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BELLOWS DESIGN CALCULATION SPREADSHEET

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Design Code: EJMA Standards, 10th Edition
Allowable Stress Basis: ASME Section II-D, 2019 Edition

BELLOWS DESIGN INFORMATION

Bellovs Material:	SA240-T321		
Collar Material:	N/A	Sa at Design Temp.:	132 (MPa)
Reinforcing Ring Mat.:	N/A	Sa at 70 deg F:	138 (MPa)
Design Pressure:	25,0 (barg)	E at Design Temp.:	186.096 (MPa)
Design Temperature:	150 (deg C)	E at 70 deg F:	195.129 (MPa)
Axial Extension:	0,00 (mm)	Weld efficiency:	1,00
Axial Compression:	90,00 (mm)		
Lateral (+):	0,00 (mm)	Cycle Life:	663 cycles
Lateral (-):	0,00 (mm)	Cycle Life Based on:	
Angular (+):	0,00 (deg.)	EJMA Standards, 10th Edition	
Angular (-):	0,00 (deg.)	EJMA fc factor:	1,00

SPRING RATE INFORMATION

	Total Expansion Joint		Spring Forces	
Axial Spring Rate:	381	(N/mm)	Axial:	34285 N
Lateral Spring Rate:	2.584	(N/mm)	Lateral:	N/A N
Angular Spring Rate:	73	(N-m/deg)	Angular:	N/A (N-m/deg)
Torsional Spring Rate:	95.112	(N-m/deg)		

BELLOWS GEOMETRY

Bellovs Inside Diameter:	273,00 (mm)	Convolution Height:	20,2 (mm)
Bellovs Outside Diameter:	318,20 (mm)	Re-roll (2r):	9,0 (mm)
Number of convolutions:	10	Bellovs Convolute Length:	220,00 (mm)
Individual Ply Thickness:	0,600 (mm)	Center Spool Length:	N/A (mm)
Number of Plies:	4	Theoretical Neutral Length:	228 (mm)

BELLOWS STRESS ANALYSIS

		Design Stress	Allowable Stress
S1	Tangent Circumferential Membrane Stress Due to Pressure	143 (MPa)	132 (MPa)
S'1	Collar Circumferential Membrane Stress Due to Pressure	N/A (MPa)	N/A (MPa)
S2	Circumferential Membrane Stress Due to Pressure	69 (MPa)	132 (MPa)
S'2	Reinforcing Ring Membrane Stress Due to Pressure	N/A (MPa)	N/A (MPa)
S3	Meridional Membrane Stress Due to Pressure	11 (MPa)	N/A (MPa)
S4	Meridional Bending Stress Due to Pressure	224 (MPa)	N/A (MPa)
S3+S4	Meridional Mem. + Bending Stress Due to Pressure	235 (MPa)	395 (MPa)
S5	Meridional Membrane Stress Due to Deflection	23 (MPa)	N/A (MPa)
S6	Meridional Bending Stress Due to Deflection	2.082 (MPa)	N/A (MPa)
St	Total Stress Range for All Movements	2.270 (MPa)	N/A (MPa)
S"1	Collar Circumferential Bending Stress Due to Pressure	N/A (MPa)	N/A (MPa)
S'1 + S"1	Collar Circumferential Bending + Membrane Stress Due to Pressure	N/A (MPa)	N/A (MPa)
Squirm	Maximum Design Pressure Based Upon Squirm	26,5 (barg)	

MISCELLANEOUS INFORMATION

Bellovs Annealed/Not-Annealed After Forming	Not-Annealed
Reinforcing Rings Utilized/Not Utilized	Not-Utilized
Reinforcing Ring Area	N/A cm ²
Bellovs Weight	10,0 kg
Bellovs Effective Area	684 cm ²
Pressure Thrust	171.322 N
Convolution Switch Value (for manufacturing)	51 mm
Pitch	22,0 mm