

<b>KLM Technology Group</b>  Project Engineering Standard	  <a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a>	Page : 1 of 9
		Rev: 01
		April 2011
KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	<b>SPECIFICATION FOR METALLIC EXPANSION JOINT</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	

## TABLE OF CONTENT

<b>SCOPE</b>	<b>2</b>
<b>REFERENCES</b>	<b>2</b>
<b>UNITS</b>	<b>2</b>
<b>DESIGN REQUIREMENTS</b>	<b>3</b>
General	3
Material	3
Bellow Design	3
Bellows Design Criteria	4
Mechanical Design	4
External Cover	5
Internal Sleeves	5
Element Identification and Dimensions	5
Welding and Non-Destructive Examination Requirements	6
Reliability	6
<b>OPERATION</b>	<b>6</b>
<b>TESTING &amp; INSPECTION</b>	<b>6</b>
General	6
Test	6
Inspection	7
Repairs	7
<b>CLEANING &amp; TAGGING</b>	<b>7</b>
Cleaning	7
Tagging and Boxing	8
<b>PREPARATION FOR SHIPMENT</b>	<b>8</b>
Shipment	8

<b>KLM Technology Group</b>  Project Engineering Standard	<b>SPECIFICATION FOR METALLIC EXPANSION JOINT</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	Page 2 of 9
		Rev: 01
		April 2011

## SCOPE

This Project Standard and Specification covers general requirement for design, material selection, inspection and packaging of expansion joints of single or double bellows with single layer corrugations to absorb thermal expansion or contraction of piping system. The requirements described herein are supplementary to the specification drawing sheet or datasheet.

## REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

### 1. American society of Mechanical Engineers (ASME)

ASME B31.1	Power Piping
ASME B31.3	Process Piping
ANSI/ ASME B16.5	Steel Pipe Flanges and Fittings
ASME B&PV Section V	Nondestructive Examination
ASME B&PV Section IX	Welding and Brazing Qualifications

### 2. Expansion Joint Manufacturers Association (EJMA)

## UNITS

This Standard is based on International System of Units (SI) except where otherwise specified. However, nominal sizes of piping components shall be in accordance with inch system.

<b>KLM Technology Group</b>  Project Engineering Standard	<b>SPECIFICATION FOR METALLIC EXPANSION JOINT</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	Page 3 of 9
		Rev: 01
		April 2011

## DESIGN REQUIREMENTS

### General

1. The expansion joint shall be able to handle the axial, lateral, angular or rotational movements or a combination of one or more above, at all operating conditions.
2. Expansion joint for connecting the reciprocating or pulsating machinery shall be able to absorb equipment vibration and vibration and the mechanical resonant condition.
3. Pressure thrust load shall be minimized in design of the expansion joint.
4. Loads and load combinations specific to the site of installation shall be considered in the expansion joint design.
5. Local stresses at attachments to spool sections shall be taken in consideration.

### Material

Selection of material for the expansion joint and its components shall be governed by the design temperature and pressure of the line, the fluid service requirements and the applicable codes listed of this Project Standard and Specification.

The materials to be used for end connections and sleeves shall be the same as the connecting pipe.

All contact areas shall be designed to eliminate electrolysis or galvanic action.

### Bellow Design

1. Design of bellows and bellows components shall be in accordance with EJMA Standards.
2. Bellows shall be formed from solution annealed sheet conforming to the latest ASTM specification. Bellows is to be hydraulically or expansion (punched) formed. Rolled forming bellows is not preferable.
3. Bellows must be a minimum of 3 convolutions in each bellow if possible.
4. Bellows shall be formed from a tube having only one full penetration welded longitudinal seam.
5. Bellows cycle life shall be determined per Appendix X of the ASME B 31.3 Code. All expansion joints shall be capable of at least 200 full coincident pressure and temperature cycles at design conditions and movements.
6. The design basis of expansion joints other than U-Shape bellows shall be submitted to Stress Engineer for approval.

<b>KLM Technology Group</b>  Project Engineering Standard	<b>SPECIFICATION FOR METALLIC EXPANSION JOINT</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	Page 4 of 9
		Rev: 01
		April 2011

7. Bellows equalizing rings shall be of the split type with bolted fasteners if applicable.
8. Vendor/ manufacturer shall supply full detailed engineering documentation (e.g. drawings, calculations, and axial/rotational spring rate data for Contractor's verification and approval). Minimum requirement for information on the specification sheet and Vendor's drawing is, but not limited to:
  - Tag-number, installation location and required quantity
  - Design and operating temperature
  - Design and operating pressure
  - Test conditions (fluid and pressure)
  - Commodity fluid service, fluid properties and velocity
  - Materials and required certificates
  - Required number of cycles (N) and allowable number of cycles of the joint
  - Vibrations
  - Actual movements and joints maximum rated movements
  - Tie rod details and installation information
  - Convolution height
  - Pitch distance
  - Connection requirements (e.g. material, line size, wall thickness, facong and rating)
  - Wall thickness
  - Internal sleeve details with internal clearance for movements, if applicable
  - Convolution inside/outside diameter
  - Special instructions
  - Total weight
  - Installation orientation with 3-D feature of proper figure (e.g. Hinge direction, tie-rod direction)
9. Butt welded expansion joints shall have adequate length of pipes so that site welding does not impair or reduce the joints efficiency.

### **Bellows Design Criteria**

Bellows shall be designed according to ASME B 31.3 Appendix X.

### **Mechanical Design**

1. Pins in hinges, gimbals and support assemblies in all joints shall be designed so that they are in double shear.
2. Hinges, gimbals and tie-rod shall be designed to withstand the pressure and velocity thrust of the expansion joint as well as the spring rate of the joint and any itemized external loads specified. Design shall be based on the