Excellence in Manufacturing

UNAFLEX®

LLC.

ISO 9001:2008 CERTIFIED

RUBBER

Expansion Joints and Flexible Connectors

MADE IN THE U.S.A. WITH PRIDE



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WHY UNAFLEX?

....because we are the GOLD STANDARD in the manufacture of expansion joints and hoses!

Expansion joints are critical system components in a vast array of industries. Their purchase and supply should not be trusted to just anyone.

The UNAFLEX® QUALITY MANAGEMENT SYSTEM is certified to ISO 9001:2008 which insures quality control of the product is rigorous and routinely monitored. Compliance inspections and audits are conducted throughout the year to guarantee continuity and compliance with all ISO requirements.

Our product line includes Rubber Expansion Joints, Metal Bellows Type Expansion Joints, High Temperature Fabric Expansion Joints and PTFE Expansion Joints, as well as Flexible Braided Metal Hose. All are manufactured in our South Carolina facility and we encourage plant tours.

Our state-of-the-art manufacturing facilities provide all of the specialized equipment and tooling necessary to produce the diversified product line UNAFLEX® offers. We provide FULL TRACEABILITY of our products from raw materials through the finished product.

EXPERIENCED FACTORY SUPPORT is available to all customers who desire a more personal and hands-on approach to ensure the proper selection, production, delivery and installation of our product. PROFESSIONAL ENGINEERING SERVICE is provided by staff highly experienced in the use of finite element analysis software and auto-cad.

UNAFLEX® employs some of the most knowledgeable sales engineers in the industry who are available for prompt, courteous and exceptional professional service. Our customer service is THE best in the industry.

Distributors and Dealers in partnership with UNAFLEX® are located throughout the United States of America and are the most reliable and dedicated suppliers available for our specialized product line. Many of our partners stock our full line of products and are able to provide IMMEDIATE service.

FUTURE SUPPORT of our product is how we attract and keep our customers. UNAFLEX®, a wholly owned family business, has a long and successful track record in the industry. We look forward to many more!

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This catalog is a compilation of standards of construction and a guide for specifying and purchasing non-metallic expansion joints. Contained is a handy reference source of pertinent information and factual data for engineers whose daily concern is designing piping systems and overseeing installations. The information contained here is widely used in customer inquiries as a reference for design and performance standards.

Careful selection of the expansion joint design and material for a given application, as well as properly engineered installation are important factors in determining performance. These factors should be fully evaluated by each person selecting and applying expansion joints for any application.

*Rubber expansion joints have been specified and used for many years by consulting engineers, mechanical contractors, pressure vessel designers, plant engineers and turn-key construction firms. They are installed to accommodate movement in piping runs, protect piping from expansion and contraction and insure efficient and economical on-stream operations.

Rubber expansion joints provide time-tested ways to accommodate pressure loads, relieve movement stresses, reduce noise, isolate vibration, compensate for misalignment after plants go on stream and prolong the life of motive equipment. Rubber expansion joints, designed by engineers and fabricated by skilled craftsmen, are used in all systems conveying fluids under pressure and/or vacuum at various temperatures:

- **Air conditioning, heating and ventilating systems** in commercial and institutional buildings, schools, apartments, stores, hospitals, motels, hotels and aboard ships.
- **Central and ancillary power-generating stations** in communities, factories, buildings and aboard ships.
- **Sewage disposal and water-treatment plants**.
- **Process piping** in paper and pulp, chemical, primary metal and petroleum refining plants.

UNAFLEX® manufactures expansion joints in accordance with FSA standards

*"Rubber" in this catalog refers to all types of elastomers, synthetic as well as natural rubber.

Excellence in Manufacturing

UNAFLEX® LLC.

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The Advantages of Rubber Expansion Joints and Flexible Connectors

The Rubber expansion joint industry has allied itself with designers, architects, contractors and erectors in designing and fabricating joints under rigid standards to meet present-day operating conditions. UNAFLEX® has kept abreast of the technological advances in rubber compounding and synthetic fabrics to provide rubber expansion joints having advantages not available in other materials.

- Economy of minimal face-to-face dimensions
- Lightweight construction requires no special handling equipment
- Insulates against the transfer of noise and vibration
- Compensates for misalignment
- No electrolysis
- Greater recovery from movement
- Ease of installation
- Small space requirements
- Low movement forces required
- Reduced fatigue factor
- Reduced heat loss
- Corrosion and erosion resistant
- No gaskets required



Style 150

- **The heavy duty proven "industry work horse"**
- Time-tested performer
- Fabric and steel reinforced
- Constructed for maximum strength and reliability
- Available in multi-arch, taper, offset and special constructions
- For pressure and vacuum



Style 1000

- Heavy Duty
- Double arch movements with single wide arch
- Reduced movement forces
- Fabric and steel reinforced
- Suitable for pressures up to 225 PSI and vacuum service depending on diameter.
- Available in multi-arch, offset and special constructions



Style 189

- Lightweight construction
- Low spring rate forces
- Can be built to handle temperatures up to 350˚F
- Less force to move; allows maximum movements
- Available in multi-arch, taper, offset and for high temperature applications



Style 1100

- Heavy Duty
- Self-flushing
- Highly resistant to chemical and abrasion
- Available in a wide variety of elastomers
- Suitable for vacuum service to 26" mercury



Style 200 (XL)

- Extra-reinforced carcass
- For pressures to 300 PSI
- Available in high temperature constructions suitable for temperatures to 400˚F
- Available in multiple arch, taper, offset and special constructions



Dura-Perm

- The excellent chemical resistance of PTFE/FEP combined with the flexibility of rubber
- Thermal stability
- Anti-stick properties
- Available in multiple arch, taper, offset and special constructions



Style 800

- Minimizes water hammer and hydraulic shock
- Less force to move; allows maximum movements
- "All-in-one" design eliminates the need for retaining rings
- Also available in two-arch design twin-sphere) for greater movement capabilities



Style 600

- Designed to absorb thermal movements and sound vibrations
- Liners and insulation can allow temperatures to 500˚F
- Available in multiple arch, taper, offset and special constructions
- Custom drilled or undrilled



EPDM

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Why Use Rubber Expansion or Vibration Joints?

Three Basic Reasons for Their Use:



1. To Prevent Stresses Due to Expansion and Contraction
2. To Insulate Against the Transfer of Noise and Vibration
3. To Compensate for Misalignment

Rubber or non-metallic expansion joints are flexible connectors fabricated of natural or synthetic elastomers, fluoroplastics and fabrics, and when necessary, metallic reinforcements provide stress relief in piping systems due to thermal and mechanical vibration and/or movements.

UNAFLEX® Rubber Expansion Joints provide relief from stresses caused by thermal expansion and contraction in pipelines. Movement is always experienced in piping systems due to varying ambient temperatures, differences in temperature of materials handled, and differences in composition. Expansion joints absorb this movement and eliminate the danger of buckling or pulling apart with the high replacement costs that would result.

Pumps, compressors and other pulsating equipment generate noise and vibration. The transmission of noise and vibration tends to reduce the efficiency of adjacent equipment and impairs working conditions in offices and plants. Expansion joints serve as reliable insulation against such vibration and noise.

Settlement, load stresses and normal wear of components will frequently cause piping and mechanical equipment to become misaligned. Expansion joints can resolve these problems within their design limits. Special designed expansion joints are available for specific conditions and misalignment.

Engineers can solve anticipated problems of vibration, noise, shock, corrosion, abrasion, stresses and space by incorporating rubber expansion joints into designed piping systems.

Functions

Reduce Vibration

Rubber expansion joints isolate or reduce vibration caused by equipment. Some equipment requires more vibration control than others. Reciprocating pumps and compressors, for example, generate greater unbalanced forces than centrifugal equipment. However, rubber pipe and expansion joints dampen undesirable disturbances including harmonic overtones and vibrations caused by centrifugal pump and fan blade frequency. This is based on actual tests conducted by nationally recognized independent testing laboratory. Rubber expansion joints reduce transmission of vibration and protect equipment from the adverse effects of vibration.

Dampen Sound Transmission

Subsequent to going on stream, normal wear, corrosion, abrasion and erosion eventually bring about imbalance in motive equipment, generating undesirable noises transmitted to occupied areas. Rubber expansion joints tend to dampen transmission of sound because of the steel-rubber interface of joints and mating flanges. Thick-wall rubber expansion joints, compared with their metallic counterparts, reduce considerably the transmission of sound.

Compensate Lateral, Torsional and Angular Movements

Pumps, compressors, fans, piping and related equipment move out of alignment due to wear, load stresses, relaxation and settling of supporting foundations. Rubber expansion joints compensate for lateral, torsional and angular movements, preventing damage and undue downtime of plant operations.

Compensate Axial Movements

Expansion and contraction movements due to thermal changes or hydraulic surge effects are compensated for with strategically located rubber expansion joints. They act as helix springs, compensating for axial movements.

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Advantages over Metal Expansion Joints

- Vibration and sound insulation
- Greater recovery from movement
- Freedom from embrittlement
- Resistance to corrosion
- No gaskets between flanges
- No electrolysis
- Axial and lateral deflection
- Small space requirements
- Lightweight
- Ease of installation
- Higher working pressures

Minimal Face-to-Face Dimensions
Minimal face-to-face dimensions in rubber expansion joints offer untold economies compared with costly bends or loops. The relative cost of the pipe itself may be less or no more than a rubber expansion joint, however, total costs are higher when considering plant space, installation labor, supports and pressure drops.

Lightweight
Rubber expansion joints are relatively light in weight, requiring no special handling equipment to position, contributing to lower installation labor costs.

Low Movement Forces Required
The inherent flexibility of rubber expansion joints permits almost unlimited flexing to recover from imposed movements, requiring relatively less force to move, thus preventing damage to motive equipment.

Reduced Fatigue Factor
Compared to steel, the inherent characteristics of natural and synthetic elastomers are not subject to fatigue breakdown or embrittlement and prevent any electrolytic action because of the steel-rubber interface of joints and mating flanges.

Reduced Heat Loss
Rubber expansion joints reduce heat loss, giving long maintenance-free service. The added piping required for loops contribute to higher operating costs after going on stream due to increase in heat losses.

Corrosion, Erosion Resistant
A wide variety of natural, synthetic and special purpose elastomers and fabrics are available to the industry. Materials are treated and combined to meet a wide range of practical pressure/temperature operating conditions, corrosive attack, abrasion and erosion. Standard and special sizes of rubber expansion joints are available with PTFE/TFE/FEP liners, fabricated to the configurations of the joint body, as added insurance against corrosive attack. Fluoroplastics possesses unusual and unique characteristics of thermal stability, non-sticking surface, extremely low co-efficient of friction and resistance to practically all corrosive fluids and forms of chemical attack.

No Gaskets
Elastomeric expansion joints are supplied with flanges of vulcanized rubber and fabric integrated with the tube, making the use of gaskets unnecessary. The sealing surfaces of the expansion joint equalize uneven surfaces of the pipe flange to provide a fluid and gas-tight seal. A ring gasket may be required for raised face flanges.

Acoustical Impedance
Elastomeric expansion joints significantly reduce noise transmission in piping systems because the elastomeric composition of the joint acts as a dampener that absorbs the greatest percentage of noise and vibration.

Greater Shock Resistance
The elastomeric type expansion joints provide good resistance against shock stress from excessive hydraulic surge, water hammer or pump cavitation.

Maximum Temperature Ratings

	Tube or Cover Elastomer						
Reinforcing Fabric	**Pure Gum Rubber**	**Neoprene**	**Butyl**	**Nitrile**	**Hypalon®**	**EPDM**	**FKM**
Nylon	180°F/82°C	225°F/107°C	250°F/121°C	210°F/99°C	250°F/121°C	250°F/121°C	250°F/121°C
Polyester	180°F/82°C	225°F/107°C	250°F/121°C	210°F/99°C	250°F/121°C	250°F/121°C	250°F/121°C
Aramid	180°F/82°C	225°F/107°C	250°F/121°C	210°F/99°C	250°F/121°C	300°F/149°C	400°F/204°C

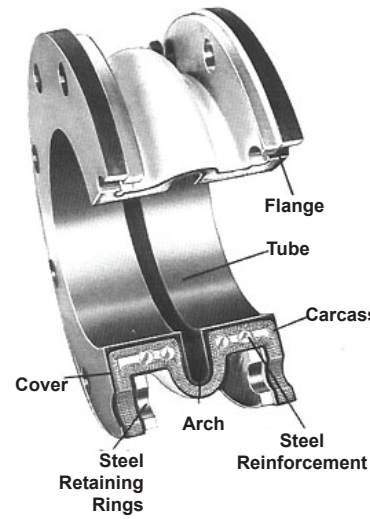
Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from
The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Construction Details

Flanges
Full-faced and made as an integral part of the joint to insure a tight reliable seal. No gaskets are necessary. Drilled to conform to the bolt pattern of the mating pipe flange.

Tube
A single piece of leakproof lining extending flange-to-flange. Can be furnished in natural rubber, neoprene, chorobutyl, Hypalon®, Viton®, nitrile, or other compounds and can also be lined with PTFE/FEP All rubber is specially formulated to provide maximum sound and heat insulation as well as abrasion resistance.

Carcass
Strong, bias-ply construction, high-strength woven polyester reinforcing fabric between the tube and cover. Will not rot or mildew and is thoroughly impregnated with a special friction compound to give maximum adhesion under pressure, vacuum and stress.



List of Elastomers Used in Expansion Joints and Rubber Pipes

MATERIAL DESIGNATION		RATING SCALE CODE	ELASTOMER PHYSICAL AND CHEMICAL PROPERTIES COMPARISON							
ANSI/ASTM D1418-77	ASTM-D-2000 D1418-77	COMMON NAME Chemical Group Name	Alkali, Conc. Animal Veg. Oil Chemical Water	Oxygenated Hydro Lacquers Oil & Gasoline Alkali, Dilute	Acid Dilute Acid, Conc. Alphatic Hydro Aromatic Hydro	Ele. Insulation Water Absorp Radiation Swelling Oil	Rebound-Cold Comp. Set Tinsile Strength Dielectric Str.	Abrasion Impermeability Dynamic Rebound-Hot	Heat Cold Flame Tear	Ozone Weather Sunlight Oxidation
CR	BC BE	**NEOPRENE** Chloroprene	4340	4401	2346	4543	5424	5245	4444	5565
NR	AA	**GUM RUBBER** Polyisoprene, Synthetic	53XX	X004	0033	0655	6646	6627	5052	4020
IR	AA	**NATURAL RUBBER** Polyisoprene, Synthetic	53XX	X004	0033	0655	6646	6226	5052	4020
IIR	AA	**BUTYL** Isobutene-Isoprene	5654	4034	0046	0455	5430	5264	4045	6556
CIIR	AA BA	**CHLOROBUTYL** Chloro-Isobutene-Isoprene	5654	4034	0046	0455	5430	5264	4045	6556
NBR	BE BK CH	**BUNA-N/NITRILE** Nitril-Butadiene	4350	4520	4644	5541	0554	4544	3034	4022
SBR	AA	**SBR/GRS/BUNA-S** Styrene-Butadiene	53X2	4004	0033	0655	4544	4425	3053	2020
CSM	CE	**HYPALON®** Chloro-Sulfonyl-Polyethylene	5644	4431	2346	4543	5222	4244	3444	6767
FKM	HK	**FLUOROCARBON** Elastomer	5660	4610	6665	6553	5562	4555	2627	7777
EPR	BA CA DA	**EPDM** Ethylene-Propylene-Diene-Terpolymer	5656	6036	0046	0766	7546	6545	4056	6767
AFMU		**PTFE/TFE/FEP** Fluoro-Ethylene-Polymers	7777	7777	7777	737X	XXXX	XXX4	XXX7	7777
SI	GE	**SILICONE**	5550	2X02	0026	2566	4036	6020	2267	6666

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Steel Reinforcements
Chemically treated, solid-round, endless steel rings or wire embedded in the carcass (with the UNAFLEX® proprietary method to prevent ring migration) giving maximum strength to the joint. Round rings are used so there will be no sharp edges to cut into the carcass while flexing of the joint occurs, eliminating premature wear.

Steel Retaining Rings
Made of flat-rolled steel, split, beveled and galvanized, painted, fluoropolymer coated or electroplated. Rings are required for installation of the joint.

Cover
The exterior surface of the joint, compounded of fire-retardant neoprene to withstand aging, cracking and corrosion. Other compounds may also be used.

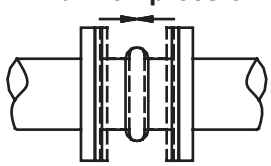
Arch
Arches are built-in as an integral part of the carcass. They function to provide flexibility to the joint in use.

Hand Wrapped Finish
Hand wrapping the finish (although more time consuming in manufacture) insures individual attention so that maximum pressure for curing has been established.

Definition of Performance

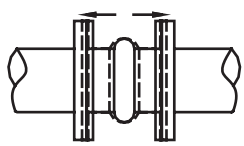
Expansion Joint Motions

Axial Compression



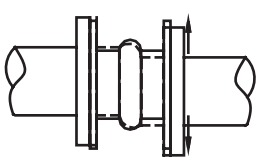
Reduction of face-to-face dimension measured along the axis.

Axial Elongation



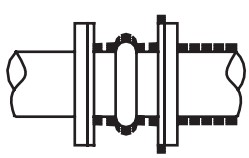
Increase of face-to-face dimension measured along the axis.

Transverse or Lateral Movement



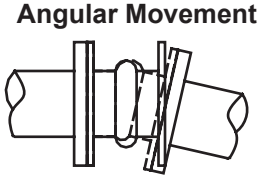
The movement of the joint perpendicular to the axis.

Vibration Absorption



The movement of the joint due to vibrations which are effectively intercepted and insulated against transmission to remainder of system.

Angular Movement



The displacement of the longitudinal axis of the joint from its initial straight line position (a combination of axial elongation and axial compression).

Sound Limiting Characteristics
The ability of a rubber expansion joint to limit or interrupt the transmission of a sound from operating equipment to the piping system.

Resistance to Fluids
The superior corrosion resistance characteristic of natural rubber and synthetic elastomers permits the safe handling of a wide variety of materials within pressure limits and temperature characteristics.

Hydrostatic Testing
If required, joints can be hydrostatic tested up to 1.5 times the Maximum Allowable Working Pressure of the product, for a minimum of 10 minutes without leaks.

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Pressure Characteristics

The pressure ratings decrease with size and/or temperature increases from 200 PSIG (1379 kPa) to 30 PSIG (207) kPa) operating pressure, dependent upon construction design. If requirements exceed these ratings, special constructions can be designed to meet the required conditions. The number of control rods are specified on the basis of the design pressure of the system, not the rated operating pressure of the expansion joint.

Force Pounds & Spring Rates

Force Pounds refers to the force needed to deflect an expansion joint. It consists of the total load required to deflect the expansion joint a distance equal to the maximum rated movement of the product. This force figure is expressed in pounds for compression, elongation and lateral movements. The force figure is expressed in foot-pounds for angular deflection.

The **spring rate** is defined as the force in pounds required to deflect an expansion joint one inch in compression and elongation or in a lateral direction. For angular movement, the spring rate is the force needed in foot-pounds to deflect the expansion joint one degree.

- **Filled Arch.** The spring rate for a Filled Arch Type Expansion Joint is approximately 4 times that of a Standard Single Arch Type. This rate will vary and is dependent upon the material used in the filled arch section of the expansion joint.
- **Multi-Arch.** The spring rate for a Multi-Arch Type expansion joint is equal to the spring rate for a Single Arch Type product divided by the number of arches.

Seismic Testing

Associated Position. Although seismic testing may apply to rigid components of a piping system, it does not apply to an individual non-metallic expansion joint due to its inherent flexibility. The problem is further complicated by the absence of any definitive specification. The UNAFLEX® is unable to quote on seismic testing unless specific information on test procedures and results required becomes available to the industry.

Cycle Life

One full movement cycle is defined as the sum of the total movements incurred when an expansion joint fully compresses from the neutral position then moves to the position of maximum allowed elongation and finally returns to neutral. Cycle life depends not only on the amount of movement, but also on the frequency of cycles or cycle rate. Cycle life can also be affected by installation practices, temperature and type of media being handled.

Testing can involve full movement cycling of an expansion joint at the rate of 10 cycles per minute at rated maximum temperatures and pressures to various duration without failure. Much longer cycle life occurs with reduced movement.

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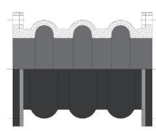
Types of Rubber Expansion Joint Construction

Arch Type

A full face integral flange design is available in both Single Arch and Multiple Arch Types. These basic types can be manufactured to meet the requirements of ASTM F1123-87 (Note: The U.S. Navy previously used MIL-E-15330D, Class A-Type I as its standard specification, but has adopted the ASTM Specification.) These types are available in several construction design series, based on the application pressure requirements.

- **Single Narrow Arch Type.** Construction is of fabric and rubber, reinforced with metal rings or wire. The full face flanges are integral with the body of the joint and drilled to conform to the bolt pattern of the companion metal flanges of the pipeline. This type of rubber face flange is of sufficient thickness to form a tight seal against the metal flanges without the use of gaskets. The shortest face-to-face dimensions are available with this type of construction.

- **Multiple Arch Type.** Joints with two or more arches may be manufactured to accommodate movements greater than those of which a Single Arch Type joint is capable. Multiple Arch joints are composites of standard sized arches and are capable of movements of a single arch multiplied by the number of arches. The minimum length of the joint is dependent upon the number of arches. In order to maintain lateral stability and prevent sagging when the joint is installed in a horizontal position, a maximum number of four (4) arches is recommended.



- **Lightweight Type.** Both the Single Arch and Multiple Arch Types are available in a lightweight series from most manufacturers. Dimensionally the same as the standard product, except for reduced body thickness, this series is designed for lower pressure and vacuum applications.

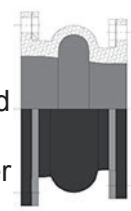
- **PTFE/FEP Lined.** Spool Arch Type joints are available in many standard pipe sizes with Fluoroplastic liners of TFE and/or FEP. These liners are fabricated as an integral part of the expansion joint during manufacture and cover all wetted surfaces in the tube and flange areas. Fluoroplastic provides exceptional resistance to almost all chemicals within the temperature range of the expansion joint body construction. Filled arches are not available.

- **Wide Arch Type.** Similar to the narrow "Arch" type, is available in a metallic reinforced and a non-metallic reinforced design. Generally, the Wide Arch Type features greater movements than the Standard Spool "Arch" type.

- **Non-metallic Reinforced Design**. Constructed similar to the Spool "Arch" type except the carcass does not contain wire or metal ring reinforcement. Pressure resistance is accomplished through the use of a special external flanged retaining ring furnished with the joint.

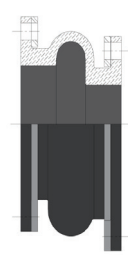
- **Metallic Reinforced Design.** A molded version of the Spool "Arch" type utilizing solid steel rings in a carcass, at the base of the arch. The reduced body thickness requires special retaining rings available from UNAFLEX.

Reducer Type: "Taper"



Reducing expansion joints are used to commend piping of unequal diameters. They may be manufactured as a concentric reducer with the axis of each end concentric with each other or as an eccentric reducer having the axis of each end offset from each other. Tapers in excess of 25 degrees are not desirable. Normally, pressures are based on the larger of the two inside dimensions. Available with or without arches.

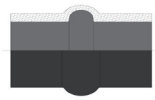
Custom Type



Offset joints are custom built to specifications to compensate for initial misalignment and nonparallelism of the axis of the piping to be connected. Offset joints are sometimes used in close quarters where available space makes it impractical to correct misalignment with conventional piping. Generally, the industry follows the practice of drilling flanges according to pipe size of flanges when not specified otherwise. It is recommended that complete drawings and specifications accompany inquiries or orders for offset joints.

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Sleeve Type



A sleeve design is available in both single and multiple arch types. Both types are available in several construction design series, based on the application pressure and flexibility requirements.

- **Sleeved Arch Type.** This joint is similar to the "Arch" Type except that the capped sleeve ends have an I.D. dimension equal to the O.D. of the pipe. These joints are designed to slip over the straight ends of the open pipe and be held securely in place with clamps. This type of joint is recommended only for low to medium pressure and vacuum service because of the difficulty of obtaining adequate clamp sealing.

- **Lightweight Type.** Dimensionally the same as the sleeve "Spool Type", except for reduced body thickness. This series is designed for very low pressure and vacuum applications. Joints are available in single and multiple arch types. This type generally offers greater flexibility than the spool type.

- **Enlarged End Type.** This joint can be manufactured in the same design as the spool type and lightweight type. The sleeve ends on this design are the same dimension as the O.D. of the pipe, while the rest of the joint is the same dimension as the I.D. of the pipe.

Special Flange Type

These expansion joint types are available with modifications to the flanges. These modifications include enlarged flanges, different drill patters and weld-end stubs.

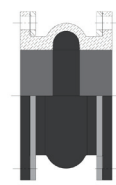
- **Enlarged Flange Type**. Expansion joints utilizing a full face integral flange design can be furnished with an enlarged flange on one end. (For example, an 8" (203mm) expansion joint can be fabricated with a flange to mate to an 8" (203mm) pipe flange on one end; and a 12" (305mm) flange on the other end to mate to a 12 (304mm) pipe flange. Additionally, drilling of different specifications may be furnished. For example, an expansion joint can be furnished with one end drilled to AINSI B16.5, Class150, and the other end drilled to MIL-F-20042C. Note: Special control rods will be required when needed.

- **Weld-End Type.** Expansion joints are offered with weld-end nipples which allow the unit to be directly welded into place on the job or welded to associated equipment before final installation. The design is basically the Sleeve Type expansion joint bonded to matching steel weld-end nipples. Normally, there are steel band clamps around the periphery of the rubber sleeve end to reinforce the rubber-metal bond.

Designs for Reduction of Turbulence and Abrasion

The open-arch design of the Standard Spool Type Expansion Joint may be modified to reduce possible turbulence and to prevent the collection of solid materials that may settle from the solution handled and remain in the archway.

- **Filled Arch Type**. Arch-type expansion joints may be supplied with a bonded-in-place soft rubber filler to provide a smooth interior bore. Filled arch joints also have a seamless tube so the arch filler cannot be dislodged during service. Filled arches, built as an integral part of the carcass, decrease the flexibility of the joint and should be used only when necessary. Movements of expansion joints with filled arches are limited to 50% of the normal movements of comparable size expansion joints with unfilled (open) arches.



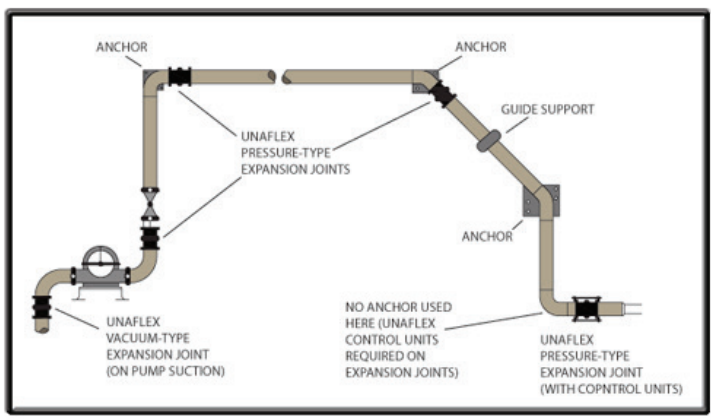
- **"Top Hat" Liner**. This product consists of a sleeve extending through the bore of the expansion joint with a full face flange on one end. Constructed of hard rubber, metal or Fluoroplastic, it reduces frictional wear of the expansion joint and provides smooth flow, reducing turbulence. This type sleeve should not be used where high viscosity fluids, such as tars, are being transmitted. These fluids may cause "packing-up or caking" of the arch area, which reduces movements and in turn may cause premature expansion joint failure. Baffles are rarely required on rubber expansion joints.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Typical Rubber Expansion Joint Applications

Industrial Applications

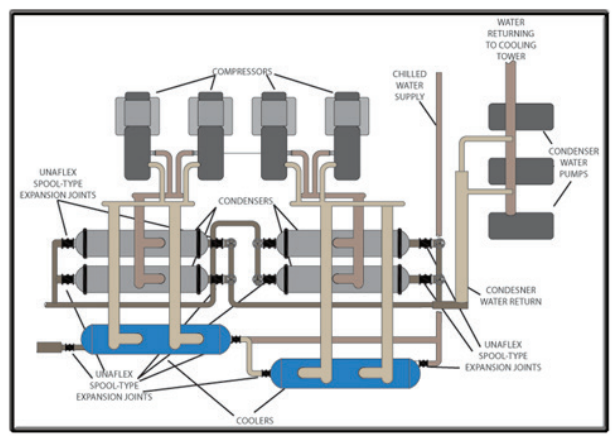
Piping installations are one of the most important locations for UNAFLEX® Expansion Joints as they compensate for the thermal expansion and contraction in the line, as well as reduce the transmission of noise and vibration.



Heating/Air Conditioning and Ventilating

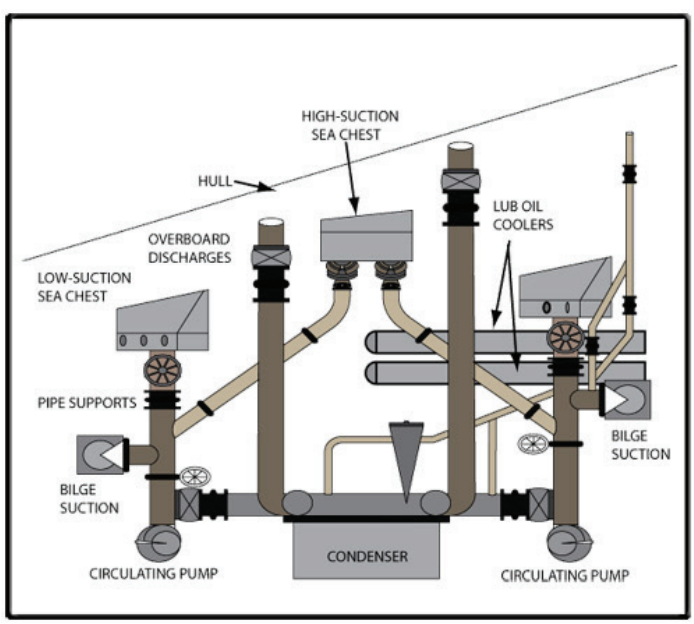
UNAFLEX® Expansion Joints are used on the header connections to the condenser and to the cooler, as well as in the water circulating lines on both hot and chilled water lines.

They will relieve stresses caused by changes in temperature as well as eliminate the transmission of noise and vibration.



Marine Applications

UNAFLEX® Expansion Joints eliminate destructive electrolytic action, as well as insulate the transmission of noise and vibration.



Central Power Stations

Due to their compactness and ease with which they accommodate all types of movement, UNAFLEX® Expansion Joints are adaptable to a variety of uses in central power plants. Applications include condenser auxiliary exhaust lines, connections to air ejector, condensate pump, and low-pressure feed suction lines. Special joints available for temperatures up to 350°F and 400°F in flue duct applications.

Sewage Treatment Plants

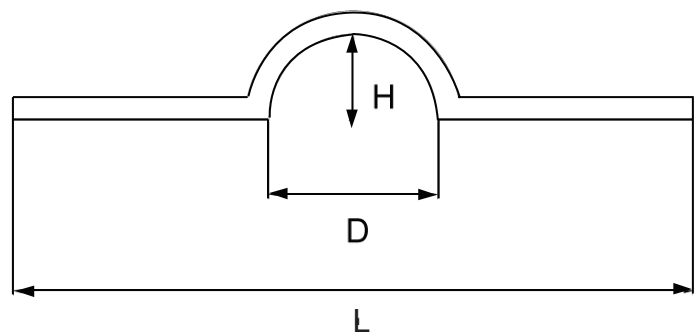
UNAFLEX® Rubber Expansion Joints are used on the aeration lines, grit pump line, raw sewage lines and sludge pumps.

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" SLIM-FLEX" EPDM

Pipe Size	Actual I.D. (in.)	Max Pressure (PSIG)	Vacuum (in. Hg)	Max Temp. (°F)	Style 1081			
					Overall Length	Comp (in.)	Ext. (in.)	Lateral (in.)
1-1/2	1-15/16	90	15	250	8	1-3/4	3/4	3/4
2	2-3/8	90	15	250	8	1-3/4	3/4	3/4
2-1/2	2-7/8	90	15	250	8	1-3/4	3/4	3/4
3	3-1/2	90	15	250	8	1-3/4	3/4	3/4
4	4-1/2	90	15	250	8	1-3/4	3/4	3/4
5	5-9/16	50	15	250	8	1-3/4	3/4	3/4
6	6-5/8	50	15	250	8	1-3/4	3/4	3/4
8	8-5/8	35	15	250	8	1-3/4	3/4	3/4
10	10-3/4	35	15	250	8	1-3/4	3/4	3/4
12	12-3/4	35	15	250	8	1-3/4	3/4	3/4





L=8 Inch D= 2 Inch H= 1 Inch

Tube 1/8: EPDM + 2 Plies Nylon Cord 1260D2 + Cover 1/16" EPDM

Size	I.D.	Length (in.)
1-1/2	1.900	8
2	2.375	8
2-1/2	2.875	8
3	3.500	8
3-1/2	4.000	8
4	4.500	8
5	5.563	8
6	6.625	8
8	8.625	8
10	10.750	8
12	12.750	8

"SUPREME" SPOOL-TYPE EXPANSION JOINTS

UNAFLEX® "SUPREME" Spool-Type Expansion Joints are available in three basic styles:

- Style 150 for pressure and vacuum
- Style 1000 for pressure, vacuum and greater movement
- Style 200 for high-pressure service. Joints that handle up to 500°F are available.
- Style 200XL for extra high pressure service (consult factory)



These basic types can be manufactured to meet the requirements of ASTM F1123-87 (Note: The U.S. Navy previously used MIL-E-15330D, Class A-Type I as its standard specification, but has adopted the ASTM Specification).

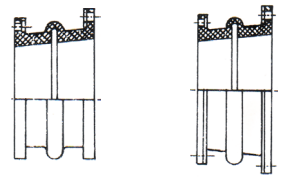
UNAFLEX® Expansion Joints can be made with filled arch, multiple arches, PTFE and (FEP)-lined, sleeve ends, without arch, tapered (eccentric or concentric), with enlarged arch and with special tube compounds for air, gas, oil, petroleum products, acids and chemicals of many types.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

UNAFLEX® "SUPREME" TAPERED EXPANSION JOINTS

UNAFLEX® "SUPREME" Tapered Spool-Type Expansion Joints are available in four types; Style 150, 1000, 200 and 200XL. Tapered joints are used to connect flanges with different diameters, whether parallel or offset, with initial misalignment less than 1/8-inch.

ECCENTRIC CONCENTRIC

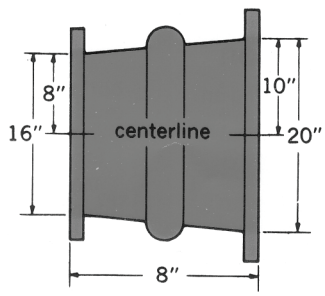


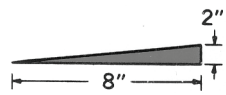
Tapered joints can be made with the following variations: with filled arch, sleeve ends, without arch; with special tube materials; with larger arch; with straight section on smaller end of joint to assure clearance of bolts on eccentric type joints and on joints with considerable taper.

Both concentric and eccentric shapes are available in a wide variety of sizes. As with the regular expansion joints, when piping is not anchored, control units must be used to prevent over-elongation of the joints.

For determining operating characteristics, use the largest I.D. dimension of the tapered expansion joint for specifying.

Note: UNAFLEX® Flexible Rubber Pipe can also be supplied in the tapered construction.





Example:
20" ID x 16" ID x 8" F-F
Arctan (2/8)=Arctan (0.25)=14 degrees
Note: drawing not to scale

Engineering Data for Tapered Expansion Joints

The degree of taper should not exceed 25°. Where a taper is more than 15° a filled arch is recommended. Where a filled arch is utilized, the available movement will be decreased 50% from that of an open arch. Where a proposed taper is greater than 25°, we recommend a steel reducer be utilized and a spool-type expansion joint be used in the adjacent piping.

The above guides are generally applicable to concentric tapers. Where an eccentric taper exceeds 25°, consult UNAFLEX® engineering department.

ORDERING INFORMATION FOR STYLES 150, 200 & 1000

Temperature Limits for Continuous Service			
Style	Temp	Style	Temp
150	180°	150 HTS	300°
200	180°	200 HTS	300°
1000	180°	1000 HTS	300°
1100	180°	150 V	400°
150 HT	250°	200 V	400°
200 HT	250°	1000 V	400°
1000 HT	250°	189 SG	400°
1100 HT	250°		

To receive a quotation or when placing an order, please specify the following:

- Style (140, 150, etc.)
- Quantity
- Inner Diameter
- Flange Drilling
- Materials Conveyed in Line
- Pressure and/or Vacuum Ranges
- Temperature Range
- Movements-Axial Compression, Extension and Lateral Deflection

Specify UNAFLEX® "SUPREME" Rubber Expansion Joints as follows:

Minimum Face-to-Face Dimensions For Styles 150, 200 & 1000			
Joint Size I.D. (in.)	Single Arch Min. f-f (in.)	Double Arch Min. f-f (in.)	Triple Arch Min. f-f (in.)
1/2 to 6	6	10/12*	12/16*
8	6	10/12*	14/18*
10	8	12/16*	14/20*
12	8	12/16*	14/20*
14 to 20	8	12/16*	16/20*
22 to 24	10	14/16*	18/22*
26 to 34	10	14/16*	18/22*
36 to 40	10	14/18*	18/22*
42 to 96	12	14/18*	18/22*
*Wide Arch Style 1000			
Note: These face-to-face dimensions are only a guide. Consult factory for special requirements.			

Contact our Engineering Department for Complete Data and Specifications

Call Toll Free: (800) 327-1286, Fax: (954) 941-7968
or visit *www.unaflex.com or email: sales @unaflex.com*

Style 150–For pressure/vacuum service
Style 189–For high temp and low spring rate, pressure limited to 25 psi
Style 200–For heavy duty high pressure/vacuum service
Style 200XL–For very high pressures. Consult factory for construction details
Style 1000–Wide arch offers more movement. Hand wrapped build process offers a large variety of construction variations.
Style 1100–Wide arch offers more movement. Molded design keeps cost low.

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"SUPREME" Lightweight and U-Type Expansion Joints

Unaflex® Style 189 Dimensions & Specifications

Unaflex® Style 189 Dimensions & Specifications					
Arch	**Joint Size I.D. (in.)**	**Min. Face-to-Face (in.)**	**Comp. (in.)**	**Ext. (in.)**	**Lateral (in.)**
Single	2 to 8	6	7/16	5/16	5/8
	10 to 13	8	11/16	9/16	5/8
	14 to 24	8	13/16	11/16	5/8
	25 to 30	8	15/16	13/16	5/8
Double	2 to 5	12	7/8	5/8	1-1/4
	6 to 13	12	1-3/8	1-1/8	1-1/4
	14 to 24	13	1-5/8	1-3/8	1-1/4
	25 to 30	13	1-7/8	1-5/8	1-1/4
Triple	2 to 5	16	1-5/16	15/16	2-1/2
	6 to 13	16	2-1/16	1-11/16	2-1/2
	14 to 24	18	2-7/16	2-1/16	2-1/2
	25 to 30	18	2-13/16	2-7/16	2-1/2

Maximum operating pressures for all sizes is 25 PSIG internal pressure and 15 inches of mercury vacuum

UNAFLEX® "SUPREME" Style 189 Lightweight Rubber Expansion Joints are available in either round or rectangular (with arch) configurations. They are recommended for pressure and limited vacuum applications such as: air, gas and water service where pressures are low and medium-not too severe. They may also be used on equipment where temperatures do not exceed 180°F.

They feature a lighter wall and flange thickness to provide flexibility. Their duck plies are reinforced with steel rings. Style 189 Joints are also available for temperatures up to 500°F and can be made with sleeve ends.



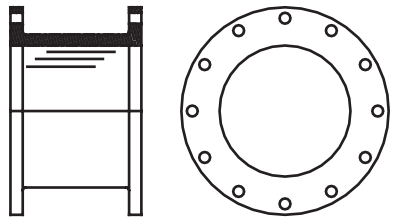
Unaflex Style 145, 155, 156, 157 and 185

UNAFLEX® "SUPREME" U-Style Rubber Expansion Joints form a flexible connection between equipment outlet and inlet flanges. They are normally constructed of a natural rubber tube, several heavy plies of rubber or neoprene–impregnated fabric and a neoprene cover to protect the carcass. Consult engineering department for maximum operating temperature. They are available in the following configurations.

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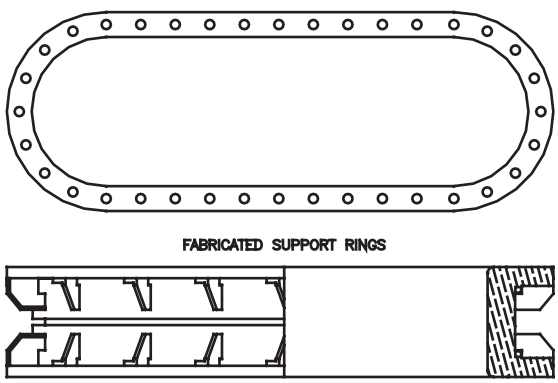
Round (Style 156 & 185)

Lightweight rubber expansion joints available in Style 156, “U”-Type, no arch, for vacuum only; Style 185, round “U”-Type, no arch, steel reinforced for vacuum and pressure. Style 156 body is of duck and rubber without metal reinforcing. Style 185 is constructed with steel reinforcement. These units can also be supplied with offset features.



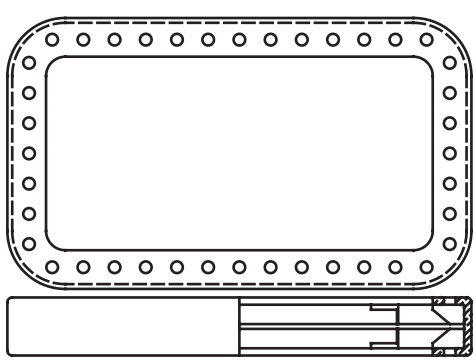
Oval (Style 155 & 157)

With external flange. Available in Style 155 for vacuum only and Style 157 for pressure and vacuum. Used in installations where external bolting is desired. Style 155 withstands 30 inches of vacuum with standard flat steel retaining rings. Style 157 is designed for both 30 inches of vacuum and 25psi gauge internal pressure and are designed with special steel fabricated support rings.



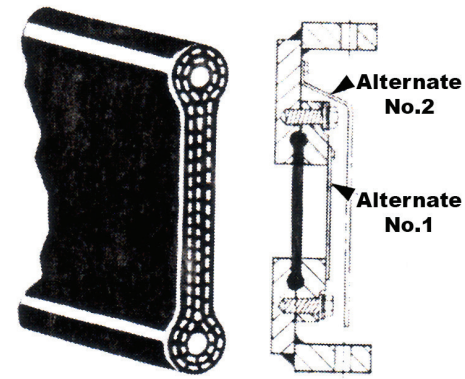
Rectangular (Style 145)

With internal flange (no arch) for vacuum and pressure. They allow ample axial and lateral movement capable of withstanding 30-inches of vacuum, or 25psi gauge internal pressure. Retaining flanges are provided for support.



Belt “Dogbone” Type

A molded construction of plies of rubber impregnated fabric, covered and spliced endless, to a specified peripheral dimension. Used as a flexible connection in central power stations on condensers. Designed for compression and lateral movements for full vacuum service and a maximum pressure of 25 PSIG (172 KPa). Must be used with special clamping devices normally supplied by the condenser equipment manufacturers.



Spherical Molded Type

A molded spherical design is manufactured in two types. One type utilizes solid floating metallic flanges. The other type has built-in full face integral flanges. The design incorporates a long radius arch, providing additional movement capabilities when compared to other types. The arch is self-cleaning, eliminating the need of Filled Arch Type construction. These types are recommended for basically the same applications as the Spool “Arch” type.

Floating Flange Spherical Type. The carcass does not contain metallic reinforcement. Utilizing special weave fabric for reinforcement, the spherical shape offers a high burst pressure. Movements and pressure ratings should be obtained directly from manufacturer. Furnished complete with solid floating flanges, this design is generally available for pipe sizes under 30 inches (762mm) in diameter and in single or double arch designs.

Integral Flange Spherical Type. Basically the same design as the Floating Flange Spherical Type, except full face flanges are integral with the body of the joint. Pressure-resisting hoop strength is a function of the special weave fabric and its ply placement in the body, as well as the design of the retaining rings. Special retaining rings are sometimes required.

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Dimensions for Spool-Type (single Arch) Expansion Joints

Measurement In (in.)			Bolt Holes		Bolt Hole Diameter	Retaining Ring I.D.	Flange Thickness	Effective Area In. Sq.
Joint Size N.D.	Face-to-Face	Flange O.D.	Bolt Cir. Dia.	No. of Bolts				Style 150, 189, 200, 200XL
½	6	3 ½	2 ⅜	4	⅝	1 ¼	½	4.91
¾	6	3 ⅞	2 ¾	4	⅝	1 ⅝	½	5.94
1	6	4 ¼	3 ⅛	4	⅝	1 ⅞	9⁄16	7.07
1 ¼	6	4 ⅝	3 ½	4	⅝	2 ⅛	9⁄16	9.62
1 ½	6	5	3 ⅞	4	⅝	2 ⅜	9⁄16	11.05
2	6	6	4 ¾	4	¾	3 ⅛	9⁄16	15.90
2 ½	6	7	5 ½	4	¾	4 ⅛	9⁄16	19.63
3	6	7 ½	6	4	¾	4 ⅝	9⁄16	23.76
4	6	9	7 ½	8	¾	5 ⅞	9⁄16	33.18
5	6	10	8 ½	8	⅞	6 ⅞	9⁄16	44.18
6	6	11	9 ½	8	⅞	7 ⅞	⅝	56.75
8	6	13 ½	11 ¾	8	⅞	9 ⅞	¾	95.03
10	8	16	14 ¼	12	1	12 ⅛	¾	132.73
12	8	19	17	12	1	14 ½	¾	176.72
14	8	21	18 ¾	12	1 ⅛	16 ½	⅞	254.47
16	8	23 ½	21 ¼	16	1 ⅛	18 ½	⅞	314.16
18	8	25	22 ¾	16	1 ¼	20 ½	⅞	380.13
20	8	27 ½	25	20	1 ¼	22 ⅝	1	452.39
22	10	29 ½	27 ¼	20	1 ⅜	24 ⅝	1	530.93
24	10	32	29 ½	20	1 ⅜	26 ⅝	1	615.75
26	10	34 ¼	31 ¾	24	1 ⅜	28 ⅞	1	730.62
28	10	36 ½	34	28	1 ⅜	30 ⅞	1	829.58
30	10	38 ¾	36	28	1 ⅜	32 ⅞	1	934.82
34	10	43 ¾	40 ½	32	1 ⅝	37	1	1164.16
36	10	46	42 ¾	32	1 ⅝	39	1	1288.25
40	10	50 ¾	47 ¼	36	1 ⅝	43	1	1555.28
42	12	53	49 ½	36	1 ⅝	45 ¼	1 3⁄16	1734.95
44	12	55 ¼	51 ¾	40	1 ⅝	47 ¼	1 3⁄16	1885.74
48	12	59 ½	56	44	1 ⅝	51 ¼	1 3⁄16	2206.18
50	12	61 ¾	58 ¼	44	1 ⅞	53 ¼	1 3⁄16	2375.83
54	12	66 ¼	62 ¾	44	1 ⅞	57 ¼	1 3⁄16	2733.97
56	12	68 ¾	65	48	1 ⅞	59 ¼	1 3⁄16	2922.46
60	12	73	69 ¼	52	1 ⅞	63 ¼	1 3⁄16	3318.31
62	12	75 ¾	71 ¾	52	2	65 ¼	1 3⁄16	3525.65
66	12	80	76	52	1 ⅞	69 ¼	1 3⁄16	3959.19
72	12	86 ½	82 ½	60	1 ⅞	75 ¼	1 3⁄16	4656.63
78	12	93	89	64	2 ⅛	81 ¼	1 3⁄16	5410.61
84	12	99 ¾	95 ½	64	2 ⅛	87 ½	1 3⁄16	6221.14
96	12	113 ¼	108 ½	68	2 ⅜	99 ⅜	1 3⁄16	8011.85
102	12	120	114 ½	72	2 ⅝	105 ½	1 3⁄16	8992.02
108	12	126 ¾	120 ¾	72	2 ⅝	111 ½	1 3⁄16	10028.75
120	12	140 ¼	132 ¾	76	2 ⅞	123 ½	1 3⁄16	12271.85
132	12	153 ¾	145 ¾	80	3 ⅛	135 ½	1 3⁄16	13684.78
144	12	167 ¼	158 ¼	84	3 ⅜	147 ½	1 3⁄16	16286.02

Note:
- All charts are applicable to DURA-PERM PTFE/FEP Expansion Joints with respect to Temperature and Pressure data.
- For a filled arch, reduce available movements by 50%.
- For multiple arch expansion joints, take the movement shown above and multiply by the number of arches.

Contact our Engineering Department for complete data and specifications
1(800) 327-1286

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Dimensions for Spool-Type (single Arch) Expansion Joints

Joint Size N.D.	Max. Working Pressure		Axial Compression	Axial Extension	Traverse Deflection	Estimated Weights		
	Style 150	Style 200	Allow. Mvt. 150/200	Allow. Mvt. 150/200	Allow. Mvt. 150/200	Exp. Joint	Ret. Rings	Control Units
½	165	200	½	¼	½	1	1.5	6
¾	165	200	½	¼	½	1.5	2	6
1	165	200	½	¼	½	2	2.25	6
1 ¼	165	200	½	¼	½	2.5	2.5	6
1 ½	165	200	½	¼	½	3	3	6
2	165	200	½	¼	½	4	4	7
2 ½	165	200	½	¼	½	4.5	5.5	7
3	165	200	½	¼	½	5.5	6	7
4	165	200	½	¼	½	8	7.5	8
5	140	200	½	¼	½	9	8	8
6	140	200	½	¼	½	11	9	9
8	100	190	¾	¼	½	15	12	12
10	100	190	¾	¼	½	23	16	16
12	100	190	¾	⅜	½	34	22	16
14	85	130	¾	⅜	½	40	25	20
16	65	110	¾	⅜	½	47	27	20
18	65	110	¾	⅜	½	56	29	21
20	65	110	⅞	⅜	½	67	35	21
22	60	100	⅞	7/16	½	70	44	32
24	60	100	⅞	7/16	½	79	46	32
26	55	90	1	½	½	100	50	32
28	55	90	1	½	½	102	55	32
30	55	90	1	½	½	117	58	32
34	55	90	1	½	½	122	91	43
36	55	90	1	½	½	143	99	43
40	55	90	1	½	½	173	108	43
42	55	80	1 ⅛	½	½	193	110	44
44	55	80	1 ⅛	½	½	198	136	44
48	55	80	1 ⅛	½	½	211	154	87
50	55	80	1 ⅛	½	½	240	163	87
54	55	80	1 ⅛	½	½	265	185	87
56	55	80	1 ⅛	½	½	288	203	87
60	55	80	1 ⅛	½	½	309	215	87
62	55	80	1 ⅛	½	½	325	230	87
66	55	80	1 ⅛	½	½	350	255	87
72	45	70	1 ⅛	½	½	385	300	87
78	45	70	1 ⅛	½	½	410	325	103
84	45	70	1 ⅛	9/16	½	435	350	113
96	45	70	1 ⅛	9/16	½	460	375	125
102	45	70	1 1/16	9/16	½	485	400	137
108	45	70	1 1/16	9/16	½	510	425	139
120	45	70	1 1/16	9/16	½	535	560	151
132	45	70	1 1/16	9/16	½	560	585	163
144	45	70	1 1/16	9/16	½	585	610	176

Note:
- All charts are applicable to DURA-PERM PTFE/FEP Expansion Joints with respect to Temperature and Pressure data.
- For a filled arch, reduce available movements by 50%.
- For multiple arch expansion joints, take the movement shown above and multiply by the number of arches.

Contact our Engineering Department for complete data and specifications
1(800) 327-1286

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Table 1: Optional Flange Drillings (other flange drillings available, consult factory)

	American 250/300# Conforms to ANSI B16.1 and B16.5					**British Standard 10:1962** Conforms to B.S-10 Table E					**Metric Series 1** Conforms to I.S.O. 2084-1974 Table NP-10					**J.I.S. Standard B-2212** Conforms to J.I.S. 10KG/CM				
I.D. in-mm	Flange Width	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	Flange Width	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	Flange Width	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	Flange Width	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.
1 25	.59 15.0	4.88 124.0	3.5 89.0	4 4	.75 19.0	.59 15.0	4.5 114.3	3.25 82.6	4 4	.563 14.2	.59 15.0	4.53 115.0	3.35 85.0	4 4	.55 14.0	.59 15.0	4.92 125.0	3.54 90.0	4 4	.75 19.0
1-1/4 32	.59 15.0	5.25 133.0	3.88 98.0	4 4	.75 19.0	.59 15.0	4.75 120.7	3.44 87.3	4 4	.563 14.2	.59 15.0	5.51 140.0	3.94 100.0	4 4	.71 18.0	.59 15.0	5.31 135.0	3.94 100.0	4 4	.75 19.0
1-1/2 40	.59 15.0	6.12 156.0	4.5 114.0	4 4	.88 22.2	.59 15.0	5.25 133.4	3.88 98.4	4 4	.563 14.2	.59 15.0	5.91 150.0	4.33 110.0	4 4	.71 18.0	.59 15.0	5.51 140.0	4.13 105.0	4 4	.75 19.0
2 50	.71 18.0	6.5 165.0	5.0 127.0	8 8	.75 19.0	.63 16.0	6.0 152.4	4.5 114.3	8 8	.75 19.0	.71 18.0	6.5 165.0	4.92 125.0	4 4	.71 18.0	.63 16.0	6.1 155.0	4.72 120.0	4 4	.75 19.0
2-1/2 65	.71 18.0	7.5 191.0	5.88 149.0	8 8	.88 22.2	.71 18.0	6.5 165.1	5.0 127.0	8 8	.75 19.0	.71 18.0	7.28 185.0	5.71 145.0	4 4	.71 18.0	.71 18.0	6.89 175.0	5.51 140.0	4 4	.75 19.0
3 80	.79 20.0	8.25 210.0	6.62 168.0	8 8	.88 22.2	.71 18.0	7.25 184.2	5.75 146.1	8 8	.75 19.0	.79 20.0	7.87 200.0	6.3 160.0	8 8	.71 18.0	.71 18.0	7.28 185.0	5.91 150.0	8 8	.75 19.0
3-1/2 90	.79 20.0	9.0 229.0	7.25 184.0	8 8	.88 22.2	.71 18.0	8.0 203.2	6.5 165.1	8 8	.75 19.0	.79 20.0	- -	- -	- -	- -	.71 18.0	7.68 195.0	6.3 160.0	8 8	.75 19.0
4 100	.79 20.0	10.0 254.0	7.88 200.0	8 8	.88 22.2	.71 18.0	8.5 215.9	7.0 177.8	8 8	.75 19.0	.79 20.0	8.66 220.0	7.09 180.0	8 8	.71 18.0	.71 18.0	8.27 210.0	6.89 175.0	8 8	.75 19.0
5 125	.87 22.0	11.0 279.0	9.25 235.0	8 8	.88 22.2	.79 20.0	10.0 254.0	8.25 209.6	8 8	.75 19.0	.87 22.0	9.84 250.0	8.27 210.0	8 8	.71 18.0	.79 20.0	9.84 250.0	8.27 210.0	8 8	.91 23.0
6 150	.87 22.0	12.5 318.0	10.62 270.0	12 12	.88 22.2	.87 22.0	11.0 279.4	9.25 235.0	12 12	.88 22.2	.87 22.0	11.22 285.0	9.45 240.0	8 8	.87 22.0	.87 22.0	11.02 280.0	9.45 240.0	8 8	.91 23.0
8 200	.94 24.0	15.0 381.0	13.0 330.0	12 12	1.0 25.4	.87 22.0	13.25 336.6	11.5 292.1	12 12	.88 22.2	.94 24.0	13.39 340.0	11.61 295.0	8 8	.87 22.0	.87 22.0	12.99 330.0	11.42 290.0	12 12	.91 23.0
10 250	1.02 26.0	17.5 445.0	15.25 387.0	16 16	1.12 28.6	.94 24.0	16.0 406.4	14.0 355.6	16 16	.88 22.2	1.02 26.0	15.55 395.0	13.79 350.0	12 12	.87 22.0	.94 24.0	15.75 400.0	13.98 355.0	12 12	.98 25.0
12 300	1.02 26.0	20.5 521.0	17.75 451.0	16 16	1.25 31.8	.94 24.0	18.0 457.2	16.0 406.4	16 16	1.0 25.4	1.02 26.0	17.52 445.0	15.75 400.0	12 12	.87 22.0	.94 24.0	17.52 445.0	15.75 400.0	16 16	.98 25.0
14 350	1.10 28.0	23.0 584.0	20.25 514.0	20 20	1.25 31.8	1.02 26.0	20.75 527.1	18.5 469.9	20 20	1.0 25.4	1.10 28.0	19.88 505.0	18.11 460.0	16 16	.87 22.0	1.02 26.0	19.29 490.0	17.52 445.0	16 16	.98 25.0
16 400	1.26 32.0	25.5 648.0	22.5 572.0	20 20	1.38 34.9	1.1 28.0	22.75 577.9	20.5 520.7	20 20	1.0 25.4	1.26 32.0	22.24 656.0	20.28 515.0	16 16	1.02 26.0	1.1 28.0	22.05 560.0	20.08 510.0	16 16	1.06 27.0
18 450	1.42 36.0	28.0 711.0	24.75 629.0	24 24	1.38 34.9	1.18 30.0	25.25 641.4	23.0 584.2	24 24	1.0 25.4	1.26 32.0	24.21 615.0	22.24 565.0	20 20	1.02 26.0	1.18 30.0	24.41 620.0	22.24 565.0	20 20	1.06 27.0
20 500	1.50 38.0	30.5 775.0	27.0 686.0	24 24	1.38 34.9	1.18 30.0	27.75 704.9	25.25 641.4	24 24	1.0 25.4	1.50 38.0	26.38 670.0	24.41 620.0	20 20	1.02 26.0	1.18 30.0	26.57 675.0	24.41 620.0	20 20	1.06 27.0
22 550	1.50 38.0	33.0 838.0	29.25 743.0	24 24	1.38 34.9	1.18 30.0	30.0 762.0	27.5 698.5	24 24	1.13 28.6	1.50 38.0	28.74 730.0	26.57 675.0	20 20	1.18 30.0	1.18 30.0	29.33 745.0	26.77 680.0	20 20	1.3 33.0
24 600	1.50 38.0	36.0 914.0	32.0 813.0	24 24	1.62 41.3	1.18 30.0	32.5 825.5	29.75 755.7	24 24	1.25 31.8	1.50 38.0	30.71 780.0	28.54 725.0	20 20	1.18 30.0	1.18 30.0	31.3 795.0	28.74 730.0	24 24	1.3 33.0
26 650	1.50 38.0	38.25 972.0	34.5 876.0	28 28	1.75 44.5	1.18 30.0	- -	- -	28 28	1.75 44.5	1.50 38.0	32.87 835.0	30.71 780.0	24 24	1.18 30.0	- -	- -	- -	- -	- -
28 700	1.50 38.0	40.75 1035.0	37.0 940.0	28 28	1.75 44.5	1.18 30.0	- -	- -	28 28	1.75 44.5	1.50 38.0	35.24 895.0	33.07 840.0	24 24	1.18 30.0	- -	- -	- -	- -	- -
30 750	1.50 38.0	43.0 1092.0	39.25 997.0	28 28	2.0 50.8	1.18 30.0	39.25 997.0	36.5 927.1	28 28	1.38 34.9	1.50 38.0	37.99 965.0	35.43 900.0	24 24	1.3 33.0	- -	- -	- -	- -	- -

Table 2: Standard/Special Drilling • Expansion Joint Dimensions • Control Units

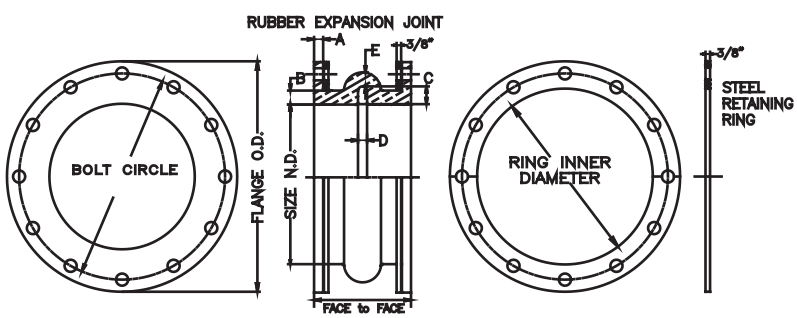
	125/150# Flange Dimensions Joints/Rings/Rods				250/300# Flange Dimensions Joints/Rings/Rods				Weights of Retaining Rings		125/150# Flange Dimensions Joints/Rings/Rods					250/300# Flange Dimensions Joints/Rings/Rods				Weights of Retaining Rings	
Joint I.D.	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	150# Rings Wt./#	300# Rings Wt./#	Joint I.D.	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	Flange O.D.	Bolt Circle	No. of Holes	Hole Dia.	150# Rings Wt./#	300# Rings Wt./#
1 1-1/4	4.25 4.625	3.125 3.5	4 4	.625 .625	4.875 5.25	3.5 3.875	4 4	.750 .750	1.9 2.4	2.9 3.0	10 12	16.0 19.0	14.25 17.0	12 12	1.0 1.0	17.5 20.5	15.25 17.75	16 16	1.125 1.25	17.0 24.1	23.0 31.3
1-1/2 2	5.0 6.0	3.875 4.75	4 4	.625 .75	6.125 6.5	4.5 5.0	4 8	.875 .75	2.6 3.6	4.4 4.3	14 16	21.0 23.5	18.75 21.25	12 16	1.125 1.125	23.0 25.5	20.25 22.5	20 20	1.25 1.375	26.8 32.1	37.0 45.0
2-1/2 3	7.0 7.5	5.5 6.0	4 4	.75 .75	7.5 8.25	5.875 6.625	8 8	.875 .875	5.3 5.6	5.5 6.0	18 20	25.0 27.5	22.75 25.0	16 20	1.25 1.25	28.0 30.5	24.75 27.0	24 24	1.375 1.375	33.6 35.9	58.0 67.0
3-1/2 4	8.5 9.0	7.0 7.5	8 8	.75 .75	9.0 10.0	7.25 7.875	8 8	.875 .875	6.5 7.3	7.0 10.0	22 24	29.5 32.0	27.25 29.5	20 20	1.375 1.375	33.0 36.0	29.25 32.0	24 24	1.625 1.625	38.5 47.3	80.0 91.0
5 6	10.0 11.0	8.5 9.5	8 8	.875 .875	11.0 12.5	9.25 10.625	8 12	.875 .875	7.9 9.1	11.6 14.5	30 36	38.75 46.0	36.0 42.75	28 32	1.375 1.625	43.0 50.0	39.25 46.0	28 32	2.0 2.25	66.0 85.3	120.0 140.0
8	13	11.75	8 8	.875	15.0	13.0	12	1.0	14.0	19.6											

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Table 3: Navy Drilling Specifications

MIL-F-20042C-50LB
MIL-F-20042C-150LB
Bu Ships Drawing B-176

Joint Size (inches)	O.D.	B.C.	No. of Holes	Hole Dia.
1/4	3-1/4	2-1/8	3	9/16
3/8	3-3/8	2-1/4	3	9/16
1/2	3-9/16	2-7/16	3	9/16
3/4	3-13/16	2-11/16	4	9/16
1	4-1/4	3-1/8	4	9/16
1-1/4	4-1/2	3-3/8	4	9/16
1-1/2	5-1/16	3-15/16	6	9/16
2	5-9/16	4-7/16	6	9/16
2-1/2	6-1/8	5	6	9/16
3	6-5/8	5-1/2	8	9/16
3-1/2	7-3/16	6-1/16	8	9/16
4	7-11/16	6-9/16	8	9/16
4-1/2	8-3/16	7-1/16	10	9/16
5	9-1/16	7-13/16	10	11/16
5-1/2	9-9/16	8-5/16	10	11/16
6	10-1/8	8-7/8	12	11/16
6-1/2	10-5/8	9-3/8	12	11/16
7	11-5/16	10	12	11/16
7-1/2	11-7/8	10-9/16	12	11/16
8	12-3/8	11-1/16	14	11/16
8-1/2	12-15/16	11-5/8	14	11/16
9	13-15/16	12-3/8	14	13/16
9-1/2	14-1/2	12-15/16	14	13/16
10	15	13-7/16	15	13/16
11	16-9/16	15	16	13/16
12	17-5/8	16-1/16	18	13/16
14	19-1/8	17-3/8	19	15/16
15	25-1/8	18-3/8	20	15/16
16	21-3/16	19-7/16	20	15/16
18	23-1/4	21-1/2	22	15/16
20	25-13/16	23-13/16	24	1-1/16
22	27-7/8	25-7/8	26	1-1/16
24	30	28	28	1-1/16
25	31-1/2	29-1/4	29	1-3/16
26	32-9/16	30-5/16	30	1-3/16
28	34-11/16	32-7/16	32	1-3/16
30	36-13/16	34-9/16	35	1-3/16
32	39	36-3/4	36	1-3/16
33	40	37-3/4	36	1-3/16
34	41	38-3/4	36	1-3/16
35	42-7/8	40-3/8	36	1-5/16
36	43-7/8	41-3/8	36	1-5/16
38	46-1/8	43-5/8	36	1-5/16
40	48-1/8	45-5/8	36	1-5/16
42	50-1/4	47-3/4	38	1-5/16
46	54-1/2	52	40	1-5/16



Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

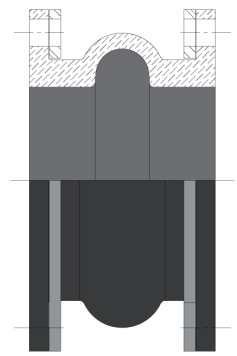
Super-Flex Style 1000
Wide-Arch Expansion Joint

The Super-Flex 1000 provides double arch movements utilizing a single low profile wide arch. Manufactured utilizing tire industry technology the style 1000 has been designed to provide greater strength and pressure capabilities. The construction combines woven polyester fabric and reinforced with wire to create a product with superior performance characteristics.



The wide self-flushing arch provides more movement than a traditional spool type joint. When built with a filled arch for smooth bore service, (such as slurry applications) the movements are one half of the single open arch spool type joints. The double reinforced construction gives longer life expectancy and is also available in a full range of elastomers to enable multi-purpose applications.

The primary difference between the Style 1000 and Style 1100 is in the manufacturing process.



The 1000 is hand-wrapped to allow for design variations including offsets, non-standard face to face dimensions, multi-arch configurations and special flanges or drillings while still offering wide arch movement.

The Style 1000 is Available in These Elastomers and Constructions:		
Clorobutyl EPDM Gum Hypalon®	Neoprene Nitrile SBR Silicone Viton® Flourel®	Multi-Arch Offset Special Ends Alternative Drilling

Optional Liners and covers are available

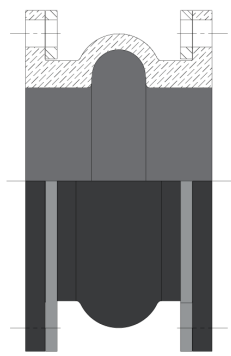
Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.



Super-Flex Style 1100

Wide-Arch Expansion Joint

UNAFLEX's® 1100 series has been designed to compete with the imports in terms of cost, and out perform the imports with a product that's made in America. The movements and benefits match the Style 1000, if you don't need the customization options of the Style 1000....the Style 1100 is a value-packed expansion joint.



The cover has been formulated with an ozone and temperature resistant compound which prevents the Style 1100 from cracking... unlike the imports. This new manufacturing technology has provided a product that has excellent performance at a competitive price.

Due to the molded construction, all face-to-face dimensions are standard. Engineered to withstand full vacuum and high pressure. The Style 1100 is an excellent performer with a super price. Specify Super-Flex!

This drawing shows the 1100 Style construction. A wide self-flushing arch allows greater movement and flexibility. Available in sizes from 2" to 36". See SuperFlex dimensions chart for movement details.

Optional liners and covers are available.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Super-flex Style 1000 and 1100 Expansion Joints

Dimensions for Wide Arch

We do not use marginal constructions which reduce safety factors and cause pressure reductions with slight operating pressure increases. All Supreme Expansion Joints have a minimum 3 to 1 safety factor at rated operating temperatures and pressures. Note: Maximum diameter for Style 1100 is 36”

Measurement In (in.)			Bolt Holes			Maxi. PSI		Movements-Inches			Joint Weight
Joint Size N.D.	Face-to-Face	Flange O.D.	Bolt Cir. Dia.	No. of Bolts	Bolt Hole Dia.	Style 1000	Style 1100	Axial Comp.	Axial Ext.	Trav. Defl.	Lbs.
½	6	3 ½	2 ⅜	4	9⁄16	225	225	1 ¾	¾	¾	1
¾	6	3 ⅞	2 ¾	4	9⁄16	225	225	1 ¾	¾	¾	1.5
1	6	4 ¼	3 ⅛	4	⅝	225	225	1 ¾	¾	¾	2
1 ¼	6	4 ⅝	3 ½	4	⅝	225	225	1 ¾	¾	¾	2.5
1 ½	6	5	3 ⅞	4	⅝	225	225	1 ¾	¾	¾	3
2	6	6	4 ¾	4	¾	225	225	1 ¾	¾	¾	4
2 ½	6	7	5 ½	4	¾	225	225	1 ¾	¾	¾	4.5
3	6	7 ½	6	4	¾	225	225	1 ¾	¾	¾	5.5
4	6	9	7 ½	8	¾	225	225	1 ¾	¾	¾	8
5	6	10	8 ½	8	⅞	225	225	1 ¾	¾	¾	9
6	6	11	9 ½	8	⅞	225	225	1 ¾	¾	1	11
8	6	13 ½	11 ¾	8	⅞	225	225	1 ¾	¾	1	15
10	8	16	14 ¼	12	1	225	225	1 ¾	¾	1	23
12	8	19	17	12	1	225	225	1 ¾	¾	1	34
14	8	21	18 ¾	12	1 ⅛	225	225	1 ¾	¾	1	40
16	8	23 ½	21 ¼	16	1 ⅛	160	160	1 ¾	¾	1	47
18	8	25	22 ¾	16	1 ¼	160	160	1 ¾	¾	1	56
20	8	27 ½	25	20	1 ¼	130	130	1 ¾	¾	1	67
22*	10	29 ½	27 ¼	20	1 ⅜	130	-	1 ¾	¾	1	70
24	10	32	29 ½	20	1 ⅜	130	130	1 ¾	1	1	79
26*	10	34 ¼	31 ¾	24	1 ⅜	110	-	1 ¾	1	1	100
28*	10	36 ½	34	28	1 ⅜	110	-	1 ¾	1	1	102
30	10	38 ¾	36	28	1 ⅜	95	100	1 ¾	1	1	117
34*	10	43 ¾	40 ½	32	1 ⅝	95	-	1 ¾	1	1	122
36	10	46	42 ¾	32	1 ⅝	90	100	2 ¼	1	1	143
40	10	50 ¾	47 ¼	36	1 ⅝	90	-	2 ¼	1	1	173
42	12	53	49 ½	36	1 ⅝	90	-	2 ¼	1	1	193
44*	12	55 ¼	51 ¾	40	1 ⅝	90	-	2 ¼	1	1	198
48	12	59 ½	56	44	1 ⅝	90	-	2 ¼	1	1	211
50*	12	61 ¾	58 ¼	44	1 ⅞	85	-	2 ¼	1	1	240
54	12	66 ¼	62 ¾	44	1 ⅞	85	-	2 ¼	1 ¼	1	265
56*	12	68 ¾	65	48	1 ⅞	85	-	2 ¼	1 ¼	1	288
60	12	73	69 ¼	52	1 ⅞	85	-	2 ¼	1 ¼	1	309
62*	12	75 ¾	71 ¾	52	2	85	-	2 ¼	1 ¼	1	325
66*	12	80	76	52	1 ⅞	85	-	2 ¼	1 ¼	1	350
72	12	86 ½	82 ½	60	1 ⅞	85	-	2 ¼	1 ¼	1	385
78	12	93	89	64	2 ⅛	85	-	2 ¼	1 ¼	1	410
84	12	99 ¾	95 ½	64	2 ⅛	85	-	2 ¼	1 ¼	1	435
96	12	113 ¼	108 ½	68	2 ⅜	85	-	2 ¼	1 ¼	1	460
102	12	120	114 ½	72	2 ⅜	85	-	2 ¼	1 ¼	1	485
108	12	126 ¾	120 ¾	72	2 ⅝	85	-	2 ¼	1 ¼	1	510
120	12	140 ¼	132 ¾	76	2 ⅞	85	-	2 ¼	1 ¼	1	535
132	12	153 ¾	145 ¾	80	3 ⅛	85	-	2 ¼	1 ¼	1	560
144	12	167 ¼	158 ¼	84	3 ⅜	85	-	2 ¼	1 ¼	1	585

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A-Flange Thickness
B-Body Thickness
C-Internal Arch Height

D-Arch Width
E-Arch Thickness

Joint Size N.D.	Effective Area In. Sq Styles 1000 & 1100	Expansion Joint Measurements					Weights	
		A	B	C	D	E	Ret. Rings Lbs.	Control Units Lbs.
½	4.91	½	⅞	1	1 ¾	⅜	1.5	6
¾	5.94	½	⅞	1	1 ¾	⅜	2	6
1	7.07	9/16	⅞	1	1 ¾	⅜	2.25	6
1 ¼	9.62	9/16	⅞	1 ⅛	1 ¾	7/16	2.5	6
1 ½	11.05	9/16	⅞	1 ⅛	1 ¾	7/16	3	6
2	15.90	9/16	29/32	1 ¼	1 ¾	½	4	7
2 ½	19.63	9/16	29/32	1 ¼	1 ¾	½	5.5	7
3	23.76	9/16	29/32	1 ¼	1 ¾	½	6	7
4	33.18	9/16	⅞	1 ¼	1 ¾	½	7.5	8
5	44.18	9/16	⅞	1 ¼	1 ¾	½	8	8
6	56.75	⅝	1	1 ¼	1 ¾	½	9	9
8	95.03	¾	1	1 ½	1 ¾	⅝	12	12
10	132.73	¾	1 5/32	1 ½	1 ¾	11/16	16	16
12	176.72	¾	1 5/32	1 ½	1 ¾	11/16	22	16
14	254.47	⅞	1 5/32	2	1 ¾	¾	25	20
16	314.16	⅞	1 5/32	2	1 ¾	¾	27	20
18	380.13	⅞	1 5/32	2	1 ¾	¾	29	21
20	452.39	1	1 5/32	2	1 ¾	25/32	35	21
22*	530.93	1	1 5/32	2	1 ¾	25/32	44	32
24	615.75	1	1 5/32	2 ¼	1 ¾	25/32	46	32
26*	730.62	1	1 3/16	2 ¼	1 ¾	13/16	50	32
28*	829.58	1	1 3/16	2 ¼	1 ¾	13/16	55	32
30	934.82	1	1 3/16	2 ¼	1 ¾	13/16	58	32
34*	1164.16	1	1 3/16	2 ¼	1 ¾	13/16	91	43
36	1288.25	1	1 3/16	2 ¼	2 ¼	13/16	99	43
40	1555.28	1	1 3/16	2 ½	2 ¼	13/16	108	43
42	1734.95	1 3/16	1 ¼	2 ½	2 ¼	29/32	110	44
44*	1885.74	1 3/16	1 ¼	2 ½	2 ¼	29/32	136	44
48	2206.18	1 3/16	1 ¼	2 ½	2 ¼	29/32	154	87
50*	2375.83	1 3/16	1 ⅜	2 ½	2 ¼	29/32	163	87
54	2733.97	1 3/16	1 ⅜	2 ½	2 ¼	29/32	185	87
56*	2922.46	1 3/16	1 ⅜	2 ½	2 ¼	29/32	203	87
60	3318.31	1 3/16	1 ⅜	2 ½	2 ¼	29/32	215	87
62*	3525.65	1 3/16	1 ⅜	2 ½	2 ¼	29/32	230	87
66*	3959.19	1 3/16	1 ⅜	2 ½	2 ¼	29/32	255	87
72	4656.63	1 3/16	1 ⅜	2 ½	2 ¼	29/32	300	87
78	5410.61	1 3/16	1 ⅜	2 ½	2 ¼	29/32	325	103
84	6221.14	1 3/16	1 ⅜	2 ½	2 ¼	29/32	350	113
96	8011.85	1 3/16	1 ⅜	2 ½	2 ¼	29/32	375	125
102	8992.02	1 3/16	1 ⅜	2 ½	2 ¼	29/32	400	137
108	10028.75	1 3/16	1 ⅜	2 ½	2 ¼	29/32	425	139
120	12271.85	1 3/16	1 ⅜	2 ½	2 ¼	29/32	560	151
132	13684.78	1 3/16	1 ⅜	2 ½	2 ¼	29/32	585	163
144	16286.02	1 3/16	1 ⅜	2 ½	2 ¼	29/32	610	176

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from
The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

"Multi-Purpose" PTFE Expansion Joints

Expansion joints manufactured of Fluoroplastic is another type of expansion joint available. This type of expansion joint has been used with highly corrosive medias, with glass or plastic piping or in heating, ventilating and air conditioning applications where space is a premium.

UNALON® Styles 112A, 113A and 115A Solid PTFE/FEP Molded Expansion Joints were developed to withstand higher pressures and temperatures. Their design allows a shorter face-to-face dimension, making them ideal for use where space is limited. They are lightweight and corrosion resistant. Available in sizes 1" to 12" Nominal Diameter and for temperature ratings from -300˚F to +400˚F. **Note: For sizes above 12", 2-ply FEP joints are available.**



Construction Details

A flexible Fluoroplastic pipe connector is a 2 or more convolution expansion joint consisting of a member of FEP, PTFE or PFA, reinforced with metal rings and attached with ductile iron flanges, designed to absorb movement and vibration in a piping system.

Performance Characteristics

Chemical Resistance
Molded or machined Fluoroplastic connectors are used in corrosive applications due to the inherent resistance of Fluoroplastic to a vast range of chemicals

Vibration Absorption
Fluoroplastic connectors are sometimes used in HVAC applications to absorb vibration and attenuate noise.

Temperature Limits
Fluoroplastic connectors can withstand temperatures as high as 450˚F and as low as -300˚F. **NOTE: Temperatures of the system significantly affect the pressure rating of the connectors.**

Pressure Limits
Pressures vary widely depending upon system temperature.

Additional Construction Details

Body
The body of the Fluoroplastic connectors are manufactured of 100% FEP, PTFE or PFA Fluoroplastic, which may be colored or opaque.

Reinforcing Rings
Metal reinforcing rings of stainless steel, Monel® or other metals may be used to add strength between the convolutions.

Flanges
The flanges are normally manufactured of ductile iron, coated or plated with a rust inhibiting paint. Flanges of other materials are available upon request.

Control Rods
All connectors are supplied with factory set control rods. The control rods are set to prevent over-extension during operation.

Liners
Internal sleeves are available for abrasive or high velocity flow rate applications.

Types of Connectors

Coupling
A two convolution connector designed for minimum movements

Expansion Joint
A three convolution connector designed for easy movement and ease of system installation.

Bellows
A five convolution connector designed for maximum movements and vibration elimination.

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Anchoring

Fluoroplastic connectors should always be installed in piping systems which are properly anchored and guided. The connectors should be protected from movements which are greater than that for which they are designed.

Installation & Maintenance

Since the connectors have a Fluoroplastic flange, no other sealing device, such as a gasket, is required. Remove flange covers only when ready to install. Thread the installation bolts from the mating flange side and be sure bolts do not extend beyond the bellows flange. No nuts are required.

Expansion Joint Data

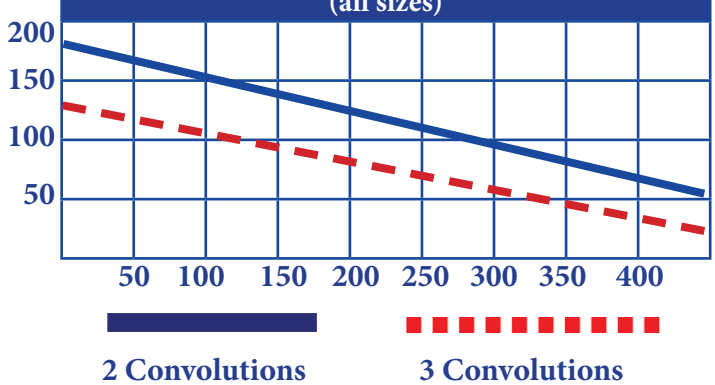
Style 112A (2 Convolutions)					Style 113A (3 Convolutions)				Style 115A (5 Convolutions)			
Nom. Dia. I.D.	Neutral Length	Movement (in.)		Weight Lbs.	Neutral Length	Movement (in.)		Weight Lbs.	Neutral Length	Movement (in.)		Weight Lbs.
		Axial	Lateral			Axial	Lateral			Axial	Lateral	
1.0	1.375	0.250	.125	2	1.750	.500	.250	2	3.000	0.500	.500	2
1.25	1.375	0.250	.125	5	1.810	.500	.250	5	2.670	0.394	.470	5
1.50	1.375	0.250	.125	3	2.000	.500	.250	4	3.500	0.750	.500	3
2.00	1.563	0.250	.125	7	2.750	.750	.375	8	4.000	1.000	.500	7
2.50	2.250	0.313	.125	10	3.188	.750	.375	11	4.600	0.980	.510	10
3.00	2.250	0.375	.188	10	3.625	1.000	.500	13	5.000	1.000	.500	10
4.00	2.625	0.500	.250	18	3.625	1.000	.500	19	5.250	1.250	.625	18
5.00	3.250	0.500	.250	24	4.000	1.000	.500	25	6.000	1.250	.625	24
6.00	2.750	0.500	.250	29	4.000	1.125	.563	30	6.000	1.250	.625	29
8.00	4.00	0.500	.250	47	6.000	1.125	.563	48	8.000	1.250	.625	47
10.00	5.250	0.500	.250	64	7.000	1.188	.500	60	8.750	1.250	.625	64
12.00	6.000	0.500	.250	115	7.875	1.188	.625	77	9.000	1.375	.688	115

WARNING
Always Use Safety Shields in Hazardous Service

For information on the "E" Series, please visit our website: www.unaflex.com and click PTFE Expansion Joints

Note: For sizes above 12", 2-ply FEP joints are available.

Unalon Performance curve of working pressures vs. operating temperatures (all sizes)



Vacuum Service Maximum temperature for full vacuum (29.9" HG.)	
Two Convolutions	
1" to 6" 8" to 10"	400°F 250°F
12"	150°F
Three Convolutions	
1" to 4" 5" to 6" 8" to 12"	400°F 300°F 125°F

Note: For greater pressure or safety requirements than shown, special Viton®/Kevlar® overlays are available.
Optional flow liners are available in PTFE, Elastomeric, Stainless Steel and Nickel Alloys. Consult our engineering department for further details.

Vacuum: Vacuum support rings can be added in the top (crest) of the convolution for full vacuum at 400°F for sizes 6" and larger. Support rings can be manufactured from various types of Stainless Steel, Tantalum and Nickel Alloys.

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"Unasphere" Style 800 Expansion Joints



Precision molded of neoprene and nylon, these units require less force to move than conventional joints, allowing maximum deflection, elongation and compression. Their design is stronger than other configurations because of the spherical shape. The smooth flow arch reduces turbulence and allows quiet flow without sediment build-up. ***All three styles also available in EPDM and nitrile with neoprene cover.***

Design Data:
Pressure–16" HG Vacuum, 225 PSIG
Temperature–20°F to 180°F.

Size, Movement, Pressure, Weight and Drilling Data

Size (in.)	Face-to-Face (in.)	Flange Thick (in.)	No. of Holes	Thread Size	Allowable Movement			
					Lateral Deflect (in.)	Axial Extension (in.)	Axial Compression (in.)	± Angular Deflect Degrees
2	6	5/8	4	5/8-11NC	±1/2	3/8	1/2	15
2-1/2	6	11/16	4	5/8-11NC	±1/2	3/8	1/2	15
3	6	11/16	4	5/8-11NC	±1/2	3/8	1/2	15
4	6	11/16	8	5/8-11NC	±1/2	1/2	3/4	15
5	6	13/16	8	3/4-10NC	±1/2	1/2	3/4	15
6	6	7/8	8	3/4-10NC	±1/2	1/2	3/4	15
8	6	7/8	8	3/4-10NC	±1/2	1/2	3/4	15
10	8	15/16	12	7/8-9 NC	±3/4	5/8	1	15
12	8	15/16	12	7/8-9 NC	±3/4	5/8	1	15



"Twin-Sphere" Style 802

The Twinsphere is precision molded of neoprene and nylon tire cord. The double arch design allows for greater movement four different ways and provides for a non-turbulent flow. Angular movement up to 30° is obtainable with its highly flexible design. Rated for 225 PSI WP at 170°F. Pressure is reduced at higher temperatures. Vacuum Rating to 26" HG.

Size (in.)	Face-to-Face (in.)	Compression Elongation	Axial Extension (in.)	Lateral Movement	± Angular Deflect Degrees
2	7	2.0	1.188	1.750	45
2-1/2	7	2.0	1.188	1.750	43
3	7	2.0	1.188	1.750	38
4	9	2.0	1.375	1.562	34
5	9	2.0	1.375	1.562	29
6	9	2.0	1.375	1.562	25
8	13	2.375	1.375	1.375	19
10	13	2.375	1.375	1.375	15
12	13	2.375	1.375	1.375	13

"Twin-Sphere" Style 803



This highly capable, low-cost expansion joint is available for smaller diameter piping systems found in power plants, chemical plants, waterworks, sewage treatment plants and private residences, etc. The Twin-Sphere provides excellent vibration absorption and stress relief in a light, compact construction.

Operating Pressure: 150 PSI. Vacuum Rating: 15" HG. Diameters are available in 3/4", 1", 1-1/4", 1-1/2" and 2"

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The Industry's Most Complete Line of Expansion Joints

Unaflex "Radi-Flex" Elbow Expansion Joints

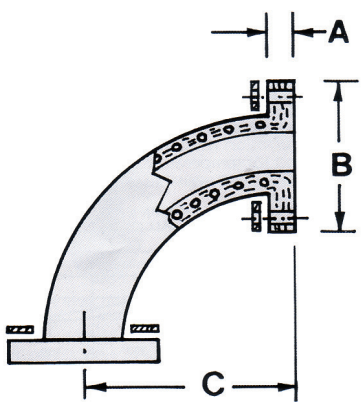
Elastomeric elbows and fittings are frequently used in place of metal fittings where high abrasion and chemical resistance is required and/or where vibration and stress relief is desirable.



"RADI-FLEX" Joints are designed to reduce noise and vibration in angled installments. Spiraled steel wires are embedded in the walls from flange-to-flange for extra strength. Standard construction is of rubber tube with polyester reinforcement with a synthetic cover. Temperature ranges up to 180°F can be handled. High temperature construction using a butyl tube with polyester reinforcement and a butyl cover allow use from 180°F to 250°F. Also available in Neoprene, Buna N, Hypalon® and EPDM (Nordel). Maximum pressures for standard units are: 2" and 3"-90 psi; 4" to 6"-80 psi; 8" to 10"-70 psi; and 12" to 14"-60 psi.

Rubber Flanged Pipe, Fittings, Pipe Elbows

Unions: Unions are small double arch rubber connectors with female threaded (usually ANSI NPT) ends. These connectors are for use with small diameter pipe and where clearance space for flanges is not available. Usually available for standard pipe sizes from 3/4 inch (19mm) to 3 inch (72mm) diameter and a wide variety of elastomers. Normally, unions are found in Heating, Ventilating and Air-Conditioning (HVAC) applications.



Unaflex® "Radi-Flex" Elbow Joints Dimensions

Size N.D. (in.)	Flange Thick. A (in.)	B Flange O.D. (in.)	C C to F 90° STD. (in.)	C C to F 90° L.R. (in.)	C C to F 45° (in.)	Allowable Movement		
						Comp. (in.)	Def. (in.)	Ext. (in.)
2	1	6	4-1/2	6-1/2	2-1/2	1/2	1/2	1/2
2-1/2	1	7	5	7	3	1/2	1/2	1/2
3	1-1/8	7-1/2	5-1/2	7-3/4	3	1/2	1/2	1/2
4	1-1/8	9	6-1/2	9	4	1/2	1/2	1/2
5	1-1/8	10	7-1/2	10-1/4	4-1/2	3/4	3/4	3/4
6	1-1/8	11	8	11-1/2	5	3/4	3/4	3/4
8	1-1/8	13-1/2	9	14	5-1/2	3/4	3/4	3/4
10	1-1/4	16	11	16-1/2	6-1/2	3/4	3/4	3/4
12	1-1/4	19	12	19	7-1/2	3/4	3/4	3/4
14	1-1/4	21	14	22-1/2	7-1/2	3/4	3/4	3/4

Notes:
1. Flange size dimensions conforms to ANSI-Class 150# drilling
2. Split rings are 3/8" Galvanized Steel Plate
3. Center-to-face dimensions are subject to ±1/4" tolerance

Crosses, Tees and Special Products



UNAFLEX® "RADI-FLEX" Crosses and Tees are custom manufactured to your specifications with all features of our Elbow Expansion Joints. ***Call for further information regarding available constructions and delivery schedules.***

Special Products:

- Pipe Clamp Sleeves
- Wellpoint Sleeves
- Endless belts for use on equipment
- Rubber Tubing
- Vacuum Sleeve Connectors
- Exhaust Connectors
- Suction Box Hose for Paper mills
- Dredge Sleeves
- Slurry Connectors
- Food Handling Connectors
- Acid Hose Connectors
- Pre-Formed Hose
- Pinch Valve Bodies

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"Mighty-Span" Rubber Flue Duct Expansion Joints



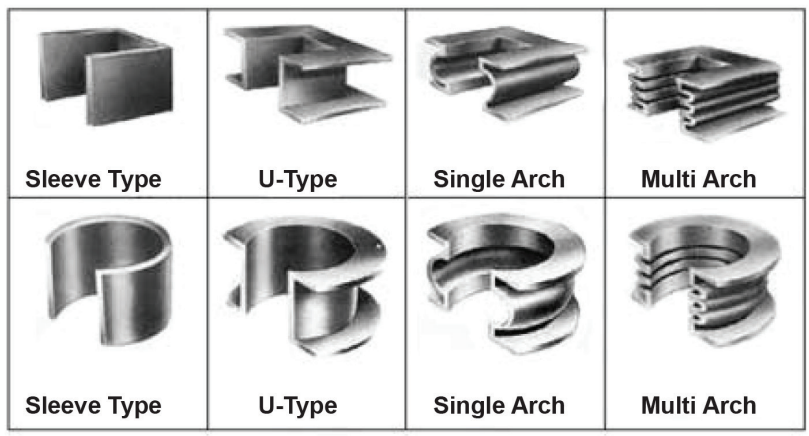
UNAFLEX® "MIGHTY-SPAN" Style 600 Rubber Flue Duct Expansion Joints are designed to handle hot air or gasses in industrial duct work, as well as those generated by power plant and pollution control equipment. They are custom constructed of rubber and fabric to absorb thermal movements and vibration in duct work and to aid in the elimination of noises caused by scrubber equipment and mechanical dust collectors.

MIGHTY-SPAN is capable of handling any combination of large movements which might occur in a ducting system due to thermal expansion. MIGHTY-SPAN creates almost no load on damper and fan interfacing flanges, thus providing much needed protection in these critical areas.

A wide range of elastomers and fabric substrates are available to provide maximum resistance to corrosion and high temperature capabilities as well as white FDA food grade elastomers. Let UNAFLEX® assist you in selecting the MIGHTY-SPAN product for your application.

Configurations

- Square, rectangular or round in any size. Standard construction "U" shape, 9" face-to-face, 3" flange.
- Arch shapes also available. One-piece body 5/16" thick. Steel retaining rings are provided (send drawing or call UNAFLEX® for quotation.)



Choice of Material

Fabric Reinforcement
Style 600 Joints may be constructed of *Nomex (to 400°F), fiberglass or polyester cloth impregnated with one of the following:

Tube and Cover

Neoprene–Resistant to heat, adverse weather, ozone and fuel gasses. Impervious to fats, oils, greases and other petroleum products. For use up to 250°F.

Chlorobutyl–An elastomer with all of the above advantages of neoprene, with the exception of its inability to withstand oil. For use up to 300°F.

***Viton®/**Fluorel®**–In addition to providing all of the properties of neoprene, Fluorel is resistant to mineral acids and usable in 400°F applications.

Silicone–A high-quality elastomer recommended for all environments except those with sulfur gas (SO_2 or SO_3). For use in -70° to 500°F applications.

EPDM–Excellent ozone, chemical, and ageing resistance. Poor resistance to petroleum-based fluids. Temperatures up to 300°F; *not for steam service*

Environmental Conditions			
Elastomer	Usable to °F	Recommended for Use In	
		Oils, Grease	Ozone & Flue Gases
Neoprene	250	good	good
Chlorobutyl	300	--	good
*Viton ®	400	good	good
Silicone	500	good	--

Recommended Service	
Pressure	to 3.0 PSIG, max
Vacuum	6.12" Hg, 83", Water
Compression*	2"
Extension*	1/2"
Transverse	1-1/2"

*DuPont trademark **3M trademark.

U-Type compression and elongation formulas

Lateral Elongation= 2 lbs. per foot of perimeter per 1/16" of movement. For example: 2' x 2' I.D.= 8' perimeter deflection= 1" = 16/16. 2 lbs. x 8" x 16"=256 lbs.

Axial Compression = 2.2 lbs. per foot of perimeter per 1/16" of movement. For example: 2' x 2' I.D. = 8' perimeter deflection = 1" = 16/16. 2.2 lbs. x 8" x 16" = 282 lbs.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Flexible Rubber Pipe Connectors

This design provides substantial flexibility to allow the expansion joint to absorb pipe movements, whether induced by thermal changes or other mechanical means. In certain applications, the features provided by arch-type construction may not be of paramount importance, and it is possible to manufacture no-arch type expansion joints. It is more common, however, to specify flanged pipe connectors having a substantially longer length than an expansion joint of the same pipe size.

Definition

A flexible rubber pipe connector is a reinforced straight rubber pipe, fabricated of natural or synthetic elastomers and fabrics, primarily designed to absorb noise and vibration in a piping system.

Performance Characteristics

Sound Limiting Characteristics

Rubber pipe connectors are used in air-conditioning and heating installations because of their ability to limit or interrupt the transmission of sound from operating equipment to the piping system.

Pressure/Temperature Limits

Flexible rubber pipe can be furnished in either 150 PSIG or 250 PSIG working pressure designs at different temperature ratings.

Resistance to Fluids

Rubber pipe corrosion resistance is the same as for elastomeric expansion joints.

Construction Details

Tube, Cover and Carcass

Details concerning the tube, cover and carcass fabric reinforcement are the same as for expansion joints.

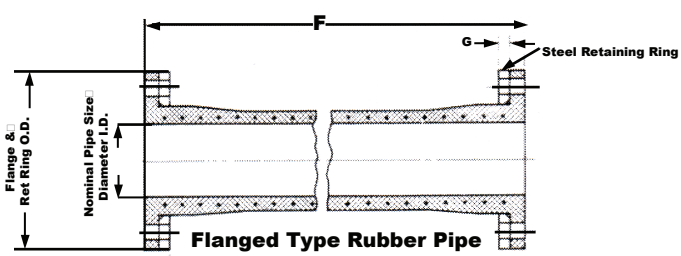
Metal Reinforcement

Helical-wound, steel reinforcement wire is imbedded in the carcass to provide strength for high pressure operations and to prevent collapse under vacuum.

Types of Pipe Connectors

Flanged Type

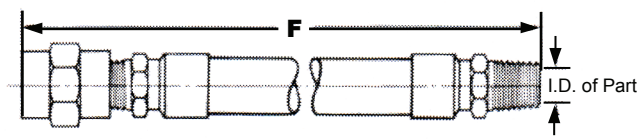
The most common type of rubber pipe incorporates a full face flange integral with the body of the pipe. The flange is drilled to conform to the bolt pattern of the companion metal flanges of the pipeline. This type of a rubber-faced flange, backed with a retaining ring, is of sufficient thickness to form a tight seal against the companion flange without the use of a gasket.



Flanged Type Rubber Pipe

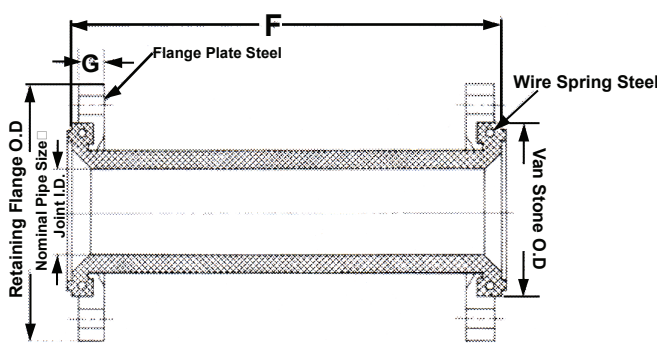
Coupled Type

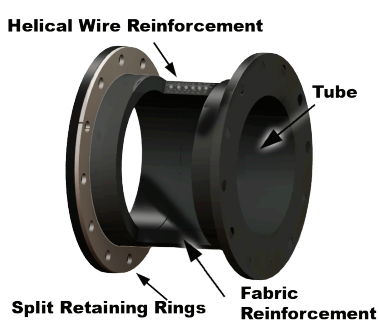
In smaller diameters, rubber pipe is available with factory attached couplings. Normally furnished with female/male couplings, this type is also available with male/female fittings.



Floating Flange Type

Similar to the flanged type. Instead of having a full-face rubber flange, this design has a solid floating metallic flange or a split interlocking flange. The Van Stone flange principle is used with the beads of the rubber part specifically designed to fit the mating pipe flange.





Cross Section View of
Flanged Type Flexible Pipe

Cross Section View of
Flanged Type Flexible Rubber Pipe

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Anchoring and Control Units

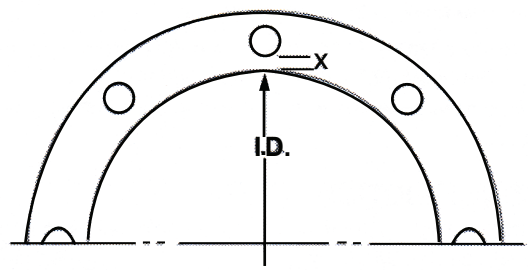
Flexible rubber connectors should always be installed in piping systems that are properly anchored so that the connectors are not required to absorb compression or elongation piping movements. If axial forces can act in the system to compress or elongate the connector, control units will be required to prevent axial movement. In general, control units are always recommended as an additional safety factor, preventing damage to the connector and associated equipment.

Tolerances for Rubber Pipe & Expansion Joints								
Nominal Pipe Size Exp. Jt. I.D.	Exp. Joint I.C.[1]	Non-Critical Flange O.D.[1]	Bolt Line[3]	Face-to-Face Length "F"2 (inches) All Dimensions to be an Averaged Reading. Applies to Open or Filled Arch				Number of Measurements to be Averaged
				0 to 6	7 to 12	14 to 18	20 & up	
0 to 10"	±3/16	±1/4	±3/16	±3/16	±3/16	±3/16	±3/16-1/4	4
12 to 22	±1/4	±3/8	±1/4	±3/16	±3/16	±3/16	±3/16-1/4	4
24 to 46	±3/8	±1/2	±5/16	±3/16	±3/16	±3/16	±1/4	4
48 to 70	±3/8-1/2	±3/4-1/2	±3/8	±1/4	±3/8	±3/8	±3/8	6
72 & up	±3/8-5/8	±1-3/4	±1/2	±1/4	±3/8	±3/8	±3/8	6

Notes:
- **All diameters to be measured with a "Pi" tape**
- **All linear dimensions to be measured with a steel rule and averaged**
- **Bolt Line= Actual I.D. +2 (Average "X" Dimension) + Bolt Hole Diameter.**

Nominal Pipe Size Connector Inside Diameter		Recommended Face-to-Face "F" Dimensions	
in	mm	in	mm
1/2	15	12	305
3/4	20	12	305
1	25	12	305
1-1/4	30	12	305
1-1/2	40	12	305
2	50	12	305
2-1/2	65	12	305
3	75	18	457
3-1/2	90	18	457
4	100	18	457
5	125	24	610
6	150	24	610
8	200	24	610
10	250	24	610
12	300	24	610
14	350	24	610
16	400	24	610
18	450	24	610
20	500	24	610
22	550	24	610
24	600	24	610

Notes: Above lengths are recommendations only



Typical Flange Thickness				
Nominal Flange Thickness		#Measurements	Tolerance	
in	mm		in.	mm
9/16	14	4	±1/16	±2
5/8 - 7/8	16 - 22	4	±3/16	±5
1	25	4	±1/4	±6
1 1/8-1 1/4	29 - 32	5	±5/16	±8
1 - 1 3/8	25 - 35	6	±3/8	±10

Note: Measurements taken at the bolt hole.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

"Super-Quiet" Rubber Vibration and Sound Absorbers

Styles 2150 and 2250

UNAFLEX® "Super-Quiet" Styles 2150 (150 psi WP) and 2250 (250 psi WP) vibration and sound absorbers are specially designed lengths of rubber pipe with factory attached ferrules for pipe and other connections involving standard IPT. They eliminate vibration between pump and pipe lines either for suction or discharge.



For Working Pressures to 150 PSI		
	For Water Service to 180°F	For Water Service from 180 to 250°F Max.
Ferruled Coupling	2150	2150 H.T.
Flanged End	3150	3150 H.T.

For Working Pressures to 250 PSI		
	For Water Service to 180°F	For Water Service from 180 to 250°F Max.
Ferruled Coupling	2250	2250 H.T.
Flanged End	3250	3250 H.T.

*Style 2150 and 2250 Dimensions			
Pipe Size N.D. (in.)	Standard Overall Length (in.)	Pipe Size N.D. (in.)	Standard Overall Length (in.)
3/4	12	2	24
1	18	2-1/2	24
1-1/4	18	3	36
1-1/2	18	4	36

IMPORTANT: UNAFLEX® Vibration and Sound Absorbers are not designed to accommodate the movement in a piping system caused by temperature change or other conditions. See Spool-Type Expansion Joints for such applications.

"Super-Quiet" Styles 3150 and 3250

UNAFLEX® "Super-Quiet" Styles 3150 (150 psi WP) and 3250 (250 psi WP) sound absorbers are built with molded rubber flanged ends with bolt holes that accommodate standard steel flanges. Available with or without helical wire reinforcement. Special tubes can be made to meet unique requirements for either suction or discharge.



Specify Unaflex® Flexible Connectors		
Style 3150	150# W.P.	180°F
Style 3250	250# W.P.	180°F
Style 3150 HT	150# W.P.	250°F
Style 3250 HT	250# W.P.	250°F

% of Reduction Vibration Input with Frequency & Pressure Compared to Steel Pipe			
Center Freq. Hz	8" I.D. X 24" F-F Vibration Joint		
	10 PSIG	50 PSIG	80 PSIG
440	87	91	93
68	95	96	99
125	98	99	99
250	96	97	99
500	91	93	94
1000	82	91	96
2000	99	99	99
4000	99	99	99
8000	97	97	98

EXAMPLE: If a steel piping system had a major vibration frequency of 1,000 Hz at 50 PSIG and 8" rubber expansion joint was installed in the pipeline, the percentage of reduction of vibration would be 96%. Above data taken from the Fluid Sealing Association Handbook.

Joint Size N.D. (in.)	Face to-Face		Style 3150 (Conforms to ANSI 150# Drilling)						Style 3250 (Conforms to ANSI 300# Drilling)					
	Min. (in.)	Max. (in.)	Ring I.D. (in.)	Flange		Bolt Cir. Dia. (in.)	Bolt Holes		Ring I.D. (in.)	Flange		Bolt Cir. Dia. (in.)	Bolt Holes	
				Dia. (in.)	Thk. (in.)		No.	Dia. (in.)		Dia. (in.)	Thk. (in.)		No.	Dia. (in.)
1-1/2	12	24	2-7/8	5	11/16	3-7/8	4	5/8	2-7/8	6-1/8	23/32	4-1/2	4	7/8
2	12	24	3-5/8	6	11/16	4-3/4	4	3/4	3-5/8	6-1/2	23/32	5	8	3/4
3	12	36	4-5/8	7-1/2	27/32	6	4	3/4	4-5/8	8-1/4	27/32	6-5/8	8	7/8
4	12	36	5-7/8	9	27/32	7-1/2	8	3/4	5-7/8	10	7/8	7-7/8	8	7/8
5	12	36	6-7/8	10	15/16	8-1/2	8	7/8	6-7/8	11	15/16	9-1/4	8	7/8
6	18	36	7-7/8	11	31/32	9-1/2	8	7/8	7-7/8	12-1/2	15/16	10-5/8	12	7/8
8	24	48	9-7/8	13-1/2	31/32	11-3/4	8	7/8	9-7/8	15	1-1/16	13	12	1
10	24	48	12-1/8	16	1-3/16	14-1/4	12	1	12-1/8	17-1/2	1-11/32	15-1/4	16	1-1/8
12	24	48	14-1/2	19	1-7/32	17	12	1	14-1/2	20-1/2	1-11/32	17-3/4	16	1-1/4

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Rubber Expansion Joint Installation and Maintenance

It is generally stated that the proper location of rubber expansion joints is close to a main anchoring point. Following the joint in the line, a pipe guide or guides should be installed to keep the pipe in line and prevent undue displacement of this line. This is the simplest application of a joint, namely, to absorb the expansion and contraction of a pipeline between fixed anchor points.

Anchoring & Guiding the Piping System

Anchors are required. **Figure 1** illustrates a simple piping system. You will notice that in all cases, solid anchoring is provided wherever the pipeline changes direction and that the expansion joints in that line are located as close as possible to those anchor points. In addition, following the expansion joints, and again as close as is practical, pipe guides are employed to prevent displacement of the pipeline. It should be pointed out that the elbows adjacent to the pump are securely supported by the pump base so that no piping forces are transmitted to the flanges of the pump itself. Anchors shown at the 90˚ and the 45˚ bend in the pipeline must be solid anchors designed to withstand the thrust developed in the line together with any other forces imposed on the system at this point.

Calculation of Thrust.
When expansion joints are installed in the pipeline, the static portion of the thrust is calculated as a product of the area of the I.D. of the arch of the expansion joint times the maximum pressure that will occur with the line. The result is a force expressed in pounds. **Refer to Figure 2.**

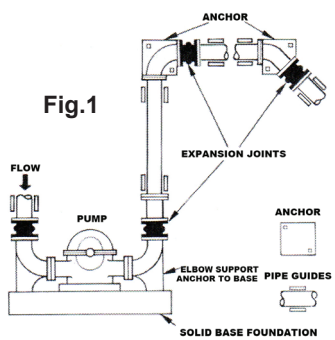


Fig.1

Branch Connection Anchors. **Figure 3** is another illustration of the proper anchoring that should be provided in a line with a branch connection. The anchor shown at the tee and elbow connections must be designed to withstand both the thrust and any other forces imposed on the system at these points. Emphasis is again placed on the relative location of the joints, their anchoring points and the pipe guides.

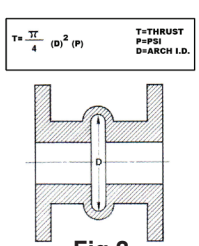


Fig.2

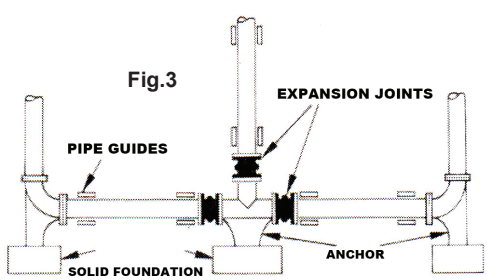


Fig.3

Typical Piping Layout Utilizing Expansion Joints and the Proper Use of Anchors in Branch Locations

Other Installations

Vibration Mounts Under Foundation. **Figure 4** shows a very common pump installation. Instead of being mounted on a solid foundation, the pump is supported off the floor on vibration mounts. There is nothing wrong with this type of installation. The supplier of the vibration mounts should be made aware of the fact that these mounts must be designed, not only to support the weight of the pump, its motor and base, but must also absorb the vertical thrust that will occur in both the suction and discharge lines.

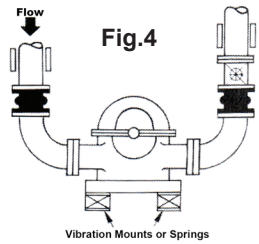


Fig.4

It should be noted that the thrust in the respective pipelines will exert a force on the inlet and outlet flanges of the pump, and the pump manufacturer should be contacted to determine whether or not the pump casing is strong enough to withstand this force. If this is not done, it is very possible that this force can be large enough to crack the connecting flanges.

Vibration Mounts or Springs Under Base and Anchor. An improved installation is shown in **Figure 5**. The vibration mounts under the pump base need only support the pump, its motor and base. The vibration mounts under the elbow supports can then be designed to withstand the thrust developed in the suction and discharge lines respectively.

Secondary Base. See **Figure 6**. In this installation, a complete secondary base is provided for the pump base and the two elbow supports. This secondary base is equipped with vibration mounts to isolate it from the floor. These mounts must be designed to take into account all of the loads and forces acting upon the secondary base. These obviously are the weight of the equipment plus the thrusts developed in the suction and discharge lines.

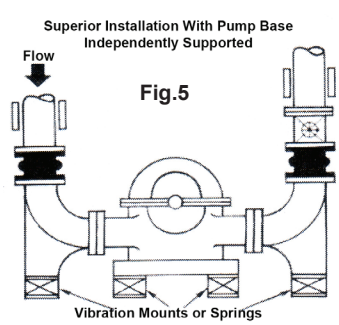


Fig.5

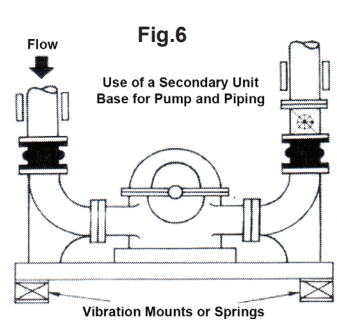


Fig.6

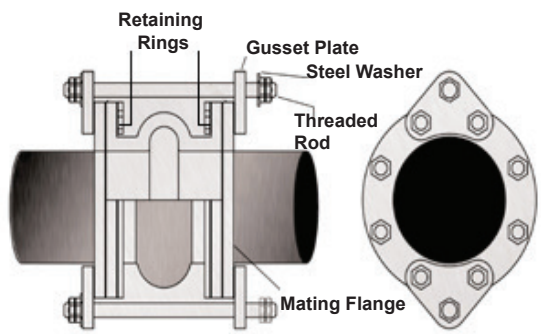
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Control Units

Control Units Used in Restraining the Piping System
Control units may be required to limit both extension and compression movements.

Extension
Control units must be used when it is not feasible in a given structure to provide adequate anchors in the proper location. In such cases, the static pressure thrust of the system will cause the expansion joint to extend to the limit set by the control rods which will then preclude the possibility of further motion that would over-elongate the joint. Despite the limiting action that control rods have on the joint, they must be used when proper anchoring cannot be provided. It cannot be emphasized too strongly that rubber expansion joints, by virtue of their function, are not designed to take end thrusts and, in all cases where such are likely to occur, proper anchoring is essential. If this fact is ignored, premature failure of the expansion joint is a foregone conclusion.

Control Unit



Expansion Joint

Compression
Pipe sleeves or inside nuts can be installed on the control rods. The purpose of the sleeve is to prevent excessive compression in the expansion joint. The length of this pipe sleeve should be such that the expansion joint cannot be compressed beyond the maximum allowable compression.

Specifications
The exact number of control rods should be selected on the basis of the actual design/test pressure of the system. Always specify the mating flange thickness when ordering control unit assemblies.

Control Unit Assemblies
When an elastomeric expansion joint with a control unit assembly is to be installed directly to a pump flange, special care must be taken. Make sure that there is sufficient clearance behind the pump flange not only for the plates, but also for the nuts, bolts and washers. In cases where there is not sufficient clearance, the control rod plates on the pump end can be mounted behind the expansion joint flange if the expansion joint flange has a metal flange. If the elastomer expansion joint has an integral flange with split retaining rings, this method is not usually recommended as the split retaining rings may not have enough strength to withstand the total force encountered.

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Control Rod Installation

- Assemble expansion joint between pipe flanges to the manufactured face-to-face length of the expansion joint. Include the retaining rings furnished with the expansion joints.

- Assemble control rod plates behind pipe flanges. Flange bolts through the control rod plate must be longer to accommodate the plate. Control rod plates should be equally spaced around the flange. Depending upon the size and pressure rating of the system, 2, 3 or more control rods may be required.

- Insert rods through top plate holes. Steel washers are to be positioned at the outer plate surface. An optional rubber washer is positioned between the steel washer and the outer plate surface.

- If a single nut per unit is furnished, position this nut so that there is a gap between the nut and the steel washer. This gap is equal to the joint's maximum extension (commencing with the nominal face-to-face length). Do not consider the thickness of the rubber washer. To lock this nut in position, either "stake" the thread in two places or tack weld the nut to the rod. If two jam nuts are furnished for each unit, tighten the two nuts together, so as to achieve a "jamming" effect to prevent loosening.

  Note: Consult UNAFLEX® if there is any question as to the rated compression and elongation. These two dimensions are critical in setting the nuts and sizing the compression pipe sleeve.

- If there is a requirement of compression pipe sleeves, ordinary pipe may be used and sized in length to allow the joint to be compressed to its normal limit.

- For reducer installations, it is recommended that all control rod installations be parallel to the piping.

- **Location**. The expansion joint should always be installed in an accessible location to allow for future inspection or replacement.

Split Metal Rings

Retaining rings must be used to distribute the bolting load and assure a pressure tight seal. They are coated for corrosion resistance and drilled as specified.

The rings are installed directly against the back of the flanges of the joint and bolted through to the mating flange of the pipe. Steel washers are recommended under the bolt heads against the retaining rings; at a minimum at the splits. Rings are normally 3/8" (9mm) thick, but can vary due to conditions. The ring I.D. edge installed next to the rubber flange should be broken or beveled to prevent cutting of the rubber.

Expansion Joint Protective Shields and Covers

Unusual applications of rubber expansion joints may require the specification of:

A. Protective Shield
B. Protective Cover
C. Fire Cover

These three types of covers, when manufactured of metal, have one end which is bolted to or clamped to the mating pipe flange. The other end is free, designed to handle the movements of the expansion joint. A **protective cover** of metal is required when an expansion joint is installed underground. **Protective shields** should be used on expansion joints in lines that carry high temperature or corrosive media. This shield will protect personnel or adjacent equipment in the event of leakage or splash. Wrap around protective shields of fluoroplastic impregnated fiberglass are the most common. Protective covers of expanded metal are used to prevent exterior damage to the expansion joint. **Fire covers**, designed oversize, are insulated on the I.D. to protect the expansion joint from rupture during a flash fire. They are normally installed on fire water lines.

When possible, it is not recommended to insulate over elastomeric expansion joints. **CAUTION: Protection/Spray shield have some insulating properties.** The containment of system temperatures can accelerate the aging of the product and makes required external inspections difficult.

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Installation Instructions
Non-Metallic Expansion Joints

Service Conditions
Ensure the expansion joint rating for temperature, pressure, vacuum and movements match the system requirements. Contact UNAFLEX® for advice if system requirements exceed those of the expansion joint selected. Make sure the elastomer selected is chemically compatible with the process fluid or gas.

Alignment
Expansion joints are not typically designed to compensate for piping misalignment errors. Piping should be lined up within 1/8". Misalignment reduces the rated movements of the expansion joint and can induce severe stress and reduce service life. Pipe guides should be installed to keep the pipe aligned and to prevent undue displacement.

Anchoring
Solid anchoring is required wherever the pipeline changes direction, and expansion joints should be located as close as possible to anchor points. If anchors are not used, the pressure thrust may cause excessive movements and damage the expansion joints.

Pipe Support
Piping must be supported so expansion joints do not carry any pipe.

Mating Flanges
Install the expansion joint against the mating pipe flanges and install bolts so that the bolt head and washer are against the retaining rings. If washers are not used, flange leakage can result–particularly at the split in the retaining rings. Flange-to-flange dimensions of the expansion joint must match the breech type opening. Make sure the mating flanges are clean and are flat-face type or no more than 1/16" raised face type. Never install expansion joints that utilized split retaining rings next to wafer type check or butterfly valves. Serious damage can result to a rubber joint of this type unless installed against full face flanges.

Additional Tips for Installation

- For elevated temperatures, do not insulate over a non-metallic expansion joint
- It is acceptable, but not necessary to lubricate the expansion joint flanges with a thin film of graphite dispersed in glycerin or water to ease disassembly at a later time.
- Do not weld in the near vicinity of a non-metallic joint
- If expansion joints are to be installed underground, or will be submerged in water, contact UNAFLEX® for specific recommendations
- If the expansion joint will be installed outdoors, make sure the cover material will withstand ozone, sunlight, etc. Materials such as EPDM and Hypalon® are recommended. Materials painted with weather resistant paint will give additional ozone and sunlight protection.
- Check the tightness of leak-free flanges two or three weeks after installation and re-tighten if necessary

Tightening Bolts
Tighten bolts in stages by alternating around the flange. If the joint has integral fabric and rubber flanges, the bolts should be tight enough to make the rubber flange O.D. bulge between the retaining rings and the mating flange. Torque bolts sufficiently to assure leak-free operation at hydrostatic test pressure. Bolt torquing values are available. If the joint has metal flanges, tighten bolts only enough to achieve a seal and never tighten to the point that there is metal-to-metal contact between the joint flange and the mating flange.

Storage
Ideal storage is a warehouse with a relatively dry, cool location. Store flange face down on a pallet or wooden platform. Do not store other heavy items on top of an expansion joint. Ten-year shelf life can be expected with ideal conditions. If storage must be outdoors, joints should be placed on wooden platforms and should not be in contact with the ground. Cover with a tarpaulin.

WARNING

Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures and may transport hazardous materials. Precautions should be taken to protect personnel in the event of leakage or splash.

Rubber joints should not be installed in inaccessible areas where inspection is impossible. Make sure proper drainage is available in the event of leakage when operating personnel are not available.

Large Joint Handling
Do not lift with ropes or bars through the bolt holes. If lifting through the bore, use padding or a saddle to distribute the weight. Make sure cables or forklift tines do not contact the rubber. Do not let expansion joints sit vertically on the edges of the flanges for any period of time.

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Inspection Procedure for Expansion Joints in Service

The following is provided to assist in determining if an expansion joint should be replaced or repaired after extended service.

Replacement Criteria

If an expansion joint is in a critical service condition and is five or more years old, consideration should be given to maintaining a spare or replacing the unit at a scheduled outage. If the service is not of a critical nature, observe the expansion joint on a regular basis and plan to replace after 10 years of service. Applications vary and life can be as long as 30 years in some cases.

Procedures

- **Cracking**
  (Sun Cracking) Cracking, or crazing my not be serious if only the outer cover is involved and the fabric is not exposed. If necessary, repair on-site with rubber cement where cracks are minor. Cracking where the fabric is exposed and torn, indicates the expansion joint should be replaced. Such cracking is usually the result of excess extension, angular or lateral movements. Such cracking is identified by (1) a flattening of the arch, (2) cracks at the base of the arch, and/or (3) cracks at the base of the flange. To avoid future problems, replacement expansion joints should be ordered with control rod units.

- **Blisters-Deformation/Ply Separation**
  Some blisters or deformations, when on the external portions of an expansion joint, may not affect the proper performance of the expansion joint. These blisters or deformations are cosmetic in nature and do not require repair. If major blisters, deformations and/or ply separations exist in the tube, the expansion joint should be replaced as soon as possible. Ply separation at the flange O.D. can sometimes be observed and is not a cause for replacement of the expansion joint.

- **Metal Reinforcement**
  If the metal reinforcement of an expansion joint is visible through the cover, the expansion joint should be replaced as soon as possible.

- **Dimensions**
  Any inspections should verify that the installation is correct—that there is no excessive misalignment between the flanges, and that the installed face-to-face dimension is correct. Check for over-elongation, over-compression, lateral or angular misalignment. If incorrect installation has caused the expansion joint to fail, adjust the piping and order a new expansion joint to fit the existing installation.

- **Rubber Deterioration**
  If the joint feels soft or gummy, plan to replace the expansion joint as soon as possible.

- **Leakage**
  If leakage or weeping is occurring from any surface of the expansion joint, except where flanges meet, replace the joint immediately. If leakage occurs between the mating flange and expansion joint flange, tighten all bolts. If this is not successful, turn off the system pressure, loosen all flange bolts and then retighten bolts in stages by alternating around the flange. Make sure there are washers under the bolt heads, particularly at the split in the retaining rings. Remove the expansion joint and inspect both rubber flanges and pipe mating flange faces for damage and surface condition. Repair or replace as required. Also make sure the expansion joint is not over elongated as this can tend to pull the joint flange away from the mating flange resulting in leakage. If leakage persists, consult the manufacturer for additional recommendations.

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Glossary of Terms

Abrasion Resistance: The ability to withstand the wearing effect of a rubbing surface. In elastomers, abrasion is a complicated process, often affected more by compounding and curing than by the elastomer. Soft, resilient compounds, such as pure gum rubber are frequently specified.

Adhesion: The strength of bond between cured rubber surfaces or cured rubber surface and a non-rubber surface.

Ambient Temperature: The environment temperature surrounding the object under consideration.

Anchor: Terminal point or fixed point in a piping system from which directional movement occurs.

Angular Movement: The movement which occurs when one flange of the expansion joint is moved to an out of parallel position with the other flange. Such movement being measured in degrees.

Arch: That portion of an expansion joint which accommodates the movement of the joint.

ASTM INTERNATIONAL: This organization has developed methods of testing and classifying elastomers as well as setting standards, such as ASTM F 1123-87, Standard Specification for Non-Metallic Expansion Joints.

Atmospheric Cracking: Cracks produced on surface of rubber articles by exposure to atmospheric conditions, especially sunlight, ozone and pollution. Chlorobutyl, EPDM, Hypalon®, Neoprene and Fluorelastomers are all highly resistant compounds.

Average Burst: Used by a manufacturer to determine Maximum Allowable Working Pressure. The average burst pressure is determined from a large number of burst tests on specimens of equal size, construction and grade.

Axial Compression: The dimensional reduction or shortening in the face-to-face parallel length of the joint measured along the longitudinal axis.

Axial Elongation: The dimensional increase or lengthening of face-to-face parallel length of the joint measured along the longitudinal axis.

Axial Extension: The dimensional lengthening of an expansion joint parallel to its longitudinal axis. Such movement being measured in inches or millimeters.

Baffle: A sleeve extending through the bore of the expansion joint with a full face flange on one end. Constructed of hard rubber, metal or Fluoroplastic, it reduces frictional wear of the expansion joint and provides smooth flow, reducing turbulence.

Bellows: See Arch or Expansion Joint.

Bench Test: A modified service test in which the service conditions are approximated, but the equipment is conventional laboratory equipment and not necessarily identical with that in which the product will be employed.

Bending Modululs: A force required to induce bending around a given radius; hence a measure of stiffness.

Blister: A raised spot on the surface or a separation between layers, usually forming a void or air-filled space in the rubber article.

Bloom: A natural discoloration or change in appearance of the surface of a rubber product caused by the migration of a liquid or solid to the surface. Examples: sulfur bloom, wax bloom. Not to be confused with dust on the surface from external sources.

Body: Carcass of the expansion joint.

Body Rings: Wire or solid steel rings imbedded in the carcass used as strengthening members of the joint.

Bolt Hole Pattern or Drill Pattern: The systematic location of bolt holes in the expansion joint flanges, where joint is to be bolted to mating flanges.

Bore: A fluid passageway, normally the inside diameter of the expansion joint.

Burst Test: A test to measure the pressure at which an expansion joint bursts.

Capped End: A seal on the end of a sleeve joint or flange to protect internal reinforcement.

Carcass: Body of the expansion joint.

Cemented Edge: An application of cement around the edges of an expansion joint with or without internal reinforcement for protection or adhesion.

Cemented End: A capped end accomplished by means of cement.

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Chalking: Formation of a powdery surface condition due to disintegration of surface binder or elastomer, due in turn to weathering or other destructive environments.

Coefficient of Thermal Expansion: Average expansion per degree over a stated temperature range, expressed in a fraction of initial dimension. May be linear or volumetric.

Cold Flow: Continued deformation under stress.

Compensator: See Expansion Joint

Compression Set: The deformation which remains in rubber after it has been subjected to and released from a specific compressive stress for a definite period of time, at a prescribed temperature.

Concurrent Movements: Combination of two or more types (axial or lateral) of movement.

Conductive: A rubber having qualities of conducting or transmitting heat or electricity. Most generally, applied to rubber products capable of conducting static electricity.

Connector: See Flexible Connector.

Control Rods or Units: Devices usually in the form of tie rods, attached to the expansion joint assembly whose primary function is to restrict the bellows axial movement range during normal operation. In the event of a main anchor failure, they are designed to prevent bellows over-extension or over-compensation while absorbing the static pressure thrust at the expansion joint, generated by the anchor failure.

Convolution: See Arch.

Coupling: See Expansion Joint.

Cracking: See Atmospheric Cracking, Flex Cracking

Crazing: See Atmospheric Cracking

Design Pressure: The maximum high temperature that the expansion joint is designed to handle during normal operating conditions. Not to be confused with excursion temperature.

Design Temperature: The maximum high or low temperature that the expansion joint is designed to handle during normal operating conditions. Not to be confused with excursion temperature.

Diameter, Inside: The length of a straight line through the geometric center and terminating at the inner periphery of an expansion joint.

Directional Anchor: A directional or sliding anchor is one which is designed to absorb loading in one direction while permitting motion in another. It may be either a main or intermediate anchor, depending upon the application involved. When designed for the purpose, a directional anchor may also function as a pipe alignment guide.

Drill Pattern: They systematic location of bolt holes on the mating flange to which the expansion joint will be attached. Usually meets a specific specification.

Duck: A durable, closely woven fabric.

Durometer: A measurement of the hardness of rubber. (also see Hardness).

Eccentricity: A condition in which the inside and outside of two diameters deviate from a common center.

EJMA: Expansion Joint Manufacturers Association (Metal Expansion Joints).

Elasticity: The ability to return to the original shape after removal of load without regard to the rate of return.

Electrical Resistivity: The resistance between opposite parallel faces of material having a unit length and unit cross section. Typically measured in Ohms/cm.

Elongation: Increase in length expressed numerically as a fraction or a percentage of initial length.

Enlarged End: An end with inside diameter greater than that of the main body of an expansion joint.

Excursion Temperature: The temperature the system could reach during an equipment failure. Excursion temperature should be defined by maximum temperature and time duration of excursion.

Face-to-Face (F/F): Dimension between the pipe flange faces to which the expansion joint will be bolted. This is also the length of the expansion joint when the system is in the cold position. Also see Pre-Compression and Pre-Set.

Fatigue: The weakening or deterioration of a material caused by a repetition of stress or strain.

Flange: See Integrally Flanged Type Expansion Joint.

Flanged End: Turned up or raised end made so that it can be bolted to an adjacent flange.

Flexible Connector: See Expansion Joint.

Flex Cracking: A surface cracking induced by repeated bending or flexing.

Information provided in this catalog is intended to help guide your selection. Some terminology and technical data has been gathered as a supplement from The Fluid Sealing Association Non-Metallic Expansion Joint Division Technical Handbook 7th Edition.

Flex Life: See Cycle Life.

Floating Flange: Metal flange which is grooved to contain the bead on each end of an expansion joint. The flange floats until lined up with mating bolt holes and bolted in place, and is used on spherical expansion joints.

Fluorelastomers: Highly resistant compounds.

Free Length: The linear measurement before being subjected to a load or force.

Friction: A rubber compound applied to an impregnating a fabric, usually by means of a calender with rolls running at different surface speed; hence the name “friction”. The process is called “frictioning”.

Frictioned Fabric: A fabric with a surface treatment which will bond two surfaces together when interposed between the surfaces. Also may be used to adhere to only one surface.

Hardness: Property or extent of being hard. Measured by extent of failure of the indentor point of any one of a number of standard hardness testing instruments to penetrate the product. (Also see Durometer.)

Heat Resistance: The ability of rubber articles to resist the deteriorating effects of elevated temperatures.

Helix: shape formed by spiraling a wore or other reinforcement around the cylindrical body of a rubber pipe.

Hydraulic Pressure: A force exerted through fluids.

Installed Length: See Face-to-Face.

Integrally Flanged Type Expansion Joint: An expansion joint in which the joint flanges are made of the same rubber and fabric as the body of the joint.

Lateral Deflection or Lateral Movement: Movement ore relating displacement of the two ends of the joint perpendicular to its longitudinal axis.

Lateral Offset: Refer to Lateral Deflection or Lateral Movement.

Limit Rods: Rods placed across an expansion joint from flange to flange to minimize possible damage to the expansion joint caused by excessive motion of the pipeline.
Lined Bolt Hole: A method of sealing exposed fabric in a bolt hole.

Liner: A sleeve extending through the bore of the expansion joint with a full face flange on one end. Constructed of hard rubber, metal or Fluoroplastic, it reduces frictional wear of the expansion joint and provides smooth flow, reducing turbulence.

Main Anchor: A main anchor is one which must withstand all of the thrust due to pressure, flow and spring forces of the system.

Mandrel: A form used for sizing and to support the expansion joint during fabrication and/or vulcanization. It may be rigid or flexible.
Mandrel Built: An expansion joint fabricated and/or vulcanized on a mandrel.

Maximum Burst: The theoretical (predetermined) burst pressure of an expansion joint.

Metal Reinforcement: Wire or solid steel rings imbedded in the carcass used as strengthening members of the joint.

Misalignment: The out of line condition that exists between the adjacent faces of the flanges.

Movements: The dimensional changes which the expansion joint is designed to absorb, such as those resulting from thermal expansion or contraction. See Angular Movement, Concurrent Movement, Resultant Movement, Lateral Movement, Torsional Movement, Thermal Movement, Transverse Movement.

NMEJ: Non-Metallic Expansion Joint Division, Fluid Sealing Association.

O-A-L: Alternative term for the face-to-face dimension of the overall length of an expansion joint.

Oil Resistant: The ability to withstand the deteriorating effects of oil (generally refers to petroleum) on the physical properties.

Oil Swell: The change in volume of rubber due to absorption of oil.

Open Arch: Rubber face flange of sufficient thickness to form a tight seal against the metal flanges without the use of gaskets.

Operating Temperature: The temperature at which the system will generally operate during normal conditions.

Permeability: The ability of a fluid or gas to pass through an elastomer.

Permanent Set: The deformation remaining after a specimen has been stressed in tension or compression a prescribed amount for a definite period and released for a definite period.

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Pipe Alignment Guide: A pipe alignment guide is framework fastened to some rigid part of the installation which permits the pipeline to move freely in only one direction along the axis of the pipe. Pipe alignment guides are designed primarily for use in applications to prevent lateral deflection and angular rotation.

Pipe Sleeve: See Compression Sleeves.

Ply: One concentric layer or ring of material, such as fabric plies in an expansion joint.

Pre-Compression: Compressing the expansion joint (shortening the F/F) so that in the cold position the joint has given amount of compression set into the joint. The purpose of pre-compression is to allow for unexpected or additional axial extension. This is performed at the job site.

Pre-Set: Dimension that joints are deflected to insure that desired movements will take place. See Lateral.

Proof Pressure Test: See Hydrostatic Test.

Pump Connector: See Expansion Joint.

Reducers: Expansion joints used to comment piping of unequal diameters.

Reinforcement: Flexible and supporting member between tube and cover; wire or solid steel rings imbedded in the carcass as strengthening members of the joint.

Resultant Movement: The net effect of concurrent movement.

Retaining Rings: Used to distribute the bolting load and assure a pressure tight seal.

RMA: The Rubber Manufacturers Association, Inc.

SAE: The Society of Automotive Engineers. This organization has developed methods of testing and classifying elastomers.

Service Test: A test in which the expansion joint is operated under service conditions in the actual equipment.

Soft Cuffs: Designed to slip over the straight ends of the open pipe and be held securely in place with clamps.

Soft End: An end in which the rigid reinforcement of the body, usually wire, is omitted.

Specific Gravity: The ratio of the weight of a given substance to the weight of an equal volume of water at a specified temperature.

Static Wire: A wire incorporated in an expansion joint for conducting or transmitting static electricity.

Straight End: An end with inside diameter the same as that of the main body.

Sun Checking: See Atmospheric Cracking

Tapers: Reducing expansion joints used to comment piping of unequal diameters.

Temperature: See Ambient Temperature, Design Temperature, Excursion Temperature, Operating Temperature.

Tensile Strength: the force required to rupture a specimen. “Dumbbell” specimens are cut from flat stock by a die of specified shape. Large elongations require special considerations in holding specimens and measuring the test results.

Testing: See Bench Test, Burst Test, Hydrostatic Test, Service Test.

Thermal Movements: Movements created within the piping system by thermal expansion. Can be axial, lateral or torsional.

Top Hat Liner: Consists of a sleeve extending through the bore of an expansion joint with a full face flange on one end.

Torsional Movement: The twisting of one end of an expansion joint with respect to the other end about its longitudinal axis.

Tube: A protective, leakproof lining made of synthetic or natural rubber as the service dictates.

Under Gauge: Thinner than the thickness specified.

Wire Reinforced: A product containing metal wire to give added strength, increased dimensional stability or crush resistance. See Reinforcement.

Wrap Marks: Impressions left on the cover surface by the material used to wrap the expansion joint during vulcanization. Usually shows characteristics of a woven pattern and wrapper with edge marks.

Van Stone Flange: A loose, rotating type flange, sometimes called a lap-joint flange.

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Pressure Terminology

Operating Pressure
The actual pressure at which the system works under normal conditions. This pressure may be positive or negative. (vacuum).

System Design Pressure
The highest or most severe pressure expected during operation. Sometimes used as the calculated operating pressure plus an allowance for safety margin.

Expansion Joint Design Pressure
The highest most severe pressure the expansion joint will handle.

Surge Pressure
Operating pressure plus the increment above operating pressure that the expression joint will be subjected. For a very short time duration due to pump starts, valve closings, etc.

Maximum Allowable Pressure
This term is used by the expansion joint manufacturer to define the maximum operating pressure recommended for a specific expansion joint.

Hydrostatic Test Pressure
The hydrostatic test pressure is used to demonstrate system or expansion joint capability. The standard test is 1-1/2 times the Maximum Allowable Pressure, held for 10 minutes, without leaks.

List of Specifications

ASTM Designation: F1123-87, "Standard Specification for Non-Metallic Expansion Joints." Approved December 31, 1987. American Society for Testing and Material, 1916 Race Street, Philadelphia, PA 19103 USA.

MIL-E-15330D (SH): "Military Specification Expansion Joint, Pipe, Non-Metallic, Fire-Retardant", revised October 14, 1977. U.S. Government Printing Office Form 1977-7103-122-6336. The section on class A, Type 1, Arched, Spool-Type Expansion Joint is replaced by ASTM F 1123-87, effective August 10, 1993.

Coast Guard: Code of Federal Regulations (C.F.R.46) Parts 56.35-10 and 56.60-1 (B). Revised 10/1/91. Office of the Federal Register, National Archives and Records of Service, General Services Administration. ASTM F 1123-87 is the governing specification.

Fan Connector Spec: MIL-R-6855-D: Military Specification, "General specification for rubber synthetic; sheets, strips, molded or extruded shapes." Class 2 is specified for Navy Fan connectors.

Torque Values

	Standard Pressure		High Pressure	
Flange Size (inches)	Pressure Rating (PSI)	Torque (ft-pounds)	Pressure Rating (PSI)	Torque (ft-pounds)
1/2	165	13	200	16
3/4	165	25	200	30
1	165	20	200	25
1-1/4	165	25	200	30
1-1/2	165	25	200	30
2	165	40	200	50
2-1/2	165	55	200	65
3	165	60	200	75
4	165	40	200	50
5	140	45	190	60
6	140	55	190	75
8	140	75	190	100
10	140	70	190	95
12	140	105	190	142
14	85	80	130	125
16	65	55	110	90
18	65	70	110	120
20	65	70	110	115
24	65	90	100	135
30	55	65	90	110
36	55	90	90	145
42	55	109	80	150
48	55	100	80	150
54	55	125	80	185
66	55	160	80	230
72	45	145	70	225

Mechanical Vibration in a Steel Piping System Reduced with the Installation of Pipe Connectors or Expansion Joints

The Non-Metallic Expansion Joint Division has done extensive work on relating the vibration absorbing qualities of rubber to rigid steel pipe. These tests were conducted by a nationally recognized independent Testing Laboratory." The chart below is an effort to show a practical application of these test results for both an expansion joint and a flexible rubber pipe.

Installation Pipe With A/AN:

Pipe System Vibration Frequency	Expansion Joint 8" ID X 6" F/F			Rubber Pipe 8" ID X 24" F/F		
	Vibration Reduction At			Vibration Reduction At		
HZ	10 PSIG	50 PSIG	80 PSIG	10 PSIG	50 PSIG	80 PSIG
40	37	55	72	87	91	93
68	60	68	78	95	96	99
125	44	50	60	98	99	99
250	44	50	50	96	97	99
500	65	89	90	91	93	94
1000	90	96	98	82	91	96
2000	94	95	96	99	99	99
4000	90	93	97	97	99	99
8000	89	89	94	94	97	98

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Noise and Vibration Transmitted Through the Hydraulic Media Reduced with the Installation of Expansion Joints

Summary Test Report of Cerami and Associates Inc.

Purpose
To measure the effects of rubber expansion joints in piping systems which produce objectionable hydraulic resonance noise.

Test System and Location
The main condenser water riser piping and the secondary chilled water piping systems running to the Board Room of a major retailer, located on the 46th floor of a building in New York City from a sub-basement.

Problem
These piping systems were found to transmit a highly objectionable surging noise in the Board Room. Noise frequency was identified as the pump impeller passage frequency) number of vances in the impeller, times the rotating frequency).

Amplified Fluid Pulsations
It is interesting to note that while the pumps are located remotely from the Board Room, the acoustical energy was conveyed by the piping for more than 500 feet, in the case of the sub-basement located condenser water pumps and transmitted structurally into the Board Room via pure riser anchors and supports located near the 46th floor. This condition represented a phenomenon which was created by a resonance condition in the piping system, re-acting in harmony with the impeller vane passage frequency and thereby amplifying the fluid pulsations to much higher levels that those at the source.

Pure-Tone Noise Fluctuations
Metal expansion joints were in the piping system prior to the installation of rubber expansion joints. Operating with the metal expansion joints in place, the system noise level had a surging quality, meaning that whenever more than one pump was operating, the puretone noise increased and decreased with a wide range of fluctuation. The peak of the surging noise was measured to be NC-49. Correcting for the highly objectionable pure-tone quality of the noise, the equivalent NC would be as high as NC-54, a totally unacceptable environment for the Board Room.

Corrective Action and Results
Rubber expansion joints were installed, replacing the metal expansion joints near the top of the main condenser discharge and return risers. Rubber expansion joints were also installed on the intake and discharge sides of the secondary water pump on the 46th floor.

Noise Level Reduced, Pure-Tone Eliminated
With the rubber expansion joints installed into the system, the noise level in the Board Room with two condenser water pumps and two secondary chilled water pumps operating simultaneously, was measured to be only NC-31. Furthermore, the new NC-31 environment contained no pure-tone quality. In fact, by shutting and starting the pumps, there was no detectable change in the ambient sound level.

Typical Recommended Noise Criteria Levels

Type of Room	NC* Range
Small Private Office	30 to 40
Conference Room for 20	30 to 40
Conference Room for 50	25 to 35
Theatres for Movies	30 to 40
Theatres for Drama	25 to 30
Concert Hall	25 to 35
Secretarial Offices	35 to 45
Home, Sleeping Areas	20 to 30
Assembly Hall	25 to 35
School Room	30 to 40

Pipe Wall Vibration Reduced
The pipe wall vibration patters were in fact significantly altered as evidenced by “before and after” readings on the pipe walls. Tables 2 and 3 show the spectrum shapes of pipe wall vibration “before and after” the installation of the rubber expansion joints. Tables show substantial reductions of pipe wall vibration, further indication of a quieter piping system. Drawing 1 shows, schematically, the location of pumps relative to the Board Room, as well as the locations where pipe wall vibration measurements were taken.

Conclusions
The installation of the rubber expansion joints into the piping system effectively lowered the noise level from NC-54 to NC-31, eliminating the pure-tone quality of the noise. We attribute the highly successful attenuation provided by the rubber expansion joints to a disruption in the acoustical standing wave pattern in the piping configuration. This disruption was being created by the sudden change in pipe wall rigidity at the expansion joint. The soft wall of the expansion joint would actually “breathe” with the fluid pulsations, thereby disrupting the steel pipe wall vibration pattern as well.

Published study from the Fluid Sealing Association Technical Handbook Seventh Edition-Non-Metallic Expansion Joints and Flexible Connectors

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