

# KE-BURGMANN

## Expansion Joints

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

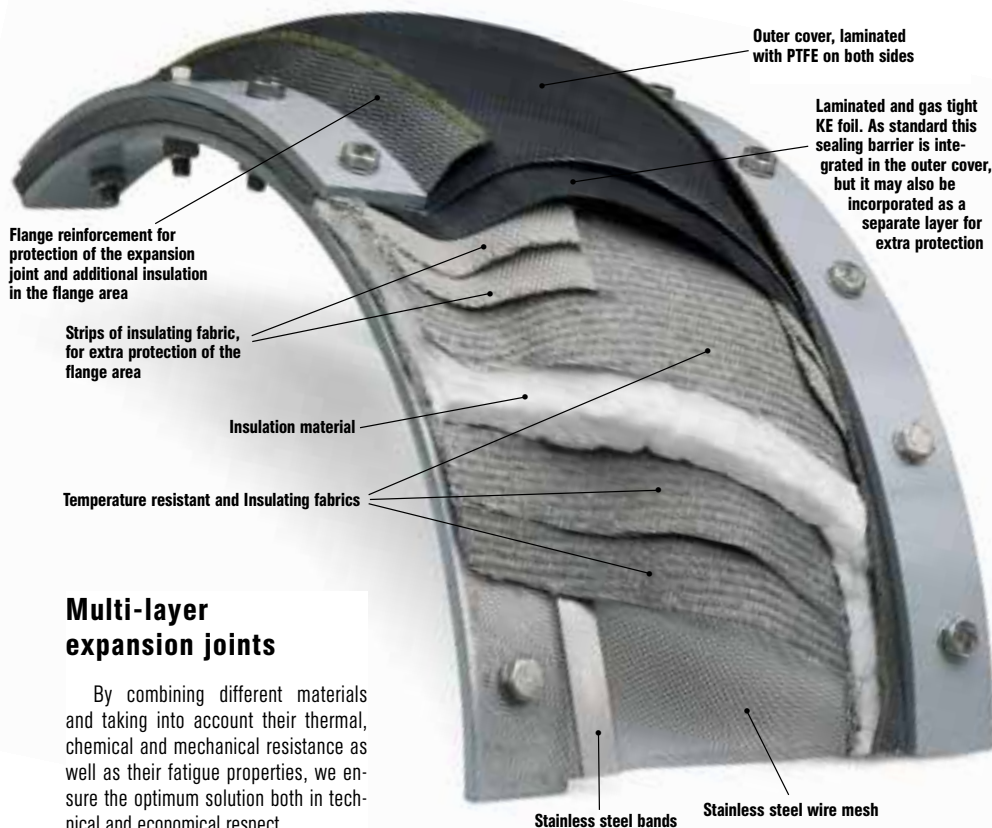


*Technology that expands with you...*

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



# Structure and



## 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.

### ● 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:  $-60 \dots +1,200 \text{ } ^\circ\text{C}$  ( $-76 \dots +2,192 \text{ } ^\circ\text{F}$ ) (dependant on design)

### ● Pressure

Will the expansion joint be used in a positive pressure or negative pressure area? This will have influence on both

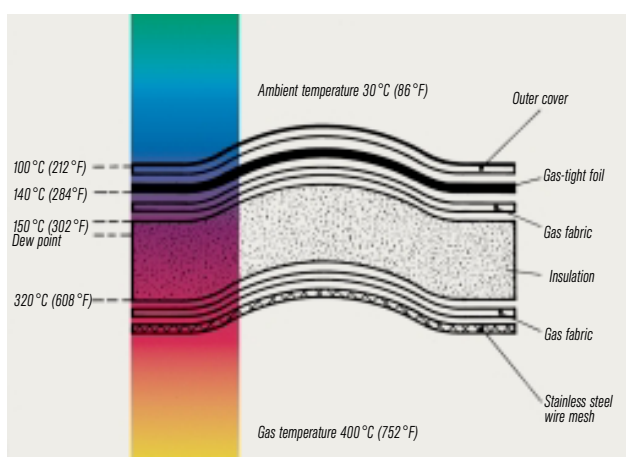
**W**hy should you use fabric expansion joints? Because they offer a number of advantages especially in plant design and building:

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.

type and design of the expansion joint. The main application area covers the pressure range of  $\pm 400 \text{ mbar}$  ( $\pm 40 \text{ kPa}$ ). (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.



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



# 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 %

## 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.

## 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 gas turbine 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.

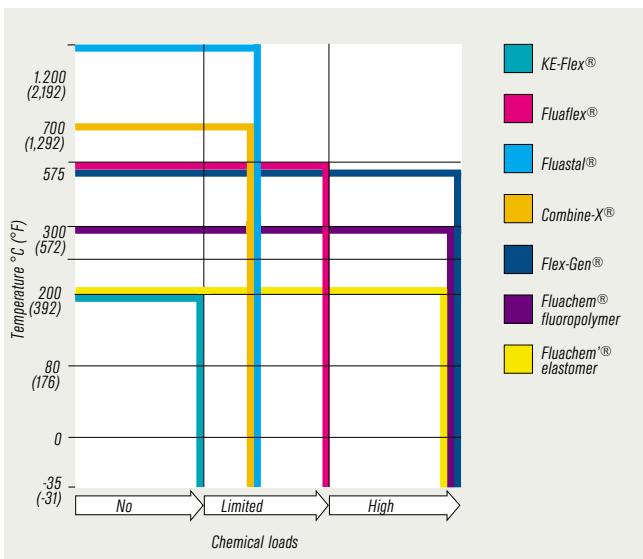
**Operating limits:**

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 %



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



**E**xpansion 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):

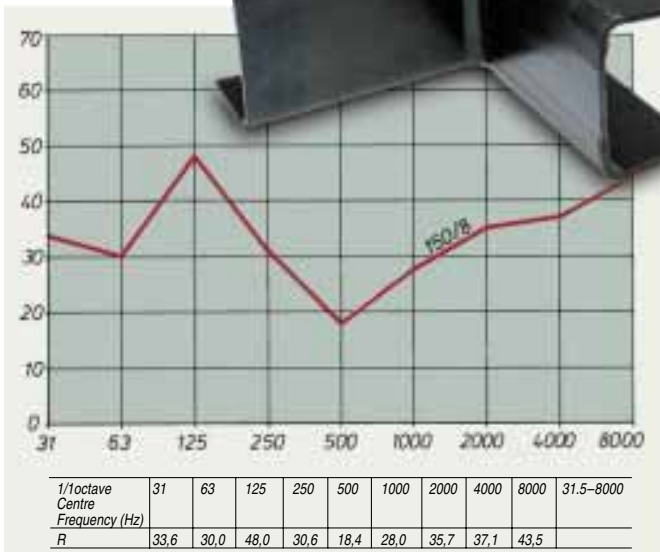
axial compression: 30 %

lateral offset ± 15 %

Gas velocity without sleeve/baffle  
(depending on type): ... 30 m/sec.

Dust content, without sleeve/baffle:  
200 mg/Nm<sup>3</sup>

# Standard and Special Expansion Joints



## 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  $\pm 10$  mm, axial and lateral
- sound emission is reduced to a minimum (see diagram)
- supplied closed for vertical flange connections
- pressure resistance  $\pm 100$  mbar/10 kPa
- temperature resistance  $-35 \dots +150$  °C ( $-31 \dots +302$  °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.

## Convuluted Expansion Joints



## 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.



Convuluted 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 combi-

ned with high temperatures. In case of double expansion joints, uniform distribution of the movements is ensured by means of scissor control guides.

Temperature:  $-60 \dots +600$  °C ( $-76 \dots +1,112$  °F)

Pressure range:  $\pm 200$  mbar/20 kPa

Movements: axial compression: 60 %  
lateral offset:  $\pm 30$  %



## 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.

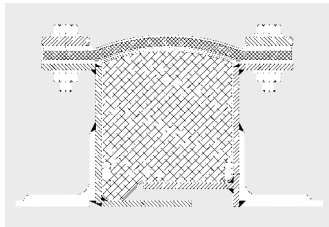
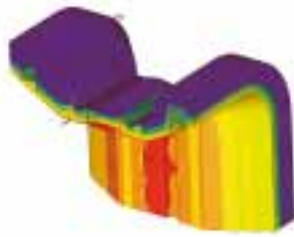
Special requirements for fireproofing exist on ships for equipment used in the fire hazard zones. These fireproofing requirements apply also to the fabric expansion joints installed on the gas turbine ducting. Combine-X® Fire Skirt expansion joints are approved by the necessary approving bodies, such 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® fluoro-

elastomer 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.

# 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/mm <sup>2</sup>									
	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



## 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.



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.

# 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 enclose 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) .....

**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<sup>3</sup>/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<sup>3</sup>) .....

Condition of medium  dry  wet

Chemical composition (type/concentration)  
 (f. ex. SO<sub>2</sub> / 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  open, with prepared joining  Unit (ready-assembled) required  
 with pre-punched holes

Sleeve/baffle  available on site  include in offer, if necessary

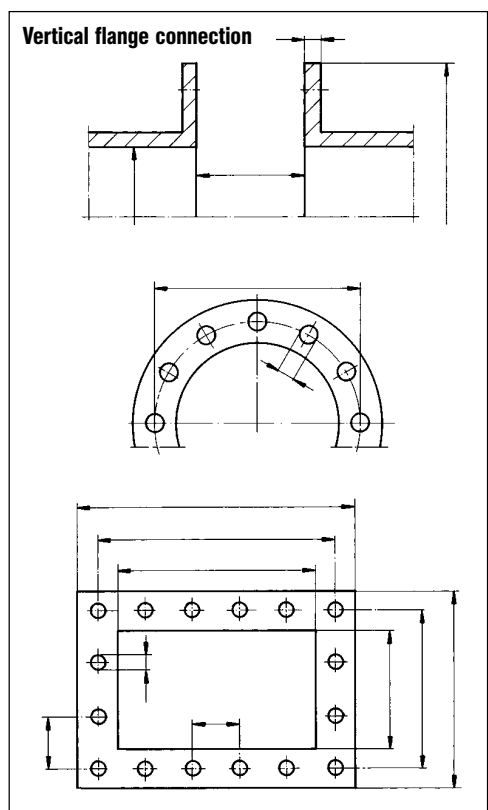
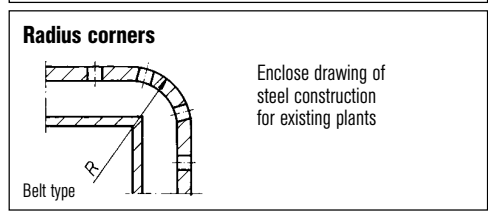
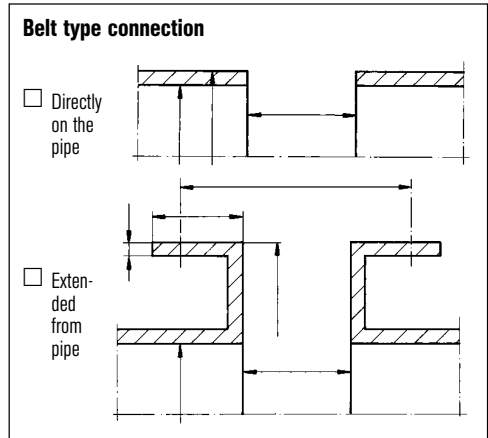
Insulation/bolster  available on site  include in offer, if necessary

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).