**BELLOWS DESIGN DATA SHEET EJMA 10th EDITION**

Bellows Design Calculation - EJMA 10
Calculation: MM-/2017/461 Revision: 0

Supplied by: TRIAD BELLOWS DESIGN AND MANUFACTURING
Client: ANY COMPANY
Project No: AC-123456
Project Desc: EXHAUST EXPANSION JOINT

Calculating: MM-/2017/461 Calculation Date: 5/22/2017
Revision: 0 Calculated By: MGM

Drawing Number: 50-180-011213
Drawing Revision: 1
Item Number: 18" PIPE T-321 S/S

Client: AN Y COMPANY
Project No: AC-123456
Project Desc: EXHAUST EXPANSION JOINT

Pipe End Material: ASME SA 240 321 2013 ed
Pipe End Type: SAMPLE EJMA CALCULATION

Pipe End Length: 0.0000
Pipe End Thickness: 0.00
Pipe End Mass: 0.0 lb

Design Data

- **Design Temp:** 1000 F
- **Design Press:** 5.0 psig
- **Axial Movement:** -3.250 / 0.000 in
- **Lateral Movement:** 0.000 / 0.375 in
- **Angular Rotation:** 0.00 / 0.00 deg
- **Req. Fatigue Cycles:** 10000
- **Addit. Fatigue Safety Factor:** 1
- **Annealed Bellows:** F
- **Weld Factor:** 0.7
- **No of Convol:** 16
- **Tangent Length:** 18.00 in
- **Layer Thickness:** 0.0120 in
- **No of Layers:** 2
- **Collar Thickness:** 0.0000 in
- **Bellows Type:** Unspecified

**Materials**

- **Bellows:** ASME SA 240 321 2013 ed
- **Nipple:** ASME SA 240 321 2013 ed

**Calculation Results**

- **Cd:** 1.55 Rated Max Axial Mov Compr Only: 5.9 in Allow ed Cycles: 195,398
- **Cf:** 1.37 Total Equivalent Axial Movement: 5.71 in Convol Depth w: 1.13 in
- **Cp:** 0.71 Bellows Allow able Stress: 16.200 psi Bellows Length Le: 13.3 in
- **S1:** 1.683 psi Bellows E at Temperature: 2.28E7 psi Bellows Length Lb: 12.0 in
- **S1':** 0 psi Bellows Yield at Temp by EJMA: 36.180 psi Bellows Length Lu: 0.0 in
- **S2:** 580 psi Axial Working Spring Rate: 50 lbs/in Total Length: 12.0 in
- **S3:** 321 psi Lateral Working Spring Rate: 191 lbs/in Thickness tp: 0.0116 in
- **S4:** 8,265 psi Bending Working Spring Rate: 40 in-lbs/deg Factor K: 0.0116
- **S5:** 350 psi Limiting Column Instability: 6.7 psi Factor K: 1.50
- **S6:** 98,464 psi Limiting Inplane Instability: 21.3 psi Thrust Force: 1,440 lbs

**EXPANSION JOINT DESIGN STARTS WITH THE METAL BELLOWS**

When the exhaust bellows is designed correctly you can be guaranteed years of trouble free service. At Triad Bellows our goal is to engineer metal bellows with both performance and value in mind. We follow the Expansion Joint Manufacturers Association latest 10th Edition guidelines to insure that we meet our goal.

**Axial and Lateral Spring Rate:** In order to evaluate the loads upon piping, supports, or equipment, it is necessary to determine the axial forces and moments required to move an Expansion Joint. The bellows resistance factor or working spring rate is shown in lbs per inch of compression or extension.

**Allowed Cycles:** The fatigue life expectancy can be defined as the total number of complete cycles which can be expected from the expansion joint. A cycle is defined as one complete movement from the initial position in the piping system to the operating position and back to the initial position. Cycle Life is theoretical and is dependent upon the maximum stress range to which the bellows is subjected. The fatigue life expectancy of an expansion joint is affected by various factors such as: operating pressure, operating temperature, the material from which the bellows is made, the movement per convolution, the thickness of the bellows, the convolution pitch, the depth and shape of the convolution. Any change in these factors will result in a change in the life of the Expansion Joint. The work hardening of austenitic stainless steel, induced during the forming of convolutions, generally improves the fatigue life of an Expansion Joint often to a marked degree.

Contact Triad Bellows Engineering for other data sheet definitions: (714)-204-4444 or (888) 866-1080