

**SECTION 230516 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING**

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 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 01 Section "Construction Waste Management."
- B. Division 01 Section "Sustainable Design Requirements - LEEDv4 BD+C" for additional LEED requirements

1.3 SUMMARY

- A. Section Includes:
  - 1. Flexible, ball-joint, packed expansion joints.
  - 2. Slip-joint packed expansion joints.
  - 3. Expansion-compensator packless expansion joints.
  - 4. Flexible-hose packless expansion joints.
  - 5. Metal-bellows packless expansion joints.
  - 6. Rubber packless expansion joints.
  - 7. Grooved-joint expansion joints.
  - 8. Pipe loops and swing connections.
  - 9. Alignment guides and anchors.

1.4 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, 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.

C. Welding certificates.

D. Product Certificates: For each type of expansion joint, from manufacturer.

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

F. LEED Submittals: Provide submittals for the products named herein as delineated in Division 01 Section, "Sustainable Design Requirements - LEED V4 BD+C" Article 1.6, Action Submittals, subparagraph 1.6.C.9 for VOC content of sealants and adhesives.

## 1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

## 1.7 WARRANTY

A. For a period of one year from substantial completion, the manufacturer shall warrant the goods contained below and shall conform to the product specifications.

## PART 2 - PRODUCTS

### 2.1 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint, Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advanced Thermal Systems, Inc.
  - b. Hyspan Precision Products, Inc.
  - c. Or approved equal.
2. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; and 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: For 360-degree rotation and angular deflection.

5. Minimum Pressure Rating: 250 psig at 400 deg F.
6. Angular Deflection for NPS 6 and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 and Larger: 15 degree minimum.
8. End Connections for NPS 2 and Smaller: Threaded.
9. End Connections for NPS 2-1/2 and Larger: Flanged.

**B. Slip-Joint Packed Expansion Joints:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Adsko Manufacturing LLC.
  - b. Advanced Thermal Systems, Inc.
  - c. Hyspan Precision Products, Inc.
  - d. Or approved equal.
2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint with base class(es) unless otherwise indicated.
6. End Connections: Flanged or weld ends to match piping system.

**2.2 PACKLESS EXPANSION JOINTS**

**A. Metal, Expansion-Compensator Packless Expansion Joints:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - a. Adsko Manufacturing LLC.
  - b. Flexicraft Industries.
  - c. Flex Pression Ltd.
  - d. Flex-Weld, Inc.
  - e. Hyspan Precision Products, Inc.
  - f. Metraflex, Inc.
  - g. Senior Flexonics Pathway.
  - h. Unaflex.
  - i. Unisource Manufacturing, Inc.
  - j. Or approved equal.
2. Minimum Pressure Rating: 150 psig unless otherwise indicated.
3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
  - a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
  - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

- a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
  - b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged or Weld.
- B. Rubber, Expansion-Compensator Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
    - b. Flex-Hose Co., Inc.
    - c. Flexicraft Industries.
    - d. General Rubber Corporation.
    - e. Mason Industries, Inc.; Mercer Rubber Co.
    - f. Proco Products, Inc.
    - g. Tozen Corporation.
    - h. Unaflex.
    - i. Unisource Manufacturing, Inc.
    - j. Or approved equal.
  2. Material: Twin reinforced-rubber spheres with external restraining cables.
  3. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
  4. End Connections for NPS 2 and Smaller: Threaded.
- C. Flexible-Hose Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flex-Hose Co., Inc.
    - b. Flexicraft Industries.
    - c. Flex Pression Ltd.
    - d. Metraflex, Inc.
    - e. Unisource Manufacturing, Inc.
    - f. Or approved equal.
  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 and Smaller: Copper-alloy fittings with solder-joint end connections.
    - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    - b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
  5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

- b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
  - 6. Expansion Joints for Steel Piping NPS 2 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 and 325 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
  - 7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged or weld end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.
  - 8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel fittings with flanged or weld end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.
  - 9. Expansion Joints for Steel Piping NPS 14 and Larger: Carbon-steel fittings with weld end connections.
    - a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.
- D. Metal-Bellows Packless Expansion Joints:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Adscos Manufacturing LLC.
    - b. American BOA, Inc.
    - c. Badger Industries, Inc.
    - d. Expansion Joint Systems, Inc.
    - e. Flex-Hose Co., Inc.
    - f. Flexicraft Industries.
    - g. Flex Pression Ltd.
    - h. Flex-Weld, Inc.
    - i. Flo Fab inc.
    - j. Hyspan Precision Products, Inc.
    - k. Metraflex, Inc.
    - l. Proco Products, Inc.
    - m. Senior Flexonics Pathway.
    - n. Tozen Corporation.

- o. Unaflex.
    - p. Unisource Manufacturing, Inc.
    - q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
    - r. U.S. Bellows, Inc.
    - s. WahlcoMetroflex.
    - t. Or approved equal.
  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 unless otherwise indicated.
  5. Configuration: Single 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 and Smaller: Solder joint or threaded.
    - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
    - c. End Connections for Copper Tubing NPS 5 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 and Smaller: Threaded.
    - b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged or Weld.
- E. Rubber Packless Expansion Joints:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
    - b. Flex-Hose Co., Inc.
    - c. Flexicraft Industries.
    - d. Flex-Weld, Inc.
    - e. Garlock Sealing Technologies.
    - f. General Rubber Corporation.
    - g. Mason Industries, Inc.; Mercer Rubber Co.
    - h. Metraflex, Inc.
    - i. Proco Products, Inc.
    - j. Red Valve Company, Inc.
    - k. Tozen Corporation.
    - l. Unaflex.
    - m. Unisource Manufacturing, Inc.
    - n. Or approved equal.
  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-NMEJ-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: 150 psig at 220 deg F.
  7. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.

8. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F.
9. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR.
10. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N.
11. Material for Water: EPDM.
12. End Connections: Full-faced, integral steel flanges with steel retaining rings.

### 2.3 GROOVED-JOINT EXPANSION JOINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Anvil International, Inc.
  2. Shurjoint Piping Products.
  3. Victaulic Company.
  4. Or approved equivalent.
- 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, flexible type for steel-pipe dimensions. Include ferrous housing sections, EPDM gasket suitable for cold and hot water, and bolts and nuts.

### 2.4 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Adscos Manufacturing LLC.
    - b. Advanced Thermal Systems, Inc.
    - c. Flex-Hose Co., Inc.
    - d. Flexicraft Industries.
    - e. Flex-Weld, Inc.
    - f. Hyspan Precision Products, Inc.
    - g. Metraflex, Inc.
    - h. Senior Flexonics Pathway.
    - i. Unisource Manufacturing, Inc.
    - j. U.S. Bellows, Inc.
    - k. Or approved equal.
  2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider 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 CONSTRUCTION WASTE MANAGEMENT (LEED)**

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

**3.2 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-NMEJ-702.
- E. Install grooved-joint expansion joints to grooved-end steel piping

**3.3 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 pipe fittings including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

### 3.4 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four 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