

Order No.: 5871 149 002

ZF – ERGOPOWER

5/6 WG-160

ZF Passau GmbH
Donaustr. 25 - 71
D- 94 034 Passau

REPAIR MANUAL
for
ZF - ERGOPOWER
5/6 WG-160

I M P O R T A N T I N F O R M A T I O N :

Due to the great variety of ZF units it is necessary to limit disassembly and reassembly manuals to a current ZF production unit. Continuous technical upgrading of the ZF units and extensions concerning design options may require differing steps, which can be carried out by qualified specialists without greater difficulties by means of the perspective views included in the corresponding spare parts lists.

This disassembly and reassembly manual is based on the design level of a ZF production unit at the time of issue of the manual.

For information on description, operation and maintenance please refer to the Operation Manual (ZF Order No.: 5872 153 002).

ZF Passau GmbH reserves the right to replace this disassembly and reassembly manual by a successive edition at any time without advance notice. Upon request, ZF Passau GmbH will advise which edition is the latest one.

ATTENTION:

Observe the vehicle manufacturer's instructions and specifications for the installation and commissioning of the unit!

ZF Passau GmbH
Donaustr. 25 - 71
D - 94034 Passau

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PREFACE

This documentation has been developed for specialized staff trained by ZF Passau for repair and maintenance work to be made on ZF units.

This documentation describes a ZF series product with a design level valid at the date of edition.

Due to the continuous technical upgrading of the product, however, the repair of the unit at your disposal may require both deviating work steps and differing setting and testing data.

We would therefore recommend you to entrust masters and servicemen with the work on your ZF product whose practical and theoretical training is constantly updated in our training school.

The Service Stations established by ZF Friedrichshafen all over the world offer you:

1. Permanently trained staff
2. Specified equipment, e.g. special tools
3. State-of-the-art genuine ZF spare parts

All work is done there with utmost care and reliability.

In addition, repair work carried out by ZF Service Stations is covered by the ZF warranty within the terms of the currently applicable contractual conditions.

Any damage resulting from work which is done in an improper and unprofessional manner by third parties and any consequential costs incurred shall be excluded from this contractual liability.
This shall also be applicable if other than genuine ZF spare parts are used.

ZF Passau GmbH

Service Department

GENERAL

The Service Manual covers all work required for disassembly and the relating reassembly.

When repairing the unit, ensure utmost cleanliness and that the work is done in a professional manner. Dismantle the unit only if any damaged parts must be replaced. After removing screws or nuts, loosen lids and housing parts, which were installed with seals, by slight hammer blows with a plastic hammer. Use suitable pulling devices for removing parts being tightly installed on the shafts, such as bearings, bearing rings and similar.

Carry out disassembly and reassembly work on a clean working place. Use special tools which have been developed for this purpose. Prior to reinstallation of the parts, clean contact faces of housings and lids from residues of seals. Remove any burrs or similar irregularities with an oil stone. Clean housings and end covers, in particular corners and angles, with a suitable detergent. Damaged or heavily worn parts must be replaced, with an expert assessing whether parts subject to normal wear during operation, such as bearings, thrust washers etc. will be reinstalled.
Parts such as seal rings, locking plates, split pins etc. must generally be replaced. Radial seal rings with worn or broken sealing lip must also be replaced. In particular, ensure that no chips or other foreign bodies remain in the housing. Check the lube oil holes and grooves regarding unhindered passage.
Oil according to the relating List of Lubricants shall be applied to all bearings prior to their installation.

NOTE: Only a heating furnace or an electric drier is permitted to be used for heating up parts such as bearings, housings, etc!
Parts fitted in heated state must be readjusted after cooling down to ensure a perfect contact.

CAUTION
When assembling the unit, exactly observe the tightening torques and setting data indicated in the manual. Tighten screws and nuts according to the enclosed standard table, unless otherwise specified. The use of fluid seals or Molykote is not permitted for the control part in transmissions – due to a possible malfunction.

Never wash disks having organic friction linings (e.g. paper disks - adverse effect on lining adhesion). Only dry cleaning is permitted (leather cloth).

DANGER
When using detergents, observe the manufacturer's instructions regarding their handling.

Structure of Service Manual

The structure of this manual reflects the sequence of the work steps for completely disassembling the dismantled unit.

The tools required for the respective repair work are listed in the current text as in chapters “special tools” and “commercial tools”.

Important information on industrial safety

As a basic principle, the workshop carrying out the repair or maintenance of ZF units shall be fully responsible for industrial safety.

The observance of all valid safety regulations and legal requirements is a prerequisite for avoiding any damage to persons and products during maintenance and repair work.
Repair workshops must familiarize themselves with these regulations prior to starting any work.

A suitably trained and skilled staff is required for a proper repair of these ZF products.

The repair workshop shall be responsible for the training.

The following safety references are used in this manual:

☞ ***CAUTION***	This symbol serves as a **reference** to special working procedures, methods, information, use of auxiliaries etc... indicated in this repair manual.

⚠ ***DANGER***	This symbol identifies situations in which lacking care may lead to **personal injury or damage to the product**.

NOTE:	Thoroughly study this manual before starting any tests or repair work.

NOTE:	Figures, drawings and parts in this manual do not always represent the original; they show the working procedure. Since the figures, drawings and parts are not shown to scale, do not draw any conclusions on size and weight (not even within one and the same illustration.) Carry out work according to the legend.

NOTE:	After repair work and tests, the expert staff must verify that the product is perfectly functioning again.

BEZEICHNUNG DER GESETZLICHEN EINHEITEN
DENOMINATION OF STANDARD DIMENSIONS
DÉNOMINATION DES DIMENSIONS STANDARDISÉES

Hinweis : längenbezogene Masse in kg/m; flächenbezogene Masse in t/m^2

Note : linear density in kg/m; areal density in t/m^2

Nota : densité linéaire en kg/m; densité superficielle en t/m^2

Begriff Unit Unité	Formelzeichen Symbol Symbole	Neu New Nouveau	Alt Old Vieux	Umrechnung Conversion Conversion	Bemerkungen Note Nota
Masse Mass Masse	m	kg (Kilogramm)	kg		
Kraft Force Force	F	N (Newton)	kp	1 kp = 9.81 N	
Arbeit Work Travail	A	J (Joule)	kpm	0.102kpm = 1J = 1Nm	
Leistung Power Puissance	P	KW (Kilowatt)	HP (DIN)	1 HP = 0.7355 KW 1 KW = 1.36 HP	
Drehmoment Torque Couple	T	Nm (Newtonmeter)	kpm	1 kpm = 9.81 Nm	T (Nm) = F (N) · r (m)
Kraftmoment Moment (Force) Moment (Force)	M	Nm (Newtonmeter)	kpm	1 kpm = 9.81 Nm	M (Nm) = F (N) · r (m)
Druck (Über-) Pressure (Over-) Pression (Sur-)	pü	bar	atü	1.02 atü = 1.02 kp/cm^2 = 1 bar = 750 torr	
Drehzahl Speed Nombre de Tours	n	min -1 rpm tr/min			

VERGLEICHSTABELLE FÜR MASSEINHEITEN
CONVERSION TABLE
TABLEAU DE CONVERSION

25.40 mm	=	1 in (inch)
1 kg (kilogram)	=	2.205 lb (pounds)
9.81 Nm (1 kpm)	=	7.233 lbf x ft (pound force foot)
1.356 Nm (0.138 kpm)	=	1 lbf x ft (pound force foot)
1 kg / cm	=	5.560 lb / in (pound per inch)
1 bar (1.02 kp/cm^2)	=	14.233 psi (pound force per square inch lbf/in^2)
0.070 bar (0.071 kp/cm^2)	=	1 psi (lbf/in^2)
1 Liter	=	0.264 Gallon (Imp.)
4.456 Liter	=	1 Gallon (Imp.)
1 Liter	=	0.220 Gallon (US)
3.785 Liter	=	1 Gallon (US)
1609.344 m	=	1 Mile (land mile)
0° C (Celsius)	=	+ 32° F (Fahrenheit)
0 ° C (Celsius)	=	273.15 Kelvin

TIGHTENING TORQUES FOR SCREWS (in Nm) ACC. TO ZF STANDARD 148

Friction coefficient: μ tot.= 0.12 for plugs and nuts without rework, as well as phosphated nuts. Tighten manually!

Take tightening torques from the following chart, unless otherwise specified:

Metric ISO standard thread DIN 13, page 13

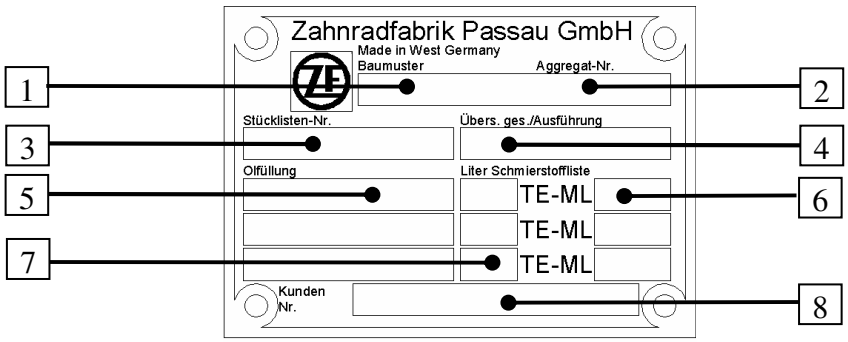
Dimension	8.8		10.9		12.9
M4	2.8		4.1		4.8
M5	5.5		8.1		9.5
M6	9.5		14		16.5
M7	15		23		28
M8	23		34		40
M10	46		68		79
M12	79		115		135
M14	125		185		215
M16	195		280		330
M18	280		390		460
M20	390		560		650
M22	530		750		880
M24	670		960		1100
M27	1000		1400		1650
M30	1350		1900		2250
M33	1850		2600		3000
M36	2350		3300		3900
M39	3000		4300		5100

Metric ISO fine thread DIN 13, page 13

Dimension	8.8		10.9		12.9
M 8 x 1	24		36		43
M 9 x 1	36		53		62
M 10 x 1	52		76		89
M 10 x 1.25	49		72		84
M 12 x 1.25	87		125		150
M 12 x 1.5	83		120		145
M 14 x 1.5	135		200		235
M 16 x 1.5	205		300		360
M 18 x 1.5	310		440		520
M 18 x 2	290		420		490
M 20 x 1.5	430		620		720
M 22 x 1.5	580		820		960
M 24 x 1.5	760		1100		1250
M 24 x 2	730		1050		1200
M 27 x 1.5	1100		1600		1850
M 27 x 2	1050		1500		1800
M 30 x 1.5	1550		2200		2550
M 30 x 2	1500		2100		2500
M33 x 1.5	2050		2900		3400
M 33 x 2	2000		2800		3300
M 36 x 1.5	2700		3800		4450
M 36 x 3	2500		3500		4100
M 39 x 1.5	3450		4900		5700
M 39 x 3	3200		4600		5300

LABELING OF IDENTIFICATION PLATE FOR ZF POWERSHIFT TRANSMISSION

1 = Transmission type
2 = Transmission number
3 = ZF parts list number
4 = Overall transmission ratio
5 = Oil filling (oil specification)
6 = ZF List of Lubricants
7 = Oil fill quantity
8 = Customer number



NOTES ON SPARE PARTS ORDERING:

Please indicate the following information when ordering genuine ZF spare parts:

1. = Transmission type
2. = Unit number
3. = ZF parts list number

You will find this information on the identification plate!

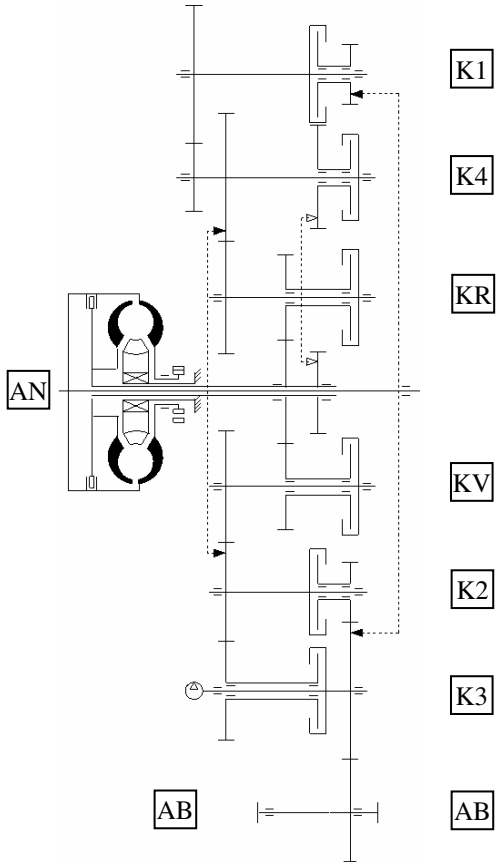
4. = Make and type of spare part
5. = Denomination of spare part
6. = Spare part number
7. = Shipping mode

Please complete the a.m. details to avoid any mistakes in the delivery of the ordered spare parts.

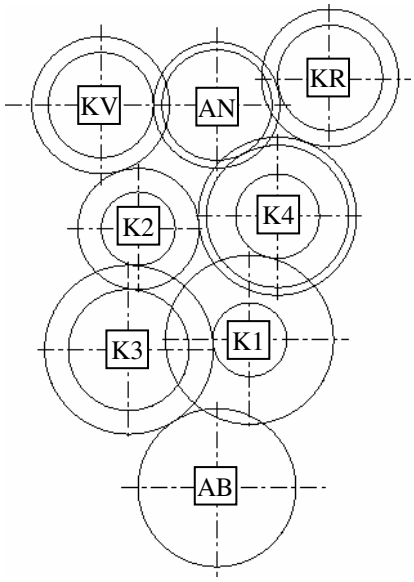
CONFIGURATION 6 WG-160

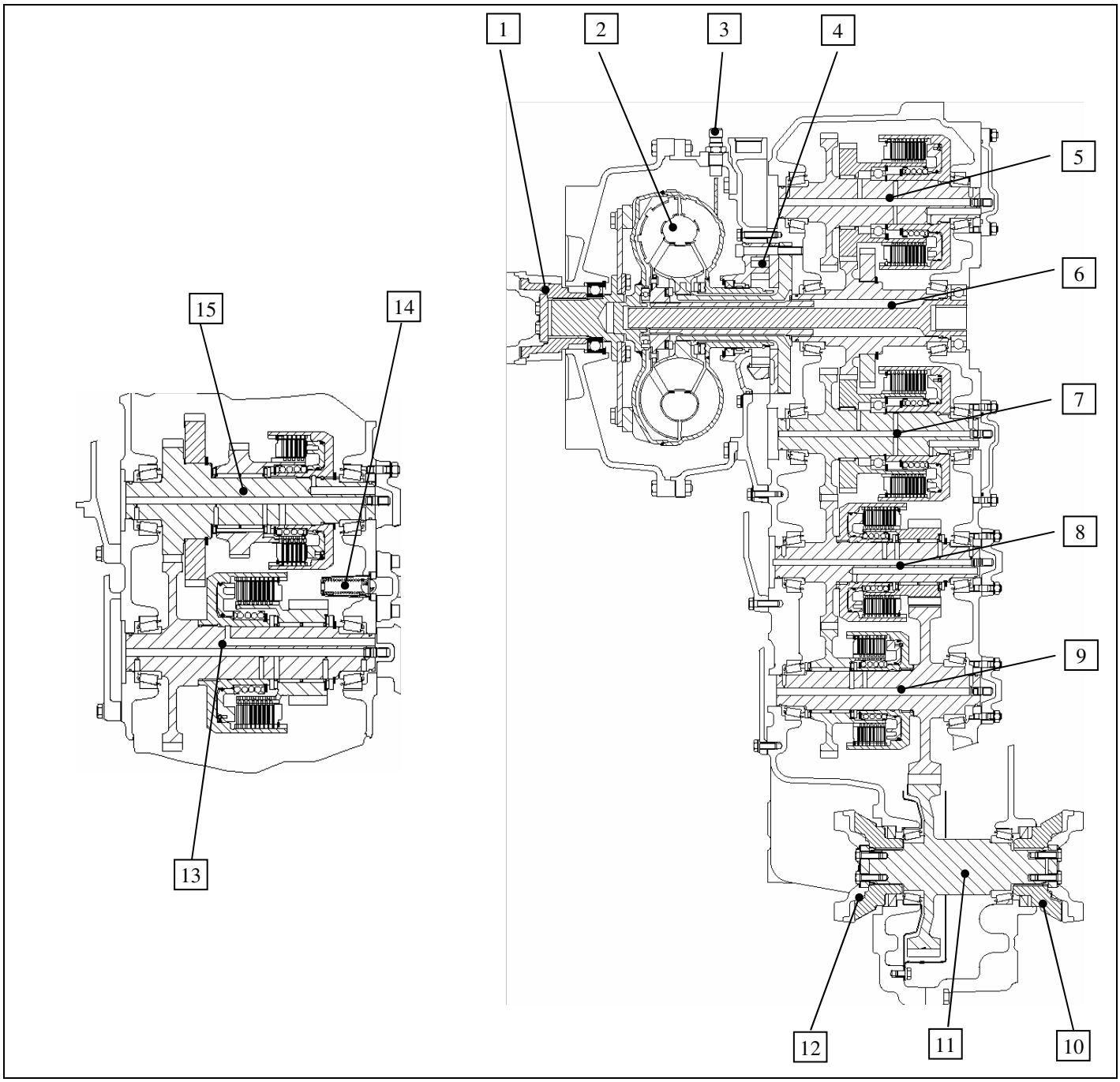
1 = Input flange - drive via prop shaft
2 = Converter
3 = Inductive sensor for engine speed
4 = Transmission pump
5 = Clutch shaft „KR“
6 = PTO; coaxial, engine-dependent
7 = Clutch shaft „KV“
8 = Clutch shaft „K2“
9 = Clutch shaft „K3“
10 = Output flange - rear side
11 = Output flange
12 = Output flange - converter side
13 = Clutch shaft „K1“
14 = Converter safety valve
15 = Clutch shaft „K4“

Transmission schematics



Gear schematics





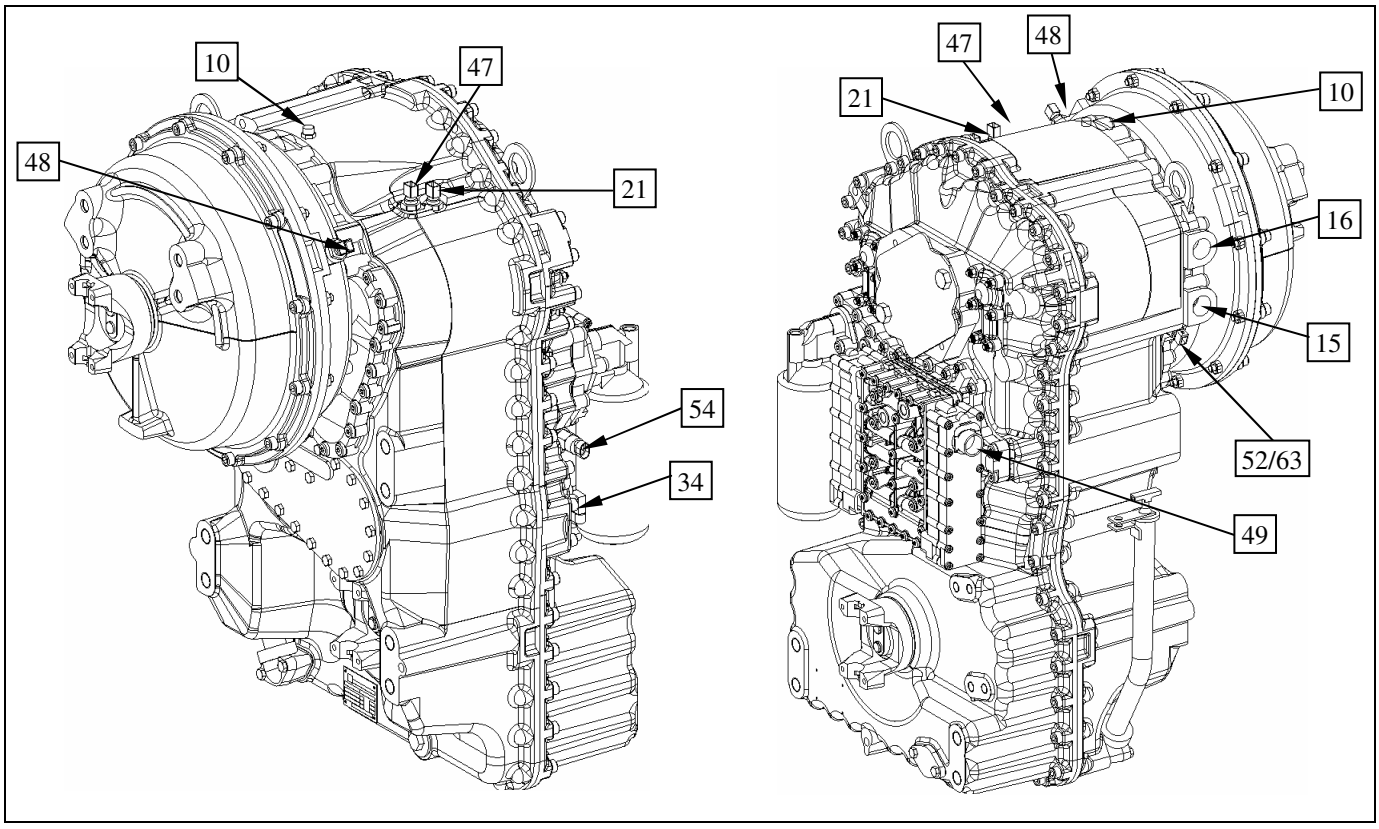
Legend:

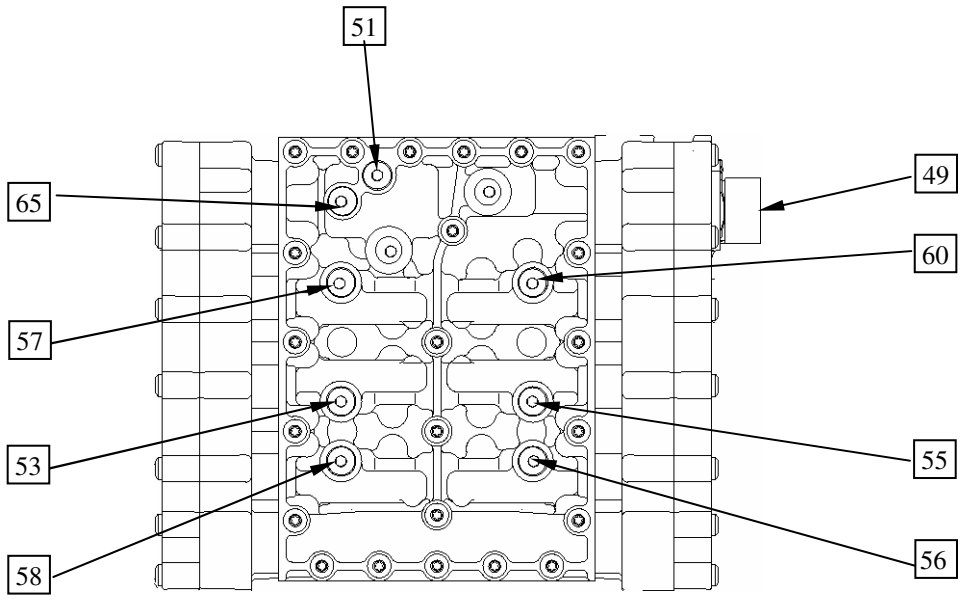
KV = Forward clutch
KR = Reverse clutch
K1 = 1st gear clutch
K2 = 2nd gear clutch
K3 = 3rd gear clutch
K4 = 4th gear clutch
AN = Input
AB = Output

MEASURING POINTS AND CONNECTIONS 6 WG-160

Carry out measurements when the transmission has reached operating temperature (approx. 80° - 90° C) !

No.	*DENOMINATION OF ITEM*			*CONNECTION*	*DESIGNATION AT VALVE BLOCK*
	MEASURING POINTS FOR PRESSURE OIL AND TEMPERATURE:				
51	= Before the converter– opening pressure		11+2 bar	M10x1	H
52	= After the converter – opening pressure		4.3+3 bar	M10x1	
53	= Forward clutch	16 +2 bar	KV	M10x1	B
55	= Reverse clutch	16 +2 bar	KR	M10x1	E
56	= Clutch	16 +2 bar	K1	M10x1	D
57	= Clutch	16 +2 bar	K2	M10x1	A
58	= Clutch	16 +2 bar	K3	M10x1	C
60	= Clutch	16 +2 bar	K4	M10x1	F
63	= After the converter, temperature 100° C, short-term 120° C			M14x1.5	
65	= System pressure	16 +2.5 bar		M10x1	K
	MEASURING POINTS FOR FLOW RATES:				
15	= Connection to heat exchanger			$1^5/_{16}$" - 12 UN-2B	
16	= Connection from heat exchanger			$1^5/_{16}$" - 12 UN-2B	
	INDUCTIVE SENSOR , IMPULSE SENSOR, SPEED SENSOR AND SWITCH:				
21	= Inductive sensor	n turbine		M18x1.5	
34	= Speed sensor	n output		----------	
47	= Inductive sensor	n central gear chain		M18x1.5	
48	= Inductive sensor	n engine		M18x1.5	
54	= Differential pressure switch for pressure filter			M14x1.5	
	CONNECTIONS:				
10	= Breather			M10x1	
49	= Plug connection at electro-hydraulic control unit				





NOTES ON THE REQUIRED OIL GRADE:

☞ Approved oils for 6 WG-160 powershift transmissions see ZF List of Lubricants TE-ML 03.

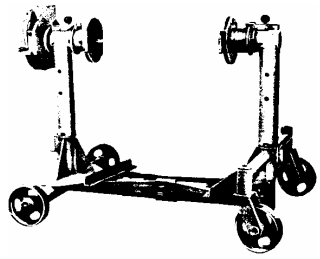
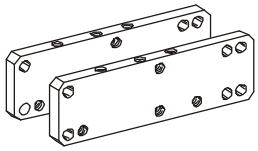
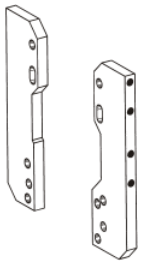
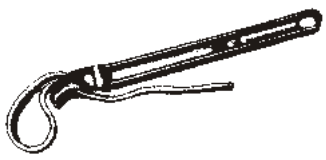
☞ The list of lubricants is being continuously updated and can be obtained or viewed as follows:

- at all ZF plants
- at all ZF service centers
- Internet http://www.zf.com **Informationen/Tech. Informationen**

☞ Information on **description, operation and maintenance** see relating operation manual (ZF Order No.: 5872 153 002).

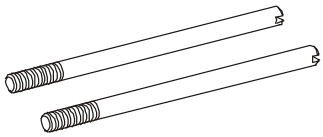
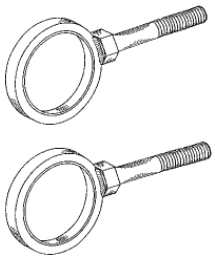
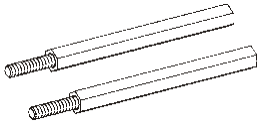
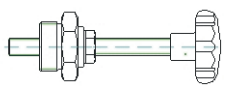
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
1		**Assembly truck** assy with tilting device **5870 350 000**	1	1/1 2/1
2		**Holding fixtures** **5870 350 063**	1	1/1 2/1
3		**Clamping angle** **5870 350 090**	1	1/1 2/1
4		**Belt spanner** **5870 105 005**	1	1/2
5		**Socket wrench** TX 40 **5873 042 004**	1	1/3 16/27 16/31

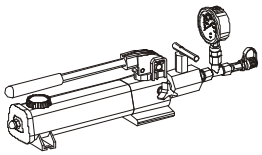
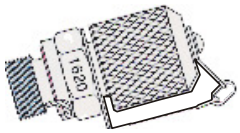
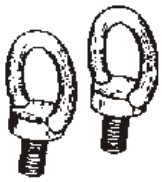
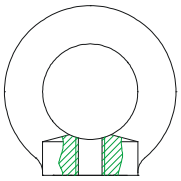
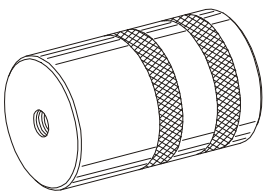
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
6		**Socket wrench** TX 27 **5873 042 002**	1	1/4 1/10 1/13 16/9 16/10 16/13 16/16 16/23 16/30
7		**Adjusting screws** M6 **5870 204 063**	1	1/5 16/18
8		**Eye bolt assortment** **5870 204 002**	1	3/2 3/4 13/16 13/27
9		**Adjusting screws** **5870 204 036**	1	1/5 16/7 16/12 16/13
10		**Assembly aid** **5870 345 107**	1	3/15 13/2

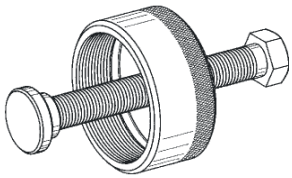
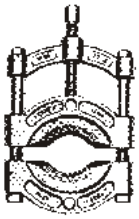
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
11		**HP hand operated pump** **5870 287 007**	1	5/5 12/9
12		**Minimess clutch (M12x1.5)** **5870 950 101**	1	5/5 12/9
13		**Eye boltM20** **0636 804 003**	1	7/1 7/5 10/13 10/18
14		**Eye nut M12** **0664 462 774**	1	7/1 7/5 10/13 10/18
16		**Handle** **5870 260 010**	1	7/6 10/12

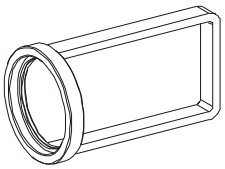
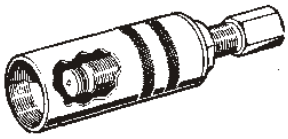
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
17		**Rolling tool** **5870 600 003**	1	7/8 10/1
18		**Back off insert** **5870 026 100**	1	8.1/3 _ 8.5/7 8.1/10 _ 8.6/2 8.2/2 _ 8.6/8 8.2/9 8.3/2 8.3/8 8.4/2 8.4/8 8.5/2
19		**Grab sleeve** **5873 001 057**	1	8.1/3 _ 8.5/7 8.1/10 _ 8.6/2 8.2/2 _ 8.6/8 8.2/9 8.3/2 8.3/8 8.4/2 8.4/8 8.5/2
20		**Rapid grip** **5873 011 011**	1	8.1/3 _ 8.5/7 8.1/10 _ 8.6/2 8.2/2 _ 8.6/8 8.2/9 _ 8.7/3 8.3/2 8.3/8 8.4/2 8.4/8 8.5/2
21		**Cut-off device** **5870 300 028**	1	8.1/6 8.2/5 8.3/11

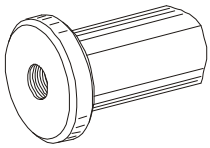
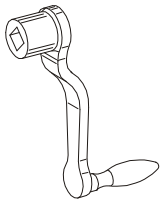
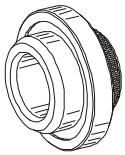
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
22		**Assembly aid** **5870 345 088**	1	8.1/13 _ 9.2/11 8.2/12 _ 9.3/5 8.4/11 _ 9.3/7 8.5/10 _ 9.4/5 8.6/11 _ 9.4/7 9.1/9 _ 9.5/6 9.1/11 _ 9.5/8 9.2/9 _ 9.6/11 9.6/13
23		**Basic tool** **5873 001 000**	1	8.7/2 8.8/1 8.8/2
24		**Grab sleeve** **5873 001 058**	1	8.7/2 8.7/3 8.8/1 8.8/2
25		**Rapid grip** **5873 011 014**	1	8.7/2 8.8/1 8.8/2
26		**Rolling tool** **5870 600 005**	1	10/1

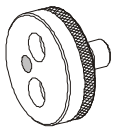
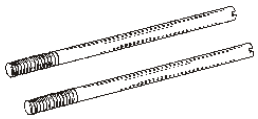
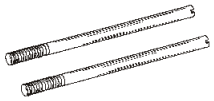
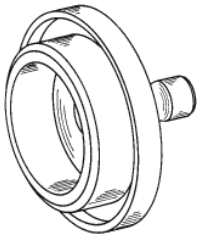
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
27		**Lubricant** **5870 451 006**	1	10/1 10/4
28		**Rolling tool** **5870 600 006**	1	10/4
29		**Driver** **5870 345 089**	1	10/20
30		**Crank handle** **5870 280 007**	1	10/20
31		**Driver tool** **5870 048 057**	1	12/1 12/5 12/12

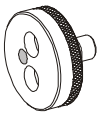
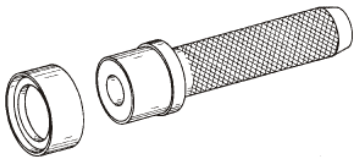
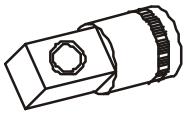
SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

ZF – ERGOPOWER 5/6 WG-160

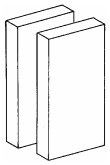
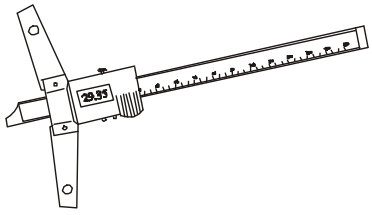
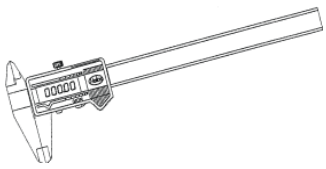
Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
32		**Driver tool** **5870 057 011**	1	12/4 12/8 12/15
33		**Handle** **5870 260 002**	1	12/4 12/8 12/15 13/8 13/26
34		**Adjusting screws (M8)** **5870 204 011**	1	13/4
35		**Adjusting screws (M10)** **5870 204 007**	1	13/5
36		**Driver tool** **5870 055 070**	1	13/8

SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

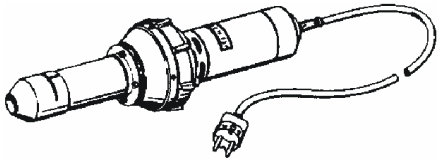
ZF – ERGOPOWER 5/6 WG-160

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Figure
37		**Driver tool** **5870 057 010**	1	13/26
38		**Driver tool** **5870 048 080**	1	14/3
39		**Reducing adapter** **5870 656 056**	1	16/9 16/10 16/13 16/16 16/23 16/30

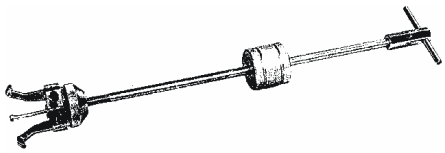
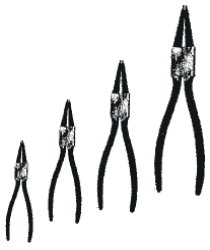
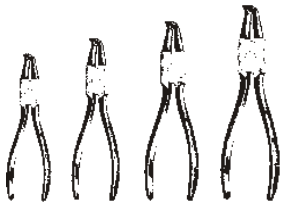
COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Fig
1		**Magnetic stand** **5870 200 055**	1	Universal
2		**Dial indicator** **5870 200 057**	1	Universal
3		**Gauge blocks** **5870 200 066** 70 mm **5870 200 067** 100 mm	1	Universal
4		**Digital depth gauge** **5870 200 072** 200 mm **5870 200 114** 300 mm	1	Universal
5		**Digital caliper gauge** **5870 200 109** 150 mm	1	Universal

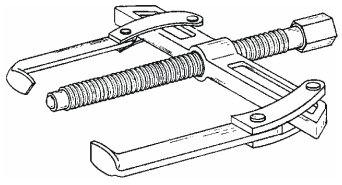
COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Fig
6	 	**Torque wrench** **5870 203 030** 0.6 -6.0 Nm **5870 203 031** 1.0 – 12 Nm **5870 203 032** 3.0 – 23 Nm **5870 203 033** 5.0 – 45 Nm **5870 203 034** 10 – 90 Nm **5870 203 039** 80 – 400 Nm **5870 203 016** 140 – 750 Nm **5870 203 011** 750 - 2000 Nm	1	Universal
7		**Hot air blower** **5870 221 500** 230 V **5870 221 501** 115 V	1	Universal
8		**Plastic hammer** **5870 280 004** Ø 60 mm **Substitute nylon insert** **5870 280 006**	1	Universal
9		**Lifting strap** **5870 281 026**	1	Universal

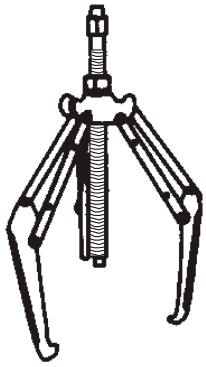
COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Fig
10		**Lifting chain** **5870 281 047**	1	Universal
11		**Pry bar** **5870 345 071**	1	Universal
12		**Striker** **5870 650 004**	1	Universal
13		**Set of internal pliers** I1-I2-I3-I4 **5870 900 013**	1	Universal
14		**Set of internal pliers** I11-I21-I31-I41 90° **5870 900 014**	1	Universal

COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Fig
15		**Set of external pliers** A1-A2-A3-A4 **5870 900 015**	1	Universal
16		**Set of external pliers** A01-A02-A03-A04 90° **5870 900 016**	1	Universal
17		**Two-armed puller** **5870 970 001** Jaw width 80 mm Throat depth 100 mm **5870 970 002** Jaw width 120 mm Throat depth 125 mm **5870 970 003** Jaw width 170 mm Throat depth 125 mm **5870 970 004** Jaw width 200 mm Throat depth 175 mm **5870 970 006** Jaw width 350 mm Throat depth 250 mm **5870 970 007** Jaw width 520 mm Throat depth 300 - 500 mm **5870 970 026** Jaw width 250 mm Throat depth 200 mm **5870 970 028** Jaw width 380 mm Throat depth 200 mm	1	Universal

COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

Cons. No.	Figure	Designation Order no.	Qty.	Chapter/Fig
18		**Three armed puller** **5870 971 001** Jaw width 85 mm Throat depth 65 mm **5870 971 002** Jaw width 130 mm Throat depth 105 mm **5870 971 003** Jaw width 230 mm Throat depth 150 mm **5870 971 004** Jaw width 295 mm Throat depth 235 mm **5870 971 005** Jaw width 390 mm Throat depth 270 mm **5870 971 006** Jaw width 640 mm Throat depth 300 mm	1	Universal

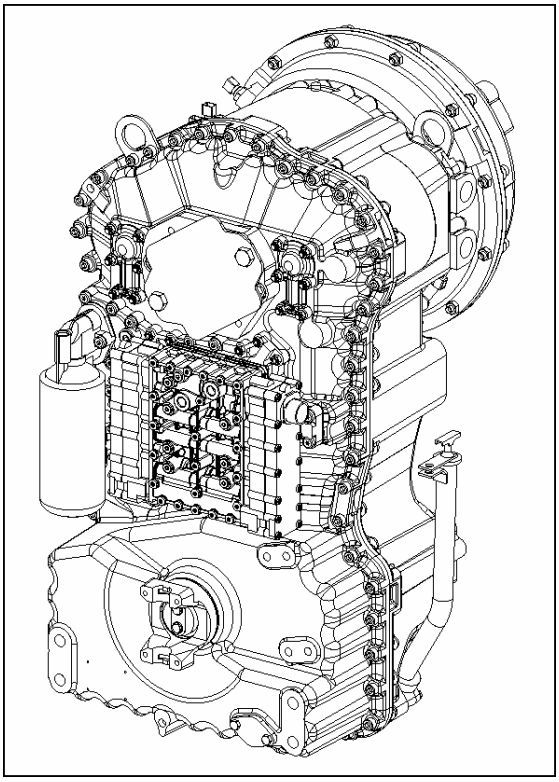


Figure 1

1. DISASSEMBLY:

Electro-hydraulic control and ZF fine filter (replaceable filter)

Attach transmission to assembly truck.

(S) Assembly truck	5870 350 000
(S) Holding fixtures	5870 350 063
(S) Clamping angles	5870 350 090

☞ **Drain oil prior to starting disassembly!**

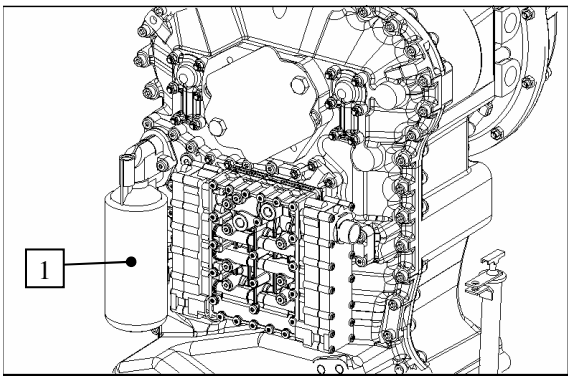


Figure 2

1.1 Removal of filter

Separate ZF fine filter (1) from filter head by means of belt wrench.

(S) Belt wrench 5870 105 005

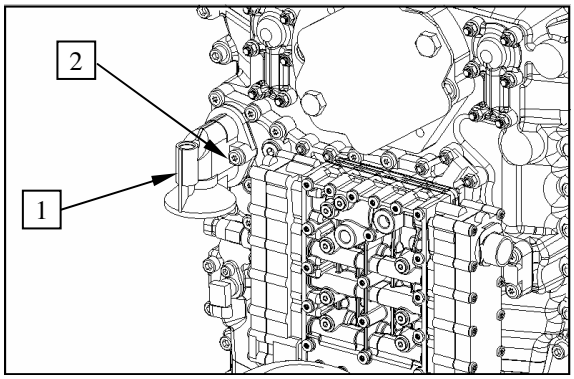


Figure 3

Loosen Torx screws (2) and separate filter head (1) from transmission housing.

☞ **Remove O-rings!**

(S) Socket wrench TX 40 5873 042 004

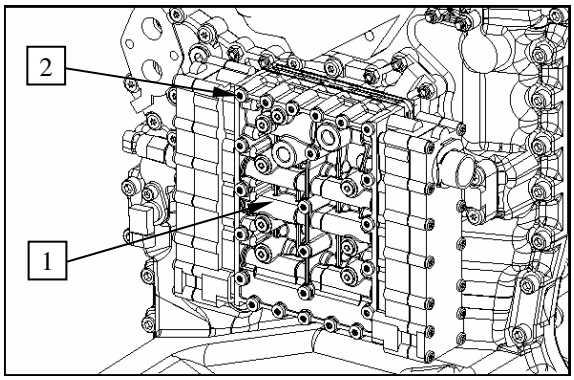


Figure 4

1.2 Removal of electric gear-shift control

Remove gear-shift control (1).

Loosen Torx screws (2) and separate gear-shift control housing from intermediate plate.

(S) Socket wrench TX-27 5873 042 002
(S) Adjusting screws M6 5870 204 063

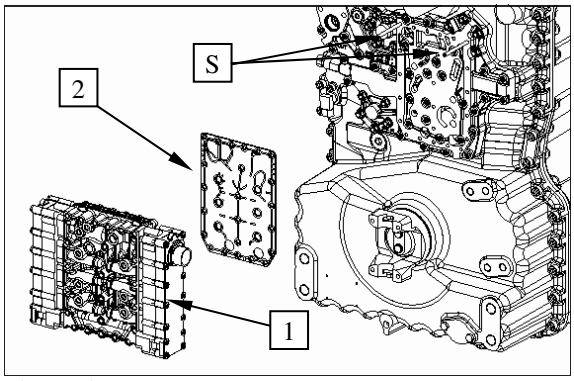


Figure 5

Remove gear-shift control assy. (1) and sealing plate (2).

(S) Adjusting screws M6 5870 204 063

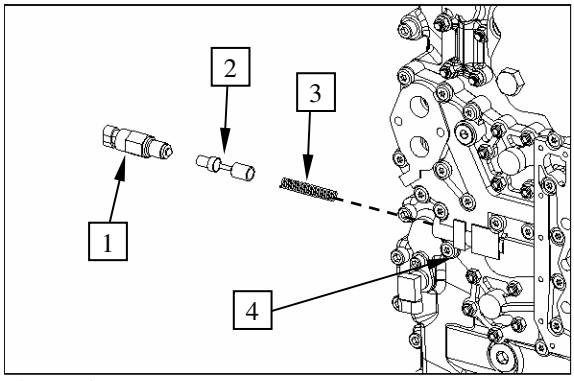


Figure 6

Remove differential pressure switch for ZF fine filter from duct plate (4) .

1 = Switch with O-ring
2 = Piston
3 = Compression spring

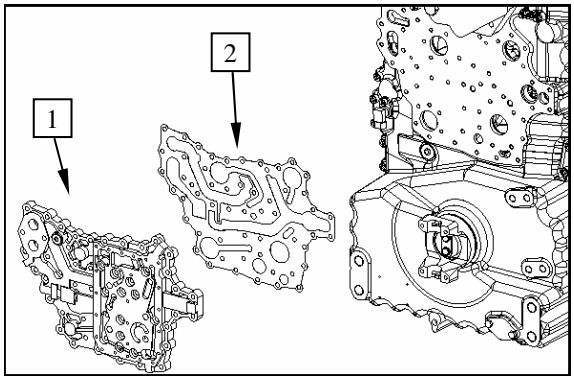


Figure 7

Loosen hexagon nuts and Torx screws and separate duct plate (1) and seal (2) from housing rear part.

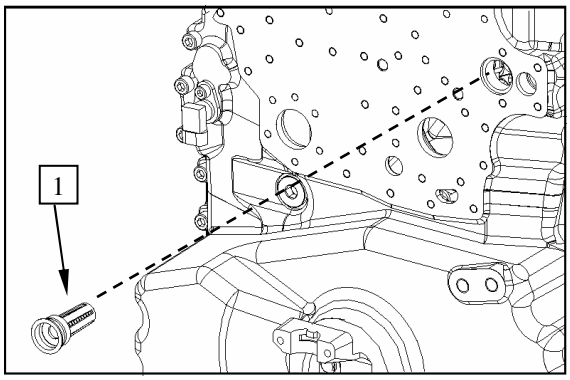


Figure 8

Pull converter safety valve (1) out of housing hole.

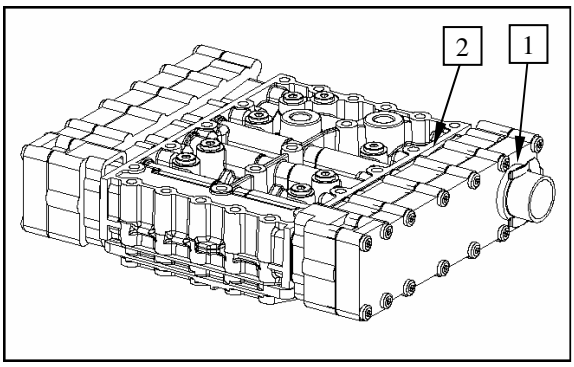


Figure 9

Mark installation position of wiring harness (1) towards valve block (2).

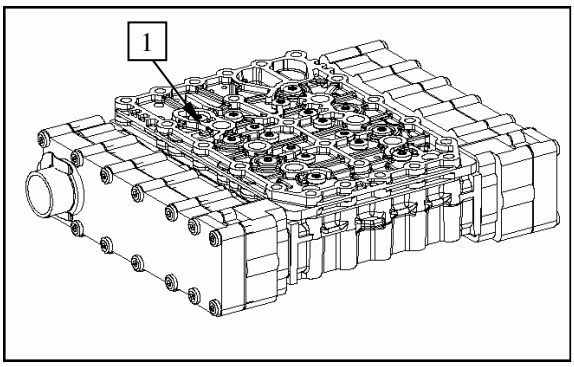


Figure 10

Loosen Torx screws (1).

(S) Socket wrench TX-27 5873 042 002

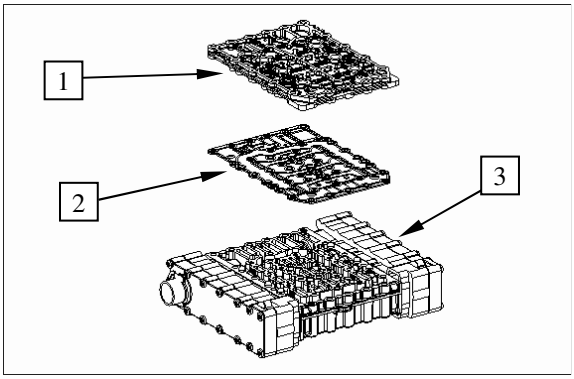


Figure 11

Separate duct plate (1) and sealing plate (2) from valve block (3).

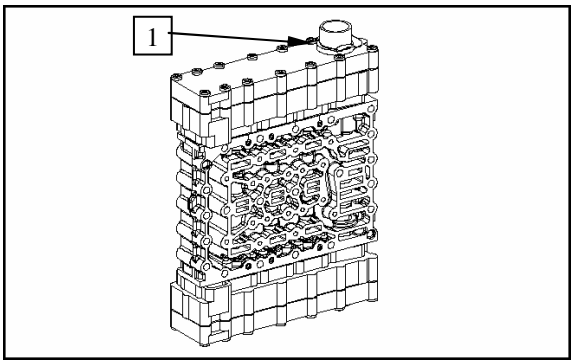


Figure 12

Remove retaining clamp (1).

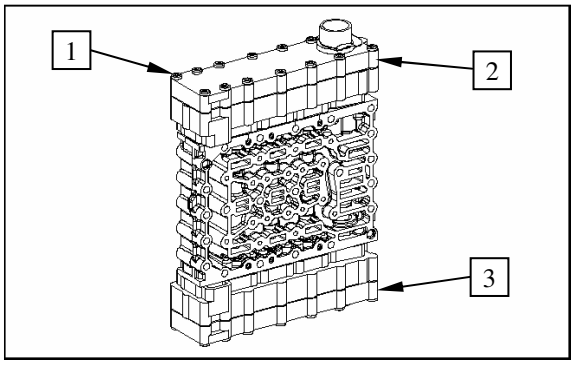


Figure 13

Loosen Torx screws (1) and remove cover (2).
Remove opposite cover (3) in the same way.

(S) Socket wrenchTX-27 5873 042 002

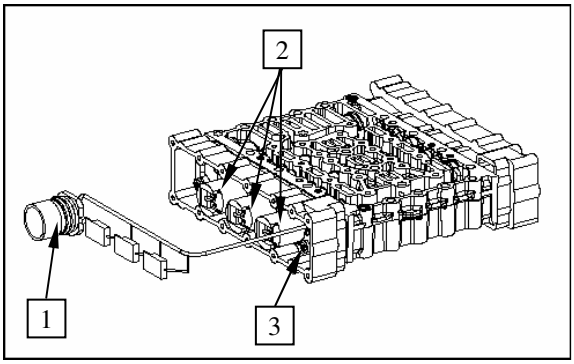


Figure 14

Remove wiring harness (1).

Loosen cylindrical screws (3), remove fixing plates and remove pressure controllers (2).

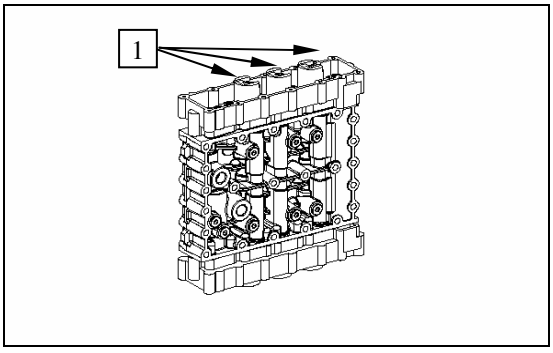


Figure 15

Loosen cylindrical screws, remove fixing plates and remove pressure controllers (1) on opposite side.

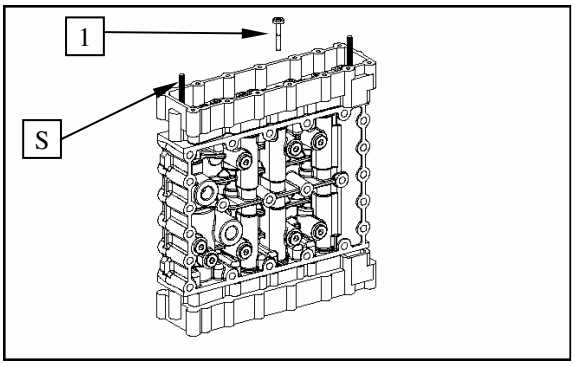


Figure 16

Loosen two Torx screws (1) and preliminarily fix housing by means adjusting screws (S). (Housing is spring-loaded.) Then loosen remaining Torx screws.

(S) Adjusting screws 5870 204 036

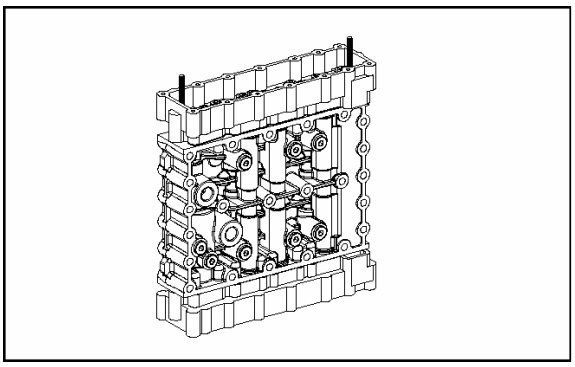


Figure 17

Separate housing from valve housing by loosening the adjusting screws equally.

(S) Adjusting screws 5870 204 036

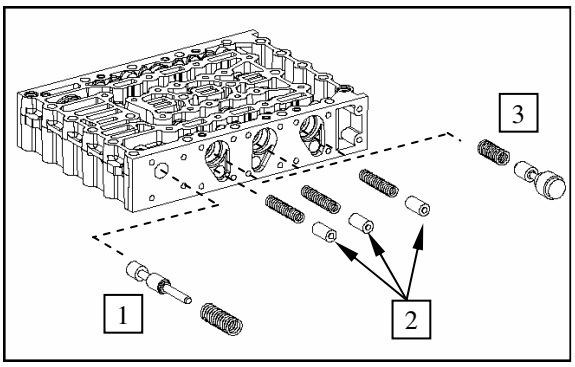


Figure 18

Remove individual parts:

1 = Pressure reducing valve
2 = Vibration dampers
3 = Follow-on slide

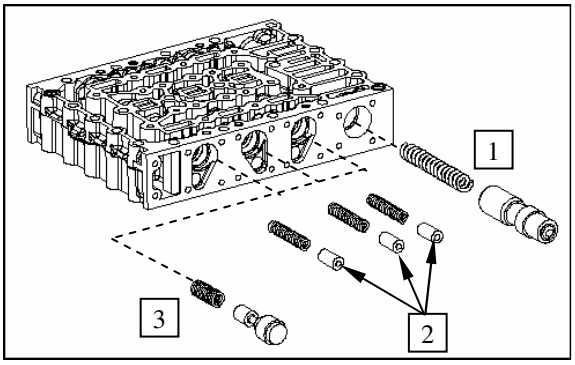


Figure 19

Remove individual parts of opposite side analogously:

1 = Main pressure valve
2 = Vibration dampers
3 = Follow-on slide

2. DISASSEMBLY:

Inductive sensor, Hall sensor, breather, oil filler and oil drain plug

Attach transmission to assembly truck.

(S) Assembly truck	5870 350 000
(S) Holding fixtures	5870 350 063
(S) Clamping angles	5870 350 090

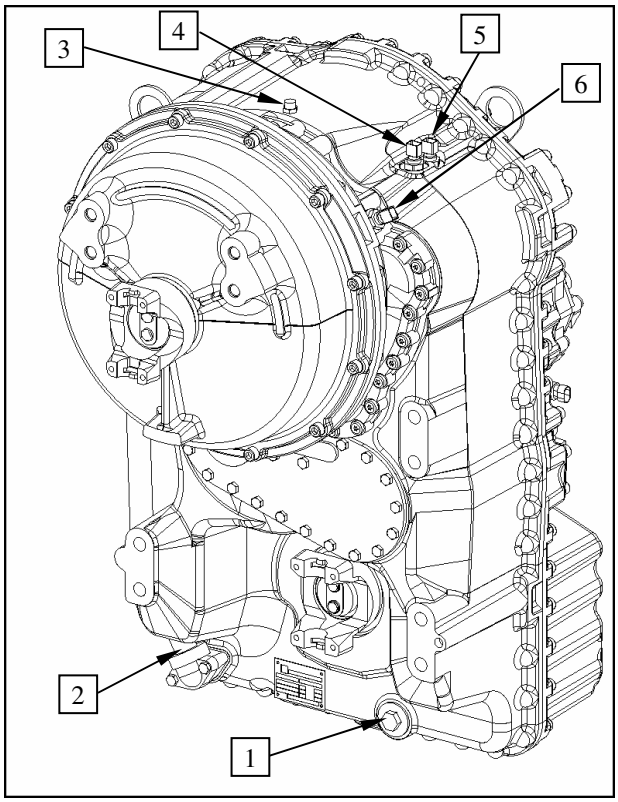


Figure 1

Remove positioned parts.

1 = Screw plug (oil drain hole)
2 = Oil filler tube with oil dipstick
3 = Breather
4 = Inductive sensor - n central gear chain
5 = Inductive sensor - n turbine
6 = Inductive sensor - n engine

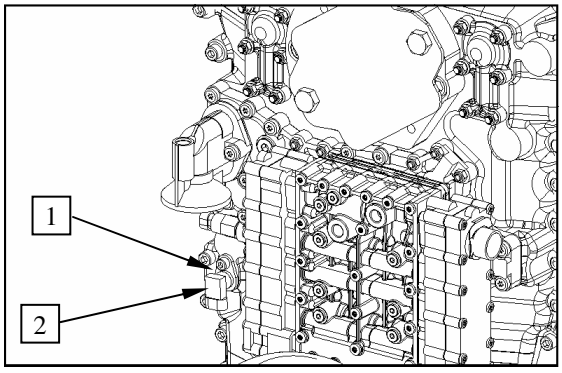


Figure 2

Loosen cylindrical screw (1) and remove speed sensor (Hall sensor).

☞ **Remove O-ring !**

2 = Speed sensor - n output

3. DISASSEMBLY:

Engine connection, oil pressure pump, converter back-pressure valve and temperature sensor (measuring point "63" after the converter).

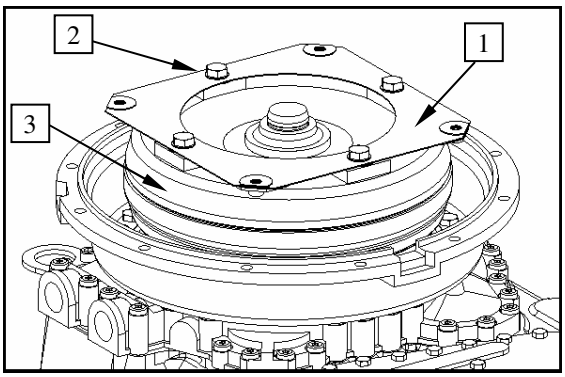


Figure 1

3.1 Engine connection (direct mount)

Loosen hexagon screw (2) and separate flexplate (1) from converter (3).

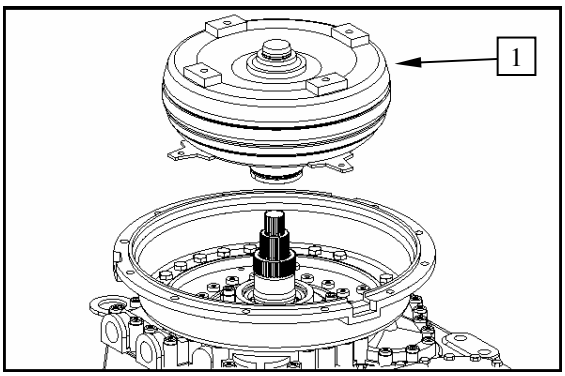


Figure 2

Separate converter (1) from transmission by means of lifting device.

(S) Eye bolts assortment 5870 204 002

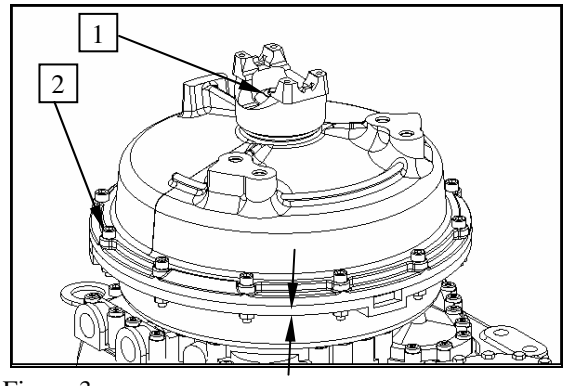


Figure 3

3.2 Engine connection (remote mount)

Remove locking plate (1), loosen hexagon screw and remove washer.

Loosen bolted connection (2) cover/converter bellhousing

☞ **Mark radial installation position of cover/converter bellhousing by center punch.**

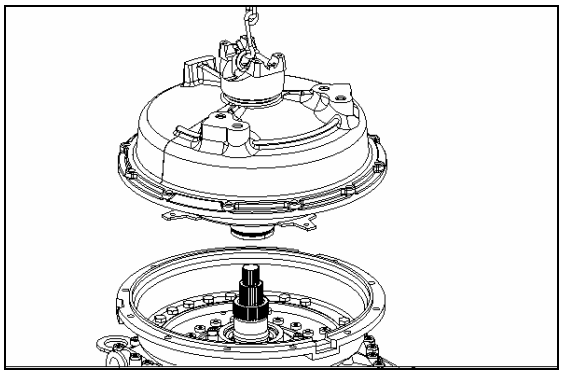


Figure 4

Separate cover from converter bellhousing by means of lifting device.

(S) Eye bolts assortment 5870 204 002

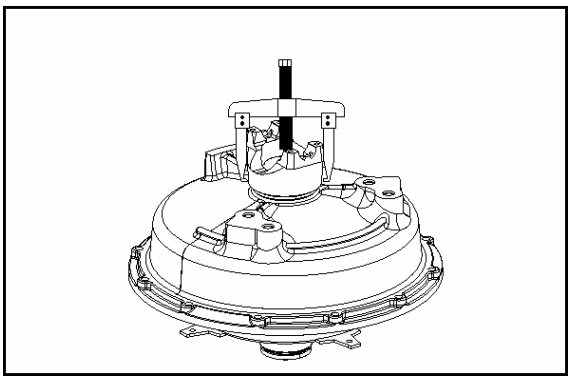


Figure 5

Pull off output flange.

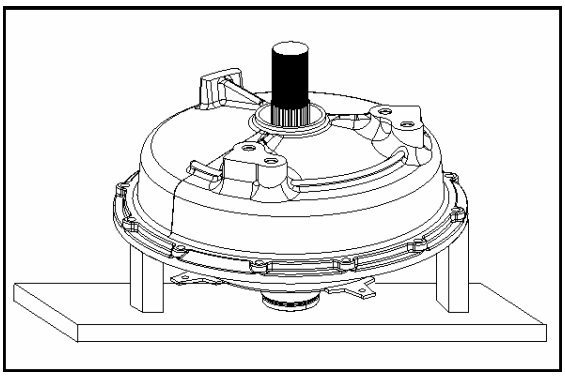


Figure 6

Press input shaft and converter out of cover (ball bearing).

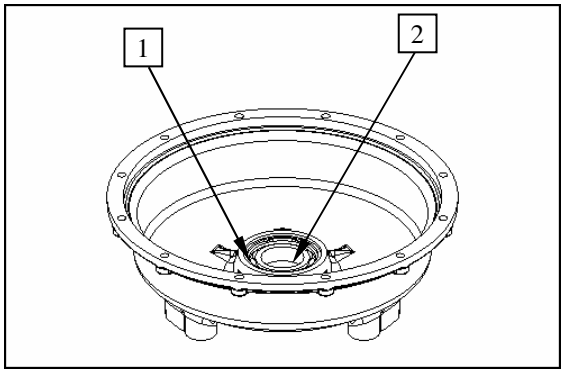


Figure 7

Snap out retaining ring (1) and remove ball bearing (2).

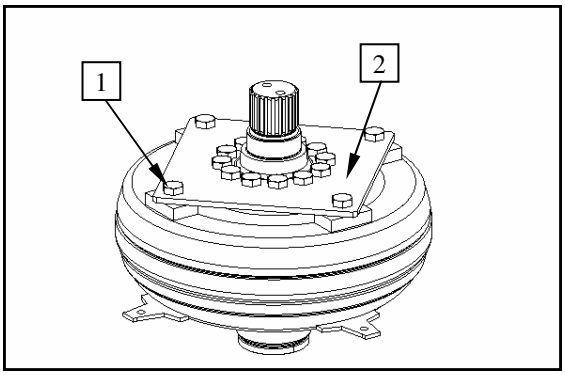


Figure 8

Loosen hexagon screws (1) and remove flexplate (2) from converter.

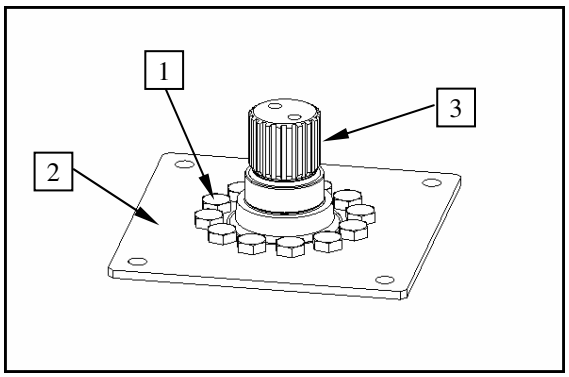


Figure 9

Loosen hexagon screws (1) and remove flexplate (2) from input shaft (3).

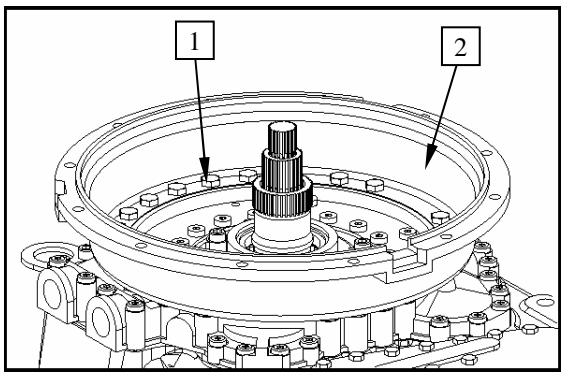


Figure 10

3.3 Oil pressure pump

Loosen bolted connection (1) converter bellhousing/oil feed housing and remove converter bellhousing (2).

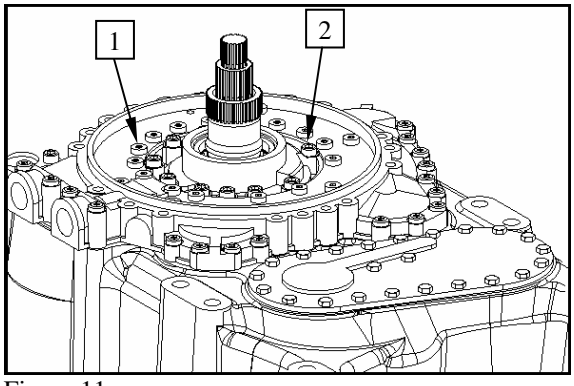


Figure 11

Loosen bolted connection (1) oil feed housing/transmission housing front part with Torx screws and bolted connection (2) oil pressure pump/transmission housing front part with cylindrical screws.

☞ **Separate oil feed housing together with oil pressure pump from transmission housing front part.**

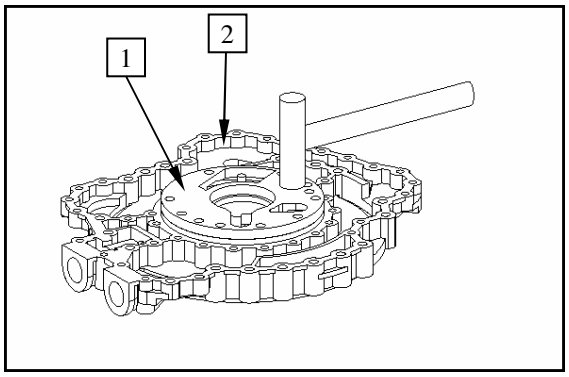


Figure 12

Separate oil pressure pump (1) from oil feed housing (2).

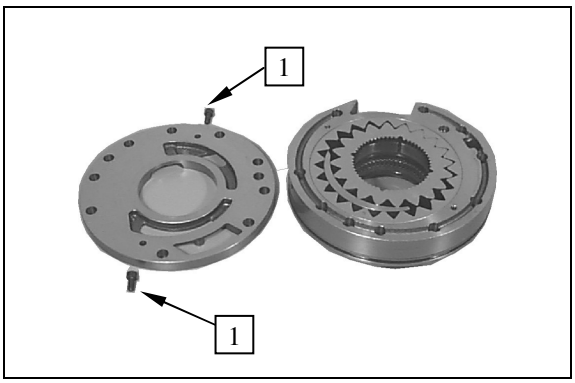


Figure 13

Loosen both cylindrical screws (1) and remove control disk.

☞ **In case of wear marks in the pump housing or on the control disk, the oil pressure pump assy must be replaced.**

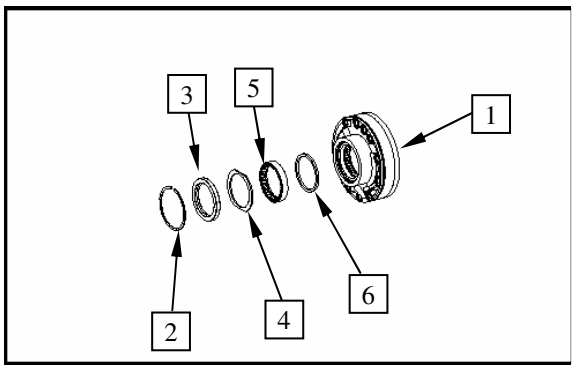


Figure 14

Remove snap ring (1) and individual parts.

1 = Pump housing with rotor
2 = Snap ring
3 = Shaft seal ring
4 = Support shim
5 = Needle bearing
6 = Ring

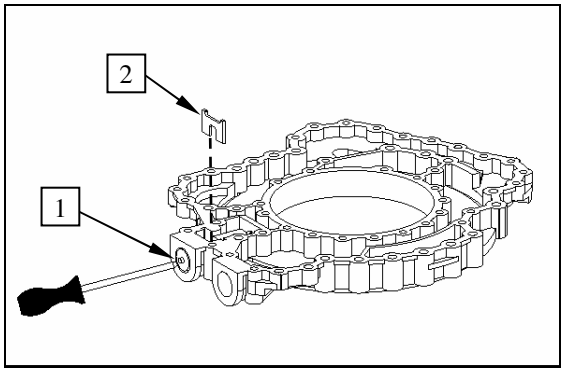


Figure 15

3.4 Converter back-pressure valve

Preload converter safety valve (1) by means of screw driver or assembly aid (S) and remove locking plate (2).

(S) Assembly aid 5870 345 107

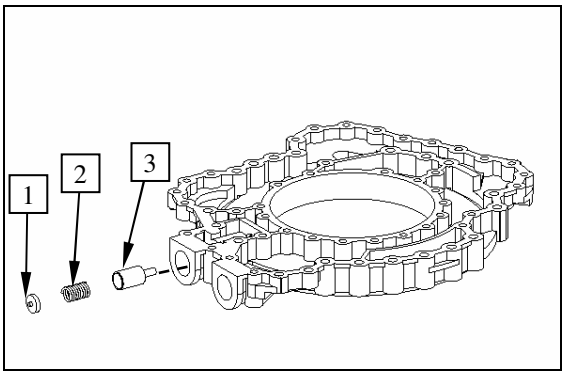


Figure 16

Remove individual parts of converter safety valve which are getting released.

1 = Pressure plate
2 = Compression spring
3 = Piston

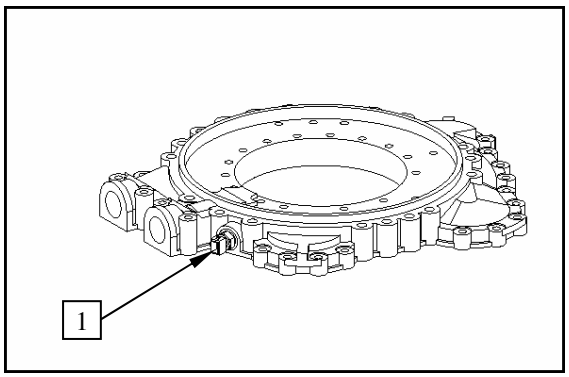


Figure 17

Remove temperature sensor (1).

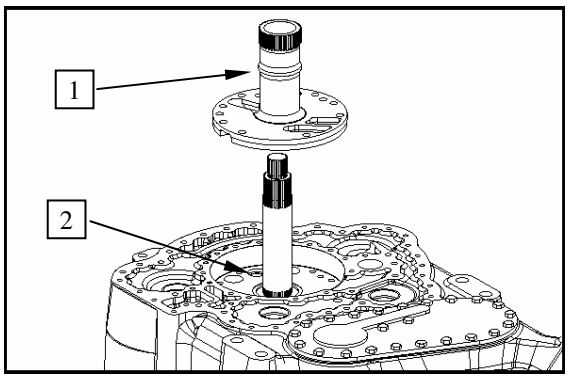


Figure 18

Remove stator shaft (1).

Pull pressure relief valve (2) out of the housing hole.

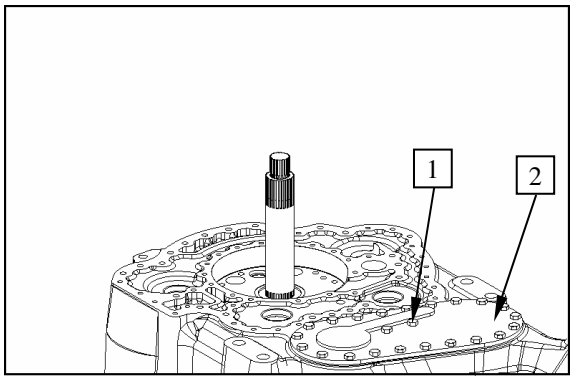


Figure 1

4. DISASSEMBLY - Emergency steering pump

4.1 Version without emergency steering pump

Loosen bolted connection (1) cover/housing front part and remove cover (2) and seal.

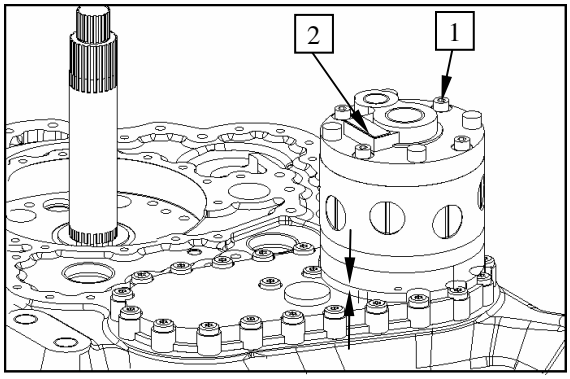


Figure 2

4.2 Version with emergency steering pump

Loosen cylindrical screws (1) and separate emergency steering pump (2) from cover.

☞ **Mark radial installation position (see arrows)!**

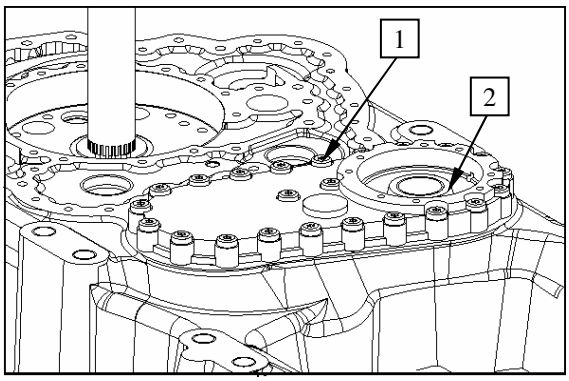


Figure 3

Loosen bolted connection (1) cover/housing front part and remove cover (2) and seal.

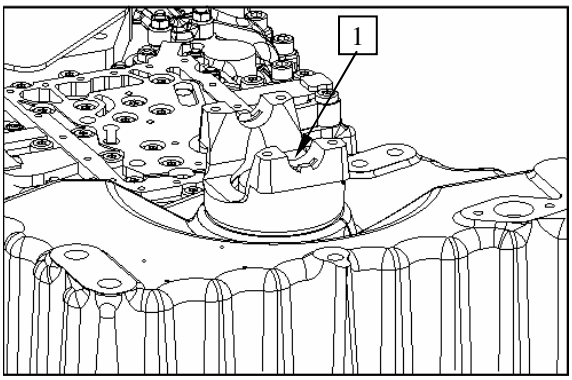


Figure 1

5. DISASSEMBLY - Outputs

5.1 Output flange on output side without parking brake

Remove locking plate (1), loosen hexagon screws, remove washer and O-ring.

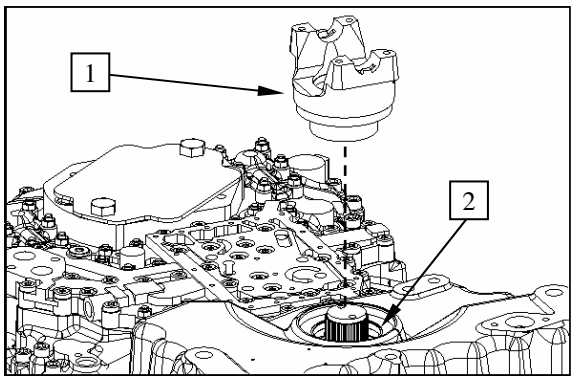


Figure 2

Pull off output flange (1) and remove shaft seal (2).

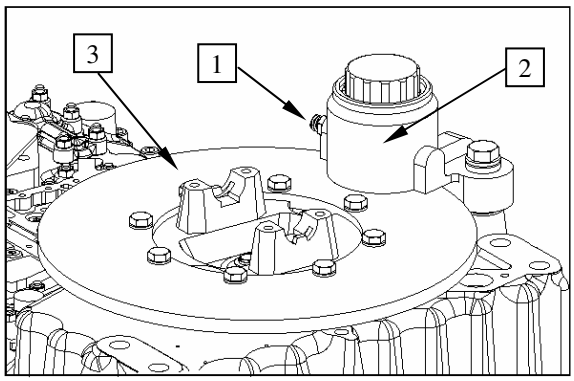


Figure 3

5.2 Output flange on output side with parking brake

Connect HP pump at port (1) and apply approx. 80 bar pressure to the hydraulically actuated parking brake (2) until the brake disc (3) can be rotated by hand.

(S) HP hand-operated pump	5870 287 007
(S) MINIMESS coupling (M12x1.5)	5870 950 101

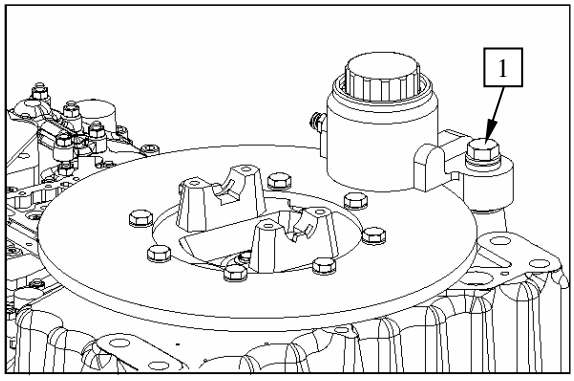


Figure 4

Loosen hexagon screws (1) of bolted connection between parking brake and bracket.

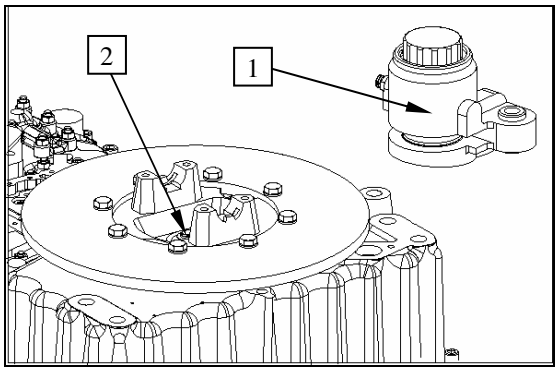


Figure 5

Remove parking brake (1).

Types:
M-90 (mechanical actuation)
FSG-75 (hydraulic actuation)
FSG-90/110 (hydraulic actuation)

All further working steps for parking brake see Knott original documentation (chapter 17)!

Remove locking plate (2), loosen hexagon screws, remove washer and O-ring.

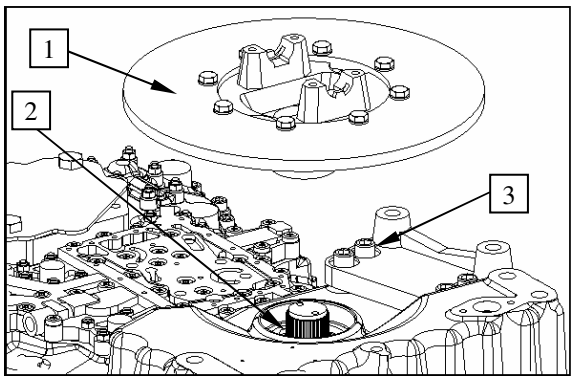


Figure 6

Pull off output flange (1) and remove shaft seal (2).

Loosen cylindrical screws (3) of bolted connection between bracket and transmission housing/rear part and remove bracket.

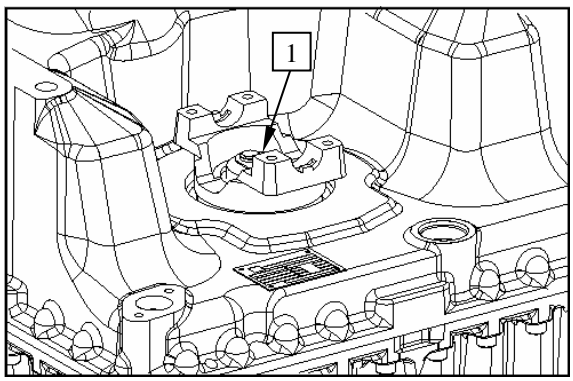


Figure 7

5.3 Output flange on converter side (without axle disconnection)

Remove locking plate (1), loosen hex. screws, remove washer and O-ring.

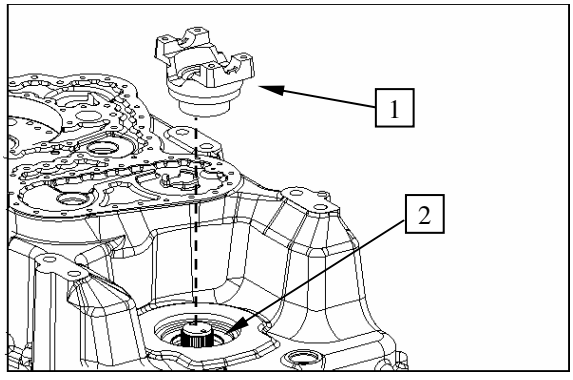


Figure 8

Pull-off output flange (1) and remove shaft seal (2).

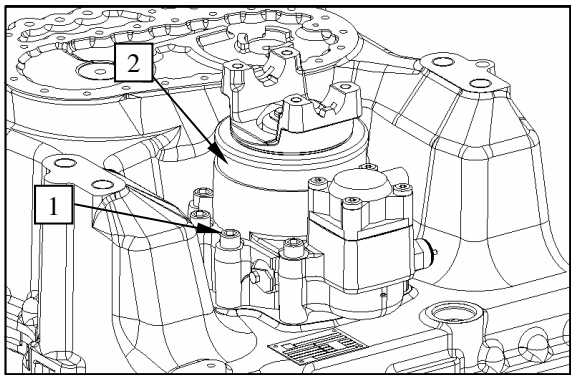


Figure 9

5.4 Output flange on converter side (with axle disconnection)

Loosen cylinder screws (1) and separate axle disconnection (2) with two assembly levers from housing.

(S) Assembly lever 5870 345 036

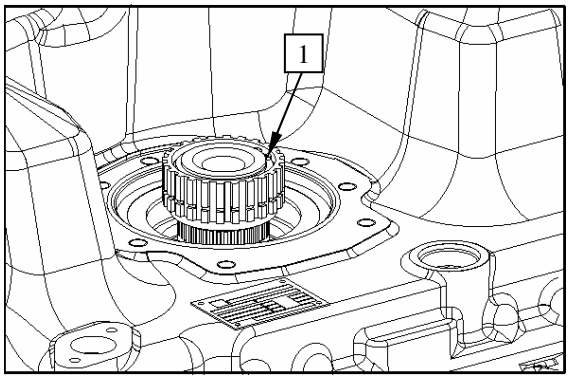


Figure 10

Unsnap retaining ring (1).

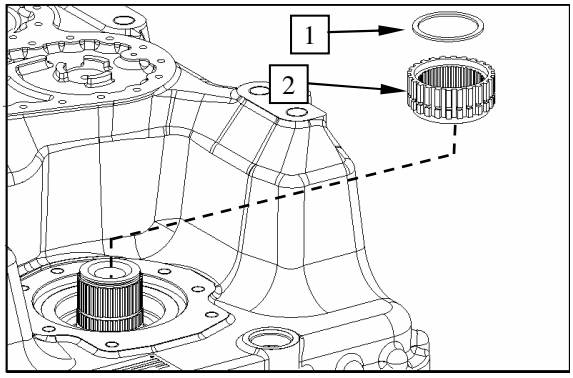


Figure 11

Remove shim (1) and bush (2).

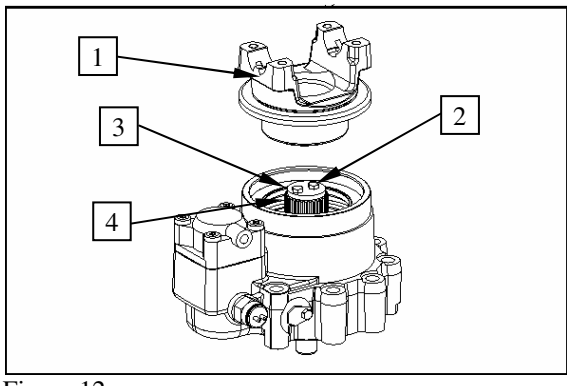


Figure 12

Pull-off output flange (1), loosen cylinder screws (2) and remove washer (3), intermediate disc and bushing (4).

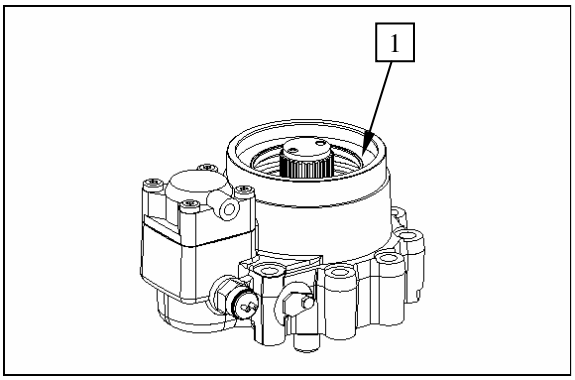


Figure 13

Remove shaft seal (1).

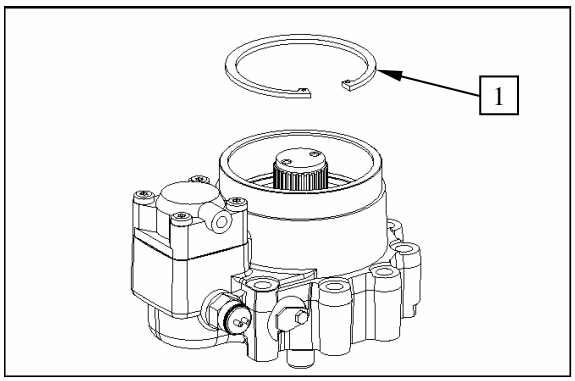


Figure 14

Unsnap retaining ring (1).

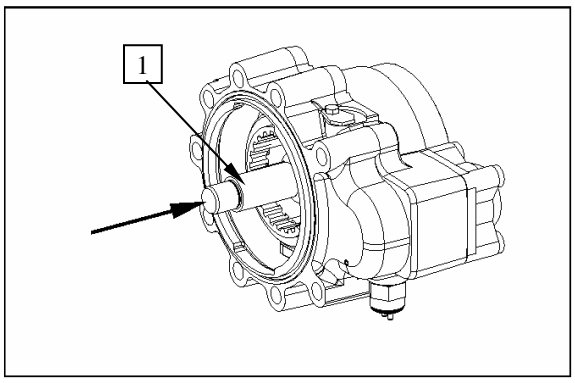


Figure 15

Force out output shaft (1) by means of a plastic hammer.

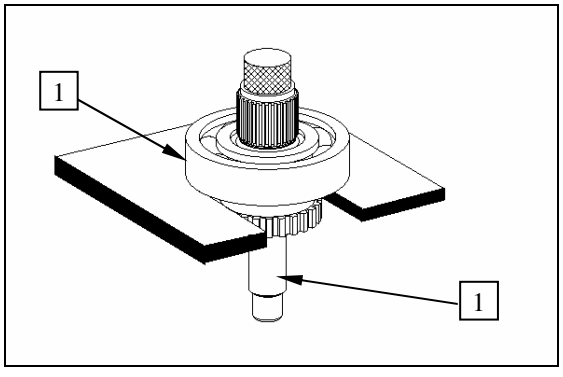


Figure 16

Press ball bearing (1) from output shaft (2).

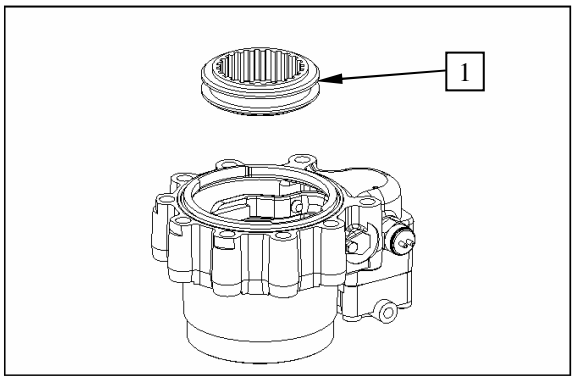


Figure 17

Remove sliding sleeve (1).

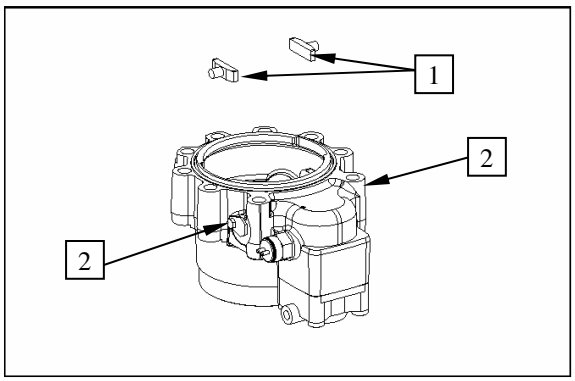


Figure 18

Remove sliding pads (1) and loosen hex screws (2).

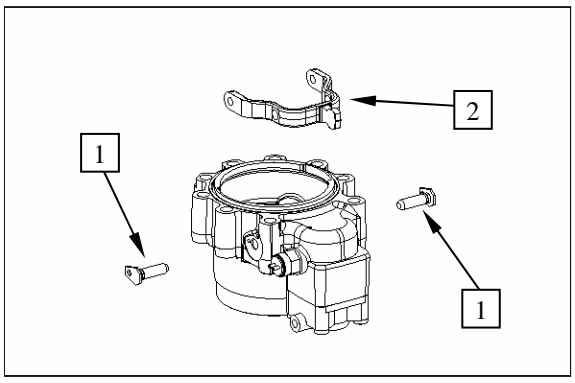


Figure 19

Remove pin (1) as well as releasing shift fork (2).

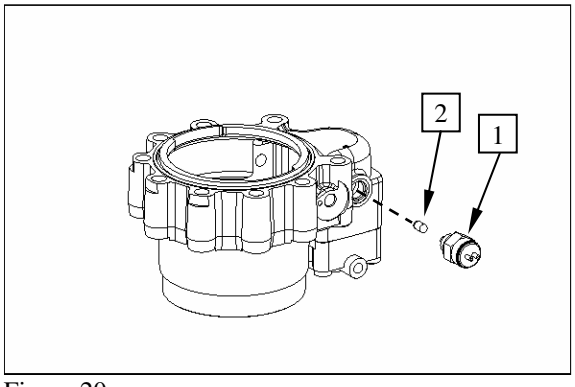


Figure 20

Dismantle switch (1) and locking pin (2).

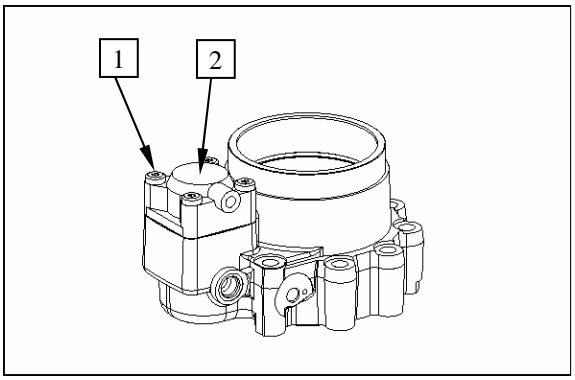


Figure 21

Loosen cylinder screws (1), take off cylinder (2) and seal.

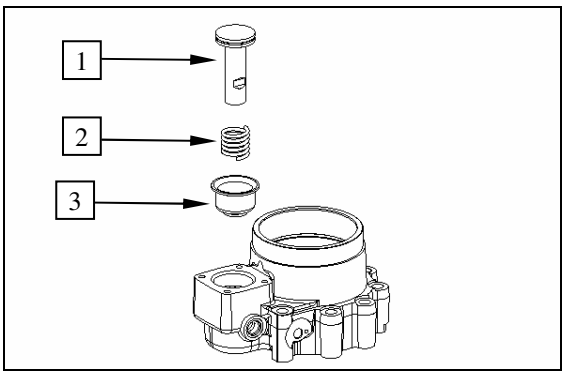


Figure 22

Remove releasing single components.

1 = piston
2 = compression spring
3 = spring cup

6. DISASSEMBLY - PTO

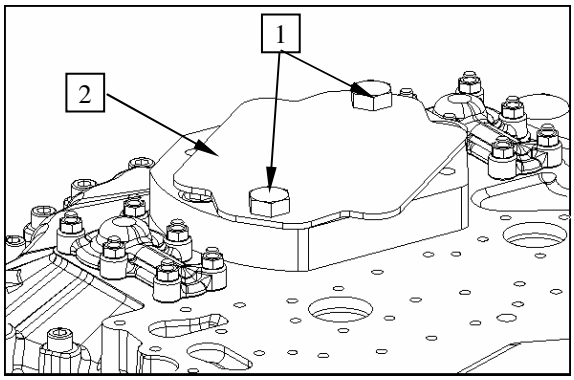


Figure 1

Loosen hexagon screws (1) and remove cover (2).

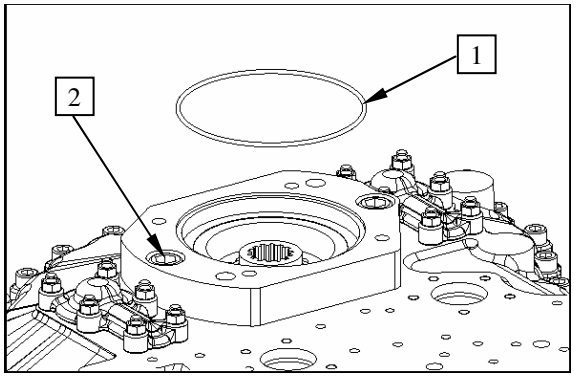


Figure 2

Take O-ring (1) out of cover and loosen cylindrical screws (2).

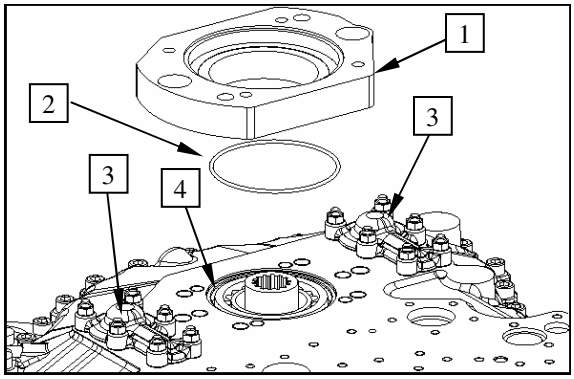


Figure 3

Remove flange (1) and O-ring (2).

Loosen hexagon nuts and remove both covers (3) with O-rings.

Snap out retaining ring (4) and remove it.

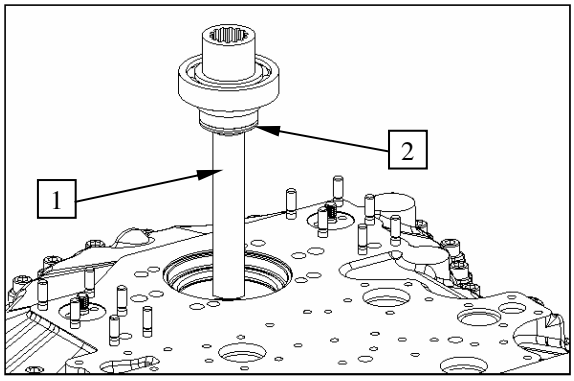


Figure 4

Pull pump shaft (1) out of housing hole.

Snap out rectangular ring (2)

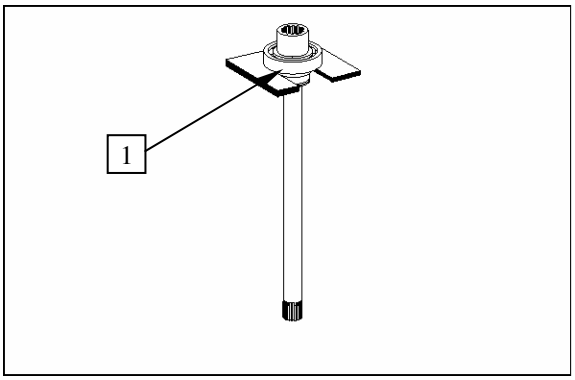


Figure 5

Press ball bearing (1) off the pump shaft.

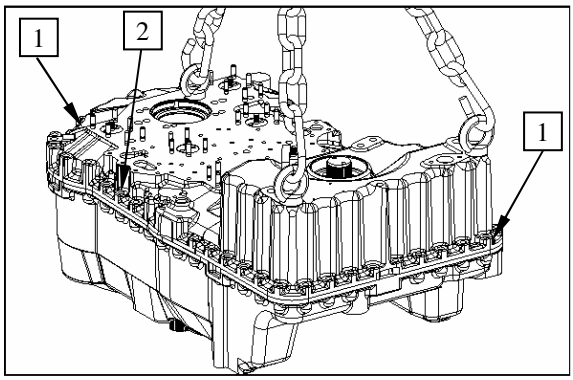


Figure 1

7. Removal of input shaft, output shaft and clutches

Force out both cylindrical pins (1).

Loosen bolted connection (2) between housing front and rear part and separate housing rear part by means of lifting device.

(S) Eye bolt M20	0636 804 003
(S) Eye nut M12	0664 462 774

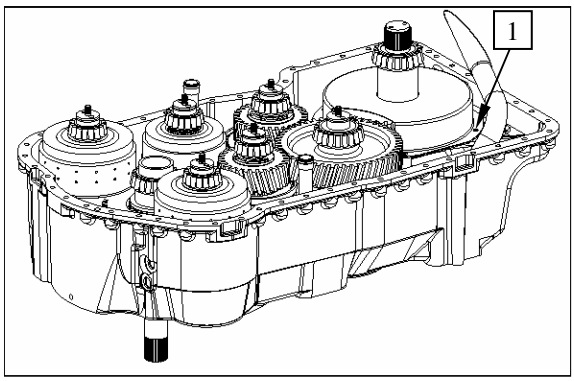


Figure 2

Loosen bolted connection (1) of oil screen sheets.

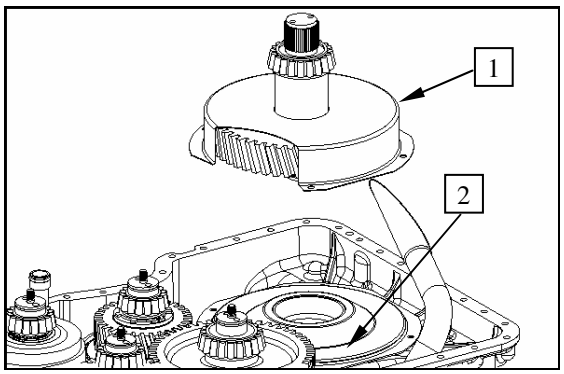


Figure 3

Remove output shaft (1) and lower oil screen sheet (2) from housing.

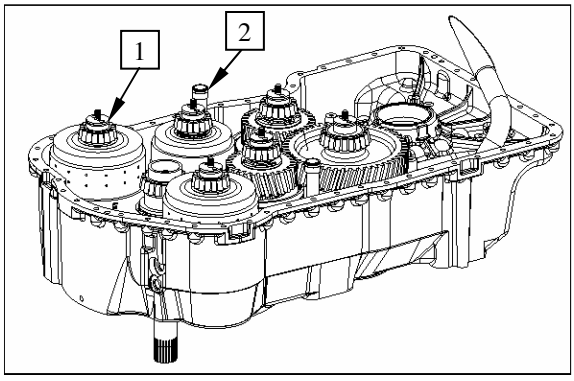


Figure 4

Remove all rectangular rings (1) from the clutches and all O-rings (2) from the oil tubes.

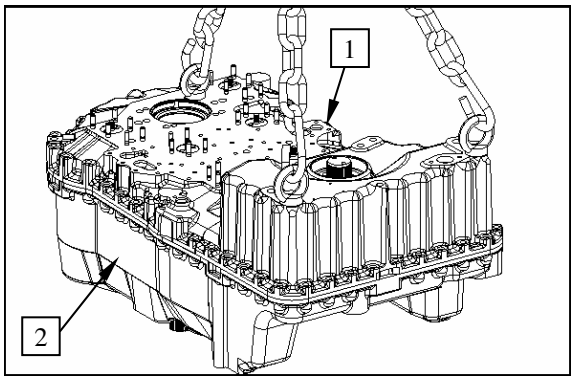


Figure 5

Use lifting device to bring housing rear part (1) into contact position with housing front part (2) again.

(S) Eye bolt M20 0636 804 003
(S) Eye nut M12 0664 462 774

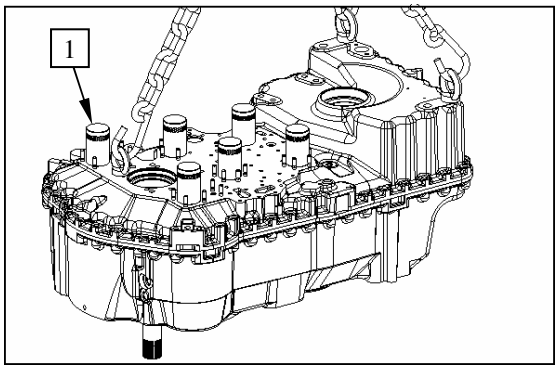


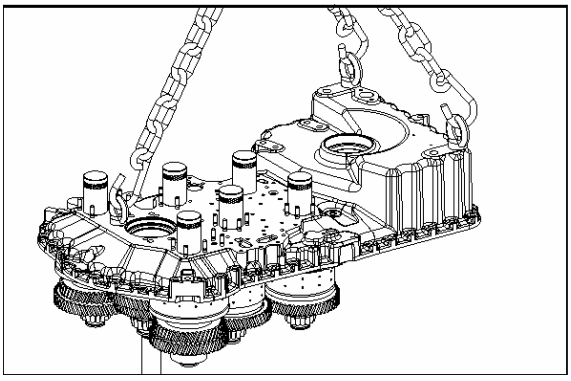
Figure 6

Due to the installation conditions, the removal of single clutches without using the special tool is not possible.

Risk of injury!

Fix all clutches by means of handle (1).

(S) Handle 5870 260 010


Figure 7

Separate housing rear part incl. clutches from housing front part by means of the lifting device and attach it to the assembly truck.

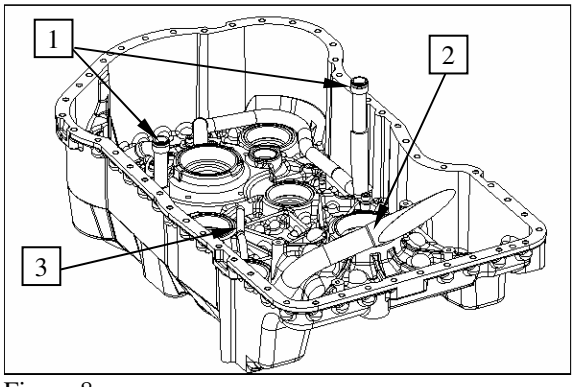


Figure 8

Loosen cylindrical screws of oil tubes (1) in the housing front part and remove them.

The suction tube (2) and the lubrication lines (3) are rolled in and are highly difficult to remove.
In case of damage, use of the appropriate ZF special tool is imperative for fitting or replacing these components.

(S) Suction tube No. 0501 210 712
(S) Rolling tool No. 5870 600 003

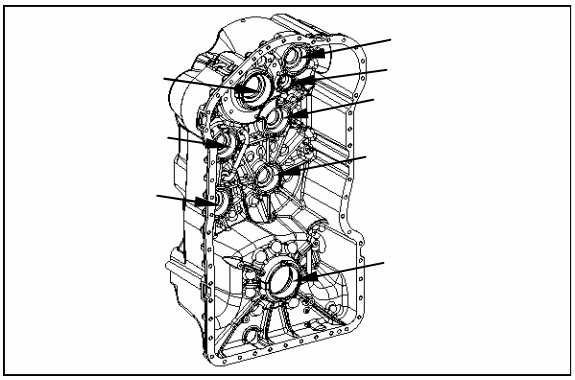


Figure 9

Remove bearing outer rings (arrows) from the housing front part.

☞ **If, contrary to the ZF recommendation, the tapered roller bearings of clutches, input and output are not replaced, it is imperative to ensure the previous pairing (bearing outer ring/ bearing inner ring).**

Bearing outer ring and bearing inner ring must be marked!

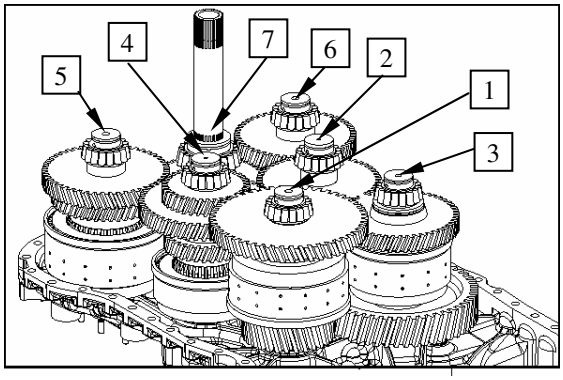


Figure 10

Lift the clutches out of the housing in numerical order as described in the legend.

1 = K1 clutch
2 = K2 clutch
3 = K3 clutch
4 = K4 clutch
5 = KR clutch
6 = KV clutch
7 = input shaft

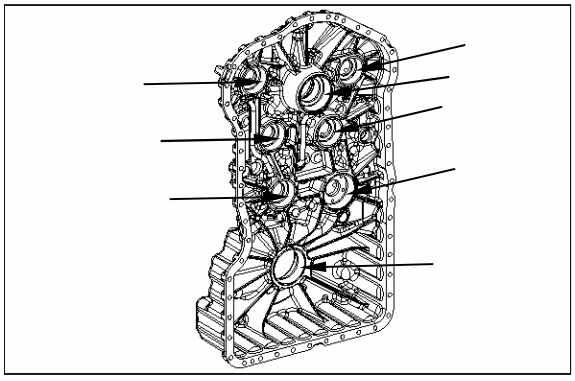


Figure 11

Remove bearing outer rings (arrows) from the housing rear part.

☞ **If, contrary to the ZF recommendation, the tapered roller bearings of clutches, input and output are not replaced, it is imperative to ensure the previous pairing (bearing outer ring/ bearing inner ring).**

Bearing outer ring and bearing inner ring must be marked!

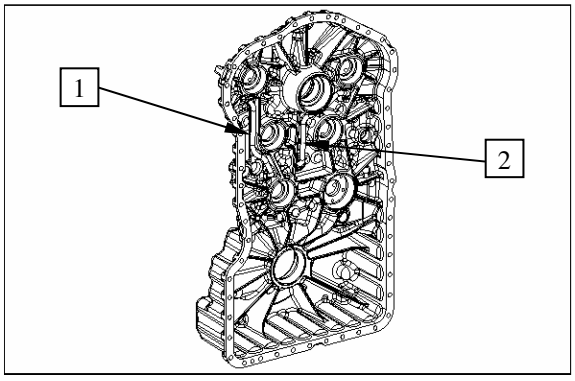


Figure 12

☞ **The lubrication lines are rolled in (1 and 2) and are highly difficult to remove.**
In case of damage, use of the appropriate ZF special tool is imperative for fitting or replacing these components.

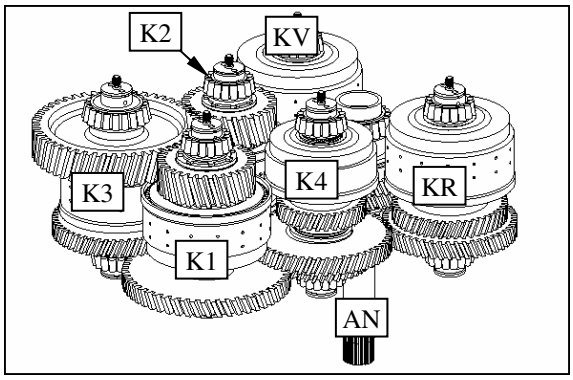


Figure 1

8. DISASSEMBLY:

Clutches KV / KR / K1 / K2 /K3 / K4 input and output shaft

See opposite picture.
K1 = clutch
K2 = clutch
K3 = clutch
K4 = clutch
KR = clutch
KV = clutch
AN = input shaft

8.1 KV clutch

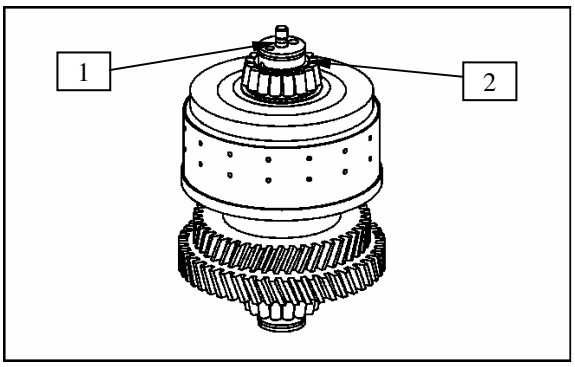


Figure 2

Remove stud bolt (1) and snap out piston ring (2).

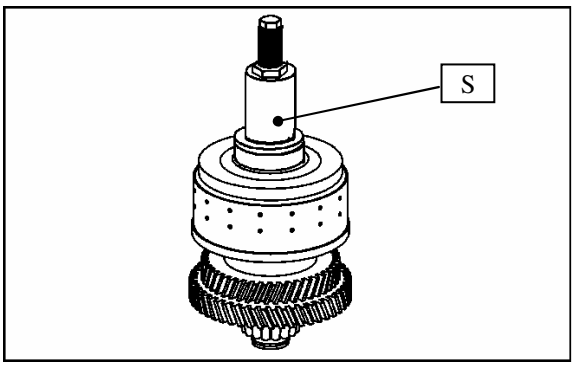


Figure 3

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

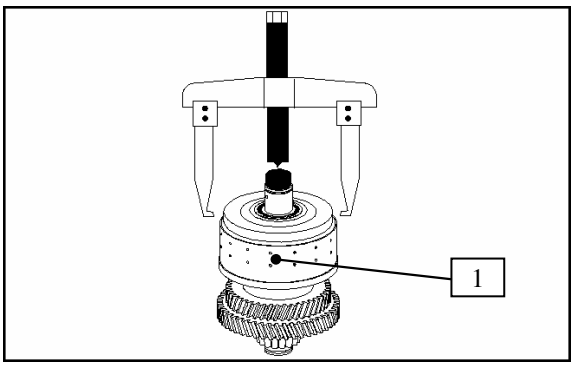


Figure 4

Pull clutch (1) off the shaft.

☞ **Disassembly clutch (1) see page 11-16!**

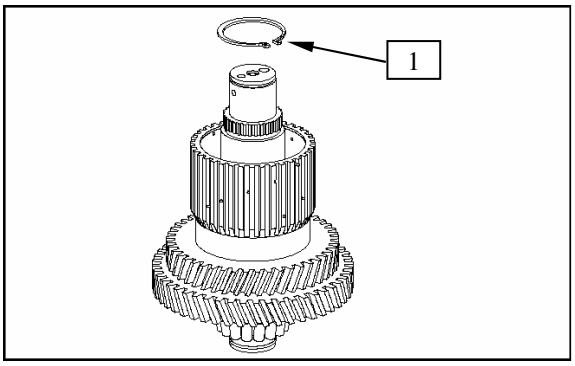


Figure 5

Snap out retaining ring (1) .

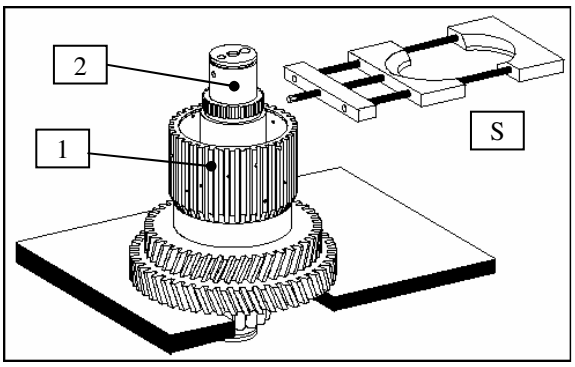


Figure 6

Fix idler gear (1) by means of cut-off device (S) and press it off the clutch shaft (2) .

(S) Cut-off device 5870 300 028

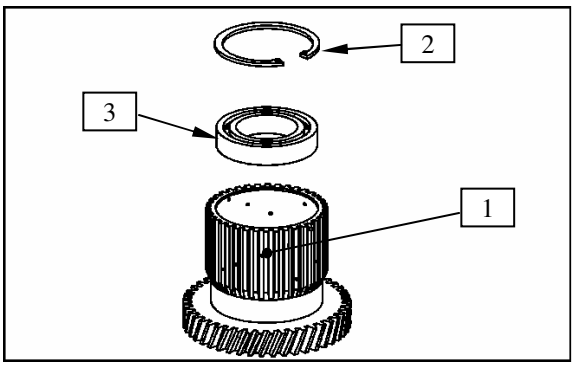


Figure 7

Snap retaining ring (2) out of the idler gear (1) and remove ball bearing (3).

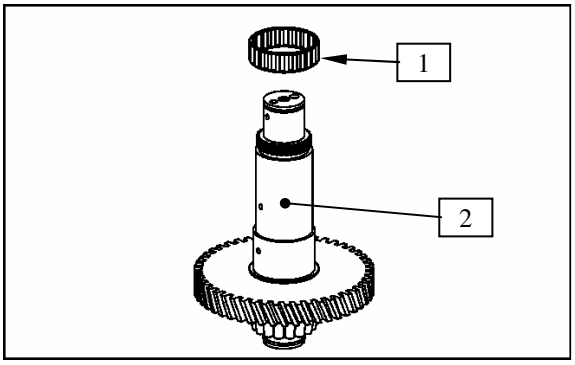


Figure 8

Remove needle cage (1) from the shaft (2).

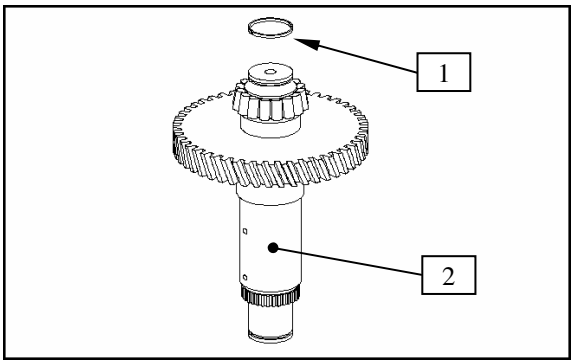


Figure 9

Turn shaft (2) by 180° and snap out piston ring (1).

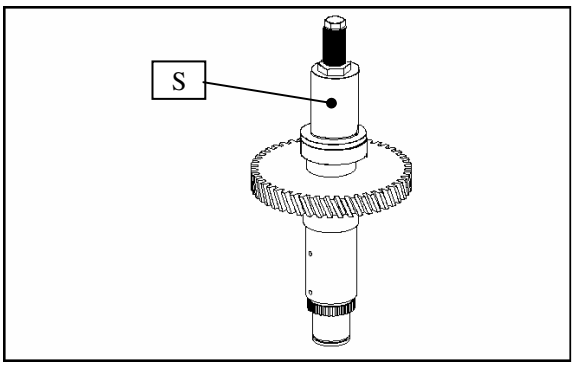
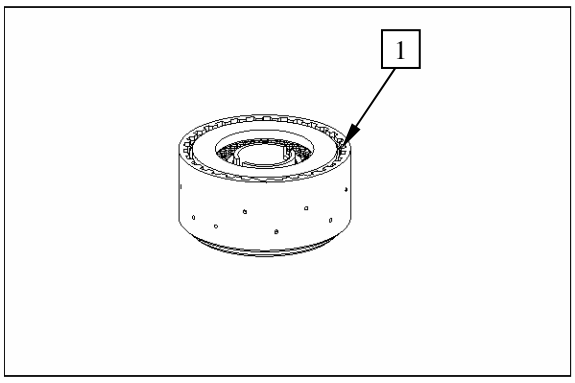


Figure 10

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011



Unsnap snap ring (1).

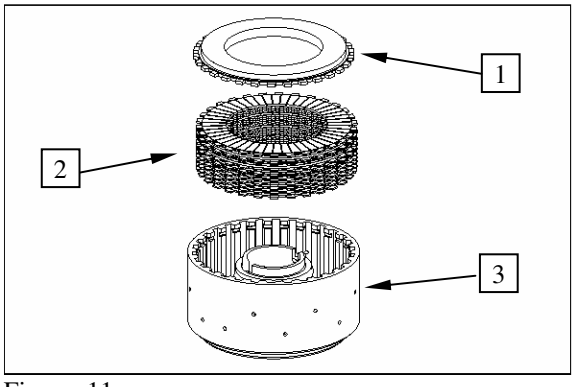


Figure 11

Remove end shim (1) and disc set (2) out the disc carrier (3).

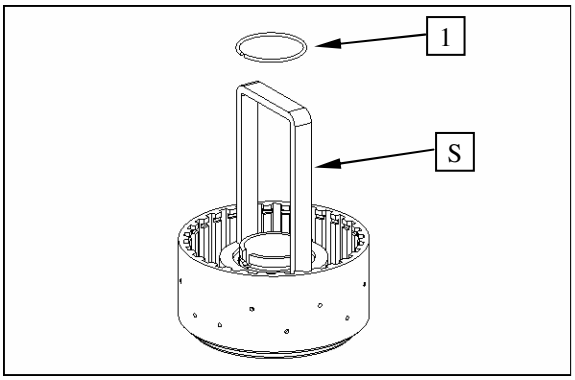


Figure 13

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

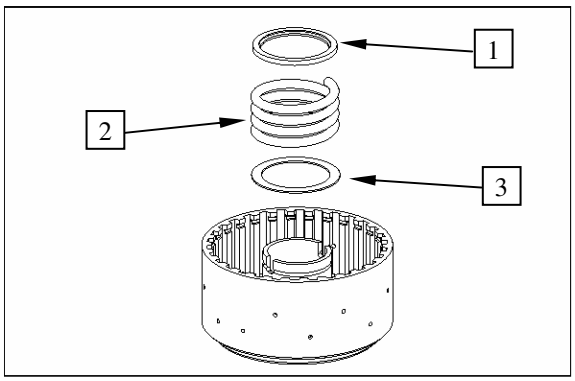


Figure 14

Remove guide ring (1), compression spring (2) and washer (3)

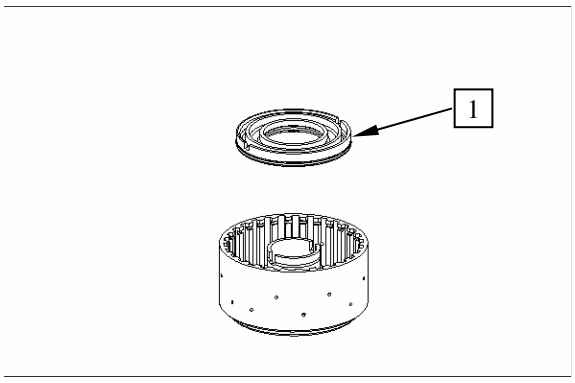


Figure 15

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

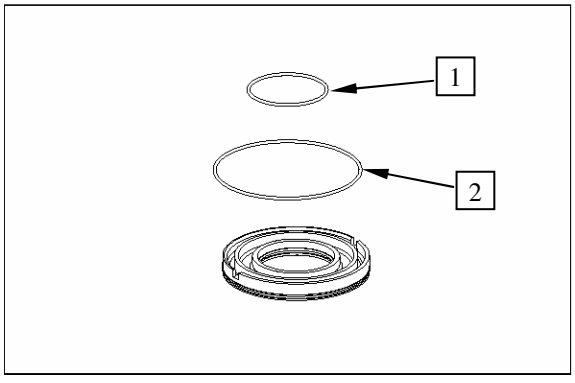


Figure 16

Remove both O-rings (1 and 2).

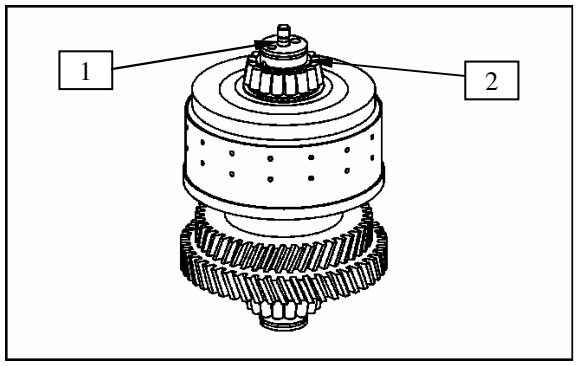


Figure 1

8.2 KR clutch

Remove stud bolt (1) and snap out piston ring (2).

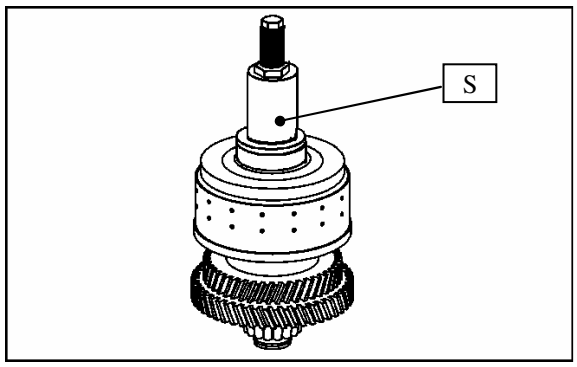


Figure 2

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

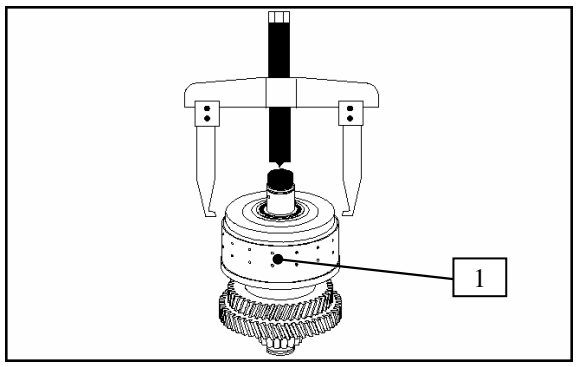


Figure 3

Pull clutch (1) off the shaft.

☞ **Disassembly clutch (1) see page 10-15!**

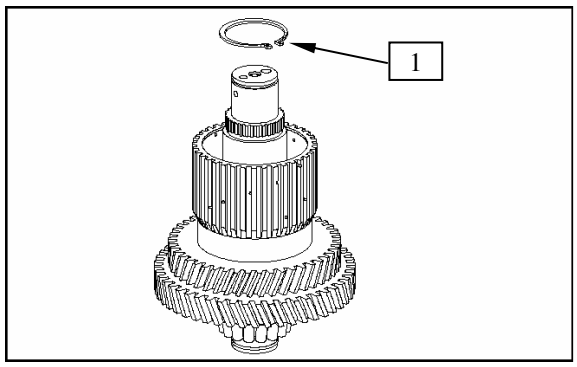


Figure 4

Snap out retaining ring (1).

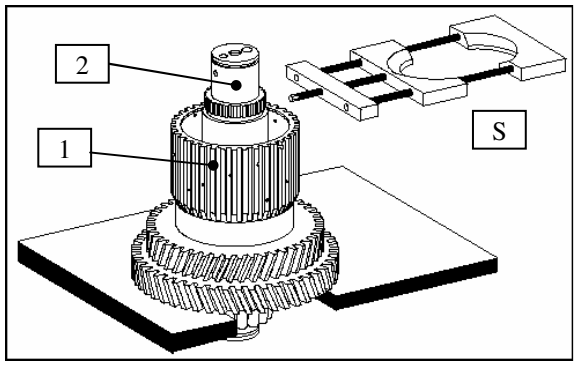


Figure 5

Fix idler gear (1) by means of cut-off device (S) and press it off the clutch shaft (2).

(S) Cut-off device 5870 300 028

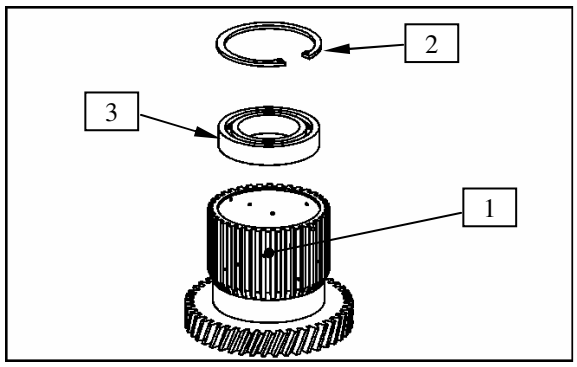


Figure 6

Snap retaining ring (2) out of the idler gear (1) and remove ball bearing (3).

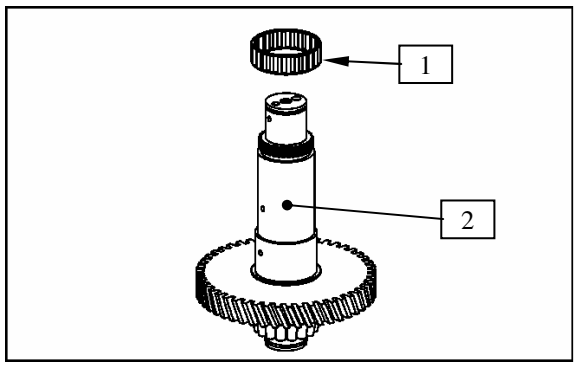


Figure 7

Remove needle cage (1) from the shaft (2).

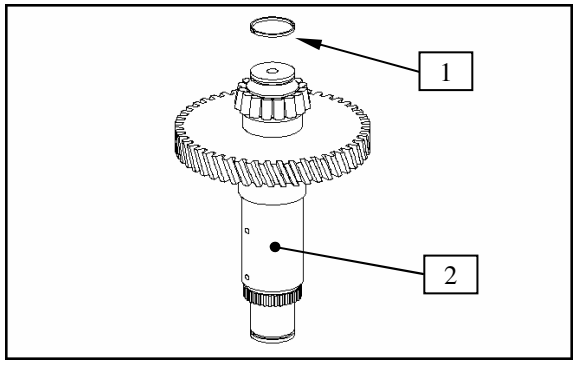


Figure 8

Turn shaft (2) by 180° and snap out piston ring (1).

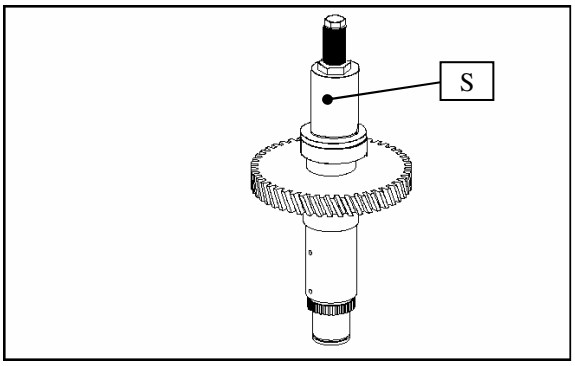


Figure 9

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

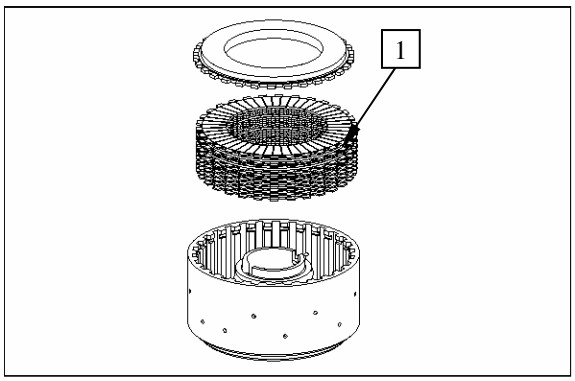


Figure 10

Unsnap snap ring (1).

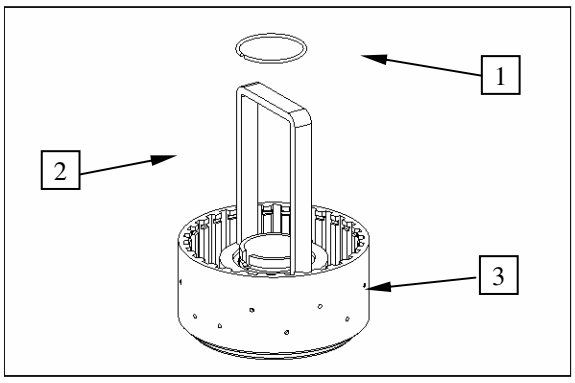


Figure 11

Remove end shim (1) and disc set (2) out the disc carrier (3).

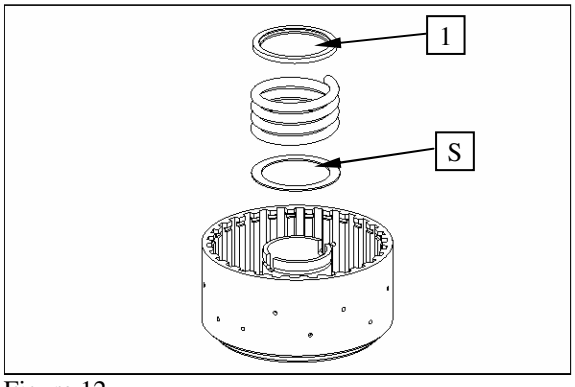


Figure 12

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

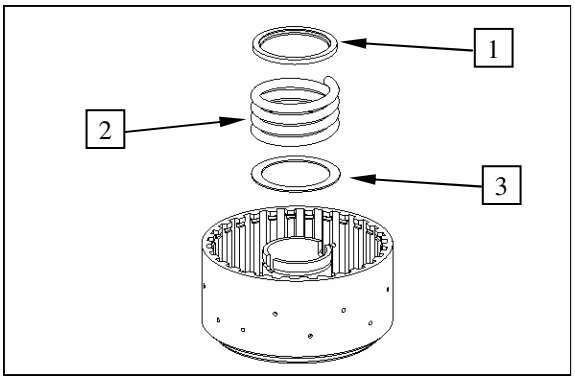


Figure 13

Remove guide ring (1), compression spring (2) and washer (3)

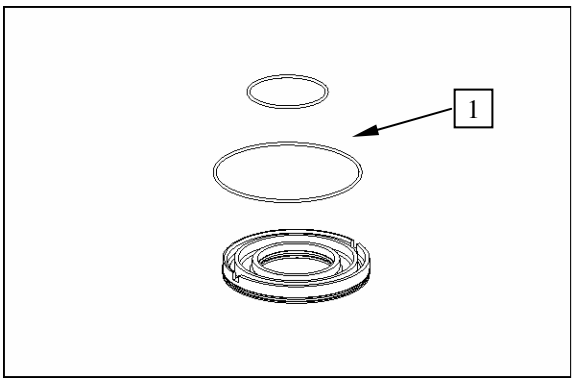


Figure 14

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

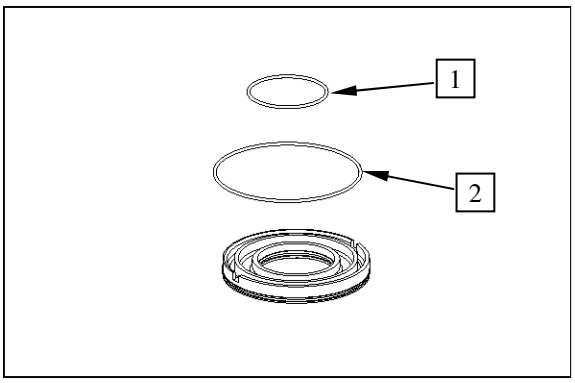


Figure 15

Remove both O-rings (1 and 2).

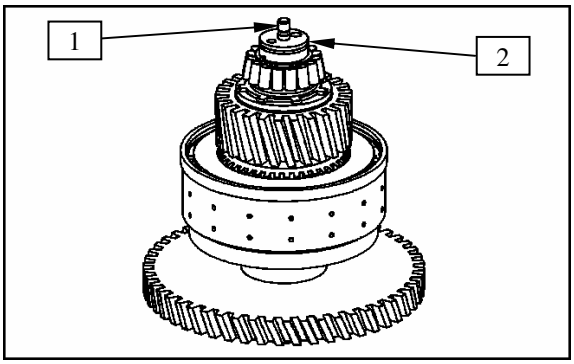


Figure 1

8.3 K1 clutch

Remove stud bolt (1) and snap out piston ring (2).

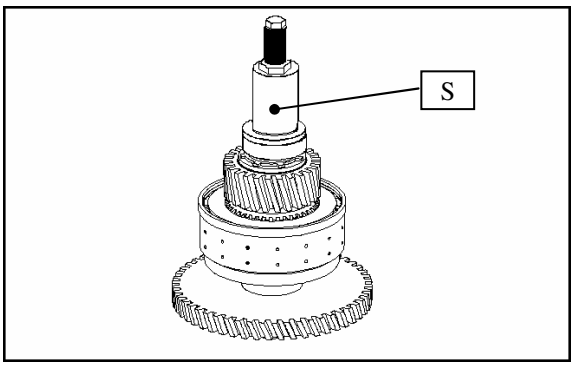


Figure 2

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

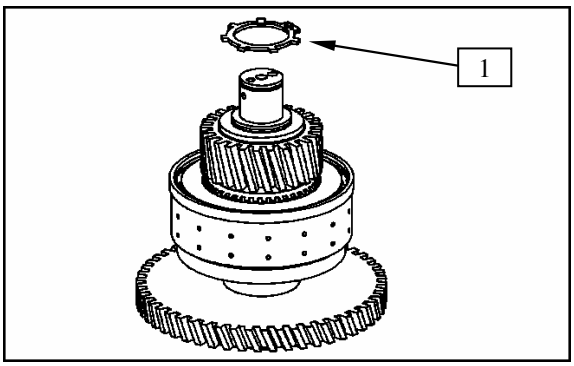


Figure 3

Snap out retaining ring (1).

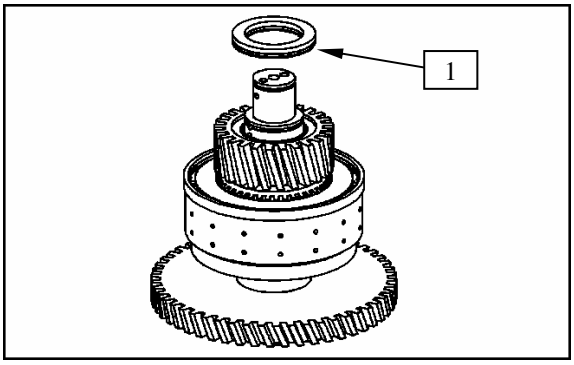


Figure 4

Remove axial bearing assy (1).

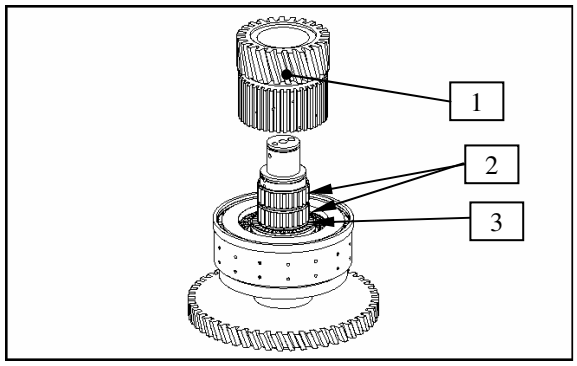


Figure 5

Take off idler gear (1), remove needle cage (2) and axial bearing assy (3).

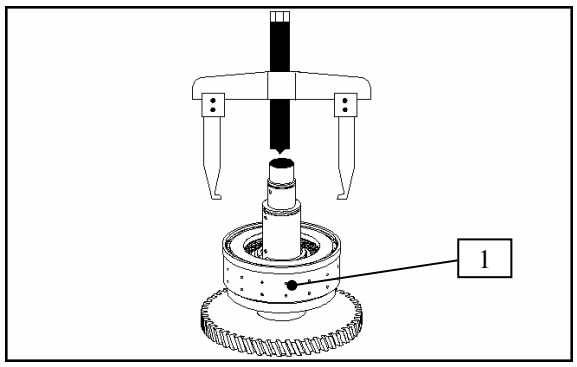


Figure 6

Pull clutch (1) off the shaft.

Disassembly clutch (1) see page 9-14!

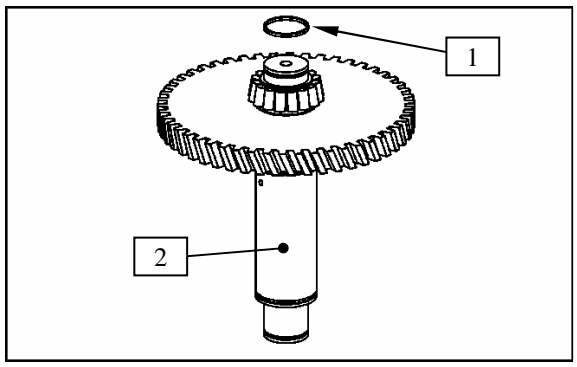


Figure 7

Turn shaft (2) by 180° and snap out piston ring (1).

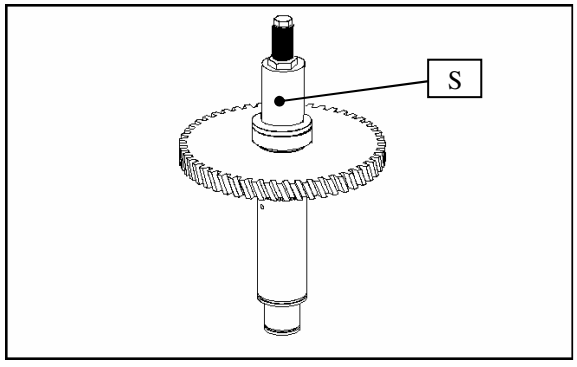


Figure 8

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

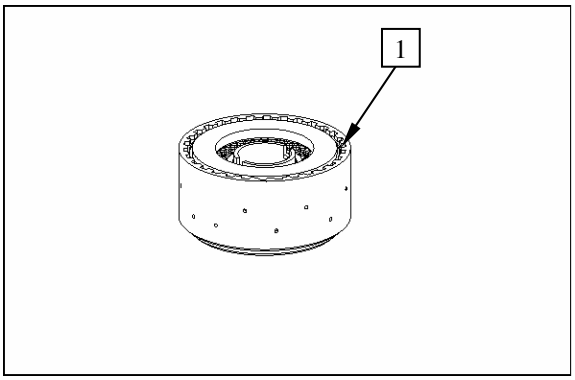


Figure 9

Unsnap snap ring (1).

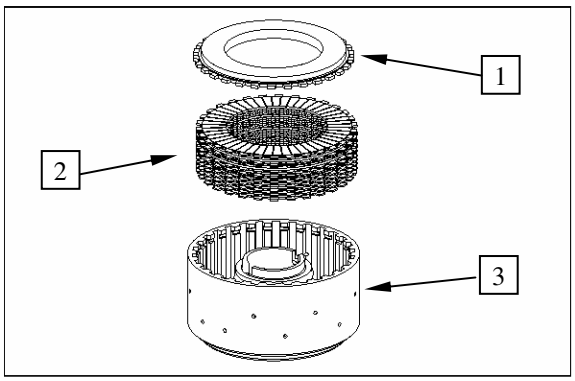


Figure 10

Remove end shim (1) and disc set (2) out the disc carrier (3).

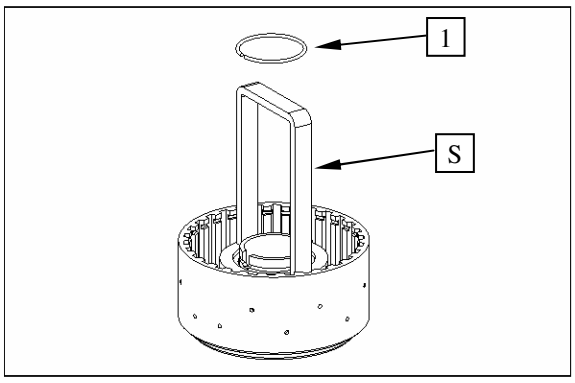


Figure 11

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

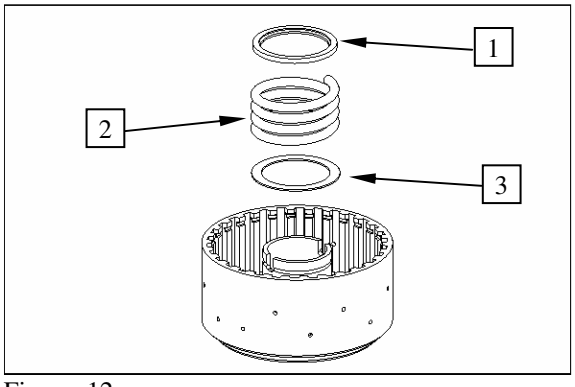


Figure 12

Remove guide ring (1), compression spring (2) and washer (3)

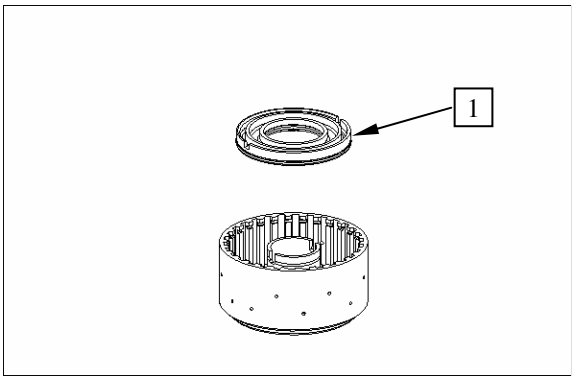


Figure 13

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

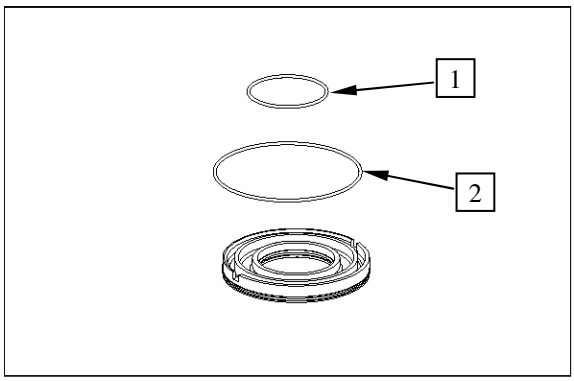


Figure 14

Remove both O-rings (1 and 2).

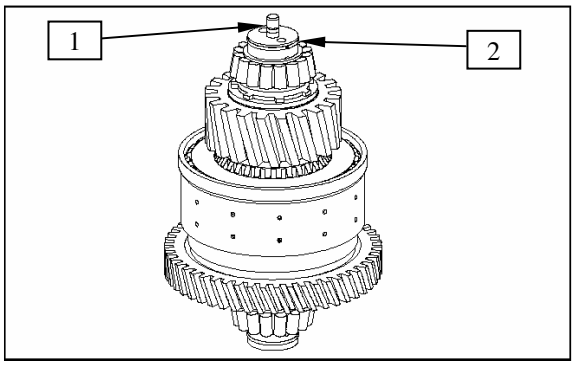


Figure 1

8.4 K2 clutch

Remove stud bolt (1) and snap out piston ring (2).

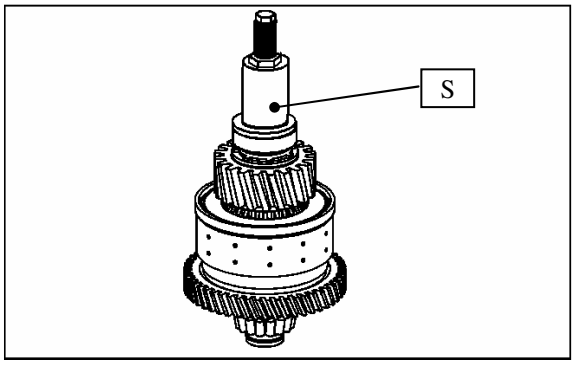


Figure 2

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

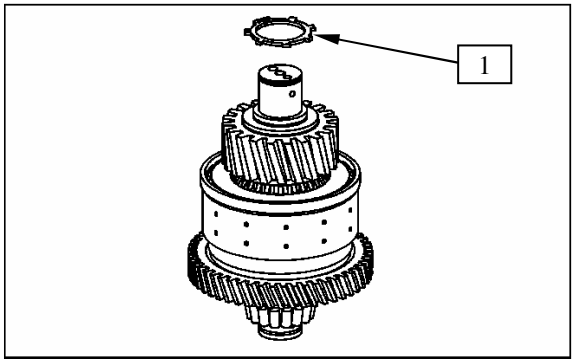


Figure 3

Snap out retaining ring (1).

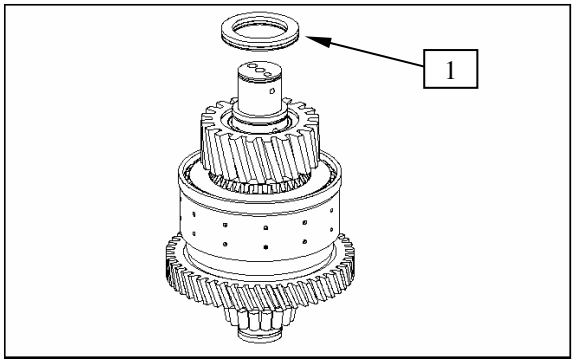


Figure 4

Remove axial bearing assy (1).

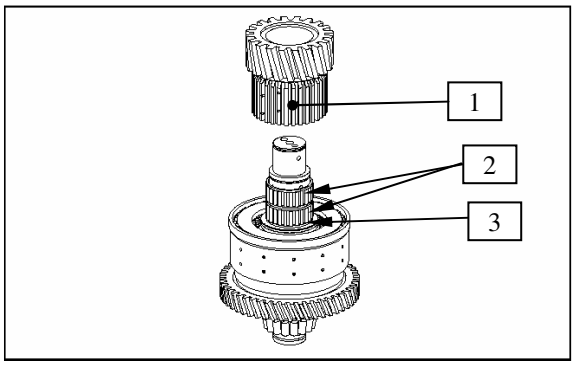


Figure 5

Take off idler gear (1), remove needle cage (2) and axial bearing assy (3).

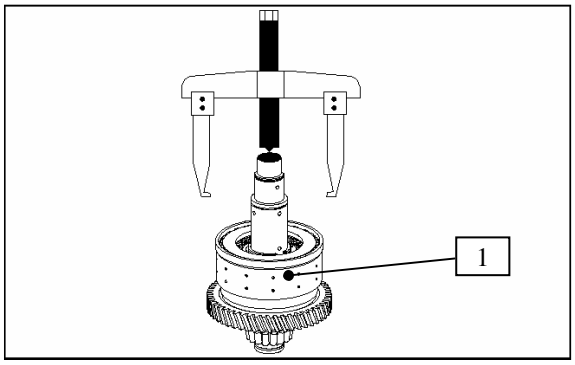


Figure 6

Pull clutch (1) off the shaft.

Disassembly clutch (1) see page 9-14!

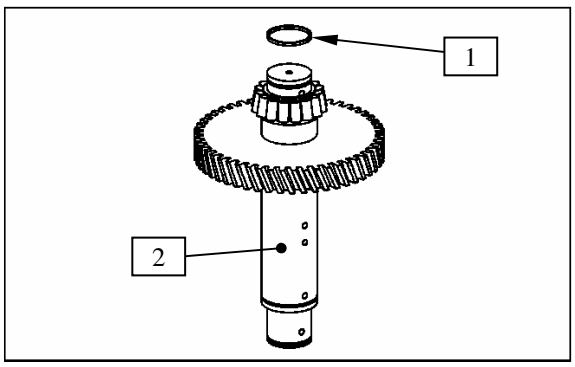


Figure 7

Turn shaft (2) by 180° and snap out piston ring (1).

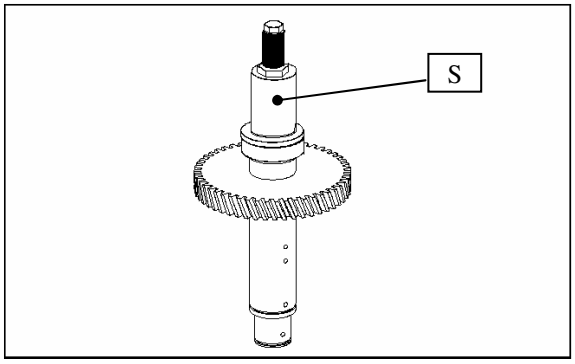


Figure 8

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

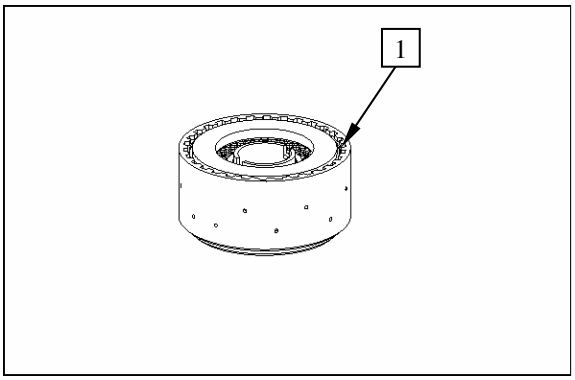


Figure 9

Unsnap snap ring (1).

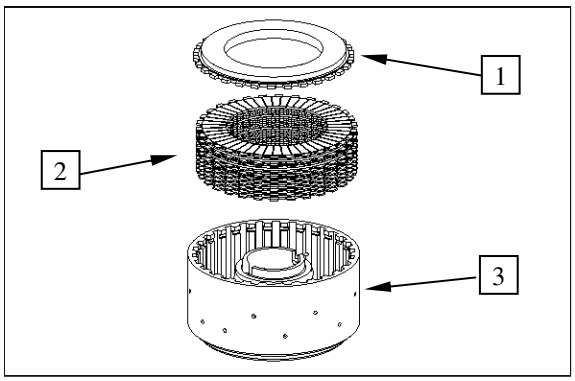


Figure 10

Remove end shim (1) and disc set (2) out the disc carrier (3).

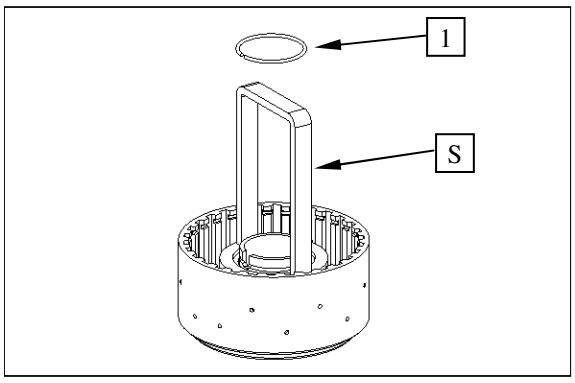


Figure 11

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

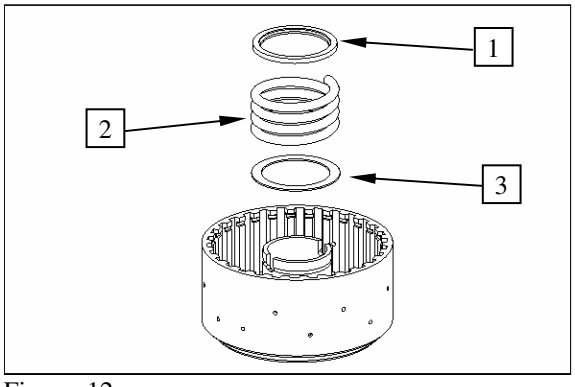


Figure 12

Remove guide ring (1), compression spring (2) and washer (3)

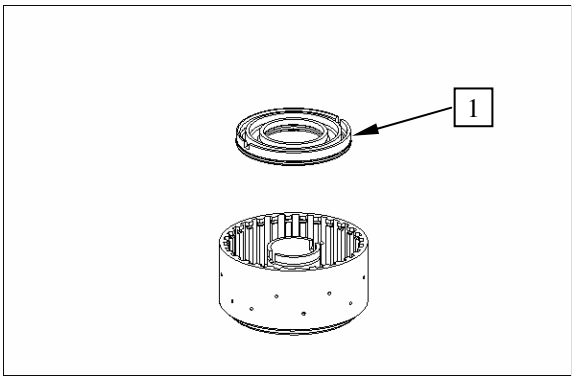


Figure 13

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

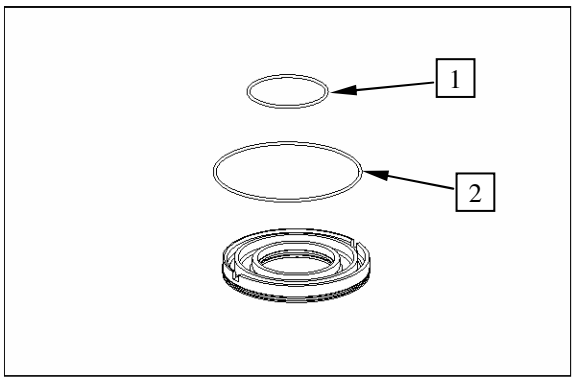


Figure 14

Remove both O-rings (1 and 2).

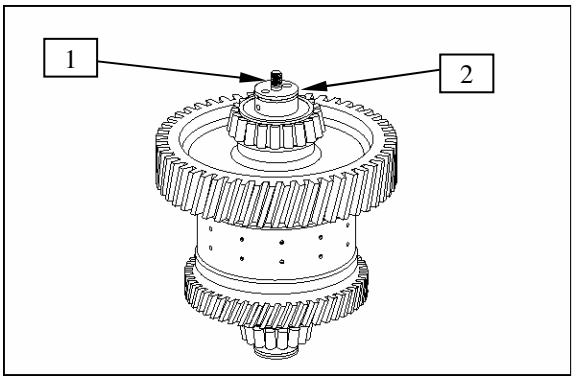


Figure 1

8.5 K3 clutch

Remove stud bolt (1) and snap out piston ring (2).

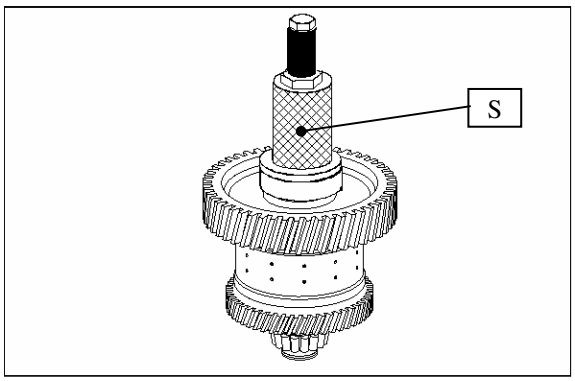


Figure 2

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 058
or	
(S) Rapid grip	5873 011 011

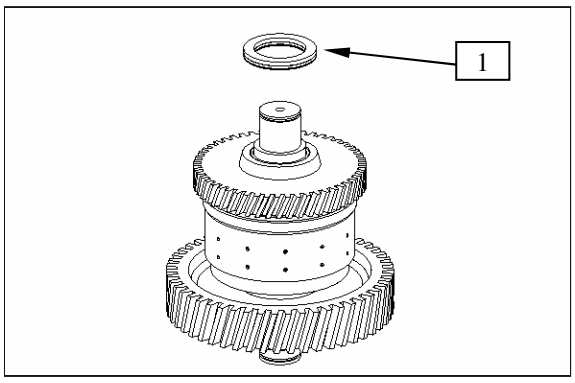


Figure 3

Remove axial bearing assy (1).

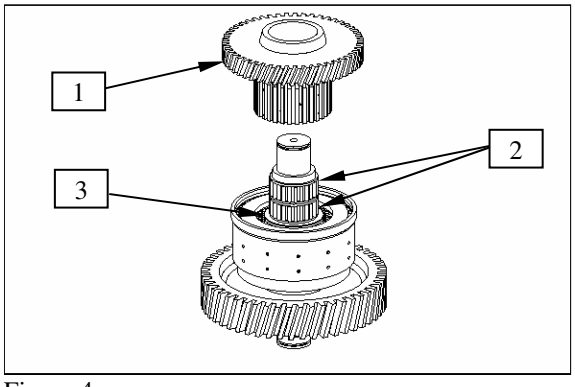


Figure 4

Take off idler gear (1), remove needle cage (2) and axial bearing assy (3).

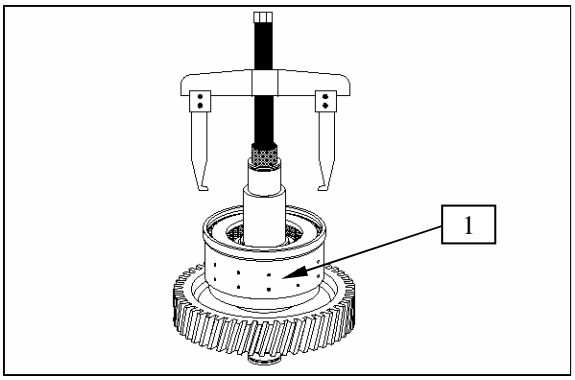


Figure 5

Pull clutch (1) off the shaft.

Disassembly clutch (1) see page 8-13!

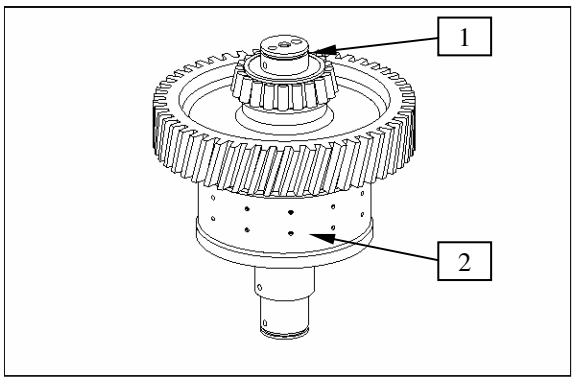


Figure 6

Turn shaft (2) by 180° and snap out piston ring (1).

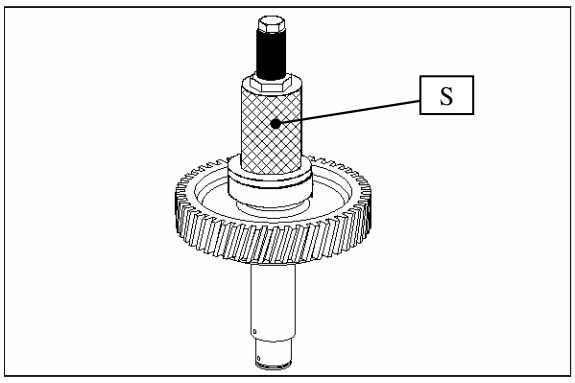


Figure 7

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

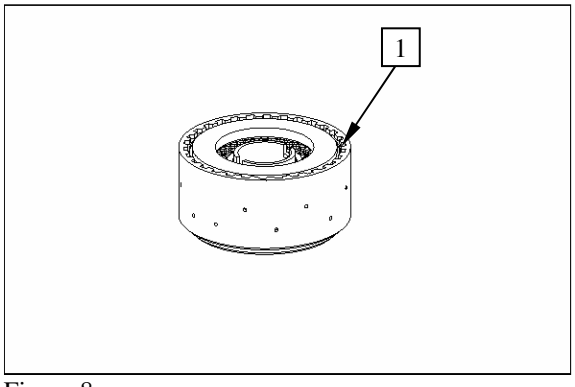


Figure 8

Unsnap snap ring (1).

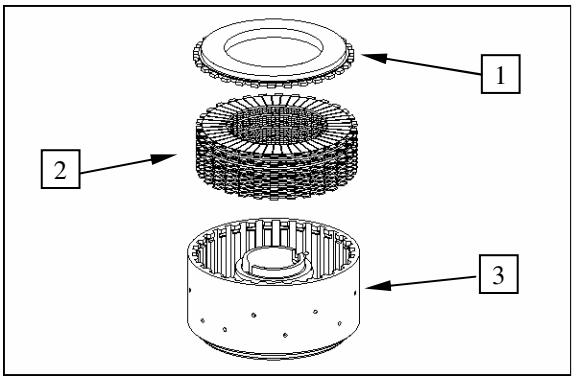


Figure 9

Remove end shim (1) and disc set (2) out the disc carrier (3).

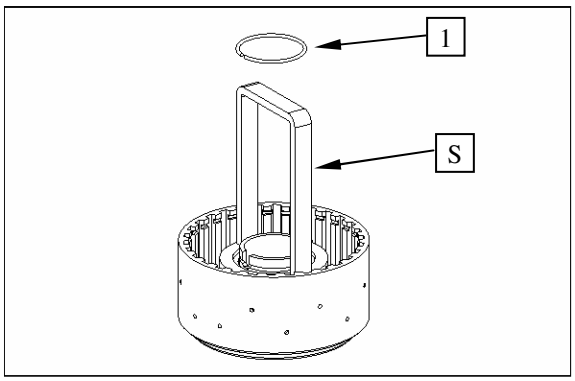


Figure 10

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

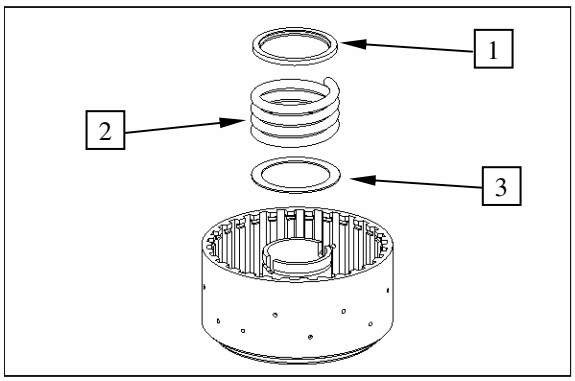


Figure 11

Remove guide ring (1), compression spring (2) and washer (3)

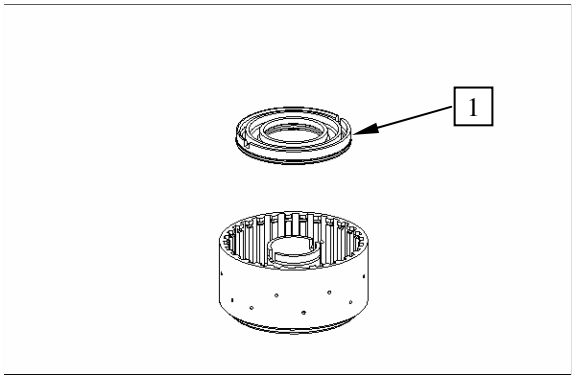


Figure 12

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

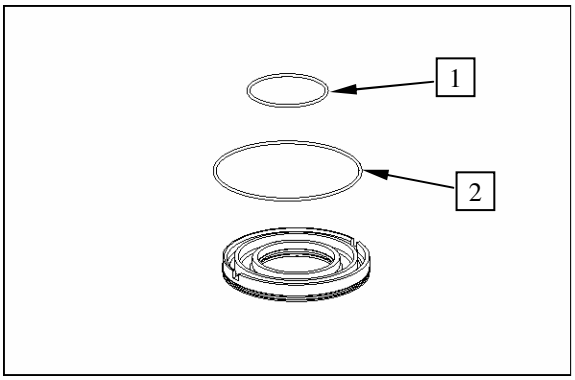


Figure 13

Remove both O-rings (1 and 2).

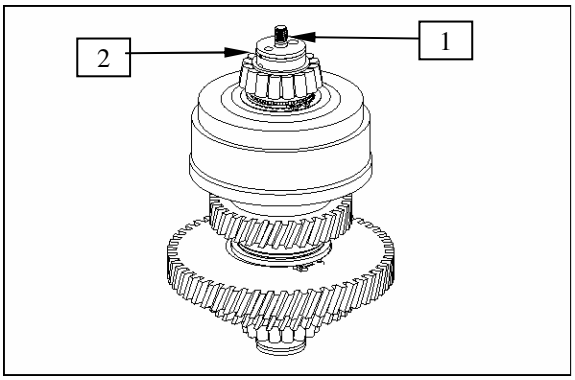


Figure 1

8.6 K4 clutch

Remove stud bolt (1) and snap out piston ring (2).

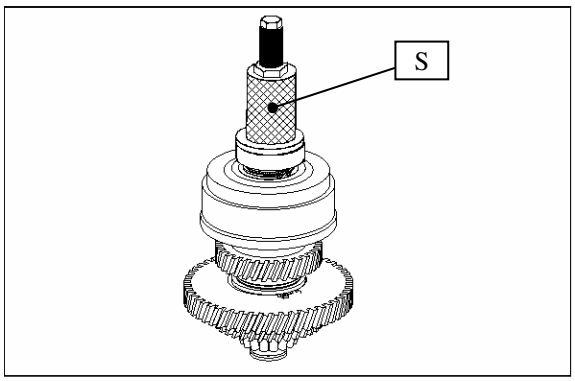


Figure 2

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

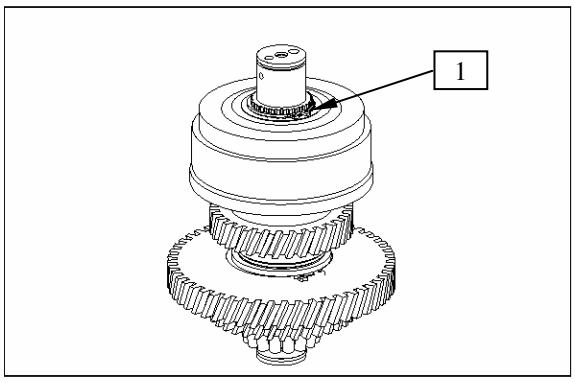


Figure 3

Snap out retaining ring.

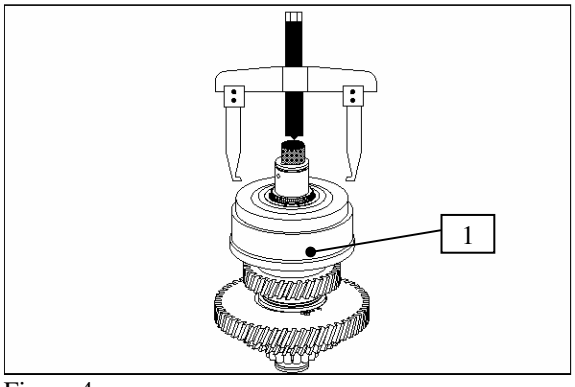


Figure 4

Pull clutch (1) off the shaft.

☞ **Disassembly clutch (1) see page 9-14!**

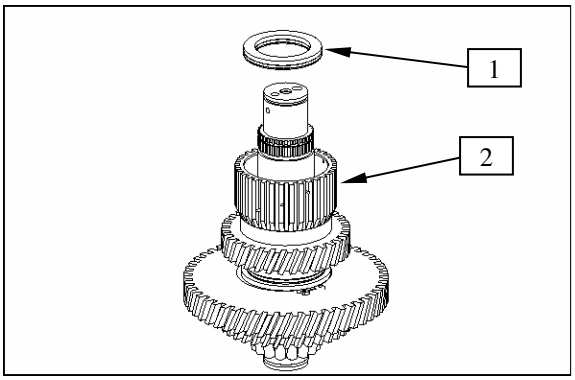


Figure 5

Remove axial bearing assy (1) and idler gear (2).

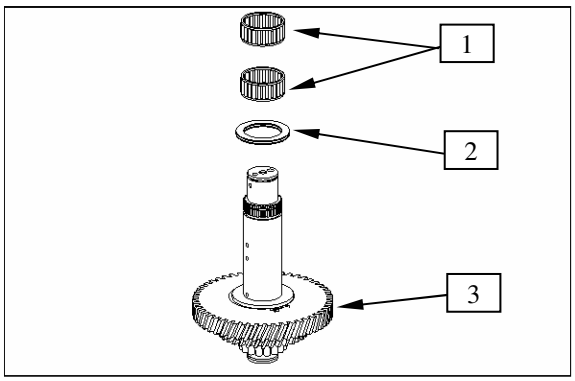


Figure 6

Remove needle cage (1) and axial bearing assy (2).

☞ **The gear (3) cannot be removed (shrink fit)!**

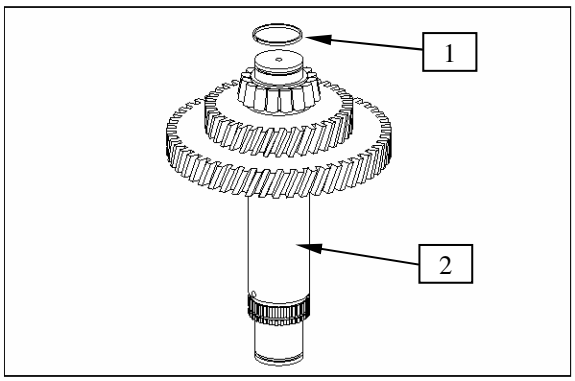


Figure 7

Turn shaft (2) by 180° and snap out piston ring (1).

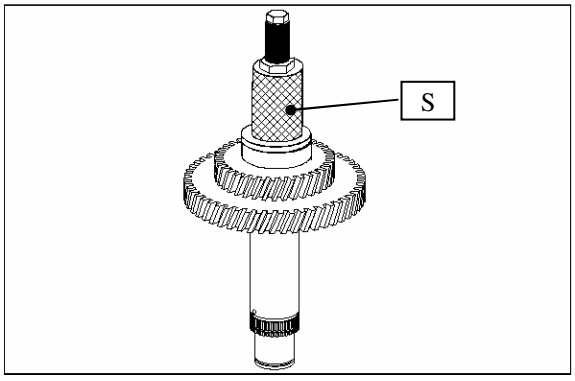


Figure 8

Pull tapered roller bearing (inner ring) off the shaft.

(S) Forcing device	5870 026 100
(S) Grab sleeve	5873 001 057
or	
(S) Rapid grip	5873 011 011

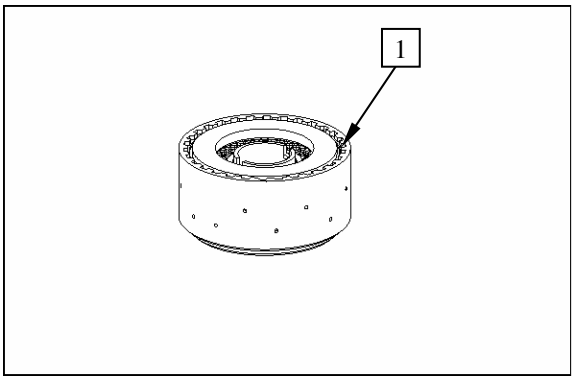


Figure 9

Unsnap snap ring (1).

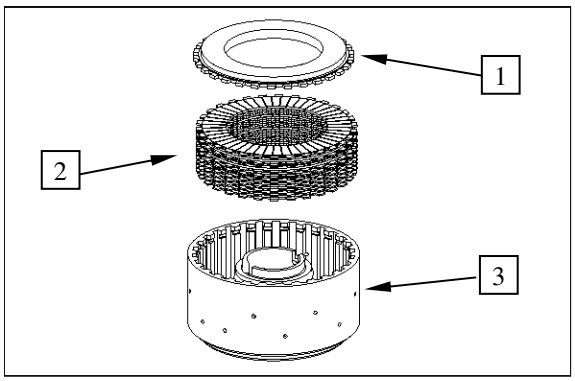


Figure 10

Remove end shim (1) and disc set (2) out the disc carrier (3).

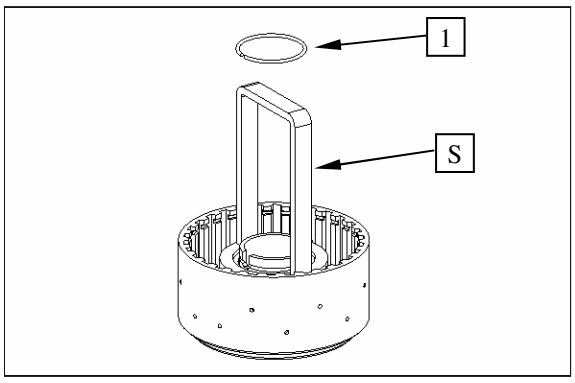


Figure 11

Preload compression spring (1) unsnap snap ring

(S) Assembly aid 5870 345 088

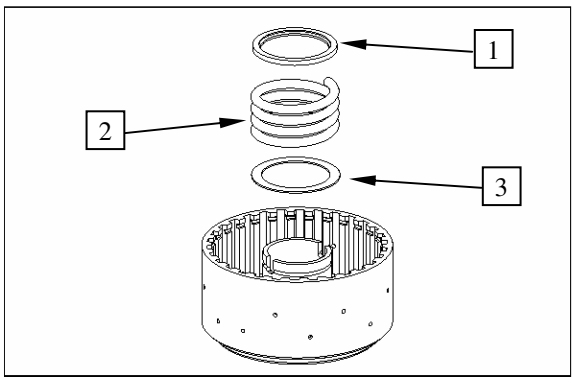


Figure 12

Remove guide ring (1), compression spring (2) and washer (3)

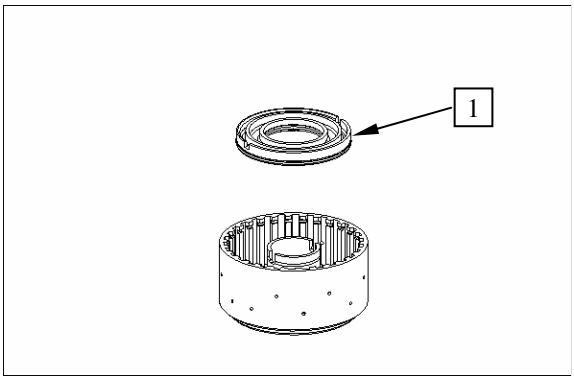


Figure 13

Lift piston (1) by means of compressed air out of the cylinder bore and remove it.

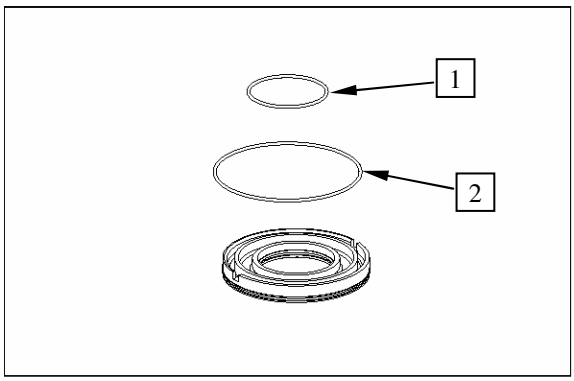


Figure 14

Remove both O-rings (1 and 2).

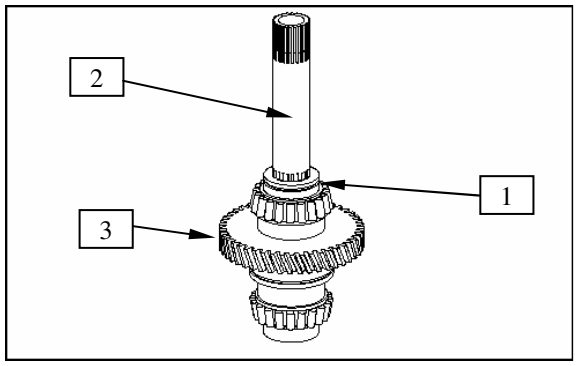


Figure 1

8.7 Input shaft

Snap out piston ring (1).

Turbine wheel shaft (2) and drive gear (3) are fixed by a snap ring.

☞ **When separated, the components will be destroyed!**

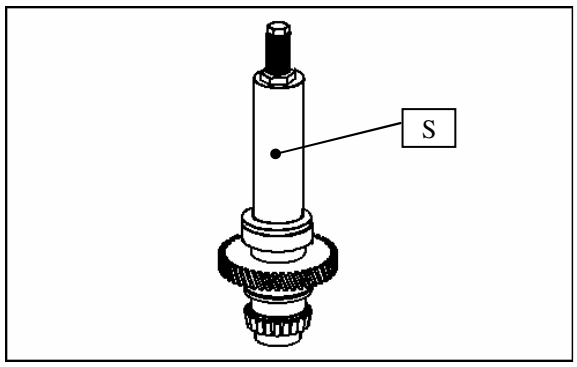


Figure 2

Pull tapered roller bearing (inner ring) off the drive gear.

(S) Basic tool	5873 001 000
(S) Grab sleeve	5873 001 058
or	
(S) Rapid grip	5873 011 014

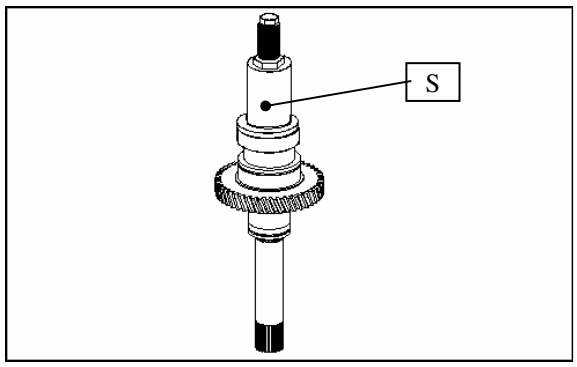


Figure 3

Pull tapered roller bearing (inner ring) off the drive gear.

(S) Grab sleeve	5873 001 058
(S) Forcing device	5870 026 100
or	
(S) Rapid grip	5873 011 011

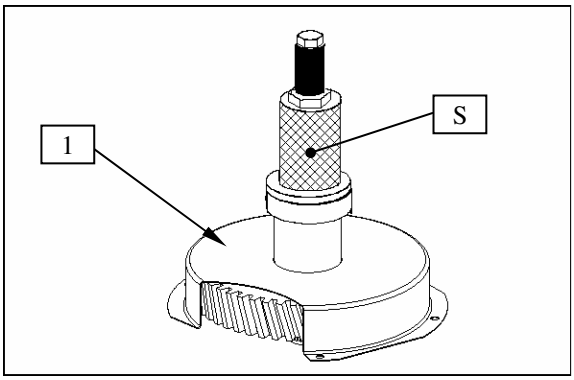


Figure 1

8.8 Output shaft

Pull tapered roller bearing (inner ring) off the output shaft and remove oil screen sheet (1).

(S) Basic tool	5873 001 000
(S) Grab sleeve	5873 001 058
or	
(S) Rapid grip	5873 011 014

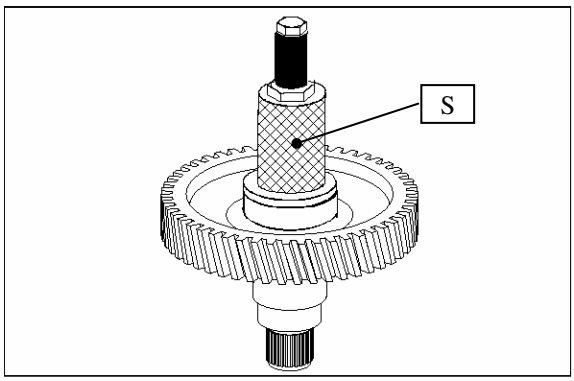


Figure 2

Turn output shaft by 180° and pull off tapered roller bearing (inner ring).

(S) Basic tool	5873 001 000
(S) Grab sleeve	5873 001 058
or	
(S) Rapid grip	5873 011 014

9. REASSEMBLY of Clutches KV / KR / K1 / K2 / K3 / K4 input shaft and output shaft

9.0 General notes on the clutch:

☞ **In our striving for continuous technical upgrading we have changed the FLOW clutch (which was only exchangeable as a complete unit) to a version which allows replacement of the individual parts.**

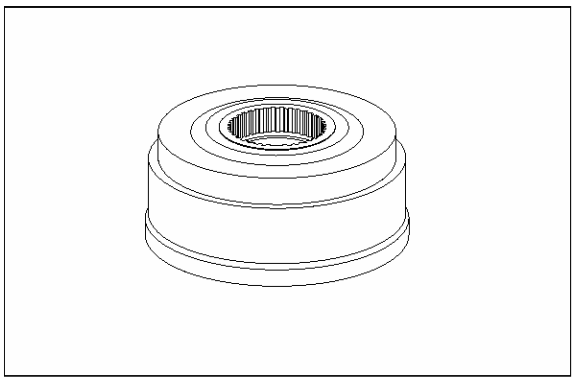


Figure 1

„OLD“ clutch version (FLOW clutch):

☞ **Exchange and delivery of the clutch are only possible as a complete unit!**

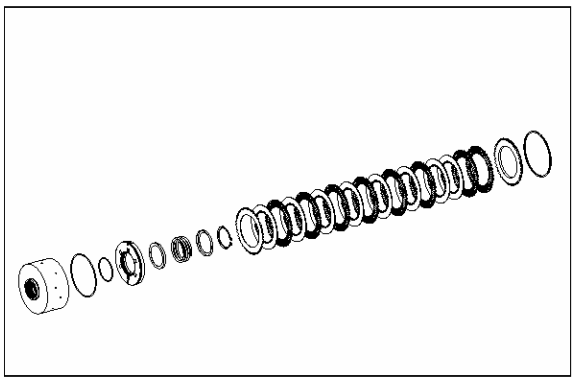


Figure 2

„NEW“ clutch version:

In case of damage, this clutch allows exchange of all individual parts.

☞ **However, the clutch can also be supplied and exchanged as a complete unit.**

☞ **For the binding part number please refer to the relating spare parts list.**

Assembly instructions for repair

☞ **Change-over to the „NEW“ clutch implemented**

effective from transmission No.: 842654.

☞ **In case of damage, please bear in mind the following information:**

The "old" clutch (FLOW clutch) and the "new" clutch are interchangeable, i.e. in case of repair the "old" clutch must be replaced by the "new" clutch.

Please find below some information regarding the change-over of the clutches involved:

Denomination	**old**	**new**
Clutch KV and KR	0501 212 261	4656 275 001
Clutch KV and KR	0501 212 263	4656 275 002
Clutch K1	0501 212 262	4656 271 006
Clutch K2 and K3	0501 212 259	4656 272 007
Clutch K4	0501 212 260	4656 274 001

These part numbers are just for information purposes. For the binding part numbers please refer to the spare parts list.
You will find the part number of the clutch assy indicated on both versions!

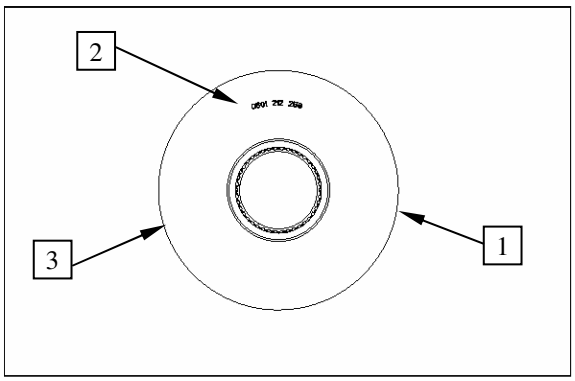


Figure 3

„OLD“ clutch (FLOW clutch):

The part number (2) of the clutch (3) is indicated on the back side of the disk carrier (1).

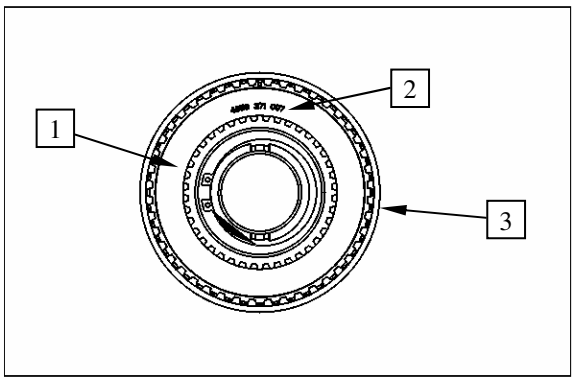


Figure 4

„NEW“ clutch

The part number (2) of the clutch (3) is indicated on the front side of the end plate (1).

9.1 KV clutch

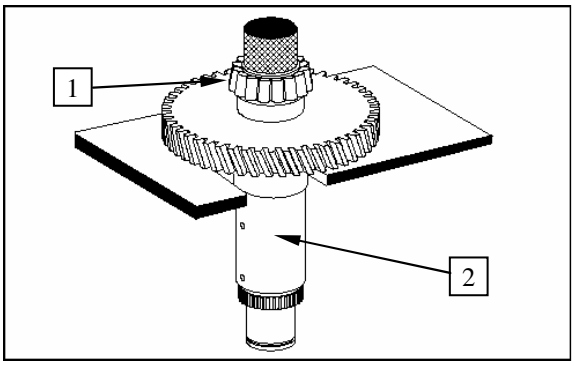


Figure 1

Press tapered roller bearing (inner ring) (1) onto the shaft (2) until contact is obtained.

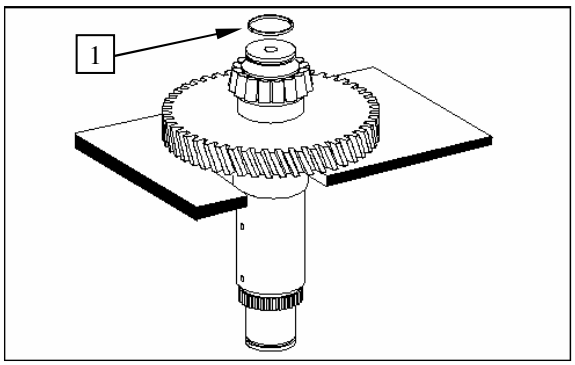


Figure 2

Install piston ring (1).

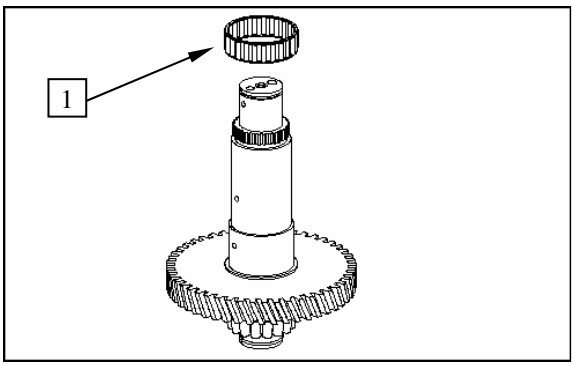


Figure 3

Mount needle bearing (1) onto the shaft.

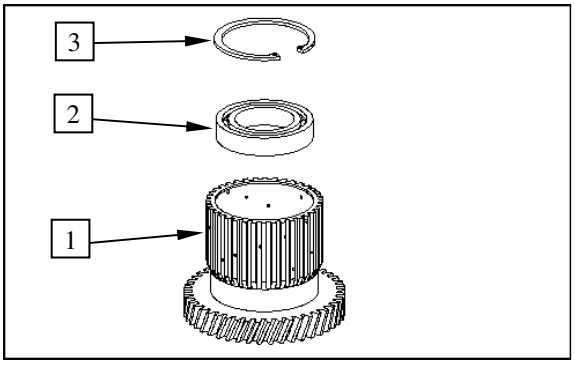


Figure 4

Install ball bearing (2) into the idler gear (1) until contact is obtained and fix it by means of retaining ring (3) .

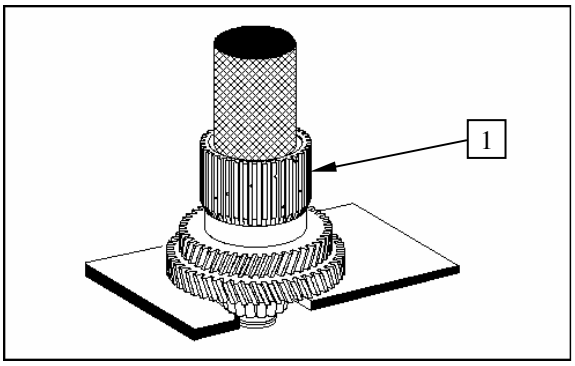


Figure 5

Press in preassembled idler gear (1) until contact is obtained.

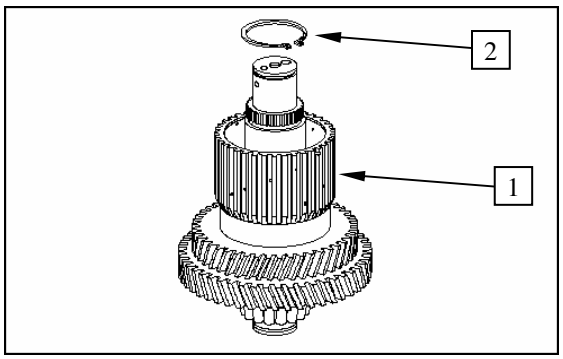


Figure 6

Fix idler gear (1) by means of retaining ring (2).

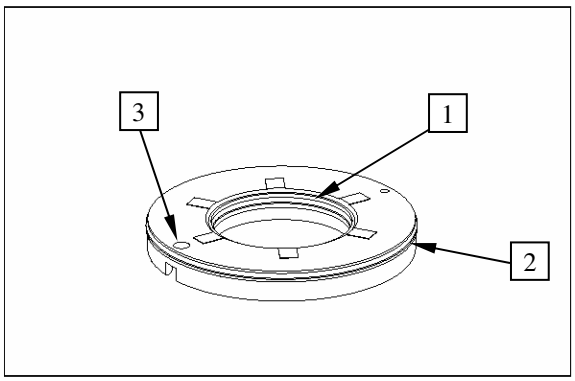


Figure 7

Place both O rings (1 and 2) into the piston grooves and oil them.

1 = 75x3
2 = 142x3

☞ **Check function of the drain valve (3) - There must be no jamming of the ball!**

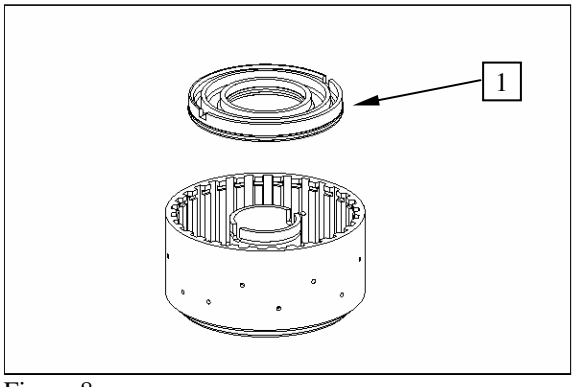


Figure 8

Place piston (1) into the disk carrier.

☞ **Observe installation position, see FIGURE!**

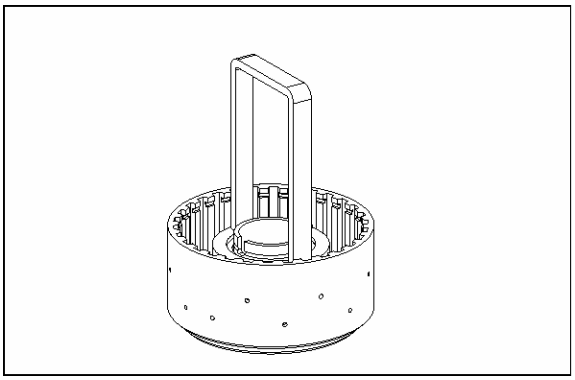


Figure 9

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

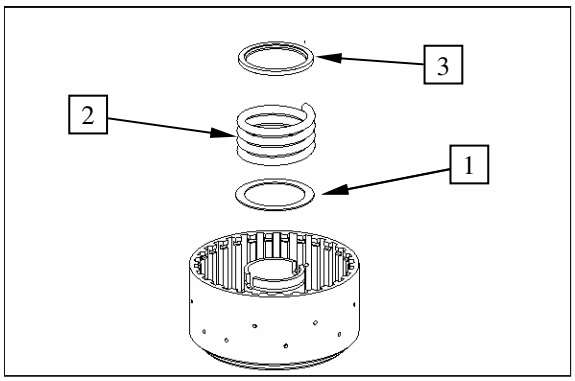


Figure 10

Mount washer (1), compression spring (2) and guide ring (3).

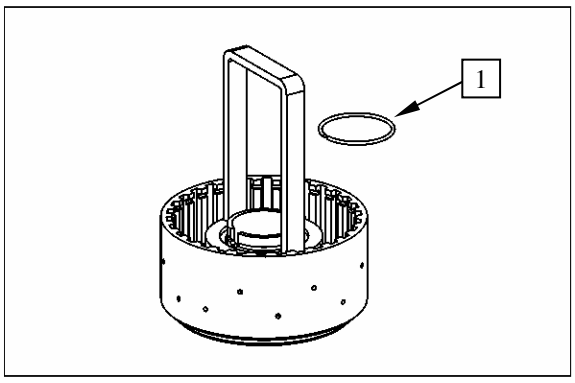


Figure 11

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

☞ **Different clutches (disc arrangements with relevant disc clearance) can be installed, depending on the parts list version.**

☞ **The actually installed clutch and disc arrangement must be taken from the corresponding spare parts list.**

☞ **Figure no.: 12 and 13 illustrates the different disc arrangements.**

☞ **The spare parts list shall be binding.**

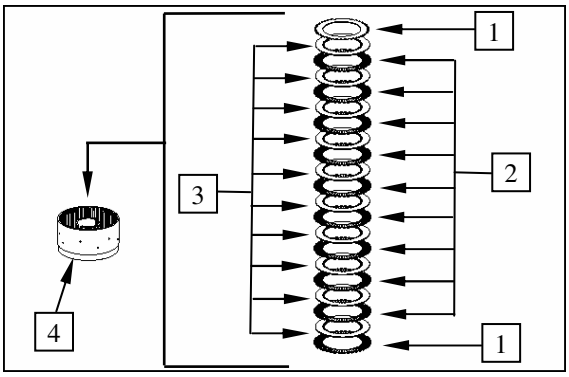


Figure 12

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 12.

Legend:

1 = Friction disk -coated on one side-	(2 pcs)
2 = Outer disks	(9 pcs)
3 = Inner disks	(10 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 20!

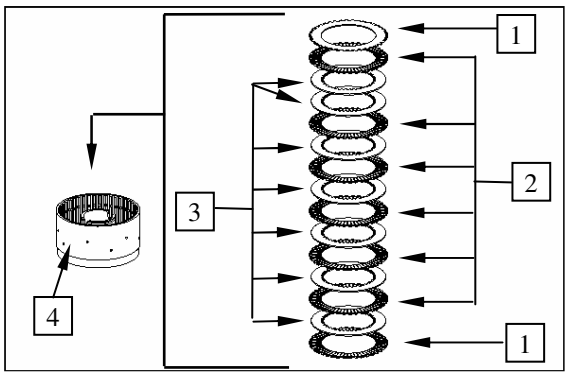


Figure 13

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 13.

Legend:

1 = Friction disk -coated on one side-	(2 pcs)
2 = Outer disks	(6 pcs)
3 = Inner disks	(7 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 12!

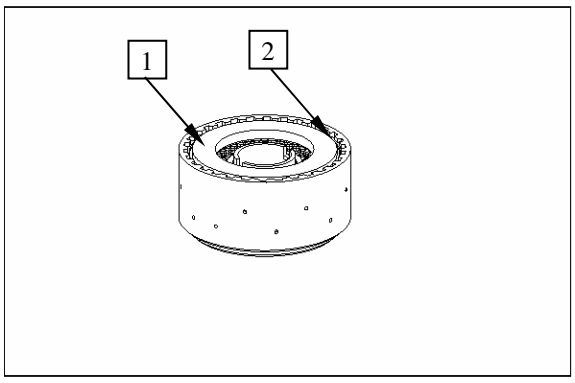


Figure 14

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

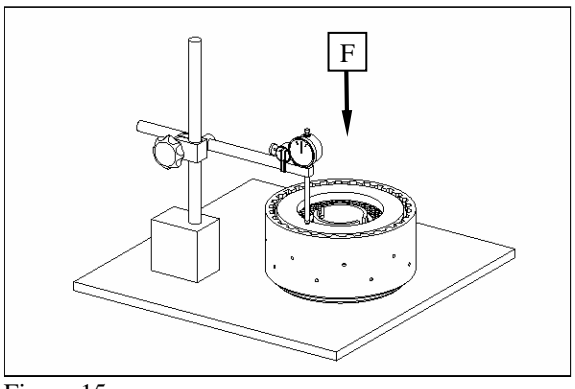


Figure 15

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

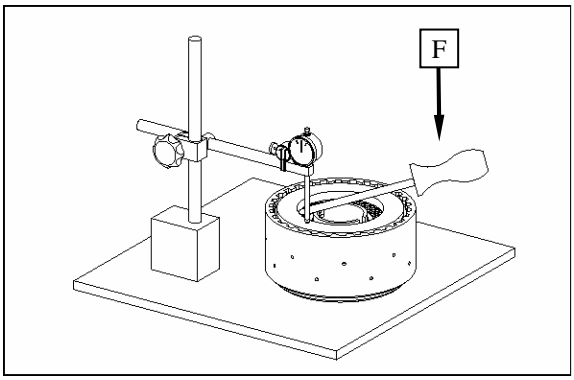


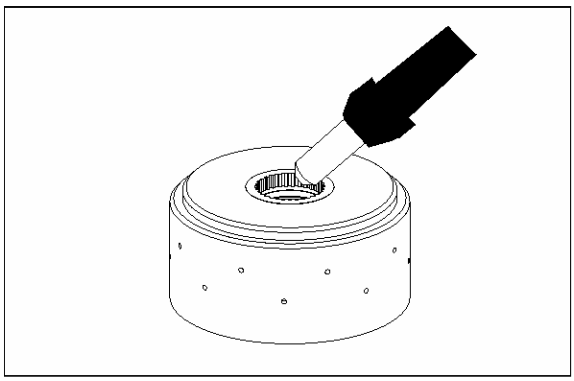
Figure 16

Then press end plate against the snap ring (upwards) and read disk clearance.

☞ **Disk clearance: 2.45 to 2.75 mm (see Figure 12)**

☞ **Disk clearance: 1.70 to 2.00 mm (see Figure 13)**

☞ **In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 …... 4.2 mm)!**


Figure 17

Heat up clutch inner diameter (approx. 120° C).

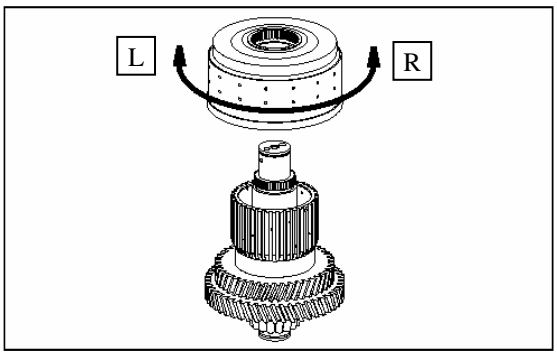


Figure 18

Install clutch until contact is obtained.

Mount inner disks onto the inner disk carrier by means of short left/right rotations.

⚠ **Wear protective gloves!**

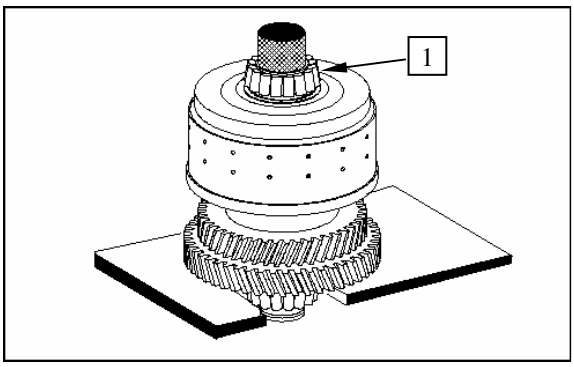
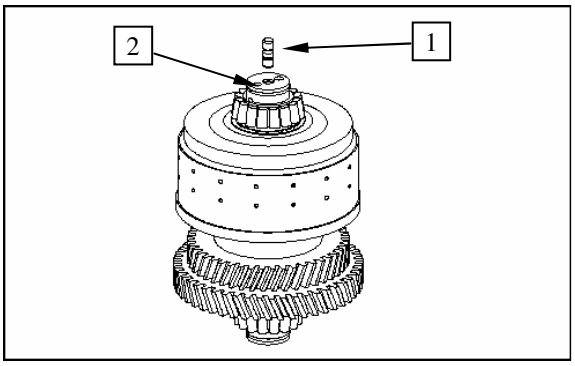


Figure 19

Press tapered roller bearing (inner ring) (1) until contact is obtained.



Mount stud bolt (1).

Tightening torque (M10 /8.8 x15).....M_A = 17 Nm

Check closing and opening of the clutch by means of compressed air at the hole (2).
Closing and opening of the clutch must be clearly audible.

9.2 KR clutch

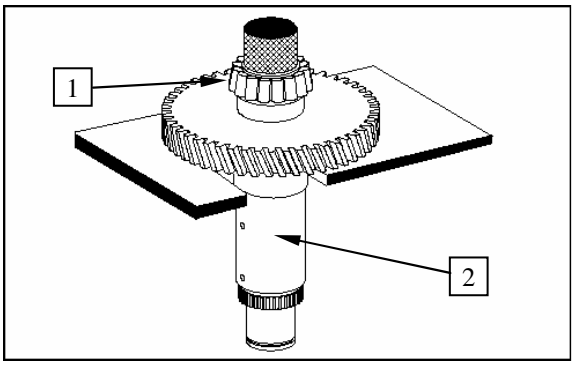


Figure 1

Press tapered roller bearing (inner ring) (1) onto the shaft (2) until contact is obtained.

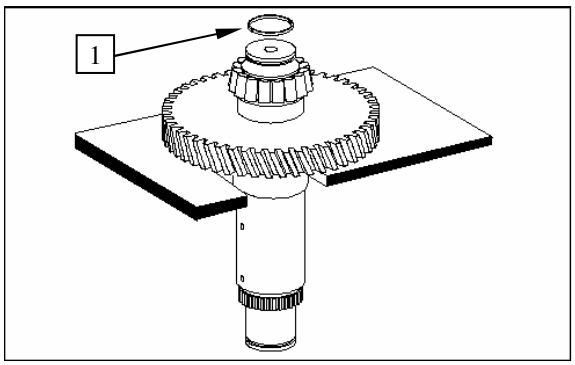


Figure 2

Install piston ring (1).

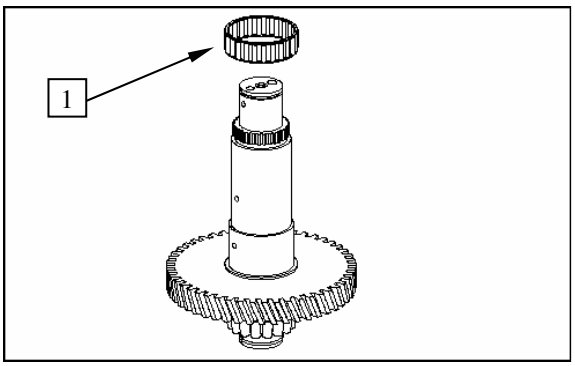


Figure 3

Mount needle bearing (1) onto the shaft.

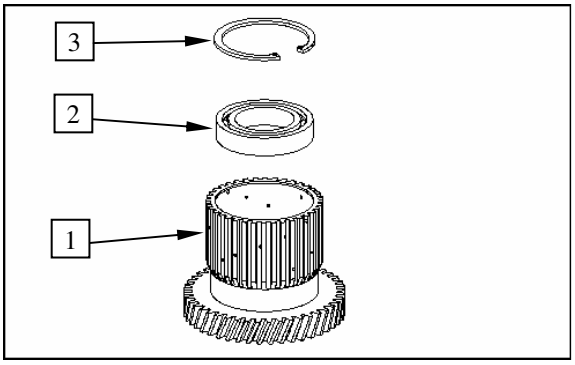


Figure 4

Install ball bearing (2) into the idler gear (1) until contact is obtained and fix it by means of retaining ring (3) .

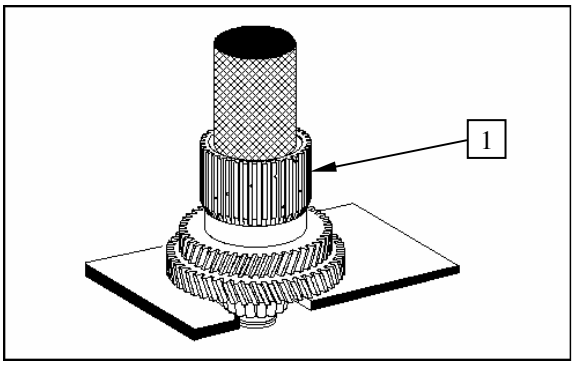


Figure 5

Press in preassembled idler gear (1) until contact is obtained.

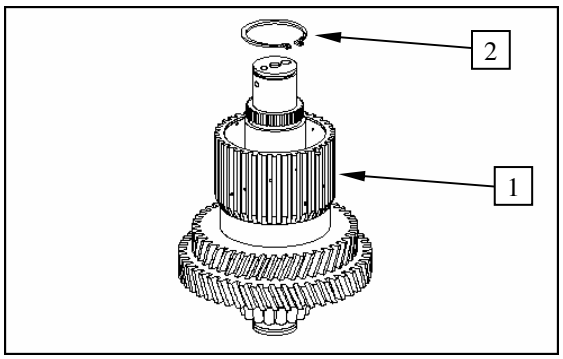


Figure 6

Fix idler gear (1) by means of retaining ring (2).

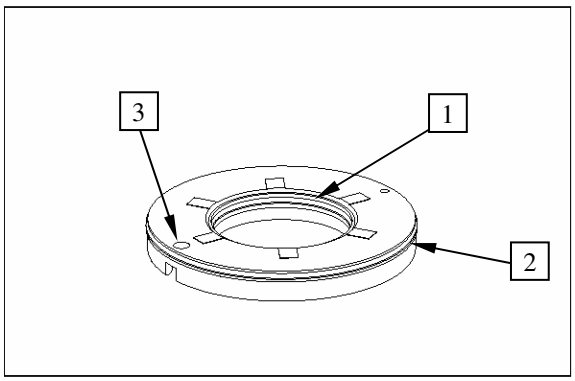


Figure 7

Place both O rings (1 and 2) into the piston grooves and oil them.

1 = 75x3
2 = 142x3

☞ **Check function of the drain valve (3) - There must be no jamming of the ball!**

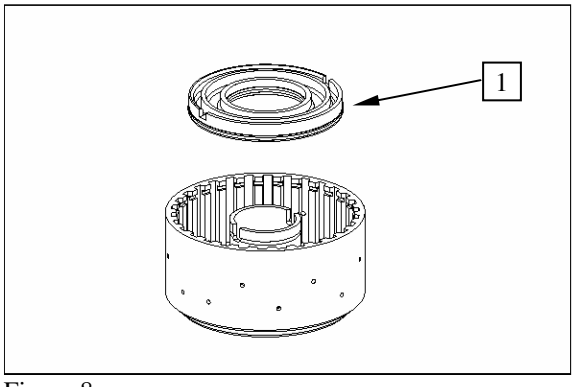


Figure 8

Place piston (1) into the disk carrier.

☞ **Observe installation position, see FIGURE!**

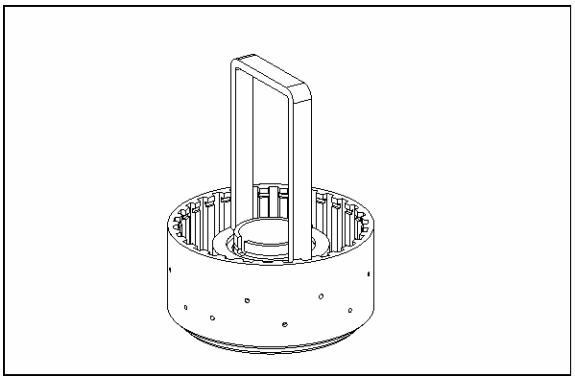


Figure 9

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

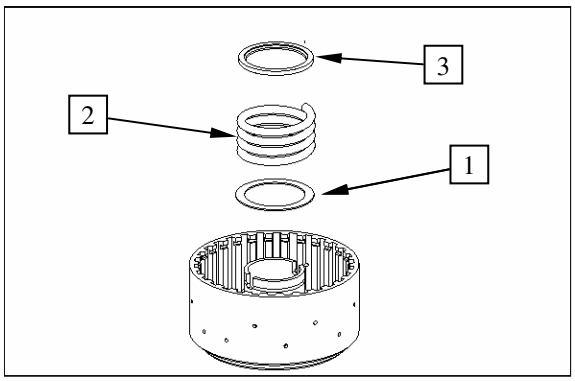


Figure 10

Mount washer (1), compression spring (2) and guide ring (3).

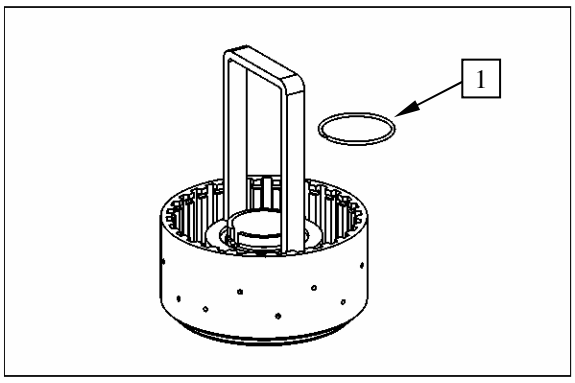


Figure 11

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

☞ **Different clutches (disc arrangements with relevant disc clearance) can be installed, depending on the parts list version.**

☞ **The actually installed clutch and disc arrangement must be taken from the corresponding spare parts list.**

☞ **Figure no.: 12 and 13 illustrates the different disc arrangements.**

☞ **The spare parts list shall be binding.**

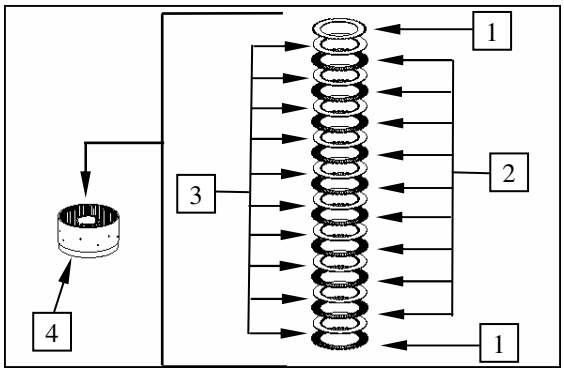


Figure 12

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 12.

Legend:

1 = Friction disk -coated on one side-	(2 pcs)
2 = Outer disks	(9 pcs)
3 = Inner disks	(10 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 20!

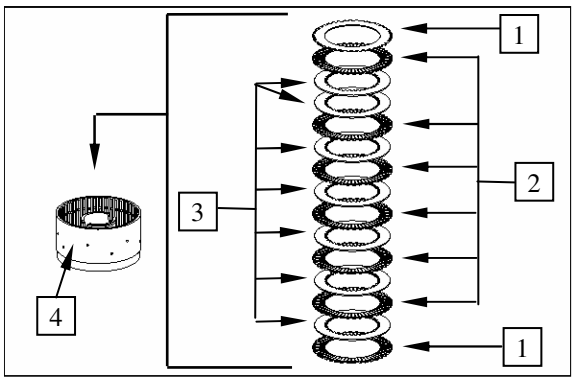


Figure 13

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 13.

Legend:

1 = Friction disk -coated on one side-	(2 pcs)
2 = Outer disks	(6 pcs)
3 = Inner disks	(7 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 12!

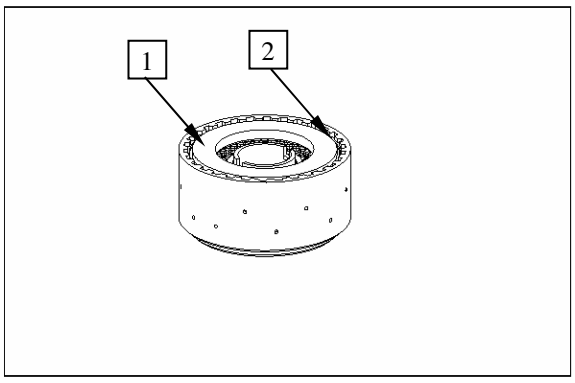


Figure 14

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

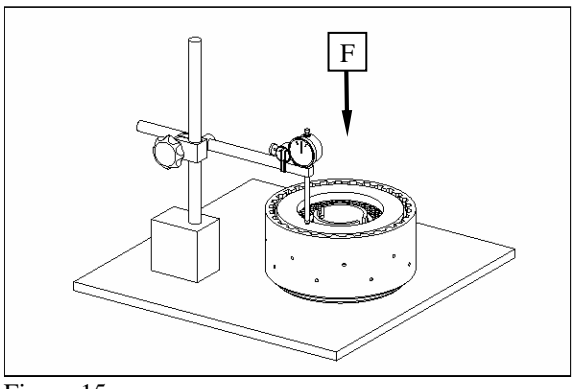


Figure 15

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

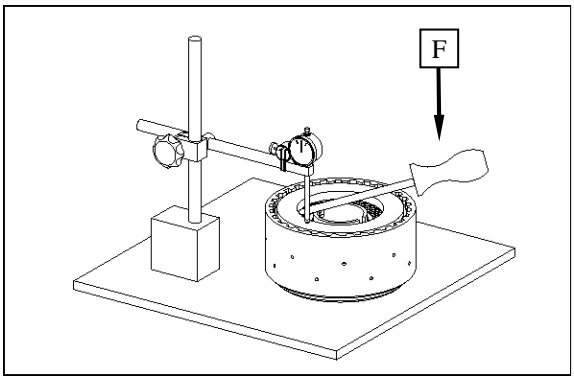


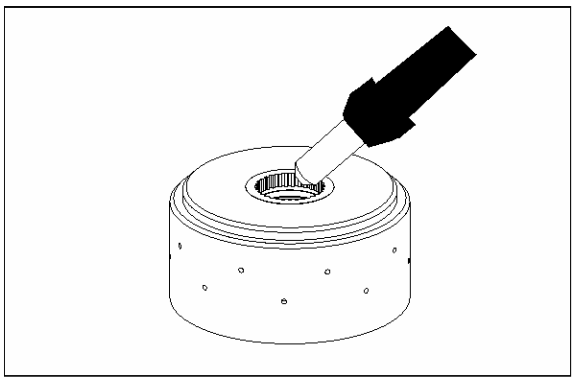
Figure 16

Then press end plate against the snap ring (upwards) and read disk clearance.

☞ **Disk clearance: 2.45 to 2.75 mm (see Figure 12)**

☞ **Disk clearance: 1.70 to 2.00 mm (see Figure 13)**

☞ **In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 …... 4.2 mm)!**


Figure 17

Heat up clutch inner diameter (approx. 120° C).

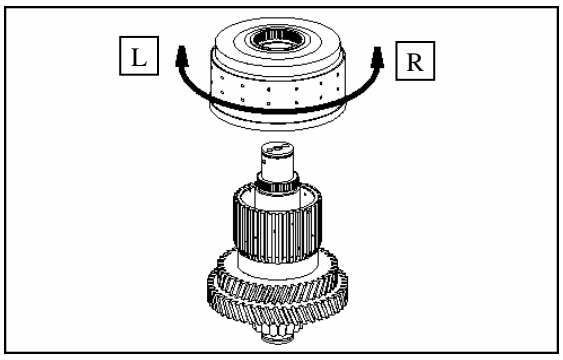


Figure 18

Install clutch until contact is obtained.

Mount inner disks onto the inner disk carrier by means of short left/right rotations.

⚠ **Wear protective gloves!**

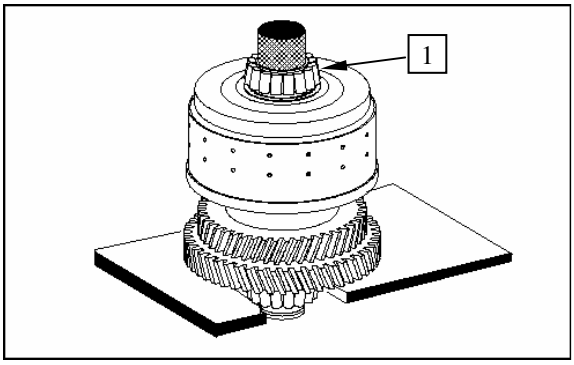
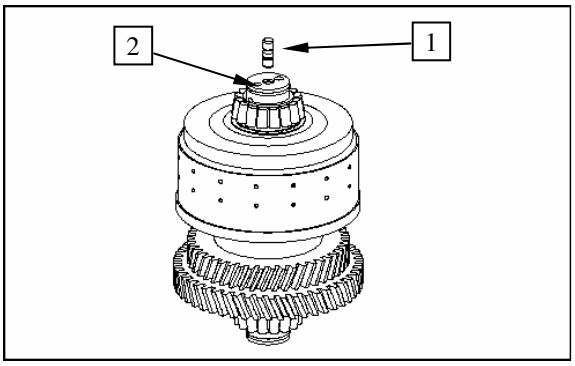


Figure 19

Press tapered roller bearing (inner ring) (1) until contact is obtained.



Mount stud bolt (1).

Tightening torque (M10 /8.8 x15).....M_A = 17 Nm

Check closing and opening of the clutch by means of compressed air at the hole (2).
Closing and opening of the clutch must be clearly audible.

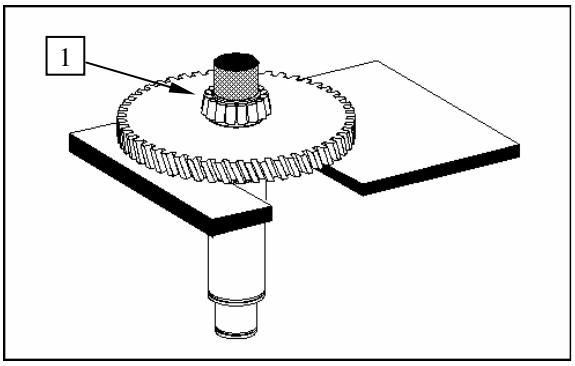


Figure 1

9.3 K1 clutch

Press tapered roller bearing (inner ring) (1) onto the shaft until contact is obtained.

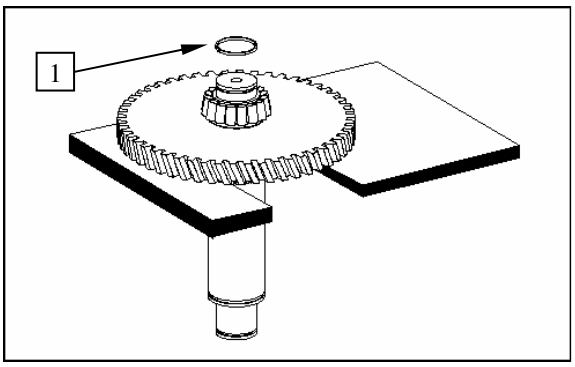


Figure 2

Install piston ring (1).

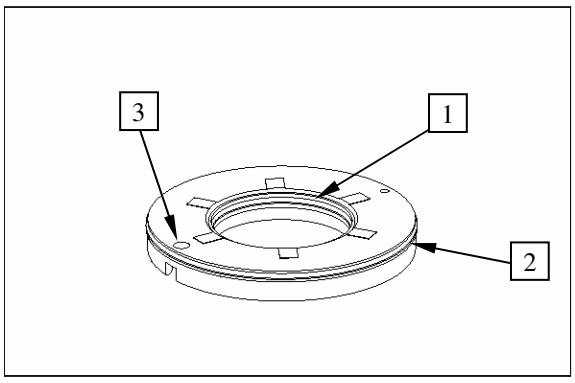


Figure 3

Place both O rings (1 and 2) into the piston grooves and oil them.

1 = 75x3
2 = 142x3

☞ **Check function of the drain valve (3) - There must be no jamming of the ball!**

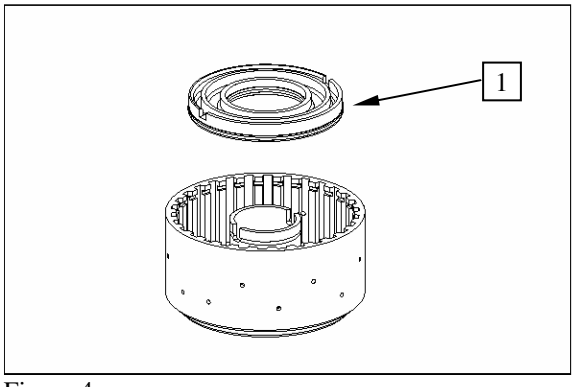


Figure 4

Place piston (1) into the disk carrier.

☞ **Observe installation position, see FIGURE!**

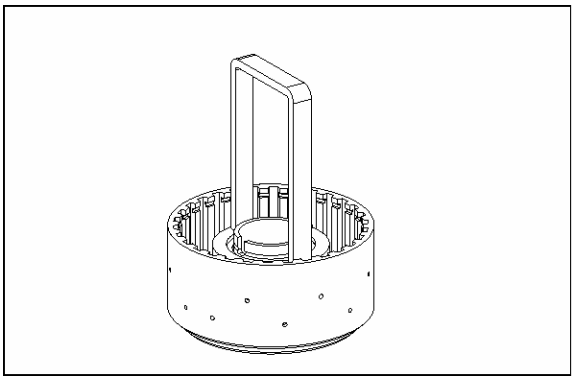


Figure 5

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

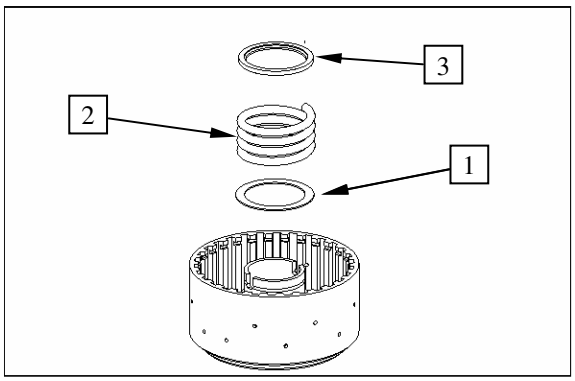


Figure 6

Mount washer (1), compression spring (2) and guide ring (3).

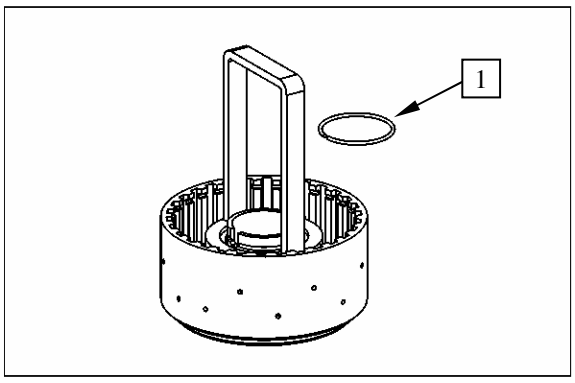


Figure 7

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

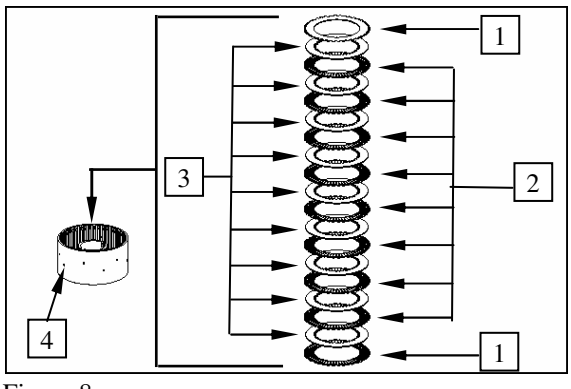


Figure 8

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 8.

Legend:

1 = Friction disk -coated on one side- (2 pcs)
2 = Outer disks (8 pcs)
3 = Inner disks (9 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 18!

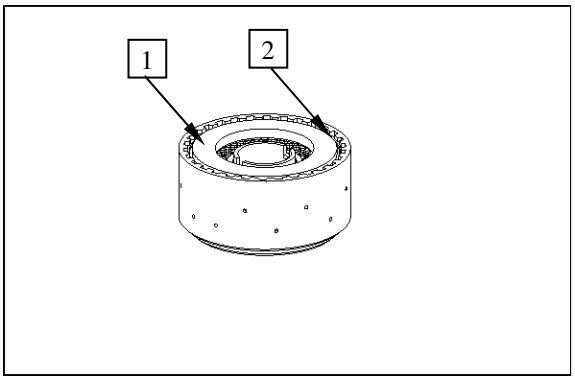


Figure 9

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

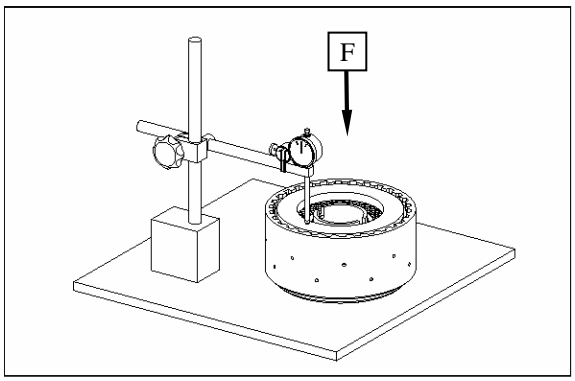


Figure 10

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

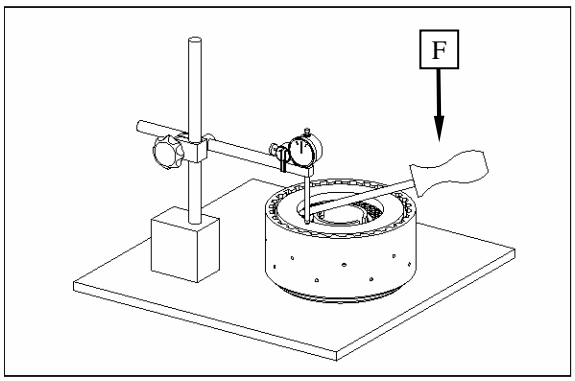
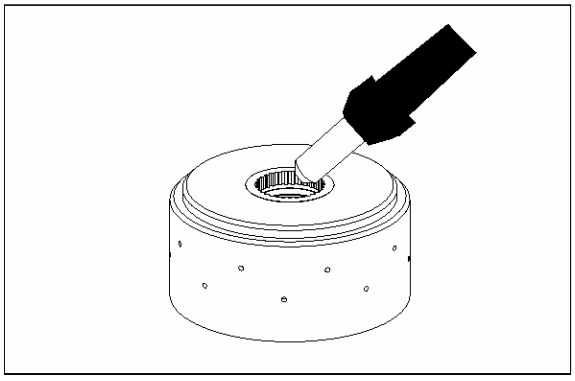


Figure 11

Then press end plate against the snap ring (upwards) and read disk clearance.

☞ **Disk clearance: 2,5 bis 2.8 mm**

☞ **In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 ….. 4.2 mm)!**


Figure 12

Heat up clutch inner diameter (approx. 120° C).

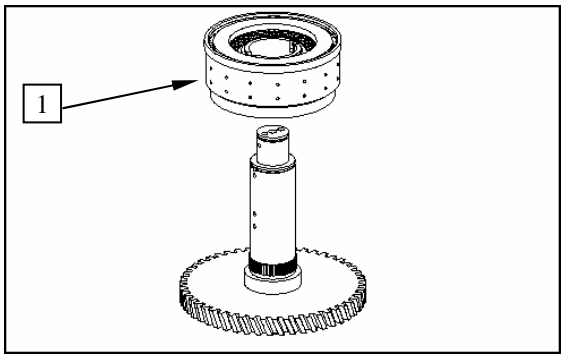


Figure 13

Mount clutch (1) until contact is obtained.

Wear protective gloves!

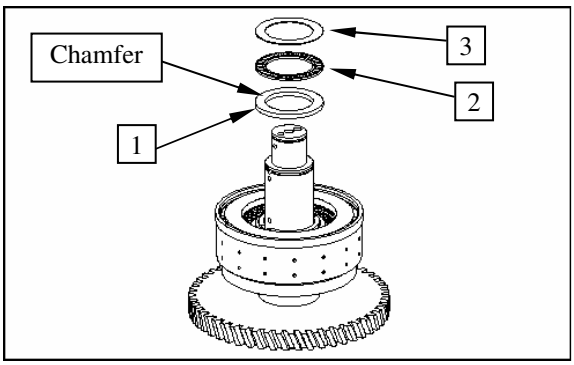


Figure 14

Mount running disk (1), axial cage (2) and axial washer (3).

Install chamfer (see arrow) of running disk (1) showing towards the axial cage!

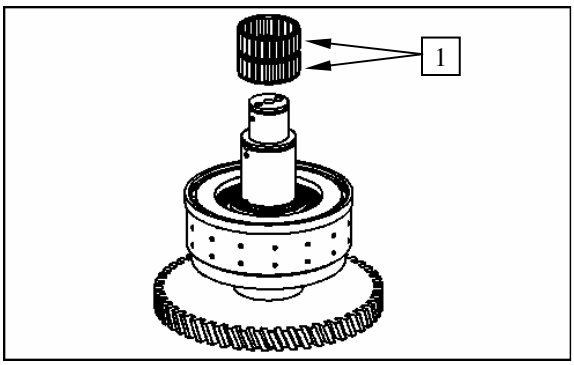


Figure 15

Mount needle cage (1).

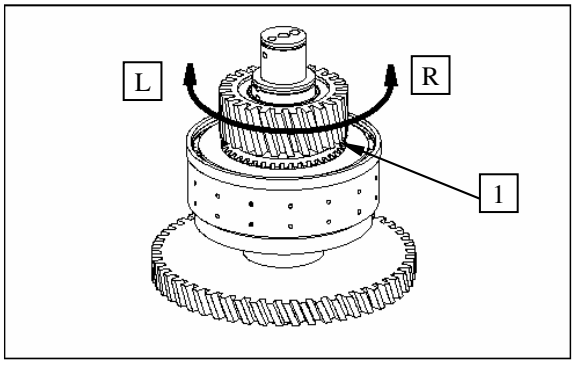


Figure 16

Install (1) idler

Mount inner disks onto the inner disk carrier (idler) by means of short left/right rotations.

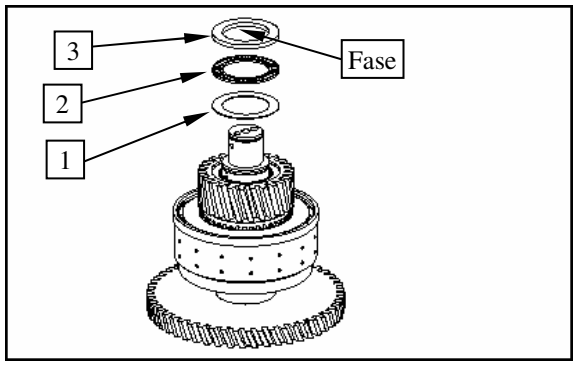


Figure 17

Mount axial washer (1), axial cage (2) and running disk (3).

☞ **Install chamfer (see arrow) of running disk (3) showing towards the axial cage!**

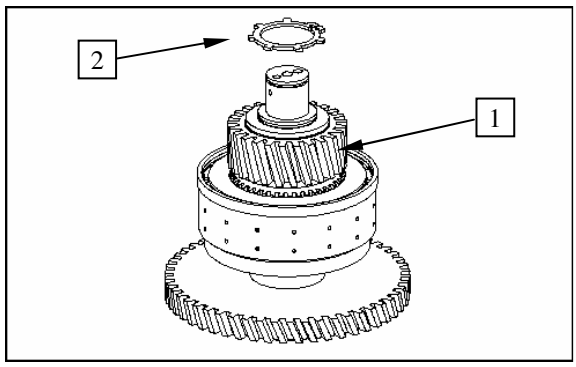


Figure 18

Fix idler gear (1) and single parts by means of retaining ring (2).

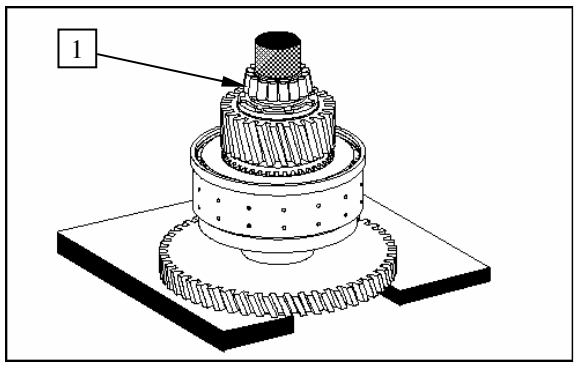


Figure 19

Press tapered roller bearing (inner ring) (1) until contact is obtained.

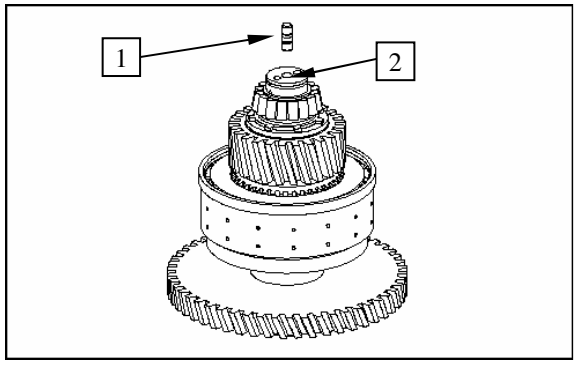


Figure 20

Mount stud bolt (1).

Tightening torque (M10 /8.8 x15).....M_A = 17 Nm

☞ **Check closing and opening of the clutch by means of compressed air at the hole (2).**
Closing and opening of the clutch must be clearly audible.

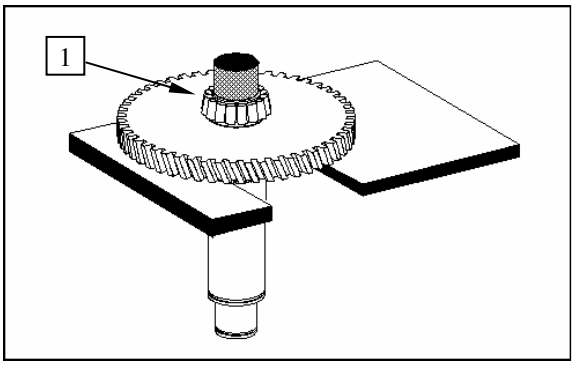


Figure 1

9.4 K2 clutch

Press tapered roller bearing (inner ring) (1) onto the shaft until contact is obtained.

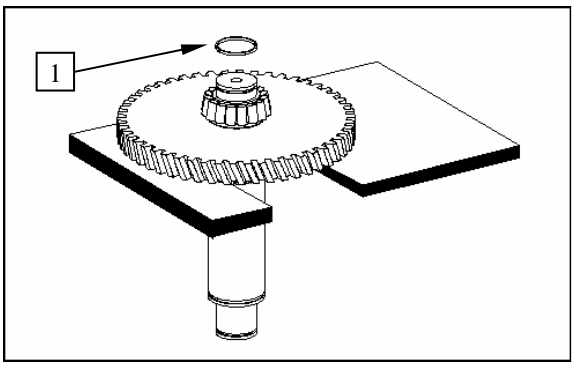


Figure 2

Install piston ring (1).

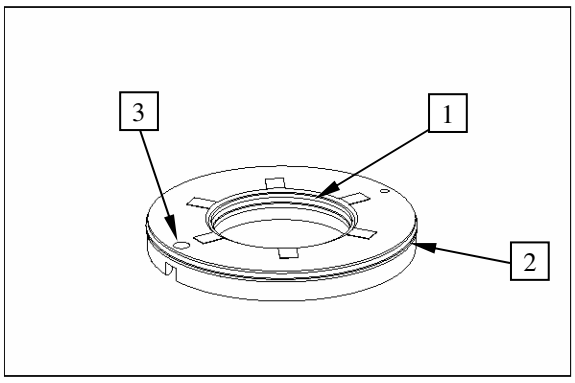


Figure 3

Place both O rings (1 and 2) into the piston grooves and oil them.

1 = 75x3
2 = 142x3

☞ **Check function of the drain valve (3) - There must be no jamming of the ball!**

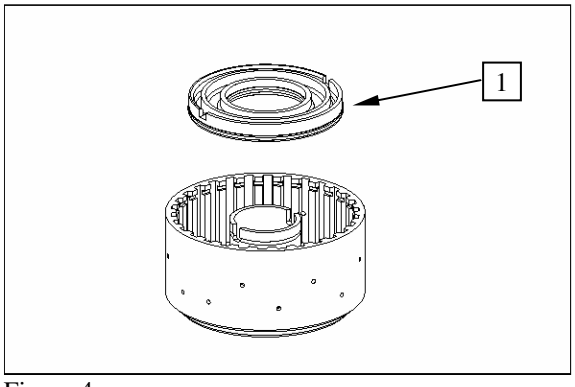


Figure 4

Place piston (1) into the disk carrier.

☞ **Observe installation position, see FIGURE!**

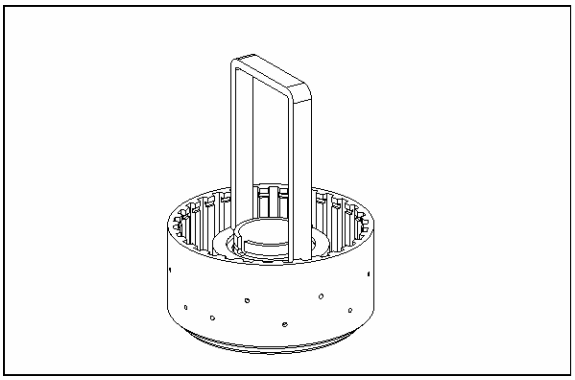


Figure 5

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

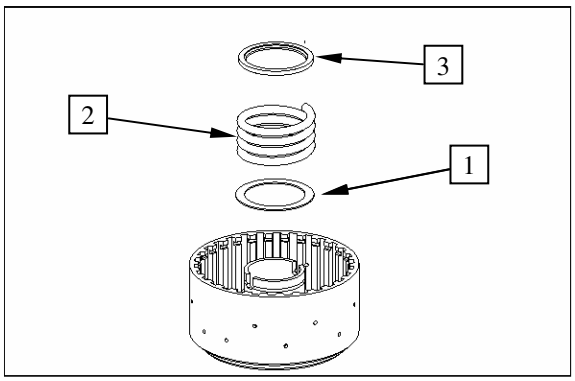


Figure 6

Mount washer (1), compression spring (2) and guide ring (3).

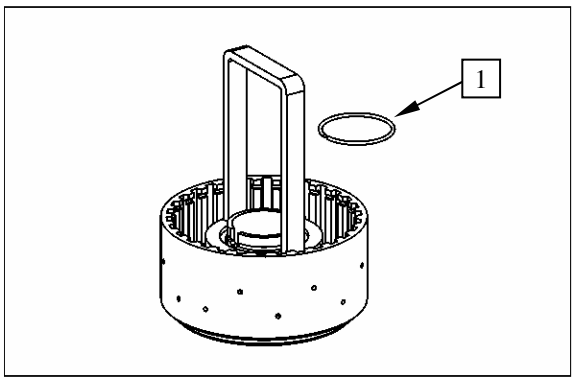


Figure 7

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

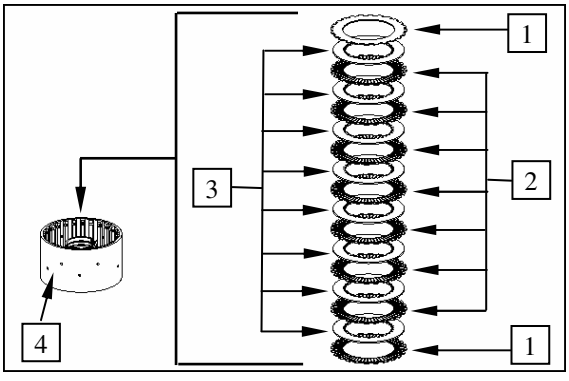


Figure 8

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 8.

Legend:

1 = Friction disk -coated on one side- (2 pcs)
2 = Outer disks (7 pcs)
3 = Inner disks (8 pcs)

☞ **Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!**
Number of friction surfaces: 16!

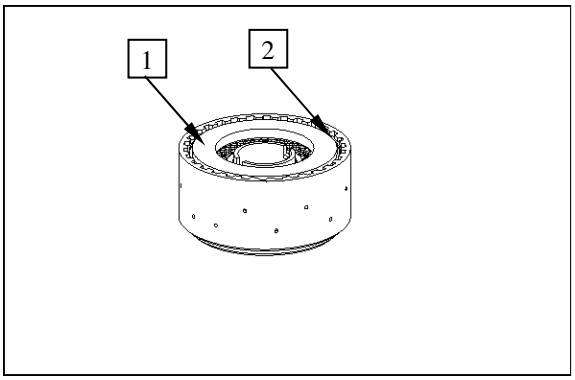


Figure 9

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

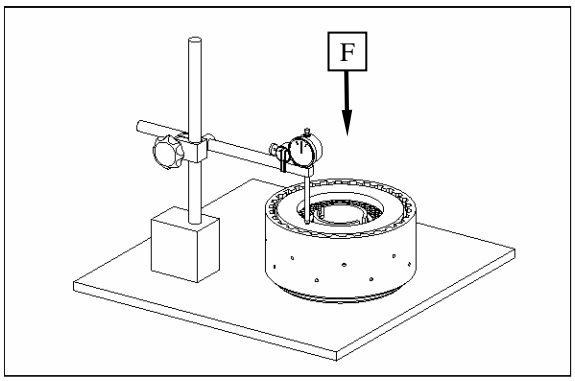


Figure 10

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

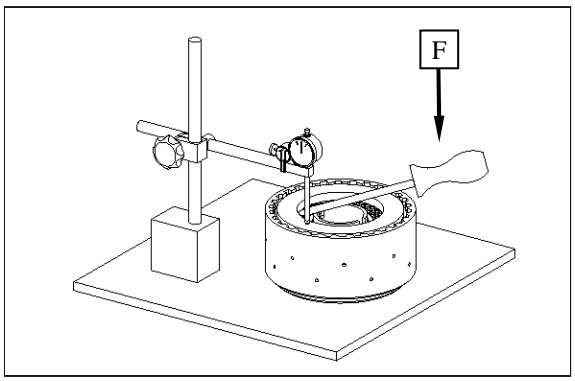
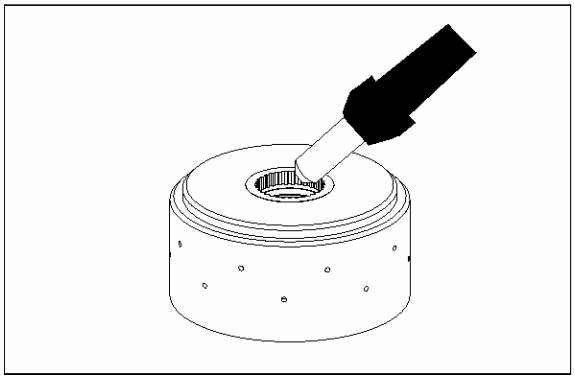


Figure 11

Then press end plate against the snap ring (upwards) and read disk clearance.

☞ **Disk clearance: 2.0 to 2.3 mm**

☞ **In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 …... 4.2 mm)!**


Figure 12

Heat up clutch inner diameter (approx. 120° C).

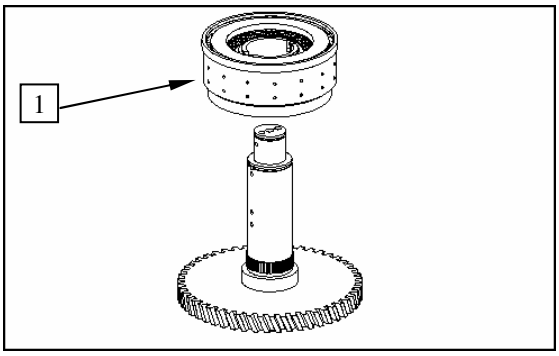


Figure 13

Mount clutch (1) until contact is obtained.

Wear protective gloves!

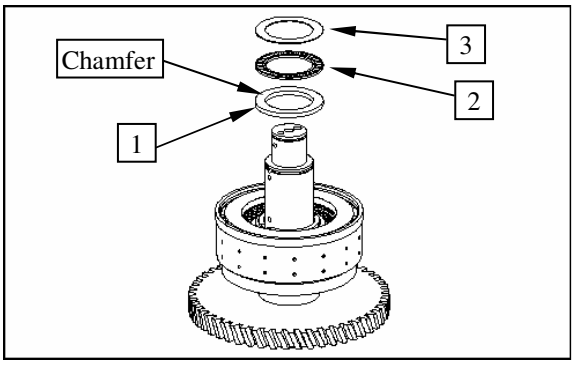


Figure 14

Mount running disk (1), axial cage (2) and axial washer (3).

Install chamfer (see arrow) of running disk (1) showing towards the axial cage!

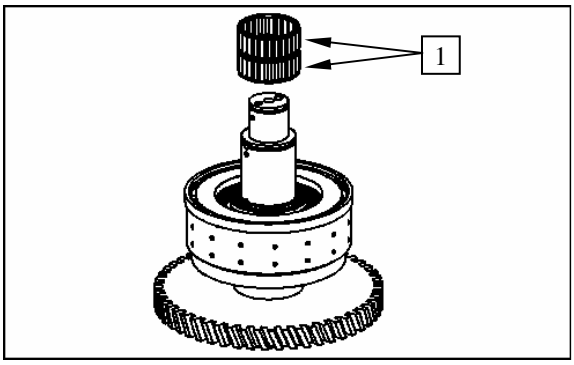


Figure 15

Mount needle cage (1).

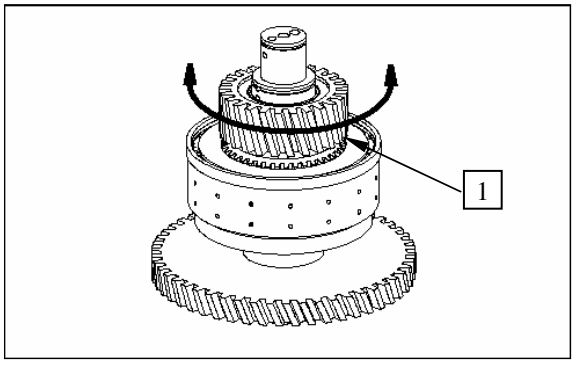


Figure 16

Install (1) idler

Mount inner disks onto the inner disk carrier (idler) by means of short left/right rotations.

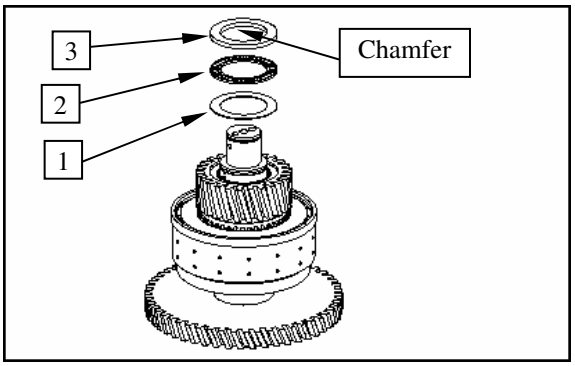


Figure 17

Mount axial washer (1), axial cage (2) and running disk (3).

Install chamfer (see arrow) of running disk (3) showing towards the axial cage!

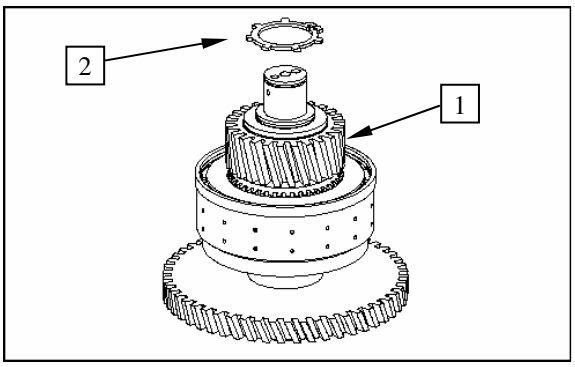


Figure 18

Fix idler gear (1) and single parts by means of retaining ring (2).

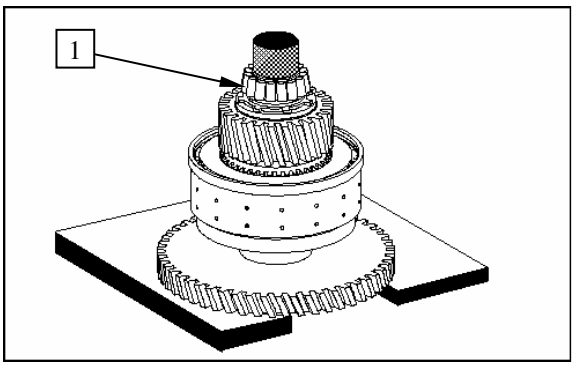


Figure 19

Press tapered roller bearing (inner ring) (1) until contact is obtained.

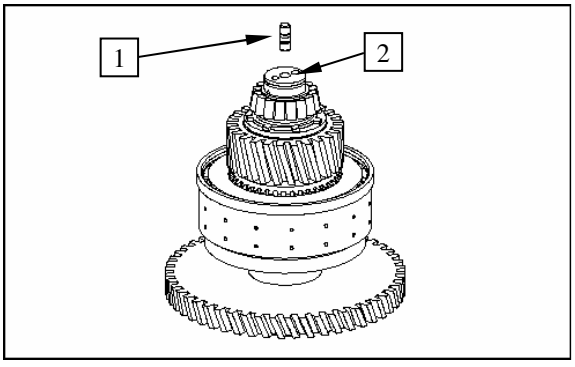


Figure 20

Mount stud bolt (1).

Tightening torque (M10 /8.8 x15)..... M_A = 17 Nm

Check closing and opening of the clutch by means of compressed air at the hole (2).
Closing and opening of the clutch must be clearly audible.

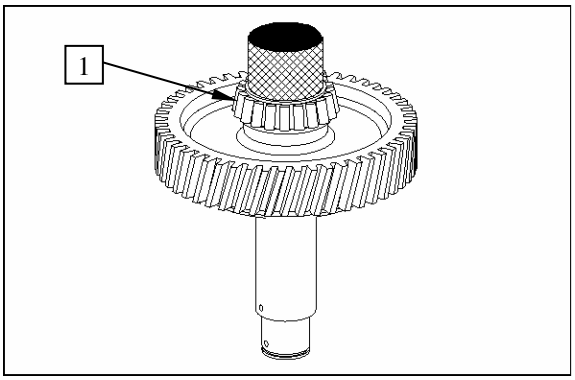


Figure 1

9.5 K3 clutch

Press tapered roller bearing (inner ring) (1) onto the shaft until contact is obtained.

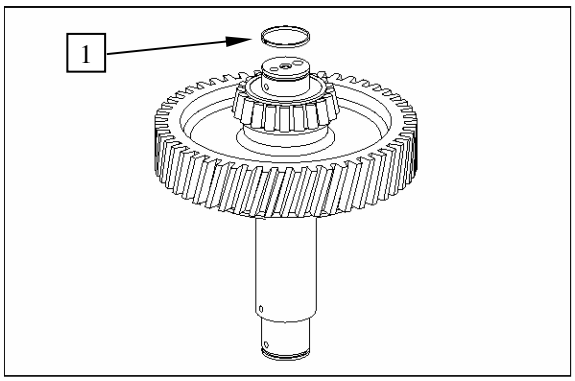


Figure 2

Install piston ring (1).

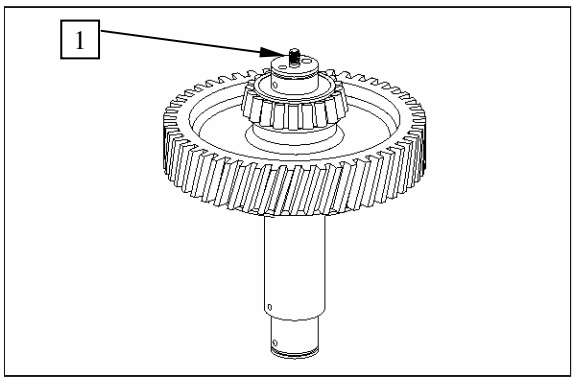


Figure 3

Mount stud bolt (1).

Tightening torque (M10 /8.8 x15).....M_A = 17 Nm

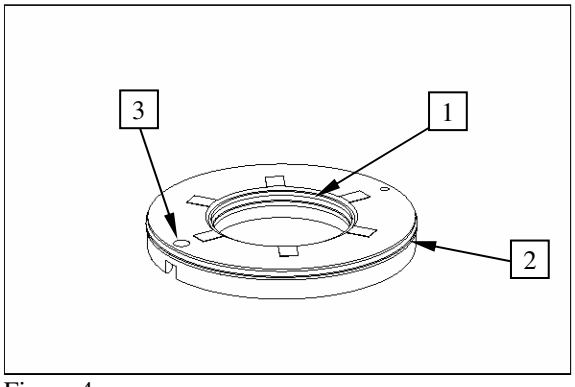


Figure 4

Place both O rings (1 and 2) into the piston grooves and oil them.

1 = 75x3
2 = 142x3

Check function of the drain valve (3) - There must be no jamming of the ball!

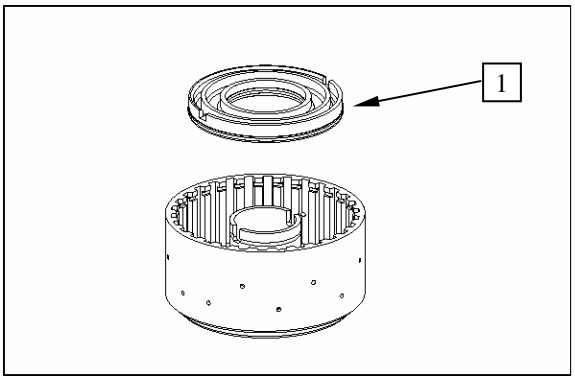
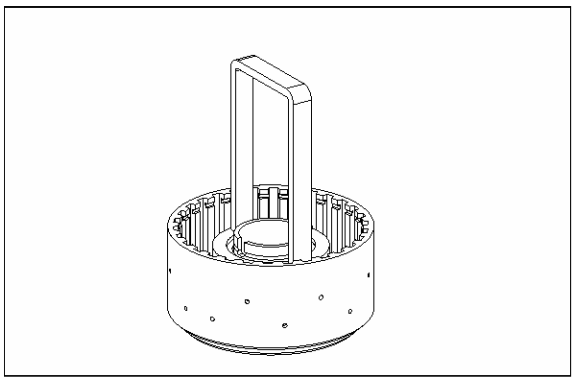


Figure 5

Place piston (1) into the disk carrier.

Observe installation position, see FIGURE!


Figure 6

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

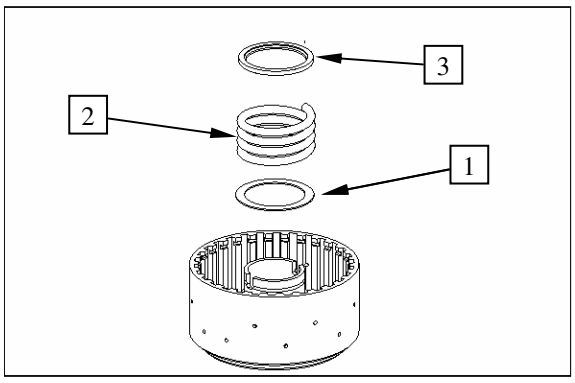


Figure 7

Mount washer (1), compression spring (2) and guide ring (3).

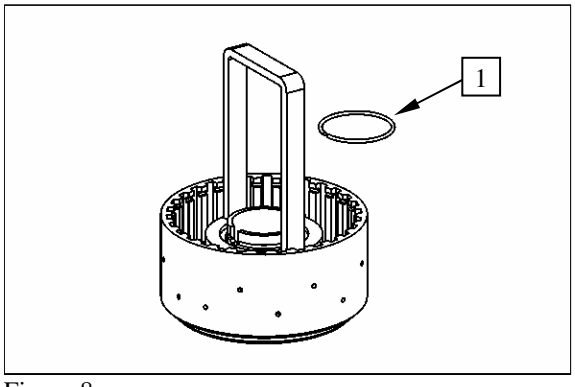


Figure 8

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

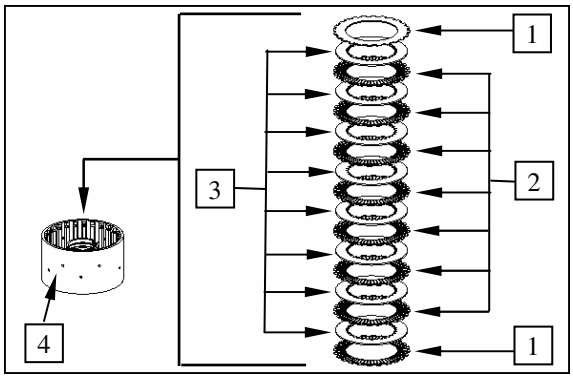


Figure 9

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 9.

Legend:

1 = Friction disk -coated on one side-	(2 pcs)
2 = Outer disks	(7 pcs)
3 = Inner disks	(8 pcs)

☞ **Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!**
Number of friction surfaces: 16!

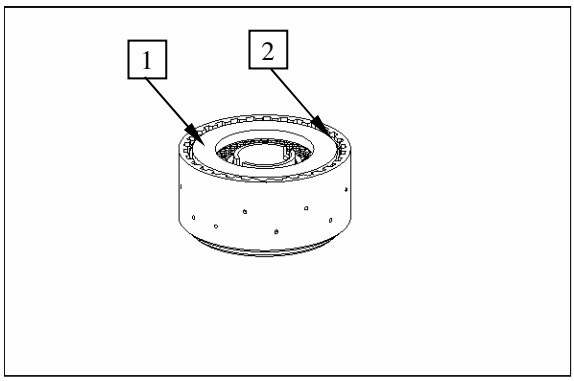


Figure 10

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

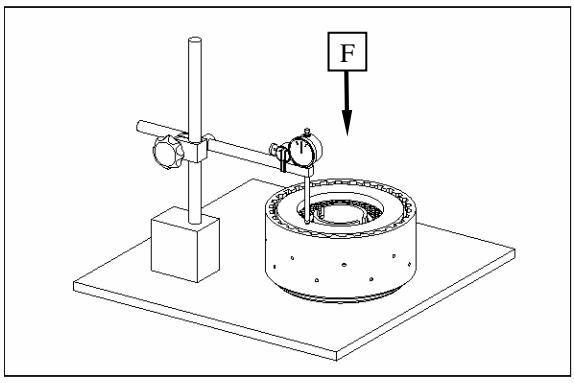


Figure 11

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

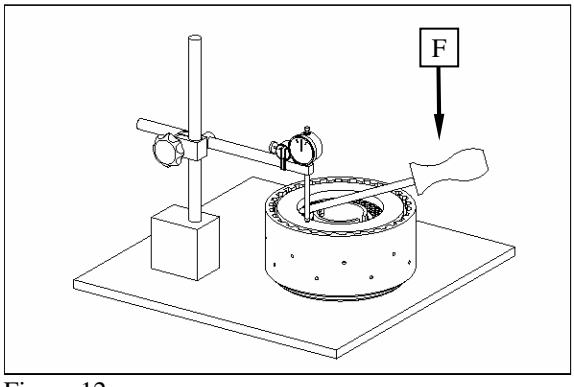


Figure 12

Then press end plate against the snap ring (upwards) and read disk clearance.

☞ **Disk clearance: 2.0 to 2.3 mm**

☞ **In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 …... 4.2 mm)!**

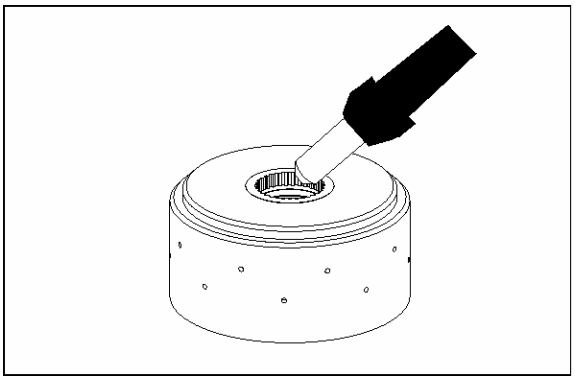


Figure 13

Heat up clutch inner diameter (approx. 120° C).

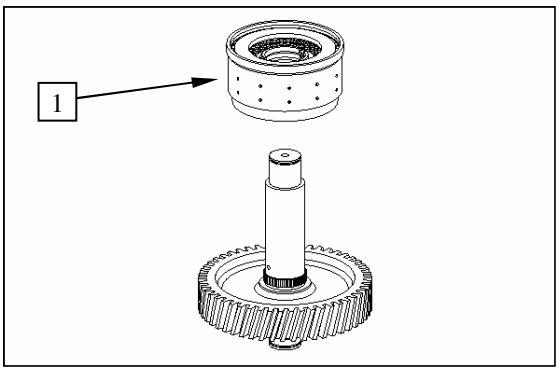


Figure 14

Mount clutch (1) until contact is obtained.

Wear protective gloves!

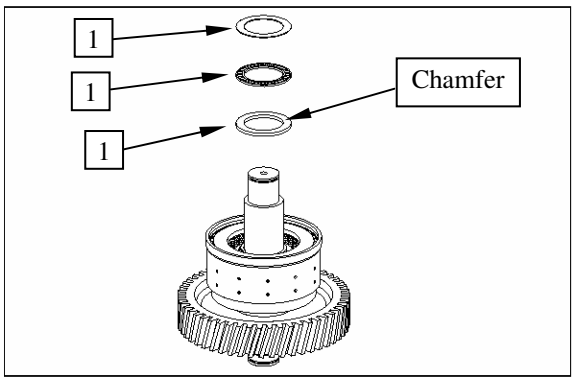


Figure 15

Mount running disk (1), axial cage (2) and axial washer (3).

Install chamfer (see arrow) of running disk (1) showing towards the axial cage!

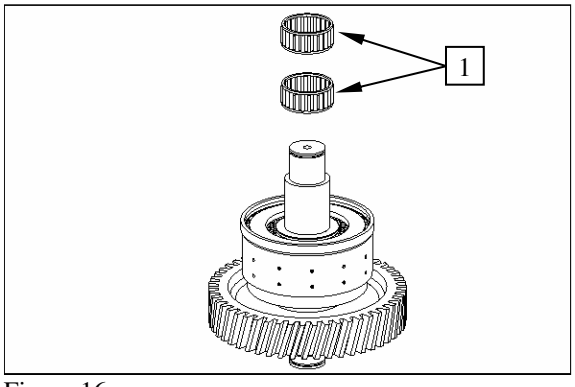


Figure 16

Mount needle cage (1).

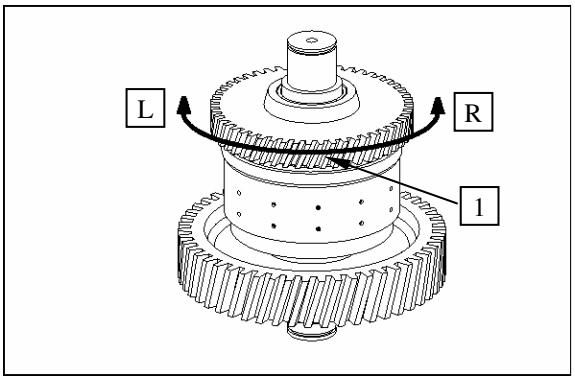


Figure 17

Install (1) idler

Mount inner disks onto the inner disk carrier (idler) by means of short left/right rotations.

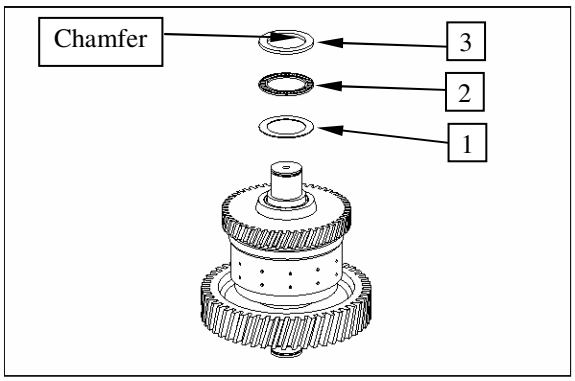


Figure 18

Mount idler gear (1).

Mount axial washer (2), axial cage (3) and running disk (4).

Install chamfer (see arrow) of running disk (4) showing towards the axial cage!

Pay attention that the running disk is flush with the shaft collar to ensure that all inner disks are mounted on the idler gear teeth.

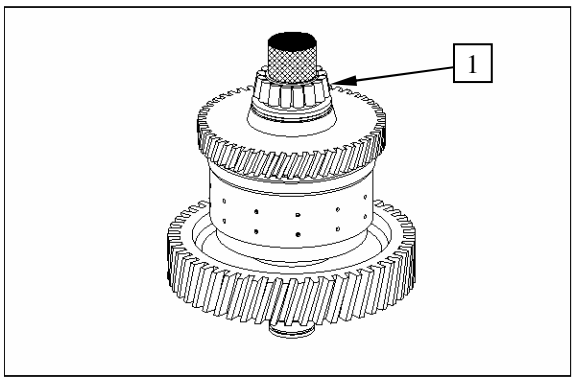


Figure 19

Press tapered roller bearing (inner ring) (1) until contact is obtained.

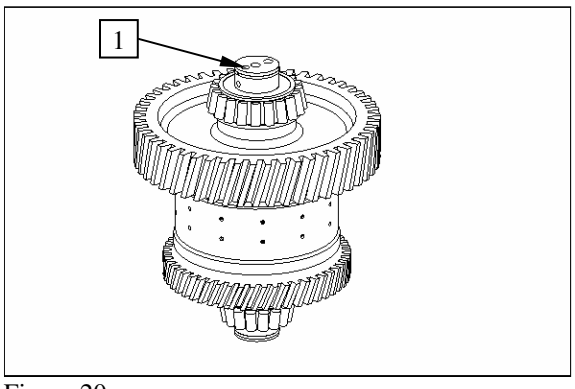


Figure 20

Check closing and opening of the clutch by means of compressed air at the hole (1).
Closing and opening of the clutch must be clearly audible.

9.6 K4 clutch

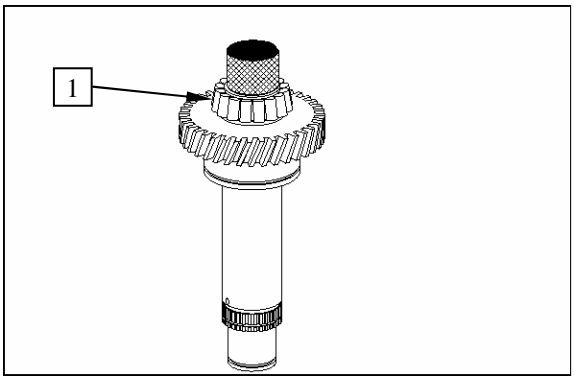


Figure 1

Press tapered roller bearing (inner ring) (1) onto the shaft (2) until contact is obtained.

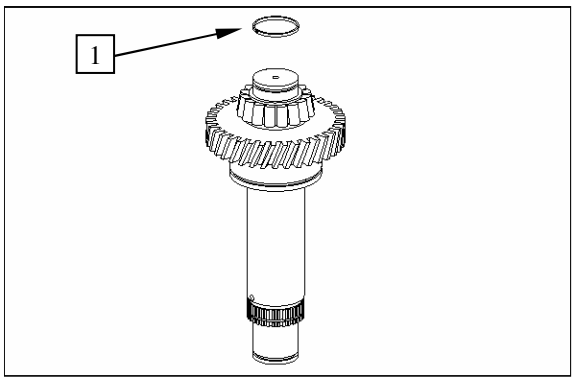


Figure 2

Install piston ring (1).

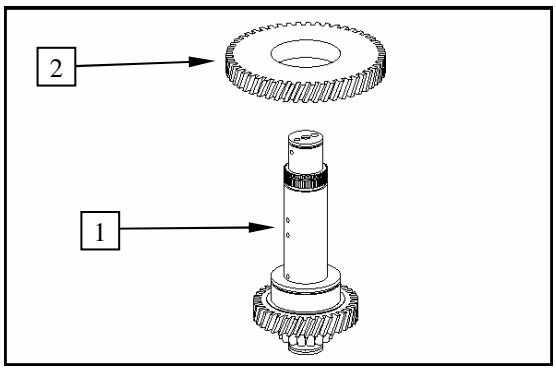


Figure 3

Undercool shaft (1) (approx. -80°C), heat up gear (2) (approx. +120°C) and mount until contact is obtained.

Wear protective gloves!

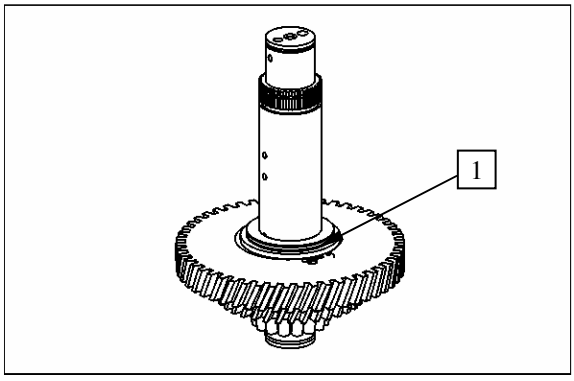


Figure 4

Secure gear by means of retaining ring 80x2.5 - (1).

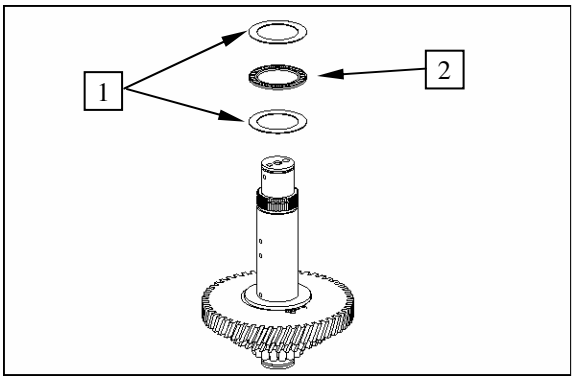


Figure 5

Mount lower axial washer (1), axial needle cage (2) and upper axial washer (1).

Upper and lower axial washer are identical (50 x 70 x 1)!

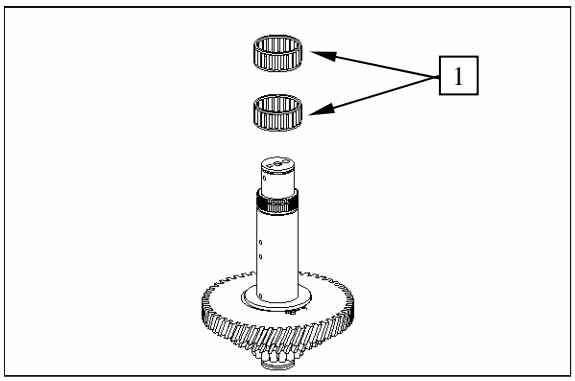


Figure 6

Mount both needle bearings (1).

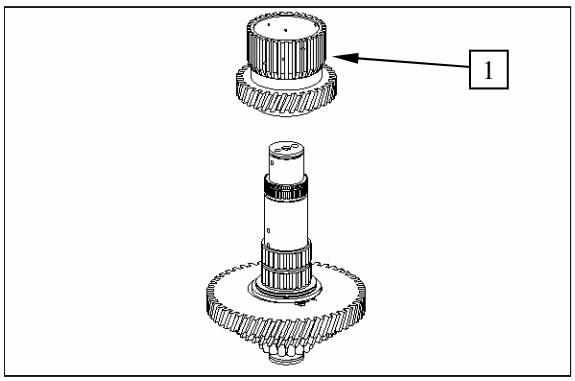


Figure 7

Mount idler gear (1).

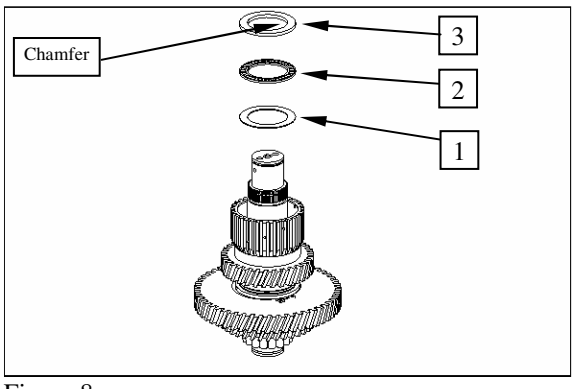


Figure 8

Mount axial washer (1), needle cage (2) and running disk (3).

Mount running disk (3) with the chamfer showing to the needle cage!

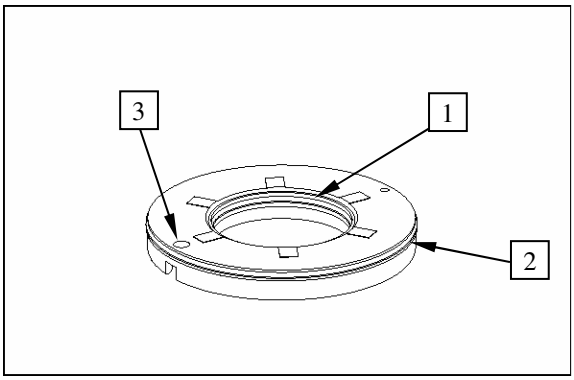


Figure 9

Mount washer (1), compression spring (2) and guide ring (3).

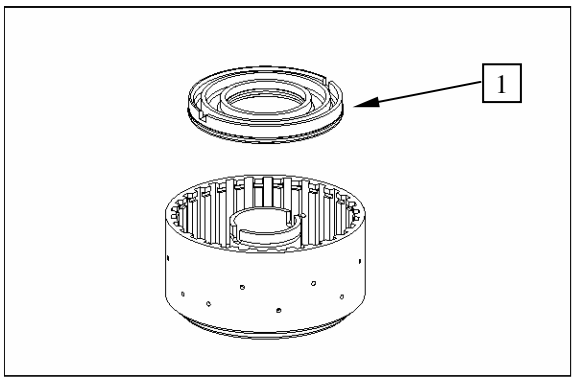


Figure 10

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

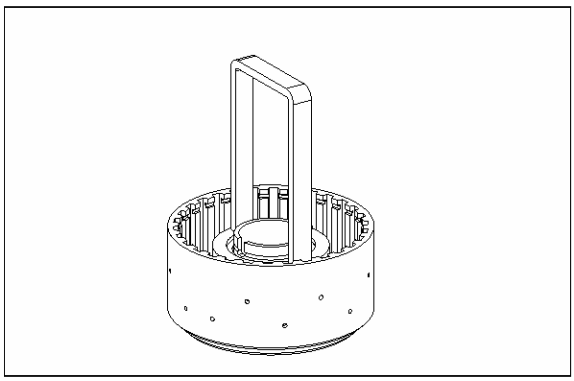


Figure 11

Use a hand-operated press to place piston into the disk carrier by means of the assembly aid.

(S) Assembly aid 5870 345 088

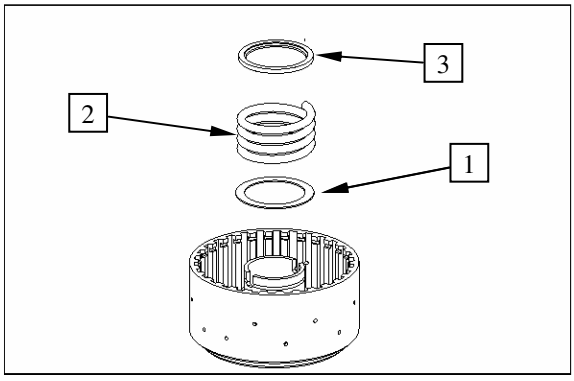


Figure 12

Mount washer (1), compression spring (2) and guide ring (3).

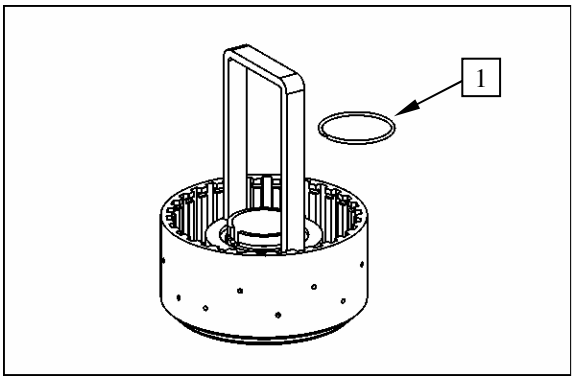


Figure 13

Preload compression spring by means of assembly aid and install snap ring 64x3.2 (1) into the annular groove.

(S) Assembly aid 5870 345 088

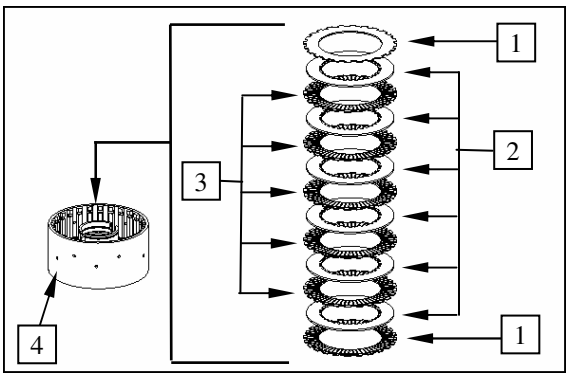


Figure 14

Install outer and inner disks alternately into the disk carrier (4) as personated in Figure 14.

Legend:

1 = Friction disk -coated on one side- (2 pcs)
2 = Inner disks (6 pcs)
3 = Outer disks (5 pcs)

Take care that the uncoated (blank) side of the friction disk (1) is showing towards the piston or end plate!
Number of friction surfaces: 12!

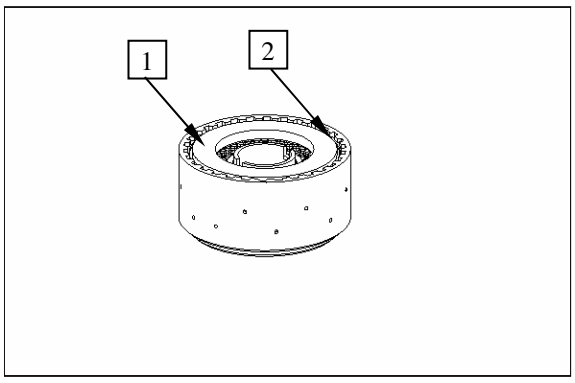


Figure 15

Mount end plate (1) and fix disk package by means of snap ring (2) (e.g. thickness = 2.65 mm / recommended value).

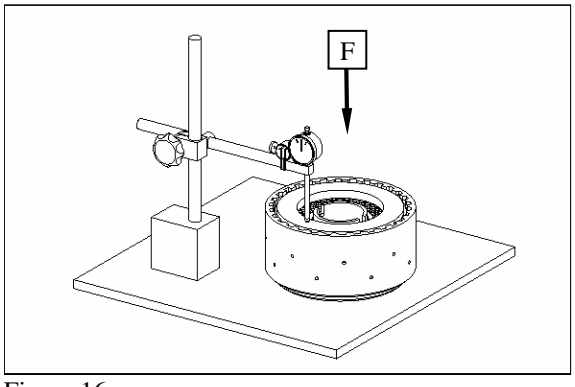


Figure 16

Press on end plate with F (approx. 100 N = 10 kg) and set dial indicator to "zero“.

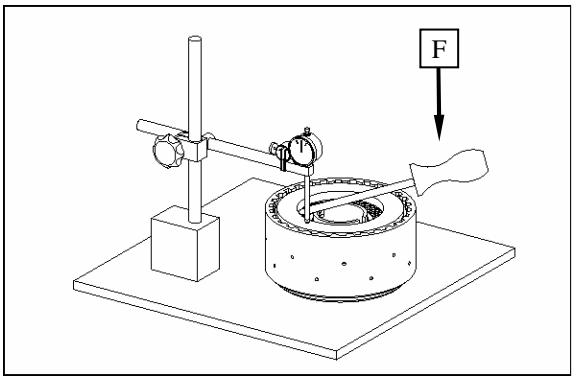
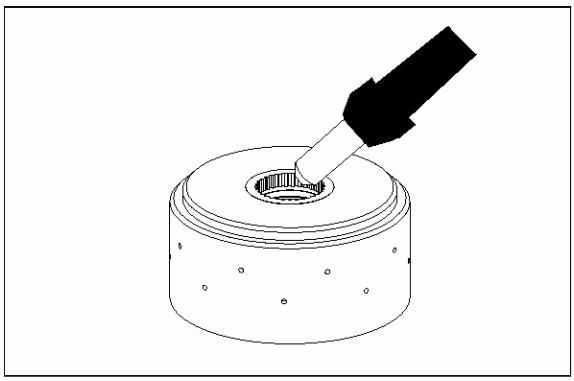


Figure 17

Then press end plate against the snap ring (upwards) and read disk clearance.

Disk clearance: 1,35 bis 1,65 mm

In case of deviations, the disk clearance must be corrected with an appropriate snap ring (optional thicknesses = 2.1 …... 4.2 mm)!


Figure 18

Heat up clutch inner diameter (approx. 120° C).

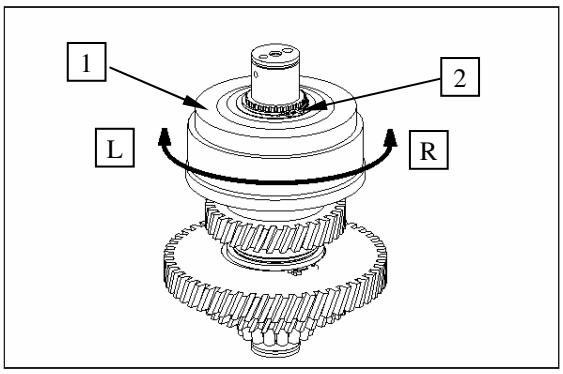


Figure 19

Mount clutch (1) until contact is obtained and fix it by retaining ring 50x2 (2).

Mount inner disks onto the inner disk carrier by means of short left/right rotations.

Wear protective gloves!

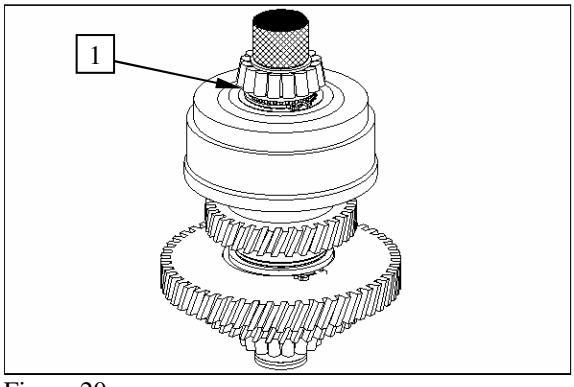


Figure 20

Press tapered roller bearing (inner ring) (1) until contact is obtained.

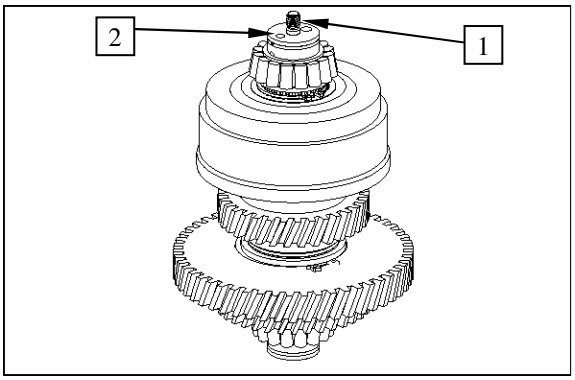


Figure 21

Mount stud bolt (1).

Tightening torque (M10 /8.8 x15)..... M_A = 17 Nm

Check closing and opening of the clutch by means of compressed air at the hole (2).
Closing and opening of the clutch must be clearly audible.

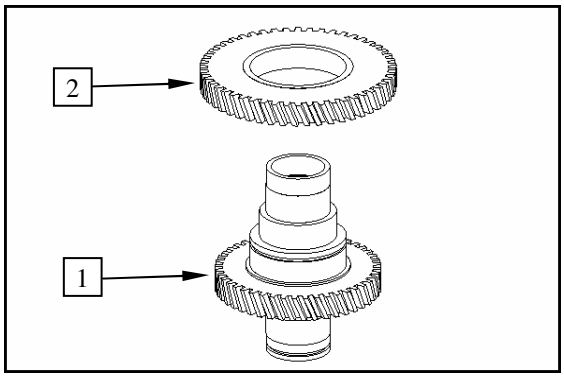


Figure 1

9.7 Input shaft

Undercool input shaft (1) (approx. -80°C), heat up drive gear (2) (approx. +120° C) and mount until contact is obtained.

Wear protective gloves!

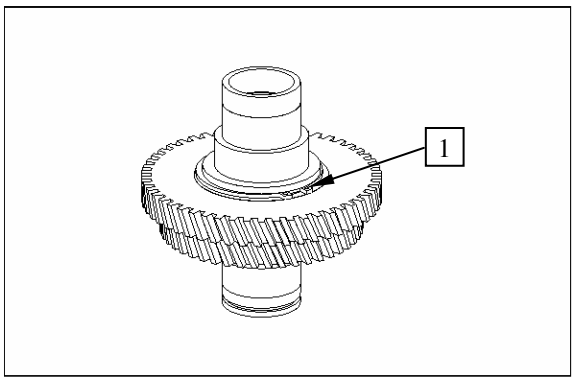


Figure 2

Secure drive gear by means of retaining ring 90x3 (1).

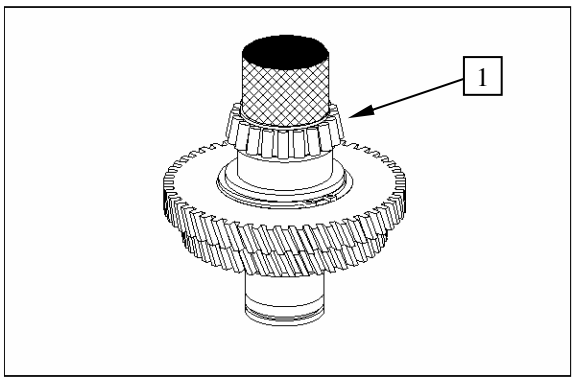


Figure 3

Press tapered roller bearing (inner ring) (1) onto the input shaft until contact is obtained.

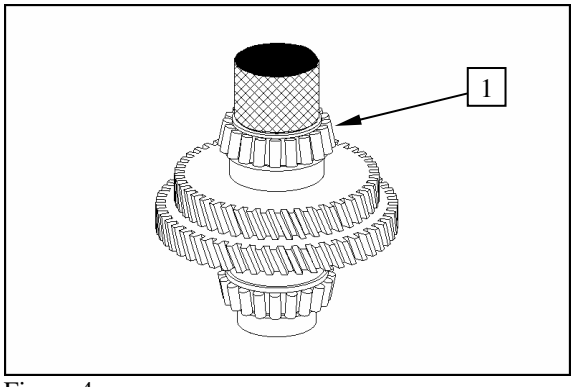


Figure 4

Press tapered roller bearing (inner ring) (1) onto the input shaft until contact is obtained.

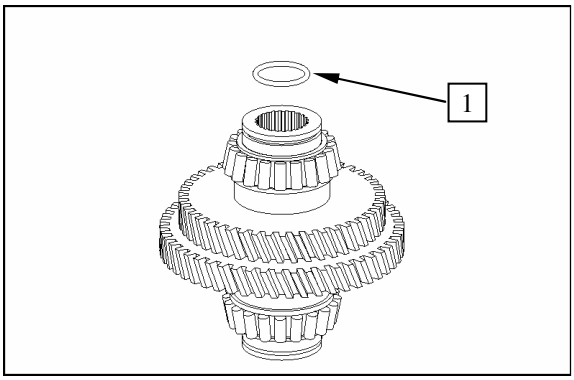


Figure 5

Version with lock-up clutch:

Place O-ring 35x2 (1) into lower annular groove of input shaft and grease it.

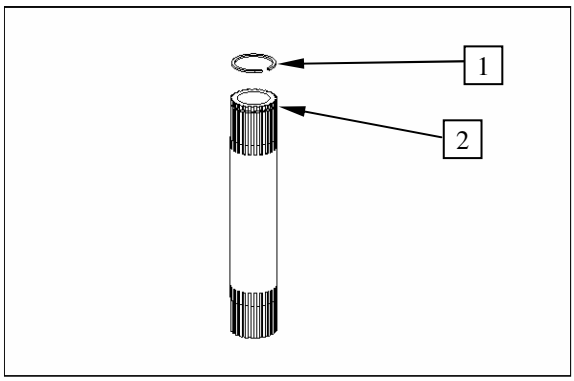


Figure 6

Install snap-ring SB 38 (1) into annular groove (2) of turbine shaft.

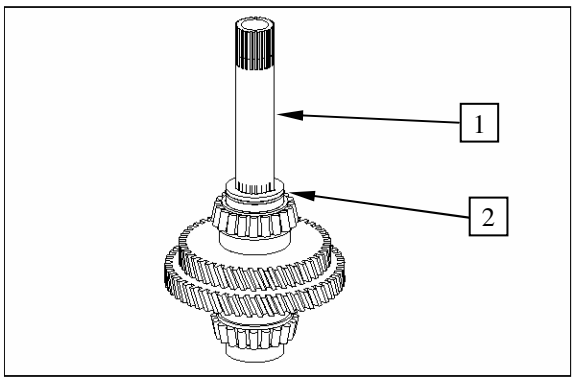


Figure 7

Mount turbine shaft (1) until the snap ring engages into the input shaft groove. Turbine shaft is axially fixed.

Snap in and interlock rectangular ring 60x3 (2).

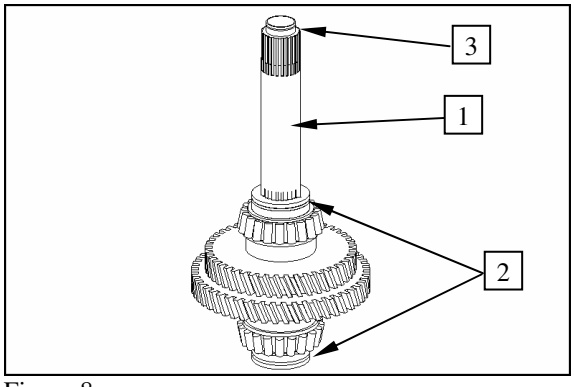


Figure 8

Version with lock-up clutch:

Mount turbine shaft (1) until the snap ring engages into the input shaft groove. Turbine shaft is axially fixed.

Snap in and interlock rectangular ring.

2 = 60x3
3 = 36x2.5

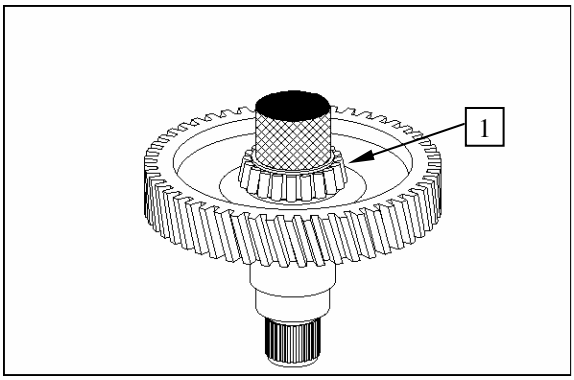


Figure 1

9.8 Output shaft

Press tapered roller bearing (inner ring) (1) onto the output shaft until contact is obtained.

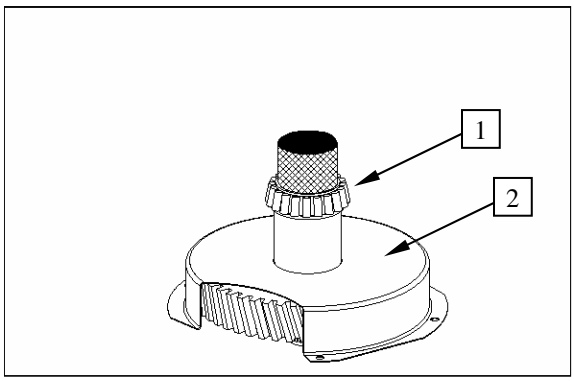


Figure 2

Mount screen sheet (2) and press tapered roller bearing (inner ring) (1) onto the output shaft until contact is obtained.

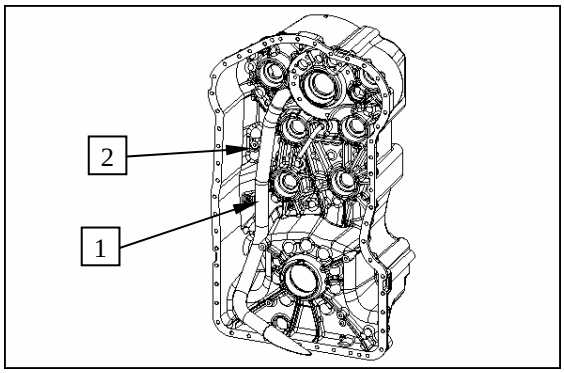


Figure 1

10. Installation of input shaft, output shaft and clutches

If the suction tube (1) in the housing front part is to be replaced, it is imperative to use the ZF special tool (rolling tool) for assembly. Then fix the tube with cylindrical screw (2).

Tightening torque (M8/8.8x12) ..... M_A = 23 Nm

(S) Rolling tool	5870 600 003
(S) Rolling tool	5870 600 005
(S) Lubricant	5870 451 006

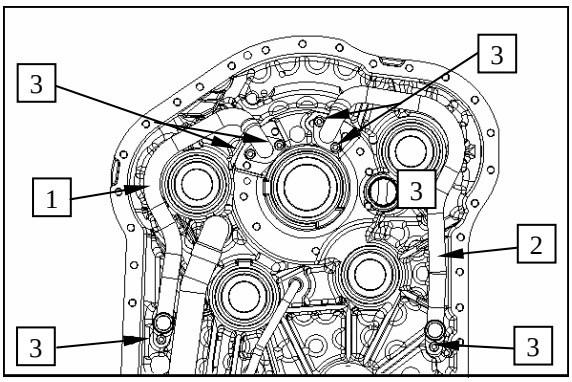


Figure 2

Mount O-rings 22x3 into the annular groove of the oil tubes (1 and 2) and oil them.
Then insert tubes into the housing front part and fix them by means of cylindrical screws (3).

Tightening torque (M8/8.8x12) ..... M_A = 23 Nm

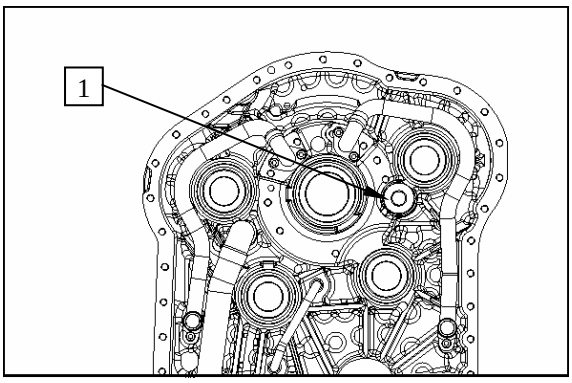


Figure 3

Mount screw plug (1) with new O-ring.

Screw plug:	M38x1.5
O-ring:	35x2

Tightening torque ……..... M_A = 140 Nm

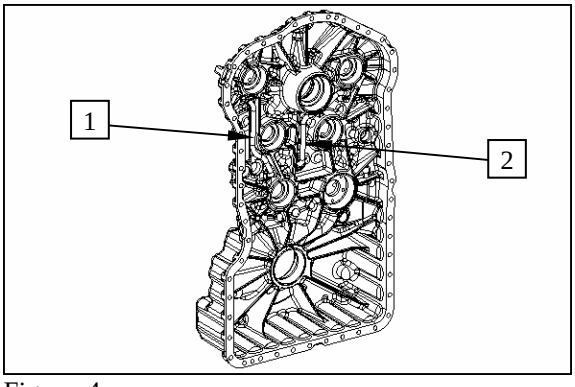


Figure 4

The spare parts service supplies the lubricating oil tubes (1 and 2) only as a complete package with the housing rear part.

Single parts delivery upon request only!

Assembly is only possible with the ZF special tool! (See also Figure 1).

(S) Rolling tool	5870 600 006
(S) Lubricant	5870 451 006

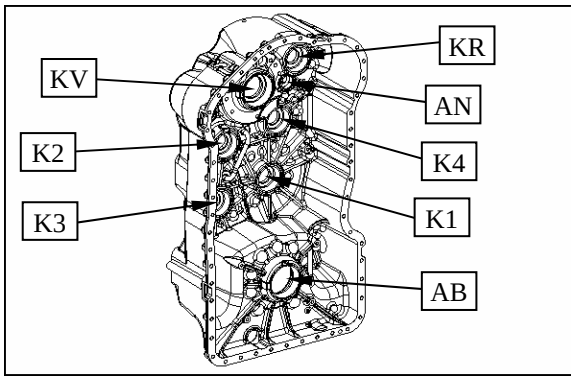


Figure 5

Insert all bearing outer rings into the bearing holes of both housing parts.

Housing front part

AN = Input
AB = Output
KV = Forward clutch
KR = Reverse clutch
K1 = 1st gear clutch
K2 = 2nd gear clutch
K3 = 3rd gear clutch
K4 = 4th gear clutch

☞ **Installation position see Figure 5 and 6!**

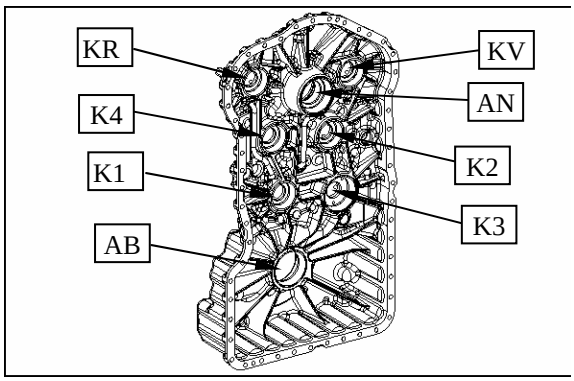


Figure 6

Housing rear part:

Legend see Figure 4!

☞ **Place bearing outer rings into the bearing holes using assembly grease.**

☞ **If, contrary to the ZF recommendation, the tapered roller bearings of clutches, input and output are not replaced, it is imperative to ensure the previous pairing (bearing inner ring/bearing outer ring) - see Chapter 7, Figures 9 and 11!**

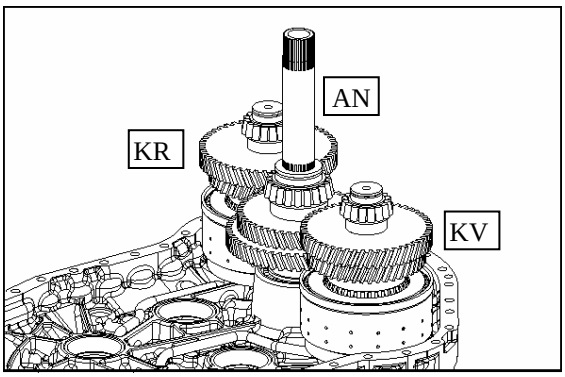


Figure 7

⚠ **Due to the installation conditions, the installation of single clutches without using the special tool is not possible.**

Risk of injury!

Install clutches by means of housing rear part.
(Figures 6 to 13)

☞ **Housing rear part will be removed again later!**

Place KR clutch, AN input shaft and KV clutch into the housing rear part at the same time.

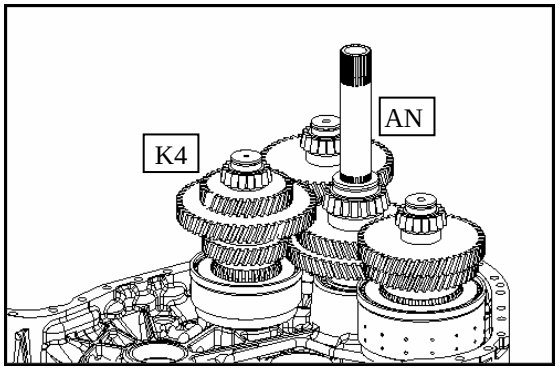


Figure 8

Slightly lift drive gear and position K4 clutch.

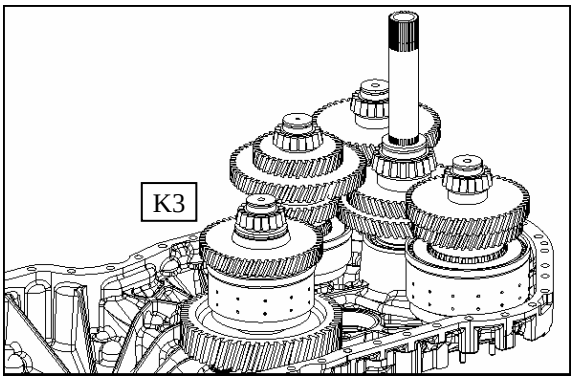


Figure 9

Mount K3 clutch.

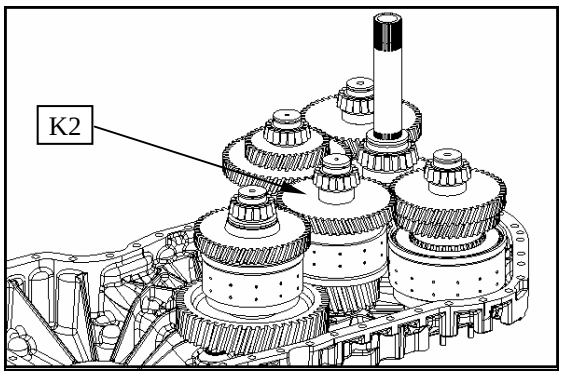


Figure 10

Position K2 clutch.

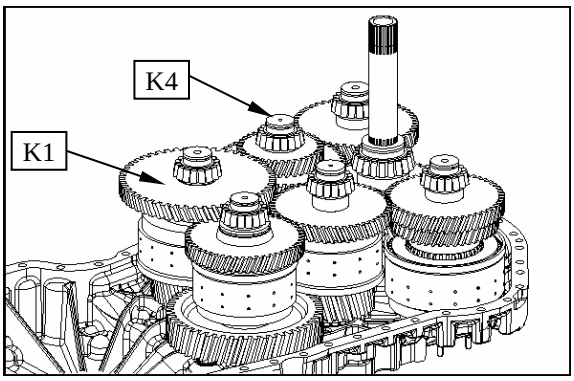


Figure 11

Slightly lift K4 clutch and position **K1 clutch**.

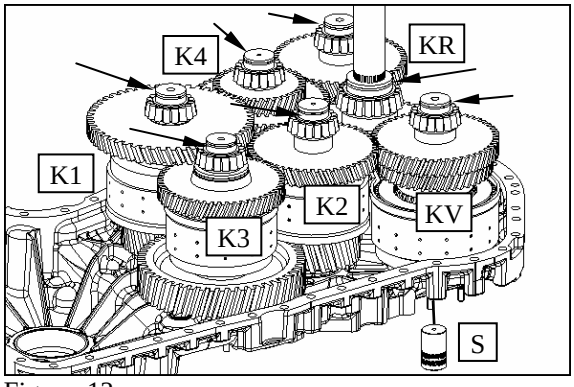


Figure 12

The figure again shows the installation position of the individual clutches in the housing rear part.

Check, grease and centrically align rectangular rings (arrows).

Fix all clutches by means of handles (S).

(S) Handle (6 pcs required) 5870 260 010

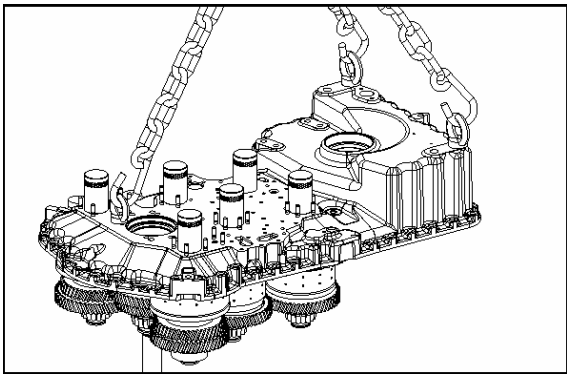


Figure 13

Rotate housing rear part by 180°, install eye bolts and eye nuts.

(S) Eye nuts (M12)	0664 462 774
(S) Eye bolts 2x (M20)	0636 804 003

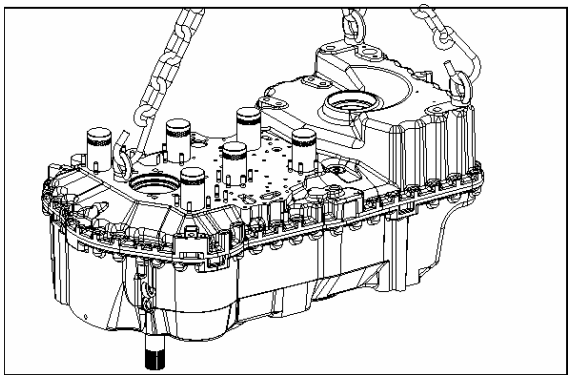


Figure 14

Use the lifting device to bring the housing rear part into contact position with the housing front part, by cautiously assembling the clutches.

Then remove handles.

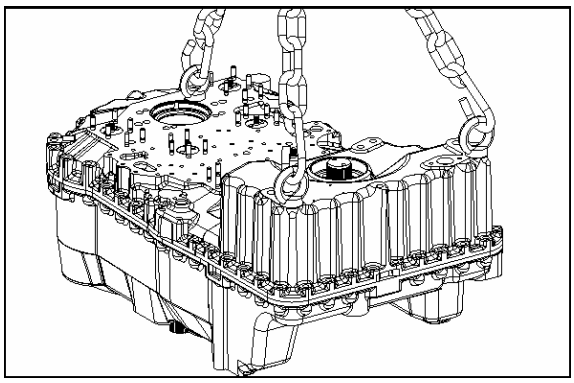


Figure 15

Remove housing rear part again.

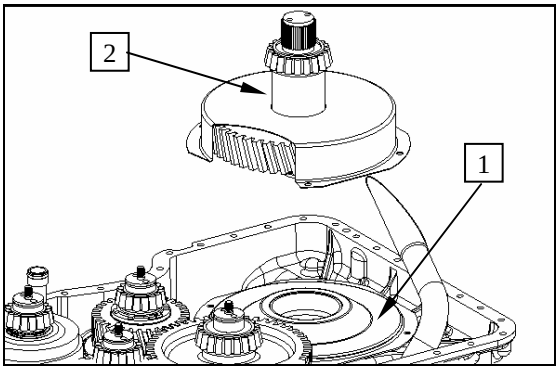


Figure 16

Put on screen sheet (1).

Install preassembled output shaft (2).

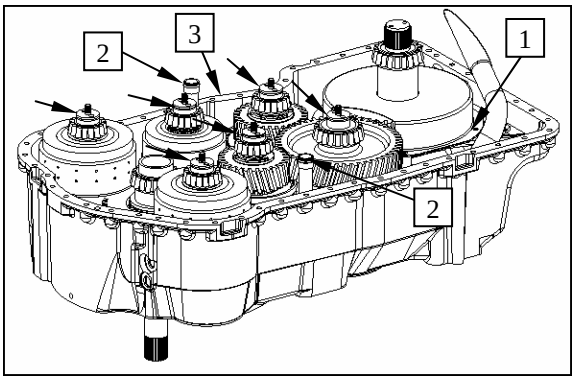


Figure 17

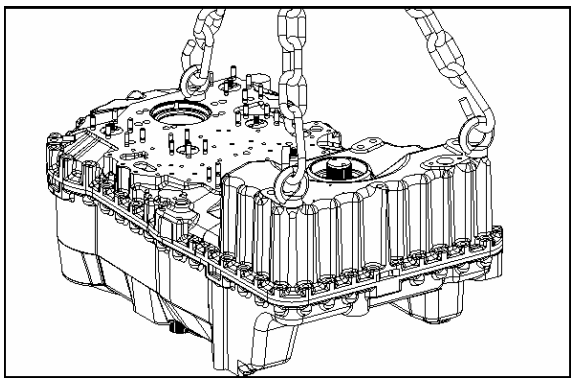
Fix screen sheets by means of cylindrical screws (1).

Tightening torque (M8/8.8x12) ..... M_A = 23 Nm

Mount O-rings 22x3 (2) into the annular groove of the oil tubes and oil them.

Install, grease and centrically align rectangular rings (arrows).

Wet mounting face (3) with sealing agent Loctite (type No. 574).


Figure 18

Carefully bring the housing front part into contact position with the housing rear part by using the lifting device.

☞ **Pay attention that both oil tubes are aligned with the holes in the housing rear part.**

(S) Eye bolts 2x (M20)	0636 804 003
(S) Eye nuts (M12)	0664 462 774

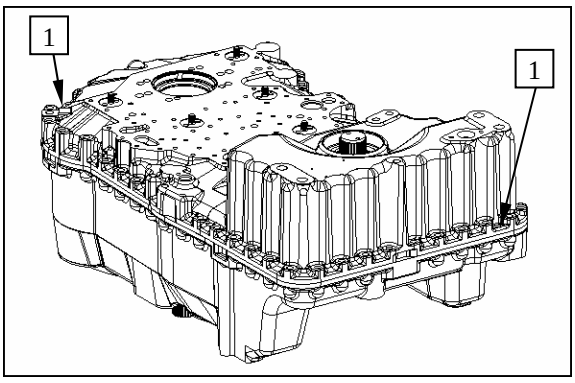


Figure 19

Fit both cylindrical pins (1) centrically to the mounting face.

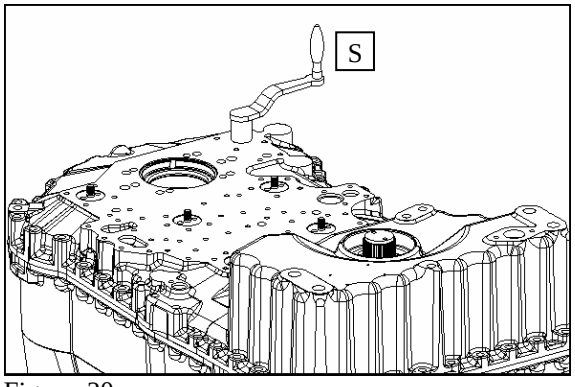


Figure 20

<u>Checking of clearance of the gear drive train</u>

Position driving element (S) and rotate KV clutch shaft.

☞ **If you notice an interference of the movable parts (e.g. on the screen sheet or on the oil tubes), you must correct this fault! Do this step on all clutch shafts!**

(S) Driving element	5870 345 089
(S) Crank handle	5870 280 007

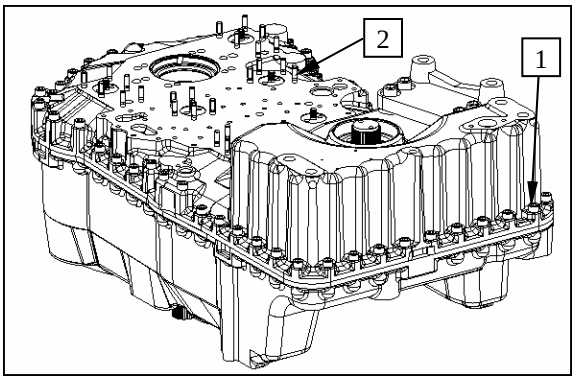


Figure 21

Fix housing front and rear part by means of cylindrical screws (1).

Tightening torque (M10/8.8x65) ..... M_A = 46 Nm
Tightening torque (M10/8.8x40) ..... M_A = 46 Nm

Mount stud bolts (2).

☞ **Wet screw-in thread with Loctite (type No. 243)!**

Tightening torque (M8/10.9x25) ..... M_A = 15 Nm

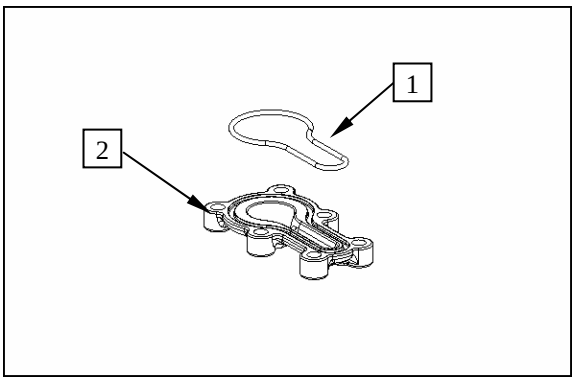


Figure 22

Place O-ring 76x3 (1) into the annular groove of the cover (2).

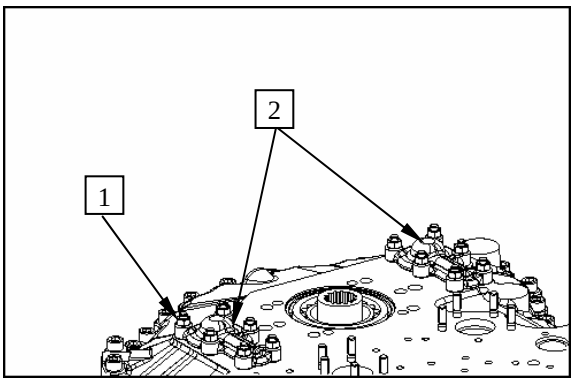


Figure 23

Fix cover (1) by means of hexagon nuts (2).

Tightening torque (M8/10)..... M_A = 25 Nm

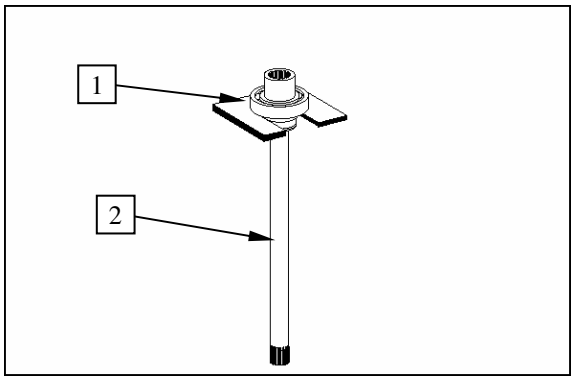


Figure 1

11. ASSEMBLY PTO

Pump shaft without lock-up clutch:

Press ball bearing (1) onto pump shaft (2) until contact.

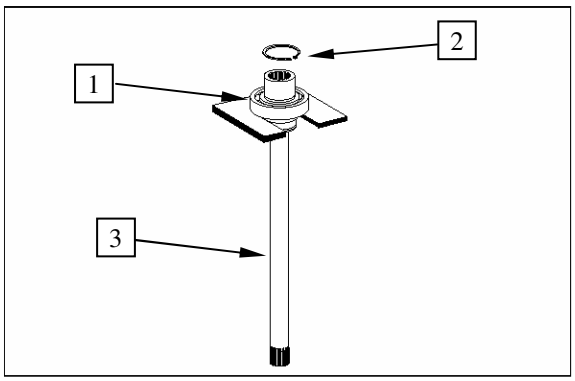


Figure 2

Pump shaft with lock-up clutch:

Install four-point bearing (1) onto pump shaft:
- Press lower bearing inner ring to contact position
- Place ball bearing
- Press upper bearing inner ring to contact position

Adjust the axial play by means of retaining ring (2).

☞ **Thickness between 2.2 …. 2.5 mm (in steps of 0.05 mm)**

☞ **Axial play 0.0 – 0.05 mm**

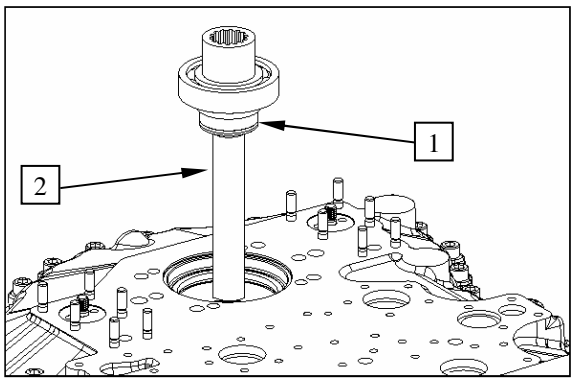


Figure 3

Install rectangular ring (1).

☞ **- 50x2.5 without lock-up clutch**
- 60x3 with lock-up clutch

Grease and centrically align rectangular ring.

Install pump shaft (2) until contact is obtained.

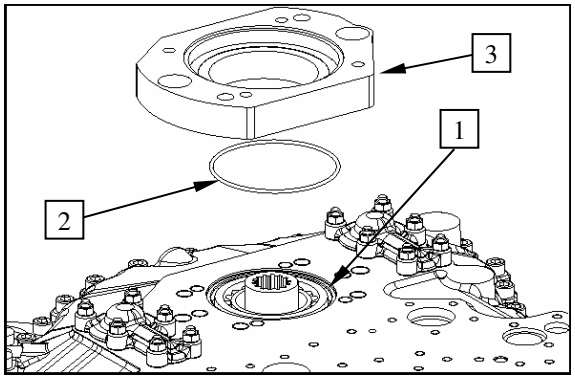


Figure 4

Fix pump shaft by means of retaining ring 85x3 (1).

Install O-ring 104x3 (2) onto flange (3) and then grease it and bring it into contact position on housing rear part

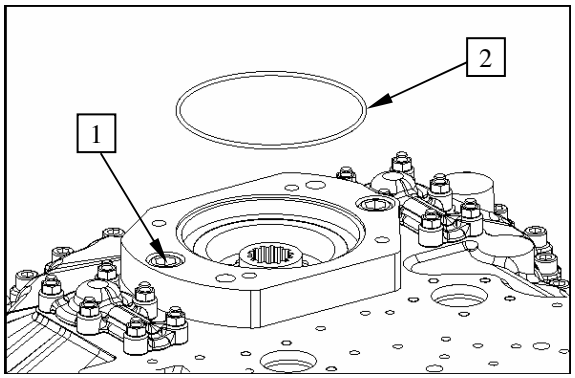


Figure 5

Fix flange with cylinder screws (1).

Insert O-ring 130x3 (2) into hole of flange and grease it.

Tightening torque (M16/8.8x30)……..... M_A = 195 Nm

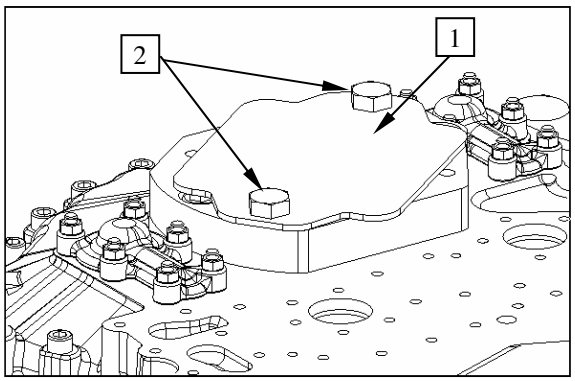


Figure 6

Place cover sheet (1) on flange and fix with hex. screws (2).

Tightening torque (M16/8.8x20)……..... M_A = 46 Nm

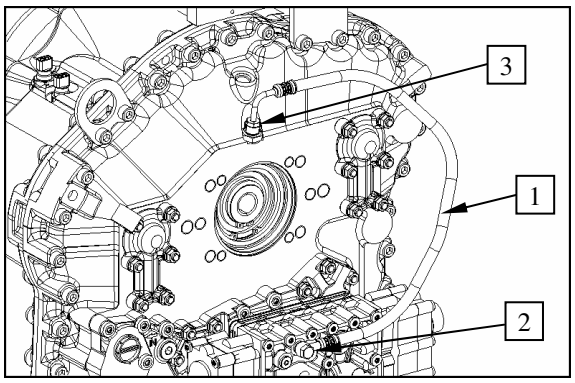


Figure 7

<u>Lubrication line for version with lock-up clutch:</u>

Install lubrication line PTO.

1 = Lubrication line PTO
2 = hollow screw (6 – DIN 7643)
seal ring (A-10 Cu)
3 = screw neck (SDS-L6 10x1)
O-ring (10x1)

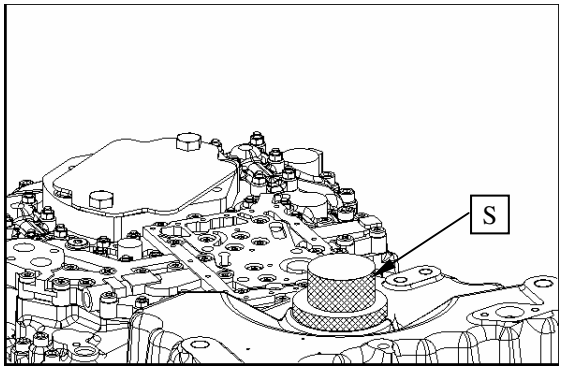


Figure 1

12. REASSEMBLY - Outputs

12.1 Output flange on output side without parking brake

Use driver (S) to mount shaft seal, with the sealing lip showing to the oil sump.

(S) Driver 5870 048 057

Use of the specified driver (S) ensures the exact installation position!

Fill space between sealing lip and dust lip with grease!
Wet outer diameter (rubber-coated) with spirit!

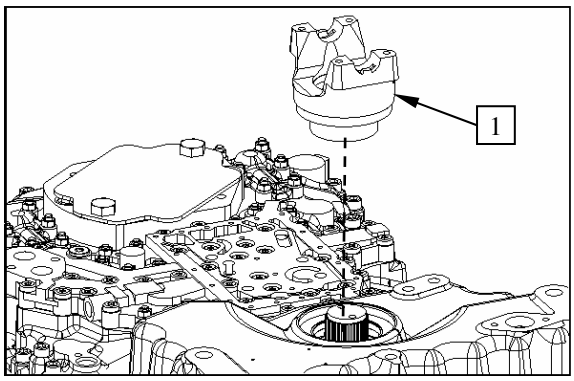


Figure 2

Mount output flange (1) until contact is obtained.

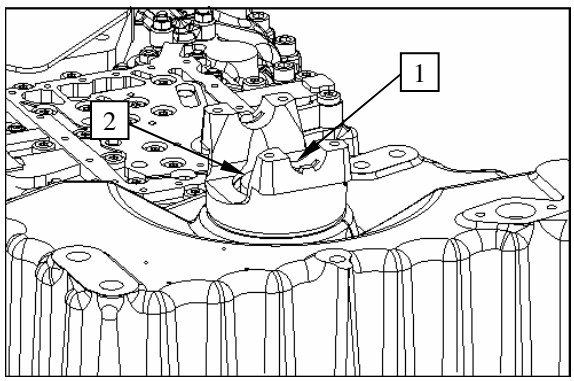


Figure 3

Insert O-ring 38x4 into the space between output flange and shaft.

Fix output flange by means of washer (1) and hexagon screws (2).

Tightening torque (M8/10.9x25) ..... M_A = 34 Nm

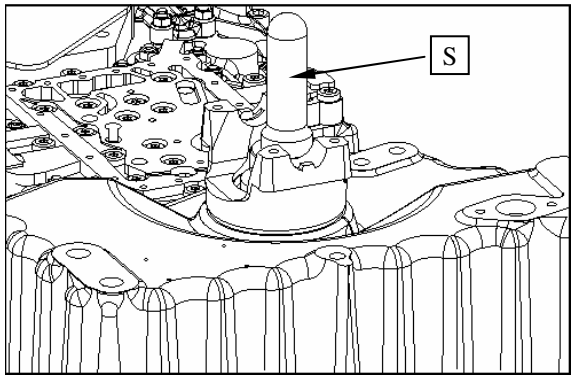


Figure 4

Fix locking plate by means of driver (S).

(S) Driver 5870 057 011
(S) Handle 5870 260 002

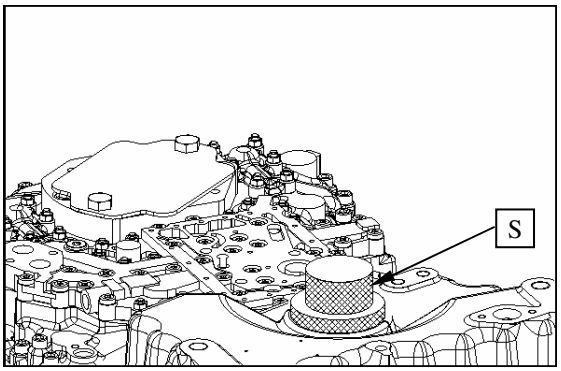


Figure 5

12.2 Output flange on output side with parking brake

Use driver to mount shaft seal, with the sealing lip showing to the oil sump.

(S) Driver 5870 048 057

☞ **Use of the specified driver (S) ensures the exact installation position!**

☞ **Fill space between sealing lip and dust lip with grease!**
Wet outer diameter (rubber-coated) with spirit!

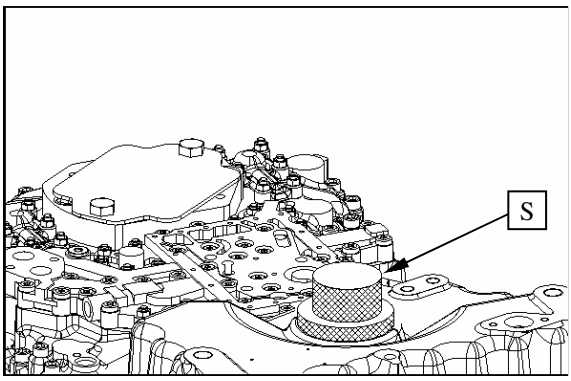


Figure 6

Fordable version:

Install 1st shaft seal with the sealing lip **showing to** the oil sump and
2nd shaft seal with the sealing lip **turned away** from oil sump.

☞ **Use the specified driver (S) to obtain the exact installation position!**
(Driver with retaining ring for 1st shaft seal)
(Driver without retaining ring for 2nd shaft seal)

(S) Driver 5870 048 301

☞ **Fill up space between the shaft seals with grease!**
Wet outer diameter (rubber coated) with spirit!

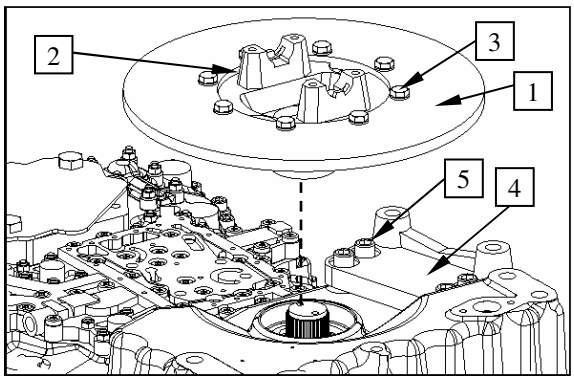


Figure 7

Fix brake disk (1) at output flange (2) by means of hexagon screws (3) and washers.

Tightening torque (M10/10.9x25) ..... M_A = 68 Nm

Bring bracket (4) into contact position with the transmission housing rear part and fix it by means of cylindrical screws (5).

Tightening torque (M14/10.9x45) ..... M_A = 200 Nm

Mount output flange (1) until contact is obtained.

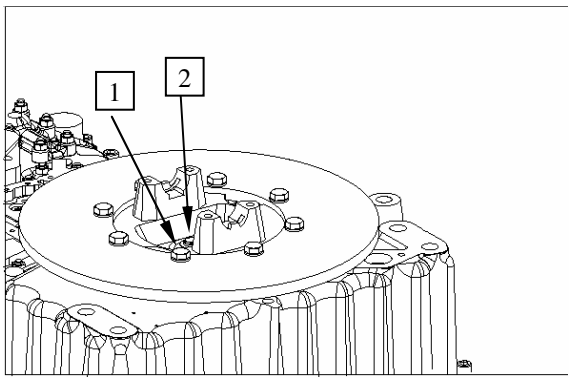


Figure 8

Insert O-ring 38x4 into the space between output flange and shaft.

Fix output flange by means of washer (1) and hexagon screws (2).

Tightening torque (M8/10.9x25) ..... M_A = 34 Nm

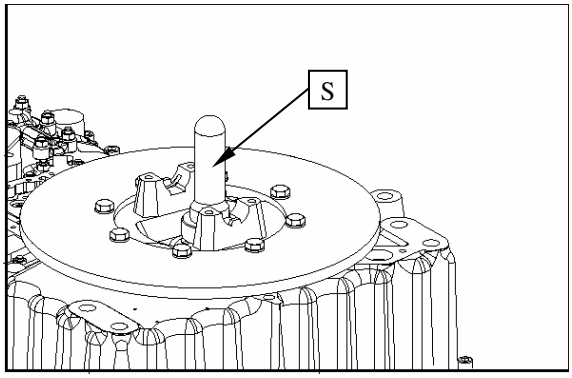


Figure 9

Fix locking plate by means of driver.

(S) Driver	5870 057 011
(S) Handle	5870 260 002

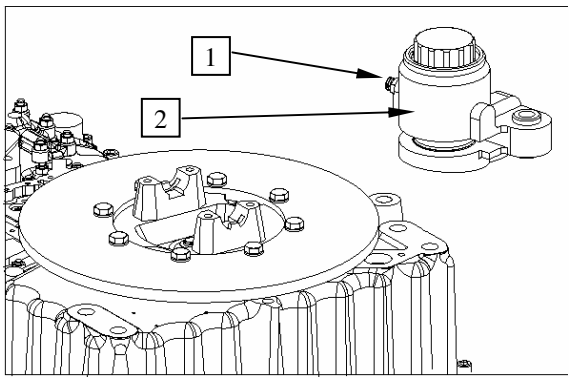


Figure 10

Connect HP-pump to port (1), apply approx. 80 bar pressure to parking brake (2) and position it until contact with the bracket is obtained.

(S) HP hand-operated pump	5870 287 007
(S) MINIMESS coupling	0501 207 939 (M10x1)
(S) MINIMESS coupling	5870 950 101 (M12x1,5)

☞ **Check connecting thread (1)!**

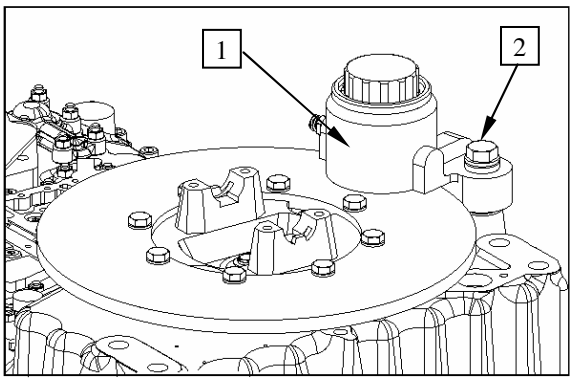


Figure 11

Fix parking brake type FSG-75 (1) to the bracket by means of hexagon screws (2).

Tightening torque (M16x1.5/10.9x85) ..... M_A = 300 Nm

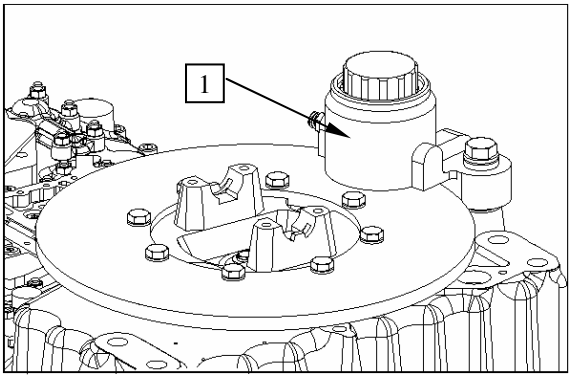


Figure 12

☞ **All installation, fitting and maintenance instructions, functional characteristics and setting specifications for the parking brake see original Knott documentation (chapter 17).**

☞ **Types:**

M-90	**(mechanical actuation)**
FSG-75	**(hydraulic actuation)**
FSG-90/110	**(hydraulic actuation)**

☞ **FSG-75/90**

Release clearance:	**0.5 – 1.5 mm**
Nom. release clearance:	**1.0 mm**

☞ **FSG-110**

Release clearance:	**1.5 –2.0 mm**
Nom. release clearance:	**1.7 mm**

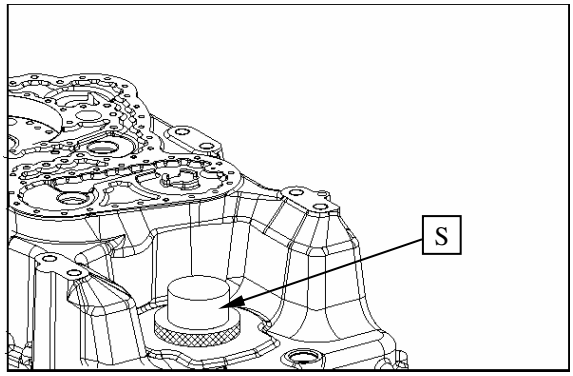


Figure 13

12.3 Output flange on converter side (without axle disconnection)

Install shaft seal with driver (S), with the sealing lip showing to oil sump.

(S) Driver 5870 048 057

Use the specified driver (S), to obtain exact installation position!

Fill up space between sealing lip and dust lip with grease!
Wet outer diameter (rubber-coated) with spirit!

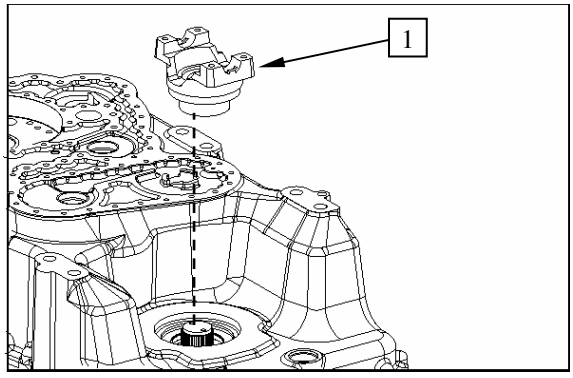


Figure 14

Mount output flange (1) until contact.

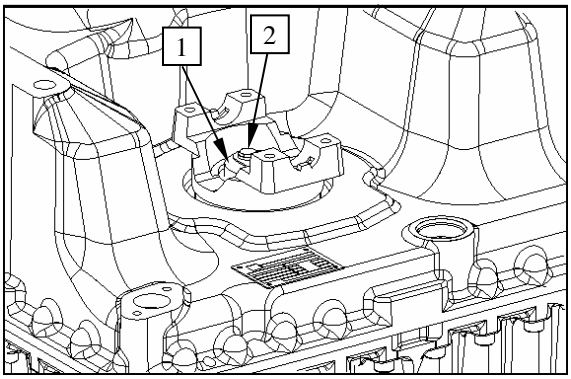


Figure 15

Insert O-ring 38x4 in space between output flange and shaft.

Fix output flange by means of washer (1) and hex. screws (2).

Tightening torque (M8/10.9x25) ..... M_A = 34 Nm

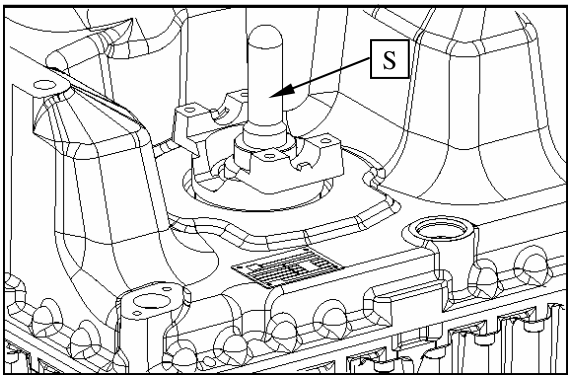


Figure 16

Fix locking plate by means of driver (S)

(S) Driver 5870 057 011
(S) Handle 5870 260 002

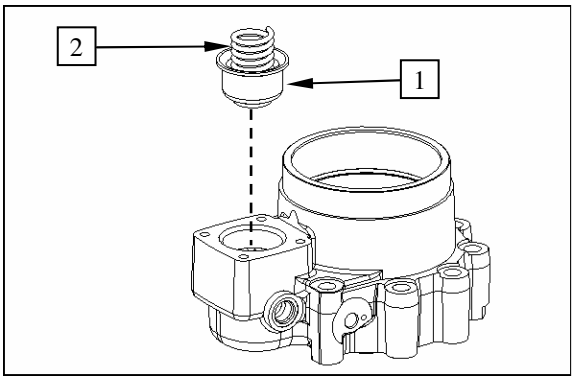


Figure 17

12.4 Output flange on converter side (with axle disconnection)

Install spring cup (1) and compression spring (2).

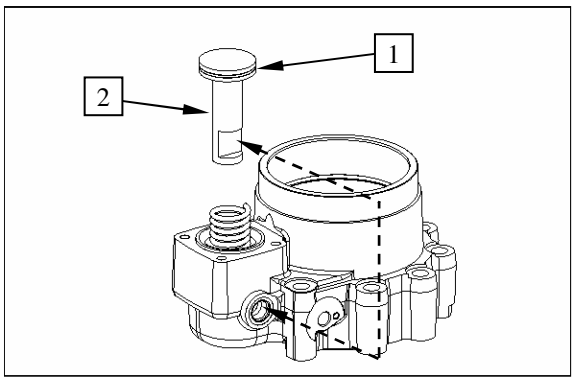


Figure 18

Put rectangular ring (Viton) 40x47x2 (1) into annular groove and grease it.
Insert piston (2).

Ensure radial installation position of piston! Contact face of locking pin must show to hole (see arrows)!

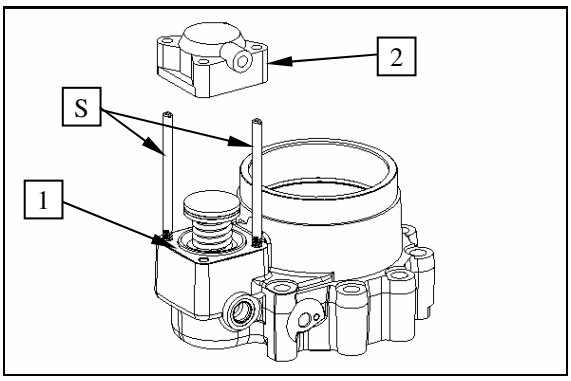


Figure 19

Mount two adjusting screws (S) and place gasket (1).

Insert cylinder (2).

(S) Adjusting screws 5870 204 011

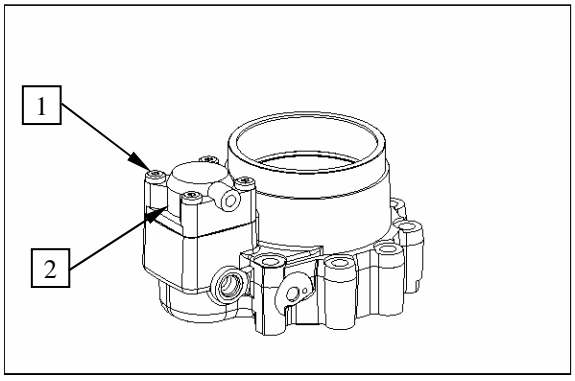


Figure 20

Mount the cylinder (2) evenly by means of Torx screws (1) until contact is obtained.

Tightening torque (M8/10.9x45) ..... M_A = 23 Nm

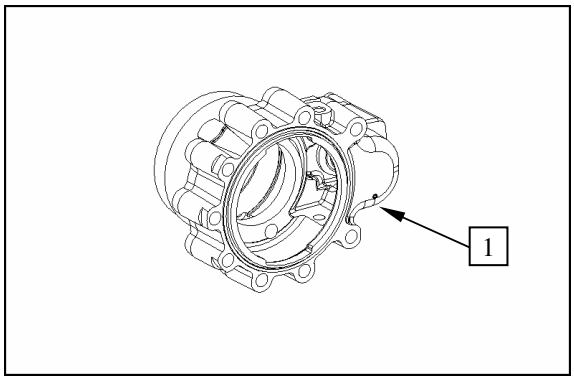


Figure 21

Install threaded pin M6x8 10.9 (1).

☞ **Wet thread with Loctite (type no. 262)!**

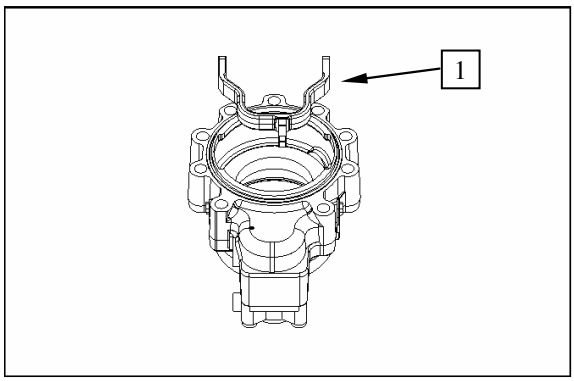


Figure 22

Bring shift fork (1) into correct position.

☞ **Observe installation position!**

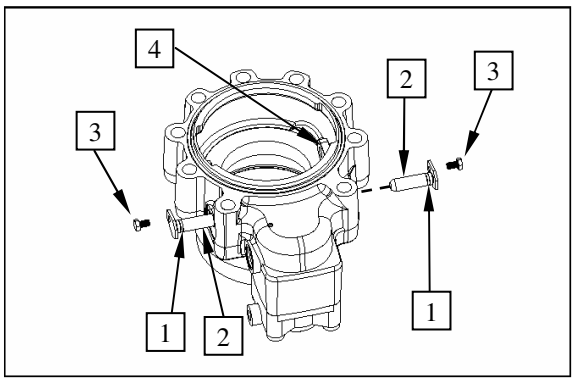


Figure 23

Put O-rings 8x2 (1) into annular grooves of bolts (2) and grease them.
Fix shift fork (4) by means of bolts (2) and fasten with hex. screws.

Tightening torque (M6/8.8x10) ..... M_A = 9.5 Nm

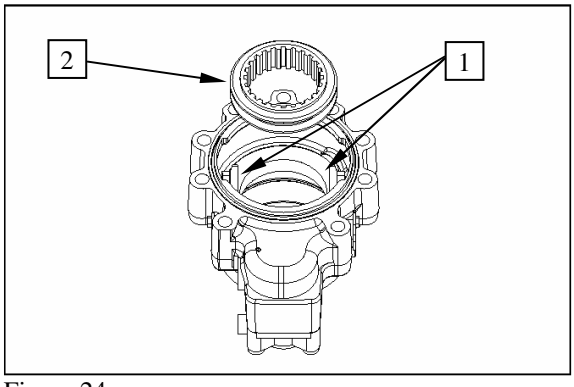


Figure 24

Mount both sliding pads (1) and insert sliding sleeve (2).

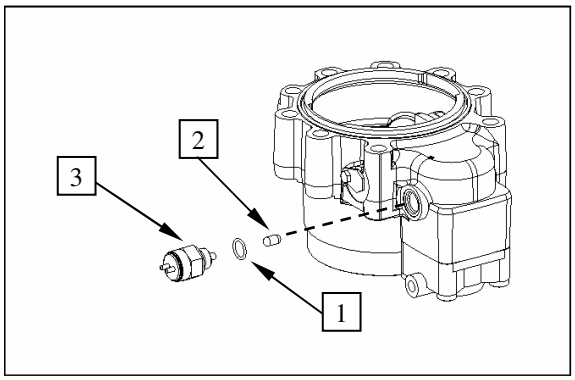


Figure 25

Install O-ring 15x2 (1) on switch (2) and grease it.

Install locking pin (2) and switch (3).

Tightening torque ..... M_A = 30 Nm

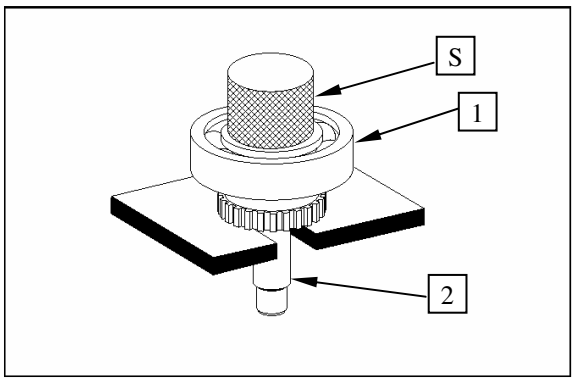


Figure 26

Press ball bearing (1) with a tube (S) on output shaft (2) until contact is obtained.

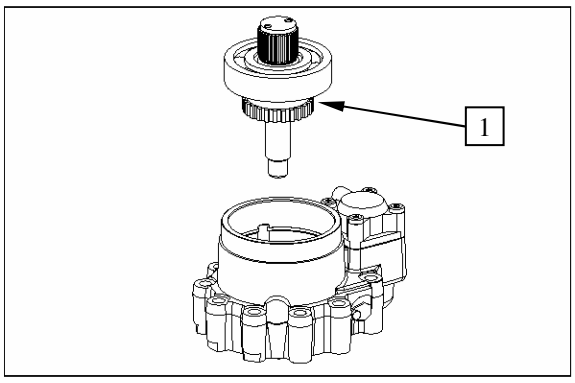


Figure 27

Install output shaft (1) (at the same time mounting the sliding sleeve) and press until contact.

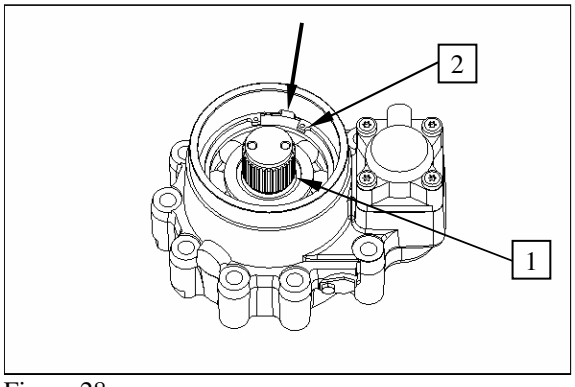


Figure 28

Fix output shaft (1) by means of retaining ring 120x4 (2).

☞ **Ensure radial installation position of retaining ring, to keep oil groove (arrow) clear.**

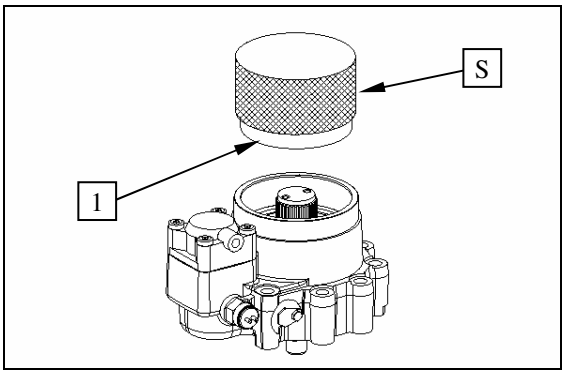


Figure 29

Standard version:

Install shaft seal (1) with the sealing lip showing to oil sump.

☞ **Use the specified driver (S), to obtain exact installation position!**

☞ **Fill up space between sealing lip and dust lip with grease!**
Wet outer diameter (rubber-coated) with spirit!

(S) Driver 5870 048 237

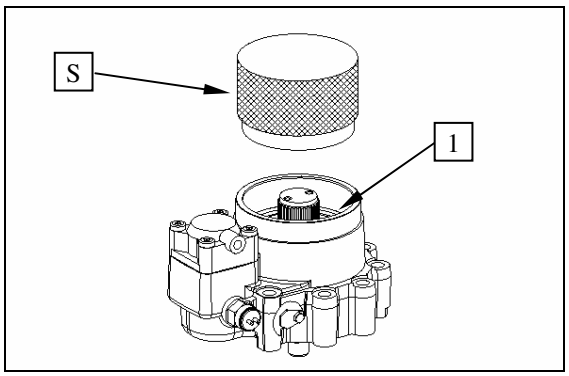


Figure 30

Fordable version (figure 30 and 31):

Install shaft seal (1) with the sealing lip showing to oil sump.

☞ **Use the specified driver (S), to obtain exact installation position!**
(Driver without retaining ring)

(S) Driver 5870 048 300

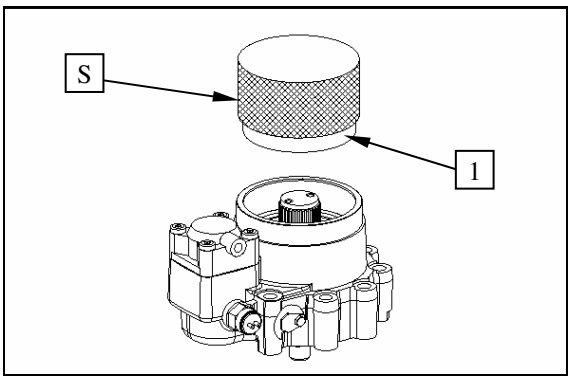


Figure 31

Install shaft seal (1) with the sealing lip showing away from oil sump.

☞ **Use the specified driver (S), to obtain exact installation position!**
(Driver with retaining ring)

(S) Driver 5870 048 300

☞ **Fill up space between shaft seals with grease!**
Wet outer diameter (rubber-coated) with spirit!

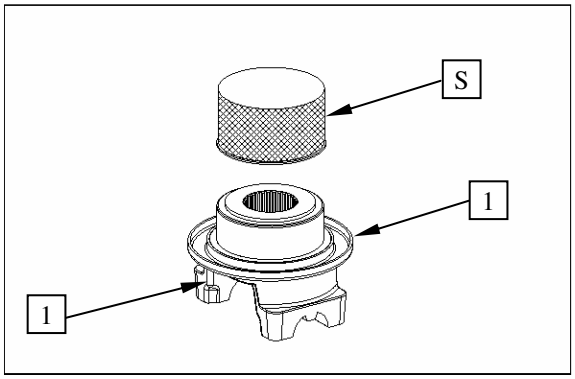


Figure 32

Press screen sheet (1) onto output flange (2) in a flush position by means of a pressure sleeve (S).

(S) Pressure sleeve 5870 506 142

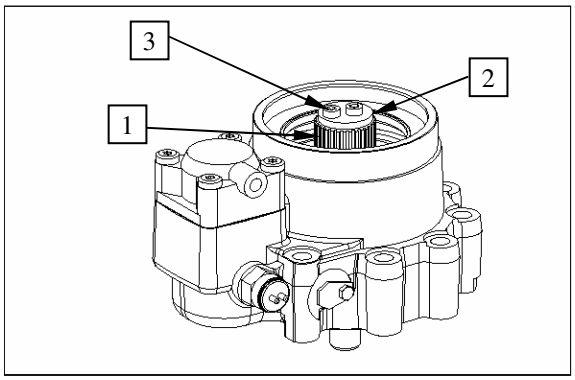


Figure 33

Version with movable output flange:
(Figure 33 – 34)

Mount bushing (1) onto output flange.
Put intermediate disc and washer (2) into bushing and secure by means of cylinder screws (3).

Tightening torque (M10/8.8x25) ..... M_A = 46 Nm

☞ **Wet thread with Loctite (type-no. 262)!**

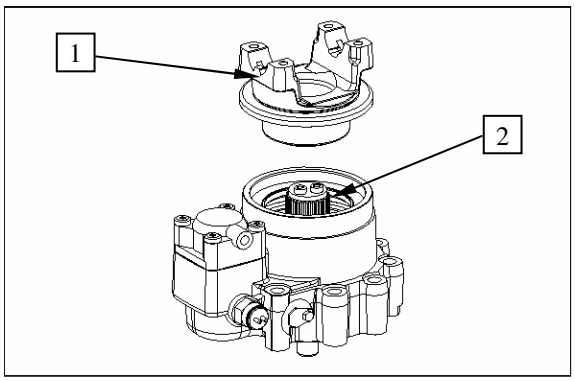


Figure 34

Mount output flange (1) onto output shaft (2).

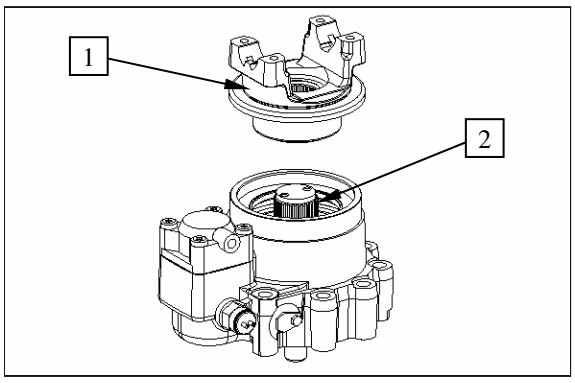


Figure 35

Version with bolted output flange:
(Figure 35 – 36)

Mount output flange (1) onto output shaft (2).

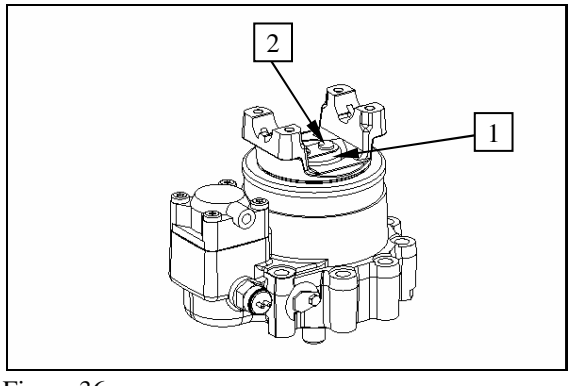


Figure 36

Put O-ring 48x4 and washer (1) into space between output flange and shaft and fix with hex. screws (2).

Tightening torque (M10/8.8x30) ..... M_A = 46 Nm

☞ **Wet thread with Loctite (type-no. 262)!**

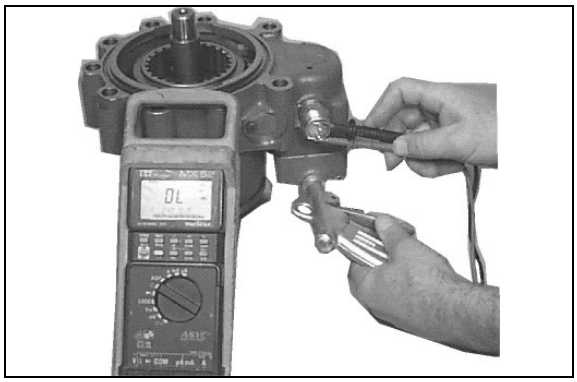


Figure 37

Check switch function by means of resistance measurement:

When actuating the axle disconnection by means of compressed air, resistance changes if switch is in good order!

(S) Measuring device (multimeter) 5870 221 196

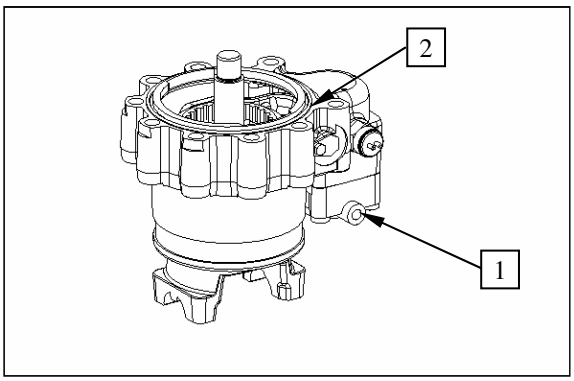


Figure 38

Insert limiting disc (perforated plate) into hole (1).

Apply assembly grease on O-ring 146x2.65 (2) and place into annular groove.

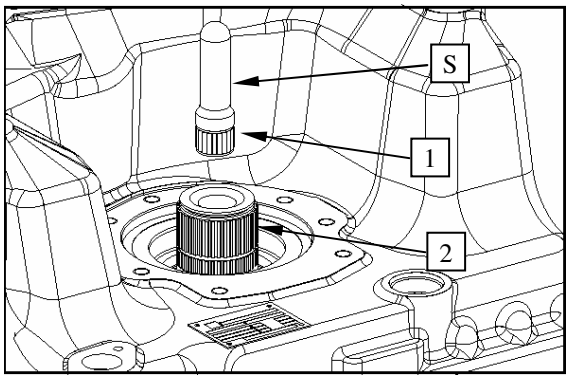


Figure 39

Insert needle sleeve (1) carefully into hole of output shaft (2) until contact, with the reinforced part of the cage showing to the special tools (S).
Then grease needle rollers.

(S) Centering bush 5870 506 099
(S) Driver 5870 048 132

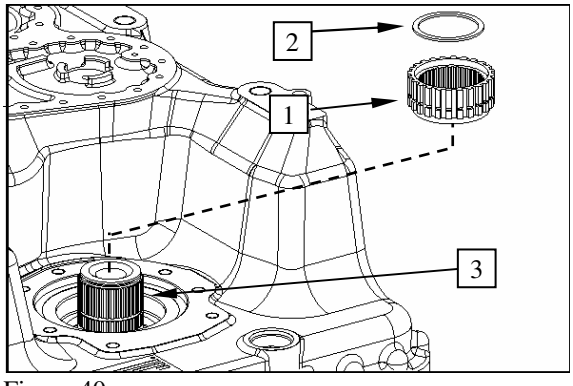


Figure 40

Mount bush (1) and shim (2) onto output shaft (3).

Observe installation position!

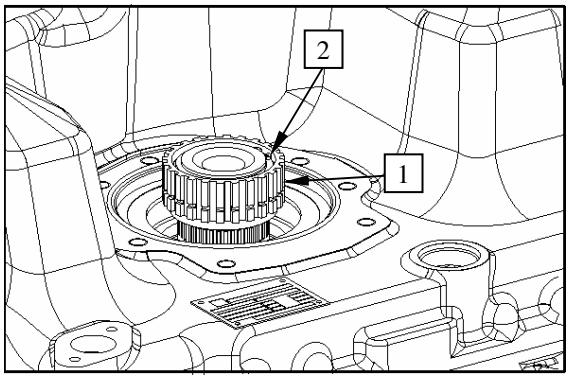


Figure 41

Fix bush (1) by means of shim (experience value s = 2.4 mm) and V-ring (2).

Ensure axial play of bush of max. 0.2 mm!

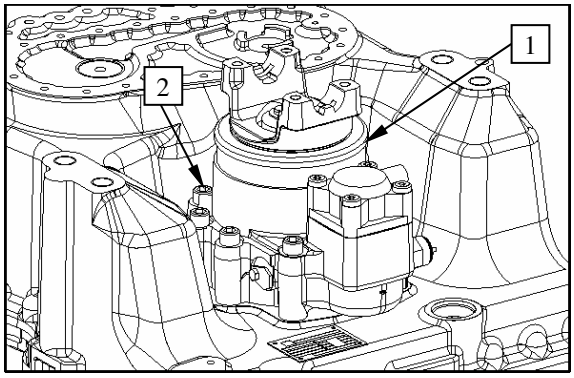


Figure 42

Insert preassembled axle disconnection (1) and fix by means of cylinder screws (2).

Tightening torque 7 pcs (M12/8.8x75) ..... M_A = 80 Nm
Tightening torque 2 pcs (M12/8.8x80) ..... M_A = 80 Nm

13. REASSEMBLY:

Engine connection, oil pressure pump, converter back-pressure valve and temperature sensor (measuring point "63" after the converter).

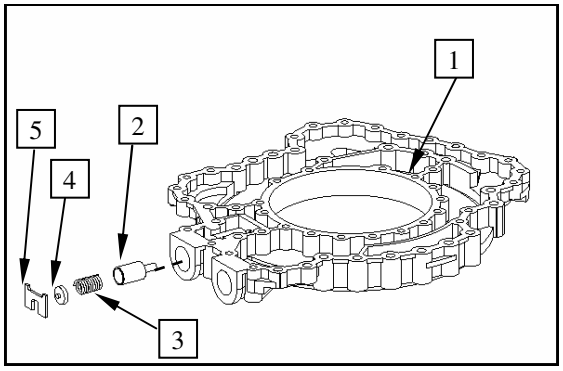


Figure 1

13.1 Converter back-pressure valve

The figure shows the single parts of the converter back-pressure valve.

1 = oil feed housing
2 = piston
3 = compression spring
4 = pressure plate
5 = locking plate

☞ **Install pressure plate (4), with the pin (∅ 6 mm) showing to the locking plate (5)!**

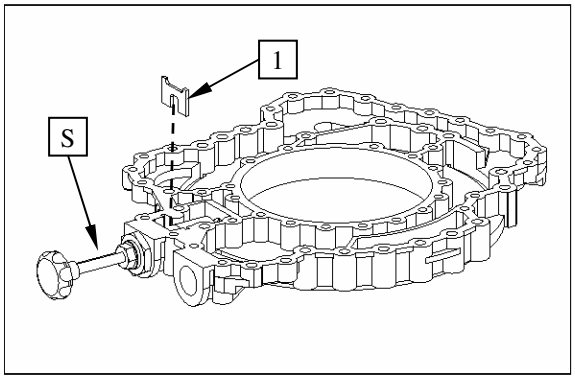


Figure 2

Assemble single parts, preload them with assembly aid (S) and fix them by means of locking plate (1).

(S) Assembly aid 5870 345 107

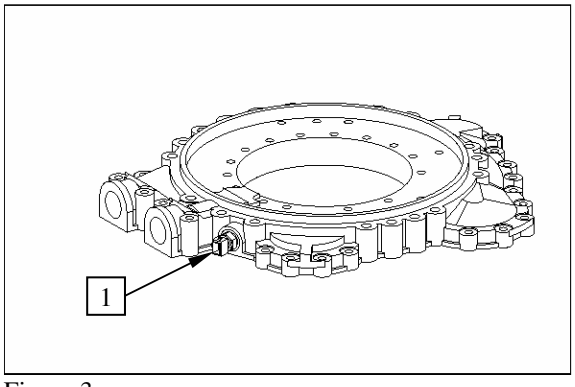


Figure 3

Mount temperature sensor (1) with new O-ring 11x2.

Tightening torque ……..... M_A = 25 Nm

☞ **Version without temperature sensor: Fit a screw plug (1) with new O-ring 11x2.**

Tightening torque (M14x1.5) ……. M_A = 25 Nm

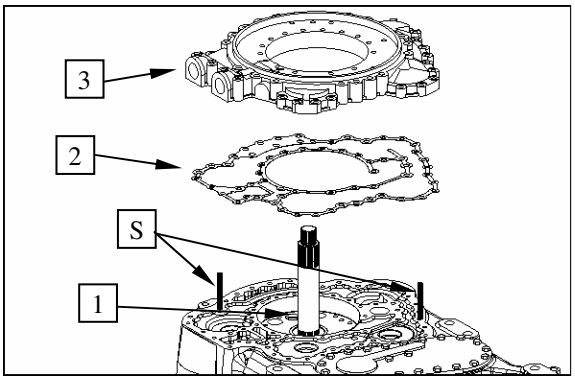


Figure 4

13.2 Oil pressure pump

Insert pressure relief valve (1) into the housing hole until contact is obtained.

Mount two adjusting screws (S) and place gasket (2) and oil feed housing (3).

Use assembly grease!

(S) Adjusting screws (M8) 5870 204 011

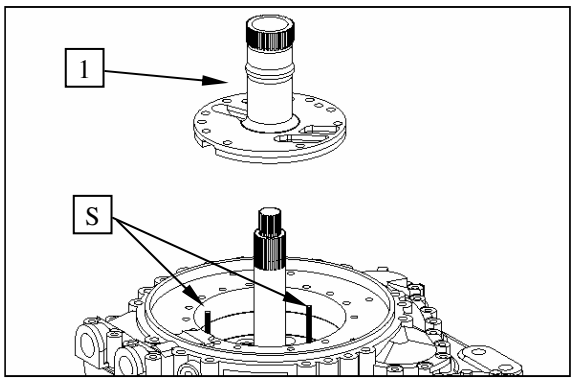


Figure 5

Install two adjusting screws (S) and mount stator shaft (1).

Pay attention to radial installation position!

(S) Adjusting screws (M10) 5870 204 007

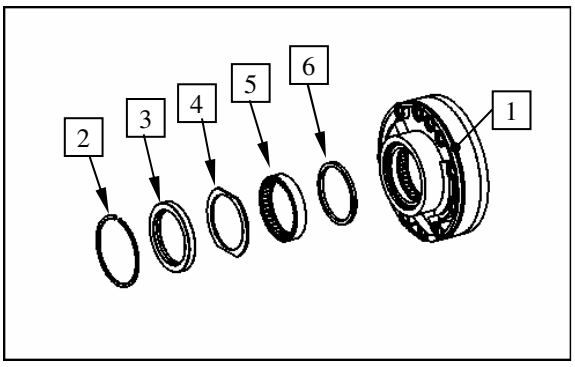


Figure 6

In case of wear marks in the pump housing or on the control disk, the pump assy must be replaced.

Items 1 - 6 may be exchanged!

1 = pump housing with rotor
2 = snap ring
3 = shaft seal (75x90x10)
4 = support shim (95x76x84x3)
5 = needle bearing assy (bearing outer ring and needle bearing)
6 = ring (75x84x4.6)

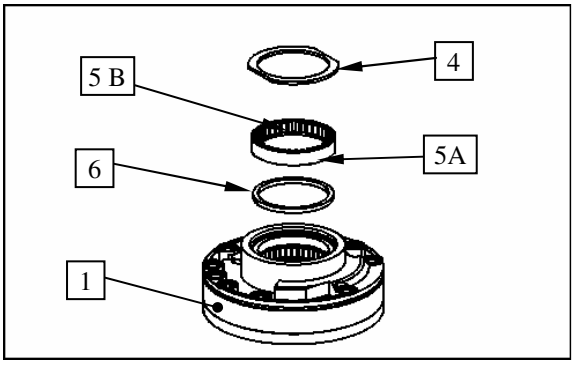


Figure 7

Install the following parts into the pump housing (1).

6 = ring
5A = bearing outer ring
5B = needle cage
4 = support shim

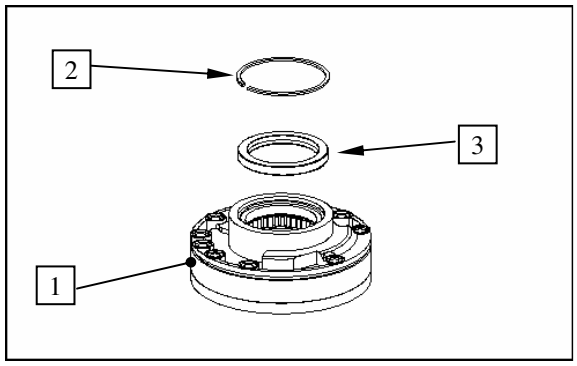


Figure 8

With the sealing lip showing downwards, carefully insert the shaft seal (3) into the pump housing (1) until contact is obtained, and fix it by means of snap ring (2).

Wet outer diameter of shaft seal with spirit!

(S) Driver	5870 055 070
(S) Handle	5870 260 002

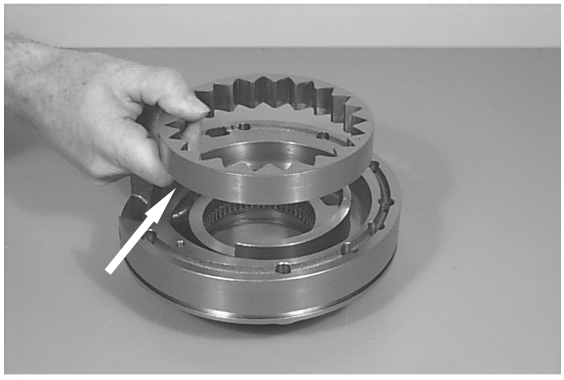


Figure 9

Install outer rotor.

Chamfer (arrow) to show downwards!

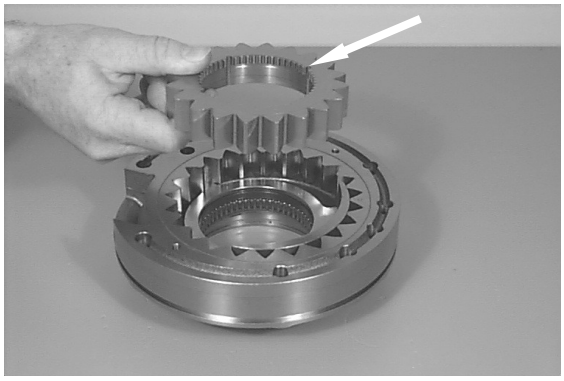


Figure 10

Install inner rotor.

Teeth (arrow) to show upwards!

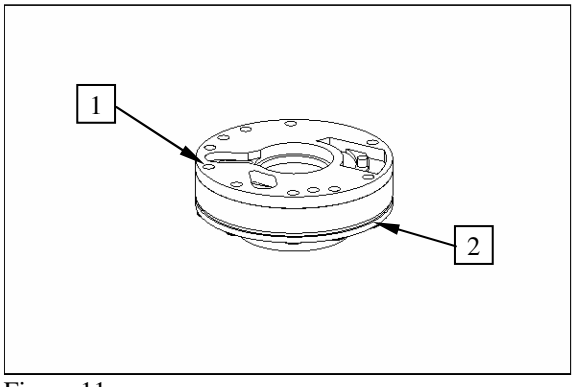


Figure 11

Place control disk and fix it radially by means of two cylindrical screws (1).

☞ **Do not tighten the cylindrical screws – just turn them in until contact is obtained and then turn them back by approx. ½ rotation!**
Pay attention to the installation position of the control disk, see figure!

Place O-ring 182x3 (2) into the annular groove and oil it.

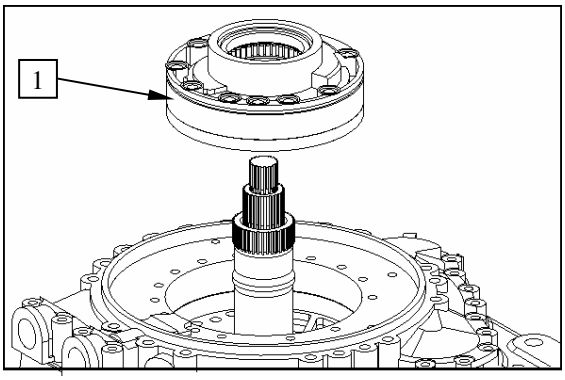


Figure 12

Mount preassembled pump (1) and, as a first step, insert it equally by means of cylindrical screws (3 pcs) until contact is obtained.

Pay attention to radial installation position!

Then remove cylindrical screws.

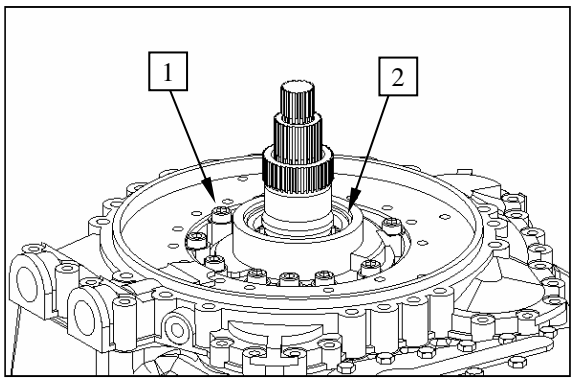


Figure 13

Fit new O-rings 9.5x1.6 to the cylindrical screws.

Grease O-rings!

Fix transmission pump (2) by means of cylindrical screws (1).

Tightening torque (10/8.8x75)..... M_A = 46 Nm

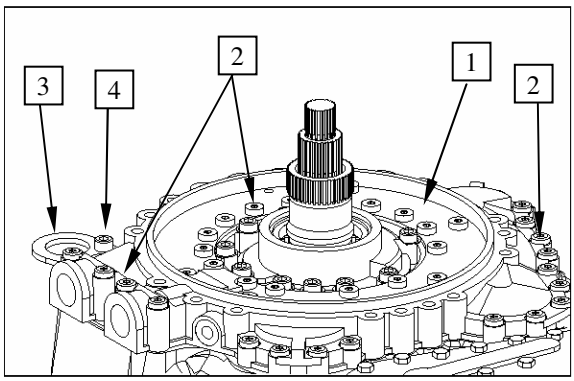


Figure 14

Fix oil feed housing (1) equally by means of Torx screws (2).

Tightening torque (M8/10.9x30) .....M_A = 23 Nm
Tightening torque (M8/10.9x45) .....M_A = 23 Nm
Tightening torque (M8/10.9x60) .....M_A = 23 Nm

Fasten fixing plate (3) by means of cylindrical screws (4).

Tightening torque (M8/8.8x40)….....M_A = 46 Nm

Pay attention to the installation position of the fixing plate!

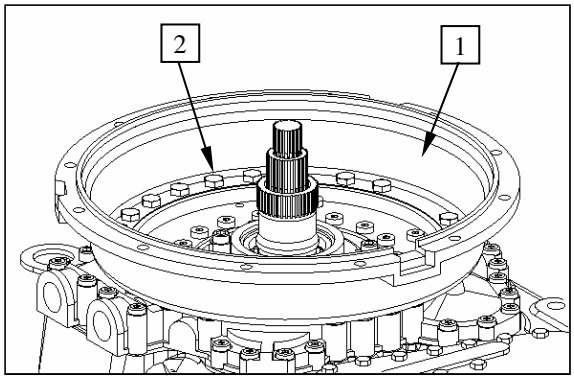


Figure 15

Fix converter bellhousing (1) by means of hexagon screws (2).

Tightening torque (M10/10.9x65) ..... M_A = 65 Nm

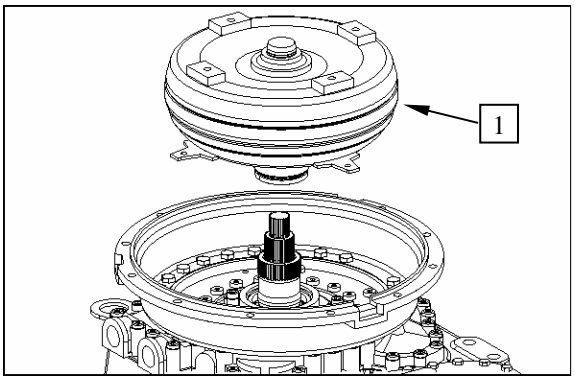


Figure 16

13.3 Engine connection (direct mount)

Position converter (1) by means of lifting device until contact is obtained.

(S) Eye bolts assortment 5870 204 002

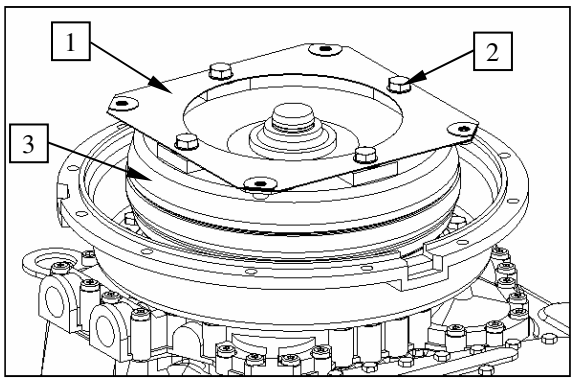


Figure 17

Fix flexplate (1) by means of hexagon screws (2).

☞ **Fit washers between converter (3) and flexplate (1) and under the hexagon screws.**

☞ **Secure hexagon screws with Loctite (type No. 262)!**

Tightening torque (M12/10.9x18) .....M_A = 115 Nm

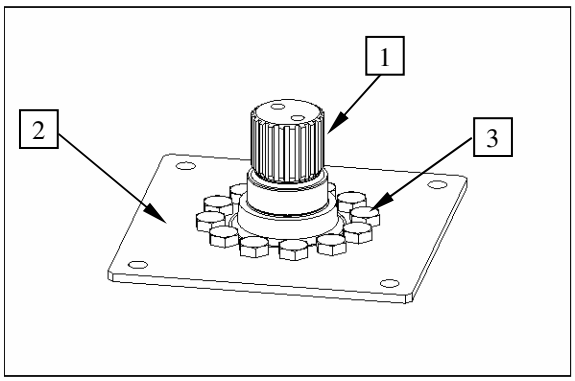


Figure 18

13.4 Engine connection (remote mount)

Bolt input shaft (1) to flexplate (2) by means of hexagon screws (3).

Tightening torque (M12/10.9x18) ..... M_A = 115 Nm

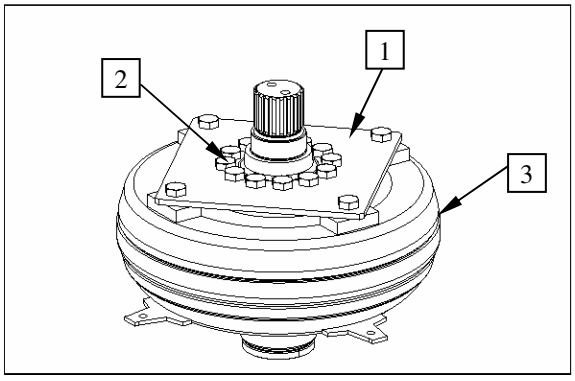


Figure 19

Fix flexplate (1) to converter (3) by means of hexagon screws (2).

☞ **Wet threads of hexagon screws with Loctite (Type No. 262)!**

Tightening torque (M10/10.9x18) ..... M_A = 115 Nm

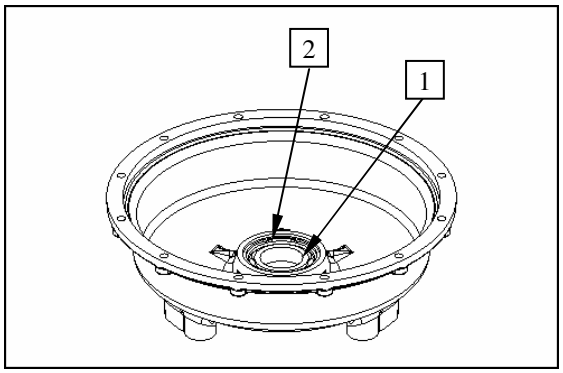


Figure 20

Install ball bearing (1) and fix it by means of V-ring JV 100 (2).

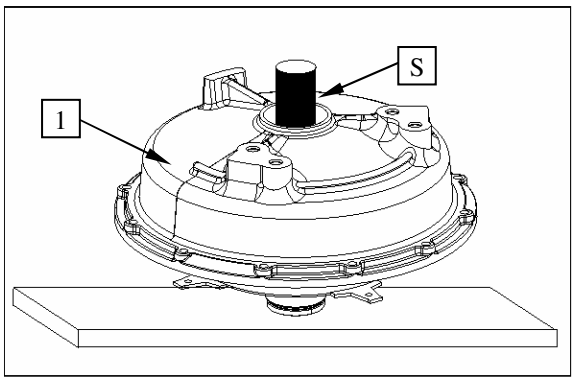


Figure 21

Put cover (1) onto the converter and press it until contact is obtained.

☞ **Support the pressure sleeve (S) on the bearing <u>inner</u> ring!**

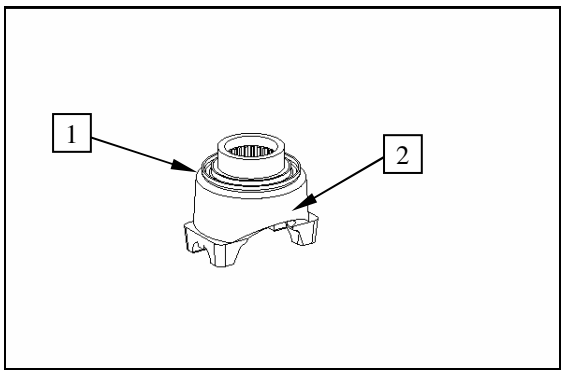


Figure 22

Press screen sheet (1) onto the input flange (2).

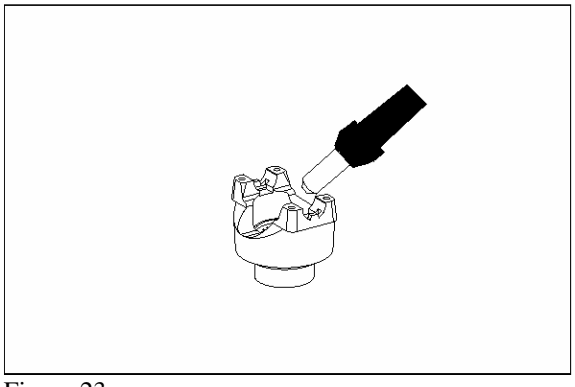


Figure 23

Heat up clutch inner diameter (approx. 120° C).

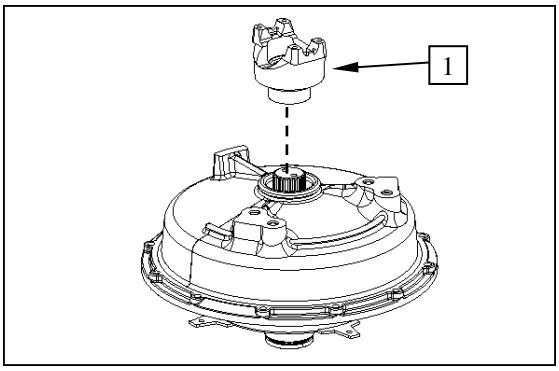


Figure 24

Mount input flange (1) until contact is obtained.

Wear protective gloves!

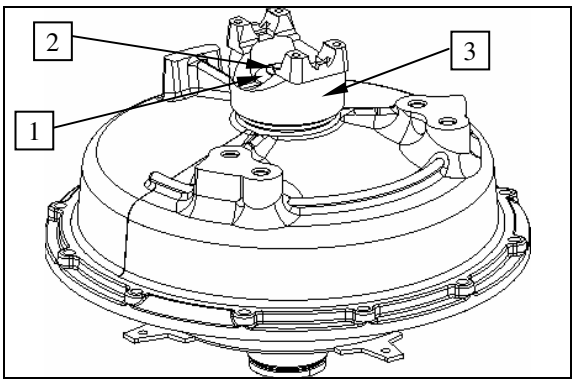


Figure 25

Fix input flange (3) by means of washer (1) and hexagon screws (2).

Tightening torque (M8/10.9x50) ..... M_A = 34 Nm

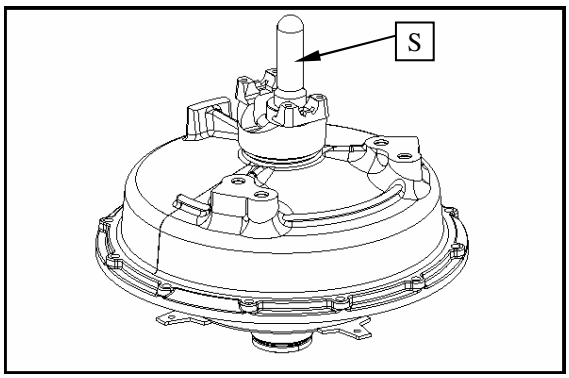


Figure 26

Fix locking plate by means of driver (S).

(S) Driver	5870 057 010
(S) Handle	5870 260 002

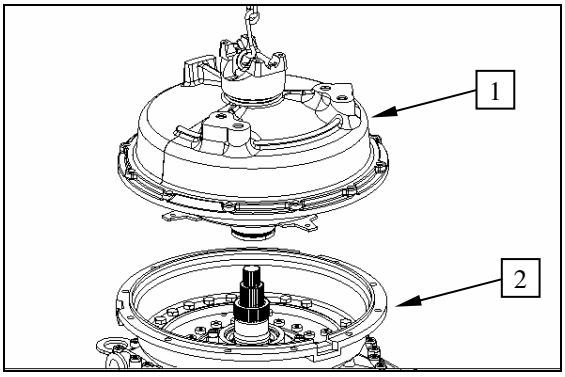


Figure 27

Position converter by means of lifting device until the cover (1) is in contact with the converter bellhousing (2).

(S) Eye bolts assortment 5870 204 002

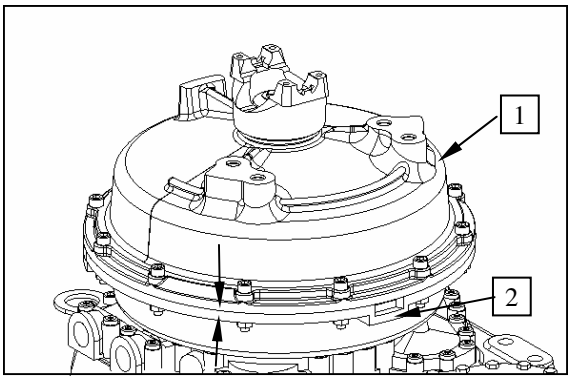


Figure 28

Bolt converter bellhousing (1) to cover (2) by means of cylindrical screws and hexagon nuts.

☞ **Pay attention to radial installation position, see markings done during disassembly (arrows)!**

Tightening torque (M10/8.8) ..... M_A = 46 Nm

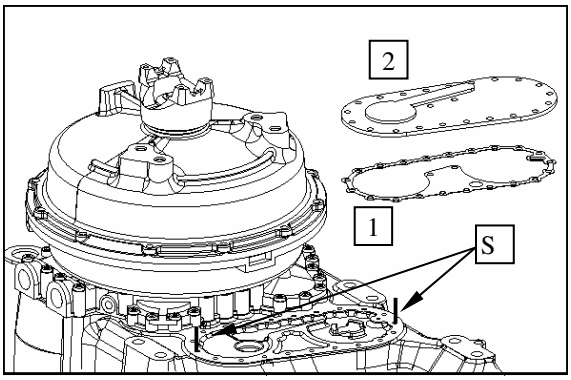


Figure 1

14. REASSEMBLY - Emergency steering pump

14.1 Version without emergency steering pump

Fit adjusting screws (S) and assemble seal (1) and cover (2).

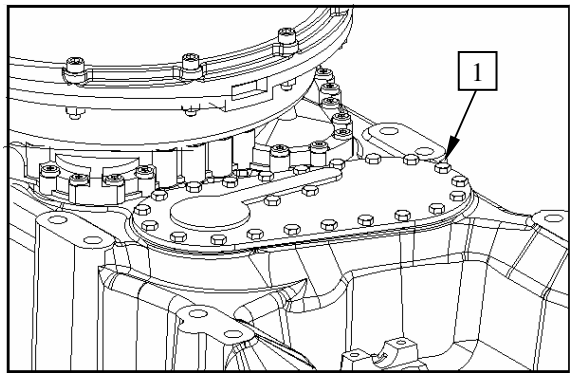


Figure 2

Fix cover by means of hexagon screws (1).

Tightening torque (M8/8.8x18) ..... M_A = 23 Nm

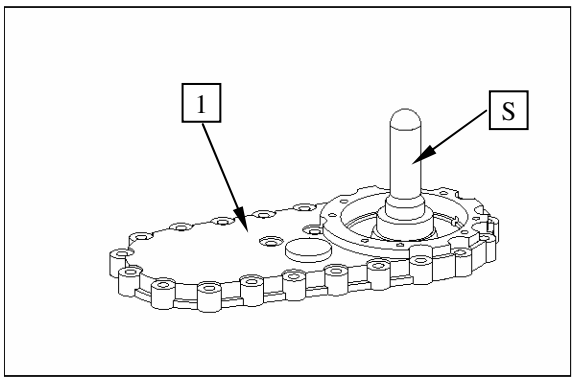


Figure 3

14.2 Version without emergency steering pump

Press sliding bearing into the cover (1) in alignment with the plane face.

(S) Driver 5870 048 080

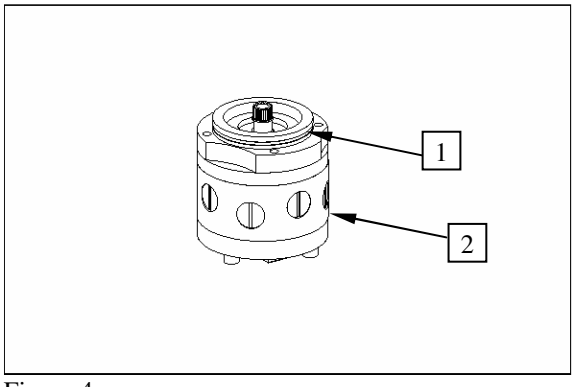


Figure 4

Place O-ring 100x3 (1) into the annular groove of the piston pump (2) and grease it.

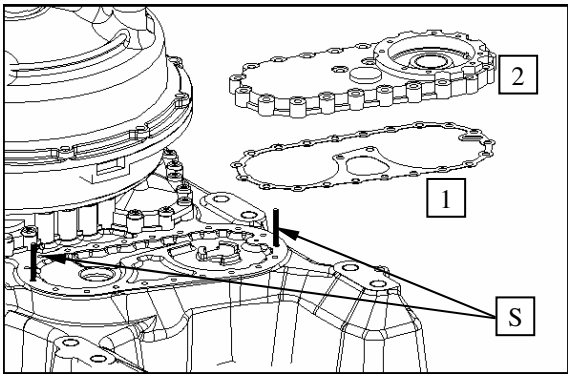


Figure 5

Fit adjusting screws (S) and assemble seal (1) and cover (2).

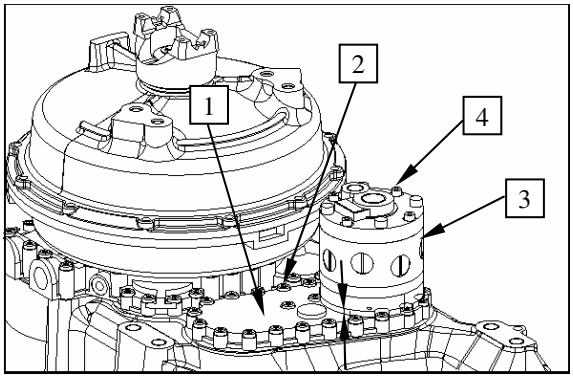


Figure 6

Fix cover (1) by means of Torx screws (2).

Tightening torque (M8/10.9 x30) ..... M_A = 34 Nm

Mount emergency steering pump (3) and fix it by means of cylindrical screws (4).

Tightening torque (M8/8x135) ..... M_A = 23 Nm

☞ **Pay attention to radial installation position, see markings done during disassembly (arrows)!**

15. Reassembly:

Inductive sensor, Hall sensor, breather, oil filler and oil drain plug

Mount inductive sensors (1, 2 and 3) with new O-rings 15x2.

1 = Inductive sensor - engine speed
2 = Inductive sensor - speed/central gear chain
3 = Inductive sensor - turbine speed

Tightening torque .....M_A = 30 Nm

Mount breather (4).

Tightening torque (3) ..... M_A = 12 Nm

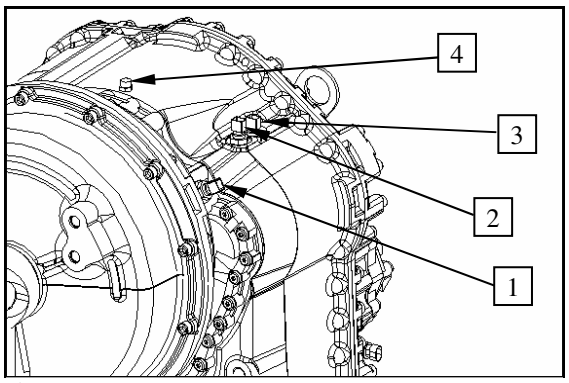


Figure 1

☞ **On some versions, it is additionally necessary to fit the inductive sensor (3) with 3 adjusting washers and to secure it by Loctite (type No. 262)!**
For the relating parts lists please refer to the spare parts list/subassembly: inductive sensor!
Parts list number see identification plate (Figure 3)!

Mount speed sensor (1) with new O-ring 15.54x2.62 and fix it by means of cylindrical screw (2).

1 = speed sensor (Hall sensor) - output speed

Tightening torque (M8/8.8x16)..... M_A = 23 Nm

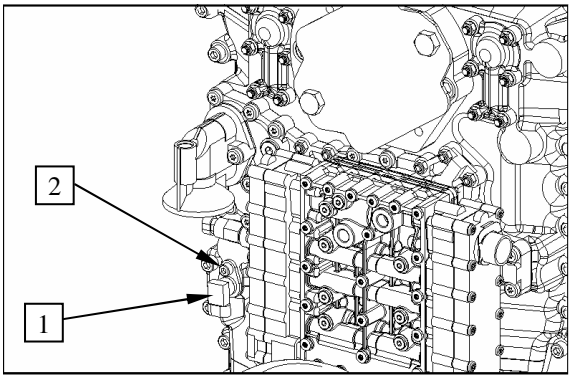


Figure 2

Mount oil drain plug (1) with new O-ring 35x2.

Tightening torque (M38x1.5)..... M_A = 80 Nm

Bring oil level tube (2) with seal into contact position with the housing front part and fix it by means of hexagon screws (3).

Tightening torque (M8/8.8x50)..... M_A = 34 Nm

Fasten dipstick (4) in oil level tube.

Fix identification plate (5) to the housing front part.

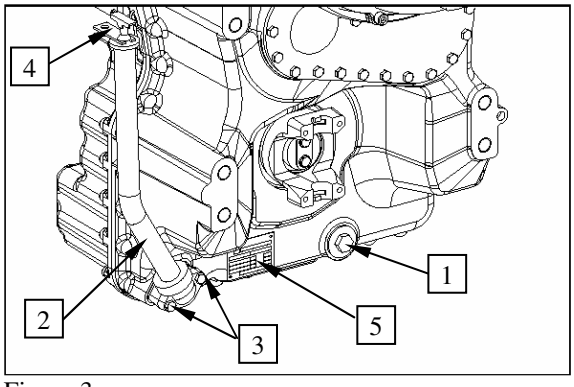


Figure 3

☞ **Use Loctite (type No. 5069)!**

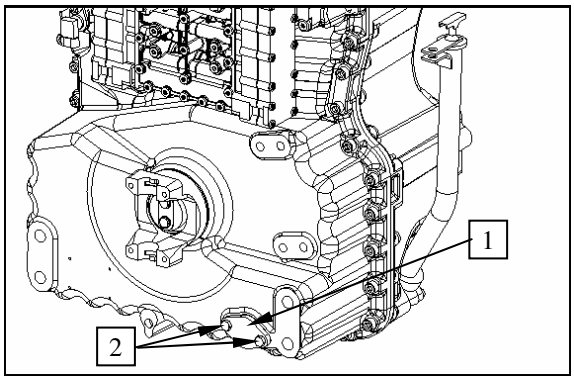


Figure 4

Bring cover (1) with seal into contact position with the housing front part and fix it by means of hexagon screws (2).

Tightening torque (M8/8.8x18).....M_A = 23 Nm

16. REASSEMBLY:

Electro-hydraulic control with proportional valves:

☞ **Different versions regarding the wiring harness position are possible!**
Please observe the vehicle manufacturer's specifications!

The following sketches show the sectional views of the electro-hydraulic control.

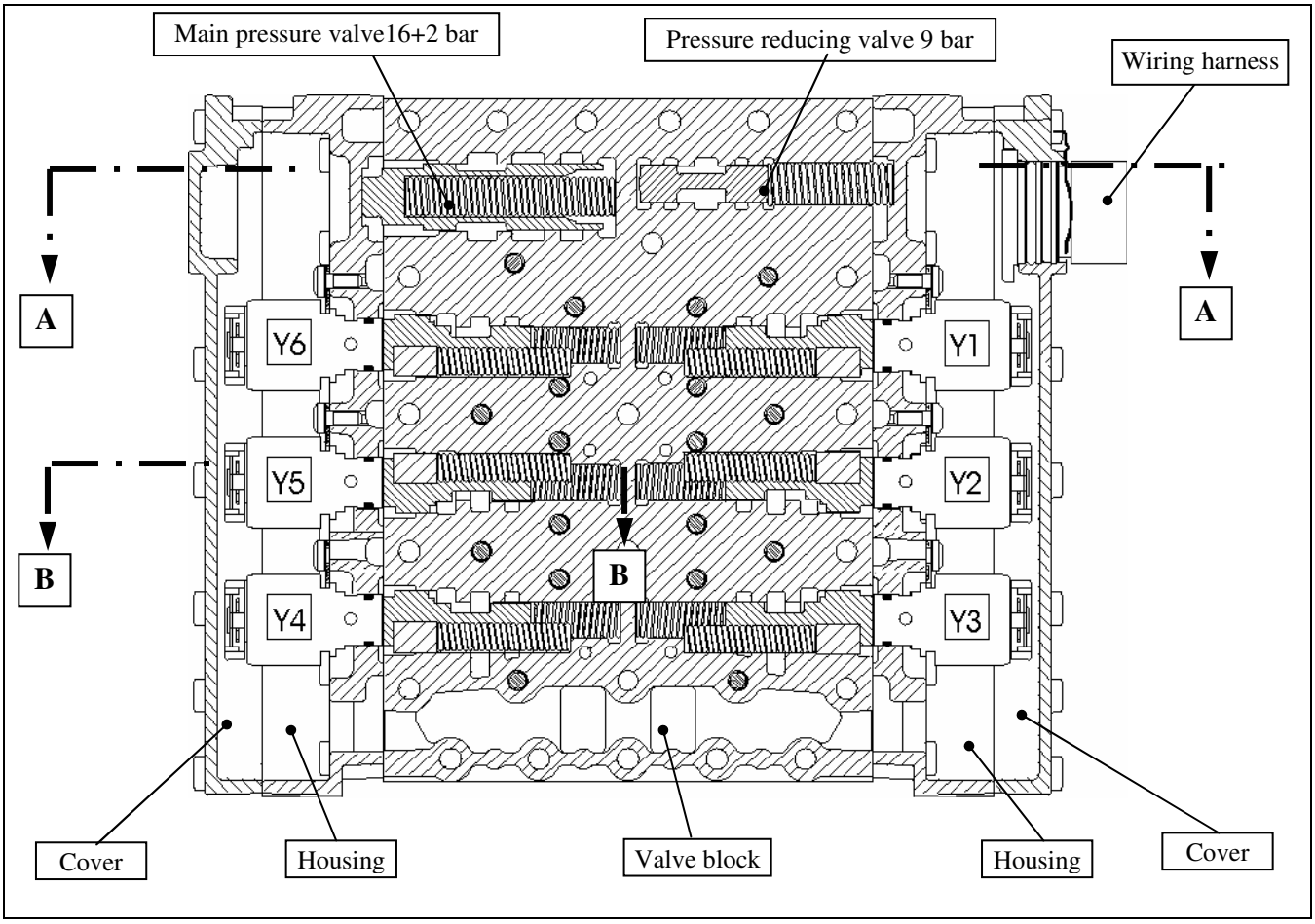


Figure 1

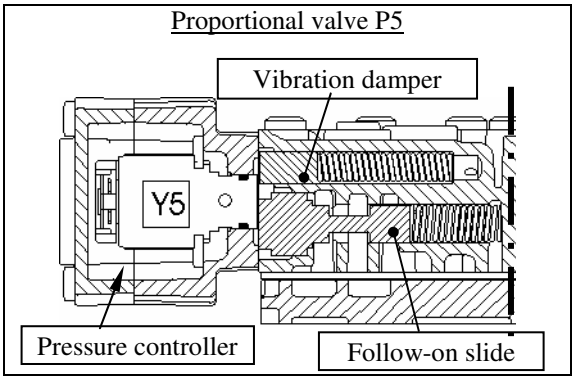


Figure 2

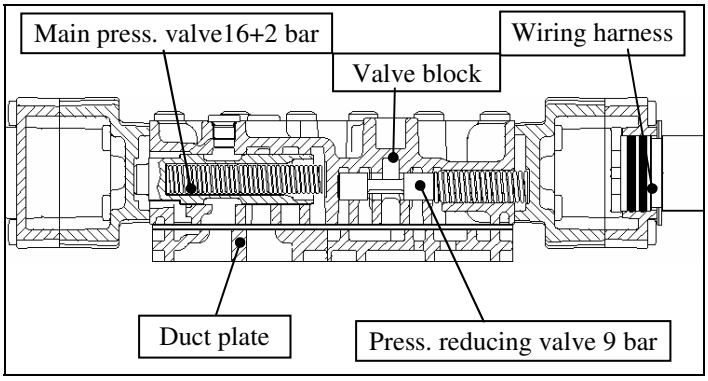


Figure 3

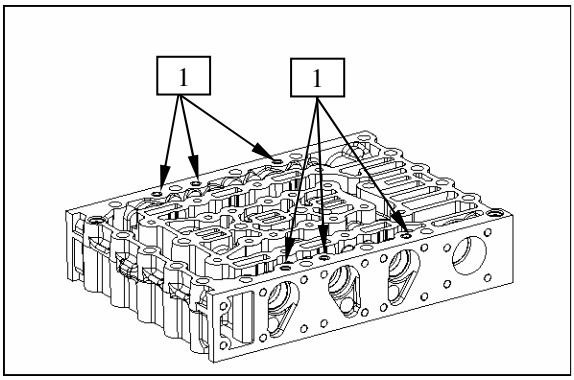


Figure 4

16.1 Fitting of electric control

All single parts are to be checked for damage and replaced, if required!
Ensure free travel of the moving parts in the valve block prior to installation! Pistons can be exchanged individually! Prior to the installation, oil single parts acc. to ZF List of Lubricants TE-ML 03!

With the concave side showing upwards, insert orifice (1) until contact is obtained!

See arrows for installation position!

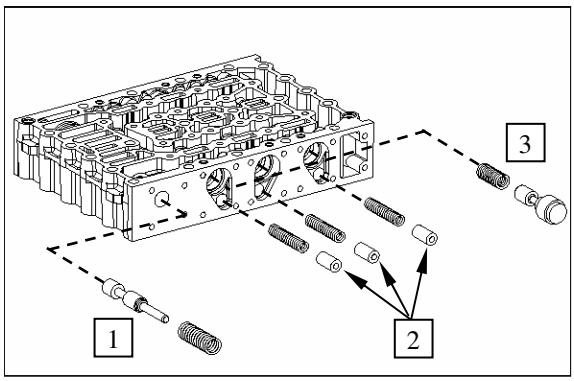


Figure 5

The opposite figure shows the following single parts:

1 = pressure reducing valve (1x, piston and compr. spring)
2 = vibration damper (3x, piston and compr. spring
3 = follow-on slide (3x, piston and compr. spring)

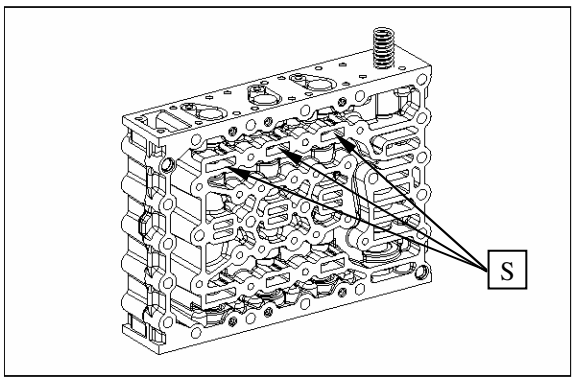


Figure 6

Install the single parts acc. to Figure 5.

Preload compression springs of the follow-on slides and preliminarily fix pistons by means of cylindrical pins ∅ 5.0 mm (assembly aid), see arrows (S)!

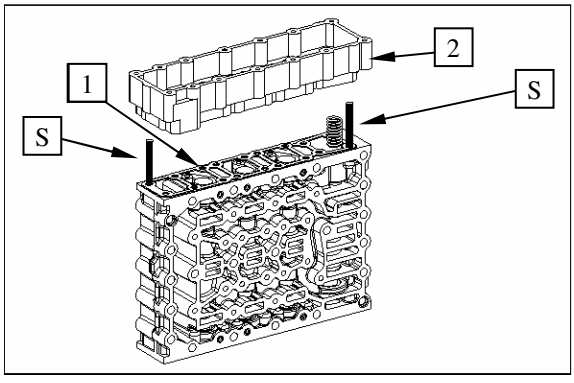


Figure 7

Fit two adjusting screws.

Mount seal (1) and housing (2).
Then position housing equally by means of adjusting screws until contact is obtained.

(S) Adjusting screws 5870 204 036

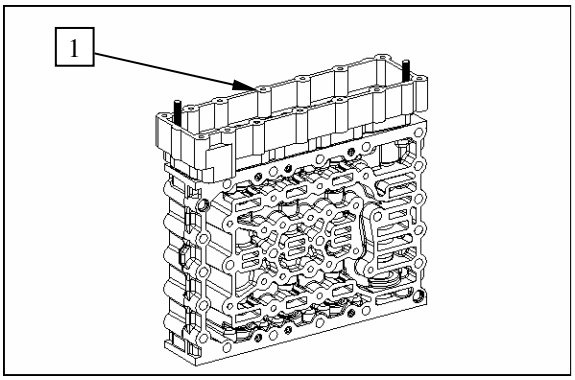


Figure 8

Bring housing (1) into contact position by means of the Torx screws. This will preload the pistons, and you can remove the cylindrical pins (assembly aid).

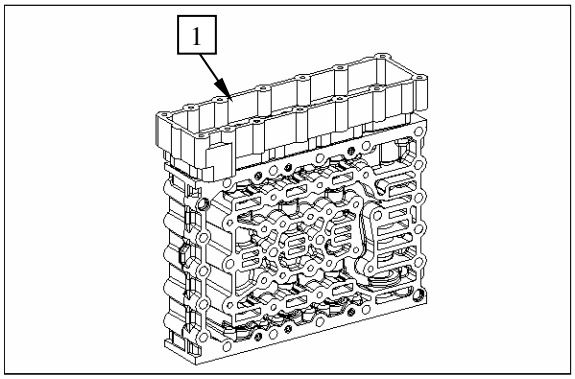


Figure 9

Fix housing by means of Torx screws (1).

Tightening torque (M5/10.9x30)..... M_A = 5.5 Nm

(S) Reducing adapter 5870 656 056
(S) Socket wrench TX-27 5873 042 002

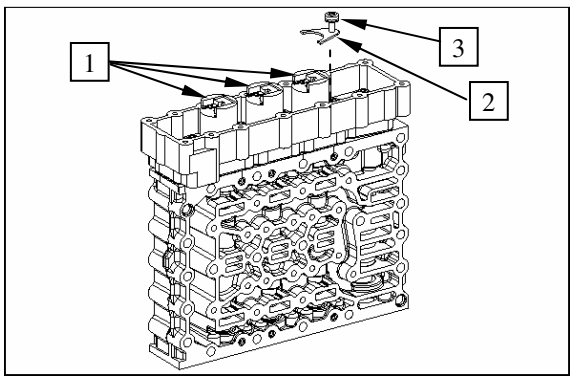


Figure 10

Mount pressure controllers (1) and fasten them by means of fixing plates (2) and cylindrical screws (3).

Install fixing plate, with the claw showing downwards!
Pay attention to the radial installation position of pressure controllers, see figure!

Tightening torque (M5/8.8x12).....M_A = 5.5 Nm

(S) Reducing adapter 5870 656 056
(S) Socket wrench TX-27 5873 042 002

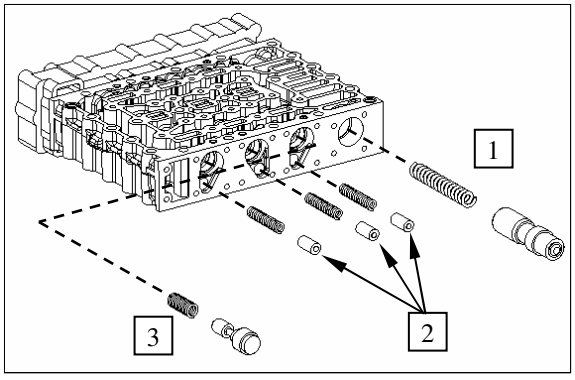


Figure 11

Preassembly of opposite side

The opposite figure shows the following single parts:

1 = Main pressure valve (1x, piston and compr. spring)
2 = Vibration damper (3x, piston and compr. spring)
3 = Follow-on slide (3x, piston and compr. spring)

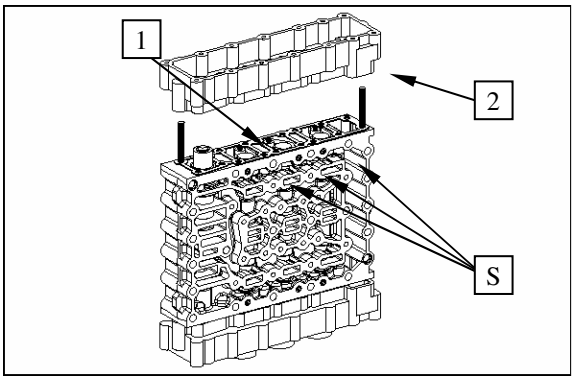


Figure 12

Install the single parts acc. to Figure 11.

Preload compression springs of the follow-on slides and preliminarily fix pistons by means of cylindrical pins ∅ 5.0 mm (assembly aid), see arrows (S)!

Fit two adjusting screws.

(S) Adjusting screws M5 5870 204 036

Mount seal (1) and housing (2) and position housing equally by means of adjusting screws until contact is obtained.

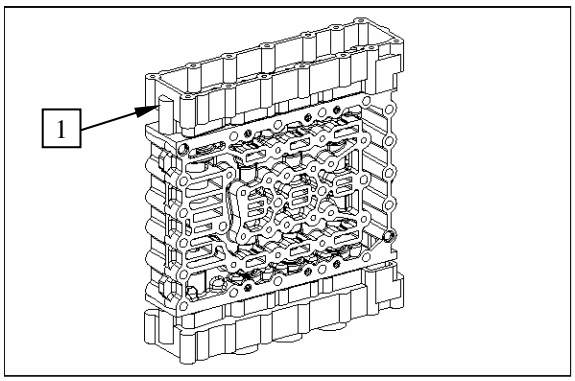


Figure 13

Bring housing (1) into contact position by means of the Torx screws. This will preload the pistons, and you can remove the cylindrical pins (assembly aid).

Then fix housing by means of the Torx screws (1).

Tightening torque (M5/10.9x30)..... M_A = 5.5 Nm

(S) Adjusting screws 5870 204 036
(S) Reducing adapter 5870 656 056
(S) Socket wrench TX-27 5873 042 002

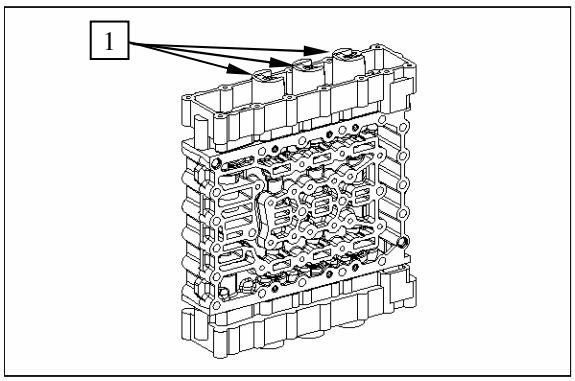


Figure 14

Mount pressure controllers (1) and fasten them by means of fixing plates and cylindrical screws.

Install fixing plate, with the claw showing downwards!
Pay attention to the radial installation position of pressure controllers, see figure!

Tightening torque (M5/8.8x12).....M_A = 5.5 Nm

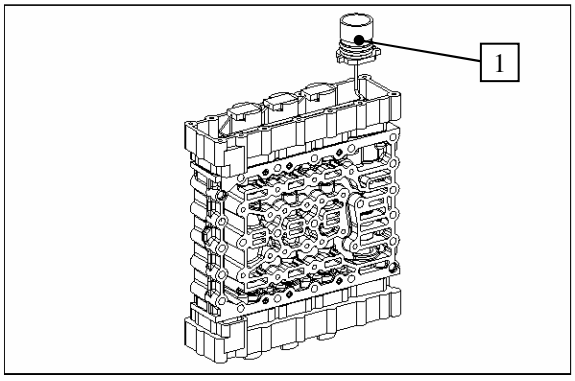


Figure 15

Mount wiring harness (1) and connect pressure controllers (6x).

Installation position of pressure controllers see Figure 1!

Pay attention to the installation position of the wiring harness. Refer to the markings done during disassembly!

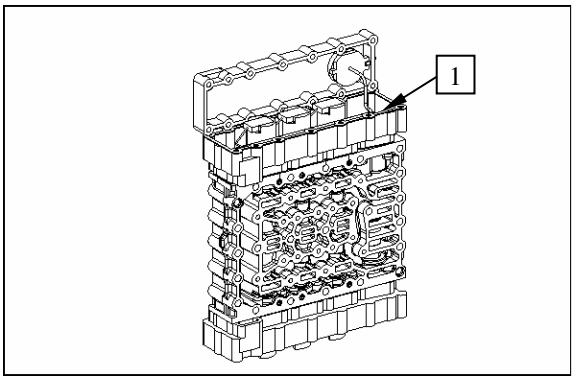


Figure 16

Place seal (1).

With the groove showing to the cover plug nose, mount socket until contact is obtained.

Fix cover by means of Torx screws.

Tightening torque (M5/10.9x30)..... M_A = 5.5 Nm

(S) Socket wrench TX-27	5873 042 002
(S) Reducing adapter	5870 656 056

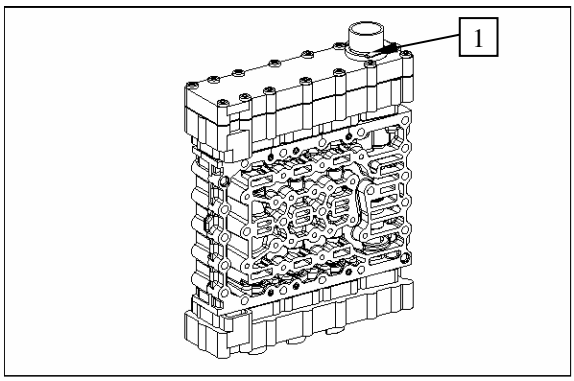


Figure 17

Fix wiring harness by means of retaining clamp (1).

Fit the opposite cover.

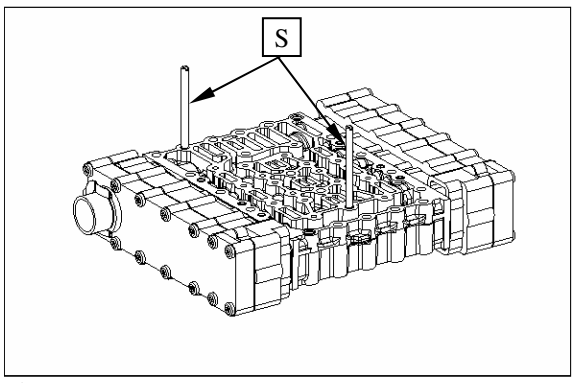


Figure 18

Fit two adjusting screws.

(S) Adjusting screws	5870 204 063

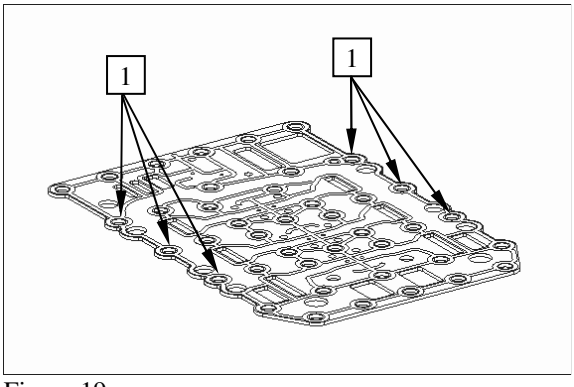


Figure 19

Flush-mount screens (1) into the holes of the sealing plate, see arrows!

Pay attention to the installation position – screens to show upwards (towards the duct plate)!

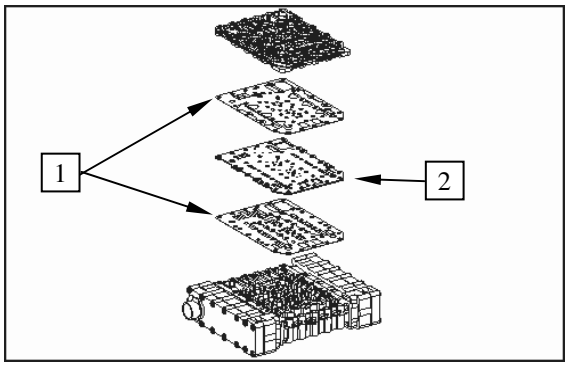


Figure 20

In the first quarter 2007 the paper seal of the shift unit shown on the opposite figure was changed over to seal plates (coated plates) in series production.

In case of repair the paper seals (1) and the intermediate plate (2) must be replaced by the seal plate (see figure-21)

Here it is indispensable to change over to the shorter fixing screws (see figure-22).

OLD ➔ Torx screw M6x25 (Paper plate)
NEW ➔ Torx screw M6x23 (Sealing plate)

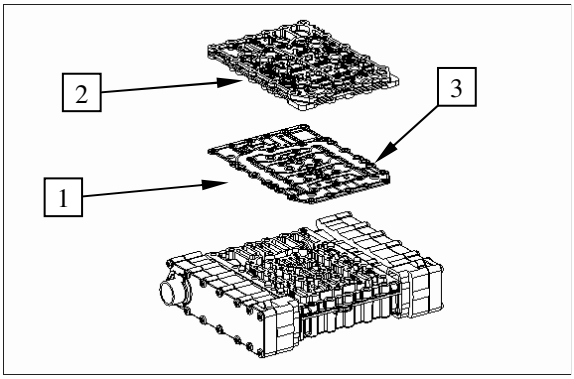


Figure 21

Put on sealing plate (1) and duct plate (2).

Screens (3) to show upwards!

It is not permitted to re-assemble the seal plate after opening the threaded joint shift unit/duct plate.
In case of repair it is always necessary to mount a new seal plate!

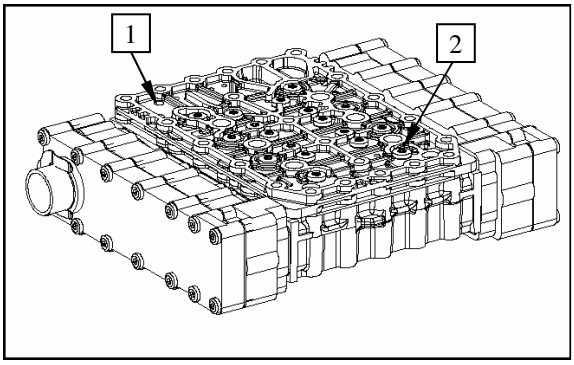


Figure 22

Place duct plate (1) and fix it equally by means of Torx screws (2).

Tightening torque (M6/10.9x23).....M_A = 10,5 Nm

(S) Socket wrench TX-27	5873 042 002
(S) Reducing adapter	5870 656 056

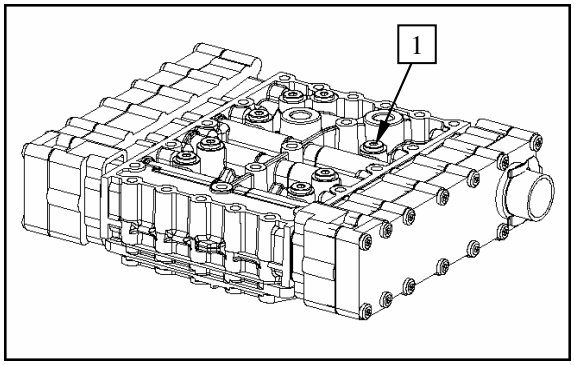


Figure 23

Provide screw plugs (1) with new O-rings 8x1.5 and install them.

Tightening torque (M10x1)..... M_A = 6 Nm

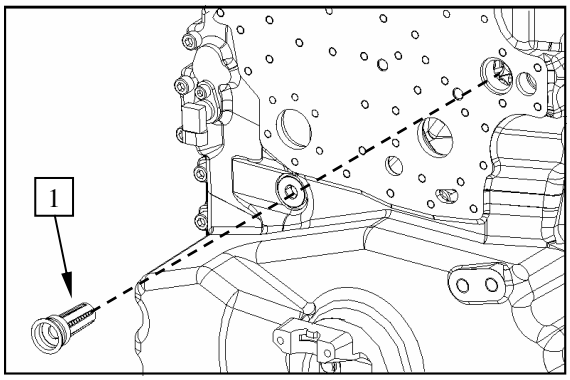


Figure 24

Insert converter safety valve (1) into the housing hole until contact is obtained.

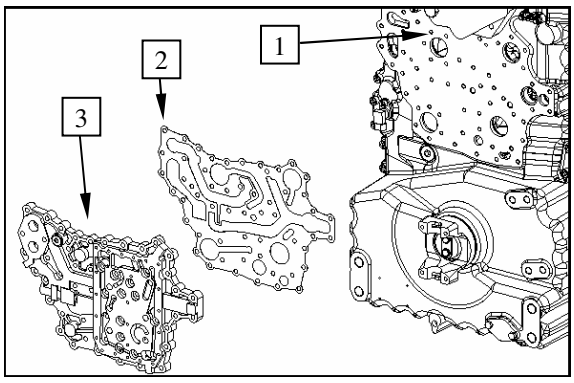


Figure 25

Mount stud bolts (1).

Wet screw-in thread with Loctite (type No. 243)!

Tightening torque (M8/10.9x25) ..... M_A = 15 Nm

Place seal (2) and duct plate (3) at the housing rear part until contact is obtained.

Use assembly grease!

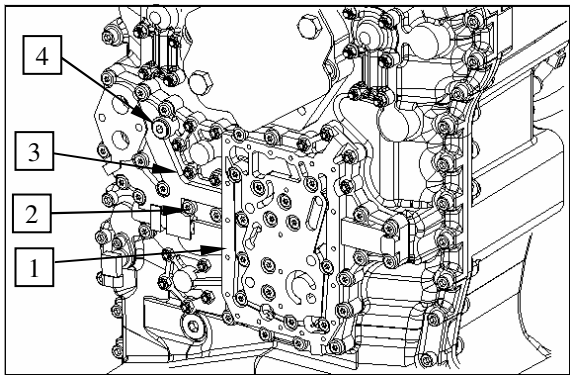


Figure 26

Fix duct plate (1) by means of Torx screws (2) and hexagon nuts (3).

Tightening torque (M8/10.9x25) ..... M_A = 9.5 Nm
Tightening torque (M8) ..... M_A = 23 Nm

Mount screw plug (4) with new O-ring 13x2.

Tightening torque (M16x1.5)..... M_A = 30 Nm

(S) Socket wrench TX-40 5873 042 004

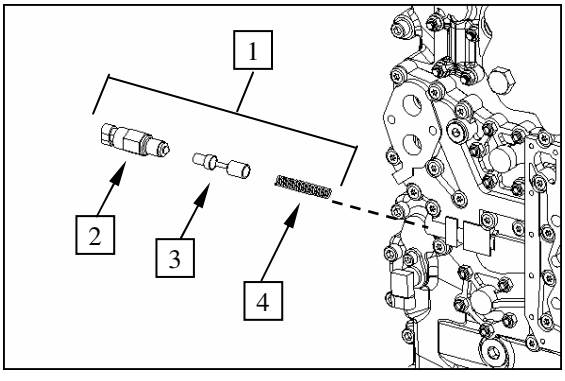


Figure 27

Mount compression spring (4), piston (3) and switch (2) with new O-ring 13x2.

1 = Filter differential pressure valve
2 = Switch with O-ring
3 = Piston
4 = Compression spring

Tightening torque ..... M_A = 30 Nm

Versions without filter differential pressure valve: Mount screw plug with new O-ring instead of switch (2).

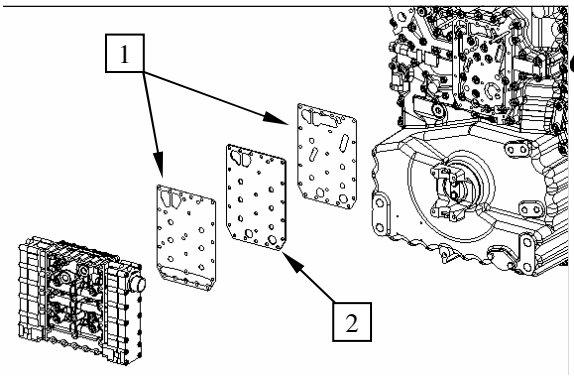


Figure 28

In the first quarter 2007 the paper seal of the shift unit shown on the opposite figure was changed over to seal plates (coated plates) in series production.

In case of repair the paper seals (1) and the intermediate plate (2) must be replaced by the seal plate (see figure-29)

Here it is indispensable to change over to the shorter fixing screws (see figure-30).

OLD ➔ Torx screw M6x80 (Paper plate)
NEW ➔ Torx screw M6x76 (Sealing plate)

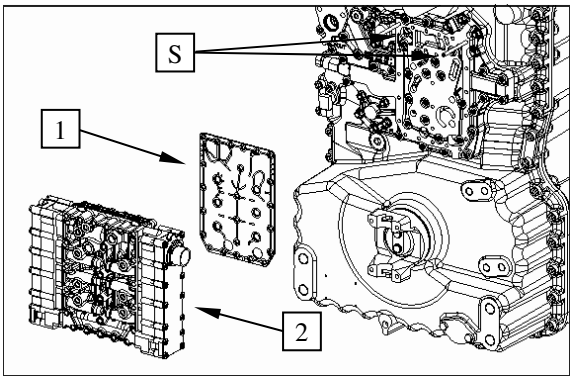


Figure 29

Fit two adjusting screws.

(S) Adjusting screws 5870 204 063

Mount sealing plate (1) and electro-hydraulic control unit (2).

It is not permitted to re-assemble the seal plate after opening the threaded joint shift unit/gearbox housing.
In case of repair it is always necessary to mount a new seal plate!

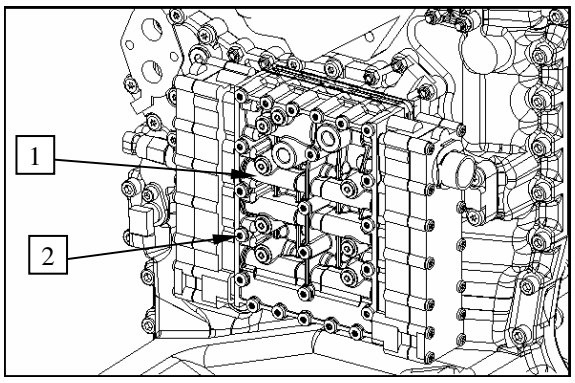


Figure 30

Fix electro-hydraulic control unit (1) equally by means of Torx screws (2).

Tightening torque (M6/10.9x80) ..... M_A = 9,5 Nm

(S) Socket wrench TX-27 5873 042 002
(S) Reducing adapter 5870 656 056

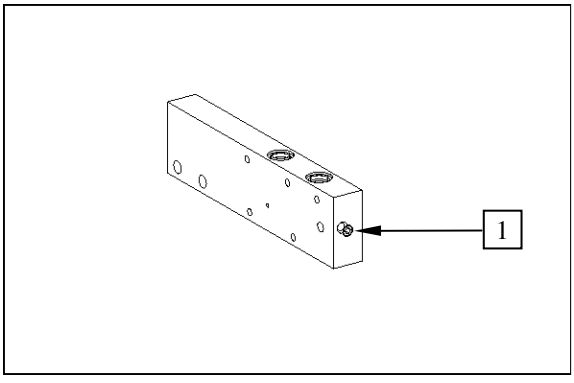


Figure 31

16.2 Lock-up valve

Insert threaded pin M8x8 (1) into lid with Loctite (type-no. 649).

Tightening torque (threaded pin) ..... M_A = 18 Nm

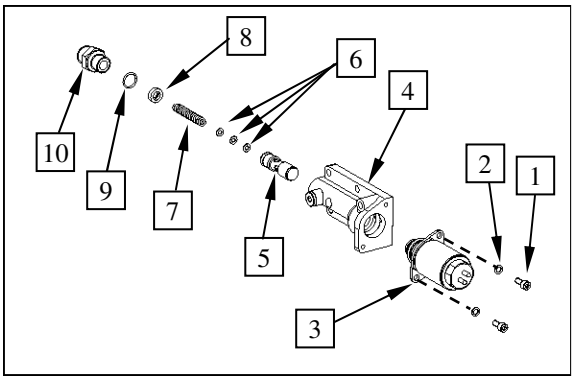


Figure 32

Install single components of lock-up valve.

1 = cylinder screw M5x12
2 = spring washer A5
3 = solenoid valve
4 = gear shift control housing
5 = piston
6 = adjusting washers 4x8x0.5 (3 pcs experience value)
7 = compression spring
8 = stop
9 = O-ring 13x2
10= fitting L12A-M

Tightening torque
Cylinder screws (M5/8.8x12)…….. M_A = 5.5 Nm
Fitting L12A-M (M16x1.5)……. M_A = 46 Nm

☞ **The adjusting washers (6) are used to determine the lock-up pressure 15+1 bar! Install stop (9) with the off-set plane face showing to the compression spring.**

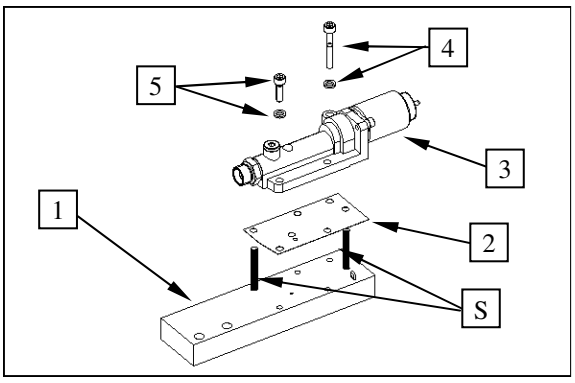


Figure 33

Mount sealing (2) and preassembled lock-up valve (3) on the lid (1) and fix by means of cylinder screws + washers (4 and 5).

(S) Adjusting screws 5870 204 063

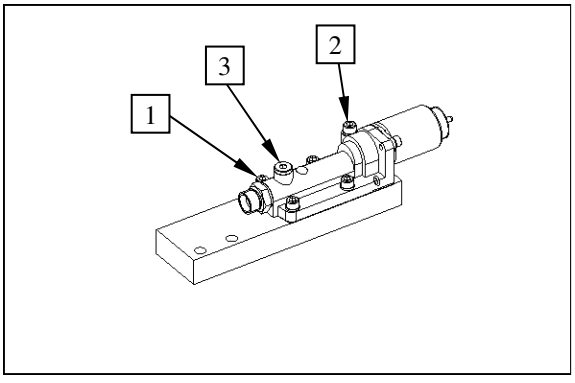


Figure 34

Fix lock-up valve by means of cylinder screws (1and 2) and install screw plug (3) with new O-ring 8x1.5.

Tightening torque
Cylinder screws (M5/8.8x40) ..... M_A = 9.5 Nm
Cylinder screws (M5/8.8x20) ..... M_A = 9.5 Nm
Screw plug (10x1)……..…… M_A = 6.0 Nm

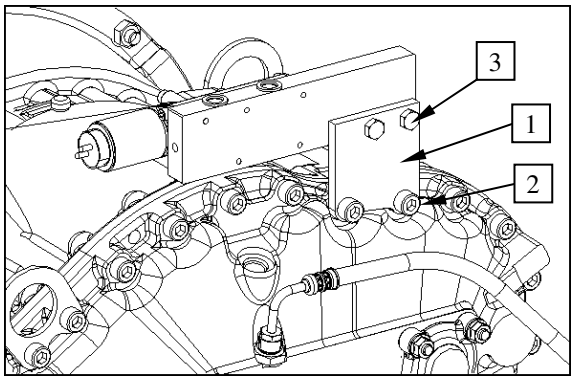


Figure 35

Fix plate (1) on housing by means of cyl. screws (2).

Tightening torque (M10/8.8x50) ..... M_A = 46 Nm

Fix lock-up valve on plate (1) by means of hex. screws and hex. nuts (3).

Tightening torque (M8/8.8x40) ..... M_A = 25 Nm

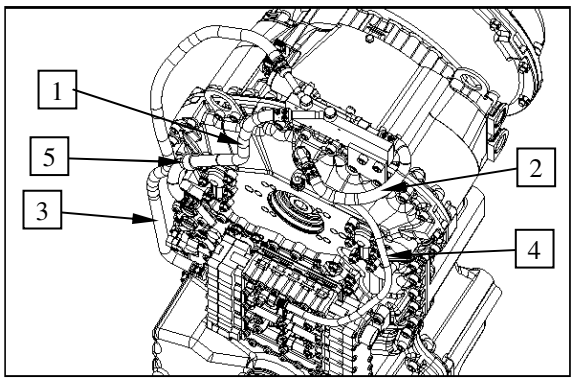


Figure 36

Fix plate (1) on housing by means of cyl. screws (2).

Tightening torque (M10/8.8x50) ..... M_A = 46 Nm

Fix lock-up valve on plate (1) by means of hex. screws and hex. nuts (3).

Tightening torque (M8/8.8x40) ..... M_A = 25 Nm

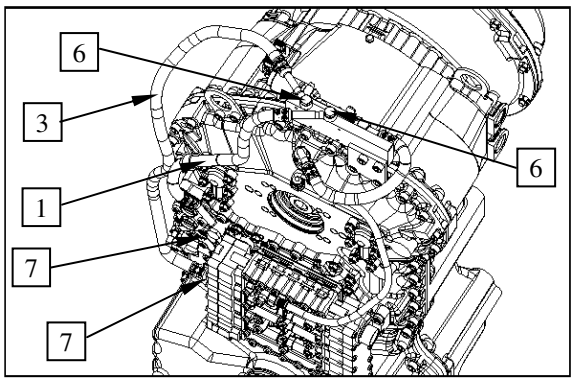


Figure 37

Tightening torques:

Hose line (1)
Hollow screw (6) M12x1.5)……. M_A = 35 Nm
Hollow screw (7) M16x1.5)……. M_A = 45 Nm

Hose line (2)
Fitting L12A-M (M16x1.5)……. M_A = 46 Nm
Hose line…….. M_A = 35 Nm

Hose line 3
Hollow screw (6) M12x1.5)……. M_A = 35 Nm
Hollow screw (7) M16x1.5)……. M_A = 45 Nm
Insert threaded bush with O-ring 23x2 into housing
Threaded bush (M26x1.5)……. M_A = 80 Nm

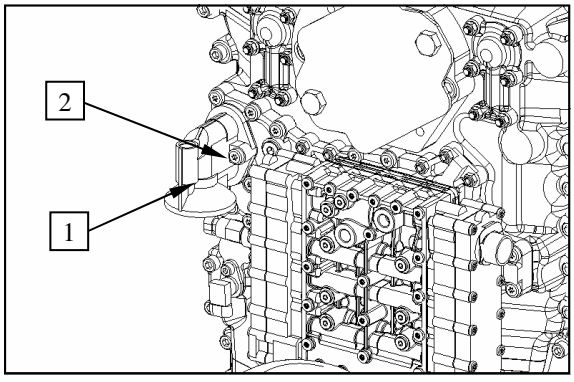


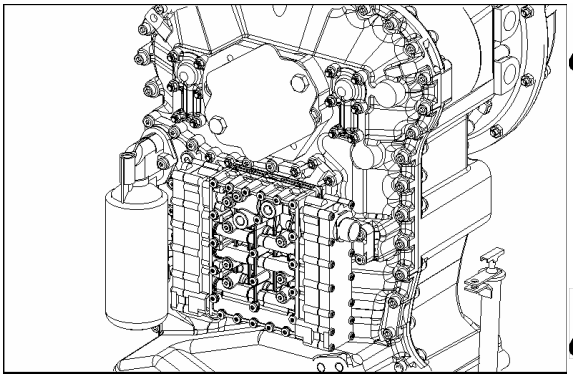
Figure 38

16.3 Fitting of ZF fine filter (pressure filter)

Fix filter head (1) with new O-rings 34.2x3 to the housing rear part by means of Torx screws (2).

Tightening torque (M8/10.9x60) ..... M_A = 34 Nm

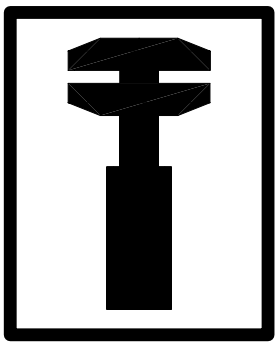
(S) Socket wrench TX-40 5870 042 004



The filter is to be installed as follows:

- **Slightly oil the seal**
- **Turn in the filter until contact with the sealing surface is obtained, and then tighten it by hand with approx. 1/3 to 1/2 rotation.**

Before putting the transmission into operation, fill it with oil according to Operation Manual/Order No. 5872 153 002!



Functional characteristics and maintenance instructions
TM 64/97
KNOTT

Mechanical sliding caliper disc brake
M 90

NOTE:
The present Assembly Manual concerns the nonmodified Reprint of the Original Assembly of the Component Manufacturer.
The ZF Passau GmbH is not liable in this connection for faulty Assembly Manuals, and is especially not responsible for the positive knowledge about a New Edition at the User of the Manual.

ZF Passau GmbH
Donaustr. 25 - 71
D- 94 034 Passau

KNOTT
Bremsen - Achsen

KNOTT GmbH
Obinger Str. 15
Germany
Telefax 08056/906-106
Telefax 08056/906-103

Postfach 20
D-83125 Eggstätt
Telefon: 08056/906-0
Konstruktion
Verkauf

Technical Information 64/97

Functional characteristics and maintenance instructions for mechanical sliding caliper M90

1. General

This data sheet covers important service procedures that apply to the M90A model brake. Refer to the exploded drawing as the steps are performed.

2. Routine Maintenance

The routine maintenance presented below is suggested to keep the brake system in good working order.

2.1 Check to insure floating parts move freely and that all other parts are mounted securely. Tighten hardware as required.

2.2 Check actuator linkage to insure that there is adequate freedom of movement for positive brake operation. Adjustment of pad gap is to be accomplished by adjusting the actuating cable or linkage. If adjustment is used up, back off cable or linkage. Unbend tab on anti-rotation clip and loosen screw enough to disengage lever spline. Rotate the lever one tooth, in the direction opposite the actuation direction, and retorque the screw making sure the spline teeth are properly engaged. Bend up a tab that aligns with one of the screw head flats, to prevent screw rotation. Both lever and linkage must be free to return to home position. An external return spring is required.

2.3 Check - disc surface condition. Replace if it is badly warped, pitted, or below minimum recommended thickness. Check for loose mount bolts. Retighten if necessary.

2.4 Check to insure friction pads are not worn to less than .039"(1.Omm) thick. Replace worn friction pads.

Generally, if the disc is still running true and the pad clearance is still adjustable, no other maintenance is required. To check for wear, measure the distance from the carrier side casting face to disc face. If the distance is less than .060" (1.5mm), replace the friction pads.

3. Replacing Friction Pads

Note: Stamped on the back of each friction pad is a code. The first 1 or 2 characters is a number that specifies the friction material type. Check to insure new pads are the same as the worn pads that were removed. Replace friction pads only in pairs.

To replace the friction pads it is necessary to release the brake and disconnect the actuator from the brake lever.

3.1 Remove one brake mounting bolt. Swing the brake up over the disc to expose the brake pads. In close clearance applications the brake may be removed from the vehicle. Using a flat bladed screw driver, pry out the used brake pads from their respective positions. The lever side friction pad is snapped onto the plastic actuator cover. Care should be used in removing the friction pad from the plastic actuator cover so as not to break off the center snap tabs.

3.2 Place the new friction pads in their respective positions. The lever side friction pad has a center hole which snaps over the plastic snap tabs of the actuator cover. The flat on the lever side pad must align which the flat on the plastic rotor cover, allowing the pad to sit flat. If the snap tabs are gone dab some silicone gasket adhesive around the back edge of the friction pad and press firmly into place aligned as described above. Before placing the carrier pad in postition, clean out existing pad glue from the pad compartment.

Place a layer of silicone gasket adhesive all along the back edge of the carrier friction pad and press firmly in place. Push the lever side pad into the brake as far as possible.

3.3 Swing the brake over the disc and install the mounting bolt and tighten all mounting bolts. (see equipment service manual for proper mounting bolt torque).

3.4 linkage. Unbend tab on anti-rotation clip and loosen screw enough to disengage the lever spline. Rotate the lever to the OEM position (see equipment service manual to determine lever position with new pads) and torque screw to 110-140 in.lbs.(12.4-15.8 Nm). Bend up a tab on the anti-rotation clip that aligns with one of the screw head flats, to prevent screw rotation. Attach actuating cable or linkage to the lever. Adjustment of pad gap is accomplished by adjusting the actuating cable or linkage.

4. Disassembly

Perform disassembly on a clean work bench.

4.1 Disconnect the actuator cable or linkage and remove brake from its mounting.

4.2 Remove friction pads. (see "Replacing Friction Pads")

4.3 Unbend anti-rotation clip tab away from lever holding screw. Remove screw, anti-rotation clip, washer, lever, and spring.

4.4 Push out rotor assembly from the casting.

CAUTION: Ball spacer and 3 ball bearings may come out with the rotor assembly. (for rotor disassembly see "Servicing Rotor Assembly").

4.5 Remove 3 ball bearings and ball spacer.

4.6 Shaft seal need only be replaced if excessively worn or cracked. If replacement is necessary, press out the plastic shaft seal from inside the casting, using a steel spacer block 1.078"(27.38mm) diameter by 2.5"(63.5mm) long and an arbor press.

Note: A popular brand name 3/8" drive 13/16" hex deep socket works weH as a spacer block.

4.7 After the shaft seal is pressed out, remove the sliver of plastic that may be left in the groove in the casting.
This completes disassembly of the brake.

5. Cleaning and Inspecting

5.1 Clean all parts with denatured alcohol and either wipe dry with a clean lint free cloth or blow dry with an air hose.

5.2 Examine all parts carefully for signs of excessive wear, damage, or corrosion. Replace any parts found to be damaged.

5.3 Check rotor assembly for cracks. Replace if necessary. The rotor assembly must be replaced as a complete unit. No individual parts are available for service.

5.4 Inspect the casting ball pockets for scoring, pitting, cracks or corrosion. A corroded or deeply scored casting should be replaced. Light scoring and stains may be removed.

5.5 Check to see that the disc is not bent or misshapen.

5.6 Check lever spring for breakage.

6. Assembly

Prior to assembly make sure all parts are clean and serviceable.

6.1 Install a new shaft seal by Leasing the seal from the outside of the casting with the extended smooth surface inserted first. Using an arbor press, with a protective spacer block between the arbor press and the seal, gently press the seal in until it snaps into the groove in the casting.

6.2 Coat with grease, the ball pockets in the casting, the shaft and ball pockets of the rotor assembly.

6.3 Insert 3 ball bearings and ball spacer into the pockets in the casting.

6.4 From the inside of the casting slide the shaft of the rotor assembly thru the shaft seal and seat the ball pockets against the ball bearings.

6.5 Place the spring over the large diameter pilot on the outside of the casting.

6.6 Install the lever, making sure the small diameter of the spring is piloted on the outside of the 4 pins in the lever. Set the lever in the OEM position. (see equipment service manual to determine lever position).

6.7 Install the washer and anti-rotation clip with its tab inserted into the lower hole in the lever.

6.8 Insert screw into rotor assembly shaft and tighten to110140 in.lbs.(12.4-15.gNm), while guiding lever over rotor assembly spline.

6.9 After the proper torque is achieved and the lever is in the OEM position, bend up a tab on the anti-rotation clip that aligns with one of the screw head flats, to prevent screw rotation.

6.10 Install the friction pads onto the rotor assembly and carrier. (see "Replacing Friction Pads").

6.11 Stroke lever in its proper direction. The lever must rotate thru 60 degrees of rotation. Return lever to the 0EM position and make sure the lever side friction pad is fully returned.

7. Replacing Mount Bushings

7.1 Push mount bushings completely out of the brake casting.

7.2 Remove the four (4) o-rings from the grooves in the casting, being careful not to damage the grooves. Clean the grooves and the bore with denatured alcohol or cleaning solvent. Let dry. Lubricate the grooves and o-rings with the grease furnished with the service kit. Install the o-rings into the grooves.

7.3 Coat the bushings with kit grease. Insert bushing through the o-rings. Wipe off any excess grease.

8. Servicing Rotor Assembly

Disassemble brake as previously described.

8.1 Using a sharp knife, make several cuts through the outside diameter of the rigid plastic rotor cover. Break apart the plastic, remove and discard.

8.2 Discard the stainless steel insert from under the plastic cover.

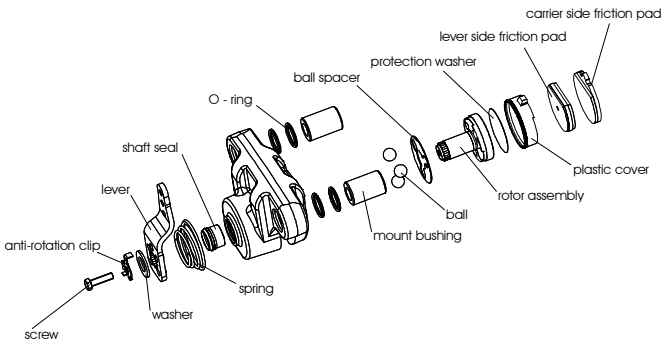
8.3 Thoroughly clean all dirt and grease residue from the rotor.

8.4 Amply grease one face of the new stainless steel insert and place it into the new rotor cover, grease to plastic. Amply grease the other face of the insert.

8.5 To assemble the new plastic rotor r-over a bench vise is necessary. Snap a friction pad onto the plastic cover. Place the plastic cover over the rotor, place in a vice, and slowly squeeze the cover and rotor until the cover snaps in place. Remove the friction pad and reassemble the brake as previously described.

NOTE: Mount bushing o-rings are also furnished in the rotor service kit. For installation see "Replacing Mount Bushings".

9. Sketch of the brake

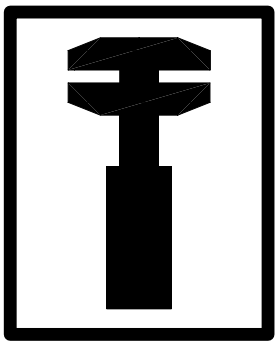


10. General

If you lock defects or troubles by non presented parts of course you have to repair it res. you must replace it by using original KNOTT – spare parts.

Loosing information res. instructions can you hear from the vehicle – or brake-manufacturer.

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Maintenance and repair instruction
TM 84/03
KNOTT

Spring applied hydraulic released sliding calliper
FSG 75

NOTE:

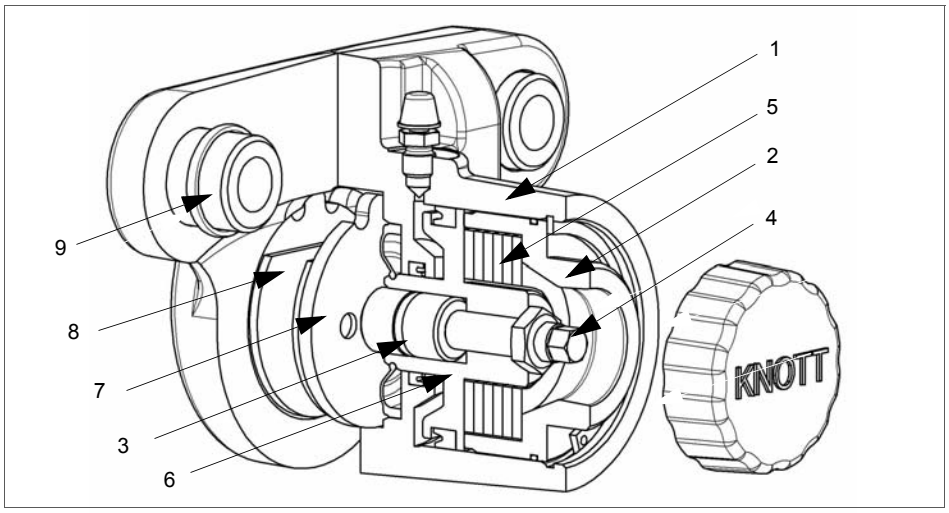
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1. Construction and function

Figure 1-1:
Brake components

1 Housing
2 Thrust collar
3 Thrust bolt
4 Adjusting screw
5 Cup spring assembly
6 Piston
7 brake pad holder
8 brake pad holder
9 Guide bolt



One of the two identical brake pad holders is permanently anchored in the housing. The second brake pad holder is mounted in the housing and can slide freely. The actual brake is bolted directly to the gearbox or axle housing via the guide bolts. The housing moves freely on the guide bolts.

When the brake is actuated, a clamping force is generated on the brake pad holder. This force is transferred to the brake disc. At the same time, the cup spring assembly of the piston, together with the adjusting screw, moves the thrust bolt and the brake pad holder in towards the brake disc. When the brake pad holder comes into contact with the brake disc, the force of reaction moves the housing on the guide bolts until the second brake pad holder is also pressed against the brake disc. The braking effect (braking torque) depends on the friction coefficients of the brake pads.

The brake is released by fully prestressing the cup spring assembly. The corresponding release pressure must move the piston back as far as the stop on the thrust collar.

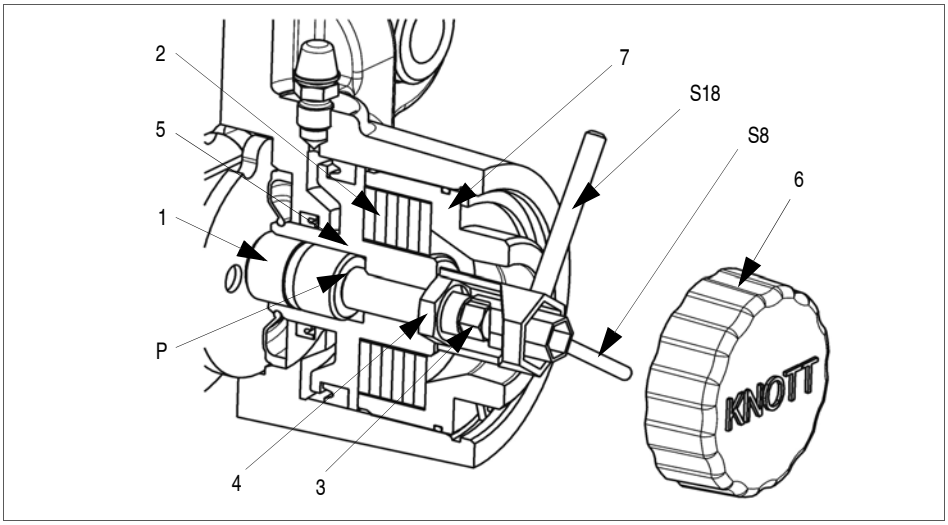
Wear on the brake pads and the brake disc reduces the clamping force. The brake must then be adjusted.

2. Assembly and adjustment instructions

The brake must be adjusted after the installation (assembly) of new brake pad holders or a new brake disc, after all repair stages or if the braking power is insufficient.

Figure 2-1:
Options for adjustment and removal

1 Thrust bolt
2 Cup spring assembly
3 Adjusting screw
4 Lock nut
5 Piston
6 Screw cap
7 Thrust collar
S8 Socket wrench size 8
S18 Socket wrench size 18
P End face



Note:

The brake must be allowed to cool down before starting any assembly work or adjustments.

2.1. Assembling the brake

1. Place the vehicle on a flat surface and secure it to prevent it rolling away.
2. Unscrew and remove the screw cap.
3. Use a suitable socket wrench to loosen the lock nut (size 18) and turn the adjusting screw anti-clockwise with a size 8 socket wrench until the end face of the thrust bolt lies against the piston.
   In this state, the brake can be pushed onto the brake disc and fixed in place.
4. Connect the compressed air connection.

Pressurise the brake with the required release pressure until the cup spring assembly is fully prestressed.
Then make the basic settings described below.

2.2. Basic settings

1. Turn the adjusting screw clockwise until both brake pad holders are in contact with the brake disc.
   From this point onwards, the adjusting screw cannot be turned without applying considerable force.
2. Set the clearance by turning the adjusting screw anti-clockwise as shown in the table below:

Version	Adjusting screw	Clearance (mm)		Turns
FSG75	Size 18 (size 8)	min.	0.5	1/3
		Nominal Clearance	1.0	2/3
		max.	1.5	1/1

3. Hold the adjusting screw in position with a socket wrench and lock it with the lock nut.
4. Refit the screw cap and tighten it hand-tight.
5. Connect to the compressed air supply following the axle or gearbox manufacturer's instructions.

Vent the piston chamber using the vent valve (size 13).

2.3. Adjustments

To make adjustments, first release the parking brake, i.e. the cup spring assembly must be fully prestressed.

1. Place the vehicle on a flat surface and secure it to prevent it rolling away.
2. Release the parking brake by pressurising with the required release pressure.
3. Unscrew and remove the screw cap.
4. Loosen the lock nut (size 18) and turn the adjusting screw clockwise with a size 8 socket wrench until the two brake pad holders are in contact with the brake disc.
5. Set the nominal clearances by turning the adjusting screw anti-clockwise (see the table in the “Basic settings” section).
6. Hold the adjusting screw in position with a socket wrench and lock it with the lock nut.
7. Refit the screw cap and tighten it hand-tight.

Actuate the brake valve several times and check that the parking brake holds the vehicle while facing up or down a gradient.

3. Emergency release of the parking brake

If the compressed air supply fails, the parking brake should be released mechanically as follows:

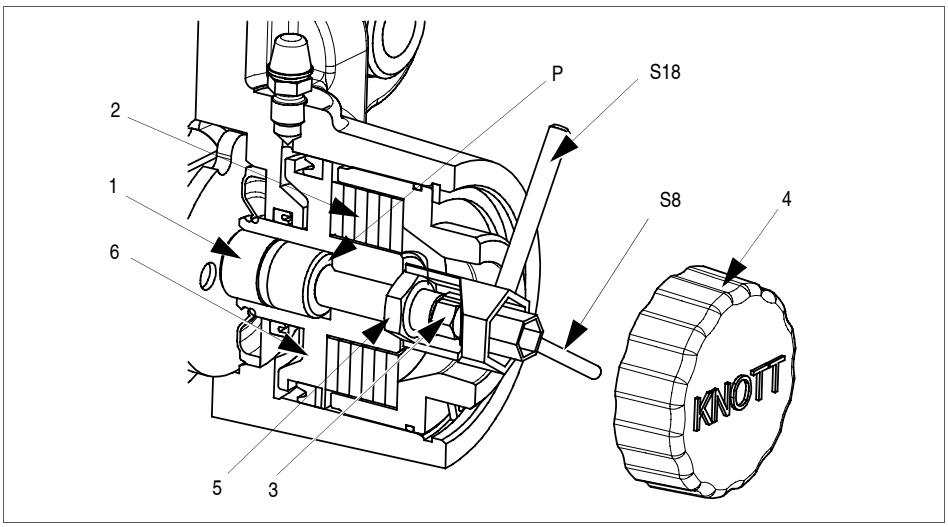


Figure 3-1:
Options for adjustment and removal

1 Thrust bolt
2 Cup spring assembly
3 Adjusting screw
4 Screw cap
5 Lock nut
6 Piston
S8 Socket wrench size 8
S18 Socket wrench size 18
P End face

1. Secure the vehicle to prevent it rolling away.
2. Unscrew and remove the screw cap.
3. Loosen the lock nut (size 18) and turn the adjusting screw anti-clockwise with a size 8 socket wrench until the brake disc is free.

Caution!

A torque of at least 40 Nm must be applied to the adjusting screw for an emergency release.

4. Lock the lock nut and screw on the screw cap a few turns (to protect against contamination).

Caution!

In this state, the vehicle has no parking brake at all and must be secured by other means to prevent it rolling away. Set the brake before restarting. See “Assembly and adjustment instructions”

4. Maintenance and repairs

4.1. Maintenance and replacement of the brake pad holder.

The actual brake pad holders are maintenance-free. They simply have to be checked for damaged parts and to ensure that the brake disc moves freely.

The pad thickness should be visually checked at regular intervals according to the use of the vehicle (but at least every 6 months). If the remaining pad thickness is too small, shorten these intervals accordingly to avoid serious damage to the brake or disc. the brake pad must be replaced when the pad thickness is as follows:

– FSG 75::
  min. residual thickness 1.0 mm per brake pad holder (holder plate is 5 mm thick).

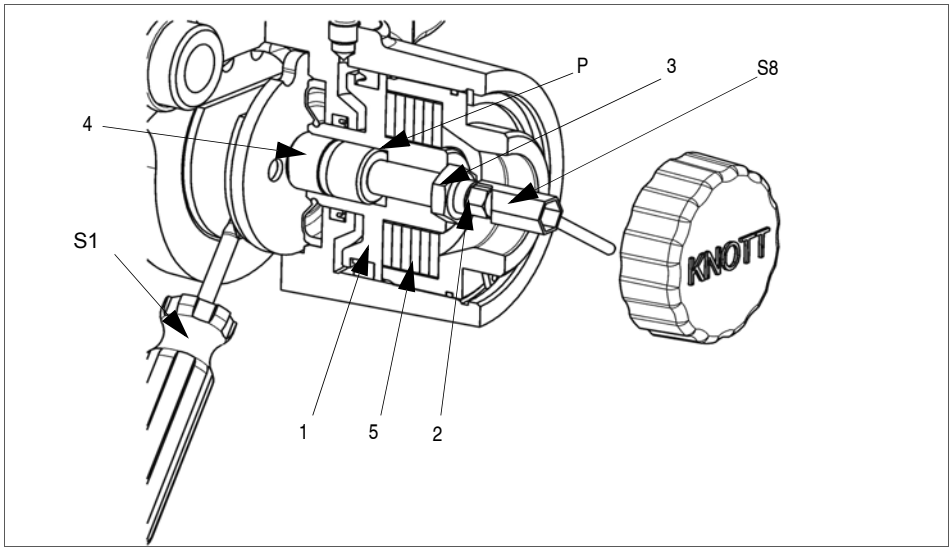


Figure 4-1:
Releasing the brake pad holder

1 Piston
2 Adjusting screw
3 Lock nut
4 Thrust bolt
5 Cup spring assembly
S1 Screwdriver
S8 Socket wrench size 8
P Inside of the piston

Note:

Use only original KNOTT spare parts. KNOTT cannot assume responsibility or offer any guarantee for the brakes and their correct functioning if other spare parts are used.

1. Place the vehicle on a flat surface and secure it to prevent it rolling away.
2. Release the parking brake by pressurising with the required release pressure.
3. Unscrew and remove the screw cap.
4. Loosen the lock nut (size 18) and turn the adjusting screw anti-clockwise with a size 8 socket wrench until the thrust bolt can be pressed fully into the piston.
5. Use a suitable screwdriver inserted between the brake pad holder and brake disc to turn (lever) the thrust bolt back until it is lying against the piston.
6. Always loosen both guide bolts and remove the complete brake by pushing it radially to the centre point of the disc.
   The brake pad holders can now be removed from the housing guide by pressing or levering out with a suitable tool.



Caution!

Check the compressed air line. If a compressed air line is too short, it must be unscrewed so that the brake can be removed.
Before detaching the compressed air line, carry out an emergency release of the parking brake.

7. Replace the brake pad holder and bolt the guide bolts to the axle or gearbox housing once more.
   If you have removed the complete brake due to insufficient clearance, you must reinstall it and bolt both guide bolts to the axle or gearbox housing.
8. Screw on the compressed air line once more and vent the brake.



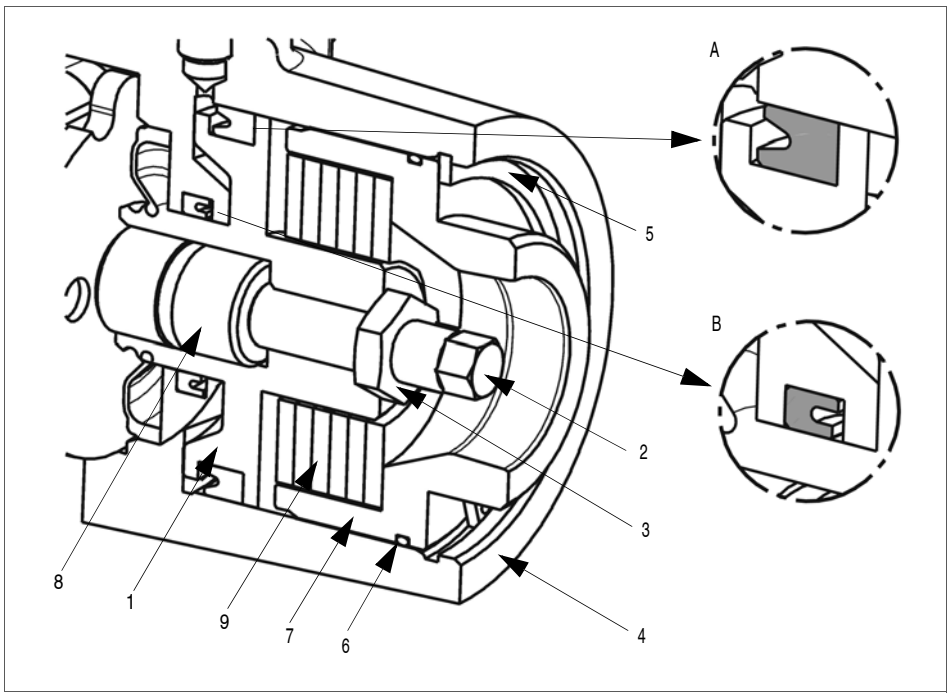
Note:

Adjust the brake after replacing or repairing the brake pad holder.

4.2. Replacing the seals

Figure 4-2:
Seal change

1 Piston
2 Adjusting screw
3 Lock nut
4 Housing
5 Retaining ring
6 Seal
7 Thrust collar
8 Thrust bolt
9 Cup spring assembly
A Detail of the seal
B Detail of the seal



Leaking seals must be replaced as described below:

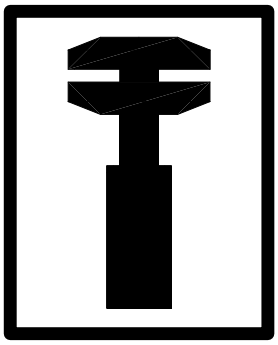
1. Place the vehicle on a flat surface and secure it to prevent it rolling away.
2. Release the parking brake by pressurising with the required release pressure.
3. Unscrew and remove the screw cap.
4. Loosen the lock nut (size 18) and turn the adjusting screw anti-clockwise with a size 8 socket wrench until it is flush with the inside of the piston.
5. Turn the thrust bolt back as far as the stop and actuate the manual brake valve (unpressurised position).
   The cup spring assembly is now fully depressurised.
6. Unscrew the compressed air line and remove the complete brake.
7. Remove the retaining ring and remove the thrust collar from the housing.
8. Remove the cup spring assembly and the piston.



Caution!

The grooved rings must installed the right way round, otherwise they will leak.

Use a suitable assembly needle with rounded edges to install the new grooved rings for the sealing lip. Be careful - Risk of injury!



Maintenance and repair instruction
TM 84/03
KNOTT

Spring applied hydraulic released sliding calliper
FSG 75

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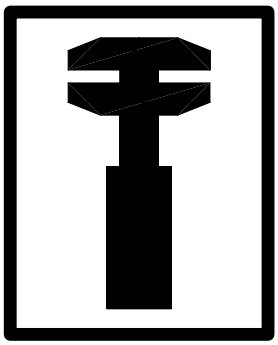
9. Replace all the seals and reverse the above sequence to reinstall the individual parts in the brake.
   When you install the piston, grease the sliding and sealing surfaces sparingly with grease conforming to DIN 51825.
   The dust cover cap has a steel ring that is vulcanised in place. This presses the cap into the locating hole. To replace it, you must "lever it out" with a suitable tool. Press the new dust cover cap in using an assembly ring and screw clamps or a manual lever press.

Follow the above instructions to fit the brake into the vehicle or on the axle.

4.3. General notes

Defects or damage identified on parts that are not listed must, of course, be rectified or the parts should be replaced with original spare parts.

If you need more information or more detailed instructions, you should contact the vehicle or brake manufacturer.



Maintenance and repair instructions
TM 63/97
KNOTT

Spring applied hydraulic released sliding calliper
FSG 90 and FSG 110

NOTE:

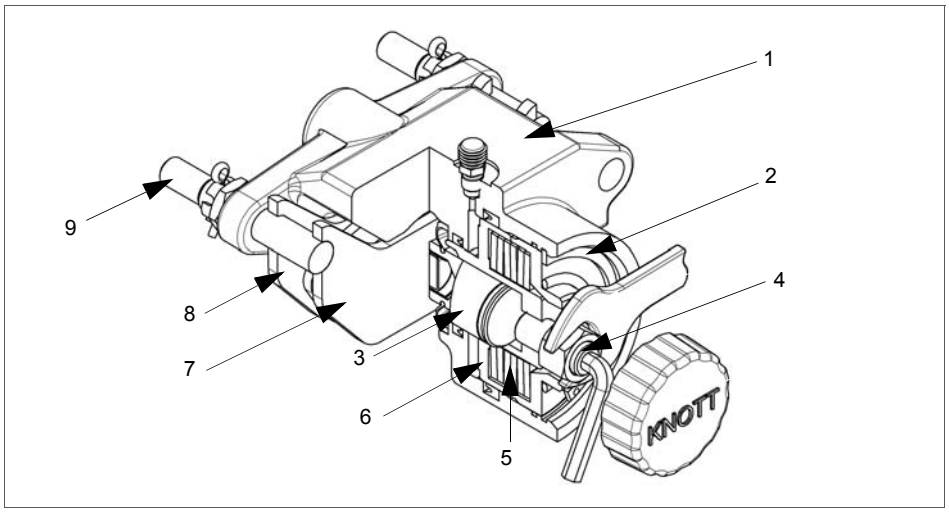
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1. Construction and funktion

Bild 1-1:
Parts of the brake

1 housing
2 pressure ring
3 thrust bolt
4 adjusting screw
5 bank of cup springs
6 piston
7 lining pad
8 lining pad
9 gliding bolt



The two identical brake pads and slide freely on the guide bolt, which is fastened in the housing. The guide bolts are guided in an additional brake anchor plate which in turn is screwed onto the vehicle, i.e. its axle.

On actuation, the brake generates a clamping force at the brake lining pads, which cause a tangential force/braking moment to be generated at the brake disk, the extent of which depends on the coefficients of friction generated by the linings.

The clamping force is generated by the bank of cup springs, during which the piston is moved together with the adjusting screw, the thrust bolt and the brake pad towards the brake disk.

When the brake pad comes into contact with the brake disk, the reaction force shifts the housing onto the guide bolts until the brake pad) is also pressed against the brake disk.

The brake is released by complete pre-tensioning of the bank of cup springs. During this process, through application of the necessary release pressure after overcoming the cup spring force, the piston must move back until it comes to rest against the pressure ring.

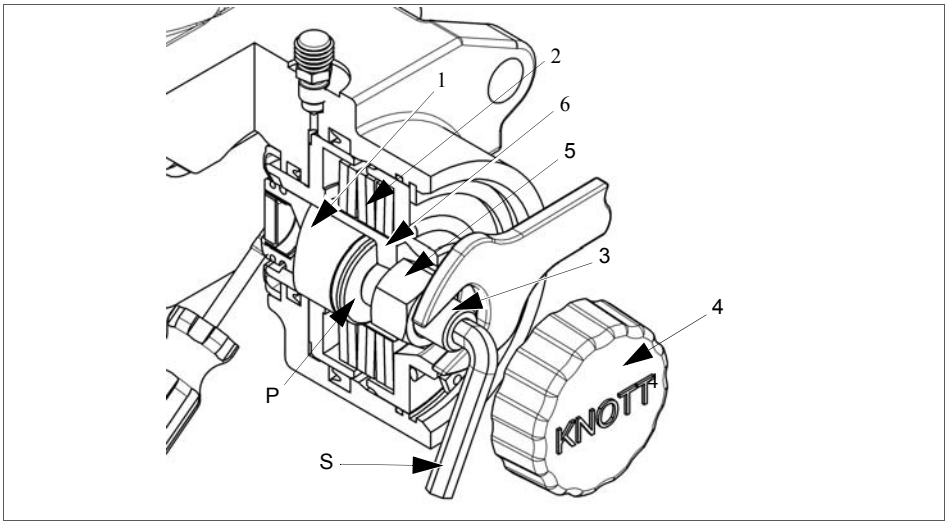
The clamping force diminishes with wear of the brake lining and brake disk. The brake must be adjusted at the latest at the times indicated by the adjusting specification below.

2. Mounting and basic setting regulations

Basic brake setting is required after mounting new brake lining plates or brake disks, as well as during all repair stages and in the event of insufficient braking performance.

Bild 2-1:
Adjusting and assembly possibilties

1 thrust bolt
2 bank of cup springs
3 adjusting screw
4 screw cap
5 lock nut
6 piston
P even surface
S socket wrench



Note:

All mounting and basic setting work must be carried out on the brake when cold.

2.1. Mounting the brake

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the screw cap.
3. Release the lock nut (size 24 or 30) and turn the adjusting screw anticlockwise using a size 8 or 10 socket wrench until the pressure bolt comes to rest against the even surface of the piston. In this status, the brake can be mounted onto the brake disk and fastened.
4. Mount the pressure connection again.

Apply the necessary release pressure to the brake until the bank of cup springs is completely pre-tensioned
Following carry out the below described basic setting regulation.

2.2. Basic setting regulation

1. Turn the adjusting screw manually clockwise until both brake pads make contact with the brake disk. Then it is not longer possible to turn the adjusting screw without exerting a major amount of force.
2. Turn the adjusting screw anticlockwise in order to set the following rated clearances:

type	adjusting srew	clearance (mm)		turns
FSG90	M16 (SW 8)	min.	0,5	1/4
		clearance	1,0	1/2
		max.	1,5	3/4
FSG110	M20 (SW 10)	min.	1,0	2/5
		clearance	2,0	4/5
		max.	3,0	1 1/5

3. Hold the adjusting screw in position with a hexagonal socket wrench and lock with lock nut.
4. Mount the screw cap and tighten as far as possible manually.
5. Stellen Sie den Druckanschluß gemäß der Vorschrift der Achs- bzw. Getriebehersteller her. Mount the pressure connection in accordance with the instructions of the axle / gear manufacturer.

For bleeding the piston chamber use the socket spanner size 13 for the bleeding valve.

2.3. Adjusting regulations

During this adjusting process, the parking brake must be released, i.e. the bank of cup springs must be completely pre-tensioned.

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by using the required release pressure.
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until the two brake pads make contact with the brake disk.
5. Turn the adjusting screw anti-clockwise and set the clearance specified in the above table.
6. Hold the adjusting screw in position with the hexagonal socket wrench and lock with the lock nut.
7. Mount the screw cap and tighten as far as possible manually.

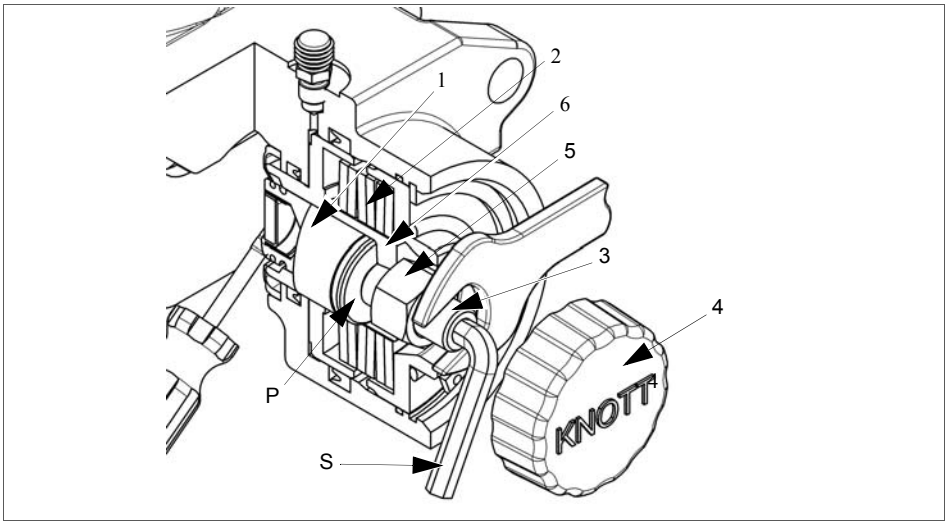
Actuate the brake valve several times and check the braking efficiency of the parking brake on a slope.

3. Emergency release of the parking brake

After the failure of the pressure release the parking brake by using following manual procedure:

Bild 3-1:
Adjusting and assembly possibilties

1 thrust bolt
2 bank of cup springs
3 adjusting screw
4 screw cap
5 lock nut
6 piston
P even surface
S socket wrenchl



1. The vehicle has to be secured against rolling away.
2. Release the screw cap and unscrew.
3. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

Caution!

For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required .

4. Mount the lock nut and the screw cap and tighten both as far as possible manually. (Protection against dirt

Caution!

Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Res. „Assembly and basic setting regulations“.

4. Maintenance and repair work

4.1. Maintenance and exchange of brake pads

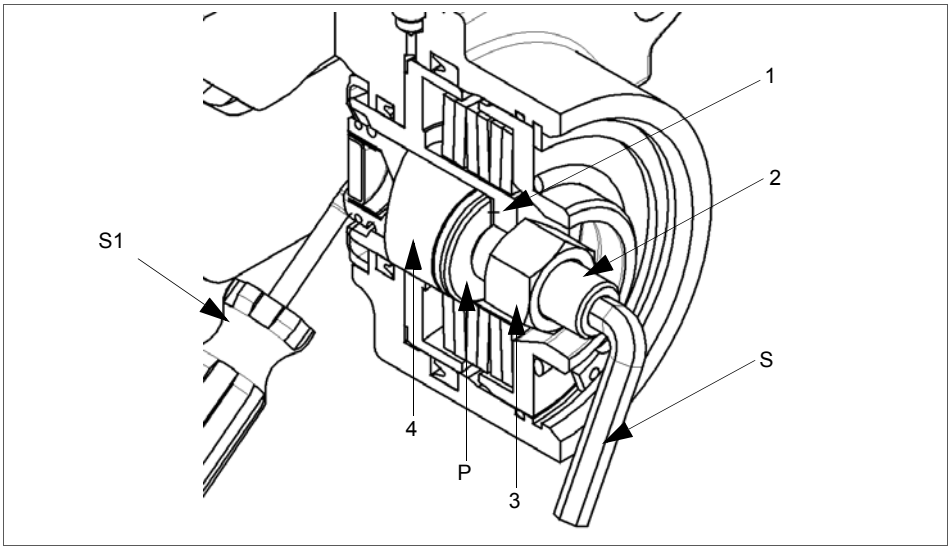
The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as inspection to ensure that the brake disk remains easy running.

The thickness of the brake lining must be subjected to a visual inspection at regular intervals, which depend on vehicle usage, but every six months at the latest. In the event of a minimal residual lining thickness, these intervals must be reduced accordingly in order to avoid major damage to the brake or disk:

– FSG 90:
  min. residual thickness 1,0 mm per lining pad (6 mm carrier plate thickness).
– FSG 100:
  min. esidual thickness 2.0 mm per lining pad (8 mm carrier plate thickness).

Bild 4-1:
Extending the lining pads

1 piston
2 adjusting screw
3 lock nut
4 thrust bolt
S socket wrench
S1 screwdriver
P inside of the piston



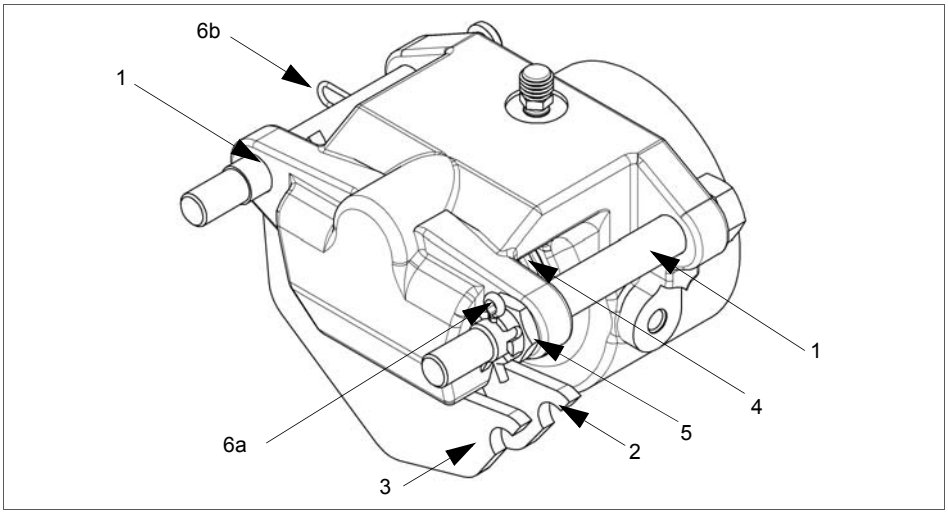
Note:

Only Knott original spare lining plates may be used. If any other spare parts are used, no warranty claims will be accepted either for the brakes or their functional characteristics

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by applying the required release pressure
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until it lies flush with the inside of the piston.
5. Press back the thrust bolt using a suitable screwdriver until it has contact with the piston.

Bild 4-2:
Exchanging the lining pads

1 guide bolt
2 lining pad
3 lining pad
4 permanent magnet
5 castellated nut
6a safety splint
6b safety clip



6. Depending on the free space available, release one of the two guide bolts, removing the safety splint, unscrewing the castellated nut and pulling the guide bolt out of the brake anchor plate. Now, the brake lining pads can be removed tangentially to the brake disk.

Note:

In the event of minimal clearance, i.e. it is not possible for space reasons to exchange the brake lining plate in accordance with these instructions, the brake must be removed completely. To do this, pull both guide bolts out of the brake anchor plate.

Caution!

Check the pressure hose. If the pressure hose is to short, it must be unscrewed to remove the brake. Before the pressure hose can be released the brake must be emergancy released.

7. Wechseln Sie die Bremsbelagträger und führen Sie den Führungsbolzen in den Bremsträger wieder ein.
   Haben Sie wegen zu geringen Freiraumes die Bremse komplett entfernt, müssen Sie diese jetzt wieder einbauen und beide Führungsbolzen einführen.Exchange the brake pads and insert the guide bolts into the brake anchor plate.If you have removed the complete brake you have to amount the brake on both guide bolt again, now.
8. Check both permanent magnets if they still have sufficient magnetic force to hold the brake lining plates.
   Should this not be the case, the permanent magnets must also be changed by using a suitable screw driver.
9. Secure the guide bolt with the castellated nut and the safety splint res. safety clip.

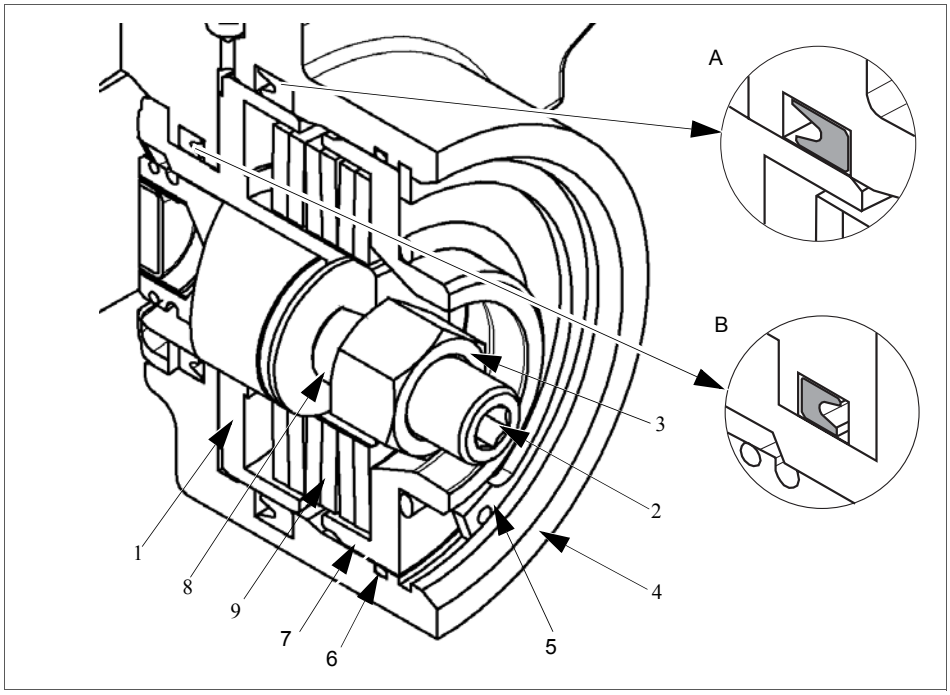
Note:

After mounting new brake lining plates or their repair, the brake must be correctly set in accordance with the instructions „Adjusting regulations“.

4.2. Changing the seal

Bild 4-3:
Change of the sealsl

1 piston
2 adjusting screw
3 lock nut
4 housing
5 circlip
6 seal
7 guide bolt
8 thrust bolt
9 bank of cup spring
A detail of the seal
B detail of the seal



Faulty seals must be exchanged in accordance with the instructions below:

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by applying the necessary release pressure.
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter clockwise until the adjuster screw is flush with the inner side of the piston.
5. Push back the thrust bolt until it has contact with the piston. Following actuate the hand brake valve. (no pressure must be in the piston chamber). The bank of cup springs is now completely depressurized.
6. Unscrew the pressure hose and remove the brake.
7. Release the circlip and remove the pressure ring of the housing.
8. Release the bank of cup spings and the piston.

Caution!

Pay attention to the mounting direction of the seal rings, otherwise leaks can occur.

Use for mounting the new seal rings a suitable mounting needle with rounded edge. Be careful,

9. Change all seals and mount the parts of the brake in other way round order. By mounting the piston, the sliding and sealing surfaces must be greased lightly using lubricating grease to DIN 51825.
   The dust protection cap is fitted with a vulcanized-in steel ring which is used to press it through the locating hole. For exchanging, "lever out" the ring using a suitable tool. The new dust protection cap must be pressed in with the aid of a suitable mounting ring and screw clamps or a lever press.

Mount the brake in accordance with the above procedure into the vehicle / at the axle.

4.3. General

Any discovered defects or damage to parts not listed here must naturally be repaired or replaced using original parts.

For any other information not contained in these instructions or for more detailed instructions, please contact the vehicle or brake manufacturer