WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

WILLBRANDT rubber expansion joints are available in two ready-to-fit versions with standard connections (according to DIN, ASA, BS, etc.):

- **Rubber sealing bead with swivel flanges**
  The sealing bead and the flange are loosely connected to each other via a special flange groove. Depending on the nominal diameter, the sealing surface protrudes approx. 1-10 mm above the flange. The counter flanges should be designed with sealing surfaces in accordance with EN 1092-1 Form A (smooth) or Form B (raised face), with the appropriate surface finish (Ra max. 12.5 µm, Rz max. 50 µm). The inner diameter of the flange must comply with EN 1092-1, type 11, or the table „Rubber bellow sealing profiles“ on page 117. If this differs, measures must be taken to compensate for the difference (see, for example, installation example EB 16 D).
- **Solid rubber flanges**
  The backing flanges lie loosely behind the solid rubber flange of the rubber bellows. For larger nominal diameters, the backing flanges may be split. The counter flanges should be designed with a sealing surface in accordance with EN 1092-1 Form A (smooth) and with the appropriate surface finish (Ra max. 12.5 µm, Rz max. 50 µm). If a sealing surface in accordance with EN 1092-1 Form B (sealing strip) is used, the solid rubber flange can be provided with a corresponding raised face compensation. The inner diameter should correspond to the nominal diameter, but special dimensions are possible. Both types of expansion joint are self-sealing; additional seals are unnecessary.

1. Planning instructions

Expansion joints must be arranged in pipes in such a way that regular maintenance and any necessary replacement can take place easily.

Ensure that the expansion joints do not rub against adjacent components also when expanded to the maximum permissible limits. The expansion joints must also not be exposed to high externally radiated or accumulated heat.

Universal expansion joints (without tie rods) for absorbing axial, lateral and angular movements

For a expansion joint to absorb the axial or lateral movements (expansion or compression) of a pipe, it must be fitted between two fixed points. Plain bearings (PB) must also be included for pipe routing/support.

The reaction forces, stiffness rates and friction forces must be taken into account in the dimensioning of the fixed points and plain bearings.

Reaction force (N) = effective area (mm²) x operating pressure (N/mm²)

F = A x P

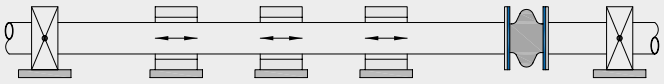
(Stiffness rates according to type data sheet)

Fitting example 1 (EB 1)

Compensation of axial expansion with expansion joints without tie rods

The reaction forces of the expansion joint are absorbed by the fixed bearings.

EB 1

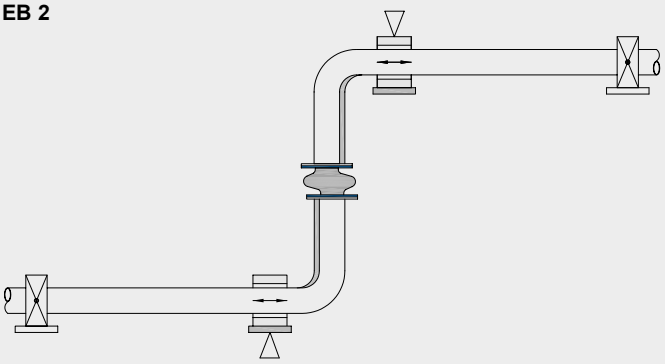


Fitting example 2 (EB 2)

Compensation of lateral and axial expansion with a expansion joint without tie rods

The reaction forces of the expansion joint are absorbed by the fixed bearings and plain bearings. The plain bearings must be appropriately supported! Stiffness rates must be absorbed by the fixed points.

EB 2



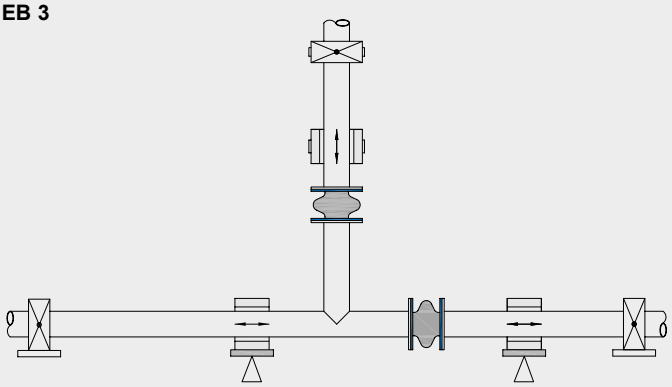
WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

Fitting example 3 (EB 3)

Compensation of lateral and axial expansion with expansion joints without tie rods arranged in a pipe outlet

The reaction forces of the expansion joint are absorbed by the fixed bearings and plain bearings. The plain bearings must be appropriately supported!

EB 3



Lateral expansion joints (with tie rods) for absorbing lateral movements

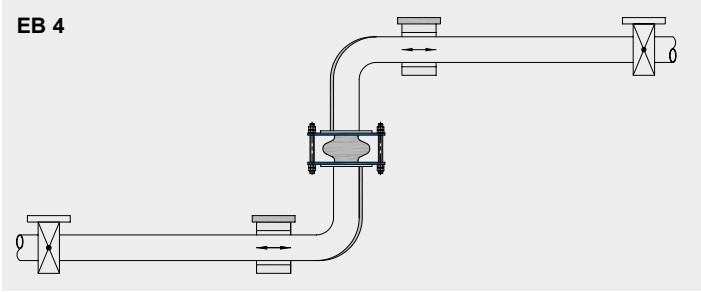
If a expansion joint for absorbing axial movements cannot be fitted between two fixed points, the axial movement must be converted into a lateral movement. This makes it possible to use an expansion joint with tie rods, which neutralises the occurring reaction forces (inside area of the expansion joint x operating pressure). With this arrangement, only appropriate plain bearings may be used for correct initiation of expansion.

Fitting example 4 (EB 4)

Compensation of axial expansion by deflection into a lateral movement with expansion joints with tie rods

The stiffness rates of the expansion joint are absorbed by the fixed bearings. The plain bearings serve only for correct initiation of movement in the expansion joint! In contrast to **EB 2**, axial movement of the vertical pipe arm is disregarded.

EB 4



Angular expansion joints (with joint tie rods) for absorbing angular movements

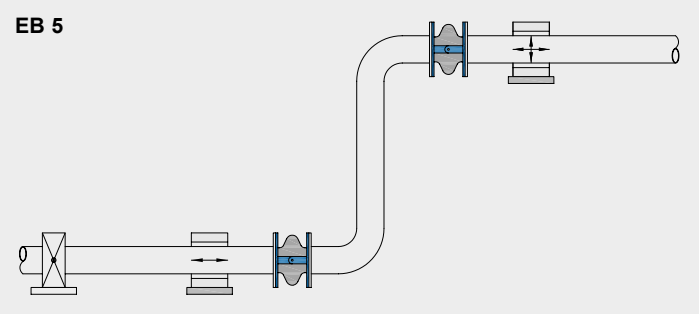
In order to absorb significant axial movements with low stiffness rates, a combination of angular expansion joints with tie rods can be used.

Fitting example 5 (EB 5)

Compensation of axial expansion by deflection to angular movement using expansion joints with tie rods

Advantage: significant axial expansion can be absorbed by only two expansion joints. The reaction forces of a expansion joint are absorbed by the joint tie rods. The plain bearings serve only for correct initiation of movement in the expansion joint!

EB 5

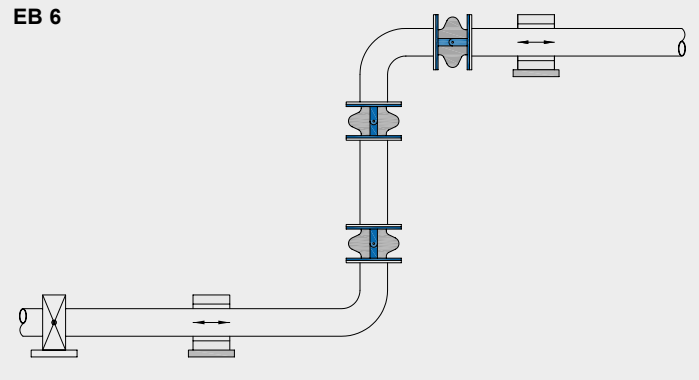


Fitting example 6 (EB 6)

Arrangement of pipe joint expansion joints in three joint systems for compensating expansion in two directions

Advantage: high expansion compensation, low stiffness rates, soft corner. The reaction forces of the expansion joint are absorbed by the joint tie rods. The plain bearings serve only for correct initiation of movement in the expansion joint!

EB 6



WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

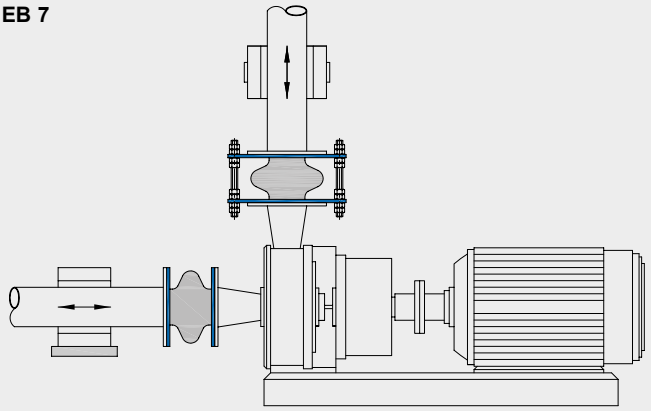
Fitting example 7 (EB 7)

Expansion joints for pump connection (with/without tie rods) for absorbing vibrations

The purpose of using rubber expansion joints on pumps is to prevent the transmission of forces, stresses and vibrations in order to decouple the piping system from the pump.

Expansion joints with tie rods should always be used for arrangement in pressure pipes to prevent the pump support from being overloaded due to the reaction forces. A vacuum supporting ring should be used on the suction side if possible (see type data sheet).

EB 7

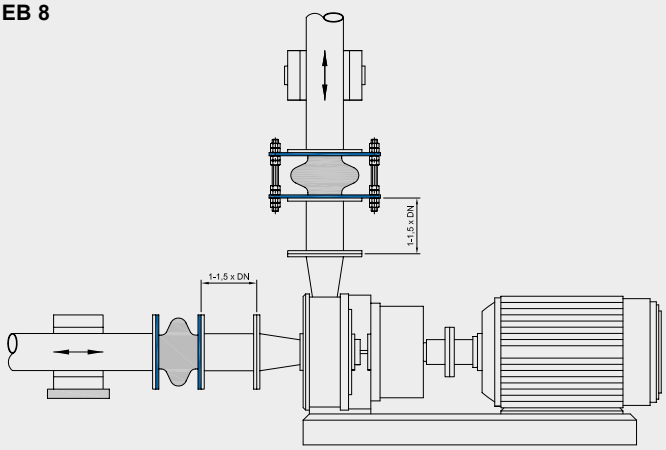


Fitting example 8 (EB 8)

For the transport of abrasive media (liquids containing solids such as water/sand), the expansion joints must not be arranged directly on the pump support (suction/pressure side) as there is a risk of the expansion joints being damaged due to relatively high velocities from turbulence and vortex formation on the pump support. This applies similarly to elbows and outlets.

The fitting distance from the pump support to the expansion joint/elbow must be 1 to 1.5 times greater than the nominal diameter. Pump operation against a fully or partly closed gate or flap valve must be avoided. Cavitation must also be avoided as this can quickly damage the expansion joint.

EB 8



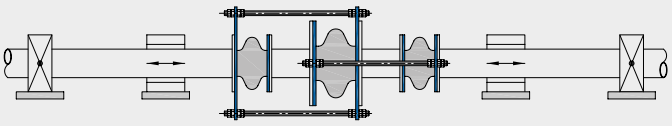
Fitting example 9 (EB 9)

Expansion joints with pressure relief for absorbing axial and lateral movement

Pressure-relieved expansion joints can be used to prevent the transmission of reaction forces resulting from excess or low pressure to adjacent fixed bearings, apparatus or machines.

Expansion joints for absorbing axial expansion without the transmission of reaction forces resulting from excess or low pressure to adjacent fixed bearings, apparatus or machines (observe stiffness rates).

EB 9

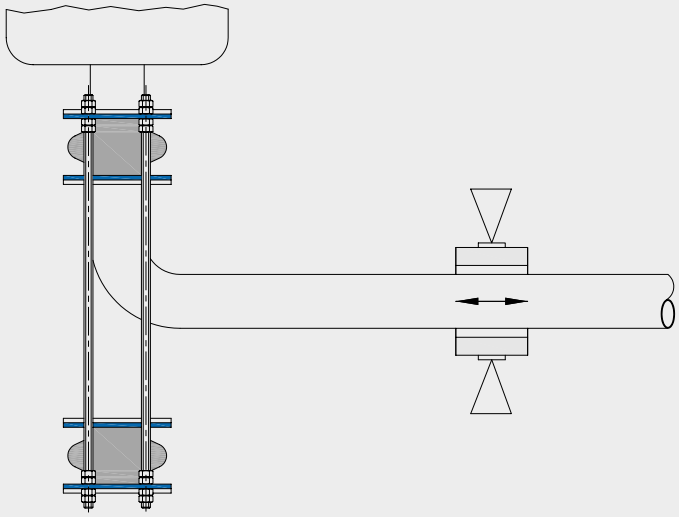


WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

Fitting example 10 (EB 10)

Expansion joints for absorbing axial and lateral expansion on an elbow without the transmission of reaction forces resulting from excess or low pressure to adjacent fixed bearings (stiffness rates).

EB 10



Expansion joints (with tie rods) for fitting/removal

To compensate for fitting inaccuracies or for easy fitting or removal, a expansion joint with tie rods can also be mounted directly on a valve.

Fitting example 11 (EB 11)

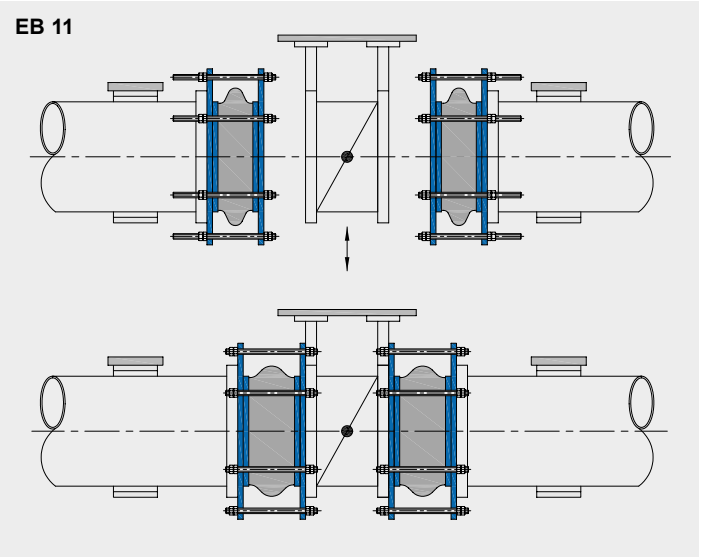
Expansion joint with tie rods for fitting/removal

Tie rods prevent the transmission of reaction forces to a connected valve and by loosening the flange connection with the aid of the tie rod flange, the rubber bellow can be compressed to its maximum axial limits to enable removal of the valve.

Warning:

This is valid only for expansion joints with pressure-resistant solid rubber flanges. In case of expansion joints with swivel flanges there is a danger that the bellow sealing bead could spring out of the flange groove. This could lead to lead to the sealing surfaces being crushed during re-fitting (see **EB 16 F**).

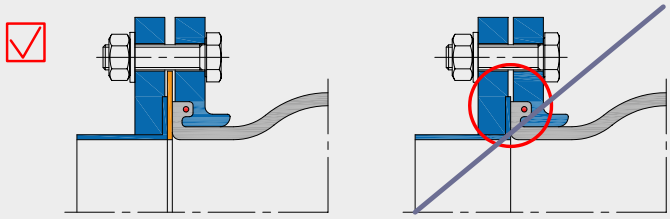
EB 11



Fitting example 12 (EB 12)

For rubberised pipes or valves, a blank gasket must be used to prevent a rubber-on-rubber seal.

EB 12



WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

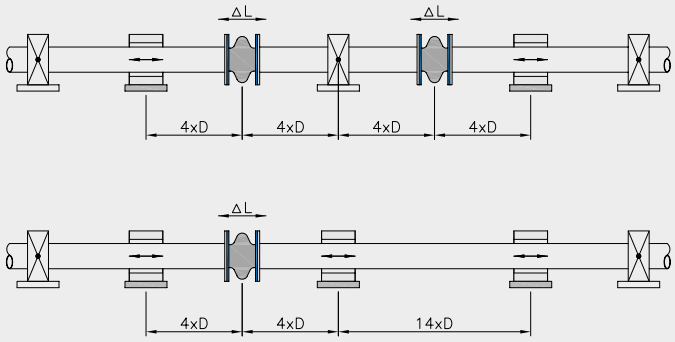
2. Pipe planning

Arrangement of guide bearings

The fixed points and guide bearings must be arranged so that:

- the expansion joint is not subject to loading from the weight of the pipe.
- bending caused by the arrangement of the fixed and floating bearings is avoided.
- suspension in self-aligning bearings is avoided. Plain or roller bearings should be used as a guide bearings.

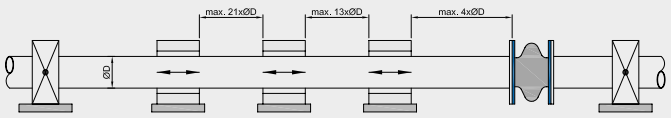
EB 13 A



Spacing of the guide bearings

- The distance between the expansion joint and the first bearing can be max. 4 x the pipe diameter.
- The distance between the first and the second bearing can be max. 14 x the pipe diameter.
- The distance between the remaining pipe bearings can be max. 21 x the pipe diameter. This distance must be reduced if necessary due to the inherent stability of the pipe.

EB 13 B



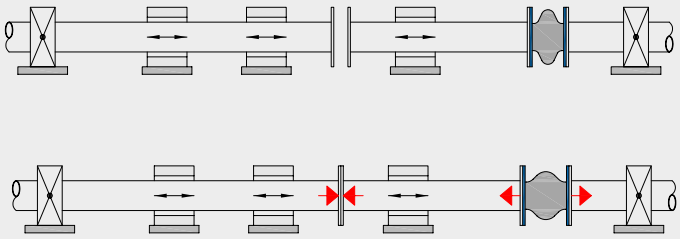
Initial tension of expansion joints

If a expansion joint is fitted with an initial tension greater than 5 mm axially or 5 mm laterally, the expansion joint must be fitted first and then the appropriate initial tension must be generated with the permanently fitted expansion joint at an open point in the pipe. **(Fitting example EB 14 + 15)**

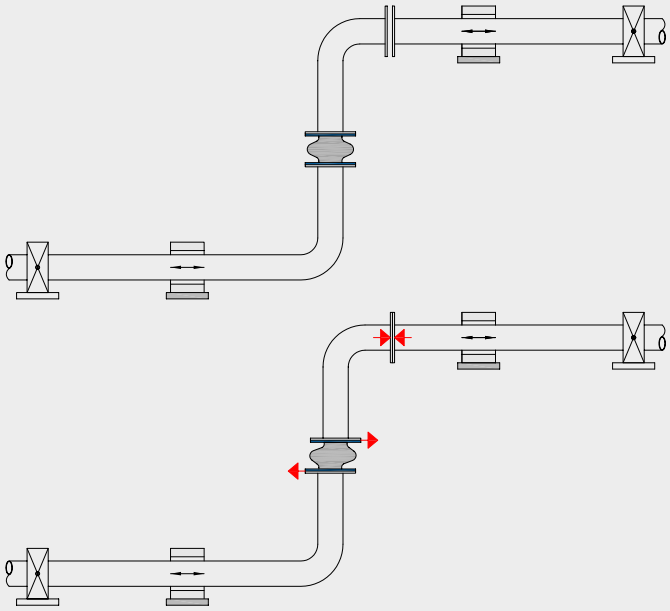
Reason: An as yet unfitted expansion joint with a higher initial tension will cause the sealing bead to spring out of the groove of the steel flange. This could damage the sealing bead or cause a leak.

For planning purposes, ensure that the pipe can be opened!

EB 14



EB 15



WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

3. Safety measures

Excess pressure, temperature rise, vacuum
Protect pipes against impermissible excess pressure, excessive temperature rise and uncontrolled vacuum. The limiting values are shown in the data sheets of our catalogue.

Water hammer and vacuum drop
Draining and venting options are provided to prevent water hammer and vacuum drop.

Resistance
The inner material of the bellow that comes into contact with the medium must be suitable for the medium transported in the pipe (see our resistance list). If the list does not contain a specific medium, we should be provided with appropriate data from the safety data sheet for chemical substances and preparations according to DIN 52900, Clauses 1 to 2.13 in order to allow us to determine whether the inner liner of the expansion joint is suitable.

Flow rate
With rubber and PTFE expansion joints, care must be taken to ensure that the permissible maximum flow rates are not exceeded. Permissible flow rates of many media without solids content:

- for rubber expansion joints 4 or 5 m/sec.
- for rubber expansion joints with PTFE lining 3 m/sec.

If higher flow rates are required, we recommend using a guide sleeve. For media containing solids, we always recommend a guide sleeve for reasons of wear.

When using guide sleeves, make sure that the standard guide sleeves are designed for lateral ± 5 mm. If higher lateral values are required, the guide sleeves must be reduced in size to twice the lateral steering value.

Vacuum supporting spiral/ring
In most cases, the expansion joint must be equipped with a vacuum supporting spiral or a vacuum supporting ring. These prevent the bellows from collapsing.For use directly downstream of a pump, flap valve or elbow, a check must be made to ensure correct positioning after fitting.

External influences
Extreme external influences make it necessary to protect the expansion joints via special measures:

- **Ground protection cover:** protects against damage to bellows, fouling and earth pressure on buried pipes.
- **UV protection cover:** protects against UV radiation and influences of weather in regions exposed to extreme sunlight.
- **Flame-retardant protective cover:** protects against fire up to 800 °C for 30 minutes.

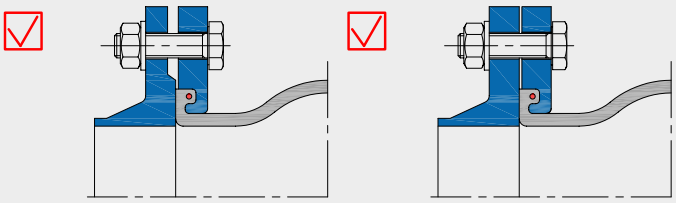
Dangerous media
The expansion joints must be provided with suitable splash protection for pipes used for transporting dangerous or environmentally harmful media.

Counter flanges / Flange connection
Counter flanges and flange connections must be as described in **Fitting example 16 A - F (EB 16..)** to ensure a reliable sealing and to prevent damage to the rubber expansion joints.

Fitting example 16 (A - E)

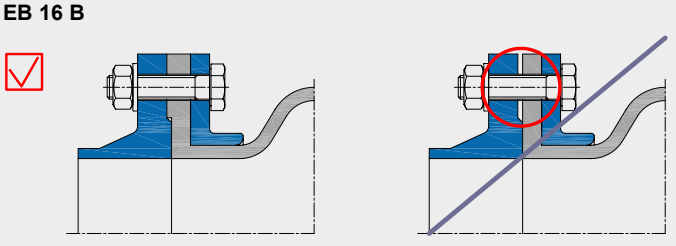
For expansion joints with rotating flanges, counter flanges with and without raised face in accordance with EN 1092-1:2001 Form A or B can be used (EB 16 A). The inner diameter of the flange must comply with EN 1092-1, type 11, or the table „Rubber bellow sealing profiles“ on page 117. For expansion joints with full flanges, only smooth counter flanges (Form A) should be used. However, if the flange is designed with a sealing surface EN 1092-1 Form B (sealing strip), the solid rubber flange can be provided with a corresponding sealing strip compensation. Other forms are available on request.

EB 16 A



If a smooth flange cannot be used for expansion joints with solid rubber flanges, the recess of the counter flange must be compensated with a sealing with an appropriately thick ring or taken into account in rubber flange fabrication.

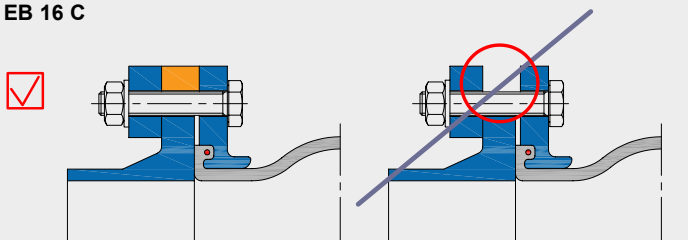
EB 16 B



WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

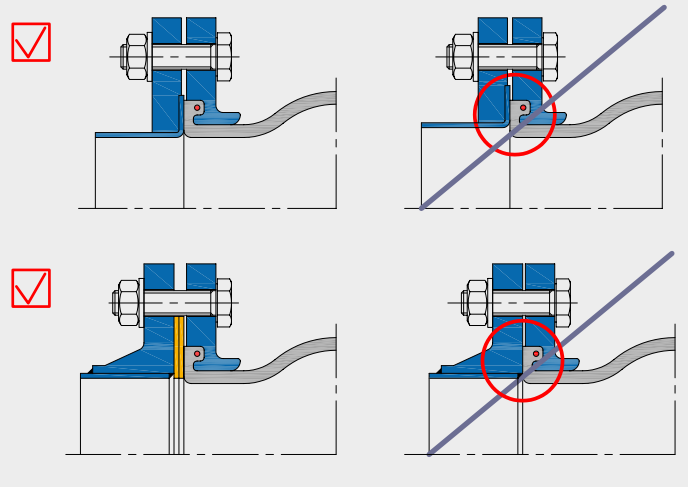
When using loose flanges with thick bead, the gap above the bolts between both flanges must be filled with an appropriate ring. This stops the loose flange from tilting and thus prevents incorrect contact with the sealing surface!

EB 16 C



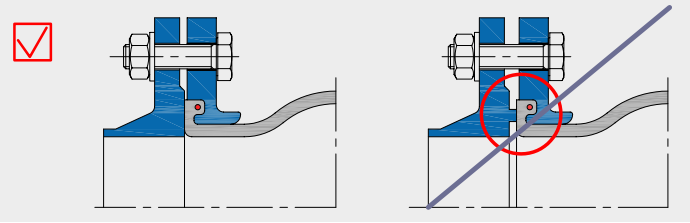
When using flare flanges and slip-on flanges, ensure that the internal diameter of the sealing surface of the counter flange corresponds to the internal diameter of the bellow. If this is not the case and the internal diameter of the counter flange is larger, a blank metal gasket and an additional sealing must be used!

EB 16 D



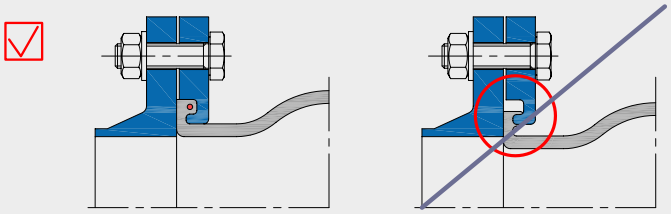
Counter flanges with a groove or tongue must not be used.

EB 16 E



Ensure during fitting that the rubber bead is located correctly in the groove of the expansion joint flange, otherwise the sealing surface may be damaged and leaks can occur!

EB 16 F



4. Packaging

- Check the packaging for external damage.
- Check the contents against the delivery note or packing list.
- If possible, do not unpack the expansion joints before fitting.
- Only open the packaging with a blunt object.
- Ensure that nails or staples in wooden crates do not come into contact with the rubber bellow.

5. Storage

See DIN 7716 - Guidelines for the storage of rubber parts:

- Rubber expansion joints must be stored without being subject to stress, deformation or kinking.
- Rubber expansion joints with steel flanges must be stored upright on the flanges (otherwise there is a risk of crushing).
- Store in a cool, dry, dust-free and moderately ventilated room.
- Protect rubber parts against draughts and cover if necessary. Ozone-generating equipment such as electric motors, fluorescent light sources, etc., must not be used at the place of storage.
- Do not store any solvents, fuels, chemicals or similar together with the expansion joints.

WILLBRANDT **Planning and Maintenance Instructions for Rubber Expansion Joints with Swivel Flanges or Solid Flanges**

6. Transport

- Leave the parts packed.
- Note „TOP“ at the top and „cable or lifting hook“.
- Steel backing rings (with bracing) and rubber expansion joint flanges must remain fastened until final fitting to avoid excessive loads on the rubber part!
- Do not use any sharp-edged tools, wire ropes, chains or lifting hooks (risk of damage to rubber).
- Always lift both steel flanges simultaneously. Shackle at both sides or place padded tie-bars through the expansion joint.
- For ground level transportation without means of transport, roll the expansion joint on the flanges.

7. Maintenance and inspection instructions

After installing the rubber expansion joints according to our installation instructions, the following points should be included in the annual inspection:

- Check the installation position of the rubber expansion joint, i.e. the permissible combined axial and lateral expansion should not be exceeded.

  Reason: Pipe movement due to loose fixed points or plain bearings.
- Check for external damage to rubber and tie rods.
- Assess corrosion and wear on the entire component.
- Check rubber bellow for blistering.

  Reason: Minor damage to the inner bellow can lead to media reaching the cover via the reinforcement, which causes minor blistering.
- Check the bellow behind the swivel flanges for circumferential cracks.

  Reason: Overexpansion can lead to cracks on the outer cover at the end of the continuous reinforcement. If these cracks are deeper than 2 mm, we recommend replacing the bellow.
- Check the surface of the bellow for hairline cracks.

  Reason: External influences and incorrect media cause the cover to harden.

  Assessment: If these surface cracks are only superficial, they must be recorded (surface photo).

  The cracks should be re-assessed during the next annual inspection. If there are only minor changes, maintenance can take place at the time of the next inspection. If the cracks are deeper than 1.5 mm, the cover must be replaced.
- Check the bellow for hardening. This can be achieved using an impression test, e.g. by pressing the edge of a coin into the rubber. If the rubber is elastic, the notch will disappear; if it is hard, the notch will remain.

  A conclusive assessment using a Shore hardness test must be made to determine whether a expansion joint must be quickly replaced. The hardness should not exceed 80 to 84 Shore.

Normally, rubber expansion joints are maintenance-free - in cooling water systems and water operation a service life of 15 to 20 years can be expected. In oil and fuel plants, expansion joints should be replaced after 5 years and in chemical plants they should be replaced after 10 years.

If in doubt, we recommend that you send us photos of the relevant expansion joints for better assessment. Our expert staff will make an assessment.

8. Electrical conductivity

In case of rubber expansion joints, ensure that the expansion joints are either insulated, conduct electricity or have surface conductivity.

The values mentioned in our catalogue for the different qualities of rubber expansion joint relate to the inner, i.e. the rubber surface in contact with media. The following should be observed:

- **Range I**
  Electrically conductive - specific resistance $R \leq 10^4$ Ωcm
- **Range II**
  Electrically dissipative - specific resistance $R \geq 10^5$ up to 10^8 Ωcm
- **Range III**
  Electrically insulating - specific resistance $R \geq 10^9$ Ωcm

WILLBRANDT **Attachments for Planning and Maintenance Instructions**

Threaded bolts and hexagon nuts for fastening expansion joints to welding neck flange according to DIN EN 1092-1 type 11 for type 39, 48, 50, 51, 52 and 55 (with through holes)

DN	PN 6			PN 10			PN 16		
	Quantity	Size	Length mm	Quantity	Size	Length mm	Quantity	Size	Length mm
20	8	M10	45	8	M12	55	8	M12	55
25	8	M10	50	8	M12	55	8	M12	55
32	8	M12	50	8	M16	55	8	M16	60
40	8	M12	50	8	M16	55	8	M16	60
50	8	M12	50	8	M16	60	8	M16	60
65	8	M12	50	16	M16	60	16	M16	60
80	8	M16	60	16	M16	65	16	M16	65
100	8	M16	60	16	M16	65	16	M16	65
125	16	M16	60	16	M16	65	16	M16	70
150	16	M16	65	16	M20	75	16	M20	75
200	16	M16	70	16	M20	80	24	M20	75
250	24	M20	75	24	M20	80	24	M24	85
300	24	M20	75	24	M20	80	24	M24	90
350	24	M20	75	32	M20	80	32	M24	90
400	32	M32	80	32	M24	90	32	M27	100
450	32	M32	85	40	M24	100	40	M27	110
500	40	M40	90	40	M24	100	40	M30	110
600	40	M40	90	40	M27	100	40	M33	120
700	48	M10	100	48	M27	110	48	M33	120
800	48	M27	110	48	M30	120	48	M36	130
900	48	M27	110	56	M30	120	56	M36	130
1000	56	M27	110	56	M33	120	56	M39	140

1 set = ISO 4017 hexagonal bolts + ISO 4032 hexagonal nuts + ISO 7089 U-washers

Warning: Refer to the tightening scheme!

Screw length for type 60 WRG with counter flanges DIN EN 1092-1, type 11 and type 13

DN	Screws DIN 931/933 with U-washers DIN 125
20	M12 x 35
25	M12 x 35
32	M16 x 35
40	M16 x 35
50	M16 x 40
65	M16 x 40
80	M16 x 40
100	M16 x 40
125	M16 x 40
150	M20 x 40
200	M20 x 45

WILLBRANDT **Attachments for Planning and Maintenance Instructions**

Threaded bolts for fastening expansion joints to welding neck flanges according to DIN EN 1092-1 type 11 for type 49

For connecting Type 49 expansion joints to the pipework sorted bolt packages (SU) are available. This ensures that when using welding neck flanges to DIN EN 1092-1 type 11, the bolts align flush with the expansion joint flange towards the expansion joint bellow (if the bolts are too long, washers can be used to achieve a flush fit).

Corresponding bolt pack (DIN)

	PN 6	PN 10	PN 16
DN 32	SU 1	SU 2	SU 2
DN 40	SU 1	SU 2	SU 2
DN 50	SU 1	SU 3	SU 3
DN 65	SU 1	SU 5	SU 5
DN 80	SU 4	SU 7	SU 7
DN 100	SU 4	SU 7	SU 7
DN 125	SU 5	SU 6	SU 6
DN 150	SU 6	SU 10	SU 10
DN 175	SU 6	SU 10	SU 10
DN 200	SU 8	SU 10	SU 11
DN 250	SU 9	SU 13	SU 17
DN 300	SU 11	SU 14	SU 18
DN 350	SU 12	SU 15	SU 19
DN 400	SU 15	SU 19	SU 21
DN 500	SU 16	SU 20	SU 22

Contents

Bolt pack	kg	Qty	Bolts ISO 4017	Qty	U-washers Ø
SU 1	0,35	8	M 12X30	8	13
SU 2	0,62	8	M 16X30	8	17
SU 3	0,67	8	M 16X35	8	17
SU 4	0,68	8	M 16X35	16	17
SU 5	1,40	16	M 16X35	16	17
SU 6	1,50	16	M 16X40	16	17
SU 7	1,55	16	M 16X40	32	17
SU 8	2,60	16	M 16X45	16	17
SU 9	2,40	24	M 16X45	48	17
SU 10	2,70	16	M 20X45	16	21
SU 11	4,10	24	M 20X45	24	21
SU 12	4,20	24	M 20X45	48	21
SU 13	4,30	24	M 20X50	48	21
SU 14	4,20	24	M 20X50	24	21
SU 15	5,80	32	M 20X50	64	21
SU 16	7,30	40	M 20X50	80	21
SU 17	6,70	24	M 24X50	48	25
SU 18	6,60	24	M 24X50	24	25
SU 19	9,30	32	M 24X55	64	25
SU 20	11,70	40	M 24X55	80	25
SU 21	13,50	32	M 27X60	64	28
SU 22	22,00	40	M 30X60	80	31

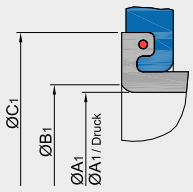
Pressure units

Unit symbol	Unit name	Pa = N/m²	bar	m WS	Torr = mm Hg	lbf/in²	in Hg
1 Pa = 1 N/m²	Pascal	1	0.00001	0.0001	0.0075	0.00014	0.000295
1 bar	bar	100000	1	10.1972	750.062	14.5037	29.53
1 kp/m² = 1 mm WC	millimetre water column	9.80665	-	0.001	0.07356	0.00142	0.0029
1 m WC	metre water column	9806.65	0.09807	1	73.5559	1.42233	2.8959
1 kp/cm² = 1 at	technical atmosphere	98066.5	0.98067	10	735.559	14.2233	28.959
1 atm	physical atmosphere	101325	1.01325	10.3323	760	14.696	29.9213
1 Torr = 1 mm Hg	millimetre of mercury	133.322	0.00133	0.013595	1	0.01934	0.03937
1 lbf/in²	pound-force per square inch	6894.76	0.06895	0.70307	51.7149	1	2.03602
1 lbf/ft²	pound-force per square foot	47.8803	0.00048	0.00488	0.35913	0.00694	0.01414
1 in Hg	inch of mercury	3386.39	0.03386	0.34532	25.4	0.49115	1

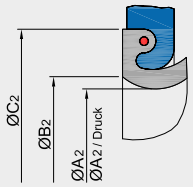
WILLBRANDT **Attachments for Planning and Maintenance Instructions**

Rubber bellow sealing profiles for expansion joints with swivelling flanges

When selecting a counter flange it is important to ensure that the internal diameter only exceeds measurement B (rubber bellow) by 2 mm. If the internal diameter is larger, it is necessary to use an adapter disc (see fitting example **EB 16 D**).



Type 50
Type 55
Type 55 SO



Type 49
Type 49 S
Type 51
Type 52

Permissible degree of utilisation rate of the movement areas types 39, 46, 48, 49, 50, 51, 52, 55, 55 SO and 61

Color code	Utilisation rate in % at temperatures up to				
	50 °C	60 °C	70 °C	90/100 °C	130 °C
red SP	100 %	-	75 %	-	50 %
red	100 %	-	80 %	60 %	-
yellow	100 %	-	80 %	60 %	-
white	100 %	-	80 %	60 %	-
green	100 %	-	80 %	60 %	-
orange	100 %	-	80 %	60 %	-
black CR	100 %	-	80 %	60 %	-
black EPDM	100 %	-	80 %	60 %	-
yellow LT	100 %	-	80 %	60 %	-
yellow ST	100 %	100 %	-	60 %	-
yellow HNBR	100 %	100 %	-	60 %	-

DN	for type 50 and type 55 / 55 SO				for type 49				for type 51 and type 52		
	C1	B1	A1	A1/ pressure	C2	B2	A2	A2/ pressure	C2	B2	A2*
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
20	66	37	28.5	30	-	-	-	-	-	-	-
25	66	37	28.5	30	-	-	-	-	-	-	-
32	66	37	28.5	30	79	42	35	37	79	38	32/26
40	74	42	36.0	39	79	42	35	37	79	38	32/26
50	86	55	45.0	48	89	57	45	47	89	45	39/33
65	106	71	60,5	64	104	69	59	61	104	56	51/47
80	118	81	74.0	77	119	86	75	77	119	70	68/62
100	138	106	94.0	98	142	110	98	100	142	93	87/83
125	166	132	121.0	125	169	137	125	127	169	120	115/110
150	192	160	147.0	151	195	164	149	151	195	146	139/135
175	252	213	202.0	206	245	200	197	200	-	-	-
200	252	213	202.0	206	245	200	197	200	245	193	188/185
250	304	257	250.0	254	295	256	252	255	295	247	244
300	354	309	300.0	304	345	304	299	302	346	298	296/293
350	412	350	330.0	340	396	358	354	357	-	-	-
400	470	414	404.0	408	450	405	402	405	-	-	-
450	520	445	445.0	450	-	-	-	-	-	-	-
500	570	514	504.0	508	550	508	504	507	-	-	-
600	675	611	603.0	607	-	-	-	-	-	-	-
700	780	708	680.0	695	-	-	-	-	-	-	-
750	820	758	751.0	755	-	-	-	-	-	-	-
800	887	813	801.0	805	-	-	-	-	-	-	-
900	987	907	897.0	900	-	-	-	-	-	-	-
1000	1087	1007	997.0	1000	-	-	-	-	-	-	-

* When designing guide sleeves, the second, smaller value must be used as the basis.

Tolerances according to the FSA handbook for handmade expansion joints types 39, 40, 42, 56, 57, 58, 59, 61, 62, 63 and 64

DN	Internal dimension	External flange dimension	Pitch circle diameter	Hole diameter	Length				Flange thickness			Flange hole alignment	
					≤ 150	≤ 300	≤ 600	> 600	≤ 10	≤ 15	>15	L ≤ 350	LF ≤ 350
≤ 550	±5	±6	±5	±2	±5	±5	±5	±1,0 %	±2	±3	±4	±3	±5
> 550 - ≤ 1150	±10	±13	±5	±2	±5	±5	±5	±1,0 %	±2	±3	±4	±3	±5
> 1150 - ≤ 1750	±10/-12	±19/-13	±6	±2	±6	±10	±10	±1,5 %	±2	±4	±4	±4	±6
> 1750	±10/-16	±25/-14	±6	±2	±6	±10	±10	±1,5 %	±2	±4	±4	±4	±6