

FLENDER COUPLINGS

ZAPEX

Operating instructions 3560 en
Edition 10/2017

ZNN, ZNNA, ZNNV, ZNZS, ZNZA, ZNZV



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ZAPEX 3560 en

Operating instructions

Translation of the original operating instructions

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Edition 10/2017

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Warning note concept

This manual comprises notes which must be observed for your personal safety and for preventing material damage. Notes for your personal safety are marked with a warning triangle or an "Ex" symbol (when applying Directive 2014/34/EU), those only for preventing material damage with a "STOP" sign.



WARNING! Imminent explosion!

The notes indicated by this symbol are given to prevent **explosion damage**.
Disregarding these notes may result in serious injury or death.



WARNING! Imminent personal injury!

The notes indicated by this symbol are given to prevent **personal injury**.
Disregarding these notes may result in serious injury or death.



WARNING! Imminent damage to the product!

The notes indicated by this symbol are given to prevent **damage to the product**.
Disregarding these notes may result in material damage.



NOTE!

The notes indicated by this symbol must be treated as general **operating information**.
Disregarding these notes may result in undesirable results or conditions.



WARNING! Hot surfaces!

The notes indicated by this symbol are made to prevent **risk of burns due to hot surfaces** and must always be observed.
Disregarding these notes may result in light or serious injury.

Where there is more than one hazard, the warning note for whichever hazard is the most serious is always used. If in a warning note a warning triangle is used to warn of possible personal injury, a warning of material damage may be added to the same warning note.

Qualified personnel

The product/system to which this documentation relates may be handled only by **persons qualified** for the work concerned and in accordance with the documentation relating to the work concerned, particularly the safety and warning notes contained in those documents.

Qualified personnel must be specially trained and have the experience necessary to recognise risks associated with these products and to avoid possible hazards.

Proper use of Flender products

Observe also the following:



Flender products must be used only for the applications provided for in the catalogue and the relevant technical documentation. If products and components of other makes are used, they must be recommended or approved by Flender. The faultfree, safe operation of the products calls for proper transport, proper storage, erection, assembly, installation, start-up, operation and maintenance. The permissible ambient conditions must be adhered to. Notes in the relevant documentations must be observed.

Trade marks

All designations to which the registered industrial property mark ® is appended are registered trademarks of Flender GmbH. Other designations used in this document may be trademarks the use of which by third parties for their own purposes may infringe holders' rights.

Exclusion of liability

We have checked the content of the document for compliance with the hard- and software described. Nevertheless, variances may occur, and so we can offer no warranty for complete agreement. The information given in this document is regularly checked, and any necessary corrections are included in subsequent editions.

Explanation regarding Machinery Directive 2006/42/EC

The couplings described here are "components" in accordance with the Machinery Directive and do not require a declaration of incorporation.

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1. Technical data

The instructions describe the coupling with shaft-hub connection by cylindrical bore with parallel key or for removal by oil-hydraulic shrinking. If different shaft-hub connections are to be used, such as drive-type parallel-key connection, splines to DIN 5480, Flender should be consulted.

The coupling described below may be used in potentially explosive areas. The couplings must have a CE marking (for marking, see item 2.2).



Couplings which do not have a CE marking, must not be used in potentially explosive areas.

If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority. The dimensioned drawing including any other documents should be made available to the user of the system.

For part numbers and part designations, see the corresponding spare-parts drawing in section 7 or the dimensioned drawing.

1.1 Types ZNN, ZNNA

The type ZNNA is only available in configuration A (S16). The distance dimensions S1, S2, S3 and S16 will be found in section 3, item 3.11.

Dimension table see item 1.5.

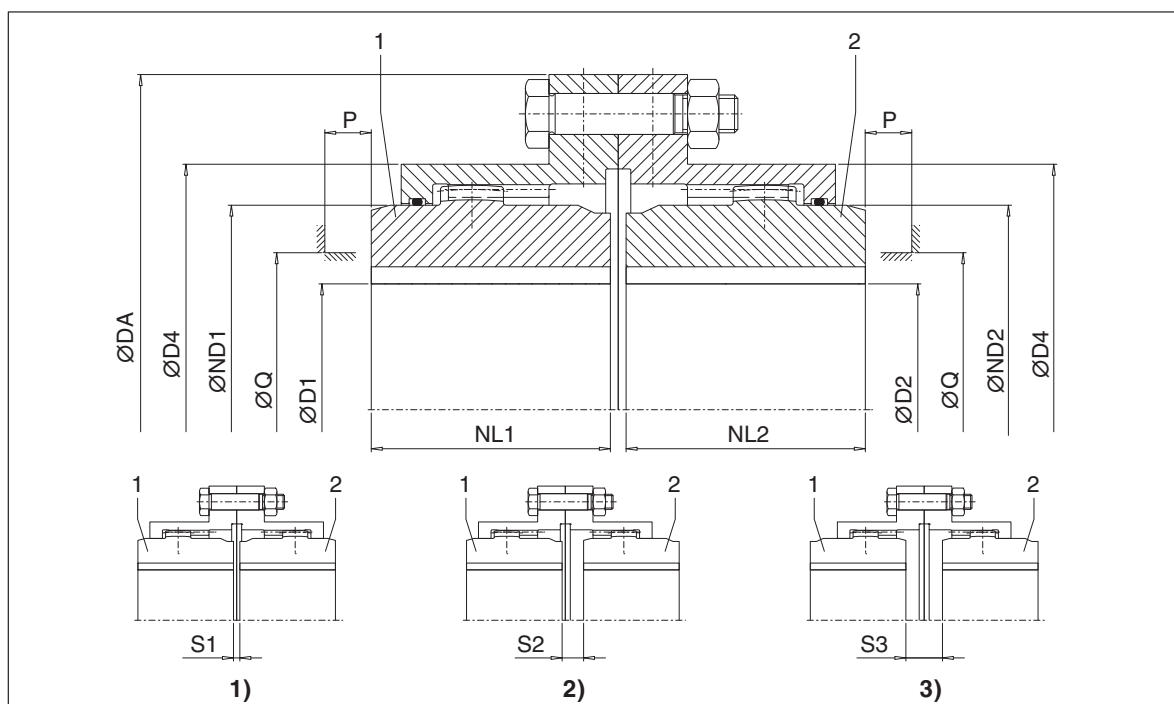


Fig. 1: Type ZNN

1) Design A

2) Design AB

3) Design B

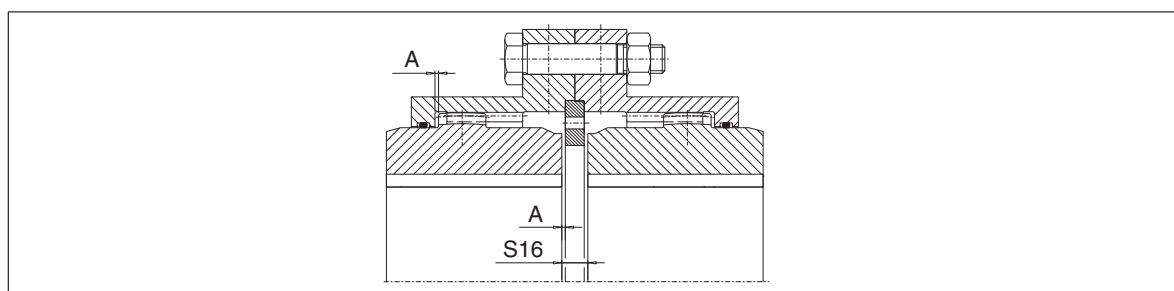


Fig. 2: Type ZNNA

1.2 Types ZNZS, ZNZA

The type ZNZA is only available in configuration A (S17). The distance dimensions S8, S9 and S17 will be found in section 3, item 3.11.

“S” dimensions according to the specifications of the customer.

Adapters with a length of ≤ 200 (dimension LZ) are delivered without part 20 ($LZ = S - 2 \times S8/9$) (however in case of type ZNZA part 20 is included)

Dimension table see item 1.5.

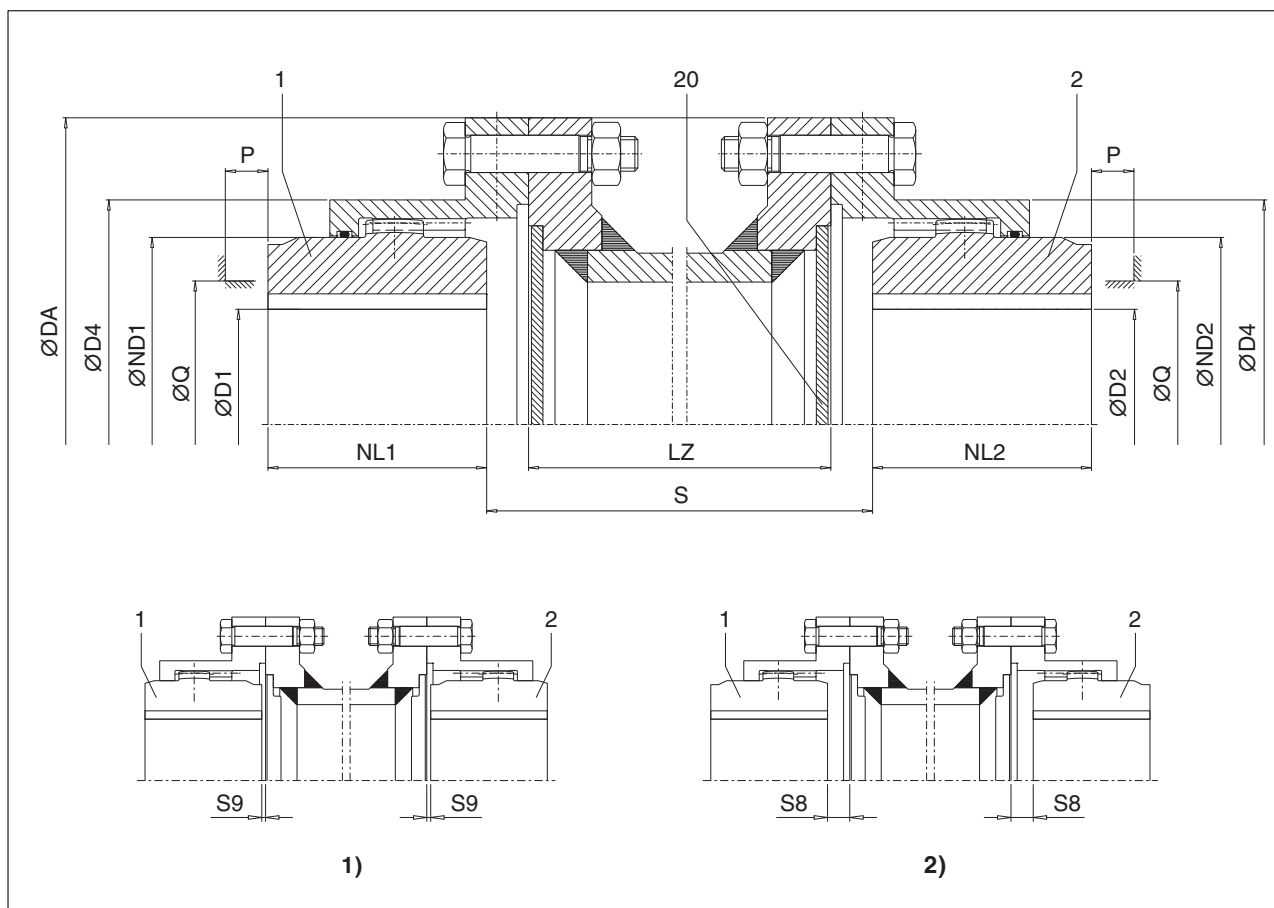


Fig. 3: Type ZNZS

1) Design A

2) Design B

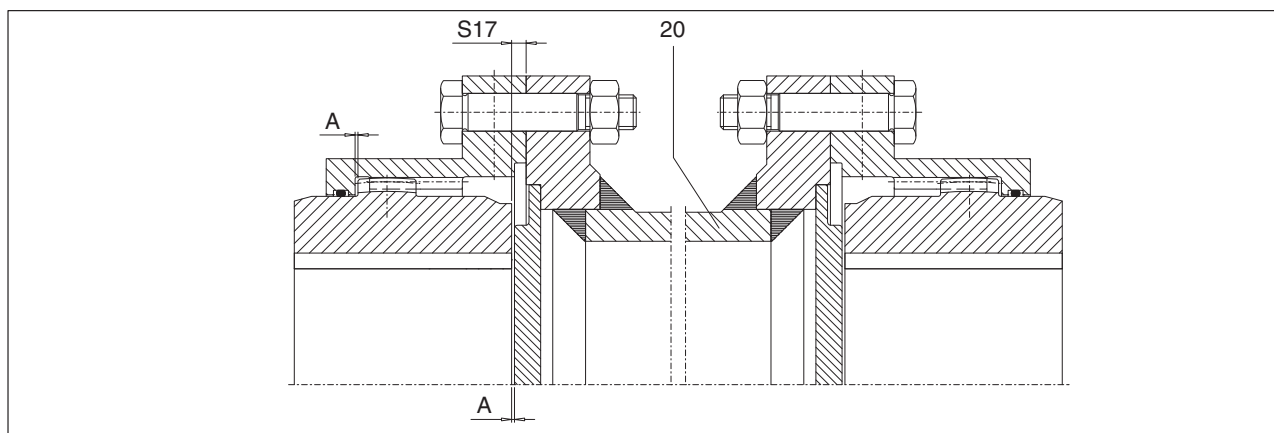


Fig. 4: Type ZNZA

1.3 Type ZNNV

The distance dimensions S11 and S12 will be found in section 3, item 3.11.

Dimension table see item 1.5.

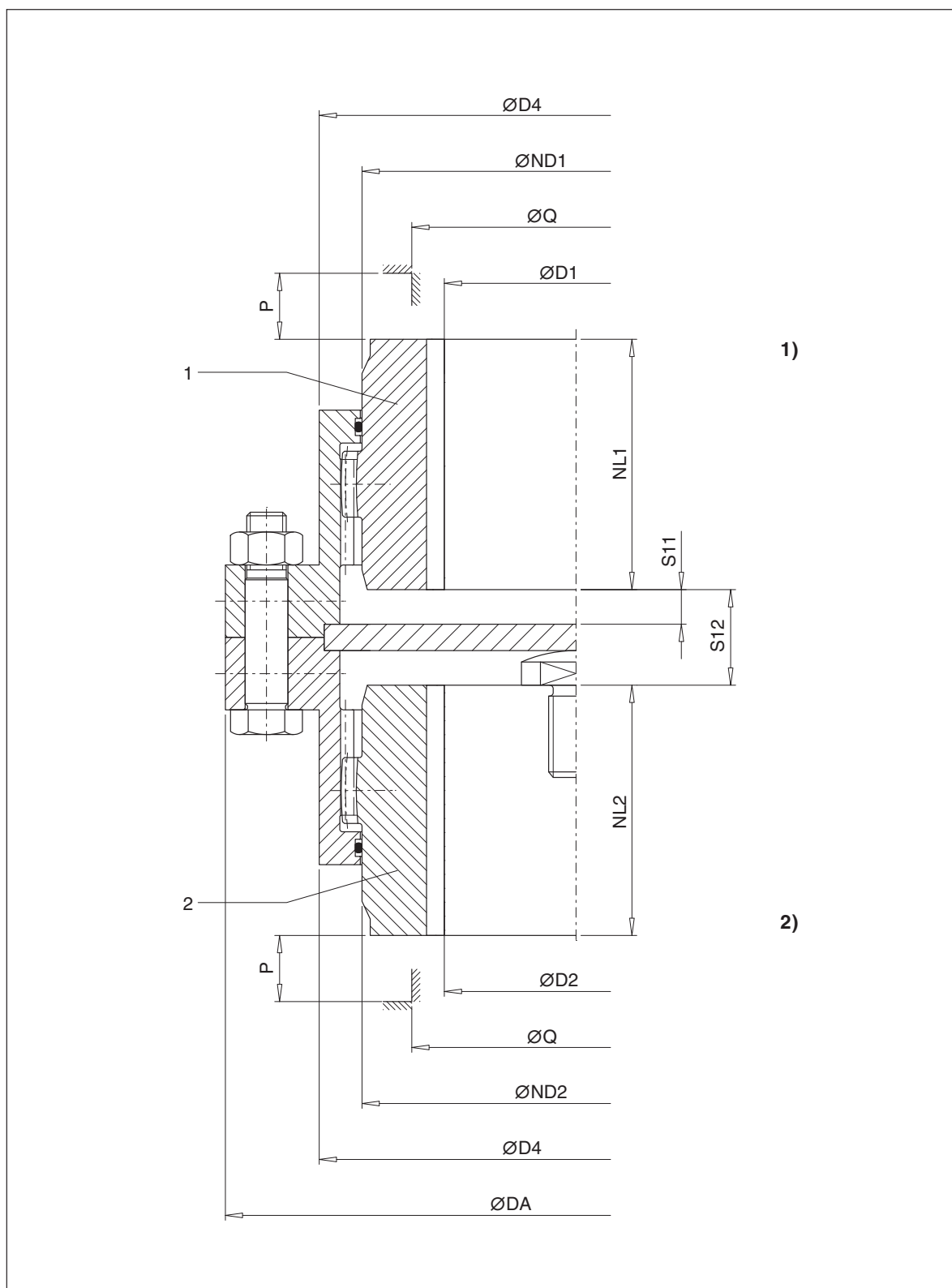


Fig. 5: Type ZNNV

1) top

2) bottom

1.4 Type ZNZV

The distance dimensions S8 and S13 will be found in section 3, item 3.11.

“S” dimensions according to the specifications of the customer.

Dimension table see item 1.5.

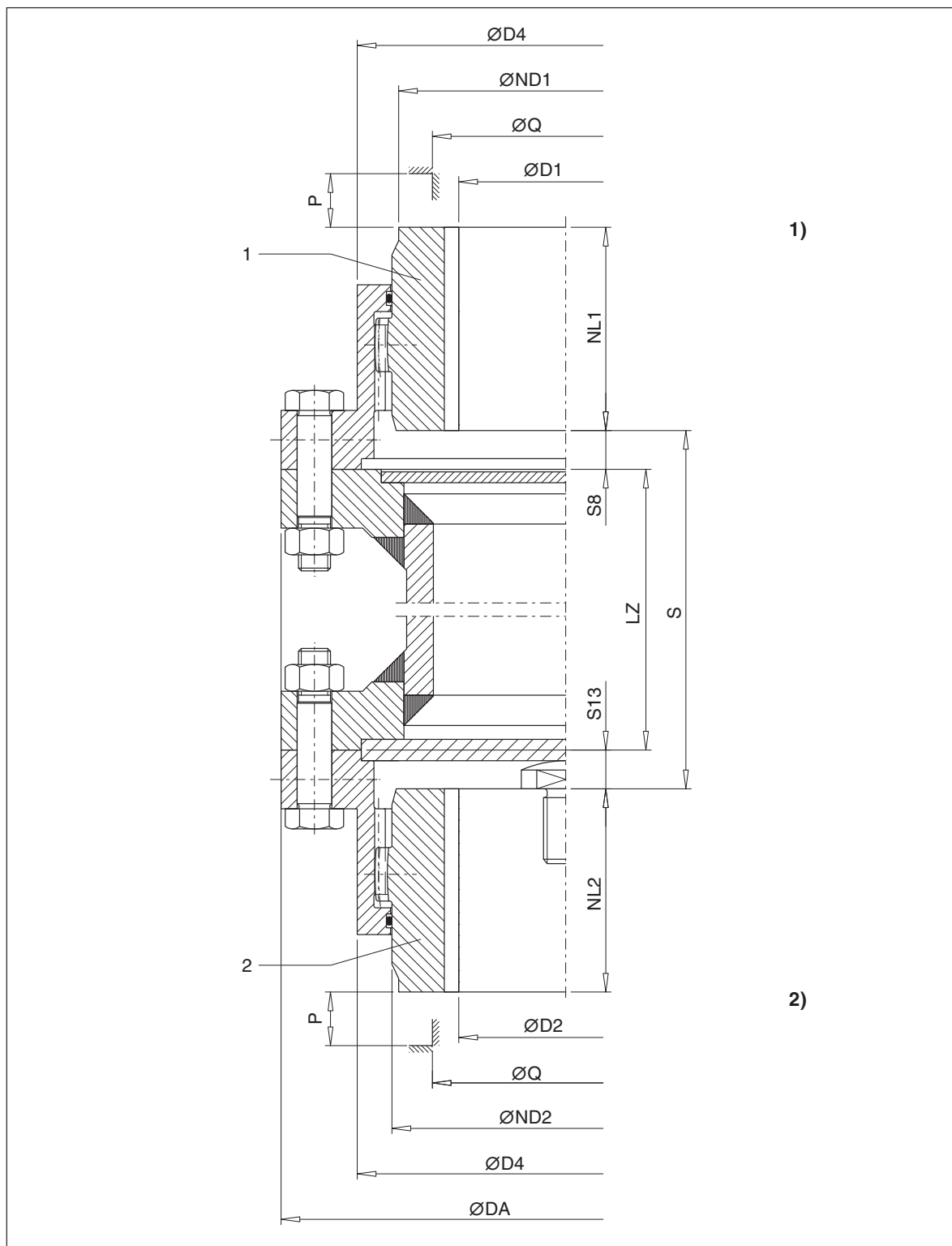


Fig. 6: Type ZNZV

1) top

2) bottom

1.5 Dimension table

Table 1: Torques, speeds, geometric data and weights

	Rated torque	Speed	Hole						Axial back-lash				Weight
Size	T _N	n _{maximum}	D ₁ / D ₂		Da	ND1 ND2	NL1 NL2	D4	A	Q	P	LZ	
	1)		from	up to 2)						3)	3)	min.	4)
	Nm	1/min	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
83	1020	8500	0	50	117	67	43	83	0.5	52	31	75	3.2
107	2210	7700	0	65	152	87	50	107	0.5	68	34	85	6.5
130	4020	6900	0	82	178	108	62	129.5	0.5	85	42	95	9.8
156	6600	6200	0	100	213	130	76	156	0.5	110	47	110	17.5
181	11000	5800	0	116	240	153	90	181	0.5	130	58	110	25.5
211	19200	5100	0	137	280	180	105	211	0.5	150	67	125	43
250	30680	4500	0	164	318	214	120	249.5	1.0	175	72	125	60
274	43550	4000	80	178	347	233	135	274	1.0	190	81	125	82
307	61750	3750	90	198	390	260	150	307	1.0	220	91	145	115
333	87100	3550	100	216	425.5	283	175	332.5	1.0	250	104	145	155
364	117000	3400	120	242	457	312	190	364	1.0	265	126	145	180
424	162500	3200	150	288	527	371	220	423.5	1.0	300	140	145	275



**The max. speed n_{max} for types ZNZS, ZNZA and ZNZV is limited by the weight and the critical speed of the adapter.
Speed n_{max} on request.**

- 1) The specified torques relate to the teeth and **not** to the shaft-hub connection. Latter must be checked separately.
- 2) Maximum bore with keyway to DIN 6885/1.
- 3) Space required for aligning the coupling parts, replacing the sealing rings and tightening the set screws.
- 4) Weights apply to maximum bores of type ZNN.

1.5.1 O-rings (12)

- O-rings may be stored for up to 5 years.
- O-rings must be protected against direct sunlight, artificial light with a ultraviolet content and extreme temperatures.
- O-rings must not come into contact with aggressive media.
- O-Rings must not be heated up to more than 80 °C during fitting work.



The O-rings (12) must not be stored while still fastened on the coupling part (1/2).

2. Notes

2.1 Safety instructions and general notes



All persons involved in the installation, operation, maintenance and repair of the coupling or clutch must have read and understood these instructions and must comply with them at all times. Disregarding these instructions may cause damage to the product and material and/or injury to persons. Damage caused by disregard of these instructions will result in exclusion of liability.

During transport, installation, dismantling, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.



Lifting gears and load equipment for handling the components must be suitable for the weight of the coupling.

Depending on national regulations, coupling and clutch components may have to be disposed of separately or separated for recycling.

The coupling must be stored in a dry environment. Adequate preservation must be carried out.

Operators and users must not make any changes to the coupling themselves over and above the treatment specified in these instructions.



If there is any visible damage the coupling must not be fitted or put into operation.

The coupling must not be operated unless housed in a suitable enclosure in accordance with the standards applying. This also applies to test runs and when checking the direction of rotation.

All work on the coupling must be carried out only when it is at a standstill. Secure the drive unit to prevent unintentional switch-on! A notice should be attached to the ON switch stating clearly that work is in progress.

In addition to any generally prescribed personal safety equipment (such as safety shoes, safety clothing, helmet) **suitable safety gloves** and **suitable safety glasses** must be worn when handling the coupling or clutch!

Only spare parts made by the manufacturer Flender must be used.

Any enquiries should be addressed to:

Flender GmbH
Schlavenhorst 100
46395 Bocholt

Tel.: +49 (0)2871 / 92-0
Fax: +49 (0)2871 / 92-2596

2.2 Marking of the coupling parts for use in potentially explosive zones

Couplings which are ordered in Atex-configuration, have the following marking on the flanged sleeve (5):

Flender GmbH	 	II 2G c IIC T5/T6 -20 °C ≤ Ta ≤ +80 °C/+65 °C
46393 Bocholt - Germany		II 2D c T 100 °C -20 °C ≤ Ta ≤ +80 °C
FLENDER couplings ZAPEX <year built>		I M2 c -20 °C ≤ Ta ≤ +80 °C

The second flanged sleeve (5) and the coupling parts (1/2) bear the marking  stamped on.

The marking is in one or two lines.

If, in addition to the CE mark, the letters "U" together with the Flender order number are stamped on, the coupling part has been delivered by Flender un- or prebored.



Flender supplies unbored and prebored couplings with CE marking only under the condition that the customer assumes the responsibility and liability for correct refinishing in a declaration of exemption.

2.3 Service conditions

The coupling is suited for service conditions in accordance with Directive 2014/34/EU:

- Equipment group II (use above ground) of categories 2 and 3 for areas where there are explosible gas, vapour, mist, air mixtures as well as for areas where dust can form explosible atmospheres.
- Equipment group I (underground applications) of the category M2.



If they are to be used below ground in potentially explosive areas the couplings must only be used with drive motors, which can be switched off on occurring of an explosible atmosphere.

The machines connected by the coupling must be earthed by an earth leakage resistance < 10⁶ Ω.

If coated couplings are used in potentially explosive areas, the requirements made of the conductivity of the coating and the limitation on the thickness of the coat applied must be observed in accordance with DIN EN 13463-1. Where lacquer coatings have a thickness less than 200 µm, no electrostatic charge is to be expected.

3. Fitting

Coupling parts (1/2) for removal by oil-hydraulic shrinking are delivered in a finish-machined state according to the order placed.

3.1 Machining the finished bore

Depreserve and clean coupling parts (1/2).

Clamp as shown in figure 7 and align.



Never clamp on the sealing surface of the O-ring.

Machine the finished bore, observe maximum bore described in section 1.

Check finished bore as described in section 7.

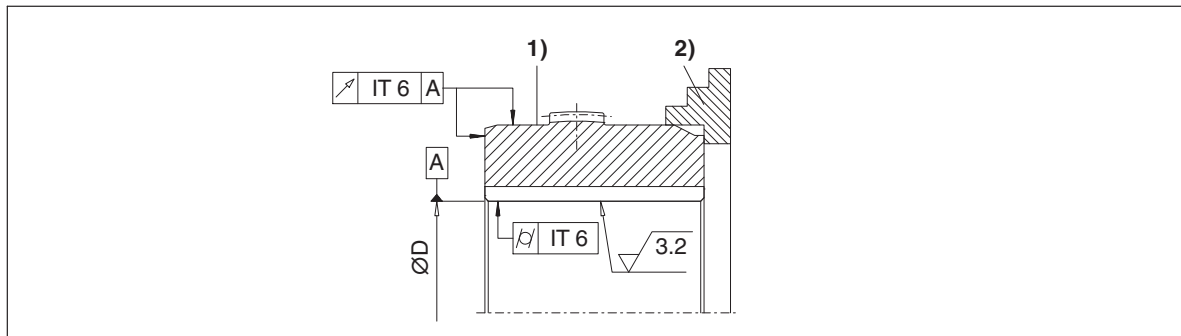


Fig. 7: Machining the finished bore

1) Sealing surface

2) Chuck

Table 2: Recommendation

Description	Interference fit with parallel-key connection, suitable for reversing operation					
Shaft tolerance	h6	k6	m6	n6	p6	s6
Bore tolerance	P7	M7	K7	J7	H7	F7



**Failure to observe these instructions may result in breakage of the coupling.
Danger to life from flying fragments.
The coupling may then become an explosion hazard.**

3.2 Machining the parallel keyway

- Parallel keyway to DIN 6885/1 ISO P9 with one keyway.
- Parallel keyway to DIN 6885/1 ISO JS9 with two keyways.

3.3 Axial fastening

Arrange set screw on the parallel keyway.

Position of the set screw to table 3, thereby considering the configuration A or B for the coupling parts (1/2).

Use threaded studs to DIN 916 with cup points as set screws (set-screw size to table 3).

The set screw should use the thread as much as possible.

Alternatively use end plate; as regards recess contact Flender.

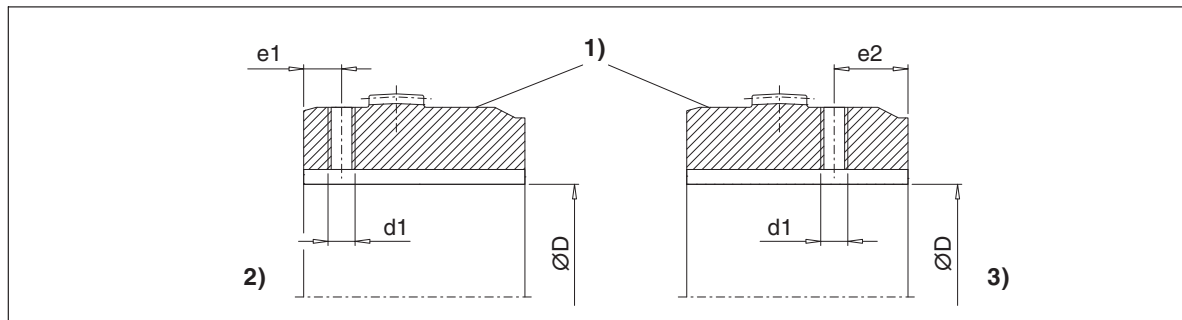


Fig. 8: Position of the set screw

1) Sealing surface

2) Design B

3) Design A

Table 3: Set-screw assignment, set-screw position and tightening torques

Size	Bore D mm	d1 mm	Tightening torque T_A Nm	Wrench width Hexagon socket wrench mm	e1 mm	e2 mm
83	10 ... 17	M 5	3	2.5	7	16
	> 17 ... 50	M 6	4	3		
107	10 ... 17	M 5	3	2.5	10	16
	> 17 ... 65	M 6	4	3		
130	10 ... 17	M 5	3	2.5	10	24
	> 17 ... 38	M 6	4	3		
	> 38 ... 82	M 8	8	4		
156	10 ... 17	M 5	3	2.5	15	27
	> 17 ... 22	M 6	4	3		
	> 22 ... 100	M 8	8	4		
181	10 ... 17	M 5	3	2.5	16	30
	> 17 ... 22	M 6	4	3		
	> 22 ... 30	M 8	8	4		
	> 30 ... 65	M10	15	5		
	> 65 ... 116	M12	25	6		
211	10 ... 17	M 5	3	2.5	18	35
	> 17 ... 22	M 6	4	3		
	> 22 ... 30	M 8	8	4		
	> 30 ... 38	M10	15	5		
	> 38 ... 137	M12	25	6		
250	10 ... 17	M 5	3	2.5	22	40
	> 17 ... 22	M 6	4	3		
	> 22 ... 30	M 8	8	4		
	> 30 ... 38	M10	15	5		
	> 38 ... 50	M12	25	6		
	> 50 ... 164	M16	70	8		
274	80 ... 178	M16	70	8	25	46
307	90 ... 198	M16	70	8	30	54
333	100 ... 216	M16	70	8	30	61
364	120 ... 242	M20	130	10	30	50
424	150 ... 288	M24	230	12	30	50

Tightening torques apply to bolts with untreated surfaces which are not or only lightly oiled (coefficient of friction $\mu = 0.14$). The use of lubricant paint or lubricant, which affects the coefficient of friction " μ ", is not permitted.

The specified tightening torques T_A must be complied with, applying DIN 25202 Screw-Connection Class C, with an output-torque scatter of $\pm 5\%$.

3.4 Balancing after machining the finished bore

The balancing quality is to be specified in accordance with the specific application (however min. G16 to DIN ISO 1940).

Balancing prescription to DIN ISO 8821 of the shaft must be observed.



Balancing bores must not affect the load-bearing capacity of the coupling parts.

The balancing bores must be applied on a large radius with sufficient distance to the hub's outer circumference.



Under no circumstances may the tooth system be damaged.

3.5 Fitting the coupling parts (1/2) in case of shaft-hub connection with parallel key

Unscrew the set screw.

Clean holes and shaft ends.

The cleaned flanged-sleeve grooves must be greased and the O-rings (12) then inserted.

The teeth of the flanged sleeves (5) must be greased and the flanged sleeves (5) must be shifted onto the shaft before pulling on the coupling parts (1/2).

Coat the bores of the coupling parts (1/2) and the shafts with MoS₂ mounting paste (e.g. Microgleit LP 405).



Coupling parts (1/2) with tapered bore and parallel-key connection must be fitted in cold condition.

Place the coupling parts (1/2), with cylindrical bore heat up to max. + 80 °C, if necessary.



Heated coupling parts form an explosion hazard, therefore there must not be an explosible atmosphere when fitting the coupling parts.

Shafts must not project from the inner sides of the hub.



The coupling parts (1/2) with a tapered bore must be secured with suitable end plates. For this, smear the hub end face with sealing compound and screw on the end plate.

On coupling parts (1/2) with keyway and set screw the threaded hole for the set screw must be filled 2/3 with sealing compound after cooling down to room temperature to prevent lubricant from escaping through the parallel keyway. Screw in the set screw (set screw must be above the parallel key).

Tighten the set screw (for tightening torques, see table 3).



**Failure to observe these instructions may result in breakage of the coupling.
Danger to life from flying fragments.
The coupling then becomes an explosion hazard.**

- 3.6 Fitting the coupling parts (1/2) in case of a cylindrical and tapered interference fit set up for removal by oil-hydraulic shrinking



The information specified on the dimensioned drawing should be observed with priority.

Unscrew screw plugs (22) from the coupling parts (1/2). Clean and dry holes and shaft ends. The oil channels and oil-circulation grooves must also be free from dirt.



The machine shaft and the bore of the coupling part must be absolutely clean and free of grease and oil.

The cleaned flanged-sleeve grooves must be greased and the O-rings (12) then inserted.

The teeth of the flanged sleeves (5) must be greased and the flanged sleeves (5) must be shifted onto the shaft before pulling on the coupling parts (1/2).



**Protect O-rings (12) and seals for the input and output side against damage and heating to above + 80 °C.
Use heat shields to protect against radiant heat.**

The coupling parts (1/2) must be mounted in hot condition and, depending on the shrink dimension, heated to the temperature indicated on the dimensioned drawing.

Heating may be done inductively, in a stove or with a burner.



Burners and heated coupling parts form an explosion hazard, therefore there must not be an explosible atmosphere when fitting the coupling parts.

Before mounting, the bore size of the heated coupling parts (1/2) must be checked, e.g. with a bore hole gauge.

The coupling parts (1/2) must be pulled smartly onto the shaft as far as stated in the dimensioned drawing.



The coupling parts (1/2) must be held in position on the shaft with the aid of a suitable retaining device, until they cool down and seat firmly.

After the coupling parts (1/2) have cooled down to ambient temperature the oil channels must be filled with clean forcing oil, e.g. ISO VG 150, and re-sealed with the screw plugs (22) (rust protection).



**Failure to observe these instructions may result in breakage of the coupling.
Danger to life from flying fragments.
The coupling then becomes an explosion hazard.**

- 3.7 Fitting the coupling

Grease the teeth on the coupling parts (1/2) and the flanged sleeves (5) and the hub circumference of the coupling parts (1/2) (sealing surfaces).

Screw the thrust piece (34) into the lower machine shaft in case of types ZNNV and ZNZV.

Using suitable tools, pull the flanged sleeves (5) onto the hub and over the teeth of the coupling parts (1/2) and hold or brace them in position.

In case of type ZNNA put the axial backlash limiting device (51) into the flanged sleeve (5).

In case of types ZNNV and ZNZV place the pressure plate (33) on the thrust piece (34) and into the flanged sleeve (5).

Move together and align the machines to be coupled (see item 3.8).

Smear the sealing surfaces of the flanged sleeves (5) and the adapter (4), if any, with sealing compound. Align the fitting holes of the flanges, noting any marks. Insert close-fitting bolts (8) and tighten the nuts (9) (for tightening torques, see item 3.12).

3.8 Alignment

To obtain the longest possible service life for the coupling, we recommend alignment with 20 % of the offsets possible in operation specified in item 3.9. The recommended alignment values in numerical values are specified in item 3.10. Very precise alignment must not be aimed at, as this will impair the formation of the lubricant film in the coupling teeth.

Alignment must be carried out using suitable measuring instruments. The following diagram shows alignment suggestions and points of alignment (A).



Flender recommendation:

To prevent measuring errors caused by sagging of the clock gauge, it is recommended that the coupling be aligned using laser technology.

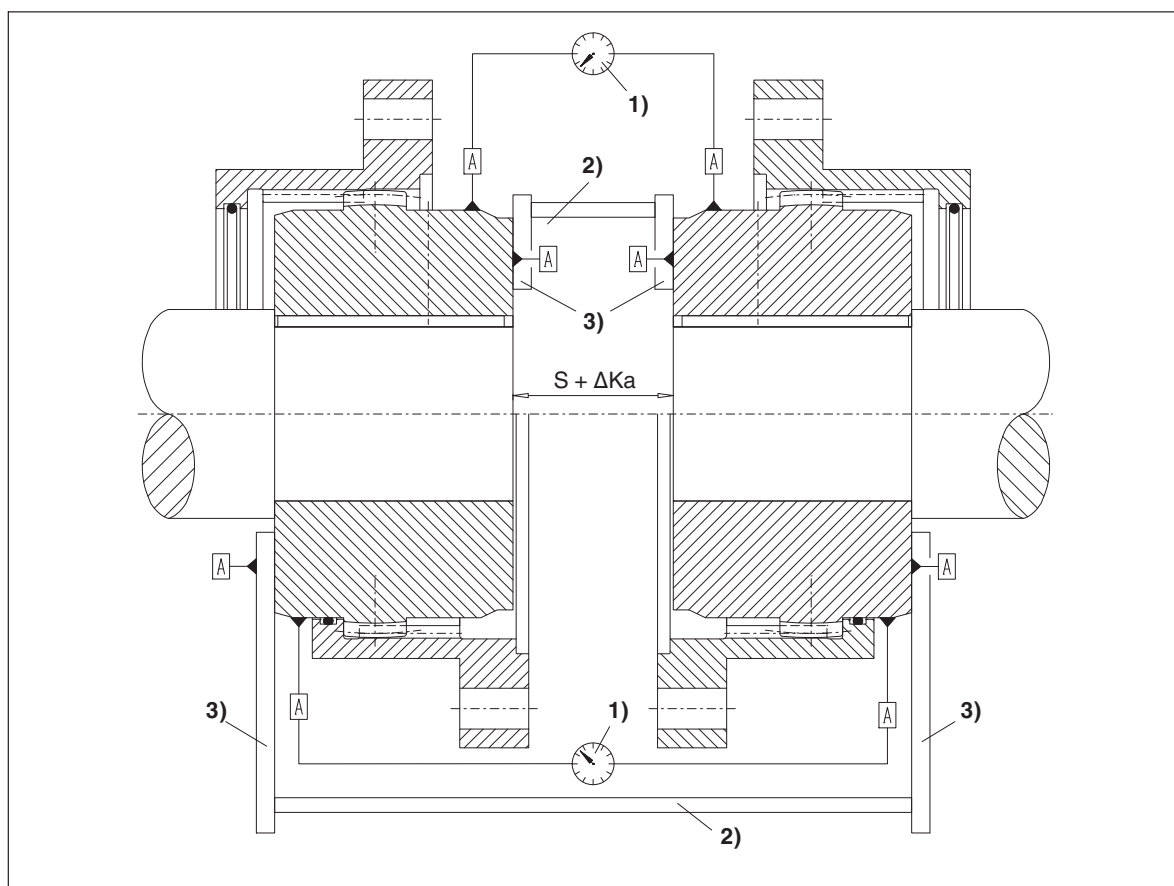


Fig. 9: Alignment

- 1) Dial gauge
- 2) Measurement of distance
- 3) Ruler

3.9 Possible misalignments

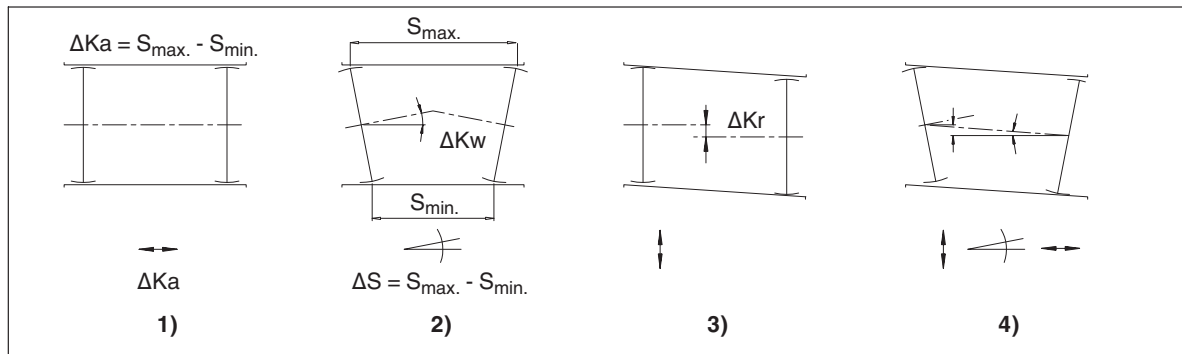


Fig. 10: Possible misalignments

- 1) Axial misalignment (ΔK_a)
- 2) Angular misalignment (ΔK_w)
- 3) Radial misalignment (ΔK_r)
- 4) Axial misalignment, angular misalignment and radial misalignment

3.9.1 Axial misalignment

Axial misalignment ΔK_a of the coupling parts relative to one another is permissible within the "permissible error" for dimension "S" (see item 3.11).

The permissible error for dimension "S" is specified as the maximum permissible increase in the hub distance of the coupling.

3.9.2 Angular misalignment

Types ZNN, ZNNV, ZNZS and ZNZV compensate for positional errors of up to a maximum angular misalignment of $\Delta K_w = 0.5^\circ$ in the shaft ends to be connected.

Due to the axial backlash limitation types ZNNA and ZNZA compensate for positional errors of up to a maximum angular misalignment of $\Delta K_w = 0.2^\circ$ in the shaft ends to be connected.

The angular misalignment ΔK_w can be measured as difference of the gap dimension ($\Delta S = S_{\max.} - S_{\min.}$).

$$\begin{aligned} \text{ZNN, ZNNV, ZNZS, ZNZV:} \quad & \Delta S = S_{\max.} - S_{\min.} \leq ND \times \tan 0.5^\circ \approx ND / 100 \\ \text{ZNNA, ZNZA:} \quad & \Delta S = S_{\max.} - S_{\min.} \leq ND \times \tan 0.2^\circ \approx ND / 300 \end{aligned}$$

Replace ND with ND1 or ND2 from section 1.

3.9.3 Radial misalignment

On types ZNN, ZNNV, ZNZS and ZNZV the maximum possible radial misalignment $\Delta K_{r_{\max.}}$ corresponds to an angular error per coupling half of $\Delta K_{w_{\max.}} = 0.5^\circ$.

On types ZNNA and ZNZA, the maximum possible radial misalignment $\Delta K_{r_{\max.}}$ corresponds to an angular error per coupling half of $\Delta K_{w_{\max.}} = 0.2^\circ$.

$$\begin{aligned} \text{ZNN, ZNNV, ZNZS, ZNNV:} \quad & \Delta K_r \leq VA \times \tan 0.5^\circ \approx VA / 100 \\ \text{ZNNA, ZNZA:} \quad & \Delta K_r \leq VA \times \tan 0.2^\circ \approx VA / 300 \end{aligned}$$



Angular and radial misalignment can occur simultaneously. The following condition must be adhered to:

$$\begin{aligned} \text{ZNN, ZNNV, ZNZS, ZNNV:} \quad & \arctan (\Delta K_r / VA) + \Delta K_w \leq 0.5^\circ \\ \text{ZNNA, ZNZA:} \quad & \arctan (\Delta K_r / VA) + \Delta K_w \leq 0.2^\circ \end{aligned}$$

3.10 Distance between teeth VA and recommended alignment values for angular and radial misalignment

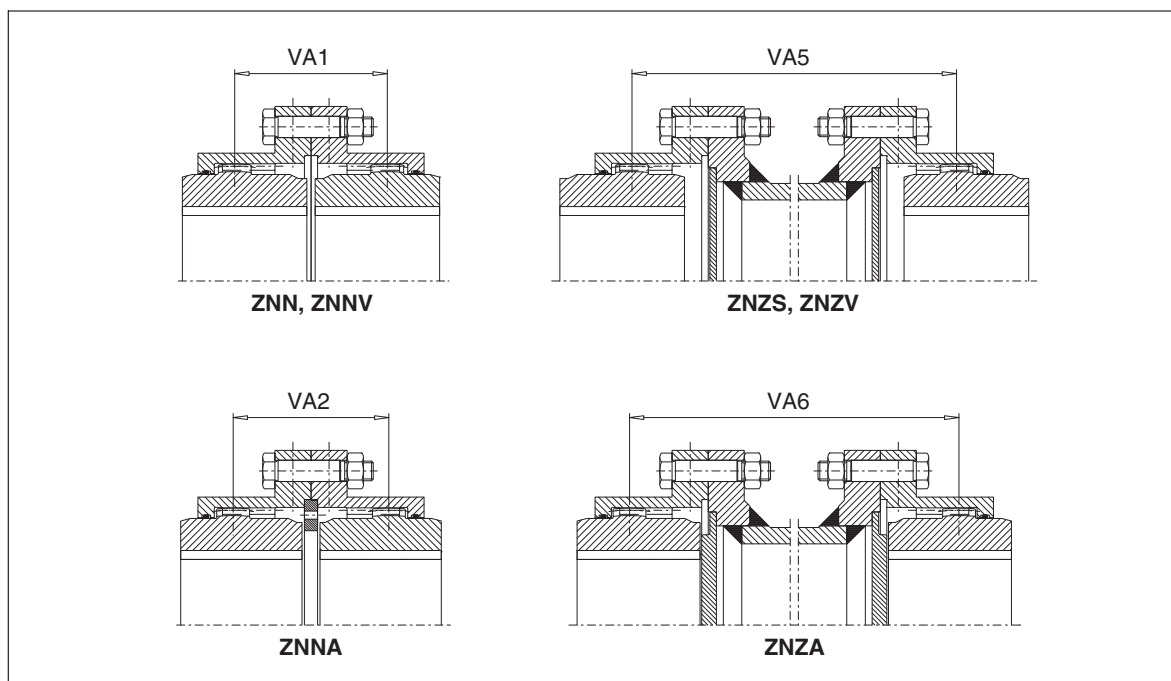


Fig. 11: Possible misalignments

Table 4: Distance between teeth, recommended alignment values for angular and radial misalignment

Size	Distance between teeth VA				Radial misalignment ΔKr at			Angular misalignment ΔS mm
	VA1 mm	VA5 mm	VA2 mm	VA6 mm	VA1 mm	VA2 mm	VA5; VA6 mm	
83	55	VA1 + LZ	57	VA2 + LZ	0.09	0.1	$\Delta Kr = VA5 \times \tan 0.1^\circ$ $\Delta Kr = VA6 \times \tan 0.1^\circ$	0.11
107	59		62		0.1	0.1		0.15
130	79		82		0.13	0.14		0.18
156	93		97		0.16	0.17		0.22
181	109		113		0.19	0.19		0.26
211	128		133		0.22	0.23		0.31
250	144		148		0.25	0.25		0.37
274	164		169		0.28	0.29		0.40
307	182		188		0.31	0.32		0.45
333	214		220		0.37	0.38		0.49
364	236		242		0.41	0.42		0.54
424	263		271		0.45	0.47		0.64



Due to the limited axial backlash, in case of types ZNNA and ZNZA the alignment values must be cut by half.

3.11 Distance dimensions S

Table 5: Distance dimensions "S" for types ZNN (S1, S2, S3), ZNNA (S16), ZNZA (S17), ZNZS (S8, S9), ZNNV (S11, S12) and ZNZV (S8, S13)

Size	S1 mm	S2 mm	S3 mm	perm. misalign- ment S1, S2, S3 mm	S8 mm	S9 mm	S11 mm	S12 mm	perm. misalign- ment S8, S9, S11, S12 mm	S13 mm	S16 mm	S17 mm
83	3	12	21	+ 1	10.5	1.5	8	21	+ 0.5	10.5	5	2.5
107	3	9	15	+ 1	7.5	1.5	4.5	15	+ 0.5	7.5	6	3
130	3	17	31	+ 1	15.5	1.5	12.5	31	+ 0.5	15.5	6	3
156	5	17	29	+ 1	14.5	2.5	10.5	29	+ 0.5	14.5	9	4.5
181	5	19	33	+ 1	16.5	2.5	12.5	33	+ 0.5	16.5	9	4.5
211	6	23	40	+ 1	20	3	15	40	+ 0.5	20	11	5.5
250	6	24	42	+ 1	21	3	17	42	+ 0.5	21	10	5
274	8	29	50	+ 1.5	25	4	19.5	50	+ 0.75	25	13	6.5
307	8	32	56	+ 1.5	28	4	22	56	+ 0.75	28	14	7
333	8	39	70	+ 1.5	35	4	29	70	+ 0.75	35	14	7
364	8	46	84	+ 1.5	42	4	36	84	+ 0.75	42	14	7
424	10	43	76	+ 1.5	38	5	30	76	+ 0.75	38	18	9



For dimensions S16 and S17 errors of ± 0.1 mm are permissible.

3.12 Assignment of the tightening torques and wrench widths



The use of an impact screwdriver is not permissible.

Tightening torques apply to bolts with untreated surfaces which are not or only lightly oiled (coefficient of friction $\mu = 0.14$). The use of lubricant paint or lubricant, which affects the coefficient of friction " μ ", is not permitted.

The specified tightening torques T_A must be complied with, applying DIN 25202 Screw-Connection Class "C", with an output-torque scatter of ± 5 %.

The tightening torques and wrench widths of the set screws are specified in table 3.

Table 6: Tightening torques and wrench widths of the parts 6 and 9

Size	Tightening torques T_A for bolts of the strength class 8.8 to DIN ISO 898 Part 1 (with $\mu = 0.14$) Part no. 9 Nm	Wrench width SW	
		Hexagon socket wrench Part no. 6 mm	Hexagon wrench Part no. 9 mm
83	25	3	13
107	49	5	17
130	49	5	17
156	86	5	19
181	86	5	19
211	210	5	24
250	210	5	24
274	210	5	24
307	410	5	30
333	410	5	30
364	410	5	30
424	710	5	36

4. Start-up and operation

4.1 Requirements for grease

For ZAPEX couplings of series ZN..., only greases containing active agents for increasing corrosion protection and resistance to ageing and for reducing wear in mixed-friction areas are approved.

- Greases must have been manufactured on the basis of mineral oil.
- Viscosity class for greases: DIN 51818, NLGI 0, NLGI 00.
- Suitability for sealing rings made of elastomer materials NBR and FPM.
- Compatibility with liquid seals: Loctite 5910, 5922



**Lubricants must never be mixed with other substances.
Before mixing different types of lubricants always ask the manufacturer on the compatibility of the lubricants.**

4.2 Recommended lubricants

The following lubricant recommendations apply to the ZAPEX couplings described in these instructions:

Table 7: Lubricants

Lubricant				FLENDER
Liquefied greases	FDP 00	Energrease LS-EP 00	Tribol 3020/1000-00 ◆ Longtime PD 00	FLENDER Hochleistungsfett
Lubricant			Mobil	
Liquefied greases	RENOLIT SO-D 6024	GRAFLOSCON C-SG 500 Plus	Mobilux EP 004	Alvania GL 00

The lubricants are suitable for operating temperatures of between - 20 °C and + 80 °C.

◆ Lubricants with this mark are suitable for operating temperatures of between - 40 °C and + 80 °C.



Observe manufacturer's instructions for handling lubricants.

4.3 Grease quantity



If the grease quantity filled is not in accordance with the specified quantity, the coupling may become an explosion hazard.

Table 8: Grease quantities

Size	Grease quantity ¹⁾		Size	Grease quantity ¹⁾		Size	Grease quantity ¹⁾	
	ZNN, ZNNA dm ³	ZNZS, ZNZA dm ³		ZNN, ZNNA dm ³	ZNZS, ZNZA dm ³		ZNN, ZNNA dm ³	ZNZS, ZNZA dm ³
83	0.04	0.02	181	0.33	0.17	307	1.4	0.7
107	0.08	0.04	211	0.42	0.21	333	1.8	0.9
130	0.16	0.08	250	0.7	0.35	364	2.3	1,15
156	0.2	0.1	274	0.9	0.45	424	3.0	1.5

¹⁾ In case of types ZNZS and ZNSA the grease quantities apply to for one coupling side.



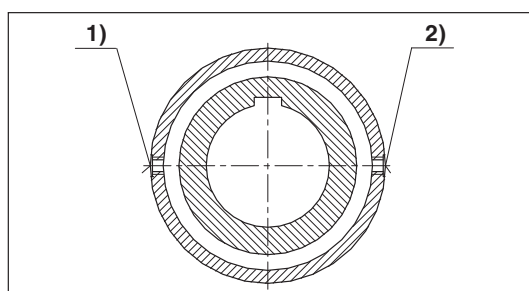
For the grease quantities for types ZNNV and ZNZV, refer to the dimensioned drawings.

For easier filling, proceed as follows:

Rotate coupling until the screw plugs (6) are in the position shown in the diagram 12 below.

The two screw plugs (6) must be removed and grease put in (if necessary, use a grease gun).

Screw in the screw plugs (6) with fitted/integrated sealing rings.



- 1) Filling hole
- 2) Ventilation hole

Fig. 12: Filling with grease



Any grease spillage must be completely collected and disposed of in accordance with the regulations applying.

4.4 Procedure before start-up



Bolt-tightening torques for the coupling and tightening torques for the foundation bolts of the coupled machine must be checked before start-up. Enclosures (coupling protection, contact guard) must be fitted. Overload conditions during start-up cannot be excluded. If the coupling breaks through overload, metal parts may fly off and cause personal injury and/or material damage.



If it is to be used below ground in potentially explosive areas, the coupling, which is made of steel, must be provided with a robust casing to preclude the risk of ignition from e.g. friction, impact or friction sparks. The depositing of heavy metal oxides (rust) on the coupling must be precluded by the casing or other suitable precautions.

The coupling must run with little noise and without vibration. Irregular behaviour must be treated as a fault requiring immediate remedy. In case of fault the drive must be stopped at once. The necessary measures for repair must be taken in accordance with the safety regulations applying.

5. Faults, causes and remedy

5.1 Possible cause of the fault:

Change in alignment:

- Rectify the cause change in alignment (e.g. loose foundation bolts).
- Align the coupling.
- Check the axial fastening and, if necessary, adjust.

Insufficient lubricant:

- Take a small grease sample at the screw plug (6) and check, whether the grease can still be used. If the consistence of the grease has changed, the grease should be changed as described in item 6.2.
- In case of leakage the lost grease quantity must be recharged, or the grease should be changed as described in item 6.2. In case of a complet grease change as described in item 6.2, the sealing rings (12) should also be replaced, as described in item 6.3.

5.2 Incorrect use



**Failure to observe these instructions may result in breakage of the coupling.
Danger to life from flying fragments.
Through incorrect use the coupling may become an explosion hazard.**

5.2.1 Frequent faults when selecting the coupling and/or coupling size

- Important information for describing the drive and the environment are not communicated.
- System torque too high.
- System speed too high.
- Application factor not correctly selected.
- Chemically aggressive environment not taken into consideration.
- The ambient temperature is not permissible.
- Finished bore with inadmissible diameter and/or inadmissible assigned fits.
- Machining of parallel keyways of which the width across corners is greater than the width across corners of the parallel keyways to DIN 6885/1 with a maximum permissible bore.
- The transmission capacity of the shaft-hub connection is not appropriate to the operating conditions.
- Maximum load or overload conditions are not being taken into consideration.
- Dynamic load conditions are not being taken into consideration.
- Shaft-hub connection resulting in impermissible material stress on the coupling.
- Operating conditions are being changed without authorisation.
- Coupling and machine / drive train form a critical torsional, axial and bending vibration system.
- Fatigue torque load too high.

5.2.2 Frequent faults when fitting the coupling

- Components with transport or other damage are being fitted.
- When fitting coupling parts in a heated condition, sealing rings are being excessively heated.
- The shaft diameter is beyond the specified tolerance range.
- Coupling parts are being interchanged, i.e. their assignment to the specified shaft is incorrect.
- Specified axial fastenings are not fitted.
- Prescribed tightening torques are not being adhered to.
- Bolts are inserted dry or greased.
- Flange surfaces of screwed connections have not been cleaned.
- Alignment or shaft-misalignment values do not match those in the instructions manual.
- The coupled machines are not correctly fastened to the foundation, and as a result shifting of the machines e.g. through loosening of the foundation-screw connection is causing excessive displacement of the coupling parts.
- The coupled machines are not sufficiently earthed.
- Sealing rings are not fitted.
- Sealing surfaces have been painted.
- The lubricant has not been correctly put in (see section 4).
- The back clearance of the parallel key has not been filled with sealing compound (when inserting the set screw no sealing compound has been put into the threaded hole).
- The coupling guard used is not suitable.

5.2.3 Frequent faults in maintenance

- Maintenance intervals are not being adhered to.
- Non-genuine ZAPEX spare parts are being used.
- Old or damaged ZAPEX spare parts are being used.
- Leakage in the vicinity of the coupling is not being identified and as a result chemically aggressive media are damaging the coupling.
- Fault indications (noise, vibration, etc.) are not being observed.
- Prescribed tightening torques are not being adhered to.
- Alignment and/or shaft-misalignment values do not match those in the instructions manual.

6. Maintenance and repair

6.1 General

The coupling must be checked for heating up and any change in the noise level at general maintenance intervals or at least every three months.

The coupling must run with little noise and without vibration in all operating phases. Irregular behaviour must be treated as a fault requiring immediate remedy.

6.2 Changing grease

During the regular inspections the coupling must be checked for leaks.



If the grease filling quantity is not in accordance with the specified quantity, the coupling may become an explosion hazard.

Change lubricant:

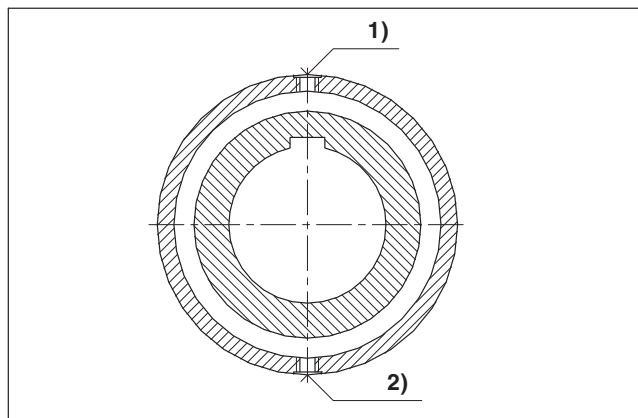
- When used at max. 70 °C: after approx. 8000 operating hours, at the latest after 2 years.
- When used at temperature above 70 °C: after approx. 3000 operating hours, at the latest after 1 year.

When changing lubricant of the same type, the quantity of lubricant remaining in the coupling should be kept as low as possible. Generally speaking, a small residual quantity will cause no particular problems. Lubricants of different types and manufacturers must not be mixed. If necessary, confirmation that the new lubricant is compatible with residues of the old lubricant should be obtained from the manufacturer of the new grease.

Unscrew screw plugs (6) and drain off the grease into a suitable vessel, as shown in the diagram. To facilitate the process, add low-viscosity oil to the used grease and mix. **Observe compatibility of the oil with the grease.**



All the grease must be completely collected and disposed of in accordance with the regulations applying.



- 1) Ventilation hole
- 2) Drain hole

Fig. 13: Changing grease

Fill with grease (see section 4).

6.3 Replacing O-rings

The grease must be drained off as described in item 6.2.

The O-rings (12) can be replaced with open-ended (cut) O-rings (12), while adhering to dimensions Q and "P" (see section 1 "Technical Data"), without having to move the machines to be connected.

For this, undo the screw connection (8, 9) of the flanged sleeves (5) and/or the adapter (4) and push the flanged sleeves (5) off the teeth and far enough off the hub for the O-ring (12) to be able to be removed. Support the adapter (4).

Clean sealing compound off the flanged sleeves (5) and the adapter (4).

Cut the new O-ring (12) through radially at one point and glue the cut ends exactly together. Adhesive e.g. LOCTITE 401.

Then place the cut section into the groove and, working from there, insert the O-ring (12) from both sides.

Smear the sealing surfaces of the flanged sleeves (5) and/or the adapter (4) with sealing compound and bolt them together (for tightening torques, see section 3, item 3.12).

Fill with grease (see section 4).

6.4 Demounting the coupling

The grease must be drained off as described in item 6.2.

Undo the close-fitting bolt connection (8; 9) and brace the flanged sleeves (5) above the shafts.

Move the coupled machines apart. Remove the adapter (4), the axial-backlash limiting device (51) and the pressure plate (33). Unscrew the thrust piece (34).

Examine the teeth, the sealings (12) and the sealing surfaces for damage. Damaged parts must be replaced.

6.5 Demounting the coupling parts (1/2) in case of shaft-hub connection with parallel key

Remove the axial fastening (set screw, end plate). Mount a suitable detaching device. Using a burner, heat coupling part (1/2) along its length and above the parallel keyway (max. + 80 °C).



Burner and heated coupling parts form an explosion hazard, therefore there must not be an explosible atmosphere when fitting the coupling parts.

Pull the coupling part off. Examine the teeth, the sealing surfaces, the hub bore and the shaft for damage and protect against rust. Damaged parts must be replaced.

For re-assembly, the instructions in sections 3 and 4 must be observed.

6.6 Disassembly of coupling parts (1/2) in case of cylindrical and tapered interference fit set up for removal by hydraulic shrinking

For demounting the following tools are needed:

- For each oil channel (for number, see the dimensioned drawing) an oil pump with pressure gauge (min. 2500 bar) or motor pump with corresponding number of independently closable connections
In case of coupling parts (1/2) with stepped bore, a motor-driven pump must be connected up to the oil channel located at the point of transition from the smaller bore to the larger, as a large quantity of oil per unit of time is needed here.
- Suitable connections and pipes.
- 1 detaching device or retaining plate with retaining screws or threaded spindles with nuts (material of screws and spindles min. 10.9, material of nuts identical to that of the screws).
- 1 hydraulic cylinder with oil pump. Note displacement and pressure of the hydraulic cylinder (for axial force, consult Flender or refer to the dimensioned drawing).



Observe manufacturer's instructions for using forcing-off/detaching device, hydraulic cylinder and pumps.

Before detaching the coupling part (1/2) the detaching device must be fitted as shown in the figure.

6.6.1 Demounting the coupling parts (1/2) in case of cylindrical interference fit

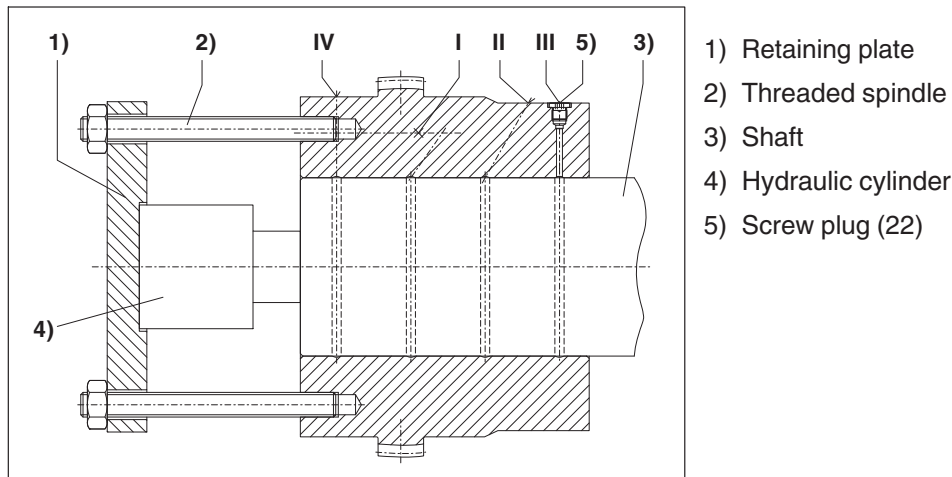


Fig. 14: Demounting the coupling parts (1/2) in case of cylindrical interference fit



Secure coupling part (1/2) and detaching device, using suitable equipment.

The screw plugs (22) must be removed from the oil channels. An oil pump must be bled and connected up to the middle oil channel (here oil channel I).

Then the pump must be operated at the pressure specified on the dimensioned drawing until oil emerges from the adjacent connections (oil channels IV and II).



The max. pressure specified on the dimensioned drawing must not be exceeded. During the entire operation the pressure must be maintained at a constant level on all the oil channels to which pressure is applied.

Bleed the next oil pump, connect it up to oil channel II and operate it at the pressure specified on the dimensioned drawing until the oil emerges at oil channel III.

Bleed the next oil pump, connect it up to oil channel IV and operate it at the pressure specified on the dimensioned drawing until a ring of oil emerges at the end face.

Bleed the next oil pump, connect it up to oil channel III and operate it at the pressure specified on the dimensioned drawing until a ring of oil emerges at the end face.

If, when pressure is applied, oil emerges to the extent that pressure cannot be maintained, a thicker oil must be used.

Only when an unbroken ring of oil emerges from both end faces can pressure be applied to the hydraulic cylinder to slide the coupling part (1/2) smartly off the shaft.

All the oil must be completely collected and disposed of in accordance with the regulations applying.



Note stroke of hydraulic cylinder. If re-adjustment is necessary, the end face of the hydraulic cylinder must stop between 2 oil channels.

After detaching, the oil pumps and detaching device must be removed from the coupling part (1/2).

Examine the teeth, the sealing surfaces, the hub bore and the shaft for damage and protect against rust. Damaged parts must be replaced.

For re-assembly, the instructions in sections 3 and 4 must be observed.

6.6.2 Demounting the coupling parts (1/2) in case of tapered interference fit

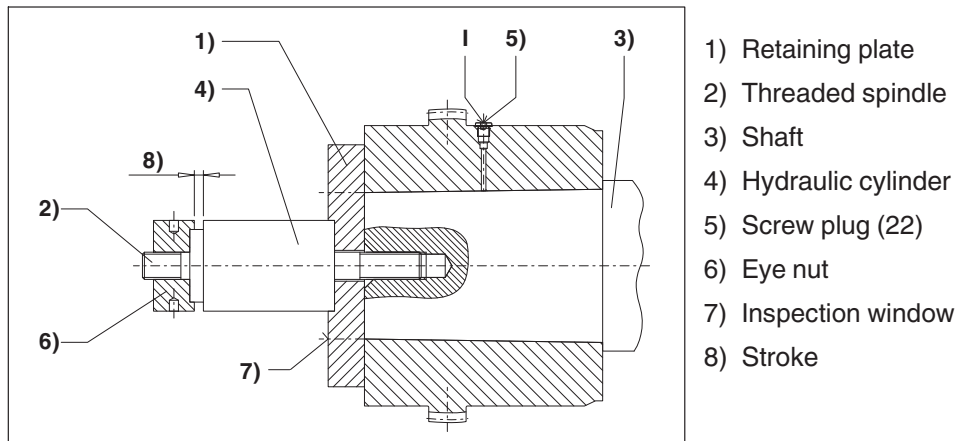


Fig. 15: Demounting the coupling parts (1/2) in case of tapered interference fit



Secure coupling part (1/2) and detaching device, using suitable equipment. To prevent the coupling part (1/2) suddenly coming off, it must be secured axially (as shown in figure 15).

The screw plugs (22) must be removed from the oil channels.

Sufficient pressure must be applied to the hydraulic cylinder for it to generate at least the axial force specified on the dimensioned drawing.

The oil pump must be bled, connected up to oil channel I and operated at the pressure indicated on the dimensioned drawing until a ring of oil emerges at the end face or from the adjacent connection.



The max. pressure specified on the dimensioned drawing must not be exceeded.

If, when pressure is applied, oil emerges to the extent that pressure cannot be maintained, a thicker oil must be used.

The pressure must be maintained until a ring of oil emerges at both end faces. This must be monitored through the inspection window at the side of the detaching device.

All the oil must be completely collected and disposed of in accordance with the regulations applying.

Only when an unbroken ring of oil emerges from both end faces can the hydraulic cylinder be bled. The coupling part (1/2) slides off the shaft until there is no adhesion between the coupling part (1/2) and the shaft.

Detach the oil pump and detaching device. Remove coupling part (1/2).

Examine the teeth, the sealing surfaces, the hub bore and the shaft for damage and protect against rust. Damaged parts must be replaced.

For re-assembly, the instructions in sections 3 and 4 must be observed.

7. Stocking spare parts

7.1 Spare parts

For ordering spare parts state the following data, as far as possible:

- Flender order number and position
- Drawing number
- Coupling type and coupling size
- Part number (see spare-parts list)
- Bore, bore tolerance, keyway and balancing as well as particular characteristics such as flange-connection dimensions, intermediate-shaft length, brake-drum dimensions.
- Any special details such as temperature, electrically insulating.

Table 9: Spare-parts list

Part number	Designation	ZNN	ZNNA	ZNNV	ZNZS	ZNZA	ZNZV
1	Coupling part 1/2	x	x	x	x	x	x
2	Coupling part 1/2	x	x	x	x	x	x
4	Adapter				x	x	x
5	Flanged sleeve	x	x	x	x	x	x
6	Screw plug	x	x	x	x	x	x
7	Sealing ring ¹⁾	x	x	x	x	x	x
8	Close-fitting bolt	x	x	x	x	x	x
9	Hexagon nut	x	x	x	x	x	x
12	O-ring	x	x	x	x	x	x
20	Plate pulley ²⁾				x	x	x
22	Screw plug ³⁾						
33	Pressure plate			x			x
34	Thrust piece			x			x
50	Sealing compound	x	x	x	x	x	x
51	Retaining ring		x				

¹⁾ The sealing ring (7) is provided only on size 83. On the other sizes the sealing ring is integrated into the screw plug (6).

²⁾ The plate pulley (20) is flanged into the adapter (4). For replacement, only the adapter (4) complete with the plate pulleys (20) can be ordered.
In case of type ZNZS with adapter lengths $LZ \leq 200$ the adapter (4) is designed without plate pulleys (20).

³⁾ The screw plugs (22) are used only with an hydraulic interference fit (see section 6, items 6.6.1 and 6.6.2).

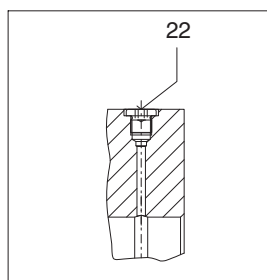


Fig. 16: Screw plug

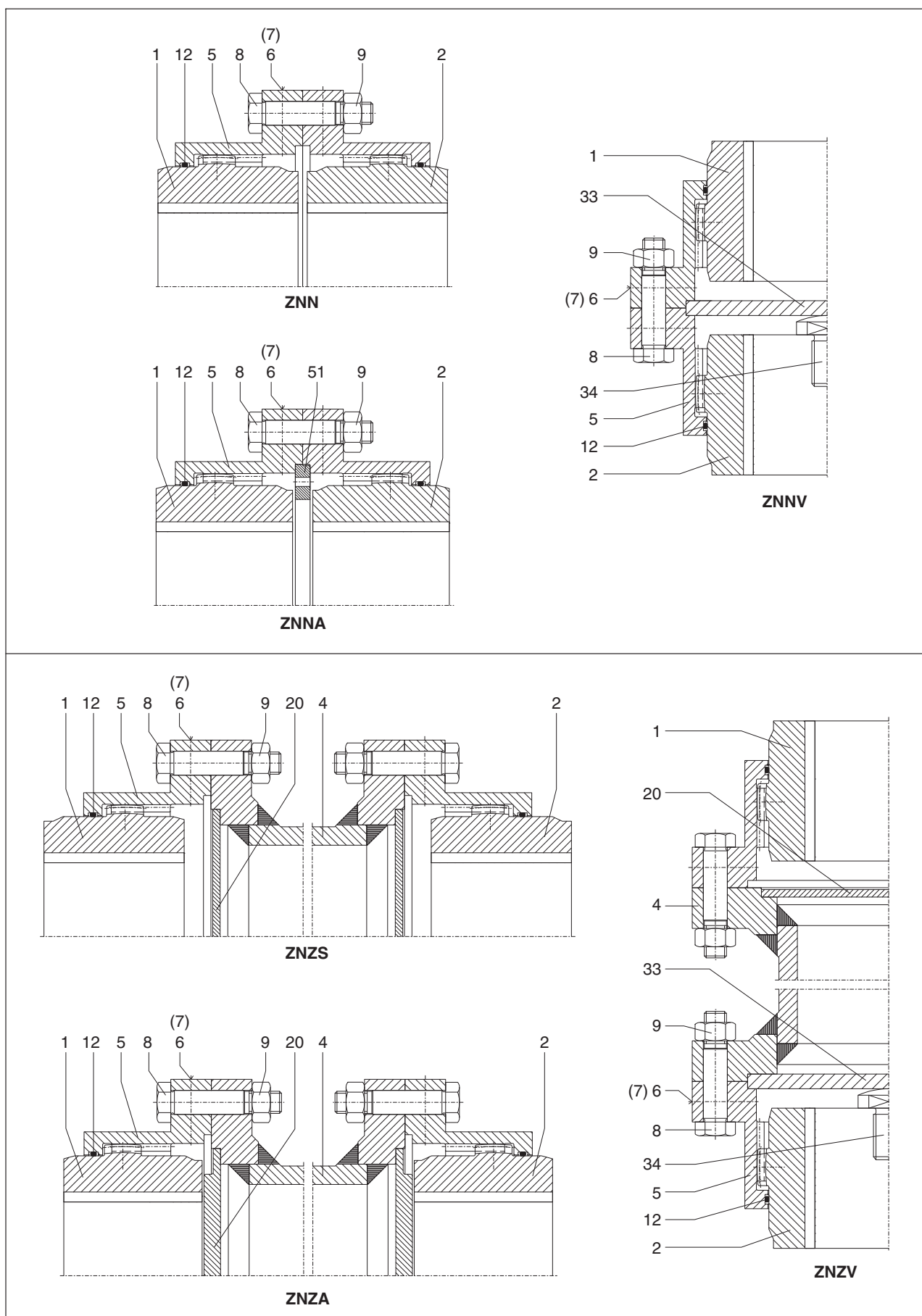


Fig. 17: Spare-parts drawings

8. Declarations

8.1 EU declaration of conformity



EU declaration of conformity

The manufacturer, Flender GmbH, 46395 Bocholt, Germany, declares that the equipment described in these operating instructions:

FLENDER ZAPEX® couplings Types ZNN, ZNNA, ZNNV, ZNZS, ZNZA, ZNZV

is in conformity with Article 1 and Article 13, Paragraph 1 b) ii) of Directive 2014/34/EU and complies with the requirements of Directive 2014/34/EU and the following standards:

EN 1127-1 : 2011
EN 13463-1 : 2009
EN 13463-5 : 2011

This declaration of conformity is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

Directive 2014/34/EU	OJ L 96, 29.03.2014, p.309-356	(effective from 20.04.2016, 00:00 a.m.)
Directive 94/9/EC	OJ L 100, 19.04.1994, p.1-29	(effective until 19.04.2016, 12.00 p.m.)

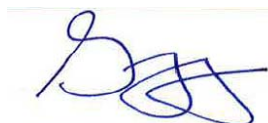
The technical documentation has been delivered to the body named below:

DEKRA EXAM GmbH, D - 44727 Bochum, code number: 0158

A handwritten signature in black ink, appearing to read 'F. Henseler'.

Bocholt, 2017-10-01

Felix Henseler, Head of PD MD AP

A handwritten signature in blue ink, appearing to read 'T. Tebrügge'.

Bocholt, 2017-10-01

Thomas Tebrügge / Head of PD MD AP COU BA

FLENDER COUPLINGS

ZAPEX

Operating instructions 3560 en

Edition 10/2017

[Flender GmbH](#)

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GERMANY