

WILLBRANDT Planning, Installation 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 125. 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 an 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)

$$F = A \times P$$

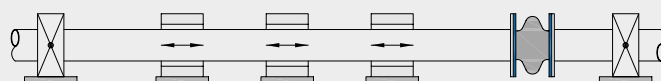
(Stiffness rates according to type data sheet)

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

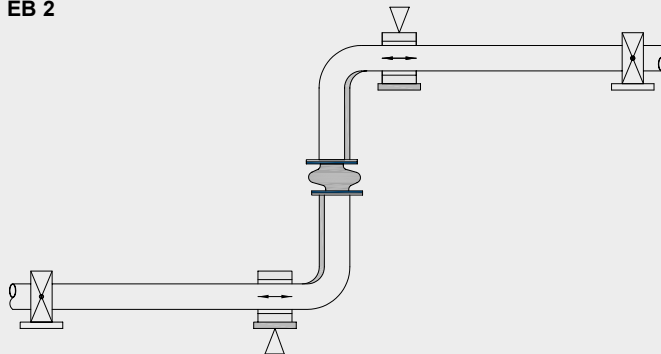


Fitting example 2 (EB 2)

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

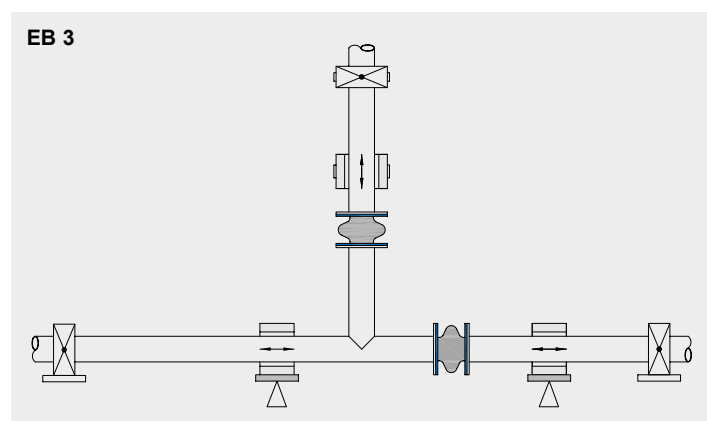


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Fitting example 3 (EB 3)

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!



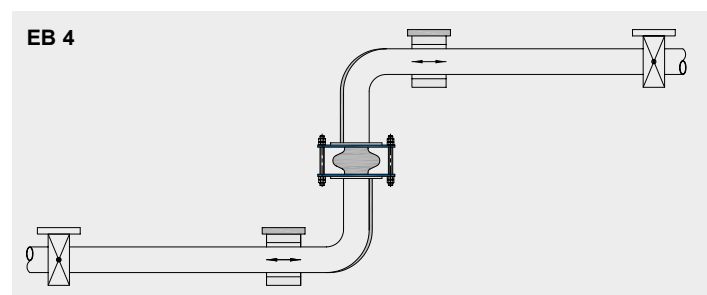
Lateral expansion joints (with tie rods) for absorbing lateral movements

If an 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.



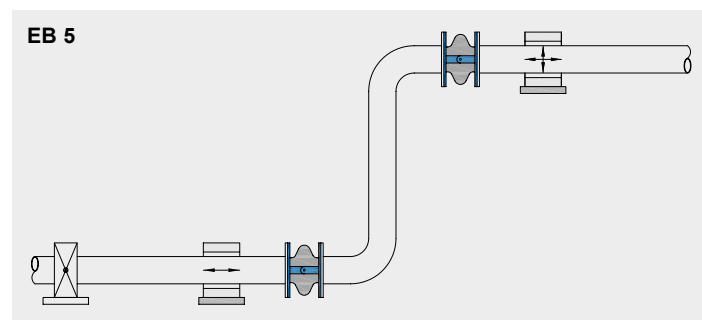
Angular expansion joints (with joint tie rods) for absorbing angular movements

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

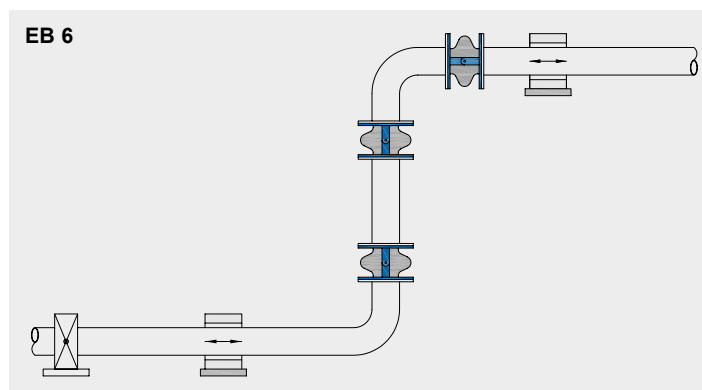
Advantage: significant axial expansion can be absorbed by only two expansion joints. The reaction forces of an expansion joint are absorbed by the joint tie rods. The plain bearings serve only for correct initiation of movement in the expansion joint!



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!



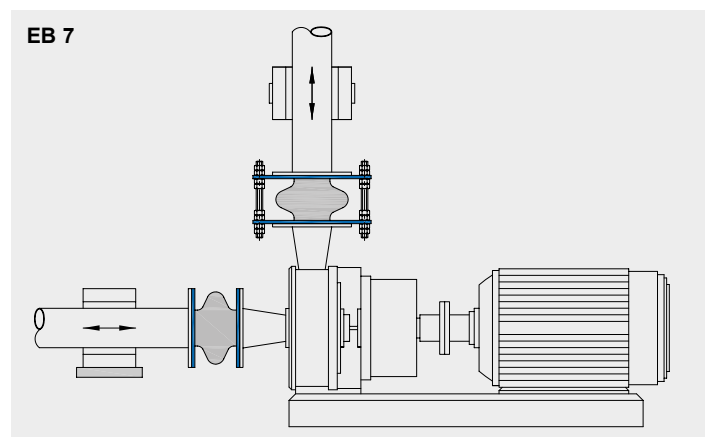
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Fitting example 7 (EB 7)

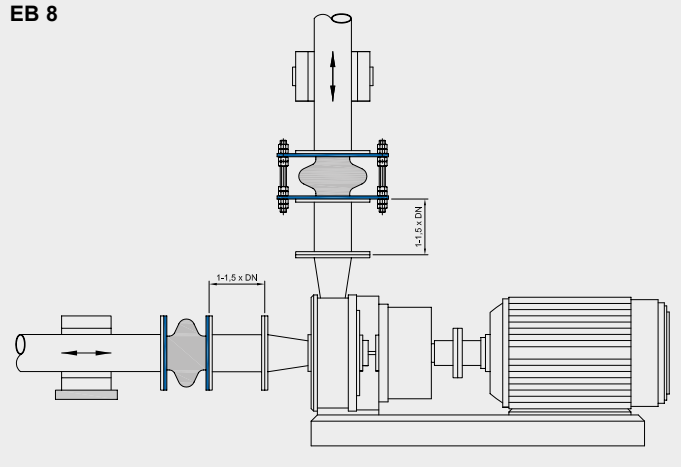
Expansion joints for pump connection (with/without tie rods) for absorbing vibrations

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 8



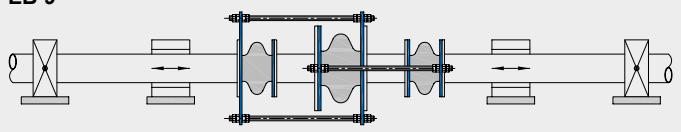
Fitting example 9 (EB 9)

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



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.

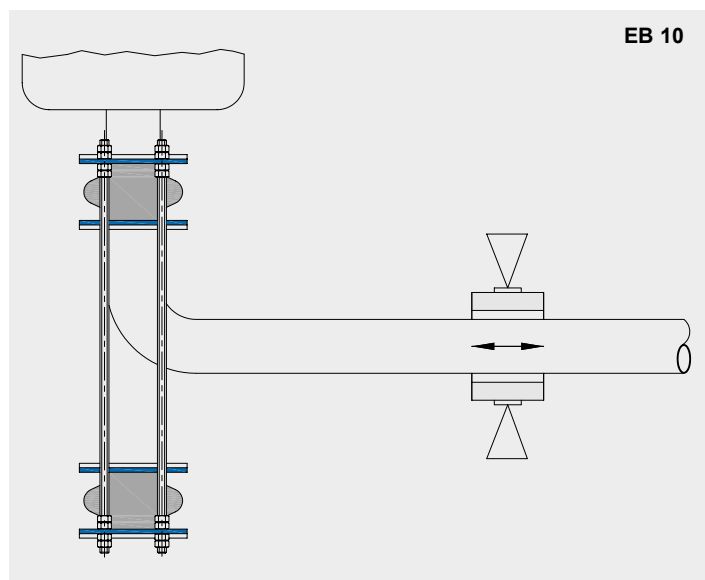
The fitting distance from the pump support to the expansion joint/elbow must be 1 to 1.5 times greater than the nominal diameter. Pump operation against a fully or partly closed gate or flap valve must be avoided. Cavitation must also be avoided as this can quickly damage the expansion joint.



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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).



Expansion joints (with tie rods) for fitting/removal

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

Fitting example 11 (EB 11)

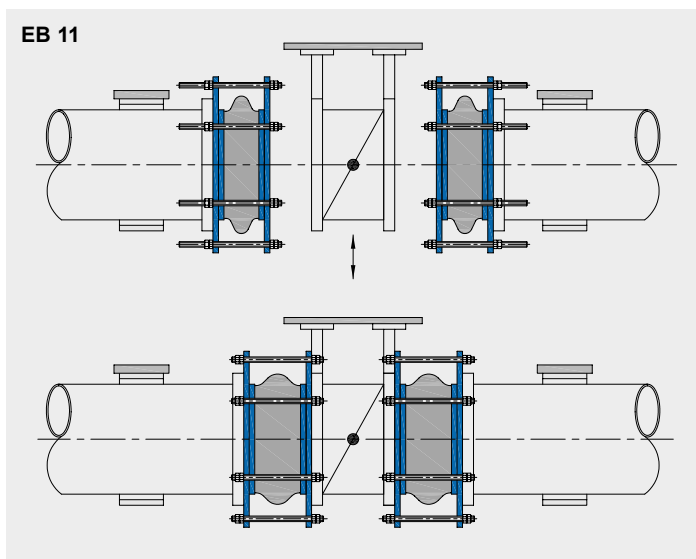
Expansion joint with tie rods for fitting/removal

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 the sealing surfaces being crushed during re-fitting (see **EB 16 F**).

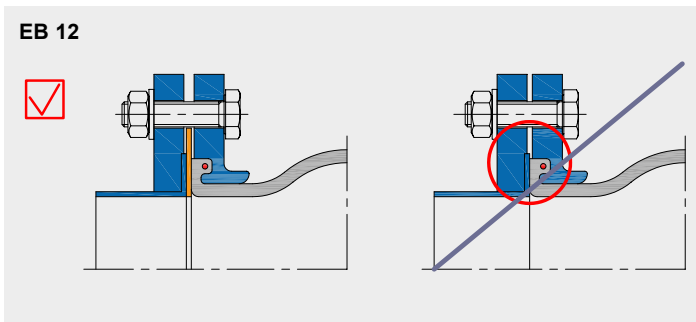
EB 11



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



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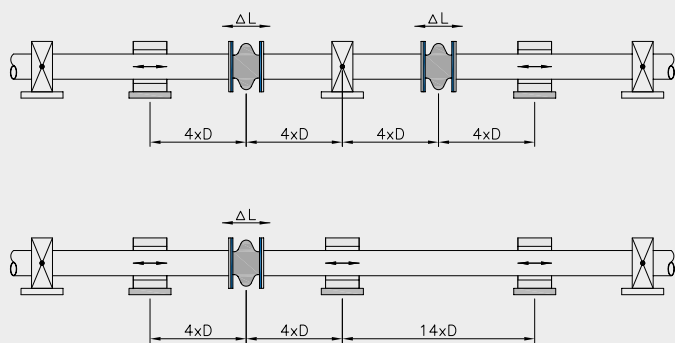
2. Pipe planning

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.

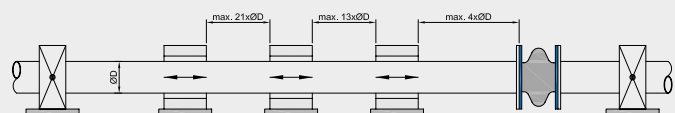
EB 13 A



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



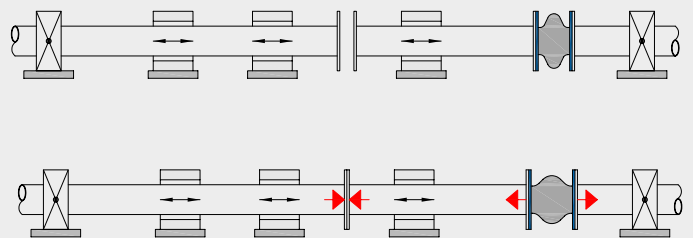
Initial tension of expansion joints

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. (See EB 14 + 15)

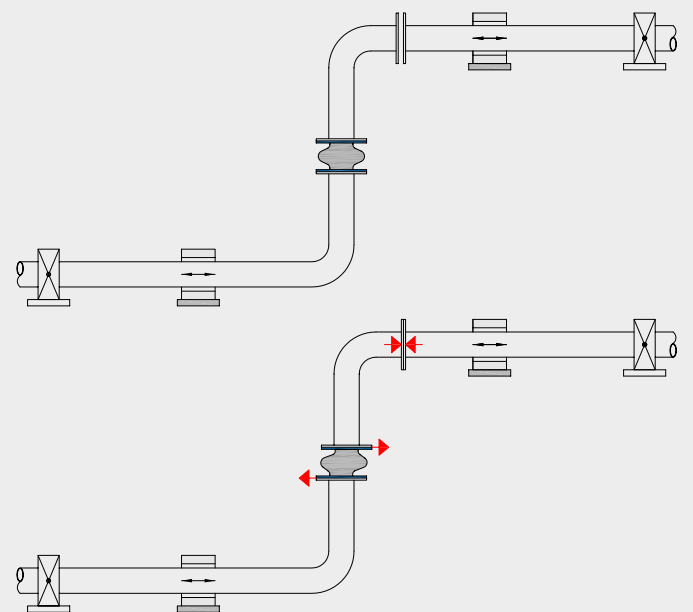
Reason: An as yet unfitted expansion joint with a higher initial tension will cause the sealing bead to spring out of the groove of the steel flange. This could damage the sealing bead or cause a leak.

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

EB 14



EB 15



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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

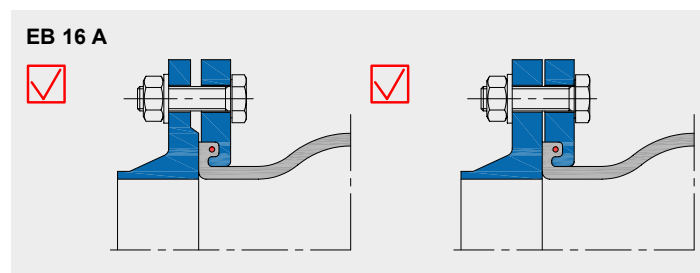
The expansion joints must be provided with suitable splash protection for pipes used for transporting dangerous or environmentally harmful media.

Counter flanges / Flange connection

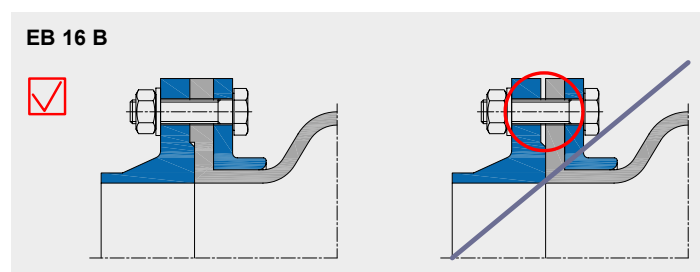
Counter flanges and flange connections must be as described in **Fitting example 16 A - F (EB 16..)** to ensure a reliable sealing and to prevent damage to the rubber expansion joints.

Fitting example 16 (A - F)

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 125. For expansion joints with full flanges, only smooth counter flanges (Form A) should be used.

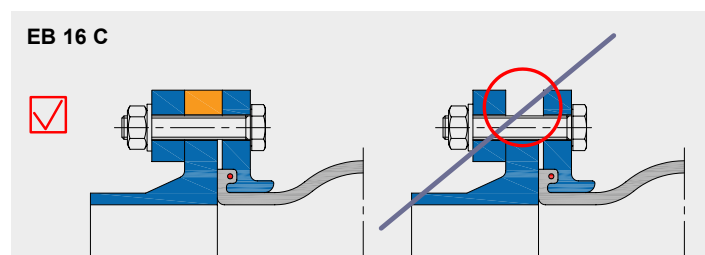


However, if the flange is designed with a sealing surface EN 1092-1 Form B (sealing strip), the solid rubber flange can be provided with a corresponding sealing strip compensation or compensated for by a ring of appropriate thickness. Other forms are available on request.

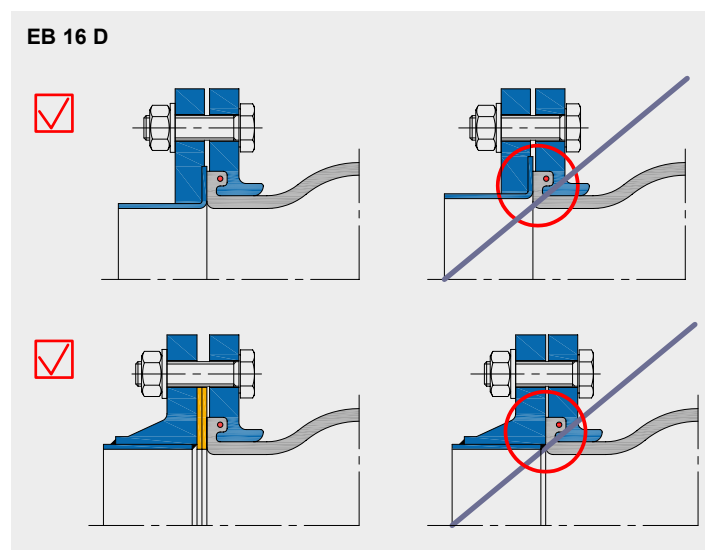


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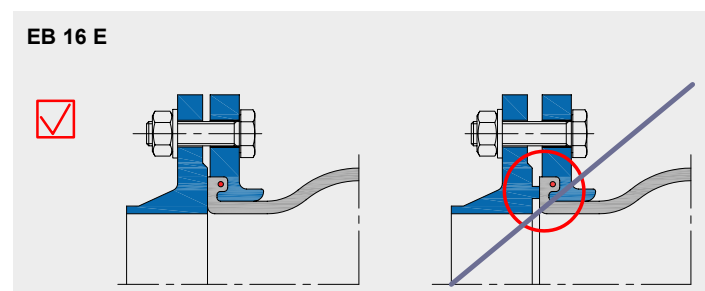
When using loose flanges with thick bead, the gap above the bolts between both flanges must be filled with an appropriate ring. This stops the loose flange from tilting and thus prevents incorrect contact with the sealing surface!



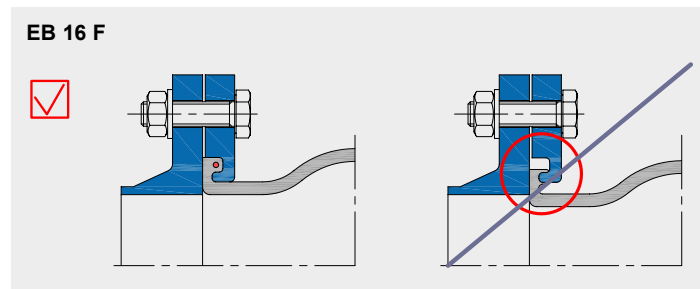
When using flare flanges and slip-on flanges, ensure that the internal diameter of the sealing surface of the counter flange corresponds to the internal diameter of the bellow. If this is not the case and the internal diameter of the counter flange is larger, a blank metal gasket and an additional sealing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



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



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!



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.

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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.

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 $R \leq 10^4 \Omega\text{cm}$
- **Range II**
Electrically dissipative - specific resistance $R \geq 10^5$ up to $10^8 \Omega\text{cm}$
- **Range III**
Electrically insulating - specific resistance $R \geq 10^9 \Omega\text{cm}$

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9. Installation Instructions

The following descriptions refer to our rubber expansion joints and cover the most important points for proper installation in the piping system.

Application Description

Rubber expansion joints are used to compensate for oscillations, vibrations, noise, and limited axial, lateral, and angular movements in piping systems. They reduce the transmission of forces to equipment and piping.

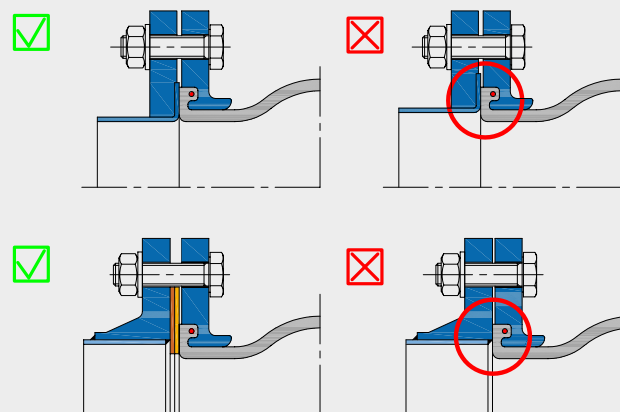
The permissible movement limits, operating pressures, and temperatures must be observed in accordance with the technical data. Rubber expansion joints are not pipe supports and must not be used to support the weight of the pipe or to absorb impermissible tensile, compressive, torsional, or bending forces.

Proper installation with adequate securing and guidance of the piping is a prerequisite for safe operation.

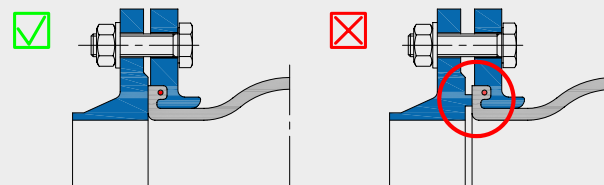
Before Installation

- Check the rubber expansion joint for damage.
- Inspect the piping in the area of the installation gap to ensure it is straight, that the flanges are aligned, and that the support is correct and sufficient. Only one expansion joint or expansion joints coupled into a single unit may be installed between two fixed points.
- Check the dimensions of the installation gap. The deviation of the installation gap relative to the expansion joint must not exceed ± 5 mm axially and laterally
- The pipe flanges/sealing surfaces must be clean, grease-free, smooth, flat, and free of burrs. The surface finish of the sealing surface must comply with EN 1092-1.
- For expansion joints with a sealing bead, the inner diameter of the pipe flanges should be checked dimensionally. The expansion joints are designed for counter flanges of steel in accordance with EN 1092-1 type 11 (**EB 17 A**). If the inner diameter is larger - as is the case, for example, with slip-on flanges - an adapter ring with an additional gasket must be provided (**EB17 B**). The same applies to sealing beads with an insufficient outer diameter (the diameter of the sealing bead/flange should be at least equal to the outer diameter of the sealing bead). Pipe flanges with tongue-and-groove joints must not be used (**EB 17 C**).

EB 17 B

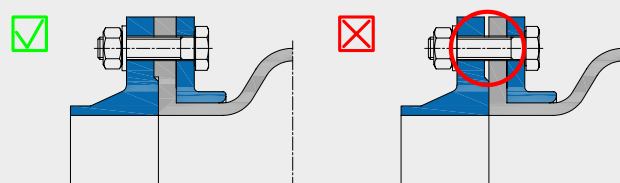


EB 17 C



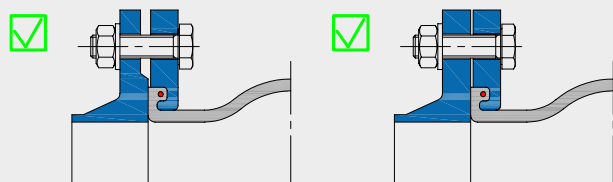
- Even for expansion joints with solid rubber flanges, the inner diameter of the pipe flanges should be checked for dimensional accuracy. It must not exceed the clear diameter of the expansion joint, with a maximum tolerance of +6 mm. The expansion joints are designed for smooth counter flanges without a sealing strip. For counter flanges with a sealing strip, the sealing surface of the expansion joint must be equipped with a sealing strip adjustment or a adjustment ring must be provided.

EB 17 D



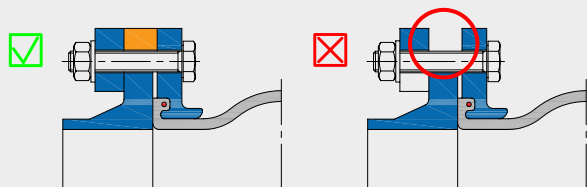
- If loose flanges with thick flanges are used on the pipeline side, the gap above the bolts between the two flanges must be filled with a suitable ring. This prevents the loose flange from tilting, which would result in improper contact with the sealing surface.

EB 17 A



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EB 17 E



- Rubber expansion joints typically do not require additional gaskets.
- For the flange connection, bolts with a strength class of 8.8 or equivalent stainless steel bolts should be used.
- Accessories such as guide tubes or vacuum support spirals/rings must be inserted into the expansion joint before it is installed in the piping. An additional gasket is required for the guide tube.

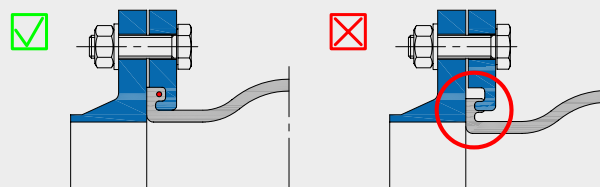
Important

- Do not weld near rubber expansion joints. If this cannot be avoided, the expansion joint must be covered with flame- and heat-resistant material to protect it from welding heat and flying sparks.
- During welding, the expansion joint may be damaged by stray currents or electrical grounding. The anode and cathode of the electric welding connection must always be located on the same section of pipe. (Not separated by the rubber expansion joint!)
- Care must be taken to ensure that the rubber bellows are not painted after installation in the piping (solvents can damage the rubber).
- The expansion joint must not be insulated when the medium temperature exceeds 50 °C, as the accumulated heat will cause the rubber bellows to heat up, accelerating curing and aging.

Installation

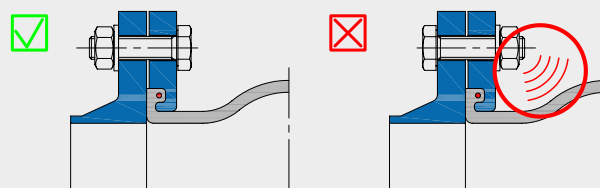
- Do not use any sharp-edged tools during installation!
- When installing tensioned expansion joints, ensure that the tension is released so that the expansion joint can settle into the installation gap as it is tightened. The tension should then be readjusted after the expansion joint has been installed.
- Carefully slide the expansion joint into the installation gap. Damage to the sealing surfaces and the sealing bead being pulled out of the flange groove must be avoided at all costs.

EB 17 F

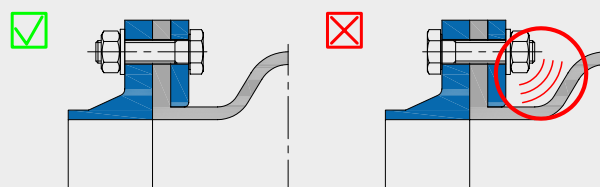


- When inserting the screws, keep the following in mind:
 - For expansion joints with through-holes, the screw head must face the bellows to prevent damage to the rubber under pressure.

EB 17 G



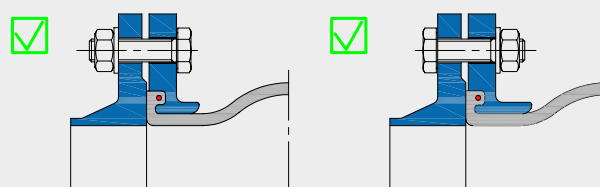
EB 17 H



- Exceptions

- 1.) If the expansion joint flange is designed with a long flange collar (support shoulder), the bolt may also be installed the other way around - however, the bolt must not be longer than the flange collar!
- 2.) If the bolts are too long - for example, if the pipe is equipped with a GRP lap-joint flange - they can also be installed the other way around; again, the bolt must not be longer than the flange collar.

EB 17 I



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- Do not use U-washers on the screw heads at the expansion joint flange.
- Half nuts (ISO 4035) may be used if necessary.
- For expansion joints with threaded holes in the flange, the bolts must be flush with the flange on the bellows side, as protruding bolts will damage the rubber bellows under pressure. If the pipe flange is designed in accordance with EN 1092-1 type 11, the required bolt lengths can be found in the table in the appendix.

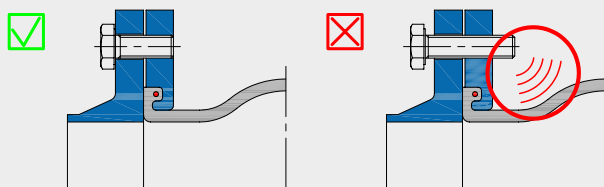
- Throughout the entire installation process, ensure that the sealing bead does not become misaligned. The protruding sealing surface should be compressed evenly all around.
- If a leak occurs during the later pressure test, retighten the bolts to the Step 3 torque setting. If the flange connection continues to leak, slightly increase the torque. Reduce the pressure in the expansion joint before retightening the bolts.
- Throughout the entire installation process, care must be taken to ensure that the expansion joint is not overstretched or crushed.

Adjusting the tensioning

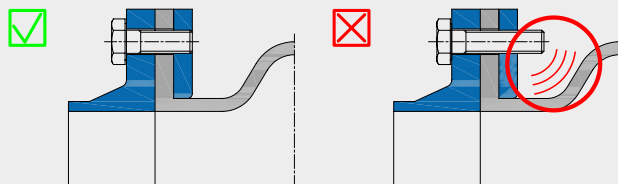
If tensioned expansion joints have been installed, the tensioning must be readjusted as follows:

- For all types of expansion joints, first tighten the outer hex nuts facing the flange evenly toward the flange until the tie rods are secured (with no play) - that is, until they can still be turned straight by hand. Then lock the tie rods in place using the corresponding hex nuts facing away from the flange.
- For type M expansion joints, after securing the tie rods as described above, the inner pairs of nuts are adjusted. Here, too, the hex nut facing the flange is first tightened toward the flange until the tie rods can still be turned straight by hand (without play). The adjustment is then locked in place with the hex nut on the side facing away from the flange.
- For type H expansion joints, after securing the tie rods as described above, the inner pairs of nuts are adjusted. To do this, first tighten each hex nut facing the flange toward the flange until the desired axial clearance is achieved. The total clearance on both sides must not exceed the allowable axial compression of the expansion joint. The adjustment is then locked in place using the hex nut on the side facing away from the flange.

EB 17 J



EB 17 K



- The flange bolts must be tightened as follows: (Tables listing the tightening torques for the various expansion joint types can be found in the appendix).

Step 1

- Tighten all bolts by hand
- Apply Step 1 torque evenly in a crisscross pattern
- Check the gap width at the outer edge of the flange
- Setting time ≥ 30 minutes.

Step 2

- Retighten all bolts in a crisscross pattern according to Step 2
- Check the gap width

Step 3

- Apply the final torque specified for Step 3 in two cycles, tightening the bolts in a crisscross pattern

- When installing silicone rubber expansion joints, the specified tightening torques must be reduced by 30 %.
- Further tightening of the screws is not necessary. It could lead to damage to the sealing surface.

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

Final installation check

- Inspect the expansion joints all around for visible external damage and clean the gap between the backing flange and the rubber bellows thoroughly (remove foreign objects, sand, etc.).
- After installation, the expansion joints should be protected from damage using a suitable protective covering, which should not be removed until immediately before commissioning.
- The rubber parts must not be painted. Solvents and chemicals attack the surface and destroy the bellows.
- Insulating rubber expansion joints is not permitted at temperatures above +50 °C, as this can cause the bellows to overheat and dry out, which will also lead to failure
- The best operating results are achieved when the expansion joint can operate without tension under operating conditions (take the corresponding preload into account during installation!).
- For tensioned expansion joints, check the tie rods. They should still be able to be turned by hand with minimal effort. The locknuts must be tightened.
- If the installation situation permits, check any support spirals/rings for proper fit and secure attachment.

Steps to take before the pressure test or commissioning

- Remove the protective covers and clean the expansion joint.
- Inspect the expansion joint for damage.
- Check that all brackets, fixed bearings, and sliding bearings of the connected piping are installed and in good working order.
- Check that the tension is evenly balanced and, if necessary, adjust it to account for the current condition of the piping.

Pressure test

- The rubber expansion joint is not a pressure vessel; rather, it is classified as "pressure-retaining equipment" under the Pressure Equipment Directive. When integrating the expansion joint into the piping system, sealing is achieved not by a separate gasket inserted into the joint, but directly at the integrated sealing surface of the rubber bellows.
- The pressure test is generally performed only after the rubber expansion joint has been installed in the fully assembled piping system. Before the pressure test, all instructions described in these installation instructions should be followed.
- The pressure test is generally performed at 1.5 times the operating pressure, or at a maximum of 1.5 times the rated pressure of the expansion joint.
- If leaks occur in the area of the flange connection during the pressure test, retighten the bolts according to Step 3 of the tightening schedule.

10. Supplementary assembly and installation instructions for type 46

Type 46 rubber expansion joints should be fitted stress-free. The bolted connections should always be made using two wrenches to avoid torsion on the expansion joint (**EB 18**).

- Mount the bolting parts on the pipe and check the fitting gap! The fitting gap should be the same length as the expansion joint bellow (e.g. 130 mm +/- 5 mm).
- Insert the expansion joint and tighten using two wrenches as follows:

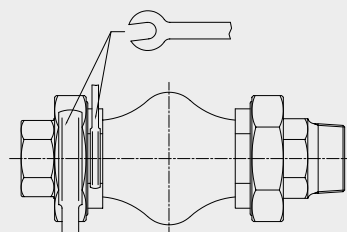
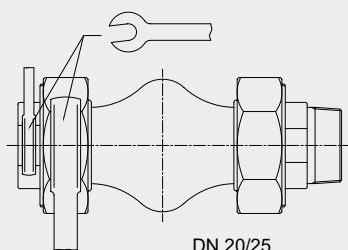
DN 20/25

The front threaded part must be used as a counter support and the sleeve nut must be tightened (to avoid torsion on the bellow).

DN 32 - 50

The rear threaded part must be used as a counter support and the sleeve nut tightened (to avoid torsion on the bellow).

EB 18



DN 32 - DN 50

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

11. Supplementary assembly and installation instructions for type 60 - WRG

- The type 60 WRG rubber-metal pipe connector must be fitted stress-free.
- The fitting gap must be 70 mm.
- The pipe connector must not be subject to tension, torsion or bending.
- No additional seals are required.
- Only hexagon head bolts according to DIN 933 with a washer should be used.
- The screw depth should be at least 10 mm.
- The bolt tightening torque is 30 Nm.

All other fitting positions are as described in our main fitting instructions.

Bolt size for	Flange PN 6	Flange PN 10
DN 20	4 x M10 x 35	4 x M12 x 35
DN 25	4 x M10 x 35	4 x M12 x 35
DN 32	4 x M12 x 35	4 x M16 x 35
DN 40	4 x M12 x 35	4 x M16 x 35
DN 50	4 x M12 x 35	4 x M16 x 35
DN 65	4 x M12 x 35	4 x M16 x 35
DN 80	4 x M16 x 35	8 x M16 x 40
DN 100	4 x M16 x 35	8 x M16 x 40
DN 125	8 x M16 x 35	8 x M16 x 40
DN 150	8 x M16 x 35	8 x M20 x 40
DN 200	-	8 x M20 x 45

12. Supplementary assembly and installation instructions for type 61

- Type 61 is fitted as part of the pipe installation. Installation in the fitting gap is difficult in the case of very large nominal diameters.
- The pipe ends must be long enough to reach the beginning of the shaft on both sides.
- Only use wide GBS-clamps for fixing the expansion joint (min. 20 x 1 mm).
- At an operating pressure of up to 2 bar, one clamp is adequate per side. Above 2 bar, two clamps should be used.

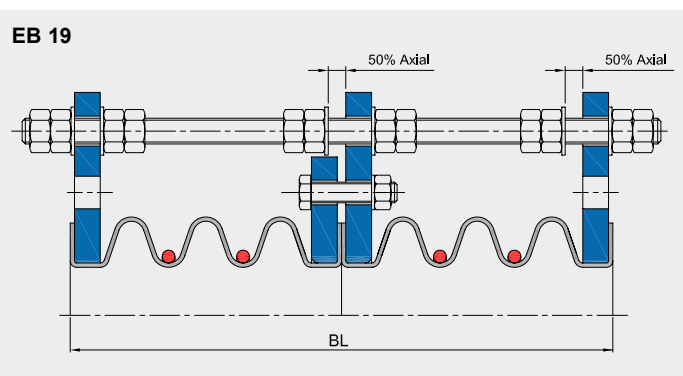
All other fitting positions are as described in our main fitting instructions.

13. Supplementary assembly and installation instructions for type 80

- The expansion joints are delivered with protective covers. These covers may only be removed directly prior to fitting. If these covers need to be removed in advance for the purpose of inspection, they must be screwed back into place.
- Welding, soldering and brazing on the PTFE bellow is not permitted as the bellow could be damaged and highly toxic gases could develop.
- It is not necessary to use seals between PTFE/PTFE sealing surfaces. It is advisable to use a 5-mm-thick PTFE sealing for connections to glass, enamel and other components.
- The flange connection bolts must be tightened according to the torque table below.
- The limiting bolts (tie rods) must be adjusted to the maximum permissible expansion after fitting the expansion joint. The limiting bolts must not be removed.
- In the course of commissioning, the flange connections should be retightened with the specified torque after reaching operating temperature.
- If leaks occur, the flange connections must be inspected to ensure that the flanges are parallel and for fouling or damage to the sealing surfaces. Minor indentations or damage can be removed with emery cloth.

When coupling type 80 expansion joints, ensure that a corresponding blank gasket is used between the bellows that are being coupled in order to avoid a double PTFE effect.

When adjusting the continuous tie rods, ensure that the central flange is appropriately fixed with lock nuts on the right and left of the flange pair in order to avoid lateral buckling. The play between nuts and flange should be a maximum of 2 mm (in order to leave clearance for lateral movement). In the case of the outer flanges, the hexagon bolts should be arranged on the inside and outside so as to accommodate the desired axial expansion. During this process, ensure that the axial expansion is equally distributed between the two expansion joints. Please refer to EB 19.



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14. Supplementary assembly and installation instructions for type 64

The expansion joint must not be fitted before completion of all work on the pipes and flanges and mounting of all anchors and supports. This is intended to prevent the expansion joint from being damaged by welding sparks, sharp-edged objects, etc.

As Type 64 expansion joints are made from extremely flexible material, their durability is dependent on careful and correct fitting.

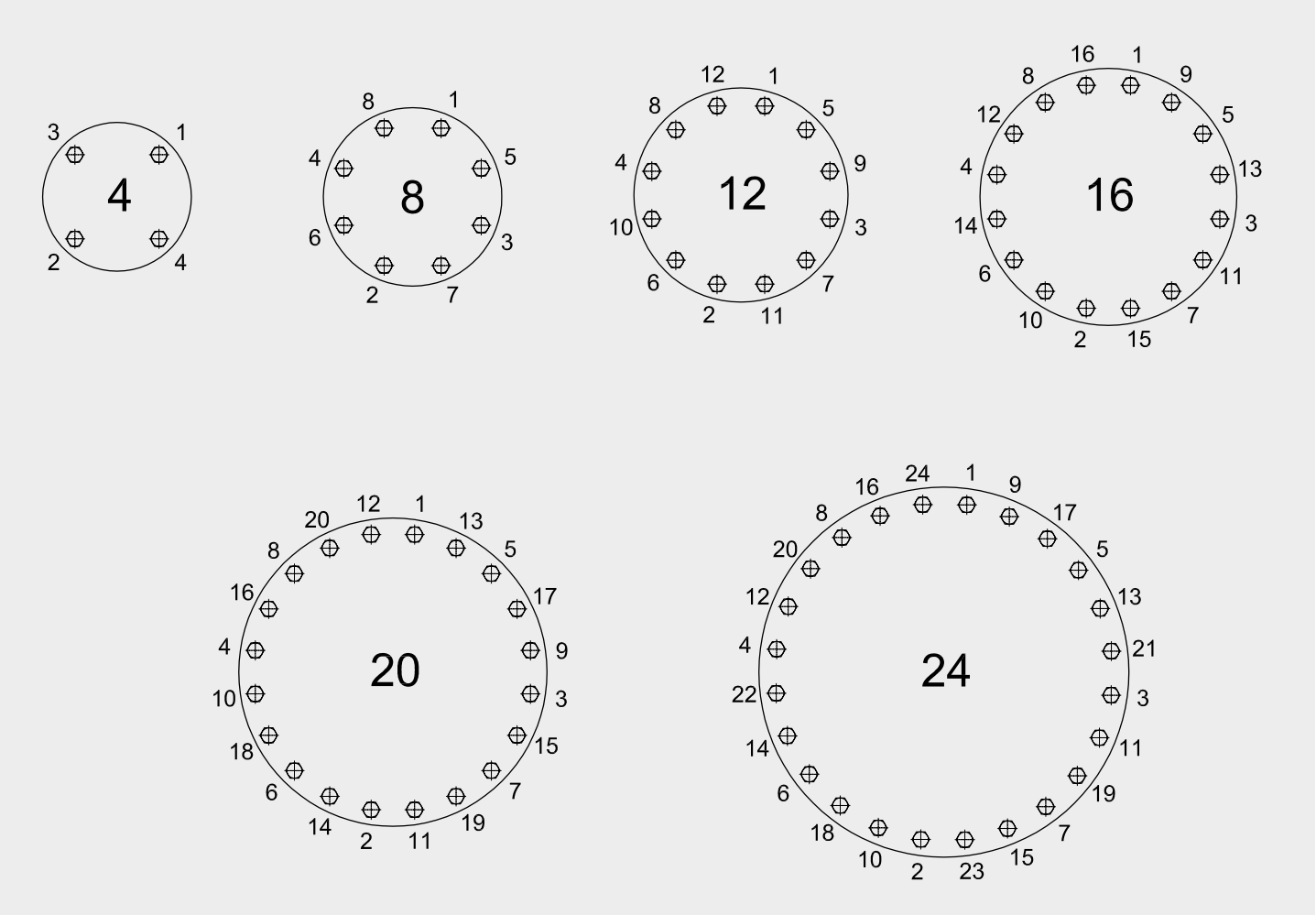
- Avoid sharp edges and folds.
- Ducting flanges, swivel flanges or other steel parts included in the scope of delivery should be checked and correspond to the drawings. The bolt holes in each flange must be symmetrical.

- It is advisable to use a support plate or an inner frame when lifting the expansion joint. Preferably, the expansion joint should be pre-assembled with loose flanges and an internal sleeve (if included in the scope of delivery) on the ground before lifting.
- All other fitting positions are as described in our main fitting instructions.

Tightening torque for type 64

Material	Swivel flanges / bolts			
	40x10/M10	50x10/M12	60x10/M12	60x12/M16
EPDM	60 Nm	80 Nm	80 Nm	80 Nm
FPM	80 Nm	80 Nm	80 Nm	

Tightening torque plan



WILLBRANDT Attachments for Planning, Installation and Maintenance Instructions

Table 1 Flange bolt tightening torques for types 40, 42, 58, 59 and 65

DN	Step 1				Step 2				Step 3			
	PN 6 Nm	PN 10 Nm	PN 16 Nm	ASA 150 Nm	PN 6 Nm	PN 10 Nm	PN 16 Nm	ASA 150 Nm	PN 6 Nm	PN 10 Nm	PN 16 Nm	ASA 150 Nm
200	34	54	37	57	67	107	74	114	100	160	110	170
250	30	44	57	50	61	87	114	101	90	130	170	150
300	47	50	70	74	94	101	141	147	140	150	210	220
350	57	47	64	97	114	94	127	194	170	140	190	290
400	47	67	87	87	94	134	174	174	140	200	260	260
450	54	60	84	100	107	121	167	201	160	180	250	300
500	47	67	117	94	94	134	234	187	140	200	350	280
550				114				227				340
600	70	97	174	134	141	194	347	267	210	290	520	400
650				124				247				370
700	67	104	134	117	134	207	267	234	200	310	400	350
750				134				267				400
800	97	144	180	200	194	287	361	401	290	430	540	600
850				190				381				570
900	110	137	170	204	221	274	341	407	330	410	510	610
950				240				481				720
1000	104	180	240	220	207	361	481	441	310	540	720	660
1050				244				487				730
1100	137	187	320	230	274	374	641	461	410	560	960	690
1150				244				487				730
1200	144	230	324	234	287	461	647	467	430	690	970	700
1250				284				567				850
1300	190	284	307	297	381	567	614	594	570	850	920	890
1350				324				647				970
1400	190	280	330	317	381	561	661	634	570	840	990	950
1450				350				701				1050
1500	204	384	450	320	407	767	901	641	610	1150	1350	960
1600	194	400	467		387	801	934		580	1200	1400	
1650				400				801				1200
1700	234	384	450		467	767	901		700	1150	1350	
1800	230	400	467	384	461	801	934	767	690	1200	1400	1150
1900	277	384	584		554	767	1167		830	1150	1750	
1950				467				934				1400
2000	280	417	567		561	834	1134		840	1250	1700	
2100	307	517	0	534	614	1034		1067	920	1550		1600
2200	297	517	600		594	1034	1201		890	1550	1800	
2250				517				1034				1550
2400	314	550	634	667	627	1101	1267	1334	940	1650	1900	2000
2500	384	567	600		767	1134	1201		1150	1700	1800	
2550				800				1601				2400
2600	400	550	634		801	1101	1267		1200	1650	1900	
2700				884				1767				2650
2800	417	600			834	1201			1250	1800		
2850				1034				2067				3100
3000	567	934		1367	1134	1867		2734	1700	2800		4100

Important note

The tightening torques for flange bolts provided in the table offer a specific surface pressure based on the entire sealing surface for solid rubber flanges or the sealing bead in the case of swivel flanges. In the case of solid rubber flanges, temporary settling process in the rubber flange area means that under operating conditions the surface pressure falls to around 50% of the final value (Step III).

The residual effective gripping and sealing force is completely sufficient and suitable for test pressures up to 1.5 times the operating pressure.

Warning: The stipulated max. tightening torque may not be substantially exceeded, as increased pressure loading on the flow in the elastomer progresses constantly and leads to destruction (crushing).

WILLBRANDT Attachments for Planning, Installation and Maintenance Instructions

Table 2: Bolt tightening torques for types 48, 49, 50, 51, 52, 55, 56 and 57

DN	Step 1 for all Nm	Step 2 for all Nm	PN 6 Nm	PN 10 Nm	Step 3 PN 16 Nm	PN 25 Nm	ASA 150 Nm
25	by hand	50	60	80	80	80	80
32	by hand	50	60	80	80	80	80
40	by hand	50	60	80	80	80	80
50	by hand	50	60	80	80	80	80
65	by hand	50	60	80	80	80	80
80	by hand	50	60	80	80	80	80
100	by hand	50	80	100	100	100	100
125	by hand	50	80	100	100	100	100
150	by hand	50	80	100	100	100	100
175	by hand	50	90	100	100	100	100
200	by hand	50	90	100	100	100	100
250	by hand	50	90	100	100	110	100
300	by hand	50	100	110	110	110	100
350	by hand	50	120	130	135	165	110
400	by hand	50	120	140	155	200	140
450	by hand	50	140	145	165	200	145
500	by hand	50	120	145	170	200	145
600	by hand	100	185	210	255	280	210
700	by hand	100	200	225	300	300	230
800	by hand	100	235	300	360	410	300
900	by hand	100	235	300	360	415	300
1000	by hand	100	300	360	425	525	360

Warning: Refer to the tightening scheme!

Table 3: Bolt tightening torques for type 80

DN	PN 10			PN 25		
	Quantity	Bolts Thread	Torque Nm	Quantity	Bolts Thread	Torque Nm
20	4	M12	10	4	M12	10
25	4	M12	20	4	M12	20
32	4	M16	30	4	M16	30
40	4	M16	40	4	M16	40
50	4	M16	50	4	M16	50
65	8	M16	70	8	M16	40
80	8	M16	40	8	M16	40
100	8	M16	40	8	M20	50
125	8	M16	50	8	M24	80
150	8	M20	60	8	M24	90
200	8	M20	90	12	M24	100
250	12	M20	60	12	M27	120
300	12	M20	70	-	-	-
350	16	M20	110	-	-	-
400	16	M24	160	-	-	-
500	20	M24	180	-	-	-
600	20	M27	240	-	-	-
700	24	M27	260	-	-	-

WILLBRANDT Attachments for Planning, Installation 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



WILLBRANDT Attachments for Planning, Installation and Maintenance Instructions

Threaded bolts and hexagonal nuts for fastening counter flanges to welding neck flanges according to DIN 1092-1 type 11 for type 39, 48, 50, 51, 52 and 55 (with perforations)

DN	Quantity	PN 6 Size	Length mm	Quantity	PN 10 Size	Length mm	Quantity	PN 16 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!

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 %	-
red KTW	100 %	-	80 %	60 %	-
blue-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 %	-
blue-red PN 10	100 %	-	80 %	60 %	-
yellow LT	100 %	-	80 %	60 %	-
yellow ST	100 %	100 %	-	60 %	-
yellow HNBR	100 %	100 %	-	60 %	-

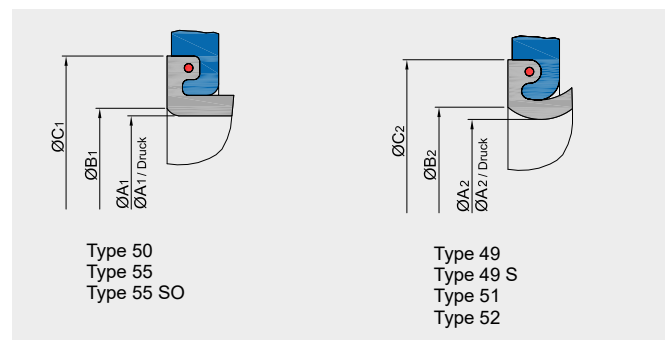
Tolerances according to the FSA handbook for handmade expansion joints types 39, 40, 42, 56, 57, 58, 59, 61, 62, 63 and 64

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

WILLBRANDT Attachments for Planning, Installation and Maintenance Instructions

Rubber bellow sealing profiles for expansion joints with swiveling 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 planning example **EB 16 D**).



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.



Unit symbol	Unit name	Pa = N/m ²	bar	m WS	Torr = mm Hg	lbf/in ²	in Hg
1 Pa = 1 N/m ²	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/m ² = 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/cm ² = 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/in ²	pound-force per square inch	6894.76	0.06895	0.70307	51.7149	1	2.03602
1 lbf/ft ²	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