KE-BURGMANN

Expansion Joints

for taking up
vibration
and thermal
expansion in
air and flue gas
duct systems

Engineering Manual 4

Technology that expands with you ...

KE-Burgmann, DK
is certified
acc. to
ISO 9001:2000

KE-BURGMANN

FABRIC EXPANSION JOINT

Expansion joint technology today

Expansion joints are vital components in most industrial plants. They are installed as flexible connections in air and flue gas pipe and duct systems to take up or compensate for thermal expansion, vibrations and misalignments.

Today, advancements in processing and generating technologies are being combined with high demands for efficiency. This, with a clear orientation towards environmental protection, puts higher demands on expansion joint designs.

In the last few years, new and improved materials have made it possible for us to meet these demands. Simultaneously we have managed to increase functionality, operating reliability and service life of our expansion joints.

Many possibilities

Regardless of whether flexible expansion joints are manufactured from elastomers or fabrics, they appear in strong contrast to the steel constructions into which they are installed.

For this very reason they offer almost unlimited flexibility and numerous design possibilities for special demands. Furthermore, they are easy to handle and easy to install.

Fabric expansion joints offer solutions to a broad range of industrial applications. Besides power generating systems as the most important field of application, expansion joints are used in all industries where one or more thermal processes take place.

More than just an expansion joint

Though we have standardised our expansion joint designs to a great extent, we customize most fabric expansion joints to the customer's individual needs.

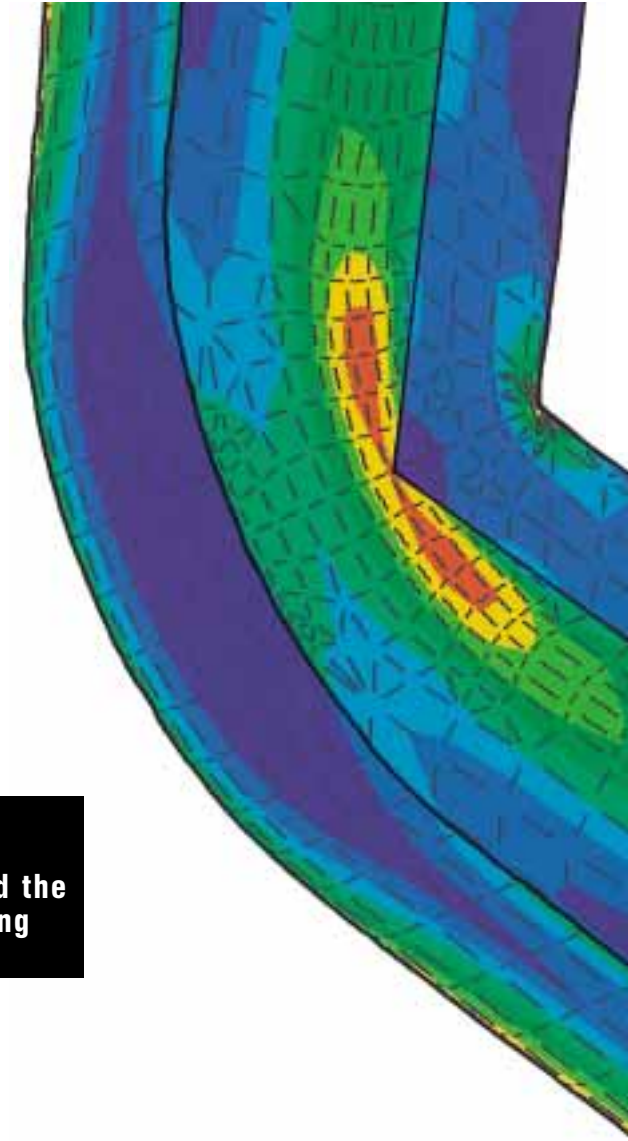
To be able to offer the optimum solution, both in terms of technical and economical requirements, we encourage you to contact us at the earliest possible stage of the project, especially so when it comes to new plants. Our vast experience, combined with our numerous references concerning all possible industrial applications, and our technical knowledge ensure the best operating reliability for your application.
Add to this our worldwide service: it comprises the whole spectrum from technical advice, research & development, engineering (incl. of CAU), design, to calculation (FEM) of steel components, measurements, installation and end-inspection, including after-sales and 'troubleshooting' service. We do not wish to leave anything to chance.

KE-Burgmann Denmark, the world leader for fabric expansion joints, offers you a reliable and competent partner for the best possible quality in product and service. We are certified to the ISO 9001:2000 quality standard and a full member of the American 'Fluid Sealing Association' and the 'European Sealing Association'.

'right to left'

ISO 9001

Member of the Fluid Sealing Association and the European Sealing Association.



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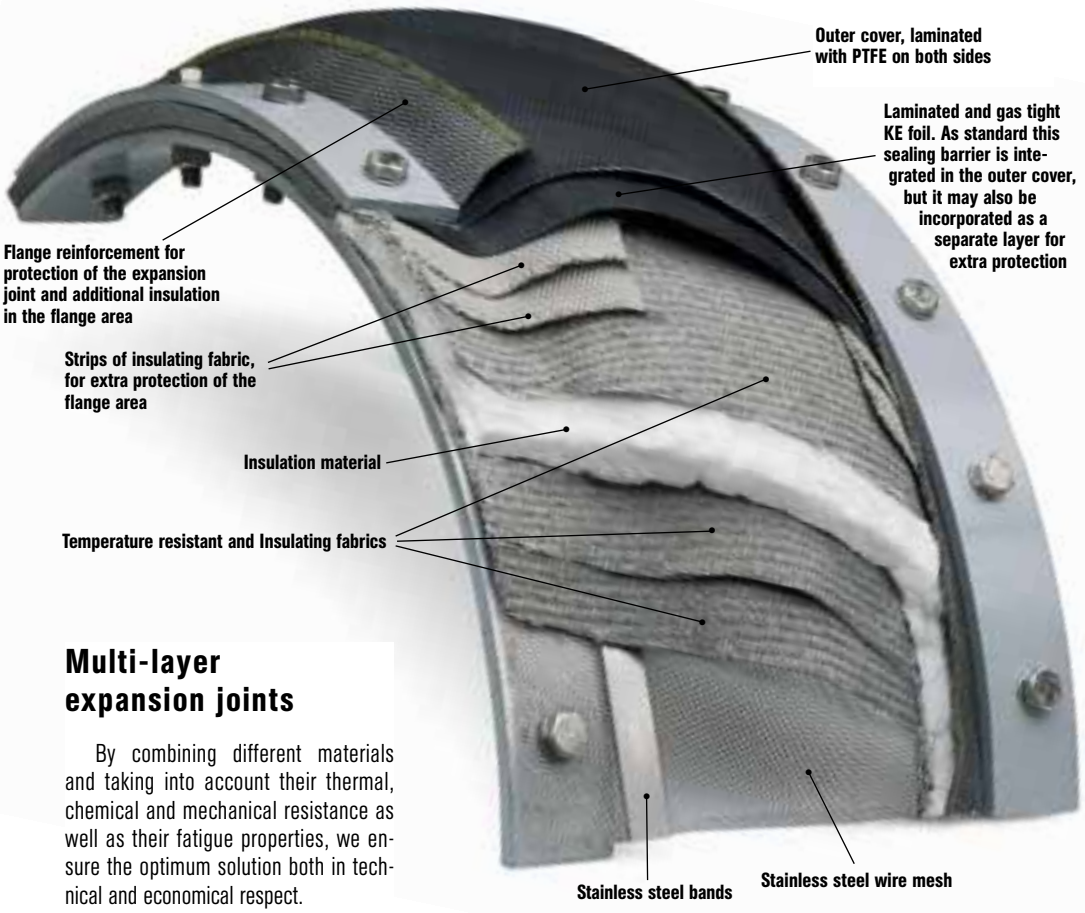
Structure and



Why should you use fabric expansion joints? Because they offer a number of advantages especially in plant design and building:

They take up movements in several directions simultaneously, they have almost no reactive forces, need little space for installation, are easy to adapt to existing physical conditions, and they are easy to transport and to install.

Multi-layer expansion joints

By combining different materials and taking into account their thermal, chemical and mechanical resistance as well as their fatigue properties, we ensure the optimum solution both in technical and economical respect.

Basically, the design of multi-layer expansion joints comprises four groups of materials:

● Outer cover material

Protects the expansion joint from pressure and temperature and guarantees form stability. In most cases the material is coated or laminated and may also function as gas sealing barrier. Stainless steel wire mesh and steel bands are further used for special designs to give added mechanical protection and dimensional stability.

● Gas sealing foil

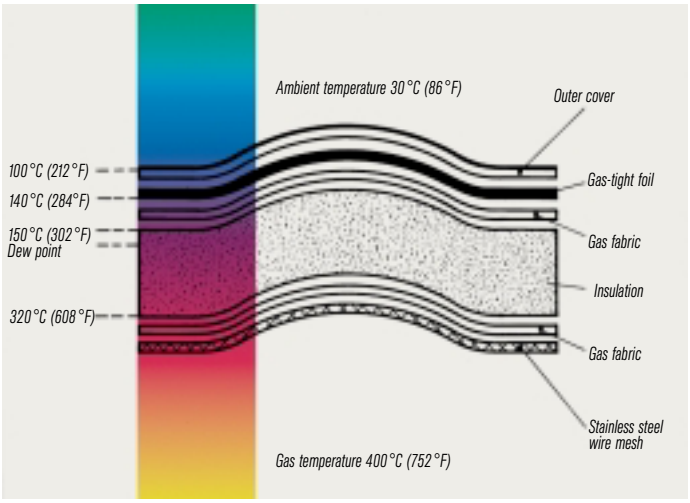
The gas sealing foil is the actual sealing element, usually imbedded between fabric layers or integrated in the outer cover. Impermeable and chemically resistant.

● Temperature-resistant fabrics

Very strong and temperature resistant fabrics are used to protect the gas sealing foil and/or the insulation materials.

● Insulating materials

Protect both the gas sealing foil and the other expansion joint materials from high temperatures of the medium.



Example: Temperature gradient and flow in a multi-layer expansion joint

● Variables to consider

The following considerations will influence the design and the choice of the right expansion joint type.

● Medium

The choice of expansion joint type is determined, among other things, by possible chemical influences. Abrasion from solid matter is largely prevented by using a sleeve/baffle construction.

● Temperature

A specific number of insulating materials are required for reducing the temperature. Our Technical Department determines the insulating effect by calculating and measuring the temperatures in a complete expansion joint. The exact temperature flow is found by means of temperature probes and recorders. Temperature range: –60 ... +1,200 °C (–76 ... +2,192 °F) (dependant on design)

● Pressure

Will the expansion joint be used in a positive pressure or negative pressure area? This will have influence on both type and design of the expansion joint. The main application area covers the pressure range of ± 400 mbar (± 40 kPa). (Fabric expansion joints will resist pressures of up to approx. 3 bars, dependant on other operating parameters.)

● Tightness (sealing)

The requirements for tightness have influence on the design and especially the configuration of the flange area. If the sealing rate must be documented (Nekal tightness or specific leakage rates), the expansion joints are built with special flange designs. We are able to determine leakage rates for various materials and complete expansion joint structures on our test rigs.

Application

The choice of the right expansion joint depends on a variety of factors of which only a few would ever be identical. The following pages will give you more information on the important features of single-layer and multi-layer expansion joints as well as preassembled units.

Single-layer expansion joints

Single-layer expansion joints consist of one material layer only. According to the application area, the layer is manufactured from either fabrics, various (fluoro) elastomers, or fluoropolymers with fabric reinforcement as composite materials.

From the very beginning, KE-Burgmann has taken an active part in the development, design and application of these expansion joints and their materials.

Single-layer expansion joints offer the utmost tightness and chemical resistance as is required when exposed to heavy condensate. We are the leading suppliers of expansion joints, both the PTFE-based fluoropolymers and the original virgin (FKM) fluoroelastomers, specifically designed for application in flue gas cleaning systems.

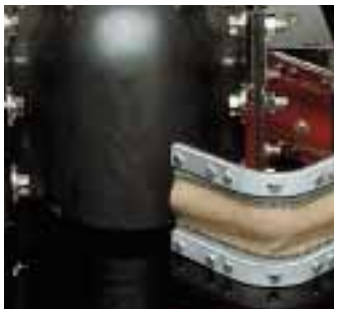
Expansion joint units

The use of expansion joint units, i.e. fabric part preassembled on steel components, offers many advantages:

- All preassembling work is carried out in our workshop
- Installation into the duct is simple and quick
- Transport brackets hold the unit in place during transport and installation
- Large units are transported in sections and welded on-site, and are thus easier to handle, to transport and to install.

Optimum design and engineering

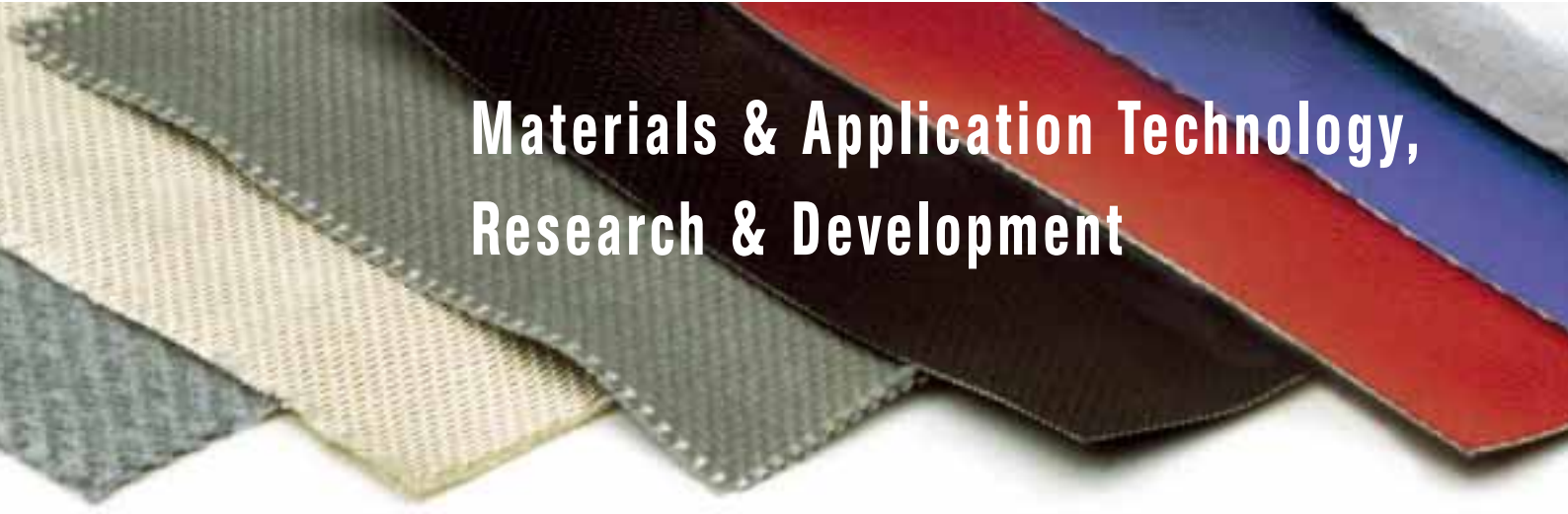
Due to our modern production facilities, machinery and tools, we are able to manufacture expansion joints of almost any form and design, independent of the size of the duct. Approvals to ISO



9001 quality standards ensure a uniform, high level of quality throughout the production processes.

We use modern computer software and methods (CAE, CAU) for the design, construction and analysis of complex expansion joints and the influences on them. On the basis of our extensive theoretical and practical experience, KE-Burgmann has developed its own FEM (Finite Element Methods) models in ANSYS® to analyse both the complete construction of which the expansion joint is a part, and the expansion joint itself. The analysis includes the temperature distribution in steel components and insulation, the gradient of both pressure and stress in steel components, and the heat loss in the complete expansion joint.

On this basis it is possible to calculate the expected service life, to optimize the design and to choose the most suitable steel quality. FEM analyses can be part of the package solution we offer.



Materials & Application Technology, Research & Development

Materials Technology

KE-Burgmann expansion joints are made from materials, some of which have been in practical use for decades, and others which have been developed in recent years on the basis of technological advancement and customer demands. Raw materials, semi-finished products and complete expansion joint constructions undergo both general and comprehensive tests and control procedures.

These tests and control procedures include recognized standard tests according to f.ex. DIN norms etc. and more advanced tests which simulate the actual conditions, under which the expansion joint construction must operate. As standard, all materials are tested with regard to:

- flexibility
- temperature resistance
- tensile, abrasive and tear strength
- mechanical strength
- chemical resistance
- heat convection
- recovery rate after compression
- fibre size and number
- weaving and the strength of same

Please ask to receive material and test specification reports for individual materials, as needed.

Application Technology

On the basis of our test and research results, we are able to document the operational reliability and lifetime of an expansion joint for a given application. We also carry out customer-specific tests. As standard, all expansion joint constructions can be tested with regard to:

- flexibility rate of the expansion joint type
- leakage rate of the expansion joint type
- sound insulation properties of the expansion joint
- temperature distribution (heat/energy loss) through the expansion joint
- FEA (Finite Element Method analyses) of expansion joint and steel parts with regard to life and fatigue

The valuable knowledge of application technology gained from this research, combined with our many years of practical experience, enables us to offer the very best in engineering and technical support to our customers.

This engineering support is available in different forms:

- Documentation of expansion joint design, with detailed construction drawings and operating specifications
- Documentation of construction of units, with measurements and instructional drawings to manufacture steel components
- Documentation of workshop drawings with relevant specifications for components, tolerances, weldings, installation etc.
- A complete documentation package, with all of the above, and FEM analyses of steel components, heat/energy loss through the expansion joint, insulation specification etc. and all other customer specified documentation

Our expertise concerning design of expansion joints, accumulated through more than 40 years, is concentrated in our own computer software, which prepares calculations and standard drawings at just a push of a button.

▲ High-temperature oven for material tests

▲ Fatigue test for tensile and torsional strength

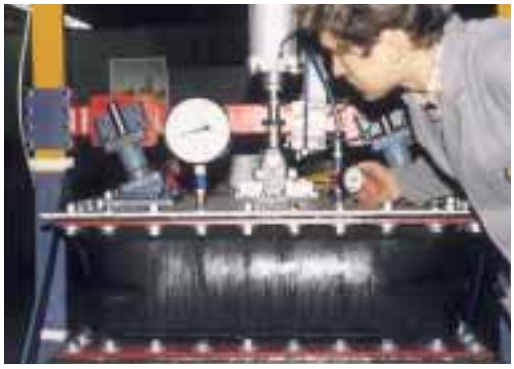
Simulation test rig for expansion joints for chimney connection ▶

Test for chemical resistance

Research, Development, Test

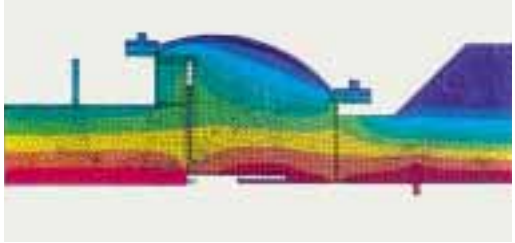
KE-Burgmann is deeply involved with improving existing materials and finding new materials in cooperation with material suppliers all over the world. Concurrently, we keep a close eye on the technical advancements so that we may use our many years of experience and practical knowhow to develop new expansion joint types for specific applications or customer needs.

Our test and development departments are optimally suited for that purpose with their modern equipment. Combinations of different materials and designs are tested on endurance and fatigue test rigs, recommendations and limits for actual operating conditions are established, and the quality of expansion joints is constantly maintained at the highest possible level.



Test setup for a nekal test ▶

Temperature gradient (FEM analysis) ▶

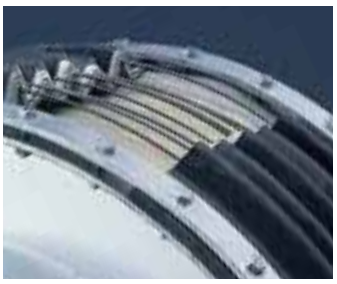


Criteria for Applications and Design

The decision on the type of expansion joint to be used and on its design is based on some fundamental considerations:

- **Is it a new plant? In this case it is possible to design the optimal solution, in both technical and economical respect.**
- **Does the plant already exist? In this case it may be necessary to design the expansion joint to compensate for less optimal conditions, technically seen.**

As a rule, however, it is necessary to state operating data and other conditions as detailed as possible to ensure maximum operating reliability.

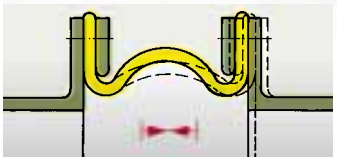


Place of Installation and Conditions A

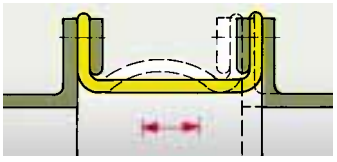
Is the place of installation easily accessible? Is scaffolding required to install the expansion joint? Is it necessary to have a crane or other equipment to lift the expansion joint in place? These and similar conditions must be considered before choosing the expansion joint design.

It is determined already at this early stage whether the expansion joint should be supplied open, to be closed on site – or closed; whether it should be supplied as a preassembled unit, or just as the fabric part, etc.

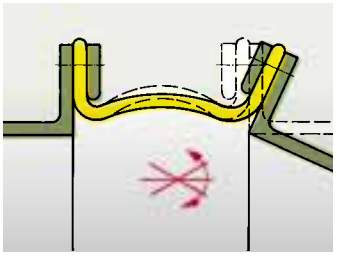
On these two pages, you will find the most essential criteria to consider. Please use the data sheet on the fold-out page at the back of the catalogue to register the operating data.



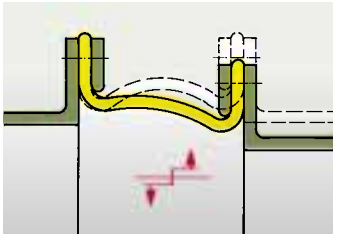
Axial compression



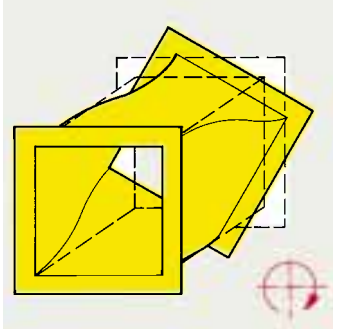
Axial elongation



Angular offset



Lateral offset



Torsion

Movements B

The following movements, alone or in combinations, are taken up by fabric expansion joints:

- axial compression
- axial elongation
- lateral offset
- angular offset
- torsion

The size and frequency of movements will affect the choice of type. For large movements, convoluted and wave-form designs (moulded corners) or multi-layer expansion joints with scissor control guides should be used. They ensure controlled movements and prevent damage to the fabric or heat pockets from occurring.

Mechanical loads

Fabric expansion joints can also take up

- vibrations and
- structural-borne noise

Essentially, the following should be considered:

- overstretching
- abrasion by solid matter
- hardened deposits
- friction along the sleeve/baffle

Pressure C

In the same way as temperature and medium, pressure will affect the design (type of fabric and number of layers). The following distinctions are made:

- positive pressure (normal, peak)
- negative pressure (normal, peak)
- variations of pressure (pulsations)
- pressure surges
- design/operating pressure

Flow rate

For reasons of flow efficiency, fitting a sleeve/baffle may be recommended (see illustration above). When flow rates are above 10 m/sec., a sleeve/baffle construction can protect the expansion joint from flutter or pulsation. FLUACHEM® elastomer expansion joints do not require a sleeve/baffle even at flow rates of up to 40 m/sec.

Medium

D

The design is essentially decided by the type of the medium.

Air
- clean
- dust content (concentration, grain size)
- chemical load by acids, solvents, etc. (type, concentration)

Flue gases
- from coal, oil, gas firing etc.
- analysis of the flue gas (content of pollutants)
- humidity (value below dew point)
- contents of soot or fly ashes
- flushing/washing of ducts

Leakage requirements

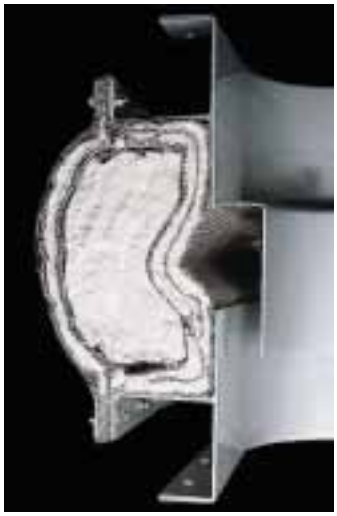
According to the application area and the medium, special leakage requirements may be necessary. In principle, a distinction is made between the tightness of the expansion joint and the tightness of the flange area. Pressure and temperature will also affect the design, and it should be noted that flanged expansion joints can be sealed more easily.

The following requirements can be made:
- nekal tightness
- flue gas tightness
- defined leakage rate
- drip-proof
- air tightness
- dust tightness

Solid matter

The contamination of the medium with solid matter, such as dust, soot, fly ashes etc. will influence both the design (type of coating, thickness) and the construction (sleeve/baffle, bolster etc.). In principle, the expansion joint should be protected from abrasive media.

The main considerations concerning solid matter are:
- content (mg/Nm^3)
- grain size (µm)
- arrangement of duct (horizontal, vertical, diagonal)
- direction of flow (upwards, downwards) and flow rate



Temperature

E

The temperature (medium, operating, ambient) has important influence on the design (insulation), the type (flanged or flat) and the construction (such as extended flanges). The outer cover materials (coated with PTFE, FKM elastomer, silicone etc.) are protected from thermal damage by insulating layers, the thickness and numbers of which are depending on the temperature.

The most important temperature values to consider are:
- operating temperature
- excursion temperature (duration, frequency)
- variations in temperature (duration, frequency)
- design temperature
- ambient temperature

Other temperature values, such as the temperature at the expansion joint and in the flange area, can be documented on request through tests performed by our R&D department.

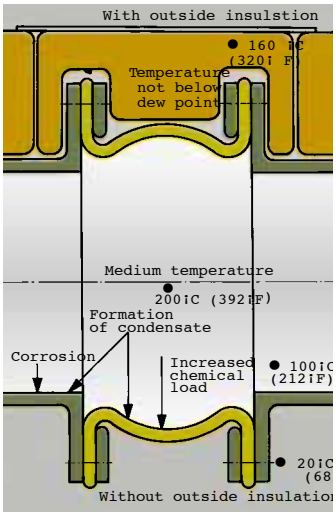
External influences

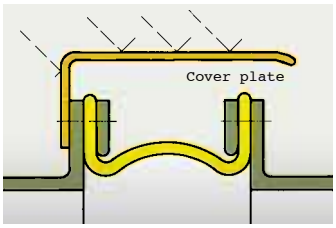
Ambient temperature

The design of expansion joints is usually based on a given ambient temperature. Higher ambient temperatures are met by adjusting the insulation thickness accordingly.

Weathering

Cover plates have proved as a suitable measure against the influences of f.ex. rain, snow, sand storms etc. These plates may also serve as a protection against contact. Please refer to KE-Burgmann's insulation instructions, which also considers the effect of heat dissipation.





Temperatures below dew point

Dependant on the process used, or if the plant is stopped, or if it is operating at a partial load, operating temperatures may drop below the dew point. The arising humidity results in an increased chemical load on the expansion joint and the duct work as well.

Dependant on medium temperature and type of expansion joint, insulation of the expansion joint can be an efficient measure to prevent the temperature from constantly falling below the dew point (see illustration above).

Temperatures below dew point will influence:
- the choice of material (chemical resistance)
- the design of the flange area (refer to fold-out page)
- the construction (flanged expansion joints)

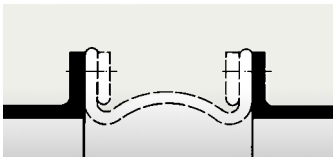
Please refer to KE-Burgmann installation and insulation instructions for further advice on this subject.

Basic Designs

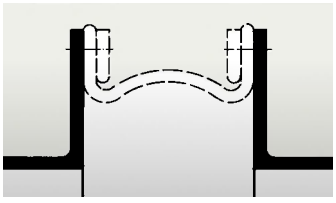
A distinction is made between belt and flanged expansion joints, according to the type of connection to pipe or duct ends. Independent of the configuration of the flange area, however, there are a wide variety of designs according to the application, and you will find the basic version on these pages. The advantage of fabric expansion joints is that there are practically no limits as to their shape and size.

Duct/Pipe Connections

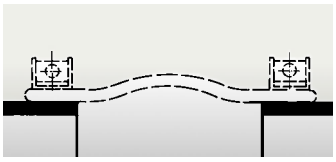
The main types of connections are listed below, and it should be noted that the material of the connecting components does not have any influence on the expansion joint. Whether the components are made from steel, plastic or brickwork, has no bearing except on the fastening method. As a rule, duct cross-sections are round or rectangular, and partly with rounded corners. Fabric expansion joints can also be designed to bridge between round and rectangular ducts.



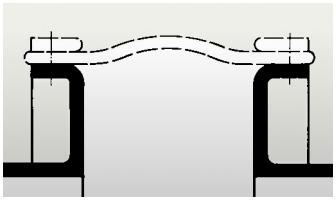
Vertical flange connection on duct level



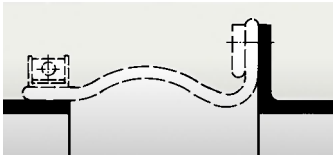
Vertical flange connection, extended



Belt connection directly on the duct

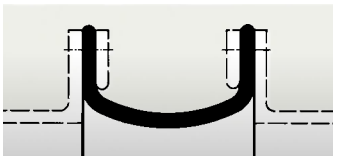


Belt connection to extended flanges

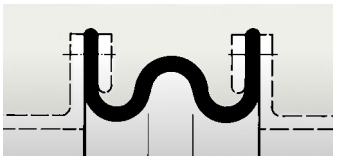


Belt/vertical flange connection

Basic Forms of Expansion Joints

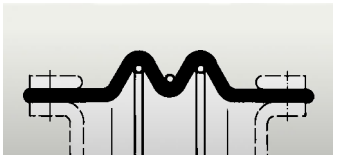


Flanged expansion joint (negative pressure)

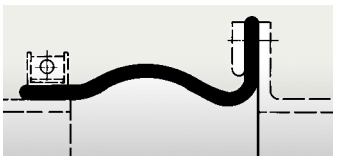


Flanged convoluted expansion joint

Flat belt expansion joint



Convoluted bellows expansion joint (belt connection)



Belt/flanged expansion joint

Which basic form of expansion joint to use, depends on the pipe and duct connections and naturally on the operating conditions: is the plant run at positive or negative pressure? will pressure changes (pulsations) occur? is a bolster necessary? what is the flow rate, etc.?

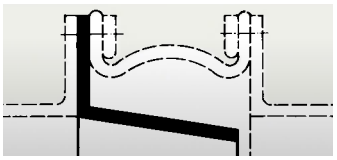
Sleeve/Baffle Constructions

The use of sleeve/baffle construction is recommended in most cases and ensures:

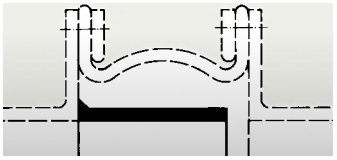
- better flow efficiency
- mechanical protection against abrasion
- prevention of duct accumulation
- longer life to the expansion joint construction
- fixation of expansion joint insulation

If expansion joints are used without sleeve constructions, their design must be equally more resistant to abrasive particles and mechanical loads. Fluachem® elastomer expansion joints have particularly proved their strength in this respect.

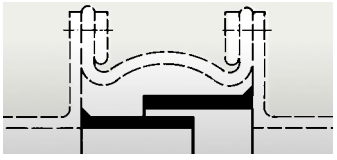
As special considerations are needed when choosing the right sleeve/baffle construction (f.ex. available space, flow direction, dust accumulation etc.), KE-Burgmann should always be consulted.



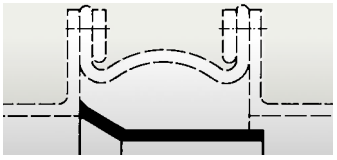
Single sleeve/baffle fitted with the expansion joint



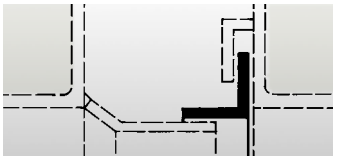
Single sleeve/baffle welded to the duct end



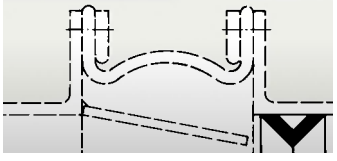
Double sleeve/baffle, with overlap



Single sleeve/baffle, overlapping the opposite duct end



Floating sleeve/baffle



Baffle plate

Expansion joints with integrated insulating layers

Bolster (insulating bag) with/without flanges

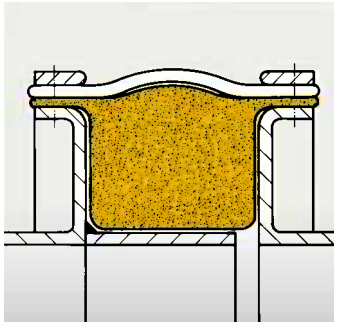
Insulation

The main purpose of insulating expansion joints is to:

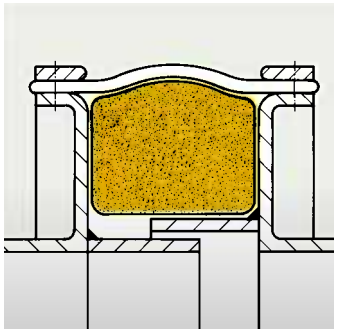
- reduce the temperature to the sealing and often thermally sensitive layers
- protect the expansion joint from fly ash etc.
- support the expansion joint in case of pulsations in the duct
- noise attenuation

There are three forms of insulating techniques:

- insulation integrated in the actual expansion joint layers
- insulation bolster bag, i.e. insulation materials protected by wire mesh or glass fabric, forming a unity with or without flanges
- loose insulating materials resting between the expansion joint and the sleeve/baffle



Bolster fitted as part of the expansion joint



Bolster without flanges, filling out the gap between expansion joint and sleeve

Various bolts; cup springs for a permanent contact pressure without retightening

Stainless steel clamping band

Backing flanges in sections (cut at 45 °)

Fastening Elements

Expansion joints are fitted to the duct ends in many different ways. For less complicated expansion joints (e.g. belt types), clamping bands can be sufficient. The higher the requirements are with regards to pressure, temperature, tightness etc., the more sophisticated will be the fastening method. KE-Burgmann expansion joints are supplied with the necessary fastening elements on request.

Standard Designs of Expansion Joints

When it may be advantageous or necessary to use a certain type of expansion joint, depends on a number of factors, such as size of the duct cross-section, site conditions, sleeve construction etc. but also on the type of application. The three basic versions with their essential features are listed below:

Closed type

- for vertical flanges and flat belt connections
- single and multi-layer designs
- accurate dimensions required
- usually supplied with holes punched
- steel components can be supplied separately

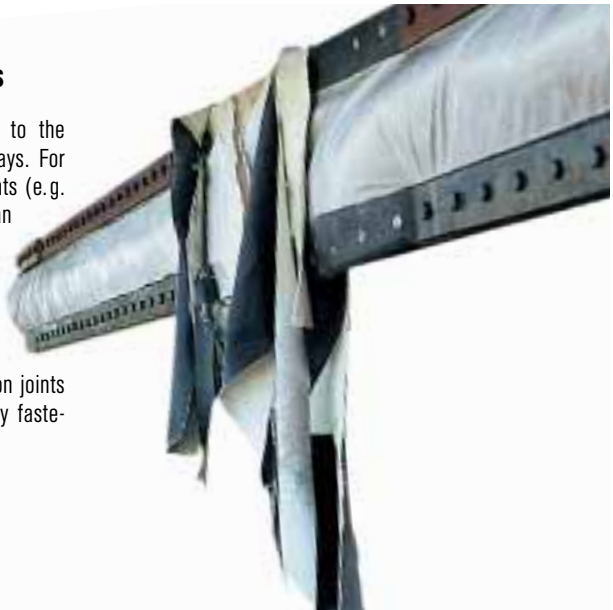
Open type

- only for belt connection
- closed on site
- not usually supplied with holes
- ideal for stockkeeping as spare parts, in rolls
- quick replacement and/or assembly in case of damage (repair work)

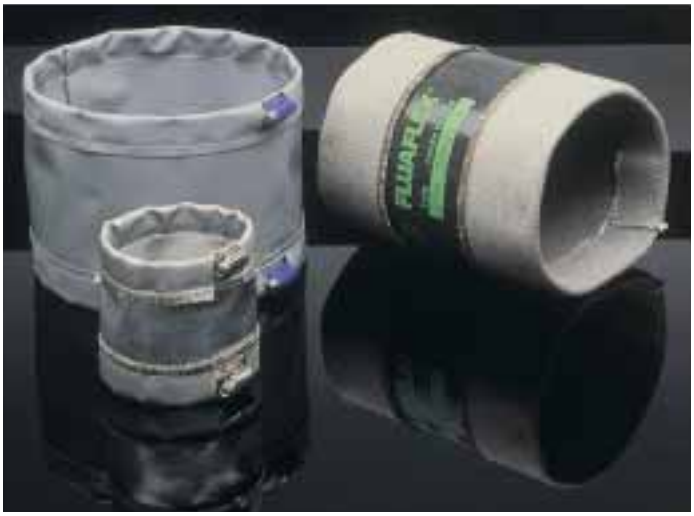
Unit ready for assembly

- for all types of connection
- complete preassembled units with all steel components, insulation etc.
- quick installation

- FEM analyses are possible
- can be supplied with scissor control guides for two or more expansion joints in line, for taking up large movements
- can be supplied in sections and joined/assembled on site



Standard Expansion Joints



KE-FLEX®

KE-Flex® is a comprehensive range of usually single-layer expansion joints for temperatures below 200 °C (392 °F) and where the media are not aggressive. Application areas are, e.g. heating and ventilation (HVAC) systems, separators, vibrating conveyor systems, powder and granulate conveyor systems etc.

KE-Flex® expansion joints are available in different versions from fabrics, plastics, and elastomers. They may be provided with rings or reinforced fabric for stabilization of pressure loads. KE-Flex® is supplied with sewn-in or loose clamping bands.

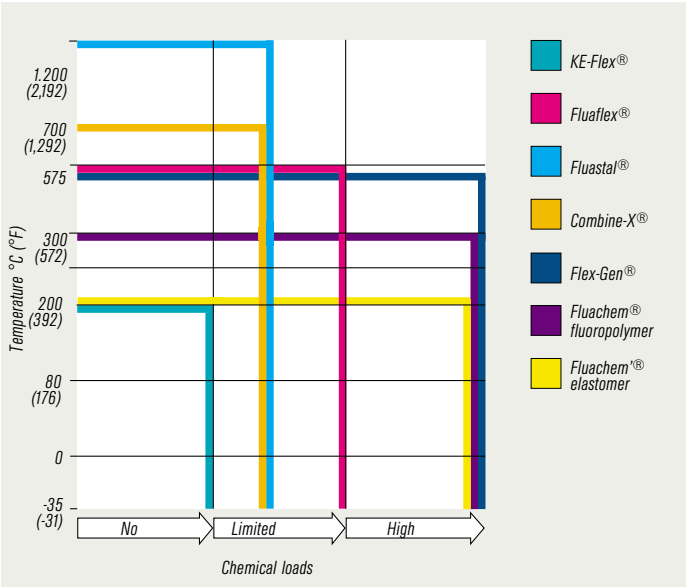
Operating limits:
Temperature: –65 ... +200 °C
(–85 ° ... +392 °F)
Pressure range: ± 250 mbar/25 kPa
Movements: axial compression: 50 %
lateral offset: ± 20 %

FLUAFLEX®

Multi-layer expansion joints for use in air and flue gas systems, e.g. in conventional power plants, gas turbine plants, incinerator plants, cement works, petrochemical plants, pulp and paper plants etc., where temperatures do not exceed 575 °C (1,067 °F). Also suitable for aggressive media.

Fluaflex® expansion joints are manufactured in round, rectangular or conical forms and in combinations thereof. They can be designed for flanged and belt type connections, with sleeve/baffle and insulation.

Operating limits:
Temperature: –35 ... +575 °C
(–31 °... +1,067 °F)
Pressure range: ± 200 mbar/20 kPa
Movements (depending on temperature and type):
axial compression: 50 %
lateral offset: ± 20 %



Max. operating limits of standard expansion joints with regard to temperature and chemical loads.

FLEX-GEN®

The new generation of expansion joints for the future: a simple, yet durable and strong expansion joint with unique thermal, chemical and mechanical properties. Flex-Gen® is manufactured from our own reinforced PTFE-based laminates, which consist of only a few individual layers. We first coat and then laminate a glass fabric on one or both sides with one or more layers of PTFE foil. Flex-Gen® expansion joints are thus excellently suited for a wide variety of applications in conventional power stations, where the operating temperatures may reach 575 °C (1,067 °F) and the medium is dry flue gas.

Operating limits:
Temperature: up to 575 °C (1,067 ° F)
Medium: Dry flue gases
Pressure range: ± 200 mbar/20 kPa
Movements (depending on temperature and type: axial compression: 50 %, lateral offset: ± 20 %
Chemical resistance: outstanding – resistant both on the inside and outside, as the PTFE foil is laminated to the outer cover.

ORIGINAL LAMINATE
THE NEW GENERATION
FROM KE-BURGMANN

FLUASTAL®

Multi-layer expansion joints, designed with stainless steel wire mesh and bands on the gas side to ensure high form stability and temperature resistance. For demanding applications in gasturbine systems, smelting works, cement plants, petrochemical plants etc.

Fluastal® expansion joints are designed to meet individual requirements to operating conditions and connection forms. Due to their special construction, Fluastal® expansion joints retain excellent form stability and are easy to install.

Operating limits:
Temperature: –35 ... +1,200 °C
(–31 °... +2,192 °F)
Pressure range: ± 200 mbar/20 kPa
Movements (depending on temperature and type):
axial compression: 40 %
lateral offset: ± 20 %

Expansion joints are customized to customer specifications. Standardization is, however, possible in view of known and recurring operating conditions, like specific temperature ranges and media. For all major applications, we can thus offer standard solutions, most of which identify the application area by product name. Your choice is made easy, and the expansion joint fulfills all requirements to both operational reliability and fast and correct delivery.

COMBINE-X®

The ideal special expansion joints for use in gas turbine and combined-cycle plants with high operating temperatures, very high gas velocities and pulsating gas flows. Combine-X® is a multi-layer expansion joint, and its design is matched exactly to the operating and structural requirements of the individual application. Specially designed steel components and sleeve/baffle constructions ensure extremely good functionality and high operating reliability. FEM (Finite Element Method) analyses can be carried out for expansion joints and their steel components to document expected life of the design in the individual installation.

Operating limits:
Temperature: –35 ... +700 °C
(–31 ... +1,292 °F)
Pressure range:
–140 ... +75 mbar/7.5 kPa
Movements (depending on temperature and type):
axial compression: 50 %
lateral offset: ± 20 %

FLUACHEM® Elastomer and Fluoropolymer Expansion Joints

Fluachem® are single-layer expansion joints, based on elastomers and fluoro-polymers, which have been specifically developed to withstand high chemical loads. Recommended for use in flue gas cleaning systems and other plants with very aggressive media. Fluachem® expansion joints are mostly used without insulation and sleeve/baffle. They are available for flange and belt connections, for round and rectangular duct cross-sections and in any dimension. If optimum tightness is required in the flange area, we recommend a design with vertical flanges. Expansion joints, supplied open, are closed on site by welding or vulcanizing.

FLUACHEM® Elastomer Expansion Joints

KE-Burgmann elastomer expansion joints are manufactured by vulcanizing the materials under pressure and temperature. As a rule, the elastomers used are fluoroelastomers (FKM), ethylene-propylene (EPDM), Butyl® and Neoprene rubber. The elastomers are reinforced by a tear-resistant and acid-proof mesh of fibre glass or stainless steel (1.4539). The well-balanced mesh size and wire thickness provides an absolutely thorough compound in vulcanization. Particularly expansion joints of 100 % virgin terpolymer have exceeded by far even high expectations at constant temperature loads of 200 °C (392 °F), thanks to their excellent resistance to acids.

Millions of hours of faultless operation under extreme operating conditions in flue gas desulphurization plants are a convincing proof of this fact.

Characteristics
- very high resistance to acids
- gas and drip tight (nekal tightness)
- abrasion-proof
- withstands high mechanical loads
- no flange gasket required
- low reactive forces
- easy to install
- pressure proof even with alternate loads and pulsations (reinforced version)
- good flexibility

Operating limits:
Temperature: –35 ... +200 °C
(–31 ... +392 °F)
Pressure range: ± 350 mbar/35 kPa
Movements (depending on temperature and type):
axial compression: 20 % (30 %*)
lateral offset: ± 10 % (15 %*)
*) wave form with moulded corners
Gas velocity (without sleeve/baffle)
... 40 m/sec.

FLUACHEM®-Fluoropolymer Expansions Joints

The core of these single-layer expansion joints is very strong glass fabric, protected on the one side by a PTFE-based coating and on the other side (facing the gas) by a PTFE foil. This material structure ensures excellent strength, great flexibility, and excellent chemical resistance even at continuous temperature loads of up to +300 °C (572 °F). KE-Burgmann was among the pioneers in developing expansion joints from this material, and since the beginning the materials have been constantly improved. Today, they more than fulfill the requirements of giving long-lasting performance in power stations, flue gas cleaning systems, the chemical industry, etc.

Characteristics
- high chemical resistance, equalling PTFE (pH 0 ... 14)
- extremely tear-resistant
- gas-tight, non-porous
- mechanically resistant
- excellent tensile strength even at high temperatures
- low reactive forces
- very flexible
- easy to install

Operating limits:
Temperature: –35 ... +300 °C
(–31 ... +572 °F)
Pressure: ± 200 mbar/20 kPa
Movements (depending on temperature and type):
axial compression: 30 %
lateral offset ± 15 %
Gas velocity without sleeve/baffle (depending on type): ... 30 m/sec.
Dust content, without sleeve/baffle: 200 mg/Nm^3

Standard and Special Expansion Joints

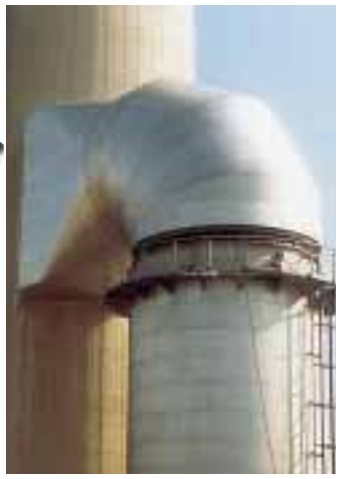
1/1octave Centre Frequency (Hz)	31	63	125	250	500	1000	2000	4000	8000	31.5–8000
R	33,6	30,0	48,0	30,6	18,4	28,0	35,7	37,1	43,5	

ACOUSEAL®

KE-Acouseal® is an elastomer expansion joint which has been developed specifically for the air intake side of gas turbines. It is placed between the filter and the compressor and ensures, apart from taking up the movements of the air ducts, a highly efficient noise attenuation which meets even the highest environmental requirements.

Characteristics:

- easy to install
- installation tolerance ± 10 mm, axial and lateral
- sound emission is reduced to a minimum (see diagram)
- supplied closed for vertical flange connections
- pressure resistance ± 100 mbar/10 kPa
- temperature resistance −35 ... +150 °C (−31 ... +302 °F)
- customized design for the specific application with documentation of sound reduction index



Expansion Joints for Chimney Connections

This flexible expansion joint with its specially-developed fastening system is used between the flue gas duct and the acid-proof brick lining of the chimney. It ensures excellent tightness and is easy to install. With this system it is possible to dispense from expensive connecting frames, which would be in contact with the flue gas. An important advantage of the KE-Burgmann expansion joint for chimney connections is its (patented) fastening system, which allows for outside fitting to the lining brick, using a special configuration. The fluoroelastomer (FKM) expansion joint is fitted with a special extruded profile that fits into a groove in the casing stone and is held in place by clamps.

We established the pressure required and the forces actually occurring in the clamping area in test series performed on original connections at our works, and from theoretical calculations. Our findings were subsequently adopted in practice and proved correct. On the duct side, the expansion joint is fastened in the usual manner. NB: if the lining brick has not been provided with grooves from the works, these may be ground in as well.

Convoluted Expansion Joints

Convoluted expansion joints are specially designed and manufactured as single or multi-layer versions, incorporating steel rings for support also in connection with high pressure loads. They are suitable for use in f.ex. coal mills, steel works, pulp and paper industry etc., where compensation is needed for very large movements combined with high temperatures. In case of double expansion joints, uniform distribution of the movements is ensured by means of scissor control guides.

Temperature: −60 ... +600 °C
(−76 ... +1,112 °F)
Pressure range: ± 200 mbar/20 kPa
Movements: axial compression: 60 %
lateral offset: ± 30 %

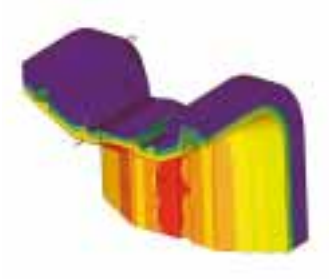
KE-Masterflex® Rubber Expansion Joints

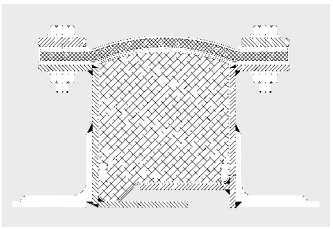
As part of our comprehensive range of expansion joints, we offer a full range of rubber bellows and fabric-reinforced rubber expansion joints (up to DN 2400) for high-pressure systems carrying liquids or gas.

Connex® and Bredan® Metal Expansion Joints

A full range of metal expansion joints, both rectangular and round bellows,e.g. for exhaust gas systems, are also part of our scope of supply. Please ask for detailed information.

Fire Skirt Expansion Joints





Combine-X® Fire Skirt expansion joints are used as flexible, fire-proof elements of the ducting in gas turbine exhaust systems on board cruise ships or other types of vessels.

Special requirements for fireproofing exist on ships for equipment used in the fire hazard zones. These fireproofing requirements apply also to the fabric expansion joints installed on the gas turbine ducting. Combine-X® Fire Skirt expansion joints are approved by the necessary approving bodies, such as Norske Veritas and Lloyds Register of Shipping and fulfill requirements for protection classes such as Jet Fire and Pool Fire. Fire Skirt expansion joints are also installed on offshore escape tunnels, which must protect against a sudden and explosive eruption of fire.

Combine-X® type Fire Skirts are supplied preassembled on steel parts as a complete unit.

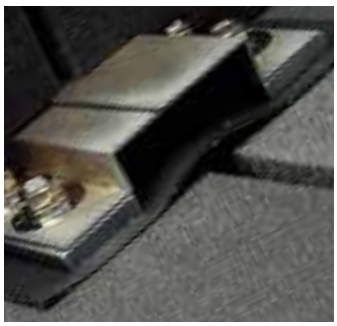
Operating data:
Exhaust gas: 600 °C
Pressure: 70 mbar / 7 KpA / 700 mm WG

Lining Joint Sealings in Chimneys

Chimneys consisting of a concrete casing and one or more internal pipes are exposed to considerable chemical loads of acid condensate as a result of the low flue gas temperatures after the flue gas cleaning system. The internal pipes, mostly made from acid-proof lining bricks, are arranged one on top of the other and rest against the outside casing.

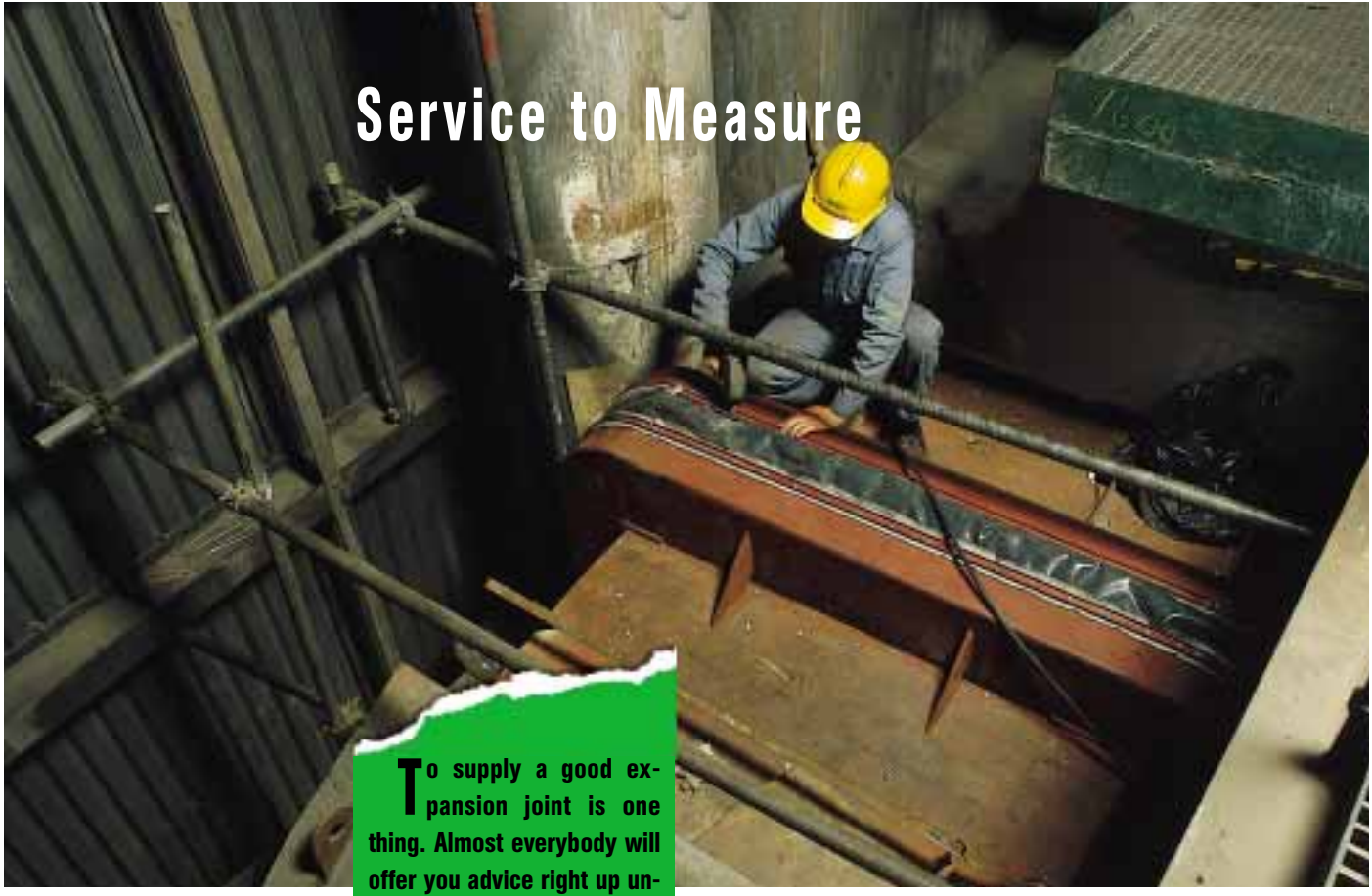
The lining joints are sealed flexibly and acid-proof with Fluachem® fluoroelastomer expansion joints (FKM), to avoid any leakage of condensate. There are comparable sealing points at the bottom of the funnel and at the opening of the chimney. The expansion joints, which are supplied open, are closed on site by hot vulcanization. Fastening elements are corrosion-proof or stainless steel.

Expanding Seam Seals in Special Waste Dumps



Protection of our ground water is vital. That is why safety has top priority in special waste dumps for water-pollutant liquids (e.g. highly concentrated AHC and CHC). A reliable and time-tested solution is the KE-Burgmann expanding seam seal of highly fluorinated elastomer with a stainless steel wire mesh. It meets the stringent requirements of the Water Resources Act. The expansion joint is secured and sealed by means of sectional strips through threaded bolts welded to the sheet metal liner and an accurately defined contact pressure. The tightness tests monitored by the German (Bavarian) Board for Technical Supervision are carried out with a suction bell (0.5 bar min. negative pressure) and a foaming agent on the readily mounted system and have proved a sealing rate of 100 %. The sealing material, FKM, has been approved by the "Institute for Building Technology" in Berlin.

Service to Measure



To supply a good expansion joint is one thing. Almost everybody will offer you advice right up until the purchase has been concluded. We offer more at KE-Burgmann: professional engineering and a comprehensive service second-to-none, as you would expect it from the No. 1 supplier of fabric expansion joints worldwide.

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Our comprehensive service offer comprises, among others, the taking of dimensions (1), installation, supervising of installation (6), end-inspection, tightness tests, inside (7) and outside (3) service inspections, thermovision measurements (4), analyses of failures and damage, repairs (8).

KE-Burgmann has extensive experience with installation and supervising tasks all over the world. We have excellent knowledge of both the conditions prevailing on site and the cultural differences that may exist. Troubleshooting with existing installations requires a special expertise, and we have been successful in analysing failures by means of, among others, FEM and subsequently recommending alternative, more reliable constructions.

As a complement to this, we offer to carry out service inspections of your expansion joints to ensure a continuous and dependable operation.

Please contact us. We are there for you. KE-Burgmann – your partner for service made to measure your needs.

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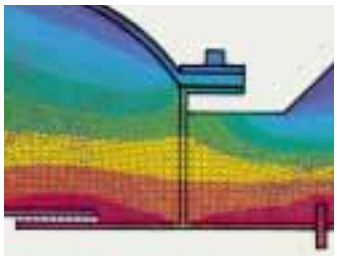

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Tools etc.

Flange Gaskets

KE-Superseal® (9654)
PTFE flat gasket, self-adhesive

Pure PTFE of a stretched structure (cold flow is virtually excluded). High sealing on irregular flanges; simple fitting; no waste, stockkeeping of only few dimensions as the gasket is practically independent of the form and nominal widths. Resistant to almost all media (pH 0 ... 14). Max. operating temperature: 300 °C (572 °F).

Application data, supply

Nominal width, uncompressed			3	5	7	10	14	17	20
Thickness, uncompressed			1.5	2.0	2.5	3.0	5	6	7
Contact pressure N/mm²	10	B	4	6	9	13	19	23	26
		D	0.4	0.5	0.9	1.1	1.5	1.8	2.4
	20	B	4.5	7	11	16	25	31	33
		D	0.3	0.4	0.6	0.7	1	1.2	1.7
	30	B	5	8	14	20	30	37	40
		D	0.25	0.3	0.4	0.5	0.8	0.9	1.1
Use up to DN			50	200	600	1500	> 1500		
Roll length (m)			25; 50			10; 25		5; 25	

Dimensions in mm
B = compressed width
D = residual thickness

PTFE round cord (9660)

Of pure PTFE, specially processed for reduced cold flow. Resistant to almost all media (pH 0 ... 14). Max. operating temperature: 260 °C (500 °F). Short periods, up to 300 °C (572 °F).

Scope of supply

Cord dia. (mm)	Roll (m)
2.5	15
3.2	15
4.0	10
6.0	5
8.0	5
10.0	5

Please note:

You will find a comprehensive range of sealing products for sealing all flanges and flange-like connections in Burgmann´s "Static Seals" catalogue which is available on request.

Installation case

The installation case comprises all tools and materials required for closing or repairing multi-layer expansion joints: Pointed pliers, universal pliers, putty knife, screw clamps, rubber gloves, measuring tape, marking pencils, scissors, manual clamping device, roller, knife, PTFE welding unit with support and backing strip, steel block, awl, assortment box, manual rivetting tongs, hammer 500 g, backing strip of aluminium sheet, sewing needles, spools with sewing yarn, PTFE welding tape, silicone cement, stainless-steel rivets dia. 3 x 12, stainless steel washers dia. 3, stainless steel staples, various fabric strips, Joudol®-"SM" (subject to modifications).

Universal welding equipment for foils and elastomers

Universal welding equipment, which can be used for joining open expansion joints, or for repair jobs. The materials, which can be welded, are PTFE foils and Teflon- or elastomer-based materials. The welding equipment is available in two versions:

- as a welding box with the necessary thermostats, timer, etc. and two welding rods to be used for the joining
- as a smaller version, a portable welding iron, excellently suited for small tasks. Easy to transport (low weight) and easy to handle.

Joudol®-"SM"

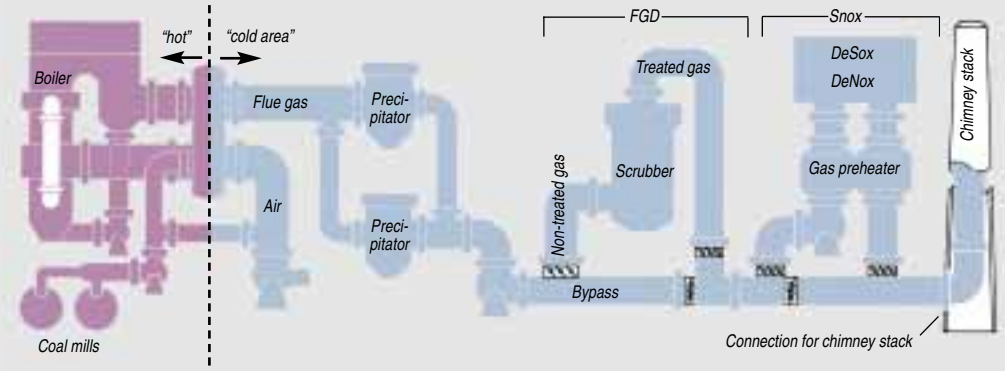
Universal graphite/grease compound

A combined separating and lubricant agent for screw connections and flanged seals on a graphite basis. The Burgmann Joudol® "SM" is an effective preservative grease which prevents gaskets from burning on to iron parts, as well as threaded connections of all types from rusting or seizing.
Scope of supply:
Tins of 1 kg, tubes of 250 g (8152)
Spray cans of 200 ml (8153)

Joining Material

The scope of supply of any expansion joint delivered open includes a set of "joining materials", matched to the specific design, as well as joining instructions. Its contents may include, for instance: sewing yarn (stainless steel, glass, etc.), sewing needles, cement (silicone, FKM elastomer, etc.), PTFE welding foil, stainless steel rivets and washers, scissors, rivetting pliers.

Application Technology – Energy



If you consider the duct system of a power plant, you can see the many different demands that are to be met by the expansion joints. Rather simplified, the power plant may be subdivided into a "hot" and a "cold" area. On the "hot" side, the temperature load and the loading of the flue gas with fly ash is decisive. On the "cold" side the expansion joint is, above all, affected by the formation of aggressive condensate, due to the temperature falling below the dew point.

A wide range of applications for expansion joints is conventional power plants fired with coal, oil and gas. In the past few years, the use of gas turbines has increased considerably. They are quite frequently used in combined cycle power stations (gas turbine and heat recovery boiler) supplying peak demand. Here, the rapid increase in gas temperature and the resulting quick expansion of the ducts present the greatest challenge for the

RWE power plant at Weisweiler/Germany (lignite fired). Location: return suction duct. Medium: Aggressive flue gas from coal firing
Temperature: up to 900 °C (1,652 °F).
Ducts are refractory-lined.
Pressure: ± 10 mbar / 1 kPa
Axial compression: 40 mm
Lateral offset: ± 40 mm

Coal-fired Power Plant

There are various places of application for expansion joints in coal-fired power plants, including the area of coal mills, e. g.

- coal dust lines
- secondary lines
- return suction ducts

Coal dust lines and the expansion joints installed here require a special design which prevents the coal dust from setting and possibly being ignited.

VEW power plant 'Gersteinwerk', Germany
Medium: gas turbine exhaust gas
Temperature: 481 °C (898 °F).
Temperature peaks to 520 °C (968 °F)
The temperature rises to full operating temperature within a few minutes (especially by quick start)
Pressure: +100 / –50 mbar / +10 / –5 kPa
Axial compression: 550 mm
Lateral offset: 100 mm

Coal Power Plant with Gas Turbine

A so-called combined cycle block, where coal is fired in the steam producer and natural gas in the gas turbine. Contrary to conventional firing for steam production, where coal dust is exclusively fired with a supply of air, in this block the air required in the steam producer is replaced by the oxygenous exhaust gases from the gas turbine.

In order to take up the extremely large axial movements, two or three expansion joints were connected in line and joined by means of a scissor control guide. The scope of supply covered statics, design, steel components, expansion joints and supervision of the installation.

Coal dust lines in the Boxberg (VEAG) power plant, Germany.
FLUACHEM® expansion joints (nekal tight) with bolster made from dust-tight glass fabric and glass felts and additional covers for wet cleaning of the ducts.
Temperature: 130 ... 200 (300) °C (266 ... 392 [572 °F])

Expansion joints on waste heat boiler pipe penetrations in the Uran power plant, India. All 166 expansion joints were closed on site.
Temperature: ... 400 °C (... 752 °F)

The power plant 'AsPontes' (Endesa), As Pontes, Spain. KE-Burgmann supplied 320 double FLUAFLEX® expansion joints with FKM elastomer outer cover. They are installed, among others, between the boiler house and the steam pipes.

Reduction of Nitrogen Oxides (DeNox)

Finding the most suitable method to reduce nitrogen oxides (DeNox) is decisive for the environmental protection. Primary measures provide for the use of expansion joints in the burner area. But secondary measures are required to meet the emission standards, and these pose highly differentiated demands on expansion joints.

High-dust procedure

- DeNox reactor arranged between boiler and air preheater
- flue gas with an extremely high dust content (up to 60 g/Nm^3)
- temperature 400 ... 450 °C (752 ... 842 °F)
- usually negative pressure

Low-dust procedure

- DeNox reactor after the FGD system
- flue gas after the FGD system
- temperature between 40 ... 350 °C (104 ... 662 °F) according to location
- as a rule, these plants work at positive pressure and therefore require absolute gas sealing

expansion joints. All power plants have one thing in common: they must produce electricity on call. Operating reliability and a long service life of expansion joints is therefore crucial as plant shut-downs cause not only a lot of trouble but are also very costly.

KE-Burgmann expansion joints have proved their high quality standard in respect of service life and reliability, not least due to the knowledge behind their design and the materials used.

'Steweag' district heating power plant, Mellach, Austria.
Multi-layer expansion joints supplied as completely preassembled units.
Medium: flue gas before the precipitator
Temperature: max. 450 °C (842 °F)
Pressure: ± 50 mbar / 5 kPa
Axial compression: up to approx. 200 mm
Lateral offset: up to 160 mm (± 80 mm)

Flue gas desulphurization at the Preussen Elektra power plant, Wilhelmshaven, Germany.

Flue Gas Desulphurization (FGD)

Particular care has to be observed for designing expansion joints for FGD, as they are sometimes exposed to extreme operating conditions. Leakages from expansion joints may cause damage to the entire plant, e.g. on the insulation. Basically, expansion joints for FGD can be subdivided into two groups:

Expansion joints before the scrubber (untreated gas side)
Medium: dry untreated gas
Temperature: according to the process, up to 250 °C (482 °F)

On the untreated gas side, the temperature and abrasive wear of the untreated gas containing dust decide the criteria of the design.

Expansion joints after the scrubber (treated gas side)
Medium: wet treated gas with a very high acid concentration (pH < 1)
Temperature: approx. 60 ° (140 °F)
Design temperature approx. 80 °C (176 °F)

On the treated gas side, the expansion joint must withstand the extreme chemical loads of the acidic concentrate. Correct matching of the acid proof structure and the configuration of the flange areas is decisive. Specifically in order to meet these requirements, KE-Burgmann offers Fluachem® elastomer and fluoropolymer expansion joints, which are operating with considerable success in a great number of FGD plants.

The FGD 'RWE' power plant Niederaussem, Germany.
In this large power plant, more than 500 KE-Burgmann expansion joints are successfully operating, among others in the following areas: precipitator, scrubbers, suction fans, chimneys, connection for chimney, connection for cooling towers. Flue gas ducts of FRP are used in areas with a strong chemical load. Here, FKM elastomer expansion joints are laminated into the duct ends by a method, developed specifically for this purpose (see the photo on the left).

Gas Turbine Plants

Gas turbine stations 'Millbank' and 'St. Rosé' in New Brunswick, Canada. Ten multilayer expansion joints with diameters of 7.2 m and 4.2 m respectively, are installed after the turbine (ABB 11N) and in the duct leading to the chimney.
Medium: Turbine exhaust gas
Temperature: 600 °C (1,112 °F)

▲
Combined Cycle Power Plant 'Tanjung Priok', Jakarta, Indonesia. Fluastal® multilayer expansion joints installed after the turbine (ABB 13E) and on the boiler (double expansion joints with scissor control guides).
Medium: Flue gas
Temperature: 600 °C (1,112 °F)
Pressure: 60 mbar / 6 kPa
Axial compression: up to approx. 140 mm
Lateral offset: ± 20 mm (–60 mm)

▲
Co-generation plant 'Hunzestrom', the Netherlands. Generates energy and process heat for the production of potato starch. Gas turbine plant (ABB GT10) equipped with KE-Burgmann Combine-X® expansion joints.

Combined cycle power plants 'Paka' & 'Pasir Gudang', Malaysia with Siemens V94.2 gas turbines. Combine-X® and Fluaflex® expansion joints are installed after the gas turbine and on the boiler.
Medium: flue gas; t: ...590 °C (1,094 °F); p: –50...+70 mbar; Axial compression: ... 170 mm; Lateral offset: ... 125 mm

Application Technology – Other Industrial

Apart from power generation as one of the primary application areas, KE-Burgmann expansion joints offer a wide range of solutions in many different industries. You will find a small selection on these two pages and besides the ones mentioned, we shall be happy to give you references from others, such as:

- **refineries**
- **petrochemical industries**
- **process industries**
- **metallurgical plants**
- **industrial furnaces**
- **sludge incinerators**
- **sintering and pelletizing plants**
- **chimney constructions**
- **engine industries**
- **air separation plants**

Chemical Industry

Fabric expansion joints have many application possibilities in chemical plants, especially where temperature and acid loads are very high (sulphuric acid plants, heat recovery plants, absorption of acid vapours etc.). Here, Fluachem® expansion joints of fluoroelastomer and fluoropolymer have proved extremely successful, thanks to their excellent chemical resistance. Further applications are in flue gas ducts, in the hot air lines of burner feeders, and in rotary kilns of special waste incinerators.

Nuclear Power Plants

Fabric expansion joints can be used in nuclear power plants in, e.g. the air ducts, on emergency electricity generators, for ring gap suction, in the exhaust gas system, as a wall penetration, or as fire protection. Requirements to meet include:
● nekal/air tightness ● non-combustibility ● ability to decontaminate ● resistance to radiation ● difficult flammability ● pressure resistance

An important factor is the possibility to manufacture according to specific quality standards. The corresponding certificates are, of course, part of the documentation needed.

Pulp and Paper Industry

"Yankee-Flex" expansion joints from KE-Burgmann are used, among others, in air dryers, in connection with Yankee Hoods, fluidized bed dryers, flash dryers, combustion chambers for natural gas, fans and ventilators. "Yankee Flex" expansion joints cover the temperature ranges from 100...500 °C (212...932 °F), according to operating conditions. The expansion joints can be provided with steel rings for greater stability in operation.

Burgmann Rotary Kiln sealing systems

Rotary Kilns

Rotary kilns are used for the continuous thermal treatment of a wide variety of products. As incinerators, they are almost "omnivorous". The temperatures reach 500 to 2000 °C (932 to 3,632 °F), dependant on the process. Used in connection with the sealing system developed by Burgmann, the fabric expansion joints compensate for movements in the ducts.

Plants

▲ **The "Piper" feed unit (ELF Enterprises) equipped with Fluastal® fabric expansion joints on the gas turbine exhaust ducts.**

"Gas Domes" on LPG ships

Fluachem® expansion joints of Neoprene with double fabric reinforcement act as elastic seals between the gas tanks, stored on deck on flexible bearings, and the deck itself. Available as round or rectangular expansion joints with vertical flanges.
Temperature:
–48 ... +60 °C (–55 ... +140 °F)
Movements:
Axial compression: ... 80 mm
Lateral offset: .... 70 mm
Pressure: 100 mbar max. / 10 kPa max.

Cement Industry ▸

Cement plant in Aalborg, Denmark. 115 Fluaflex® and Fluastal® fabric expansion joints are installed on precipitators, the chimney, the cyclone tower, the Folax building and the coal mills.
Medium: flue gas from the cement production and drying process
Temperatures: 100 ... 1,000 °C
(212 ... 1,832 °F), dependant on location

Offshore

Fire seals and fabric expansion joints are in use on all major off-shore platforms, e. g. Draugden, Troll, Asunto, Piper, Oseberg A, Stattfjord A, etc.

To increase safety in case of fire, single and double-sided penetration seals are installed on pipe penetrations on decks and scots.

Fabric expansion joints are used in exhaust gas ducts from gas turbines, and in heating and ventilation ducts.

▲ **Incinerator plant with flue gas cleaning in Ingolstadt, Germany**
Medium: flue gas (chemically very aggressive, H_2SO_4, HCL, HF)
Temperature: 60 ... 350 °C (140 ... 662 °F)
Pressure: 35 mbar / 3.5 kPa
Axial compression: 40 mm
Lateral offset: ± 20 mm

◂ **Inside view of the duct with a specially preformed FKM elastomer expansion joint, in the Bielefeld incinerator plant, Germany**

Incineration

The requirements to expansion joints in incineration plants correspond more or less to those in the general power plant sector. A special factor, however, is the very high percentage of aggressive content in the flue gas. A careful selection of materials and extremely good tightness in the expansion joint design is essential.

Diesel Gas Engines

Diesel gas engines in the Blohm & Voss block heating power plant, Hamburg, Germany. Seven Fluastal® expansion joints are installed in the duct system and directly on the turbocharger of the largest engine (18 cylinders) of this type. Because of their low reactive forces, fabric expansion joints were preferred to steel expansion joints.
Medium: exhaust gas
t: 530 °C (995 °F); p: 500 mbar/50 kPa

Ventilators (Howden Variax) in the St. Gotthard tunnel, Switzerland, with KE-Burgmann expansion joints.

Ventilators

In connection with fans and ventilators, Fanflex single-layer and multi-layer expansion joints are installed on both suction and pressure sides of the ventilator. Here, they prevent vibrations from being conveyed to the ducts, and static offset to occur between the ventilator and the duct.

The ABC of Expansion Joint Technology,

On the following two pages you will find, in alphabetical order, a list of special words, technical terms, and special features in connection with expansion joint technology. The list gives brief explanations as well as references to the relevant pages in the catalogue, where you can find more information on the subject. If you wish more detailed information, any KE-Burgmann partner will be happy to help you. Refer to the back page for contact addresses.

ACOUSEAL® (→ page 14)

Ambient temperature (→ page 9)

Angular offset (→ page 8)

Baffle, baffle plate (→ page 10)

Belt type expansion joint
(→ page 10)

Bolster
Insulation, Insulating bags (→ page 11)

Bolt torque
The torque with which bolts have to be fastened. Varies according to bolt dimensions, bolt lubrication, flange pressure etc. Correct tightening and retightening of flanges are important factors to achieve gas tightness in the flange-area.

CAU
Computerized calculation and design software for expansion joints and steel components, specially developed by KE-Burgmann. The software bases its calculations and design on operating data such as dimensions, temperature, pressure, movements, and media.

Cement industry (→ page 21)

Changed lengths
of duct work due to **changing temperatures** are calculated according to the following formula:

$$\Delta L = \cdot L \cdot \alpha \cdot \Delta T$$

$\Delta L =$ changed length in mm
$L =$ length of duct work between fixing point in mm
$\alpha =$ coefficient of expansion on $°C^{-1}$
$\Delta T =$ temperature difference in °C

Chemical industry (→ page 20)

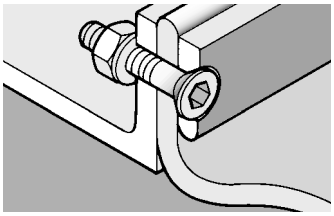
Chimney joint (→ page 14)

COMBINE-X® (→ page 13)

Conventional power stations
(→ page 18)

Convoluted bellows/expansion joints (→ page 14)

Corners
In connection with rectangular fabric expansion joints, corners can be made either as moulded, pre-formed, or as radius corners, dependant on the type of expansion joint and the application. For steel components radius corners have certain advantages. The radius is calculated using FEM, so that the corner can take up the exact stress and strain.



Countersunk socket head bolt
Bolt where the head is countersunk to be level with the surface of the backing flange. Primarily used in connection with angle flanges.

Crystallization (kristoballit)
Certain ceramic wool materials form harmful crystals at temperatures in excess of 800 °C (1,472 °F).

Dew point (→ page 9, 18)

Diesel gas engines (→ page 21)

Double sleeve/baffle
(→ page 10)

Drain fitting
A fitting to drain the expansion joint of condensate or other liquids at its lowest point.

Elastomer
Designation for rubber and fluoroelastomers such as FKM, Butyl®, EPDM, NPG, etc. Frequently used to manufacture expansion joints in combination with wire mesh or glass fabric.

Expansion joints in line
In order to compensate particularly extensive and/or lateral movements, it may become necessary to install two or more expansion joints in line, which are then combined by a scissor control guide system to distribute the movements uniformly among them.
(→ Scissor control guide)

Expanding seam seals (→ page 15)

External insulation (→ page 9)

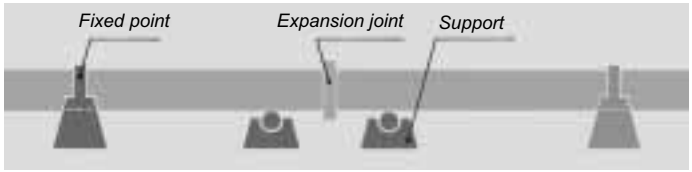
External influences (→ page 9)

Fastening elements (→ page 11)

FEM
Finite Element Method. A procedure for calculating temperature areas, and carry out structural analyses (to determine deformations).

Filaments
Number of threads used for weaving. Indicates the flexibility and strength of the fabric.

Fixed point, bearing point (also, shifting point)
Points of support for the duct system; their location is dependent on where expansion joints are required to take up expansion and/or movements. It is also essential here that fabric expansion joints are not supporting elements.



Flange
Steel component which is used either as duct flange, backing flange or as an angle or flat flange (flange mounting strip) to fasten the expansion joint to the duct or pipe flange.

Flanged expansion joint
(→ page 10)

Flange gasket (→ page 17)

Flange reinforcement
Additional sheath of fabric in the flange area to protect the expansion joint from thermal and mechanical loads.

Floating sleeve/baffle
(→ page 10)

Flow velocity (→ page 8)

FLUACHEM® (→ page 13)

FLUAFLEX®, FLUASTAL® (→ page 12)

Flue gas desulphurization/cleaning
(→ page 18, 19)

Fluoropolymer, Fluoroelastomer
(→ page 13)

Form stabilizers
Stainless steel bands integrated in the expansion joint design to fix the form and avoid torsion. Only for Fluastal® type expansion joints.

Gas sealing foil (→ page 4)

Gas turbine systems (→ page 18)

Glueing
Joinings of e.g. silicone coated outside cover materials are glued together to ensure flexibility and strength in the joinings.

Infrared (camera)
Used for measuring temperature differences on the outer cover of the expansion joint, to find possible weak points or leakage areas.

Installation case (→ page 17)

Insulation
Thermally protective material layers designed to reduce the temperature of the gas or medium to a specific value. Also serves as a protection against dust.

Joining material (→ page 17)

KE-FLEX® (→ page 12)

Lamination
Fastening method of single-layer elastomer expansion joints on flue gas ducts of FRP.

Lateral offset (→ page 8)

Leakage rate
Rate of gas leaking through the expansion joint or through the flange area. It can be calculated or checked by KE-Burgmann for the individual expansion joint or structure of materials. Special demands for gas sealing must be specified.

Index

Life expectancy (fatigue)
Fatigue is a condition which sets in when fabric and/or steel components have been exposed to a certain amount of stress and strain.
(→ FEM, Stress analysis)

Lifting points
Positions marked on the steel components of a unit to indicate that the unit should be lifted at these points by means of special lifting tackles.

Lining joint sealing (→ page 15)

Materials technology (→ page 6)

Metal fabric (→ page 4)

Moulded expansion joint types
By means of a special mould, the 'wall' of the expansion joint is moulded e.g. into a 'U' or to form a bellows. Such forms ensure a selective and controlled forming of the folds.

Movements (→ page 8)

Multi-layer expansion joints
(→ page 4)

Nekal tightness
Leakage test carried out with a bubble-forming liquid applied to the installed expansion joint which is under pressure (bubble test). It indicates whether the expansion joint and specifically the flange area is nekal tight.

Noise attenuation (→ page 14)

Nuclear power stations
(→ page 20)

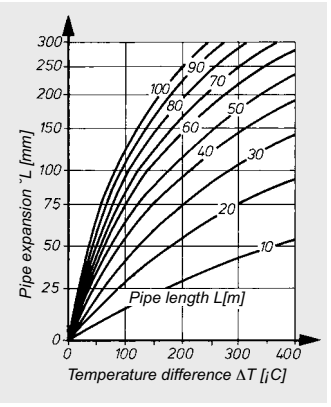
Offshore (→ page 21)

Outer cover (→ page 4)

Overlock
A method for stitching the ends of materials to obtain a good finish and to prevent the material from fraying.

Pipe expansion
Coefficient of expansion ($°C^{-1}$) of the most commonly used materials.

Material	Temperature	
	100 °C	440 °C
St 37-2	$11.0 \cdot 10^{-6}$	–
1,4541	$16.0 \cdot 10^{-6}$	$180 \cdot 10^{-6}$
1,4571	$16.5 \cdot 10^{-6}$	$18.5 \cdot 10^{-6}$



Pipe expansion diagramme for St.37.2

Precompression/presetting
The expansion joint is precompressed when cold and installed in this position. This method is used when expansion joints have to take up considerable lateral movements or great axial extensions.

Pressure
Amount of pressure to which the expansion joint is exposed in the duct system, It is measured in Kpa, mbar or mmWG.

Pulp & paper (→ page 20)

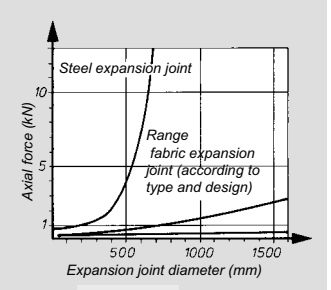
Pulsations
Pressure variations in the duct system e.g. turbulence from a gas turbine. It is a major factor for the design and material structure of expansion joints.

Reactive force F_R
Force (in N) from the duct system acting on the → fixed point.
Determination:

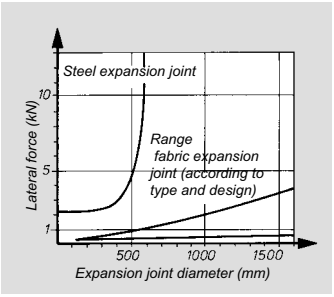
$$F_R = A \cdot p$$

A = duct cross-section in cm^2;
p = operating pressure in N/cm^2

Reactive forces
Contrary to steel expansion joints, fabric expansion joints carry only very low reactive forces to the duct system. This means that duct support systems and fixtures can be practically neglected.



Reactive forces in axial direction



Reactive force in lateral direction

Rotary kilns (→ page 20)

Scissor control guide
A special metal construction using a 'scissor' principle, thereby distributing large movements equally between two or more expansion joints in line and combined.
(→ Expansion joints in line)

Shore
Designation for the hardness of 'soft' materials, such as elastomer rubbers.

Single-layer expansion joints
(→ page 5)

Sleeve (→ page 10)

Sound insulation (→ page 14)

Stress (and strain) analyses (FEA)
Analyses carried out to determine the heat distribution in the expansion joints and steel components, the heat transmission in steel components, and the subsequent stress or strain in the steel by means of finite elements.
(→ FEM, Life expectancy)

Taptites
Special self-tapping threaded screws which do not require a nut for fastening.

Tensile strength
Ability of a material to resist or take up tensile loads until the breakage point.

Torsion (→ page 8)

Transit clamps
Clamps which are fitted to the expansion joint flanges of complete units ready for assembly to protect them during transport. They also assure that the correct installation dimensions are maintained. They must be removed after installation and before start-up of the plant.
(→ page 5)

Units (→ page 5, 11)

Ventilators, fans (→ page 21)

Waste incineration (→ page 21)

Wear resistance
The ability of a material to resist abrasive particles without decomposing.

Weathering (→ page 9)

Welding equipment (→ page 17)

Inquiry Data Sheet

Company: ..... ☐ Consultant
. . .. ☐ OEM
. . .. ☐ End-user
☐ Other

Department: .....

Contact person: .....

Tel.: ..... Fax: .....

Inquiry no.: .....

Requested delivery time: .....

Nos./pcs.: .....

Signature/date .....

Place of Installation A

Project name: .....
.....

Location: .....
.....

Type or part of plant (f.ex. flue gas duct before FGD):
.....
.....

☐ New plant ☐ Existing plant
Installation: ☐ outside ☐ inside

Direction of duct system:
☐ horizontal ☐ vertical ☐ diagonal

Measurements of connecting pipe or duct ends

Enter measurements in mm on the relevant drawings or enlose as separate measurement sheet.

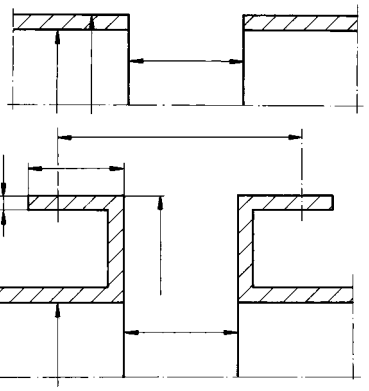
Cross-section of pipe/duct ends .....
☐ Round ☐ Rectangular ☐ with ☐ without
Radius corners

☐ (Others) .....

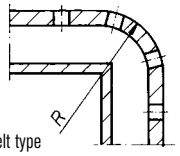
Duct; Steel quality ..... Steel thickness .....

Duct insulation ☐ outside ☐ inside
Thickness (mm) .....

Belt type connection

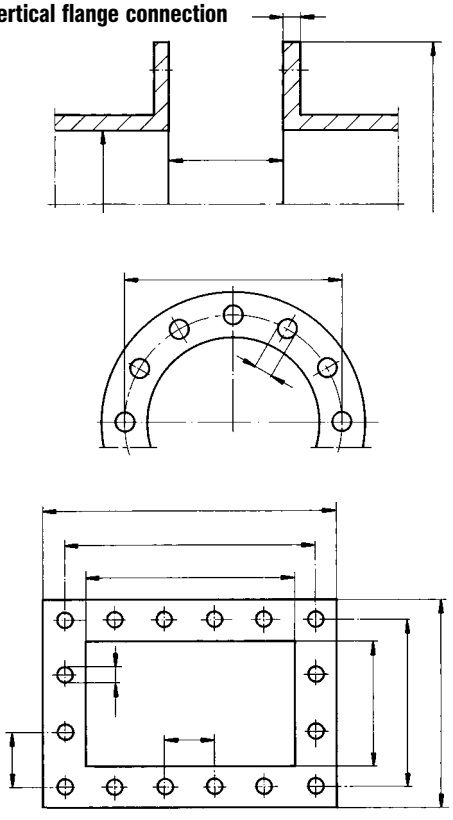


Radius corners



Enclose drawing of steel construction for existing plants

Vertical flange connection



Movements B

Axial compression (mm) .....
Axial elongation (mm) .....
Lateral offset Y (mm) ..... Z (mm) .....
Angular offset .....
Torsion (°) .....
Vibration/oscillation of system components, type:
Frequency (Hz) ..... Amplitude (mm) .....

Pressure C

Positive press. (mbar/kPa) ..... Duration ... Peak
Negative press. (mbar/kPa) .... Duration ... Peak
Design pressure (mbar/kPa) .....
Flow velocity (m/s) or volume (Nm^3/h): .....
Flow direction
☐ upwards ☐ downwards ☐ horizontal

Medium D

Medium (f.ex. flue gas from coal-firing)
. .....
. .....
Solid matter content (f.ex. fly ashes) .....
. .....
. .....
Load (mg/Nm^3) .....
Condition of medium ☐ dry ☐ wet
Chemical composition (type/concentration)
(f. ex. SO_2 / 5 %) .....
.....
Leakage test required ☐ yes ☐ no
Required leakage rate .....
.....

Temperature E

Medium temp. (°C/°F) ..... Duration .... Peak
Design temp. (°C/°F) .....
Ambient temp. (°C/°F) approx. from ..... to .....
Undercutting of dew point
☐ yes ☐ no Temp. (°C/°F) .....
Frequency .....
Excursion
☐ at each stop/start cycle ☐ continuous
. .....
Nos. of cycles per year .....
Other influences (f. ex. external)
. .....
. .....
.....

Desired design, accessories, other services

Expansion joint	☐ closed ☐ with pre-punched holes	☐ open, with prepared joining	☐ Unit (ready-assembled) required
Sleeve/baffle	☐ available on site	☐ include in offer, if necessary	
Insulation/bolster	☐ available on site	☐ include in offer, if necessary	
Fastening elements (flanges, bolts, nuts, washers, etc.)			☐ Include in offer
Flange gasket			☐ include in offer
Taking of dimensions/measurements required		☐ no	☐ yes
Installation	☐ own (onsite)	☐ Supervising required	☐ Include in offer

**Please copy these pages and enter the necessary data as detailed as possible. Refer also to pages 8/9.
Use separate inquiry sheets for each different expansion joint or measurement. Please mail or fax the inquiry sheet to your nearest KE-Burgmann partner, to KE-Burgmann in Denmark, or Burgmann in Wolfratshausen.
All addresses can be found on the back of the catalogue. You will then receive an offer (with no obligation).**