SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flexible, ball-joint packed expansion joints.
2. Slip-joint, packed expansion joints.
3. Metal, compensator packless expansion joints.
4. Rubber union connector packless expansion joints.
5. Flexible-hose packless expansion joints.
6. Metal-bellows packless expansion joints.
7. Externally pressurized metal-bellows packless expansion joints.
8. Rubber packless expansion joints.
9. Grooved-joint expansion joints.
10. Alignment guides and anchors.
11. Pipe loops and swing connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.

4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint Packed Expansion Joints [**FBJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
3. Material: Carbon-steel assembly with asbestos-free composition packing.
4. Design: Provide 360-degree rotation and angular deflection.
5. Minimum Pressure Rating: [**250 psig at 400 deg F (1725 kPa at 204 deg C)**] <**Insert value**>.
6. Angular Deflection for NPS 6 (DN 150) and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 (DN 200) and Larger: 15 degree minimum.
8. Seal Type: Two carbon steel and graphite seals suitable for continuous operation at temperature up to 650 deg F (343 deg C).
9. Internal Ball: Plated with minimum 1-mil chrome cover.
10. Ball Socket: One- or two-piece design with integral socket/retainer.

a. Stuffing Box: Incorporates containment seals and compression seals for containment of injectable packing.
b. Packing Cylinders: Provides packing under full line pressure with check valves to prevent blowback.

11. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
12. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

B. Slip-Joint Packed Expansion Joints [**SJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection ports for repacking under full system pressure. Housing shall be furnished with drain ports and lifting ring. Include drip connection if used for steam piping.
5. Configuration: [**Single joint**] [**Single joint with base**] [**and**] [**double joint with base**] class(es), unless otherwise indicated.
6. Slip Tube for sizes NPS 1-1/2 (DN 40) through NPS 16 (DN 400): Schedule 80.
7. Slip Tube for sizes NPS 18 (DN 450) through NPS 24 (DN 600): Schedule 60.
8. Sliding Surface: 2 mil thick chrome finish.
9. End Connections: Flanged or welded ends to match piping system.

2.3 PACKLESS EXPANSION JOINTS

A. Metal, Compensator Packless Expansion Joints [**MCEJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Minimum Pressure Rating: [**150 psig (1035 kPa)**] [**175 psig (1200 kPa)**] [**200 psig (1380 kPa)**] <**Insert value**>, unless otherwise indicated.
3. Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.
4. Joint Axial Movement: 2 inches (50 mm) of compression and 1/2 inch (12 mm) of extension.
5. Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.

a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: [**Solder joint**] [**or**] [**threaded**].
b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Threaded.

6. Configuration for Steel Piping: Multi-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

a. End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [**Flanged**] [**Threaded**] [**Welded**].

B. Rubber Union Connector Expansion Joints [**RUEJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Material: Twin reinforced-rubber spheres[**with external restraining cables**].
3. Minimum Pressure Rating: [**150 psig at 170 deg F (1035 kPa at 77 deg C)**] <**Insert value**>, unless otherwise indicated.
4. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

C. Flexible-Hose Packless Expansion Joints [**FHEJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with [**solder-joint**] <**Insert type**> end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with [**threaded**] <**Insert type**> end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.

6. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Carbon-steel fittings with [**flanged**] [**welded**] end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.

8. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Carbon-steel fittings with [**flanged**] [**welded**] end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

9. Expansion Joints for Steel Piping NPS 14 (DN 350) and Larger: Carbon-steel fittings with [**flanged**] [**welded**] end connections.

    a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

D. Metal-Bellows Packless Expansion Joints [**MBEJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows[**with external tie rods**].
4. Minimum Pressure Rating: [**150 psig (1035 kPa)**] [**175 psig (1200 kPa)**] [**200 psig (1379 kPa)**] <**Insert value**>, unless otherwise indicated.
5. Configuration: [**Single joint**] [**Single joint with base**] [**and**] [**double joint with base**] class(es), unless otherwise indicated.
6. Expansion Joints for Copper Tubing: [**Single-**] [**or**] [**multi-**] ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

    a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: [**Solder joint**] [**or**] [**threaded**].
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [**Solder joint**] [**or**] [**threaded**].
    c. End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.

7. Expansion Joints for Steel Piping: [**Single-**] [**or**] [**multi-**] ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

    a. End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
    b. End Connections for Steel Pipe NPS 2-1/2 (DN 65) and Larger: [**Flanged**] [**Welded**].

E. Externally Pressurized Metal-Bellows Packless Expansion Joints [**EPEJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Minimum Pressure Rating: [**150 psig (1035 kPa)**] [**200 psig (1379 kPa)**] [**300 psig (2068 kPa)**] <**Insert value**>, unless otherwise indicated.
3. Description:

a. Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.
b. Carbon-steel housing.
c. Drain plugs and lifting lug for the NPS 3 (DN 80) and larger.
d. Bellows shall have operating clearance between the internal pipe sleeves and the external shrouds.
e. Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.
f. Joint Axial Movement: [**4 inches (100 mm)**] [**6 inches (150 mm)**] [**8 inches (200 mm)**] <**Insert compression limit**> of compression and [**0.75 inch (19 mm)**] [**1 inch (25 mm)**] [**2 inches (50 mm)**] <**Insert extension limit**> of extension.

4. Permanent Locking Bolts: Set locking bolts to maintain joint lengths during installation. Temporary welding tabs that are removed after installation in lieu of locking bolts are not acceptable.
5. End Connection Configuration: Flanged; one raised, fixed and one floating flange.

F. Rubber Packless Expansion Joints [**REJ-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
3. Material: Fabric-reinforced rubber complying with FSA-PSJ-703.
4. Arch Type: [**Single**] [**or**] [**multiple**] arches[**with external control rods**].
5. Spherical Type: [**Single**] [**or**] [**multiple**] spheres[**with external control rods**].
6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): [**150 psig (1035 kPa) at 220 deg F (104 deg C)**] <**Insert value**>.
7. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): [**140 psig (966 kPa) at 200 deg F (93 deg C)**] <**Insert value**>.
8. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): [**140 psig (966 kPa) at 180 deg F (82 deg C)**] <**Insert value**>.
9. Material for Fluids Containing Acids, Alkalis, or Chemicals: [**Butyl rubber**] [**Chlorosulfonyl-polyethylene rubber**] [**Ethylene-propylene-diene terpolymer rubber**] <**Insert material**>.
10. Material for Fluids Containing Gas, Hydrocarbons, or Oil: [**Buna-N**] [**Chlorosulfonated polyethylene synthetic rubber**] <**Insert material**>.
11. Material for Water: [**Butyl rubber**] [**Buna-N**] [**Chlorosulfonated polyethylene synthetic rubber**] [**Chlorosulfonyl-polyethylene rubber**] [**Ethylene-propylene-diene terpolymer rubber**] [**Natural rubber**].
12. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.4 GROOVED-JOINT EXPANSION JOINTS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: [**Galvanized,**]ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: [**Five**] [**Seven**] [**10**] [**12**] <**Insert number**>, flexible type for steel-pipe dimensions. Include ferrous housing sections, [**Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water**] [**ethylene-propylene-diene terpolymer rubber gasket suitable for cold and hot water**], and bolts and nuts.

2.5 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides [**AG-01**] <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

D. Install rubber packless expansion joints according to FSA-PSJ-703.

E. Install grooved-joint expansion joints to grooved-end steel piping.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least [**five**] <**Insert number**> pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least [**four**] <**Insert number**> pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least [**four**] <**Insert number**> pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install [**one**] [**two**] guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than [**four**] <**Insert number**> pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516