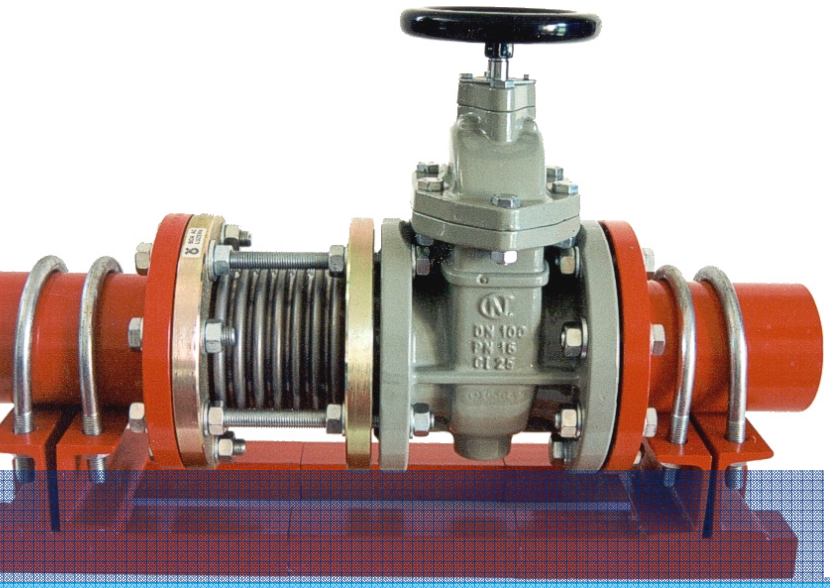
BOA® Group

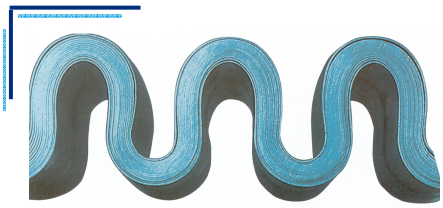


Expansion Joints Guide Module 8

- Disassembly Joints General
- Standard Program (EFB)
- Installation Instructions
- Technical Data

Expansion Joints Guide

Summary Module 8



Elastomer Formed Bellows (EFB):

- several to multi-ply (2 to 16 layers)
- high flexibility
- short construction length
- low displacement forces
- big movement capacity
- small corrugation height
- vibration absorbing

1 Disassembly Joints General

When assembling piping systems, particularly when later removal and replacement of individual components becomes necessary, an axial gap is essential to easily remove and replace the components.

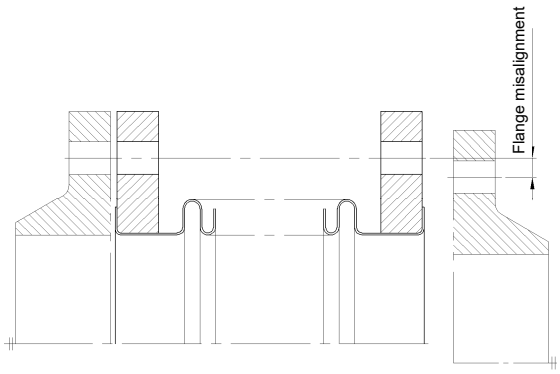
The compact BOA disassembly joint is completely wear-free, resistant to aging and facilitates considerably the installation and removal of components.

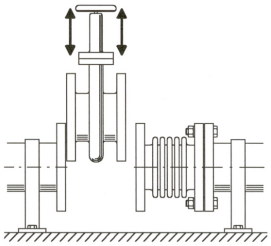
By taking advantage of the bellows' spring force, a gap is automatically generated upon release of the connecting bolts, and components can be quickly and easily removed and replaced. The other way round, a mounting gap previously set is closed by definitely restraining the bellows.

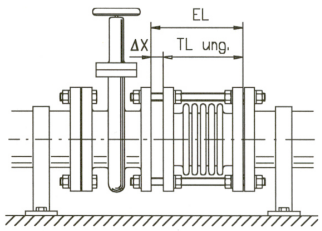
As the moving part consists of a one-piece bellows, the BOA disassembly joint remains tight even after many installation and removal operations. In the component itself no additional gaskets are required. Only while installing piping components, appropriate gaskets are to be provided on site.

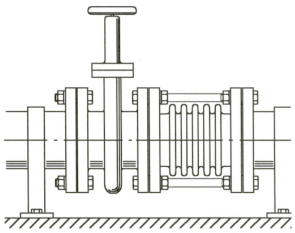
Thanks to the extreme flexibility of the multi-ply bellows, a minor flange misalignment during pipe installation can be compensated without tightness problems. Possible radial divergences:
≤DN 500 = ca. ± 10 mm
>DN 500 = ca. ± 5 mm

During installation, the BOA disassembly joint is at one side flanged to the pipe end and then, using the connection bolts, pulled to the components. In assembled mode, the BOA disassembly joint is restrained. While demounting the piece, just the connecting bolts must be released. The disassembly joint will spring back and generate automatically the gap, necessary for easy demounting and later reinstallation of the components.









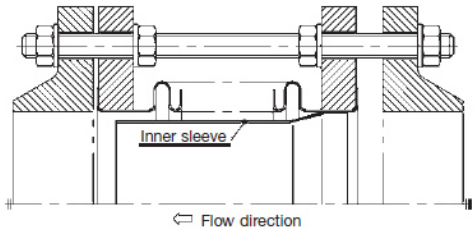
Reaction force
When using disassembly joints without tie rods, the following remarks must be considered:

The bellows put under pressure tends to return in its smooth tube shape, generating an axial reaction force F_P. This force can be calculated according to Module 2a, section 1. This reaction force must be compensated by the pipe construction, or taken in account by the layout of the anchor points. If axial movements occur, the spring rate has also to be considered (displacement rate x movement, values are listed in section 2 oft this Module).

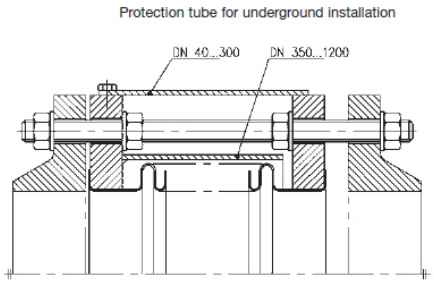
Inner sleeves
Inner sleeves protect the bellows and prevent it from being stimulated to oscillate by the fluid. The installation of an inner sleeve is recommended in the following cases:

- abrasive media
- large temperature variations
- flow rates **higher than approx. 8m/s for gaseous media**
- flow rates **higher than approx. 3m/s for liquid media**

When installing, the flow direction must be observed!



Underground laying
BOA disassembly joints are suitable for underground installation when equipped with outside protection sleeves.



2 Standard Programm BOA Disassembly Joints (EFB)

2.1 General

Expansion joints manufactured by BOA AG Switzerland are formed in the elastomer process (EFB). The core element is the multi-ply metal bellows (2 to 16 layers) made of austenitic steel. Expansion joints produced by this method have a large expansion capacity and are very flexible. They are especially appropriate to compensate for thermal expansion and minor misalignment during installation. Their advantages are:

- BOA AG has over 70 years experience in manufacturing expansion joints
- multi-ply construction of the bellows, made of high-grade stainless steel (1.4571 and 1.4541), which means high resistance against ageing, temperature, UV-rays and most of aggressive media.
- very low spring rate due to the multi-ply construction of the bellows.
- large movements at short construction lengths
- due to reasonable stocks, various types in different sizes and pressure ranges are usually available at short time.

Inner sleeve
Inner sleeves protect the bellows and prevent it from being stimulated to oscillate by the fluid. The installation of an inner sleeve is recommended in the following cases:

- abrasive media
- large temperature variations
- flow rates **higher than approx. 8m/s for gaseous media**
- flow rates **higher than approx. 3m/s for liquid media**

When installing, the flow direction must be observed!

Disassembly joints usually must absorb large lateral movements /vibrations. Therefore, they are usually used without inner sleeve. An inner guide sleeve structure allowing large lateral movements inevitably leads to a strong constriction of the flow cross-section. The resulting local acceleration of the flow medium very often is not accepted. On request (extra charge) inner sleeves may be installed.
Of course expansion joints can be designed and manufactured specifically for other materials, pressure ranges and life cycles.

2.2 Reduction

2.2.1 Expansion capacity

NOTE (Hereinafter the term **load cycle** is used for full load change cycle.)
The maximum permissible expansion capacity is indicated on the expansion joint. It refers to 1000 load cycles (for expansion joints conforming to EC standards: 500 load cycles with safety factor 2). At higher load cycles, the expansion capacity must be reduced by the load cycle factor K_L according to table 1. For the accurate determination of the load factor K_L the following formula can be applied:

$$K_L = (1000 / N_{adm})^{0.29}$$

Load cycles N_{adm}	Load cycle factor K_L
1'000	1.00
2'000	0.82
3'000	0.73
5'000	0.63
10'000	0.51
30'000	0.37
50'000	0.32
100'000	0.26
200'000	0.22
1'000'000	0.14
25'000'000	0.05

Table 1

2.2.2 Temperature related movement and pressure reduction

NOTE
The admissible operating pressure is determined by the nominal pressure considering the reduction factor K_P according to tab. 2. At higher temperatures, the expansion capacity K_Δ has to be reduced according to the reduction factors.

Reduction factors [1] for pressure [K_P] and expansion capacity [K_Δ]		
Temperature °C	K_P	K_Δ
-10...20	1.00	1.00
50	0.92	0.97
100	0.87	0.94
150	0.83	0.92
200	0.79	0.90
250	0.74	0.88
300	0.67	0.86
350	0.60	0.85
400	0.53	0.84

Table 2

[1] linear interpolation for intermediate values

2.3 Variants

Variant I

- multi-layer bellows design by proven BOA practice, made of high-grade chrome-nickel steel (1.4571)
- flared flanges (except for DN > 1000 mm) made of carbon steel
- restraining elements made of carbon steel, galvanized

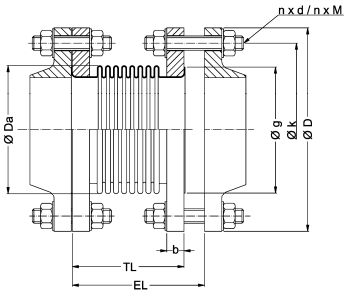
Variant II

- multi-layer bellows design by proven BOA practice, made of high-grade chrome-nickel steel (1.4571)
- flared flanges (except for DN > 1000 mm) made of 1.4301
- tie rods made of A2
- screws and nuts made of A4

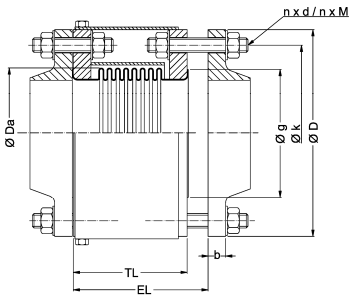
2.4 Types/ Design

2.4.1 Type AKF-U

without tie rods, not for underground laying

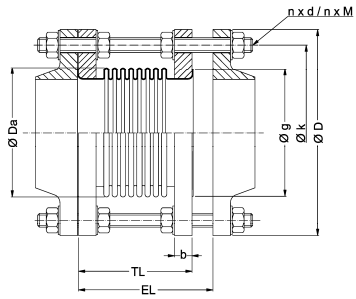


for underground laying

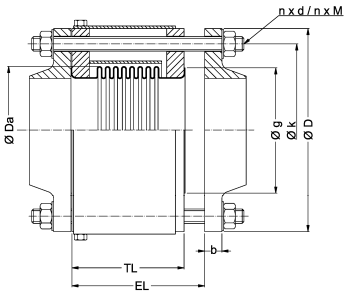


2.4.2 Type AKF-Z

with tie rods, not for underground laying

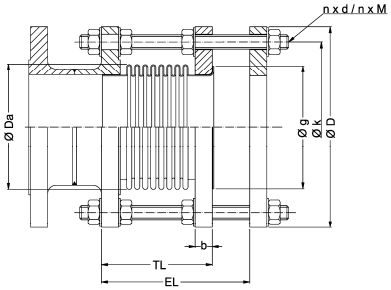


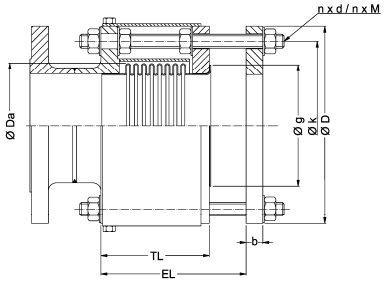
for underground laying



2.4.3 Type AK-Z

with tie rods, one side with through threaded bolt





3 Installation Instructions Disassembly Joints

3.1 General safety recommendations

Prior to installation and start-up, installation and start-up instructions must be read and observed. Installation, start-up and maintenance work shall only be performed by **qualified and authorized staff.**

Maintenance
Disassembly joints are maintenance free.

CAUTION
Prior to disassembly and maintenance, the system must be
- depressurized,
- cooled down,
- emptied.

Otherwise there is a risk of accident!

Transport, packaging and storage
- The consignment must be checked for completeness upon receipt.
- Any transport damage must be reported to the carrier and the manufacturer.
- At an intermediate storage we recommend to use the original packaging.

Admissible ambient conditions for storage and transport:
- ambient temperature - 4°C to +70 °C
- relative humidity up to 95%.

Disassembly joints must be protected against wetness, humidity, dirt, shocks and damage.

Warranty
A warranty claim requires professional installation and start-up in accordance with installation and start-up instructions. The necessary installation, start-up and maintenance work must be performed by qualified and authorized staff.

Operating pressure
NOTE
- The permissible operating pressure results in the nominal pressure considering the reduction factors given in section 2.2 "Reduction".
- At higher temperatures, the expansion capacity has to be reduced according to the reduction factors (see section 2.2).

Start-up and check
Before starting-up check if
- the pipeline is installed with sufficient inclination to avoid water pockets
- there is sufficient drainage
- pipe anchors and pipe supports/ guides are firmly installed prior to filling and pressure testing the system
- the expansion joint is not stressed by torsion, especially not expansion joints with socket attachment
- the flow direction has been observed for expansion joints with inner sleeves
- the steel bellows is free of dirt, welding, plaster or mortar splatters or any other soiling; clean if necessary
- all screwed connections are tightened properly
- the general due diligence requirements to avoid corrosion damage are observed, such as water treatment, or prevention of galvanic corrosion in copper and galvanized pipes.

Insulation
Expansion joints may be insulated exactly as the pipeline.
- If no coating is provided, protect the bellows by means of a slidable metal sleeve to avoid insulation material dropping into the convolutions.
- If the expansion joint is to be placed under plaster, a protective cover is essential. This ensures the bellows' function, protects against soiling and avoids contact with structure materials.

.
Improper operation
- The limits given in the technical data of the standard range must not be exceeded.
- Swinging suspensions adjacent to expansion joints are not permitted.
- Do not clean the newly installed pipeline by blowing it with steam to avoid water hammers and unacceptable vibration stimulating of the bellows.

System start-up
CAUTION
- During pressure testing and operation, the allowable test pressure or operating pressure defined for the expansion joint must not be exceeded.
- Excessive pressure peaks as a consequence of valves closing too abruptly, water hammers etc. are not permitted.
- Avoid contact with aggressive media.
- The start-up of steam lines must be performed such that the condensate has time to drain off.

3.2 Installation advice

Assembly

- Anchor points and pipe guides must be firmly installed before filling and pressure testing the system.
- Expansion joints must be installed without being subject to torsion. This applies particularly to expansion joints with socket connection.
- The steel bellows must be protected against damage and dirt (e.g. welding, plaster or mortar splatter).
- Steam pipelines should be installed in such a way that water hammers are avoided. This can be achieved by adequate drainage, insulation, by preventing water pockets and by sufficient inclination of the line.
- Observe the flow direction while installing expansion joints with inner sleeves.
- Avoid the installation of expansion joints in the immediate vicinity of pressure reducers, hot steam coolers and shut-down valves, if high-frequency oscillations are expected due to turbulence. Otherwise special measures must be installed (e.g. thick-walled sleeves, perforated disks, calming sections etc.).
- If high frequency vibrations or turbulence or high flow speed are expected, we recommend the installation of expansion joints with inner sleeve.
- Inner sleeves are also recommended for expansion joints with DN ≥ 150, if the flow speed of air, gas or steam media exceeds 8 m/s, or 3 m/s in case of liquid media.

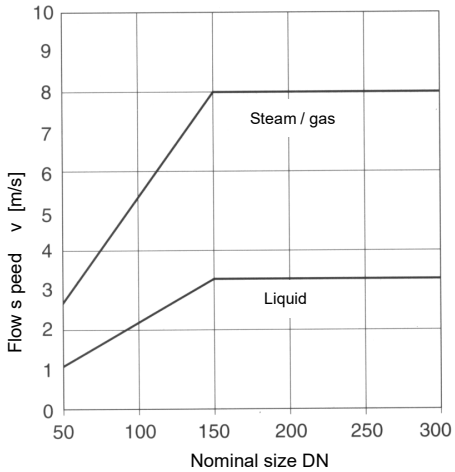


Diagram 1

Pipe guides, pipe supports

- Provide inclination for drainage
- Align the pipeline, distance between pipe guides according to fig. 1, table 3 and diagram 2

NOTE
Sliding or roller supports are the safest measures to avoid buckling and lifting of the pipeline.

CAUTION
Swing suspensions are not permitted adjacent to expansion joints!

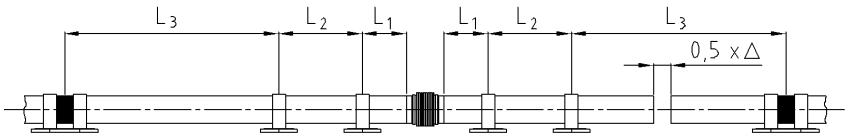


Fig. 1

Δ = expansion capacity of the expansion joint [mm]
L_1 = max. 2 x DN + Δ/2 [mm]
L_2 = 0.7 x L_3 [mm]
L_3 = 400 x $\sqrt{DN}$ [mm] valid only for steel pipelines
L_3 is the distance between the pipe supports according to the formula above. If buckling must be expected, L_3 must be reduced according to diagram 2.

DN	L_1 [mm]	L_2 [mm]	L_3 [mm]
15	30 +Δ	1050	1550
20	40 +Δ	1200	1750
25	50 +Δ	1400	2000
32	64 +Δ	1550	2250
40	80 +Δ	1750	2500
50	100 +Δ	1950	2800
65	130 +Δ	2250	3200
80	160 +Δ	2500	3550
100	200 +Δ	2800	4000
125	250 +Δ	3100	4450
150	300 +Δ	3450	4900
200	400 +Δ	3950	5650
250	500 +Δ	4400	6300
300	600 +Δ	4850	6900
350	700 +Δ	5200	7450
400	800 +Δ	5600	8000
450	900 +Δ	5900	8450
500	1000 +Δ	6250	8900
600	1200 +Δ	6850	9800
700	1400 +Δ	7450	10600
800	1600 +Δ	7900	11300

Table 3 (only valid for steel pipelines)

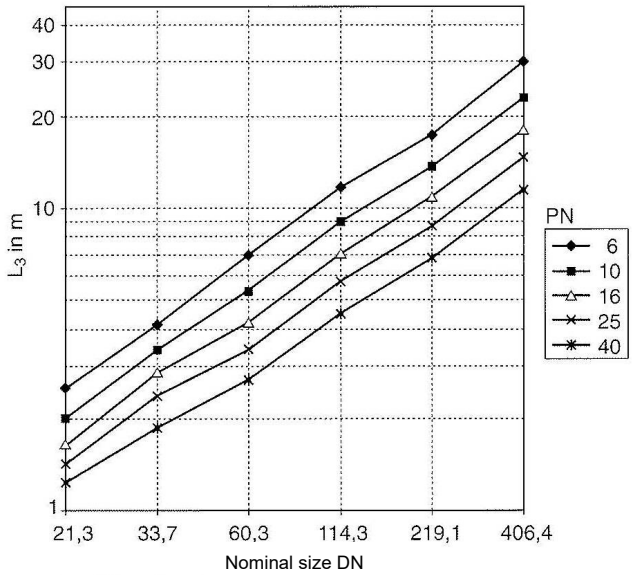


Diagram 2

Anchor points

- Install main anchors at locations where the pipeline changes direction.
- Limit by anchors each pipe section to be compensated for.
  - Only one expansion joint is allowed between two anchors.
  - Main anchors must be installed at locations where the pipeline changes direction. They must take up 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. In that case, several axial expansion joints are required.
  - In vacuum mode, the anchor points must be capable to take up tensile and pressure forces.

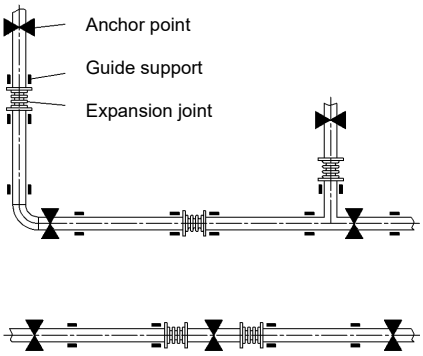


Fig. 2

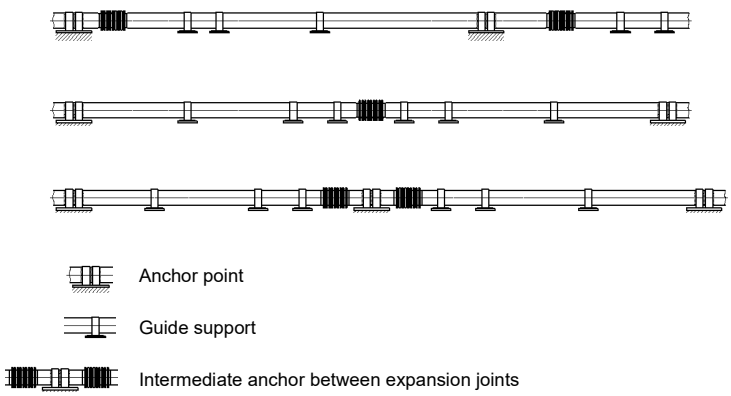


Fig. 3

Vibration compensation

- The expansion joint should be installed as close as possible to the vibrating unit to make use of its entire absorption capacity.
- The vibration absorber must be installed as close as possible to the vibration source so as to avoid resonance of the other parts.
- Primarily it must be ensured that the vibration amplitude acts laterally, i.e. perpendicular to the vibration absorber axis.
- Install an anchor directly behind the expansion joint. Installation is made without prerestraint.

CAUTION
If unrestrained vibration absorbers are installed, the reaction force must be taken into account.

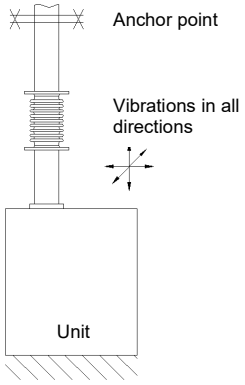


Fig. 4

Prerestraint
All common expansion joints must be installed prerestrained by 50% of their movement capacity (for heating systems: overall length of expansion joint plus 50%, whereas 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 at the highest operating temperature of a cooling system (e.g. repair of a still-warm pipe), an individual prerestraint mode must be chosen (see diagram 3).

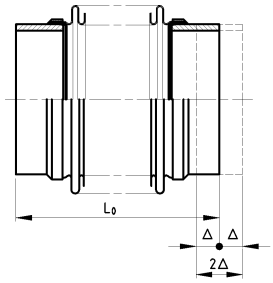


Fig. 5

Prerestraint diagram

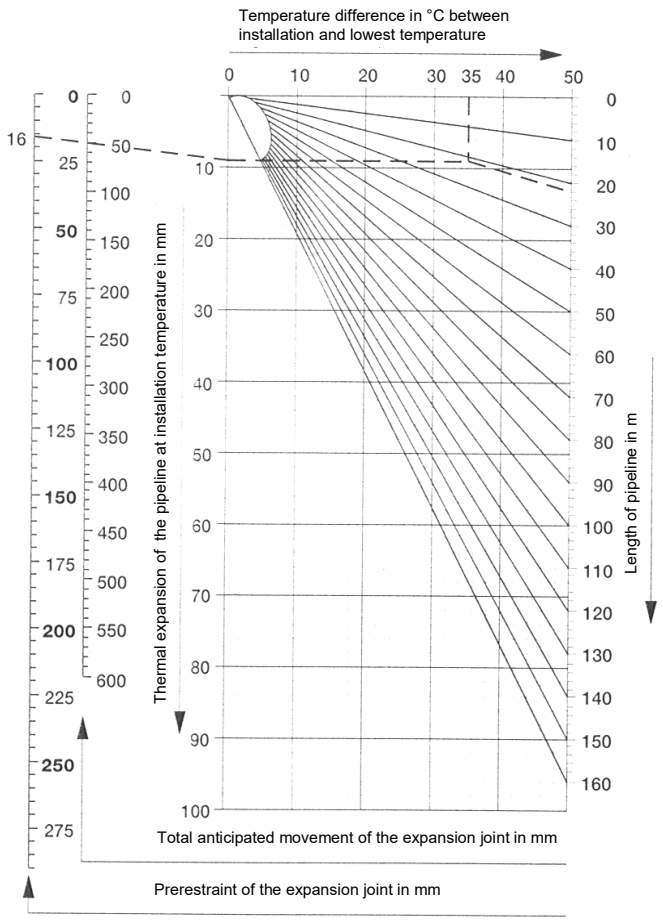


Diagram 3

Example for Diagram 3
Order is placed for an axial expansion joint to be installed in a pipeline of 22 m length.
Lowest temperature: –15°C.
Highest temperature: +165°C.
Max. expansion corresponding to 180°C heating = 50 mm.
The expansion joint shall be restrained by 50% of this expansion = prerestrained by 25 mm, i.e. pulled apart.
The remaining 50% = 25 mm will be compressed in operation mode.
Special attention must be given to the restraint during installation. The temperature shall not be –15°C, but +20°C.
This results in a corresponding expansion of the pipeline of 9 mm (see diagram 3), by which the expansion joint must be less prerestrained: 25-9 = 16 mm.

The prerestraint diagram (3) allows to determine the correct prerestraint value without intermediate calculation:

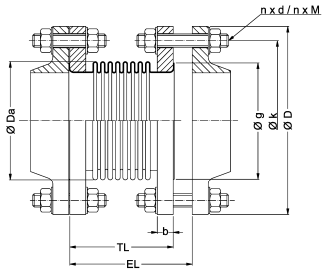
1. Temperature difference between installation and lowest temperature: –15°C to +20°C = 35°C.
2. Length of the pipe section to be compensated for: = 22 m.
3. Draw a straight line from point "22 m pipe length“ to the "0°C" point.
4. Draw a vertical line from the "35°C" point towards the beam coming from "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" = 50 mm, and lengthen the connecting straight line to "Prerestraint of the expansion joint in mm".

This results in a prerestraint value of 16 mm, which is the value by which the axial expansion joint must be pulled apart during installation.

4 Technical Data BOA Standard Disassembly Joints

4.1 Disassembly joints Type AKF-U without tie rods

Type AKF-U
without tie rods, not for underground laying



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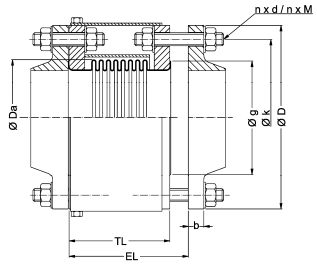


Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
Type designation:
U1 = without inner sleeve; U2 = with inner sleeve
FB = flared design, with movable flanges
FS = welded design

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Bellows			
		AKF- U	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	cm²	N/mm
80	6	AKFB-U1	130	150	5.8	90	190	16	150	4	18	118	120	82.4	51.0
80	6	AKFB-U2	130	150	5.8	81	190	16	150	4	18	118	120	82.4	51.0
80	10	AKFB-U1	130	150	8.5	90	200	20	160	8	18	118	120	82.4	120.0
80	10	AKFB-U2	130	150	8.5	81	200	20	160	8	18	119	120	82.4	120.0
80	16	AKFB-U1	130	150	8.5	90	200	20	160	8	18	118	120	82.4	120.0
80	16	AKFB-U2	130	150	8.5	81	200	20	160	8	18	119	120	82.4	120.0
80	25	AKFS-U1	160	180	12.5	90	200	26	160	8	18	119	-	82.4	202.0
80	25	AKFS-U2	160	180	12.5	81	200	26	160	8	18	119	-	82.4	202.0
100	6	AKFB-U1	130	150	7.0	110	210	16	170	4	18	139	144	122.4	48.0
100	6	AKFB-U2	130	150	7.0	100	210	16	170	4	18	139	144	122.4	48.0
100	10	AKFB-U1	130	150	11.0	110	220	22	180	8	18	141	144	122.4	114.0
100	10	AKFB-U2	130	150	11.0	98	220	22	180	8	18	142	144	122.4	114.0
100	16	AKFB-U1	130	150	11.0	110	220	22	180	8	18	141	144	122.4	114.0
100	16	AKFB-U2	130	150	11.0	98	220	22	180	8	18	142	144	122.4	114.0
100	25	AKFS-U1	160	180	15.7	110	235	26	190	8	22	144	-	182.5	261.0
100	25	AKFS-U2	160	180	15.7	98	235	26	190	8	22	144	-	182.5	261.0
125	6	AKFB-U1	130	150	9.2	137	240	18	200	8	18	169	174	182.5	58.0
125	6	AKFB-U2	130	150	9.2	123	240	18	200	8	18	169	174	182.5	58.0
125	10	AKFB-U1	130	150	15.2	137	250	24	210	8	18	172	174	182.5	155.0
125	10	AKFB-U2	130	150	15.2	123	250	24	210	8	18	172	174	182.5	155.0
125	16	AKFB-U1	130	150	15.2	137	250	24	210	8	18	172	174	182.5	155.0
125	16	AKFB-U2	130	150	15.2	123	250	24	210	8	18	172	174	182.5	155.0
125	25	AKFS-U1	170	190	21.4	137	270	28	220	8	26	172	-	182.5	264.0
125	25	AKFS-U2	170	190	21.4	137	270	28	220	8	26	172	-	182.5	264.0
150	6	AKFB-U1	130	150	12.0	161	265	20	225	8	18	195	200	257.3	98.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Bellows			
		AKF- U	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	cm²	N/mm
150	6	AKFB-U2	130	150	12.0	147	265	20	225	8	18	195	200	257.3	98.0
150	10	AKFB-U1	130	150	18.5	161	285	24	240	8	22	198	200	257.3	148.0
150	10	AKFB-U2	130	150	18.5	147	285	24	240	8	22	198	200	257.3	148.0
150	16	AKFB-U1	130	150	18.5	161	285	24	240	8	22	198	200	257.3	148.0
150	16	AKFB-U2	130	150	18.5	147	285	24	240	8	22	198	200	257.3	148.0
150	25	AKFS-U1	170	190	26.1	165	300	30	250	8	26	204	-	257.3	375.0
150	25	AKFS-U2	170	190	26.1	165	300	30	250	8	26	204	-	257.3	375.0
200	6	AKFB-U1	130	150	17.3	213	320	22	280	8	18	250	256	424.2	98.0
200	6	AKFB-U2	130	150	17.3	198	320	22	280	8	18	250	256	424.2	116.0
200	10	AKFB-U1	130	150	24.9	213	340	26	295	8	22	254	256	424.2	162.0
200	10	AKFB-U2	130	150	24.9	198	340	26	295	8	22	254	256	424.2	162.0
200	16	AKFB-U1	130	150	25.5	213	340	26	295	12	22	253	253	424.2	314.0
200	16	AKFB-U2	130	150	25.5	198	340	26	295	12	22	253	256	424.2	330.0
200	25	AKFS-U1	170	190	32.6	200	360	32	310	12	26	259	-	424.2	573.0
200	25	AKFS-U2	170	190	32.6	200	360	32	310	12	26	259	-	424.2	573.0
250	6	AKFB-U1	130	150	22.8	263	375	24	335	12	18	304	308	642.5	121.0
250	6	AKFB-U2	130	150	22.8	248	375	24	335	12	18	304	308	642.5	122.0
250	10	AKFB-U1	130	150	34.8	263	395	28	350	12	22	308	308	642.5	170.0
250	10	AKFB-U2	130	150	30.8	248	395	28	350	12	22	308	308	642.5	170.0
250	16	AKFB-U1	130	150	40.0	263	405	32	355	12	26	307	308	642.5	498.0
250	16	AKFB-U2	130	150	37.0	255	405	32	355	12	26	307	308	642.5	498.0
250	25	AKFS-U1	190	210	47.8	263	425	36	370	12	30	317	-	642.5	688.0
250	25	AKFS-U2	190	210	47.8	248	425	36	370	12	30	317	-	642.5	688.0
300	6	AKFB-U1	130	150	31.5	313	440	24	395	12	22	356	361	892.0	132.0
300	6	AKFB-U2	130	150	27.4	298	440	24	395	12	22	356	361	892.0	132.0
300	10	AKFB-U1	130	150	34.1	313	445	28	400	12	22	359	360	892.0	200.0
300	10	AKFB-U2	130	150	34.1	298	445	28	400	12	22	359	360	892.0	200.0
300	16	AKFB-U1	130	150	47.7	313	460	32	410	12	26	361	361	892.0	570.0
300	16	AKFB-U2	130	150	42.2	305	460	32	410	12	26	361	361	892.0	570.0
300	25	AKFS-U1	190	210	61.3	318	485	40	430	16	30	362	-	892.0	856.0
300	25	AKFS-U2	190	210	61.3	298	485	40	430	16	30	362	-	892.0	856.0
350	6	AKFB-U1	130	150	36.4	353	490	26	445	12	22	402	353	1081.0	238.0
350	6	AKFB-U2	130	150	36.4	336	490	26	445	12	22	402	353	1081.0	238.0
350	10	AKFB-U1	130	150	47.4	332	505	30	460	16	22	397	400	1081.0	526.0
350	10	AKFB-U2	130	150	47.4	332	505	30	460	16	22	397	400	1081.0	526.0
350	16	AKFB-U1	150	170	63.1	353	520	36	470	16	26	404	404	1081.0	650.0
350	16	AKFB-U2	150	170	63.1	340	520	36	470	16	26	404	404	1081.0	710.0
350	25	AKFS-U1	190	210	94.5	350	555	44	490	16	33	399	-	1081.0	891.0
350	25	AKFS-U2	190	210	94.5	336	555	44	490	16	33	399	-	1081.0	891.0
400	6	AKFB-U1	130	150	42.9	404	540	28	495	16	22	455	456	1393.0	318.0
400	6	AKFB-U2	130	150	42.9	386	540	28	495	16	22	455	456	1393.0	318.0
400	10	AKFB-U1	130	150	59.4	404	565	32	515	16	26	456	456	1393.0	427.0
400	10	AKFB-U2	130	150	62.0	380	565	32	515	16	26	449	453	1393.0	479.0
400	16	AKFB-U1	160	180	79.5	404	580	38	525	16	30	458	456	1393.0	762.0
400	16	AKFB-U2	160	180	79.5	386	580	38	525	16	30	458	456	1393.0	762.0
400	25	AKFS-U1	210	230	124.4	400	620	48	550	16	36	449	-	1393.0	1009.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Bellows			
		AKF- U	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	cm²	N/mm
400	25	AKFS-U2	210	230	124.4	386	620	48	550	16	36	449	-	1393.0	1009.0
450	6	AKFB-U1	130	150	49.7	455	595	28	550	16	22	507	508	1776.0	327.0
450	6	AKFB-U2	130	150	49.7	439	595	28	550	16	22	507	508	1776.0	327.0
450	10	AKFB-U1	130	150	65.1	455	615	32	565	20	26	509	508	1776.0	552.0
450	10	AKFB-U2	130	150	65.1	439	615	32	565	20	26	509	508	1776.0	552.0
450	16	AKFB-U1	160	180	100.8	455	640	42	585	20	30	510	508	1776.0	782.0
450	16	AKFB-U2	160	180	100.8	439	640	42	585	20	30	510	508	1776.0	782.0
450	25	AKFS-U1	210	230	141.3	453	670	50	600	20	36	508	-	1776.0	1723.0
450	25	AKFS-U2	210	230	141.3	439	670	50	600	20	36	508	-	1776.0	1723.0
500	6	AKFB-U1	130	150	57.5	506	645	30	600	20	22	559	563	2173.0	350.0
500	6	AKFB-U2	130	150	57.5	489	645	30	600	20	22	559	563	2173.0	350.0
500	10	AKFB-U1	135	155	79.5	503	670	34	620	20	26	556	558	2173.0	588.0
500	10	AKFB-U2	135	155	79.5	489	670	34	620	20	26	560	563	2173.0	588.0
500	16	AKFB-U1	160	180	133.0	503	715	44	650	20	33	562	563	2173.0	1086.0
500	16	AKFB-U2	160	180	133.0	489	715	44	650	20	33	562	563	2173.0	1086.0
500	25	AKFS-U1	210	230	176.5	503	730	54	660	20	36	559	-	2173.0	1724.0
500	25	AKFS-U2	210	230	176.5	489	730	54	660	20	36	559	-	2173.0	1724.0
600	6	AKFS-U1	170	200	74.0	592	755	30	705	20	26	659	-	3088.0	718.0
600	6	AKFS-U2	170	200	74.0	590	755	30	705	20	26	659	-	3088.0	718.0
600	10	AKFS-U1	186	216	104.0	592	780	36	725	20	30	660	-	3088.0	963.0
600	10	AKFS-U2	186	216	104.0	590	780	36	725	20	30	660	-	3088.0	963.0
600	16	AKFS-U1	240	270	191.0	592	840	48	770	20	36	661	-	3088.0	728.0
600	16	AKFS-U2	240	270	191.0	590	840	48	770	20	36	661	-	3088.0	728.0
600	25	AKFS-U1	260	290	256.0	592	845	62	770	20	39	663	-	3088.0	1289.0
600	25	AKFS-U2	260	290	256.0	590	845	62	770	20	39	663	-	3088.0	1289.0
700	6	AKFS-U1	170	200	71.0	703	860	24	810	24	26	763	-	4174.0	728.0
700	6	AKFS-U2	170	200	71.0	693	860	24	810	24	26	763	-	4174.0	728.0
700	10	AKFS-U1	174	204	110.0	703	895	30	840	24	30	764	-	4174.0	977.0
700	10	AKFS-U2	174	204	110.0	693	895	30	840	24	30	764	-	4174.0	977.0
700	16	AKFS-U1	240	270	159.0	703	910	36	840	24	36	766	-	4174.0	890.0
700	16	AKFS-U2	240	270	159.0	693	910	36	840	24	36	766	-	4174.0	890.0
700	25	AKFS-U1	260	290	246.0	703	960	46	875	24	42	768	-	4174.0	1202.0
700	25	AKFS-U2	260	290	246.0	693	960	46	875	24	42	768	-	4174.0	1202.0
800	6	AKFS-U1	170	200	87.0	803	975	24	920	24	30	865	-	5450.0	802.0
800	6	AKFS-U2	170	200	87.0	793	975	24	920	24	30	865	-	5450.0	802.0
800	10	AKFS-U1	220	250	151.0	803	1015	32	950	24	33	866	-	5450.0	646.0
800	10	AKFS-U2	220	250	151.0	793	1015	32	950	24	33	866	-	5450.0	646.0
800	16	AKFS-U1	240	270	193.0	803	1025	38	950	24	39	868	-	5450.0	981.0
800	16	AKFS-U2	240	270	193.0	793	1025	38	950	24	39	868	-	5450.0	981.0
800	25	AKFS-U1	270	300	328.0	803	1085	50	990	24	56	870	-	5450.0	1324.0
800	25	AKFS-U2	270	300	328.0	793	1085	50	990	24	56	870	-	5450.0	1324.0
1000	6	AKFS-U1	212	242	118.0	1008	1175	26	1120	28	30	1066	-	8463.0	668.0
1000	6	AKFS-U2	212	242	118.0	998	1175	26	1120	28	30	1066	-	8463.0	668.0
1000	10	AKFS-U1	240	270	211.0	1008	1230	34	1160	28	36	1068	-	8463.0	1126.0
1000	10	AKFS-U2	240	270	211.0	998	1230	34	1160	28	36	1068	-	8463.0	1126.0
1000	16	AKFS-U1	270	300	302.0	1008	1255	42	1170	28	42	1070	-	8463.0	1595.0

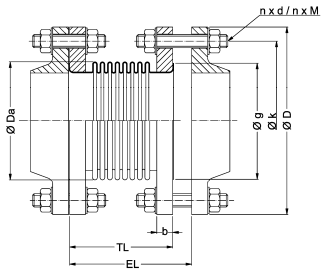
DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Bellows			
		AKF- U	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	cm²	N/mm
1000	16	AKFS-U2	270	300	302.0	998	1255	42	1170	28	42	1070	-	8463.0	1595.0
1000	25	AKFS-U1	244	274	512.0	1008	1320	58	1210	28	56	1081	-	8463.0	1908.0
1000	25	AKFS-U2	244	274	512.0	998	1320	58	1210	28	56	1081	-	8463.0	1908.0
1100	6	AKFS-U1	190	220	162.0	1112	1305	26	1240	28	33	1177	-	10279.0	575.0
1100	6	AKFS-U2	190	220	162.0	1100	1305	26	1240	28	33	1177	-	10279.0	575.0
1100	10	AKFS-U1	210	240	244.0	1112	1340	34	1270	32	36	1179	-	10279.0	969.0
1100	10	AKFS-U2	210	240	244.0	1100	1340	34	1270	32	36	1179	-	10279.0	969.0
1100	16	AKFS-U1	240	270	324.0	1112	1355	42	1270	32	42	1182	-	10279.0	1578.0
1100	16	AKFS-U2	240	270	324.0	1100	1355	42	1270	32	42	1182	-	10279.0	1578.0
1100	25	AKFS-U1	244	274	554.0	1112	1420	58	1310	32	56	1189	-	10296.0	1833.0
1100	25	AKFS-U2	244	274	554.0	1100	1420	58	1310	32	56	1189	-	10296.0	1833.0
1200	6	AKFS-U1	190	220	171.0	1212	1405	28	1340	32	33	1277	-	12154.0	625.0
1200	6	AKFS-U2	190	220	171.0	1200	1405	28	1340	32	33	1277	-	12154.0	625.0
1200	10	AKFS-U1	210	240	298.0	1212	1455	38	1380	32	39	1279	-	12154.0	1054.0
1200	10	AKFS-U2	210	240	298.0	1200	1455	38	1380	32	39	1279	-	12154.0	1054.0
1200	16	AKFS-U1	262	292	442.0	1212	1485	48	1390	32	48	1282	-	12154.0	1715.0
1200	16	AKFS-U2	262	292	442.0	1200	1485	48	1390	32	48	1282	-	12154.0	1715.0
1200	25	AKFS-U1	244	274	748.0	1212	1530	70	1420	32	56	1281	-	12154.0	3201.0
1200	25	AKFS-U2	244	274	748.0	1200	1530	70	1420	32	56	1281	-	12154.0	3201.0
1300	6	AKFS-U1	190	220	214.0	1312	1520	28	1450	32	36	1377	-	14187.0	675.0
1300	6	AKFS-U2	190	220	214.0	1297	1520	28	1450	32	36	1377	-	14187.0	675.0
1300	10	AKFS-U1	220	250	364.0	1312	1575	38	1490	32	42	1379	-	14187.0	1138.0
1300	10	AKFS-U2	220	250	364.0	1297	1575	38	1490	32	42	1379	-	14187.0	1138.0
1300	16	AKFS-U1	262	292	476.0	1312	1585	48	1490	32	48	1382	-	14187.0	1852.0
1300	16	AKFS-U2	262	292	476.0	1297	1585	48	1490	32	48	1382	-	14187.0	1852.0
1300	25	AKFS-U1	244	274	843.0	1312	1645	70	1530	32	62	1381	-	14187.0	3448.0
1300	25	AKFS-U2	244	274	843.0	1297	1645	70	1530	32	62	1381	-	14187.0	3448.0
1400	6	AKFS-U1	190	220	251.0	1412	1630	32	1560	36	32	1479	-	16377.0	660.0
1400	6	AKFS-U2	190	220	251.0	1397	1630	32	1560	36	32	1479	-	16377.0	660.0
1400	10	AKFS-U1	230	260	426.0	1412	1675	42	1590	36	42	1481	-	16377.0	1113.0
1400	10	AKFS-U2	230	260	426.0	1397	1675	42	1590	36	42	1481	-	16377.0	1113.0
1400	16	AKFS-U1	262	292	548.0	1412	1685	52	1590	36	48	1484	-	16377.0	1810.0
1400	16	AKFS-U2	262	292	548.0	1397	1685	52	1590	36	48	1484	-	16377.0	1810.0
1400	25	AKFS-U1	256	286	1002.0	1412	1755	76	1640	36	62	1481	-	16377.0	3695.0
1400	25	AKFS-U2	256	286	1002.0	1397	1755	76	1640	36	62	1481	-	16377.0	3695.0
1500	6	AKFS-U1	190	220	270.0	1520	1730	32	1660	36	32	1587	-	18918.0	710.0
1500	6	AKFS-U2	190	220	270.0	1505	1730	32	1660	36	32	1587	-	18918.0	710.0
1500	10	AKFS-U1	230	260	458.0	1520	1785	42	1700	36	42	1589	-	18918.0	1195.0
1500	10	AKFS-U2	230	260	458.0	1505	1785	42	1700	36	42	1589	-	18918.0	1195.0
1500	16	AKFS-U1	295	325	645.0	1520	1820	52	1710	36	56	1593	-	18918.0	2000.0
1500	16	AKFS-U2	295	325	645.0	1505	1820	52	1710	36	56	1593	-	18918.0	2000.0
1500	25	AKFS-U1	256	286	1100.0	1520	1865	76	1750	36	62	1589	-	18918.0	3960.0
1500	25	AKFS-U2	256	286	1100.0	1505	1865	76	1750	36	62	1589	-	18918.0	3960.0
1600	6	AKFS-U1	210	240	309.0	1623	1830	34	1760	40	36	1691	-	21517.0	1014.0
1600	6	AKFS-U2	210	240	309.0	1608	1830	34	1760	40	36	1691	-	21517.0	1014.0
1600	10	AKFS-U1	262	292	585.0	1623	1915	46	1820	40	48	1693	-	21517.0	1238.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Bellows			
		AKF- U	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	cm²	N/mm
1600	10	AKFS-U2	262	292	585.0	1608	1915	46	1820	40	48	1693	-	21517.0	1238.0
1600	16	AKFS-U1	295	325	781.0	1623	1930	58	1820	40	56	1698	-	21517.0	2139.0
1600	16	AKFS-U2	295	325	781.0	1608	1930	58	1820	40	56	1698	-	21517.0	2139.0
1600	25	AKFS-U1	272	302	1297.0	1623	1975	84	1860	40	62	1692	-	21517.0	4213.0
1600	25	AKFS-U2	272	302	1297.0	1608	1975	84	1860	40	62	1692	-	21517.0	4213.0

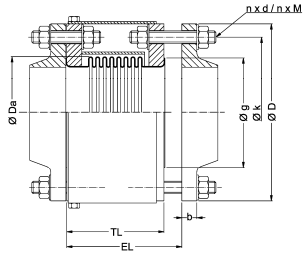
Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
Type designation:
U1 = without inner sleeve; U2 = with inner sleeve
FB = flared design, with movable flanges
FS = welded design

Type AKF-U

without tie rods, not for underground laying



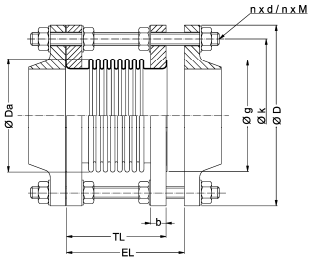
for underground laying



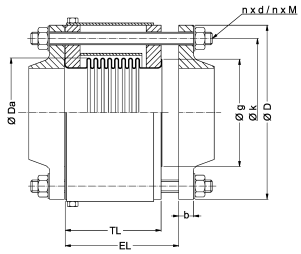
Subject to changes; latest specifications on www.boagroup.com

4.2 Disassembly joint Type AKF-Z with tie rods

Type AKF-Z
with tie rods, not for underground laying



for underground laying



Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
Type designation:
U1 = without inner sleeve; U2 = with inner sleeve
FB = flared design, with movable flanges
FS = welded design

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Tie rod		Bellows			
		AKF-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm^2	N/mm
80	6	AKFB-Z1	130	150	5.8	90	190	16	150	4	18	240	4xM16	118	120	82.4	51.0
80	6	AKFB-Z2	130	150	5.8	81	190	16	150	4	18	240	4xM16	90	120	82.4	51.0
80	10	AKFB-Z1	130	150	8.5	90	200	20	160	8	18	240	4xM16	119	120	82.4	120.0
80	10	AKFB-Z2	130	150	8.5	81	200	20	160	8	18	240	4xM16	119	120	82.4	120.0
80	16	AKFB-Z1	130	150	8.5	90	200	20	160	8	18	240	4xM16	119	120	82.4	120.0
80	16	AKFB-Z2	130	150	8.5	81	200	20	160	8	18	240	4xM16	119	120	82.4	120.0
80	25	AKFS-Z1	160	180	12.5	90	200	26	160	8	18	280	4xM16	119	-	82.4	202.0
80	25	AKFS-Z2	160	180	12.5	81	200	26	160	8	18	280	4xM16	119	-	82.4	202.0
100	6	AKFB-Z1	130	150	7.0	110	210	16	170	4	18	240	4xM16	139	144	122.4	48.0
100	6	AKFB-Z2	130	150	7.0	100	210	16	170	4	18	240	4xM16	139	144	122.4	48.0
100	10	AKFB-Z1	130	150	11.0	110	220	22	180	8	18	240	4xM16	142	144	122.4	114.0
100	10	AKFB-Z2	130	150	11.0	98	220	22	180	8	18	240	4xM16	110	144	122.4	114.0
100	16	AKFB-Z1	130	150	11.0	110	220	22	180	8	18	240	4xM16	142	144	122.4	114.0
100	16	AKFB-Z2	130	150	11.0	98	220	22	180	8	18	240	4xM16	110	144	122.4	114.0
100	25	AKFS-Z1	160	180	15.7	110	235	26	190	8	22	280	4xM20	144	-	182.5	261.0
100	25	AKFS-Z2	160	180	15.7	98	235	26	190	8	22	280	4xM20	144	-	182.5	261.0
125	6	AKFB-Z1	130	150	9.2	137	240	18	200	8	18	240	4xM16	169	174	182.5	58.0
125	6	AKFB-Z2	130	150	9.2	123	240	18	200	8	18	240	4xM16	169	174	182.5	58.0
125	10	AKFB-Z1	130	150	15.2	137	250	24	210	8	18	240	4xM16	172	174	182.5	155.0
125	10	AKFB-Z2	130	150	15.2	123	250	24	210	8	18	240	4xM16	172	174	182.5	155.0
125	16	AKFB-Z1	130	150	15.2	137	250	24	210	8	18	240	4xM16	172	174	182.5	155.0
125	16	AKFB-Z2	130	150	15.2	123	250	24	210	8	18	240	4xM16	172	174	182.5	155.0
125	25	AKFS-Z1	170	190	21.4	137	270	28	220	8	26	315	4xM24	172	-	182.5	264.0
125	25	AKFS-Z2	170	190	21.4	137	270	28	220	8	26	315	4xM24	172	-	182.5	264.0
150	6	AKFB-Z1	130	150	12.0	161	265	20	225	8	18	240	4xM16	195	200	257.3	98.0
150	6	AKFB-Z2	130	150	12.0	147	265	20	225	8	18	240	4xM16	195	200	257.3	98.0
150	10	AKFB-Z1	130	150	18.5	161	285	24	240	8	22	260	4xM20	198	200	257.3	148.0
150	10	AKFB-Z2	130	150	18.5	147	285	24	240	8	22	260	4xM20	198	200	257.3	148.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Tie rod		Bellows			
		AKF-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm²	N/mm
150	16	AKFB-Z1	130	150	18.5	161	285	24	240	8	22	260	4xM20	198	200	257.3	148.0
150	16	AKFB-Z2	130	150	18.5	147	285	24	240	8	22	260	4xM20	198	200	257.3	148.0
150	25	AKFS-Z1	170	190	26.1	165	300	30	250	8	26	315	4xM24	204	-	257.3	375.0
150	25	AKFS-Z2	170	190	26.1	165	300	30	250	8	26	315	4xM24	204	-	257.3	375.0
200	6	AKFB-Z1	130	150	17.3	213	320	22	280	8	18	240	4xM16	250	256	424.2	116.0
200	6	AKFB-Z2	130	150	17.3	198	320	22	280	8	18	240	4xM16	250	256	424.2	116.0
200	10	AKFB-Z1	130	150	24.9	213	340	26	295	8	22	260	4xM20	254	256	424.2	162.0
200	10	AKFB-Z2	130	150	24.9	198	340	26	295	8	22	260	4xM20	254	256	424.2	162.0
200	16	AKFB-Z1	130	150	25.5	213	340	26	295	12	22	260	4xM20	253	256	424.2	330.0
200	16	AKFB-Z2	130	150	25.5	198	340	26	295	12	22	260	4xM20	253	256	424.2	330.0
200	25	AKFS-Z1	170	190	32.6	200	360	32	310	12	26	350	4xM24	259	-	424.2	573.0
200	25	AKFS-Z2	170	190	32.6	200	360	32	310	12	26	350	4xM24	259	-	424.2	573.0
250	6	AKFB-Z1	130	150	22.8	263	375	24	335	12	18	240	4xM16	304	308	642.5	122.0
250	6	AKFB-Z2	130	150	22.8	248	375	24	335	12	18	240	4xM16	304	308	642.5	122.0
250	10	AKFB-Z1	130	150	30.8	263	395	28	350	12	22	260	4xM20	308	308	642.5	170.0
250	10	AKFB-Z2	130	150	30.8	248	395	28	350	12	22	260	4xM20	308	308	642.5	170.0
250	16	AKFB-Z1	130	150	37.0	263	405	32	355	12	26	280	4xM24	307	308	642.5	498.0
250	16	AKFB-Z2	130	150	37.0	255	405	32	355	12	26	280	4xM24	307	308	642.5	498.0
250	25	AKFS-Z1	190	210	47.8	263	425	36	370	12	30	350	4xM27	317	-	642.5	688.0
250	25	AKFS-Z2	190	210	47.8	248	425	36	370	12	30	350	4xM27	317	-	642.5	688.0
300	6	AKFB-Z1	130	150	27.4	313	440	24	395	12	22	260	4xM20	356	361	892.0	132.0
300	6	AKFB-Z2	130	150	27.4	298	440	24	395	12	22	260	4xM20	356	361	892.0	132.0
300	10	AKFB-Z1	130	150	34.1	313	445	28	400	12	22	260	4xM20	359	361	892.0	200.0
300	10	AKFB-Z2	130	150	34.1	298	445	28	400	12	22	260	4xM20	359	361	892.0	200.0
300	16	AKFB-Z1	130	150	42.2	313	460	32	410	12	26	280	4xM24	361	361	892.0	570.0
300	16	AKFB-Z2	130	150	42.2	305	460	32	410	12	26	280	4xM24	361	361	892.0	570.0
300	25	AKFS-Z1	190	210	61.3	318	485	40	430	16	30	350	4xM27	362	-	892.0	856.0
300	25	AKFS-Z2	190	210	61.3	298	485	40	430	16	30	350	4xM27	362	-	892.0	856.0
350	6	AKFB-Z1	130	150	36.4	353	490	26	445	12	22	300	4xM20	402	353	1081.0	238.0
350	6	AKFB-Z2	130	150	36.4	336	490	26	445	12	22	300	4xM20	402	353	1081.0	238.0
350	10	AKFB-Z1	130	150	47.4	332	505	30	460	16	22	260	4xM20	397	400	1081.0	526.0
350	10	AKFB-Z2	130	150	47.4	332	505	30	460	16	22	260	4xM20	397	400	1081.0	526.0
350	16	AKFB-Z1	150	170	63.1	353	520	36	470	16	26	315	6xM24	404	404	1081.0	650.0
350	16	AKFB-Z2	150	170	63.1	340	520	36	470	16	26	315	6xM24	404	404	1081.0	710.0
350	25	AKFS-Z1	190	210	94.5	350	555	44	490	16	33	350	4xM30	399	-	1081.0	891.0
350	25	AKFS-Z2	190	210	94.5	336	555	44	490	16	33	350	4xM30	399	-	1081.0	891.0
400	6	AKFB-Z1	130	150	42.9	404	540	28	495	16	22	270	4xM20	455	456	1393.0	318.0
400	6	AKFB-Z2	130	150	42.9	386	540	28	495	16	22	270	4xM20	455	456	1393.0	318.0
400	10	AKFB-Z1	130	150	59.4	404	565	32	515	16	26	270	4xM24	456	456	1393.0	427.0
400	10	AKFB-Z2	130	150	62.0	380	565	32	515	16	26	270	4xM24	449	453	1393.0	479.0
400	16	AKFB-Z1	160	180	79.5	404	580	38	525	16	30	315	4xM27	458	456	1393.0	762.0
400	16	AKFB-Z2	160	180	79.5	386	580	38	525	16	30	315	4xM27	458	456	1393.0	762.0
400	25	AKFS-Z1	210	230	124.4	400	620	48	550	16	36	460	4xM33	449	-	1393.0	1009.0
400	25	AKFS-Z2	210	230	124.4	386	620	48	550	16	36	460	4xM33	449	-	1393.0	1009.0
450	6	AKFB-Z1	130	150	49.7	455	595	28	550	16	22	270	4xM20	507	508	1776.0	327.0
450	6	AKFB-Z2	130	150	49.7	439	595	28	550	16	22	270	4xM20	507	508	1776.0	327.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Tie rod		Bellows			
		AKF-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm²	N/mm
450	10	AKFB-Z1	130	150	65.1	455	615	32	565	20	26	270	8xM24	509	508	1776.0	552.0
450	10	AKFB-Z2	130	150	65.1	439	615	32	565	20	26	270	8xM24	509	508	1776.0	552.0
450	16	AKFB-Z1	160	180	100.8	455	640	42	585	20	30	315	8xM27	510	508	1776.0	782.0
450	16	AKFB-Z2	160	180	100.8	439	640	42	585	20	30	315	8xM27	510	508	1776.0	782.0
450	25	AKFS-Z1	210	230	141.3	453	670	50	600	20	36	460	8xM33	508	-	1776.0	1723.0
450	25	AKFS-Z2	210	230	141.3	439	670	50	600	20	36	460	8xM33	508	-	1776.0	1723.0
500	6	AKFB-Z1	130	150	57.5	506	645	30	600	20	22	270	8xM20	559	563	2173.0	350.0
500	6	AKFB-Z2	130	150	57.5	489	645	30	600	20	22	270	8xM20	559	563	2173.0	350.0
500	10	AKFB-Z1	135	155	79.5	503	670	34	620	20	26	280	8xM24	560	563	2173.0	588.0
500	10	AKFB-Z2	135	155	79.5	489	670	34	620	20	26	280	8xM24	560	563	2173.0	588.0
500	16	AKFB-Z1	160	180	133.0	503	715	44	650	20	33	380	8xM30	562	563	2173.0	1086.0
500	16	AKFB-Z2	160	180	133.0	489	715	44	650	20	33	380	8xM30	562	563	2173.0	1086.0
500	25	AKFS-Z1	210	230	176.5	503	730	54	660	20	36	460	8xM33	559	-	2173.0	1724.0
500	25	AKFS-Z2	210	230	176.5	489	730	54	660	20	36	460	8xM33	559	-	2173.0	1724.0
600	6	AKFS-Z1	170	200	74.0	592	755	30	705	20	26	335	8xM24	659	-	3088.0	718.0
600	6	AKFS-Z2	170	200	74.0	590	755	30	705	20	26	335	8xM24	659	-	3088.0	718.0
600	10	AKFS-Z1	186	216	104.0	592	780	36	725	20	30	355	8xM27	660	-	3088.0	963.0
600	10	AKFS-Z2	186	216	104.0	590	780	36	725	20	30	355	8xM27	660	-	3088.0	963.0
600	16	AKFS-Z1	240	270	191.0	592	840	48	770	20	36	480	8xM33	661	-	3088.0	728.0
600	16	AKFS-Z2	240	270	191.0	590	840	48	770	20	36	480	8xM33	661	-	3088.0	728.0
600	25	AKFS-Z1	260	290	256.0	592	845	62	770	20	39	500	8xM36	663	-	3088.0	1289.0
600	25	AKFS-Z2	260	290	256.0	590	845	62	770	20	39	500	8xM36	663	-	3088.0	1289.0
700	6	AKFS-Z1	170	200	71.0	703	860	24	810	24	26	390	8xM24	763	-	4174.0	728.0
700	6	AKFS-Z2	170	200	71.0	693	860	24	810	24	26	390	8xM24	763	-	4174.0	728.0
700	10	AKFS-Z1	174	204	110.0	703	895	30	840	24	30	405	8xM27	764	-	4174.0	977.0
700	10	AKFS-Z2	174	204	110.0	693	895	30	840	24	30	405	8xM27	764	-	4174.0	977.0
700	16	AKFS-Z1	240	270	159.0	703	910	36	840	24	36	490	8xM33	766	-	4174.0	890.0
700	16	AKFS-Z2	240	270	159.0	693	910	36	840	24	36	490	8xM33	766	-	4174.0	890.0
700	25	AKFS-Z1	260	290	246.0	703	960	46	875	24	42	540	12xM39	768	-	4174.0	1202.0
700	25	AKFS-Z2	260	290	246.0	693	960	46	875	24	42	540	12xM39	768	-	4174.0	1202.0
800	6	AKFS-Z1	170	200	87.0	803	975	24	920	24	30	335	8xM27	865	-	5450.0	802.0
800	6	AKFS-Z2	170	200	87.0	793	975	24	920	24	30	335	8xM27	865	-	5450.0	802.0
800	10	AKFS-Z1	220	250	151.0	803	1015	32	950	24	33	400	8xM30	866	-	5450.0	646.0
800	10	AKFS-Z2	220	250	151.0	793	1015	32	950	24	33	400	8xM30	866	-	5450.0	646.0
800	16	AKFS-Z1	240	270	193.0	803	1025	38	950	24	39	470	12xM36	868	-	5450.0	981.0
800	16	AKFS-Z2	240	270	193.0	793	1025	38	950	24	39	470	12xM36	868	-	5450.0	981.0
800	25	AKFS-Z1	270	300	328.0	803	1085	50	990	24	56	540	12xM45	870	-	5450.0	1324.0
800	25	AKFS-Z2	270	300	328.0	793	1085	50	990	24	56	540	12xM45	870	-	5450.0	1324.0
1000	6	AKFS-Z1	212	242	118.0	1008	1175	26	1120	28	30	380	12xM27	1066	-	8463.0	668.0
1000	6	AKFS-Z2	212	242	118.0	998	1175	26	1120	28	30	380	12xM27	1066	-	8463.0	668.0
1000	10	AKFS-Z1	240	270	211.0	1008	1230	34	1160	28	36	430	12xM33	1068	-	8463.0	1126.0
1000	10	AKFS-Z2	240	270	211.0	998	1230	34	1160	28	36	430	12xM33	1068	-	8463.0	1126.0
1000	16	AKFS-Z1	270	300	302.0	1008	1255	42	1170	28	42	490	12xM39	1070	-	8463.0	1595.0
1000	16	AKFS-Z2	270	300	302.0	998	1255	42	1170	28	42	490	12xM39	1070	-	8463.0	1595.0
1000	25	AKFS-Z1	244	274	512.0	1008	1320	58	1210	28	56	515	12xM52	1081	-	8463.0	1908.0
1000	25	AKFS-Z2	244	274	512.0	998	1320	58	1210	28	56	515	12xM52	1081	-	8463.0	1908.0

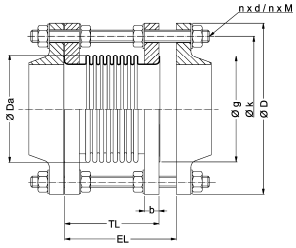
DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Tie rod		Bellows			
		AKF-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm²	N/mm
1100	6	AKFS-Z1	190	220	162.0	1112	1305	26	1240	28	33	360	8xM30	1177	-	10279.0	575.0
1100	6	AKFS-Z2	190	220	162.0	1100	1305	26	1240	28	33	360	8xM30	1177	-	10279.0	575.0
1100	10	AKFS-Z1	210	240	244.0	1112	1340	34	1270	32	36	400	12xM33	1179	-	10279.0	969.0
1100	10	AKFS-Z2	210	240	244.0	1100	1340	34	1270	32	36	400	12xM33	1179	-	10279.0	969.0
1100	16	AKFS-Z1	240	270	324.0	1112	1355	42	1270	32	42	460	12xM39	1182	-	10279.0	1578.0
1100	16	AKFS-Z2	240	270	324.0	1100	1355	42	1270	32	42	460	12xM39	1182	-	10279.0	1578.0
1100	25	AKFS-Z1	244	274	554.0	1112	1420	58	1310	32	56	515	12xM52	1189	-	10296.0	1833.0
1100	25	AKFS-Z2	244	274	554.0	1100	1420	58	1310	32	56	515	12xM52	1189	-	10296.0	1833.0
1200	6	AKFS-Z1	190	220	171.0	1212	1405	28	1340	32	33	360	12xM30	1277	-	12154.0	625.0
1200	6	AKFS-Z2	190	220	171.0	1200	1405	28	1340	32	33	360	12xM30	1277	-	12154.0	625.0
1200	10	AKFS-Z1	210	240	298.0	1212	1455	38	1380	32	39	470	12xM36	1279	-	12154.0	1054.0
1200	10	AKFS-Z2	210	240	298.0	1200	1455	38	1380	32	39	470	12xM36	1279	-	12154.0	1054.0
1200	16	AKFS-Z1	262	292	442.0	1212	1485	48	1390	32	48	540	12xM45	1282	-	12154.0	1715.0
1200	16	AKFS-Z2	262	292	442.0	1200	1485	48	1390	32	48	540	12xM45	1282	-	12154.0	1715.0
1200	25	AKFS-Z1	244	274	748.0	1212	1530	70	1420	32	56	540	16xM52	1281	-	12154.0	3201.0
1200	25	AKFS-Z2	244	274	748.0	1200	1530	70	1420	32	56	540	16xM52	1281	-	12154.0	3201.0
1300	6	AKFS-Z1	190	220	214.0	1312	1520	28	1450	32	36	380	12xM33	1377	-	14187.0	675.0
1300	6	AKFS-Z2	190	220	214.0	1297	1520	28	1450	32	36	380	12xM33	1377	-	14187.0	675.0
1300	10	AKFS-Z1	220	250	364.0	1312	1575	38	1490	32	42	435	12xM39	1379	-	14187.0	1138.0
1300	10	AKFS-Z2	220	250	364.0	1297	1575	38	1490	32	42	435	12xM39	1379	-	14187.0	1138.0
1300	16	AKFS-Z1	262	292	476.0	1312	1585	48	1490	32	48	540	16xM45	1382	-	14187.0	1852.0
1300	16	AKFS-Z2	262	292	476.0	1297	1585	48	1490	32	48	540	16xM45	1382	-	14187.0	1852.0
1300	25	AKFS-Z1	244	274	843.0	1312	1645	70	1530	32	62	550	16xM56	1381	-	14187.0	3448.0
1300	25	AKFS-Z2	244	274	843.0	1297	1645	70	1530	32	62	550	16xM56	1381	-	14187.0	3448.0
1400	6	AKFS-Z1	190	220	251.0	1412	1630	32	1560	36	32	380	12xM33	1479	-	16377.0	660.0
1400	6	AKFS-Z2	190	220	251.0	1397	1630	32	1560	36	32	380	12xM33	1479	-	16377.0	660.0
1400	10	AKFS-Z1	230	260	426.0	1412	1675	42	1590	36	42	450	16xM39	1481	-	16377.0	1113.0
1400	10	AKFS-Z2	230	260	426.0	1397	1675	42	1590	36	42	450	16xM39	1481	-	16377.0	1113.0
1400	16	AKFS-Z1	262	292	548.0	1412	1685	52	1590	36	48	540	16xM45	1484	-	16377.0	1810.0
1400	16	AKFS-Z2	262	292	548.0	1397	1685	52	1590	36	48	540	16xM45	1484	-	16377.0	1810.0
1400	25	AKFS-Z1	256	286	1002.0	1412	1755	76	1640	36	62	620	20xM56	1481	-	16377.0	3695.0
1400	25	AKFS-Z2	256	286	1002.0	1397	1755	76	1640	36	62	620	20xM56	1481	-	16377.0	3695.0
1500	6	AKFS-Z1	190	220	270.0	1520	1730	32	1660	36	32	380	12xM33	1587	-	18918.0	710.0
1500	6	AKFS-Z2	190	220	270.0	1505	1730	32	1660	36	32	380	12xM33	1587	-	18918.0	710.0
1500	10	AKFS-Z1	230	260	458.0	1520	1785	42	1700	36	42	450	16xM39	1589	-	18918.0	1195.0
1500	10	AKFS-Z2	230	260	458.0	1505	1785	42	1700	36	42	450	16xM39	1589	-	18918.0	1195.0
1500	16	AKFS-Z1	295	325	645.0	1520	1820	52	1710	36	56	560	16xM52	1593	-	18918.0	2000.0
1500	16	AKFS-Z2	295	325	645.0	1505	1820	52	1710	36	56	560	16xM52	1593	-	18918.0	2000.0
1500	25	AKFS-Z1	256	286	1100.0	1520	1865	76	1750	36	62	570	20xM56	1589	-	18918.0	3960.0
1500	25	AKFS-Z2	256	286	1100.0	1505	1865	76	1750	36	62	570	20xM56	1589	-	18918.0	3960.0
1600	6	AKFS-Z1	210	240	309.0	1623	1830	34	1760	40	36	400	16xM33	1691	-	21517.0	1014.0
1600	6	AKFS-Z2	210	240	309.0	1608	1830	34	1760	40	36	400	16xM33	1691	-	21517.0	1014.0
1600	10	AKFS-Z1	262	292	585.0	1623	1915	46	1820	40	48	540	12xM45	1693	-	21517.0	1238.0
1600	10	AKFS-Z2	262	292	585.0	1608	1915	46	1820	40	48	540	12xM45	1693	-	21517.0	1238.0
1600	16	AKFS-Z1	295	325	781.0	1623	1930	58	1820	40	56	560	16xM52	1698	-	21517.0	2139.0
1600	16	AKFS-Z2	295	325	781.0	1608	1930	58	1820	40	56	560	16xM52	1698	-	21517.0	2139.0

DN	PN	Type	Construction length		Weight (without inner sleeve)	Clear internal Ø	Flange					Tie rod		Bellows			
		AKF-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm^2	N/mm
1600	25	AKFS-Z1	272	302	1297.0	1623	1975	84	1860	40	62	620	22xM56	1692	-	21517.0	4213.0
1600	25	AKFS-Z2	272	302	1297.0	1608	1975	84	1860	40	62	620	22xM56	1692	-	21517.0	4213.0

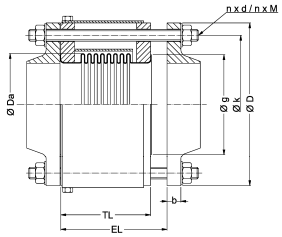
Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
Type designation:
U1 = without inner sleeve; U2 = with inner sleeve
FB = flared design, with movable flanges
FS = welded design

Type AKF-Z

with tie rods, not for underground laying



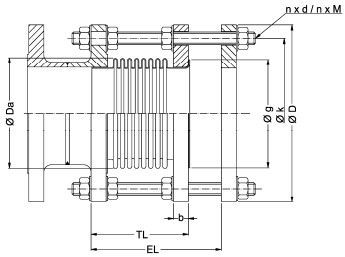
for underground laying

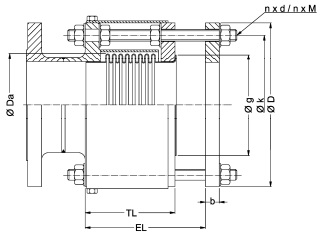


Subject to changes; latest specifications on www.boagroup.com

4.3 Disassembly joints Type AK-Z with tie rods, one side with through threaded bolt

Type AK-Z
with tie rods, one side with through threaded bolt





Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
* = welded design

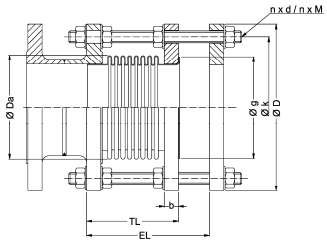
DN	PN	Type	Construction length		Weight (without inner sleeve)	Clearance Ø	Flange					Tie rod		Bellows			
		AK-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	Ø Di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm²	N/mm
80	10	AK-Z	275	325	18.5	90	200	20	160	8	18	325	4xM16	90		82.4	111.0
80	16	AK-Z	275	325	18.5	90	200	20	160	8	18	325	4xM16	90		82.4	187.0
100	10	AK-Z	275	325	22.8	112	220	22	180	8	18	325	4xM16	112		122.4	153.0
100	16	AK-Z	275	325	22.8	112	220	22	180	8	18	325	4xM16	112		122.4	153.0
125	10	AK-Z	275	325	30.4	137	250	24	210	8	18	323	4xM16	137		182.5	107.0
125	16	AK-Z	275	325	30.4	137	250	24	210	8	18	323	4xM16	137		182.5	240.0
150	10	AK-Z	325	375	38.8	165	285	24	240	8	22	381	4xM20	165		257.3	130.0
150	16	AK-Z	325	375	38.8	165	285	24	240	8	22	381	4xM20	165		257.3	254.0
175	10	AK-Z	325	375	46.1	190	315	26	270	8	22	375	4xM20	190		335.3	116.0
175	16	AK-Z	325	375	46.4	190	315	26	270	8	22	375	4xM20	190		335.3	200.0
200	10	AK-Z	325	375	52.2	215	340	26	295	12	22	371	4xM20	215		424.2	252.0
200	16	AK-Z	325	375	52.2	215	340	26	295	12	22	375	4xM20	215		424.2	382.0
250	10	AK-Z	325	375	64.6	268	395	28	350	12	22	343	4xM20	268		642.5	280.0
250	16	AK-Z	325	375	75.2	268	405	32	355	12	26	371	4xM24	268		642.5	495.0
300	10	AK-Z	325	375	73.3	318	445	28	400	12	22	343	4xM20	318		892.0	253.0
300	16	AK-Z	325	375	93.0	318	460	32	410	12	26	359	4xM24	318		892.0	1152.0
350	10	AK-Z	325	375	94.9	350	505	30	460	16	22	337	4xM20	350		1081.0	403.0
350	16	AK-Z	325	375	127.5	350	520	36	470	16	26	359	4xM24	350		1081.0	1656.0
400	10	AK-Z	350	400	119.3	400	565	32	515	16	26	396	4xM24	400		1393.0	460.0
400	16	AK-Z	350	400	161.7	400	580	38	525	16	30	388	4xM27	400		1393.0	1880.0
450	10	AK-Z	350	400	139.9	453	615	32	565	20	26	396	5xM24	453		1776.0	417.0
450	16	AK-Z	350	400	210.7	453	640	42	585	20	30	410	5xM27	453		1776.0	1721.0
500	10	AK-Z	350	400	164.9	503	670	34	620	20	26	394	5xM24	503		2173.0	1178.0
500	16	AK-Z	350	400	270.4	503	715	44	650	20	33	396	5xM30	503		2173.0	1781.0
600	10	AK-Z	375	425	210.9	604	780	36	725	20	30	419	7xM27	604		3088.0	1403.0
600	16	AK-Z	375	425	365.5	604	840	48	770	20	36	419	6xM33	604		3088.0	2120.0
700	10	AK-Z	375	425	254.8	705	895	30	840	24	30	413	8xM27	705		4174.0	1435.0
700	16	AK-Z	375	425	343.1	705	910	36	840	24	36	391	8xM33	705		4174.0	1858.0
800	10	AK-Z	425	475	346.1	807	1015	32	950	24	33	447	8xM30	807		5450.0	1105.0

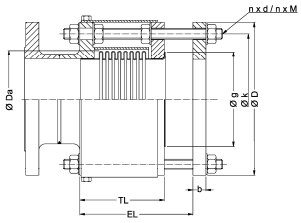
DN	PN	Type	Construction length		Weight (without inner sleeve)	Clearance Ø	Flange					Tie rod		Bellows			
		AK-Z	Standard length	Max. construction length			Outside Ø	Thickness	Hole circle Ø	Number of holes	Hole Ø	Length	Number x threads	Outside Ø	Male face Ø	Effective area of bellows	Spring rate ± 30%
			TL	EL	m	Ø Di	D	b	k	n	d	L	n x M	Ø Da	g	A_B	C_{ax}
-	-	-	mm	mm	kg	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	cm²	N/mm
800	16	AK-Z	425	475	455.9	807	1025	38	950	24	39	441	12xM36	807		5450.0	1668.0
900	10	AK-Z	425	475	406.2	908	1115	34	1050	28	33	441	10xM30	908		6867.0	1291.0
900	16	AK-Z	425	475	534.3	908	1125	40	1050	28	39	435	12xM36	908		6867.0	3267.0
1000	10	AK-Z	450	500	484.0	1010	1230	34	1160	28	36	472	10xM33	1010		8463.0	1940.0
1000	16	AK-Z	450	500	700.4	1010	1255	42	1170	28	42	450	12xM39	1010		8463.0	3250.0
*1100	10	AK-Z	450	500	590.8	1112	1340	28	1270	32	36	450	12xM33	1112		10280.0	650.0
*1100	16	AK-Z	450	500	803.3	1112	1355	42	1270	32	42	440	12xM39	1112		10280.0	785.0
*1200	10	AK-Z	500	550	728.1	1212	1455	38	1380	32	39	496	12xM36	1212		12155.0	850.0
*1200	16	AK-Z	500	550	1041.4	1212	1485	48	1390	32	48	504	12xM45	1212		12155.0	980.0

Consider the reaction force of the expansion joint: 10x cross section area = reaction force in [N/bar]
* = welded design

Type AK-Z

with tie rods, one side with through threaded bolt





Subject to changes; latest specifications on www.boagroup.com