

Nominal Pipe Size
Joint I.D.

EXPANSION JOINTS TECHNICAL GUIDELINES



Anchor
Pump
Glass Pipe Flange Bolting (Corning #2)
Dia.
Split Ret. Ring
I.D.

Garlock

SEALING TECHNOLOGIES®

ANSI Standard
125 & 150 Lb.

Garlock...

in service to world industries since the 1880's, and for over fifty years a leader in producing and implementing the latest in Expansion Joint Technology.

Just a few of the "firsts" developed by Garlock Engineering and Manufacturing:

- Development of high temperature elastomers to the levels now considered the industry standard
- Developing the patented construction with bonded rectangular body rings
- Creation of fused FEP liners designed specifically for chemical use
- Abilities to combine fabric, FEP and elastomers effectively
- Design of spool type joints to over 10 foot (120" or 3m) I.D.'s
- Development of the flowing arch design

Contents

Expansion Joint Styles

Recommended Styles	1
GUARDIAN® 200 and 200HP	2
Styles 204 and 204HP	3
Style 206 EZ-FLO®	4
Styles 207 and 208	5
Styles 214 and 215 Flexible Couplings	6
GUARDIAN® 306 EZ-FLO®	8
MASTERFLEX™	10
GARFLEX® 8100	14
Style 9394	15
Style 8400 Flue Ducts	16
Style 7250 FLEXO-MATIC®	17
Navy & Coast Guard Approved Styles	17

Engineering Data

Size Chart	12
Movement Capabilities	12
Drilling Specifications	13
Pressure Ratings and Conversion Chart	13
Types of Expansion Joints	18
Expansion Joint Components	19
Types of Pipe Movements	20
Properties of Elastomers	21
Temperature Ratings	21
Expansion Joint Installation	22
Troubleshooting	23
Weights	24
Application Data Form	25

Introduction

An expansion joint is a specially engineered product inserted in a rigid piping system to achieve one or more of the following:

- Absorb movement
- Relieve system strain due to thermal change, load stress, pumping surges, wear or settling
- Reduce mechanical noise
- Compensate for misalignment
- Eliminate electrolysis between dissimilar metals

At Garlock, the range of our engineering emphasis extends from the selection of the fabric used for reinforcement to the choice of materials used in actual expansion joint construction.

Rigid laboratory and field tests of Garlock expansion joints are what back up our assurances of long life and reliable service. An important word on safety: all Garlock expansion joints carry safety ratings **exceeding** product specifications in such areas as temperature and pressure.

Garlock nonmetallic expansion joints and flexible couplings are ideally suited for hundreds of applications in a wide range of industries, including:

- Power generating stations
- Pulp and paper
- Chemical and industrial process piping
- Waste water and sewage disposal
- Marine applications
- Heating, ventilating and air conditioning

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Expansion Joint Selection

To select the proper type of expansion joint, consider:

- Pipe size
- Pumped medium: type of liquid, gas, or vapor in system
- Temperature range
- Pressure/vacuum range
- Movements needed
- Environment: degree of exposure to:
 - Weathering
 - Sunlight
 - Liquids
 - Gases
 - Vapors
 - Oil
 - Open flame
 - Chemicals
 - Other
- Installed face-to-face dimensions
- Degree of pipe misalignment
 - If greater than 0.125" (3.2 mm), correct or use a special joint
- Drilling: if other than standard 125 lb. ANSI, determine:
 - Flange O.D.
 - Bolt circle
 - Number of bolt holes
 - Diameter of hole
- Need for retaining rings
 - Recommended for use with most expansion joints
 - Must be used in cases of insufficient pipe support
- Need for special construction



Garlock Recommendations

	200	200HP	204, 204HP	206	207, 208	214, 215	306	7706-S	7250	8100	9394
Standard Piping—High Pressure		★	★	★					★	★	
Standard Piping—Low Pressure					★						★
Chemical Piping	★					★	★				
Standard Ducts											★
Nuclear		★	★	★	★						
Naval and Coast Guard				★				★			

GUARDIAN® 200 and 200HP

Garlock GUARDIAN® 200 expansion joints consist of a chemically-resistant FEP* liner mechanically bonded to an abrupt arch. A chlorobutyl cover and blue protectant coating add resistance to environmental effects. (Alternate cover materials available.)

Benefits

- High-density FEP liner reduces permeation and offers optimal chemical resistance
- Mechanically bound liner reduces delamination; no glue to be vulnerable to chemical attack
- High pressure and vacuum resistance ensures suitability for broad range of applications
- Available with GYLON® 3545 gasket face for raised face flange connections

Design

- **Tube**
 - Seamless FEP lining extends to the outer edge of the flange; completely fused to the joint body
 - Abrupt arch design used for maximum movement capabilities
- **Body**
 - Chlorobutyl/polyester construction with welded, treated metal body rings for dimensional stability
- **Cover**
 - Homogeneous layer of chlorobutyl elastomer is standard
 - Elastomer extends to the outside diameter of the flange

Fully Tested and Field Engineered

All Garlock expansion joint styles have been rigorously lab- and field-tested, and engineered to ensure long life and reliable service.

Temperature

	Max. Temp.
Standard chlorobutyl/polyester	+250°F (+120°C)
Chlorobutyl/fiberglass/Kevlar** with EPDM cover	+300°F (+150°C)
Fluoroelastomer w/ fiberglass/Kevlar	+400°F (+205°C)

* Fluorinated Ethylene Propylene

** Kevlar is a registered trademark of DuPont.



Pressure and Vacuum Rating

	Pipe I.D.		Pressure		Vacuum	
	Inch	mm	psi	bar	in. Hg	mm Hg
GUARDIAN® 200†	2-4	50-100	165	11	Full	750
	5-12	125-300	140	10	Full	750
	14	350	85	6	Full	750
	16-24	400-600	65	5	Full	750
	26-30	650-750	55	4	Full	750
GUARDIAN® 200HP†	2-6	50-150	200	14	Full	750
	8-12	200-300	190	13	Full	750
	14	350	130	9	Full	750
	16-20	400-500	110	8	Full	750
	22-24	550-600	100	7	Full	750
	26-30	650-750	90	6	Full	750

† Higher pressure designs are available. Call Garlock with application details.

Consult Garlock for sizes over 30" (750 mm). Metric sizes available on request.

Made in the U.S.A.

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Styles 204 and 204HP

Styles 204 and 204HP spool-type expansion joints can be constructed as single- or multiple-arch types. They connect pipe flanges in concentric or eccentric tapers, to join piping of unequal diameters.

Benefits

- Fully lab- and field-tested for long life and exceptional reliability
- Seamless flange face eliminates need for gaskets
- High pressure- and vacuum-resistance increases safety and ensures suitability for wide range of applications
- Can be custom-designed for greater movement capability and easier installation
- Variety of elastomer and fabric combinations meet the demands of temperature, pressure and media

Design

- **Tube**
 - Chlorobutyl resists cracking due to high temperatures, weathering, oxidation and chemicals
 - Abrupt arch configuration provides maximum movement, and pressure and vacuum resistance
 - Seamless tube creates a positive flange seal without gaskets
- **Body**
 - Chlorobutyl/polyester construction with welded, treated metal body rings for dimensional stability
- **Cover**
 - Chlorobutyl extends to outside flange diameter
 - Durable coating resists weathering and oxidation

Special Liner and Cover Materials

- Hypalon**
- EPDM
- Nitrile
- Neoprene
- Natural (tube only)
- FDA tubes of EPDM, neoprene and natural

* Not available on tapers

** Kevlar is a registered trademark of DuPont; Hypalon is a registered trademark of DuPont Dow Elastomers.



Temperature

	Max. Temp.
Standard chlorobutyl/polyester	+250°F (+120°C)
Chlorobutyl/fiberglass/Kevlar**	
with EPDM tube and cover	+300°F (+150°C)
Fluoroelastomer w/ fiberglass/Kevlar	+400°F (+205°C)

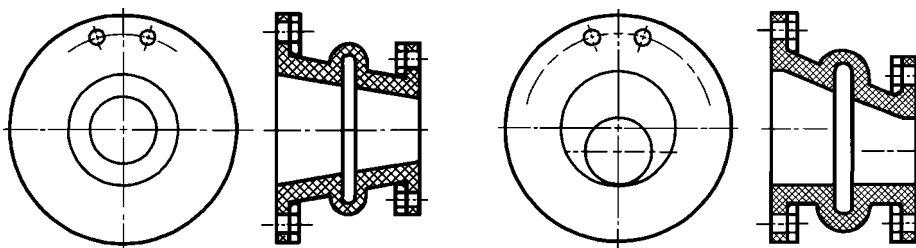
Pressure and Vacuum Rating

	Pipe I.D.		Pressure		Vacuum	
	Inch	mm	psi	bar	in. Hg	mm Hg
Style 204†	1/2-4	13-100	165	11	Full	750
	5-12	125-300	140	10	Full	750
	14	350	85	6	Full	750
	16-24	400-600	65	4.5	Full	750
	26-66	650-1650	55	4	Full	750
Style 204HP†	72-84	1800-2100	45	3	Full	750
	1/2-6	13-150	200	14	Full	750
	8-12	200-300	190	13	Full	750
	14	350	130	9	Full	750
	16-20	400-500	110	8	Full	750
	22-24	550-600	100	7	Full	750
	26-40	650-1000	90	6	Full	750
	42-66	1050-1650	80	5.5	Full	750
	68-84	1700-2100	70	5	Full	750

† Higher pressure designs are available. Call Garlock with application details.

Consult Garlock for pressure ratings of larger sizes up to 144" (3660 mm). Metric sizes available on request.

Optional Configurations



Concentric Tapered

Eccentric Tapered

Style 206 EZ-FLO®

EZ-FLO® expansion joints contain a single wide flowing arch, eliminating the need for filled arches on slurry services. Garlock EZ-FLO® expansion joints have successfully served all major industries, including pulp and paper, steel, waste and water, HVAC, power generation, chemical, petrochemical and marine.

Benefits

- Self-flushing design eliminates media buildup and reduces fluid turbulence
- High pressure- and vacuum-resistance ensures longer life and reduces inventory requirements
- Lightweight design installs easily, costs less to ship

Design

- **Tube**
 - Standard chlorobutyl liner extends to outer edge of the flange for excellent chemical resistance
 - Flowing arch design adds pressure resistance and reduces product buildup
- **Body**
 - Rubber impregnated tire cord and polyester cross-wrapped in bias-ply construction
- **Cover**
 - Homogeneous layer of chlorobutyl elastomer extends to the outside edge of the flange
 - Coated with a weather-resistant protectant

Fully Tested and Field Engineered

All Garlock expansion joint styles have been rigorously lab- and field-tested, and engineered to ensure long life and reliable service.

Special Liner* and Cover Materials

- Neoprene
- EPDM
- Hypalon**
- FDA tubes in EPDM, neoprene and natural
- Nitrile
- Natural (tube only)

Temperature

Max. Temp.

Chlorobutyl/nylon tire cord +250°F (+120°C)

Chlorobutyl/Kevlar** tire cord/

EPDM tube and cover +300°F (+150°C)

* When EZ-FLO® expansion joints are furnished with special liners, temperature and pressure ratings may change.

** Kevlar is a registered trademark of DuPont; Hypalon is a registered trademark of DuPont Dow Elastomers.



Pressure and Vacuum Rating

	Pipe I.D.		Pressure		Vacuum	
	Inch	mm	psi	bar	in. Hg	mm Hg
Style 206 EZ-FLO†	2-10	50-250	250	17	26	650
	12	300	250	17	12	300
	14	350	130	9	12	300
	16-20	400-500	110	8	12	300
	22-24	550-600	100	7	12	300
	26-40	650-1000	90	6	12	300
	42-66	1050-1650	80	5.5	12	300
	68-84	1700-2100	70	5	12	300

† Pressure and vacuum ratings are for standard FF dimensions only. Consult Garlock for alternate sizes and corresponding pressure/vacuum ratings. Consult Garlock for larger sizes. Metric sizes available on request.

Movement Capabilities

	Type Movement	Pipe I.D.		Movement	
		Inch	mm	Inch	mm
	Compression	2-5	50-125	3/4	19
		6-18	150-450	1	25
		20-24	500-600	1-1/8	30
		26-40	650-1000	1-1/4	32
		42 & Up	1050 & Up	1-3/8	35
	Elongation	2-5	50-125	3/8	10
		6-18	150-450	1/2	12
		20-24	500-600	1/2	12
		26 & Up	650 & Up	1/2	12
	Transverse (Lateral)	2-8	50-200	1/2	12
		10 & Up	250 & Up	1/2	12

Control Units

Control units must be used to protect expansion joints from excessive movement if piping is not properly anchored. See page 17 for information.

Styles 207 and 208

Styles 207 and 208 are U-type expansion joints constructed of specialty rubber and fabric. Available in round or rectangular configurations, they are used as flexible connectors between a turbine and condenser, or other similar applications.

Style 207

- Internally flanged for full vacuum and low pressure applications
- Temperature: To +250°F (+120°C)*
Pressure: Full vacuum to 15 psig (1.0 bar)

Style 208




- Externally flanged, primarily for vacuum service
- Temperature: To +250°F (+120°C)*
Pressure: Full vacuum to 25 psig (1.7 bar)
- Available in very narrow face-to-face dimensions; staggered drilling facilitates installation
- Also recommended to reduce vibration and noise on lightweight piping, i.e. those carrying coal-laden air to pulverized coal burners

Fully Tested and Field Engineered

All Garlock expansion joint styles have been rigorously lab- and field-tested, and engineered to ensure long life and reliable service.

NOTE: For recommendations for specific applications, including range of available elastomers, consult Garlock.

Movement Capabilities

	Type Movement	Pipe I.D.		Movement	
		Inch	mm	Inch	mm
	Compression	2-20	50-500	1/2	12
		22 & Up	550 & Up	3/4	19
	Elongation	2-20	50-500	1/4	6
		22 & Up	550 & Up	1/4	6
	Lateral	2-20	50-500	1/2	12
		22 & Up	550 & Up	1/2	12

* For higher temperature capabilities, consult Garlock.



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Styles 214 and 215

These PTFE concentric spool-type flexible couplings are designed to reduce noise and compensate for expansion, contraction and minor piping misalignment in chemical processing, air conditioning and heating systems.

Style 214

- Two convolutions
- Temperature: -100°F (-70°C) to +450°F (+230°C)
Pressure: To 178 psig (12 bar),
Full vacuum to +350°F (+180°C)

Style 215

- Three convolutions
- Temperature: -100°F (-70°C) to +450°F (+230°C)
Pressure: To 132 psig (9 bar),
Full vacuum to +180°F (+80°C)

Benefits

- Convolution shape provides extra-long flex life at high temperatures
- Proprietary contour molding process ensures consistent wall thickness for blowout resistance
- PTFE body withstands corrosion, water, steam, and most chemicals and gases
- Higher pressure and temperature ratings mean extended service life in most piping systems
- Preset restriction bolts prevent over-extension
- Available silicone-free

Design

- Complete assembly includes fluorocarbon resin PTFE body, plated ductile iron flanges, polyethylene-covered restriction bolts and corrosion-resistant reinforcing rings
- Standard sizes from 1" (25 mm) through 8" (200 mm) pipe I.D.



Pressure and Vacuum Rating

Garlock PTFE expansion joints and couplings have pressure ratings high enough to handle most applications. As the pipe size gets larger, Garlock increases the bellows thickness and the strength of the reinforcing rings to compensate for the change in internal forces. This permits the same high pressure rating for all sizes.

Temperature		214 Pressure		215 Pressure	
		psi	bar	psi	bar
50°F	10°C	178	12	132	9
100°F	50°C	165	11	120	8
150°F	65°C	150	10	103	7
200°F	90°C	130	9	90	6
250°F	120°C	110	8	75	5
300°F	150°C	92	6	60	4
350°F	180°C	78	5	50	3.5
400°F	205°C	65	4.5	42	3
450°F	230°C	60	4	35	2

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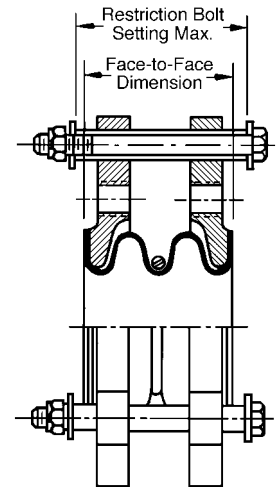
Movement

Style 214 PTFE Flexible Couplings

Pipe Size (Inches)	1	1-1/2	2	2-1/2	3	4	5	6	8
Nominal Installed Face to-Face	1-3/8	1-3/8	1-9/16	2-1/4	2-1/4	2-5/8	3-1/4	2-3/4	4
Max. Restriction Bolt Setting	1-1/4	1-5/16	1-15/32	2-7/32	2-1/4	2-23/32	3-5/16	2-3/4	4
Max. Axial Movement + or -	1/4	1/4	1/4	5/16	3/8	1/2	1/2	1/2	1/2
Max. Transverse Deflection, + or -*	1/8	1/8	1/8	1/8	3/16	1/4	1/4	1/4	1/4

Maximum angular movement approximately 7°.

* Based on unit being in normal installed position with no axial movement or angular deflection.

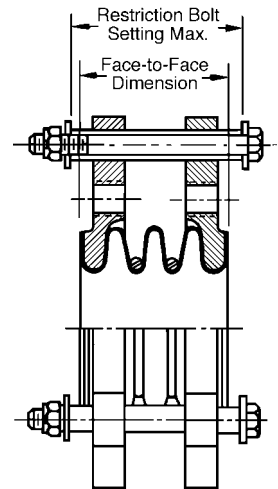


Style 215 PTFE Flexible Couplings

Pipe Size (Inches)	1	1-1/2	2	2-1/2	3	4	5	6	8
Nominal Installed Face to-Face	1-3/4	2	2-3/4	3-3/16	3-5/8	3-5/8	4	4	6
Max. Restriction Bolt Setting	1-7/8	2-5/32	3-5/32	3-9/16	4-1/4	4-1/4	4-9/16	4-5/8	6-5/8
Max. Axial Movement + or -	1/2	1/2	3/4	3/4	1	1	1	1-1/8	1-1/8
Max. Transverse Deflection, + or -*	1/4	1/4	3/8	3/8	1/2	1/2	1/2	9/16	9/16

Maximum angular movement approximately 14°.

* Based on unit being in normal installed position with no axial movement or angular deflection.



PTFE Control Units and Flanges

All PTFE joints and couplings are furnished with ductile iron flanges and control units ready for immediate installation on the job site. Flanges in other alloys are available by special order.

Flanges are protected to resist atmosphere corrosion and are tapped to 150 lbs. ANSI Standard drilling.

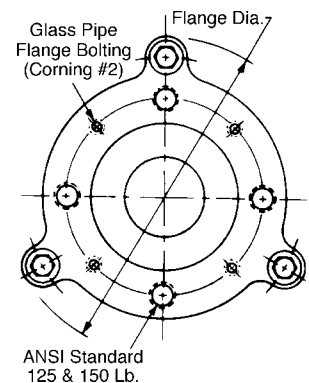
Control units are assembled with flanges to prevent joints from excessive axial elongation. They are

designed to accept the static pressure thrust in the piping system.

Tie rods are set at the factory at the maximum face-to-face working limits, with lock nuts as insurance against overextension of the expansion joint. The tie rods are covered with polyethylene to eliminate metal-to-metal contact between the rods and flanges—the most frequent cause of noise transmission and electrolysis.

Flange Dimensions and Drilling

Pipe Size (Inches)	1	1-1/2	2	2-1/2	3	4	5	6	8
Flange Dimension	5-11/16	6-7/16	7-7/8	9-1/8	10	11-1/8	12-7/8	13-7/8	15-1/2
Thickness	3/8	3/8	1/2	5/6	5/8	11-1/16	11/16	11/16	11/16
ANSI Std. Drilling Bolt Circle Dia.	3-1/8	3-7/8	4-3/4	5-1/2	6	7-1/2	8-1/2	9-1/2	11-3/4
No. Bolt Holes	4	4	4	4	4	8	8	8	8
Bolt Hole Thread	1/2-13	1/2-13	5/8-11	5/8-11	5/8-11	5/8-11	3/4-10	3/4-10	3/4-10
Corning Style* #2 Glass Pipe Bolt Circle	3-1/8	3-7/8	4-3/4	—	6	7-1/2	—	9-1/2	—
No. Bolt Holes	4	4	4	—	4	8	—	8	—
Bolt Hole Thread	5/16-18	5/16-18	5/16-18	—	5/16-18	5/16-18	—	3/8-16	—



* Special order only

GUARDIAN® 306 EZ-FLO®

Garlock GUARDIAN® 306 EZ-FLO® spool-type expansion joints feature an FEP lining that is fused to the body of the expansion joint.

The GUARDIAN® 306 EZ-FLO® is designed for the chemical processing and pulp & paper industries, where its ability to resist corrosive attack at normal or elevated temperatures and pressures is unequalled.

Benefits

- FEP liner is non-contaminating and suits a wide range of applications
- Flowing arch design prevents media buildup and reduces turbulence and vibration
- 250 psig (17 bar) pressure rating ensures longer service life and consolidates inventory
- Liner extends to outer diameter of flange to prevent chemical attack on expansion joint flanges
- Mechanically bonded liner resists delamination

Design

- **Tube**
 - Seamless FEP lining extends to the outer edge of the flange; completely fused to the expansion joint body
 - Incorporates a flowing arch design to resist product build-up
- **Body**
 - Impregnated nylon tire cord fabric cross-wrapped in bias-ply construction
- **Cover**
 - Homogeneous layer of chlorobutyl elastomer extends to the outside edge of the flange
 - Coated with a weather-resistant protectant
- **Special Designs**
 - Non-standard face-to-face dimensions (pressure / vacuum ratings may be affected)
 - Non-standard drill patterns
 - Blind flanges (no drilling)
 - Lightweight designs available for low pressure and non-metallic pipe applications
 - Available with GYLON® 3545 gasket face for raised face flange connections



Pressure and Vacuum Rating*

	Pipe I.D.		Pressure		Vacuum	
	Inch	mm	psi	bar	in. Hg	mm Hg
Style 306 EZ-FLO®	3-10	75-250	250	17	26	650
	12	300	250	17	17	425
	14	350	130	9	17	425
	16-20	400-500	110	8	15	375

* Pressure and vacuum ratings are for neutral FF dimensions only. Consult Garlock for alternate sizes and corresponding pressure/vacuum ratings. Consult Garlock for larger sizes. Metric sizes available on request.

Temperature

	Max. Temp.
Chlorobutyl/nylon tire cord	+250°F (+120°C)
Chlorobutyl/Kevlar** tire cord with EPDM cover	+300°F (+150°C)

** Kevlar is a registered trademark of DuPont.

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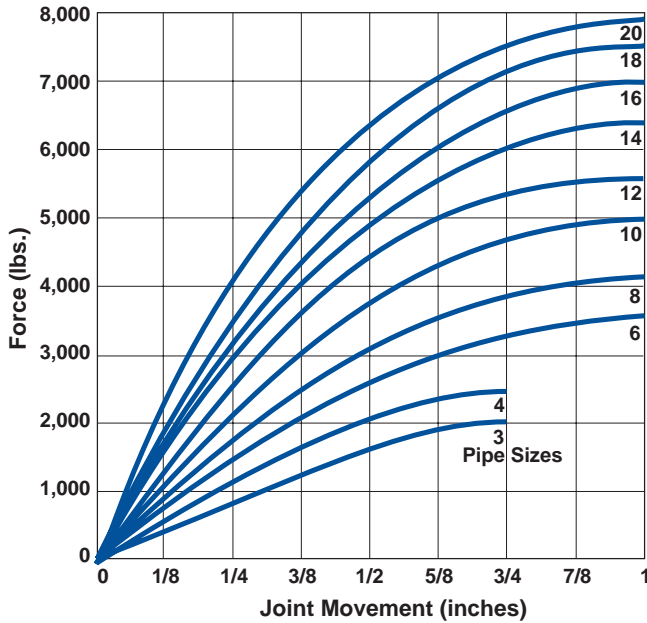
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Movement Capabilities

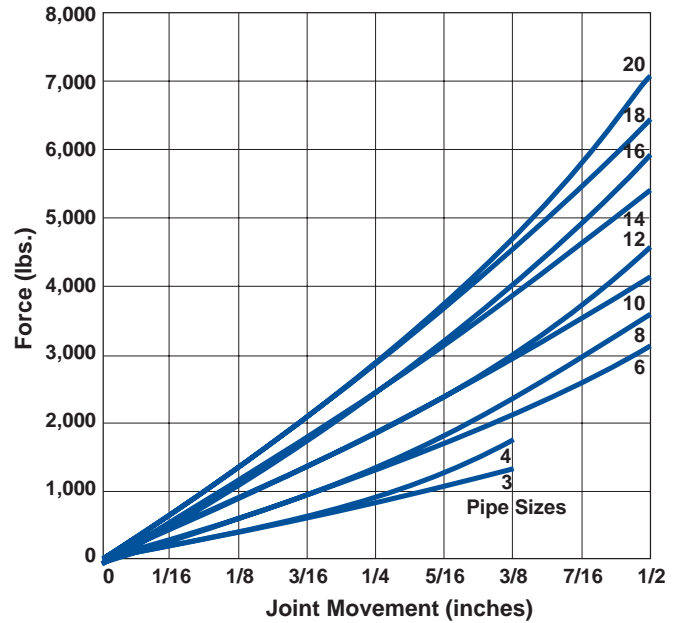
Type Movement	Pipe I.D.		Movement	
	Inch	mm	Inch	mm
Compression	3-4	75-100	3/4	19
	6-20	150-500	1	25
Elongation	3-4	75-100	3/8	10
	6-20	150-500	1/2	12
Lateral	3-4	75-100	1/2	12
	6-20	150-500	1/2	12

Type Movement	Pipe I.D.		Movement Degrees
	Inch	mm	
Angular	3-4	75-100	8
	6-8	150-200	5
	10-12	250-300	4
	14-16	350-400	2.5
	18-20	450-500	2
Torsional	3-12	75-300	3
	14-16	350-400	2
	18-20	450-500	1

Compression



Elongation



Fully Tested and Field Engineered

All Garlock expansion joint styles have been rigorously lab- and field-tested, and engineered to ensure long life and reliable service.

Control Units

Control units must be used to protect expansion joints from excessive movement if piping is not properly anchored. See page 17 for information.

NOTES:

- Sizes 3"-20" indicate nominal ANSI pipe sizes.
- 3" and 4" I.D. have 3/4" maximum compression and 3/8" maximum elongation.
- Forces to compress and elongate are based on zero pressure conditions and ambient temperatures in the pipeline.
- To convert force in pounds to kilograms, divide by 2.205.
- Metric sizes available by special request.

Benefits

- EPDM tube and cover provide resistance to a wide range of chemicals and environmental conditions, and withstand temperatures to 250°F (120°C).
- Reinforcement materials (chlorobutyl-impregnated polyester and nylon tire cord) help withstand pressure and vacuum.
- Oversized single arch allows greater movement than many double arch designs.
- EPDM construction stocked in many standard sizes. Also available with chlorobutyl, nitrile, and neoprene materials as production items.



Specifications

Expansion Joint				Application				Movement Rating					
Size I.D.		Face-to-Face		Pressure†		Vacuum†		Elongation		Compression		Lateral	
Inch	mm	Inch	mm	psi	bar	Inch Hg	mm Hg	Inch	mm	Inch	mm	Inch	mm
2	50	6	150	165	11	20	508	1/2	13	1	25	3/4	19
3	80	6	150	165	11	20	508	1/2	13	1	25	3/4	19
4	100	6	150	165	11	20	508	1/2	13	1	25	1	25
5	125	6	150	140	10	20	508	1/2	13	1	25	1	25
6	150	6	150	140	10	20	508	1/2	13	1	25	1	25
8	200	6	150	140	10	20	508	1/2	13	1	25	1	25
10	250	8	200	140	10	17	432	3/4	19	1-1/2	38	1	25
12	300	8	200	140	10	17	432	3/4	19	1-1/2	38	1	25
14	350	8	200	85	6	8	203	3/4	19	1-1/2	38	1	25
16	400	8	200	65	4	8	203	3/4	19	1-1/2	38	1	25
18	450	8	200	65	4	8	203	3/4	19	1-1/2	38	1	25
20	500	8	200	65	4	8	203	3/4	19	1-1/2	38	1	25
24	600	10	250	65	4	8	203	7/8	22	1-3/4	44	1	25

Exp. Joint Size I.D.		Spring Rate						Force Pounds					
Inch	mm	Elongation		Compression		Lateral		Elongation		Compression		Lateral	
		lb/inch	kg/mm	lb/inch	kg/mm	lb/inch	kg/mm	lb	kg	lb	kg	lb	kg
2	50	475	8.5	425	7.5	450	8	238	108	425	193	338	153
3	80	500	9	450	8	475	8.5	250	113	450	204	356	161
4	100	550	10	525	9	525	9.5	275	125	525	238	525	238
5	125	600	11	550	10	575	10	300	136	550	249	575	261
6	150	675	12	650	11.5	675	12	338	153	650	295	675	306
8	200	725	13	675	12	700	12.5	363	165	675	306	700	318
10	250	750	13.5	700	12.5	725	13	563	255	1050	476	725	329
12	300	850	15	825	15	850	15	638	289	1238	562	850	386
14	350	1015	17.5	975	17	1000	18	761	332	1463	664	1000	454
16	400	1150	20	1100	20	1125	20	863	381	1650	748	1125	510
18	450	1250	22.5	1200	21.5	1225	22	938	425	1800	816	1225	556
20	500	1470	26	1415	26	1450	26	1100	499	2170	984	1450	658
24	600	1885	34	1800	32	1870	34	1650	748	3150	1429	1870	848

† All sizes are rated for minimum 2 to 1 burst pressure.

Joint Movement

Expansion Joint Size		Angular Movement Degrees	Torsional Movement Degrees
Inch	mm		
2	50	29	4
3	80	20	4
4	100	15	4
5	125	12	4
6	150	10	3.5
8-12	200-300	8	3.5
14-16	350-400	5	2.5
18-24	450-600	4	1.5

NOTES:

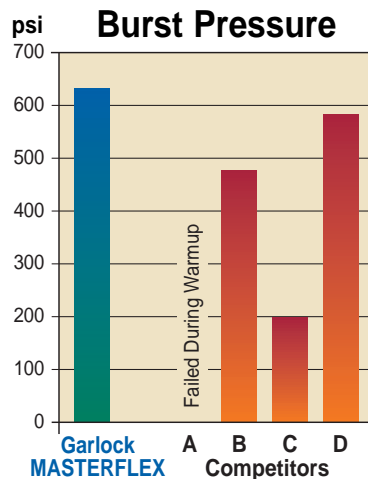
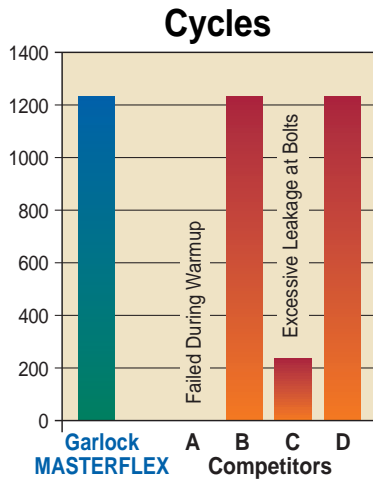
1. Movements listed are non-concurrent and are based on proper pipe flange alignment ($\pm 1/8"$ [3.2 mm] typical).
2. Force pounds and spring rates are based on zero pressure conditions and room temperature in the pipe line and should be considered as approximate.
3. The degree of angular movement is based on the maximum elongation shown.
4. Vacuum ratings based on neutral installed face-to-face dimension.

ANSI Class 150 Flange Drilling*

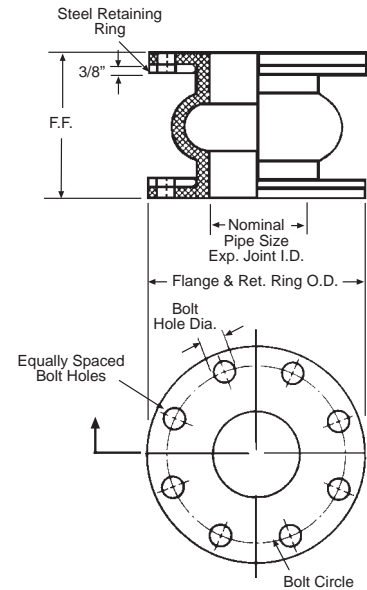
Expansion Joint				Bolt Circle		No. of Holes	Bolt Hole Dia.	
I.D.		O.D.		Inch	mm		Inch	mm
2	50	6	152	4-3/4	121	4	3/4	19
3	80	7-1/2	191	6	152	4	3/4	19
4	100	9	229	7-1/2	191	8	3/4	19
5	125	10	254	8-1/2	216	8	7/8	22
6	150	11	279	9-1/2	241	8	7/8	22
8	200	13-1/2	343	11-3/4	298	8	7/8	22
10	250	16	406	14-1/4	362	12	1	25
12	300	19	483	17	432	12	1	25
14	350	21	533	18-3/4	476	12	1-1/8	29
16	400	23-1/2	597	21-1/4	540	16	1-1/8	29
18	450	25	635	22-3/4	578	16	1-1/4	32
20	500	27-1/2	699	25	635	20	1-1/4	32
24	600	32	813	29-1/2	749	20	1-3/8	35

* Consult Garlock for other flange drillings.

Test Results



Spool Configuration



WARNING:

Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury.

Performance data published in this brochure has been developed from field testing, customer field reports and/or in-house testing.

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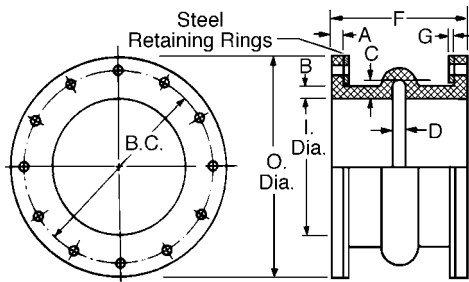
Technical Data

Sizes • Dimensions • Movements • Forces to Compress, Deflect, Elongate

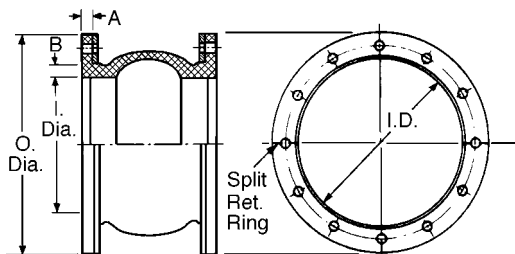
Joint Size (Inside Dia.) ¹	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	34	36	
Flange Outside Dia.	4¼	4⅝	5	6	7	7½	9	10	11	13½	16	19	21	23½	25	27½	29½	32	34¼	36½	38¾	43¾	46	
Bolt Circle Dia.	3⅞	3½	3⅞	4¾	5½	6	7½	8½	9½	11¾	14¼	17	18¾	21¼	22¾	25	27¼	29½	31¾	34	36	40½	42¾	
Number Bolt Holes	4	4	4	4	4	4	8	8	8	8	12	12	12	16	16	20	20	20	24	28	28	32	32	
Diameter Bolt Holes	⅝	⅝	⅝	¾	¾	¾	¾	⅞	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1⅜	1⅜	1⅜	1⅜	1⅜	1⅝	1⅝	
Single Arch	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8	10	10	10	10	10	10	10	
Recom. F	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8	10	10	10	10	10	10	10	
Dimensions 204, 204HP	A	⅞	⅞	⅞	⅞	⅞	⅞	⅞	⅞	⅞	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1	1	
	B	½	½	⅝	¾	¾	¾	¾	¾	¾	¾	1	1⅜	1⅜	1⅜	1⅜	1¼	1¼	1¼	1⅜	1⅜	1⅜	1⅜	
	C	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	2	2	2	2	2	2	2¼	2¼	2¼	2¼	2¼
	D	½	½	½	½	½	½	½	½	½	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1	1
	Single Arch	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	7	7	7	7	7	7	9	9	9	9	9	9	9
Double Arch	9	9	9	9	9	9	9	9	9	10	10	10	11¾	11¾	11¾	12¾	12¾	12¾	12¾	12¾	12¾	12¾	12¾	
Triple Arch	12	12	12	12	12	12	12	12	12	14	14	14	15½	15½	15½	16¾	16¾	16¾	16¾	16¾	16¾	16¾	16¾	
Min. F ³	12	12	12	12	12	12	12	12	12	14	14	14	15½	15½	15½	16¾	16¾	16¾	16¾	16¾	16¾	16¾	16¾	
G	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	
204, 204HP, 200, 200HP	Max. Axial Compression	¼	¼	¼	½	½	½	½	½	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	
	Max. Lateral Deflection	¼	¼	¼	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	
	Max. Axial Elongation	⅛	⅛	⅛	¼	¼	¼	¼	¼	¾	¾	¾	¾	¾	¾	¾	7/16	7/16	7/16	½	½	½	½	
Dimensions 206 EZ-FLO®	A	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	⅝	⅝	⅝	⅝	
	B	¾	¾	¾	¾	¾	¾	¾	¾	9/16	9/16	9/16	5/8	5/8	5/8	5/8	5/8	5/8	5/8	13/16	13/16	13/16	13/16	
206 EZ-FLO®, G-306 EZ-FLO®	Max. Axial Compression	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1	1	1	1½	1½	1½	1¼	1¼	1¼	1¼	
	Max. Lateral Deflection	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	
	Max. Axial Elongation	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
204/204HP	Total Force Lbs ⁴ : Compress Jt	170	230	350	430	460	520	550	640	680	780	900	1450	1650	1800	2000	2200	2800	3000	3300	3400	3700	4150	
	Deflect Joint	95	255	410	500	530	560	620	700	780	850	1000	1150	1200	1400	1500	1600	1750	1850	2000	2100	2250	2450	
	Elongate Jt	85	115	175	215	230	260	275	320	340	390	450	725	825	900	1000	1100	1400	1500	1650	1700	1850	2075	

All specifications in inches unless otherwise noted.

Styles 200, 200HP, 204, 204HP



Styles 206, 306 EZ-FLO®



Single Abrupt Arch Movement

Size (Inches)	Angular Movement (Degrees)	Torsional Movement (Degrees)
2	14.5	3
3	10	3
4	7.5	3
5	6	3
6-8	5	3
10-12	4	3
14-16	2.5	2
18-30	2	1
34-54	1.5	1
56-96	1	1

Note: The degree of angular movement is based on the max. extension shown.

NOTES:

- Pipe sizes through 1½" are supplied with a filled arch (Style 204, 204HP), and movements have been reduced accordingly. Open-arch construction is available on special order.
- Pressure/vacuum ratings are for standard FF dimensions only. Consult Garlock for non-standards.
- For shorter "F" dimensions, consult Garlock.
- Forces to compress, deflect and elongate elastomeric expansion joints are based on zero pressure conditions in the pipeline. These forces should be

Pressure Ratings

Style 204 / GUARDIAN® 200

Pressure and vacuum service

Pipe Size I.D.		Pressure		Vacuum	
Inches	mm	psi	bar	In. Hg	mm Hg
1/2-4	13-100	165	11	Full	750
5-12	125-300	140	10	Full	750
14	350	85	6	Full	750
16-24	400-600	65	4.5	Full	750
26-66	650-1650	55	4	Full	750
72 & up	1800 & up	45	3	Full	750

Style 204HP / GUARDIAN® 200HP

High pressure and vacuum service

Pipe Size I.D.		Pressure		Vacuum	
Inches	mm	psi	bar	In. Hg	mm Hg
1/2-6	13-150	200	14	Full	750
8-12	200-300	190	13	Full	750
14	350	130	9	Full	750
16-20	400-500	110	8	Full	750
22-24	550-600	100	7	Full	750
26-40	650-1000	90	6	Full	750
42-66	1050-1650	80	5.5	Full	750
68-84	1700-2100	70	5	Full	750

Style 206 EZ-FLO®

High pressure service

Pipe Size I.D.		Pressure		Vacuum	
Inches	mm	psi	bar	In. Hg	mm Hg
2-6	50-150	250	17	26	650
8-10	200-250	250	17	26	650
12	300	250	17	12	300
14	350	130	9	12	300
16-20	400-500	110	8	12	300
22-24	550-600	100	7	12	300
26-40	650-1000	90	6	12	300
42-66	1050-1650	80	5.5	12	300
68-84	1700-2100	70	5	12	300

- See pages 8 and 9 for temperature and pressure ratings of GUARDIAN® 306 EZ-FLO® expansion joint.
- Pressure and vacuum ratings at neutral FF dimension.

Drilling Specifications

ANSI B16.1	1975 Class 125
ANSI B16.24	1971 Class 150
ANSI B16.5	1973 Class 150
MSS SP-51	1965 MSS 150 lb.
AWWA C201	Class B

Note: Special drillings available.

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	ID	40	42	48	50	54	60	66	72	78	84	90	96	108	120
OD	50 ³ / ₄	53	59 ¹ / ₂	61 ³ / ₄	66 ¹ / ₄	73	80	86 ¹ / ₂	93	99 ³ / ₄	106 ¹ / ₂	113 ¹ / ₄	126 ³ / ₄	140 ¹ / ₄	
ØBC	47 ¹ / ₄	49 ¹ / ₂	56	58 ¹ / ₄	62 ³ / ₄	69 ¹ / ₄	76	82 ¹ / ₂	88 ³ / ₄	95 ¹ / ₂	102	108 ¹ / ₂	120 ³ / ₄	132 ³ / ₄	
#BH	36	36	44	44	44	52	52	60	60	64	68	68	72	76	
ØBH	1 ³ / ₄	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁷ / ₈	2	2	2	2	2 ¹ / ₈	2 ¹ / ₄	2 ³ / ₈	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	
F	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12
A	1	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ³ / ₈
B	1 ³ / ₈	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹³ / ₁₆	1 ¹³ / ₁₆	1 ¹³ / ₁₆	1 ¹³ / ₁₆	1 ¹³ / ₁₆	1 ¹³ / ₁₆	2
C	2 ¹ / ₄	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂
D	1	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈
F1	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
F2	14	14	14	14	14	14	14	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂
F3	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂	17 ¹ / ₂
G	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈	3 ⁸ / ₈
204															
C	1	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈	1 ¹ / ₈
L	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
E	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
A	5 ⁸ / ₈	7 ⁸ / ₈	7 ⁸ / ₈	7 ⁸ / ₈	7 ⁸ / ₈	7 ⁸ / ₈	7 ⁸ / ₈	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ³ / ₈
B	1 ¹³ / ₁₆	1	1	1	1	1	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ¹ / ₂
206															
C	1 ¹ / ₄	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈
L	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
E	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
204															
C	4800	5000	5600	6000	6400	7200	7800	8500	9450	10,500	11,200	11,800	12,850	13,950	
L	2850	2950	3300	3450	3700	4050	4400	4800	5240	6600	6820	7120	9400	10,250	
E	2400	2500	2800	3000	3200	3600	3900	4250	4765	5170	5400	5870	8700	9470	

Pressure Conversion Chart

To Convert To	Atmospheres	Lbs. per Sq. Inch	Kgs per Sq. Cm*	Inches Mercury†	Meters Mercury†	Meters Water††	Feet of Water††	Inches Water††	Bar
From	Multiply by								
Atmospheres	1.000	14.700	1.033	29.921	0.760	10.340	33.910	406.900	1.013
Lbs per Sq. In.	0.068	1.000	0.070	2.036	0.052	0.704	2.307	27.680	0.069
Kg per Sq. Cm	0.968	14.220	1.000	28.960	0.736	10.010	32.840	394.100	0.981
Inches Mercury	0.033	0.491	0.035	1.000	0.025	0.346	1.132	13.590	0.034
Meters Mercury	1.316	19.340	1.360	39.370	1.000	13.610	44.640	535.700	1.333
Meters of Water	0.097	1.421	0.010	2.893	0.073	1.000	3.281	39.370	0.098
Feet of Water	0.029	0.433	0.030	0.882	0.022	0.305	1.000	12.000	0.030
Inches of Water	0.002	0.036	0.003	0.074	0.002	0.025	0.083	1.000	0.002
Bar	0.987	14.500	1.020	29.530	0.750	10.210	33.490	401.800	1.000

Example: Convert 10 psi to feet of water
 1 psi = 2.307 ft. of water (from table)
 10 x 2.307 = 23.07 feet of water

Note: psig = psia minus atmospheric pressure (14.7)
 * Metric atmosphere † at +32°F (0°C)
 †† at +60°F (+16°C)

considered only as approximate and may vary with the elastomers and fabric used in construction.

To convert force in pounds to kilograms, divide by 2.205.

- Movement of multiple-arch joints can be determined by multiplying the number of arches by the single-arch values in the table above.
- For filled-arch joints, reduce the axial compression, elongation and transverse deflection value by 50%. Rated movements are non-concurrent.
- Control units are recommended for most applications.

GARFLEX® 8100

GARFLEX® expansion joints feature rugged yet flexible nylon cord reinforcement in a molded, spherical bellows design that ensures an exceptional burst pressure rating. The streamlined flowing arch design reduces turbulence and allows smooth, quiet flow—no need to fill the arch and restrict its movement.

Benefits

- Flowing arch design prevents sediment buildup and reduces turbulence
- Floating flanges can be rotated to accommodate torsional misalignment
- Molded spherical bellows accommodate up to one inch of axial movement and transverse deflection
- Nylon-reinforced nitrile tube earns high pressure rating without sacrificing flexibility; resists most hydrocarbons, oils and gasoline
- Supplied silicone-free

Design

- **Tube**
 - Nitrile bellows with rugged nylon tire cord reinforcement ensure strength yet flexibility
 - Incorporates a flowing arch design to eliminate product buildup
- **Cover**
 - Homogeneous layer of neoprene coated with a protectant withstands weathering and ozone
- **Flanges**
 - Zinc-coated ductile iron flanges are corrosion-resistant

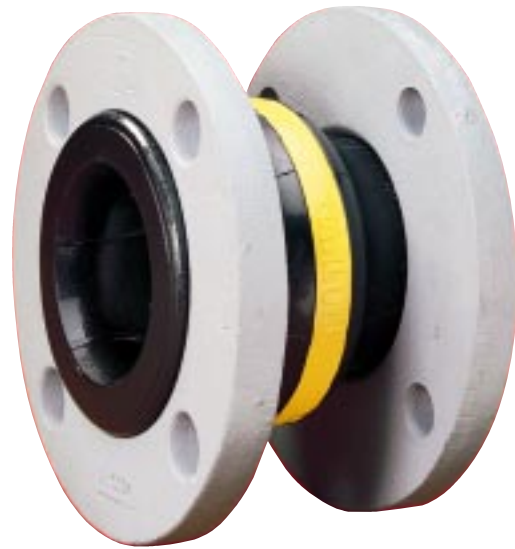
NOTE:

Style 8100 expansion joints are supplied with rotating flanges drilled to ANSI Class 150# specifications. Can be installed against raised face pipe flanges.

Bellow Sizes

	Nominal F-F (in.)	Nominal Bellow I.D. (inch)									
		2	2.5	3	4	5	6	8	10	12	
Series 50	5	■	■	■	■	■	■	■	■	■	■
Series 60	6	■	■	■	■	■	■	■	■	NA	NA
Series 80	8	NA	NA	NA	NA	NA	NA	NA	■	■	

NA = Not available



Temperature / Pressure Nylon-Reinforced Nitrile

Operating Temperature		Pressure	
°F	°C	psi	bar
To 120°F	To 50°C	232	16
120°F to 160°F	50°C to 70°C	174	12
160°F to 195°F	70°C to 90°C	139	9.5
195°F to 210°F	90°C to 100°C	70	5
210°F to 230°F	100°C to 110°C	25	1.7

Vacuum Rating* — Nitrile

Pipe I.D.		Vacuum	
Inch	mm	in. Hg	mm Hg
2 to 2-1/2	50 to 63	23	575
3	75	20	500
4	100	17	425
5 to 6	125 to 150	11	275
8	200	8	200
10 to 12	250 to 300	5	125

* At nominal FF dimensions only.

Movement — Nylon-Reinforced Nitrile

Type Movement	Movement	
	Inch	mm
Compression	1	25
Elongation	1	25
Transverse Deflection (at recommended installed position)	± 1	± 25

Movements are non-concurrent.

Type Movement	Pipe I.D.		Max. Allowed
	Inch	mm	
Angular Deflection (at recommended installed position)	2	50	35°
	2-1/2 to 3	63 to 75	30°
		4	100
	5 to 6	125 to 150	20°
		8	200
	10 to 12	250 to 300	10°

Style 9394

This multi-convoluted, lightweight expansion joint is designed for low pressure applications that require significant amounts of movement, axially and/or laterally. Its low spring rates make it ideal for load cell applications.

Benefits

- Lightweight design installs easily, costs less to ship
- Can be custom-designed for even greater movement capability
- Choice of construction materials suitable for wide range of temperatures
- Available in flanged or sleeve type design, up to 48" (1219 mm) I.D.

NOTE: Flanged designs require retaining rings for an effective seal. Sleeve type requires clamps; the overall length of the expansion joint should include an additional 4" (101.6 mm) for clamping space.

Pressure

- Without external reinforcing rings: up to 3 psi (0.2 bar)
- With external reinforcing rings: up to 15 psi (1.0 bar)

Vacuum

- Without internal reinforcing rings: up to 3 inches (75 mm) Hg
- With internal reinforcing rings: up to 15 inches (381 mm) Hg

Contact Garlock if higher vacuum or pressure ratings are required.

Movement Capabilities

- 3/4" (19 mm) axial compression per convolution
- 5/8" (16 mm) axial elongation per convolution
- 5/8" (16 mm) lateral deflection per convolution

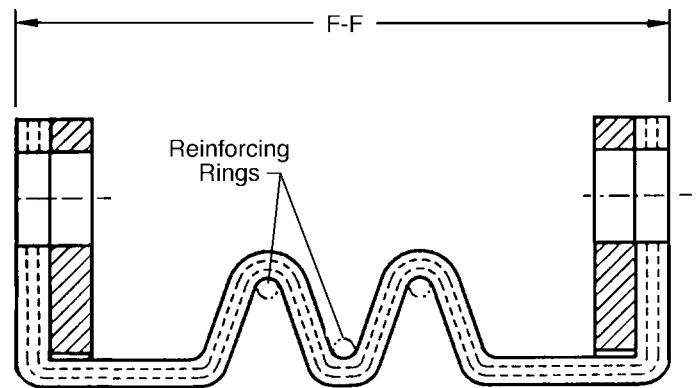
Movements are non-concurrent.

Larger convolutions are available to provide more movement. Contact Garlock if above listed movements need to be exceeded.

Temperature

Standard Materials	Max. Temp.
Chlorobutyl/polyester	+250°F (+120°C)
Chlorobutyl/fiberglass/Kevlar*	+300°F (+150°C)
Fluoroelastomer/fiberglass/Kevlar	+400°F (+205°C)

* Kevlar is a registered trademark of DuPont; Viton and Hypalon are registered trademarks of DuPont Dow Elastomers.



Cross Section of Style 9394 with Reinforcing Rings

Alternate Tube and Cover Materials

- | | |
|----------------------|----------------|
| ■ Neoprene | ■ EPDM |
| ■ Nitrile | ■ FDA Neoprene |
| ■ Hypalon* | ■ FDA EPDM |
| ■ Natural/gum rubber | ■ Viton* |

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GARLOCK is a registered trademark for packings, seals, gaskets, and other products of Garlock.

Style 8400 Flue Ducts

Garlock offers a wide range of flue duct type expansion joints for lightweight applications, especially for scrubbers, precipitators, baghouses, and fans in air handling systems. Style 8400 flue ducts are available in round, rectangular or square configurations, as belt type (without flanges) or U-type (flanged), with virtually no size restrictions.

Garlock also provides on-site vulcanization for flue ducts that require splicing into position due to obstructions or interferences that prevent continuous construction installations.

Rectangular / Square

- Face-to-face dimensions: typically 6" (152 mm), 9" (229 mm), 12" (305 mm) or 16" (406 mm)
- If any leg is smaller than 30" (762 mm), joint will be built on a metal form with column corners
- Movement capabilities: 1/4" (6.4 mm) in all directions

Note: Other sizes also available.

If more movement is required, please contact Garlock.

Round

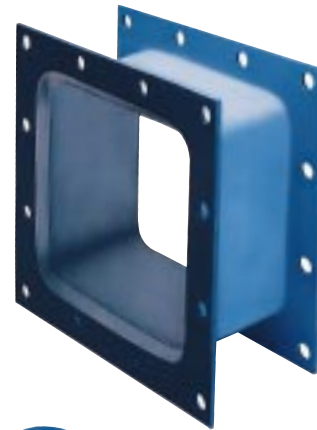
- Supplied in any size, with or without flanges or arch
- Variety of materials available: neoprene chlorobutyl, fluoroelastomer, nitrile, EPDM, Hypalon*, white neoprene, white EPDM or natural/gum rubber.
- Movement capabilities depend on expansion joint size and arch configuration

Belt Type

- Supplied in any size, without flanges, with or without an arch
- Available in the same materials as round flue ducts
- Movement capabilities depend on installation width and arch configuration
- Supplied open-ended (wraparound), or continuous to fit over ducting

Temperature

Style No.	Standard Materials	Max. Temp.
8400-250	Neoprene/fiberglass/Kevlar**	+250°F (+120°C)
8400-300	Chlorobutyl/fiberglass/Kevlar	+300°F (+150°C)
8400-400	Fluoroelastomer/fiberglass/Kevlar	+400°F (+205°C)



Pressure

- Standard flue duct designs are rated for ± 3 psi (0.2 bar) pressure

Movement Capabilities

- Consult factory for movement capabilities

Made in the U.S.A.

* Hypalon is a registered trademark of DuPont Dow Elastomers.

** Kevlar is a registered trademark of DuPont.

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Style 7250 FLEXO-MATIC®

Style 7250 is a flexible rubber pipe connector with integral flanges. Designed to absorb noise and vibration in a piping system, rubber pipe connectors are frequently used in air conditioning and heating installations because of their ability to limit or interrupt the transmission of sound from operating equipment to the pipes.

- Material: chlorobutyl/polyester with steel reinforcement
- Temperature: Up to +250°F (+120°C)
- Pressure: Up to 150 psig (10 bar)
- Flanges: 125/150 lb. standard
- Vacuum: Up to 8" I.D. 26" Hg
Over 10" I.D. 12" Hg

Sizes and Dimensions*

For 125/150 lb USA Drilling

	Connector Size - Inside Diameter								
	2	2-1/2	3	4	5	6	8	10	12
Flange Outside Dia.	6	7	7-1/2	9	10	11	13-1/2	16	19
Bolt Circle	4-3/4	5-1/2	6	7-1/2	8-1/2	9-1/2	11-3/4	14-1/4	17
Number Bolt Holes	4	4	4	8	8	8	8	12	12
Diameter Bolt Holes	3/4	3/4	3/4	3/4	7/8	7/8	7/8	1	1
Retaining Ring I.D.	3-5/8	4-1/8	4-5/8	5-7/8	6-7/8	7-7/8	9-7/8	12-1/8	14-1/2
Recommended FF Dim.	18	18	18	18	24	24	24	24	24
Minimum FF Dimension	5	5	5	5	5	5	6	6	6
Maximum FF Dimension	24	24	36	36	36	48	48	48	48
Elongation	1/4	1/4	1/4	1/4	1/4	5/16	5/16	3/8	3/8
Compression	3/16	1/4	1/4	1/4	1/4	5/16	5/16	3/8	3/8
Lateral	1/4	1/4	1/4	1/4	1/4	3/16	3/16	3/16	3/16

Consult Garlock for larger sizes or higher pressure capabilities.
Metric sizes available on request.

* All dimensions in inches.

Navy and Coast Guard

Navy

Garlock manufactures numerous expansion joints in accordance with U.S. Navy specifications.

Style 9278 EZ-FLO® is designed to meet the requirements of ASTM F1123, and is constructed of neoprene and polyamide. Retaining rings must be galvanized in accordance with the specification. Hydrostatic testing may be required and is performed in-house at our Palmyra, New York, facility.

Style 7706 S-type (as pictured) has been developed specifically for submarine service.

Other styles are available per application. Consult the factory for specific designs.



Coast Guard

Garlock expansion joints certified to Coast Guard Specification 46CFR56.60-25(E) are:

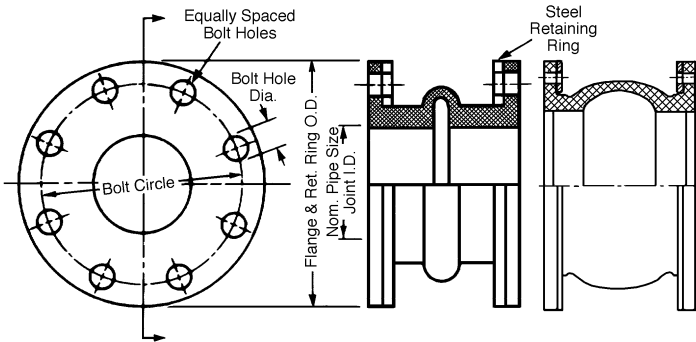
- Style 206 EZ-FLO®
- Style 204 CL 11
- GARFLEX® 8100

All of these styles must have a neoprene cover (with no paint). Coast Guard certification should be requested at the time of quotation or order.

Types of Expansion Joints

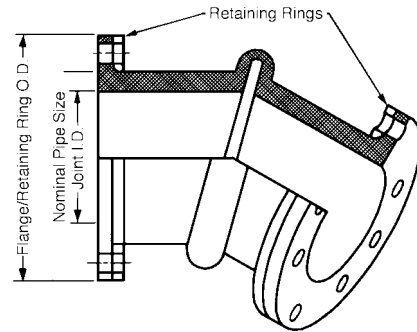
Single Arch

- Fabric and rubber construction
- Reinforced with metal/wire rings
- Full-face flanges integral with joint body
- Flanges drilled to companion bolt pattern
- Gaskets not required



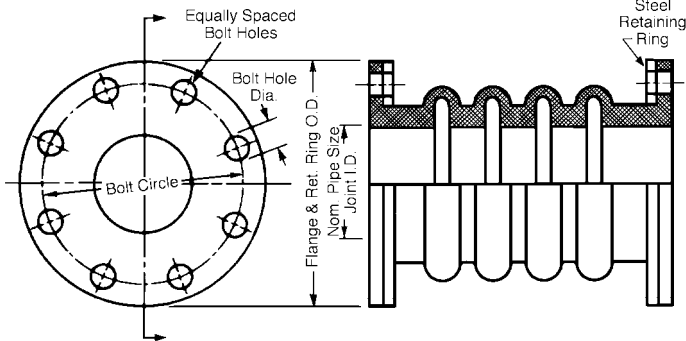
Offset

- Compensates for initial misalignment and non-parallelism of piping axis
- Custom-built to your specifications
- Complete drawings and specifications recommended with inquiries/orders



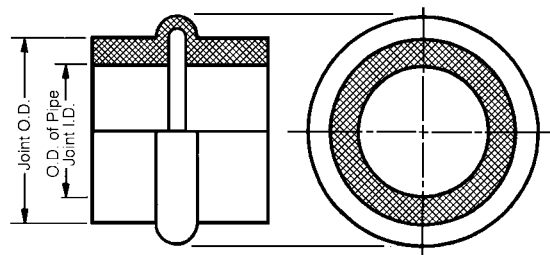
Multiple Arch

- Accommodates greater movement than single arch
- Minimum joint length depends on number of arches
- Maximum of four arches recommended to maintain lateral stability



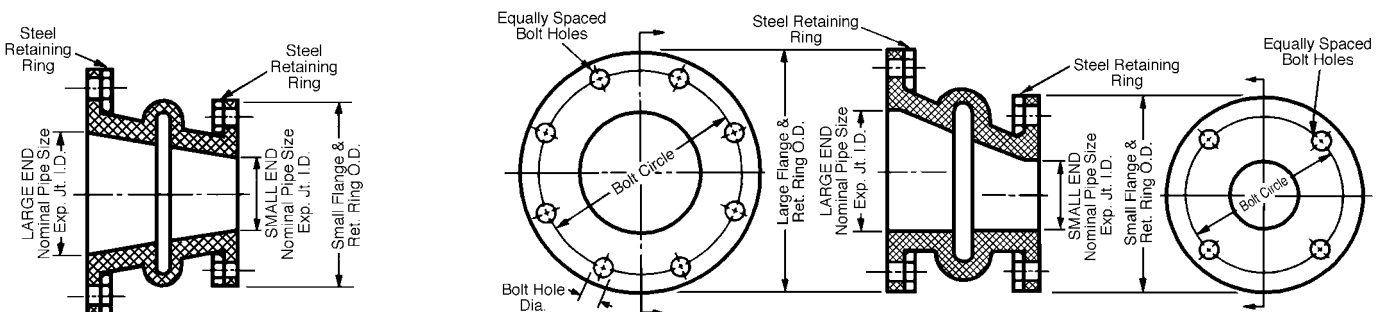
Sleeve

- Same as single arch type, except sleeve end I.D. equals pipe O.D.
- Slips over straight ends of open pipe
- Ends secured by suitable clamps
- Recommended for low pressure service only



Taper or Reducer

- Connects piping of different diameters
- Concentric tapered joints: same axis for both ends
- Eccentric: axis of one end offset from other end
- Tapers in excess of 15° are not recommended
- Pressure ratings are based on larger I.D.
- Available with or without arches



Expansion Joint Components

Tube

- Synthetic or natural rubber forms seamless, leak-proof lining
- Extends fully through bore to outer flange edge
- Common materials include chlorobutyl, neoprene, natural rubber, EPDM, Viton* and Hypalon*

Body or Carcass

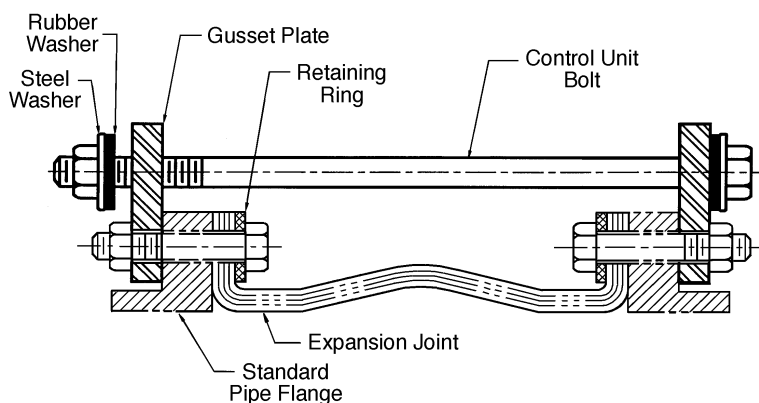
- When wrapped or plied, reinforcements provide support and flexibility between tube and cover
- Fabric reinforcement: polyester or other suitable fabrics impregnated with specified elastomers
- Metal reinforcement: bonded rectangular steel rings exclusive to Garlock, or continuous strands of wire and round steel body rings
- Metal reinforcement rings provide longer service life, extra safety protection, and extra rigidity, allowing higher pressure ratings

Cover

- Homogeneous layer of synthetic or natural rubber
- Chlorobutyl is standard; other elastomers available to meet your specific applications
- Rubber or other weather-resistant coating protects carcass from corrosion or damage

Metal Retaining Rings

- Must be used in all applications; provides metal surface to distribute bolting pressure equally, preventing flange damage during bolt tightening
- Install behind and against inner face of each flange

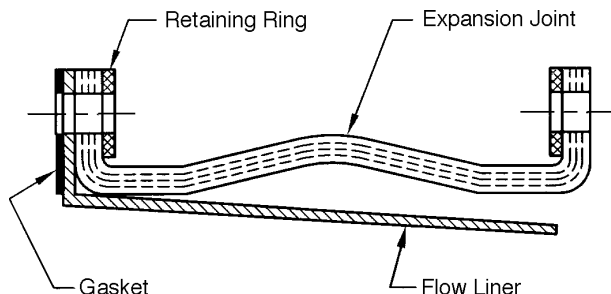


Control Unit Installation

- Standard material: mild steel with corrosion-resistant coating; galvanized or stainless steel also available

Metal Flow Liners

- Extends service life by providing protection from abrasive materials or solids, especially in high velocity applications
- Flanged at one end, installed at the head of the flow, tapered to a 5° angle, allows lateral deflection
- Liner flange thickness: 10 gauge
Liner body thickness: 12 gauge
- Available in 304/316 stainless steel; also: titanium, Hastelloy C**
- Special metal liner configurations also available for reducing or multiple arch design. Contact Garlock.



Metal Flow Liner Installation

Control Units

- Recommended on most applications to prevent damage due to excessive pipe movement
- Consists of two or more tie rods connected between flanges
- Triangular end plate has two holes for bolting plate securely to flange, and one hole to accommodate plate connecting tie rod
- Rubber washer between plate and rod substantially reduces both noise and vibration
- Installing pipe sleeves over tie rods provides additional protection against overcompression damage
- NOT designed to replace pipeline anchoring

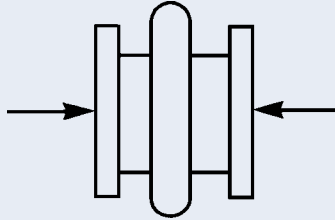
* Viton and Hypalon are registered trademarks of DuPont Dow Elastomers

** Hastelloy is a registered trademark of Haynes International.

Types of Pipe Movements

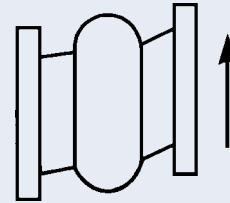
Axial Compression

- Longitudinal movement shortens face-to-face dimension along axis of expansion joint or flexible coupling
- Pipe flanges remain perpendicular to axis



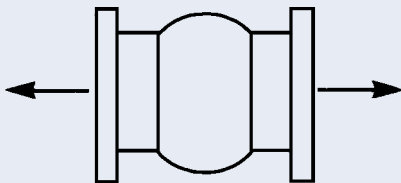
Lateral/Transverse Movement

- Offset movement of one or both pipe flanges
- Both flanges remain parallel to each other while forming angle to axis of joint



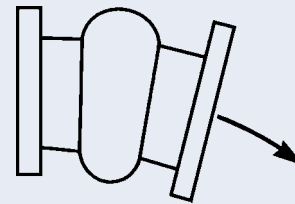
Axial Elongation

- Longitudinal movement lengthens face-to-face dimension along axis of expansion joint or flexible coupling
- Pipe flanges remain perpendicular to axis



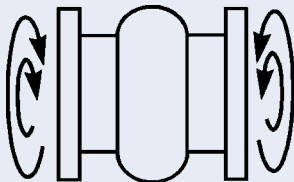
Angular Movement

- Deflection or rotation of one or both flanges
- Forms angle with axis of expansion joint or flexible coupling



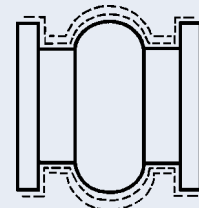
Torsional Movement

- Rotation of one flange with stationary counterpart
- Simultaneous rotation of both flanges in opposing motion



Vibration

- Oscillating movement around axis of expansion joint or flexible coupling
- Pipe flanges remain parallel with each other
- Flanges remain perpendicular to axis
- Mechanical vibration in steel piping system reduced with installation of pipe connectors or expansion joints



Properties of Elastomers

Material Designation		Rating Scale Code	Elastomer Physical and Chemical Properties Comparison									
ANSI / ASTM D1418-77	ASTM D-2000 D1418-77	7 - Outstanding 6 - Excellent 5 - Very Good 4 - Good X - Contact Manufacturer	3 - Fair to Good 2 - Fair 1 - Poor to Fair 0 - Poor	Water Chemical Animal & Vegetable Oil Alkali, Condensed	Alkali, Dilute Oil & Gasoline Lacquers	Oxygenated Hydrocarbons Aromatic Hydrocarbons Aliphatic Hydrocarbons Acid, Concentrated Acid, Dilute	Swelling in Oil Radiation Water Absorption Electrical Insulation	Dielectric Strength Tensile Strength Compression Set Rebound, Cold	Rebound, Hot Dynamic Impermeability Abrasion	Tear Flame Cold Heat	Oxidation Sunlight Weather Ozone	
		COMMON NAME Chemical Group Name										
CR	BC BE	NEOPRENE chloroprene		4 3 4 0	4 4 0 1	2 3 4 6	4 5 4 3	5 4 2 4	5 2 4 5	4 4 4 4	5 5 6 5	
NR	AA	GUM RUBBER polyisoprene, synthetic		5 3 X X	X 0 0 4	0 0 3 3	0 6 5 5	6 6 4 6	6 6 2 7	5 0 5 2	4 0 2 0	
IR	AA	NATURAL RUBBER polyisoprene, synthetic		5 3 X X	X 0 0 4	0 0 3 3	0 6 5 5	6 6 4 6	6 2 2 6	5 0 5 2	4 0 2 0	
IIR	AA	BUTYL isobutene-isoprene		5 6 5 4	4 0 3 4	0 0 4 6	0 4 5 5	5 4 3 0	5 2 6 4	4 0 4 5	6 5 5 6	
CIIR	AA BA	CHLOROBUTYL chloro-isobutene-isoprene		5 6 5 4	4 0 3 4	0 0 4 6	0 4 5 5	5 4 3 0	5 2 6 4	4 0 4 5	6 5 5 6	
NBR	BE BK CH	BUNA-N / NITRILE nitrile-butadiene		4 3 5 0	4 5 2 0	4 6 4 4	5 5 4 1	0 5 5 4	4 5 4 4	3 0 3 4	4 0 2 2	
SBR	AA	SBR / GRS / BUNA-S styrene-butadiene		5 3 X 2	4 0 0 4	0 0 3 3	0 6 5 5	4 5 4 4	4 4 2 5	3 0 5 3	2 0 2 0	
CSM	CE	HYPALON* chloro-sulfonyl-polyethylene		5 6 4 4	4 4 3 1	2 3 4 6	4 5 4 3	5 2 2 2	4 2 4 4	3 4 4 4	6 7 6 7	
FKM	HK	VITON* / FLUOREL** fluorocarbon elastomer		5 6 6 0	4 6 1 0	6 6 6 5	6 5 5 3	5 5 6 2	4 5 5 5	2 6 2 7	7 7 7 7	
EPR	BA CA DA	EPDM ethylene-propylene- diene-terpolymer		5 6 5 6	6 0 3 6	0 0 4 6	0 7 6 6	7 5 4 6	6 5 4 5	4 0 5 6	6 7 6 7	
AFMU		TEFLON† / TFE / FEP fluoro-ethylene-polymers		7 7 7 7	7 7 7 7	7 7 7 7	7 3 7 X	X X X X	X X X 4	X X X 7	7 7 7 7	
S	GE	SILICONE		5 5 5 0	2 X 0 2	0 0 2 6	2 5 6 6	4 0 3 6	6 0 2 0	2 3 6 7	6 6 6 6	

Temperature Ratings

Body Material

Max. Temp.

Chlorobutyl/polyester	+250°F (+120°C)
Chlorobutyl/nylon tire cord	+250°F (+120°C)
Chlorobutyl/fiberglass/Kevlar† with EPDM tube and cover	+300°F (+150°C)
Fluoroelastomer/fiberglass/Kevlar	+400°F (+205°C)

Liner and/or Cover Material

Max. Temp.

EPDM	+300°F (+150°C)
FEP fluorocarbon	+400°F (+205°C)
Fluoroelastomer	+400°F (+205°C)
HNBR (hydrogenated nitrile)	+300°F (+150°C)
Hypalon	+250°F (+120°C)
Natural/gum	+180°F (+80°C)
Neoprene	+250°F (+120°C)
Nitrile	+250°F (+120°C)
PTFE	+450°F (+230°C)

* Hypalon and Viton are registered trademarks of DuPont Dow Elastomers.

** Fluorel is a registered trademark of 3M Companies.

† Teflon and Kevlar are registered trademarks of DuPont.

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Expansion Joint Installation

Preparation

Check service range

- Double check performance limits against anticipated operating conditions
- Check temperature, pressure, vacuum recommendations
- Check total joint deflection—alter as needed to reduce deflection to correct range
- Anchor lines

Check location

- Proper location is usually close to main anchoring point
- Install pipe guide(s) for proper alignment
- Joint should absorb pipeline expansion / contraction between fixed anchor points

Check cover

- Check outside joint cover for damage
- Cover will keep harmful materials from penetrating joint carcass

Check alignment

- Alignment should be 0.125" (3.2 mm) or less
- If 0.125" (3.2mm) must be exceeded, use a special offset joint

Check support

- Weight must not be carried by joint
- Support with hangers or anchors

Check flanges

- Clean all mating flanges
- Do not gouge or mutilate surfaces during cleaning
- Carefully examine used parts for smoothness

Installation

Apply lubricant

- On elastomeric joints only, not required with all PTFE- or FEP-lined joints
- Coat rubber faces with graphite in water, or glycerine, to prevent joint adherence to pipe flanges

Insert bolts from arch side

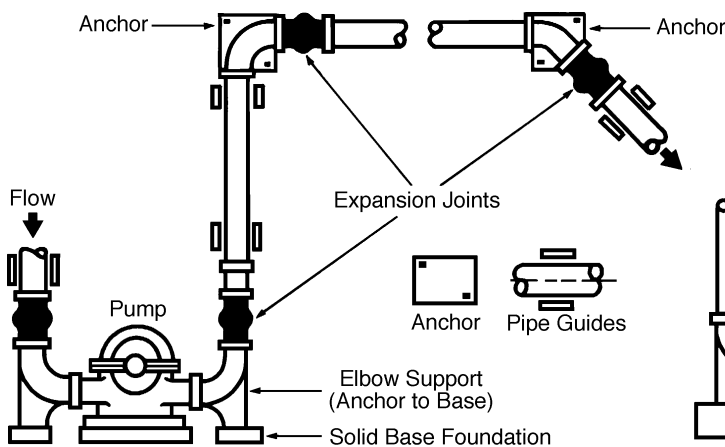
- On elastomeric joints only, not necessary with PTFE joints/couplings with threaded holes
- Set bolt heads adjacent to arch

Tighten bolts

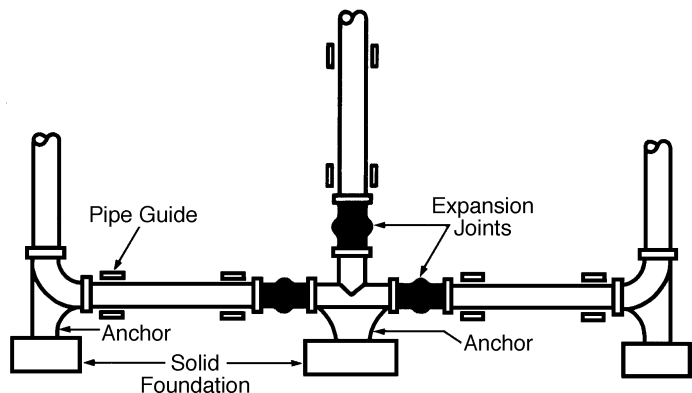
- Elastomeric joints only, tighten gradually and equally, alternating around flange
- Edges of joint must bulge slightly at flange O.D.

Check tightness

- Within one week after application, then periodically
- In hot or cold water systems during cyclical changes



Typical Piping Layout



Proper Use of Anchors in Branch Connections

Troubleshooting

General Precautions

Elastomeric Joints Only

- Use proper care breaking seal
- Drive flanges apart gently with wooden wedges
- Bring insulation only to pipe flange—do not insulate over or around joint
 - Covering joints may make leak detection difficult
 - Insulation could restrict joint movement or cause overheating
- Store in cool, dry, dark area
- Do not rest on flange edges
- Carefully protect joints near welding operations
- Never install spool-type joints next to flangeless check valves or butterfly valves
- Install only against full-face metal flanges or damage/leakage could result; restrictions also apply to raised face or any non-full face flange

Flange leakage

- Check bolt tightness
- Check mating flange surface area for:
 - Grooves
 - Scratches
 - Distorted areas
- Over-extension may indicate need for control units

Liquid weeping from bolt holes

- Check tube portion of joint for leaks; replace if necessary

Cracking at base of arch or flange

- Check installed face-to-face dimensions for over-extension or over-compression
- Check for proper pipe alignment: must not exceed 0.125" (3.2mm)

Excessive ballooning of arch

- Indicates distortion/deterioration of joint strengthening members, or excessive system pressure
- Re-evaluate service conditions
- Install new joint



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Expansion Joint Weights*

For Rubber Spool-Type Joints, and Styles 200 and 204

Joint Size (Inches)	Approx Lbs per Joint				Approx. Lbs / Set	
	Face to-Face Dimension				Retaining Rings	Control Units
6 Inches	8 Inches	10 Inches	12 Inches			
2	3.5	4.0	—	—	3.5	6.5
2-1/2	4.0	5.0	—	—	5.0	7.5
3	4.5	5.5	—	—	5.5	8.0
3-1/2	5.5	6.6	—	—	6.5	8.0
4	6.5	7.8	—	—	6.8	8.0
5	7.5	9.5	—	—	7.5	8.0
6	8.8	11.5	13.8	15.5	8.8	10.0
8	12.5	15.0	20.0	22.0	12.5	13.0
10	16.0	23.5	25.0	28.0	15.8	19.0
12	—	28.8	35.0	41.5	23.5	20.0
14	—	38.0	45.0	53.0	25.5	27.0
16	—	48.0	52.0	60.0	31.0	27.0
18	—	50.0	55.0	68.0	29.5	29.5
20	—	55.0	67.0	78.0	36.0	38.5
24	—	—	77.0	91.0	46.0	45.0
26	—	—	92.0	110.0	50.0	45.0
28	—	—	110.0	120.0	60.0	56.0
30	—	—	118.0	130.0	63.0	58.0
34	—	—	128.0	140.0	82.0	103.0
36	—	—	140.0	152.0	85.0	130.0
42	—	—	—	222.0	113.0	163.0
48	—	—	—	252.0	138.0	150.0
54	—	—	—	275.0	157.0	226.0
60	—	—	—	337.0	180.0	262.0
72	—	—	—	365.0	250.0	321.0
78	—	—	—	405.0	295.0	368.0
84	—	—	—	430.0	350.0	438.0

* For total approximate weights add the weight of the expansion joint in the required face-to-face dimension to the weight of retaining rings and/or control units.

To convert pounds to kilograms, divide by 2.205.

NOTE: For calculating weight of Style 206 EZ-FLO® expansion joint = Style 204 x 0.66.

Example (Metrics):

A 100 mm joint (200 mm face-to-face) with retaining rings equals 3.5 Kg. + 3.1 Kg., or 6.6 Kg. A 350 joint (250 mm face-to-face) with retaining rings and control units equals 20.4 Kg. + 11.6 Kg. + 12.2 Kg., or 44.2 Kg.

For PTFE Couplings, with Flanges and Restricting Bolts

	Pipe Size (Inches)								
	1	1-1/2	2	2-1/2	3	4	5	6	8
Style 214	2 lbs.	4 lbs.	7 lbs.	10 lbs.	12 lbs.	18 lbs.	24 lbs.	29 lbs.	47 lbs.
Style 215	2 lbs.	4 lbs.	8 lbs.	11 lbs.	13 lbs.	19 lbs.	25 lbs.	30 lbs.	47 lbs.

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Application Data Form

For quotation or application recommendations, simply copy this page, fill it out entirely and mail or fax it to Garlock or to your local authorized distributor.

Name: _____	Date: _____
Phone No.: _____	Company: _____
	Fax No.: _____
Pipe Size: _____	Control Units?: _____
Temperature: _____	Hydrostatic Testing?: _____
Pressure/Vacuum: _____	Replacement?: For What Style?: _____
Media: _____	Comments: _____
Movements - Compression: _____	_____
Elongation: _____	_____
Lateral: _____	_____
Face-to-Face Dimension: _____	_____
Drilling (if other than 125/150 lb.): _____	_____
Retaining Rings: _____	_____

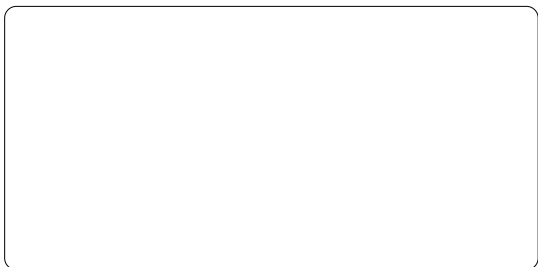
More than just great products...

Beyond offering you the widest available range of products for packing and sealing, Garlock enhances the value of its products with technical services and comprehensive training programs:

- ISO 9002-94 registration for Industrial Gasketing, Industrial Packing, KLOZURE® Oil Seals, Bearing Protectors, Expansion Joints, Hydraulic Components, Mechanical Seals, and Industrial Rubber Products.
- A global network of stocking Authorized Garlock Distributors.
- Factory sales representatives and applications engineers available for problem solving when and where it is needed.
- Toll-free 800 telephone and fax numbers for immediate product information.
- In-plant surveys of equipment and processes, providing the customer with recommendations to identify and eliminate sealing and packing problems before they start.
- The most sophisticated and most comprehensive test facilities available.
- Technical field seminars on all Garlock products.
- Factory-sponsored product training programs, including hands-on seminars, to ensure that Garlock representatives and their distributor personnel are the best in the industry.
- Technical Bulletins to keep you up-to-date on product enhancements and changes.

Customers who specify Garlock fluid sealing products get, at no extra cost, the high quality support needed to run a profitable operation.

AUTHORIZED DISTRIBUTOR



ISO 9002-94
Cert. #001762

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www.garlock.net

Other Garlock facilities are located in:

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Sydney, Australia	61-2-9793-2511	Fax: 61-2-9793-2544
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