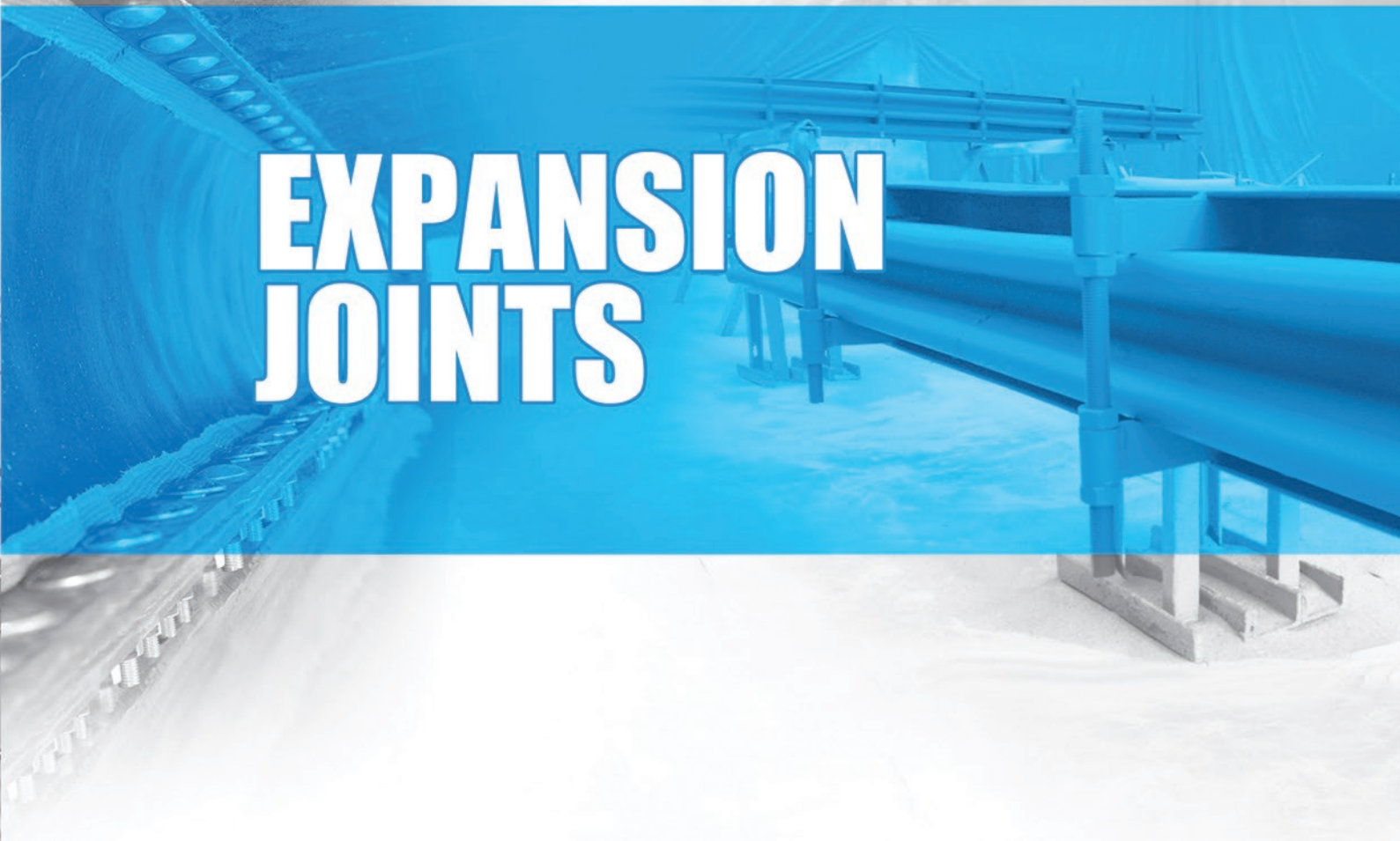




EXPANSION JOINTS





Fabric Expansion Joints

INBRAS ENERGOSERWIS is a manufacturer of the highest quality fabric expansion joints. The requirements for installation availability and emphasis on lengthened periods between renovations impose applying components of high quality. Therefore, we exclusively apply excellent materials from acclaimed European suppliers to manufacture our expansion joints. Technical parameters of applied fabrics enable to offer wide range of products for majority of industrial applications – even those highly demanding.



We offer cooperation on any realization stage and provide preliminary consultancy and detailed information during designing stage, relating to the selection of proper compensation solutions and introductory designs.

During the realization phase we provide our own design of expansion joints and technical documentation as well as post-implementation designs. The range of our offer and delivery includes also steel constructions and other essential elements of expansion joint fitting.

The production potential, our machinery, experienced staff and storage facilities enable to react immediately to the market needs and delivery expectations in terms of meeting deadlines. In order to provide constantly high quality of our products, we control the materials and test the products in our own laboratory.

The professional service team is at client's disposal. We offer services relating to measurements and analysis of applications at the site, complete fitting or service supervision as well as inter-renovation reviews.



INBRAS

- 13 Transportowca Street ● 88-100 Inowrocław
- tel. 52 52 40 040 ● tel. 52 52 40 041
- biuro@inbras.com.pl ● www.inbras.com.pl

Manufacturing plant:

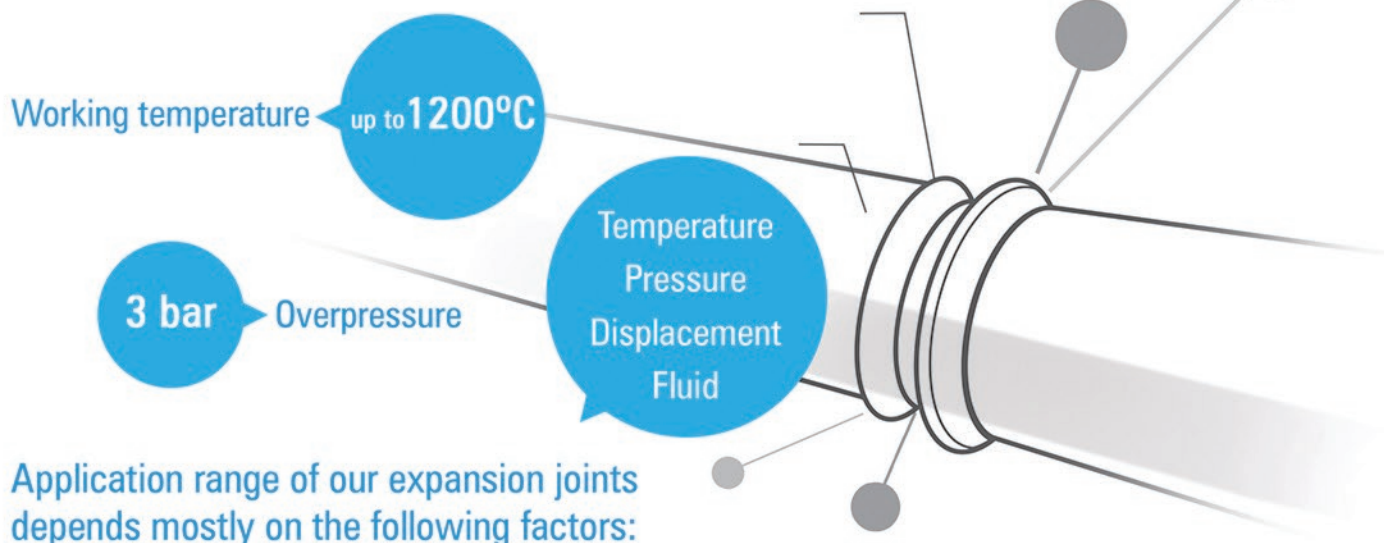
INBRAS Engineering Plastics Plant

- 8 E. Kwiatkowskiego Street ● 33-101 Tarnów
- tel. 14 637 27 08 ● tel. 14 637 27 38
- tarflen@inbras.com.pl

FABRIC EXPANSION JOINTS

Expansion joints are essential and vital elements in majority of industrial installations. They are applied as flexible elements in pipelines, flue gas ducts and processing gas ducts in order to compensate for thermal extensions, take over vibrations or level misalignment of ducts.

Depending on pressure, temperature and fluid, metal, rubber, material (e.g. PTFE) or fabric expansion joints are applied.



Among the latter types, fabric expansion joints are characterized by a wide range of properties and advantages enabling their extensive application:

- low-height fitting
- simultaneous compensation of displacement in every direction
- minimal (generally negligible) reaction force on props
- possibility to design connections and adaptations for the existing conditions
- simple to mount
- dimension and shape of any kind
- high temperature resistance
- high chemical resistance

INBRAS ENERGOSERWIS expansion joints, produced as single or multi-layered, could be applied in many industrial installations. The users of our expansion joints are:

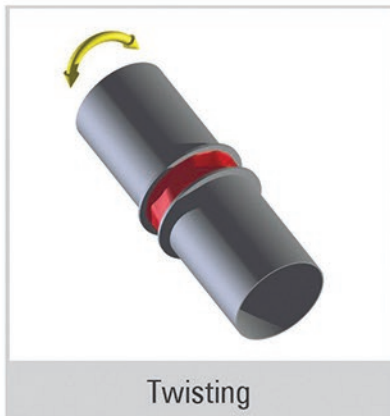
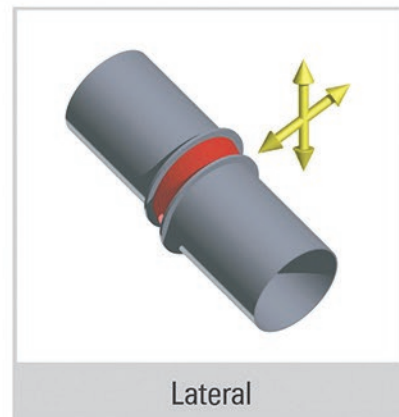
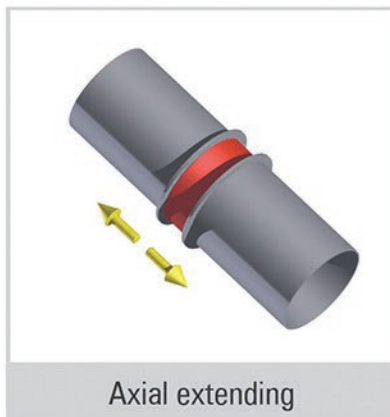
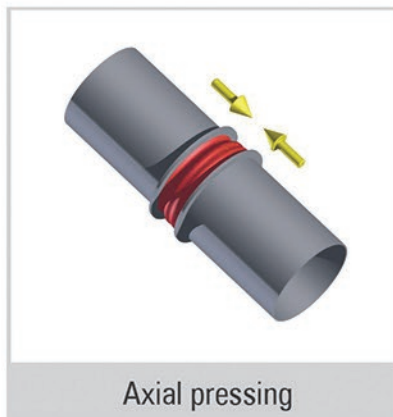
- power plants
- electrical power and heating plants
- steel and coking industry
- waste management and incineration plants
- chemical plants
- cement plants
- paper mills

INBRAS ENERGOSERWIS fabric expansion joints in most of the cases are manufactured individually for each application and selected in close cooperation with the user.

SELECTION

Fabric expansion joints transfer thermal displacement and are able to correct misalignment of ducts. Direction and size of displacement which the expansion joint should transfer will have an impact on the suggested expansion joint type, materials used to its production as well as the design of steel elements of construction.

Displacements: Expansion joints take over displacements in every direction.



Size of extension ΔL depends on:

- duct material on which expansion joint is installed
- working temperature
- length of the compensated section, from the fixed point to expansion joint flange

and is calculated according to the following formula:

$$\Delta L = L \times \alpha \times \Delta T$$

L – initial length of the section

α – coefficient of thermal expansion $\times 10^{-6} \times K^{-1}$

ΔT – difference of temperatures from cold state to hot

Below we provide the coefficient value of some types of steel depending on temperature.

Temperature in °C	200	300	400	500	600
Carbon steel (e.g. RSt 37.2)	13,0	13,6	14,1		
Boiler steel (e.g. 16Mo3)	12,7	13,2	13,6	14,0	
Austentic steel (e.g. 1.4301)	17,2	17,7	18,1	18,4	18,8

Pressure

For the proper selection of INBRAS ENERGOSERWIS fabric expansion joints, it is essential to provide a complete information about the pressure in the system with the applied expansion joint.

Information which has influence on the selection of the expansion joint relating to quantity and quality of its layers is as follows:

- size of overpressure or subpressure
- possible increases of the value of pressure
- changes of pressure – cyclical or emergency
- possible pulsation

Essential information in terms of permanence of applied materials and durability of expansion joint is the possibility to work in changeable pressure conditions that could cause an uncontrolled pulsation of expansion joint fabric. For such work conditions, fitting design should take into consideration a particular way of mounting and the application of a material of increased fatigue strength. Nevertheless, it has to be emphasized that fabric expansion joints are not resistant to pulsation within a satisfying and long-lasting period of usage. In this case, we propose applying elastomeric expansion joints - IES Bestchem EL type.

Impurity

Composition of fluid has a vital impact on the selection of proper steel construction and the fabric expansion joint materials. The majority of expansion joints could work without applying any additional covers within the particulates content of up to $50\text{mg}/\text{Nm}^3$ and the velocity of flowing fluid of up to 10m/s . When exceeding these values, it is recommended to apply guide metal plates preventing an early abrasion of the expansion joint and its leakiness.

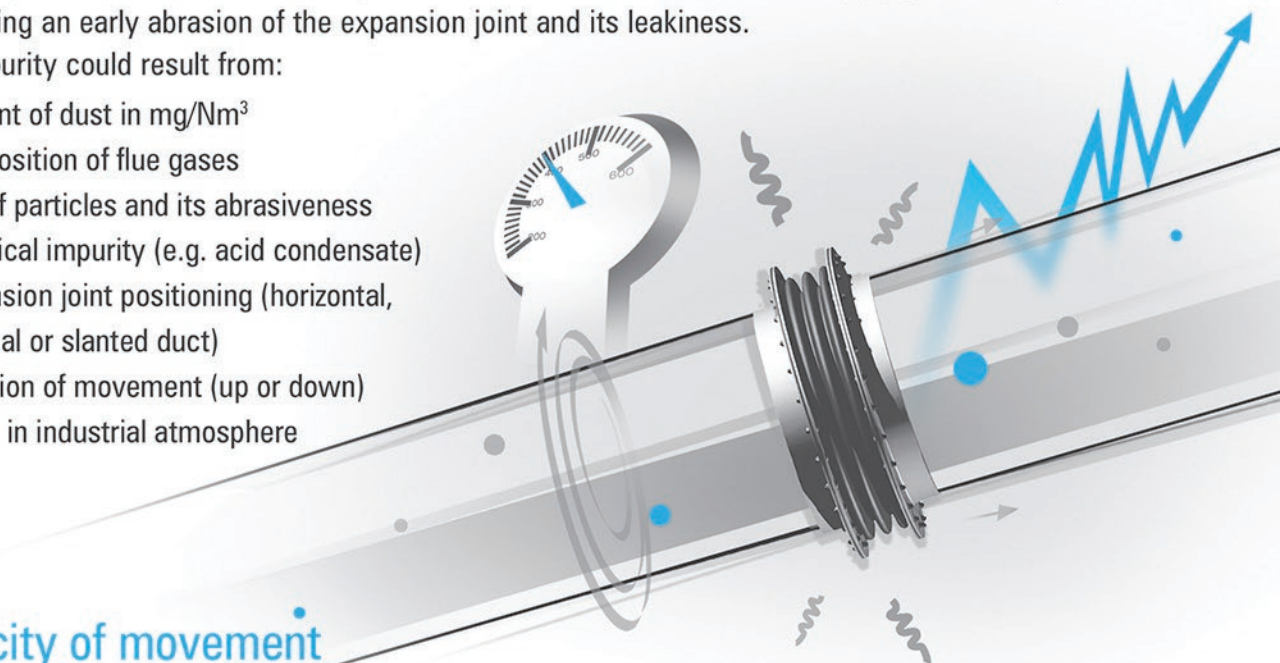
The impurity could result from:

- amount of dust in mg/Nm^3
- composition of flue gases
- size of particles and its abrasiveness
- chemical impurity (e.g. acid condensate)
- expansion joint positioning (horizontal, vertical or slanted duct)
- direction of movement (up or down)
- fitting in industrial atmosphere

Velocity of movement

The velocity of fluid movement and other factors, e.g. dustiness or pressure, have an essential impact on steel constructions and application of possible elements such as protective metal plate or isolation packages guarantees a correct functioning of the compensation system.

High movement velocity urgently requires application of interior protective metal plates (directional, guide) or - where is it possible – using materials of lasting durability and resistant to abrasion (e.g. expansion joints from elastomer).



Temperature

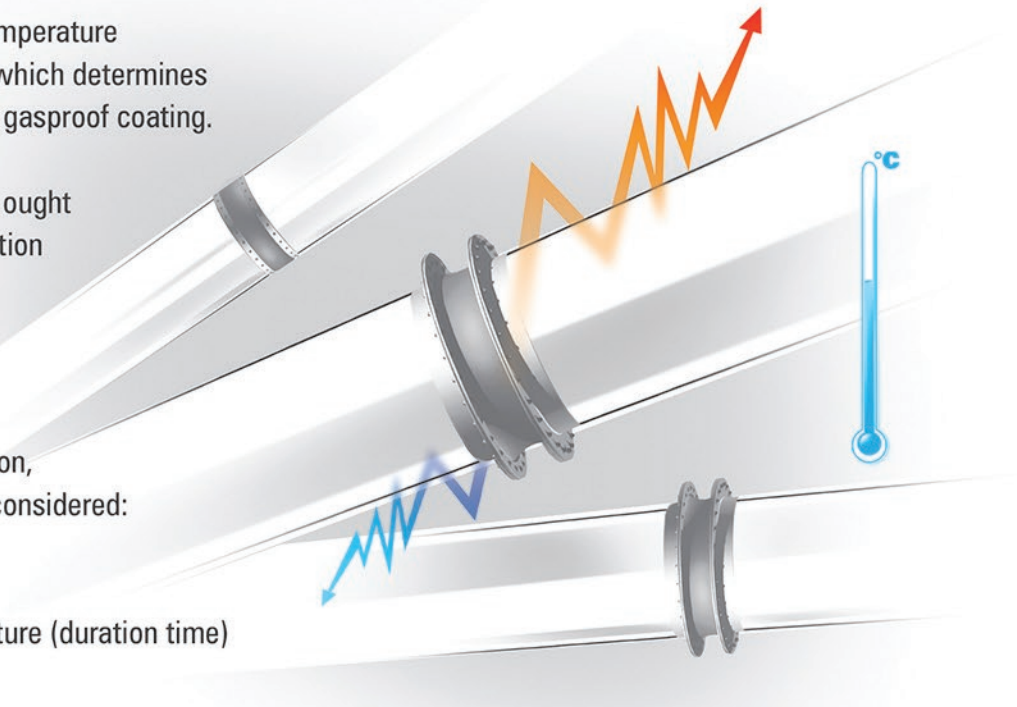
Fluid temperature has a crucial importance in selecting the type of expansion joint (fitting method) as well as indicating the quantity and thickness of insulation layers necessary to reduce the temperature on the exterior layer of expansion joint.

What is also significant is the temperature of expansion joint surroundings which determines the type of exterior protective or gasproof coating.

Typically, fabric expansion joints ought to be provided with heat abstraction and a proper ventilation.

In order to design the best solution, the following issues have to be considered:

- design temperature
- working temperature
- possible increases of temperature (duration time)
- surroundings temperature



Characteristics of fluid

The kind and chemical composition of the fluid flowing through the expansion joint is the key information allowing construction analysis of applied materials in terms of their strength to specific chemical compounds.

The selection depends on:

- type of flue gases (e.g. hot from a boiler fueled by biomass)
- chemical analysis of flue gases
- dew-point temperature
- technological processes influencing the expansion joint (e.g. washing / rinsing ducts)

Location and kind of the installation

Familiarity with the fitting location and investment or modernization stage enables to propose optimal solutions regarding technological and economic aspects.

Possible solutions to consider:

- delivery of the expansion joint / insulation package in opened state for independent closure
- delivery of ready compensation units (elastic elements built in steel constructions and ready to screw or weld at the duct)
- delivery of only the spare parts, e.g. exterior gasproof expansion joint fabric

Our expansion joints

Basic types of INBRAS ENERGOSERWIS expansion joints

Expansion joint 001.1

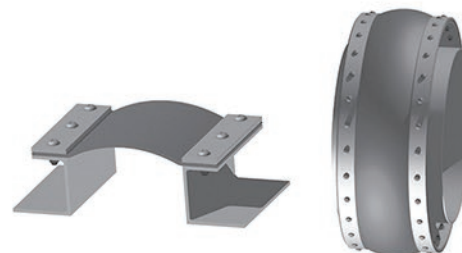
Most popular solution for ducts with clean gases, flue gases and air.

Allowable dustiness: up to $50\text{mg}/\text{Nm}^3$

Mostly concerns multi-layered expansion joints.

Maximum working temperature: up to 750°C

Allowable pressure: up to $-20/+20\text{kPa}$



Sleeve expansion joint

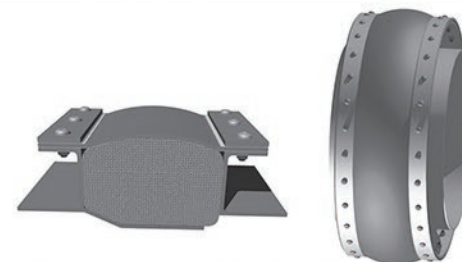
Expansion joint 001.2

Mostly used for compensation of ducts in which fluid is hot and dusty gas.

Mostly concerns multi-layered expansion joints.

Maximum working temperature: up to 1200°C

Allowable pressure: up to $-20/+20\text{kPa}$



Sleeve expansion joint with insulation package

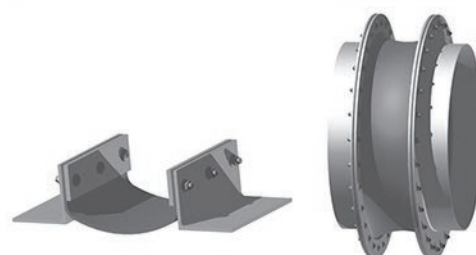
Expansion joint 002.1

Mostly used in ducts with flue gases and air of lower temperature. Single or multi-layered expansion joints are possible to use.

Allowable dustiness: up to $200\text{mg}/\text{Nm}^3$

Maximum working temperature: up to 450°C

Allowable pressure: up to $-35/+35\text{kPa}$



Flange expansion joint

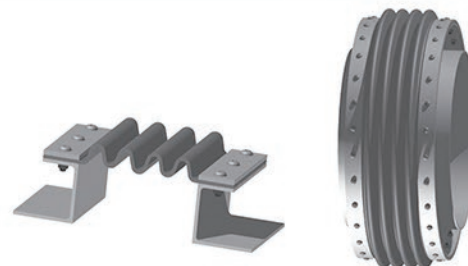
Expansion joint 003.1

Mostly used in ducts with flue gases and air where expansion joint stability against bigger axial displacement and lower pressure is required. Single or multi-layered expansion joints are possible to use.

Used mainly with lower diameter (up to 1800mm)

Maximum working temperature: up to 450°C

Allowable pressure: up to $-10/+10\text{kPa}$



Sleeve-pleated expansion joint

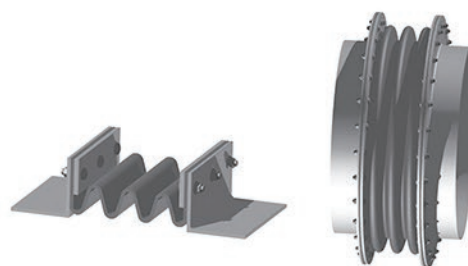
Expansion joint 003.2

Mostly used in ducts with flue gases and air where expansion joint stability against bigger axial displacement and lower pressure is required. Single or multi-layered expansion joints are possible to use.

Used mainly with lower diameter (up to 1800mm)

Maximum working temperature: up to 450°C

Allowable pressure: up to $-10/+10\text{kPa}$



Flange-pleated expansion joint

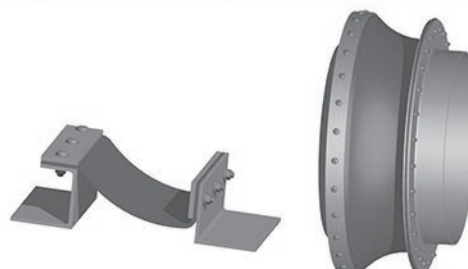
Expansion joint 004.1

Mostly used in ducts with flue gases and air of lower temperature. Single or multi-layered expansion joints are possible to use.

Allowable dustiness: up to $200\text{mg}/\text{Nm}^3$

Maximum working temperature: up to 450°C

Allowable pressure: up to $-20/+20\text{kPa}$

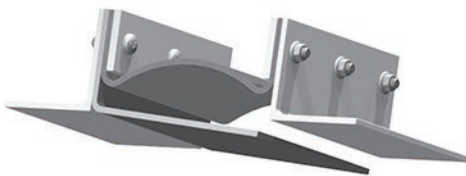


Sleeve-flange expansion joint

Examples of guide metal plates in expansion joints. When choosing a kind of a cover, we have to take into consideration the direction and velocity of the flow, the size of dustiness, the direction and value of displacement and many other factors.

We recommend applying protective metal plates in majority cases which provide:

- stability of flow and pressure
- protection against abrasion of fabric by flowing dust
- support for expansion joint insulation
- protection against surging of dust in inter-flange space
- extended durability of the expansion joint



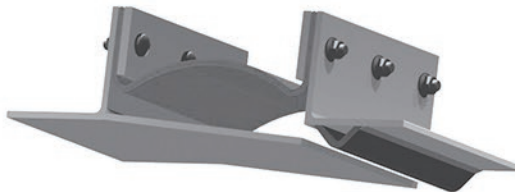
Single welded cover



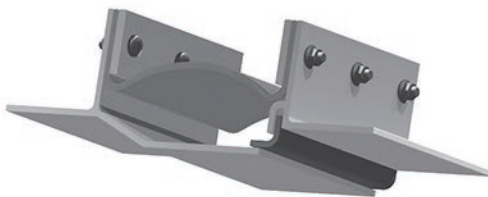
Single cover screwed with the duct



Double cover



Dust-proof cover



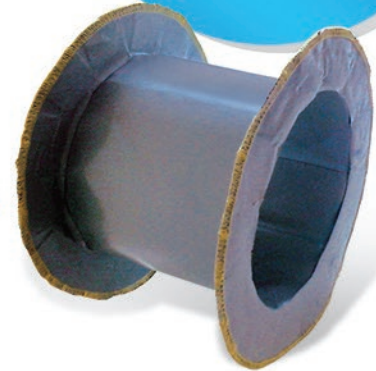
Floating ring

INBRAS ENERGOSERWIS expansion joints can also be installed without guide covers. Expansion joints of IES BestChem batch ought to be considered in such cases as they can operate in particular failure-free conditions for many years due to their exceptional resistance to abrasion and very high mechanical durability.

ELASTEX range of expansion joints is dedicated to operations in low temperatures and with dry fluid. They are produced as single-layered and mainly applied in heating and ventilation systems (HVAC) on feeding ducts for cold air, transfer ducts, extraction ducts and many others. **ELASTEX** fabrics are characterized by high resistance to vibration and high durability parameters.

Pressure range: from -25kPa to 30kPa
Working temperature: up to 200°C

INBRAS ENERGOSERWIS expansion joints are manufactured in three basic types, depending on the location of application and kind of applied fabric.



MULTITERM series of expansion joints is a group of multi-layered expansion joints applied in operations in high temperature. The flowing fluid are flue gases and industrial gases or hot air. In many cases, they are delivered to mount with the insulation package. A wide range of applied materials enables to apply such expansion joints in many industrial locations. They are mostly installed in power plants and electrical power and heating plants, cement plants, incineration plants and chemical plants.

Pressure range: from -20kPa to +20kPa
Temperature range: from -35°C to 750°C



Size and shape of expansion joints as well as manner of connection with the duct – flange or sleeve – basically random. They can be delivered either as ready-to-install components built in steel constructions or as open versions to fit on existing connections. Due to high temperatures or in order to provide stable positioning of insulation layers, they can be manufactured with interior load-bearing layer made of stainless steel.

We recommend **IES BESTCHEM** expansion joints for more demanding implementations with a 100% requirement of tightness and chemical resistance to very aggressive or wet flue gases. They guarantee reliability and certainty of exploitation for many years due to the high quality of used elastomers or fabrics based on fluoropolymers. These basic single-layered expansion joints are applied in desulphurization stations as well as in different plants with aggressive, chemical and wet flue gases.

Pressure range: from -35kPa to +35kPa
Temperature range: from -35°C to 300°C



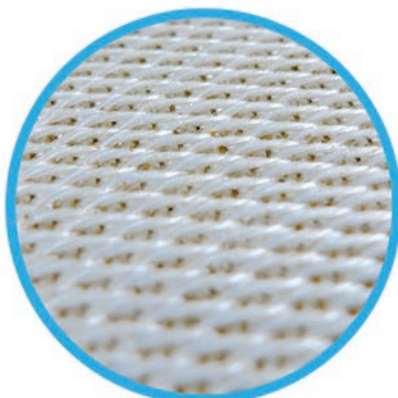
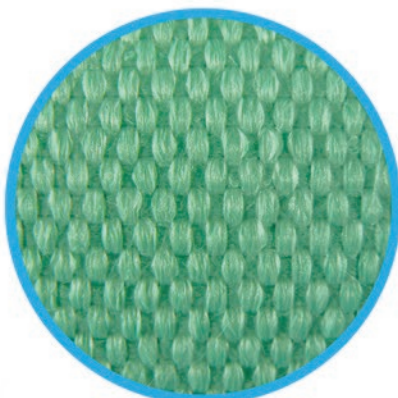
Basic types of fabric used in our expansion joints

Depending on the expansion joint type as well as application, we provide optimal solutions based on available insulation materials and gasproof materials with chemical resistance.

FABRIC TYPE	WORKING TEMPERATURE [°C]
Polyester fabric	120
Polyadimic fabric	150
Aramid fabric	280
Glass fabric of E type	500
Glass fabric of HT type	700
Silicate fabric	1000
Ceramic fabric	1200

Fabrics with elastomer and thermoplastic coatings

COATING	CARRIER FABRIC	WORKING TEMPERATURE [°C]	CHARACTERISTICS
PVC	Polyester fabric	60	Good tightness and mechanical durability in low temperature range
EPDM	Polyester fabric	60	Good mechanical and chemical resistance
Silicone	Polyadimic fabric	150	Fabric dedicated to connections with the occurrence of vibrations and in mediocre temperature range
Silicone	Aramid fabric	250	Very high mechanical resistance and tightness in mediocre temperature range
FPM	Glass fabric	200	Very high chemical resistance
PTFE	Glass fabric	260	Very high chemical resistance



Having selected **MULTITERM** series of multi-layered expansion joint, working conditions, temperature resistance, mechanical properties, chemical resistance and tightness requirements are taken into consideration.

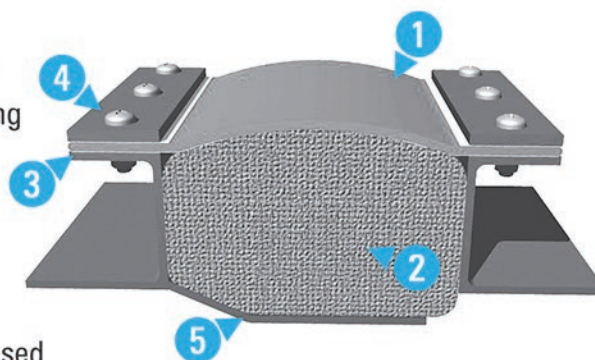
Model cross-section of multi-layered fabric expansion joint dedicated to work with flue gases in temperature of 550°C

- ① Carrier grating applied as mechanical and stabilizing protection
- ② Insulation and sealing fabric
- ③ Glass fiber mats
- ④ Insulation fabric
- ⑤ Gasproof foil
- ⑥ Exterior fabric, coated or laminated as a protection layer and resistant to pressure
- ⑦ Reinforcing and stabilizing cuff



Component parts of a compensation unit

- ① Gasproof sleeve
- ② Insulation package applied in order to protect gasproof sleeve against direct exposure to fluid temperature. Moreover, it prevents from amassing dust between the flanges, mutes noise and reduces possible pulsation of fabric
- ③ Expansion joint frame is used to connect the duct with the expansion joint sleeve
- ④ Clamp flats of suitable thickness and width are used to connect the expansion joint with the frame and provide the necessary clamping force for achieving proper tightness
- ⑤ Guide metal plate provides stabilization of flow and protects soft elements against devastation caused by wearing out by particulates



Our expansion joints

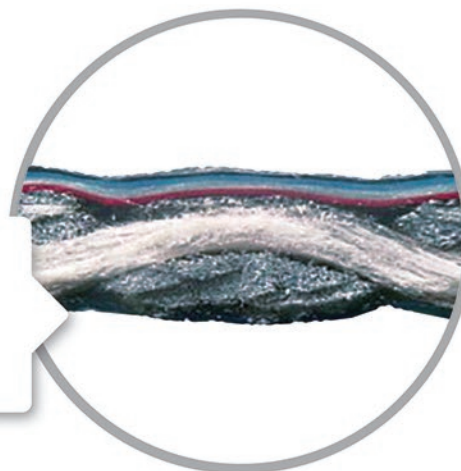
IES BESTCHEM single-layered expansion joints are manufactured from the materials of highest quality where the excellent chemical and mechanical resistance is provided by combination of high-strength carrier fabrics followed by laminated PTFEs or elastomers. They are mainly dedicated to operations in wet and aggressive environment. They are applied as basic expansion joints in gas purification installations. Due to their high durability parameters, they can be applied in many cases without the necessity of using protective metal plates. They are installed with additional tightness of PTFE tape.

Depending on applied materials, we distinguish three types of expansion joints in IES BESTCHEM group.

IES BESTCHEM LFP

IES BESTCHEM expansion joints are produced on the basis of laminated glass fabrics, in accordance with the best and up-to-date technologies, using multi-layered, cross laminated PTFE foil.

In the photo we can observe a cross-section of expansion joint fabric. From the gas side, there are a few layers of PTFE foil cross-applied and laminated to glass fabric coated with PTFE.



The technology of multi-layered cross laminate guarantees excellent chemical and mechanical resistance of expansion joint. Thousands of expansion joints made of cross laminate and installed in desulphurization stations around the world confirm its long-lasting life-span.

Laboratory research, fatigue tests (number of working cycles), confirmed in actual expansion joints operations, show five-times higher fatigue strength of PTFE cross laminated fabrics in comparison to different technologies of coating PTFE fabrics.

Expansion joint properties

Working temperature: from -30°C to +316°C

Pressure: +/- 30kPa

Resistance to acid condensate.

Mechanical resistance: 10724 N/mm



2 IES BESTCHEM BF 1000

IES BESTCHEM single-layered expansion joints are composed of PTFE laminate on glass fabric. The expansion joints offer excellent chemical resistance also in wet conditions of work and under aggressive condensate. The different PTFE lamination (lengthwise laminate) predisposes this type of expansion joints to apply as economical alternative for IES BESTCHEM LFP expansion joints.

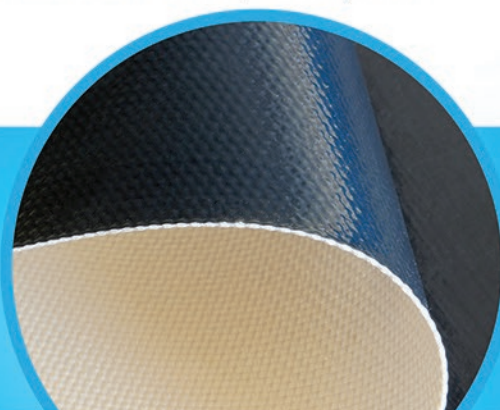
Expansion joint properties

Working temperature: from -30°C to +300°C

Pressure: +/- 20kPa

Resistance to acid condensate.

Mechanical resistance: 8550 N/mm



IES BESTCHEM LFP and IES BESTCHEM BF 1000 expansion joints are implemented in installations with aggressive chemical gases and acid condensate, where a 100% requirement of tightness is required as well as a guarantee of long-lasting life-span and safe exploitation.

They are the most commonly used expansion joints in ducts of wet desulphurization stations.

3 IES BESTCHEM EL

IES BESTCHEM EL series of expansion joints are made of elastomers reinforced by stainless steel net or / and glass fabric. Mechanical resistance as well as resistance to possible pulsations resulting from pressure and exceptional chemical resistance to acid environment qualify these expansion joints to be recommended for:

- FGD fans
- chimney flues
- chimney sealings
- intake and mouth of the absorber
- ducts cleaned for heating

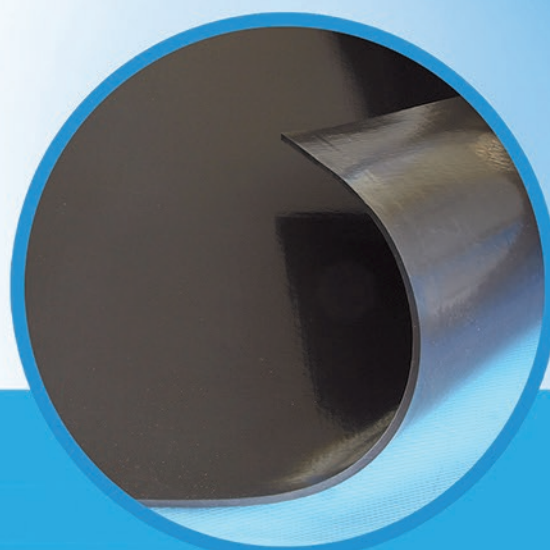
Expansion joint properties

Working temperature: from -30°C to +200°C
(temporary resistance to 340°C / 16h)

Pressure: +/- 40kPa

Velocity of flow: up to 40 m/s

Mechanical resistance, depending on the reinforcement type: up to 8000 N/mm



Materials used by **INBRAS ENERGOSERWIS** come from acclaimed manufacturers. The basic material for producing expansion joints is Viton®B (DuPont). Expansion joints made out of EPDM and Butyl can also be found in our offer.

Main advantages of IES **BESTCHEM EL** expansion joints are:

- excellent acid resistance
- very high resistance to abrasion (possibility to fit without using protective metal plates)
- high mechanical strength
- resistance to changing pressure load
- ease of assembly without needing to use any additional gaskets

SERVICE OF EXPANSION JOINTS INBRAS ENERGOSERWIS

As a manufacturer of high-quality fabric expansion joints we have our own certified service, whose experienced workers are able to carry out any work related to measuring, assembling and monitoring of expansion joints.

Our service range includes:

- inspection and analysis of the fitting place
- geodetic measurements
- preproduction measurements
- thermal measurements
- control of steel construction conditions and guidelines for fitting
- welding
- assembly supervision
- full assembly
- warranty and post-warranty repairs
- urgent emergency protections and deliveries
- periodic and emergency inspections

Availability of materials used in expansion joint production and our equipment allow instant repairs of both our and other providers' expansion joints.

It should be noted that fabric expansion joints regardless of their quality and installation as maintenance-free do wear. That is why periodic assessment of their operation and condition enables to plan repairs and can help in deciding to refit if it is necessary to avoid emergencies and costly stoppages.

STEEL EXPANSION JOINTS

Steel expansion joints are used in high-pressure and high-temperature applications. We offer steel expansion joints: • **single and multi-wave** • **bellows**.

Wave steel expansion joints are manufactured according to individual technical designs. Dimensions are not a problem. It is possible to use any number of waves which allows transferring appropriate amount of displacement and forces in the system. They can be manufactured from all types of steel.



Constructional solutions:

- axial • lateral • angular
- with lateral joints and ties
- with interior and exterior covering
- heating.

Materials used in steel expansion joints:

- a broad range of materials is used in expansion joint bellows, including stainless steel, alloy steel, heat-resistant steel as well as bellows with PTFE coating for special applications,
- connections are individually chosen depending on application. They are made of carbon and stainless steel.

Pressure range: up to PN 63

Temperature range: up to 800°C

Diameter range: up to DN 3000

Every expansion joint must be individually chosen taking into account such factors as: • dimensions

- occurring displacement • pipeline supports
- pipeline settings • current fluid – appropriate selection of materials
- occurring temperature and pressure.

RUBBER EXPANSION JOINTS

Rubber expansion joint are used to reduce internal strain of an installation caused by occurring pressures, thermal strain, vibrations or other physical movement.

They are meant to minimize axial, angular and lateral displacement of working systems.

The structure of rubber expansion joints is mostly based on elastomers which, depending on internal strain are strengthened with synthetic materials creating a cord as well as steel rings that stabilize their work. We offer a broad range of materials used in rubber expansion joints such as: • **EPDM** • **NBR** • **SBR** • **Butyl** • **Neopren** • **Hypalon** • **Viton**.

It is possible to manufacture expansion joints with an inside PTFE layer.

Maximum work temperature: 160°C

Maximum pressure load: 25 bar, also vacuum systems.

Available diameters:
DN 15 DN 3200



Expansion joints are produced with stationary and rotating flanges.

Flange materials: Carbon steel, hot-dip or galvanised, stainless and acid-resistant steel, aluminum. Additionally, expansion joints can be fitted with lateral ties, which can be used to control design fitting and prevent excessive stretches. In applications with abrasive fluid, it is recommended to use interior guide covering.

Every expansion joint must be chosen individually while taking into account such factors as:

- dimensions
- occurring displacement
- pipeline supports
- pipeline settings
- current fluid – appropriate selection of materials
- occurring temperature and pressure.



PTFE EXPANSION JOINTS

Inbras Energoserwis is a part of INBRAS group and is the only manufacturer of PTFE expansion joints in the country. After taking over the production facility in nitrogen plants in Tarnów we have professional machinery for manufacturing materials with PTFE as well as a research laboratory.

One of many products are PTFE bellows expansion joints. They are used in applications for aggressive fluid where conventional compensation solutions cannot be applied.

Expansion joints are produced in diameter range of DN25 - DN300

Operating temperature: up to 200°C



There are two types of manufactured expansion joints:

1 Protective expansion joints

Most often used as protective bellows for such devices as servo-motors protecting working parts against aggressive environment. They're mainly monitored using band clips.

2 Flange expansion joints

Most often used in places where various kinds of displacement occur as well as vibrations / pulsations where application of rigid connection is not possible, and steel or rubber expansion joints cannot be installed due to aggressive working environment. PTFE expansion joints have clamping flange in order to connect using such fasteners as screws. Using exterior displacement reducers (ties) is possible.

INBRAS
13 Transportowca Street
88-100 Inowrocław

☎ 52 52 40 040

☎ 52 52 40 041

@ biuro@inbras.com.pl

🌐 www.inbras.com.pl

INBRAS Engineering Plastics Plant
8 E. Kwiatkowskiego Street
33-101 Tarnów

☎ 14 637 27 08

☎ 14 637 27 38

@ tarflen@inbras.com.pl

