Metal Expansion Joints

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WHAT IS AN EXPANSION JOINT ?

Expansion joints, also known as expansion bellows or flexible joints, are essential components in piping systems. Typically made of materials like stainless steel, rubber and nickel alloys, they compensate displacement brought on by vibrations, heat, and misalignment. They reduce strains on pipes and equipment and extend system lifespan, which makes them essential in industries susceptible to thermal expansion. By removing fix points and guides, expansion joints allow engineers to increase flexibility in pipe designs while minimizing expenses. Their ability to withstand movements and their space-saving design makes them superior to alternatives such as pipe bends. Their unique design incorporates a variety of parts, such as bellows, welding ends, flanges, hinges, and tie-rods.

The fundamental principle of physics is that materials can expand and contract in response to temperature variations.
Expansion joints are made to absorb these vibrations, contractions, and expansions.
Metallic expansion joints are designed to satisfy the requirements of a variety of industrial applications, especially pipeline systems, by following the EJMA tandards and production procedures.

Gassó expansion joints are engineered to offer

- Reliable connection and safe operation
- Resistance to temperature and pressure fluctuations
- Exceptional service life
- Dimensional flexibility to prevent pipe and equipment damage
- Material versatility with high-temperature and corrosion resistance
- Stress reduction to minimize system and equipment failure
- Space-efficient installation by eliminating complex fix points
- Cost savings through reduced maintenance and material expenses
- Accommodate system Vibrations, Thermal Expansion and Contractions.

By addressing these critical requirements, expansion joints enable the smooth and reliable functioning of industrial systems, ensuring uninterrupted performance.

Purpose of Metallic Expansion Joints

Steel expansion joints are widely used in space-constrained industrial applications like appliances, machinery, piping, and pumps. They are preferred for:

- Compensating directional movement
- Absorbing expansion and compression
- Reducing stress
- Preventing noise and vibration
- Compensating for settlement
- Eliminating installation issues

Testing Capabilities

- Hydrostatic Pressure and Leak Testing
- Pneumatic Bubble Soap Leak Testing
- Dye Penetrant Testing
- Visual Inspection
- Fatigue Testing
- Spring Rate Testing
- Radiography Testing (By TPA Agency)
- Ultrasonic Testing (By TPA Agency)
- Weld Penetration Test
- Helium Leak Detection Testing (By TPA Agency)

Applications

Expansion joints find widespread application across various industries, including:

Power Plants

Steel Plants

Refineries

Chemical Plants

Process Industries

Paper & Pulp Industries

Automobile Industries

HVAC Industries

Cryogenic Applications

Infrastructure Projects

Instrumentation and Valve Industries

Locomotives

Gensets & Exhaust Systems

Liquid Storage Terminals

Water Treatment Plant

Quality Assurance

- Delivering high-quality products and services is fundamental to our principles.
- We aim to consistently provide expansion joints that meet our customers' expectations.
- We adhere to recognized quality assurance systems to ensure accurate process execution.
- Our project cycle includes initial specification review, design, manufacturing, testing, and documentation, all tailored to customer requirements.
- Accreditation and certificates allow us to efficiently conduct in-house tests and inspections, optimizing project timelines.
- Our expansion joint design and production processes utilize cutting-edge technologies.
- Accredited authorities regularly monitor and test our processes to ensure efficiency and professionalism.

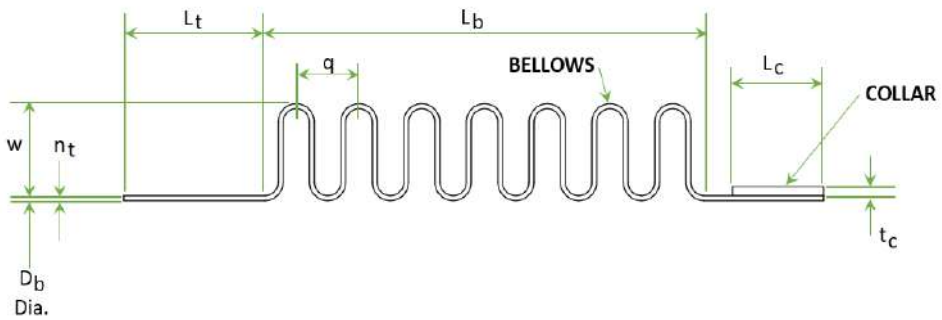
Company Approvals

- EN ISO 9001:2015
- EN ISO 14001:2015
- EN ISO 45001:2018
- DNV & BV Type Approval
- DNV PED 2014/68/EU
- EN ISO 3834-2

Expansion Joints

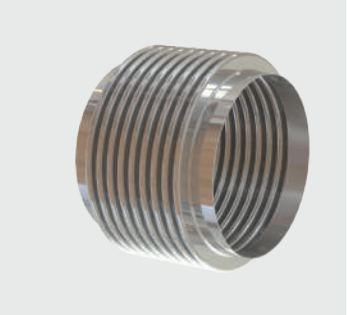
- Nominal Diameters: DN50 – DN3000
- Nominal Pressures: As per request
- Connections: Weld ends per ISO, Flanges per DIN EN 1092/1 & as per request
- Material of Construction:
  Bellow: SS 304/304L, SS 316/316L, SS 321, Inconel
  End Fittings: Carbon Steel, Stainless Steel, Cast Fitting, Forged Fittings

Bellow Nomenclature

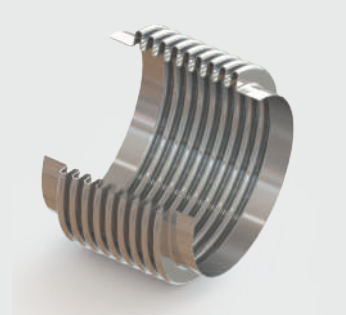


Db - Internal diameter
nt - Total thickness (No of layers X layer thickness)
w - Convolution Height
Lt - Tangent Length
q - Convolution Pitch
Lb - Convolution length
Lc - Collar length
tc - Collar thickness

Bellow Elements



Bellow Element



Single-Ply Bellow

Multi-Ply Bellow

Technical Considerations

Temperature
Material selection is crucial to cater to a broad temperature range, considering factors like working pressure, conveyed media, and application specifics.

Pressure
Nominal pressure ratings vary by type, material, and size, determined according to relevant design specifications and influenced by actual working conditions.

Size
Expansion joint size is designated by nominal diameter, with existing piping typically dictating the metal bellow size.

Motion or Movements Required
Expansion joints primarily address thermal expansion and contraction, as well as rectify misalignment, provide handling flexibility, compensate for movement, and absorb vibration.

Temperature Adjustment Factors
With rising temperature, expansion joint strength and pressure rating decline, requiring adjustments to the maximum allowable working pressure.

Expansion Joint Components

Bellows: The flexible element of an expansion joint, consisting of one or more convolutions and the end tangents. The convolution is the smallest flexible unit of the bellow. The total movement capacity of bellow is proportional to the number of convolutions.

Control Rods: Devices usually in the form of rods or bars, attached to the expansion joint assembly whose function is to distribute the movement between the two bellows of an universal expansion joint. These devices are not designed to restrain bellows pressure thrust.

Flange Ends: The ends of expansion joint equipped with flanges for the purpose of bolting it to the mating flanges of adjacent equipment of piping.

Internal Sleeve: A device which minimizes contact between the inner surface of the bellow of an expansion joint and the fluid flowing through it. These devices have also been referred to as liners.

Shipping Devices: Rigid support devices installed on an expansion joint to maintain the overall length of the assembly for shipment. These devices may also be used to pre-compress, pre-extend or laterally offset of the bellows.

Tie Rods: Devices usually in the form of rods or bars, attached to the expansion joint assembly whose primary function is to restrain the bellows pressure thrust. Tie rods may be designed to provide the feature of control rods. It should be pointed out that when tie rods furnished on expansion joints subject to external axial movement, they will only restrain the pressure thrust.

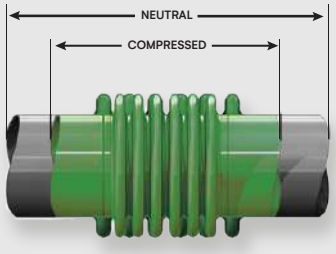
Tube: A single piece of leak-proof lining extending flange-to-flange, furnished in various compounds for insulation, abrasion resistance, and other properties.

Weld Ends: The ends of expansion joint equipped with pipe suitably bevelled for welding to adjacent equipment or piping.

Stability: Column Instability & In-plane Deformation

- Expansion joints balance flexibility with strength and stability to transfer fluid at designated pressure and temperature.
- Excessive internal pressure can lead to bellows instability, resulting in column instability or in-plane deformation (squirm).
- Understanding these phenomena ensures the reliability and longevity of expansion joint systems.

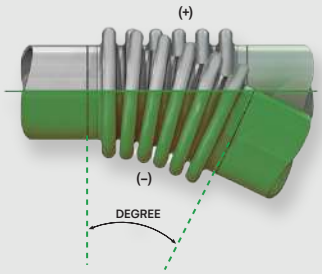
Movements



Axial Movements

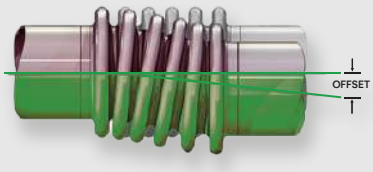
Axial Compression: The dimensional shortening of an expansion joint along its longitudinal axis. Axial compression has been referred to as Axial movement, traverse, or compression.

Axial Extension: The dimensional lengthening of an expansion joint along its longitudinal axis. Axial extension has been referred to as Axial movement, traverse, elongation or extension.



Angular Movements

The displacement of longitudinal axis of the expansion joint from its initial straight-line position into a circular arc. Angular rotation is occasionally referred to as rotational movement. This is not torsional rotation.



Lateral Deflections

A relative displacement of the two ends of an expansion joint perpendicular to its longitudinal axis. This has been referred as lateral offset, lateral movement, parallel misalignment, direct shear, transverse movement.

Types	Design	Pressure thrust restraint	Axial	Movement			
				Angular		Movement	
				Single Plane	Multi Plan	Single Plane	Single Plane
Axial	Internally Pressurized	✗	✓				
	Externaly Pressurized	✗	✓				
	In-line pressure balanced	✓	✓	✗	✗	✗	✗
Angular	Hinge	✓	✗	✓	✗	✗	✗
	Gimbal	✓	✗	✓	✓	✗	✗
Lateral	Two tie-bars spherical	✓	✗	✓	✗	✓	✓
	Two tie-bars Pinned (Plane)	✓	✗	✗	✗	✓	✗
	Double Gimbal	✓	✗	✓	✓	✓	✓
Universal	Unrestrained One or two bellows	✗	✓	✓	✓	✓	✓
		✗	✓	✓	✓	✓	✓
	Elbow Pressure balanced	✓	✓	✓	✗	✓	✓

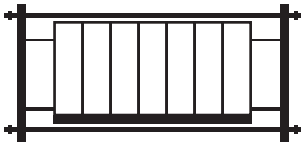
✓ Yes ✗ No  Limited ✓ Yes with two tie rods only

Types of Metallic Expansion Joints

Single Expansion Joint

This is the simplest form of expansion joint having single bellow construction, designed to absorb all of the movements of pipe section in which it is installed.

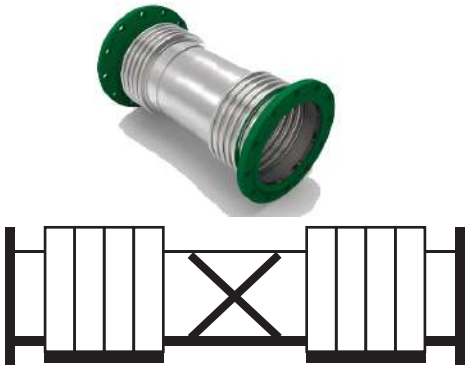
Single Expansion Joint



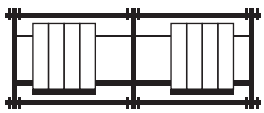
Single Expansion Joint With Tie Rod

Double Expansion Joint

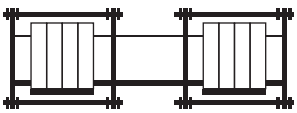
A double expansion joint consists of two bellows joined by common connector which is anchored to some rigid part of the installation by means of anchor base. The anchor base may be attached to the common connector either at installation or at time of manufacture. Each bellows acts as a single expansion joint and absorb the movements of the pipe section in which it is installed independently of the other bellows. Double expansion should not be confused with universal expansion joint.



Double Expansion Joint



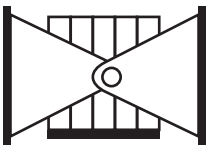
Universal Joint With Overall Tie Rods



Universal Joint With Short Tie Rods

Universal Expansion Joint

A Universal expansion joint is one containing two bellows joined by common connector for the purpose of absorbing any combination of the three basic movements i.e, axial movement, lateral deflections and angular rotation. Universal expansion joints are usually furnished with control rods to distribute the movements between the two bellows of the expansion joint and stabilize the common connector. This definition does not imply that only a universal joint can absorb combined movements.



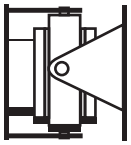
Hinged Expansion Joint

Hinged Expansion Joint

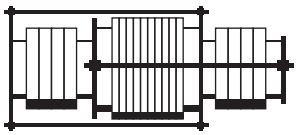
A hinged expansion joint contains one bellows and is designed to permit angular rotation in one plane only by the use of a pair of pins through hinge plates attached to the expansion joint ends. The hinges and the hinge pins must be designed to restrain the thrust of the expansion joint due to internal pressure and extraneous forces, where applicable. Hinged expansion joints should be used in sets of two or three to function properly.

Gimbal Expansion Joint

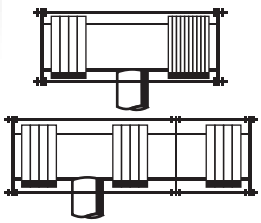
A gimbal expansion joint is designed to permit angular rotation in any plane by the use of two pairs of hinges affixed to a common floating gimbal ring. The gimbal ring, hinges and pins must be designed to restrains the thrust of the expansion joint due to internal pressure and extraneous forces, where applicable.



Gimbal Expansion Joint



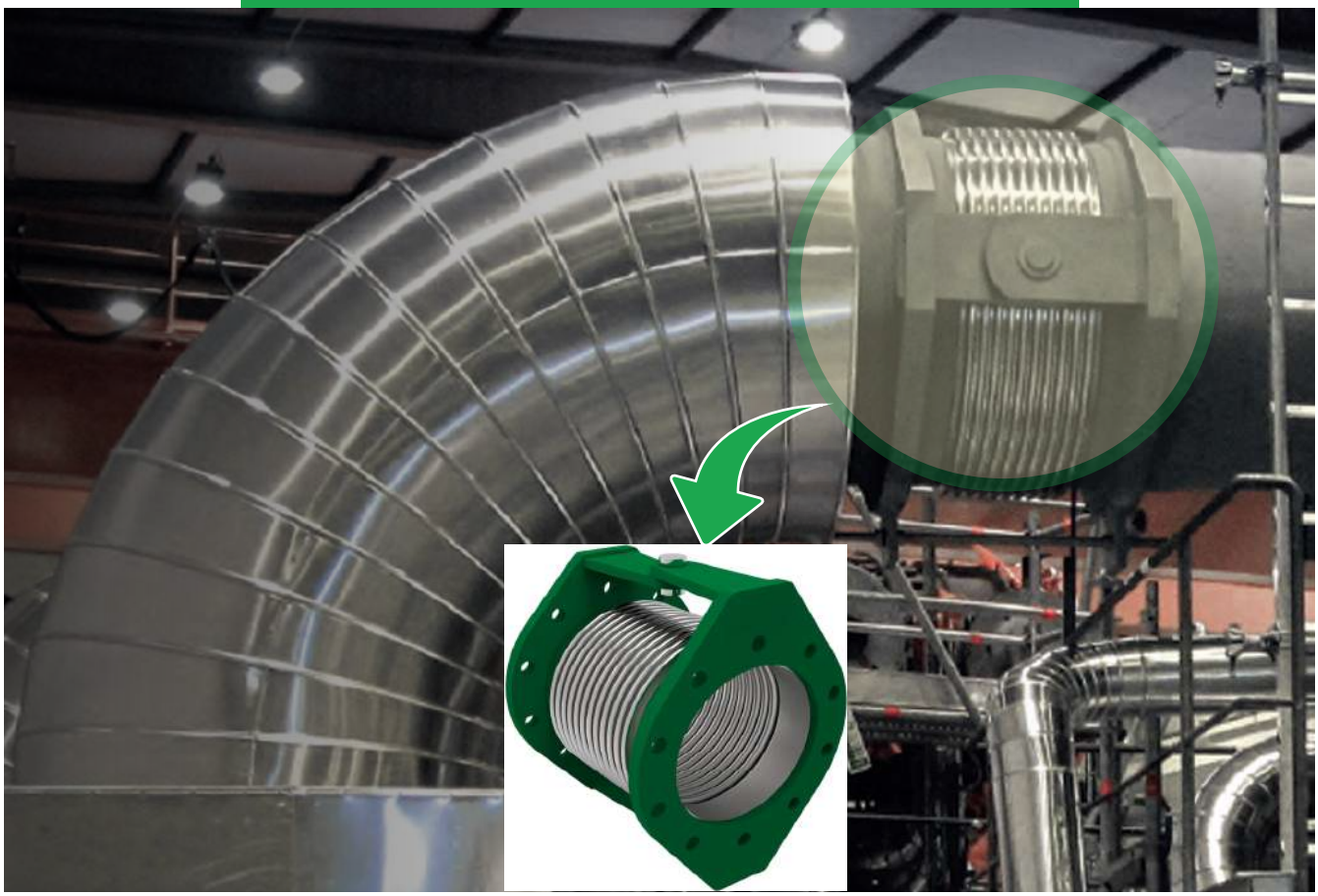
Inline Pressure Balanced Expansion Joint

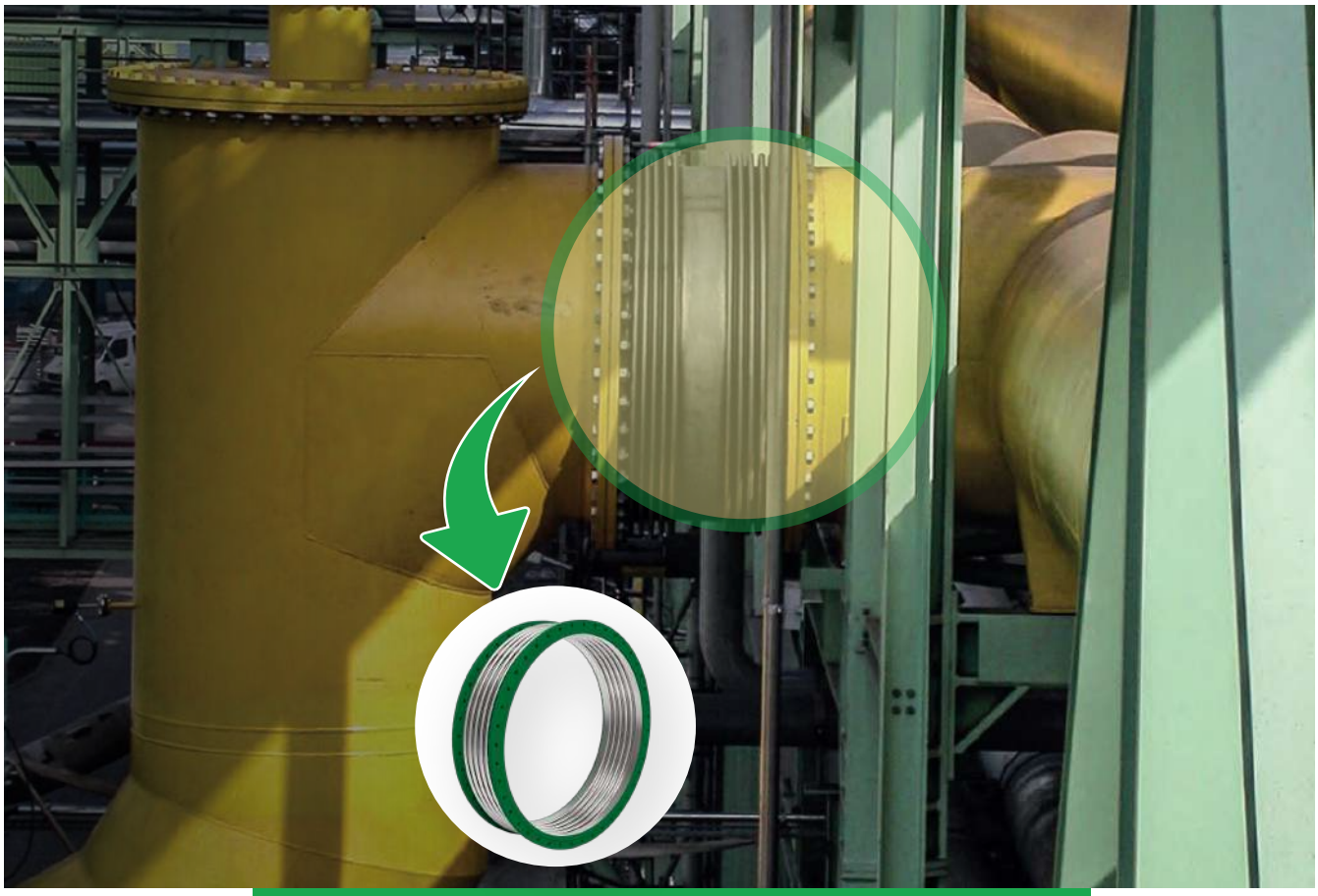


Universal Pressure Balanced Expansion Joint

Pressure Balanced Expansion Joint

A pressure balanced expansion joints absorbs axial movements and/or lateral deflection while retaining the pressure thrust by means of tie devices inter connecting the flow bellows with an opposed bellows also subjected to line pressure. This type of expansion joint is normally used where a change of direction occurs in a run of piping. The flow end of pressure balanced expansion joint sometimes contain two bellows separated by a common connector, which case it is called a Universal pressure balanced expansion joint.





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ENQUIRY FORM

Customer: Sr. No. : Date:

Email Id: Mob. No.: PO No.:

Types of Bellow

Circular: Rectangle: Other:

Quantity: Size (NB/DN): Overall Length:

Installation

Vertical: Horizontal: Universal:

Bellow Material

Material: No. of Ply:

Ply Thickness:

Linear / Sleeve

Yes: No: Ply Thik:

Material: Lenght:

End Fitting

	1st Side	2nd Side	Hole Dia.	No. of Holes
Fix Flange				
Rotating Flange				
Weld End				
Material				
ID (I/S)				
OD (O/S)				
PCD (CD)				
Thik.				
RF				
RF Depth				

Movements:

Axial (+/-): Lateral:

Angular (+/-):

Spring Rates

Axial: Lateral: Angular:

Temperature

Operating: Design:

Pressure

Operating: Design:

Media

Media: Flow Velocity: Flow Direction:

Fatigue life expectancy

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Especialista en conducción de fluidos

Barcelona
Polígon Industrial Can Calderón
Múrcia, 35
08830 Sant Boi de Llobregat
+34 936529800
gasso@gasso.com
www.gasso.com

Pamplona
+34 948506247
gassopamplona@gasso.com

Madrid
+34 91642 22 21
gassomadrid@gasso.com

Tarragona
+34 977545755
gassotarraco@gasso.com

Sevilla
+34 955 986 694
gassosevilla@gasso.com

Lisboa
+351 212267850
gassopt@gasso.com