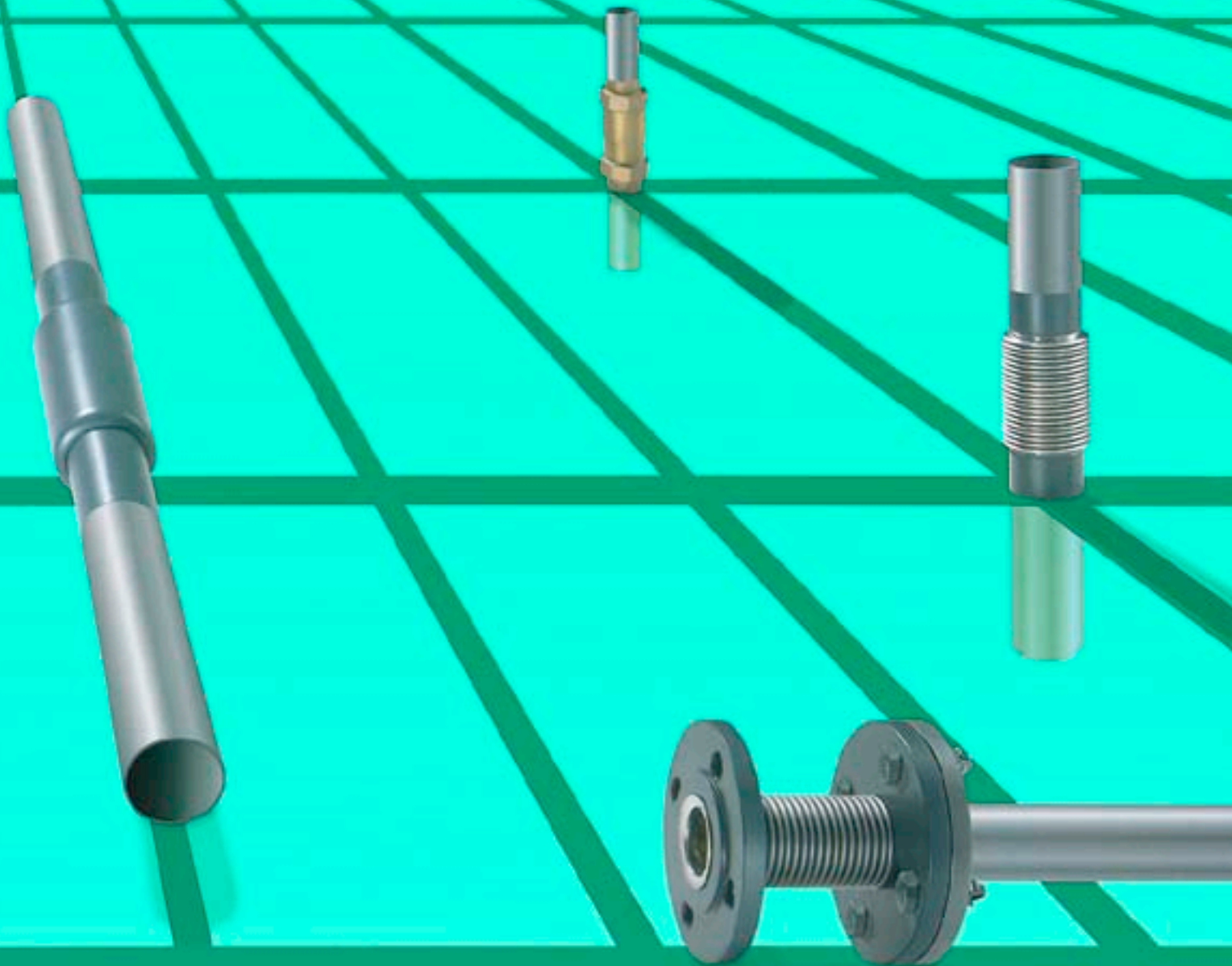




**BOA Group**

## **AXIAL- EXPANSION JOINTS**



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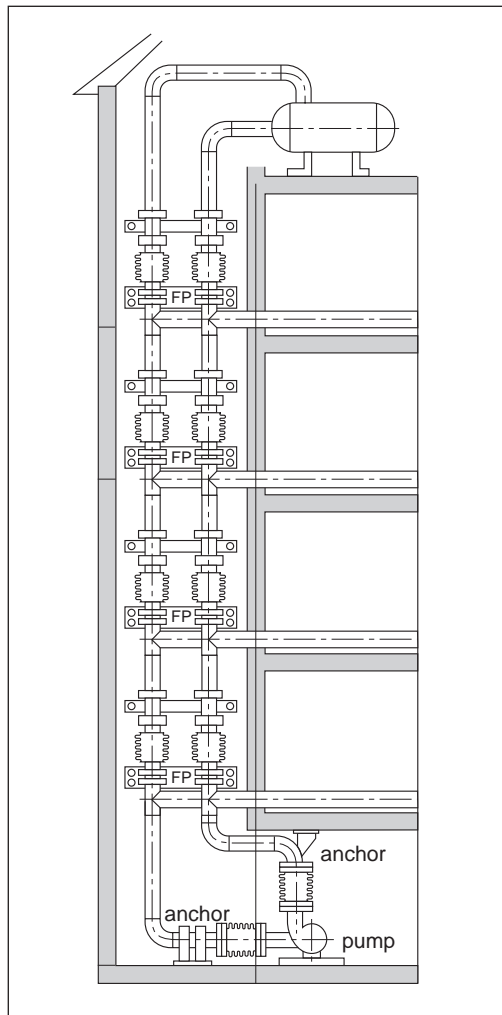
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Axial expansion joints are suited to compensate for axial movements in straight pipeline sections.

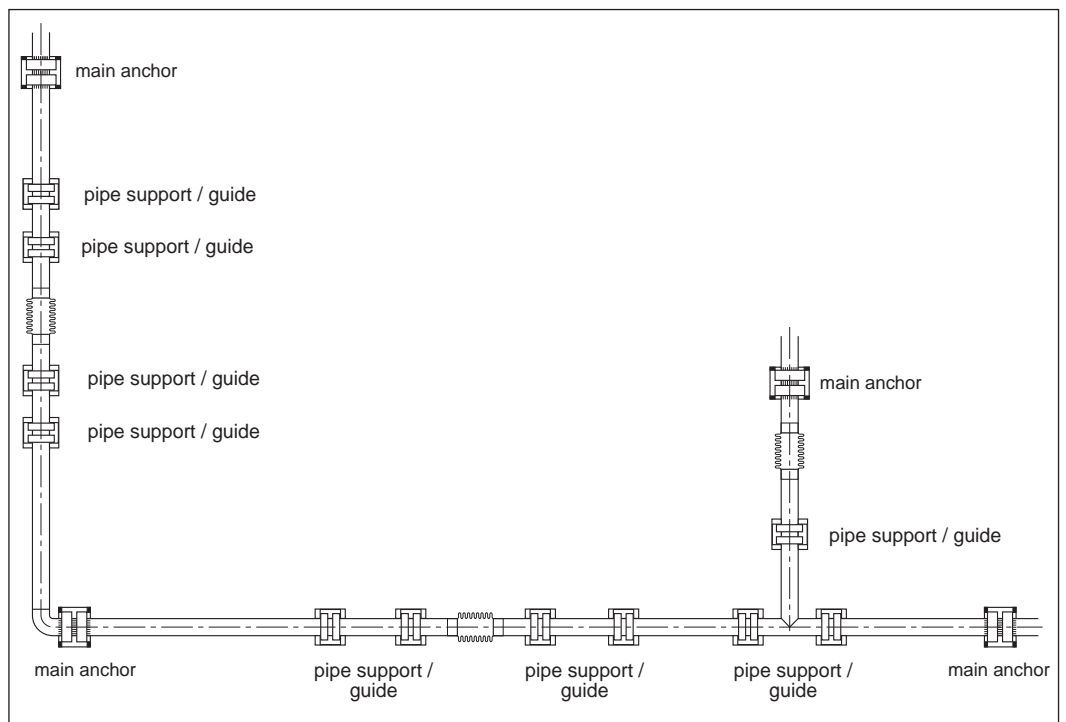
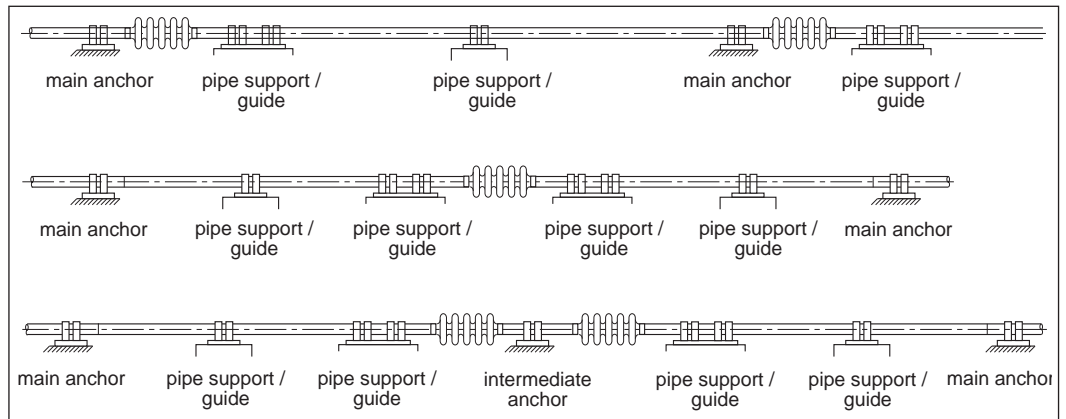
Additionally, axial expansion joints are used:

- to dampen mechanical vibrations and reduce sound conducted through solids on pumps and compressors
- as flexible seals at the end of jacketed pipes in district heating systems
- to compensate for thermal movements and vibrations in flue gas ducts of boilers and engines
- as assembly aids for pumps, fittings and plate heat exchangers
- as gas tight wall penetrations of pipelines in nuclear power stations and ships
- in boilers and pressure vessels to compensate for differential expansion

A precondition for the diverse applications of axial expansion joints is the presence of suitable anchors and guides/supports.



# General



## Sleeves

If high frequency vibrations or turbulence are expected in the flow media, we recommend the installation of expansion joints with internal sleeves.

Sleeves are also recommended for expansion joints that are larger than DN 150 mm if the flow velocity of the air or gas exceeds 8 m/s or 3 m/s in the case of a liquid flow media.

Based on the routing and length of the pipeline as well as the operating temperature, one has to calculate the thermal expansion that the individual expansion joints must compensate for.

According to the type of joint, this can be axial or lateral movements. For a precise calculation of the expansion, particularly for heat resistant and stainless pipe materials, we recommend the use of the following formula:

$$\Delta_{Ro} = \frac{L_o \cdot \Delta_t \cdot \alpha}{100} \text{ [mm]}$$

$\Delta_{Ro}$  = Calculated pipe expansion (mm)

$L_o$  = Length of pipeline between anchors (m)

$\Delta_t$  = Temperature difference (°C)

$\alpha$  = Thermal expansion coefficient

### Thermal expansion coefficient $\alpha$

For temperatures from...to [°C]	Temp. resistant pipe materials	Austenitic mat. 1.4541/1.4878	Austenitic mat. 1.4571
-190 to 0	-0.88	-1.42	-1.46
0 to 100	1.11	1.64	1.68
0 to 200	1.21	1.71	1.75
0 to 300	1.29	1.76	1.80
0 to 400	1.35	1.80	1.84
0 to 500	1.39	1.83	1.88
0 to 600	1.43	1.86	1.91

# Design

## Anchor forces

The purpose of anchors in pipelines is to restrain the longitudinal forces safely and to direct the thermal expansion to a specific section of the pipe.

Essential loads that these anchors must restrain when untied expansion joints are installed are:

1. the pressure thrust  $F_{DR}$
2. the bellows spring force  $F_E$
3. the friction forces  $\sum F_{LR}$

Ref. 1.

The pressure thrust attempts to expand the bellows of an expansion joint. As the pressure thrust is normally greater than the bellows spring force, no equilibrium can be established between both forces before the bellows reaches its expansion limit.

This would cause an excessive elongation of the bellows and its subsequent failure if no anchors were installed. The pressure thrust is determined by the product of the bellows cross section area and the line pressure.

$$F_{DR} = 10 \cdot p \cdot A_B \text{ [N]}$$

Ref. 2.

The bellows spring force describes the opposing force of a bellows to its compression or extension. The specific bellows spring rates per + or - 1 mm are listed in the expansion joint data sheets under spring rate  $c_{ax}$  and  $c_{lat}$  [N/mm].

$$F_E = c_{ax} \cdot \Delta_{ax} \text{ [N]}$$

Ref. 3.

The friction forces depend on the weight of the pipe, flow medium and insulation and the coefficient of friction in the pipe guides.

Some figures for coefficients of friction  $\mu_{LR}$ : drawn from experience are

for steel on steel	0.15–0.5
for steel on PTFE	0.1 –0.25
for roller supports	0.03–0.1

$$F_{LR} = 9.81 \cdot G_{LR} \cdot \mu_{LR} \text{ [N]}$$

The largest portion of the anchor force results from the pressure thrust when axial expansion joints are used.

Axial expansion joints represent an elastic interruption of the pipeline which releases the pressure thrust that has then to be restrained by the pipe anchors (see Fig. 1).

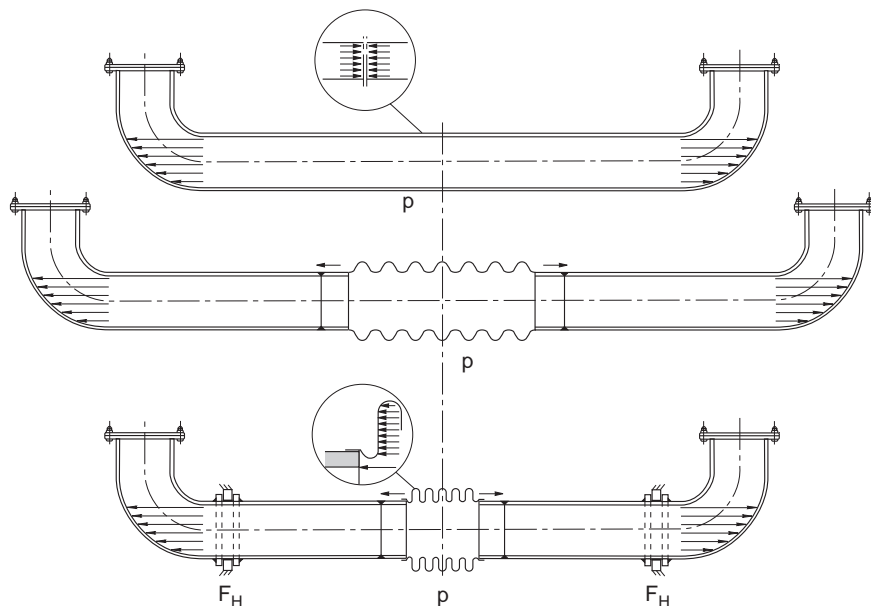


Fig. 1

Basically, one differentiates between main anchors and intermediate anchors.

Main anchors are always positioned at the beginning and the end of a pipeline, at points of a change of direction and at points where a pipeline branches. Main anchors are generally subjected to the full pressure thrust or cumulated thrust (see Fig. 2).

$$F_H = F_{DR} + F_E + \sum F_{LR} \text{ [N]}$$

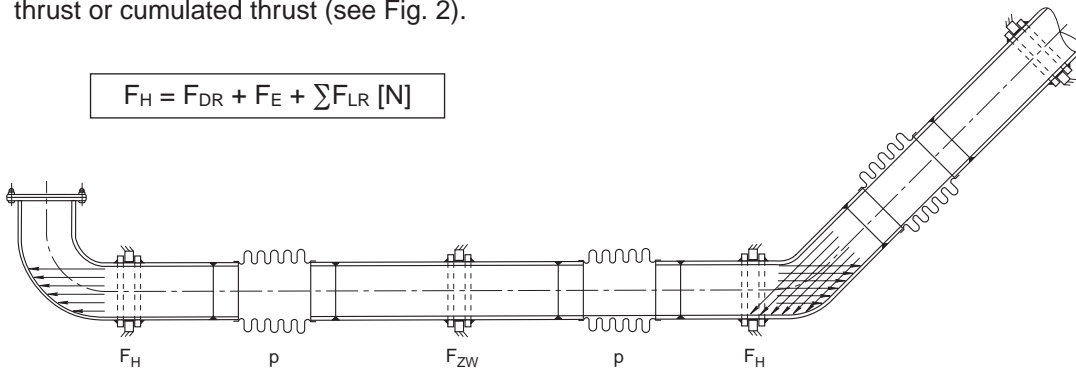


Fig. 2

Intermediate anchors normally separate 2 adjacent expansion systems. As the pressure thrusts are commonly equal on each side of an intermediate anchor, it is only exposed to the difference in the spring forces of the expansion joints and friction forces in the pipe supports.

$$F_{ZW} = F_E + F_{LR} \text{ [N]}$$

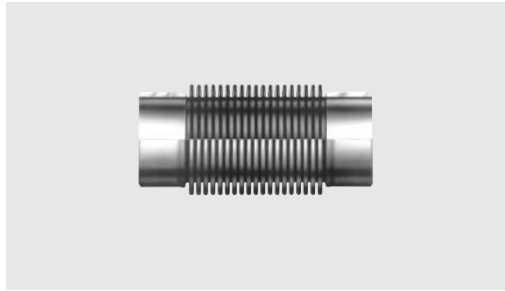
**Note:**

If anchors cannot be constructed or become too expensive, tied expansion joints should be utilized.

- $A_B$  = bellows cross section area [cm<sup>2</sup>]
- $C_{ax}$  = axial spring rate [N/mm]
- $F_{DR}$  = pressure thrust [N]
- $F_E$  = bellows spring force [N]
- $F_{LR}$  = friction force [N]
- $F_H$  = main anchor force [N]
- $F_{ZW}$  = intermediate anchor force [N]
- $p$  = design or test pressure [bar]
- $\Delta$  = pipe expansion [mm]
- $G_{LR}$  = weight of pipeline [kg]
- $\mu_{LR}$  = coefficient of friction in pipe guides [-]

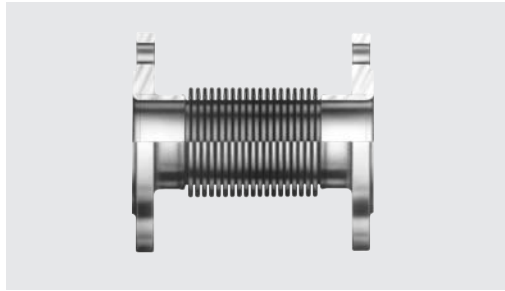
# Program

## Axial expansion joints



Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with weld ends of carbon steel

**Type 7110 000 (previous: 307/210)**  
DN ....., PN .....,  $\Delta_{ax} \pm$  ....., BI .....



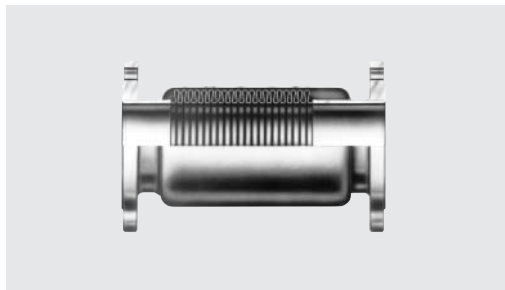
Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with flanges of carbon steel

**Type 7120 000 (previous: 307/211)**  
DN ....., PN .....,  $\Delta_{ax} \pm$  ....., BI .....



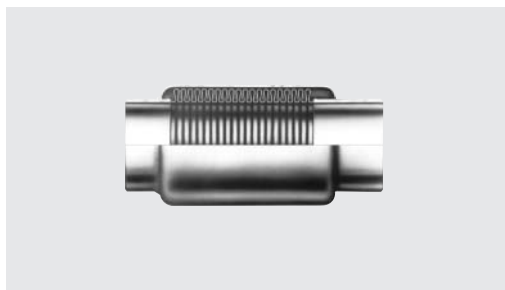
Axial expansion joint with bellows of stainless steel 1.4541. On both sides with weld ends of carbon steel, with external shroud of carbon steel

**Type 7112 000 (previous: 307/212)**  
DN ....., PN .....,  $\Delta_{ax} \pm$  ....., BI .....



Axial expansion joint with bellows of stainless steel 1.4541. On both sides with flanges of carbon steel, with external shroud of carbon steel

**Type 7122 000 (previous: 307/213)**  
DN ....., PN .....,  $\Delta_{ax} \pm$  ....., BI .....



### DN 800 to DN 1000

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with weld ends of carbon steel, with external shroud of carbon steel.

**Suitable for  $\Delta_{ax}$  without prestressing.**  
**Type 7112 00X (previous: 307/214)**  
DN ....., PN .....,  $\Delta_{ax}$  ....., BI .....

### DN 200 to DN 700

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with weld ends of carbon steel, with external shroud of carbon steel

**50% prestressed**  
**Type 7114 00X (previous: 307/214)**  
DN ....., PN .....,  $\Delta_{ax}$  ....., BI .....





#### DN 800 to DN 1000

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with flanges of carbon steel, with external shroud of carbon steel

**Suitable for  $\Delta_{ax}$  without prestressing**

**Type 7122 00X (previous: 307/215)**

**DN ...., PN ...,  $\Delta_{ax}$  ....., BI ....**

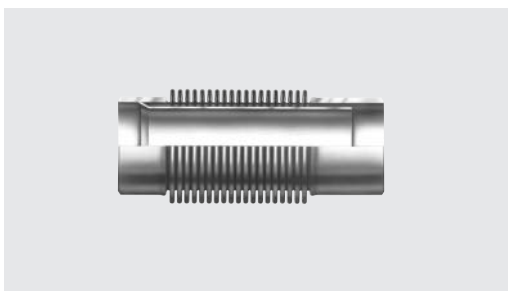
#### DN 200 to DN 700

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with flanges of carbon steel, with external shroud of carbon steel

**50% prestressed**

**Type 7124 00X (previous: 307/215)**

**DN ...., PN ...,  $\Delta_{ax}$  ....., BI ....**

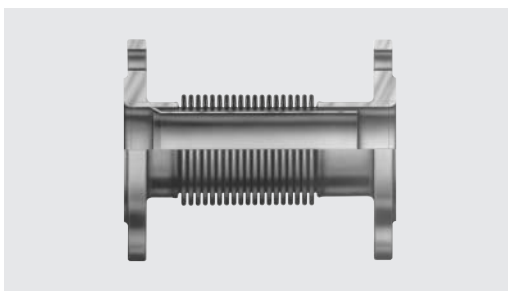


Axial expansion joint

with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with weld ends of carbon steel with inner sleeve of carbon steel

**Type 7111 000 (previous: 307/220)**

**DN ...., PN ...,  $\Delta_{ax}$  ....., BI ....**



Axial expansion joint

with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with flanges of carbon steel with inner sleeve of carbon steel

**Type 7121 000 (previous: 307/221)**

**DN ...., PN ...,  $\Delta_{ax}$  +/- ....., BI ....**



Axial expansion joint

with bellows of stainless steel 1.4541. On both sides with weld ends of carbon steel with inner sleeve and external shroud of carbon steel

**Type 7119 000 (previous: 307/222)**

**DN ...., PN ...,  $\Delta_{ax}$  +/- ....., BI ....**

# Program

## Axial expansion joints



Axial expansion joint with bellows of stainless steel 1.4541. On both sides with flanges of carbon steel with inner sleeve and external shroud of carbon steel

**Type 7129 000 (previous: 307/223)**  
**DN ...., PN ....,  $\Delta_{ax}$  +/- ...., BI ....**



**DN 15 to DN 150 and DN 800 to DN 1000**  
Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with weld ends of carbon steel with inner sleeve and external shroud of carbon steel

**suitable for  $\Delta_{ax}$  without prestressing.**  
**Type 7119 00X (previous: 307/224)**  
**DN ...., PN ....,  $\Delta_{ax}$  ....., BI ....**

### DN 200 to DN 700

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with weld ends of carbon steel with inner sleeve and external shroud of carbon steel

**50% prestressed**  
**Type 7117 00X (previous: 307/224)**  
**DN ...., PN ....,  $\Delta_{ax}$  ....., BI ....**



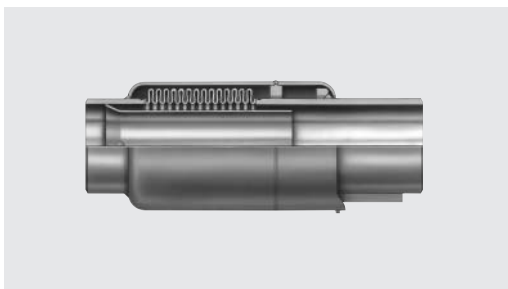
**DN 15 to DN 150 and DN 800 to DN 1000**  
Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with flanges of carbon steel with inner sleeve and external shroud of carbon steel

**suitable for  $\Delta_{ax}$  without prestressing.**  
**Type 7129 00X (previous: 307/225)**  
**DN ...., PN ....,  $\Delta_{ax}$  ....., BI ....**

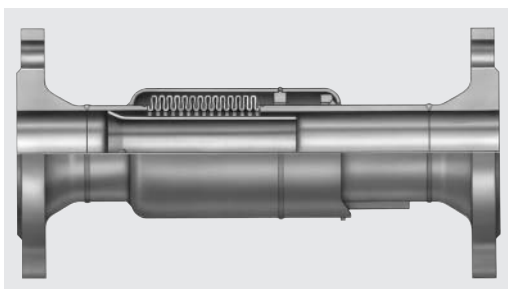
### DN 200 to DN 700

Axial expansion joint with bellows of stainless steel 1.4541. On both sides with flanges of carbon steel with inner sleeve and external shroud of carbon steel

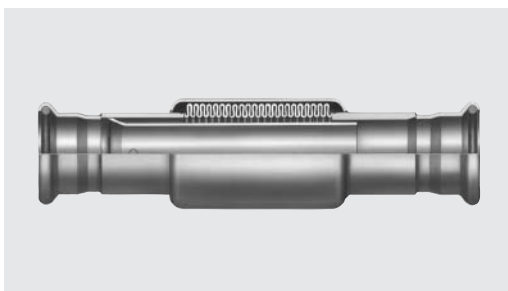
**50% prestressed**  
**Type 7127 00X (previous: 307/225)**  
**DN ...., PN ....,  $\Delta_{ax}$  ....., BI ....**



Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with weld ends of carbon steel with inner sleeve and external shroud of carbon steel, with movement limitation stops and torque protection, **suitable for  $\Delta_{ax}$  without prestressing**  
**Type 7918 00S (previous: 307/234)**  
 DN ..., PN ...,  $\Delta_{ax}$  ..., BI ...

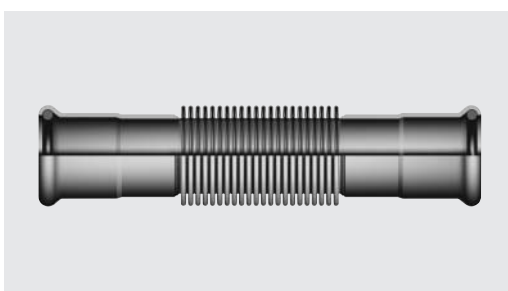


Axial expansion joint with bellows of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with flanges of carbon steel with inner sleeve and external shroud of carbon steel, with movement limitation stops and torque protection, **suitable for  $\Delta_{ax}$  without prestressing.**  
**Type 7928 00S (previous: 307/235)**  
 DN ..., PN ...,  $\Delta_{ax}$  ..., BI ...



**Axial steel expansion joint with Mapress connecting piece**  
 Bellows made of 1.4571, on both sides welded ends, with connecting piece made of C steel, with guide pipe and protective tube made of C steel, **suitable for  $\Delta_{ax}$ . without pre-stressing** (pre-stressing not necessary)  
**Type 7179 00X-MS**  
 DN ..., PN ...,  $\Delta_{ax}$  -..., BI ...

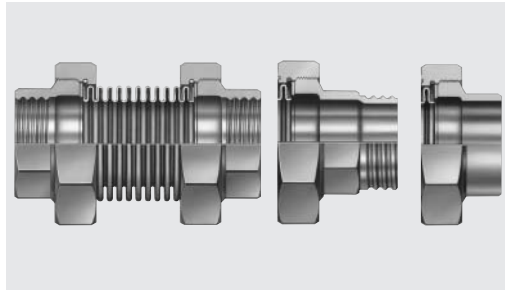
**Axial steel expansion joint with Mapress connecting piece**  
 Bellows made of 1.4571, on both sides welded ends made of 1.471 with connecting piece made of 1.4404, with guide pipe and protective tube made of 1.4571 or 1.4404, **suitable for  $\Delta_{ax}$ . without pre-stressing** (pre-stressing not necessary)  
**Type 7179 00X-ME**  
 DN ..., PN ...,  $\Delta_{ax}$  -..., BI ...



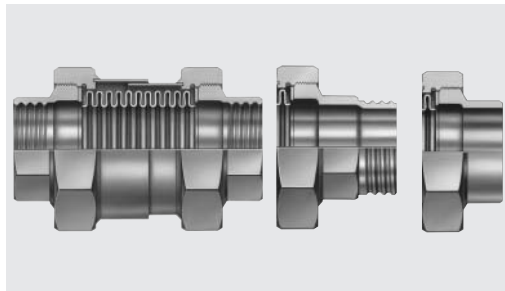
**Axial steel expansion joint with Mapress connecting piece**  
 Bellows made of 1.4571, on both sides connecting piece made of 1.4404,  
**Type 7170 00S-ME**  
 DN ..., PN ...,  $\Delta_{ax}$   $\pm$ ..., BI ...

# Program

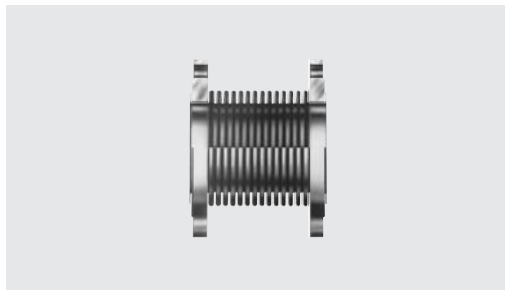
## Axial expansion joints



Axial expansion joint with bellows of stainless steel 1.4571. On both sides with threaded sockets, **suitable for  $\Delta_{ax}$  without prestressing.**  
**Type 7160 00S (previous: 307/243)**  
**Fitting TI** (malleable iron, female thread)  
**RI** (gunmetal, female thread)  
**TA** (malleable iron, male thread)  
**RA** (gunmetal, male thread)  
**EI** (stainless steel, female thread)  
**LF** (brazing fitting)  
**DN ...., PN ....,  $\Delta_{ax}$  ...., BI ....**



Axial expansion joint with bellows of stainless steel 1.4571. On both sides with threaded sockets, with external shroud, **suitable for  $\Delta_{ax}$  without prestressing**  
**Type 7162 00S (previous: 307/245)**  
**Fitting TI** (malleable iron, female thread)  
**RI** (gunmetal, female thread)  
**TA** (malleable iron, male thread)  
**RA** (gunmetal, male thread)  
**EI** (stainless steel, female thread)  
**LF** (brazing fitting)  
**DN ...., PN ....,  $\Delta_{ax}$  ...., BI ....**

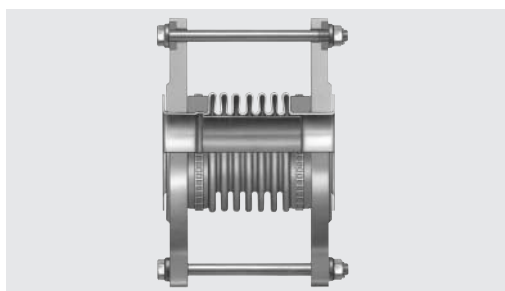


Axial expansion joint with bellows and van-stone ends of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with loose flanges of carbon steel.  
**Type 7150 000 (previous: 307/241)**  
**DN ...., PN ....,  $\Delta_{ax}$  +/- ...., BI ....**

## Sound absorbing expansion joints



Sound absorbing expansion joint with bellows and van-stone ends of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with loose flanges of carbon steel, with inner sleeve of wire mesh (up to DN 150)  
**Type 7951 00S (previous: 303/445)**  
**DN ...., PN ....,  $\Delta_{ax}$  +/- ...., BI ....**



Sound absorbing expansion joint with bellows and van-stone ends of stainless steel 1.4571 (up to DN 50), or stainless steel 1.4541 (from DN 65 and larger). On both sides with loose flanges of carbon steel, external tie rod restraints of carbon steel and with inner sleeve of wire mesh (up to DN 150)  
**For vibration dampening only.**  
**Type 7951 DFS (previous: 303/487)**  
**DN ...., PN ...., BI ....**

### Safety instruction



- Anchors and pipe guides must be firmly installed prior to filling and pressure testing the system.
- The expansion joint must not be strained by torsion. This is particularly important for the installation of expansion joints with threaded sockets. Excluded from this rule are the expansion joints types 7918 ... and 7928 ... which are equipped with a torsion protection.
- The steel bellows must be protected against damage and dirt (e.g. welding chips, plaster or mortar splatter).
- Steam pipelines should be installed in such a way that water hammers are avoided. This is achieved by means of a sufficiently designed drainage, by correct insulation, by avoiding water pockets and by installing the pipeline with an inclination.
- Expansion joints with internal sleeves must be installed with consideration given to the flow direction.
- Avoid the installation of expansion joints in the immediate proximity of pressure reducers, superheated steam coolers and shut-down valves, if high frequency vibrations are to be expected due to turbulence. Otherwise, special precautions must be taken (e.g. heavy-walled sleeves, perforated disks, etc.).
- If high frequency vibrations or turbulence or higher flow velocity are to be expected in the medium, we recommend the installation of expansion joints with internal sleeves.

- Internal sleeves are also recommended for expansion joints with  $DN \geq 150$  if the flow velocity of the air, gas, or steam exceeds 8 m/s, or 3 m/s in case of liquid media.

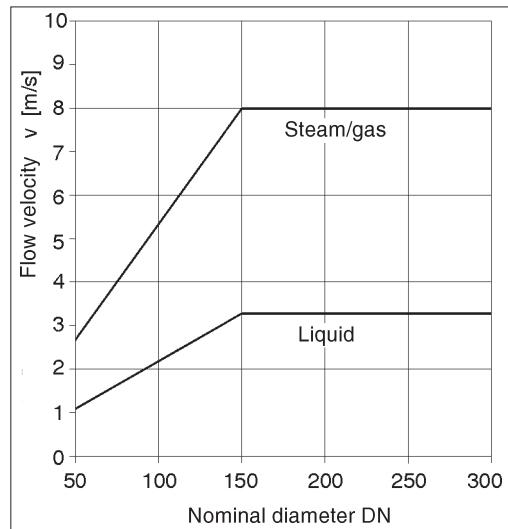


Fig. 3

- **Installation of expansion joints with threaded sockets in gas conduits**
  - Due to the threaded fittings, the maximum permitted excess pressure of these expansion joints is only 4 bar when used in gas conduits.
  - Rubber seals must not be lubricated or greased.
  - Oxygen pipelines must not get into contact with oil or grease. Otherwise, there is danger of explosion!

# Installation

## Installation instructions

## Pipe guides and support

- Allow inclination for condensate drainage.
- Align pipeline and install the pipe guides acc. to Figs. 4, 5, and 6.

### NOTE

Gliding or roller supports are the safest

measures to avoid buckling and lifting of the pipeline.

### CAUTION

Swing supports or suspensions are not acceptable adjacent to expansion joints!

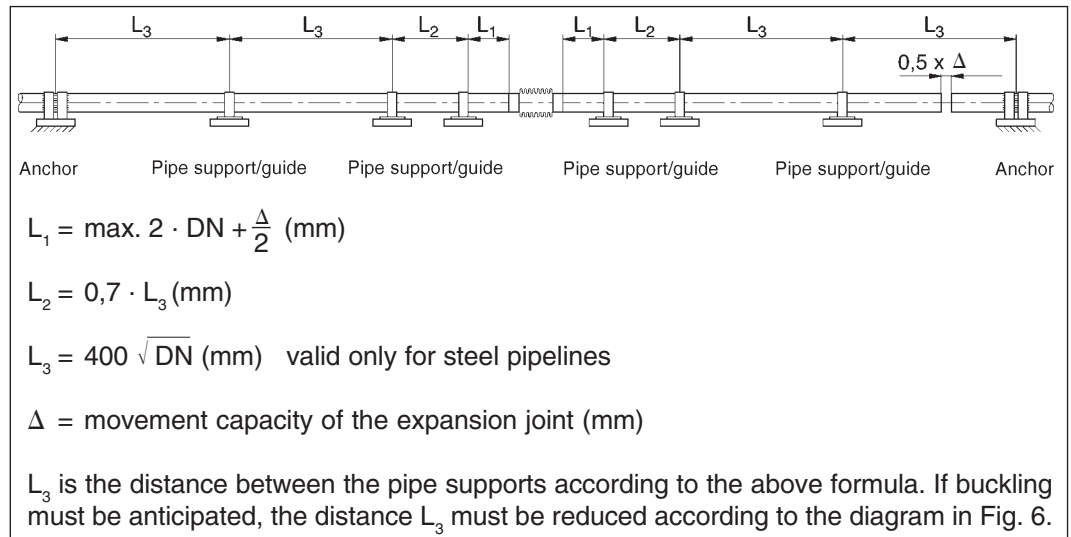


Fig. 4

DN	$L_1$ mm	$L_2$ mm	$L_3$ mm
15	$30 + \Delta/2$	1050	1550
20	$40 + \Delta/2$	1200	1750
25	$50 + \Delta/2$	1400	2000
32	$64 + \Delta/2$	1550	2250
40	$80 + \Delta/2$	1750	2500
50	$100 + \Delta/2$	1950	2800
65	$130 + \Delta/2$	2250	3200
80	$160 + \Delta/2$	2500	3550
100	$200 + \Delta/2$	2800	4000
125	$250 + \Delta/2$	3100	4450
150	$300 + \Delta/2$	3450	4900

DN	$L_1$ mm	$L_2$ mm	$L_3$ mm
200	$400 + \Delta/2$	3950	5650
250	$500 + \Delta/2$	4400	6300
300	$600 + \Delta/2$	4850	6900
350	$700 + \Delta/2$	5200	7450
400	$800 + \Delta/2$	5600	8000
450	$900 + \Delta/2$	5900	8450
500	$1000 + \Delta/2$	6250	8900
600	$1200 + \Delta/2$	6850	9800
700	$1400 + \Delta/2$	7450	10600
800	$1600 + \Delta/2$	7900	11300

Fig. 5 (valid only for steel pipelines)

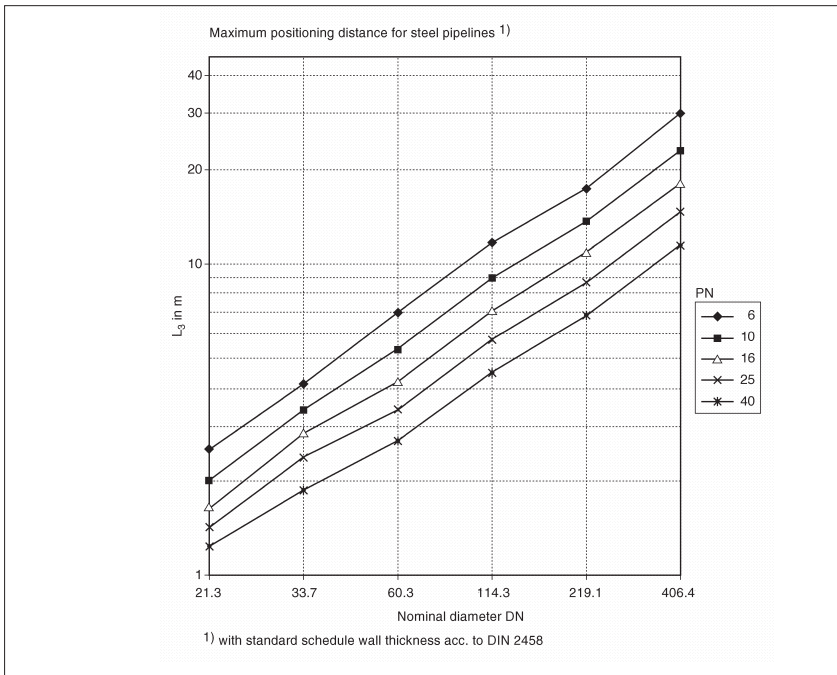


Fig. 6

- Install main anchors at locations where the pipeline changes its direction.
- Each pipe section that is to be compensated for must be reduced in length by anchors.
  - Only one expansion joint is allowed between two anchors.
  - Main anchors must be installed at locations where the pipeline changes its direction. They must absorb the pressure thrusts of the expansion joints as well as the frictional forces of the pipe supports / guides.
- Intermediate anchors must be installed if the movement capacity of one axial expansion joint is not sufficient to compensate for the entire expansion of a long pipeline and if several axial expansion joints are required.
- In the case of vacuum operation, the anchors must be capable of withstanding compression and tensile forces.

## Anchors

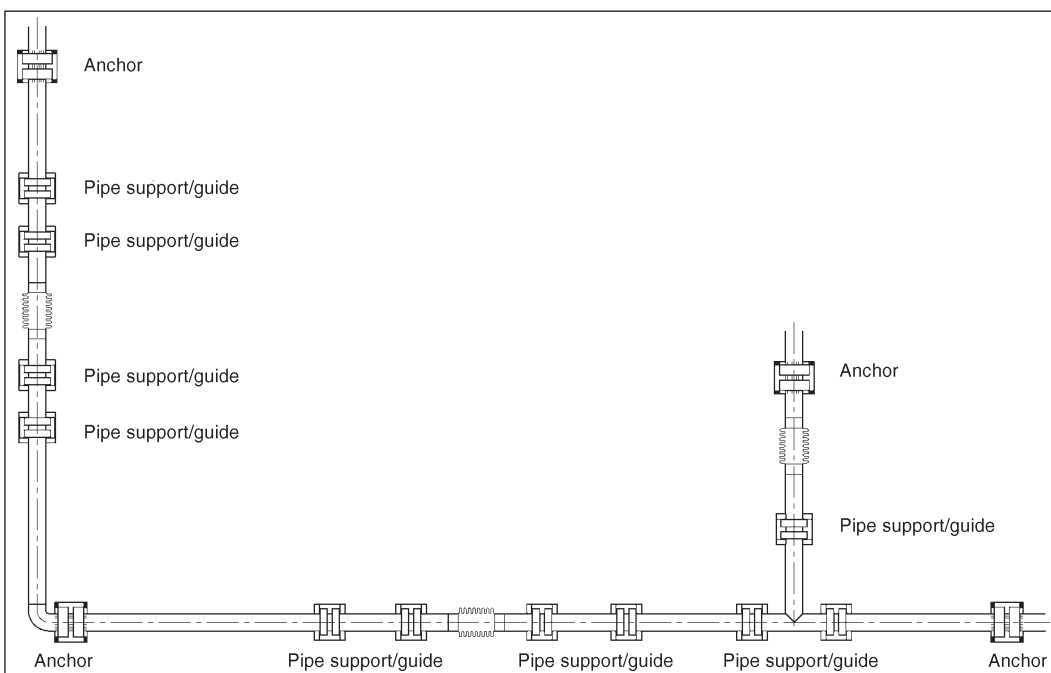


Fig. 7

# Installation

## Vibration compensation

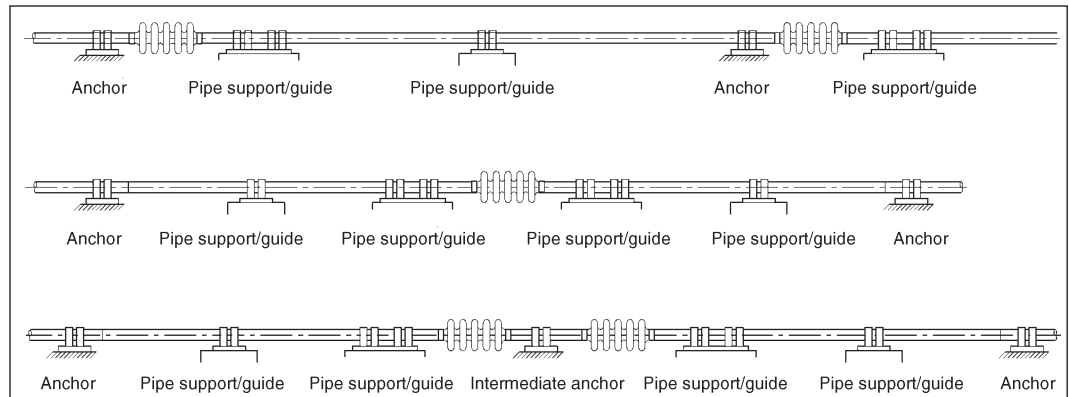


Fig. 8

- The expansion joint should be installed as closely as possible to the vibrating aggregate.
- A pipe anchor should be mounted directly behind the expansion joint which is to be installed without pre-stressing.

### CAUTION

If unrestrained expansion joints are used, the thrust must be taken into account.

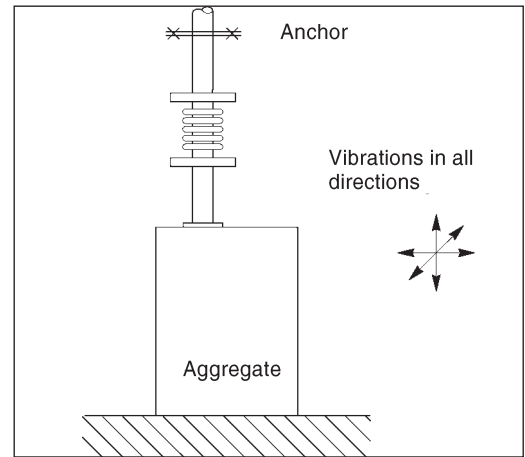


Fig. 9

## Movement capacity

### NOTE

The maximum permissible extension, which can be compensated for, is specified on the expansion joint. It refers to 1000 fatigue cycles. With higher fatigue cycles, the movement capacity must be reduced by the fatigue cycle factor  $K_L$  according to the table in Fig. 10.

Fatigue cycles $N_{perm.}$	Fatigue cycle factor $K_L$
1000	1.00
2000	0.82
3000	0.73
5000	0.63
10000	0.51
30000	0.37
50000	0.32
100000	0.26
200000	0.22
1000000	0.14
25000000	0.05
$K_L = (1000 / N_{perm.})^{0.29}$	

Fig. 10

## Operating pressure

### NOTE

The permissible operating pressure is determined by the nominal pressure, taking the reduction factors listed in the "Axial Expansion Joints" brochure, section Technical Data, into account.

- At higher temperatures the nominal pressure must be reduced in accordance with the reduction factors.



## Installation

### Pre-Stressing

All common expansion joints must be installed pre-stressed by 50 % of their movement capacity (for heating systems – overall length of expansion joint plus 50 %, and for cooling systems – overall length of expansion joint minus 50 % of the movement).

If an expansion joint is not installed at the lowest operating temperature of a heating system or the highest operating temperature of a cooling system (e.g. replacement at pipe that is still warm) it must be pre-stressed individually (see pre-stressing diagram Fig. 13).

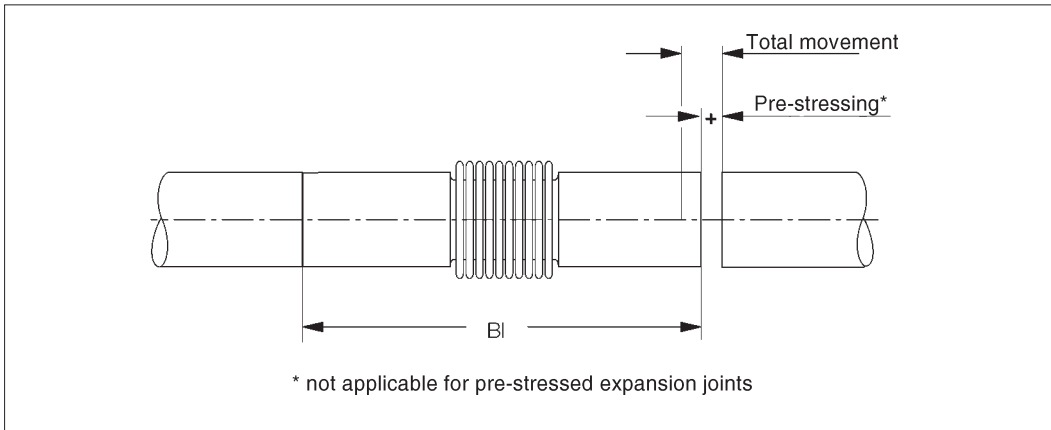


Fig. 11

#### NOTE

The following axial expansion joints are delivered already pre-stressed (expanded), see also Fig. 2.

#### 50 % pre-stressed

7114 00X  
7124 00X  
7117 00X  
7127 00X

#### suitable for $\Delta_{ax}$ without pre-stressing

7112 00X  
7122 00X  
7119 00X  
7129 00X  
7179 00X - ME  
7179 00X - MS  
7170 00S - ME  
7918 00X  
7928 00X  
7160 00S  
7162 00S

Expansion joints delivered in a pre-stressed state

#### CAUTION

The anchors of the pipeline must be firmly secured prior to the removal of the pre-stressing tab.

- Remove the pre-stressing tab (pre-stressing lock) after installation and prior to starting-up of the axial expansion joint. Make sure that
  - the expansion joint is not damaged;
  - the bellows does not get into contact with shavings.

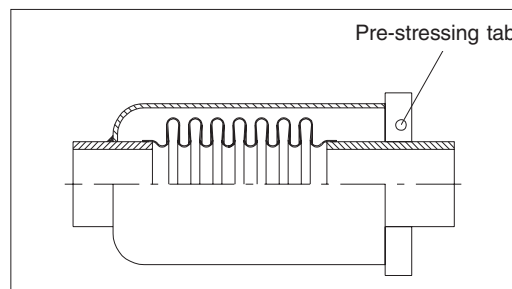


Fig. 12

# Installation

## Pre-stressing diagram

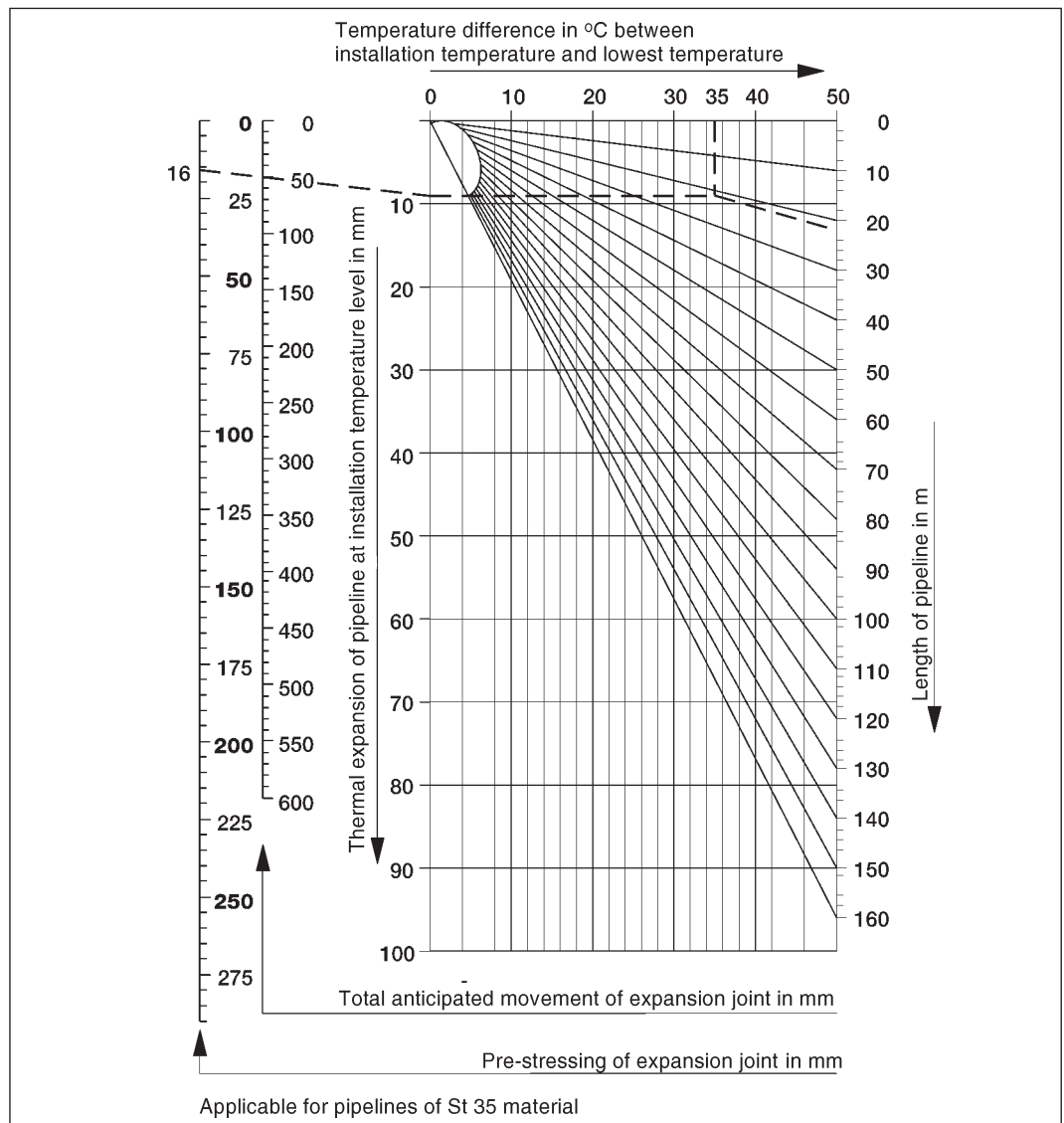


Fig. 13

## Example to the diagram

An axial expansion joint is utilized to compensate for a pipeline measuring 22 m in length. The lowest temperature is  $-15^{\circ}\text{C}$ . The highest temperature is  $+165^{\circ}\text{C}$ . The maximum anticipated thermal movement equals 50 mm at the temperature difference of  $180^{\circ}\text{C}$ . If the expansion joint is installed at the lowest temperature it shall be pre-stressed (expanded) by 50 % of this movement (25 mm). During operation, the expansion joint will then be compressed by the thermal movement of 50 mm. When the expansion joint is installed, special care should be taken to assure correct pre-stressing. If the temperature at the time of installation is not  $-15^{\circ}\text{C}$  but  $+20^{\circ}\text{C}$ , the corresponding thermal movement of the pipeline is 9 mm (see Fig. 13). This amount must be subtracted from the original pre-stressing value of the expansion joint:

$$25 - 9 = 16 \text{ mm}$$

The pre-stressing diagram Fig.13 allows to determine the correct pre-stressing value as

follows:

1. Temperature difference between installation temperature and lowest temperature  $-15^{\circ}\text{C} \div +20^{\circ}\text{C} = 35^{\circ}\text{C}$
2. Length of pipeline to be compensated for: 22 m
3. Draw a straight line from the point "Length of pipeline 22 m" to the " $0^{\circ}\text{C}$ " point.
4. Draw a vertical line from the " $35^{\circ}\text{C}$ " point towards the beam coming from "22 m".
5. Draw a horizontal line from this intersection to the line "Thermal expansion of pipeline in mm"; the result is, as stated above, 9 mm.
6. Draw a straight line from the "9 mm" point to "Total anticipated movement", this equals 50 mm and go further to "Pre-stressing of expansion joint in mm".

The intersection shows a pre-stressing of 16 mm. This is the value by which the axial expansion joint is to be expanded during installation.

## Installation

### Installation of flanged expansion joints

- Align flange bolt holes.
  - Ensure flanges are parallel.
  - Ensure gaskets are on center.
  - Tighten bolts crosswise.
- Make sure that the expansion joint is not exposed to torque.
- Ensure that bellows are free of objects that hinder free movement.

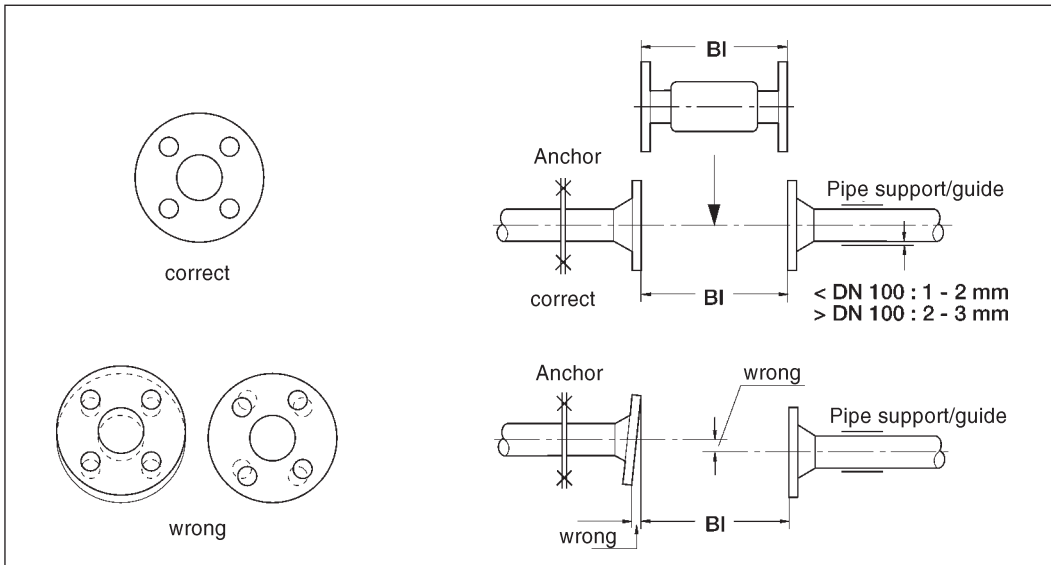


Fig. 14

IWK axial expansion joints types 7179 00X und 7170 00S are suitable for the compensation of axial movements in straight pipelines and are especially developed for the Mapress system. With the connection elements welded on both sides, fast and pro-

per assembly is possible at site.

- **When expansion joints are installed in HVAC systems, the installation guidelines of the Mannesmann-Pressfitting-System company must be observed.**

### Installation of pipes with pressfittings

- Align flange bolt holes.
  - Ensure flanges are parallel.
  - Tighten bolts crosswise.
- Make sure that the expansion joint is not exposed to torque.
- Ensure that bellows are free of objects that hinder free movement.

### Installation of expansion joints with threaded sockets

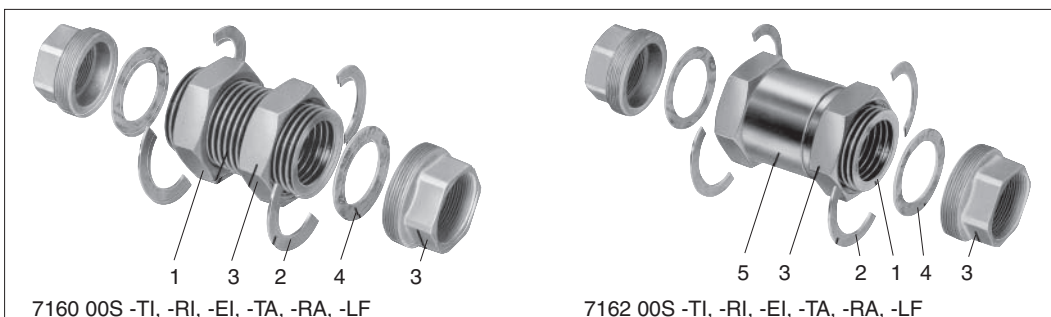


Fig. 15

- |                    |  |           |   |
|--------------------|--|-----------|---|
| 1 bellows:         | stainless steel<br>material No. 1.4571   | 4 gasket: | Klinger C-4400                                    |
| 2 support ring:    | stainless steel<br>material-No. 1.4301   | 5 shroud: | type T: carbon steel, galvanized<br>soft soldered |
| 3 threaded socket: | type T: gunmetal<br>type R: stainless steel<br>type E: brazing fitting<br>type LF: brazing fitting |           | type R: brass<br>soft soldered                    |
|                    |  |           | type E: stainless steel                           |
|                    |  |           | type L: brass<br>soft soldered                    |

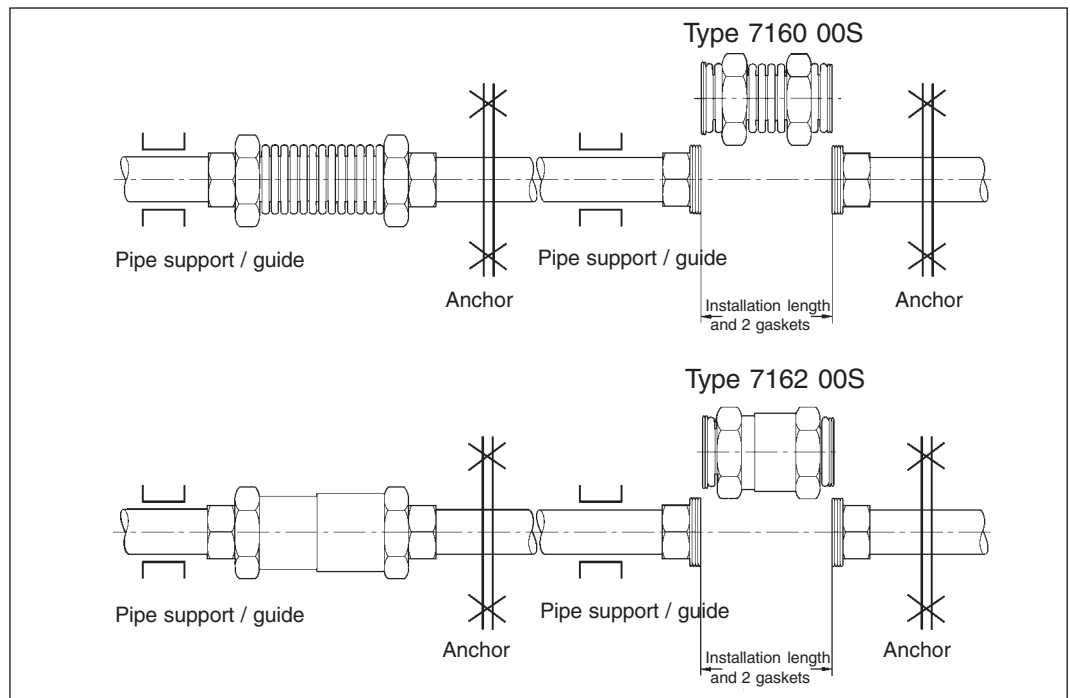


Fig. 16

## Installation of BOA disassembly joints

### NOTE

Depending on the nominal diameter, the installation length EL of the disassembly joint must be max. 20 to 30 mm longer than the unrestrained total length  $TL_{neutral}$

- Install fixed points on each side:  
With unrestrained expansion joints the thrust must be absorbed by the anchors.

### Installation

- Flange the disassembly joint with one side to the pipe end (Fig. 18). On the other side, pull the disassembly joint towards the components (valve, shut-off valve, pumps etc.) either with long bolts (unrestrained) or with the delivered threaded rods (restrained) (Fig. 19). When installed correctly, the disassembly joint is restraint.

### Disassembly

- Untie the long bolts or threaded rods. The disassembly joint swings back, creating a gap, which is necessary for comfortable assembly and disassembly of the components.

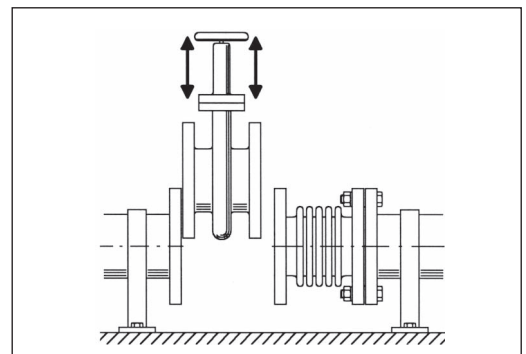


Fig. 17

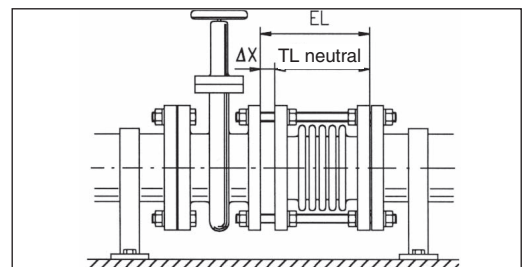


Fig. 18

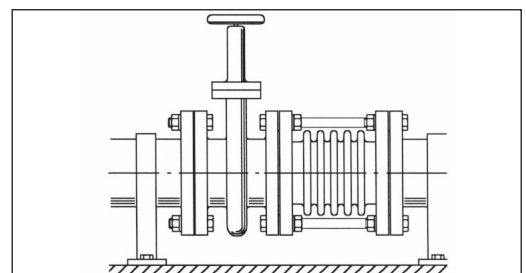


Fig. 19

# Installation

## Control



## Insulation

## Unacceptable modes of operation

## Start-up of the system

## Maintenance



### Before starting-up, make sure that:

- the pipeline is installed with an inclination to avoid water pockets;
- there is sufficient drainage;
- pipe anchors and pipe supports/guides are completely installed prior to filling and pressure testing the system;
- the expansion joint is not exposed to torque (with the exception of types 7918 ... and 7928 ... which are equipped with a torque protection). This is especially important for the expansion joints with threaded sockets.

### Insulation

Axial expansion joints shall be insulated like the complete pipeline unless stated otherwise.

- Protect the bellows by means of a suitable cover to avoid insulation material dropping into the convolutions.

- The restrictions listed in the "Axial Expansion Joints" brochure, section "Technical Data", must not be exceeded.

### CAUTION

- During pressure testing and operation, the permissible test pressure or operating pressure for the expansion joint must not be exceeded.

### Maintenance

The axial expansion joints are maintenance-free.

- Prior to disassembly and maintenance the system must be
  - **depressurized,**
  - **cooled down, and**
  - **drained.**

Failure to do so can result in serious accidents !

- the flow direction has been observed for expansion joints with internal sleeves,
- the steel bellows is free from dirt, welding chips, plaster or mortar splatter or any other soiling – clean, if necessary;
- all screwed connections are tightened properly;
- in general, special care is taken to avoid corrosion damages, e.g. in water treatment or measures to avoid galvanic corrosion in copper and galvanized pipes.

- If the axial expansion joint will be installed under plaster, the bellows again requires protection to avoid that plaster and other building material negatively affects the free movement of the bellows. The utilization of IWK expansion joints with a standard bellows cover is to be considered.

- If the pipeline will be cleaned with steam, make sure that no steam hammers occur as they may damage the expansion joint.

- Excessive pressure peaks as a consequence of closing valves too quickly and water hammers, etc. are not permitted.
- Avoid contact with aggressive media.
- Steam pipelines must be started in such a way that condensate can drain off in time.

# Expansion joint data sheet

Type of expansion joint: \_\_\_\_\_

Nominal diameter DN: \_\_\_\_\_

**Design conditions**

Design pressure \_\_\_\_\_ bar

Design temperature \_\_\_\_\_ °C

Movements

- axial compress. +/- \_\_\_\_\_ mm

- axial extension +/- \_\_\_\_\_ mm

- lateral +/- \_\_\_\_\_ mm

- angular +/- \_\_\_\_\_ degr.

Vibrations frequency \_\_\_\_\_ Hz

amplitude \_\_\_\_\_ mm

Type of vibration \_\_\_\_\_

Number of cycles \_\_\_\_\_

Flow medium \_\_\_\_\_

Flow velocity \_\_\_\_\_

**Limitations mechanical properties:**

axial spring rate \_\_\_\_\_ N/mm

lateral spring rate \_\_\_\_\_ N/mm

angular spring rate \_\_\_\_\_ Nm/degr.

axial force \_\_\_\_\_ N

lateral force \_\_\_\_\_ N

angular moment \_\_\_\_\_ Nm

pressure thrust \_\_\_\_\_ N

**Quality tests:**

Hydraulic press. test  yes  no

Leak test

with air  yes  no

with helium  yes  no

permissible leak rate \_\_\_\_\_ mbar l/s

**Auxiliary items:**

Inner sleeve  yes  no

External shroud  yes  no

Other items (specify) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**End fittings:**

Weld ends \_\_\_\_\_

Fixed flange \_\_\_\_\_

Loose flange \_\_\_\_\_

Other (specify) \_\_\_\_\_

**Size/  
material:**

**Space:**

maximum length: \_\_\_\_\_ mm

maximum diameter: \_\_\_\_\_ mm

Additional NDE		BL	RL	BRR	RR	other items
X-ray examination	%					
dye penetrant examination	%					
ultrasonic examination	%					
magnetic particle examination	%					

BL = bellows longitudinal weld seam  
BRR = bellows to pipe circumferential weld seam

RL = pipe longitudinal weld seam  
RR = pipe circumferential weld seam

**QA/QC requirements**

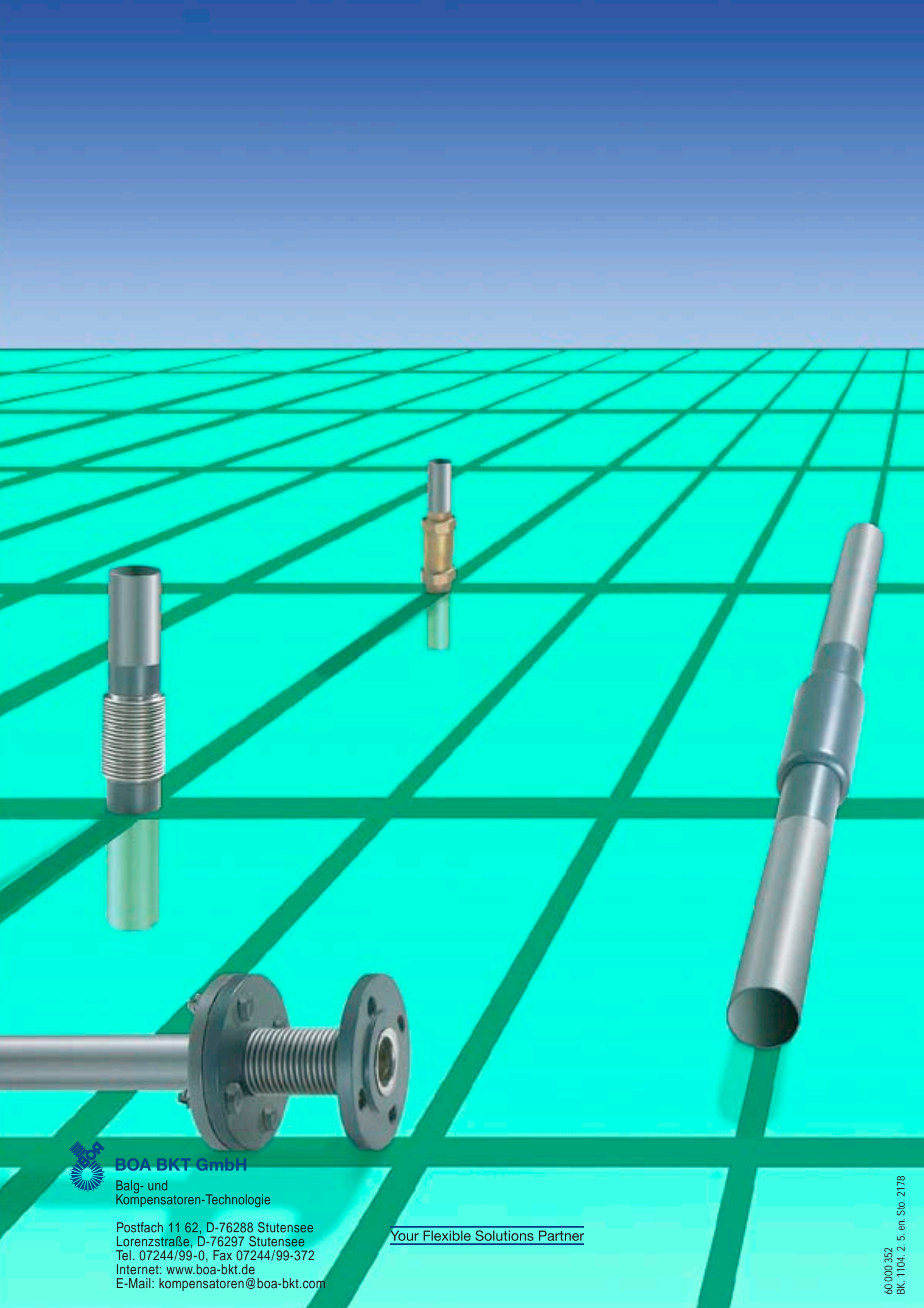
Design code \_\_\_\_\_

Special specifications \_\_\_\_\_

Certification \_\_\_\_\_

Authorized inspection party \_\_\_\_\_





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