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SCOPE

- I 1.1 This practice covers the design, fabrication, examination, and testing of expansion joints used in pressure vessels, heat exchangers and piping.
- I * 1.2 **Expansion joints shall not be used unless approved by the Owner's Engineer.**
- R 1.3 Expansion joints used in pressure vessels and heat exchangers shall meet the requirements of the **ASME Code Section VIII, Division 1, Appendix 26 or CC** as appropriate, and the additional requirements of this practice.
- R 1.4 Expansion joints used in piping systems shall meet the requirements of **ASME B31.3, Appendix X**, and the additional requirements of this practice.
- I 1.5 **An asterisk (*)** indicates that a decision by the Owner's Engineer is required or that additional information is furnished by the Purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the practices, codes and standard which shall be used with this practice.

TABLE 1

PRACTICES	
IP 18-7-1	Welding Procedures
IP 18-10-1	Additional Requirements for Materials
IP 18-12-1	Positive Material Identification
IP 20-1-1	Inspection of Equipment and Materials
CODES AND STANDARD	
ASME Codes	
Section VIII Pressure Vessels, Division 1	
B31.3 Process Piping	
EJMA Standard	
Standards of the Expansion Joint Manufacturers Association	

DOCUMENTATION

- I * 3.1 **Proposal information.** Vendor shall submit the following information to the Purchaser for approval by the Owner's Engineer:
 - a. Dimensions.
 - b. Materials and heat treatment.
 - c. Design conditions including design movements and cycle life.
 - d. Design basis, including calculations.
 - e. Bellows spring rate.
 - f. Design details for guiding components (tie rods, hinges, gimbals, etc.) and attachments.
 - g. Design details for pressure reinforcement rings.
 - h. Design details for sleeves and other internal design details.
 - i. Design details for purge connections, including size, number, and location.
 - j. Test procedures including test pressures.
 - k. Completed [Table 2](#), "Expansion Joint Data Sheet."

Dimensions supplied shall be sufficient to solve the pressure stress and deflection stress calculation procedures given by the performance equations in the **ASME Code Section VIII, Division 1, Appendix 26** or CC as appropriate.



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IP 3-8-1		Expansion Joints	
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(This practice is appropriate for attachment to Inquiry or Purchase Document)

- I * 3.2 Prior to the start of fabrication, the vendor shall submit the following information to the Purchaser for approval by the Owner's Engineer:
- Outline drawing including all data requested in **Par. 3.1**.
 - Fabrication drawings including all weld details with reference to applicable welding procedures.
 - Welding procedures.
 - Heat treatment procedures, if any.

MATERIALS

- R * 4.1 **Bellows material** for expansion joints will be specified at time of inquiry in [Table 2](#).

DESIGN

- R * 5.1 The design life (N) shall be specified by the Owner's Engineer. 1,000 cycles minimum shall be specified for piping.
- R * 5.2 The bellows design shall consider the design pressure coincident with the full fluid design temperature.
- R * 5.3 For expansion joints with a **design temperature above the limits** given for the fatigue design equations, but below 1200°F (650°C), and with a design life (N) ≤ 1000 cycles, the maximum permitted value of the combined meridional membrane and bending stress range (S_n) shall be as follows:
- For design temperatures at or above 950°F (510°C), S_n shall be equal to the sum of the specified minimum yield strength of the material at room temperature plus the basic allowable stress in tension at design temperature.
 - For temperatures between the limits of the fatigue design equations and 950°F (510°C), " S_n " shall be determined by straight line interpolation between the value corresponding to the design life from the appropriate fatigue design equation and the value determined in (a) above.
- R * 5.4 For **expansion joints in fluids solids units** used as grid seals and contained completely below the grid, the maximum combined meridional membrane and bending stress range for fatigue evaluation, S_n , shall not exceed 120,000 psi (824 MPa).
- R 5.5 For **high temperature services** above 900°F (482°C), the bellows shall be designed to operate between 350 - 800°F (177 - 427°C) through the use of appropriate design features, such as shrouds and/or insulation.
- R * 5.6 The bellows thickness before forming shall not be less than 0.035 in. (0.9 mm). Unless otherwise specified, the minimum bellows thickness before forming for fluid solids transfer lines and grid seals shall be 0.075 in. (1.9 mm).
- R * 5.7 If two-ply construction is specified, each ply shall be designed for the full design pressure at the fluid design temperature. A provision shall be made for leak detection/testing between the plies.
- R 5.8 "Flanged only" (ref. ASME Sect VIII, Div 1, Appendix CC) or similar type expansion joints shall not be used.
- R 5.9 The bellows assembly of expansion joints in piping systems shall be equipped with a removable **external steel cover** designed to protect the bellows from external mechanical damage. The cover shall not prevent the required thermal movement of the joint. The cover shall be equipped with an **indicating device** to measure axial, lateral and angular joint movement. If the joint is internally insulated, the cover shall be vented as necessary to limit bellows metal temperature to the design value.
- R * 5.10 In **fluid solids and other erosive services**, an internal erosion sleeve shall be installed to shield the entire bellows length from the flow stream. The following are required:
- The sleeve shall be welded on the upstream end of the bellows assembly stub end, and permit differential thermal expansion at the downstream end.
 - The flow direction shall be permanently indicated on the exterior of the joint with an arrow marked "flow."
 - Ceramic fiber insulation shall be provided to fill the void between the bellows and sleeve. A retaining device to keep the ceramic fiber in position shall also be provided and its design must be approved by the Owner's Engineer.
- R * 5.11 **Purge connections** shall not be provided to purge the area between the bellows and internal sleeve unless specified by the Owner's Engineer.



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