

Operating instruction for expansion joints according to pressure equipment directive 2014/68/EU



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Please read this operating instruction carefully to ensure a safe operation, and keep it for further use

Safety instructions



This sign is used in case of imminent danger.

Possible consequences can be injury to persons and damage to property.

It is generally recommended to use a personal protective equipment!

References:

108080 AKB expansion joints permissible operating pressures

Guideline of the VCI (German Association of the chemical industry) for the assembly of flange connections in process plants

1. Designated Use

PTFE expansion bellows consist of a PTFE bellows with connection flanges made of ferritic or austenitic steel grades. With multi-shaft design, there is a stainless steel support ring between each shaft. Due to the support ring, the PTFE bellows can be used at a higher internal pressure.

The expansion joints are exclusively for use in piping systems for the compensation of relative movement between pipeline sections or connection pieces, e.g. to uncouple vessels by forces of adjacent pipelines. The expansion joints are not suitable for the use in case of high-frequency vibrations (e.g. as vibration dampers or sound absorbers). For this or other applications, the manufacturer has to be contacted.

Expansion joints are not designed to be used as adjustment for assembly or construction errors!

2. Transport

The protective covers may only be removed immediately prior to installation!

General information

The local national (safety) regulations for transport, installation, operation and maintenance must be observed. The selection as well as the instruction of the installation and the operating staff is the responsibility of the operator.

Transport and storage

Heavy shocks and blows during transport, unloading and bringing-in process should be avoided. An additional load of the expansion joints, e.g. by piling is not allowed. Corrosive influences on the expansion joint, such as ambient air or media should be avoided.

Protective cover

For protecting the liner from dirt and mechanical damages during handling and storage and for holding down the flanges, all parts are provided with protective covers.

The transport lock must be removed before installation!

Weight specification

The weight is indicated on the delivery note.

3. Installation

Avoidance of damage

During installation work, the bellows may not be damaged, e.g. by tools or fasteners.

Bolts that protrude over the flange towards the bellows should be avoided. When using stud bolts, these have to be flush with the flange. With clearance holes, the bolt may not protrude the bolt nut.

The specified bolt connections are designed so that no damage to the component can occur during normal operation.

Generally it is not allowed to weld on lined parts, as otherwise, the fluoroplastic might be damaged.

Heat input above the permissible operating temperature, e.g. by bevelling or by sawing, is generally forbidden!

Even in direct proximity these works are to be avoided or appropriate protective measures to protect the expansion joint should be taken.

Installation works have to be carried out by qualified personnel (DIN CEN/TS 1591-4).

Preferably the guideline of the VCI *for the assembly of flange connections in process plants* should be observed.

Required Qualification of fitters

Installation work may only be carried out by qualified personnel (DIN EN 1591-4).

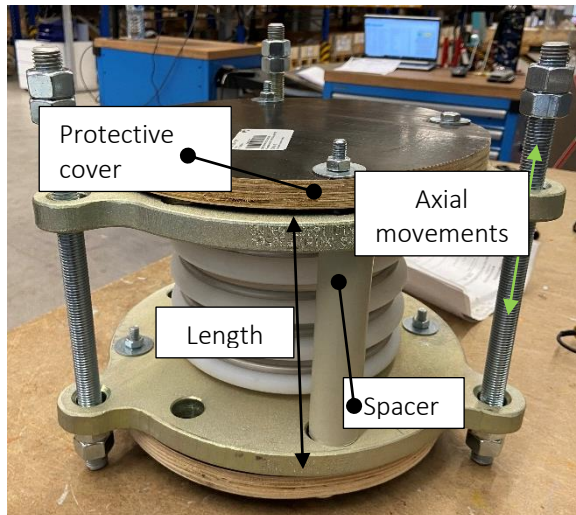
The VCI GUIDELINES for the assembly of flange connections in process plants should preferably be used.

Initial inspection

The pressure equipment must be inspected for transportation damage before installation. In the event of damage to pressure-bearing components (e.g. damage to the sealing surface of the PTFE flange, indentations, knocks on the expansion joint), commissioning is prohibited. In the event of damage, the manufacturer of the pressure device must be contacted immediately.

Removal of accompanying material for transportation

The PTFE bellows expansion joints are supplied with transportation locks.



- Protective cover for the flanges made of wood including clamping screws to protect and hold down the flare
- Spacers between the flanges (usually plastic pipe sections) to prevent uncontrolled transport movements

These transport locks must be removed shortly before installation. The flares must not be left open for long periods without the protective cover, as they will otherwise stand up.

The pressure equipment may only be put into operation if it has been checked for proper condition with regard to assembly, installation, set-up conditions and safe operation, taking into account the intended mode of operation.

Checking the installation situation

The expansion joints are typically used to absorb movements (axial, lateral, angular, mostly thermal expansion) in piping systems. It is therefore important to install the expansion joints in a neutral state and not in a deflected state. Before installation, check that the distance between the flanges corresponds to the specified dimensions of the expansion joints.

The movement clearances specified in the expansion joint data sheets must not be exceeded.

If different types of movement are used, the sum of 1 must not be exceeded.

Example: $0.5 \times \text{axial movement} + 0.3 \times \text{lateral movement} + 0.2 \times \text{angular movement}$.



In this example, the expansion joint was installed in the stretched state.

Axial \pm movement is not possible.

Installing the expansion joint and tightening the screws

All flange bolts must be professionally installed and tightened using a torque wrench. The bellows must not be subjected to torsion during installation or operation.

The use of a torque wrench on flange screw connections is prescribed by the manufacturer!

The sealing surfaces must be clean, dry and free of grease. The sealing surfaces must be cleaned with a clean cloth before installation. The bolts must be tightened crosswise in several steps and finally clockwise evenly according to the table below.

The screws must be tightened crosswise in 3 stages using a torque wrench with the appropriate torque for the screw material according to the tightening diagram in the appendix:

- 1st stage 30% of the required torque
- 2nd stage 60% of the required torque
- 3rd stage 100% of the required torque

Note: The assembly tightening torques only apply at room temperature!

Due to the flow behavior of the lining, the screw connections should be retightened after one day. The minimum waiting time for retightening is 6 hours. For systems with higher operating temperatures, e.g. 150 degrees C, the piping system must be kept at operating temperature for at least 2 hours before retightening and then cooled back down to room temperature for retightening. Recommended installation torques can be found below.

Tightening torques apply to lightly oiled/greased screws at normal temperature and are designed for easy flow of the lining to achieve a secure seal.

Depending on the application (e.g. TA-Luft 2021), higher tightening torques may be required. These must be specified by the planner or manufacturer. Higher material classes may also be specified for the flanges.

The increased installation torques may be applied a maximum of 3 times. After this, the installation torques must be reduced again (see tables in the appendix).

Diameter Nominal [DN]	PN10		PN16		PN25		PN40	
	bolts	Torque [Nm]	bolts	Torque [Nm]	bolts	Torque [Nm]	bolts	Torque [Nm]
15	4 x M12	15	-	-	-	-	-	-
20	4 x M12	25	-	-	-	-	-	-
25	4 x M12	34	4 x M12	34	4 x M12	34	4 x M12	34
32	4 x M16	55	4 x M16	55	4 x M16	55	4 x M16	55
40	4 x M16	68	4 x M16	68	4 x M16	68	4 x M16	68
50	4 x M16	86	4 x M16	86	4 x M16	86	4 x M16	86
65**	4 x M16	115	4 x M16	115	-	-	-	-
65	8 x M16	58	8 x M16	58	8 x M16	58	8 x M16	58
80	8 x M16	71	8 x M16	71	8 x M16	71	8 x M16	71
100	8 x M16	78	8 x M16	78	8 x M20	107	8 x M20	107
125	8 x M16	89*	8 x M16	89*	8 x M24	156	8 x M24	156
150	8 x M20	141	8 x M20	141	8 x M24	192	8 x M24	192
200	8 x M20	181*	12 x M20	141	12 x M24	200	12 x M27	252
250	12 x M20	166	12 x M24	201	12 x M27	296	12 x M30	378
300	12 x M20	169*	12 x M24	273*	16 x M27	301	16 x M30	399
350	16 x M20	212*	16 x M24	280	16 x M30	479	16 x M33	611
400	16 x M24	291*	16 x M27	430	16 x M33	562	16 x M36	1137
500	20 x M24	315*	20 x M30	567	20 x M33	609	20 x M39	1008
600	20 x M27	457	20 x M33	829	20 x M36	1049	20 x M45	1596
700	24 x M27	467*	-	-	-	-	-	-
800	24 x M30	611*	-	-	-	-	-	-
	- For all DIN torque without specific comments we recommend to use screw quality 5.6., A2-70, A4-70 or compatible approved grade.							
*	- For flanged connections marked with * lightly oiled screws 25CrMo4 or higher-quality are required.							
**	- In this special case, we recommend to use screws quality 8.8 or approved comparable grad.							

Source: Anzugsdrehmomente DIN & ANSI - PTFE Bauteile Rev 6

Nominal pipe size [NPS]	Pressure class 150			Pressure class 300		
	no. of bolts x thread	Torque [Nm]	Torque [ft-lb]	no. of bolts x thread	Torque [Nm]	Torque [ft-lb]
1/2"	4 x 1/2"	6	4,4	4 x 1/2"	6	4,4
3/4"	4 x 1/2"	10	7,4	4 x 5/8"	12	8,8
1"	4 x 1/2"	14	10,3	4 x 5/8"	18	13,3
1 1/2"	4 x 1/2"	28	20,6	4 x 3/4"	41	30,2
2"	4 x 5/8"	53	39,1	8 x 5/8"	27	19,9
2 1/2"	4 x 5/8"	66	48,7	8 x 3/4"	39	28,8
3"	4 x 5/8"	94	69,3	8 x 3/4"	56	41,3
4"	8 x 5/8"	67	49,4	8 x 3/4"	80	59
5"	8 x 3/4"	101	74,5	8 x 3/4"	101	74,5
6"	8 x 3/4"	128	94,4	12 x 3/4"	73	53,8
8"	8 x 3/4"	178	131,3	12 x 7/8"	138	101,8
10"	12 x 7/8"	175	129,1	16 x 1"	150	110,6
12"	12 x 7/8"	228	168,1	16 x 1 1/8"	220	162,2
14"	12 x 1"	285	210,2	20 x 1 1/8"	192	141,7
16"	16 x 1"	265	195,4	20 x 1 1/4"	265	195,6
18"	16 x 1 1/8"	389	286,9	24 x 1 1/4"	288	212,5
20"	20 x 1 1/8"	344	253,7	24 x 1 1/4"	318	234,7
24"	20 x 1 1/4"	487	359,1	24 x 1 1/2"	487	359,4

- For ANSI torque we recommend to use screws ASTM A193 Grade B7 or approved comparable grad.

Source: Anzugsdrehmomente DIN & ANSI - PTFE Bauteile Rev 6

Seals

Additional seals between the PTFE sealing surfaces are not necessary. When changing the pipe class, e.g. change to metal, glass, ceramics, enamel, ETFE, PVDF, etc., the necessity of a seal has to be checked by the system designer/operator. In this case, the tightening torques mentioned in the above table are not valid and have to be determined by the operator/system designer considering the adjacent flanges.

The general rules for the arrangement of expansion joints in the piping construction must be observed!

Between two fixed bearings, only one expansion joint is to be located!

The pipeline may not exceed the maximum movement clearance of the expansion joint!

In case of combined occurring movement loads (axial, lateral and angular), the specifications for single loads are limited and have to be requested from the manufacturer.

It is recommended to strive for a short distance of the expansion joint to the fixed bearing.

A distance of < 3x nominal size is advantageous.

Spacers of universal expansion joints serve to limit (elongation and compression) an impermissible load during operation. Here, we are not dealing with power transmitting devices, such as expansion joint articulations.

The adjacent pipelines have to be conducted through bearings and mounted in alignment.

The mounting of spectacle blinds at the expansion joint should be avoided.

4. Commissioning

Removal of accompanying material for transport

Remove after installation the transport lock made of plastic or wood to ensure the setting of the expansion joint to neutral dimension.

The pressure equipment may only be commissioned, if, taking its designed operating method, it has been checked for a proper condition concerning installation, setting-up, set-up conditions and a safe function.

The assembly has to be carried out by a qualified specialist.

All local national regulations must be observed before commissioning. The commissioning regulations of the plant operator have to be observed.

Prior to commissioning of the delivered components after mounting of the fixed and friction bearings, a pressure/tightness test (ideally with water) has to be carried out in built-in. The required testing pressure is marked on the name plate or has to be agreed with the manufacturer.

Pressure and temperature changes

During commissioning fast pressure and temperature changes should be avoided.

Leaks and deformations

During commissioning, the flange connections have to be checked on leaks and the components of deformations.

In case of leaks, the piping system/container has to be decommissioned.

The pressure equipment should be driven up slowly to operating condition, with a simultaneous heating of all components.

5. Operation

Intended use

The existing pressure device may only be operated for the designated use. Changes have to be approved by the manufacturer.

The specified maximum values for pressure (PS) and temperature (TS) must not be exceeded. The values can be found in the document *108080 AKB expansion joints permissible operating pressures*, on the type plate or on the engineering drawing.

The pressure/temperature rating of the manufacturer has to be observed, and none of the two pair of values may be exceeded.

Limitation of use

The mounting of safety devices against overheating/overpressure and the protective measures to be initiated are the responsibility of the operator.

Resistance

The responsibility for the chemical resistance of the material used to the fluids handled in the pressure equipment is in the responsibility of the customer/operator. The operator has to check if the lining material is suitable with regard to the medium used.

A change of the service medium must not have negative effects on the safety and durability of the pressure equipment.

6. Maintenance and inspection

Usually, ferritic flanges are treated with a corrosion protection primer, as well as with a top coat. As long as this coating is not damaged, external corrosion can normally be neglected (depending on the ambient air). The protection layer has to be checked regularly for damages.

Particularly in case of an aggressive environment, the expansion joint has to be checked periodically for corrosion and damages.

If no malfunctions occur that indicate leaks in the pressure equipment, and as long as no interventions have been made at the system that could make a contamination possible, maintenance of the pressure equipment is not necessary.


In case of obvious leaks, the component has to be decommissioned immediately.

Primarily, maintenance works are limited to cleaning.


Only trained qualified personnel may carry out maintenance works.

The service life of the expansion joint is 5 years. After this time, the expansion joint has to be replaced.

 In case of failure the expansion joint has to be replaced!

 For chemical cleaning of equipment parts made of austenitic non-corroding materials only acids that are absolutely free of chloride may be used!


Prior to repairing, the consent of the manufacturer has to be obtained.

 Prior to opening, the pressure equipment has to be depressurized. As long as the conducts for inflowing and outflowing media are not dismantled, these have to be closed by means of blanking plates.

Bolts and nuts have to be checked on usability and replaced if necessary. The material for bolts and nuts have to correspond to the original. Other materials require the consent of the manufacturer of the pressure equipment! Only clean and greased threads, together with the correct tightening torque lead to the required bolt pretension. The bolts have to be tightened crosswise in 3 stages by means of a torque wrench with the corresponding torque for the bolt:

1 st stage	40% of the needed torque
2 nd stage	80% of the needed torque
3 rd stage	100% of the needed torque

Inspection

 The pressure equipment has to be controlled on tightness at regular intervals. External, internal and strength tests should be carried out within the periods and by the persons according to the relevant national regulations.

7. Decommissioning / Disposal

The operator is responsible for disposing the plant in an environmentally sound manner after closing-down the operation, in particular contaminated components during operation.