

Three-phase geared motors

KD-DG 99 E Service Manual

BG-series helical-geared motors

Motor power ratings from 0.03 kW to 75 kW
Torques from 20 Nm to 8 400 Nm

BF-series shaft-mounted geared motors

Motor power ratings from 0.03 kW to 75 kW
Torques from 200 Nm to 16 800 Nm

BK-series bevel-geared motors

Motor power ratings from 0.03 kW to 75 kW
Torques from 170 Nm to 16 800 Nm

BS-series worm-geared motors

Motor power ratings from 0.03 kW to 5.5 kW
Torques from 25 Nm to 1 000 Nm

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8	International Organisation Technical offices Germany Approved service stations Germany	

Safety instructions for operation of geared motors

(in accordance with Low-Voltage Directive 73/23/EEC)

General

These safety instructions apply in addition to the respective operating instructions for specific products and for reasons of safety must be carefully observed in all cases.

The safety instructions are intended to protect people and equipment from injury and danger, which could arise with unsuitable installation, incorrect maintenance and inadequate servicing, or other faulty management of electrical drives in industrial installations. Low-voltage machines possess rotating parts, some of which may also be live at standstill, and their surfaces may be hot.

It is essential to observe warning and information plates on the machine. More information is included in our detailed operating instructions. They are delivered with the machine and can also be requested separately on request if the motor type is specified.

1 Personnel

Any necessary work on electrical drives and particularly planning work, transportation, fitting, installation, commissioning, servicing and repairs should be undertaken only by adequately qualified personnel (e. g. electrical technicians in accordance with EN 50 110-1/DIN VDE 0105; IEC 364). In addition, the respective work must be consistently carried out in accordance with, among others, the supplied operating instructions and further product documentation. Such work must be supervised by responsible specialists.

Qualified staff are persons who, on the basis of their training, experience and instruction, together with their knowledge of relevant standards, regulations, accident prevention rules and working practices, are qualified to be responsible for the safety of the installation when undertaking the necessary activities and hence are able to foresee and avoid possible hazards.

Among other things, a knowledge of First-Aid procedures and of the local method of escape and emergency equipment is also necessary.

Work on geared motors by non-qualified staff must be forbidden.

2 Normal use, observing the relevant technical specifications

These machines are intended for industrial use, unless another purpose has been expressly agreed. They comply with the standards from series EN 60034/DIN VDE 0530.

Use in explosion-hazard areas is forbidden, unless these machines have been specifically designed for this purpose (observe additional notes).

If there is a need for more stringent requirements (e.g. protection against access by children's fingers) in special cases – use in non-industrial installations – these requirements must be met by the operator of the installation when it is installed or erected.

The machines have been designed for ambient temperatures from 0°C to + 40°C and site altitudes up to 1000 m above sea level.

Always observe any deviating data on the rating plate. The conditions at the place of use must conform with all specifications on the rating plate.

Low-voltage machines are components for installations in machines as defined in Machine Directive 89/392/EEC. The final product must not be put into operation until its conformity with this Directive has been established (observe EN 60204-1).

A manufacturer's declaration concerning the Machine Directive is available on request.

3 Shipment, storage

When transporting electrical drives, the eyebolts – where these are provided in the construction – must be firmly tightened into their seatings. They may only be used for moving the drive unit and not for lifting the drive unit together with the driven machine.

Immediately notify the haulage contractor about any damage discovered after delivery; commissioning must be excluded, if necessary.

Drives must be stored in a dry, dust-free and low-vibration ($V_{rms} < 0.2$ mm/s) environment (stationary bearing damage). The useful life of the lubricants and seals decreases in the case of an extended storage time.

At very low temperatures (below about -20°C) there is a danger of breakage.

When replacing eyebolts, drop-forged eyebolts complying with DIN 580 must be used (tensile strength at least 500 N/mm²).

4 Fitting

With the IM.. mounting arrangement, the drive must be fixed by its feet or flange. Shaft-mounted drives with hollow shaft are to be pulled onto the driven shaft using suitable tools.

Warning! Geared motors develop considerably higher torques and forces than fast running motors of comparable rating.

Fasteners, foundation and torque reaction support must be dimensioned in accordance with the high forces to be expected in service and must be adequately secured against loosening.

The drive shaft(s) and any second shaft extension, together with any transmission elements mounted on them (couplings, sprocket wheels etc.) must be suitably guarded.

5 Connection

All work must be performed only by qualified staff. The machine must be stationary, isolated from the mains and secured against switching back on. This also applies to auxiliary circuits (e. g. anti-condensation heater).

Remove any shipping braces before commissioning.

Check safe isolation from supply voltage!

Terminal boxes may be opened only after it has been made certain that the current has been switched off.

The information regarding voltage and frequency given on the rating plate must correspond to the mains voltage connected to the respective terminals.

If the tolerances in accordance with EN 60034/DIN VDE 0530 – i. e. voltages $\pm 5\%$, frequency $\pm 2\%$, curve shape, symmetry – are exceeded, this can lead to increased heating and a shorter service life.

Connection diagrams which are provided must be taken into account. This applies particularly to special designs such as pole-changing and thermistor protected machines etc.

The type and size of the mains leads and of the earth connection and of any necessary bonding connection must comply with the general and local installation requirements. For intermittent duties, the starting current must be considered as appropriate.

The drive must in principle be protected against over-load and from danger of unintentional restarting due to automatic reclosure of the circuit.

Terminal boxes must be maintained in an enclosed condition in order to prevent electric shock from contact with live parts.

6 Commissioning

Before commissioning, the mechanical coupling to the driven machine must be disconnected where possible and the direction of rotation checked on no-load. For this purpose, shaft drive keys must either be removed or secured so that they cannot be thrown out.

Care must then be taken to see that the current consumption in the loaded condition will not exceed the full-load current, as specified on the rating plate, for extensive periods of time. After the initial start-up, the drive must be observed for at least an hour for any exceptional heating or noise.

7 Operation

With some designs, including for example: non-ventilated motors, relatively high casing temperatures can occur, although these may lie within the limits specified within the standards. Where such drives may be subject to close physical contact by personnel, suitable protective covers must be fitted by the installer or the operator.

8 Spring-loaded brakes

Attached spring-loaded brakes are safety brakes which operate even when there is a power failure or normal wear.

If a manual release bracket is supplied with the equipment, it must be removed before operation.

Because of the possibilities of failure of other components which may prevent the brake from operating, suitable safety measures must be applied where unbraked movement could cause danger to persons or equipment.

9 Servicing

In order to avoid faults, hazards and damage, the drives must be regularly checked, depending on the circumstances governing the operating conditions.

The periods between relubrication, specified in the respective operating instructions for the bearings and gearing, must be observed.

Worn or damaged parts must be replaced using genuine authorised spares or standard parts.

Clean air passages regularly in dusty conditions.

Observe Section 5 and information in the detailed operating instructions when performing any inspection and servicing work.

10 Operation instructions

Due to lack of space, instruction handbooks and safety instructions may not contain information on every type of construction for geared motors and cannot take into account the operation and maintenance for every conceivable design.

The information is limited essentially to that which is necessary for routine work by qualified staff.

Any uncertainties must be clarified by consulting BAUER.

11 Faults

Changes from normal operation, such as higher temperatures, vibration, noise etc., will indicate that the function of the equipment is impaired.

In order to avoid faults which may directly or indirectly lead to injury to personnel or damage to plant, the responsible maintenance staff must be informed.

Where there is any doubt, geared motor units must be immediately switched off.

12 Electromagnetic compatibility

In normal use, the low-voltage machine must comply with the protection requirements stipulated by EMC Directive 19/336/EEC during operation.

Proper installation (e. g. screened leads) is the responsibility of the plant or installation installer. More detailed information is given in the operating instructions.

The manufacturer's EMC instructions must also be observed if installations with frequency converters or power converters are used.

When used and installed properly, BAUER geared motors also comply with the EMC Directive in accordance with DIN EN 50081 Part 2 (industrial applications) and DIN EN 55011 (Class A) in combination with BAUER frequency converters or BAUER power converters.

The additional information in the operating instructions must be observed when the motors are used in the domestic area, business and commercial area as well as in small plants as defined in DIN EN 50081 – Part 1 – and DIN EN 55011 (Class B).

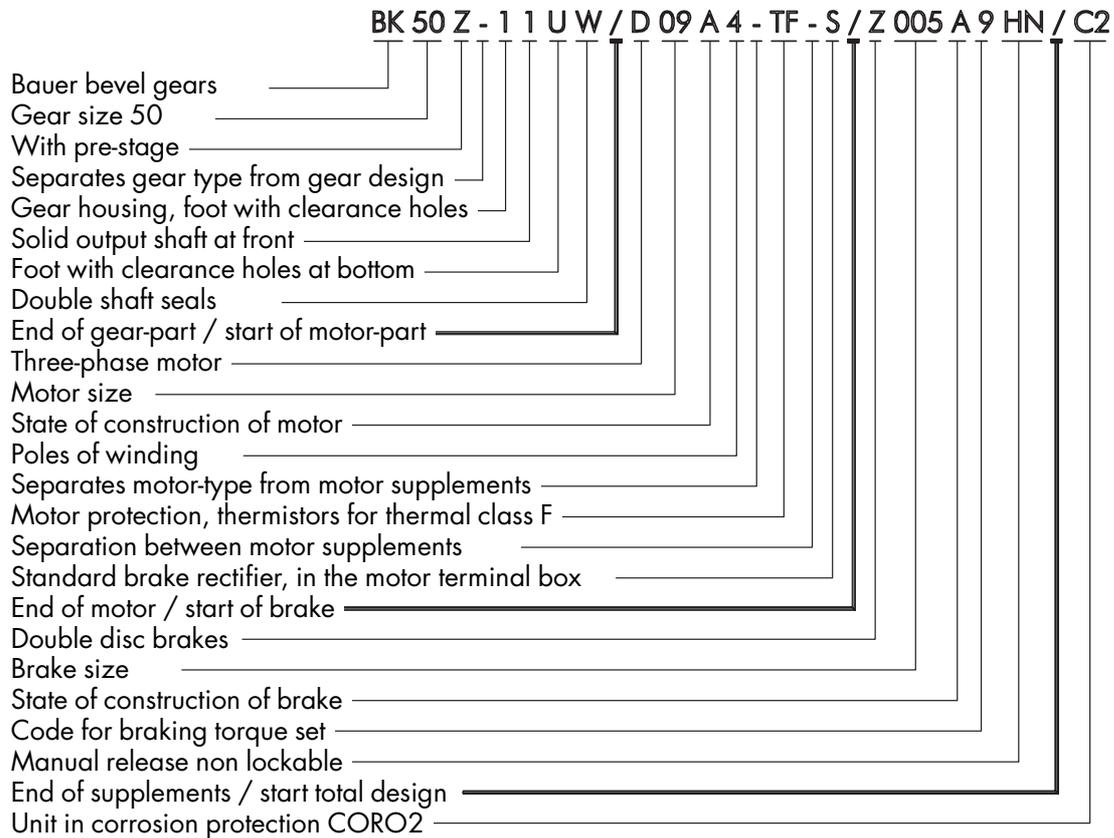
13 Guarantee and liability

The guarantee obligations of BAUER are part of the respective contract of supply and are neither extended nor limited by these safety instructions or other instructions.

1 General information

1.1 Type designation The type designation for BAUER geared motors describes the full structure of the drive.

1.2 Basic construction Gear and design/motor and design/brake and design



1.3 Gear designation

Helical gear	BG (see page 21 for description)
Shaft mounted gear	BF (see page 29 for description)
Bevel gear	BK (see page 39 for description)
Worm gear	BS (see page 55 for description)

1.4 Lubricant The drives are supplied ready for operation with initial gear lubricant fill, which means that the gear is suitable for ambient temperatures of -10°C to $+30^{\circ}\text{C}$. The fill is optimised for the required installation (fitting position) and is stated on the motor rating plate. The type of lubricant is stated in the operating manual. Lubricants for other temperature ranges or for special applications are available upon request.

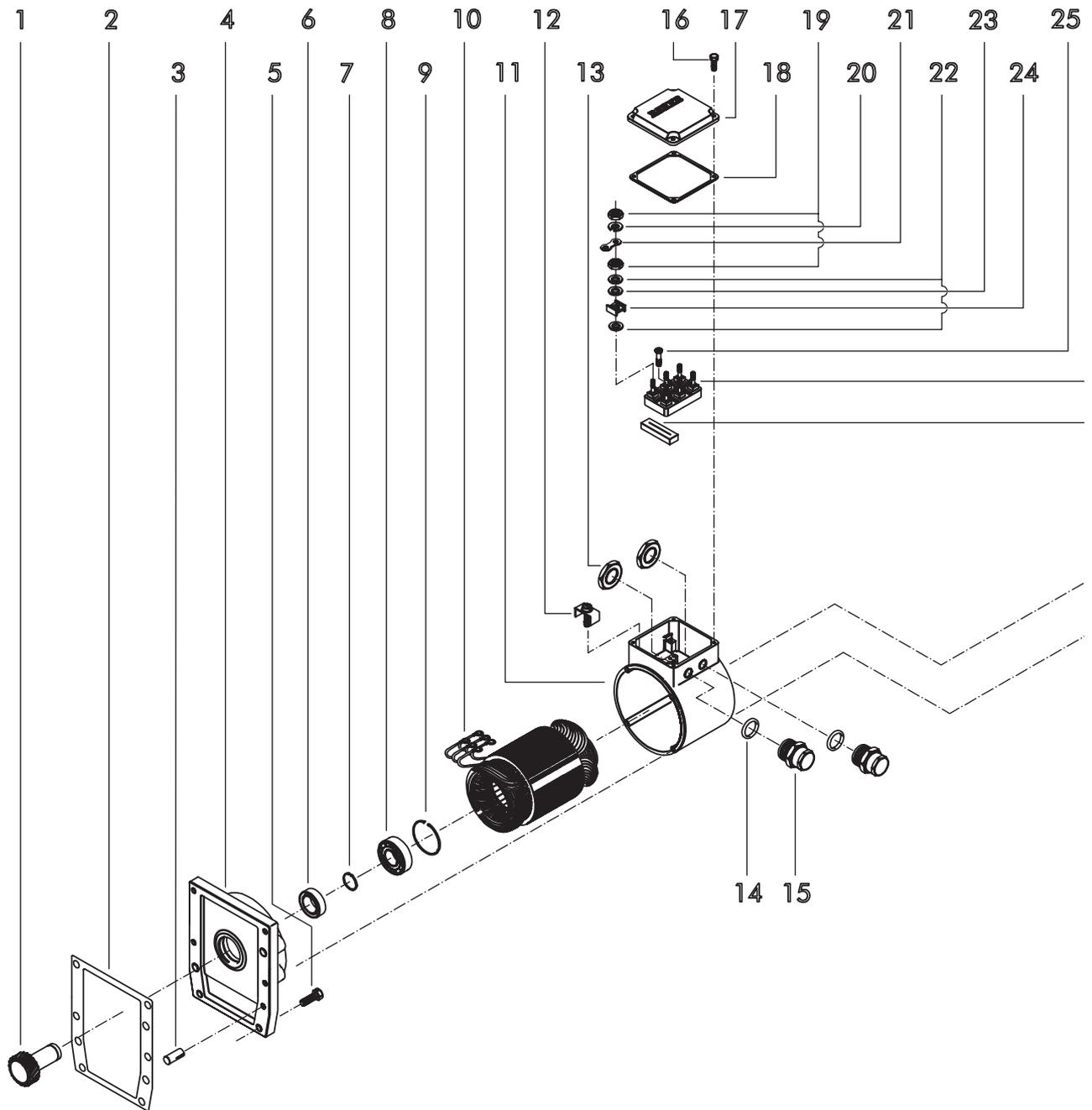
1.5 Servicing The BAUER geared motor requires very little servicing under normal operating conditions. Trouble-free operation is guaranteed for years if the following advice is followed provided the motor is correctly selected, installed and connected.

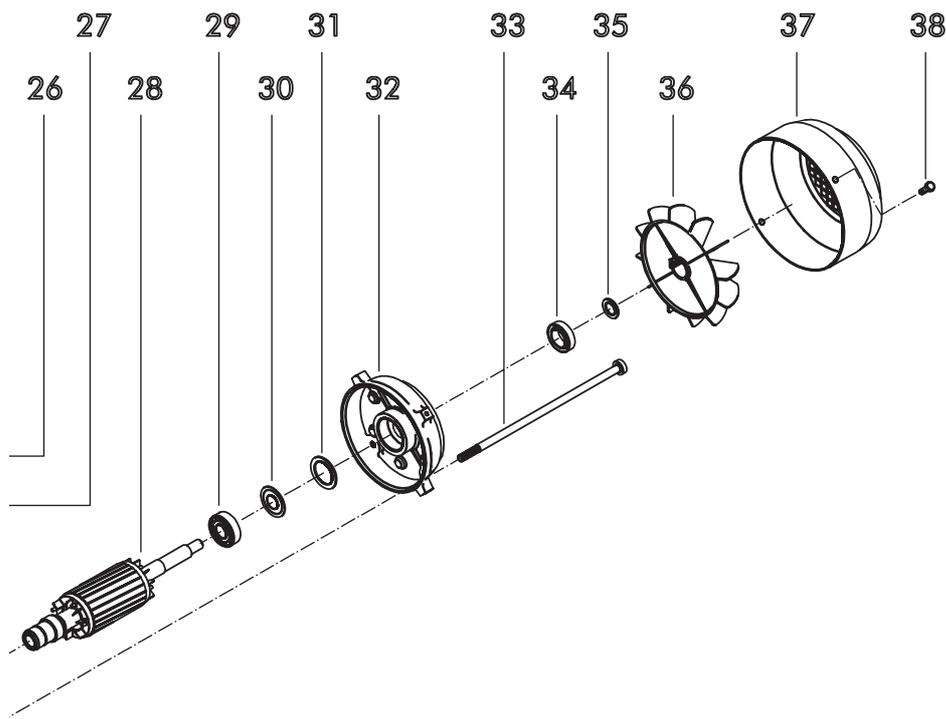
- 1.5.1 Servicing the gears** Splash-lubricated gears are supplied ready for operation with an initial lubricant fill. When changing the lubricant fill the gears with the quantity of lubricant specified for each mounting position on the rating plate (lubricant quantity table) in such a way that the uppermost gearwheels and roller bearings in each case are sufficiently reliably lubricated.
- 1.5.2 Servicing the motors** Essentially, motor servicing only involves lubricating the rotor roller bearings. These are lubricated in the factory with roller bearing grease. In order to refill with lubricant remove the roller bearings from the small and medium-sized motors, clean them with petroleum ether or clean petrol and then dry. Then lubricate them with a good-quality roller bearing grease. Fill about half the cavity between the roller bearing rollers with grease as the bearings may overheat if more lubricant is used. The roller bearings in larger motors can be lubricated via a lubricating nipple at regular intervals without dismantling. A device which controls the quantity of grease throws the old excess grease into a grease chamber which needs to be emptied from time to time. Consult the separate operating manual for more information concerning service intervals, types of lubricant and suchlike for splash-lubricated gears.
- 1.6 Surface seals** Nowadays, highly elastic chemical sealants that can applied with a brush are mainly used for sealing gear locating surfaces. During maintenance work carefully remove remnants and sealant and coat the surfaces with a sealing compound of equivalent quality. This method is better for the workshop than replacing surface seals made of pressed flat material which generally has to be obtained from the gear manufacturer.
- 1.7 Shaft seals** Standardised sealing rings made of high-quality rubber materials are mostly used on the shafts. The knife-shaped lips of these seals abut the extremely finely machined shaft by prestressing a flat coil. Cut off the film of lubricant without the rubber lip itself running completely dry and heating excessively.

2 Motors

2.1 Explosion diagrams

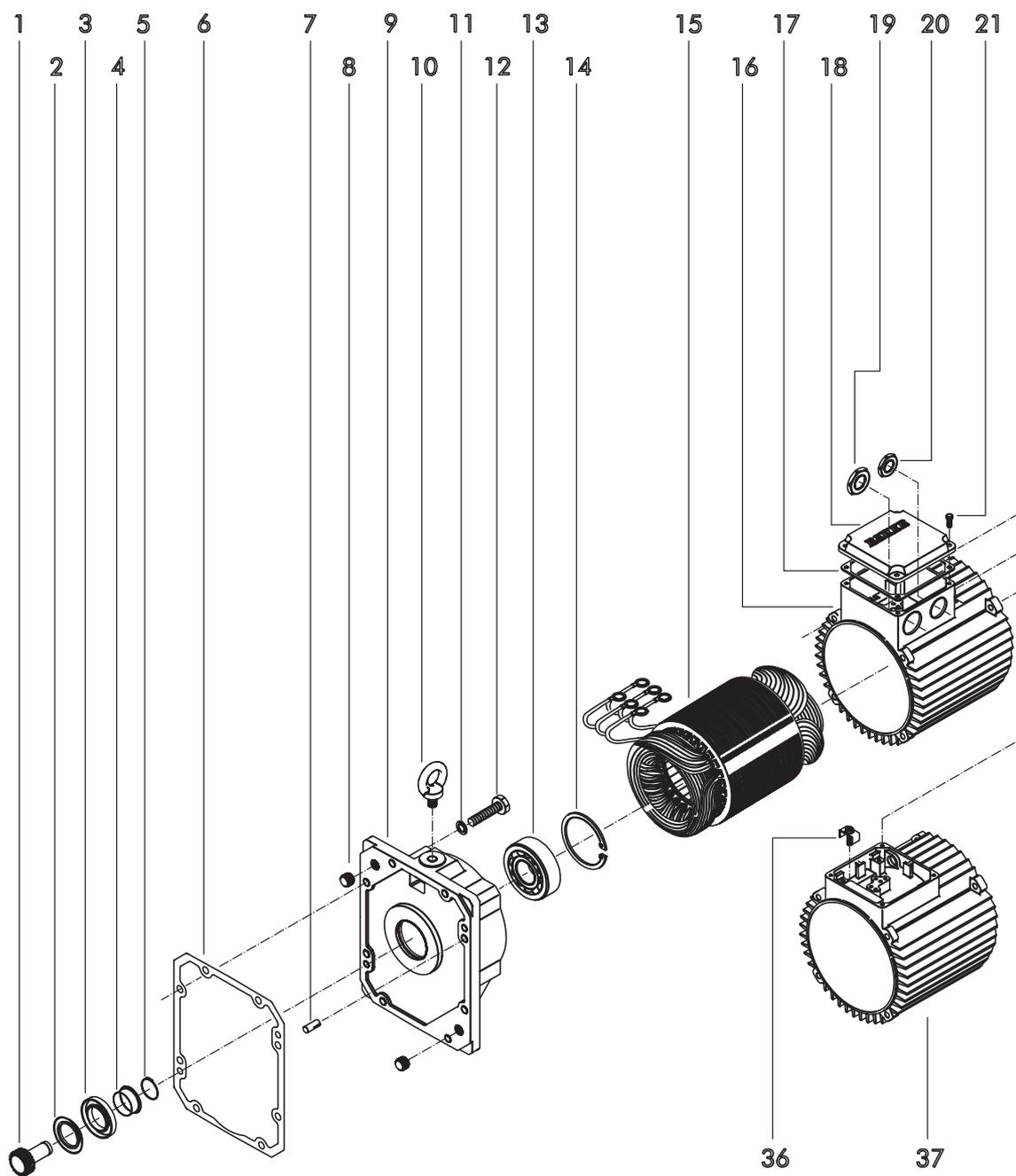
2.1.1 Explosion diagram D04, D05, E04, E05

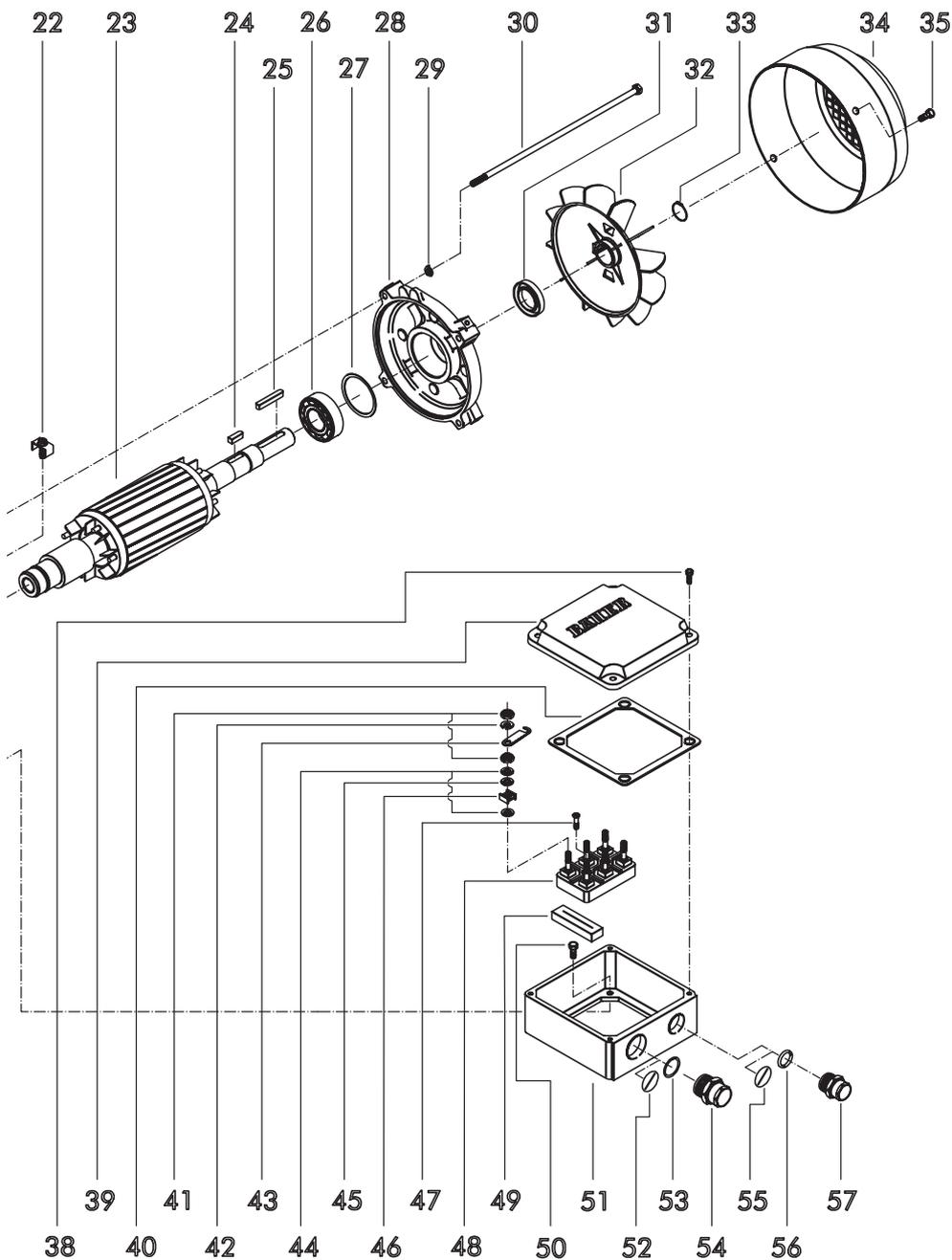




Part	Designation
1	Pinion
2	Liquid seal
3	Alignment pin
4	System cover
5	Hexagon bolt
6	Shaft seal
7	Retainer ring
8	Roller bearing
9	Retainer ring
10	Statorpacket
11	Stator housing
12	Stator earth terminal
13	Hexagon nut
14	Gasket
15	Screwed cable gland
16	Hexagon bolt
17	Terminal box cover
18	Gasket
19	Hexagon nut
20	Spring washer
21	Terminal board link
22	Washer
23	Connection disc
24	Clamping unit
25	Allen screw
26	Terminal board
27	Packing piece
28	Rotor shaft
29	Roller bearing
30	Kula-Shim
31	Tuning package
32	End shield
33	Fillister head screw
34	Shaft seal
35	Support washer
36	Fan
37	Fan cowl
38	Hexagon bolt

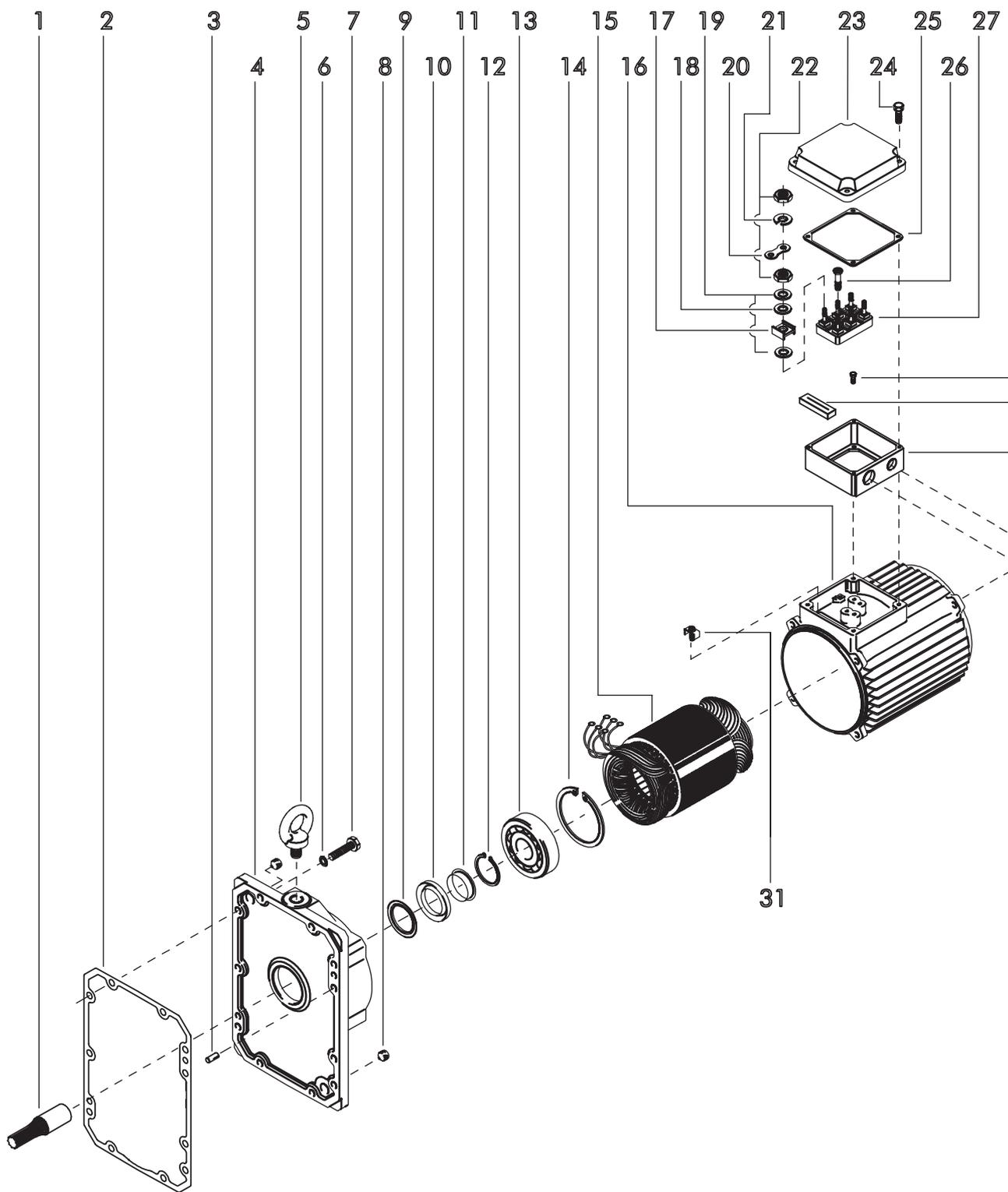
2.1.2 Explosion diagram D06, D08, D09

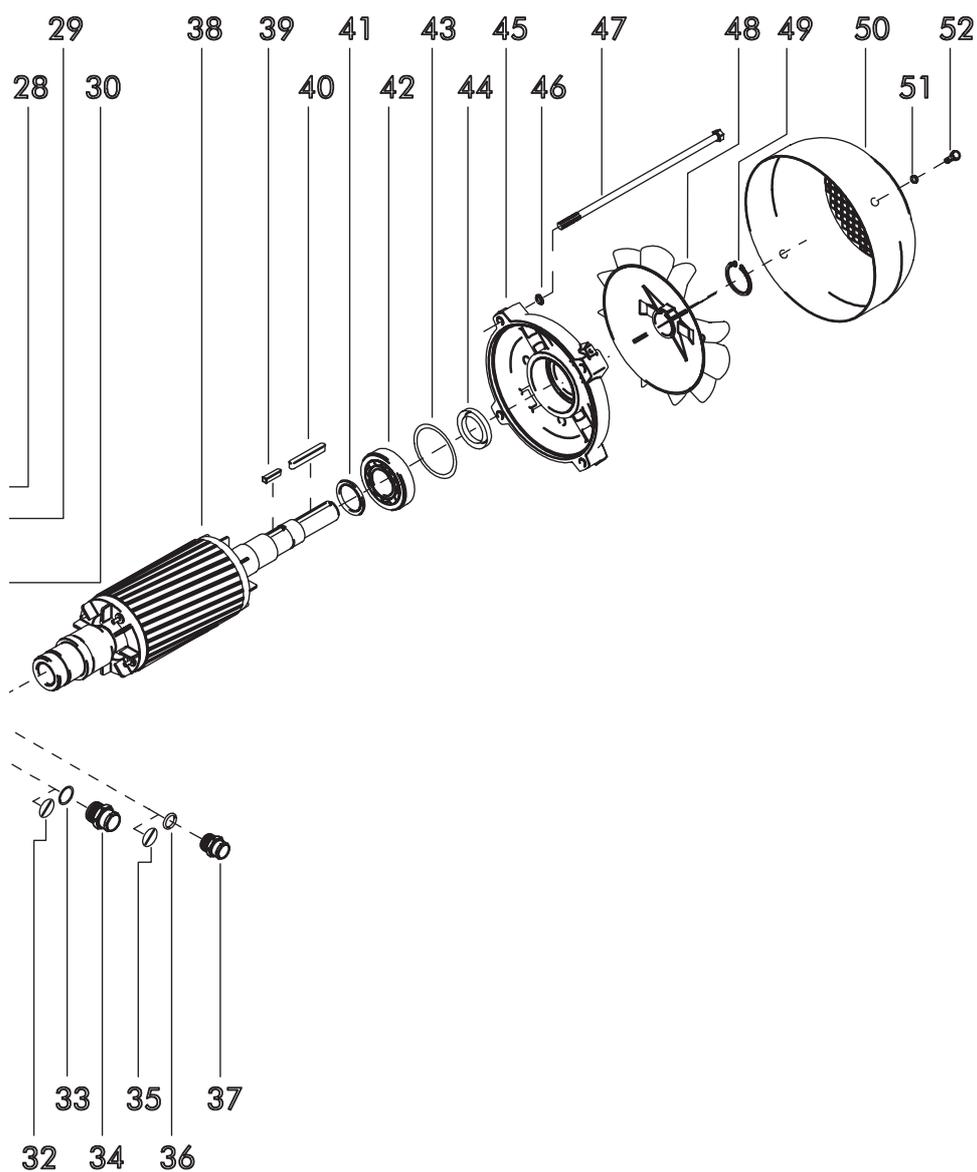




Part	Designation
1	Pinion
2	Centrifugal washer
3	Shaft seal
4	Protective shaft sleeve (not for D06)
5	Retainer ring
6	Liquid seal
7	Alignment pin
8	Cover screw
9	System cover
10	Eye bolt
11	Spring washer
12	Hexagon bolt
13	Roller bearing
14	Retainer ring
15	Statorpacket
16	Stator housing
17	Gasket
18	Terminal box cover
19	Hexagon nut
20	Hexagon nut
21	Hexagon bolt
22	Stator earth terminal
23	Rotor shaft
24	Key
25	Key
26	Roller bearing
27	Kula-Shim
28	End shield
29	Spring washer
30	Hexagon bolt
31	Shaft seal
32	Fan
33	Retainer ring
34	Fan cowl
35	Hexagon bolt
36	Stator earth terminal
37	Stator housing
38	Hexagon bolt
39	Terminal box cover
40	Gasket
41	Hexagon nut
42	Spring washer
43	Terminal board link
44	Washer
45	Connection disc
46	Clamping unit
47	Allen screw
48	Terminal board
49	Packing piece
50	Hexagon bolt
51	Terminal box
52	Seal
53	Gasket
54	Screwed cable gland
55	Seal
56	Gasket
57	Screwed cable gland

2.1.3 Explosion diagram D11, D13, D16, D18



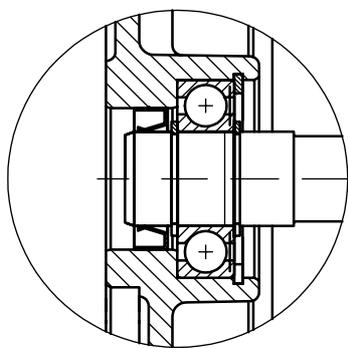


Part	Designation
1	Pinion
2	Liquid seal
3	Alignment pin
4	System cover
5	Eye bolt
6	Spring washer
7	Hexagon bolt
8	Cover screw
9	Centrifugal washer
10	Shaft seal
11	Protective shaft sleeve
12	Retainer ring
13	Roller bearing
14	Retainer ring
15	Statorpacket
16	Stator housing
17	Clamping unit
18	Connection disc
19	Washer
20	Terminal board link
21	Spring washer
22	Hexagon nut
23	Terminal box cover
24	Hexagon bolt
25	Gasket
26	Allen screw
27	Terminal board
28	Hexagon bolt
29	Packing piece
30	Terminal box
31	Stator earth terminal
32	Seal
33	Gasket
34	Screwed cable gland
35	Seal
36	Gasket
37	Screwed cable gland
38	Rotor shaft
39	Key
40	Key
41	Support washer
42	Roller bearing
43	Kula-Shim
44	Shaft seal
45	End shield
46	Spring washer
47	Hexagon bolt
48	Fan
49	Retainer ring
50	Fan cowl
51	Spring washer
52	Hexagon bolt

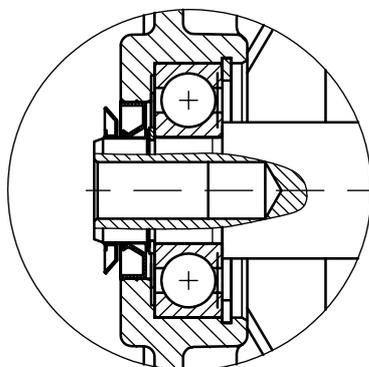
2.2 Rotor shaft seal

Careful fitting with the correct dimensions and position is required for a reliable sealing effect with the maximum possible service life. The oil splash ring arranged additionally on the gear side protects the sealing area from oil escaping through the gearing.

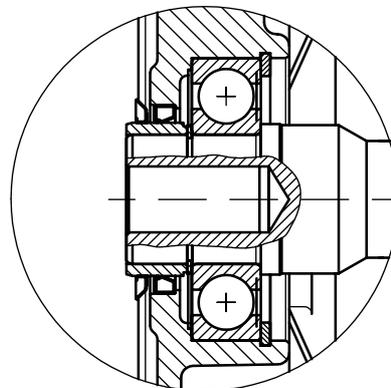
It is also important for the seal to be fitted on the correct side so that the sealing lip is pressed against the shaft by the lubricant pressure. The trailing shaft seal is a wear part and its effect must be tested when the lubricant is changed and replaced if necessary.



D04 - D06



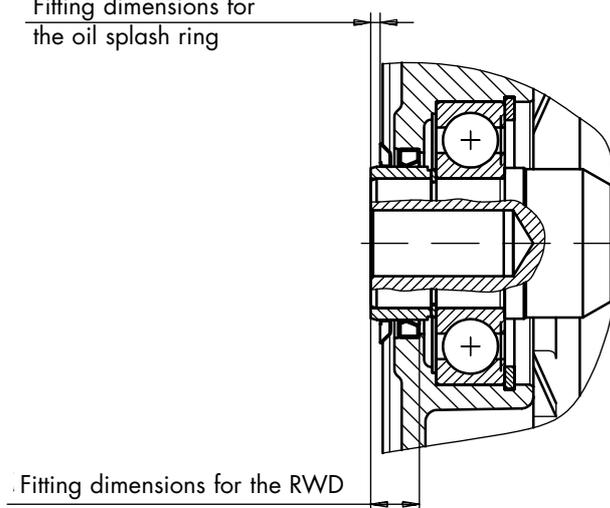
D08 - D11



D13 - D18

2.3 Dismantling and fitting instructions for motors

Fitting dimensions for the oil splash ring



Fitting dimensions for the RWD

Motor Type	Fitting dimension for the oil splash ring	Fitting dimension for the RWD
D04	-	9
D05	-	9
D06	-	9
D08	3	14.5
D09	3	14.5
D11	3.5	16
D13	4	20.5
D16	4	20.5
D18	4	22

2.3.1 Dismantling the motor section

In the case of the motors the motor pinion takes the form of a so-called plug-in pinion with pinion shaft depending on the motor size for shrinking in or shrink glued in the motor rotor shaft. The pinions are removed hydraulically (Fig. 1 and 2). Using an hydraulic pump oil is pressed behind the pinion at a pressure of up to 2800 bar, so that the oil can be pumped out of the rotor shaft. For this we recommend an Enerpac hydraulic pump in accordance with sheet BV7020 A/1. In the case of shrink glue connections the connection should be warmed to approx. 150 degrees C in order to make it easier to press the pinion out.

The Enerpac hydraulic pump covers the area from large to the smallest pinions. For connecting the pump the larger pinions have a thread in the front side of the pinion with through bore in the pinion shaft, into which the connection piece can be screwed directly. (Fig. 1).

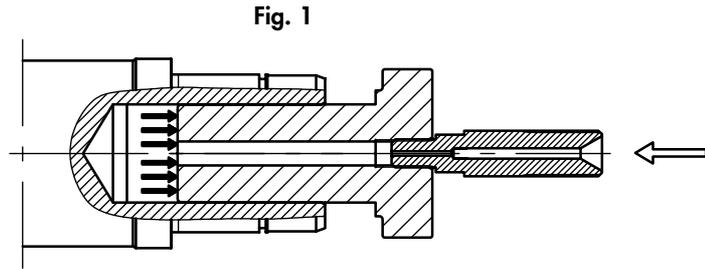


Fig. 1

With the smaller pinions without their own connection thread the threaded bore is inserted behind the pinion seat into the rotor shaft (Fig. 2)

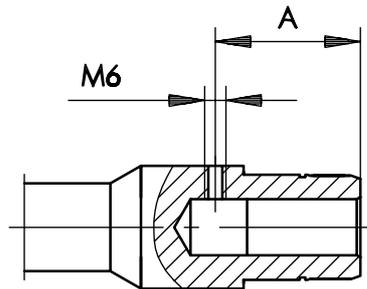
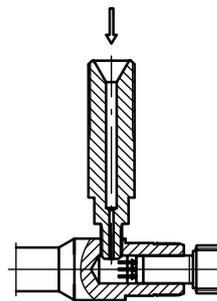


Fig. 2

“Position of the thread for connection piece connection”

Typ	A (mm)
D04	25
D05	26
D06	26
D08	40
D09	42

in accordance with the table. To do this, remove the rotor.



Note: Before connecting the hydraulic pump to the appropriate thread in the pinion or in the rotor shaft all cavities must be filled with oil behind the pinion. There must be no air bubbles in the cavity and the pump must be bled. There is the risk particularly with small units that the connection can work loose suddenly due to the high pump pressure. We therefore recommend that the motor shaft and the pinion be suitably secured. Dismantling is easier if the motor pinion is heated to about 100°C. The connection must be sealed with an appropriate sealant, for example Teflon strip.

2.3.2 Assembling the motor section

In the case of motors with sealing ring running sleeve it must be fitted before the shaft sealing ring is inserted.

Important: Ensure that the sealing ring running surface is flawless and undamaged. Replace the running sleeve if the running surface is damaged!

2.3.2.1 Shrink connection

Fitting the pinions is made easier by heating the bore to 150°C maximum and cooling the pinion to -194°C using liquid nitrogen, or dry ice, cold spray or a refrigerator. In doing so and if necessary and especially when cooling the pinion with the substitute coolants press again.

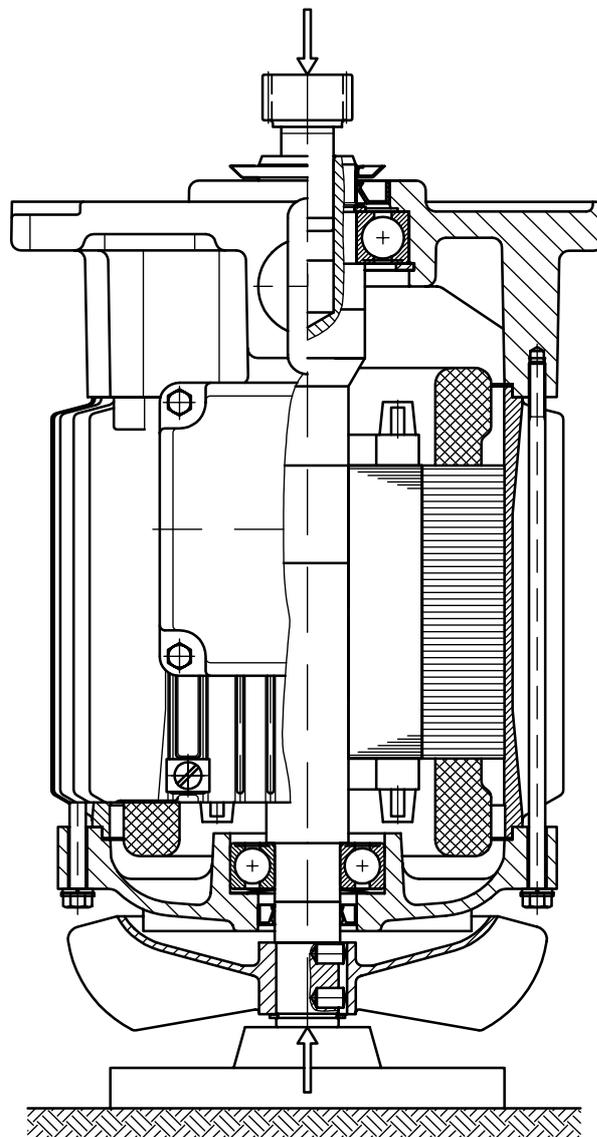
2.3.2.2 Shrink glued connection

In this case the pinion is fitted at room temperature. Use Loctite 640 or an equivalent product as adhesive. In doing so ensure that the bore and pinion shaft are covered uniformly. Assemble by pressing in.

Warning: When pressing in or re-pressing the pinions the rotor shaft has to be supported so that no force or shocks to the roller bearing can have an effect (Fig. 3). If the shaft end is extended the support should not be at the end of the shaft itself but using a suitable bush at the shaft collar.

We recommend that the pinion shaft and the bore in the rotor shaft be thoroughly degreased as a matter of course for assembling the pinion.

Fig. 3



In the case of R1 pinions with a outside diameter of the gearwheel smaller than the pinion shaft diameter, the pinion must be fitted to the correct fitting dimension with the appropriate aids.

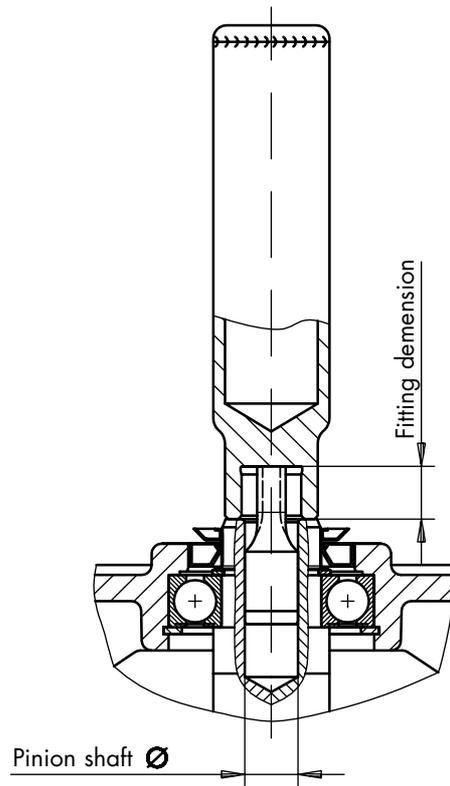


Table with assembly dimension for pinion

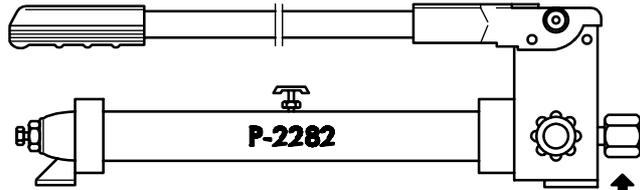
Pinion shaft Ø	Pinion dimension	
	Getr.B.04-B.40	Getr.B.50-B.90
9	16	-
16	16	39
28	16	39
40	-	39
50	-	39

2.3.2.3 Motor housing

In order to guarantee IP65 protection seal the stator with an appropriate sealing compound, e.g. Sikaflex.

2.4 Pull-off device

Pull-off device **BV 7020A/1**



Motors

Rotor shaft

Connector

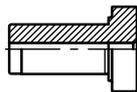
D04
D05
D06
D08
D09



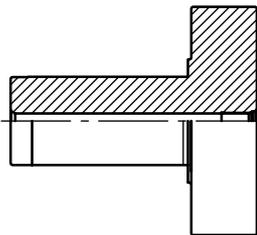
Pinion



D08
D09



D11
D13
D16



D18



BV 522-M6.2



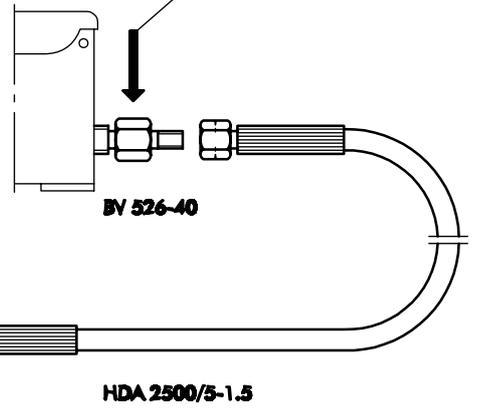
BV 522-M6.2



BV 522-M8.2

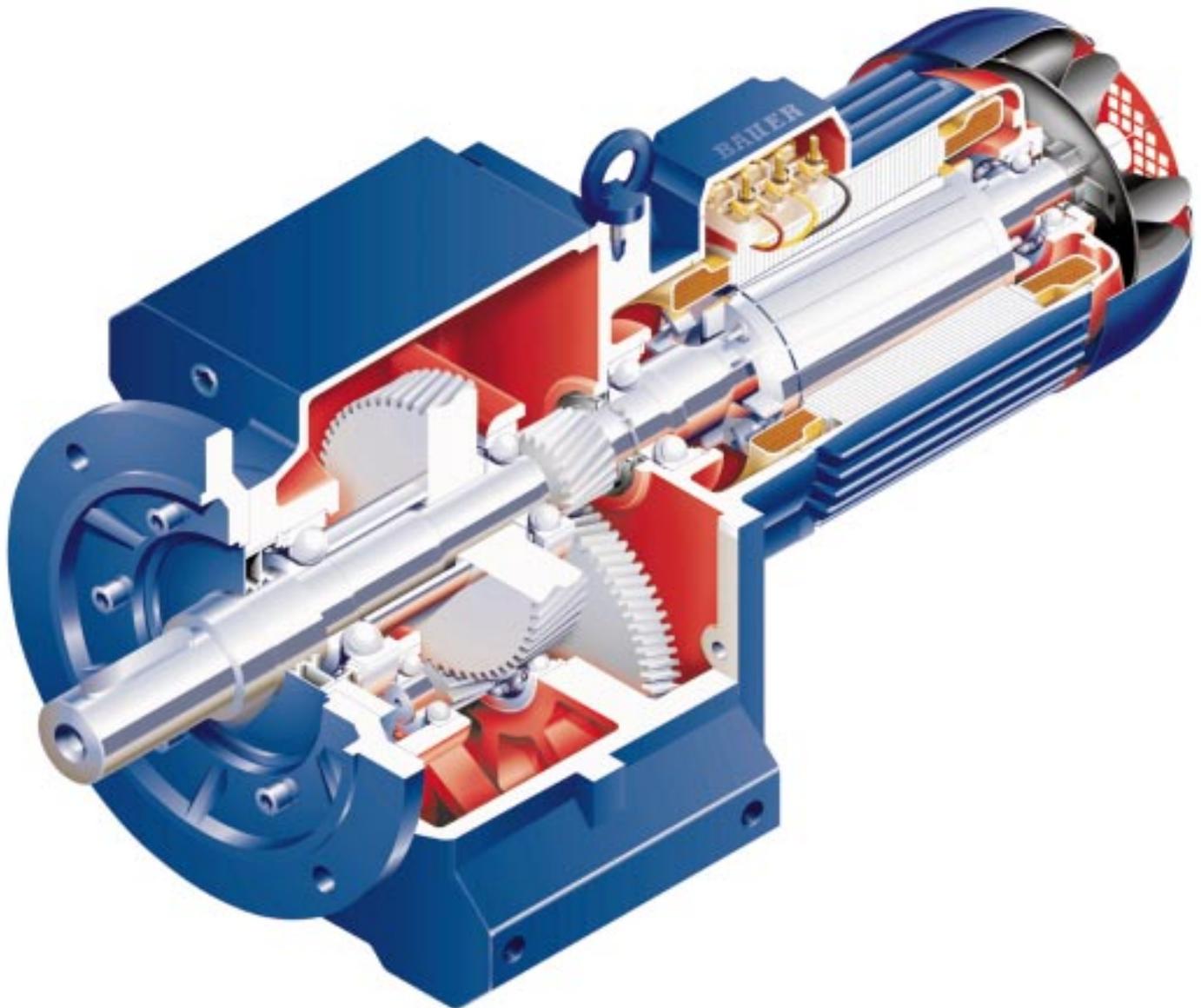


BV 522-M10.2



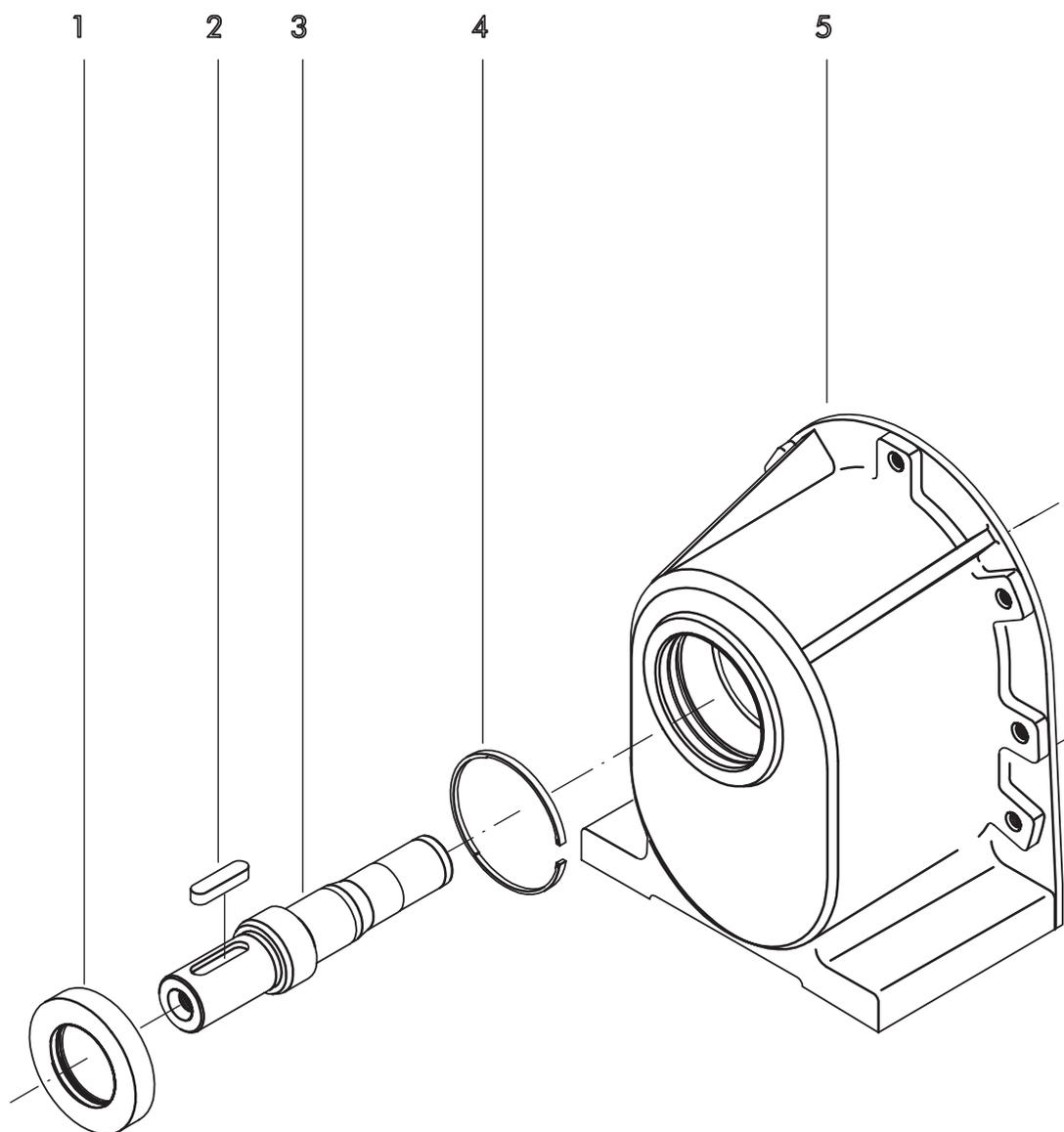
3 BG series helical geared motor

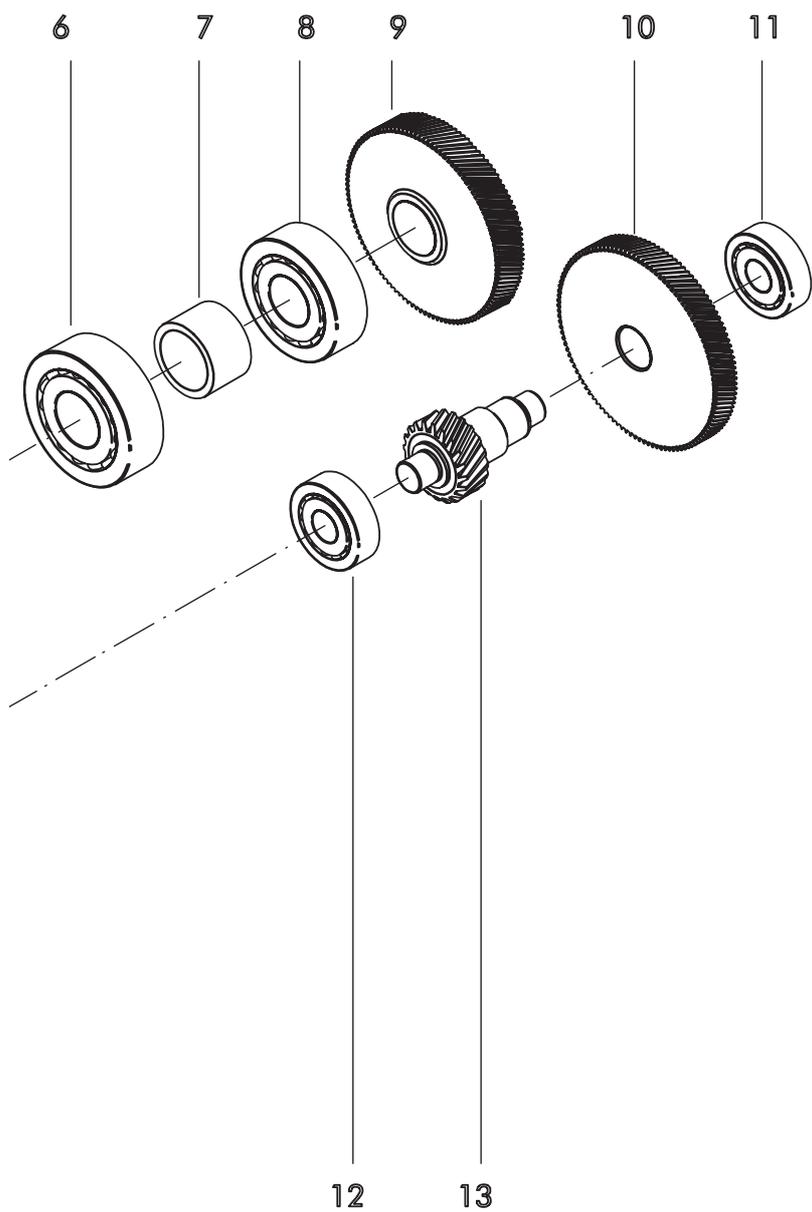
3.1 Section through a Bauer helical geared motor



3.2 Explosion diagrams

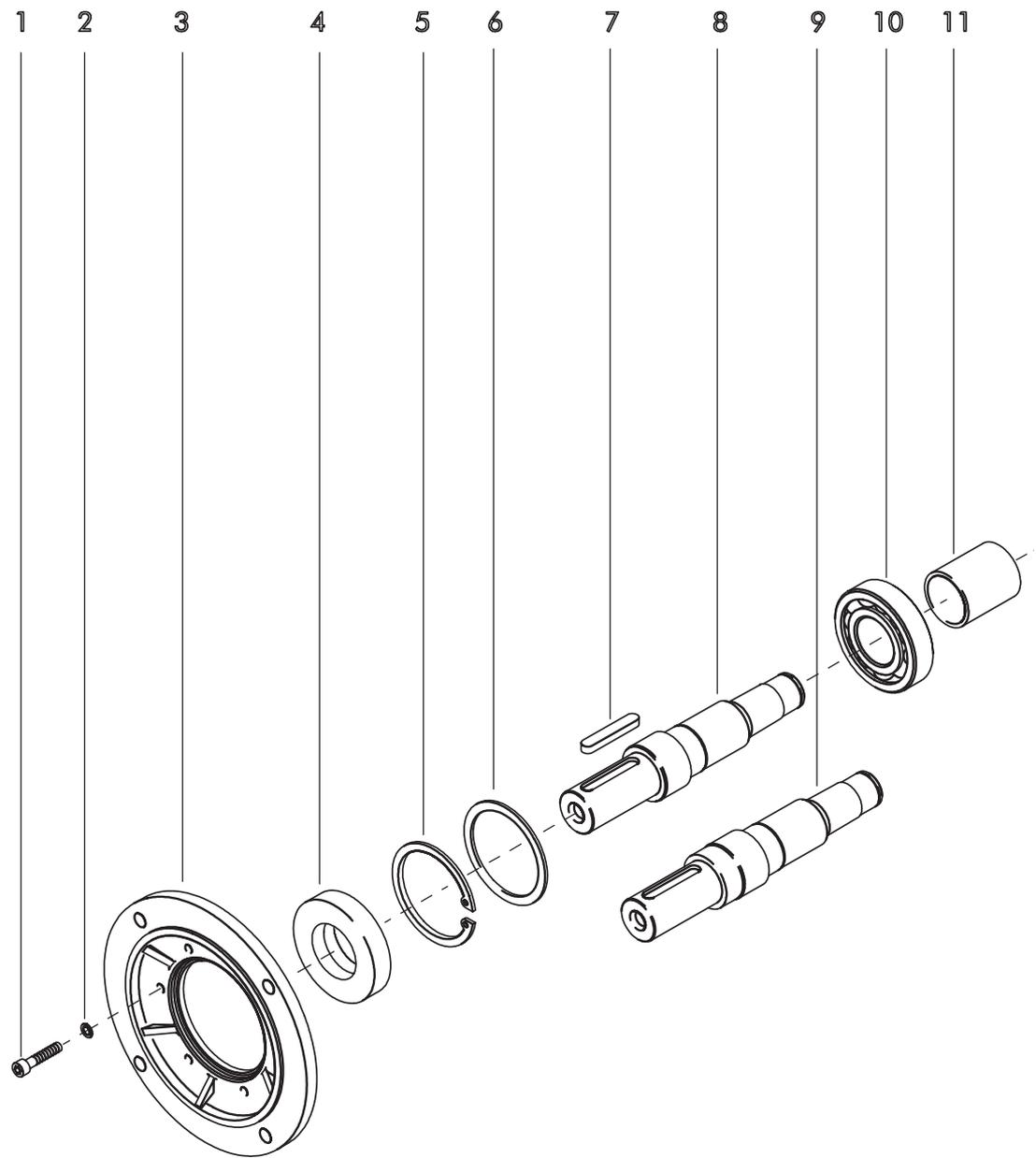
3.2.1 Explosion diagram of helical gears BG04, BG05, BG06

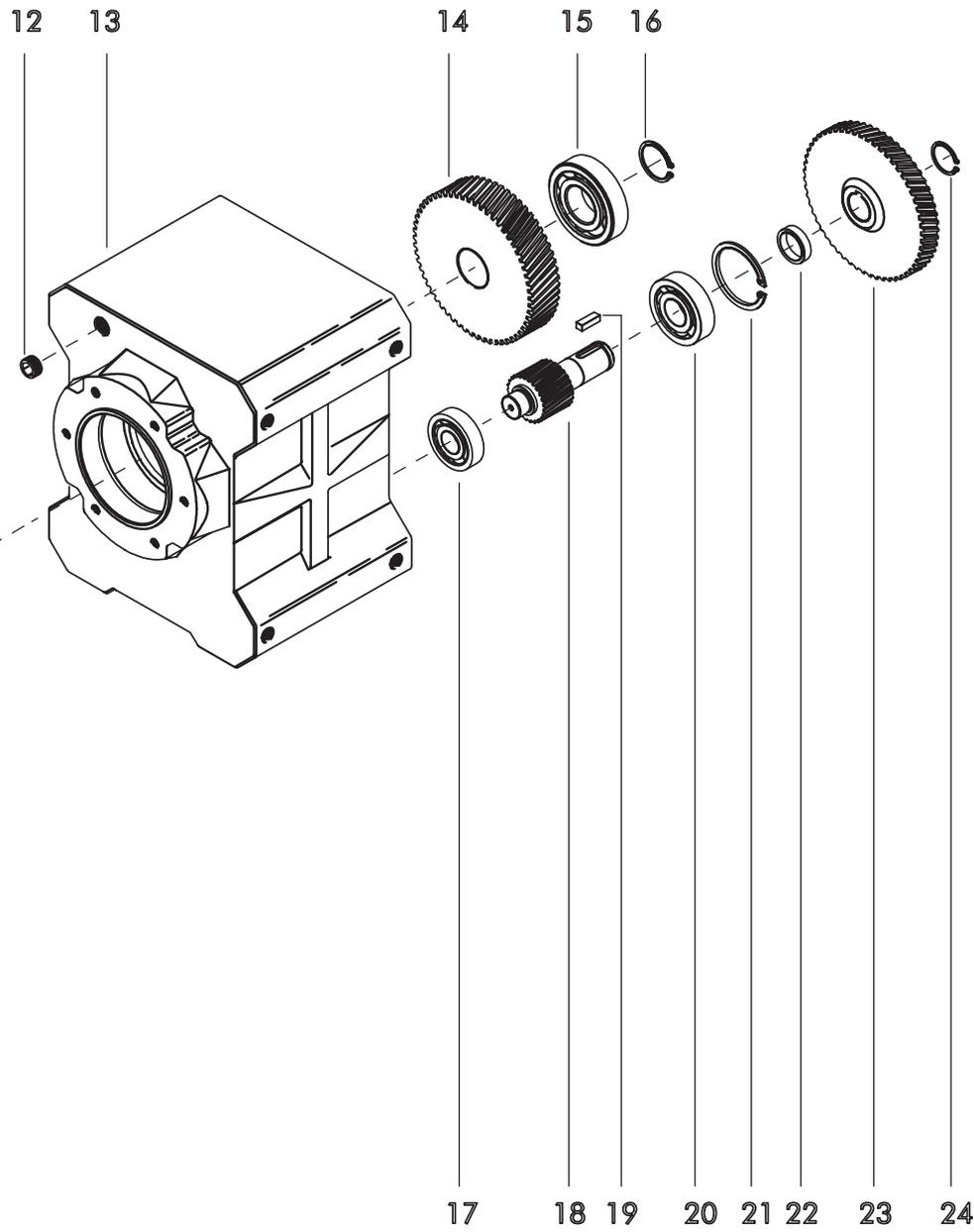




<u>Part</u>	<u>Designation</u>
1	Shaft seal
2	Key
3	Output shaft
4	Retainer ring
5	Gearbox, foot resp. Gearbox, flange
6	Roller bearing
7	Spacer
8	Roller bearing
9	Gear
10	Gear
11	Roller bearing
12	Roller bearing
13	Pinion shaft

3.2.2 Explosion diagram of helical gears BG10, BG20, BG30, BG40, BG50, BG60

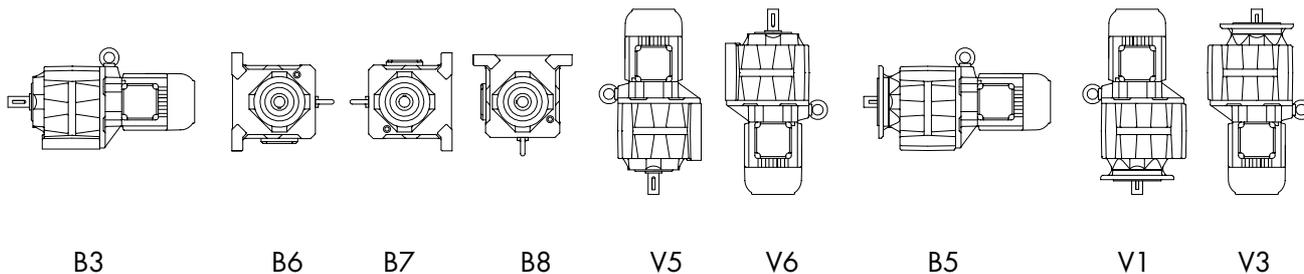




Part	Designation
1	Allen screw
2	Spring washer
3	Flange
4	Shaft seal
5	Retainer ring
6	Support washer
7	Key
8	Solid output shaft
9	Solid output shaft, long
10	Roller bearing
11	Spacer
12	Cover screw
13	Attachment housing / Gearbox, foot
14	Gear
15	Roller bearing
16	Retainer ring
17	Roller bearing
18	Pinion shaft
19	Key
20	Roller bearing
21	Retainer ring
22	Spacer
23	Gear
24	Retainer ring

3.3 Standard fitting positions for helical geared motors

The following fitting positions are defined for BAUER helical geared motors.



3.4 Standard lubricant quantities for helical gears

Lubricant quantity in l or kg

Gear type										
BG10-BG60		H4	H1	H2	H3					
BG04-BG90		B3	B6	B7	B8	V5	V6	B5	V1	V3
BG04		0.05	0.05	0.05	0.05	0.1	0.05	0.03	0.05	0.05
BG05		0.08	0.08	0.08	0.08	0.16	0.08	0.05	0.08	0.08
BG06		0.12	0.12	0.12	0.12	0.24	0.15	0.08	0.15	0.15
Add-on housing	BG10	0.55	0.55	0.55	0.55	0.9	0.75	0.55	0.9	0.75
	Foot housing	0.45	0.45	0.45	0.45	0.75	0.6	0.45	0.75	0.6
Add-on housing	BG20	0.7	0.7	0.7	0.7	1.4	1.0	0.7	1.4	1.0
	Foot housing	0.6	0.6	0.6	0.6	1.2	0.9	0.6	1.2	0.9
Add-on housing	BG30	1.0	1.0	1.0	1.0	2.1	1.4	1.0	2.1	1.4
	Foot housing	0.8	0.8	0.8	0.8	1.55	1.3	0.8	1.55	1.3
BG40		1.7	1.7	1.7	1.7	3.3	2.1	1.7	3.3	2.1
BG50		3.0	3.0	3.0	3.0	5.0	3.3	3.0	5.0	3.3
BG60		5.5	5.5	5.5	5.5	10.9	6.4	5.5	10.9	6.4
BG70		6.5	6.5	6.5	6.5	13.0	9.0	6.5	13.0	9.0
BG80		11.0	11.0	11.0	11.0	22.5	15.0	11.0	22.5	15.0
BG90		19.0	19.0	19.0	19.0	40.0	26.0	19.0	40.0	26.0

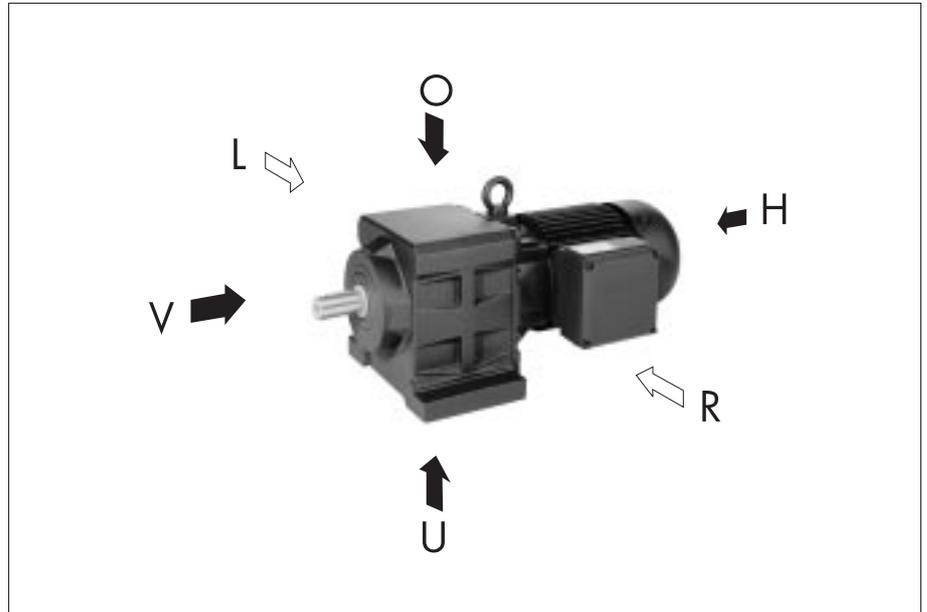
Lubricant quantities and lubricant types should be compared with the rating plate.

3.5 Dismantling and fitting helical gears

3.5.1 Dismantling the gear stage

Remove wheel 2 after draining the lubricant and removing the motor stage. Then remove the radial shaft seals from the output shaft, the circlip and the supporting ring.

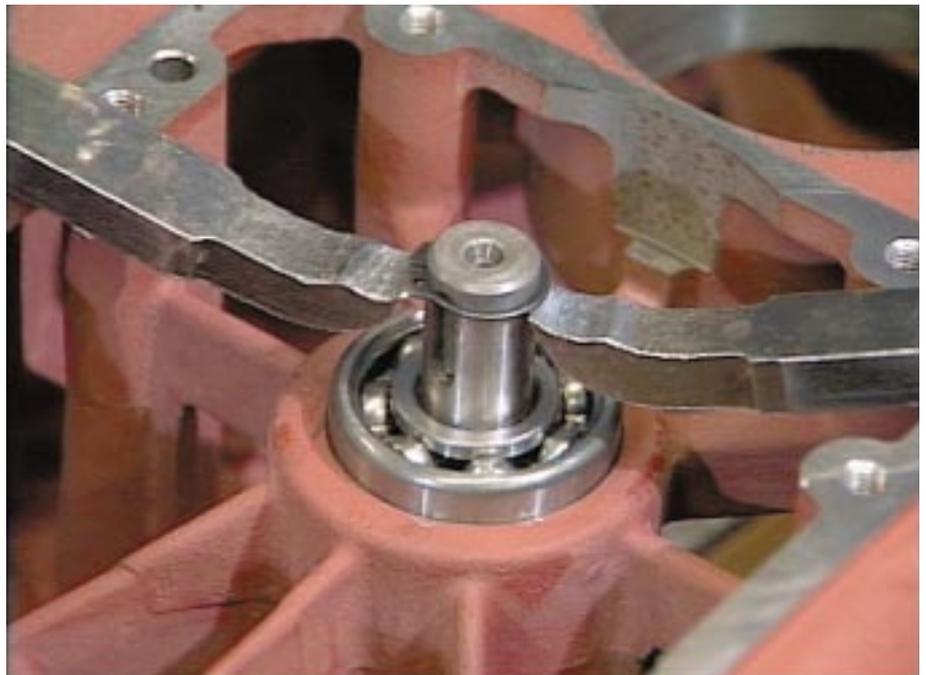
In the case of gear sizes BG10 to BG60 the end wheel/output shaft assembly unit is designed as a shrink connection. To press out the output shaft place the gear vertically on a matching support ring for these sizes.



Important: The support ring must abut the inner ring of the front output shaft bearing.

In the case of gears from BG70 to BG90 the end wheel/output shaft connection is designed as a feather key connection. To press out the output shaft support the end wheel against the housing using suitable stops.





The last component to be removed is the pinion shaft.

3.5.2 Fitting the gear stage

The first component to be fitted is the pinion shaft.

In order to fit the output shaft heat the end wheel to about 160°C. Support the inner output shaft bearing already fitted in the gear using a suitable ring. Make sure that the bearing is positioned a few mm in the direction of the front output shaft bearing.

Note: In the case of gears from BG70 the front output shaft bearing, the spacer sleeve and the feather key for the end wheel are pre-mounted on the output shaft. Before inserting the end wheel place the spacer ring provided for these sizes on the inner output shaft bearing.

After inserting the heated end wheel, fit the output shaft as well as the spacer sleeve and the front output shaft bearing.

Note:

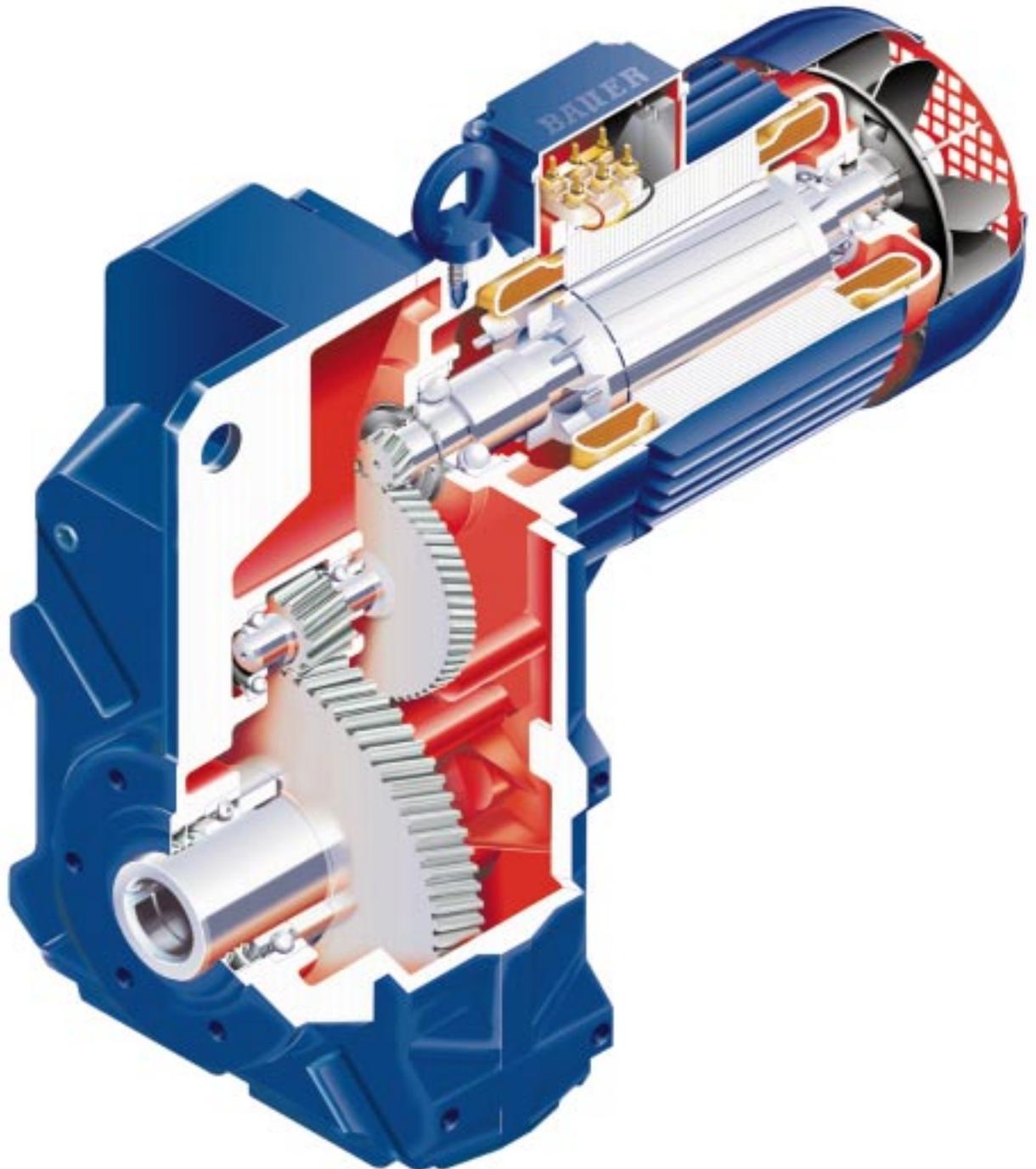
Assembly is much easier if the output shaft is cooled.

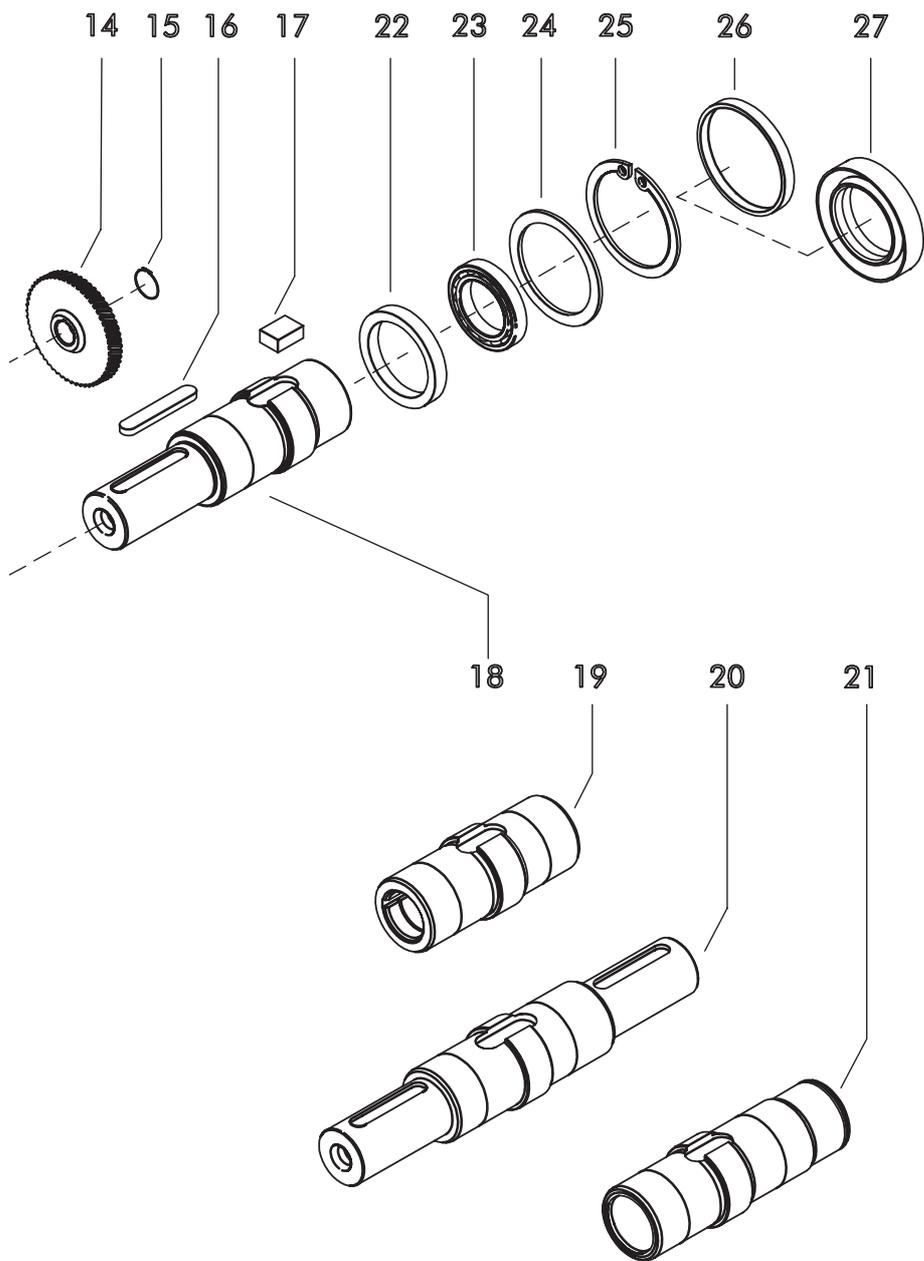
Before fitting the radial shaft seal coat its outer diameter with a slip additive. In the case of a double shaft seal fit both sealing rings together to form one unit. Grease the sealing lips before starting fitting work.

It is advisable to heat the wheel to about 160°C to make it easier to fit wheel 2.

4 BF series shaft mounted geared motors

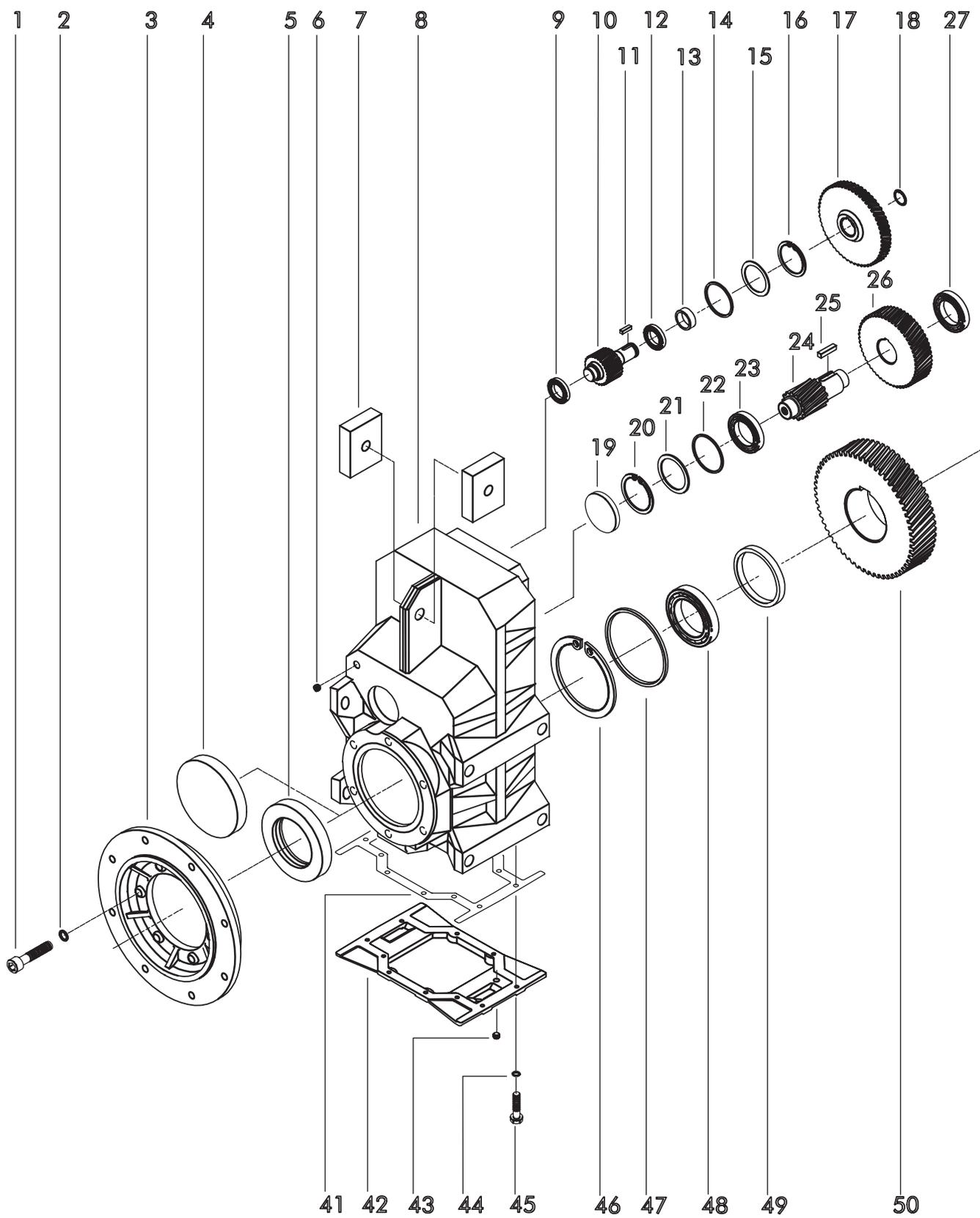
4.1 Section through a Bauer shaft mounted geared motor

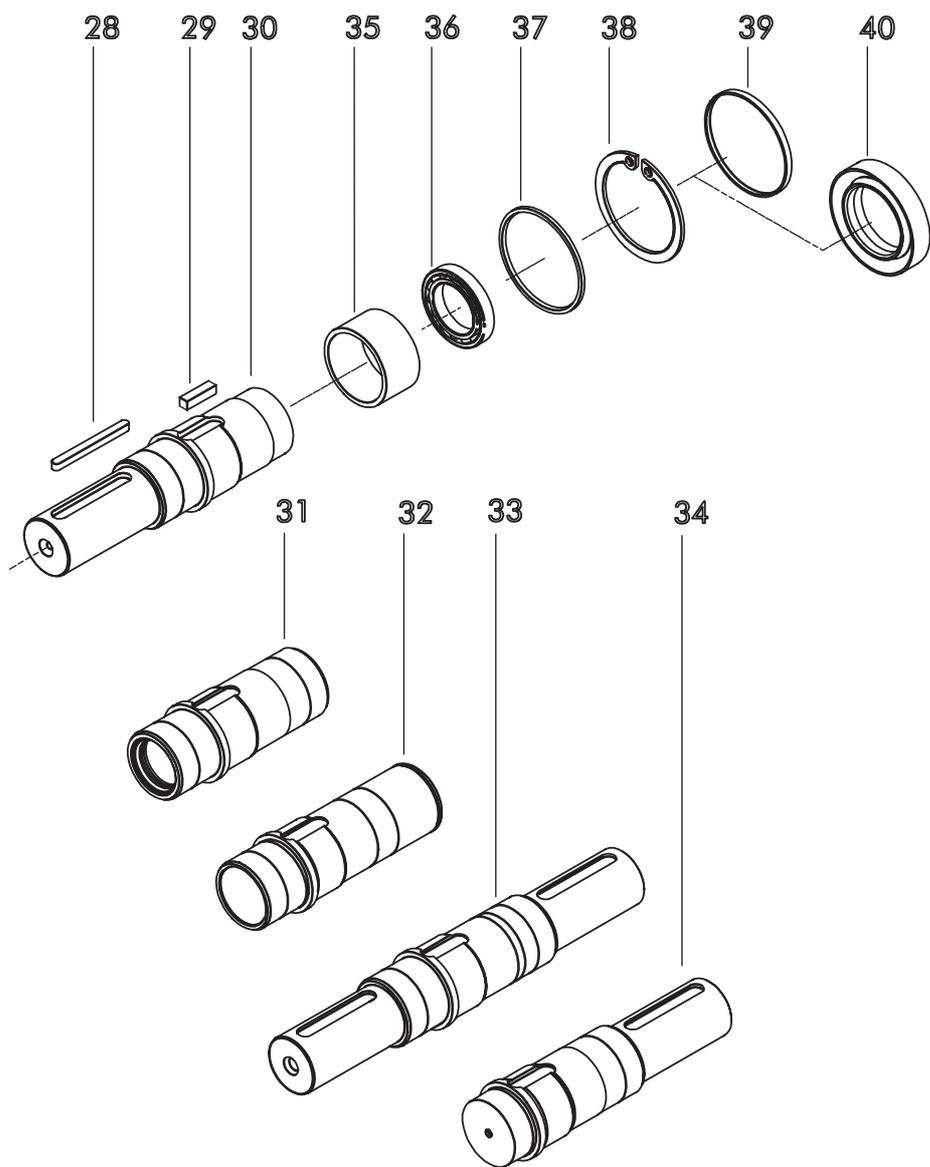




Part	Designation
1	Allen screw
2	Spring washer
3	Flange
4	Shaft seal
5	Cover screw
6	Attachment housing
7	Rubber puffer
8	Roller bearing
9	Pinion
10	Key
11	Roller bearing
12	Retainer ring
13	Spacer
14	Gear
15	Retainer ring
16	Key
17	Key
18	Solid output shaft, one side
19	Hollow shaft with keyway
20	Solid output shaft, both sides
21	Hollow shaft for shrink disk
22	Spacer
23	Roller bearing
24	Support washer
25	Retainer ring
26	Sealing cover
27	Shaft seal
28	Liquid seal
29	System cover
30	Cover screw
31	Hexagon bolt
32	Spring washer
33	Roller bearing
34	Spacer
35	Gear

4.2.2 Explosion diagram 3-stage shaft mounted gear BF80 and BF90

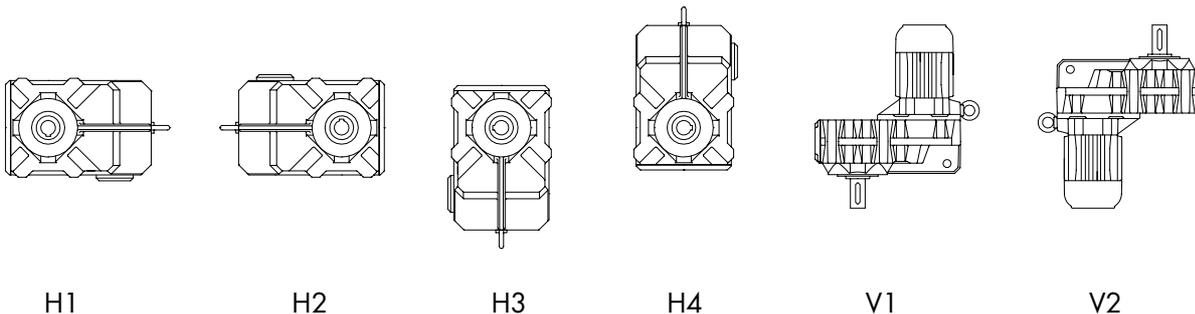




Part	Designation
1	Allen screw
2	Spring washer
3	Flange
4	Sealing cover
5	Shaft seal
6	Cover screw
7	Rubber puffer
8	Attachment housing
9	Roller bearing
10	Pinion shaft
11	Key
12	Roller bearing
13	Spacer
14	Support washer
15	Tuning package
16	Retainer ring
17	Gear
18	Retainer ring
19	Sealing cover
20	Retainer ring
21	Tuning package
22	Support washer
23	Roller bearing
24	Pinion shaft
25	Key
26	Gear
27	Roller bearing
28	Key
29	Key
30	Solid output shaft V
31	Hollow shaft with keyway
32	Hollow shaft for shrink disk
33	Solid output shaft, both sides
34	Solid output shaft H
35	Spacer
36	Roller bearing
37	Support washer
38	Retainer ring
39	Sealing cover
40	Shaft seal
41	Liquid seal
42	System cover
43	Cover screw
44	Spring washer
45	Hexagon bolt
46	Retainer ring
47	Tuning package
48	Roller bearing
49	Spacer
50	Gear

4.3 Standard fitting positions

The following standard fitting positions are defined for Bauer shaft mounted geared motors.



4.4 Quantities of lubricant for shaft mounted gears

Lubricant quantity in l or kg

Gear type	Lubricant quantity in l or kg					
	H1	H2	H3	H4	V1	V2
BF10	0.85	0.85	0.85	1.1	1.45	1.5
BF20	1.3	1.3	1.3	1.7	2.2	2.25
BF30	1.7	1.7	1.7	2.2	2.9	3.0
BF40	2.7	2.7	2.7	3.5	4.6	4.8
BF50	3.8	3.8	3.8	5.0	6.5	6.7
BF60	6.7	6.7	6.7	9.0	11.6	12.0
BF70	12.2	12.2	12.2	16.0	22.3	21.8
BF80	17.0	17.0	17.0	21.0	31.7	27.5
BF90	32.0	32.0	32.0	41.0	61.0	53.0

Lubricant quantities and lubricant types should be compared with the rating plate.

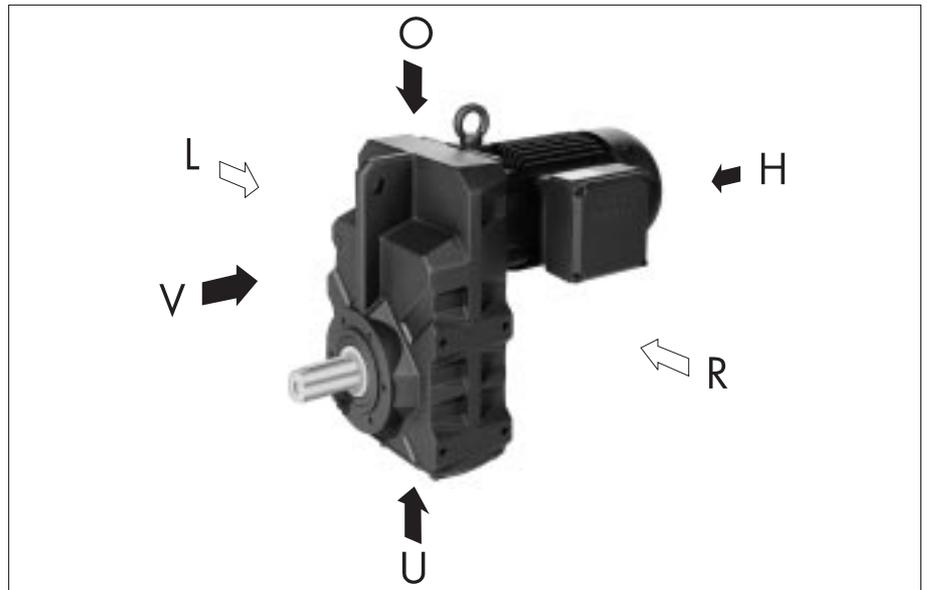
4.5 Dismantling and assembly instructions for shaft mounted gears

4.5.1 Dismantling the gear section

After draining the lubricant and dismantling the motor section R2 can be removed. After that the shaft seal and the sealing cap on the output shaft, the circlip and supporting disk should be removed.

In order to press out the output shaft the gear is placed vertically on a suitable supporting ring. The end wheel must also be supported on the inside of the housing using two adapted shims.

The output shaft can not be pressed out in the direction of gear side H. After removing the inner gear parts the pinion shaft can also be removed.



Warning:

From size BF80 the gears are 3-stage.

It should be noted here that the pinion shaft 2 (R5) must be dismantled before removing the pinion shaft 3 (R3). In doing so, the toothed wheel (R4) on the pinion shaft must also be supported against the housing using suitably adapted shims.

4.5.2 Assembling the gear section

The first item to be fitted again is the pinion shaft 3 (R3).

In order to fit the output shaft the output bearing on gear side V is first fitted in the housing. The spacer sleeve is then placed in the inner bearing ring and placed on the end wheel which has been heated to approx. 160°C.

Bearing, spacer sleeve and end wheel must be aligned in the middle in order to fit the output shaft. The second spacer sleeve and the second output shaft bearing is now fitted. Supporting ring, circlip and shaft sealing rings or sealing cap must also be fitted.

In the case of the 3-stage BF, from gear size BF80, the pinion shaft 2 (R5) and R4 must be fitted before the end wheel is fitted. The R4 should also be heated here for easier fitting.

In the case of tapered roller bearings ensure as a matter of principle that these are adjusted again so that they are free from play using the matching shims that have been removed.

Advice:

The shaft seal and the sealing cap must be fully lubricated at the outer diameter with a lubricant before fitting.

In the case of a double shaft seal both sealing rings should be fitted together in one block.

In order to fit R2 more easily we recommend that the wheel be heated to about 160°C.

Cooling the output shaft and pinion shaft also makes fitting easier.

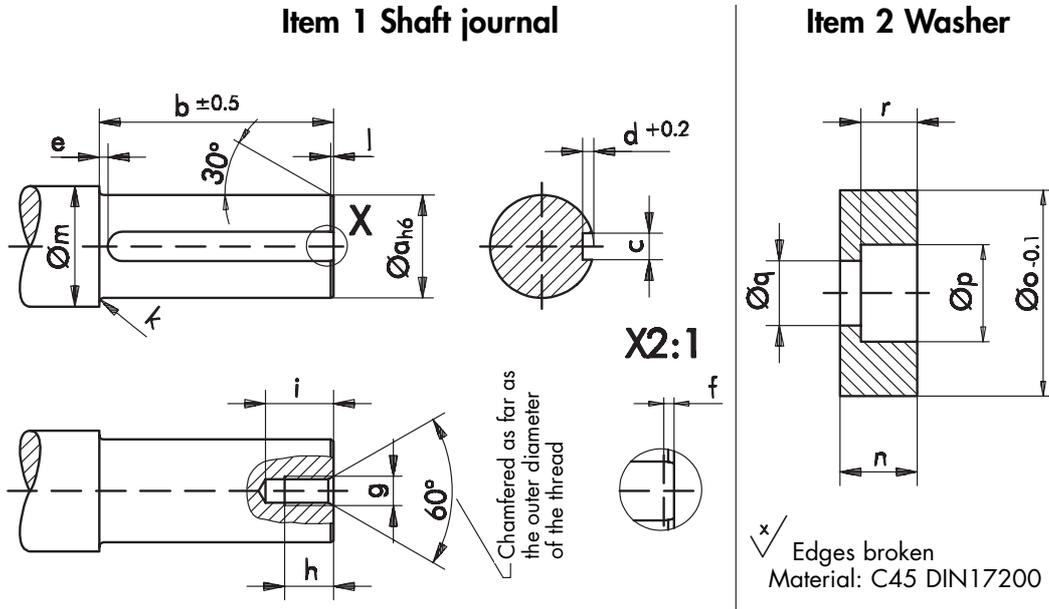
4.6 Assembly aid for shaft-mounted execution with hollow shaft and keyway

Assembly: The threaded bolt is screwed into the front thread of the shaft to be driven. The shaft-mounted gear is pressed onto the shaft using the nut via the thrust member and the circlip.

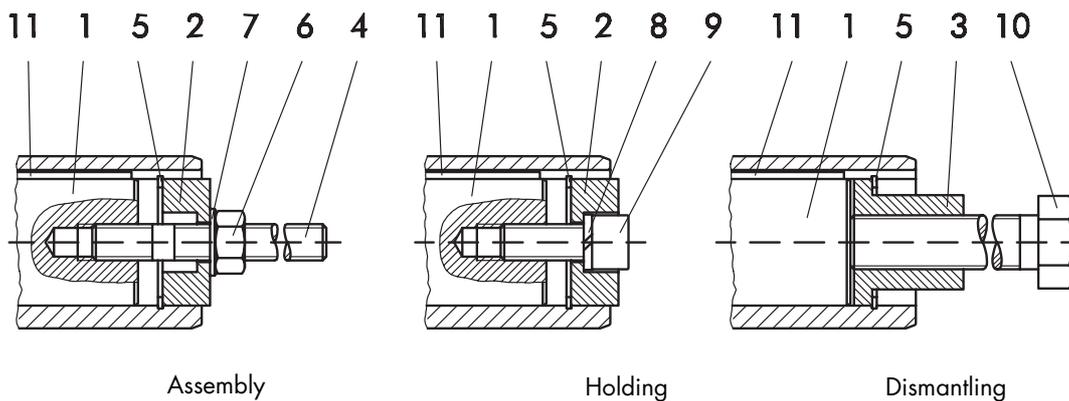
Retaining: The thrust member is rotated and pulled up to the circlip using the fixing screw.

Dismantling: The push-off piece is inserted between the shaft front and circlip. The push-off screw presses against the shaft front and draws off the shaft-mounted gear.

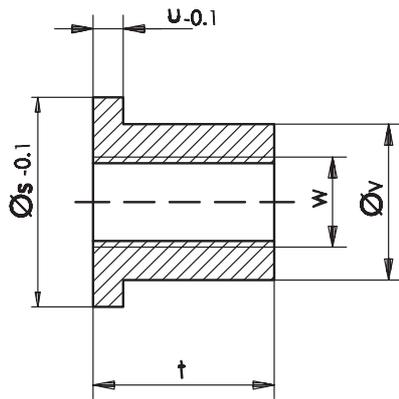
Assembly drawing T2010/1. The parts are not supplied.



Type	Dimensions																
	Item 1 Shaft journal											Item 2 Washer					
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
BF10	25	102	8	4	5	2	M8	18	24	2,5	1,5	33	13,5	24,8	15	9	8,5
BF20	30	108	8	4	5	2	M10	20	26	3	1,5	38	15	29,8	18	11	10
BF30	35	118	10	5	5	2	M10	20	26	3	1,5	43	16	34,8	18	11	10
BF40	40	141	12	5	5	2	M12	22	29	3	2	48	18	39,8	20	13,5	12
BF50	50	148	14	5,5	6	3	M16	30	37	3,5	2	58	21	49,8	26	17,5	15
BF60	60	173	18	7	6	3	M20	38	46	3,5	2	68	24	59,8	33	22	18
BF70	80	205	22	9	8	4	M20	38	46	4	2	90	27	79,8	33	22	20
BF80	100	317	28	10	8	5	M24	45	54	4	3	110	32	99,8	40	26	25
BF90	120	383	32	11	8	6	M24	45	54	4,5	3	130	35	119,8	40	26	28

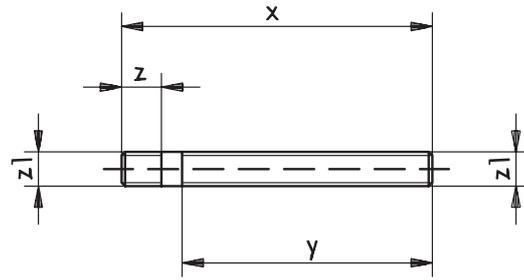


Item 3 Sleeve



^x Edges broken
Material: C45 DIN17200

Item 4 Threaded bolt

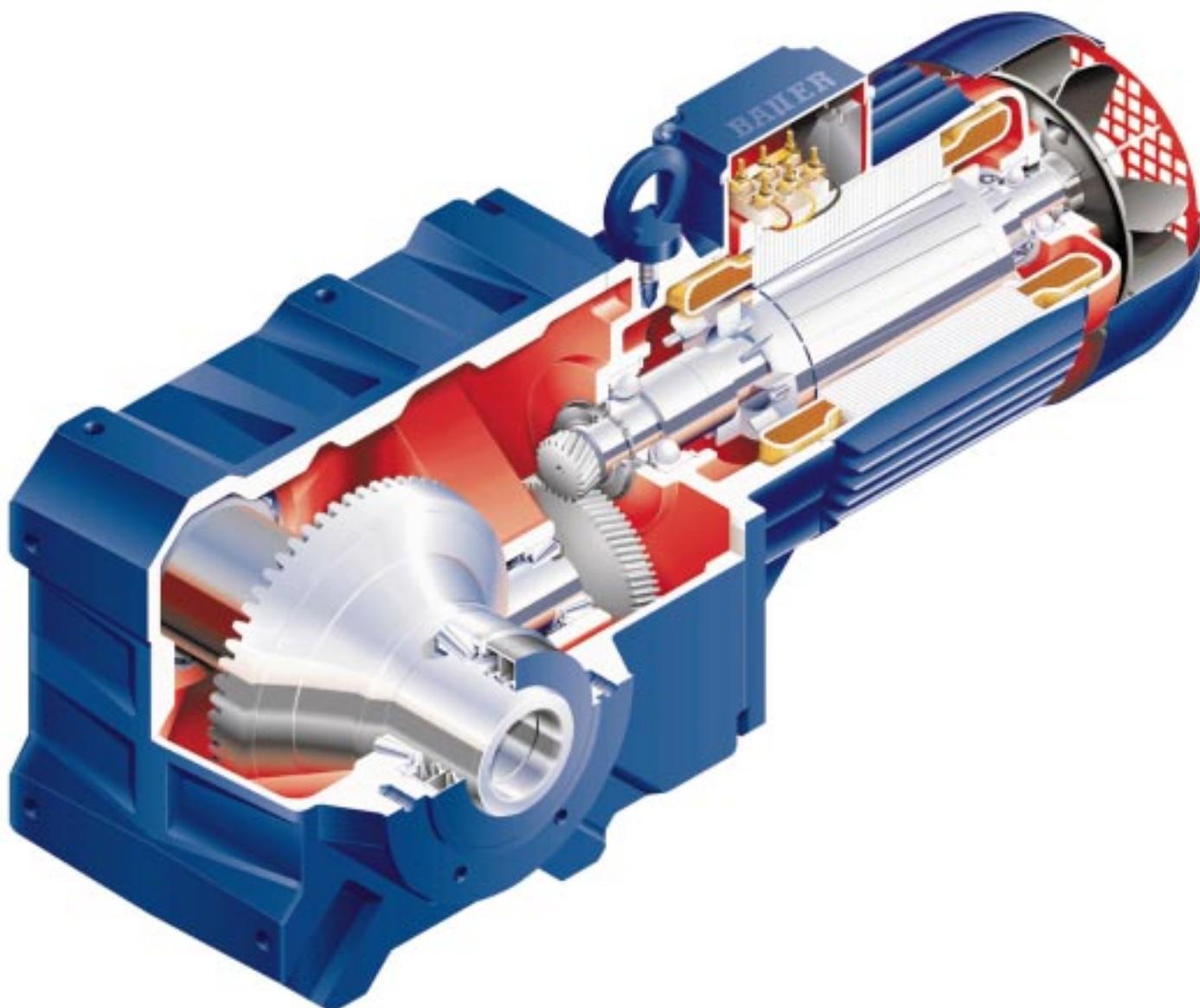


Material: steel, tensile strength $\geq 1000 \text{ N/mm}^2$
Thread rolled

Type	Dimensions										Circlip DIN 472	Nut DIN 9348	Washer DIN 125-S1	Spring washer DIN 7980	Cylinder screw DIN 9128.8	Hexagon screw DIN 933.8.8	Key DIN 6885 Width x Height x Length
	Item 3, Sleeve					Item 4, Threaded bolt											
	s	t	u	v	w	x	y	z	z1	Item 5							
BF10	24,8	24	5	16	M12	160	130	20	M8	25x1,2	M8	8,4	8	M8x30	M12x140	AB 8x7x95	
BF20	29,8	28	5	20	M14	170	135	23	M10	30x1,2	M10	10,5	10	M10x30	M14x150	AB 8x7x101	
BF30	34,8	28	5	23	M14	180	145	23	M10	35x1,5	M10	10,5	10	M10x35	M14x160	AB 10x8x111	
BF40	39,8	40	6	31	M20	210	170	28	M12	40x1,75	M12	13	12	M12x35	M20x200	AB 12x8x134	
BF50	49,8	48	6	36	M24	230	175	37	M16	50x2,0	M16	17	16	M16x40	M24x210	AB 14x9x139	
BF60	59,8	60	6	44	M30	270	205	45	M20	60x2,0	M20	21	20	M20x50	M30x250	AB 18x11x164	
BF70	79,8	60	8	55	M30	310	240	45	M20	80x2,5	M20	21	20	M20x50	M30x280	AB 22x14x193	
BF80	99,8	72	10	75	M36	440	360	55	M24	100x3,0	M24	25	24	M24x60	M36x410	AB 28x16x304	
BF90	119,8	72	10	80	M36	510	430	55	M24	120x4,0	M24	25	24	M24x60	M36x480	AB 32x18x369	

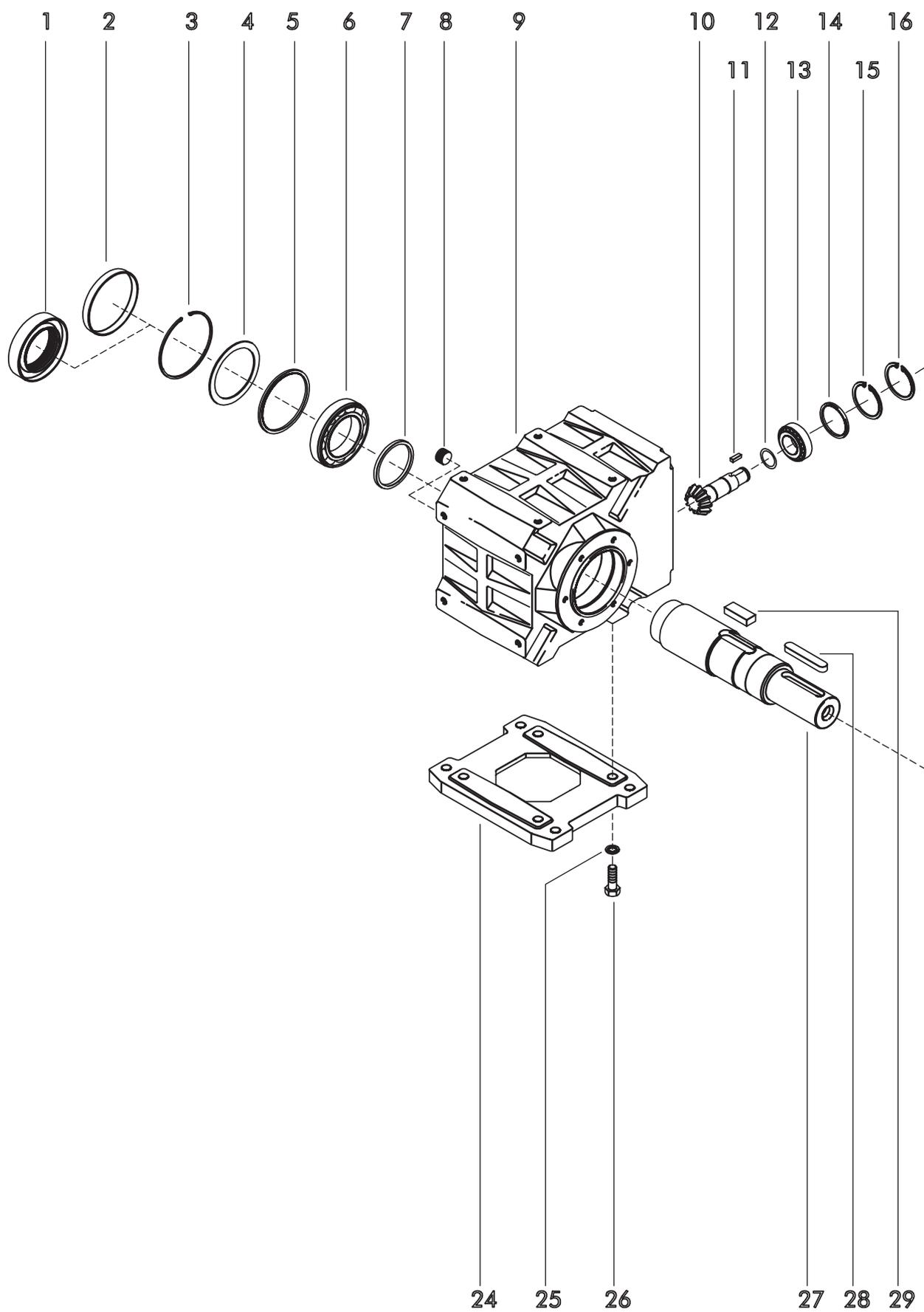
5 BK series bevel geared motors

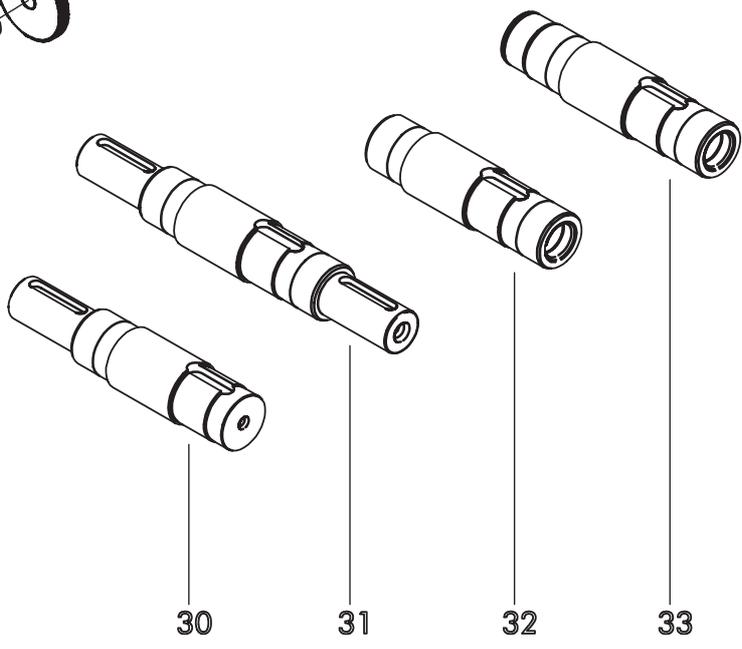
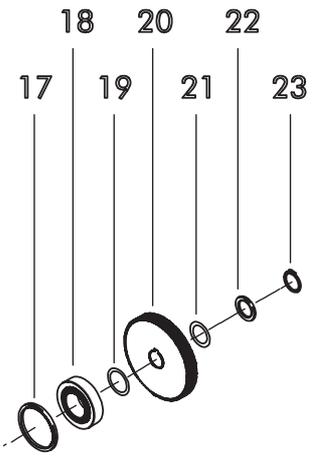
5.1 Section through a BAUER bevel geared motor



5.2 Explosion diagrams

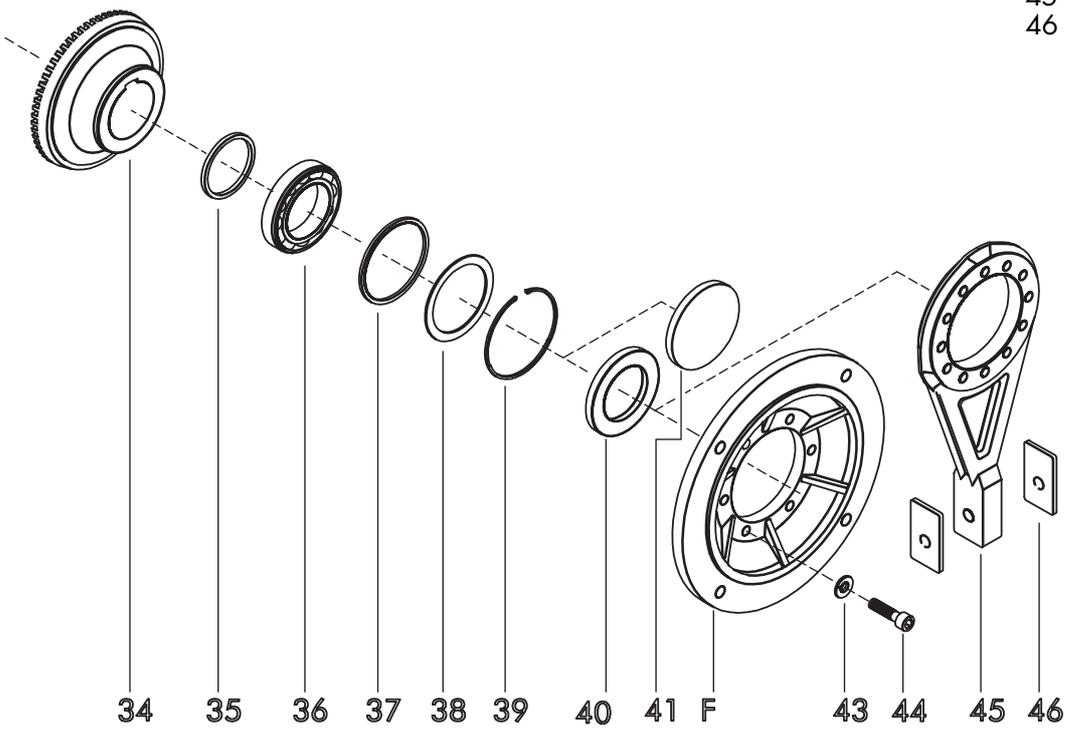
5.2.1 Explosion diagram of 2-stage bevel gears BK10, BK20, BK30, BK40, BK50



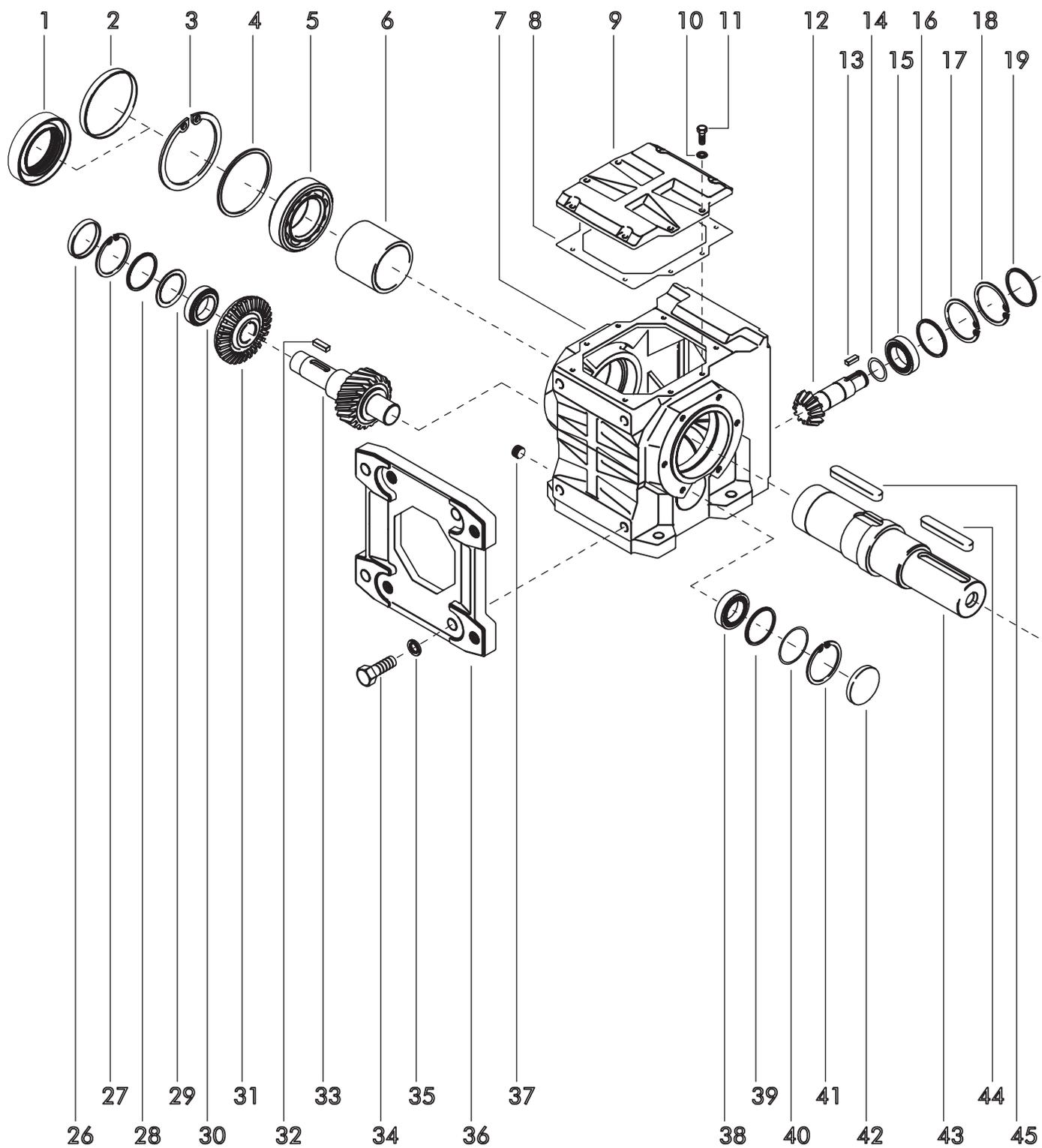


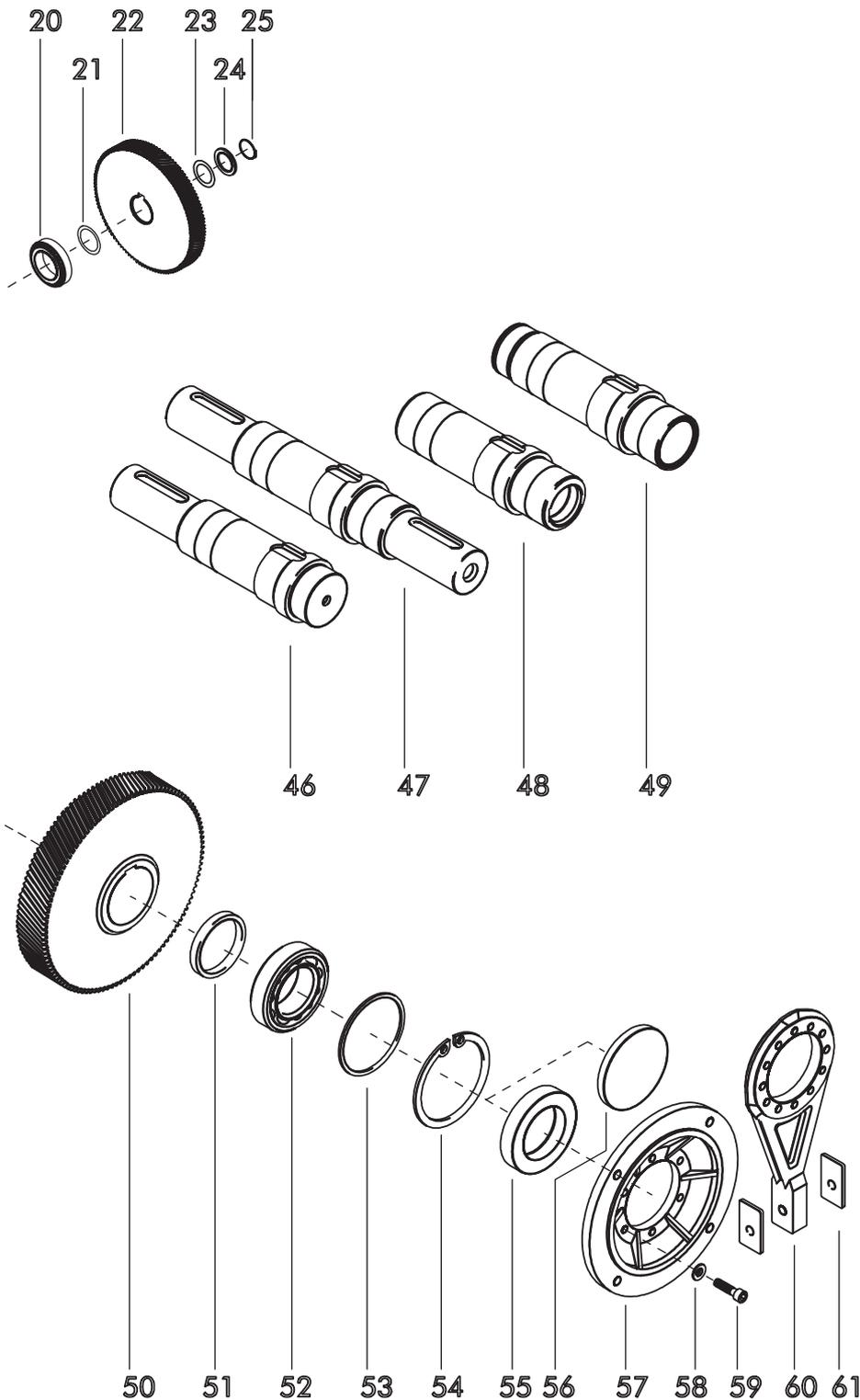
Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Tuning package
5	Support washer
6	Roller bearing
7	Spacer
8	Cover screw
9	Attachment housing

10	Conical pinion
11	Key
12	Tuning package
13	Roller bearing
14	Support washer
15	Retainer ring
16	Retainer ring
17	Support washer
18	Roller bearing
19	Tuning package
20	Gear
21	Tuning package
22	Support washer
23	Retainer ring
24	Foot plate
25	Spring washer
26	Hexagon bolt
27	Solid output shaft V
28	Key
29	Key
30	Solid output shaft H
31	Solid output shaft, both sides
32	Hollow shaft with keyway
33	Hollow shaft for shrink disk
34	Bevel gear
35	Spacer
36	Roller bearing
37	Support washer
38	Tuning package
39	Retainer ring
40	Shaft seal
41	Sealing cover
42	Flange
43	Spring washer
44	Allen screw
45	Torque restraining arm
46	Rubber puffer



5.2.2 Explosion diagram of 3-stage bevel gears BK60, BK70, BK80, BK90

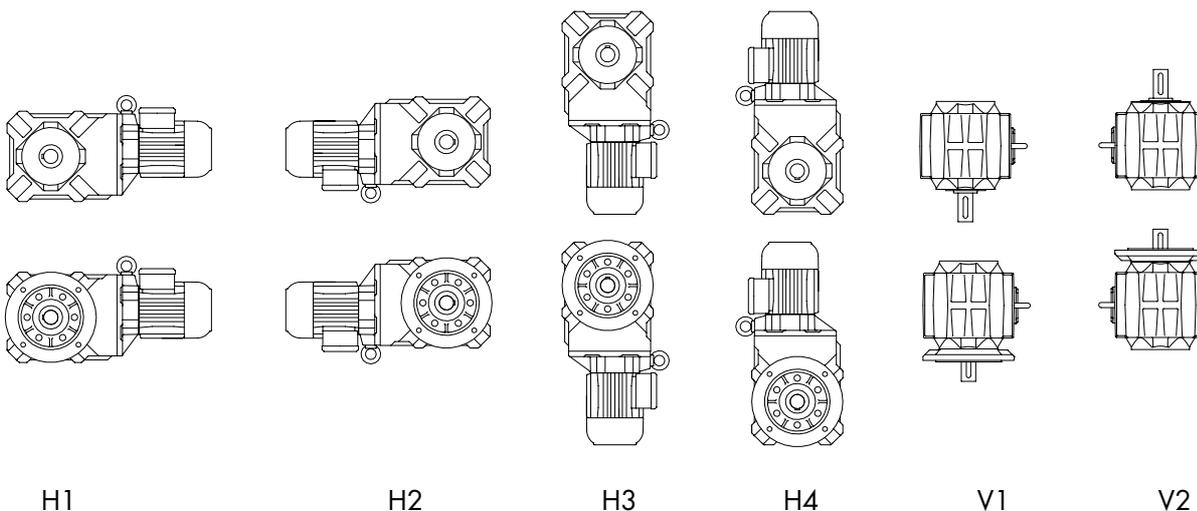




Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Support washer
5	Roller bearing
6	Spacer
7	Attachment housing
8	Liquid seal
9	System cover
10	Spring washer
11	Hexagon bolt
12	Conical pinion
13	Key
14	Tuning package
15	Roller bearing
16	Support washer
17	Retainer ring
18	Retainer ring
19	Support washer
20	Roller bearing
21	Tuning package
22	Gear
23	Tuning package
24	Tuning package
25	Retainer ring
26	Sealing cover
27	Retainer ring
28	Tuning package
29	Support washer
30	Roller bearing
31	Bevel gear
32	Key
33	Pinion shaft
34	Hexagon bolt
35	Spring washer
36	Foot plate
37	Cover screw
38	Roller bearing
39	Support washer
40	Tuning package
41	Retainer ring
42	Sealing cover
43	Solid output shaft V
44	Key
45	Key
46	Solid output shaft H
47	Solid output shaft, both sides
48	Hollow shaft with keyway
49	Hollow shaft for shrink disk
50	Gear
51	Spacer
52	Roller bearing
53	Support washer
54	Retainer ring
55	Shaft seal
56	Sealing cover
57	Flange
58	Spring washer
59	Allen screw
60	Torque restraining arm
61	Rubber puffer

5.3 Standard fitting position for bevel geared motors

The following standard fitting positions are defined for BAUER bevel geared motors.



5.4 Standard lubricant quantities for bevel gears

Lubricant quantity in l or kg

Gear type	Lubricant quantity in l or kg					
	H1	H2	H3	H4	V1	V2
BK10	0.83	0.83	0.92	1.65	0.92	0.92
BK20	1.5	1.5	1.6	2.8	1.65	1.65
BK30	2.2	2.2	2.3	4.2	2.4	2.4
BK40	3.5	3.5	3.5	6.7	3.7	3.7
BK50	5.8	5.8	5.8	11.0	6.0	6.0
BK60	6.0	8.7	6.9	11.7	8.6	8.6
BK70	10.2	15.0	11.5	21.2	13.5	14.5
BK80	18.0	25.5	19.0	37.0	23.5	25.5
BK90	33.0	48.0	36.0	70.7	45.0	48.0

Lubricant quantities and lubricant types should be compared with the rating plate.

5.5 Removing and fitting bevel gears

5.5.1 Dismantling the gear stage

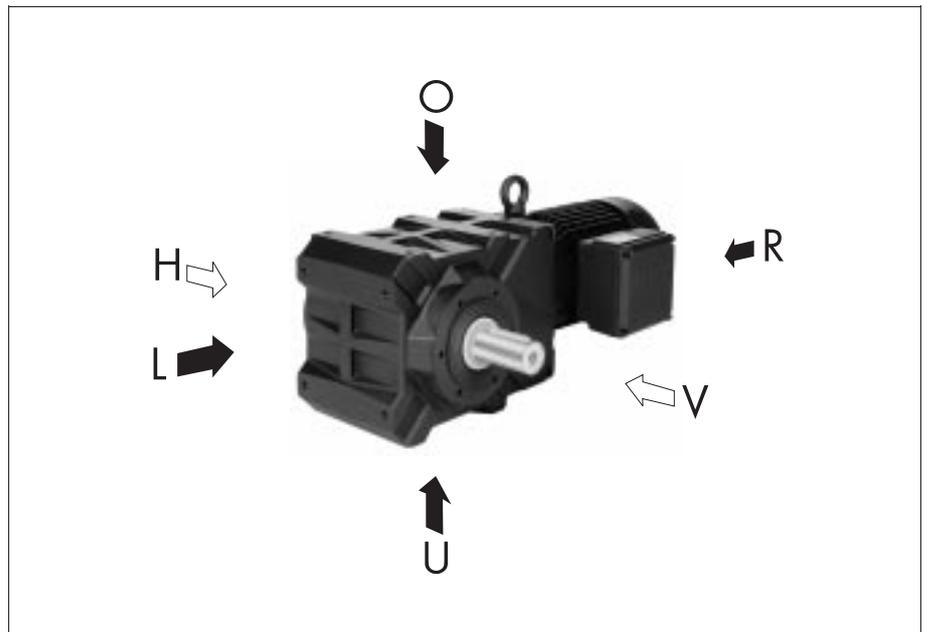
Remove wheel 2 after draining the lubricant and removing the motor stage. Then remove the radial shaft seal and the sealing cap on the output shaft, the circlips and supporting ring with matching packet.

To press out the output shaft move it together with the bevel wheel in the direction of gear side V until they touch a stop that can be felt. The bevel gear stage teeth are then disengaged.

In this position support the bevel gear with appropriately prepared elements against the gear housing so that no harmful pressure can act on the bevel pinion when pressing out the output shaft.

Press out the output shaft in the direction of gear side H.

Then remove the bevel pinion shaft together with bearing.



Note:

The bevel gears are 3-stage from size BK60.

Before removing the bevel gear stage dismantle the output shaft. To do this, support the end wheel using suitable stops against the gear housing. Then press out the output shaft in the direction of gear side V.



To remove the bevel gear remove the sealing caps, circlips and support disks. Now move the pinion shaft together with bevel wheel in the direction of gear side H as far as the stop so that the teeth are disengaged. After removing the feather key from wheel 2, carefully push the bevel pinion into the gear as far as it will go. After pulling the pinion shaft back remove the outer bearing and the circlips for both pinion shaft bearings. then pull the pinion shaft out together with the inner bearing.

Now push pinion shaft 2 with bevel wheel back again and tilt the complete pinion shaft out of the bearing and remove it through the assembly opening.

5.5.2 Fitting the gear stage

It is important for the gear stage to be fitted so that it can function correctly, which involves trouble-free running of the bevel gear stage (tooth edge play, appearance of the bearing surface after bedding in) in particular. This is only guaranteed once the bevel gear stage has been matched precisely in relation to its position in the gear housing with the aid of adjusting washers.

If the position of the bevel gear or of the bevel pinion in the gear alters due to new components (see matching diagram), then re-matching and therefore a fresh definition of the actual dimensions for the matching packets is required.

These can be calculated with the aid of equations in accordance with matching plan BK-AR1 for BK10 to BK50 and BK-AR2 for BK60 to BK90. The nominal dimensional variations required for the calculation are shown in the measuring points listed in the matching plan.

Note:

The bevel gear stage must be replaced as a unit due to paired wheel sets.

The pinions can be fitted more easily if they are heated and cooled alternately.

Now fit the bevel pinion again as the first step in accordance with the corresponding matching plan. To do this, pre-assemble the inner bearing without the outer bearing ring but together with the computed matching packet on the pinion shaft.

Important: The matching packet must be pressed in between the pinion shaft shoulder the inner bearing ring so that there is no play

Now place the outer ring for bearing 1 in the housing as well as the supporting rings and the circlips.

Fit the outer bearing ring for bearing 2 and insert the pre-assembled pinion shaft into the bearing from the inside, then push on the heated inner ring for bearing L2 (approx. 150°C) so that there is no play.

By rotating the pinion shaft several times make sure that the rollers about the bevel roller bearings to achieve play-free running of the pinion shaft.

Fit the bevel gear in accordance with the matching plan. Again, make sure that there is no play after fitting as described for the bevel pinion.

Important: The torsional backlash must be between 0.05 mm and 0.25 mm as a minimum.

Now fit the output shaft in the case of the 3-stage gear sizes.

Fit the output shaft bearing with supporting ring and circlip on gear side H and then inert spacer sleeve and heated end wheel and fit the output shaft. It is advisable to heat the inner ring for the fitted bearing beforehand.

Finally, fit the front bearing with supporting ring and circlip.

If the output shaft bearing is reinforced adjust the bevel roller bearings with the matching packets so that there is no play.

Note:

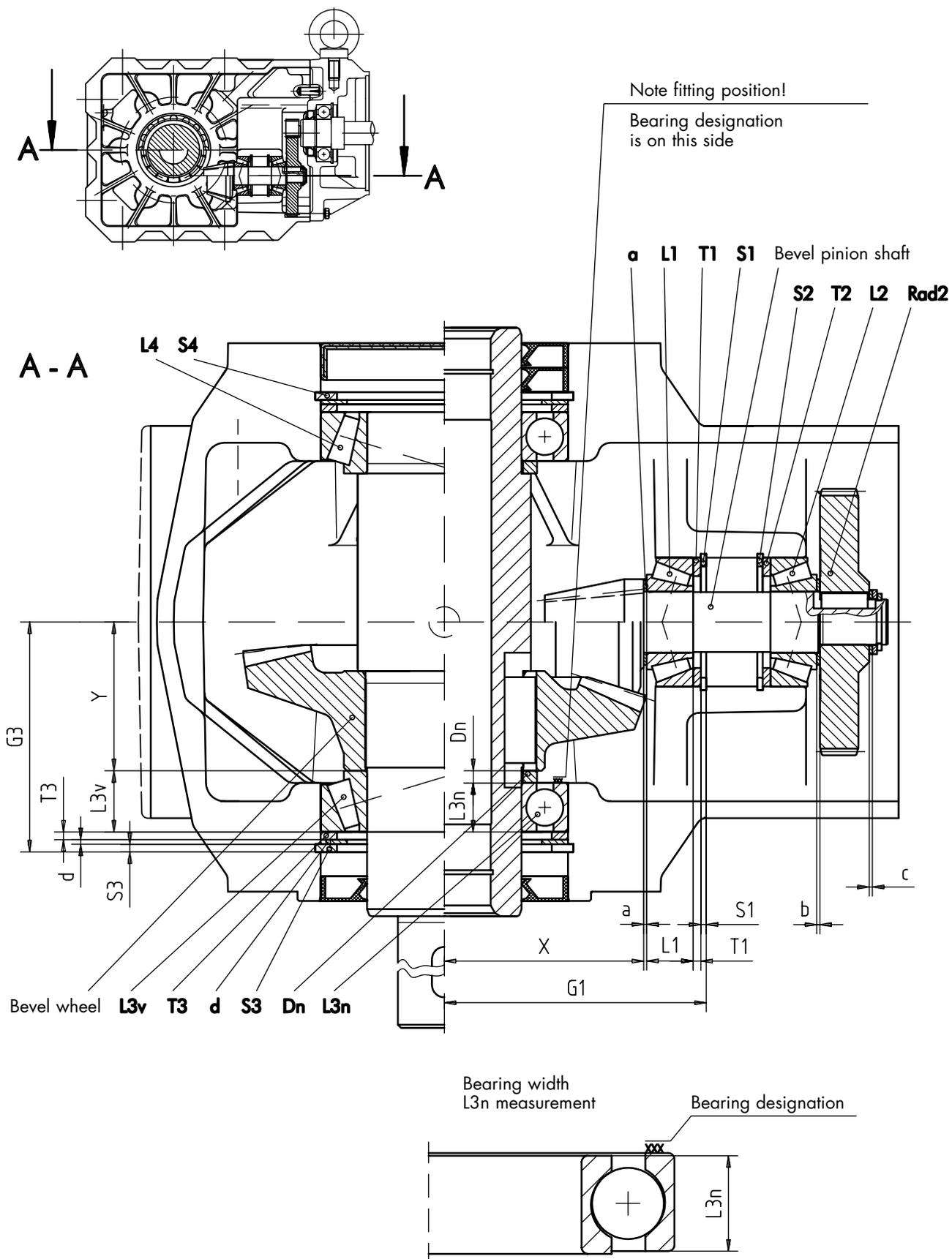
Coat the shaft sealing rings and sealing caps on the outer jacket with a slip additive to make fitting easier.

In the case of a double shaft seal both sealing rings should be fitted together in one unit. Grease the sealing lips before fitting.

It is advisable to heat wheel 2 to about 160°C to make fitting easier.

As a matter of principle: Cool the output shaft and pinion shaft to make fitting easier.

5.5.3 Matching and fitting two-stage bevel gears BK10, BK20, BK30, BK40, BK50



Measure points:

- Dn measured at spacer sleeve
- G1 measured at housing
- G3 measured at housing
- L1 measured at bearing
- L3n measured at bearing
- L3v measured at bearing
- S1 measured at circlip
- S3 measured at circlip
- T1 measured at supporting ring
- T3 measured at supporting ring
- X nominal dimension \pm inscribed deviation at bevel pinion shaft
- Y nominal dimension \pm inscribed deviation at bevel wheel
- Play standard value

Assembly instructions for bevel pinion:

- 1.) Fit circlip S1, supporting ring T1 and outer ring bearing L1 in the housing.
 - 2.) Coord. dimension $a = G1 - (X + L1 + T1 + S1)$
 - 3.) Draw matching packet a and inner ring bearing L1 onto bevel pinion shaft; fit in housing.
 - 4.) Fit circlip S2, supporting ring T2 and bearing L2 so that there is no play.
 - 5.) Select thickness of matching packet so that enclosure is flush with shaft shoulder.
 - 6.) Insert key. draw wheel 2 up as far as top on shaft shoulder and matching packet b.
 - 7.) Fill space between wheel 2 and circlip with matching washers and supporting ring.
- Attention: Fit supporting ring against circlip!

Nominal Dimensions

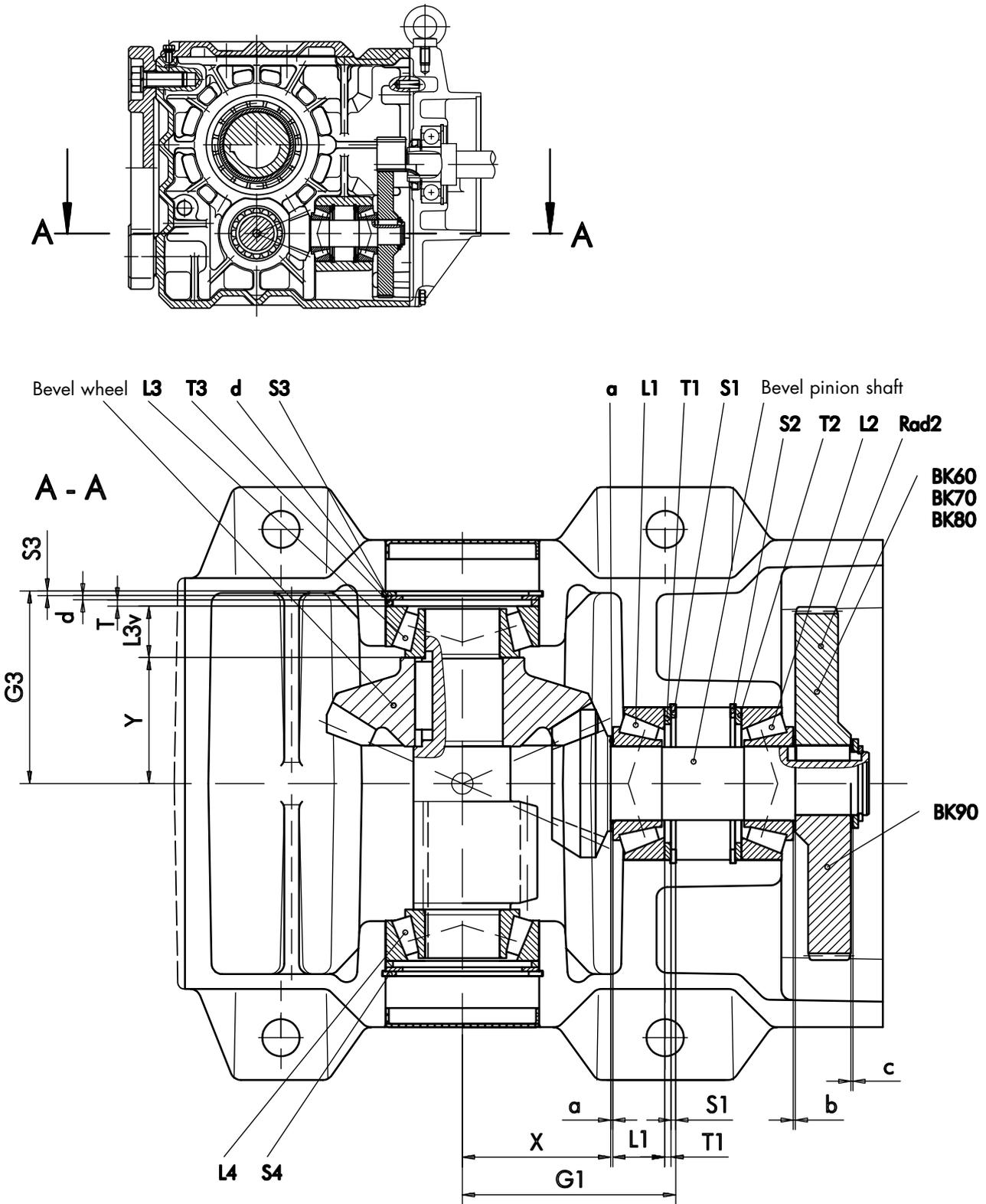
BK	10	20	30	40	50
Dn	*)	4	5	5	5
G1	71	84.75	94.25	111.5	128
G3	64.5	75.5	87	104	111
L1	13.25	15	15	17	18
L3n	16	16	18	18	20
L3v	-	20	23	23	25
S1	1.6	1.6	1.6	1.85	1.85
S3	2.2	2.2	2.7	2.7	3.7
T1	2	2.5	2.5	3	3
T3	3	3	3.5	3.5	3.5
X	53	64.5	74	88.5	104
Y	41.5	48.5	56	73	77
a	1.15				
b	1.15				
c	1.1	1.1	1.1	1.15	1.2
d	1.8				

*) Spacer sleeve n/a for standard bearing

Assembly instructions for bevel wheel:

- 8.) Shaft sealing ring(s), circlip S3, matching packet d, supporting ring T3 and bearing L3 in this sequence. Position spacer sleeve Dn for normal bearing (L3n).
Attention: The 1mm thick matching washer must fit against the circlip!
Standard bearing:
Matching dimension $d = G3 - (Y + L3n + Dn + T3 + S3)$
Reinforced bearing:
Matching dimension $d = G3 - (Y + L3v + T3 + S3)$
- 9.) Insert bevel wheel in housing and place on fitted parts.
- 10.) Fit output shaft (and spacer sleeve for standard bearing) and bearing L4 so that there is no play.
- 11.) Fill space between bearing L4 and circlip S4 with matching washer and supporting ring.
Attention: Fit supporting ring against bearing L4!
1mm thick matching washer must fit against circlip!

5.5.4 Matching and fitting three-stage bevel gears BK60, BK70, BK80, BK90



Measure points:

- G1 measured at housing
- G3 measured at housing
- L1 measured at bearing
- L3v measured at bearing
- S1 Nominal thickness circlip
- S3 Nominal thickness circlip
- T1 measured at supporting ring
- T3 measured at supporting ring
- X nominal dimension ± inscribed deviation at bevel pinion shaft
- Y nominal dimension ± inscribed deviation at bevel wheel

Assembly instructions for bevel pinion:

- 1.) Fit circlip S1, supporting ring T1 and outer ring bearing L1 in the housing.
 - 2.) Coord. dimension $a = G1 - (X + L1 + T1 + S1)$
 - 3.) Draw matching packet a and inner ring bearing L1 onto bevel pinion shaft; fit in housing.
 - 4.) Fit circlip S2, supporting ring T2 and bearing L2 so that there is no play.
 - 5.) Select thickness of matching packet so that enclosure is flush with shaft shoulder.
 - 6.) Insert key. draw wheel 2 up as far as top on shaft shoulder and matching packet b.
 - 7.) Fill space between wheel 2 and circlip with matching washers and supporting ring.
- Attention: Fit supporting ring against circlip!

Nominal Dimensions

BK	60	70	80	90
G1	100.1	126.1	156.35	191.35
G3	90.75	103.25	127	150
L1	24.25	24.75	35	41
L3v	24.25	27.25	35	41
S1	2.2	2.7	2.7	3.7
S3	2.2	2.7	2.7	3.7
T1	3	3.5	3.5	3.5
T3	3	3.5	3.5	3.5
X	69.5	94	114	142
Y	59.5	68	84	100
a	1.15			
b	1.5	1.5	1.5	1.5
c	1	1	1.2	1.2
d	1.8			

Assembly instructions for bevel wheel:

- 8.) Shaft sealing ring(s), circlip S3, matching packet d, supporting ring T3 and bearing L3 in this sequence fit in.
Attention: The 1mm thick matching washer must fit against the circlip!
Coord. dimension:
Matching dimension $d = G3 - (Y + L3v + T3 + S3)$
- 9.) Insert bevel wheel in housing and place on fitted parts.
- 10.) Fit pinion shaft (R5) and bearing L4 so that there is no play.
- 11.) Fill space between bearing L4 and circlip S4 with matching washer and supporting ring.
Attention: Fit supporting ring against bearing L4!
1mm thick matching washer must fit against circlip!

5.6 Assembly advice for shaft-mounted execution with hollow shaft and keyway

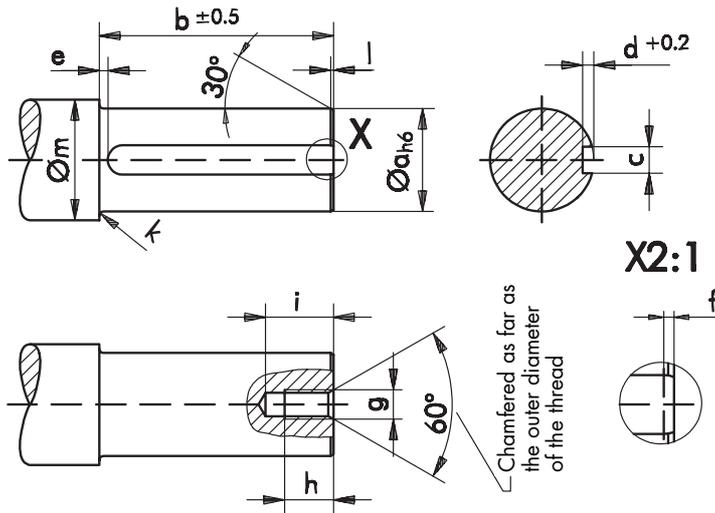
Assembly: Screw the threaded bolt into the face thread of the shaft to be driven. Press the shaft-mounted gear onto the shaft with the aid of the nut via the thrust piece and the circlip.

Retaining: Rotate the thrust piece and draw it with the fixing screw against the circlip.

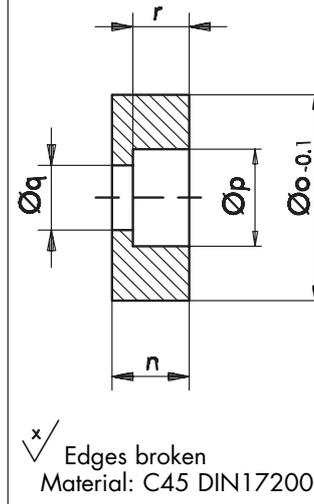
Dismantling: Place the thrust piece between shaft face and circlip. The press-off screw presses against the shaft face and draws off the shaft-mounted gear.

The parts are not supplied.

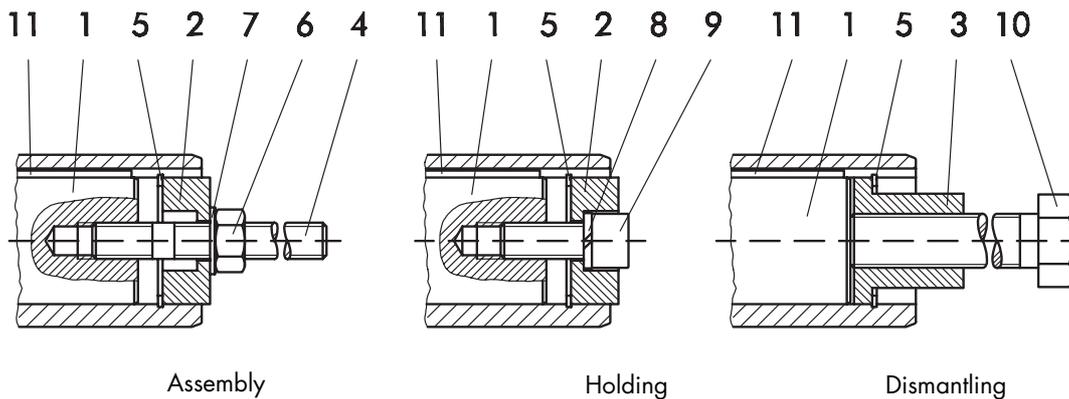
Item 1 Shaft journal



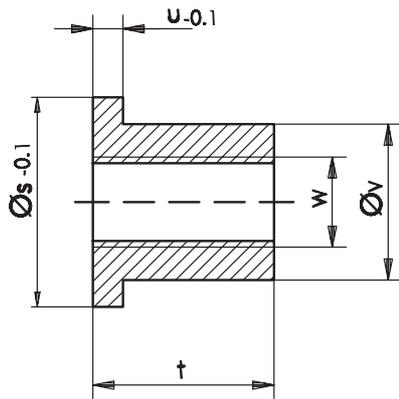
Item 2 Washer



Type	Dimensions																
	Item 1 Shaft journal											Item 2 Washer					
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
BK10	25	148	8	4	5	2	M8	18	24	2,5	1,5	33	13,5	24,8	15	9	8,5
BK20	30	170	8	4	5	2	M10	20	26	3	1,5	38	15	29,8	18	11	10
BK30	35	201	10	5	5	2	M10	20	26	3	1,5	43	16	34,8	18	11	10
BK40	40	235	12	5	5	2	M12	22	29	3	2	48	18	39,8	20	13,5	12
BK50	50	254	14	5,5	6	3	M16	30	37	3,5	2	58	21	49,8	26	17,5	15
BK60	60	273	18	7	6	3	M20	38	46	3,5	2	68	24	59,8	33	22	18
BK70	80	316	22	9	8	4	M20	38	46	4	2	90	27	79,8	33	22	20
BK80	100	360	28	10	8	5	M24	45	54	4	3	110	32	99,8	40	26	25
BK90	120	432	32	11	8	6	M24	45	54	4,5	3	130	35	119,8	40	26	28

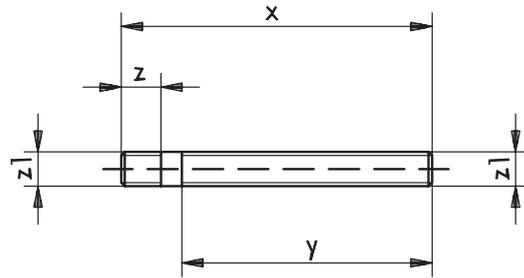


Item 3 Sleeve



^x Edges broken
Material: C45 DIN17200

Item 4 Threaded bolt

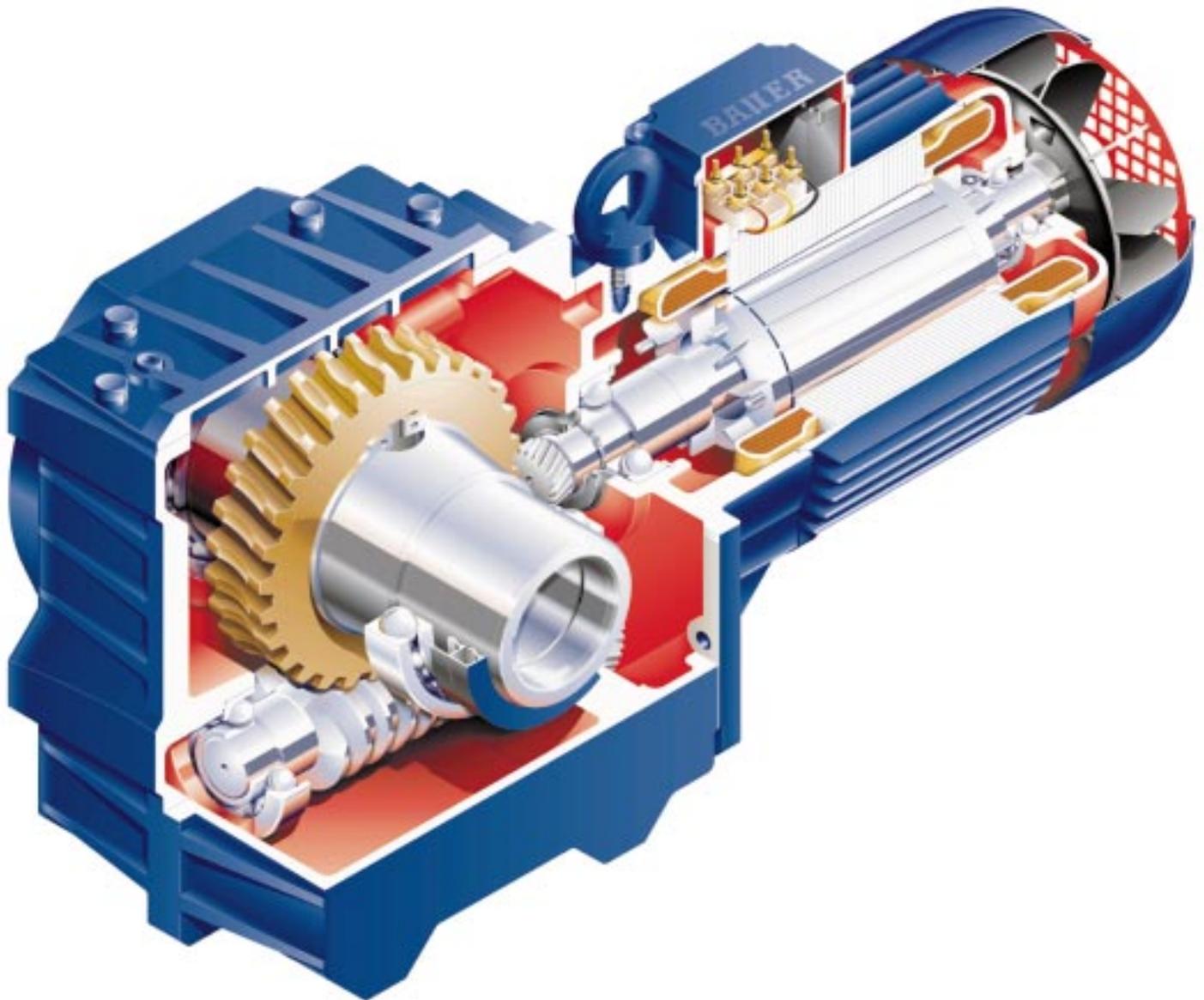


Material: steel, tensile strength $\geq 1000 \text{ N/mm}^2$
Thread rolled

Type	Dimensions									Circlip DIN 472 Item 5	Nut DIN 9348 Item 6	Washer DIN 125-SI Item 7	Spring washer DIN 7980 Item 8	Cylinder screw DIN 9128.8 Item 9	Hexagon screw DIN 933.8.8 Item 10	Key DIN 6885 Width x Height x Length Item 11
	Item 3, Sleeve					Item 4, Threaded bolt										
	s	t	u	v	w	x	y	z	z1							
BK10	24,8	24	5	16	M12	200	170	20	M8	25x1,2	M8	8,4	8	M8x30	M12x190	AB 8x7x141
BK20	29,8	28	5	20	M14	230	195	23	M10	30x1,2	M10	10,5	10	M10x30	M14x210	AB 8x7x163
BK30	34,8	28	5	23	M14	260	220	23	M10	35x1,5	M10	10,5	10	M10x35	M14x240	AB 10,8x194
BK40	39,8	40	6	31	M20	300	260	28	M12	40x1,75	M12	13	12	M12x35	M20x290	AB 12,8x228
BK50	49,8	48	6	36	M24	340	290	37	M16	50x2,0	M16	17	16	M16x40	M24x320	AB 14,9x245
BK60	59,8	60	6	44	M30	370	310	45	M20	60x2,0	M20	21	20	M20x50	M30x350	AB 18x11x264
BK70	79,8	60	8	55	M30	420	360	45	M20	80x2,5	M20	21	20	M20x50	M30x400	AB 22x14x304
BK80	99,8	72	10	75	M36	480	410	55	M24	100x3,0	M24	25	24	M24x60	M36x450	AB 28x16x347
BK90	119,8	72	10	80	M36	560	480	55	M24	120x4,0	M24	25	24	M24x60	M36x520	AB 32x18x418

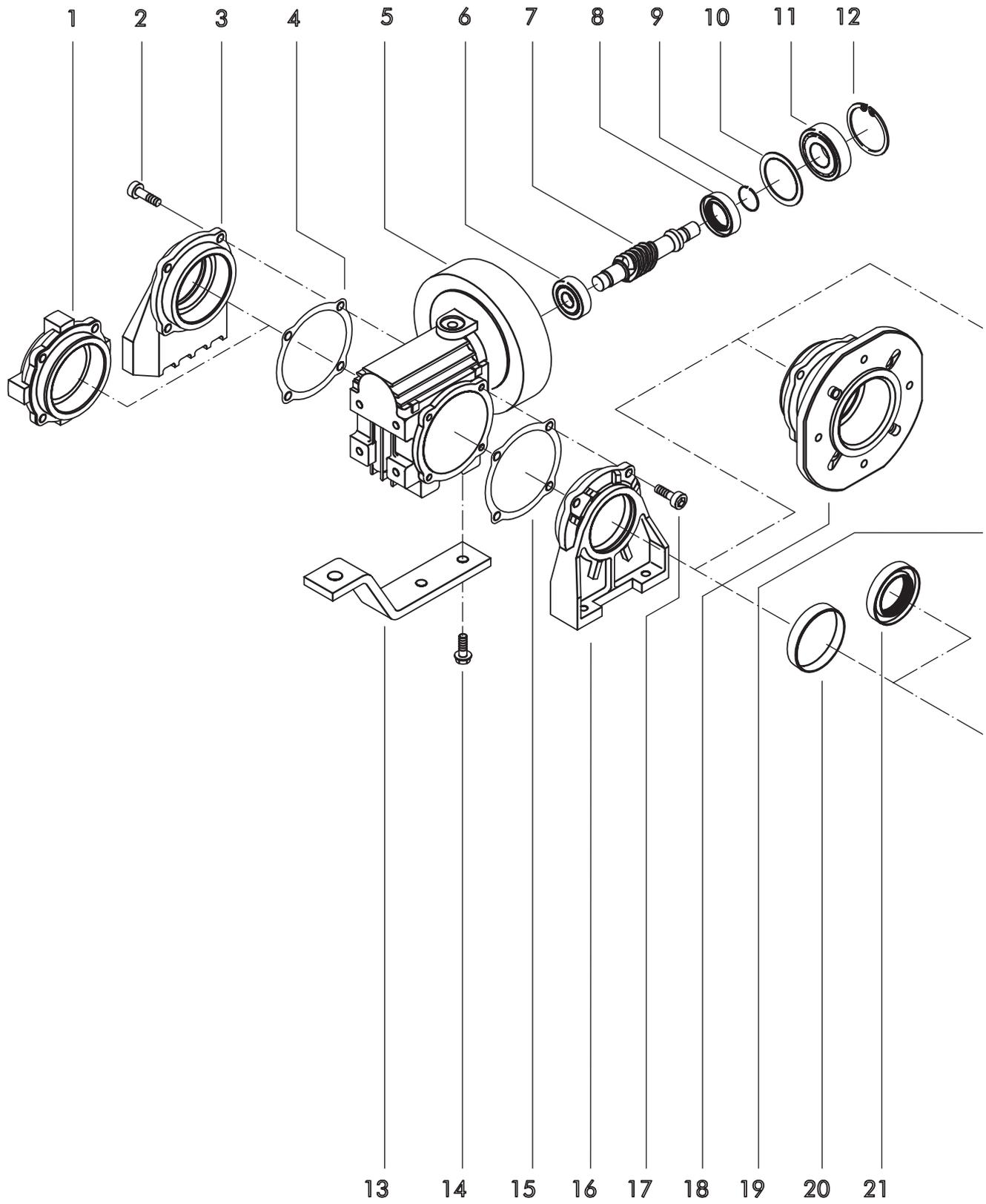
6 BS series worm geared motor

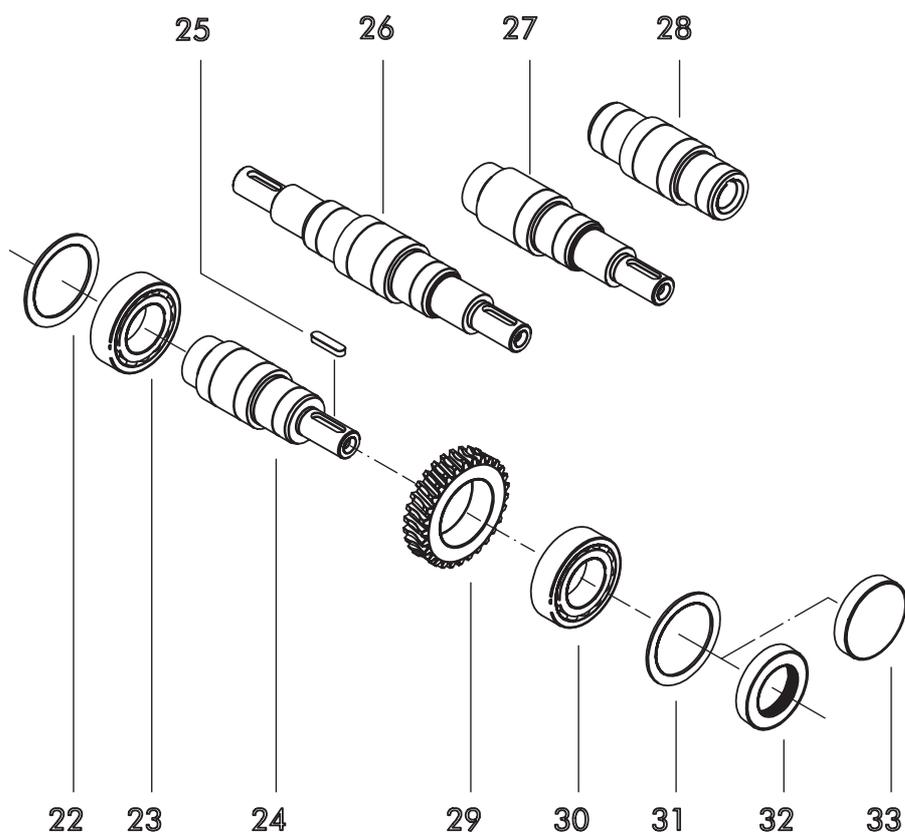
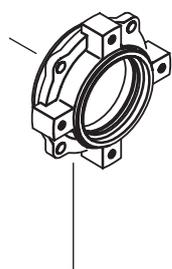
6.1 Section through a Bauer worm geared motor



6.2 Explosion drawing

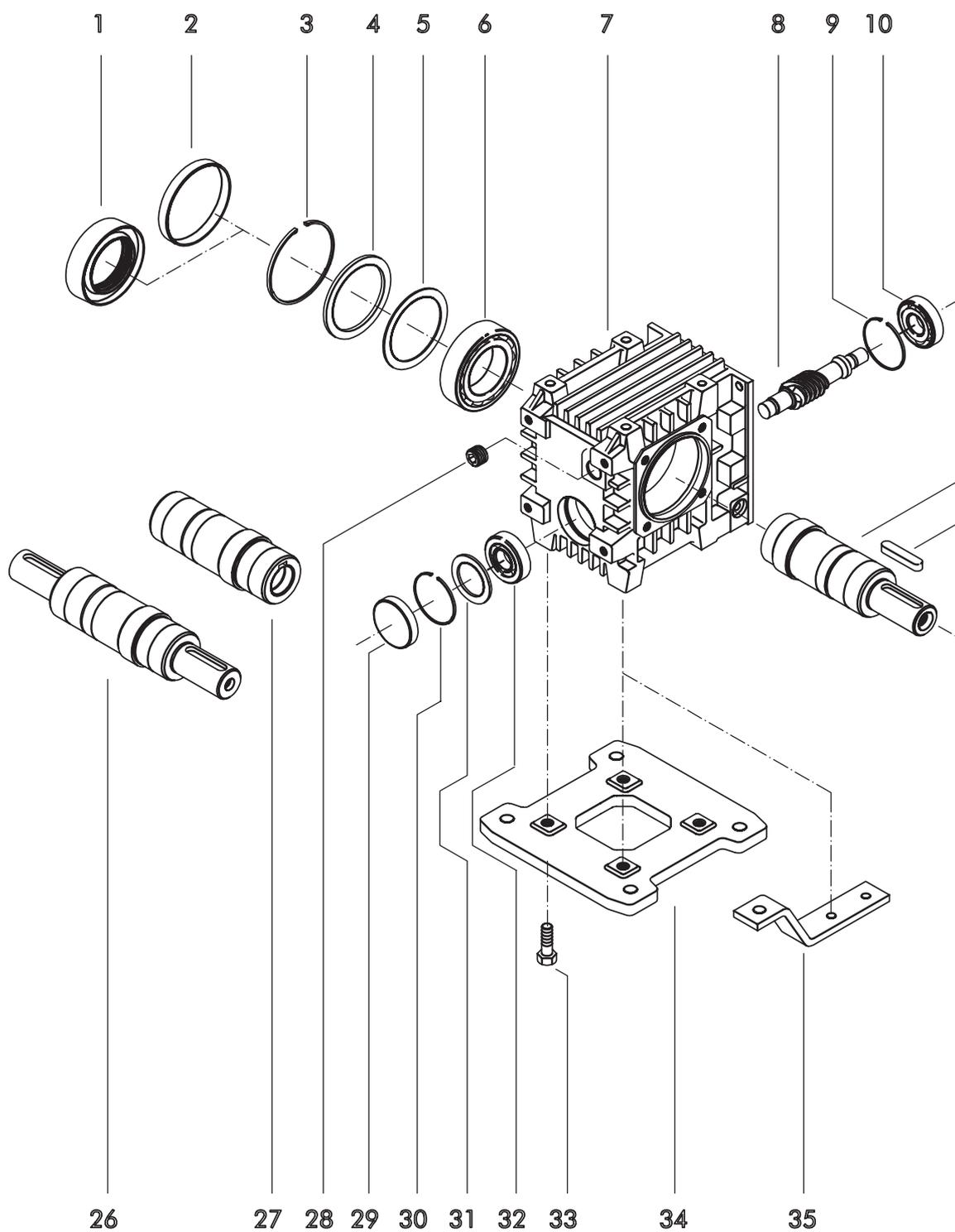
6.2.1 Explosion drawing single-stage worm gear BS02, BS03

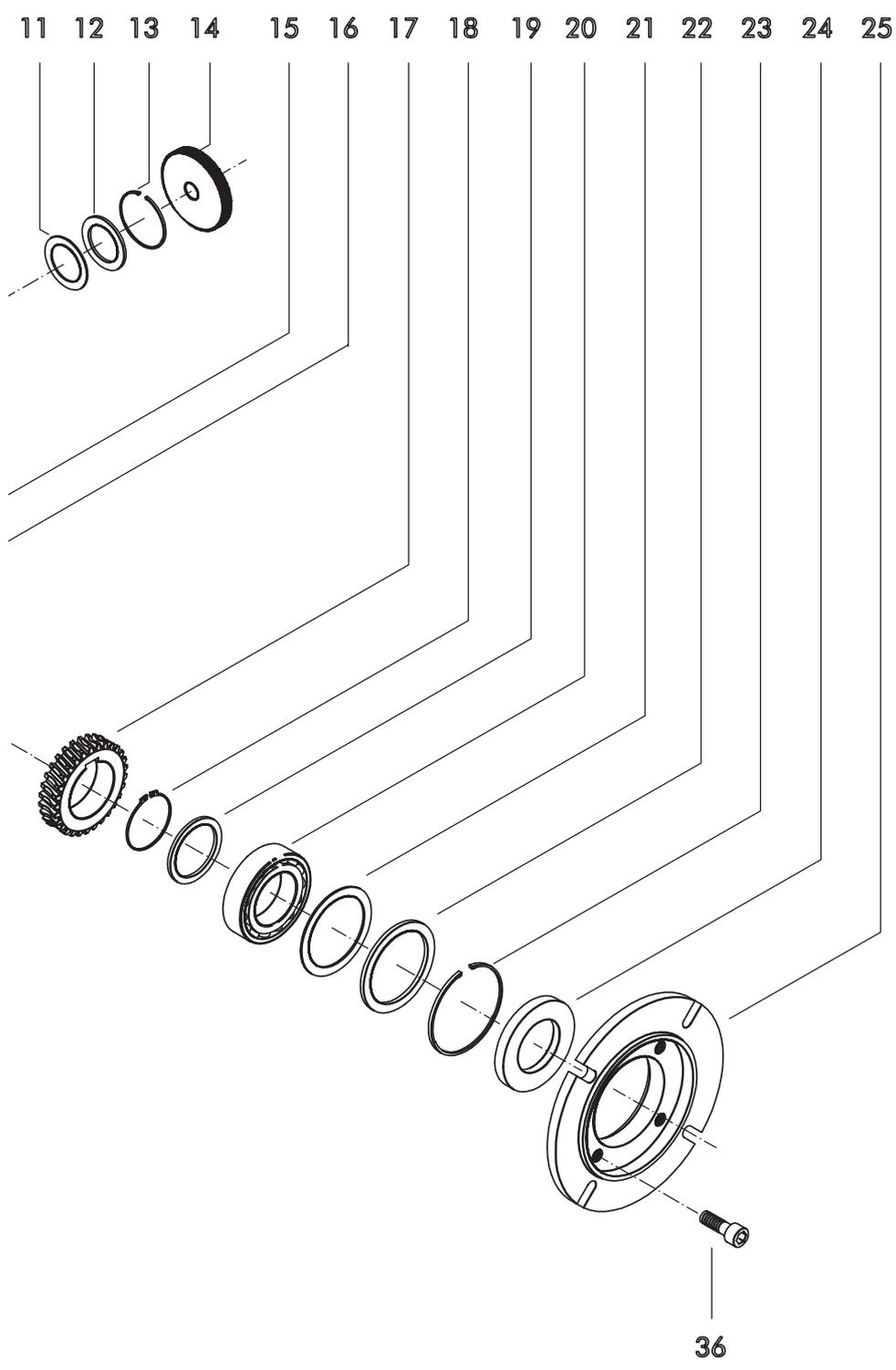




Part	Designation
1	Flange C
2	Allen screw
3	Gearbox, foot
4	Gasket
5	Attachment housing
6	Roller bearing
7	Worm shaft
8	Shaft seal
9	Retainer ring
10	Thrust washer
11	Roller bearing
12	Retainer ring
13	Torque restraining arm
14	Hexagon bolt
15	Gasket
16	Gearbox, foot
17	Allen screw
18	Flange A
19	Flange C
20	Sealing cover
21	Shaft seal
22	Tuning package
23	Roller bearing
24	Solid output shaft
25	Key
26	Solid output shaft, both sides
27	Solid output shaft, long
28	Hollow shaft
29	Wormgear
30	Roller bearing
31	Tuning package
32	Shaft seal
33	Sealing cover

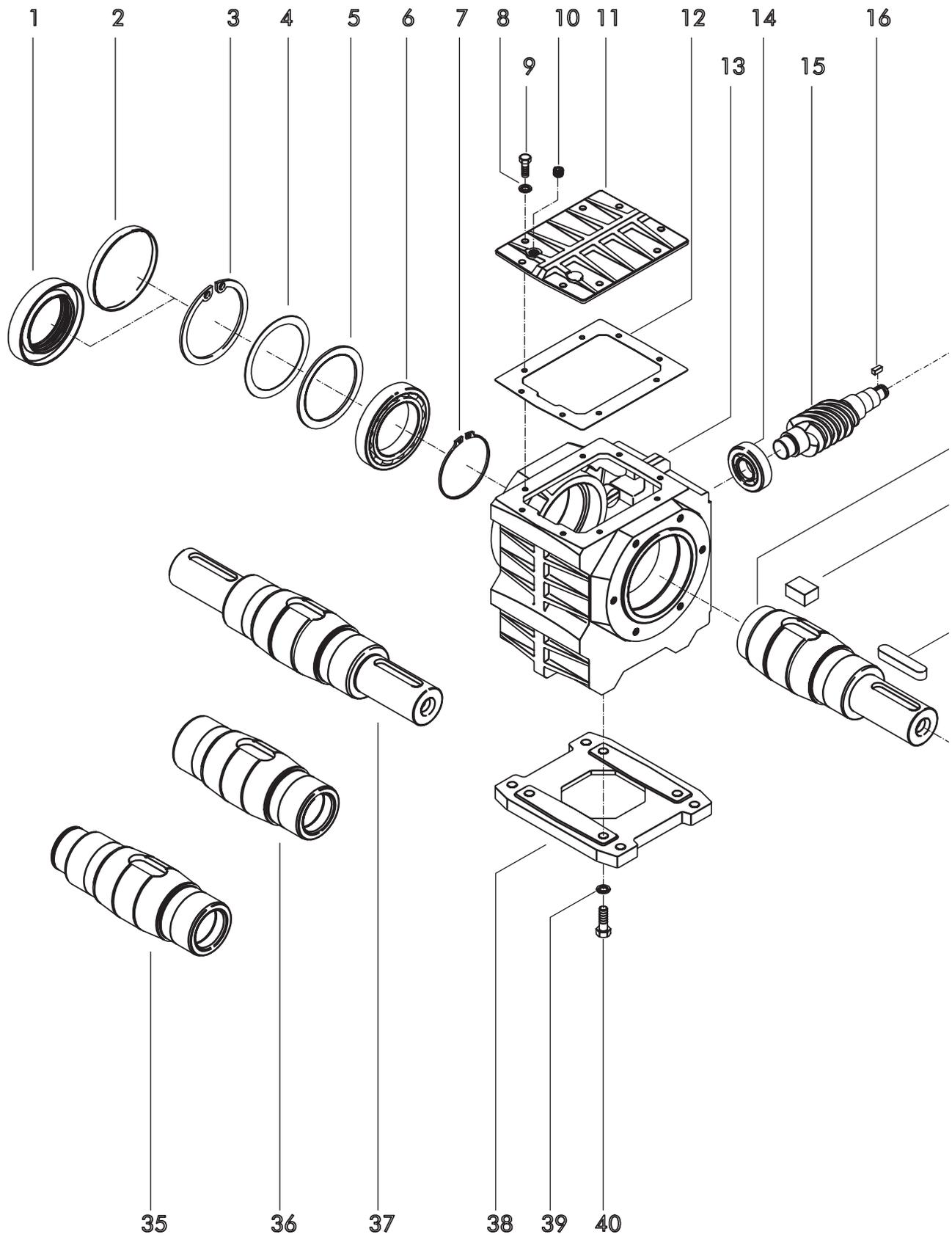
6.2.2 Explosion drawing 2-stage worm gear BS04, BS06

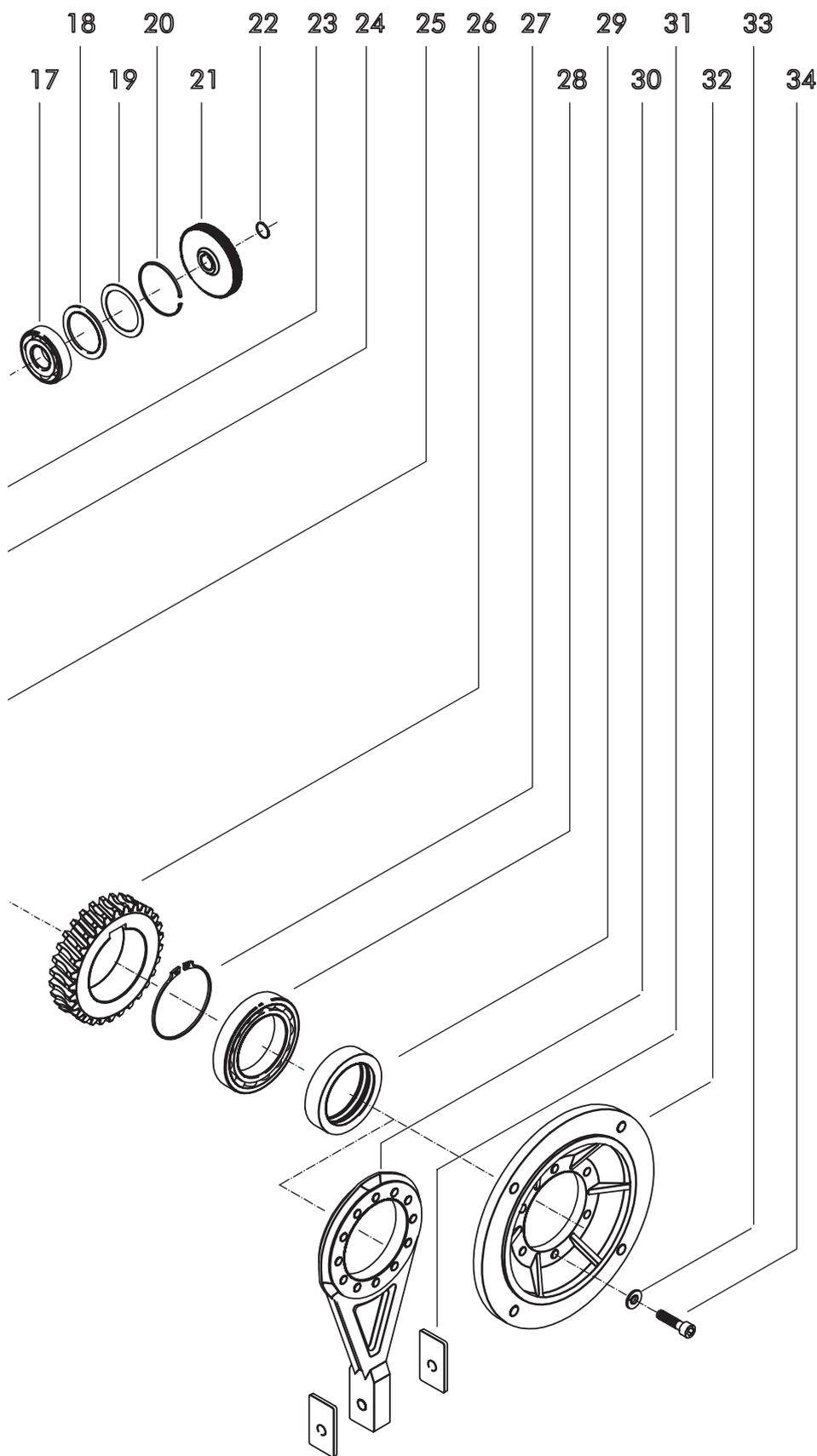




Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Support washer
5	Tuning package
6	Roller bearing
7	Attachment housing
8	Worm shaft
9	Retainer ring
10	Roller bearing
11	Tuning package
12	Support washer
13	Retainer ring
14	Gear
15	Solid output shaft
16	Key
17	Wormgear
18	Retainer ring
19	Support washer
20	Roller bearing
21	Tuning package
22	Support washer
23	Retainer ring
24	Shaft seal
25	Flange
26	Solid output shaft, both sides
27	Hollow shaft with keyway
28	Cover screw
29	Sealing cover
30	Retainer ring
31	Support washer
32	Roller bearing
33	Hexagon bolt
34	Foot plate
35	Torque restraining arm
36	Allen screw

6.2.3 Explosion drawing 2-stage worm gear BS10, BS20, BS30, BS40

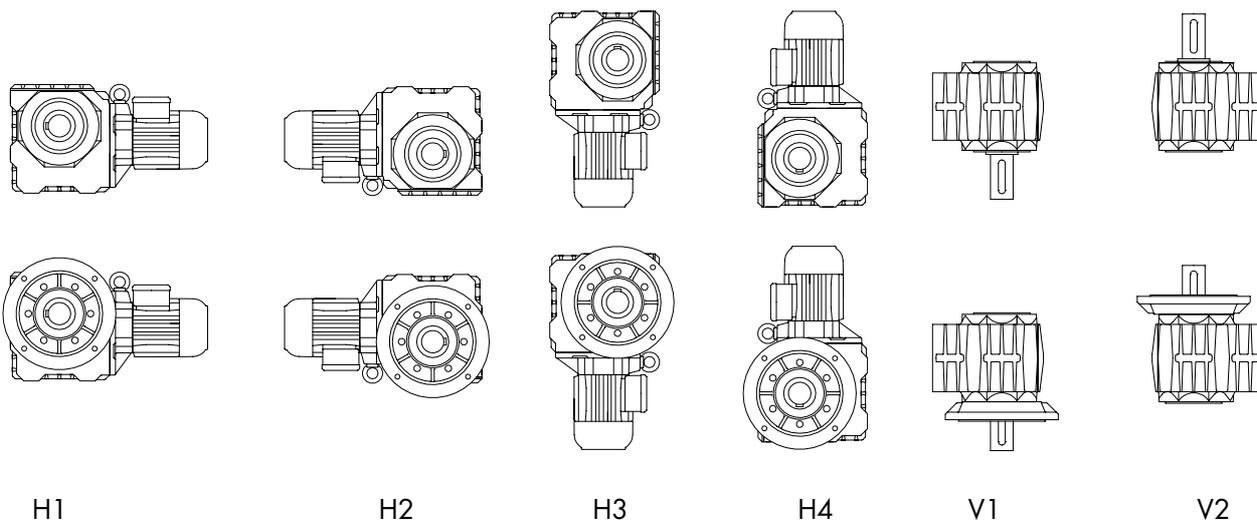




Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Support washer
5	Tuning package
6	Roller bearing
7	Retainer ring
8	Spring washer
9	Hexagon bolt
10	Cover screw
11	System cover (not for BS10 and BS20)
12	Liquid seal (not for BS10 and BS20)
13	Attachment housing
14	Roller bearing
15	Worm shaft
16	Key
17	Roller bearing
18	Tuning package
19	Support washer
20	Retainer ring
21	Gear
22	Retainer ring
23	Solid output shaft, one side
24	Key
25	Key
26	Wormgear
27	Retainer ring
28	Roller bearing
29	Shaft seal
30	Torque restraining arm
31	Rubber puffer
32	Flange
33	Spring washer
34	Allen screw
35	Hollow shaft for shrink disk
36	Hollow shaft with keyway
37	Solid output shaft, both sides
38	Foot plate
39	Spring washer
40	Hexagon bolt

6.3 Standard fitting positions

The following standard fitting positions are defined for BAUER worm geared motors



6.4 Quantities of lubricant for worm gears

Lubricant quantities in l or kg

Gear type	Lubricant quantities in l or kg					
	H1	H2	H3	H4	V1	V2
BS02	0.06	0.06	0.06	0.06	0.06	0.06
BS03	0.17	0.17	0.17	0.17	0.17	0.17
BS04	0.11	0.11	0.11	0.2	0.11	0.11
BS06	0.24	0.24	0.24	0.45	0.24	0.24
BS10	0.9	0.9	0.9	1.6	0.9	0.9
BS20	1.5	1.5	1.5	2.7	1.5	1.5
BS30	2.2	2.2	2.2	3.8	2.2	2.2
BS40	3.5	3.5	3.5	6.0	3.5	3.5

Lubricant quantities and lubricant types should be compared with the rating plate.

6.5 Dismantling and assembly instructions for worm gears

6.5.1 Dismantling gear parts

6.5.1.1 Dismantling BS02 and BS03

First of all, remove the two flanges (warning: the oil runs out), then remove the output shaft with the worm wheel, remove the motor from the B side and then the winding and the circlip on the outer ring of the A bearing.

Pull the rotor with the worm shaft out of the gear housing end shield using a general-purpose lever.

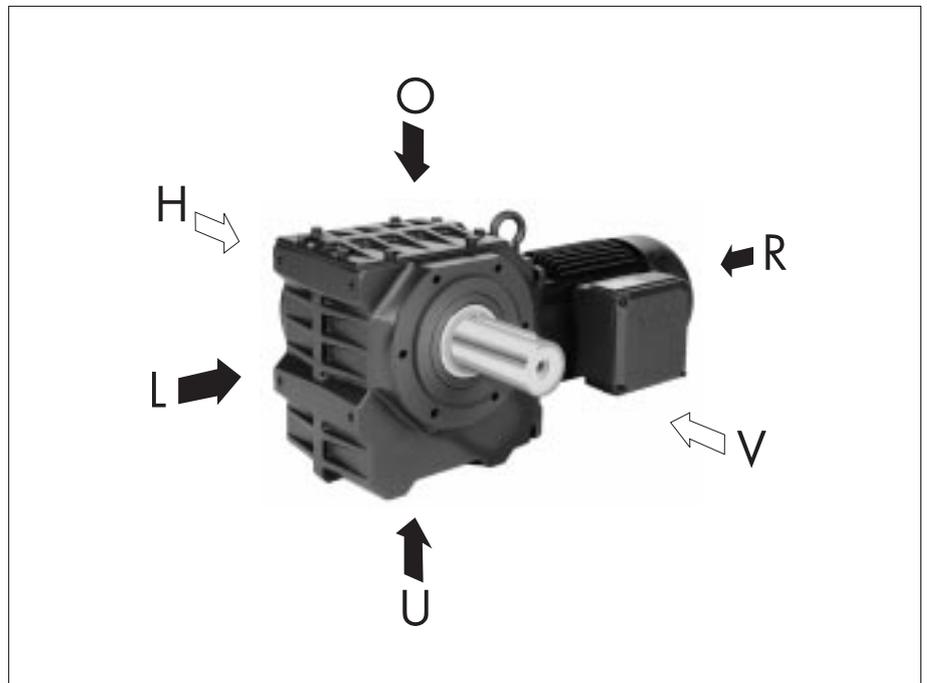
Pull the ball bearing from the worm shaft using an extractor.

Remove the worm wheel from the output shaft using a press or extractor. Heat the worm wheel to about 150°C to make the process easier.

6.5.1.2 Dismantling BS04 and BS06

After removing the motor part drain the oil. Then remove R2 using the extractor and the sealing cap on the gear face.

BS04: Remove the circlip behind R2 and press the worm shaft out in the direction of gear side R.



BS06: Remove the circlip behind the sealing cap and press the worm shaft out in the direction of gear side L.

After removing shaft sealing rings/sealing cap, circlips, support disks and matching packets on the output shaft, push these out of the housing together with bearing and worm gear, and then draw the ball bearing, the support disk and the circlip from the output shaft.

Heat the worm wheel to about 150°C and remove it from the output shaft.

6.5.1.3 *Dismantling
BS10 and BS20*

After draining the lubricant and dismantling the motor section remove R2 using an extractor. Then remove circlip, support disk and matching packet from the worm shaft.

Now lift the worm shaft out of the gear using an appropriate disk and re-fitted circlip from R2 using a general-purpose lever (spacer ring for BS10 with internal diameter approx. 12 mm and for BS20 approx. 14 mm).

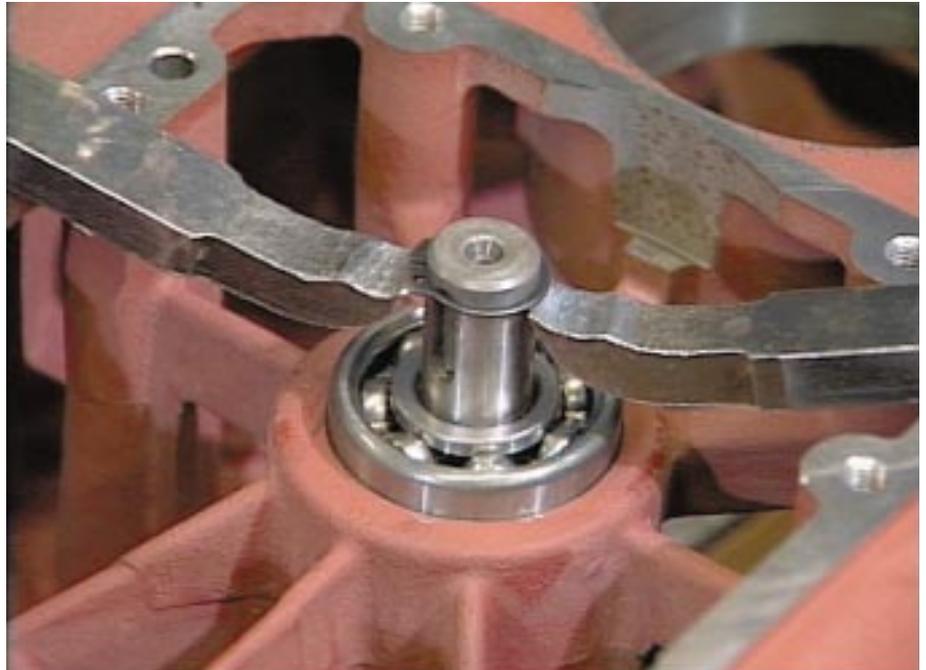
Remove shaft seals/sealing cap, circlip, supporting disk and matching packet on the output shaft, as well as circlip, supporting disk and matching packet on the worm shaft, the circlip for the worm wheel on the output shaft on gear side V, and then press the output shaft out in the direction of gear side H. When doing so, the worm wheel abuts the gear housing on the inside.

6.5.1.4 *Dismantling
BS30 and BS40*

After draining the lubricant and dismantling the motor section remove R2. Then remove the shaft seal and the sealing cap on the output shaft, the circlips and the supporting disk with matching packet.

These two gear sizes are constructed with a housing cover for better fitting.

To pull out the worm shaft insert the circlip for wheel 2 again, raise the shaft slightly using assembly hooks and then remove it together with the bearing (see Fig.).



To remove the output shaft remove the circlip on gear side V using cranked circlip pliers. Support the worm wheel against the gear housing with matched support stops and then press the output shaft out in the direction of gear side H.

6.5.2 Assembling the gear parts

In order to assemble the worm gear parts so that they function correctly, it is important for the worm stage to be fitted so that it is free from play and positioned correctly using the appropriate matching packets.

To do this, place the bearing and matching packets that have been carefully removed back in their original place.

If new parts are fitted which affect the matching, then the matching packets must be altered accordingly by the differential dimension of the parts.

Warning: The worm stage must be always be completely replaced due to the paired wheel sets.

Fitting the worm pinion is made easier by heating and cooling it alternately.

6.5.2.1 Assembly BS02 and BS03

The worm shaft and the rotor shaft bore must be cleaned and de-greased. Place the circlip behind the A bearing of the rotor shaft, draw on the bearing and fit the shaft circlip (for D08 now draw on the speedi sleeve). Then place the adjusting washer onto the ball bearing and push the shaft sealing ring (greased slightly) onto the shaft. (For D08 fit the the oil splash ring as well).

D04 – D06: Apply adhesive, Loctite 648 evenly to the worm shaft shank and press the shaft into the rotor shaft bore.

D08: Cool the worm shaft using liquid nitrogen and press it in the rotor shaft bore. Then place the front ball bearing on the worm shaft, push the rotor which is now complete in the gear housing and fit the circlip to the rotor shaft A bearing. In doing so heat the gear housing to 50°C.

Heat the worm wheel to about 160°C and glue it **to the centre** of the output shaft using Loctite 648 and wherever possible using the assembly device BS02-MO-1011 or BS03-MO-1001. After pushing on the two output shaft bearings place the output shaft which has thus been prepared in the gear housing. Then fit the two flanges with seal and the matching packets (prior to fitting the second flange fill the lubricant up again).

6.5.2.2 Assembly BS04 and BS06

First heat the worm wheel to about 150°C, apply Loctite 648 to the shrink glue seat and fit the wheel on the output shaft. Then draw on the output shaft bearing, fit circlip, support disk and matching packet on one side in the gear housing, heat the gear housing to about 50°C and insert the pre-assembled output shaft in the housing. Now fit the output shaft on the second gear side so that it is free from play using the matching packet, the support disk and the circlip.

BS04: Insert the dismantling circlip on the outer worm shaft bearing

BS06: Insert the dismantling circlip on the inner worm shaft bearing

Fit the angular ball bearing on gear side L, including support disk, circlip, but without sealing cap, and press the worm shaft in from the motor side. Fit the motor-side angular ball bearing for the worm shaft so that the worm shaft runs free from axial play. Now de-grease the R2 press seat, heat the wheel to 200°C and press it onto the worm shaft (Warning: support worm shaft on side L).

Finally, re-fit shaft seals and sealing caps to the output shaft and worm shaft, fill up with lubricant and then re-fit the motor.

Important: Clean sealing surfaces carefully.

6.5.2.3 Assembly BS10 and BS20

First start with the fitting by inserting the ball bearing for the output shaft on gear side V and the angular ball bearing for the worm shaft on gear side L, and draw the second angular ball bearing onto the worm shaft for R2 seat.

Then fit the circlip for the worm wheel and the bearing on the output shaft on the H side, heat the worm wheel to about 180 degrees and insert in the gear using locking pincers. Now place the front worm wheel circlip in the housing on the already fitted output shaft bearing and then push the output shaft already fitted with circlip and bearing from the side H into the gear as far as the bearing stop in one go. Now lock the front circlip in the groove, press the shaft carefully as far as the stop and fit the matching packet, supporting disk, circlip and shaft sealing rings/sealing cap.

Now push the worm shaft already fitted with angular ball bearing into the housing, press in as far as the stop and adjust so that it is free from play using matching packet, support disk and circlip.

Important: The matching packets on the output and worm shaft must be clamped so that they are free from play.

6.5.2.4 Assembly BS30 and BS40

First fit the lower worm shaft bearing and the output shaft bearing on the gear side V in the housing, then place it on the support element that has been prepared, so that the worm wheel is approx. 10 mm above the final mounting position.

Now place the circlip in the centre of the support element and then position the worm wheel heated to about 150°C and also align it in the centre.

Now fit the output shaft pre-fitted with the second circlip.

When fitting the output shaft expand the circlip on the support elements using a pair of pliers.

After removing the support elements ensure that the circlip is engaged in the groove and press it in again if necessary. The output shaft must abut the V-side bearing. Now fit the H-side output shaft bearing as well, adjust it so that it is free from play with the support and matching disks that have been removed and insert the shaft sealing rings and/or sealing caps.

Important: Press the matching packet between circlip and inner bearing ring so that it is free from play.

Now pre-fit the worm shaft with the bearing on top, push it carefully into the housing, adjust it so that it is free from play using support and matching disks and fit wheel 2.

Hints:

Coat the shaft sealing rings and the sealing caps with a slip additive on the outer sheath to improve fitting.

Both sealing rings should be fitted together as a unit in the case of double shaft seal.

We recommend that the wheel be heated to about 160°C so as to fit R2 more easily.

As a matter of principle: Cooling the output shaft and the pinion shaft also makes fitting easier.

6.6 Assembly aid for shaft-mounted design with hollow shaft and keyway

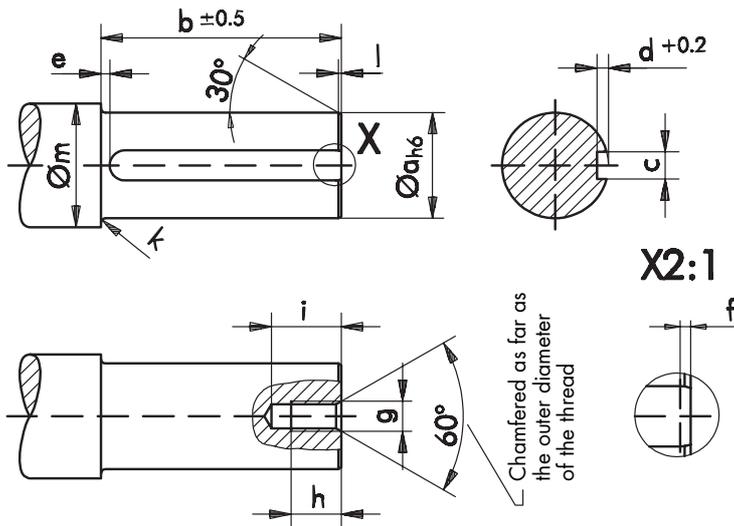
Assembly: Screw the threaded bolt into the face thread of the drive shaft. Press the shaft-mounted gear onto the shaft using the nut via the thrust member and the circlip?.

Retaining: Rotate the thrust member and draw against the circlip using the fixing screw.

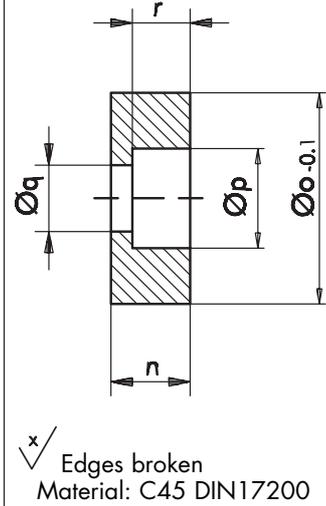
Dismantling: Insert the thrust member between shaft face and circlip. The push-off screw presses against the shaft face and draws off the shaft-mounted gear.

Manufacturing drawing T2010/3. The parts are not supplied.

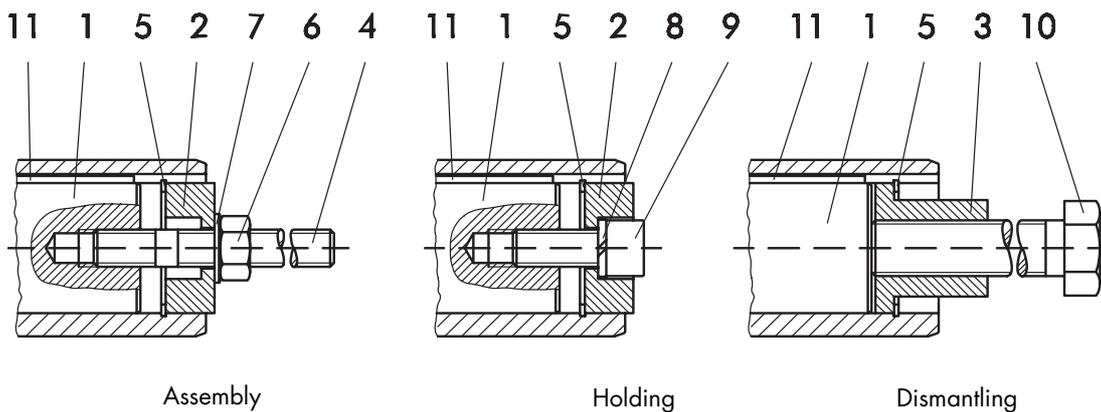
Item 1 Shaft journal



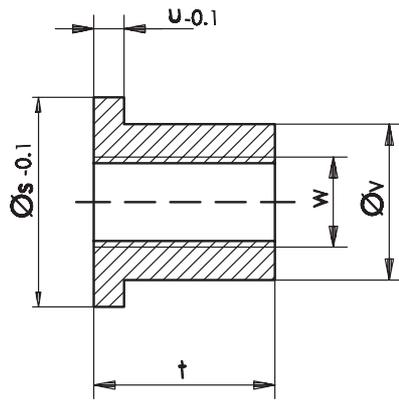
Item 2 Washer



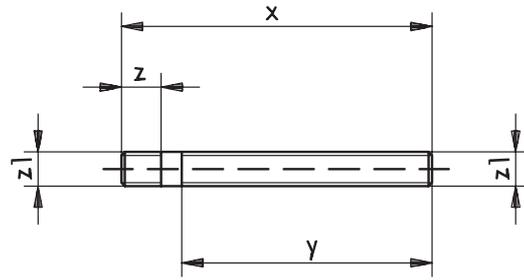
Type	Dimensions																
	Item 1 Shaft journal											Item 2 Washer					
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
BS03	20	75	6	3.5	5	2	M6	16	21	2	1.5	28	13.5	19.8	11	6.6	6.5
BS04	20	71	6	3.5	5	2	M6	16	21	2	1.5	28	13.5	19.8	11	6.6	6.5
BS06	25	99	8	4	5	2	M8	18	24	2.5	1.5	33	13.5	24.8	15	9	8.5
BS10	30	152	8	4	5	2	M10	20	26	3	1.5	38	15	29.8	18	11	10
BS20	35	186	10	5	5	2	M10	20	26	3	1.5	43	16	34.8	18	11	10
BS30	40	212	12	5	5	2	M12	22	29	3	2	48	18	39.8	20	13.5	12
BS40	60	227	18	7	6	3	M20	38	46	3.5	2	68	24	59.8	33	22	18



Item 3 Sleeve



Item 4 Threaded bolt



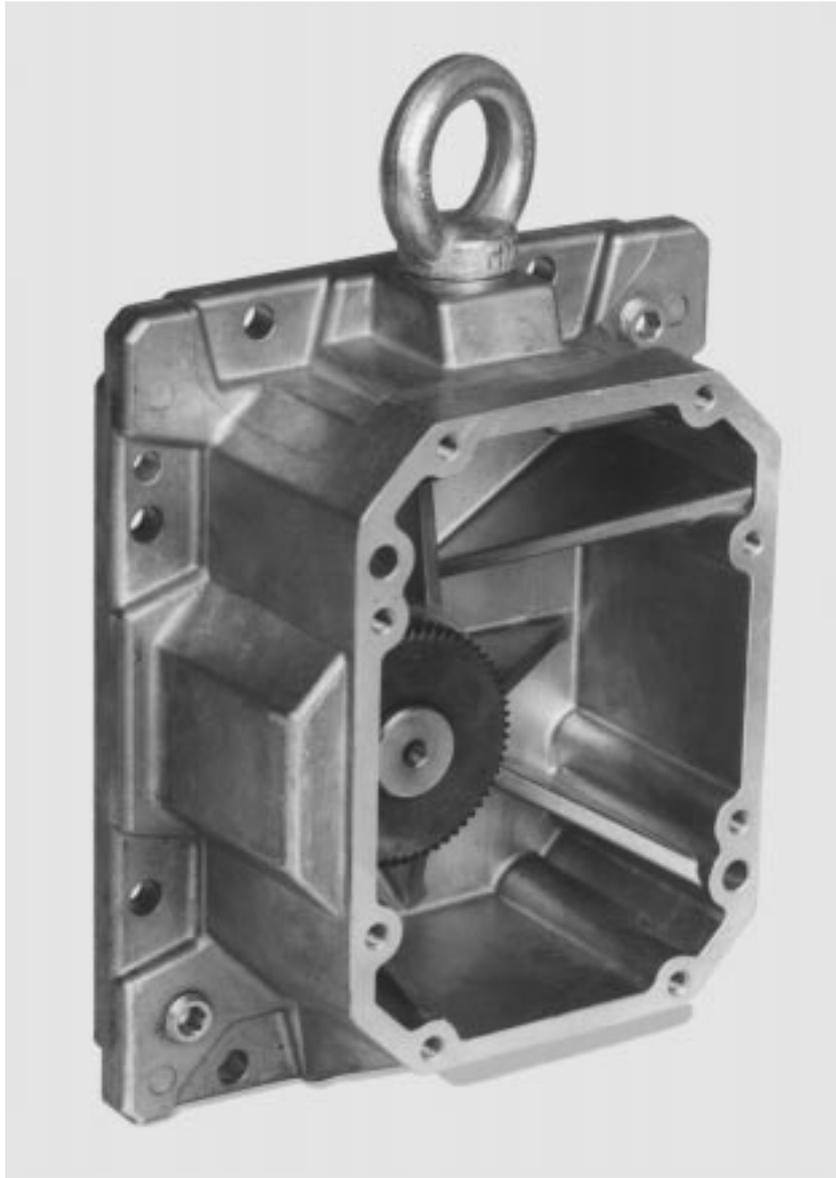
Material: steel, tensile strength $\geq 1000 \text{ N/mm}^2$
Thread rolled

^x Edges broken
Material: C45 DIN17200

Type	Dimensions									Circlip DIN 472 Item 5	Nut DIN 9348 Item 6	Washer DIN 125-S1 Item 7	Spring washer DIN 7980 Item 8	Cylinder screw DIN 9128.8 Item 9	Hexagon screw DIN 933-8.8 Item 10	Key DIN 6885 Width x Height x Length Item 11
	Item 3, Sleeve					Item 4, Threaded bolt										
	s	t	u	v	w	x	y	z	z ₁							
BS03	19,8	24	5	11	M8	120	90	18	M6	20x1,0	M6	6,4	6	M6x25	M8x110	AB 8x7x64
BS04	19,8	24	5	11	M8	120	90	18	M6	20x1,0	M6	6,4	6	M6x25	M8x110	AB 8x7x64
BS06	24,8	24	5	16	M12	150	120	20	M8	25x1,2	M8	8,4	8	M8x30	M12x140	AB 8x7x92
BS10	29,8	28	5	20	M14	210	175	23	M10	30x1,2	M10	10,5	10	M10x30	M14x190	AB 8x7x145
BS20	34,8	28	5	23	M14	250	215	23	M10	35x1,5	M10	10,5	10	M10x35	M14x230	AB 10x8x179
BS30	39,8	40	6	31	M20	280	240	28	M12	40x1,75	M12	13	12	M12x35	M20x270	AB 12x8x205
BS40	59,8	60	6	44	M30	320	260	45	M20	60x2,0	M20	21	20	M20x50	M30x310	AB 18x11x218

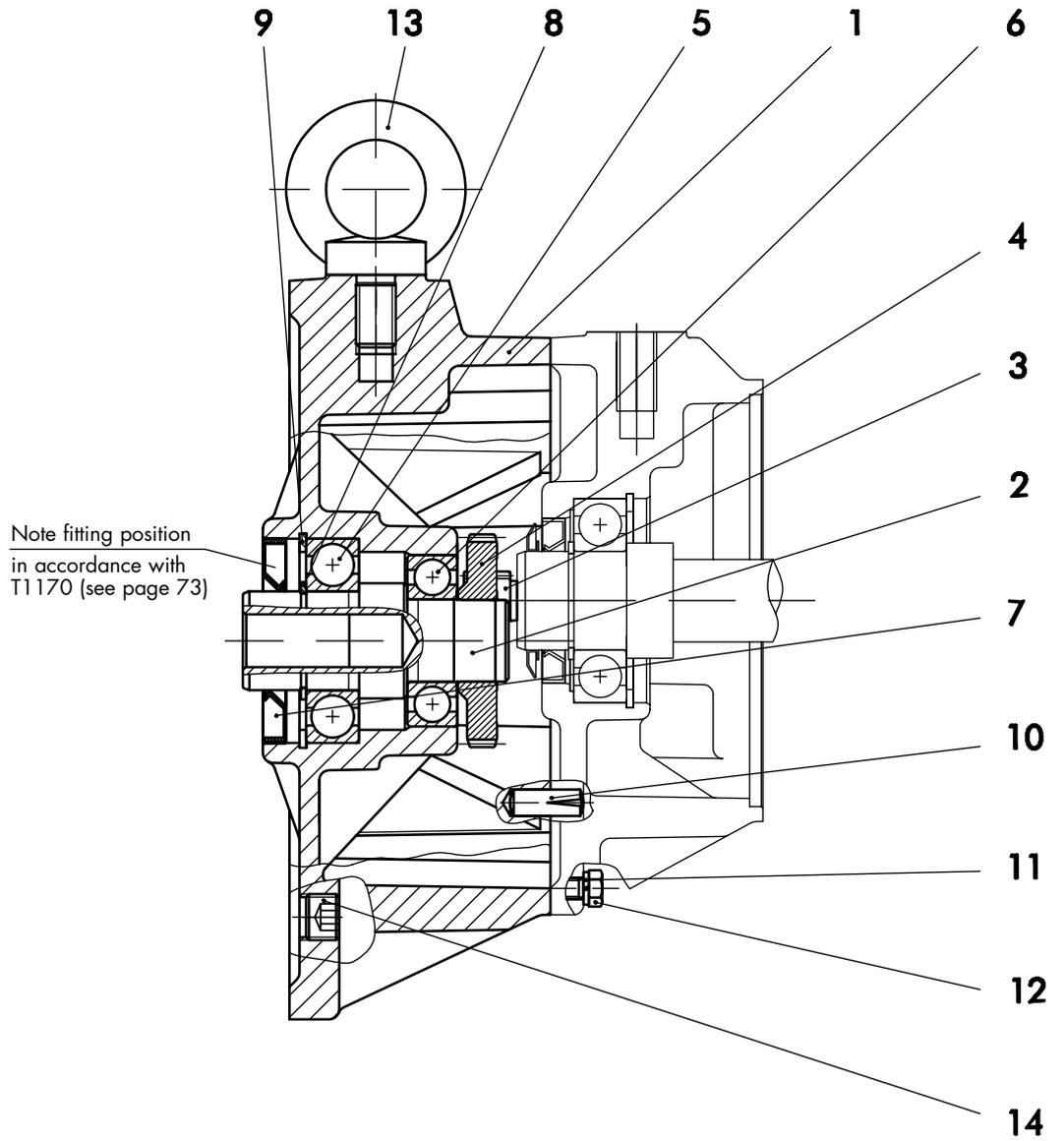
7 Preliminary stages ZB

7.1 Figure of the preliminary gear stage ZB 40

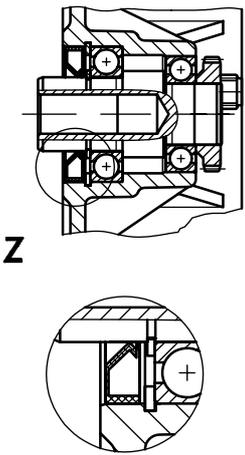
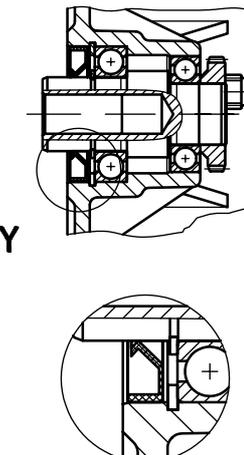


7.2 Sectional drawing of the preliminary gear stage ZB40

Part	Designation
1	Pre-stage housing
2	Intermediate shaft
3	Pinion
4	Gear
5	Ball bearing
6	Ball bearing
7	Shaft seal
8	Retainer ring
9	Retainer ring
10	Dowel pin
11	Spring washer
12	Hexagon bolt
13	Eye bolt
14	Cover screw
15	Lubricant

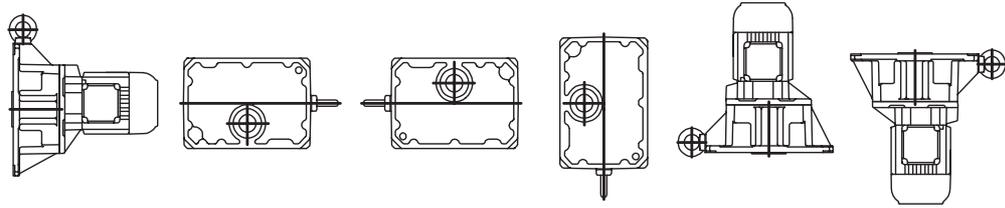


7.3 Fitting positions of the shaft sealing ring for preliminary stages T1170

	Fitting position I 	Fitting position II 
BG	B3,B5,B6,B7,B8,V1,V5 (H1,H2,H3,H4) *	V3,V6
BF	H1,H2,H4,V1	H3,V2
BK	H1,H2,H4,V1,V2	H3
BS	H1,H2,H4,V1,V2	H3
<p>* Add-on housing with foot tapped holes</p> <p>Fitting position for shaft sealing ring on preliminary stage Z</p>		

7.4 Quantities of lubricant for preliminary stages T2020-5

Lubricant quantity in l or kg



BG and BF		B3 H4 B5	B6 H1	B7 H2	B8 H3	V5 V1	V6 V3 V2
BK and BS		H1	V1	V2	H2	H4	H3
Gear type							
BG10Z	BF10Z	0.10	0.05	0.10	0.07	0.16	0.07
BK10Z	BS10Z						
BG20Z	BF20Z	0.15	0.07	0.17	0.17	0.27	0.10
BK20Z	BS20Z						
BG30Z	BF30Z	0.2	0.10	0.26	0.22	0.35	0.19
BK30Z	BS30Z						
BG40Z	BF40Z	0.32	0.17	0.45	0.37	0.6	0.32
BK40Z	BS40Z						
BG50Z	BF50Z	0.5	0.3	0.8	0.7	1.15	0.5
BK50Z							
BG60Z	BF60Z	0.9	0.5	1.3	1.1	2.0	0.7
BK60Z							
BG70Z	BF70Z	1.2	0.6	1.8	1.6	2.4	1.4
BK70Z	BF80Z						
BG80Z	BF90Z	2.6	1.3	3.3	2.6	5.2	2.0
BK80Z							
BG90Z		4.2	1.5	4.9	3.5	7.7	3.0
BK90Z							

7.5 Disassembly and assembly instructions for ZB preliminary stages

7.5.1 Dismantling of the preliminary stage

After draining the lubricant and dismantling the motor section and the main gear preliminary stage dismantling then follows in the case of R1 pinions with outside diameter of the gearwheel less than the diameter of the R1 intermediate shaft diameter. This is done as described for the dismantling of motor sections under 2.3.1.

After removing the shaft sealing ring and the circlip the intermediate shaft is pressed out in the direction of the large flange surface.

7.5.2 Assembling the preliminary stage

The intermediate shaft is pre-fitted with both bearings and the circlip. Heat wheel 2 (approx. 150°C), place in the housing with the appropriate spacer element and fit the shaft. Insert the outer circlip and press the shaft sealing ring in so that it is flush with the housing in accordance with fitting instructions T1170.

Then fit the R1 pinion as described for the assembly of the motor section under 2.3.2.

Hints:

The shaft sealing ring should be coated with an appropriate slip additive on the outer sheath to make fitting easier.

We recommend that the wheel be heated to about 150°C to make fitting easier.

As a matter of principle: Cooling the shaft and heating the hub makes fitting easier.

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