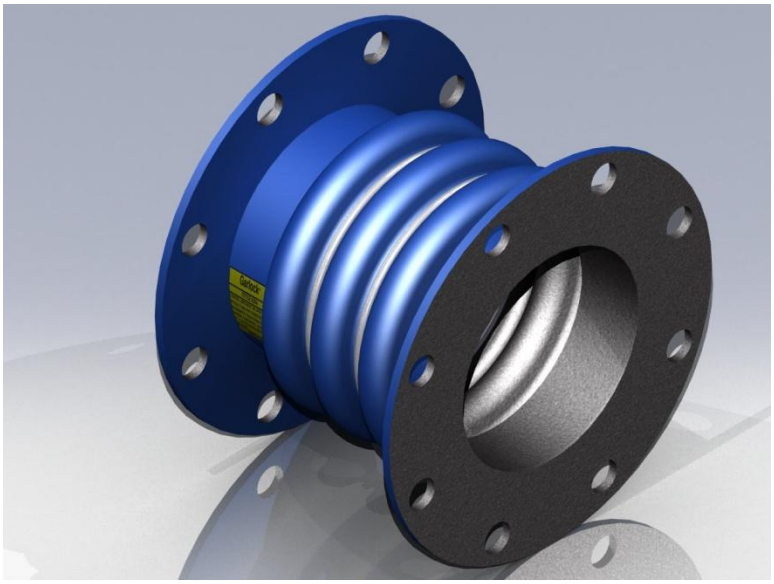
1.0 Application



The Style 9394 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 very low spring rates and very high movements are required. The product can be specially designed and manufactured to compensate for permanent piping misalignment or varying pipe sizes. This expansion joint is commonly used in load cell applications and other gravity-feed systems.

2.0 Construction

The product construction shall include an elastomeric inner liner (tube) and consistent layers of fabric 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 (3/32" 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 2 biased plies of high quality synthetic fabric, impregnated with compatible elastomers are to be utilized to provide flexibility as well as durability. Standard fabric is to be spun 20oz polyester. The polyester shall meet the following 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

2.3 Metal Reinforcement

If required, expansion joints may have metal reinforcement inside and/or outside the body. The reinforcement is carbon steel meeting the specifications below. If inside the body, the body ring(s) are to be placed at the top of each arch to prevent arch inversion when subjected to vacuum. If outside the body, the body ring(s) are to be placed in between the arches on the cover, to increase the pressure resistance of the expansion joint.

Specification	Value
Yield Strength 0.2% Offset (psi)	54,000 min
Ultimate Strength (psi)	64,000 min
Brinell Hardness (HBW)	126 min
Rockwell Hardness (HRB)	77 min

2.4 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.

2.5 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 Convolutions

To accommodate excessive movement, multiple convolutions can be utilized. A maximum of six (6) convolutions is recommended. The total rated movement equals the standard single convolution movement multiplied by the number of convolutions.

5.2 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.

5.3 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 9394 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

All Style 9394 expansion joints are rated for 3 psi. With external reinforcement rings, the expansion joints can accommodate 15psi.

6.2 Vacuum Capabilities

All Style 9394 expansion joints are rated for 3" Hg. With internal reinforcement rings, the expansion joints can accommodate 15" Hg.

6.3 Movement Capabilities

Pipe ID	Axial Compression	Axial Elongation	Lateral Deflection
2 – 6	3/4"	5/8"	5/8"
8 – 10	7/8"	3/4"	3/4"
12 – 18	1-1/8"	1"	1"
20 +	1-5/8"	1-1/4"	1-1/4"

These movements are for single convolution designs. Multiply these movement values by number of convolutions for greater movement ratings.

7.0 Material Variations

7.1 Tube Materials

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

7.3 Body Reinforcement Materials

The standard fabric reinforcement shall be 20oz. polyester bonded to chlorobutyl. Alternative fabrics include 20oz polyester bonded to neoprene, fiberglass/Kevlar bonded to chlorobutyl and fiberglass/Kevlar bonded to fluoroelastomer.

7.4 Temperature Resistance

7.4.1 Standard Temperature Rating

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

7.4.2 **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.

7.4.3 **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 **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 **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.

9.2 **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.