

ASSE International

Professional Qualifications Standard for **Medical Gas Systems Personnel**

- Medical Gas Systems Generalists
- Medical Gas Systems Installers
- Bulk Medical Gas Systems Installers
- Medical Gas Systems Inspectors
- Medical Gas Systems Verifiers
- Bulk Medical Gas Systems Verifiers
- Medical Gas Systems Maintenance Personnel
- Medical Gas Systems Instructors
- Bulk Medical Gas Systems Instructors

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Professional Qualifications Standards for Medical Gas Systems Personnel

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FOREWORD

Professional Qualifications Standards for Medical Gas Systems Personnel

This foreword shall not be considered a part of the standard. However, it is offered to provide background information.

ASSE International, formerly known as the American Society of Sanitary Engineering, is dedicated to the preservation of public health and safety through “Prevention Rather Than Cure.”

In 1987, ASSE’s Board of Directors recognized the need to develop professional qualifications standards for the plumbing and mechanical industries. Since that time, ASSE has developed a number of professional qualifications standards directly related to healthcare, including the ASSE/IAPMO/ANSI Series 5000, *Cross-Connection Control Professional Qualifications Standard*, ASSE/IAPMO/ANSI Series 12000, *Health and Safety of Construction and Maintenance Personnel*, and this ASSE/IAPMO/ANSI Series 6000, *Professional Qualifications Standard for Medical Gas Systems Personnel*. These important documents, now each considered the industry standard, are necessary to allow the Authority Having Jurisdiction (AHJ) to have nationally recognized standards, developed in an open consensus process, to use in ensuring that individuals working on these critically important systems possess the knowledge and experience required to successfully perform the installation, testing, maintenance, inspection and verification needed within the industry.

The healthcare industry’s dedication to continually improving positive patient outcomes and safety made it clear that there was a need to develop a standard to address minimum requirements for medical gas and vacuum systems installers, inspectors, verifiers, maintenance personnel and instructors. In 1997, the Series 6000 met that industry need. In subsequent revisions, requirements for medical gas generalists, bulk medical gas systems installers, bulk medical gas systems verifiers, and bulk medical gas systems instructors were added.

The ASSE/IAPMO/ANSI Series 6000, *Professional Qualifications Standard for Medical Gas Systems Personnel*, is based on the requirements of NFPA 99-2015, *Health Care Facilities Code*. The standards within the Series 6000 allow regulatory officials to have uniform minimum requirements for qualified medical gas systems installers, inspectors, maintenance personnel and instructors, and bulk medical gas systems installers, verifiers and instructors. In addition, these standards give uniform requirements for third-party certifiers so individuals can be certified to these standards.

The ASSE/IAPMO/ANSI Series 6000 standards will continue to change through revision – not only because of periodic updates to NFPA 99, *Health Care Facilities Code*, but also because the medical gas industry continually responds to the experience gained in the field through the use of these standards.

Recognition is made of the time volunteered by members of the ASSE Series 6000 Working Groups who participated in the initial development of this standard and the subsequent revisions.

This series of standards was promulgated in accordance with procedures developed by the American National Standards Institute (ANSI).

ASSE International does not approve, endorse, regulate, influence, inspect or certify any medical gas training facilities, third-party certification agencies, procedures, installations, equipment, materials, or access to or pricing of certifications. In determining the acceptability of training facilities, third-party certification agencies, procedures, installations, equipment or materials, the Authority Having Jurisdiction (AHJ) may base acceptance on compliance with ASSE or other appropriate standards.

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Listed Standards and Terminology in ASSE/IAPMO/ANSI Series 6000 Professional Qualifications Standard

1-1.1 Reference and Industry Standards

The following list of reference and industry standards is part of the requirements of ASSE Standard 6005, ASSE Standard 6010, ASSE Standard 6015, ASSE Standard 6020, ASSE Standard 6030, ASSE Standard 6035, ASSE Standard 6040, ASSE Standard 6050 and ASSE Standard 6055. Refer to Annex K for information on contacting the various standards organizations.

- | | | | |
|----------|--|----------|--|
| 1-1.1.1 | ASME <i>Boiler and Pressure Vessel Code</i> , Section IX, <i>Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators</i> , 2015 edition | 1-1.1.11 | ASSE Standard 6050-2015, <i>Medical Gas Systems Instructors Professional Qualifications Standard</i> |
| 1-1.1.2 | ASSE/IAPMO/ANSI Series 12000-2014, <i>Professional Qualifications Standard for the Health and Safety of Construction and Maintenance Personnel</i> | 1-1.1.12 | ASSE Standard 6055-2015, <i>Bulk Medical Gas Systems Instructors Professional Qualifications Standard</i> |
| 1-1.1.3 | ASSE/IAPMO/ANSI 5000-2009, <i>Cross-Connection Control Professional Qualifications Standard</i> | 1-1.1.13 | ASTM A269-14, <i>Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service</i> |
| 1-1.1.4 | ASSE Standard 6005-2015, <i>Medical Gas Systems Generalists Professional Qualifications Standard</i> | 1-1.1.14 | ASTM B32-08(2014), <i>Standard Specification for Solder Metal</i> |
| 1-1.1.5 | ASSE Standard 6010-2015, <i>Medical Gas Systems Installers Professional Qualifications Standard</i> | 1-1.1.15 | ASTM B819-00(2011), <i>Standard Specification for Seamless Copper Tube for Medical Gas Systems</i> |
| 1-1.1.6 | ASSE Standard 6015-2015, <i>Bulk Medical Gas Systems Installers Professional Qualifications Standard</i> | 1-1.1.16 | ASTM B828-02(2010), <i>Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings</i> |
| 1-1.1.7 | ASSE Standard 6020-2015, <i>Medical Gas Systems Inspectors Professional Qualifications Standard</i> | 1-1.1.17 | AWS B2.2/B2.2M-2010, <i>Specification for Brazing Procedure and Performance Qualification</i> |
| 1-1.1.8 | ASSE Standard 6030-2015, <i>Medical Gas Systems Verifiers Professional Qualifications Standard</i> | 1-1.1.18 | CGA C-9-2013, <i>Standard Color Marking of Compressed Gas Containers for Medical Use</i> , 5th edition |
| 1-1.1.9 | ASSE Standard 6035-2015, <i>Bulk Medical Gas Systems Verifiers Professional Qualifications Standard</i> | 1-1.1.19 | CGA E-10-2013, <i>Maintenance of Medical Gas and Vacuum Systems in Health Care Facilities</i> , 4th edition |
| 1-1.1.10 | ASSE Standard 6040-2015, <i>Medical Gas Systems Maintenance Personnel Professional Qualifications Standard</i> | 1-1.1.20 | CGA G-4.1-2009, <i>Cleaning Equipment for Oxygen Service</i> , 6th edition |
| | | 1-1.1.21 | CGA G-10.1-2008, <i>Commodity Specification for Nitrogen</i> , 7th edition |
| | | 1-1.1.22 | CGAM-1-2015, <i>Guide for Medical Gas Supply Systems at Consumer Sites</i> , 4th edition |
| | | 1-1.1.23 | CGA M-7-2014, <i>Guideline for Qualifying Suppliers used by Medical Gas Manufacturers and Distributors</i> , 4th edition |
| | | 1-1.1.24 | CGA P-2-2013, <i>Characteristics and Safe Handling of Medical Gases</i> , 10th edition |

- 1-1.1.25 CGA P-18-2013, *Standard for Bulk Inert Gas Systems at Consumer Sites*, 4th edition
- 1-1.1.26 CGA P-41-2010, *Locating Bulk Storage Systems in Courts*, 1st edition
- 1-1.1.27 CGA PS-40-2015, *Requirements for Installers of Bulk Medical Gas Supply Systems*, 1st edition
- 1-1.1.28 CGA SB-45-2011, *Proper Handling of Insulated Tanks that are in Obvious Signs of Loss of Vacuum*, 1st edition
- 1-1.1.29 CGA V-1-2013, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections*, 13th edition
- 1-1.1.30 CGA V-5-2013, *Standard for Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)*
- 1-1.1.31 CSA Z7369.1-2012, *Medical Gas Pipeline Systems - Part 1: Pipelines for Medical Gases and Vacuum*.
- 1-1.1.32 CDA *The Copper Tube Handbook*, 2011
- 1-1.1.33 NFPA 55-2013, *Compressed Gases and Cryogenic Fluids Code*
- 1-1.1.34 NFPA 70-2014, *National Electrical Code*
- 1-1.1.35 NFPA 99-2015, *Health Care Facilities Code*
- 1-1.1.36 NFPA 101-2015, *Life Safety Code*
- 1-1.1.37 SB-11-2013, *Hazards of Oxygen in the Health Care Facilities Primary or Reserve Bulk Storage Tank Systems*, 3rd edition
- 1-1.1.38 SB-23-2013, *Liquid Oxygen USP Withdrawal from Health Care Environment*, 2nd edition
- 1-1.1.39 U.S. FDA *Current Good Manufacturing Practices*, Title 21 CFR, Parts 210 and 211, revised 2014.
- NOTE: All questions related to applicability shall be directed to the Authority Having Jurisdiction (AHJ).

1-1.2 Terminology

The following list of terms is part of the requirements of ASSE Standard 6005, ASSE Standard 6010, ASSE Standard 6015, ASSE Standard 6020, ASSE Standard 6030, ASSE Standard 6035, ASSE Standard 6040, ASSE Standard 6050 and ASSE Standard 6055.

- 1-1.2.1 Acceptable joints
- 1-1.2.2 Alarms: area, local, master
- 1-1.2.3 Anesthetizing location
- 1-1.2.4 Authority Having Jurisdiction (AHJ)
- 1-1.2.5 Blowdown
- 1-1.2.6 Brazed joints
- 1-1.2.7 Bulk medical gas systems
- a) Bulk inert gas systems
- b) Bulk nitrous oxide system
- c) Bulk oxygen system
- d) Micro-bulk cryogenic system
- 1-1.2.8 Bulk Medical Gas Systems Installer
- 1-1.2.9 Bulk Medical Gas Systems Instructor
- 1-1.2.10 Bulk Medical Gas Systems Verifier
- 1-1.2.11 Carbon dioxide, USP
- 1-1.2.12 Category 1 medical gas and Category 1 medical/surgical vacuum system
- 1-1.2.13 Category 2 medical gas and Category 2 medical/surgical vacuum system
- 1-1.2.14 Category 3 medical gas and Category 3 vacuum system
- 1-1.2.15 Category 3 gas powered devices supply system
- 1-1.2.16 Code
- 1-1.2.17 Contamination
- 1-1.2.18 Critical care and life support area
- 1-1.2.19 Cross-connection
- 1-1.2.20 Cryogenic systems
- 1-1.2.21 Dew point
- 1-1.2.22 Emergency oxygen supply connection (EOSC)
- 1-1.2.23 Fire stopping
- 1-1.2.24 Flowmeter
- 1-1.2.25 Gas contamination
- 1-1.2.26 Gas powered systems
- 1-1.2.27 Gas-specific demand check fittings
- 1-1.2.28 Gas tungsten arc welding (GTAW) autogenous orbital welded joints
- 1-1.2.29 General anesthesia and levels of sedation/analgesia
- 1-1.2.30 Health care facility requirements
- 1-1.2.31 Helium, USP
- 1-1.2.32 Hyperbaric
- 1-1.2.33 Hyperbaric medical gas piping systems and accessories
- 1-1.2.34 In-building emergency reserve (IBER)
- 1-1.2.35 Infection control
- 1-1.2.36 Instrument air
- 1-1.2.37 Labeled

- 1-1.2.38 Limited care facility requirements
- 1-1.2.39 Listed
- 1-1.2.40 Local jurisdiction
- 1-1.2.41 Local signal
- 1-1.2.42 Manifold
- 1-1.2.43 Manufactured assemblies
- 1-1.2.44 Medical air, USP
- 1-1.2.45 Medical gas and vacuum systems
- 1-1.2.46 Medical gas rails (MGR)
- 1-1.2.47 Medical Gas Systems Inspector
- 1-1.2.48 Medical Gas Systems Installer
- 1-1.2.49 Medical Gas Systems Instructor
- 1-1.2.50 Medical Gas Systems Maintenance Personnel
- 1-1.2.51 Medical Gas Systems Verifier
- 1-1.2.52 Medical support gases
- 1-1.2.53 Metal inert gas (MIG) welded joints
- 1-1.2.54 Nitrogen, NF
- 1-1.2.55 Nitrogen purge gas source alarm
- 1-1.2.56 Nitrous oxide, USP
- 1-1.2.57 Nonflammable
- 1-1.2.58 Nursing home requirements
- 1-1.2.59 Oxygen, USP
- 1-1.2.60 Particulate contaminants
- 1-1.2.61 Pathogens
 - a) Biological pathogens
 - b) Waterborne pathogens
- 1-1.2.62 Patient care space
- 1-1.2.63 Patient medical gases
- 1-1.2.64 Piped distribution system
- 1-1.2.65 Pressure
 - a) Absolute pressure
 - b) Ambient pressure
 - c) Gauge pressure
 - d) High pressure
 - e) Operating pressure
 - f) Partial pressure
 - g) Positive pressure
 - h) Working pressure
- 1-1.2.66 Prohibited piping joints
- 1-1.2.67 Purge
- 1-1.2.68 Qualified person
- 1-1.2.69 SCFM, ACFM, CFM, CFH, LPM
- 1-1.2.70 Special fittings
- 1-1.2.71 Standard
- 1-1.2.72 Surface-mounted medical gas rails (MGR)
- 1-1.2.73 Third-party certification agency (See 1.3)
- 1-1.2.74 Tungsten inert gas (TIG) welded joints
- 1-1.2.75 Use point
- 1-1.2.76 Waste anesthetic gas disposal (WAGD) systems

1-1.3 Third-Party Certification Agencies

A recognized third-party certification agency shall, at a minimum, be able to demonstrate to interested parties the following components:

- 1-1.3.1 Management System
 - a) Management system that includes management review, document controls and internal audits.
- 1-1.3.2 Applications and Security
 - a) Accept applications and issue certifications in a non-discriminatory manner.
 - b) Determine pass/fail scores through an accepted validation process, and if multiple tests are used for the same certification, the tests are consistent in the degree of difficulty.
 - c) Examinations and related items are protected and kept in a secure environment.
- 1-1.3.3 Procedures and Certificates
 - a) Appeal process.
 - b) Recertification process.
 - c) Suspension and/or revocation process.
 - d) Procedure for employers and customers to verify the certified person's validity.
 - e) Demonstrate that agency procedures and policies are not in conflict with generally accepted business ethics and adhere to all applicable laws, both federal and state.
 - f) Certification documents are issued to the applicant, which include name, ID number, expiration date and title of the standard that the certification test is based on so certified persons are assured they were tested to a standard that is applicable to the reason for becoming certified.
 - g) Provision for discontinued use of the certificate if the certificate is used in a misleading manner.

Medical Gas Systems Generalists

5-1.1 Scope

This standard provides general knowledge of medical gas and vacuum systems for the purpose of providing continuing education. Eligible individuals include any person with an interest in medical gas and vacuum systems and equipment.

This standard does not apply to those who work with medical gas systems as a Medical Gas Systems Installer per ASSE Standard 6010, Bulk Medical Gas Systems Installer per ASSE Standard 6015, Medical Gas Systems Inspector per ASSE Standard 6020, Medical Gas Systems Verifier per ASSE Standard 6030, Bulk Medical Gas Systems Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050 or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

Medical gas systems and equipment covered in this standard include health care facilities within the scope of NFPA 99-2015, *Health Care Facilities Code*. Medical gas systems include vacuum piping.

5-1.2 Purpose

The purpose of this standard is to provide minimum criteria, identified by an industry consensus, for medical gas systems, to ensure compliance with the referenced standards in Section 5-1.4.

5-1.3 Limitations

Compliance with this standard in itself shall not constitute compliance with the requirements for a Medical Gas Systems Installer per ASSE Standard 6010, Bulk Medical Gas Systems Installer per ASSE Standard 6015, Medical Gas Systems Inspector per ASSE Standard 6020, Medical Gas Systems Verifier per ASSE Standard 6030, Bulk Medical Gas Systems

Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050, or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

5-1.4 Reference and Industry Standards

The reference and industry standards listed in ASSE Standard 6001 are a part of this standard.

5-2.1 General Knowledge

5-2.1.1 The individual shall be able to identify and show knowledge of the applicable laws, codes, rules, listing agencies and regulations from the federal, state and local levels pertaining to medical gas and vacuum systems.

5-2.1.2 The individual shall be able to identify and describe the basic concepts pertaining to:

- a) Absolute pressure
- b) Alarm panel locations
- c) Alarm settings
- d) Atmospheric pressure
- e) Building systems categories
- f) Gauge pressure
- g) Manual valves, including source valves, main valves, riser valves, service valves, in-line shut-off valves, zone valves and valves for future connections
- h) Medical support gases
- i) Medical-surgical vacuum
- j) Oxygen deficient atmosphere
- k) Oxygen enriched atmosphere
- l) Patient medical gases
- m) Pressure and vacuum sensors
- n) Vacuum measurement
- o) Zone valve location

5-2.2 Product Performance Knowledge

5-2.2.1 The individual shall be able to list the parts and identify the major components of medical gas and vacuum systems and equipment.

5-2.2.2 The individual shall be able to describe the categories of medical gas systems and their limitations with respect to Chapter 4 of NFPA 99-2015.

5-2.2.3 The individual shall be able to identify and describe the operating principles and performance characteristics of medical gas and vacuum systems, and identify the following components:

- a) Master, area and local alarm systems
- b) Medical air compressors and accessories
- c) Medical air proportioning systems
- d) Medical gas control panels
- e) Medical gas manifolds
- f) Medical gas outlets
- g) Medical support gas systems and their components
- h) Medical-surgical vacuum systems and their components
- i) Operation of bulk medical gas supplies
- j) Pressure and vacuum switches and transducers
- k) Pressure regulating valves
- l) Pressure relief valves
- m) Shut-off valves
- n) Vacuum inlets
- o) Waste anesthetic gas disposal (WAGD) systems

5-2.3 Product Installation Knowledge

5-2.3.1 The individual shall be able to describe the proper installation requirements for medical gas systems relating to:

- a) Local jurisdiction requirements
- b) Manufacturer recommendations
- c) Physical location, ventilation and accessibility

5-2.3.2 The individual shall be able to identify and describe the problems resulting from the improper installation of medical gas systems.

5-2.4 System and System Component Testing Knowledge

5-2.4.1 The individual shall be able to describe test requirements associated with the following components:

- a) Bulk medical gas supplies
- b) Master, area and local alarm systems
- c) Medical air compressors and accessories
- d) Medical gas manifolds

- e) Medical gas outlets
- f) Medical support gas systems and their components
- g) Medical-surgical vacuum systems and their components
- h) Pressure and vacuum switches and transducers
- i) Pressure regulating valves
- j) Pressure relief valves
- k) Shut-off valves
- l) Vacuum inlets
- m) Vacuum systems and components
- n) Waste anesthetic gas disposal (WAGD) systems

5-2.4.2 The individual shall be able to identify and describe procedures for the use of the following:

- a) Flow meter
- b) Oxygen analyzer
- c) Pressure gauge
- d) Vacuum gauge

5-2.5 Documenting and Recording of Inspections and Tests Knowledge

The individual shall be familiar with the check lists contained in the annexes of the ASSE/IAPMO/ANSI Series 6000.

5-3.1 Terminology

5-3.1.1 The individual shall be able to demonstrate a basic working knowledge of all terminology listed in ASSE Standard 6001, as used in NFPA 99-2015 and other listed industry standards.

5-4.1 Certification of Medical Gas Systems Generalists

5-4.1.1 Certification shall include the successful completion of a minimum 24-hour training course covering ASSE Standard 6005 and applicable sections of NFPA 99 and NFPA 55. Course instruction shall be conducted by a Medical Gas Systems Instructor certified to ASSE 6050.

5-4.1.2 Certification shall include a written examination covering ASSE Standard 6005 and applicable sections of NFPA 99. The exam shall be a minimum of 50 questions with a minimum passing score of 70%. Certification shall be through a recognized third-party certification agency.

5-4.2 Recertification

- 5-4.2.1 The individual shall be recertified by review of the latest edition of NFPA 99 followed by a written exam that shall be a minimum of 25 questions with a minimum passing score of 70%.
- 5-4.2.2 Recertification shall be through a recognized third-party certification agency and include a test to subsequent editions of NFPA 99.



Medical Gas Systems Installers

10-1.1 Scope

This standard applies to any individual who installs medical gas and vacuum systems. Medical gas systems and equipment covered in this standard include health care facilities within the scope of NFPA 99-2015, *Health Care Facilities Code*. Installers include anyone who works on or installs piping or components, including brazers and welders. Medical gas piping systems include vacuum systems.

10-1.2 Purpose

The purpose of this standard is to provide minimum performance criteria, identified by industry consensus, for the qualification of Medical Gas Systems Installers to ensure compliance with the referenced standards in Section 10-1.4.

10-1.3 Limitations for a Medical Gas Systems Installer

Compliance with this standard in itself shall not constitute compliance with the requirements for a Bulk Medical Gas Systems Installer per ASSE Standard 6015, Medical Gas Systems Inspector per ASSE Standard 6020, Medical Gas Systems Verifier per ASSE Standard 6030, Bulk Medical Gas Systems Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050 or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

10-1.4 Reference and Industry Standards

The reference and industry standards listed in ASSE Standard 6001 are a part of this standard.

10-2.1 General Knowledge

10-2.1.1 The Medical Gas Systems Installer shall be able to identify and demonstrate knowledge of the applicable laws, codes, rules, listing agencies and regulations from the federal, state and local levels pertaining to medical gas and vacuum systems.

10-2.1.2 The Medical Gas Systems Installer shall be able to identify and describe the actions that take place prior to and after installing and testing a medical gas system, including notification to:

- a) Architect/engineer of record
- b) Job inspector
- c) Premise owners
- d) Proper authorities (Authority Having Jurisdiction (AHJ))

10-2.1.3 The Medical Gas Systems Installer shall be able to identify and describe the basic concepts pertaining to:

- a) Absolute pressure
- b) Alarm panel locations
- c) Alarm settings
- d) Atmospheric pressure
- e) Category 3 gas-powered device supply systems
- f) Category 3 medical gas systems
- g) Category 3 vacuum and scavenging systems
- h) Gauge pressure
- i) Hyperbaric medical gas piping systems and accessories
- j) Instrument air
- k) Personal protection from infectious pathogens
- k) Manual valves, including source valves, main valves, riser valves, service valves, in-line valves, zone valves and valves for future connections
- l) Manufactured assemblies
- m) Medical gas rails (MGR)
- n) Medical support gases
- o) Medical-surgical vacuum
- p) Oxygen deficient atmosphere
- q) Oxygen enriched atmosphere
- r) Patient medical gases

- s) Pressure and vacuum sensors
- t) Station outlets/inlets
- u) Vacuum measurement
- v) Ventilation
- w) Waste anesthesia gas disposal (WAGD)
- x) Zone valve locations

10-2.2 Product Performance Knowledge

- 10-2.2.1 The Medical Gas Systems Installer shall be able to list the parts and identify the major components of medical gas and vacuum systems and equipment.
- 10-2.2.2 The Medical Gas Systems Installer shall be able to describe the categories of medical gas and vacuum systems with respect to Chapter 4 of NFPA 99-2015
- 10-2.2.3 The Medical Gas Systems Installer shall be able to identify and describe the operating principles and performance characteristics of medical gas and vacuum systems, and identify the following components:
- a) Master, area and local alarm systems
 - b) Medical air compressors and accessories
 - c) Medical air proportioning systems
 - d) Medical gas manifolds
 - e) Medical gas outlets
 - f) Medical support gas systems and their components
 - g) Medical-surgical vacuum systems and their components
 - h) Operation of bulk medical gas supplies
 - i) Pressure and vacuum switches and transducers
 - j) Pressure regulating valves
 - k) Pressure relief valves
 - l) Shut-off valves
 - m) Vacuum inlets
 - n) Waste anesthetic gas disposal (WAGD) systems

10-2.3 Product Installation Knowledge

- 10-2.3.1 The Medical Gas Systems Installer shall be able to identify and describe the proper installation requirements for medical gas and vacuum systems pertaining to:
- a) Local jurisdiction requirements
 - b) Manufacturer recommendations
 - c) Physical location, ventilation and accessibility
- 10-2.3.2 The Medical Gas Systems Installer shall be able to identify and describe the problems resulting from the improper installation of medical gas and vacuum systems.

10-2.4 System and System Component Testing Knowledge

- 10-2.4.1 The Medical Gas Systems Installer shall be able to describe test procedures associated with the following components:
- a) Brazed joints
 - b) Master, area, and local alarm systems
 - c) Medical air compressors and accessories
 - d) Medical air proportioning systems
 - e) Medical gas manifolds
 - f) Medical gas outlets
 - g) Medical support gas system components
 - h) Medical-surgical vacuum system components
 - i) Pressure and vacuum switches and transducers
 - j) Pressure regulating valves
 - k) Pressure relief valves
 - l) Shut-off valves
 - m) Vacuum inlets
 - n) Vacuum systems and components
 - o) Waste anesthetic gas disposal (WAGD) systems
 - p) Welded joints
- 10-2.4.2 The Medical Gas Systems Installer shall be able to identify and describe procedures for the use of the following:
- a) Flow meter
 - b) Leak detectants
 - c) Oxygen analyzer
 - d) Pressure gauge
 - e) Vacuum gauge
- 10-2.4.3 The Medical Gas Systems Installer shall be able to describe the precautions and hazards associated with:
- a) Biological pathogens
 - b) Confined spaces
 - c) Cryogenics
 - d) Electricity
 - e) Pressure
 - f) Shutdowns
 - g) Site conditions
 - h) Tool usage
- 10-2.4.4 The Medical Gas Systems Installer shall be able to demonstrate knowledge of the following:
- a) Acceptable pipeline materials and joining methods
 - b) Brazing materials
 - c) Qualifications of brazers and welders
 - d) Installer-performed testing
 - e) Pipeline installation requirements
 - f) Proper labeling requirements
 - g) Proper material handling
 - h) Qualifications of brazing and welding procedures
 - i) Verification tests

10-2.5 Documenting and Recording

- 10-2.5.1 The Medical Gas Systems Installer shall be able to identify and report the physical locations for the following items on “as-built” drawings:
- a) Emergency oxygen supply connection (EOSC)
 - b) Main line shut-off valves
 - c) Master, area and local alarm panels
 - d) Medical support gas outlets
 - e) Medical-surgical vacuum inlets
 - f) Patient medical gas outlets
 - g) Pressure and vacuum switches and transducers
 - h) Pressure regulating valves
 - i) Pressure relief valves
 - j) Riser valves
 - k) Service valves
 - l) Source equipment for each patient medical gas
 - m) Source equipment for each medical support gas
 - n) Source equipment for medical-surgical vacuum
 - o) Source equipment for WAGD
 - p) Source shut-off valves
 - q) Zone valves
- 10-2.5.2 The Medical Gas Systems Installer shall be able to document and submit a written report (see Annex M) on all performance testing to the hospital, verifier, inspector or Authority Having Jurisdiction (AHJ) as necessary. Written reports shall include, as a minimum, the following:
- a) Date of test
 - b) Name of tester
 - c) System tested
 - d) Test performed
 - e) Test pressure and pressure loss, where applicable
 - f) Test results (pass/fail)
 - g) Test witnessed by

- 10-3.2.2 Certification shall include the successful completion of a minimum 32-hour training course covering ASSE 6010 and applicable sections of NFPA 99. Course instruction shall be conducted by a Medical Gas Systems Instructor certified to ASSE 6050.

- 10-3.2.3 Certification to this standard shall be through a recognized third-party certification agency. Certification shall include a written and a practical examination covering ASSE 6010 and applicable sections of NFPA 99. The written exam shall be a minimum of 100 questions with a minimum passing score of 70%. The practical exam shall be a brazing exam in accordance with NFPA 99-2015.

10-3.3 Recertification

- 10-3.3.1 Medical Gas Systems Installers shall be recertified through a minimum 4-hour training course to subsequent editions of NFPA 99.
- 10-3.3.2 Recertification shall be through a recognized third-party certification agency and include a test to subsequent editions of NFPA 99. The written exam shall be a minimum of 25 questions with a minimum passing score of 70%.

10-3.1 Terminology

- 10-3.1.1 The Medical Gas Systems Installer shall be able to demonstrate a basic working knowledge of all terminology listed in ASSE Standard 6001, as used in NFPA 99-2015.

10-3.2 Certification of Medical Gas Systems Installers

- 10-3.2.1 The candidates for the ASSE 6010 certification shall have a minimum of four (4) years of documented practical experience in the field of installation of plumbing or mechanical piping systems.

Bulk Medical Gas Systems Installers

15-1.1 Scope

This standard applies to any individual who installs bulk or micro-bulk systems for medical gas at health care facilities. Bulk systems for medical gas covered in this standard include health care facilities within the scope of NFPA 99-2015, *Health Care Facilities Code*, and NFPA 55. Installers include anyone who works on or installs bulk medical gas systems or bulk medical gas system components, including brazers and welders on bulk medical gas supply systems.

15-1.2 Purpose

The purpose of this standard is to provide minimum performance criteria, identified by industry consensus, for the qualification of Bulk Medical Gas Systems Installers to ensure compliance with the referenced standards in Section 15-1.4.

15-1.3 Limitations for a Bulk Medical Gas Systems Installer

Compliance with this standard in itself shall not constitute compliance with the requirements for a Medical Gas Systems Installer per ASSE Standard 6010, Medical Gas Systems Inspector per ASSE Standard 6020, Medical Gas Systems Verifier per ASSE Standard 6030, Bulk Medical Gas Systems Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050 or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

15-1.4 Reference and Industry Standards

The applicable reference and industry standards listed in ASSE Standard 6001 are a part of this standard.

15-2.1 General Knowledge

15-2.1.1 The Bulk Medical Gas Systems Installer shall be able to identify and demonstrate knowledge of NFPA 99-2015, NFPA 55, CGA M-1, as well as all standards referenced in Section 15-1.4 and all applicable laws, codes, rules, listing agencies and regulations from the federal, state and local levels pertaining to bulk systems for medical gases.

15-2.1.2 The Bulk Medical Gas Systems Installer shall be able to demonstrate current training and knowledge of the *United States Food Drug and Cosmetic Act*, the Food and Drug Administration (FDA) *Current Good Manufacturing Practices* (CGMPs), Parts 210, 211 and 820, and how they pertain to all aspects of medical gas bulk systems installation.

15-2.1.3 The Bulk Medical Gas Systems Installer shall be able to demonstrate knowledge of their firm's standard operating procedures (SOPs), as approved by the firm's quality control unit (QCU), and how they pertain to all aspects of medical gas bulk systems installation.

15-2.1.4 The Bulk Medical Gas Systems Installer shall be able to describe the following actions that take place prior to and after installing and testing a bulk system for medical gas:

- a) Documentation requirements
- b) Maintenance of the system
- c) Procurement of components
- d) Selection and qualification of components
- e) Sizing of the bulk medical gas system
- f) Temporary supply systems
- g) Training of healthcare facility personnel on the operation of the bulk medical gas supply system

15-2.1.5 The Bulk Medical Gas Systems Installer shall be able to describe the basic concepts pertaining to:

- a) Cryogenic gases
 - 1) Properties
 - 2) Hazards

- b) Properties of gases
 - 1) Oxygen deficient atmosphere
 - 2) Oxygen enriched atmosphere
- c) Oxygen cleanliness
- d) Requirements for medical gases
 - 1) As defined by the CGMPs
 - 2) United States Pharmacopoeia / National Formulary testing requirements
- e) Testing requirements for the bulk medical gas supply system
- f) Security requirements
- g) Site access
- h) Labeling and identification
- i) Hazardous work permitting
 - 1) Hot work
 - 2) Lock out, tag out
- j) Personnel protection equipment
- k) Hyperbaric medical gas piping systems and accessories
- l) Medical air proportioning systems

- c) The first filling of a cryogenic vessel
 - 1) Vessel purging
 - 2) Vessel cool down
- d) System purging
- e) Physical location
 - 1) Ventilation
 - 2) Accessibility
- f) Local jurisdiction requirements

15-2.3.2 The Bulk Medical Gas Systems Installer shall be able to identify and describe the problems resulting from the improper installation of a bulk medical gas system.

15-2.4 System and System Component Testing Knowledge

15-2.4.1 The Bulk Medical Gas Systems Installer shall be able to describe test procedures associated with the following components:

- a) Final line pressure regulators
- b) Main supply
- c) Medical gas manifolds
- d) Pressure regulating valves
- e) Pressure relief valves
- f) Pressure switches and transducers
- g) Reserve supply
- h) Shut-off valves
- i) Vaporization system

15-2.4.2 The Bulk Medical Gas Systems Installer shall be able to identify and describe procedures for the use and calibration of the following:

- a) Flow meter
- b) Oxygen analyzer
- c) Pressure gauge

15-2.4.3 The Bulk Medical Gas Systems Installer shall be able to describe the precautions and hazards associated with:

- a) Biological pathogens
- b) Confined spaces
- c) Cryogenics
- d) Electricity
- e) Pressure
- f) Shutdowns
- g) Site conditions
- h) Tool usage

15-2.4.4 The Bulk Medical Gas Systems Installer shall be able to demonstrate knowledge of the following:

- a) Acceptable pipeline materials
- b) Brazing materials
- c) Qualification of brazers and welders
- d) Installer-performed testing
- e) Material inspection and acceptance

15-2.2 Product Performance Knowledge

15-2.2.1 The Bulk Medical Gas Systems Installer shall be able to list the parts and identify the major components of a bulk system for medical gas.

15-2.2.2 The Bulk Medical Gas Systems Installer shall be able to identify and describe the operating principles and performance characteristics of a bulk medical gas system, and identify the following components:

- a) Bulk medical gas system alarms
- b) Fill circuit and individual components
- c) Gas economizing system
- d) Liquid level gauge
- e) Main supply
- f) Pressure building system
- g) Pressure regulating valves
- h) Pressure relief valves
- i) Product withdrawal
- j) Reserve supply
- k) Shut-off valves
- l) Source valve
- m) Vaporization system
- n) Vessel vacuum and insulation

15-2.3 Product Installation Knowledge

15-2.3.1 The Bulk Medical Gas Systems Installer shall be able to identify and describe the proper installation requirements for bulk medical gas systems pertaining to:

- a) The firm's standard operating procedures (SOPs)
- b) Manufacturer recommendations

- f) Proper labeling requirements
- g) Proper material handling
- h) Qualification of brazing procedures
- i) System installation requirements
- j) Vendor qualifications
- k) Verification tests

15-2.5 Documenting and Recording

15-2.5.1 The Bulk Medical Gas Systems Installer shall be able to describe and document the following activities:

- a) System validation
 - 1) Installation qualification (IQ)
 - 2) Operation qualification (OQ)
 - 3) Performance qualification (PQ)
- b) Revalidation
- c) Change management
- d) System documentation, record keeping requirements
- e) Quality control unit (QCU) acceptance

15-2.5.2 The Bulk Medical Gas Systems Installer shall be able to identify and report the physical locations for the following items on “as-built” drawings of a bulk medical gas system:

- a) Emergency oxygen supply connection (EOSC)
- b) In-building emergency reserve
- c) Main bulk medical gas supply
- d) Main bulk medical gas supply shut-off valves
- e) Pressure regulating valves
- f) Pressure relief valves
- g) Pressure switches and transducers
- h) Reserve bulk medical gas supply
- i) Reserve bulk medical gas supply shut-off valve
- j) Source shut-off valves
- k) Vaporizers

15-2.5.3 The Bulk Medical Gas Systems Installer shall be able to document and submit a written report on all performance testing to the hospital, verifier, inspector or Authority Having Jurisdiction (AHJ) as necessary.

Written reports shall include, as a minimum, the following:

- a) Date of test
- b) Name of tester
- c) System tested
- d) Test performed
- e) Test pressure and pressure loss, where applicable
- f) Test results (pass/fail)
- g) The firm’s QCU acceptance

15-3.1 Terminology

15-3.1.1 The Bulk Medical Gas Systems Installer shall be able to demonstrate a basic working knowledge of all terminology listed in the FDA CGMPs, CGA M-1 and the applicable terminology of ASSE Standard 6001, as used in NFPA 99-2015 and NFPA 55.

15-3.2 Certification of Bulk Medical Gas Systems Installers

15-3.2.1 Certification to this standard shall be through a method approved by the firm’s quality control unit (QCU).

15-3.2.2 The candidates for ASSE 6015 certification shall have documented practical experience in the installation of bulk medical gas systems in accordance with the firm’s standard operating procedures (SOPs).

15-3.2.3 Certification shall include the successful completion of a minimum 32-hour training course covering the firm’s SOPs as they relate to bulk medical gas installations, the FDA CGMPs, CGA M-1 and applicable sections of ASSE/IAPMO/ANSI Series 6000, NFPA 99 and NFPA 55. Course instruction shall be conducted by a Bulk Medical Gas Systems Instructor certified to ASSE 6055.

15-3.2.4 Certification to this standard shall be through a recognized third-party certification agency. Certification shall include a written and a practical examination covering the firm’s SOPs as they relate to bulk medical gas installations, the FDA CGMPs, CGA M-1 and applicable sections of ASSE/IAPMO/ANSI Series 6000, NFPA 99 and NFPA 55. The written exam shall be a minimum of 100 questions with a minimum passing score of 70%.

15-3.3 Recertification

15-3.3.1 Bulk Medical Gas Systems Installers shall be recertified through a minimum 4-hour training course to subsequent editions of NFPA 99 and applicable editions of CGA M-1 and NFPA 55.

15-3.3.2 Recertification shall be through a recognized third-party certification agency and include a test to subsequent editions of NFPA 99 and applicable editions of CGA M-1 and NFPA 55. The written exam shall be a minimum of 25 questions with a minimum passing score of 70%.

Medical Gas Systems Inspectors

20-1.1 Scope

This standard applies to any individual who inspects the installation of medical gas and vacuum distribution systems. Medical gas systems and equipment covered in this standard include health care facilities within the scope of NFPA 99-2015, *Health Care Facilities Code*. Medical gas systems include vacuum systems.

20-1.2 Purpose

The purpose of this standard is to provide minimum performance criteria, identified by an industry consensus, for the qualification of Medical Gas Systems Inspectors to ensure compliance with the referenced standards in Section 20-1.4.

20-1.3 Limitations for a Medical Gas Systems Inspector

Compliance with this standard in itself shall not constitute compliance with the requirements for a Medical Gas Systems Installer per ASSE Standard 6010, Bulk Medical Gas Systems Installer per ASSE Standard 6015, Medical Gas Systems Verifier per ASSE Standard 6030, Bulk Medical Gas Systems Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050 or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

20-1.4 Reference and Industry Standards

The reference and industry standards listed in ASSE Standard 6001 are a part of this standard.

20-2.1 General Knowledge

20-2.1.1 The Medical Gas Systems Inspector shall be able to identify and show knowledge of the applicable laws, codes, rules, listing agencies and regulations from the federal, state and local levels pertaining to medical gas and vacuum systems.

20-2.1.2 The Medical Gas Systems Inspector shall be able to identify and describe the basic concepts pertaining to:

- a) Absolute pressure
- b) Alarm panel locations
- c) Alarm settings
- d) Atmospheric pressure
- e) Gauge pressure
- f) Manual valves, including source valves, main valves, riser valves, service valves, in-line valves, zone valves and valves for future connection
- g) Medical support gases
- h) Medical-surgical vacuum
- i) Oxygen deficient atmosphere
- j) Oxygen enriched atmosphere
- k) Patient medical gases
- l) Pressure and vacuum sensors
- m) Vacuum measurement
- n) Waste anesthesia gas disposal (WAGD)
- o) Zone valve locations

20-2.2 Product Performance Knowledge

20-2.2.1 The Medical Gas Systems Inspector shall be able to list the parts and identify the major components of medical gas and vacuum systems and equipment.

20-2.2.2 The Medical Gas Systems Inspector shall be able to describe the categories of medical gas and vacuum systems with respect to Chapter 4 of NFPA 99-2015.

20-2.2.3 The Medical Gas Systems Inspector shall be able to identify and describe the operating principles and performance characteristics of medical gas and vacuum systems, and identify the following components:

- a) Master, area and local alarm systems
- b) Medical air compressors and accessories
- c) Medical air proportioning systems
- d) Medical gas manifolds
- e) Medical gas outlets
- f) Medical support gas systems and their components
- g) Medical-surgical vacuum systems and their components
- h) Operation of bulk medical gas supplies
- i) Pressure and vacuum switches and transducers
- j) Pressure regulating valves
- k) Pressure relief valves
- l) Shut-off valves
- m) Vacuum inlets
- n) Waste anesthetic gas disposal (WAGD) systems

- r) Welded joints

20-2.4.2 The Medical Gas Systems Inspector shall be able to identify and describe procedures for the use of the following:

- a) Flow meter
- b) Leak detectants
- c) Oxygen analyzer
- d) Pressure gauge
- e) Vacuum gauge

20-2.5 Documenting and Recording of Inspections and Tests Knowledge

The Medical Gas Systems Inspectors shall be familiar with the check lists contained in the annexes of ASSE/IAPMO/ANSI Series 6000.

20-2.3 Product Installation Knowledge

- 20-2.3.1 The Medical Gas Systems Inspector shall be able to describe the proper installation requirements for medical gas systems relating to:
- a) Local jurisdiction requirements
 - b) Manufacturer recommendations
 - c) Physical location, ventilation and accessibility
- 20-2.3.2 The Medical Gas Systems Inspector shall be able to identify and describe the problems resulting from the improper installation of medical gas systems.

20-3.1 Terminology

- 20-3.1.1 The Medical Gas Systems Inspector shall be able to demonstrate a basic working knowledge of all terminology listed in ASSE Standard 6001, as used in NFPA 99-2015 and other listed industry standards.

20-2.4 System and System Component Testing Knowledge

- 20-2.4.1 The Medical Gas Systems Inspector shall be able to describe test procedures associated with the following components:
- a) Brazed joints
 - b) Bulk medical gas supplies
 - c) Master, area and local alarm systems
 - d) Medical air compressors and accessories
 - e) Medical air proportioning systems
 - f) Medical gas manifolds
 - g) Medical gas outlets
 - h) Medical support gas system components
 - i) Medical-surgical vacuum pumps and accessories
 - j) Micro-bulk medical gas supplies
 - k) Pressure and vacuum switches and transducers
 - l) Pressure regulating valves
 - m) Pressure relief valves
 - n) Shut-off valves
 - o) Vacuum inlets
 - p) Vacuum systems and components
 - q) Waste anesthetic gas disposal (WAGD) systems

20-4.1 Certification of Medical Gas Inspectors

- 20-4.1.1 The candidates for ASSE 6020 certification shall be employed by a governmental unit as a plumbing and/or mechanical inspector, or as an administrator of such inspectors, or be a person regularly involved in the design, inspection or verification of medical gas systems, or be a 6010 installer. Candidates shall have a minimum of two (2) years of documented practical experience or any combination of the above.
- 20-4.1.2 Certification shall include the successful completion of a minimum 24-hour training course covering ASSE Standard 6020 and applicable sections of NFPA 99-2015 and NFPA 55. Course instruction shall be conducted by a Medical Gas Systems Instructor certified to ASSE 6050.
- 20-4.1.3 Certification to this standard shall be through a recognized third-party certification agency. Certification shall include a written examination covering ASSE Standard 6020 and applicable sections of NFPA 99-2015 and NFPA 55. The written exam shall be a minimum of 100 questions with a minimum passing score of 70%.

20-4.2 Recertification

- 20-4.2.1 Medical Gas Systems Inspectors shall be recertified through a minimum 4-hour training course to subsequent editions of NFPA 99.
- 20-4.2.2 Recertification shall be through a recognized third-party certification agency and include a test to subsequent editions of NFPA 99. The written exam shall be a minimum of 25 questions with a minimum passing score of 70%.

Medical Gas Systems Verifiers

30-1.1 Scope

This standard applies to any individual who tests and verifies the operation of medical gas and vacuum systems. Where a medical gas system is supplied by a bulk medical gas supply system, the ASSE 6030 Medical Gas Systems Verifier shall test and verify the work on the patient side of the bulk system supply source valve. (Note: Bulk medical gas supply systems shall be verified by persons certified to ASSE 6035). Medical gas systems and equipment covered in this standard include health care facilities within the scope of NFPA 99-2015, *Health Care Facilities Code*. Medical gas systems include medical/surgical vacuum systems.

30-1.2 Purpose

The purpose of this standard is to provide minimum performance criteria, identified by industry consensus, for the qualification of Medical Gas Systems Verifiers to ensure compliance with the referenced standards in Section 30-1.4.

30-1.3 Limitations for a Medical Gas Systems Verifier

Compliance with this standard in itself shall not constitute compliance with the requirements for a Medical Gas Systems Installer per ASSE Standard 6010, Bulk Medical Gas Systems Installer per ASSE Standard 6015, Medical Gas Systems Inspector per ASSE Standard 6020, Bulk Medical Gas Systems Verifier per ASSE Standard 6035, Medical Gas Systems Maintenance Person per ASSE Standard 6040, Medical Gas Systems Instructor per ASSE Standard 6050 or Bulk Medical Gas Systems Instructor per ASSE Standard 6055.

30-1.4 Reference Standards

The reference and industry standards listed in ASSE Standard 6001 are a part of this standard.

30-2.1 General Knowledge

30-2.1.1 The Medical Gas Systems Verifier shall be able to identify and show knowledge of NFPA 99-2015, as well as all standards referenced in Section 30-1.4 and all applicable laws, codes, rules, listing agencies and regulations from the federal, state and local levels pertaining to medical gas and vacuum systems.

30-2.1.2 The Medical Gas Systems Verifier shall be able to identify and describe the basic concepts pertaining to medical gas systems as stated in NFPA 99, including, but not limited to, the following:

- a) Absolute pressure
- b) Alarm panel locations
- c) Alarm settings
- d) Atmospheric pressure
- e) Dynamic (flowing) pressure
- f) Gauge pressure
- g) Hyperbaric medical gas piping systems and accessories
- h) Manual valves including source valves, main valves, riser valves, service valves, in-line valves, zone valves and valves for future connections
- i) Medical support gases
- j) Medical-surgical vacuum
- k) Oxygen deficient atmosphere
- l) Oxygen enriched atmosphere
- m) Patient medical gases
- n) Patient safety
- o) Pressure and vacuum sensors
- p) Static pressure
- q) Vacuum measurement
- r) Ventilation of storage areas
- s) Waste anesthetic gas disposal (WAGD) systems
- t) Zone valve locations