

FLENDER COUPLINGS

ZAPEX

Operating instructions 3500 en
Edition 10/2017

ZWN, ZWNA, ZWD, ZWDA,
ZZS, ZZSA, ZZSD, ZZDA, ZWNV, ZZSV



FLENDER COUPLINGS

ZAPEX 3500 en

Operating instructions

Translation of the original operating instructions

ZWN, ZWNA, ZWD, ZWDA,
ZZS, ZZSA, ZZSD, ZZDA, ZWNV, ZZSV

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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

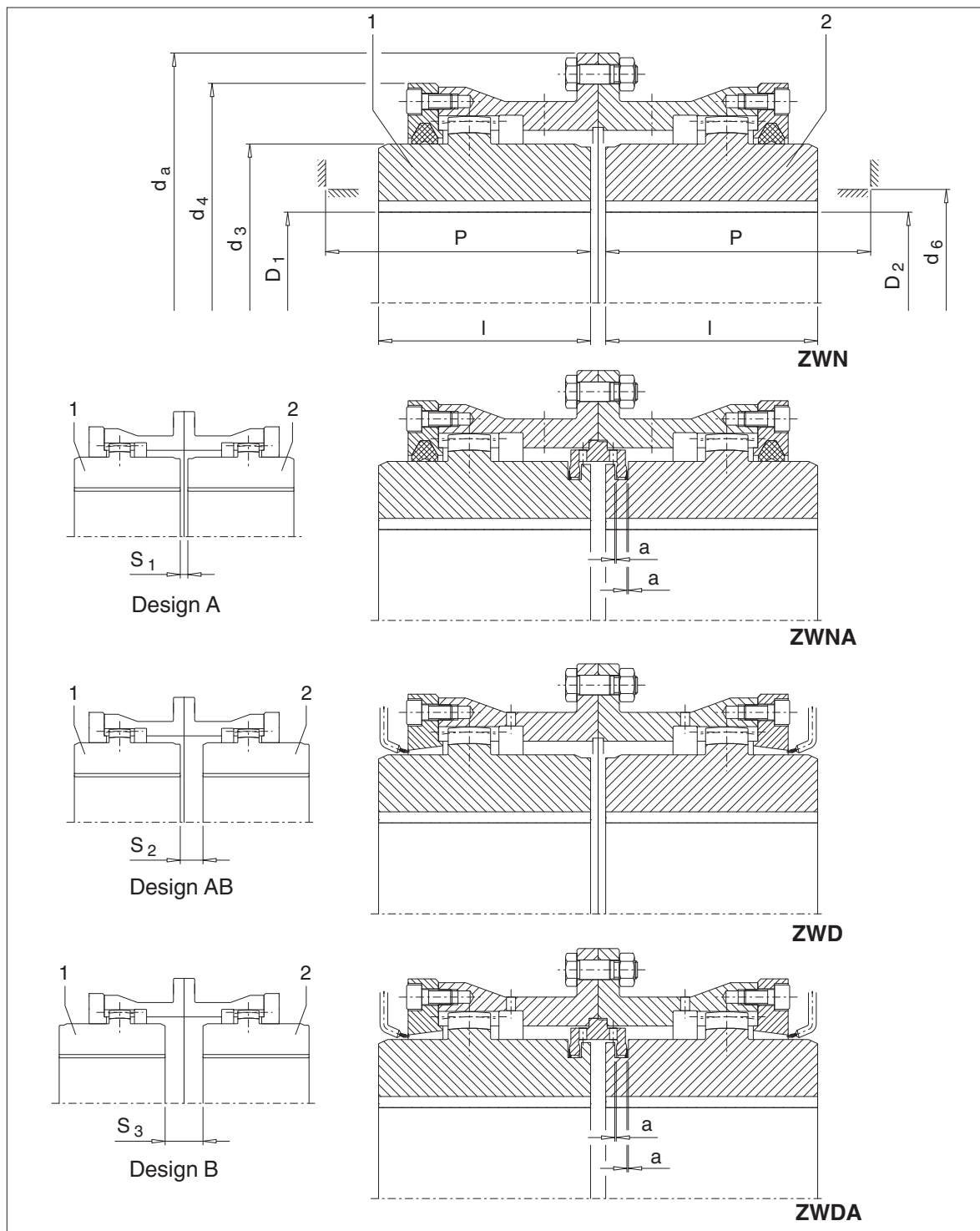


If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority. The dimensioned drawing should be made available to the user of the system.

1.1 Types ZWN, ZWNA, ZWD, ZWDA

The types ZWNA and ZWDA are only available in configuration A (S_1). The distance dimensions S_1 to S_3 will be found in section 6, item 6.9.

For dimension table, see item 1.5.



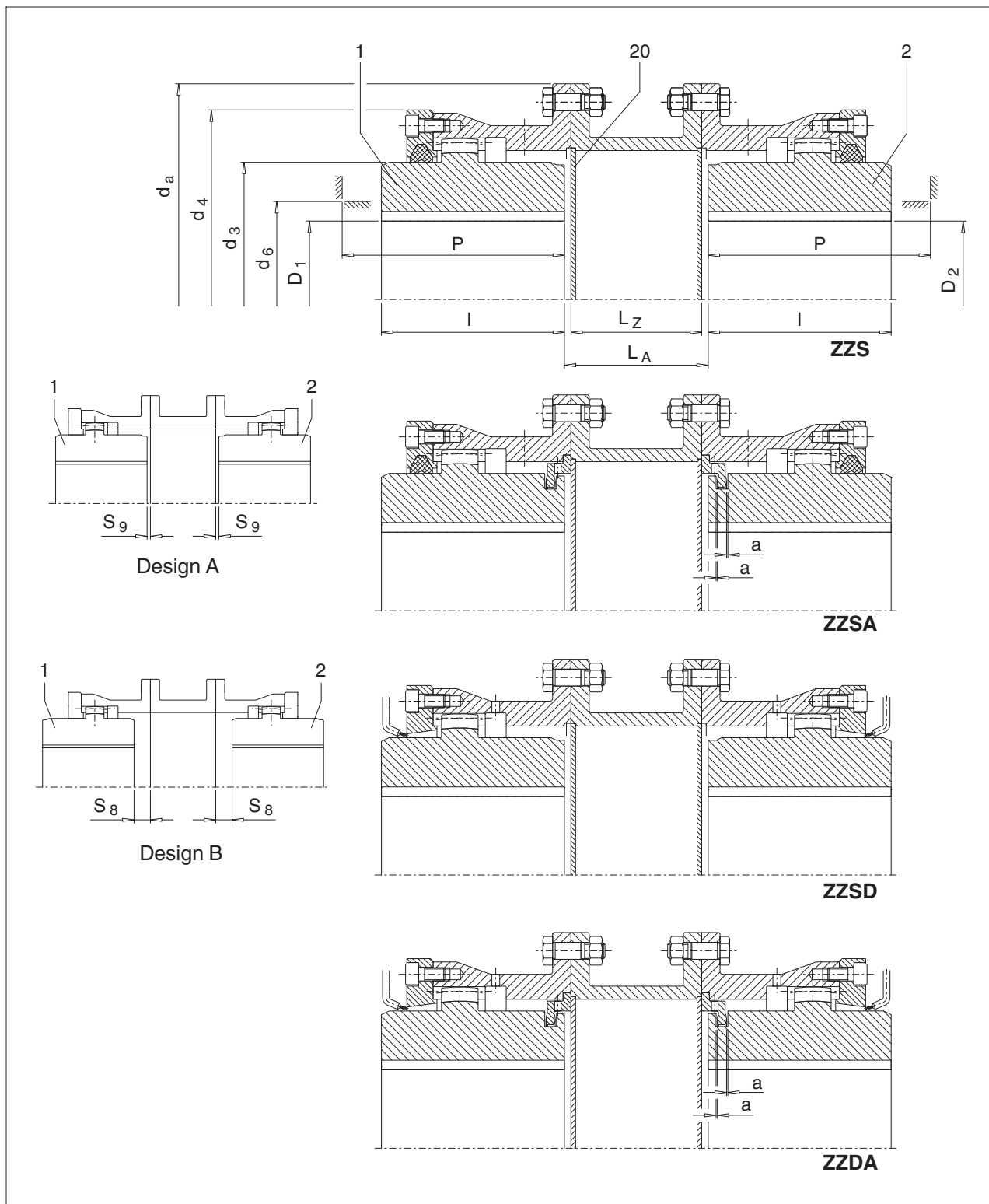
1.2 Types ZZS, ZZSA, ZZSD, ZZDA

The types ZZSA and ZZDA are only available in configuration A (S_9). The distance dimensions S_8 and S_9 will be found in section 6, item 6.9.

L_A dimensions according to the specifications of the customer.

L_Z dimensions ≤ 200 are delivered without part 20 ($L_A = L_Z + 2 \times S_{8/9}$)

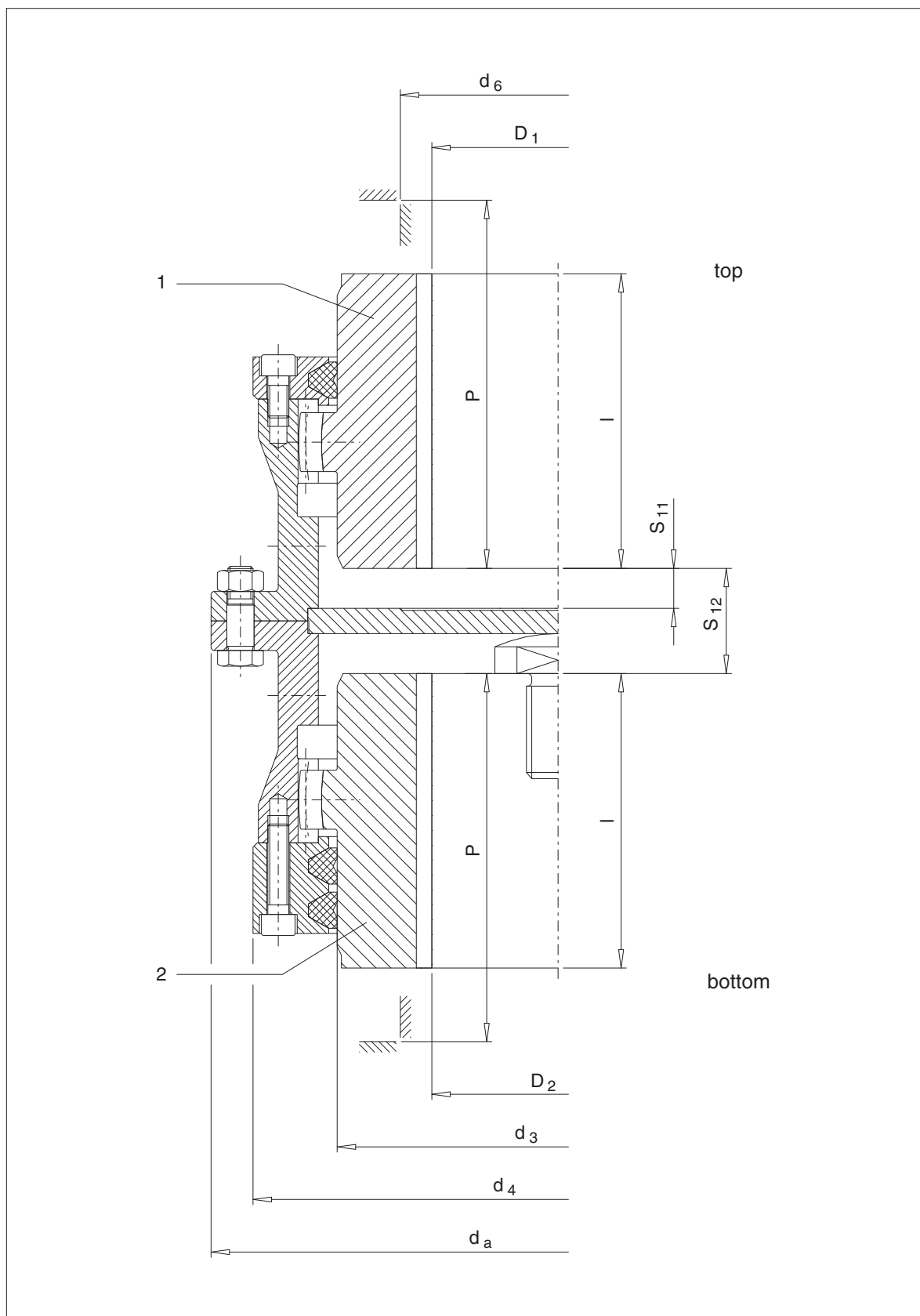
For dimension table, see item 1.5.



1.3 Type ZWNV

The distance dimensions S_{11} and S_{12} will be found in section 6, item 6.9.

For dimension table, see item 1.5.

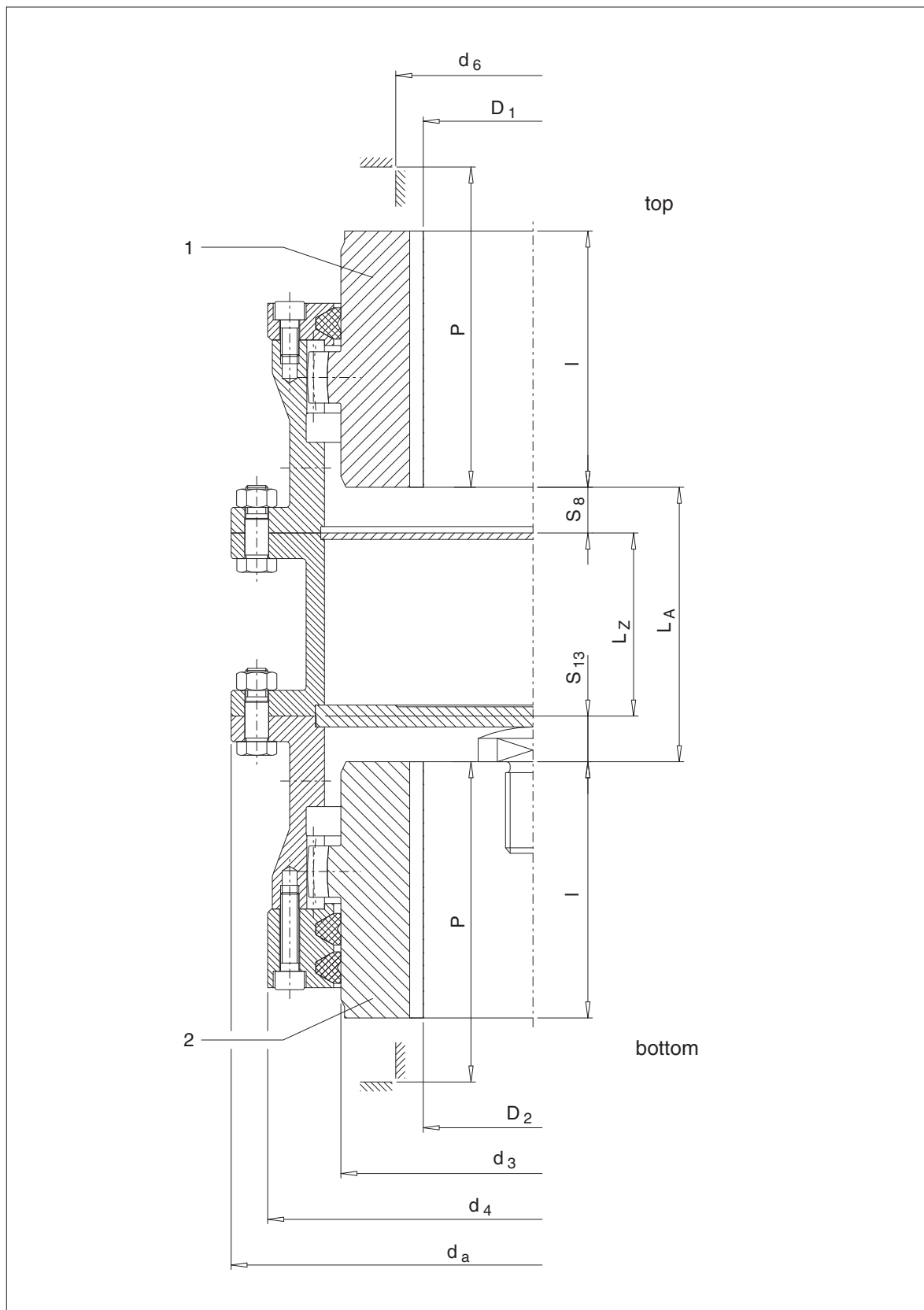


1.4 Type ZZSV

The distance dimensions S_8 and S_{13} will be found in section 6, item 6.9.

L_A dimensions according to the specifications of the customer.

For dimension table, see item 1.5.



1.5 Dimension table

Size	Rated torque	Speed	Hole		d _a	d ₃	d ₄	d ₆	l	P	Axial back-lash	L _z min. mm	Weight 4) kg
	T _N 1) Nm	n _{max.} 1/min	D ₁ / D ₂ from mm	up to 2) mm							a mm		
112	1300	9400	0	45	143	65	110	45	50	85	-	120	7.2
128	2500	8300	0	55	157	80	128	60	60	105	-	120	10
146	4300	7300	0	65	177	95	146	75	75	120	0.5	120	15
175	7000	6400	0	80	215	112	175	85	90	140	0.5	130	26
198	11600	5500	0	95	237	135	198	110	100	150	0.5	130	37
230	19000	4700	0	110	265	160	230	135	110	160	0.5	130	53
255	27000	4100	0	125	294	185	255	160	125	175	1.0	140	74
290	39000	3700	70	145	330	210	290	180	140	200	1.0	140	100
315	54000	3300	80	160	366	230	315	200	160	220	1.0	180	130
342	69000	3000	90	180	392	255	340	225	180	240	1.0	180	170
375	98000	2700	100	200	430	290	375	260	200	260	1.0	180	235
415	130000	2500	120	220	478	320	415	285	220	300	1.0	200	300
465	180000	2200	140	250	528	360	465	325	240	320	1.0	200	400
505	250000	2000	160	275	568	400	505	365	260	340	1.5	200	510
545	320000	1800	180	300	620	440	545	405	280	360	1.5	220	670
585	400000	1700	210	330	660	480	585	445	310	390	1.5	220	830
640	510000	1600	230 > 330	330 360	738	480 520	640	445	330	420	1.5	250	990 930
690	660000	1450	250 > 360	360 390	788	520 560	690	475	350	440	1.5	250	1200 1100
730	790000	1350	275 > 390	390 415	834	560 600	730	515	380	470	1.5	250	1450 1400
780	1000000	1250	300 > 415	415 450	900	600 650	780	555	400	510	2.0	280	1750 1750
852	1200000	1150	325 > 450	450 490	970	650 710	850	595	420	530	2.0	280	2200 2150
910	1600000	1050	350 > 490	490 520	1030	710 750	910	655	450	560	2.0	280	2700 2550
1020	1900000	1000	375 > 520	520 550	1112	750 800	1020	695	480	610	2.0	380	3300 3200
1080	2200000	950	400 > 550	550 600	1162	800 860	1080	735	500	635	2.0	380	3800 3700
1150	2700000	900	425 > 600	600 650	1222	860 930	1150	795	520	655	2.0	380	4600 4400
1160	3350000	850	450 > 600 > 650	600 650 690	1292	860 930 990	1160 1160 1210	795	550	685	2.0	380	5000 4900 5100
1240	3800000	800	475 > 650 > 690	650 690 730	1400	930 990 1055	1240 1240 1290	865	580	735	2.0	400	6200 5800 6300

Size	Rated torque	Speed	Hole		d _a	d ₃	d ₄	d ₆	l	P	Axial back-lash	L _z	Weight	
	T _N	n _{max.}	D ₁ / D ₂								a			min.
	1) Nm	1/min	from mm	up to 2) mm							mm			mm
1310	4600000	750	500 > 650 > 690 > 730	650 690 730 780	1470	930 990 1055 1120	1310 1310 1310 1370	850	610	765	2.5	400	6900 6600 7000 7400	
1380	5300000	700	525 > 690 > 730 > 780	690 730 780 810	1540	990 1055 1120 1170	1380 1380 1380 1430	910	640	795	2.5	400	8000 7700 8100 8300	
1440	6250000	670	550 > 730 > 780 > 810	730 780 810 860	1600	1055 1120 1170 1240	1440 1440 1440 1510	975	670	825	2.5	400	9400 8800 9000 9700	
1540	7200000	630	575 > 780 > 810 > 860	780 810 860 910	1710	1120 1170 1240 1310	1540 1540 1540 1610	1030	700	875	2.5	600	11000 10000 10500 12000	

Table 1.5: Torques T_N, speeds n_{max.}, dimensions and weights



The max. speed for types ZZS, ZZSA, ZZSD, ZZDA and ZZSV 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** the shaft/hub connection. This must be checked separately.
- 2) Max. bore with keyway to DIN 6885/1
- 3) Space required for alignment of the coupling parts and replacement of the sealing rings.
- 4) Weights are valid for medium bores of type ZWN

The rated torques T_N apply to:

- daily operating cycle of up to 24 h
- operation within the specified alignment
- operation over the temperature range of between - 20 °C and + 80 °C (ambient temperature or temperature of shaft ends).
- up to 25 starts per hour, where double the rated torque is permissible during the start.



For sustained faultfree operation the coupling must be designed with an application factor appropriate to the application. In the event of a change in operating conditions (output, speed, changes to the prime mover and driven machine) the design must always be checked.

2. General notes

2.1 Introduction

These instructions are an integral part of the delivery of the coupling and must be kept in its vicinity for reference at all times.



All persons involved in the installation, operation, maintenance and repair of the coupling must have read and understood these operating instructions and must comply with them at all times. Flender accepts no responsibility for damage or disruption caused by disregard of these instructions.

The "**FLENDER coupling**" described in these instructions has been developed for stationary use in general engineering applications. The coupling serves to transmit power and torque between two shafts or flanges connected by this coupling.

The coupling is designed only for the application described in section 1, "Technical data". Other operating conditions must be contractually agreed.

The coupling has been manufactured in accordance with the state of the art and is delivered in a condition for safe and reliable use. It complies with the requirements in Directive 2014/34/EU.

The coupling must be used and operated strictly in accordance with the conditions laid down in the contract governing performance and supply agreed by Flender and the customer.

The coupling described in these instructions reflects the state of technical development at the time these instructions went to print.

In the interest of technical progress we reserve the right to make changes to the individual assemblies and accessories which we regard as necessary to preserve their essential characteristics and improve their efficiency and safety.

2.2 Copyright

The copyright to these operating instructions is held by Flender.

These instructions must not be wholly or partly reproduced for competitive purposes, used in any unauthorised way or made available to third parties without our agreement.

Technical enquiries should be addressed to the following works or to one of our customer services:

Flender GmbH
Schlavenhorst 100
46395 Bocholt

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

3. Safety instructions



Any changes on the part of the user are not permitted. This applies equally to safety features designed to prevent accidental contact.

3.1 Obligations of the user

- The operator must ensure that all persons involved in installation, operation, maintenance and repair have read and understood these operating instructions (BA) and comply with them at all times in order to:
 - avoid injury or damage,
 - ensure the safety and reliability of the coupling,
 - avoid disruptions and environmental damage through incorrect use.
- During transport, assembly, installation, dismantling, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.
- The coupling may only be operated, maintained and/or repaired by persons qualified for the work concerned (see "Qualified personnel" on page 3 of this manual).
- All work must be carried out with great care and with due regard to safety.
- All work on the gear unit must be carried out only when it is at a standstill.
The drive unit must be secured against being switched on accidentally (e.g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the ON switch stating clearly that work is in progress.
- The coupling must be fitted with suitable safeguards to prevent accidental contact. The operation of the coupling must not be impaired by the safeguard.
- The drive unit must be shut down as soon as changes to the coupling are detected during operation.
- If the coupling is intended for installation in plant or equipment, the manufacturer of such plant or equipment must ensure that the contents of the present operating instructions are incorporated in his own instructions.
- All spare parts must be obtained from Flender.

4. Transport and storage

Observe the instructions in section 3, "Safety instructions"!

4.1 Scope of supply

The products supplied are listed in the despatch papers. Check on receipt to ensure that all the products listed have actually been delivered. Parts damaged during transport or missing parts must be reported in writing immediately.

The ZAPEX coupling is delivered in separate parts and/or subassemblies (for transport) ready for installation, but **without** oil or grease charge.



The coupling in design in accordance with the Directive 2014/34/EU is provided with the CE identification mark as described in section 5.

4.2 Transport



When transporting our products, use only lifting and handling equipment of sufficient load-bearing capacity!



The coupling must be transported using suitable transport equipment only.

Different forms of packaging may be used depending on the size of the coupling and method of transport. Unless otherwise agreed, the packaging complies with the **HPE Packaging Guidelines**.

The symbols marked on the packing must be observed at all times. These have the following meanings:

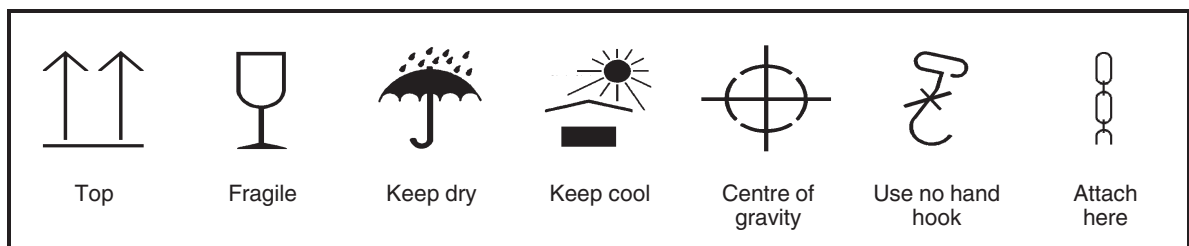


Fig. 1: Transport symbols

4.3 Storage of the coupling

4.3.1 Storage of the coupling parts

Unless otherwise expressly agreed, the coupling is delivered in a preserved condition and can be stored in a covered, dry place for up to 3 months. If the unit is to be stored for a protracted period, it should be treated with a long-term preservative agent (Flender must be consulted).

4.3.2 Storage of DUO sealing rings

4.3.2.1 General

Correct storage will preserve the service life of the DUO sealing rings (12). Unfavourable storage conditions and improper treatment will negatively affect the physical properties of the DUO sealing rings (12). Such negative effects may be caused by e.g. the action of ozone, extreme temperatures, light, moisture, or solvents.



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

4.3.2.2 Storage area

The storage area must be dry and free from dust. The DUO sealing rings (12) must not be stored with chemicals, solvents, motor fuels, acids, etc. Furthermore, they should be protected against light, in particular direct sunlight and bright artificial light with a high ultraviolet content.



The storage areas must not contain any ozone-generating equipment, e.g. fluorescent light sources, mercury vapour lamps, high-voltage electrical equipment. Damp storage areas are unsuitable. Ensure that no condensation occurs. The most favourable atmospheric humidity is below 65 %.

5. Technical description

Observe the instructions in section 3, "Safety instructions"!



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

5.1 General description

ZAPEX couplings types ZWN, ZWNA, ZWD, ZWDA, ZWNV, ZZS, ZZSA, ZZSD, ZZDA and ZZSV are designed for connecting two shafts. The shaft ends to be connected must be supported immediately upstream of and downstream of the coupling.

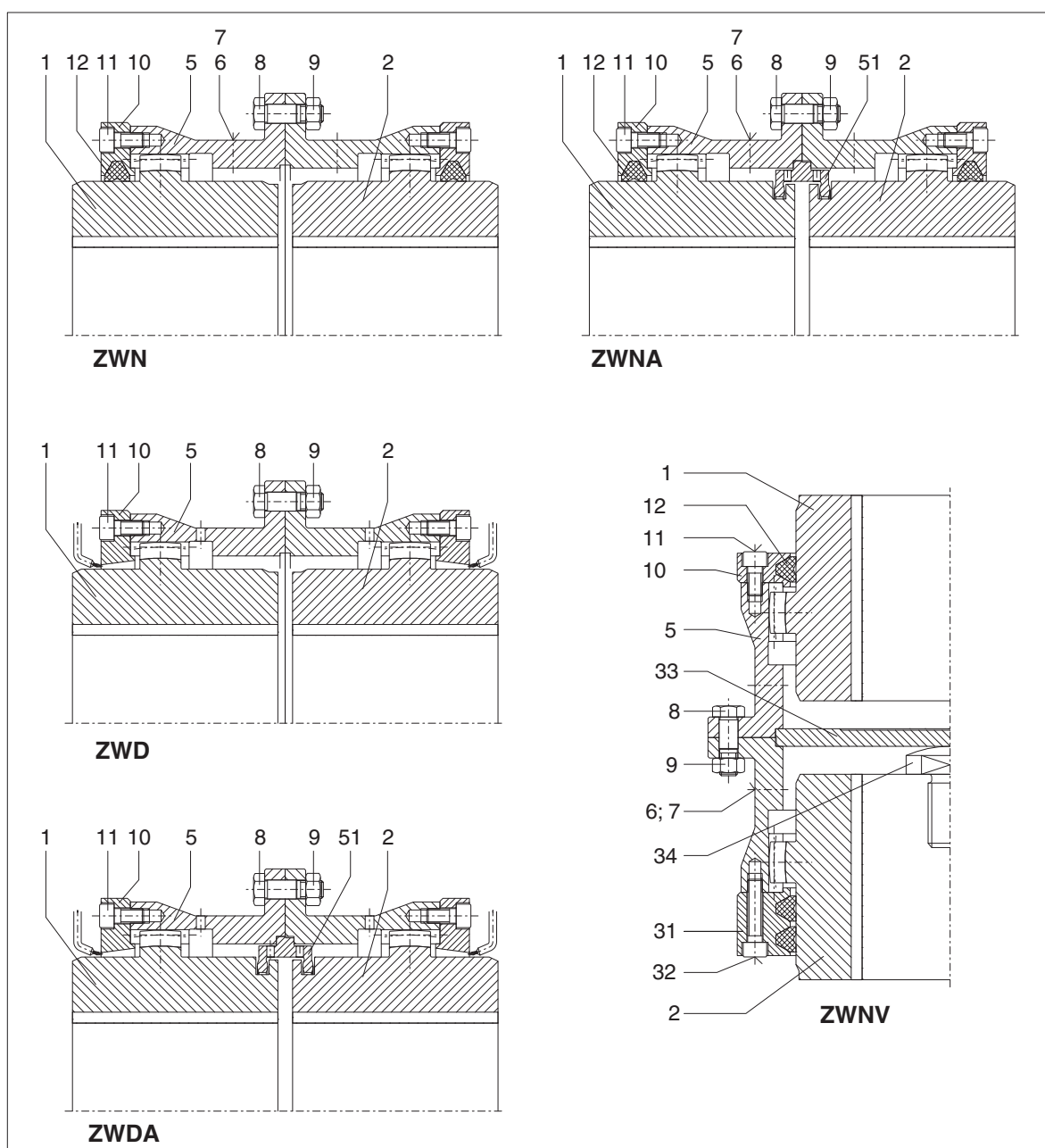
ZAPEX couplings are suitable for clockwise and anticlockwise rotation and reversing operation.

For types ZWN, ZWNA, ZWNV, ZZS, ZZSA and ZZSV DUO sealing rings (12) are used for sealing the oil/grease chambers on the outside.



Where overload moments are excessively high, the result may be breakage of the coupling or irreparable damage to the connected machine. The coupling then becomes an explosion hazard.

5.1.1 Types ZWN, ZWNA, ZWD, ZWDA and ZWNV



Torque transmission is effected from the shaft over parallel key, shrink fit or a comparable connection to the coupling part (1), then over the tooth system to the flanged sleeve (5) and then via the close-fitting bolt connection (8; 9) to the second flanged sleeve (5), over the tooth system to the coupling part (2) and then again via the parallel key, shrink fit or a comparable connection to the shaft.

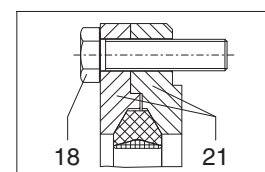
In case of types ZWNA and ZWDA the axial backlash is restricted by the two-part retaining ring (51).

Types ZWD and ZWDA are designed for flow lubrication and are thus not equipped with DUO sealing rings (12).

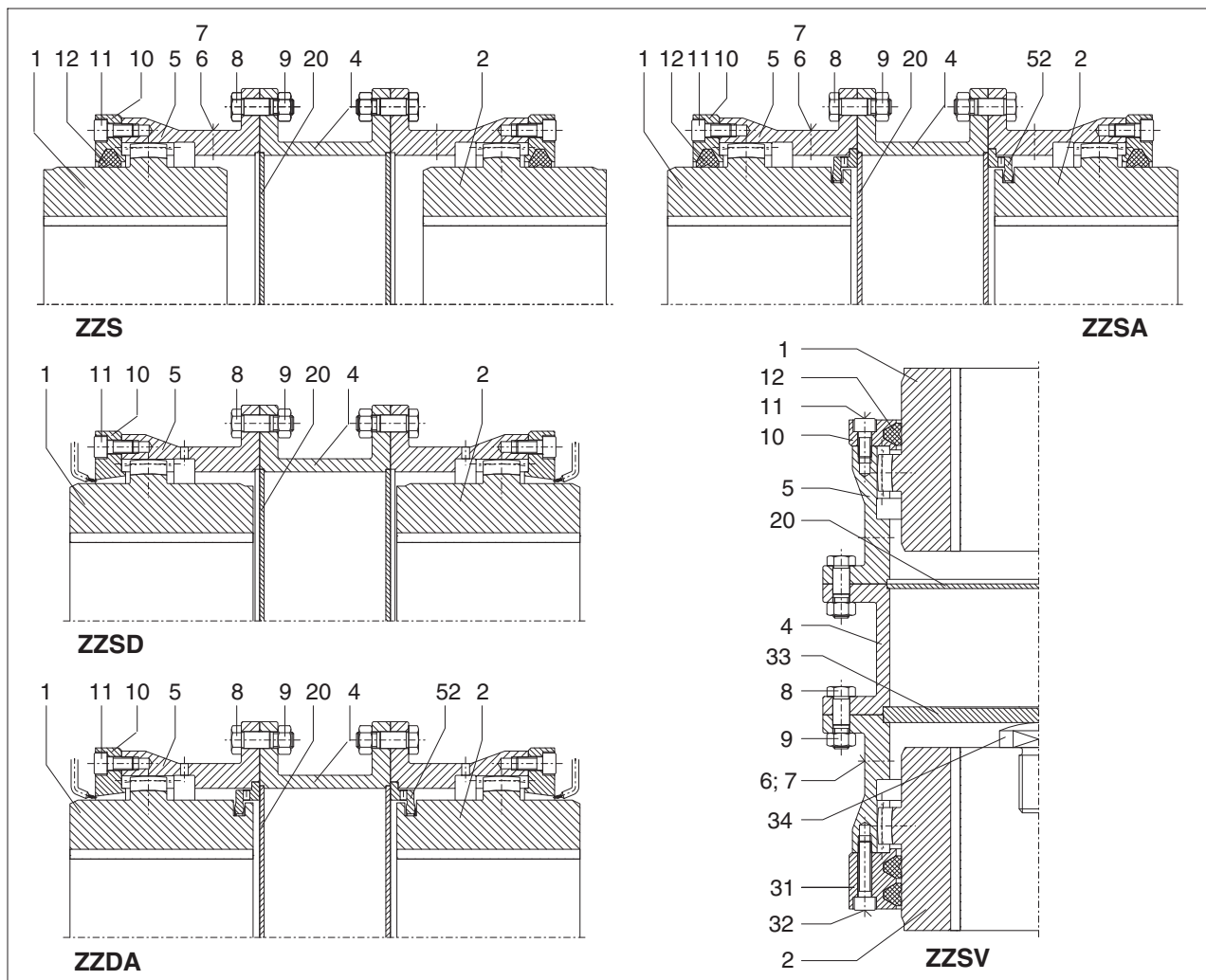
The type ZWNV is a vertical version. The covers (10+31) and flanged sleeves (5) are supported by means of the spacer washer (33) and thrust piece (34) on the shaft.

On types ZWN, ZWNA and ZWNV the cover (10) can, if required by the customer, also be designed as a two-piece split cover (21). The two-piece split cover (21) is fastened to the flanged sleeve (5) with the bolts (18).

The cover (31) to type ZWNV can also be designed as a multi-piece split cover.



5.1.2 Types ZZS, ZZSA, ZZSD, ZZDA and ZZSV



Torque is transmitted from the shaft through a parallel key, shrink fit or a comparable connection to the coupling part (1), then through the teeth to the flanged sleeve (5), then through the close-fitting bolt connection (8; 9), the adapter (4) and through another close-fitting bolt connection (8; 9) to the second flanged sleeve (5), through the teeth to the coupling part (2) and then again through a parallel key, shrink fit or a comparable connection to the shaft.

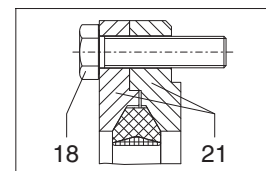
In case of types ZZSA and ZZDA the axial backlash is restricted by the two-part retaining rings (52).

Types ZZSD and ZZDA are designed for flow lubrication and are thus not equipped with DUO sealing rings (12).

The type ZZSV is a vertical version. The covers (10+31), flanged sleeves (5) and the adapter (4) are supported by means of the spacer washer (33) and the thrust piece (34) on the shaft.

On types ZZS, ZZSA and ZZSV the cover (10) can, if required by the customer, also be designed as a two-piece split cover (21). The two-piece split cover (21) is fastened to the flanged sleeve (5) with the bolts (18).

The cover (31) to type ZZSV can also be designed as a multi-piece split cover.



5.2 Marking the coupling parts for explosion protection



Couplings which are intended for use in potentially explosive areas must bear the following markings on the flanged sleeve (5):

Flender GmbH



II 2G c IIC T5/T6 $-20\text{ °C} \leq T_a \leq +80\text{ °C}/+65\text{ °C}$

46393 Bocholt - Germany




II 2D c T 100 °C $-20\text{ °C} \leq T_a \leq +80\text{ °C}$

FLENDER couplings ZAPEX <year built>



I M2 c $-20\text{ °C} \leq T_a \leq +80\text{ °C}$

The second flanged sleeve (5) and the coupling parts (1/2) must 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.

5.3 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.

6. Fitting

Observe the instructions in section 3, "Safety instructions"!



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

The necessary refinishing must be carried out in strict compliance with the following specifications and with particular care!



Responsibility for carrying out the refinishing is borne by the customer. Flender will accept no guarantee claims arising from unsatisfactory refinishing!

6.1 Instructions for machining the finished bore, parallel keyway, axial retaining means, set screws and balancing

According to the order placed, the coupling parts (1/2) for removal by oil hydraulic shrinking are delivered with finished bores.

6.1.1 Finished bore for parallel key connection

Depreserve coupling parts (1/2).



Note manufacturer's instructions for handling solvent.

For making the finished bore, the coupling parts (1/2) must be clamped as shown in the following figure.



Never clamp on the sealing surface.

The coupling part must be aligned carefully. For the permissible radial and axial runout errors and the permissible cylindricity tolerances, see DIN ISO 286.

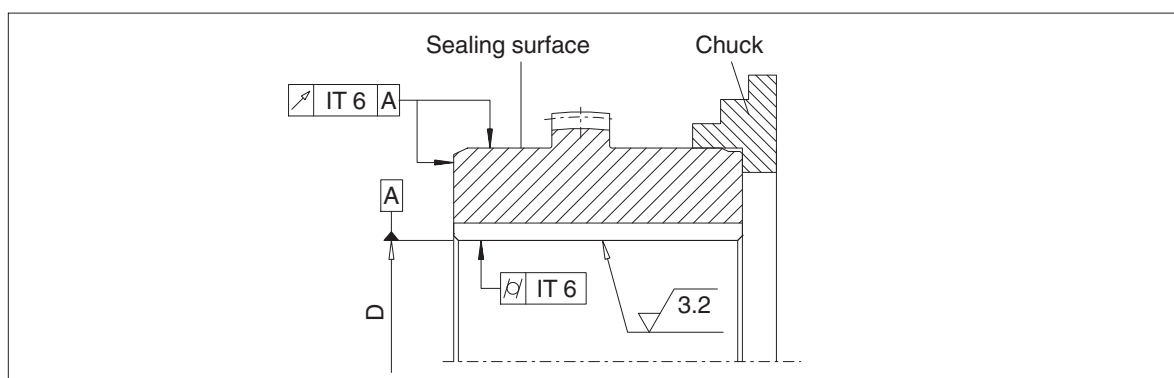


The maximum permissible boring diameters (see section 1, item 1.5) are designed for parallel key connections without tightening according to DIN 6885/1 and must not be exceeded in any case.

When the keyway is to be designed deviating from DIN 6885/1 for a parallel key connection, Flender should be consulted.

The finish-machined bores must be 100 % checked with suitable measuring equipment.

If other hub connections (e.g. spline bore hub profile, tapered or stepped bores, parallel key connections with tightening etc.) are to be used instead of the provided parallel key connection, Flender should be consulted.



In case of a parallel-key connection the following is recommended for bore and shaft:

Shaft end tolerances	h6	k6	m6	n6	p6	s6
Bore tolerances	P7	M7	K7	J7	H7	F7

Table 6.1.1: Fit pairs



The assigned fits must be adhered to in each case. Failure to adhere to the fits may impair the shaft-hub connection.
If the tolerance values of the shafts deviate from those in table 6.1.1, Flender must be consulted.



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

6.1.2 Parallel keyway

With the parallel key connection to DIN 6885/1 and a single keyway the tolerance zone of the hub keyway width **ISO P9** is recommended.

With the parallel key connection to DIN 6885/1 and two keyways the tolerance zone of the hub keyway width **ISO JS9** is recommended.

6.1.3 Axial securing in case of parallel key connection

A set screw or end plate must be provided to secure the coupling parts axially. If end plates are used, Flender must be consulted with regard to machining the recesses in the coupling parts.

If the clutch part mounted on the shaft does not lie up against the shaft shoulder, we recommend using spacer rings.

6.1.4 Set screws in case of parallel key connection

Hexagon socket set screws with cup points to DIN 916 must be used for set screws.

The following guidelines must be observed!

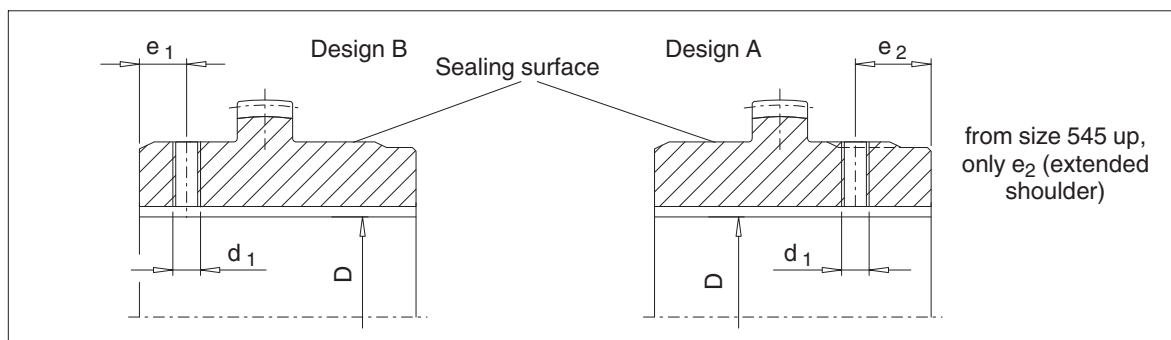


The length of the set screw must be selected so that it fills the threaded hole, but does not project from the hub ($L_{min.} = d_1$).



The set screws must be arranged on the parallel keys. Check the length of the parallel keys.

The threaded holes are to be arranged in accordance with the drawing considering the used configuration A or B for the coupling parts (1/2).
In case of size 112, the set screws must generally be arranged in the hub side which has not been ground.



Size	Bore D mm	d_1 mm	Tightening torque T_A Nm	Wrench width Hexagon socket wrench mm	e_1 mm	e_2 mm
112	10 ... 17 > 17 ... 45	M 5 M 6	3 4	2.5 3	15	-
128	10 ... 17 > 17 ... 30 > 30 ... 55	M 5 M 6 M 8	3 4 8	2.5 3 4	14	20

Size	Bore D mm	d₁ mm	Tightening torque T_A Nm	Wrench width Hexagon socket wrench mm	e₁ mm	e₂ mm
146	10 ... 17 > 17 ... 30 > 30 ... 38 > 38 ... 65	M 5 M 6 M 8 M10	3 4 8 15	2.5 3 4 5	16	26
175	10 ... 17 > 17 ... 22 > 22 ... 30 > 30 ... 80	M 5 M 6 M 8 M10	3 4 8 15	2.5 3 4 5	20	26
198	10 ... 17 > 17 ... 22 > 22 ... 30 > 30 ... 44 > 44 ... 95	M 5 M 6 M 8 M10 M12	3 4 8 15 25	2.5 3 4 5 6	22	36
230	10 ... 17 > 17 ... 22 > 22 ... 30 > 30 ... 38 > 38 ... 58 > 58 ... 110	M 5 M 6 M 8 M10 M12 M16	3 4 8 15 25 70	2.5 3 4 5 6 8	25	38
255	10 ... 17 > 17 ... 22 > 22 ... 30 > 30 ... 38 > 38 ... 50 > 50 ... 110 > 110 ... 125	M 5 M 6 M 8 M10 M12 M16 M20	3 4 8 15 25 70 130	2.5 3 4 5 6 8 10	30	45
290	> 70 ... 75 > 75 ... 145	M16 M20	70 130	8 10	30	48
315	80 ... 160	M20	130	10	40	55
342	90 ... 170 > 170 ... 180	M20 M24	130 230	10 12	40	60
375	100 ... 110 > 110 ... 200	M20 M24	130 230	10 12	35	70
415	120 ... 220	M24	230	12	40	90
465	140 ... 250	M24	230	12	40	110
505	160 ... 275	M24	230	12	45	130
545	180 ... 300	M24	230	12		80
585	210 ... 330	M24	230	12		90
640	230 ... 360	M24	230	12		100
690	250 ... 390	M24	230	12		120
730	275 ... 415	M24	230	12		140
780	300 ... 450	M24	230	12		140
852	325 ... 490	M24	230	12		150
910	350 ... 520	M24	230	12		180
1020	375 ... 550	M24	230	12		180
1080	400 ... 600	M24	230	12		190
1150	425 ... 650	M24	230	12		200
1160	450 ... 690	M24	230	12		220

Size	Bore D mm	d ₁ mm	Tightening torque T _A Nm	Wrench width Hexagon socket wrench mm	e ₁ mm	e ₂ mm
1240	475 ... 730	M24	230	12		215
1310	500 ... 780	M24	230	12		230
1380	525 ... 810	M24	230	12		250
1440	550 ... 860	M24	230	12		270
1540	575 ... 910	M24	230	12		250

Table 6.1.4: Set screw assignment, tightening torques and wrench widths of the set screws

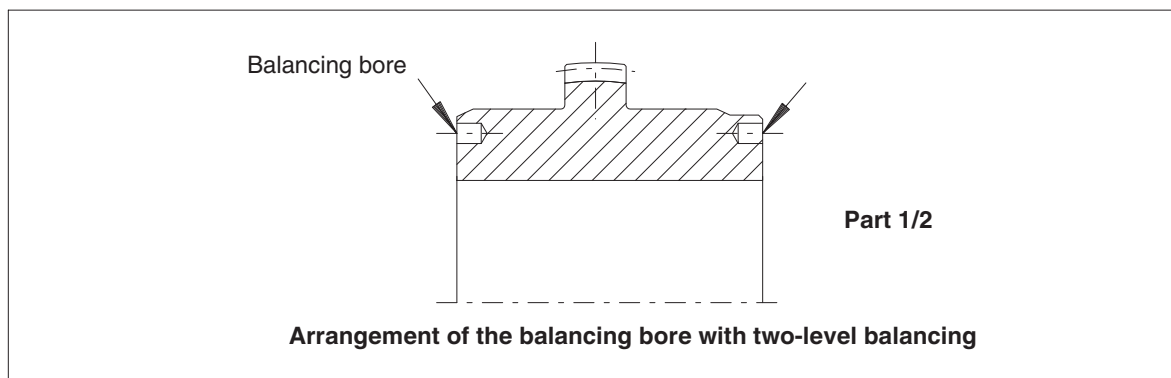
6.1.5 Balancing

Prebored coupling parts (1/2) are delivered unbalanced. It is recommended that these parts are balanced to suit the application after finish-boring (see DIN ISO 1940 and DIN 740/2).

Balancing is normally done by drilling material away.

If balancing is to be done after cutting the keyways, Flender must be consulted.

Finished-bored couplings are only balanced if requested by the customer.



6.2 General information on fitting

During fitting, the "Safety Instructions" in section 3 must be observed.

Fitting work must be done with great care by trained and qualified personnel.

As early as during the planning phase it must be ensured that sufficient space is available for installation and subsequent care and maintenance work.

Adequate lifting equipment must be available before beginning the fitting work.



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



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



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

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

Before starting assembly all coupling parts and shaft ends must be carefully cleaned.



The DUO sealing rings (12) must not come into contact with solvents and cleansing agents.

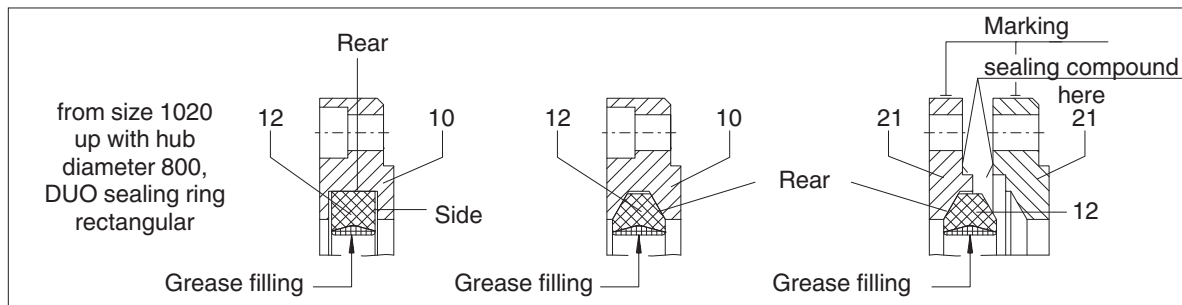


Note manufacturer's instructions for handling solvent and cleansing agent.

Grease the back and/or the sides of the DUO sealing ring (12) and the groove in the cover (10; 21; 31) thoroughly and fit it/them in the cover (10; 21; 31).

Insert a quantity of grease in the ring-shaped space between the seal lips.

In case of axially split covers (21), carefully smear both sides of the parting line of the two cover halves with sealing compound and join them. Doing so ensure that the through-holes are aligned and note the marks.



Check space requirement for inserting the bolts (11; 18; 32), and, if necessary, insert the bolts (11; 18; 32) in the cover (10; 21; 31).

Position the cover (10; 21; 31) with the fitted DUO sealing ring (12) on the shaft so that the DUO sealing ring (12) cannot be damaged by the coupling parts (1/2) to be fitted.



Note mounting position.



Unscrew set screws from the coupling parts (1/2).

Protect DUO sealing rings (12) and seals for the input and output side against damage and heating to over + 80 °C.



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

Slightly heating (max. + 80 °C) the coupling parts (1/2) with cylindrical bore may facilitate the pulling-on process. Heating may be done inductively, in a stove or with a burner. If heating is done with a burner, it must be done along the length of the hub above the groove.



Heated coupling parts form an explosion hazard, therefore a non-explosive environment must be ensured.



Take precautions to avoid burns from hot parts!



The coupling parts (1/2) should be fitted with the aid of suitable equipment to avoid possible damage to the shaft bearings through axial joining forces.

Always use suitable lifting equipment.

Care must be taken that the hole and the sealing surface for the DUO sealing ring are not damaged by lifting gear, etc.



The coupling parts (1/2) with a tapered bore must be secured with suitable end plates. For this, smear the hub end face on the shaft 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 2/3 must be filled 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).



Tightening the set screws to a tightening torque in accordance with item 6.1.4.



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

6.4

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



The information specified on the dimensioned drawing must be observed.

Before assembly, the screw plugs (22) must be unscrewed from the coupling parts (1/2) and all parts and the shaft ends carefully cleaned and dried. The oil channels and oil circulation grooves must also be free from dirt.



The DUO sealing rings (12) must not come into contact with solvents and cleansing agents.



Note manufacturer's instructions for handling solvent and cleansing agent.

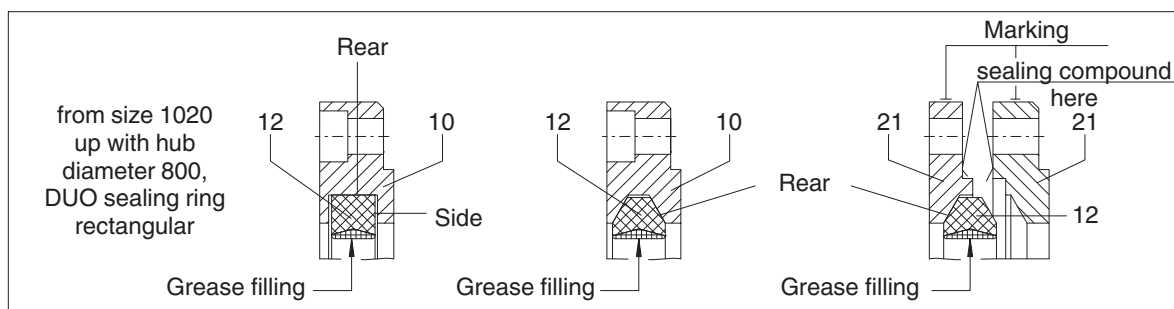


Under no circumstances must the fitting surfaces be lubricated with grease containing molybdenum sulphite (Molykote, etc.).

Grease the back and/or the sides of the DUO sealing ring (12) and the groove in the cover (10; 21; 31) thoroughly and fit it/them in the cover (10; 21; 31).

Insert a quantity of grease in the ring-shaped space between the seal lips.

In the case of axially split covers (21), carefully smear both sides of the parting line of the two cover halves with sealing compound and join them. Doing so ensure that the through-holes are aligned and note the marks.



Check space requirement for inserting the bolts (11; 18; 32), and, if necessary, insert the bolts (11; 18; 32) in the cover (10; 21; 31).

Position the cover (10; 21; 31) with the fitted DUO sealing ring (12) on the shaft so that the DUO sealing ring (12) cannot be damaged by the coupling parts (1/2) to be fitted.



Note mounting position.



**Protect DUO sealing rings (12) and seals for the input and output side against damage and heating to over + 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.



Heated coupling parts form an explosion hazard, therefore a non-explosive environment must be ensured.



Take precautions to avoid burns from hot parts!

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



**The heated coupling parts (1/2) should be fitted with the aid of suitable equipment to avoid possible damage to the shaft bearings through axial joining forces.
Always use suitable lifting equipment.
Care must be taken that the bore and the sealing surface for the DUO sealing ring (12) are not damaged by lifting gear, etc.**

The couplings parts (1/2) should be pushed smartly onto the shaft up to the position specified 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 from flying fragments!
The coupling then becomes an explosion hazard.**

6.5 Installation of the coupling

Oil the teeth of the coupling parts (1/2) and of the flanged sleeves (5) and the hub diameters of the coupling parts (1/2) (sealing surfaces).

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

Push the flanged sleeves (5) onto the teeth of the coupling parts (1/2) and hold and/or brace them in position.

In case of types ZWNA, ZWDA, ZZSA and ZZDA the axial backlash limitation (51/52) should be placed into the recess of the coupling parts (1/2) and the flanged sleeve (5) be pulled over the axial backlash limitation (51/52).

In case of types ZWNV and ZZSV the spacer washer (33) should be placed on the thrust piece (34) and into the flanged sleeve (5).

Move together and align the machines to be coupled (see item 6.6).

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 6.10).


Smear the sealing surfaces of the covers (10; 21; 31) and flanged sleeves (5) with sealing compound.

Using suitable tools, pull the covers (10; 21; 31) onto the hub.

Bolt the covers (10; 21; 31) and flanged sleeves (5) together (for tightening torques, see item 6.10).

6.6 Alignment

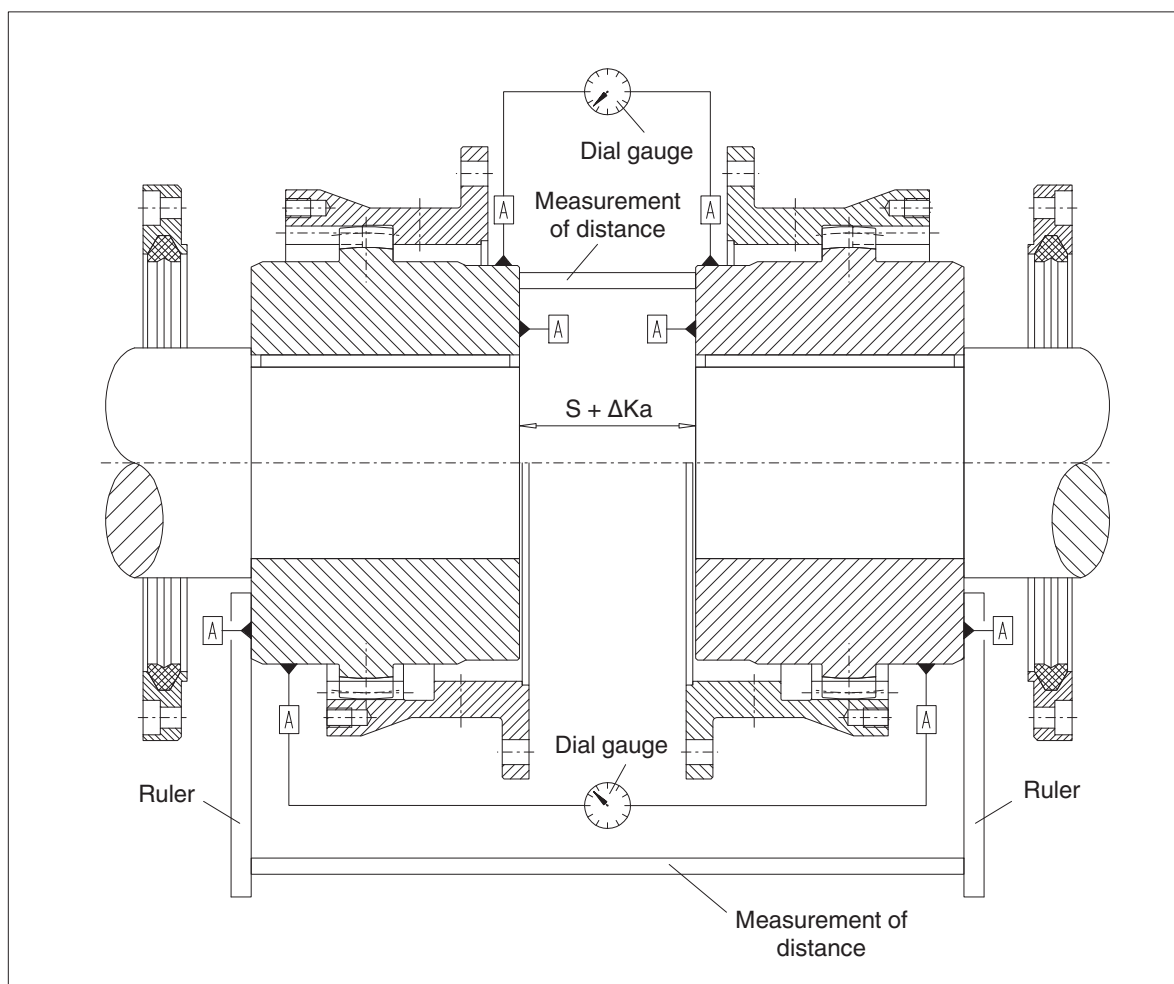
To obtain the longest possible service life for the coupling, we recommend alignment with 10 % of the offsets possible in operation specified in item 6.7. The recommended alignment values in numerical values are specified in item 6.8. Very precise alignment must not be aimed at, as this will impair the 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 ().

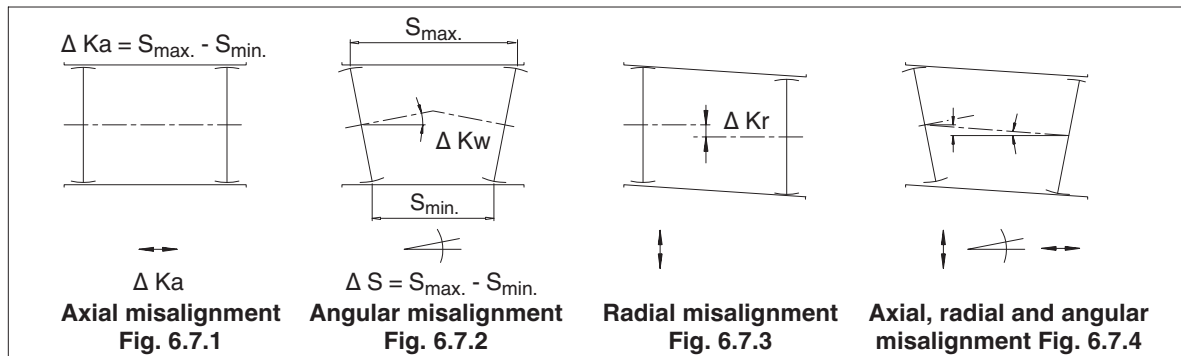


Flender recommendation:

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



6.7 Possible misalignments



Misalignments of the machine shafts in relation to each other can be caused by inaccurate alignment during assembly, but also by actual operation of the equipment (expansion due to heat, shaft deflection, insufficiently rigid machine frames, etc.).



The following maximum permissible misalignments must by no means be exceeded during operation.

6.7.1 Axial misalignment

Axial misalignment ΔK_a (Fig. 6.7.1) of the coupling parts relative to one another is possible within the "permissible error" for dimension "S" (see item 6.9).

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

6.7.2 Angular misalignment

Types ZWN, ZWD, ZZS, ZZSD, ZWNV and ZZSV compensate for positional errors of up to a maximum angular misalignment of $\Delta K_w = 1^\circ$ in the shaft ends to be connected.

Due to the axial backlash limitation types ZWNA, ZWDA, ZZSA and ZZDA 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 (Fig. 6.7.2) can usefully be measured as the difference in the gap dimension "S" ($\Delta S = S_{\max.} - S_{\min.}$).

ZWN, ZWD, ZZS, ZZSD, ZWNV, ZZSV:	$\Delta S = S_{\max} - S_{\min} \leq d_3 \tan 1^\circ \approx d_3 / 60$
ZWNA, ZWDA, ZZSA, ZZDA:	$\Delta S = S_{\max} - S_{\min} \leq d_3 \tan 0.2^\circ \approx d_3 / 300$

For the hub diameter d_3 (smallest hub diameter), see section 1, "Technical Data".

6.7.3 Radial misalignment

On types ZWN, ZWD, ZZS, ZZSD, ZWNV and ZZSV the max. possible radial misalignment $\Delta K_{r_{\max.}}$ (Fig. 6.7.3) corresponds to an angular error per coupling half of $\Delta K_{w_{\max.}} = 1^\circ$.

On types ZWNA, ZWDA, ZZSA, ZZDA the max. possible radial misalignment $\Delta K_{r_{\max.}}$ (Fig. 6.7.3) corresponds to an angular error per coupling half of $\Delta K_{w_{\max.}} = 0.2^\circ$.

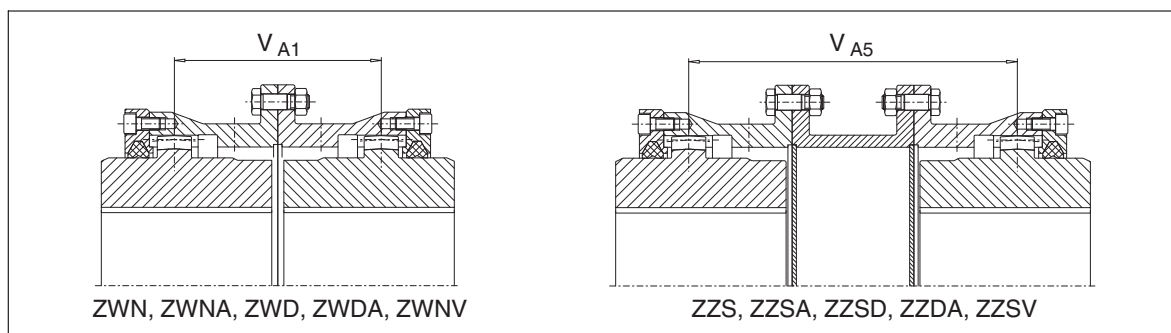
ZWN, ZWD, ZZS, ZZSD, ZWNV, ZZSV:	$\Delta K_r \leq V_A \times \tan 1^\circ \approx V_A / 60$
ZWNA, ZWDA, ZZSA, ZZDA:	$\Delta K_r \leq V_A \times \tan 0.2^\circ \approx V_A / 300$



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

ZWN, ZWD, ZZS, ZZSD, ZWNV, ZZSV:	$\arctan \left(\frac{\Delta K_r}{V_A} \right) + \Delta K_w \leq 1^\circ$
ZWNA, ZWDA, ZZSA, ZZDA:	$\arctan \left(\frac{\Delta K_r}{V_A} \right) + \Delta K_w \leq 0.2^\circ$

6.8 Distance between teeth V_A and recommended alignment values for angular and radial misalignment



Size	Distance between teeth		Radial misalignment ΔK_r at		Angular misalignment ΔS
	V_{A1} mm	V_{A5} mm	V_{A1} mm	V_{A5} mm	mm
112	56	$V_{A1} + L_Z$	0.10	$\Delta K_r = V_{A5} \times \tan 0.1^\circ$	0.11
128	73		0.12		0.14
146	88		0.15		0.16
175	104		0.18		0.19
198	119		0.20		0.23
230	130		0.22		0.28
255	150		0.26		0.32
290	170		0.29		0.36
315	190		0.33		0.40
342	222		0.38		0.44
375	242		0.42		0.50
415	294		0.51		0.55
465	336		0.58		0.62
505	366		0.64		0.70
545	406		0.71		0.76
585	460		0.80		0.83
640	479		0.84		0.83
690	516		0.90		0.90
730	560		0.98		0.97
780	576		1.01		1.04
852	605		1.06		1.13
910	665		1.16		1.24
1020	693		1.21		1.30
1080	726		1.27		1.40
1150	758		1.32		1.50
1160	810		1.41		1.50
1240	830		1.45		1.62
1310	875		1.53		1.62
1380	915		1.60		1.72
1440	965		1.68		1.84
1540	975		1.70		1.95

Table 6.8: Distance between teeth, recommended alignment values for angular and radial misalignment



Due to the limited axial backlash, in the case of types ZWNA, ZWDA, ZZSA and ZZDA the alignment values must be cut by half.

6.9 Distance dimensions "S"

Size	S ₁ mm	S ₂ mm	S ₃ mm	perm. misalign- ment S ₁ , S ₂ , S ₃ mm	S ₈ mm	S ₉ mm	perm. misalign- ment S ₈ , S ₉ mm	S ₁₁ mm	S ₁₂ mm	perm. misalign- ment S ₁₁ , S ₁₂ mm	S ₁₃ mm
112	6	-	-	+ 1	3	3	+ 0.5	-	-	+ 0.5	-
128		13	20		10	3		6.5	26		16
146		13	20		10	3		6.0	28		18
175	8	14	20	+ 1	10	4	+ 0.5	5.5	33	+ 0.5	23
198		19	30		15	4		10	40		25
230		20	32		16	4		11	32		16
255	10	25	40	+ 1.5	20	5	+ 0.8	14	40	+ 0.8	20
290		30	50		25	5		19	50		25
315		30	50		25	5		18	50		25
342	12	42	72	+ 1.5	36	6	+ 0.8	29	72	+ 0.8	36
375		42	72		36	6		29	72		36
415		74	136		68	6		60	136		68
465	16	96	176	+ 2	88	8	+ 1	80	176	+ 1	88
505		106	196		98	8		89	196		98
545		126	236		118	8					
585	20	150	280	+ 2	140	10	+ 1				
640		149	278		139	10					
690		166	312		156	10					
730		180	340		170	10					
780	25	176	327	+ 3	163	12.5	+ 1.5				
852		185	345		172	12.5					
910		215	405		202	12.5					
1020		213	401		200	12.5					
1080	30	226	422	+ 3	211	15	+ 1.5				
1150		238	446		223	15					
1160		260	490		245	15					
1240		250	470		235	15					
1310	35	265	495	+ 4	247	17.5	+ 2				
1380		275	515		257	17.5					
1440		295	555		277	17.5					
1540		275	515		257	17.5					

Table 6.9: Distance dimensions "S" for types ZWN, ZWNA, ZWD, ZWDA (S₁, S₂, S₃), for types ZZS, ZZSA, ZZD, ZZDA (S₈, S₉) and for types ZWNV, ZZSV (S₈, S₁₁, S₁₂, S₁₃)



On types ZWNA, ZWDA (S₁, S₂, S₃) and on types ZZSA, ZZDA (S₈, S₉) errors in the "S" dimensions of up to ± 0.1 mm are permissible.

6.10 Assignment of the tightening torques and wrench widths

Size	Tightening torques T_A for bolts of the strength class 8.8 to DIN ISO 898 Part 1 (with $\mu = 0.14$)		Wrench width S_W				
	Part no. 9	Part no. 11; 18; 32	Part no. 6	Part no. 9	Part no. 18	Part no. 11, 32	
	Nm	Nm	Hexagon socket wrench mm	Hexagon head mm	Hexagon head mm	Hexagon socket wrench mm	Hexagon head mm
112	25	10	3	13	10	5	
128	25	10	3	13	10	5	
146	25	10	5	13	10	5	
175	49	25	5	17	13	6	
198	49	25	6	17	13	6	
230	49	25	6	17	13	6	
255	86	25	8	19	13	6	
290	86	49	8	19	17	8	
315	210	49	8	24	17	8	
342	210	49	8	24	17	8	
375	210	49	10	24	17	8	
415	410	86	10	30	19	10	
465	410	86	10	30	19	10	
505	410	86	10	30	19	10	
545	710	86	10	36	19	10	
585	710	86	10	36	19	10	
640	1450	210	10	46	24	14	
690	1450	210	10	46	24	14	
730	1450	210	12	46	24	14	
780	2530	210	12	55	24	14	
852	2530	210	12	55	30	14	
910	2530	410	12	55	30	17	
1020	4070	410	12	65	30	17	30
1080	4070	410	17	65	30		30
1150	4070	410	17	65	30		30
1160	4070	410	17	65	30		30
1240	6140	710	17	75	36		36
1310	6140	710	17	75	36		36
1380	6140	710	17	75	36		36
1440	6140	710	17	75	36		36
1540	7350	1450	17	80	46		46

Table 6.10: Tightening torques and wrench widths



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 the like, which affects the coefficient of friction μ , is not permitted.



The tightening torques and wrench widths of the set screws are specified in item 6.1.4.

7. Start-up





Observe the instructions in section 3, "Safety instructions"!







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

7.1 Recommended lubricants

The following recommended lubricants apply to the ZAPEX couplings described in these operating instructions:

Lubricant					FLENDER
Mineral oils	Degol BG 680 Plus	Energol GR-XF 680	Tribol 1100 / 680 Optigear BM 680	SPARTAN EP 680 ¹⁾	
	Degol BG 460 Plus	Energol GR-XF 460	Tribol 1100 / 460 Optigear BM 460	SPARTAN EP 460 ¹⁾	
Liquefied greases	Aralub Fließfett AN 0	Energrease LS-EP 00	Tribol 3020/1000-00 Longtime PD 00		FLENDER Hochleistungsfett

Lubricant					
Mineral oils	Renolin CLP 680 PLUS	STRUCTOVIS BHD-MF	Mobilgear 636 Mobilgear XMP 680	Shell Omala 680 Shell Omala F 680	
	Renolin CLP 460 PLUS		Mobilgear 634 Mobilgear XMP 460	Shell Omala 460 Shell Omala F 460	
Liquefied greases	RENOLIT SO-D 6024	GRAFLOSCON C-SG 500 Plus	Mobilux EP 004	Alvania GL 00	

¹⁾ ESSO guarantees the qualities required by Flender only for products from Europe

For normal operating conditions we recommend the filling with oil which can be changed easily.

The specified mineral oils are suitable for operating temperatures of between - 10 °C and + 80 °C.

In case of conditions of use in ambient temperatures exceeding + 30 °C oils with viscosity VG 680 should be used.

All liquefied greases and the mineral oil "Castrol Tribol 1100" are suitable for use in ambient temperatures from - 20 °C to + 80 °C.



Observe manufacturer's instructions for handling oils/greases!



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

Size	Oil filling quantity ¹⁾		Size	Oil filling quantity ¹⁾		Size	Oil filling quantity ¹⁾	
	ZWN, ZWNA dm ³	ZZS, ZZSA dm ³		ZWN, ZWNA dm ³	ZZS, ZZSA dm ³		ZWN, ZWNA dm ³	ZZS, ZZSA dm ³
112	0.04	0.02	415	1.7	0.9	1020	13.5	6.8
128	0.05	0.03	465	2.7	1.4	1080	14.5	7.3
146	0.1	0.05	505	3	1.5	1150	16	8
175	0.2	0.1	545	3.5	1.8	1160	18.5	9.3
198	0.2	0.1	585	4.5	2.3	1240	23	11.5
230	0.3	0.15	640	5	2.5	1310	24.5	12.3
255	0.3	0.15	690	7	3.5	1380	34	17
290	0.55	0.3	730	7.5	3.8	1440	40	20
315	0.8	0.4	780	8.5	4.3	1540	44	22
342	0.9	0.5	852	9	4.5			
375	1.1	0.6	910	10.5	5.3			

Table 7.2: Oil quantities

¹⁾ In case of types ZZS and ZZSA the oil quantities are valid for one coupling side.

If liquefied grease is used, 1.3 times the quantity of the specified oil quantity must be specified.



For the oil quantities / grease quantities for types ZWNV and ZZSV, refer to the dimensioned drawings.



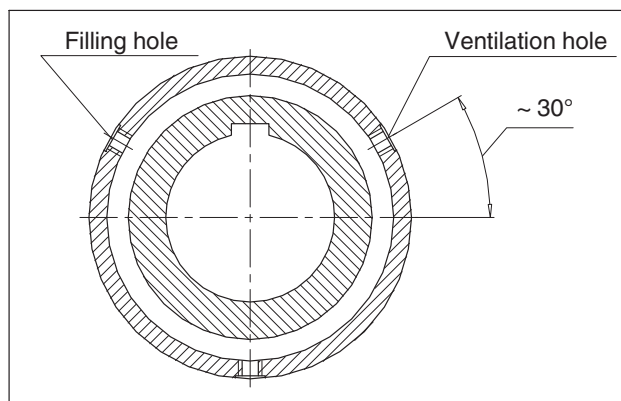
For the oil flow quantities for types ZWD, ZWDA, ZZSD, and ZZDA, refer to the dimensioned drawings.

For easier filling, proceed as follows:

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

Remove the two top screw plugs (6) and put in oil/grease. Measure the correct oil/grease quantity with the measuring beaker.

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



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

7.3 Procedure before start-up

Before starting up, the unit must be checked for correct assembly, alignment and oil or grease filling, any errors remedied and all screw connections checked for correct tightening torques.



Then fit the coupling guard to prevent unintentional contact.



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.

8. Operation

Observe the instructions in section 3, "Safety instructions"!

8.1 General operating data

During operation of the coupling watch for:

- changes in running noise
- leaks (escaping oil/grease)



If any irregularities are noticed during operation, switch the drive assembly off at once. Determine the cause of the fault, using the table in section 9.

The trouble-shooting table contains a list of possible faults, their causes and suggested remedies.

If the cause cannot be identified or the unit repaired with the facilities available, you are advised to contact one of the Flender customer-service offices for specialist assistance (see section 2).

9. Faults, causes and remedy

Observe the instructions in section 3, "Safety instructions"!

9.1 General

The following irregularities can serve as a guide for fault tracing.

Where the system is a complex one, all the other component units must be included when tracing faults.

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.



Faults and malfunctions occurring during the guarantee period and requiring repair work on the coupling must be carried out only by the Flender Customer Service.

In the case of faults and malfunctions occurring after the guarantee period and whose cause cannot be precisely identified, we advise our customers to contact our customer service.



Flender will not be bound by the terms of the guarantee or otherwise be responsible in cases of improper use of the coupling, modifications carried out without the agreement of Flender, or use of spare parts not supplied by Flender.



When remedying faults and malfunctions, the gear unit must always be taken out of service.

Secure the drive unit to prevent it from being started up unintentionally.

Attach a warning notice to the start switch!

9.2 Possible faults

Faults	Causes	Remedy
Sudden changes in the noise level and/or sudden vibrations.	Exceeding the permissible misalignments.	Take the installation out of service. If necessary, re-align as described in section 6.
	Insufficient lubricant.	Take the installation out of service. Change the lubricant as described in section 10, making sure to check the teeth and the seals at the same time. If necessary, replace the seals as described in section 10.

Table 9.2: Faults, causes and remedy

9.3 Incorrect use

Experience has shown that the following faults can result in incorrect use of the ZAPEX coupling. In addition to observing the other instructions in these instructions, care must therefore be taken to avoid these faults. Directive 2014/34/EU requires the manufacturer and user to exercise especial care.



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



Incorrect use of the ZAPEX coupling can result in damage to the coupling.



Coupling damage may result in stoppage of the drive and the entire system.

9.3.1 Possible faults when selecting and designing 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. For this observe section 1, "Technical data".
- Finished bore with impermissible diameter (see section 1, "Technical data") and/or impermissible fit assignment (see section 6, "Fitting").
- Machining of keyways of which the width across corners is greater than the width across corners of 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.

9.3.2 Possible faults when installing the coupling

- Components with transport or other damage are being fitted.
- When mounting coupling parts in a heated condition, ZAPEX DUO sealing rings (12) 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.
- The design of the coupling parts is not observed and the coupling parts are thus placed incorrectly.
- Specified axial fastenings are not fitted.
- Prescribed tightening torques are not being adhered to.
- Alignment and/or shaft-misalignment values do not match the instructions.
- 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.
- ZAPEX DUO sealing rings (12) are not being fitted or not being correctly positioned.
- Sealing surfaces are being painted.
- The oil/grease has not been correctly put in (see section 7, "Start-up").
- 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 protection used is not suitable for operation within the meaning of the explosion-protection requirements and/or in accordance with Directive 2014/34/EU.
- Operating conditions are being changed without authorisation.

9.3.3 Possible faults in maintenance

- Maintenance intervals are not being adhered to.
- The sealing rings used are not genuine ZAPEX DUO sealing rings (12).
- Old or damaged ZAPEX DUO sealing rings (12) 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.

10. Maintenance and repair

Observe the instructions in section 3, "Safety instructions"!



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



All work on the gear unit must be carried out only when it is at a standstill. The drive unit must be secured against being switched on accidentally (e.g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the ON switch stating clearly that work is in progress.

10.1 General

The coupling must be checked for leaks and heating, 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.

10.2 Oil or grease change

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



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

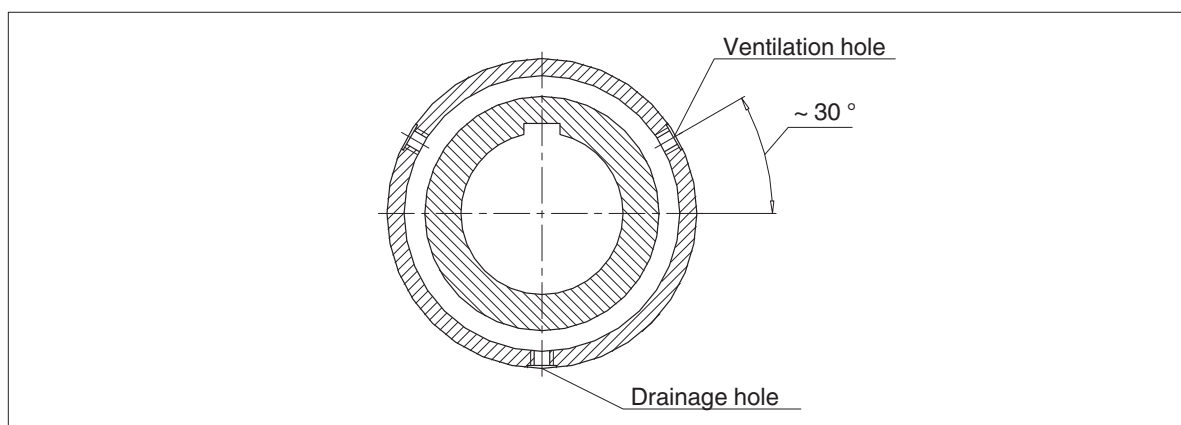
Lubricant change approx. every 8000 operating hours or at latest every 2 years in case of operation at up to 70 °C; in case of operation at over 70 °C approx. every 3000 operating hours or at the latest at yearly intervals.

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 together. If necessary, confirmation that the new lubricant is compatible with residues of the old lubricant should be obtained from the manufacturer.

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



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



Fill with oil/grease as described in section 7. "Start-up".

10.3 Replacement of DUO sealing rings

The oil/grease must be drained off as described in item 10.2.

The DUO sealing rings (12) can, if the dimensions d_6 and P are adhered to (see section 1, "Technical data") without having to detach the coupling, be replaced with open-ended (cut) DUO sealing rings (12).

For this, undo the cover screw connection (11; 18; 32) and push the cover (10; 21; 31) away off the hub until the DUO sealing ring (12) can be removed.

Clean the sealing compound off the cover (10; 21; 31) and flanged sleeve (5).



Note manufacturer's instructions for handling solvent.

Cut the new DUO sealing ring (12) radially at one point. Before inserting the DUO sealing ring (12) grease the groove in the cover (10; 21; 31) and the DUO sealing ring (12) thoroughly from all sides.

DUO sealing rings (12) with trapezium-shaped back section can be fitted without adhesive. For this, place the cut ends together in the groove and then, working from the cut ends, insert the DUO sealing ring (12) on both sides.

DUO sealing rings (12) with rectangular back section (from size 1020 up with hub diameter 800) must be placed on the shaft after cutting and the cut ends glued so that they exactly match together. Adhesive e.g. LOCTITE 401.



Observe manufacturer's instructions for handling adhesive.

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

In the case of split covers (21), carefully smear the parting line of the two cover halves with sealing compound. Join the cover halves together on the hub over the DUO sealing ring (12), ensuring that the through-holes are aligned and noting the marks.



Observe manufacturer's instructions for handling sealing compound!



Note marks.

Insert a quantity of grease in the ring-shaped space between the sealing lips of the DUO sealing rings (12).

Smear the sealing surfaces of the covers (10; 21; 31) and flanged sleeves (5) with sealing compound and bolt them together (for tightening torques, see section 6, item 6.10).

Fill with oil/grease as described in section 7, "Start-up".

10.4 Demounting the coupling

The oil/grease must be drained off as described in item 10.2.

Undo the close-fitting bolt connection (8; 9) and the screw connection of the cover (11; 18; 32). Pull off the covers (10; 21; 31) and support them over the shafts.

Move the coupled machines apart. Remove the adapter (4), the axial backlash-limiting device (51; 52), the flanged sleeves (5) and the spacer washer (33). Unscrew the thrust piece (34).



Always use suitable lifting equipment!



Danger of squeezing!

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

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

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



Heated coupling parts form an explosion hazard, therefore a non-explosive environment must be ensured.



Take precautions to avoid burns from hot parts!



Protect DUO sealing rings (12) and seals for the input and output side against damage and heating to over + 80 °C.



**Pull off coupling parts (1/2) smartly.
Always use suitable lifting equipment and detaching device. The shaft bearings must not be overloaded.
Care must be taken that the hole and the sealing surface for the DUO sealing ring are not damaged by lifting gear, etc.**

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-fitting, the instructions in section 6, "Assembly", and section 7, "Start-up", must be carefully observed.

10.6 Demounting of coupling parts (1/2) in case of cylindrical and taper interference fit set up for hydraulic shrinking

For demounting the following tools are needed:

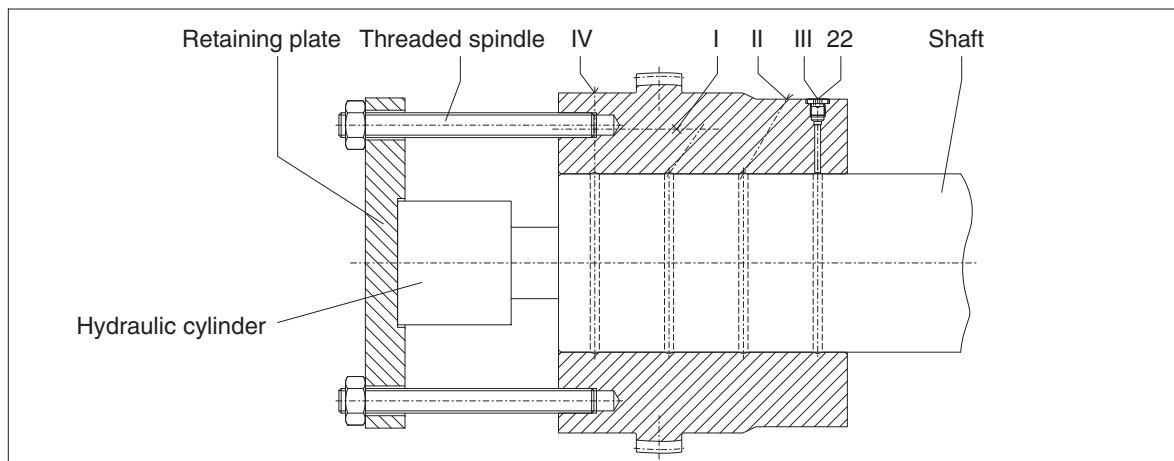
- for each oil channel (for number, see the dimensioned drawing) an oil pump with pressure gauge (min. 2500 bar) and/or motor pump with corresponding number of independently closable connections
- suitable connections and pipes
- 1 detaching device or retaining plate with retaining screws or threaded 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 and/or refer to dimensioned drawing).



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

Before detaching the coupling hub the detaching device must be mounted as shown in diagrams, illustrations, etc.

10.6.1 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.



Always note the order!

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

Only when an unbroken ring of oil emerges from both end faces and after a subsequent waiting period of approx. 30 minutes can pressure be applied to the hydraulic cylinder to slide the coupling hub smartly off the shaft.



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



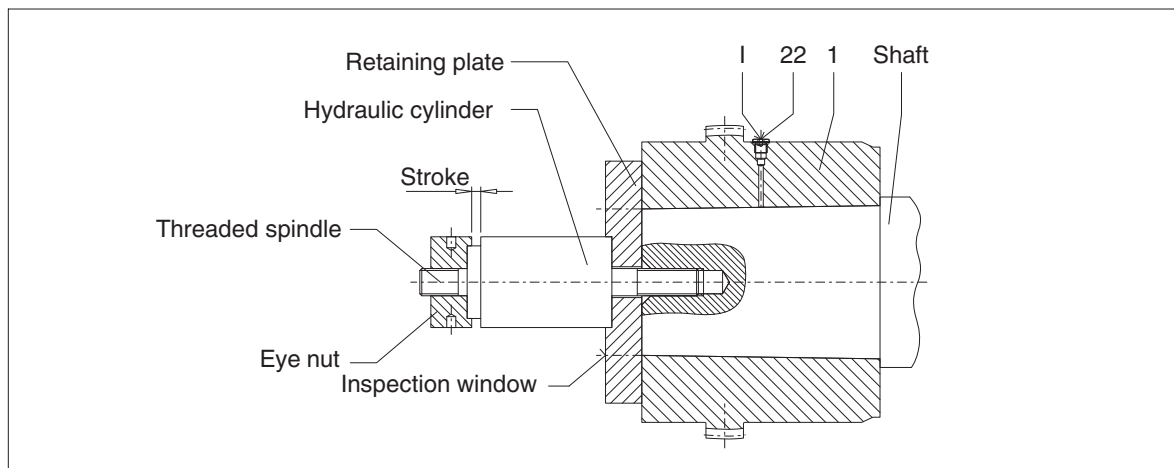
Note stroke of hydraulic cylinder. If re-adjustment is necessary, the end face of the hydraulic cylinder must stop between 2 oil channels.

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-fitting, the instructions in section 6, "Assembly", and section 7, "Start-up", must be carefully observed.

10.6.2 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 the diagram.

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 and/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 specified.

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.

The hydraulic cylinder must then 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-fitting, the instructions in section 6, "Assembly", and section 7, "Start-up", must be carefully observed.

10.7 Demounting the coupling parts (1/2) with stepped bore for removal by oil-hydraulic shrinking

Demounting is done as described in item 10.6, except that a motor-driven pump is 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.

For re-fitting, the instructions in section 6, "Assembly", and section 7, "Start-up", must be carefully observed.

11. Spare parts, customer service

By stocking the most important spare and wearing parts on site you can ensure that the coupling is ready for use at any time.

When ordering spare parts, always state the following:

- Original order number
- Part number (see item 11.1, 11.2 and section 5.)
- Description size
- Quantity

We guarantee only the original spare parts supplied by us.



Please note that spare parts and accessories not supplied by us have not been tested or approved by us. The installation and/or use of such products may therefore impair essential characteristics of the coupling under certain circumstances and so pose an active or passive hazard. Flender will assume no liability or guarantee for damage caused by non-genuine spare parts and accessories.

Please note that certain components often have special production and supply specifications and that we supply you with spare parts which comply fully with the current state of technical development as well as current legislation.

11.1 Spare-parts list

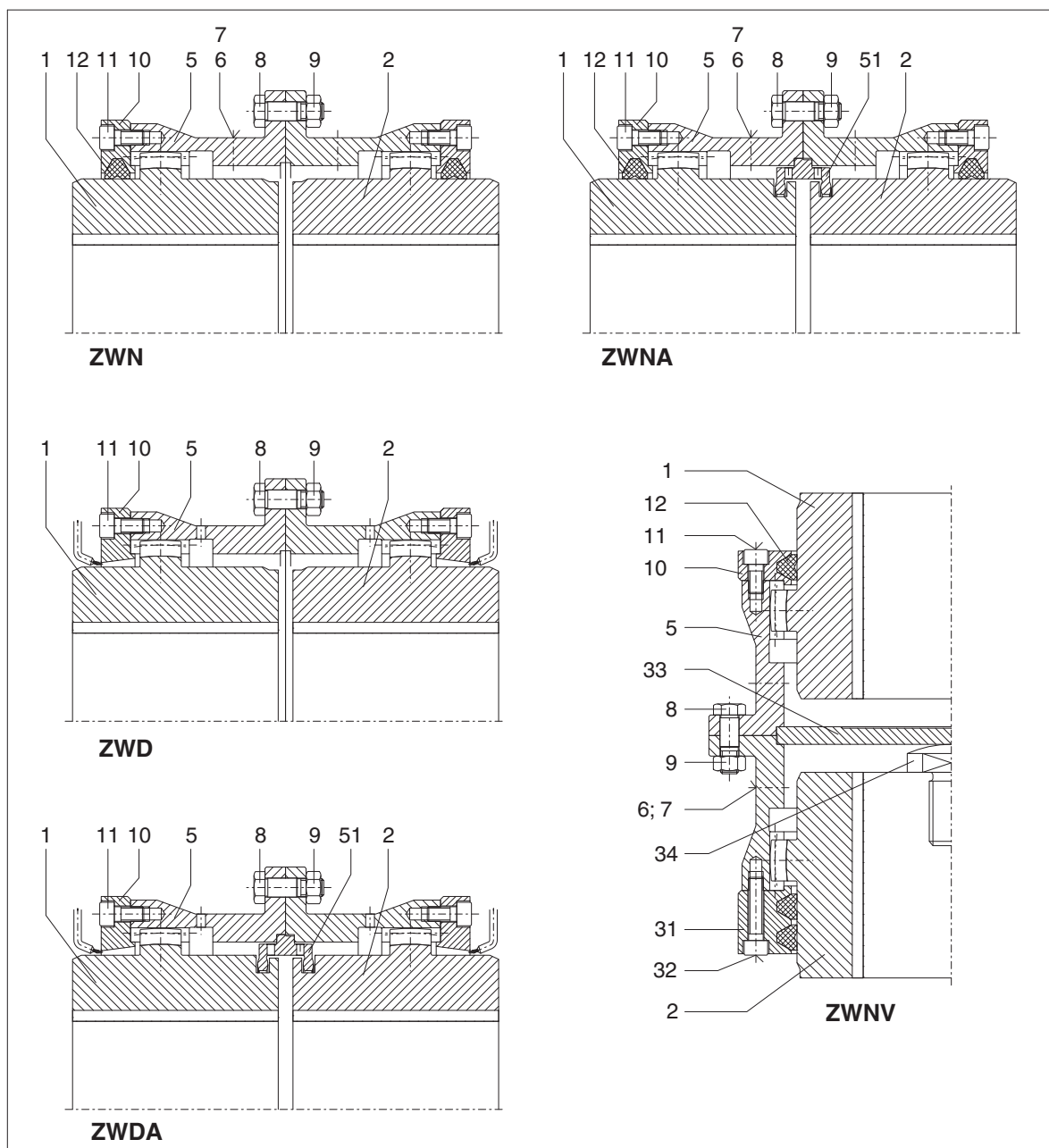
Spare parts											
Part number	Designation	ZWN	ZWNA	ZWNV	ZWD	ZWDA	ZZS	ZZSA	ZZSD	ZZSV	ZZDA
1	Part 1/2	x	x	x	x	x	x	x	x	x	x
2	Part 1/2	x	x	x	x	x	x	x	x	x	x
4	Adapter						x	x	x	x	x
5	Flanged sleeve	x	x	x	x	x	x	x	x	x	x
6	Screw plug	x	x	x			x	x	x	x	
7	Sealing ring ¹⁾	x	x	x			x	x	x	x	
8	Close-fitting bolt	x	x	x	x	x	x	x	x	x	x
9	Hexagon nut	x	x	x	x	x	x	x	x	x	x
10	Cover	x	x	x	x	x	x	x	x	x	x
11	Bolt	x	x	x	x	x	x	x	x	x	x
12	DUO sealing ring	x	x	x			x	x		x	
18	Bolt ³⁾										
20	Plate pulley ²⁾						x	x	x	x	x
21	Two-piece split cover ³⁾										
22	Screw plug ⁴⁾										
31	Cover			x						x	
32	Bolt			x						x	
33	Spacer washer			x						x	
34	Thrust piece			x						x	
50	Sealing compound	x	x	x	x	x	x	x	x	x	x
51	Split retaining ring		x			x					
52	Split retaining ring							x			x

Table 11.1: Spare-parts list

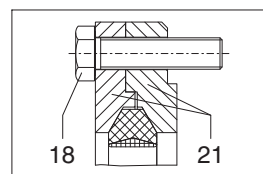
- ¹⁾ The sealing ring (7) is provided only on sizes 112 and 128. On the other sizes the sealing ring is integrated into the screw plug (6).
- ²⁾ The plate pulley (20) is flanged into the adapter (4). For replacement, only the adapter (4) complete with the plate pulleys (20) can be ordered.
In case of adapter lengths $L_Z \leq 200$ the adapter (4) is designed without plate pulleys (20).
- ³⁾ The two-piece split cover (21) is supplied only on request. It is fastened to the flanged sleeve (5) with the bolts (18).
- ⁴⁾ The screw plugs (22) are used only with an hydraulic interference fit (see section 10, item 10.6.1 and 10.6.2).

11.2 Spare parts drawings

11.2.1 Types ZWN, ZWNA, ZWD, ZWDA and ZWNV

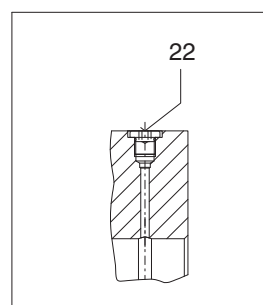


On types ZWN, ZWNA and ZWNV the cover (10) can, if required by the customer, also be designed as a two-piece split cover (21). The two-piece split cover (21) is fastened to the flanged sleeve (5) with the bolts (18).

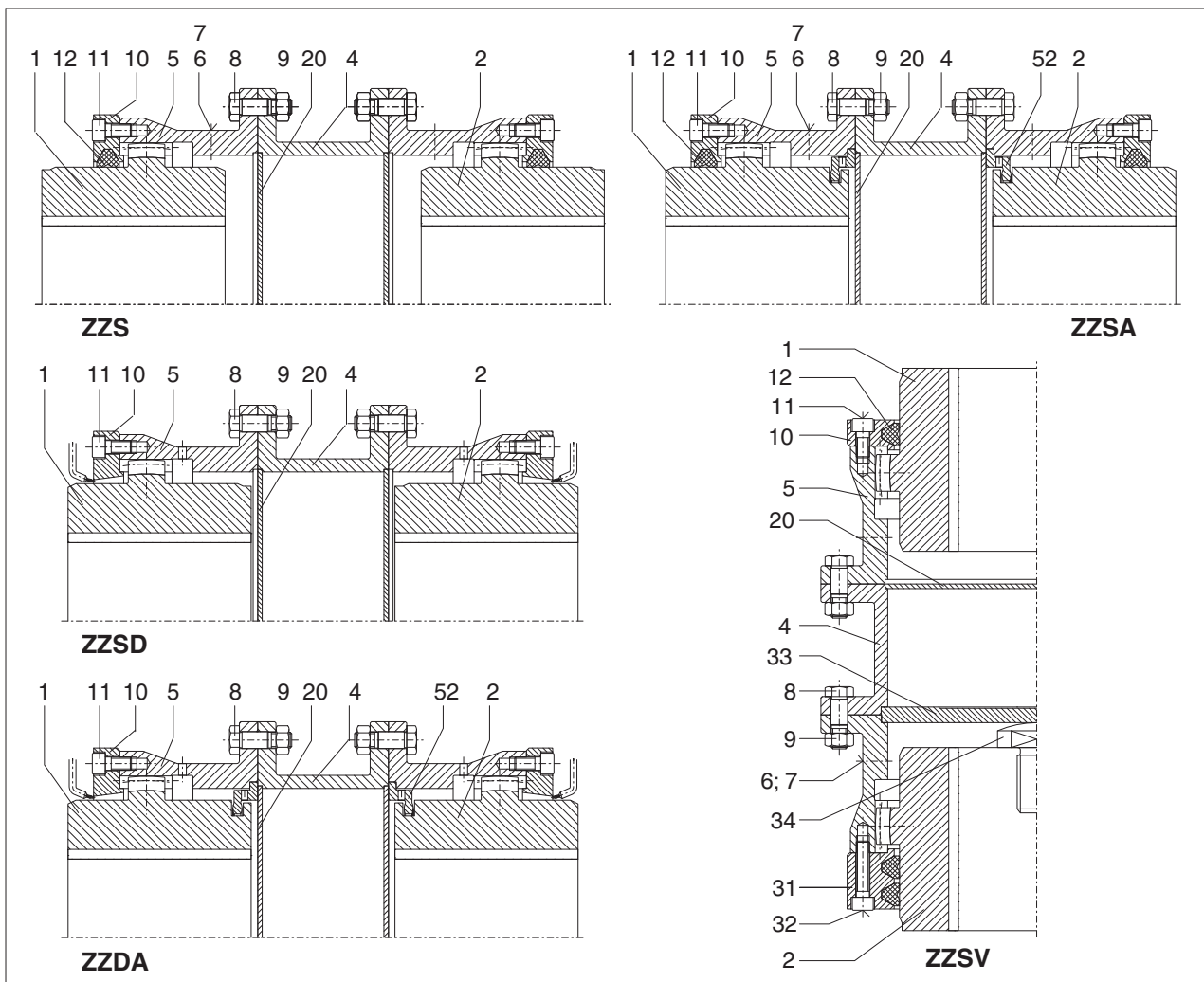


The cover (31) to type ZWNV can also be designed as a multi-piece split cover.

The screw plugs (22) are used only with an hydraulic interference fit (see section 10, items 10.6.1 and 10.6.2).



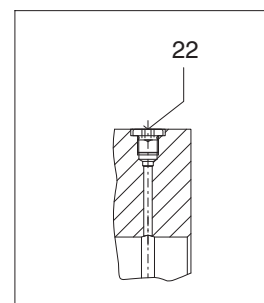
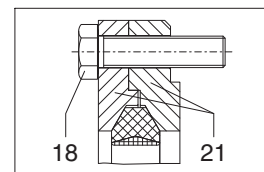
11.2.2 Types ZZS, ZZSA, ZZSD, ZZDA and ZZSV



On types ZZS, ZZSA and ZZSV the cover (10) can, if required by the customer, also be designed as a two-piece split cover (21). The two-piece split cover (21) is fastened to the flanged sleeve (5) with the bolts (18).

The cover (31) to type ZZSV can also be designed as a multi-piece split cover.

The screw plugs (22) are used only with an hydraulic interference fit (see section 10, items 10.6.1 and 10.6.2).



11.3 Spare parts and customer-service addresses

When ordering spare parts or requesting a service specialist, please contact Flender first (see section 2, "General notes").

12. Declarations

12.1 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 ZWN, ZWNA, ZWD, ZWDA,
ZZS, ZZSA, ZZSD, ZZDA, ZWNV, ZZSV

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 3500 en

Edition 10/2017

[Flender GmbH](#)

Alfred-Flender-Straße 77

46395 Bocholt

GERMANY