



# Standard Specification for Pipeline Expansion Joints of the Packed Slip Type for Marine Application<sup>1</sup>

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## 1. Scope

1.1 This specification covers the design, manufacturing, and testing of packed slip-type expansion joints used in pipelines for accommodating axial thermal growth or contraction from the pipeline carrying fluid.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 53/A 53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless<sup>2</sup>

A 216/A 216M Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service<sup>3</sup>

A 285/A 285M Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength<sup>4</sup>

B 650 Specification for Electrodeposited Engineering Chromium Coatings on Ferrous Substrates<sup>5</sup>

### 2.2 ANSI Standards:<sup>6</sup>

B16.5 Steel Pipe Flanges and Flanged Fittings

B16.25 Buttwelding Ends

B31.1 Power Piping

### 2.3 ASME Standards:<sup>7</sup>

Section V Nondestructive Examination

Section VIII, Division 1 Pressure Vessels

Section IX Welding and Brazing Qualifications

### 2.4 AISI Standard:

C-1018 Carbon Steel<sup>8</sup>

## 3. Classification

3.1 The expansion joints shall be of the following types, styles, classes, and forms:

3.1.1 *Type I*—Injectable semiplastic packing type, designed for injecting packing under full-line pressure.

3.1.2 *Style I*—Internally externally guided with guides integral with stuffing box.

3.1.3 *Style II*—Internally externally guided with guides integral with stuffing box and with low-friction inserts at the guide surfaces.

3.1.4 *Class I*—Single joint, single slip.

3.1.5 *Class II*—Double joint, double slip.

3.1.6 *Form I*—Weld end.

3.1.7 *Form II*—Flanged end.

3.1.8 *Form III*—Other.

## 4. Ordering Information

4.1 Expansion joints shall meet all the requirements of the latest issue of this specification. Where possible, the expansion joint shall be the manufacturer's standard commercial product. Additional or superior features that are not prohibited by this specification but which are a part of the manufacturer's standard product, shall be included with the expansion joint being offered. A standard commercial product is a product that has been sold or is currently being offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

4.2 Purchase order or inquiry for expansion joints to this specification shall specify the following:

4.2.1 Title, number, and latest revision of this specification.

4.2.2 Style, class, and form required.

4.2.3 Materials, other than standard as specified (see Section 8).

4.2.4 Service conditions shall specify the following:

4.2.4.1 Maximum and minimum operating temperature ( $^{\circ}$ F).

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.02.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 02.05.

<sup>6</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

<sup>7</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5900.

<sup>8</sup> Available from American Iron and Steel Institute (AISI), 1101 17th St., NW, Suite 1300, Washington, DC 20036.

- 4.2.4.2 Maximum operating pressure (psig).
- 4.2.4.3 Fluid handled.
- 4.2.4.4 Corrosive conditions, if applicable.
- 4.2.5 Total axial expansion or contraction.
- 4.2.6 ANSI pressure class, facing, and drilling for flanged end joint and pipe schedule or wall thickness of ends for weld end joint.
- 4.2.7 If base is required for support or main anchor on Class I expansion joint.
- 4.2.8 Drain connection, if required.
- 4.2.9 Service connection if required, noting location and type of connection.
- 4.2.10 Slip protectors, if required.
- 4.2.11 Adjustment rods for field extension or compression of the slip if required.
- 4.2.12 If hot-dip galvanizing of parts is required.
- 4.2.13 Spare parts, accessories, and special tools, if required.
- 4.2.14 Hydrostatic testing and test pressure, if required.
- 4.2.15 Radiographic or other nondestructive testing of weld joints if required.

## 5. Materials and Manufacture

### 5.1 Materials:

5.1.1 Materials of construction shall conform to the requirements as specified in this specification (see Section 8) and shall be new and free from defects that would adversely affect the performance of individual components or assemblies.

5.1.2 As specified in this specification and as required, the expansion joint shall be provided with flanged or welded end connections, limit stops, stuffing boxes with integral guides, base, drain connection, service connection, slip protectors, and adjustment rods.

### 5.2 Manufacture:

5.2.1 *General*—Unless otherwise required by this specification, the manufacturer's standard shop practices for the fabrication of the expansion joint is acceptable, provided these practices conform to the requirements and recommendations of this specification.

5.2.2 *All Welding*—Welding procedure qualifications, welder performance qualification, welding materials, preheat, and postweld heat treatment if required, shall be in accordance with ANSI B31.1 and ASME Code Section IX.

5.2.3 *Identification*—Each completed expansion joint shall have a name plate made from a corrosion-resistant material permanently attached showing as a minimum the following:

- 5.2.3.1 Manufacturer's model number and joint size,
- 5.2.3.2 Design pressure and design temperature range,
- 5.2.3.3 Nominal traverse or movement per slip,
- 5.2.3.4 Type of packing and service fluid, and
- 5.2.3.5 Date of manufacture.

## 6. Joint Descriptions

### 6.1 Styles:

6.1.1 *Style I*—The slip of the expansion joint shall be guided with the body of the expansion joint by internal and external guides that are integral with the stuffing box. Semiplastic packing shall be injected into the stuffing box and may be contained within the stuffing box chamber by ring-type pack-

ing. All packing shall be of the self-lubricating type. The expansion joint and semiplastic packing shall be suitable for the safe injection of the packing under full-line pressure to stop leakage. Provisions for packing injection shall be by devices located radially about the stuffing box and designed to permit a maximum evacuation of packing at the bottom of the packing device when the injector is fully engaged. The number of devices with injectors for each stuffing box shall be in accordance with the manufacturer's standard practice. The design of the packing injection devices shall be such as to ensure no blowback of injectable packing or the service fluid when injecting packing under full-line pressure.

6.1.2 *Style II*—The expansion joint shall be the same as Style I except low-friction corrosion-resistant material or inserts shall be used for internal and external guiding to prevent slip scoring from pipe misalignment or vibration and to prevent corrosion of the guide surfaces.

### 6.2 Classes:

6.2.1 *Class I*—The expansion joint shall have slip at only one end of the joint. Class I expansion joints may or may not require a base.

6.2.2 *Class II*—The expansion joint shall have slip at both ends of the joint. Class II expansion joints shall require a base.

### 6.3 Forms :

6.3.1 *Form I—Welded End*: The expansion joint shall have provisions at each end of the joint for field welding to the adjoining pipe line.

6.3.2 *Form II—Flanged End*: The expansion joint shall have flanges at each end of the joint for bolting to the mating flanges of the adjoining pipe line.

6.3.3 *Form III*—The expansion joint shall have other end connections as specified for attaching to the adjoining pipe line.

## 7. Design

7.1 The expansion joint shall be designed to conform to applicable sections of the latest edition of ANSI B31.1 and other applicable documents as noted in Section 2.

7.2 *Compression Force*—Unless otherwise specified, the force to compress or extend the slip of the expansion joint shall not exceed 1000 lbf/in. (175 100 N/m) of nominal pipe diameter.

## 8. Construction

8.1 *Slip*—The slip shall be manufactured from steel pipe conforming to Specification A 53/A 53M, Grade B, or a rolled and welded cylinder from Specification A 285/A 285M, Grade C plate, or equal with the longitudinal weld seam 100 % radiographed. The minimal wall thickness of the pipe or rolled cylinder shall be equivalent to Schematic 80 pipe for all sizes to 14 in. (356 mm), inclusive and Schematic 60 for sizes 16 to 24 in. (406 to 610 mm) to preclude slip collapse as a result of external loading of the injectable packing. Heavier wall pipe may be required for expansion joints subjected to pressures above 600 psig and for pipe sizes above 24-in. (610-mm) diameter.

8.1.1 *Chrome Plate*—The slip of the expansion joints shall be chrome plated with engineering chrome in accordance with Specification B 650, Class 50.

8.2 *Stuffing Box*—The stuffing box with integral internal and external guides shall be machined from Specification A 53/A 53M, Grade B Pipe, or AISI C-1018 seamless tubing or cast steel in accordance with A 216/A 216M, Grade WCB. A rolled and welded cylinder from Specification A 285/A 285M, Grade C plate, or equal may be used provided the longitudinal weld seam is 100 % radiograph examined in accordance with ANSI B31.1 and ASME Code Section V.

8.3 *Traverse Chamber*—This chamber, also referred to as the “E.J. Body,” shall be machined from Specification A 53/A 53M, Grade B seamless steel pipe having a wall thickness suitable for the design service conditions. A rolled and welded cylinder from Specification A 285/A 285M, Grade C, or equal steel plate of suitable thickness for the design service conditions may also be used if the longitudinal weld seam is 100 % radiograph inspected to ANSI B31.1 and ASME Code Section V.

8.4 *End Connections*—The end connections of the expansion joint (see Section 6) shall be flanged, weld end, combination of both, or others as specified. Flanges shall conform to ANSI B16.5 and be of the size, material, pressure class, and facing specified. Weld ends shall be beveled for welding to conform to ANSI B16.25 and be of the size, material, and nominal wall thickness as specified for the mating pipe.

8.4.1 *Body End Connection for Class I Expansion Joints*:

8.4.1.1 *Form I—Weld End*: The reduction of the body size to the pipeline size shall be accomplished by a formed reduction of the traverse chamber (body) or by a reducer butt welded to the traverse chamber (body) that meets the requirements of ANSI B31.1 and the ASME Code Section VIII, Division 1.

8.4.1.2 *Form II—Flanged End*: Forged flanges shall be attached to the body by butt welding only and shall be in accordance with the requirements of ANSI B31.1 and the ASME Code Section VIII, Division 1.

8.5 *Limit Stops*—Limit stops may be of the external or internal type manufactured from a suitable material and designed to withstand the full-line pressure thrust load in the event of a pipeline anchor failure.

8.6 *Internal and External Guides*—See 8.2.

8.6.1 *Low-Friction Internal and External Guides*—The low-friction internal and external guides or inserts shall be made from noncorrosive materials with appropriate differential hardness to also prevent scoring or binding of the slip.

8.7 *Base*:

8.7.1 *Expansion Joint Without a Service Connection*—When a base is specified for Class I expansion joints, the base shall be designed for use as a main anchor. Class II expansion joints shall have a base that is suitable as an intermediate anchor. The base shall be of cast or fabricated steel that conforms to the applicable ASTM standard and shall be suitably attached to the joint and drilled in accordance with the manufacturer’s standard practice.

8.7.2 *Expansion Joint With a Service Connection*—Class I and Class II expansion joints with a service connection shall be provided with a main anchor base and all anchor loading data (forces and moments) shall be made available to the manufacturer to assure adequate anchor design. The base shall be of

cast or fabricated steel that conforms to the applicable ASTM standard and shall be suitably attached to the joint and drilled in accordance with the manufacturer’s standard practice.

8.8 *Service Connection*—Unless otherwise specified, a service connection, when required, shall be the manufacturer’s standard design and shall meet the applicable requirements of the ASTM, ANSI, and ASME Codes. The service connection shall be supplied with end connections as specified (see 8.5).

8.9 *Drain Connection*—When required, a drain connection shall be attached to the body of the expansion joint and shall be the manufacturer’s standard unless otherwise specified. The drain connection shall meet the requirements for fitting connections as specified in ANSI B31.1.

8.10 *Packing*—Unless otherwise specified, the packing shall be the manufacturer’s standard-type packing and shall be suitable for the specified service conditions.

8.11 *Other Materials of Construction*—Where the expansion joint is to transfer corrosive fluids, or be installed in a corrosive atmosphere, corrosive-resistant materials as specified may be substituted for the carbon steel components, especially the sliding slip.

## 9. Drawing Requirements

9.1 *Drawings*—When specified, dimensional sketches or drawings sufficiently detailed to describe the expansion joint to be supplied, shall be submitted with bid proposals. The inch-pound system of measurements shall be used to dimension drawings. Drawings shall note that the design of the components or products is in full compliance with this specification.

## 10. Cleaning and Surface Preservation

10.1 *Cleaning*—The internal and external surfaces of the expansion joint shall be cleaned of dirt, oil, grease, and other foreign material using a suitable cleaning solvent. Extreme care shall be used to ensure the interior is free of any slag, steel chips, or other similar materials that could lodge between the slip and the body and score the slip surface.

10.2 *Surface Preservation*—Unless specified, no preservation will be required on the internal surface of the expansion joint. All external surfaces except the chrome-plated slip surface, flanged faces, and weld bevel surfaces shall be painted in accordance with the manufacturer’s standard practice. Weld end joint surfaces for field welding shall be coated with “deoxaluminat” preservative.

## 11. Packaging and Package Marking

11.1 All openings shall be suitably sealed to protect the opening connection surfaces and prevent entrance of foreign materials.

11.2 Unless otherwise specified, the exposed chrome-plated surface of the slips shall be protected in accordance with the manufacturer’s standard practice.

11.3 Unless otherwise specified, the completed expansion joints shall be suitably attached with steel strapping or hold down bolting to wood skids or crates in accordance with standard commercial practice for domestic shipments.

## 12. Quality Assurance

12.1 *Inspection*—Unless otherwise specified, the contractor shall perform inspections as required to assure compliance with this specification. The procuring agency may establish inspection requirements, and it is the contractor's responsibility to provide access to his facilities for the procuring agency's inspection of material, work in process, and quality assurance testing or results as required.

12.2 *Material Certification*—Certified material test reports or certificates of compliance shall be required for all pressure-retaining material. To maintain traceability, all pressure-retaining material shall be metal stamped or otherwise suitably marked with heat treat numbers or other identification codes. If metal stamping is used, the indentations shall not exceed  $\frac{1}{32}$  in. (0.8 mm) or infringe on minimum wall thickness. A round-nose, low-impression-type stamping die shall be used.

12.3 *Nondestructive Testing*—When required, all nondestructive testing shall be performed by qualified personnel in accordance with qualified acceptable procedures.

12.3.1 *Radiography*—Radiographic examination of welds shall be in accordance with ANSI B31.1 and Section V of the ASME Code.

12.3.2 *Visual Examination, Magnetic Particle, and Liquid Penetrant Examination*—Whenever required, these examinations shall be in accordance with ANSI B31.1 and Section V of the ASME Code.

## 13. Keywords

13.1 axial thermal growth; expansion joint; fluid pipeline; marine technology; packed slip expansion joint; pipeline; ship

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