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		Drawing Number:	50-180-011213		Calculation Date:	5/22/2017
Project No:	AC-123456		Drawing Revision:	1		Calculated By:	MGM
Project Desc:	EXHAUST EXPANSION JOINT		Item Number:	18" PIPE T-321 S/S		Bellows Number:	SAMPLE EJMA CALCULATION

Design Data

Design Temp:	1000	F	Axial Movement:	-3.250 / 0.000	in	Req. Fatigue Cycles:	10000
Design Press:	5.0	psig	Lateral Movement:	0.000 / 0.375	in	Addit. Fatigue Safety Factor:	1
			Angular Rotation:	0.00 / 0.00	degr	Annealed Bellows:	No
						Weld Factor:	0.7

Dimensions

			Tool Radius:	0.166	in	Nipple Length:	0.0 in
Bellows ID:	18.00	in	Pitch:	0.75	in	Nipple Mass:	0.0 lb
Bellows OD:	20.30	in	Tangent End ID:	18.00	in	Nipple Angle:	0.00 degr
No of Convol:	16		Tangent Length:	0.63	in	Pipe End Length:	0.0 in
Layer Thickness:	0.0120	in	Collar Length:	0.00	in	Pipe End Thickness:	0.00 in
No of Layers:	2		Collar Thickness:	0.0000	in	Bellows Type:	Unspecified

Materials

Bellows:	ASME SA 240 321 2013 ed	Pipe Ends:		Bellows material's Yield:	30,000 psi
Nipple:		Collar:		Bellows in Creep Range:	No

Calculation Results

Cd:	1.55		Rated Max Axial Mov Compr Only:	5.9	in	Allowed Cycles:	195,398		
Cf:	1.37		Tot Equivalent Axial Movement:	5.71	in	Convol Depth w:	1.13	in	
Cp:	0.71		Bellows Allowable 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	
S'1:	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:	121	psi	Lateral Working Spring Rate:	191	lbs/in	Thickness tp:	0.0116	in	
S4:	8,265	psi	Bending Working Spring Rate:	40	in-lbs/degr	Effective Area Ae:	288.02	in^2	
S5:	350	psi	Limiting Column Instability:	6.7	psi	Factor Ku:	1.50		
S6:	99,464	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