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SECTION 232213_STEAM AND CONDENSATE PIPING SYSTEMS ABOVE GRADE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aboveground steam and condensate

B. Pipe and pipe fittings

C. Steam piping system.

D. Steam condensate piping system.

1.02 RELATED REQUIREMENTS

A. Section 23 07 19 - HVAC Piping Insulation.

B. Section 23 22 14 - Steam and Condensate Heating Specialties.

C. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

C. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2012 (ANSI/ASME B31.1).

D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless; 2012.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

I. Use in conjunction with the following University of Delaware Standards:

1. Common Work for HVAC Systems 23 05 00
2. Common Requirements for HVAC Systems 23 05 01
3. Identification of HVAC Piping and Equipment 23 05 53
4. HVAC Insulation 23 07 00
5. Steam & Condensate Valves 23 05 23
6. Steam and Condensate Piping Systems Below Grade 23 22 13.1
7. Steam and Condensate Specialties 23 22 14

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 and ASME B31.1 code for installation of piping system.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 – PRODUCTS

2.01 LOW AND MEDIUM PRESSURE STEAM PIPING

A. Design Requirements

Low and Medium Pressure Steam	
Operating Pressure	0-50 psig
Design Pressure	100 psig
Design Temp.	338 deg. F.
Test Pressure	100 psig

High Pressure Steam	
Operating Pressure	125 psig
Design Pressure	150 psig
Design Temp.	366 deg. F.
Test Pressure	225 psig

B. Pipe

1. Pipe sizes ½" through 2", Schedule 80 steel, ERW to SW2F or ASTM A106, Grade B.
2. Pipe sizes 2-1/2" through 10", Schedule 40 steel, ERW to SW2F (NPS 2-4) or ERW to ASTM A53, Grade, Grade B; or ERW to ASTM A135, Grade B; or ERW to ASTM A139, Grade B; or ERW to API5L, Grade B.
3. Pipe sizes 12" through 24", Standard Weight steel, ERW to SW2F (NPS 2-4) or ERW to ASTM A53, Grade, Grade B; or ERW to ASTM A135, Grade B; or ERW to ASTM A139, Grade B; or ERW to API5L, Grade B.

Note: Seamless to ASTM A106, ASTM A53, OR API 5L, Grade B may be substituted in all size.

C. Fittings

1. Pipe size ½" through 2" 3000# threaded, forged steel, ASTM A105, ANSI B16.11
2. Pipe sizes 2-½" through 24", schedule 40, butt-welding, carbon steel, ASTM A234, Grade WPB or WPBW, ANSI B16.9

D. Joints

1. Runs - Pipe sizes ½" through 24", butt welded.
2. Maintenance
   a. Pipe sizes ½" through 2", class 300 malleable iron unions with iron to brass seats, threaded ends or Class 150 forged steel welding neck or slip-on flanges, ASTM A105, ANSI B16.5 (welding neck flanges bore shall match the inside diameter of abutting pipe)
   b. Pipe sizes 2-½" through 24", class 150 forged steel welding neck or slip-on flanges ASTM A105, ANSI B16.5 (welding neck flanges bore shall match the inside diameter of abutting pipe).

D. Gaskets - 150# 1/8" thick ring gasket for steam and condensate per ASME B16.20 suitable for 950ºF. Gaskets shall be spiral wound, flexible graphite type (98% minimum purity) with a type 304 stainless sheet insert as manufactured by Garlock Flexseal, type FG (color gray) equal Flexitallic.

E. Nuts and Bolts

1. Bolts: Cadmium plated, hex, head, carbon steel, grade 5.
2. Nuts: Cadmium plated, hex head, carbon steel, grade 5.

2.02 CONDENATE PIPING

A. Design Requirements

Operating Pressure	0-50 psig
Design Pressure	100 psig
Design Temp.	338 deg. F.
Test Pressure	100 psig

B. Pipe

1. Pipe size ½" through 2" shall be Schedule 160 steel, seamless to ASTM A106, Grade B.
2. Pipe sizes 2-1/2" through 10" shall be Schedule 160 steel, seamless to ASTM A106, Grade B.

C. Fittings

1. Pipe size ½" through 2" 2000# threaded, forged steel, ASTM A105, ANSI B16.11.
2. Pipe size 2" through 2" 3000# socket welding, forged steel, ASTM A105, ANSI B16.11.
3. Pipe sizes 2-½" through 10", schedule 160, butt-welding carbon steel, ASTM A234, Grade WPB or Grade WPBW, ANSI B16.9.

D. Joints
   1. Runs
      a. Pipe size ½" through 10", butt-welded.
   2. Maintenance
      a. Pipe sizes ½" through 2", class 300 malleable iron unions with iron to brass seats, threaded ends or class 150 forged steel welding neck or slip-on flanges, ASTM A105, ANSI B16.5 (welding neck flanges bore shall match the inside diameter of abutting piping).
      b. Pipe sizes 2-½" through 10", class 150 forged steel welding neck or slip-on flanges ASTM A105, ANSI B16.5 (welding neck flanges bore shall match inside diameter of abutting pipe).
   3. Fit-Up to Threaded Equipment
      a. Pipe sizes ½" through 2" minimum length, schedule 160, seamless threaded nipple and union as specified above for maintenance.

E. Gaskets - 150# 1/8” thick ring gasket for steam and condensate per ASME B16.20 suitable for 950ºF. Gaskets shall be spiral wound, flexible graphite type (98% minimum purity) with a type 304 stainless sheet insert as manufactured by Garlock Flexseal, type FG (color gray) or equal by Flexitallic.

F. Nuts and Bolts
   1. Bolts: Cadmium plated, hex, head, carbon steel, grade 5.
   2. Nuts: Cadmium plated, hex head, carbon steel, grade 5.

2.03 MANHOLE VENT PIPING

A. Pipe - Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) class to thickness designed per ANSI 21.50 (AWWA C150), Tar (Seal) coated unless otherwise specified, with bolted mechanical joints or push-on joints as indicated on the plans or special provisions. Ductile iron pipe shall be Class 50.

B. Fittings - Fittings shall be gray or ductile iron and shall conform to ANSI A21.10 (AWWA C110) or A21.53 (AWWA C153), and ANSI A21.11 (AWWA C111). Fittings shall be bolted mechanical joints or push-on joints unless otherwise indicated on the plans, bid items, or the special provisions.

Fittings shall be tar (seal) coated and cement mortar lined per ANSI A21.4 (AWWA C104). Above grade fittings shall be flanged and from the list of approved manufacturers.

C. Restrained System - Restrained joint water pipe shall be EBBA IRON “Mega-lug System

2.04 STEAM AND CONDENSATE CONDUIT VENT PIPING

A. Pipe - 3/8" through 2", Type L, seamless copper tubing, ASTM B88, hard temper (drawn) or soft temper (annealed).

B. Fittings - Pipe sizes 3/8" through 2", solder-joint type per ANSI B16.22.

C. Joints - Pipe sizes 3/8" through 2", wrought copper or wrought bronze solder-joint couplings, conforming to ANSI B16.22. Cast brass solder-joint coupling conforming to ANSI B16.18.

D. Solder: 95/5- tin/antimony

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
C. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
D. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
E. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches: Steel channels with welded spacers and hanger rods.
F. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.
G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
H. Wall Support for Pipe Sizes 4 to 5 Inches: Welded steel bracket and wrought steel clamp.
I. Wall Support for Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.
J. Vertical Support: Steel riser clamp.
K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
L. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.06 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:

1. Ferrous Piping: 150 psig malleable iron, threaded.

B. Flanges for Pipe Over 2 Inches:

1. Ferrous Piping: 150 psig forged steel, slip-on.

PART 3 – EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
E. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
C. Install piping to conserve building space and avoid interference with use of space.
D. Sleeve pipe passing through partitions, walls, and floors.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Slope steam piping one inch in 20 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.

I. Slope steam condensate piping one inch in 20 feet. Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Install valves with stems upright or horizontal, not inverted.

L. All positive shut off valves required for service shall be installed in a "block and bleed" arrangement to allow for service.

3.03 SCHEDULES

A. Hanger Spacing for Steel Steam Piping.

1. 1/2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
2. 3/4 inch and 1 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
3. 1-1/4 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
4. 1-1/2 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
5. 2 inches: Maximum span, 13 feet; minimum rod size, 3/8 inch.
6. 2-1/2 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
7. 3 inches: Maximum span, 15 feet; minimum rod size, 1/2 inch.
8. 4 inches: Maximum span, 17 feet; minimum rod size, 5/8 inch.
9 6 inches: Maximum span, 20 feet; minimum rod size, 3/4 inch.
10 8 inches thru 12 inches: Maximum span, 20 feet; minimum rod size, 7/8 inch.

B. Hanger Spacing for Steel Steam Condensate Piping.

1. 1/2 inch: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. 3/4 inch and 1 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
3. 1-1/4 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
4. 1-1/2 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
5. 2 inches: Maximum span, 14 feet; minimum rod size, 3/8 inch.
6. 2-1/2 inches: Maximum span, 16 feet; minimum rod size, 1/2 inch.
7. 3 inches: Maximum span, 18 feet; minimum rod size, 1/2 inch.
8. 4 inches: Maximum span, 20 feet; minimum rod size, 5/8 inch.
9 6 inches: Maximum span, 20 feet; minimum rod size, 3/4 inch.

END OF SECTION