Notes on Using this Pamphlet:

This pamphlet is presented as a service to systems designers working with medical gas and vacuum in medical facilities. The design process used in this booklet is detailed in Chapter 1 - Design Process.

This Guide is not in any way intended to be a substitute for a properly qualified engineer, and any pretence to being alone sufficient for the proper design of any medical gas system is explicitly disclaimed.

It is BeaconMedæs’ intent that this book should only be used as one tool among many by properly qualified engineers who are in a position by training and experience to know it’s applications and limitations.

You will find in using the Guide that there are innumerable decisions, judgement calls, and subtleties in the design of medical gases which cannot be incorporated in any book, but serve to dramatically emphasize the value of the engineer’s expertise.


Comments on this booklet or on any aspect of medical gases are welcome and encouraged. Please send to mark.allen@beaconmedaes.com
Chapter 2
Codes, Standards and References

Introduction: The Medical Gases Library

These are the codes and standards which apply, in part or in total, to the design specification, construction and commissioning of medical gas piping. Additionally, it contains some useful reference works on the subject and some useful materials from other sources which the designer may wish to use. Addresses for the organizations referenced are at the end of this section. This list is not exhaustive, and local standards should be addressed for each jurisdiction.

Required Standards

One of the following five (as relevant) is the absolute minimum requirement for medical gas work.

“Health Care Facilities”

NFPA 99, 2005, National Fire Protection Association

This is the standard for pressurized medical gas, vacuum and WAGD systems in the United States and some other countries. The NFPA 99, 2005 edition is a collection of the healthcare standards which formerly were published as separate pamphlets. Included are the 3M, 56A, 56B, 56C, 56D, 56E, 56F, 56G, 56HM, 56K, 76A, 76B and 76C.

The NFPA 56F was incorporated as of November 1986. The 56F was the most often referenced document on medical gases and is cited in local, state and federal regulations. The NFPA 99, 2005 edition replaces it in every important respect.

The chapter of greatest relevance in the NFPA 99, 2005 edition is chapter 5, containing the former 56F and the former NFPA 99 chapter 6 on Medical-Surgical Vacuum Systems.

CSA 7396 - 2009

This is the standard equivalent to the NFPA 99 adopted in Canada. It was inspired by the ISO 7396 with numerous Canada-only requirements which makes it essentially a blend of ISO and NFPA requirements.

HTM 02-01 - 2007

This is the standard equivalent to the NFPA 99 used by the United Kingdom. It contains all the elements found in other standards and a particularly strong set of requirements for the qualifications of persons working on medical gases and on procedures for working with medical gases. It is a derivative of the ISO 7396 which is much more complete and non-specialist friendly.

“Medical gas systems—Installation and testing of non-flammable medical gas pipeline systems”

AS 2896-1998 (Revised)

This is the standard equivalent to the NFPA 99 or HTM 02 followed in Australia.

ISO 7396

This is the standard equivalent to the NFPA 99 written by the International Organization for Standardization.

Local Requirements

Within the United States, standards may vary between local jurisdictions. To determine the standards in force, contact your local authority having jurisdiction. Two other sources also exist who may be helpful:

“Directory of State Building Codes and Regulations”

National Conference of States on Building Codes and Standards
505 Huntmar Park Dr.
Suite 210
Herndon VA 22070

www.ncsbc.org
(703) 437-0100
Useful Standards

“Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks”

NFPA 55, 2010, National Fire Protection Association

Incorporates the NFPA 50, “Bulk Oxygen Systems at Consumer Sites”

Where an oxygen source contains more than 20,000 cubic feet (566 m³) of gas or liquid equivalent, this code will supplement the NFPA 99.

“Guidelines for Design and Construction of Health Care Facilities”

2010, Facilities Guidelines Institute

These are guidelines which are based on earlier federal government specifications and the earlier AIA document now published through ASHE. They may be incorporated by reference into state or local standards. Most important are Tables 2.1-6 and 3-1.1 outlining outlet locations.

“Guide for Medical Gas Supply Systems at Consumer Sites”

CGA M-1, 2007 Compressed Gas Association

“Professional Qualifications Standard for Medical Gas Systems Installers, Inspectors, Verifiers, Maintenance Personnel and Instructors”

ASSE 6000 Series, 2006 edition, American Society of Sanitary Engineering

This standard is a guide to the qualifications desirable in persons working in medical gases. Two of the five standards are referenced in the NFPPA, making them mandatory in most jurisdictions. These are the 6010 for Installers, and the 6030 for Verifiers. The document also contains additional guidance on various aspects of medical gas work in it’s appendixes.

“The Copper Tube Handbook”

2004, Copper Development Association (CDA)

This publication describes copper tubing, its uses, installation and limitations.

“ASPE Databook”

American Society of Plumbing Engineers (ASPE)

General information for accurate design and specification of plumbing systems used in healthcare facilities. Volume 3 contains the medical gas material.

“Comprehensive Accreditation Manual for Hospitals: The Official Handbook (CAMH)”

2009, Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

The JCAHO is of foremost importance to the operating facility, and wields considerable power over the economic well-being of the facility. Perusing their manual will give a picture of the requirements expected in the finished facility. Medical gases and vacuum fall under requirements for utilities. This document is now being followed in many countries as part of the Joint Commission International’s accreditation program.

“Amerians with Disabilities Act Public Law 101-336: Overview and Introduction”

American Hospital Association (AHA)

Facility design and specification guidelines intended to ensure compliance with the Americans with Disabilities Act (ADA) of 1991.

“Nitrous Oxide Security and Control”

CGA SB-6, 1999, Compressed Gas Association

Describes the problem of nitrous oxide security and offers some ideas on designing for the problem.

“Safe Handling of Compressed Gases in Containers”

CGA P-1, 2008, Compressed Gas Association

General information on handling compressed gases is presented.

“Characteristics and Safe Handling of Medical Gases”

CGA P-2, 2006, Compressed Gas Association

General information on proper use of medical gases is presented.

Informative

“Cleaning Equipment for Oxygen Service”
This is an informational pamphlet intended for organizations doing commercial cleaning for oxygen service. It contains a wealth of information about different acceptable methods and packaging.

“Diameter Index Safety System”

This is the U.S. standard for threaded medical gas couplers. It describes a system of non-interchangeable couplers based on interfering diameters.

Describes the installation of bulk systems for medical gases.

“Standard for Insulated Liquid Carbon Dioxide Systems at Consumer Sites”

This standard applies to the installation of carbon dioxide systems. The provisions of this standard account for the particular properties and risks inherent in carbon dioxide. In medical applications, it should be used to supplement NFPA 99, 2005 edition.

“Standard for Nitrous Oxide Systems at Consumer Sites”

This standard applies to the installation of large nitrous oxide installations exceeding 28,000 cu. ft. (793 cu. m) of gas or liquid equivalent. In medical applications, it should be used to supplement NFPA 99, 2002 edition.

A good medical dictionary

While obviously not a code or standard, such a dictionary is particularly useful when trying to understand the treatments administered in various occupancies. One often referenced dictionary is Dorlands Pocket Medical Dictionary published by Saunders.

Of Interest to the Specialist

“Commissioning of Medical Gas Systems in Health Care Facilities”

The CGA Handbook is an excellent reference guide to the properties, safe handling, and required devices used for each type of gas. Its scope covers much more than medical gases.

“Commodity Specifications”

These are industry standards for gas purities. They are available for oxygen, carbon dioxide, air, nitrous oxide and nitrogen. Describe purity grades for gases from bottling plants. Some grades are prescribed for certain uses. These should be considered as secondary to USP requirements.

“Recommendations for Medical-Surgical Vacuum Systems in Health Care Facilities”
Now withdrawn by the CGA, this document was at one time the code in many jurisdictions. Today it has been largely supplanted by the NFPA 99. The sizing recommendations in the P-2.1 have been used with success for almost 20 years, and continue to be the basis of the tables in any number of standards and design guides.

“Development and Evaluation of Methods for the Elimination of Waste Anesthetic Gases and Vapors in Hospitals”

National Institute of Occupational Safety and Health (NIOSH)

An early study of the principles involved in waste anesthetic gas removal. Some considerations in the design of WAGD systems may be found here.

“Compressed Gas Cylinder Valve Inlet and Outlet Connections”

CGA V-1, 2005, Compressed Gas Association

The standard for high pressure connections between cylinders and manifolds.

“United States Pharmacopoeia XXXII/National Formulary XXVII”

United States Pharmacopoeial Convention (USP)

This is the standard for drug purities in the United States. Monographs on all important medical gases are included, including compressor-produced medical air.

Code Writing Organizations and Sources

AIA:
American Institute of Architects
1735 New York Ave NW
Washington DC 20006-5292
(202) 626-7300
(800) 242-3837
www.aia.org

ANSI:
American National Standards Institute
25 West 43rd Street
4th floor
New York NY 10036
(212) 642-4900
www.ansi.org

ASPE:
American Society of Plumbing Engineers
2980 S River Rd,
Des Plaines, IL 60018
847-296-0002
www.aspe.org

Standards Australia:
Standards Association Of Australia
1 The Crescent, Homebush, NSW 2140 AUSTRALIA
www.standards.com.au

ASTM:
American Society of Testing and Materials
100 Barr Harbor Drive
West Conshohocken PA 19428-2959
(610) 832-9585
www.astm.org

ASSE:
American Society of Sanitary Engineering
901 Canterbury Road, Suite A
Westlake, OH  44145-1480
(440) 835 3040
www.asse-plumbing.org

AWS:
American Welding Society
550 NW LeJeune Rd.
Miami FL 33126
(305) 443-9353