HOSE MASTER

Expansion Joint Catalog

Who Is Hose Master?

Hose Master is North America's leading manufacturer of metal hose and expansion joints, with the industry's largest in-house fabricating footprint - almost 500,000 square feet of manufacturing space in Cleveland, Ohio; Houston, Texas; Atlanta, Georgia; and Reno, Nevada.

Recognized for technical expertise and innovation, 10% of Hose Master's workforce is dedicated to research and development which provides continuous improvements to our wide range of flexible metal products.

Hose Master is unique in its ability to implement a solution from initial concept to completion because we design and build our own state-of-the-art production equipment in-house.

Key to Hose Master's success is its team of engineers. They are ready to assist with any complex, non-standard, or critical applications, and provide customized and timely solutions.

Delivering the highest quality products for the most demanding applications is a guiding principle at Hose Master. Expansion joint designs conform to the stringent standards of EJMA and ASME B31.1 and/or B31.3. Additionally, Hose Master has been certified to ASME Section VIII, Division 1 and approved to provide ASME U and PP Designators, as well as the National Board R Stamp in recognition of product and process compliance.

Customer specifications can be verified through Finite Element Analysis (FEA), or 3D CAD modeling. Expansion joint test options include pneumatic, hydrostatic, high-pressure gas, or liquid penetrant methods, as well as helium mass spectrometry and radiography.

With 90+ ASME IX Certified welders and comprehensive material stocking program, Hose Master provides the exceptional service our industry demands. In addition to providing the best standard delivery lead-time, Hose Master offers our After Hours Emergency Service for hose and expansion joints, providing customers an expedited response for critical and time-sensitive situations that arise beyond normal business hours.

A key to permanently solving any tough expansion joint application is to accurately identify the root cause(s) of past failure modes of products removed from service. Hose Master's in-house product and failure analysis lab can identify various failure modes, whether a result of fatigue, corrosion, deformation, or from a host of other possible causes.

Hose Master is the only metal hose and expansion joint manufacturer in North America that offers in-house failure analysis and reverse engineering as a no-charge service to its distributor partners.

Pre-Engineered or Custom Designed Expansion Joints

Pre-Engineered Expansion Joint Products

Pre-engineered expansion joint products incorporate designs for common industrial applications to provide more immediate order availability. Hose Master's pre-engineered expansion joint data charts are presented as a resource to assist sales, engineering, MRO, and purchasing professionals by providing baseline data during discussions in the initial design phase.

Custom Designed Expansion Joints

Because no two opportunities are identical, pre-engineered solutions are sometimes impractical for addressing all critical variables of the most demanding applications, Hose Master offers custom solutions. Custom designed expansion joint products range in size for 2" - 120" nominal diameter, and are available with an array of alloys and end fittings to suit any expansion joint application. Because of their many options, custom-designed expansion joints are engineered to suit specific needs.

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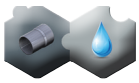
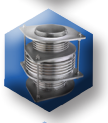
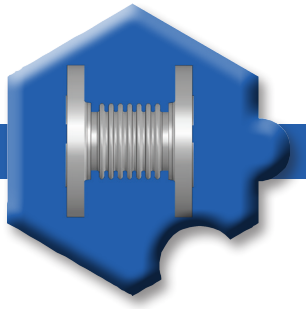




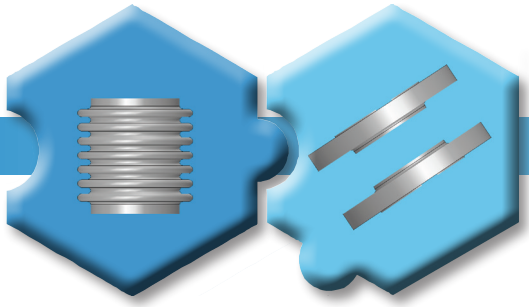
Pre-Engineered Expansion Joints



STEP 1 - Expansion Joint Type

Select the type of expansion joint required
(*Please refer to page 4 for illustrations and explanations*):

- Unrestrained Single (i.e. US)
- Limit Single (i.e. LS)
- Tied Single (i.e. TS)



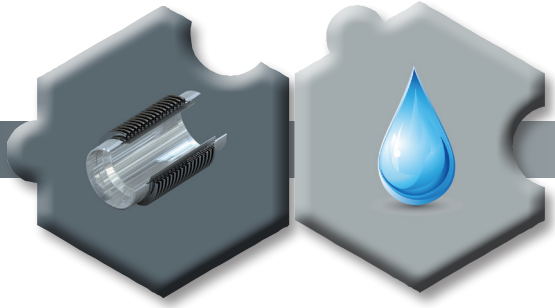
STEP 2 - Series

Select the specifications for the bellows and fittings using the 4 digit SERIES CODE provided on the charts (pages 5-12).

- 15 PSI (i.e. A001) - pages 5 & 6
- 50 PSI (i.e. B217) - pages 7 & 8
- 150 PSI (i.e. C430) - pages 9 & 10
- 300 PSI (i.e. D637) - pages 11 & 12

Note:

- All parts come standard with carbon steel fittings
- Flanges for designs 150 PSI and below will have van stone ends
- Flanges for designs of 300 PSI will be fixed
- For alternative material, please indicate at the time of order
- All pipe is schedule 40



Step 3 - Options for Accessories & Testing

If required, additional hardware or hydrostatic testing* can be added. Options on pre-engineered products include:

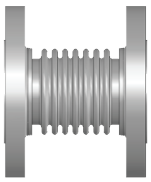
Accessories:

- Liner (i.e. L)
- Cover (i.e. C)
- Cover & Liner (i.e. B)
- No Accessories (i.e. X)

Testing:

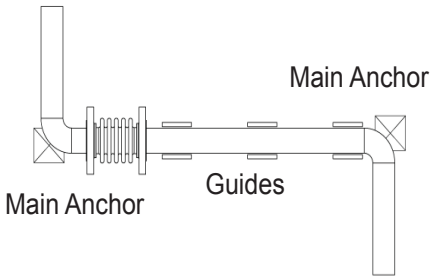
- Standard (i.e. S)
- Hydrostatic (i.e. H)

**All expansion joints are 100% leak tested however, for an additional cost, Hydrostatic testing is available upon request*

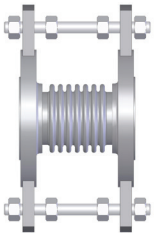


US - Unrestrained Single

An Unrestrained Single expansion joint is best used when piping systems are equipped with proper guides and anchors to absorb axial, angular, and a small amount of lateral movement.

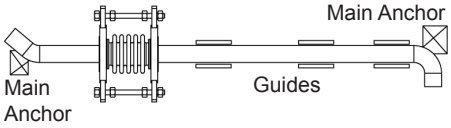


Example of an Unrestrained Single expansion joint used in a proper piping system to absorb axial pipeline expansion

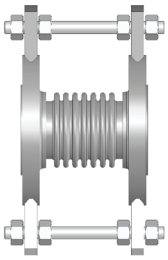


LS - Limit Single

A Limit Single expansion joint is best used when main anchors and guides are in the pipeline. It allows for some axial movement as well as lateral movement; however, the hardware protects the expansion joint from exceeding its design movements.

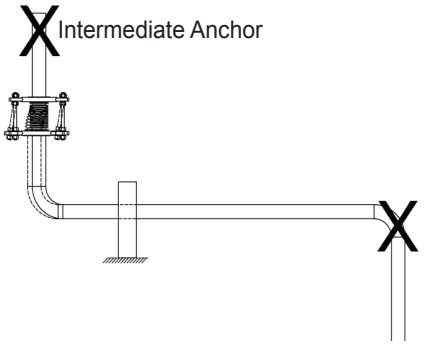


Example of a Limit Single expansion joint used in piping systems with main anchors. The limit rods prevent damage to the expansion joint and piping system by absorbing full pressure thrust.

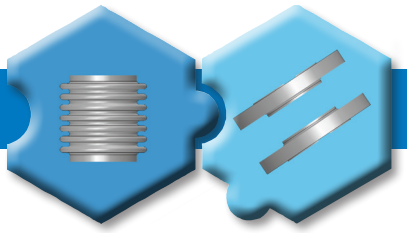


TS - Tied Single

A Tied Single expansion joint is best used in piping systems without a main anchor. It allows for lateral movement while also restraining pressure thrust.

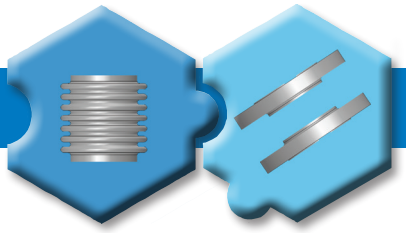


Example Right: Tied Single expansion joint where the expansion joint is installed 90° to the thermal growth of the piping. Because of the rods, the expansion joint is able to absorb lateral movement only.



STEP 2 - *Series A* 15 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
2	A001	4			4	-0.59	0.59	0.06	10	276	1520	4
	A002		6									
	A003			8								
2	A004	4			6	-0.9	0.9	0.2	10	184	450	2
	A005		6									
	A006			10								
2	A007	6			8	-1.21	1.21	0.39	10	138	190	2
	A008		6									
	A009			10								
2	A010	6			10	-1.52	1.52	0.63	10	110	97	1
	A011		6									
	A012			10								
2	A013	6			12	-1.83	1.83	0.93	10	92	56	1
	A014		9									
	A015			12								
2	A016	8			14	-1.79	1.79	1.28	10	78	35	1
	A017		9									
	A018			12								
2	A019	8			16	-1.56	1.56	1.68	10	69	23	1
	A020		9									
	A021			12								
2.5	A022	4			4	-0.7	0.7	0.07	10	258	1774	6
	A023		6									
	A024			8								
2.5	A025	4			6	-1.07	1.07	0.21	10	172	525	4
	A026		6									
	A027			10								
2.5	A028	6			8	-1.43	1.43	0.41	10	129	221	3
	A029		6									
	A030			10								
2.5	A031	6			10	-1.8	1.8	0.66	10	103	113	2
	A032		9									
	A033			10								
2.5	A034	8			12	-2.16	2.16	0.98	10	86	65	2
	A035		9									
	A036			12								
2.5	A037	8			14	-2.48	2.48	1.34	10	73	41	1
	A038		9									
	A039			12								
2.5	A040	8			16	-2.17	2.17	1.77	10	64	27	1
	A041		9									
	A042			14								
3	A043	4			4	-0.78	0.78	0.07	10	120	992	4
	A044		6									
	A045			8								
3	A046	6			8	-1.59	1.59	0.41	10	60	124	2
	A047		9									
	A048			10								
3	A049	8			12	-2.4	2.4	1	10	47	43	1
	A050		9									
	A051			12								
3	A052	10			16	-2.72	2.72	1.85	10	63	30	2
	A053		12									
	A054			14								



STEP 2 - *Series A* 15 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
4	A055	4			4	-0.86	0.86	0.07	10	152	1608	8
	A056		6									
	A057			8								
4	A058	6			8	-1.75	1.75	0.4	10	76	201	4
	A059		9									
	A060			10								
4	A061	8			12	-2.64	2.64	0.96	10	52	61	2
	A062		9									
	A063			12								
4	A064	10			16	-3.53	3.53	1.78	10	70	44	3
	A065		12									
	A066			14								
4	A067	12			20	-3.15	3.15	2.81	10	89	36	4
	A068		15									
	A069			16								
4	A070	14			24	-2.55	2.55	3.34	10	107	29	5
	A071		15									
	A072			18								
4	A073	14			26	-2.33	2.33	3.59	10	116	26	5
	A074		18									
	A075			20								
6	A076	4			4	-1.02	1.02	0.06	10	99	1695	11
	A077		6									
	A078			10								
6	A079	8			8	-2.06	2.06	0.37	10	49	211	5
	A080		9									
	A081			12								
6	A082	10			12	-3.11	3.11	0.9	10	61	112	6
	A083		12									
	A084			14								
6	A085	12			16	-4.15	4.15	1.64	10	83	84	9
	A086		15									
	A087			16								
6	A088	14			20	-5.2	5.2	2.63	10	104	66	11
	A089		15									
	A090			18								
6	A091	16			24	-4.92	4.92	3.81	10	127	56	14
	A092		18									
	A093			20								
6	A094	18			26	-4.49	4.49	4.08	10	138	51	15
	A095		18									
	A096			22								
8	A097	6			4	-1.18	1.18	0.06	10	108	2314	20
	A098		9									
	A099			10								
8	A100	8			8	-2.38	2.38	0.38	9	54	289	10
	A101		9									
	A102			12								
8	A103	10			12	-3.59	3.59	0.93	10	70	161	13
	A104		12									
	A105			14								
8	A106	14			16	-4.79	4.79	1.7	10	95	121	17
	A107		15									
	A108			18								

* T316 Stainless Steel available upon request

**Some Pre-Engineered Expansion Joints are available with more flexibility

For Quick & Easy **Pre-Engineered** Inquiries: Scan the QR Code right with a smart phone camera for a direct link to our on-line Inquiry Sheet, or simply **Click Here**.

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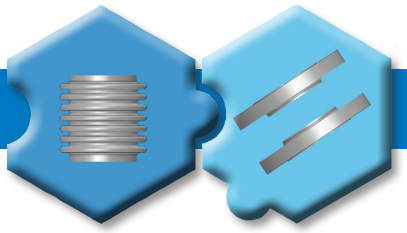
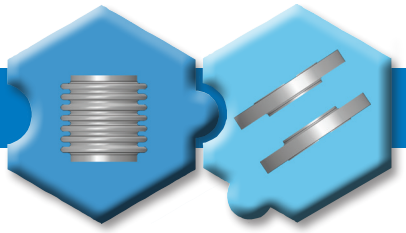


STEP 2 - *Series A* 15 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
8	A109	16			20	-5.86	5.86	2.65	10	118	94	21
	A110		18									
	A111			20								
8	A112	20			24	-6.77	6.77	4.06	10	148	76	27
	A113		21									
	A114			22								
8	A115	20			26	-6.19	6.19	4.79	10	162	70	30
	A116		21									
	A117			24								
10	A118	6			4	-1.34	1.34	0.06	10	83	2151	24
	A119		9									
	A120			10								
10	A121	8			8	-2.7	2.7	0.39	7	52	337	15
	A122		12									
	A123			12								
10	A124	12			12	-4.06	4.06	0.95	10	80	224	23
	A125		15									
	A126			16								
10	A127	14			16	-5.42	5.42	1.75	10	107	163	30
	A128		18									
	A129			18								
10	A130	18			20	-6.78	6.78	2.77	10	135	131	39
	A131		21									
	A132			22								
10	A133	20			24	-6.59	6.59	3.29	10	203	133	57
	A134		24									
	A135			24								
12	A136	6			4	-1.49	0.69	0.06	9	82	2391	33
	A137		9									
	A138			10								
12	A139	10			8	-3.01	3.01	0.42	7	58	419	23
	A140		12									
	A141			14								
12	A142	12			12	-4.52	4.52	1.01	10	88	277	35
	A143		15									
	A144			16								
12	A145	16			16	-6.04	6.04	1.83	10	120	209	49
	A146		18									
	A147			20								
12	A148	20			20	-7.56	7.56	3	10	153	158	61
	A149		21									
	A150			24								
14	A151	6			4	-1.49	0.07	-0.03	2	90	3125	44
	A152		9									
	A153			10								
14	A154	10			8	-3.01	3.01	0.38	6	58	503	28
	A155		12									
	A156			14								
14	A157	12			12	-4.52	4.52	0.92	9	88	332	42
	A158		15									
	A159			16								
14	A160	16			16	-6.04	6.04	1.68	10	118	243	55
	A161		18									
	A162			20								
14	A163	20			20	-7.56	7.56	2.74	10	153	190	73
	A164		24									
	A165			24								



STEP 2 - *Series A* 15 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
16	A166	6			4	-1.49	0.3	0	4	103	4601	64
	A167		9									
	A168			10								
16	A169	10			8	-3.01	3.01	0.33	6	58	646	36
	A170		12									
	A171			14								
16	A172	12			12	-4.52	4.52	0.8	8	89	431	55
	A173		15									
	A174			16								
16	A175	16			16	-6.04	6.04	1.47	10	119	316	72
	A176		18									
	A177			20								
16	A178	20			20	-7.56	7.56	2.4	10	153	245	94
	A179		24									
	A180			24								
18	A181	6			4	-1.65	1.65	0.06	8	103	4663	83
	A182		12									
	A183			10								
18	A184	10			8	-3.33	3.33	0.36	5	64	737	50
	A185		15									
	A186			14								
18	A187	14			12	-5	5	0.88	8	98	488	76
	A188		18									
	A189			18								
18	A190	18			16	-6.68	6.68	1.64	10	135	356	106
	A191		21									
	A192			22								
20	A193	8			4	-1.65	1.65	0.05	7	101	5609	100
	A194		12									
	A195			10								
20	A196	10			8	-3.33	3.33	0.33	5	66	902	64
	A197		15									
	A198			14								
20	A199	14			12	-5	5	0.79	7	98	599	94
	A200		18									
	A201			18								
20	A202	18			16	-6.68	6.68	1.48	10	134	435	129
	A203		21									
	A204			22								
24	A205	8			4	-1.65	1.65	0.03	7	151	11686	209
	A206		12									
	A207			10								
24	A208	10			8	-3.33	3.33	0.27	5	75	1460	104
	A209		15									
	A210			14								
24	A211	14			12	-5	5	0.65	6	98	851	133
	A212		18									
	A213			18								
24	A214	18			16	-6.68	6.68	1.2	8	130	627	175
	A215		21									
	A216			20								

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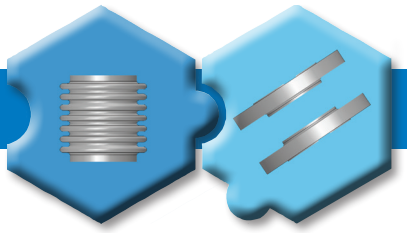
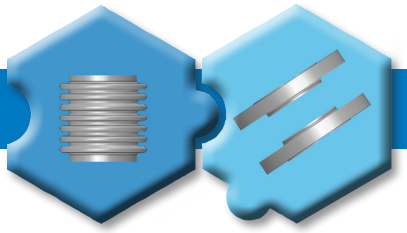


STEP 2 - *Series B* 50 PSI (Specifications For T321 Stainless Steel 800F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
2	B217	4			4	-0.57	0.57	0.06	10	276	1520	4
	B218		6									
	B219			8								
2	B220	4			6	-0.87	0.87	0.19	10	184	450	2
	B221		6									
	B222			10								
2	B223	6			8	-1.17	1.17	0.37	10	138	190	2
	B224		6									
	B225			10								
2	B226	6			10	-1.47	1.47	0.61	10	110	97	1
	B227		6									
	B228			10								
2	B229	6			12	-1.47	1.47	0.75	10	132	78	1
	B230		9									
	B231			12								
2	B232	8			14	-1.7	1.7	1.31	10	169	68	2
	B233		9									
	B234			12								
2	B235	8			16	-1.52	1.52	1.19	10	180	59	2
	B236		9									
	B237			12								
2.5	B238	4			4	-0.69	0.69	0.07	10	258	1774	6
	B239		6									
	B240			8								
2.5	B241	4			6	-1.05	1.05	0.21	10	172	525	4
	B242		6									
	B243			10								
2.5	B244	6			8	-1.41	1.41	0.4	10	129	221	3
	B245		6									
	B246			10								
2.5	B247	6			10	-1.63	1.63	0.61	10	122	132	2
	B248		9									
	B249			10								
2.5	B250	8			12	-1.64	1.64	0.75	10	147	107	3
	B251		9									
	B252			12								
2.5	B253	8			14	-1.88	1.88	1.01	10	178	96	4
	B254		9									
	B255			12								
2.5	B256	8			16	-1.88	1.88	1.17	10	198	80	4
	B257		9									
	B258			14								
3	B259	4			4	-0.78	0.43	0.07	10	143	1168	4
	B260		6									
	B261			8								
3	B262	6			8	-1.59	1.59	0.43	10	106	209	3
	B263		9									
	B264			10								
3	B265	8			12	-2.09	2.09	0.89	10	163	138	5
	B266		9									
	B267			12								
3	B268	10			16	-2.03	2.03	1.19	10	217	99	6
	B269		12									
	B270			14								



STEP 2 - *Series B* 50 PSI (Specifications For T321 Stainless Steel 800F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
4	B271	4			4	-0.86	0.21	0.02	9	176	1846	9
	B272		6									
	B273			8								
4	B274	6			8	-1.75	1.75	0.41	10	116	298	5
	B275		9									
	B276			10								
4	B277	8			12	-2.3	2.3	0.86	10	180	199	9
	B278		9									
	B279			12								
4	B280	10			16	-3.4	3.4	1.81	10	252	142	13
	B281		12									
	B282			14								
4	B283	12			20	-2.62	2.62	1.71	10	304	115	15
	B284		15									
	B285			16								
4	B286	16			24	-2.41	2.41	3.3	10	397	92	21
	B287		18									
	B288			20								
4	B289	16			26	-2.2	2.2	3.53	10	432	84	22
	B290		18									
	B291			20								
6	B292	4			4	-1.02	1.02	0.06	10	216	3441	25
	B293		6									
	B294			10								
6	B295	8			8	-2.06	2.06	0.38	9	137	554	15
	B296		9									
	B297			12								
6	B298	10			12	-2.72	2.72	0.8	10	208	363	23
	B299		12									
	B300			14								
6	B301	12			16	-3.18	3.18	1.29	10	284	274	32
	B302		15									
	B303			16								
6	B304	14			20	-3.06	3.06	1.58	10	352	212	39
	B305		15									
	B306			18								
6	B307	16			24	-3.91	3.91	2.47	10	441	180	51
	B308		18									
	B309			22								
6	B310	18			26	-3.84	3.84	2.64	10	478	165	55
	B311		21									
	B312			22								
8	B313	6			4	-1.18	0.98	0.07	10	241	4800	46
	B314		9									
	B315			10								
8	B316	8			8	-2.38	2.38	0.4	8	161	792	30
	B317		9									
	B318			12								
8	B319	10			12	-3.59	3.59	0.94	10	246	547	47
	B320		12									
	B321			14								
8	B322	14			16	-3.52	3.52	1.27	10	324	392	60
	B323		15									
	B324			18								

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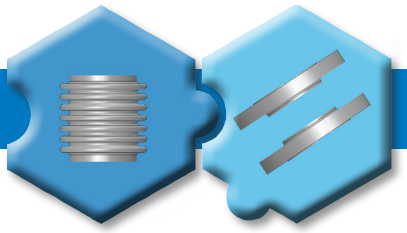
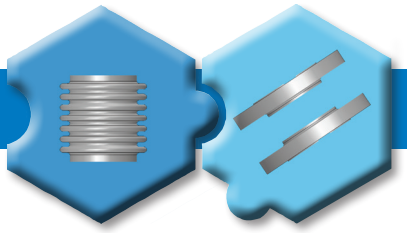


STEP 2 - *Series B* 50 PSI (Specifications For T321 Stainless Steel 800° F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
8	B325	16			20	-5.25	5.25	2.53	10	430	299	81
	B326		18									
	B327			20								
8	B328	20			24	-4.1	4.1	2.3	10	546	280	103
	B329		21									
	B330			22								
8	B331	20			26	-3.76	3.76	2.31	10	660	284	123
	B332		24									
	B333			24								
10	B334	6			4	-1.34	0.65	0.07	10	291	6956	83
	B335		9									
	B336			10								
10	B337	10			8	-2.7	2.7	0.41	7	181	1069	51
	B338		12									
	B339			12								
10	B340	12			12	-4	4	0.96	10	271	725	78
	B341		15									
	B342			16								
10	B343	16			16	-5.42	5.42	1.86	10	384	521	112
	B344		18									
	B345			20								
10	B346	18			20	-4.85	4.85	2.03	10	469	430	137
	B347		21									
	B348			22								
12	B349	6			4	-1.49	0.39	0.02	6	340	9113	135
	B350		9									
	B351			10								
12	B352	10			8	-3.01	3.01	0.43	7	204	1360	83
	B353		12									
	B354			14								
12	B355	12			12	-4.27	4.27	0.97	10	302	907	121
	B356		15									
	B357			16								
12	B358	16			16	-5.39	5.39	1.67	10	412	681	170
	B359		18									
	B360			20								
12	B361	20			20	-4.8	4.8	1.9	10	582	598	234
	B362		24									
	B363			24								
14	B364	6			4	-1.49	0.28	0	4	366	11708	173
	B365		9									
	B366			10								
14	B367	10			8	-3.01	3.01	0.39	6	204	1623	100
	B368		12									
	B369			14								
14	B370	12			12	-4.4	4.4	0.91	9	301	1083	144
	B371		15									
	B372			16								
14	B373	16			16	-6.04	6.04	1.78	10	421	775	202
	B374		21									
	B375			20								
14	B376	20			20	-4.77	4.77	1.72	10	637	781	305
	B377		24									
	B378			24								



STEP 2 - *Series B* 50 PSI (Specifications For T321 Stainless Steel 800F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
16	B379	6			4	-1.49	0.69	0.05	9	463	18929	291
	B380		9									
	B381			10								
16	B382	10			8	-3.01	1.41	0.32	6	231	2366	145
	B383		12									
	B384			14								
16	B385	12			12	-4.52	4.52	0.82	8	302	1404	187
	B386		15									
	B387			16								
16	B388	16			16	-6.04	6.04	1.56	10	422	1006	263
	B389		21									
	B390			20								
16	B391	20			20	-4.74	4.74	1.5	10	722	1141	446
	B392		24									
	B393			24								
18	B394	6			4	-1.65	0.47	0.02	6	493	20898	388
	B395		12									
	B396			10								
18	B397	10			8	-3.33	0.97	0.2	6	246	2612	194
	B398		15									
	B399			14								
18	B400	14			12	-4.82	4.82	0.86	8	331	1591	257
	B401		18									
	B402			18								
18	B403	18			16	-6.68	6.68	1.69	10	463	1151	361
	B404		21									
	B405			22								
20	B406	8			4	-1.65	0.35	0	4	550	28441	528
	B407		12									
	B408			10								
20	B409	10			8	-3.33	0.73	0.13	5	275	3555	264
	B410		15									
	B411			14								
20	B412	14			12	-4.98	4.39	0.8	7	331	1953	315
	B413		18									
	B414			18								
20	B415	18			16	-6.68	6.68	1.52	10	461	1404	440
	B416		21									
	B417			22								
24	B418	8			4	-1.65	0.02	-0.04	1	710	51901	965
	B419		12									
	B420			10								
24	B421	10			8	-3.33	0.06	-0.03	1	355	6487	482
	B422		15									
	B423			14								
24	B424	14			12	-5	5	0.68	6	338	2723	455
	B425		18									
	B426			18								
24	B427	18			16	-6.68	6.68	1.27	9	462	2006	629
	B428		24									
	B429			22								

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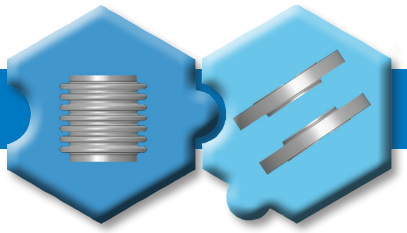
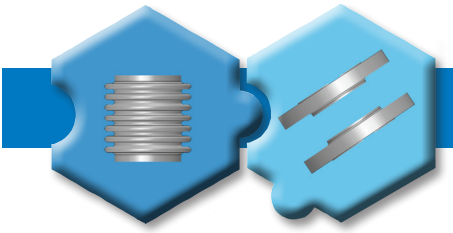


STEP 2 - *Series C* 150 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
2	C430	4			4	-0.4	0.15	0.02	10	480	2521	7
	C431		6									
	C432			8								
2	C433	4			6	-0.61	0.23	0.09	10	320	747	4
	C434		6									
	C435			10								
2	C436	6			8	-0.78	0.78	0.24	10	265	345	3
	C437		6									
	C438			10								
2	C439	6			10	-0.92	0.92	0.38	10	334	276	5
	C440		6									
	C441			10								
2	C442	8			12	-1.34	1.34	0.74	10	465	236	7
	C443		9									
	C444			12								
2	C445	8			14	-1.38	1.38	0.9	10	511	186	7
	C446		9									
	C447			12								
2	C448	8			16	-1.06	1.06	0.76	10	557	169	8
	C449		9									
	C450			12								
2.5	C451	4			4	-0.68	0.68	0.07	10	520	3233	12
	C452		6									
	C453			8								
2.5	C454	4			6	-1.04	1.04	0.22	10	346	957	8
	C455		6									
	C456			10								
2.5	C457	6			8	-1.29	1.29	0.39	10	307	471	7
	C458		6									
	C459			10								
2.5	C460	6			10	-1.01	1.01	0.37	10	371	380	8
	C461		9									
	C462			10								
2.5	C463	8			12	-1.53	1.53	0.76	10	479	301	11
	C464		9									
	C465			12								
2.5	C466	8			14	-1.19	1.19	0.66	10	532	267	12
	C467		9									
	C468			12								
2.5	C469	10			16	-1.74	1.74	1.23	10	719	231	16
	C470		12									
	C471			14								
3	C472	4			4	-0.78	-0.02	-0.04	1	515	3674	16
	C473		6									
	C474			8								
3	C475	6			8	-1.4	1.4	0.39	10	336	587	10
	C476		9									
	C477			10								
3	C478	8			12	-1.3	1.3	0.56	10	504	401	16
	C479		9									
	C480			12								
3	C481	10			16	-1.92	1.92	1.24	10	752	286	24
	C482		12									
	C483			14								



STEP 2 - *Series C* 150 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
4	C484	4			4	-0.83	-0.02	-0.04	1	631	5923	32
	C485		6									
	C486			8								
4	C487	6			8	-1.75	1.75	0.43	10	421	969	22
	C488		9									
	C489			10								
4	C490	8			12	-1.41	1.41	0.53	10	553	577	28
	C491		9									
	C492			12								
4	C493	10			16	-2.13	2.13	1.19	10	798	408	41
	C494		12									
	C495			16								
4	C496	12			20	-1.7	1.7	1.15	10	953	333	49
	C497		15									
	C498			18								
4	C499	16			24	-2.25	2.25	2.32	10	1285	257	69
	C500		18									
	C501			20								
6	C502	6			4	-1.02	0.15	-0.01	5	923	13434	104
	C503		6									
	C504			10								
6	C505	8			8	-2.06	0.32	0.1	7	461	1679	52
	C506		9									
	C507			12								
6	C508	10			12	-2.59	2.59	0.82	10	686	1037	78
	C509		12									
	C510			14								
6	C511	12			16	-2.09	2.09	0.86	10	882	797	101
	C512		15									
	C513			16								
6	C514	14			20	-2	2	1.06	10	1109	623	123
	C515		18									
	C516			18								
6	C517	18			24	-2.49	2.49	1.66	10	1667	606	196
	C518		21									
	C519			22								
6	C520	18			26	-2.29	2.29	1.67	10	2014	612	233
	C521		21									
	C522			24								
8	C523	6			4	-1.17	1.17	0.07	10	1578	27985	302
	C524		9									
	C525			10								
8	C526	8			8	-2.36	2.36	0.42	10	789	3498	151
	C527		12									
	C528			12								
8	C529	12			12	-2.87	2.87	0.81	10	770	1485	144
	C530		12									
	C531			16								
8	C532	14			16	-2.3	2.3	0.84	10	1008	1152	189
	C533		15									
	C534			18								

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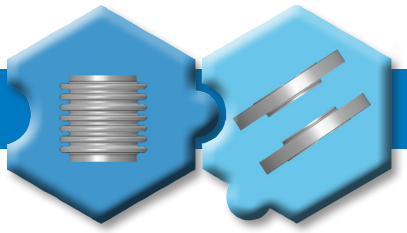
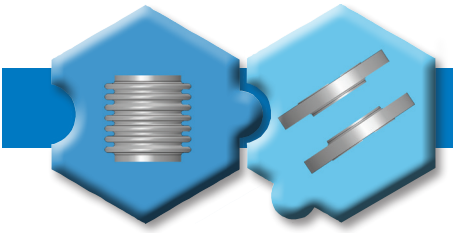


STEP 2 - *Series C* 150 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
8	C535	18			20	-3.41	3.41	1.74	10	1375	848	260
	C536		21									
	C537			22								
8	C538	20			24	-2.45	2.45	1.44	10	2294	1054	435
	C539		21									
	C540			24								
10	C541	6			4	-1.34	0.11	-0.02	3	1549	33647	452
	C542		9									
	C543			10								
10	C544	10			8	-2.7	0.25	0.05	4	774	4205	226
	C545		12									
	C546			14								
10	C547	12			12	-2.59	1.92	0.63	10	841	2133	246
	C548		15									
	C549			16								
10	C550	16			16	-3.87	3.87	1.39	10	1219	1491	358
	C551		18									
	C552			20								
10	C553	18			20	-2.91	2.91	1.27	10	1943	1614	571
	C554		21									
	C555			22								
12	C556	6			4	-1.43	0.1	-0.02	2	1758	43239	706
	C557		9									
	C558			10								
12	C559	10			8	-2.89	0.22	0.04	3	879	5404	353
	C560		12									
	C561			14								
12	C562	14			12	-2.75	0.16	0.04	2	932	2668	375
	C563		15									
	C564			16								
12	C565	18			16	-4.13	4.13	1.39	10	1335	1869	541
	C566		21									
	C567			22								
12	C568	20			20	-2.89	2.89	1.18	10	2409	2265	970
	C569		24									
	C570			24								
14	C571	6			4	-1.39	0.08	-0.03	2	1949	57116	933
	C572		9									
	C573			10								
14	C574	10			8	-2.8	0.18	0.02	3	974	7139	466
	C575		12									
	C576			14								
14	C577	12			12	-2.68	0.07	0	1	1053	3590	505
	C578		15									
	C579			16								
14	C580	18			16	-4.27	4.27	1.31	10	1332	2231	646
	C581		21									
	C582			22								
14	C583	20			20	-2.87	2.87	1.07	10	2639	2960	1268
	C584		24									
	C585			24								



STEP 2 - *Series C* 150 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
16	C586	6			4	-1.32	0.05	-0.04	1	2286	86168	1408
	C587		9									
	C588			10								
16	C589	10			8	-2.67	0.12	-0.01	2	1143	10771	704
	C590		12									
	C591			14								
16	C592	14			12	-1.56	-0.01	-0.04	1	1349	5898	830
	C593		18									
	C594			16								
16	C595	18			16	-4.56	4.56	1.23	10	1333	2886	836
	C596		21									
	C597			22								
16	C598	20			20	-2.84	2.84	0.93	10	3022	4365	1869
	C599		24									
	C600			24								
18	C601	8			4	-1.65	0.05	-0.03	1	2967	110973	2389
	C602		12									
	C603			10								
18	C604	12			8	-3.33	0.13	0	2	1483	13871	1194
	C605		15									
	C606			14								
18	C607	14			12	-4.89	4.89	0.94	9	1091	4515	875
	C608		18									
	C609			18								
18	C610	18			16	-4.73	4.73	1.24	10	1455	3308	1140
	C611		24									
	C612			22								
20	C613	8			4	-1.65	0.07	-0.03	1	3304	150605	3243
	C614		12									
	C615			10								
20	C616	12			8	-3.33	0.17	0	2	1652	18825	1621
	C617		15									
	C618			14								
20	C619	16			12	-5	0.27	0.06	2	1101	5577	1081
	C620		18									
	C621			18								
20	C622	18			16	-4.99	4.99	1.18	10	1450	4043	1393
	C623		24									
	C624			22								
24	C625	8			4	-1.65	0.02	-0.04	1	4000	257458	5544
	C626		12									
	C627			10								
24	C628	12			8	-3.32	0.06	-0.03	1	2000	32182	2772
	C629		15									
	C630			14								
24	C631	16			12	-5	0.1	-0.01	1	1333	9535	1848
	C632		21									
	C633			18								
24	C634	20			16	-5.44	5.44	1.07	9	1449	5758	1984
	C635		24									
	C636			22								

* T316 Stainless Steel available upon request

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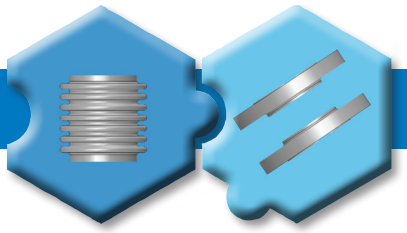
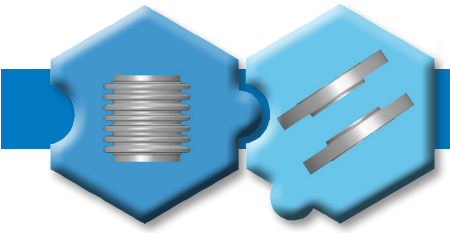


STEP 2 - *Series D* 300 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
2	D637	N/A			4	-0.41	0.41	0.04	10	1397	6389	21
	D638		6									
	D639			8								
2	D640	N/A			6	-0.63	0.63	0.14	10	931	1893	14
	D641		6									
	D642			10								
2	D643	N/A			8	-0.85	0.85	0.29	10	698	798	10
	D644		6									
	D645			10								
2	D646	N/A			10	-0.71	0.71	0.29	10	716	568	11
	D647		9									
	D648			10								
2	D649	N/A			12	-0.7	0.7	0.36	10	842	449	12
	D650		9									
	D651			12								
2	D652	N/A			14	-1.1	1.1	0.75	10	1079	358	16
	D653		9									
	D654			12								
2.5	D655	N/A			4	-0.51	0.25	0.05	10	1202	6902	28
	D656		6									
	D657			8								
2.5	D658	N/A			6	-0.78	0.39	0.16	10	801	2045	18
	D659		6									
	D660			10								
2.5	D661	N/A			8	-1.03	1.03	0.31	10	633	905	14
	D662		9									
	D663			10								
2.5	D664	N/A			10	-0.78	0.78	0.29	10	773	757	17
	D665		9									
	D666			12								
2.5	D667	N/A			12	-1.22	1.22	0.63	10	1008	573	23
	D668		9									
	D669			12								
3	D670	N/A			4	-0.54	0.01	-0.03	2	1386	9162	45
	D671		6									
	D672			8								
3	D673	N/A			8	-1.11	0.04	0	3	693	1145	22
	D674		9									
	D675			10								
3	D676	N/A			12	-1.31	1.31	0.62	10	1102	741	36
	D677		12									
	D678			12								
4	D679	6			4	-0.61	0.61	0.04	10	2263	19010	121
	D680		9									
	D681			10								
4	D682	8			8	-1.24	1.24	0.31	10	1131	2376	60
	D683		9									
	D684			12								
4	D685	10			12	-1.16	1.16	0.44	10	1176	1170	62
	D686		12									
	D687			14								
4	D688	12			16	-1.67	1.67	0.98	10	1927	868	104
	D689		15									
	D690			16								



STEP 2 - *Series D* 300 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
6	D691	6			4	-0.69	0.08	-0.02	3	2647	35503	299
	D692		9									
	D693			10								
6	D694	8			8	-1.41	0.19	0.05	5	1323	4437	149
	D695		12									
	D696			12								
6	D697	10			12	-1.33	0.01	-0.03	1	1421	2254	161
	D698		12									
	D699			14								
6	D700	14			16	-1.64	1.64	0.7	10	2408	1976	284
	D701		15									
	D702			16								
6	D703	16			20	-1.82	1.82	1	10	2364	1223	275
	D704		18									
	D705			20								
6	D706	18			24	-1.76	1.76	1.19	10	2833	994	322
	D707		21									
	D708			22								
8	D709	6			4	-0.73	0.73	0.03	9	5442	85047	1043
	D710		9									
	D711			10								
8	D712	10			8	-1.49	1.49	0.27	10	2721	10630	521
	D713		12									
	D714			12								
8	D715	12			12	-2.25	2.25	0.66	10	1814	3149	347
	D716		15									
	D717			16								
8	D718	16			16	-1.85	1.85	0.7	10	2609	2743	503
	D719		18									
	D720			18								
8	D721	18			20	-2.02	2.02	0.98	10	2649	1757	503
	D722		21									
	D723			22								
10	D724	8			4	-0.92	0.05	-0.03	2	4650	91235	1372
	D725		9									
	D726			10								
10	D727	10			8	-1.87	0.13	0.01	3	2325	11404	686
	D728		12									
	D729			14								
10	D730	14			12	-2.58	2.58	0.68	10	1823	3940	533
	D731		18									
	D732			16								
10	D733	16			16	-2.27	2.27	0.78	10	2353	3060	693
	D734		18									
	D735			20								
10	D736	20			20	-2.2	2.2	0.96	10	2951	2400	849
	D737		24									
	D738			22								
12	D739	8			4	-0.95	0.03	-0.03	1	5425	121433	2198
	D740		12									
	D741			10								
12	D742	12			8	-1.93	0.09	0	2	2712	15179	1099
	D743		15									
	D744			14								

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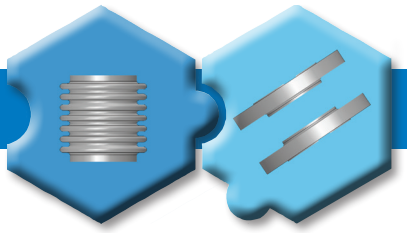

STEP 2 - *Series D* 300 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
12	D745	14			12	-1.9	0.01	-0.03	1	3134	8287	1277
	D746		18									
	D747			18								
12	D748	18			16	-2.41	0.69	0.43	7	2593	3838	1052
	D749		21									
	D750			20								
14	D751	8			4	-0.91	-0.02	-0.04	1	6174	164388	2975
	D752		12									
	D753			10								
14	D754	12			8	-1.85	-0.02	-0.04	1	3087	20548	1487
	D755		15									
	D756			14								
14	D757	16			12	-2.79	-0.02	-0.04	1	2058	6088	991
	D758		18									
	D759			18								
14	D760	20			16	-3.43	3.43	1.13	10	3523	5073	1733
	D761		24									
	D762			22								
16	D763	10			4	-0.82	0.82	0.02	6	16367	485016	10358
	D764		12									
	D765			10								
16	D766	14			8	-1.67	1.67	0.21	10	8183	60627	5179
	D767		15									
	D768			14								
16	D769	18			12	-2.52	2.52	0.53	10	5455	17963	3452
	D770		21									
	D771			18								
16	D772	20			16	-3.36	3.36	0.97	10	4091	7578	2589
	D773		24									
	D774			22								
18	D775	10			4	-1.18	1.18	0.04	7	10136	326648	8190
	D776		12									
	D777			12								
18	D778	14			8	-2.38	2.38	0.3	10	5068	40831	4095
	D779		18									
	D780			16								
18	D781	18			12	-3.59	3.59	0.73	10	3378	12098	2730
	D782		21									
	D783			20								
18	D784	22			16	-3.53	3.53	0.99	10	4348	8550	3430
	D785		24									
	D786			24								
20	D787	10			4	-1.23	0.78	0.04	7	10278	405253	10161
	D788		12									
	D789			12								
20	D790	14			8	-2.48	1.59	0.28	10	5139	50656	5080
	D791		18									
	D792			16								
20	D793	18			12	-3.74	2.4	0.69	10	3426	15009	3387
	D794		21									
	D795			20								
20	D796	22			16	-3.51	3.51	0.89	10	4820	11577	4644
	D797		27									
	D798			24								

STEP 2 - *Series D* 300 PSI (Specifications For T321 Stainless Steel 800º F.)

Nominal I.D. Size	Part Number	Overall Length (in.) Plate. Flange	Slip on Flange	Pipe	Number of Convolutions	Axial Compression (in.)	Axial Extension (in.)	Lateral (in.)	Angular (deg.)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Angular Spring Rate (in.- lb./deg.)
24	D799	10			4	-1.06	1.06	0.01	5	15741	867959	21762
	D800		15									
	D801			12								
24	D802	14			8	-2.14	2.14	0.19	9	7870	108494	10881
	D803		18									
	D804			16								
24	D805	20			12	-3.22	3.22	0.49	10	5247	32146	7254
	D806		24									
	D807			20								
24	D808	24			16	-3.48	3.48	0.73	10	5747	19559	7846
	D809		27									
	D810			24								

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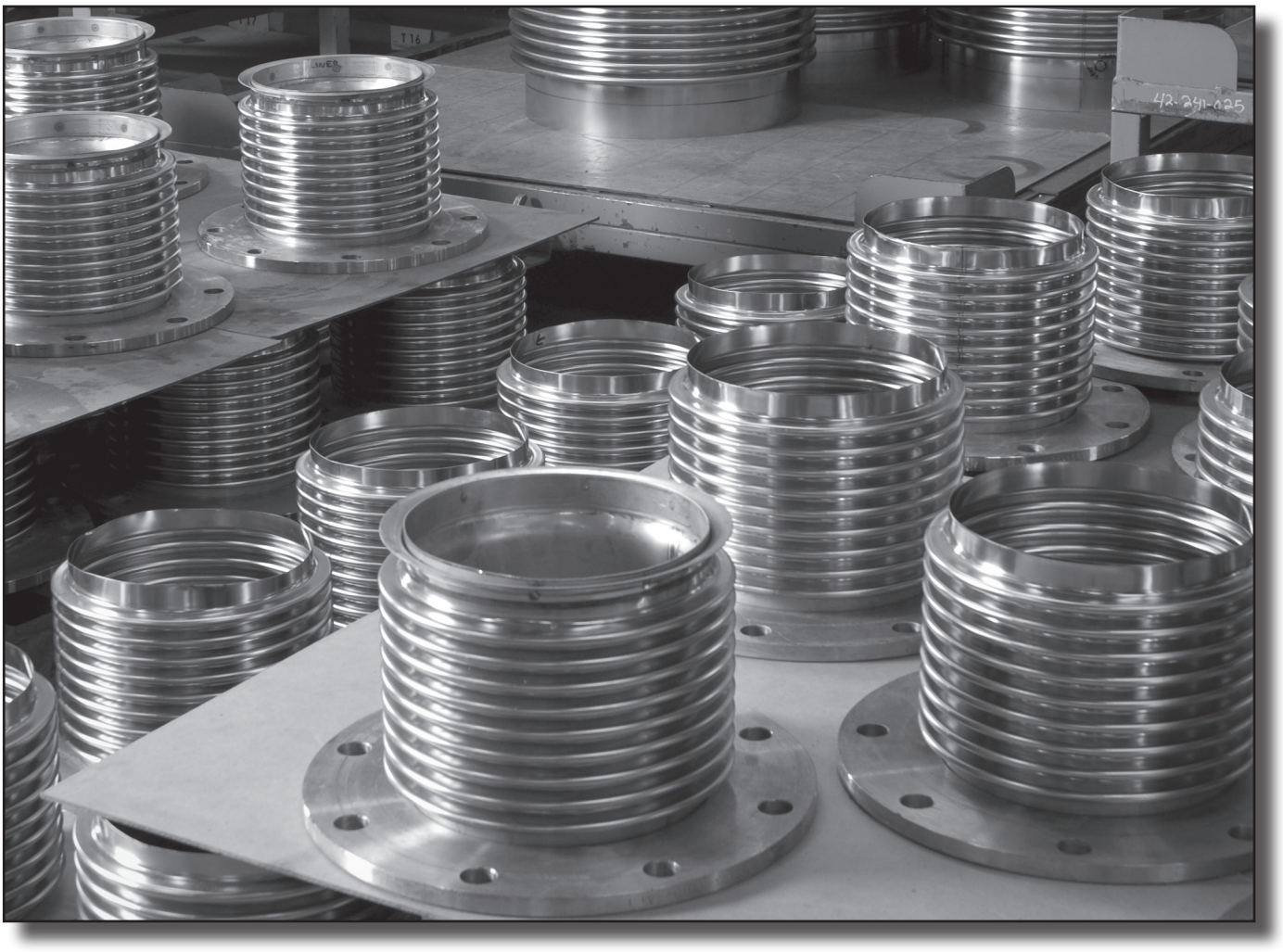
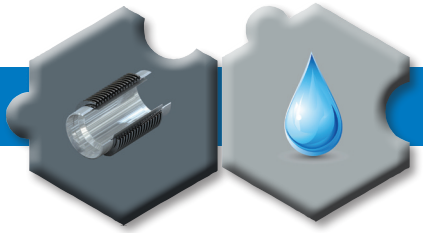
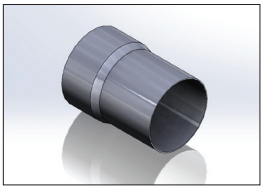


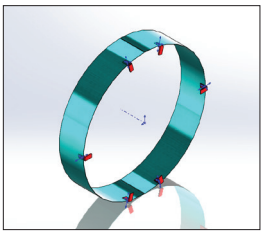


OPTIONS for Pre-Engineered Expansion Joints



Liners

Liners are used to protect the bellows from high flow velocity or particulate matter. It is not always safe to assume a liner is required, as the liner diameter is smaller than the bellows diameter, and may limit flow. When available, the customer should provide the media and flow velocity, and Hose Master will provide the liner when it is required.



Covers

Covers are used to protect the bellows from impact damage. If there is a risk of damage to the bellows, then the customer should request a cover.

All expansion joints are 100% leak tested. For an additional cost, Hydrostatic testing is available upon request

Custom-Designed Expansion Joints

Size Range

- From 2” - 120” nominal diameter (tube sizes also available), single and multi-ply

Alloys

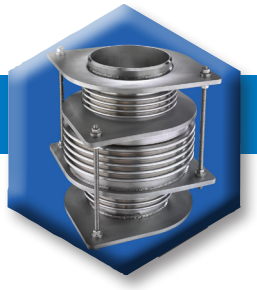
- Stainless steels - T304, T304L, T309, T310, T321, T316, T316L
- Nickel - 400, 600, 625, 625LCF, 800, 800H, Nickel 200, C276
- Other alloys available upon request

Pressure

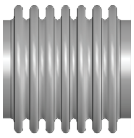
- From full vacuum to 3000 psi

Temperature

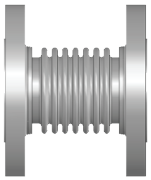
- Range from -450º F to 2000º F



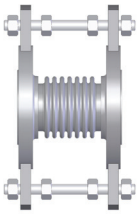
Types of Expansion Joints



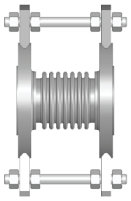
BB
Banded
Bellows



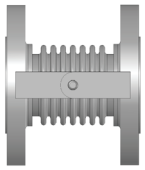
US
Unrestrained
Single



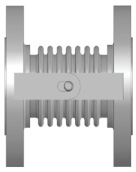
LS
Limit Single



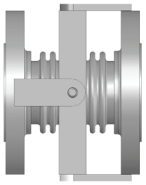
TS
Tied Single



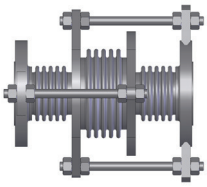
HS
Hinged Single



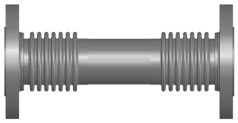
SHS
Slotted Hinged
Single



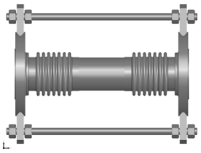
GS
Gimbaled Single



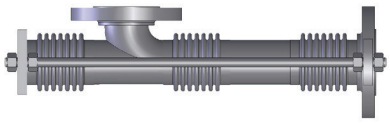
PBI
Pressure Balanced
In-Line



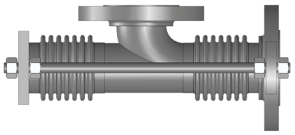
UU
Unrestrained Universal



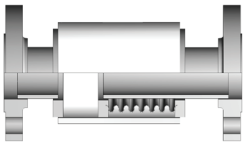
TU
Tied Universal



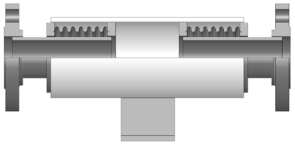
PBU
Pressure Balanced,
Elbow, Universal



PBS
Pressure Balanced,
Elbow, Single

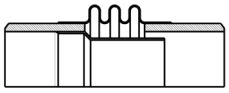


EPS
Externally
Pressurized Single

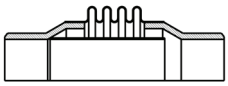


EPD
Externally
Pressurized Dual

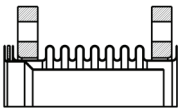
Internal Liners



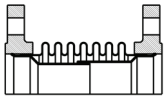
SW - Single Welded
These liners are the most
common type of internal liner



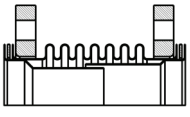
W - Flush Welded
Also knows as “full-flow liners”, these
offer no protrusion into flow stream
and cause minimal pressure drop



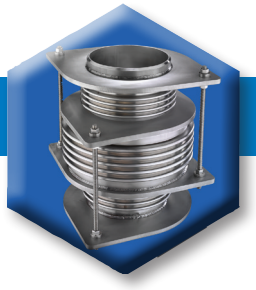
SD - Single Drop-in
These liners can be
removed for cleaning



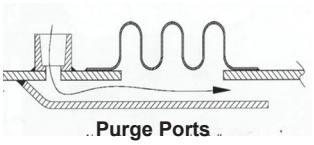
TW - Telescoping Welded
These liners are used when large axial movement
is a concern

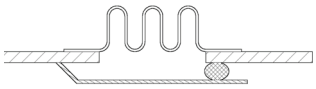


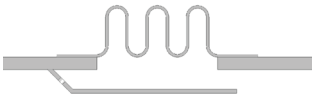
TD - Telescoping Drop-in
These liners are used for large axial
movement and can be removed for cleaning



Custom-Designed Expansion Joint Options


Purge Ports

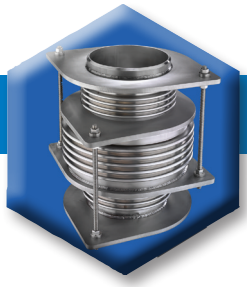

Packed Bellows


Self-Draining Liner

Comparison of Ratings, Features & Options

Expansion Joint Types	Relative Movement Capacity			Relative Spring Forces			Pressure Thrust on a Piping System	Available Features		
	Axial	Angular	Lateral	Axial	Angular	Lateral		Internal Flow Liner Types	External Cover	Redundant Ply Design
US Unrestrained Single	↔	↔	↓	↔	↔	↑	Yes	SW, TW, FW, SD, TD	Yes	Yes
LS Limit Single	↔	↔	↓	↔	↔	↑	Yes	SW, TW, FW, SD, TD	Yes	Yes
TS Tied Single	–	–	↓	–	–	↑	No	SW, TW, FW, SD, TD	Yes	Yes
HS Hinged Single	–	↔	–	–	↔	–	No	SW, TW, FW, SD, TD	Yes	Yes
SHS Slotted Hinge Single	↔	↔	–	↔	↔	–	Yes	SW, TW, FW, SD, TD	Yes	Yes
GS Gimbaled Single	–	↔	–	–	↔	–	No	SW, TW, FW, SD, TD	Yes	Yes
PBI Pressure-Balanced In-Line	↔	–	–	↔	–	–	No	SW, TW, FW, SD, TD	Yes	Yes
UU Unrestrained Universal	↔	↔	↑	↔	↔	↓	Yes	SW, TW, FW, SD, TD	Yes	Yes
TU Tied Universal	–	–	↑	–	–	↓	No	SW, TW, FW, SD, TD	Yes	Yes
PBU Pressure-Balanced, Elbow, Universal	↔	–	↑	↔	↔	↓	No	SW, TW, FW, SD, TD	Yes	Yes
PBS Pressure-Balanced, Elbow, Single	↔	–	↔	↔	↔	↑	No	SW, TW, FW, SD, TD	Yes	Yes
EPS Externally-Pressurized Single	↑	–	–	↔	–	–	Yes	FW	Incl	Yes
EPD Externally-Pressurized Dual	↑	–	–	↔	–	–	Yes	FW	Incl	Yes

Legend: ↑ Higher ↔ Moderate ↓ Lower – Non Applicable



Custom-Designed Expansion Joint Drawings

Determining the right expansion joint for mission critical applications can be intimidating. Contact the experts at Hose Master for assistance in designing the expansion joint best suited for your specific application, and let our staff of engineers take the worry out of the selection process.

Accompanying every product quotation is a design package complete with full performance specifications and detailed engineering drawings.

Cover Sheet - Lists standard manufacturing procedures and provides summary of options selected in accordance with the expansion joint design, including:

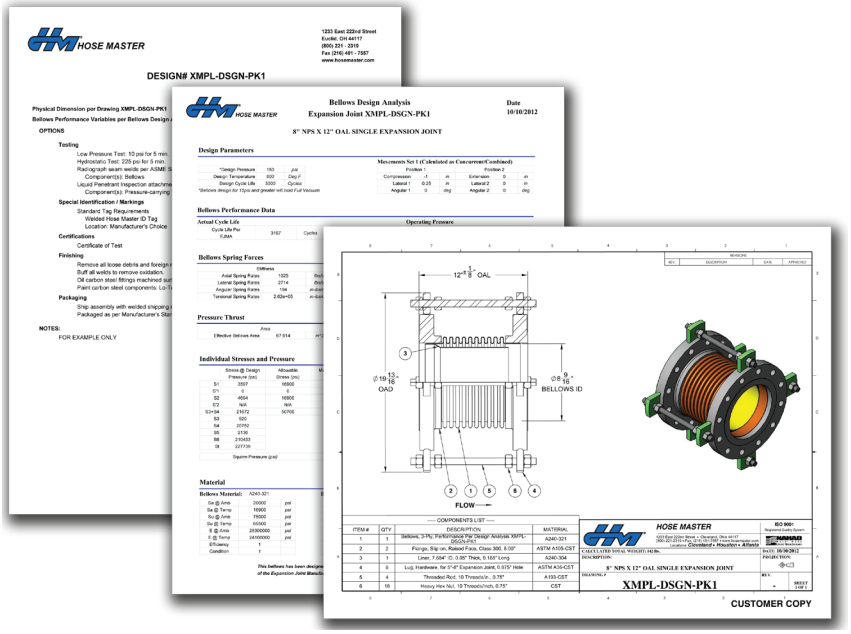
- Test and inspection criteria
- Tagging and identification specifications
- Accessories *(such as lifting lugs and insulation)*
- Certifications *(such as agency approval, material origin, conformance, and fabrication)*
- Finishing details
- Packaging and shipping accessories

Design Stress Analysis - Documents the bellows design specifications and corresponding forces acting upon the piping system in which the expansion joint will be installed.

- Expansion Joint Design Parameters
  (*Pressure, Temperature, Design Cycle Life, Movements)*
- Bellows Performance Data *(Cycle Life, Operating Pressure)*
- Bellows Spring Forces *(Spring Rates and Resultant Force)*
- Pressure Thrust *(Area, Pressure, and Resultant Force)*
- Individual stresses for the given bellows convolution profile

Detailed Drawings and Components List

- Drawings completed to scale, with maximum envelope dimensions
- Component list showing all materials used in manufacturing



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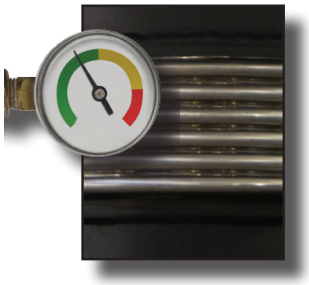
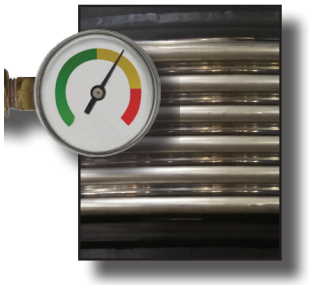
Understanding Pressure Thrust





Expansion joints must be very flexible in order to absorb axial movement. This inherent flexibility prevents the expansion joint from restraining longitudinal pressure loads and results in a force being exerted on the piping system known as **pressure thrust**.

Pressure thrust is calculated by multiplying the effective area of the bellows by the system pressure. With larger diameter bellows and/or higher pressure applications, the pressure thrust exerted by the bellows can be quite significant — hundreds of thousands of pounds.

If the ends of an expansion joint were capped and it was then pressurized, the bellows would extend freely until it formed a tube (its original shape). This type of unrestrained extension would destroy the expansion joint. To maintain the structural integrity of the piping system, the pressure thrust must be balanced or restrained. Often, pipe anchors can be designed to withstand the pressure thrust. If no axial movement is required, tie rods can be installed on the expansion joint to contain the pressure thrust. In some situations, where axial movement is required and pipe anchors are not practical, a pressure-balanced expansion joint is the solution.

Pressure-balanced expansion joints completely balance the pressure thrust within the expansion joint assembly through the addition of an opposing (or balancing) bellows, greatly simplifying piping anchor and support requirements. Turbines and other reciprocating equipment frequently require the implementation of pressure-balanced expansion joints to eliminate nozzle loads due to pressure thrust.

Most common pressure-balanced systems require a change in piping direction. These applications use our Pressure-Balanced Single (PBS) or Pressure-Balanced Universal (PBU) styles. For those applications where there is no change in piping direction our Pressure-Balanced In-Line (PBI) style is the preferred selection.

Expansion Joint Rebuilds

Using customer-provided components from an expansion joint removed from service, Hose Master can replace bellows and often reuse pre-existing pipe and fittings. This offers a cost-effective option when dealing with very large diameter expansion joints and special designs.

Hose Master can also reverse-engineer the product for its specified application or evaluate the parts that are being replaced in our laboratory to determine the cause of failure. Backed with this knowledge, Hose Master's team of engineers and ASME IX certified welders can design and make any necessary changes to the expansion joint to enhance its performance and extend its service life.

Pre-Engineered Expansion Joint Inquiry Sheet

Pre-Engineered Expansion Joint Part Numbers

Step 1 -Type (pick one)	Step 2 Series Number	Options - Accessories
US -Unrestrained Single LS - Limit Single TS - Tied Single		L - Liner C - Cover B - Cover & Liner X - No Accessory **Options - Testing** S - Standard Testing H - Hydrostatic Testing

Part Number Example: US-A001-LS

Type	Series Number	Options
US	**A001**	**LS**

Unrestrained Single 15 PSI 2" ID with 4 convolutions made from T321 stainless steel, plate flanges each end and liner, Standard Testing

SCAN ME

For Quick & Easy **Pre-Engineered** Inquiries: Scan the QR Code with a smart phone camera for a direct link to our on-line Inquiry Sheet, or simply **Click Here**.

Custom-Designed Expansion Joint Inquiry

SCAN ME

For **Custom-Designed** Expansion Joint Inquiries: Scan the QR Code with a smart phone camera for a direct link to our on-line Inquiry Sheet, or simply **Click Here**.