recovery, intensive care, coronary care, nurseries, infection/isolation rooms, emergency treatment spaces, and general patient rooms, and pressure maintenance (jockey or make-up) pump(s) for water-based fire protection systems
(b)* Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:
   1. The outside design temperature is higher than +20°F (-6.7°C), or
   2. The outside design temperature is lower than +20°F (-6.7°C) and a selected room(s) is provided for the needs of all confined patients [then only such room(s) need be heated], or
   3. The facility is served by a dual source of normal power as described in 4.4.1.1.1.

(c)* Elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power service.

A.4.4.2.2.3.5 For elevator cab lighting, control, and signal system requirements, see 4.4.2.2.2(f).

In instances where interruption of normal power would result in other elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for
the release of patients or other persons who are confined between floors.

(d) Supply, return, and exhaust ventilating systems for surgical and obstetrical delivery suites, intensive care, coronary care, nurseries, and emergency treatment spaces.

(e) Supply, return, and exhaust ventilating systems for airborne infectious/isolation rooms, protective environment rooms, exhaust fans for laboratory fume hoods, nuclear medicine areas where radioactive material is used, ethylene oxide evacuation and anesthesia evacuation. Where delayed automatic connection is not appropriate, such ventilation systems shall be permitted to be placed on the critical branch.

(f) Hyperbaric facilities

(g) Hypobaric facilities

(h) Autoclaving equipment shall be permitted to be arranged for either automatic or manual connection to the alternate source.

(i) Controls for equipment listed in 4.4.2.2.3.

(j) Other selected equipment shall be permitted to be served by the equipment system.

4.4.2.2.4 Wiring Requirements.

4.4.2.2.4.1* Separation from Other Circuits. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment.

4.4.2.2.4.2 Receptacles. The requirements for receptacles shall be as follows:

(a) The number of receptacles on a single branch circuit for areas described in 4.4.2.2.23(b) shall be minimized to limit the effects of a branch circuit outage. Branch circuit overcurrent devices shall be readily accessible to nursing and other authorized personnel.

(b) The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.4.2.2.4.3 Switches. Switches installed in the lighting circuits connected to the essential electrical system shall comply with Article 700, Section E, of NFPA 70, National Electrical Code.

4.4.2.2.4.4 Mechanical Protection of the Emergency System. The wiring of the emergency system shall be mechanically protected by raceways, as defined in NFPA 70, National Electrical Code.

4.4.2.2.4.5 Flexible power cords of appliances or other utilization equipment connected to the emergency system shall not be required to be enclosed in raceways.

4.4.2.2.4.6 Secondary circuits of transformer-powered communication or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8 of NFPA 70, National Electrical Code.

4.4.3 Performance Criteria and Testing (Type I EES).

4.4.3.1 Source. The branches of the emergency system shall be installed and connected to the alternate power source specified in 4.4.1.1.4 and 4.4.1.1.5 so that all functions specified herein for the emergency system shall be automatically restored to operation within 10 seconds after interruption of the normal source.

4.4.3.2 Transfer Switches.

4.4.3.2.1 The essential electrical system shall be served by the normal power source except when the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.4.3.2.2 Failure of the normal source shall automatically start the alternate source generator after a short delay as described in [see 4.4.2.1.4(d)]. When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

4.4.3.2.3 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The load comprising the equipment system shall be connected either automatically after a time delay as described in [see 4.4.2.1.4(e)] or nonautomatically and in such a sequential manner as not to overload the generator.

4.4.3.2.4 When the normal power source is restored, and after a time delay as described in [see 4.4.2.1.4(j)], the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in [see 4.4.2.1.4(j)].

4.4.3.2.5 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay timer.

4.4.3.2.6 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.4.3.2.7 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.4.4 Administration (Type I EES).

4.4.4.1 Maintenance and Testing of Essential Electrical System.

4.4.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.4.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.8 and 4.4.3.1. Maintenance shall be performed in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, Chapter 6.

4.4.4.1.1.2 Inspection and Testing. Criterial, conditions and personnel requirements shall be in accordance with the following:

(a)* Test Criteria. Generator sets shall be tested twelve (12) times a year with testing intervals between not less than 20 days or exceeding 40 days. Generator sets serving emergency and equipment systems shall be in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, Chapter 6.

(b) Test Conditions. The scheduled test under load conditions shall include a complete simulated cold start and appropriate automatic and manual transfer of all essential electrical system loads.

(c) Test Personnel. The scheduled tests shall be conducted by competent personnel. The tests are needed to keep the machines ready to function and, in addition, serve to detect causes of malfunction and to train personnel in operating procedures.

4.4.4.1.2 Maintenance and Testing of Circuitry.

4.4.4.1.2.1* Circuit Breakers. Main and feeder circuit breakers shall be inspected annually and a program for periodically exercised and maintained, and available for inspection by the authority having jurisdiction.

4.5 Essential Electrical System Requirements — Type 2.

4.5.1 Sources (Type 2 EES). The requirements for sources for Type 2 essential electrical systems shall conform to those listed in 4.4.1.

4.5.2 Distribution (Type 2 EES).

4.5.2.1 General. The distribution requirements for Type 2 essential electrical systems shall conform to those listed in 4.4.2.1.

4.5.2.2 Specific Requirements.
A.4.5.2.2.1 Type 2 essential electrical systems are comprised of two separate systems capable of supplying a limited amount of lighting and power service, which is considered essential for the protection of life and safety and effective operation of the institution during the time normal electrical service is interrupted for any reason. These two separate systems are the emergency system and the critical system.

The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each branch of the emergency system and each critical system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW).

4.5.2.2.2 Emergency System. The emergency system shall supply power for the following lighting, receptacles, and equipment as follows:

(a) Illumination of means of egress in accordance with NFPA 101, Life Safety Code

(b) Exit signs and exit directional signs in accordance with NFPA 101, Life Safety Code

(c) Alarm and alerting systems, including the following:
   1. Fire alarms
   2. Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 4, "Gas and Vacuum Systems"
   (d)* Communication systems, where used for issuing instructions during emergency conditions
   (e) Sufficient lighting in dining and recreation areas to provide illumination to exit ways of a minimum of 5 footcandles
   (f) Task illumination and selected receptacles at the generator set location
   (g) Elevator cab lighting, control, communication, and signal systems

   No function other than those listed above in items (a) through (g) shall be connected to the emergency system.

4.5.2.2.3 Critical System.

4.5.2.2.3.1 General. The critical system shall be so installed and connected to the alternate power source that equipment listed in 4.5.2.2.3(b) shall be automatically restored to operation at appropriate time-lag intervals following the restoration of the emergency system to operation. Its arrangement shall also provide for the additional connection of equipment listed in 4.5.2.2.3(c) by either delayed-automatic or manual operation.

4.5.2.2.3.2 Delayed-Automatic Connections to Critical System. The following equipment shall be connected to the critical system and be arranged for delayed-automatic connection to the alternate power source:

(a) Task illumination and selected receptacles in the following:
   1. Patient care areas
   2. Medication preparation areas
   3. Pharmacy dispensing areas
   4. Nurses’ stations (unless adequately lighted by corridor luminaires)

(b) Supply, return, and exhaust ventilating systems for airborne infectious isolation rooms

(c) Sump pumps and other equipment required to operate for the safety of major apparatus and associated control systems and alarms

(d) Smoke control and stair pressurization systems

(e) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood

4.5.2.2.3.3* Delayed-Automatic or Manual Connections to Critical System. The following equipment shall be connected to the critical system and be arranged for either delayed-automatic or manual connection to the alternate power source:

(a) Heating Equipment to Provide Heating for General Patient Rooms. Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:

1.* The outside design temperature is higher than +20°F (-6.7°C), or
2. The outside design temperature is lower than +20°F (-6.7°C); and, where a selected room(s) is provided for the needs of all confined patients, then only such room(s) need be heated, or
3. The facility is served by a dual source of normal power as described in 4.4.1.1.1.

(b)* Elevator Service. In instances where interruptions of power would result in elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of passengers.

A.4.5.2.2.3.3(b) Additional equipment shall be connected to the critical system by transfer to the emergency system.

4.5.2.2.4* Separation from Other Circuits. The emergency system shall be kept entirely independent of all other wiring and equipment.

4.5.2.2.4.2 Receptacles. The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.5.3 Performance Criteria and Testing (Type 2 EES).

4.5.3.1 Source. The emergency system shall be installed and connected to the alternate source of power specified in 4.4.1.1.2 and 4.4.1.1.3 so that all functions specified herein for the emergency system will be automatically restored to operation within 10 seconds after interruption of the normal source.

4.5.3.2 Transfer Switches.

4.5.3.2.1 The essential electrical system shall be served by the normal power source until the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.5.3.2.2 Failure of the normal source shall automatically start the alternate source generator, after a short delay as described in see 4.4.2.1.4(d)]. When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

†All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance. (110: 5-12.5)

4.5.3.2.3 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The loads comprising the critical system shall be connected either automatically after a time delay as described in see 4.4.2.1.4(e)] or nonautomatically and in such a sequential manner as not to overload the generator.

4.5.3.2.4 When the normal power source is restored, and after a time delay as described in [see 4.4.2.1.4(f),] the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in [see 4.4.2.1.4(j)].

4.5.3.2.5 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay timer.

4.5.3.2.6 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.5.3.2.7 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.5.4 Administration (Type 2 EES).
4.5.4.1 Maintenance and Testing of Essential Electrical System.
4.5.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.
4.5.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.8 and 4.4.3.1.
4.5.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.1.1(b).
4.5.4.1.2 Maintenance and Testing of Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.1.2.
4.5.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.1.3.
4.5.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

4.6 Essential Electrical System Requirements — Type 3.
4.6.1 Sources (Type 3 EES). The alternate source of power for the system shall be specifically designed for this purpose and shall be either a generator, battery system, or self-contained battery integral with the equipment.
4.6.1.1 Generators shall conform to 4.4.1.1.
4.6.1.2 Battery systems shall conform to 4.4.1.2.
4.6.2 Distribution (Type 3 EES).
4.6.2.1 General. The distribution requirements for Type 3 essential electrical systems shall conform to those listed in 4.4.2.1.
4.6.2.2 Specific Requirements.
4.6.2.2.1 General. A Type 3 essential electrical systems are comprised of a system capable of supplying a limited amount of lighting and power service that is considered essential for life safety and orderly cessation of procedure during the time normal electrical service is interrupted for any reason.
4.6.2.2.2 Connection to the Essential Electrical System. The system shall supply power for task illumination that is related to the safety of life and that is necessary for the safe cessation of procedures in progress.
4.6.2.2.3 Wiring Requirements.
4.6.2.2.3.1 General. The design, arrangement, and installation of the system shall be in accordance with NFPA 70, National Electrical Code.
4.6.2.2.3.2* Receptacles. The cover plates for the electrical receptacles or the electrical receptacle themselves supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.6.3 Performance Criteria and Testing (Type 3 EES).
4.6.3.1 Source.
4.6.3.1.1 The emergency system shall have an alternate source of power separate and independent from the normal source that will be effective for a minimum of 1 1/2 hours after loss of the normal source.
4.6.3.1.2 The emergency system shall be so arranged that, in the event of failure of normal power source, the alternate source of power shall be automatically connected to the load within 10 seconds.
4.6.3.2 Transfer Switches with Engine Generator Sets.
4.6.3.2.1 The operation of the equipment shall be arranged such that the load will be served by the normal source until the normal source is interrupted, or when the voltage drops below the setting of the voltage sensing device. The settings of the voltage sensing relays shall be determined by careful study of the voltage requirements of the load.
4.6.3.2.2 When the normal source is restored, and after a time delay as described in (see 4.4.2.1.4(f)), the automatic transfer switch shall disconnect the alternate source of power and connect the loads to the normal power source.
4.6.3.2.3 If the alternate power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate.

4.6.3.3 Transfer Switches with Battery System.
4.6.3.3.1 Failure of the normal source shall automatically transfer the load to the battery system.
4.6.3.3.2 Retransfer to the normal source shall be automatic upon restoration of the normal source.

4.6.4 Administration (Type 3 EES).
4.6.4.1 Maintenance and Testing.
4.6.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.
4.6.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.1 and 4.6.3.1.
4.6.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.1.1.2.
4.6.4.1.1.3 Stored Energy Power Source. Maintenance and testing of stored emergency power supply systems shall be in accordance with NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems, Section 6-1 through 6-4.5.
4.6.4.1.2 Maintenance and Testing Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.1.2.
4.6.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.1.3.
4.6.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

SUBSTANTIATION: The revised chapter incorporated the Manual of Style edits. This included renumbering the chapter from Chapter 3 to Chapter 4.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION: 
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

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(Log #84)
Committee: HEA-ELS

99- 33 - (3-3.2.1.2(a11): Reject
SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: At end of paragraph 1, add the following:
These circuits shall supply no other patient bed locations.
SUBSTANTIATION: To prevent a problem at one patient location from interrupting power to another patient bed location if the branch circuit opens due to overload, short circuit, etc.
COMMITTEE ACTION: Reject
COMMITTEE STATEMENT: The committee is unaware of any substantiated problem.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION: 
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

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(Log #287)
Committee: HEA-ELS

99- 54 - (3-3.2.1.2(a4a): Reject
SUBMITTER: Joseph Pavia, Wildwood, MO
RECOMMENDATION: Add new text as “a” and move the current “a” to new “b,” and the current “b” to new “c.” Delete the current Note."
a. Circuit breakers and fuses shall be selectively coordinated so that power interruption in that part of the circuit that precedes the interrupting device closest to a fault will not occur.


SUBSTANTIATION: The 1996 edition of NFPA 99 called out for mandatory selective coordination between fuses, circuit breakers, and equipment ground fault protection. The 1996 edition loosened these requirements by only mandating coordination for two levels of equipment ground fault protection and simply suggesting selective coordination for fuses and circuit breakers for all other types of short-circuit currents. This has resulted in a very hazardous situation because consulting engineers no longer are required to take the extra time to make sure the systems are selectively coordinated, and as a result, systems are being designed with built-in blackouts.

For example, in the last several years, I have completed numerous coordination studies and have found that the design engineer often does not take into consideration the selectivity of the electrical distribution system. The submitted one-line diagram is taken from a recently designed health care facility in the southeastern United States. As designed, faults in Panel “BUS-PLA” from 6,000 to 37,290 amperes would not only open the device “OCPD-4-200,” but also devices “OCPD-2-400,” and “OCPD-1-600.” At that time the emergency generator would start and try to supply power to the system. Since “OCPD-2-400” had already opened, the entire PHA panel would be out of power, even with back-up emergency power. This same would occur for Panel EM1HA for fault currents as low as 2,900 amperes and up to 16,405 amperes. As designed, this system could not be selectively coordinated whether fuses or circuit breakers are utilized. But, by rearranging the loads, both fuses and circuit breakers are available to meet the requirements of this proposal. Fuses can be coordinated through the use of “ratio charts” and circuit breakers have adjustable instantaneous trips, short time delays, and zone selective interlocking to help them coordinate.

It is a shame, but this system now meets the requirements of NFPA 99-1996. It does not meet the requirements of NFPA 99-1990. I urge the committee to reconsider their action which changed the 1996 edition and simply require that the overcurrent protective devices be selectively coordinated for all types of short circuits, not just for shorts to ground. I believe that my suggested wording will do just that.

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

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee believes 3-4.1.1.1(a) adequately covers the coordination requirement. The committee still believes that it is impractical to mandate the requirements.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: 
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: 
Accept in Principle.

TCC NOTE: The Technical Correlating Committee directs the Technical Committee on Electrical Systems and the Technical Committee on Gas Delivery Equipment to consider battery operated automatic activating battery pack emergency lighting. The Technical Correlating Committee therefore directs that public comments be submitted in the correlating committee’s name requesting that HEA-ELS and HEA-GAS reconsider this proposal with the following proposed revision to the proposal as follows: “...shall be provided in each operating room anesthetizing location and procedure room.” The Technical Correlating Committee proposes the following definition: Procedure room. Where the proceduralist is using instrumentation that requires constant observation and control. Substantiation: Introduction of a new term requires a definition. (Technical Correlating Committee explanation: The intended application of the definition in correlation with the new 12-4.1.2.10 is that constant observation means with light to see, i.e. the removal of a corn and not the retraction of an instrument from a body cavity.)

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: 1. Delete 3-3.2.1.2(a)5e.
2. Insert new 12-4.1.2.10 to read: Battery Powered Lighting. At least one battery-powered emergency unit shall be provided in each operating room. Units shall be wired in accordance with NFPA 70, National Electrical Code.
COMMITTEE STATEMENT: The committee believes that the performance criteria is adequately addressed in NFPA 99 and that installation criteria is adequately addressed in NFPA 70.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE ACTION: Reject.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 7
NOT RETURNED: 4 Aronow, Carlson, Meyer, Peglow

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: 3-3.3.2.3 is a requirement for voltage measurements. The committee assumes the submitter intended to address 3-3.2.2.3. This is a test for the line isolation monitoring system whereas the test in 7-5.1.3.3 and 9-2.1.13.3 are for equipment requirements.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.

SUBMITTER: Charles Rawlings, SBI
RECOMMENDATION: Revise the characteristics of leakage-current meters so that the specifications in various chapters and the recommended “loading circuit(s)” are the same.

SUBSTANTIATION: Chapter 3 specifies certain characteristics of meters of leakage currents. Chapters 7 and 9 specify other characteristics for such meters. The specifications refer to different circuits in Appendix A. The numbers’ are 3-3.3.2.3, A-3-3.3.2.3(a) and (b), 7-5.1.3.3, A-7-5.1.3.3, and 9-2.1.13.3.

COMMITTEE ACTION: Accept in Principle.

The committee will seek to harmonize Chapters 7 and 9 with the Technical Committee chairs for Electrical Systems and for Electrical Equipment are directed to collaborate in developing consistent requirements with specific wording, and rationale, for applicable paragraphs.
SUBSTANTIATION: NFPA 99 requires the receptacle ground contact to exhibit at least 4 ounces of retention. UL-1436 has established levels of accuracy and endurance as well as calibration, for listed tension testers. By accepting this proposal, the accurate and repeatable measurement can be achieved.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: There is no substantiation that this would improve performance.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: Improper proposal, a value number was not provided.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: What are the requirements for impedance testing of mobile patient care units such as mobile cath labs? The current code only addresses permanent locations. Mobile units are frequently moved and set up. This causes a lot of stress to the wiring/grounding system.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: No recommendation was given.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: Wording was inadvertently omitted in the committee actions on the proposal.

SUBMITTER: Lawrence A. Bey, Onan Corp.

RECOMMENDATION: Revise last sentence as follows: “...vacuum pumps, fire trucks, jet 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: Editorially clarification and continuity. It continues to be the committees intent not to include fire pumps.

COMMITTEE ACTION: Accept in Principle.
99-48 - (3-4.1.1.5(b)): Accept in Principle

**RECOMMENDATION:** The Technical Correlating Committee directs that this proposal be returned to Committee for revision. The Technical Correlating Committee does not understand the intended actions.

**SUBMITTER:** Hugh Nash, Nash Lipsey Burch, LLC

**RECOMMENDATION:** Change (b) to read:

"Any loads served by the generating equipment not permitted in health care facilities, as provided in Chapters 3 (now 4), 12, 13, 16, and 17, to be on the..."

**SUBSTANTIATION:** Some authorities having jurisdiction have been requiring load shed for contiguous medical office buildings, nursing homes, and other health care facilities.

**COMMITTEE ACTION:** Accept in Principle.

Replace "It" with "This use shall not constitute..." in the last sentence of paragraph (b).

**COMMITTEE STATEMENT:** Editorial clarification.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-49 - (3-4.1.1.5(b)): Reject

**SUBMITTER:** Hugh Nash, Nash Lipsey Burch, LLC

**RECOMMENDATION:** Delete all wording from (1) to the end of the section and replace with, "are transferred manually."

**SUBSTANTIATION:** It may not be practical to monitor the generator load in order to shed one transfer switch.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** Automatic transfer means is preferred for load shedding of these optional loads. Current technology makes it practical.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-50 - (3-4.1.1.5(b)): Accept in Principle

**SUBMITTER:** Hugh Nash, Nash Lipsey Burch, LLC

**RECOMMENDATION:** Add fine print note at end of section to read:

"Care should be taken that the requirements of NFPA 70, Article 700, are met without service from the generating equipment."

**SUBSTANTIATION:** The facility or area that is shed may be required to have egress and exit lighting on emergency power.

**COMMITTEE ACTION:** Accept in Principle.

Add as a very last sentence:

"and where optional loads are connected the requirements of NFPA 101 and NFPA Article 700 shall be met under load shed conditions."

**COMMITTEE STATEMENT:** Editorially rewritten to be incorporated within the mandatory text.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-51 - (3-4.1.3): Accept

**SUBMITTER:** Laurence A. Bey, Onan Corp.

**RECOMMENDATION:** Delete: 3-4.1.3 Separate Utility

**SUBSTANTIATION:** The standard is clear under 3-4.1.1.1 that a second source of normal power, while encouraged, does not constitute a separate source of power.

**COMMITTEE ACTION:** Accept.

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

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99-52 - (3-4.2.2.2(b)):

**RECOMMENDATION:** Revise last sentence to read:

"One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA or less."

**SUBSTANTIATION:** To clarify the intent, and to eliminate ambiguity with the rating of the generator set.

**COMMITTEE ACTION:** Accept.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-53 - (3-4.2.2.1, 5-5.2.2.1):

**RECOMMENDATION:** Move Paragraph 2 ["All ac-powered support..." and performance. (NFPA 110: 5-12.5)" to Section 3-4.3.2 and number it 3-4.3.2.2. Renumber existing 3-4.3.2.2 to 3-4.3.2.7 accordingly.

**SUBSTANTIATION:** Editorial. Committee Action on Comment 99-34 in 1998 Fall ROP appears to have a typographical error. Insertion of this text in Section 3-4.3.2.2 is correct.

**COMMITTEE ACTION:** Accept.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-54 - (3-4.2.2.2(a)):

**RECOMMENDATION:** Dennis Moss, University of Utah

**RECOMMENDATION:** Add the following at the beginning of the paragraph:

"Generator Set Location."

**SUBSTANTIATION:** This addition clarifies the intent of this paragraph that it applies only to the generator set location. This is consistent with and will read the same as NFPA 70 (NEC) 517-32(c).

**COMMITTEE ACTION:** Accept.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher

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99-55 - (3-4.2.2.2(b)5): Accept

**SUBMITTER:** Dennis Moss, University of Utah

**RECOMMENDATION:** Add the following at the beginning of the paragraph:

"Generator Set Location."

**SUBSTANTIATION:** This addition clarifies the intent of this paragraph that it applies only to the generator set location. This is consistent with and will read the same as NFPA 70 (NEC) 517-32(c).

**COMMITTEE ACTION:** Accept.

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

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 14

**NOT RETURNED:** 3 Crawford, Longhitano, Swisher
99-56 - (3-4.2.2.2(b) and (c)) : Reject

SUBMITTER: Western Regional Fire Code Dev. Committee

RECOMMENDATION: Delete the current 3-4.2.2.2(b) and (c) and replace with NFPA 70, Section 517.32 and 517.33.

COMMITTEE STATEMENT: The primary purpose of the critical branch is to supply power for patient care. The critical branch shall supply power for the following lighting, receptacles, and equipment.

(a) Illumination of Means of Egress. Illumination of means of egress, such as lighting required for corridors, passageways, stairways, and landings at exit doors, and all necessary ways of approach to exits. Switching arrangements to transfer patient care corridor lighting in hospitals from general illumination circuits to night illumination circuits shall be permitted provided only one of two circuits can be selected and both circuits cannot be extinguished at the same time.


(b) Exit Signs. Exit signs and exit directional signs.


(c) Alarm and Alerting Systems. Alarm and alerting systems including the following:

1. Fire alarms.
2. Alarms required for systems used for the piping of nonflammable medical gases.


(d) Communications Systems. Hospital communications systems, where used for issuing instructions during emergency conditions.

(e) Generator Set Location. Task illumination battery charger for emergency battery-powered lighting unit(s) and selected receptacles at the generator set location.

(f) Elevators. Elevator cab lighting, control, communications, and signal systems.

COMMITTEE ACTION:

1. Critical care areas that utilize anesthetizing gases — task illumination, selected receptacles, and fixed equipment.
2. The isolated power systems in special environments.
3. Patient care areas — task illumination and selected receptacles in the following:
   a. Infant nurseries.
   b. Medication preparation areas.
   c. Pharmacy dispensing areas.
   d. Selected acute nursing areas.
   e. Psychiatric bed areas (omit receptacles)
   f. Ward treatment rooms.
   g. Nurses' stations (unless adequately lighted by corridor luminaires).
4. Additional specialized patient care task illumination and receptacles, where needed.
5. Nurse call systems.
7. Telephone equipment rooms and closets.
8. Task illumination, selected receptacles, and selected power circuits for the following:
   a. General care beds (at least one duplex receptacle per patient bedroom)
   b. Angiographic labs.
   c. Cardiac catheterization labs.
   d. Coronary care units.
   e. Hemodialysis rooms or areas.
   f. Emergency room treatment areas (selected).
   g. Human physiology labs.
   h. Intensive care units.
   i. Postoperative recovery rooms (selected).
9. Additional task illumination, receptacles, and selected power circuits needed for effective hospital operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch.
(b) Subdivision of the Critical Branch. It shall be permitted to subdivide the critical branch into two or more branches.

FPN: It is important to analyze the consequences of supplying an area with only critical care branch power when failure occurs between the area and the transfer switch. Some proportion of normal and critical power, or critical power from separate transfer switches, may be appropriate.

COMMITTEE STATEMENT: As performance criteria this material is extracted from NFPA 99 by NFPA 70.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-57 - (3-4.2.2.2(c)(8)a): Accept in Principle

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

SUBMITTER: Hugh Nash, Nash Lipsey Burch, LLC

RECOMMENDATION: Change (c)(8)a. to read:
   a. General care beds [at least one duplex receptacle per patient bedroom and selected (as needed) task lighting].

COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-31 (Log #309)

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-58 - (3-4.2.2.3(c)): Accept

SUBMITTER: Technical Committee on Electrical Systems

RECOMMENDATION: Delete AC from the header.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

99-59 - (3-4.2.2.3(c)(1)c): Reject

TCC NOTE: 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.

SUBMITTER: Hugh Nash, Nash Lipsey Burch, LLC

RECOMMENDATION: Delete 3-4.2.2.3(c)(1)c.

SUBSTANTIATION: 3-3.2.1.1 (referring to two services) no longer exists. Moreover, the existence of two services exactly constitutes two services and what makes two services truly separate is a vague concept.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: See Committee Proposal 99-61 (Log #CP203)

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher
COMMITTEE STATEMENT: The committee believes that discretion of the operator does not compromise the intent of this paragraph.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: See Committee Proposal 99-65 (Log #205).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: See Committee Proposal 99-65 (Log #302).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: See Committee Proposal 99-65 (Log #88).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher

COMMITTEE STATEMENT: See Committee Proposal 99-65 (Log #303).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 17
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NOT RETURNED: 3 Crawford, Longhitano, Swisher
We have seen oxygen and nitrous oxide piped in PVC plastic; tanks of gas in the same operating room as the staff and patient; flare and compression fittings used for oxygen and nitrous oxide; no consideration for WAGD disposal thereby dumping the waste anesthetic gas back into the same room as the staff using it; plastic tubing with plastic compression fittings used for high pressure nitrogen; etc.

As a minimum we would like to see the requirements for office-based facilities be applied to veterinary uses since frequently the equipment comes from the same supplier.

In larger health care facilities that have animal research areas within their buildings, merely by using a separate supply of gas than the main hospital supply, minimal safety rules are subverted.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-10 (Log #262).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 6

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 5

**NOT RETURNED:** 1 MePeck

—to be added to end of paragraph would read:

“This chapter also covers the installation of nonflammable gas and vacuum systems installed in veterinary facilities. New sentence for the staff.”

**SUBSTANTIATION:** Oxygen, nitrogen, nitrous oxide, and vacuum are routinely installed in veterinary care facilities. The installation is often haphazard and frequently uses inappropriate materials which can and do expose human staff to potentially serious fire hazards.
4-3.1.1 Central Supply System Management.

(a) 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.

(b) Cylinder contents shall be identified by attached labels or stencils naming the contents. Cylinders and containers shall be identified in accordance with CGA Pamphlet C-4 “Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained.”

(c) Contents of cylinders and containers shall be identified by reading the labels prior to use. Labels shall not be defaced, altered, or removed. Cylinders without correct markings or whose markings and gas specific fittings do not match shall not be used.

(d) Cylinders and containers shall be handled in strict accordance with 4-3.5.2.

(e) Racks, shelves, and supports used in areas containing medical gas shall be constructed of noncombustible materials or limited combustible materials.

(f) Only Medical gas cylinders, their immediate packaging materials, and their accessories shall be permitted to be stored in rooms containing central supply systems or medical gas cylinders. No flammable materials, cylinders containing flammable gases, or containers containing flammable liquids shall be stored in these rooms. Wooden racks for cylinder storage are permitted.

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

(h) Cylinders not in use shall have their valve protection caps secured tightly in place.

(i) Locations containing Medical gases other than Oxygen and Medical Air shall have their door 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.

(j) Locations containing only Oxygen and/or Medical Air shall have their door labeled substantially as follows:

   CAUTION
   Medical Gases
   NO Smoking or Open Flame

(k) Cryogenic Liquid storage units intended to supply gas to the facility shall not be used to fill other liquid storage vessels.

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

4-3.1.2 Central Supply Location (Level 1 and 2) (Placement, Construction, Arrangement).

(a) Location of Central Supply Systems: Central Supply Systems for medical gases and mixtures of these Gases shall be located:

1. Systems complying with 4-3.1.1.4, 4-3.1.1.5, and 4-3.1.1.6: Outdoors in an enclosure used only for this purpose sited to comply with Table 2-2.4 in NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.

2. Systems complying with 4-3.1.1.8, 4-3.2.1, and 4-3.3.1: Indoors in a dedicated mechanical equipment area, adequately ventilated and with any required utilities. It is permitted to locate more than one of these systems together in the same room. These systems shall not be located in the same room with any systems complying with 4-3.1.1.4, 4-3.1.1.5, or 4-3.1.1.6, except medical air reserve headers complying with 4-3.1.3(a)16.

3. Systems complying with 4-3.1.1.4, 4-3.1.1.5: Indoors within a room used only for this purpose. It is permitted to locate more than one of these systems together in the same room.

4. Indoor locations shall be placed on exterior walls whenever possible.

5. Locations shall be chosen to admit access by delivery vehicles and management of cylinders (e.g., Proximity to loading docks, access to elevators, passage of cylinders through public areas). Bulk Liquid Vessels shall additionally be provided free access for the positioning and safe operation of the standard delivery vehicle during filling.

6. Indoor locations for oxygen, nitrous oxide, and mixtures of these gases shall not communicate with areas involved in critical patient care, anesthetizing locations, locations storing flammables, rooms containing open electrical conductors or transformers, storage tanks for flammable or combustible liquids, engines, kitchens, or areas with open flames.

7. Cylinders shall be prevented from reaching temperatures in excess of 130°F (54°C). In outdoor locations, they shall be protected from direct sun.

8. Central Supply Systems for Nitrous Oxide and Carbon Dioxide shall be prevented from reaching temperatures lower than 0°F (-18°C).

(b) Central Supply systems for Oxygen complying with 4-3.1.1.6 shall comply with NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.

(c) Central Supply systems for Nitrous Oxide with a total capacity connected and in storage of 3,200 lbs (1452 kg) or more shall comply with CGA G-6.1, Standard for the Installation of Nitrous Oxide Systems at Consumer Sites.

(d) Storage Locations for full or empty Medical Gas Cylinders when not connected shall be located:

1. Outdoors in an enclosure complying with 4-3.1.2(a), (e) and (f)1. Indoors within a room complying with 4-3.1.2(e) and (f)1.

2. In the same rooms or enclosures as their respective Central Supply systems.

3. If Oxygen in storage exceeds 30,000 ft³ (506 m³) at Standard Temperature and Pressure (STP), storage locations shall comply with 4-3.1.1.2(b).

4. If total Nitrous Oxide in storage exceeds 3,200 lbs (1452 kg) at Storage Temperature and Pressure, storage locations shall comply with 4-3.1.1.2(c).

(e) Construction.
1. Locations for Central Supply Systems and the storage of medical Gases shall be:
   a. Constructed with access sufficient to move cylinders, equipment, etc. in and out.  
      Proposal #12
   b. Doors or gates shall be lockable or otherwise secured.  
      4-3.1.1.2(a)11c
   c. Outdoor locations shall be provided with a substantial enclosure (wall or fencing)  
      constructed of noncombustible or limited combustible materials.  
      Proposal #13
   d. Indoor locations and their interior finishes shall be constructed of noncombustible or  
      limited combustible materials and all walls, floors, ceilings, and doors shall be of a minimum  
      one-hour fire resistance rating.  
      4-3.1.1.2(b)3
   e. Electrical installation shall comply with NFPA 70, National Electrical Code, for ordinary  
      locations. Electrical fixtures shall be placed at or above 5 ft (1.5 m) Above Finished Floor  
      (AFF) to avoid physical damage.  
      4-3.1.1.2(a)4 4-3.1.1.2(a)11d
   f. Heating shall be by indirect means (e.g., steam, hot water).  
      4-3.1.1.2(a)11g
   g. Racks, chains, or other fastenings shall be provided to secure cylinders from falling.  
      Such restraints shall be provided for all cylinders, whether connected, unconnected, full, or  
      empty.  
      4-3.1.1.2(a)3  Proposal #14

2. Electrical supply for central supply systems shall be from the Life Safety Branch of the  
   Essential Electrical System (Chapter 3).  
   Proposal #39

10. Ventilation.

1. All 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.  
    4-3.1.1.2(a)10c

2. Indoor Supply Systems complying with 4-3.1.1.6 and 4-3.1.1.7 shall:
   a. Have all relief valves vented to outside per 4-3.1.1.3(a)3ii.  
      Proposal #15
   b. Be provided with dedicated mechanical ventilation discharging from the floor. This  
      mechanical ventilation shall operate continuously and shall be connected to the Life Safety  
      Branch of the Emergency Electrical System. Where the total gas connected and in storage is  
      less than 3,000 ft3 (85 m3), or the only gas in the room is medical air, natural ventilation may  
      be employed. Natural ventilation shall be to the outdoors whenever possible, and shall be  
      through a louvered opening with a minimum free area of 72 in.2 (0.05 m2) placed at floor level.  
      In the event that an outside wall is not available, and the vent will not open to an exit access  
      corridor, this opening shall be permitted to be through the door or wall.  
      Proposal #16
   c. Outdoor locations surrounded by impermeable walls shall have grated ventilation  
      openings of 72 in.2 (0.05 m2) free area each, located at the base of each wall to allow free  
      circulation of air within the enclosure.  
      Proposal #18
   d. Components intended for outdoor installation shall be weather resistant. Proposal #19

3. Locations for Medical air compressors, Vacuum pumps, and WAGD producers shall be  
   adequately ventilated to prevent accumulation of heat.  
   4-3.1.1.4

4-3.1.1.3 Central Supply Systems, Level 1. A central supply system shall consist of cylinder  
manifolds for gas cylinders per 4-3.1.1.4, manifolds for cryogenic liquid cylinders per 4-3.1.1.5, bulk  
cryogenic liquid systems per 4-3.1.1.6, medical air compressor systems per 4-3.1.1.7, vacuum  
producers per 4-3.2.1, or WAGD producers per 4-3.1.1. Selection between types shall be made  
based on owner preference, good engineering practice, and the ability of the system to meet all  
requirements of this standard when installed at the chosen location and in the available space.  

(a) Central Supply Systems, Level 1, Common Requirements.

1. Materials. Materials of construction for Central Supply Systems shall be suited to the gases  
   and pressures conveyed, the temperatures encountered, and the environmental challenges of  
   their location.  
   4-3.1.1.3
   Proposal #20

   a. Portions of systems intended to handle oxygen at pressures >300 psig (2,070 kPa) shall  
      contain no polymeric materials. All components shall be made of materials having a  
      resistance to combustion not lower than that of Red Brass in ASTM STP 1197-1995.  
      Proposal #21
   b. Portions of systems intended to handle Oxygen or Nitrous Oxide at pressures lower than  
      300 psig (2,070 kPa) shall be constructed of materials having adequate compatibility with  
      oxygen under the temperatures 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 25.5 percent oxygen. Components include but are not limited to containers, valves,  
      valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hoses. Easily  
      ignitable materials shall be avoided.  
      4-3.1.1.3(a)  Proposal #21
   c. Components and controls which may be subjected to cryogenic exposure shall be  
      suitable for low temperature service.  
      Proposal #22
   d. Components intended for outdoor installation shall be weather resistant.  
      Proposal #23

2. Emergency Oxygen Supply Connection. Supply connections complying with 4-3.1.1.8 shall  
be installed for Oxygen systems where:
   a. The central supply system is outside of and remote from the building which the oxygen  
      supply serves.  
      4-3.1.1.8(h)
   b. There is not in the building a connected oxygen reserve sufficient for an average day’s  
      supply.  
      Proposal #24
   c. Multiple buildings are served from a single oxygen source such that damage to the  
      interconnecting oxygen line could result in (a) building(s) losing oxygen supply.  
      Proposal #24

   3. Regulators and Relief Valves.  [See Figure 4-3.1.1.3(a)] All positive pressure central  
supply systems shall:
   a. Be provided with duplex final line pressure regulators, installed in a four valve bypass  
      arrangement permitting service to either regulator without interruption of supply. Each  
      regulator outlet shall be provided with a pressure gauge.  
      4-3.1.1.8(c) and 4-3.1.1.9(g)
   b. Be provided with at least one Relief Valve of brass, bronze, or stainless steel construction  
designed for the gas service, which:  
Proposal #25
i. Is located between the Source Valve and the final line regulator bypass valves. 4-3.1.1.8(e) and figs.

ii. Is set at 50 percent above the normal system operating pressure (4-3.1.2.4). 4-3.1.1.8(e)

iii. For all gases other than Air, and for air where total connected cylinder capacity exceeds 5,000 ft³ (85 m³) of gas at Standard Temperature and Pressure, is vented to the outside of the building. Relief Valve vent lines shall be sized to prevent back pressure from rupturing the pipe when the relief valve is fully open. Materials shall comply with 4-3.1.1.3. Vent lines shall discharge in areas away from flammable materials and not where passerby may be endangered by the discharge. Vent lines shall be turned down and screened to prevent the entry of water or vermin.

4. 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 4-3.1.1.3(a)3 and 4-3.1.1.3(a)5.

5. Alarms and Indicators. Visual indicators shall be located at Central Supply Systems complying with 4-3.1.1.5, 4-3.1.1.6, and 4-3.1.1.7. These shall be visual indicators (audible indicators are not required except as otherwise noted) labeled for the service and condition being monitored. Appropriate weather resistant indicators or housings shall be provided for outdoor locations.

6. Headers. (See Figure 4-3.1.1.3(a)16.) In Central Supply systems using pressurized cylinders, either gas or liquid, each header shall consist of:

   a. Sufficient cylinder connections to provide for at least an average day’s supply. The appropriate number of headers shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility's emergency plan. In no case shall fewer than two cylinders be provided.

   b. A Cylinder lead for each cylinder which 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.

   c. A filter of a material complying with 4-3.1.1.3(a) shall be provided to prevent the intrusion of debris into the manifold controls.

7. Header Connections. Headers shall be constructed so that each cylinder connection, connections between header sections, and connection of the header to the manifold shall be made using a noninterchangeable, gas specific fitting 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 header pipe.

8. Vaporizers. Vaporizers provided to convert cryogenic liquids to the gas state shall be ambient heat transfer units so that flow from the vaporizer is unaffected by 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 use.

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

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

Vaporizers shall be installed in a manner which permits the switching of units to allow deicing. Vaporizers shall be installed in a manner which permits the switching of units to allow deicing. Switching valves shall:

   a. Not be solenoid type 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 flow of gas to the facility during switching.

It shall be the responsibility of the facility to inform the owner or agency performing maintenance on the supply systems of changes in the site or use pattern which would affect the performance of the vaporizers.

4-3-1.1.5 Manifolds for Gas Cylinders without Reserve Supply (see Figure 4-3-1.1.3). 4-3-1.1.5

(a) Manifolds for Gas Cylinders without Reserve Supply shall be located per 4-3-1.1.2.

(b) A Manifold for Gas Cylinders shall consist of:

   1. Two equal Headers [4-3-1.1.3(a)6]. These two assemblies shall then connect to the final line pressure regulator assembly in such a manner that either header may supply the system.

   2. A relief valve(s) shall be provided to protect the piping between the Header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure. This (ese) relief valve(s) shall be piped to outside in accordance with 4-3-1.1.3(a)3.

(c) An automatic means of controlling the two headers shall be provided such that:

   4-3-1.1.6(a)–(b)
1. In normal operation, one Header is the Primary and the other is the Secondary. Either Header shall be capable of either role. 4-3.1.1.6(a)–(b)

2. When the Primary Header is supplying the system, the Secondary Header is prevented from supplying the system until the Primary Header is depleted, at which point the Secondary Header shall automatically begin to supply the system. 4-3.1.1.6(a)–(b)

(d) Alarms shall be actuated by the manifold:

1. When or just before the Secondary Header begins to supply the system, indicating changeover has occurred. This Alarm shall actuate at a Local indicator and at all Master Alarms. Proposal #34

2. If the manifold requires a manual operation to exchange the role of Primary and Secondary Header, then the manifold shall include a contents indication to indicate when either header is below an average day’s supply. This Alarm shall actuate at a Local indicator and at all Master Alarms. This indication is not required if the manifold is designed to automatically rotate Primary and Secondary.

(c) If manifolds are located out of doors, they shall be weather resistant. Proposal #20

4-3.1.1.6 Manifolds for Cryogenic Liquid Cylinders (see Figure 4-3.1.1.6).

(a) Location

1. Manifolds for Cryogenic Liquid Cylinders shall be located per 4-3.1.1.2. If indoors, the mechanical venting system required in 4-3.1.1.2(b)(4) shall be provided.

2. The Primary and Secondary Headers shall be located in the same enclosure. The Reserve Header may be located in the same enclosure or in another enclosure compliant with 4-3.1.1.2. Proposal #35

(b) A Manifold for Cryogenic Liquid Cylinders shall consist of:

1. Two equal Headers [4-3.1.1.6(a)6] for Cryogenic Liquid Cylinders. These two assemblies shall connect to the Final Line Pressure Regulator Assembly in such a manner that either header may supply the system. (b), Fig. 4-3.1.1.6

2. A third Header [4-3.1.1.6(a)6] for Gas Cylinders connected downstream of the Primary/Secondary headers and upstream of the Final Line Pressure regulators. This Reserve Header shall include sufficient cylinder connections to provide for at least an average day’s supply but not less than three cylinder connections. The appropriate number of cylinders shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility’s emergency plan. Proposal #29

3. A Pressure relief valve shall be installed in the piping after the connection of the Reserve Header and before the Final Line Pressure Regulating Assembly. This relief valve shall be set at or below the relief pressure for the Cryogenic Liquid Cylinders. Fig. 4-3.1.1.6 Proposal #36

(c) An automatic means of controlling the three headers shall be provided such that:

1. In normal operation, one Cryogenic Liquid Header is the Primary and the other is the Secondary. Either Header shall be capable of either role. The Gas Cylinder Reserve Header operates to supply the system only in the event of depletion or failure of both Headers for Cryogenic Liquid Cylinders, and shall not be included in the rotation of Primary and Secondary.

2. When the Primary Header is supplying the system, the Secondary Header is prevented from supplying the system until the Primary Header is depleted, at which point the Secondary Header shall automatically begin to supply the system. Except that a means to conserve the gas produced by evaporation of the cryogenic liquid in the Secondary Header shall be provided. This mechanism shall discharge the gas into the line upstream of the final line regulator assembly. 4-3.1.1.6(a)–(b)

3. A means shall be provided to exchange the Primary and Secondary Banks. Such means may be manual or automatic. Fig. 4-3.1.1.6

4. If for any reason the Primary and Secondary cannot supply the system, the Reserve Header shall automatically operate to supply the system. 4-3.1.1.6(a)3

(d) Alarms shall be actuated by the Central Supply System:

1. When or just before the Secondary Header begins to supply the system, indicating changeover at a Local indicator and at all Master Alarms. 4-3.1.1.6(a)2

2. When or just before the Reserve Header begins to supply the system, indicating Reserve is in Use at a Local indicator and at all Master Alarms. 4-3.1.1.6(a)3

(b) A Bulk Cryogenic Liquid System shall consist of:

1. One or more Main Supply Vessel(s), including all elements pertinent to its proper functioning. The appropriate capacity shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility’s emergency plan. Proposal #29

2. Bulk Cryogenic Installations shall comply with CGA, Guidelines for Medical Gas Installations at Consumer Sites, and shall be sited on poured concrete, enclosed as per (c) above with the poured concrete pad (equipment pad) completely filling the enclosed space.

No drain shall be located within the pad or closer than 8 ft (2.4 m) from the edge of the pad. The location intended for the delivery vehicle (the vehicle pad) shall be concrete. Drainage from the vehicle pad shall be away from the building, parked vehicles, or other potential sources of ignition.

The location intended for the delivery vehicle shall comply with NFPA 50. Consideration shall 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.

Proposal #38
2. A Reserve Supply sized for greater than an average day's supply. The appropriate size of vessel or number of cylinders shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility’s emergency plan. Reserve Supply shall consist of either:

a. A second Cryogenic Liquid Vessel including an actuating switch/sensor monitoring internal pressure and a contents gauge and provided with a check valve to prevent backflow into the reserve system.

   4-3.1.1.7(b)2

b. A Gas Cylinder Header [4-3.1.1.3(a)6] which shall include not less than three cylinder connections, and shall include a contents pressure switch.

   4-3.1.1.7(b)1

c. An automatic means of controlling the Main Supply(ies) and Reserve Supply shall be provided such that:

1. In normal operation, the Main Supply operates to serve the system. The Reserve Supply operates to supply the system only in the event of depletion or failure of the Main Supply.

   4-3.1.1.7(a)2

2. When the Main Supply is supplying the system, the Reserve Supply is 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.

   4-3.1.1.7(b)2

3. 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. This mechanism shall discharge the gas into the line upstream of the final line regulator assembly.

   4-3.1.1.7(a)1

4. Where there is more than one Main Supply Vessel, the system shall operate as described in 4-3.1.1.4(c) for Primary/Secondary/Reserve operation.

   4-3.1.1.7(a)

(d) Alarms shall be actuated by the Central Supply System:

1. When or just before the Main Supply reaches an average day’s supply, indicating Low Contents at a Local indicator and at all Master Alarms.

   Proposal #3

2. When or just before the Reserve Supply begins to supply the system, indicating Reserve is in Use at a Local indicator and at all Master Alarms.

   4-3.1.1.7(a)

3. When or just before the Reserve Supply contents fall to one day’s average supply, indicating Reserve Low at a Local indicator and at all Master Alarms.

   4-3.1.1.7(b)1 & 2

4. If the Reserve is a Cryogenic Vessel, when or just before the Reserve Internal Pressure falls too low for the reserve to operate properly, indicating Reserve Failure at a Local indicator and at all Master Alarms.

   4-3.1.1.7(b)2

5. Where there is more than one Main Supply Vessel, when or just before the Secondary Vessel begins to supply the system, indicating Changeover at a Local indicator and at all Master Alarms.

   4-3.1.1.7(a)

SUBSTANTIATION: NOTE: Supporting material is available for review at NFPA Headquarters.

| COMMITTEE ACTION: Accept in Principle. | Revise as follows: |

4-3.1.1.1 Central Supply System Management.

(a) 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.

   4-3.1.1.1(a)

(b) Cylinder contents shall be identified by attached labels or stencils naming the contents. Cylinders and containers shall be identified in accordance with CGA Pamphlet C7, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers, 1992.

   4-3.1.1.1(b)

(c) Contents of cylinders and containers shall be identified by reading the labels prior to use. Labels shall not be defaced, altered, or removed. Cylinders without correct markings or whose markings and gas specific fittings do not match shall not be used.

   4-3.1.1.1(c)

Log #145

(d) Cylinders and containers shall be handled in strict accordance with 4-3.5.2.

   Log #146

(e) Racks, shelves, and supports used in areas containing medical gas shall be constructed of non-combustible materials or limited combustible materials.

   4-3.1.1.2(a)

(f) Only medical gas cylinders, their immediate packaging materials, and their accessories shall be permitted to be stored in rooms containing central supply systems or medical gas cylinders. No flammable materials, cylinders containing flammable gases or containers containing flammable liquids shall be stored in these rooms. Wooden racks for cylinder storage are permitted.

   4-3.1.1.2(a)7

   4-3.1.1.2(a)11c

   4-3.1.1.2(a)7

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

   4-3.1.1.2(a)7

(h) Cylinders not in use shall have their valve protection caps secured tightly in place.

   4-3.1.1.2(a)8

(i) Locations containing central supply systems or cylinders supplying same shall have their door labeled as follows:

   CAUTION
   Medical Gases
   NO Smoking or Open Flame

   Log #147

   Log #148

(j) Cryogenic liquid storage units intended to supply gas to the facility shall not be used to fill other liquid storage vessels.

   4-3.1.1.4(a)5

4-3.1.2 Central Supply Location (Level 1 and 2) (Placement, Construction, Arrangement).

(a) Location of Central Supply Systems. Central supply systems for medical gases and mixtures of these gases shall be located:

1. Systems complying with 4-3.1.1.4, 4-3.1.1.5, and 4-3.1.1.6: Outdoors in an enclosure used only for this purpose sited to comply with minimum distance requirements in Table 2-2.4 in NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.

   4-3.1.1.2(a)10a

   Log #149
2. Systems complying with 4-3.1.1.8, 4-3.2.1, and 4-3.3.1: Indoors in a dedicated mechanical equipment area, adequately ventilated and with any required utilities. It is permitted to locate more than one of these systems together in the same room. These systems shall not be located in the same room with any systems complying with 4-3.1.1.4, 4-3.1.1.5, or 4-3.1.1.6, except medical air reserve headers complying with 4-3.1.1.3(a)6.

3. Systems complying with 4-3.1.1.4, 4-3.1.1.5: Indoors within a room used only for this purpose. It is permitted to locate more than one of these systems together in the same room.

4. Locations shall be provided to admit access by delivery vehicles and management of cylinders (e.g., Proximity to loading docks, access to elevators, passage of cylinders through public areas). Log #151

5. Indoor locations for oxygen, nitrous oxide, and mixtures of these gases shall not communicate with areas involved in critical patient care, anesthetizing locations, locations storing flammables, rooms containing open electrical conductors or transformers, storage tanks for flammable or combustible liquids, engines, kitchens, or areas with open flames.

6. Cylinders shall be prevented from reaching temperatures in excess of 54°C (130°F).

7. Central supply systems for nitrous oxide and carbon dioxide shall be prevented from reaching temperatures lower than -18°C (0°F).

(b) Central supply systems for oxygen complying with 4-3.1.1.6 shall comply with NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites.

(c) Central supply systems for nitrous oxide with a total capacity connected and in storage of 1452 kg (3,200 lbs) or more shall comply with CGA G-8.1, Standard for the Installation of Nitrous Oxide Systems at Consumer Sites.

(d) Storage locations for full or empty medical gas cylinders when not connected shall be located:

1. outdoors in an enclosure complying with 4-3.1.1.2(a, 1), (e) and (f), or Indoors within a room complying with 4-3.1.1.2(e) and (f);

2. in the same rooms or enclosures as their respective central supply systems.

3. if oxygen in storage exceeds 566 m³ (20,000 ft³) at Standard Temperature and Pressure (STP), storage locations shall comply with 4-3.1.1.2(b).

4. if total nitrous oxide in storage exceeds 1452 kg (3,200 lbs) at Storage Temperature and Pressure (STP), storage locations shall comply with 4-3.1.1.2(c).

(e) Construction.

1. Locations for central supply systems and the storage of medical gases shall be:

   a. constructed with access to move cylinders, equipment, etc. in and out.

   b. doors or gates shall be lockable or otherwise secured.

   c. outdoor locations shall be provided with an enclosure (wall or fencing) constructed of non-combustible materials.

   d. indoor locations and their interior finishes shall be constructed of non-combustible or limited combustible materials and all walls, floors, ceilings and doors shall be of a minimum one-hour fire resistance rating.

   e. electrical installation shall comply with NFPA 70, NEC for ordinary locations. Electrical fixtures shall be placed at or above 1.5 m (5 ft) Above Finished Floor (AFF) to avoid physical damage.

   f. heating shall be by indirect means (e.g., steam, hot water).

   g. racks, chains, or other fastenings shall be provided to secure cylinders from falling. Such restraints shall be provided for all cylinders, whether connected, unconnected, full, or empty.

   h. central power supplies shall be subdivided into circuits.

2. Electrical supply for central supply systems shall conform to the requirements of the essential electrical systems as described in Chapter 3 of this document.

(f) Ventilation.

1. All 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.

2. Indoor supply systems complying with 4-3.1.1.5 and 4-3.1.16 shall:

   a. have all relief valves vented to outside per 4-3.1.1.3(a)3iii.

   b. where the total gas connected and in storage is greater than 85 m³ (3,000 ft³), be provided with dedicated mechanical ventilation drawing from the floor. This mechanical ventilation shall operate continuously and shall conform to the requirements of the essential electrical systems as described in Chapter 3 of this document.

   c. where the total gas connected and in storage is less than 85 m³ (3,000 ft³), or the only compressed gas in the room is medical air, natural ventilation shall be permitted to be employed. A louvered opening with a minimum free area of 500 cm² (72 sq in.) shall be located 25 cm (1 ft) above floor level. A second vent of equal or greater free area shall be placed 25 cm (1 ft) below ceiling level.

   d. natural ventilation openings as in (f)2.c. above shall not open onto egress corridors. Where no alternative to an egress corridor is available, the mechanical ventilation required in (f)2.b. above shall be employed.

3. 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.

4. Locations for medical air compressors, vacuum pumps, and WAGD producers shall be adequately ventilated to prevent accumulation of heat.

4-3.1.1.3 Central Supply Systems, Level 1. A central supply system shall consist of cylinder manifolds for gas cylinders per 4-3.1.1.4, manifolds for cryogenic liquid cylinders per 4-3.1.1.5, bulk cryogenic liquid systems per 4-3.1.1.6, medical air compressor systems per 4-3.1.1.8, vacuum producers per 4-3.2.1, or WAGD producers per 4-3.3.1.
1. Piped oxygen, medical air, nitrous oxide, carbon dioxide, nitrogen and all other medical gases shall not be supplied to or used for, any purpose except for use in patient care applications.

2. Materials of construction for central supply systems shall be suited to the gases and pressures conveyed, the temperatures encountered and the environmental challenges of their location.

a. Portions of systems intended to handle oxygen at pressures 2,070 kPa (>300 psig) shall contain no polymeric materials. All components shall be made of materials having a resistance to combustion not lower than that of red brass in ASTM STP 1197-1993.

b. Portions of systems intended to handle oxygen or nitrous oxide at pressures lower than 2,070 kPa (300 psig) shall be constructed of materials having adequate compatibility with oxygen under the temperatures 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. Components include but are not limited to containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hoses. Easily ignitable materials shall be avoided.

c. Components and controls which may be subjected to cryogenic exposure shall be designed for low temperature service.

d. Components intended for outdoor installation shall be listed and approved for outdoor use.

3. Regulators and Relief Valves. [See Figure 4-3.1.1.3(a)3.] All positive pressure central supply systems shall:
   a. 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. (ADJUST FIGURES) Each regulator outlet shall be provided with a pressure gauge.
   b. be provided with at least one relief valve of brass, bronze, or stainless steel construction designed for the gas service, which:
      i. is located between the source valve and the final line regulator bypass valves.
      ii. is set at 50 percent above the normal system operating pressure (see Table 4-3.1.2.4).
      iii. for all gases other than air, and for air where total connected cylinder capacity exceeds 83 m³ (3,000 ft³) of gas at Standard Temperature and Pressure, is vented to the outside of the building. Relief valve vent lines shall be sized at least at the full size of the relief valve outlet(s).
   Where multiple outlets are tied to a single vent line, they shall be sized at the aggregate internal area. Materials shall comply with 4-3.1.1.3. Vent lines shall discharge in areas away from flammable materials and not where passersby may be endangered by the discharge. Vent lines shall be turned down and screened to prevent the entry of water or vermin.

4. 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 4-3.1.1.3(a)1 and 4-3.1.1.3(a)3.

5. Alarms and Indicators. Visual indicators shall be located at central supply systems complying with 4-3.1.1.4, 4-3.1.1.5, and 4-3.1.1.6. These shall be visual indicators (audible indicators are not required except as otherwise noted) labeled for the service and condition being monitored. Indicators or housings listed and approved for outdoor use shall be provided for outdoor locations.

6. Headers. [See Figure 4-3.1.1.3(a)6.] In central supply systems using pressurized cylinders, either gas or liquid, each header shall consist of:
   a. sufficient cylinder connections to provide for at least an average day’s supply. The appropriate number of cylinders shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility's emergency plan. In no case shall fewer than two cylinders connections be provided.
   b. a cylinder lead for each cylinder which 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.
   c. a filter of a material complying with 4-3.1.1.3(a)1 shall be provided to prevent the intrusion of debris into the manifold controls.
   d. 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.

7. a. a pressure gauge indicating header contents. Figure 4-3.1.1.5
   f. a check valve to prevent backflow into the header and to permit service to the header.

   g. if intended for gas cylinder service:
      i. each cylinder connection shall be provided with a check valve at the header to prevent loss of gas in the event of damage to a cylinder lead or operation of an individual cylinder relief valve.
      ii. a pressure regulator to reduce the pressure to an intermediate pressure under 300 psig and an intermediate pressure gauge.
   h. if intended for service with cryogenic liquid cylinders, the header shall include a pressure relief valve. No check valve in each cylinder lead is required.
4-3.1.1.4 Manifolds for Gas Cylinders without Reserve Supply (see Figure 4-3.1.1.4).

(a) Manifolds for gas cylinders without reserve supply shall be located per 4-3.1.1.2.

(b) A manifold for gas cylinders shall consist of:

1. two equal Headers [4-3.1.1.3(a)6] each containing an average day's supply but not fewer than two cylinders. These two assemblies shall then connect to the final line pressure regulator assembly in such a manner that either header may supply the system.

2. an intermediate relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure. Relief valve(s) shall be piped to outside in accordance with 4-3.1.1.3(a)5.

(c) An automatic means of controlling the two headers shall be provided such that:

1. in normal operation, one header is the primary and the other is the secondary. Either header shall be capable of either role.

2. when the primary header is supplying the system, the secondary header is prevented from supplying the system until the primary header is depleted, at which point the secondary header shall automatically begin to supply the system.

(d) Alarms shall be actuated by the manifold:

1. when or just before the secondary header begins to supply the system, indicating changeover has occurred. This alarm shall actuate at a local indicator and at all master alarms:

2. if for any reason the primary and secondary cannot supply the system, the reserve header shall be capable of either role.

4-3.1.1.5 Manifolds for Cryogenic Liquid Cylinders (see Figure 4-3.1.1.5).

(a) Location.

1. Manifolds for cryogenic liquid cylinders shall be located per 4-3.1.1.2. If indoors, the mechanical venting system required in 4-3.1.2(b)4 shall be provided.

2. The primary and secondary headers shall be located in the same enclosure. The reserve header shall be permitted to be located in the same enclosure or in another enclosure in accordance with 4-3.1.1.2.

(b) A manifold for cryogenic liquid cylinders shall consist of:

1. two equal headers [4-3.1.1.3(a)6] for cryogenic liquid cylinders each containing an average day's supply but not fewer than two cylinders. These two assemblies shall connect to the final line pressure regulator assembly in such a manner that either header may supply the system.

2. a third header [4-3.1.1.3(a)6] for gas cylinders connected downstream of the primary/secondary headers and upstream of the final line pressure regulators. This reserve header shall include sufficient cylinder connections to provide for at least an average day's supply but not less than three cylinder connections. The appropriate number of cylinders shall be-selected after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility's emergency plan.

3. 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 at or below the relief pressure for the cryogenic liquid cylinders.

(c) An automatic means of controlling the three headers shall be provided such that:

1. in normal operation, one cryogenic liquid header is the primary and the other is the secondary. Either header shall be capable of either role. The gas cylinder reserve header operates to supply the system only in the event of depletion or failure of both headers for cryogenic liquid cylinders, and shall not be included in the rotation of primary and secondary.

2. when the primary header is supplying the system, the secondary header is prevented from supplying the system until the primary header is depleted, at which point the secondary header shall automatically begin to supply the system. Except that a means to conserve the gas produced by evaporation of the cryogenic liquid in the secondary header shall be provided. This mechanism shall discharge the gas into the line upstream of the final line regulator assembly.

3. a means shall be provided to exchange the primary and secondary banks. Such means may be manual or automatic.

4. if for any reason the primary and secondary cannot supply the system, the reserve header shall automatically operate to supply the system.

(d) Alarms shall be actuated by the central supply system:

1. when or just before the secondary header begins to supply the system, indicating changeover at a local indicator and at all master alarms:

2. when or just before the reserve header begins to supply the system, indicating reserve is in use at a local indicator and at all master alarms:

3. when or just before the reserve header contents fall to one day's average supply, indicating reserve low at a-local indicator and at all master alarms:

4-3.1.1.6 Bulk Cryogenic Liquid Systems (see Figure 4-3.1.1.6).

(a) Location.

1. Bulk cryogenic liquid systems shall be located outdoors in accordance with 4-3.1.1.2.

2. Bulk cryogenic installations shall comply with CGA, Guidelines for Medical Gas Installations at Consumer Sites, and shall be sited on poured concrete, enclosed as per (c) above with the poured concrete pad (equipment pad) completely filling the enclosed space.

No drain shall be located within the pad or closer than 2.4 m (8 ft) from the edge of the pad.

The location intended for the delivery vehicle (the vehicle pad) shall be concrete. Drainage from the vehicle pad shall be away from the building, parked vehicles, or other potential sources of ignition.

The location intended for the delivery vehicle shall comply with NFPA 50. Consideration shall 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 bulk cryogenic liquid system shall consist of:

1. one or more main supply vessel(s), including a contents gauge. The appropriate capacity shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility's emergency plan.

2. a reserve supply sized for greater than an average day's supply. The appropriate size of vessel or number of cylinders shall be determined after consideration of delivery schedules, proximity of the facility to alternate supplies, and the facility's emergency plan. Reserve supply shall consist of either:
   a. a second cryogenic liquid vessel including an actuating switch/sensor monitoring internal pressure and a contents gauge and provided with a check valve to prevent backflow into the reserve system.
   b. a gas cylinder header (4-3.1.1.3(a)1) which shall include not less than three cylinder connections, and shall include a contents pressure switch.
   c. an automatic means of controlling the main supply(ies) and reserve supply shall be provided such that:
      1. in normal operation, the main supply operates to serve the system. The reserve supply operates to supply the system only in the event of depletion or failure of the main supply.
      2. when the main supply is supplying the system, the reserve supply is 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.
      3. 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. This mechanism shall discharge the gas into the line upstream of the final line regulator assembly.
      4. where there is more than one main supply vessel, the system shall operate as described in 4-3.1.1.4(c) for primary/secondary/reserve operation.

4-3.1.1.7 Emergency Oxygen Supply Connection.

1. emergency oxygen supply connections shall be installed for oxygen systems to permit connection of a temporary auxiliary source of supply for emergency or maintenance situations as follows:
   a. the central supply system is outside of and remote from the building which the oxygen supply serves.
   b. there is not in the building a connected oxygen reserve sufficient for an average day's supply. If the reserve is intended to function in the event of loss of the remote supply, the main line shall be provided with a check valve to prevent flow of gas to the remote source. This check valve shall be placed on the distribution system side of the main line valve. The reserve shall activate an alarm at the two master panels when or just before it begins to serve the system.

2. Location. Emergency oxygen supply connections shall be located:
   a. On the exterior of the building served where it is accessible by emergency supply vehicles at all times in all weather conditions. The connection shall not be mounted on or at the main oxygen supply source.
   b. downstream of the shutoff valve on the main supply line.

3. The emergency oxygen supply connection shall include:
   a. physical protection to prevent unauthorized tampering.
   b. necessary valves to allow emergency supply of oxygen and isolation of the piping to the normal source of supply.
   c. one check valve in the main line between the main line shutoff valve and the tee'd connection and one check valve between the tee'd connection and the emergency supply shutoff valve.
   d. a relief valve of adequate size to protect the downstream piping system and related equipment from exposures to pressures in excess of 50 percent higher than normal line pressure.
   e. a female NPT inlet, sized for 100 percent of the system demand at the emergency source gas pressure.

4. if the reserve is a cryogenic vessel, when or just before the reserve internal pressure falls too low for the reserve to operate properly, indicating reserve failure at a local indicator and at all master alarms.

5. where there is more than one main supply vessel, when or just before the secondary vessel begins to supply the system, indicating changeover at a local indicator and at all master alarms.

4-3.1.1.8(h)1

NOMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: The committee incorporated several of the accepted proposals into this proposal to make a more comprehensive rewrite.

COMMENTS ON AFFIRMATIVE:
HOFFMAN: Remove the Note 1 and the Gas Specific Connection at the end of the header. There is no 4-3.1.1.3(a)8 and therefore no requirement that this connection be gas specific.
WAGNER: 4-5.1.2(a)5 "Locations shall be chosen to admit..." Permit access and management... 4-3.1.1.3(a)2a. "lower than that of Red Brass red brass..." There are a number of places where words are capitalized that should not be capitalized.

LOG #172 and 34
LOG #181 and 36
LOG #167
LOG #167
Number of Committee Members Eligible to Vote: 23

Vote on Committee Action:

Affirmative: 22

Not Returned: 1 Bancroft

Committee: HEA-PIP

(7-97) - (4-3.1.1): Accept in Principle

Submitter: Mark Allen, Beacon Medical Products

Recommendation: Add new wording at end of first sentence: “and multiple buildings are served from a single oxygen source such that damage to the interconnecting oxygen line could result in a building or buildings losing oxygen supply.”

Substantiation: The oxygen inlet is intended to provide for an alternate supply when no other means exist. In the case of a multi-building facility, a single connection may be inadequate to provide the necessary capability.

Committee Action: Accept in Principle.

Committee Statement: See Committee Action and Statement on Proposal 99-71 (Log #144).

Number of Committee Members Eligible to Vote: 23

Vote on Committee Action:

Affirmative: 22

Not Returned: 1 Bancroft
COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-71 (Log #144).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-80 - (4-3.1.1.2(a)11g):
TCC NOTE: The Technical Correlating Committee directs the
Committee to substantiate the Committee Statement. Supporting
data is necessary, i.e., temperature and heat absorption.

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Insert the wording:
"In outdoor locations, cylinders shall be protected from direct
sun."

SUBSTANTIATION: When placed out of doors and in direct sun,
as might occur in a warm climate, cylinders could easily reach the
130° temperature level. The user should be cautioned against this.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Committee is not aware of any
problems with cylinders stored in direct sunlight and does not feel
this is a hazard.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-81 - (4-3.1.1.2(a)3): Accept in Principle

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new text:
"Such restraints shall be provided for all cylinders, whether
connected, unconnected, full, or empty."

SUBSTANTIATION: Cylinder restraints (where provided at all)
are often provided only for the cylinders connected to the
manifolds, and none are provided for the full cylinders awaiting
their turn or the empties awaiting return. This additional language
will make it clear that restraints are necessary in all cases.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-71 (Log #144).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-82 - (4-3.1.1.2(a)9): Accept in Principle

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new text:
"Outdoor locations surrounded by impermeable walls shall have
grated ventilation openings of 72 in.² (0.05 m²) free area each,
located at the base of each wall to allow free circulation of air
within the enclosure."

SUBSTANTIATION: This addition is intended to prevent the
undesirable accumulation of gases in those cases where the
enclosure surrounding an outdoor central supply is a wall (as
sometimes happens in locations with security concerns). By
mandating a minimum ventilation, some way for the gas to ventilate
is assured.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-71 (Log #144).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-83 - (4-3.1.1.2(a)10): Accept in Principle

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add a new paragraph:
"Construct with access sufficient to move cylinders, equipment,
etc. in and out."

SUBSTANTIATION: This is a common sense requirement which
will be useful to users while laying out the systems and will be
immensely useful to the user of the systems thereafter.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-71 (Log #144).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-84 - (4-3.1.1.2(a)10): Reject

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new text:
"Selection between types shall be made based on owner
preference, good engineering practice, and the ability of the system
to meet all requirements of this standard when installed at the
chosen location and in the available space."

SUBSTANTIATION: This wording is intended to give general
guidance on the selection of the source type. The most important
provision intended here is the implied requirement to change a
source type selection if the type otherwise preferred cannot be
safely installed or used. This is intended to address the practice of
(for instance) placing liquid cylinders into locations suited only for
gas cylinders.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The language is non mandatory and
unenforceable.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-85 - (4-3.1.1.2(a)11): Reject

TCC NOTE: The Technical Correlating Committee directs the
Committee Action be changed to Accept In Principle. The
Committee Statement must provide justification for its actions.

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add wording:
"Locations containing medical gases other than Oxygen and
medical air shall have their door 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."

SUBSTANTIATION: In locations containing gases which will not
sustain life, the greatest hazard is asphyxiation, not fire. The user
should be so warned.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-86 (Log #148) and Proposal 99-71 (Log
#144).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-86 - (4-3.1.1.2(a)11g):
TCC NOTE: The Technical Correlating Committee directs the
Committee to substantiate the Committee Statement. Supporting
data is necessary, i.e., temperature and heat absorption.

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new text:
"When placed out of doors and in direct sun,
as might occur in a warm climate, cylinders could easily reach the
130° temperature level. The user should be cautioned against this."
99-86 - (4-3.1.1.2(a)(11)): Accept in Principle

**SUBMITTER:** Mark Allen, Beacon Medical Products

**RECOMMENDATION:** Add wording:

"Locations containing only Oxygen and/or medical air shall have their door labeled substantially as follows:

**CAUTION**

Medical Gases

NO Smoking or Open Flame"

**SUBSTANTIATION:** In locations containing oxidizing gases the greatest hazard is fire. The user should be so warned.

**COMMITTEE ACTION:** Accept in Principle.

Revise to read:

"Locations containing medical gas central supply or cylinders supplying same shall have their doors labeled as follows:

**CAUTION**

Medical Gases

NO Smoking or Open Flame".

Incorporated into Proposal 99-71 (Log #144).

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-71 (Log #144).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 22

**NOT RETURNED:** 1 Bancroft

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99-87 - (4-3.1.1.2(a)(11)): Accept in Principle

**SUBMITTER:** Mark Allen, Beacon Medical Products

**RECOMMENDATION:** Add a new paragraph:

"Outdoor locations shall be provided with a substantial enclosure (wall or fencing) constructed of noncombustible or limited combustible materials."

**SUBSTANTIATION:** Locations for medical gases need to be secured (witness the numerous warnings about nitrous oxide abuse) and these enclosures need to be fire safe. Surrounding an oxygen manifold with a wooden fence may be aesthetically pleasing, but it is clearly inappropriate.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-71 (Log #144).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 22

**NOT RETURNED:** 1 Bancroft

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99-88 - (4-3.1.1.2(a)(11)): Accept in Principle

**SUBMITTER:** Mark Allen, Beacon Medical Products

**RECOMMENDATION:** Require central supply systems to be secured (witness the numerous warnings about nitrous oxide abuse).

**SUBSTANTIATION:** Certain central supply systems require power. This is a life safety application and should be so treated.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-71 (Log #144). The word was modified slightly.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 22

**NOT RETURNED:** 1 Bancroft

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99-89 - (4-3.1.1.2(b)): Accept in Principle

**SUBMITTER:** Mark Allen, Beacon Medical Products

**RECOMMENDATION:** Add a new paragraph:

"Central supply systems for Nitrous Oxide and Carbon Dioxide shall be prevented from reaching temperatures lower than 0°F (=18°C)."

**SUBSTANTIATION:** These gases have very low vapor pressures at low ambient temperatures. This requirement will help ensure the systems operate when placed out of doors in colder climates.

**COMMITTEE ACTION:** Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-93 - (4.3.1.1.2(c) and Exception (New)): Accept in Principle
SUBMITTER: J. Richard Wagner, The Poole & Kent Company
RECOMMENDATION: Revise 4.3.1.1.2(c) as follows:
(c) Storage Requirements for Nonflammable Gases Less Than 3000 ft³ (85 m³). Doors to such locations shall be provided with louvered openings having a minimum of 72 in² (0.05 m²) in total free area. Where the location of the supply system door opens onto an exit access corridor, louvered openings shall not be used and the requirements of 4.3.1.1.2(b)3 and 4 (and the dedicated mechanical ventilation system required in 4.3.1.1.2(b)4) shall be complied with.

SUBSTANTIATION: 4.3.1.1.2(b)4 does not require a dedicated mechanical ventilation system. It permits natural venting. The requirements for when a door opens onto an exit access corridor are exceptions to 4.3.1.1.2(c).
COMMITTEE ACTION: Accept in Principle.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-94 - (4.3.1.1.3): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new requirement where appropriate:
“Components and controls which are located out of doors shall be weather resistant and suited to the temperatures encountered and the environmental challenges of their site.”

SUBSTANTIATION: Manifolds and other source equipment is often located out of doors. The result is premature failure where the equipment is incorrectly applied or the equipment is not suited to the heat/cold/wet environment. The user of the standard should be cautioned to apply the equipment with foreknowledge of its environmental limits.
COMMITTEE ACTION: Accept in Principle.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-95 - (4.3.1.1.3): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new paragraph:
“Components and controls which may be subjected to cryogenic exposure shall be suitable for cryogenic service.”

SUBSTANTIATION: Conversions from gas to liquid manifolds has produced issues with regulators, check valves, and other components. These were never designed for cryogenic service, and are thus subject to failure. The standard should require that components be suited to the temperatures encountered just as it requires material compatibility with oxygen.
COMMITTEE ACTION: Accept in Principle.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-96 - (4.3.1.1.3(a)) : Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new text:
“Portions of systems intended to handle oxygen at high pressures >300 psig (2,070 kPa) shall contain no polymeric materials. All components shall be made of materials having a resistance to combustion not lower than that of Red Brass in ASTM STP 1197-1993.”

SUBSTANTIATION: A substantial problem has been reported with 1. Flexible cylinder pigtails lined with Teflon, 2. Check valves with soft (polymeric) seats, and 3. Aluminum regulators. These problems are the result of ignition of the polymeric materials or aluminum respectively under adiabatic compression, with the probable complicating factor of particulate. These materials have been banned in other countries and may be argued to have now demonstrated their unsuitability for use with high pressure oxygen. The available literature as well as contemporary experience argue that the materials used with high pressure oxygen should be limited as proposed.
COMMITTEE ACTION: Accept in Principle.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft
COMMITTEE ACTION: Accept in Principle.

The committee incorporated this concept into Proposal 99-71 (Log #144).


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

TCC NOTE: The Technical Correlating Committee directs the Committee to reflect the submitter's substantiation in the Technical Committee Statement, being more explicit by citing reasons.

SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: Add a requirement:

"If the manifold requires a manual operation to exchange the role of primary and secondary header, then the manifold shall activate a contents alarm to indicate when either header is below an average day's supply. This alarm shall indicate visually locally and shall activate a signal at the master alarms. This alarm is not required if the manifold is designed to automatically rotate primary and secondary."  

SUBSTANTIATION: The most common mode of failure in manifolds is when a semiautomatic manifold is improperly assembled, and the line pressure regulators from over pressure in the event of a header regulator failure.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: 1) The current drawing Figure 4-3.1.1.5 shows all the items listed above, but 4-3.1.1.5 reads that each bank shall have a common header and pressure regulator. It doesn’t talk about the requirement for the high pressure shutoff valve or the check valve.

2) The way the standard reads now, it allows a single cylinder in each bank if the single cylinder supply is more than an average day’s supply. In many cases I've seen partially filled or even empty cylinders sent mistakenly for full cylinders. I don’t know if it was ever the committee’s intent to allow a single cylinder to be used as a bank of cylinders.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: This relief valve will protect the system from the consequences of a failure in the header regulator, and is common engineering practice.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

TCC NOTE: The Technical Correlating Committee directs the Committee to reflect the submitter's substantiation in the Technical Committee Statement, being more explicit by citing reasons.

SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: Add a requirement:

"A relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure."  

SUBSTANTIATION: This relief valve is shown in the figure but shows all the items listed above, but 4-3.1.1.5 reads that each bank shall have a common header and pressure regulator. It doesn’t talk about the requirement for the high pressure shutoff valve or the check valve.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: The most common mode of failure in manifolds is when a semiautomatic manifold is improperly operated and the manifold banks are both allowed to run empty. In a fully automatic manifold, this is avoided by the "rotation of stock" inherent in the device. Provision of an alarm would help compensate for this all too common operator failure.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee feels that the current warning requirements are sufficient.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: The most common mode of failure in manifolds is when a semiautomatic manifold is improperly operated and the manifold banks are both allowed to run empty. In a fully automatic manifold, this is avoided by the "rotation of stock" inherent in the device. Provision of an alarm would help compensate for this all too common operator failure.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: A relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: A relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: A relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: A relief valve(s) shall be provided to protect the piping between the header pressure regulator and the line pressure regulator assembly, and the line pressure regulators from over pressure in the event of a header regulator failure.
primary and high-pressure gas cylinders as secondary shall operate the master signals when the secondary supply pressure drops to one day's supply.

**SUBSTANTIATION:** With the advent of hybrid cryogenic liquid by-high-pressure gas delivery systems, it is not necessary to have an additional high-pressure reserve cylinder supply since the secondary high-pressure supply will not inadvertently vent-off its content before it is used. A signal to the master alarm indicating that the secondary supply is low will provide the facility with adequate time to provide fresh filled high-pressure cylinders in the advent that the secondary supply pressure becomes too low due to normal use.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** The committee feels that due to the nature of the design of the proposed system, it has the potential to run out of gas.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**
- **AFFIRMATIVE:** 22
- **NOT RETURNED:** 1 Bancroft
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft
EXPLANATION OF NEGATIVE: SHOEMAKER: Cylinders should be individually secured for safety to the person changing the cylinders. During the changing process the caps on cylinders still in service are not installed. The possibility of in service cylinders falling over is eliminated when individually secured.
WYRICK: This should be accepted. This is an OSHA requirement for all facilities, this is to protect the person changing cylinders for any reason and prevent other cylinders falling on the person or damaging cylinder or property. OSHA will write a report if cylinders do not have the valve caps in place, full or empty. This should be opened and discussed in committee.

COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-113 (Log #37) which reads as follows: The committee does not feel that each individual cylinder needs to be secured as long as the cylinders as a whole are secured.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee feels that a CGA V-1 fitting will not pass sufficient volume of gas.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee feels that a CGA V-1 fitting will not pass sufficient volume of gas.
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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-117 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:
"Pressure relief valves set at 50 percent above normal line pressure shall be vented to the outside from all gas systems, except medical air, if the total capacity of the supply system is in excess of 3000 ft³ (85 m³) of gas.

SUBSTANTIATION: This was mistakenly left in the 1999 Standard.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-118 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add a new requirement that all relief valves in a manifold be vented (when any is vented) to outside.

SUBSTANTIATION: The present language in the standard only makes it clear that the final line relief valve need be vented to outside. Given that manifolds commonly are provided with relief valves in several locations, it is only sensible that they all be piped to outside when such is required.

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-119 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add requirements for pressure gauges with each pressure regulator to indicate regulated pressure and on each header to indicate contents.

SUBSTANTIATION: Presently, there is no requirement for gauges. Since they are necessary to adjust any element of a manifold or to determine the contents of a header, the standard should call for them.

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-120 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add after "brass or bronze": "or stainless steel."

SUBSTANTIATION: Stainless would be an acceptable material under all circumstances as well.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-121 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add after "3,000 ft³ (85 m³) of gas" the words:
"at standard temperature and pressure. Relief valve vent lines shall be sized to prevent back pressure from rupturing the pipe when the relief valve is fully open. Materials shall comply with 4-3.1.1.3. Vent lines shall discharge in areas away from flammable materials and not where passerby may be endangered by the discharge. Vent lines shall be turned down and screened to prevent the entry of water or vermin."

SUBSTANTIATION: The standard gives no guidance on the relief piping. This statement would give the designer/installer some assistance.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-122 - (4-3.1.1.8(e)): Accept in Principle
SUBMITTER: Thomas J. Mraulak, American Society of Sanitary Engineering
RECOMMENDATION: Delete text as follows:
"Pressure relief valves set at 50 percent above normal line pressure shall be vented to the outside from all gas systems, except medical air, or if the total capacity of the supply...

SUBSTANTIATION: If a relief valve on medical air goes off in an equipment room the room will fill with air. This by itself is not a problem. There is a safety problem with the amount of pressure (at least 75 psi) being released from the valve. Somebody could get hurt if they were to get hit with that kind of pressure.

COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: Revise as follows:
"Pressure relief valves set at 50 percent above normal line pressure shall be vented to the outside from all gas systems except medical air, which shall be premitted to be diffused locally."

This allows the option of the gas to be vented locally and not outside.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-123 - (4-3.1.1.8(h)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Add new wording at end of first sentence:
"and there is not in the building a connected oxygen reserve sufficient for an average day’s supply."

SUBSTANTIATION: The oxygen inlet is intended to provide for an alternate supply when no other means exist. In the case of a facility with a reserve capability inside the building, this need is obviated. In that case, the inlet can safely be eliminated.

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)

99-124 - (4-3.1.1.8(h)): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: The vent to outside should not terminate into the watertight box as shown in the drawing in Figure 4-3.1.1(8)(h).

COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Committee: HÉA-PIP)
99-125 - (Figure 4-3.1.1.8(h) Note): Accept in Principle

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-126 - (Figure 4-3.1.1.9): Accept in Principle

TCC NOTE: The Technical Correlating Committee directs this proposal be returned to Committee.

a. It is not apparent where or why recommendation No. 2 was not accepted.

b. It is not clear where recommendations 4 and 5 were inserted in the document. The Committee Statement should reflect this action.

c. The Committee Statement cites a figure which was not included for review.

d. Recommendation No. 5 says the note was omitted, but the note was not included with the proposal for review.

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows:

- “General. The medical air compressor shall take its source from the outside atmosphere and shall not add contaminants in the form of particulate matter, odor, or other gases. It shall be connected only to the medical air piping distribution system and shall not be used for any other purpose only be used for air in the application of human respiration.”

SUBSTANTIATION: Changing the wording, as indicated above, will allow hospitals to continue their practice of using their medical air supply system to supply respirators used by staff in the process of decontaminating patients. This limited application would not compromise the hospital’s medical air system for the following reasons:

- The hospital’s medical air system is a one-way, closed system that prevents air source contamination.
- There is no danger of cross contamination because the supplied air respirator (SAR) would not be tied into any other air system (i.e., the air system used for instrumentation).
- Supplied air respirators are connected to a medical air outlet via a NIOSH point of attachment (POA) which regulates airflow, thereby maintaining pressure throughout the system.
- The supplied air respirator is connected to a medical air outlet which is on a zoned system that has a monitoring device that measures the pressure and alarms when the pressure begins to drop. In addition, since the SAR is only used by personnel in the immediate area (using the buddy system), if a SAR became damaged or breached, personnel in the area would only need to disconnect the SAR from the POA to shut off the flow of air.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-127 - (Figure 4-3.1.1.9): Reject

SUBMITTER: Christopher P. Swayze, Sherman Engineering Co.

RECOMMENDATION: Remove requirement for CO monitor.

SUBSTANTIATION: CO monitor is an added expense for hospitals that require frequent maintenance. With proper air intake location and use of approved medical air compressor, which are described in great detail in ’90, meter is unnecessary.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The continuous monitoring of CO is necessary for maintaining patient safety.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21

NEGATIVE: 1

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE: Esherick: We have been in the testing business for over 17 years. We regularly test for carbon monoxide (CO) and have NEVER found more than 1 or 2 ppm of CO in any medical gas piping system. USP limits are 10 ppm.
99-129 - (4-3.1.9(b)): Reject

SUBMITTER: Peter Esherick, Patient Instrumentation Corp.

RECOMMENDATION: Revise text to read as follows:
“Compressor intake piping shall be as described in 4-3.1.2.2.9(a)3: “Piping shall be hard-drawn seamless medical gas tube, type K or L (ASTM B819), and bear one of the following markings...”

SUBSTANTIATION: Vacuum piping may not be cleaned for oxygen service - may have oil remaining from tube drawing and galvanized steel pipe is oily.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Clean medical gas piping is not necessary for this application because it is exposed to the atmosphere.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NEGATIVE: 1

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ESHERICK: Compressor intake piping should be cleaned for oxygen service. If the intake has oil remaining from the manufacturing process, the oil could migrate throughout the piping system and ultimately get to the patient. Oil in the lungs is very harmful.

99-130 - (4-3.1.9(e)): Accept

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise 4-3.1.9(e) as follows:
“4. The use of a liquid ring air compressor, as defined in 4-3.1.9(e)1 under medical air compressor - type (a), shall require separate compressor sensors that shut down that compressor when the water exceeds the design level in the separator and activates a local alarm. At a high water level in the receiver shall activate an alarm that shuts down the liquid ring compressor system and activates the local alarm. Service water and seal water shall be as recommended by the manufacturer.
5. The use of permanently lubricated sealed bearing compressors, as defined in 4-3.1.9(e)1 under medical air compressor - type (a), shall require monitoring of the air compressor intake temperature at the immediate outlet of each cylinder with a “high temperature” switch that shuts down the compressor and activates both master and local alarms. If the compressor has water-cooled heads, a high temperature level switch in the receiver shall activate both master and local alarms, and shut down the system. “High temperature switch setting shall be as recommended by the manufacturer.
6. The use of a medical air compressor, as defined in 4-3.1.9(e)1 under medical air compressor - type (a), shall monitor air temperature at the immediate outlet of each cylinder with a “high temperature” switch that shuts down the compressor and activates both master and local alarms. If the compressor has water-cooled heads, a high temperature level switch in the receiver shall activate both master and local alarms, and shut down the system. The temperature switch setting shall be as recommended by the manufacturer. The compressor shall contain collecting filters with an “element change indicator” and a charcoal filter with colometric hydrocarbon indicator.
“4. Where liquid ring air compressors or compressors having water-cooled heads are used, air receivers shall be equipped with a high water level sensor that activates the local alarm system and shuts down the compressor system.
5. Where liquid ring compressors are used, each compressor shall have a liquid level sensor that shuts down its compressor and activates the local alarm when the liquid level in the air/water separator is above the design level. Service water and seal water shall be as recommended by the compressor manufacturer.
6. Where compressors are the reciprocating piston type, the air temperature at the immediate outlet of each cylinder shall be monitored by a high temperature sensor that shuts down the compressor and activates the local alarm system. The temperature setting shall be as recommended by the compressor manufacturer.
7. Where compressors have an oil-containing section, as permitted in 4-3.1.9(e)1b, the final line filters shall include collecting filters with “element change indicators” and charcoal filters with colometric hydrocarbon indicators.”

99-131 - (4-3.1.9(e)): Reject

SUBMITTER: Craig B. Williams, Hill-Rom

RECOMMENDATION: Delete this entire paragraph.

SUBSTANTIATION: Liquid-ring compressors can not be used for manufacturing medical air as defined in 4-3.1.9(e) because of the chemicals that are in all public water systems. Since the water in the liquid-ring compressors is actually part of the working compressor, any chemicals that may be in the water will be introduced into the medical air pipeline. As stated in this section, this can not be permitted.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: There is no technical substantiation to support the deletion of this technology.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-132 - (4-3.1.9(f)): Accept in Principle

SUBMITTER: Craig B. Williams, Hill-Rom

RECOMMENDATION: Revise text as follows:
“Receivers. The receiver shall be equipped with a pressure relief valve, automatic drain, sight glass, and pressure gauge and shall have the capacity to ensure practical on-off operation. The receiver shall comply with Section VIII, Unfired Pressure Vessels, of the ASME Boiler and Pressure Vessel Code and shall be corrosion resistant. Piping within compressor systems upstream of the source shutoff valve shall not contribute to contaminates levels, be made of oxygen compatible material and cleaned for oxygen use.”

SUBSTANTIATION: Requiring the piping within manufactured equipment to meet with the same requirements for a pipeline distribution system is not necessarily beneficial to the user or a safety issue. Soft copper that is cleaned for oxygen use can provide the supplier of the system with the ability to use copper piping that is easier to shape and install while allowing for the use of compression fittings instead of brazed or threaded connections. Compression-fittings allows for easier servicing of the equipment by the user after the system is installed and operating. The use of compression fittings also prevents the possibility of piping scaling paste to be introduced inside the piping when the system is assembled using threaded copper pipes and fittings.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: This coordinates with Proposal 99-126 (Log #11).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

LOG #224

COMMITTEE ACTION: Accept in Principle.

99-139 - (4-3.1.9(f)): Reject

SUBMITTER: Craig B. Williams, Hill-Rom

RECOMMENDATION: Revise text as follows:

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: This coordinates with Proposal 99-145 (Log #263) proposed that compressor intake piping be medical gas tube; but was rejected as unnecessary because it is exposed to the atmosphere.

99-145 (4-3.1.9(b) [Log #263]) proposed that compressor intake piping be medical gas tube; but was rejected as unnecessary because it is exposed to the atmosphere.

99-150 - (4-3.1.9(f)): Accept in Principle

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: This coordinates with Proposal 99-145 (Log #263) proposed that compressor intake piping be medical gas tube; but was rejected as unnecessary because it is exposed to the atmosphere.

99-150 (4-3.1.9(f)): Accept in Principle

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: This coordinates with Proposal 99-145 (Log #263) proposed that compressor intake piping be medical gas tube; but was rejected as unnecessary because it is exposed to the atmosphere.
Range of acceptable dew point conditions that would not cause an alarm to annunciate.

99-135 - (4-3.1.1.9(g) & (i)): Accept in Principle

SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: Rewrite 4-3.1.1.9(i)(3) as follows:

a. High Dew Point
b. High Carbon Monoxide
c. Backup Compressor Operating

Liquid Ring Compressors complying with 4-3.1.1.9(e)1a shall include a Local Alarm indicating a, b, c, and:
d. High Water Level in Separators
e. High Water Level in Receiver

Oilless Compressors complying with 4-3.1.1.9(e)1a shall include a Local Alarm indicating a, b, c, and:
f. Thermal Shutdown
g. High Water Level in Receiver (if equipped with water cooled aftercoolers or cylinders)

OffLine Compressors complying with 4-3.1.1.9(e)1b shall include a Local Alarm indicating a, b, c, and:
f. Thermal Shutdown
g. High Water Level in Receiver (if equipped with water cooled aftercoolers or cylinders)

4. The Medical Air Compressor shall activate signals at both Master alarms [ref. 4-3.1.2.1(b)2] for either:
   a. Each signal required in 3a through 3g (as required above) or
   b. Dow point (3a above) and a Compressor Fault signal activated by any of 3a through 3g (as required above)

5. The Local alarm shall be mounted in the machine room at or near the compressor site. If the facility has multiple medical air systems, each shall have a separate local alarm.

SUBSTANTIATION: This paragraph is very awkward. The proposal represents an attempt at a more coherent organization.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft
99-138 - (4-3.1.1.9(i)): Reject
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: In 1. and 2, delete: “Carbon Monoxide” and substitute in 3, second sentence, “a test for the level of carbon monoxide shall be performed at equipment startup and once annually.”

Delete 4-3.1.1.2(d)3.
In Table 4-3.4.1.4 delete “Carbon Monoxide High.”

SUBSTANTIATION: The requirement for carbon monoxide monitoring has proven very problematic and costly to implement and maintain. It is also a requirement of questionable value in light of: 1. The minuscule number of facilities actually reporting problems with persistent CO, and 2. The disputable value of the 10 ppm limit (i.e., there are no known issues at 11 ppm which do not occur at 9 ppm). To ensure safe medical air, an annual test is proposed as an allowable substitute.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-127 (Log #83) which reads as follows:

The continuous monitoring of CO is necessary for maintaining patient safety.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

Explanation of Negative:
ALLEN: The continuation of the CO monitor is not justified in light of the actual problem(s) in the field. The evidence available to the writer does not indicate that this monitor is performing a function equal to it’s cost or maintenance.

ESHERICK: See my Explanation of Negative on Proposal 99-127 (Log #83).

99-139 - (4-3.1.1.9(i)): Reject
SUBMITTER: Craig B. Williams, Hill-Rom
RECOMMENDATION: Eliminate any reference to requiring continuous monitoring of carbon monoxide levels within this document.

SUBSTANTIATION: Carbon monoxide is not an element that is made by the medical compressed air system but a contaminant brought in through the system’s fresh air intake. There is no reason to continuously monitor this contaminant over other contaminants that could also be introduced through the fresh air intake. This contaminant level along with the others must be verified during the system verification to ensure that the quality of medical air meets the requirements of USP.

COMMITTEE ACTION: Reject.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Reject.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

Explanation of Negative:
ALLEN: The continuation of the CO monitor is not justified in light of the actual problem(s) in the field. The evidence available to the writer does not indicate that this monitor is performing a function equal to it’s cost or maintenance.

ESHERICK: See my Explanation of Negative on Proposal 99-127 (Log #83).

99-140 - (4-3.1.1.9(i)): Accept
SUBMITTER: Gerald P. Austin, Rapid City Regional Hospital
RECOMMENDATION: First paragraph, following first “a-e”:
“at least one signal from the local alarm shall be connected to the two master alarm panels [4-3.1.242(b)2].”
SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: Add a new definition:

Instrument Air. For the purposes of this standard, Instrument Air is air that:

(a) Is intended for the powering of medical devices unrelated to human respiration (e.g., surgical tools, ceiling arms). Medical Air and Instrument Air are distinct systems for mutually exclusive applications.

(b) Complies with Instrument Air in ANSI/ISA S-7.0.01 1996 and

(c) Complies with the following:

1. Is filtered to 0.01 µ
2. Is free of liquids (e.g., water, hydrocarbons, solvents, etc.)
3. Is free of hydrocarbon vapors
4. Is dry to a dew point of -40 °

Add new:
4.3.1.1.10 (see Figure 4.3.1.1.10) Instrument Air. Instrument air systems shall never be interconnected with medical air systems, and shall not be used for any purpose where the air will be intentionally respired by patients or staff. 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 shall be permitted (if appropriate to the procedures) to be used in laboratories.

(a) Source.

1. Air compressors and related equipment shall be permitted to be of any type suitable for the service, capable of 200 psig (1,380 kPa) output pressure and of providing air meeting the definition of "Instrument Air" in 2.2.

2. Air compressors shall be:
   a. At least duplexed complying with 4.3.1.1.9(c) and 4.3.1.1.9(d) or
   b. Simplex and provided with a standby compressor complying with 4.3.1.1.6(a)3 with attached cylinders sufficient for one hour normal operation. Cylinders attached to the reserve header shall contain Medical Air. The reserve header shall automatically serve the system in the event of a failure of the compressor and shall enter the system upstream of the final line regulators (see Figure 4.3.1.1.10).

3. Intake air for Instrument Air Compressors may be drawn from any location appropriate to the compressor. Drawing intake air from outside in compliance with 4.3.1.1.9(b) is recommended.

4. Instrument Air Sources shall comply with 4.3.1.1.9(g) except that the final filters shall be 0.01 µ and the system shall be provided with charcoal filter(s) as described in 4.3.1.1.9(e). Sources complying with 4.3.1.1.10(a)2b shall be permitted to have a simplex aftercooler and dryer.

(b) Monitoring and Alarms.

1. Sources complying with 4.3.1.1.10(a)2a shall be provided with: an actuating switch(es) or sensor(s) to indicate when or just before the Second Compressor activates, indicating Reserve Compressor in Operation at a Local alarm and at all Master Alarms.

2. Sources complying with 4.3.1.1.10(a)2b shall be provided with:
   a. An actuating switch or sensor to indicate when or just before the reserve begins to supply the system, indicating Reserve in Use at a Local alarm and at all Master Alarms.
   b. An actuating switch or sensor to indicate when or just before the reserve falls below an average hours supply, indicating Reserve Low at a Local alarm and at all Master Alarms.

Add to Table 4.3.1.2.4:

<table>
<thead>
<tr>
<th>Gas Service</th>
<th>Abbreviated Name</th>
<th>Colors</th>
<th>Standard Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Air</td>
<td>Yellow and white</td>
<td>160 psig + 25/0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagonal Stripe/black</td>
<td>1145 kPa + 175/0</td>
<td></td>
</tr>
</tbody>
</table>

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The requirement for a high water level indicator in the receiver is only required if the compressor is a liquid ring or if the compressor has a water-cooled head.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept.


99-143 - (4.3.1.1.10, 2.2 Instrument Air (New)): TCC NOTE: Technical Correlating Committee directs the proposed definition be referred to the Technical Committee on Administration for review and action.

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Eliminate the exterior wall, pressure relief valve, and emergency piping from this figure.

SUBSTANTIATION: In 1999 a new drawing [Figure 4.3.1.1.8(h)] was included in the Standard for the emergency oxygen supply connection and any reference to this connection was supposed to be eliminated from the drawing in Figure 4.3.1.2.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept.


99-145 - (4.3.1.1.10): TCC NOTE: The Technical Correlating Committee directs the Committee to be more specific and complete in its actions.


RECOMMENDATION: Revise text as follows:

Affected paragraphs: 4.3.1.2 through 4.6.1.2.5 (Levels 1, 2, 3, and 4 affecting piping, materials, and installation).

The left column is the complete proposed text. New material is bold. Where the text is sourced in the current document, the source paragraph is listed in the right-hand column. Where the text is new, the relevant proposal is noted.
### NFPA 99 — November 2001 ROP — Copyright 2001, ROP

#### 4-3.1.2 Distribution — Level 1 (Manifold, Piping, Valving) - Level 1, 2, 3, and 4 Gas and Vacuum Piping and Materials Controls. Outlets (Terminals, Alarms). See Figure 4-3.1.2.

#### 4-3.1.2.1 General Requirements.

(a) **Oxygen Compatibility.** Components in nonflammable medical gas and vacuum systems shall be of materials that are suitable for oxygen service. (See 4-3.1.1.3, Material — Oxygen Compatibility.) Pipe (tube), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.

(b) **Cleanliness.** Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.

(c) **On-Site ReCleaning.** On-site recleaning of the interior surfaces of tubes, valves, fittings, and other components shall be limited to recleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.

#### 4-3.1.2.7 Piping Materials. The provisions of this section apply to field-installed piping for the distribution of medical piped gases and vacuum systems.

(a) Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.

(b) Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-3.1.2.1. Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

(c) **Piping shall be** ASTM B 819 specification hard drawn seamless medical gas tubing; ASTM B 819 tubing is identified by the markings “OXY,” “MED,” “OXY/MED,” “OXY/ACR,” or “ACR/MED” in green (Type K) or blue (Type L). Main and branches shall be not less than 1/2 in. nominal size for positive gases and 3/4 in. nominal for vacuum. Drops to individual outlet/inlets shall be not less than 1/2 in. nominal. Factory-installed tube on station outlets extending no further than 8 in. from the outlet body shall be permitted to be 3/8 in. O.D. (1/4 in. nominal) size. Connections to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 3/8 in. O.D. (1/8 3/8 in. nominal) size.

(d) Where seismic construction is required by the building code, piping shall be properly braced.

#### Exceptions: Vacuum System Piping.

1. **Vacuum system piping** (See 4-3.1.1.3, Material — Oxygen Compatibility.)

#### 4-3.1.2.8 Pipe Joints.

(e)* Except as provided under 4-3.1.2.7(g) and (h), joints in copper tubes shall be brazed using capillary fittings complying with ANSI B 16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings, or brazing fittings complying with MSS SP-73, Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings. Cast fittings shall not be used for brazed joints.

(f) Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

(g) Joints in medical gas tube shall be brazed except that memory-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Flared and compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system.

Exception: Threaded connections for air compressor/vacuum sets and devices such as manifolds, pressure regulators, relief valves, pressure/vacuum switches, and pressure/vacuum gauges.

(h) 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, shall be permitted to be used in lieu of brazed joints.

(i) **Threads on pipe and fittings shall be** tapered pipe threads complying with ANSI B 1.20.1, Pipe Threads, General Purpose.

(j)* Threaded Joints.

1. Threaded joints in medical gas distribution piping shall be limited to the connection of pressure/vacuum gauges, alarm pressure/vacuum switches, and similar devices.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B 1.20.1, Pipe Threads, General Purpose.

(j)* Brazed Joints.
6. Tube ends shall be inserted fully into the socket of the fitting or in accordance with socket depths required by MSS SP-75 in Table A-4.3.1.2.7(e). The use of a shallow cup fitting shall be accomplished by cutting the cup to the depth required by MSS SP-75 or with a mechanical stop meeting the required depth of MSS SP-75 and not be partial insertion of tube ends into the soldering cup fittings. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook.

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen NF to prevent the formation of copper oxide on the inside surface of the joint. An alarm signal shall alert the braze operator of insufficient purge gas. The flow of purge gas shall be maintained with the use of a flow meter and the flow maintained until the joint is cool to the touch.

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 pipeline shall be tested in accordance with 4-3.1.2.7(i) with the gas of system designation.

8. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas and to prevent debris or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

9. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

a. Flux or flux residue (BaG series rods used with dissimilar metals only)

b. Excessive oxidation of the joint, Tube or fitting melting or erosion

c. Presence of unmelted filler metal

d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube

e. Cracks in the tube or component

f. Cracks in the braze filler metal

g. Failure of the joint to hold the test pressure under 4-3.1.2.7(e) (b) and (e)

11. Brazed joints that are found to be defective under 4-3.1.2.7(b)10, conditions a, c, d, f, or g, shall be permitted to be repaired, except that no joint shall be repaired more than once. Brazed joints that are found to be defective under 4-3.1.2.7(b)10, conditions h and e, shall be replaced.

Exceptions: Level 1, 2, 3, and 4 Vacuum and WAGD Systems

1. Mechanically Formed Branch Connections. The use of drilled and extruded tee-branch connections to copper mains and branches shall be permitted. Such connections shall be made in accordance with the tool manufacturer’s instructions and the joints shall be brazed...
4-3.1.2.9 Piping Installation.

(a) Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures. Horizontal runs from all manifolds and branches shall be taken off above the center line of the pipe and rise vertically or at an angle of not more than 45 degrees from the vertical. Proposal

(b) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports — Materials, Design, and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>Maximum Support Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 in. (0.63 mm) nominal</td>
<td>5 ft (1.52 m)</td>
</tr>
<tr>
<td>5/32 in. (0.39 mm) nominal</td>
<td>6 ft (1.83 m)</td>
</tr>
<tr>
<td>3/32 in. (0.23 mm) nominal</td>
<td>6 ft (1.83 m)</td>
</tr>
<tr>
<td>1/8 in. (1.27 mm) nominal</td>
<td>7 ft (2.13 m)</td>
</tr>
<tr>
<td>5/32 in. (1.59 mm) nominal</td>
<td>8 ft (2.44 m)</td>
</tr>
<tr>
<td>1/8 in. (3.17 mm) nominal</td>
<td>9 ft (2.74 m)</td>
</tr>
<tr>
<td>3/16 in. (3.91 mm) nominal and larger</td>
<td>10 ft (3.05 m)</td>
</tr>
</tbody>
</table>

Vertical risers, all sizes: Every floor, but not to exceed 15 ft (4.57 m)

(c) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses, the minimum backfill depth for buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage during backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to allow for uniform support of the pipe. A continuous tape or marker placed immediately above the enclosure shall be clear to the owner. Ground water. Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

(d) Medical gas risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

(e) Piping shall not be installed in elevator shafts, kitchens, or electrical switchgear rooms.

(f) Medical gas piping shall be permitted to be located 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 130°F (54°C) maximum. Medical gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

(h) Hoses and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure of 1000 psig (6900 kPa gauge).

(i) Where a system originally used or constructed for use at one pressure and for a gas is converted for operation at another pressure or for another gas, all provisions of 4-3.1.2.1, 4-3.1.2.4, 4-3.1.2.8, 4-3.1.2.10, 4-3.1.2.12, 4-3.4.1, and the Exception to 4-3.1.2.7(c) shall apply as if the system were new. Vacuum systems shall never be converted for use as gas systems.

4-3.2.2.2 Installation Requirements.

(a) Equipment and Component Installation.

1. The installation of individual components shall be made in accordance with the instructions of the manufacturer. Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper installation, testing, maintenance, and operation of the medical gas systems. These instructions shall be left with the owner.

2. The installation shall be made by qualified, competent technicians experienced in making such installations. (See 4-3.1.2.12 for brazed performance.)

3. Brazing shall be performed by individuals who are qualified under the provisions of 4-3.1.2.12.

(b) Health care organization personnel shall be permitted to install piping systems if all the requirements of Section 4-3 are met during installation.

(c) The installer of medical gas piping and equipment shall maintain on the job site documentation regarding the qualification of brazing procedures and individual brazers per 4-3.1.2.12 prior to installation.

(d) Two or more medical gas piping systems shall not be interconnected or testing or for any other reason. Leak testing shall be accomplished by separately charging and testing the individual piping system.

4-3.1.2.11 Systems Having Nonstandard Operating Pressures. The following requirements apply to gas piping systems having an operating pressure other than the standard 50 to 55 psig (345 to 380 kPa) [or 160 psig (1105 kPa) for nitrogen], and are in addition to the minimum requirements listed in 4-3.1.2.3 through 4-3.1.2.9.
(a) Pipelines, shut-off valves, and station outlets in systems having nonstandard operating pressures shall be labeled for gas name and operating pressure.

(b) Where operating pressures are 200 to 300 psig (1380 to 2068 kPa), the following applies:

1. Only Type K medical gas tube (ASTM B819) shall be used. (Under 4-3.1.2.7, Exception)

2. Brazing procedures and brazers shall be qualified as required under 4-3.1.2.12.

(c) Station outlets in systems having nonstandard operating pressures shall meet the following additional requirements:

1. Be gas-specific.

2. Be pressure-specific where a single gas is piped at more than one operating pressure [e.g., a station outlet for oxygen, 80 psig (550 kPa) shall not accept an adapter for oxygen, 5 psig (345 kPa)].

3. If operated at a pressure above 80 psig (550 kPa) but below 200 psig (1380 kPa), be either DISS style or comply with 4-3.1.2.4.

4. If operated at a pressure between 200 and 300 psig (1380 to 2068 kPa), 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. Be labeled for the gas name and operating pressure [e.g., nitrogen, 250 psig (1725 kPa)].

(d) Testing. When systems operated at different pressures are installed, each pipeline shall be tested separately.

4-3.1.2.12 Qualification of Brazing Procedures and Brazer Performance. Brazing procedures and brazer performance shall be qualified 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.

(a) Brazers shall be qualified by visual examination of the test coupon followed by sectioning except that a tension test shall be permitted to be substituted for sectioning. Where tension tests are used for brazer qualification, they shall be performed in accordance with ASME IX. Proposal

(b) The Brazing Procedure Specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

(c) The Brazing Procedure Qualification Record and the Record of Brazer Performance Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate used during brazing of the test coupon, and no internal oxidation exhibited on the completed test coupon.

(d) Brazing procedures qualified by a technically competent group or agency are permitted under the following conditions:

1. The Brazing Procedure Specification and the Procedure Qualification Record shall meet the requirements of this standard.

2. The employer shall obtain a copy of both the Brazing Procedure Specification and the supporting qualification records from the group or agency and shall sign and date these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.

3. The employer shall qualify at least one brazer following each Brazing Procedure Specification used.

(e) An employer shall be permitted to accept Brazer Qualification Records of a previous employer under the following conditions:

1. The brazer shall have been qualified following the same or an equivalent procedure as that which he/she will use for the new employer.

2. The new employer shall obtain a copy of the record of Brazer Performance Qualification tests from the previous employer and shall sign and date these records, thereby accepting responsibility for the qualifications performed by the previous employer.

(f) Performance qualification of brazers shall remain in effect indefinitely unless the brazer does not braze with the qualified procedure for a period exceeding 12 months, or there is a specific reason to question the ability of the brazer.

4-3.1.2.13 Labeling. The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where supplementary color identification of piping is used, it shall be in accordance with the gases and colors indicated in CGA Pamphlet C9, Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use. Only those systems operating at nonstandard pressures shall be labeled with the name of the gas and the operating pressure.

4-3.1.2.7 Vacuum System Piping Network.

(a) Vacuum Network Piping. Piping shall be corrosion-resistant metal such as seamless copper water tube (ASTM B88, Type K, L, M), copper ACR tube (ASTM B280), copper medical gas tube (ASTM B819), steel pipe (ASTM A53), pipe threads shall comply with ANSI B1.20.1, Pipe Threads, General Purpose. Copper tube shall be hard-drawn temper except that annealed tube shall be permitted underground. Joints in copper tube shall be soldered or brazed. Joints in stainless steel tube shall be brazed or welded. Joints in galvanized steel pipe shall be threaded or flanged. Soldering shall be performed in accordance with ASTM B28, Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings. Solder metal (ASTM B29) shall contain less than 0.2 percent lead. Brazing shall be in accordance with 4-3.1.2.12(e) except that nitrogen purging while brazing shall not be required.

Included in 4-3.1.2.7
Installation of Vacuum System Piping

(a) General. The provisions of this section shall apply to field-installed piping for vacuum systems.

(b) Materials and Joints. Piping materials and joining methods shall be in accordance with 4-3.2.2.3.

(c) Open Ends. Care shall be taken to maintain the interior of the piping system free of debris or other foreign matter. Pipe, tubing, and fittings shall be inspected visually prior to installation. During installation, pipe ends shall be temporarily sealed. Cleaning shall be performed to remove any residue and permit visual inspection of the joint.

(d) Fitting. Where flux is used for soldered or brazed joints, it shall be used sparingly to avoid excess flux inside the finished joint.

(e) Cleaning. After soldering or brazing, the outside of all joints shall be cleaned by washing with hot water and a suitable cleaning agent to remove any residue and permit visual inspection of the joint. If flux has been used, joints shall be washed with hot water.

(f) Visual Inspection. Each soldered or brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

1. Flux or flux residue
2. Excessive oxidation of the joint
3. Presence of unmelted solder or brazing filler metal
4. Cracks in the tube or component

If copper vacuum piping is installed along with any medical gas piping, either the vacuum piping or the medical gas piping shall, prior to installation, be prominently labeled or otherwise identified to prevent the use of material or installation procedures in the medical gas system that are not suitable for oxygen service. If medical gas tubing (ASTM B819) with brazed joints is used for the vacuum piping, such special marking shall not be required, provided that the vacuum piping installation meets all requirements for medical gas piping, including the prohibition of flux on copper to copper joints and the use of a nitrogen purge while brazing.

(e) Minimum Size. Mains and branches shall be not less than \( \frac{3}{8} \) in. O.D. (\( \frac{1}{8} \) in. nominal). Drops to individual vacuum inlets shall be not less than \( \frac{1}{8} \) in. O.D. (\( \frac{1}{8} \) in. nominal) size (0.250 in. minimum inside diameter), except that the tube attached immediately to the station inlet body and not extending more than 8 in. (20.3 cm) from the station inlet shall be permitted to be \( \frac{1}{4} \) in. O.D. (\( \frac{3}{8} \) in. nominal) size (0.375 in. minimum inside diameter). Connections to gauges and alarm switches and conduits and alarm panels shall be permitted to be \( \frac{1}{4} \) in. O.D. (\( \frac{3}{8} \) in. nominal) size.

(f) Support. Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Pipe Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports — Materials, Design, and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:

1. Membrane-coupling providing joints equivalent to a soldered or brazed joint shall be permitted.
2. Union, flare nut, and similar straight-threaded connections shall be permitted only in exposed locations and shall not be concealed in walls or ceilings.
3. Protection. Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected. Piping embedded in concrete floors or walls shall be installed in a continuous conduit.

4. Underground Piping. Piping shall be protected against freezing, corrosion, and physical damage. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The minimum backfill cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 24 in. (61.0 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of buried underground piping within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

5. Penetration. Where piping penetrates fire barriers such as walls, partitions, or ceiling/floor assemblies having fire resistance ratings, the penetration shall be protected in accordance with the requirements of NFPA 101, Life Safety Code, and the applicable building codes.

6. Conversion. Vacuum piping systems shall not be converted for use as a pressurized gas system.
5. Failure of the solder or brazed filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
6. Failure of the solder or brazed filler metal
7. Failure of the joint to hold the test pressure under 4-3.2.2.11(f)7 shall be permitted to be repaired, except that no joint shall be repaired more than twice.

6. Cracks in the solder or brazed filler metal

7. Failure of the joint to hold the test pressure under 4-3.2.2.11(f)2 or 5 shall be replaced.

8. Printed codes or color codes shall be visible in or above each room or area. Flow arrows (if used) shall point from the station outlets toward the receiver or pump.

4.3.1.2.7  Gas Piping.

4.3.1.2.7  Gas Piping. The provisions of this section apply to field-installed piping for the distribution of nonflammable medical piped gases.

1. Valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.

2. Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-5.1.2.10(a)3. Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

3. Piping shall be ASTM B 619 specification hard-drawn seamless medical gas tubing. ASTM B 619 tubing is identified by the marking “OXY-MED” or “OXY-LAC” or “MED” (Type K) or blue (Type L). Main and branches shall not be less than 1/2 in. nominal size. Factory-installed tube on station outlets extending no farther than 8 in. from the outlet body shall be permitted to be 1/4 in. O.D. (1/2 in. nominal size). Connection to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/2 in. nominal size).

4. Except as provided under 4-5.1.2.10(a)8 and 9, joints in copper tubes shall be brazed using capillary fittings complying with ANSI B16.22, “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings,” or brazing complying with MSS SP-75, “Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings.” Cast fittings shall not be used for brazed joints.

5. Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, “Cleaning Equipment for Oxygen Service,” except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

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

7. Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-60, “Piping Hangers and Supports: Selection and Application.” Hangers and supports shall comply with MSS Standard Practice SP-60, “Piping Hangers and Supports: Materials, Design and Manufacture.” Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:

8. Junctions in medical gas tube shall be brazed except that metal-to-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution piping system.

9. 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 shall be permitted to be used in lieu of brazed joints.

10. Turnouts, offsets, and other changes in direction in piping shall be made with fittings complying with 4-5.1.2.10(a)4.
### Copper Tube Joints

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Joints to be brazed shall be in place all accessible for proper preparation, assembly, heating, application, cooling, cleaning, and inspection. The ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips coming into the tube or pipe.</td>
</tr>
<tr>
<td>4.</td>
<td>The surfaces to be brazed shall be mechanically cleaned using a clean stainless steel wire brush or equivalent. The use of steel wool shall be prohibited due to the possible presence of oil. Mechanical cleaning shall not result in gouging of the surface to be joined. After mechanical cleaning, the surface shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the cleaned item for oxygen internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.</td>
</tr>
<tr>
<td>5.</td>
<td>Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the noncopper component and the interior of the subassembly shall be cleaned of flux prior to installation in the piping system. Flux-coated brazing rods shall be permitted to be used in lieu of the application of flux to the surfaces to be joined on tube and pipe.</td>
</tr>
<tr>
<td>6.</td>
<td>Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquified. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. Techniques shall be used to place the joint applying the brazing filler metal, and making horizontal, vertical, and large-diameter joints shall be covered in sections on “Applying Heat and Brazing” and “Horizontal and Vertical Joints” in the chapter on “Joining and Bending” in the CDA Copper Tube Handbook.</td>
</tr>
<tr>
<td>7.</td>
<td>While being brazed, joints shall be covered with oil-free dry nitrogen to prevent the formation of copper oxide on the inside surface of the joint. The flow of purge gas shall be maintained until the joint is cool to the touch.</td>
</tr>
</tbody>
</table>

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1. Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stress. The minimum backfilled cover of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of bury. Where underground piping is installed through a wall or floor, the ends of the joint shall be sealed to prevent the entrance of ground water. Piping underground within buildings or imbedded in concrete floors or walls shall be installed in a continuous conduit. |

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

3. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-5.1.2.10(h). Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metal, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer's instructions.

4. Dissimilar metals, such as copper and bronze or brass, shall be brazed using a copper-phosphorus or copper-phosphorus-silver brazing filler metal (BCuP series) without flux.

5. Mechanical cleaning shall not result in gouging of the surface to be joined. After mechanical cleaning, the surface shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the cleaned item for oxygen internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.

6. Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. The cutting wheel shall be free from grease, oil, or other lubricant not suitable for oxygen service. The cut ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe. The surfaces to be brazed shall be mechanically cleaned using a clean stainless steel wire brush or equivalent. The use of steel wool shall be prohibited due to the possible presence of oil. Mechanical cleaning shall not result in gouging of the surface to be joined. After mechanical cleaning, the surface shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the cleaned item for oxygen internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.
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 pipeline shall be tested in accordance with 4-5.4.1.3 with the gas of system designation.

4-5.1.3  Distribution for Gas-Powered Devices — Level 3.

Piping shall be cleaned and degreased in accordance with 4-5.4.1. To preclude inadvertent inclusion in a nonflammable medical gas piping system, or the Level 3 system when the Level 3 system dynamic gas piping is installed simultaneously with other patient gas piping systems, the Level 3 system piping shall be labeled or otherwise identified prior to installation in order to preclude inadvertent inclusion in a nonflammable medical gas piping system, or the Level 3 system piping shall be cleaned and degreased in accordance with 4-5.4.1.

Table: Threaded Joints

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Flux or flux residue</td>
<td>No</td>
</tr>
<tr>
<td>b. Excessive oxidation of the joint</td>
<td>Yes</td>
</tr>
<tr>
<td>c. Presence of unmelted filler metal</td>
<td>Yes</td>
</tr>
<tr>
<td>d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube</td>
<td>No</td>
</tr>
<tr>
<td>e. Cracks in the tube or component</td>
<td>No</td>
</tr>
<tr>
<td>f. Cracks in the brass filler metal</td>
<td>No</td>
</tr>
<tr>
<td>g. Failure of the joint to hold the test pressure under 4-5.1.9</td>
<td>No</td>
</tr>
</tbody>
</table>

11. Brazed joints that are found to be defective under 4-5.1.2.10(b)10 conditions a, c, d, f, or g, shall be permitted to be repaired, except that no joint shall be repaired more than once. Brazed joints that are found to be defective under 4-5.1.2.10(b)10, conditions b and e, shall be replaced.

4-5.1.2.10(b)10

c. Presence of unmelted filler metal

d. Underfilling

e. Cracks in the tube or component

Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

f. Filler metal that is fused to one side only

g. Presence of unmelted filler metal

During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas while brazing and to prevent debris or other contaminants from entering the system. Except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

9. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

a. Flux or flux residue
b. Excessive oxidation of the joint
c. Presence of unmelted filler metal

d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube

e. Cracks in the tube or component
f. Cracks in the brass filler metal

g. Failure of the joint to hold the test pressure under 4-5.1.9

11. Brazed joints that are found to be defective under 4-5.1.2.10(b)10 conditions a, c, d, f, or g, shall be permitted to be repaired, except that no joint shall be repaired more than once. Brazed joints that are found to be defective under 4-5.1.2.10(b)10, conditions b and e, shall be replaced.

4-5.1.2.10(b)10

c. Presence of unmelted filler metal

d. Underfilling

e. Cracks in the tube or component

Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

f. Filler metal that is fused to one side only

g. Presence of unmelted filler metal

After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B1.20.1, "Pipe Threads: General Purpose.

3. Threaded joints in piping systems shall be made up with polytetrafluoroethylene (such as Teflon®) tape or other thread sealant suitable for oxygen service. Sealants shall be applied to the male threads only.

4-5.1.3  Distribution for Gas-Powered Devices — Level 3.

1. Threaded joints in medical gas distribution piping shall be limited to the connection of pressure gauges, alarm pressure switches, and similar devices.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B1.20.1, "Pipe Threads: General Purpose.

3. Threaded joints in piping systems shall be made up with polytetrafluoroethylene (such as Teflon®) tape or other thread sealant suitable for oxygen service. Sealants shall be applied to the male threads only.


1. The installation of individual components shall be in accordance with the instructions of the manufacturer. Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper installation, testing, maintenance, and operation of the medical gas systems. These instructions shall be left with the owner.

2. The installation shall be made by qualified, competent technicians experienced in making such installations.

(a) Prohibited Interconnections. Two or more medical gas piping systems shall not be interconnected for testing or for any other reason. Leak testing shall be accomplished by separately changing and testing the individual piping system.

(b) Fittings. Fittings shall be manufactured from metallic corrosion-resistant materials suitable for the system pressures (not to exceed 160 psig [1103 kPa]).

(c) Connection and Joints. Connectors and joints shall be brazed or threaded NPT.


1. Oxygen Compatibility. Components in nonflammable medical gas systems shall be of materials that are suitable for oxygen service. (See 4-3.1.1.3, Material — Oxygen Compatibility.) Pipe (tubing), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.

2. Cleanliness. Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.

3. On-Site Cleaning. On-site cleaning of the interior surfaces of tubes, valves, fittings, and other components shall be limited to reconditioning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.
(b) Fittings shall be manufactured from corrosion-resistant materials suitable for the system pressures (not to exceed 160 psig (1103 kPa)).

(c) Connectors and joints shall be brazed or threaded NPT.

(d) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Support — Materials, Design and Manufacture.

(e) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The minimum backfilled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of bury. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping underground within buildings or imbedded in concrete floors or walls shall be installed in a continuous conduit.

(f) Gas piping shall be permitted to be located 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 130°F (54°C) maximum. Gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

### SUBSTANTIATION:

This is an attempt to meld the vacuum and positive gas piping systems. NFPA eliminated the vacuum subcommittee a number of years ago with the intention of bringing two sections into one document. This is just a continued effort to accomplish this goal.

### COMMITTEE ACTION:

Accept in Principle.

Revise the proposal as follows:

Affected Paragraphs: 4-3.1.2 through 4-6.1.2.5 (Level 1, 2, 3, and 4 affecting piping, materials and installation). This is an attempt to meld the vacuum and positive gas piping systems. NFPA eliminated the vacuum subcommittee a number of years ago with the intention of bringing the two sections into one document. This is just a continued effort to accomplish this goal.

The Left Column is the complete proposed text. New material is

**Bold.** Where the text is sourced in the current document, the source paragraph is listed in the right-hand column. Where the text is new, the relevant proposal is noted.
### 4-3.1.2 Distribution — Level 1, 2, 3, and 4 Gas and Vacuum

#### Piping and Materials Controls, Outlets/Terminals, Alarms)

**4-3.1.2.1 General Requirements.**

- **(a) Oxygen Compatibility.** Components in nonflammable medical gas and vacuum systems shall be of materials that are suitable for oxygen service. *(See 4-3.1.1.3, Material — Oxygen Compatibility.)*

  - Pipe (tube), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.
  - Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.

- **(b) Cleaning.** Materials that have been cleaned for use in medical gas piping systems shall be thoroughly scrubbed and rinsed with clean, hot alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot water.

- **(c) On-Site Reclining.** On-site reclining of the interior surfaces of tube ends, valves, fittings, and other components shall be limited to reclining surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.

- **(d) Pressure Gauges for Gases.** The scale range of positive pressure analog gauges shall be such that the normal reading falls within the middle 50 percent of the scale. The scale range of digital gauges shall be not more than two times the working pressure. The rated accuracy of pressure gauges used for testing shall be one percent (full scale) or better at the point of reading. Pressure gauges shall be in compliance with ANSI/ASME B-40.1, Gauges, Pressure Indicating Dial-Type, Elastic Elements.

  - 1.* A pressure gauge shall be installed in the main line adjacent to the actuating switch required in 4-3.1.2.2(b)(b). It shall be appropriately labeled and shall be readily visible from a standing position.

  - 2.* An appropriately identified pressure gauge, connected to the line being monitored, shall be installed at each area alarm panel location. It shall be appropriately labeled and shall be readily visible from a standing position.

- **(e) Vacuum System Gauges.**

  - **(a) Main-Line Gauge.** A vacuum gauge shall be provided in the main vacuum line adjacent to the actuator (vacuum switch) for the master alarms, with this gauge located immediately upstream (on the terminal or inlet side) terminal or inlet of the source valve (the main line valve, if so equipped). Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).

  - **(b) Area Gauge.** Vacuum gauges shall be located at each area vacuum alarm signal location, with this gauge connected upstream (on the terminal or inlet side) of any valve controlling that area. Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).

  - **(c) Vacuum Gauge Identification.** All permanently installed vacuum gauges and manometers for the vacuum system shall be continuous reading, manufactured expressly for vacuum, and labeled: VACUUM.

#### Piping Materials

**4-3.1.2.7(b) Piping Materials, Controls, Outlets/Terminals, Alarms.** See Figure 4-3.1.2.

- **(a) Copper Alloy Solder Joints Pressure Fittings.**

  - Connecting tubing for gauges and alarm switches and runouts to alarm panels extending no further than 8 in. from the outlet body shall be permitted to be 1/2 in. O.D. (3/8 in. nominal) size. Connecting tubing for gauges and alarm switches and runouts to alarm panels extending no further than 8 in. from the outlet body shall be permitted to be 1/2 in. O.D. (3/8 in. nominal) size.

- **(b) Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-3.1.2.2.** Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

  - **(c) Piping shall be ASTM B 819 specification hard drawn seamless medical gas tubing; ASTM B 819 tubing is identified by the markings “OXY,” “MED,” “OXY/MED,” “OXY/ACR,” or “ACR/MED” in blue (Type L).** Main and branches shall be not less than 1/2 in. nominal size for positive gases and 3/4 in. nominal for vacuum. Drops to individual outlet/inlets shall be not less than 1/2 in. nominal. Factory-installed tube on station outlets extending no further than 8 in. from the outlet body shall be permitted to be 1/2 in. O.D. (3/8 in. nominal) size. Connecting tubing for gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/2 in. O.D. (1/4 in. nominal) size.

  - **(d) Where seismic construction is required by the building code, piping shall be properly braced.**

  - **(e) Except as provided under 4-3.1.2.7(g) and (h), joints in copper tubes shall be brazed using capillary fittings complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings, or brazing fittings complying with MSS SP-73, Brazing Fittings for Wrought and Cast Copper Alloy Solder Joints Pressure Fittings. Cast fittings shall not be used for brazed joints.**

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*AIP Log #229
AIP Log #62
4-3.1.2.7(c)
4-3.1.2.7(d)
(f) Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

(g) Joints in medical gas tube shall be brazed except that memory-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Flared and compression fittings shall be prohibited throughout the piping system, including connections to station outlet/inlet alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system.

**Exception:**
1. Threaded connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges.

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 shall be permitted to be used in lieu of brazed joints.

3. Turns, offsets, and other changes in direction in piping shall be made with fittings complying with 4-3.1.2.7(e).

### Vacuum System Piping

1. Seamless copper water tube (ASTM B88), Type K,L,M copper ACR tube, (ASTM B280), or (ASTM B819) medical gas tube shall be permitted to be used.

2. Soft annealed copper tubing (ASTM B88) shall be permitted underground.

**Exception: Nonstandard Operating Pressure Systems**

1. Where operating pressures are $200$ to $300$ psig (1380 to 2068) above $185$ psig (1,276 kPa) only Type K medical gas tube (ASTM B819) shall be used for piping larger than 3 1/8 in. O.D. (3 in. nominal).

### 4-3.1.2.8 Pipe Joints.

**Threaded Joints.**

1. Threaded joints in medical gas distribution piping shall be limited to the connection of pressure/vacuum gauges, alarm pressure/vacuum switches, and similar devices.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B1.20.1, Pipe Threads, General Purpose.

3. Threaded joints in piping systems shall be made up with polytetrafluoroethylene (such as Teflon™) tape or other thread sealant suitable for oxygen service. Sealants shall be applied to the male threads only.

**Brazed Joints.**

1. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-3.1.2.8(b)1b. Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metals except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer’s instructions.

   - Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorous-silver brazing filler metal (BCuP series) without flux.
   - Dissimilar metals, such as copper and bronze or brass, shall be brazed using an appropriate flux with a silver (BAg series) brazing filler metal.

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

   - Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. The cutting wheel shall be free from grease, oil, or other lubricant not suitable for oxygen service. The cut ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe.

   - The fitting surfaces to be brazed shall be pre-cleaned by the manufacturer and the tube ends to be brazed shall be cleaned with a non-abrasive pad. The use of steel wool shall be prohibited due to the possible presence of oil. Mechanical cleaning shall not result in grooving of the surfaces to be joined. After mechanical cleaning, the surfaces shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the “cleaned for oxygen” internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.
5. Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the non-copper component and the interior of the sub-assembly shall be cleaned of flux prior to installation in the piping system. Flux-coated brazing rods shall be permitted to be used in lieu of the application of flux to the surfaces to be joined on tube 3/4 in. nominal size and smaller. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook. AIP Log #64

6. Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook. AIP Log #64

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen NF to prevent the formation of copper oxide on the inside surface of the joint. The purge gas shall be monitored and audibly alert the brazer of low content of purge gas. The flow of purge gas shall be maintained with the use of a flow meter until the joint is cool to the touch. Accept Log #52

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 pipeline shall be tested in accordance with 4-3.4.1.3(a). Twenty-five percent of the existing zones downstream from the connection shall be tested for particulate matter in accordance with the piping purge test in 4-3.4.1.3(e) with using the gas of system designation. AIP Log #230

8. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas while brazing and to prevent debris or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube. AIP Log #93

9. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used. AIP Log #291

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:
   a. Flux or flux residue (BAG series rods used with dissimilar metals only)
   b. Excessive oxidation of the joint. Tube or fitting melting or erosion
   c. Presence of unmelted filler metal
   d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
   e. Cracks in the tube or component
   f. Cracks in the brazing filler metal
   g. Failure of the joint to hold the test pressure under 4-3.4.1.2(e), (b) and (e)

   11. Brazed joints that are found to be defective under 4-3.1.2.8(b)10, conditions a, c, d, f, or g, shall be permitted to be repaired and reheated, except that no joint shall be repaired more than once before being replaced. Brazed joints that are found to be defective under 4-3.1.2.8(b)10, conditions b and e, shall be replaced. Accept Log #231

**Exceptions: Level 1 and 2 Vacuum and WAGD Systems**

1. Mechanically Formed Branch Connections. The use of drilled and extruded tee-branch connections to copper mains and branches shall be permitted. Such connections shall be made in accordance with the tool manufacturer’s instructions and the joints shall be brazed. 4-3.2.2.2(f)

2. Unions, flare nuts, and similar straight-threaded connections shall be permitted only in exposed locations and shall not be concealed in walls or ceilings. 4-3.2.2.2(h)

4-3.1.2.9 Piping Installation.

(a) Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures. Horizontal runouts from all mains and branches shall be taken off above the center line of the pipe and rise vertically or at an angle of not more than 45° from the vertical. Accept Log #231

(b) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports — Materials, Design and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows.
<table>
<thead>
<tr>
<th>Diameter (Nominal)</th>
<th>Vertical Riser Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 in. (0.635 cm) nominal</td>
<td>5 ft (1.52 m)</td>
</tr>
<tr>
<td>3/8 in. (0.953 cm) nominal</td>
<td>6 ft (1.83 m)</td>
</tr>
<tr>
<td>1/2 in. (1.27 cm) nominal</td>
<td>6 ft (1.83 m)</td>
</tr>
<tr>
<td>3/4 in. (1.91 cm) nominal</td>
<td>7 ft (2.13 m)</td>
</tr>
<tr>
<td>1 in. (2.54 cm) nominal</td>
<td>8 ft (2.44 m)</td>
</tr>
<tr>
<td>1 1/4 in. (3.175 cm) nominal</td>
<td>9 ft (2.74 m)</td>
</tr>
<tr>
<td>1 1/2 in. (3.81 cm) nominal</td>
<td>10 ft (3.05 m) and larger</td>
</tr>
</tbody>
</table>

(c) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The minimum backfilled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench.

Underground piping shall be installed in a continuous enclosure to protect the pipe from damage during backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of bury. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

(d) Medical gas risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

(e) Piping shall not be installed in elevator shafts, kitchens or electrical switch gear rooms.

(f) Medical gas piping shall be permitted to be located 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 130°F (54°C) maximum. Medical gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

(h) Hoses 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. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure of 1000 psig (6900 kPa gauge).

(i) Where a system originally used or constructed for use at one pressure and for a gas is converted for operation at another pressure or for another gas, all provisions of 4-3.1.2.10* Installation Requirements, Exhisting hold.

4-3.1.2.10* Installation Requirements.

(a) Equipment and Component Installation.

1. The installation of individual components shall be made in accordance with the instructions of the manufacturer. Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper installation, testing, maintenance, and operation of the medical gas systems. These instructions shall be left with the owner.

2. The installation shall be made by qualified, competent technicians experienced in making such installations and meeting the requirements of ANSI/ASSE Series 6000, Standard 6010. (See 4-3.1.2.12 for brazer performance.)

3. Brazing shall be performed by individuals who are qualified under the provisions of 4-3.1.2.12.

(b) Health care organization personnel shall be permitted to install piping systems if all the requirements of Section 4 are met during installation.

(c) The installer of medical gas piping and equipment shall maintain on the job site documentation the qualification of brazing procedures and individual brazers per 4-3.1.2.12 prior to installation.

(d) Two or more medical gas piping systems shall not be interconnected for testing or for any other reason. Leak testing shall be accomplished by separately charging and testing the individual piping system.
4-3.1.2.11 Systems Having Nonstandard Operating Pressures. The following requirements apply
to gas piping systems having an operating pressure other than the standard 50 to 55 psig (345 to
380 kPa) [or 160 psig (1103 kPa) for nitrogen], and are in addition to the minimum
requirements listed in 4-3.1.2.3 through 4-3.1.2.9.
(a) Pipelines, shutoff valves, and station outlets in systems having nonstandard operating
pressures shall be labeled for gas name and operating pressure.

(b) Where operating pressures are 200 to 300 above 185 psig (1380 to 2068
1276 kPa), the
following applies:
1. Only Type K medical gas tubing (ASTM B819) shall be used.
Proposal (sent 6/30 not in
ROP's)
2. Brazing procedures and brazers shall be qualified as required under 4-3.1.2.12.

(c) Station outlets in systems having nonstandard operating pressures shall meet the following
additional requirements:
1. Be gas-specific
2. Be pressure-specific where a single gas is piped at more than one operating pressure [e.g.,
a station outlet for oxygen, 80 psig (550 kPa) shall not accept an adapter for oxygen, 50 psig (345
kPa)]
3. If operated at a pressure above 80 psig (550 kPa) but below 200 185 psig (1380 1276 kPa),
be either DISS style or comply with 4-3.1.2.4
AIP Log #48
4. If operated at a pressure between 200 and 300 psig (1380 to 2068 above 185 psig (1276
kPa), 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. Be labeled for the gas name and operating pressure [e.g., nitrogen, 250 psig (1725 kPa)]

(d) Testing. When systems operated at different pressures are installed, each pipeline shall be
tested separately.

4-3.1.2.12 Qualification of Brazing Procedures and Brazer Performance. Brazing procedures and
brazer performance shall be qualified 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.

(a) Brazers shall be qualified by visual examination of the test coupon followed by sectioning
except that a tension test shall be permitted to be substituted for sectioning. Where tension tests
are used for brazer qualification, they shall be performed in accordance with ASME IX.
Accept Log #56
(b) The Brazing Procedure Specification shall address cleaning, joint clearance, overlap,
internal purge gas, purge gas flow rate, and filler metal.
(c) The Brazing Procedure Qualification Record and the Record of Brazer Performance
Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge
gas and flow rate used during brazing of the test coupon, and no internal oxidation exhibited on
the completed test coupon.
(d) Brazing procedures qualified by a technically competent group or agency are permitted
under the following conditions:
1. The Brazing Procedure Specification and the Procedure Qualification Record shall meet
the requirements of this standard.
2. The employer shall obtain a copy of both the Brazing Procedure Specification and the
supporting qualification records from the group or agency and shall sign and date these records,
thereby accepting responsibility for the qualifications that were performed by the group or
agency.
3. The employer shall qualify at least one brazer following each Brazing Procedure
Specification used.
(e) An employer shall be permitted to accept Brazer Qualification Records of a previous
employer under the following conditions:
1. The brazer shall have been qualified following the same or an equivalent procedure as
that which he/she will use for the new employer.
2. The new employer shall obtain a copy of the record of Brazer Performance Qualification
tests from the previous employer and shall sign and date these records, thereby accepting
responsibility for the qualifications performed by the previous employer.
(f) Performance qualification of brazers shall remain in effect indefinitely unless the brazer
does not braze with the qualified procedure for a period exceeding 12 months, or there is a
specific reason to question the ability of the brazer.

4-3.1.2.13 Labeling. The gas content of medical gas piping systems shall be readily identifiable by
appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by
means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily
removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at
least once in each room and each story traversed by the piping system. Where supplementary
color identification of piping if used, it shall be in accordance with the gases and colors indicated
in CGA Pamphlet G9, Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use.
Only those systems operating at nonstandard pressures shall be labeled with the name of the gas
and the operating pressure.
### 4-5.1.2.10 Gas Piping

- **Gas Piping.** The provisions of this section apply to field installed piping for the distribution of nonflammable medical piped gases.

1. Tubing, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.

2. Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-5.1.2.10(a). Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

3. Piping shall be ASTM B 819 specification hard drawn seamless medical gas tubing; ASTM B 819 tubing is identified by the markings “OXY,” “MED,” “OXY/MED,” “OXY/ACR,” or “ACR/MED” in green (Type K) or blue (Type L). Main and branches shall not be less than 1/2 in. nominal size. Factory-installed tube on station outlets extending no farther than 8 in. from the outlet body shall be permitted to be 3/8 in. O.D. (1/4 in. nominal) size. Connection to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/8 in. nominal) size.

**Exception:** For systems operated at pressures between 200 and 300 psig (1380 and 2070 kPa, respectively), ASTM B 819, Type K copper shall be used.

Copper tube shall, wherever possible, be installed over-head or below floor level. Only where the installation requires installing in a slab, exceptions below are permitted to apply:

1. Annealed (soft temper) ASTM B 88 (Type K or L) copper tube that has been prepared for oxygen service according to CGA Pamphlet G-4.1, *Cleaning Equipment for Oxygen Service,* shall be permitted to be used up to 1/2 in. O.D. (3/8 in. nominal) size.

2. The tube shall be installed in conduit sufficiently large to accept the following gases (if used): O2, N2 O, N2, MA, DA, Level 3 vacuum.

3. The pipe shall be a continuous run from entry to exit of the conduit. PVC conduit shall be permitted for Level 3 vacuum only.

4. All station outlets (inlets) shall be permitted to be completed after the slab is complete.

5. All tests shall be completed per 4-5.4.1.2.

4. Except as provided under 4-5.1.2.10(a)8 and 9, joints in copper tubes shall be brazed using capillary fittings complying with ANSI B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings,* or brazing fittings complying with MSS SP-73, *Brazing Joints for Wrought and Cast Copper Alloy Solder-Joint Pressure Fittings.* Cast fittings shall not be used for brazed joints. **Exception:** Flared connections shall be permitted where exposed at station outlets and manifold connections.

5. Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, *Cleaning Equipment for Oxygen Service,* except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

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

7. Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, *Piping Hangers and Supports—Selection and Application.* Hangers and supports shall comply with MSS Standard Practice SP-69, *Pipe Hangers and Supports—Materials, Design and Manufacture.* Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:

8. Joints in medical gas tube shall be brazed except that memory metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system. **Exception:** Threaded connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges.

9. 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 shall be permitted to be used in lieu of brazed joints.

10. Turns, offsets, and other changes in direction in piping shall be made with fittings complying with 4-5.1.2.10(a)4.
11. Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from damage while backfilling. The depth for back-filled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to prevent and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one half the depth of burial. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping underground within buildings or imbedded in concrete floors or walls shall be installed in a continuous conduit.

12. Medical gas lines shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

13. Piping shall not be installed in kitchens or electrical switch gear rooms.

14. Medical gas piping shall be permitted to be located 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 130°F (54°C) maximum. Medical gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

15. Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

16. Where a system originally used or constructed for use at one pressure and for another gas, all provisions of 4-5.1.2.10(b), 4-5.4, and the Exception to 4-5.1.2.10(c) shall apply as if the system were new. vacuum systems shall never be converted for use as gas systems.

17. Brazed Joints

1. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-5.1.2.10(b)1b. Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metal, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer's instructions.

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

b. Dissimilar metals, such as copper and bronze or brass, shall be brazed using an appropriate flux with a silver (Bag series) brazing filler metal.

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

3. Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. The cutting wheel shall be free from grease, oil, or other lubricant not suitable for oxygen service. The cut ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe.

4. The surface to be brazed shall be mechanically cleaned using a clean stainless steel wire brush or equivalent. Mechanical cleaning shall not result in grooving of the surfaces to be joined. After mechanical cleaning, the surfaces shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the cleaned surface for oxygen internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.

5. Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the non-copper component and the interior of the subassembly shall be thoroughly cleaned. Filler metals shall be permitted to be used in lieu of the application of flux to the surface to be joined on tube 3/4 in. nominal size and smaller.

6. Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook.

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen to prevent the formation of copper oxide on the inside surface of the joint. The flow of purge gas shall be maintained until the joint is cool to the touch.
### General Requirements

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1.1</td>
<td>Oxygen Compatibility. Components in nonflammable medical gas systems shall be of materials that are suitable for oxygen service. (See 4.3.1.3, Material – Oxygen Compatibility.) Pipe (tube), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.</td>
</tr>
<tr>
<td>4.3.1.2</td>
<td>Cleanliness. Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.</td>
</tr>
<tr>
<td>4.5.1.3</td>
<td>Distribution for Gas-Powered Devices — Level 3.</td>
</tr>
</tbody>
</table>
COMMITTEE STATEMENT: The revised proposal incorporated the accepted proposal and inserted.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

WYRICK: As I understand this proposal, we eliminate Level 3 paragraph 4-5.1.2.10*. Why are we changing what has worked and Level 3 users understand? Reminder, this is not Level 1 and we do not want to be referred back to some place else in the document.

COMMENT ON AFFIRMATIVE:

ESHERICK: The exception AIP (Log #230) is not the direct quote of committee action on Log #250 which AIP.

FRANKEL: 1. In title and other places delete reference to level 4 systems which are no longer part of this committee's responsibility.
2. C, 3 and 4, clarify the language to include 185 psig. The way the paragraphs are written, paragraph 3 states "...but below 185 psig". Paragraph 4 states ...above 185 psig. Revise paragraph to read: ")...185 psig and above".

SHOEMAKER: The committee rejected all items regarding Level 3 in this Log. Assure that the original committee conclusion that all matters included with this proposal that apply to Level 3 not be added back into this proposal.

WAGNER: 1. In 4-3.1.2.7(c), why is the reference to Type K copper deleted? Its use is permissible.
2. In 4-3.1.2.8(b), it is not clear whether the low content of purge gas is in the tube being brazed or in the nitrogen cylinder.
3. The changes to the Exception following 4-5.1.2.10*. Why are we changing what has worked and Level 3 users understand? Reminder, this is not Level 1 and we do not want to be referred back to some place else in the document.

AFFIRMATIVE: 22
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows:

"On-Site Recleaning. On-site recleaning of the interior surface of tubes, valves, fittings, and other components shall be limited to recleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.".

SUBSTANTIATION: Since on-site cleaning has been prohibited since 1990, it was the committee’s call in 1999 to change the wording from on-site cleaning to on-site recleaning. This change missed the 1999 Standard.

COMMITTEE ACTION: Accept in Principle.

Revise as follows:

"...interior surface of tube ends...".


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

99-146 - (4-3.1.2.1(c)): Accept in Principle

Dale J. Dumbleton, American Medical Gas Inst.
99-147 - (4-3.1.2.1(c)): Reject
SUBMITTER: Peter Esherick, Patient Instrumentation Corp.
RECOMMENDATION: In third sentence, delete “..or trisodium phosphate..”.
SUBSTANTIATION: For quite a few years, the US government has been trying to eliminate phosphates in our daily lives. Most detergents no longer contain phosphates, for example. Hence, we should eliminate references to TSP (Trisodium Phosphate).
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The material is readily available, and cleans equally as well as presenting a limited environmental impact.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft
EXPLANATION OF NEGATIVE: Esherick: As expressed in subject substantiation: Since the Federal Government has succeeded in eliminating phosphates from detergents, fertilizer, etc., I strongly feel that we should eliminate recommending tri-sodium phosphate.
Note: Sodium carbonate is NOT lye and it also is readily available.

99-148 - (4-3.1.2.1(c)): Accept
SUBMITTER: Technical Committee on Piping Systems
RECOMMENDATION: Modify 4-3.1.2.1 c as follows:
c. On-Site Re-Cleaning: On-site re-cleaning of the interior surfaces of tube ends, valves, fittings, and other components shall be limited to reconditioning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in an aqueous cleaning solution as recommended in CGA Pamphlet G-4.1-1996, "Cleaning Equipment for Oxygen Service" and listed in CGA Pamphlet O2-DIR-2000, "2000 Directory of Cleaning Agents for Oxygen Service" a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.
Note: This proposal will be incorporated into 99-145 (Log #291).
SUBSTANTIATION: Solutions such as sodium carbonate or trisodium phosphate are require to be dissolved into, and used with water having a minimum temperature of 140°F. If inadequately heated and/or temperature not maintained, cleaning will not be accomplished. If inadequately rinsed the sodium carbonate or trisodium phosphate will crystallize during drying and attack to the surfaces of object cleaned.
This changes allows the use of new aqueous cleaning solutions that are recommended to the manufacturers of "oxygen cleaned" equipment.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-149 - (4-3.1.2.2(a)4a): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst./National ITC
RECOMMENDATION: Delete the following text:
4a. At least one panel shall be connected directly to the sensor(s) or switch(es).
SUBSTANTIATION: This sentence should be removed to eliminate confusion regarding the requirement for alarm wiring for the master alarm sensor or switch.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-150 - (4-3.1.2.2(a)4b): Accept in Principle
SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: 1. Delete 4-3.1.2.2(a)4a.
2. Renumber 4-3.1.2.2(a)4 accordingly.
SUBSTANTIATION: Subparagraph 4a appears to contradict Subparagraph 4b with respect to master alarm panels. The only situation where Subparagraph 4a would be applicable would be a local or area alarm panel that was duplexed. But these panels are not intended to cover such large areas or where more than one alarm panel would be necessary.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-151 - (4-3.1.2.2(a)6): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:
"All pressure switches, pressure gauges, and pressure-sensing devices downstream of the source valve except gauges in area alarm panels and zone valve boxes shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement."
SUBSTANTIATION: As the Standard reads now it requires even the gauges in area alarm panels and all zone valve box gauges to have a demand check fitting. I don’t think it was the intent of the committee to require demand check fitting on these gauges.
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256).
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-152 - (4-3.1.2.2(a)4): Accept in Principle
SUBMITTER: J. Richard Wagner, The Poole & Kent Company
RECOMMENDATION: Revise text as follows:
4-3.1.2.2(a)4. Where multiple panels are intended to indicate the same condition(s):
a. Except for master alarm panels, at least one panel shall be connected directly to the sensor(s) or switch(es). Signals from this panel may be relayed to other panels.
b. Both master alarms required by 4-3.1.2.2(b)2 shall be connected by dedicated wiring directly to the sensor(s) or switch(es). Master alarm panels shall each connect directly and independently to the alarm initiating devices that they monitor. Master alarms shall not be relayed from one master alarm panel to another. Alarm initiating devices for master alarms shall have electrically isolated outputs. Where multi-pole alarm relays are used, the control power source shall be independent of any master alarm panel. The master alarms shall activate upon loss of control power or an open circuit condition.
c. Other panels other than master alarm panels shall be permitted to be connected through indirect means such as data transmission lines provided that such indirect means are fully supervised and failure of such indirect means is indicated at all panels so connected. Such panels shall be designed and manufactured specifically to monitor medical gas systems.
SUBSTANTIATION: The existing language is not clear on how to connect master alarm panels to their alarm initiating devices. Connecting two master alarm panels to the same alarm contacts creates a cross-connection between two independent power sources. This decreases, not increases, the reliability of the system. A fault in one panel could take down both panels. Alarm initiating devices with dual contacts or dual outputs, or the use of multi-pole alarm relays will keep the master alarm panels electrically isolated from one another. If indirect means are used to connect alarm panels other than master alarm panels, they should be custom-engineered on each particular project.

COMMITTEE ACTION: Accept in Principle.

Replaces existing 4-3.1.2.2, 4-3.2.2.8, 4-3.2.2.9, 4-3.2.2.10 with the following:

5.1.4.4 Warning Systems (Level 1)

5.1.4.4.1 General

5.1.4.4.1.1 All local, area, and master alarm systems used for medical gas and vacuum systems shall provide the following: [was 4-3.1.2.2(a) + Log #227]

(1) separate visual indicators for each condition monitored, except as permitted in 5.1.4.4.8(i) and (j). [was 4-3.1.2.2(a)1a + Log #233]

(2) visual and audible indication that the monitored condition has occurred. [was 4-3.1.2.2(a)2 + Log #233]

(3) cancelable audible indication of an alarm condition, producing a minimum of 80 dbA measured at 3 ft (1 m). [was 4-3.1.2.2(a)1b + Log #233]

(4) re-initiation of the audible signal if a second alarm condition occurs while the audible alarm is silenced. [was 4-3.1.2.2(a)2b + Log #233]

(5) a means to visually indicate a lamp or LED failure. [was 4-3.1.2.2(a)1c + Log #233]

(6) visual and audible indication that the wiring to an alarm initiating device is disconnected. [was 4-3.1.2.2(a)2c + Log #233]

(7) labeling of each indicator, indicating the condition monitored, (e.g. O₂, medical air, vacuum, etc.) [was 4-3.1.2.2(a)3 + Log #233]

(8) labeling of each alarm panel for its area of surveillance. [Log #225 + Log #233]

(9) automatic restart after a power loss for 10 seconds (e.g. during generator startup) without giving false signals or requiring manual reset. (Log #131)

5.1.4.4.1.2 Where multiple local and area alarm panels are intended to indicate the same condition(s), [was 4-3.1.2.2(a)4]

(a) at least one panel shall be connected directly to the alarm initiating device. [was 4-3.1.2.2(a)4a]

(b) an alarm signal from a panel connected to an alarm initiating device shall be permitted to be relayed to other panels. [Log #226 + Log #233]

5.1.4.4.1.3 Local and area alarm panels shall be permitted to be connected through indirect means such as data transmission lines, provided that: [was 4-3.1.2.2(a)6 + Log #233]

(a) the indirect means are fully supervised and failure of such indirect means is indicated at all panels so connected. [was 4-3.1.2.2(a)6a]

(b) the panels are designed and manufactured specifically to monitor medical gas and vacuum systems. [Log #226]

(c) the panels are dedicated to monitoring only medical gas and vacuum systems. [Log #226]

5.1.4.4.1.4 Electrical power sources for local, area, and master alarms shall be in accordance with Chapter 3, “Electrical Systems”. [was 4-3.1.2.2(a)8 + Log #223]

5.1.4.4.1.5 The responsible authority of the facility shall ensure that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date. [was 4-3.1.2.2(a)7 + Log #223]

5.1.4.4.1.6 All wiring from alarm initiating devices shall be supervised or protected as required by Section 517-30 (c) (3) of NFPA 70, National Electrical Code, for emergency system circuits. [was 4-3.1.2.2(a)8 + Log #223]

5.1.4.4.1.7 A centralized computer system (e.g., a building management system) shall not substitute for any required medical gas or vacuum alarm panel, but shall be permitted to be used to supplement the medical gas and vacuum alarm system. [was 4-3.1.2.2(a)9 + Log #223]

5.1.4.4.2 Master Alarms

5.1.4.4.2.1 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 of the in the main lines of each medical gas and medical-surgical vacuum piping system. [was 4-3.1.2.2(b)1, 4-3.2.2.8, and Log #227]

5.1.4.4.2.2 Master alarm systems shall comply with the general requirements of 5.1.1.4.1.1. [was 4-3.1.2.2(a) + Log #223]

5.1.4.4.2.3 Master alarm systems shall consist of at least two master alarm panels located at least two separate locations as follows: [was 4-3.1.2.2(b) + Log #227 + Log #233]

(a) One master alarm panel shall be located in the principal working area of the individual responsible for the maintenance of the medical gas and vacuum pipeline systems. [was 4-3.1.2.2(b)2 + 4-3.2.2.8]

(b) One or more other master alarm panels shall be installed in locations that assure continuous surveillance during the working hours of the facility (e.g., the telephone switchboard, security office, or other continuously staffed location). [was 4-3.1.2.2(b)2, 4-3.2.2.8, and Log #227]

5.1.4.4.2.4 The master alarm panels required in 5.1.4.4.2.3 shall connect directly to the alarm initiating devices that they monitor. [was 4-3.1.2.2(a)4 + Log #223]

5.1.4.4.2.5 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. [Log #226 + Log #233]

5.1.4.4.2.6 Master alarm panels monitoring medical gas piping systems shall each include the following: [was 4-3.1.2.2(b)1]

(a) a separate visual and audible alarm indicator for the source equipment in each medical gas system. [was 4-3.1.2.2(b)1]

(b) an alarm indication when, or just before, changeover occurs in a medical gas system that is supplied by a manifold or an alternate-size multi-pipe source without a shut off device that has as part of its normal operation a changeover from one portion of the operating supply to another portion. [was 4-3.1.2.2(b)3a]

(c) 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 case of an emergency. [was 4-3.1.2.2(b)3b]

(d) an alarm indication when the reserve supply is reduced to one average day’s supply where check valves are not provided for each cylinder lead of the reserve supply for a manifold or bulk supply system. These alarms are not required if check valves are provided in each cylinder lead. [was 4-3.1.2.2(b)3c]

(e) an alarm indication when the contents of the reserve is reduced to one average day’s supply where a cryogenic liquid storage unit is used as a reserve for a bulk supply system. [was 4-3.1.2.2(b)3d]

(f) an alarm indication when the gas pressure available in the reserve unit is below that required for the medical gas system to function properly. [was 4-3.1.2.2(b)3e]

(g) an alarm indication when the pressure in the main line of each separate medical gas system decreases 20 percent or decreases 20 percent from the normal operating pressure. [was 4-3.1.2.2(b)3f]

(h) high and low pressure alarm initiating devices installed in the main lines immediately downstream (on the terminal or outlet side) of the main line shutoff valves (if installed) or the source shutoff valves if main line shutoff valves are not installed. [was 4-3.1.2.2(b)3g]

(i) an alarm indication(s) for the local alarms required for medical air systems in 4-3.1.2.2(d)1, either by separate indications for individual conditions or as one or more group alarms. [was 4-3.1.2.2(b)3j]

(j) group alarms (if used) labeled “Medical Air System Fault – indicate site” or similar wording that indicates that one or more units that continuously supply the piping system while another unit remains as the reserve supply and operates only in case of an emergency. [was 4-3.1.2.2(b)3j]

(k) a medical air dew point alarm per 4-3.1.1.9(j1). [was 4-3.1.2.2(b)3k]

(l) an alarm indication when the pressure of the in the main lines of each medical gas and medical-surgical vacuum piping system drops to or below 12 in. Hg of vacuum. [was 4-3.2.2.8]
5.1.4.4.2.10 Master alarms for medical-surgical vacuum systems shall be permitted to be displayed on the same master alarm panel as medical gas alarms. [Log #233]

5.1.4.4.3 Area Alarms

5.1.4.4.3.1 Area alarms shall be provided where a piped medical gas and vacuum systems serve anesthetizing locations and other vital life support and critical care areas such as post-anesthesia recovery, intensive care units, and coronary care units. [was 4-3.1.2.2(c)(1) + 4-3.2.2.9]

5.1.4.4.3.2 Area alarm panels shall be located at the nurse’s station or other location that will provide for responsible surveillance. [was 4-3.1.2.2(c)(2) + 4-3.2.2.9(c)]

5.1.4.4.3.3 Area alarm panels shall comply with the general requirements of 5.1.4.1. [was 4-3.1.2.2(a) + Log #233]

5.1.4.4.3.4 Area alarms for medical gas systems shall indicate if the pressure in the local line increases 20 percent or decreases 20 percent from the normal line pressure. [was 4-3.1.2.2(c)(3)]

5.1.4.4.3.5 Area alarms for medical vacuum systems shall indicate if the vacuum in the local line drops to or below 12 in. Hg of vacuum. [was 4-3.2.2.8]

5.1.4.4.3.6 Alarm initiating devices for critical care areas shall be placed in monitor the individual line supplying each such specific area. [was 4-3.1.2.2(c)(4) & 4-3.2.2.9(d)]

5.1.4.4.3.7 No valve, other than valves located in areas accessible only to authorized personnel, shall intervene between alarm initiating devices and the outlets intended to be monitored by the device. [was 4-3.1.2.2(c)(4) & 4-3.2.2.9(d)]

5.1.4.4.3.8 Alarm initiating devices for anesthetizing areas shall be placed in the individual line supplying each such specific area, with the individual room shutoff valve being the only valve between the alarm actuating device and the outlets. [was 4-3.1.2.2(c)(5) & 4-3.2.2.9(d)]

5.1.4.4.4 Local Alarms

5.1.4.4.4.1 Local alarms shall comply with the general requirements of 5.1.4.4.1. [was 4-3.1.2.2(a)(1)]

5.1.4.4.4.2 Local alarms, where required, shall be grouped together in a single location (e.g., in an alarm panel or with the system controls) at the source equipment site(s) for each system. [was 4-3.1.2.2(d)(1)]

5.1.4.4.4.3 Local alarms for medical air compressor systems shall provide individual indication of the following conditions in accordance with 4-3.1.1.9(b): [see 4-3.1.1.9(f)]

(a) High water level in receiver (if so equipped). [Log 13, 259]

(b) High water level in air/water separator (if so equipped).

(c) High discharge air temperature (if so equipped).

(d) High carbon monoxide level.

(e) High dew point temperature.

(f) Backup compressor operating.

5.1.4.4.4.4 Local alarms for medical-surgical vacuum systems shall include individual indication of the following conditions in accordance with 5.2.2.1.2:

(a) Reserve or off-duty pump is in operation. [see 4-3.2.1.2]

5.1.4.4.5 Waste Anesthetic Gas Disposal (WAGD) Alarms

Alarms or other automatic mechanisms shall be provided to inform the user when the WAGD system is operational but not functioning properly. [was 4-3.3.2.4, see Log #95]

5.2.4.4 Warning Systems (Level 2)

5.2.4.4.1 General

5.2.4.4.1.1 All local, area, and master alarm systems used for Level 2 medical gas and vacuum systems shall provide the following: [was 4-3.1.2.2(a)(1) + Log #233]

1. (1) separate visual indicators for each condition monitored. [was 4-3.1.2.2(a)(1) + Log #233]

2. visual and audible indication that the monitored condition has occurred. [was 4-3.1.2.2(a)(2) + Log #233]

3. cancelable audible indication of an alarm condition, producing a minimum of 80 dBA measured at 3 ft (1 m). [was 4-3.1.2.2(a)(3) + Log #233]

4. re-initiation of the audible signal if a second alarm condition occurs while the audible alarm is silenced. [was 4-3.1.2.2(a)(4) + Log #233]

5. a means to visually indicate a lamp or LED failure. [was 4-3.1.2.2(a)(5) + Log #233]

6. visual and audible indication that the wiring to an alarm initiating device is disconnected. [was 4-3.1.2.2(a)(6) + Log #233]

7. labeling of each indicator, indicating the condition monitored, (e.g. O₂ medical air, vacuum, etc.) [was 4-3.1.2.2(a)(7) + Log #233]

8. labeling of each alarm panel for its area of surveillance. [Log #226 + Log #233]

9. automatic restart after a power loss for 10 seconds (e.g. during generator startup) without giving false signals or requiring manual reset. [Log #171]

5.2.4.4.1.2 Where multiple local and area alarm panels are intended to indicate the same condition(s), [was 4-3.1.2.2(a)(4)]

(a) at least one panel shall be connected directly to the alarm initiating device. [was 4-3.1.2.2(a)(4a)]

(b) an alarm signal from a panel connected to an initiating alarm device shall be permitted to be relayed to other panels. [Log #226 + Log #233]

5.2.4.4.1.3 Local and area alarm panels shall be permitted to be connected through indirect means such as data transmission lines, provided that: [was 4-3.1.2.2(a)(4) + Log #233]

(a) the indirect means are fully supervised and failure of such indirect means is indicated at all panels so connected. [was 4-3.2.2.8(a)(c)]

(b) the panels are designed and manufactured specifically to monitor medical gas and vacuum systems. [Log #226]

(c) the panels are dedicated to monitoring only the medical gas and vacuum systems. [Log #226]

5.2.4.4.1.4 Electrical power sources for local, area, and master alarm devices shall be in accordance with Chapter 3, “Electrical Systems”. [was 4-3.1.2.2(a)8 + Log #233]

5.2.4.4.1.5 The responsible authority of the facility shall ensure that the labeling of alarms, where room numbers or designations are used, is accurate and legible. [was 4-3.1.2.2(a)(7) + Log #233]

5.2.4.4.1.6 All wiring from alarm initiating devices shall be supervised or protected as required by Section 517-50 (c)(3) of NFPA 70, National Electrical Code, for emergency system circuits. [was 4-3.1.2.2(a)8 + Log #233]

5.2.4.4.1.7 A centralized computer system (e.g., a building management system) shall not substitute for any required medical gas or vacuum alarm panel, but shall be permitted to be used to supplement the medical vacuum alarm system. [was 4-3.1.2.2(a)(9) + Log #233]

5.2.4.4.2 Master Alarms

5.2.4.4.2.1 A master alarm panel shall be provided to monitor the operation and condition of the pressure in the main lines of each medical gas and medical-surgical vacuum piping system. [was 4-3.1.2.2(b)(1) + 4-3.2.2.8 & Log #233]

5.2.4.4.2.2 Master alarm panels shall comply with the general requirements of 5.2.4.4.1.1. [was 4-3.1.2.2(a) + Log #233]

5.2.4.4.2.3 At least one master alarm panel shall be installed in a location(s) that is under continuous surveillance during the working hours of the facility (e.g., the telephone switchboard, security office, or other continuously staffed location). [was 4-3.1.2.2(b)(2) + Log #227 + Log #233]

5.2.4.4.2.4 The master alarm panel required in 5.2.4.4.2.3 shall connect directly to the alarm initiating devices that it monitors. [Log #226 + 4-3.2.2.8(a)(4) + Log #233]

5.2.4.4.2.5 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. [Log #226 + Log #233]

5.2.4.4.2.6 Master alarm panels monitoring medical gas piping systems shall each include the following:

(a) a separate visual and audible alarm indicator for the source equipment in each medical gas system. [was 4-3.1.2.2(b)(1)]

(b) an alarm indication when, or just before, changeover occurs in a medical gas system that is supplied by a manifold or an alternating-type bulk system that has as part of its normal operation a changeover from one portion of the operating supply to another portion. [was 4-3.1.2.2(b)(3a)]

(c) 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 case of an emergency. [was 4-3.1.2.2(b)(3b)]

(d) an alarm indication when the reserve supply is reduced to one average day’s supply while check valves are not provided for each cylinder lead of the reserve supply for a manifold or bulk supply system. These alarms are not required if check valves are provided in each cylinder lead. [was 4-3.1.2.2(b)(3c)]

(e) an alarm indication when the contents of the reserve is reduced to one average day’s supply where a cryogenic liquid...
Storage unit is used as a reserve for a bulk supply system. An alarm indication when the source line is not critical or have any concern for patient safety.

5.3.4.4.3 Alarms shall indicate when the pressure in the main line of each monitored pressurized gas system increases 20 percent or decreases 20 percent from the normal operating pressure. 

5.3.4.4.4 High and low pressure alarm initiating devices shall be connected to the main line in each monitored gas system immediately downstream (on the piping distribution side) of the main line shutoff valve (if installed) or the source shutoff valve if a main line shutoff valve is not installed.

5.3.4.4.5 Where facilities include monitored source equipment that provides automatic changeover to secondary or reserve sources, an alarm shall be provided for each system indicating when automatic changeover has occurred or is about to occur.

5.3.4.4.6 The alarm initiating devices for changeover alarms shall be independent of the alarm initiating devices for high or low line pressure.

5.3.4.4.7 Where two treatment facilities are served by a common monitored supply system, automatic changeover alarms shall indicate in both facilities.

5.3.4.4.8 Visual changeover alarms shall remain un-cancelable until the secondary or reserve supply source is replenished.

5.3.4.4.9 Warning systems shall not be required for Level 3 gas powered systems, Level 3 vacuum systems, and Level 3 WAGD (scavenging) systems.

COMMITTEE STATEMENT: Pursuant to the proposal would have created requirements that did not increase reliabilities of the systems installed.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 20

NEGATIVE: 2

NOT RETURNED: 1 Bancroft

EXPLANATION OF VOTE:

FAN: The negative vote does not directly reflect the decision taken by the Committee on Log #225 but rather the Committee action taken in response to Log #226 and others (e.g., Log #238) cumulated actions taken on. Warning Systems (Level 3) in the document accompanying Log #226. There are contradictions that need to be resolved as follows:

5.3.4.4.1 A warning systems shall be installed in each single treatment facility served by a Level 3 medical patient gas supply or Level 3 compressed air supply system [was 4-5.1.2.8(b), Log #238]

5.3.4.4.9 Warning system shall not be required for Level 3 gas powered systems, Level 3 vacuum systems, and Level 3 WAGD (scavenging) systems. [was 4-5.1.3.4]

Section 5.3.4.4.1 requires a warning system when a facility is served by a Level 3 compressed air supply system. However, Log #CP710 defines compressed air systems as “A Level 3 gas distribution system comprises of component parts, including, but not limited to, air compressor, motor, receiver, compression filters, dryers, valves and piping, that delivers compressed air (gauge pressure < 600 psi (1100 KPa)) to power devices (e.g., hand pieces, syringes, cleaning devices as a power source.” Furthermore section 5.3.4.4.9 indicates that “warning systems shall be required for Level 3 gas powered systems, Level 3 vacuum systems, and Level 3 WAGD (scavenging) systems.”

This apparent contradiction needs to be resolved.

Thus a suggested change to eliminate the apparent contradiction (deletion indicated as strike-through, addition indicated as underline) is presented below.

5.3.4.4.1 A warning system shall be installed in each single treatment facility served by a Level 3 medical patient gas supply or Level 3 compressed air supply system [was 4-5.1.2.8(b), Log #238]

5.3.4.4.9 Warning systems shall not be required for Level 3 compressed air systems, Level 3 gas powered systems, Level 3 vacuum systems, and Level 3 WAGD (scavenging) systems. [was 4-5.1.3.4]

WYRICK: Item 5.3.4.4.1 would require an alarm for the Level 3 compressed air supply system. Why would we require an alarm on a power source, it is not critical or have any concern for patient safety. No manufacturer of Level 3 air compressors supplies or never has supplied or required an alarm. This is then removed in 5.3.4.4.9

COMMENT ON AFFIRMATIVE: HOFFMAN: Replace the word "condition" with "service". The monitored condition is required to be alarmed in (2). The examples in (4) (7), (e.g., 02, medical air, vacuum, etc.) are "services" not conditions.
SHOEemaker: Is it the opinion of the committee that with approval Log #226 would require an alarm system on Level 3 Compressed Air Supply Systems? There is no substantiation for alarms on these systems. Life support is not an indication.

99-153 - (4-3.1.2.2(a)5): Accept in Principle
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-153 (Log #226) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-156 (Log #256) which reads as follows: Revise 4-3.1.2.2(a)6 as follows: “All pressure switches, mainline pressure gauges, analyzers, and pressure-sensing devices downstream of the source valve shall be provided with a gas specific demand check fitting to facilitate servicing, testing, or replacement.”
COMMITTEE ACTION: Accept in Principle.
99-158 - (4-3.1.2.2(b)3g, and 4-3.1.2.2 (d)2): Accept 
SUBMITTER: David B. Mohile, Medical Engineering Services, Inc.
RECOMMENDATION: Move and restructure contents of 4-3.1.2.2(b)3g, Master Alarms, and 4-3.1.2.2(d)2, Local Alarms, to 4-3.1.2.2(g). (g) would then read as follows: 
"A separate indicator shall be provided for dew point of the medical air. Dew point shall be monitored continuously per 4-3.1.1.9(1) and alarmed to indicate a line pressure dew point above 39°F (3.9°C)."

SUBSTANTIATION: There has been confusion as to where the dew point signal should alarm. Since elevated dew point levels need to be addressed immediately, the TC has for many years mandated an alarm on the master panels. Almost all dew point analyzers have their own built in alarm, so requiring an alarm on the local panel has not been necessary, and in point, the list of local alarms [4-3.1.1.9(i)3] in the standard has for years not included a signal for dew point high.

COMMITTEE ACTION: Accept
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-159 - (4-3.1.2.2(b)2): Accept 
SUBMITTER: J. Richard Wagner, The Poole & Kent Company
RECOMMENDATION: Revise 4-3.1.2.2(b)2 as follows:
1. The master alarm system shall consist of no more than two alarm panels located in at least two separate locations. One panel shall be located in the principle working area of the individual responsible for the maintenance of the medical gas piping systems, and one or more panels shall be located to assure one or more other panels shall be installed in locations that assure continuous surveillance during the working hours of the facility (e.g., the telephone switchboard, security office, or other continuously staffed location).

SUBSTANTIATION: Master alarm panels could be located in three (3) or more locations.

COMMITTEE ACTION: Accept
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-160 - (4-3.1.2.2(b)3g): Accept in Principle 
SUBMITTER: Craig B. Williams, Hill-Rom
RECOMMENDATION: Revise text:
"Dew point for medical air shall be monitored and alarmed per 4-3.1.1.9(i) to indicate a line pressure dew point above 39°F.

SUBSTANTIATION: This statement was mistakenly placed into 4-3.1.2.2(d)2. An alarm at the local alarm for high dew point is not required.

COMMITTEE ACTION: Accept in Principle
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft
EXPLANATION OF NEGATIVE: FRANKEL: If Log #253 is accepted, revise the alarm limits. The present high dew point alarm of 39°F remains unchanged since no revision has been proposed. Secondly, if the dew point is lowered to 32°F this would now be the upper alarm limit and the air dryer must provide a lower dew point of about 28°F in order to allow a range of acceptable dew point conditions that would not cause an alarm to annunciate.
(l) A shutoff valve shall be located outside each anesthetizing location in each medical gas line, so located as to be readily accessible at all times for use in an emergency. These 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. Values shall be of an approved type, mounted on a pedestal, or otherwise properly safeguarded against physical damage, and marked in accordance with 4.3.5.4.2.

SUBSTANTIATION: When the changes for the 1999 edition were compiled, editorial changes caused duplication in wording. Additionally, changes over the years have left some wording which was subject to misinterpretation. This revision of the entire section is a cleaner way to resolve the problems. Useless titles to paragraphs have been dropped and the numbering of the paragraphs has been updated. Also, the sequence of the valves from source to inline has been changed to reflect actual installation sequence.

COMMITTEE ACTION: Accept in Principle.

| Revise as shown on the following pages:
| COMMITTEE STATEMENT: Editorially revised.
| NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
| VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
| NOT RETURNED: 1 Bancroft

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4-3.1.2.3 Gas/Vacuum Shutoff Valves

(a) General. Shutoff valves shall be provided to isolate appropriate sections or portions of the piping system for maintenance, repair, or planned future expansion need, and to facilitate periodic testing. All boxes, other than those in valve boxes, (with frangible or removable windows large enough to permit manual operation of valves,) shall be located in a secure area accessible to authorized personnel only, or be locked open (or closed) and labeled as to gas supplied and area(s) controlled.

(b) Valve Types. Pipeline shutoff valves shall be a quarter-turn ball type manufactured with extensions for brazing, and with an indicating handle and shall be of metallic construction brass or bronze body construction. Ball valves shall be three-piece type with full-size ports, permitting inline serviceability. Vacuum valves shall be permitted to be ball or butterfly. Exception: Shutoff valves for use in certain areas, such as psychiatric or pediatric, shall be permitted to be secured to prevent inappropriate access.

(c) Source Valve. A shutoff valve shall be placed at the immediate outlet of the source of supply to permit the entire source of supply, including all accessory devices (such as air dryers, final line regulators, etc.), to be isolated from the piping system. The source valve shall be located in the immediate vicinity of the source equipment. It shall be labeled "SOURCE VALVE FOR THE (SOURCE NAME)."

(d) Main Valve. The main supply line shall be provided with a shutoff valve. The valve shall be located to permit access by authorized personnel only (e.g., by locating in a ceiling or behind a locked access door). The main supply valve shall be located downstream of the source valve and outside of the source room, enclosure, or where the main line first enters the building. This valve shall be labeled main valve for the (gas name) serving the [name of the building(s)].

(e) Riser Valve. Each riser supplied from the main line shall be provided with a shutoff valve adjacent to the riser connection. Riser valves shall remain accessible and shall not be obstructed. These valves shall be labeled, riser for the (GAS NAME) serving the [floor(s)] and the [name(s)] of the area served by the particular riser.

(f) Service Valves. Service shutoff valves shall be placed where the lateral branches off of the riser prior to any zone valve box assembly on that branch. Only one valve shall be required for each branch off of a riser regardless of how many zone valve boxes are installed on that lateral. These valves shall be installed to allow a facility to make changes in piping in individual areas. Without shutting down an entire riser or facility. These valves shall be installed in a locked chase or shall be located in a secure area, locked opened and identified in accordance with 4-3.2.2.6.

(g) Zone Valve. Station outlets / inlets shall not be supplied directly from a riser unless a manual shutoff valve located in the same story is installed between the riser and the outlet / inlet with a wall intervening between the valve and the outlet / inlet (see Figure 4-3.1.2). This valve shall be positioned in the same floor it serves. Each lateral branch line serving patient rooms shall be provided with a shutoff valve that controls the flow of medical gas to the patient rooms. Zone valves shall be so arranged that shutting off the supply of medical gas to one zone will not affect the supply of medical gas to the rest of the system. A pressure gauge shall be provided on the (patient side) of each zone valve. These boxes shall not be located in closed rooms or closets, nor behind normally open or normally closed doors, or otherwise hidden from plain view.

(h) A shutoff zone valve shall be located immediately outside each vital life-support or critical care area in each medical gas and /or vacuum line, and located so as to be readily accessible in an emergency. Valves shall be protected and marked in accordance with 4-3.5.4.2. All gas-delivery columns, hose reels, ceiling tracks, control panels, pendants, booms, alarm panels, or other special installations shall be located downstream of this valve.

(i) A shutoff zone valve shall be located outside each anesthetizing location in each medical gas line, so located as to be readily accessible at all times for use in an emergency. These valves shall be so arranged that shutting off the supply of gas to any one operating room or anesthetizingation will not affect the others. Valves shall be of approved type, mounted on a pedestal or otherwise properly safeguarded against physical damage, and marked in accordance with 4-3.3.12.

(j) All gas-delivery columns, hose reels, ceiling tracks, control panels, pendants, booms, alarm panels, or other special installations shall be located downstream patient side of the valve.

(k) In-Line Valves. In-line shutoff valves intended for use to isolate piping maintenance or modification shall be located in a secure area, be locked open, and be identified in accordance with 4-3.2.2.6. In-line valves in secured areas shall not affect the location of sensors for area alarm panels as required in 4-3.1.2(c)(4) or 5.

(l) Shutoff Valves. Shutoff valves provided for the connection of future piping shall be located in a secure area, and be locked closed. Downstream piping shall be closed with a brazed cap with tubing allowance for removal and re-brazing.

(m) Shutoff Valves (New or Replacement). New or replacement pipeline shutoff valves shall be of a quarter-turn ball type manufactured with extensions for brazing, and with an indicating handle and shall be of metallic construction. Valves shall be the three-piece type with full-size ports.

(n) Shutoff Valves (manual). Manual shutoff valves in boxes shall be installed where they are visible and accessible at all times. The boxes shall be installed behind normally open or normally closed doors, or otherwise hidden from plain view.
(j) Shutoff Valves (Service). Service shutoff valves shall be placed where the lateral branches off of the riser prior to any zone valve box assembly on that branch. Only one valve shall be required for each branch off of a riser regardless of how many zone valve boxes are installed on that lateral. These valves shall be installed to allow a facility to make changes in piping in individual areas without shutting down an entire riser or facility. These valves shall be installed in a locked chase or shall be located outside each anesthetizing location in each medical gas line, so to be readily accessible at all times for use in an emergency. These 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. Valves shall be of an approved type, mounted on a pedestal or otherwise properly safeguarded against physical damage, and marked in accordance with 4-3.5.4.2.

**Consolidate these two paragraphs.**

**Substantiation:** These two paragraphs deal with zone valves, without shutting down an entire riser or facility. These valves shall be installed to allow a facility to make changes in piping in individual areas without shutting down an entire riser or facility.

**Committee Statement:** See Committee Action and Statement on Proposal 99-162 (Log #258).

**Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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99-166 - (4-3.1.2.3(e) and (j)): Accept in Principle

**Committee:** HEA-PIP

**Submitter:** Mark Allen, Beacon Medical Products

**Recommendation:** Consolidate these two paragraphs.

**Substantiation:** These two paragraphs deal with zone valves, which are partially redundant, and should be consolidated.

**Committee Action:** Accept in Principle.

**Committee Statement:** See Committee Action and Statement on Proposal 99-162 (Log #258).

**Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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99-167 - (4-3.1.2.3(i)): Accept in Principle

**Committee:** HEA-PIP

**Submitter:** Dale J. Dumbleton, American Medical Gas Inst.

**Recommendation:** Delete the following text:

“Shutoff Valve (Manual).—Manual shutoff valves in boxes shall be installed where they are visible and accessible at all times. The boxes shall not be installed behind normally open or normally closed doors, or otherwise hidden from plain view.”

**Substantiation:** Shutoff Valves (Manual) are also covered in 4-3.1.2.3(d) of this Standard. I incorporated this section into 4-3.1.2.3(d) with another proposal.

**Committee Action:** Accept in Principle.

**Committee Statement:** See Committee Action and Statement on Proposal 99-162 (Log #258).

**Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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99-168 - (4-3.1.2.3(j)): Accept in Principle

**Committee:** HEA-PIP

**Submitter:** Dale J. Dumbleton, American Medical Gas Inst.

**Recommendation:** Delete the following text:

“(j) Shutoff Valves (Service). Service shutoff valves shall be placed where the lateral branches off of the riser prior to any zone valve box assembly on that branch. Only one valve shall be required for each branch off of a riser regardless of how many zone valve boxes are installed on that lateral. These valves shall be installed to allow a facility to make changes in piping in individual areas without shutting down an entire riser or facility.”

**Substantiation:** Delete in its entirety, it is a duplication of 4-3.1.2.3(c).

**Committee Action:** Accept in Principle.

**Committee Statement:** See Committee Action and Statement on Proposal 99-162 (Log #258).

**Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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99-169 - (Table 4-3.1.2.4): Accept

**Committee:** HEA-PIP

**Submitter:** Craig B. Williams, Hill-Rom

**Recommendation:** Include MedAir as the abbreviated name for Medical Air and MedVac for the abbreviated name for Medical-surgical vacuum.

**Substantiation:** These two abbreviated names were not included for this table but are included in the table used for Level 3 gas and vacuum systems.

**Committee Action:** Accept.

**Committee Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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99-170 - (Table 4-3.1.2.4, Table 4-5.1.2.12): Accept

**Committee:** HEA-PIP

**Submitter:** Dale J. Dumbleton, American Medical Gas Inst.

**Recommendation:** Abbreviated name for Nitrogen should be N2 or HPN.

**Substantiation:** These two abbreviated names were not included for this table but are included in the table used for Level 3 gas and vacuum systems.

**Committee Action:** Accept.

**Committee Statement:** See Committee Action and Statement on Proposal 99-162 (Log #258).

**Number of Committee Members Eligible to Vote:** 23

**Vote on Committee Action:**

**Affirmative:** 22

**Not Returned:** 1 Bancroft

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(footnotes)

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<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>Nitrogen</td>
<td>N₂ or HPN₂</td>
<td>Black/white</td>
<td>160 psig + 25/-0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1145 kPa + 173/-0</td>
</tr>
<tr>
<td>Non-standard pressure</td>
<td>Black/white</td>
<td></td>
<td>200 psig + 100/-0</td>
</tr>
<tr>
<td>O₂/CO₂ n%</td>
<td>Green/grey</td>
<td></td>
<td>1379 kPa + 690/-0</td>
</tr>
</tbody>
</table>

SUBSTANTIATION: The term high pressure nitrogen was changed for non-standard pressure in the last code revision. The table, as it stands, recognizes that nitrogen and high pressure nitrogen, as it is called, are within the same standard pressure limits. The conversion from psig to kPa is to multiply psig by 6.895. To change 160 psig to kPa would be 160 x 6.895 = 1103 kPa.

COMMITTEE ACTION: Accept in Principle.

REVISE TABLE AS SHOWN:

<table>
<thead>
<tr>
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<th>Colors (Background/Text)</th>
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<td></td>
<td>1379 kPa + 690/-0</td>
</tr>
</tbody>
</table>

COMMITTEE STATEMENT: The changes were made for consistency.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-172 - (4-3.1.2.4(a), 4-3.1.2.13, 4-3.1.2.14): Accept in Principle
SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: Correlate these three sections with respect to the labeling (i.e., name or chemical symbol).

SUBSTANTIATION: Change will make wording consistent for these three sections with respect to the labeling (i.e., name or chemical symbol).

COMMITTEE ACTION: Accept in Principle.

REVISE TABLE AS SHOWN:

<table>
<thead>
<tr>
<th>Gas Service</th>
<th>Abbreviated Name</th>
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<th>Standard Pressure</th>
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<td></td>
<td>1379 kPa + 690/-0</td>
</tr>
</tbody>
</table>

COMMITTEE STATEMENT: All manufacturers of gas outlets in North America submit their outlets for design certification by testing agencies such as UL and CSA. Some third party verification inspectors are making individual judgments regarding outlet design.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: No testing agency currently tests to the NFPA 99 standard for medical gas outlets.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NEGATIVE: 1

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

HOFFMAN: I disagree with the Committee’s action rejecting this proposal. Throughout the document references are made to “listed” or “approved”. If the committee does not wish to cite UL or CSA then have the sentence read: “Outlets shall be listed/certified by a recognized testing agency as meeting the requirements of this paragraph.”

SUBSTANTIATION: All manufacturers of gas outlets in North America submit their outlets for design certification by testing agencies such as UL and CSA. Some third party verification inspectors are making individual judgments regarding outlet design.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The changes were made for consistency.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-174 - (4-3.1.2.6(a)): Accept in Principle
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Change the parenthetic from “(i.e., can be manipulated...)” to “(i.e., cannot be manipulated...)”

SUBSTANTIATION: The sense of the parenthetic does not agree with the previous statement and the intent of the requirement.

COMMITTEE ACTION: Accept in Principle.

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

COMMITTEE STATEMENT: All manufacturers of gas outlets in North America submit their outlets for design certification by testing agencies such as UL and CSA. Some third party verification inspectors are making individual judgments regarding outlet design.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: No testing agency currently tests to the NFPA 99 standard for medical gas outlets.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NEGATIVE: 1

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

HOFFMAN: I disagree with the Committee’s action rejecting this proposal. Throughout the document references are made to “listed” or “approved”. If the committee does not wish to cite UL or CSA then have the sentence read: “At the terminal where the user makes connection, which shall be fully and immediately accessible, a second primary check, omitting the secondary check as above shall be provided. The connection between the two terminals shall be considered a semi-permanent connection (see Figure 4-3.1.2.6).”

3. In 4-3.1.2.6(a), delete 4-3.1.2.4(a).

SUBSTANTIATION: The term high pressure nitrogen was changed for non-standard pressure in the last code revision. The table, as it stands, recognizes that nitrogen and high pressure nitrogen, as it is called, are within the same standard pressure limits. The conversion from psig to kPa is to multiply psig by 6.895. To change 160 psig to kPa would be 160 x 6.895 = 1103 kPa.
COMMITTEE STATEMENT: Clarify.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMENT ON AFFIRMATIVE: HOFFMAN: The left illustration showing Terminals in Manufactured Assemblies shows two “Primary Checks”. The top check should be labeled as a “Gas Specific Secondary Check”. The text should require gas specific checks but not mandate the use of DIISS. There are many ways to achieve gas specificity and mandating the use of DIISS as the only way is design restrictive.

委员会意见：阐明。
投票委员会成员：投票：22

否决：1 Bancroft

附加意见：霍夫曼：图中的左图显示了在组装时的两个“主要检查”。上部的检查应标记为“气体具体次级检查”。应要求具体气体检查但不要求使用DIISS。有许多方法可以实现气体特定性，强制使用DIISS作为唯一方法是设计限制。
**COMMITTEE ACTION:** Accept.
**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**SUBMITTER:** Dale J. Dumbleton, American Medical Gas Inst.

**RECOMMENDATION:** Revise text as follows:

“The fitting surfaces to be brazed shall be pre-cleaned by the manufacturer, mechanically cleaned using a clean stainless steel wire brush or equivalent, and the tube ends to be brazed shall be cleaned with a nonabrasive pad.”

**SUBSTANTIATION:** Copper fittings cleaned for oxygen service according to G GA is degreased and sealed nitrogen purged atmosphere bags. Common practice is to use a nonabrasive pad. Making it mandatory will eliminate the use of sand cloth which could induce contamination in the piping system.

**COMMITTEE STATEMENT:** The remainder of the section to remain. The revision is to the first sentence only.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**SUBMITTER:** Dale J. Dumbleton, American Medical Gas Inst.

**RECOMMENDATION:** Revise text as follows:

“Tube ends shall be inserted fully into the socket of the fitting in accordance with socket depths required by MSS SP-73 in Table 4-3.1.2.7(e). The use of a shallow cup fitting shall be accomplished by cutting the cup to the depth required by MSS SP-73 or with a mechanical stop meeting the requirements of MSS SP-73 and not by partial insertion of tube ends into the soldering cup fittings.”

**SUBSTANTIATION:** The copper fittings used for medical gas installations are the same fittings used for soft solder in the plumbing industry. The fitting cup depth is designed for soldering; brazing does not require the same cup depth. In the 1996 standard a table was, and is still, part of the 1999 standard which designates the minimum cup depth for each size of copper tubing for brazing.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** These fittings are not manufactured at this time. Fittings are not currently manufactured to MSS SP-73 and the proposed method would create non-uniform installation procedures in violation of current requirements.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**SUBMITTER:** Dale J. Dumbleton, American Medical Gas Inst.

**RECOMMENDATION:** Revise text as follows:

“While being brazed, joints shall be continuously purged with oil-free dry nitrogen NF to prevent the formation of copper oxides on the inside surface of the joint. The purge gas shall be monitored and audibly alarmed to alert the brazor of low content of purge gas. The flow of purge gas shall be maintained with the use of a flow meter until the joint is cool to the touch.”

**SUBSTANTIATION:** NF oil-free dry is required for the purging of medical gas systems. The monitoring of the purge gas will eliminate copper oxides from forming on the interior of the medical gas piping due to a cylinder running empty. In many cases the installer/contractor will try to use a nitrogen regulator to maintain a low flow of purge gas. Regulators are not designed to be used to maintain low flow, they’re designed to regulate from a high pressure to a lower pressure and not the low flow used in the purging of medical gas systems.

**COMMITTEE ACTION:** Accept.
**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**SUBMITTER:** Dale J. Dumbleton, National Inspection, Testing and Certification

**RECOMMENDATION:** Revise text as follows:

“Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-3.1.2.8(b)1b. Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metal, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer’s instructions.”

**SUBSTANTIATION:** Allowing filler metals that do not conform to a standard opens the door for manufacturers to use whatever composition of alloys they desire, whether it meets a standard or not.

**COMMITTEE ACTION:** Accept.
**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**TCC NOTE:** The Technical Correlating Committee 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.

**SUBMITTER:** Thomas J. Mraulak, American Society of Sanitary Engineering

**RECOMMANDATION:** Revise text as follows:

“The surfaces to be brazed shall be mechanically cleaned. The fittings shall be cleaned using a clean stainless steel wire brush or equivalent. The use of steel wool and sandcloth shall be prohibited, due to the possible presence of oil. Mechanical cleaning of the tube shall be done with a nonabrasive pad (such as Scotchbrite™), not result in the grooving of the surfaces to be joined.”

**SUBSTANTIATION:** The process for cleaning the fittings is different from the tube and the text needs to be a little clearer. Sandcloth usually puts grooves in the surface of the tube and should be prohibited along with steel wool. Scotchbrite does not put grooves in the surface of the tube.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-180 (Log #50) which reads as follows:

The remainder of the section to remain. The revision is to the first sentence only.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23
**VOTE ON COMMITTEE ACTION:**
**AFFIRMATIVE:** 22
**NOT RETURNED:** 1 Bancroft

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**SUBMITTER:** J. Richard Wagner, The Poole & Kent Company

**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 4-3.1.2.8(d) twenty-five percent of the existing zones downstream from the connection...
shall be tested for particulate matter in accordance with the piping purge test in 4-3.4.1.3(e) with using the gas of system designation.

SUBSTANTIATION: The zones downstream from a final connection to an existing system that has not been purged should be tested for particulate matter, not gas concentration.

COMMITTEE ACTION: Accept in Principle.

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 in 4-3.4.1.3(e) with using the gas of system designation.

COMMITTEE STATEMENT: Change mandates testing for particulate matter on tie-ins done without nitrogen. Testing for the 25 percent of the zones downstream is considered excessive.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

SUBMITTER: Mark Allen, Beacon Medical Products

RECOMMENDATION: Add wording:

...electrical switchgear rooms or locations with open flames.

SUBSTANTIATION: The intent of the prohibition against locating medical gases in kitchens appears to be prevention of exposure to flame. As there are other locations where open flames may present the same hazard (e.g., boiler rooms, locations with decorative fireplaces, closets with gas water heaters, etc.) it seems useful to include this prohibition.

COMMITTEE ACTION: Accept in Principle.

Revise as follows:

...electrical switchgear rooms or areas with open flames.

COMMITTEE STATEMENT: This change was for consistency. See Committee Action and Statement on Proposal 99-79 (Log #152).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMENT ON AFFIRMATIVE:

WAGNER: This proposal is not incorporated in Log #291.
The installation shall be made by qualified, competent technicians experienced in making such installations and meeting the requirements of ANSI/ASSE Series 6000, Standard 6010.

COMMITTEE ACTION: Accept in Principle.

The committee agrees with the recommendation and will incorporate into 99-145 (Log #291).


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 18
NEGATIVE: 4
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

DAVIDSON: There are many independent installers both union and open shop who presently meet or exceed the ASSE Series 6000 standards, while there are those certified under the ASSE Series 6000 standards who have installed systems using copper water tubing, using non-oxygen clean pipe and fittings, have no pressure and provide manuals and brazed the systems without nitrogen gas purge. Certification does not deal with the problems of poor installers, internal contractor management, or construction management/supervision and poor certification. The requirement for the installation contractor should be defined within NFPA 99, Chapter 4, not through a third party standards making body.

ERICKSON: Reject the Proposal. The section as currently written is more than adequate to handle the competency issues of installing medical gas piping systems in health care facilities. Just because an independent non-consensus organization develops a standard for training and qualifications does not mean it needs to be codified in a national standard. Where local or state governments see a need for these qualifications, then ANSI/ASSE 6000, Standard 6010. Just by having an installer take a 35 hour course and a test does not guarantee that the installation will be of any higher quality than if the installer just followed NFPA 99 or NFPA 99C.

SHOEMAKER: The current wording is more than sufficient to ensure the quality of the task of installing med gas piping systems. As a member of the ASSE working group responsible for the drafting and revision of the ANSI/ASSE Series 6000 standards, I would like to go on record stating that contrary to Mr. Erickson’s allegations, the American Society of Sanitary Engineering (ASSE) is an internationally recognized, ANSI accredited standards developer. ASSE has been in existence since 1906, and began developing standards for the plumbing and pipefitting industries in the 1950’s. ASSE standards are referenced in all of the model plumbing codes used in the United States, and have a working relationship to develop standards with CSA International in Ontario, Canada.

Currently, ASSE is approved by the American National Standards Institute, require that the technical committees (Professional Qualifications Standards and Product Standards Committee) be balanced, provide for due process and openness, have a mechanism for appeals in place, that a standard must be approved by two-thirds of the committee, and that all comments be addressed by the committee and/or Board of Directors. ASSE Standards, including the ANSI/ASSE Series 6000, are submitted to ANSI for the open review process and are reviewed to ensure that all ASSE and ANSI requirements are met prior to becoming an American National Standard.

I believe that the requirement for training and certification of medial gas installers and verifiers is necessary, and is not currently addressed within the NFPA 99. These two changes are necessary to ensure the proper installation of the critical life-sustaining systems.

COMMITTEE ACTION: Accept in Principle.

The reference to pressures are now consistent with the codes written by private organizations. If we approve this, we loose control over future changes in our code, we essentially abdicate our responsibility to a private, non-consensus organization. Our focus should be “performance based,” not a “bog to a standard,” but the method for performing installations, and certainly not the training program itself.

SMIDT: Reject the proposal: The current standards address the appropriate level of installer competency. The additional time spent in class will only serve to raise the cost of the installation while providing no more promise of compliance. NFPA 99 as currently written provides the guidance necessary for a well installed system.

COMMENT ON AFFIRMATIVE:

MRaulak: After the circulation of votes, I wish to formally comment on the negative ballot and supporting rationale submitted by Douglas S. Erickson on the revised draft of NFPA 99. Specifically, I wish to comment on Mr. Erickson’s rationale to reject Log #190 and Log #195.

As a member of the ASSE working group responsible for the drafting and revision of the ANSI/ASSE Series 6000 standards, I would like to go on record stating that contrary to Mr. Erickson’s allegations, the American Society of Sanitary Engineering (ASSE) is an internationally recognized, ANSI accredited standards developer. ASSE has been in existence since 1906, and began developing standards for the plumbing and pipefitting industries in the 1950’s. ASSE standards are referenced in all of the model plumbing codes used in the United States, and have a working relationship to develop standards with CSA International in Ontario, Canada.

Currently, ASSE is approved by the American National Standards Institute to promulgate standards under two types of accreditation - Organizational Accreditation and Canvass Accreditation. ASSE’s procedures, as approved by the American National Standards
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-195 - (4-3.1.2.11(c) 5): Reject
SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: Delete 4-3.1.2.11(c).
SUBSTANTIATION: This subject is addressed in 4-3.1.2.11(a).
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The recommendation was to delete all of 4-3.1.2.11 (c) and was inappropriate.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBSTANTIATION: A tension test does not prove the ability of a brazor to achieve adequate penetration of the braze filler metal into a joint with no more than 20 percent voids.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-196 - (4-3.1.2.11(c)5d): Reject
SUBMITTER: Craig B. Williams, Hill-Rom
RECOMMENDATION: Delete this requirement from section 4-3.1.2.11 (Systems having nonstandard operating pressures) and place it under section 4-3.4.1.1 (General).
SUBSTANTIATION: The testing requirement for systems having nonstandard operating pressures should be placed under Section 4-3.4.1.1 because this section provides general guidelines for inspection and testing Level-1 Piped Gas Systems.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: It is more appropriate in it's current location because it deals with non standard operating pressures.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-197 - (4-3.1.2.12(a)): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:
"Brazors shall be qualified by visual examination of the test coupon followed by sectioning. Except that a tension test shall be permitted to be substituted for sectioning. Where tension tests are used for brazor qualification, they shall be performed in accordance with ASME IX."
SUBSTANTIATION: The tension test to qualify the brazor was a mistake corrected by a TIA back in 1996. The tension test is used by ASME Section IX to qualify a brazor procedure, not the brazor.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-198 - (4-3.1.2.12(a)): Accept in Principle
SUBMITTER: J. Richard Wagner, The Poole & Kent Company
RECOMMENDATION: Revise text as follows:
4-3.1.2.12(a) Brazors shall be qualified by visual examination of the test coupon followed by sectioning except that a tension test shall be permitted to be substituted for sectioning. Where tension tests are used for brazor qualification, they shall be performed in accordance with ASME IX.
SUBSTANTIATION: AWS and ASME are the dominant standards used by NFPA 99 and this standard can not be made less restrictive than the dominant standard for brazing.
COMMITTEE ACTION: Accept.
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-145 (Log #291) which reads as follows:
Revise the proposal as follows:
Affected Paragraphs: 4-3.1.2 through 4.6.1.2.5 (Level 1,2,3 and 4 affecting piping, materials and installation). This is an attempt to meld the vacuum and positive gas piping systems. NFPA eliminated the vacuum subcommittee a number of years ago with the intention of bringing the two sections into one document. This is just a continued effort to accomplish this goal.
The Left Column is the complete proposed text. New material is Bold. Where the text is sourced in the current document, the source paragraph is listed in the right-hand column. Where the text is new, the relevant proposal is noted.
4-3.1.2 Distribution — Level 1, (Manifold, Piping, Tubing, Level 1, 2, 3, and 4 Gas and Vacuum Piping and Materials Controls, Outlets/Terminals, Alarms). See Figure 4-3.1.2.

### 4-3.1.2.1 General Requirements.

(a) **Oxygen Compatibility.** Components in nonflammable medical gas and vacuum systems shall be of materials that are suitable for oxygen service. (See 4-3.1.1.3, Material — Oxygen Compatibility.) Pipe (tubing), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.

(b) **Cleanliness.** Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.

(c) **On-Site Re-Cleaning.** On-site re-cleaning of the interior surfaces of tube ends, valves, fittings, and other components shall be limited to re-cleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.

(d) **Pressure Gauges for Gases.** The scale range of positive pressure analog gauges shall be such that the normal reading falls within the middle 50 percent of the scale. The scale range of digital gauges shall be not more than two times the working pressure. The rated accuracy of pressure gauges used for testing shall be one percent (full scale) or better at the point of reading. Pressure gauges shall be in compliance with ANSI/ASME B-40.1, Gauges, Pressure Indicating Dial-Type, Elastic Elements.

1.* A pressure gauge shall be installed in the main line adjacent to the actuating switch required in 4-3.1.2.2(b)3e. It shall be appropriately labeled and shall be readily visible from a standing position.

2.* An appropriately identified pressure gauge, connected to the line being monitored, shall be installed at each area alarm panel location. It shall be appropriately labeled and shall be readily visible from a standing position.

(f) **Vacuum System Gauges.**

(a) **Main-Line Gauge.** A vacuum gauge shall be provided in the main vacuum line adjacent to the actuator (vacuum switch) for the master alarms, with this gauge located immediately upstream (on the terminal or inlet side) terminal or inlet of the source valve (the main line valve, if so equipped). Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).

(b) **Area Gauge.** Vacuum gauges shall be located at each area vacuum alarm signal location, with this gauge connected upstream (on the terminal or inlet side) of any valve controlling that area. Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).

(c) **Vacuum Gauge Identification.** All permanently installed vacuum gauges and manometers for the vacuum system shall be continuous reading, manufactured expressly for vacuum, and labeled: VACUUM.

4-3.1.2.7 Piping Materials. The provisions of this section apply to field-installed piping for the distribution of medical piped gases and vacuum systems.

(a) **Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.**

(b) **Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-3.1.2.1. Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.**

(c) **Piping shall be ASTM B 819 specification hard drawn seamless medical gas tubing; ASTM B 819 tubing is identified by the markings "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green (Type K) or blue (Type L). Main and branches shall be not less than 1/2 in. nominal size for positive gases and 3/4 in. nominal for vacuum. Drops to individual outlet/inlets shall be not less than 1/2 in. nominal. Factory-installed tube on station outlets extending no further than 8 in. from the outlet body shall be permitted to be 1/2 in. O.D. (3/8 in. nominal) size. Connecting tubing for gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/8 in. nominal) size.**

(d) **Where seismic construction is required by the building code, piping shall be properly braced.**

(e)* Except as provided under 4-3.1.2.7(g) and (h), joints in copper tubes shall be brazed using capillary fittings complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings, or brazing fittings complying with MSS SP-73, Brazing Joints for Wrought and Cast Copper Alloy Solder Joints Pressure Fittings. Cast fittings shall not be used for brazed joints.
(f) Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, *Cleaning Equipment for Oxygen Service*, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

(g) Joints in medical gas tube shall be brazed except that memory-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Flared and compression fittings shall be prohibited throughout the piping system, including connections to station outlet/alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system.

Exception:
1. Threaded connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges.
2. Diellectric fittings at equipment requiring isolation between the piping distribution system and the equipment.  
AIP Log #77

(h) 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 shall be permitted to be used in lieu of brazed joints.

(i) Turns, offsets, and other changes in direction in piping shall be made with fittings complying with 4-3.1.2.7(e).

**Vacuum System Piping**

1. Seamless copper water tube (ASTM B88), Type K,L,M copper ACR tube, (ASTM B280), or (ASTM B819) medical gas tube shall be permitted to be used.

2. Soft annealed copper tubing (ASTM B88) shall be permitted underground

Accept Log #192

Exception: Nonstandard Operating Pressure Systems

1. Where operating pressures are 200 to 300 psig (1380 to 2068) above 185 psig (1,276 kPa) only Type K medical gas tube (ASTM B819) shall be used for piping larger than 3 1/8 in. O.D. (3 in. nominal)

4-3.1.2.8 Pipe Joints.

(a) Threaded Joints.

1. Threaded joints in medical gas distribution piping shall be limited to the connection of pressure/vacuum gauges, alarm pressure/vacuum switches, and similar devices.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B1.20.1, *Pipe Threads, General Purpose*.

3. Threaded joints in piping systems shall be made up with polytetrafluoroethylene (such as Teflon™) tape or other thread sealant suitable for oxygen service. Sealants shall be applied to the male threads only.

(b) Brazed Joints.

1. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-3.1.2.8(b)1b. Brazing filler metals shall comply with ANSI/AWS A5.8, *Specification for Brazing Filler Metal*, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used in accordance with the manufacturer's instructions.

Accept Log #289

Accept Log #50
5. Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the non-copper component and the interior of the sub-assembly shall be cleaned of flux prior to installation in the piping system. Flux-coated brazing rods shall be permitted to be used in lieu of the application of flux to the surfaces to be joined on tube 3/4 in. nominal size and smaller.

6. Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint, 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook.

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen NF to prevent the formation of copper oxide on the inside surface of the joint. The purge gas shall be monitored and audibly alert the brazor of low content of purge gas. The flow of purge gas shall be maintained with the use of a flow meter until the joint is cool to the touch.

8. During and after installation, openings in the piping system shall be kept capped or plugged as gas or liquid to avoid unnecessary loss of purge gas or loss of joint debris or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

9. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:
   a. Flux or flux residue (BAg series rods used with dissimilar metals only)
   b. Excessive oxidation of the joint, Tube or fitting melting or erosion
   c. Presence of unmelted filler metal
   d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
   e. Cracks in the tube or component
   f. Cracks in the brazing filler metal
   g. Failure of the joint to hold the test pressure under 4-3.4.1.2(e) before being replaced

11. Brazed joints that are found to be defective under 4-3.1.2.8(b), except that no joint shall be repaired more than once before being replaced. Brazed joints that are found to be defective under 4-3.1.2.8(b), conditions b and e, shall be replaced.

Exceptions: Level 1 and 2 Vacuum and WAGD Systems

1. Mechanically Formed Branch Connections. The use of drilled and extruded tee-branch connections to copper mains and branches shall be permitted. Such connections shall be made in accordance with the tool manufacturer's instructions and the joints shall be brazed.

2. Unions, flare nuts, and similar straight-threaded connections shall be permitted only in exposed locations and shall not be coned in walls or ceilings.

4-3.2.2.9 Piping Installation.

(a) Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures. Horizontal runouts from all mains and branches shall be taken off above the center line of the pipe and rise vertically or at an angle of not more than 45° from the vertical.

(b) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports Materials, Design and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:
1/4 in. (0.635 cm) nominal & 5 ft (1.52 m)
3/8 in. (0.953 cm) nominal & 6 ft (1.83 m)
1/2 in. (1.27 cm) nominal & 6 ft (1.83 m)
3/4 in. (1.91 cm) nominal & 7 ft (2.13 m)
1 in. (2.54 cm) nominal & 8 ft (2.44 m)
1 1/4 in. (3.175 cm) nominal & 9 ft (2.74 m)
1 1/2 in. (3.81 cm) nominal & 10 ft (3.05 m) and larger

Vertical risers, all sizes & Every floor, but not to exceed 15 ft (4.57 m)

(c) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The minimum backfilled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench.

Underground piping shall be installed in a continuous enclosure to protect the pipe from damage during backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of bury. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

(d) Medical gas risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

(e) Piping shall not be installed in elevator shafts, kitchens or electrical switch gear rooms.

(1) Medical gas piping shall be permitted to be located 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 130°F (54°C) maximum. Medical gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

(b) Hoses 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. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure of 1000 psig (6900 kPa gauge).

(i) Where a system originally used or constructed for use at one pressure and for a gas is converted for operation at another pressure or for another gas, all provisions of 4-3.1.2.1, 4-3.1.2.2, 4-3.1.2.4, 4-3.1.2.8, 4-3.1.2.10, 4-3.1.2.12, 4-3.4.1, and the Exception to 4-3.1.2.7(c) shall apply as if the system were new. Vacuum systems shall never be converted for use as gas systems.

4-3.1.2.10* Installation Requirements.

(a) Equipment and Component Installation.

1. The installation of individual components shall be made in accordance with the instructions of the manufacturer. Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper installation, testing, maintenance, and operation of the medical gas systems. These instructions shall be left with the owner.

2. The installation shall be made by qualified, competent technicians experienced in making such installations and meeting the requirements of ANSI/ASSE Series 6000, Standard 6010. (See 4-3.1.2.12 for brazer performance.)

3. Brazing shall be performed by individuals who are qualified under the provisions of 4-3.1.2.12.

(b) Health care organization personnel shall be permitted to install piping systems if all the requirements of Section 4-3.1.2.10 are met during installation.

(c) The installer of medical gas piping and equipment shall maintain on the job site documentation of brazing procedures and individual brazers per 4-3.1.2.12 prior to installation.

(d) Two or more medical gas piping systems shall not be interconnected for testing or for any other reason. Leak testing shall be accomplished by separately charging and testing the individual piping system.

4-3.1.2.11 Systems Having Nonstandard Operating Pressures. The following requirements apply to gas piping systems having an operating pressure other than the standard 50 to 55 psig (345 to 380 kPa) [or 160 psig (1103 kPa) for nitrogen] and are in addition to the minimum requirements listed in 4-3.1.2.3 through 4-3.1.2.9.
### NFPA 99 — November 2001 ROP — Copyright 2001, ROP

<table>
<thead>
<tr>
<th>(a)</th>
<th>Pipelines, shutoff valves, and station outlets in systems having nonstandard operating pressures shall be labeled for gas name and operating pressure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Where operating pressures are <strong>200 to 300 above 185 psig (1380 to 2068 1276 kPa)</strong>, the following applies:</td>
</tr>
<tr>
<td>1.</td>
<td>Only Type K medical gas tube (ASTM B819) shall be used.</td>
</tr>
<tr>
<td>2.</td>
<td>Brazing procedures and brazers shall be qualified as required under 4-3.1.2.12.</td>
</tr>
<tr>
<td>(c)</td>
<td>Station outlets in systems having nonstandard operating pressures shall meet the following additional requirements:</td>
</tr>
<tr>
<td>1.</td>
<td>Be gas-specific.</td>
</tr>
<tr>
<td>2.</td>
<td>Be pressure-specific where a single gas is piped at more than one operating pressure [e.g., a station outlet for oxygen, 80 psig (550 kPa) shall not accept an adapter for oxygen, 50 psig (345 kPa)].</td>
</tr>
<tr>
<td>3.</td>
<td>If operated at a pressure above 80 psig (550 kPa) but below <strong>200 185 psig (1380 1276 kPa)</strong>, be either DISS style or comply with 4-3.1.2.4.</td>
</tr>
<tr>
<td>4.</td>
<td>If operated at a pressure between 200 and 300 psig (1380 to 2068 1276 kPa), 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.</td>
</tr>
<tr>
<td>5.</td>
<td>Be labeled for the gas name and operating pressure [e.g., nitrogen, 250 psig (1725 kPa)].</td>
</tr>
<tr>
<td>(d)</td>
<td><strong>Testing.</strong> When systems operated at different pressures are installed, each pipeline shall be tested separately.</td>
</tr>
</tbody>
</table>

#### 4-3.1.2.12 Qualification of Brazing Procedures and Brazer Performance

Brazing procedures and brazer performance shall be qualified 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 Procedures and Performance Qualifications, both as modified below:

- **(a)** Brazers shall be qualified by visual examination of the test coupon followed by sectioning except that a tension test shall be permitted to be substituted for sectioning. Where tension tests are used for brazer qualification, they shall be performed in accordance with ASME IX.
- **(b)** The Brazing Procedure Specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.
- **(c)** The Brazing Procedure Qualification Record and the Record of Brazer Performance Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate used during brazing of the test coupon, and no internal oxidation exhibited on the completed test coupon.
- **(d)** Brazing procedures qualified by a technically competent group or agency are permitted under the following conditions:
  1. The Brazing Procedure Specification and the Procedure Qualification Record shall meet the requirements of this standard.
  2. The employer shall obtain a copy of both the Brazing Procedure Specification and the supporting qualification records from the group or agency and shall sign and date these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.
  3. The employer shall qualify at least one brazer following each Brazing Procedure Specification used.

- **(e)** An employer shall be permitted to accept Brazer Qualification Records of a previous employer under the following conditions:
  1. The brazer shall have been qualified following the same or an equivalent procedure as that which he/she will use for the new employer.
  2. The new employer shall obtain a copy of the record of Brazer Performance Qualification tests from the previous employer and shall sign and date these records, thereby accepting responsibility for the qualifications performed by the previous employer.

- **(f)** Performance qualification of brazers shall remain in effect indefinitely unless the brazer does not braze with the qualified procedure for a period exceeding 12 months, or there is a specific reason to question the ability of the brazer.

#### 4-3.1.2.13 Labeling

Gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where supplementary color identification of piping if used, it shall be in accordance with the gases and colors indicated in CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use. Only those systems operating at nonstandard pressures shall be labeled with the name of the gas and the operating pressure.

### 4-3.1.2.14 Gas Piping

- **(a)** Gas Piping. The provisions of this section apply to field-installed piping for the distribution of nonflammable medical piped gases.
  1. Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.
2. Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-5.1.10(a)3. Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

3. Piping shall be ASTM B 819 specification hard-drawn seamless medical gas tubing. ASTM B 819 tubing having the trade names “OXY,” “MED,” “OXY/MED,” “OXY/ACP,” or “ACP/MED” in green (Type K) or blue (Type L). Main and branches shall not be less than 1/2 in. nominal size. Factory-installed tube on station outlets extending no further than 8 in. from the outlet body shall be permitted to be 3/8 in. O.D. (1/4 in. nominal) size. Connection to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/8 in. nominal) size.

Exception: For systems operated at pressures between 200 and 500 psig (1380 and 2070 kPa, respectively), ASTM B 819, Type E, copper shall be used.

4. Copper tube shall, wherever possible, be installed over head or below floor level. Only where the installation requires installing in a slab, exceptions below are permitted to apply:
   a. Annealed (soft-tapered) ASTM B 819 copper tubing that has been prepared for oxygen service according to CGA Pamphlet C-11, Cleaning Equipment for Oxygen Service, shall be permitted to be used up to 1/2 in. O.D. (3/8 in. nominal) size.
   b. The tube shall be installed in conduit sufficiently large to accept the following gases (if used): O2, N2O, N2, MA, DA, Level 3 vacuum.
   c. The pipe shall be a continuous run from entry to exit of the conduit. PVC conduit shall be permitted for Level 3 vacuum only.
   d. All station outlets (inlets) shall be permitted to be completed after the slab is complete.
   e. All tests shall be completed per 4-5.1.1.4.

5. Joints in medical gas tubing shall be brazed except that memory-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution piping system.

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

7. Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-58, Piping Hangers and Supports Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Piping Hangers and Supports: Materials, Design, and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:
   a. Joints in medical gas tubing shall be brazed except that memory metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution piping system.

Exception: Brazed connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges shall be permitted in lieu of brazed joints.

8. Listed or approved metallic gas tubing that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint shall be permitted.

9. Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

10. Piping shall not be installed in a continuous conduit.

11. Piping shall be installed against surface loads. Buried piping shall be backfilled with clean and compacted soil as to protect and uniformly support the piping. A continuous warning means shall be provided above the pipe to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access to the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous warning means shall be provided above the pipe to protect the pipe from damage while backfilling.

12. Medical gas risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with dirt.

13. Piping shall not be installed in kitchens or electrical switch gear rooms.

14. Piping shall not be installed in continuous conduit.
### 1. Brazed Tube Joints

#### Brazed Joints

- **Brazed tube joints shall be the socket type.** Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-5.1.2.10(b). Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metal, except that filler metal having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer’s instructions.

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

- **Dissimilar metals, such as copper and bronze or brass, shall be brazed using an appropriate flux with a silver (silver series) brazing filler metal.**

- **2. Joints to be brazed in place shall be accessible for proper preparation, assembly, heating, filler application, cooling, cleaning, and inspection.**

- **3. Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube.** The cut ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe.

- **4. The surfaces to be brazed shall be mechanically cleaned using a clean stainless steel wire brush.** The use of tool oil shall be prohibited due to the possible presence of oil. Mechanical cleaning shall not result in grooving of the surfaces to be joined. After mechanical cleaning, the surfaces shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the cleaned item for oxygen internal surfaces of the tube and component. Joints shall be recleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.

- **5. Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux.** The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the noncopper component and the interior of the subassembly shall be cleaned of flux prior to installation in the piping system. Flux-coated brazing rods shall be permitted to be used in lieu of the application of flux to the surfaces to be joined on tube 3/4 in. nominal size and smaller.

- **6. Tube ends shall be inserted fully into the socket of the fitting.** Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. Techniques for heating the brazing filler metal, and making horizontal, vertical, and large-diameter joints shall be stated in sections on “Applying Heat and Brazing” and “Horizontal and Vertical Joints” in the chapter on “Joining and Brazing” in the COPPER TUBE HANDBOOK.

- **7. While being brazed, joints shall be continuously purged with 99.99% nitrogen to prevent the formation of copper oxide on the inside surface of the joint.** The flow of purge gas shall be maintained until the joint is cool to the touch.

**Exception:** A final connection to an existing pipeline shall be permitted to be made without the use of a final connection fitting provided the inside surface of the joint is not deformed. Alternate provisions of the pipeline shall be tested in accordance with 4-5.1.2.10(b) with the gas of system designation.

- **8. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas while brazing and to prevent debris or other contaminants from entering the system; except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced.** During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

- **9. After brazing, the outside of all joints shall be cleaned by brushing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint.** Where flux has been permitted, hot water shall be used.

- **10. Each brazed joint shall be visually examined after cleaning of the outside of the joint.** The following conditions shall be considered unacceptable:

  - a. Flux or flux residue
  - b. Excessive oxidation of the joint
  - c. Presence of unmelted filler metal
  - d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
  - e. Crack in the tube or component
  - f. Crack in the brazed filler metal
  - g. Failure of the joint to hold the test pressure under
Trenches shall be excavated wide enough so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provided access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one half the depth of bury. Where underground piping is installed through walls or slabs of the enclosure shall be sealed to prevent the entrance of ground water. Piping underground within buildings or imbedded in concrete floors or walls shall be installed in a continuous conduit.
(f) Gas piping shall be permitted to be located 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 130°F (54°C) maximum. Gas piping shall not be located where subject to contact with oil, including flooding in the case of a major oil leak.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

4-6.1.2.3 Piping systems for nonflammable gases shall comply with Level 1 gas systems as specified in this chapter.

The revised proposal incorporated the accepted proposal and inserted.

<table>
<thead>
<tr>
<th>VOTE ON COMMITTEE ACTION:</th>
<th>AFFIRMATIVE: 22</th>
</tr>
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<tbody>
<tr>
<td>NOT RETURNED: 1 Bancroft</td>
<td></td>
</tr>
</tbody>
</table>

99-201 - (4-3.1.2.13): Reject

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: Delete last sentence ("Only those systems operating ... and the operating pressure.")

SUBSTANTIATION: Sentence 1 already covers the subject of labeling piping. In addition, 4-3.1.2.14(a) covers the subject of pipe labeling.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Non-standard operating pressure pipeline should have the pressure on the pipeline.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

<table>
<thead>
<tr>
<th>VOTE ON COMMITTEE ACTION:</th>
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<tbody>
<tr>
<td>NOT RETURNED: 1 Bancroft</td>
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</table>

99-202 - (4-3.1.2.13): Accept in Principle in Part

TCC NOTE: The Technical Correlating Committee directs the Committee to review and be more specific in the Committee Action. State what is accepted and what is not accepted.

SUBMITTER: David Escherick, Patient Instrumentation Corp.

RECOMMENDATION: Revise text as follows:

"The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. If the medical gas system is operating at non-standard pressure the labeling shall then include the name of the gas as well as the operating pressure."

SUBSTANTIATION: The problem is that this sentence makes it seem as if all medical gas systems should be labeled with pressure of system. Per my recollection this was not the committee’s intent. It was the intent of the committee that only the non-standard operating pressure systems be so labeled.

COMMITTEE ACTION: Accept in Principle in Part.

COMMITTEE STATEMENT: The existing wording is adequate.

See Committee Action and Statement on Proposal 99-145 (Log #291) which reads as follows:

Revise the proposal as follows:

Affected Paragraphs: 4-3.1.2 through 4-6.1.2.5 (Level 1, 2, 3, and 4 affecting piping, materials and installation). This is an attempt to meld the vacuum and positive gas piping systems. NFPA eliminated the vacuum subcommittee a number of years ago with the intention of bringing the two sections into one document. This is just a continued effort to accomplish this goal.

The Left Column is the complete proposed text. New material is Bold. Where the text is sourced in the current document, the source paragraph is listed in the right-hand column. Where the text is new, the relevant proposal is noted.
### NFPA 99 — November 2001 ROP — Copyright 2001, ROP

<table>
<thead>
<tr>
<th>4-3.1.2 Distribution — Level 1 (Manifold, Piping, Valving— Level 1, 2, 3, and 4 Gas and Vacuum Piping and Materials Controls, Outlet/Terminals, Alarms). See Figure 4-3.1.2.1 General Requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) <strong>Oxygen Compatibility.</strong> Components in nonflammable medical gas and vacuum systems shall be of materials that are suitable for oxygen service. (See 4-3.1.1.3, Material — Oxygen Compatibility.) Pipe (tube), fittings, valves, and other components shall have been thoroughly cleaned internally to remove oil, grease, and other readily oxidizable materials, as if for oxygen service.</td>
</tr>
<tr>
<td>4-3.1.2.1(a)</td>
</tr>
<tr>
<td>(b) <strong>Cleanliness.</strong> Materials that have been cleaned for use in medical gas piping systems shall be plugged, capped, or otherwise sealed until installed. Particular care shall be taken in the storage and handling of such material to maintain its clean condition. Immediately before final assembly, such material shall be visually examined internally for contamination. Material that has become contaminated and is no longer suitable for oxygen service shall not be installed.</td>
</tr>
<tr>
<td>4-3.1.2.1(b)</td>
</tr>
<tr>
<td>(c) <strong>On-Site Re-Cleaning.</strong> Re-cleaning of the interior surfaces of tube ends, valves, fittings, and other components shall be limited to recleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Such surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or trisodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot potable water.</td>
</tr>
<tr>
<td>AIP Log #43</td>
</tr>
<tr>
<td>(d) <strong>Pressure Gauges for Gases.</strong> The scale range of positive pressure analog gauges shall be such that the normal reading falls within the middle 50 percent of the scale. The scale range of digital gauges shall be not more than two times the working pressure. The rated accuracy of pressure gauges used for testing shall be one percent (full scale) or better at the point of reading. Pressure gauges shall be in compliance with ANSI/ASME B-40.1, Gauges, Pressure Indicating Dial-Type, Elastic Elements.</td>
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<tr>
<td>1.* A pressure gauge shall be installed in the main line adjacent to the actuating switch required in 4-3.1.2.5(b)3e. It shall be appropriately labeled and shall be readily visible from a standing position.</td>
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<tr>
<td>2.* An appropriately identified pressure gauge, connected to the line being monitored, shall be installed at each area alarms panel location. It shall be appropriately labeled and shall be readily visible from a standing position.</td>
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<tr>
<td>(f) <strong>Vacuum System Gauges.</strong></td>
</tr>
<tr>
<td>(a) <strong>Main-Line Gauge.</strong> A vacuum gauge shall be provided in the main vacuum line adjacent to the actuator (vacuum switch) for the master alarms, with this gauge located immediately upstream (on the terminal or inlet side) terminal or inlet of the source valve (the main line valve, if so equipped). Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).</td>
</tr>
<tr>
<td>4-3.2.2.10</td>
</tr>
<tr>
<td>(b) <strong>Area Gauge.</strong> Vacuum gauges shall be located at each area vacuum alarm signal location, with this gauge connected upstream (on the terminal or inlet side) of any valve controlling that area. Those with normal range display shall indicate normal only between 12 and 19 in. Hg (vacuum).</td>
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<tr>
<td>(c)* Vacuum Gauge Identification. All permanently installed vacuum gauges and manometers for the vacuum system shall be continuous reading, manufactured expressly for vacuum, and labeled: VACUUM.</td>
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<tr>
<td>4-3.1.2.7 Piping Materials. The provisions of this section apply to field-installed piping for the distribution of medical piped gases and vacuum systems.</td>
</tr>
<tr>
<td>(a) Tubing, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service prior to installation.</td>
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<td></td>
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<tr>
<td>(b) Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-3.1.2.1. Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.</td>
</tr>
<tr>
<td>4-3.1.2.7(c) and 4-3.2.2.2(c)</td>
</tr>
<tr>
<td>(c) Piping shall be ASTM B 819 specification hard drawn seamless medical gas tubing; ASTM B 819 tubing is identified by the markings &quot;OXY,&quot; &quot;MED,&quot; &quot;OXY/MED,&quot; &quot;OXY/ACR,&quot; or &quot;ACR/MED&quot; in green (Type K) or blue (Type L). Main and branches shall be not less than 1/2 in. nominal size for positive gases and 3/4 in. nominal for vacuum. Drops to individual outlet/inlets shall be not less than 1/2 in. nominal. Factory-installed tube on station outlets extending no further than 8 in. from the outlet body shall be permitted to be 1/2 in. O.D. (3/8 in. nominal) size. Connecting tubing for gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/8 in. O.D. (1/4 in. nominal) size.</td>
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<tr>
<td>AIP Log #292</td>
</tr>
<tr>
<td>AIP Log #62</td>
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<tr>
<td>4-3.1.2.7(d)</td>
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<tr>
<td>(d) Where seismic construction is required by the building code, piping shall be properly braced.</td>
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<td>(e)* Except as provided under 4-3.1.2.7(g) and (h), joints in copper tubes shall be brazed using capillary fittings complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings, or brazing fittings complying with MSS SP-73, Brazing Joints for Wrought and Cast Copper Alloy Solder Joints Pressure Fittings. Cast fittings shall not be used for brazed joints.</td>
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</table>
(f) Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, *Cleaning Equipment for Oxygen Service*, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

(g) Joints in medical gas tube shall be brazed except that memory-metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Flared and compression fittings shall be prohibited throughout the piping system, including connections to station outlet/inlet alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system.

**Exception:**

1. Threaded connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges.

2. Dielectric fittings at equipment requiring isolation between the piping distribution system and the equipment.  

(h) 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 shall be permitted to be used in lieu of brazed joints.

(i) Turns, offsets, and other changes in direction in piping shall be made with fittings complying with 4-3.1.2.7(e).

**Vacuum System Piping**

1. Seamless copper water tube (ASTM B88), Type K,L,M copper ACR tube, (ASTM B280), or (ASTM B819) medical gas tube shall be permitted to be used.  

2. Soft annealed copper tubing (ASTM B88) shall be permitted underground.

**Exception: Nonstandard Operating Pressure Systems**

1. Where operating pressures are 200 to 300 psig (1380 to 2068 kPa) above 185 psig (1,276 kPa), only Type K medical gas tube (ASTM B819) shall be used for piping larger than 3 1/8 in. O.D. (3 in. nominal).

**4-3.1.2.8 Pipe Joints.**

(a)** Threaded Joints.**

1. Threaded joints in medical gas distribution piping shall be limited to the connection of pressure/vacuum gauges, alarm pressure/vacuum switches, and similar devices.

2. Threads on pipe and fittings shall be tapered pipe threads complying with ANSI B1.20.1, *Pipe Threads, General Purpose*.

3. Threaded joints in piping systems shall be made up with polytetrafluoroethylene (such as Teflon™) tape or other thread sealant suitable for oxygen service. Sealants shall be applied to the male threads only.

(b)** Brazed Joints.**

1. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-3.1.2.8(b)1b. Brazing filler metals shall comply with ANSI/AWS A5.8, *Specification for Brazing Filler Metals*, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer's instructions.

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

   b. Dissimilar metals, such as copper and bronze or brass, shall be brazed using an appropriate flux with a silver (BAg series) brazing filler metal.

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

   3. Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. The cutting wheel shall be free from grease, oil, or other lubricant not suitable for oxygen service. The cut ends of tube and pipe shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe.

   4. The fitting surfaces to be brazed shall be pre-cleaned by the manufacturer and the tube ends to be brazed shall be cleaned with a non-abrasive pad. The use of steel wool shall be prohibited due to the possible presence of oil. Mechanical cleaning shall not result in grooving of the surfaces to be joined. After mechanical cleaning, the surfaces shall be wiped using a clean, lint-free white cloth. During this cleaning, care shall be taken to avoid contamination of the “cleaned for oxygen” internal surfaces of the tube and components. Joints shall be re-cleaned if contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.
5. Where dissimilar metals, such as copper and bronze or brass, are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the surfaces to be brazed using a stiff stainless steel bristle brush to ensure adequate coverage and wetting of the surfaces with flux. Where possible, short sections of copper tube shall be brazed to the non-copper component and the interior of the sub-assembly shall be cleaned of flux prior to installation in the piping system. Flux-coated brazing rods shall be permitted to be used in lieu of the application of flux to the surfaces to be joined on tube 3/4 in. nominal size and smaller.

6. Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. 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 the chapter on “Joining and Bending” in the CDA Copper Tube Handbook.

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen to prevent the formation of copper oxide on the inside surface of the joint. The purge gas shall be monitored and audibly alert the brazzer of low content of purge gas. The flow of purge gas shall be maintained with the use of a flow meter until the joint is cool to the touch. Accept Log #52

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 portion of the pipeline shall be tested in accordance with 4-3.4.1.3(e) twenty-five percent of the existing zones downstream from the connection shall be tested for particulate matter in accordance with the piping purge test in 4-3.4.1.3(e) with the use of the gas of system designation. Accept Log #230

8. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

9. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint.

The following conditions shall be considered unacceptable:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Accept Log #</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Flux or flux residue</td>
<td>#291</td>
</tr>
<tr>
<td>b. Excessive oxidation of the joint</td>
<td>#291</td>
</tr>
<tr>
<td>c. Presence of unmelted filler metal</td>
<td>#291</td>
</tr>
<tr>
<td>d. Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube</td>
<td>#291</td>
</tr>
<tr>
<td>e. Cracks in the tube or component</td>
<td>#291</td>
</tr>
<tr>
<td>f. Cracks in the braze filler metal</td>
<td>#291</td>
</tr>
<tr>
<td>g. Failure of the joint to hold the test pressure under 4-3.4.1.2(c)</td>
<td>#231</td>
</tr>
</tbody>
</table>

11. Brazed joints that are found to be defective under 4-3.1.2.8(b)10, conditions a, c, d, f, or g, shall be permitted to be reinserted and reheated, except that no joint shall be repaired more than once before being replaced. Brazed joints that are found to be defective under 4-3.1.2.8(b)10, conditions b and e, shall be replaced.

Accept Log #231

Exceptions: Level 1 and 2 Vacuum and WAGD Systems

1. Mechanically Formed Branch Connections. The use of drilled and extruded tee-branch connections to copper mains and branches shall be permitted. Such connections shall be made in accordance with the tool manufacturer's instructions and the joints shall be brazed.

2. Unions, flare nuts, and similar straight-threaded connections shall be permitted only in exposed locations and shall not be concealed in walls or ceilings.

4-3.2.2.2(h)

4-3.1.2.9 Piping Installation.

(a) Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures. Horizontal runouts from all mains and branches shall be taken off above the center line of the pipe and rise vertically or at an angle of not more than 45° from the vertical.

(b) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports — Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports Materials, Design and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic-coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:
### NFPA 99 — November 2001 ROP — Copyright 2001, ROP

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Minimum Burst Pressure (PSIG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 in.</td>
<td>5</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>6</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>6</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>7</td>
</tr>
<tr>
<td>1 in.</td>
<td>9</td>
</tr>
<tr>
<td>1 1/4 in.</td>
<td>10</td>
</tr>
<tr>
<td>1 1/2 in.</td>
<td>12</td>
</tr>
</tbody>
</table>

### Vertical Riser, All Sizes

- Every floor, but not to exceed 15 ft (4.57 m)

### Requirements Listed in 4-3.1.2.3 Through 4-3.1.2.9

- Gas piping systems have an operating pressure other than the standard 50 to 55 psig (345 to 380 kPa) [or 160 psig (1103 kPa) for nitrogen], and are in addition to the minimum requirements listed in 4-3.1.2.3 through 4-3.1.2.9.

### Systems Having Nonstandard Operating Pressures

- The requirements listed in 4-3.1.2.3 through 4-3.1.2.9 apply to gas piping systems having an operating pressure other than the standard 50 to 55 psig (345 to 380 kPa) [or 160 psig (1103 kPa) for nitrogen], and are in addition to the minimum requirements listed in 4-3.1.2.3 through 4-3.1.2.9.

### Equipment and Component Installation

1. The installation of individual components shall be made in accordance with the instructions of the manufacturer. Such instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper installation, testing, maintenance, and operation of the medical gas systems. These instructions shall be left with the owner.

2. The installation shall be made by qualified, competent technicians experienced in making such installations and meeting the requirements of ANSI/ASSE Series 6000, Standard 6010, (See 4-3.1.2.12 for brazer performance.)

3. Brazing shall be performed by individuals who are qualified under the provisions of 4-3.1.2.12.

(b) Health care organization personnel shall be permitted to install piping systems if all the requirements of Section 4-3.1.2.12 are met during installation.

(c) The installer of medical gas piping and equipment shall maintain on the job site documentation for brazing procedures and individual brazers per 4-3.1.2.12 prior to installation.

(d) Two or more medical gas piping systems shall not be interconnected for testing or for any other reason. Leak testing shall be accomplished by separately charging and testing the individual piping system.

4-3.1.2.11 Systems Having Nonstandard Operating Pressures

- The following requirements apply to gas piping systems having an operating pressure other than the standard 50 to 55 psig (345 to 380 kPa) [or 160 psig (1103 kPa) for nitrogen], and are in addition to the minimum requirements listed in 4-3.1.2.3 through 4-3.1.2.9.
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4-3.1.2.10* Gas Piping.

The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where tension tests are used for brazer qualification, they shall be performed in accordance with ASME IX.

4-5.1.2.13 Labeling. The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where tension tests are used for brazer qualification, they shall be performed in accordance with ASME IX.

4-3.1.2.12 Qualification of Brazing Procedures and Brazer Performance. Brazing procedures and brazer performance shall be qualified 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 Procedures and Performance Qualifications, both as modified below.

(a) Brazers shall be qualified by visual examination of the test coupon followed by sectioning except that a tension test shall be permitted to be substituted for sectioning. Where tension tests are used for brazer qualification, they shall be performed in accordance with ASME IX.

(b) The Brazing Procedure Specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal.

(c) The Brazing Procedure Qualification Record and the Record of Brazer Performance Qualification shall document filler metal used, cleaning, joint clearance, overlap, internal purge gas and flow rate used during brazing of the test coupon, and no internal oxidation exhibited on the completed test coupon.

(d) Brazing procedures qualified by a technically competent group or agency are permitted under the following conditions:

1. The Brazing Procedure Specification and the Procedure Qualification Record shall meet the requirements of this standard.

2. The employer shall obtain a copy of both the Brazing Procedure Specification and the supporting qualification records from the group or agency and shall sign and date these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.

3. The employer shall qualify at least one brazer following each Brazing Procedure Specification used.

(e) An employer shall be permitted to accept Brazer Qualification Records of a previous employer under the following conditions:

1. The brazer shall have been qualified following the same or an equivalent procedure as that which he/she will use for the new employer.

2. The new employer shall obtain a copy of the record of Brazer Performance Qualification tests from the previous employer and shall sign and date these records, thereby accepting responsibility for the qualifications performed by the previous employer.

(f) Performance qualification of brazers shall remain in effect indefinitely unless the brazer does not braze with the qualified procedure for a period exceeding 12 months, or there is a specific reason to question the ability of the brazer.

4-3.1.2.13 Labeling. The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where supplementary color identification of piping if used, it shall be in accordance with the gases and colors indicated in CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use. Only those systems operating at nonstandard pressures shall be labeled with the name of the gas and the operating pressure.

4-5.1.2.13 Labeling. The gas content of medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft (6 m) and at least once in each room and each story traversed by the piping system. Where supplementary color identification of piping if used, it shall be in accordance with the gases and colors indicated in CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use. Only those systems operating at nonstandard pressures shall be labeled with the name of the gas and the operating pressure.
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1. Piping for nonflammable medical gas systems shall be suitable for oxygen service in accordance with 4-5.1.2.10(a)(3). Each length of tube shall be permanently labeled and delivered plugged or capped. Fittings, valves, and other devices shall be sealed and marked. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of this paragraph.

2. Piping shall be ASTM B 819 specification hard-drawn seamless medical gas tubing. ASTM B 819 tubing shall be identified by the markings “OXY,” “MED,” “OXY/MED,” “OXY/ACP,” or “ACP/MED” in green (Type K) or blue (Type L). Main and branches shall be not less than 1/2 in. nominal size. Factory installed tube on station outlets extending no farther than 8 ft. from the outlet body shall be permitted to be 3/8 in. O.D. (1/2 in. nominal) size. Connection to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (3/8 in. nominal) size.

Exception: For systems operated at pressure between 200 and 300 psig (1380 and 2070 kPa, respectively), ASTM B 819. Type K copper shall be used.

3. Copper tube shall, wherever possible, be installed overhead or below floor level. Only where the installation requires installing in a slab, exceptions below are permitted to apply:
   a. Annealed (soft temper) ASTM B 819 (Type K or L) copper tube that has been prepared for oxygen service according to CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, shall be permitted to be used up to 1/2 in. O.D. (3/8 in. nominal) size.
   b. The tube shall be installed in conduit sufficiently large to accept the following gases (if used) O2, N2 O, N2, MA, DA, Level 3 vacuum.
   c. The pipe shall be a continuous run from entry to exit of the conduit. PUC conduit shall be permitted for Level 3 vacuum only.
   d. All station outlets (inlets) shall be permitted to be completed after the slab is complete.
   e. All tests shall be completed per 4-5.1.1.2.

4. 3/8 in. dia. or smaller, as provided under 4-5.1.2.10(a)(3) and 9, joints in copper tubes shall be brazed using capillary fitting complying with ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings, or brazing fittings complying with MSS SP-73, Brazing Fittings for Wrought and Cast Copper Alloy Solder-Joint Pressure Fittings. Cast fittings shall not be used for brazed joints.

Exception: Brazed connections shall be permitted when exposed at station outlets and manifold connections.

5. Valves, fittings, and other piping components shall be cleaned for oxygen service by the manufacturer in accordance with CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, except that fitting shall be permitted to be cleaned by a supplier or agency other than the manufacturer.

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

7. Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Supports Materials, Design and Manufacture. Hangers for copper tube shall have a copper finish. In potentially damp locations, copper tube hangers or supports shall be plastic coated or otherwise insulated from the tube. Maximum support spacing shall be as follows:
   a. Joints in medical gas tube shall be brazed except that monometal cut-offs having temperature and pressure ratings not less than that of a brazed joint shall be permitted. Compression-type connections shall be prohibited throughout the piping system, including connections to station outlets, alarm devices, and other components. Unions shall not be permitted in the distribution pipeline system.

Exception: Brazed connections for air compressor sets and devices such as manifolds, pressure regulators, relief valves, pressure switches, and pressure gauges.

8. 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 shall be permitted to be used in lieu of brazed joints.

9. Turn, offsets, and other changes in direction in piping shall be made with fittings complying with 4-5.1.2.10(a)(4).

10. Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that is subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stresses. The minimum back-filled cover above the top of buried piping outside of buildings shall be 30 in. (0.762 m), except that the minimum cover shall be reduced to 10 in. (0.254 m) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access to the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at builder's handholes. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit.

11. Medical gas lines shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, and leakage as follows:

   a. Copper tube shall be installed in a metal pipe shaft and wrapped with a 10 in. (0.254 m) thick sheath of batt insulation. The metal pipe shall be sheathed with a minimum of 1/2 in. (1.27 cm) thick metal sheathing.
   b. The pipe shall be supported from the building, with the metal pipe shaft, at not more than 10 ft. (3.05 m) intervals.
   c. The enclosure shall be split or otherwise provide access to the joints during visual inspection and leak testing.
   d. The enclosure shall be of a material that will protect the pipe from corrosion and physical damage.

12. Medical gas lines shall not be installed in kitchens or electrical switch gear rooms.
### Brazed Joints

1. Brazed tube joints shall be the socket type. Filler metals shall bond with and be metallurgically compatible with the base metals being joined. Flux shall not be used except where permitted under 4-5.1.2.10(b). Brazing filler metals shall comply with ANSI/AWS A5.8, Specification for Brazing Filler Metal, except that filler metal having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer's instructions.

2. Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorous silver brazing filler metal (RC1 series) without flux.

3. Dissimilar metals, such as copper and bronze or brass, shall be brazed using an appropriate flux with a silver (RS series) brazing filler metal.

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

5. Tube ends shall be cut square using a sharp tubing cutter to avoid deformation of the tube. The cut end of each tube shall be free from burrs, chips, oil, or other contaminants. The cut ends of tube and pipe shall be deburred with a sharp, deburring tool, taking care to prevent chips from entering the tube or pipe.

6. Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. Techniques for heating 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 the chapter on “Joining and Brazing” in the CDA Copper Tube Handbook.

7. While being brazed, joints shall be continuously purged with oil-free dry nitrogen to prevent the formation of copper oxide on the inside surface of the joint. The flow of purge gas shall be maintained until the joint is cool to the touch.

**Exception:** A final connection to an existing pipeline shall be permitted to be made without the use of a purge to brazing. Joints shall be brazed within 1 hour of being cleaned.

8. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas while brazing and to prevent debris or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

9. After brazing, the outside of all joints shall be cleaned by working with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.

10. Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:

   - Flux or flux residue
   - Excessive oxidation of the joint
   - Presence of unmelted filler metal
   - Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
   - Crack in the tube or component
   - Crack in the braze filler metal
   - Failure of the joint to hold the test pressure under positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

### Additional Guidelines

- The cut ends of tube and pipe shall be deburred with a sharp, deburring tool, taking care to prevent chips from entering the tube or pipe.
- Tube ends shall be inserted fully into the socket of the fitting. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. Once this has occurred, or where flux is not used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. Techniques for heating 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 the chapter on “Joining and Brazing” in the CDA Copper Tube Handbook.
- While being brazed, joints shall be continuously purged with oil-free dry nitrogen to prevent the formation of copper oxide on the inside surface of the joint. The flow of purge gas shall be maintained until the joint is cool to the touch.
- During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas while brazing and to prevent debris or other contaminants from entering the system, except that during brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.
- After brazing, the outside of all joints shall be cleaned by working with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.
- Each brazed joint shall be visually examined after cleaning of the outside of the joint. The following conditions shall be considered unacceptable:
   - Flux or flux residue
   - Excessive oxidation of the joint
   - Presence of unmelted filler metal
   - Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube
   - Crack in the tube or component
   - Crack in the braze filler metal
   - Failure of the joint to hold the test pressure under positive pressure in the piping system. After brazing, the discharge opening shall be plugged or capped to prevent contamination of the inside of the tube.

### References

- NFPA 99 — November 2001 ROP
- Copper Tube Handbook
- ANSI/AWS A5.8, Specification for Brazing Filler Metal
<table>
<thead>
<tr>
<th>Section</th>
<th>Text</th>
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</table>
| 44-1.3.1 | The provisions of this section apply to field-installed piping for the distribution of gases to power devices. (a) Piping shall be Type K or L copper (hard drawn or annealed) or brass (schedule 40 or 80). If Level 3 system dynamic gas piping is installed simultaneously with other patient gas piping systems, the Level 3 system piping shall be labeled or otherwise identified prior to installation in order to preclude inadvertent inclusion in a nonflammable medical gas piping system, or the Level 3 system piping shall be cleaned and degreased in accordance with 44.1.1. (b) Piping shall be manufactured from corrosion-resistant materials suitable for the system pressures (not to exceed 160 psig (1103 kPa)). (c) Connectors and joints shall be brazed or threaded NPT.
| (d) Piping shall be supported with MSS Standard Practice SP-58, Piping Hangers and Supports — Selection and Application, Hangers and supports shall comply with MSS Standard Practice SP-38, Pipe Hangers and Support — Materials, Design and Manufacture.
| (e) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth to protect the piping from excessive stress. The minimum backfilled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Underground piping shall be installed in a continuous enclosure to protect the pipe from damage while backfilling. The enclosure shall be split or otherwise provide access at the joints during visual inspection and leak testing. Backfill shall be clean and compacted so as to protect and uniformly support the piping. A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. In addition, a continuous warning means shall be provided above the pipeline at approximately one-half the depth of bury. Where underground piping is installed through a wall, the ends of the wall shall be sealed to prevent the entrance of ground water. Piping underground within buildings or imbedded in concrete floors or walls shall be installed in a continuous conduit.

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The revised proposal incorporated the accepted proposal and inserted.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-203 - (4-3.1.2.13 and 4-3.1.2.14(a)) : Accept in Principle
SUBMITTER: Thomas J. Mravulak, American Society of Sanitary Engineering
RECOMMENDATION: Revise text as follows:
"The gas content of all medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling – Only those systems operating at nonstandard pressure shall be labeled with the name and gas pressure.
SUBSTANTIATION: For years the last sentence in these paragraphs has contradicted the first sentence. All gases should be marked with both the name of the gas and the pressure.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: It is the committee’s intent that only non standard systems be labeled for pressure.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-204 - (4-3.1.2.13 and 4-5.4.1): Reject
SUBMITTER: Thomas J. Mravulak, American Society of Sanitary Engineering
RECOMMENDATION: Revise text as follows:
"The gas content of all medical gas piping systems shall be readily identifiable by appropriate labeling with the name and pressure of the gas contained. Such labeling – Only those systems operating at nonstandard pressure shall be labeled with the name and gas pressure.
SUBSTANTIATION: For years the last sentence in these paragraphs has contradicted the first sentence. All gases should be marked with both the name of the gas and the pressure.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: It is the committee’s intent that only non standard systems be labeled for pressure.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-205 - (4-3.1.2.14(a)) : Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:
"Identification. (a) Piping. Pipe labeling shall include the name or chemical symbol for the system gas and its operating pressure.
SUBSTANTIATION: The pressure of the gases in standard operating pressure systems, agreed in 1999, is not required to be on the label.
COMMITTEE ACTION: Accept in Principle.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-206 - (4-3.1.2.14(b)4 (New) ) : Accept
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Add the following:
"4. The pressure of the gas if nonstandard.
SUBSTANTIATION: By marking the pressure of the nonstandard gas system shutoff valves it will distinguish the valve just as it did for the pipe labeling.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-207 - (4-3.1.2.14(c)) : Reject
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:
"Station Outlets and Inlets. Station outlets and inlets shall be identified as to the specific medical or vacuum provided.
Nonstandard pressure shall be identified with the pressure/vacuum on the outlet/inlet.
SUBSTANTIATION: The identification of pressure on the station outlets/inlets that are nonstandard is important for patient safety.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: Already covered in 4-3.2.11(c)5.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-208 - (4-3.2.1.6): Reject
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Revise the first sentence:
"Vacuum receiver(s) shall be provided when required by the technology of the pump but may be omitted if the pump is designed to operate without them.
SUBSTANTIATION: The requirement for vacuum receivers was written when the available technologies required or preferred “on-off operation.” This is not true of all technologies now employed, and the requirement should be changed to admit this advance.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The use of a receiver provides protection for pumps.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

EXPLANATION OF NEGATIVE: Allen: The protection provided by the receiver and referred to by the committee is necessary in many but not all pumps, and it has not been the practice of this standard to be design restrictive, as this now is and would remain by this action.

Committee: HEA-PIP

99-209 - (Figure 4-3.2.1.10): Reject
SUBMITTER: Kurt P. Kubili, M/E Engineering
RECOMMENDATION: Per 4-3.2.2.8(b) Master alarm switch should be located between the source shutoff valve and the medical piping systems.

Included in 4-3.1.2
Figure 4-3.2.1.10  Typical Level 1 vacuum source.

SUBSTANTIATION: None given.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: This was corrected in the 1999 edition of the standard.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: This drawing shows a swing check used on the inlet of the vacuum pumps. Swing checks are designed to be used in horizontal piping and not in vertical piping because the seat which stops the back pressure uses gravity to close the seat of the valve.
SUBSTANTIATION: Spring check valves should be drawn since the spring check can and will operate in both the horizontal and vertical position.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The check valve indicated does not represent any particular type of check valve.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-211 - (4-3.2.2.2): Reject
SUBMITTER: S. Karl Sellers, Victaulic Company of America
RECOMMENDATION: Revise text as follows:
4-3.2.2.2 Vacuum System Piping Network.
(a)* Vacuum Network Piping. Piping shall be corrosion-resistant metal such as seamless copper water tube (ASTM B88, Types K, L, M), copper ACR tube (ASTM B280), copper medical gas tube (ASTM B819), stainless steel tube, or galvanized steel pipe [1 1/2 in. minimum size] (ASTM A53). Pipe threads shall comply with ANSI B1.20.1, Pipe Threads, General Purpose. Copper tube shall be hard drawn temper except that annealed tube shall be permitted underground. Joints in copper tube shall be soldered, brazed or roll grooved and joined by flush seal rubber gasketed grooved mechanical couplings. Joints in stainless steel tube shall be brazed, welded, roll grooved and joined by flush seal rubber gasketed grooved mechanical couplings or piping shall be schedule 5, Type 316 stainless steel approved for use with and joined with mechanical pressfitting pipe joining method. Joints in galvanized steel pipe shall be threaded, flanged or roll grooved schedule 10 or schedule 40 galvanized steel pipe and joined by flush seal rubber gasketed grooved mechanical couplings. Soldering shall be performed in accordance with ASTM B828, Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings. Solder metal (ASTM B32) shall contain less than 0.2 percent lead. Brazing shall be in accordance with 4-3.1.2.3(c) except that flux shall be permitted to be used for copper-to-copper joints and nitrogen purging while brazing shall not be required.
SUBSTANTIATION: Roll grooved copper tube, stainless steel pipe, and galvanized steel pipe provides a permanent mechanical joint, equivalent or superior to soldered, brazed, welded, threaded or flanged joints, without requiring heat or open flame (eliminates fire hazards).
Pressfit stainless steel pipe provides a permanent mechanical joint, equivalent or superior to brazed or welded joints, without requiring heat or open flame (eliminates fire hazards).
Note: Supporting material is available for review at NFPA Headquarters.
COMMITTEE ACTION:  Reject.

COMMITTEE STATEMENT:  Vacuum systems now need to be brazed which implies that a joint meeting the requirements of AWS 5.8 be met. Vacuum systems shall have the same piping integrity of positive piping systems.

VOTE ON COMMITTEE ACTION:  AFFIRMATIVE:  17  
NEGATIVE:  3  
NOT RETURNED:  1 Bancroft  

EXPLANATION OF NEGATIVE:  

ALLEN:  The positions on these three points are not substantiated by actual experience nor are they defensible on theoretical principles. It represents a cost hardship and a design restriction. In addition, exclusion of the Victaulic or similar fitting systems cannot be justified in light of the evidence presented, and is further indefensible in light of the committee's undertaking to further study the proposal.

ERICKSON:  Accept the Proposal. The committee has been very short sighted in the exclusion of this technology from vacuum installations in health care facilities. This system is not a positive pressure system and therefore does not require the same materials and brazing requirements. There is no safety rationale for not permitting roll grooved and joined by flush seal rubber gasketed grooved mechanical couplings. Vacuum systems because of the nature of their design do not pose a health or fire safety problem if they are not installed to the same high standards of positive pressure gases. I see no evidence in the Technical Committee's substantiation for turning this proven technology down as meeting the standard's requirements.

FRANKEL:  I strongly disagree with the rejection of the Victaulic coupling method of joining pipe for vacuum systems. This Victaulic joint has been successfully used for many years and has proven very reliable. The information provided in the log application proves the gasket and joint suitable for use in vacuum systems.

SHOEMAKER:  The product presented was for vacuum, not for any positive pressured gas. The application of this product does not cause any safety issues. There was no reason presented that was convincing and lacked any factual substantiation for rejection.

SMDT:  Accept the proposal. In our last cycle the committee sent this proposal back for the submitter to provide more substantiation. This time the submitter provided the information requested and showed that the system proposed will perform as a vacuum piping system. The committee has not provided adequate reason to reject this proposal.


SUBMITTER:  Dale J. Dumbleton, American Medical Gas Inst./National ITC.

RECOMMENDATION:  Revise text as follows:

(a) Vacuum Network Piping. Piping shall be corrosion-resistant metal such as seamless copper water tube (ASTM B 88, Type "K," "L," "M"), copper ACR tube (ASTM A280), copper medical gas tube (ASTM B 819), stainless steel tube or galvanized steel pipe [1 1/2 in. minimum size] (ASTM A53). Joints in copper tube shall be soldered or brazed. Joints in stainless steel tube shall be brazed or welded. Joints in galvanized steel pipe shall be threaded or flanged. Solder metal (ASTM B32) shall contain less than 0.2 percent lead. Brazing shall be in accordance with 4-2.1.2.3(c) except that nitrogen purging while brazing shall not be required.

SUBSTANTIATION:  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.

COMMITTEE ACTION:  Accept in Principle.


SUBMITTER:  Dale J. Dumbleton, American Medical Gas Inst./National ITC.

RECOMMENDATION:  Revise text as follows:

(a) Vacuum Network Piping. Piping shall be corrosion-resistant metal such as seamless copper water tube (ASTM B 88, Type "K," "L," "M"), copper ACR tube (ASTM A280), copper medical gas tube (ASTM B 819), stainless steel tube or galvanized steel pipe [1 1/2 in. minimum size] (ASTM A53). Joints in copper tube shall be soldered or brazed. Joints in stainless steel tube shall be brazed or welded. Joints in galvanized steel pipe shall be threaded or flanged. Solder metal (ASTM B32) shall contain less than 0.2 percent lead. Brazing shall be in accordance with 4-2.1.2.3(c) except that nitrogen purging while brazing shall not be required.

SUBSTANTIATION:  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.

COMMITTEE ACTION:  Accept in Principle.

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piping shall be made with fittings complying with 4-3.1.2.7(e). Joints in copper tube shall be soldered or brazed. Joints in stainless steel tube shall be brazed or welded. Joints in galvanized steel pipe shall be threaded or flanged. Solder metal (ASTM B32) shall contain less than 0.2 percent lead. Brazing shall be in accordance with Section 4-3.1.2 except that hydrogen purging while brazing shall not be required.

COMMITTEE STATEMENT: The committee revised the wording for clarity.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 17
NEGATIVE: 5
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ALLEN: See my Explanation of Negative on Proposal 99-211 (Log #32).

ERICKSON: Reject the Proposal. There is no reason for eliminating perfectly good technology based on the fact that it "may" increase the cost of construction. If an organization wants to install stainless steel or other corrosion resistant metal tubing then this standard should not prohibit it.

FRANKEL: I strongly disagree with the elimination of any piping material for vacuum piping system that has a proven successful record based on years of service. By restricting the piping to only copper we are precluding the use of other materials and joining methods. The cost of an installed system is not the committee's concern, only suitability for the intended service.

SHOEMAKER: No reason was presented that proved or even hinted that installations using these products would be substandard. The fact that "costs" may be higher is subjective and if in the future manufacturing costs are reduced for some reason, we will have excluded their use by our rejection.

SMIDT: Reject the proposal. There is no good reason to not allow owners or designers flexibility in materials that they choose for an installation. Cost of a system is not the purview of the committee; performance of the system is. The committee is not taking a reasonable action.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: The committee revised the wording for clarity.

99-214 - (4-3.2.2.2(a)): Accept in Principle

SUBMITTER: Thomas J. Mraulak, American Society of Sanitary Engineering

RECOMMENDATION: Add text as follows: "Copper tube shall be hard drawn temper except that annealed tube shall be permitted underground. Turn, offsets, and other changes in direction in piping shall be made with fittings complying with 4-3.1.2.7(e)."

SUBSTANTIATION: The use of fittings has not been addressed in this section. All changes in direction should be made with appropriate fittings.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 23
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: The committee failed to correct a mistake in the 1999 edition because Beacon Medical (Mark Allen) changed their vacuum inlet connections to 5/8 in. O.D. because of Richard Wagner’s mistake of O.D. and I.D. I don’t think we, as a committee should not correct a mistake unless proof indicates that the 3/8 in. O.D., 1/4 in. nominal inlet extensions, that has been used for years, are inadequate.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: 1/4 in. nominal is not used anywhere else in this document. It should not be any change from the 1996 edition of NFPA 99.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: 1. Larger flows are provided by the larger tube. Manufacturers have adapted to the existing requirement.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 25

COMMITTEE ACTION: Accept in Principle in Part.

Revise text as follows:
"Minimum Sizes. Mains and branches shall be not less than 7/8 in. O.D. (5/4 in. nominal) size. Drops to individual vacuum inlets shall be not less than 5/8 in. O.D. (1/2 in. nominal) size (0.500 in minimum inside diameter) except that the tube attached immediately to the station inlet and not extending more than 8 in. (20.3 cm) from the station inlet shall be permitted to be 1/2 in. O.D. (5/4 in. nominal) size (0.300 in. minimum inside diameter). Connections to gauges and alarm switches and runout to alarm panels shall be permitted to be 1/4 in. O.D. (1/4 in. nominal) size."

SUBSTANTIATION: The station inlets are manufactured with 3/8 O.D. tubing, not 1/2 O.D. tubing. Alarm switches and runouts are normally piped with 3/8 in. O.D. copper tubing, the 1/4 in. O.D. tubing is a special order, 3/8 in. O.D. tubing is common.

COMMITTEE ACTION: Accept in Principle in Part.

Revise text as follows:
"Minimum Sizes. Mains and branches shall be not less than 7/8 in. O.D. (5/4 in. nominal) size. Drops to individual vacuum inlets shall be not less than 5/8 in. O.D. (1/2 in. nominal) size (0.500 in minimum inside diameter), except that the tube attached immediately to the station inlet body and not extending more than 8 in. (20.3 cm) from the station inlet shall be permitted to be 1/2 in. O.D. (5/4 in. nominal) size (0.300 in. minimum inside diameter). Connections to gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/4 in. nominal) size."

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-215 (Log #70) for the rejection of the first proposed change and the second modification was for correlation with pressure systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
RIDENOUR: The committee failed to correct a mistake in the 1999 edition because Beacon Medical (Mark Allen) changed their vacuum inlet connections to 5/8 in. O.D. because of Richard Wagner’s mistake of O.D. and I.D. I don’t think we, as a committee should not correct a mistake unless proof indicates that the 3/8 in. O.D., 1/4 in. nominal inlet extensions, that has been used for years, are inadequate.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: 1/4 in. nominal is not used anywhere else in this document. It should not be any change from the 1996 edition of NFPA 99.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: 1. Larger flows are provided by the larger tube. Manufacturers have adapted to the existing requirement.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-215 (Log #9) which reads as follows: 1. Larger flows are provided by the larger tube. Manufacturers have adapted to the existing requirement.

NUMEROUS COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-218 - (4-3.2.2.6(g)): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Add the following text:

"Zone Valve. Station inlets shall not be supplied directly from a riser unless a manual shutoff valve located in the same story is installed between the riser and the inlet with a wall intervening between the valve and the inlet. This valve shall be readily operable from a standing position in the corridor on the same floor it serves. Each lateral branch line serving patient rooms shall be provided with a shutoff valve that controls the vacuum to the patient rooms. Zoning valves shall be so arranged that shutting off the supply of vacuum to one zone will not affect the vacuum to the rest of the system. A vacuum gauge shall be provided on the patient room side of each zone valve. A shutoff valve shall be located immediately outside of each vital life-support, critical care, or anesthetizing location in each vacuum line, and located as to be readily accessible in an emergency or for maintenance of the terminals or piping within the individual zone served."

SUBSTANTIATION: This will require a zone valve before serving a patient inlet on the vacuum system as it is required for patient outlets on positive gas systems.

COMMITTEE ACTION: Accept in Principle.


NUMEROUS COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft


COMMITTEE STATEMENT: Committee: HEA-HEA

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

SUBMITTER: J. Richard Wagner, The Poole & Kent Company
RECOMMENDATION: Revise text as follows:

4-3.2.2.10 Vacuum System Gauges.
(a) Main Line Gauge. A vacuum gauge shall be provided in the main vacuum line (i.e., the vacuum piping downstream of the master alarm switch) for the master alarms, with this gauge located immediately upstream (on the terminal or inlet side) of any valve controlling that area. Those with "normal range" display shall indicate normal only between 12 and 19 in. Hg of vacuum.
(b) Area Gauge. Vacuum gauges shall be located at each area vacuum alarm signal location, with this gauge connected upstream (on the terminal or inlet side) of any valve controlling that area. Those with "normal range" display shall indicate normal only between 12 and 19 in. Hg of vacuum.
(c) Vacuum Gauge Identification. All permanently installed vacuum gauges and manometers for the vacuum system shall be continuous reading, manufactured expressly for vacuum, and labeled VACUUM.
(d) Vacuum Warning Systems.

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-215 (Log #9) which reads as follows: 1. Larger flows are provided by the larger tube. Manufacturers have adapted to the existing requirement.

NUMEROUS COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-215 (Log #9) which reads as follows: 1. Larger flows are provided by the larger tube. Manufacturers have adapted to the existing requirement.

TCC NOTE: The Technical Correlating Committee directs the Committee to review the Committee Statement and provide a more explicit explanation to their action.
3. Actuating switches or sensors for critical care areas shall be provided to monitor vacuum in the local line at the source equipment and the operation of reserve or off-duty vacuum pumps.

4. Actuating switches or sensors for anesthetizing areas shall be placed in the individual line supplying each such specific area with the individual room shutoff valve being the only one between the valve (if installed) or the source shutoff valve if a main line valve is upstream (on the terminal or inlet side) of the main line shutoff valve (if installed) or the source shutoff valve if a main line valve is not installed.

b. It shall indicate when a reserve or off-duty vacuum pump is in operation.

c. Area Alarms. 1. Area alarms shall be provided where the medical-surgical vacuum system serves anesthetizing locations and other vital life support and critical care areas such as post-anesthesia recovery, intensive care units, and coronary care units.

2. Area alarm panels shall be located at the nurse's station or other location that will provide for responsible surveillance.

3. Area alarms shall indicate if the vacuum in the local line drops to or below 12 in. Hg of vacuum.

4. Actuating switches or sensors for critical care areas shall be placed in the individual line supplying each such specific area. No value, other than valves located in areas accessible only to authorized personnel, shall intervene between the sensor or switch and the outlets intended to be monitored by the alarm.

5. Actuating switches or sensors for anesthetizing areas shall be placed in the individual line supplying each such specific area with the individual room shutoff valve being the only one between the actuating switch and the outlets.

d. Local Alarms. 1. A local alarm indicator shall be provided for the operation of a reserve or off-duty vacuum pump. The indicator shall comply with 4-3.2.2.8(a)(1), (2), and (3) and shall be located in an alarm panel or with the vacuum pump controls.

c. Vacuum System Gauges. All permanently installed vacuum gauges and manometers for the vacuum system shall be continuous reading, manufactured expressly for vacuum, and labeled "VACUUM. Those that display "normal range" shall indicate normal only between 12 in. and 19 in. Hg (vacuum). Gauges shall be in compliance with ANSI/ASME B-40.1, Gauges, Pressure Indicating Dial-Type, Elastic Elements. The rated accuracy of vacuum gauges used for testing shall be one percent (full scale) or better at the point of reading.

1. A vacuum gauge shall be installed in the main line adjacent to the actuating switch or sensor required in 4-3.2.2.8(b)(4). It shall be appropriately labeled and shall be readily visible from a standing position.

2. A vacuum gauge, connected to the line being monitored, shall be installed at each area alarm panel location. It shall be appropriately labeled and shall be readily visible from a standing position.

SUBSTANTIATION: To format the requirements for vacuum warning systems the same as for gas warning systems and include their more complete and detailed descriptions.

COMMITTEE ACTION: Accept in Principle. See Committee Action on Proposal 99-152 (Log #226) which reads as follows:

Replace existing 4-3.1.2.2, 4-3.2.2.8, 4-3.2.2.9, 4-3.2.10 with the following:

5.1.4.4.4 Warning Systems (Level 1)

5.1.4.4.1 General

5.1.4.4.1.4 All local, area, and master alarms used for medical gas and vacuum systems shall provide the following: [was 4-3.1.2.2(a)(1) + Log #226]

1. separate visual indicators for each condition monitored, except as permitted in 5.1.4.4.2.(i) and (j). [was 4-3.1.2.2(a)(1a) + Log #226]

2. visual and audible indication that the monitored condition has occurred. [was 4-3.1.2.2(a)(2a) + Log #226]

3. cancelable audible indication of an alarm condition, producing a minimum of 80 dB(A) measured at 3 ft (1 m). [was 4-3.1.2.2(a)(3) + Log #226]

4. re-initiation of the audible signal if a second alarm condition occurs while the audible alarm is silenced. [was 4-3.1.2.2(a)(4) + Log #226]

5. a means to visually indicate a lamp or LED failure. [was 4-3.1.2.2(a)(5)]

6. visual and audible indication that the wiring to an alarm initiating device is disconnected. [was 4-3.1.2.2(a)(6b)]

7. labeling of each indicator, indicating the condition monitored, (e.g. O₂, medical air, vacuum, etc.) [was 4-3.1.2.2(a)(7)]

8. labeling of each alarm panel for its area of surveillance. [Log #226] + Log #226

9. automatic restart after a power loss for 10 seconds (e.g. during generator startup) without giving false signals or requiring manual reset. [Log #131] + Log #226

5.1.4.4.1.2 Where multiple local and area alarm panels are intended to indicate the same condition(s), [was 4-3.1.2.2(a)(4) + Log #226]

(a) at least one panel shall be connected directly to the alarm initiating device. [was 4-3.1.2.2(a)(4a)] + Log #226

(b) an alarm signal from a panel connected to an alarm initiating device shall be permitted to be relayed to other panels. [Log #226]

5.1.4.4.1.3 Local and area alarm panels shall be permitted to be connected through indirect means such as data transmission lines, provided that: [was 4-3.1.2.2(a)(5)]

(a) the indirect means are fully supervised and failure of such indirect means is indicated at all panels so connected. [was 4-3.1.2.2(a)(5a)] + Log #226

(b) the panels are designed and manufactured specifically to monitor medical gas and vacuum systems. [Log #226]

(c) the panels are dedicated to monitoring only medical gas and vacuum systems. [Log #226]

5.1.4.4.1.4 Electrical power sources for local, area, and master alarms shall be in accordance with Chapter 3, "Electrical Systems". [Log #226] + Log #226

5.1.4.4.1.5 The responsible authority of the facility shall ensure that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date. [Log #226]

5.1.4.4.1.6 All wiring from switches, sensors, and alarm initiating devices shall be supervised or protected as required by Section 517-30(c)(3) of NFPA 70, National Electrical Code, for emergency system circuits. [Log #226]

5.1.4.4.1.7 A centralized computer system (e.g., a building management system) shall not substitute for any required medical vacuum alarm system. [Log #226] + Log #226

5.1.4.4.2 Master Alarms

5.1.4.4.2.1 A master alarm system shall be provided to monitor the operation and condition of the source of supply, the reserve source
immediately upstream (on the terminal or inlet side) of the main drops to or below 12 in. Hg of vacuum.

Each master alarm panels located in at least two separate locations as follows:

(a) One master alarm panel shall be located in the principal working area of the individual responsible for the maintenance of the medical gas and vacuum pipeline systems. [was 4-3.1.2.2(b)(3) + 4-3.2.2.8]

(b) One or more master alarm panels shall be installed in locations that assure continuous surveillance during the working hours of the facility (e.g., the telephone switchboard, security office, or other continuously staffed location). [was 4-3.1.2.4(b)(2), 4-3.2.2.8, and Log #237]

The master alarm panels required in 5.1.4.4.2.3 shall connect directly to the alarm initiating devices that they monitor. [was 4-3.1.2.2(a)(4) + Log #233]

Where multiple 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. [Log #226 + Log #233]

Master alarm panels monitoring medical gas piping systems shall each include the following:

(a) A separate visual and audible alarm indicator for the source equipment in each medical gas system. [was 4-3.1.2.2(b)(1)]

(b) An alarm indication when, or just before, changeover occurs in a medical gas system that is supplied by a manifold or an alternating-type bulk system that has as part of its normal operation a changeover from one portion of the operating supply to another portion. [was 4-3.1.2.2(b)(3a)]

(c) 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 case of an emergency. [was 4-3.1.2.2(b)(3b)]

(d) An alarm indication when the reserve supply is reduced to one average day’s supply where check valves are not provided for each cylinder lead of the reserve supply for a manifold or bulk supply system. These alarms are not required if check valves are provided in each cylinder lead. [was 4-3.1.2.2(b)(3c)]

(e) An alarm indication when the contents of the reserve is reduced to one average day’s supply where a cryogenic liquid storage tank is used as a reserve for a bulk supply system. [was 4-3.1.2.2(b)(3d)]

(f) An alarm indication when the gas pressure available in the reserve unit is below that required for the medical gas system to function properly. [was 4-3.1.2.2(b)(3e)]

(g) 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. [was 4-3.1.2.2(b)(3f)]

(h) High and low pressure alarm initiating devices installed in the main lines immediately downstream (on the terminal or outlet side) of the main line shut off valves (if installed) or the source shut off valves if main line shut off valves are not installed. [was 4-3.1.2.2(b)(3g)]

(i) An alarm indication(s) for the local alarms required for medical air systems in 4-3.1.2.2(d)(1), either by separate indications for individual conditions or as one or more group alarms. [was 4-3.1.2.2(b)(3h)]

(j) Group alarms (if used) labeled “Medical Air System Fault – (indicate site) or similar wording that indicates that one in a group of monitored conditions has occurred at a particular site. [was 4-3.1.2.2(b)(3i)]

(k) A medical air dew point alarm per 4-3.1.1.9(1). [was 4-3.1.2.2(b)(3j) + Log #253]

Master alarm panels monitoring medical-surgical vacuum system source equipment shall each include the following:

(a) An alarm indication when the vacuum in the main line drops to or below 12 in. Hg of vacuum. [was 4-3.2.2.8]

(b) The alarm initiating device connected to the main line immediately upstream (on the terminal or inlet side) of the main line shut off valve (if installed) or the source shut off valve if a main line shut off valve is not installed. [was 4-3.2.2.8]

(c) An alarm indication when the reserve or off-duty vacuum pump is in operation. [was 4-3.2.2.8]
5.2.4.4.1.1 Where multiple local and area alarm panels are intended to indicate the same condition(s), at least one panel shall be connected directly to the alarm initiating device and an alarm signal from a panel connected to an alarm initiating device shall be permitted to be relayed to other panels.

5.2.4.4.1.3 Local and area alarm panels shall be permitted to be connected through indirect means such as data transmission lines, provided that:

(a) the indirect means are fully supervised and failure of such indirect means is indicated at all panels so connected.

(b) the panels are designed and manufactured specifically to monitor medical gas and vacuum systems.

(c) the panels are dedicated to monitoring only the medical gas and vacuum systems.

5.2.4.4.1.4 Electrical power sources for local, area, and master alarms shall be in accordance with Chapter 3, "Electrical Systems."

5.2.4.4.1.5 The responsible authority of the facility shall ensure that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date.

5.2.4.4.1.6 All wiring from alarm initiating devices shall be supervised or protected as required by Section 517-30 (c)(3) of NFPA 70, National Electrical Code, for emergency system circuits.

5.2.4.4.1.7 A centralized computer system (e.g., a building management system) shall not substitute for any required medical gas or vacuum alarm panel, but shall be permitted to be used to supplement the medical vacuum alarm system.

5.2.4.4.2 Master Alarms

5.2.4.4.2.1 A master alarm panel shall be provided to monitor the operation and condition of the pressure in the main lines of each medical gas and medical-surgical vacuum piping system.

5.2.4.4.2.2 Master alarm panels shall comply with the general requirements of 5.2.4.4.1.1.

5.2.4.4.2.3 At least one master alarm panel shall be installed in a location(s) that is under continuous surveillance during the working hours of the facility (e.g., the telephone switchboard, security office, or other continuously staffed location).

5.2.4.4.2.4 The master alarm panel required in 5.2.4.4.2.3 shall connect directly to the alarm initiating devices that it monitors.

5.2.4.4.2.5 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.

5.2.4.4.2.6 Master alarm panels monitoring medical gas piping systems shall each include the following:

(a) a separate visual and audible alarm indicator for the source equipment in each medical gas system.

(b) an alarm indication when, or just before, changeover occurs in a medical gas system that is supplied by a manifold or an alternating-type bulk system that has as part of its normal operation a changeover from one portion of the operating supply to another portion.

(c) 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 case of an emergency.

(d) an alarm indication when the reserve supply is reduced to one average day’s supply where check valves are not provided for each cylinder line of the reserve supply for a manifold or bulk supply system. These alarms are not required if check valves are provided in each cylinder lead.

(e) an alarm indication when the contents of the reserve are reduced to one average day’s supply where a cryogenic liquid storage unit is used as a reserve for a bulk supply system.

(f) 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.

(g) high and low pressure alarm initiating devices mounted at the source equipment.

(h) the alarm initiating device connected to the main line immediately upstream (on the terminal or inlet side) of the main line shutoff valve (if installed) or the source shutoff valve if a main line shutoff valve is not installed.

5.2.4.4.3 Area Alarms

5.2.4.4.3.1 Area alarms shall be provided where a piped medical gas and vacuum systems serve anesthetizing locations and other vital life support and critical care areas such as post-anesthesia recovery, intensive care units, and coronary care units.

5.2.4.4.3.2 Area alarm panels shall be located at the nurse’s station or other location that will provide for responsible surveillance.

5.2.4.4.3.3 Area alarm panels shall comply with the general requirements of 5.2.4.4.1.

5.2.4.4.3.4 Area alarms for medical gas systems shall indicate if the pressure in the local line increases 20 percent or decreases 20 percent from the normal line pressure.

5.2.4.4.3.5 Area alarms for medical vacuum systems shall indicate if the vacuum in the local line drops to or below 12 in. Hg of vacuum.

5.2.4.4.3.6 Alarm initiating devices for critical care areas shall be placed in monitor the individual line supplying each such specific area.

5.2.4.4.3.7 No valve, other than valves located in areas accessible only to authorized personnel, shall intervene between alarm initiating devices and the outlets intended to be monitored by the device.

5.2.4.4.3.8 Alarm initiating devices for anesthetizing areas shall be placed in the individual line supplying each such specific area, with the individual room shutoff valve being the only valve between the alarm actuating device and the outlets.

5.2.4.4.4 Local Alarms

5.2.4.4.4.1 Local alarms shall comply with the general requirements of 5.2.4.4.1.

5.2.4.4.4.2 Local alarms, where required, shall be grouped together in a single location (e.g., in an alarm panel or with the system controls) at the source equipment site(s) for each system.

5.2.4.4.4.3 Local alarms for medical air compressor systems shall provide individual indication of the following conditions in accordance with 4-3.1.9.1(b): [see 4-3.1.9.1(b) (Log #13, #259)]

(a) High water level in receiver (if so equipped).

(b) High water level in air/water separator (if so equipped).

(c) High discharge air temperature (if so equipped).

(d) High carbon monoxide level.

(e) High dew point temperature.

5.2.4.4.4.5 Waste Anesthetic Gas Disposal (WAGD) Alarms. Alarms or other automatic mechanisms shall be provided to inform the user when the WAGD system is not functioning normally.

5.2.4.4.4.6 Waste Anesthetic Gas Disposal (WAGD) Systems (Level 3)

5.2.4.4.4.7 A warning system shall be installed in each single treatment facility served by a Level 3 medical patient gas supply system or Level 3 compressed air supply system.

5.2.4.4.5.2 The warning system shall include audible and non-cancelable visual alarm indications that can be seen and heard at a continually attended location during the time of operation of the facility.
5.3.4.4.3 Alarms shall indicate when the pressure in the main line of each monitored pressurized gas system increases 20 percent or decreases 20 percent from the normal operating pressure. [was 4-5.1.2.8(d)]

5.3.4.4.4 High and low pressure alarm initiating devices shall be connected to the main line in each monitored pressurized gas system immediately downstream (on the piping distribution side) of the main line shutoff valve (if installed) or the source shutoff valve is a main line shutoff valve is not installed. [was 4-5.1.2.8(d)]

5.3.4.4.5 Where facilities include monitored source equipment that provides automatic changeover to secondary or reserve sources, an alarm shall be provided for each system indicating when automatic changeover has occurred or is about to occur. [was 4-5.1.2.8(b), Log #230]

5.3.4.4.6 The alarm initiating devices for changeover alarms shall be independent of the alarm initiating devices for high or low line pressure. [was 4-5.1.2.8(c)]

5.3.4.4.7 Where two treatment facilities are served by a common monitored supply system, automatic changeover alarms shall indicate in both facilities. [was 4-5.1.2.8(c)]

5.3.4.4.8 Visual changeover alarms shall remain un-cancelable until the secondary or reserve supply source is replenished. [was 4-5.1.2.8(c)]

5.3.4.4.9 Warning systems shall not be required for Level 3 gas powered systems, Level 3 vacuum systems, and Level 3 WAGD (scavenging) systems. [was 4-5.1.3.4]

COMMITTEE STATEMENT: Portions of the proposal would have created requirements that did not increase reliabilities of the systems installed.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Chair) Dale J. Dumbleton, American Medical Gas Inst.

(Committee: HEA-PIP)

99-220 - (4-3.2.2.11(d-g)): Accept in Principle

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows:
(d) Flux. Where flux is used for soldered or brazed joints, flux shall be used sparingly to avoid excess flux inside of the finished joint. Joints that are found to be defective under 4-3.2.2.11(f)1, 3, 4, 5, 6, or 7 shall be permitted to be repaired, except that no joint shall be repaired more than once before being replaced. Joints that are found to be defective under 4-3.2.2.11(f)2 or 5 shall be replaced.

SUBSTANTIATION: The numbers 4 and 5 are in the wrong spots and need to be changed.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Chair) Dale J. Dumbleton, American Medical Gas Inst.

(Committee: HEA-PIP)

99-222 - (4-3.2.2.11(g)): Accept in Principle

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:
(g) Repairs. Soldered or brazed joints that are found to be defective under 4-3.2.2.11(f)1, 3, 4, 5, 6, or 7 shall be permitted to be repaired, except that no joint shall be repaired more than once before being replaced. Joints that are found to be defective under 4-3.2.2.11(f)2 or 5 shall be replaced.

SUBSTANTIATION: To make the requirements for repairing joints in vacuum systems similar to those for pressure gases.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Chair) Dale J. Dumbleton, American Medical Gas Inst.

(Committee: HEA-PIP)

99-235 - (4-3.2.2.11(b)): Accept in Principle in Part

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows:
"Distribution Network. WAGD distribution networks shall be constructed of corrosion-resistant materials appropriate for use with oxygen, nitrous oxide, and halogenated anesthetics in the concentrations encountered in the anesthetic breathing circuit. Consistent with the requirements of 4-3.2.1 Piped Vacuum Systems, WAGD distribution networks shall be connected at the source of equipment through a separate network of piping.

SUBSTANTIATION: The 1999 Standard required installation of WAGD inlets in all locations where nitrous oxide or halogenated anesthetic agents are likely to be administered. With a mandatory requirement for piping to all anesthetic locations, the standard should at least require the piping to meet the minimum requirements of vacuum piping for a Level 1 facility.

COMMITTEE ACTION: Accept in Principle in Part.

REVISE TEXT AS FOLLOWS:
"Distribution Network. WAGD distribution networks shall be constructed of corrosion-resistant materials appropriate for use with oxygen, nitrous oxide, and halogenated anesthetics in the concentrations encountered in the anesthetic breathing circuit. When a WAGD distribution network is connected to a medical surgical vacuum system it shall conform to the requirements of 4-3.4.2, Piped Vacuum Systems."

COMMITTEE STATEMENT: There was no technical substantiation for mandating separate systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

(Chair) Dale J. Dumbleton, American Medical Gas Inst.
One of the two positions is incorrect, and this must be reconciled.

functions. There is not justification for assuming the equipment honest, or we must assume that a conflict of interest is a vendor is not disqualified from testing the equipment he/she has tested. Testing one's own equipment supply is a conflict of interest.

stands and places the NFPA in a very false position. The installer

Not RETURNED: 1 Bancroft

AFFIRMATIVE: 22

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 22

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 17

NEGATIVE: 6

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ALLEN: The rejection of this proposal is inexplicable on logical grounds and places the NFPA in a very false position. The installer is disqualified from testing the equipment he/she installs, but the vendor is not disqualified from testing the equipment he/she has manufactured and sold. If the ultimate protection of the patient is the issue, then either we must accept that qualified means qualified and assert that the installer, certifier and manufacturer are equally honest, or we must assume that a conflict of interest is a disqualification, and we must preclude crossover between the functions. There is not justification for assuming the equipment vendor is naturally a finer, more honest fellow than the installer. One of the two positions is incorrect, and this must be reconciled.

DAVIDSON: 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.

ESHERICK: Although the committee statement is correct, the author of this log was trying to change that statement. He stated that to be completely objective, the testing agency shall not be connected to the supplier in any manner. Just look at fire doors. An outside, independent testing agency such as UL or Factory Mutual, etc., must test the fire doors and so certify as to their fire rating.

MOHILE: We wish to speak in opposition to the Committee rejection on this proposal. For years we have taken the position that the company supplying and/or installing the equipment shall not verify that equipment. The Committee’s action on this proposal continues a long standing situation in which there is no clear cut separation between the supplier and/or installer, and the verifier. Although there are many honest suppliers and installers, there also exist some suppliers and installers who continue to take advantage of the position and may reject a competitor’s product during the verification process.

Accepting this proposal would eliminate any chance of a conflict of interest.

RIDENOUR: This change will not allow verifiers to sell equipment.

TCC NOTE: The Technical Correlating Committee directs that the Committee Action be revised to read as Accept.

SUBMITTER: Christopher P. Swayze, Sherman Engineering Co.

RECOMMENDATION: Revise text to read as follows:

"Automatic mechanisms shall be provided to inform the user when the WAGD system is not functioning normally."

OR

Revise 4-3.3.2.4 to read as follows:

"Automatic mechanisms shall be provided to inform the user when the WAGD system is operational."

SUBSTANTIATION: Current wording suggests that alarms are to activate when the WAGD system is operational.

COMMITTEE ACTION: Accept.

Accept the first recommendation only.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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NOT RETURNED: 1 Bancroft

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NOT RETURNED: 1 Bancroft

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NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

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AFFIRMATIVE: 21

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NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

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NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

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NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NOT RETURNED: 1 Bancroft

AFFIRMATIVE: 21

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21
99-229 - (4-3.4.1.2): Accept in Principle
SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.
RECOMMENDATION: Revise text as follows:

"Documented proof of the following tests shall be conducted by the installer or representative prior to those tests listed in 4-3.4.1.3. System Verification. Test gas shall be oil-free, dry nitrogen NF." 

SUBSTANTIATION: Documented proof is essential to verify that these tests were performed properly. The test gas is required to be oil-free, dry nitrogen NF (National Formulary).

COMMITTEE ACTION: Accept in Principle.

Revise text as follows:

"The following tests shall be conducted and documented by the installer or representative prior to those tests listed in 4-3.4.1.3. System Verification. Test gas shall be oil-free, dry nitrogen NF."

COMMITTEE STATEMENT: Editorial. Note this revises the first paragraph only.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-230 - (4-3.4.1.2(b)): 

TCC NOTE: The Technical Correlating Committee directs that the Committee Action be revised to read as Accept in Principle in Part A.

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows:

"Initial Pressure Test. Before attachment of system components (e.g., pressure-actuating switches for alarms, manifolds, pressure gauges, or pressure relief valves), but after installation of the station outlets, with test caps (if supplied) in place (e.g., rough-in assembly), before walls are closed, each section of the piping system shall be subjected to a test pressure of 1.5 times the working pressure [minimum 150 psig (4.03 MPa gauge)] with oil-free, dry nitrogen NF. (see Section 2-2, Definitions). This 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 safe for use with oxygen. The source shutoff valve shall be closed. The test gas shall be regulated to maintain 150 psig (1.03 MPa) until each joint is tested. Leaks, if any, shall be located, repaired, and restested in accordance with this paragraph."

SUBSTANTIATION: The wording "before walls are closed" was inadvertently removed in the 1999 edition. The change from 1 to 1.03 MPa is because 1 MPa is equal to 145 psig instead of 150 psig. The NF. behind the oil-free dry nitrogen was a change in the 1999 Standard. To maintain a test pressure of 150 psig, someone would have to regulate the source gas to maintain a constant pressure. If you closed the source shutoff valve and there was a leak, the entire system would lose pressure making it impossible to test each joint to 150 psig.

COMMITTEE ACTION: Accept in Principle.

Revise text as follows:

"Initial Pressure Test. Before attachment of system components (e.g., pressure-actuating switches for alarms, manifolds, pressure gauges, or pressure relief valves), but after installation of the station outlets, with test caps (if supplied) in place (e.g., rough-in assembly), before walls are closed, each section of the piping system shall be subjected to a test pressure of 1.5 times the working pressure [minimum 150 psig (4.03 MPa gauge)] with oil-free, dry nitrogen NF. (see Section 2-2, Definitions). This 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 safe for use with oxygen. The source shutoff valve shall be closed. The test gas shall be regulated to maintain 150 psig (1.03 MPa) until each joint is tested. Leaks, if any, shall be located, repaired, and restested in accordance with this paragraph."

COMMITTEE STATEMENT: The committee does not agree the source shut off valve should be closed.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

723
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:

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

COMMITTEE STATEMENT:

quarterly basis [see 4-3.1.1.9(i)]. Regarding the hydrocarbons as methane testing, the majority of manufacturers are not using processes that can leave solvents in the tubing. In addition, the hydrocarbon testing has become very expensive and is very difficult to perform in the field.

Regarding the hydrocarbons as methane testing, the majority of new compressors do not even have oil in them. Oil based compressors must be monitored for oil vapor on a daily and quarterly basis (see 4-3.1.19(i)).

COMMITTEE ACTION: Reject.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

MOHILE: We wish to speak in opposition to the Committee’s action to reject this proposal which is the same as Log #27. We do not feel that eliminating this testing lowers the safety level of testing for hospitals. The test for hydrocarbons as methane equivalents does not work at all. This test was inserted into NFPA 99 in an attempt to measure compressor oil that has made its way into the pipeline from machinery that lubricated compressors. In point of fact, compressor oil does not vaporize as hydrocarbons as methane and is not detectable as such. Therefore this test is invalid.

And a survey of laboratories and verifiers that have performed the halogenated hydrocarbon test thousands of times indicated that this test is unecessary since the results have all been negative. This is an expensive test to perform and the cost savings to the end users could be appreciative.

ESHOCK: See my Explanation of Negative on Proposal 99-252 (Log #261).

RECOMMENDATION: 99- 234 - (4-3.4.1.3): Accept

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: Revise Paragraph 3 (“When systems have ...”) to read:

“If a system has not been installed by in-house personnel, testing shall be permitted by personnel of that organization who meet the requirements of 4-3.1.1.

SUBSTANTION: Paragraph 4-3.1.2.10(b) permits “in-house” health care facility personnel to install piping systems if all requirements of 4-3 are met during installation. However, Section 4-3.4.1.3 requires system verification to be performed by a party “other than the installing contractor.” If health care facility personnel were to install a piping system, someone other than personnel of the health care facility needs to be retained to verify the installation (i.e., someone not employed by the governing body of the health care facility).

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

RECOMMENDATION: Revise text as follows:

“The testing shall be conducted by a party technically competent and experienced in the field of medical gas pipeline testing and meeting the requirements of ANSI/ASSE Series 6000, Standard 6030.

SUBSTANTION: Until the ANSI/ASSE Series 6000 became available there were no professional qualification standards for the verifier. I believe we should take advantage of and use this standard.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 18
NEGATIVE: 4
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

DAVIDSON: Is it the intent of NFPA through the enabling of ASSE’s Series 6000, Standard 6030 to subterfuge the individual State Registration Board of Professional Engineer’s right to certify the professional Engineer’s ability to certify a medical gas system in order to safeguard life, health and property and to promote public welfare?

For your information the following is the declaration of purpose and definition of unlawful practice of engineering typically found in most states and commonwealths enabling legislative engineer’s act.

“In order to safeguard life, health, and property and to promote the public welfare, the practice of engineering in this State is hereby declared to be subject to regulation in the public interest. It shall be unlawful for any person to practice or to offer to practice engineering in this State, to use in connection with his name, by verbal claim, sign, advertisement, letterhead, card or to in any other way, represent himself to be an engineer, a professional engineer or through the use of some other title imply that he is a professional engineer registered under this chapter, or to advertise any title or description tending to convey the impression that he is an engineer unless such person has been duly registered or exempted under this chapter. The right to engage in the practice of engineering shall be deemed a personal right based on the qualifications of the individual as evidenced by his certificate of registration, which shall not be transferable.”

“Practice of engineering” or “to practice engineering” or “practice engineering” includes any professional service performed for the general public such as consultation, investigation, evaluation, planning, design, or responsible supervision of construction or operation in connection with any public or private utility, structure, buildings, machines, equipment, processes, works, or projects wherein the public welfare or the safeguarding of life, health or property is concerned or involved when such professional service requires the application of engineering principles and data, but it does not include the work ordinarily performed by persons who operate or maintain machinery or equipment, neither does it include engineering services performed by an employee of a firm or corporation that does not offer professional engineering services to the general public.

With the acceptance of Log #195, NFPA will subterfuge the individual State Registration Board of Professional Engineers powers to the Professional Engineer’s ability to certify a medical gas system in order to safeguard life, health and property and to promote public welfare.

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.

ERICKSON: Reject the Proposal. This section of the standard was fine without having the new requirement for meeting ANSI/ASSE Series 6000, Standard 6030. Just because one organization has developed a standard, in a non-consensus process, and it is now available doesn’t mean it should become a requirement in NFPA 99. If there is a problem with testing agency the requirement for the medical gas system and equipment “certifier” should be defined within NFPA 99, Chapter 4, not through a third party standards making body.

SHOEMAKER: While extra training such as a 30 hour course, such as adapting the ANSI/ASSE Series 6000, Standard 6030 would require, may increase the knowledge and understanding base of the installer it does not mean that there will be any increase in the quality of installations. The local state and municipalities should and must maintain ultimate responsibility for meeting standards for installations. I am very concerned that we adapt any non-consensus standard.

SMIDT: Reject the proposal: While I agree that systems in the past have been improperly “verified”, I don’t believe that inclusion of a requirement to ANSI/ASSE series 6000/6030 will improve that record. This is a issue that individual state authorities and the facilities themselves should police. Lets not codify this requirement!
COMMENT ON AFFIRMATIVE:
MRaulak: See my Comment on Affirmative on Proposal 99-191
(Log #190).

COMMITTEE ACTION: Accept.  (Log #196)
Committee: HEA-PIP

RECOMMENDATION: Revise text as follows:
"The test gas shall be oil-free dry nitrogen NF.
This testing shall be conducted by a party competent and
experienced in the field of medical gas pipeline testing.  Such
testing shall be performed by a party other than the installing
contractor.

When systems have been installed by in-house personnel, testing
shall be permitted by personnel of that organization who meet the
requirements of 4-3.4.1.3."

SUBSTANTIATION: According to the definition of nitrogen, NF
needs to be added. To me the third paragraph is a conflict of
interest. If we don’t allow the contractor to test his own work, why
would we let the in-house personnel test in-house personnel work?
Who’s to say that all the proper tests will be done and/or done
honestly? The verifier should be responsible for all testing since he
has all the proper equipment and expertise.

COMMITTEE ACTION: Accept In Part.
Accept the part that added “NF” only.

COMMITTEE STATEMENT: Part 2 was addressed in Proposal 99-
235 (Log #96).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
It is the committees opinion that the standards existing language
clearly indicates that the supplier/vendor and verifier do not have
to be independent of each other.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
It is the committees opinion that the standards existing language
clearly indicates that the supplier/vendor and verifier do not have
to be independent of each other.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
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clearly indicates that the supplier/vendor and verifier do not have
to be independent of each other.

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VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
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(Log #261).

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AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
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VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
It is the committees opinion that the standards existing language
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to be independent of each other.

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VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
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to be independent of each other.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
ESHERICK: See my Explanation of Negative on Proposal 99-252
(Log #261).

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and
Statement on Proposal 99-226 (Log #82) which reads as follows:
It is the committees opinion that the standards existing language
clearly indicates that the supplier/vendor and verifier do not have
to be independent of each other.
is conducted using the Operational Pressure Test and it is the final data that is collected during this test that will allow any future outlet performance testing to be used as a variance.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft
SUBSTANTIATION: The existing standard of one ten-thousandth of a gram of particulate matter is extremely difficult to measure in the field and is not necessary for a construction project. Even if the installer has not adequately performed his blow down and pipe purging as mandated in 4-3.4.1.2(a) and (d), the verifier must also purge the system down as required in 4-3.4.1.3(e) prior to weighing a sample. A chemical balance sensitive enough to measure in the one ten-thousandth of a gram range is difficult to maintain and use in the field and is usually not being utilized by the majority of companies performing verifications.

The proposed amount of 0.01 grams of material is an extremely small amount of matter per 35 cubic ft (1,000 liters) of gas. This would equate to less than .000001 grams of matter per liter.

COMMITTEE ACTION: Accept in Principle.

Revise to read as follows:

“The filter shall accrue no more than 0.01 gram (1 milligram) of particulate matter from any outlet tested. This test shall be performed only after the pipeline has been thoroughly purged using the white cloth specified in the previous paragraph.”

The existing two sentences will remain.

COMMITTEE STATEMENT: The committee feels that the .001 gram of particulate matter is adequate to protect patient safety.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 20
NEGATIVE: 2
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Proposal 99-24 (Log #341).

MOHILE: We continue to feel that this revised number of .001 gram should be reduced to .01 gram. There was some considerable discussion regarding the about of particulate matter acceptable and we still feel that a level of .01 gram is more than adequate to protect patient safety.

We remind Committee members that a level of .01 gram would equate to less than .000001 grams of matter per liter. It is a very small amount of matter and more easily measured in the field by the verifiers who are performing this test, which would provide more immediate feedback for facilities who are in a rush to open and accept patients.

99-245 - (4-3.4.1.3(e)): Accept in Principle

SUBMITTER: Richard L. Miller, Medical Gas Technology Inc.

RECOMMENDATION: Revise second sentence, fourth sentence, to read as follows:

“The filter shall accrue no more than 0.01 gram (10 milligrams) of particulate matter.

SUBSTANTIATION: The existing standard of one ten-thousandth of a gram is virtually impossible to measure. The verifier must purge the system down as required in 4-3.4.1.3(e) prior to weighing a sample. A chemical balance sensitive enough to measure in the one ten-thousandth of a gram range is difficult to maintain and use in the field and is usually not being utilized by the majority of companies performing verifications. It has been our experience that one ten-thousandth of a gram of particulate can be produced directly from the nitrogen test cylinder.

The proposed amount of 0.01 grams of material is an extremely small amount of matter per 35 cubic ft (1,000 liters) of gas. This would equate to less than .000001 grams of matter per liter.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-244 (Log #26).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Proposal 99-24 (Log #341).

99-246 - (4-3.4.1.3(e)): Reject

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

SUBMITTER: D. A. McWhinnie, Jr., Mechanical Dynamics Associates

RECOMMENDATION: (e) Piping Purge Test.

Delete entire new second paragraph:

“For each positive pressure... (through to end) - oil-free, dry, nitrogen."

SUBSTANTIATION: Material above has been, and is, contrary to Regulations Governing Committee Projects, 4-3.3(6).

The committee has failed to provide any written report, meeting minute, or known verbal report of either the required “Statement of the problem and substantiation for Proposal... Since the early 1950s, NFPA 50F, 56K, and Code 99 to date many hundreds of hospitals, and well over a thousand medical gases and vacuum piping systems* we have never found, or heard of, justification for the above.

*Encyclopedia of Medical Devices and Instrumentation, Wiley, N.Y., 1988)

The issue of med-gases piping systems’ internal cleanliness is stressed in Chapter 4, with mandate terms throughout:

Cleaning (13)/ Blow down (1)/ blown clear (1)/ Purge (9)/ high-flow purge (2)/ heavy intermittent purging (2)/ reduce to atmosphere (5) – and repressure. (33 mandate terms within pages.)

Code 99 Sections 4-3.4.1.2(d) and 4-3.4.1.3(e) require “heavy,” “high-flow,” and “high purge” cleaning processes. These pressures, volumes and velocities will never be reached in normal use/and no materials (if any remain) would be moved.

These two sections (one by the installer, and the other by certifier) are clearly adequate.

To mandate this unsupported requirement is improper, and in conflict with NFPA Regulations. It inflicts an unnecessary expense on construction A/E, installers, certifiers, and infects every new hospital, and all existing hospitals in the U.S. with expansions, modifications, and with replacement or repair of piping systems components.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The piping purge test is still valid and necessary as modified by Committee Action on Proposal 99-244 (Log #26) which reads as follows:

“... (through to end) ...oil-free, dry, nitrogen."

REVISE to read as follows:

“The filter shall accrue no more than 0.001 gram (1 milligram) of particulate matter from any outlet tested. This test shall be performed only after the pipeline has been thoroughly purged using the white cloth specified in the previous paragraph.”

The existing two sentences will remain.

The committee feels that the .001 gram of particulate matter is adequate to protect patient safety.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ESHERICK: See my Explanation of Negative on Proposal 99-24 (Log #341).

99-247 - (4-3.4.1.3(e)): Reject

SUBMITTER: Fritz Koppenberger, Environmental Testing Services Inc.

RECOMMENDATION: Revise second sentence of second paragraph of (e) as follows:

“A minimum of 35 ft³ (1000 L) of gas shall be filtered through a clean, white (0.8 micron or less) 0.45 micron filter at a minimum flowrate of 3.5 SCFM (100 L/min).”

SUBSTANTIATION: The required pore size of the filter for particulate testing hinders data collection. A filter with a pore size of .45 microns is used for filtration of bacteria in a liquid application. The physics of liquid filtration are different than gas filtration. The filtration process in a gas stream can be 10 times as efficient as in a liquid. NIOSH, the research branch of OSHA, performed extensive research many years ago to determine appropriate filter pore sizes. None of the OSHA particulate tests in a gas specify a .45 micron filter. Most OSHA filter pore sizes are 0.8.
The use of 0.45 micron filters need not be restricted. The problem is that the only filter media readily available in this pore size is cellulose ester. This substance readily absorbs water, which makes the filter weighing process difficult and can cause falsely high readings due to excessive water absorption. Some cellulose ester filters contain glycerine which absorbs water and may not release the water at all, even after desiccating or heating the filters. Field samples can be ruined in high humidity.

An exceptional filter media for this application is PVC (polyvinyl chloride), which absorbs very little water. The PVC filters are not available in .45 microns without expensive custom ordering. They are readily available in 0.8 microns. This pore size will perform as well as a .45 micron filter in a gas stream, and will allow less restrictive handling and processing, and deliver more reliable data for this application.

The data submitted shows results of water absorption in cellulose vs. PVC filter media and filter pore size data required by OSHA for particulates in air. The industry standard for collecting small particulates in a gas stream is 0.8 microns, and NFPA should adopt this standard.

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

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee feels the 0.45 micron filter traps an adequate amount of material more efficiently. There are commercially available filters of 0.45 micron that do not trap water. A cellulose fiber filter is hydroscopic, however the committee does not wish to specify the type of filter in the standard.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-249 - (4-3.4.1.3(e)): Accept
SUBMITTER: Fritz Koppenberger, Environmental Testing Services Inc.
RECOMMENDATION: Revise second paragraph as follows:
"For each positive pressure gas system, the cleanliness of the piping system shall be verified. A minimum of 35 ft³ (1000 L) of gas shall be filtered through a clean, white, 0.45 micron filter at a minimum flow rate of 3.5 SCFM (100 L/min). Twenty-five percent of the zones shall be tested at the outlet most remote from the source. The filter shall accrue no more than 0.1 mg of matter. If any outlet fails this test, the test shall be repeated at the same location and if the outlet still fails, the entire zone shall be tested. The test shall be performed with the use of oil-free, dry nitrogen."

SUBSTANTIATION: This is an uncompromising and unfair section of the code. An honest verifier is going to be reluctant to quadruple the filter testing bill and delay a hospital opening by what could have either been a stray particle or a mishandled filter. The installer deserves the right to a second test before being penalized to this extent, and the verifier deserves the right to retest and prove in front of witnesses that he is not taking advantage of the situation. The current code is a "license to steal" for a dishonest verifier.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The verification is already a written certified document.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-250 - (4-3.4.1.3(e)): Reject
SUBMITTER: D. A. McWhinnie, Jr., Mechanical Dynamics Associates
RECOMMENDATION: Add the following text:
"An acceptable alternative to the weighed filter is this: Purge each outlet through a 0.45 micron filter at a minimum flow rate of 3.5 SCFM (100 L/min). Rapidly interrupt the flow of gas several times. Run gas through a 0.45 micron filter until no particulate is noted on filter."

SUBSTANTIATION: The weighted particulate test is another unnecessary step in the certification of medical gas systems. Let's keep testing more cost efficient for the hospitals involved.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The current requirement for a quantified test is necessary.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

99-251 - (4-3.4.1.3(e)): Accept
SUBMITTER: David Esherick, Patient Instrumentation Corp.
RECOMMENDATION: Revise text as follows:
"One hundred percent of the zones shall be tested..."

SUBSTANTIATION: The medical gas system is too important to randomly check for particulate. All zones should be tested to assure the system is clean from particulate.

COMMITTEE ACTION: Accept.
COMMITTEE STATEMENT: The existing testing of 25 percent is still necessary.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-252 - (4-3.4.1.3(f)): Reject
SUBMITTER: D. A. McWhinnie, Jr., Mechanical Dynamics Associates
RECOMMENDATION: One issue - related references in several places:
Delete from 4-3.4.1.3(f), Piping Purity Test: "total hydrocarbons (as methane), and halogenated hydrocarbons."
Delete from Table 4-3.4.1.3(f): "Total hydrocarbons as methane... 1 ppm."
"Halogenated hydrocarbons... 2 ppm."

SUBSTANTIATION: The committee has not given "the specific reason" (required by 4. above), nor the required "Statement of the problem and its substantiation..." NFPA Regulation 4-3.3(d).
It has also failed to provide any written report, meeting minute, or known report in support of determining, and mandating, the degrees of medical gases’ purities (which is not within the NFPA scope).

These are packaged commodity gases, purchased principally by hospitals, which must meet the medgases’ chemical requirements determined by the medical profession. These are the responsibilities solely of the supplier and its clients, and has nothing to do with NFPA.

The only responsibility of NFPA re these gases is to assure adequate, and safe, delivery to the points of use.

Should NFPA determine, and mandate, the purity degree of water for patient treatments and/or consumption?

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-231 (Log #27), which reads as follows:

“The proposal lowers the safety level.”

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NEGATIVE: 2

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

ESHERICK: With over 17 years of testing experience we have never found excessive amounts of total hydrocarbons nor any halogenated hydrocarbons in medical gas pipelines. Why test the nitrogen (at extra cost) when the patient does not use it? This proposal does NOT lower the limit of safety.

___________________

(Log #293)

Committee: HEA-PIP

99- 253 - (4-3.4.1.3(f)): Accept in Principle

SUBMITTER: David Esherick, Patient Instrumentation Corp.

RECOMMENDATION: Revise text as follows:

“The test shall be performed with the use of oil free dry nitrogen or gas of system.”

SUBSTANTIATION: There is no reason for the hospital to pay for a test of the quality of the contractor’s nitrogen.

COMMITTEE ACTION: Accept in Principle.

Revise as follows:

“The test shall be performed with the use of oil free dry nitrogen, NF, or gas of system.”

COMMITTEE STATEMENT: The removal of oil free dry nitrogen is not necessary. Either is permitted.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NEGATIVE: 1

NOT RETURNED: 1 Bancroft
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 21
NEGATIVE: 1
NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:
RIDEPOUR: Rejection of the verifier to check for labeling. This
should be a check and balance, just because it’s the installer’s
obligation to install the labels, someone, the verifier, should check.

COMMITTEE STATEMENT:
This paragraph relates to vacuum and the
performance of the vacuum system. This is best done with
vacuum.

COMMITTEE ACTION: Accept in Principle.

RECOMMENDATION: Make Sentence 2 (“It is against ... Bureau of
Explosives,”) a Note or move to Appendix A.

SUBSTANTIATION: Conform to NFPA Standards Manual on
non-mandatory text in chapter portion of standards.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: See Committee Proposal 99-7 (Log
#C709).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

4. For “Dew point high” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).
5. For “Local alarm” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

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“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

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SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

4. For “Dew point high” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).
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“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

4. For “Dew point high” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).
5. For “Local alarm” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

4. For “Dew point high” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).
5. For “Local alarm” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:

(3 places).

4. For “Dew point high” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).
5. For “Local alarm” change reference from “4-3.1.1.9(h)” to
“4-3.1.1.9(i)” (3 places).

SUBSTANTIATION:

1. Title of column is not complete.
2. Title of column is not complete.
3. Reference paragraphs are not applicable.
4. Update reference due to change in paragraph numbering in
text.
5. Update reference due to change in paragraph numbering in
text.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

COMMITTEE ACTION:
<table>
<thead>
<tr>
<th>Master Alarm Signals</th>
<th>Air Vis Oil-free Compressor</th>
<th>Air Vis Oil-lube Compressor</th>
<th>Air Vis Liquid Ring Compressor</th>
<th>Vacuum Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm Condition</strong></td>
<td>4-3.1.1.5(a)</td>
<td>4-3.1.1.5(b)</td>
<td>4-3.1.2.1.2</td>
<td></td>
</tr>
<tr>
<td><strong>Master Signals from Sources</strong></td>
<td>4-3.1.1.6(a)2</td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.1.7(a)2</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Cryogenic Bulk w/Cryogenic Reserve</strong></td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
</tr>
<tr>
<td><strong>Cryogenic Bulk w/Cylinder Reserve</strong></td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
</tr>
<tr>
<td><strong>Air Via Oil-free Compressor</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Air Via Oil-lube Compressor</strong></td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
</tr>
<tr>
<td><strong>Air Via Liquid Ring Compressor</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Vacuum Pump</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
</tbody>
</table>

**Table 4-3.4.1.4 Monitoring Requirements for Required Alarm Signals (Level 1 Systems)**

<table>
<thead>
<tr>
<th>Master Alarm Signals</th>
<th>Air Vis Oil-free Compressor</th>
<th>Air Vis Oil-lube Compressor</th>
<th>Air Vis Liquid Ring Compressor</th>
<th>Vacuum Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm Condition</strong></td>
<td>4-3.1.1.5(a)</td>
<td>4-3.1.1.5(b)</td>
<td>4-3.1.2.1.2</td>
<td></td>
</tr>
<tr>
<td><strong>Master Signals from Sources</strong></td>
<td>4-3.1.1.6(a)2</td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.1.7(a)2</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Cryogenic Bulk w/Cryogenic Reserve</strong></td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
</tr>
<tr>
<td><strong>Cryogenic Bulk w/Cylinder Reserve</strong></td>
<td>4-3.1.2.2(b)3a</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
<td>4-3.1.2.2(b)3b</td>
</tr>
<tr>
<td><strong>Air Via Oil-free Compressor</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Air Via Oil-lube Compressor</strong></td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
<td>4-3.1.1.9(b)1b</td>
</tr>
<tr>
<td><strong>Air Via Liquid Ring Compressor</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
<tr>
<td><strong>Vacuum Pump</strong></td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
<td>4-3.1.1.9(b)1a</td>
</tr>
</tbody>
</table>
5. Add new 8-6.4.3.8 to read as follows: “8-6.4.3.8 Cylinders shall not be chained to portable or movable apparatus such as beds and oxygen tents.”

SUBSTANTIATION: The subject of this paragraph is not related to piped gas systems, and thus does not belong in Chapter 4.

2. Same reason as item 1.
3. More appropriate location for sentence 1 of 4-3.5.2.1(b)(25). 4. More appropriate location for idea contained in sentence 2 of 4-3.5.2.1(b)(25). Address issue of a cylinder being held for immediate use in a patient room by a patient. Only one cylinder per patient should be permitted to be stationed like this.
5. More appropriate location for text of 4-3.5.2.1(b)(28).

COMMITTEE ACTION: Accept

NUMEROUS COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

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99-268 - (4-5.1.1.2(c) (New)): Accept in Principle

RECOMMENDATION: Insert new 4-5.1.1.2(c) to read:

“(c) Nonflammable Gases (greater than 3,000 ft³; In-Storage, Connected, or Both). Storage locations for nonflammable gases greater than 3,000 ft³ (85 m³) shall comply with 4-3.1.1.2 and 4-3.5.2.2.”

SUBSTANTIATION: There are no requirements listed when quantities exceed 3,000 ft³. Recommendation is based on requirements for the storage of cylinders not related to piped gas systems, as listed in 8-3.11.11 in Chapter 8.

COMMITTEE ACTION: Accept in Principle.

Revise to read as follows:

“(c) Nonflammable Gases (greater than 3,000 ft³; In-Storage, Connected, or Both). Storage locations for nonflammable gases greater than 3,000 ft³ (85 m³) shall comply with Level 1 systems in accordance with 4-3.1.1.2 and 4-3.5.2.2.”

COMMITTEE STATEMENT: Level 1 was added for clarity.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

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99-270 - (4-5.1.1.3): Accept

RECOMMENDATION: Revise text as follows:

(a) Same (b) Same (c) Same (d) Same (e) Same (f) Same (g) Same (h) Same (i) Same

Add:

“The provisions of this section apply to field-installed piping for the distribution of Level 3 compressed air to power devices.

(a) Piping shall be Type K or L copper (hard drawn or annealed) or brass (schedule 40 or 80). If Level 3 compressed air piping is installed simultaneously with patient gas piping systems, either the Level 3 system piping shall be labeled or otherwise identified prior to installation in order to preclude inadvertent inclusion in a nonflammable medical gas piping system, or the Level 3 system piping shall be cleaned and degased in accordance with 4-5.4.1.

(b) Fittings shall be manufactured from corrosion resistant materials suitable for the system pressures [not to exceed 160 psig (1103 kPa)].

(c) Connectors and joints shall be soldered with 95-5 tin antimony, silver brazed, or threaded NPT.

(d) Piping shall be supported from the building structure in accordance with MSS Standard Practice SP-69, Piping Hangers and Supports – Selection and Application. Hangers and supports shall comply with MSS Standard Practice SP-58, Pipe Hangers and Support – Materials, Design, and Manufacture.

(e) Piping shall be protected against freezing, corrosion, and physical damage. Buried piping outside of buildings shall be installed below the local level of frost penetration. Buried piping that will be subject to surface loads shall be buried at a sufficient depth.”

COMMITTEE ACTION: Accept in Principle.
depth to protect the piping from excessive stresses. The minimum backfilled cover above the top of buried piping outside of buildings shall be 36 in. (91.4 cm), except that the minimum cover shall be permitted to be reduced to 18 in. (45.7 cm) where physical damage to the piping is not likely to occur. Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Backfill shall be clean and compacted so as to protect and uniformly support the piping. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water. Piping embedded in concrete floors or walls shall be installed in a continuous conduit.

(f) Level 3 compressed air piping shall be permitted to be located 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 compressed air piping is limited to 130°F (54°C) maximum.

(g) Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be suitably protected.

(h) Hoses and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions, except where removable panels or doors permit access for connections and service. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure of 300 psig.

(i) Emergency compressed air shutoff valves shall not be required. Shutoff valves for isolation of a duplex system’s operating components shall be provided as recommended by the manufacturer.

(j) Where nitrogen gas is used as a backup for a Level 3 compressed air system, a check valve and shutoff valve shall be located in each supply line prior to the tee connection in the main compressed air system. See Chapter 2 definition and the appendix. This would be permitted under the supervision of a manufacturer(s) or supplier(s) who is (are) familiar with the proper practices for its construction, installation, and use. The emergency compressed air shutoff valves for the dental air compressor supply system as connected in each individual installation, Maintenance programs that incorporate the equipment manufacturer’s recommendations shall be established for each Level 3 compressed air system.

SUBSTANTIATION: Current wording does not include standards for what is allowed for Level 3 compressed air piping. Therefore many refer to subsequent paragraphs under medical gas piping for standards. Many plan checkers and inspectors are confused. These additions will reduce the confusion.

COMMITTEE ACTION: Accept in Principle.

Revised to read as follows:

Reference Log#271 on page# 196 Change location from 4-5.1.1.3 to 4-5.1.3 to replace existing.

4-5.1.3 Distribution for Gas Powered Systems-Level 3. (Rename to “Distribution for Compressed Air Source Systems”)

“The provisions of this section apply to field-installed piping for the distribution of Level 3 Compressed Air to power devices.

(a) No Change.

(b) No Change.

(c) Connectors and joints shall be brazed as required in accordance with 4-5.1.2.10 (b) with solder metal (ASTM B32) containing less than 0.2 percent lead, or brass threaded NPT.

(d) No Change.

(e) No Change.

(f) “Gas Level 3 Compressed Air Piping shall be permitted to be located in the same service...”

“Gas piping shall not be located where subject to contact with oil, including flooding in case of a major oil leak.”

(h) “Hoses and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions, except where removable panels or doors permit access for connections and service. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure of 1000 300 psig.”

(i) Emergency Compressed Air shutoff valves shall not be required. Shutoff valves for isolation of a duplex system’s operating components shall be provided as recommended by the manufacturer.

(j) Where nitrogen gas is used as a backup for a Level 3 Compressed Air system, a check valve and shutoff valve shall be located in each supply line prior to the tee connection in the main line. [See Figure 4-5.1.1.3(b).]

COMMITTEE STATEMENT: The change clarified the submitter recommendation.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMENT ON AFFIRMATIVE:

FRANKEL: Clarify wording in “h” to read 1,000 psig only in lieu of the 1000 300 burst pressure that appears in the committee action portion of the log.

SHOEMAKER: Ensure that Level 3 Compressed Air NOT be connected to Medical Air Station Outlets.

WAGNER: 1. According to the Committee Action, it appears that Log #271 does not change 4-5.1.1.3. In 4-5.1.3(c), it requires brazing but calls for a solder filler metal (ASTM B32). In 4-5.1.3(i), the meaning of “1000 300 psig” is not clear. In 4-5.1.3(i), what are “emergency compressed air shutoff valves”? Non-emergency shutoff valves are proposed to be deleted by Proposal 99-291 (4-5.1.2.11(a) [Log #242]).

2. What is the title of this section? Log #246 (A) says “Compressed Air Systems”. Log #237 (AIP) says “Compressed Air Supply Systems”.

(Log #330)

Committee: HEA-PIP

99-271 - (4-5.1.1.3 and Figure 4-5.1.1.3): Accept in Principle

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

RECOMMENDATION: Delete Level 3 Patient Gas Supply Systems and insert Level 3 Air-Powered Devices Supply Systems. This issue is the figure 4-5.1.3(i) as the title is also incorrect.

SUBSTANTIATION: Level 3 Air Compressor is not a patient air system. See Chapter 2 definition and the appendix. This would be uniform with 4-5.1.4, Level 3 Gas-Powered Devices Supply Systems.

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

(Log #237)

Committee: HEA-PIP

99-272 - (4-5.1.1.3, Figure 4-5.1.1.3): Accept in Principle

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:

4-5.1.3 Level 3 Patient Gas Supply Compressed Air Supply Systems.

4-5.1.1.3(b) Equipment shall be obtained from and be installed under the supervision of a manufacturer(s) or supplier(s) who is (are) familiar with the proper practices for its construction, installation, and use in accordance with the recommendations of manufacturer(s), shall be established for the dental air compressor supply system as connected in each individual installation. Maintenance programs that incorporate the equipment manufacturer’s recommendations shall be established for each Level 3 compressed air system.

4-5.1.1.3(i) The service outlets Station outlets for Level 3 compressed air shall not be interchangeable with the medical air station outlets.

Figure 4-5.1.1.3 Level 3 patient gas compressed air supply system typical.

SUBSTANTIATION: The existing section covers Level 3 compressed air systems, not all patient gases. The existing language requires maintenance only on dental compressed air systems, not any Level 3 system.

COMMITTEE ACTION: Accept in Principle.

Change “station outlets” to “service outlets”. In addition, add the following at the end of the second recommendation: “Systems shall be maintained and repaired in accordance with the manufacturers instructions.”

COMMITTEE STATEMENT: The intent was to provide service outlets in Level 3.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft
RECOMMENDATION: Revise text as follows:

- 4-5.1.1.3 and 4-5.1.1.4. The oil indication device shall be capable of being installed according to manufacturer(s) instructions under the supervision of a manufacturer(s) or supplier(s) familiar with proper practices for its construction and use. Maintenance programs, in accordance with the recommendations of manufacturer(s), shall be established for the dental air compressor supply system as connected in each individual installation.

SUBSTANTIATION: This source of the product does not relate to safety and therefore it should not be included in this document. Installation according to manufacturer's instruction is appropriate; as manufacturers are the best source of information on how the product should be installed.

COMMITTEE ACTION: Accept in Principle in Part.

Accept the part regarding the manufacturer's instruction and incorporate into Proposal 99-272 (Log #257).


NUMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

EXPLANATION OF NEGATIVE:

RIDENOUR: This allows anyone with the will and desire to build Level 3 equipment. The dentist, doctor, or garbage collector can now install, repair, and change out manifolds, pumps, and compressors in Level 3 facilities. Level 3 facilities are not just dentist offices.

Committee: HEA-PIP

99-274 - (4.5.1.1.3(c)): Accept

TCC NOTE: The Technical Correlating Committee directs that the Committee Action be revised to read as Accept in Principle.

SUBMITTER: Fred Quarnstrom, American Dental Association

RECOMMENDATION: Revise text as follows:

(c) Level 3 compressed air systems shall be equipped with intake filter-muffler(s) of the dry type; receiver(s); shutoff valves; air dryer(s); In-line final particulate filters rated at 5 microns, 98 percent efficiency, with filter-status indicator; and downstream pressure regulator(s) to ensure the delivery of compressed air with a maximum allowable 0.05 ppm liquid oil and 40 percent relative humidity at operating pressure and temperature. Alternatively, the system shall comply with American National Standard/American Dental Association Specification No. 94, Dental Compressed Air Quality.

SUBSTANTIATION: As there is an American National Standard/American Dental Association Specification No. 94, Dental Compressed Air Quality, applicable to this area, it should be allowed to provide a viable alternative. A copy of the ANSI/ADA Specification No. 94 is submitted with this proposal.

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

COMMITTEE ACTION: Accept.

Change the word “alternatively” to “or” and change “should” to “shall“.

COMMITTEE STATEMENT: The changes conform to the Manual of Style.

NUMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-275 - (4.5.1.1.3(h)): Reject

SUBMITTER: Fred Quarnstrom, American Dental Association

RECOMMENDATION: Revise text as follows:

(h) If desired, an oil indicator sensor per 4-5.1.1.3(c) shall be located downstream of the receiver as shown in Figures 4-5.1.3 and 4-5.1.1.4. The oil indication device shall be capable of measuring an oil concentration of 0.05 ppm with an accuracy of ± 0.05 ppm in compressed air at 80 to 100 psig (552 to 689 kPa).

SUBSTANTIATION: Clarify this section by making the oil sensor optional. Figure 4-5.1.1.3 indicates that the oil monitor is optional (as denoted by dotted lines). There is no automatic oil indicator sensor commercially available, so no dental manufacturers can comply with this requirement. For oil-less compressor systems, this requirement does not apply.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Level III does not only include dental air but other pneumatic powered devices. Oil indicator sensors are commercially available.

NUMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-276 - (4.5.1.4): Reject

SUBMITTER: Fred Quarnstrom, American Dental Association

RECOMMENDATION: 4.5.1.4 Level 3 Gas-Powered Devices Supply Systems. Question: Nitrogen oil-free, dry is defined in Chapter 2. Is there a need for a dryer and optional oil monitor as indicated in Figure 4-5.1.1.4?

SUBSTANTIATION: Clarify the requirements in 4.5.1.1.4 and Figure 4.5.1.4. The discrepancy between 4.5.1.1.4 and Figure 4.5.1.4 needs to be clarified.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The submitter did not offer specific wording for change.

NUMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-277 - (4.5.1.2): Accept

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

RECOMMENDATION: Revise as follows:

“4-5.1.2 Distribution for Patients Level 3 (Manifold,…”

4-5.1.2 Level 3 Source Distribution (Manifold,…”

SUBSTANTIATION: The intent was not to distribute patients, but explain the Level 3 requirements from the source (gases, vacuum, and air power) to the end station inlet or outlet.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The submitter did not offer specific wording for change.

NUMER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-278 - (4.5.1.2.8): Accept in Principle

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:

4-5.1.2.8 Warning Systems for Gases

(a) An automatic pressure switch, which will actuate a visual and audible alarm when the line pressure drops below or increases above normal line pressure, shall be connected to each main supply line within a single treatment facility. [See 4-5.1.2.8.1.

The automatic pressure switch shall be installed downstream from any main supply line shutoff valve that may be required by the provisions of 4-5.1.2.10(f) and 1.7.

(b) A warning system as required in 4-5.1.2.8(a) shall be installed in each single treatment facility served by the supply system. The warning system shall be comprised of an audible and non cancellable visual signal and shall be installed to be heard and seen at a continuously attended location during the time of operation of the facility.

(c) A warning system as outlined in 4-5.1.2.8(b) shall be installed to indicate whenever automatic changeover occurs or is about to occur. The signal shall also indicate whenever the reserve supply bank has been replenished. The sensor alarm shall be independent of the sensor actuator of 4-5.1.2.8(a). When two treatment facilities are served by a common supply system, the automatic changeover alarm shall indicate in both facilities.
4-5.1.2.10.(3): Accept in Principle

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

RECOMMENDATION: Delete "...Main and Branches shall be not less than 1/2 in. OD (3/8 in. nominal size.)"

SUBSTANTIATION: This conflicts with Appendix A-4.5.1.2.10, where the intent is explained. This was accepted as Comment 99-74 (Log #16) on Page 150 of the F98 ROC. This has caused many problems and all Level 3 is supplied as 1/2 in. OD for Oxygen and 5/8 in. OD for other gases and vacuum. The chance for cross connection has been reduced.

COMMITTEE ACTION: Accept in Principle.

Delete “nominal”.

COMMITTEE STATEMENT: Editorial.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 21

NEGATIVE: 1

NOT RETURNED: 1 Bankcort

EXPLANATION OF NEGATIVE: RIDENOUR: This allows Level 3 gas systems to be piped in 3/8 in. O.D. or 1/4 in. nominal tubing. Before it was 1/2 in. O.D. which shouldn’t have been changed.

COMMENT ON AFFIRMATIVE: RIDENOUR: WAGNER: Log #398 (AIP) is not coordinated with Log #399 (AIP). Log #399 calls for 3/8 in. OD minimum pipe sizes (which covers gases other than oxygen). Oxygen is normally 1/2 in. OD in Level 3 systems. The standard should call for 1/2 in. OD minimum for oxygen and 3/8 in. OD minimum for gases other than oxygen. Otherwise, people can install 3/8 in. OD for oxygen.

(Committee: HEA-PIP)

99-287 - (4-5.1.2.10(a)): Accept in Principle

TCC NOTE: The Technical Correlating Committee directs that the proposal be returned to committee. The proposal and Committee Action are difficult to decipher; the Committee Statement is not germane to the proposal or Committee Action.

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise 4-5.1.2.10(a) as follows:

Piping shall be ASTM B819 specification hard copper seamless medical gas tubing; ASTM B819 tubing is identified by the markings "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green (Type K) or blue (Type L). Main and branches shall be not less than 1/2 in. nominal size. Factory-installed tube on station outlets (or inlets) shall be permitted to be 3/8 in. O.D. (1/4 in. nominal) size. Connections to Connecting tubing for gauges and alarm switches and runouts to alarm panels shall be permitted to be 1/4 in. O.D. (1/8 in. nominal) size.

Exception: For systems operated at pressures between 210 and 300 psig (1380 and 2070 kPa, respectively), ASTM B819, Type K copper shall be used.

4. Copper tube shall, whenever possible, be installed overhead or below floor level. Only where the installation requires installing in a slab, exceptions below are permitted to apply. Piping shall be installed overhead or below floor level wherever possible. The following exceptions are permitted only when piping must be run within a floor slab to reach the service outlets/inlets:

a. Anamed (soft temper) ASTM B88 (Type K or L) copper tube, up to 1/2 in. O.D. (3/8 in. nominal) size, that has been prepared for oxygen service according to CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service, shall be permitted to be used, up to 1/2 in. O.D. (3/8 in. nominal) size.

b. The tube shall be installed in conduit sufficiently large to accept the following gases (if used): O₂, N₂, O₃, N₂O, MA, DB. Level 3 vacuum. A conduit(s) shall be embedded in the floor slab that is sufficiently large and has adequate bend radii to permit subsequent installation of the necessary gas and/or vacuum lines.

c. The pipe shall be a continuous run from entry to exit of the building. PVC conduit permitted to be attached to masonry walls. Each line pulled into the conduit shall be a continuous length of tube having no joints within the conduit.

d. All station outlets (inlets) shall be permitted to be completed after the slab is complete.

Ordinary - Except as provided...
COMMITTEE ACTION: Accept in Principle.

SUBSTANTIATION: All piping is a continuous run. If the intent is to have no joint within the conduit, it needs to be spelled out. The PVC in this sentence refers to the material of the vacuum piping, not the conduit (encasement piping). Vacuum piping run in PVC piping requires joints within the conduit which in the first sentence is prohibited. Running vacuum piping in a conduit would require annealed copper tubing for a continuous run from entry to exit of the conduit.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: The wording was changed to agree with previous wording. In addition, this issue falls under the building code, is job specific, and not under the scope of the committee.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMENT ON AFFIRMATIVE:

SHOEMAKER: See my Comment on Affirmative on Proposal 99-280 (Log #298).

WAGNER: In the Committee Action on 4b, the following should be deleted: The tube shall be installed in conduit sufficiently large to accept the following gases (if used O2, N2O, N2, MA, DA, Level 3 vacuum. Conduits, when run underground or embedded in the floor slab, shall be large enough to permit subsequent installation of the necessary gas and/or vacuum lines.

Committee: HEA-PIP

COMMITTEE ACTION: Accept in Principle.


NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

RECOMMENDATION: Revise as follows:

"Vertical risers, all sizes. Every floor, but not to exceed 15 ft (4.57 m)."

SUBSTANTIATION: Editorial change.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMITTEE: HEA-PIP

COMMITTEE ACTION: Accept in Principle.

COMMENT ON AFFIRMATIVE:

SHOEMAKER: Thomas J. Mraulak, American Society of Sanitary Eng.

RECOMMENDATION: Revise text as follows:

"Vertical risers, all sizes. Every floor, but not to exceed 15 ft (4.57 m)."

SUBSTANTIATION: To correct an apparent typographical error.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

COMMITTEE: HEA-PIP

COMMITTEE ACTION: Accept in Principle.

COMMENT ON AFFIRMATIVE:


WAGNER: In the Committee Action on 4b, the following should be deleted: The tube shall be installed in conduit sufficiently large to accept the following gases (if used O2, N2O, N2, MA, DA, Level 3 vacuum. Conduits, when run underground or embedded in the floor slab, shall be large enough to permit subsequent installation of the necessary gas and/or vacuum lines.

Committee: HEA-PIP

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: The wording was changed to agree with previous wording. In addition, this issue falls under the building code, is job specific, and not under the scope of the committee.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

EDITORIAL:

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Delete text as follows:

"Brazed tube joints shall be of the socket type ... Brazing filler metals shall comply with ANSI/AWS A5.8, Specifications for Brazing Filler Metal, except that filler metals having compositions not conforming to the exact ANSI/AWS A5.8 classifications shall be permitted when used according to the manufacturer’s instructions."

SUBSTANTIATION: The current wording allows the use of virtually any brazing filler metal, whether it is suitable for the purpose or not, as long as the installer follows the manufacturer’s instructions. The referenced ANSI/AWS standards allow a wide
choice of readily available filler metals with proven characteristics of chemical composition and thermal integrity.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-183 (Log #289).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 22

**NOT RETURNED:** 1 Bancroft

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99-287 - (4-5.1.2.10(b)11): Accept

**SUBMITTER:** J. Richard Wagner, The Poole & Kent Company

**RECOMMENDATION:** Revise text as follows:

1. Brazed joints that are found to be defective under 4-5.1.2.10(b)10, conditions a, c, d, f, or g, shall be permitted to be repaired, except that no joint shall be reheated more than once before being replaced. Brazed joints that are found to be defective under 4-5.1.2.10(b)10, conditions b and e, shall be replaced.

**SUBSTANTIATION:** To indicate that joints must be replaced if they cannot be repaired after one attempt at reheating.

**COMMITTEE ACTION:** Accept

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

**NOT RETURNED:** 1 Bancroft

**EXPLANATION OF NEGATIVE:**

RIDENOUR: This rejection allows Level 3 facilities with oxygen, nitrogen, nitrous oxide, carbon dioxide, etc., to be installed by the doctor’s nephew or the garbage collector, if he desires. Keep in mind the mind set of the committee was dentist but this covers many doctors offices, surg-centers, etc.

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99-288 - (4-5.1.2.10(b)12): Reject

**SUBMITTER:** Thomas J. Mraulak, American Society of Sanitary Engineers

**RECOMMENDATION:** Add the following text:

"Brazing procedures and brazer performance shall be qualified as required under 4-3.1.12."

**SUBSTANTIATION:** Brazing procedures and brazer performance requirements are not covered in Level 3 systems. Level 3 brazing requirements should be the same as Level 1 requirements.

**COMMITTEE ACTION:** Reject

**COMMITTEE STATEMENT:** Level 3 systems do not need to be installed by certified brazers.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 21

**NEGATIVE:** 1

**NOT RETURNED:** 1 Bancroft

**EXPLANATION OF NEGATIVE:**

MOHILE: We wish to speak in opposition to the Committee’s rejection of this proposal. Why are the installers of medical oxygen and nitrous oxide systems in level 3 locations not required to have to meet the same brazing performance requirements as the installers of medical oxygen and nitrous oxide systems in hospitals? As review of the Level 3 requirements it would now appear to be as follows:

1. The installer does not have to have any special qualifications as far as brazing medical gas pipelines.
2. Soft tempered tubing is permitted on positive pressure gases in certain circumstances while it is prohibited in hospitals.
3. Tubing that is not specifically marked as ASTM B-819 (cleaned for medical gas service) is permitted to be used.
4. Flared fittings are permitted to be used while they are prohibited in hospitals.
5. Testing for actual gas content (oxygen, nitrous oxide, etc.), as required in hospitals per 4-3.4.1.3(i) is not required in office-based facilities.

Why do we not remove the Level 3 systems from the requirements of NFPA 99 entirely?
99-292 - (4-5.1.2.12): Accept in Principle

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:

4-5.1.2.12 Gas Station Outlets. See C-4.2.

(a) Station outlets shall be located at an appropriate height above the floor to prevent physical damage to equipment attached to the outlet.

Floor mounts for Level 3 gas systems shall not be recessed and shall be permitted to be mounted in or on the dental junction box, when mounted to the floor.

(b) Outlets shall be located to avoid physical damage to the valve outlet and attached equipment.

(b) Floor outlets shall not be recessed and shall be permitted to be installed in or on a recessed junction box.

COMMITTEE STATEMENT: Recessed was added to clarify the options available.

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-293 - (4-5.1.2.12): Accept in Principle

SUBMITTER: Fred Quarnstrom, American Dental Association

RECOMMENDATION: Revise text as follows:

4-5.1.2.12 Gas Station Outlets. See C-4.2.

(a) Station outlets shall be located at an appropriate height above the floor to prevent physical damage to equipment attached to the outlet.

Floor mounts for Level 3 gas systems shall not be recessed and shall be permitted to be mounted in or on the dental junction box, when mounted to the floor.

(b) Outlets shall be located to avoid physical damage to the valve outlet and attached equipment.

COMMITTEE ACTION: Accept in Principle.

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-294 - (4-5.1.3.4(a)): Accept

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: In 4-5.1.3.4(a), delete “as well as Level 3 vacuum systems.” Paragraph would read:

“(a) Gases used to power devices, such as in a compressed air or nitrogen system shall not be required to have an alarm system.”

COMMITTEE ACTION: Accept

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-295 - (4-5.2.1.2): Accept

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: In paragraph 2, sentence 2, delete "dental" from “the dental air compressor supply.” Sentence would read:

“Maintenance programs, in accordance ... shall be established for the air compressor supply system ...” (remaining of sentence the same).

COMMITTEE ACTION: Accept

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-296 - (4-5.2.1.2): Accept in Principle

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:

4-5.2.1.2 Level 3 vacuum pumps shall be suitable for the intended purpose. Wet vacuum piping system shall have include a liquid/air separator in the system. [See Figures 4-5.2.1.2(a) through (d).]

Equipment shall be obtained from and be installed under the supervision of a manufacturer(s) or supplier(s) who is (are) familiar with the proper practices for its construction, installation and use. Maintenance programs, in accordance with the recommendations of manufacturer(s), shall be established for the dental air compressor supply system is connected in each individual installation. Maintenance programs that incorporate the equipment manufacturer’s recommendations shall be established for each Level 3 vacuum system.

COMMITTEE ACTION: Accept in Principle.

Add the following:

"Systems shall be maintained and repaired in accordance with the manufacturer’s instructions,” to the end of the recommendation.

COMMITTEE STATEMENT: This was added to be consistent with Proposal 99-273 (Log #247).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-297 - (4-5.2.1.2): Accept in Principle

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

RECOMMENDATION: Editorial error: Delete "..., shall be established for the dental air compressor supply and insert Level 3 vacuum supply system as “.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: This is incorrect text.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99-298 - (4-5.2.1.6 and 4-5.2.1.8): Accept

SUBMITTER: J. Richard Wagner, The Poole & Kent Company

RECOMMENDATION: Revise text as follows:

4-5.2.1.6 Exhaust to the outdoors shall be protected against the entry of insects, vermin, debris, and precipitation. Exhaust lines shall be sized to minimize back pressure in accordance with the vacuum pump manufacturer’s requirements.

4-5.2.1.8 Vacuum exhaust from separate pumps shall follow the manufacturer’s recommendations.

COMMITTEE ACTION: Accept

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft
**RECOMMENDATION**

SUBMITTER: Burton R. Klein, Burton Klein Associates

99-299 - (4-5.2.1 and 4-5.2.2.3): Accept in Principle

COMMITTEE ACTION: Accept in Principle

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

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**SUBSTANTIATION:**
The explanatory material in Appendix A discusses exhaust from dual pumps. 4-5.2.1.8 addresses separate pumps.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**COMMITTEE STATEMENT:**

Vacuum systems should be covered in Section 4-5.4.3.

**COMMITTEE ACTION:**

In addition to the proposed change, revise 4-5.2.2.3 by changing the word "per" to "when recommended by".

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**COMMITTEE STATEMENT:**

This text is already stated in 4-1.4. If this text is not deleted, then Section 4-5.4 does not correlate with 4-3.4.1.1 and 4-4.1.1.

**COMMITTEE ACTION:**

Alternatively, this information can be included in 4-5.5, which covers existing systems.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**RECOMMENDATION:**

SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.

99-304 - (4-5.5.2.3): Accept

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

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99-305 - (4-5.5.2.3):

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**COMMITTEE STATEMENT:**

Committee: HEA-PIP

The wording does apply to Level 3 nonflammable medical gas systems covered in installations and 4-5.2.1.8 addresses separate pumps.

**COMMITTEE ACTION:**

In paragraph 1, delete in the parenthesis "Scavenging"

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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99-303 - (4-5.4.1.3):

**COMMITTEE ACTION:**

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**RECOMMENDATION:**

SUBMITTER: Mark Allen, Beacon Medical Products

99-304 - (4-5.5.2.3): Accept

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

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**COMMITTEE STATEMENT:**

This text is to delete the entire section 4-5.4.1.3.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**COMMITTEE STATEMENT:**

Move these requirements to Chapters 12, 13, 16, 17, and 20.

**COMMITTEE ACTION:**

Submitter’s Note: See related proposals on 12/13/16/17, 3-4.1.

**SUBSTANTIATION:**
The requirements contained in this paragraph no longer belong here. The selection of a level for a facility is governed by Chapters 12, 13, 16, 17, and 20 and there should not be these limitations within the level itself.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:** AFFIRMATIVE: 22

**NOT RETURNED:** 1 Bancroft

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**COMMITTEE STATEMENT:**

Move Paragraph 4-5.5.2.3(a) in its entirety between 4-5.1 and 4-5.1.1, without assigning it a paragraph number.

**COMMITTEE ACTION:**

Move Paragraph 4-5.5.2.3(b) to Section 4-5.1.2, and number it new 4-5.1.2.12.

**COMMITTEE STATEMENT:**

This text relates to new manufactured assemblies, and thus should be moved to the same new section as that text.

**COMMITTEE ACTION:**

Move Paragraph 4-5.5.2.3(c) to Section 4-5.1.2, and number it new 4-5.1.2.13, new 4-5.1.3.5, and new 4-5.2.2.8.

**COMMITTEE STATEMENT:**

This text applies to new manufactured assemblies, and thus belongs in Section 4-5.1.2.

**COMMITTEE ACTION:**

This text relates to Paragraph 4-5.5.2.3(a), and thus should be moved to the same new section as that text.

**COMMITTEE STATEMENT:**

**COMMITTEE ACTION:**

This text is installation criteria and belongs in Sections 4-5.1 and 4-5.2.

**COMMITTEE STATEMENT:**

Text under 4-5.1, but before 4-5.1.1, would read as follows:

**"Level 3 nonflammable medical gas systems cover installations that:**

1. Have not more than 3000 ft³ (85 m³) total capacity of all gases (excluding nitrogen and medical air in cylinder for powered devices) connected and in storage at one time, except that the total capacity of all gasses shall be permitted to be increased to 5000 ft³
(143 m$^3$) excluding nitrogen and medical air for powered devices) if oxygen is used in a DOT Specification 4L (liquid) cylinder, and
2. Have a listed pressure regulator directly connected to each cylinder, and
3. Supply only a single treatment facility and also as a minimum comply with the specific requirements of 4-5.1.2.6, or
4. Supply a maximum of two adjoining single treatment facilities and also as a minimum comply with the specific requirements of 4-5.1.2.7.

Medical gas systems not specifically provided for in above paragraph, such as systems within a hospital served by a central supply system, or systems serving three or more treatment facilities, as might be found in a medical or dental office building, shall comply in all respects with Level 1 systems.

New section 4-5.1.2.12 would read as follows:

"4-5.1.2.12 Manufactured assemblies in which are intended to be piped nitrous oxide or oxygen shall be (a) constructed of metal, or
(b) tested to pass a minimum 200 flame spread rating and 200 smoke developed index in accordance with NFPA 255. Standard Method of Test of Surface Burning Characteristics of Building Materials, or, if constructed of polymers (plastic, fiberglass, etc.), a rating of 94 VO or better." 

New Section 4-5.1.2.13 would read as follows:

"4-5.1.2.13 Equipment shall be obtained from and be installed under the supervision of a manufacturer or supplier familiar with proper practices for its construction and use.

New section 4-5.1.3.5 would read as follows:

"4-5.1.3.5 Equipment shall be obtained from and be installed under the supervision of a manufacturer or supplier familiar with proper practices for its construction and use.

New section 4-5.2.2.8 would read as follows:

"4-5.2.2.8 Equipment shall be obtained from and be installed under the supervision of a manufacturer or supplier familiar with proper practices for its construction and use.

Section 4-5.5.2.3 would read as follows:

4-5.5.2.3 Patient Gas Systems — Level 3.

(a) Material Oxygen Compatibility.

1. Oxygen system components including, but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components may be exposed in the containment and use of oxygen. Easily ignitable materials shall be avoided unless they are parts of equipment or systems that are approved, listed, or proved suitable by tests or by past experience.

2. The provisions of 4-5.5.2.3(a)1 also apply to nitrous oxide-oxygen-nitrous oxide mixtures, and to other medical gas mixtures containing more than 25.5 percent oxygen.

(b) Maintenance programs in accordance with the manufacturer’s recommendations shall be established for the medical air compressor supply system as connected in each individual installation.

(c) Every facility shall establish a procedure for manually turning off the gas supply at the cylinder valve at the end of the work day, or when the facility is not in use. No other method such as Emergency Shutoff Valves or remote actuators [4-5.1.2.11(b)] shall be used to turn off the gas supply. 

COMMITTEE ACTION: Accept

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-306 - (4-5.5.2.3(a)(4)): Accept

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Revise text as follows: "Supply a maximum of two adjoining single treatment facilities and also as a minimum comply with the specific requirements of 4-5.1.2.7."

SU. STANZATION: Editorial.

COMMITTEE ACTION: Accept

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-307 - (4-5.5.2.3(c)(i)): Accept in Principle

SUBMITTER: Richard E. Hoffman, Compressed Gas Association

RECOMMENDATION: Add: Reference: "CGA Pamphlet E-10, Maintenance of Medical Gas and Vacuum Systems in Health Care Facilities."

SUBSTANTIATION: Need reference to E-10 as a guide.

COMMITTEE ACTION: Accept in Principle. Add the following to the annex 4-5.5.2.3(c): "See CGA Pamphlet E-10, Maintenance of Medical Gas and Vacuum Systems in Health Care Facilities."

COMMITTEE STATEMENT: This informational guideline were moved to the annex.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-308 - (4-6): Accept

TCC NOTE: 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.

SUBMITTER: Technical Committee on Piping Systems

RECOMMENDATION: Move all of 4-6 to Chapter 10 except 4-6.1.2 which would become 4-3.2.2.1(b).

Existing 4-3.2.2.1 would become 4-3.2.2.1(a).

SUBSTANTIATION: Laboratory gas piping more appropriately belongs in Chapter 10.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-309 - (4-6.1.2.3): Reject

TCC NOTE: 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.

SUBMITTER: Burton R. Klein, Burton Klein Associates

RECOMMENDATION: Revise 4-6.1.2.3 to read: "Piping systems for nonflammable gases shall comply with 4-3.1.2 as specified in Chapter 4. (Wording changed is underlined.)"

SUBSTANTIATION: To clarify that only the section on piping distribution is to be applied since 4-6.1.2 covers only distribution portion of system.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Proposal 99-308 (Log #CP707) which reads as follows: Move all of 4-6 to Chapter 10 except 4-6.2.2 which would become 4-3.2.2.1(b).

Existing 4-3.2.2.1 would become 4-3.2.2.1(a).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

99-310 - (4-6.2.3 (New)): Reject

TCC NOTE: 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.

SUBMITTER: Dale J. Dumbleton, American Medical Gas Inst.

RECOMMENDATION: Add the following text: "Vacuum piping shall comply with 4-3.2.2.2, Vacuum System Piping Network."

SUBSTANTIATION: The piped vacuum system for Level 4 has no requirements with regard to the material or joining methods.

COMMITTEE ACTION: Reject.
C.8.2.1
8.2.1* Adequate grounding for electrical equipment is an important safeguard against fire and electric shock (see 3-3.3.2 and 7-5.1.2.2).

8.2.2* Effects of Moisture. Moisture, in the form of liquids, vapors, or mists, can degrade insulation to the point where fire, equipment malfunction, and electric shock hazard become a threat. Moisture can enter equipment as a result of defective seals, leaks, or inadvertent spillage. Vessels containing liquids should not be placed on electrical equipment.

8.2.2.1 Personnel are cautioned to be aware of the hazards presented by defective or improperly employed electrical equipment (see 7-2.3.2) and to avoid the use of defective electrical equipment (see 7-2.3.2.2). Personnel shall be trained to recognize the shock hazards created by the use of defective or improperly used electrical equipment.

8.2.3* Burns.

8.2.3.1* Heated Surfaces.

8.2.3.1 Sustained skin contact with surfaces of equipment that have temperatures in excess of 42°C (107°F) can cause burns. Caution is recommended when exposing patients to warmed surfaces, particularly when they are helpless.

8.2.3.2* High-Frequency Electromagnetic Fields.

8.2.3.2 Particularly those from electrocautery generators and from lasers, are used to intentionally destroy tissue. Inadvertent burns, or ignition of combustible materials, is a hazard.

8.2.4* Interruption of Power. (Reserved)

8.2.5* 2.2.5.2 RF Interference.

8.2.6 Mechanical Injury. (Reserved)

8.2.7 Source.

8.3* 23.1.2 Electrical System.

8.3.2 Battery. (Reserved)

8.4* 23.4 Distribution. (Reserved)

8.4.1* 23.4.1 Performance Criteria and Testing.

8.4.1.1 23.4.1.1 Patient-Care-Related Electrical Appliances and Equipment.

8.4.1.2 23.4.1.2 Grounding of Appliances.

8.4.1.2.1 General. All patient-care-related electrical equipment supplied by a flexible cord and plug, carrying 20 V or more, shall meet the requirements of 8.4.1.2.1.2 Exception: Double-insulated appliances shall be permitted to have two conductor cords.

8.4.1.2.2 Grounding of Appliances.

8.4.1.2.3 Cord- and Plug-Connected (Portable).

8.4.1.2.4 Power Cords. Power cords installed by the facility shall meet the requirements of 9-2.1.2.2.

8.4.2* 23.4.2 Line Voltage Equipment - Anesthetizing Locations. Flexible cord for portable lamps or portable electrical appliances operating at more than 12 V between conductors, intended for use in anesthetizing locations, shall meet all of the following requirements: be continuous and without switches from the appliance to the attachment plug and of a type designated for extra-hard usage in accordance with Section 501.11 of NFPA 70, National Electrical Code.

(a) Be continuous

(b) Be without switches from the appliance to the attachment plug

(c) Be of a type designated for extra-hard usage in accordance with NFPA 70, National Electrical Code

(d) Be protected at the entrance to equipment by an insulating grommet

(e) Be of sufficient length to reach any position in which the portable device is to be used.
(f) The attachment plug shall be inserted only in a fixed approved receptacle.
(g) Adaptors shall be used and maintained in accordance with 8.4.12.4.1.

8.4.12.4.1 Exception No. 1: Foot-treadle-operated controllers are shall be permitted in any anesthetizing location if appended to portable electric appliances in an approved manner. Foot-treadle-operated controllers and their connector shall be splashproof.

Exception No. 2: Two or more power receptacles supplied by a flexible cord shall be permitted to be used to supply power to plug-connected components of a movable equipment assembly that is rack-, table-, or pedestal-mounted provided all of the following conditions are met:
(a) The receptacles are an integral part of the equipment assembly, permanently attached; and
(b) The sum of the ampacity of all appliances connected to the receptacles shall not exceed 75 percent of the ampacity of the flexible cord supplying the receptacles; and
(c) The ampacity of the flexible cord is suitable and shall be in accordance with the current edition of NFPA 70, National Electrical Code; and
(d) The electrical and mechanical integrity of the assembly is regularly verified and documented through an ongoing maintenance program.

8.4.12.5 Adapters and Extension Cords. Adapters and extension cords shall meet the following requirements:
(a) Attachment plugs shall meet the requirements of 9-2.1.2.1.
(b) Power cords shall be adequate for the application to avoid overloads (i.e., 16 AWG or greater) and shall meet the requirements of 9-2.1.2.2.
(c) * Frequency of Leakage Current. The leakage current measurement shall apply only to appliances that are used in the patient care vicinity. (See A-7-5.1.3.2 for suggested test methods.)

8.4.12.5.1 Physical Integrity. The physical integrity of the power cord assembly composed of the power cord, attachment plug and cord-strain relief shall be confirmed by visual inspection or other applicable appropriate tests.

8.4.12.5.2 Resistance. For appliances that are used in the patient care vicinity (the resistance between the appliance chassis, or any exposed conductive surface of the appliance, and the ground pin of the attachment plug shall be measured. The resistance shall be less than 0.50 ohm under the following conditions:
(a) The cord shall be flexed at its connection to the attachment plug or connector.
(b) The cord shall be flexed at its connection to the strain relief on the chassis during the resistance measurement. This measurement shall apply only to appliances that are used in the patient care vicinity. (See A-7-5.1.3.2 for suggested test methods.)

Exception: The requirement shall not apply to escutcheons or nameplates, small screws, and so forth, that are unlikely to become energized.

8.4.12.5.3 Leakage Current Tests - General. The following requirements apply to all tests.
(a) Resistance Test. The resistance tests of 7-5.1.3.2 shall be conducted before undertaking any leakage current measurements.
(b) Techniques of Measurement. Each test shall be performed with the appropriate connection to a properly grounded ac power system at nominal voltage of the equipment.

* Frequency of Leakage Current. The leakage current limits stated in 7-5.1.3.4, 7-5.1.3.5, and 7-5.1.3.6 shall be rms values for 60 Hz sinusoidal waveforms up to 1 kHz. For frequencies above 1 kHz, the leakage current limits shall be the values given in 7-5.1.3.4, 7-5.1.3.5, and 7-5.1.3.6 multiplied by the frequency, in kHz, up to a maximum of 10 mA.
(d) Leakage Current in Relation to Polarity. Leakage current measurements shall be made as follows:
(1) with the polarity of the power line normal,
(2) with the power switch of the appliance in the position shown in Table 7-5.1.3.5(d), and
(3) with all operating controls in the position to cause maximum leakage current readings.

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**Table 7-5.1.3.3(d) Leakage Current Tests-Power**

<table>
<thead>
<tr>
<th>Par. No.</th>
<th>Switch Setting</th>
<th>Power Switch Setting</th>
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<tbody>
<tr>
<td>7-5.1.3.4</td>
<td>On and Off</td>
<td>On</td>
</tr>
<tr>
<td>7-5.1.3.5</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7-5.1.3.6(a)</td>
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<tr>
<td>7-5.1.3.6(b)</td>
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<tr>
<td>7-5.1.3.6(c)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7-5.1.3.6(d)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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**Figure 8.4.1.3.5.5 Test circuit for measuring chassis leakage current.**

7-5.1.3.5 Chassis Leakage Current, Portable Equipment.

4a. The leakage current for cord-connected appliances shall be measured. The limit shall be 300 microamperes. Figure 7-5.1.3.5 shows one method of performing this test.
If multiple devices are connected together and one power cord supplies power, the leakage current shall be measured as an assembly. When multiple devices are connected together and more than one power cord supplies power, the devices shall be separated into groups according to their power supply cord and the leakage current shall be measured independently for each group as an assembly.

Exception No. 1: Where existing or special equipment (such as mobile X-ray machines) exhibits excess leakage current, this condition does not represent a hazard to the patient as long as the grounding connection is intact. Such equipment shall be permitted to be kept in service provided a documented maintenance schedule is established to ensure the integrity of the grounding connection. A three-month interval is a nominal period. Depending on the intensity of use of the appliance and prior test data, the hospital shall be permitted to establish a protocol with shortened or lengthened time intervals.

Exception No. 2: Where existing equipment exceeds 500 microamperes, methods to reduce leakage current, such as the addition of small isolation transformers to that device, or methods that provide equivalent safety by adding redundant equipment ground are permissible.

Figure 7-5.1.3.6 Test circuit for measuring chassis leakage current. (b) — Measurements shall be made with the appliance ground broken in two modes of appliance operation: power plug connected normally and with the appliance both on and off (if equipped with an on/off switch). When the appliance has fixed redundant grounding (e.g., permanently fastened to the grounding system), the chassis leakage test shall be conducted with the redundant grounding intact. Test shall be made with Switch A in Figure 7-5.1.3.5 closed.

Lead Leakage Current Tests and Limits, Portable Equipment

8.4.1.3.6.1 Lead to Ground (Nonisolated Input). The leakage current between all patient leads connected together and ground shall be measured with the power plug connected normally and with the appliance both on and off (if equipped with an on/off switch). When the appliance has fixed redundant grounding (e.g., permanently fastened to the grounding system), the chassis leakage test shall be conducted with the redundant grounding intact. Test shall be made with Switch A in Figure 7-5.1.3.5 closed.

8.4.1.3.6.2 Lead to Ground (Isolated Input). The leakage current between each patient lead and ground for an appliance with isolated leads shall be measured with the power plug connected normally and the device on. Figure 7-5.1.3.6(b) is an example of An acceptable test configuration shall be as illustrated in Figure 8.4.1.3.6.1. The leakage current shall not exceed 100 microamperes for ground wire open and closed.

Figure 8.4.1.3.6.1 7-5.1.3.6(a) Test circuit for measuring leakage current between patient leads and ground. (nonisolated).

8.4.1.3.6.3 Isolation Test (Isolated Input). Only isolated patient leads shall be connected to intracardiac catheters or electrodes. The current driven into the leads of an appliance that has isolated leads, when an external power source at line voltage and frequency is applied between each lead and ground, shall be measured in accordance with Figure 8.4.1.3.6.3(b). The leakage current shall not exceed 50 microamperes in each case. The test shall be made with the appliance’s normal patient cables.

Figure 8.4.1.3.6.3 7-5.1.3.6(b) Test circuit for measuring leakage current between patient leads and ground (isolated).

Suitable Safety precautions (such as including a resistance in series to limit the current, insulation of the meter, and a momentary switch) shall be taken to protect the operator. The following test procedures shall be followed for the indicated test conditions:

(a) In appliances without a power cord or with ungrounded, exposed conductive surfaces, measurements shall be made with the exposed conductive surfaces temporarily grounded.

(b) If there is no exposed conductive surface, measurement shall be made with a simulated surface, as described in 9-2.1.13.4(b), Appliances With No Exposed Conductive Surfaces, that is also temporarily grounded.

Only isolated patient leads shall be connected to intracardiac catheters or electrodes.

8.4.1.3.6.4 Between Leads (Nonisolated Input). The leakage current between any one lead (not ground) and each other lead shall be measured. Figure 7-5.1.3.6.4(b) is an example of An acceptable test configuration shall be as illustrated in Figure 8.4.1.3.6.4. The leakage current shall not exceed 50 microamperes for the ground wire open and closed.
Figure 8.4.1.3.6.4 7-5.1.2.3(d). Test circuit for measuring leakage current between patient leads (nonisolated and isolated).

8.4.1.3.6.4(a) Between Leads (Isolated Input). The leakage current between any one lead (not ground) and each other lead shall be measured. Figure 7-5.1.2.3(d) is an example of an acceptable test circuit with an interlock arranged to disconnect the heating elements when the fan is inoperative, unless the fan is not essential to safe operation.

8.4.2.2.2.4(b) All electrical heating equipment to be used for laboratory procedures shall be equipped with overtemperature-limit controls so arranged that thermostatic failure will not result in hazardous temperatures.

8.4.2.2.2.3 When electrical heating equipment is intended for use with flammable or combustible liquids, its electrical components shall be at least one of the following:

- (1) Explosion proof
- (2) Intrinsically safe
- (3) Ventilated explosionproof, intrinsically safe, or ventilated in a manner that will prevent accumulation of flammable atmospheres under normal conditions of operation.

8.4.3.2.4.5(b) When electrical heating equipment equipped with faceplates shall be arranged with an interlock designed to disconnect the heating elements when the fan is inoperative, unless the fan is not essential to safe operation.

8.4.4.2.2.5(c) Electrical equipment intended for use in laboratories shall meet the requirements of NFPA 45, Standard for Laboratories Using Chemicals. 8.5.2.4 Administration.

8.5.2.4.1 Responsibilities of Governing Body. (Reserved)

8.5.2.4.2 Policies.

8.5.2.4.3 General. 8.5.2.4.4 Medical and surgical electrical instrumentation and monitoring devices, as well as all electric appliances used for the care and entertainment of the patient, purchased or otherwise acquired for use by the facility (e.g., purchased, leased, donated, constructed on-site, loaned, etc.), shall meet the safety performance criteria of 9.2.1, Patient-Care-Related Electrical Appliances, in Chapter 9, “Manufacturer Requirements.”
Manuals for Appliances. Purchase specifications shall require the vendor to supply suitable manuals for operators or users upon delivery of the appliance as follows: The manuals shall include:

1. Installation and operating instructions,

2. Inspection and testing procedures, and

3. Maintenance details. [See 9-2.1.8.1(c).]

8.5.2.1.1.1 Any system consisting of several electric appliances shall be demonstrated as a complete system, after installation, by the vendor designated to assume system responsibility, and prior to acceptance of the system by the facility. The vendor shall demonstrate the operation of the system and provide appropriate initial instruction to operators and maintenance personnel.

8.5.2.1.1.2 Subparagraph 8.5.2.1.1 shall not apply to facilities that assemble their own systems.

Exception: Facilities that assemble their own systems.

8.5.2.1.1.3 Electrical Equipment Systems. Purchase contracts for electrical equipment systems, such as nurse call and signaling, that consist of interconnected elements, shall require all of the following:

1. That the elements be listed to function together,

2. That the manufacturers provide appropriate documentation for such interconnection, and

3. That the systems be installed by personnel qualified to do such installations.

8.5.2.1.1.4 Appliances Not Provided by the Facility. Policies shall be established for the control of appliances not supplied by the facility.

8.5.2.2 Servicing and Maintenance of Equipment.

8.5.2.2.1 Service manuals, instructions, and procedures provided by the manufacturer shall be used in the maintenance of equipment.

8.5.2.2.2 Planned Preventive Maintenance Programs. A scheduled preventive maintenance program shall be followed.

8.5.2.2.3 Use of Manual. Areas designated for the servicing of oxygen equipment shall be clean, free of oil and grease, and not used for the repair of other equipment.

8.5.2.2.4 Defective electrical apparatus shall be tagged and repaired or discarded.

8.5.2.2.5 Administrative vigilance shall be exercised to ensure that the health care facility monitors the use of and portable electrical equipment, such as drills, that can cause electrical interference during operating procedures.

8.5.2.2.6 During Surgery.

8.5.2.3 Active electrodes or other applicators of electrocautery, and fiberoptics.

8.5.2.4.1 Active electrodes or other applicators of electrocautery devices shall be properly secured.

8.5.3 Documentation. A permanent file of instruction and maintenance manuals as described in 9-2.1.8.1 shall be maintained and be accessible.

8.5.3.1.1 A permanent file of instruction and maintenance manuals as described in 9-2.1.8.1 shall be maintained and be accessible.

8.5.3.1.1.2 It shall preferably be in the custody of the engineering group responsible for the maintenance of the appliance.

8.5.3.1.3 Duplicate instruction and maintenance manuals shall be available to the user. [Log #CP105]

8.5.3.1.4 Any safety labels and condensed operating instructions on an appliance shall be maintained in readable legible condition.

8.5.3.1.5 A record shall be maintained of the tests required by this chapter and associated repairs or modifications.

8.5.3.1.5.2 At a minimum, this record shall contain all of the following: date, time, indication of which items have met or have failed to meet the performance requirements of 8.5.3.1.4

8.5.3.1.6 Test Logs. A log of test results and repairs shall be maintained and kept for an appropriate time period of time in accordance with a health care facility’s record retention policy.

8.5.4 Use. (Reserved)

8.5.4.1 Qualification and Training of Personnel.

8.5.4.1.1 Personnel concerned with the application and maintenance of electric appliances, including physicians, nurses, nurse aids, engineers, and technicians, and orderlies, shall be cognizant of the risks associated with their use.

8.5.4.1.2 To achieve this end, the hospital health care facilities shall provide appropriate programs of continuing education for its personnel.

8.5.5 These programs shall include periodic review of manufacturers’ safety guidelines and usage requirements for electrocautery units and similar appliances.

8.5.5.2 Personnel involved in the use of energy-delivering devices—excluding, but not limited to, electrocautery, laser, surgical lasers, electrocauteries, and fiberoptic devices—shall receive periodic training in fire suppression.

8.5.5.3 Equipment shall be serviced by qualified personnel only.


COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 7

NOT RETURNED: 4 Aronow, Carlson, Meyer, Peglow

COMMENT ON AFFIRMATIVE: LIPSCHEULTZ: Although I am voting in favor of Log #CP105, there is a serious flaw in Section 8.4.2.2.1.1 that must be corrected in the next go around. What was meant to be simple editorial change to comply with the manual of style will have a major implication for health care facilities in my opinion.

Section 8.4.2.2.1.1 used to have the qualifier that only equipment “likely to contact the patient” needs to be measured. The new proposed wording takes out this restriction. Without the restriction, every vacuum cleaner, electric drill, floor buffer, etc., will have to have electrical leakage current measured. This issue has been thoroughly discussed in the committee before and the very clear conclusion was that most of these devices were extremely unlikely to
to have patient contact. Because they were very unlikely to have patient contact, most institutions do not routinely check this type of device for leakage current. The change in the wording will impose a large unnecessary burden on these institutions.

8.2.1 Fire and Explosions.

8.2.1.1 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.

8.2.1.2 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. The materials that could be found on or near patients include the following:

- hair oils, oil-based lubricants, and skin lotions,
- clothing, linens, paper, rubber,
- alcohols, acetone, and some plastics.

8.2.1.3 A hazard exists if any of the components of an oxygen or nitrous oxide supply system become contaminated with oil or grease.

8.2.1.4 Sources of ignition can include open flames, burning tobacco, electric heating coils, defective electrical equipment, and adiabatic heating of gases. Sudden compression or recompression of a gaseous high pressure can generate large increase in temperature [(up to 100°C (200°F)] that can ignite any organic material present, including grease. (See also NFPA 53, Recommended Practice on Materials, Equipment, and Systems Used in Oxygen Enriched Atmospheres.)

8.2.1.5 A hazard exists if either oxygen or nitrous oxide leaks into a closed space, creating an oxygen-enriched atmosphere.

8.2.1.6 A hazard exists if improper components are employed to connect equipment containing pressurized oxygen or nitrous oxide.

8.2.2 During Respiratory Therapy Administration.

8.2.2.1 The occurrence of a fire is dependent on 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.

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8.2.2.1.2 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. The materials that could be found on or near patients include the following:

- hair oils, oil-based lubricants, and skin lotions,
- clothing, linens, paper, rubber,
- alcohols, acetone, and some plastics.

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8.2.2.1.5 A hazard exists if either oxygen or nitrous oxide leaks into a closed space, creating an oxygen-enriched atmosphere.

8.2.2.1.6 A hazard exists if improper components are employed to connect equipment containing pressurized oxygen or nitrous oxide.

8.2.2.2 Combustible materials that could be found near patients who are to receive respiratory therapy include the following items:

- 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.
8.2.1.12 The transfer of liquid oxygen from one container to another container, can create an oxygen-enriched atmosphere within the vicinity of the container.

8.2.1.13 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 (see 4-3.1.1.2(a)9).

8.2.1.14 Sources of ignition include not only the usual ones in ordinary atmospheres, but others that become significant hazards in oxygen-enriched atmospheres (see 8.2.1.2.1) such as the following:

(a) open flames,
(b) burning tobacco, and,
(c) electric radiant heaters,
(d) electro surgical units, can serve as a source of ignition
(e) the discharge of a cardiac defibrillator, can serve as a source of ignition.
(f) arcing and excessive temperatures in electrical equipment, are sources of ignition.
(g) electrically powered oxygen apparatus and electrical equipment intended for use in an oxygen-enriched atmosphere are sources of ignition if electrical defects are present,
(h) electrical equipment not conforming to the requirements of 7-6.2.4.1, which can include, but are not limited to:
   (1) electric razors,
   (2) electric bed controls,
   (3) hair dryers,
   (4) remote television controls, and telephone handsets, can create a source of ignition if introduced into an oxygen-enriched atmosphere (see 7-6.2.4.1),
   (i) a static discharge having an energy content that can be generated under normal conditions in respiratory therapy will not constitute an ignition source as long as easily ignited substances (such as alcohols, acetone, oils, greases, or lotions) are not present.
   (j) rapid opening of cylinder valves which can cause a sudden increase in downstream gas pressure and temperature caused by the adiabatic heat of recompression with consequent ignition of combustible materials in contact with the hot gas downstream, including the valve seat.

8.2.2.2.2 Toxicity.

8.2.2.1.1 Chemical hazards can be associated with the presence of residual sterilant in high-pressure equipment.

8.2.2.2 Some breathing mixtures can decompose when in contact with heat sources, and produce toxic or flammable substances (see 8.6.2).

8.2.2.3 Smoldering combustion of flammable substances can occur with the production of significant amounts of may produce toxic gases and fumes.

8.2.3.3 Safety (Mechanical Injury; Cross Connection, and So Forth) Mechanical.

8.2.3.1 Inhalation Anaesthetizing Locations.

8.2.3.2 Cylinders and containers can be heavy 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 [see 4-3.5.2.1(b)30 and 4-3.5.2.1(b)31]. A hazardous situation could develop if these cylinders or containers are heated [see 4-3.5.2.1(b)29].

8.2.3.3 Improper maintenance, handling, or assembly of equipment can result in personal injury, property damage, or fire.

8.2.3.4 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 if on contact with skin.

8.2.3.5 A hazardous condition exists if there is improper labeling of cylinders or containers or inattention to the manufacturer’s label or instructions.

8.2.3.6 A hazardous condition exists if care is not exercised in making slip-on and other interchangeable connections when setting up equipment.

8.2.3.7 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.

8.2.3.8 Extreme danger to life and property can result when compressed gases are mixed or transferred from one cylinder to another.

8.2.3.9 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.

8.2.3.10 Hazardous conditions are created when pressure-reducing regulators or gauges are defective.

8.2.4 Electric Shock. (Reserved).

8.3 Cylinder and Container Source.

8.3.1 Cylinders and Containers.

8.3.1.1 Cylinders and containers shall comply with 4-3.1.1.1(a).

8.3.1.2 Cylinder valve outlet connections shall conform to CGA V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1) (includes Pin-Index Safety System for medical gases). (See 4-3.1.1.1(a).)

8.3.1.3 When low-pressure threaded connections are employed, they shall be in accordance with the Compressed Gas Association standard for noninterchangeable, low-pressure connections for medical gases, air, and suction, CGA Pamphlet V-3, Diameter-Index Safety System.

8.3.1.4 Low-pressure quick-coupler connections shall be noninterchangeable between gas services.

8.3.1.5 Regulators and gauges intended for use in high-pressure service shall be listed for such service.

8.3.1.6 Pressure-reducing regulators shall be used on high-pressure cylinders to reduce the pressure to working pressures.

8.3.1.7 Approved regulators or other gas-flow control devices shall be used to reduce the cylinder pressure of every cylinder used for medical purposes. All such devices shall have connections so designed that they attach only to cylinders of gas for which they are designated.

8.3.1.8 Gas equipment that will permit the intermixing of different gases, either through defects in the mechanism or through error in manipulation in any portion of the high-pressure side of any system in which these gases might flow, shall not be used for coupling cylinders containing compressed gases.

8.3.1.9 Cylinder valve outlet connections for oxygen shall be Connection No. 540 as described in CGA V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1).

8.3.1.10 Cylinder valve outlet connections for nitrous oxide shall be Connection No. 326 as described in CGA V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1).

8.4 Cylinder and Container Storage Requirements.
8.4.1 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. (Log #CP302)

8.4.2 Storage for nonflammable gases greater than 8.5 m³ (300 ft³) but less than 85 m³ (3000 ft³), uncompressed. (Log #CP302)

(1) (a) Storage locations shall be outdoors in an enclosure or within an enclosed interior space of noncombustible or limited-combustible construction, with doors (or gates outdoors) that can be secured against unauthorized entry.

(2) (b) Oxidizing gases, such as oxygen and nitrous oxide, shall not be stored with any flammable gas, liquid, or vapor.

(3) (c) Oxidizing gases such as oxygen and nitrous oxide shall be separated from combustibles or materials by either one of the following:

(a) A minimum distance of 6.1 m (20 ft), or
(b) A minimum distance of 1.5 m (5 ft) if the entire storage location is protected by an automatic sprinkler system designed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, or
(c) An enclosed cabinet of noncombustible construction having a minimum fire protection rating of one-half hour, for cylinder storage. An approved flammable liquid storage cabinet shall be permitted to be used for cylinder storage.

(4) Liquefied gas container storage shall comply with 4-3.1.1.2(b)4.

(5) Cylinder and container storage locations shall meet 4-3.1.1.2(a)11e with respect to temperature limitations.

(6) Electrical fixtures in storage locations shall meet 4-3.1.1.2(a)11d.

(7) Cylinder protection from mechanical shock shall meet 4-3.5.2.1(b)13.

(8) Cylinder or container restraint shall meet 4-3.5.2.1(b)27.

(9) Smoking, open flames, electric heating elements, and other sources of ignition shall be prohibited within storage locations and within 6.1 m (20 ft) of outside storage locations.

(10) Cylinder valve protection caps shall meet 4-3.5.2.1(b)14.

8.4.3 Signs.

8.4.3.1 A precautionary sign, readable from a distance of 1.5 m (5 ft), shall be displayed on each door or gate of the storage room or enclosure.

8.4.3.2 The sign shall include the following wording as a minimum:

CAUTION

OXIDIZING GAS(ES) STORED WITHIN

NO SMOKING

8.5 Performance Criteria and Testing.

8.5.1 Portable Patient Care Gas Equipment.

8.5.1.1 Anesthetic apparatus shall be subject to approval by the authority having jurisdiction.

8.5.1.2 Each yoke on anesthetic apparatus constructed to permit attachment of small cylinders equipped with flush-type valves shall have two pins installed as specified in CGA V-1 (Pin-Index Safety System) (ANSI B57.1).

8.5.1.3 After any adjustment or repair involving use of tools, or any modification of the gas piping supply connections or the pneumatic power supply connections for the anesthesia ventilator, or other pneumatically-powered device if one is present, and before use on patients, the gas anesthesia apparatus shall be tested at the final common path to the patient to determine that oxygen and only oxygen is delivered from the oxygen flowmeters and the oxygen flush valve if any. Interventions requiring such testing shall include, but not be limited to, the following:

8.5.1.3.1 Interventions requiring testing shall include, but not be limited to, the following:

1. Alteration of pipeline hoses or fittings
2. Alteration of internal piping
3. Adjustment of selector switches or flush valves
4. Replacement or repair of flowmeters or bobbins

8.5.1.3.2 After any adjustment or repair involving use of tools, or any modification of the gas piping supply connections or the pneumatic power supply connections for the anesthesia ventilator, or other pneumatically-powered device if one is present, and before use on patients, the gas anesthesia apparatus shall be tested at the final common path to the patient to determine that oxygen and only oxygen is delivered from the oxygen flowmeters and the oxygen flush valve if any.

8.5.1.3.3 Before the gas anesthesia apparatus is returned to service, each fitting and connection shall be checked to verify its proper indexing to the respective gas service involved.

An oxygen analyzer, or a similar device, known to be accurate at 0 percent, 21 percent, and 100 percent oxygen, is a suitable test instrument. (see C-12.2)

8.5.1.3.4 Before the gas anesthesia apparatus is returned to service, an oxygen analyzer, or a similar device, shall be used to verify the oxygen concentration.

8.5.1.4 Yoke-type connections between anesthesia apparatus and flush-type cylinder valves (commonly used with anesthetizable gas cylinders) shall be Connection No. 860 in accordance with CGA V-1, Compressed Gas Cylinder Valve Outlet and Inlet Connections (ANSI B57.1).

8.5.2 Apparatus for Administering Respiratory Therapy.

8.5.2.1 Oxygen delivery equipment intended to rest on the floor shall be equipped with a base designed to render the entire assembly stable during storage, transport, and use. If casters are used, they shall conform to Class C of U.S. Government Commercial Standard 223-59, Casters, Wheels, and Glides for Hospital Equipment. (Log #CP303)

8.5.2.2 Oxygen test circulation/conditioning apparatus, pressure breathing apparatus, and other equipment.

8.5.2.3 Equipment supplied from cylinders or containers shall be designed and constructed for service at full cylinder or container pressure, or constructed for use with, or equipped with pressure-reducing regulators.

8.5.2.4 Humidifiers or reservoirs containing liquid shall be fabricated of materials having a maximum burning rate classification of “slow burning.”

8.5.2.5 Humidifiers and nebulizers shall be equipped with provisions for overpressure relief or alarm if the flow becomes obstructed.

8.5.2.6 Humidifiers and nebulizers shall be incapable of tipping or shall be mounted so that any tipping or alteration from the vertical shall not interfere with function or accuracy.

8.5.3 Nonpatient Gas Equipment.

8.5.3.1 Carts and Hand Trucks.

8.5.3.1.1 Construction. Carts and hand trucks for cylinders and containers shall be constructed for the intended purpose, be self-supporting and be provided with appropriate chains or stays to retain cylinders or containers.

8.5.3.1.2 Use. Carts and hand trucks that are intended to be used in anesthetizing locations or cylinder and container storage rooms communicating with anesthetizing locations shall comply with the appropriate provisions of 12-4.1.
8.6 Administration.

8.6.2 Policies.

8.6.2.2 Misuse of Flammable Substances.

8.6.2.3 Servicing and Maintenance of Equipment.

8.6.2.4 Signs.

8.6.2.5 Transferring Cylinders.

8.6.2.6 Transferring Liquid Oxygen.

8.6.2.7 Transferring of Low-Pressure Gases.

8.6.2.8 Use (Including Information and Warning Signs).

8.6.2.9 Labelling.

8.6.2.10 Labeling.

8.6.2.11 Equipment listed for use in oxygen-enriched atmospheres shall be so labeled.

8.6.2.12 Oxygen-metering equipment and pressure-reducing regulators shall be conspicuously labeled:

OXYGEN — USE NO OIL.

8.6.2.13 Flowmeters, pressure-reducing regulators, and oxygen-dispensing apparatus shall be clearly and permanently labeled, designating the gas or mixture of gases for which they are intended.

8.6.2.14 Apparatus whose calibration or function is dependent on gas density shall be labeled as to the proper supply gas pressure (psig/kPa) for which it is intended.

8.6.2.15 Oxygen-metering equipment, pressure-reducing regulators, humidifiers, and nebulizers shall be labeled with the name of the manufacturer or supplier.

8.6.2.16 Cylinders and containers shall be labeled in accordance with ANSI/CGA C-4, Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained. Color coding shall not be utilized as a primary method of determining cylinder or container content.

8.6.2.17 All labeling shall be durable and withstand cleansing or disinfection.

8.6.2.18 Signs.

8.6.2.19 In health care facilities where smoking is prohibited and signs are prominently (strategically) placed at all major entrances, secondary signs with no-smoking language are not required. The nonsmoking policies shall be strictly enforced.

8.6.3 Transferring Cylinders and Liquefied Gases in Containers.

8.6.3.1 Transferring of High Pressure Gaseous Oxygen to Be Used for Respiration.

8.6.3.2 Flow-control valves on administering equipment shall be closed prior to connection and when not in use.

8.6.3.3 Apparatus shall not be stored or transported with liquid agents in reservoirs.

8.6.3.4 Fixed or adjustable orifice mechanisms, metering valves, regulators, and gauges shall not be connected directly to high-pressure cylinders unless specifically listed for such use and provided with appropriate safety devices.
Subcommittee:-navigation, regarding mandatory language, annex information, paragraphing, exceptions, and separating multiple requirements.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 8

NOT RETURNED: 3 Bancroft, Mills, Swope

COMMENT ON AFFIRMATIVE:

Hoffman, Alan Lipschultz, Christianity Care Health Services

RECOMMENDATION: Storage for nonflammable gases with a total volume (compressed) of greater than 150 cu ft shall comply with 4-3.1.1.2.

SUBSTANTIATION: Original section referred to 3000 cu ft without specifying if that volume referred to gases in the compressed state, or if it referred to the volume that would exist if the gas was released from the cylinder.

The committee has interpreted the wording to be compressed, 3000 cu ft compressed is a lot of cylinders. This proposal sets the volume in the section to be approximately what would have been intended if the original volume had been interpreted as uncompressed.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee believes the accepted and commonly referenced 3000 cubic feet should be retained. See Committee Proposal 99-323 (Log #CP301),

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 8

NOT RETURNED: 3 Bancroft, Mills, Swope

AFIRMATIVE: 8

NOT RETURNED: 3 Bancroft, Mills, Swope
SUBSTANTIATION: Current text [Subparagraph (d)] addresses venting only for liquefied containers. It would seem appropriate to include requirements for venting for both cylinders and containers. Recommendation would have requirement the same as that in Chapter 4 for storage rooms holding ≤3000 ft³ of gas, irrespective of state of gas (liquefied or gaseous).

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
NOT RETURNED: 3 Bancroft, Mills, Swope

99-325 - (8-3.11.1 and 8-3.11.2): Reject

SUBMITTER: Technical Committee on Gas Delivery Equipment

RECOMMENDATION: Background: Both sections refer to 3000 ft³ without specifying if the volume refers to gases in the compressed state (in cylinders) or the uncompressed state (out of cylinders).

Question: Does the volume measurement [3000 ft³ (85 m³)] mentioned in Sections 8-3.11.1 and 8-3.11.2 refer to gases in the compressed state?

Answer: Yes.

SUBSTANTIATION: The Regulations Governing Committee Projects require that a proposal be processed to clarify the text of a document on which a Formal Interpretation has been issued. After issuance of the next edition of the document, the Formal Interpretation will no longer be published.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee has reconsidered the intent of 3,000 cubic feet to mean uncompressed volume.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
NOT RETURNED: 3 Bancroft, Mills, Swope

99-324 - (8-3.11.3): Reject

TCC NOTE: It was the action of the Technical Correlating Committee to propose this be returned to committee for further consideration. The Technical Committee Statement did not address the submitter’s substantiation.

SUBMITTER: Alan Lipschutz, Christiana Care Health Services

RECOMMENDATION: Insert new Section 8-3.11.3 with text as follows. Rename current 8-3.11.3:

“Storage for nonflammable gases with a total volume (compressed) of less than or equal to 5 cu ft and greater than .20 cu ft.

(a) Storage locations shall not be located where heavy moving objects are likely to strike them.

(b) Cylinders shall be stored in a secure manner so as to prevent falling.”

SUBSTANTIATION: The primary risk when storing relatively small quantities of nonflammable gases is that of kinetic energy released from physical damage to the cylinder. They need to be secured to prevent damage to the neck.

The previous language made these small storage locations comply with inappropriately stringent requirements. In hospitals around the country, it is very common to store 6-16 “E” oxygen cylinders or an “H” cylinder in a location with no other precautions than securing the tank. No incidents or problems have been reported as a result of this practice to my knowledge. The onus should be on the committee to document the hazard if they feel more stringent requirements are needed.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee believes the existing requirements are appropriate.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 8
NOT RETURNED: 3 Bancroft, Mills, Swope
10.2.2.13 Exception No. 1. Appliances used in special locations or for special purposes, shall be equipped with attachment plugs equipped with cords approved for the location (e.g., 3-52.1.2(d)).

10.2.2.13 Exception No. 2. If the power cord of an appliance which does not require and does not contain a grounding conductor, shall not be fitted with a grounding-type plug (see 9-2.1.2(e), Cords without Grounding Conductors).

10.2.2.14 Exception No. 3. Appliances supplied by other than 120-V single-phase systems shall use the grounding-type plug (cap) appropriate for the particular power system (e.g., ANSI C73.16, C73.17, C73.18, C73.29, C73.8, C73.94, C73.96, C73.97, C73.98, C73.99, C73.99, C73.100, C73.110). The grounding conductor shall be the last to be connected and the last to be disconnected from the receptacle.

10.2.2.15. The grounding prong shall be constructed so that it cannot be easily broken. The grounding prong of the plug shall be the first to be connected to and the last to be disconnected from the receptacle.

10.2.2.16. If screw terminals are used, the stranded conductor shall be twisted to prevent stray strands, but the bundle shall not be turned. If the conductor is not twisted, it shall be attached by an approved terminal lug.

10.2.2.17. The power cord conductors shall be arranged so that the conductors are not under tension in the plug.

10.2.2.18. The grounding conductor shall be the last one to disconnect when a failure of the plug's strain relief allows the energized conductors to be disrupted.

10.2.2.19. The grounding conductor shall be the last to disconnect when a failure of the strain relief allows the energized conductors to be disrupted.

10.2.2.1.10 Exception. Strain Relief. Strain relief shall be provided. The strain relief shall not require and does not contain a grounding conductor, shall not be fitted with a grounding-type plug.

10.2.2.1.10. The strain relief of replaceable plugs shall be capable of being disassembled.

10.2.2.1.10.3. The cord is not intended to be replaced by the user.

10.2.2.2.1. Protection of Wiring in Appliances. Within the appliance, the power conductors of the cord and the associated primary wiring (other than the grounding conductor) shall be mounted and dressed to minimize the likelihood of accidental electrical contact with the frame or exposed conductive parts of the appliance.

10.2.2.2.2. Protection of Wiring in Appliances. Within the appliance, the power conductors of the cord and the associated primary wiring (other than the grounding conductor) shall be mounted and dressed to minimize the likelihood of accidental electrical contact with the frame or exposed conductive parts of the appliance.

10.2.2.2.3. National Electrical Code.

10.2.2.2.4. Cord Without Grounding Conductors. The power cord of an appliance that does not require and does not contain a grounding conductor, shall not be fitted with a grounding-type plug.

10.2.2.2.5. Cord Without Grounding Conductors. The power cord of an appliance that does not require and does not contain a grounding conductor, shall not be fitted with a grounding-type plug.

10.2.2.2.6. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

10.2.2.2.7. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

10.2.2.2.8. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

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10.2.2.2.10. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

10.2.2.2.11. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

10.2.2.2.12. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.

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10.2.2.2.54. Power Cords. A power cord set shall be permitted to be integrally molded onto the cord jacket if the design is fitted for the purpose.
The overcurrent protective device shall precede any other components within the appliance, including the primary power-control switch. Listed insulated terminal blocks or strips, listed connecting devices, and RFI filters for use on power systems shall be permitted to precede the overcurrent device (see 10.2.3.5.

10.2.3.5.1 Exception: This requirement shall not preclude the use of overcurrent protective devices within the appliance that shall be permitted.

10.2.3.5.2 The power-control switch and overcurrent protective device shall be permitted to be combined into one component provided it is identified to indicate the combined function.

10.2.3.5.3 Primary Power-Control Switch.

10.2.3.5.4 Where a primary power-control switch is provided on an appliance, it shall interrupt all primary power conductors, including the neutral conductor.

10.2.3.5.5 The grounding conductor shall not be interrupted by the switch.

10.2.3.5.6 Exception: When the primary power wiring of an appliance is polarized, a primary power control switch shall not be required to interrupt the neutral conductor, so as to ensure the proper connection of its neutral conductor to the electric distribution system of the building, that neutral conductor need not be interrupted by the power-control switch.

10.2.3.5.7 An in-line switch shall be permitted in a primary power cord only if the switch is listed with the appliance with which it is intended to be used.

10.2.3.5.8 Each appliance mounted in an equipment rack or cart, when rated by the manufacturer as a stand-alone appliance, shall independently meet the requirements of 9-2.1.3.

10.2.3.5.9 When multiple appliances, as designated by the manufacturer, are mounted together in a cart or rack, and one power cord supplies power, the cart or rack shall meet the requirements of 9-2.1.3.

10.2.3.5.10 Connectors and Connections to Devices.

10.2.3.5.11 Indexing of Receptacles for Patient Leads.

10.2.3.5.12 Receptacles on appliances shall be designed and constructed so that those contacts that deliver electric current in a way and of a magnitude greater than 500 microamperes, when measured in accordance with 9-2.1.13.5(a), (b), (d), and (e), are female and indexed.

10.2.3.5.13 Receptacles and plugs shall be polarized if improper orientation can create a hazard.

10.2.3.5.14 Distinctive Receptacles for Patient Leads. Where reversion or misconnection of patient leads to an appliance might constitute a possible hazard (for example: reversal of active and dispersive electrodes of electrosurgical machines), distinctive, noninterchangeable connections shall be employed.

10.2.3.5.15 Patient Lead Connections.

10.2.3.5.16 Isolated Patient Lead. The appliance connector of an isolated patient lead shall be constructed so that, when not inserted properly in the appliance, the end of the conductor of the lead cannot electrically contact a surface that might conductive surface be grounded.

10.2.3.5.17 Line Voltage Variations and Transients — General. All appliances shall be capable of operating within line voltage variations that conform with ANSI C84.1, Voltage Ratings: Electric Power Systems and Equipment.

10.2.3.5.18 General Design and Manufacturing Requirements.

10.2.3.5.19 Thermal Standards.

10.2.3.5.20 Electric appliances not designed to supply heat to the patient, and operated within reach of a nonambulatory patient, shall not have exposed surface temperatures in excess of 50°C (122°F).

10.2.3.5.21 Surfaces maintained in contact with the skin of patients and not intended to supply heat shall not be hotter than 40°C (104°F).

10.2.3.5.22 Toxic Materials.

10.2.3.5.23 Surfaces that contact patients shall be free of materials that commonly cause toxic adverse reactions.

10.2.3.6.1.1 General. Equipment (fixed or appliances) shall be designed to operate normally when energized by a standby power source that conforms to the requirements of Chapter 3.

10.2.3.6.1.2 Power Transfer.

10.2.3.6.2 Following transfer of power between the normal power system and the essential electrical system, a patient-care-related appliance shall function in the mode of operation that existed prior to the transfer.

10.2.3.6.3 Exception: If the appliance cannot maintain its mode of operation in the event of a power transfer, it shall default to a nonhazardous status and clearly indicate by audible or visible signals that its mode of operation has changed.

10.2.3.6.4 Programmable Appliances. Decennialization of the power supply of a programmable appliance shall not result in the loss or change of any part of the program or data required for normal operation.

10.2.3.6.5.1.1 Exception: This requirement does not apply to computers and programmable appliances that are not directly related to patient care.

10.2.3.6.5.1.2 Exception No. 2. Patient-care-related appliances that could suffer a loss of program or vital data shall default to a start-up status and clearly indicate by audible or visual signals that its mode of operation has changed.

10.2.3.6.5.2.1 Fire and Explosion Hazards.

10.2.3.6.5.2.2 Materials and Supplies.

10.2.3.6.5.2.3 Oxygen-Enriched Atmospheres. Electric appliances employing oxygen, or that are intended to be used in oxygen-enriched atmospheres, shall comply with all of the following provisions:

- Chapter 9-2.1.7.2.1 “Fire and Explosion Hazards.”
- Chapter 9-2.1.7.2.2 “Materials and Supplies.”
- Chapter 9-2.1.7.2.3 “Oxygen-Enriched Atmospheres.”

10.2.3.6.5.2.4 Exception: all of the following provisions.

- Chapter 9-2.1.7.2.1 “Fire and Explosion Hazards.”
- Chapter 9-2.1.7.2.2 “Materials and Supplies.”
- Chapter 9-2.1.7.2.3 “Oxygen-Enriched Atmospheres.”

10.2.3.6.5.3 Coatings used on these surfaces shall conform to ANSI Z661. Specifications for Paints and Coatings Accessible to Children to Minimize Dry Film Toxicity.

10.2.3.6.5.4 Chemical Agents. Electric appliances containing hazardous chemicals shall be designed to facilitate the replenishment of these chemicals without spillage to protect the patient, the operating personnel, and the safety features of the appliance from such chemicals.

10.2.3.6.5.5 Operation with Essential Electrical System.

10.2.3.6.5.6 General. Equipment (fixed or appliances) shall be designed to operate normally when energized by a standby power source that conforms to the requirements of Chapter 3.
Functional description of the circuit, inspecting, installing, adjusting, and aligning

Conditions for Meeting Safety Requirements.

Signal transmission lines from an appliance in a patient location to remote appliances shall employ a signal transmission system designed to prevent hazardous current flowing in the grounding interconnection of the appliances. The limits of electrical supply variations — performance specifications of the appliance shall be given for the applicable limits of electrical supply variations.

Technical performance specifications including design levels of leakage current, operating conditions for unpacking, and alignment

Comprehensive preventive and corrective maintenance and repair procedures

Where appropriate, The information itemized shall be permitted to be issued in the form of a separate operating manual and separate maintenance manual, except that the separate maintenance manual shall also include essentially all the information included in the operating manual.

Condensed operating instructions shall be visible and permanently attached to, or displayed on, any appliance that is intended to be used in emergency situations and so could result in injury or death to the operator or patient if improperly used.

The manufacturer shall furnish, for all appliances, labels and precautionary statements if applicable.

All appliances labeling shall include the following, shall be labeled with:

- Model numbers,
- Date of manufacture,
- Manufacturer's name, and the
- Electrical ratings including voltage, frequency, current, and/or wattage of the device.

Date of manufacture shall be permitted to be a code, if its interpretation is provided to the user.

Appliances shall be labeled to indicate if they are listed for use as medical equipment and have isolated patient leads.

Appliances intended for use in anesthetizing locations shall be labeled in an approved manner. (See 12.4.1.3.4.)

Additional Requirements for Special Appliances.

Signal Transmission Between Appliances.

General. Signal transmission lines from an appliance in a patient location to remote appliances shall employ a signal transmission system designed to prevent hazardous current flowing in the grounding interconnection of the appliances.

Outdoor Signal Transmission. Outdoor signal transmission lines from appliances attached to patients shall be equipped with surge protection appropriate to the type of transmission line used. Such appliances or signal transmission lines shall be designed to prevent a hazard to the patient from exposure of the lines to lightning, power contact, power induction, rise in ground potential, radio interference, and so forth.

Appliances Intended to Deliver Electrical Energy.

Conditions for Meeting Safety Requirements.

Electrical-energy-delivering appliances shall conform to the leakage, grounding, and other requirements of this chapter when powered but not delivering energy.

Specific Requirements by Type of Device.

Electrically Powered Transducers. Exposed metal parts of these devices shall be considered electrodes and meet the applicable requirements of 10.2.13.3.4, Manufacturer's Tests for Safety of Patient Care-Related Electrical Appliances.

Connectors shall be designed to prevent inadvertent interchange of leads if interchange could constitute a hazard to the patient or operator.

Patient Impedance Measuring Devices. For a particular application, the combination of frequency and current levels shall limit the applied current to the minimum necessary to achieve the medical purposes, and shall not exceed the limits given in 10.2.13.5, 10.2.13.6, and 10.2.13.7, Lead Leakage Current Tests and Limits.

Figure 10.2.9.3(a) 9-2.1.9.3(a). Resistance circuits (L < 1 mH). Minimum igniting currents, applicable to all circuits containing cadmium, zinc, or magnesium.

(b) Sealed so as to prevent an oxygen-enriched atmosphere from reaching electrical components. The sealing material shall be of the type that will still seal even after repeated exposure to water,
oxygen, mechanical vibration, and heating from the external circuitry.

(c) Ventilated so as to limit the oxygen concentration surrounding electrical components to below 23.5 percent by volume.

Figure 10.2.9.3(b) 9-2.1.9.3(b). Resistance circuits (L < 1 mH). Minimum igniting currents, applicable to circuits where cadmium, zinc, or magnesium can be excluded.

(d) Both of the following:
1. No hot surfaces over 300°C (573°F), except for Exception: Small (less than 2-W) hermetically sealed heating elements such as light bulbs.
2. No exposed switching or sparking points of electrical energy that fall to the right of the curve for the appropriate type of circuit illustrated in Figures 10.2.9.3 9-2.1.9.3 (a) through (f). The dc (or peak ac) open-circuit voltage and short-circuit current shall be used.
Open circuit voltage $V_{sc}$ : $V$

Minimum value of $I_{sc}$ for ignition: $A$

$2.0 \times 10^{-1}$

$10 \times 10^{-1}$

$1 \times 10^{0}$

$10 \times 10^{0}$

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Figure 10.2.9.3(d) 9.2.1.9.3(d). Inductance circuits ($L > 1 \text{ mH}$).
Minimum igniting currents for various voltages, applicable to all circuits containing cadmium, zinc, or magnesium.

Figure 10.2.9.3(e) 9.2.1.9.3(e). Capacitance circuits minimum ignition voltages. The curves correspond to values of current-limiting resistance as indicated. The curve marked Sn is applicable only where cadmium, zinc, or magnesium can be excluded.

10.2.10 Low-Voltage Appliances and Appliances Not Connected to the Electric Power Distribution System.
10.2.10.1 General. Appliances and instruments operating from batteries or their equivalent or from an external source of low voltage or that are not connected to the electric power distribution system shall conform to all applicable requirements of Section 10.2.
10.2.1.10 Patient-Care-Related Electrical Appliances. This shall include communication except for telephones, signaling, entertainment, remote-control, and low-energy power systems.
Exception: Telephones.
10.2.10.2 Rechargeable Appliances. Battery-operated appliances that are rechargeable while in use shall meet all the requirements of 10.2.13.3, Leakage Current Tests, for line-operated appliances.
10.2.10.3 Low-Voltage Connectors. Attachment plugs used on low-voltage circuits shall have distinctive configurations that do not permit interchangeable connection with circuits of other voltages.
10.2.10.4 Isolation of Low-Voltage Circuits.
10.2.10.4.1 Circuits of 30 V (dc or ac rms) or less shall be electrically isolated from the power distribution system.
10.2.10.4.2 Grounded low-voltage circuits shall be permitted provided that load currents are not carried in the grounding conductor.
10.2.11* Cardiac Monitors and Electrocardiographs. Design of electrocardiographs, cardiac monitors, or blood-pressure monitors intended for use on patients in critical care shall include protection against equipment damage during defibrillation of the patient.
A.10.2.11 Monitoring of cardiac activity is crucial to effective defibrillation.
10.2.12* Direct Electrical Pathways to the Heart.
The requirements of this section shall apply only to manufacturers except where specifically noted.
10.2.12.1 Cardiac Electrodes.
General. Appliances that have isolated patient leads shall be labeled as having isolated patient leads in accordance with 9-2.113.5, Lead Leakage Current Tests and Limits.

Insulation of Cardiac Leads. Pacemaker leads and other wires intended for insertion into the heart, together with their adapters and connections to appliances, shall be insulated except for their sensing or stimulation areas.

Conductive Cardiac Catheters. Any conductive element to ensure that each finished appliance shall meet the applicable requirements of 9-2.1.13.4. An insulated wire designed to be grounded shall be insulated as required above by 10.2.12.1.

Patient-Care-Related Electrical Appliances.

Safety Requirements for Cardiac Electrodes. The electrode catheter, fitting, and associated appliance, when assembled, shall meet the applicable requirements of 10.2.13.5.0.1. When guide wires are used in conjunction with electrical devices (e.g., positioning catheters by use of ECG recordings), the guide wire shall be insulated as required above.

Exception No. 2:

In insulated wires designed to be introduced through a surgical needle, or other special wires where it is not practicable to maintain insulation, shall not be required to maintain insulation during introduction or manipulation. At such times the operator shall take appropriate extreme safeguards.

9-2.1.13.4, Liquid-Filled Catheters.

Conductive Catheter System. Any conductive element of a liquid catheter system that can come in contact with the liquid column shall be insulated from ground or electric energy sources.

Nonconductive Cardiac Catheters. A nonconductive catheter containing a conductive liquid, when connected to its transducer appropriate system, shall meet the applicable requirements of 9-2.1.13.5, Lead Leakage Current Tests and Limits, for isolated patient leads, with the patient end of the liquid-filled catheter considered to be an electrode.

Conductive Cardiac Catheters.

If the liquid column is contained in a catheter made of conductive material having an electrical conductivity approximating that of blood, the system shall not require connection to an isolated patient lead.

Conductive Catheter System. Any conductive element of a catheter system that can come in contact with the liquid column shall be insulated from ground or electric energy sources.

Conductive Catheters shall be appropriately insulated.

10.2.13.2.2.3.4.2, Anthropomorphic Test Person.
10.2.13.5.1 The leakage current shall not exceed 100 microamperes.

10.2.13.5.2 (a) Lead to Ground (Isolated Input).

10.2.13.5.2.1 The leakage current to ground between each patient lead and ground shall be measured under the conditions of 10.2.13.3. Leakage Current Tests.

10.2.13.5.2.2 The test shall be made with the patient leads active (e.g., in the case of a multilead instrument, the lead selector switch shall be advanced through all operating positions).

10.2.13.5.2.3 Each measurement shall be performed with the grounding conductors both opened and closed. For this purpose the grounding conductor shall be interrupted at the plug end of the appliance cord. Figure 9-2.1.13.5(b) is an example of an acceptable test configuration shall be as illustrated in Figure 10.2.13.5.2. The leakage current shall not exceed 10 microamperes with the ground intact and 50 microamperes with the ground open.

Figure 10.2.13.5.2 9-2.1.13.5(b) Test circuit for measuring leakage current between patient leads and ground (isolated).

10.2.13.5.3 (a) Isolation Test (Isolated Input).

10.2.13.5.3.1 The isolation between each patient lead and ground for an appliance that has been labeled as having isolated patient leads shall be measured by observing the current produced by applying an external source of power-line frequency and voltage between the lead and ground while the leads are approximately 20 cm (8 in.) from a grounded conductive surface.

10.2.13.5.3.2 Similarly, the isolation at the apparatus terminals to the patient cables shall be measured. Figure 9-2.1.13.5(c) is an example of an acceptable test configuration shall be as illustrated in Figure 10.2.13.5.3.

Figure 10.2.13.5.3 9-2.1.13.5(c) Test circuit for measuring the electrical isolation of isolated patient leads.

10.2.13.5.3.3 At the patient end of the leads, the leakage current shall not exceed 50 microamperes and at the apparatus terminals, 25 microamperes.

10.2.13.5.3.4 Only appliances meeting this requirement shall be permitted to be identified as having isolated patient leads.

10.2.13.5.3.5 Suitable safety precautions (such as including a resistance in series to limit the current, insulation of the meter, and a momentary switch) shall be taken to protect the operator. The following test procedures shall be followed for the indicated test conditions:

(a) In appliances without a power cord or with ungrounded, exposed conductive surfaces, measurements shall be made with the exposed conductive surfaces temporarily grounded.

(b) If there is no exposed conductive surface, measurement shall be made with a simulated surface, as described in 10.2.13.4.2.1-13.4.2(b) Appliances with Exposed Conductive Surfaces, which is also temporarily grounded.

10.2.13.5.4 (d) Between Leads (Nonisolated Input).

10.2.13.5.4.1 The current between any pair of leads or any single lead and all others shall be measured under the conditions of 10.2.13.3. Leakage Current Tests. Each measurement shall be performed with the grounding conductors both opened and closed. For this purpose the grounding conductor shall be interrupted at the plug end of the appliance cord. Figure 9-2.1.13.5(d) is an example of an acceptable test configuration shall be as illustrated in Figure 10.2.13.5.4. The leakage current shall not exceed 50 microamperes.

10.2.13.5.4.2 Exceptions Measuring leakage current between any single lead and all other leads shall need only be performed only to assure the approval agency of design compliance.

10.2.13.5.5 (c) Between Leads (Isolated Input).

10.2.13.5.5.1 The current between any pair of leads or any single lead and all others shall be measured under the conditions of 9-2.1.13.3. Leakage Current Tests. Each measurement shall be performed with the grounding conductors both opened and closed. For this purpose the grounding conductor shall be interrupted at the plug end of the appliance cord. Figure 9-2.1.13.5(d) is an example of an acceptable test configuration shall be as illustrated in Figure 10.2.13.5.4. The leakage current shall not exceed 10 microamperes with the ground intact and 50 microamperes with the ground open.

10.2.13.5.5.2 Exceptions Measuring leakage current between any single lead and all other leads shall need only be performed only to ensure the approval agency of design compliance.
NFPA 99 — November 2001 ROP — Copyright 2001, ROP

**Figure 10.2.13.5.4. 9-2.1.13.5(d)(4)(a)** Test circuit for measuring leakage current between patient leads (nonisolated and isolated).

Exception: Measuring leakage current between any single lead and all other leads shall be performed only to assure the approval agency of design compliance.

**SUBSTANTIATION:** To editorially conform to NFPA Manual of Style (MOS) as rewritten to address mandatory requirements, annex information, exceptions, and multiple requirements.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 11

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 4 Aronow, Carlson, Meyer, Peglow

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99-329 - (9-2.1.122): Accept

**SUBMITTER:** Charles Rawlings, SBI

**RECOMMENDATION:** Revise text as follows:

&ldquo;Any conductive element of a liquid catheter system that can come in contact with the liquid column shall be insulated from ground &ldquo;and sources of electric energy.&rdquo;&rdquo;

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 11

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 4 Aronow, Carlson, Meyer, Peglow

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99-330 - (Chapter 10):

**TCC NOTE:** It was the action of the Technical Correlating Committee that a portion of this proposal be editorially corrected. This section has maintained its original wording as follows:

10-1 (new 11.1.1) Applicability.

11.1.2 Many of the requirements to protect against fire or explosion such as those for hood exhaust systems, also serve to protect persons from exposure to nonfire health hazards of these materials.

10-1.2.1 (new 11.1.3)* NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals, is the basic NFPA standard for laboratories that covers the construction, ventilation systems, and related fire protection of all laboratories in all facilities. However, this chapter (Chapter 10) has more stringent requirements for laboratories located in health care facilities. Where interface with existing NFPA or other consensus codes and standards occurs, reference is made to the appropriate source in the text.

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Add a new paragraph 11.2.1 as follows:

11.2.1 (new 11.2.1) Nature of Hazards.


10-2.1.1 (new 11.2.1.1) Hazard Assessment.

10-2.1.1.1 (new 11.2.1.1.1) Reword to read as follows: &ldquo;An evaluation... begun. The evaluation shall include hazards associated with:&rdquo;

1. The properties of chemicals used
2. The operation of the equipment
3. The nature of the proposed reactions (e.g., evolution of acid vapors or flammable gases)

10-2.1.1.2 (new 11.2.1.1.2) Reword to read as follows: &ldquo;Procedures for laboratory emergencies shall be developed, including:

1. Alarm actuation
2. Evacuation
3. Equipment shutdown procedures&rdquo;

Add a new paragraph 11.2.1.3 as follows:

10-2.1.3 (new 11.2.1.3) Reword to read as follows: &ldquo;Emergency control group within the organization or a public fire department.&rdquo;

10-2.1.3.1 (new 11.2.1.3.1)* Construction of... additional requirements.

Add a new paragraph which incorporates Exception No. 1 as follows:

11.3.1.1.2 Openings in a laboratory corridor barrier shall be permitted to be held open by an automatic release device complying with the applicable requirements in NFPA 101, Life Safety Code.

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Add a new paragraph which incorporates Exception No. 2 as follows:

11.3.1.1.2 Openings in a laboratory corridor barrier shall be permitted to be held open by an automatic release device complying with the applicable requirements in NFPA 101, Life Safety Code.

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Add new paragraph 11.3.2 as follows:

11.3.2 (new 11.3.2)* "Any room... 92.9 m² (1000 ft²)" egress."
provided with the following safeguards and interlocks as part of a monitored audible and visual alarm:

(1) Low liquid level
(2) High vapor (#CP610)

10-4.2.1.2 (new 11.4.2.1.2) The safeguards above shall be connected to an audible alarm in a constantly attended location. (#CP610).

10-4.2.2* (new 11.4.2.2*)

10-5* (new 11.5*)

10-5.1* (new 11.5.1*)

10-5.2 (new 11.5.2)

10-5.3 (new 11.5.3) "Portable... Extinguishers."

Add a new paragraph for the second sentence above.

11.5.4 Clinical laboratories that typically employ quantities of flammable, combustible, or hazardous materials less than that which would constitute classified by the authority having jurisdiction severe shall be classified defined (#CP604) as ordinary hazard per NFPA 10 for purposes of extinguisher placement. Restructure and paragraph 10-6* as follows:

10-6* (new 11.6.*) "Where... use."

Add a paragraph number to the second sentence:

11.6.1 Fixed... pressure.

Rewrite the third sentence as follows:

11.6.2 If shutoff valves or stops are installed in the branch line to safety drenching equipment, the valves shall be:

(1) OS&Y (outside stem and yoke)
(2) Labeled for identification
(3) Sealed in the open position

11.6.3 The installation of wall-mounted portable eye-wash stations shall not preclude the adherence to the provisions of this section.

10-7 (new 11.7)

10-7.1 (new 11.7.1)

10-7.2* (new 11.7.2*)

Restructure paragraph 10-7.2.1* as follows:

10-7.2.1* (new 11.7.2.1*) Flammable... chemicals."

11.7.2.2 "Storage... code."

Rewrite and reparagraph 10-7.2.2* incorporating the existing exception as follows:

10-7.2.2* (new 11.7.2.3*) In laboratories not classified by the authority having jurisdiction as very small work areas, established laboratory practice shall limit working supplies of flammable or combustible liquids.

11.7.2.3.1 The total volume of Class I, II, and IIIA liquids outside of approved storage cabinets and safety cans shall not exceed 3.8 L (1 gal) per 9.25 m² (100 ft²).

11.7.2.3.2 The total volume of Class I, II, and IIIA liquids, including those contained in approved storage cabinets and safety cans, shall not exceed 7.57 L (2 gal) per 9.25 m² (100 ft²).

11.7.2.3.3 No flammable or combustible liquid shall be stored or transferred from one vessel to another in any exit access (#CP605) corridor or passageway leading to an exit.

11.7.2.3.4 Approved flammable or combustible inside liquid storage area(s) designed, constructed and operated in accordance with NFPA 30 shall be available within any health care facility regularly maintaining a reserve storage capacity in excess of 1135.5 L (300 gal) (#CP606).

11.7.2.3.5 Quantities of flammable and combustible liquids for disposal shall be included in the total inventory.

Restructure paragraph 10-7.2.5 as follows:

10-7.2.5 (new 11.7.2.4) "Venting... permitted."

11.7.2.4.1 "Storage... system."

11.7.2.4.2 "Construction... cabinet."

Rewrite paragraph 10-7.2.4 (#CP607) as follows:

10-7.2.4 (new 11.7.2.5) Flammable or combustible liquids shall not be positioned:

(1) Near Bunsen burners
(2) Near ovens
(3) Heat hot pipes and valves
(4) Near other sources of heat
(5) In corridors

Restructure paragraph 10-7.2.5 as follows:

10-7.2.5* (new 11.7.2.6) "Class I flammable... coolers."

11.7.2.6.1 "If Class I flammable... Group C locations in accordance with NFPA 70."

11.7.2.6.2 If the refrigerator is not listed for the purpose, the warning shall be worded to prohibit all storage of flammable liquids.

10-7.3 (new 11.7.3) "Transfer... of at least 30.5 m (100 ft) per minute."

10-7.4 (new 11.7.4)

10-7.4.1 (new 11.7.4.1) Flammable liquids and combustible liquids with flash points lower than 93.3°C (200°F) shall be heated in hoods or with special local exhaust ventilation if the quantities exceed 10 ml, or if the liquid is heated to within 16.6°C (30°F) of the flash point of the liquid.

Restructure paragraph 10-7.4.2 as follows:

10-7.4.2 (new 11.7.4.2) "Flammable... boiling points."

11.7.4.3 Open flames shall not be employed.

11.7.5* (new 11.7.5*)

10-8* (new 11.8*)

10-8.1 (new 11.8.1*)


Rewrite and restructure paragraph 10-8.1.2* as follows:

10-8.1.2* (new 11.8.1.1*) "A safety officer... laboratory."

11.8.1.2.1 Responsibilities of the safety officer shall include ensuring that the equipment and preparation for fire fighting are appropriate for the specific fire hazards present.

11.8.2.2 These responsibilities shall be in addition to surveillance of hazards attendant to:

(1) Caustics
(2) Corrosives
(3) Compressed gases
(4) Electrical installations
(5) Other hazards indigenous to laboratories in health care facilities.

11.8.1.3 The safety officer shall also supervise the periodic education of laboratory personnel including:

(1) New employee orientation
(2) The nature of combustible and flammable liquids and gases
(3) First aid
(4) Fire fighting
(5) The use of protective equipment
(6) Unsafe conditions observed or reported

11.8.1.2.4 The laboratory safety officer shall prepare and supervise the proper completion of a safety checklist that can be preserved for record. (last sentence of 10-8.1.3)

10-8.1.3 (new 11.8.1.3) Operations and equipment related to safe operations and practices, including such items as:

(1) Ventilating provisions
(2) Fire protection apparatus
(3) Periodic flushing of sinks, emergency showers, and eye wash units
(4) Shelf stocks and storage of flammable and combustible materials and caustic and corrosive liquids shall be reviewed at appropriate, regular intervals.

11.8.2.1.3.1 A system of prompt reporting of defective equipment and its prompt repair shall be instituted.

11.8.2.1.3.2 Periodic inspections shall be made of all electrical and gas equipment.

10-8.1.4 (new 11.8.1.4)

10-8.1.5* (new 11.8.1.5*) A written procedure for disposing of hazardous chemicals and combustible trash in accordance with good safety practices and environmental standards shall be established and regularly maintained. (#CP609)

10-8.2 (new 11.8.2)

Rewrite and restructure paragraph 10-8.2.1* as follows:

10-8.2.1* (new 11.8.2.1*) "All doors... the area."

11.8.2.2 "For signage... following:

(a) (1) Hazardous... 4.4 L (1 gal)... larger

(b) (1) Compressed... than 12.7 cm (5 in.). 48 cm (15 in.) in length.

(c) (3) Dry... of 2.27 kg (5 lb)

(d) (4) Aggregate... 91 kg (200 lb), or... 44.4 L (10 gal)."

10-8.2.1** (new 11.8.2.1)

10-8.2.2 (new 11.8.2.2)

10-8.2.3 (new 11.8.2.3)

10-8.2.4 (new 11.8.2.4)

10-8.2.5 (new 11.8.2.5)

10-8.2.6 (new 11.8.2.6)

10-9 (new 11.9)

10-9.1 (new 11.9.1) "Transfer... 8-6.2.5.1(b).” (check new paragraph number)

10-9.2 (new 11.9.2)

10-9.3 (new 11.9.3) "Transfer... 8-6.2.5.2.” (check new paragraph number)

10-10 (new 11.10)

10-10.1 (new 11.10.1) “Requirement... 4-3.1.1.1.” (check new paragraph number)

10-10.2 (new 11.10.2)

10-10.2.1 (new 11.10.2.1) "Storage... 4-3.1.1.1.” (check new paragraph number)

Rewrite, reparagraph and incorporate the exception of paragraph 10-10.2.2 as follows:

10-10.2.2 (new 11.10.2.2) Flammable gas cylinder storage for a laboratory, if inside any health care facility shall be in a separate room or enclosure:

(1) Reserved exclusively for that purpose
(2) Having a fire-resistance classification of at least 2 hours.
(3) Ventilated in accordance with 2-6.5 of Annex 2.
11.10.2.2.1 When a laboratory is intended to be routinely and frequently operated with flammable gases supplied from a manifold compressed system, storage shall comply with 4-7.1.1.1. (check new paragraph number)

- 11.10.2.2.2 Cylinders in storage shall be kept in racks or secured in position.
- Reparagraph 10-10.2.3 as follows:
  - 10-10.2.3 (new 11.10.2.3) "Rooms... ventilated."
  - 11.10.2.4 "Electrical... locations."
- Reparagraph 10-10.3 as follows:
  - 10-10.3 (new 11.10.3) "The total quantity... chemicals."
  - 11.10.4 "The number... supply."

**SUBSTANTIATION:** To editorially conform to NFPA Manual of Style (MOS) as rewritten, deleting exceptions and incorporating them as requirements, and separating multiple requirements.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 9

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 2 Nickasch, Simmons

99-331 - (10-3.1.1): Accept

**COMMITTEE:** HEA-LAB

**SUBMITTER:** Technical Committee on Laboratories

**RECOMMENDATION:** In the second sentence insert the word **access** between “exit” and “corridors.” Text will now read as follows:

- “Health care laboratories shall be separated from surrounding health care areas and from exit access corridors by fire resistive construction with a minimum rating of 1 hour, and all openings protected by 3/4 hour rated assemblies.”

**SUBSTANTIATION:** Clarifies the committee’s intent to have the requirement include exit access corridors rather than limit the requirement to exit corridors as defined by NFPA.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 9

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 2 Nickasch, Simmons

99-332 - (10-7.2.2): Accept

**COMMITTEE:** HEA-LAB

**SUBMITTER:** Technical Committee on Laboratories

**RECOMMENDATION:** Delete exceptions by incorporating them into new or existing paragraphs as requirements.

**SUBSTANTIATION:** See Committee Proposal 99-330 (Log #CP609).

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 9

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 2 Nickasch, Simmons

99-333 - (10-7.2): Accept

**COMMITTEE:** HEA-LAB

**SUBMITTER:** Technical Committee on Laboratories

**RECOMMENDATION:** Add the following new paragraphs after paragraph 10-4.2.1:

- 10-4.2.1.1 All new tissue processors and similar automatic equipment that release ignitable vapors shall be provided with the following safeguards and interlocks as part of a monitored audible and visual alarm:
  - (1) Low liquid level
  - (2) High vapor

- 10-4.2.1.2 The safeguards above shall be connected to an audible alarm in a constantly attended location.

**SUBSTANTIATION:** Unattended tissue processors are common ignition sources of laboratory fires.

**COMMITTEE ACTION:** Accept.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 9

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 7

**NOT RETURNED:** 2 Nickasch, Simmons
Recommendation: Bring this up for re-discussion with design professionals present and reword the sentence.

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(Log #CP606)
Committee: HEA-LAB

99- 337 - (10-7.2.2): Accept

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Delete “or within exhaust canopies.” Text will now read as follows:

“Flammable or combustible liquids shall not be positioned near Bunsen burners, ovens, hot pipes and valves, or other sources of heat, or in corridors within the exhaust canopy area.”

SUBSTANTIATION: The committee believes that flammable or combustible liquids within an exhaust canopy do not present a hazard.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 6
NEGATIVE: 1
NOT RETURNED: 2 Nickasch, Simmons

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(Log #CP607)
Committee: HEA-LAB

99- 338 - (10-7.2.4): Accept

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Delete “or within exhaust canopies.” Text will now read as follows:

“Flammable or combustible liquids shall not be positioned near Bunsen burners, ovens, hot pipes and valves, or other sources of heat, or in corridors within the exhaust canopy area.”

SUBSTANTIATION: The committee believes that flammable or combustible liquids within an exhaust canopy do not present a hazard.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 6
NEGATIVE: 1
NOT RETURNED: 2 Nickasch, Simmons

EXPLANATION OF NEGATIVE:
LINDNER: My vote is to Reject

Substantiation: The entire sentence is vague. Does that mean it is OK to position flammables and combustibles near Bunsen Burners, ovens, etc. in the lab?
If we support the basic idea of no flammables and combustibles near heat or flame (etc. etc.), we should say so and not confine this to “corridors”.

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(Log #CP608)
Committee: HEA-LAB

99- 339 - (10-7.2.5): Accept

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Rewrite the second sentence as follows:

“If Class I flammable liquids are stored under refrigeration (e.g., for analytical purposes), the storage devices shall be listed flammable materials storage refrigerators or refrigerators listed for flammable materials in accordance with NFPA 70, National Electrical Code.” (see new paragraph 11.7.2.6.1)

SUBSTANTIATION: Refers the document user to the appropriate code for that definition.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 7
NOT RETURNED: 2 Nickasch, Simmons

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(Log #CP609)
Committee: HEA-LAB

99- 340 - (10-8.1.5):

TCC NOTE: It was the action of the Technical Correlating Committee that this proposal be returned to committee. The proposed new wording needs to provide concise, specific, and enforceable language.

SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Rewrite paragraph 10-8.1.5 as follows:

A written procedure for disposing of hazardous chemicals and combustible trash in accordance with NFPA 90 shall be available within any health care facility regularly maintaining a reserve capacity in excess of 300 gals (1135.5 L). (see new paragraph 11.7.2.3.4)

SUBSTANTIATION: The committee wants to refer authorities having jurisdiction, designers, and users to the appropriate requirements when a storage area(s) is required.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 7
NEGATIVE: 1
NOT RETURNED: 2 Nickasch, Simmons

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(Log #CP401)
Committee: HEA-HCE

99- 341 - (Chapter 11): Accept

SUBMITTER: Technical Committee on Health Care Emergency Preparedness and Disaster Planning

RECOMMENDATION: Replace the term “disaster” in the locations identified with the proposed wording:

11-2 ‘...responsibility for disaster emergency management planning...’;
11-5.1 ‘...disaster exists, the disaster emergency management plan shall...’;
A-11-4.1 ‘...model of a disaster emergency management plan is feasible...’;
A-11-4.3 ‘...A policy group...decisions not in the disaster emergency management plan...’;
C-11-5.2 ‘...to activate the Health Care Disaster Emergency Management Plan in advance of...’;
C-11-3.9 ‘Radioactive Contamination. Disaster Emergency Management planning must consider...’;

SUBSTANTIATION: Provide continuity with current terminology concerning emergency planning and ICS.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 14
NEGATIVE: 1
NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin
This chapter is applicable to any health care facility that is intended to provide medical care during an emergency or maintain services for patients during a disaster. (Log #207)

11.2 Purpose. The purpose of 11.1.2 is to provide those with the responsibility for emergency management planning in health care facilities with a framework to assess, mitigate, prepare for, respond to, and recover from disasters. This chapter is intended to aid in meeting requirements for having an emergency management plan.

SUBSTANTIATION: See Committee Proposal 99-5 (Log #CP400), 99-341 (Log #CP401), 99-343 (Log #CP405), 99-345 (Log #CP405), 99-346 (11-5.3.3), 99-348 (Log #CP405), and 99-349 (Log #CP405).

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14

NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin
99-347 - (11-5.3.6): Accept
SUBMITTER: Technical Committee on Hyperbaric and Hypobaric Facilities
RECOMMENDATION: Revise to read as follows:
11-5.3.6 Security. Security plans shall be developed to meet the needs of the facility, that address facility access, crowd control, security staff needs, and traffic control.
SUBSTANTIATION: See Committee Proposal 99-5 (Log #CP400).
The deleted information is appendix information.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin

99-348 - (12-3.4): Accept in Principle
TCC NOTE: 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.
SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Rewrite this section as follows:
12.3.4 Gas and Vacuum System Requirements,
12.3.4.1 General. Where medical gas, instrument air, vacuum, and WAGD systems are installed they shall conform to the requirements for the appropriate level. Systems conforming to different levels within the same building are permitted. The appropriate level shall be determined as follows:
(a) All systems shall comply to Level 1 if any part of the systems are Level 1, unless:
1. The system(s) is (are) entirely separate from the Level 1 system(s) (i.e., are stand alone) and are not connected to Level 1 sources or distribution pipelines and
2. The occupancy to be served and the function of that occupancy is distinct from other occupancies in the building.
(b) Medical gas and vacuum systems shall be permitted to be Level 2 systems only where:
1. 12.3.4.1(a)1 and 2 are true and
2. Patients served by the system(s) are not dependent on mechanical ventilation or assisted mechanical ventilation at any time, including during administration of anesthesia.
(c) Medical gas and vacuum systems shall be permitted to be Level 3 systems only where:
1. 12.3.4.1(a)1 and 2 and 12.3.4.1(b)1 are true and
2. The patient population, during or subsequent to treatment, are not dependent for life on the gases or vacuum system(s), and the treatment(s) which the facility will perform can be completed without detrimental effect on patient outcomes in the event of sudden loss of the gas or vacuum system(s) and
3. The total of all gases in cylinders or containers, except nitrogen, connected and in storage at one time does not exceed 3,000 ft³ (85 m³) at standard temperature and pressure (STP), except that 5,000 ft³ (143 m³) at standard temperature and pressure (STP), shall be permitted if oxygen is stored in a DOT Specification 4L (cryogenic liquid) cylinder and
4. The system(s) supply not more than two adjoining single treatment facilities.
(d) Gas and vacuum systems shall be permitted to be Level 4 systems only where:
1. 12.3.4.1(a)1 and 2, 12.3.4.1(b)2, and 12.3.4.1(c)2 are true and
2. The pipeline system serves only laboratories, except that instrument air systems used for medical support may also serve laboratories (ref. 4-3.1.1.10).
SUBSTANTIATION: The intent of these paragraphs has not been met by the wording. It is presently unusable because it is incomplete and many terms are not clear. The proposal suggests:
1. Assembling all the requirements in a single place.
2. Defining a logical decision tree.
In the proposal, underscore indicates a new requirement. All others are presently elsewhere in the standard.
COMMITTEE ACTION: Accept in Principle.
| Delete all of recommendation (d). |
| COMMITTEE STATEMENT: | Delete of (d) is due to Committee Proposal 99-308 (Log #CP707) which reads as follows: |
| Move all of 4-6 to Chapter 10 except 4-6.2.2 which would become 4-3.2.2.1(b). |
| Existing 4-3.2.2.1 would become 4-3.2.2.1(a). |
| NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23 |
| VOTE ON COMMITTEE ACTION: | AFFIRMATIVE: 22 |
| NOT RETURNED: 1 Bancroft |

99-349 - (12-3.4.5): Accept
SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: Revise 12-3.4.5 to read:
"Where nitrous oxide or halogenated agents are intended to be administered, a patient WAGD shall be installed and conform to Level 1 WAGD systems in Chapter 4."
SUBSTANTIATION: To correlate with 4-3.3.2.3 requirement in Chapter 4.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

Committee: HEA-PIP

99-350 - (13.2 (New)): TCC NOTE: The Technical Correlating Committee directs that this proposal be returned to Committee; the action and accomplishment are not clear.
SUBMITTER: F. David Wyrick, Sr., Cambiare Ltd.
RECOMMENDATION: I have provided a table of explanation which was omitted in the 1999 Edition. It should have been within Chapter 15 as 15-3.4. Since Chapter 15 was changed and now (Reserved) the table should have been put in Chapter 13.
SUBSTANTIATION: This table was to feature each level and how and what products could be used and in what level.
COMMITTEE ACTION: Accept in Principle.

Table 15-3.4 Gas and Vacuum System Requirements

<table>
<thead>
<tr>
<th>Sources</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical gas</td>
<td>Large facilities</td>
<td>Reserved</td>
<td>Small systems w/task mounted regs.</td>
<td>—</td>
</tr>
<tr>
<td>50 psig</td>
<td>Life support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>include flammable</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Lab</td>
</tr>
<tr>
<td>Compressed air</td>
<td>Large medical air</td>
<td>Small, (max .50 psi)</td>
<td>0-60 psi for dynamic devices</td>
<td>Lab</td>
</tr>
<tr>
<td>Nitrogen system</td>
<td>0-300 psi</td>
<td>dynamic devices, (med-surg only)</td>
<td>Reserved</td>
<td>0-160 psi dynamic devices</td>
</tr>
<tr>
<td>Vacuum</td>
<td>Medical surgical</td>
<td>—</td>
<td>Small, non-life-support</td>
<td>Lab</td>
</tr>
<tr>
<td>Life support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAGD (gas or vac)</td>
<td>Hospital</td>
<td>—</td>
<td>Small, i.e., dental vacuum</td>
<td>—</td>
</tr>
<tr>
<td>Non-flammable gas</td>
<td>Inhalation anesthesia</td>
<td>—</td>
<td>General anesthesia and conscious sedation</td>
<td>—</td>
</tr>
<tr>
<td>Med. Air cylinders</td>
<td>Yes</td>
<td>—</td>
<td>No</td>
<td>—</td>
</tr>
<tr>
<td>(life support)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COMMITTEE STATEMENT: See Committee Action and Statement on Proposal 99-20 (Log #CP710) which reads as follows: Add definitions as follows:

Compressed Air System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gage pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, cylinders, manifolds, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gage pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Level 1 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS would place patients in imminent danger of morbidity or mortality.

Level 2 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS would place patients at manageable risk of morbidity or mortality.

Level 3 Vacuum System. 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 liquids and solids before the service inlet and to accommodate air/gas flow through the service inlet.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

SUBMITTER: Burton R. Klein, Burton Klein Associates
RECOMMENDATION: Revise 13-3.3.1 to read as follows:

13-3.3.1 Electrical Distribution System. For ambulatory health care centers, the electrical distribution system for patient care areas shall conform to the requirements in Chapter 3, “Electrical Systems.”

These requirements apply to new construction. Existing installations need not be modified, provided that they meet the operational safety requirements in 3-3.3.2 and 3-3.3.3.

SUBSTANTIATION: Proposal 99-322 in the ROP for the 1998 Fall Meeting recommended the above change to then Chapter 13, Ambulatory Health Care Center Requirements (AHCC). That proposal was accepted. However, it was superseded by a proposal that completely revised Chapters 13, 14, and 15. This new proposal only reintroduces Proposal 99-322 for that completely revised Chapters 13, 14, and 15.

This new proposal only reintroduces Proposal 99-322 for that completely revised Chapters 13, 14, and 15.

NOT RETURNED: 1 Bancroft

COMMITTEE STATEMENT:

Delete all of recommendation (d).

AFFIRMATIVE: 21
NOT RETURNED: 1 Bancroft

SUBMITTER: Mark Allen, Beacon Medical Products
RECOMMENDATION: Delete the second paragraph.

SUBSTANTIATION: See related proposals on 12/15/16/17, 3-4.1.

COMMITTEE ACTION: Accept.

AFFIRMATIVE: 29
NOT RETURNED: 1 Bancroft

TCC NOTE: The Technical Correlating Committee directs the Committee to review the Committee Statement. The Committee Statement does not address the submitter’s recommendation.

SUBMITTER: Thomas J. Mraulak, American Society of Sanitary Engineering
RECOMMENDATION: Revise text as follows:

“If installed where patients, due to medical, surgical, or diagnostic intervention, are not dependent on the piped gas system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.”

NOT RETURNED: 1 Bancroft
SUBSTANTIATION: If the patients are dependent on the piped gas systems to keep them alive the systems should conform to Level 1 where everything is multiplexed. If the patients are not dependent on the piped gas systems to live the systems could conform to Level 2.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Proposal 99-20 (Log #CP710) which reads as follows:
Add definitions as follows:

Compressed Air System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

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Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

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Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

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Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

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Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.
SUBSTANTIATION: 1. This section was omitted in the 1999 edition of NFPA 99. This section is necessary in order to complete the requirements for anesthetizing locations in facilities other than hospitals. This information was included in the 1996 edition of NFPA 99 for ambulatory health care centers, but appears to have been inadvertently left out of the 1999 edition as a result of the complete revision of Chapters 13, 14, and 15 in the 1996 edition of NFPA 99.

2. Requirements for anesthetizing locations other than in hospitals have over the years been modified to the point that in the 1996 edition of NFPA 99, requirements for anesthetizing locations in ambulatory health care centers referenced requirements in Chapter 12 for hospital anesthetizing locations. This proposal would require all anesthetizing locations designated as "anesthetizing locations" to meet the same criteria as those for hospitals.

3. The Technical Committee may want to apply this new Section 15-3.4.1 just to "ambulatory health care centers." If so, it will then have to address those anesthetizing locations being constructed in other health care facilities (i.e., so-called "office O/Rs").

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: No substantiation provided for 13-4.2. Referred to Technical Correlating Committee.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 7
NOT RETURNED: 2 Nickasch, Simmons

TCC NOTE: 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.

SUBMITTER: Joseph Klapp, Collins & Assoc. Technical Services, Inc.

RECOMMENDATION: Revise text:
"...laboratory gas systems shall conform to Level 4 Type A vacuum systems of Chapter 4."  
SUBSTANTIATION: Chapter 4 has levels, not types.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Proposal 99-308 (Log #CP707) as this item was deleted which reads as follows:
Move all of 4-6 to Chapter 10 except 4-6.2.2 which would become 4-3.2.2.1(b).
Existing 4-3.2.2.1 would become 4-3.2.2.1(a).

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 25
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

TCC NOTE: The Technical Correlating Committee directs the Committee to review the Committee Statement. The Committee Statement does not address the submitter's substantiation.

SUBMITTER: Thomas J. Mraulak, American Society of Sanitary Engineering

RECOMMENDATION: Revise text as follows:
"If installed where patients, due to medical, surgical, or diagnostic intervention, are dependent on the piped gas system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4."  
SUBSTANTIATION: If the patients are dependent on the piped gas systems to keep them alive the systems should conform to Level 1 where everything is multiplexed. If the patients are not dependent on the piped gas systems to keep the patients alive the systems could conform to Level 2.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: See Committee Proposal 99-20 (Log #CP710) which reads as follows:
Add definitions as follows:
Compressed Air System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi(1100kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.
Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psi(1100kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.
Level 1 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS would place patients in imminent danger of morbidity or mortality.
Level 2: Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS system would place patients at manageable risk of morbidity or mortality.

Level 3 Vacuum System. A Level 3 vacuum distribution system serves occupancies where interruption of the PGS would place patients at risk of morbidity or mortality.

Level 3 Vacuum System. 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 liquids and solids before the service inlet and to accommodate air/gas only through the service inlet.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

(Log #129)

Committee: HEA-PIP

99-361 - (17-3.4): Accept in Principle

**TCC NOTE:** 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.

**SUBMITTER:** Mark Allen, Beacon Medical Products

**RECOMMENDATION:** Rewrite this section as follows:

17.3.4 Gas and Vacuum System Requirements.

17.3.4.1 General. Where medical gas, instrument air, vacuum, and WAGD systems are installed they shall conform to the requirements for the appropriate level. Systems conforming to different levels within the same building are permitted. The appropriate level shall be determined as follows:

(a) All systems shall comply to Level 1 if any part of the systems are Level 1, unless:

1. The system(s) is (are) entirely separate from the Level 1 system(s) (i.e., are stand alone) and are not connected to Level 1 sources or distribution pipelines and

2. The occupancy to be served and the function of that occupancy is distinct from other occupancies in the building.

(b) Medical gas and vacuum systems shall be permitted to be Level 2 systems only where:

1. 17.3.4.1(a)1 and 2 are true and

2. Patients served by the system(s) are not dependent on mechanical ventilation or assisted mechanical ventilation at any time, including during administration of anesthesia.

(c) Medical gas and vacuum systems shall be permitted to be Level 3 systems only where:

1. 17.3.4.1(a)1 and 2 are true and

2. The patient population, during or subsequent to treatment, are not dependent on the piped gas systems to keep them alive. The systems should conform to Level 1 systems.

3. The total of all gas in cylinders or containers, except nitrogen, connected and in storage at one time does not exceed 3,000 ft³ (85 m³) at standard temperature and pressure (STP), except that 5,000 ft³ (143 m³) at standard temperature and pressure (STP), shall be permitted if oxygen is stored in a DOT Level 1 except that 5,000 ft³ (143 m³) at standard temperature and pressure (STP), shall be permitted if oxygen is stored in a DOT Level 1 unless:

4. The system(s) supply not more than two adjoining single treatment facilities

(d) Gas and vacuum systems shall be permitted to be Level 4 systems only where:

1. 17.3.4.1(a)1 and 2, 17.3.4.1(b)1 and 2, and 17.3.4.1(c)2 are true and

2. The pipeline system serves only laboratories, except that instrument air systems used for medical support may also serve laboratories (ref 4.3.1.10)

**SUBSTANTIATION:** The intent of these paragraphs has not been met by the wording. It is presently unusable because it is incomplete and many terms are not clear. The proposal suggests:

1. Assembling all the requirements in a single place.

2. Defining a logical decision tree.

In the proposal, underscore indicates a new requirement. All others are presently elsewhere in the standard.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Proposal 99-308 (Log #CP707) which reads as follows:

Move all of 4-6 to Chapter 10 except 4-6.2.2 which would become 4-3.2.2.1(b)

Existing 4-3.2.2.1 would become 4-3.2.2.1(a).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 25

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

(Log #129)

Committee: HEA-HYP

99-362 - (17-3.4.2): Reject

**TCC NOTE:** The Technical Correlating Committee directs the Committee to review the Committee Statement. The Committee Statement does not address the submitter’s substantiation.

**SUBMITTER:** Thomas J. Mraulak, American Society of Sanitary Engineering

**RECOMMENDATION:** Revise text as follows:

“If installed where patients, due to medical, surgical, or diagnostic intervention, are not dependent on the piped gas system, the patient gas system shall conform to Level 2 piped gas systems of Chapter 4.”

**SUBSTANTIATION:** If the patients are dependent on the piped gas systems to keep them alive the systems should conform to Level 1 wherever it is multiplexed. If the patients are not dependent on the piped gas systems to live the systems could conform to Level 2

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** See Committee Proposal 99-20 (Log #CP710) which reads as follows:

Add definitions as follows:

Compressed Air System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psig (1100 kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Gas Powered System. A Level 3 gas distribution system comprised of component parts, including, but not limited to, cylinders, manifolds, air compressor, motor, receiver, controls, filters, dryers, valves, and piping, that delivers compressed air [gauge pressure <160 psig (1100kPa)] to power devices (e.g., hand pieces, syringes, cleaning devices) as a power source.

Level 1 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS would place patients in imminent danger of morbidity or mortality.

Level 2 Medical Piped Gas and Vacuum Systems. Systems serving occupancies where interruption of the MPGVS system would place patients at manageable risk of morbidity or mortality.

Level 3 Piped Gas Systems. Systems serving occupancies where interruption of the PGS would terminate procedures but would not place patients at risk of morbidity or mortality.

Level 3 Vacuum System. 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 liquids and solids before the service inlet and to accommodate air/gas only through the service inlet.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 23

**VOTE ON COMMITTEE ACTION:**

AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

(Log #CP501)

Committee: HEA-HYP

99-363 - (Chapter 19):

**TCC NOTE:** It was the action of the Technical Correlating Committee that a portion of this proposal (19-2.5.5) 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.

**SUBMITTER:** Technical Committee on Hyperbaric and Hypobaric Facilities

**RECOMMENDATION:** Split the existing paragraph into separate paragraphs – one paragraph for each sentence. Revise text as follows:

19-3 Application of this Chapter. This chapter shall apply to new facilities. This chapter shall also apply to the altered, renovated, or modernized portion of an existing system or individual component, shall be required to meet the requirements of this chapter. It shall not require the alteration or replacement of existing construction or equipment. Existing construction or equipment shall be permitted to be continued in use when such use does not constitute a distinct hazard to life.
(each sentence is a new paragraph under 19-1.3)

19-2.1.1.2 (create two paragraphs under 19-2.1.1)

19-2.2.1 (create three paragraphs under 19-2.2)

19-2.4.2.2 (make 2nd sentence a new paragraph under 19-2.4.2.2)

19-2.4.2.3 (make 2nd sentence a new paragraph under 19-2.4.2.3)

19-2.4.2.4 (create two paragraphs under 19-2.4.2.4)

19-2.5.2.1 (make 2nd sentence a new paragraph under 19-2.5.2.1)

19-2.5.3.2 (make 2nd sentence a new paragraph under 19-2.5.3.2)

19-2.5.3.4 (make 2nd sentence a new paragraph under 19-2.5.3.4)

19-2.5.4 (make 2nd sentence a new paragraph under 19-2.5.4)

19-2.5.5 Testing Requirements. The deluge and handline systems shall be functionally tested at least semiannually per 19-2.5.2.3 for deluge systems and 19-2.5.3.4 for handline systems. (new paragraph under 19-2.5.5) During initial construction, or whenever changes are made to the installed deluge system which will affect the spray pattern, testing of spray coverage per to demonstrate conformance to the requirements of 19-2.5.2.3 shall be performed at surface pressure, and at maximum operating pressure. The requirements of 19-2.5.2.3 shall be satisfied under both conditions. (new paragraph under 19-2.5.5) A detailed record of the test results shall be submitted to the authority having jurisdiction and the hyperbaric facility safety director.

19-2.7.2.1 All hyperbaric facilities intended for human occupancy shall contain an electrical service that is supplied from two independent sources of electric power. (new paragraph under 19-2.7.2.1) For hyperbaric facilities located in a hospital, one power source shall be a prime-mover-driven generator set located on the premises of the facility. (new paragraph under 19-2.7.2.1) This system shall be designated as the Emergency System and shall meet the requirements of Chapter 3, “Electrical Systems,” of this standard for hyperbaric systems based in health care facilities. (new paragraph under 19-2.7.2.1) Article 700, Emergency Systems, of NFPA 70, National Electrical Code, shall apply to hyperbaric systems located in facilities other than health care facilities.

19-2.7.2.2 …of interruption of normal power. Such equipment shall be limited to…

(a) Electrical power outlets located within the chamber

(b) Chamber emergency lighting, whether internally or externally mounted

(c) Chamber intercommunications

(d) Alarm systems, including fire detectors

(e) Chamber fire suppression system equipment and controls.

(f) Other electrical controls used for chamber pressurization and ventilation control

(g) A number of chamber room lights (either overhead or local) to ensure continued safe operation of the facility during a normal power outage

19-2.7.3.6 (make 2nd sentence a new paragraph under 19-2.7.3.6)

19-2.7.4.1 (make 2nd sentence a new paragraph under 19-2.7.4.1)

19-2.8.1.1 (create two paragraphs under 19-2.8.1.1)

19-2.8.4.1 (make 2nd sentence a new paragraph under 19-2.8.4.1)

19-2.8.5.2 (make 2nd sentence a new paragraph under 19-2.8.5.2)

19-2.9.3 (make 2nd sentence a new paragraph under 19-2.9.3)

19-3.1.5.6* The use of flammable…

(new paragraph under 19-3.1.5.6) Whenever possible, patients shall be stripped...

(new paragraph under 19-3.1.5.6) All cosmetics, lotions, and…

19-3.3.5 (make 2nd and 3rd sentences new paragraphs under 19-3.3.5)

19-3.4.1.5 (make 2nd sentence a new paragraph under 19-3.4.1.5)

19-3.4.2.1 Installation, repairs, and modifications of equipment, and all work performed at the chamber shall be evaluated by engineering personnel, tested under pressure, and approved by the safety director. (new paragraph under 19-3.4.2.1) Logs of the various all tests shall be maintained.

19-3.4.2.2 Operating equipment logs shall be maintained by engineering personnel. (new paragraph under 19-3.4.2.2) These Operating equipment logs shall be signed before chamber operation by the person in charge (see A-19-3.1.3.2).

SUBSTANTIATION: Editorial restructuring is required to meet the April 2000 Manual of Style format. Multiple requirements were split into separate paragraphs.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

Committee: HEA-HYP

99-364 - (Chapter 19): Accept

SUBMITTER: Technical Committee on Hyperbaric and Hypobaric Facilities

RECOMMENDATION: Add text to introduce a list of items.

Revise text as follows:

19-4.2.3* Occupancy. Hyperbaric chambers shall be classified according to the following criteria:

(a) Class A — Human, multiple occupancy

(b) Class B — Human, single occupancy

(c) Class C — Animal, no human occupancy

19-7.3.2 Cord-Connected Devices. Cord-connected devices shall meet the following requirements:

(a) All portable, cord-connected equipment shall have an on-off power switch.

(b) The equipment electrical rating shall not exceed 120 V and 2 A unless the electrical portions of the equipment are inert gas purged.

Exception: Cord-connected devices not meeting the requirements of (b) shall be permitted if the electrical portions of the equipment meet the following requirements:

(c) The plug of cord-connected devices shall not be used to interrupt power to the device.

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements. Introductory sentences were added to lists.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

Committee: HEA-HYP

99-365 - (Chapter 19): Accept

SUBMITTER: Technical Committee on Hyperbaric and Hypobaric Facilities

RECOMMENDATION: Revise text as follows: (new entire 19-1.3 to annex as modified)

19-1.5* Nature of Hazards.

19-1.5.1 A-19-1.5 Potential hazards involved in the design, construction, operation, and maintenance of hyperbaric facilities are formidable. The chapter for the design of hyperbaric facilities is intended to provide protection against fire, explosion, and other hazards without unduly limiting the activities of professional personnel involved in patient care (in the care of hospitals) or other care. This principle, without minimizing the hazards, recognizes that professional personnel shall be guided by all of the hazards that are inherent in and around hyperbaric treatment procedures.

19-1.5.2 Potential hazards involved in the design, construction, operation, and maintenance of hyperbaric facilities...
A-19-3.1.3.3 Hincen It is incumbent upon the governing body to insist that adequate rules and regulations with respect to practices and conduct in hyperbaric facilities, including qualifications and training of hyperbaric personnel, be adopted by the medical or administrative staff of the institution, and that adequate regulations for inspection and maintenance are in use by the administrative, maintenance, and ancillary (and in the case of a hospital, nursing and other professional) personnel.

19-3.1.3.5* (move the following three sentences to annex with annex text from 19-3.1.3.5) In meeting its responsibilities for safe practices in hyperbaric facilities, the administration of the facility shall adopt or correlate regulations and standard operating procedures to ensure that both the physical qualities and the operating maintenance methods pertaining to hyperbaric facilities meet the standards set in this chapter. The controls adopted shall cover the conduct of personnel in and around hyperbaric facilities and the apparel and footwear allowed. They shall provide for periodic inspection of static-dissipating materials and of all electrical equipment, including testing of ground contact indicators. (leave next sentence as text of 19-3.1.4.5) The safety director shall ensure that electrical, monitoring, life support, protection, and ventilating arrangements in the hyperbaric chamber shall be inspected and tested regularly as part of the routine maintenance program of the facility.

19-3.1.4.5 (move to annex and make text annex to 19-3.1.4.6) 19-3.1.5.3 Personnel.

19-3.2.3 Equipment used inside the chamber requiring radiation equipment shall not be required to have sprinkler protection as specified in 19-2.1.2. 19-2.7.3.1 Conductor Insulation. … as defined in Chapter 2.

19-3.2.3.2 Conductive Accessories. Conductive accessories, such as belting, rubber accessories, plastics, covers, and sheeting, shall be installed inside the chamber shall meet the conductivity and antistatic requirements of 2-6.3.8, Reduction in Electrostatic Hazard in Annex 2.

/create new sentence and add to annex) Conductive accessories can include belting, rubber accessories, plastics, covers, and sheeting.

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements. Nonmandatory language was moved to the annex or revised to make it mandatory.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

RECOMMENDATION: Revise to eliminate exceptions as follows: 19-2.1.1 ...shall be protected by 2-hour fire-resistive-rated construction.

Exception No. 1: (new paragraph under 19-2.1.1) *Free-standing, dedicated buildings containing only a Class A chamber(s) and ancillary service equipment shall not be required to be protected by 2-hour fire-resistive-rated construction.

Exception No. 2: (new paragraph under 19-2.1.1) Chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation. Trailer or vehicle-mounted facilities shall be permitted without a 2-hour fire-resistive-rated perimeter.

(new paragraph under 19-2.1.1) When trailer or vehicle-mounted facilities are located contiguous to a health care facility, or another structure, a 2-hour fire-resistive-rated barrier shall be placed between the facility and the contiguous structure.

Exception No. 3: (new paragraph under 19-2.1.1) Where building exterior walls form part of the facility boundary, that portion of the facility boundary shall not require 2-hour fire-resistive-rated construction.

19-2.1.2 ...housing a Class A chamber and in any ancillary equipment rooms.

Exception: (new paragraph under 19-2.1.2) Class A chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation shall not be required to be protected as specified in 19-2.1.2.

19-2.1.2 ...housing a Class A chamber and in any ancillary equipment rooms.

Exception: (new paragraph under 19-2.1.2) Class A chambers not contiguous to a health care facility, and located in a mobile, vehicle mounted facility.

19-2.1.3 The room or rooms housing Class B and C chambers shall be afforded sprinkler protection in accordance with 19-2.1.2.

Exception: (new paragraph under 19-2.1.3) Chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation shall not be required to have sprinkler protection as specified in 19-2.1.2.

19-2.7.3.1 Conductor Insulation. … as defined in Chapter 2.

Exception No. 1: (new paragraph under 19-2.7.3.1) Insulation classified as flame resistant shall not be required on conduits that form an integral part of electrical equipment approved for use inside the chamber, including patient leads, such conductors need not meet the flame resistance classification.

Exception No. 2: (new paragraph under 19-2.7.3.1) Insulation shall not be required on ground conductors inside of a conduit need not be insulated.

19-3.2.3 Equipment used inside the chamber requiring lubrication shall be lubricated with oxygen-compatible flame-resistant material.

Exception: (new paragraph under 19-3.2.3) Factory-sealed antifriction bearings...

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements. The exceptions were written as requirements.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood
Hypobaric Facilities

SUBMITTER: The intent of "See also A-19.3.2.2" is unclear.

is unclear whether it pertains to the paragraph above or below.

3.2.2 and 19-3.5.1.1 there is a directive to relocate text; the meaning is unclear whether it pertains to the paragraph above or below.

The intent of "See also A-19.3.2.2" is unclear.

SUBMITTER: Technical Committee on Hyperbaric and Hypobaric Facilities

RECOMMENDATION: Create a list for a series of items as follows:

19-2.2.3 The interior of Class A chambers shall be unfinished or treated with a finish that is one of the following:
(a) inorganic-zinc-based
(b) high-quality epoxy or equivalent, or that is flame resistant

19-2.7.1.4* For the fixed electrical installation, none of the following shall be permitted inside the chamber:
(a) no circuit breakers
(b) line fuses
(c) transformers
(d) relays
(e) lighting panels
(f) ballasts

19-2.7.3.2 Wiring Methods. The following shall be installed outside of the chamber:
(a) control equipment
(b) power amplifiers
(c) output transformers,
(d) monitoring equipment associated with communications and monitoring equipment shall be installed outside of the chamber or shall comply with the requirements of 19-2.7.3.11.

19-2.8.1.2 The following equipment shall be all metal to the extent possible:
(a) valves
(b) fittings,
(c) and interconnecting equipment shall be all metal to the extent possible.

19-3.2.4 The following shall be compatible with oxygen under service conditions:
(a) hoses and
(b) lubricants shall be selected carefully for oxygen compatibility under service conditions.

19-3.2.4* Equipment made of the following shall be prohibited from the chamber interior:
(a) cerium
(b) magnesium
(c) magnesium alloys
(d) similar materials shall be prohibited from the chamber interior

Relocate the following text to Annex for 19-3.2.4: "(See also A-19.3.2.2)

19-3.5.1.1 All electrical circuits shall be tested before chamber pressurization. [new paragraph under 19-3.5.1.1] This Electrical circuit test shall include the following:
(a) a ground fault check to verify that no conductors are grounded to the chamber shell,
(b) a test of normal functioning (see 19-2.7.2.3).

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements. The paragraphs were restructured to include lists.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20 VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 15 NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMENT ON AFFIRMATIVE: GURNEE: Suggest: "None of the following shall be permitted inside the chamber pressure envelope".

Reason: Some electrical components can be physically inside the chamber but are in their own pressure housing vented to the surface and thus not a risk.

HAMILTON: Section 19-3.2 is not clear. The second sentence says "facility" where it probably means "chamber".

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20 VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 15 NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood
RECOMMENDATION: Revise text as follows:
19-2.1.1.3 The supporting foundation for any chamber shall be sufficiently strong designed to support the chamber. Consideration shall be given to any added floor stress that will be created during manometric hydrostatic testing.

19-2.1.1.4 If on-site hydrostatic testing will be performed, the chamber supporting foundation shall be designed to support the additional water weight.

19-2.2 Chamber safety shall be an approved type equipped with fusible elements. (new paragraph under 19-2.1.2) The element temperature ratings shall be as low as possible, consistent with the requirements against false operation in NFPA 13.

19-2.2.2 Class A chambers shall be equipped with a floor that is structurally capable of supporting. The floor of a Class A chamber shall be designed to support equipment and personnel necessary for the operation of the chamber according to its expected purpose.

19-2.2.2.3 If a bilge is installed, access to the bilge shall be provided for cleaning purposes. The floor overlapping the bilge shall be removable or, as an alternative, there shall be other suitable access for cleaning the bilge.

19-2.2.4* A sufficient number of viewing ports and access ports for piping and wiring monitoring and related leads shall be installed during initial fabrication of the chamber.

19-2.4* Sources of air for chamber atmospheres shall be such that air or flammable gases are not introduced. (new paragraph under 19-2.4.2) Compressor intakes shall be located so as to avoid air contaminated by exhaust from activities of vehicles, internal combustion engines, stationary engines, or building exhaust outlets.

19-2.4.2* Positive efforts shall be undertaken to ensure that air for chamber atmosphere is not fouled by handling. This air supply for chamber atmosphere shall be monitored as required in 19-2.5.7.

19-2.5.1.4* A fire alarm signaling device shall be provided at the chamber operator's control console for signaling the telephone operator or a suitable authority to activate the emergency fire/rescue network of the institution containing the hyperbaric facility.

19-2.5.2.3* The number and positioning of sprinkler heads shall be sufficient to provide reasonably uniform spray coverage with vertical and horizontal (or near horizontal) jet. Average spray density at floor level shall be not less than [(81.5 L/min/m²(2 gpm/ft²)] with no floor area larger than 1 m² receiving less than [40.75 L/min/m² (1 gpm/ft²)].

19-2.5.3.3 Handlines shall be equipped with override valves placed in easily accessible locations that are accessible to personnel outside the chamber.

19-2.5.4* The number of detectors employed and their location shall be dependent on the sensitivity of each detector and the chamber interior.

19-2.5.4.1* The system shall include self-monitoring functions for fault detection and appropriate fault alarms and indications.

19-2.7.1.6 In the event of activation of the room sprinkler system, electrical equipment shall be protected from sprinkler water to the maximal extent possible, but need not remain functional so long as if means is sufficient to safely to control and decompress the chamber is provided.

19-2.8.5.1 Oxygen levels shall be continuously monitored in any chamber in which nitrogen or other diluent gas is added to the chamber to reduce the volumetric concentration of oxygen in the atmosphere (saturation operations). Audible and visual alarms shall indicate unsafe for oxygen partial pressure in the chamber.

19-2.8.5.2 Oxygen monitors shall be equipped with audible and visual alarms.

19-2.8.6 Carbon Dioxide Monitoring. The chamber atmosphere shall be monitored for carbon dioxide levels during saturation operations whenever ventilation is not used (see 19-2.4.1.1). Exception to ensure that carbon dioxide levels do not exceed safe levels.

19-3.1.3.1 ... installations are employed, shall establish and enforce appropriate programs to fulfill the provisions of this chapter.

19-3.1.3.4 By virtue of its responsibility for the professional conduct of members of the medical staff of the health care facility, the organized medical staff shall adopt adequate and enforce regulations with respect to the use of hyperbaric facilities located in health care facilities (see C-19.2 and C-19.3) and through its formal organization shall ascertain that these regulations are regularly adhered to. (new paragraph under 19-3.1.3.4) The safety director shall be included in the planning phase development of these regulations.

19-3.1.4.1* General. The administrative, technical, and professional staffs shall jointly consider and agree upon necessary rules and regulations to develop policies for the control of personnel, equipment, and use associated with the use of hyperbaric facilities. (new paragraph under 19-3.1.4.1) Upon adoption, rules and regulations policies shall be promulgated posted in and around the hyperbaric chamber the facility. (move the following two sentences to annex) Positive measures are necessary to acquaint all personnel with the rules and regulations established and to assume enforcement. Training and discipline are mandatory.
RECOMMENDATION: Review text as follows:
19-2.3.1.2 Gasket material shall be of a type that permits the movement of thermal expansion and shall be available in the event the deluge system is activated.

19-2.4.1.2 Individual breathing apparatus shall be supplied for each occupant of a Class A chamber for use in case of fire in the chamber. The chamber shall not be equipped for use in the event that the chamber atmosphere is fouled by combustion or otherwise.

19-2.4.1.3 Each breathing apparatus shall be available for immediate use, and the breathing mixture supplied to the breathing apparatus shall be independent of the chamber atmosphere.

19-2.4.1.4 The breathing gas supply shall be sufficient designed for simultaneous use.

19-2.4.1.5 In the event of a fire within a chamber provision shall be made to switch...
supply air for the chamber pressurization are provided, the compressor(s) and auxiliary equipment need not have shall not be required to have an alternate source of power.

Rewrite existing 19-2.7.3 as follows: 19-2.7.3.3 Wiring and Equipment Inside Class A Chambers. The following general rules shall be satisfied in the use of electrical devices and equipment:

(1) The requirements under this section are intended to protect against the elevated fire risks known to exist in a pressurized environment and shall not be construed as classifying the chamber interior as a Class I (as defined in NFPA 70, National Electrical Code, Article 500) hazardous location.

(2) Equipment or equipment component installed in or used in the chamber shall not present an explosion or implosion hazard under the conditions of hyperbaric use. (new paragraph under 19-2.7.3) All equipment shall be rated, tested and documented, for intended hyperbaric conditions prior to use.

(3) Only the minimum amount of electrical equipment necessary for the safe operation of the chamber and for required patient care shall be permitted in the chamber. (new paragraph under 19-2.7.3) Portable equipment shall be permitted in the chamber which is not needed for the patient treatment at hand. Only portable equipment necessary for the logistical and operational support shall be permitted in the chamber during manned pressurization.

(4) Signs prohibiting the introduction of flammable liquids, gases, and other articles not permitted by this chapter, into the chamber shall be posted at the chamber entrance(s).

Exception: (new paragraph under 19-2.7.3) Where conformance with Class 1, Division 1 requirements is specified in the following paragraphs, conformance with Class 1, Division 2 requirements shall be permitted to be substituted. (move this sentence to annex)

The limitations on the use in the chamber of alcohol and other agents that emit flammable vapors in the Exception to 19-3.1.5.2 shall be strictly observed and such restrictions should be prominently posted.

A-19-2.7.3 This section contains requirements for the safe use of electrical equipment in the hyperbaric, oxygen-enriched environment (OEE) of the Class A chamber.

19-2.7.3.2 Wiring Methods. (new paragraph under 19-2.7.3.2) Fixed wiring shall be installed in threaded RMC or IMC conduit utilizing the following waterproof components:

(a) threaded metal joints
(b) fittings
(c) boxes
(d) enclosures

(new paragraph under 19-2.7.3.2) A continuous ground shall be maintained between all conductive surfaces enclosing electrical circuits and the chamber hull using approved grounding means. (new paragraph under 19-2.7.3.2) All threaded conduit shall be threaded with an NPT standard conduit cutting die that provides 3/4-in. taper per ft (1.9 cm per every 0.3 m). (new paragraph under 19-2.7.3.4) The normal cord supply air for the chamber pressurization are provided, the compressor(s) and auxiliary equipment need not have shall not be required to have an alternate source of power.

Rewrite existing 19-2.7.3 as follows: 19-2.7.3.3 Wiring and Equipment Inside Class A Chambers. The following general rules shall be satisfied in the use of electrical devices and equipment:

(1) The requirements under this section are intended to protect against the elevated fire risks known to exist in a pressurized environment and shall not be construed as classifying the chamber interior as a Class I (as defined in NFPA 70, National Electrical Code, Article 500) hazardous location.

(2) Equipment or equipment component installed in or used in the chamber shall not present an explosion or implosion hazard under the conditions of hyperbaric use. (new paragraph under 19-2.7.3) All equipment shall be rated, tested and documented, for intended hyperbaric conditions prior to use.

(3) Only the minimum amount of electrical equipment necessary for the safe operation of the chamber and for required patient care shall be permitted in the chamber. (new paragraph under 19-2.7.3) Portable equipment shall be permitted in the chamber which is not needed for the patient treatment at hand. Only portable equipment necessary for the logistical and operational support shall be permitted in the chamber during manned pressurization.

(4) Signs prohibiting the introduction of flammable liquids, gases, and other articles not permitted by this chapter, into the chamber shall be posted at the chamber entrance(s).

Exception: (new paragraph under 19-2.7.3) Where conformance with Class 1, Division 1 requirements is specified in the following paragraphs, conformance with Class 1, Division 2 requirements shall be permitted to be substituted. (move this sentence to annex)

The limitations on the use in the chamber of alcohol and other agents that emit flammable vapors in the Exception to 19-3.1.5.2 shall be strictly observed and such restrictions should be prominently posted.

A-19-2.7.3 This section contains requirements for the safe use of electrical equipment in the hyperbaric, oxygen-enriched environment (OEE) of the Class A chamber.

19-2.7.3.2 Wiring Methods. (new paragraph under 19-2.7.3.2) Fixed wiring shall be installed in threaded RMC or IMC conduit utilizing the following waterproof components:

(a) threaded metal joints
(b) fittings
(c) boxes
(d) enclosures

(new paragraph under 19-2.7.3.2) A continuous ground shall be maintained between all conductive surfaces enclosing electrical circuits and the chamber hull using approved grounding means. (new paragraph under 19-2.7.3.2) All threaded conduit shall be threaded with an NPT standard conduit cutting die that provides 3/4-in. taper per ft (1.9 cm per every 0.3 m). (new paragraph under 19-2.7.3.4) The normal cord supply air for the chamber pressurization are provided, the compressor(s) and auxiliary equipment need not have shall not be required to have an alternate source of power.

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(2) Equipment or equipment component installed in or used in the chamber shall not present an explosion or implosion hazard under the conditions of hyperbaric use. (new paragraph under 19-2.7.3) All equipment shall be rated, tested and documented, for intended hyperbaric conditions prior to use.

(3) Only the minimum amount of electrical equipment necessary for the safe operation of the chamber and for required patient care shall be permitted in the chamber. (new paragraph under 19-2.7.3) Portable equipment shall be permitted in the chamber which is not needed for the patient treatment at hand. Only portable equipment necessary for the logistical and operational support shall be permitted in the chamber during manned pressurization.

(4) Signs prohibiting the introduction of flammable liquids, gases, and other articles not permitted by this chapter, into the chamber shall be posted at the chamber entrance(s).

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The limitations on the use in the chamber of alcohol and other agents that emit flammable vapors in the Exception to 19-3.1.5.2 shall be strictly observed and such restrictions should be prominently posted.

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(a) threaded metal joints
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(new paragraph under 19-2.7.3.2) A continuous ground shall be maintained between all conductive surfaces enclosing electrical circuits and the chamber hull using approved grounding means. (new paragraph under 19-2.7.3.2) All threaded conduit shall be threaded with an NPT standard conduit cutting die that provides 3/4-in. taper per ft (1.9 cm per every 0.3 m). (new paragraph under 19-2.7.3.4) The normal cord supply air for the chamber pressurization are provided, the compressor(s) and auxiliary equipment need not have shall not be required to have an alternate source of power.
The appliance shall conform to the requirements of 19-2.7.3(a) and 19-2.7.3.12. The appliance shall be of a sealed type that does not off-gas during normal use.

19-2.7.12.1 Battery-Operated Devices. Battery-operated devices shall meet the following requirements:

(a) Batteries shall be fully enclosed and secured within the equipment enclosure.

(b) Batteries shall be of a sealed type that does not off-gas during normal use.

(c) Batteries or battery-operated equipment shall not undergo charging while located in the chamber. (new list item under 19-2.7.12.1) Batteries shall not be changed on in-chamber equipment located in the chamber while the chamber is in use.

(d) The equipment electrical rating shall not exceed 12 V and 48 W.

19-2.7.4.2 ... with a line isolation monitor with appropriate signal lamp and audible alarm. (new paragraph under 19-2.7.4.2) Such circuits shall meet the requirements of NFPA 70, Article 517-160, Isolated Power Systems, and 517-160(b). Line Isolation Monitor. (new paragraph under 19-2.7.4.2) Branch circuits shall not exceed 125 V or 15 A.

19-2.7.6.1 Electrical equipment inside Class B chambers shall be restricted to communication functions and patient physiological monitoring leads. (new paragraph under 19-2.7.6.1) Circuits shall be designed to limit the electrical energy to wire leads into the chamber under normal or fault conditions to no more than 28 V and 1/8 W. (new paragraph under 19-2.7.6.1) Communication lines shall be protected from physical damage and from coming into contact with flammable materials in the chamber by appropriate barriers or conduit. (new paragraph under 19-2.7.6.1) Patient monitoring leads shall be part of approved medical apparatus meeting the requirements of 19-2.7.12.1.

19-2.8.7* Chamber Gas Supply Monitoring. The air supply of Class A and Class B chambers shall be sampled periodically for concentrations of carbon monoxide. (move next sentence to annex) The frequency of such monitoring shall depend on the location of the air intake relative to potential sources of contamination. (new paragraph under 19-2.8.7) Air supplied to oil-lubricated compressors capable of contaminating the compressor output due to wear or failure shall be continuously monitored for volatized hydrocarbons as well as carbon monoxide at a location downstream from the oil filter when the compressors are running. (new paragraph under 19-2.8.7) As a minimum, the air supplied to Class A and B chambers shall meet the requirements for medical air as defined in Chapter 2.

19-2.9.2 Exhaust from all classes of chambers shall be piped outside of the building, the point of exit being clear of all neighboring hazards and clear of possible reentry of exhaust gases. (new paragraph under 19-2.9.2) The point of exhaust shall not create a hazard. (new paragraph under 19-2.9.2) The point of exhaust shall not allow reentry of exhaust gases into the building. (new paragraph under 19-2.9.2) The point of exhaust shall be of the following:

(a) located above the building height

(b) protected by a grille or fence of at least 24 in. (0.6 m) radius from the exhaust port. A protective grille or fence is not required when the exhaust is above the building height.

19-3.1.3.2* Each hyperbaric facility shall designate a safety director shall be designated to be in charge of all hyperbaric equipment and overall facility safety. (new paragraph under 19-3.1.3.2) The safety director shall work closely with facility management personnel and the hyperbaric physician(s) to establish in developing procedures for safe operation and maintenance of the hyperbaric facility. (new paragraph under 19-3.1.3.2) He or the The safety director shall make necessary recommendations for departmental safety policies and procedures. (new paragraph under 19-3.1.3.2) The safety director shall have the authority to restrict or remove any potentially hazardous supply or equipment items from the chamber.

19-3.1.4.2 The medical director of hyperbaric medicine shall work closely with the safety director to establish all the safety measures and the safety director shall jointly develop the minimum staff qualifications, experience, and compliment based on the following:

(a) the number and type of hyperbaric chambers in use.

(b) the maximum treatment capacity.

(c) the type of hyperbaric therapy normally provided.

19-3.1.4.4 Emergency procedures best suited to the needs of the individual specific to the hyperbaric facility shall be established. (new paragraph under 19-3.1.4.4) All personnel shall become familiar with the hyperbaric procedure prior to implementation. Personnel trained to be on emergency procedures, (move next sentence to annex) Individual circumstances dictate whether such familiarization can best be afforded through the medium of a procedure manual. (new paragraph under 19-3.1.4.4) Personnel shall be trained to control the chamber and decompress occupants when all powered equipment has been rendered inoperative.

19-3.1.5.1 Open Flames and Hot Objects. (create new section as annex text) Flame detectors can be prematurely activated by certain radiation sources. (leave next sentence as text of 19-3.1.5.1) The following shall be prohibited from inside the chamber and the immediate vicinity outside the chamber:

(a) smoking

(b) open flames

(c) hot objects, and

(d) ultraviolet sources, which would cause premature operation of flame detectors, when installed, shall be prohibited from the hyperbaric facility, both inside and outside, and in the immediate vicinity of the chamber. (move next sentence to annex) The immediate vicinity of the chamber is defined as the general surrounding area around the chamber from which activation of the flame detector can occur.

19-3.1.5.2 Flammable Gases and Liquids. (new paragraph under 19-3.1.5.2) Flammable agents... shall be forbidden inside the chamber and from the proximity of the compressor intake. Exception: (new paragraph under 19-3.1.5.2) For Class A chambers, flammable... if the following conditions are met:

1. (a) Such use is approved by the safety director, or other authority having jurisdiction.

2. (b) The quantities of such agents are limited so that they are incapable of releasing sufficient flammable vapor into the chamber atmosphere to exceed the LEL for the material. (new list item c) A safety factor shall be included to account for the localized concentrations, stratification, and the absence of ventilation.

3. (d) The oxygen monitoring requirement of 19-2.8.5.2 is observed.

4. (new paragraph under 19-3.1.5.2) No flammable liquids, gases, or vapors shall not be permitted inside any Class B chamber.

19-3.1.5.4 Textiles.

1. (new paragraph under 19-3.1.5.4) Silk, wool, or... (new paragraph under 19-3.1.5.4) Garments fabricated of... The physician or surgeon in charge, with the concurrence of the safety director shall be permitted to use prohibited items in the chamber that are one of the following:

(a) suture material

(b) alloplastic devices

(c) bacterial barriers

(d) surgical dressings and

(e) biologic interfaces of otherwise prohibited materials shall be permitted to be used at the discretion of the physician or surgeon in charge, with the concurrence of the safety director. (new paragraph under 19-3.1.5.4) This permission. Physician and safety director approval to use prohibited items shall be stated in writing for all prohibited materials employed (see A-19-3.1.3.2).

2. (new paragraph under 19-3.1.5.4) Where flame resistance is specified, the fabric shall meet the requirements set forth for the small-scale test in NFPA 701, Standard Methods of Fire Tests for Flame-Resistant Textiles and Films, except that the test shall be performed in an atmosphere equivalent to the maximum oxygen concentration and pressure proposed for the chamber.

19-3.2.1.1 The safety director, in developing the minimum staff qualifications, experience, and compliment based on the following:

(a) portable X-ray devices

(b) electrocatheter equipment and others.
(c) High-energy devices shall not be operated in the hyperbaric chamber unless approved by the safety director for such use. (new paragraph under 19-3.2.1) Photographic equipment employing the following shall not remain in the chamber when the chamber is pressurized:

(a) Photoflash

(b) Flood lamps, or similar equipment shall not remain in the hyperbaric chamber when the chamber is pressurized. (new paragraph under 19-3.2.1) Lasers shall not be used under any condition.

19-3.6.2 Furniture Used in the Chamber.

(a) (new paragraph under 19-3.6.2.2) Periodic inspection shall be made of leg tips, tires, casters, or other conductive devices on furniture and equipment to ensure that they are maintained. Conductive devices on furniture and equipment shall be inspected to ensure that they are free of wax, lint, or other extraneous material that could insulate them and defeat the purpose for which they are used conductive properties. (create new sentence and move to annex) Conductive devices include leg tips, tires, and casters. Periodic inspection shall also be made to avoid transporting such materials from other areas to conductive floors. (new paragraph under 19-3.6.2.2) Metallic capable of impact

(b) (new paragraph under 19-3.6.2.2) Casters shall not be lubricated with oils or other flammable materials. (new paragraph under 19-3.6.2.2) Lubricants shall be oxygen compatible and flame resistant.

(c) (new paragraph under 19-3.6.2.2) Wheelchairs and gurneys with bearings lubricated and sealed by the manufacturer shall be permitted in Class A chambers where conditions prescribed in 19-2.8.5 are met. 19-3.6.5 Housekeeping. (move next sentence to annex) It is absolutely essential that all areas of, and components associated with, the hyperbaric chamber be kept meticulously free of grease, lint, dirt, and dust. (leave next sentence as text of 19-3.6.5) A regular housekeeping program shall be implemented whether or not the facility is in regular use. (new paragraph under 19-3.6.5) The persons assigned to this task shall be thoroughly indoctrinated and trained in the hazards to occupants under normal operation.

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements.

COMMITTEE ACTION: Accept

VOTE ON COMMITTEE ACTION: Affirmative: 15

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

COMMITTEE STATEMENT: Revised to read as follows:

Exception No. 2: Chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation.

SUBSTANTIATION: For practical purposes, once a Class A or Class B hyperbaric chamber is installed in a room and connected to the requisite supply and exhaust piping, it becomes "permanent," whether the chamber skids, pedestals or casters are secured to the floor or not. During a fire emergency, no chamber, regardless of its classification is going to be removed to a location not threatened by fire. In today's marketplace, there are small Class A chambers with casters and Class B chambers without casters that are positioned but not affixed to the floor. These chamber designs should be afforded the same level of protection as more traditional chamber designs.

COMMITTEE ACTION: Accept in Principle

REVISE TO READ AS FOLLOWS:

"Trailer or vehicle-mounted facilities shall be permitted without a 2 hour fire-resistive-rated barrier. However, when such facilities are located contiguous to a health care facility, or another associated facility that is used, or intended to be used, for medical applications and experimental procedures at pressures greater than 0.21 atmosphere absolute (3.09 psia)."

The existing requirement for a two hour fire-resistive-rated barrier is intended to protect the

19-1.2* Scope. The scope of this chapter shall be as specified in 1.X.X.

Move the following to Chapter 1:

19-1.2.1* This chapter applies to hyperbaric chambers and associated facilities that are used, or intended to be used, for medical applications and experimental procedures at pressures greater than 0.21 atmosphere absolute (3.09 psia).

19-1.2.2* This chapter covers the recognition of and protection against hazards of an electrical, explosive, or implosive nature, as well as fire hazards.

Move to Annex A-19-1.2:

19-1.2.2* Medical complications of hyperbaric procedures are discussed primarily to acquaint rescue personnel with these problems.

19-1.2.2* This chapter applies to both single- and multipatient occupancy hyperbaric chambers, to animal chambers the size of which precludes human occupancy, and to those in which the chamber atmosphere contains an oxygen partial pressure greater than 0.21 atmosphere absolute (3.09 psia).

SUBSTANTIATION: Editorial restructuring is required to comply with the April 2000 Manual of Style requirements.

COMMITTEE ACTION: Accept

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: Affirmative: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood
chamber and its occupants from a fire elsewhere in the building in circumstances where substantial decompression obligations may exist thus preventing rapid evacuation of the chamber. However, for chambers limited to 3 ATA working pressure and non-saturation exposures, the probable exit times for the chamber occupants in a Class A chamber in the event of a fire in the building are similar to those for occupants in Class B chambers where the two hour fire-resistive-rated construction is not required.

**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** The committee feels that the current requirements are considered adequate.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 20

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 15

**NOT RETURNED:** 5 Dornette, Foreman, Leland, Martin, Wood

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**COMMITTEE ACTION:** Accept in Principle.

**SUBMITTER:** W. T. Workman, Workman Hyperbaric Services, Inc.

**RECOMMENDATION:** Revise to read as follows:

Exception: Class A chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation.

**SUBSTANTIATION:** For practical purposes, once a Class A or Class B hyperbaric chamber is installed in a room and connected to the requisite supply and exhaust piping, it becomes “permanent,” whether the chamber skids, pedestals or casters are secured to the floor or not. During a fire emergency, no chamber, regardless of its classification is going to be removed to a location not threatened by fire. In today’s marketplace, there are small Class A chambers with casters and Class B chambers without casters that are positioned but not affixed to the floor. These chamber designs should be afforded the same level of protection as more traditional chamber designs.

**COMMITTEE ACTION:** Accept in Principle.

**COMMITTEE STATEMENT:** See Committee Action and Statement on Proposal 99-376 (Log #215) and Committee Proposal 99-376 (Log #CP504).

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 20

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 15

**NOT RETURNED:** 5 Dornette, Foreman, Leland, Martin, Wood

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**COMMITTEE ACTION:** Reject.

**COMMITTEE STATEMENT:** Committee believes the present location is adequate.

**NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:** 20

**VOTE ON COMMITTEE ACTION:**

**AFFIRMATIVE:** 15

**NOT RETURNED:** 5 Dornette, Foreman, Leland, Martin, Wood
99-380 - (19-2.4.2.2):  Reject
SUBMITTER:  Mark Allen, Beacon Medical Products
RECOMMENDATION:  Rewrite 19-2.4.2.2 as follows:
19-2.4.2  Medical gas systems serving hyperbaric chambers shall comply with Chapter 4, Level 1, except as specified below:
19-2.4.2.1  Hyperbaric air systems serving only the hyperbaric chamber shall be permitted to be oil lubricated compressors fitted with oil separation, filtration, and adsorption devices such that the air produced meets the definition for Medical Air under all conditions of intake air and the system is monitored according to 19-2.8.7. Air treatment systems shall include automatic safeguards.
19-2.4.2.2  Air compressor installations shall be permitted to comply with Level 2 Medical Air Systems if a reserve manifold of cylinders containing medical air are installed so as to automatically activate in the event of failure of the compressor or air treatment system. The reserve manifold shall contain sufficient cylinders to maintain pressure and ventilation airflow within the chamber and supply air for the chamber pressurization.
SUBSTANTIATION:  Installations of medical gases in hyperbaric areas are in every way as important and subject to the exact same hazards as medical gases piped anywhere. The present 19-2.4 is incomplete on the subject of medical gases, which causes users difficulties with certifiers who attempt to enforce Chapter 4 based on the scope of that chapter. In addition, the present 19-2.4 does not account for Levels 1 or 2.
COMMITTEE ACTION:  Reject.
COMMITTEE STATEMENT:  Many of the requirements of Chapter 4 for Level 1 and Level 2 medical air systems are not acceptable for hyperbaric facilities.
Hyperbaric facility requirements are covered by Chapter 19 and its references.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:  20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE:  15
NOT RETURNED:  5 Dornette, Foreman, Leland, Martin, Wood

99-381 - (19-2.5):  Reject
SUBMITTER:  Steven Reimers, Larry Wischhoefer, Reimers Systems Inc
RECOMMENDATION:  Add a new paragraph as follows:
19-2.4.4  Atmospheric Uniformity.  The atmosphere within all Class A chambers shall be stirred sufficiently so that excessive local concentrations of oxygen or other gases do not occur.

99-382 - (19-2.4.5):  Reject
SUBMITTER:  Steven Reimers, Larry Wischhoefer, Reimers Systems Inc
RECOMMENDATION:  Add a new paragraph as follows:
19-2.4.5  Emergency Depressurization Capability.  All chambers shall be provided with an emergency depressurization mechanism capable of depressurizing the chamber from 3 ATA to surface pressure in less than 120 seconds. Operation of this mechanism shall be possible only by direct operator action. A lock-out capability shall be permitted for use when chamber occupants have incurred a decompression obligation.

SUBSTANTIATION:  In recent years some chambers have appeared on the market from which the minimum egress time is several minutes due to a very slow depressurization capability. In a clinical setting where prompt evacuation may be required for medical as well as fire safety reasons, the absence of an ability to quickly depressurize a chamber is considered an unnecessary risk.
Existing Class A chambers already have this capability. This capability is already in place on many multiplace clinical chambers in Germany and some in the United States.
COMMITTEE ACTION:  Reject.
COMMITTEE STATEMENT:  The recommendation is beyond the scope of this committee.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE:  20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE:  15
NOT RETURNED:  5 Dornette, Foreman, Leland, Martin, Wood

99-383 - (19-2.5.1):  TCC NOTE: It was the action of the Technical Correlating Committee that this proposal be returned to committee for reconsideration. The Technical Committee did not substantiate why it is beyond the scope of the committee. The Technical Correlating Committee believes it is part of the Technical Committee’s scope, and that the proposal be reconsidered.
SUBMITTER:  Steve Reimers, Larry Wischhoefer, Reimers Systems Inc
RECOMMENDATION:  Add a new paragraph as follows:
19-2.5.1  Alternative Source of Breathing Air

to see if there is support in the Hyperbaric Community and agreement in the committees that this is a worthwhile task.

As a Project Engineer and then Program Manager for US Navy shore-based hyperbaric facilities (multiples) for seventeen years, I have a responsibility to meet NFPA 99. There is one area where I do not meet the standard, it is in the fire systems. On a five foot diameter multiplace chamber, I do not put a hand held or a deluge system. We provide the chamber with a pressurized water fire extinguisher. On the US Navy’s 6.5 diameter chamber, only a hand held hose system is provided (actually two in inner lock (either end) and one in outer lock). Any chamber larger than 6.5 foot diameter, both a deluge and a hand held system are provided.

After years of designing, talking and reviewing fire systems, the justification I have for this is based on the following:

In US Navy shore-base hyperbaric chambers:
1. Patients are only allowed to wear approved clothing that is fire retardant.
2. Patients are not allowed to bring any external items into me chamber, i.e., hand heaters, etc.
3. All items (bunks, benches, tables) inside the chamber are grounded.
4. The chamber is grounded.
5. No items are allowed in the chamber that can offgas or provide a fuel.
6. The chamber atmosphere is continuously monitored for high oxygen concentrations and an alarm sounds if levels are high.
7. Systems are designed to have gas storage and compressors sized large enough that when oxygen levels are high, ventilation can be provided to reduce the high oxygen levels in the chamber.
8. BIBs systems are “dumped” to the exterior and not “dumpeed” in the chamber.
9. Oxygen systems are grounded and provided with butt welded piping systems.
10. External lighting sources provided.
11. All internal/external wiring in rigid conduit with sealed connectors.
12. Highest voltage source in chamber is 24 volts.

SUBSTANTIATION: Our position is based on the fact we have done all we can to eliminate a source (spark), gaseous fuel, or nongaseous fuel to start a fire. If there is a problem and there is a fire, it should be a local fire that is easily maintainable with the hand held hose system and not a flash fire. The US Navy has chosen 6.5 foot diameter as the maximum size not provided with a deluge system because at this size, with a handheld hose at either end and one in the outer lock, the fire hose is always within a tenders reach. Much larger than 6.5 ft diameter and it is not that easy to get to the hose and usually the number of patients is large enough to warrant a deluge system.

As is the case for all people deciding to purchase a multiplace chamber, I would have extreme problems “selling” a US Navy 6.5 ft diameter chamber if I had to provide a deluge system. The cost of a deluge system would be detrimental to the project cost. I do not feel that I am jeopardizing safety with this approach and feel confident that by providing these systems meeting items 1-12, I have eliminated the risk of a flash fire or a fire that would require a deluge system to extinguish.

I also provide a push button switch to change from oxygen to air at the control console in the event that the hand held hose system is activated.

If this philosophy was adopted by NFPA and in turn PVHO, multiplace chambers would become more attractive to potential customers. I have always had a problem with requiring the smaller multiplace chamber with these enormous fire systems (both hand held and deluge) and yet a monoplace, using 100 percent oxygen as its internal media, having neither a hand held hose or a deluge system.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The proposal did not contain a specific recommendation. The committee feels that the procedures described, while essential, are not sufficient to warrant deletion of the deluge capability.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-384 (19-2.5.1.1): Accept in Principle

SUBMITTER: William C. Gearhart, University of Pennsylvania, Institute for Environmental Medicine

RECOMMENDATION: We recommend the following text as follows:
“A fire suppression system consisting of an independently supplied and operating handline and deluge systems shall be installed in all Class A chambers.

SUBSTANTIATION: Encourage consistent and appropriate language associated with fixed fire suppression systems (i.e., NFPA 15; NFPA 25, 1-5 Definitions, 25-12; NFPA Handbook).

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

COMMITTEE ACTION: Accept in Principle.

Add the word “system” following the word “handline.” Revise text as follows:
“A fire suppression system consisting of an independently supplied and operating handline and deluge type water spray system shall be installed in all Class A chambers.

COMMITTEE STATEMENT: Clarify that there are two separate systems.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood
The fire suppression system shall be permitted to be supplied to suppression systems inside Class A chambers, not to the fire

COMMITTEE STATEMENT:
Section 19-2.5. refers to fire suppression systems inside Class A chambers, not to the fire suppression requirements for the room housing the chamber.

SUBSTANTIATION:
The additional text provides consistency with 19-2.1.1 which has similar wording. It is almost impossible to provide a trailer with an independent handlines and deluge system. The proposed wording better clarifies the intent of this section.

COMMITTEE ACTION: Reject.

99- 389 - (19-2.5.2.3): Accept in Principle
SUBMITTER: William C. Gearhart, University of Pennsylvania, Institute for Environmental Medicine
RECOMMENDATION: Revise text as follows:
“The number and positioning of sprinkler heads fixed discharge nozzles shall be sufficient to provide reasonably uniform spray coverage with vertical and horizontal (or near horizontal) jets.”

SUBSTANTIATION: Encourage consistent and appropriate language associated with fixed fire suppression systems. (NFPA 15, NFPA Handbook.)
NOTE: Supporting material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99- 388 - (19-2.5.1.1, Exception Nos. 1 and 2 (New)): Reject
SUBMITTER: Western Regional Fire Code Dev. Committee
RECOMMENDATION: Revise to read:
19-2.5.1.1 A fire suppression system consisting of an independently supplied and operating handline and deluge system shall be installed in all Class A chambers.
Exception No. 1: Free-standing, dedicated buildings containing only a Class A chamber(s) and ancillary service equipment.
Exception No. 2: Chambers not contiguous to a health care facility, and either located in a mobile, vehicle-mounted facility or not permanently affixed to a foundation.

SUBSTANTIATION: The proposed wording better clarifies the intent of this section.

COMMITTEE ACTION: Reject.

99- 388 - (19-2.5.1.1): Accept
SUBMITTER: William C. Gearhart, University of Pennsylvania, Institute for Environmental Medicine
RECOMMENDATION: Revise text as follows:
“Water shall be delivered from the sprinkler heads fixed discharge nozzles as specified in 19-2.5.2.4 within 3 seconds of activation of any affiliated deluge control.”

SUBSTANTIATION: Encourage consistent and appropriate language associated with fixed fire suppression systems. (NFPA 15, NFPA 25, 1-5 Definitions, 25-12; NFPA Handbook.)
NOTE: Supporting material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood
SUBSTANTIATION: To create a quantitative benchmark consistent with the fire protection industry’s approach to handline nozzle operating pressure requirements.

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

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The existing text is acceptable.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-392 - (19-2.5.5): Accept in Principle

SUBMITTER: William G. Gearhart, University of Pennsylvania, Institute for Environmental Medicine

RECOMMENDATION: Revise text as follows:

“The deluge and handline systems shall be functionally tested at least annually quarterly per 19-2.5.2.4 for deluge systems and... Following the test, all valves should be placed in their baseline position.”

Appendix A: “The primary focus for the “quarterly” test of a water based extinguishing system is to ensure water flow through the system i.e., inspector’s test. Other vitally important benefits are the activation of water flow devices, alarm appliances, notification and annunciator systems.”

SUBSTANTIATION: 1) To be consistent with NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems schedules.

2) To improve and ensure the reliability of hyperbaric fire suppression systems and their companion alarm devices and appliances.

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

COMMITTEE ACTION: Accept in Principle.

Modify by replacing “quarterly” with “semiannually”. Text will read as follows:

“The deluge and handline systems shall be functionally tested at least semiannually per 19-2.5.2.4 for deluge systems and... Following the test, all valves should be placed in their baseline position.”

Appendix A: “The primary focus for the “quarterly” test of a water based extinguishing system is to ensure water flow through the system i.e., inspector’s test. Other vitally important benefits are the activation of water flow devices, alarm appliances, notification and annunciator systems.”

SUBSTANTIATION: 1) To be consistent with NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems schedules.

2) To improve and ensure the reliability of hyperbaric fire suppression systems and their companion alarm devices and appliances.

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

COMMITTEE ACTION: Accept in Principle.

Modify by replacing “quarterly” with “semiannually”. Text will read as follows:

“The deluge and handline systems shall be functionally tested at least semiannually per 19-2.5.2.4 for deluge systems and... Following the test, all valves should be placed in their baseline position.”

Appendix A: “The primary focus for the “quarterly” test of a water based extinguishing system is to ensure water flow through the system i.e., inspector’s test. Other vitally important benefits are the activation of water flow devices, alarm appliances, notification and annunciator systems.”

SUBSTANTIATION: Semi-annual testing has been found to be sufficient.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 13

NEGATIVE: 7

NOT RETURNED: 4 Dornette, Foreman, Leland, Martin, Wood

EXPLANATION OF NEGATIVE:

MILLS: I do not agree with increasing frequencies without supportive documentation.

SALAMONE: I don’t agree with the change to increase frequency due to a lack of data to substantiate this change.

99-393 - (19-2.7.3(c)): Accept

SUBMITTER: Kevin I. Posey, International ATMO Inc.

RECOMMENDATION: Move Paragraph 19-2.7.3(c) to two new Paragraphs 19-2.5.1.7 and 19-2.6.1.

SUBSTANTIATION: This paragraph is out of place at its current location and would improve the organization and readability of the document if moved under the above mentioned paragraphs. I believe this concept is more general in nature and therefore belongs under these paragraphs.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-394 - (19-2.7.3.4): Accept

SUBMITTER: Kevin I. Posey, International ATMO Inc.

RECOMMENDATION: Add the following:

“19-2.7.3.4 Flexible Electrical Cords [BOLD] Flexible ... Article 501-11.”

SUBSTANTIATION: From a user’s viewpoint, I have often scanned through NFPA 99, Chapter 19, looking for a specific piece of information. Many paragraphs have bold text giving the reader easy identification of the material contained in the paragraph. Other paragraphs are misleading inasmuch as the bold lettering of the paragraph above would lead one to think that the subsequent paragraphs contain information on that subject when it does not. I believe this change would improve readability for the user. The addition of the bold lettering would quickly identify the paragraph.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-395 - (19-2.7.3.8): Accept

SUBMITTER: Kevin I. Posey, International ATMO Inc.

RECOMMENDATION: Move Paragraph 19-2.7.3.8 to Paragraph 19-2.7.3(c).

SUBSTANTIATION: This paragraph is out of place at its current location and would improve the organization and readability of the document if moved under Paragraph 19-2.7.3. I believe this concept is more general in nature and therefore belongs under this paragraph.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-396 - (19-2.7.3.9): Accept

SUBMITTER: Kevin I. Posey, International ATMO Inc.

RECOMMENDATION: Add the following:

“19-2.7.3.9 Motors [BOLD] Motors ... (3).”

SUBSTANTIATION: From a user’s viewpoint, I have often scanned through NFPA 99, Chapter 19, looking for a specific piece of information. Many paragraphs have bold text giving the reader easy identification of the material contained in the paragraph. Other paragraphs are misleading inasmuch as the bold lettering of the paragraph above would lead one to think that the subsequent paragraphs contain information on that subject when it does not. I believe this change would improve readability for the user. The addition of the bold lettering would quickly identify the paragraph.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

99-397 - (19-2.8.3): Accept

SUBMITTER: Kevin I. Posey, International ATMO Inc.

RECOMMENDATION: Move Paragraph 19-2.8.3 to new Paragraph 19-2.5.4.6 and change as indicated below:

“Automatic fire detection equipment, when used, shall meet the applicable requirements in 19-2.7.3 and 19-2.5.7.”

SUBSTANTIATION: This paragraph is out of place at its current location and would improve the organization of the document if moved under Paragraph 19-2.5.4.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

RECOMMENDATION: Move Paragraph 19-3.1.5.5 to Paragraph 19-3.1.5.4 through 19-3.1.5.7.
SUBMITTER: Kevin I. Posey, International ATMO Inc.
COMMITTEE STATEMENT: The organization of the document would improve by combining the contents of these sections.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMITTEE STATEMENT: Current paragraph structure is adequate.
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

EXPLANATION OF NEGATIVE VOTES:
MILLS: I don’t agree with the committee action because the original recommendation included language that provided a facility safety officer who is also responsible for safe operation of hyperbaric equipment.

COMMITTEE STATEMENT: To clarify the intent that each facility should have an onsite hyperbaric safety director.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 13
NEGATIVE: 2
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMITTEE ACTION: Accept.

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMITTEE STATEMENT: The use of tightfitting, jumpsuit type garments is not practical in a patient care environment where scrubs are the standard of care.
COMMITTEE ACTION: Reject.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

RECOMMENDATION: Revise to read as follows:
"Each hyperbaric facility shall designate a safety director to be in charge of all hyperbaric equipment and overall facility safety."

SUBMITTER: Kevin I. Posey, International ATMO Inc.
COMMITTEE STATEMENT: There is sufficient wording elsewhere in Chapter 19.
COMMITTEE ACTION: Reject.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20
VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

VOTE ON COMMITTEE ACTION:
AFFIRMATIVE: 15
NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

COMMITTEE STATEMENT: 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.
SUBMITTER: Kevin I. Posey, International ATMO Inc.
RECOMMENDATION: Move Paragraph 19-3.1.5.5 to Paragraph 19-3.1.5.3(e) and change as follows:
"All chamber personnel in Class A chambers shall wear either garments of the overall or jumpsuit type, completely covering all skin areas possible, and as tightfitting as possible, or hospital scrubs made of an anti-static blend or scrubs approved for use in hospital operating rooms."

SUBSTANTIATION: Moving the paragraph under Paragraph 19-3.1.5.3, Personnel, would improve organization and readability. The use of tightfitting, jumpsuit type garments is not practical in a patient care environment where scrubs are the standard of care.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: There is sufficient wording elsewhere in Chapter 19.
TCC NOTE: It was the action of the Technical Correlating Committee that this proposal be returned to committee for reconsideration. The Committee Statement needs to cite specific paragraphs.

SUBMITTER: William C. Gearhart, University of Pennsylvania, Institute for Environmental Medicine

RECOMMENDATION: Revise text as follows:

“Electrical switches, valves, and electrical monitoring equipment associated with fire detection and extinguishment suppression systems shall be visually inspected verified operational before each chamber pressurization. Automatic fire detection equipment shall be tested each week and functionally tested quarterly (by-pass test), including discharge of extinguishing suppression media, conducted annually. Automatic fire detection equipment testing shall include activation of trouble circuits and signals.”

SUBSTANTIATION: To replace “weak” wording with strong, direction oriented text.

To encourage consistent and appropriate language associated with fire suppression and fire detection systems.

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

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Operational is a maintenance function already covered elsewhere in chapter 19, and term operational is vague.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 20

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 15

NOT RETURNED: 5 Dornette, Foreman, Leland, Martin, Wood

__________(Log #203) Committee: HEA-PIP

99- 405 - (21-1.2.1): Accept

SUBMITTER: Thomas J. Mraulak, American Society of Sanitary Engineering

RECOMMENDATION: Add:

“ANSI / ASNE Series 6000 Professional Qualifications Standard for Medical Gas Systems Installers, Inspectors, and Verifiers.”

SUBSTANTIATION: If one or both of my changes dealing with the 6000 Series Standard are accepted we need to add the reference.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

__________(Log #209) Committee: HEA-PIP

99- 406 - (21-1.2.6): Accept in Principle

SUBMITTER: Richard E. Hoffman, Compressed Gas Association

RECOMMENDATION: Replace list of CGA publications with the following:

G-4 Oxygen, 1996
P-2 Characteristics and Safe Handling of Medical Gases, 1996.
P-2.5 Transfilling of High Pressure Gaseous Oxygen to be Used for Respiration, 2000.
P-2.6 Transfilling of Liquid Oxygen to be Used for Respiration, 1995.
E-10 Maintenance of Medical Gas and Vacuum Systems in Health-Care Facilities, 1997.

SUBSTANTIATION: List needs to be updated.

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: Accept in Principle.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22

NOT RETURNED: 1 Bancroft

__________(Log #CP5) Committee: HEA-ADM

99- 408 - (A-2-2): Accept

TCC NOTE: 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.

SUBMITTER: Technical Committee on Administration

RECOMMENDATION: Delete A-2-2 “Governing Body”.

SUBSTANTIATION: This material is outdated.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 6

VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 4
NEGATIVE: 1
NOT RETURNED: 1 McPeck
EXPLANATION OF NEGATIVE:

BULOW: Removing the term “Governing Body” may be appropriate for the reason given by the committee, however the term “Senior Management” is used in 11-4.2 and has no definition. I propose that the definition found in Section 3-2 of the 1999 edition of NFPA 99, “Governing Body” be titled to “Senior Management” using the existing text as follows:

Senior Management. The person or persons who have the overall legal responsibility for the operation of the health care facility.

SUBSTANTIATION: Changes needed to reflect the widely used “unified command concept.”

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Existing wording reflects current practices and principles.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14

NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin

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SUBMITTER: Technical Committee on Laboratories

RECOMMENDATION: Delete “Do Not Smoke” from “... A warning sign such as the one indicated here should be posted on every box.

DANGER
NOT EXPLOSIONPROOF
NOT VENTILATED
GROUND ALL ELECTRICAL EQUIPMENT
DO NOT STORE DRY ICE
DO NOT SMOKE.”

SUBSTANTIATION: Smoking in working areas in health care facilities is not permitted by other regulatory agencies.

COMMITTEE ACTION: Accept.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 9

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 7

NOT RETURNED: 2 Nickasch, Simmons

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SUBMITTER: Steve Ennis, The Reciprocal Group

RECOMMENDATION: Revise text as follows and change Figure A-11-4.3:

A policy group may be constituted to provide decisions related to items or incident decisions outside the scope of authority of the facility management team. This group may

SUBSTANTIATION: Changes needed to reflect the widely used “unified command concept.”

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Existing wording reflects current practices and principles.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14

NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin

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SUBMITTER: Steve Ennis, The Reciprocal Group

RECOMMENDATION: Revise text as follows and change Figure A-11-4.3:

A policy group may be constituted to provide decisions related to items or incident decisions outside the scope of authority of the facility management team. This group may

SUBSTANTIATION: Changes needed to reflect the widely used “unified command concept.”

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Existing wording reflects current practices and principles.

NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18

VOTE ON COMMITTEE ACTION:

AFFIRMATIVE: 14

NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin

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Figure A-11-4.3
99- 412 - (A-11-5.3.6(d) (New) ): Accept
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99- 413 - (C-4 through C-4.8): Accept
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin

99- 414 - (C-4-3): Accept
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 23
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 22
NOT RETURNED: 1 Bancroft

99- 415 - (C-4-3.3 Example 3): Accept
COMMITTEE ACTION: Accept.
NUMBER OF COMMITTEE MEMBERS ELIGIBLE TO VOTE: 18
VOTE ON COMMITTEE ACTION: AFFIRMATIVE: 14
NOT RETURNED: 4 Kitchin, McPeck, Sinsigalli, Woodfin