MULTI ASSEMBLY

ASTM
F1123 -87
KFI
STANDARDS

DIAMETER SIZE
25mm TO 2000mm

RUBBER BELLOW NON-METALLIC EXPANSION JOINT

High Pressure

Technical Description

- The expansion joints are designed, fabricated and tested to provide an accurate and effective solution to the customer's requirements.
- Rubber bellows are manufactured as per standard **ASTM F1123 – 87**and **KFI** standards.
- The number, shape and construction of the convolution depend on the movement, pressure, temperature, media and fatigue life
- A combination of experience, calculation and practical testing make a good bellow, which is critical in order to give the level of performance as required.
- While designing a bellow following parameters are taken into consideration, Pressure, Temperature, Corrosion resistance, Minimum maintenance, Durability, Reliability, Long life, Economy, Performance and Safety.

Industries

Construction Details

- Rubber Expansion joints are fabricated with an elastomeric tube reinforced with multiple plies of fabrics covered with synthetic rubber
- The fabrics are Nylon®, Polyester and Aramid.
- An additional reinforcement to the fabric may be provided in the body of the expansion joint and may be solid metal rings or wire embedded in the rubber.

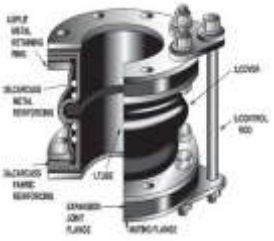
Applications

- Refineries
- Chemical Plants
- Cement Plants
- Agricultural Fertilizers
- Tyre Industry
- Nuclear and Thermal power stations

Advantages

- Reduced fatigue factor. Lightweight
- Extraordinary resistance to abrasion and corrosion
- Minimal face-to-face dimensions while absorbing large movements
- Low Spring Rates due to inherent flexibility of rubber
- No gaskets required for installation

Types of Expansion Joints

Handmade or Moulded with floating flange	Full face rubber with backing metal fixed flange	Tied with control units
		
Arch Filled	**Rectangular**	**Reducing**
		

Key Features

Absorb Lateral movements
Lateral movement is the relative displacement of one end of the bellows to the other end in a direction perpendicular to its longitudinal axis.

Absorb Angular and Torsional Movements
Angular movement is the rotational displacement of the longitudinal axis of the bellows toward a point of rotation. Torsion refers to twisting one end of the bellows with respect to the other end, about the bellows centreline

Reduce Vibration
Rubber expansion joints isolate or reduce vibration caused by equipment. The transmission of vibration is reduced and they protect equipment from these adverse effects

Dampen Sound Transmission.
Rubber expansion joints tend to dampen transmission of sound because of the steel rubber interface of joints and mating flanges

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Expansion Joints – Handmade | Molded with floating flange

- Hand built rubber bellows are designed to neutralise movement, compensate for small amounts of misalignment and reduce noise and vibration in pipelines.
- They are purpose manufactured and tailored to fit any application.
- These are the standard moulded or custom-made Expansion Joints consisting of high-quality rubber body incorporating floating flanges.
- Where negative pressures and vacuum conditions exist, it is recommended that vacuum support rings be used.
- These are usually built in to the body of the bellows, but can be retrofitted if required. The size of vacuum support rings is determined by the negative pressure rating require

Expansion Joints – Full Face Rubber backing Metal Fixed Flange

- Hand built rubber bellows are designed to neutralise movement, compensate for small amounts of misalignment and reduce noise and vibration in pipelines.
- They are purpose manufactured and tailored to fit any application.
- These are the standard moulded or custom-made Expansion Joints consisting of high-quality rubber body incorporating floating flanges.
- Where negative pressures and vacuum conditions exist, it is recommended that vacuum support rings be used.
- These are usually built in to the body of the bellows, but can be retrofitted if required. The size of vacuum support rings is determined by the negative pressure rating require

Expansion Joints – Tied with Control Units

- Control Unit (Limit rods) to restrict the bellows axial movement range during normal operation. In the event of a main anchor failure, they are designed to prevent bellows overextension while restraining the full pressure loading and dynamic forces generated by the anchor failure.
- A control unit assembly is a system of 2 or more control rods placed across the expansion joint from flange to flange to set the maximum allowable expansion/contraction of the expansion joint and that will contain the pressure thrust.
- Recommended on most applications to prevent damage due to excessive pipe movements, each rod incorporates double nuts on each end to keep the expansion joint from over- elongating and spherical washers to allow Lateral, Angular and some Torsional movements as well as to accommodate moderate piping misalignments.

Expansion Joints – Arch Filled

- Filled arch-type expansion joints may be supplied with a bonded-in-place soft rubber filler to provides a smooth interior bore. Filled arch design reduces possible turbulence and prevents the collection of solid materials that may settle from the solution handled and remain in the archway. Filled arch joints also have a seamless tube so the arch filler cannot be dislodged during service
- Advantages: Reduces flow turbulences, Avoids solid deposits in the corrugations.
- Disadvantages: Decrease the flexibility. Movements of expansion joints with filled arches are limited to 50% of the normal movements of comparable size expansion joints with unfilled (open) arches.

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Expansion Joints – Rectangular

- Rectangular Rubber expansion joints can be manufactured in square or rectangular shape and in any dimension.
- They can be also produced with or without arch and with multiple arch design for absorbing greater movements

Expansion Joints – Reducing

- Reducing expansion joints are designed and manufactured to allow the connection of different diameter pipes. There are two main types of reducer: concentric and eccentric reducers. Reducers are usually concentric but eccentric reducers are used when required to maintain the same top-or bottom of-pipe level.

DN (Dia)	Length(mm) Min/Max	Compression (mm)	Elongation (mm)	Deflection Lateral (+/- mm)	Deflection Angular (Deg)	Working Pressure
25	130/500	15	8	15	5	20
32	130/500	15	8	15	5	20
40	130/500	15	8	15	5	20
50	130/500	15	8	15	5	20
65	130/500	15	8	15	5	20
80	130/500	15	8	15	5	20
100	130/500	15	8	15	5	20
125	130/500	20	10	15	5	20
150	130/750	20	10	20	10	20
200	130/750	20	10	20	10	16
250	130/750	20	10	25	10	16
300	150/1000	20	10	25	15	16
350	150/1000	25	12	25	15	16
400	200/1000	25	12	30	15	16
450	200/1000	25	12	30	15	10
500	200/1000	25	12	30	15	10
600	250/1000	25	12	30	15	10
700	250/100	25	12	30	15	10
800	300/1000	25	12	30	15	10
900	300/1000	25	12	30	15	10
1000	300/1000	30	15	30	15	10
1200	300/1000	30	15	30	15	8
1300	300/1000	30	15	30	15	8
1400	300/1000	30	15	30	15	8
1500	300/1000	30	15	30	15	8
1800	300/1000	30	15	30	15	6
2000	300/1000	30	15	30	15	6

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Installation and Maintenance

- An expansion joint acts as a piston by the forces arising from the internal pressure. The calculated service life of an expansion joint is based on the precondition that the expansion joint will never be subjected to mechanical or thermal load exceeding the stated design data.
- To achieve the maximum service life, pressure resistance and reliability, caution should be taken during expansion joint handling, expansion joint storage and expansion joint installation.
- Failure in the expansion joint installation to comply with the installation instructions could reduce the service life and pressure capacity of the expansion joint, which could lead to damage or at worst breakdown of the expansion joint or the pipe system.
- Installation should be carried out by suitably trained and competent staff working in compliance with relevant legislation and regulations for occupational safety.

During Installation

- Position the expansion joint, making sure the holes of the expansion joint counter-flanges and flanges are in line with the holes of mating pipe flanges.
- Care must be taken to avoid accidental arcing on the thin-walled bellows in the expansion joint.
- Flow the arrow on the expansion joint points in the direction of the system flow.
- Do not apply torsion to the expansion joint to align the bolts on flanged units
- Components such as tie rods, hinge links and gimbals must not be removed. They form part of the integrity and functionality of the expansion joint.
- Care should be taken with fitting tools, to not damage the bellows with spanners or wrenches when tightening bolts.
- On flanged units ensure that over-long studs or bolts do not contact and damage the bellows.
- When expansion joints are supplied without external covers and insulation is to be added, a lagging cover should be fitted to prevent insulation material becoming trapped between the bellows convolutions where it can prevent the bellows from functioning correctly.
- The bolts should be tightening when installing the expansion joint. Gradually tighten all bolts, including those of the tie-rod plates, in a diametrical crosswise order, in several passes.
- Tie-rods should be adjusted to conform to the installed length of the expansion joint. The only play allowed (if any) after tightening is shown in contractual tie-rod drawings.
- Once the tie-rods have been adjusted and slightly tightened by fitting the nuts on either side of the fixing plates, tighten the counter nuts. Lock the nut/counter nut assembly by hand to state-of-art procedure.
- After tightening, make sure the tie-rod play values (if any) are all identical so that reaction will be evenly distributed between each tie-rod.

Post Installation

- Remove any dust or foreign bodies which may have found their way inside the expansion joints. Make sure there is no possibility of accidental damage or sabotage. It is advisable to cover the expansion joints with light metal sheeting. Check that no lubricant can fall onto the expansion joints.
- Before the completed system is tested and commissioned, it should be subjected to a visual inspection. Before pressure testing and as part of the inspection regime ensure that all temporary shipping and pretension devices are removed from the expansion joint.

Pre-Installation

- To avoid any damage, the expansion joints should be handled with great care, unless clearly stated in the design data of the expansion joint, the expansion joint is not designed to compensate for installation inaccuracies in the piping and must not be used to connect them.
- Prior to expansion joint it is essential that the expansion joints are mounted on flat faced piping flanges that have been degreased and are clean and dry installation, the expansion joint should also be checked that it is undamaged and has no dents, damaged fittings and water marks on the steel (incipient rust) etc. It should also be checked that:
- The gap in the pipeline where the expansion joint is to be installed matches the specified installation length of the expansion joint with design tolerances taken into account. The expansion joint must be fitted at the length stated in the specifications.
- The expansion of the pipeline is in accordance with the design data of the expansion joint.
- The adjacent pipework is correctly installed with anchors, guides and supports in place.
- Anchors must be adequate to accept reaction forces from the expansion joint and all other pipework loads.
- Only one expansion joint is fitted between two anchors.
- Tie rods on lateral expansion joints are correctly fitted and are secure.

Pressure Test and Start up

- Pressure test must be carried out according to the stated test specifications on the drawing and/or the tag plates on the expansion joint. Check for leakage. If necessary, check efficiency of tie-rods.
- As soon as the expansion joints are working, make sure they are not subjected to movements exceeding their allowable limits

Maintenance

It is advisable to inspect the expansion joints every 12 months. Any changes in outer cover will be indicative of serious deterioration. Make sure the bolts are properly tightened. Check the extent of expansion joint movements, which must remain within their allowable limits.