

## SECTION 226113 - COMPRESSED-AIR PIPING FOR LABORATORY 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. Compressed-air piping and specialties for nonmedical laboratory facilities, designated "laboratory air."
- B. Related Sections include the following:
1. Division 11 Section "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.
  2. Division 12 Section "Laboratory Casework" for compressed-air outlets in casework.
  3. Division 22 Section "General-Service Compressed-Air Piping" for general-service compressed-air piping.
  4. Division 22 Section "Compressed-Air Equipment for Laboratory Facilities" for laboratory air compressors.

#### 1.3 SUBMITTALS

- A. Product Data: For the following:
1. Compressed-air valves and valve boxes.

#### 1.4 QUALITY ASSURANCE

- A. 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."

Retain first paragraph below only if specialties with electrical components are specified.

- B. 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.
- C. ASME Compliance:

1. Comply with ASME B31.1, "Power Piping," for laboratory compressed-air piping operating at more than 150 psig (1035 kPa).
2. Comply with ASME B31.9, "Building Services Piping," for laboratory compressed-air piping operating at 150 psig (1035 kPa) or less.

## 1.5 PROJECT CONDITIONS

Delete this Article if no interruption of existing compressed-air service is required.

- A. Interruption of Existing Laboratory Compressed-Air Service(s): Do not interrupt laboratory compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of laboratory compressed-air service(s).
  2. Do not proceed with interruption of laboratory compressed-air service(s) without Owner's written permission.

## 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 in 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.
- B. 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.
- C. Copper Water Tube: ASTM B 88, Type M (ASTM B 88M, Type C), seamless, drawn temper.
1. Copper Fittings: ASME B16.18, cast-copper or ASME B16.22, wrought-copper, solder-joint pressure type.

### 2.2 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

### 2.3 VALVES

Copper-alloy ball valves with copper-tube extensions, for use with copper medical gas tube, are available in NPS 4 (DN 100) and smaller. Wrought-copper reducer fittings are used with valves when NPS 5 (DN 125) or larger medical gas tube is required.

- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. NIBCO INC.
  - 2. Pressure Rating: 300 psig (2070 kPa) minimum.
  - 3. Ball: Full-port, chrome-plated brass.
  - 4. Seats: PTFE or TFE.

Retain locking-type handle in first subparagraph below if required.

- 5. Handle: Lever type with locking device.
    - 6. Stem: Blowout proof with PTFE or TFE seal.
    - 7. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
- C. Check Valves: In-line pattern, bronze.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
  - 2. Pressure Rating: 300 psig (2070 kPa) minimum.
  - 3. Operation: Spring loaded.
  - 4. 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. Pressure Rating: 300 psig (2070 kPa) minimum.
  - 2. Ball: Full-port, chrome-plated brass.
  - 3. Seats: PTFE or TFE.
  - 4. Handle: Lever type with locking device.
  - 5. Stem: Blowout proof with PTFE or TFE seal.
  - 6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
  - 7. Pressure Gage: Manufacturer installed on one copper-tube extension.

Retain one of first two paragraphs and associated subparagraphs below. Coordinate with Architect for intended aesthetic effects. Retain first paragraph for steel; retain second for aluminum.

- 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. Interior Finish: Factory-applied white enamel.
  - 2. Cover Plate: Aluminum or extruded-anodized aluminum with frangible or removable windows.
  - 3. 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. Interior Finish: Factory-applied white enamel.
  - 2. Cover Plate: Stainless steel with NAAMM AMP 503, No. 4 finish with frangible or removable windows.
  - 3. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
  
- G. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
  
- H. 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 air pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.

Add other drain valves if required.

- I. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket where wall mounting is indicated.

#### 2.4 COMPRESSED-AIR-CYLINDER STORAGE RACKS

Retain this Article if storage racks are required; detail storage racks on Drawings.

- A. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
  
- B. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.

## 2.5 FLEXIBLE PIPE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flex-Hose Co., Inc.
  - 2. Hyspan Precision Products, Inc.
  - 3. Metraflex, Inc.
  - 4. Universal Metal Hose; a Hyspan Co.
- B. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
  - 2. End Connections: Threaded copper pipe or plain-end copper tube.

## 2.6 NITROGEN

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

## PART 3 - EXECUTION

### 3.1 PREPARATION

### 3.2 PIPING APPLICATIONS

- A. Connect new tubing to existing tubing with memory-metal couplings.
- B. Laboratory Air Piping: Use the following piping materials for each size range:
  - 1. NPS 2 (DN 50) and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
  - 2. NPS 2-1/2(DN 65) and Larger: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
- C. Drain Piping: Use the following piping materials:
  - 1. Copper water tube, cast- or wrought-copper fittings, and soldered joints.

### 3.3 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic installation requirements.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air 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.

- C. Comply with ASSE Standard #6010 for installation of compressed-air piping.
- D. Install piping adjacent to equipment and specialties to allow service and maintenance.
- E. Install air and drain piping with 1 percent slope downward in direction of flow.
- F. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
- G. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- H. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- I. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."
- J. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- K. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.
- L. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.

### 3.4 VALVE INSTALLATION

- A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.
- B. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.
- 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 safety valves on compressed-air receivers where required by NFPA 99 and where recommended by specialty manufacturers.
- F. Install pressure regulators on compressed-air piping where reduced pressure is required.

- G. Install automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain so contents spill over or into it.
- H. Install flexible pipe connectors in discharge piping of each air compressor.

### 3.5 JOINT CONSTRUCTION

- A. 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.
- B. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
- C. 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 COMPRESSED-AIR SERVICE COMPONENT INSTALLATION

- A. Install compressed-air pressure control panel in walls. Attach to substrate.
- B. Install compressed-air manifolds on concrete base anchored to substrate.

Retain paragraph below if Contractor must provide compressed-air cylinders.

- C. Install compressed-air cylinders and connect to manifold piping.
- D. Install compressed-air-cylinder wall storage racks attached to substrate.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. 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.
- D. 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.
- E. Base of Vertical Piping: MSS Type 52, spring hangers.
- F. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.

- G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Maximum spans in remainder of this Article were taken from MSS SP-69 for copper tube and vapor service. Horizontal spacing also matches NFPA 99 for medical gas tubing.

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

### 3.8 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for nonmedical laboratory compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

### 3.9 FIELD QUALITY CONTROL FOR COMPRESSED-AIR PIPING IN NONMEDICAL LABORATORY FACILITIES

- A. Perform tests and inspections of compressed-air piping in nonmedical laboratory facilities and prepare test reports.
- B. Tests and Inspections:
1. Piping Leak Tests for Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air 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 filters and pressure regulators for proper operation.



3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain medical compressed-air alarm systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 226113