SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section Includes:

Packed expansion joints.

Grooved-joint expansion joints.

Alignment guides and anchors.

* + - 1. SUBMITTALS

Retain "Delegated-Design Submittal" paragraph below if design services have been delegated to Contractor.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Product Data: For each type of product.

Retain "Welding certificates" paragraph below if retaining "Welding Qualifications" paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.
      1. CLOSEOUT SUBMITTALS
         1. Maintenance Data: For expansion joints to include in maintenance manuals.
      2. QUALITY ASSURANCE

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
        2. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1. PRODUCTS
   * + 1. PERFORMANCE REQUIREMENTS
          1. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
          2. Capability: Products to absorb 200 percent of maximum axial movement between anchors.
       2. PACKED EXPANSION JOINTS
          1. Flexible, Ball-Joint Packed Expansion Joints

[Manufacturers:](http://www.specagent.com/Lookup?ulid=3018) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advanced Thermal Systems, Inc](http://www.specagent.com/Lookup?uid=123457177015).

[Hyspan Precision Products, Inc](http://www.specagent.com/Lookup?uid=123457177016).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457177017).

Approved equivalent.

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.

Material: Carbon-steel assembly with asbestos-free composition packing.

Design: Provide 360-degree rotation and angular deflection.

Minimum Pressure Rating: **250 psig at 400 deg F**Angular Deflection for NPS 6 and Smaller: 30 degree minimum.

Angular Deflection for NPS 8and Larger: 15 degree minimum.

Seal Type: Two carbon steel and graphite seals suitable for continuous operation at temperature up to 650 deg F

Internal Ball: Plated with minimum 1-mil chrome cover.

Ball Socket: One- or two-piece design with integral socket/retainer.

Stuffing Box: Incorporates containment seals and compression seals for containment of injectable packing.

Packing Cylinders: Provides packing under full line pressure with check valves to prevent blowback.

Welded end connections are available, if required, for NPS 2-1/2 (DN 65) and larger.

End Connections for NPS 2 and Smaller: Threaded.

End Connections for NPS 2-1/2 and Larger: Flanged.

* + - * 1. Slip-Joint Packed Expansion Joints

[Manufacturers:](http://www.specagent.com/Lookup?ulid=3019) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

[Advanced Thermal Systems, Inc](http://www.specagent.com/Lookup?uid=123457176948).

[Hyspan Precision Products, Inc](http://www.specagent.com/Lookup?uid=123457176949).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457176950).

Approved equivalent.

Standard: ASTM F1007.

Material: Carbon steel with asbestos-free PTFE packing.

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.

Configuration: [**Single joint**] [**Single joint with base**] [**and**] [**double joint with base**] class(es), unless otherwise indicated.

Slip Tube for sizes NPS 1-1/2 through NPS 16 Schedule 80.

Slip Tube for sizes NPS 18 through NPS 24 Schedule 60.

Sliding Surface: 2 mil thick chrome finish.

End Connections: Flanged or welded ends to match piping system.

* + - 1. PACKLESS EXPANSION JOINTS
         1. Metal, Compensator Packless Expansion Joints

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11224) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

[Hyspan Precision Products, Inc](http://www.specagent.com/Lookup?uid=123457177011).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457177012).

[Metraflex Company (The)](http://www.specagent.com/Lookup?uid=123457177013).

Approved equivalent.

Minimum Pressure Rating: [**150 psig** [**175 psig** [**200 psig**] <**Insert value**>, unless otherwise indicated.

Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.

Joint Axial Movement: 2 inchesofinches of compression and 1/2 inchofinch of extension.

Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.

End Connections for Copper Tubing NPS 2 and Smaller: [**Solder joint**] [**or**] [**threaded**].

End Connections for Copper Tubing NPS 2-1/2 to NPS 4 Threaded.

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

End Connections for Steel Pipe NPS 2 and Smaller: Threaded.

End Connections for Steel Pipe NPS 2-1/2 to NPS 4 [**Flanged**] [**Threaded**] [**Welded**].

* + - * 1. Rubber Union Connector Expansion Joints

Product equal to:

Flexicraft Industries, http://www.flexicraft.com/

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, <https://www.metraflex.com/>

Approved equivalent.

Material: Twin reinforced-rubber spheres[**with external restraining cables**].

Minimum Pressure Rating: [**150 psig at 170 deg F**] <**Insert value**>, unless otherwise indicated.

End Connections for NPS 2 and Smaller: Threaded.

* + - * 1. Flexible-Hose Packless Expansion Joints

Product equal to:

Flexicraft Industries, http://www.flexicraft.com/

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, https://www.metraflex.com/

Approved equivalent.

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.

Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with [**solder-joint**] <**Insert type**> end connections.

Retain one or both of first two subparagraphs below to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.

Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.

Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 Copper-alloy fittings with [**threaded**] <**Insert type**> end connections.

Retain one or both of first two subparagraphs below to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.

Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

Retain one or both of first two subparagraphs below to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.

Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.

Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 Carbon-steel fittings with [**flanged**] [**welded**] end connections.

Retain one or both of first two subparagraphs below to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.

Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

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

Retain one or both of first two subparagraphs below to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.

Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.

Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

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

Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

* + - * 1. Metal-Bellows Packless Expansion Joints

Product equal to:

Flexicraft Industries, http://www.flexicraft.com/

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, <https://www.metraflex.com/>

Approved equivalent.

Standards: ASTM F1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

Type: Circular, corrugated bellows[**with external tie rods**].

Minimum Pressure Rating: [**150 psig**] [**175 psig**] [**200 psig**] <**Insert value**>, unless otherwise indicated.

Configuration: [**Single joint**] [**Single joint with base**] [**and**] [**double joint with base**] class(es), unless otherwise indicated.

Expansion Joints for Copper Tubing: [**Single-**] [**or**] [**multi-**]ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

End Connections for Copper Tubing NPS 2 and Smaller: [**Solder joint**] [**or**] [**threaded**].

End Connections for Copper Tubing NPS 2-1/2 to NPS 4: [**Solder joint**] [**or**] [**threaded**].

End Connections for Copper Tubing NPS 5 and Larger: Flanged.

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

End Connections for Steel Pipe NPS 2 and Smaller: Threaded.

End Connections for Steel Pipe NPS 2-1/2 and Larger: [**Flanged**] [**Welded**].

* + - * 1. Externally Pressurized Metal-Bellows Packless Expansion Joints

Product equal to:

Hyspan Precision Products, Inc, <https://www.hyspan.com/>

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, https://www.metraflex.com/

Approved equivalent.

Minimum Pressure Rating: [**150 psig**] [**200 psig**] [**300 psig**] <**Insert value**>, unless otherwise indicated.

Description:

Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.

Carbon-steel housing.

Drain plugs and lifting lug for the NPS 3 and larger.

First two subparagraphs below are optional features.

Bellows shall have operating clearance between the internal pipe sleeves and the external shrouds.

Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.

Joint Axial Movement: [**4 inches**] [**6 inches**] [**8 inches**] <**Insert compression limit**> of compression and [**0.75 inch**] [**1 inch**] [**2 inches**] <**Insert extension limit**> of extension.

Retain "Permanent Locking Bolts" Subparagraphsubparagraph below if using carbon steel. Locking bolts can also be used to set pre-compression or pre-extension, if required, and to lock the position of the connector for easy removal and reinstallation, if required for system maintenance.

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.

The floating flange ensures that joint will not be over stressed during installation.

End Connection Configuration: Flanged; one raised, fixed and one floating flange.

* + - * 1. Rubber Packless Expansion Joints

Product equal to:

Flexicraft Industries, http://www.flexicraft.com/

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, https://www.metraflex.com/

Approved equivalent.

Standards: ASTM F1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

Material: Fabric-reinforced rubber complying with FSA-PSJ-703.

Retain one or both of first two subparagraphs below. If retaining both, indicate location of each on Drawings.

Arch Type: [**Single**] [**or**] [**multiple**] arches[**with external control rods**].

Spherical Type: [**Single**] [**or**] [**multiple**] spheres[**with external control rods**].

Pressure and temperature ratings in first subparagraph below are generally minimum values. Consult manufacturers' literature for available options.

Minimum Pressure Rating for NPS 1-1/2 to NPS 12: [**225 psig at 170 deg F**] <**Insert pressure and temperature values**>.

Retain only those materials in first three subparagraphs below that are required. If retaining more than one, indicate location of each on Drawings. See "Packless Expansion Joints" Article in Evaluations for discussion of rubber materials.

Material for Fluids Containing Acids, Alkalis, or Chemicals: [**Butyl rubber**] [**Chlorosulfonyl-polyethylene rubber**] [**Ethylene-propylene-diene terpolymer rubber**] <**Insert material**>.

Material for Fluids Containing Gas, Hydrocarbons, or Oil: [**Buna-N**] [**Chlorosulfonated polyethylene synthetic rubber**] <**Insert material**>.

Material for Water: [**Butyl rubber**] [**Buna-N**] [**Chlorosulfonated polyethylene synthetic rubber**] [**Chlorosulfonyl-polyethylene rubber**] [**Ethylene-propylene-diene terpolymer rubber**] [**Natural rubber**].

End Connections: Full-faced, integral steel flanges with steel retaining rings.

* + - 1. GROOVED-JOINT EXPANSION JOINTS
         1. Product equal to:

Grinnell G-Fire by Johnson Controls Company, https://www.grinnell.com/,

Shurjoint-Apollo Piping Products USA Inc, http://www.shurjoint.com/eng/

Victaulic Company, <https://www.victaulic.com/>

Approved equivalent.

Indicate on Drawings the number of couplings or amount of expansion required.

* + - * 1. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
        2. Standard: AWWA C606, for grooved joints.
        3. Nipples: [**Galvanized,**] ASTM A53/A53M, Schedule 40, Type E or S, steel pipe with grooved ends.
        4. 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.
      1. ALIGNMENT GUIDES AND ANCHORS
         1. Alignment Guides

Products equal to:

Flexicraft Industries, <http://www.flexicraft.com/>

Mason Industries, Inc, https://mason-ind.com/

Metraflex Company, <https://www.metraflex.com/>

Approved equivalent.

Indicate alignment-guide length and maximum slider travel on Drawings.

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.

* + - * 1. Anchor Materials:

Steel Shapes and Plates: ASTM A36/A36M.

Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.

Washers: ASTM F844, steel, plain, flat washers.

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.

Stainless-steel studs are available.

Stud: Threaded, zinc-coated carbon steel.

Expansion Plug: Zinc-coated steel.

Washer and Nut: Zinc-coated steel.

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

Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

Stainless-steel studs are available.

Stud: ASTM A307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.

Washer and Nut: Zinc-coated steel.

1. EXECUTION
   * + 1. INSTALLATION OF EXPANSION JOINTS
          1. Install expansion joints of sizes matching sizes of piping in which they are installed.
          2. Install packed-type expansion joints with packing suitable for fluid service.
          3. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
          4. Install rubber packless expansion joints according to FSA-PSJ-703.
          5. Install grooved-joint expansion joints to grooved-end steel piping.
       2. INSTALLATION OF PIPE LOOPS AND SWING CONNECTIONS

Chapter 46, "Pipes, Tubes, and Fittings," in the 2012 ASHRAE HANDBOOK - "HVAC Systems and Equipment," states that cold springing is not recommended for most HVAC piping. If retaining first paragraph below, indicate dimensions of loops and swing connections and locations of guides and anchors on Drawings.

* + - * 1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
        2. Connect risers and branch connections to mains with at least [five] <Insert number> pipe fittings, including tee in main.
        3. Connect risers and branch connections to terminal units with at least [four] <Insert number> pipe fittings, including tee in riser.
        4. Connect mains and branch connections to terminal units with at least [**four**] <**Insert number**> pipe fittings, including tee in main.
      1. INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS
         1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

Indicate locations and number of guides on Drawings.

* + - * 1. 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.

Coordinate first paragraph below with structural Drawings if welding is included in structural work.

* + - * 1. Attach guides to pipe, and secure guides to building structure.
        2. 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.
        3. Anchor Attachments:

Coordinate first subparagraph below with Structural Drawings if welding is included in structural work.

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."

Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

Coordinate first paragraph below with Structural Drawings if welding is included in structural work.

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

Anchor Attachment to Steel Structural Members: Attach by welding.

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

* + - * 1. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516