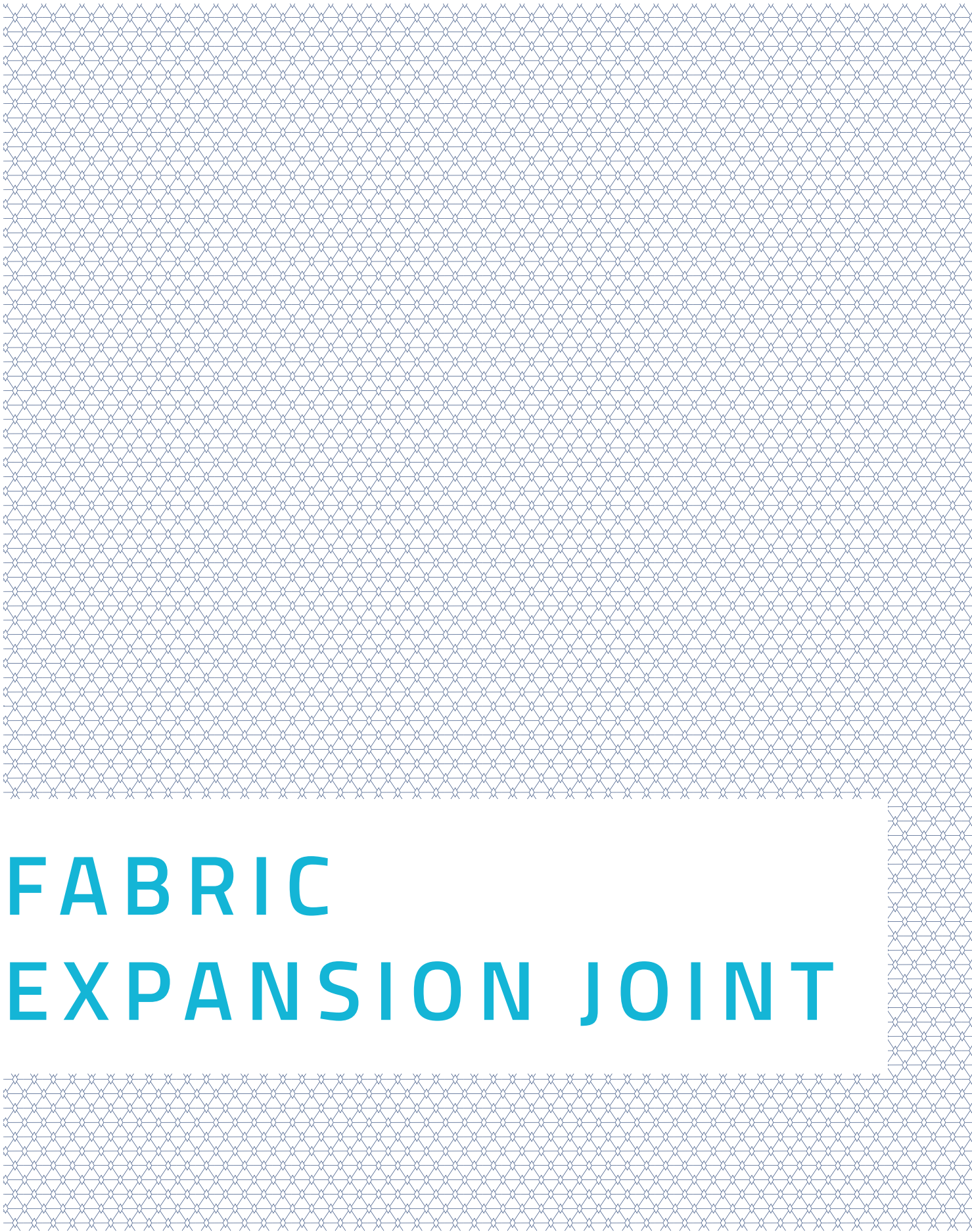




FABRIC EXPANSION JOINT



PRODUCT DEFINITION

Fabric Expansion Joint is a flexible Joint specifically designed to withstand physical elongation on a ducting system caused by the increase in temperature.

The primary function of Fabric Expansion Joint is to reduce the stress level applied to the ducting system due to these changes. Apart from its main function, Fabric Expansion Joint has other functionalities such as:

- To connect ducting with misaligned conditions
- To withstand vibrations
- Shock Absorber

In general, a Fabric Expansion Joint is comprised of the following basic materials:

- Fabric Materials
- Synthetic Elastomers
- Insulation Material
- Fluoroplastics

Industry Applications

Fabric Expansion Joints are widely used in the Power Plant Industry. However, continuous development in Design Concept, combined with the dynamic creativity of our Design Frame has put 3Star Fabric Expansion Joints as a highly promising option to be widely used in many other applications. Our Fabric Expansion Joints have been applied in the loop of many other major industries such as:

- Pulp and Paper Plants
- Power Plants
- Refineries (Oil & gas)
- Steel Mills
- Foundries
- Cement Plants
- Food Processing, and many others

Advantages of Fabric Expansion Joint

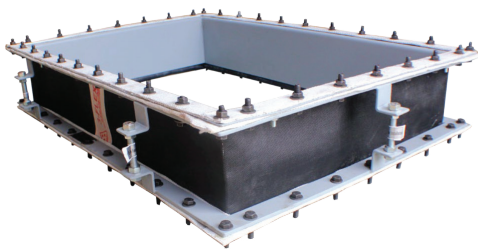
3Star Fabric Expansion Joints offer a significant number of comparative advantages as opposed to Metallic Expansion Joints. This is partly due to the continuous development of our Fabric Expansion Joint Design Concepts which can cover a broader area of applications. The advantages can be seen as follows:

Technical Advantages

- a. With Fabric Expansion Joint, extra lengths are unnecessary for the ducting system to withstand the bigger and more complex type of movements.
- b. Pressure Thrust and Total Spring Rate Bellows are two crucial issues that must be calculated accurately when applying Metal Expansion Joints on a piping or ducting system. But a Fabric Expansion Joint constructively will only give an extra load from the lowest spring rate to the Anchor Side or Fix Point. (Spring Rate: the amount of force needed to move Expansion Joint).
- c. Sound and Vibration elimination.
- d. For applications with extremely high temperatures, Metal Expansion Joint must be manufactured with the correct material and accurately designed to prevent premature failures on the bellows element. On the other hand, a Fabric Expansion Joint can offer a design with such thermal resistance by combining and applying the correct materials such as high-temperature insulation products and others. Our 3Star Fabric Expansion Joints can withstand extreme temperatures of more than 2,000°F.
- e. Fabric Expansion Joint can offer corrosion resistance. The advancement in materials technology such as Elastomers, Fabric, and Fluoroplastics gives users the flexibility to choose materials depending on the Corrosion level for each application.

DESIGN SPECIFICATIONS & APPLICATIONS

Basic Type of Fabric Expansion Joint



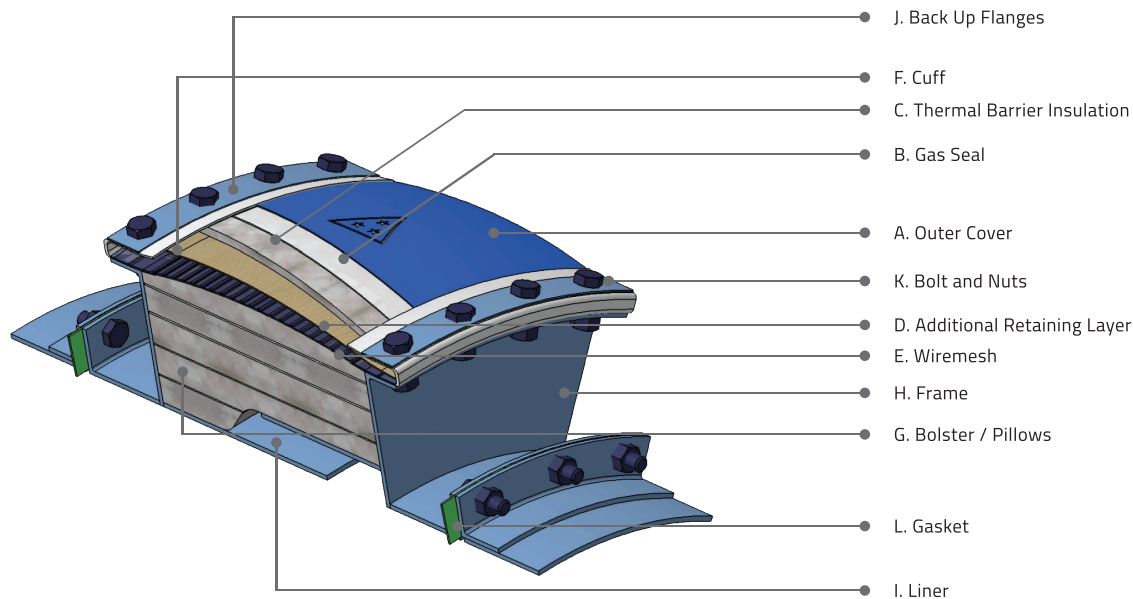
Single Layer

This type is comprised of one or more reinforcement plies with coatings of elastomers or fluoroplastics to form a homogenous material.



Composite Layer Type

This type of Fabric Expansion Joint comprises different layers of materials, which are glued, knitted, or bolted together on its flange clamp area. This gives the Composite layer type a unique advantage as each layer of materials has its own characteristics & functionalities.



ANATOMY OF FABRIC EXPANSION JOINT

Main Components of Fabric Expansion Joint

A. Outer Cover

This is the outermost layer of the expansion joint, where it is directly exposed to the environment. Hence, the main characteristics of this layer are its relatively high tensile strength and its aptitude to withstand movements in all directions. In certain cases, it can be combined with Gas seal.

B. Gas Seal

This is an extremely crucial part of Fabric Expansion Joint, as its function is to prevent gas leaking out of the Expansion Joint body as well as sustaining internal pressure from the system, certain chemical conditions from the flowing medium, and must be able to counterbalance the movement of the ducting. For specific Expansion Joint requirements, 3Star™ offers a special Gas Seal membrane LFP™ CrossFilm™ which is an exceptionally thin, high strength, PTFE laminate that has been targeted for challenging Thermo / chemical applications.

Note

Fabric Expansion Joint can be designed for application with extreme temperature and corrosive media. However, it is only applicable for low-pressure applications (max 0.35 Bar). For an application that requires higher operating pressure, please do a prior consultation with our Design Engineers.

C. Thermal Barrier Insulation

The primary function is to reduce temperature to the acceptable level by the Gas Seal Membrane. The insulation material may also mitigate the risk of media condensation.

D. Additional Retaining Layer

The function is to retain the insulation layer to stick on its position and also provides extra protection for the Expansion Joint during handling and at work. The retaining layer also provides additional Thermal protection.

E. Wiremesh

Several Fabric Expansion Joint models utilize additional wire mesh on its innermost layer. It amplifies the strength of the Expansion Joint and also assists in sustaining the other outer layers to stay on their positions. 3Star uses a special type of knitted wire mesh to be combined with other layers. This gives 3Star Fabric Expansion Joint product an exceptional strength and flexibility needed for its application.

F. Cuff

The function of cuffs is to combine several layers of material in our Multi-Layer Design and also to hamper heat conductivity from the hot metal flanges, back up flanges, or the bolts, to the fabric elements.



G. Bolster / Pillows

Bolster or accumulation pillows are very effective for filling the Expansion Joint cavity that may produce fly ash. The existence of bolster/pillows will greatly reduce the emission of fly ash, which can cause overload in expansion joint or generate additional corrosion, leading to premature failure on the flexible elements and reduce the expansion joints' ability to withstand the desired movements. Most importantly, bolster/pillows can also protect the Expansion Joint element from excessive heat.

H. Frame

Apart from the model's design, a Fabric Expansion Joint can work effectively if also supported by the correct Frame material. There are many different frame types and shapes which can be applied accordingly to different applications.

I. Liner

Liner is used to avoid turbulence in the media flow which may cause fluttering in the fabric element or the insulation pillow. Additionally, a liner can also prevent fly ash from pilling up in the Expansion Joint cavity.

Note

The liner's position must be parallel with the media flow

J. Back Up Flanges

Back up flanges function as a binder between the Fabric Expansion Joint and its metallic frame to maximize the seal's effectiveness. Back up flanges are normally made of steel plates. Extra radius is provided on the parts where they are directly connected to the fabric flexible element to avoid damage on the fabric during pressure or movements.

K. Bolt and Nuts

To ensure if back up flanges provide sufficient force to the fabric element on the frame, precise selections of size, amount and material type for the bolts and nuts are very crucial, 3Star standard design uses A193 grade B7 for bolts and A194 grade 2H for nuts. Other materials are also available upon request.

L. Gasket

Gaskets are occasionally required for Single Layer type Fabric Expansion Joint to provide extra sealing capability.



DESIGN FACTOR

An effective Fabric Expansion Joint must be safe, cost effective, and provides a worthy lifetime. Thus the following factors/ conditions must be considered carefully:

Service Condition

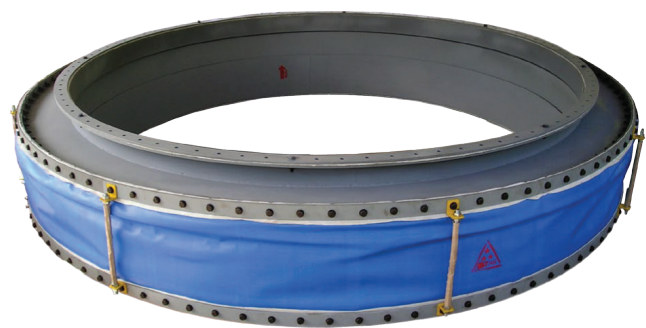
In-depth data on the operational and service of the Expansion Joint is the most important basic information that will assist our engineers to design an effective, safe, and price competitive Expansion Joint.

There are many types of determinants that the engineers may consider during product designing, such as the category of site plant and operational condition of the site plant such as the Plant's cycle per annum (on/off).

Media

Information on the type of media characteristics is crucial for determining the typical frame design and also for material selection. The main characteristics of the media that must be carefully assessed are as follows:

- Type of Media: air, flue gas, dust, wet or dry
- Chemical Composition
- Velocity
- Dust load and content



3Star Fabric Expansion Joint design with Floating Liner for Cement Plant to avoid dust entering the Expansion Joint cavity

Temperature

Basic material selection of the Fabric Expansion Joint is highly dependent on the temperature (ambient and operation/design) level. Accurate data on the operating temperature will aid the engineers in arbitrating the correct material combination, and supported by the correct design frame. For example, a frame with refractory will be a suitable choice for applications with high-temperature conditions.

Extensive knowledge of the media's dew point temperature is also one factor to be considered carefully during the designing process. Achievement of dew point temperature is possible during operational start up or shut down, and must be considered carefully by our engineers during material selection.

Pressure

Unlike Metal Expansion joint that is specifically designed for high pressure, generally, a Fabric Expansion Joint can only handle the lower level of internal pressures (max 0.35 bar). This is parallel with the ducting system pressure which is also generally low.

Fabric Expansion Joint lower resistance to pressure could lead to premature failure due to pressure pulsation and flutter. Fluttering may occur in the materialis closest point to the fan or may be triggered by high gas velocity.

An Expansion Joint with specific weight or Liner design can be an effective option to prevent fluttering from occurring.



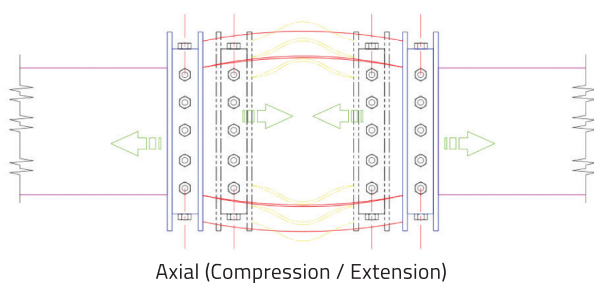
3Star Fabric Expansion Joint ducting specially designed with Pantograph Frame and Liner for PIA transfer from Truck to Storage Tank, during operation, the Expansion Joint accepts very large axial motion and the pantograph allows equal movement for every section of a fabric expansion joint

Duct Type

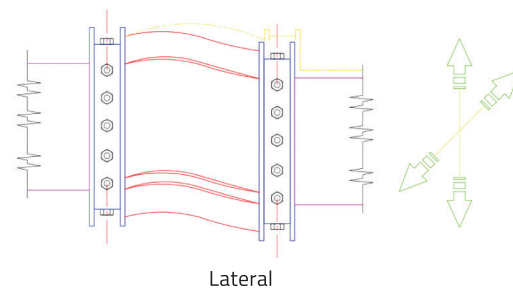
The exact configuration of the Ducting system geometry is also a key factor in determining the correct type of Expansion Joints. The following pieces of information are crucial:

- **Duct Size**
Size of the Expansion Joint (Circular or Rectangular)
- **End to end product (Space Expansion Joint)**
The overall length of the expansion joint (OAL)
- **Duct Material**
Frame Material
- **Duct Expansion Joint connection**
Flanges or Welded frame type
- **Duct corner**
Radius or Square
- **Flow direction**
Frame accessories such as Liner type, dust reflector, and more
- **Duct Insulation**
Inside or outside

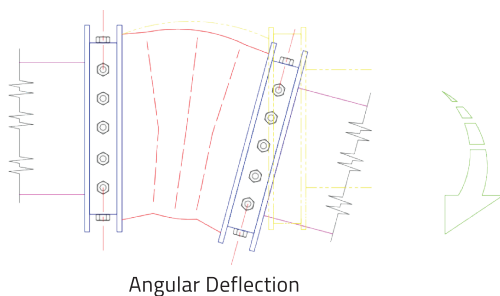
BASIC MOVEMENT FABRIC EXPANSION JOINT



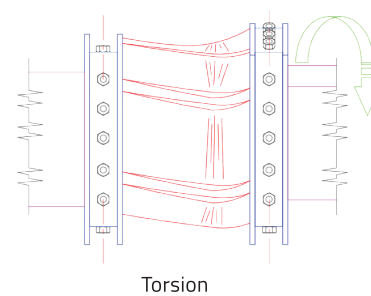
Axial (Compression / Extension)



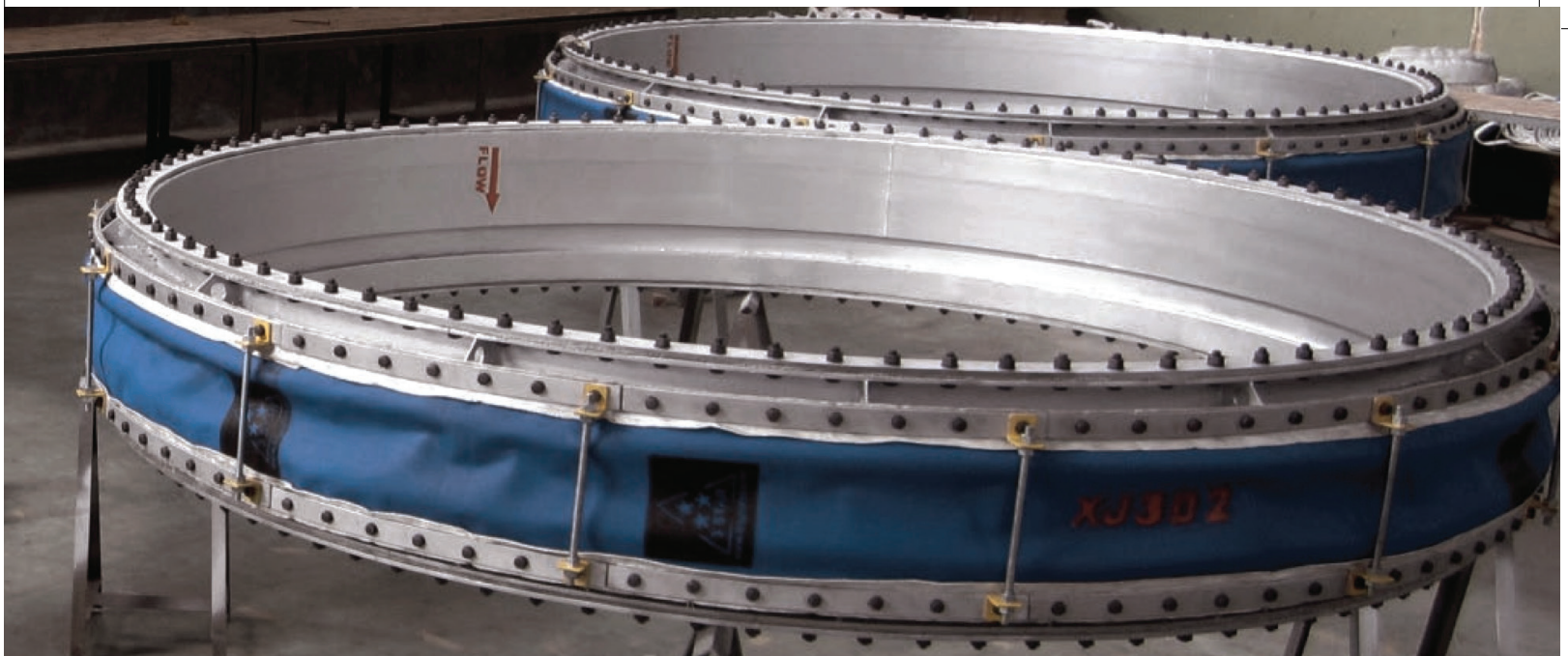
Lateral



Angular Deflection

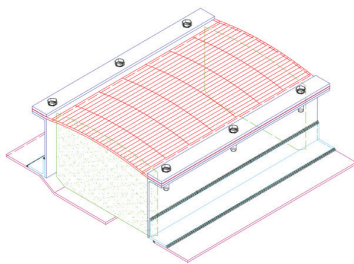


Torsion



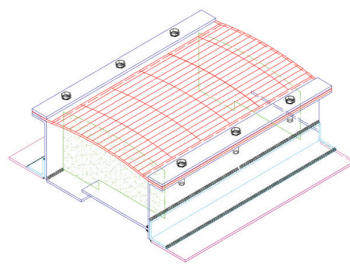
3 STAR FRAME MODEL

This is the outermost layer of the expansion joint, where it is directly exposed to the environment. Hence, the main characteristics of this layer are its relatively high tensile strength and its aptitude to withstand movements from all directions. In certain cases, it can be combined with Gas Seal.



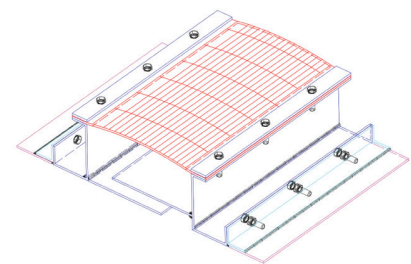
Type A

- Complete with set back
- Bolster
- Single liner construction
- Welded Connection
- Easy site assembly and installation



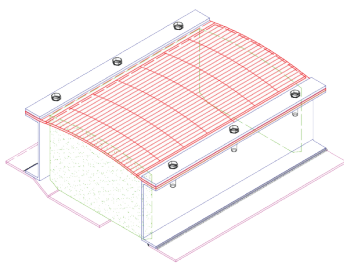
Type B

- Complete with set back
- Bolster
- Single liner construction
- Welded Connection
- Easy site assembly and installation



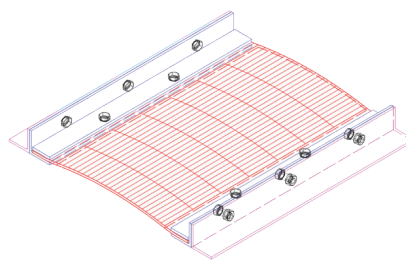
Type C

- Complete with set back
- Bolster
- Single liner construction
- Welded Connection
- Easy site assembly and installation



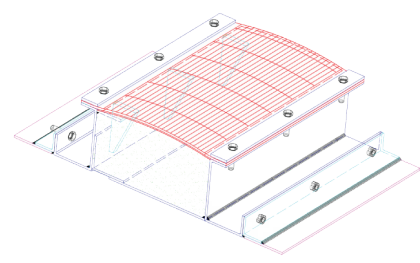
Type D

- Complete with set back UNC 150 x 75 x 6mm (Universal Channel)
- Bolster
- Welded Connection
- For Rectangular Fabric EJ
- Economical Caption
- Single Liner



Type E

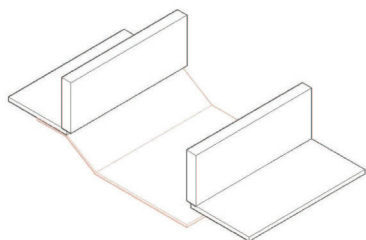
- Flange Type
- No Liner
- No Bolster
- Only for low temperature
- Very economical option



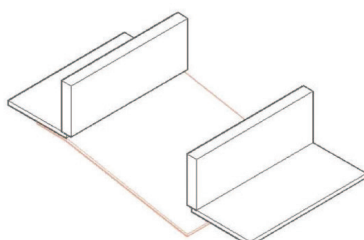
Type F

- Complete with set back
- Floating
- Bolster
- Flanges Connection
- Good for dust media

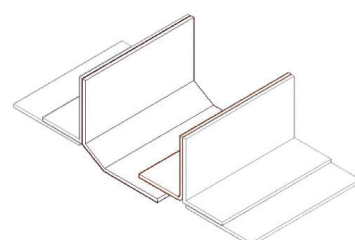
3 STAR LINER TYPE



Semi Airfoil Type

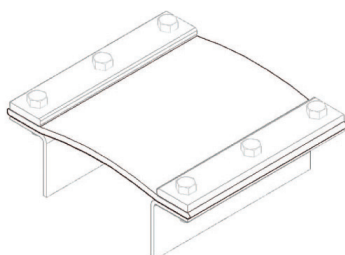


3Star Straight Type

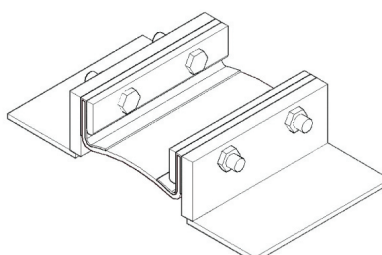


3Star Telescope Liner

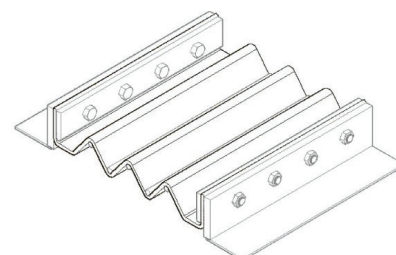
3 STAR FABRIC EXPANSION JOINT TYPE



Belt Type Fabric Expansion Joint



Flange Type Fabric Expansion Joint



Bellow Type Fabric Expansion Joint

MATERIAL SPECIFICATION

Environmental conditions and various duct system application may affect the performance of a Fabric Expansion Joint. To achieve the expected lifetime, an exceptional Fabric Expansion Joint must be carefully planned and designed using the correct materials.

3Star Fabric Expansion Joint is designed and manufactured using highly skilled engineering considerations and also high-quality materials. We offer Elastomers such as EPDM, Neoprene, or FKM, various types of Fiberglass Coating, or special laminated PTFE-coated fiberglass for single layer, or to be further combined as a Multi-Layer Fabric Expansion Joint. Everything is being calculated and considered carefully based on each application's unique condition, be it high temperature, corrosive, abrasive, dry, or wet. The next table exhibits some of the 3Star standard type Fabric Expansion Joint. Other models with different specifications and material combinations are also available upon customer's specific request.

3-FLEX 30



Material Construction

- a. Single or Multilayer constructions
- b. Laminated PTFE-Coated Fiberglass

Operating Limitation

Temp : 300°C (max)
Press : 0.3 barG

Characteristic

Very suitable for dry application in case of a wet medium single layer with proper frame construction as an option.

3-FLEX 40



Material Construction

Multi layer consist of:

- a. Outer Cover
- b. Gas Seal Membrane
- c. 1/2 - 1" Thk
- d. 1 Ply retaining layer

Operating Limitation

Temp : 400°C (max)
Press : 0.3 barG

Characteristic

Dry applications, available in belt or flange connections, in case of higher operating temp adding bolster will be required.

3-FLEX 50



Material Construction

- a. Single Layer, high temperature expansion joint material

Operating Limitation

Temp : 538°C (max)
Press : 0.3 barG

Characteristic

Latest technology of fabric expansion joint, constructed from insulation component laminated to PTFE / Fiber-glass composite. Very good for high-temperature exposure, and can be combined with a pillow if required very low outer cover surface temperature.

3-FLEX 60



Material Construction

- a. Outer Cover
- b. Gas Seal Membrane
- c. Fiber Glass Cloth
- d. Fiber Glass Mat Insulation
- e. Retaining Silica Cloth
- f. Knitted Mesh SS 316

Operating Limitation

Temp : 600°C (max)
Press : 0.3 barG

Characteristic

Fiber-glass Mat and Knitted mesh provide excellent mechanical stability. Supplied with bolster.

3-FLEX 100



Material Construction

- a. Outer Cover
- b. Gas Seal Membrane
- c. Fiber Glass Cloth
- d. Fiber Glass Mat Insulation
- e. Retaining Silica Cloth
- f. Knitted Mesh SS 316

Operating Limitation

Temp : 1000°C (max)
Press : 0.3 barG

Characteristic

Incoloy Knitted Mesh, Ceramic Needle Mat, and silica are suitable for high-temperature resistance. Supplied with bolster and refractory.