

# RUBBER EXPANSION JOINTS CATALOGUE



American Society of Mechanical Engineers  
"U" Stamp Accredited



**KEYSER TECHNOLOGIES PTE LTD**  
(DESIGN, MANUFACTURE OF EXPANSION JOINTS & ASSOCIATED STEEL FABRICATION WORKS)



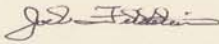
# CERTIFICATE OF AUTHORIZATION

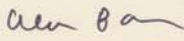
This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY: **Keyser Technologies Pte., Ltd.**  
74 Tuas Avenue 11, 639093  
Singapore

SCOPE: **Manufacture of pressure vessels at the above location only**

AUTHORIZED: **May 22, 2008**  
EXPIRES: **May 22, 2011**  
CERTIFICATE NUMBER: **37,575**

  
Chairman of The Boiler  
And Pressure Vessel Committee

  
Director, Accreditation and Certification

The American Society of Mechanical Engineers



The **American Society of Mechanical Engineers (ASME)** is a professional society focused on mechanical engineering known for setting codes and standards for mechanical devices. The ASME was founded in 1880 by Alexander Lyman Holley, Henry Rossiter Worthington, John Edison Sweet and Matthias N. Forney in response to numerous steam boiler pressure vessel failures. The ASME conducts one of the world's largest technical publishing operations through its ASME Press, holds numerous technical conferences and hundreds of professional development courses each year, and sponsors numerous outreach and educational programs.

As of 2006, the ASME has 120,000 members.

**Stiftelsen Det Norske Veritas or DNV**, established in 1864 in Norway, is a classification society organized as a foundation, with the objective of "Safeguarding life, property, and the environment". It was established in Norway to inspect and evaluate the technical condition of Norwegian merchant vessels. Together with Lloyd's Register and American Bureau of Shipping, DNV is one of the three major companies in the classification society business. DNV has its headquarters in Norway and has 300 offices in 100 countries, with 8,400 employees.

Important industries where the company operates include ship transport, energy, aviation, automotive, finance, food, health care and information technology. It also conducts research in several fields where it operates.



## DET NORSKE VERITAS MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 43360-2008-AQ-SNG-UKAS

*This is to certify that the Management System of*

### KEYSER TECHNOLOGIES PTE LTD

*At*

No. 74 Tuas Avenue 11  
Singapore 639093

*has been found to conform to*

**ISO 9001:2000**

*This Certificate is valid for the following product or service ranges:*

**DESIGN, MANUFACTURE AND SALES OF EXPANSION JOINTS AND ASSOCIATED STEEL FABRICATION WORKS.**

*Initial Certification date:*

16 December 2002

*This Certificate is valid until:*

15 November 2010

*The audit has been performed under the supervision of*

Chui Heng Tak  
Lead Auditor



013

*Place and date:*

Singapore, 19 January 2009

*for the Accredited Unit:*  
DNV CERTIFICATION B.V.,  
THE NETHERLANDS

  
Peter D. Dombey  
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

HEAD OFFICE: Det Norske Veritas AS, Veritansien 1, 1322 Høvik, Norway. Tel: +47 67 57 99 00 Fax: +47 67 57 99 11 - www.dnv.com



## **VISION STATEMENT**

Together, we will be the recognised leader in our industry for quality, service and responsiveness to customer needs.

## **MISSION STATEMENT**

Our mission is to provide the highest quality products and services to our customers. We will do this through investments in technology, product innovations, production processes, and the people, who are our asset to growth and profitability. Keyser Technologies shall continually improve the effectiveness of the company's quality management system.

## **OUR VALUES**

- Respect for individuals
- Superior Customer Service
  - Pride in craftsmanship
  - Honesty and Integrity
    - Teamwork
  - Strong Work Ethic
    - Simplicity
- An atmosphere of open communications



## INTRODUCTION

Keyser Technologies Pte Ltd specializes in the Manufacturing of Thermal Expansion Joints in Singapore. Keyser was established in Year 1995, solely as a Trading Service Company in various products. In Year 1999, Keyser entered into the Metal Expansion Joints Industry and ventured with full steam into the Manufacturing of Metal Expansion Joints. This is where the first KEYFLEX bellow was produced. Since then, Keyser has progressively grown and expanded into many sectors of industry in Singapore, Asia and Pacific regions.

Keyser Technologies Pte Ltd is a diversified company where our main activity is to supply Expansion Joints in Metal, Rubber and Fabric types. We also provide a wide range of services, such as fabrication work and trading services. For Quality ASSURANCE - Keyser obtained the Quality System Standard, as an ISO 9001:2000 Company in Singapore, certified by Det Norske Veritas (DNV). We are also accredited to ASME Stamp by Association of Mechanical Engineers (ASME). With respect to ISO 9001:2000 certification and America Society of Mechanical Engineering (ASME) U Symbol Stamp, Keyser is recognized in the Designing, Manufacturing and Sales of Thermal Expansion Joints and Associated Steel Fabrication Works. From achieving of ISO 9001:2000 certification, Keyser holds a very strong stand in:

- Supplying high quality products;
- Prompt & efficient delivery;
- Providing premium services to our customers.

Keyser leads the region in the design, manufacture and supply with a comprehensive range of rubber expansion joints that suits different industries. Keyser Technologies ensures top quality control through the constant investments in its staff and equipments. Keyser's rubber expansion joints are used throughout the region to cater in Marine industries, Reverse Osmosis systems and other industrial applications.

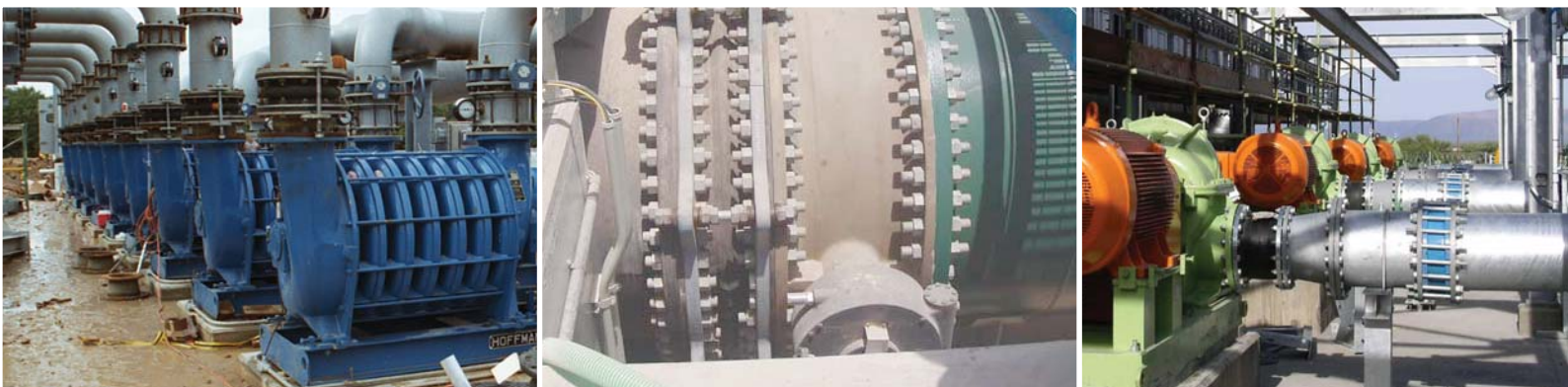


## KEYSER RUBBER EXPANSION JOINTS

KEYSER Rubber expansion joints are used by professionals in industries such as plant engineers, consulting engineers, pressure vessel designers and mechanical contractors. Rubber expansion joints are installed for the purpose of protecting piping from expansion and contraction, as well as ensuring maximum efficient and economical on-stream operations. Rubber expansion joint is a specifically engineered and designed section of the pipes that is flanged. They are able to be inserted within a rigid piping system to achieve the following:

- a) Absorb movements
- b) Relieving of system strain due to various reasons such as thermal change, load stress, pumping surges, wear or settling
- c) Reducing mechanical noise
- d) Compensation for any misalignment that occurred
- e) Eliminating electrolysis between dissimilar metals

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.



## PRODUCT DESCRIPTION

### Definition:

A rubber expansion joint is a flexible connector fabricated using natural or synthetic elastomers and fabrics. At times, metallic reinforcements are used when necessary to provide stress relief in piping systems due to thermal and mechanical vibration and/or movements. Flexibility and concurrent movements in either single or multiple arch type construction, isolation of vibration and noise resistance to abrasion and chemical erosion are some of the key features.

### Functions:

By incorporating rubber expansion joints during the piping system design, engineers are able to remove or significantly reduce any likelihood of problems such as vibration, shock, noise, stresses, corrosion and abrasion.

### Reduced Vibration:

Vibration caused by equipment are isolated or significantly reduced with the installation of Rubber expansion joints. The following example is based on true tests conducted by a independent, nationally recognized testing laboratory. The use of reciprocating pumps and compressor generate greater unbalanced forces than centrifugal equipment. By using rubber pipe and expansion joints, any undesirable disturbances including harmonic overtones and vibrations caused by centrifugal pump and fan blade frequency are greatly reduced or removed. Thus, with this illustration, rubber expansion joints reduce transmission of vibration and protect equipment from the adverse effects of vibration.

### Dampening of Sound Transmission:

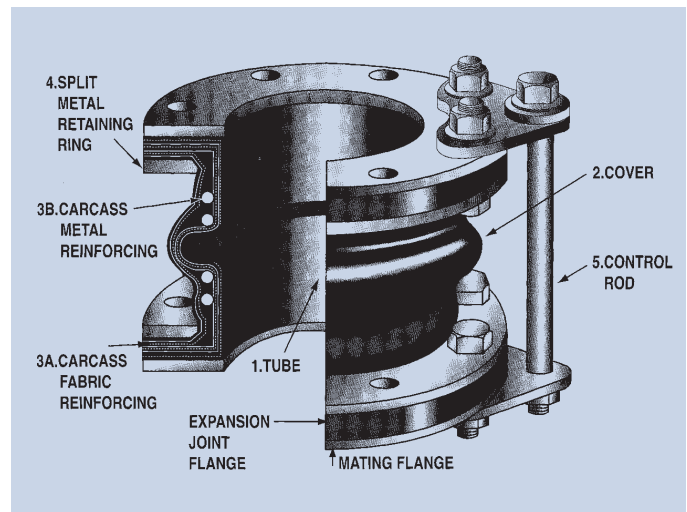
Imbalance in motive equipment generates undesirable noises transmitted to occupied areas due to reasons such as going on stream, normal wear, corrosion, abrasion and erosion. The use of rubber expansion joint dampens likelihood of transmission of such sound because of the steel-rubber expansion joints, compared with their metallic counterparts

### Compensate Lateral, Torsional and Angular Movements.

Due to wear and load stresses, equipments such as pumps, compressors, fans and piping equipment tends to move out of alignment. The use of rubber expansion joints compensate for any lateral, torsional and angular movements thus greatly reduces or removes any damage and undue downtime of plant operation.

### Compensate Axial Movements

The use of rubber expansion joints in strategic locations will reduce any expansion and contraction movements due to thermal changes or hydraulic surge effects. They act as helix springs, compensating for axial movements.



## ADVANTAGES

The industry has allied itself with designers, architects, contractors and erectors in designing and fabricating rubber expansion joints under rigid standards to meet present-day operating conditions.

By keeping abreast of the technological advances in rubber compounding and synthetic fabrics, the industry allies itself with different rubber expansion joints having advantages not available in other materials.

### Minimal Face to face Dimensions

When compared with costly expansion bends or loops, there is minimal face-to-face dimensions in rubber expansion joints. The relative cost of the pipe itself may be less than rubber expansion joints. Taking into account plant space, installation labour, supports and pressure drops, the end total cost could be significantly higher.

### Light-weight

Rubber expansion joints are light thus there is no special equipment required to fit them into position, and this lowers installation and labour costs.

### Reduced Fatigue Factor

The inherent characteristics of natural and synthetic elastomers are not subjected to fatigue breakdown or embrittlement. This prevents any electrolytic action because of the steel-rubber interface of joints and flanges.

### Reduced Heat Loss

Rubber expansion joints significantly reduce heat loss and also reducing frequency of maintenance.

### Corrosion & Erosion Resistant

There is a wide range and variety of natural synthetic and special purpose elastomers and fabrics available. Materials are treated and combined in order to meet a wide range practical pressure-temperature operating conditions and other forms of corrosive attack, abrasion and erosion. There are standard and special sizes of rubber expansion joints which are available with TFE/FEP liners, fabricated to the configurations of the joint body, as added insurance against corrosive attack. Teflon possess unusual and unique characteristics of thermal stability, non-sticking surface, extremely low co-efficient of friction and resistance to most corrosive fluids and forms of chemical attack.

### No Gasket required

The use of gasket are unnecessary as the elastomeric expansion joints are supplied with flanges of vulcanized rubber and fabric integrated with the tube. The sealing surfaces of the expansion joint equalize uneven surfaces of the pipe flange to provide a fluid and gas-tight seal.

### Excellent Noise & Shock resistance

The elastomeric composition of the elastomeric expansion joints acts as a dampener that absorbs the noise and vibration, thus greatly reduces any noise transmission in piping systems. They also provide good resistance against shock stress from excessive hydraulic surge, water hammer or pump cavitation.

## CONSTRUCTION DETAILS

### Cover:

The exterior surface of the joint is formed from natural or synthetic rubber, depending on service requirements. Its primary function is to protect the carcass from external abuse or damage. A protective coating may be applied to the exterior of the joint for additional protection. Similarly, special polymers can be added to resist chemicals, oils, sunlight, acid fumes and ozone.

### Tube:

A protective leak-proof lining made up of synthetic or natural rubber as the service dictates. This is a seamless tube that extends through the bore to the outside edges of the flanges. Its purpose is to eliminate the possibility of the materials being handled penetrating the carcass and weakening the fabric. These tubes can be designed to cover service conditions for chemical petroleum, sewage, gaseous and abrasive materials.

### Metal Reinforcements:

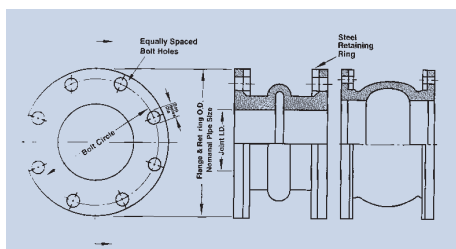
Wire or solid steel rings are embedded in the carcass are used as strengthening members of the joint. At times, this raises the rated working pressure and can supply rigidity to the joint for vacuum service.

### Fabric Reinforcements:

The carcass fabric reinforcement is the flexible and supporting member between the tube and cover. Standard constructions usually utilize high quality synthetic fabric. At times, natural fabrics are used at some pressures and temperatures. All fabric plies added with rubber or synthetic compounds to permit flexibility between the plies.

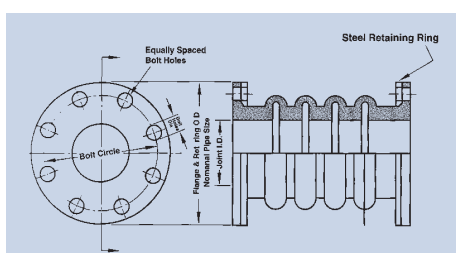
| Material Designation  |                          | Elastomer Physical And Chemical Properties Comparison                                                                       |        |                                               |                                  |                               |                                     |                            |                             |                                     |                                    |                          |                        |                |                  |       |              |                       |                  |
|-----------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------|----------------------------------|-------------------------------|-------------------------------------|----------------------------|-----------------------------|-------------------------------------|------------------------------------|--------------------------|------------------------|----------------|------------------|-------|--------------|-----------------------|------------------|
| Ansi/Astm<br>D1418-77 | Ansi D-2000<br>Sae J-200 | 7 - Outstanding<br>6 - Excellent<br>5 -Very Good<br>4 - Good<br>3 - Fair To Good<br>2 - Fair<br>1 - Poor<br>X - Contact Mfg | Water  | Alkali, Conc.<br>Animal & Veg oil<br>Chemical | Alkali, Dilute<br>Oil & Gasoline | Oxygenated Hydro,<br>Lacquers | Aliphatic Hydro,<br>Aromatic Hydro. | Acid Dilute<br>Acid, Conc. | Radation<br>Swelling in oil | Ele. Insulation<br>Water Absorption | Dielectric Str<br>Tensile Strength | Rebound-Cold<br>Comp,Set | Rebound-Hot<br>Dynamic | Impermeability | Abrasion<br>Tear | Flame | Heat<br>Cold | Sunlight<br>Oxidation | Ozone<br>Weather |
|                       |                          | Common Name<br>Chemical Group Name                                                                                          |        |                                               |                                  |                               |                                     |                            |                             |                                     |                                    |                          |                        |                |                  |       |              |                       |                  |
| CR                    | BC, BE                   | <b>NEOPRENE</b><br>Chloroprene                                                                                              | 4340   | 4401                                          | 2346                             | 4543                          | 5424                                | 5245                       | 4444                        | 5565                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| NR                    | AA                       | <b>GUM RUBBER</b><br>Polyisoprene, Synthetic                                                                                | 53 x x | x 004                                         | 0033                             | 0655                          | 6646                                | 6627                       | 5052                        | 4020                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| IR                    | AA                       | <b>NATURAL RUBBER</b><br>Polyisoprene, Synthetic                                                                            | 53 x x | x 004                                         | 0033                             | 0655                          | 6646                                | 6226                       | 5052                        | 4020                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| IIR                   | AA                       | <b>BUTYL</b><br>Isobutene-Isoprene                                                                                          | 5654   | 4034                                          | 0046                             | 0455                          | 5430                                | 5264                       | 4045                        | 6556                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| CIIR                  | AA, BA                   | <b>CHLOROBUTYL</b><br>Chloro-Isobutene-Isoprene                                                                             | 5654   | 4034                                          | 0046                             | 0455                          | 5430                                | 5264                       | 4045                        | 6556                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| NBR                   | BE, BK, CH               | <b>BUNA-N/NITRILE</b><br>Nitril-Butadiene                                                                                   | 4350   | 4520                                          | 4644                             | 5541                          | 0554                                | 4544                       | 3034                        | 4022                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| SBR                   | AA                       | <b>SBR/GRS/BUNA-S</b><br>Styrene-Butadiene                                                                                  | 53 x 2 | 4004                                          | 0033                             | 0655                          | 4544                                | 4425                       | 3053                        | 2020                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| CSM                   | CE                       | <b>HYPALON</b><br>Chloro-Sulfonyl-Polyethylene                                                                              | 5644   | 4431                                          | 2346                             | 4543                          | 5222                                | 4244                       | 3444                        | 6767                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| FKM                   | HK                       | <b>VITON/FLUOREL</b><br>Fluorocarbon Elastomer                                                                              | 5660   | 4610                                          | 6665                             | 6553                          | 5562                                | 4555                       | 2627                        | 7777                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| EPR                   | BA, CA, DA               | <b>EPDM</b><br>Ethylene-Propylene-Diene-Terpolymer                                                                          | 5656   | 6036                                          | 0046                             | 0766                          | 7546                                | 6545                       | 4056                        | 6767                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| AFMU                  |                          | <b>Teflon*/TFE/FEP</b><br>Fluoro-Ethylene-Polymers                                                                          | 7777   | 7777                                          | 7777                             | 737 x                         | x x x x                             | x x x 4                    | x x x 7                     | 7777                                |                                    |                          |                        |                |                  |       |              |                       |                  |
| SI                    | GE                       | <b>SILICONE</b>                                                                                                             | 5550   | 2 x 02                                        | 0026                             | 2566                          | 4036                                | 6020                       | 2267                        | 6666                                |                                    |                          |                        |                |                  |       |              |                       |                  |

## BASIC SPOOL TYPE EXPANSION JOINTS



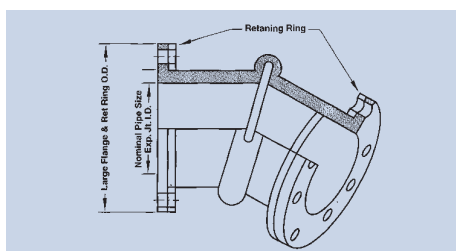
### Single Arch Type

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



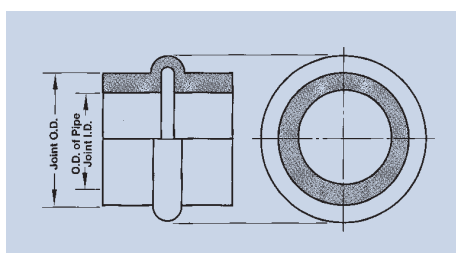
### Multiple Arch Type

- Allows greater movement compared to single arch type joints
- The minimum joint length is dependent on the number of arches
- For maximum stability, 4 arches is recommended



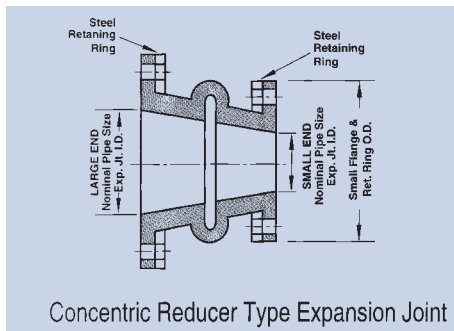
### Offset Type

- Can be customised to specific requirements
- Initial misalignment and non-parallelism of piping axis will be compensated.

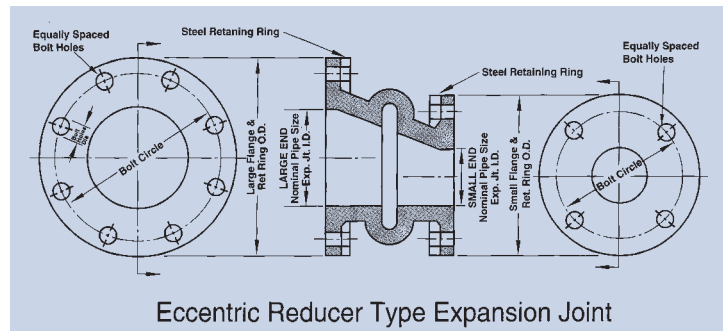


### Sleeve Type

- This type has the same design as the single arch type. The only difference is that the sleeve ends have an I.D. equal to the pipe O.D.
- Clamps are used to secure the ends
- Only recommended for low pressure service only



Concentric Reducer Type Expansion Joint

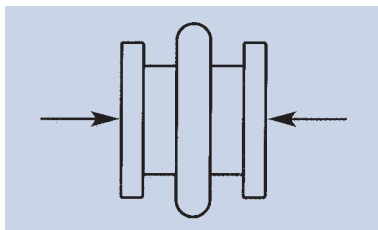


Eccentric Reducer Type Expansion Joint

### “Taper” Reducer Type

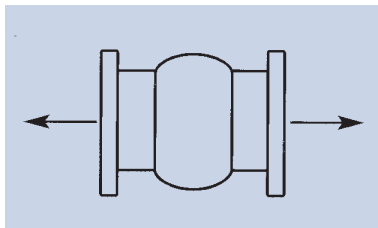
- Able to connect different piping
- May be customised according to specific requirements.
- Tapers of 15” or less are recommended.
- Pressure ratings are based on larger I.D.
- Available with and without arches

## MOVEMENTS IN INDUSTRIAL PIPING



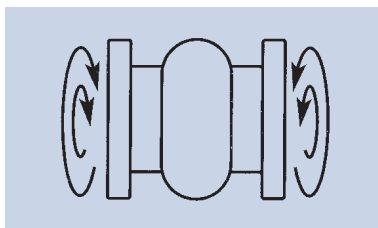
### Axial Compression

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



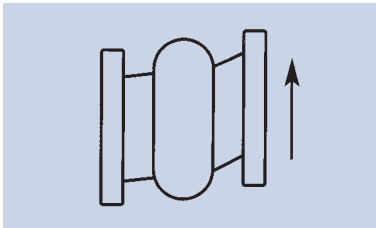
### Axial Extension

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



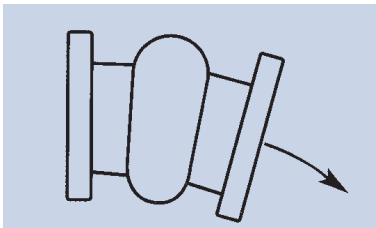
### Torsional Movement

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



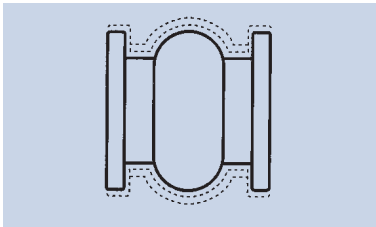
**Lateral/Transverse Movement**

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



**Angular Movement**

- Deflection/rotation of one or both flanges
- Angle with axis of expansion joint/flexible coupling is formed



**Vibration**

- By definition, this is the oscillating movement around axis of expansion joint/flexible coupling
- Pipe flanges remain parallel with each other
- Flanges remain perpendicular to axis
- Mechanical vibration in steel piping system reduced with installation of pipe connection of pipe connectors/expansion joints

| Exp. Joint Size (inches)   | 2 to 6 |     | 8     |     | 10    |       | 12  |       | 4     |     | 16    |       | 18  |       | 20    |     | 22 to 24 |       | 26 to 40 |       | 42 to 96 |      |       |       |     |    |       |       |       |         |  |
|----------------------------|--------|-----|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|----------|-------|----------|-------|----------|------|-------|-------|-----|----|-------|-------|-------|---------|--|
| <b>To Handle</b>           |        |     |       |     |       |       |     |       |       |     |       |       |     |       |       |     |          |       |          |       |          |      |       |       |     |    |       |       |       |         |  |
| Axial Compression (Inches) | 1/2    | 1   | 1 1/2 | 3/4 | 1 1/2 | 2 1/4 | 3/4 | 1 1/2 | 2 1/4 | 3/4 | 1 1/2 | 2 1/4 | 3/4 | 1 1/2 | 2 1/4 | 3/4 | 1 1/2    | 2 1/4 | 7/8      | 1 3/4 | 2 5/8    | 7/8  | 1 3/4 | 2 5/8 | 1   | 2  | 3     | 1 1/8 | 2 1/4 | 2 3/8   |  |
| Axial Extension (Inches)   | 1/4    | 1/2 | 3/4   | 3/8 | 3/4   | 1 1/4 | 3/8 | 3/4   | 1 1/4 | 3/8 | 3/4   | 1 1/4 | 3/8 | 3/4   | 1 1/4 | 3/8 | 3/4      | 1 1/4 | 7/16     | 7/8   | 5/16     | 7/16 | 7/8   | 5/16  | 1/2 | 1  | 1 1/2 | 9/16  | 1 1/8 | 1 11/16 |  |
| In-Lateral Deflection      | 1/2    | 1   | 1 1/2 | 1/2 | 1     | 1 1/2 | 1/2 | 1     | 1 1/2 | 1/2 | 1     | 1 1/2 | 1/2 | 1     | 1 1/2 | 1/2 | 1        | 1 1/2 | 1/2      | 1     | 1 1/2    | 1/2  | 1     | 1 1/2 | 1/2 | 1  | 1 1/2 | 1/2   | 1     | 1 1/2   |  |
| <b>USE</b>                 |        |     |       |     |       |       |     |       |       |     |       |       |     |       |       |     |          |       |          |       |          |      |       |       |     |    |       |       |       |         |  |
| Face-to-face (Inches)      | 6      | 10  | 12    | 6   | 10    | 14    | 8   | 12    | 14    | 8   | 12    | 14    | 8   | 12    | 16    | 8   | 12       | 16    | 8        | 12    | 16       | 10   | 14    | 18    | 10  | 14 | 18    | 12    | 14    | 18      |  |
| Number (Arches)            | 1      | 2   | 3     | 1   | 2     | 3     | 1   | 2     | 3     | 1   | 2     | 3     | 1   | 2     | 3     | 1   | 2        | 3     | 1        | 2     | 3        | 1    | 2     | 3     | 1   | 2  | 3     | 1     | 2     | 3       |  |

# SINGLE SPHERE CONNECTORS

## With Floating Flange



### Features

- **May be used both for Suction and Delivery**

Because of the excellent moulding technique combined with tough chemical fibres, it may be used at a bursting pressure of over 850 p.s.i. and within a normal internal pressure of 225 p.s.i. Since it can satisfactorily withstand the force for creating a vacuum, it may be used on both the delivery and the suction sides. Its carcass is made of special spherical type, it will not come in contact with the connecting bolt head even if it expands, this connector may be used with a sense of security even when subjected to high pressures.

- **Easy Installation on Piping**

Since its carcass is soft and can be readily deformed, pipe connections can be quickly and readily completed despite some misalignment.

- **Excellent Ability to isolate Sound and Vibration**

The highly soft carcass isolates vibration and solid sound in all directions and prevents the production of noise.

• **Other Advantages and Effects**

- 1) Need neither gasket nor packing.
- 2) Since the flange is a sort of loose fit type, it can be installed on pipes without difficulty.
- 3) Since it absorbs the elongation and contraction of pipes caused by variations in temperature, it prevents the piping system and equipment from breaking down.
- 4) It absorbs the pulsation of water and prevents water hammering to some extent.
- 5) When pipes made of different engineering materials are connected with this connector, it prevents them from developing electrolytic corrosion.

**Typical Applications:**

- 1) Pressure piping systems for water and warm water used in building equipment and general industrial plants, etc.
- 2) Pump lines and turbine lines used for power generation plants, industrial machinery, universal pump blowers, etc
- 3) Feed-water and drainage lines for waterworks, sewerage, sanitary piping systems, etc.
- 4) Oil lines for industrial plants, shipbuilding yards, etc.
- 5) Loading and unloading lines to and from ships for harbour facilities, etc.

*Others: This connector has a wide range of applications in waste disposal plants, mines, chemical plants, etc.*

| Available Styles / Materials |                 |                |                           | Norminal Diam |      | 100PSI | 150PSI | 200PSI | 225PSI |
|------------------------------|-----------------|----------------|---------------------------|---------------|------|--------|--------|--------|--------|
| Material Code                | Cover Elastomer | Tube Elastomer | Maximum Opertaing Temp °C |               |      |        |        |        |        |
| BB                           | Chloro Butyl    | Chloro Butyl   | 105                       | 1             | 25mm |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 1 1/4         | 32   |        |        | ⊕      | ⊕      |
| EE                           | EPDM            | EPDM           | 105                       | 1 1/2         | 40   |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 2             | 50   |        |        | ⊕      | ⊕      |
| NH                           | Neoprene        | Hypalon        | 100                       | 2 1/2         | 65   |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 3             | 80   |        |        | ⊕      | ⊕      |
| NN                           | Neoprene        | Neoprene       | 105                       | 4             | 100  |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 5             | 125  |        |        | ⊕      | ⊕      |
| NP                           | Neoprene        | Nitrile (Buna) | 100                       | 6             | 150  |        | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 8             | 200  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 10            | 250  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 12            | 300  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 14            | 350  | ⊕      | ⊕      |        |        |
|                              |                 |                |                           | 16            | 400  | ⊕      |        |        |        |
|                              |                 |                |                           | 18            | 450  | ⊕      |        |        |        |
|                              |                 |                |                           | 20            | 500  | ⊕      |        |        |        |
|                              |                 |                |                           | 22            | 550  | ⊕      |        |        |        |
|                              |                 |                |                           | 24            | 600  | ⊕      |        |        |        |
|                              |                 |                |                           | 28            | 700  | ⊕      |        |        |        |
|                              |                 |                |                           | 30            | 750  | ⊕      |        |        |        |

**Single Sphere Connectors *FSF* Type**

| Nominal Diameter |     | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm  | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1 1/4"           | 32  | 95                    | 89 - 97           | 87 - 99                   | 8                                | 4               | 8                  | 15°             | 225                      | 660              |
| 1 1/2"           | 40  | 95                    | 89 - 97           | 87 - 99                   | 8                                | 4               | 8                  | 15°             | 225                      | 660              |
| 2"               | 50  | 105                   | 99 - 107          | 99 - 110                  | 8                                | 5               | 8                  | 15°             | 225                      | 660              |
| 2 1/2"           | 65  | 115                   | 107 - 118         | 103 - 121                 | 12                               | 6               | 10                 | 15°             | 225                      | 660              |
| 3"               | 80  | 130                   | 122 - 133         | 118 - 133                 | 12                               | 6               | 10                 | 15°             | 225                      | 660              |
| 4"               | 100 | 135                   | 122 - 140         | 117 - 145                 | 18                               | 10              | 12                 | 15°             | 225                      | 660              |
| 5"               | 125 | 170                   | 156 - 175         | 152 - 180                 | 18                               | 10              | 12                 | 15°             | 225                      | 660              |
| 6"               | 150 | 180                   | 167 - 185         | 162 - 190                 | 18                               | 10              | 12                 | 15°             | 225                      | 660              |
| 8"               | 200 | 205                   | 186 - 212         | 180 - 220                 | 25                               | 14              | 22                 | 15°             | 225                      | 660              |
| 10"              | 250 | 240                   | 221 - 247         | 215 - 254                 | 25                               | 14              | 22                 | 15°             | 225                      | 660              |
| 12"              | 300 | 260                   | 241 - 267         | 235 - 274                 | 25                               | 14              | 22                 | 15°             | 225                      | 660              |
| 14"              | 350 | 265                   | 246 - 273         | 240 - 281                 | 25                               | 14              | 22                 | 15°             | 150                      | 660              |
| 16"              | 400 | 265                   | 246 - 273         | 240 - 281                 | 25                               | 14              | 22                 | 15°             | 125                      | 660              |
| 18"              | 450 | 265                   | 246 - 273         | 240 - 281                 | 25                               | 14              | 22                 | 15°             | 125                      | 660              |
| 20"              | 500 | 265                   | 246 - 273         | 240 - 281                 | 25                               | 14              | 22                 | 15°             | 125                      | 660              |
| 24"              | 600 | 265                   | 246 - 273         | 240 - 281                 | 25                               | 14              | 22                 | 15°             | 125                      | 660              |

∅ Flange is available with DIN Standard, ANSI Standard, JIS Standard, and BS Standard.

**Single Sphere Connectors *FSF- A Type***

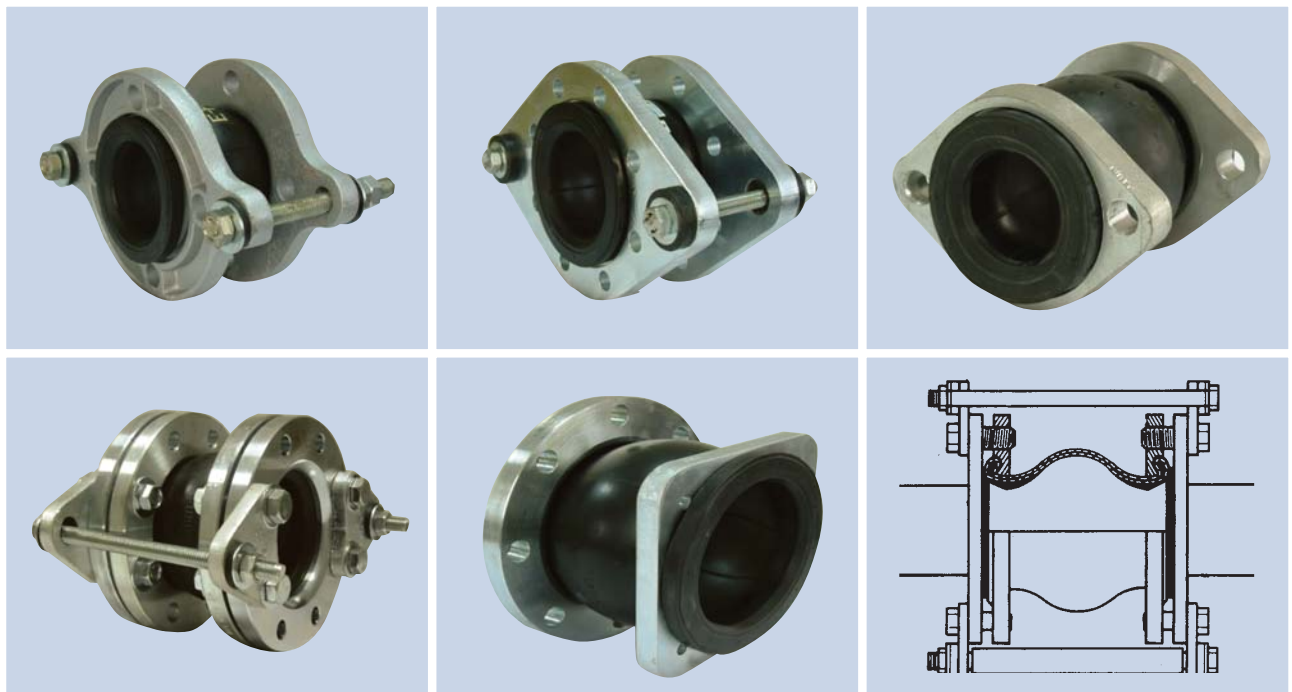
| Nominal Diameter |     | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm  | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1"               | 25  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 1 1/4"           | 32  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 1 1/2"           | 40  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 2"               | 50  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 2 1/2"           | 65  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 3"               | 80  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
|                  |     | 203                   | 194 - 208         | 191 - 213                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 3 1/2"           | 90  | 152                   | 143 - 157         | 140 - 162                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 4"               | 100 | 152                   | 138 - 159         | 133 - 165                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
|                  |     | 203                   | 189 - 210         | 216 - 184                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
| 5"               | 125 | 152                   | 138 - 159         | 133 - 165                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
|                  |     | 203                   | 189 - 210         | 216 - 184                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
| 6"               | 150 | 152                   | 138 - 159         | 133 - 165                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
|                  |     | 203                   | 189 - 210         | 216 - 184                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
| 8"               | 200 | 152                   | 138 - 159         | 133 - 165                 | 19                               | 13              | 13                 | 15°             | 225                      | 660              |
| 10"              | 250 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 225                      | 660              |
|                  |     | 229                   | 210 - 237         | 203 - 244                 | 25                               | 16              | 19                 | 15°             | 225                      | 660              |
|                  |     | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 15°             | 225                      | 660              |
| 12"              | 300 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 225                      | 660              |
|                  |     | 229                   | 210 - 237         | 203 - 244                 | 25                               | 16              | 19                 | 15°             | 225                      | 660              |
| 14"              | 350 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 150                      | 660              |
| 16"              | 400 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 125                      | 660              |
| 18"              | 450 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 125                      | 660              |
| 20"              | 500 | 203                   | 184 - 211         | 178 - 219                 | 25                               | 16              | 19                 | 15°             | 125                      | 660              |
| 22"              | 550 | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 15°             | 115                      | 660              |
| 24"              | 600 | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 15°             | 110                      | 660              |
| 26"              | 650 | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 10°             | 110                      | 660              |
| 28"              | 700 | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 10°             | 110                      | 660              |
| 30"              | 750 | 254                   | 235 - 262         | 229 - 270                 | 25                               | 16              | 19                 | 10°             | 110                      | 660              |

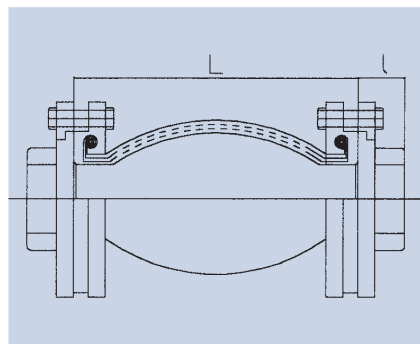
∅ Flange is available with DIN Standard, ANSI Standard, JIS Standard, and BS Standard.

Single Sphere Connectors *FSF-B Type*

| Nominal Diameter |     | Installed Length (mm) |                     | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|---------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| Inch             | mm  | Natural Length        | Min - Max Installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 3/4"             | 20  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 1"               | 25  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 1 1/4"           | 32  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 1 1/2"           | 40  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 2"               | 50  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 2 1/2"           | 65  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 3"               | 80  | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 4"               | 100 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 5"               | 125 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 6"               | 150 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 8"               | 200 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 15°             | 225                      | 660              |
| 10"              | 250 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 10°             | 225                      | 660              |
| 12"              | 300 | 130                   | 116 - 130           | 113 - 135                 | 13                               | 9               | 13                 | 10°             | 225                      | 660              |

Product Samples



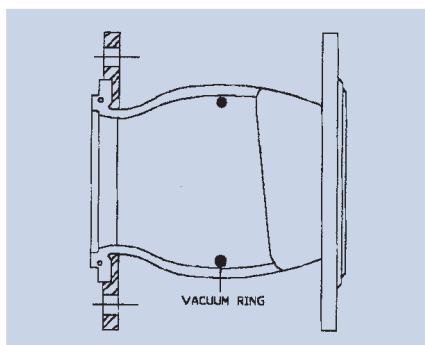


**Single Sphere Connectors *With Bolt-on Flanges***

| Nominal Diameter |    | Installed Length (mm) |                      |                     | Travel                    | Allowable Movements from Neutral (mm) |                 |                    |                 | Working Pressures        |               |
|------------------|----|-----------------------|----------------------|---------------------|---------------------------|---------------------------------------|-----------------|--------------------|-----------------|--------------------------|---------------|
| inch             | mm | Length of Rubber (L)  | Length of Flange (l) | Min - Max installed | Total Compressed Extended | Axial Compression                     | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating |
| 3/4"             | 20 | 130                   | 24.5                 | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 1"               | 25 | 130                   | 0                    | 116 - 130           | 13 - 135                  | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 30                   | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 1 1/4"           | 32 | 95                    | 31.5                 | 89 - 97             | 87 - 99                   | 8                                     | 4               | 8                  | 15°             | 225                      | 660           |
|                  |    | 130                   | 31.5                 | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 31.5                 | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 1 1/2"           | 40 | 95                    | 37                   | 89 - 97             | 87 - 99                   | 8                                     | 4               | 8                  | 15°             | 225                      | 660           |
|                  |    | 130                   | 37                   | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 37                   | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 2"               | 50 | 95                    | 38                   | 99 - 107            | 99 - 110                  | 8                                     | 5               | 8                  | 15°             | 225                      | 660           |
|                  |    | 130                   | 38                   | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 38                   | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 2 1/2"           | 65 | 115                   | 43                   | 107 - 118           | 103 - 121                 | 12                                    | 6               | 10                 | 15°             | 225                      | 660           |
|                  |    | 130                   | 43                   | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 43                   | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
| 3"               | 80 | 130                   | 42                   | 116 - 130           | 113 - 135                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |
|                  |    | 152                   | 42                   | 143 - 157           | 140 - 162                 | 13                                    | 9               | 13                 | 15°             | 225                      | 660           |

Ø Flange is available with BSP Thread and NPT

**Single Sphere Connectors *Special Type With Vacuum Ring***



Vacuum Ring is placed inside the face of rubber for reinforcing the rubber bellow to endure higher vacuum.

|                                  | Vacuum Rating |
|----------------------------------|---------------|
| Rubber Joint without Vacuum Ring | 660 mm/hg     |
| Rubber Joint with Vacuum Ring    | 760 mm/hg     |

## TWIN SPHERE CONNECTORS

### With Floating Flanges



### Features

- **May be used both for Suction and Delivery**

Because of the excellent moulding technique combined with tough chemical fibres it may be used at a bursting pressure of over 850 p.s.i. and within a normal internal pressure of withstand the force for creating a vacuum it may be used on both the carcass is of will not come in contact with the connecting bolt head even if it expands, this connector may be used with a sense of security even when subjected to high pressures.

- **Easy Installation on Piping**

Since its carcass is soft and can be readily deformed, pipe connections can be quickly and readily completed despite some misalignment.

- **Excellent Ability to isolate Sound and Vibration**

The highly soft carcass isolates vibration and solid sound in all directions and prevents the production of noise.

- **Other Advantages and Effects**

- 1) Need neither gasket nor packing.
- 2) Since the flange is a sort of loose fit type, it can be installed on pipes without difficulty.
- 3) Since it absorbs the elongation and contraction of pipes caused by variations in temperature, it prevents the piping system and equipment from breaking down.
- 4) It absorbs the pulsation of water and prevents water hammering to some extent.
- 5) When pipes made of different engineering materials are connected with this connector, it prevents them from developing electrolytic corrosion.

**Typical Applications:**

- 1) Pressure piping systems for water and warm water used in building equipment and general industrial plants, etc.
- 2) Pump lines and turbine lines used for power generation plants, industrial machinery, universal pump blowers, etc
- 3) Feed-water and drainage lines for waterworks, sewerage, sanitary piping systems, etc.
- 4) Oil lines for industrial plants, shipbuilding yards, etc.
- 5) Loading and unloading lines to and from ships for harbour facilities, etc.

*Others: This connector has a wide range of applications in waste disposal plants, mines, chemical plants, etc.*

| Available Styles / Materials |                 |                |                           | Nominal Diam |      | 100PSI | 150PSI | 200PSI | 225PSI |
|------------------------------|-----------------|----------------|---------------------------|--------------|------|--------|--------|--------|--------|
| Material Code                | Cover Elastomer | Tube Elastomer | Maximum Operating Temp °C |              |      |        |        |        |        |
| BB                           | Chloro Butyl    | Chloro Butyl   | 105                       | 1            | 25mm |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 1 1/4        | 32   |        |        | ⊕      | ⊕      |
| EE                           | EPDM            | EPDM           | 105                       | 1 1/2        | 40   |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 2            | 50   |        |        | ⊕      | ⊕      |
| NH                           | Neoprene        | Hypalon        | 100                       | 2 1/2        | 65   |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 3            | 80   |        |        | ⊕      | ⊕      |
| NN                           | Neoprene        | Neoprene       | 105                       | 4            | 100  |        |        | ⊕      | ⊕      |
|                              |                 |                |                           | 5            | 125  |        |        | ⊕      | ⊕      |
| NP                           | Neoprene        | Nitrile (Buna) | 100                       | 6            | 150  |        | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 8            | 200  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 10           | 250  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 12           | 300  | ⊕      | ⊕      | ⊕      | ⊕      |
|                              |                 |                |                           | 14           | 350  | ⊕      | ⊕      |        |        |
|                              |                 |                |                           | 16           | 400  | ⊕      |        |        |        |
|                              |                 |                |                           | 18           | 450  | ⊕      |        |        |        |
|                              |                 |                |                           | 20           | 500  | ⊕      |        |        |        |
|                              |                 |                |                           | 22           | 550  | ⊕      |        |        |        |
|                              |                 |                |                           | 24           | 600  | ⊕      |        |        |        |
|                              |                 |                |                           | 28           | 700  | ⊕      |        |        |        |
|                              |                 |                |                           | 30           | 750  | ⊕      |        |        |        |

**Twin Sphere Connectors *FTF Type***

| Nominal Diameter |     | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm  | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1 1/4"           | 32  | 175                   | 137 - 190         | 125 - 205                 | 53                               | 27              | 45                 | 40°             | 225                      | 660              |
| 1 1/2"           | 40  | 175                   | 137 - 190         | 125 - 205                 | 53                               | 27              | 45                 | 40°             | 225                      | 660              |
| 2"               | 50  | 175                   | 137 - 190         | 125 - 205                 | 53                               | 27              | 45                 | 40°             | 225                      | 660              |
| 2 1/2"           | 65  | 175                   | 137 - 190         | 125 - 205                 | 53                               | 27              | 45                 | 40°             | 225                      | 660              |
| 3"               | 80  | 175                   | 137 - 190         | 125 - 205                 | 53                               | 27              | 45                 | 40°             | 225                      | 660              |
| 4"               | 100 | 225                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 5"               | 125 | 225                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 6"               | 150 | 225                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 8"               | 200 | 325                   | 280 - 342         | 265 - 360                 | 65                               | 30              | 35                 | 30°             | 225                      | 660              |
| 10"              | 250 | 325                   | 280 - 342         | 265 - 360                 | 65                               | 30              | 35                 | 30°             | 225                      | 660              |
| 12"              | 300 | 325                   | 280 - 342         | 265 - 360                 | 65                               | 30              | 35                 | 30°             | 225                      | 660              |
| 14"              | 350 | 350                   | 315 - 364         | 304 - 380                 | 43                               | 30              | 30                 | 20°             | 150                      | 660              |
| 16"              | 400 | 350                   | 315 - 364         | 304 - 380                 | 43                               | 30              | 30                 | 20°             | 125                      | 660              |
| 18"              | 450 | 350                   | 315 - 364         | 304 - 380                 | 43                               | 30              | 30                 | 20°             | 125                      | 660              |
| 20"              | 500 | 350                   | 315 - 364         | 304 - 380                 | 43                               | 30              | 30                 | 20°             | 125                      | 660              |
| 24"              | 600 | 350                   | 315 - 364         | 304 - 380                 | 43                               | 30              | 30                 | 20°             | 110                      | 660              |

∅ Flange is available with DIN Standard, ANSI Standard, JIS Standard, and BS Standard.

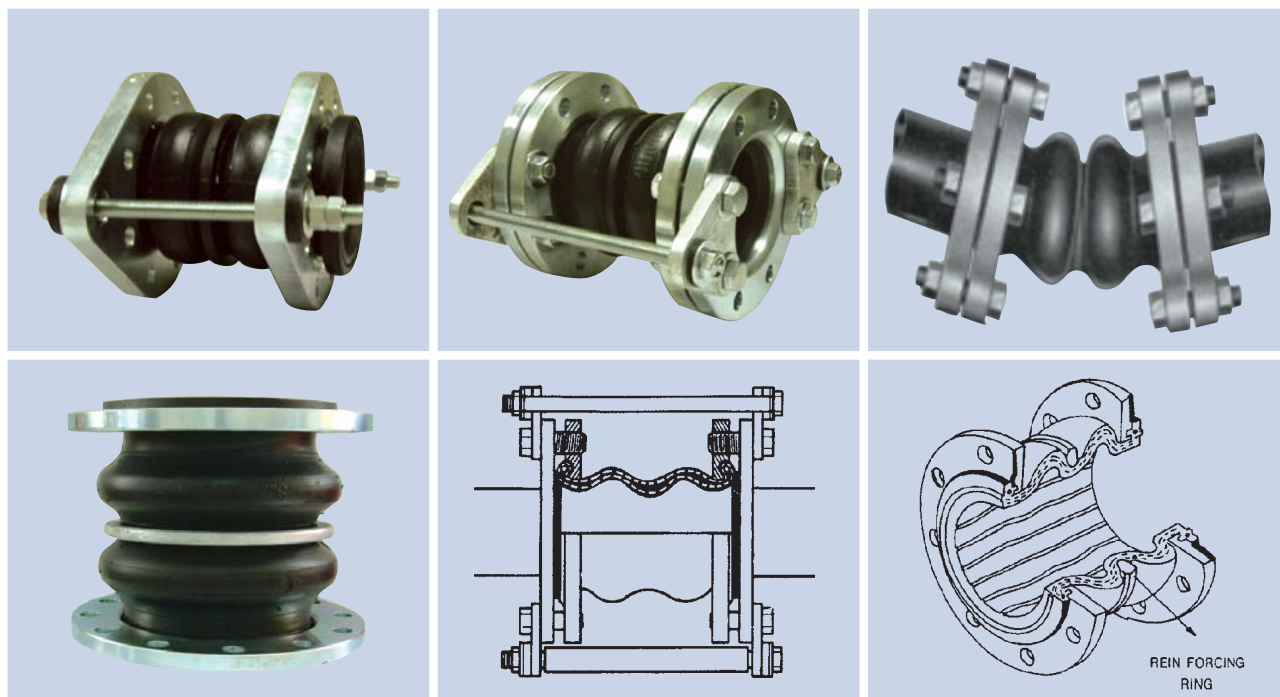
**Twin Sphere Connectors *FSF- A Type***

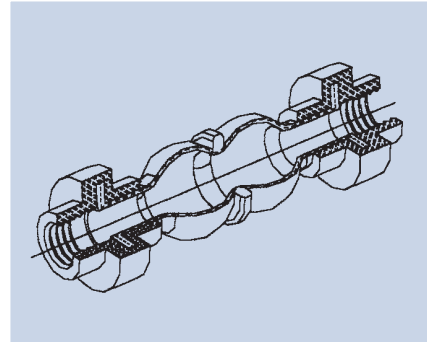
| Nominal Diameter |     | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm  | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1 1/4"           | 32  | 152                   | 115 - 167         | 102 - 182                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 1 1/2"           | 40  | 152                   | 115 - 167         | 102 - 182                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 2"               | 50  | 152                   | 115 - 167         | 102 - 182                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 2 1/2"           | 65  | 152                   | 115 - 167         | 102 - 182                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 3"               | 80  | 229                   | 216 - 243         | 178 - 258                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 4"               | 100 | 229                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 5"               | 125 | 229                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 6"               | 150 | 229                   | 187 - 242         | 175 - 260                 | 53                               | 31              | 40                 | 35°             | 225                      | 660              |
| 8"               | 200 | 229                   | 183 - 246         | 169 - 264                 | 59                               | 35              | 35                 | 30°             | 225                      | 660              |
| 10"              | 250 | 305                   | 261 - 322         | 245 - 340                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
| 12"              | 300 | 305                   | 261 - 322         | 245 - 340                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
| 14"              | 350 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 30°             | 150                      | 660              |
| 16"              | 400 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 125                      | 660              |
| 18"              | 450 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 125                      | 660              |
| 20"              | 500 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 125                      | 660              |
| 24"              | 600 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 110                      | 660              |
| 28"              | 700 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 100                      | 660              |
| 30"              | 750 | 305                   | 271 - 320         | 260 - 335                 | 45                               | 30              | 30                 | 20°             | 100                      | 660              |

**Twin Sphere Connectors *FTF- B Type***

| Nominal Diameter |     | Installed Length (mm) |                     | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|-----|-----------------------|---------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| Inch             | mm  | Natural Length        | Min - Max Installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1"               | 25  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 1 1/4"           | 32  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 1 1/2"           | 40  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 2"               | 50  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 2 1/2"           | 65  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 3"               | 80  | 254                   | 216 - 269           | 204 - 284                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
|                  |     | 305                   | 267 - 320           | 255 - 335                 | 50                               | 30              | 45                 | 40°             | 225                      | 660              |
| 4"               | 100 | 254                   | 216 - 271           | 204 - 289                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
|                  |     | 305                   | 267 - 322           | 255 - 340                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
| 5"               | 125 | 254                   | 216 - 271           | 204 - 289                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
|                  |     | 305                   | 267 - 322           | 255 - 340                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
| 6"               | 150 | 254                   | 216 - 271           | 204 - 289                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
|                  |     | 305                   | 267 - 322           | 255 - 340                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
|                  |     | 350                   | 318 - 373           | 306 - 391                 | 50                               | 35              | 40                 | 35°             | 225                      | 660              |
| 8"               | 200 | 254                   | 209 - 271           | 194 - 289                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
|                  |     | 305                   | 260 - 322           | 245 - 340                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
|                  |     | 350                   | 311 - 373           | 296 - 391                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
| 10"              | 250 | 350                   | 312 - 373           | 296 - 391                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |
| 12"              | 300 | 350                   | 312 - 373           | 296 - 391                 | 60                               | 35              | 35                 | 30°             | 225                      | 660              |

**Product Samples**





**Twin Sphere Connectors *Screw On Female Unions - FTU Type***

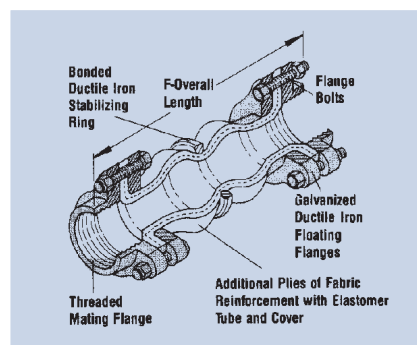
| Nominal Diameter |    | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 3/4"             | 20 | 166                   | 150 - 169         | 144 - 172                 | 22                               | 6               | 22                 | 32°             | 150                      | 660              |
| 1"               | 25 | 172                   | 155 - 175         | 150 - 178                 | 22                               | 6               | 22                 | 25°             | 150                      | 660              |
| 1 1/4"           | 32 | 176                   | 160 - 179         | 154 - 182                 | 22                               | 6               | 22                 | 25°             | 150                      | 660              |
| 1 1/2"           | 40 | 182                   | 165 - 185         | 160 - 188                 | 22                               | 6               | 22                 | 20°             | 150                      | 660              |
| 2"               | 50 | 212                   | 196 - 215         | 190 - 218                 | 22                               | 6               | 22                 | 15°             | 150                      | 660              |
| 2 1/2"           | 65 | 224                   | 207 - 227         | 202 - 229                 | 22                               | 6               | 22                 | 12°             | 150                      | 660              |
| 3"               | 80 | 226                   | 209 - 229         | 204 - 231                 | 22                               | 6               | 22                 | 10°             | 150                      | 660              |

Φ Union is available with BSP Thread and NPT

**Twin Sphere Connectors *Screw On Female Unions - FTU-A Type***

| Nominal Diameter |    | Installed Length (mm) |                   | Travel (mm)               | Allowable Movements from Neutral |                 |                    |                 | Working Pressures        |                  |
|------------------|----|-----------------------|-------------------|---------------------------|----------------------------------|-----------------|--------------------|-----------------|--------------------------|------------------|
| inch             | mm | Natural Length        | Min-Max installed | Total Compressed Extended | Axial Compression                | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating mm |
| 1/2"             | 15 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 32°             | 150                      | 660              |
| 3/4"             | 20 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 32°             | 150                      | 660              |
| 1"               | 25 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 25°             | 150                      | 660              |
| 1 1/4"           | 32 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 25°             | 150                      | 660              |
| 1 1/2"           | 40 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 20°             | 150                      | 660              |
| 2"               | 50 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 15°             | 150                      | 660              |
| 2 1/2"           | 65 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 12°             | 150                      | 660              |
| 3"               | 80 | 203                   | 186 - 206         | 181 - 209                 | 22                               | 6               | 22                 | 10°             | 150                      | 660              |

Φ Union is available with BSP Thread and NPT



**Twin Connectors *With Bolt-on Flanges - FTU Type***

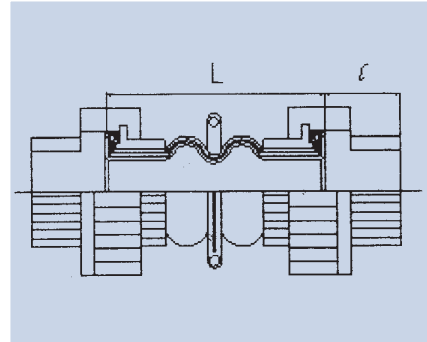
| Nominal Diameter |    | Installed Length (mm) |                      |                     | Travel                    | Allowable Movements from Neutral (mm) |                 |                    |                 | Working Pressures        |               |
|------------------|----|-----------------------|----------------------|---------------------|---------------------------|---------------------------------------|-----------------|--------------------|-----------------|--------------------------|---------------|
| inch             | mm | Length of Rubber (L)  | Length of Flange (f) | Min - Max installed | Total Compressed Extended | Axial Compression                     | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating |
| 3/4"             | 20 | 166                   | 24.5                 | 150 - 169           | 144 - 172                 | 22                                    | 6               | 22                 | 32°             | 150                      | 660           |
| 1"               | 25 | 172                   | 30                   | 155 - 175           | 150 - 178                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/4"           | 32 | 176                   | 31.5                 | 160 - 179           | 154 - 182                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/2"           | 40 | 182                   | 37                   | 165 - 185           | 160 - 188                 | 22                                    | 6               | 22                 | 20°             | 150                      | 660           |
| 2"               | 50 | 212                   | 38                   | 196 - 215           | 190 - 218                 | 22                                    | 6               | 22                 | 15°             | 150                      | 660           |
| 2 1/2"           | 65 | 224                   | 43                   | 207 - 227           | 202 - 229                 | 22                                    | 6               | 22                 | 12°             | 150                      | 660           |
| 3"               | 80 | 226                   | 42                   | 209 - 229           | 204 - 231                 | 22                                    | 6               | 22                 | 10°             | 150                      | 660           |

Φ Flange is available with BSP Thread and NPT

**Twin Connectors *With Bolt-on Flanges - FTU- A Type***

| Nominal Diameter |    | Installed Length (mm) |                      |                     | Travel                    | Allowable Movements from Neutral (mm) |                 |                    |                 | Working Pressures        |               |
|------------------|----|-----------------------|----------------------|---------------------|---------------------------|---------------------------------------|-----------------|--------------------|-----------------|--------------------------|---------------|
| inch             | mm | Length of Rubber (L)  | Length of Flange (f) | Min - Max installed | Total Compressed Extended | Axial Compression                     | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating |
| 1/2"             | 15 | 203                   | 24.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 32°             | 150                      | 660           |
| 3/4"             | 20 | 203                   | 24.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 32°             | 150                      | 660           |
| 1"               | 25 | 203                   | 30                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/4"           | 32 | 203                   | 31.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/2"           | 40 | 203                   | 37                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 20°             | 150                      | 660           |
| 2"               | 50 | 203                   | 38                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 15°             | 150                      | 660           |
| 2 1/2"           | 65 | 203                   | 43                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 12°             | 150                      | 660           |
| 3"               | 80 | 203                   | 42                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 10°             | 150                      | 660           |

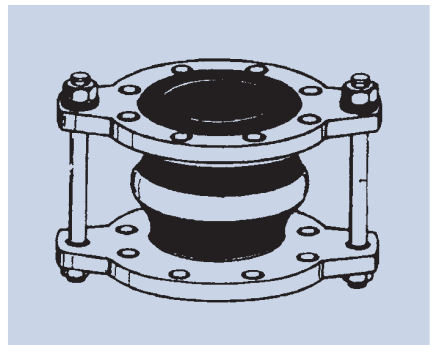
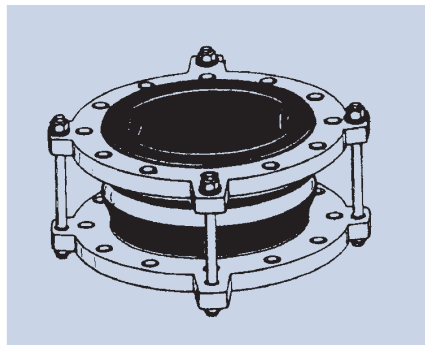
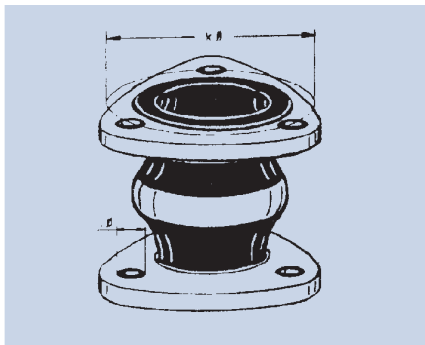
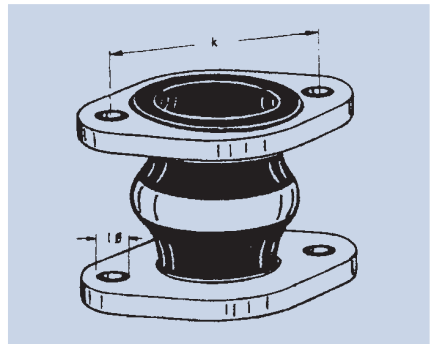
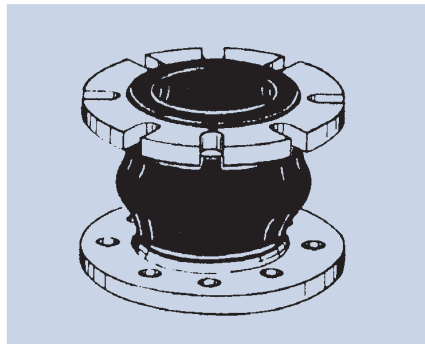
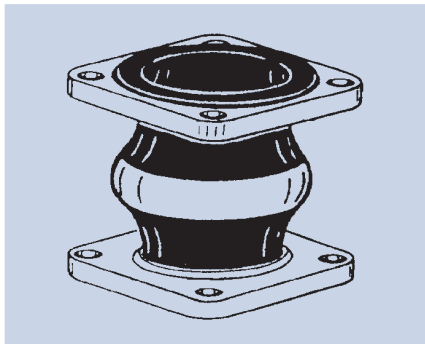
Φ Flange is available with BSP Thread and NPT



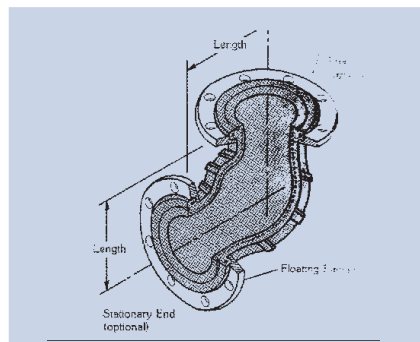
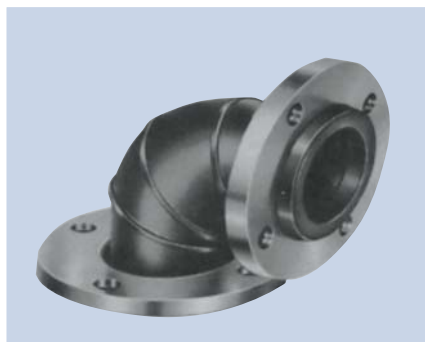
**Twin Sphere Connectors *With PVC Unions***

| Nominal Diameter |    | Installed Length (mm) |                      |                     | Travel                    | Allowable Movements from Neutral (mm) |                 |                    |                 | Working Pressures        |               |
|------------------|----|-----------------------|----------------------|---------------------|---------------------------|---------------------------------------|-----------------|--------------------|-----------------|--------------------------|---------------|
| inch             | mm | Length of Rubber (L)  | Length of Flange (l) | Min - Max installed | Total Compressed Extended | Axial Compression                     | Axial Extension | Lateral Deflection | Angular Degrees | Positive P.S.I.G at 80°C | Vacuum Rating |
| 1/2"             | 15 | 154                   | 24.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 32°             | 150                      | 660           |
| 3/4"             | 20 | 154                   | 24.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 32°             | 150                      | 660           |
| 1"               | 25 | 143                   | 30                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/4"           | 32 | 140                   | 31.5                 | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 25°             | 150                      | 660           |
| 1 1/2"           | 40 | 129                   | 37                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 20°             | 150                      | 660           |
| 2"               | 50 | 127                   | 38                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 15°             | 150                      | 660           |
| 2 1/2"           | 65 | 117                   | 43                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 12°             | 150                      | 660           |
| 3"               | 80 | 117                   | 42                   | 186 - 206           | 181 - 209                 | 22                                    | 6               | 22                 | 10°             | 150                      | 660           |

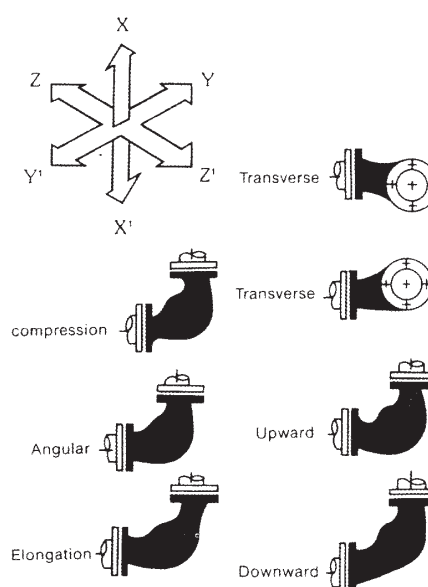
**Product Samples**



## Elbow Connectors



Keyser elbow connector completely solves the vibratory directional problem at the pumps or any other location where the piping must make a right angle turn as it leaves the equipment. The Keyser neoprene elbow accepts motion in all modes without difficulty as the sphere is at the curvature of the connector and the flow through length is even longer than the twin sphere. Rather than taking additional space or using additional fittings, the elbow joint actually substitutes for the cast welded elbow that would ordinarily have to be used anyway. The cost of Keyser rubber bellow is comparable to the steel it replaces and certainly less than the cost of a steel elbow plus a straight line connector. When Keyser rubber elbows are used, the pump foundation need no longer be made large enough to support the base elbows and this reduces the cost of the foundation. Because the piping must be properly supported from above rather than rest on the pump foundation, there is better chance that the pump foundation can operate properly. The reduced foundation weight is often important in lightweight equipment rooms as well.



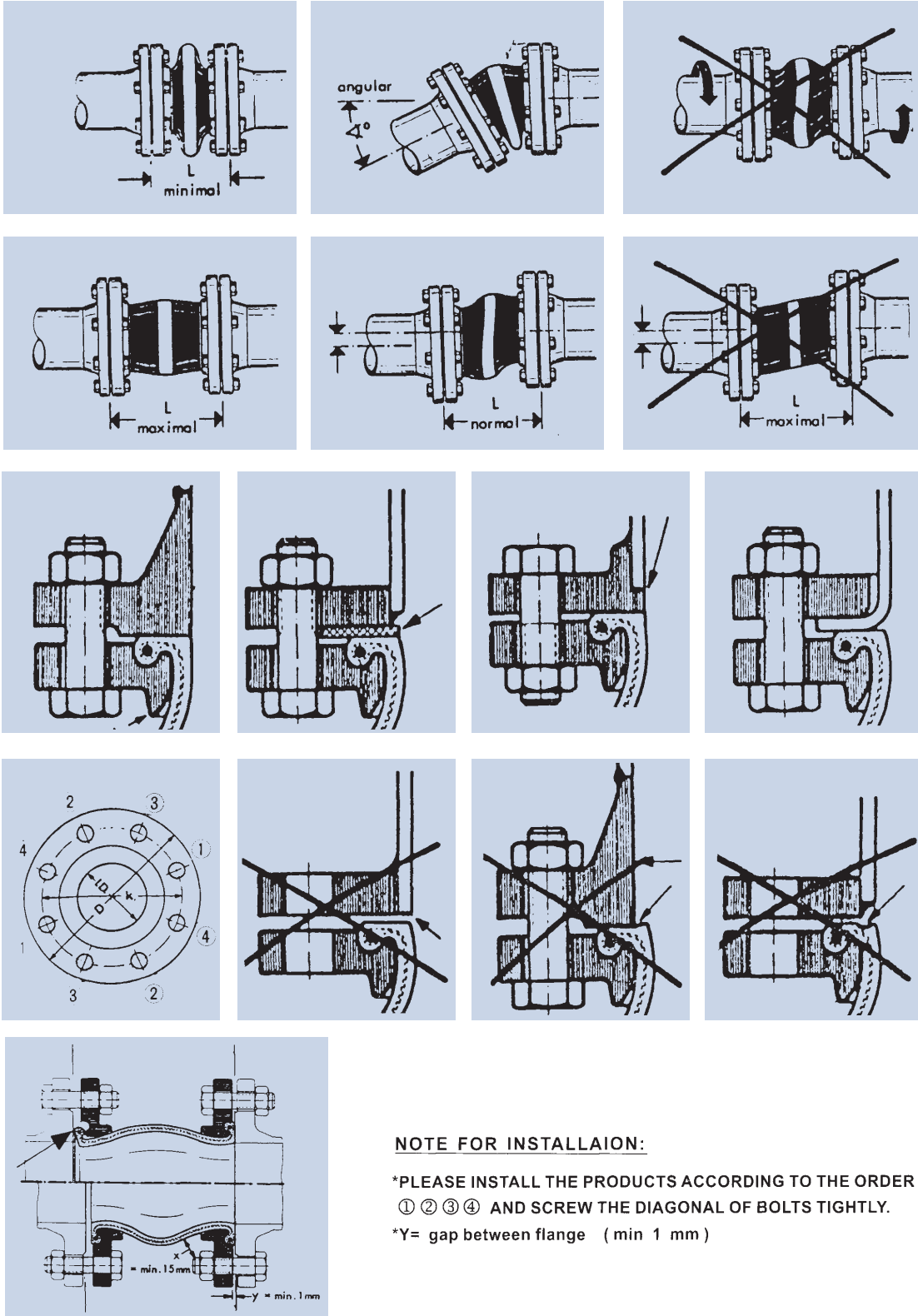
## Movements

| Nominal Diameter X Length (Mm) | X  | X1 | Y  | Y1 | Z  | Z1 |
|--------------------------------|----|----|----|----|----|----|
| 32 x 95                        | 20 | 16 | 20 | 16 | 16 | 16 |
| 40 x 102                       | 20 | 16 | 20 | 16 | 16 | 16 |
| 50 x 114                       | 20 | 16 | 20 | 16 | 16 | 16 |
| 65 x 127                       | 20 | 16 | 20 | 16 | 16 | 16 |
| 80 x 140                       | 20 | 16 | 20 | 16 | 16 | 16 |
| 100 x 165                      | 20 | 16 | 20 | 16 | 16 | 16 |
| 125 x 191                      | 20 | 16 | 20 | 16 | 16 | 16 |
| 150 x 203                      | 20 | 16 | 20 | 16 | 16 | 16 |
| 200 x 229                      | 20 | 16 | 20 | 16 | 16 | 16 |
| 250 x 279                      | 20 | 16 | 20 | 16 | 16 | 16 |
| 300 x 305                      | 20 | 16 | 20 | 16 | 16 | 16 |

| Operating Pressures |         |         | Temperatures |         |         |
|---------------------|---------|---------|--------------|---------|---------|
| 80°C                | 85°C    | 90°C    | 95°C         | 100°C   | 105°C   |
| 214 Psi             | 200 Psi | 180 Psi | 150 Psi      | 145 Psi | 125 Psi |

Operating Conditions : ( 32mm - 300mm )  
 Operating Pressure : 15 kg/cm<sup>2</sup> ( 214 psi )  
 Burst Pressure : 60 kg/cm<sup>2</sup> ( 850 psi )  
 Vacuum Rating : 750 mm/hg  
 Temperature : -10°C to 105°C  
 Fluids : Water, Hot Water, Sea Water, Fluids,  
 Weak Acids, Compressed Air.

Installation Instructions

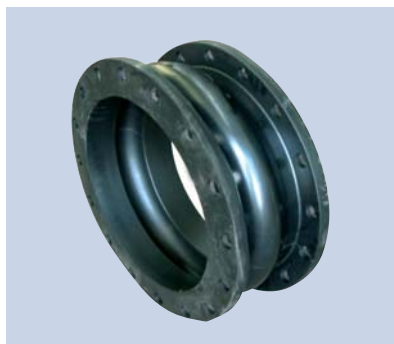


**NOTE FOR INSTALLATION:**

\*PLEASE INSTALL THE PRODUCTS ACCORDING TO THE ORDER ① ② ③ ④ AND SCREW THE DIAGONAL OF BOLTS TIGHTLY.

\*Y= gap between flange ( min 1 mm )

**Wide Arch - By Mould *Single Open Arch Expansion Joints - Type Key - 1***



| Pipe Size (mm) | Face to Face (mm) | Axial Compression (mm) | Axial Extension (mm) | Lateral Deflection (mm) | Angular Degrees | Torsional Degrees | Working Pressure (P.S.I) | Vacuum Rating (mm Hg) |
|----------------|-------------------|------------------------|----------------------|-------------------------|-----------------|-------------------|--------------------------|-----------------------|
| 32             | 150               | 19                     | 13                   | 13                      | 14.5            | 3                 | 165                      | 660                   |
| 40             | 150               | 19                     | 13                   | 13                      | 14.5            | 3                 | 165                      | 660                   |
| 50             | 150               | 19                     | 13                   | 13                      | 14.5            | 3                 | 165                      | 660                   |
| 65             | 150               | 19                     | 13                   | 13                      | 11.5            | 3                 | 165                      | 660                   |
| 80             | 150               | 19                     | 13                   | 13                      | 10.0            | 3                 | 165                      | 660                   |
| 100            | 150               | 19                     | 13                   | 13                      | 7.5             | 3                 | 165                      | 660                   |
| 125            | 150               | 19                     | 13                   | 13                      | 6.0             | 3                 | 140                      | 660                   |
| 150            | 150               | 19                     | 13                   | 13                      | 5.5             | 3                 | 140                      | 660                   |
| 200            | 150               | 19                     | 13                   | 13                      | 5.0             | 3                 | 140                      | 660                   |
| 250            | 200               | 25                     | 16                   | 16                      | 4.5             | 2                 | 140                      | 660                   |
| 300            | 200               | 25                     | 16                   | 16                      | 3.8             | 2                 | 140                      | 660                   |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E

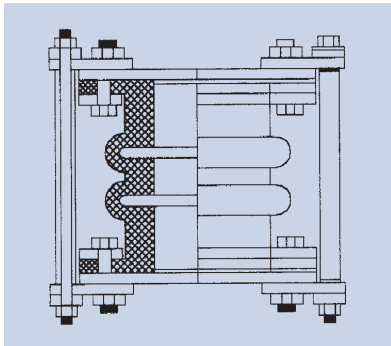
**Wide Arch - By Hand Built *Single Open Arch Expansion Joints - Type Key - 1B***



| Pipe Size (mm) | Face to Face (mm) | Axial Compression (mm) | Axial Extension (mm) | Lateral Deflection (mm) | Angular Degrees | Working Pressure (P.S.I) | Vacuum Rating (mm Hg) |     |
|----------------|-------------------|------------------------|----------------------|-------------------------|-----------------|--------------------------|-----------------------|-----|
| 350            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 400            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 450            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 500            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 600            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 700            | 250               | 300                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 800            | 300               | 310                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 900            | 300               | 310                    | 40                   | 15                      | 30              | 6                        | 145                   | 660 |
| 1000           | 300               | 310                    | 40                   | 15                      | 30              | 6                        | 116                   | 660 |
| 1100           | -                 | 350                    | 40                   | 15                      | 30              | 5                        | 116                   | 660 |
| 1200           | -                 | 350                    | 40                   | 15                      | 30              | 5                        | 116                   | 660 |
| 1300           | -                 | 350                    | 40                   | 15                      | 30              | 5                        | 116                   | 660 |
| 1400           | -                 | 350                    | 40                   | 15                      | 30              | 5                        | 116                   | 660 |
| 1500           | -                 | 350                    | 40                   | 15                      | 30              | 5                        | 87                    | 660 |
| 1600           | -                 | 350                    | 40                   | 15                      | 30              | 4                        | 87                    | 660 |
| 1800           | -                 | 350                    | 40                   | 15                      | 30              | 4                        | 87                    | 660 |
| 2000           | -                 | 350                    | 40                   | 15                      | 25              | 4                        | 87                    | 660 |
| 2200           | -                 | 350                    | 40                   | 15                      | 25              | 4                        | 87                    | 660 |
| 2400           | -                 | 350                    | 30                   | 15                      | 25              | 3                        | 87                    | 660 |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E

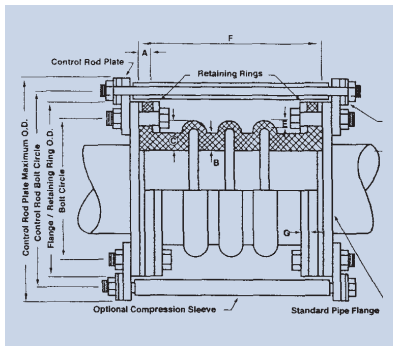
Wide Arch - By Hand Built *Double Open Arch Expansion Joints - Type Key- 2*



| Pipe Size (mm) | Face to Face (mm) | Axial Compression (mm) | Axial Extension (mm) | Lateral Deflection (mm) | Angular Degrees | Torsional Degrees | Working Pressure (P.S.I) | Vacuum Rating (mm Hg) |
|----------------|-------------------|------------------------|----------------------|-------------------------|-----------------|-------------------|--------------------------|-----------------------|
| 32             | 250               | 37.5                   | 25.0                 | 25.0                    | 19.5            | 5                 | 165                      | 660                   |
| 40             | 250               | 37.5                   | 25.0                 | 25.0                    | 19.5            | 5                 | 165                      | 660                   |
| 50             | 250               | 37.5                   | 25.0                 | 25.0                    | 19.5            | 5                 | 165                      | 660                   |
| 65             | 250               | 37.5                   | 25.0                 | 25.0                    | 16.5            | 5                 | 165                      | 660                   |
| 80             | 250               | 37.5                   | 25.0                 | 25.0                    | 15.5            | 5                 | 165                      | 660                   |
| 100            | 250               | 37.5                   | 25.0                 | 25.0                    | 12.5            | 5                 | 165                      | 660                   |
| 125            | 250               | 37.5                   | 25.0                 | 25.0                    | 11.0            | 5                 | 140                      | 660                   |
| 150            | 250               | 37.5                   | 25.0                 | 25.0                    | 10.5            | 5                 | 140                      | 660                   |
| 200            | 250               | 37.5                   | 25.0                 | 25.0                    | 10.0            | 5                 | 140                      | 660                   |
| 250            | 300               | 50.0                   | 31.3                 | 31.3                    | 9.5             | 5                 | 140                      | 660                   |
| 300            | 300               | 50.0                   | 31.3                 | 31.3                    | 8.8             | 5                 | 140                      | 660                   |
| 350            | 300               | 50.0                   | 31.3                 | 31.3                    | 8.3             | 4                 | 90                       | 660                   |
| 400            | 300               | 50.0                   | 31.3                 | 31.3                    | 7.8             | 4                 | 70                       | 660                   |
| 450            | 300               | 50.0                   | 31.3                 | 31.3                    | 7.5             | 3                 | 70                       | 660                   |
| 500            | 300               | 50.0                   | 31.3                 | 31.3                    | 7.5             | 3                 | 70                       | 660                   |
| 550            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.3             | 3                 | 70                       | 660                   |
| 600            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.0             | 3                 | 70                       | 660                   |
| 650            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.0             | 3                 | 70                       | 660                   |
| 700            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.0             | 3                 | 60                       | 500                   |
| 750            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.0             | 3                 | 60                       | 500                   |
| 800            | 350               | 62.5                   | 37.5                 | 31.3                    | 7.0             | 3                 | 60                       | 500                   |
| 900            | 350               | 62.5                   | 37.5                 | 31.3                    | 6.5             | 3                 | 60                       | 500                   |
| 1000           | 350               | 62.5                   | 37.5                 | 31.3                    | 6.5             | 3                 | 60                       | 500                   |
| 1100           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.5             | 2                 | 60                       | 375                   |
| 1200           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.5             | 2                 | 60                       | 375                   |
| 1300           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.3             | 2                 | 60                       | 375                   |
| 1400           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.3             | 2                 | 60                       | 375                   |
| 1500           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.0             | 2                 | 60                       | 375                   |
| 1600           | 400               | 75.0                   | 43.8                 | 37.5                    | 6.0             | 2                 | 50                       | 375                   |
| 1800           | 400               | 75.0                   | 43.8                 | 37.5                    | 5.9             | 2                 | 50                       | 375                   |
| 2000           | 400               | 75.0                   | 43.8                 | 37.5                    | 5.9             | 2                 | 50                       | 375                   |
| 2200           | 400               | 75.0                   | 43.8                 | 37.5                    | 5.8             | 2                 | 50                       | 375                   |
| 2400           | 400               | 75.0                   | 43.8                 | 37.5                    | 5.7             | 2                 | 50                       | 375                   |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E

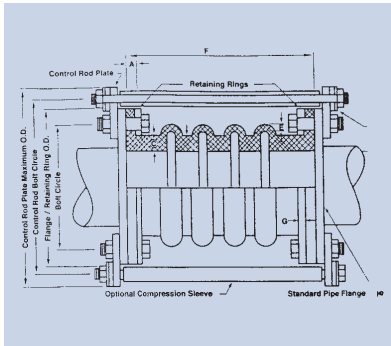
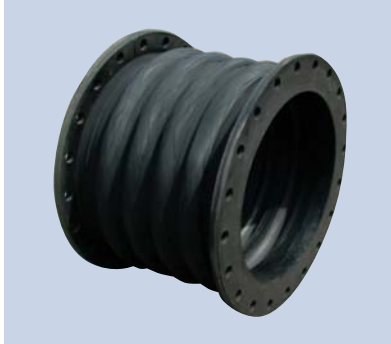
Wide Arch - By Hand Built *Triple Open Arch Expansion Joints - Type Key-3*



| Pipe Size (mm) | Face to Face (mm) | Axial Compression (mm) | Axial Extension (mm) | Lateral Deflection (mm) | Angular Degrees | Torsional Degrees | Working Pressure (P.S.I) | Vacuum Rating (mm Hg) |
|----------------|-------------------|------------------------|----------------------|-------------------------|-----------------|-------------------|--------------------------|-----------------------|
| 32             | 350               | 56.25                  | 37.5                 | 37.5                    | 24.5            | 7                 | 165                      | 375                   |
| 40             | 350               | 56.25                  | 37.5                 | 37.5                    | 24.5            | 7                 | 165                      | 375                   |
| 50             | 350               | 56.25                  | 37.5                 | 37.5                    | 24.5            | 7                 | 165                      | 375                   |
| 65             | 350               | 56.25                  | 37.5                 | 37.5                    | 21.5            | 7                 | 165                      | 375                   |
| 80             | 350               | 56.25                  | 37.5                 | 37.5                    | 19.5            | 7                 | 165                      | 375                   |
| 100            | 350               | 56.25                  | 37.5                 | 37.5                    | 17.5            | 7                 | 165                      | 375                   |
| 125            | 350               | 56.25                  | 37.5                 | 37.5                    | 16.0            | 7                 | 140                      | 375                   |
| 150            | 350               | 56.25                  | 37.5                 | 37.5                    | 15.5            | 7                 | 140                      | 375                   |
| 200            | 350               | 56.25                  | 37.5                 | 37.5                    | 15.0            | 7                 | 140                      | 375                   |
| 250            | 400               | 75.0                   | 47.0                 | 47.0                    | 14.9            | 7                 | 140                      | 375                   |
| 300            | 400               | 75.0                   | 47.0                 | 47.0                    | 12.8            | 7                 | 140                      | 375                   |
| 350            | 400               | 75.0                   | 47.0                 | 47.0                    | 12.8            | 6                 | 90                       | 375                   |
| 400            | 400               | 75.0                   | 47.0                 | 47.0                    | 12.8            | 6                 | 70                       | 375                   |
| 450            | 400               | 75.0                   | 47.0                 | 47.0                    | 12.5            | 5                 | 70                       | 375                   |
| 500            | 400               | 75.0                   | 47.0                 | 47.0                    | 12.5            | 5                 | 70                       | 375                   |
| 550            | 450               | 93.75                  | 47.0                 | 47.0                    | 12.3            | 5                 | 70                       | 375                   |
| 600            | 450               | 93.75                  | 56.25                | 47.0                    | 12.0            | 5                 | 70                       | 375                   |
| 650            | 450               | 93.75                  | 56.25                | 47.0                    | 12.0            | 5                 | 70                       | 375                   |
| 700            | 450               | 93.75                  | 56.25                | 47.0                    | 12.0            | 5                 | 60                       | 250                   |
| 750            | 450               | 93.75                  | 56.25                | 47.0                    | 12.0            | 5                 | 60                       | 250                   |
| 800            | 450               | 93.75                  | 56.25                | 47.0                    | 12.0            | 5                 | 60                       | 250                   |
| 900            | 450               | 93.75                  | 56.25                | 47.0                    | 11.5            | 5                 | 60                       | 250                   |
| 1000           | 450               | 93.75                  | 56.25                | 47.0                    | 11.5            | 5                 | 60                       | 250                   |
| 1100           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.5            | 4                 | 60                       | 250                   |
| 1200           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.5            | 4                 | 60                       | 250                   |
| 1300           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.3            | 4                 | 60                       | 250                   |
| 1400           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.3            | 4                 | 60                       | 250                   |
| 1500           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.0            | 4                 | 60                       | 250                   |
| 1600           | 500               | 112.5                  | 65.8                 | 56.25                   | 11.0            | 4                 | 50                       | 250                   |
| 1800           | 500               | 112.5                  | 65.8                 | 56.25                   | 10.9            | 4                 | 50                       | 250                   |
| 2000           | 500               | 112.5                  | 65.8                 | 56.25                   | 10.9            | 4                 | 50                       | 250                   |
| 2200           | 500               | 112.5                  | 65.8                 | 56.25                   | 10.8            | 4                 | 50                       | 250                   |
| 2400           | 500               | 112.5                  | 65.8                 | 56.25                   | 10.7            | 4                 | 50                       | 250                   |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E

Wide Arch - By Hand Built *Multiple Open Arch Expansion Joints - Type Key - 4*



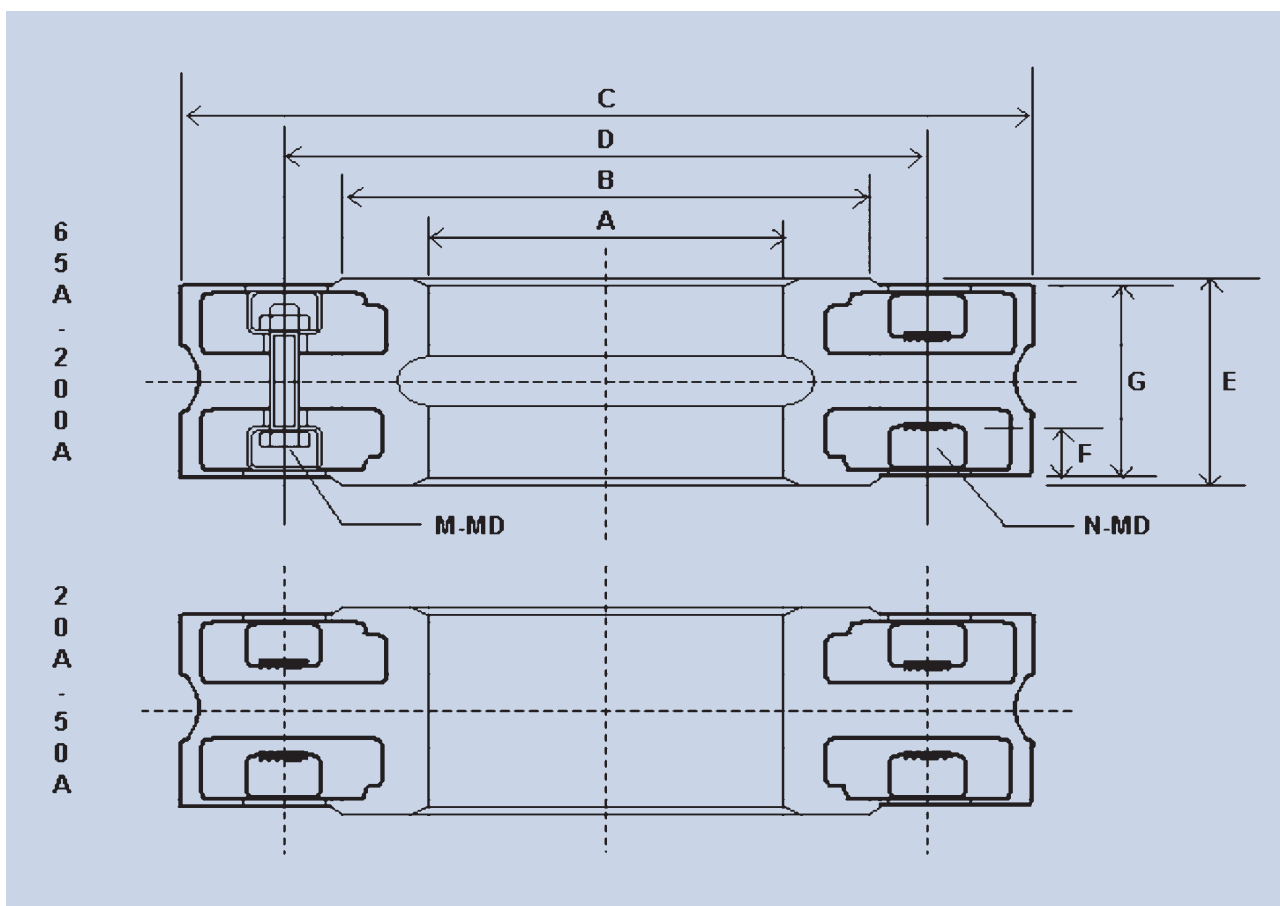
| Pipe Size (mm) | Face to Face (mm) | Axial Compression (mm) | Axial Extension (mm) | Lateral Deflection (mm) | Angular Degrees | Torsional Degrees | Working Pressure (P.S.I) | Vacuum Rating (mm Hg) |
|----------------|-------------------|------------------------|----------------------|-------------------------|-----------------|-------------------|--------------------------|-----------------------|
| 32             | 450               | 75                     | 50.0                 | 50.0                    | 29.5            | 8                 | 165                      | 375                   |
| 40             | 450               | 75                     | 50.0                 | 50.0                    | 29.5            | 8                 | 165                      | 375                   |
| 50             | 450               | 75                     | 50.0                 | 50.0                    | 29.5            | 8                 | 165                      | 375                   |
| 65             | 450               | 75                     | 50.0                 | 50.0                    | 26.5            | 8                 | 165                      | 375                   |
| 80             | 450               | 75                     | 50.0                 | 50.0                    | 24.5            | 8                 | 165                      | 375                   |
| 100            | 450               | 75                     | 50.0                 | 50.0                    | 22.5            | 8                 | 165                      | 375                   |
| 125            | 450               | 75                     | 50.0                 | 50.0                    | 21.0            | 8                 | 140                      | 375                   |
| 150            | 450               | 75                     | 50.0                 | 50.0                    | 20.5            | 8                 | 140                      | 375                   |
| 200            | 450               | 75                     | 50.0                 | 50.0                    | 20.0            | 8                 | 140                      | 375                   |
| 250            | 500               | 100                    | 62.5                 | 62.5                    | 19.9            | 8                 | 140                      | 375                   |
| 300            | 500               | 100                    | 62.5                 | 62.5                    | 17.8            | 8                 | 140                      | 375                   |
| 350            | 500               | 100                    | 75.0                 | 62.5                    | 17.8            | 7                 | 90                       | 375                   |
| 400            | 500               | 100                    | 75.0                 | 62.5                    | 17.8            | 7                 | 70                       | 375                   |
| 450            | 500               | 100                    | 75.0                 | 62.5                    | 17.5            | 6                 | 70                       | 375                   |
| 500            | 500               | 100                    | 75.0                 | 62.5                    | 17.5            | 6                 | 70                       | 375                   |
| 550            | 550               | 125                    | 75.0                 | 62.5                    | 17.3            | 6                 | 70                       | 375                   |
| 600            | 550               | 125                    | 75.0                 | 62.5                    | 17.0            | 6                 | 70                       | 375                   |
| 650            | 550               | 125                    | 75.0                 | 62.5                    | 17.0            | 6                 | 70                       | 375                   |
| 700            | 550               | 125                    | 75.0                 | 62.5                    | 17.0            | 6                 | 60                       | 250                   |
| 750            | 550               | 125                    | 87.5                 | 75.0                    | 17.0            | 6                 | 60                       | 250                   |
| 800            | 550               | 125                    | 87.5                 | 75.0                    | 17.0            | 6                 | 60                       | 250                   |
| 900            | 550               | 125                    | 87.5                 | 75.0                    | 16.5            | 6                 | 60                       | 250                   |
| 1000           | 550               | 125                    | 87.5                 | 75.0                    | 16.5            | 6                 | 60                       | 250                   |
| 1100           | 600               | 150                    | 87.5                 | 75.0                    | 16.5            | 5                 | 60                       | 250                   |
| 1200           | 600               | 150                    | 87.5                 | 75.0                    | 16.5            | 5                 | 60                       | 250                   |
| 1300           | 600               | 150                    | 87.5                 | 75.0                    | 16.3            | 5                 | 60                       | 250                   |
| 1400           | 600               | 150                    | 87.5                 | 75.0                    | 16.3            | 5                 | 60                       | 250                   |
| 1500           | 600               | 150                    | 87.5                 | 75.0                    | 16.0            | 5                 | 60                       | 250                   |
| 1600           | 600               | 150                    | 87.5                 | 75.0                    | 16.0            | 5                 | 50                       | 250                   |
| 1800           | 600               | 150                    | 87.5                 | 75.0                    | 15.9            | 5                 | 50                       | 250                   |
| 2000           | 600               | 150                    | 87.5                 | 75.0                    | 15.8            | 5                 | 50                       | 250                   |
| 2200           | 600               | 150                    | 87.5                 | 75.0                    | 15.8            | 5                 | 50                       | 250                   |
| 2400           | 600               | 150                    | 87.5                 | 75.0                    | 15.7            | 5                 | 50                       | 250                   |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E

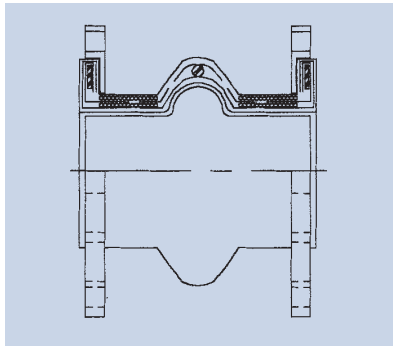
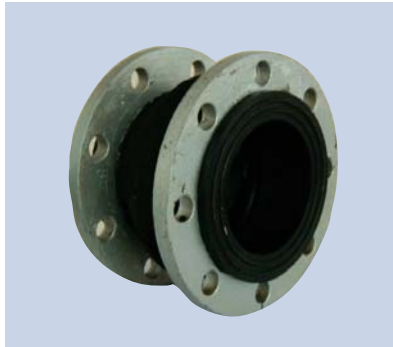
Rubber Joints By Mould - Type Key - 10



| Size | A   | B   | C   | D   | E  | F  | G  | N-MD   | M-MD  |
|------|-----|-----|-----|-----|----|----|----|--------|-------|
| 20   | 20  | 56  | 105 | 75  | 76 | 12 | 70 | 4-M12  |       |
| 25   | 26  | 66  | 115 | 85  | 76 | 12 | 70 | 4-M12  |       |
| 32   | 32  | 76  | 140 | 100 | 76 | 14 | 70 | 4-M16  |       |
| 40   | 40  | 88  | 150 | 110 | 76 | 14 | 70 | 4-M16  |       |
| 50   | 50  | 100 | 165 | 125 | 76 | 14 | 70 | 4-M16  |       |
| 65   | 68  | 120 | 185 | 145 | 76 | 14 | 70 | 4-M16  |       |
| 80   | 80  | 134 | 200 | 160 | 76 | 14 | 70 | 8-M16  | 4-M8  |
| 100  | 105 | 154 | 220 | 180 | 76 | 14 | 70 | 8-M16  | 4-M8  |
| 125  | 130 | 182 | 250 | 210 | 76 | 16 | 70 | 8-M16  | 4-M10 |
| 150  | 155 | 212 | 285 | 240 | 76 | 16 | 70 | 8-M20  | 4-M10 |
| 200  | 200 | 264 | 340 | 295 | 96 | 16 | 90 | 12-M20 | 6-M12 |



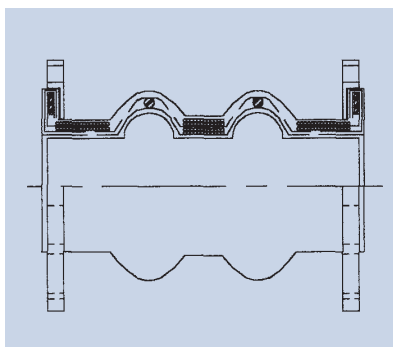
Hand Built Rubber Joints *Single Sphere - Type Key - 11*



| Size | Length | Axial Extension | Axial Compression | Lateral Deflection |
|------|--------|-----------------|-------------------|--------------------|
| 20   | 150    | 15              | 20                | 20                 |
| 25   | 150    | 15              | 20                | 20                 |
| 32   | 150    | 15              | 20                | 20                 |
| 40   | 150    | 15              | 20                | 20                 |
| 50   | 150    | 15              | 20                | 20                 |
| 65   | 150    | 15              | 20                | 20                 |
| 80   | 150    | 20              | 20                | 20                 |
| 100  | 150    | 20              | 20                | 20                 |
| 125  | 150    | 20              | 20                | 20                 |
| 150  | 200    | 20              | 20                | 20                 |
| 200  | 200    | 20              | 20                | 20                 |
| 250  | 200    | 20              | 20                | 20                 |
| 300  | 200    | 20              | 20                | 20                 |
| 350  | 200    | 25              | 30                | 20                 |
| 400  | 200    | 25              | 30                | 20                 |
| 450  | 200    | 25              | 30                | 20                 |
| 500  | 250    | 25              | 30                | 20                 |
| 600  | 250    | 25              | 30                | 20                 |
| 700  | 250    | 25              | 30                | 20                 |
| 800  | 300    | 25              | 30                | 20                 |
| 900  | 300    | 25              | 30                | 20                 |
| 1000 | 300    | 25              | 30                | 20                 |
| 1100 | 300    | 25              | 30                | 20                 |
| 1200 | 300    | 25              | 30                | 20                 |
| 1350 | 300    | 25              | 30                | 20                 |
| 1500 | 350    | 25              | 30                | 20                 |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E For Underground Purpose, Joint Must Be Completed With Middle Steel Ring

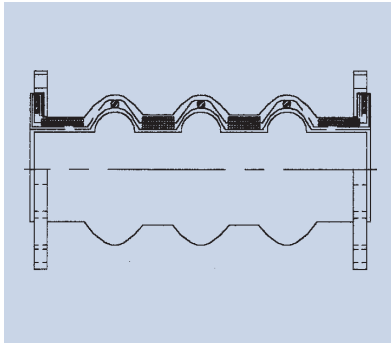
Hand Built Rubber Joints *Single Sphere - Type Key - 12*



| Size | Length | Axial Extension | Axial Compression | Lateral Deflection |
|------|--------|-----------------|-------------------|--------------------|
| 20   | 250    | 30              | 45                | 50                 |
| 25   | 250    | 30              | 45                | 50                 |
| 32   | 250    | 30              | 45                | 50                 |
| 40   | 250    | 30              | 45                | 50                 |
| 50   | 250    | 30              | 45                | 50                 |
| 65   | 250    | 30              | 45                | 50                 |
| 80   | 300    | 30              | 45                | 50                 |
| 100  | 300    | 30              | 45                | 50                 |
| 125  | 300    | 30              | 45                | 50                 |
| 150  | 300    | 30              | 45                | 50                 |
| 200  | 300    | 30              | 45                | 50                 |
| 250  | 300    | 30              | 45                | 50                 |
| 300  | 300    | 30              | 45                | 50                 |
| 350  | 350    | 40              | 50                | 50                 |
| 400  | 350    | 40              | 50                | 50                 |
| 450  | 350    | 40              | 50                | 50                 |
| 500  | 350    | 40              | 50                | 50                 |
| 600  | 400    | 40              | 50                | 50                 |
| 700  | 400    | 40              | 50                | 50                 |
| 800  | 400    | 40              | 50                | 50                 |
| 900  | 400    | 40              | 50                | 50                 |
| 1000 | 450    | 40              | 50                | 50                 |
| 1100 | 450    | 40              | 50                | 50                 |
| 1200 | 450    | 40              | 50                | 50                 |
| 1350 | 450    | 40              | 50                | 50                 |
| 1500 | 450    | 40              | 50                | 50                 |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E For Underground Purpose, Joint Must Be Completed With Middle Steel Ring

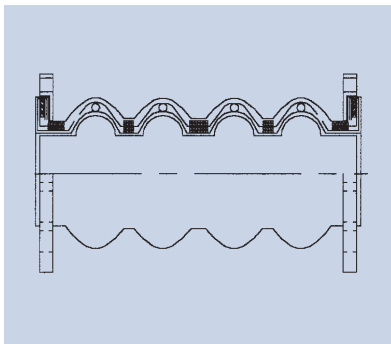
Hand Built Rubber Joints *Single Sphere - Type Key - 13*



| Size | Length | Axial Extension | Axial Compression | Lateral Deflection |
|------|--------|-----------------|-------------------|--------------------|
| 20   | 350    | 40              | 60                | 100                |
| 25   | 350    | 40              | 60                | 100                |
| 32   | 350    | 40              | 60                | 100                |
| 40   | 350    | 40              | 60                | 100                |
| 50   | 350    | 40              | 60                | 100                |
| 65   | 350    | 40              | 60                | 100                |
| 80   | 350    | 40              | 60                | 100                |
| 100  | 350    | 40              | 60                | 100                |
| 125  | 350    | 40              | 60                | 100                |
| 150  | 500    | 40              | 60                | 100                |
| 200  | 500    | 40              | 60                | 100                |
| 250  | 500    | 40              | 60                | 100                |
| 300  | 550    | 40              | 60                | 100                |
| 350  | 550    | 50              | 70                | 100                |
| 400  | 550    | 50              | 70                | 100                |
| 450  | 550    | 50              | 70                | 100                |
| 500  | 550    | 50              | 70                | 100                |
| 600  | 550    | 50              | 70                | 100                |
| 700  | 650    | 50              | 70                | 100                |
| 800  | 650    | 50              | 70                | 100                |
| 900  | 650    | 50              | 70                | 100                |
| 1000 | 700    | 50              | 70                | 100                |
| 1100 | 700    | 50              | 70                | 100                |
| 1200 | 700    | 50              | 70                | 100                |
| 1350 | 700    | 50              | 70                | 100                |
| 1500 | 750    | 50              | 70                | 100                |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E For Underground Purpose, Joint Must Be Completed With Middle Steel Ring

Hand Built Rubber Joints *Single Sphere - Type Key- 14*



| Size | Length | Axial Extension | Axial Compression | Lateral Deflection |
|------|--------|-----------------|-------------------|--------------------|
| 20   | 450    | 40              | 60                | 200                |
| 25   | 450    | 40              | 60                | 200                |
| 32   | 450    | 40              | 60                | 200                |
| 40   | 450    | 40              | 60                | 200                |
| 50   | 450    | 40              | 60                | 200                |
| 65   | 450    | 40              | 60                | 200                |
| 80   | 450    | 40              | 60                | 200                |
| 100  | 450    | 40              | 60                | 200                |
| 125  | 450    | 40              | 60                | 200                |
| 150  | 600    | 40              | 60                | 200                |
| 200  | 600    | 40              | 60                | 200                |
| 250  | 600    | 40              | 60                | 200                |
| 300  | 650    | 40              | 60                | 200                |
| 350  | 650    | 50              | 70                | 200                |
| 400  | 650    | 50              | 70                | 200                |
| 450  | 650    | 50              | 70                | 200                |
| 500  | 650    | 50              | 70                | 200                |
| 600  | 650    | 50              | 70                | 200                |
| 700  | 750    | 50              | 70                | 200                |
| 800  | 750    | 50              | 70                | 200                |
| 900  | 750    | 50              | 70                | 200                |
| 1000 | 800    | 50              | 70                | 200                |
| 1100 | 800    | 50              | 70                | 200                |
| 1200 | 800    | 50              | 70                | 200                |
| 1350 | 800    | 50              | 70                | 200                |
| 1500 | 950    | 50              | 70                | 200                |

Note : Retaining Ring Is Available With Din Pn16, Ansi 150# And Bs Table E For Underground Purpose, Joint Must Be Completed With Middle Steel Ring

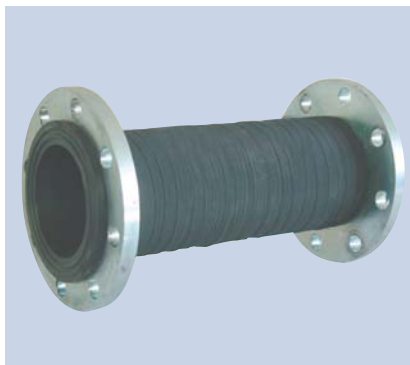
Rubber Pipe Connectors - By Mould - Type Key - 21



| Nominal Diameter |      | Natural Length<br>(inch) | Allowable Movement from Neutral |                         |                            |                 | Operating Pressure             |                       |
|------------------|------|--------------------------|---------------------------------|-------------------------|----------------------------|-----------------|--------------------------------|-----------------------|
| (inch)           | (mm) |                          | Axial Compression<br>(mm)       | Axial Extension<br>(mm) | Lateral Deflection<br>(mm) | Angular Degrees | Positive Pressure<br>(P.S.I.G) | Vacuum Rating<br>(mm) |
| 1                | 25   | 12                       | 4                               | 4                       | 45                         | 18              | 150                            | 660                   |
| 1 1/4            | 32   | 12                       | 4                               | 4                       | 40                         | 14              | 150                            | 660                   |
| 1 1/2            | 40   | 12                       | 4                               | 4                       | 35                         | 11              | 150                            | 660                   |
| 2                | 50   | 12                       | 4                               | 4                       | 30                         | 9               | 150                            | 660                   |
|                  |      | 18                       | 6                               | 4                       | 45                         | 14              | 150                            | 660                   |
| 2 1/2            | 65   | 12                       | 4                               | 4                       | 25                         | 7               | 150                            | 660                   |
|                  |      | 18                       | 6                               | 6                       | 38                         | 11              | 150                            | 660                   |
| 3                | 80   | 12                       | 4                               | 4                       | 20                         | 6               | 150                            | 660                   |
|                  |      | 18                       | 6                               | 6                       | 30                         | 9               | 150                            | 660                   |
| 4                | 100  | 12                       | 4                               | 4                       | 15                         | 5               | 150                            | 660                   |
|                  |      | 18                       | 6                               | 6                       | 23                         | 7               | 150                            | 660                   |
| 5                | 125  | 24                       | 8                               | 8                       | 30                         | 9               | 150                            | 660                   |
|                  |      | 12                       | 4                               | 4                       | 11                         | 4               | 150                            | 660                   |
| 6                | 150  | 18                       | 6                               | 6                       | 17                         | 6               | 150                            | 660                   |
|                  |      | 24                       | 8                               | 8                       | 23                         | 7               | 150                            | 660                   |
| 8                | 200  | 12                       | 4                               | 4                       | 11                         | 3               | 150                            | 660                   |
|                  |      | 18                       | 6                               | 6                       | 17                         | 5               | 150                            | 660                   |
| 10               | 250  | 24                       | 8                               | 8                       | 23                         | 6               | 150                            | 660                   |
|                  |      | 30                       | 7                               | 7                       | 23                         | 4               | 150                            | 660                   |
| 12               | 300  | 18                       | 4                               | 4                       | 12                         | 2               | 150                            | 660                   |
|                  |      | 24                       | 6                               | 6                       | 16                         | 3               | 150                            | 660                   |
|                  |      | 18                       | 4                               | 4                       | 9                          | 2               | 150                            | 660                   |

Note : Flange Available With Din Standard, Ansi Standard, Bs Standard And Jis Standard

Rubber Pipe Connectors  
By Hand Built  
Type Key - 21B



Available With Any Lengths As Per User Request

Filled Arch Expansion Joints  
By Hand Built  
Type Key - 21B





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