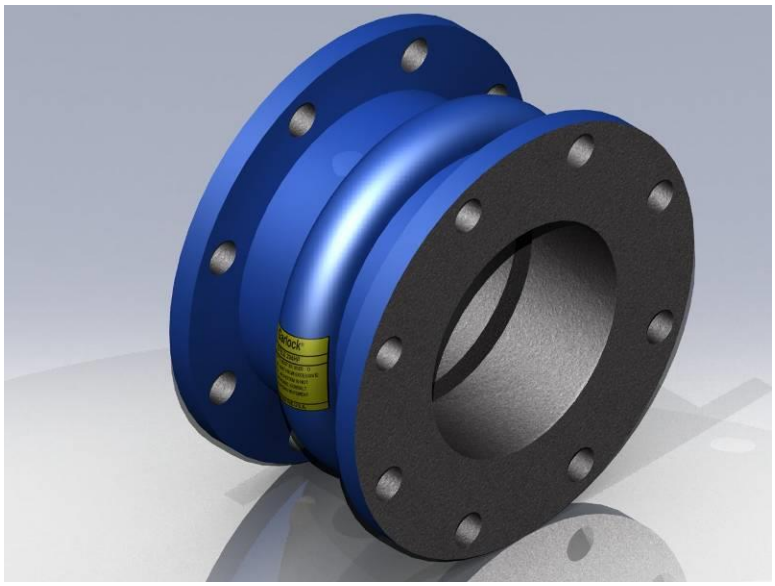
1.0 Application



The Style 204 EPS is used in rigid piping systems to compensate for axial, lateral, torsional and angular movement and misalignment due to thermal expansion and contraction, mechanical effects, system settlement, pressure surges and system vibration. It is intended to be used in dynamic conditions where pressure and vacuum concerns are present. The product can be specially designed and manufactured to compensate for permanent piping misalignment or varying pipe sizes. This expansion joint is the industry standard design. This expansion joint is to be used in applications where necessary rated pressures exceed those of the Garlock Style 204 and 204HP expansion joints.

2.0 Construction

The product construction shall include an elastomeric inner liner (tube) and consistent layers of fabric and metal reinforcement (body), bonded together with an elastomeric exterior cover. A protective coating shall be applied to the product exterior to impede deterioration due to environmental conditions.

2.1 Inner Elastomer Tube

The tube shall be a layer of homogeneous, elastomeric compound (1/8" minimum thickness) which is leak-proof and compatible with the conveyed media. The standard elastomer shall be chlorobutyl meeting ASTM D2000 Grade 4AA 610 A13 EA14.

2.2 Fabric Reinforcement

A minimum of 8 plies of high quality synthetic fabric, impregnated with compatible elastomers are to be utilized to provide flexibility as well as durability. The minimum 8 plies are to be placed over the body and arch of the expansion joint for proper pressure retention. Standard fabric is to be spun 20oz polyester

and/or nylon tire cord. The polyester and tire cord shall meet the following specifications:

Polyester Specifications		
Specification	**Method**	**Value**
Thread Count: Warp (Ends/Inch) Fill (Picks/Inch)	ASTM D3775	Warp: 19 ± 2 Fill: 20 ± 2
Gauge (Inch)	ASTM D1777	0.045 ± 0.004
Weight (oz/yd^2)	ASTM D3776	20.5 ± 1.5
Tensile Strength (lbs)	ASTM D5034	Warp: 700 min Fill: 700 min

Nylon Tire Cord Specifications		
Specification	**Method**	**Value**
Thread Count: EPI-1 Direction (threads)	ASTM D3775	25 min
Gauge (Inch)	ASTM D1777	0.040 ± 0.005
Tensile Strength (lbs)	ASTM D5034	1000 min

2.3 **Metal Reinforcement**

Along with fabric plies, expansion joints shall have metal reinforcement within the body. The reinforcement may be metal wire or metal rectangular/round body rings. When wire is used, it must be coated with fabric in order to obtain proper bonding strength with the subsequent fabric and rubber plies.

2.4 **Metal Tie-In Ply**

In order to prevent the metal reinforcement from migrating away from the arch during movement, a fabric ply must be wrapped around the metal closest to the arch and overlapped over the arch. On the opposite side of the arch, a second tie-in ply should be wrapped around the metal and overlapped onto the other side of the arch as well.

2.5 **Exterior Elastomer Cover**

The cover shall be a homogenous layer of elastomeric compound (1/16" minimum thickness) to protect against environmental conditions or mechanical damage. The standard elastomer shall be chlorobutyl meeting ASTM D200 4AA 610 A13 EA14.

2.6 **Exterior Coating**

The cover of the expansion joint shall have an acrylic, blue paint coating exhibiting excellent weathering characteristics without hindering the product's flexibility. The coating shall be applied completely and uniformly.

3.0 **Retaining Rings**

Metal retaining rings shall be used with all expansion joints. Standard retaining rings shall be constructed of carbon steel and coated with a rust-resistant coating. Retaining rings shall be 3/8" thick and must be flat (not "L" shaped) to allow for full movements without damage to the elastomeric bellows. Alternative materials may include galvanized carbon steel and stainless steel.

4.0 **Control Units**

Control units consist of two or more tie rods (ASTM A193 B7) connected between flanges. The standard gusset plate material shall be ASTM A36 carbon steel. Control units are utilized to prevent over-elongation; thus prolonging the life expectancy of the expansion joint. When it is required, compression nuts may be installed on the tie rods to prevent over-compression of the expansion joint.

5.0 **Variations**

5.1 **Multiple Arches**

To accommodate excessive movement, multiple arches can be utilized. A maximum of four (4) arches is recommended. The total rated movement equals the standard single arch movement multiplied by the number of arches.

5.2 **Taper**

When connecting piping of unequal diameters, a tapered (reducing) expansion joint is required. Concentric tapered expansion joints are used when the center lines of two connecting pipes are inline. Eccentric tapered expansion joints are required when center lines are offset.

5.3 **Filled Arch**

A filled arch can be used to eliminate sediment buildup in the arch. It can also be used to reduce the risk of abrasion due to solids. When filled arches are used, the movement ratings of the expansion joint is reduced by 50% (For full range of movement without entrapment of solids, see the Style 206 EZ-Flo Specification).

5.4 **Offset**

When pipe flange centerlines are not aligned or when flanges are non-parallel, an expansion joint can be manufactured with this offset to prevent stretching the joint at installation. This also allows the joint to move to its full rated movement during operation.

5.5 **Sleeve Type**

When pipes do not have flanges, a sleeve type joint can be used to slip over both ends of the piping. The ID of the expansion joint shall equal the pipe OD +1/8" (typically for ease of installation) and shall be used in conjunction with suitable t-bolt clamps. It is recommended to use an overlap of 2" minimum to clamp the expansion joint to the pipe OD. Sleeve type expansion joints do not follow standard pressure ratings of Style 204 expansion joints.

6.0 Operating Capabilities

All expansion joints shall conform to (but may exceed) the guidelines of the Rubber Expansion Joint Division of the Fluid Sealing Association as stated in the Technical Handbook.

6.1 Pressure Capabilities with 3:1 Burst Ratio

Pressure capabilities of these expansion joints are dependent on customer requirements. All expansion joints are rated and designed based on a 3:1 burst factor.

Pipe ID		Pressure Rating		Vacuum Rating	
inch	mm	psi	bar	in. Hg	mm Hg
½ - 4	13 - 100	250	17.2	29.9	750
5 - 12	125 - 300	250	17.2	29.9	750
14 - 24	350 - 600	150	10.3	29.9	750
26 - 66	650 - 1,650	100	6.9	29.9	750
68 - 96	1,700 - 2,400	100	6.9	29.9	750
98 - 108	2,400 - 2,700	80	5.5	29.9	750
110 - 120	2,750 - 3,000	80	5.5	29.9	750

6.2 Vacuum Capabilities

All sizes shall be rated for 29.9 Inches Hg.

6.3 Movement Capabilities

Movement capabilities of these expansion joints are dependent on customer requirements. Various configurations are possible.

Pipe ID		Movements					
		Compression		Lateral		Elongation	
inch	mm	inch	mm	inch	mm	inch	mm
0.5 - 1.5	25 - 40	0.25	6	0.25	6	0.125	3
2 - 5	50 - 150	0.5	13	0.5	12	0.25	6
6 - 18	200 - 450	0.75	19	0.5	12	0.375	9
20 - 24	500 - 600	0.875	22	0.5	12	0.438	11
26 - 40	650 - 1,000	1.0	25	0.5	12	0.5	12
42 - 120	1,050 - 3,000	1.125	29	0.5	12	0.5	12

7.0 Material Variations

7.1 Tube Materials

The standard material for the tube shall be chlorobutyl. Alternative materials include EPDM, Nitrile, Neoprene, Fluoroelastomer, Natural Rubber, Natural Gum Rubber, Hypalon, HNBR and a High-Performance Fluoroelastomer.

7.2 Cover Materials

The standard material for the cover shall be chlorobutyl. Alternative materials include EPDM, Nitrile, Neoprene, Fluoroelastomer, Hypalon, HNBR and a High-Performance Fluoroelastomer.

7.3 Temperature Resistance

7.3.1 Standard Temperature Rating

The standard combination of a chlorobutyl tube and cover with polyester reinforcement is rated from -20°F up to 250°F.

7.3.2 300°F Temperature Rating

To achieve a 300°F temperature rating, a chlorobutyl or EPDM tube and cover is used with fiberglass/Kevlar reinforcement bonded to chlorobutyl.

7.3.3 **400°F Temperature Rating**

The achieve a 400°F temperature rating, a fluoroelastomer tube and cover is used with fiberglass/Kevlar reinforcement bonded to fluoroelastomer

8.0 **Product Qualifications**

8.1 **10CFR50 Appendix B and 10CFR21 Safety Related**

This expansion joint shall be able to be supplied as a "Safety Related" component in nuclear power plants per 10CFR50 Appendix B and 10CFR21.

8.2 **Domestically Manufactured**

All expansion joints shall be manufactured within the United States. All components within the expansion joints shall be manufactured within the United States of America.

9.0 **Available Testing**

9.1 **Hydrostatic Testing**

All expansion joints shall be hydrostatically tested prior to shipment. The standard test shall use a pressure of 1.5 times the design pressure for a 10 minute period.

9.2 **Vacuum Testing**

All expansion joints can be vacuum tested prior to shipment. The standard test shall use a vacuum of 26" Hg for a 10 minute period.

9.3 **Fabric Testing**

Upon receipt of all fabric material, all tests specified in section 2.2 are to be performed to ensure conformance to internal specifications. All appropriate documentation shall be maintained indefinitely.

9.4 **Elastomer Testing**

All elastomers are to be tested to ensure their compliance with the necessary ASTM D2000 material description. All appropriate documentation shall be maintained indefinitely.

10.0 Manufacturer Qualifications

10.1 ISO Registration

The manufacturer of expansion joints shall have a current ISO 9001:2008 certification.

10.2 NUPIC Auditing

The manufacturer shall have undergone a positive performance audit by the Nuclear Procurement Issues Committee (NUPIC) in order to supply expansion joints in accordance with 10CFR50 Appendix B, 10CFR21 and NQA-1 Basic.

11.0 Field Services

The manufacturer shall be able to provide a range of on-site services including: field measurements, visual inspection of existing products in service, evaluation of piping misalignments to determine build dimensions for offset expansion joints, training seminars and installation supervision.