

**SECTION 22 05 16  
EXPANSION COMPENSATION FOR PLUMBING**

**PART 1 – GENERAL**

**1.01 WORK INCLUDED**

- A. The work of this Section shall include, but is not limited to, the following:
  - 1. Expansion loops and flexible expansion loops
  - 2. Expansion compensators
  - 3. Pipe alignment guides and anchors
  - 4. Expansion joints

**1.02 RELATED DOCUMENTS**

- A. Section 22 05 01 – Plumbing General Provisions
- B. Section 22 05 29 – Supports, Hangers, Anchors and Sleeves for Plumbing
- C. Section 22 05 48 – Vibration Isolation and Seismic Restraints for Plumbing
- D. Section 22 11 10 – Plumbing Piping and Accessories

**1.03 REFERENCE STANDARDS**

Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

- A. AGA – American Gas Association
- B. ANSI – American National Standards Institute
  - 1. ANSI Z223.1 – 2012: National Fuel Gas Code
- C. ASME – American Society of Mechanical Engineers
  - 1. ASME Standard for Boiler and Pressure Vessel Code – 2013
    - a. ASME BPVC – I through XII
  - 2. ASME B18.10 – 2006: Track Bolts and Nuts
  - 3. ASME B31.9 – 2011: Building Services Piping
- D. ASTM – American Society for Testing and Materials
  - 1. ASTM A53 / A53M – 2012: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 2. ASTM A183 – 2003 Revised 2009: Standard Specification for Carbon Steel Track Bolts and Nuts
  - 3. ASTM B650 – 1995 Revised 2013: Standard Specification for Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
  - 4. ASTM F844 – 2013: Standard Specification for Washers, Steel, Plain (Flat),

- Unhardened for General Use
5. ASTM F1120 – 1987 Revised 2010: Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications
  6. ASTM F1123 – 1987 Revised 2010: Standard Specification for Non-Metallic Expansion Joints

E. AWWA – American Water Works Association

1. AWWA C153/A21.53 – 2011: Ductile-Iron Compact Fittings for Water Service
2. AWWA C210 – 2008: Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
3. AWWA C213 – 2007: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

F. NSF – National Sanitation Foundation

1. NSF Standard 61, Edition 2012: Drinking Water System Components – Health Effects

G. UL – Underwriters Laboratories Inc.

1.04 QUALITY ASSURANCE

- A. Flexible expansion joints shall be AGA certified for use on gas piping.
- B. Flexible expansion joints for potable water piping shall be UL classified in accordance with NSF 61.

1.05 SUBMITTALS

- A. Product Data: For each type of expansion fitting indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
  1. Design Calculations: For thermal expansion of piping systems and selection and design of expansion fittings and loops.
  2. Anchor Details: Detail fabrication of each indicated. Show dimensions and methods of assembly.
  3. Alignment Guide Details: Detail field assembly and anchorage.
- C. Schedule: Indicate manufacturer's number, size, location, and features for each expansion fitting and loop.

**PART 2 – PRODUCTS**

2.01 ACCEPTABLE MANUFACTURERS

- A. Flexible Expansion Loops: MetraFlex, Hyspan
- B. Flexible Expansion Joints, Buried: Double ball configuration, "Flex-Tend" as manufactured by EBAA Iron, Inc., or equal (no known equal)
- C. Expansion Compensator: MetraFlex Model HP, Flexonics Model H or HP, Hyspan

Series 8540 up to 4-inch pipe size

- D. Pipe Alignment Guides: Pipe Shields Series E2000 for insulated pipes; B-Line, Grinnell, Hyspan Series 9500 or MetraFlex for uninsulated pipes
- E. Expansion Joints:
  - 1. Flexible Hose: Flexicraft, MetraFlex
  - 2. Flexible Ball: Advanced Thermal, Hyspan
  - 3. Metal-Bellows: Adsco, Anamet, Badger, Hyspan, MetraFlex, Proco

## 2.02 PERFORMANCE REQUIREMENTS

- A. Expansion compensator shall be capable of elongating and compressing to absorb 200 percent of maximum piping expansion between anchors.
- B. Pipe alignment guides shall be selected for both upward and downward motion.

## 2.03 FLEXIBLE EXPANSION LOOPS

- A. Provide flexible expansion loops of size and material noted on the Drawings.
- B. Flexible loops shall be designed to not impart thrust loads on the anchors. The loop shall consist of two flexible sections of hose and braid, two (2) 90-degree elbows, and a 180-degree return. Loops shall be installed in a neutral, pre-compressed, or pre-extended condition as required for application.
- C. Loops installed hanging down shall have a drain plug. Loops installed straight up may be fitted with an automatic air release valve that purges air from the high point of the loop. Loops installed in any position other than hanging down must have the 180-degree return supported. **[Loops for drainage piping must be installed hanging down and be provided with a full-size cleanout Tee at bottom of loop.]**
- D. Joints for copper piping and fittings with solder-joint end connections:
  - 1. 2-inch and smaller: Bronze hoses and single-braid bronze sheaths with 340 psig at 450 degrees F minimum pressure ratings.
  - 2. 2.5 to 4-inch: Stainless-steel hoses and single-braid, stainless-steel sheaths with 225 psig at 450 degrees F minimum pressure ratings.
- E. Joints for steel piping:
  - 1. End connections shall be threaded up to 2-inch and flanged for all other sizes.
  - 2. Joints, up to 2-inch: Stainless-steel hoses and single-braid, stainless-steel sheaths with 325 psig at 600 degrees F minimum pressure ratings.
  - 3. Joints, 2.5 to 6-inch: Stainless steel hoses and single-braid, stainless steel sheaths with 145 psig at 600 degrees F minimum pressure ratings.
  - 4. Joints up to 2-inch: Stainless steel hoses and single-braid, stainless steel sheaths with 90 psig at 600 degrees F minimum pressure ratings.
  - 5. Joints for 2.5 to 6-inch: Stainless steel hoses and double-braid, stainless steel sheaths with 200 psig at 600 degrees F minimum pressure ratings.
  - 6. Joints for 8-inch and larger: Stainless steel hoses and double-braid, stainless steel sheaths with 120 psig at 600 degrees F minimum pressure ratings.

## 2.04 FLEXIBLE EXPANSION JOINT

### A. Buried Flexible Expansion Joints:

1. Flexible expansion joints shall be installed in the locations indicated on the Drawings and shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53.
2. Provide double ball joint design with each flexible expansion joint shall be pressure tested against its own restraint to a minimum of 350 psi **[250 psi for flexible expansion joints 30 inches and larger]**.
3. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20 degrees, 3 inches-expansion and total expansion range of not less than 6 inches.
4. All internal surfaces parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be holiday tested with a 1,500-volt spark test conforming to said specification. All external surfaces shall be coated with a catalyzed coal tar epoxy conforming to the material requirements of AWWA C210.
5. Install with polyethylene wrap over all joints.
6. Provide restrained mechanical joint or flange ends as required to mate rigidly to piping at both ends. Consult with factory authorized manufacturer representative for guidelines for installations and pipe connection and support accessories required for complete and effective installation.
7. Provide thrust restraint devices to complete installation including thrust restraint products to adequately transfer loading to expansion joint.

## 2.05 EXPANSION COMPENSATORS

- A. Constructed of two-ply stainless steel bellows with copper shrouds, and with copper solder joint fittings. Compensators shall be rated 175 psig minimum, with internal guides, anti-torque device, and removable end clip for positioning.
- B. Provide internal guides for the full length of the bellows travel.

## 2.06 EXPANSION JOINTS

### A. Flexible Ball Type:

1. Carbon-steel assembly with asbestos-free composition packing, designed for 360-degree rotation and angular deflection.
2. 250 psig at 400 degrees F minimum pressure rating; comply with ASME Boiler and Pressure Vessel Code: Section II, and ASME B31.9 for materials and design of pressure-containing parts and bolting.
3. End connections shall be threaded up to 2-inch and flanged for all other sizes.
4. Joints for 6-inch and smaller shall be 30-degree angular deflection minimum. Joints for 8-inch and larger shall be 15-degree angular deflection minimum.

### B. UL-Listed Seismic Type:

1. All sprinkler and fire standpipe piping passing through or crossing building seismic joints shall contain a flexible expansion loop designed for seismic

- movement.
2. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be located at, or near, the building seismic joint.
  3. A vertical support hanger, located within 4 pipe diameters, shall be installed on each side of the flexible loop. Each hanger to be transversely and longitudinally braced per local codes. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure.
  4. Flexible loops shall be capable of movement in the  $\pm X$ ,  $\pm Y$ ,  $\pm Z$  planes. Movement requirements and location, relative to seismic separation, shall be confirmed by the structural design engineer.
  5. Flexible loops may be installed to accommodate thermal expansion, seismic movement, and building settlement.
  6. Flexible loop connections to sprinkler piping shall be installed, inspected, and tested in accordance with current NFPA 13 standards.
  7. Flexible loops shall consist of two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return. Loops shall include a factory supplied, center support nut located at the bottom of the 180-degree return, and a drain/air release plug.
  8. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings.
  9. Flexible expansion/seismic loops to be Metraloop® Fireloop™ as manufactured by The MetraFlex Company, Chicago, IL.

## 2.07 MISCELLANEOUS MATERIALS

- A. Guides shall be steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
- B. Bolts and Nuts: ASME B18.10 or ASTM A183, steel, hex head.
- C. Washers: ASTM F844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened Portland cement concrete, and tension and shear capacities appropriate for application.

## **PART 3 – EXECUTION**

### 3.01 INSTALLATION

- A. Provide at least two (2) guides each side of each expansion loop, compensator or joint. Size guide cylinder to allow the full insulation thickness to be carried through the guide with ample clearance and without restricting the free movement of the pipe. Size guide cylinder for sufficient length to contain the total movement of the spider. Rigidly anchor pipe guide to building structure.
- B. Install expansion fittings according to manufacturer's written instructions in sizes matching pipe size in which they are installed. Align expansion fittings to avoid end-loading and torsional stress.
- C. Provide expansion loops, compensators or joints as shown on the Drawings.

- D. Provide minimum of three (3) elbow offsets on branch pipe connections into mains and at each riser takeoff to allow piping flexibility and expansion.
- E. Install flexible loop within four (4) pipe diameters, both upstream and downstream, from a pipe guide or anchor.

### 3.02 EXPANSION COMPENSATOR OR JOINT INSTALLATION

- A. The bellows element shall be protected from damage. Dents, scores, arc strikes, weld spatter, and other damage can cause the joint to fail. Damaged compensators or joints shall not be used.
- B. Align joint flange and pipe flange holes. Do not try to compensate for flange or pipe misalignment by putting a torsional, compressive, extension, or offset loads on the expansion compensator or joint. Good practice requires that a mating flange in the piping system remain unwelded until the expansion compensator or joint has been bolted into position.
- C. All anchors, guides, and supports must be installed according to manufacturer's recommendations.
- D. Unit lengths must not be altered during installation except for the application of cold pull.
- E. Remove shipping restraints after installation, but before hydrotesting. Test pressure shall not exceed 1.5 times design pressure. Water free of halogens shall be used for hydrotesting.
- F. If testing medium is significantly heavier than the product to be carried in the system, care must be taken to support the additional weight.
- G. Paints containing low melting point metals or their compounds, particularly aluminum, lead or zinc, must not be allowed to come into contact with the bellows convolutions.

END OF SECTION 22 05 16