

Garlock Expansion Joints

Technical Manual



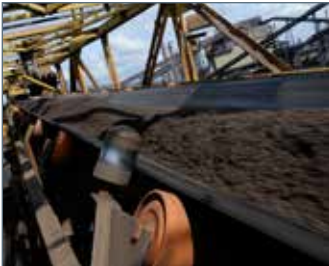
Garlock began manufacturing expansion joints in the 1940s focusing on meeting the needs of the power generation and chemical processing industries. It then worked closely with Engineering and Construction firms in the 1960s to support the growing nuclear industry and as a result maintains a 10CFR50 Appendix B (Safety Related) Quality Program. Garlock expansion joints continue to be the brand leader and were the first to market with several distinct styles of expansion joints. A few of these includes:

- » The GUARDIAN® Series of expansion joints which include FEP liners for chemical applications.
- » The EZ-FLO® arch design which consists of a flowing wide arch that eliminates media build up and reduces fluid turbulence.
- » ABRA-LINE™ expansion joints which utilize a polyurethane elastomer tube for superior abrasion resistance.

Garlock rubber expansion joints are specified where performance, reliability and safety are valued and are used extensively in the following industries.



POWER GENERATION



MINING



PULP & PAPER



CHEMICAL PROCESSING



MARINE



WATER/WASTE WATER



OIL & GAS



FOOD & BEVERAGE



NUCLEAR

Garlock expansion joints offer superior performance, reliability and service life. This in turn improves plant safety, increases the mechanical integrity of equipment and allows customers to gain a competitive advantage in the market place.

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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 pressure and movement.

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

- » Power generating
- » Pulp and paper
- » Chemical
- » Waste water and sewage disposal
- » Marine
- » Heating, ventilating and air conditioning
- » Food & Beverage
- » Oil & Gas and Petrochemical
- » Mining

Joint Selection

To select the proper 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
- » Drilling: if other than standard 125lb. ANSI, determine:
 - › Flange O.D.
 - › Bolt circle
 - › Number of bolt holes
 - › Diameter of hole
- » Need for retaining rings
- » Need for control units
 - › 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	8100	9394	8400	406	404	404HP	404EPS	4394
Abrasive Applications											•	•	•	•	•
Full Vacuum/Suction Applications	•	•	•		•							•	•	•	
Low Pressure									•	•					•
Marine			•	•				•							
Chemical	•	•				•	•								
Nuclear			•	•											

Styles 204, 204HP & 204EPS

Styles 204, 204HP and 204EPS 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 laboratory 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

SPECIAL LINER AND COVER MATERIALS

- » CSM
- » Nitrile
- » Natural Rubber
- » EPDM
- » Neoprene
- » FDA EPDM, Neoprene & Nitrile
- » FKM Fluoroelastomer

	PIPE I.D.		PRESSURE RATING		VACUUM RATING	
	inch	mm	psi	bar	in. Hg	mm Hg
Style 204 [†]	½-4	13-100	165	11	29.9	750
	5-12	125-300	140	10	29.9	750
	14	350	85	6	29.9	750
	16-24	400-600	65	4.5	29.9	750
	26-66	650-1,650	55	3.8	29.9	750
	68-96	1,700-2,400	45	3	29.9	750
	98-108	2,450-2,700	40	2.8	29.9	750
Style 204HP [†]	½-4	13-100	200	14	29.9	750
	5-12	125-300	190	13	29.9	750
	14	350	130	9	29.9	750
	16-20	400-500	110	8	29.9	750
	22-24	550-600	100	7	29.9	750
	26-40	650-1,000	90	6	29.9	750
	42-66	1,050-1,650	80	5.5	29.9	750
Style 204EPS [†]	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

[†] Higher pressure designs are available. Call Garlock with application details and to inquire about larger sizes. Please refer to table on pages 24 & 25 for technical data including sites, dimensions and movements.



STANDARD 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

TEMPERATURE

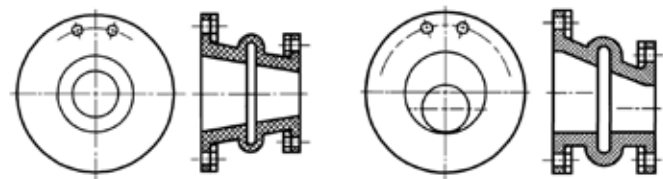
	Max. Temp.
Chlorobutyl/Polyester w/ Natural Rubber	+180°F (82°C)
Standard Chlorobutyl/Polyester	+250°F (+120°C)
Chlorobutyl/Fiberglass/Kevlar** with EPDM tube and cover	+300°F (+150°C)
Fluoroelastomer w/ Fiberglass/Kevlar.....	+400°F (+205°C)

** Kevlar is a registered trademark of DuPont

CERTIFICATIONS

- » CRN's all provinces - 204HP
- » 10CFR50 Appendix B - 204, 204HP, 204EPS
- » ABS Type Approval - 204HP
- » ASTM F-1123 Compliant - 204HP, 204EPS

OPTIONAL CONFIGURATIONS



Concentric Tapered

Eccentric Tapered

Style 204MAX

Style 204MAX is a fully customizable abrupt arched expansion joint for rigid piping systems. This expansion joint is to be used in applications where necessary rated pressures exceed those of the Garlock Style 204EPS designs.

	PIPE I.D.		PRESSURE RATING		VACUUM	
	inch	mm	psi	bar	in. Hg	mm Hg
Style 204MAX	½-4	13-100	Designed as needed		29.9	750
	5-12	125-300	Designed as needed		29.9	750
	14	350	Designed as needed		29.9	750
	16-24	400-600	Designed as needed		29.9	750
	26-66	650-1,650	Designed as needed		29.9	750
	68-96	1,700-2,400	Designed as needed		29.9	750
	98-108	2,450-2,700	Designed as needed		29.9	750
	110-120	2,750-3,000	Designed as needed		29.9	750

Style 204EVS

Extreme Vacuum Service

BENEFITS

- » Arch support ring reduces risk of arch collapse during vacuum service and system start-up
- » Single open arch provides full range of movement
- » The chlorobutyl cover and sealed bolt holes help to eliminate O₂ intrusion
- » Unique combination of rubber and fabric reinforcement, combined with metal body rings, ensure best adhesion and dimensional stability
- » Offset configurations available to accommodate misaligned piping and equipment, eliminating realignment
- » Ideal for the dual challenges of extreme vacuum and aggressive systems dynamics
- » Condensate pump applications with less than ideal support and/or long cantilevered pipe runs




SPECIFICATIONS

Temperature, max.	180°F (82°C)
Pressure, max.	55 psig (3.8 bar)
Vacuum	29.9" Hg
Available sizes	14" through 48" ID

Contact Garlock customer service for pricing and delivery. Use of control units with compression nuts are always recommended.



MOVEMENT CAPABILITIES

	PIPE I.D.		MOVEMENTS	
	inch	mm	inch	mm
Compression 	14-18	350-450	3/4	19
	20-24	500-600	7/8	22
	26-40	650-1,000	1	25
	42-48	1,050-1,200	1-1/8	29
Elongation 	14-18	350-450	3/8	9
	20-24	500-600	7/16	11
	26-40	650-1,000	1/2	12
	42-48	1,050-1,200	1/2	12
Lateral 	14-18	350-450	1/2	12
	20-24	500-600	1/2	12
	26-40	650-1,000	1/2	12
	42-48	1,050-1,000	1/2	12

* Movements listed are non-concurrent. For concurrent movements, contact Garlock.

Style 206 EZ-FLO®

EZ-FLO® expansion joints contain a single wide flowing arch, eliminating the need for filled arches on slurry services. It's self flushing arch design eliminates media build up and reduces turbulence.

BENEFITS

- » Self-flushing design eliminates media buildup and reduces fluid turbulence
- » High pressure ensures longer life and reduces inventory requirements
- » Lightweight design installs easily

STANDARD DESIGN

- » **Tube**
 - › Chlorobutyl resists cracking due to high temperatures, weathering, oxidation and chemicals
 - › Flowing arch design adds pressure resistance and reduces product buildup
- » **Body**
 - › Rubber reinforced tire cord and polyester
- » **Cover**
 - › Homogeneous layer of chlorobutyl elastomer extends to the outside edge of the flange

SPECIAL LINER AND COVER MATERIALS

- » CSM
- » Nitrile
- » Natural Rubber
- » FKM Fluoroelastomer
- » EPDM
- » Neoprene
- » FDA EPDM, Neoprene, Nitrile

TEMPERATURE

Chlorobutyl/Nylon Tire Cord w/ Natural Rubber..... +180°F (82°C)
 Chlorobutyl/Nylon Tire Cord..... +250°F (+120°C)
 Chlorobutyl/Kevlar**
 w/ EPDM tube and cover +300°F (+150°C)

* When EZ-FLO® expansion joints are furnished with special liners, temperature ratings may change
 ** Kevlar is a registered trademark of DuPont



PRESSURE & VACUUM RATING

PIPE I.D.		PRESSURE		VACUUM	
Inch	mm	psi	bar	in. Hg	mm Hg
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	650-1,000	90	6	12	300
42-66	1,050-1,650	80	5.5	12	300
68-96	1,700-2,400	70	5	12	300
98-108	2,450-2,700	60	4	12	300
110-120	2,750-3,000	50	3.5	12	300

* Pressure and vacuum ratings at neutral FF dimension. Extended face to face dimensions result in reduced pressure and vacuum ratings for Style 206 EZ-FLO® expansion joints.

MOVEMENT CAPABILITIES

Please refer to table on pages 24 & 25.

CERTIFICATIONS AND COMPLIANCE

- » ABS Type Approved
- » ISO 15540 Fire Safe***
- » 10CFR50 Appendix B
- » ASTM F1123
- » 46CFR56 (USCG)
- » CRN - All provinces

*** Requires use of fire safe cover

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
- » Can be installed against raised face pipe flanges

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
 - › Metal flanges with rust resistant coating

Note: Style 8100 expansion joints are supplied with rotating flanges drilled to ANSI Class 150# specifications.

* Retaining Rings for 10"/12" ID joints have control units built in.

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	•	•	

CERTIFICATIONS AND COMPLIANCE

- » ABS Type Approved
- » ISO 15540 Fire Safe***
- » ASTM F1123
- » 46CFR56 (USCG)

*** Requires use of fire safe cover



TEMPERATURE / PRESSURE

Nylon-Reinforced Nitrile

OPERATING TEMPERATURE		PRESSURE	
°F	°C	psi	bar
to 120°	to 50°	232	16
120° - 160°	50° - 70°	174	12
160° - 195°	70° - 90°	139	9.5
195° - 210°	90° - 100°	70	5
210° - 230°	100° - 110°	25	1.7

VACUUM RATING*

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

* At nominal FF dimensions only.

MOVEMENT CAPABILITIES

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 - 3	63 - 75	30°
	4	100	25°
	5 - 6	125 - 150	20°
	8	200	15°
	10 - 12	250 - 300	10°

ABRA-LINE™ Style 404, 404HP & 404EPS

Style 404, 404HP and 404EPS ABRA-LINE™ Expansion Joints are specially designed for full vacuum abrasive service applications. The tube material is a proprietary urethane formulation. Style 404 can be constructed as a single or multiple arch design. It can also connect pipe flanges in concentric or eccentric tapers, to join piping of unequal diameters.

DESIGN

» Tube

- › Proprietary urethane formula for abrasive applications
- › Abrupt filled arch configuration provides maximum movement, and pressure and vacuum resistance in slurry application

» Body

- › Composite fabric construction with welded, treated metal body rings for dimensional stability and pressure/vacuum resistance

» Cover

- › Wide selection of elastomers available which are resistant to oxidation

SPECIAL COVER MATERIALS

- » CSM
- » Nitrile
- » FKM Fluoroelastomer
- » Natural Rubber
- » EPDM
- » Neoprene
- » Chlorobutyl

CERTIFICATIONS

- » 404HP - CRN (Alberta)

TARGET MARKETS

- » Power Generation
- » Fertilizer
- » Mining

TEMPERATURE

- » Standard Chlorobutyl/Polyester
w/ ABRA-LINE™ Liner.....+180°F (82°C)

MOVEMENT CAPABILITIES

Please refer to table on pages 24 & 25.



	PIPE I.D.		PRESSURE RATING		VACUUM RATING	
	inch	mm	psi	bar	in. Hg	Hg
Style 404	½ - 4	13 - 100	165	11.3	29.9	750
	5 - 12	125 - 300	140	9.6	29.9	750
	14	350	85	5.8	29.9	750
	16 - 24	400 - 600	65	4.5	29.9	750
	26 - 66	650 - 1,650	55	3.8	29.9	750
	68 - 96	1,700 - 2,400	45	3.1	29.9	750
	98 - 108	2,450 - 2,700	40	2.8	29.9	750
	110 - 120	2,750 - 3,000	30	2	29.9	750
	½-4	13-100	200	14	29.9	750
	5-12	125-300	190	13	29.9	750
Style 404HP	14	350	130	9	29.9	750
	16-20	400-500	110	8	29.9	750
	22-24	550-600	100	7	29.9	750
	26-40	650-1,000	90	6	29.9	750
	42-66	1,050-1,650	80	5.5	29.9	750
	68-96	1,700-2,400	70	5	29.9	750
	98-108	2,450-2,700	60	4	29.9	750
	110-120	2,750-3,000	50	3.5	29.9	750
Style 404EPS	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 - 96	650 - 2,400	100	6.9	29.9	750
	98 - 120	2,400 - 3,000	80	5.5	29.9	750

ABRA-LINE™ Style 406 EZ-FLO®

Style 406 EZ-FLO® expansion joints contain a single wide flowing arch, eliminating the need for filled arches on slurry services. It's self flushing arch design eliminates media build up and reduces turbulence.

DESIGN

- » **Tube**
 - › Proprietary urethane formula for abrasive applications
 - › Flowing arch design adds pressure resistance and reduces product buildup
- » **Body**
 - › Rubber reinforced tire cord and polyester
- » **Cover**
 - › Homogeneous layer of chlorobutyl elastomer extends to the outside edge of the flange

OPTIONAL CONFIGURATIONS

- › Custom Drilling- ANSI, DIN, AWWA, BS, JIS, and special drilling patterns available on request
- › Extended Face-to-face
- › Offsets: lateral, angular, and torsional

SPECIAL COVER MATERIALS

- › CSM
- › Nitrile
- › FKM Fluoroelastomer
- › EPDM
- › Neoprene

MOVEMENT CAPABILITIES

PIPE SIZE I.D.		MOVEMENTS					
		Compression		Lateral		Elongation	
inches	mm	inches	mm	inches	mm	inches	mm
1 - 5	25 - 100	3/4	19	1/2	13	3/8	10
6 - 18	125 - 450	1	25	1/2	13	1/2	13
20 - 24	500 - 600	1 1/4	29	1/2	13	1/2	13
26 - 40	650 - 1000	1 1/4	32	1/2	13	1/2	13
42 - 120	1050 - 3000	1 1/4	35	1/2	13	1/2	13

CERTIFICATIONS

- › CRN - Alberta



TARGET MARKETS

- › Power Generation
- › Fertilizer
- › Mining

RETAINING RINGS

- › Required for all applications; provides metal surface to distribute bolt load evenly, preventing flange damage during bolt tightening
- › Standard material: mild steel with corrosion-resistant coating; galvanized or stainless steel also available

CONTROL UNITS/TIE RODS

- › Recommended on most applications to prevent damage due to excessive pipe movements
- › Standard material: mild steel, galvanized or stainless steel also available

TEMPERATURE

- › Standard Chlorobutyl/Nylon Tire Cord w/ ABRA-LINE™ Liner.....+180°F (82°C)

PRESSURE TABLE

PIPE SIZE I.D.		PRESSURE		VACUUM	
inches	mm	psi	bar	inch Hg	mm Hg
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 - 96	1700 - 2400	70	5	12	300
98 - 108	2450 - 2700	60	4	12	300
110 - 120	2750 - 3000	50	3.5	12	300

ABRA-LINE™ Style 4394

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

BENEFITS

- » Proprietary urethane formula for abrasive applications
- » Lightweight design installs easily and costs less to ship
- » Can be custom designed for even greater movement capabilities
- » Choice of construction materials suitable for wide range of temperatures
- » Available in flanged or sleeve type design, up to 48" max. (1,219mm) I.D.
- » Contact Garlock for large I.D. sizes

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 (75mm) Hg
- » With internal reinforcing rings: up to 15 inches (381mm) Hg

ALTERNATE COVER MATERIALS

- » Neoprene
- » EPDM
- » Nitrile
- » FKM Fluoroelastomer
- » CSM

OPTIONAL CONFIGURATIONS




- » Sleeve end connections
- » External and internal reinforcement rings
- » Extended face to face
- » Multiple convolutions for higher movements

TEMPERATURE

- » Standard Chlorobutyl/Polyester
w/ ABRA-LINE™ +180°F (82°C)



MOVEMENT CAPABILITIES

	PIPE I.D.		MOVEMENT	
	inch	mm	inch	mm
Compression 	2-6	50-150	3/4	19
	8-10	200-250	7-8	22
	12-18	300-450	1-1/8	28
	20-up	500-up	1-5/8	41
Elongation 	2-6	50-150	5/8	16
	8-10	200-250	3/4	19
	12-18	300-450	1	25
	20-up	500-up	1-1/4	31
Lateral 	2-6	50-150	5/8	16
	8-10	200-250	3/4	19
	12-18	300-450	1	25
	20-up	500-up	1-1/4	31

* Movements listed are non-concurrent. For concurrent movements, contact Garlock.

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 protective 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. A gasket is not required on FF flange. FEP is compressible to achieve seal.

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



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 & VACUUM RATING

	PIPE I.D.		PRESSURE		VACUUM	
	Inch	mm	psi	bar	in. Hg	mm Hg
GUARDIAN® 200†	2-4	50-100	165	11	29.9	750
	5-12	125-300	140	10	29.9	750
	14	350	85	6	29.9	750
	16-24	400-600	65	5	29.9	750
	26-30	650-750	55	4	29.9	750
GUARDIAN® 200HP†	2-4	50-100	200	14	29.9	750
	5-12	125-300	190	13	29.9	750
	14	350	130	9	29.9	750
	16-20	400-500	110	8	29.9	750
	22-24	550-600	100	7	29.9	750
	26-30	650-750	90	6	29.9	750

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

MOVEMENT CAPABILITIES

Please refer to table on pages 24 & 25.

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.

This product 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 unequaled.

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 & VACUUM RATING*

	PIPE I.D.		PRESSURE		VACUUM	
	inch	mm	inch	mm	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.

MOVEMENT CAPABILITIES

		PIPE I.D.		MOVEMENTS	
		inch	mm	inch	mm
Compression		3-5	75-125	3/8	9
		6-20	150-500	1/2	12
Elongation		3-5	75-125	3/16	5
		6-20	150-500	1/4	6
Lateral		3-5	75-125	1/4	6
		6-20	150-500	1/4	6

* Movements listed are non-concurrent. For concurrent movements, contact Garlock.

TEMPERATURE

Max. Temp.

Chlorobutyl/Nylon Tire Cord +250°F (120°C)
 Chlorobutyl/Kevlar** Tire Cord w/ EPDM cover ... +300°F (+150°C)

** Kevlar is a registered trademark of DuPont

Styles 214, 215 and 216

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)

STYLE 216

- » Custom Option / Engineered Solution for up to 24 inch inner diameter and multiple convolutions

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
- » 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 24" (800 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

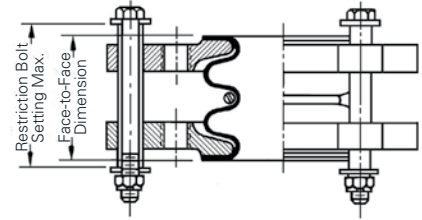
MOVEMENT CAPABILITIES

Style 214 PTFE Flexible Coupling

Pipe Size (Inches)	1	1-1/2	2	2-1/2	3	4	5	6	8	10	12	14	16	18	20	24
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	3-1/2	3-5/8	3-15/16	3-15/16	3-15/16	4	4
Max. Axial Movement, + or -	1/4	1/4	1/4	5/16	3/8	1/2	1/2	1/2	1/2	5/8	5/8	21/32	21/32	21/32	11/16	11/16
Max. Transverse Deflection, + or -	1/8	1/8	1/8	1/8	3/16	1/4	1/4	1/4	1/4	3/8	3/8	3/8	3/8	3/8	13/32	13/32

Maximum angular movement approximately 7°.

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

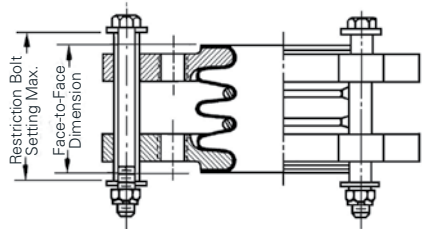


Style 215 PTFE Flexible Coupling

Pipe Size (Inches)	1	1-1/2	2	2-1/2	3	4	5	6	8	10	12	14	16	18	20	24
Nominal Installed Face to-Face	1-3/4	2	2-3/4	3-3/16	3-5/8	3-5/8	4	4	6	4-5/8	4-15/16	4-15/16	5-1/4	5-1/4	5-1/2	5-1/2
Max. Axial Movement, + or -	1/2	1/2	3/4	3/4	1	1	1	1-1/8	1-1/8	15/16	15/16	1	1	1	1-1/16	1-1/16
Max. Transverse Deflection, + or -	1/4	1/4	3/8	3/8	1/2	1/2	1/2	9/16	9/16	9/16	9/16	9/16	9/16	9/16	5/8	5/8

Maximum angular movement approximately 14°.

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



STYLE 216 - CUSTOM

- » Custom Engineered solution
- » Consult Garlock engineering

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 150lbs. 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	10	12	14	16	18	20	24
Flange Dimensions																
Outside Diameter	5-13/16	6-11/16	7-7/16	8-7/16	9-3/16	10-11/16	11-11/16	13-1/4	15-3/4	15-15/16	19	20-15/16	23-1/2	25	27-1/2	32
Thickness	3/8	3/8	1/2	5/6	5/8	11/16	11/16	11/16	11/16	13/16	13/16	13/16	15/16	1-1/16	1-1/16	1-1/8

Style 9394

This multi-convoluted, lightweight expansion joint is designed for lower 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" max. (1,219 mm) I.D. *Contact Garlock for larger ID sizes

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" (101.6mm) 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

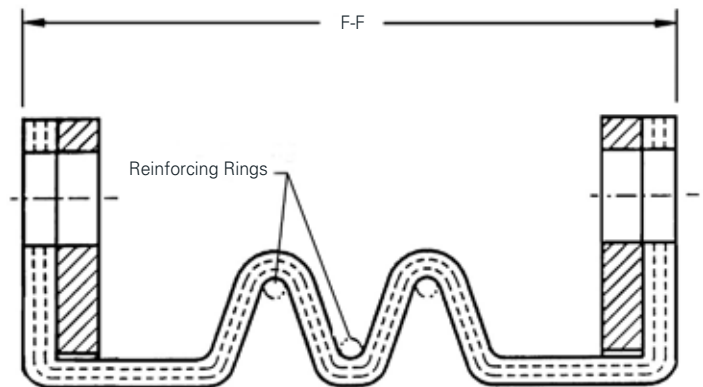
- » Without internal reinforcing rings: up to 3 inches (75 mm) Hg
- » With internal reinforcing rings: up to 15 inches (381 mm) Hg

Contact Garlock if higher vacuum or pressure ratings are required.

MOVEMENT CAPABILITIES

Type Movement		Pipe I.D.		Movement	
		inch	mm	inch	mm
Compression		2 - 6	50 - 150	3/4	19
		8 - 10	200 - 250	7/8	22
		12 - 18	300 - 450	1-1/8	28
		20 - up	500 - up	1-5/8	41
Elongation		2 - 6	50 - 150	5/8	16
		8 - 10	200 - 250	3/4	19
		12 - 18	300 - 450	1	25
		20 & up	500 & up	1-5/8	6
Lateral		2-6	50-150	5/8	16
		8 - 10	200 - 250	3/4	19
		12 - 18	300 - 450	1	25
		20 & up	500 & up	1-1/4	31

Movements listed are per convolution



Cross Section of Style 9394 with Reinforcing Rings

ALTERNATE TUBE AND COVER MATERIALS

- » Neoprene
- » Nitrite
- » CSM
- » PDM
- » FKM Fluoroelastomer
- » Natural Rubber

TEMPERATURE

- Chlorobutyl/Polyester w/ Natural Rubber +180°F (82°C)
- Chlorobutyl/Polyester +250°F (+120°C)
- Chlorobutyl/Fiberglass/Kevlar*
w/ EPDM tube and cover +300°F (+150°C)
- Fluoroelastomer/Fiberglass/Kevlar +400°F (+250°C)

* Kevlar is a registered trademark of DuPont.

Style 8400 Flue Ducts

Garlock offers a wide range of flue duct type expansion joints for lightweight applications, especially for scrubbers, precipitators, bag houses, 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) or 12" (305 mm)
- » If any leg is smaller than 30" (762 mm), joint will be built on a metal form with column corners
- » Consult factory for movement capabilities

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, CSM, FDA neoprene, FDA EPDM, natural rubber or FDA Nitrile.
- » 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

PRESSURE & VACUUM RATING*

	CONSTRUCTION	PRESSURE		VACUUM	
		psi	bar	in. Hg	mm Hg
250	Fabric reinforced Neoprene	3	0.20	6	152.4
300	Fabric Reinforced Chlorobutyl	3	0.20	6	152.4
400	Fabric Reinforced Fluoroelastomer	3	0.20	6	152.4

* 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

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)

MOVEMENT CHART

F - F		Max. Compression		Max. Elongation		Max. Lateral	
inch	mm	inch	mm	inch	mm	inch	mm
6	150	1½	38	½	13	±1	25
9	225	3	76	1	25	±2	50
12	300	4	100	1	25	±2½	63
16	400	6	150	1	25	±3½	89

** Kevlar is a registered trademark of DuPont

Style 7250 FLEXO-MATIC™

Rubber Connectors designed to absorb noise and vibration in air-conditioning, heating, and industrial piping systems.

Garlock FLEXO-MATIC™ Rubber Connectors are composed of three basic elements: the tube, the body or carcass, and the cover. The construction features of each are as follows:

1. The Tube - A protective, leakproof lining made of a synthetic rubber which may vary depending on the service.
2. The Body or Carcass—Consists of fabric and rubber, reinforced with metal.
 - A. Fabric Reinforcement—Polyester, or other suitable fabrics impregnated with an elastomer are wrapped and plied to provide the flexibility and support required between the tube and cover.
 - B. Metal Reinforcement—Helical-wound steel reinforcement wire is firmly embedded in the carcass to provide resistance to both vacuum and pressure.
3. The Cover—A homogeneous layer of synthetic rubber to protect the carcass from corrosive attack or mechanical damage, the rugged cover withstands aging and weathering for a long, trouble-free life.

TEMPERATURE

	Max. Temp.
Chlorobutyl/Polyester w/ Natural Rubber	+180°F (82°C)
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)

** Kevlar is a registered trademark of DuPont

STANDARD SIZES

PIPE I.D.		RECOMMENDED LENGTH	
inch	mm	inch	mm
0 - 2.5	0 - 65	12	305
3 - 4	75 - 100	18	457
5 - 24	125 - 600	24	610



ADVANTAGES

- » Eliminates noise at its source. Garlock FLEXO-MATIC™ rubber connectors are designed to absorb equipment noise before it is transmitted through piping systems.
- » Reduces vibration and lengthens equipment life because high-frequency vibrations are virtually eliminated.
- » Expansion, contraction, and misalignment are all compensated for with FLEXO-MATIC™ connectors.
- » Absorbs water hammer, vibrations of the fluid itself, by the Garlock FLEXO-MATIC™ design.
- » No electrolytic action since there is no metal-to-metal contact between connectors and metal pipe.

PRESSURE & VACUUM RATING

PIPE I.D.		PRESSURE		VACUUM	
inch	mm	psi	bar	in. Hg	mm Hg
2	50	150	10.3	29.9	750
3	75	150	10.3	29.9	750
4	100	150	10.3	29.9	750
5	125	150	10.3	29.9	750
6	150	150	10.3	29.9	750
8	200	150	10.3	29.9	750
10	250	150	10.3	29.9	750
12	300	150	10.3	29.9	750
14	350	150	10.3	29.9	750
16	400	150	10.3	29.9	750
18	450	100	6.9	29.9	750
20	500	100	6.9	29.9	750
24	600	100	6.9	29.9	750

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 often used as flexible connectors between a turbine and condenser, or other shorter full face applications.

STYLE 207

- » Internally flanged for full vacuum and low pressure applications
- » Temperature: To +250°F (+120°C)*
- » Pressure: 29.9"Hg to 15 psig (1.0 bar)

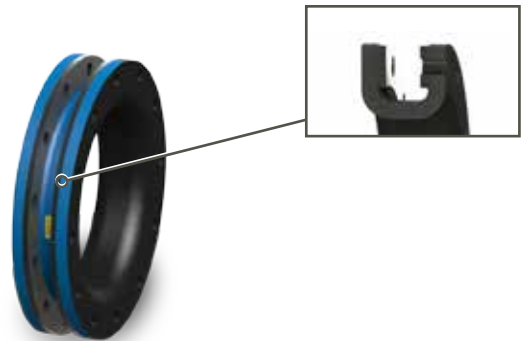
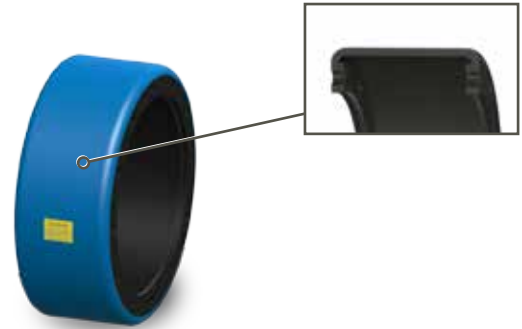
STYLE 208

- » Externally flanged, primarily for vacuum service
- » Temperature: To +250°F (+120°C)*
- » Pressure: 29.9"Hg 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

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

SPECIAL LINER AND COVER MATERIALS

- » Neoprene
- » Nitrile
- » CSM
- » EPDM
- » Fluoroelastomer
- » Natural Rubber



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.

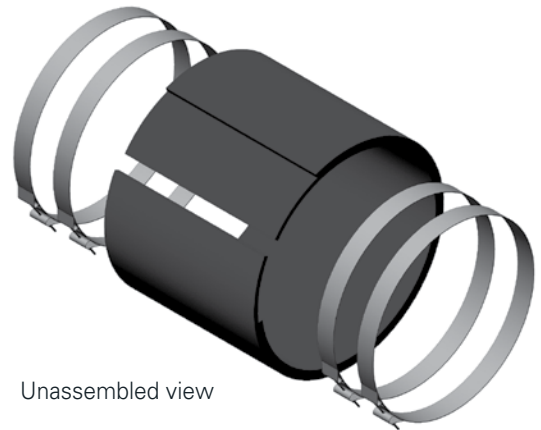
** Hypalon is a registered trademark of DuPont Dow Elastomers.

Style 8420 Split

Easy installation and removal

- » Split design eliminates equipment disassembly, reducing costly downtime.
- » Available in EPDM, Nitrile* and Fluoroelastomer in sizes from 2" to 24" standard. Contact Garlock for larger sizes.
- » Can be customized for your application; contact Garlock with your specifications.

* EPDM and nitrile are standard - other elastomers available on request.



SPECIFICATIONS

	2" Max. Pipe Gap Opening	4" Max. Pipe Gap Opening	6" Max. Pipe Gap Opening
Clamps Required:	4	4	4
Thickness:			
2"-12" Size (50.8mm-304.8mm)	1/4" (6.4mm)	1/4" (6.4mm)	1/4" (6.4mm)
14"-24" Size (355.6mm-609.6mm)	3/8" (9.5mm)	3/8" (9.5mm)	3/8" (9.5mm)
Pressure, Max:	15psi (1.043 bar)	5psi (0.345 bar)	5psi (0.345 bar)
Vacuum:	14" Hg (356mm Hg)	5" Hg (127mm Hg)	5" Hg (127mm Hg)
Temperature, Max.			
with standard adhesive kit	165°F (74°C)	165°F (74°C)	165°F (74°C)
with Viton* adhesive	400°F (204°C)	400°F (204°C)	400°F (204°C)
Movement:	Vibration Only	Vibration Only	Vibration Only
Lateral Misalignment, Max.:	1/2" (12.7mm)	1/2" (12.7mm)	1/2" (12.7mm)
Width of Joint:	8" (203.2mm)	10" (254mm)	12" (304.8mm)

NOTES:

1. All applications above 165°F (74°C) require Viton* adhesive kits
2. T-bolt clamps recommended on all applications; not included with adhesive kits
3. Adhesive kits are sold separately

* Viton is a registered trademark of DuPont Dow Elastomers

Industry Specifics

NUCLEAR

Garlock is the **only** manufacturer of **safety related** elastomeric expansion joints in the United States. Garlock maintains an active nuclear quality program in accordance to **10CFR50 Appendix B and 10CFR21** as detailed in our Quality Manual for select product offerings. We are also an ISO 9001 registered company since 1992 and NUPIC (Nuclear Procurement Issues Committee) audited. Here are a couple of our key products for the nuclear industry:

- » Style 204/204HP
- » Style 8420 (204EPS)
- » Style 206
- » Style 204EVS

U.S. NAVY

Garlock manufactures numerous expansion joints in accordance with U.S. Navy specifications. U.S. Navy specification **MIL-E-15330D** was superseded by **ASTM F 1123**. Contact the product line for information relating to other military specifications.

- » Style 206
- » Style 7706-S Type
- » Style 204 HP
- » Style 8100

U.S. COAST GUARD

Garlock manufactures to applicable Code of Federal Regulations and ASTM standards. **46CFR56 series**

- » Style 206
- » Style 204HP
- » Style 8100

INTERNATIONAL

Garlock has undergone design review and received provincial **Canadian Registration Number (CRN) - (all provinces)**

- » Style 204HP
- » Style 206

Canadian Registration Number (CRN) - Alberta

- » Style 404HP
- » Style 406

ABS TYPE APPROVAL

- » Style 206
- » Style 8100
- » Style 204HP

FIRE RESISTANCE ISO 15540*

- » Style 206
- » Style 8100

* with use of fire safe cover



Style 204HP



Style 7706



Style 8100

Technical Data

STYLE 204/404/GUARDIAN® 200 PRESSURE RATINGS

Pressure and vacuum service

Pipe ID		Pressure		Vacuum	
Inch	mm	psi	bar	in. Hg	mm Hg
1/2 - 4	13 - 100	165	11	29.9	750
5 - 12	125 - 300	140	10	29.9	750
14	350	85	6	29.9	750
16 - 24	400 - 600	65	4.5	29.9	750
26 - 66	650 - 1650	55	3.8	29.9	750
68 - 96	1700 - 2400	45	3	29.9	750
98 - 108	2450 - 2700	40	2.8	29.9	750
110 - 120	2750 - 3000	30	2	29.9	750

STYLE 204HP/404HP/GUARDIAN® 200HP PRESSURE RATINGS

High pressure and vacuum service

Pipe ID		Pressure		Vacuum	
Inch	mm	psi	bar	in. Hg	mm Hg
1/2 - 4	13 - 100	200	14	29.9	750
5 - 12	125 - 300	190	13	29.9	750
14	350	130	9	29.9	750
16 - 20	400 - 500	110	8	29.9	750
22 - 24	550 - 600	100	7	29.9	750
26 - 40	650 - 1000	90	6	29.9	750
42 - 66	1050 - 1650	80	5.5	29.9	750
68 - 96	1700 - 2400	70	5	29.9	750
98 - 108	2450 - 2700	60	4	29.9	750
110 - 120	2750 - 3000	50	3.5	29.9	750

STYLE 206 EZ-FLO®/406 EZ-FLO®/GUARDIAN® 306 PRESSURE RATINGS

High pressure and vacuum service

Pipe ID		Pressure		Vacuum	
Inch	mm	psi	bar	in. Hg	mm Hg
1 - 10	25 - 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 - 96	1700 - 2400	70	5	12	300
98 - 108	2450 - 2700	60	4	12	300
110 - 120	2750 - 3000	50	3.5	12	300

STYLE 204 EPS/404 EPS PRESSURE RATINGS

High pressure service and vacuum service

Pipe ID		Pressure		Vacuum	
Inch	mm	psi	bar	in. Hg	mm Hg
1/2 - 12	13 - 100	250	17.2	29.9	750
14 - 24	350	150	10.3	29.9	750
26 - 96	650 - 1,650	100	6.9	29.9	750
98 - 120	2,400 - 2,700	80	5.5	29.9	750

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 150lb
AWWA C201	Class B

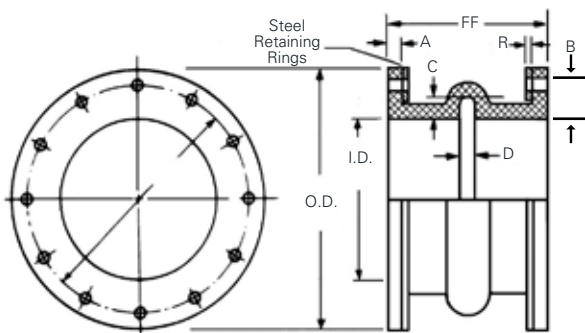
Technical Data

SIZES | DIMENSIONS | MOVEMENTS | STANDARD 150# DRILLING

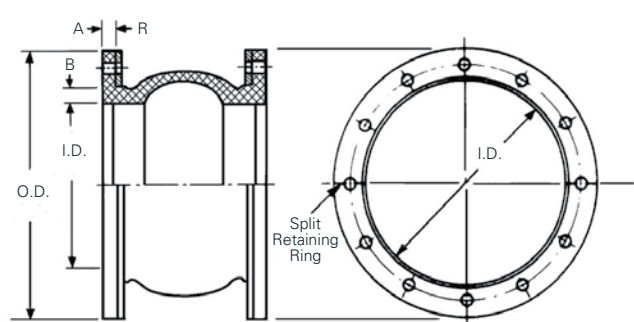
Joint Size (inside Dia.) ¹	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	22
Flange Outside Dia.	4 1/4	4 5/8	5	6	7	7 1/2	9	10	11	13 1/2	17	19	21	23 1/2	25	27 1/2	29 1/2
Bolt Circle Dia.	3 5/8	3 3/2	3 3/8	4 3/4	5 1/2	6	7 1/2	8 1/2	9 1/2	11 1/4	14 1/4	17	18 3/4	21 1/2	22 3/4	25	27 1/4
Number Bolt Holes	4	4	4	4	4	4	8	8	8	8	12	12	12	16	16	20	20
Diameter Bolt Holes	5/8	5/8	5/8	3/4	3/4	3/4	3/4	7/8	7/8	7/8	1	1	1 1/8	1 1/8	1 1/4	1 1/4	1 5/8
Single Arch																	
Std FF	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8	10
Dimensions																	
Arch Ht. C	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2	2	2
200, 200HP, Arch Width D	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
204HP, 404, Std Double Arch FF	10	10	10	10	10	10	10	10	10	10	12	12	12	12	12	14	14
404HP Std Triple Arch FF	14	14	14	14	14	14	14	14	14	14	16	16	16	16	16	18	18
Retaining Ring Thk. R	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
204, 204HP, 200, 200HP, 404, 404HP																	
Max. Axial Compression	1/4	1/4	1/4	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
Max. Lateral Deflection	1/4	1/4	1/4	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Max. Axial Elongation	1/8	1/8	1/8	1/4	1/4	1/4	1/4	1/4	1/4	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16
206 EZ-FLO®																	
Max. Axial Compression	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1	1	1 1/8	1 1/8
Max. Lateral Deflection	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Max. Axial Elongation	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

All specifications in inches unless otherwise noted.

STYLE 200, 200HP, 204, 204HP, 404, 404HP



STYLE 206, 406, 306 EZ-FLO®



24	26	28	30	32	34	36	40	42	48	50	54	60	66	72	78	84	90	96	108	120
32	34¼	36½	38¾	41¼	43¾	46	50¾	53	59½	61¾	66¼	73	80	86½	93	99¾	106½	113¼	126¾	140¼
29½	31¼	34	36	38½	40½	42¾	47¼	49½	56	58¼	62¾	69¼	76	82½	88¾	95½	102	108½	120¾	132¾
20	24	28	28	28	32	32	36	36	44	44	44	52	52	60	60	64	68	68	72	76
1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	2	2	2	2	2⅝	2¼	2⅝	2½	2½	2½
10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12	12
2	2¼	2¼	2¼	2¼	2¼	2¼	2¼	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½
⅞	1	1	1	1	1	1	1	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
14	14	14	14	14	14	14	14	16	16	16	16	16	16	16	18	18	18	18	18	18
18	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22
¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾
⅞	1	1	1	1	1	1	1	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
⅞	1	1	1	1	1	1	1	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
1⅝	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½

204 SINGLE ARCH MOVEMENTS

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

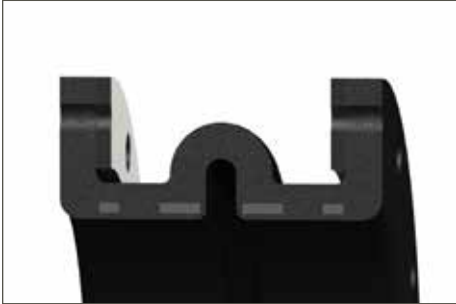
NOTES:

1. 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.
2. Pressure/vacuum ratings are for standard FF dimensions only. Consult Garlock for non-standards.
3. For shorter "FF" dimensions, consult Garlock.
4. Forces to compress, deflect and elongate elastomeric expansion joints are based on ambient temperature and zero pressure in the pipeline. These forces should be considered only as approximate and may vary with the elastomers and fabrics used in construction. To convert force in pounds to kilograms, divide by 2.205.
5. Movement of multiple-arch joints can be determined by multiplying the number of arches by the single-arch values in the table above.
6. For filled-arch joints, reduce the axial compression, elongation and transverse deflection value by 50%.
7. Rated movements are non-concurrent.
8. Control units are recommended for most applications.

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



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

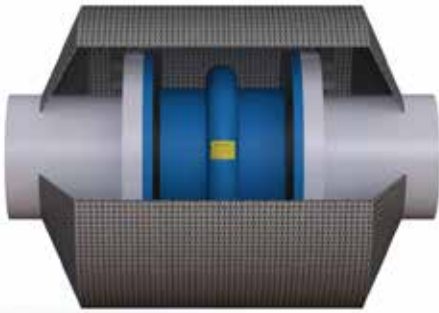


Expansion Joint Accessories

FIRE RESISTANT COVERS

Recommended on applications where flammable liquids are being used or in fire water systems.

- » Consists of several layers of fiberglass fabric with a surface cover of silver-colored high temperature resistant silicone aluminum-glass fabric
- » Tested to ISO 1554 at 800°C for 30 mins for fire resistance
- » Split design which allows for easy installation or inspection
- » Cover is oil resistant and provides added protection against weathering and aging of the expansion joints.



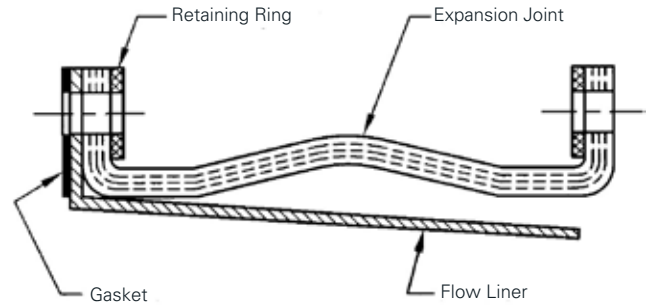
METAL RETAINING RINGS

- » Must be used in all applications; provides metal surface to distribute bolting pressure equally, preventing flange damage during bolt tightening
- » Install against external flange surface
- » 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
- » Recommended for Flow Rates: 8 fps
- » 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 movements
- » Consists of two or more tie rods connected between pipe flanges
- » Triangular end plates (gussets) have two holes for bolting securely to flange and one hole to accommodate the connecting tie rod
- » Spherical washers are incorporated to accommodate moderate piping alignments but also assists with angular, torsional and lateral movements
- » Each rod incorporates double nuts on each end to keep the expansion joint from over-elongating
- » When excessive axial compression is a concern, compression nuts can be incorporated to restrict movements as needed and to protect the expansion joint from damage
- » NOT designed to replace pipeline anchoring

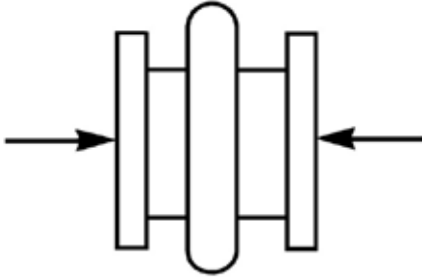
TYPICAL CONTROL UNIT FOR RUBBER EXPANSION JOINT



Types of Pipe Movement

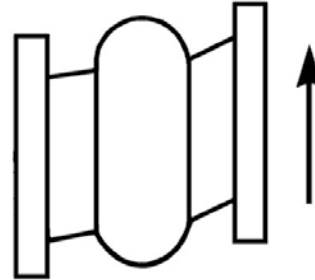
AXIAL COMPRESSION

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



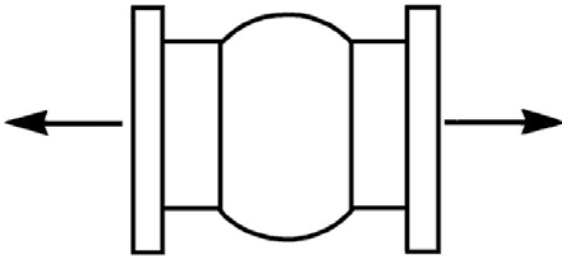
LATERAL/TRANSVERSE MOVEMENT

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



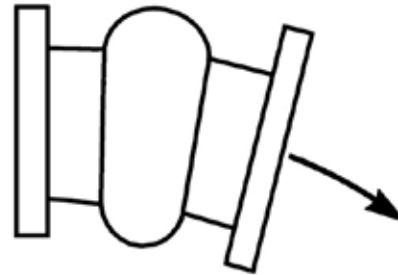
AXIAL ELONGATION

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



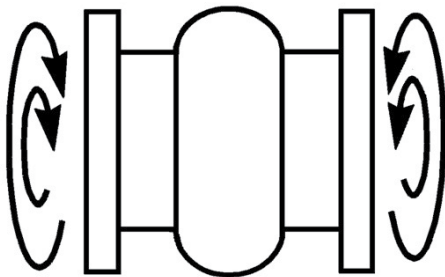
ANGULAR MOVEMENT

- » 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



Typical 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 3 - Fair to Good	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	Electric Insulation	Dielectric Strength	Tensile Strength	Compression Set	Rebound, Cold	Rebound, Hot	Dynamic	Impermeability	Abrasion	Tear	Flame	Cold	Heat	Oxidation	Sunlight	Weather	Ozone
		6 - Excellent 2 - Fair																																
		5 - Very Good 1 - Poor to Fair																																
		4 - Good 0 - Poor																																
		4* - good @ room temp, poor above 180°F (80°C)																																
		X - Contact manufacturer																																
		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	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	6	2	7	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
AU	AA BA	POLYURETHANE	4*	3	5	0	1	5	1	2	3	6	0	1	6	6	4*	3	5	7	3	3	4	6	4	7	6	2	6	4	5	4	6	6
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)
Neoprene/Fiberglass/Kevlar.....	+250°F (+120°C)
Chlorobutyl/Fiberglass/Kevlar†.....	+300°F (+150°C)
Fluoroelastomer/fiberglass/Kevlar	+400°F (+205°C)

Liner and/or Cover Material	Max. Temp.
Chlorobutyl	+300°F (+150°C)
EPDM	+300°F (+150°C)
GUARDIAN® FEP	+400°F (+205°C)
Fluoroelastomer.....	+400°F (+205°C)
HNBR (hydrogenated nitrile).....	+300°F (+150°C)
CSM.....	+250°F (+120°C)
Natural	+180°F (+80°C)
Neoprene.....	+250°F (+120°C)
Nitrile	+250°F (+120°C)
PTFE	+450°F (+230°C)
ABRA-LINE	+180°F (80°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.

NOTE: All layers are rated for max. temperature

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

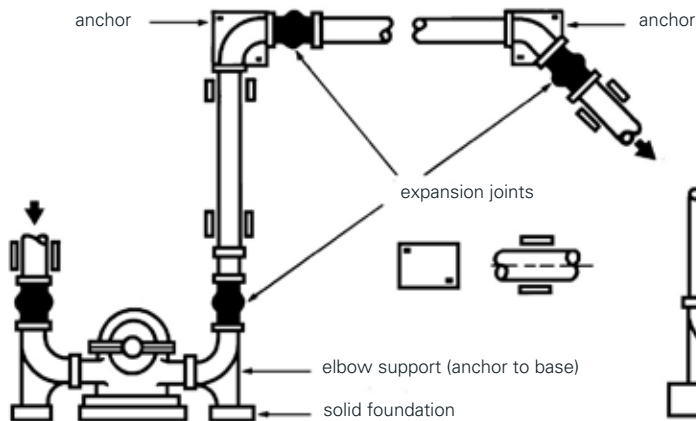
Tighten bolts

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

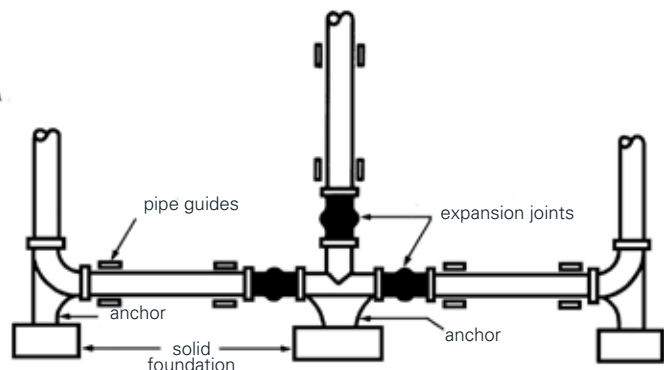
Check tightness

- » 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

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

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



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.

While the utmost care has been used in compiling this brochure, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice.

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

Expansion Joint Weights*

FOR RUBBER SPOOL-TYPE JOINTS AND STYLES 200, 204 & 404

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	5.5
2½	4.0	5.0	-	-	5.0	6.5
3	4.5	5.5	-	-	5.5	6.5
3½	5.5	6.6	-	-	6.5	6.5
4	6.5	7.8	-	-	6.8	5.5
5	7.5	9.5	-	-	7.5	10.5
6	8.8	11.5	13.8	15.5	8.8	10.5
8	12.5	15.0	20.0	22.0	12.5	10.5
10	16.0	23.5	25.0	28.0	15.8	22
12	-	28.8	35.0	41.5	23.5	22
14	-	38.0	45.0	53.0	25.5	29
16	-	48.0	52.0	60.0	31.0	29
18	-	50.0	55.0	68.0	29.5	29
20	-	55.0	67.0	78.0	36.0	26
24	-	-	77.0	91.0	46.0	33
26	-	-	92.0	110.0	50.0	52
28	-	-	110.0	120.0	60.0	52
30	-	-	118.0	130.0	63.0	58
34	-	-	128.0	140.0	82.0	76
36	-	-	140.0	152.0	85.0	76
42	-	-	-	222.0	113.0	115
48	-	-	-	252.0	138.0	150
54	-	-	-	275.0	157.0	162
60	-	-	-	337.0	180.0	298
72	-	-	-	365.0	260.0	361
78	-	-	-	405.0	280.0	301
84	-	-	-	430.0	320.0	393



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

Example (Metric):

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.

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.

FOR PTFE COUPLINGS WITH FLANGES & RESTRICTING BOLTS

	Pipe Size (Inches)								
	1	1½	2	2½	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.

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 125/150lb.): _____	_____
Retaining Rings: _____	_____

Spring Rate Table

STYLE 204 - OPEN ARCH

ID in. (DN)	F-F in. (mm)	Spring Rate lb/in (N/mm)			Angular Spring Rate in-lb/deg (N-m/deg)	Effective Area in ² (mm ²)
		Compression	Elongation	Lateral		
2 (50)	6 (152)	860 (151)	860 (151)	1000 (175)	8 (1)	16 (10118)
2.5 (65)	6 (152)	920 (161)	920 (161)	1060 (186)	13 (1)	20 (12969)
3 (80)	6 (152)	1040 (182)	1040 (182)	1120 (196)	20 (2)	24 (16173)
4 (100)	6 (152)	1100 (193)	1100 (193)	1240 (217)	38 (4)	33 (20995)
5 (125)	6 (152)	1280 (224)	1280 (224)	1400 (245)	70 (8)	44 (27907)
6 (150)	6 (152)	1360 (238)	1360 (238)	1560 (273)	107 (12)	57 (35800)
8 (200)	6 (152)	1040 (182)	1040 (182)	1700 (298)	145 (16)	95 (59915)
10 (250)	8 (203)	1200 (210)	1200 (210)	2000 (350)	262 (30)	133 (83571)
12 (300)	8 (203)	1930 (338)	1930 (338)	2300 (403)	606 (69)	177 (111155)
14 (350)	8 (203)	2200 (385)	2200 (385)	2400 (420)	941 (106)	254 (160176)
16 (400)	8 (203)	2400 (420)	2400 (420)	2800 (490)	1340 (151)	314 (197608)
18 (450)	8 (203)	2667 (467)	2667 (467)	3000 (525)	1885 (213)	380 (238967)
20 (500)	8 (203)	2514 (440)	2695 (472)	3200 (560)	2352 (266)	452 (284253)
22 (550)	10 (254)	3200 (560)	3430 (600)	3500 (613)	3622 (409)	531 (333466)
24 (600)	10 (254)	3429 (600)	3677 (643)	3700 (648)	4620 (522)	616 (386606)
26 (650)	10 (254)	3300 (578)	3539 (619)	4000 (700)	5219 (590)	731 (458794)
28 (700)	10 (254)	3400 (595)	3646 (638)	4200 (735)	6236 (705)	830 (520785)
30 (750)	10 (254)	3700 (6480)	3968 (694)	4500 (788)	7790 (880)	935 (586704)
34 (850)	10 (254)	4150 (726)	4450 (779)	4900 (858)	11223 (1268)	1164 (730322)
36 (900)	10 (254)	4350 (761)	4665 (816)	5200 (910)	13188 (1490)	1288 (808021)
40 (1000)	10 (254)	4800 (840)	5147 (901)	5700 (998)	17966 (2030)	1555 (975201)
42 (1050)	12 (305)	4444 (778)	4765 (834)	5900 (1033)		1735 (1088035)
48 (1200)	12 (305)	4978 (871)	5338 (934)	6600 (1155)		2206 (1383030)
50 (1250)	12 (305)	5333 (933)	5719 (1001)	6900 (1208)		2376 (1489216)
54 (1350)	12 (305)	5689 (996)	6100 (1068)	7400 (1295)		2734 (1713369)
60 (1500)	12 (305)	6400 (1120)	6863 (1201)	8100 (1418)		3318 (2079050)
66 (1650)	12 (305)	6933 (1213)	7434 (1301)	8800 (1540)		3959 (2480075)
72 (1800)	12 (305)	7555 (1322)	8101 (1418)	9600 (1680)		4657 (2916442)
84 (2100)	12 (305)	9333 (1633)	10008 (1751)	13200 (2310)		6221 (3895205)
96 (2400)	12 (305)	10500 (1838)	11259 (1970)	14240 (2492)		8012 (5015340)
108 (2700)	12 (305)	11422 (1999)	12248 (2143)	18800 (3290)		10029 (6276846)
120 (3000)	12 (305)	12400 (2170)	13297 (2327)	20500 (3588)		12272 (7679725)

*All spring rates should be considered approximate and are based on a zero pressure system at ambient temperatures.

Spring Rate Table

STYLE 204HP - OPEN ARCH

ID in. (DN)	F-F in. (mm)	Spring Rate lb/in (N/mm)			Angular Spring Rate in-lb/deg (N-m/deg)	Effective Area in ² (mm ²)
		Compression	Elongation	Lateral		
2 (50)	6 (152)	989 (173)	989 (173)	1150 (201)	9 (1)	16 (10118)
2.5 (65)	6 (152)	1058 (185)	1058 (185)	1219 (213)	14 (2)	20 (12969)
3 (80)	6 (152)	1196 (209)	1196 (209)	1288 (225)	23 (3)	24 (16173)
4 (100)	6 (152)	1265 (221)	1265 (221)	1426 (250)	44 (5)	33 (20995)
5 (125)	6 (152)	1472 (258)	1472 (258)	1610 (282)	80 (9)	44 (27907)
6 (150)	6 (152)	1564 (274)	1564 (274)	1794 (314)	123 (14)	57 (35800)
8 (200)	6 (152)	1196 (209)	1196 (209)	1955 (342)	167 (19)	95 (59915)
10 (250)	8 (203)	1380 (242)	1380 (242)	2300 (403)	301 (34)	133 (83571)
12 (300)	8 (203)	2220 (388)	2220 (388)	2645 (463)	697 (79)	177 (111155)
14 (350)	8 (203)	2530 (443)	2530 (443)	2760 (483)	1082 (122)	254 (160176)
16 (400)	8 (203)	2760 (483)	2760 (483)	3220 (564)	1541 (174)	314 (197608)
18 (450)	8 (203)	3067 (537)	3067 (537)	3450 (604)	2168 (245)	380 (238967)
20 (500)	8 (203)	2891 (506)	3099 (542)	3680 (644)	2704 (306)	452 (284253)
22 (550)	10 (254)	3680 (644)	3945 (690)	4025 (704)	4165 (471)	531 (333466)
24 (600)	10 (254)	3943 (690)	4228 (740)	4255 (745)	5313 (600)	616 (386606)
26 (650)	10 (254)	3795 (664)	4069 (712)	4600 (805)	6001 (678)	731 (458794)
28 (700)	10 (254)	3910 (684)	4193 (734)	4830 (845)	7171 (810)	830 (520785)
30 (750)	10 (254)	4255 (745)	4563 (798)	5175 (906)	8958 (1012)	935 (586704)
34 (850)	10 (254)	4773 (835)	5118 (896)	5635 (986)	12906 (1458)	1164 (730322)
36 (900)	10 (254)	5003 (875)	5364 (939)	5980 (1047)	15167 (1714)	1288 (808021)
40 (1000)	10 (254)	5520 (966)	5919 (1036)	6555 (1147)	20661 (2335)	1555 (975201)
42 (1050)	12 (305)	5111 (894)	5480 (959)	6785 (1187)		1735 (1088035)
48 (1200)	12 (305)	5725 (1002)	6139 (1074)	7590 (1328)		2206 (1383030)
50 (1250)	12 (305)	6133 (1073)	6576 (1151)	7935 (1389)		2376 (1489216)
54 (1350)	12 (305)	6542 (1145)	7015 (1228)	8510 (1489)		2734 (1713369)
60 (1500)	12 (305)	7360 (1288)	7892 (1381)	9315 (1630)		3318 (2079050)
66 (1650)	12 (305)	7973 (1395)	8549 (1496)	10120 (1771)		3959 (2480075)
72 (1800)	12 (305)	8688 (1520)	9316 (1630)	11040 (1932)		4657 (2916442)
84 (2100)	12 (305)	10733 (1878)	11509 (2014)	15180 (2657)		6221 (3895205)
96 (2400)	12 (305)	12075 (2113)	12948 (2266)	16376 (2866)		8012 (5015340)
108 (2700)	12 (305)	13135 (2299)	14085 (2465)	21620 (3784)		10029 (6276846)
120 (3000)	12 (305)	14260 (2496)	15291 (2676)	23575 (4126)		12272 (7679725)

*All spring rates should be considered approximate and are based on a zero pressure system at ambient temperatures.

Spring Rate Table

STYLE 204 - FILLED ARCH

ID in. (DN)	F-F in. (mm)	Spring Rate lb/in (N/mm)			Angular Spring Rate in-lb/deg (N-m/deg)	Effective Area in ² (mm ²)
		Compression	Elongation	Lateral		
2 (50)	6 (152)	3440 (602)	3440 (602)	4000 (700)	30 (3)	3 (1963)
2.5 (65)	6 (152)	3680 (644)	3680 (644)	4240 (742)	50 (6)	5 (3318)
3 (80)	6 (152)	4160 (728)	4160 (728)	4480 (784)	82 (9)	7 (5027)
4 (100)	6 (152)	4400 (770)	4400 (770)	4960 (868)	154 (17)	13 (7854)
5 (125)	6 (152)	5120 (896)	5120 (896)	5600 (980)	279 (32)	20 (12272)
6 (150)	6 (152)	5440 (952)	5440 (952)	6240 (1092)	427 (48)	28 (17671)
8 (200)	6 (152)	4160 (728)	4160 (728)	6800 (1190)	581 (66)	50 (31416)
10 (250)	8 (203)	4800 (840)	4800 (840)	8000 (1400)	1047 (118)	79 (49087)
12 (300)	8 (203)	7720 (1351)	7720 (1351)	9200 (1610)	2425 (274)	113 (70686)
14 (350)	8 (203)	8800 (1540)	8800 (1540)	9600 (1680)	3763 (425)	154 (96211)
16 (400)	8 (203)	9600 (1680)	9600 (1680)	11200 (1960)	5362 (606)	201 (125664)
18 (450)	8 (203)	10668 (1867)	10668 (1867)	12000 (2100)	7541 (852)	254 (159043)
20 (500)	8 (203)	10056 (1760)	10780 (1887)	12800 (2240)	9407 (1063)	314 (196350)
22 (550)	10 (254)	12800 (2240)	13720 (2401)	14000 (2450)	14487 (1637)	380 (237583)
24 (600)	10 (254)	13716 (2400)	14708 (2574)	14800 (2590)	18482 (2088)	452 (282743)
26 (650)	10 (254)	13200 (2310)	14154 (2477)	16000 (2800)	20875 (2359)	531 (331831)
28 (700)	10 (254)	13600 (2380)	14583 (2552)	16800 (2940)	24943 (2819)	616 (384845)
30 (750)	10 (254)	14800 (2590)	15870 (2777)	18000 (3150)	31161 (3521)	707 (441786)
34 (850)	10 (254)	16600 (2905)	17800 (3115)	19600 (3430)	44892 (5073)	908 (567450)
36 (900)	10 (254)	17400 (3045)	18658 (3265)	20800 (3640)	52754 (5961)	1018 (636173)
40 (1000)	10 (254)	19200 (3360)	20588 (3603)	22800 (3990)	71866 (8121)	1257 (785398)
42 (1050)	12 (305)	17776 (3111)	19061 (3336)	23600 (4130)		1385 (865901)
48 (1200)	12 (305)	19912 (3485)	21352 (3737)	26400 (4620)		1810 (1130973)
50 (1250)	12 (305)	21332 (3733)	22874 (4003)	27600 (4830)		1963 (1227185)
54 (1350)	12 (305)	22756 (3982)	24401 (4270)	29600 (5180)		2290 (1431388)
60 (1500)	12 (305)	25600 (4480)	27451 (4804)	32400 (5670)		2827 (1767146)
66 (1650)	12 (305)	27732 (4853)	29737 (5204)	35200 (6160)		3421 (2138246)
72 (1800)	12 (305)	30220 (5289)	32405 (5671)	38600 (6720)		4072 (2544690)
84 (2100)	12 (305)	37332 (6533)	40031 (7005)	52800 (9240)		5542 (3463606)
96 (2400)	12 (305)	42000 (7350)	45037 (7881)	56960 (9968)		7238 (4523893)
108 (2700)	12 (305)	45688 (7995)	48991 (8573)	75200 (13160)		9161 (5725553)
120 (3000)	12 (305)	49600 (8680)	53186 (9308)	82000 (14350)		11310 (7068583)

*All spring rates should be considered approximate and are based on a zero pressure system at ambient temperatures.

Spring Rate Table

STYLE 204HP - FILLED ARCH

ID in. (DN)	F-F in. (mm)	Spring Rate lb/in (N/mm)			Angular Spring Rate in-lb/deg (N-m/deg)	Effective Area in ² (mm ²)
		Compression	Elongation	Lateral		
2 (50)	6 (152)	3956 (692)	3956 (692)	4600 (805)	35 (4)	3 (1963)
2.5 (65)	6 (152)	4232 (741)	4232 (741)	4876 (853)	646 (73)	5 (3318)
3 (80)	6 (152)	4784 (837)	4784 (837)	5152 (902)	939 (106)	7 (5027)
4 (100)	6 (152)	5060 (886)	5060 (886)	5704 (998)	1590 (180)	13 (7854)
5 (125)	6 (152)	5888 (1030)	5888 (1030)	6440 (1127)	2569 (290)	20 (12272)
6 (150)	6 (152)	6256 (1095)	6256 (1095)	7176 (1256)	3603 (407)	28 (17671)
8 (200)	6 (152)	4784 (837)	4784 (837)	7820 (1369)	4509 (509)	50 (31416)
10 (250)	8 (203)	5520 (966)	5520 (966)	9200 (1610)	7707 (871)	79 (49087)
12 (300)	8 (203)	8878 (1554)	8878 (1554)	10580 (1852)	17664 (1996)	113 (70686)
14 (350)	8 (203)	10120 (1771)	10120 (1771)	11040 (1932)	25964 (2934)	154 (96211)
16 (400)	8 (203)	11040 (1932)	11040 (1932)	12880 (2254)	36224 (4093)	201 (125664)
18 (450)	8 (203)	12268 (2147)	12268 (2147)	13800 (2415)	48177 (5444)	254 (159043)
20 (500)	8 (203)	11564 (2024)	12397 (2169)	14720 (2576)	59501 (6724)	314 (196350)
22 (550)	10 (254)	14720 (2576)	15778 (2761)	16100 (2818)	89359 (10098)	380 (237583)
24 (600)	10 (254)	15773 (2760)	16914 (2960)	17020 (2979)	113357 (12809)	452 (282743)
26 (650)	10 (254)	15180 (2657)	16278 (2849)	18400 (3220)	137573 (15546)	531 (331831)
28 (700)	10 (254)	15640 (2737)	16771 (2935)	19320 (3381)	149573 (16902)	616 (384845)
30 (750)	10 (254)	17020 (2979)	18251 (3194)	20700 (3623)	185146 (20921)	707 (441786)
34 (850)	10 (254)	19090 (3341)	20470 (3582)	22540 (3945)	265720 (30026)	908 (567450)
36 (900)	10 (254)	20010 (3502)	21457 (3755)	23920 (4186)	310077 (35039)	1018 (636173)
40 (1000)	10 (254)	22080 (3864)	23676 (4143)	26220 (4589)	419428 (47395)	1257 (785398)
42 (1050)	12 (305)	20442 (3577)	21920 (3836)	27140 (4750)		1385 (865901)
48 (1200)	12 (305)	22899 (4007)	24554 (4297)	30360 (5313)		1810 (1130973)
50 (1250)	12 (305)	24532 (4293)	26305 (4603)	31740 (5555)		1963 (1227185)
54 (1350)	12 (305)	26169 (4580)	28061 (4911)	34040 (5957)		2290 (1431388)
60 (1500)	12 (305)	29440 (5152)	31569 (5524)	37260 (6521)		2827 (1767146)
66 (1650)	12 (305)	31892 (5581)	34198 (5985)	40480 (7084)		3421 (2138246)
72 (1800)	12 (305)	34753 (6082)	37266 (6521)	44160 (7728)		4072 (2544690)
84 (2100)	12 (305)	42932 (7513)	46036 (8056)	60720 (10626)		5542 (3463606)
96 (2400)	12 (305)	48300 (8453)	51792 (9064)	65504 (11463)		7238 (4523893)
108 (2700)	12 (305)	52541 (9195)	56340 (9859)	86480 (15134)		9161 (5725553)
120 (3000)	12 (305)	57040 (9982)	61164 (10704)	94300 (16503)		11310 (7068583)

*All spring rates should be considered approximate and are based on a zero pressure system at ambient temperatures.

Spring Rate Table

STYLE 206 EZ-FLO® ARCH

ID in. (DN)	F-F in. (mm)	Spring Rate lb/in (N/mm)			Angular Spring Rate in-lb/deg (N-m/deg)	Effective Area in ² (mm ²)
		Compression	Elongation	Lateral		
2 (50)	6 (152)	610 (107)	650 (114)	620 (109)	6 (1)	8 (5249)
2.5 (65)	6 (152)	630 (110)	665 (116)	615 (108)	9 (1)	11 (7352)
3 (80)	6 (152)	720 (126)	750 (131)	710 (124)	15 (2)	14 (9808)
4 (100)	6 (152)	765 (134)	870 (152)	825 (144)	30 (3)	22 (13633)
5 (125)	6 (152)	925 (162)	980 (172)	950 (166)	53 (6)	31 (19298)
6 (150)	6 (152)	1150 (201)	1265 (221)	1180 (207)	99 (11)	41 (25944)
8 (200)	6 (152)	1270 (222)	1380 (242)	1230 (215)	193 (22)	67 (42182)
10 (250)	8 (203)	1590 (278)	1725 (302)	1540 (270)	376 (43)	104 (65189)
12 (300)	8 (203)	1910 (334)	2070 (362)	1850 (324)	650 (73)	143 (89780)
14 (350)	8 (203)	1970 (345)	2050 (359)	1890 (331)	877 (99)	189 (118298)
16 (400)	8 (203)	2050 (359)	2160 (378)	1950 (341)	1206 (136)	241 (150743)
18 (450)	8 (203)	2150 (376)	2375 (416)	2210 (387)	1679 (190)	299 (187115)
20 (500)	8 (203)	2350 (411)	2470 (432)	2380 (417)	2155 (244)	363 (227413)
22 (550)	10 (254)	2550 (446)	2650 (464)	2575 (451)	2798 (316)	452 (283498)
24 (600)	10 (254)	2750 (481)	2830 (495)	2790 (488)	3556 (402)	531 (332648)
26 (650)	10 (254)	2900 (508)	3025 (529)	2980 (522)	4461 (504)	616 (385725)
28 (700)	10 (254)	3185 (557)	3275 (573)	3100 (543)	5601 (633)	707 (442729)
30 (750)	10 (254)	3200 (560)	3450 (604)	3120 (546)	6774 (765)	804 (503661)
34 (850)	10 (254)	3600 (630)	3845 (673)	3625 (634)	9697 (1096)	1018 (637304)
36 (900)	10 (254)	4250 (744)	4500 (788)	4300 (753)	12723 (1438)	1134 (710016)
40 (1000)	10 (254)	4380 (767)	4700 (823)	4565 (799)	16406 (1854)	1385 (867221)
42 (1050)	12 (305)	4550 (796)	4870 (852)	5050 (884)	18742 (2118)	1521 (951715)
48 (1200)	12 (305)	4870 (852)	5270 (922)	5930 (1038)	26490 (2993)	1963 (1228756)
50 (1250)	12 (305)	Contact Garlock for Engineering Evaluation				2124 (1328957)
54 (1350)	12 (305)					2463 (1541140)
60 (1500)	12 (305)					3019 (1888867)
66 (1650)	12 (305)					3632 (2271937)
72 (1800)	12 (305)					4301 (2690350)
84 (2100)	12 (305)					5809 (3633205)
96 (2400)	12 (305)					7543 (4717432)
108 (2700)	12 (305)					9503 (5943030)
120 (3000)	12 (305)					11690 (7310000)

*All spring rates should be considered approximate and are based on a zero pressure system at ambient temperatures.

GARLOCK

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