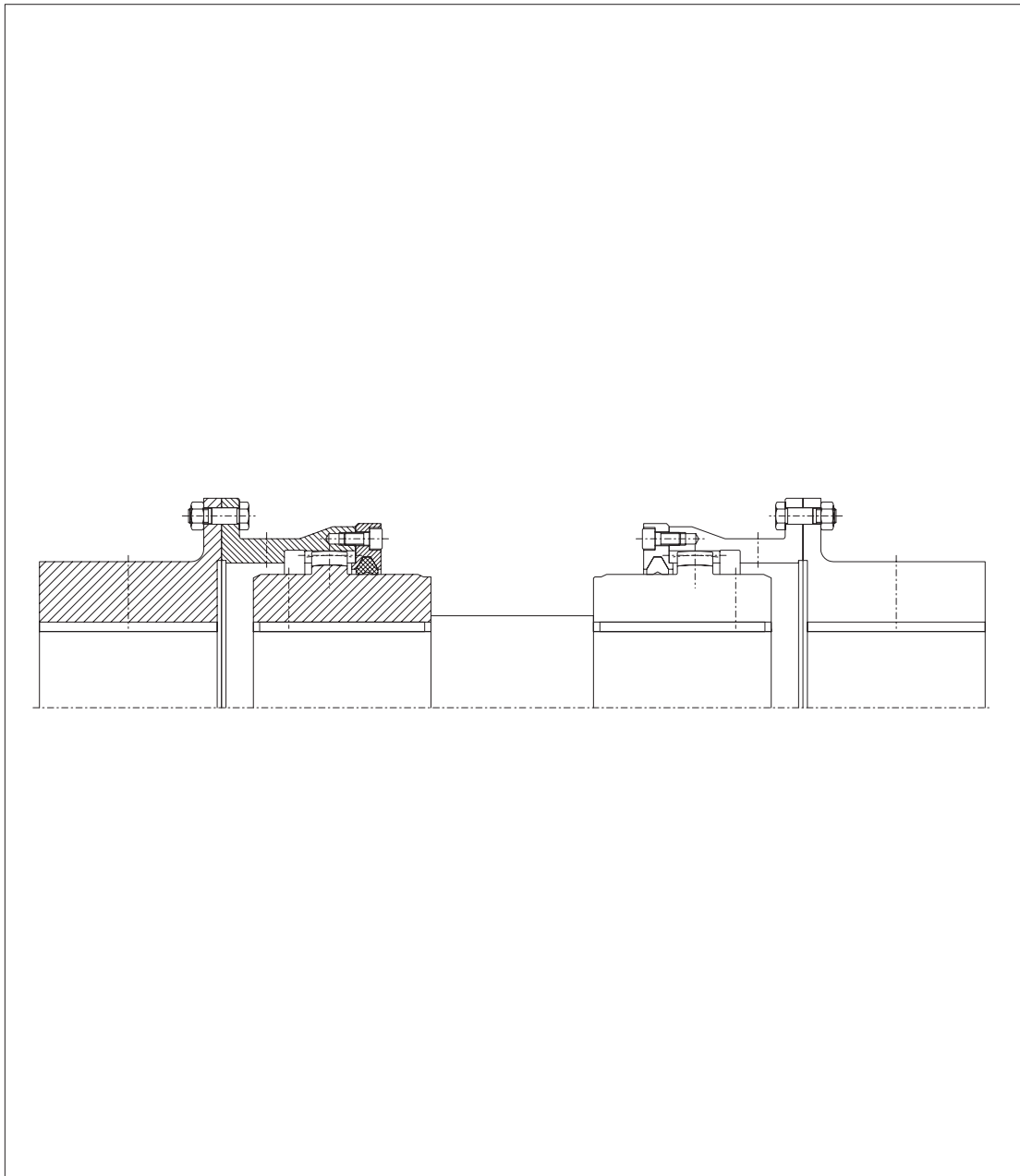


# Operating Instructions

**BA 3501 EN 09.99**

**ZAPEX couplings type  
ZZW**



**FLENDER**

A. Friedr. Flender AG · 46393 Bocholt · Tel. 02871/92-0 · Telefax 02871/92-2596 · [www.flender.com](http://www.flender.com)

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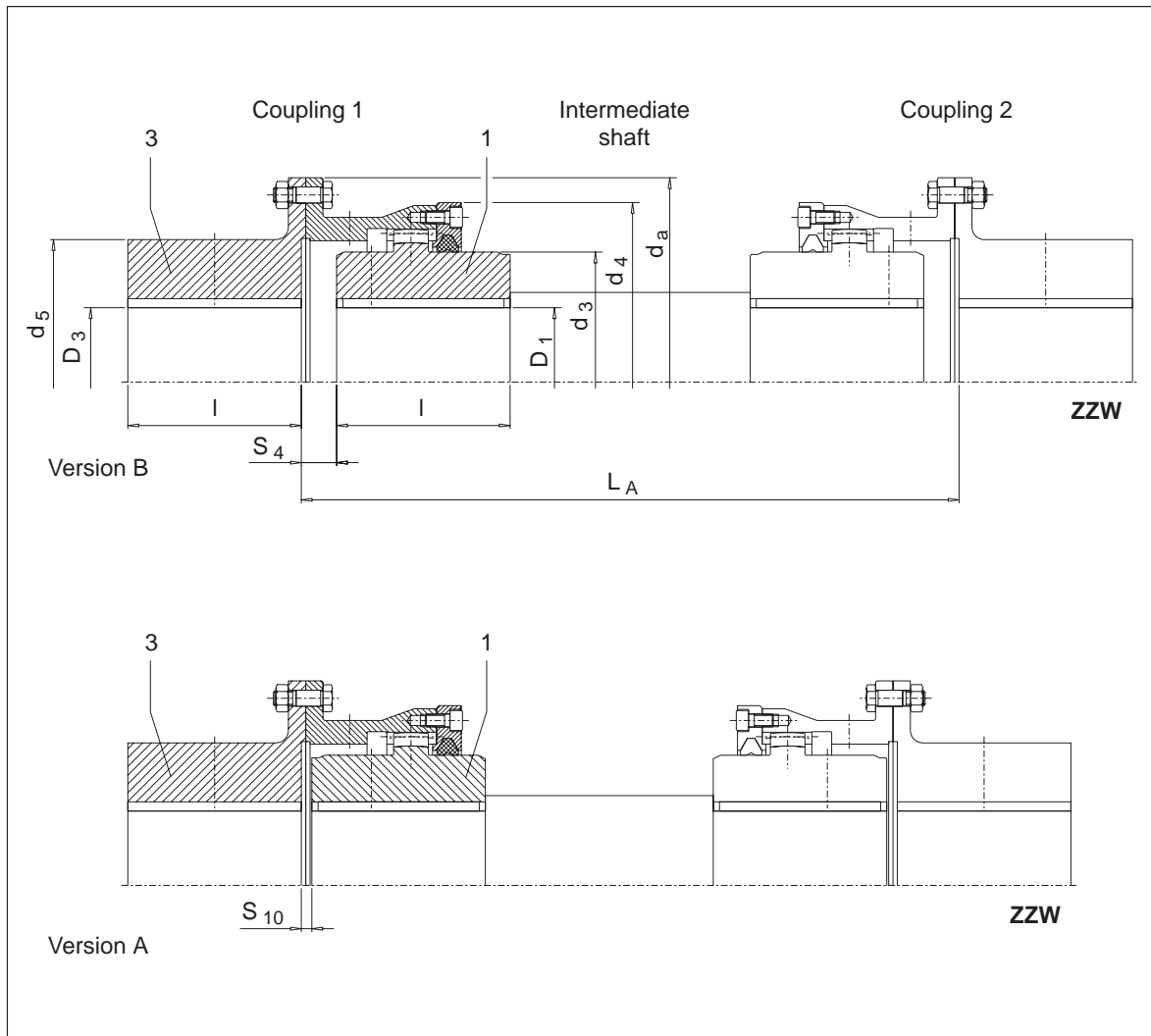
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## 1. Technical data

### 1.1 Type ZZW

The type ZZW is only available in version A ( $S_{10}$ ) and version B ( $S_4$ ). The distance dimensions  $S_4$  and  $S_{10}$  will be found in section 6., item 6.9.

$L_A$  – Dimensions according to the specifications of the orderer.



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Size	Nominal torque $T_N$ 1) Nm	Speed $n_{max}$ 2) 1/min	Bore 3)				$d_a$ mm	$d_3$ mm	$d_4$ mm	$d_5$ mm	l mm	Weight 4) kg
			$D_1$		$D_3$							
			from mm	to mm	from mm	to mm						
112	1300		0	45	20	55	143	65	110	80	50	6.4
128	2500		0	55	25	65	157	80	128	95	60	8.6
146	4300		0	65	30	80	177	95	146	112	75	13.5
175	7000		0	80	35	95	215	112	175	135	90	23
198	11600		0	95	40	110	237	135	198	160	100	33
230	19000		0	110	50	125	265	160	230	185	110	48
255	27000		0	125	60	145	294	185	255	210	125	67
290	39000		0	145	70	160	330	210	290	230	140	90
315	54000		80	160	80	180	366	230	315	255	160	125
342	69000		90	180	90	200	392	255	340	290	180	165
375	98000		100	200	100	220	430	290	375	320	200	225
415	130000		120	220	120	250	478	320	415	360	220	295
465	180000		140	250	140	275	528	360	465	400	240	390
505	250000		160	275	160	300	568	400	505	440	260	500
545	320000		180	300	180	330	620	440	545	480	280	650
585	400000		210	330	210 > 330	330 360	660	480	585	480 520	310	750 730
640	510000		230 > 330	330 360	230 > 360	360 390	738	480 520	640	520 560	330	930 870
690	660000		250 > 360	360 390	250 > 390	390 415	788	520 560	690	560 600	350	1100 1050
730	790000		275 > 390	390 415	275 > 415	415 450	834	560 600	730	600 650	380	1350 1300
780	1000000		300 > 415	415 450	300 > 450	450 490	900	600 650	780	650 710	400	1700 1650
852	1200000		325 > 450	450 490	325 > 490	490 520	970	650 710	850	710 750	420	2100 1950
910	1600000		350 > 490	490 520	350 > 520	520 550	1030	710 750	910	750 800	450	2550 2350
1020	1900000		375 > 520	520 550	375 > 550	550 600	1112	750 800	1020	800 860	480	3100 2950
1080	2200000		400 > 550	550 600	400 > 600	600 650	1162	800 860	1080	860 930	500	3600 3500
1150	2700000		425 425 > 600	600 600 650	425 > 600 > 650	600 650 690	1222	860 860 930	1150	860 930 990	520	4100 4000 4000
1160	3350000		450 > 600 > 650	600 650 690	450 > 650 > 690	650 690 730	1292	860 930 990	1160	930 960 1055	550	4700 4400 4800
1240	3800000		475 475 > 650 > 690	650 650 690 730	475 > 650 > 690 > 730	650 690 730 780	1400	930 930 990 1055	1240	930 990 1055 1120	580	5500 5400 5400 5800
1310	4600000		500 > 650 > 690 > 730	650 690 730 780	500 > 690 > 730 > 780	690 730 780 810	1470	930 990 1055 1120	1310	990 1055 1120 1170	610	6300 6000 6400 6800

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Size	Nominal torque $T_N$ 1) Nm	Speed $n_{max}$ 2) 1/min	Bore 3)				$d_a$ mm	$d_3$ mm	$d_4$ mm	$d_5$ mm	l mm	Weight 4) kg
			$D_1$		$D_3$							
			from mm	to mm	from mm	to mm						
1380	5300000		525	690	525	730	1540	990	1380	1055	640	7400
			> 690	730	> 730	780		1055		7000		
			> 730	780	> 780	810		1120		7300		
			> 780	810	> 810	860		1170		7700		
1440	6250000		550	730	550	780	1600	1055	1440	1120	670	8600
			> 730	780	> 780	810		1120		7900		
			> 780	810	> 810	860		1170		8300		
			> 810	860	> 860	910		1240		9000		
1540	7200000		575	780	575	810	1710	1120	1540	1170	700	10000
			> 780	810	575	810		1170		9600		
			> 810	860	> 810	860		1240		9600		
			> 860	910	> 860	960		1310		11000		

Table 1.1: Torques  $T_N$ , speeds  $n_{max}$ , dimensions and weights

- 1) The given torques refer to the tooth system and **not** to the shaft / hub connection. This must be checked separately.
- 2) The max. speed is restricted by the weight and the critical speed. Speed  $n_{max}$  on request.
- 3) Maximum bore in case of keyway according to DIN 6885/1.
- 4) Weights apply to clutch 1 or 2 with middle bores, without intermediate shaft.

The nominal torques  $T_N$  are valid for:

- daily operating cycle up to 24 h
- Operation within the prescribed alignment
- Operation in the temperature range of - 30 °C to + 80 °C (ambient temperature or temperature of the shaft ends).
- Up to 25 starts per hour with double torque permissible during start.

**Caution!**

**For permanent trouble-free operation, the coupling has to be designed with a service factor appropriate to the respective application. When changing the operating conditions (performance, speed, changes on power engine and machine), a check of the design is absolutely necessary.**

## 2. General notes

### 2.1 Introduction

These Operating Instructions (BA) are an integral part of the coupling supplied and must be kept in its vicinity for reference at all times.

**Caution!**

**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. We accept no responsibility for damage or disruption caused by disregard of these Instructions.**

The "**coupling**" dealt with in these Operating Instructions was developed for stationary use in general engineering.

The coupling is designed only for the application described in section 1. "Technical data". Possible use in any other area must be contractually agreed.

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 AG**.

These Operating 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 plant:

FLENDER AG  
D 46393 Bocholt

Telefon: 02871/92-2800  
Telefax: 02871/92-2801

or to our customer-service addresses. A list of our customer-service addresses is given in section 11. "Spare parts, customer-service addresses".

## 3. Safety notes

### 3.1 Proper use

- The coupling has been manufactured in accordance with the state of the art and is delivered in a condition for safe and reliable use. All changes to the coupling on the part of the user which may affect its safety and reliability are prohibited. This applies equally to safety features designed to prevent accidental contact.
- The coupling should be used and operated only within the context of the conditions laid down in the contract governing performance and supply.

### 3.2 Obligations of the user

- The user must ensure that all persons involved in the installation, operation, maintenance and repair of the coupling have read and understood these Operating Instructions and comply with them at all times in order to:

- avoid injury or damage,
- ensure the safety and reliability of the coupling,

and

- avoid disruptions and environmental damage through incorrect use.
- During transport, assembly, installation, dismantling, operation and maintenance of the coupling, the relevant safety and environmental regulations must be complied with at all times.
- The coupling should be operated, maintained or repaired by authorised, trained and qualified personnel.
- All work on the coupling must be carried out with great care and with due regard to safety.
- All work on the coupling must be carried out only when it is not in operation. The drive assembly 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.
- Protect the coupling against accidental contact by means of appropriate guards. The guard must not impair the function of the coupling.
- The drive unit should be shut off at once if changes in the coupling are detected during operation.
- If the coupling is intended for installation in plant or machinery, the manufacturer of such plant or machinery must ensure that the contents of these Instructions are incorporated in his own instructions.
- All spare parts must be obtained from FLENDER.

### 3.3 Warnings and symbols used in these Instructions



This symbol indicates safety measures which must be observed to avoid **personal injury**.

**Caution!**

This symbol indicates safety measures which must be observed to avoid **damage to the coupling**.

**Note:**

This symbol indicates general **operating procedures** which are of particular importance.



## 4. Handling and storage

**Note:** Observe the "Safety notes" in section 3.

### 4.1 Scope of supply

The products supplied are listed in the dispatch papers. Check immediately on receipt to ensure that all the products listed have actually been delivered. Damaged or missing parts must be notified in writing immediately.

The ZAPEX coupling is delivered in components ready for installation, however, **without** oil or grease filling.

### 4.2 Handling

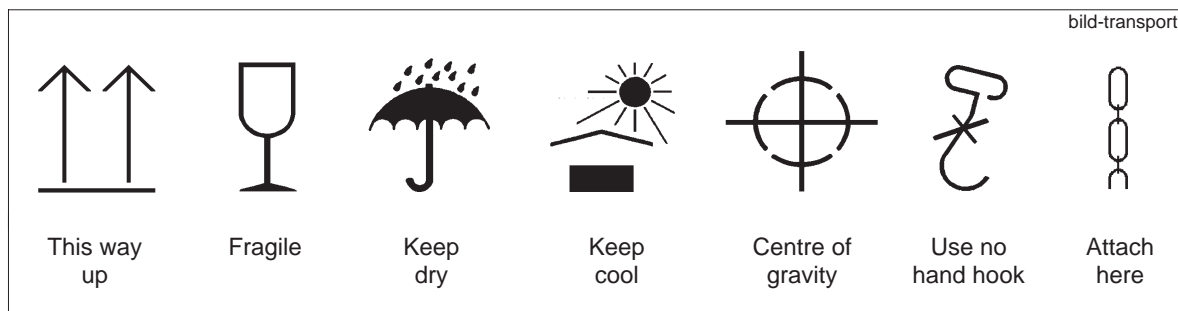


**When handling FLENDER products use only lifting and handling equipment of sufficient load-carrying capacity!**

**Note:** The coupling must be transported using suitable equipment only.

The packing of the coupling will differ depending on method of shipment and size. The packing, unless otherwise agreed contractually, complies with **HPE Packing Guidelines**.

The symbols shown on the packing should be noted. Their meaning is as follows:



### 4.3 Storage

#### 4.3.1 Storage of the coupling parts

The coupling is delivered in a preserved state and can be stored at a covered dry place up to 6 months. If the coupling shall be stored for a longer period of time, an appropriate long-term preservation is necessary (consultation with FLENDER required).

#### 4.3.2 Storage of the DUO sealing rings

##### 4.3.2.1 General

Proper storage maintains the life of the DUO sealing rings (12). Unfavourable storage conditions and improper treatment of the DUO sealing rings (12) result in a negative change of the physical characteristics. These changes can be caused by the effects of e.g. ozone, extreme temperatures, light, moisture or solvents.

**Caution!**

**The DUO sealing rings must not be stored installed on the coupling part 1 (1).**

##### 4.3.2.2 Storage room

The storage room should be dry and dust-free. The DUO sealing rings (12) must not be stored together with chemicals, solvents, fuels, acids, etc. Furthermore, they should be protected against light, especially against direct sunlight and strong artificial light with a high ultra-violet percentage.

**Caution!**

**The storage rooms must not contain any ozone-producing devices like e.g. fluorescent light sources, mercury-vapour lamps, electric high-voltage devices. Damp storage rooms are unsuitable. Make sure that no condensation develops. The relative humidity of air is most favourable below 65 %.**

## 5. Technical description

**Note:** Observe the "Safety notes" in section 3.

**Caution!**

**If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.**

### 5.1 General description

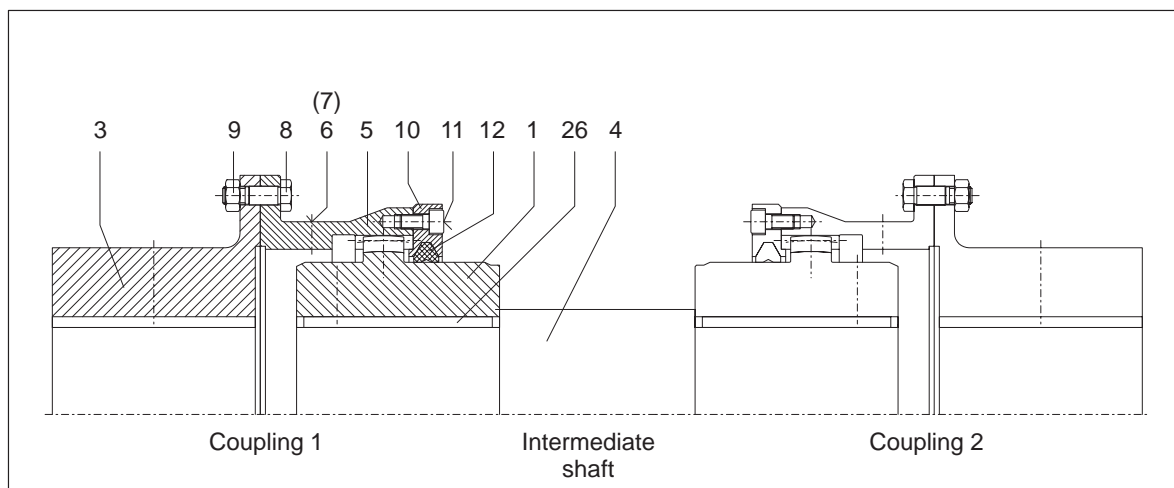
Type ZZW ZAPEX Coupling is provided for connecting and disconnecting two shafts. The shaft ends to be connected must be supported in bearings directly before and behind the coupling.

**Note:** To be able to compensate radial misalignment, coupling (1), intermediate shaft (4) and coupling (2) are always required.

ZAPEX couplings are suitable for clockwise and counter-clockwise operation as well as reversing operation.

The coupling parts 1 with external gear teeth (1) engage with the internal teeth of the coupling sleeve (5).

DUO sealing rings (12) serve for sealing the oil/grease spaces towards the outside.



Torque transmission is effected from the shaft via parallel key, shrink connection or the like onto coupling part 3 (3) of coupling 1, onwards via the close fitting bolt connection (8, 9) to the sleeve (5) and from there via the gear teeth to coupling part 1 (1), and then again via the parallel key (26), the shrink connection or the like onto the intermediate shaft (4). The torque is transmitted from the intermediate shaft (4) via parallel key (26), shrink connection or the like onto coupling part 1 (1) of coupling 2, from there via the gear teeth to the sleeve (5), further via the close fitting bolt connection (8, 9) to coupling part 3 (3), and then again via parallel key, shrink connection or the like onto the shaft.

## 6. Assembly

**Note:** Observe the "Safety notes" in section 3.

**Caution!**

**If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.**

### 6.1 Notes on fitting the finished bore, the axial securing, the set screws, the balancing

According to the order placed, the coupling parts (1; 3) for removal by oil hydraulic shrinking are delivered with finished bores.

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## 6.1.1 Finished bore for parallel keyway connection

- Depreserve coupling parts (1; 3).



**Observe the manufacturer's instructions on handling the solvents.**

For making the finished bore, the coupling parts (1; 3) must be clamped as shown in the following figure.

**Caution!**

**In the case of part 1 (1), the clamping chuck must always be opposite the sealing surface.**

The coupling part must be aligned carefully. For the permissible radial eccentricity see DIN ISO 286 degree of fundamental tolerance IT 6 (see table 6.1).

**Caution!**

**The maximum permissible boring diameters (see section 1.) 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.**

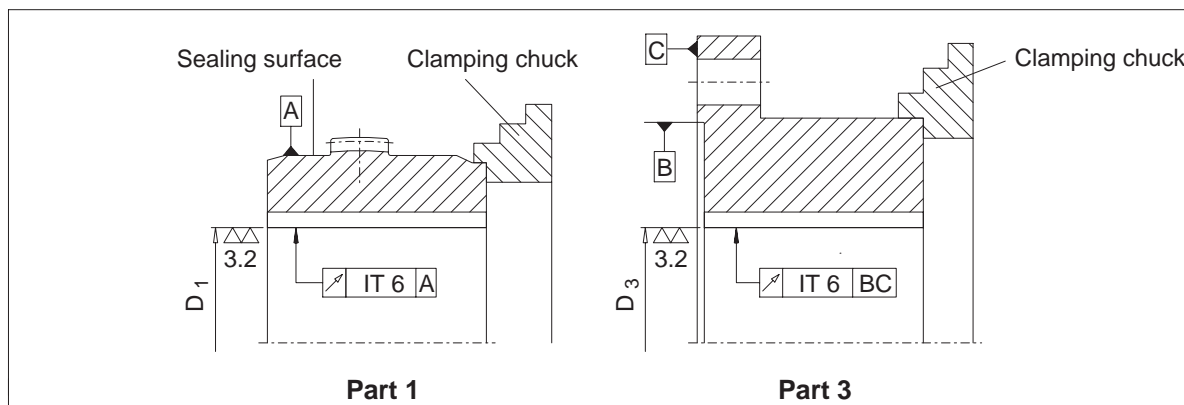
If other hub connections (e.g. spline bore hub profile, tapered or stepped bores, parallel key connections with tightening etc.) are to be used instead of the provided parallel key connection, FLENDER should be consulted.



**Non-observance of these notes may lead to the drifting of coupling. There is a danger to life due to broken pieces flying around!**

Dimension or nom. dimension	> 18 to 30	> 30 to 50	> 50 to 80	> 80 to 120	> 120 to 180	> 180 to 250	> 250 to 315	> 315 to 400	> 400 to 500	> 500 to 630	> 630 to 800	> 800 to 960
Perm. deviation according to DIN ISO 286/1, IT6	0.013	0.016	0.019	0.022	0.025	0.029	0.032	0.036	0.040	0.044	0.050	0.056

Table 6.1: Permissible radial run-out



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

<b>Shaft end tolerances</b>	h6	h8	k6	m6	n6	p6	s6
<b>Bore tolerances</b>	P7	S7	M7	K7	J7	H7	F7

Table 6.2: Fit pairings

**Caution!**

**The tolerance field must be observed in anyway, in order to restrict the hub tension resulting from the oversize to the permissible load. In case of non-observance of the tolerance field, the shaft / hub connection may be damaged.**



**Non-observance of these notes may lead to the drifting of coupling. There is a danger to life due to broken pieces flying around!**

## 6.1.1.1 Parallel keyway

In the case of a parallel key connection according to DIN 6885/1 and one keyway, we recommend the tolerance zone of the hub keyway width **ISO P9**.

In the case of a parallel key connection according to DIN 6885/1 and two keyways, we recommend the tolerance zone of the hub keyway width **ISO JS9**.

## 6.1.2 Axial securing in case of parallel key connection

For axially securing the coupling parts, a set screw or an end plate has to be provided for. When using end plates, FLENDER is to be consulted with regard to the insertion of recess in the coupling parts.

## 6.1.3 Set screws in case of parallel key connections

Headless pins with notched cut point according to DIN 916 are to be used as set screws.

It is absolutely necessary to observe the following guidelines!



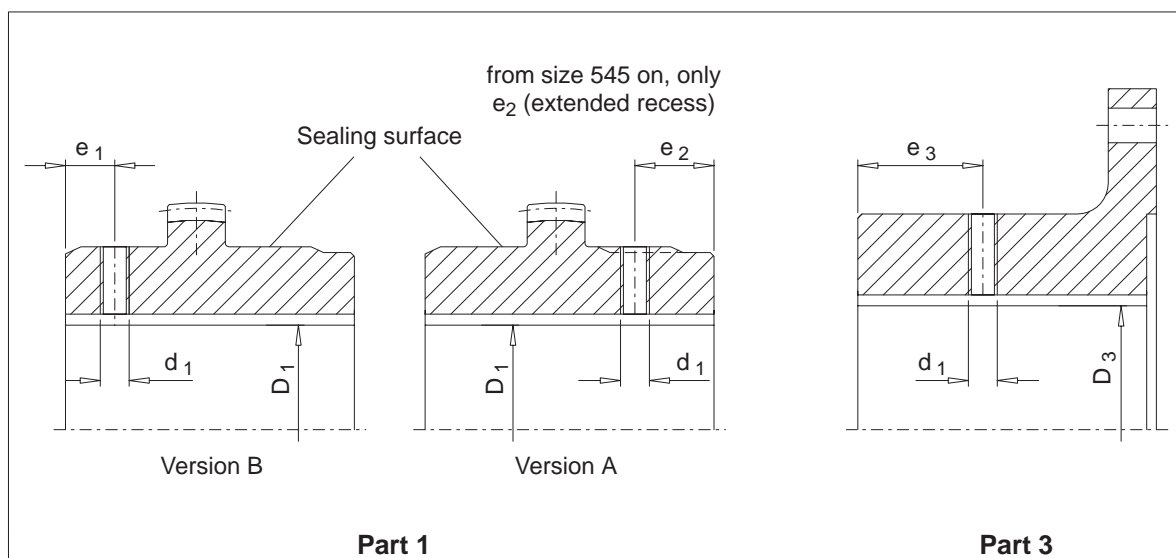
**The length of the set screw is to be chosen so that it completely fills the cut hole but that it does not protect over the hub ( $L_{min} = d_1$ ).**

**Caution!**

**The set screws should generally be arranged on the parallel key. Check the length of the parallel key.**

The tapped holes are to be arranged in accordance with the drawing considering the used version A or B for the coupling part 1 (1).

In the case of size 112, the set screw in coupling part 1 (1) should always be arranged in the unground hub side.



Size	Bore $D_1$ mm	Bore $D_3$ mm	$d_1$ mm	$e_1$ mm	$e_2$ mm	$e_3$ mm
112	20 ... 45	20 ... 55	M 6	15	–	25
128	25 ... 30 > 30 ... 55	25 ... 30 > 30 ... 65	M 6 M 8	14	20	30
146	30 > 30 ... 38 > 38 ... 65	30 > 30 ... 38 > 38 ... 80	M 6 M 8 M10	16	26	35
175	35 ... 80	35 ... 85 > 85 ... 95	M10 M12	20	26	40
198	40 ... 44 > 44 ... 95	40 ... 44 > 44 ... 110	M10 M12	22	36	45

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Size	Bore D <sub>1</sub> mm	Bore D <sub>3</sub> mm	d <sub>1</sub> mm	e <sub>1</sub> mm	e <sub>2</sub> mm	e <sub>3</sub> mm
230	50 ... 58 > 58 ... 110	50 ... 58 > 58 ... 125	M12 M16	25	38	50
255	60 ... 110 > 110 ... 125	60 ... 110 > 110 ... 145	M16 M20	30	45	60
290	70 ... 75 > 75 ... 145	70 ... 75 > 75 ... 160	M16 M20	30	48	70
315	80 ... 160	80 ... 180	M20	40	55	80
342	90 ... 170 > 170 ... 180	90 ... 170 > 170 ... 200	M20 M24	40	60	90
375	100 ... 110 > 110 ... 200	100 ... 110 > 110 ... 220	M20 M24	35	70	100
415	120 ... 220	120 ... 250	M24	40	90	110
465	140 ... 250	140 ... 275	M24	40	110	120
505	160 ... 275	160 ... 300	M24	45	130	130
545	180 ... 300	180 ... 330	M24		80	140
585	210 ... 330	210 ... 360	M24		90	155
640	230 ... 360	230 ... 390	M24		100	165
690	250 ... 390	250 ... 415	M24		120	175
730	275 ... 415	275 ... 450	M24		140	190
780	300 ... 450	300 ... 490	M24		140	200
852	325 ... 490	325 ... 520	M24		150	210
910	350 ... 520	350 ... 550	M24		180	225
1020	375 ... 550	375 ... 600	M24		180	240
1080	400 ... 600	400 ... 650	M24		190	250
1150	425 ... 650	425 ... 690	M24		200	260
1160	450 ... 690	450 ... 730	M24		220	275
1240	475 ... 730	475 ... 780	M24		215	290
1310	500 ... 780	500 ... 810	M24		230	305
1380	525 ... 810	525 ... 860	M24		250	320
1440	550 ... 860	550 ... 910	M24		270	335
1540	575 ... 910	575 ... 960	M24		250	350

Table 6.3: Set screw assignment

## 6.1.4 Balancing

Prebored couplings resp. prebored coupling parts are shipped unbalanced. For these parts it is recommended to balance them depending on the application case after finish boring (see also DIN ISO 1940 part 1).

**Note:**

FLENDER recommendation:

Balancing on two levels Q6.3 for velocities  $v = 36$  m/s or exceeding this value measured at  $d_4$  according to item 1.5.

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Balancing is usually carried out by material cutting through boring. In order to restrict the material quantity to be cut to a minimum, the biggest possible balancing radius is to be selected. The removal of material should only be carried out at the marked locations (see Figure).

## Caution!

The gear teeth of coupling parts 1 (1) and the fitting holes in the flange of coupling parts 3 (3) must absolutely not be damaged.

The coupling parts 3 (3) should be balanced together with the fastened sleeves (5) in two planes.

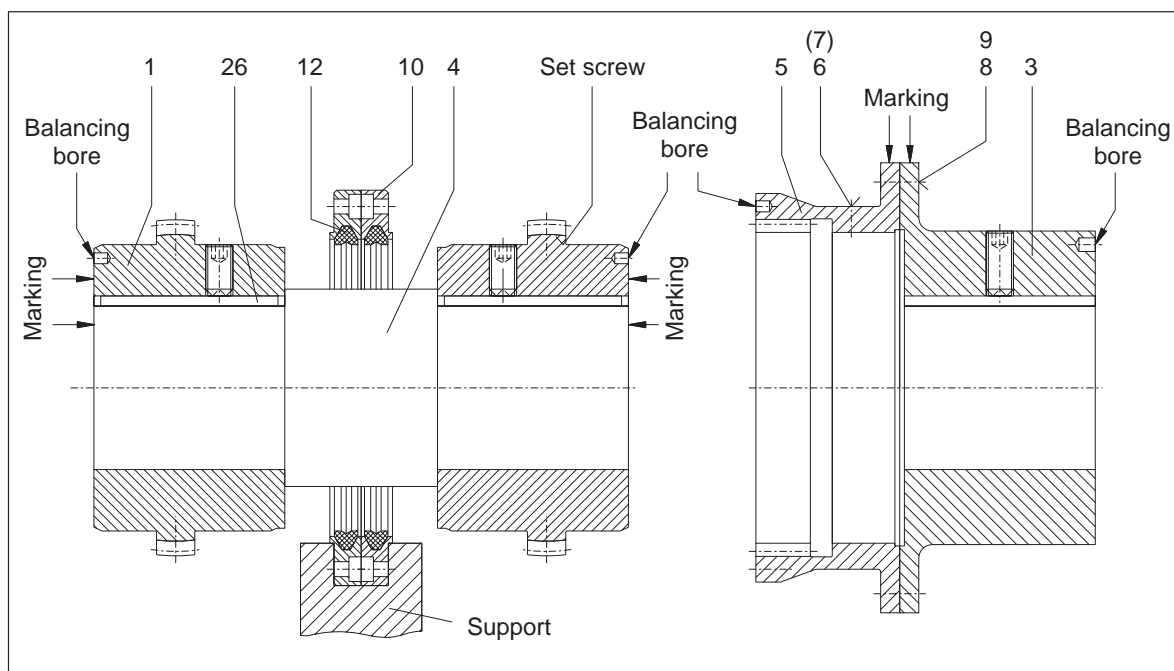
## Caution!

Make a permanent record of the position of coupling parts 1 (1) in relation to the sleeves (5) prior to balancing by marking (↓) at the outside diameter of the flange.

When balancing coupling parts 3 (3) prior to keyway milling, note the final position of the set screw. After balancing, the screw union (8, 9) should be undone again.

In the case of balancing after keyway milling, please consult FLENDER.

The coupling parts 1 (1) should be balanced with the mounted intermediate shaft (4), the parallel keys (26), the tightened set screws and the backed covers (10 or 21). For assembly please refer to Item 6.3 or Item 6.4. The backed covers (10 or 21) should be supported during the balancing operation.



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

## 6.2 General installation notes

For the installation the safety notes in Section 3. are to be observed.

The installation has to be carried out with utmost care by trained personnel.

Already during the planning phase it is to be observed that sufficient room is to be provided for the installation and later inspection and maintenance work.

Before starting the installation a sufficient number of hoists must be provided for.

## Caution!

If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.

## 6.3 Installing the coupling parts (1; 3) in case of shaft / hub connection with parallel key

Before starting the assembly all parts and shaft ends must be cleaned thoroughly.

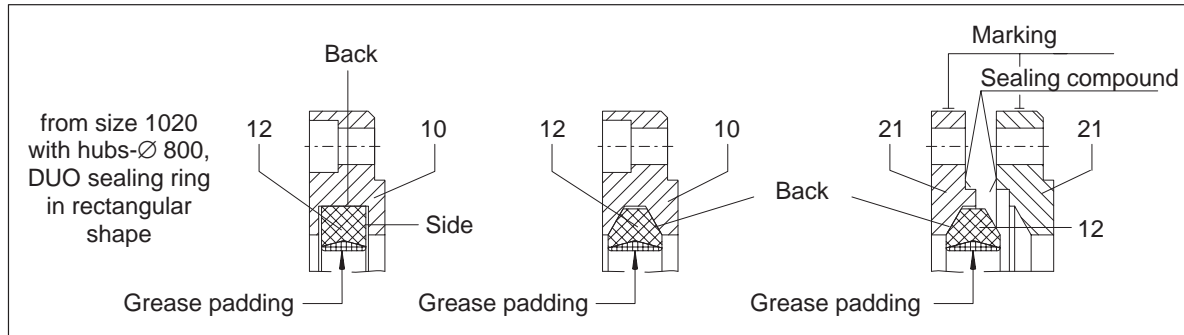
**Caution!** The DUO sealing rings (12) must not come into contact with the solvent!



Observe the manufacturer's instructions on handling the solvents.

Grease the back or the sides of the DUO sealing ring (12) and the groove in the cover (10) thoroughly and fit it in the cover (10 or 21). Apply a grease padding in the ring-shaped hollow space. When using two-part covers (21) the connecting points must be sealed with sealing compound on one side.

**Caution!** Observe the marking.



Back the cover (10 or 21) with inserted DUO sealing ring (12) on the intermediate shaft (4) in such a way that the DUO sealing ring (12) cannot be damaged by the coupling part 1 (1) to be fitted.

**Caution!** Unscrew set screws from coupling parts (1; 3). Protect DUO sealing rings (12) and seals of the input and output sides from damage and heating above +80 °C.

**Caution!** Coupling parts (1; 3) with tapered bore and parallel key connection should be fitted cold.

Heating (max. +80 °C) the coupling parts (1; 3) with cylindrical bore may ease pulling on. Heating can be effected inductively in the oven or by means of a burner. Heating by means of a burner must be carried out in longitudinal direction of the hub above the groove.



Protect yourself against burns by hot parts!

**Caution!** The coupling parts (1; 3) should be fitted using suitable devices. Damage to the shaft bearing arrangement by the axial joining force should be precluded. Make sure that suitable hoists are used. Make sure that the bore and the sealing surface for the DUO sealing ring (12) are not damaged by hoists etc.

**Note:** The coupling parts (1; 3) with tapered bore should be secured by means of appropriate end plates. For this purpose, apply sealing compound to the hub face on the shaft face and screw on the end plate.

In the case of coupling parts (1; 3) with keyway and set screw, the tapped hole for the set screw should be filled 2/3rd with sealing compound after cooling down to room temperature in order to avoid the egress of lubricant through the parallel keyway. Screw the set screw into place (the set screw must be positioned above the parallel key).

**Caution!** Tightening of the set screws only by means of a hexagon socket head wrench according to DIN 911, without an extension pipe.

- 6.4 Installing the coupling parts (1; 3) in case of cylindrical and tapered interference fit set for oil hydraulic removal by shrinking

**Caution!** The data given in the dimensioned drawing must be observed in any case.

Prior to commencing assembly, the screw plugs (22) must be unscrewed from the coupling parts (1; 3) and all parts and shaft ends must be thoroughly cleaned and dried. The oilways and the oil circulation keyways must, likewise, not show any signs of contamination.

**Caution!** The DUO sealing rings (12) must not come into contact with the solvent!

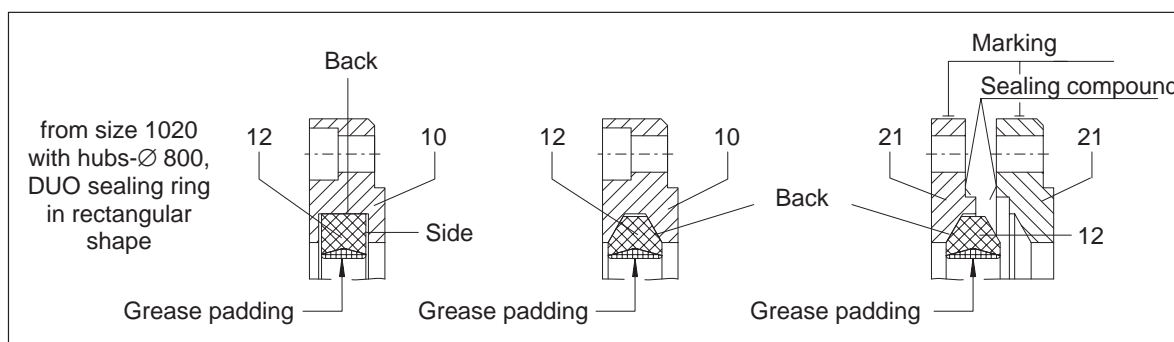


Observe the manufacturer's instructions on handling the solvents.

**Caution!** The fit surfaces may never be greased with grease containing molybdenum sulphide (Molykote or comparable products).

Grease the back or the sides of the DUO sealing ring (12) and the groove in the cover (10) thoroughly and fit it in the cover (10 or 21). Apply a grease padding in the ring-shaped hollow space. When using two-part covers (21) the connecting points must be sealed with sealing compound on one side.

**Caution!** Observe the marking.



Back the cover (10 or 21) with inserted DUO sealing ring (12) on the intermediate shaft (4) in such a way that the DUO sealing ring (12) cannot be damaged by the coupling part 1 (1) to be fitted.

**Caution!** Protect DUO sealing rings (12) and seals of the input and output sides from damage and heating above +80 °C.  
(Use heat insulation shields against heat radiation.)

The coupling parts (1; 3) should be mounted while they are warm and heated to the temperature given in the dimensioned drawing in accordance with the shrinking dimension.

Heating can be effected inductively by means of a burner or in the oven.



**Protect yourself against burns by hot parts!**

Before mounting, the bore size of the heated coupling parts (1; 3) must be checked, e.g. by means of a gauge for bore holes.

**Caution!** The heated coupling parts (1; 3) are to be fitted by means of suitable devices in order to prevent damage to the shaft bearing by the axial fitting force.  
Make sure that suitable hoists are used.  
Make sure that the bore and the sealing surface for the DUO sealing ring (12) are not damaged by hoists etc.

The coupling parts (1; 3) should be pulled quickly onto the shaft according to the specifications in order specific dimensioned drawing.

**Note:** Until the coupling parts (1; 3) have cooled down and are tight, they must be held on the shaft by means of a suitable holding device.

After the coupling parts (1; 3) have cooled down to room temperature, the oil ducts must be filled with clean oil, e.g. ISO VG 150 and closed with the plug screws (22) (protection against corrosion).



## 6.5 Assembly of the coupling

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

Fit the sleeves (5) onto the hub and over the gear teeth of coupling parts 1 (1) using suitable tools in such a manner that the sleeves (5) will not project beyond the hub/shaft end faces. Retain and/or support the sleeves (5).

Push the machines to be coupled together. The dimension S (see item 6.9) is to be observed. Align the coupling in accordance with item 6.6 to item 6.8.

Pull the covers (10 and 21) with suitable tools onto the hub.

Apply sealing compound to the sealing surfaces of the covers (10 or 21) (always apply the sealing compound to only one side) and fix them to the sleeves by means of screws (the tightening torques will be found under item 6.10).

Coat the sealing surfaces of the sleeves (5) with sealing compound (always apply sealing compound to one side only). Position the intermediate shaft (4) with the fitted coupling parts 1 (1) and the fitted sleeves (5) between coupling parts 3 (3) using suitable tools.

Align the fitting holes of the flanges and check for possible markings. Insert the fitting bolts (8) and tighten the nuts (9) (the tightening torques will be found under item 6.10).

## 6.6 Aligning

The couplings compensate for positional deviations of the shaft ends to be connected up to 1°.

When aligning, keep the radial and angular misalignment of the shaft ends as small as possible because hereby the service life of the coupling is increased under otherwise the same operating conditions. However, the angular misalignment may not be smaller than 0.05°.

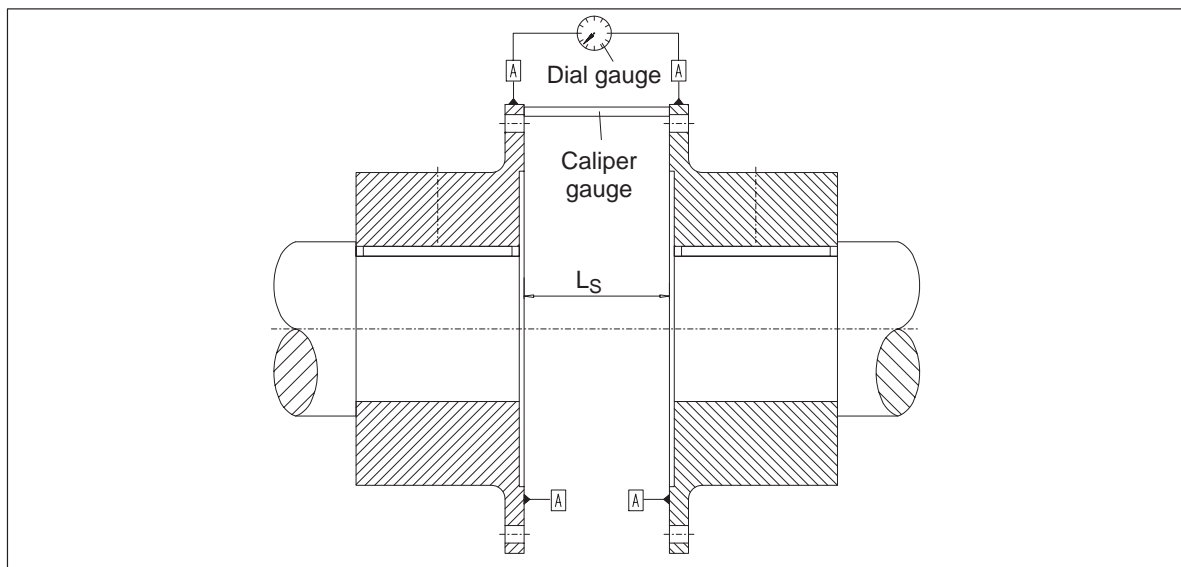
Aligning is done by means of suitable measuring tools. The following figure shows aligning proposals and the alignment surfaces (  $\square A$  ).

Measuring should be carried out successively from right to left and from left to right or with two dial gauges simultaneously. The sag of the dial gauge should be allowed for.

### Note:

FLENDER recommendation:

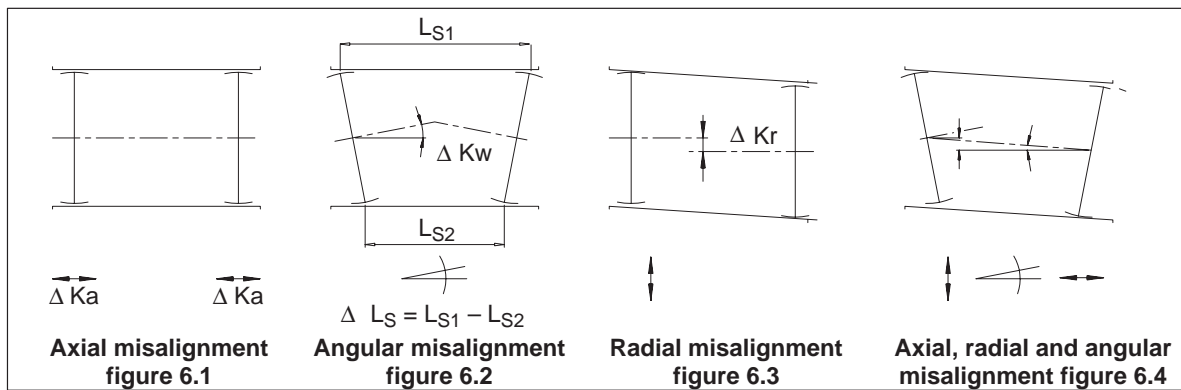
In order to preclude measuring errors caused by the sag of the dial gauge, it is recommended to effect alignment using laser technology.



### Caution!

The max. permissible misalignments depend on the operating factor and the coupling speed. When changing the speed, a check is absolutely necessary. As further misalignments may occur during operation (expansion due to heat, bending of the shaft, foundation settling, etc.), only 10% of the max. permissible misalignments are to be obtained during aligning. However, the misalignments may not be less than 0.05°. The alignment values will be found under item 6.8.

## 6.7 Possible misalignments



Misalignments of the coupling parts may result from an inexact alignment during the assembly but also from the operation of the plant (expansion due to heat, bending of the shaft, machine frame too soft, etc.).

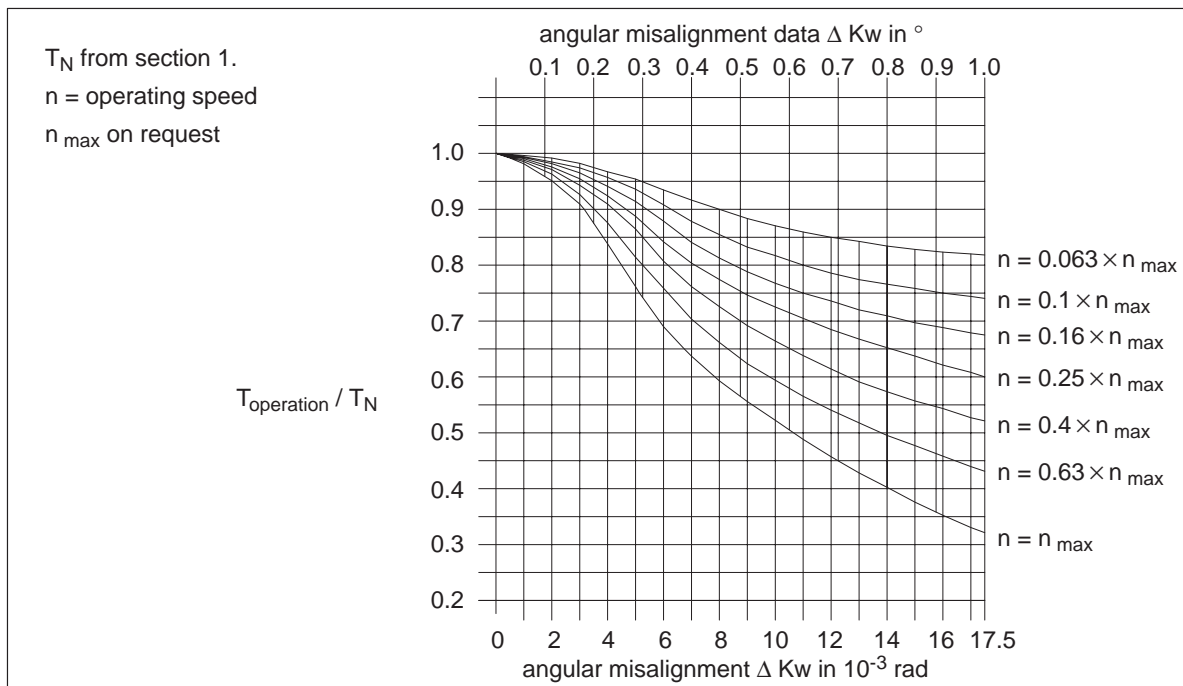
### Caution!

The following max. permissible misalignments must not be exceeded during operation under any circumstances.

#### 6.7.1 Axial misalignment

Axial misalignment  $\Delta K_a$  (figure 6.1) of the coupling parts to each other is permissible within the "permissible variation" for the dimension S (see item 6.6 and 6.8).

#### 6.7.2 Angular misalignment in dependence on the operating torque and the operating speed



For reasons of simplification, the angular misalignment  $\Delta K_w$  (figure 6.2) is determined as difference ( $\Delta L_S$ ) of the dimension  $L_S$  (alignment surface  $\square A$ , see item 6.6). The measurement should be carried out at several points on the periphery.

For the permissible alignment values see item 6.8

#### 6.7.3 Radial misalignment

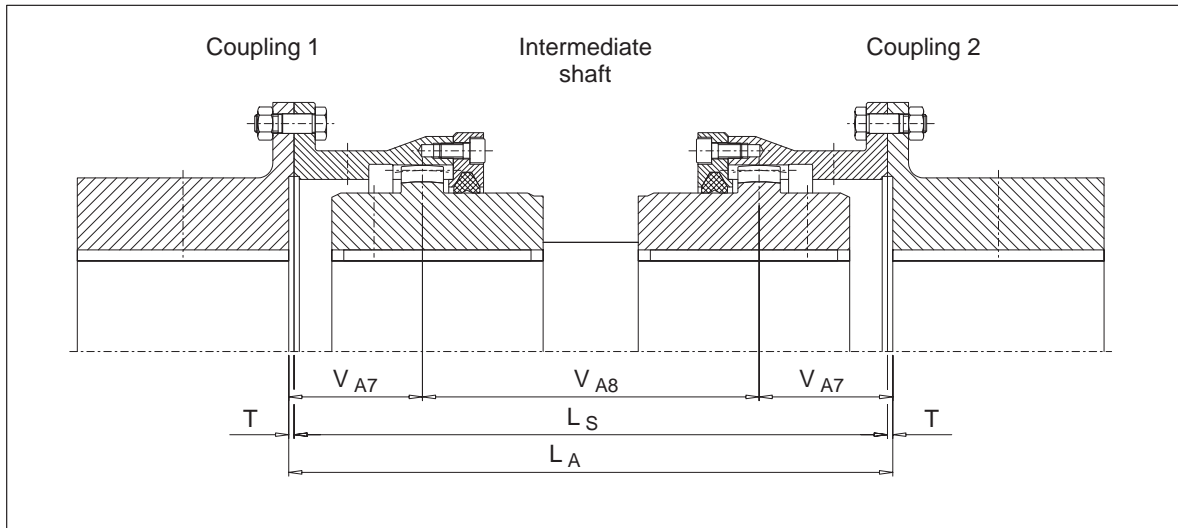
The max. possible radial misalignment  $\Delta K_{r_{\text{max}}}$  (figure 6.3) corresponds to a possible angular deviation per coupling half of  $\Delta K_{w_{\text{max}}} = 0.0175 \text{ rad} = 1^\circ$ .

For the permissible alignment values see item 6.8

### Caution!

Angular and radial misalignment (figure 6.4) may occur at the same time. The sum of both misalignments must not exceed  $\Delta K_w$  or  $\Delta K_r$ .

## 6.8 Alignment values



Size	gearing distance $V_{A7}$ mm	radial misalignment $\Delta K_r$ with $V_{A8}$ mm	angular misalignment $\Delta L_S = L_{S1} - L_{S2}$ 2) mm	axial misalignment $\Delta K_a$		T mm
				$L_S$ mm	perm. deviation mm	
112	37.5	1)	0.24	3)	+ 1	9.5
128	39		0.27		+ 1	2.5
146	46.5		0.3		+ 1	2.5
175	54.5		0.37		+ 1	2.5
198	62		0.41		+ 1	2.5
230	67.5		0.46		+ 1	2.5
255	78.5		0.51		+ 1.5	3.5
290	88.5		0.57		+ 1.5	3.5
315	98.5		0.63		+ 1.5	3.5
342	114.5		0.68		+ 1.5	3.5
375	124.5		0.75		+ 1.5	3.5
415	150.5		0.83		+ 1.5	3.5
465	171.5		0.92		+ 2	3.5
505	187.5		0.99		+ 2	4.5
545	207.5		1.08		+ 2	4.5
585	234.5		1.15		+ 2	4.5
640	244		1.28		+ 2	4.5
690	262.5		1.37		+ 2	4.5
730	286		1.45		+ 2	6
780	296		1.57		+ 3	8
852	310.5	1.69	+ 3	8		
910	340.5	1.79	+ 3	8		
1020	356.5	1.94	+ 3	10		
1080	373	2.02	+ 3	10		
1150	389	2.13	+ 3	10		
1160	415	2.25	+ 3	10		
1240	425	2.44	+ 3	10		

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Size	gearing distance $V_{A7}$ mm	radial misalignment $\Delta K_r$ with $V_{A8}$ mm	angular misalignment $\Delta L_S = L_{S1} - L_{S2}$ 2) mm	axial misalignment $\Delta K_a$		T mm
				$L_S$ mm	perm. deviation mm	
1310	448.5	1)	2.56	3)	+ 4	11
1380	468.5		2.68		+ 4	11
1440	493.5		2.79		+ 4	11
1540	498.5		2.98		+ 4	11

Table 6.4: Alignment values

1)  $\Delta K_r = V_{A8} \times \tan 0.1^\circ$ ;  $V_{A8} = L_A - 2 \times V_{A7}$

2) measured at  $d_a$  as per Section 1, "Technical Data".

3)  $L_S = L_A - 2 \times T$

**Caution!**

During operation values up to 10 times higher are permissible, taking into consideration the table under item 6.7.2.

6.9 Distance dimensions  $S_4$  and  $S_{10}$

Size	$S_4$ mm	$S_{10}$ mm	perm. deviation $S_4, S_{10}$ mm	Size	$S_4$ mm	$S_{10}$ mm	perm. deviation $S_4, S_{10}$ mm
112	12.5	12.5	+0.5	640	143.5	14.5	+1
128	12.5	5.5		690	160.5		
146	12.5			730	176	16	
175	12.5	6.5	+0.5	780	171	20.5	+1.5
198	17.5			852	180		
230	18.5			910	210		
255	23.5	8.5	+0.8	1020	210	22.5	+1.5
290	28.5			1080	221	25	
315	28.5			1150	233		
342	39.5	9.5	+0.8	1160	255	25	+1.5
375	39.5			1240	245		
415	71.5			1310	258	28.5	
465	91.5	1380	268				
505	102.5	1440	288				
545	122.5	12.5	+1	1540	268		
585	144.5	14.5					

Table 6.5: Distance dimensions S for type ZZW ( $S_4, S_{10}$ )

## 6.10 Assignments of the tightening torques and wrench width

Size	Tightening torque $T_A$ (with $\mu = 0.14$ )		Wrench width $S_W$			
	Part No. 9	Part No. 11	Part No. 6 hexagon socket wrench	Part No. 9 hexagon wrench	Part No. 11	
	Nm	Nm	mm	mm	hexagon socket wrench mm	hexagon wrench mm
112	25	10	3	13	5	
128	25	10	3	13	5	
146	25	10	5	13	5	
175	49	25	5	17	6	
198	49	25	6	17	6	
230	49	25	6	17	6	
255	86	25	8	19	6	
290	86	49	8	19	8	
315	210	49	8	24	8	
342	210	49	8	24	8	
375	210	49	10	24	8	
415	410	86	10	30	10	
465	410	86	10	30	10	
505	410	86	10	30	10	
545	710	86	10	36	10	
585	710	86	10	36	10	
640	1450	210	10	46	14	
690	1450	210	10	46	14	
730	1450	210	12	46	14	
780	2530	210	12	55	14	
852	2530	210	12	55	14	
910	2530	410	12	55	17	
1020	4070	410	12	65	17	30
1080	4070	410	17	65		30
1150	4070	410	17	65		30
1160	4070	410	17	65		30
1240	6140	710	17	75		36
1310	6140	710	17	75		36
1380	6140	710	17	75		36
1440	6140	710	17	75		36
1540	7350	1450	17	80		46

Table 6.6: Tightening torques and wrench width

**Note:** The tightening torques apply only for screws with untreated surfaces which are not or only slightly oiled (friction coefficient  $\mu = 0.14$ ). The use of a gliding lacquer or comparable products which modify the friction coefficient  $\mu$  is not permissible.

## 7. Start-up






**Note:** Observe the "Safety notes" in section 3.

**Caution!**

If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.

### 7.1 Lubricant recommendation

The following lubricants are recommended for the FLENDER ZAPEX mentioned in these Operating Instructions.

Manufacturer						FLENDER
Oils	Degol BG 460/680	Energol GR-XP 460/680	Alpha SP / MW 460/680	Falcon CLP 460/680	Spartan EP 460/680	–
Liquified greases	Aralub Fließfett ANO	Energrease LS-EP 00	CLS Grease	Orona FG EP 0	Fibrax EP 370	FLENDER Hochleistungsfett
NLGI grade	0	00	00	0-00	0-1	0-00






Manufacturer		Mobil				
Oils	Structovis BHD-MF	Mobilgear 634/636	Optigear BM 460/680	Omala 460/680	Tribol 1100 460/680	Renolin CLP 460/680 Plus
Liquified greases	Grafloscon C-SG 500	Mobilux EP 004	Longtime PD 00	Alvania GL 00	Tribol 3020/1000-00	Renolit SO-D 6024
NLGI grade	0-00	00	00	00	00	00

Table 7.1: Lubricant recommendations

For normal operating conditions, we recommend an oil filling. This is advantageous because the lubricant is easy to change and the surface is wetted adequately.

The lubricants are suited for operating temperatures from -10 °C to +80 °C. In case of deviating temperatures, consult FLENDER.



**Observe the manufacturer's notes on handling oils / greases!**

### 7.2 Oil filling quantity / grease filling quantity

Size	Oil filling quantity per coupling dm <sup>3</sup>	Size	Oil filling quantity per coupling dm <sup>3</sup>	Size	Oil filling quantity per coupling dm <sup>3</sup>	Size	Oil filling quantity per coupling dm <sup>3</sup>
112	0.02	315	0.4	640	2.5	1150	8
128	0.03	342	0.5	690	3.5	1160	9.3
146	0.05	375	0.6	730	3.8	1240	11.5
175	0.1	415	0.9	780	4.3	1310	12.3
198	0.1	465	1.4	852	4.5	1380	17
230	0.15	505	1.5	910	5.3	1440	20
255	0.15	545	1.8	1020	6.8	1540	22
290	0.3	585	2.3	1080	7.3		

Table 7.2: Oil filling quantities

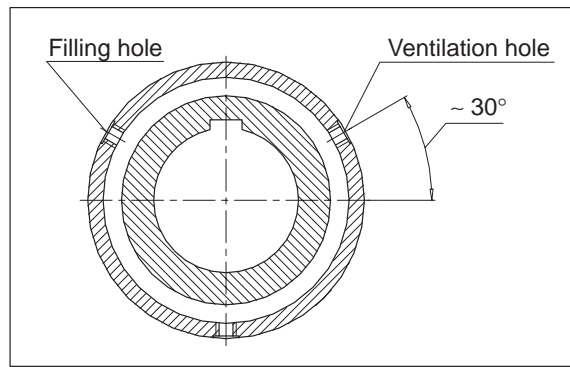
When using liquefied grease, 1.3 x given oil filling quantity must be used.

For simplified filling proceed as follows:

Rotate the coupling until the plug screws (6) are positioned as shown in the figure.

Remove the upper plug screws (6) and fill in oil / grease. Measure the correct oil quantity / grease quantity by means of a measuring jug.

Screw in the plug screws (6) with inserted / vulcanised sealing rings.



**Caution!**

**Overflow oil / grease should be collected without residue and disposed of in compliance with the current regulations.**

### 7.3 Measures before startup

Before startup, check the proper assembly, the alignment and the oil or grease filling and correct, if necessary and check all screw connections for the prescribed tightening torques.

**Caution!**

**Finally, fix the coupling guard to prevent accidental contact.**

## 8. Operation

**Note:** Observe the "Safety notes" in section 3.

**Caution!**

**If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.**

### 8.1 General operating data

During operation, the coupling should be checked for

- any changes in running noises
- leakages (oil leakage / grease leakage).

**Caution!**

**If irregularities are detected during operation, the drive assembly should be set off immediately. The cause of the malfunction should be determined with the aid of the Troubleshooting Table (Section 9).**

**The Troubleshooting Table lists possible malfunctions, their causes and suggestions for remedying them.**

**If the cause cannot be determined or there is no facility for repair with suitable equipment, we recommend calling in one of our service fitters (see Section 11.).**

## 9. Disturbances, reasons and remedy

**Note:** Observe the "Safety notes" in section 3.

**Caution!** If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.

### 9.1 General

The malfunctions listed below can only be hints for a troubleshooting.

In case of a complex plant, all other components have always to be included in the troubleshooting.

The coupling has to run with low noise and without shaking in all operating phases. Any deviating behaviour is to be regarded as malfunction and should be repaired immediately.

**Note:** Faults and malfunctions occurring during the guarantee period and which require repair work on the coupling, must be carried out only by 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.

**Caution!** 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 consent of FLENDER, or use of spare parts not supplied by FLENDER.



To remedy faults and malfunctions, the coupling must always be taken out of service.  
Secure the drive assembly to prevent it from being started up accidentally.  
Attach a warning notice to the start switch.

### 9.2 Possible malfunctions

Malfunctions	Causes	Remedy
Sudden change of the noise level and/or sudden shaking	Exceeding the permissible misalignments	Shut down the plant  Re-align according to Section 6., if necessary
	Lack of lubricant	Shut down the plant  Change lubricant according to Section 10., when doing so, check the tooth system and the seals.  If necessary, replace the seals according to Section 10.

Table 9.1: Malfunction, causes and remedy



## 10. Maintenance and repair

**Note:** Observe the "Safety notes" in section 3.

**Caution!**

**If a dimensioned drawing has been made out for the coupling, the data in this drawing must be given priority.**

### 10.1 General

Check the coupling for leakages, heating, change of noise level at the regular maintenance intervals, at least every three months.

The coupling must run at low noise and without vibration during all operation phases. Any deviating behaviour should be regarded as malfunction and rectified immediately.

### 10.2 Oil change or grease change

When carrying out the regular inspections, check the coupling for leakages, check the lubricant level and refill, if necessary.

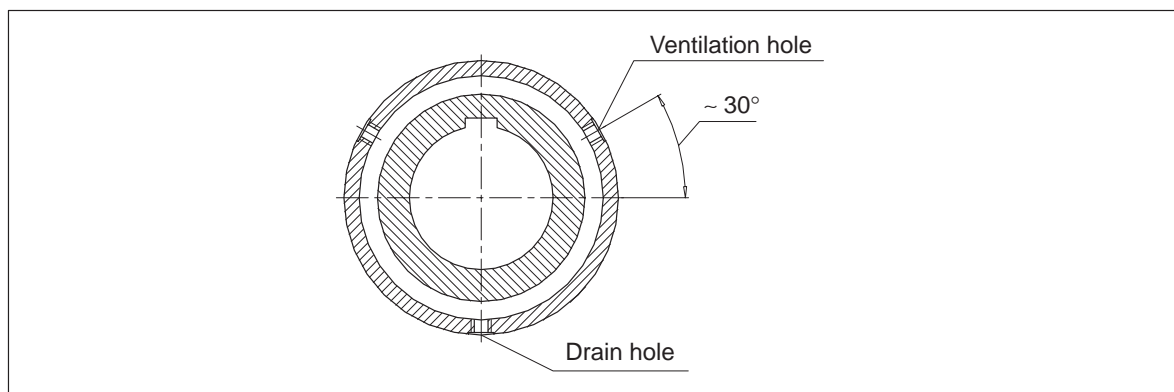
Change of lubricant after approx. 8000 operating hours max. 2 years in case of use up to 70 °C , above 70 °C and after approx. 3000 operating, max. 1 year.

### 10.3 Change of wear parts

Unscrew screw plugs (6) and drain the oil/grease into a suitable container, as shown in the figure (in the case of grease filling, add light-bodied oil to the used grease and mix thoroughly).

**Caution!**

**The oil / grease should be collected without residue and disposed of in compliance with the current regulations.**



The DUO sealing rings (12) can be replaced by finite (cut) DUO sealing rings (12). To do so, loosen the cover joint (11) and push the cover (10 or 21) off the hub until the DUO sealing ring (12) can be taken out.

Cut the new DUO sealing ring (12) radially at one point. Prior to inserting the DUO sealing ring (12), be sure to grease the keyway.

DUO sealing rings (12) with trapezoidal back can be inserted without bonding. For this purpose, insert the connecting point without clearance into the V-groove and then insert the DUO sealing ring (12) starting at the connecting point on both sides.

DUO sealing rings (12) with rectangular back must be positioned on the shaft after cutting and bonded flush at the connecting points. Bonding agent e.g. Loctite 401.

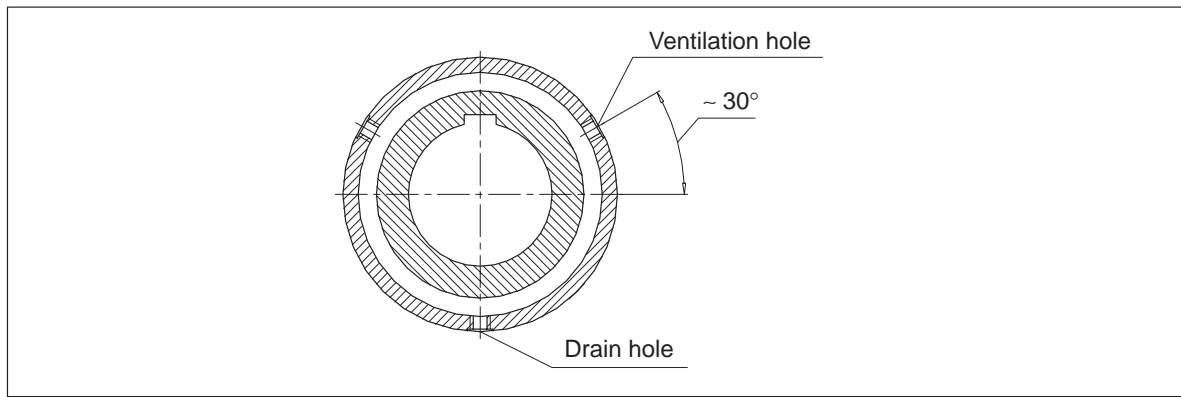


**Observe the manufacturer's instructions on handling the bonding agent.**

Afterwards, insert the connecting point into the groove and insert the DUO sealing ring (12) starting from this point on both sides.

Replace the cover (10 or 21) as described in Section 6. "Assembly". Effect the oil/grease filling as described in Section 7. "Startup".

## 10.4 Disassembly of the coupling parts (1; 3) in case of shaft / hub connection with parallel key



Unscrew screw plugs (6) and drain the oil/grease into a suitable container, as shown in the figure (in the case of grease filling, add light-bodied oil to the used grease and mix thoroughly).

**Caution!**

**The oil / grease should be collected without residue and disposed of in compliance with the current regulations.**

Hold the intermediate shaft (4) with the fitted coupling parts 1 (1), the sleeves (5) and the covers (10 or 21) using suitable lifting gear, loosen the close fitting bolt connection (8; 9) on both sides and remove the subassembly.

**Caution!**

**Make sure that suitable hoists are used.**

Loosen the cover joint (11). Pull off the cover (10 or 12) and support above the intermediate shaft (4). Remove the sleeves (5).

Remove the set screw and/or the axial safety mechanism. Position a suitable detaching device. Warm coupling part (1; 3) by means of a burner above the parallel keyway in longitudinal direction (max. +80 °C).

**Caution!**

**Protect DUO sealing rings (12) and seals of the input and output sides from damage and heating above +80 °C.**



**Protect yourself against burns by hot parts!**

**Caution!**

**Pull off the coupling part (1; 3) quickly. Make sure that suitable lifting gear and detaching devices are used. The shaft bearing arrangement must not be loaded. Make sure that the bore and the sealing surface for the DUO sealing ring are not damaged by hoists etc.**

For the reassembly, observe the instructions in section 6. "Assembly" and in section 7. "Startup".

- 10.5 Disassembly of the coupling parts (1; 3) in case of cylindrical and tapered interference fit set for removal by oil hydraulic shrinking

The disassembly of the coupling must be carried out considering all precautions.

Unscrew screw plugs (6) and drain the oil/grease into a suitable container, as shown in the figure (see item 10.4) (in the case of grease filling, add light-bodied oil to the used grease and mix thoroughly).

**Caution!**

**The oil / grease should be collected without residue and disposed of in compliance with the current regulations.**

Hold the intermediate shaft (4) with the fitted coupling parts 1 (1), the sleeves (5) and the covers (10 or 21) using suitable lifting gear, loosen the close fitting bolt connection (8; 9) on both sides and remove the subassembly.

**Caution!**

**Make sure that suitable hoists are used.**

Loosen the cover joint (11). Pull off the cover (10 or 12) and support above the intermediate shaft (4). Remove the sleeves (5).

Check the tooth system, seals (12) and sealing surfaces for damages. Replace damaged parts.



**Danger of squeezing!**

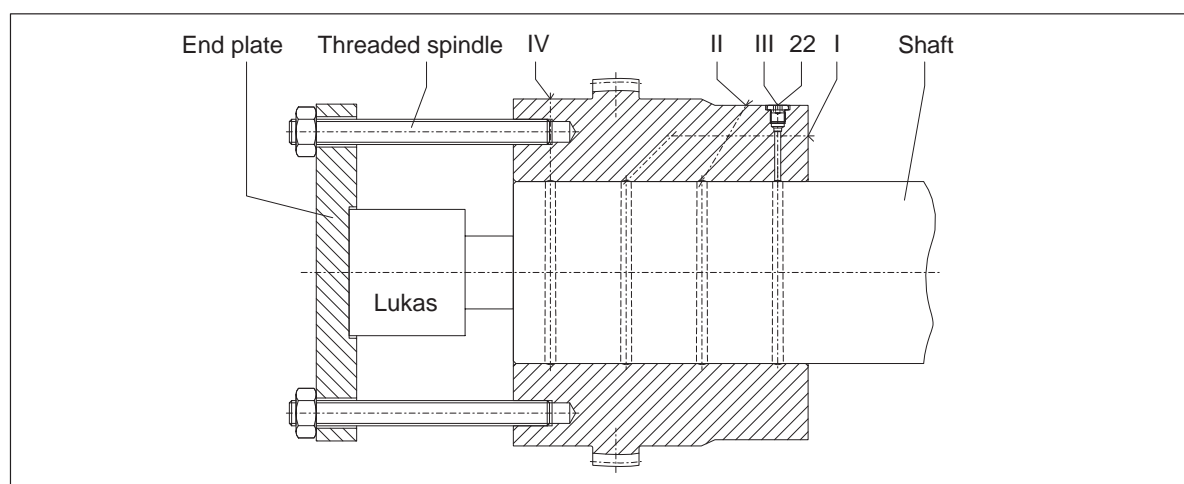
The following tools are required for disassembly:

- One oil pump with pressure gauge (min. 2500 bar) per oil duct (the number can be taken from the dimensioned drawing)
- Suitable connections and lines
- 1 Pulling-off device or end plate with locking screws or threaded spindles with nuts (material of screws and spindles min. 10.9; material of nuts min. 10).
- 1 Hydraulic cylinder (Lukas) with oil pump. Observe the adjustment path and compressive force of the Lukas.



**Observe the manufacturer's notes on handling the forcing-off device / pulling-off device and pumps.**

Before pulling off the coupling hub, the pulling-off device must be mounted as shown in the figure.



**Caution!**

**Secure the coupling parts (1; 3) and the holding device by means of suitable hoists.**

**In case of coupling parts with tapered bore, axial securing against sudden loosening of the coupling part must be provided.**

Remove the plug screws (22) from the oil ducts. Bleed the oil pump and connect it to the centre oil duct.

Afterwards, pressurise the pump with the pressure indicated in the assembly drawing until oil leaks from the neighboured connections.

**Caution!** Observe the order!

Ventilate the next oil pumps, connect and apply the pressure indicated in the dimensioned drawing until oil emerges ring-like at the front sides.

**Caution!** During the entire process, the pressure must be kept constant at all pressurised oil ducts.

Only when oil leaks as a closed oil ring from both faces and after waiting for approx. 30 minutes, Lukas may be pressurised so that the coupling hub can slide off the coupling hub quickly.

**Caution!** Observe the stroke of the hydraulic cylinder. When readjusting, if necessary, the face of Lukas must stop between 2 oil ducts.

If so much oil leaks during pressurising that the pressure cannot be kept, oil with a higher viscosity must be used.

**Caution!** The oil should be collected without residue and disposed of in compliance with the current regulations.

After pulling off, the oil pumps and holding devices must be removed from the coupling hub.

Check the coupling bore and shaft for damages and protect them against corrosion. Replace damaged parts if necessary.

For the reassembly, carefully follow the instructions in section 6. "Assembly" and in section 7. "Startup".

## 10.6 Disassembly of the coupling parts in case of stepped bore for removal by oil hydraulic shrinking

The disassembly is carried out as described under item 10.5. The only difference is that a motor driven pump is connected to the oil duct at the change-over from the smaller bore to the larger bore since a larger oil quantity per time unit is required.

For the reassembly, carefully follow the instructions in section 6. "Assembly" and in section 7. "Startup".

## 11. Spare parts stock, service facility addresses

Maintaining a stock of the most essential spare and wear parts is an important prerequisite for the permanent service ability of the coupling.

When ordering spare parts, the following data should be stated:

- Original Order No.
- Part No. (see Section 5.)
- Type / size
- Quantity

We assume warranty only for original spare parts supplied by us.

### Caution!

**We would expressly draw attention to the fact that spare parts and accessories not supplied by us have not been tested or approved by us either. Fitting and/or use of such products can therefore under certain circumstances adversely affect structurally specified properties of the coupling and will thus impair active and/or passive safety. No form of reliability or warranty will be assumed by FLENDER for damage occasioned by use of non-original spare parts and accessories.**

Please note that production and supply specifications frequently exist for components and we will always offer spare parts in accordance with the state of the art and in accordance with the latest legal requirements.

### 11.1 Service facility addresses

When ordering spare parts or requesting a service fitter, please contact FLENDER AG first of all.

#### FLENDER Germany

##### A. FRIEDR. FLENDER AG

46393 Bocholt - Tel.: (0 28 71) 92-0 - Fax: (0 28 71) 92 25 96  
E-mail: [contact@flender.com](mailto:contact@flender.com) • [www.flender.com](http://www.flender.com)  
Shipping address: Alfred - Flender - Strasse 77 - 46395 Bocholt

##### A. FRIEDR. FLENDER AG - Kupplungswerk Mussum

Industriepark Bocholt - Schlavenhorst 100 - 46395 Bocholt - Tel.: (0 28 71) 92 28 68 - Fax: (0 28 71) 92 25 79  
E-mail: [couplings@flender.com](mailto:couplings@flender.com) • [www.flender.com](http://www.flender.com)

##### A. FRIEDR. FLENDER AG - Werk Friedrichsfeld

Am Industriepark 2 - 46562 Voerde - Tel.: (0 28 71) 92-0 - Fax: (0 28 71) 92 25 96  
E-mail: [contact@flender.com](mailto:contact@flender.com) • [www.flender.com](http://www.flender.com)

##### A. FRIEDR. FLENDER AG - Getriebewerk Penig

Thierbacher Strasse 24 - 09322 Penig - Tel.: (03 73 81) 60 - Fax: (03 73 81) 8 02 86  
E-mail: [ute.tappert@flender.com](mailto:ute.tappert@flender.com) • [www.flender.com](http://www.flender.com)

##### FLENDER - TÜBINGEN GMBH

72007 Tübingen - Tel.: (0 70 71) 7 07-0 - Fax: (0 70 71) 70 74 00  
E-mail: [sales-motox@flender-motox.com](mailto:sales-motox@flender-motox.com) • [www.flender.com](http://www.flender.com)  
Shipping address: Bahnhofstrasse 40 - 72072 Tübingen

##### LOHER GMBH

94095 Ruhstorf - Tel.: (0 85 31) 3 90 - Fax: (0 85 31) 3 94 37  
E-mail: [info@loher.de](mailto:info@loher.de) • [www.loher.de](http://www.loher.de)  
Shipping address: Hans-Loher-Strasse 32 - 94099 Ruhstorf

##### FLENDER SERVICE GMBH

44607 Herne - Tel.: (0 23 23) 940-0 - Fax: (0 23 23) 940 333  
E-mail: [infos@flender-service.com](mailto:infos@flender-service.com) • [www.flender-service.com](http://www.flender-service.com)  
24h Service Hotline +49 (0) 17 22 81 01 00  
Shipping address: Südstrasse 111 - 44625 Herne

##### A. FRIEDR. FLENDER AG - FLENDER GUSS

Obere Hauptstrasse 228-230 - 09228 Chemnitz / Wittgensdorf - Tel.: (0 37 22) 64-0 - Fax: (0 37 22) 64 21 89  
E-mail: [flender.guss@flender-guss.com](mailto:flender.guss@flender-guss.com) • [www.flender-guss.de](http://www.flender-guss.de)

## Germany

**A. FRIEDR. FLENDER AG**

**46393 BOCHOLT - TEL.: (0 28 71) 92 - 0 - FAX: (0 28 71) 92 25 96**

**SHIPPING ADDRESS: ALFRED - FLENDER - STRASSE 77 - 46395 BOCHOLT**

---

**E-mail: [contact@flender.com](mailto:contact@flender.com) • [www.flender.com](http://www.flender.com)**

---

### **VERTRIEBSZENTRUM BOCHOLT**

46393 Bocholt  
Alfred-Flender-Strasse 77, 46395 Bocholt  
Tel.: (0 28 71) 92 - 0  
Fax: (0 28 71) 92 - 14 35  
E-mail: [vz.bocholt@flender.com](mailto:vz.bocholt@flender.com)

---

### **VERTRIEBSZENTRUM STUTT GART**

70472 Stuttgart  
Friedlzheimer Strasse 3, 70499 Stuttgart  
Tel.: (07 11) 7 80 54 - 51  
Fax: (07 11) 7 80 54 - 50  
E-mail: [vz.stuttgart@flender.com](mailto:vz.stuttgart@flender.com)

---

### **VERTRIEBSZENTRUM MÜNCHEN**

85750 Karlsfeld  
Liebigstrasse 14, 85757 Karlsfeld  
Tel.: (0 81 31) 90 03 - 0  
Fax: (0 81 31) 90 03 - 33  
E-mail: [vz.muenchen@flender.com](mailto:vz.muenchen@flender.com)

---

### **VERTRIEBSZENTRUM BERLIN**

Schlossallee 8, 13156 Berlin  
Tel.: (0 30) 91 42 50 58  
Fax: (0 30) 47 48 79 30  
E-mail: [vz.berlin@flender.com](mailto:vz.berlin@flender.com)

---

### EUROPE

#### AUSTRIA

Flender Ges.m.b.H.  
Industriezentrum Nö-Süd  
Strasse 4, Objekt 14, Postfach 132  
2355 Wiener Neudorf  
Phone: +43 (0) 22 36 6 45 70  
Fax: +43 (0) 22 36 6 45 70 10  
E-mail: office@flender.at  
www.flender.at

#### BELGIUM & LUXEMBOURG

N.V. Flender Belge S.A.  
Cyriel Buyssestraat 130  
1800 Vilvoorde  
Phone: +32 (0) 2 - 2 53 10 30  
Fax: +32 (0) 2 - 2 53 09 66  
E-mail: sales@flender.be

#### BULGARIA

A. Friedr. Flender AG  
Branch Office  
c/o Auto - Profi GmbH  
Alabin Str. 52, 1000 Sofia  
Phone: +359 (0) 2 - 9 80 66 06  
Fax: +359 (0) 2 - 9 80 33 01  
E-mail: sofia@auto-profi.com

#### CROATIA / SLOVENIA BOSNIA-HERZEGOVINA

A. Friedr. Flender AG  
Branch Office  
c/o HUM - Naklada d.o.o.  
Mandroviceva 3, 10000 Zagreb  
Phone: +385 (0) 1 - 2 30 60 25  
Fax: +385 (0) 1 - 2 30 60 24  
E-mail: flender@hi.hinet.hr

#### CZECH REPUBLIC

A. Friedr. Flender AG  
Branch Office  
Hotel DUO, Teplicka 17  
19000 Praha 9  
Phone: +420 (0) 2 - 83 88 23 00  
Fax: +420 (0) 2 - 83 88 22 05  
E-mail: flender\_pumprla@hotelduo.cz

#### DENMARK

Flender Scandinavia A/S  
Rugmarken 35 B, 3520 Farum  
Phone: +45 - 70 22 60 03  
Fax: +45 - 44 99 16 62  
E-mail: kontakt@flenderscandinavia.com  
www.flenderscandinavia.com

#### ESTHONIA / LATVIA / LITHUANIA

Flender Branch Office  
Addinol Mineralöl Marketing OÜ  
Suur-Sõjamäe 32  
11415 Tallinn / Esthonia  
Phone: +372 (0) 6 - 27 99 99  
Fax: +372 (0) 6 - 27 99 90  
E-mail: flender@addinol.ee  
www.addinol.ee

#### FINLAND

Flender Oy  
Ruosilantie 2 B, 00390 Helsinki  
Phone: +358 (0) 9 - 4 77 84 10  
Fax: +358 (0) 9 - 4 36 14 10  
E-mail: webmaster@flender.fi  
www.flender.fi

#### FRANCE

Flender s.a.r.l.  
3, rue Jean Monnet - B.P. 5  
78996 Elancourt Cedex  
Phone: +33 (0) 1 - 30 66 39 00  
Fax: +33 (0) 1 - 30 66 35 13  
E-mail: sales@flender.fr

#### SALES OFFICES:

Flender s.a.r.l.  
36, rue Jean Broquin  
69006 Lyon  
Phone: +33 (0) 4 - 72 83 95 20  
Fax: +33 (0) 4 - 72 83 95 39  
E-mail: sales@flender.fr

Flender - Graffenstaden SA  
1, rue du Vieux Moulin  
67400 Illkirch-Graffenstaden  
B.P. 84  
67402 Illkirch - Graffenstaden  
Phone: +33 (0) 3 - 88 67 60 00  
Fax: +33 (0) 3 - 88 67 06 17  
E-mail: flencomm@flender-graff.com

#### GREECE

Flender Hellas Ltd.  
2, Delfon str., 11146 Athens  
Phone: +30 210 - 2 91 72 80  
Fax: +30 210 - 2 91 71 02  
E-mail: flender@otenet.gr  
Mangrinox S.A.  
14, Grevenon str., 11855 Athens  
Phone: +30 210 - 3 42 32 01  
Fax: +30 210 - 3 45 99 28  
E-mail: mangrinox@otenet.gr

#### HUNGARY

A. Friedr. Flender AG  
Branch Office  
Bécsi Út 3-5, 1023 Budapest  
Phone: +36 (0) 1 - 3 45 07 90 / 91  
Fax: +36 (0) 1 - 3 45 07 92  
E-mail: jambor.laszlo@axelero.hu

#### ITALY

Flender Cigala S.p.A.  
Parco Tecnologico Manzoni  
Palazzina G  
Viale delle industrie, 17  
20040 Caponago (MI)  
Phone: +39 (0) 02 - 95 96 31  
Fax: +39 (0) 02 - 95 74 39 30  
E-mail: info@flendercigala.it

#### THE NETHERLANDS

Flender Nederland B.V.  
Industrieterrein Lansinghage  
Platinastraat 133  
2718 ST Zoetermeer  
Postbus 725  
2700 AS Zoetermeer  
Phone: +31 (0) 79 - 3 61 54 70  
Fax: +31 (0) 79 - 3 61 54 69  
E-mail: sales@flender.nl  
www.flender.nl

#### SALES OFFICES:

Flender Nederland B.V.  
Lage Brink 5-7  
7317 BD Apeldoorn  
Postbus 1073  
7301 BH Apeldoorn  
Phone: +31 (0) 55 - 5 27 50 00  
Fax: +31 (0) 55 - 5 21 80 11  
E-mail: tom.alberts@flender-group.com

#### Bruinhof B.V.

Boterdiep 37  
3077 AW Rotterdam  
Postbus 9607  
3007 AP Rotterdam  
Phone: +31 (0) 10 - 4 97 08 08  
Fax: +31 (0) 10 - 4 82 43 50  
E-mail: info@bruinhof.nl  
www.bruinhof.nl

#### NORWAY

Elektroprosess AS  
Frysjaveien 40, 0884 Oslo  
Postboks 165, Kjelsås  
0411 Oslo  
Phone: +47 (0) 2 - 2 02 10 30  
Fax: +47 (0) 2 - 2 02 10 50 / 51  
E-mail: post@elektroprosess.no

#### POLAND

A. Friedr. Flender AG  
Branch Office  
Przedstawicielstwo w Polsce  
ul. Wyzwolenia 27  
43 - 190 Mikołów  
Phone: +48 (0) 32 - 2 26 45 61  
Fax: +48 (0) 32 - 2 26 45 62  
E-mail: flender@pro.onet.pl  
www.flender.pl

#### PORTUGAL

Rodamientos FEYC, S.A.  
R. Jaime Lopes Dias, 1668 CV  
1750 - 124 Lissabon  
Phone: +351 (0) 21 - 7 54 24 10  
Fax: +351 (0) 21 - 7 54 24 19  
E-mail: info@rportugal.com

#### ROMANIA

A. Friedr. Flender AG  
Branch Office  
98 - 106, Soseaua Mihai Bravu  
Sector 2, Bloc D 16, Sc 1, Apartament 4  
021331 Bucuresti - 2  
Phone: +40 (0) 21 - 4 91 10 08  
Fax: +40 (0) 21 - 4 91 10 08  
E-mail: flender@fx.ro

#### RUSSIA

F & F GmbH  
Tjuschina 4-6  
191119 St. Petersburg  
Phone: +7 (0) 8 12 - 3 20 90 34  
Fax: +7 (0) 8 12 - 3 40 27 60  
E-mail: flendergus@mail.spbnit.ru

#### SLOVAKIA

A. Friedr. Flender AG  
Branch Office  
Vajanského 49  
P.O. Box 286, 08001 Presov  
Phone: +421 (0) 51 - 7 70 32 67  
Fax: +421 (0) 51 - 7 70 32 67  
E-mail: micenko.flender@nextra.sk

#### SPAIN

Flender Ibérica S.A.  
Poligono Industrial San Marcos  
Calle Morse, 31 (Parcela D-15)  
28906 Getafe - Madrid  
Phone: +34 (0) 91 - 6 83 61 86  
Fax: +34 (0) 91 - 6 83 46 50  
E-mail: f-iberica@flender.es  
www.flender.es

#### SWEDEN

Flender Scandinavia  
Åsensvägen 2  
44339 Lerum  
Phone: +46 (0) 302 - 1 25 90  
Fax: +46 (0) 302 - 1 25 56  
E-mail: kontakt@flenderscandinavia.com  
www.flenderscandinavia.com

#### SWITZERLAND

Flender AG  
Zeughausstr. 48  
5600 Lenzburg  
Phone: +41 (0) 62 8 85 76 00  
Fax: +41 (0) 62 8 85 76 76  
E-mail: info@flender.ch  
www.flender.ch

#### TURKEY

Flender Güc Aktarma Sistemleri  
Sanayi ve Ticaret Ltd. Sti.  
IMES Sanayi, Sitesi  
E Blok 502, Sokak No. 22  
81260 Dudullu - Istanbul  
Phone: +90 (0) 2 16 - 4 66 51 41  
Fax: +90 (0) 2 16 3 64 59 13  
E-mail: cuzkan@flendertr.com  
www.flendertr.com

#### UKRAINE

A. Friedr. Flender AG  
Branch Office, c/o DIV - Deutsche Industrie-  
vertretung, Prospect Pobedy 44  
252057 Kiev  
Phone: +380 (0) 44 - 4 46 80 49  
Fax: +380 (0) 44 - 2 30 29 30  
E-mail: flender@div.kiev.ua

#### UNITED KINGDOM & EIRE

Flender Power Transmission Ltd.  
Thornbury Works, Leeds Road  
Bradford  
West Yorkshire BD3 7EB  
Phone: +44 (0) 12 74 65 77 00  
Fax: +44 (0) 12 74 66 98 36  
E-mail: flenders@flender-power.co.uk  
www.flender-power.co.uk



# FLENDER

## SERBIA-MONTENEGRO ALBANIA / MACEDONIA

A. Friedr. Flender AG  
Branch Office  
c/o G.P.Inzenjering d.o.o.  
III Bulevar 54 / 19  
11070 Novi Beograd  
Phone: +381 (0) 11 - 60 44 73  
Fax: +381 (0) 11 - 3 11 67 91  
E-mail: flender@eunet.yu

## AFRICA

### NORTH AFRICAN COUNTRIES

Please refer to Flender s.a.r.l.  
3, rue Jean Monnet - B.P. 5  
78996 Elancourt Cedex  
Phone: +33 (0) 1 - 30 66 39 00  
Fax: +33 (0) 1 - 30 66 35 13  
E-mail: sales@flender.fr

### EGYPT

Sons of Farid Hassanen  
81 Matbaa Ahlia Street  
Boulac 11221, Cairo  
Phone: +20 (0) 2 - 5 75 15 44  
Fax: +20 (0) 2 - 5 75 17 02  
E-mail: hussein@sonfarid.com

### SOUTH AFRICA

Flender Power Transmission (Pty.) Ltd.  
Cnr. Furnace St & Quality Rd.  
P.O. Box 131, Isando 1600  
Johannesburg  
Phone: +27 (0) 11 - 5 71 20 00  
Fax: +27 (0) 11 - 3 92 24 34  
E-mail: sales@flender.co.za  
www.flender.co.za

### SALES OFFICES:

Flender Power Transmission (Pty.) Ltd.  
Unit 3 Marconi Park  
9 Marconi Crescent, Montague Gardens  
P.O. Box 37291  
Chempet 7442, Cape Town  
Phone: +27 (0) 21 - 5 51 50 03  
Fax: +27 (0) 21 - 5 52 38 24  
E-mail: sales@flender.co.za

Flender Power Transmission (Pty.) Ltd.  
Unit 3 Goshawk Park  
Falcon Industrial Estate  
P.O. Box 1608  
New Germany 3620, Durban  
Phone: +27 (0) 31 - 7 05 38 92  
Fax: +27 (0) 31 - 7 05 38 72  
E-mail: sales@flender.co.za

Flender Power Transmission (Pty.) Ltd.  
9 Industrial Crescent, Ext. 25  
P.O. Box 17609, Witbank 1035  
Phone: +27 (0) 13 - 6 92 34 38  
Fax: +27 (0) 13 - 6 92 34 52  
E-mail: sales@flender.co.za

Flender Power Transmission (Pty.) Ltd.  
Unit 14 King Fisher Park, Alton  
Cnr. Ceramic Curve & Alumina Allee  
P.O. Box 101995  
Meerensee 3901, Richards Bay  
Phone: +27 (0) 35 - 7 51 15 63  
Fax: +27 (0) 35 - 7 51 15 64  
E-mail: sales@flender.co.za

## AMERICA

### ARGENTINA

Chilicote S.A.  
Avda. Julio A. Roca 546  
C 1067 ABN Buenos Aires  
Phone: +54 (0) 11 - 43 31 66 10  
Fax: +54 (0) 11 - 43 31 42 78  
E-mail: chilicote@chilicote.com.ar

### BRASIL

Flender Brasil Ltda.  
Rua Quatorze, 60 - Cidade Industrial  
32211 - 970, Contagem - MG  
Phone: +55 (0) 31 - 33 69 21 00  
Fax: +55 (0) 31 - 33 69 21 66  
E-mail: vendas@flenderbrasil.com

### SALES OFFICES:

Flender Brasil Ltda.  
Rua James Watt, 142  
conj. 142 - Brooklin Novo  
04576 - 050, São Paulo - SP  
Phone: +55 (0) 11 - 55 05 99 33  
Fax: +55 (0) 11 - 55 05 30 10  
E-mail: flesao@uol.com.br

Flender Brasil Ltda.  
Rua Campos Salles, 1095  
sala 04 - Centro 14015 - 110,  
Ribeirão Preto - SP  
Phone: +55 (0) 16 - 6 35 15 90  
Fax: +55 (0) 16 - 6 35 11 05  
E-mail: flender.ribpreto@uol.com.br

### CANADA

Flender Power Transmission Inc.  
215 Shields Court, Units 4 - 6  
Markham, Ontario L3R 8V2  
Phone: +1 (0) 9 05 - 3 05 10 21  
Fax: +1 (0) 9 05 - 3 05 10 23  
E-mail: flender@ca.inter.net  
www.flenderpti.com

### SALES OFFICE:

Flender Power Transmission Inc.  
34992 Bemina Court  
Abbotsford - Vancouver  
B.C. V3G 1C2  
Phone: +1 (0) 6 04 - 8 59 66 75  
Fax: +1 (0) 6 04 - 8 59 68 78  
E-mail: tvickers@rapidnet.net

### CHILE / ARGENTINA / BOLIVIA ECUADOR / PARAGUAY / URUGUAY

Flender Cono Sur Limitada  
Avda. Galvarino Gallardo 1534  
Providencia, Santiago  
Phone: +56 (0) 2 - 2 35 32 49  
Fax: +56 (0) 2 - 2 64 20 25  
E-mail: flender@flender.cl  
www.flender.cl

### COLOMBIA

A.G.P. Representaciones Ltda.  
Flender Liaison Office Colombia  
Av Boyaca No 23A  
50 Bodega UA 7-1, Bogotá 53  
Phone: +57 (0) 1 - 5 70 63 54  
Fax: +57 (0) 1 - 5 70 73 35  
E-mail: aguerrero@agp.com.co  
www.agp.com.co

### MEXICO

Flender de Mexico S.A. de C.V.  
17, Pte. 713 Centro  
72000 Puebla  
Phone: +52 (0) 2 22 - 2 37 19 00  
Fax: +52 (0) 2 22 - 2 37 11 33  
E-mail: szugasti@flendermexico.com  
www.flendermexico.com

### SALES OFFICES:

Flender de Mexico S.A. de C.V.  
Lago Nargis No. 38  
Col. Granada,  
11520 Mexico, D.F.  
Phone: +52 (0) 55 - 52 54 30 37  
Fax: +52 (0) 55 - 55 31 69 39  
E-mail: info@flendermexico.com

Flender de Mexico S.A. de C.V.  
Ave. San Pedro No. 231-5  
Col. Miravalle  
64660 Monterrey, N.L.  
Phone: +52 (0) 81 - 83 63 82 82  
Fax: +52 (0) 81 - 83 63 82 83  
E-mail: info@flendermexico.com

### PERU

Potencia Industrial E.I.R.L.  
Calle Victor González Olaechea N° 110  
Urb. La Aurora - Miraflores,  
P.O.Box: Av. 2 de Mayo N° 679  
Of.108-Miraflores  
Casilla N° 392, Lima 18  
Phone: +51 (0) 1 - 2 42 84 68  
Fax: +51 (0) 1 - 2 42 08 62  
E-mail: cesarzam@chavin.rcp.net.pe

### USA

Flender Corporation  
950 Tollgate Road  
P.O. Box 1449, Elgin, IL. 60123  
Phone: +1 (0) 8 47 - 9 31 19 90  
Fax: +1 (0) 8 47 - 9 31 07 11  
E-mail: flender@flenderusa.com  
www.flenderusa.com

Flender Corporation  
Service Centers West  
4234 Foster Ave.  
Bakersfield, CA. 93308  
Phone: +1 (0) 6 61 - 3 25 44 78  
Fax: +1 (0) 6 61 - 3 25 44 70  
E-mail: flender1@lightspeed.net

### VENEZUELA

F. H. Transmisiones S.A.  
Urbanización Buena Vista  
Calle Johan Schafer o Segunda Calle  
Municipio Sucre, Petare  
Caracas  
Phone: +58 (0) 2 - 21 52 61  
Fax: +58 (0) 2 - 21 18 38  
E-mail: fhtransm@telcel.net.ve  
www.fhtransmisiones.com

## ASIA

### BANGLADESH / SRI LANKA

Please refer to Flender Limited  
No. 2 St. George's Gate Road  
5th Floor, Hastings  
Kolkata - 700 022  
Phone: +91 (0) 33 - 2 23 05 45  
Fax: +91 (0) 33 - 2 23 18 57  
E-mail: flender@flenderindia.com

### PEOPLE'S REPUBLIC OF CHINA

Flender Power Transmission  
(Tianjin) Co. Ltd.  
ShuangHu Rd.- Shuangchen Rd. West  
Beichen Economic Development  
Area (BEDA)  
Tianjin 300400  
Phone: +86 (0) 22 - 26 97 20 63  
Fax: +86 (0) 22 - 26 97 20 61  
E-mail: flender@flendertj.com  
www.flendertj.com  
Flender Power Transmission  
(Tianjin) Co. Ltd.  
Beijing Office  
C-415, Lufthansa Center  
50 Liangmaqiao Road, Chaoyang District  
Beijing 100016  
Phone: +86 (0) 10 - 64 62 21 51  
Fax: +86 (0) 10 - 64 62 21 43  
E-mail: beijing@flenderprc.com.cn

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Shanghai Office  
1101-1102 Harbour Ring Plaza  
18 Xizang Zhong Rd.  
Shanghai 200 001  
Phone: +86 (0) 21 - 53 85 31 48  
Fax: +86 (0) 21 - 53 85 31 46  
E-mail: shanghai@flenderprc.com.cn

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Wuhan Office  
Rm. 1503, Jianyin Building,  
709 Jiashedadao  
Wuhan 430 015  
Phone: +86 (0) 27 - 85 48 67 15  
Fax: +86 (0) 27 - 85 48 68 36  
E-mail: wuhan@flenderprc.com.cn

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Guangzhou Office  
Rm. 2802, Guangzhou International  
Electronics Tower  
403 Huanshi Rd. East  
Guangzhou 510 095  
Phone: +86 (0) 20 - 87 32 60 42  
Fax: +86 (0) 20 - 87 32 60 45  
E-mail: guangzhou@flenderprc.com.cn

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Chengdu Office  
G-6 / F Guoxin Mansion,  
77 Xiyu Street  
Chengdu 610 015  
Phone: +86 (0) 28 - 86 19 83 72  
Fax: +86 (0) 28 - 86 19 88 10  
E-mail: chengdu@flenderprc.com.cn



# FLENDER

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Shenyang Office  
Rm. 2-163, Tower I, City Plaza Shenyang  
206 Nanjing Street (N), Heping District  
Shenyang 110 001  
Phone: +86 (0) 24 - 23 34 20 48  
Fax: +86 (0) 24 - 23 34 20 46  
E-mail: shenyang@flenderprc.com.cn

Flender Power Transmission  
(Tianjin) Co. Ltd.  
Xi'an Office  
Rm. 302, Shaanzi Zhong Da  
International Mansion  
30 Southern Rd.  
Xi'an 710 002  
Phone: +86 (0) 29 - 7 20 32 68  
Fax: +86 (0) 29 - 7 20 32 04  
E-mail: xian@flenderprc.com.cn

## INDIA

Flender Limited  
Head Office:  
No. 2 St. George's Gate Road  
5<sup>th</sup> Floor, Hastings  
Kolkata - 700 022  
Phone: +91 (0) 33 - 22 23 05 45  
Fax: +91 (0) 33 - 22 23 08 30  
E-mail: flender@flenderindia.com

Flender Limited  
Industrial Growth Centre  
Rakhajungle, Nimpura  
Kharagpur - 721 302  
Phone: +91 (0) 3222 - 23 33 07  
Fax: +91 (0) 3222 - 23 33 64  
E-mail: works@flenderindia.com

SALES OFFICES:  
Flender Limited  
Eastern Regional Sales Office  
No. 2 St. George's Gate Road  
5<sup>th</sup> Floor, Hastings  
Kolkata - 700 022  
Phone: +91 (0) 33 - 22 23 05 45  
Fax: +91 (0) 33 - 22 23 08 30  
E-mail: ero@flenderindia.com

Flender Limited  
Western Regional Sales Office  
Plot No. 23, Sector 19 - C  
Vashi, Navi Mumbai - 400 705  
Phone: +91 (0) 22 - 27 65 72 27  
Fax: +91 (0) 22 - 27 65 72 28  
E-mail: wro@flenderindia.com

Flender Limited  
Southern Regional Sales Office  
41 Nelson Manickam Road  
Aminjikarai,  
Chennai - 600 029  
Phone: +91 (0) 44 - 23 74 39 21  
Fax: +91 (0) 44 - 23 74 39 19  
E-mail: sro@flenderindia.com

Flender Limited  
Northern Regional Sales Office  
209-A, Masjid Moth, 2nd Floor  
(Behind South Extension II)  
New Delhi - 110 049  
Phone: +91 (0) 11 - 26 25 02 21  
Fax: +91 (0) 11 - 26 25 63 72  
E-mail: nro@flenderindia.com

## INDONESIA

Flender Singapore Pte. Ltd.  
Representative Office  
Perkantoran Puri Niaga II  
Jalan Puri Kencana Blok J1  
No. 2i, Kembangan  
Jakarta Barat 11610  
Phone: +62 (0) 21 - 5 82 86 24  
Fax: +62 (0) 21 - 5 82 86 23  
E-mail: bobwall@cbn.net.id

## IRAN

Cimaghand Co. Ltd.  
P.O. Box 15745-493  
No. 13, 16<sup>th</sup> East Street  
Beyhaghi Ave., Argentina Sq.  
Tehran 15156  
Phone: +98 (0) 21 - 8 73 02 14  
Fax: +98 (0) 21 - 8 73 39 70  
E-mail: info@cimaghand.com

## ISRAEL

Greenshpon Engineering Works Ltd.  
Haamelim Street 20  
P.O. Box 10108, 26110 Haifa  
Phone: +972 (0) 4 - 8 72 11 87  
Fax: +972 (0) 4 - 8 72 62 31  
E-mail: sales@greenshpon.com  
www.greenshpon.com

## JAPAN

Flender Japan Co., Ltd.  
WBG Marive East 21F  
Nakasa 2 - 6  
Mihama-ku, Chiba-shi  
Chiba 261-7121  
Phone: +81 (0) 43 - 2 13 39 30  
Fax: +81 (0) 43 - 2 13 39 55  
E-mail: contact@flender-japan.com

## KOREA

Flender Ltd.  
7<sup>th</sup> Fl. Dorim Bldg.  
1823 Bangbae-Dong, Seocho-Ku,  
Seoul 137-060  
Phone: +82 (0) 2 - 34 78 63 37  
Fax: +82 (0) 2 - 34 78 63 45  
E-mail: flender@unitel.co.kr

## KUWAIT

South Gulf Company  
Al-Reqai, Plot 1, Block 96  
P.O. Box 26229, Safat 13123  
Phone: +965 (0) - 4 88 39 15  
Fax: +965 (0) - 4 88 39 14  
E-mail: adelameen@hotmail.com

## LEBANON

Gabriel Acar & Fils s.a.r.l.  
Dahr-el-Jamal  
Zone Industrielle, Sin-el-Fil  
B.P. 80484, Beyrouth  
Phone: +961 (0) 1 - 49 82 72  
Fax: +961 (0) 1 - 49 49 71  
E-mail: gacar@beirut.com

## MALAYSIA

Flender Singapore Pte. Ltd.  
Representative Office  
37 A - 2, Jalan PJU 1/39  
Dataran Prima  
47301 Petaling Jaya  
Selangor Darul Ehsan  
Phone: +60 (0) 3 - 78 80 42 63  
Fax: +60 (0) 3 - 78 80 42 73  
E-mail: flender@tm.net.my

## PAKISTAN

Please refer to  
A. Friedr. Flender AG  
46393 Bocholt  
Phone: +49 (0) 28 71 - 92 22 59  
Fax: +49 (0) 28 71 - 92 15 16  
E-mail: ludger.wittag@flender.com

## PHILIPPINES

Flender Singapore Pte. Ltd.  
Representative Office  
28/F, Unit 2814  
The Enterprise Centre  
6766 Ayala Avenue corner  
Paeso de Roxas, Makati City  
Phone: +63 (0) 2 - 8 49 39 93  
Fax: +63 (0) 2 - 8 49 39 17  
E-mail: roman@flender.com.ph

## BAHRAIN / IRAQ / JORDAN / LYBIA OMAN / QATAR / U.A.E. / YEMEN

Please refer to A. Friedr. Flender AG  
Middle East Sales Office  
IMES Sanayi Sitesi  
E Blok 502, Sokak No. 22  
81260 Dudullu - Istanbul  
Phone: +90 (0) 2 16 - 4 99 66 23  
Fax: +90 (0) 2 16 - 3 64 59 13  
E-mail: meso@flendertr.com

## SAUDI ARABIA

South Gulf Co.  
Al-Khobar, Dahrn Str.  
Middle East Trade Center  
3rd floor, Flat # 23  
P.O. Box 20434 31952 Al-Khobar  
Phone: +966 (0) 3 - 8 87 53 32  
Fax: +966 (0) 3 - 8 87 53 31  
E-mail: adelameen@hotmail.com

## SINGAPORE

Flender Singapore Pte. Ltd.  
13 A, Tech Park Crescent  
Singapore 637843  
Phone: +65 (0) - 68 97 94 66  
Fax: +65 (0) - 68 97 94 11  
E-mail: flender@singnet.com.sg  
www.flender.com.sg

## SYRIA

Misrabi Co & Trading  
Mezzeh Autostrade Transportation  
Building 4/A, 5<sup>th</sup> Floor  
P.O. Box 12450, Damascus  
Phone: +963 (0) 11 - 6 11 67 94  
Fax: +963 (0) 11 - 6 11 09 08  
E-mail: ismael.misrabi@gmx.net

## TAIWAN

A. Friedr. Flender AG  
Taiwan Branch Company  
1F, No. 5, Lane 240  
Nan Yang Street, Hsichih  
Taipei Hsien 221  
Phone: +886 (0) 2 - 26 93 24 41  
Fax: +886 (0) 2 - 26 94 36 11  
E-mail: flender\_tw@flender.com.tw

## THAILAND

Flender Singapore Pte. Ltd.  
Representative Office  
23/F M Thai Tower, All Seasons Place  
87 Wireless Road, Phatumwan  
Bangkok 10330  
Phone: +66 (0) 2 - 6 27 91 09  
Fax: +66 (0) 2 - 6 27 90 01  
E-mail: christian.beckers@flender.th.com

## VIETNAM

Flender Singapore Pte. Ltd.  
Representative Office  
Suite 6/6A, 16F Saigon Tower  
29 Le Duan Street, District 1  
Ho Chi Minh City, Vietnam  
Phone: +84 (0) 8 - 8 23 62 97  
Fax: +84 (0) 8 - 8 23 62 88  
E-mail: flender@hcm.vnn.vn

## A U S T R A L I A

Flender (Australia) Pty. Ltd.  
9 Nello Place, P.O. Box 6047  
Wetherill Park  
N.S.W. 2164, Sydney  
Phone: +61 (0) 2 - 97 56 23 22  
Fax: +61 (0) 2 - 97 56 48 92, 97 56 14 92  
E-mail: sales@flender.com.au  
www.flender.com.au

SALES OFFICES:  
Flender (Australia) Pty. Ltd.  
Suite 3, 261 Centre Rd.  
Bentleigh, VIC 3204 Melbourne  
Phone: +61 (0) 3 - 95 57 08 11  
Fax: +61 (0) 3 - 95 57 08 22  
E-mail: sales@flender.com.au

Flender (Australia) Pty. Ltd.  
Suite 5, 1407 Logan Rd.  
Mt. Gravatt  
QLD 4122, Brisbane  
Phone: +61 (0) 7 - 34 22 23 89  
Fax: +61 (0) 7 - 34 22 24 03  
E-mail: sales@flender.com.au

Flender (Australia) Pty. Ltd.  
Suite 2 403 Great Eastern Highway  
W.A. 6104, Redcliffe - Perth  
Phone: +61 (0) 8 - 94 77 41 66  
Fax: +61 (0) 8 - 94 77 65 11  
E-mail: sales@flender.com.au

## NEW ZEALAND

Please refer to Flender (Australia) Pty. Ltd.  
9 Nello Place, P.O. Box 6047  
Wetherill Park  
N.S.W. 2164, Sydney  
Phone: +61 (0) 2 - 97 56 23 22  
Fax: +61 (0) 2 - 97 56 48 92  
E-mail: sales@flender.com.au

## 12. Declaration by the manufacturer

### Declaration by the manufacturer

in accordance with EC Engineering Guideline 98/37/EC, Appendix II B

We hereby declare that the

### **ZAPEX couplings type ZZW**

described in these Operating Instructions are intended for incorporation in a machine, and that it is prohibited to put them into service before verifying that the machine into which they are incorporated complies with the EC Guidelines (original edition 98/37/EC including any subsequent amendments thereto).

This Manufacturer's Declaration takes into account all the unified standards (inasmuch as they apply to our products) published by the European Commission in the Official Journal of the European Community.



Bocholt, 1999-09-01

\_\_\_\_\_  
Signature (person responsible for products)