SECTION 23 15 13

UTILITY COMPRESSED AIR PIPING

BASED ON DFD MASTER SPECIFICATION DATED 5/9/2022

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# P A R T 1 - G E N E R A L

## SCOPE

This section contains specifications for all HVAC Compressed Air pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Reference Standards

Shop Drawings

Quality Assurance

Delivery, Storage, and Handling

Design Criteria

Welder Qualifications

PART 2 - PRODUCTS

Compressed Air Pipe

PART 3 - EXECUTION

Erection

Welded Pipe Joints

Copper Pipe Joints

Piping System Leak Tests

Piping System Purging

Construction Verification Items

Piping System Leakage Test Report

Piping System Flushing Report

## RELATED WORK

Section 01 91 01 or 01 91 02 - Commissioning Process

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

## REFERENCE

Applicable provisions of Division 1 govern work under this section.

## REFERENCE STANDARDS

Edit the following list so only the standards that are needed in your spec are included in it.

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A181 Forgings, Carbon Steel for General Purpose Piping

ASTM B88 Seamless Copper Water Tube

## SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

### TYPE E OR S STEEL PIPE:

Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

### COPPER TUBE:

Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

## QUALITY ASSURANCE

Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

## DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

## DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

## WELDER QUALIFICATIONS

Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.

The A/E or DFD reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor’s expense.

# P A R T 2 - P R O D U C T S

## COMPRESSED AIR PIPE

2" and Smaller: ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper pressure fittings

2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

Consultant must verify that all system components have been designed for these test pressures; contact DFD engineering personnel if there are questions.

COMPRESSED AIR VALVES

Shut-off valves:

2 Inch and Smaller: Three piece bronze body; full port, SS ball; MPTFE seat; Brazing/solder ends ; blowout-proof stem; 600 psig WOG. Apollo 82-240, Milwaukee BA350STE, Nibco CS-595-YX-66.

**COMPRESSED AIR (DIRECT BURIED PIPE)**

2” and Smaller: ASTM 88 B306, B819, type K, soft temper copper tubing (100 lineal feet rolls) (minimal joints underground) with braised joints.

**UNIONS AND FLANGES**

2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use ANSI B16.18 cast copper alloy unions on copper piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 grade I or A105, grade III hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star washers for grounding.)

**GASKETS**

Compressed Air Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978-C or approved equal.

# P A R T 3 - E X E C U T I O N

## ERECTION

Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.

Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.

Remove all lose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.

During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.

During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.

Furnish and install all flanges, caps, bypasses, drains, valves, etc. required to facilitate flushing and draining all heating and cooling system piping.

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

See comment on expansion provisions in Section 23 05 15. Show all needed expansion loops, anchors and guides on the drawings.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Install drains throughout the systems to permit complete drainage.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

This requirement is based on NFPA 70-1987, 384-4 and 450-47.

Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

## WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders in accordance with the Contractor’s Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.
2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16”.
3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
4. Girth Butt Welds:
	1. Girth butt welds shall be complete penetration welds.
	2. Concavity will not exceed 1/32”
	3. Under cuts will not exceed 1/32”
	4. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

## COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use AWS A5.8 BCuP: Flux and silver brazing alloy and silver brazing alloy AWS A5.8 BAg for copper to brass/bronze joints. Clean piping and fitting in accordance with CGA G 4.1.

Brazing alloy shall be 15% silver.

Where mechanically formed tee fittings are allowed, form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Remove all debris created by the forming process from the inside of the pipe. Braze the joint, applying heat properly so that pipe and tee do not distort; remove distorted connections.

## PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Division's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Do not insulate pipe until it has been successfully tested.

Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

|  |  |  |  |
| --- | --- | --- | --- |
| System | Pressure | Medium | Duration |
| Compressed Air | 15 PSIG | Air | 1 hr |
|  |  |  |  |

\*\*Verify operating system pressure with DFD and specify test pressure accordingly. Several state agencies have systems that operate at higher pressures and require test pressures in excess of that scheduled above. The intent of this test is to look for initial leaks in a safe manner. The piping system is intended to undergo an in service test at actual operating pressure

All pressure tests are to be documented on a Division of Facilities Development form included in this specification.

## COMPRESSED AIR PIPING SYSTEM PURGING

All new compressed air pipe shall be brazed. While brazing compressed air shall be purged with nitrogen. Follow the NCPWB guidelines for brazing compressed air pipe.

All purging procedures shall be documented by completing and submitting the report form included at the end of this Section.

## CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

\*\*\*END OF SECTION\*\*\*

# PIPING SYSTEM LEAKAGE TEST REPORT

**State of Wisconsin**

**Department of Administration Date**

**Division of Facilities Development Submitted:**

**Project Name:**

**Location: DFD Project No:**

**Contractor:**

 **□ Compressed Air □ Other**

 **Test Medium:** □ **Nitrogen** □ **Water** □ **Other**

**Test performed per specification section No.**

**Specified Test Duration \_\_\_\_\_ Hours Specified Test Pressure PSIG**

**System Identification:**

**Describe Location:**

 **Test Date:**

**Start Test Time: Initial Pressure: PSIG**

**Stop Test Time: Final Pressure: PSIG**

**Tested By: Witnessed By:**

**Title: Title:**

**Signed: Signed:**

**Date: Date:**

**Comments:**

# PIPING SYSTEM PURGING REPORT

**State of Wisconsin**

**Department of Administration Date**

**Division of Facilities Development Submitted**:

**Project Name:**

**Location: DFD Project No:**

**Contractor:**

**❒ Compressed Air ❒ Other**

**Describe procedure:**

**Purge Date:**   **Start Time:**   **Stop Time:**

**Pressure of Nitrogen Source:**  **PSIG**

**Describe nitrogen source and method of connection to source:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**