



Series 440



Molded PTFE Expansion Joints



The Expansion Joint People



PROCO Products, Inc. is the leading manufacturer of rubber, TEFLON®, metal, and fabric connectors and expansion joints in North America, and also offers the industry's widest selection available.

Our manufacturing history of expansion joints dates back to the old Uniroyal company, who invented the rubber expansion joint in 1930. PROCO Products, Inc., previously **PRO**tective **CO**atings of Fort Wayne, Indiana, began marketing rubber expansion joints under its shortened name PROCO in 1980. Protective Coatings manufactured rubber expansion joints for Uniroyal under a private label arrangement from 1965 to 1979. In 1984 PROCO Products acquired all assets of Protective Coatings—including tooling, specifications and technologies used in producing rubber expansion joints—and remains the sole property of PROCO Products today.

PROCO Products operates worldwide through a global agent and distribution network providing a wide range of products and services. This allows us to service the customer during all phases of a project regardless of location. PROCO's main goal is to provide quality products and superior service to the demanding global marketplace.

Quality and service will always be PROCO's highest priority.

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***The Expansion Joint People
Can Be Reached At Any Time!***

***24-Hour Service From
Our Dedicated Staff!***

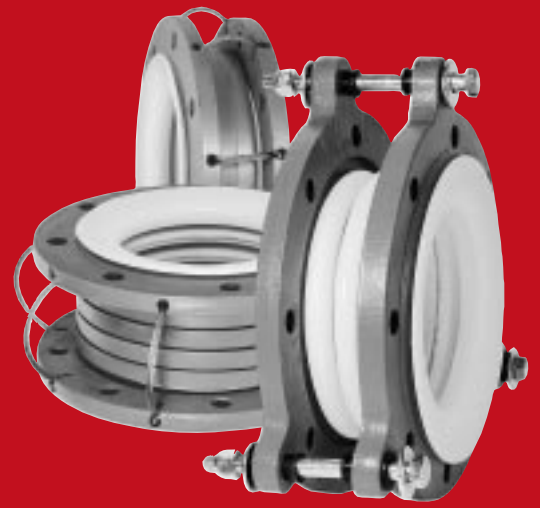
**Steve Bowman
Tony Diaz
Kathy Wilson
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Sylvia Augusto
Cal Hayes
Mike Lassas
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Ed Marchese
Merv Vater**

Demand the best — insist on PROCO!

PROCO™

SERIES

440



molded PTFE expansion joints

The PROCO Series 440 PTFE Molded Expansion Joints are used for corrosive applications found in: Chemical-Petrochemical, Industrial Process Piping Systems, Power Generation Plants, Pulp/Paper Plants, Water-Wastewater Sewage and Pollution Control Systems where metallic joints/lap joints or PTFE & FEP-lined rubber expansion joints may have been previously used or specified. Specify PROCO Series 440 expansion joints for installation between anchor points or next to mechanical equipment such as: Absorption Machines, Blowers, Chillers, Fans, Graphite Heat Exchangers, Glass Lined Vessels, Pumps, and Exotic Alloy/Plastic/Glass Lined Piping Systems. The Series 440 expansion joints are designed to: (1) Absorb Pipe Movements/Stress, (2) Reduce System Noise, (3) Reduce Mechanical Vibration, (4) Compensate Alignment/Offset, (5) Eliminate Electrolysis, (6) Protect against Start-up/Surge Forces. Our history in the manufacture of expansion joint products dates back to 1930. When an engineered solution is needed to solve a piping problem, call PROCO.

Engineered For Your Application. The PROCO Series 440 PTFE expansion joints are available in 2, 3, and 5 convolutions. Each convolution profile offers different overall lengths (face-to-face dimensions), movements and pressure/temperature rating to fit the required specification. Available styles include:

- **Style 442-BD:** Features two convolutions for minimal movements, higher pressure/temperature ratings and short face-to-face opening requirements. Style 442-BD sizes range from 1" to 24" diameter. (See Table 1)
- **Style 442-E:** Features two convolutions, and is engineered with T-band compression limiters, limit cables (meets MIL-W-8342), and face-to-face lengths to be an exact equal to other more expensive, competitor models. Style 442-E sizes range from 1" to 12" diameter. (See Table 2)
- **Style 443-BD:** Features three convolutions and is designed for moderate movement and ease of system installation. Style 443-BD sizes range from 1" to 24" diameter. (See Table 3)
- **Style 443-E:** Features three convolutions, and is engineered with T-band compression limiters, limit cables (meets MIL-W-8342), and face-to-face lengths to be an exact equal to other more expensive, competitor models. Style 443-E sizes range from 1" to 8" diameter. (See Table 4)
- **Style 445-BD:** Features five convolutions, and is designed for maximum movements, low pressure/temperature ranges, vibration reduction and greater face-to-face lengths. Style 445-BD sizes range from 1" to 20" diameter. (See Table 5)
- **Style 445-E:** Features five convolutions, and is engineered with T-band compression limiters, limit cables (meets MIL-W-8342), and face-to-face lengths to be an exact equal to other more expensive, competitor models. Style 445-E sizes range from 1" to 6" diameter. (See Table 6)
- **Style 440-BE:** Features Styles' 440-E Neutral Lengths with Styles' 440-BD Limit Bolts. (See Table 7)

Absorbs Pipe-Wall and Fluid-Borne Noise. The quiet operating PROCO Series 440 PTFE expansion joints are a replacement for "sound transmitting" metallic/lap joints. Pipe Wall sound loses energy and is absorbed as the noise carried by the piping enters and exits the PTFE section. Fluid-borne noise is absorbed by the volumetric expansion (breathing of the connector). This action cushions water hammer and smoothes out pumping impulses.

Isolates Vibration and Motion. PROCO Series 440 PTFE expansion joints should be installed immediately after and ahead of equipment generating vibration in order to isolate the rotating/vibrating equipment from the rest of the piping system. For optimum performance, the PROCO Series 440 PTFE expansion joints should be installed horizontally to the shaft. Vertical and perpendicular installations are also acceptable as these expansion joints will accept axial, lateral and angular movements as well as vibration. Note: For maximum vibration transmission reduction, the pipe section beyond the PTFE expansion joints must be anchored or sufficiently rigid.

Reduces System Stress and Strain. Rigid attachment of piping to critical or mechanical equipment can produce excessive loading. Thermal or mechanically created strain-stress-shock are cushioned and absorbed with the installation of a flexible, low spring rate, PROCO Series 440 PTFE expansion joint. The PROCO Series 440 PTFE expansion joint adds a flexible component to the system that automatically self-corrects for misalignment created by structural movements caused by settling, pipe expansion or ground shifts.

Tested Force Pound and Spring Rate Tables. At PROCO we have machine tested nearly every size of the Series 440 PTFE expansion joints for Axial and Lateral Spring Rates and have provided Thrust/Force factors so designers can properly design system restraints. It should be noted that the PROCO Series 440 PTFE expansion joints are in accordance with the performance characteristics of the Fluid Sealing Association's Non-Metallic Expansion Joint Division.

Superior "Flex Life" and Strength. The PROCO Series 440 PTFE expansion joints are contour molded from extruded tubing providing superior "Flex Life" and Strength. Utilizing TEFLON® T-62 resins from DuPont, the PROCO Series 440 PTFE expansion joints provide dramatically more cycle life than that of PFA or FEP.

Flange and Limit Bolts/Cables. All PROCO Series 440 PTFE expansion joint flange configurations are coated with a rust inhibitive primer to prevent corrosion and are dimensionally tapped to ANSI 125/150# Standards. Hole drilling on center line, other drilling standards, or other flange materials, such as 316 stainless, 304 stainless, or Epoxy Coated flanges are available on special order. In addition, all PROCO Series 440 PTFE expansion joints are supplied with factory set limit bolts or cables to prevent over-extension during operation.

Chemical Service Capability at Minimal Cost. Expensive, exotic metal, PTFE or FEP lined rubber expansion joints for severe chemical service can be replaced with the low cost PROCO Series 440 PTFE expansion joints. The PTFE bellows are van stoned to the flanges which allows all wetted surfaces to come in contact with only the PTFE material. Specify the PROCO Series 440 PTFE expansion joints where high temperatures coupled with lower pressures or lower temperatures coupled with higher pressures are proposed. The PROCO Series 440 PTFE offers the lowest cost expansion joint that is impervious to chemical attack. Use the PROCO "Chemical to Elastomer Guide" for reference on chemical compatibility.

Services and Locations. PROCO Series 440 PTFE Expansion Joints have been supplied and successfully used by a range of customers worldwide in the process industries for use in both organic and inorganic chemical processing and production, including such demanding applications as agrochemical and pharmaceutical chemical production, acid processing and food manufacture.

Information • Ordering • Pricing • Delivery. Day or night, weekends and holidays...the PROCO phones are monitored 24 hours around the clock. When you have a question, you can call us.

Toll-Free Phone 800 / 344-3246 USA/CANADA

International Calls 209 / 943-6088

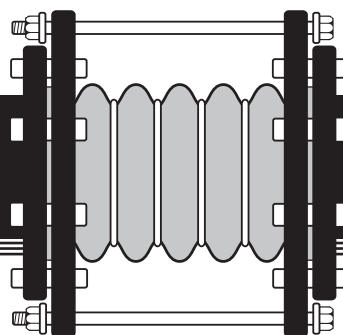
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Weekday office hours are 5:30 a.m. to 5:15 p.m. Pacific Time.

**Protecting Piping And Equipment
Systems From Stress/Motion**



PROCO™

STYLE

442-BD

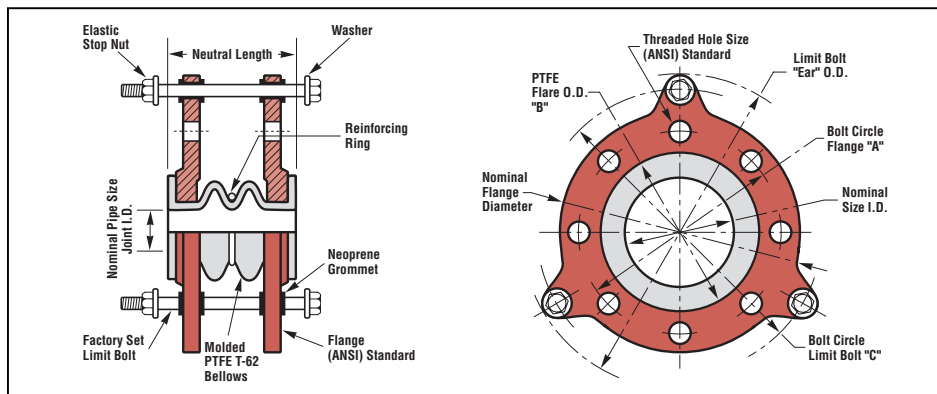


molded PTFE expansion joints

Table 1: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON TWO CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING								PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS	
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "C"	LIMIT BOLT "EAR" O.D.	70°	100°	150°	200°	250°	300°	350°			400°
		IN	IN	DEG.	LB _y /IN	LB _y /IN	LB _y /IN																				
1.00	1.375	0.250	.125	7	104	80	104	2.76	4	1/2-13	3.125	2.000	.313	4.250	.250	5.125	6.000	185	170	148	130	115	100	84	68	29.9" @ 425°F	2
1.25	1.375	0.250	.125	7	61	137	400	2.25	4	1/2-13	3.500	2.520	.394	4.630	.250	5.196	6.850	185	170	148	130	115	100	84	68	CF	5
1.50	1.375	0.250	.125	7	320	180	224	4.60	4	1/2-13	3.875	2.875	.344	5.000	.250	5.875	6.750	185	170	148	130	115	100	84	68	29.9" @ 425°F	3
2.00	1.563	0.250	.125	7	512	300	240	7.07	4	5/8-11	4.750	3.625	.438	6.000	.375	6.875	8.125	185	170	148	130	115	100	84	68	29.9" @ 425°F	7
2.50	2.250	0.313	.125	7	457	278	328	9.62	4	5/8-11	5.500	4.125	.500	7.000	.375	8.125	9.375	185	170	148	130	115	100	84	68	29.9" @ 425°F	10
3.00	2.250	0.375	.188	7	648	320	319	15.90	4	5/8-11	6.000	5.000	.500	7.500	.375	8.750	10.000	185	170	148	130	115	100	84	68	29.9" @ 425°F	10
4.00	2.625	0.500	.250	7	480	280	400	23.75	8	5/8-11	7.500	6.188	.625	9.000	.375	9.875	11.125	185	170	148	130	115	100	84	68	29.9" @ 400°F	18
5.00	3.250	0.500	.250	7	440	440	320	33.17	8	3/4-10	8.500	7.313	.750	10.000	.500	11.500	13.000	185	170	148	130	115	100	84	68	29.9" @ 400°F	24
6.00	2.750	0.500	.250	7	440	386	440	50.24	8	3/4-10	9.500	8.500	.750	11.000	.500	12.500	14.000	185	170	148	130	115	100	84	68	29.9" @ 400°F	29
8.00	4.000	0.500	.250	7	450	390	480	83.49	8	3/4-10	11.750	10.625	.938	13.500	.500	14.750	16.250	164	150	129	112	100	87	73	60	29.9" @ 250°F	47
10.00	5.250	0.500	.250	7	760	600	580	108.38	12	7/8-9	14.250	12.750	1.000	16.000	.500	17.500	19.000	164	150	129	112	100	87	73	60	29.9" @ 250°F	64
12.00	6.000	0.500	.250	7	1300	420	700	176.63	12	7/8-9	17.000	15.000	1.000	19.000	.625	20.500	22.000	70	59	48	40	35	30	26	22	29.9" @ 75°F	115
14.00	6.313	0.750	.375	7	320	1056	1256	233.59	12	1-8	18.750	16.250	1.188	21.000	1.420	24.172	27.313	70	59	48	40	35	30	26	22	10.0" @ 212°F	126
16.00	7.000	1.000	.375	7	297	1096	1256	259.68	16	1-8	21.250	18.500	1.188	23.500	1.420	27.563	31.500	70	59	48	40	35	30	26	22	10.0" @ 212°F	159
18.00	7.938	1.000	.375	7	440	1941	1370	321.90	16	1 1/8-8	22.750	21.000	1.188	25.000	1.420	29.000	32.906	70	59	48	40	35	30	26	22	9.0" @ 212°F	174
20.00	9.000	1.000	.375	7	—	—	—	374.57	20	1 1/8-8	25.000	23.000	1.188	27.500	1.420	31.500	35.438	70	59	48	40	35	30	26	22	6.0" @ 212°F	183
24.00	6.313	0.625	.375	7	—	—	—	538.36	20	1 1/4-7	29.500	27.250	1.344	32.000	1.420	35.906	39.844	70	59	48	40	35	30	26	22	4.0" @ 212°F	238

NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Bolts installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Vacuum Rating is based from fully extended position. CF = Contact Factory.



SERIES 442-BD MATERIALS OF CONSTRUCTION

DESCRIPTION	1" THROUGH 12"	14" THROUGH 24"
BELLOWS	PTFE T-62	PTFE T-62
FLANGES	DUCTILE IRON	ZINC PLATED CARBON STEEL
REINFORCING RINGS	STAINLESS STEEL	STAINLESS STEEL
LIMIT BOLTS	CARBON STEEL	CARBON STEEL
NUTS	CARBON STEEL	CARBON STEEL
GROMMETS	NEOPRENE	NEOPRENE
WASHERS	CARBON STEEL	CARBON STEEL

PROCO™

STYLE

442-E

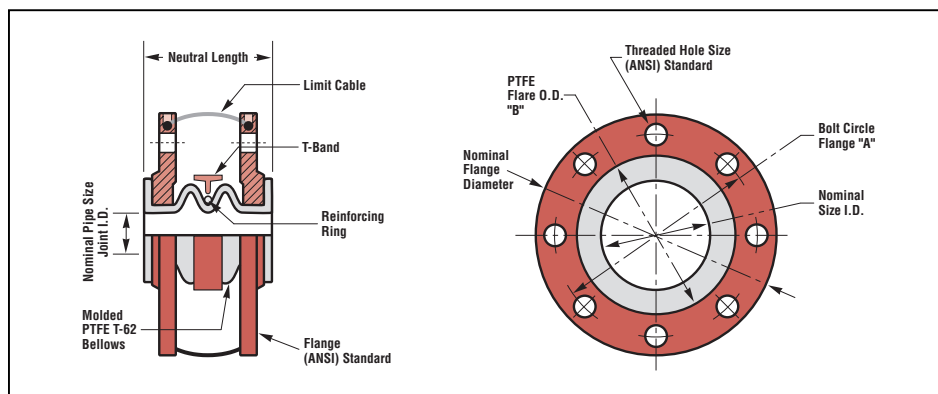


molded PTFE expansion joints

Table 2: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON TWO CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.										
															IN	IN	DEG.	LB _f /IN	LB _f /IN	LB _f /IN	70°	100°		
1.00	1.750	0.344	.250	16	140	144	120	2.76	4	1/2-13	3.125	2.000	.438	4.250	185	170	148	130	115	100	84	68	29.9" @ 425°F	3
1.50	1.813	0.344	.250	13	240	200	240	4.60	4	1/2-13	3.875	2.875	.469	5.000	185	170	148	130	115	100	84	68	29.9" @ 425°F	4
2.00	1.875	0.344	.281	12	430	350	440	7.07	4	5/8-11	4.750	3.625	.484	6.000	185	170	148	130	115	100	84	68	29.9" @ 425°F	7
3.00	2.188	0.406	.313	10	650	320	350	15.90	4	5/8-11	6.000	5.000	.578	7.500	185	170	148	130	115	100	84	68	29.9" @ 425°F	10
4.00	2.281	0.438	.313	9	360	280	630	23.75	8	5/8-11	7.500	6.188	.578	9.000	185	170	148	130	115	100	84	68	29.9" @ 400°F	17
6.00	2.531	0.469	.375	7	460	350	720	50.24	8	3/4-10	9.500	8.500	.641	11.000	185	170	148	130	115	100	84	68	29.9" @ 400°F	27
8.00	2.750	0.531	.406	6	300	230	800	81.48	8	3/4-10	11.750	10.625	.688	13.500	164	150	129	112	100	87	73	60	29.9" @ 250°F	35
10.00	2.969	0.563	.438	5	1280	870	1000	108.38	12	7/8-9	14.250	12.750	.734	16.000	164	150	129	112	100	87	73	60	29.9" @ 250°F	52
12.00	3.094	0.594	.469	5	380	240	1000	176.63	12	7/8-9	17.000	15.000	.813	19.000	70	59	48	40	35	30	26	22	29.9" @ 75°F	107

- NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Cables installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Vacuum Rating is based from fully extended position.



SERIES 442-E MATERIALS OF CONSTRUCTION	
DESCRIPTION	1" THROUGH 12"
BELLOWS	PTFE T-62
FLANGES	DUCTILE IRON
REINFORCING RINGS	STAINLESS STEEL
T-BANDS	CARBON STEEL
LIMIT CABLES	MIL-W-8342

PROCO™

STYLE

443-BD

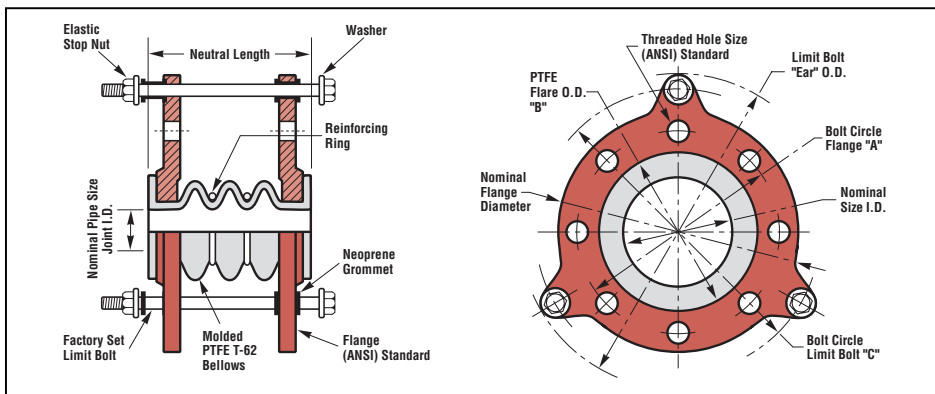


molded PTFE expansion joints

Table 3: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON THREE CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING								PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS	
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "C"	LIMIT BOLT "EAR" O.D.	70°	100°	150°	200°	250°	300°	350°			400°
		IN	IN	DEG.	LB _p /IN	LB _p /IN	LB _p /IN																				
1.00	1.750	0.500	.250	14	190	82	96	2.81	4	1/2-13	3.125	2.000	.313	4.250	.250	5.125	6.000	138	126	107	90	76	64	53	45	29.9" @ 400°F	2
1.25	1.810	0.500	.250	14	40	120	314	2.25	4	1/2-13	3.500	2.520	.394	4.630	.250	5.196	6.850	128	120	96	85	72	56	42	36	CF	5
1.50	2.000	0.500	.250	14	84	66	108	5.09	4	1/2-13	3.875	2.875	.344	5.000	.250	5.875	6.750	138	126	107	90	76	64	53	45	29.9" @ 400°F	4
2.00	2.750	0.750	.375	14	69	76	109	9.11	4	5/8-11	4.750	3.625	.438	6.000	.375	6.875	8.125	138	126	107	90	76	64	53	45	29.9" @ 400°F	8
2.50	3.188	0.750	.375	14	91	97	160	11.41	4	5/8-11	5.500	4.125	.500	7.000	.375	8.125	9.375	138	126	107	90	76	64	53	45	29.9" @ 400°F	11
3.00	3.625	1.000	.500	14	124	125	194	16.91	4	5/8-11	6.000	5.000	.500	7.500	.375	8.750	10.000	138	126	107	90	76	64	53	45	29.9" @ 400°F	13
4.00	3.625	1.000	.500	14	220	155	264	25.40	8	5/8-11	7.500	6.188	.625	9.000	.375	9.875	11.125	138	126	107	90	76	64	53	45	29.9" @ 400°F	19
5.00	4.000	1.000	.500	14	320	210	324	34.45	8	3/4-10	8.500	7.313	.750	10.000	.500	11.500	13.000	138	126	107	90	76	64	53	45	29.9" @ 300°F	25
6.00	4.000	1.125	.563	14	289	187	266	50.24	8	3/4-10	9.500	8.500	.750	11.000	.500	12.500	14.000	138	126	107	90	76	64	53	45	29.9" @ 300°F	30
8.00	6.000	1.125	.563	14	178	218	423	83.49	8	3/4-10	11.750	10.625	.938	13.500	.500	14.750	16.250	120	110	94	80	67	57	47	38	29.9" @ 125°F	48
10.00	7.000	1.188	.500	14	420	531	857	128.55	12	7/8-9	14.250	12.750	1.000	16.000	.500	17.500	19.000	82	70	64	52	46	39	34	30	19.0" @ 212°F	60
12.00	7.875	1.188	.625	14	743	542	857	144.72	12	7/8-9	17.000	15.000	1.000	19.000	.625	20.500	22.000	82	70	64	52	46	40	34	30	10.0" @ 212°F	77
14.00	8.500	1.250	.688	14	239	628	970	233.59	12	1-8	18.750	16.250	1.188	21.000	1.420	24.172	27.313	82	70	64	52	46	40	34	30	10.0" @ 212°F	132
16.00	9.188	1.375	.750	14	245	571	970	259.68	16	1-8	21.250	18.500	1.188	23.500	1.420	27.563	31.500	82	70	64	52	46	40	34	30	10.0" @ 212°F	165
18.00	11.063	1.188	.750	14	—	—	1085	321.90	16	1 1/8-8	22.750	21.000	1.188	25.000	1.420	29.000	32.906	60	58	48	42	36	30	28	26	9.0" @ 212°F	201
20.00	12.875	1.188	1.000	14	—	—	1142	374.57	20	1 1/8-8	25.000	23.000	1.188	27.500	1.420	31.500	35.438	60	58	48	42	36	30	28	26	6.0" @ 212°F	243
24.00	11.875	1.000	.750	14	—	—	—	538.36	20	1 1/4-7	29.500	27.250	1.344	32.000	1.420	35.906	39.844	60	58	48	42	36	30	28	26	4.0" @ 212°F	309

NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Bolts installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Vacuum Rating is based from fully extended position. CF = Contact Factory.



SERIES 443-BD MATERIALS OF CONSTRUCTION		
DESCRIPTION	1" THROUGH 12"	14" THROUGH 24"
BELLOWS	PTFE T-62	PTFE T-62
FLANGES	DUCTILE IRON	ZINC PLATED CARBON STEEL
REINFORCING RINGS	STAINLESS STEEL	STAINLESS STEEL
LIMIT BOLTS	CARBON STEEL	CARBON STEEL
NUTS	CARBON STEEL	CARBON STEEL
GROMMETS	NEOPRENE	NEOPRENE
WASHERS	CARBON STEEL	CARBON STEEL

PROCO™

STYLE

443-E

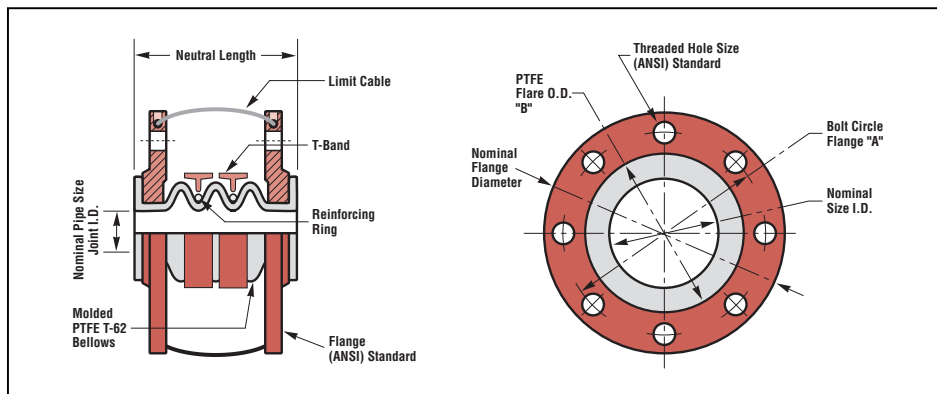


molded PTFE expansion joints

Table 4: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON THREE CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS	
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	70°	100°	150°	200°	250°	300°	350°	400°			Hg at Temp.
		IN	IN	DEG.	LB _f /IN	LB _f /IN	LB _f /IN																		
1.00	2.313	0.500	.375	24	130	130	260	2.81	4	1/2-13	3.125	2.000	.438	4.250	138	126	107	90	76	64	53	45	29.9" @ 400°F	3	
1.50	2.406	0.531	.375	20	80	70	110	5.09	4	1/2-13	3.875	2.875	.469	5.000	138	126	107	90	76	64	53	45	29.9" @ 400°F	5	
2.00	2.500	0.531	.406	17	70	80	160	9.11	4	5/8-11	4.750	3.625	.484	6.000	138	126	107	90	76	64	53	45	29.9" @ 400°F	8	
3.00	2.906	0.625	.469	15	140	160	190	16.91	4	5/8-11	6.000	5.000	.578	7.500	138	126	107	90	76	64	53	45	29.9" @ 400°F	14	
4.00	3.063	0.656	.500	13	220	160	190	25.40	8	5/8-11	7.500	6.188	.578	9.000	138	126	107	90	76	64	53	45	29.9" @ 400°F	19	
6.00	3.375	0.719	.531	10	350	190	540	50.24	8	3/4-10	9.500	8.500	.641	11.000	138	126	107	90	76	64	53	45	29.9" @ 300°F	30	
8.00	3.656	0.781	.594	9	450	170	750	81.48	8	3/4-10	11.750	10.625	.688	13.500	120	110	94	80	67	57	47	38	29.9" @ 125°F	39	

- NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Cables installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Vacuum Rating is based from fully extended position.

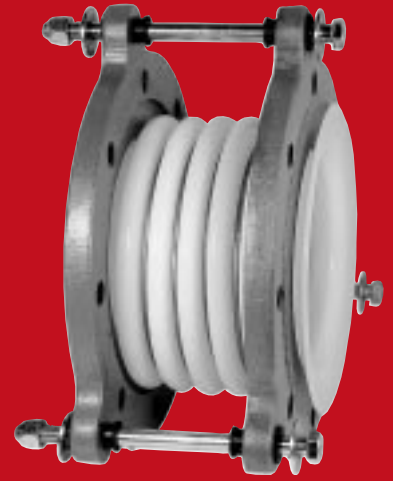


SERIES 443-E MATERIALS OF CONSTRUCTION	
DESCRIPTION	1" THROUGH 8"
BELLOWS	PTFE T-62
FLANGES	DUCTILE IRON
REINFORCING RINGS	STAINLESS STEEL
T-BANDS	CARBON STEEL
LIMIT CABLES	MIL-W-8342

PROCO™

STYLE

445-BD

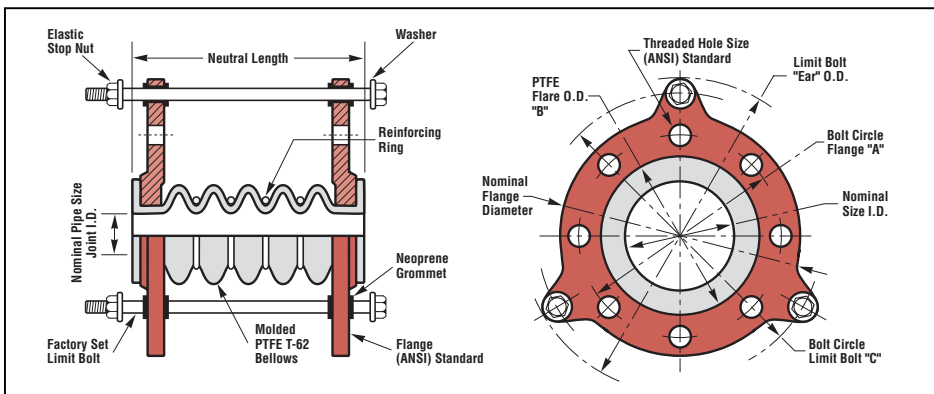


molded PTFE expansion joints

Table 5: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON FIVE CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING								PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS	
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "C"	LIMIT BOLT "EAR" O.D.										
																		IN	IN	DEG.	LB _f /IN	LB _f /IN	LB _f /IN	70°			100°
1.00	3.000	0.500	.500	20	30	44	22	2.81	4	1/2-13	3.125	2.000	.313	4.250	.250	5.125	6.000	72	61	46	40	34	29	27	24	NOT	2
1.25	2.670	0.394	.470	20	36	114	171	2.25	4	1/2-13	3.500	2.520	.394	4.630	.250	5.196	6.850	62	56	42	36	30	26	22	22		5
1.50	3.500	0.750	.500	20	75	83	46	5.09	4	1/2-13	3.875	2.875	.344	5.000	.250	5.875	6.750	72	61	46	40	34	29	27	24		5
2.00	4.000	1.000	.500	20	60	47	50	9.11	4	5/8-11	4.750	3.625	.438	6.000	.375	6.875	8.125	72	61	46	40	34	29	27	24	DESIGNED	9
2.50	4.600	0.980	.510	20	116	319	285	10.08	4	5/8-11	5.500	4.125	.500	7.000	.375	8.125	9.375	62	56	42	36	30	26	22	22		11
3.00	5.000	1.000	.500	20	55	60	170	16.91	4	5/8-11	6.000	5.000	.500	7.500	.375	8.750	10.000	72	61	46	40	34	29	27	24		14
4.00	5.250	1.250	.625	20	72	60	80	25.40	8	5/8-11	7.500	6.188	.625	9.000	.375	9.875	11.125	72	61	46	40	34	29	27	24	FOR	20
5.00	6.000	1.250	.625	20	140	388	400	32.33	8	3/4-10	8.500	7.313	.750	10.000	.500	11.500	13.000	62	56	42	36	30	26	22	22		26
6.00	6.000	1.250	.625	20	190	130	195	50.24	8	3/4-10	9.500	8.500	.750	11.000	.500	12.500	14.000	72	61	46	40	34	29	27	24		31
8.00	8.000	1.250	.625	20	304	388	457	76.07	8	3/4-10	11.750	10.625	.938	13.500	.500	14.750	16.250	48	42	34	30	26	22	22	22	VACUUM	49
10.00	8.750	1.250	.625	20	458	388	457	128.55	12	7/8-9	14.250	12.750	1.000	16.000	.500	17.500	19.000	48	42	34	30	26	22	22	22		64
12.00	9.000	1.375	.688	20	529	445	457	144.72	12	7/8-9	17.000	15.000	1.000	19.000	.625	20.500	22.000	48	42	34	30	26	22	22	22		88
14.00	12.790	1.375	.688	20	203	371	514	233.59	12	1-8	18.750	16.250	1.188	21.000	1.420	24.172	27.313	48	42	34	30	26	22	22	22	SERVICE	143
16.00	13.500	1.625	1.000	20	180	383	514	259.68	16	1-8	21.250	18.500	1.188	23.500	1.420	27.563	31.500	48	42	34	30	26	22	22	22		179
20.00	20.470	1.625	1.000	20	185	371	571	374.57	20	1 1/8-8	25.000	23.000	1.188	27.500	1.420	31.500	35.438	48	42	34	30	26	22	22	22		243

NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Bolts installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Style 445-BD is not designed for Vacuum Service.



SERIES 445-BD MATERIALS OF CONSTRUCTION		
DESCRIPTION	1" THROUGH 12"	14" THROUGH 20"
BELLOWS	PTFE T-62	PTFE T-62
FLANGES	DUCTILE IRON	ZINC PLATED CARBON STEEL
REINFORCING RINGS	STAINLESS STEEL	STAINLESS STEEL
LIMIT BOLTS	CARBON STEEL	CARBON STEEL
NUTS	CARBON STEEL	CARBON STEEL
GROMMETS	NEOPRENE	NEOPRENE
WASHERS	CARBON STEEL	CARBON STEEL

PROCO™

STYLE

445-E

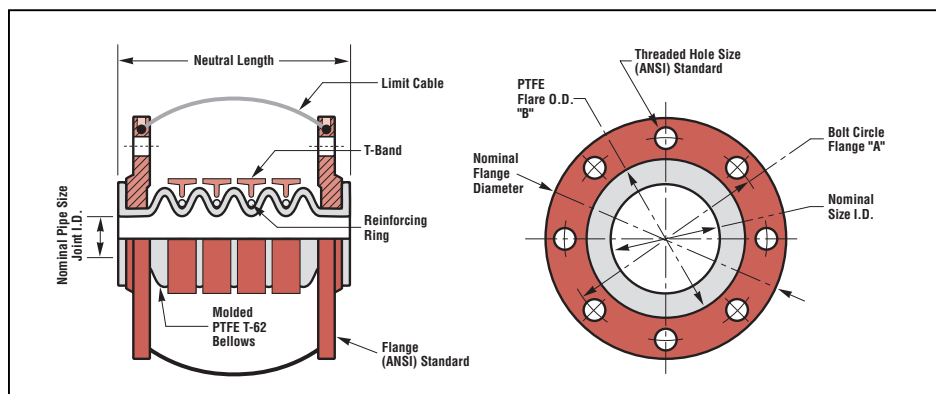


molded PTFE expansion joints

Table 6: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON FIVE CONVOLUTION DESIGN ¹			SPRING RATE CAPABILITY ²			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	70°	100°	150°	200°	250°	300°	350°			400°	
		IN	IN	DEG.	LB _f /IN	LB _f /IN	LB _f /IN																		
1.00	3.500	0.844	.625	39	50	110	50	2.81	4	1/2-13	3.125	2.000	.438	4.250	72	61	46	40	34	29	27	24	24	NOT	3
1.50	3.625	0.875	.656	32	75	80	50	5.09	4	1/2-13	3.875	2.875	.469	5.000	72	61	46	40	34	29	27	24	24	DESIGNED	7
2.00	3.750	0.875	.656	29	60	50	50	9.11	4	5/8-11	4.750	3.625	.484	6.000	72	61	46	40	34	29	27	24	24	FOR	10
3.00	4.375	1.031	.781	25	55	60	170	16.91	4	5/8-11	6.000	5.000	.578	7.500	72	61	46	40	34	29	27	24	24	VACUUM	16
4.00	4.563	1.094	.813	21	70	60	80	25.40	8	5/8-11	7.500	6.188	.578	9.000	72	61	46	40	34	29	27	24	24	VACUUM	23
6.00	5.031	1.188	.906	17	190	130	195	50.24	8	3/4-10	9.500	8.500	.641	11.000	72	61	46	40	34	29	27	24	24	SERVICE	34

- NOTES: 1. Movements are non-concurrent and based from Neutral Length with Limit Cables installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Style 445-E is not designed for Vacuum Service.



SERIES 445-E MATERIALS OF CONSTRUCTION	
DESCRIPTION	1" THROUGH 6"
BELLOWS	PTFE T-62
FLANGES	DUCTILE IRON
REINFORCING RINGS	STAINLESS STEEL
T-BANDS	CARBON STEEL
LIMIT CABLES	MIL-W-8342

PROCO™

STYLE

440-BE



molded PTFE expansion joints (440-E Neutral Lengths with 440-BD Limit Bolts)

Table 7: Sizes • Movements • Spring Rates • Flange Standards • Temperatures • Vacuum • Weights																											
NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES ¹			SPRING RATE CAPABILITY ²				EXPANSION JOINT FLANGE DRILLING								PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM RATING ³	WEIGHT / LBS	
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	COMPRESSION SPRING RATE	EXTENSION SPRING RATE	LATERAL SPRING RATE	THRUST FACTOR	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	PTFE FLARE O.D. "B"	FLANGE THICKNESS	NOMINAL FLANGE O.D.	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "C"	LIMIT BOLT "EAR" O.D.	70°	100°	150°	200°	250°	300°	350°			400°
		IN	IN	DEG.	LB _v /IN	LB _v /IN	LB _v /IN																				
Style 442-BE — 442-E Neutral Lengths with 442-BD Limit Bolts																											
1.00	1.750	0.344	.125	7	140	144	120	2.76	4	1/2- 13	3.125	2.000	.438	4.250	.250	5.125	6.000	185	170	148	130	115	100	84	68	29.9° @ 425°F	2
1.50	1.813	0.344	.125	7	240	200	240	4.60	4	1/2- 13	3.875	2.875	.469	5.000	.250	5.875	6.750	185	170	148	130	115	100	84	68	29.9° @ 425°F	2
2.00	1.875	0.344	.125	7	430	350	440	7.07	4	5/8- 11	4.750	3.625	.484	6.000	.375	6.875	8.125	185	170	148	130	115	100	84	68	29.9° @ 425°F	7
3.00	2.188	0.406	.188	7	650	320	350	15.90	4	5/8- 11	6.000	5.000	.578	7.500	.375	8.750	10.000	185	170	148	130	115	100	84	68	29.9° @ 425°F	10
4.00	2.281	0.438	.250	7	360	280	630	23.75	8	5/8- 11	7.500	6.188	.578	9.000	.375	9.875	11.125	185	170	148	130	115	100	84	68	29.9° @ 400°F	18
6.00	2.531	0.469	.250	7	460	350	720	50.24	8	3/4- 10	9.500	8.500	.641	11.000	.500	12.500	14.000	185	170	148	130	115	100	84	68	29.9° @ 400°F	29
8.00	2.750	0.531	.250	7	300	230	800	81.48	8	3/4- 10	11.750	10.625	.688	13.500	.500	14.750	16.250	164	150	129	112	100	87	73	60	29.9° @ 250°F	47
10.00	2.969	0.563	.250	6	1280	870	1000	108.38	12	7/8- 9	14.250	12.750	0.734	16.000	.500	17.500	19.000	164	150	129	112	100	87	73	60	29.9° @ 250°F	64
12.00	3.094	0.594	.250	5	380	240	1000	176.63	12	7/8- 9	17.000	15.000	0.813	19.000	.625	20.500	22.000	70	59	48	40	35	30	26	22	29.9° @ 75°F	115
Style 443-BE — 443-E Neutral Lengths with 443-BD Limit Bolts																											
1.00	2.313	0.500	.250	14	130	130	260	2.81	4	1/2- 13	3.125	2.000	.438	4.250	.250	5.125	6.000	138	126	107	90	76	64	53	45	29.9° @ 400°F	2
1.50	2.406	0.531	.250	12	80	70	110	5.09	4	1/2- 13	3.875	2.875	.469	5.000	.250	5.875	6.750	138	126	107	90	76	64	53	45	29.9° @ 400°F	4
2.00	2.500	0.531	.375	12	70	80	160	9.11	4	5/8- 11	4.750	3.625	.484	6.000	.375	6.875	8.125	138	126	107	90	76	64	53	45	29.9° @ 400°F	8
3.00	2.906	0.625	.500	10	140	160	190	16.91	4	5/8- 11	6.000	5.000	.578	7.500	.375	8.750	10.000	138	126	107	90	76	64	53	45	29.9° @ 400°F	13
4.00	3.063	0.656	.500	10	220	160	190	25.40	8	5/8- 11	7.500	6.188	.578	9.000	.375	9.875	11.125	138	126	107	90	76	64	53	45	29.9° @ 400°F	19
6.00	3.375	0.719	.563	9	350	190	540	50.24	8	3/4- 10	9.500	8.500	.641	11.000	.500	12.500	14.000	138	126	107	90	76	64	53	45	29.9° @ 300°F	30
8.00	3.656	0.781	.563	9	450	170	750	81.48	8	3/4- 10	11.750	10.625	.688	13.500	.500	14.750	16.250	120	110	94	80	67	57	47	38	29.9° @ 125°F	48
Style 445-BE — 445-E Neutral Lengths with 445-BD Limit Bolts																											
1.00	3.500	0.844	.500	20	50	110	50	2.81	4	1/2- 13	3.125	2.000	.438	4.250	.250	5.125	6.000	72	61	46	40	34	29	27	24	NOT	2
1.50	3.625	0.785	.500	20	75	80	50	5.09	4	1/2- 13	3.875	2.875	.469	5.000	.250	5.875	6.750	72	61	46	40	34	29	27	24	DESIGNED	5
2.00	3.750	0.875	.500	15	60	50	50	9.11	4	5/8- 11	4.750	3.625	.484	6.000	.375	6.875	8.125	72	61	46	40	34	29	27	24	FOR	9
3.00	4.375	1.031	.500	17	55	60	170	16.91	4	5/8- 11	6.000	5.000	.578	7.500	.375	8.750	10.000	72	61	46	40	34	29	27	24	VACUUM	14
4.00	4.563	1.094	.625	15	70	60	80	25.40	8	5/8- 11	7.500	6.188	.578	9.000	.375	9.875	11.125	72	61	46	40	34	29	27	24	SERVICE	20
6.00	5.031	1.188	.625	15	190	130	195	50.24	8	3/4- 10	9.500	8.500	.641	11.000	.500	12.500	14.000	72	61	46	40	34	29	27	24	SERVICE	31

NOTES: 1. Movements are non-concurrent and based on Neutral Length with Limit Bolts installed.
 2. Spring Rate Capability is based on 1" of movement at zero pressure conditions.
 3. Vacuum Rating is based from fully extended position. Style 445-BE is not designed for Vacuum Service.

PROCO STYLE NUMBER:	STYLE 440-BE MATERIALS OF CONSTRUCTION						
	BELLEWS	FLANGES	REINFORCING RINGS	LIMIT BOLTS	NUTS	GROMMETS	WASHERS
442-BE — 1" THROUGH 12"							
443-BE — 1" THROUGH 8"							
445-BE — 1" THROUGH 6"	PTFE T-62	DUCTILE IRON	STAINLESS STEEL	CARBON STEEL	CARBON STEEL	NEOPRENE	CARBON STEEL

Installation Instructions for Series 440 PTFE Expansion Joints

TORQUE TABLE LISTING

SIZE I.D. (IN)	1.0	1.25	1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0
TORQUE (FT/LBS)	10	16	25	52	47	82	54	80	100	135	125	155
TOLERANCE (+/-)(FT/LBS)	2	3	6	13	11	20	13	20	24	32	31	38

Notes: 1. Bolt Torque requirements may vary depending on mating flange material and installation.
2. "Over-Torque" may cause the PTFE material to creep.

1. Service Conditions: Make sure the expansion joint ratings for temperature, vacuum, spring rates and movements match the system requirements. Contact PROCO if the system requirements exceed those of the expansion joint selected.

2. Alignment: PROCO Series 440 PTFE expansion joints are not designed to make up for piping misalignment error. Pipe misalignment should be no more than 1/8" in any direction. Misalignment of an expansion joint will reduce the rated movements and can cause stress of material properties, thus causing reduced service life.

3. Limit Bolt/Cable: Limit bolts and cables are factory set at the maximum allowable travel position to prevent over extension. Do not remove or alter nuts at any time. Damage or personal injury can result due to changes in limit bolt/cable settings.

4. Anchoring: Solid anchoring is required whenever the pipeline changes direction. PROCO Series 440 PTFE expansion joints should be located as close as possible to these anchor points. If an anchoring system is not used, any associated pressure thrust can cause excessive movement, ultimately damaging the expansion joint. **(It should be noted that the attached limit bolts/cables are designed to limit movement and are not designed to handle pressure thrust.)**

5. Pipe Support: Piping must be supported by hangers or anchors so expansion joints do not carry any pipe weight.

6. Personnel Protection: It is strongly recommended that spray shields be used for all hazardous service to protect against serious personal injury in the event of expansion joint failure. (Contact PROCO for spray shield information.)

7. Installation:

a. Store expansion joints with wood covers in-place to protect PTFE flange surfaces from damage until ready to install.

b. Check to make sure PTFE surfaces are clean and free of foreign sediment. Remove nicks, burrs and deep scratches with a fine emery cloth. If surface irregularities cannot be completely removed, install a PTFE envelope-type gasket to obtain an adequate seal.

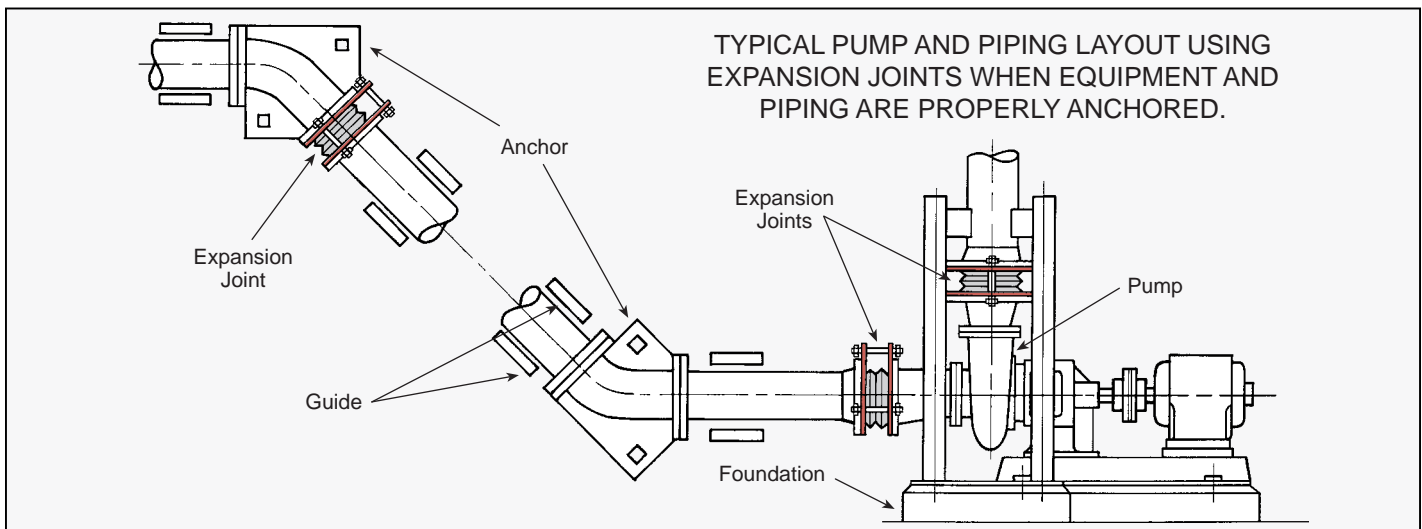
c. Install the PROCO Series 440 PTFE expansion joints to the prescribed neutral lengths. If expansion joints are used in high temperature processes, it is recommended that units be installed at/near the extended values. For cold process installations, expansion joints should be installed in a nearly compressed length. These settings will enable the expansion joint to realize full travel capabilities. (See appropriate Tables for Neutral Lengths.)

d. Thread installation bolts from mating flange side to prevent possible damage to PTFE elements. Extend bolts beyond the expansion joint flange by no more than 1-2 threads. Nuts are not necessary due to threaded flange holes.

e. Tighten flange bolts with a torque wrench. Tighten in an alternate crossing pattern in 20% increments until 80% of final bolt torques have been achieved. Tighten to final torque values (listed in Torque Table Listing) in a clockwise fashion around the flange to ensure bolts carry equal stress burdens.

f. Re-tighten bolts after first cycle of operation. Re-tighten as necessary after every planned maintenance shutdown. All bolts should be re-torqued to the above listed values.

8. Operations: After expansion joints are installed, it may be necessary to air blast the exterior to remove foreign debris, such as metal chips, from between the convolutions. The expansion joint should then be covered with a shield to protect from damage and foreign debris during operation. **(Note: Do not weld in immediate vicinity of expansion joint unless it is properly protected.)**



ENGINEERING DESIGN NOTES:

1. It is essential that piping system thrusts be calculated to ensure correct sizing of anchors and pipe supports, plus ensure that allowable thrust forces on adjacent mechanical and rotating equipment are not exceeded. Please use the following formulas:

$$T_p = P \cdot T_1$$

T_p is the pressure thrust (lb_f), P is the system operating pressure (Psig) and T_1 is the thrust factor (or bellows effective area [in²]). The pressure thrust, T_p , will act in the axial direction and must be added to the axial spring force ($F_x \cdot \Delta x$) to give the total axial reaction force, R_x .

$$R_x = T_p + (F_x \cdot \Delta x)$$

R_x is the pipe support reaction force (lb_f), T_p is the pressure thrust (lb_f), F_x is the axial spring force of the unit and Δx is the expected or designed axial movement of the unit (See Tables 1-6).

2. It should be noted that axial spring rate values found in Tables 1 through 6 are based on an ambient temperature (70°F) and will decrease as the system temperature rises. In addition, spring rates decrease over time due to thermoplastic creep if units are operated under pressure.

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Warning: Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures. Normal precautions should be taken to make sure these parts are installed correctly and inspected regularly. Precautions should be taken to protect personnel in the event of leakage or splash. Note: Piping must be properly aligned and anchored to prevent damage to an expansion joint. Movement must not exceed specified ratings and control units are always recommended to prevent damage in the event other anchoring in the system fails. Properties applications shown throughout this data sheet are typical. This information does not constitute a warranty or representation and we assume no legal responsibility or obligation with respect thereto and the use to which such information may be put. Your specific application should not be undertaken without independent study and evaluation for suitability.

PROCO™

SERIES 4400



convoluted heavy-duty molded PTFE bellows

The PROCO Series 4400 PTFE Molded Bellows Expansion Joints are used for corrosive applications found in: Chemical-Petrochemical, Industrial Process Piping Systems, Power Generating Plants, Pulp/Paper Plants, Water/Wastewater Sewage and Pollution Control Systems where metallic joints/lap joints of PTFE & FEP-lined rubber expansion joints may have been previously used or specified. Specify PROCO Series 4400 Expansion Joints for installation between anchor points or next to mechanical equipment such as: Absorption Machines, Blowers, Chillers, Compressors, Fans, Graphite Heat Exchangers, Glass Lined Vessels, Pumps, and Exotic Alloy/Glass Lined Piping Systems. The Series 4400 Expansion Joints are designed to: (1) Absorb Pipe Movements/Stress, (2) Reduce System Noise, (3) Reduce Mechanical Vibration, (4) Compensate Alignment/Offset, (5) Eliminate Electrolysis, (6) Protect Against Start-up/Surge Forces. Our history in the manufacture of expansion joint products dates back to 1930. When an engineered solution is needed to solve a piping problem, call PROCO.

Engineered For Your Application. The PROCO Series 4400 PTFE Expansion Joints are hot formed from a PTFE tube made with a tape wrapping process. The tube is processed so that the PTFE has a low level of crystallinity, which translates into an improved service life. The seamless PTFE tube is also engineered to have a controlled wall thickness and production methods ensure optimum hoop strength, therefore providing an excellent pressure/vacuum to temperature ratio in the finished product. In most cases this can match that of PTFE lined steel pipe and fittings.

The PROCO Series 4400 is available in 2 convolute through 10 convolute configurations. Each convolute profile offers different overall lengths (face-to-face dimensions) and movements to fit the required specification.

Absorbs Pipe-Wall And Fluid-Borne Noise. The PROCO quiet-operating Series 4400 expansion joints are a replacement for "sound transmitting" metallic/lap joints. Pipe-Wall sound loses energy and is absorbed as the noise carried by the piping enters and exits the PTFE section. Fluid-Borne noise is absorbed by the volumetric expansion (breathing of the connector). This action cushions water hammer and smoothes out pumping impulses.

Isolates Vibration And Motion. PROCO Series 4400 PTFE Expansion Joints should be installed right after and ahead of equipment generating vibration in order to isolate the rotating/vibrating equipment from the rest of the piping system. This layout will improve the overall operating performance of the piping system. For optimum performance, the Series 4400 expansion joints should be installed horizontally to the shaft. Vertical and perpendicular installations are also acceptable, as these expansion joints will accept axial, lateral and angular movements as well as vibration. **Note: For maximum vibration transmission reduction, the pipe section beyond the PTFE expansion joints must be anchored or sufficiently rigid.**

Reduces System Stress and Strain. Rigid attachment of piping to critical or mechanical equipment can produce excessive loading. Thermal or mechanically created strain/stress/shock are cushioned and absorbed with the installation of a flexible PROCO Series 4400 PTFE Expansion Joint. The Series 4400 expansion joint adds a flexible component to the system that automatically self-corrects for misalignment created by structural movements caused by settling, pipe expansion or ground shifts.

Tested Force Pound And Spring Rate Tables. At PROCO we have machine tested several sizes of the Series 4400 expansion joints for Axial Spring Rates and can provide Thrust/Force factors so designers can properly design system restraints. It should be noted that the Series 4400 Molded PTFE Expansion Joints are in accordance with the performance characteristics of the Fluid Sealing Association's Rubber Expansion Joint Division, Technical Handbook Section on Convoluted PTFE Bellows.

Flange And Limit Rods. All PROCO Series 4400 expansion joint flange configurations are made of ductile iron, coated with a rust inhibitive primer to prevent corrosion and are dimensionally tapped to ANSI 125/150# Standards. Hole drilling on centerline, other drilling standards, or other flange materials, (such as epoxy coated flanges), are available on special order. In addition, all PTFE expansion joints are supplied with factory set limit rods to prevent over-extension during operation.

Chemical Service Capability at Minimal Cost. Expensive, exotic metal or PTFE or FEP lined rubber expansion joints for severe chemical service can be replaced with the PROCO Series 4400 PTFE Expansion Joints. The PTFE bellows are vanstoned to ductile iron flanges, which allows all wetted surfaces to come in contact with the PTFE material. Specify the Series 4400 expansion joints where high temperatures coupled with lower pressures or lower temperatures coupled with higher pressures are proposed. Molded from PTFE materials, the Series 4400 offers a low-cost expansion joint that is impervious to chemical attack. Use the PROCO "Chemical to Elastomer Guide" for reference on chemical compatibility.

Services And Locations. PROCO Series 4400 PTFE Expansion Joints have been supplied to, and successfully used by a range of customers worldwide in the process industries for use in both organic and inorganic chemical processing and production, including such demanding applications as agrochemical and pharmaceutical chemical production, acid processing and food manufacture.

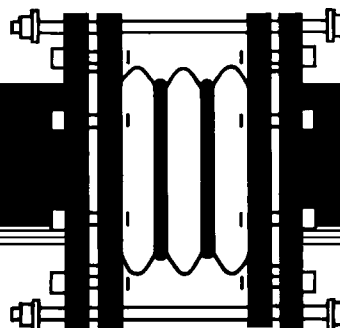
Information • Ordering • Pricing • Delivery. Day or night, weekends and holidays ... the PROCO phones are monitored 24 hours around the clock. When you have a question, you can call us.

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Rev. 1 3/02

The Expansion Joint People



Protecting Piping And Equipment Systems From Stress/Motion



PROCO™

STYLE 4402



two convolution heavy-duty molded PTFE bellows

TABLE 1

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON TWO CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM Hg at Temp.	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT IN	LATERAL (Δy) DEFLECTION IN	ANGULAR DEFLECTION DEG.	FORCE LBS PER 1" RATED EXTENSION LB/IN	FORCE LBS PER 1" RATED COMPRESSION LB/IN	FORCE LBS PER 1" RATED LATERAL DEFLECTION LB/IN	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
																70°	100°	150°	200°	250°	300°			350°	400°
1.00	1.772	.276	.157	16	1485	971	2342	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	29.9° @ 390°F	4
1.25	1.969	.315	.157	16	1485	971	2342	4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9° @ 390°F	6
1.50	2.165	.315	.157	16	1485	971	2342	4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9° @ 390°F	8
2.00	2.362	.433	.236	12	1999	971	2342	4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50	29.9° @ 390°F	9
2.50	2.362	.433	.236	12	2170	971	2342	4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	29.9° @ 390°F	10
3.00	2.560	.512	.276	11	2627	1085	2570	4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50	29.9° @ 390°F	12
4.00	2.756	.591	.315	10	2627	1142	2741	8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	29.9° @ 390°F	14
5.00	2.953	.591	.315	9	3083	1313	3026	8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50	29.9° @ 390°F	18
6.00	2.953	.630	.315	8	3655	1485	3940	8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	29.9° @ 390°F	22
8.00	2.953	.669	.315	7	4229	1771	5082	8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50	29.9° @ 260°F	32
10.00	3.150	.748	.354	7	4968	1999	5539	12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	29.9° @ 260°F	49
12.00	3.347	.748	.354	6	5621	2341	6338	12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	29.9° @ 260°F	57
14.00	3.346	.787	.394	5	ENGINEERED PER SPECIFICATIONS			12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	14.9° @ 70°F	74
16.00	3.543	.787	.394	5				16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	14.9° @ 70°F	107
18.00	3.740	.787	.433	4				16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	14.9° @ 70°F	127
20.00	3.937	.787	.433	4				20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	14.9° @ 70°F	150
22.00	3.937	.709	.354	3				20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	14.9° @ 70°F	182
24.00	4.134	.709	.354	3				20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	14.9° @ 70°F	224

Larger diameters, custom lengths, and performance requirements available upon request.

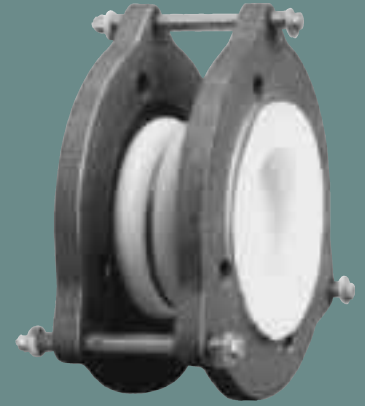
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4402
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4403



three convolution heavy-duty molded PTFE bellows

TABLE 2

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON THREE CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM Hg at Temp.	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
		IN	IN	DEG.	LB/IN	LB/IN	LB/IN								70°	100°	150°	200°	250°	300°	350°			400°	
1.00	2.165	.472	.236	19	857	571	1599	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	29.9" @ 350°F	4
1.25	2.559	.748	.236	18	910	571	1599	4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9" @ 350°F	6
1.50	2.756	.748	.236	18	971	571	1599	4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9" @ 350°F	8
2.00	2.756	.748	.354	16	1142	571	1599	4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50	29.9" @ 350°F	9
2.50	3.150	.748	.354	16	1256	571	1599	4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	29.9" @ 350°F	10
3.00	3.346	.984	.472	15	1370	571	1599	4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50	29.9" @ 350°F	12
4.00	3.543	.984	.472	14	1370	685	1884	8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	29.9" @ 350°F	14
5.00	3.740	.984	.472	12	1542	799	1999	8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50	29.9" @ 350°F	20
6.00	3.937	1.102	.551	11	1770	857	2227	8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	29.9" @ 350°F	23
8.00	4.134	1.102	.551	10	2227	1085	2798	8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50	29.9" @ 212°F	33
10.00	4.331	1.181	.591	10	2684	1256	3198	12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	29.9" @ 212°F	51
12.00	4.528	1.181	.591	10	3141	1485	3883	12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	29.9" @ 212°F	59
14.00	4.528	1.181	.591	8	ENGINEERED PER SPECIFICATIONS			12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	14.9" @ 70°F	77
16.00	4.921	1.181	.591	8				16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	14.9" @ 70°F	110
18.00	5.512	1.181	.591	6				16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	14.9" @ 70°F	132
20.00	5.315	1.181	.591	6				20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	14.9" @ 70°F	154
22.00	5.315	.984	.472	5				20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	14.9" @ 70°F	187
24.00	5.512	.984	.472	5				20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	14.9" @ 70°F	231

Larger diameters, custom lengths, and performance requirements available upon request.

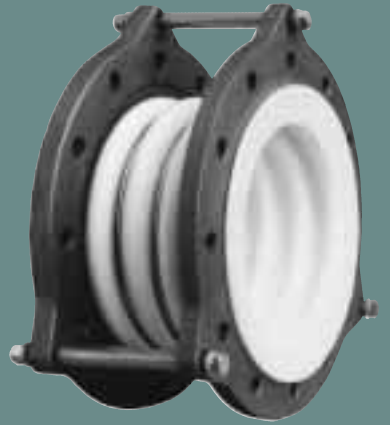
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4403
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4404



four convolution heavy-duty molded PTFE bellows

TABLE 3

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON FOUR CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM Hg at Temp.	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
		IN	IN	DEG.	LB/IN	LB/IN	LB/IN									70°	100°	150°	200°	250°	300°			350°	400°
1.00	2.560	.591	.315	25	686	457	1200	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	29.9° @ 350°F	4
1.25	2.969	.709	.315	24	686	457	1200	4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9° @ 350°F	6
1.50	3.346	.709	.315	24	743	457	1200	4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9° @ 350°F	8
2.00	3.346	.906	.551	23	971	486	1257	4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50	29.9° @ 350°F	9
2.50	3.937	1.024	.591	21	1028	486	1257	4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	29.9° @ 350°F	10
3.00	4.134	1.181	.591	19	1199	486	1342	4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50	29.9° @ 350°F	12
4.00	4.528	1.181	.591	18	1199	571	1542	8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	29.9° @ 350°F	15
5.00	4.921	1.260	.630	16	1285	657	1656	8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50	29.9° @ 350°F	22
6.00	5.118	1.260	.669	15	1542	743	1942	8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	29.9° @ 350°F	24
8.00	5.315	1.299	.669	13	1913	943	2484	8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50	29.9° @ 212°F	34
10.00	5.709	1.339	.709	12	2370	1114	2941	12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	29.9° @ 212°F	52
12.00	5.906	1.339	.709	11	2742	1314	3427	12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	29.9° @ 212°F	62
14.00	5.906	1.339	.709	10	ENGINEERED PER SPECIFICATIONS			12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	14.9° @ 70°F	80
16.00	6.300	1.378	.709	10				16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	14.9° @ 70°F	113
18.00	6.300	1.378	.709	8				16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	14.9° @ 70°F	136
20.00	6.496	1.378	.709	8				20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	14.9° @ 70°F	159
22.00	6.496	1.260	.591	7				20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	14.9° @ 70°F	193
24.00	6.102	1.260	.591	6				20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	14.9° @ 70°F	236

Larger diameters, custom lengths, and performance requirements available upon request.

Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4404
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4405



five convolution heavy-duty molded PTFE bellows

TABLE 4

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON FIVE CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM Hg at Temp.	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
		IN	IN	DEG.	LB/IN	LB/IN	LB/IN									70°	100°	150°	200°	250°	300°			350°	400°
1.00	2.560	.779	.394	30	514	343	800	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	29.9" @ 350°F	4
1.25	3.150	.984	.472	30	514	343	800	4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9" @ 350°F	6
1.50	3.937	.984	.472	30	514	343	800	4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50	29.9" @ 350°F	8
2.00	3.937	1.107	.551	26	800	400	914	4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50	29.9" @ 350°F	9
2.50	4.724	1.230	.591	25	800	400	914	4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	29.9" @ 350°F	10
3.00	5.118	1.393	.669	24	1028	400	1085	4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50	29.9" @ 350°F	13
4.00	5.512	1.475	.709	22	1028	457	1200	8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	29.9" @ 350°F	15
5.00	5.906	1.516	.709	19	1028	514	1313	8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50	29.9" @ 350°F	24
6.00	6.103	1.557	.748	17	1314	629	1656	8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	29.9" @ 350°F	25
8.00	6.693	1.598	.748	15	1599	800	2170	8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50	29.9" @ 212°F	36
10.00	6.890	1.598	.748	13	2056	971	2684	12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	29.9" @ 212°F	54
12.00	7.087	1.639	.787	13	2342	1142	2970	12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	29.9" @ 212°F	65
14.00	7.087	1.680	.787	12	ENGINEERED PER SPECIFICATIONS			12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	14.9" @ 70°F	81
16.00	7.480	1.721	.827	12				16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	14.9" @ 70°F	117
18.00	7.480	1.721	.827	10				16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	14.9" @ 70°F	141
20.00	7.677	1.762	.827	10				20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	14.9" @ 70°F	163
22.00	7.677	1.762	.866	8				20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	14.9" @ 70°F	198
24.00	7.874	1.762	.866	8				20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	14.9" @ 70°F	243

Larger diameters, custom lengths, and performance requirements available upon request.

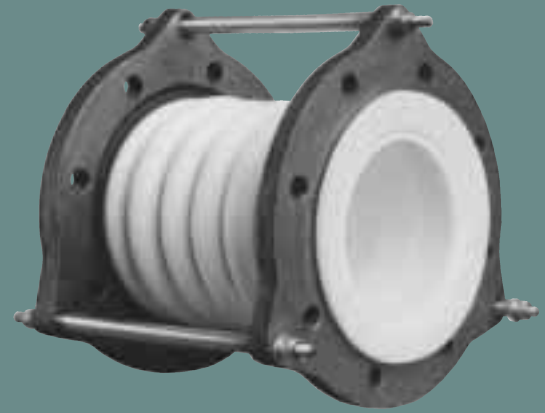
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4405
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4406



six convolution heavy-duty molded PTFE bellows

TABLE 5

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON SIX CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM Hg at Temp.	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT IN	LATERAL (Δy) DEFLECTION IN	ANGULAR DEFLECTION DEG.	FORCE LBS PER 1" RATED EXTENSION LB/IN	FORCE LBS PER 1" RATED COMPRESSION LB/IN	FORCE LBS PER 1" RATED LATERAL DEFLECTION LB/IN	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
																70°	100°	150°	200°	250°	300°			350°	400°
1.00	3.622	.945	.472	38			4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	NOT	4	
1.25	4.528	1.181	.591	36	ENGINEERED		4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50		6	
1.50	4.528	1.181	.591	36		4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50	8			
2.00	4.528	1.260	.669	32		4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50	9			
2.50	5.315	1.496	.748	30		4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	DESIGNED	11		
3.00	6.496	1.614	.787	28	4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50	13				
4.00	6.496	1.654	.827	27	PER		8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	FOR	15	
5.00	6.890	1.693	.827	23		8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50	26			
6.00	7.087	1.732	.866	19		8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	VACUUM	26		
8.00	7.874	1.772	.866	17		8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50		36		
10.00	8.071	1.772	.906	15	SPECIFICATIONS		12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	VACUUM	55	
12.00	8.268	1.850	.906	15		12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	67			
14.00	8.268	1.890	.945	14		12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	SERVICE	82		
16.00	8.661	1.969	.984	14		16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50		121		
18.00	8.661	1.969	.984	12	16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	145				
20.00	8.858	2.008	.984	12	20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	168				
22.00	8.858	2.047	1.024	11	20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	203				
24.00	9.055	2.047	1.024	10	20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	249				

Larger diameters, custom lengths, and performance requirements available upon request.

Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4406
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4407

seven convolution heavy-duty molded PTFE bellows

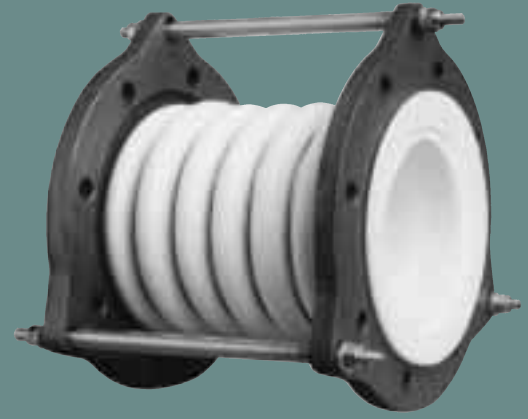


TABLE 6

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON SEVEN CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
																IN	IN	DEG.	LB/IN	LB/IN	LB/IN			70°	100°
1.00	4.134	1.181	.669	45	ENGINEERED	PER	SPECIFICATIONS	4	1/2- 13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	NOT DESIGNED FOR VACUUM SERVICE	4
1.25	5.118	1.378	.866	42				4	1/2- 13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50		6
1.50	5.118	1.378	.866	42				4	1/2- 13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50		8
2.00	5.315	1.535	.866	42				4	5/8- 11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50		9
2.50	6.102	1.654	.945	36				4	5/8- 11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50		11
3.00	7.480	1.772	.984	33				4	5/8- 11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50		13
4.00	7.480	1.890	1.024	30				8	5/8- 11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50		16
5.00	8.268	1.929	1.063	27				8	3/4- 10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50		28
6.00	8.268	1.969	1.102	23				8	3/4- 10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50		33
8.00	9.055	2.008	1.102	20				8	3/4- 10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50		38
10.00	9.252	2.047	1.181	18	12	7/8- 9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	57				
12.00	9.449	2.087	1.260	17	12	7/8- 9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50	69				
14.00	9.449	2.165	1.339	16	12	1- 8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	85				
16.00	9.843	2.323	1.339	16	16	1- 8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	125				
18.00	9.843	2.362	1.378	14	16	1 1/8- 7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	150				
20.00	10.039	2.362	1.378	14	20	1 1/8- 7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	174				
22.00	10.039	2.441	1.417	13	20	1 1/4- 7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	210				
24.00	10.236	2.441	1.417	11	20	1 1/4- 7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	255				

Larger diameters, custom lengths, and performance requirements available upon request.

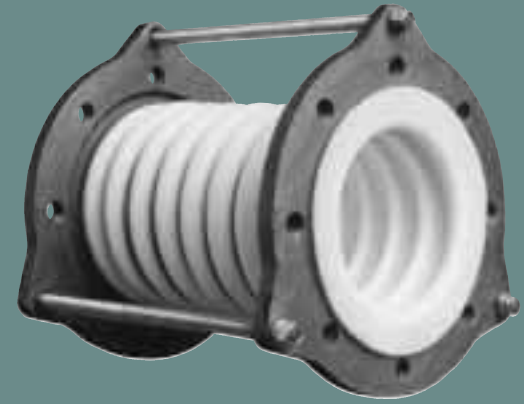
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4407
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4408



eight convolution heavy-duty molded PTFE bellows

TABLE 7

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON EIGHT CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM	WEIGHT / LBS			
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.										
																IN	IN	DEG.	LB/IN	LB/IN	LB/IN			70°	100°	150°
1.00	4.528	1.339	.787	51	ENGINEERED	PER	SPECIFICATIONS	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	NOT	4	
1.25	5.709	1.496	1.024	47				4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50		6	
1.50	5.709	1.496	1.024	47				4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50		8	
2.00	5.906	1.654	1.063	46				4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50		10	
2.50	6.890	1.772	1.102	41				4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50		DESIGNED	11
3.00	8.071	1.929	1.181	37				4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50			13
4.00	8.661	2.087	1.220	34				8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50		FOR	16
5.00	8.858	2.165	1.260	31				8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50			20
6.00	9.055	2.244	1.339	27				8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50		VACUUM	27
8.00	10.236	2.244	1.378	23				8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50			39
10.00	10.630	2.283	1.457	21				12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50		SERVICE	58
12.00	10.630	2.362	1.496	20				12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50			72
14.00	10.630	2.559	1.575	18	12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	88					
16.00	11.024	2.717	1.575	18	16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50	123					
18.00	11.024	2.913	1.654	16	16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	148					
20.00	11.220	2.913	1.654	16	20	1 1/8-7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50	172					
22.00	11.220	2.953	1.693	15	20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	207					
24.00	11.614	2.953	1.693	13	20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	252					

Larger diameters, custom lengths, and performance requirements available upon request.

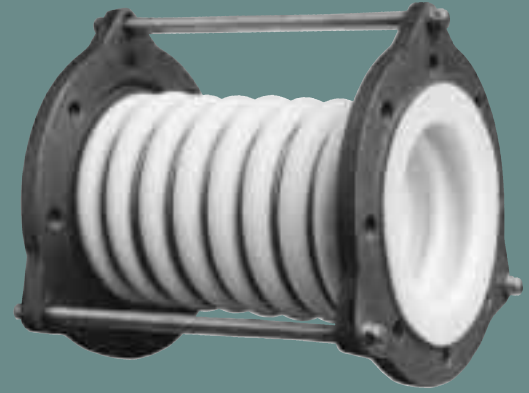
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4408
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4409



nine convolution heavy-duty molded PTFE bellows

TABLE 8

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON NINE CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM	WEIGHT / LBS				
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.											
																IN	IN	DEG.	LB/IN	LB/IN	LB/IN			70°	100°	150°	200°
1.00	4.921	1.535	.906	55	ENGINEERED	PER	SPECIFICATIONS	4	1/2- 13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	NOT	4		
1.25	6.300	1.654	1.220	52				4	1/2- 13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50		DESIGNED	6	
1.50	6.300	1.654	1.220	52				4	1/2- 13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50			FOR	8
2.00	6.496	1.811	1.260	50				4	5/8- 11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50				VACUUM
2.50	7.677	1.929	1.299	46				4	5/8- 11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	SERVICE			
3.00	9.055	2.087	1.378	41				4	5/8- 11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50		FOR		
4.00	9.449	2.283	1.417	37				8	5/8- 11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50			VACUUM	
5.00	10.236	2.362	1.457	35				8	3/4- 10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50				SERVICE
6.00	10.433	2.480	1.575	31				8	3/4- 10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	FOR			
8.00	11.417	2.598	1.614	26				8	3/4- 10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50		VACUUM		
10.00	11.811	2.677	1.693	23				12	7/8- 9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50			SERVICE	
12.00	11.811	2.756	1.732	22				12	7/8- 9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50				FOR
14.00	11.811	2.913	1.811	20	12	1- 8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	VACUUM	91					
16.00	12.205	3.110	1.811	20	16	1- 8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50		SERVICE	127				
18.00	12.205	3.307	1.850	18	16	1 1/8- 7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50			FOR	152			
20.00	12.402	3.307	1.890	18	20	1 1/8- 7	25.000	.866	27.500	.375	28.500	29.134	232	183	150	104	90	75	62	50				VACUUM	176		
22.00	12.402	3.346	1.890	16	20	1 1/4- 7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	SERVICE				212		
24.00	12.992	3.346	1.929	15	20	1 1/4- 7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50		FOR			258		

Larger diameters, custom lengths, and performance requirements available upon request.

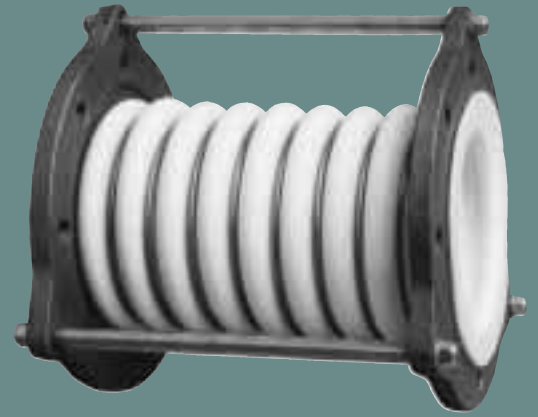
Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4409
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

PROCO™

STYLE 4410



ten convolution heavy-duty molded PTFE bellows

TABLE 9

NOMINAL SIZE I.D.	NEUTRAL LENGTH INCHES	MOVEMENT CAPABILITIES BASED ON TEN CONVOLUTION DESIGN			SPRING RATE CAPABILITY BASED ON 1" OF MOVEMENT AT ZERO PRESSURE CONDITIONS			EXPANSION JOINT FLANGE DRILLING						PRESSURE AT TEMPERATURE (PSIG) @ °F								VACUUM	WEIGHT / LBS		
		± AXIAL (Δx) MOVEMENT	LATERAL (Δy) DEFLECTION	ANGULAR DEFLECTION	FORCE LBS PER 1" RATED EXTENSION	FORCE LBS PER 1" RATED COMPRESSION	FORCE LBS PER 1" RATED LATERAL DEFLECTION	# HOLES	THREADED HOLE SIZE	BOLT CIRCLE FLANGE "A"	FLANGE THICKNESS	NOMINAL FLANGE DIAMETER	LIMIT BOLT DIAMETER	BOLT CIRCLE LIMIT BOLT "B"	LIMIT BOLT "EAR" O.D.	All units are hydrostatically tested at 1.5 times rated pressure after manufacturing.									
																IN	IN	DEG.	LB/IN	LB/IN	LB/IN			70°	100°
1.00	5.315	1.732	1.063	61	ENGINEERED	PER	SPECIFICATIONS	4	1/2-13	3.125	.551	4.250	.250	5.300	6.102	232	183	150	104	90	75	62	50	NOT	4
1.25	6.890	1.890	1.378	58				4	1/2-13	3.500	.551	4.625	.250	6.700	7.480	232	183	150	104	90	75	62	50		6
1.50	6.890	1.890	1.378	58				4	1/2-13	3.875	.630	5.000	.250	6.700	7.480	232	183	150	104	90	75	62	50		8
2.00	7.087	2.008	1.496	55				4	5/8-11	4.750	.630	6.000	.250	7.300	8.071	232	183	150	104	90	75	62	50		10
2.50	8.465	2.047	1.535	51				4	5/8-11	5.500	.630	7.000	.250	8.100	8.858	232	183	150	104	90	75	62	50	DESIGNED	11
3.00	10.040	2.244	1.575	45				4	5/8-11	6.000	.630	7.500	.250	8.700	9.449	232	183	150	104	90	75	62	50		14
4.00	10.433	2.480	1.654	40				8	5/8-11	7.500	.630	9.000	.250	9.400	10.236	232	183	150	104	90	75	62	50	FOR	17
5.00	11.614	2.598	1.732	38				8	3/4-10	8.500	.630	10.000	.375	11.000	11.417	232	183	150	104	90	75	62	50		34
6.00	11.417	2.756	1.811	35				8	3/4-10	9.500	.709	11.000	.375	12.400	13.583	232	183	150	104	90	75	62	50	VACUUM	38
8.00	11.417	2.913	1.850	28				8	3/4-10	11.750	.709	13.500	.375	14.600	15.748	232	183	150	104	90	75	62	50		42
10.00	12.600	3.071	1.890	26				12	7/8-9	14.250	.709	16.000	.375	16.700	17.913	232	183	150	104	90	75	62	50	SERVICE	62
12.00	13.189	3.150	1.929	24				12	7/8-9	17.000	.709	19.000	.375	19.700	21.260	232	183	150	104	90	75	62	50		76
14.00	13.189	3.346	1.969	22	12	1-8	18.750	.787	21.000	.375	22.200	22.244	232	183	150	104	90	75	62	50	SERVICE	94			
16.00	13.386	3.346	1.969	22	16	1-8	21.250	.787	23.500	.375	24.300	25.000	232	183	150	104	90	75	62	50		130			
18.00	13.386	3.543	2.087	20	16	1 1/8-7	22.750	.866	25.000	.375	25.800	27.362	232	183	150	104	90	75	62	50	156				
20.00	13.583	3.543	2.087	20	20	1 1/8-7	25.000	.866	27.500	.375	28.800	29.134	232	183	150	104	90	75	62	50	181				
22.00	13.583	3.583	2.165	18	20	1 1/4-7	27.250	.945	29.500	.375	30.500	31.890	232	183	150	104	90	75	62	50	218				
24.00	14.173	3.583	2.205	17	20	1 1/4-7	29.500	.945	32.000	.375	32.900	34.646	232	183	150	104	90	75	62	50	264				

Larger diameters, custom lengths, and performance requirements available upon request.

Pressure Rating Note:

316 Stainless Steel Anti-Squirm Flanges are available for higher pressure applications. (See Back Cover.)

MATERIALS OF CONSTRUCTION	
DESCRIPTION	STYLE 4410
BELLOWS	WHITE PTFE
FLANGES	DUCTILE IRON
REINFORCING RINGS	304 SS
LIMIT BOLTS	CARBON STEEL
NUTS	CARBON STEEL
INSULATING SLEEVES	POLYETHYLENE
WASHERS	CARBON STEEL / NYLON

Installation Instructions for Convoluted Molded PTFE Bellows

TORQUE TABLE LISTING							
SIZE I.D. (IN)	TORQUE (FT/LBS)	SIZE I.D. (IN)	TORQUE (FT/LBS)	SIZE I.D. (IN)	TORQUE (FT/LBS)	SIZE I.D. (IN)	TORQUE (FT/LBS)
1	15	3	30	10	55	20	85
1.25	15	4	35	12	60	22	90
1.5	15	5	40	14	70	24	90
2	20	6	44	16	75	—	—
2.5	25	8	50	18	80	—	—

OPTIONAL PRESSURE RATINGS					
Deg F	LIGHT DUTY	EXTRA HEAVY DUTY	Deg F	LIGHT DUTY	EXTRA HEAVY DUTY
	PRESSURE RATING (psig)			PRESSURE RATING (psig)	
70°	145	290	250°	62	107
100°	120	217	300°	48	85
150°	72	175	350°	44	70
200°	62	125	400°	38	65

1. Service Conditions: Make sure the expansion joint ratings for temperature, vacuum, spring rates and movements match the system requirements. Contact PROCO if the system requirements exceed those of the expansion joint selected.

2. Alignment: Expansion joints are not designed to make up for piping misalignment error. Pipe misalignment should be no more than 1/8" in any direction. Misalignment of an expansion joint will reduce the rated movements and can cause stress of material properties, thus causing reduced service life.

3. Limit Rod Bolting: Limit bolts are factory set at the maximum allowable travel position to prevent over extension. Do not remove or alter nuts at any time. Damage or personal injury can result due to changes in limit rod nut settings.

4. Anchoring: Solid anchoring is required whenever the pipeline changes direction. Expansion joints should be located as close as possible to these anchor points. If an anchoring system is not used, any associated pressure thrust can cause excessive movement, ultimately damaging the expansion joint. **(It should be noted that the attached limit rods are designed to limit movement and are not designed to handle pressure thrust.)**

5. Pipe Support: Piping must be supported by hangers or anchors so expansion joints do not carry any pipe weight.

6. Personnel Protection: It is strongly recommended that safety shields be used for all hazardous service to protect against serious personal injury in the event of expansion joint failure. (See Back Cover.)

7. Installation:

a. Store expansion joints with plastic covers in-place to protect PTFE flange surfaces from damage until ready to install.

b. Check to make sure PTFE surfaces are clean and free of foreign sediment. Remove nicks, burrs and deep scratches with a fine emery cloth. If surface irregularities cannot be completely removed, install a PTFE envelope-type gasket to obtain an adequate seal.

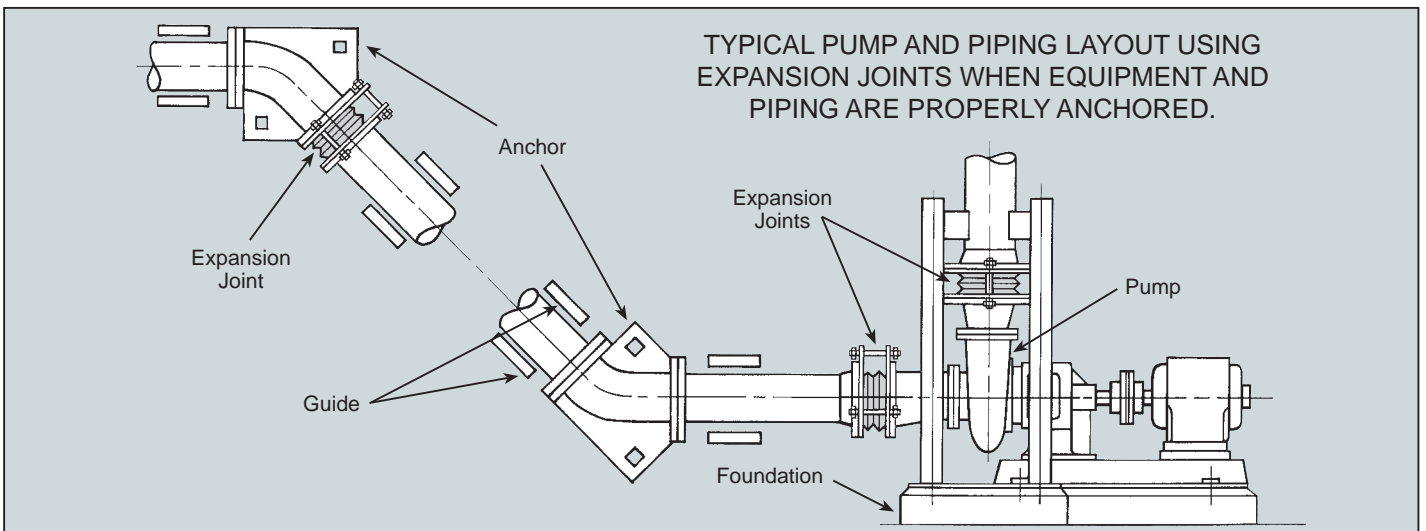
c. Install expansion joints to the prescribed neutral lengths. If expansion joints are used in high temperature processes, it is recommended that units be installed at near extended values. For cold process installations, expansion joints should be installed in a nearly compressed length. These settings will enable the expansion joint to realize full travel capabilities.

d. Thread installation bolts from mating flange side to prevent possible damage to PTFE elements. Extend bolts beyond the expansion joint flange by no more than 1-2 threads. Nuts are not necessary due to threaded flange holes.

e. Tighten flange bolts with a torque wrench. Tighten in an alternate crossing pattern in 20% increments until 80% of final bolt torques have been achieved. Tighten to final torque values (listed in torque table listing) in a clockwise fashion around the flange to ensure bolts carry equal stress burdens.

f. Re-tighten bolts after first cycle of operation. Re-tighten as necessary after every planned maintenance shutdown. All bolts should be re-torqued to the above listed values.

8. Operations: After expansion joints are installed, it may be necessary to air blast the exterior to remove foreign debris, such as metal chips, from between the convolutions. The expansion joint should then be covered with a shield to protect from damage and foreign debris during operation. **(Note: Do not weld in immediate vicinity of expansion joint unless it is properly protected.)**



TYPICAL PUMP AND PIPING LAYOUT USING EXPANSION JOINTS WHEN EQUIPMENT AND PIPING ARE PROPERLY ANCHORED.

ENGINEERING DESIGN NOTES:

1. It is essential that piping system thrusts be calculated to ensure correct sizing of anchors and pipe supports, plus ensure that allowable thrust forces on adjacent mechanical and rotating equipment are not exceeded. Please use the following formulas:

$$T_p = P \cdot T_f$$

T_p is the pressure thrust (lbf), P is the system operating pressure (Psig) and T_f is the thrust factor (or bellows effective area [in²]). The pressure thrust, T_p , will act in the axial direction and must be added to the axial spring force ($F_x \cdot \Delta x$) to give the total axial reaction force, R_x .

$$R_x = T_p + (F_x \cdot \Delta x)$$

R_x is the pipe support reaction force (lbf), T_p is the pressure thrust (lbf), F_x is the axial spring force of the unit and Δx is the expected or designed axial movement of the unit (See Tables 1-9).

2. It should be noted that axial spring rate values found in Tables 1 through 9 are based on an ambient temperature (70°F) and will decrease as the system temperature rises. In addition, spring rates decrease over time due to thermoplastic creep if units are operated under pressure.

PROCO™ Expansion Joint Accessories

Spray Shields



PROCO Spray Shields are used to help prevent injury to personnel or damage to equipment in the event of a leak or sprayout at expansion joint connections of acids, caustics, chlorine and other dangerous liquids.

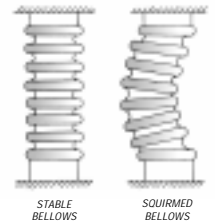
- Same quality design as other cloth shields
- pH indicating patch to signal leaks
- Weep holes behind patch allow indicator to change color
- Attached by Velcro fasteners and drawstrings
- Allows for full movement of the expansion joint
- Available for all PROCO style joints

Anti-Squirm Flanges



When under pressure, a longer bellows will react the same as a column when subjected to compression. At some point both will buckle or "squirm". PROCO can offer a solution to prevent this squirming effect during operation or testing.

Squirm can cause a catastrophic failure of the expansion joint, and serious thought must be given to this condition at time of system engineering. If desired, PROCO can offer a design that will eliminate the squirming effect. Once manufactured, a hydrostatic test of the joint provides assurance that it will hold its form under pressure. If a hydrostatic test is required, it should be specified at the time of quotation.



"When personnel safety and equipment performance are concerns ... contact PROCO."

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INTERNATIONAL

Warning: Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures. Normal precautions should be taken to make sure these parts are installed correctly and inspected regularly. Precautions should be taken to protect personnel in the event of leakage or splash. Note: Piping must be properly aligned and anchored to prevent damage to an expansion joint. Movement must not exceed specified ratings and control units are always recommended to prevent damage in the event other anchoring in the system fails. Properties applications shown throughout this data sheet are typical. This information does not constitute a warranty or representation and we assume no legal responsibility or obligation with respect thereto and the use to which such information may be put. Your specific application should not be undertaken without independent study and evaluation for suitability.