

SECTION 15225  
STAINLESS STEEL HVAC PIPING SYSTEMS

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

1.02 SUMMARY

- A. Nonelectropolished stainless steel tubing and fittings specified in this Section are intended for the following services:
  - 1. Clean steam use for humidification and tool hook-up.

1.03 SUBMITTALS

- A. In addition to the standard requirements, the Contractor shall provide the following with the Bid:
  - 1. Product data, including catalog cuts, on equipment and materials purchased by the Contractor.
  - 2. Workmanship samples.
  - 3. Welder certificates of qualification.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Refer to Section 01410 for applicable codes. In addition, comply with the provisions of the following:
  - 1. ASME B 31.9 "Building Services Piping: for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
  - 2. Fabricate and stamp flash tanks to comply with ASME "Boiler and Pressure Vessel Code", Section VIII, Division 1.
  - 3. ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators.

1.05 COORDINATION

- A. Coordinate layout and installation of piping and flash tanks with steam and condensate equipment and with other installations.
- B. Coordinate pipe sleeve installation for foundation wall penetrations.
- C. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies. Coordinate with Division 7 Section "Firestopping" for fire and smoke wall and floor assemblies.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. All materials and equipment shall be handled and stored in a sheltered location through the progress of the job in such a manner as to prevent damage and/or contamination. Piping and fittings shall be stored separately by type, and isolated from any electropolished tube and fittings.
- B. Any material or equipment that becomes damaged in handling on the job shall not be used unless it is repaired to the original requirements by the Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by the Owner or his representative before its use.
- C. All piping and fittings components shall be inspected and cleaned before being installed.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Safety Pressure Relief Valves: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong Machine Works, A-Y Division
  - 2. Spirax Sarco.
  - 3. Watts Regulator Co.
- B. Pressure Regulating Valves: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong Machine Works, A-Y Division
  - 2. Fisher Controls International, Inc.
  - 3. Hoffman Specialty ITT; Fluid Handling Div.
  - 4. Leslie Co.
  - 5. Spirax Sarco.
  - 6. Spence Engineering Co., Inc.
- C. Steam Traps: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dunham-Bush, Inc.
  - 2. Hoffman Specialty ITT; Fluid Handling Division
  - 3. Spirax Sarco.
- D. Air Vents: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong Machine Works.
  - 2. Hoffman Specialty ITT; Fluid Handling Div.
  - 3. Spirax Sarco.
- E. Dielectric Waterway Fittings: Subject to compliance with requirements, provide products by one of the following:
  - 1. Victaulic Company of America

- F. Dielectric Unions: Subject to compliance with requirements, provide products by one of the following:
  - 1. Watts Regulator Co.
- G. Strainers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong Machine Works.
  - 2. Hoffman Specialty ITT; Fluid Handling Div.
  - 3. Metraflex Co.
  - 4. Spirax Sarco.
  - 5. Victaulic Co. of America. (low pressure applications only)
  - 6. Watts Regulator Co.

2.02 PIPING AND FITTING MATERIALS:

- 1. Material Requirements:
  - a. All piping shall be schedule 40, seamless stainless steel ASTM A-312, grade TP 316.
  - b. Fittings shall be stainless steel ASTM A403, WP 316, ANSI B16.9 and ANSI B36.19
  - c. Flanges 300-pound, forged corrosion-resistant steel, welded neck, with raised face and concentric serrated finish, conforming to ASTM A182, Grade F 316 and ANSI B16.5
- 2. Dimensional Tolerance Requirements: End connections on tubing and fittings shall be faced and squared to 1/2 degree for sizes 1/4-inch through 3/4-inch, inclusive. Squareness of 1-inch and larger shall be +0.006-inch.

2.03 MANUAL VALVE DESIGN PARAMETERS

- A. Valves shall be built in accordance with ANSI B16.34 -Valves - Flanged and Butt-welding End, or qualified to the terms of ANSI B31.3.
- B. Cast bodies are not allowed.
- C. The valve shall have a maximum pressure rating of at least 450 psig. Working pressure is 145 psig.
- D. Temperature Range: -20 degrees F to 300 degrees F.
- E. Pressure retaining parts must be made of materials with melting points greater than 2,000 degrees F.
- F. Valves shall be designed with a clean flow path to minimize dead volumes.
- G. Valves shall be designed to meet a minimum cycle life at 150 psig of 25,000 cycles for bellows valves and 50,000 cycles for diaphragm valves.
- H. Valves shall be designed to meet the rate at a valve closure torque of 10 foot-pounds maximum.

- I. Where specified, purge ports located on the upstream and downstream side of the valve shall be an available option. The ports, where required, shall be 1/4-inch male VCR connections as specified herein, with blind nut and solid nickel gasket. Where ports are not required, they shall not be machined into the valve body.
- J. Components shall be designed and constructed so that outgassing of H<sub>2</sub>O, THC, and O<sub>2</sub> will attain levels below 1 ppb, within one month of installation during which time gas of equal quality has been flowing through the component. -
- K. Valve body shall be AOD/VAR or VIM/VAR material only.
- L. Valves shall have mechanical locking capability and visual indication of OPEN and CLOSE position.
- M. Approved Manufacturers:
  - 1. Nupro
  - 2. Tescom
  - 3. Carten

#### 2.04 CLEANING AND PACKAGING

- A. The following requirements specify packaging of piping and fittings by the supplier, prior to shipment.
- B. Tube and Fitting Marking:
  - 1. Finished components shall be mill and heat traceable and permanently marked for correspondence to the applicable mill test reports.
  - 2. All tubing, fittings, and components shall be permanently marked using indelible ink roller, vibratory, or electroetch process. The location for marking the tube shall be 2 feet from each end of the finished tube. Etching shall not damage the internal surface or degrade the tube pressure rating (1/4-inch and 3/4-inch). Include the following:
    - a. Manufacturer's name or unique symbol.
    - b. Manufacturer's product name.
    - c. Nominal size.
    - d. Wall thickness.
    - e. Alloy.
    - f. Heat number and lot number.
  - 3. Heat number shall also be color coded on the inner bag as noted in other portions of this Section.
- C. Packaging:
  - 1. Pack and ship to prevent damage to bagging, tubing, and fittings.
  - 2. Package tubing and components to prevent movement or impact between adjacent material and/or the container.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Threaded connections are not permitted. All connections will be welding or mechanical fittings.
- B. Use only tools and handling techniques which will not mar, disturb the shape, or in any way reduce the quality of the materials used in this system.

### 3.02 MATERIALS INSPECTION

- A. The Contractor shall inspect stainless steel piping, fittings, and components prior to Fitup and installation. Contractor inspection procedures shall be limited to the following scope:
  - 1. Visually examine all stainless steel piping and fittings for damage or gross contamination.
  - 2. Visually examine each length of tube to be cut for obvious defects such as contaminants, bends, cracks, and material defects.
- B. Documentation of all inspections specified herein shall be furnished to the Owner.

### 3.03 WELDING QUALIFICATIONS

- A. Welding work for stainless steel piping systems shall be done in a competent and workmanlike manner, using the best manufacturing practice and latest techniques of the trade.
- B. Employ only qualified welders to install stainless steel piping systems:

### 3.04 WELDING PROCEDURE

- A. Contractor fabrication piping within the shop where possible to limit the amount of field welding.
- B. End Preparation:
  - 1. Pipe tube, fittings, and cutting tools shall be maintained scrupulously clean (the cutting tools for carbon steel and copper must be kept separate from the stainless steel tools).
  - 2. A cutting and joint preparation tool shall be used which produces a clean, close tolerance Fitup so that an acceptable butt weld can be made.
  - 3. All burrs on the outside and inside of the tube shall be completely removed.
- C. Alignment and Spacing: A maximum of 0.02-inch mismatch maybe allowed between piping and fitting.
- D. Welding Procedure:

1. All stainless steel lines shall be welded using an automatic orbital tube welder (suggested automatic tube welders are: Arc Machine, Astro-Arc or Di-Metrics) gas-tungsten-arc welding process, with 100 percent argon shielding and backup purge. A constant-current power supply equipped with high frequency starting and remote foot control is suggested for all manual welds.
2. During welding, all gas lines and the welding head must be continuously purged with argon and allowed to escape to atmosphere through a restrictor. A welded joint must be more than 6 inches away from the end of purge line, or an extension shall be required with a restrictor. For each purge restrictor used, use a minimum flow of 40 cfh of argon gas, but in all cases, use sufficient purge gas to prevent oxidation and to carry off vapors.

E. Installation:

1. Just prior to installation, inspect each pipe length.
2. Lines shall never be left without positive pressure. Temporary compression caps with nylon ferrules may be used to cap tees and used to contain the purge to minimize argon consumption for overnight and weekends. These fittings shall be cleaned and recleaned according to this specification.
3. Lines shall be run as direct as possible and run from nearest terminal valve.
4. Support the lines and fittings as necessary to keep their axes straight and in alignment. Maintain equal clearance between tubing and fittings to permit uniform capillary action to have proper effect on alloy position.
5. Purging requirements are as follows:
  - a. Set the pipe section in the rack so that the capped end of the new section is next to the end of the installed section. With a positive flow of purge gas in the previously installed section, remove the cap from the new section and together with a clean fitting, make assembly as fast as possible (within a period of 30 to 60 seconds).
  - b. Let the purge gas flow for a period of time to ensure that any entrapped air is removed prior to the start of welding of next assembly.
  - c. After the section is welded and no further work is being done on the system for a period of time, (such as the end of the working day or weekend), the purge restrictor may be taped closed by always keeping a slight positive pressure in line, so if a leak develops during the inactive period, the system will not lose its inert purge.
6. All welded joints which show evidence of overheating, c-racking, poor penetration, or other defects of Fitup or workmanship shall be subject to removal and replacement.
7. Each welder shall identify his production joint by marking his assigned identification symbol on the tube adjacent to the joint at the time the joint is made.

8. Install lines without bending, springing, forcing, or placing undue stress on the pipe or tube, fittings, connected equipment, or terminals. Lines shall not directly contact the structure except where shown or specified otherwise.

### 3.06 INSTALLATION OF FITTINGS, VALVES, AND COMPONENTS

- A. General: All components and fittings shall be installed using welding practices consistent with the tubing installation procedures described in this specification.

### 3.07 FIELD INSTALLATION OF TUBE AND SUBASSEMBLIES

- A. Tube and subassembly supports and anchors: All supports and anchors shall be installed in accordance with Section 15060 "HANGERS AND SUPPORTS"
- B. Make all necessary preparations for installing pipe and pipe subassemblies such that exposure of the interior surface to atmosphere is minimized.
- C. Pipe and subassemblies shall be mechanically fitted into place, dimensionally verified, clearances verified, welding parameters set, and all preweld procedures completed in readiness to begin the welding process prior to removing protective caps.

### 3.08 INSPECTION AND EXAMINATION

- A. All materials and workmanship shall be subject to inspection and examination by the Owner at any place where fabrication, and erection are performed, as follows:
  1. When deemed necessary by the Owner, random samples of installed work will be removed to assure compliance with accepted cleaning and installation procedures. Rewelding of the joint shall be at the Contractor's costs only if work is unsatisfactory.
  2. At any time during the project installation, upon request of the Owner, and at extra cost to the Owner, additional samples shall be removed by the Contractor sufficient to establish the quality of materials and workmanship. If any samples indicate the materials or workmanship do not meet the contract specification, the Contractor will be required, at his expense, to clean or replace the installed work as deemed necessary by the Owner. If the additional samples are acceptable, the Owner will pay for the direct labor and materials required for the cutting-out and restoration of these samples. Any leak or purity testing that has been performed on the deficient system must then be repeated at the Contractor's expense after corrections have been made.
  3. If the number of unacceptable samples exceeds one-third of the total number tested in that system, all joints must be removed, new piping installed with new fittings at Contractor's expense. The reinstalled system must meet all requirements for a new system.

### 3.09 PRESSURE TEST REQUIREMENTS

- A. Each system shall successfully complete a pressure retention test before final acceptance by the Owner. Each system covered by this Section shall be tested with the media and for the duration specified. Portions of each system may be pretested as directed by the Owner during

construction to verify the integrity of individual branches; however, each system must be tested in its entirety to qualify for final acceptance.

- B. Testing shall be performed by the Contractor on all piping after erection, but before any installation of insulation. Furnish all necessary equipment and material and make all taps in or connections to the pipe, as required. The Owner's designated representative will monitor the tests. Test pressures, media, and durations shall be as specified in Table 1 at the end of this section.
- C. Unless otherwise required by the specifications, shop fabricated pipe spools are not required to be hydrostatically tested at the shop. Spools shall be field tested after erection. The shop fabricator shall be responsible for the cost of correction of any defects revealed during field hydrostatic tests.
- E. Test Procedures:
  - 1. Calibration records for gauges used for testing shall be submitted to Construction Manager.
  - 2. Two pressure gauges shall be installed for each testing system. Gauges used for testing shall be installed as close as possible to the low point of the piping system.
  - 3. When starting the filling of lines to be hydrostatically tested, all vents and other connections that can serve as vents shall be open during filling so that all air is vented prior to applying test pressure to a system.
  - 4. If the maximum operating conditioned of piping attached to a vessel are the same as those of the vessel, the piping and the vessel may be tested together. However, if the vessel has different maximum operating conditions, it must be isolated and tested separately.
  - 5. Examination for leakage shall be made at all joints and connections. The piping system shall show no visual evidence of weeping or leaking. Any visible leakage shall be corrected at the Contractor's sole expense.
  - 6. If the pressure falls after the pressurizing system is shut off, the source of the pressure loss shall show be determined and corrected. The system shall be able to hold the test pressure for the test duration specified to be in Table 1 without any detectable loss.
- F. Test Repairs:
  - 1. Materials such as gaskets, bolting, etc., damaged during tests and flushing shall be replaced.
  - 2. New gaskets shall be used each time a flanged joint is made up.
  - 3. Any welded joint that is defective shall be repaired in accordance with the applicable requirements. Repaired components shall be reexamined by the original method to determine freedom from defects, and all repaired joints shall re tested. Costs for such repair shall be the responsibility of the Contractor.



- G. Test Records: Record shall be made by the Contractor for each piping installation. These records shall include at a minimum the following items:
1. Date of test.
  2. Description and identification of piping tested.
  3. Test fluid.
  4. Test pressure, gauge identification, initial and final pressures.
  5. Test duration.
  6. Remarks, to include such items as:
    - a. Leaks (type, location),
    - b. Repairs made on leaks.
  7. Signature and date of person witnessing the test.
  8. Certification by Contractor and reviewed by the Construction Manager.
- H. Test pressure and duration.
1. Clean Steam @ 150 psig, 4 hours

ENDOF SECTION 15225