FLENDER COUPLINGS

ZAPEX

Operating instructions 3503 en
Edition 10/2017

ZBR, ZZBR, ZWS, ZZWS

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ZAPEX
3503 en

Operating instructions

Translation of the original operating instructions

ZBR, ZZBR, ZWS, ZZWS

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Legal notes

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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GERMANY

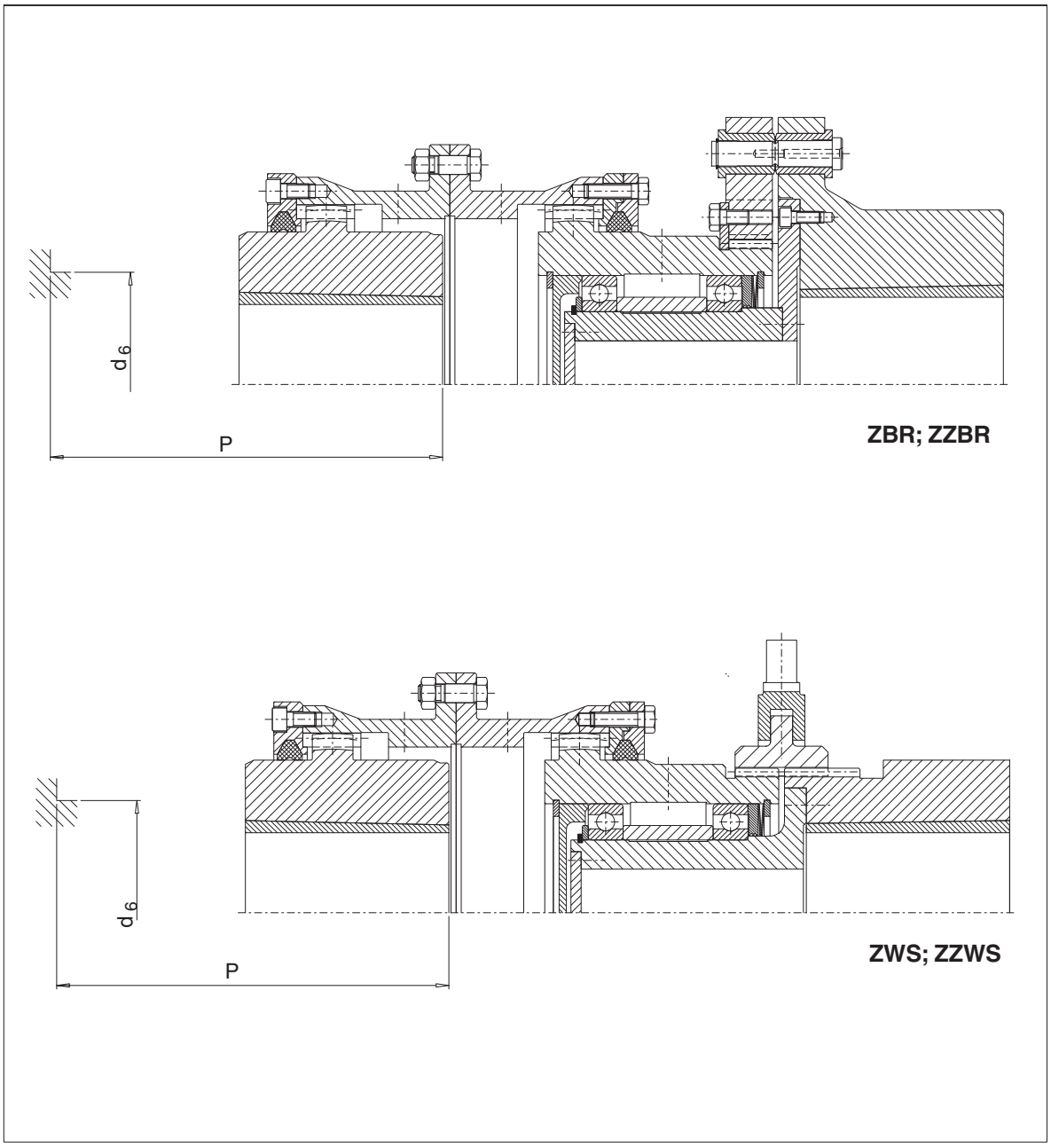
Document number: 3503 en
℗ 10/2017 Subject to alterations

Contents

1. Technical data

For dimensions, technical data and a detailed view, see the dimensioned drawing in the coupling documentation.

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.



ZBR ZZBR Size	Rated torque T_N 1) Nm	Shear torque T_{BR} Nm	Speed n_{max} 1/min	d_6 2) mm	P 2) mm	ZWS ZZWS Size	Rated torque T_N 1) Nm	Speed n_{max} 1/min	d_6 2) mm	P 2) mm
112	1300	1690	9400	45	85					
128	2500	3250	8300	60	105	**128**	2500	1500	60	105
146	4300	5590	7300	75	120	**146**	4300	1300	75	120
175	7000	9100	6400	85	140	**175**	7000	1100	85	140
198	11600	15080	5500	110	150	**198**	11600	960	110	150
230	19000	24700	4700	135	160	**230**	19000	830	135	160
255	27000	35100	4100	160	175	**255**	27000	750	160	175
290	39000	50700	3700	180	200	**290**	39000	660	180	200
315	54000	70200	3300	200	220	**315**	54000	600	200	220
342	69000	89700	3000	225	240	**342**	69000	560	225	240
375	98000	127400	2700	260	260	**375**	98000	510	260	260
415	130000	169000	2500	285	300	**415**	130000	460	285	300
465	180000	234000	2200	325	320	**465**	180000	410	325	320
505	250000	325000	2000	365	340	**505**	250000	380	365	340
545	320000	416000	1800	405	360	**545**	320000	350	405	360
585	400000	520000	1700	445	390					
640	510000	663000	1600	445	420					
690	660000	858000	1450	475	440					
730	790000	1027000	1350	515	470					

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

The max. speed for types ZZBR and ZZWS is limited by the weight and the critical speed. 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) Space required for alignment of the coupling parts and replacement of the sealing rings.

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 and/or temperature of shaft ends).
- up to 25 starts per hour where double the 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. We accept 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 is designed only for the application described in section 1, "Technical data". Other operating conditions must be contractually agreed.

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

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 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 coupling 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 dispatch 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.

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:

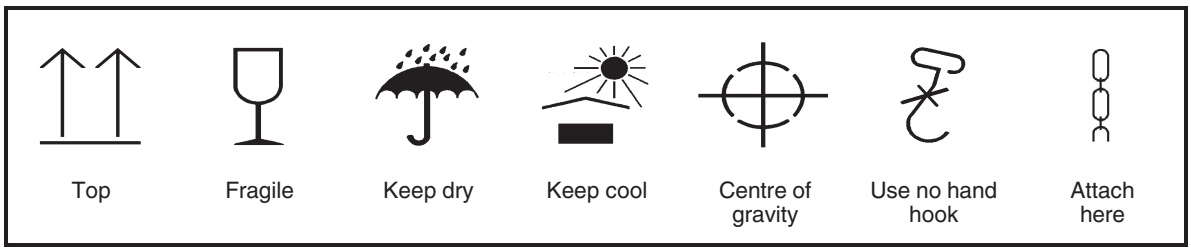


Fig. 1: Transport symbols

4.3 Storage of the coupling

4.3.1 Storage of the coupling parts

The coupling is delivered in a preserved condition and can be stored in a covered, dry place for up to 6 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.

STOP **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.

STOP **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"!

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

5.1 General description

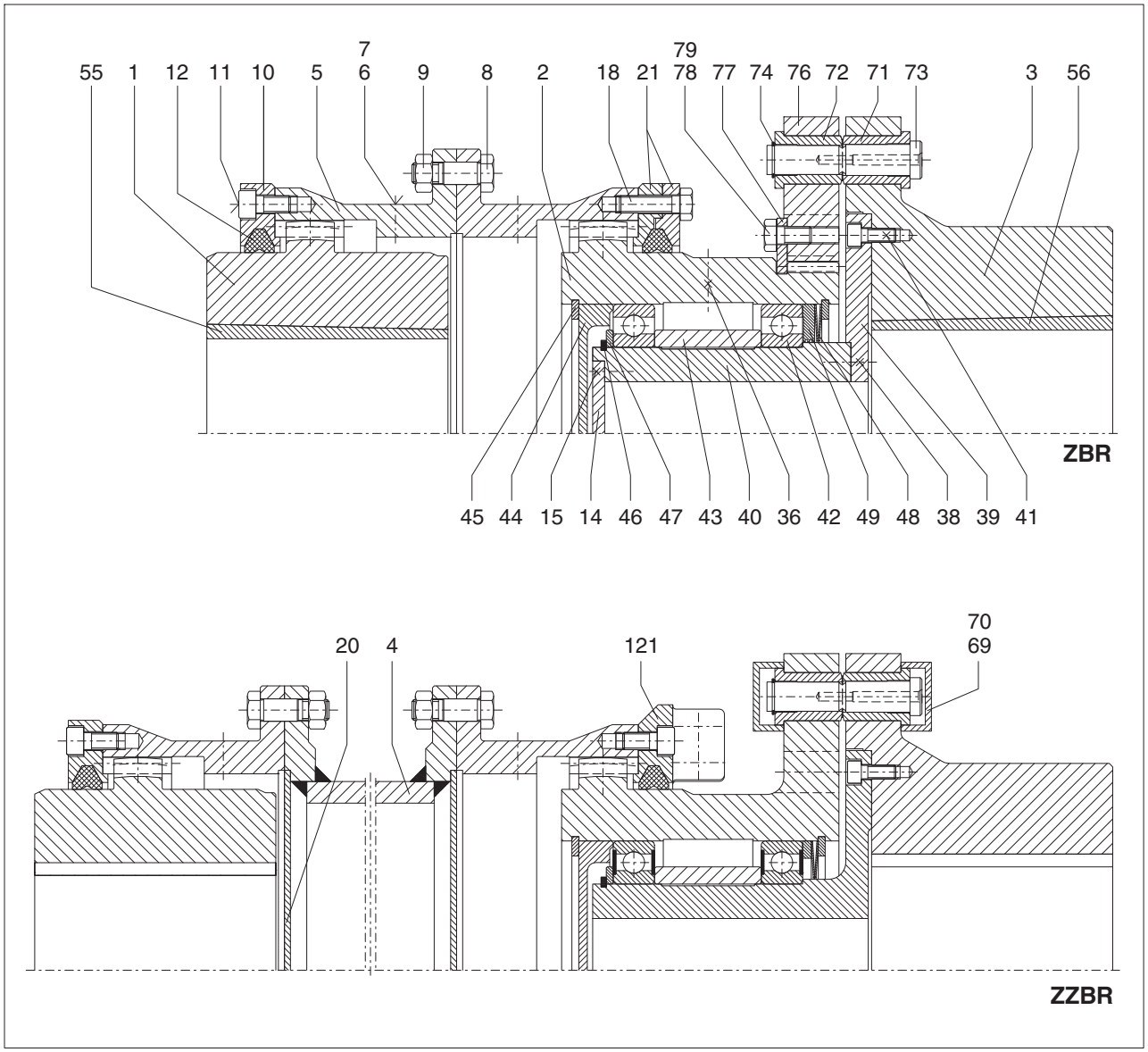
ZAPEX type ZBR, ZZBR, ZWS and ZZWS couplings are specified to connect and detach two shafts. The shaft ends to be connected must be supported immediately upstream of and downstream of the coupling.

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

The coupling parts (1, 2) with external teeth engage with the internal teeth of the flanged sleeves (5) and/or coupling sleeve (5).

DUO sealing rings (12) serve to seal off the oil chambers from outside influences.

5.1.1 Types ZBR and ZZBR



The torque is transmitted from the shaft via the parallel key, shrink connection or similar to the coupling part 1 (1), from there via the coupling teeth to the flanged sleeve (5) and finally via the close-fitting bolt connection (8, 9) to the second flanged sleeve (5). From there the torque is transmitted via the coupling teeth and the teeth of the parts 2 / 76 and via the shear pins (73) to coupling part 3 (3). The torque is then transmitted from the coupling part 3 (3) via the parallel key, shrink connection or similar to the shaft.

Type ZZBR also has the adapter (4) located between the flanged sleeves (5).

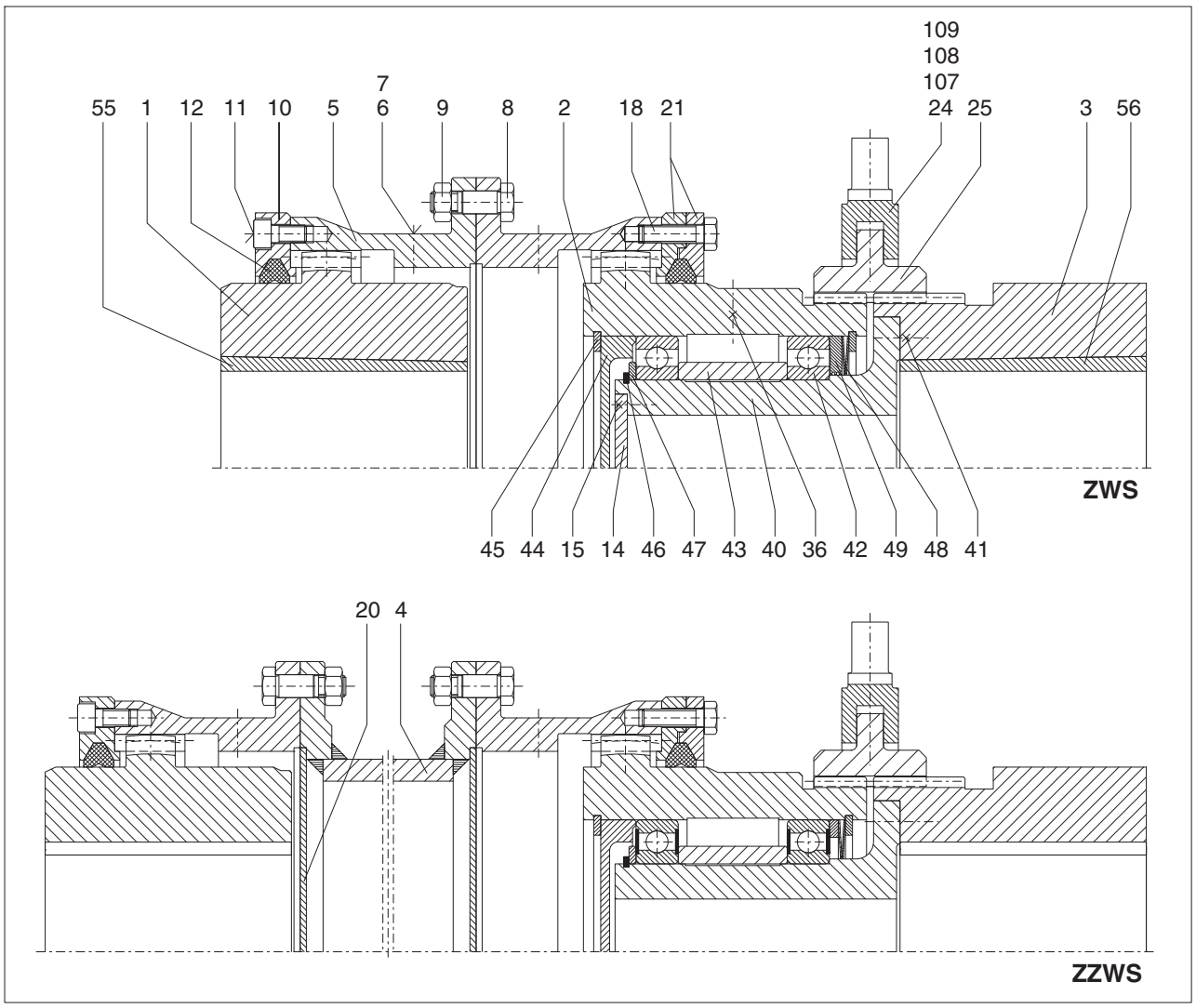
If the specified shear torque is exceeded, the shear bolts (73) will be sheared through (see instructions for replacing the shear bolts in section 10, item 10.4) and the torque transmission interrupted. The coupling part 3 (3) and the flanged shaft (40) stop. The relative movement takes place in the bearings (42).

STOP **After the shear pins (73) have sheared through, the drive must be switched off immediately.**

Depending on the size, part 2 (2) and the coupling flange (76) must also be constructed as a single part 2 (2). Then the radially split cover (121) is used (see example ZZBR).

For the detailed view and construction of the coupling, see the dimensioned drawing in the coupling documentation.

5.1.2 Type ZWS and ZZWS



When the coupling is started, the torque is transmitted from the shaft via the parallel key, shrink connection or similar to the coupling part 1 (1), then via the coupling teeth to the flanged sleeve (5) and finally via the close-fitting bolt connection (8, 9) to the second flanged sleeve (5). From there the torque is transmitted via the coupling teeth and the teeth of part 2 (2) to the control sleeve (25) and from there to coupling part 3 (3). The torque is then transmitted from the coupling part 3 (3) via the parallel key, shrink connection or similar to the shaft.

Type ZZWS also has the adapter (4) located between the flanged sleeves (5).

STOP **ZAPEX ZWS-type couplings can be shifted only when at a standstill.**

For easier engagement the teeth on coupling part 2 (2) and the control sleeve (25) have been sharpened.

For the detailed view and construction of the coupling, see the dimensioned drawing in the coupling documentation.

6. Fitting

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

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

6.1 Instructions for applying the finished bore and fitting the axial retaining means, set screws and balancing

Coupling parts (1; 3) are delivered finish-machined, according to order.

A set screw or end plate is specified for axial retention of the coupling parts (1; 3) with parallel key connection.

The couplings are balanced only if this is 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.

6.3 Fitting the coupling parts (1; 3) in case of shaft-hub connection with parallel key

Before beginning the installation the subassemblies, with the exception of the bushes (72) in the coupling flange (76) on types ZBR and ZZBR, must be demounted. All parts and shaft ends must be carefully cleaned and dried.

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

Note manufacturer's instructions for handling the solvent.

Before fitting the coupling parts (1; 3) the covers (10; 21; 121) must be fitted as described in item 6.5.

Unscrew set screws from the coupling parts (1; 3).
Protect DUO sealing ring (12) and seals for the input and output side against damage and heating to over + 80 °C.

Coupling parts (1, 3) with tapered bore and parallel key connection must be mounted in cold condition.

Slightly heating (max. + 80 °C) the coupling parts (1; 3) 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.

Take precautions to avoid burns from hot parts!

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

The set screws should be tightened only with a hexagon socket spanner to DIN 911, without extension tube.

6.4 Fitting of coupling parts (1; 3) in case of a cylindrical and tapered interference fit set up for oil-hydraulic shrinking off

The information specified on the dimensioned drawing must be observed.

Before beginning assembly the subassemblies, with the exception of the bushes (72) in the coupling flange (76) on types ZBR and ZZBR, must be demounted and the screw plugs (22) unscrewed from the coupling parts (1; 3). All parts and shaft ends must be 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.

Observe manufacturer's instructions for handling solvents.

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

Before fitting the coupling parts (1; 3) the covers (10; 21; 121) must be fitted as described in item 6.5.

On versions with "Bratt" bushes(55; 56) these must be heated to approx. + 80 °C and fitted on the shafts.

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.

Before continuing assembly, allow the Bratt bushes (55; 56) to cool down to room temperature!

The coupling parts (1; 3) must be fitted in hot condition and, depending on the shrink dimension, heated to the temperature indicated on the dimensioned drawing.

Protect DUO sealing ring (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.)

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

Take precautions to avoid burns from hot parts!

Before fitting, the bore size of the heated coupling parts (1; 3) must be checked, e.g. with a bore hole gauge.

The heated coupling components (1; 3) 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 components (1; 3) should be pushed smartly onto the shaft up to the position specified in the order-specific dimensioned drawing.

☞ The coupling parts (1; 3) 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; 3) 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).

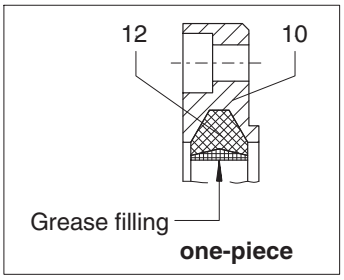
6.5 Fitting the covers (10; 21; 121)

Check space requirement for inserting the bolts (11; 18), and, if necessary, insert the bolts (11; 18) in the cover (10; 21; 121).

6.5.1 One-piece cover (10)

STOP **Note fitting position.**

If using the one-piece cover (10), thoroughly grease the groove in the cover (10) and the DUO sealing ring (12) from all sides and insert the DUO sealing ring (12) in the cover (10) as shown in the diagram. Insert a quantity of grease in the ring-shaped space between the seal lips.

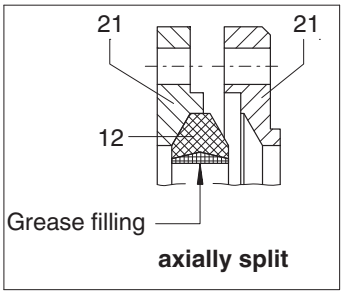


Position the cover (10) with the fitted DUO sealing ring (12) on the shaft so that the DUO sealing ring (12) cannot be damaged by the coupling part 1 (1) to be fitted.

6.5.2 Axially split cover (21)

STOP **Note fitting position.**

If using the axially split cover (21), place the uncut DUO sealing ring (12) over the smallest hub diameter of part 2 (2) (protect against damage by the splines). Thoroughly grease the groove in the cover (21) and the DUO sealing ring (12) from all sides and fit the DUO sealing ring (12) in the cover (21) as shown in the diagram. Insert a quantity of grease in the ring-shaped space between the seal lips.



Position the cover (21) with the inserted DUO sealing ring (12) on the shaft or part 2 (2) so that the DUO sealing ring (12) cannot be damaged by the coupling part 1 (1) to be fitted or by the splines.

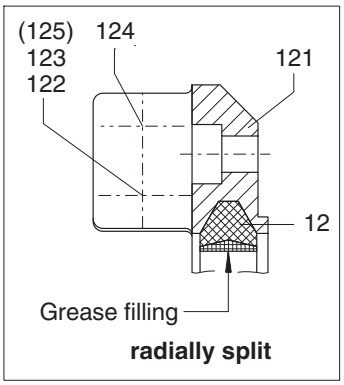
6.5.3 Radially split cover (121)

STOP **Note fitting position.**

Carefully smear the joining edge of both cover halves on one side only with sealing compound and join the halves together on the hub.

⚠ **Observe manufacturer's instructions for handling sealing compound!**

Screw the cover halves together with the cheese-head screws (124) and the close fitting bolts (122) and nuts (123) (for tightening torque see item 6.12). Depending on the size, the close fitting bolt connection (122; 123) can also be replaced with a taper pin (125).



Cut the DUO sealing ring (12) radially at one point. Position the cut DUO sealing ring (12) over the smallest hub diameter of part 2 (2) (protect against damage by the splines).

Thoroughly grease the groove in the cover (21) and the DUO sealing ring (12) from all sides and insert the trapezium-shaped DUO sealing ring (12) in the cover so that the cut in the DUO sealing ring (12) is offset approx. 30° from the parting line of the cover (121). For this, place the cut ends together in the groove and then, working outwards from the cut ends, insert the DUO sealing ring (12) on both sides. If using DUO sealing rings (12) with rectangular back-section (from size 1020 upwards with hub diameter 800) the cut ends must first be glued so that they exactly match together. Adhesive e.g. LOCTITE 401.

Observe manufacturer's instructions for handling adhesive.

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

Position the cover (121) with the inserted DUO sealing ring (12) on the shaft or part 2 (2) so that the DUO sealing ring (12) cannot be damaged by the coupling part 1 (1) to be fitted or by the splines.

6.6 Fitfing the type ZBR and ZZBR couplings

Screw flanged shaft (40) to coupling part 3 (3) with the cheese-head screws (41) (for tightening torque T_A see item 6.12). In case of the two-part version of the flanged shaft (40; 39), first fasten the support flange (39) to the flanged shaft (40) with the screws (38) (for tightening torque T_A see item 6.12).

Push shear pin bushes (71) into coupling part 3 (3) so that they correspond with the shear pin bushes (72) in the coupling flange (76).

Note marks on the outside circumference of the coupling flange (76) and coupling part 3 (3).

The bearings in part 2 (2) must be fitted as described in item 6.8.

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

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

Move together the machines to be coupled. Note dimension "S" (see item 6.9 and dimensioned drawing). Align the coupling as described in items 6.9 to 6.11.

If using the axially split cover (21), carefully smear the joining edge of both cover halves on one side only with sealing compound.

Observe manufacturer's instructions for handling 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.

Note marks.

Using suitable tools, pull the covers (10; 21; 121) onto the hub.

Smear the sealing surfaces of the covers (10; 21; 121) with sealing compound (apply sealing compound to one side only) and screw together with the flanged sleeves (5) (for tightening torques see item 6.12).

Smear the sealing surfaces of the flanged sleeves (5) or the adapter (4) 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 6.12).

Noting the fitting position, push shear pins (73) into the shear pin bushes (71; 72) and fasten axially with the circlip (74). Fasten the safety covers (69), if provided, to the coupling flange (76) and coupling part 3 (3) with the screws (70) (for tightening torque T_A see item 6.12).

6.7 Fitting the type ZWS and ZZWS couplings

Lightly grease the splines of part 3 (3) and the control sleeve (25). Slide the control sleeve (25) onto the splines of part 3 (3) until it makes contact. Fasten the slip ring (24) over the control sleeve (25) with the screws (107) and the nuts (108). Before inserting the lubricating nipple (109) inject a little grease in the hole.

Screw flanged shaft (40) to coupling part (3) with the cheese-head screws (41)(for tightening torque T_A see item 6.12). In case of the two-part version of the flanged shaft (40; 39), first fasten the support flange (39) to the flanged shaft (40) with the screws (38) (for tightening torque T_A see item 6.12).

The bearings in part 2 (2) must be fitted as described in item 6.8.

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

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

Move together the machines to be coupled. Note dimension "S" (see item 6.9 and dimensioned drawing). Align the coupling as described in items 6.9 to 6.11.

If using the axially split cover (21), carefully smear the joining edge of both cover halves on one side only with sealing compound.

Observe manufacturer's instructions for handling 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.

Note marks.

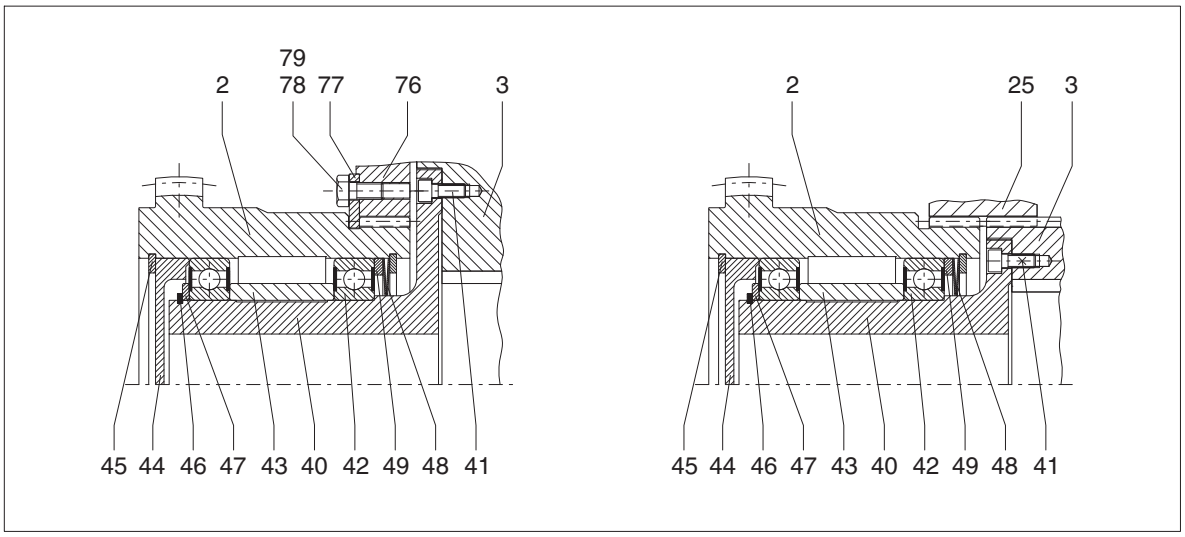
Using suitable tools, pull the covers (10; 21) onto the hub.

Smear the sealing surfaces of the covers (10; 21) with sealing compound (apply sealing compound to one side only) and screw together with the flanged sleeves (5) (for tightening torques, see item 6.12).

Smear the sealing surfaces of the flanged sleeves (5) or the adapter (4) 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 6.12).

6.8 Fitting the bearings in part 2 (2)

6.8.1 Rolling bearings (42) with two gaskets (...2RSR) or with two cover plates (...2ZR)



Fit circlip (45) in part 2. Fit disk springs (48) (note fitting position on dimensioned drawing), ring (49), rolling bearing (42), spacer ring (43) and rolling bearing (42) in part 2 (2) in that order and secure axially with the bearing cover (44) and the circlip (45).

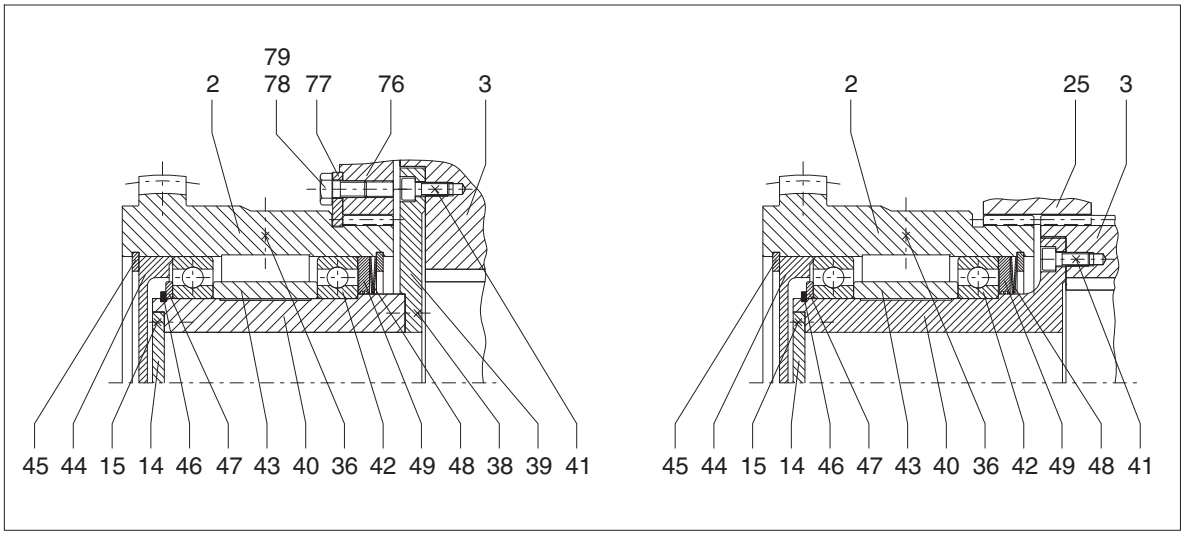
Lightly grease the splines of the coupling flange (76) and part 2 (2), push the coupling flange (76) over the splines of part 2 (2) and secure with the 2T retaining ring (77), the screws (78) (for tightening torque T_A see item 6.12) and, if provided, the dowel pins (79). Depending on the size, the coupling flange (76) and part 2 (2) are also constructed as a single part (2).

Push this pre-assembled unit onto the hub of the flanged shaft (40) up to the stop. To facilitate fitting, the pre-assembled unit can be heated to max. + 80 °C.

Demount the circlip (45) and the bearing cover (44) in part 2 (2) and re-fasten the bearing to the flanged shaft (40) with the ring (47) and the circlip (46). Fit bearing cover (44) and circlip (45). The bearing cover (44) also serves as a gasket and must be inserted with sealing compound.

Observe manufacturer's instructions for handling sealing compound!

6.8.2 Rolling bearings with labyrinth seal



Mount circlip (45) and disk springs (48) (note mounting position on drawing) in part 2. Fit the labyrinth ring (49) with sealing compound.

Observe manufacturer's instructions for handling sealing compound!

Fit rolling bearing (42), spacer ring (43) and rolling bearing (42) in part 2 (2) in that order and secure axially with the bearing cover (44) and the circlip (45).

Lightly grease the splines of the coupling flange (76) and part 2 (2), push the coupling flange (76) over the splines of part 2 (2) and secure with the 2T retaining ring (77), the screws (78) (for tightening torque T_A see item 6.12) and, if provided, the dowel pins (79).

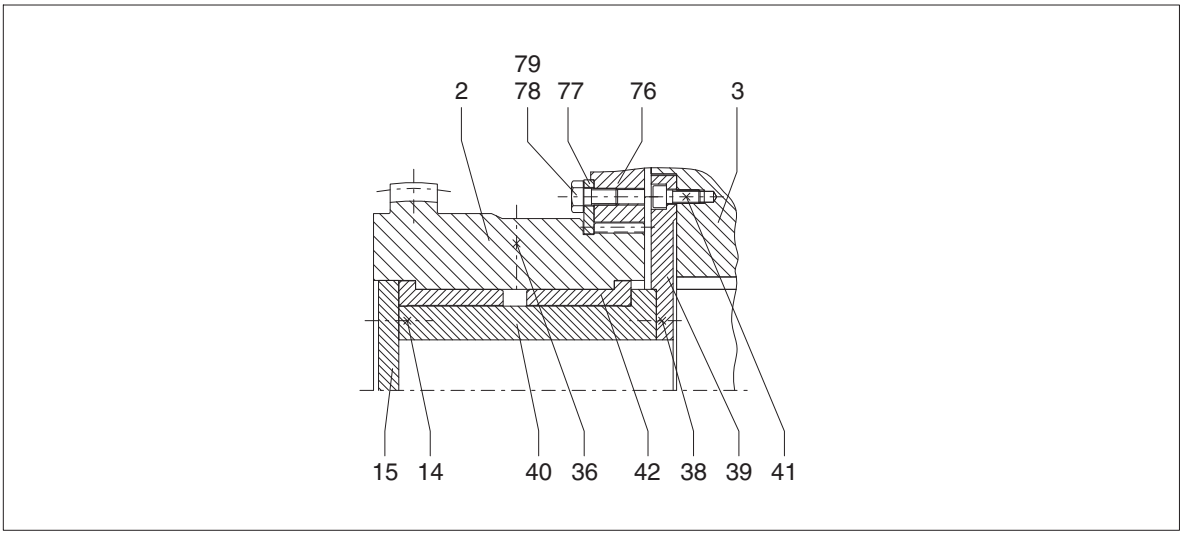
Push this pre-assembled unit onto the hub of the flanged shaft (40) up to the stop. To facilitate fitting, the pre-assembled unit can be heated to max. + 80 °C.

Demount the circlip (45) and the bearing cover (44) in part 2 (2) and re-fasten the bearing to the flanged shaft (40) with the ring (47) and the circlip (46). Insert the gasket (14) with sealing compound and fasten to the flanged shaft (40) with the screws (15). Fit bearing cover (44) and circlip (45). The bearing cover (44) also serves as a gasket and must be inserted with sealing compound.

Observe manufacturer's instructions for handling sealing compound!

Remove the screw plugs (36) from part 2 (2) and inject rolling-bearing grease into a hole until rolling-bearing grease emerges from the holes on the opposite side. Insert screw plugs (36) again and tighten.

6.8.3 Sliding bearings



Smear the sliding surface between the sliding bushes (42) and the flanged shaft (40) well with plenty of rolling-bearing grease.

The sliding bushes (42) and part 2 (2) form a unit and must under no circumstances be removed from part 2 (2).

Lightly grease the splines of the coupling flange (76) and part 2 (2), push the coupling flange (76) over the splines of part 2 (2) and secure with the 2T retaining ring (77), the screws (78) (for tightening torque T_A see item 6.12) and, if provided, the dowel pins (79).

Push this pre-assembled unit onto the hub of the flanged shaft (40) up to the stop. To facilitate fitting, the pre-assembled unit can be heated to max. + 80 °C.

Insert the gasket (14) with sealing compound and fasten to the flanged shaft (40) with the screws (15). (For tightening torque T_A see item 6.12.)

Observe manufacturer's instructions for handling sealing compound!

Remove the screw plugs (36) from part 2 (2) and inject rolling-bearing grease into a hole until rolling bearing grease emerges from the holes on the opposite side. Insert screw plugs (36) again and tighten.

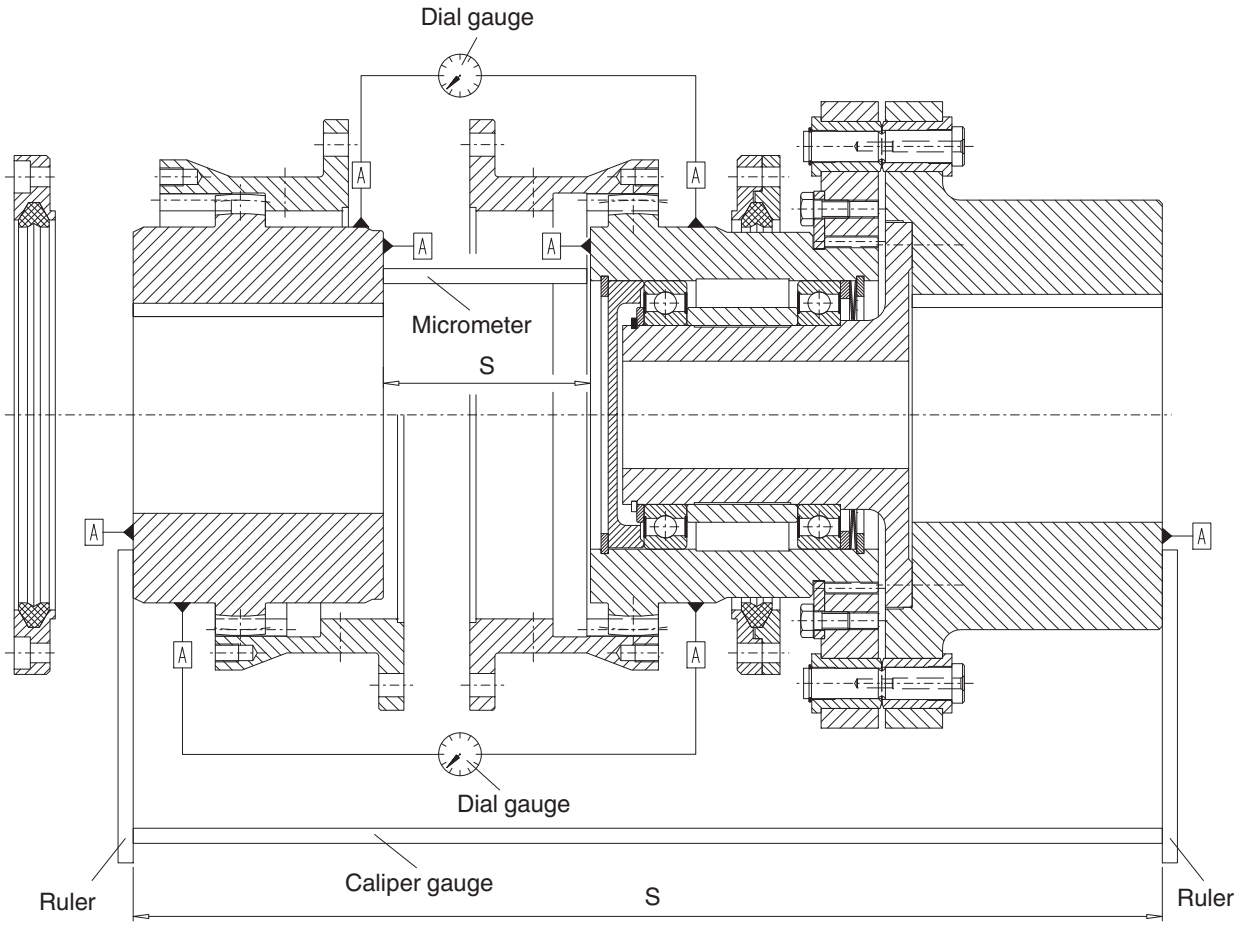
6.9 Alignment

The couplings compensate for positional errors up to 1° on the shaft ends to be connected.

When aligning, the radial and angular misalignment of the shaft ends must be kept as small as possible, because, other conditions being equal, this increases the service life of the coupling. The angular misalignment must, however, be not less than 0.05°.

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

ZBR, ZZBR, ZWS, ZZWS

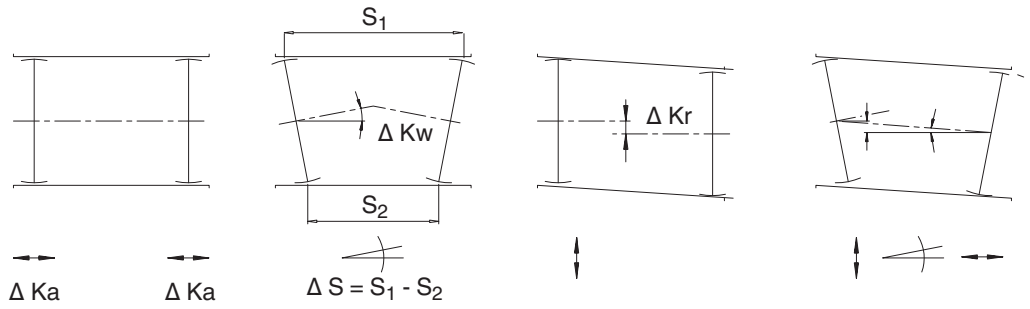


With small distances ”S”, a feeler gauge or micrometer can be used instead of a ruler and caliper gauge.

STOP

The max. permissible misalignments depend upon the duty factor and the coupling speed. If the speed changes, a check must imperatively be carried out. Since misalignments (expansion due to heat, shaft deflection, settling of foundations, etc.) can occur during operation, a misalignment of 0.1° must be aimed for when aligning. Misalignments during alignment must, however, be not less than 0.05°. For alignment values, see item 6.11.

6.10 Possible misalignments



Axial misalignment Fig. 6.4 | **Angular misalignment Fig. 6.5** | **Radial misalignment Fig. 6.6** | **Axial, radial and angular misalignment Fig. 6.7**

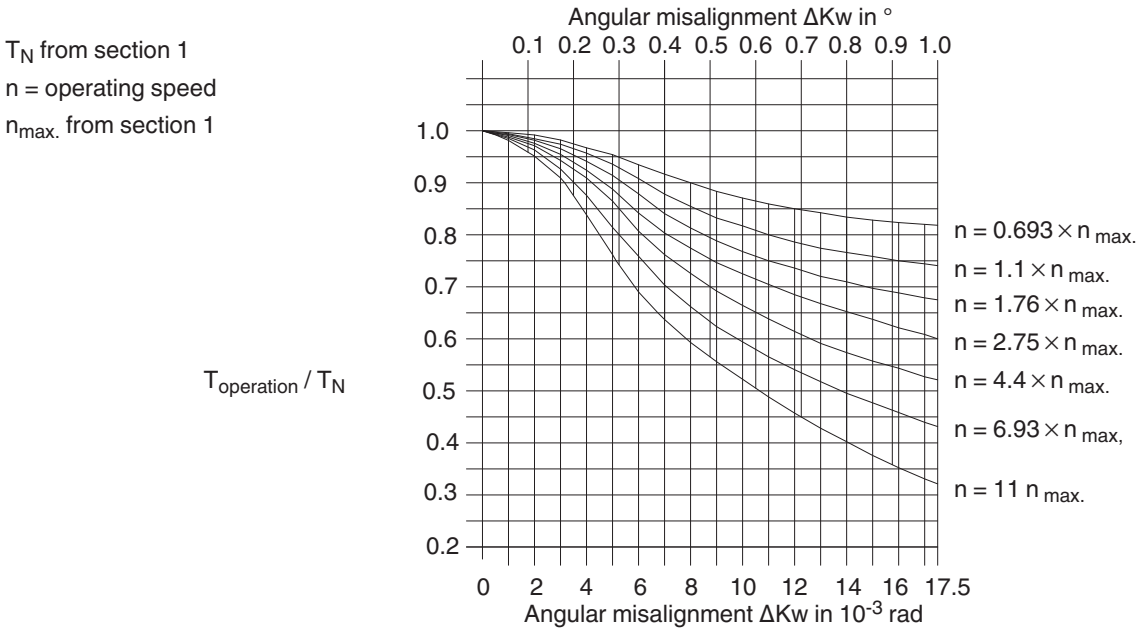
Misalignments of the coupling parts in relation to each other can be caused by inaccurate alignment during assembly, but also by actual operation of the equipment (expansion due to heat, shaft deflection, insufficiently rigid machine frames, etc.).

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

6.10.1 Axial misalignment

Axial misalignment ΔKa (Fig. 6.4) of the coupling parts relative to one another is possible within the ”permissible error” for dimension ”S” (see section 1).

6.10.2 Angular misalignment as a function of operating torque and operating speed



To simplify matters, the angular misalignment ΔKw (figure 6.5) is calculated as the difference (ΔS) of dimension ”S” (for point of alignment A , see item 6.9). The measurement must be taken at several points on the circumference.

For permissible alignment values, see item 6.11.

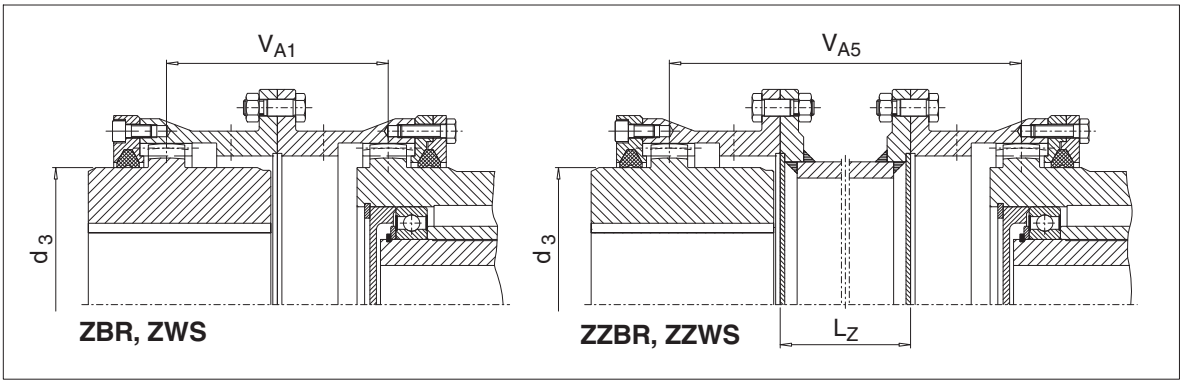
6.10.3 Radial misalignment

The max. possible radial misalignment $\Delta Kr_{max.}$ (Fig. 6.6) represents a possible angular deviation for each coupling half of $\Delta Kw_{max.} = 0.0175$ rad = 1°.

For permissible alignment value, see item 6.11.

STOP **Angular and radial misalignments (Fig. 6.7) may occur at the same time. The sum of the two misalignments must not exceed ΔKw or ΔKr.**

6.11 Alignment values



Size	Distance between teeth V_{A1} mm	V_{A5} mm	Size	Distance between teeth V_{A1} mm	V_{A5} mm
112	56	$V_{A1} + L_Z$	**375**	242	$V_{A1} + L_Z$
128	73		**415**	294	
146	88		**465**	336	
175	104		**505**	366	
198	119		**545**	406	
230	130		**585**	460	
255	150		**640**	479	
290	170		**690**	516	
315	190		**730**	560	
342	222				

Table 6.4: Alignment values

Angular misalignment ΔKw :

$\Delta S = S_1 - S_2 = d_3 \times \tan 0.1°$

For hub diameter d_3, see dimensioned drawing.

Radial misalignment ΔKr :

ZBR, ZWS: $\Delta Kr = V_{A1} \times \tan 0.1°$; for distance between teeth V_{A1}, see dimensioned drawing and/or table.

ZZBR, ZZWS: $\Delta Kr = V_{A5} \tan 0.1°$; $V_{A5} = V_{A1} + L_Z$; for distance between teeth V_{A1}, see dimensioned drawing and/or table.

STOP **Angular and radial misalignments may occur at the same time. The sum of the two misalignments must not exceed ΔKw or ΔKr.**

STOP **Values up to 10 times higher are permissible during operation, taking into consideration the table in item 6.10.2.**

6.12 Tightening torques

Thread diameter	Tightening torques T_A in Nm (with μ = 0.14) Strength class to DIN ISO 898 Part 1			Thread diameter	Tightening torques T_A in Nm (with μ = 0.14) Strength class to DIN ISO 898 Part 1		
d	**8.8**	**10.9**	**12.9**	**d**	**8.8**	**10.9**	**12.9**
M 6	10	14	17	**M 24**	710	1000	1200
M 8	25	35	41	**M 30**	1450	2000	2400
M 10	49	69	83	**M 36**	2530	3560	4150
M 12	86	120	145	**M 42**	4070	5720	6650
M 16	210	295	355	**M 48**	6140	8640	10100
M 20	410	580	690	**M 56**	9840	13850	16100

Table 6.6: Tightening torques

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

7. Start-up

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

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

7.1 Recommended lubricants

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

Company	ARAL	BP	Castrol	DEA	ESSO	FLENDER
Oils	Degol BG 460/680 Plus	Energol GR-XF 460/680	Alpha SP 460/680	Falcon CLP 460/680	Spartan EP 460/680	-
Liquefied greases	Aralub Fließfett ANO	Energrease LS-EP 00	CLS Grease	Orona FG EP 0	Fibrax EP 370	FLENDER Hoch-leistungsfett
NLGI class	0	00	00/000	0-00	0	0-00

Company	KLÜBER LUBRICATION	Mobil	Optimol	Shell	Tribol A BURMAH CASTROL COMPANY	FUCHS
Oils	Structovis BHD-MF	Mobilgear 634/636	Optigear BM 460/680	Shell Omala Oil 460/680	Tribol 1100 460/680	Renolin CLP 460/680 Plus
Liquefied greases	Grafloscon C-SG 500	Mobilux EP 004	Longtime PD 00	Alvania GL 00	Tribol 3020 1000-00	Renolit SO-D 6024
NLGI class	0-00	00	00	00	00	00

Table 7.1: Recommended lubricants

For normal operating conditions we recommend oil. This has the advantage of easy oil changing and good surface wetting.

The lubricants are suitable for operating temperatures of between - 10 °C and + 80 °C. If temperatures deviate from these, consult Flender.

Observe manufacturer's instructions for handling oils and greases!

7.2 Oil quantity/grease quantity

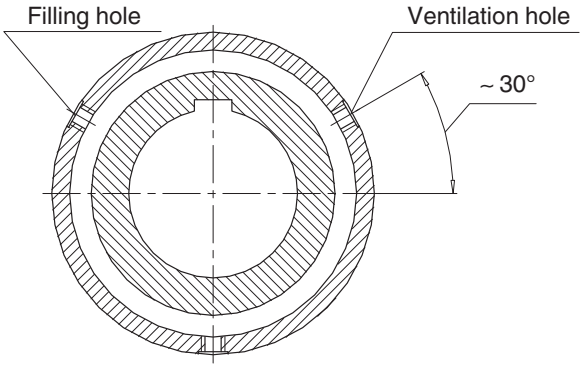
For oil quantities/grease quantities, see dimensioned drawing.

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

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 again the screw plugs (6) with fitted/vulcanised 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 and/or grease filling, any errors remedied and all screw connections checked for correct tightening torques (for tightening torque T_A see item 6.12).

Then fit the coupling guard to prevent unintentional contact.

8. Operation

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

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

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 and/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"!

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

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 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 warranty nor 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 coupling 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 misalignment values.	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 9.1: Faults, causes and remedy

10. Maintenance and repair

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

The user of the system must make the dimensioned drawing available. The information entered on it must be given priority.

All work on the coupling 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.

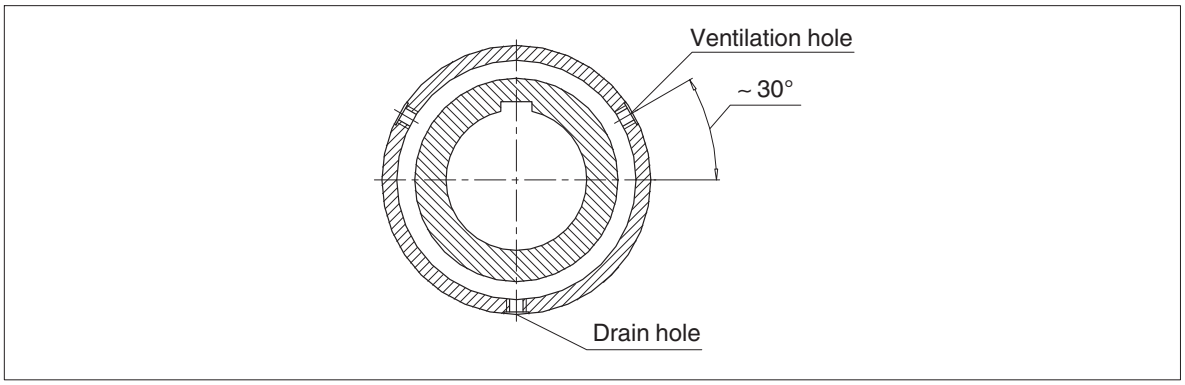
10.2 Oil change and/or grease change

During regular inspections the coupling must be checked for leaks, and the lubricant level checked and, if necessary, topped up.

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.

Unscrew screw plugs (6) and drain off the oil/grease into a suitable vessel, as shown in the diagram (to simplify matters, in case of grease, add light-bodied oil to the used grease and mix).

All the oil and 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".

In case of versions with rolling bearing and labyrinth seal or with sliding bearings we recommend that the rolling bearing grease in the rolling-bearing gap/sliding bearing gap is also topped up whenever the oil is changed.

Remove the screw plugs (36) from part 2 (2) and inject rolling-bearing grease into a hole until rolling-bearing grease emerges from the holes on the opposite side. Insert screw plugs (36) again and tighten.

10.3 Replacing the DUO sealing rings (12)

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) and push the cover (10; 21; 121) away from the hub until the DUO sealing ring (12) can be removed. With radially split cover (121) undo the connection between the two cover halves (122; 123; 124).

Clean the sealing compound off the cover (10; 21; 121).

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; 121) 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 case of split covers (21; 121), carefully smear the joining edge of both cover halves on one side only 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.

Smear the sealing surfaces of the covers (10; 21; 121) with sealing compound (apply sealing compound to one side only) and screw together with the flanged sleeves (5) (for tightening torques see section 6, item 6.12).

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

10.4 Replacing the shear pins

If the specified shear torque is exceeded, the shear bolts (73) will be sheared through and the torque transmission interrupted. The coupling part 3 (3) and the flanged shaft (40) stop. The relative movement takes place in the bearings (42).

After the shear pins (73) have sheared through, the drive must be switched off immediately.

It must be ensured that the entire drive train has stopped running and that the drive motors cannot be accidentally started. We also refer to the relevant accident prevention regulations applying at the place of installation.

Remove the safety covers (69; 70).

Remove the circlips (74).

Rotate the coupling flange (76) relative to coupling part 3 (3) so that each sheared through shear pin is aligned with a free hole. Using a suitable tool, knock the pins out of the bush (71; 72) through the free hole.

Rotate the coupling flange (76) back.

Note marks on the outside circumference of the coupling flange (76) and coupling part 3 (3).

Noting the fitting position, push the new shear pins (73) into the bushes (71; 72) and fasten axially with the circlip (74). Fit the safety cover (69; 70), if provided, again (for tightening torques, see section 6, item 6.12).

10.5 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 undo the screw connection of the cover (11; 18).

Remove the covers (10; 21; 121) and support them over the shaft or part 2 (2), at the same time protecting the DUO sealing ring (12) from being damaged by the splines.

Move the coupled machines apart. Remove the adapter (4) and the flanged sleeves (5).

Always use suitable lifting equipment.

Danger of squeezing!

Demount the safety covers (69; 70) and the circlips (74) and push out the shear pins (73) with a suitable device.

Align the holes in the coupling flange (76) with the screws (41) by rotating the coupling flange (76) relative to the support flange (39) and/or to the flanged shaft (40). Undo and remove the screws (41) through the holes.

With the aid of the forcing thread, release the support flange (39) and/or the flanged shaft (40) from the centre hole in part 3 (3). Hold and/or remove part 2 (2) with the bearings, the cover (21; 121) and the coupling flange (76) using suitable lifting gear.

If further disassembly of part 2 (2) is necessary, remove the circlip (45), bearing cover (44), rolling bearing (42), spacer ring (43), rolling bearing (42), ring (49), disk springs (48) and circlip (45). In case of the sliding bearings the sliding bushes (42) remain in part 2 (2).

In case of the version with sliding bearings the sliding bushes (42) and part 2 (2) form a single unit and must under no circumstances be removed from part 2 (2).

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

10.6 Demounting the coupling parts (1; 3) 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 part (to max. + 80 °C) along its length and above the parallel keyway.

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

Take precautions to avoid burns from hot parts!

Pull off coupling parts (1; 3) 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.

10.7 Demounting the coupling parts (1; 3) in case of cylindrical and taper interference fit set up for oil-hydraulic shrinking off

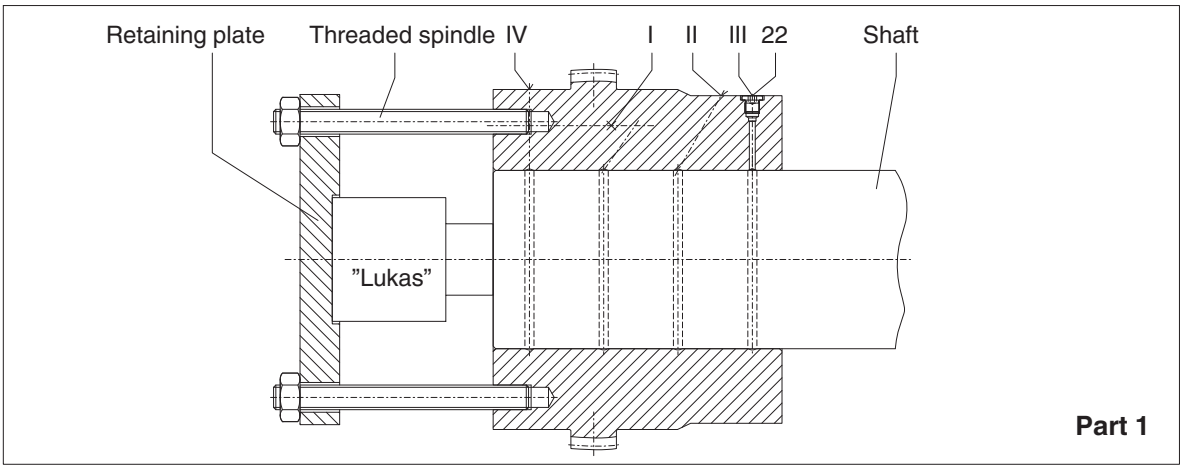
For demounting the following tools are needed:

- 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 (”Lukas”) with oil pump. Note displacement and pressure of the hydraulic cylinder ("Lukas") (for axial force, consult Flender and/or refer to dimensioned drawing).

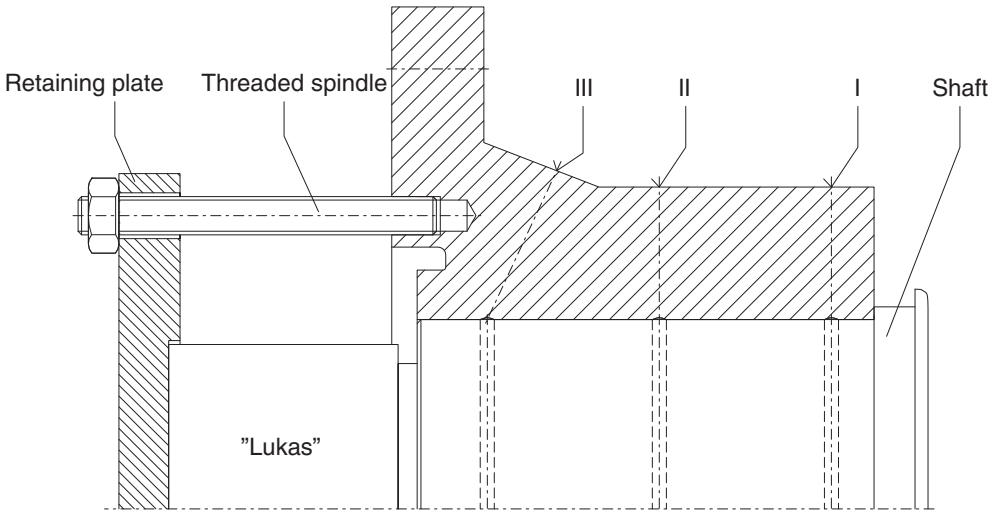
Observe manufacturer’s instructions for using forcing-off/detaching device and pumps.

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

10.7.1 Demounting the coupling parts (1; 3) in case of cylindrical interference fit



Part 1



Part 3

Secure coupling part (1; 3) and detaching device, using suitable lifting equipment!

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

Bleed one of the oil pumps and connect it up to the middle oil channel (in case of part 1 (1): oil channel I; in case of part 3 (3): oil channel II). Then apply the pressure specified in the dimensioned drawing to the pump until oil emerges from the adjacent connections.

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.

Proceed with the next oil channels in the same way, connecting up to the oil channels in the following order:

Part 1 (1): Oil channel II, oil channel IV and oil channel III
Part 3 (3): Oil channel III and oil channel I.

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 (”Lukas”) 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.

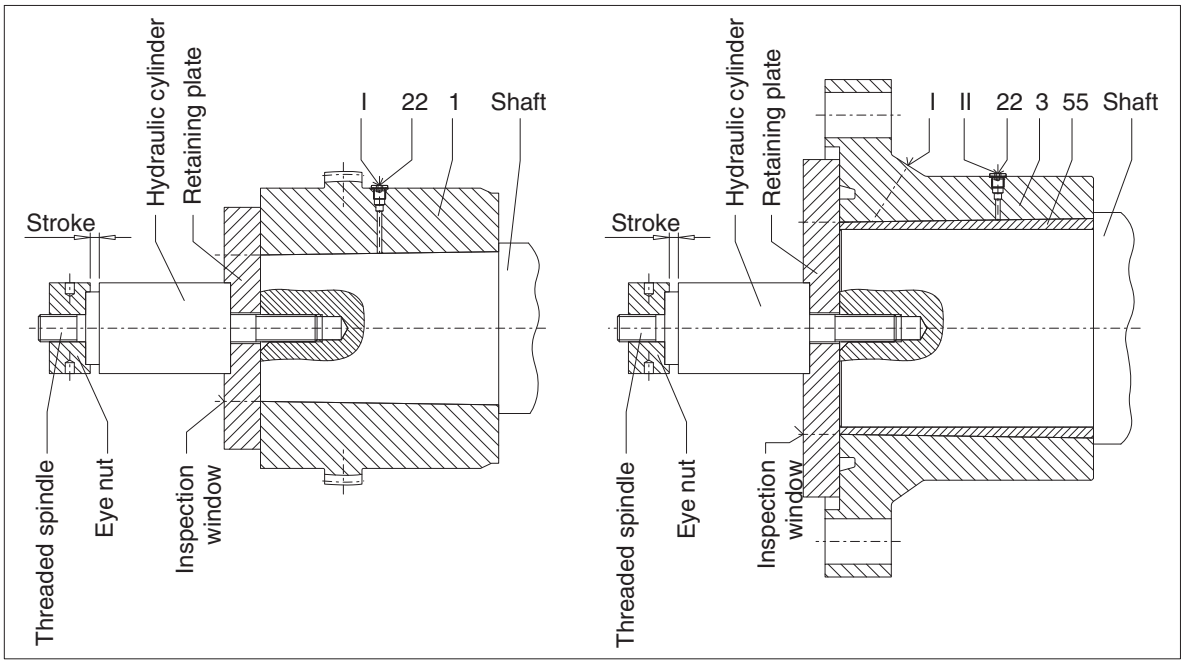
Note stroke of hydraulic cylinder. If re-adjustment is necessary, the end face of the hydraulic cylinder (”Lukas”) must stop between two oil channels.

After detaching, the oil pumps and retaining device must be removed from the coupling hub.

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.

10.7.2 Demounting the coupling part (1; 3) in case of tapered interference fit or cylindrical interference fit with Bratt bush (55; 56)



STOP **Using suitable tools, secure coupling part (1; 3) and retaining device! To prevent the coupling part (1; 3) from 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.

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

STOP **During the entire operation the pressure must be maintained at a constant level on all the oil channels to which pressure is applied.**

The next oil pump must be bled, connected up to oil channel II and pressure applied to it as specified on the dimensioned drawing until a ring of oil emerges at the end face.

STOP **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.

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 retaining device.

STOP **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; 3) slides off the shaft/Bratt bush (55; 56) until there is no adhesion between the coupling part (1; 3) and the shaft/Bratt bush (55; 56).

Remove the oil pumps and retaining device from the coupling hub. Remove coupling part (1; 3).

Pull the Bratt bush (55; 56) off the shaft.

Examine the teeth, the sealing surfaces, the hub bore, the shaft and the Bratt bush (55; 56) 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.

10.8 Demounting the coupling parts with stepped bore for removal by oil-hydraulic shrinking off

Demounting is done as described in item 10.7, 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:

– Number of the original order

– Part number (see section 5)

– Description, size

– Quantity

We guarantee only the original spare parts supplied by Flender.

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 and customer-service addresses

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

FLENDER COUPLINGS

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