

SECTION 22 63 13 - GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Nitrogen piping and specialties designated "medical nitrogen" operating at 160 to 185 psig (1100 to 1275 kPa).
2. Nitrous oxide piping and specialties designated "medical nitrous oxide" operating at 50 to 55 psig (345 to 380 kPa).
3. Oxygen piping and specialties designated "medical oxygen" operating at 50 to 55 psig (345 to 380 kPa).

- B. Owner-Furnished Material:

1. Ceiling columns and panels.
2. Owner will furnish gases for medical gas concentration testing specified in this Section.
3. Supply of gases in cylinders or containers as appropriate for manifolds.
4. Initial supply of liquid oxygen.
5. Bulk cryogenic systems. Coordinate all plumbing and alarm connections to the bulk gas source, source start-up and system testing, providing the owner with systems ready for use.

- C. Related Sections include the following

1. Division 22 Section "Compressed-Air Piping for Laboratory and Healthcare Facilities" for compressed-air piping systems for laboratory and healthcare facilities.
2. Division 22 Section "Vacuum Piping for Laboratory and Healthcare Facilities" for vacuum piping systems for laboratory and healthcare facilities.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. D.I.S.S.: Diameter-index safety system.

- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- D. Medical gas piping systems include medical carbon dioxide, medical nitrogen, medical nitrous oxide and medical oxygen nonflammable gas for healthcare facility patient care or for healthcare laboratory applications.
- E. Specialty Gas: Gas, other than medical gas, for nonmedical laboratory facility applications.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Gas manifolds and bulk gas storage tanks and piping shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Tubes and fittings.
 - 2. Valves and valve boxes.
 - 3. Medical gas service connections.
 - 4. Electrical service connections.
 - 5. Medical nitrogen pressure control panels.
 - 6. Ceiling columns. Include integral service connections.
 - 7. Medical gas alarm system components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 requirements.
- D. Qualification Data: For Installer.
- E. Brazing certificates.
- F. Manufacturer Seismic Qualification Certification: Submit certification that gas manifolds and bulk gas storage tanks, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- G. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.

- H. Field quality-control test reports.
- I. Operation and Maintenance Data: For medical gas piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Gas Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010 for installers.
2. All materials used shall be new and of the best grade and quality obtainable and workmanship shall be first class in every respect. Contractor shall be responsible for compliance with all local, state or federal codes.
3. Provide all elements and accessories required for complete system per NFPA 99 most recent edition.
4. Contractor shall make all necessary connections to owner furnished equipment.
5. Install all piping as shown on drawings, as described herein and as described in section 1050, basic materials and methods, using methods of fabrication, grading, testing, repairing, cleaning and other procedures as described.
6. Electrical power wiring for vacuum pumps, medical air compressors, WAGD producers, ceiling columns, alarms and modular accessories associated with the system shall be part of the electrical contract. Any equipment supplied by this contractor that require additional electrical services shall be the responsibility of this contractor to supply these services.
7. Perform installer pressure testing, cross connection testing and final testing per NFPA 99 most recent edition and using procedures as specified.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- E. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- F. NFPA Compliance:
 - 1. Comply with NFPA 50, "Bulk Oxygen Systems at Consumer Sites," for bulk oxygen storage tanks.
 - 2. Comply with NFPA 99, "Health Care Facilities," for medical gas piping system materials and installation.
- G. CGA Compliance: Comply with CGA G-8.1, "Nitrous Oxide Systems at Consumer Sites," for bulk nitrous oxide storage tanks.
- H. UL Compliance:
 - 1. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.
 - 2. Comply with UL 544, "Medical and Dental Equipment," for medical gas specialties.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate medical gas service connections with other service connections. Compressed-air service connections are specified in Division 22 Sections "Compressed-Air Piping for Laboratory and Healthcare Facilities" and "Vacuum Piping for Laboratory and Healthcare Facilities."
- C. Work with metal and stud partition installer and/or mason to ensure anchors, sleeves and similar items are provided in sufficient time to avoid delays, chases and openings are properly sized and prepared.
- D. Medical gas contractor shall supply and install the master alarm system and area alarm systems, including the signal wiring. The electrical contractor shall provide power wiring to each alarm panel. The medical gas contractor is responsible for proper termination, testing and marking of alarm panels. Termination shall be done under supervision of manufacturer of alarm panels.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.
 - a. Medical Air: Equal to 10 percent of amount installed.

- b. Medical Carbon Dioxide: Equal to 10 percent of amount installed.
 - c. Medical Nitrous Oxide: Equal to 10 percent of amount installed.
 - d. Medical Oxygen: Equal to 10 percent of amount installed.
 - e. Medical Vacuum: Equal to 10 percent of amount installed.
 - f. WAGD Evacuation: Equal to 10 percent of amount installed.
2. D.I.S.S. Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets complying with CGA V-5.
- a. Medical Air D.I.S.S. No. 1160: Equal to 10 percent of amount installed.
 - b. Medical Carbon Dioxide D.I.S.S. No. 1080: Equal to 10 percent of amount installed.
 - c. Medical Nitrogen D.I.S.S. No. 1120: Equal to 10 percent of amount installed.
 - d. Medical Nitrous Oxide D.I.S.S. No. 1040: Equal to 10 percent of amount installed.
 - e. Medical Oxygen D.I.S.S. No. 1240: Equal to 10 percent of amount installed.
 - f. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of amount installed.
 - g. WAGD Evacuation D.I.S.S. No. 2220: Equal to 10 percent of amount installed.
3. Vacuum Bottle Brackets: Equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Copper Medical Gas Tube: ASTM B 819, Types K and L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
1. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
 2. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 3. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 4. Press-Type Fittings:
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Viega; Plumbing and Heating Systems.

- c. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - d. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
5. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory-alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Smart Technology, Inc.

2.2 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- B. Threaded-Joint Tape: PTFE.

2.3 VALVES

- A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
- B. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. BeaconMedaes.
 - b. Conbraco Industries, Inc.
 - c. NIBCO INC.
 - 4. Pressure Rating: 300 psig (2070 kPa) minimum.
 - 5. Ball: Full-port, chrome-plated brass.
 - 6. Seats: PTFE or TFE.
 - 7. Handle: Lever type with locking device.
 - 8. Stem: Blowout proof with PTFE or TFE seal.
 - 9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

- C. Check Valves: In-line pattern, bronze.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - a. BeaconMedaes.
 - b. Conbraco Industries, Inc.
 4. Pressure Rating: 300 psig (2070 kPa) minimum.
 5. Operation: Spring loaded.
 6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
- D. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.
 4. Pressure Rating: 300 psig (2070 kPa) minimum.
 5. Ball: Full-port, chrome-plated brass.
 6. Seats: PTFE or TFE.
 7. Handle: Lever type with locking device.
 8. Stem: Blowout proof with PTFE or TFE seal.
 9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 10. Pressure Gage: Manufacturer-installed on one copper-tube extension.
- E. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.
 4. Interior Finish: Factory-applied white enamel.
 5. Cover Plate: Aluminum or extruded-anodized aluminum with frangible or removable windows.
 6. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- F. Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - a. Tri-Tech Medical.
 - b. BeaconMedaes.
 - c. Chemetron Div.
 4. Interior Finish: Factory-applied white enamel.
 5. Cover Plate: Aluminum or extruded-anodized aluminum with frangible or removable windows.
 6. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- G. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.

4. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
 5. Inlet: Manufacturer-installed, NPS 1 or NPS 1-1/4 (DN 25 or DN 32), ASTM B 819, copper tubing with NPS 1 (DN 25) minimum ball valve and plugged inlet.
 6. Safety Valve: Bronze-body, pressure relief valve set at 75 or 80 psig (520 or 550 kPa).
 7. Instrumentation: Pressure gage.
- H. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
- I. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig (1725-kPa) minimum inlet pressure; and capable of controlling delivered gas pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.

2.4 MEDICAL GAS SERVICE CONNECTIONS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
1. Amico Corporation.
 2. BeaconMedaes.
- D. General Requirements for Medical Gas Service Connections,: For specific medical gas pressure and suction service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
1. Roughing-in Assembly:
 - a. Steel outlet box for recessed mounting and concealed piping.
 - b. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
 - c. Double seals that will prevent gas leakage.
 - d. ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 2. Finishing Assembly:
 - a. Brass housing with primary check valve.

- b. Double seals that will prevent gas leakage.
 - c. Cover plate with gas-service label.
3. Quick-Coupler Service Connections: Pressure outlets for nitrogen service connections with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 4. D.I.S.S. Service Connections: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - a. Medical Nitrogen Service Connections: D.I.S.S. No. 1120.
 5. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish and permanent, color-coded, identifying label matching corresponding service.

2.5 MEDICAL NITROGEN PRESSURE CONTROL PANELS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 1. BeaconMedaes (Nitrogen Control Panel Series 6-120276-XX) (IA Control Panel Series 6-12-274-00) (Air Control Panel Series 6-120881-00)
- D. Description: Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 1. Minimum Working Pressure: 200 psig (1380 kPa).
 2. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 3. Pressure Gages: 0- to 300-psig (0- to 2070-kPa) range.
 4. Service Connection: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
 5. Before final assembly, provide temporary dust shield and U-tube for testing.
 6. Label cover plate "Nitrogen Pressure Control."

2.6 MEDICAL GAS PIPING ALARM SYSTEMS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
 - 1. Amico Corporation.
 - 2. BeaconMedaes.
- D. Panels for medical gas piping systems may be combined in single panels with medical compressed-air and medical vacuum piping systems.
- E. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
- F. Pressure Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - 1. Low-Pressure Operating Range: 0- to 100-psig (0- to 690-kPa).
 - 2. High-Pressure Operating Range: Up to 250-psig (1725-kPa).
- G. General Requirements for Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - 1. Mounting: Recessed installation.
 - 2. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
- H. Master Alarm Panels: With separate trouble alarm signals, pressure gages, and indicators for medical gas piping systems.
 - 1. Include alarm signals when the following conditions exist:
 - a. Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - b. Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa) and changeover is made to alternate bank.
 - c. Medical Nitrous Oxide: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, and reserve level is low.
 - d. Medical Nitrous Oxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.

- e. Medical Oxygen: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - f. Medical Oxygen: Pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
- I. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; pressure gages; and indicators for medical gas piping systems.
 - 1. Include alarm signals when the following conditions exist:
 - a. Medical Nitrous Oxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - b. Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa).
 - c. Medical Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - J. Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
 - 1. Include alarm signals when the following conditions exist:
 - a. Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
- 2.7 COMPUTER INTERFACE CABINET
- A. Description: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical gas system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20 alarm signals.
- 2.8 SLEEVES
- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 - B. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.9 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Escutcheons: Cast iron.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.10 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.11 NITROGEN

- A. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing are not available or if precleaned fittings or tubing must be recleaned

because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction, perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING APPLICATIONS

- A. Medical Gas Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
- B. Medical Nitrogen Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
- C. Medical Nitrogen Piping NPS 2-1/2 (DN 65) and Smaller: Type K, copper medical gas tube; wrought-copper fittings; and brazed joints.
- D. Medical Nitrogen Piping NPS 3 (DN 80) and Larger: Type K, copper tube; wrought-copper fittings; and brazed joints.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Comply with ASSE Standard #6010 for installation of medical gas piping.
- C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.

- G. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
- H. Install piping to permit valve servicing.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
- L. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
- M. Install seismic restraints on gas piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- N. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- O. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- P. Install unions, in copper tubing adjacent to each valve and at final connection to each piece of equipment and specialty.

3.4 VALVE INSTALLATION

- A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
- B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
- E. Install pressure regulators on gas piping where reduced pressure is required.
- F. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve and with ball valve and check valve in supply main from bulk oxygen storage tank.

3.5 JOINT CONSTRUCTION

- A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- B. Threaded Joints: Apply appropriate tape to external pipe threads.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.
- D. Pressure-Sealed Joints: Join copper tube and press-type fittings with tools recommended by fitting manufacturer.
- E. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.

3.6 GAS SERVICE COMPONENT INSTALLATION

- A. Assemble patient service console with service connections. Install with supplies concealed, in walls. Attach console box or mounting bracket to substrate.
- B. Install nitrogen pressure-control panels in walls. Attach to substrate.
- C. Assemble ceiling columns and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
- D. Assemble ceiling assemblies and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
- E. Install gas manifolds anchored to substrate.
- F. Install gas cylinders and connect to manifold piping.
- G. Install gas manifolds with seismic restraints as indicated.
- H. Install bulk gas storage tanks and reserve supply tanks level on concrete bases. Set tanks and connect gas piping to tanks. Install tanks level and plumb, firmly anchored to concrete bases; maintain NFPA 50 and tank manufacturer's recommended clearances. Orient tanks so controls and devices are accessible for servicing.
- I. Install bulk gas storage tanks and reserve supply tanks with seismic restraints.

3.7 MEDICAL GAS PIPING ALARM SYSTEM INSTALLATION

- A. Install medical gas alarm system components in locations required by and according to NFPA 99.
- B. Install medical gas area and master alarm panels where indicated.
- C. Install computer interface cabinet with connection to medical gas piping alarm system and facility computer.

3.8 SLEEVE INSTALLATION

- A. Sleeves are not required for core-drilled holes.
- B. Permanent sleeves are not required for holes formed by removable PE sleeves.
- C. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe.
 - 1. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - 2. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- D. Install sleeves in new walls and slabs as new walls and slabs are constructed.
- E. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - 3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - a. Seal space outside of sleeve fittings with grout.
- F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.9 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.10 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - 2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
- H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
8. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
9. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
10. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
11. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
12. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
13. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
14. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.

- J. Install supports for vertical copper tubing every 10 feet (3 m).

3.11 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
1. Carbon Dioxide: Black or white letters on gray background.
 2. Nitrogen: White letters on black background.
 3. Nitrous Oxide: White letters on blue background.
 4. Oxygen: White letters on green background or green letters on white background.

3.12 FIELD QUALITY CONTROL FOR LABORATORY FACILITY SPECIALTY GAS

- A. Testing Agency: Engage qualified testing agency to perform field tests and inspections of specialty gas piping for nonhealthcare laboratory facilities and prepare test reports.
- B. Perform field tests and inspections of specialty gas piping for nonhealthcare laboratory facilities and prepare test reports.
- C. Tests and Inspections:
1. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.
3. Inspect specialty gas regulators for proper operation.

3.13 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.
- B. Perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.
- C. Tests and Inspections:
 1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blow down.
 - b. Initial pressure test.
 - c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for positive pressure medical gas piping.
 - f. Standing pressure test for vacuum systems.
 - g. Repair leaks and retest until no leaks exist.
 3. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical gas piping systems and perform the following tests and inspections:
 - a. Standing pressure test.
 - b. Individual-pressurization cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Piping particulate test.
 - g. Piping purity test.
 - h. Final tie-in test.
 - i. Operational pressure test.
 - j. Medical gas concentration test.
 - k. Medical air purity test.
 - l. Verify correct labeling of equipment and components.
 - m. Verify the following source equipment:
 - 1) Medical gas supply sources.
 4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

- a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.
- D. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.14 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain bulk gas storage tanks and medical gas alarm system. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION