SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.

B. See Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.3 SUBMITTALS

A. Product Data: For the following:

1. Pressure regulators. Include rated capacities and operating characteristics.
2. Automatic drain valves.
3. Filters. Include rated capacities and operating characteristics.
4. Lubricators. Include rated capacities and operating characteristics.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE


PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.

4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.

B. Copper Tube: ASTM B 88, Type L seamless, drawn-temper, water tube.
1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

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

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

2.3 VALVES

A. Metal Ball, Butterfly, Check and Gate Valves: Comply with requirements in Division 15 Section "General Duty Valves for Plumbing Piping."

2.4 FLEXIBLE PIPE CONNECTORS

A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.
2.5 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, pilot-operated direct acting, spring-loaded manual pressure-setting adjustment, and rated for 300-psig inlet pressure, unless otherwise indicated.

C. Air-Line Pressure Regulators: [Diaphragm] [Diaphragm or pilot] [Pilot] operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 300-psig minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 300-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

G. Air-Line Lubricators: Sizes and capacities indicated; equip with drip chamber and sight dome for observing oil drop entering airstream; with oil-feed adjustment screw and quick-release collar for easy bowl removal.

1. Provide with automatic feed device for supplying oil to lubricator.

2.6 QUICK COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation; Eaton Corp.
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
6. Rectus Corp.
7. Schrader-Bridgeport; Amflo Div.
9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
10. TOMCO Products Inc.
11. Tuthill Corporation; Hansen Coupling Div.
B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
   1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.

D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
   1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
   2. Plug End: With barbed outlet for attaching hose.

2.7 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
   2. Hose Clamps: Stainless-steel clamps or bands.
   3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
   4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PREPARATION

A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed interruption of compressed-air service.
   2. Do not proceed with interruption of compressed-air service without Owner’s written permission.

3.2 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:
1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints. Use black or galvanized pipe and fitting inside building and galvanized pipe and fittings exterior of building.
2. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed joints.

B. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
   1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints. Use black or galvanized pipe and fitting inside building and galvanized pipe and fittings exterior of building.
   2. NPS 2 and Smaller: Type K or L, copper tube; wrought-copper fittings; and brazed joints.

C. Drain Piping: Use the following piping materials:
   1. NPS 2 and Smaller: Type L copper tube; wrought-copper fittings; and brazed or soldered joints.

3.3 VALVE APPLICATIONS
A. Comply with requirements in "Valve Applications" Article in Division 15 Section "General Duty Valves for Plumbing Piping."
B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.4 PIPING INSTALLATION
A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping installation.
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.
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 at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
F. Install piping adjacent to equipment and machines to allow service and maintenance.
G. Install air and drain piping with 1 percent slope downward in direction of flow.
H. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
I. Equipment and Specialty Flanged Connections:
   1. Use steel companion flange with gasket for connection to steel pipe.
   2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.

J. 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.

K. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 15 Section "Meters and Gages for Plumbing Piping."

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

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

O. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

P. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

3.5 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

E. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.6 VALVE INSTALLATION

A. Refer to Division 22 Section "Common work Results for Plumbing" for basic piping and valve installation.
B. General-Duty Valves: Comply with requirements in Division 15 Section "General-Duty Valves for Plumbing Piping."

C. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

D. Install shutoff valve at inlet to each automatic drain valve.

E. Install shutoff valve at inlet and outlet from each filter, lubricator, pressure regulator and other specialties.

F. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.7 DIELECTRIC FITTING INSTALLATION

A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.8 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.9 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install safety valves where recommended by specialty manufacturers.

C. Install air-main pressure regulators in compressed-air piping at or near air compressors.

D. Install air-line pressure regulators in branch piping to equipment.

E. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

F. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. [Mount on wall at locations indicated.]

G. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. [Mount on wall at locations indicated.]

H. Install quick couplings at piping terminals for hose connections.

I. Install hose assemblies at hose connections.
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 15 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 or Less: MSS Type 1, adjustable, steel clevis hangers.
   2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

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

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

I. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
   2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
   3. NPS 1-1/2: 12 feet with 3/8-inch rod.
   4. NPS 2: 13 feet with 3/8-inch rod.

J. Install supports for vertical, Schedule 40, steel piping every 15 feet.

K. 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.
   4. NPS 1: 96 inches with 3/8-inch rod.
   6. NPS 1-1/2: 10 feet with 3/8-inch rod.
   7. NPS 2: 11 feet with 3/8-inch rod.

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

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 15 Section "Identification for Plumbing Piping and Equipment."
3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. 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] [lubricators] [and] [pressure regulators] for proper operation.

4. Test and adjust piping safety controls. Replace damaged and malfunctioning safety controls.

5. Report results in writing.

END OF SECTION