SECTION 22 61 13 – LABORATORY AND HEALTHCARE COMPRESSED-AIR AND VACUUM PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gas-powered-tool air piping and specialties, designated "instrument air," operating at 175 psig.

1.2 DEFINITIONS

A. PTFE: Polytetrafluoroethylene plastic.

B. TFE: Tetrafluoroethylene plastic.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide laboratory and healthcare compressed-air and vacuum piping systems that comply with NFPA 99, Level 4 requirements for materials and installation.

1.4 SUBMITTALS

A. Product Data:

1. Compressed-air and vacuum pipe, tube, and fittings.
2. Laboratory and healthcare compressed-air and vacuum valves and valve boxes.
3. Flexible pipe connectors.

B. Piping Material Certification: Signed by Installer certifying that healthcare compressed-air piping materials comply with NFPA 99 requirements.

C. Coordination Drawings: For laboratory compressed-air and vacuum systems. Include relationship to other services that serve same work area.

D. Field quality-control test reports.

E. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Gas Tube: ASTM B 819, Type L, seamless, drawn temper, that has been manufacturer cleaned, purged, and sealed according to CGA G-4.1 for compressed-air and vacuum services.

1. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for compressed-air and vacuum services 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. Cast-Copper-Alloy Flanges: ASME B16.24, Class 300.
4. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.

2.2 JOINING MATERIALS

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

B. Threaded-Joint Tape: PTFE.

C. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, 1/8 inch maximum thickness, full face type.

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, 2-piece body, brass or bronze.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. Allied Healthcare Products, Inc.; Chemetron Div.
    b. Allied Healthcare Products, Inc.; Oxequip Health Industries.
    c. BeaconMedaes.
    d. Hill-Rom.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Squire-Cogswell/Aeros Instruments, Inc.

2. Pressure Rating: 300 psig minimum.
3. Ball: Full-port, chrome-plated brass.
4. Seats: PTFE or TFE.
5. Handle: Lever type with locking device.

6. Stem: Blowout proof with PTFE or TFE seal.
7. Ends: Threaded or manufacturer-installed ASTM B 819, copper-tube solder joint extensions.

C. Check Valves: In-line pattern, bronze.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Allied Healthcare Products, Inc.; Chemetron Div.
   b. BeaconMedaes.
   c. Conbraco Industries, Inc.
   d. Squire-Cogswell/Aeros Instruments, Inc.

2. Pressure Rating: 300 psig minimum.
3. Operation: Spring loaded.
4. Ends: Threaded or manufacturer-installed ASTM B 819, copper-tube solder end extensions.

2.4 FLEXIBLE PIPE CONNECTORS

A. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections: Threaded copper pipe or plain-end copper tube.

2.5 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, Floor-Plate Escutcheons: Cast iron.

F. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.6 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, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 NITROGEN

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Interruption of Existing Laboratory and Healthcare Compressed-Air and Vacuum Services: Comply with requirements in Division 01 Section “Temporary Facilities and Controls.”

3.2 PIPING APPLICATIONS

A. Laboratory and Healthcare Compressed-Air and Vacuum Piping: Use Type L, copper tube; wrought-copper fittings; and soldered joints.

B. Drain Piping: Use the following piping materials:

1. Copper water tube, cast- or wrought-copper fittings, and soldered joints.

C. Joining New to Existing Copper Tubes NPS 2 and Smaller: Use memory-metal couplings.

D. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and soldered joint for connection to copper tube.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used for laboratory and healthcare compressed-air and vacuum piping. If specific valve types are not indicated, the following requirements apply:

1. Shutoff Valves NPS 3 and Smaller: Copper-alloy ball valve.
2. Check Valves NPS 3 and Smaller: Bronze.
3. Zone Valves: With copper-tube extensions and gage.

3.4 PIPING INSTALLATION

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with ASSE Standard #6010 for installation of laboratory and healthcare compressed-air and vacuum 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 laboratory and healthcare compressed-air, vacuum, drain piping with 1 percent slope downward in direction of flow.

H. 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.

I. Install eccentric reducers, if available, where laboratory and healthcare compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to laboratory and healthcare compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points of vacuum piping.

K. Install thermometer and pressure gage in accordance with requirements in Division 23 Section "Meters and Gages for Piping."

L. Install flexible pipe connector at each connection to laboratory and healthcare compressed-air and vacuum equipment.

M. Install piping to permit valve servicing.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install laboratory and healthcare compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

Q. Install unions in copper laboratory and healthcare compressed-air and vacuum tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.

3.5 VALVE APPLICATIONS

A. Valves for Copper Vacuum Tubing: Use copper alloy ball and bronze check types.

3.6 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from laboratory and healthcare compressed-air and vacuum equipment and specialties.

B. Install check valves to maintain correct direction of laboratory and healthcare compressed-air and vacuum flow from laboratory compressed-air and vacuum 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 automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain so contents spill over or into it.

E. Install flexible pipe connectors in discharge piping of each air compressor and in suction inlet piping to each vacuum producer.

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."

3.7 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of cleaned tubing and fittings before assembly.

C. Threaded Joints: Apply appropriate tape to external pipe threads.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.

E. Join new copper tube to existing copper tube with memory-metal couplings. Follow coupling manufacturer's product-specific procedure.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.

3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
5. Bare Piping in Equipment Rooms: One piece, cast brass.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 23 Section "Hangers and Supports for Mechanical Piping" for pipe hanger and support devices.

B. Vertical Piping: MSS SP-69 Type 8 or 42, clamps.

C. Individual, Straight, Horizontal Piping Runs: According to the following:

1. 100 Feet and Less: MSS SP-69 Type 1, adjustable, steel, clevis hangers.
2. Longer than 100 Feet: MSS SP-69 Type 43, adjustable, roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS SP-69 Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment" for trapeze hangers.

E. Support horizontal piping within 12 inches of each fitting and coupling.

F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

3.10 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for laboratory and healthcare compressed-air piping systems. Refer to Division 23 Section "Identification for Mechanical Piping and Equipment" for labeling and identification materials.

3.11 FIELD QUALITY CONTROL

A. Arrange for Owner’s Representative to witness all tests. Provide seven days notice to Owner prior to tests. Perform the following field tests and inspections and prepare test reports:

1. Inspect, test, and certify completed laboratory and healthcare compressed-air and vacuum systems according to requirements specified. Inspect, test, and certify each piping system, including specialties, safety devices, and source equipment.
2. Provide oil-free dry nitrogen, materials, and equipment required for testing.
3. Laboratory and Healthcare Compressed-Air Piping Testing: Perform procedures and tests as indicated in NFPA 99 performance and testing paragraphs for piped gas systems. Include the following:

    a. Piping Integrity Tests:

        1) Blow Down: Clear piping before connecting service connections or outlets.
        2) Initial Pressure Tests: Subject each piping section to test pressure of 1.5 times system working pressure, but not less than 150 psig, before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
        3) Purge Tests: Perform heavy intermittent purging of piping and full-flow purging of service connections.

    b. Verification and Final Testing: Activate systems with laboratory and healthcare compressed-air at normal operating pressure.

        1) Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test. Verify that pressure differences comply with required calibration. Repair leaks with new materials and retest systems.
        2) Pressure Relief Valve Tests: Verify proper valve operation.
        3) Cross-Connection Tests: Activate only laboratory and healthcare compressed-air system. Verify that air flows from each laboratory and healthcare compressed-air outlet and does not flow from vacuum inlets. Repeat cross-connection test for laboratory and healthcare vacuum system.
        4) Secondary Equipment Tests: Verify operation of equipment if available.
        5) Labeling: Verify correct labeling.

4. Test and adjust controls and safeties.

B. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

1. Inspections performed.
2. Procedures, materials, and gases used.
3. Test methods used.
4. Results of tests.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

END OF SECTION 22 61 13