

Reparaturanleitung
Repair Manual
Manuel de Réparation
Manual de Reparaciones
Manuale di Riparazione



6 AP 1000 B / 6 AP 1200 B / 6 AP 1400 B /
6 AP 1700 B / 6 AP 2000 B
and Angle Drive RHD
Level 3

4181 751 101



Subject to technical changes

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Index	Date of issue	Chapter	Initiator	Comment

This documentation is intended for skilled personnel trained by ZF Friedrichshafen AG to carry out maintenance and repair work on ZF products.

This manual deals with the standard ZF products in accordance with the state of development on the date of issue.

However, due to continuing technical development of the product, repair work might require work practices and test or adjustment data not contained in this manual.

We recommend that work done on your ZF product is carried out only by skilled mechanics who have had their practical and theoretical knowledge updated on a regular basis at our Customer Service / After Sales training center.

Service Centers equipped by ZF Friedrichshafen AG all over the world offer you:

1. Continually trained personnel,
2. Specified equipment, e.g. special tools,
3. Genuine ZF spares, according to our latest specifications.

All work performed at these Service Centers is carried out conscientiously and with utmost care.

Warranty:

Repair work carried out at ZF Service Centers is subject to the contractual conditions prevailing in the individual case.

Damage resulting from work performed by non-ZF personnel in an improper and unprofessional manner and any consequential costs are excluded from the contractual liability agreement. Exclusion of liability also applies if genuine ZF spares are not used.

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Safety Instructions

In principal, companies repairing ZF units are responsible for their own work safety.

To avoid injury to personnel and damage to products, all safety regulations and legal requirements which apply to repair and maintenance work must be adhered to.

Before starting work, mechanics must familiarize themselves with these regulations.

Personnel required to carry out repairs on ZF products must receive appropriate training in advance. It is the responsibility of each company to ensure that their repair staff is properly trained.

The following safety instructions appear in this manual:

NOTE

Refers to special working procedures, methods, information, use of auxiliary equipment, etc.

CAUTION

This is used when incorrect, unprofessional working practices could damage the product.



DANGER

This is used when lack of care could lead to personal injury or death.

General Information

Read this manual carefully before starting any tests or repair work.

CAUTION

Pictures, drawings, and components shown do not always represent the original object, but are used to illustrate working procedures.

Pictures, drawings, and components are not to scale. Conclusions about size and weight should not be drawn (even within a complete illustration).

Always follow the working steps as described in the text.

After completion of repair work and testing, skilled staff must check whether the product is functioning correctly.



THREATS TO THE ENVIRONMENT !

Lubricants, consumables, and cleaning agents must not be allowed to enter the soil, ground water, or sewage system.

- **Ask your local environment agency for safety information on the relevant products and adhere to their requirements.**
 - **Collect used oil in a suitably large container.**
 - **Dispose of used oil, dirty filters, lubricants, and cleaning agents in accordance with environmental protection guidelines.**
 - **When working with lubricants and cleaning agents always refer to the manufacturer's instructions.**
-

CAUTION

The transmission must NOT be suspended by the input shaft NOR by the output flange.

ZF Service Information must be observed. This information is available at all ZF Service Centers or via the ZF-ServiceLine.

In case of doubt always turn to the relevant department within ZF Customer Service / After Sales Service for advice.

All work on transmissions is to be performed by experts only and under clean conditions.

Use specified tools to dismantle and assemble transmissions.

After removing the transmission from the vehicle, clean it thoroughly with a suitable cleaning agent before opening.

Pay particular attention to the projections and recesses of housings and covers when cleaning.

Parts joined with Loctite are easier to separate if warmed with a fan heater.

Cleaning Parts

Remove remains of old gaskets on all sealing surfaces. Carefully remove burrs or similar patches of roughness using an oilstone.

Lube bores and grooves must be free of anti-corrosion agents and foreign matter; check for perfect passage.

Carefully cover opened transmissions to prevent foreign matter from entering.

Reusing Parts

Parts such as roller bearings, disks, thrust washers etc., must be inspected by a competent person who should decide whether or not they can be re-used. Replace parts which are damaged or have suffered from excessive wear.

Gaskets, Locking Plates

Parts which cannot be removed without being damaged must always be replaced with new parts (e.g. gaskets and locking plates).

Shaft Seals

Always change shaft seals with rough, ripped, or hardened sealing lips. Seal contact surfaces must be totally clean and in perfect condition.

Reworking

Rework may be carried out on seal contact surfaces using plunge-cut grinding only, never use an emery cloth. Ensure that there are no traces of grinding or scroll.

If rework is needed on spacer disks, shims etc. because of clearance adjustment, ensure that the reworked areas contain no face runout and have the same surface quality.

Transmission Assembly

Find a clean work area to assemble the transmission. Gaskets are installed without sealing compound or grease. When measuring silicon-coated gaskets, do **not include the silicon layer**. During assembly, comply with all adjustment data and tightening torques in the Repair Manual.

Bearings

If bearings are mounted in heated condition, they are to be heated evenly (e.g. heating cabinet). Temperature should be at approx. 85 °C and must not exceed 120 °C. Each mounted bearing must be lubricated with operating oil.

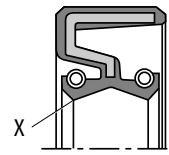
Sealing

If a specific sealing agent* is to be used for sealing, comply with the manufacturer's directions for use. Apply a thin layer of sealing agent to the surfaces and spread evenly. Do not allow sealing to enter oil ducts and bores. On oil-carrying ducts and bores, wipe off the sealing agent on the surfaces to be sealed near apertures to ensure that no sealing agent enters the oil feeds when the parts are pressed together.

Shaft Seals

- a) Apply a light coat of sealing agent* on circumference of shaft seals with "steel jacket".
- b) **Never apply sealing agent** to shaft seals with "rubber jacket", but apply a thin coat of Vaseline 8420 to the outer circumference or wet with a lubricant, e.g. a water-soluble, concentrated washing-up liquid (e.g. Pril, Coin, Palmolive).
- c) Shaft seals with steel and rubber jackets should be treated on the outer circumference of the rubber jacket as described for shaft seal b).

- d) Dual shaft seals have two sealing lips. The dust-proof sealing lip (X) must face outwards.



- e) Fill the gap between the sealing lips so it is 60 % filled with grease (e.g. produced by Aral, such as Aralub HL2 or by DEA, such as Spectron FO 20).
- f) If possible, heat shaft seal bores to between 40 and 50 °C (makes fitting easier). Press in shaft sealing ring with mounting or face plate until firmly home at relevant installation depth.

Retaining Agents

Retaining agents* may only be used where specified by the parts list.

Always comply with manufacturer's directions for use when using retaining agents (e.g. Loctite).

During assembly, comply with all adjustment data, checking data, and tightening torques.

Transmission Oil

After completing repairs, fill transmissions with transmission oil. For the procedure and approved oil grades, refer to the transmission Operating Instructions and TE-ML List of Lubricants (refer to identification plate) which can be obtained from all ZF Customer Service / After Sales Centers and on the Internet under www.zf.com.

After filling the transmission with oil, tighten the screw plugs at the oil filling point and the oil overflow using the specified torques.

* refer to expendable material

Tightening Torques for Bolts/Screws and Nuts

Extract from ZFN 148

This standard applies to screws/bolts acc. to DIN 912, DIN 931, DIN 933, DIN 960, DIN 961, as well as ISO 4762, ISO 4014, ISO 4017, ISO 8765, ISO 8676, and to nuts acc. to DIN 934 as well as ISO 4032, ISO 8673.

This Standard contains data on tightening torques for screws/bolts and nuts in strength categories 8.8, 10.9, and 12.9, and nuts in strength categories 8, 10, and 12.

Surface condition of bolts/screws and nuts: Thermally blackened and oiled or galvanized and oiled or galvanized, chromated, and oiled.

Tighten screws/bolts with a calibrated ratchet dial torque or ratchet wrench.

NOTE

Deviating tightening torques are listed separately in the Repair Manual.

Regular screw thread			
Size Screw/Bolt Nut	Tightening torque (Nm) for		
	8.8	10.9	12.9
	8	10	12
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

Fine screw thread			
Size Screw/Bolt Nut	Tightening torque (Nm) for		
	8.8	10.9	12.9
	8	10	12
M8x1	24	36	43
M9x1	36	53	62
M10x1	52	76	89
M10x1.25	49	72	84
M12x1.25	87	125	150
M12x1.5	83	120	145
M14x1.5	135	200	235
M16x1.5	205	300	360
M18x1.5	310	440	520
M18x2	290	420	490
M20x1.5	430	620	720
M22x1.5	580	820	960
M24x1.5	760	1100	1250
M24x2	730	1050	1200
M27x1.5	1100	1600	1850
M27x2	1050	1500	1800
M30x1.5	1550	2200	2550
M30x2	1500	2100	2500

Screw Plugs DIN 908, 910, and 7604

The screw plug tightening torques were determined according to DIN 7604 for screwing into steel, gray cast, and aluminum alloys.

The values are based on experience and are intended as reference values for the fitter.

The values for the tightening torque apply analogously to screw plugs according to DIN 908 and DIN 910, as the thread geometries are almost identical.

General rule:

Screw/Bolt class 5, ZFN 148-1

Screw/Bolt material: Steel acc. to DIN 7604.

Surface condition: As manufactured (without surface protection) and lightly oiled or galvanized, chromated, and lightly oiled.

Screw plugs (DIN 908, 910, 7604)		
Dimensions	Tightening torque in Nm screwed into	
	steel/gray cast	Al alloy
M8x1	20*	10*
M10x 1	25 / 30*	15 / 20*
M12x1.5	35	25
M14x1.5	35	25
M16x1.5	40	30
M18x1.5	50	35
M20x1.5	55	45
M22x1.5	60 / 80*	50 / 65*
M24x1.5	70	60
M26x1.5	80 / 105*	70 / 90*
M27x2	80	70
M30x1.5	100 / 130*	90 / 130*
M30x2	95	85
M33x2	120	110
M36x1.5	130	115
M38x1.5	140	120
M42x1.5	150	130
M42x2	145	125
M45x1.5	160	140
M45x2	150	130
M48x1.5	170	145
M48x2	160	135
M52x1.5	180	150
M60x2	195	165
M64x2	205	175

Union Screws DIN 7643

The tightening torques were determined for screwing into steel, gray cast, and aluminum alloys.

The values are based on experience and are intended as reference values for the fitter.

General rule:

Screw/Bolt class 5, ZFN 148-1

Material: 9SMnPb28K acc. to DIN 1651

Surface condition: As manufactured (without surface protection) and lightly oiled or galvanized, chromated, and lightly oiled.

Union screws (DIN 7643)		
Pipe outer diameter	Thread	Tightening torque in Nm
4 - 5	M8x1	20 - 25
6	M10x1	25 - 35
8	M12x1.5	30 - 40
10	M14x1.5	35 - 40
12	M16x1.5	45
15	M18x1.5	50
18	M22x1.5	60
22	M26x1.5	90
28	M30x1.5	130
35	M38x1.5	140

* DIN 7604 Form C

Designation ZF item number	Name(s)	Quantity Approx.	Application	Comments
Grease 0750 199 001	For example Spectron FO 20		Assembly aids in general	
Grease 0671 190 016	techn. Vaseline 8420		Assembly aids in general	
Transmission oil	Refer to TE-ML14 List of Lubricants		Assembly aid in general	

NOTE: Inquire size of containers before placing any orders!

Designation	Dimension	Measurement device	Comment
01. Screw Plug Clutch - Measurement Connection Valve	65,0 Nm	Torque wrench	
02. Screw Plug Valve Clutch	8,0 Nm	Torque wrench	
03. Impulse Sensor 1599E KITAS2	35,0 Nm	Torque wrench	
04. Union Screw 10S DIN7643 0637.835.013	40,0 Nm	Torque wrench	
05. Nut Retarder Accumulator	80,0 Nm	Torque wrench	
06. TORX Screws Stator Ring M6X25	9,5 Nm	Torque wrench	
07. TORX Screws Multidisk Carrier D/E M6X25	9,5 Nm	Torque wrench	
08. TORX Screw, Speed Sensor M6x25	9,5 Nm	Torque wrench	
09. TORX Screw Speed Sensor M6x17	9,5 Nm	Torque wrench	
10. TORX Screw Valve Block M6X55	9,5 Nm	Torque wrench	
11. TORX Screws Solenoid Valves Hydraulic Control Unit M6X17	9,5 Nm	Torque wrench	
12. Hex Head Screw/Bolt Control Unit M6X26	9,5 Nm	Torque wrench	
13. Hex Head Screw/Bolt Holding Plate Wiring Harness M6X17	9,5 Nm	Torque wrench	
14. Hex Head Screw/Bolt Suction Filter M6X25	9,5 Nm	Torque wrench	
15. Cylindrical Screw/Bolt Planet Carrier Output Impulse Ring M6X12	9,5 Nm	Torque wrench	
16. TORX Screw Valve Block Sheet Metal Duct Plate M6X55	9,5 Nm	Torque wrench	
17. TORX Screw Pump Support Plate M8X50	20,0 Nm	Torque wrench	

Designation	Dimension	Measurement device	Comment
18. TORX Screw Sealing Disk Oil Feed Flange M8X60	23,0 Nm	Torque wrench	
19. TORX Screw Valve Housing M8X60	23,0 Nm	Torque wrench	
20. TORX Screw Pump Housing Pump Cover M8x28	23,0 Nm	Torque wrench	
21. TORX Screw Baffle Plate Clutch B M8x28	23,0 Nm	Torque wrench	
22. Hex Head Screw/Bolt Power Lock M8X29	34,0 Nm	Torque wrench	
23. TORX Screw Oil Supply M8X85	20,0 Nm	Torque wrench	
24. TORX Screw Oil Supply Pump Oil Feed Flange M8X50	20,0 Nm	Torque wrench	
25. TORX Screw Oil Supply M8X36	20,0 Nm	Torque wrench	
26. TORX Screw Cover Plate M8X36	20,0 Nm	Torque wrench	
27. TORX Screw Shift Actuation System M8X36	20,0 Nm	Torque wrench	
28. TORX Screw Change-Over Valve Brake D M8X36	20,0 Nm	Torque wrench	
29. Hex Head Screw/Bolt Filter Cover Oil Sump M8X30	23,0 Nm	Torque wrench	
30. Hex head bolt/screw Deckel M8X30	23,0 Nm	Torque wrench	
31. Hex Head Screw/Bolt Oil Sump M8X55	23,0 Nm	Torque wrench	

Designation	Dimension	Measurement device	Comment
32. Dipstick Parts Filler Tube M8X22	23,0 Nm	Torque wrench	
33. Hex Head Screw/Bolt Pipe ROC Return Flow M8X30	23,0 Nm	Torque wrench	
34. Hex Head Screw/Bolt Pipe ROC Coolant Return Flow /Feed-In Flow M8X12	23,0 Nm	Torque wrench	
35. Hex Head Screw/Bolt Pipe ROC Fastening M8X12	23,0 Nm	Torque wrench	
36. Heat Exchanger M8X22	23,0 Nm	Torque wrench	
37. TORX Screw Bearing Unit Output Cover M8X28	23,0 Nm	Torque wrench	
38. M10x1 screw plug	15,0 Nm	Torque wrench	
39. Screw Plug Oil Sump M10X1	12,0 Nm	Torque wrench	
40. Hex Head Screw/Bolt Bracket M10X53	46,0 Nm	Torque wrench	
41. Hex Head Screw/Bolt Output Cover M10X53	46,0 Nm	Torque wrench	
42. Hex Head Screw/Bolt Output Cover M10X73	46,0 Nm	Torque wrench	
43. TORX Screw Brake M10X135	50,0 Nm	Torque wrench	
44. TORX Screw Support Plate Valve Housing Stator Shaft Oil Feed M10X60	46,0 Nm	Torque wrench	
45. Hex Head Screw/Bolt Heat Exchanger M10X100	46,0 Nm	Torque wrench	
46. Hex Head Screw/Bolt Oil Sump M10X53	46,0 Nm	Torque wrench	

Designation	Dimension	Measurement device	Comment
47. Hex head bolt/screw Cover M10X35	46,0 Nm	Torque wrench	
48. Hex Head Screw/Bolt Oil Sump M12X55	88,00 Nm	Torque wrench	
49. Hex Head Screw/Bolt Output Flange M12X60	80,0 Nm	Torque wrench	
50. Hex Head Screw/Bolt Planetary Gear Set M12X60	80,0 Nm	Torque wrench	
51. Hex Head Screw/Bolt Output Flange M12X60	80,0 Nm	Torque wrench	
52. Screw Plug Clutch M14X1.5	35,0 Nm	Torque wrench	
53. Screw Plug Filter Cover M14X1.5	25,0 Nm	Torque wrench	
54. Cylindrical Screw/Bolt Converter M16	185,0 Nm	Torque wrench	
55. Screw Plug Converter M36X1.5	120,0 Nm	Torque wrench	
56. Screw Plug Output Cover M18X1.5	35,0 Nm	Torque wrench	
57. Screw Plug Oil Sump M14X1.5	25,0 Nm	Torque wrench	
58. Screw Plug Transmission Housing M36X1.5	120,0 Nm	Torque wrench	
59. Central Play	0,60 - 0,80 mm	Measuring Ledges and Depth Gage	Adjusting Washer A=5.4 OTK no.: 0730 113 055(0)- A= 2.60- 6.00
60. Preload Tapered Roller Bearing Output Cover	-0,05 mm up to +0,05 mm	Setting Ring and Dial Gage	OTK no.: 0730 113 417()- A= 1,10- 2,00

Designation	Dimension	Measurement device	Comment
01. Screw plug for M14x1.5 connecting housing	35,0 Nm	Torque wrench	
02. Output shaft bevel gear M14x1.5x30	250,0 Nm	Torque wrench	
03. Hex head bolt/screw for M12x60 planetary gear set	80,0 Nm	Torque wrench	
04. Stud for output housing M14x1.5x40	40,0 Nm	Torque wrench	
05. Hex head bolt/screw for piping of inner M8x29 angle drive	34,0 Nm	Torque wrench	
06. M42x1.5 screw plug	120,0 Nm	Torque wrench	
07. Hex head bolt/screw Cover of the M12x1.5x55 output housing	100,0 Nm	Torque wrench	
08. Hexagon nut for the M14x1.5 connecting housing	170,0 Nm	Torque wrench	
09. Hex head bolt/screw for the M14x1.5x45 connecting housing	170,0 Nm	Torque wrench	
10. TORX screw for speed sensor M6x45	8,5 Nm	Torque wrench	
11. Impulse sensor	45,0 Nm	Torque wrench	
12. M10x53 hex head bolt/screw	46,0 Nm	Torque wrench	
13. M10 hexagon nut	46,0 Nm	Torque wrench	
14. Union screw for piping of clutch, outer angle drive	40,0 Nm	Torque wrench	
15. M8x22 hex head bolt/screw	23,0 Nm	Torque wrench	
16. Preload connecting housing	0,02 mm up to 0,07 mm	Spacer bush and adjusting washer	
17. Preload output shaft	0,02 mm up to 0,07 mm	Adjusting washer	OTK no.: 0730 113 240

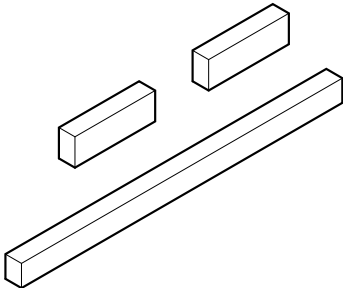
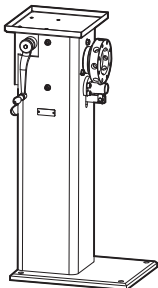
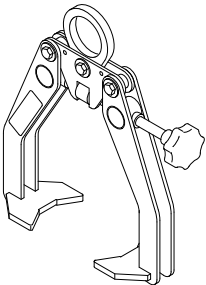
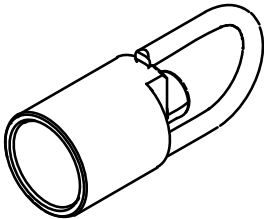
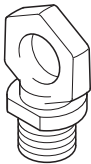
Fig. no.	Figure	Order no.	Application	Qty.	Comments
1		1P01 139 821 Measuring support OPTIONAL!		1	
2		1P01 181 850 Assembly stand for transmission support (in conjunction with clamping device 1X56 139 475)		1	
3		1T66 153 417 Spindle pliers for lifting the clutch carrier		1	
4		1T66 156 231 Adapter for mounting the turbine shaft		1	
5		1T66 160 674 Eye bolt for lifting the converter		1	

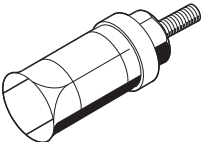
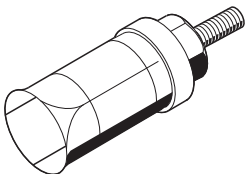
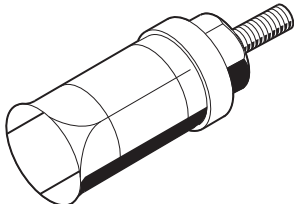
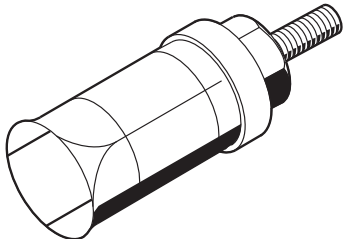
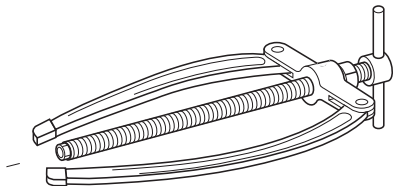
Fig. no.	Figure	Order no.	Application	Qty.	Comments
6		1X56 122 207 Extractor 28-40 in conjunction with 1X56 122 227		1	
7		1X56 122 209 Extractor 45-58 in conjunction with 1X56 122 227		1	
8		1X56 122 210 Extractor 56-70 in conjunction with 1X56 122 228		1	
9		1X56 122 211 Extractor 70-100 in conjunction with 1X56 122 228		1	
10		1X56 122 227 Basic equipment used in conjunction with internal extractor 1X56 122 207 1X56 122 209		1	

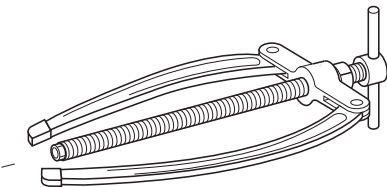
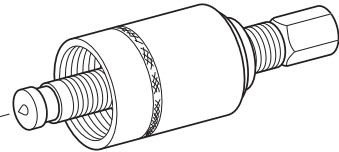
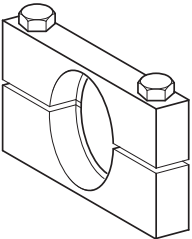
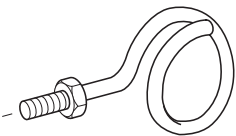
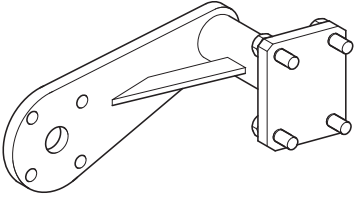
Fig. no.	Figure	Order no.	Application	Qty.	Comments
11		1X56 122 228 Basic equipment used in conjunction with internal extractor 1X56 122 210 1X56 122 211		1	
12		1X56 122 306 Basic equipment in conjunction with 1X56 138 539		1	
13		1X56 124 659 Extractor plate for the bearing inner race of the stator quill shaft		1	
14		1X56 136 564 Lifting device M10		2	
15		1X56 136 594 Adapter (left) for transmission location (in conjunction with assembly support 1X56 137 450) OPTIONAL - no longer available!		1	

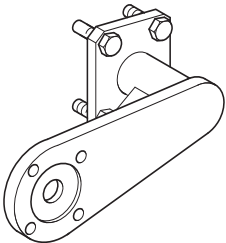
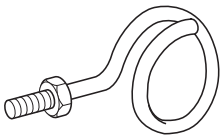
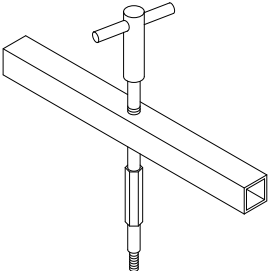
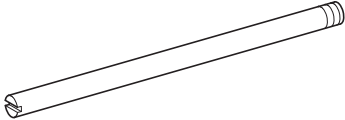
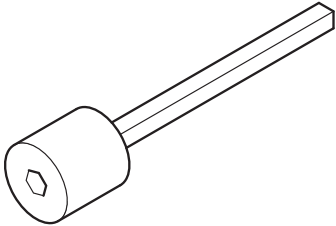
Fig. no.	Figure	Order no.	Application	Qty.	Comments
16		1X56 136 595 Adapter (right) for transmission location (in conjunction with assembly support 1X56 137 450) OPTIONAL - no longer available!		1	
17		1X56 136 599 Lifting device M12 for lifting the output cover		1	
18		1X56 136 815 Extractor for extracting the cover plate		3	A package contains three extracting fixtures
19		1X56 136 821 Guide screws M8 x 160		2	
20		1X56 136 863 Plug insert (long internal hexagon in conjunction with 1X56 136 864)		1	

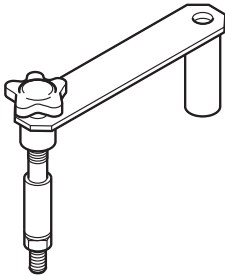
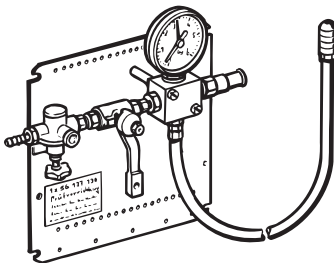
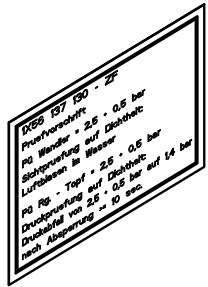
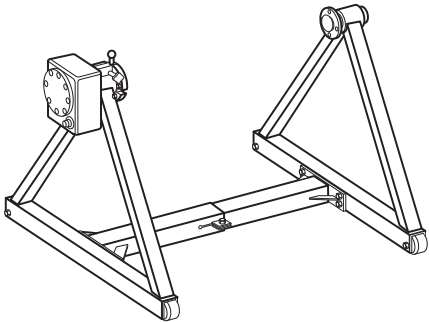
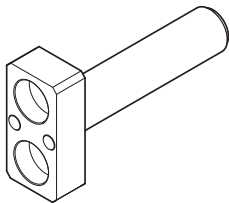
Fig. no.	Figure	Order no.	Application	Qty.	Comments
21		1X56 136 864 Holding device for loosening and removing the M16 cylindrical screw in the converter in conjunction with the Allen wrench no.: 1X56 136 863		1	
22		1X56 137 130 Compressed-air unit for leakage test		1	
23		1X56 137 130/1 Plate for the compressed-air reservoir inspection of the EcoLife Stuck to the compressed-air reservoir no.: 1X56 137 130		1	
24		1X56 137 450 Assembly stand (in conjunction with the adapter no.: 1X56 136 594/595) OPTIONAL - no longer available!		1	
25		1X56 137 452 Adapter for safety plate on output flange		1	

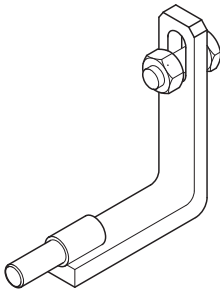
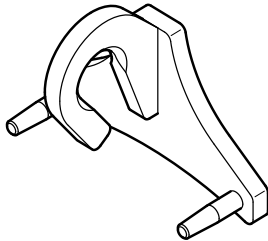
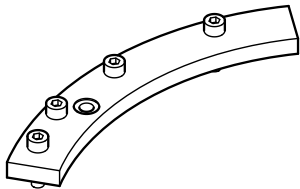
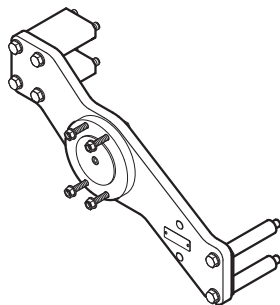
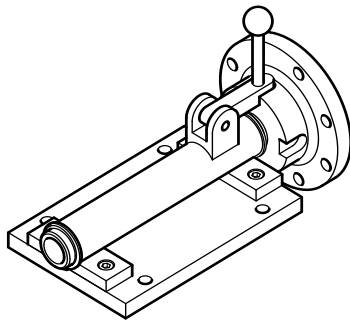
Fig. no.	Figure	Order no.	Application	Qty.	Comments
26		1X56 137 658 Counter holder for loosening and tightening the screw plug in the converter	1		
27		1X56 137 997 Lifting fixture for lifting the transmission	1		
28		1X56 138 540 Press-off device for TOC leakage test	1		
29		1X56 138 541 Clamping device for Ecomat and EcoLife transmission location (in conjunction with the assembly support no.: 1P01 181 850) OPTIONAL	1		
30		1X56 138 542 Clamping device for 1X56 189 852	1		

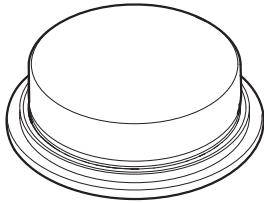
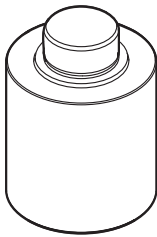
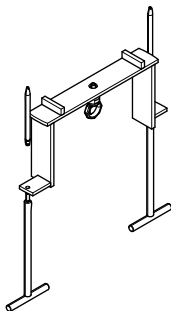
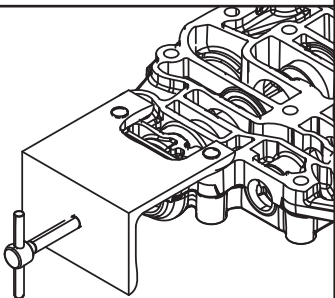
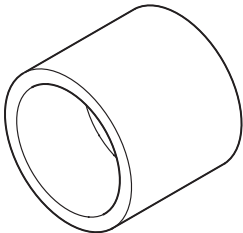
Fig. no.	Figure	Order no.	Application	Qty.	Comments
31		1X56 138 551 Press-in mandrel for pressing in needle bush 0735 298 323 in planet carrier I		1	
32		1X56 138 552 Press-in adapter for pressing in needle bearing in turbine shaft		1	
33		1X56 138 556 Holding device for assembly of complete planetary drive		1	
34		1X56 138 557 Assembly device for mounting holding plate in valve housing		1	
35		1X56 138 558 Bush for pressing in inner ring in planet carrier 2		1	

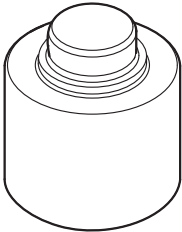
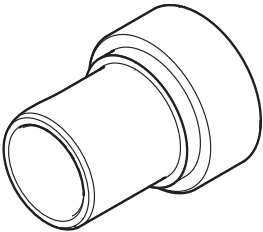
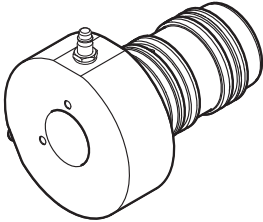
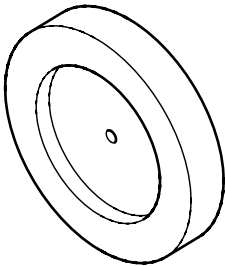
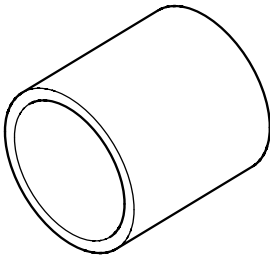
Fig. no.	Figure	Order no.	Application	Qty.	Comments
36		1X56 138 559 Press-in mandrel for pressing in needle bush in planet carrier 3		1	
37		1X56 138 560 Press-in mandrel for pressing in needle bush in planet carrier 2		1	
38		1X56 138 562 Press-off device for pressing off the pistons A + B		1	
39		1X56 138 588 Support for the stator bearing		2	
40		1X56 138 589 Support for the tapered roller bearings at the output		1	

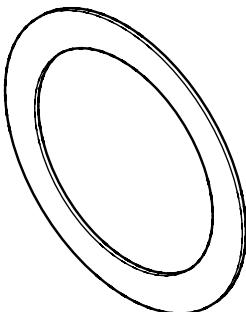
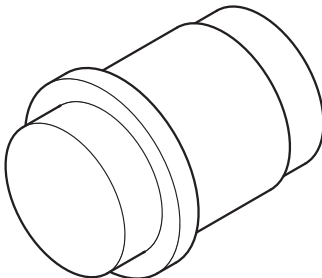
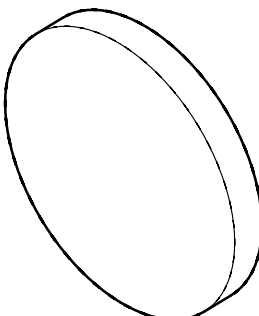
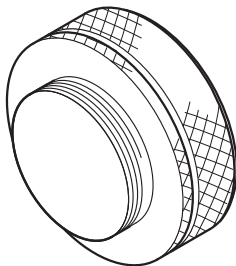
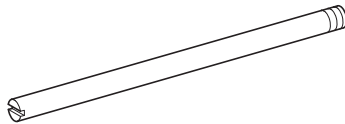
Fig. no.	Figure	Order no.	Application	Qty.	Comments
41		1X56 138 590 Assembly tool for the shaft sealing ring output second position	1		
42		1X56 138 591 Adapter for the tapered roller bearing for pressing it out of and into the converter	1		
43		1X56 138 592 Adapter for the roller bearing installation in the converter	1		
44		1X56 138 596 Gripper for the tapered roller bearing at the output (coax) and the angle drive in conjunction with 1X56 122 306	1		
45		1X56 138 599 Guide screw for the tapered roller bearing at the output in M10 x 160	2		

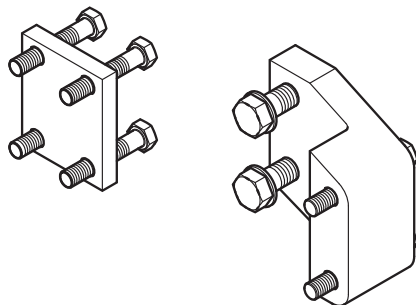
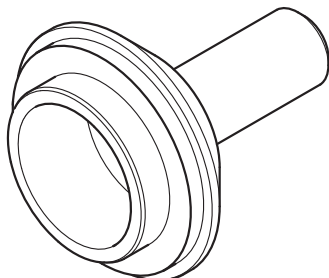
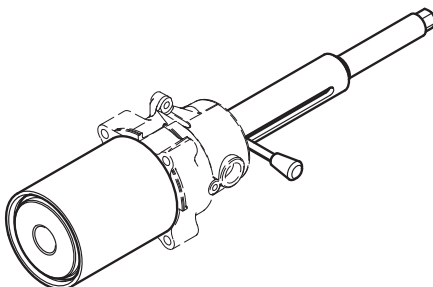
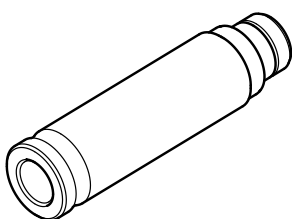
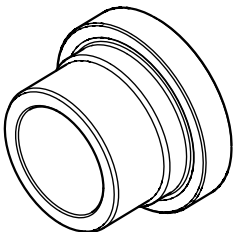
Fig. no.	Figure	Order no.	Application	Qty.	Comments
46		1X56 138 607 Adapter for transmission support EcoLife (in conjunction with clamping plate Ecomat no.: 1X56 139 475) OPTIONAL	1		
47		1X56 138 625 Press-in mandrel for the shaft sealing ring - output	1		
48		1X56 138 642 Tools for the assembly/disassembly of the accumulator	1		
49		1X56 138 648 Press-in mandrel for pressing in the bush in the stator quill shaft	1		
50		1X56 138 649 Press-in adapter for pressing in needle bearing in clutch carrier for pressing on the ball bearing on the converter's torsional absorber	1		

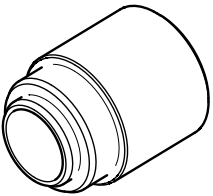
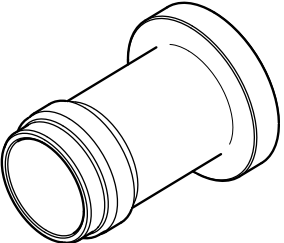
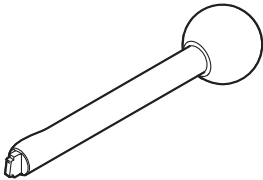
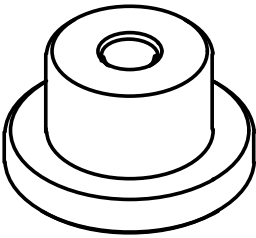
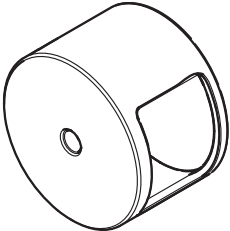
Fig. no.	Figure	Order no.	Application	Qty.	Comments
51		1X56 138 650 Press-in mandrel for pressing in quill shaft		1	
52		1X56 138 651 Press-in adapter for pressing in needle bearing in clutch carrier		1	
53		1X56 138 652 Assembly adapter for mounting pistons in valve housing		1	
54		1X56 138 653 Press-in adapter for pressing in drive gear on drive shaft		1	
55		1X56 138 655 Press-in adapter for mounting locking ring		1	

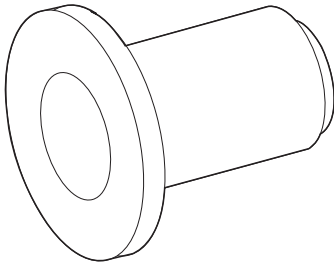
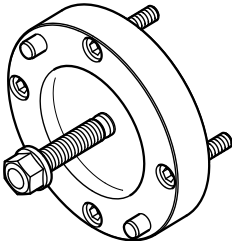
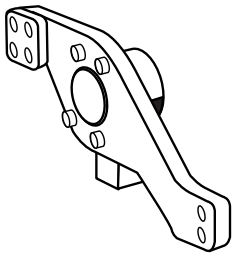
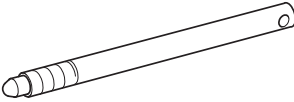
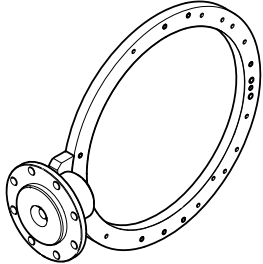
Fig. no.	Figure	Order no.	Application	Qty.	Comments
56		1X56 138 680 Adapter for pressing in the shaft sealing ring into the cover plate		1	
57		1X56 139 464 Clamping device for the assembly fixture no.: 1X56 189 852 OPTIONAL!		1	
58		1X56 139 475 Ecomat clamping fixture for placing transmission in assembly support (in conjunction with the assembly support no.: 1P01 181 850)		1	
59		1X56 150 111 Guide screw M6 x 130		1	
60		1X56 189 852 Assembly device for the OPTIONAL control insert with 1X56 139 464		1	


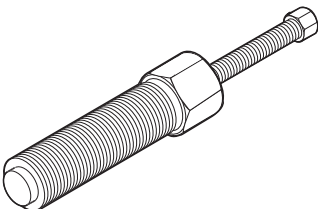
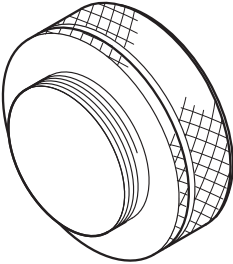
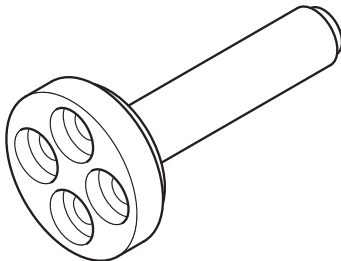
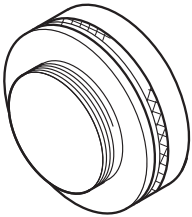
Fig. no.	Figure	Order no.	Application	Qty.	Comments
1		1T66 160,889 Eye bolt for lifting output shaft from angle drive		1	
2		1X56 122 292 Hydraulic spindle (in conjunction with basic unit no.: 1X56 122 306)		1	
3		1X56 136 705 Gripper for extracting tapered roller bearing B02 (in conjunction with 1X56 122 306)		1	
4		1X56 138 067 Adapter for locking plate on the bevel gear		1	
5		1X56 138 130 Gripping adapter for the bearing puller no.: 1X56 138 643		1	

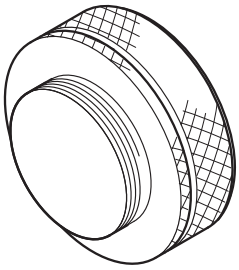
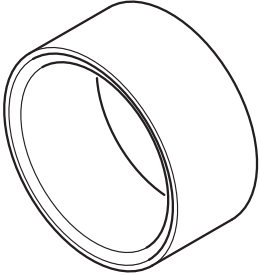
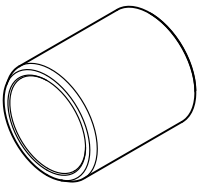
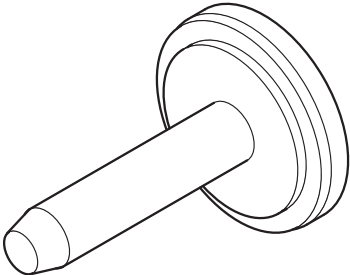
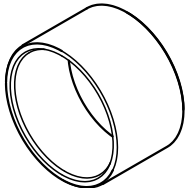
Fig. no.	Figure	Order no.	Application	Qty.	Comments
6		1X56 138 596 Gripper for the tapered roller bearing at the output (coax) and the angle drive bearing A01 (in conjunction with 1X56 122 306)		1	
7		1X56 138 622 Press-off/press-in device for bevel gear on output shaft		1	
8		1X56 138 623 Assembly adapter for mounting taper roller bearing A02 to output shaft		1	
9		1X56 138 624 Pressing device for mounting taper roller bearing B02 to output shaft		1	
10		1X56 138 638 Assembling sleeve for mounting taper roller bearing B01 to bevel gear		1	

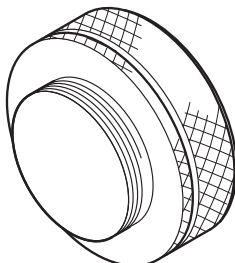
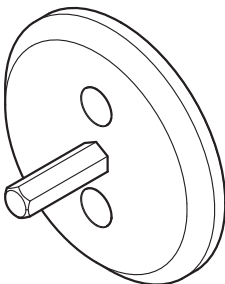
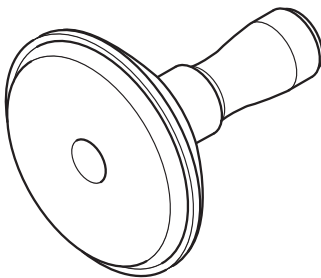
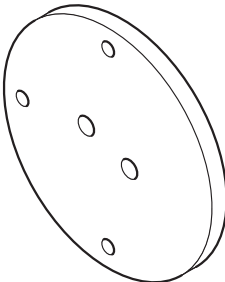
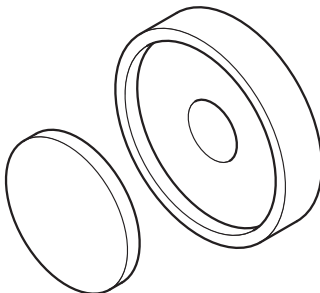
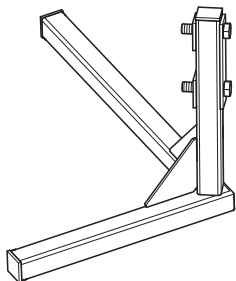
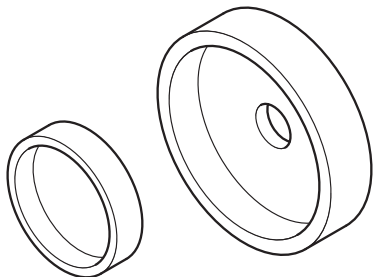
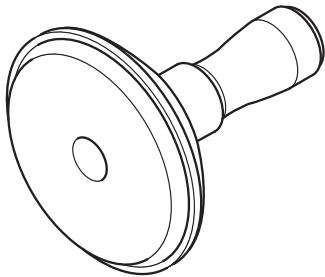
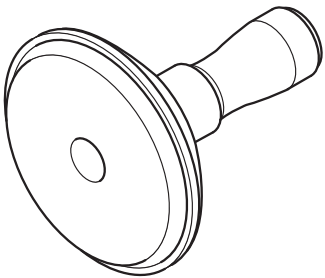
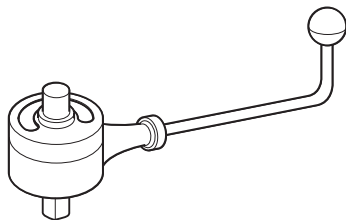
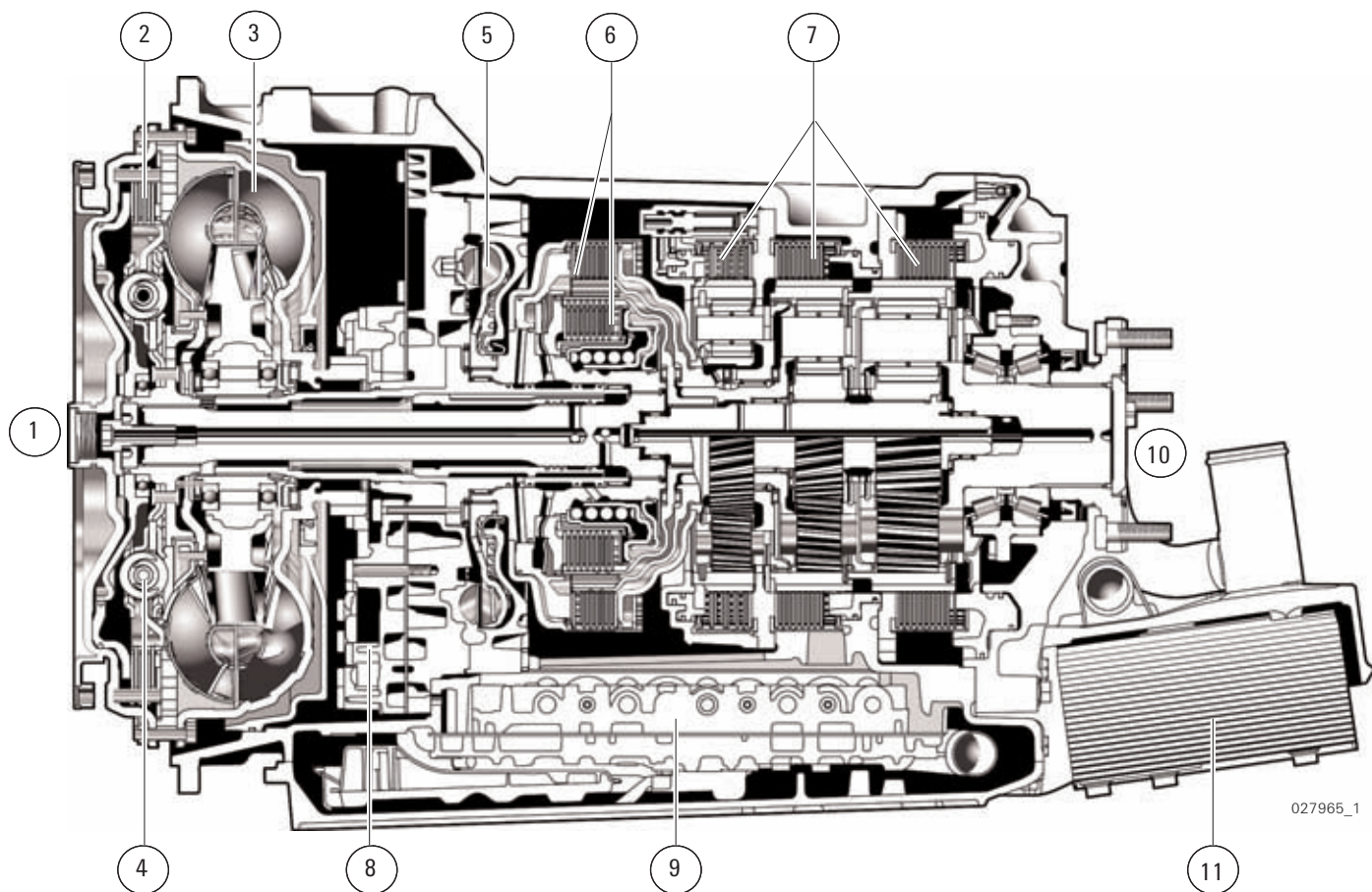
Fig. no.	Figure	Order no.	Application	Qty.	Comments
11		1X56 138 643 Gripper for input-end bevel gear, for extracting taper roller bearing B01	1		
12		1X56 138 644 Measuring device for measuring rolling resistance of taper roller bearings	1		
13		1X56 138 645 Press-in fixture for pressing in bearing outer ring of taper roller bearing B02	1		
14		1X56 138 646 Measuring device for bearing pack output	1		
15		1X56 138 657 Measuring device for bearing output shaft, for measuring taper roller bearing B02	1		

Fig. no.	Figure	Order no.	Application	Qty.	Comments
16		1X56 138 647 Assembly support for angle drive		1	
17		1X56 138 658 Measuring device for bearing drive unit, for measuring taper roller bearing B01		1	
18		1X56 138 659 Press- in fixture for pressing in bearing outer ring of taper roller bearing A02		1	
19		1X56 138 660 Press-in fixture for pressing in bearing outer ring of taper roller bearing A01		1	
20		1X56 186 359 Torque gage for rolling-resistance measurement on tapered roller bearings		1	

6 AP 1000 B, 6 AP 1200 B, 6 AP 1400 B, 6 AP 1700 B, and 6 AP 2000 B

027965_1

Key to drawing

1	Input	6	Clutches A, B
2	Torque converter lockup clutch (WK)	7	Brakes D, E, F
3	Torque Converter	8	Oil pump
4	Torsional-vibration damper	9	Hydraulic control
5	Retarder	10	Output
		11	Retarder heat exchanger

Cleanliness Instructions

NOTE

In the case of repair work, attention must be paid to ultimate cleanliness, in particular in the area of the hydraulic control unit, the oil pump, the pressure filter, the valve housing, and the oil feed flange. Dirt particles in the above mentioned sectors may lead to impairments of the transmission's functions.

ZF recommends not to clean the transmission outer parts together with the above mentioned components but to install separate and/or additional cleaning processes respectively.

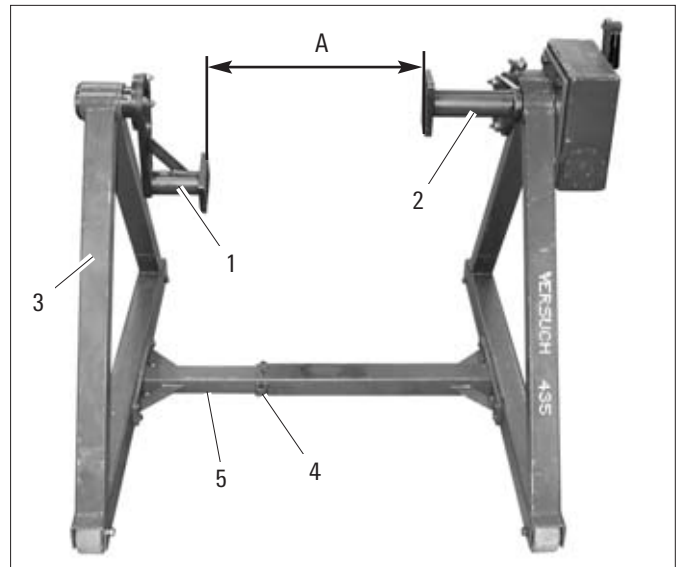
The following requirements must be observed for the assembly process and/or the working environment:

- Metal-cutting machining (rework) during assembly including subsequent blowing-off activities for the components may (if at all!) only be carried out in separate, specifically designated rooms.
- The working surfaces must be wear-resistant and easy-to-clean e.g. by means of using V4A sheet metal with rubber support (noise protection); avoid corners and offsets which are not easily accessible.
- Support surfaces for material/tools and similar items must always be designed in such a way (e.g. grate, perforated sheet metal) that no deposits may occur.
- Equipment (cabins, racks, lathes) and its respective arrangement in the room must always be designed in such a way that problem-free and easy cleaning of the room/floor is possible.
- In the case of components made from Fe-metals, you must ensure that the parts are demagnetized.
- Only use process materials of a defined purity category e.g. compressed air for inspection processes or Vaseline and, if necessary, cover up prior to/after utilization.
- The application of lubricants must always be effected by means of "wear-free" high-quality brooms since the utilization of low-cost brooms may lead to soiling caused by the broom's bristles falling off.
- Fixtures must be designed and used in such a way that mechanical damage of the part/product is excluded and the fixture does not suffer from excessive wear.
- The use of mechanical stroke and blow processes should be reduced to an absolute minimum. In the case it cannot be avoided at all: Use impact adapter with large stroke/impact face.
- Make sure that cleaning cloths do not loose their fibers; suitable products can be procured on the market.
- Only warehouse and transport ready-to-install components and assembly groups when properly covered.
- If possible, exclude the ingress and utilization of wood, styrofoam, fiber plates, waxed paper, and other easily distributable auxiliary materials in the assembly area.
- Thanks to wear-resistant sealing, the floor can be easily cleaned.
- Do not sweep the workshop area; make sure it is vacuum-cleaned. Plan regular cleaning (wet!) intervals for the floor sections.

1 Placing transmission in assembly support and lifting it out

1.1 Placing transmission in assembly support

- 1 Mount adapters **1X56 136 594** and **1X56 136 595 (1/2)** to transmission assembly support **1X56 137 450 (3)**.
- 2 Tighten hexagon nuts and M10 hex head screws/bolts.
Tightening torque: 46 Nm
- 3 Loosen the Allen screws **(4)** lösen.
- 4 The distance "A" for the transmission to be placed can be adjusted by moving the central crossbeam **(5)**.
- 5 After adjusting distance "A", the Allen screws **(4)** must be tightened.



022078

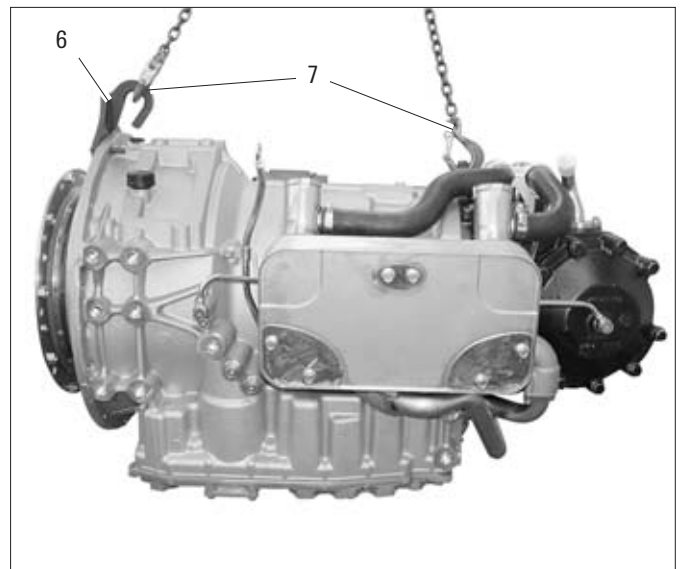


DANGER

Transmission may fall down!

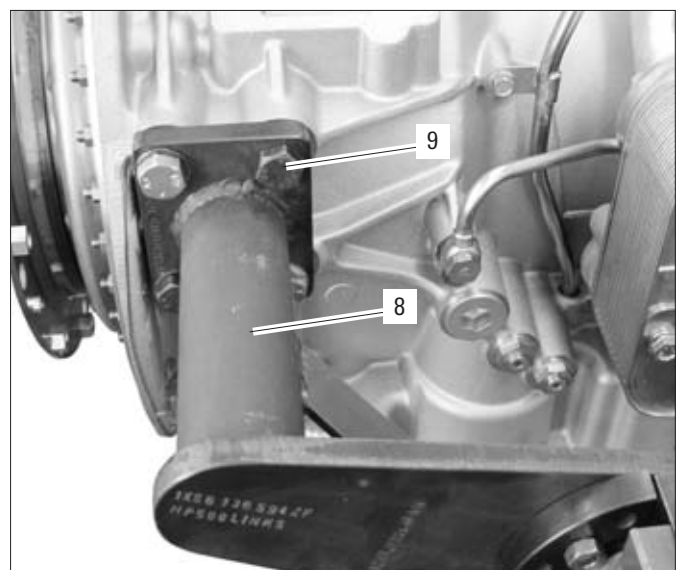
Risk of injury!

Use suitable lifting equipment. The lifting equipment must be configured for the total weight of the transmission.



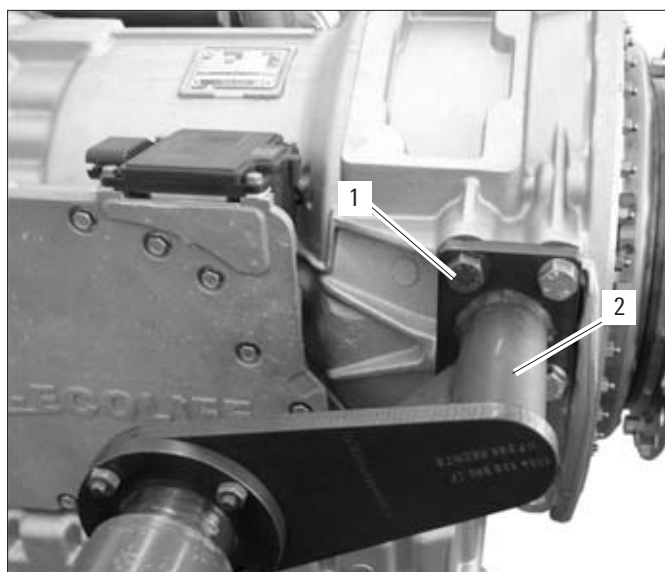
030391

- 6 Mount the lifting device **1X56 137 997 (6)**.
- 7 Mount the lifting equipment **(7)**.
- 8 Lift transmission and position it over assembly support, center it between the adapters, and then let down.
- 9 Swivel up the first adapter **(8)**, opposite to the crank) and attach to transmission using four hex head screws/bolts **(9)**.
Tightening torque: 225 Nm



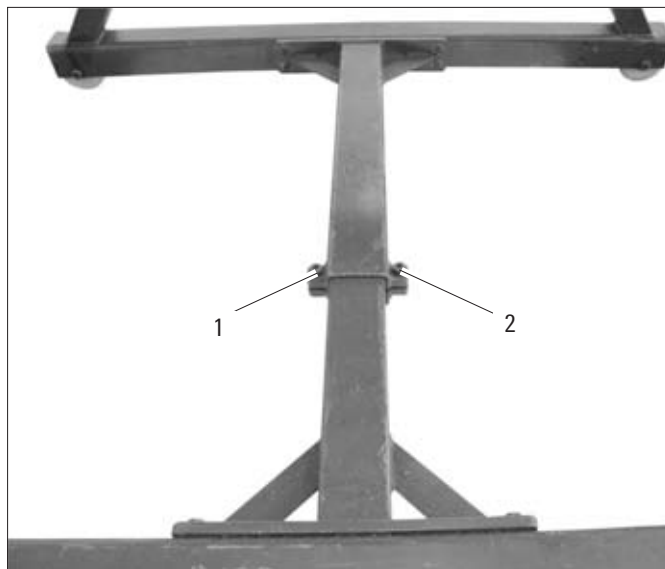
025899

- 10 Bring second adapter **(2)** with crank in the correct position and attach to the transmission by means of four hex head screws/bolts M16x1.5 **(1)**.
Tightening torque: 225 Nm



025900

- 12 Tighten Allen screws **(1, 2)**.



030001

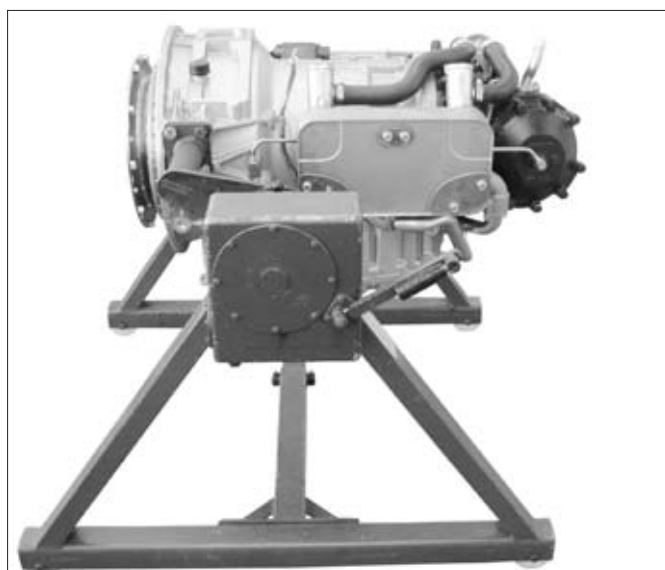
**DANGER**

Transmission is not protected from swiveling around!

Risk of injury!

Avoid jolts and impacts outside of the swiveling axis.

- 13 Remove the lifting equipment.



030000

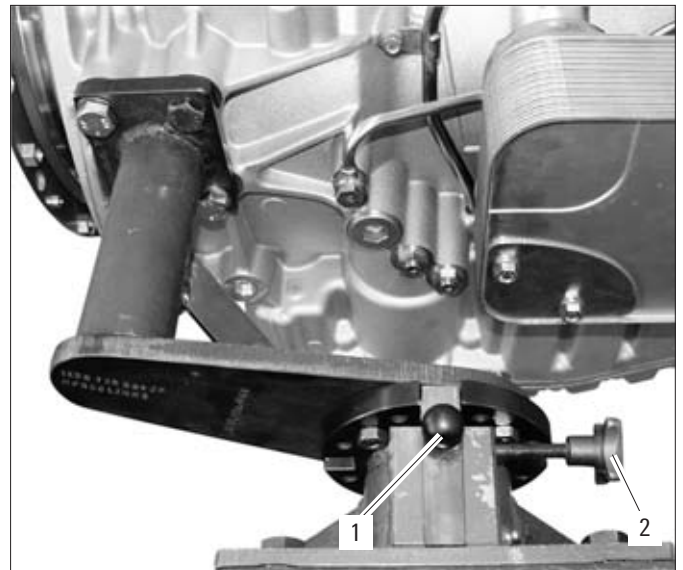
**DANGER**

Transmission is moving!

Risk of squashing/bruising!

Do not remain within swiveling range during the swiveling movement. Use detent (1) to lock the assembly support after each swiveling process. Lock detent (1) safely with butterfly nut (2).

- 13 Swivel transmission into requested working position and lock it.



030002

1.2 Lifting transmission out of the assembly support



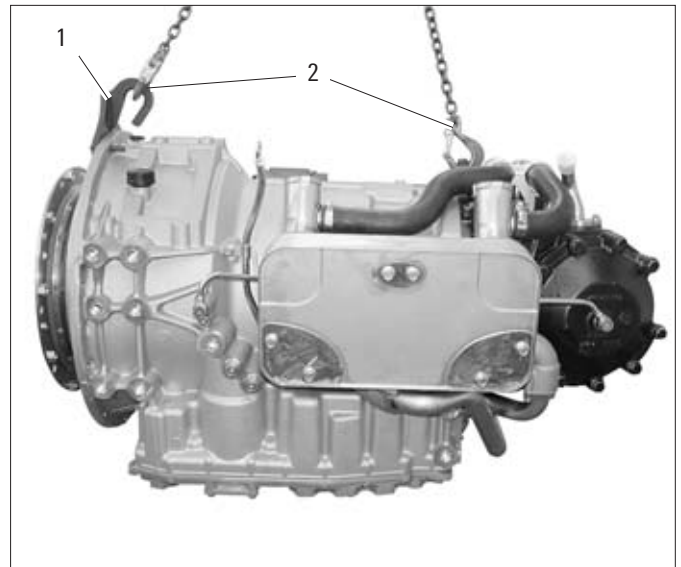
DANGER

Transmission may fall down!

Risk of injury!

Use suitable lifting equipment. The lifting equipment must be configured for the total weight of the transmission.

- 1 Mount the lifting device 1X56 137 997 (1).
- 2 Mount the lifting equipment (2).



030391



DANGER

Uncontrolled moving of the transmission!

Risk of injury!

Assembly support must not be lifted.

- 3 Raise lifting device until the lifting equipment is slightly under tension.



DANGER

Adapter is not locked safely!

Risk of injury!

Protect adapter (opposite to crank) from swiveling down.



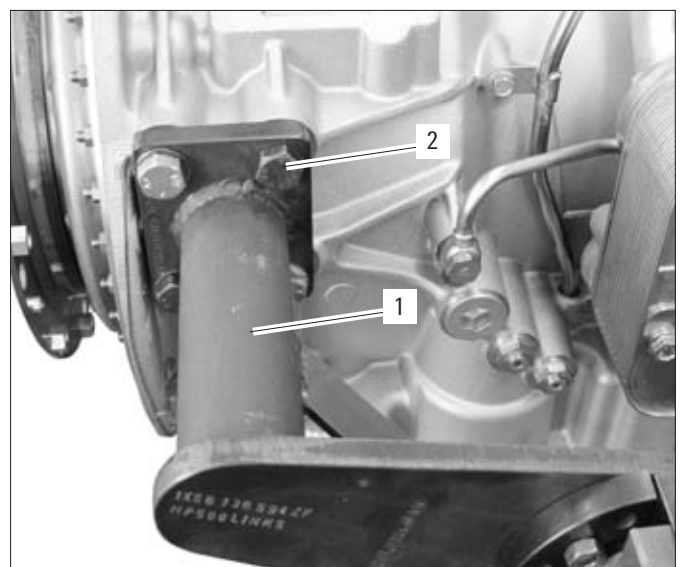
DANGER

The transmission might drop slightly when unscrewing the hex head screws/bolts!

Risk of squashing/bruising!

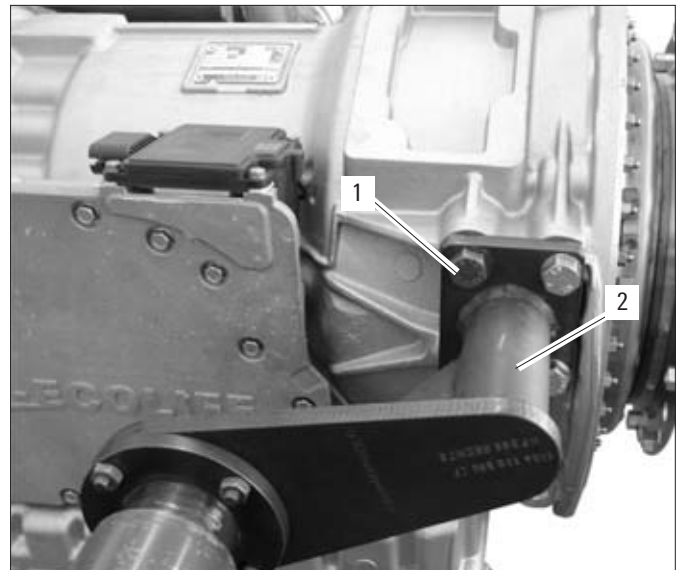
Avoid having your hands or body within the swiveling range of the transmission.

- 4 Remove the hex head screws/bolts (2) of the first adapter (1).



025899

- 5 Remove the hex head screws/bolts **(1)** of the second adapter **(2)**.

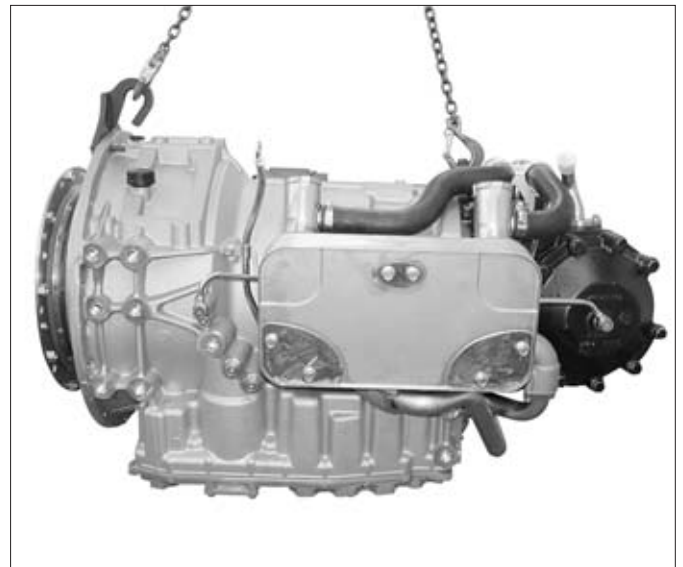


025900

**DANGER**

The transmission may swivel slightly!
Risk of squashing/bruising!
Leave the transmission swivel range.

- 6 Getriebe aus Montageständer herausheben und an geeigneter Stelle absetzen.

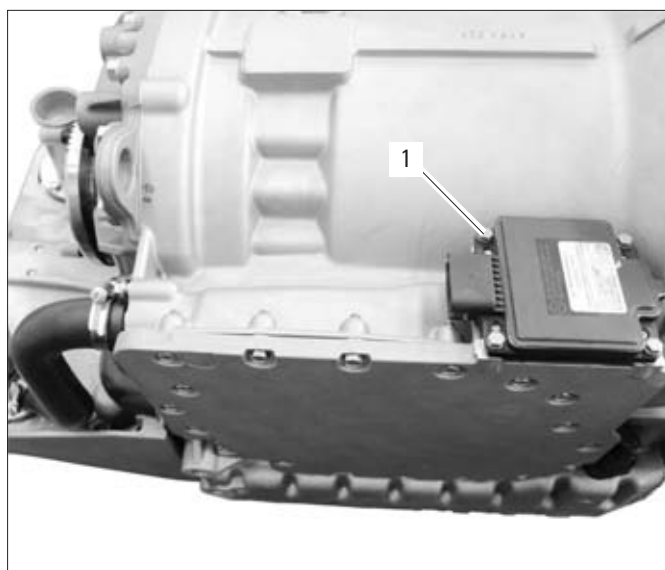


030391

2 Replacing the ECU, the Electronic Automatic Control Unit

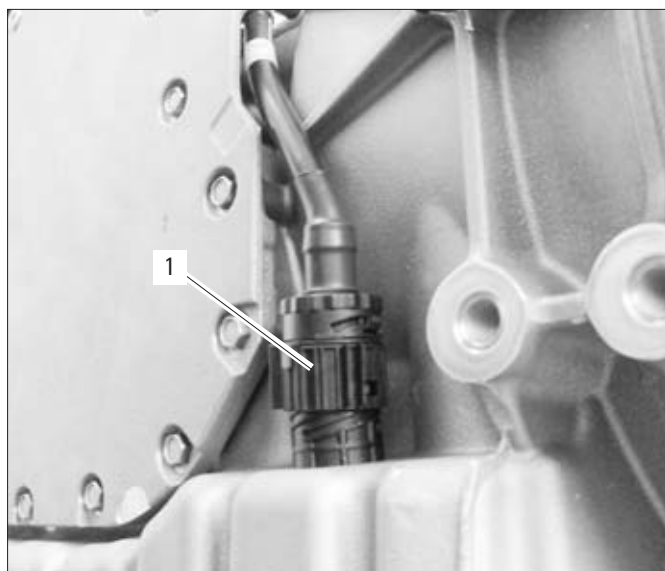
2.1 Removing the ECU

- 1 Unscrew the four hex head bolts/screws **(1)** of the ECU.



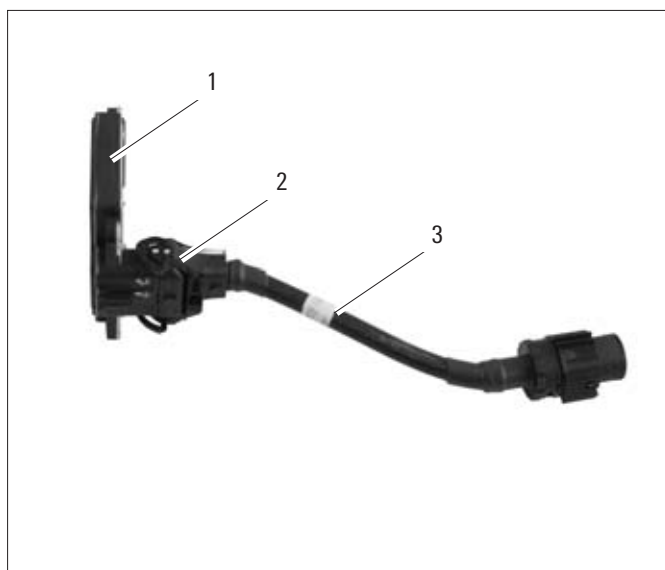
025893

- 2 Loosen the lock **(1)** and pull out the connector.



025894

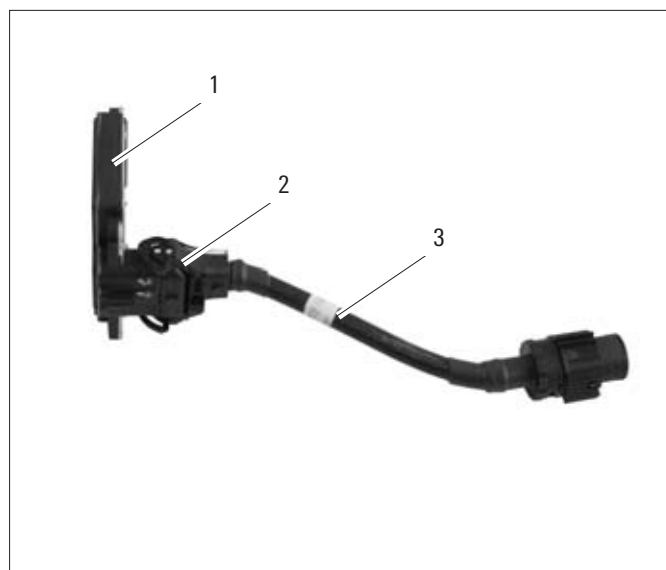
- 3 Take off the ECU **(1)** together with the cable harness **(3)**.
- 4 Separate the connector **(2)** from the ECU.
- 5 Open the lock of the connector **(2)** and separate the connector **(2)** from the ECU.



025000

2.2 Mounting the ECU

- 1 Plug in the wiring harness (3) with the connector (2) in the new ECU (1) and close the lock.



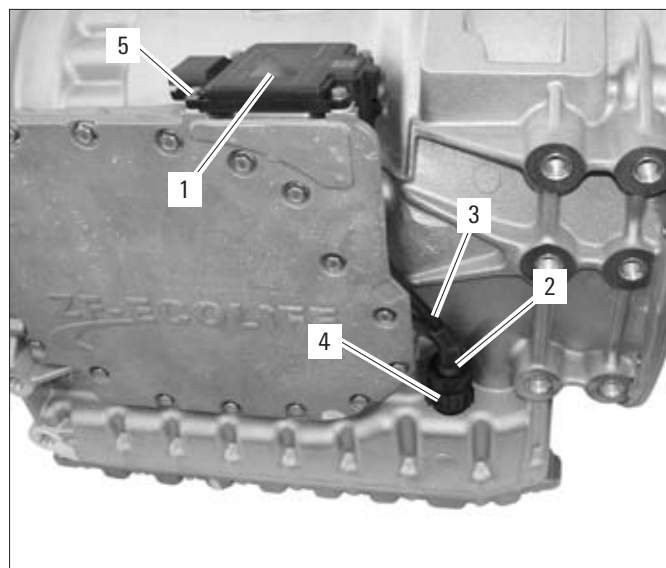
025000

- 2 Position the ECU (1) together with the wiring harness (3) on the transmission.

CAUTION

The contact faces of the ECU and the transmission must be even and clean; otherwise, the ECU might be damaged.

- 3 Plug in the connector (2).
- 4 Engage the lock (4).
- 5 Screw in four M6x26 hex head screws/bolts (5) and tighten.
Tightening torque: 9.5 Nm

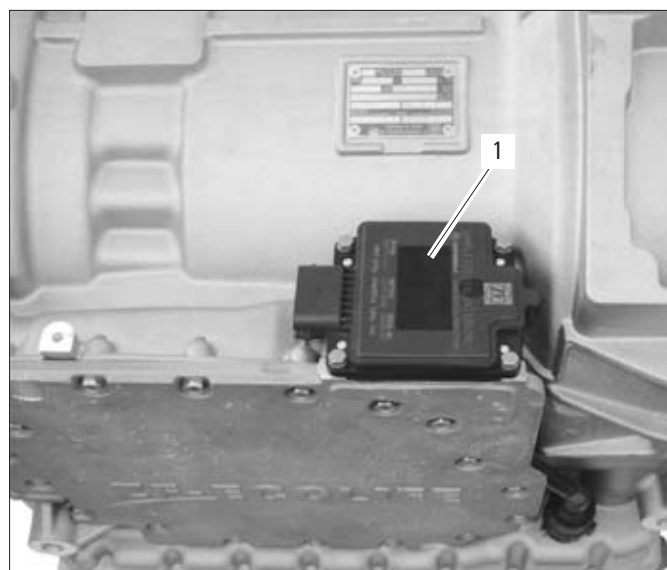


025047

3 Removing and Installing the Transmission Oil Cooler (TOC)

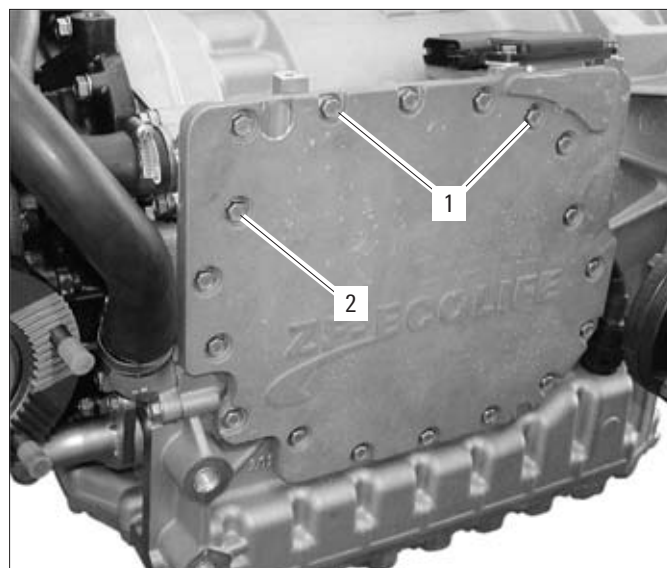
3.1 Removing the Transmission Oil Cooler (TOC)

- 1 Removing the ECU (1), also refer to Chapter Kap. 2.1 "Removing the ECU".



025045

- 2 Place (strip) tray for coolants below the transmission.
- 3 Unscrew two M8 (1) screws from the cover and screw in the two M8 guide screws.
- 4 Unscrew the remaining 16 hex head bolts/screws M8 (2) from the cover.



030003

- 5 Remove cover (1).



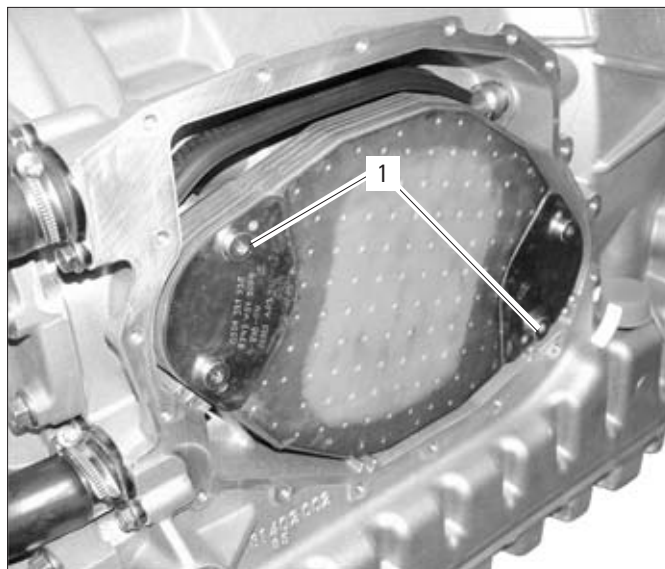
030018

- 6 Take off the cover with the sealing element **(1)** and the sealing compound **(2)**.
- 7 Unscrew the guide screws.
- 8 Take off the sealing compound **(2)**.
- 9 Take off the sealing element **(1)** from the cover.



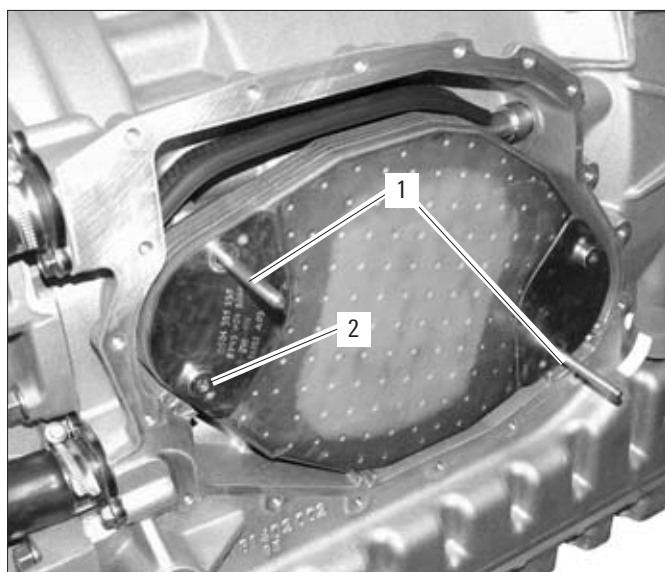
030019

- 10 Unscrew two TORX screws M8 **(1)**.



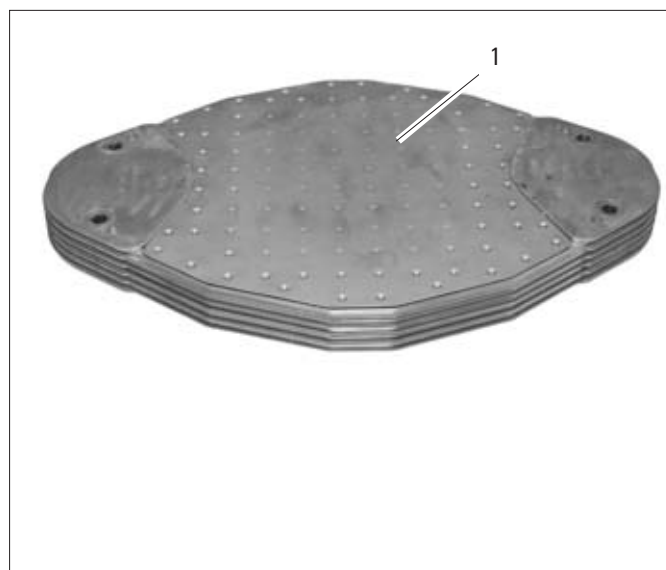
025306

- 11 Screw in two guide screws M8 **(1)**.
- 12 Unscrew the two TORX screws M8 **(2)**.



025307

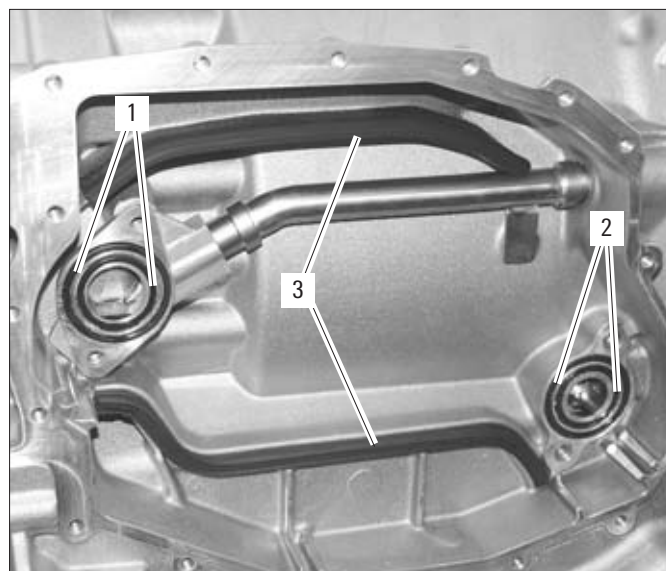
- 13 Take off the transmission oil cooler **(1)**.



025308

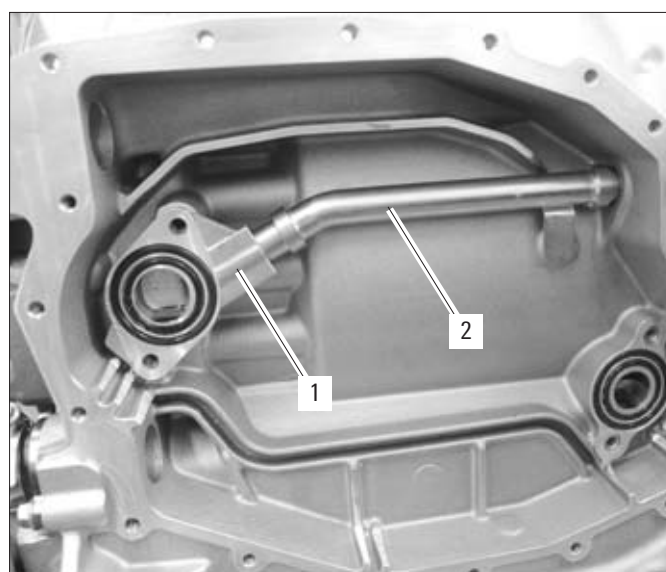
- 14 Take off the four O-rings **(1, 2)**.

- 15 Take off the two sealing elements **(3)**.



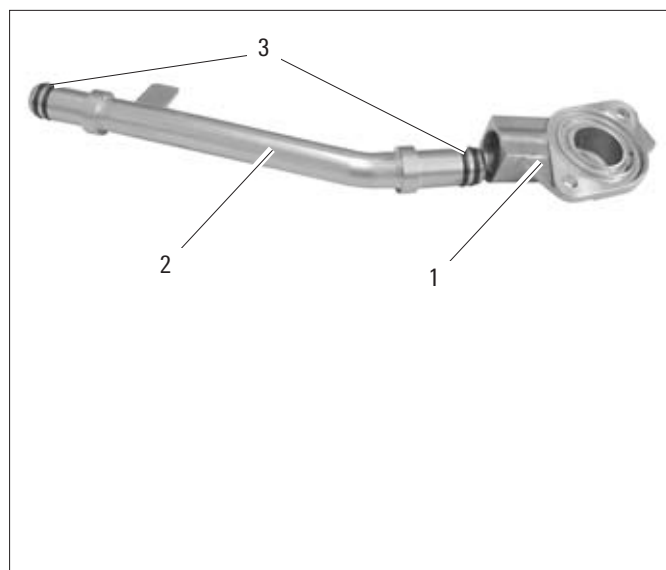
025309

- 16 Take out the flange **(1)** and the tube **(2)**.



025310

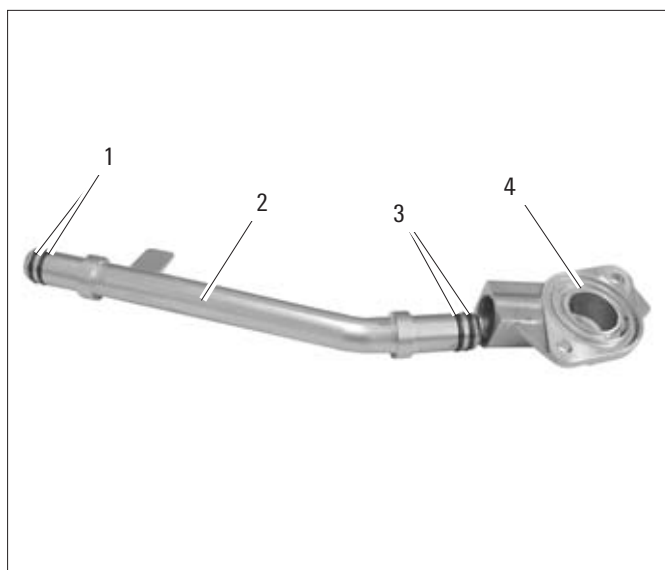
- 17 Pull off the flange **(1)** from the tube **(2)**.
- 18 Take off the two O-rings **(3)** from the two ends respectively.



025589

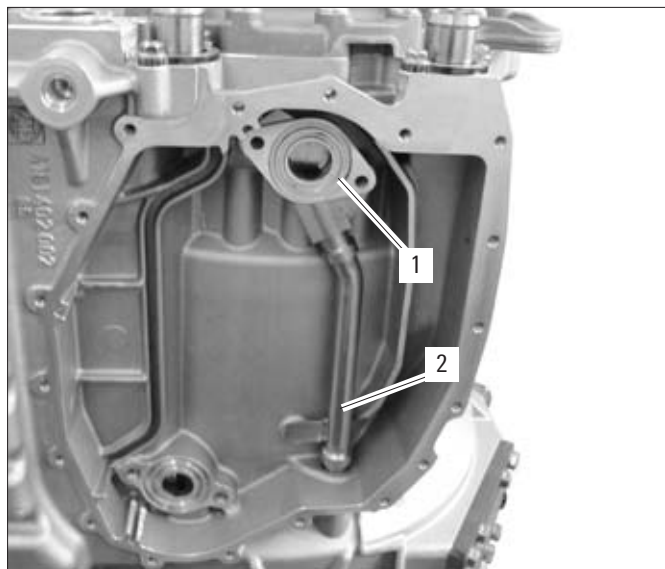
3.2 Installing the Transmission Oil Cooler (TOC)

- 1 Coat four O-rings **(1, 3)** with technical Vaseline.
- 2 Insert the four O-rings **(1, 3)** in the corresponding grooves.
- 3 Insert the tube **(2)** in the flange **(4)**.



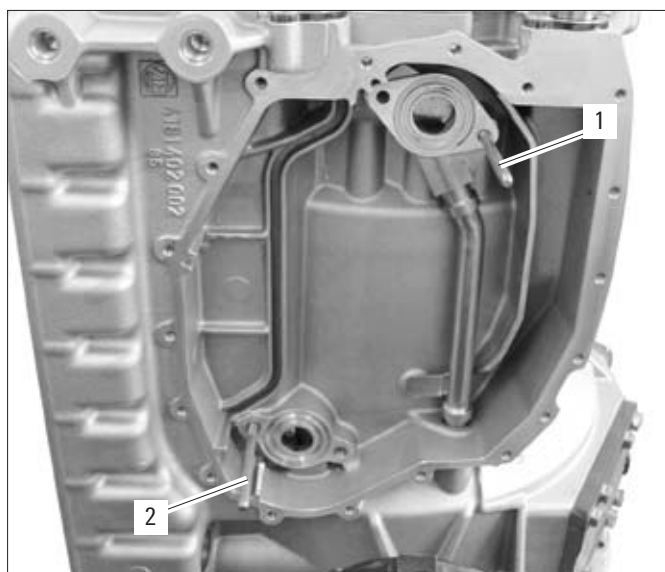
025589

- 4 Insert the tube **(2)** with the flange **(1)** in the transmission housing.



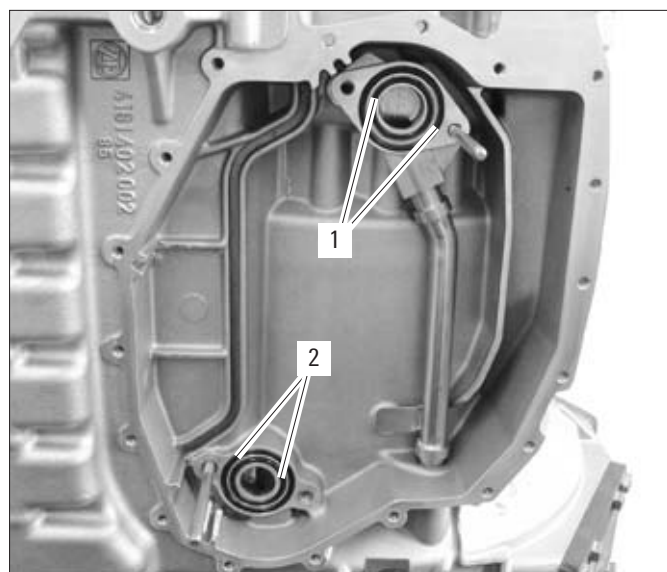
025590

- 5 Screw in the guide screws M8 **(1, 2)**.



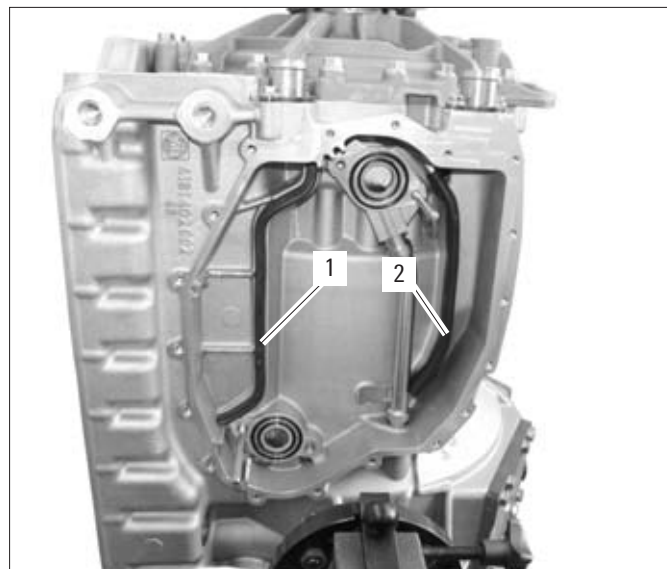
025591

- 6 Coat the four O-rings **(1, 2)** with technical Vaseline.
- 7 Insert the four O-rings **(1, 2)** in the corresponding grooves.



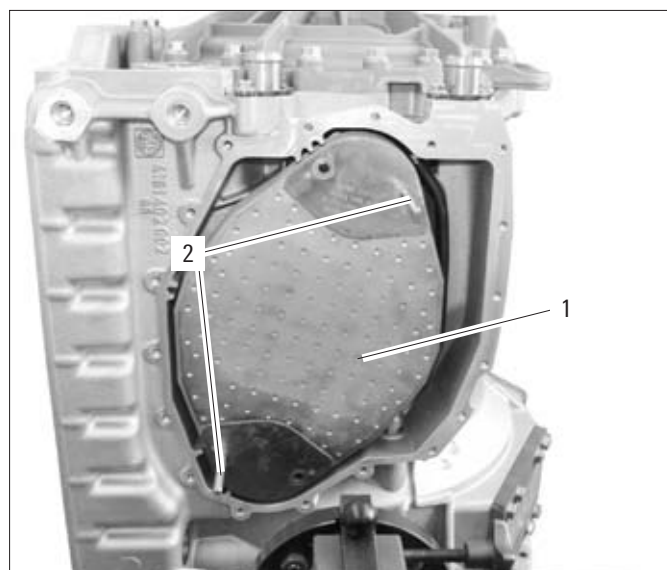
025592

- 8 Insert the two sealing elements **(1, 2)**.



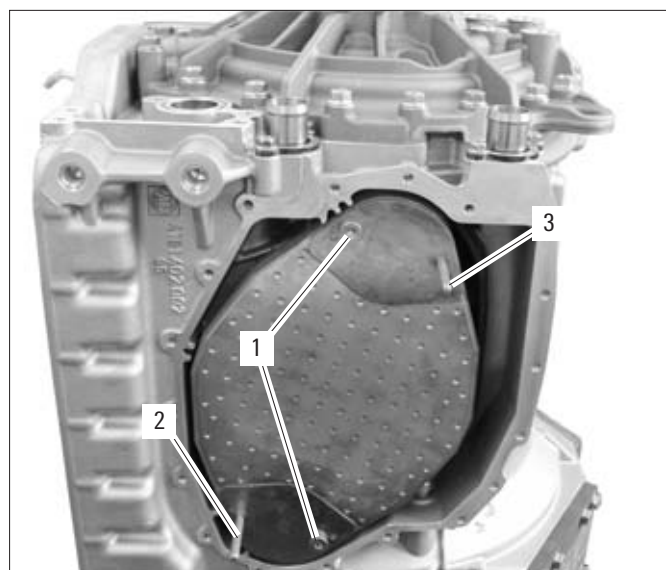
025593

- 9 Insert the cooler **(1)** by means of the guide screws **(2)**.



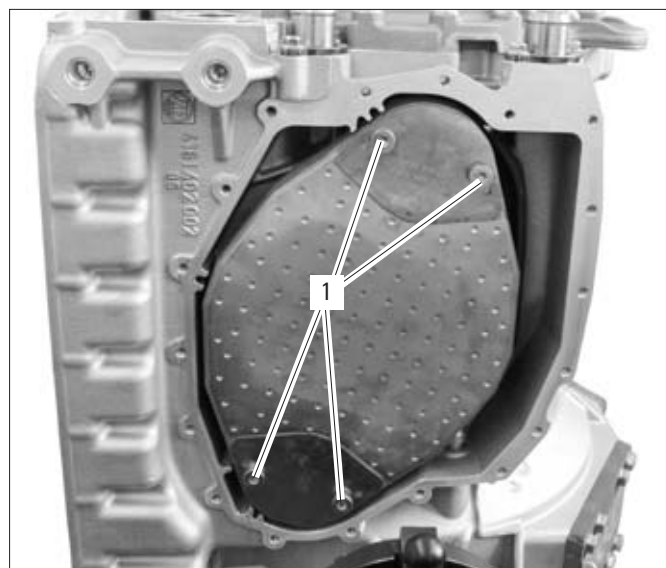
025594

- 10 Screw in two TORX screws M8x50 **(1)**.
- 11 Replace the two guide screws M8 **(2, 3)** by TORX screws M8x50.



025595

- 12 Tighten the four TORX screws **(1)**.
Tightening torque: 20 Nm

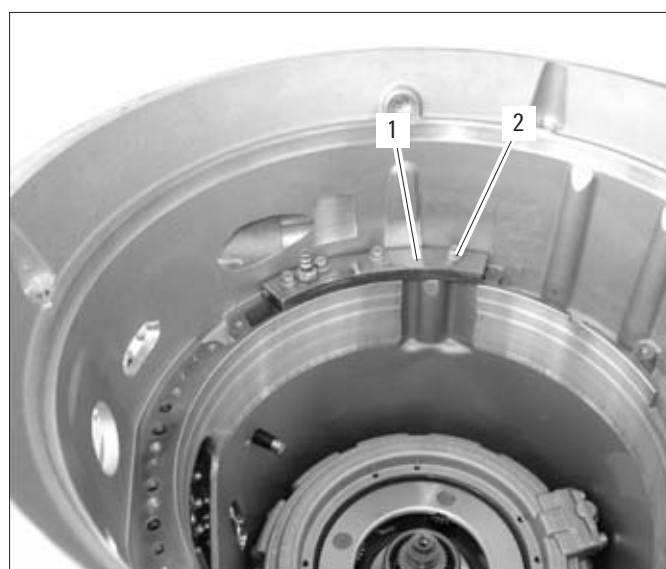


025596

- 13 Prior to inserting the control insert, mount the tool no.: **1X56 138 540 (1)** for the leakage test.
- 14 Screw in the four hex head screws/bolts M8 **(2)**.
Tightening torque: 20 Nm

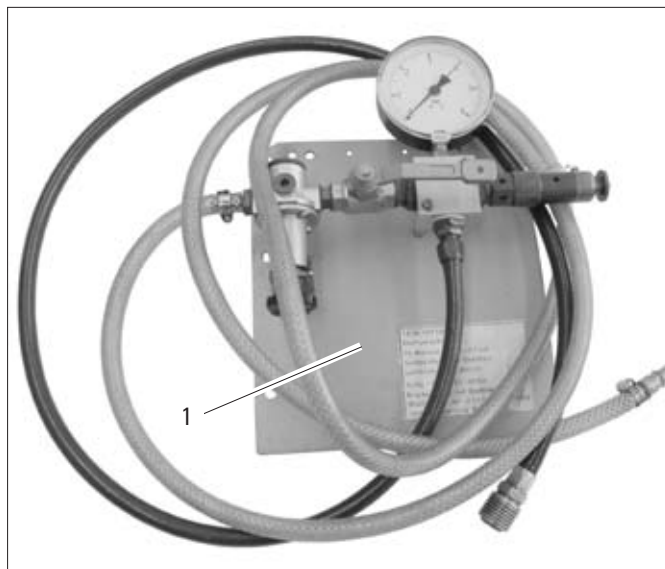
NOTE

If necessary, level out the sealing faces by means of the oil stone.



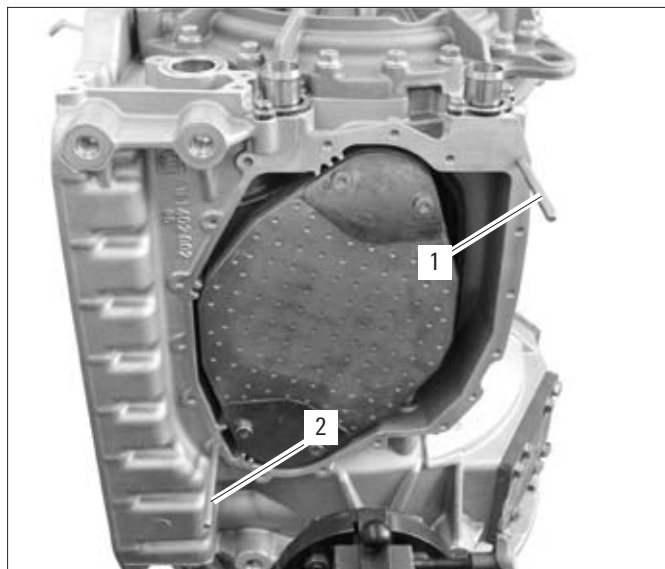
030375

- 15 Carry out the 3.0 bar leakage test with the basic tool no.: **1X56 137 130 (1)**.
- 16 Apply at max. 3.0 bar pressure (valve open).
- 17 Close the valve for the air supply. Pressure drops are not permissible.



025895

- 18 Screw in the two guide screws M8 (**1, 2**).



025597

- 19 Put on the gasket/seal (**1**).
- 20 Insert the sealing element (**2**).

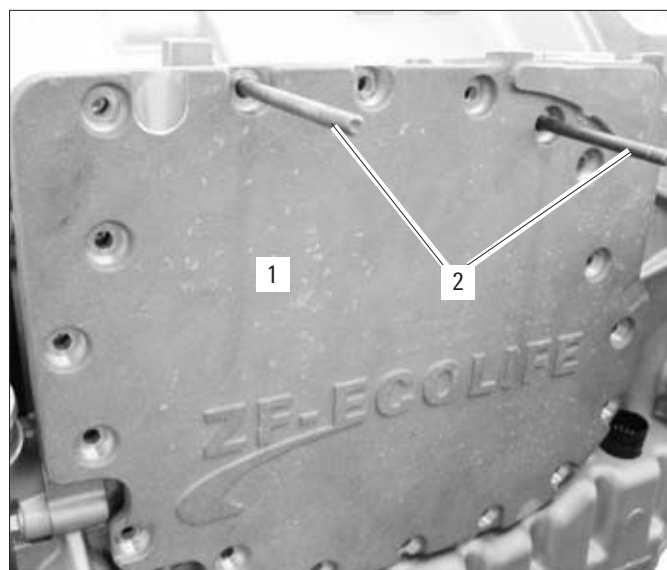


025598

- 21 Push the cover **(1)** onto the guide screws **(2)**.

CAUTION

Ensure correct seating of the seal.



030018

- 22 Manually screw in the 18 M8x30 hex head screws/bolts **(1)** - but do not tighten yet. Replace guide screws with hex head screws/bolts.
- 23 Screw in the 18 M8 hex head bolts/screws **(1)** and tighten evenly. Tightening torque: 23 Nm



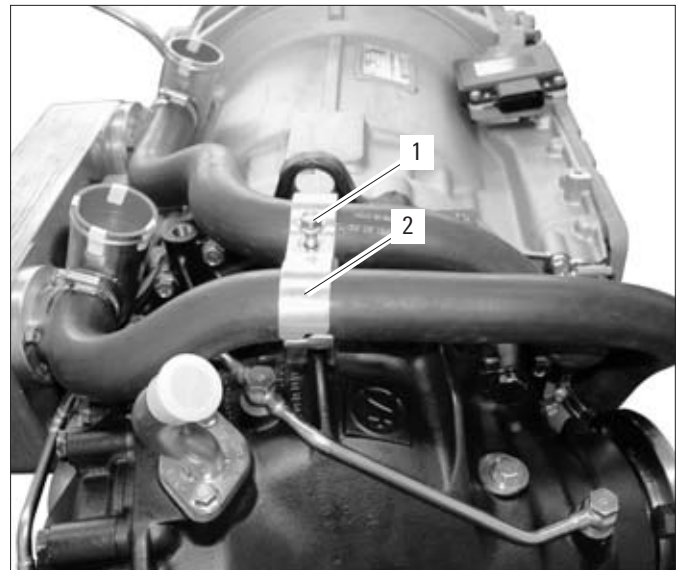
030003

4 Removing and Installing the Retarder Oil Cooler (ROC) (Angle Drive)

4.1 Removing the Retarder Oil Cooler (ROC)

1 Unscrew the M8 **(1)** hex head bolt/screw.

2 Take off the upper fixture **(2)**.



030004

3 Take off the lower fixture **(1)**.



030005

4 Open the coolant hoses **(2)** respectively at the hose clamps **(1, 3)**.

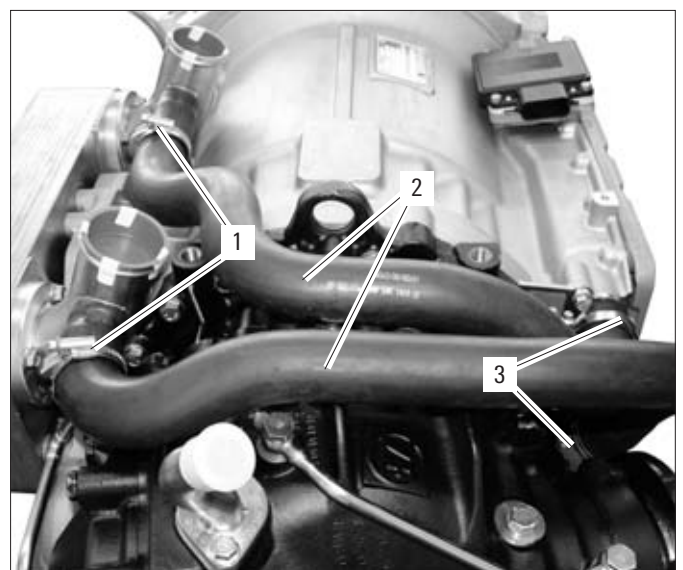
5 Pull off the coolant hoses **(2)**.

**DANGER**

Hot coolant may spill.

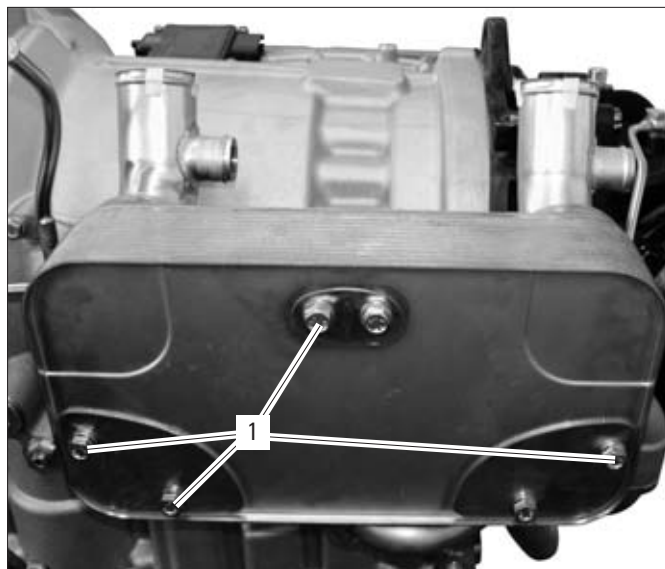
Danger of burns!

Let cooler cool down beforehand.



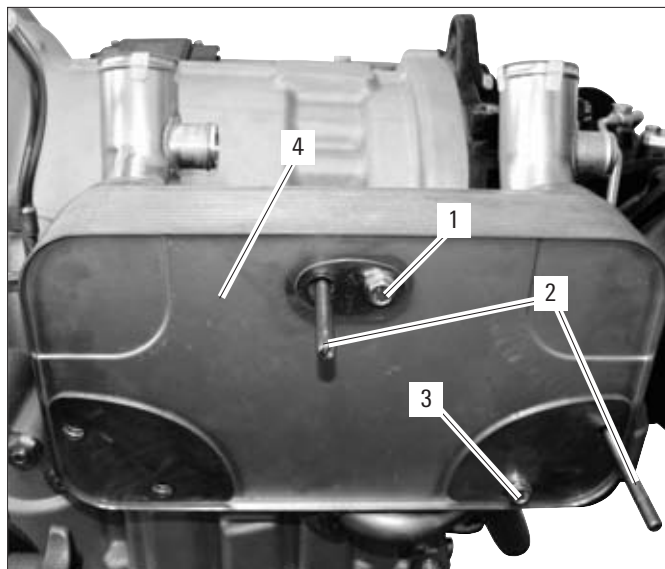
030006

- 6 Unscrew the four hexagon head screws/bolts **(1)**.



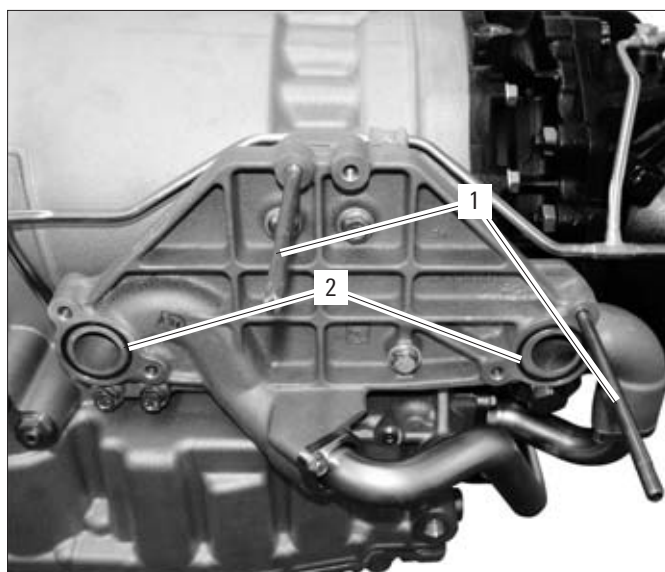
030007

- 7 Screw in two guide screws **(2)**.
- 8 Unscrew the two hex head bolts/screws **(1, 3)**.
- 9 Take off the heat exchanger **(4)**.

**DANGER****Oil may spill.****Environmental hazard!****Collect oil in a suitably large container.**

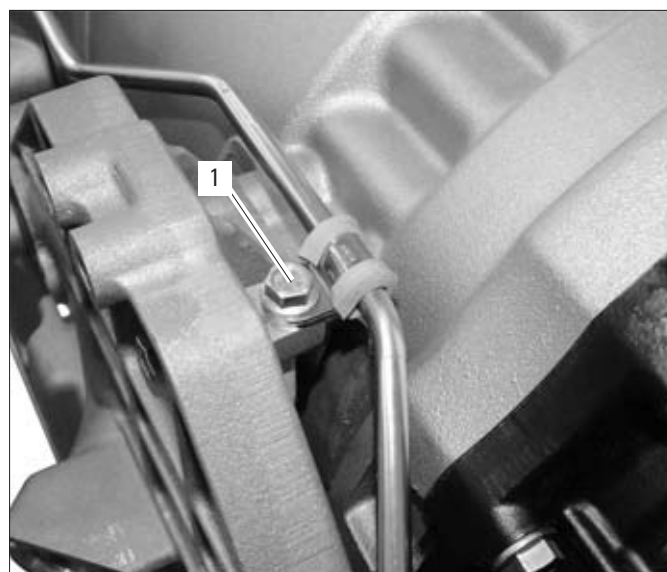
030008

- 10 Unscrew the two guide screws **(1)**.
- 11 Take off the O-rings **(2)**.



030009

- 12 Unscrew one M8 hex head screw/bolt **(1)** and remove with pipe clamp.

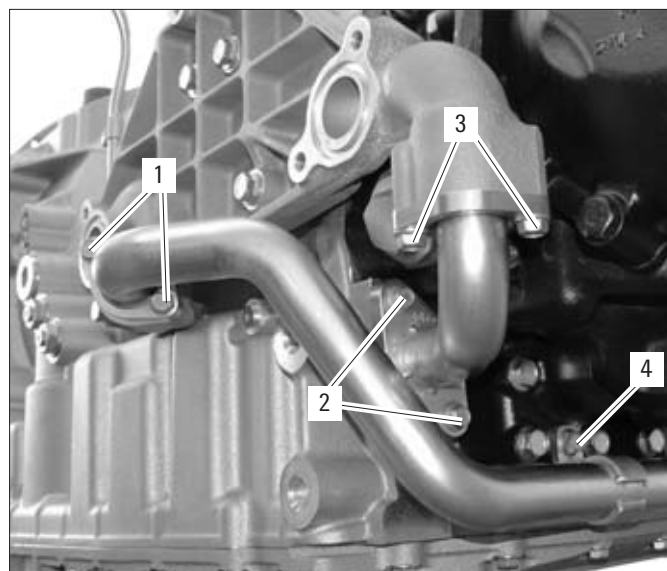


030380

- 13 Unscrew six hex head screws/bolts **(1, 2, 3)**.

**DANGER****Oil may spill.****Environmental hazard!****Collect oil in a suitably large container.**

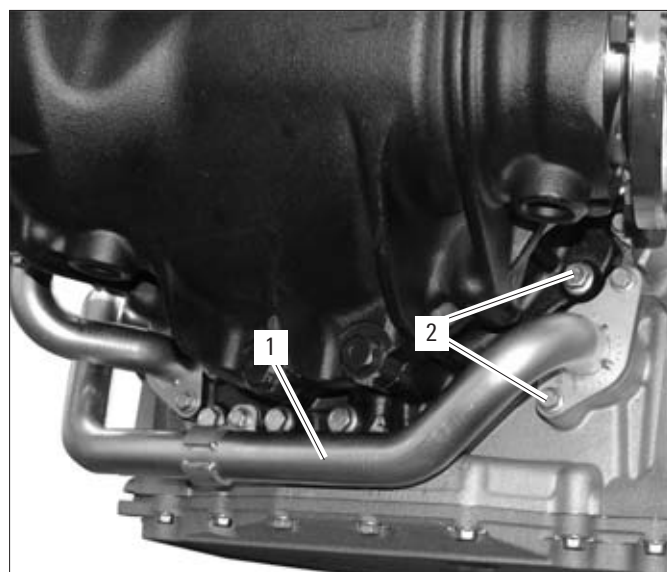
- 14 Unscrew one hex head screw /bolt **(4)** from the fixture.



030011

- 15 Unscrew the two hexagon head screws/bolts **(2)**.

- 16 Take off the pipe **(1)**.



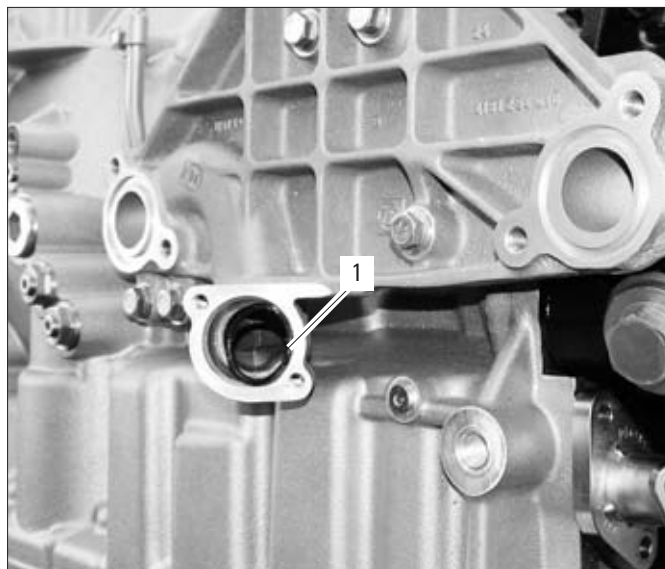
030012

- 17 Take off the two O-rings (1).



030013

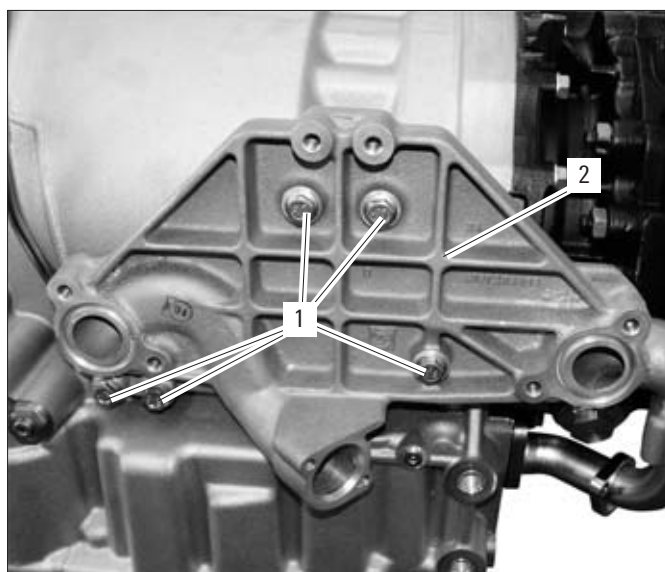
- 18 Remove the O-ring (1).



030014

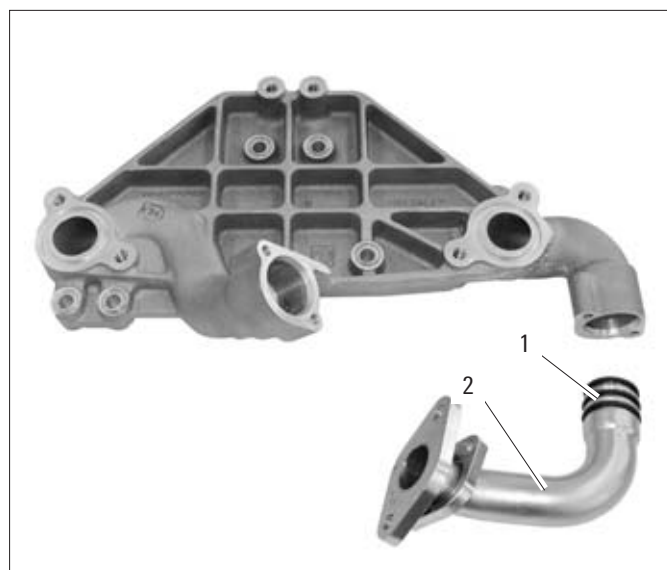
- 19 Unscrew the five hex head screws/bolts (1).

- 20 Take off the bracket (2).



030015

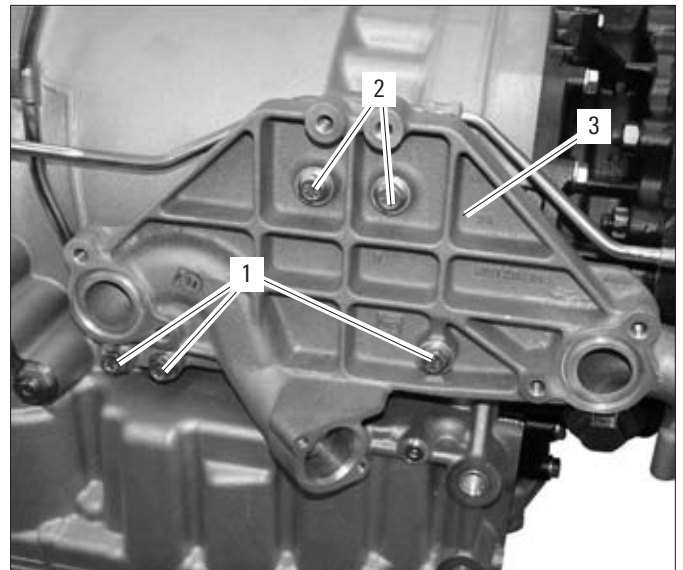
- 21 Pull off the tube **(2)**.
- 22 Take off the three O-rings **(1)**.



030016

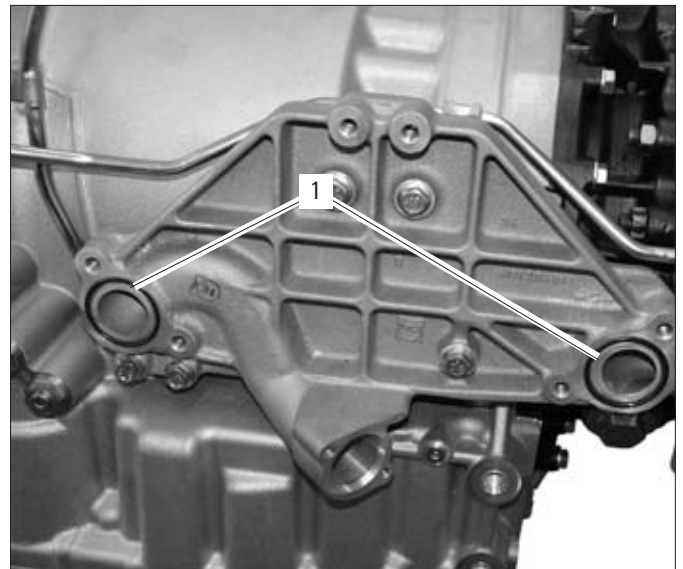
4.2 Installing the Retarder Oil Cooler (ROC)

- 1 Put on the bracket for the retarder oil cooler (3).
- 2 Screw in two hex head screws/bolts M10x73 (2).
Tightening torque: 46 Nm
- 3 Screw in three hex head screws/bolts M10x53 (1).
Tightening torque: 46 Nm



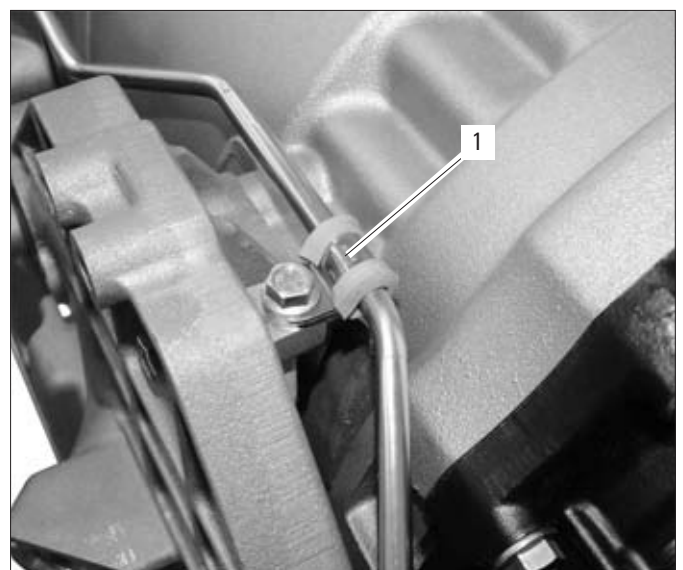
030378

- 4 Coat two O-rings (1) with technical Vaseline.
- 5 Insert the two O-rings (1).



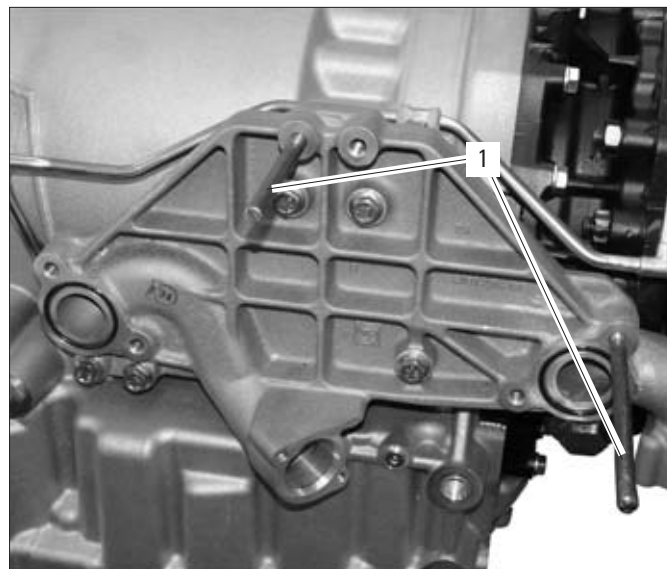
030379

- 6 Fasten the pipe clamp (1) with the hex head screw/bolt M8x22.
Tightening torque: 23 Nm



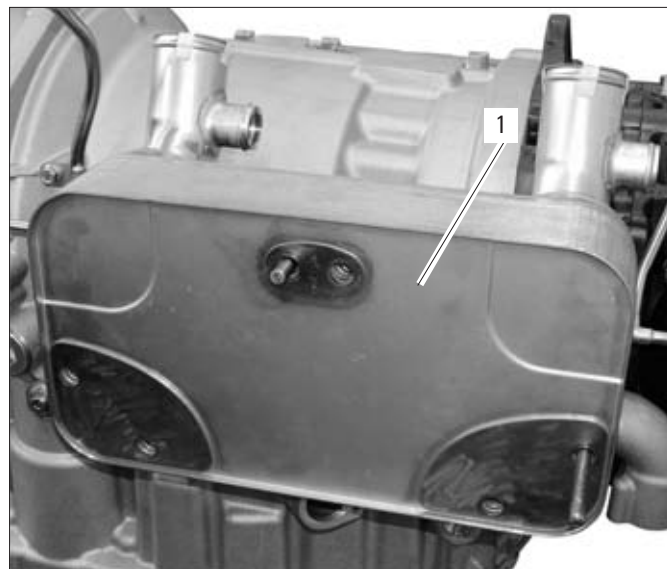
030380

- 7 Screw in two guide screws M10 (1).



030381

- 8 Push on the retarder oil cooler (1).



030382

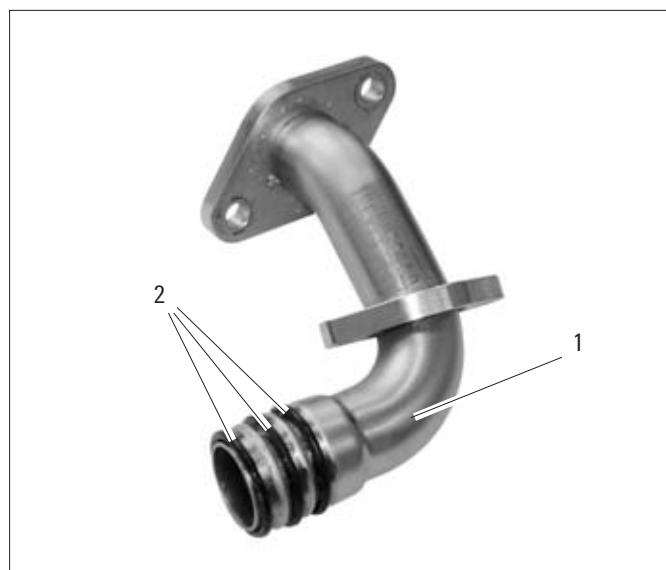
- 9 Screw in six hex head screws/bolts M10x100 (1), replace guide screws.
Tightening torque: 46 Nm



030383

10 Coat three O-rings **(2)** with technical Vaseline.

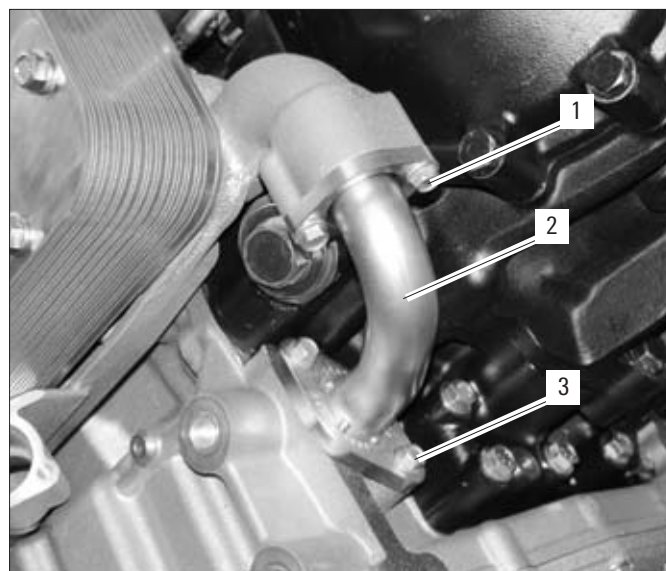
11 Put the three O-rings **(2)** on the tube **(1)**.



030384

12 Insert the tube **(2)**.

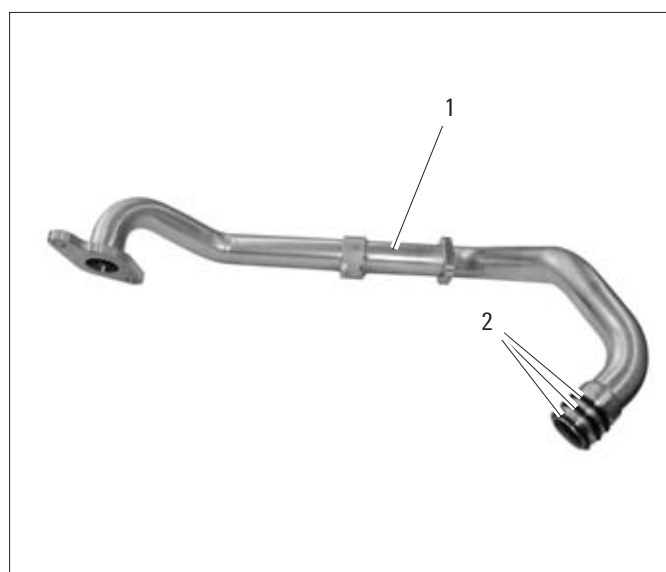
13 Fasten the tube **(2)** by means of four M8x30 hex head screws/bolts **(1, 3)**. Tighten the hex head screws/bolts **(1)** first.
Tightening torque: 23 Nm



030385

14 Coat three O-rings **(2)** with technical Vaseline.

15 Put the three O-rings **(2)** on the tube **(1)**.



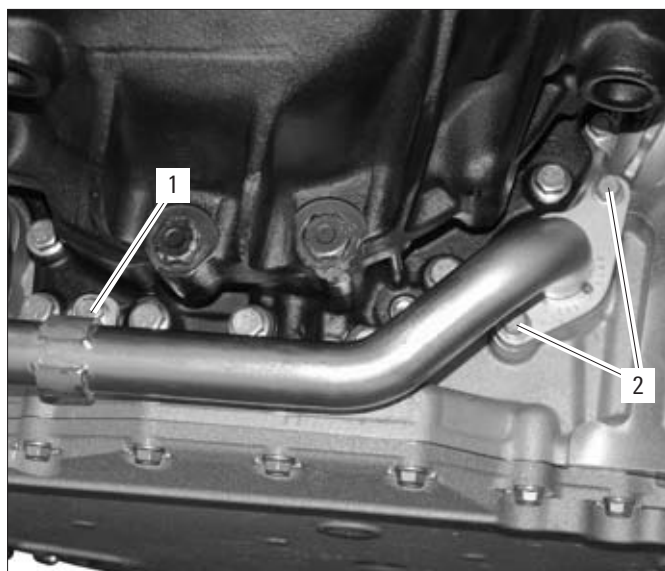
030386

- 16 Insert the tube (1).
- 17 Screw in two hex head screws/bolts M8x30 (2).
Tightening torque: 23 Nm



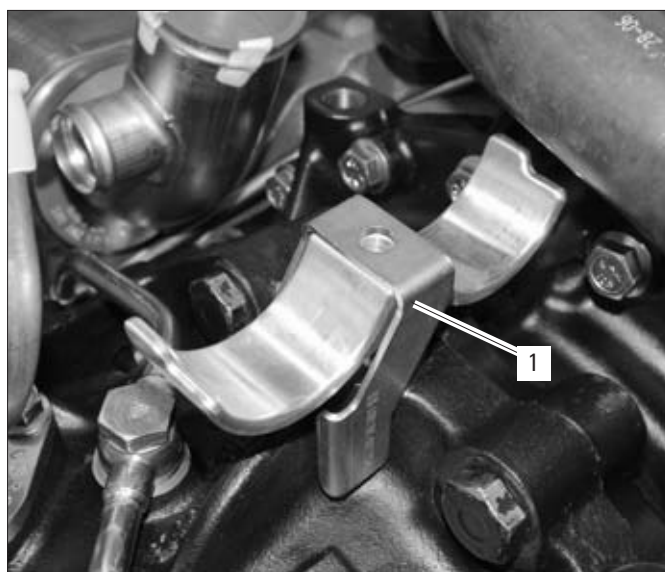
030387

- 18 Screw in an M8x22 hex head bolt/screw (1).
Tightening torque: 23 Nm
- 19 Screw in two hex head screws/bolts M8x30 (2).
Tightening torque: 23 Nm



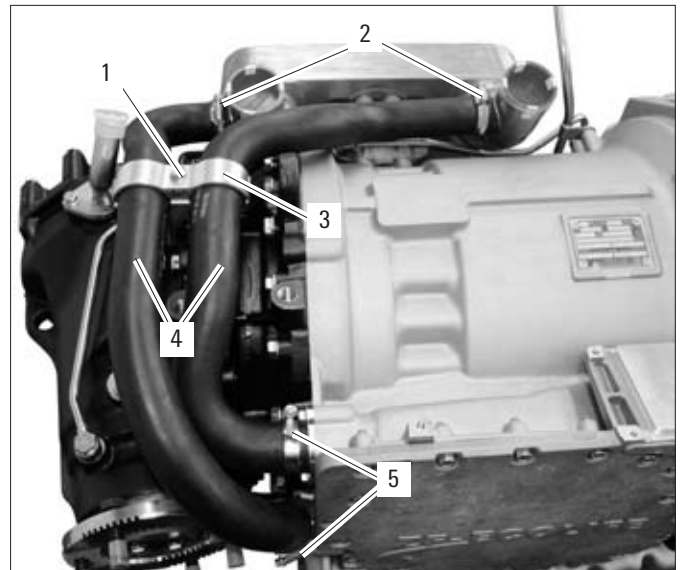
030388

- 20 Put on the lower shell and the fixing plate (1).



030389

- 21 Mount the two coolant hoses (4).
- 22 Tighten the four hose clamps (2, 5).
- 23 Mount the upper shell of the fixture (3).
- 24 Screw in the M8x55 hex head bolt/screw (1).
Tightening torque: 23 Nm

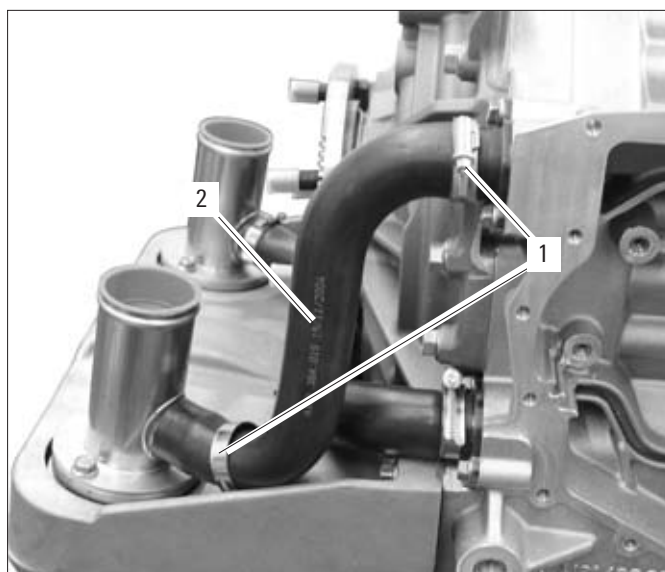


030390

5 Removing and Installing the Retarder Oil Cooler (ROC) Coax

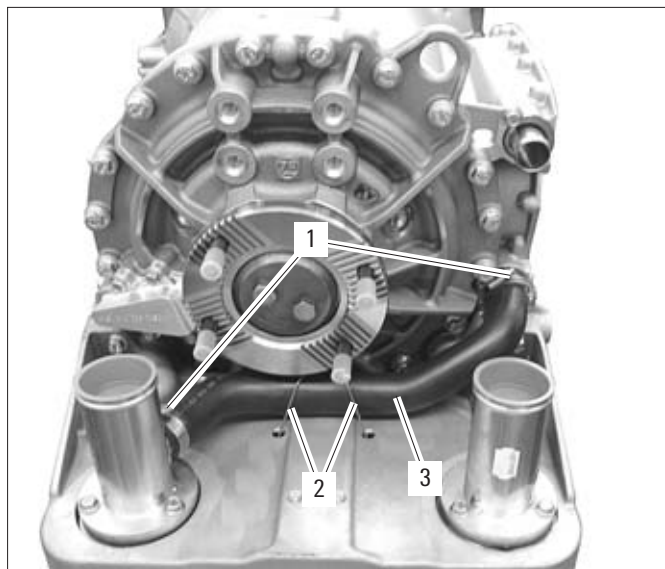
5.1 Removing the Retarder Oil Cooler (ROC) Coax

1. Loosen two hose clamps **(1)**.
2. Take off the hose **(2)**.



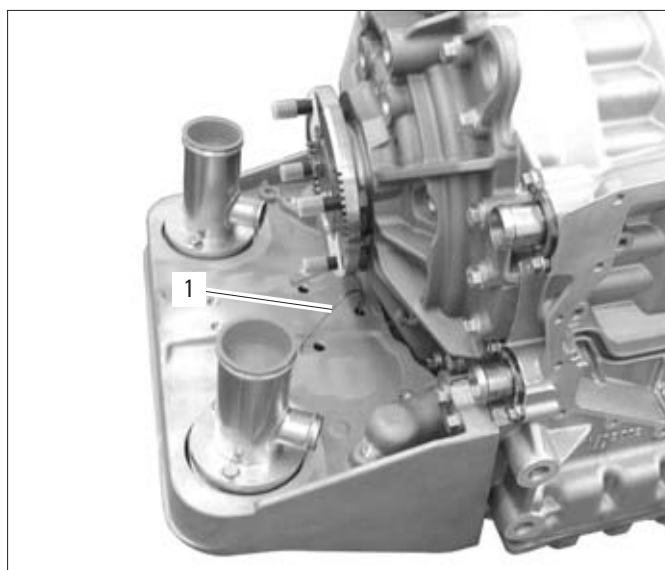
025311

3. Loosen the two hose clamps **(1)**.
4. Unhook the retaining clamp of the hose **(2)**.
5. Take off the hose **(3)**.



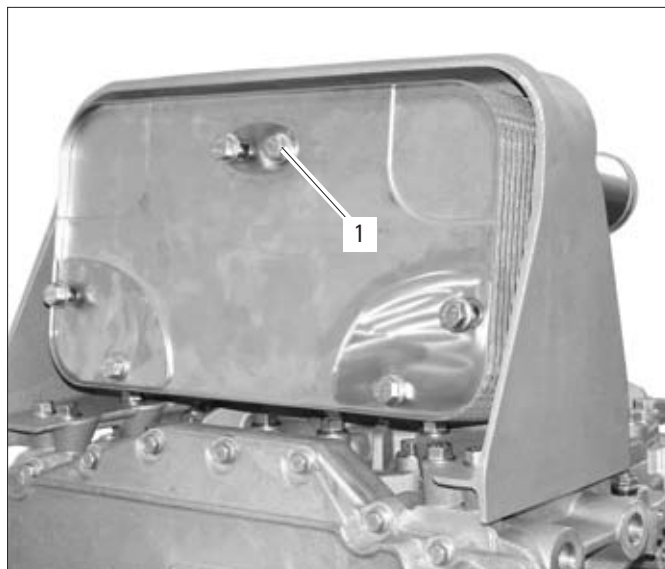
025312

6. Take off the retaining clamp **(1)**.



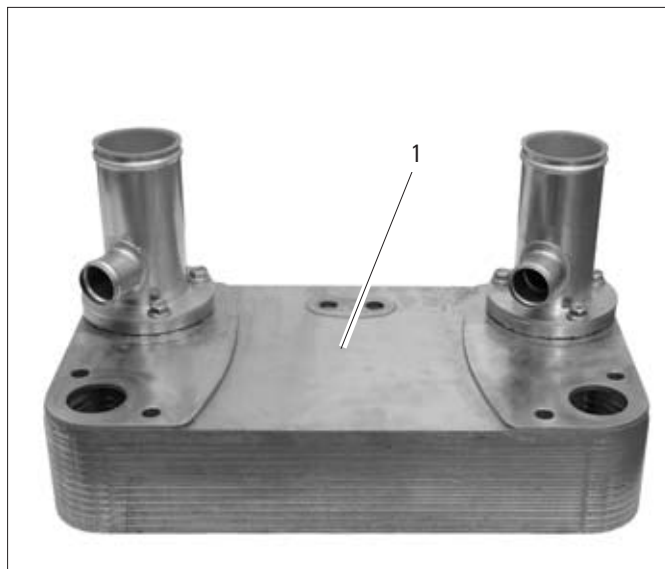
025313

- 7 Unscrew six M10 hex head screws/bolts **(1)**.



025314

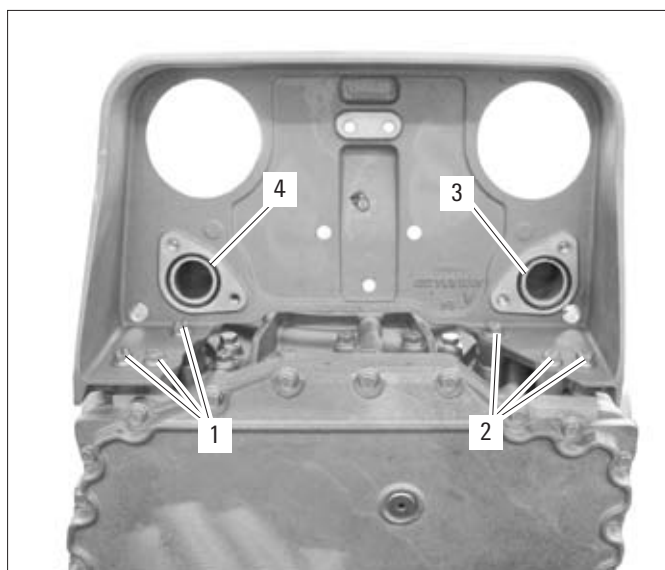
- 8 Take off the retarder oil cooler **(1)**.



025316

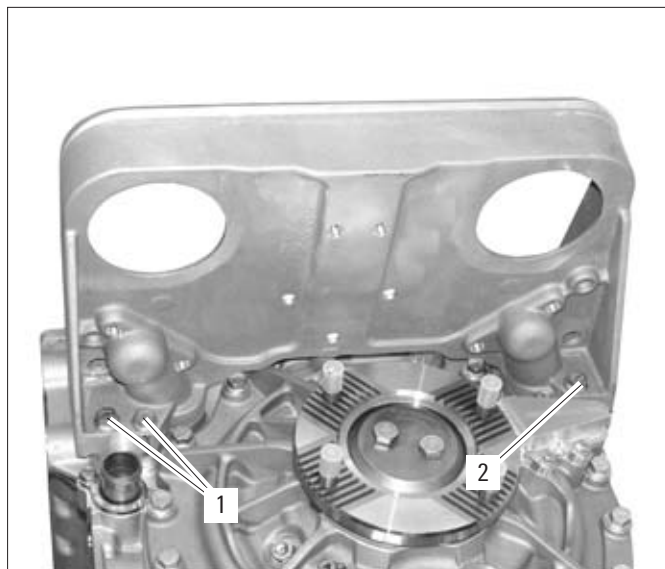
- 9 Unscrew six hex head screws/bolts **(1, 2)** at the bracket.

- 10 Take off the three O-rings **(3, 4)**.



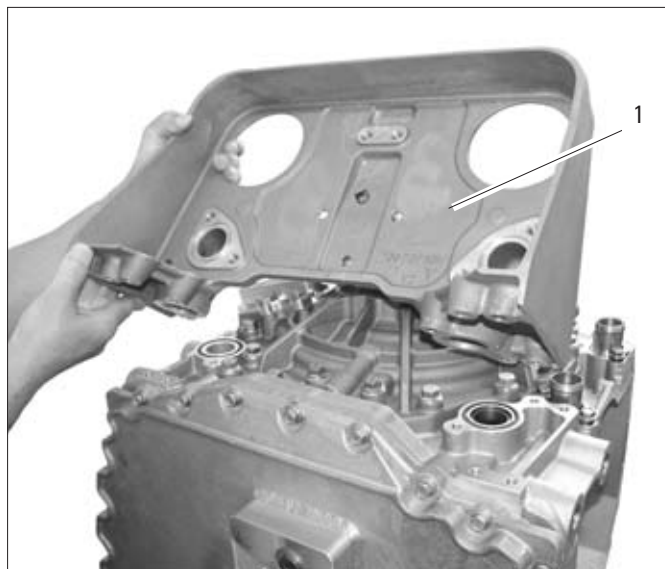
025845

- 11 Unscrew three hex head screws/bolts **(1, 2)** at the bracket.



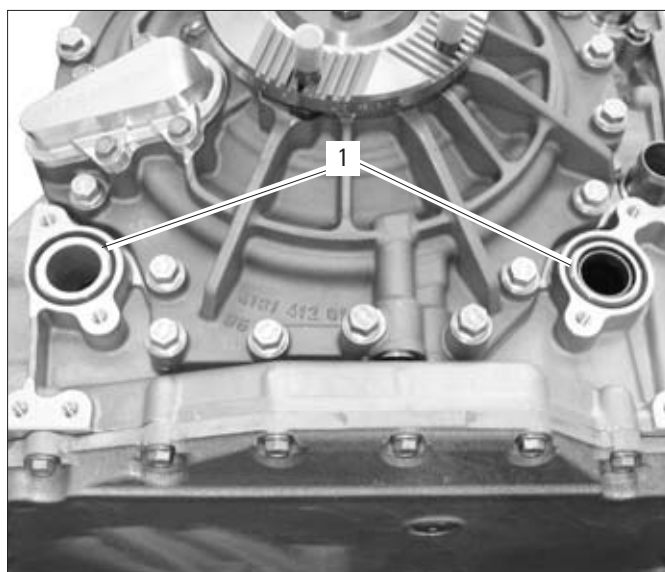
025318

- 12 Take off the bracket **(1)**.



025319

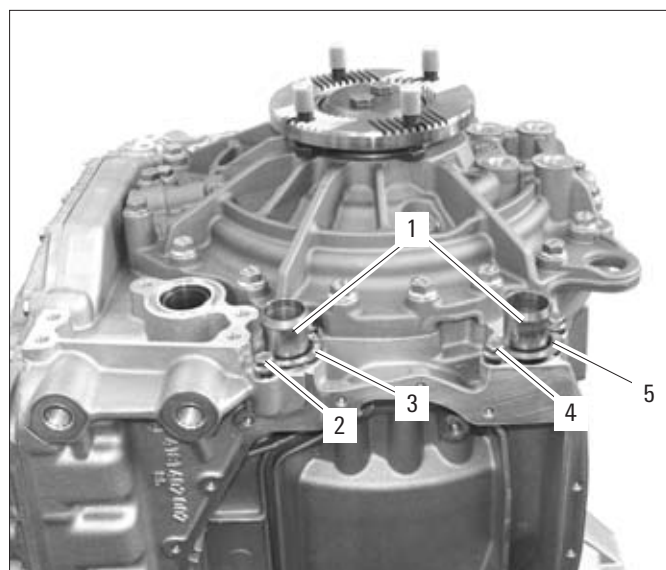
- 13 Remove two O-rings **(1)**.



025836

14 Unscrew two hex head screws/bolts **(2)** respectively at the connecting pipes **(1)**.

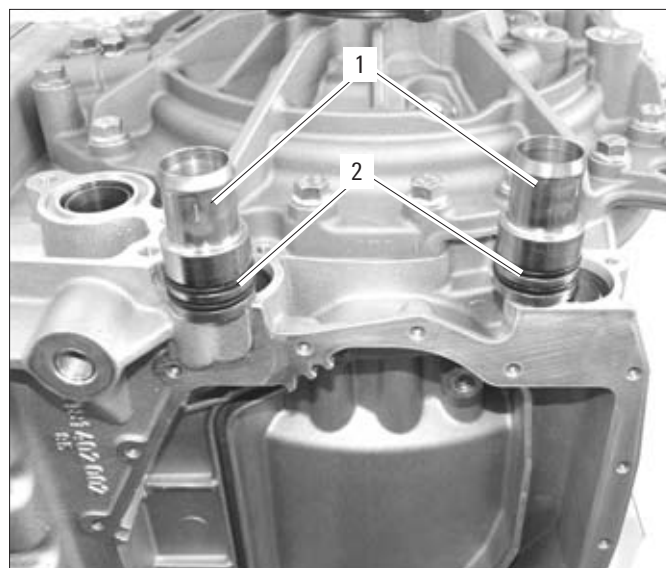
15 Take off the two holding plates **(3, 4)**.



025320

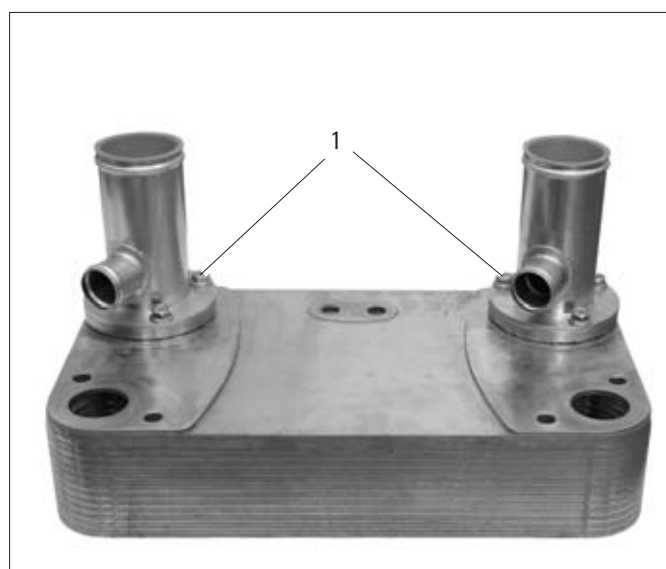
16 Pull out the connecting pipes **(1)**.

17 Take off the two O-rings **(2)** respectively from the connecting pipes.



025321

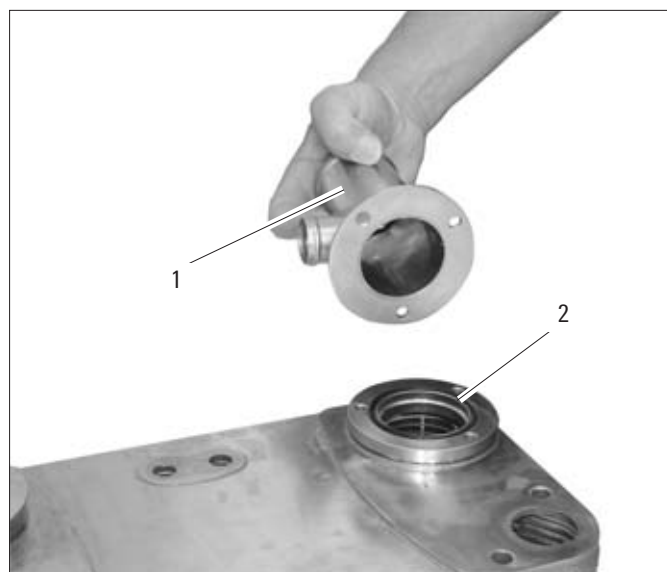
18 Unscrew three M8 hex head screws/bolts **(1)** respectively at the two connecting pipes.



025316

19 Take off the two connecting pipes **(1)**.

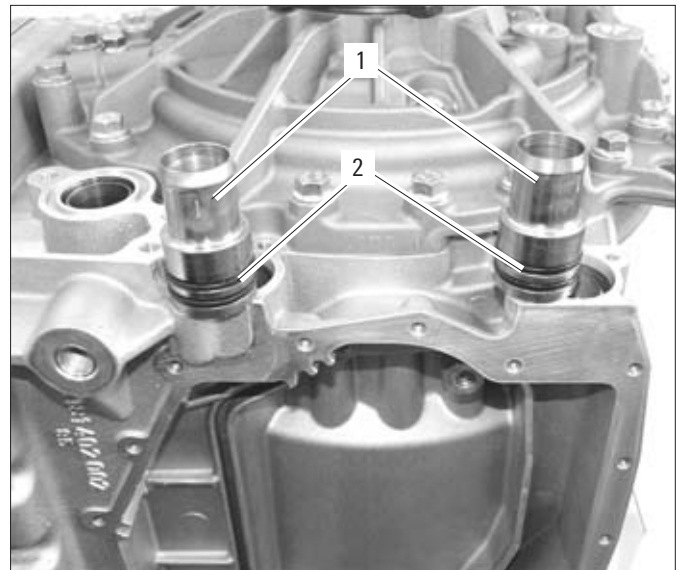
20 Take out the two O-rings **(2)**.



025332

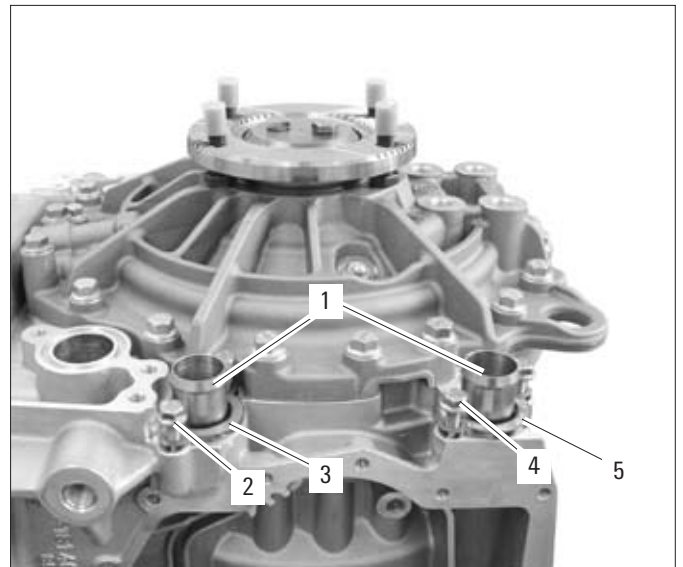
5.2 Installing the Retarder Oil Cooler (ROC) Coax

1. Coat four O-rings **(2)** with technical Vaseline.
2. Mount the O-rings **(2)** on the connecting pipes.



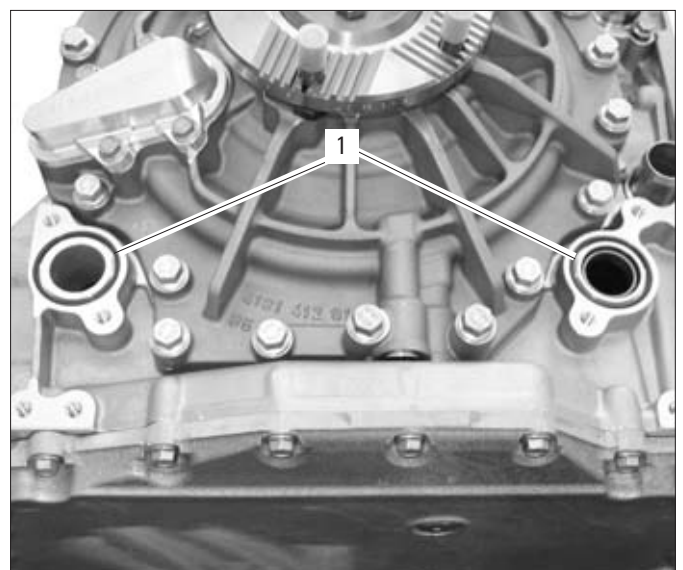
025321

3. Cautiously drive in the connecting pipes **(1)** into the transmission housing by means of a plastic hammer.
4. Put on the bracket **(3, 5)** for the connecting pipes.
5. Screw in two M8x22 hex head bolts/screws **(2, 4)** respectively and tighten. Tightening torque: 23 Nm



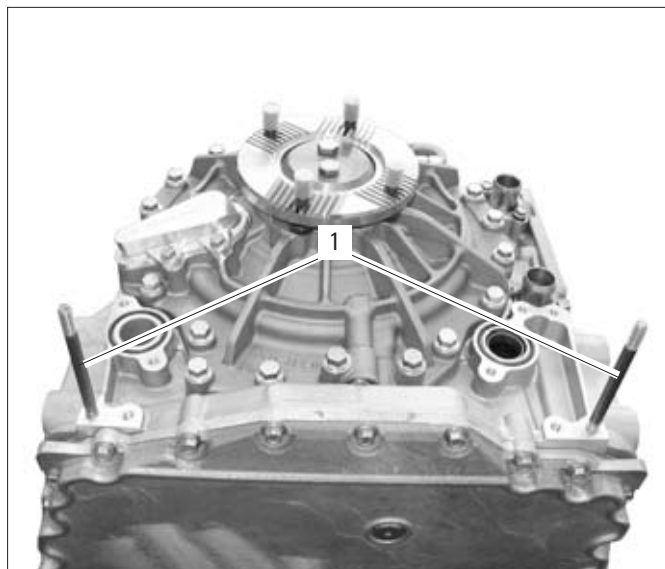
025588

6. Coat two O-rings **(1)** with technical Vaseline.
7. Insert the two O-rings **(1)**.



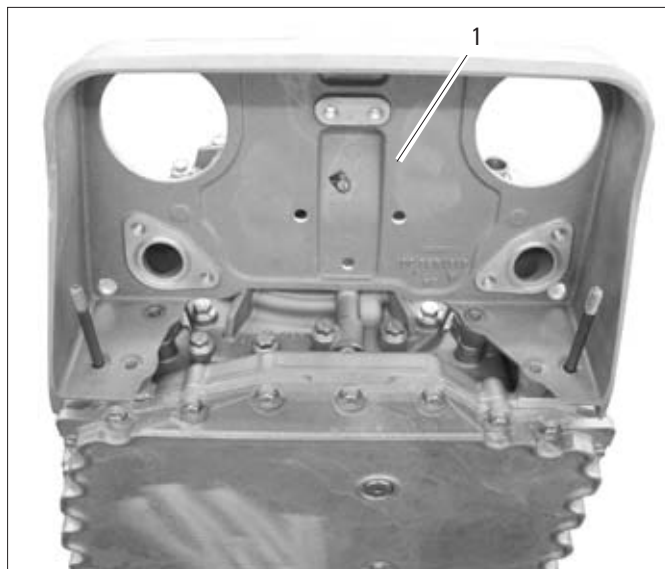
025836

- 8 Screw in two guide screws M10 **(1)**.



025837

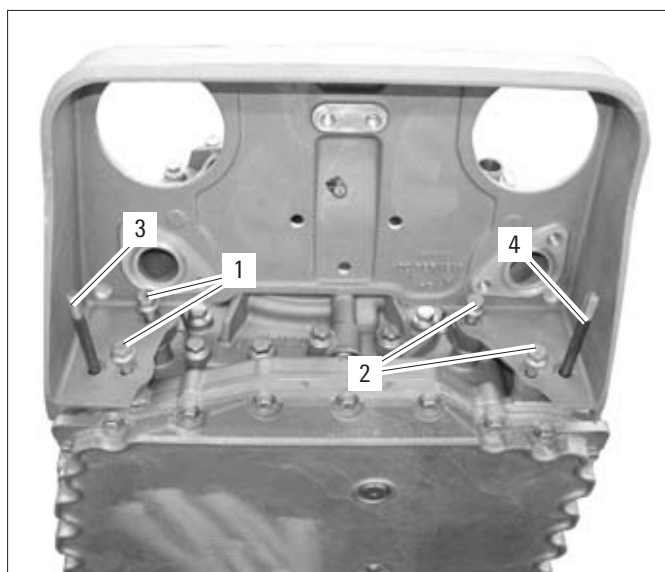
- 9 Put on the bracket **(1)**.



025838

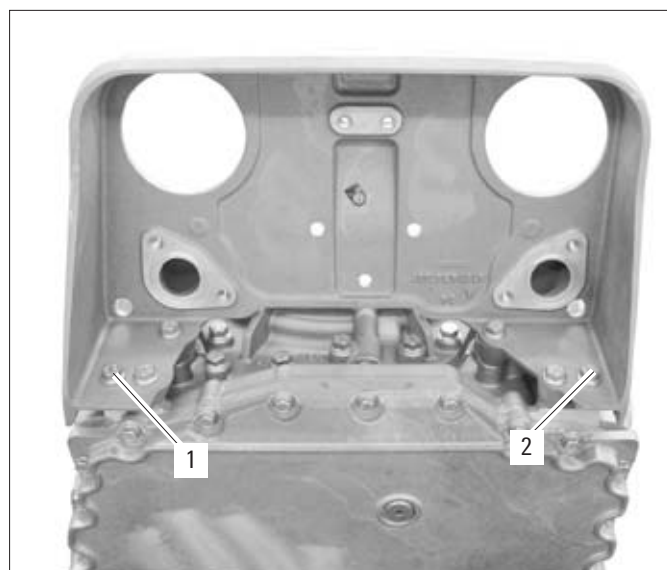
- 10 Manually screw in four M10 hex head screws/bolts **(1, 2)** - but do not tighten yet.

- 11 Remove the two guide screws **(3, 4)**.



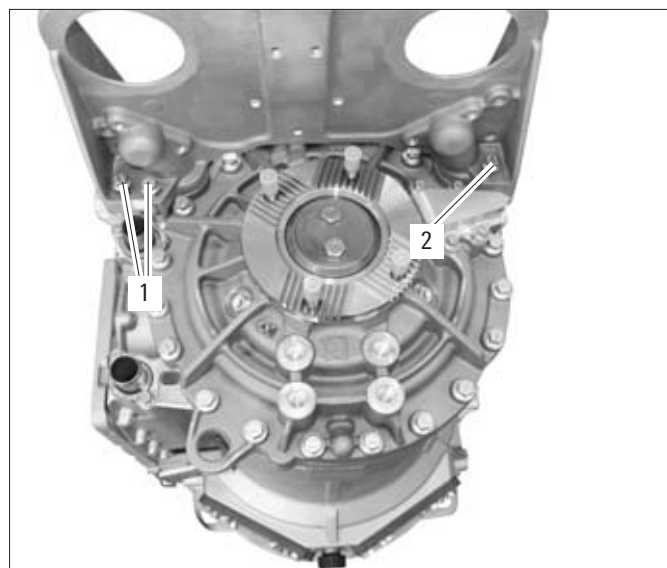
025839

- 12 Manually screw in two M10 hex head screws/bolts **(1)** - but do not tighten yet.



025841

- 13 Screw in three M10 hex head screws/bolts **(1, 2)** at the other side of the bracket - but do not tighten yet.
- 14 Now, tighten all nine hex head screws/bolts for fixing the bracket.
Tightening torque: 46 Nm



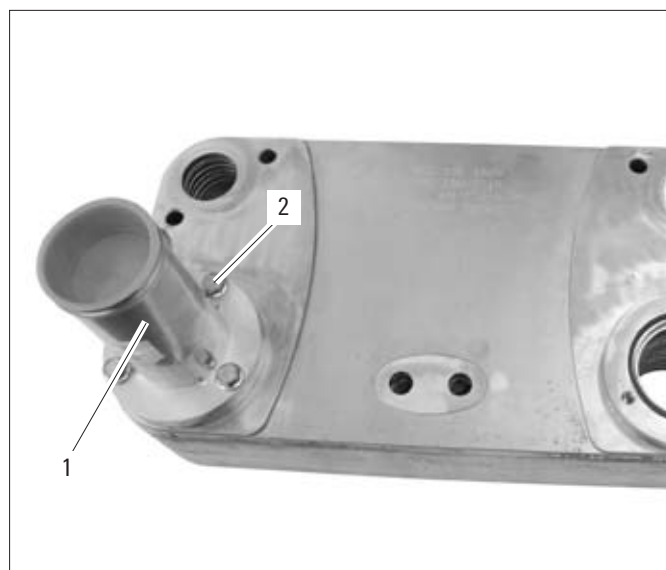
025840

- 15 Coat O-ring **(1)** with technical Vaseline.
- 16 Insert the O-ring **(1)** in the flange.



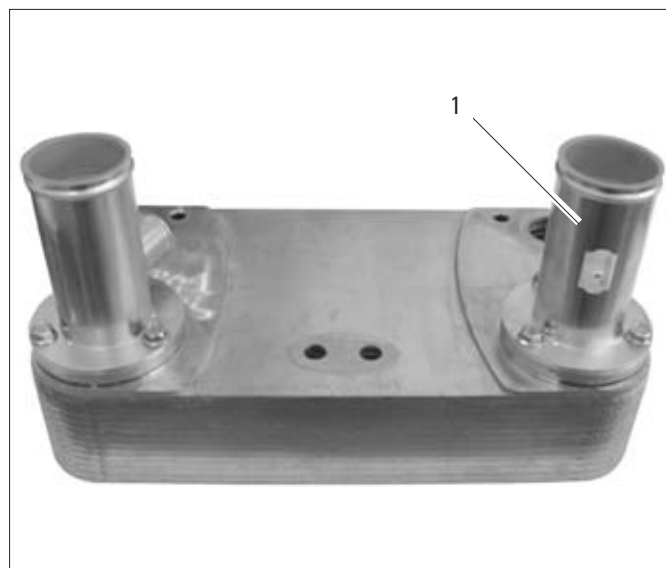
025842

- 17 Put the connecting pipe **(1)** on the flange.
- 18 Screw in three M8 hex head bolts/screws **(2)** and tighten.
Tightening torque: 23 Nm



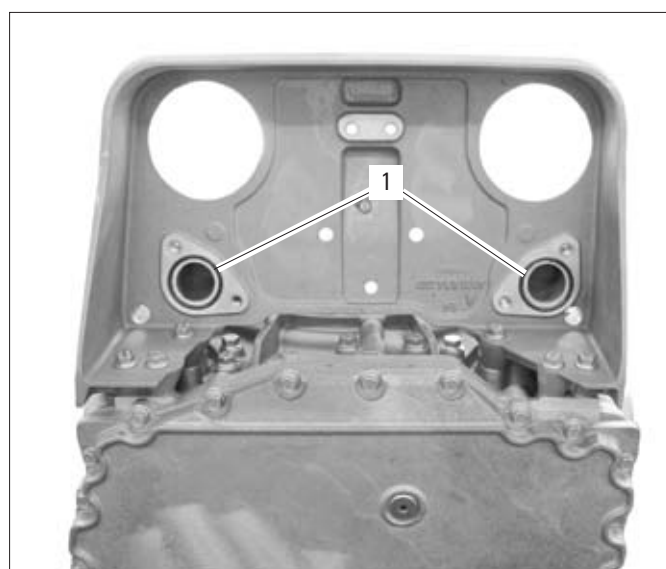
025843

- 19 The assembly process for the second connecting pipe **(1)** is identical.



025844

- 20 Coat two O-rings **(1)** with technical Vaseline.
- 21 Put two O-rings **(1)** in the bracket.



025845

22 Insert the ROC **(1)** heat exchanger.

23 Screw in six M10x100 hex head bolts/screws **(2)** and tighten.
Tightening torque: 46 Nm

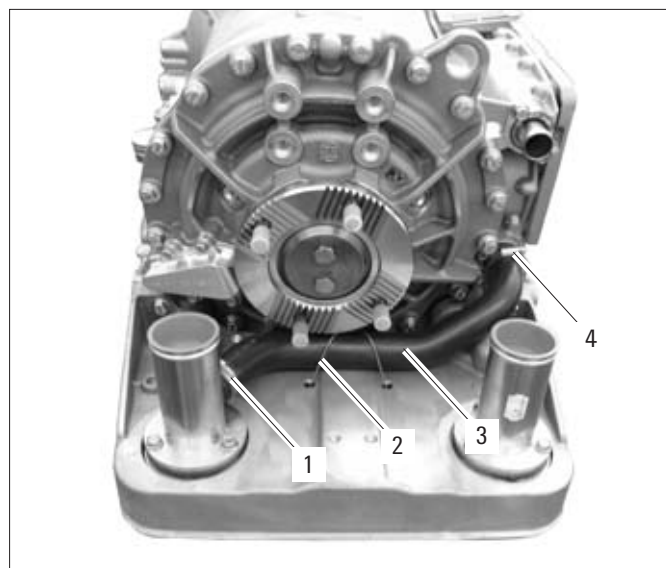


025846

24 Insert the lower hose **(3)**.

25 Tighten the two hose clamps **(1, 4)**.

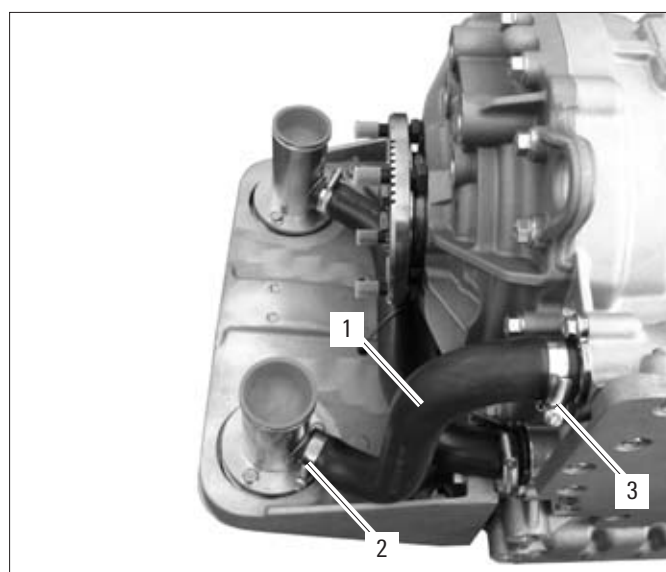
26 Mount the retaining clamp **(2)**.



025847

27 Oberen Schlauch **(1)** einsetzen.

28 Zwei Schlauchschellen **(2, 3)** festziehen.

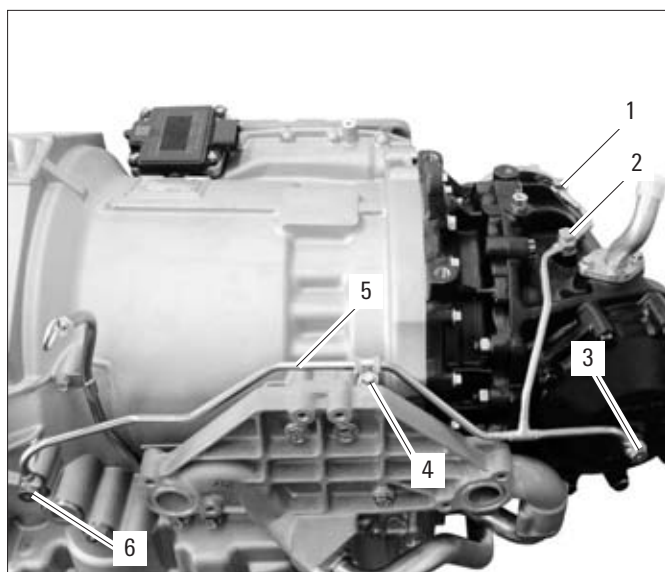


025848

6 Mount / Remove the Lube Oil Pipe of the Angle Drive

6.1 Remove the angle drive's lube oil pipe

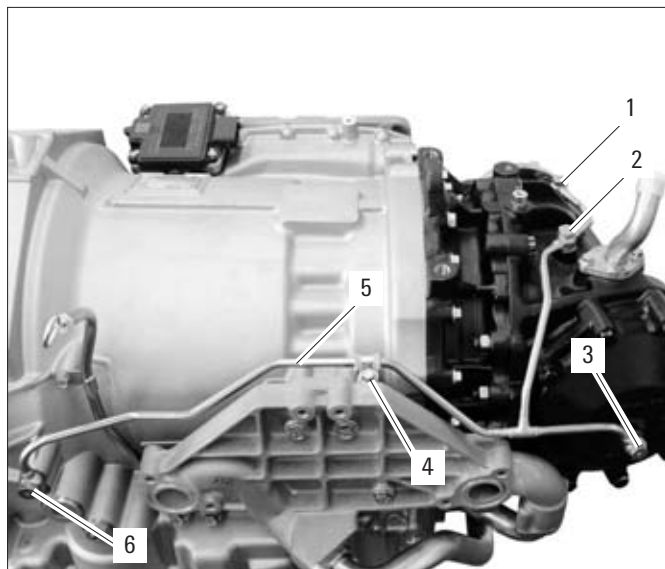
- 1 Unscrew four union screws **(1, 2, 3, 6)** with the two copper sealing rings respectively.
- 2 Unscrew the pipe clamp **(4)** and take out.
- 3 Remove the lube oil pipe **(5)**.



030010

6.2 Mount the angle drive's lube oil pipe

- 1 Put on the lube oil pipe **(5)**.
- 2 Screw in the four union screws **(1, 2, 3, 6)** with the two copper sealing rings respectively and tighten.
Tightening torque: 40 Nm
- 3 Mount the pipe clamp **(4)** with the hex head bolts/screws M8x22.
Tightening torque: 23 Nm



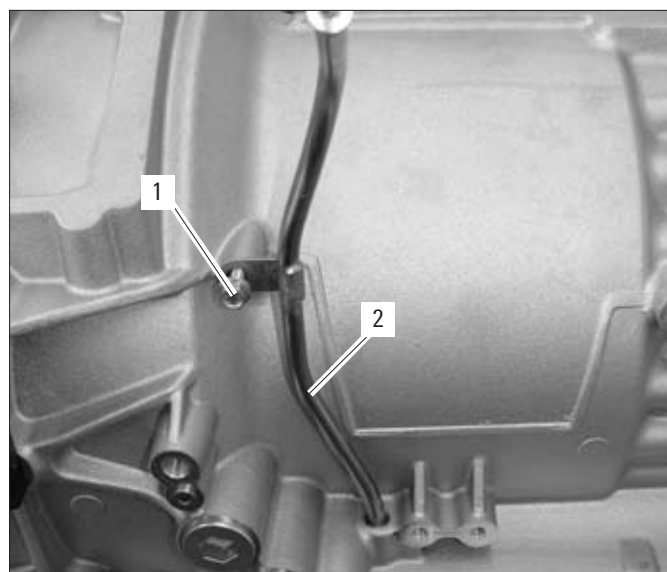
030010

7 Removing and Assembling the Oil Level Tube

7.1 Removing the Oil Level Tube

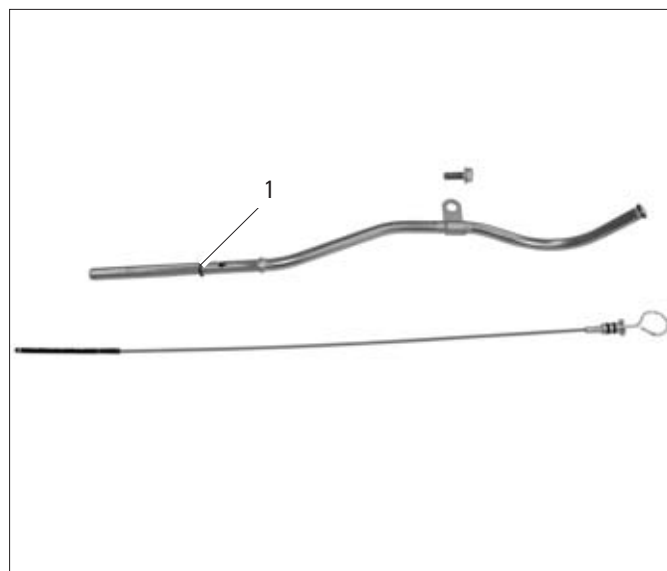
1 Unscrew the M8 **(1)** hex head bolt/screw.

2 Pull out the **(2)** oil level tube.



030377

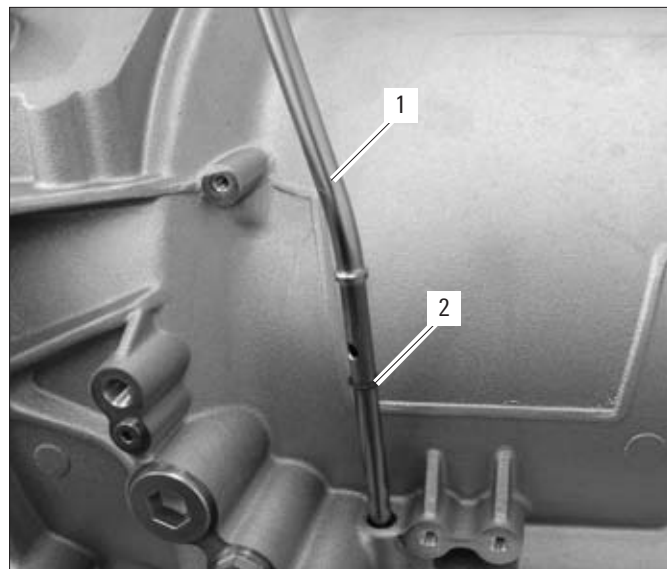
3 Take off the O-ring **(1)** from the oil level tube.



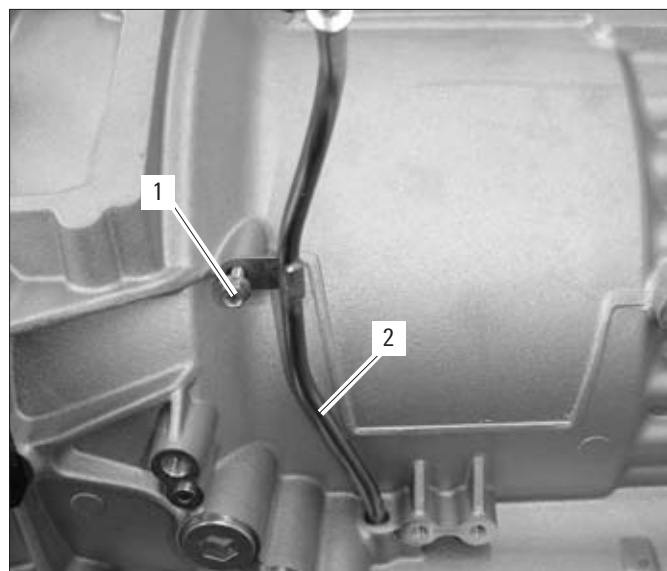
030017

7.2 Removing the Oil Level Tube

1. Coat O-ring **(2)** with technical Vaseline.
2. Pus the O-ring **(2)** onto the oil level tube **(1)**.
3. Insert the oil level tube **(1)** into the transmissi-on housing.
4. Screw in M8x22 hex head bolt/screw **(1)**.
Tightening torque: 23 Nm



030376



030377

8 Remove and Install the Oil Sump and the Filter

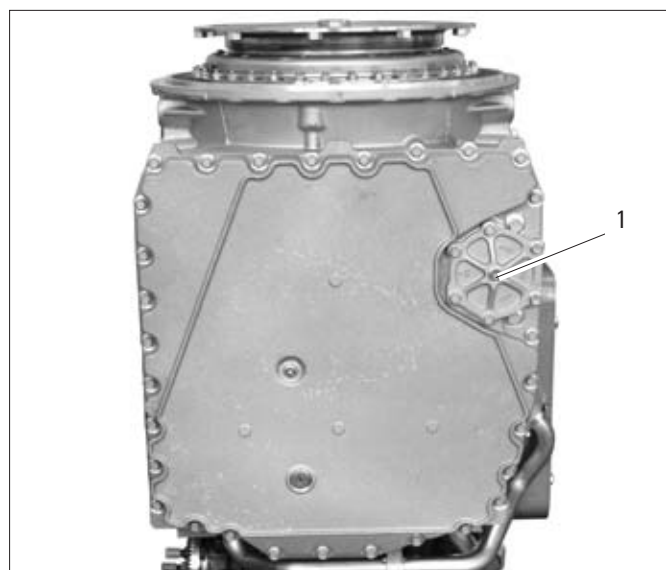
8.1 Remove the Oil Sump and the Filter

8.1.1 Remove the Oil Sump and the Filter Cover

NOTE

Drain transmission oil (also refer to repair instructions level 1-2).

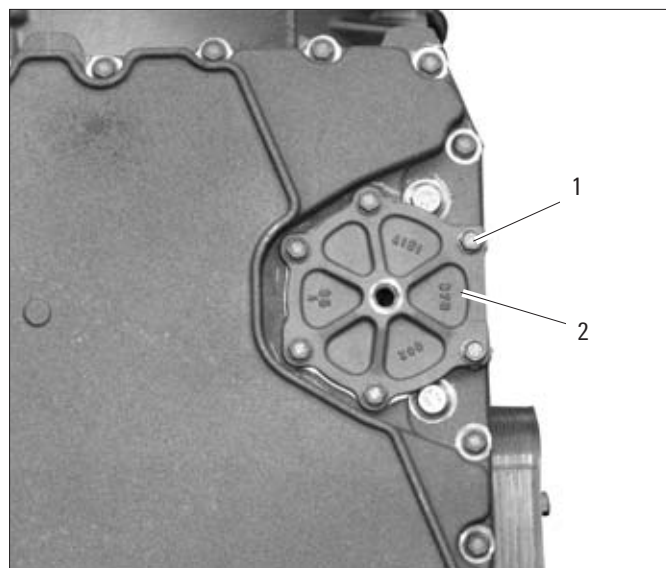
1 Unscrew the plug (1).



025015

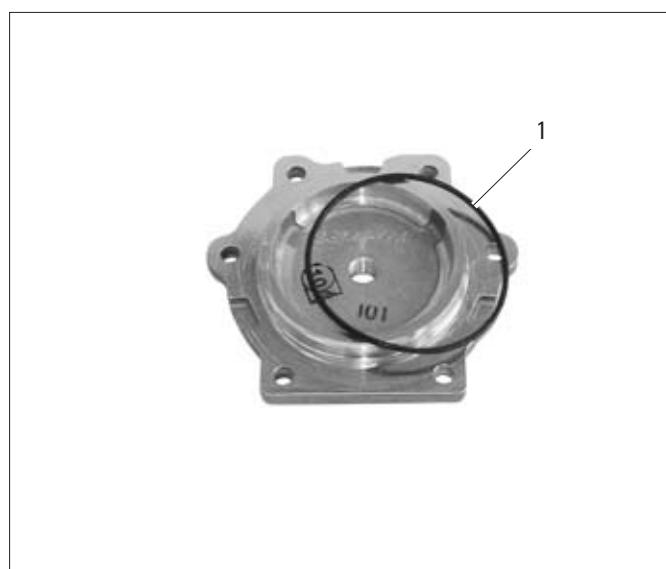
2 Unscrew the six M8 hex head screws/bolts (1) at the filter cover (2).

3 Take off the filter cover (2).



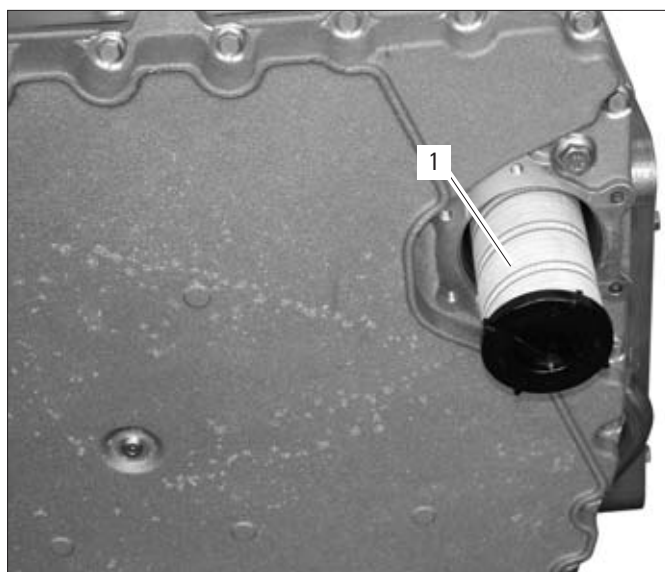
025016

4 Take off the O-ring (1) the filter cover.



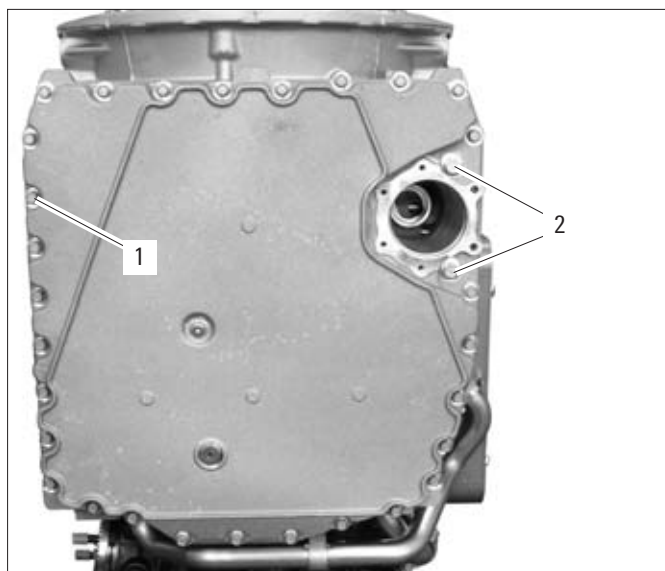
025021

- 5 Pull out the filter **(1)**.



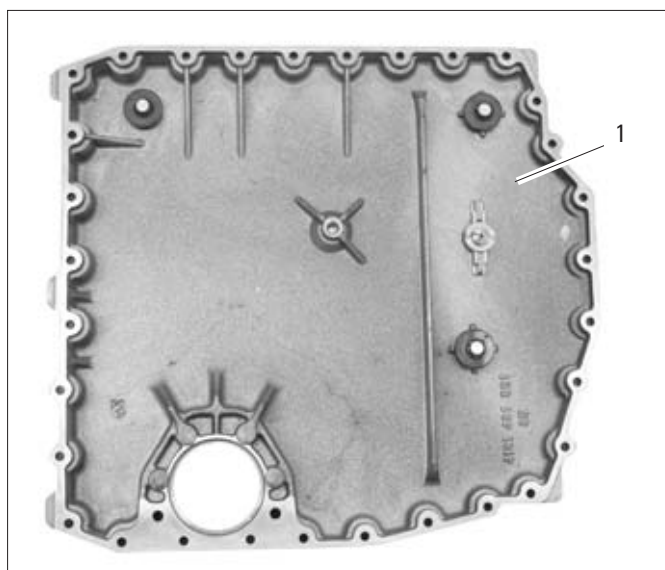
025018

- 6 Unscrew the two hexagon head screws/bolts **(2)**.
- 7 Unscrew 29 hex head screws/bolts **(1)** at the circumference of the oil sump.



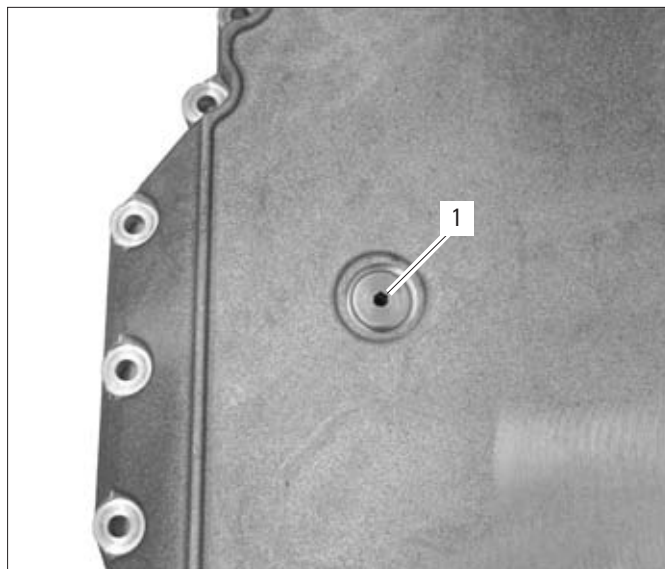
025019

- 8 Take off the oil sump **(1)**.



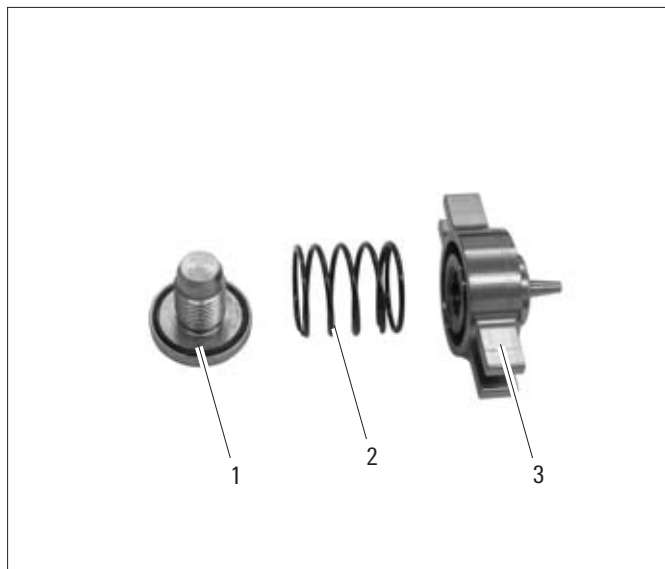
025857

- 9 Unscrew the oil drain plug **(1)** from the oil sump.



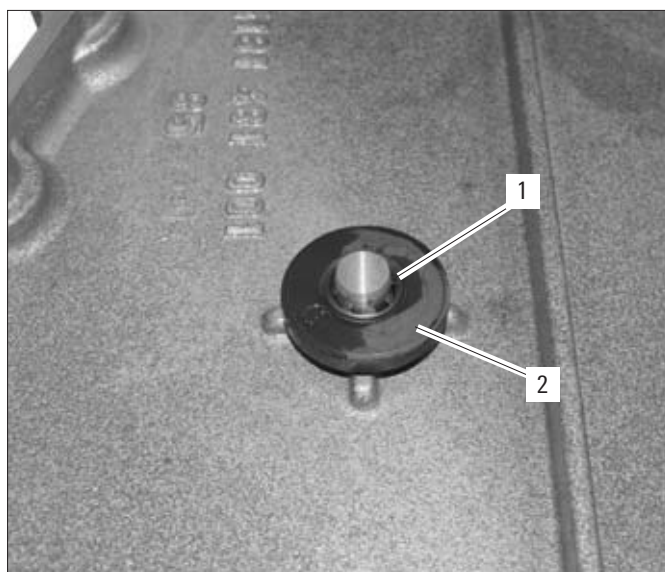
025890

- 10 Take out the converter drain valve **(3)** and the spring **(2)**.
- 11 Take out the O-ring **(1)** from the oil drain plug.



025891

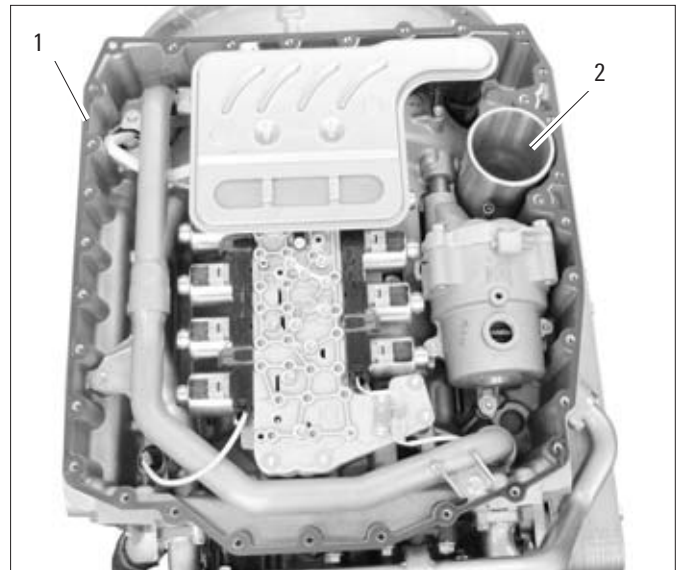
- 12 Disassemble the three securing rings **(1)** at the three magnets of the oil sump.
- 13 Take off the three magnets **(2)** from the oil sump and clean them.



025892

8.1.2 Remove the Oil Filter (Pressure Filter)

1. Take off the sealing **(1)** from the oil sump.
2. Take off the pipe **(2)**.
3. Take off the two O-rings **(1, 2)** from the pipe.



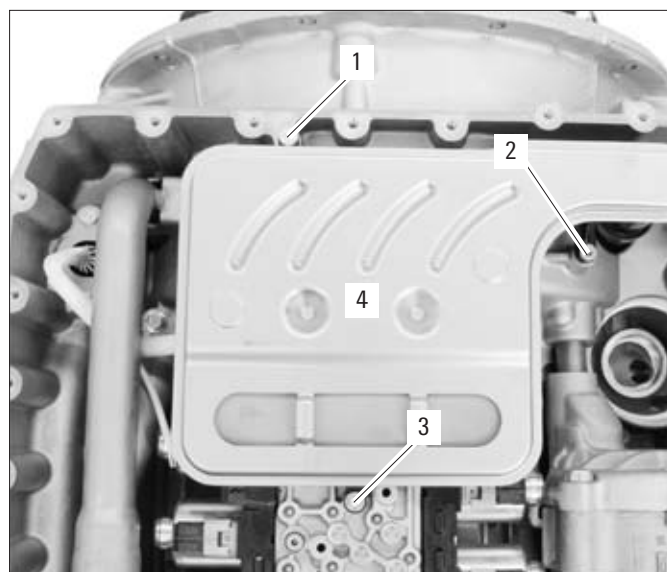
025024



025667

8.1.3 Remove the Suction Filter

1. Unscrew three TORX screws **(1, 2, 3)** from the suction filter **(4)**.



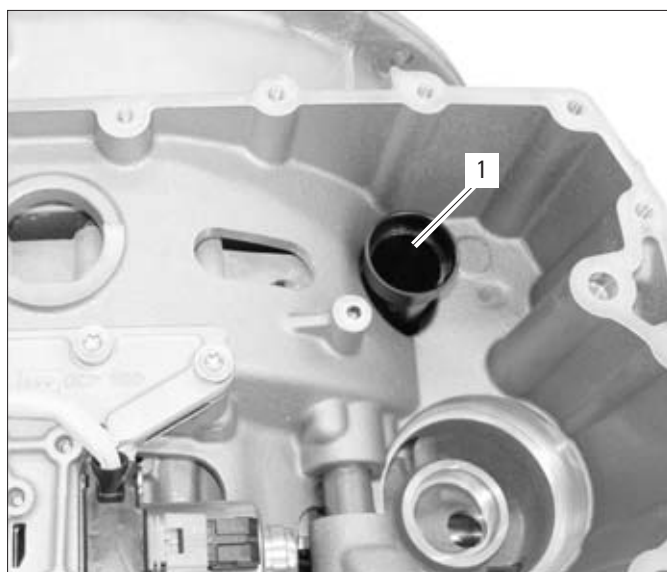
030020

- 2 Remove the suction filter **(1)**.



025026

- 3 Pull out the suction tube **(1)**.



030021

- 4 Take off the O-ring **(1)** from the suction tube **(2)**.

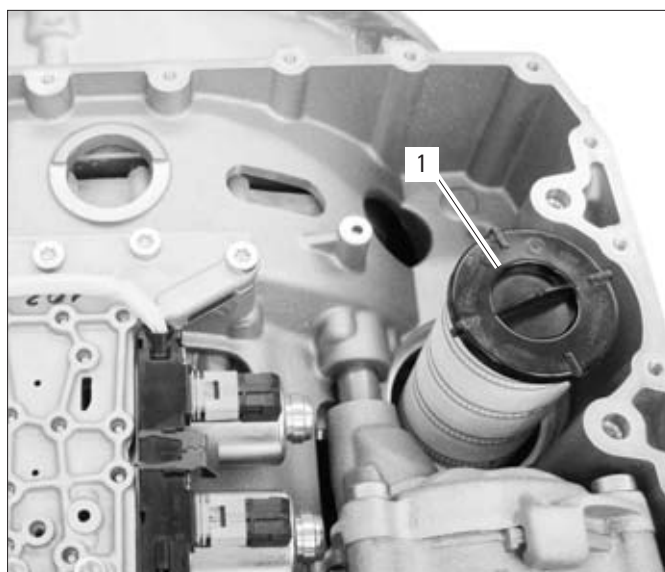


030022

8.2 Install the Oil Sump and the Filter

8.2.1 Install the Oil Filter (Pressure Filter)

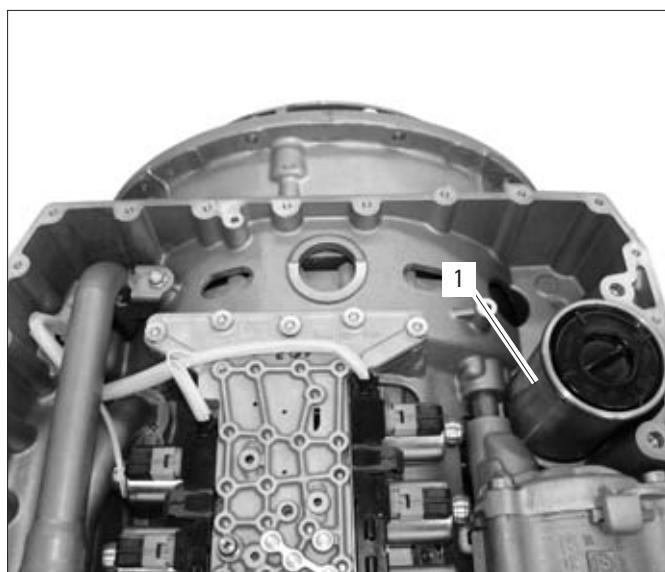
1. Coat the O-ring of the pressure filter **(1)** with technical Vaseline.
2. Insert the pressure filter **(1)**.
3. Coat two O-rings **(1, 2)** with technical Vaseline.
4. Mount the two O-rings **(1, 2)** on the tube for the pressure filter.
5. Insert the tube **(1)**.



030023



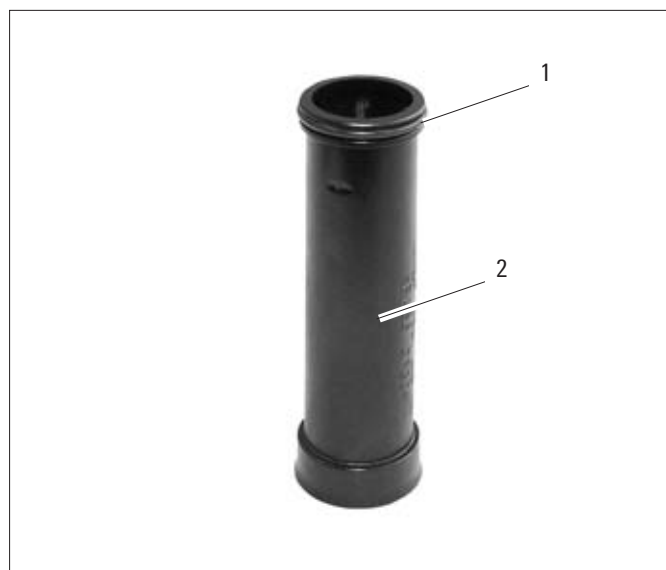
025667



030024

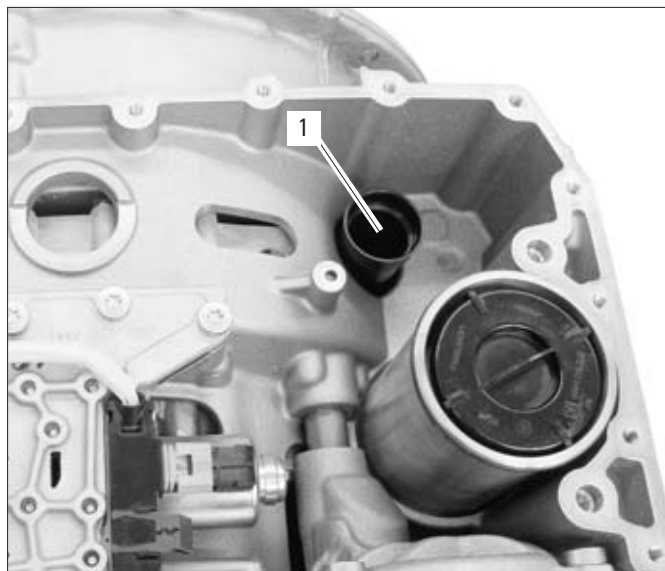
8.2.2 Install the Suction Filter

1. Coat O-ring (1) with technical Vaseline.
2. Mount the O-ring (1) on the suction tube (2).



030022

3. Insert the suction tube (1).



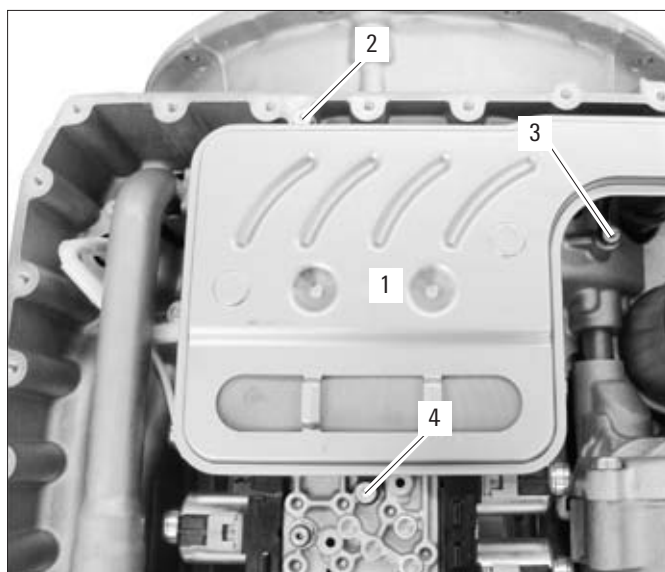
030025

4. Coat the O-ring of the suction filter (1) with technical Vaseline.
5. Insert the suction filter (1).

CAUTION

When inserting the suction filter, the wiring harness must not be squeezed.

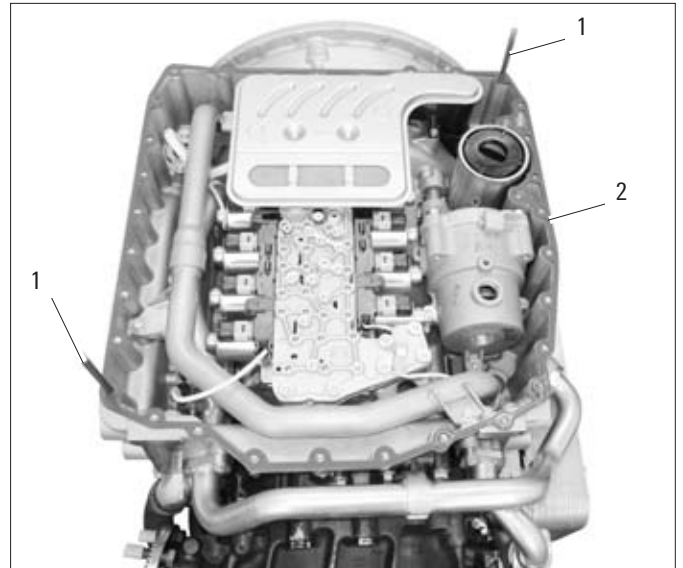
6. Screw in three TORX screws M6x25 (2, 3, 4) and tighten.
Tightening torque: 9.5 Nm



030026

8.2.3 Install the Oil Sump and the Filter Cover

1. Screw in the M8 guide screws (1).
2. Add on the sealing (2) for the oil sump.

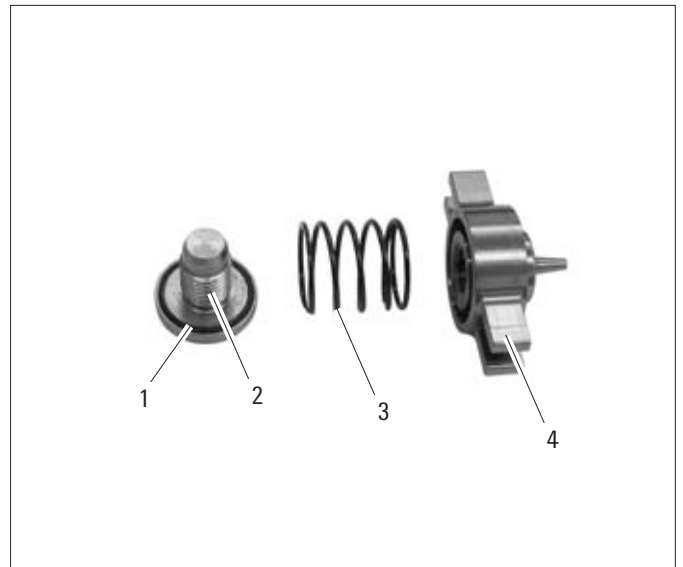


025896

- 3 Converter drain valve:

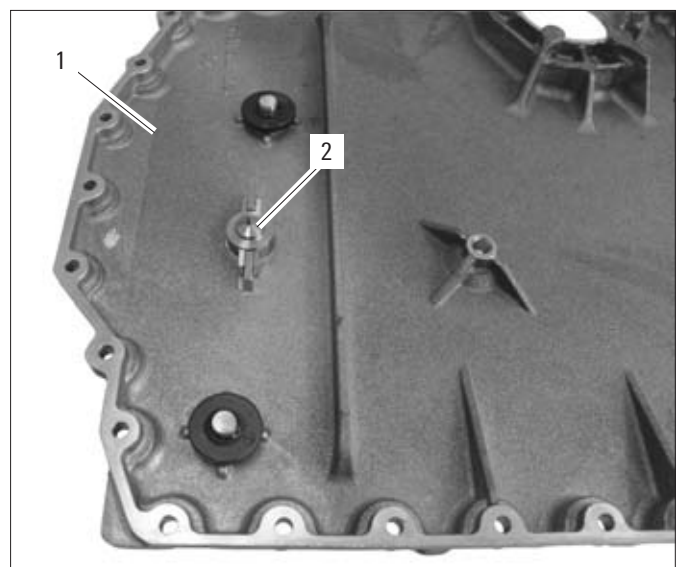
- Plugs (2)
- Spring (3)
- Drain valve (4)

- 4 Coat the new O-ring (1) with technical Vaseline.
- 5 Insert the new O-ring (1) in the plug.



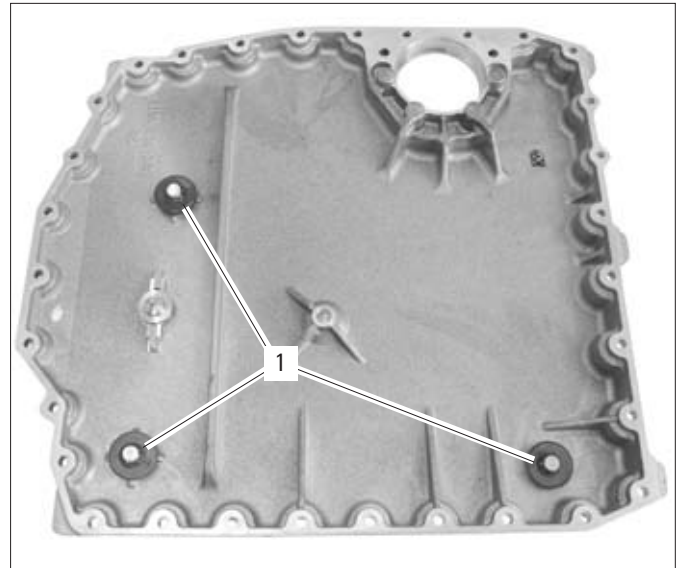
025891

- 6 Insert the converter drain valve (2) in the oil sump (1).
- 7 Insert the spring from below in the oil sump.
- 8 Screw in the M14x1.5 plug from below in the oil sump and tighten.
Tightening torque: 35 Nm



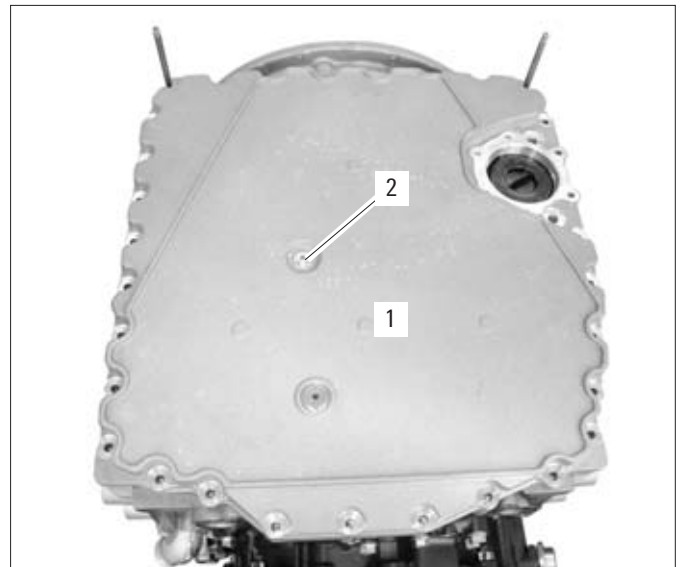
025818

- 9 If required, mount the three magnets **(1)** to the oil sump.



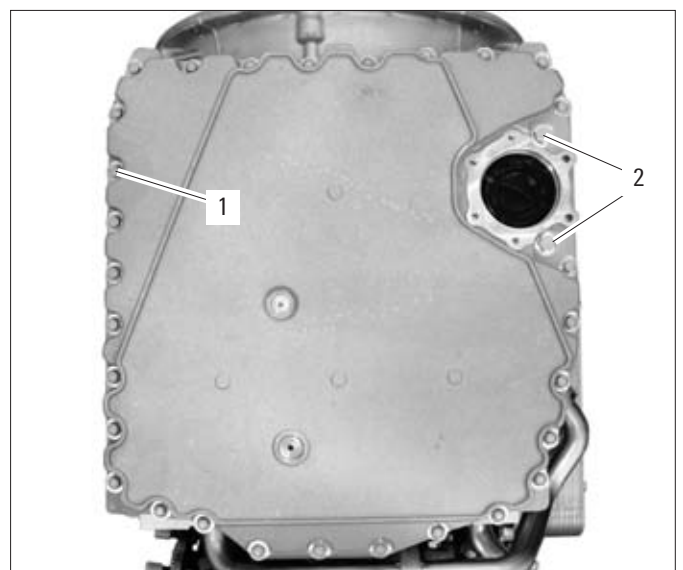
025819

- 10 Put the oil sump **(1)** on the transmission.
- 11 Pay due attention to the filter's O-ring during the assembly process!
- 12 If necessary, screw in the screw plug M10x1 **(2)** with the new O-ring and tighten. Tightening torque: 12 Nm



030374

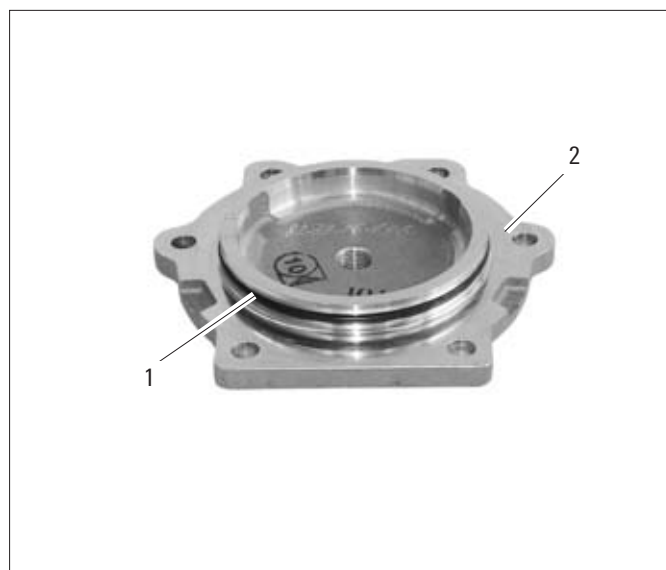
- 13 Screw in 29 hex head screws/bolts M8x30 **(1)** at circumference of oil sump by hand - do not tighten yet. Replace guide screws with M8 hex head screws/bolts.
- 14 Screw in two hex head screws/bolts M12x55 **(2)** and tighten. Tightening torque: 88 Nm
- 15 Tighten 29 hex head screws/bolts M8x30 **(1)** at circumference of oil sump. Tightening torque: 23 Nm



025898

16 Coat O-ring **(1)** with technical Vaseline.

17 Insert the O-ring **(1)** in the cover **(2)**.



025020

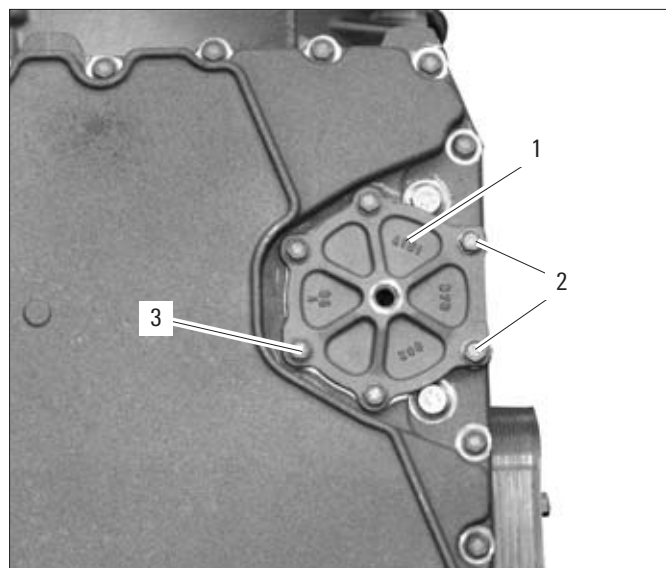
18 Put on the cover **(1)**.

19 Screw in two hex head screws/bolts M8x55 **(2)** and tighten.

Tightening torque: 23 Nm

20 Screw in four hex head screws/bolts **(3)** M8x30 and tighten.

Tightening torque: 23 Nm



025016

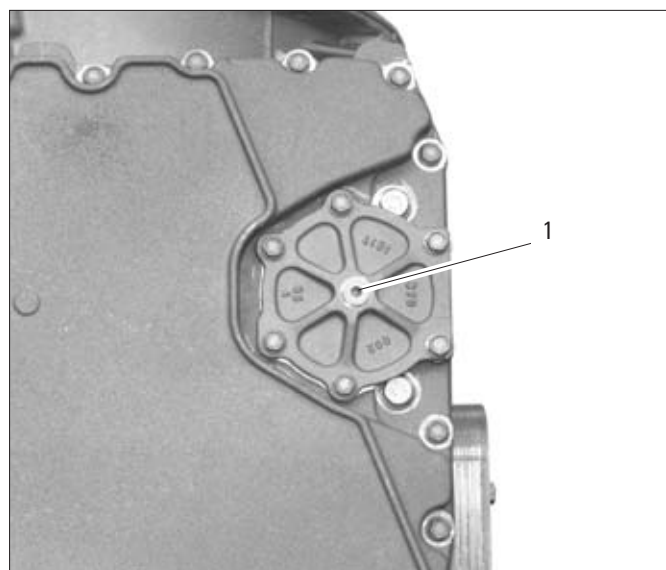
21 Coat O-ring **(1)** with technical Vaseline.

22 Fit new O-ring **(1)** to screw plug.



024194

- 23 Screw in screw plug M14x1.5 **(1)** and tighten.
Tightening torque: 25 Nm

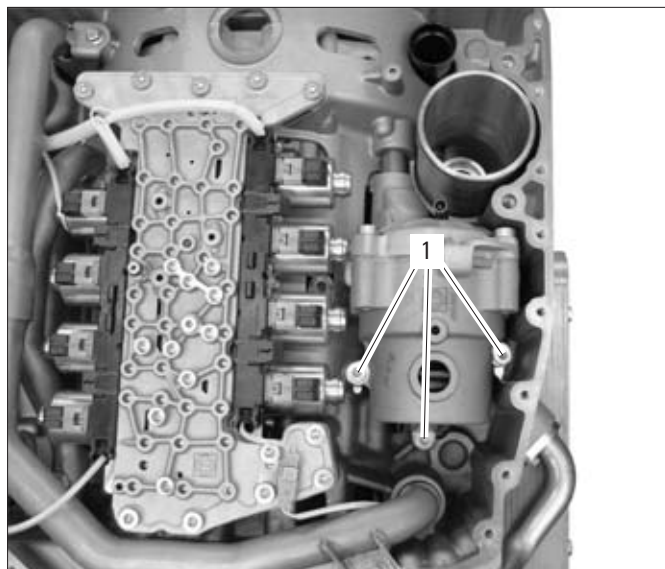


025022

9 Replace the Retarder Accumulator

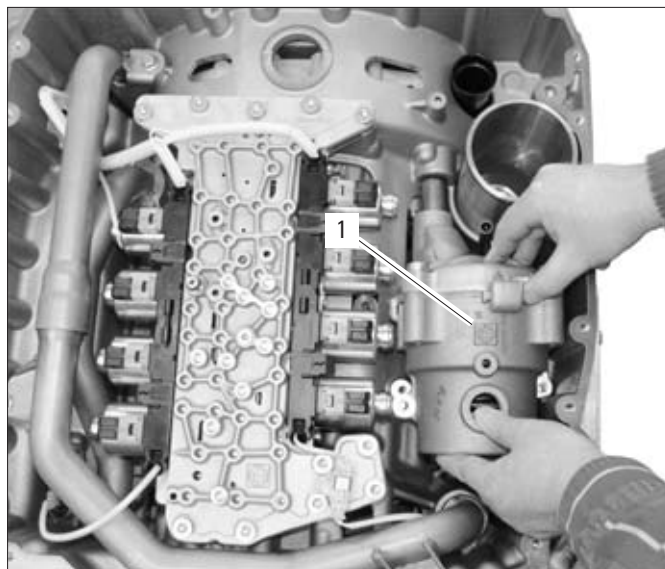
9.1 Remove the Retarder Accumulator

- 1 Unscrew the three TORX screws (1).



025032

- 2 Pull retarder accumulator (1) in direction of output.

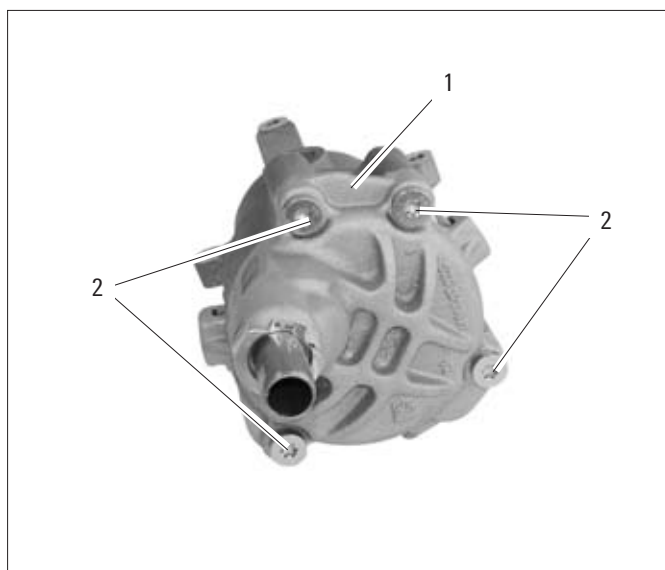


025033

- 3 Remove the retarder accumulator (1).

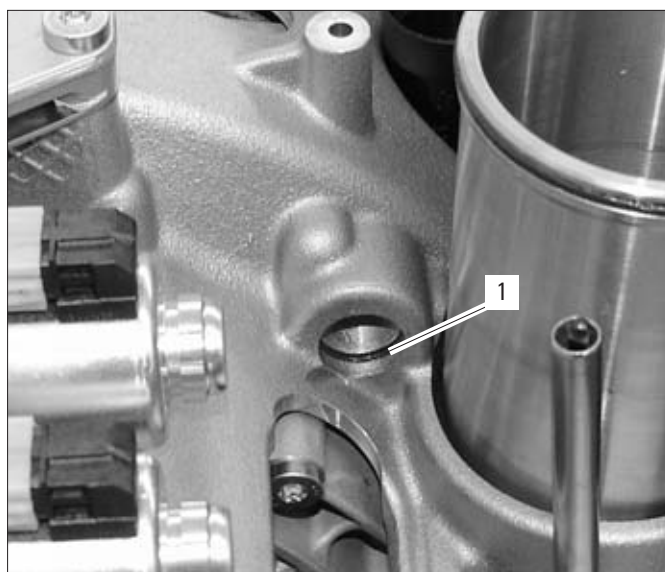
**DANGER**

The four TORX screws (2) must only be opened with the corresponding counter support. Failure to do so leads to a considerable risk of injury.



025034

- 4 Remove the O-ring (1).



025035

9.2 Dismantle the Retarder Accumulator

- 1 Clamp in the retarder accumulator **(1)** in a vise.

NOTE

Use protective chucks made from aluminum.

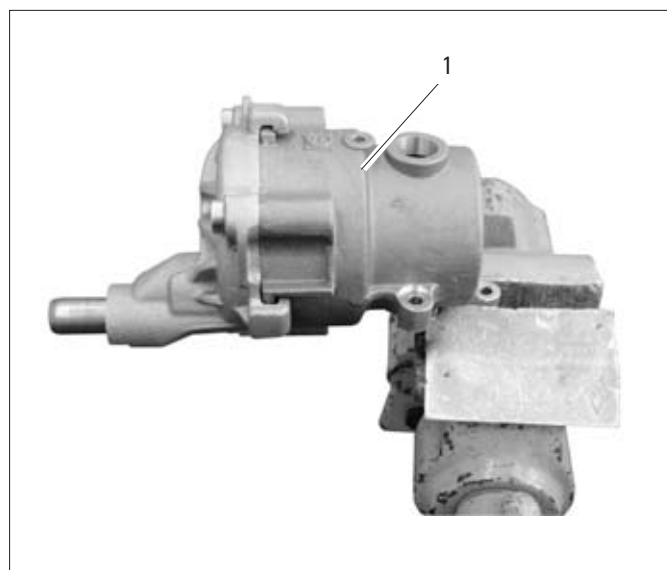


DANGER

The spring may jump out.

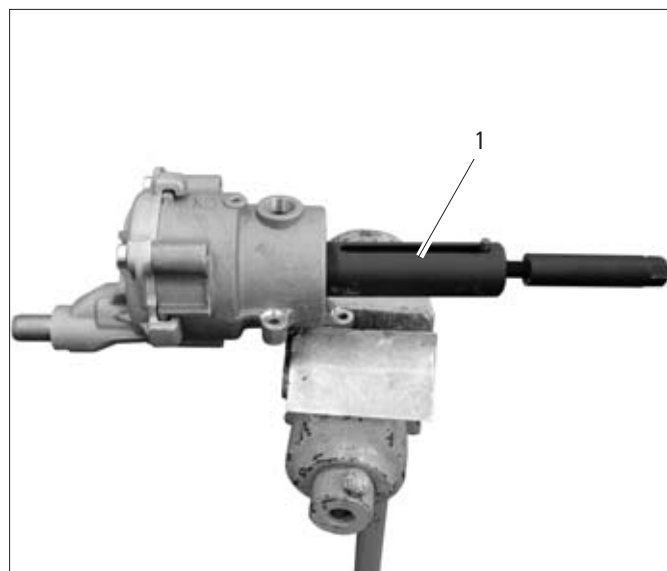
Risk of injury!

The retarder accumulator may only be dismantled by means of the tool no.: **1X56 138 642**.



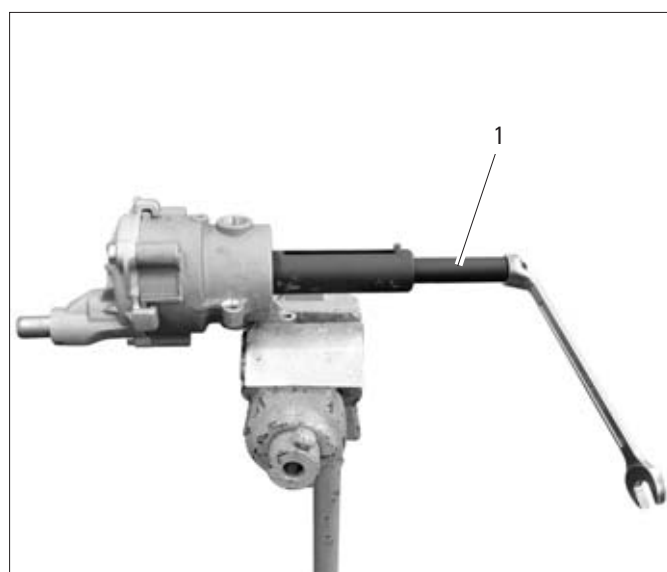
030425

- 2 Screw in the tool no.: **1X56 138 642 (1)** in the retarder accumulator.



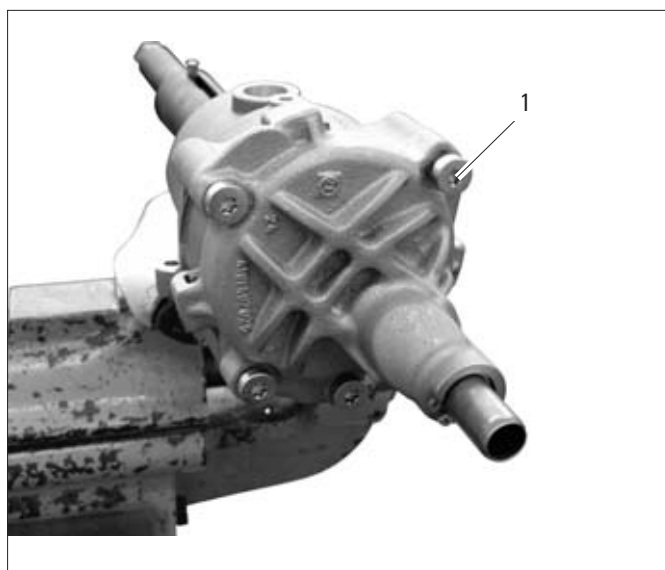
030426

- 3 Screw in the clamping nut **(1)** of the tool no.: **1X56 138 642** until the tool is under stress.



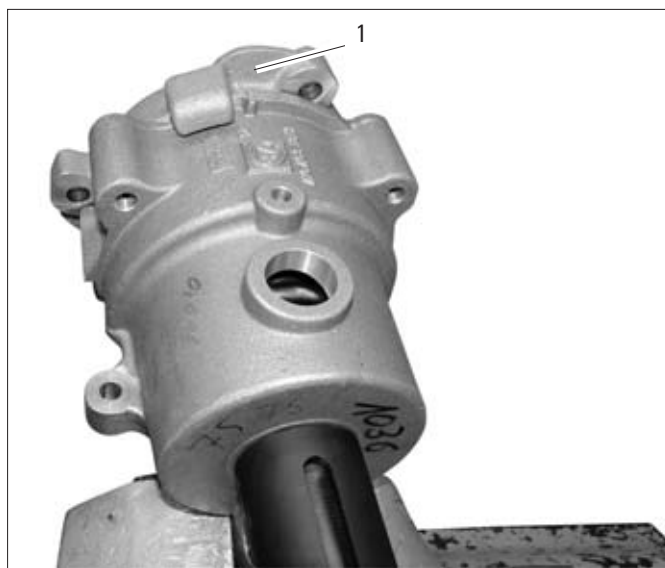
030427

- 4 Unscrew four TORX screws M10 **(1)**.



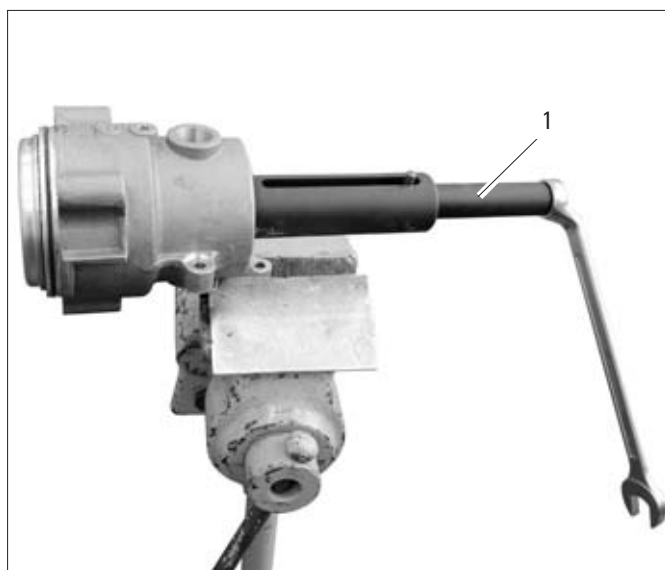
030428

- 5 Turn the cover **(1)** from the locking device and take off.



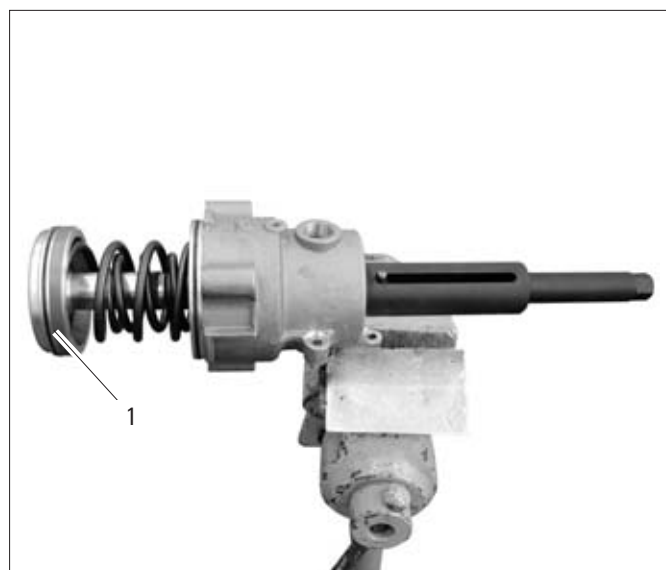
030429

- 6 Release the stress from the spring in the retarder accumulator by loosening the clamping nut **(1)**.



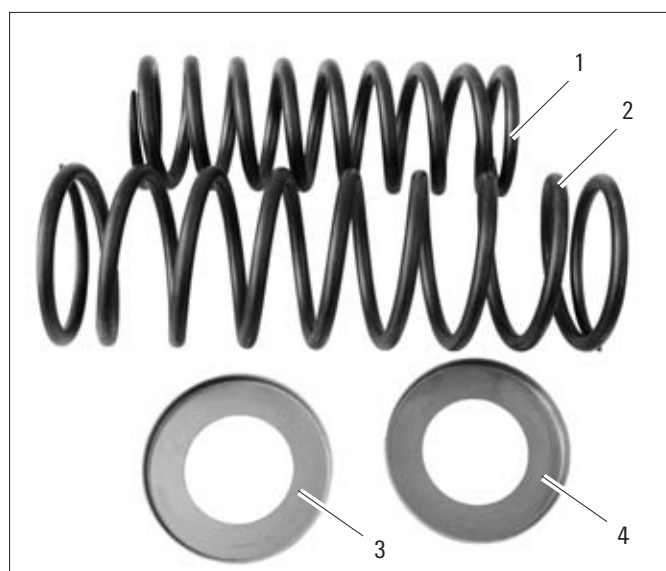
030430

- 7 Screw off the piston (1).



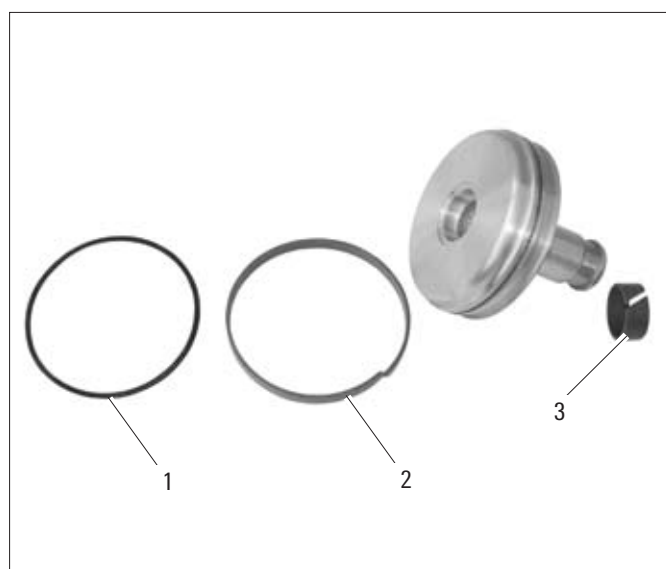
030431

- 8 Take out two centering plates (3, 4) and two springs (1, 2).



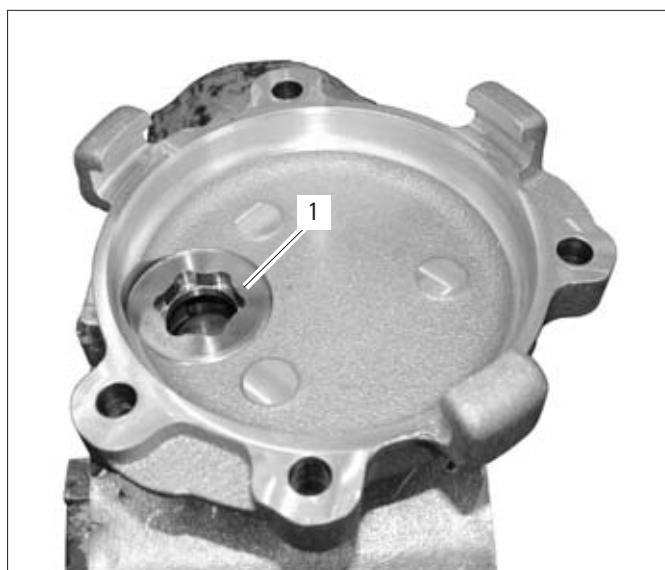
030432

- 9 Take off the sealing elements (1, 2, 3) from the piston.



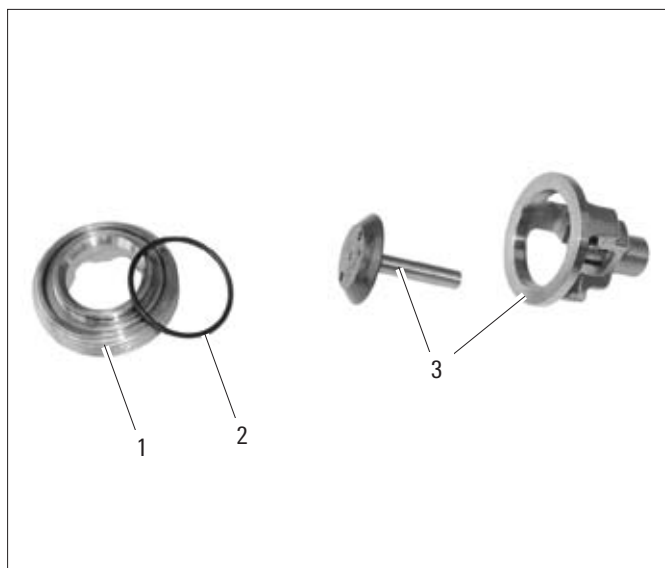
030433

- 10 Unscrew the protection cap **(1)** for valves.



030434

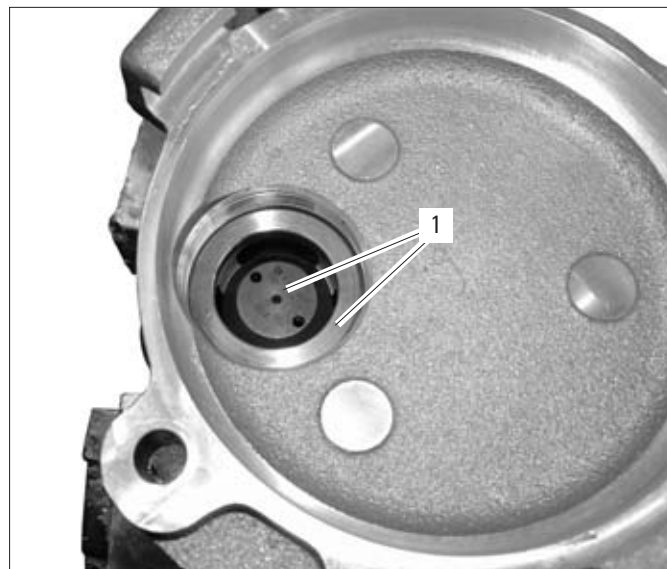
- 11 Take out the protection cap **(1)**, O-ring **(2)**, and valve **(3)**.



030435

9.3 Assemble the Retarder Accumulator

- 1 Insert the valve **(1)**.



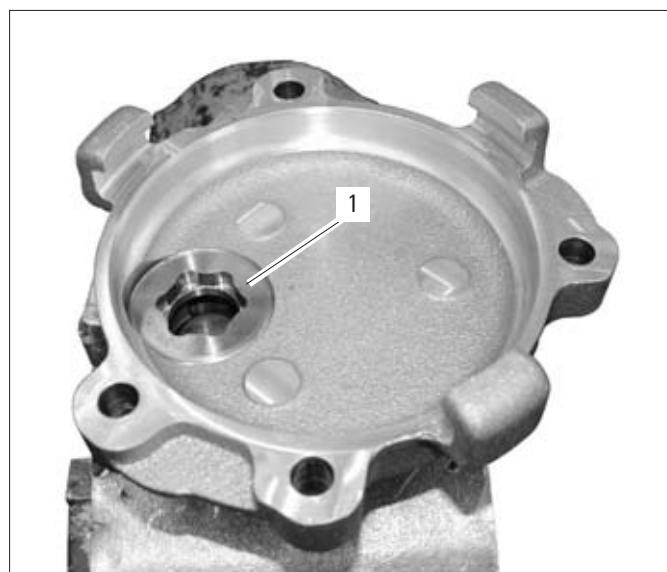
030437

- 2 Insert the O-ring **(1)** in the protection cap.



030436

- 3 Screw in the protection cap **(1)** for the valves.
Tightening torque: 80 Nm



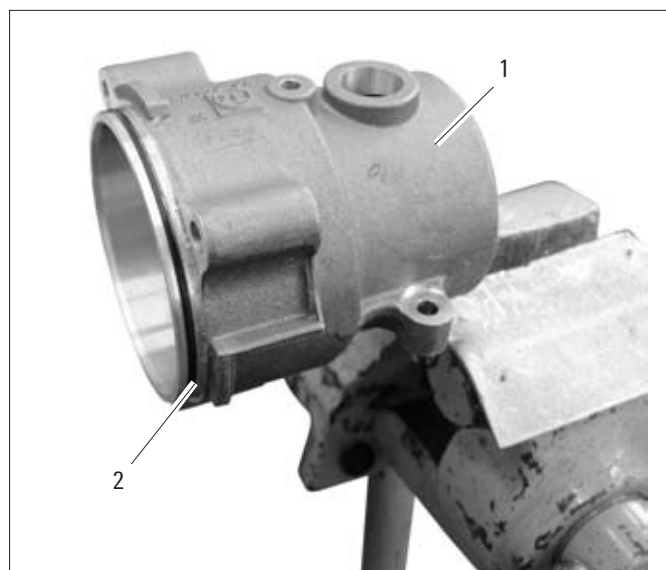
030434

- 4 Clamp in the retarder accumulator **(1)** in a vise.

NOTE

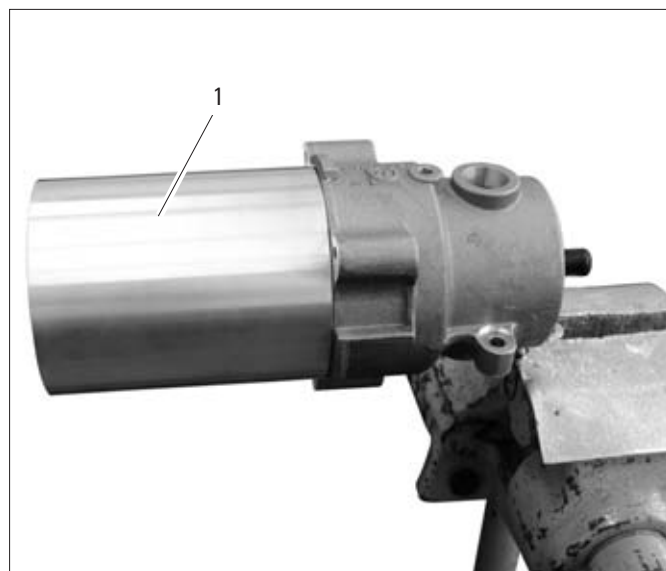
Use protective chucks made from aluminum.

- 5 Insert the O-ring **(2)**.



030438

- 6 Put on the guide bush **(1)** on the retarder accumulator.



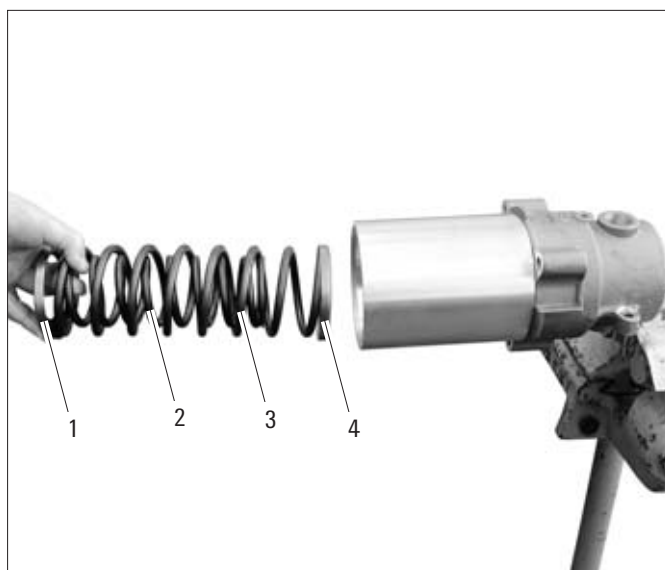
030439

- 7 Insert the sealing elements **(1, 2, 3)** in the piston.



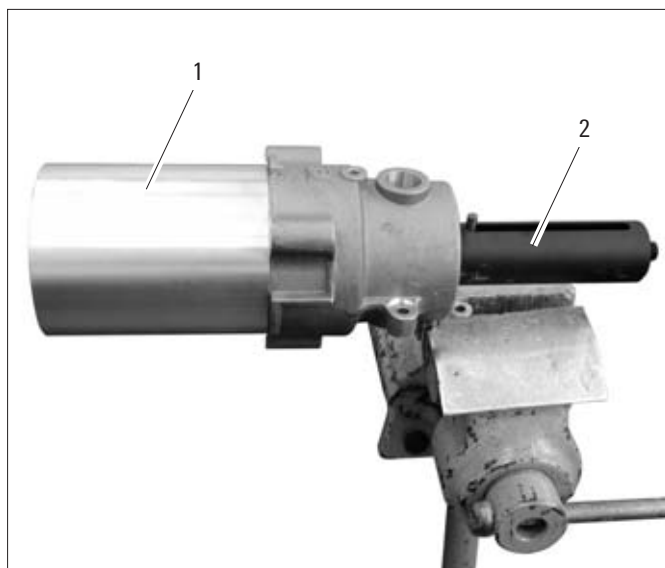
030440

- 8 Insert the two springs (2, 3) with two spring seats (1, 4).



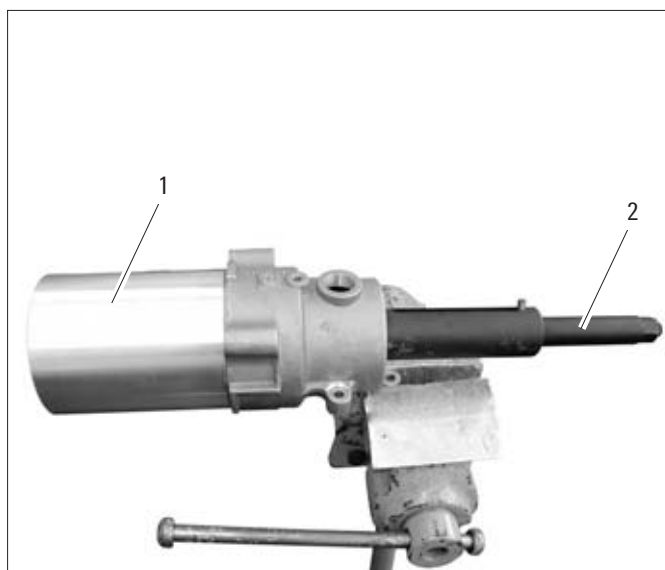
030441

- 9 Insert the tool no.: **1X56 138 642 (1)** in the retarder accumulator.
- 10 Insert the piston in the guide bush (1) and screw in the tool no.: **1X56 138 642** until fully home.



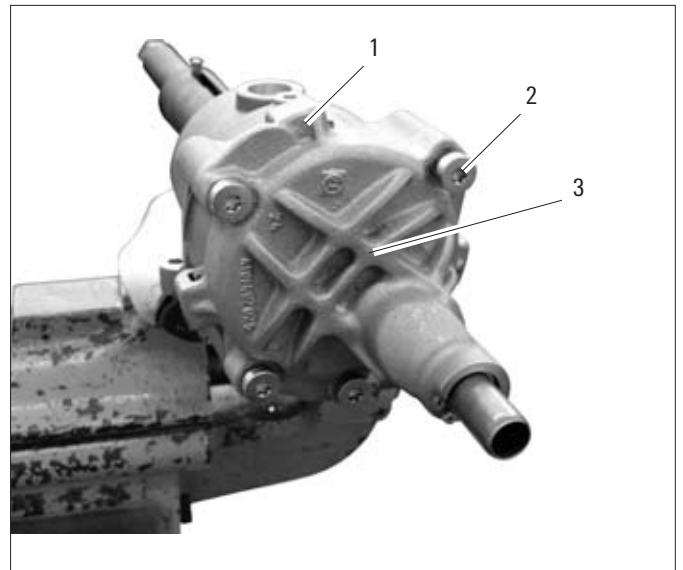
030442

- 11 Screw in the clamping nut (2) to such an extent that the piston is inserted in the housing.
- 12 Take off the guide bush (1).



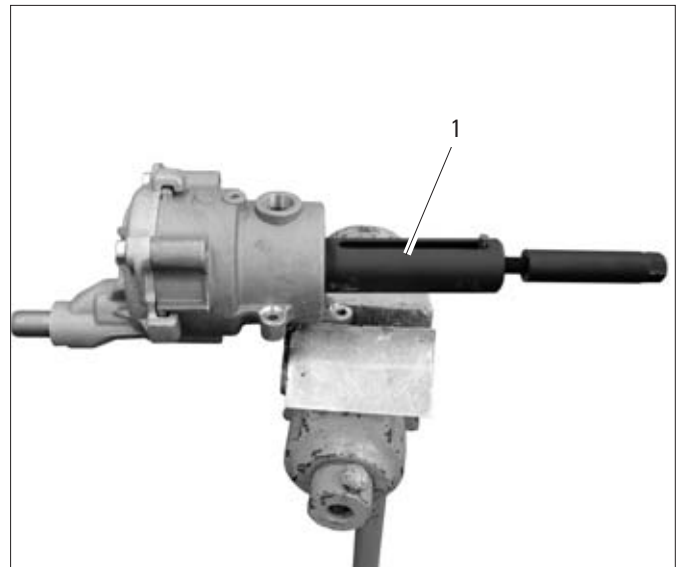
030443

- 13 Put on the cover **(3)** and lock **(1)**.
- 14 Screw in four TORX screws M10 **(2)**.
Tightening torque: 46 Nm



030428

- 15 Relieve the tool no.: **1X56 138 642 (1)** and unscrew.

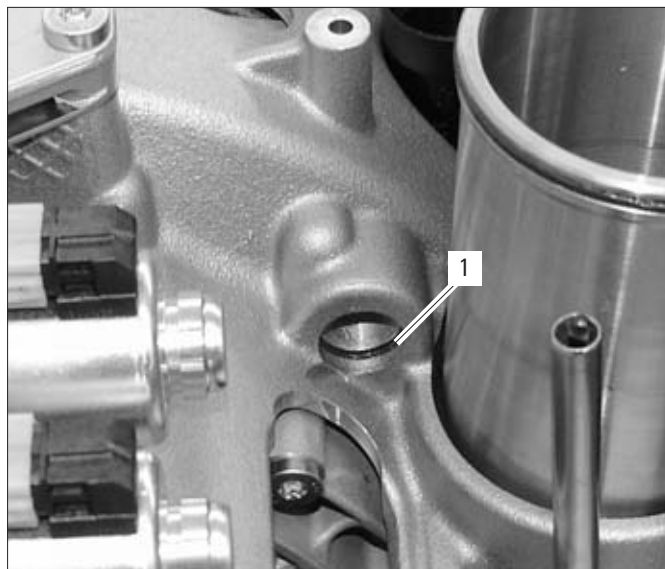


030426

9.4 Install the Retarder Accumulator

1 Coat O-ring **(1)** with technical Vaseline.

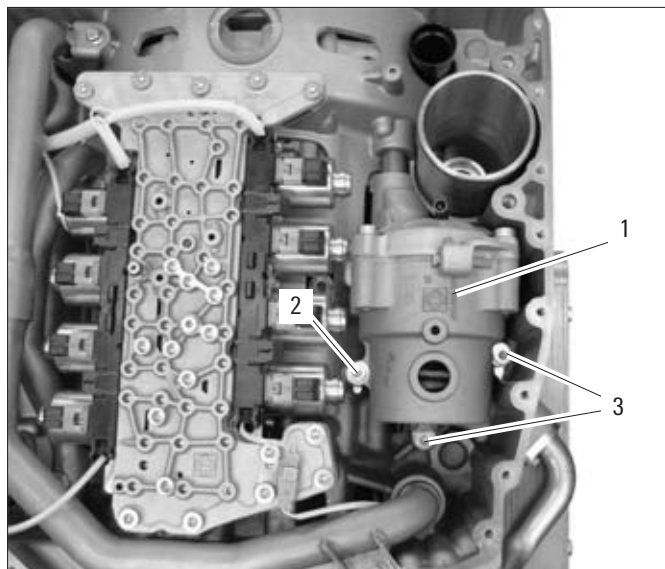
2 Insert the O-ring **(1)**.



025035

3 Insert the retarder accumulator **(1)**.

4 Screw in three TORX screws M8x35 **(2, 3)**.
Tightening torque: 20 Nm

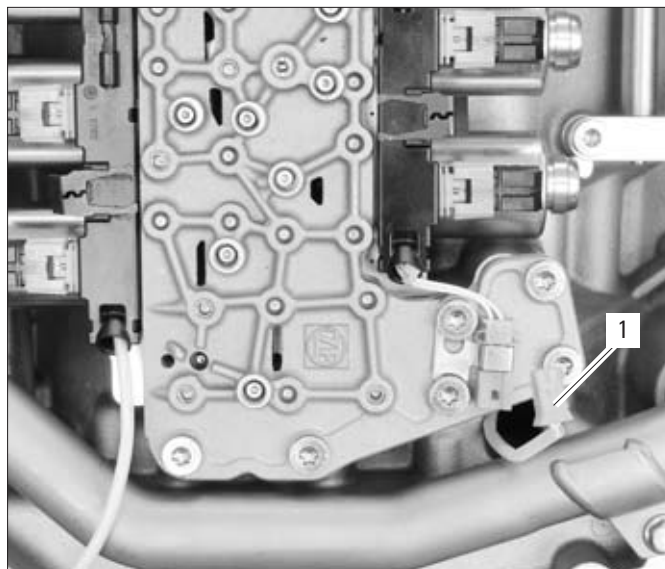


025032

10 Installing, Removing, Dismantling, and Assembling the Hydraulic Control Unit

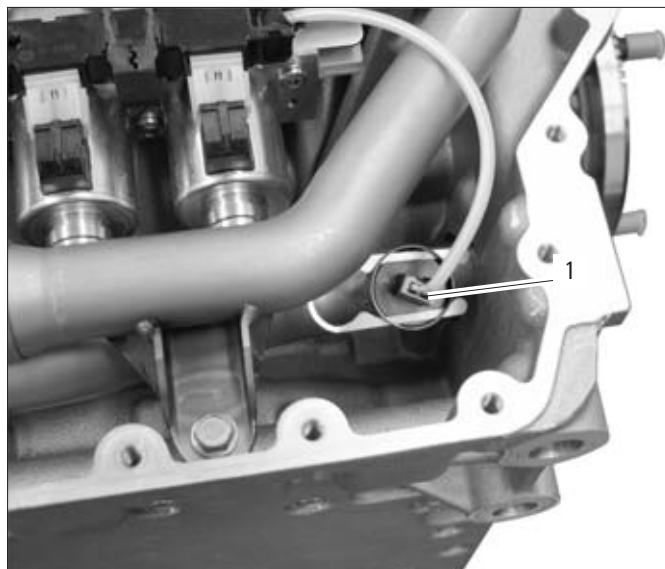
10.1 Removing the Hydraulic Control Unit

- 1 Pull out the connector from the inductive sensor output **(1)**.



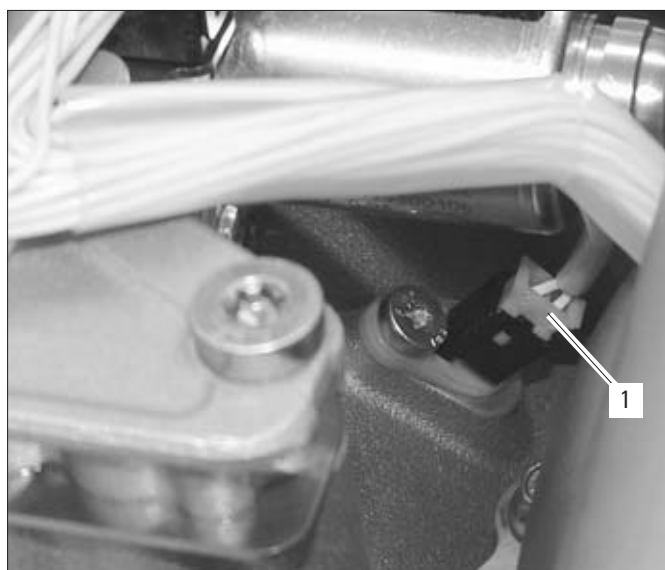
024199

- 2 Pull out the connector of the temperature sensor **(1)**.



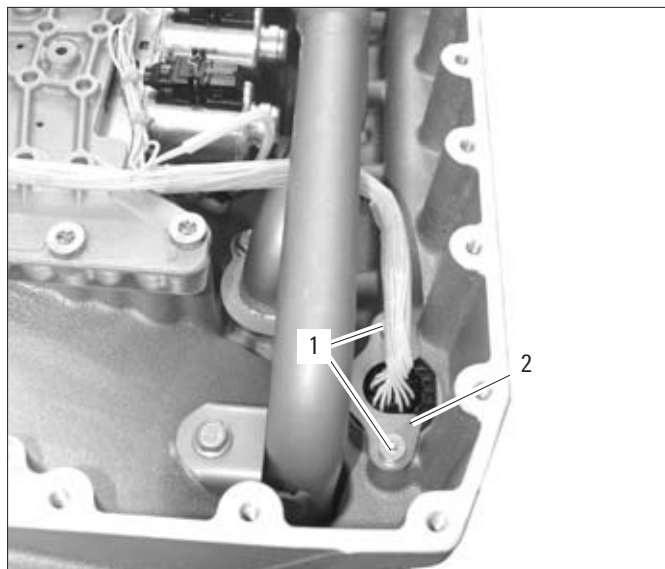
025883

- 3 Pull out the connector of the inductive sensor **(1)** turbine.



024192

- 4 Unscrew the two TORX screws of transmission connector (1) retaining plate.
- 5 Take off the retaining plate (2).

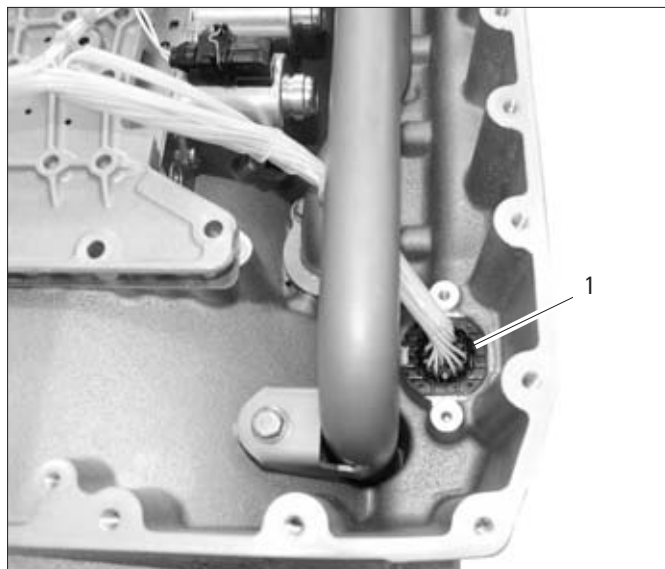


025337

- 6 Push out the transmission connector (1) from below.

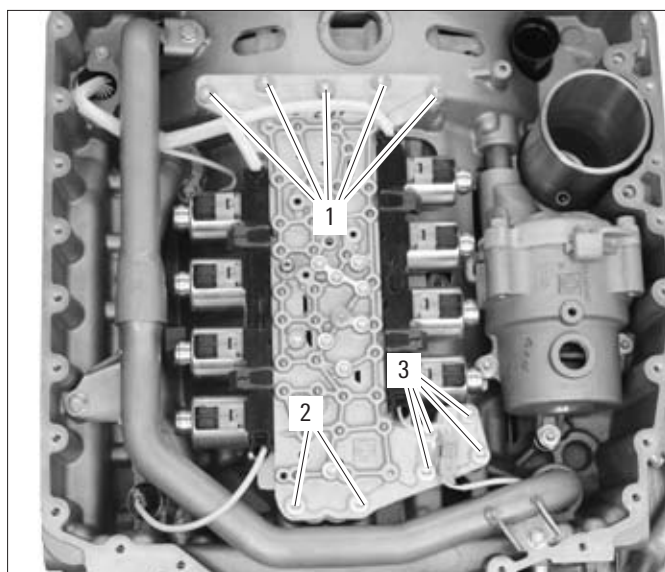
CAUTION

Do not pull on the cable. This could lead to damage of the connector.



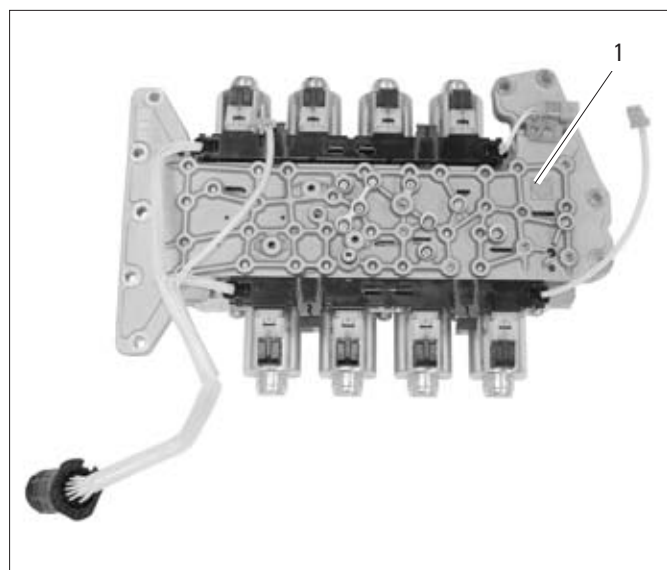
024191

- 7 Screw out eleven TORX screws (1, 2, 3) from the hydraulic control unit.



025027

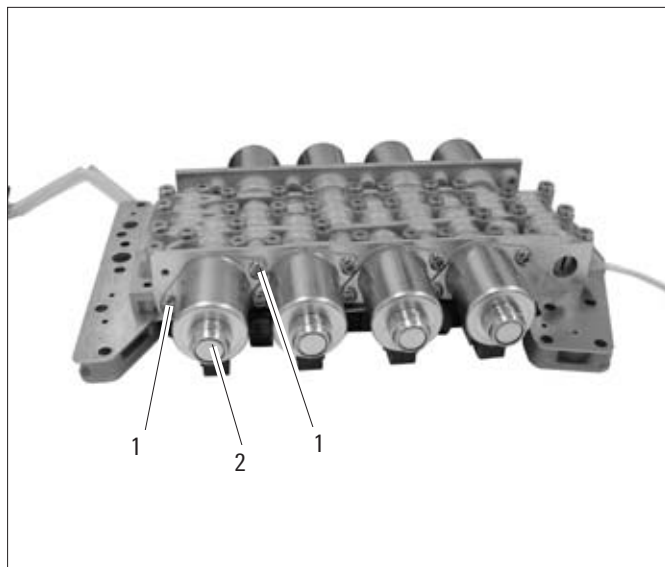
- 8 Remove the hydraulic control unit **(1)**.



024193

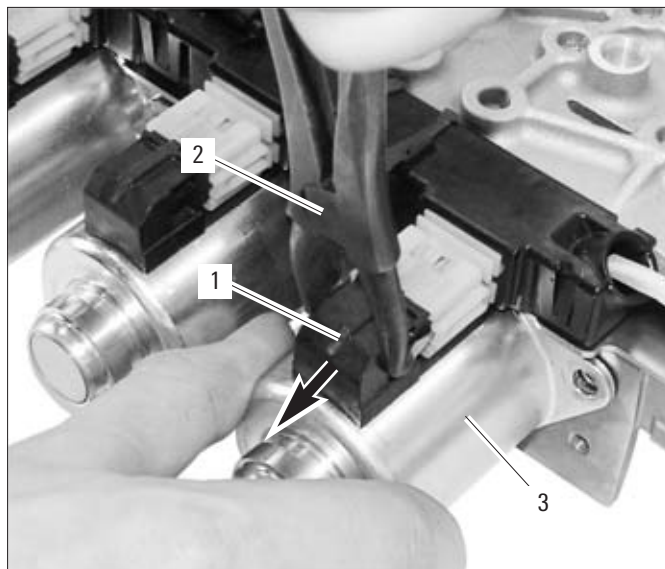
10.2 Dismantling the Hydraulic Control Unit

- 1 Unscrew two TORX screws **(1)** M6 respectively at all the solenoid valves **(2)**.



025864

- 2 Disassemble eight solenoid valves:
Unlock the connector **(1)** a both sides by means of a suitable tool **(2)** and pull out the solenoid valves **(3)** in the direction of the arrow.



030027

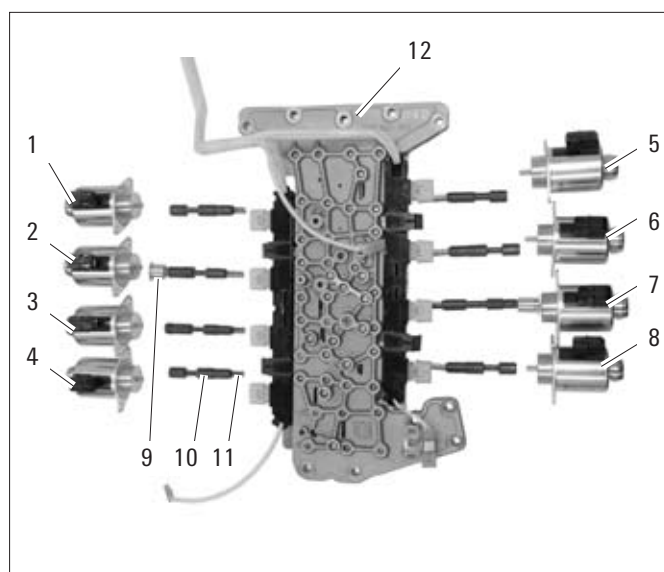
- 3 Take out all the thrust pieces (9), pistons (10), and springs (11) from the hydraulic control unit (12).

CAUTION

Parts must not be mixed up.

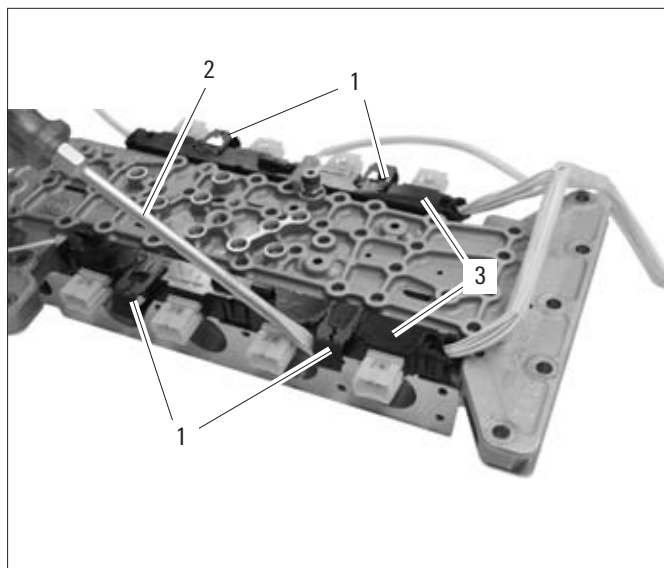
The following table contains information on the allocation of the solenoid valves:

Item.	Designation
1	A
2	Lock-up clutch
3	D
4	F
5	RR3
6	B
7	RHD
8	E



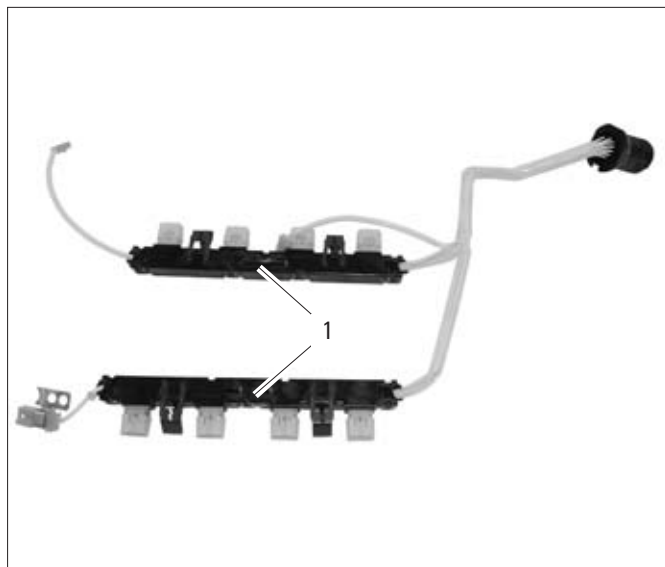
025866

- 4 Cautiously pull out the four retaining devices (1) of the cable ducts (3) by means of a screw driver (2) as far as they will go.



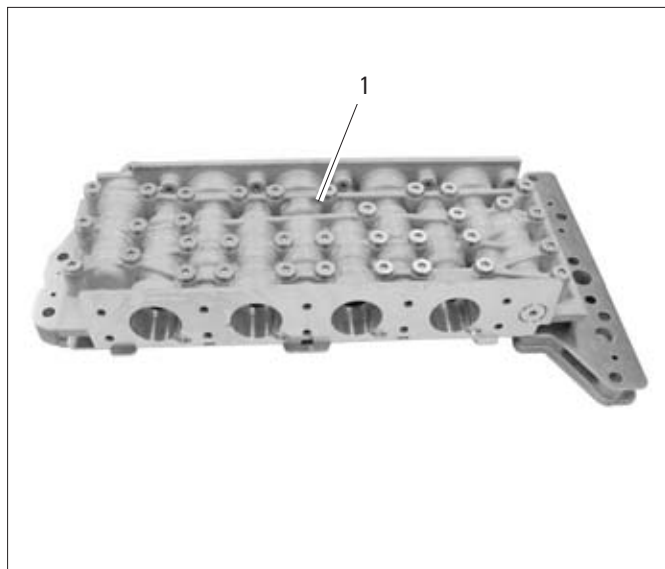
025867

- 5 The wiring harness **(1)** from the hydraulic control unit is to be removed.



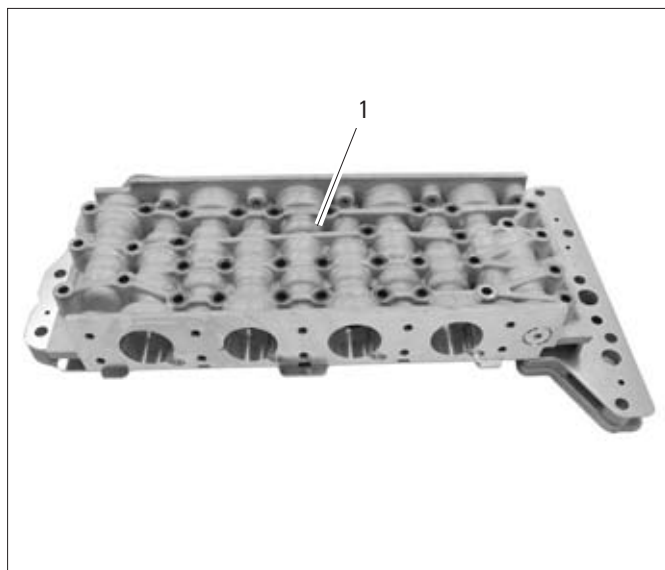
025868

- 6 Screw out all M6 TORX screws **(1)** from the hydraulic control unit.



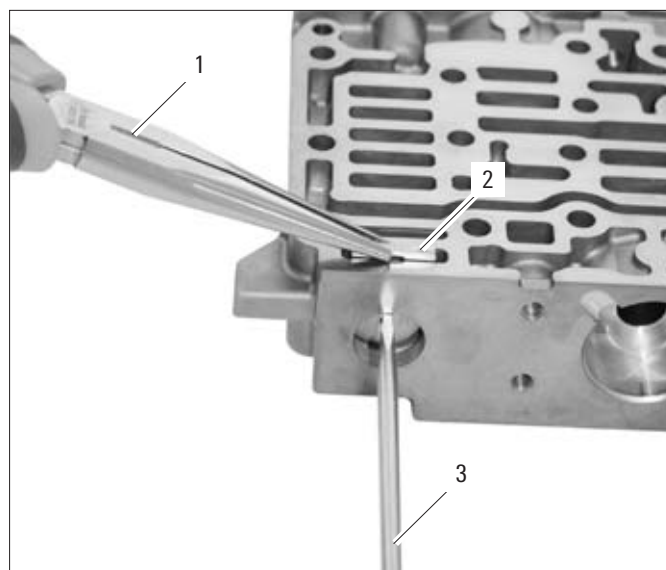
025869

- 7 Take off the valve strip **(1)**.



025870

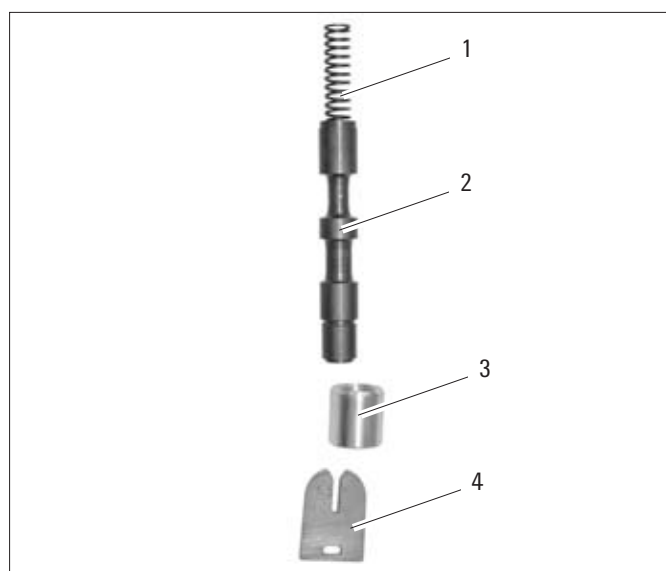
- 8 Press in the F/D change-over valve by means of a screw driver **(3)** and take out the valve locking device **(2)** with the pliers **(1)**.



030399

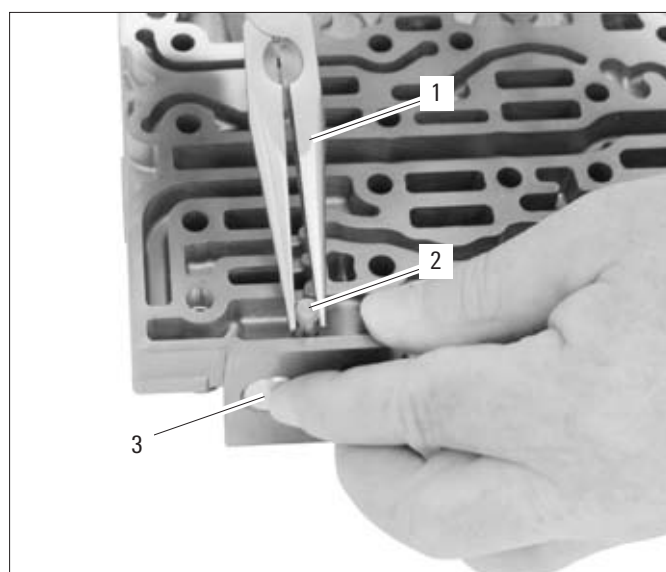
- 9 Take out the thrust piece, piston, and spring from the F/D change-over valve:

- 1: Spring **(1)**
- 2: Piston **(2)**
- 3: Thrust piece **(3)**
- 4: Valve locking device **(4)**



030400

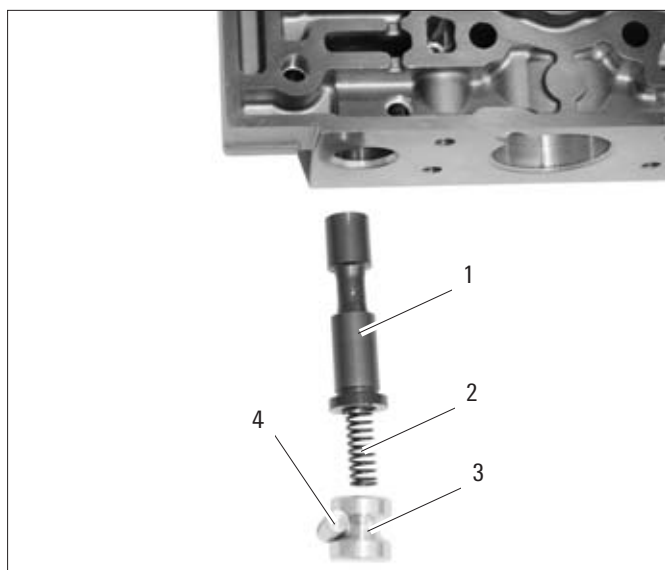
- 10 Press in the thrust piece **(3)** of the shift valve from the cooler change-over valve and take out pin **(2)** with the pliers **(1)**.



030401

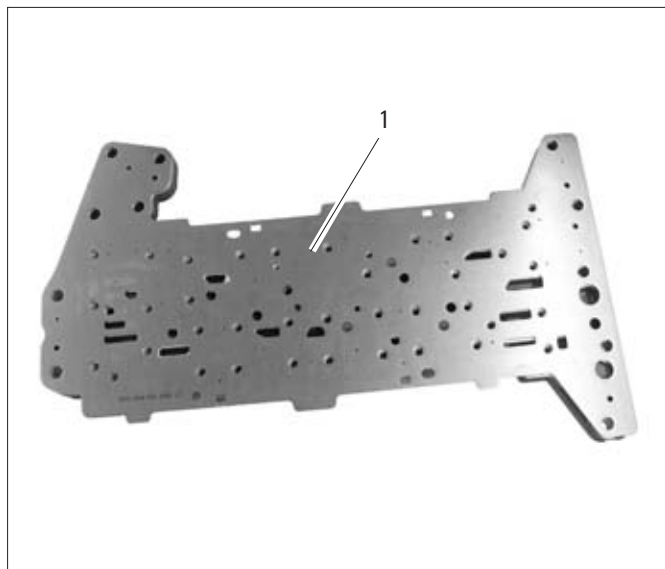
- 11 Take out the thrust piece, piston, and spring of the shift valve from the cooler change-over valve:

- 1: Piston (1)
- 2: Spring (2)
- 3: Thrust piece (3)
- 4: Pin (4)



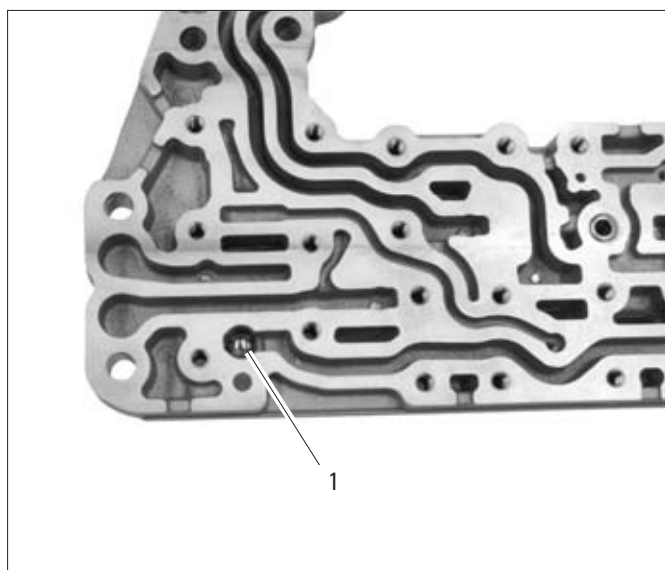
030402

- 12 Take off the intermediate plate (1).



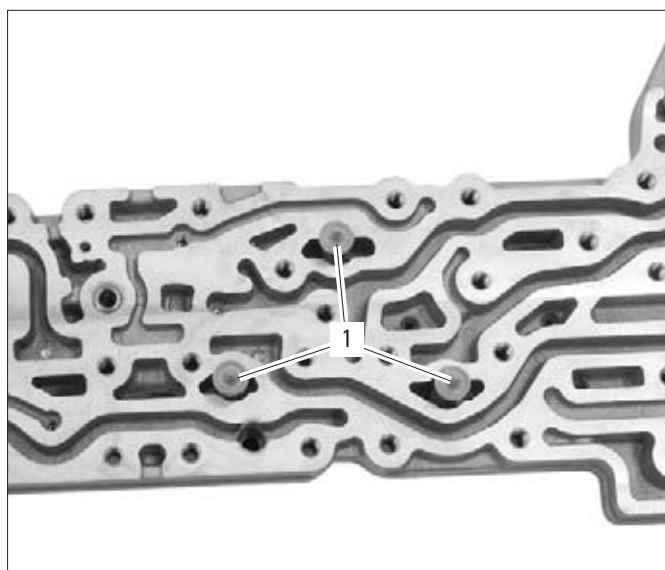
025871

- 13 Take out the ball (1) from the duct plate.



025873

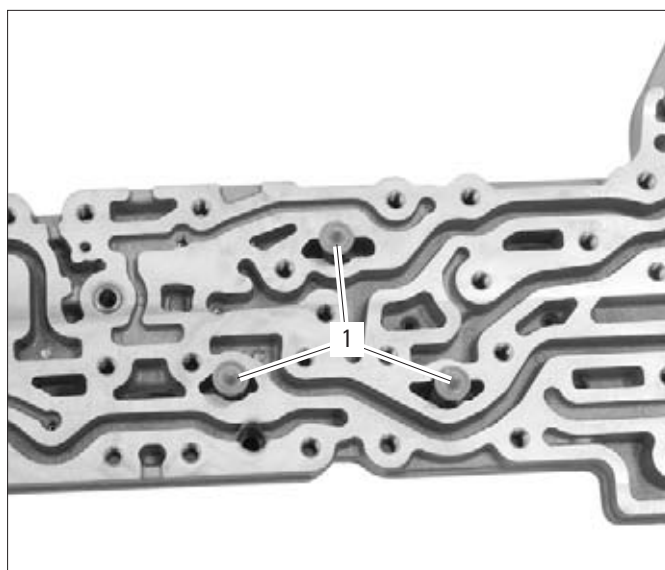
- 14 Take off the valve tappet **(1)** with the springs.



025874

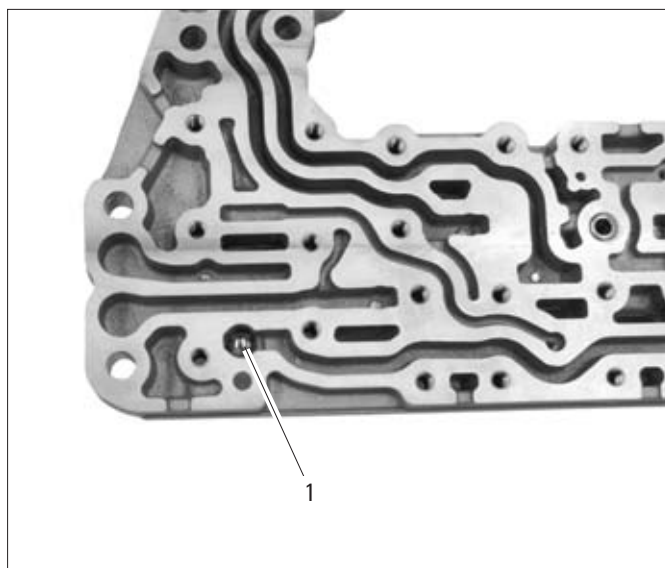
10.3 Assembling the Hydraulic Control Unit

- 1 Insert three valve tappets **(1)** with springs in the duct plate.



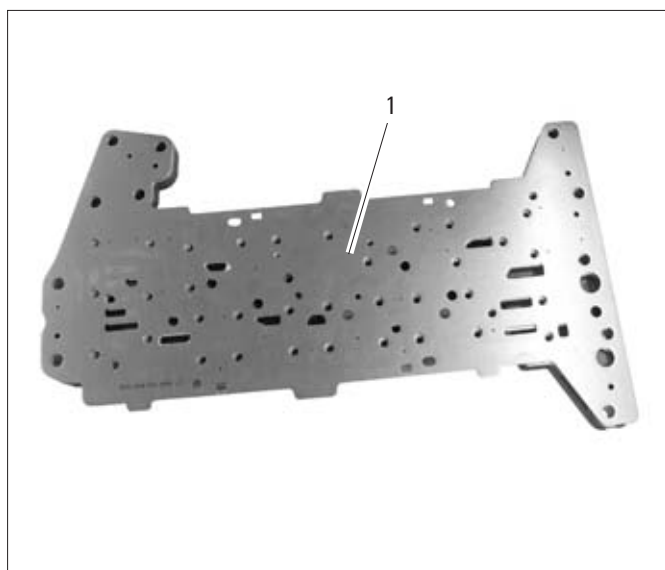
025874

- 2 Insert the ball **(1)** in the duct plate.



025873

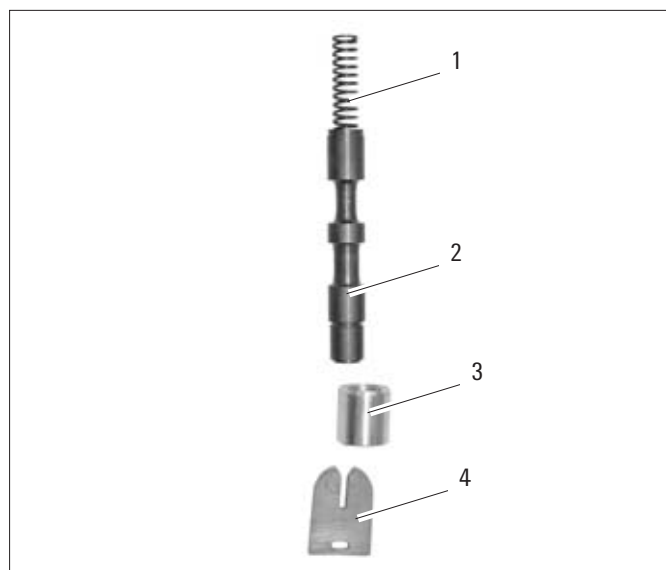
- 3 Put the intermediate plate **(1)** on the duct plate.



025871

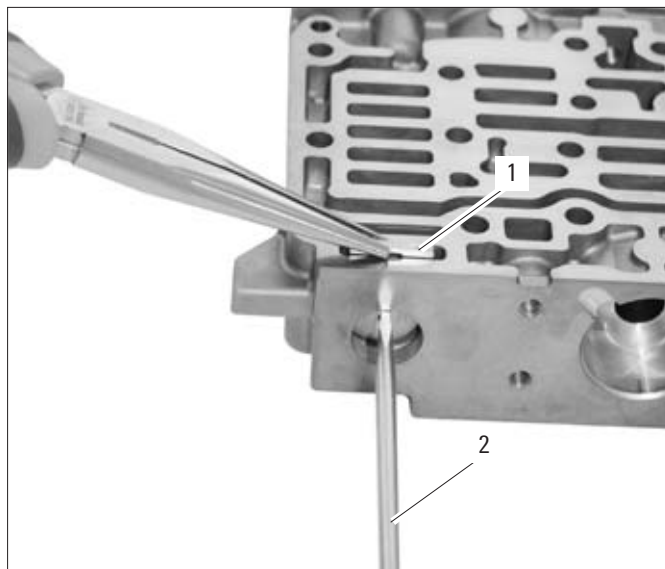
4 F/D change-over valve:

- 1: Spring **(1)**
- 2: Piston **(2)**
- 3: Thrust piece **(3)**
- 4: Valve locking device **(4)**



030400

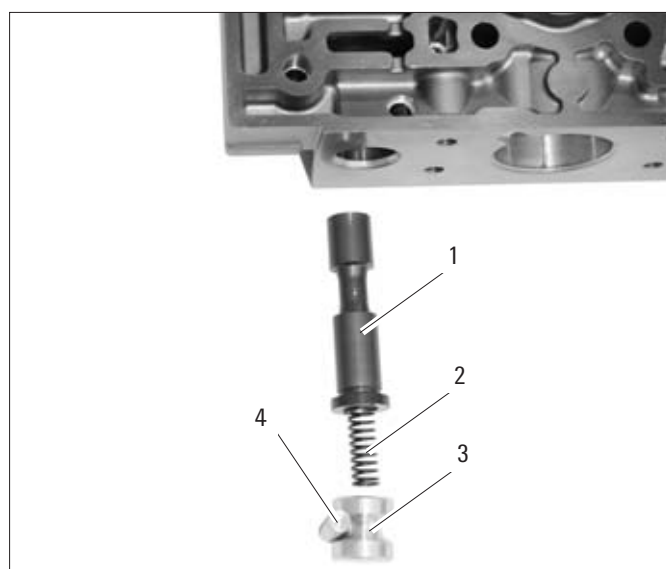
5 Insert the thrust piece, piston, and spring from the F/D change-over valve in the valve strip.

6 Press in the F/D change-over valve by means of a screw driver **(2)** and insert the valve locking device **(1)**.

030399

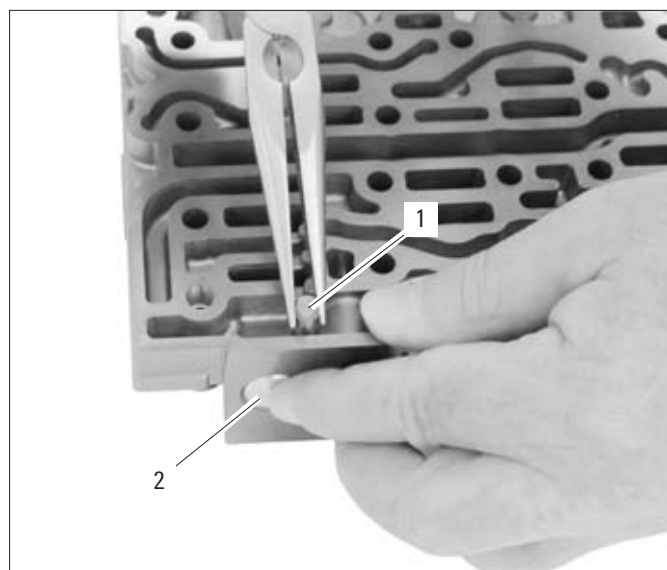
7 Shift valve for the cooler change-over valve:

- 1: Piston **(1)**
- 2: Spring **(2)**
- 3: Thrust piece **(3)**
- 4: Pin **(4)**



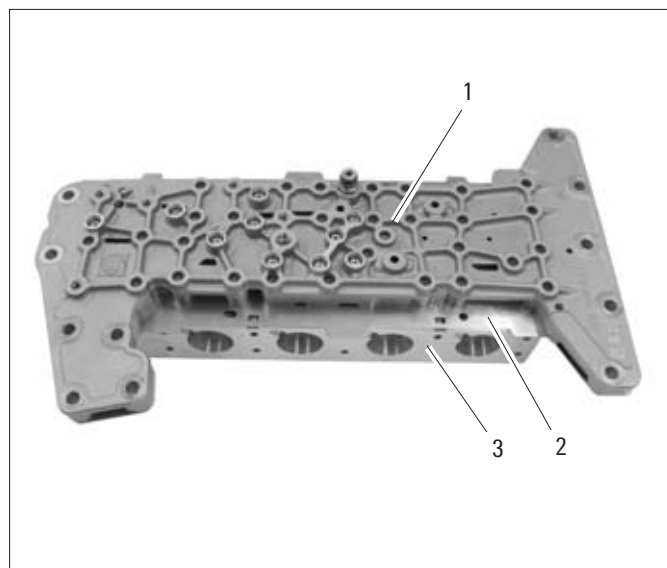
030402

- 8 Insert the thrust piece, piston, and spring from the shift valve of the cooler change-over valve in the valve strip.
- 9 Press in the thrust piece **(2)** of the shift valve from the cooler change-over valve and insert the pin **(1)**.



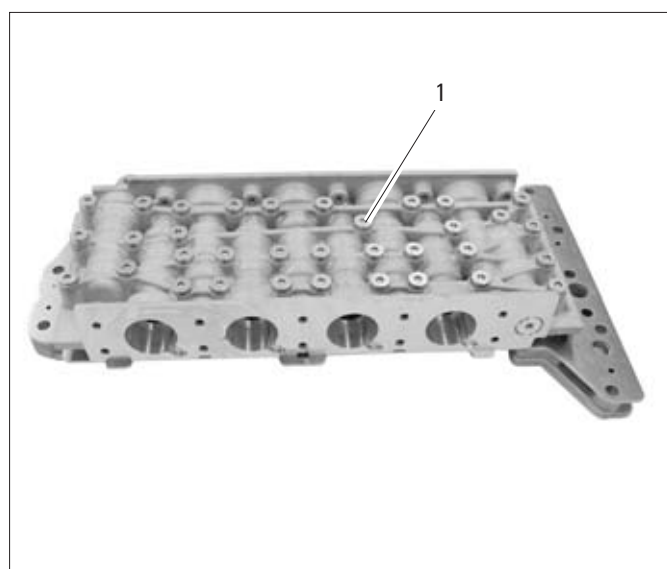
030401

- 10 Add on the duct plate **(1)** together with the intermediate plate **(2)** on the valve housing **(3)**.



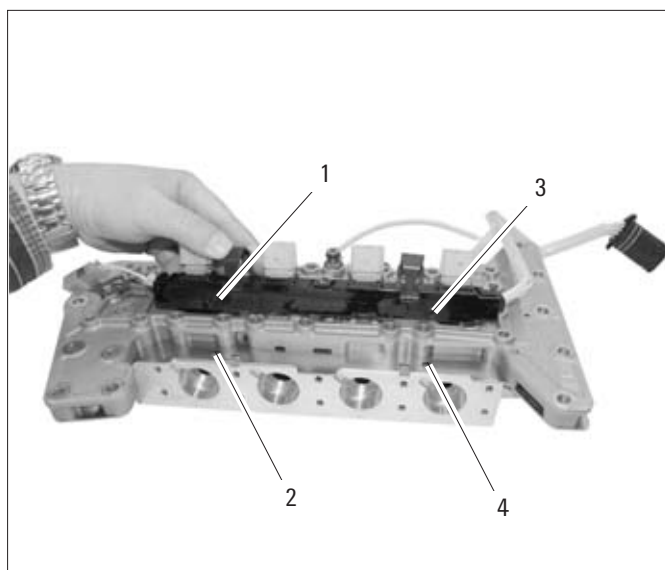
025875

- 11 Turn around the duct plate with the intermediate plate and the valve strip.
- 12 Screw in 34 TORX screws M6x55 **(1)** and tighten.
Tightening torque: 9.5 Nm



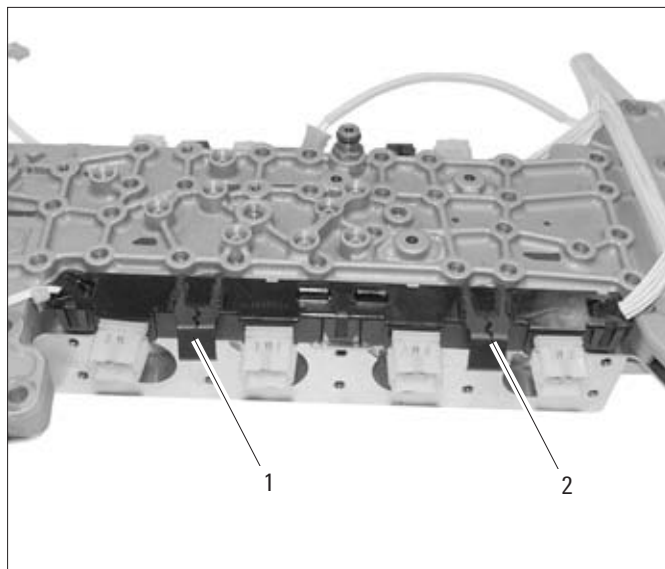
025869

- 13 Insert the wiring harness. Here, pay attention to the fact that the spigots **(1, 3)** are inserted in the bores **(2, 4)**.



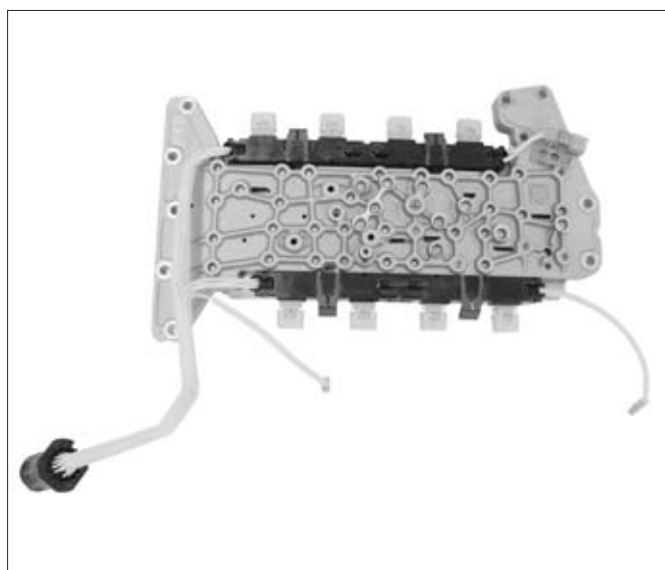
025876

- 14 Press in the locking devices **(1, 2)** of the wiring harness as far as they will go.



025877

- 15 Mount other side of the wiring harness in the same way.



025878

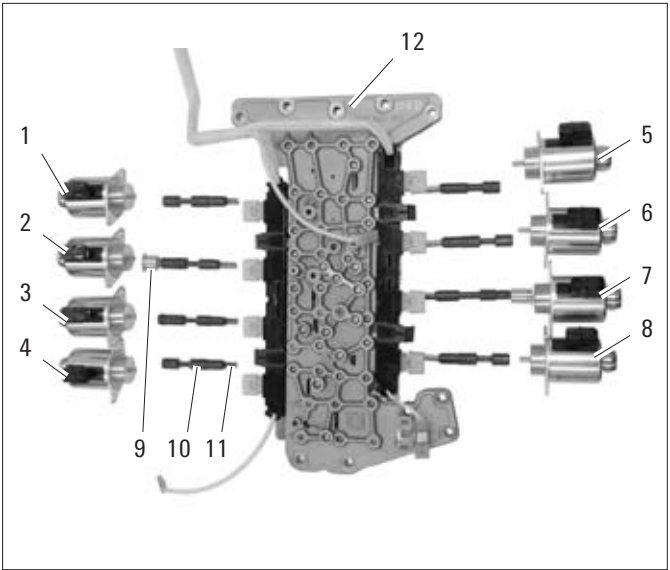
- 16 Insert all the thrust pieces (9), pistons (10), and springs (11) in the hydraulic control unit (12).

CAUTION

Parts must not be mixed up.

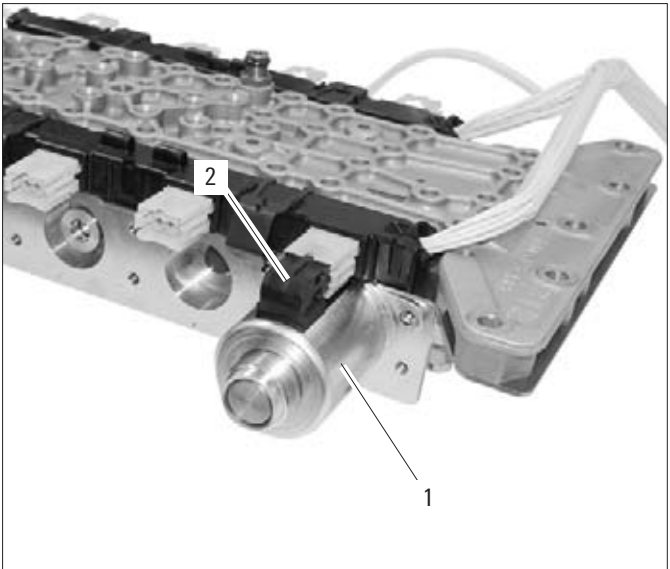
The following table contains information on the allocation of the solenoid valves:

Item	Designation
1	A
2	Lock-up clutch
3	D
4	F
5	RR3
6	B
7	RHD
8	E



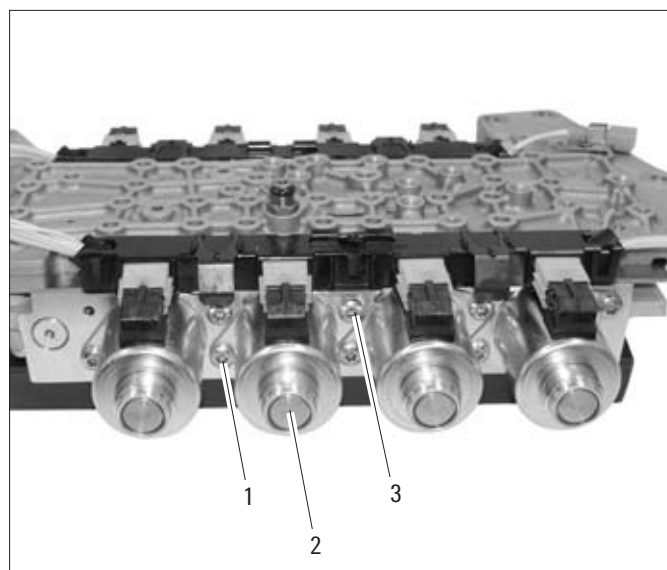
025866

- 17 Insert all eight solenoid valves (1) in the hydraulic control unit. Here, the connectors (2) must fully engage.



025879

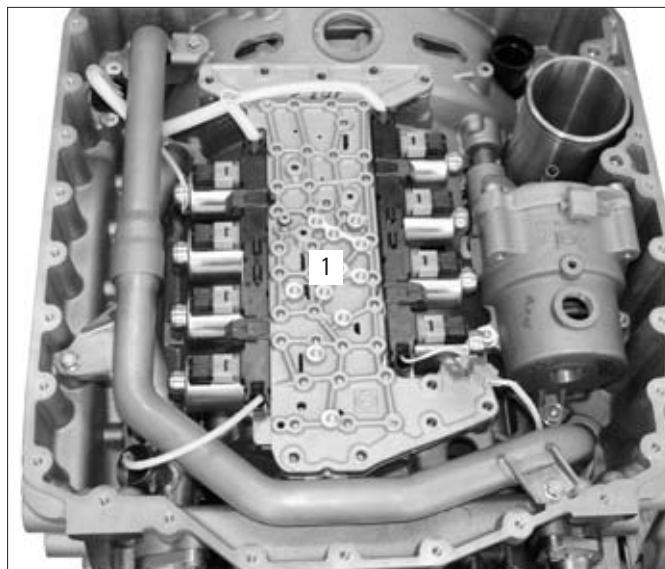
- 18 Screw in two TORX screws **(1, 3)** M6x17 respectively at all the eight solenoid valves **(2)** and tighten.
Tightening torque: 9.5 Nm



025880

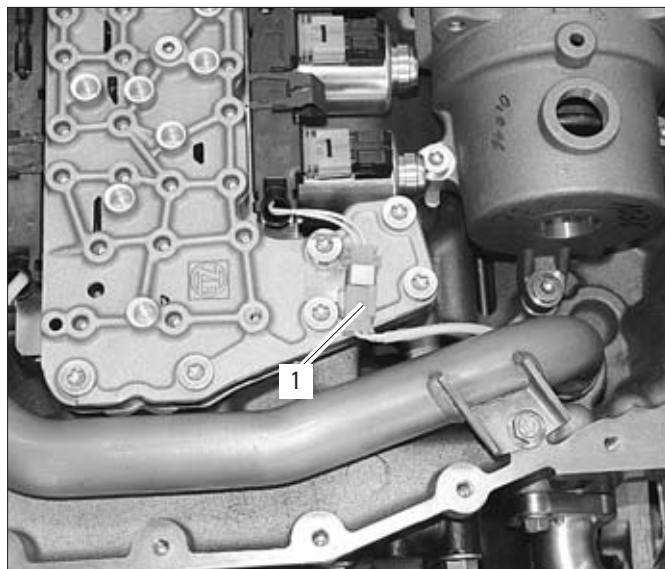
10.4 Installing the Hydraulic Control Unit

- 1 Insert the hydraulic control unit **(1)** into the transmission.



025030

- 2 Plug in the inductive sensor connector output **(1)**.



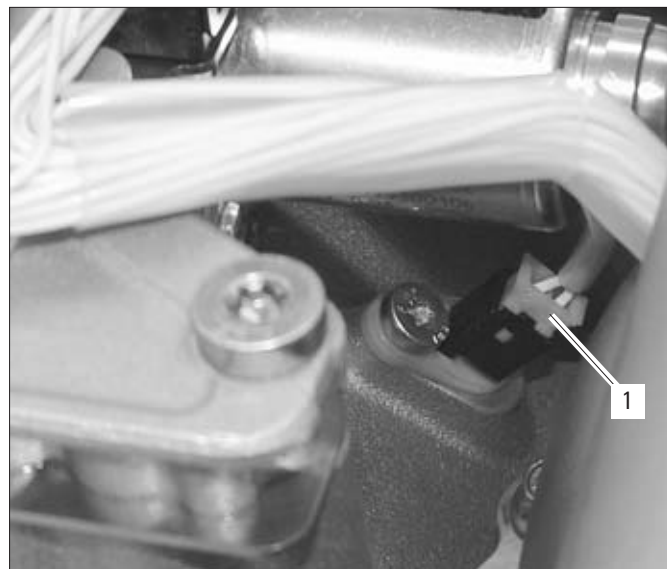
025031

- 3 Plug in the temperature sensor oil temperature **(1)**.



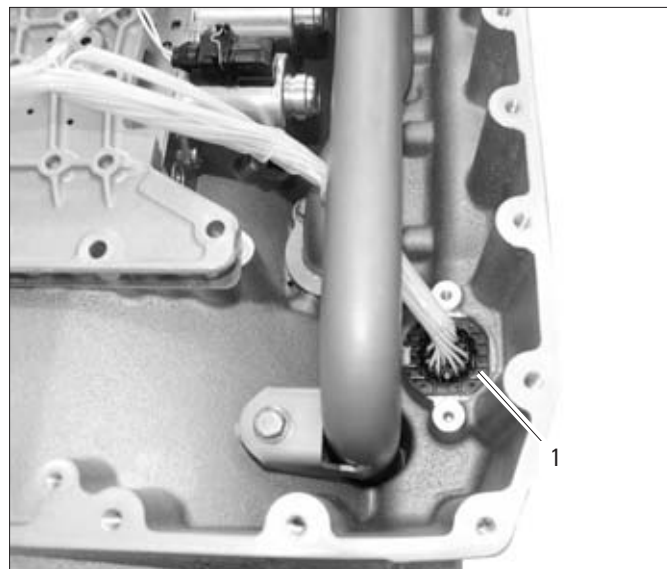
025002

- 4 Plug in the inductive sensor turbine (1).



024192

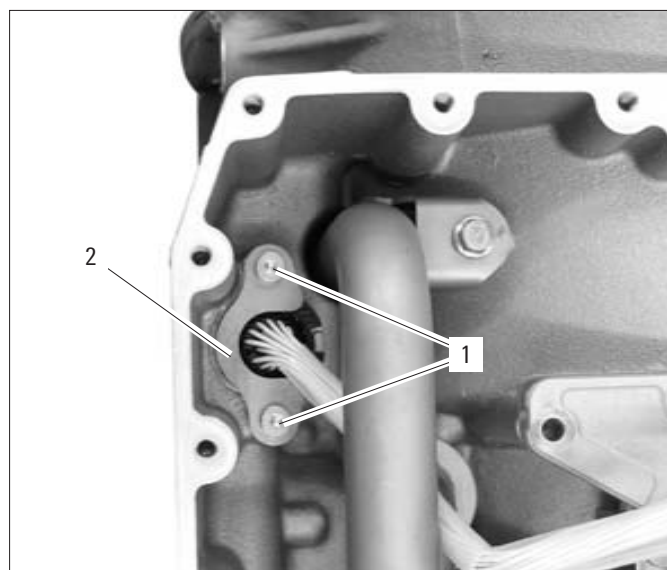
- 5 Insert transmission connector (1).



024191

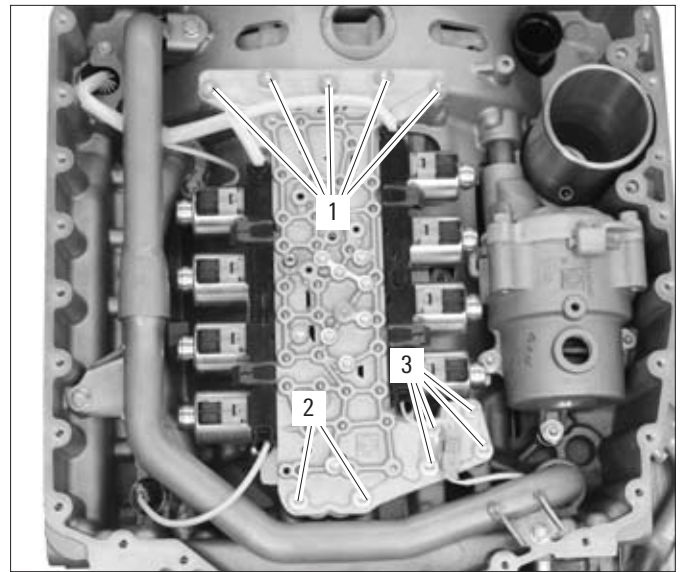
- 6 Fit fixing plate (2).

- 7 Screw in two TORX screws M6x17 (1) and tighten.
Tightening torque: 9.5 Nm



025884

- 8 Screw in eleven M8x36 TORX screws **(1, 2, 3)** for fastening the hydraulic control unit and tighten.
Tightening torque: 20 Nm

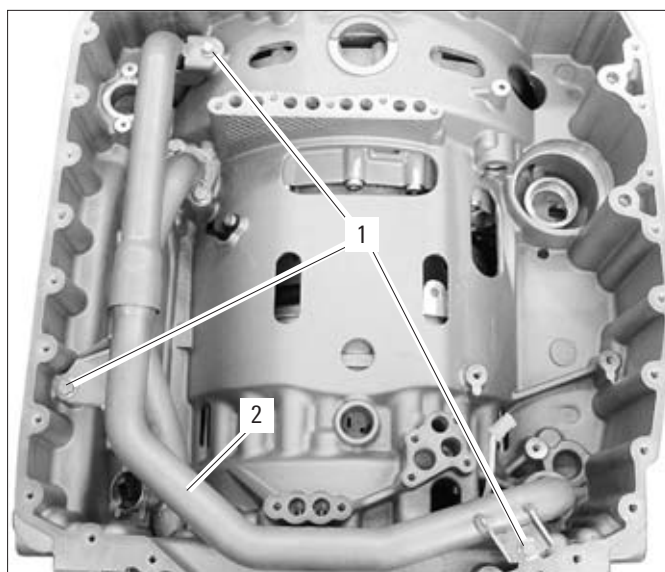


025027

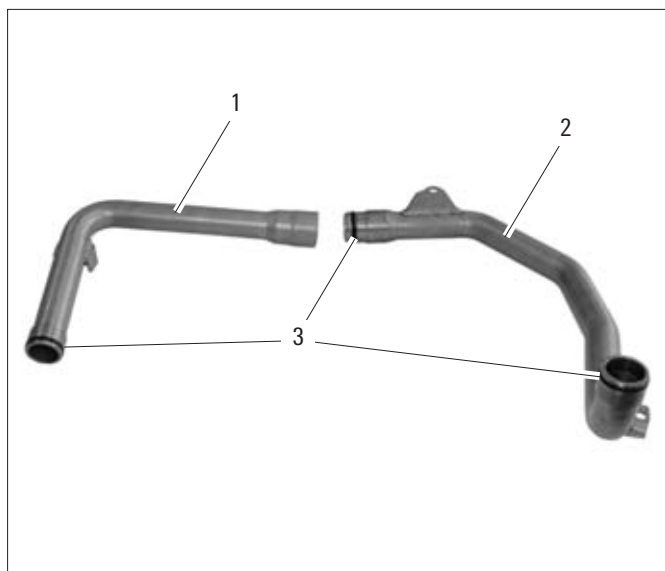
11 Remove and Install the Oil Pipes

11.1 Remove the Oil Pipes

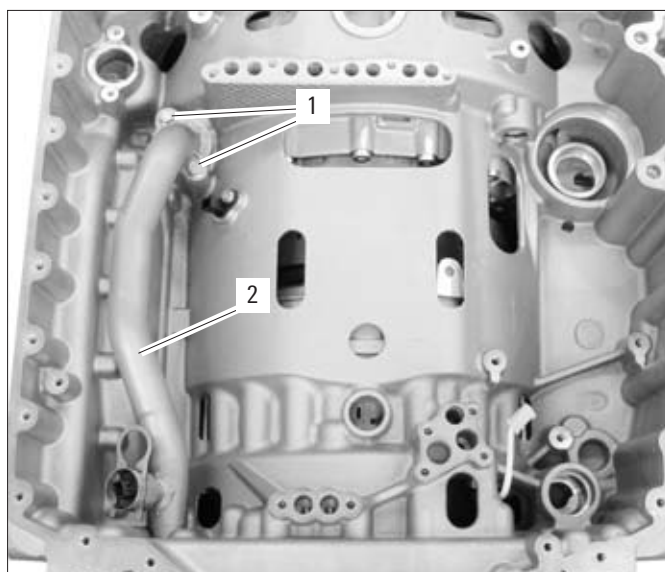
- 1 Unscrew the three screws M8 **(1)** at the brackets of the upper oil pipe (return flow).
- 2 Pull out the upper oil pipe **(2)**.
- 3 Take apart the oil pipe **(1)** and the oil pipe **(2)**.
- 4 Take off the three O-rings **(3)**.
- 5 Unscrew the two M8 screws **(1)** at the lower oil pipe (inlet).
- 6 Pull out the lower oil pipe **(2)** in the direction of the output.



030028

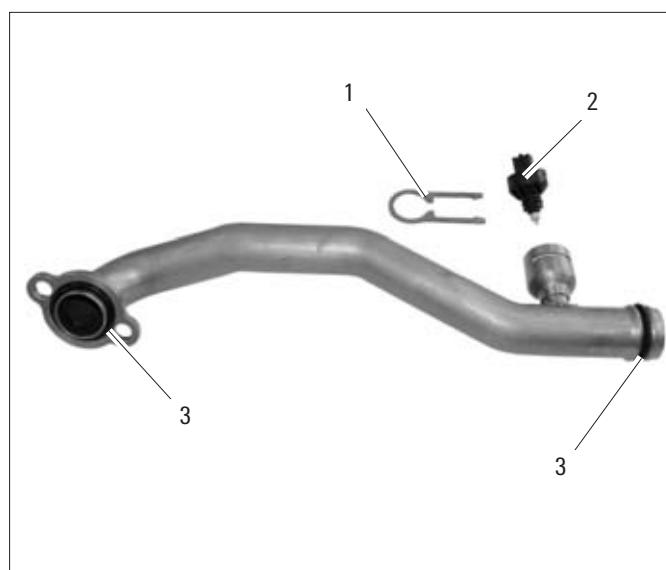


030030



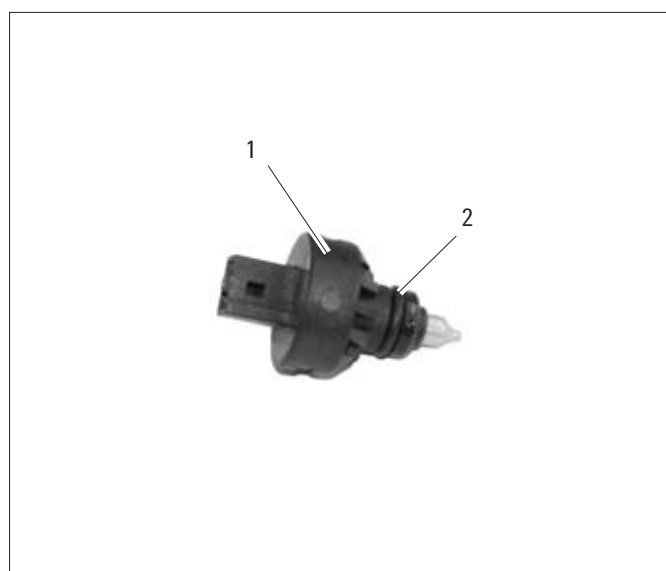
030029

- 7 Pull out the retaining clip **(1)**.
- 8 Take out the temperature sensor **(2)**.
- 9 Take off the three O-rings **(3)**.



030031

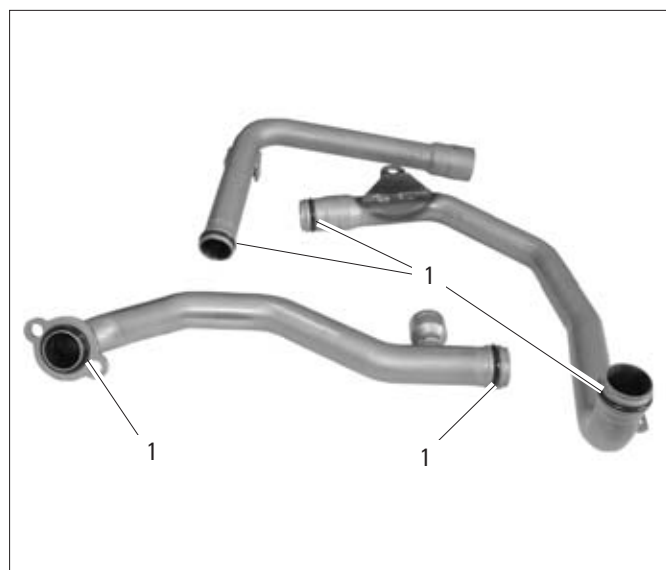
- 10 Take off the O-ring **(2)** of the temperature sensor **(1)**.



024198

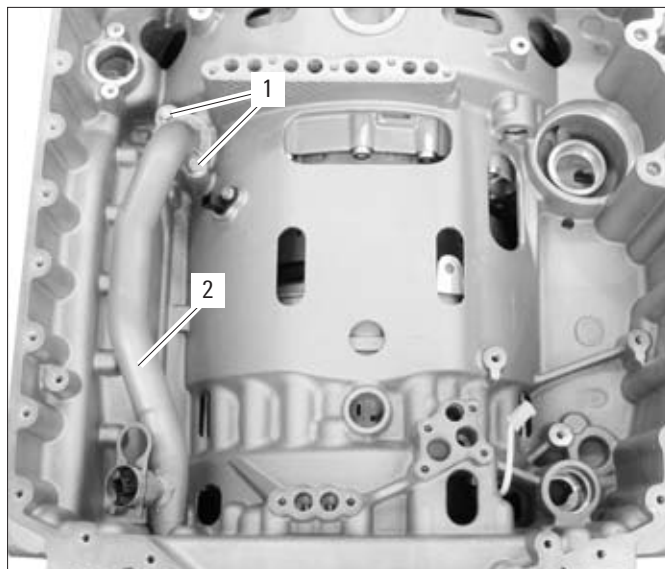
11.2 Install the Oil Pipes

- 1 Coat five O-rings **(1)** with technical Vaseline.
- 2 Mount the five O-rings **(1)** on the oil pipes.



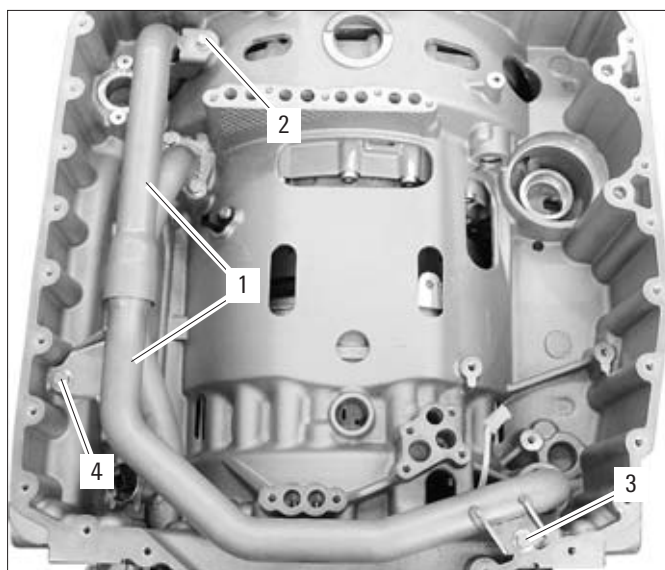
025812

- 3 Insert the lower oil pipe **(2)**.
- 4 Screw in two TORX screws M8x22 **(1)** and tighten.
Tightening torque: 23 Nm



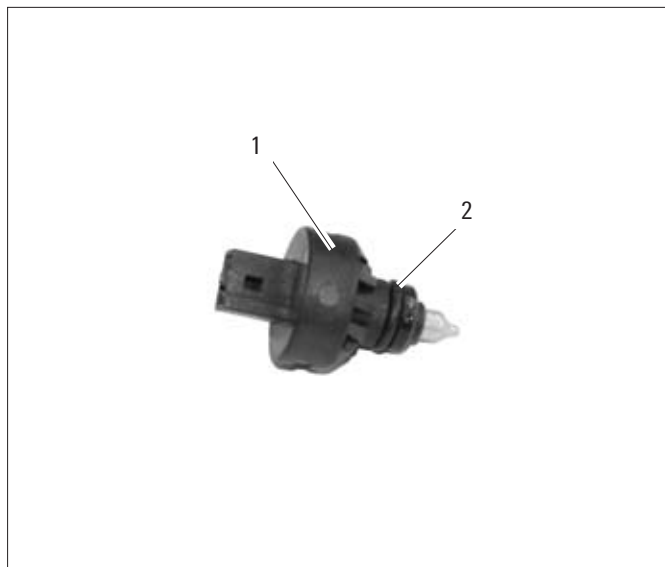
030029

- 5 Put the two parts of the upper oil pipe **(1)** together.
- 6 Insert the the upper oil pipe **(1)**.
- 7 Screw in three TORX screws M8x22 **(2, 3, 4)** at the brackets of the upper oil pipe and tighten.
Tightening torque: 23 Nm



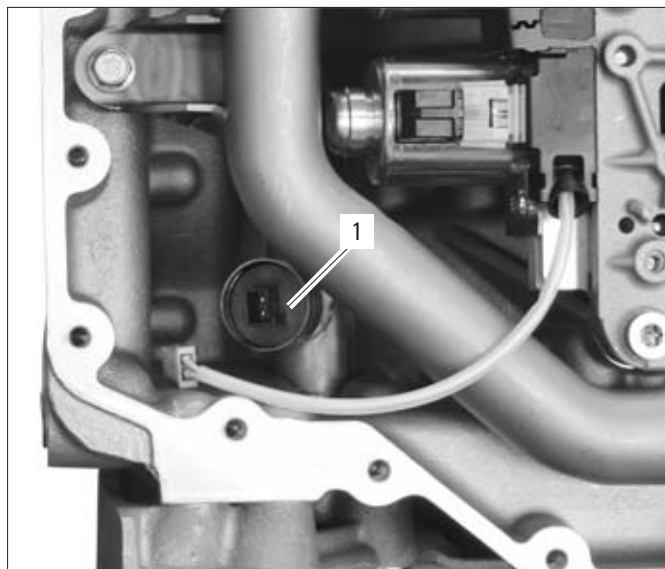
030028

- 8 Coat new O-ring **(2)** of temperature sensor **(1)** with technical Vaseline.
- 9 Fit O-ring **(2)** to temperature sensor **(1)**.



024198

- 10 Insert the temperature sensor **(1)** for the oil temperature.



025001

- 11 Fit the retaining clip **(1)**.

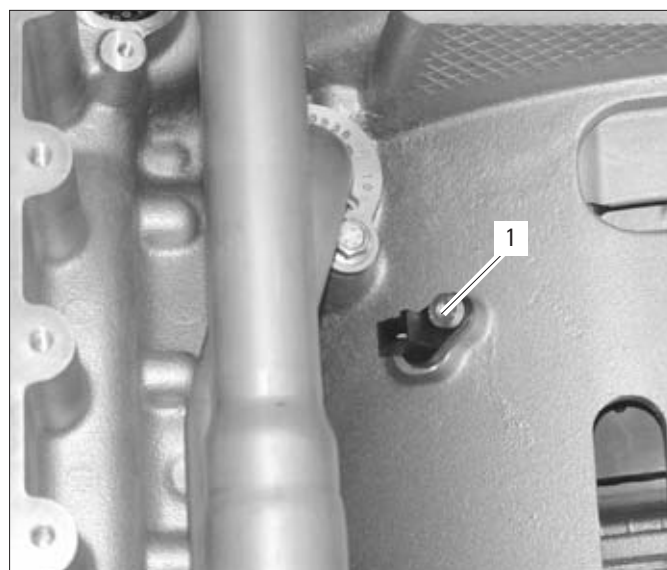


024196

12 Install and Remove the Inductive Sensor Turbine

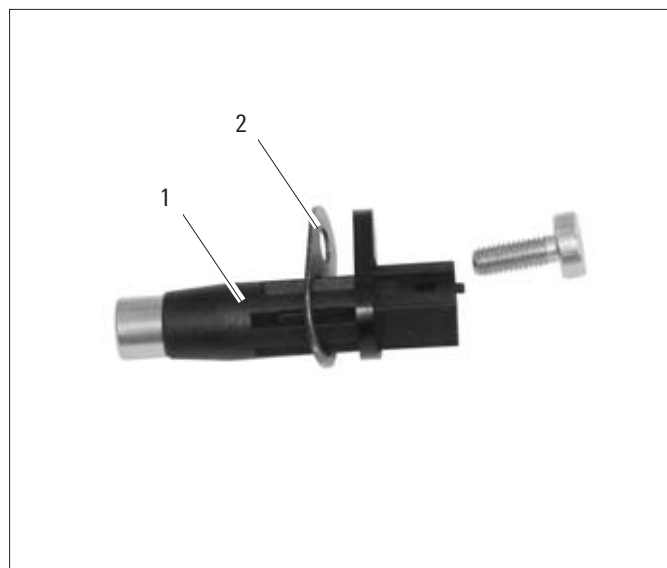
12.1 Remove the Inductive Sensor Turbine

- 1 Unscrew one **(1)** TORX screw.



025028

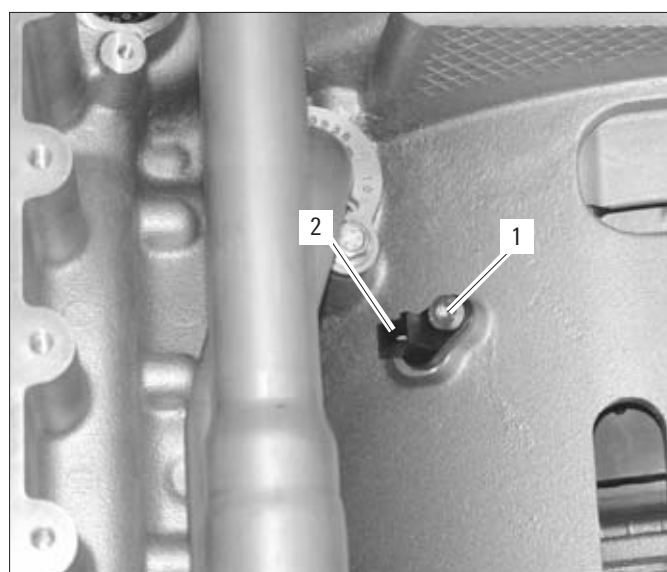
- 2 Take out inductive sensor turbine **(1)** and washer **(2)**.



025029

12.2 Install the Inductive Sensor Turbine

- 1 Insert the inductive sensor turbine **(2)** with the washer.
- 2 Screw in a TORX screw M6x17 **(1)** and tighten.
Tightening torque: 9.5 Nm



025028

13 Installing, Removing, Dismantling, and Assembling the Torque Converter

13.1 Removing the Torque Converter

- 1 Mounter the counter support no.: **1X56 137 658 (1)**.



030032

- 2 Loosen the Allen screw (1) at the torque converter.



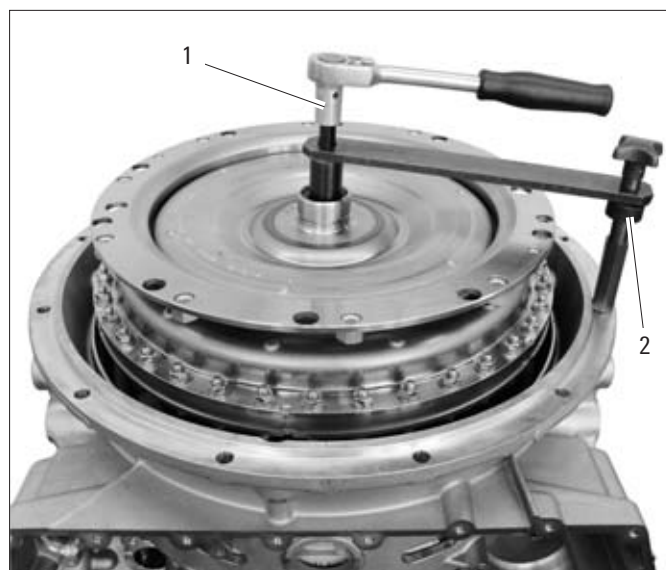
030034

- 3 Unscrew the Allen screw (1) and take off the sealing ring (2).



030035

- 4 Mount the counter support no.: **1X56 136 864 (2)**.
- 5 Loosen the screw connection of the torque converter from the turbine shaft with the Allan wrench no.: **1X56 136 863 (1)**.
- 6 Dismantle the counter support no.: **1X56 136 864 (2)**.



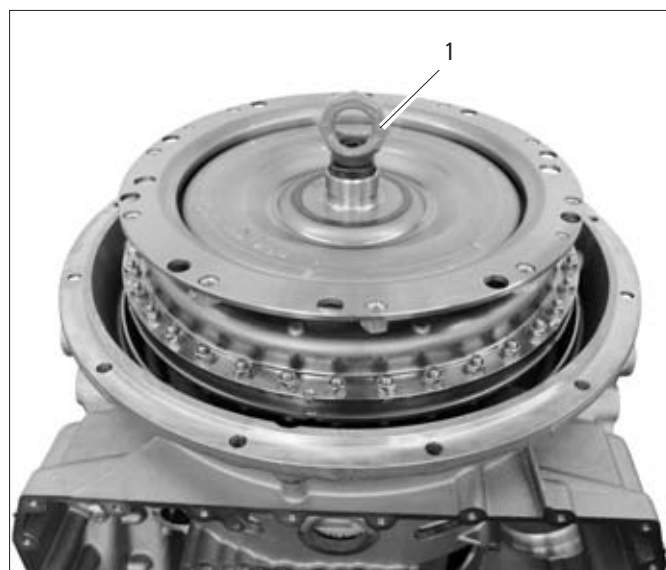
030036

- 7 Take out the cylindrical screw/bolt (1).



030037

- 8 Mount the lifting device no.: **1T66 160 674 (1)**.



030038

- 9 Attach suitable lifting gear.
- 10 Vertically lift the torque converter with the crane out of the transmission housing.

**DANGER**

Oil may spill.

Environmental hazard!

Collect oil in a suitably large container.



030039

- 11 Take off the adjusting disks (1).

NOTE

The adjusting disks may also be located in the torque converter.



030040

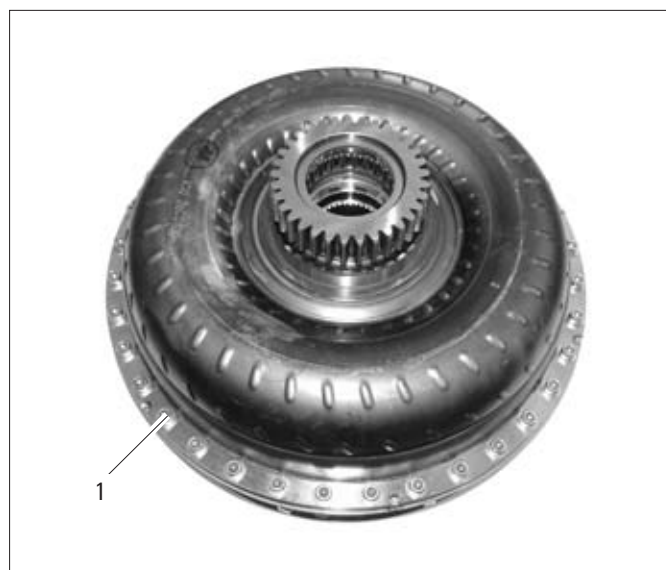
- 12 Screw in the lifting device with the turbine shaft 1T66 156 231 (1).



030041

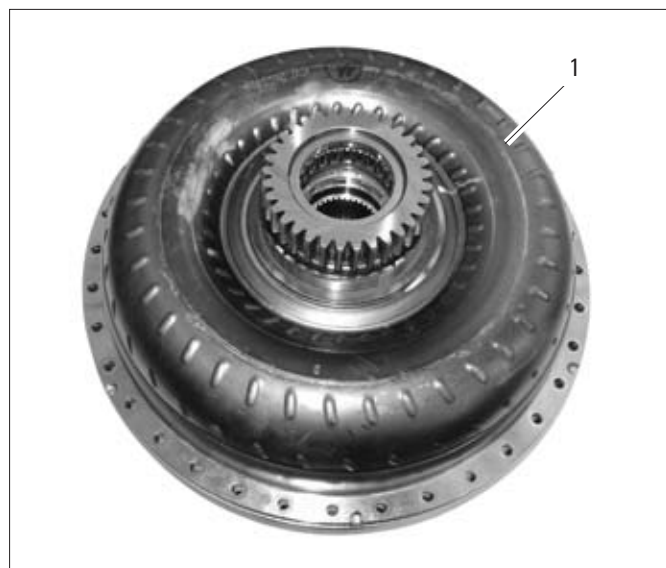
13.2 Dismantling the Torque Converter

- 1 Unscrew all Allen screws M8 **(1)** at the circumference of the torque converter. During the process, ensure that you provide counter-support from below by means of a ring wrench of 13 mm width across flats.



030042

- 2 Take off the impeller **(1)**.



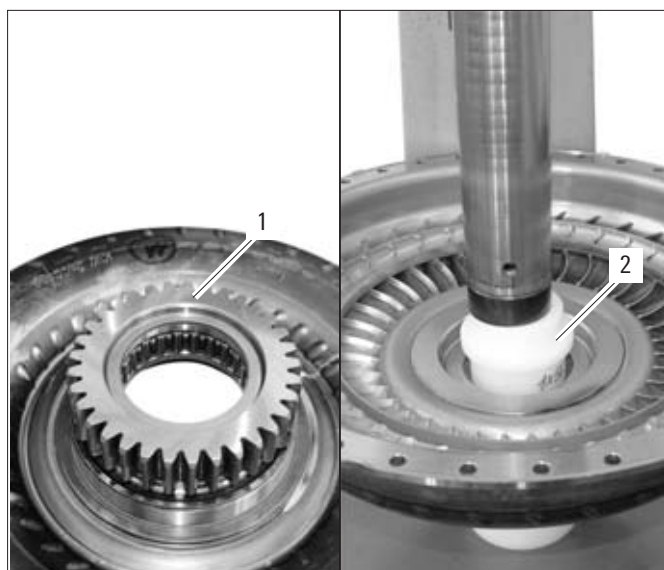
030043

- 3 Unsnap the circlip **(1)**.



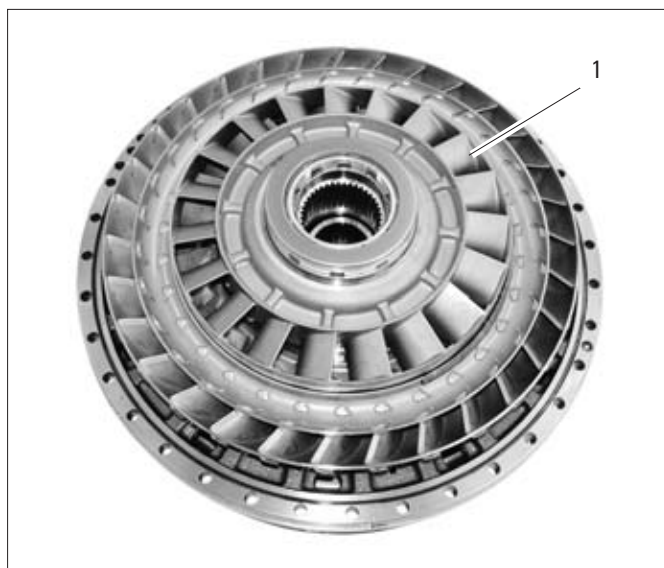
030044

- 4 If required, press out the bearing (1) by means of the tool no.: **1X56 138 591 (2)**.



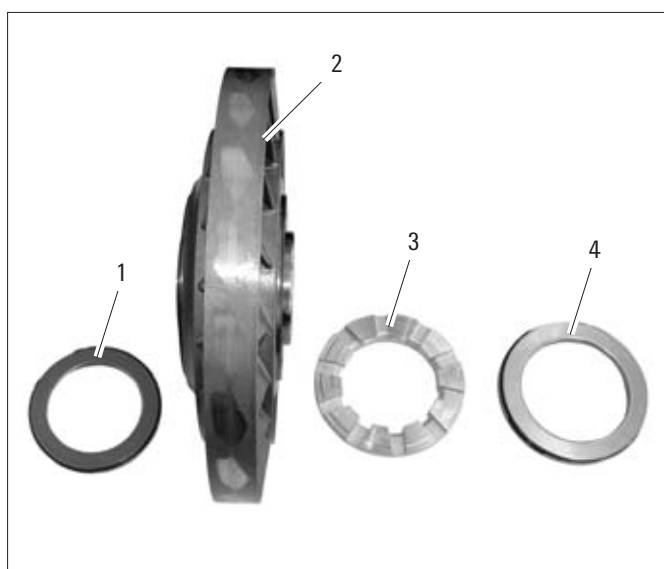
030045/030046

- 5 Take off the stator (1).



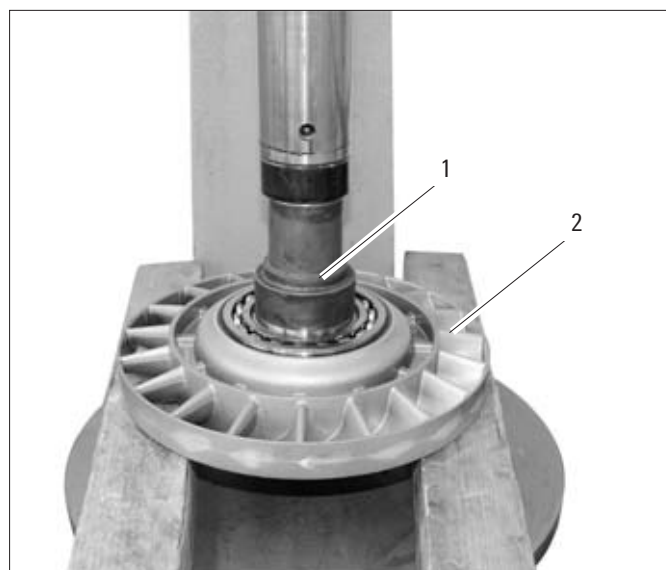
030047

- 6 Take off the bearings (1, 4) and disk/washer (3) from the two sides respectively of the stator (2).



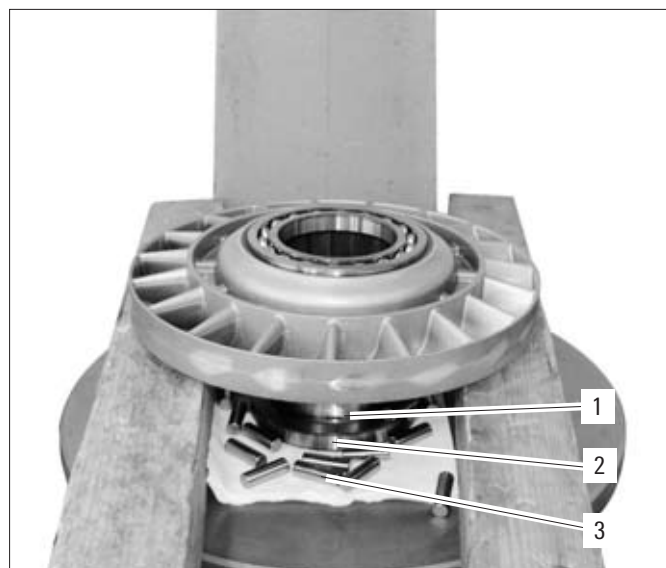
030048

- 7 Provide cushioning for the stator (2) by means of suitable square skids.
- 8 Press out the hub (1) and the lower bearing (2) by means of a suitable thrust piece (1).



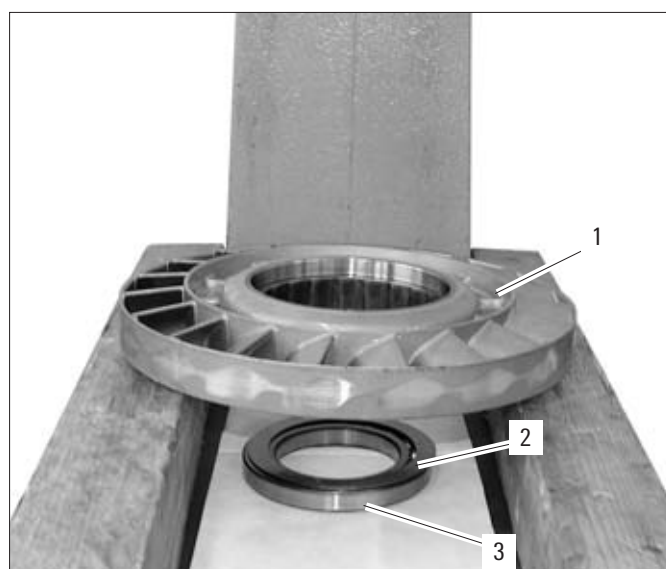
030049

- 9 Take out the hub (1) with the axial disk and the lower bearing (2).
- 10 Take out the rolls (3).



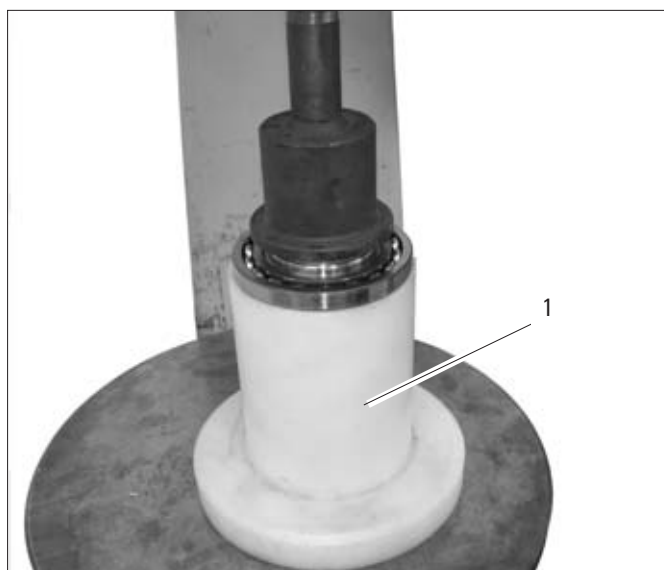
030050

- 11 Turn the stator (1) around and press out the upper bearing (3) by means of a suitable thrust piece.
- 12 Take out the bearing (3) and the axial disk (2).



030051

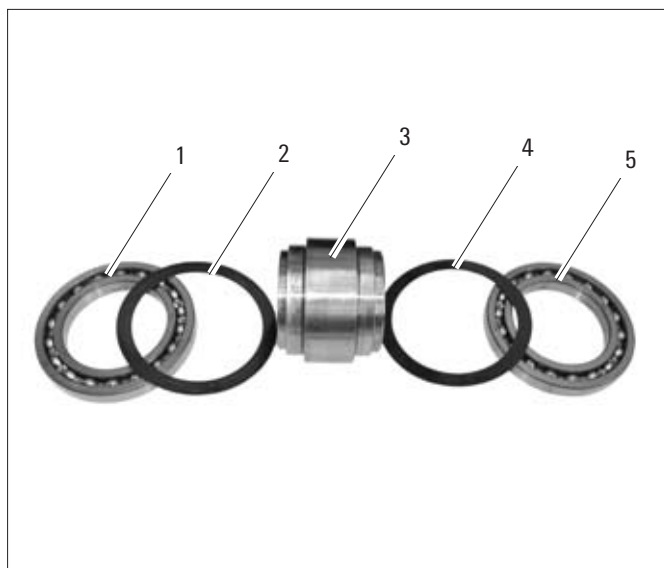
- 13 Insert the hub with the bearing in a suitable tool **(1)**.
- 14 Press out the hub from the bearing by means of a suitable thrust piece.



025425

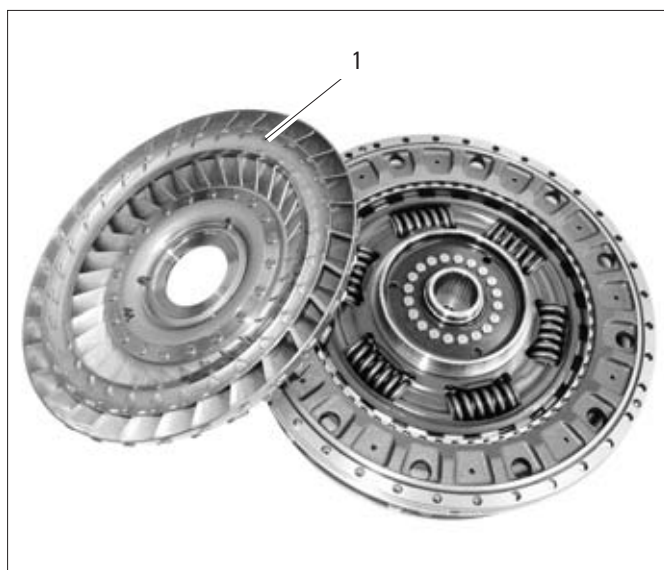
- 15 Allocation of bearing and hub on the stator:

- Bearing **(1)**
- Axial disk **(2)**
- Hub **(3)**
- Axial disk **(4)**
- Bearing **(5)**



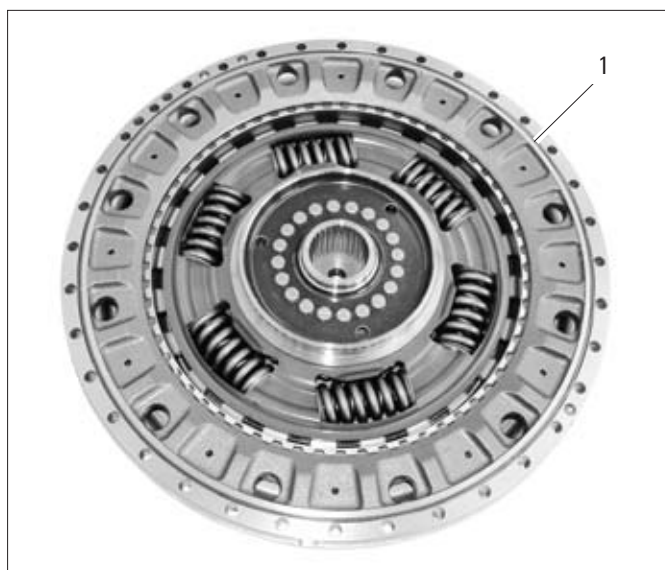
025426

- 16 Take off the turbine wheel **(1)**.



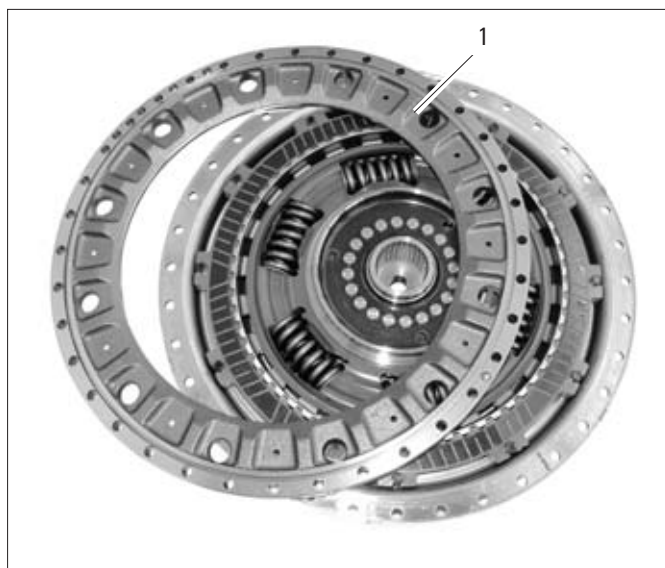
030052

- 17 Take out the sealing ring (1).



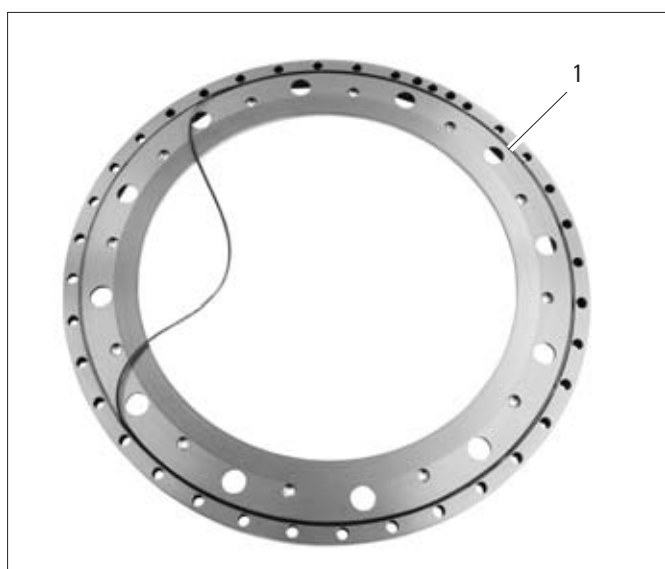
030053

- 18 Take out the end disk (1).



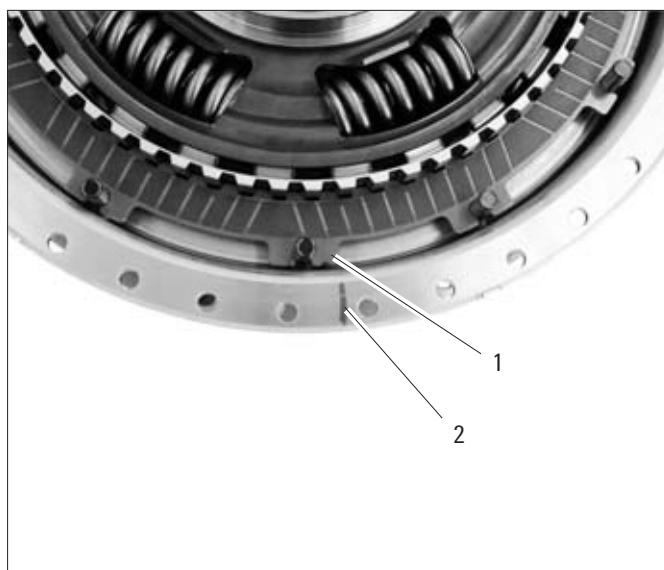
030054

- 19 Take out the sealing ring (1).



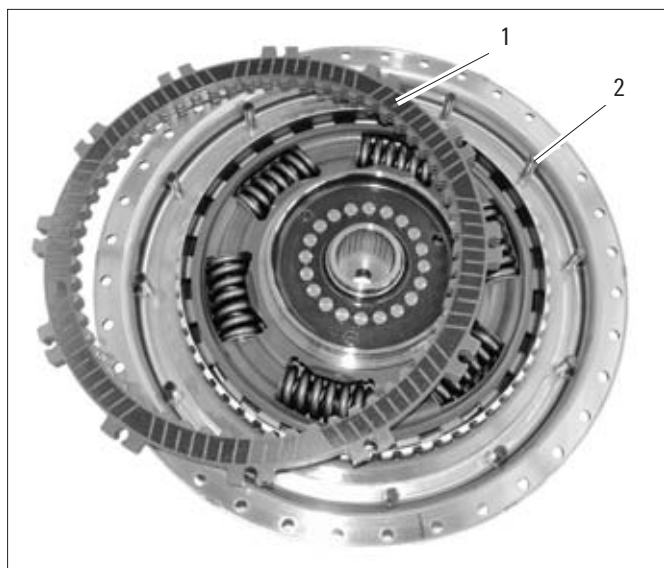
030055

- 20 Mark the position of the notch **(1)** on the multidisks of the torque converter lock-up clutch **(2)**.



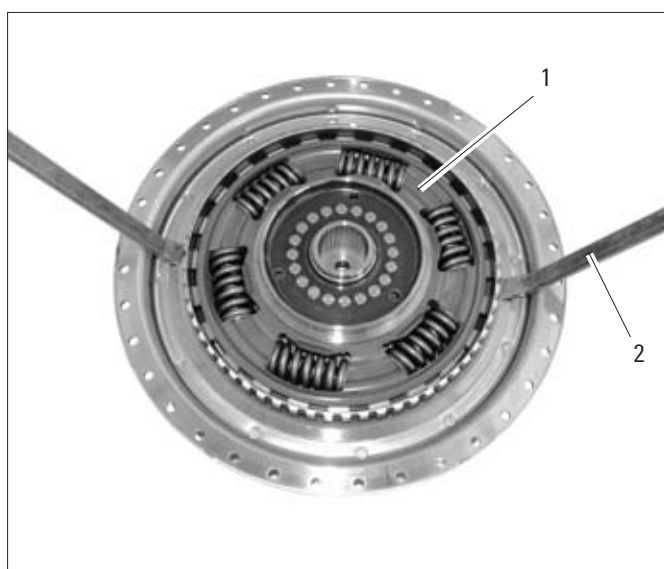
030070

- 21 Take out the multidisks of the torque converter lock-up clutch **(1)**.
- 22 Take out the rolls **(2)**.



030056

- 23 Lift out the torsional vibration damper **(1)** by means of suitable pry bars **(2)**.



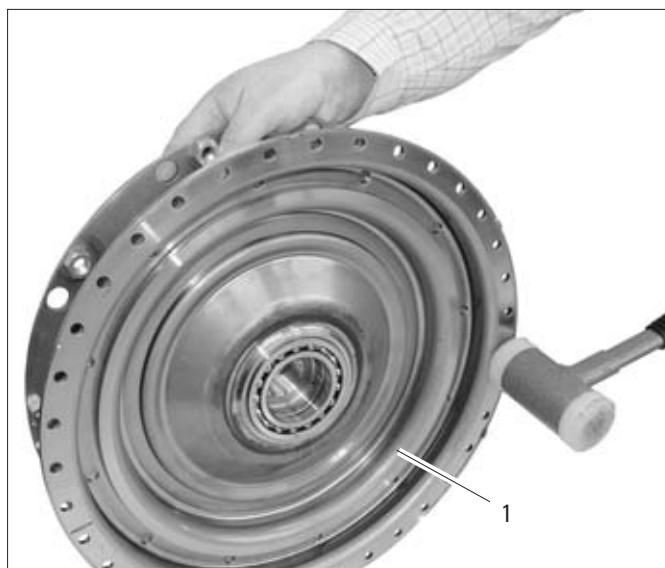
030057

- 24 Take out the rectangular ring (1).



030058

- 25 Loosen the piston (1) by means of light plastic hammer blows and take it out.



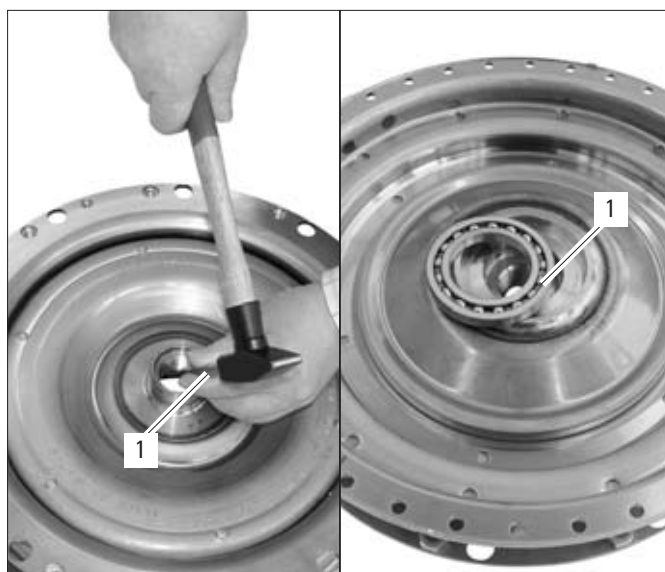
030059

- 26 Take out the two sealing rings (1, 2).



030060

- 27 Drive out the bearing **(2)** by means of a suitable mandrel **(1)**.



030061/030062

13.3 Assembling the Torque Converter

- 1 Press in the bearing **(1)** with a suitable thrust piece.



030063

- 2 Coat the outer **(2)** and inner **(1)** sealing ring with technical Vaseline.
- 3 Insert the outer **(2)** and inner **(1)** sealing ring in the torque converter piston **(3)**.



030064

- 4 Insert the piston of the torque converter lock-up clutch **(1)** and cautiously drive it in by means of light plastic hammer blows until firmly home.



030065

- 5 Insert the rectangular ring (1).



030066

- 6 Insert the torsional vibration damper (1) and drive it in by means of light plastic hammer blows until firmly home.



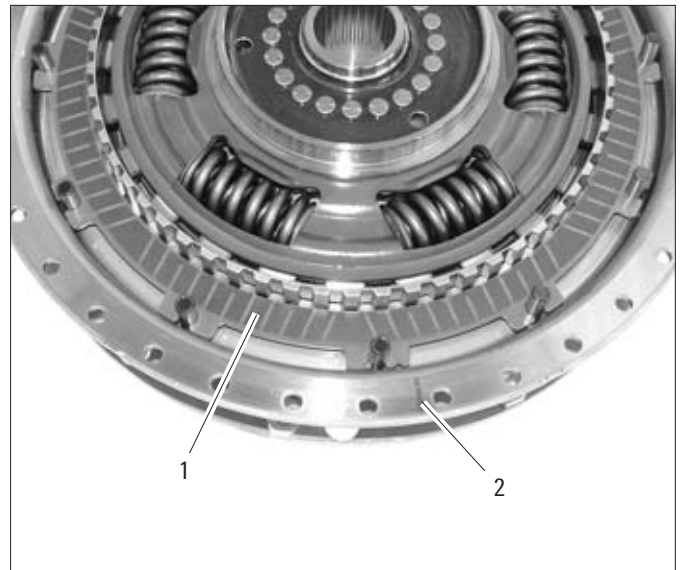
030067

- 7 Insert the twelve rolls (1).



030068

- 8 Insert the multidisks (1) of the torque converter lock-up clutch in accordance with the parts list (BoM). Align the multidisks in such a way that the notches of the multidisks point towards the marking (2).



030069

- 9 Prepare measurement setup as described in illustration.
- 10 Measure the distance between the measuring caliper and the torque converter lock-up clutch multidisks: **Dimension A**



030071

- 11 Measure the distance between the measuring caliper and the abutment face: **Dimension B**
- 12 Calculation of the play of the torque converter lock-up clutch multidisks:

S_{LUC} = torque converter lock-up clutch multidisk play

$S_{LUC} = \text{dimension A} - \text{dimension B}$

The nominal value for S_{LUC} is 0.9 mm up to 1.5 mm. In the case that S_{LUC} is bigger, then an end disk with a raised section must be used (also refer to the parts list).

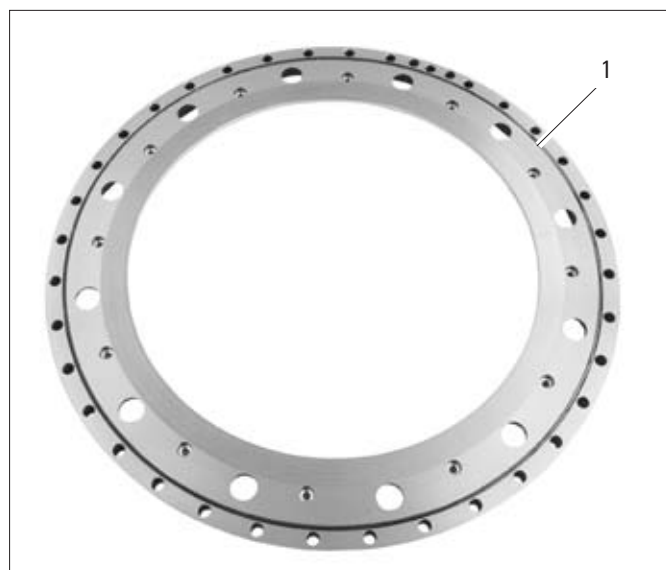
NOTE

In the case that the end disk features a raised section, then the latter must be deducted from the torque converter lock-up clutch multidisk play.



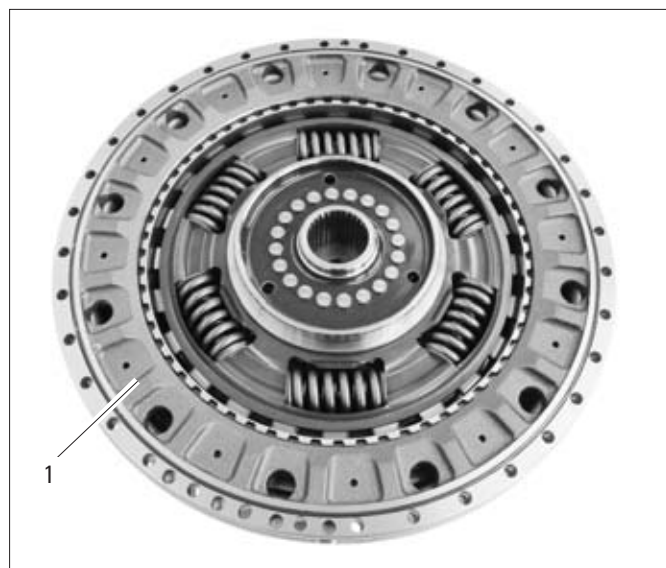
030072

- 13 Coat the sealing ring **(1)** with technical Vaseline.
- 14 Insert the sealing ring **(1)** in the end disk of the torque converter lock-up clutch.



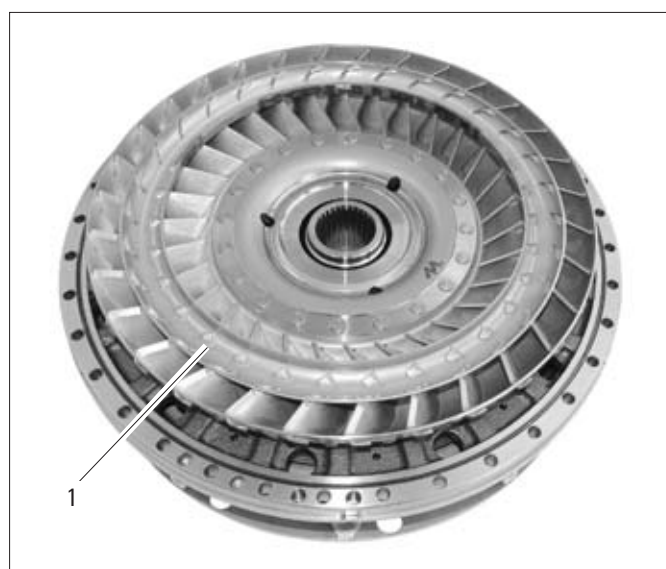
030073

- 15 Put on the end disk **(1)**.



030074

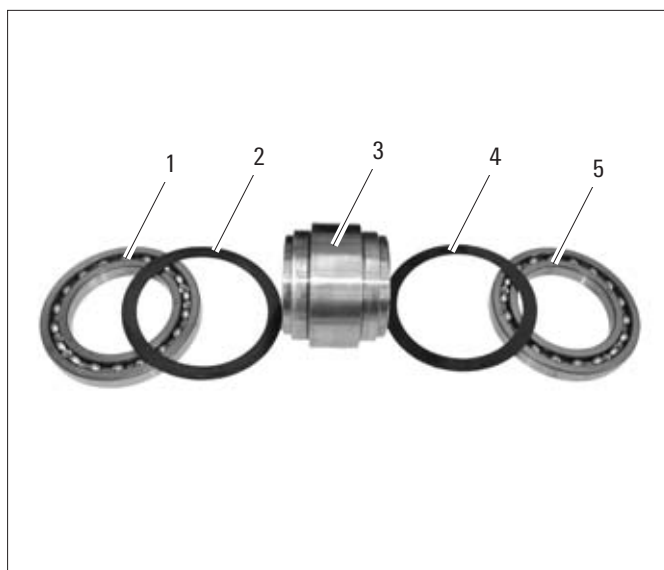
- 16 Put on the turbine wheel **(1)**.



030075

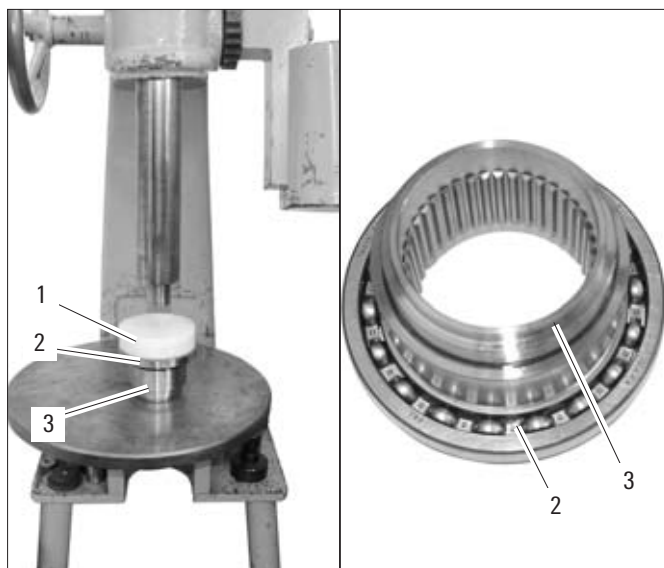
17 Allocation of bearing and hub on the stator:

- Bearing (1)
- Axial disk (2)
- Hub (3)
- Axial disk (4)
- Bearing (5)



025426

18 Press on the bearing (2) by means of a suitable thrust piece (1) onto the hub (3).

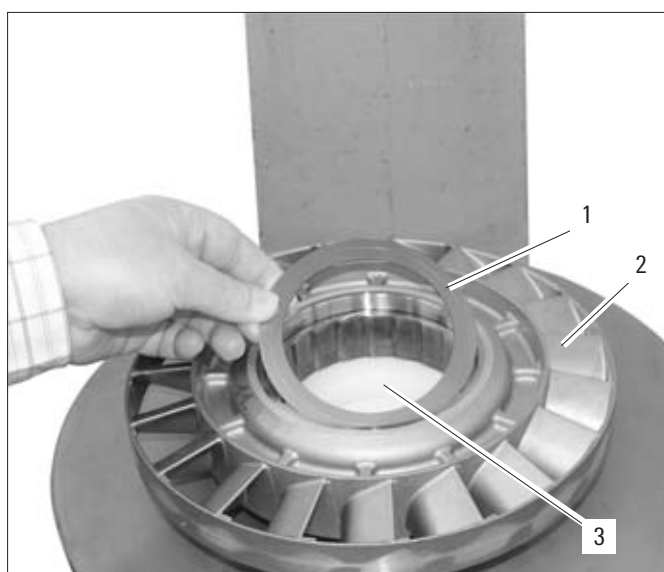


025443/025444

19 Put on a suitable support (3).

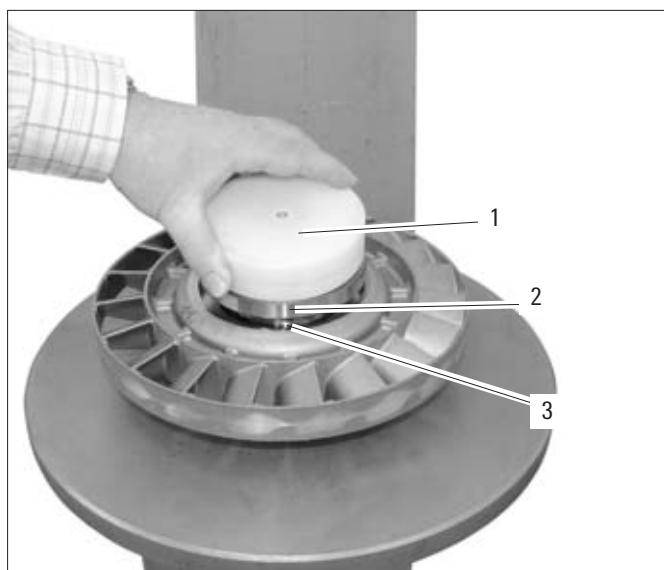
20 Put on the stator (2).

21 Add on the axial disk (1).



030076

- 22 Insert the hub **(3)**.
- 23 Put on the bearing **(2)**.
- 24 Put on the tool no.: **1X56 138 588 (1)** and press in the bearing.



030077

- 25 Put the tool no.: **1X56 138 588** on the press.
- 26 Turn the stator **(2)** around and put it on.
- 27 Insert 20 bearing rolls **(1)** in the stator **(2)**.



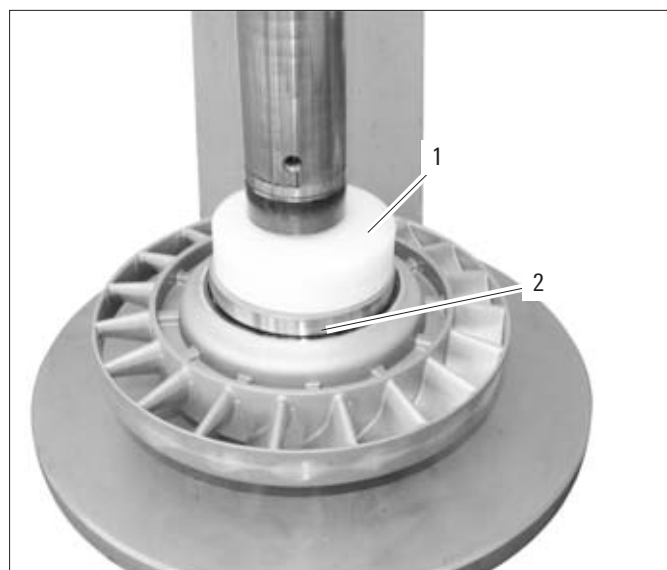
030078

- 28 Insert the axial disk **(1)** in the stator.



030079

- 29 Put on the bearing **(2)**.
- 30 Put on the tool no.: **1X56 138 588 (1)**.
- 31 Press in the bearing **(2)**.



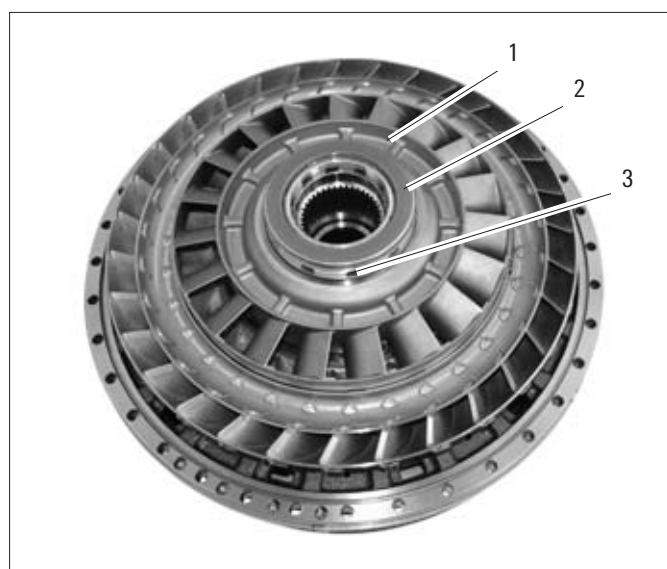
030080

- 32 Insert the bearing **(1)**.



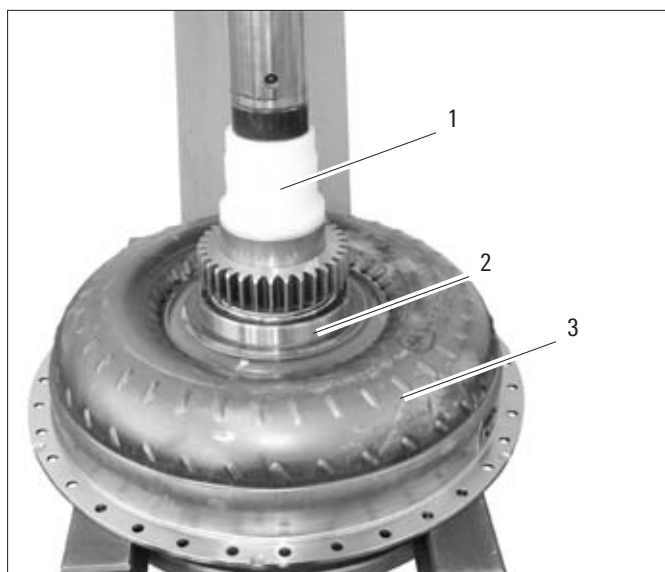
030081

- 33 Turn the stator **(1)** around and insert the unit.
- 34 Put on the oil supply ring **(3)**.
- 35 Put on the bearing **(2)**.



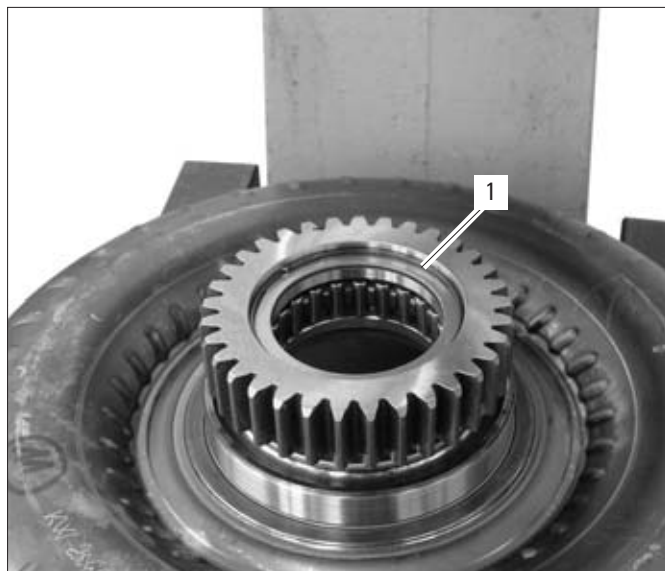
030082

- 36 Put the impeller **(3)** on the press.
- 37 Put on the bearing **(2)** with the broad shoulder facing upwards.
- 38 Press in the bearing **(2)** with the tool no.: **1X56 138 591 (1)**.



030083

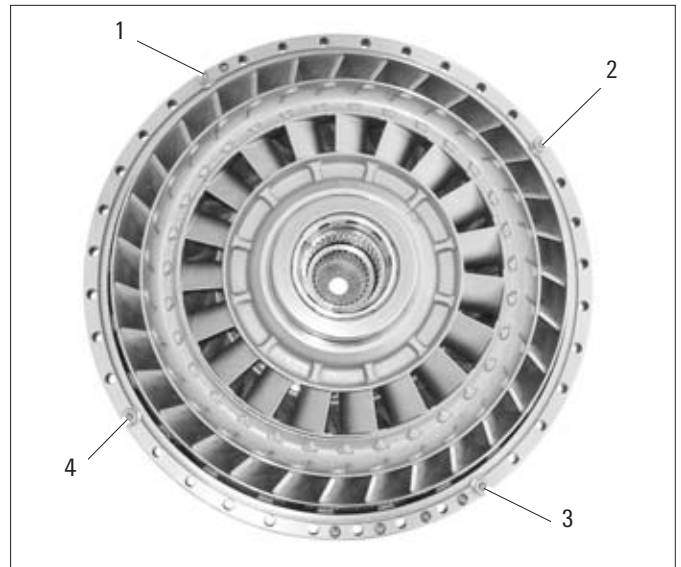
- 39 Insert the circlip **(1)**.



030084

Measure the axial play of the torque converter

- 40 Screw in the thrust collar and the circuit cover by means of four screws/bolts (1, 2, 3, 4).



030085

- 41 Prepare measurement setup as described in illustration.
- 42 Measure the distance between the measuring caliper and the sealing face:
Dimension A (e.g. 179.99 mm)



030086

- 43 Measure the distance between the measuring caliper and the bearing:
Dimension B (e.g. 97.25 mm)

NOTE

Measure from the two ends respectively; then calculate the mean value.

Dimension X = dimension A - dimension B

Dimension X = 179.99 mm - 97.25 mm
= 82.74 mm



030087

- 44 Measure the distance between the measuring caliper and the sealing face of the impeller:
Dimension E (e.g. 80.0 mm)



030088

- 45 Measure the distance between the measuring caliper and the bearing's abutment face in the impeller: **Dimension D** (e.g. 163.41 mm)

Dimension Y = dimension D - dimension E

Dimension Y = 163.41 mm - 80.0 mm
 = 83.41 mm

- 46 Calculate the axial play in the torque converter.

S_W = axial play in the torque converter

S_W = dimension Y - dimension X

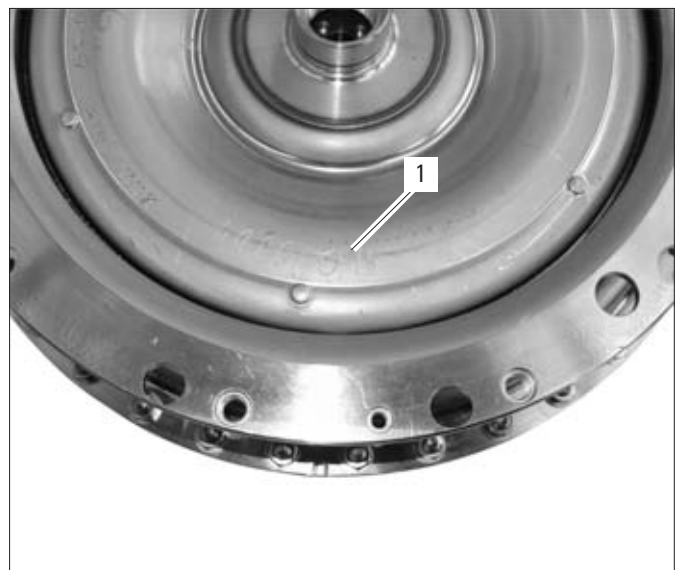
$S_W = 83,41 \text{ mm} - 82,74 \text{ mm} = 0,67 \text{ mm}$

The nominal setting for the torque converter play is 0.1 mm up to 1.1 mm.



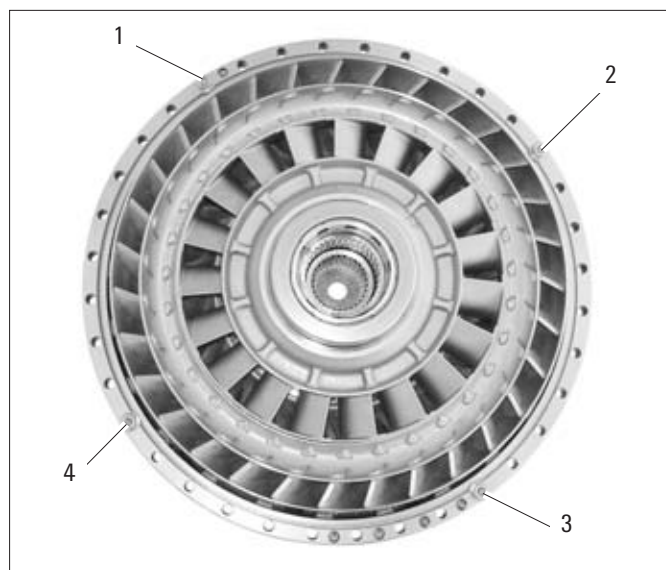
030089

- 47 If required, correct the engraved **dimension H (1)** at the torque converter.



030095

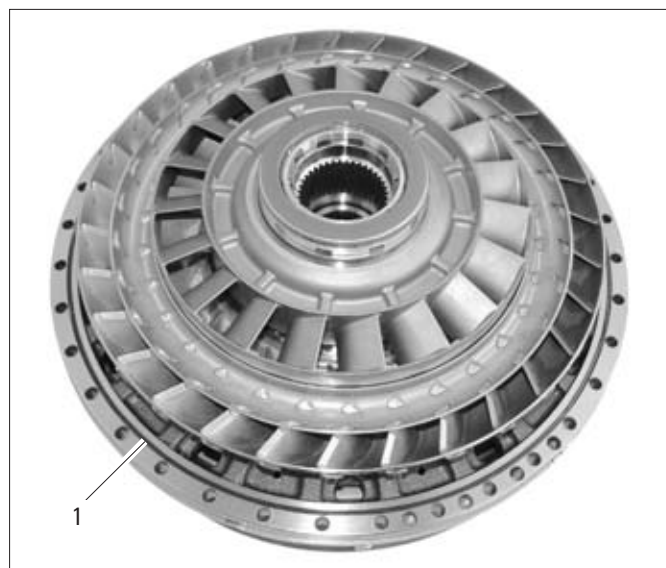
- 48 Unscrew the four screws/bolts **(1, 2, 3, 4)** once again.



030085

- 49 Coat the sealing ring **(1)** with technical Vaseline.

- 50 Insert the sealing ring **(1)**.



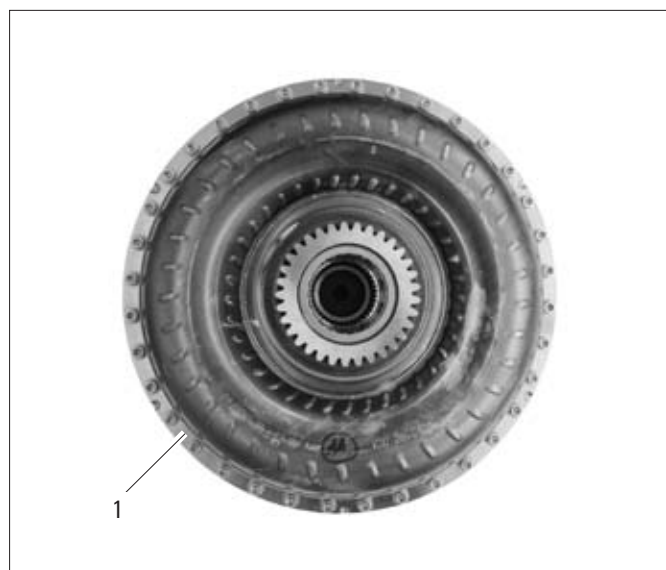
030090

- 51 Put on the impeller **(1)**.



030091

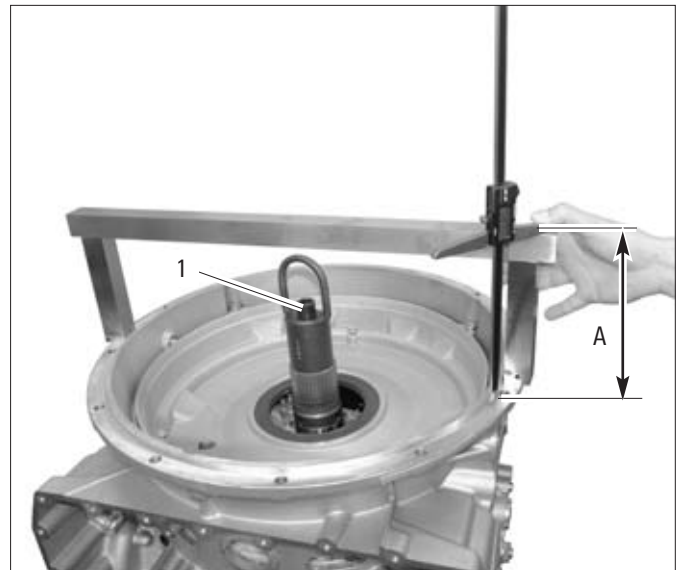
- 52 Screw in and tighten the Allen screws.
Tightening torque: 30 Nm



030092

13.4 Installing the Torque Converter

- 1 Screw on the lifting device no.: **1T66 156 231 (1)**.
- 2 Establish a measurement setup.
- 3 Measure the distance between the measuring caliper to the transmission's abutment face: **Dimension A**



030093

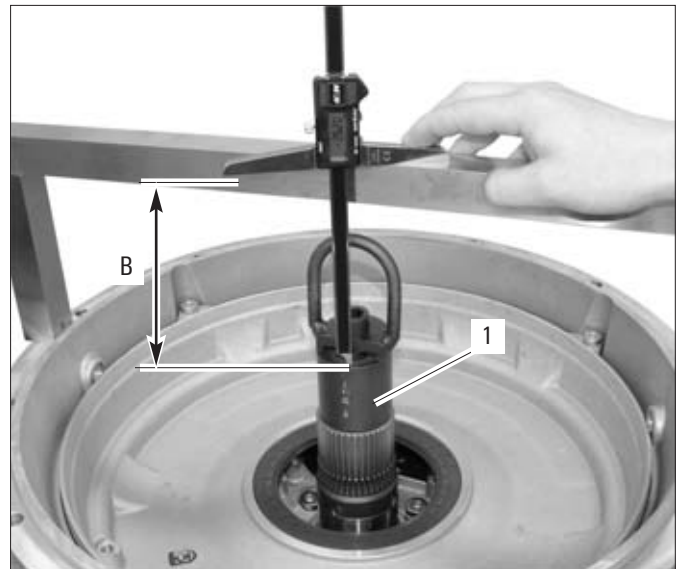
- 4 Measure distance from measuring bench to the internal front face of the turbine shaft: **Dimension B**

NOTE

Screw in lifting device **1T66 156 231 (1)** for measurement and tighten by hand, so that the turbine shaft abuts at top.

Target tractive force at turbine shaft: 2000 N

- 5 Remove the measurement setup.
- 6 Unscrew the lifting device no.: **1T66 156 231 (1)**.



030094

- 7 Read off the **dimension C (1)** and the **dimension H (2)** at the torque converter.

NOTE

After completion of the torque converter repair job, the **dimensions C** and **H** must be newly determined.

Dimension C: Also refer to the Chapter "Determining Dimension C of the Torque Converter".

Dimension H: Axial play in the torque converter, also refer to Chapter "Assembling the Torque Converter" under "Measure the axial play of the torque converter".



030095

- 8 Calculating the shim's thickness S:

E = installation dimension of the torque converter (also refer to the parts list)

S = thickness of the shim

Dimension I = dimension A - dimension B

**Dimension D = dimension I + dimension C
+ dimension H**

S = E - dimension D

Beispiel:

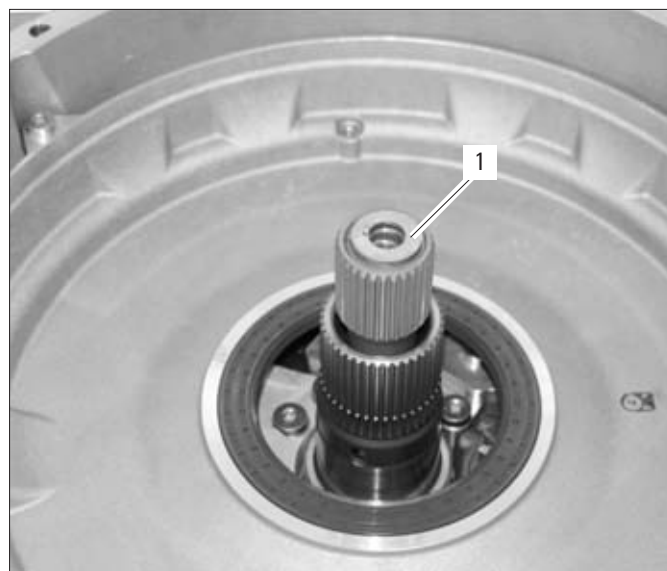
Dimension I = 180,0 mm - 152,9 mm

Dimension D = 27,1 mm + 49,0 mm + 0,15 mm

Dimension D = 76,25 mm

S = 81,25 mm - 76,25 mm = 5,0 mm

- 9 Put a shim/disk with the determined shim thickness S onto the turbine shaft.



025828

- 10 Screw an eye bolt no.: **1T66 160 674 (1)** into the torque converter.



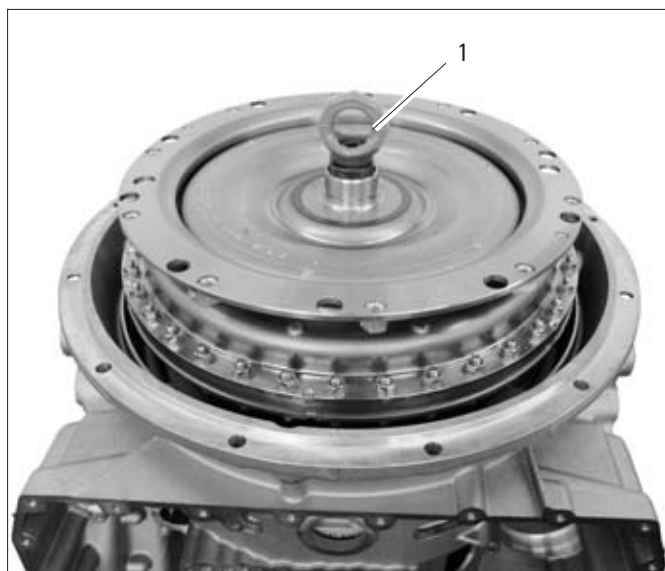
030096

- 11 Attach suitable lifting gear.
- 12 Insert the torque converter (1) by means of a crane into the transmission. To this end, during the lowering process, the torque converter must be swiveled. Ensure that the torque converter meshes with the two splines (turbine shaft and hollow shaft).



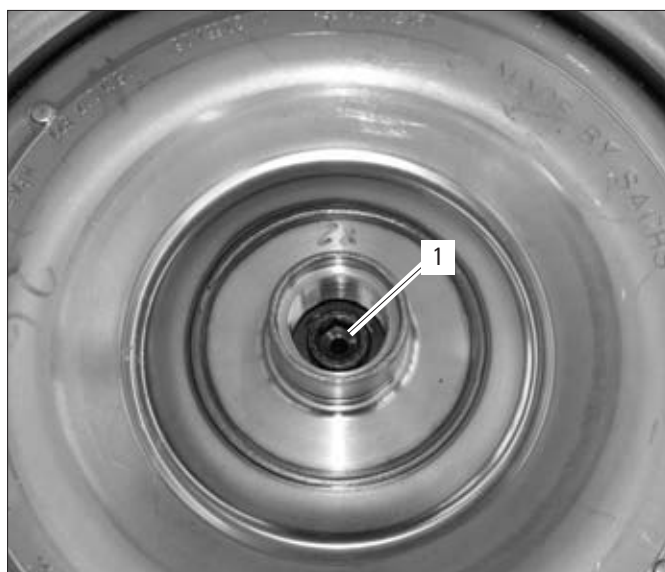
030039

- 13 Unscrew the lifting device no.: **1T66 160 674 (1)**.



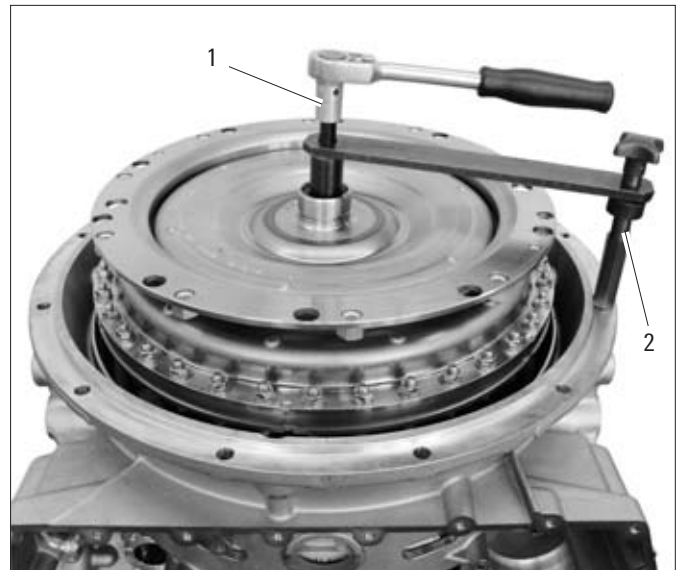
030038

- 14 Screw in the Allen screw (1) in the torque converter.



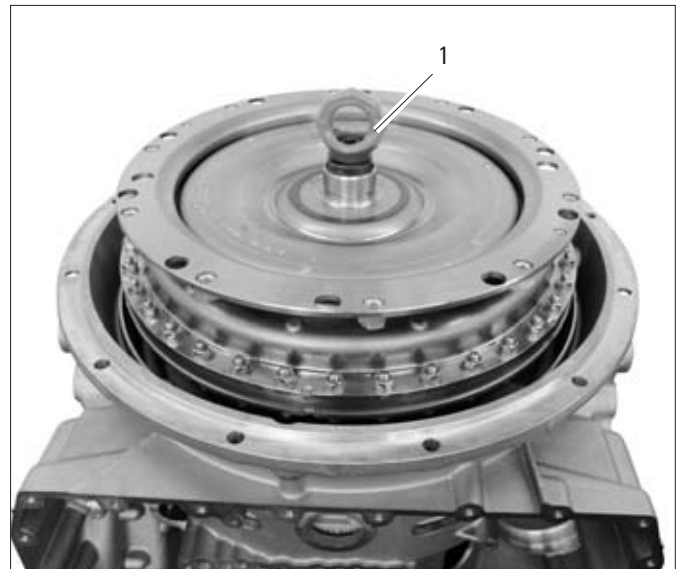
030097

- 15 Mount the counter support no.:
1X56 136 864 (2).
- 16 Tighten the M16 Allen screw of the torque converter with the Allan wrench no.:
1X56 136 863 (1).
Tightening torque: 185 Nm
- 17 Remove the counter support no.:
1X56 136 864 (2).



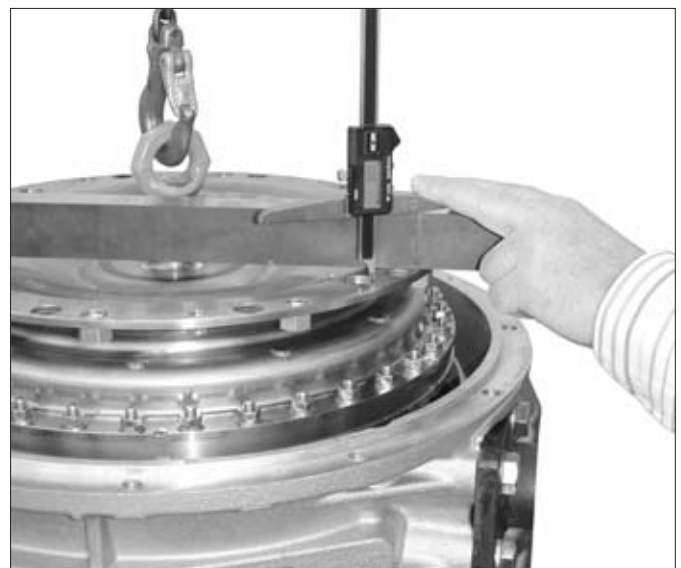
030036

- 18 Screw in the lifting device no.:
1T66 160 674 (1).



030038

- 19 Use a crane to pull converter upwards, free from backlash and rotate the converter to fit bearing.
Target tractive force at converter: 2750 Nm
- 20 Put on the measuring caliper and determine the distance in accordance with the instructions given by the illustration:
Dimension A (e.g. 40 mm).



030394

- 21 Determine the distance to the housing in accordance with the illustration: **Dimension B** (e.g. 121.18 mm).

- 22 Calculation of the torque converter's installation dimension:

Torque converter installation dimension = dimension B - dimension A

Torque converter installation dimension = 121.18 mm - 40 mm

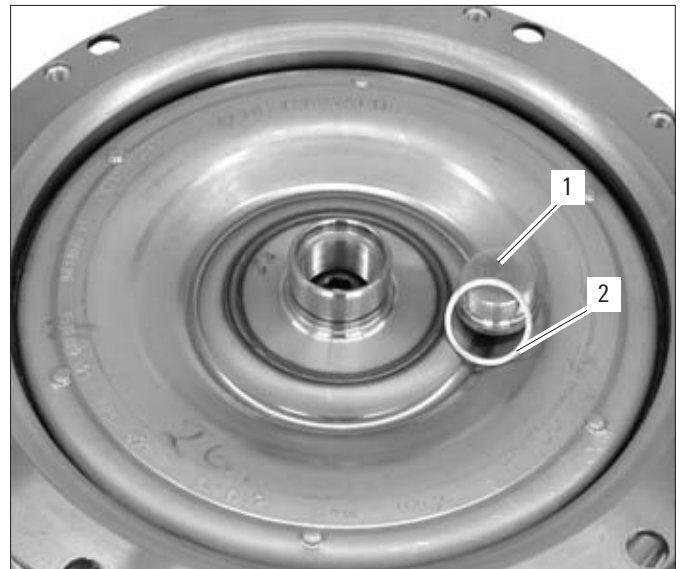
Torque converter installation dimension = 81.18 mm

The nominal value for the torque converter installation dimension can be taken from the parts list (BoM).



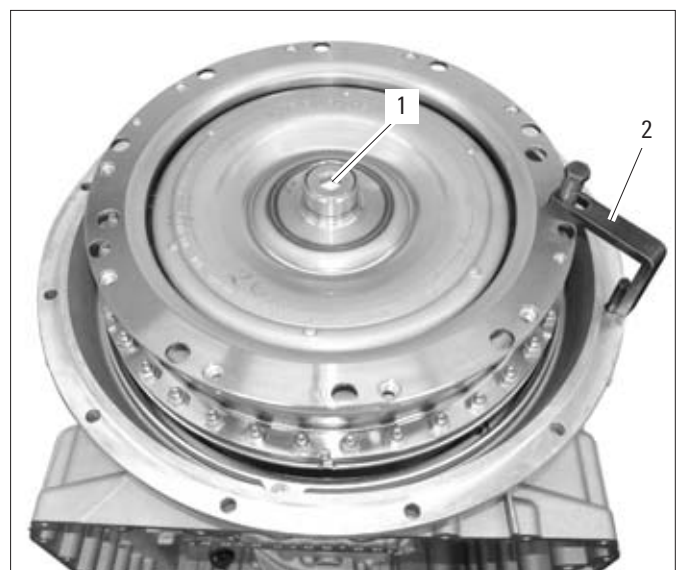
030395

- 23 Push a new copper seal ring **(2)** onto the sealing plug **(1)**.



030035

- 24 Mount the counter support no.: **1X56 137 658 (2)**.
- 25 Screw in the sealing plug M36x1.5 **(1)** with the copper seal ring and tighten. Tightening torque: 120 Nm
- 26 Remove the counter support no.: **1X56 137 658 (2)**.



030033

13.5 Determining Dimension C of the Torque Converter

NOTE

In the case that the circuit cover, the torsional vibration damper, or the bearing of the torque converter have been replaced, then the engraved **dimension C (1)** of the torque converter must be re-determined.



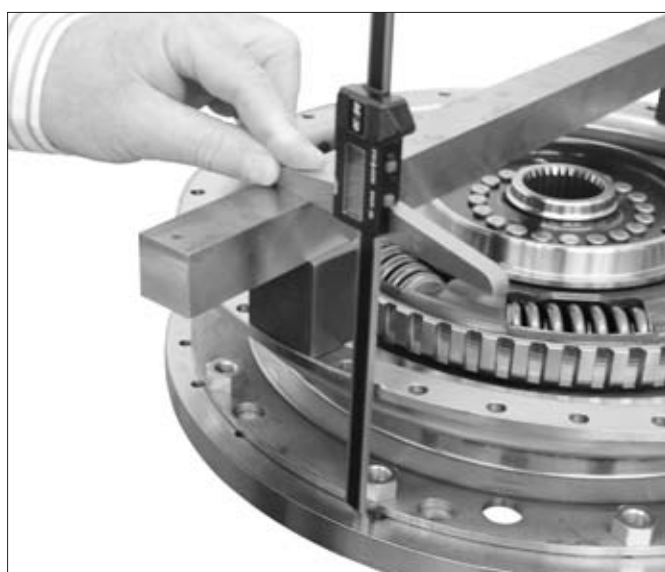
030095

- 1 Mount the circuit cover as shown in the illustration and add the assembly ring on top.



030396

- 2 Prepare measurement setup as described in illustration.
- 3 Measure the distance between the measuring caliper and the assembly ring: **Dimension A** (e.g. 155.73 mm).



030397

- 4 Measure the distance between the measuring caliper and the shim/disk:
Dimension B (e.g. 106.39 mm)

- 5 Calculation of **dimension C**:

$$\text{Dimension C} = \text{dimension A} - \text{dimension B}$$

$$\begin{aligned}\text{Dimension C} &= 155.73 \text{ mm} - 106.39 \text{ mm} \\ &= 49.34 \text{ mm}\end{aligned}$$



030398

- 6 In the case that the engraved **dimension C** differs from the calculated dimension, then, the engraving on the torque converter must be corrected.

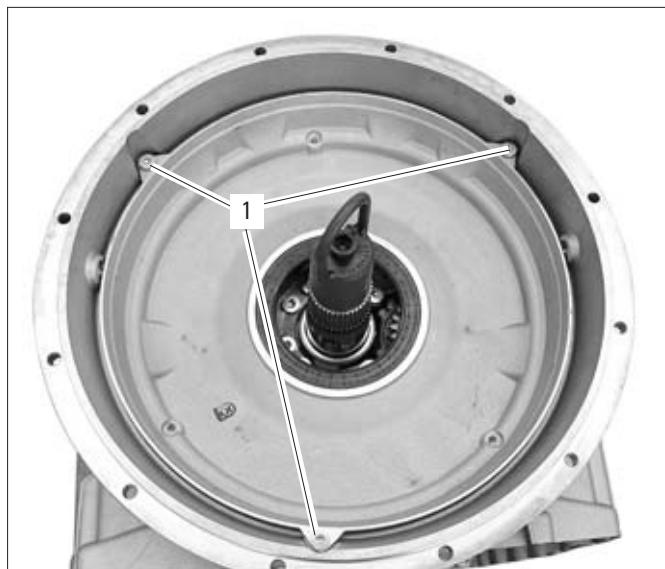


030095

14 Remove and Install the Cover Plate

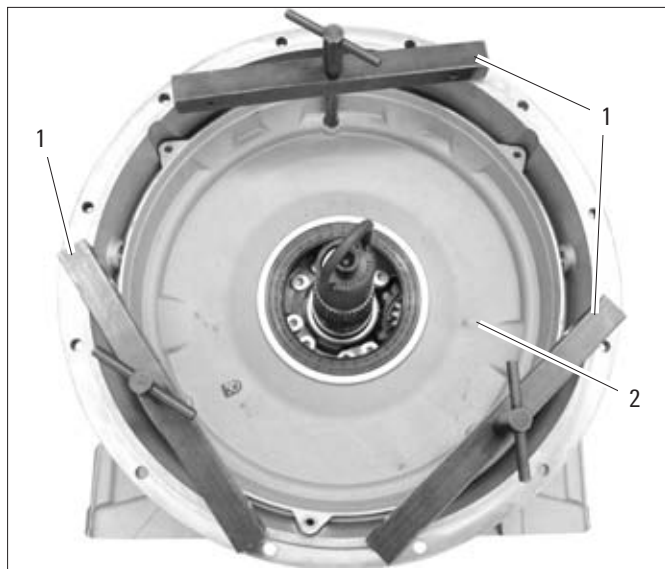
14.1 Remove the Cover Plate

- 1 Unscrew the three TORX screws M8 **(1)** at the cover plate.



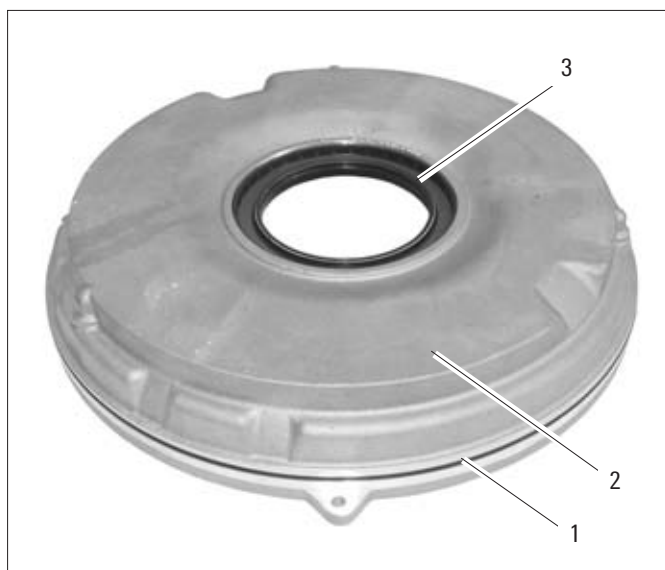
030098

- 2 Mount the three withdrawal tools **1X56 136 815 (1)**.
- 3 Pull off cover plate **(2)** with the withdrawal tools **(1)**.
- 4 Disassemble the withdrawal tools **(1)**.
- 5 Take off the cover plate **(2)**.



030099

- 6 Take out the O-ring **(1)** from the cover plate **(2)**.
- 7 Disassemble the shaft sealing ring **(3)**.

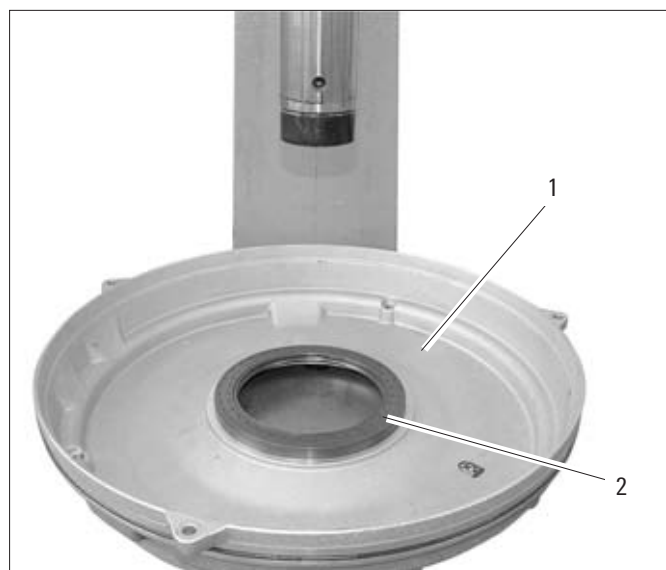


025358

14.2 Install the Cover Plate

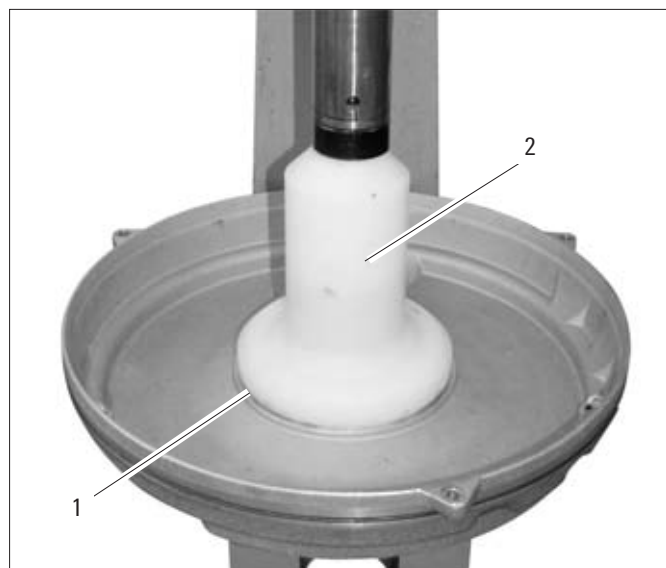
1 Place the cover plate **(1)** on the press.

2 Put on the shaft sealing ring **(2)**.



030100

3 Press in the shaft sealing ring **(1)** with the tool no.: **1X56 138 680 (2)** in the cover plate. The installation dimension of the shaft sealing ring (1.0+0.6 mm) is pre-determined by the tool.



030409

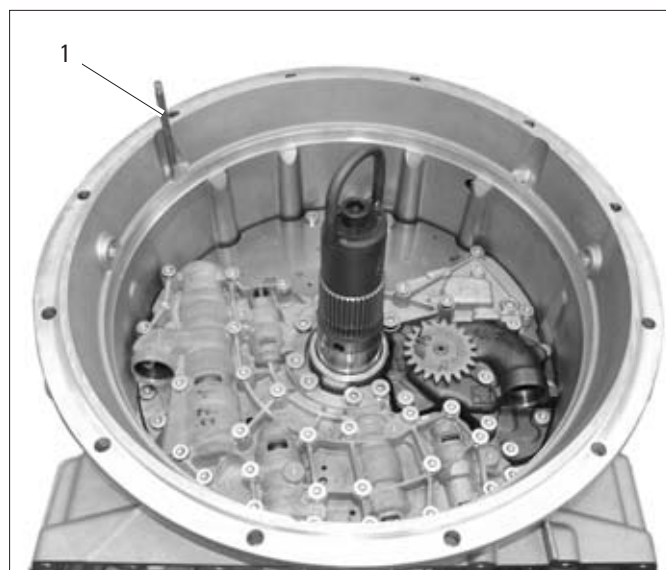
4 Coat O-ring **(1)** with technical Vaseline.

5 Insert the O-ring **(1)**.



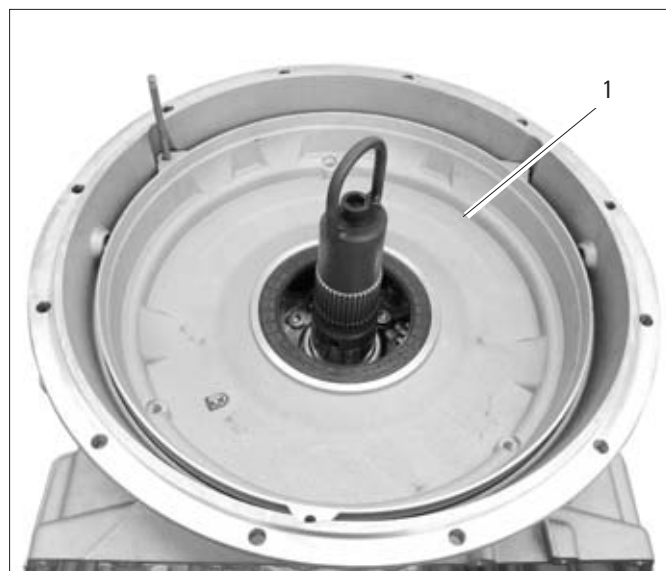
025808

- 6 Screw in the guide screw M8 **(1)**.



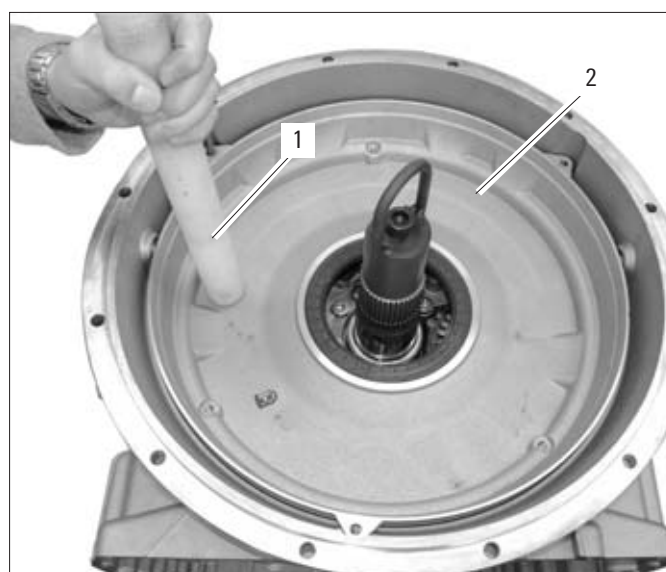
030102

- 7 Insert the cover plate **(1)**.



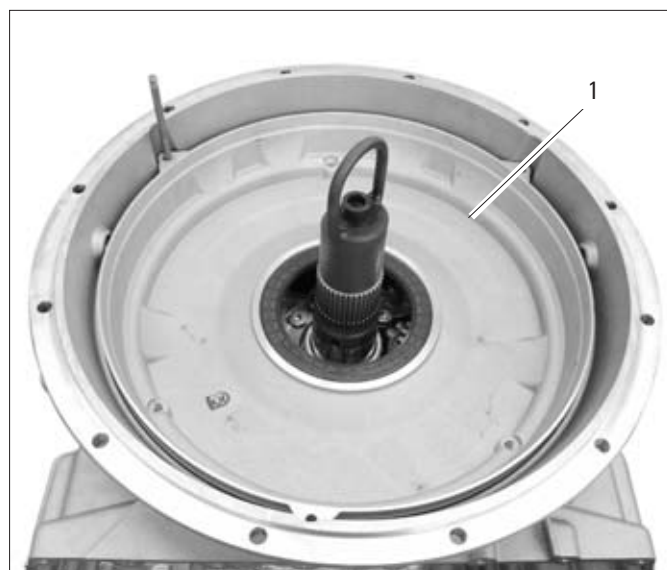
030103

- 8 Use a plastic punch **(1)** and a plastic hammer in order to drive in the cover plate **(2)** with light blows until firmly home.



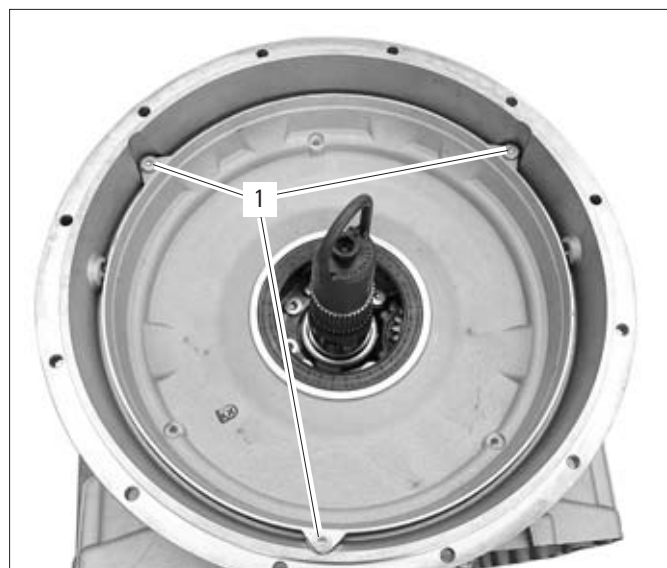
030104

- 9 Unscrew the guide screw **(1)**.



030103

- 10 Screw in three TORX screws M8x36 **(1)** and tighten.
Tightening torque: 20 Nm

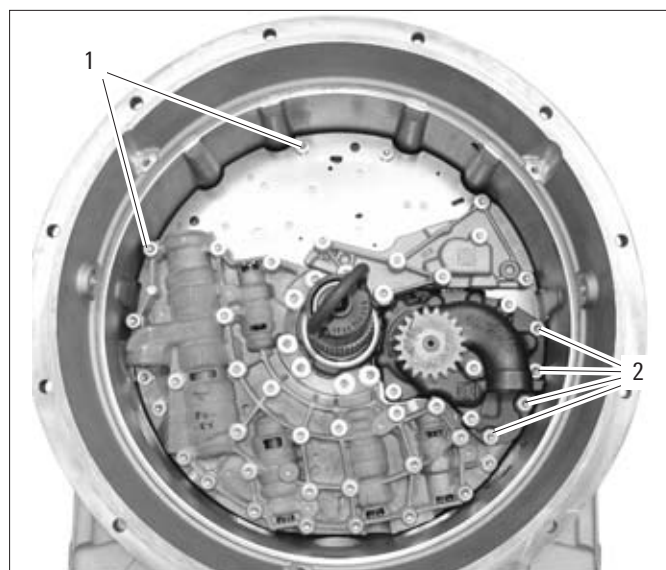


030098

15 Remove and Install, Dismantle and Assemble the Control Unit

15.1 Remove the Control Unit

- 1 Loosen 16 TORX screws **(1)** at the circumference of the control insert.
- 2 Loosen four TORX screws **(2)** at the pump.



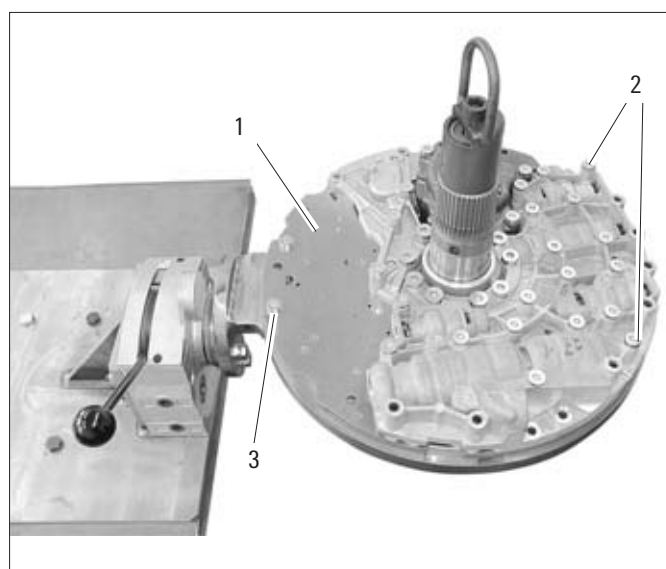
030105

- 3 Lift out the control unit with a crane.



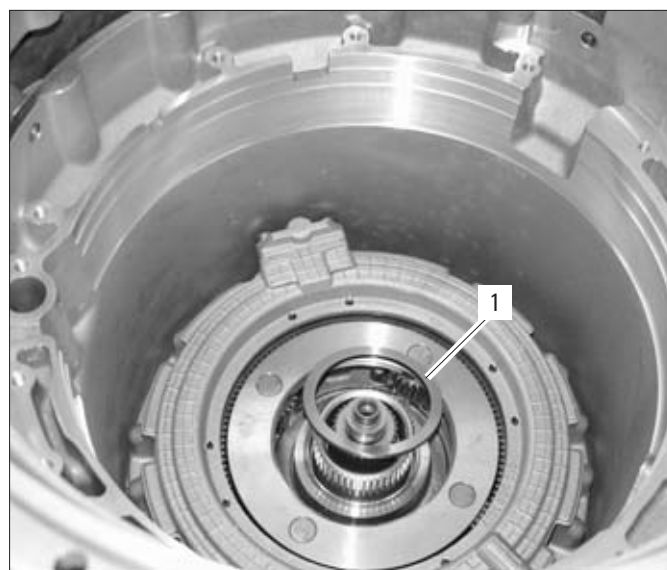
030106

- 4 Insert the control unit **(1)** with a crane in the indexable tip.
- 5 Fix the control unit with some TORX screws **(2, 3)** at the circumference.



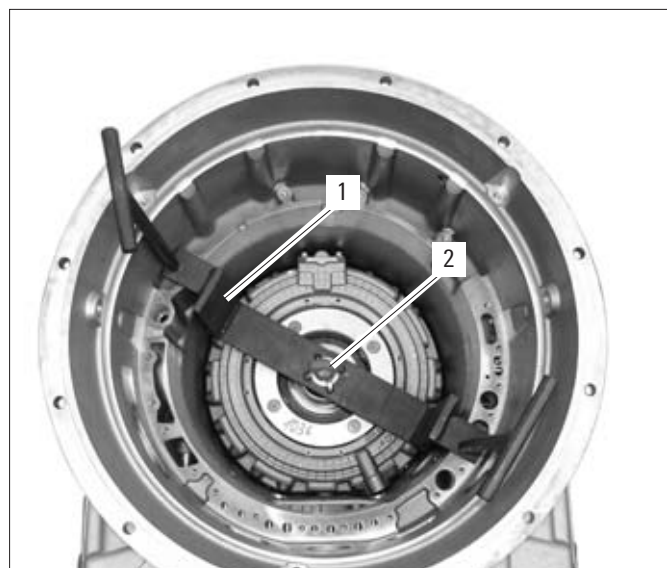
030107

- 6 Take out the setting ring **(1)**.



025361

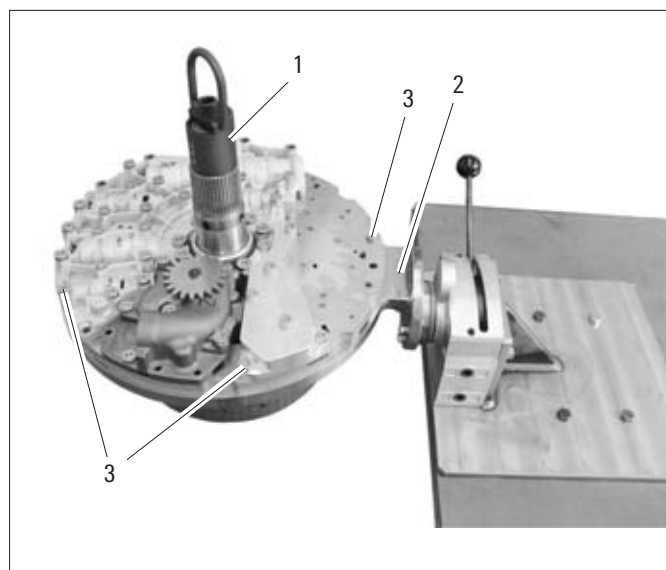
- 7 Insert the bracket **1X56 138 556 (1)**.
- 8 Screw in the lifting device **1T66 160 645 (2)**.



030181

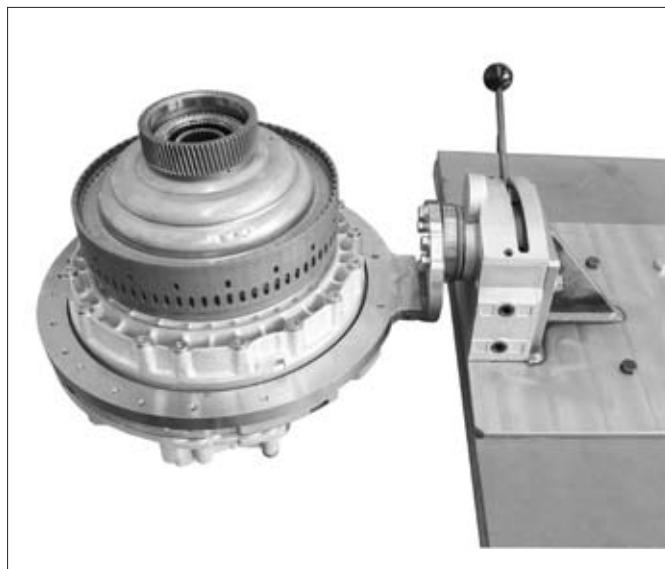
15.2 Dismantle the Control Unit

- 1 Leave the lifting device **1T66 156 231 (1)** at the control unit.
- 2 Insert the control unit in the indexable tip **(2)** by means of the crane.
- 3 Fix the control unit by means of some TORX screws **(3)** at the circumference.



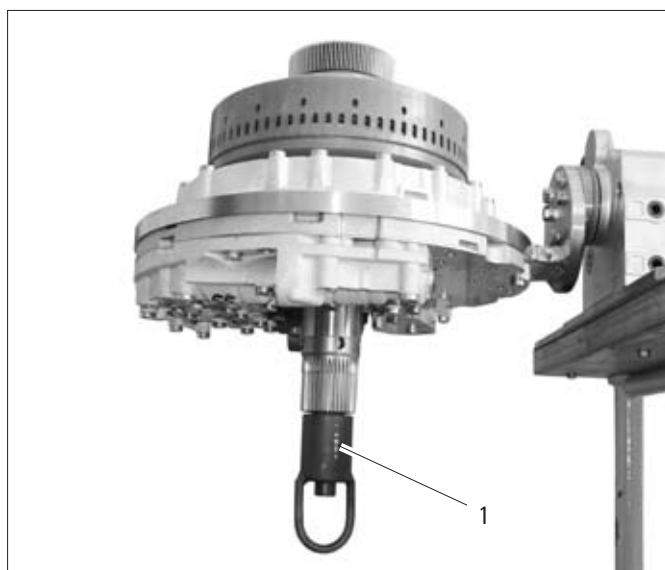
025665

- 4 Turn the control unit around.



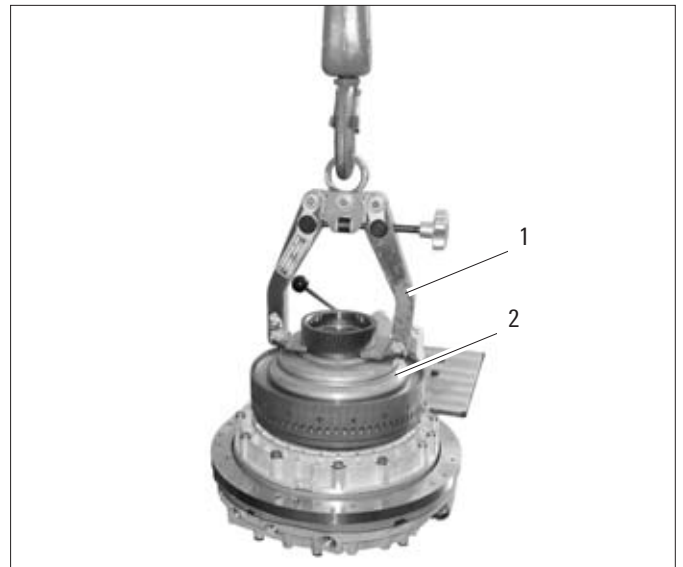
025668

- 5 Disassemble the lifting equipment **1T66 156 231 (1)**.



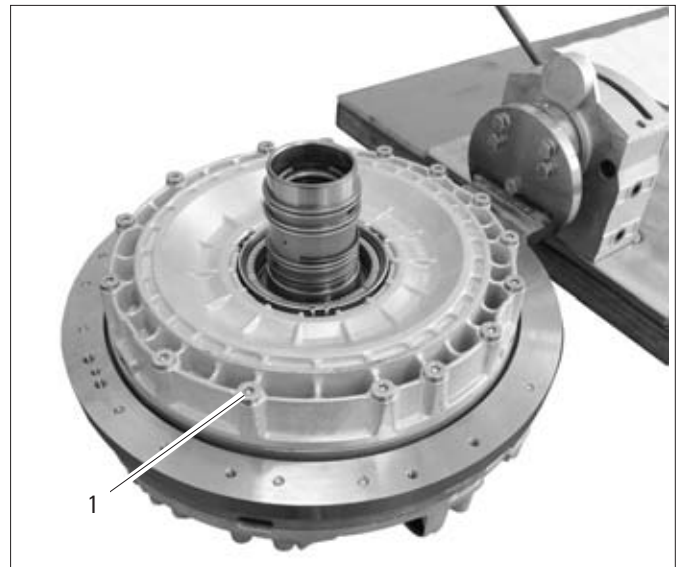
025669

- 6 Apply the spindle tongs **1T66 153 417 (1)**.
- 7 Lift off the clutch carrier **(2)** with the crane.



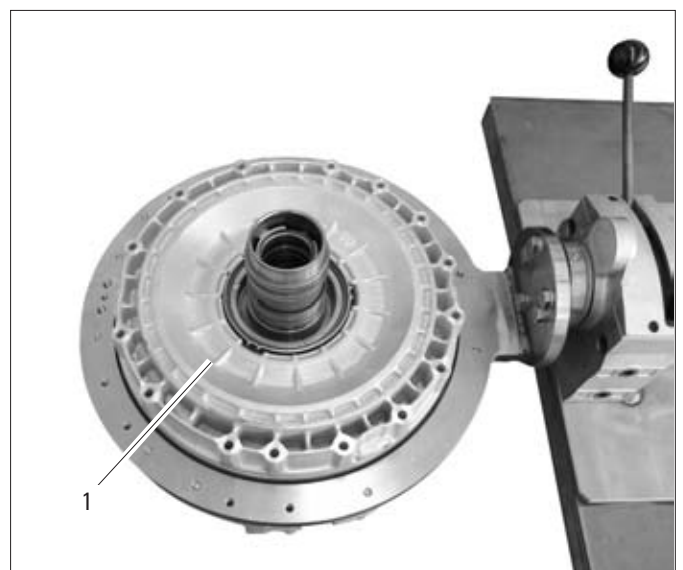
025670

- 8 Unscrew 16 TORX screws M8 **(1)** at the stator.



025725

- 9 Take off the stator **(1)**.



025726

- 10 Take out the rectangular ring **(1)** from the stator **(2)**.

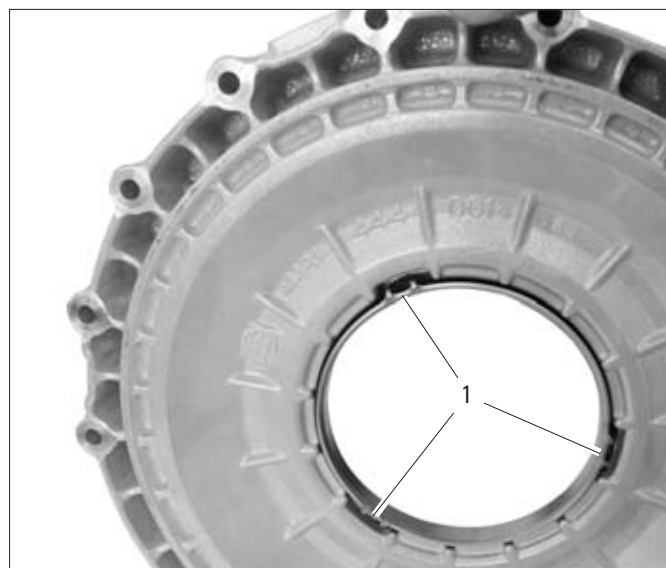


030108

- 11 Bend the straps **(1)** of the piston ring insert to such an extent to the inside that, at a later point in time, these will be bypassing the housing during the press-out process.

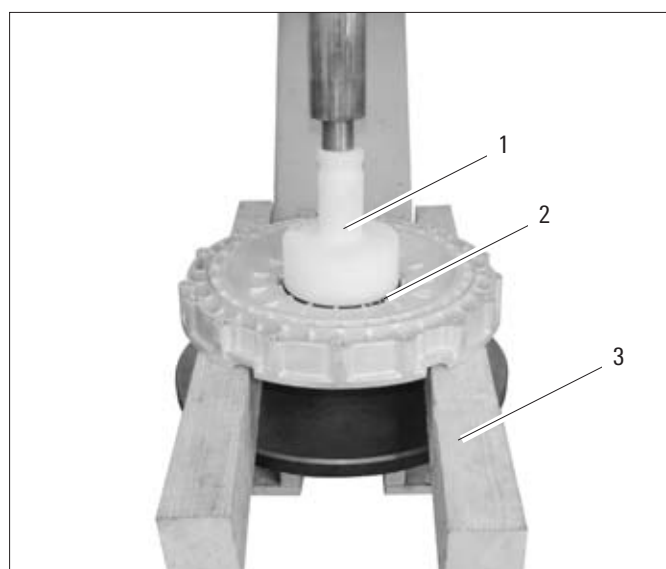
NOTE

Only in the case of wear must the piston ring insert of the piston ring race be disassembled.



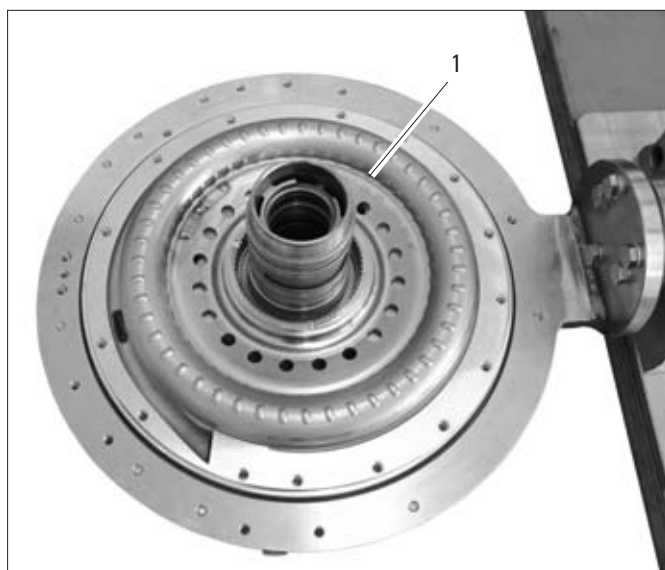
025728

- 12 Place the **(3)** skids on the press.
- 13 Press out the piston support **(2)** with the tool no.: **1X56 138 654 (1)**.



025729

- 14 Take off the rotor (1).

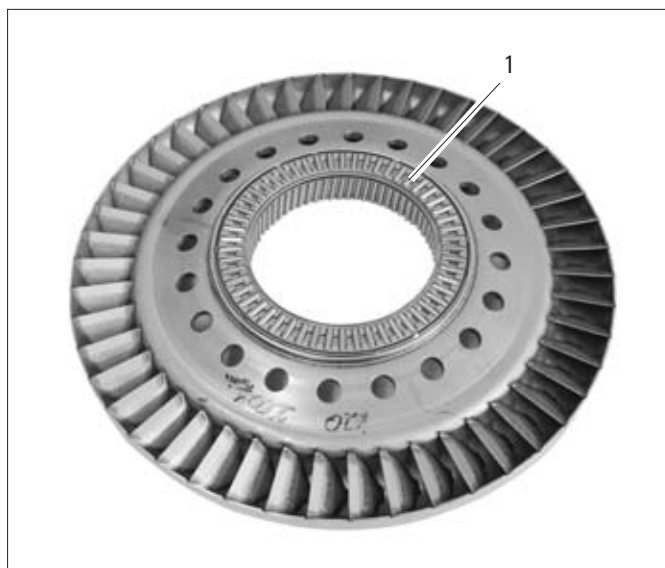


025731

- 15 If necessary, take off the axial bearing (1).

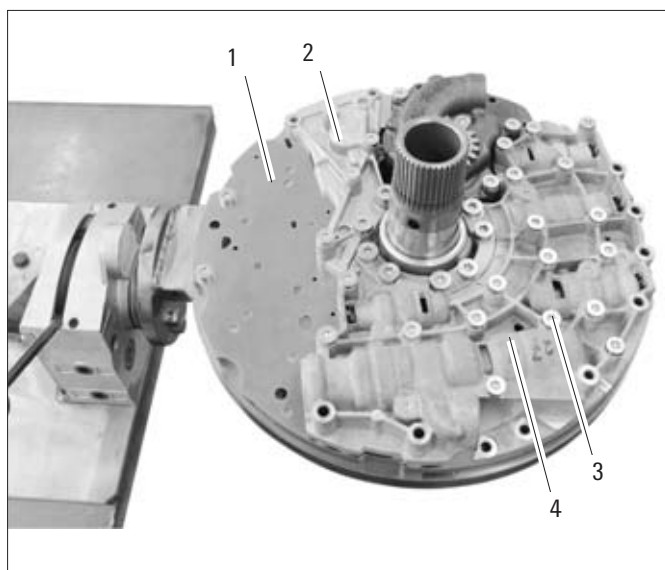
NOTE

In the case of disassembly, the bearing must be replaced.



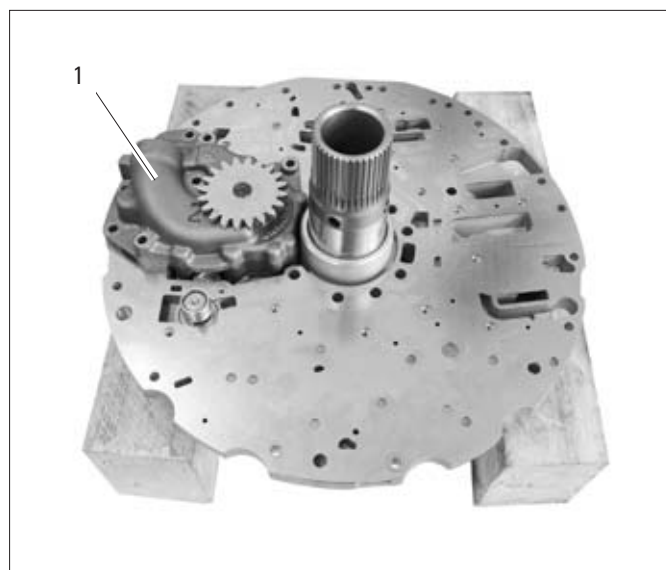
025732

- 16 Turn the control unit (1) upside with the turning equipment.
- 17 Unscrew all the TORX screws (3) from the control unit.
- 18 Take off the cover (2) and the valve block (4).



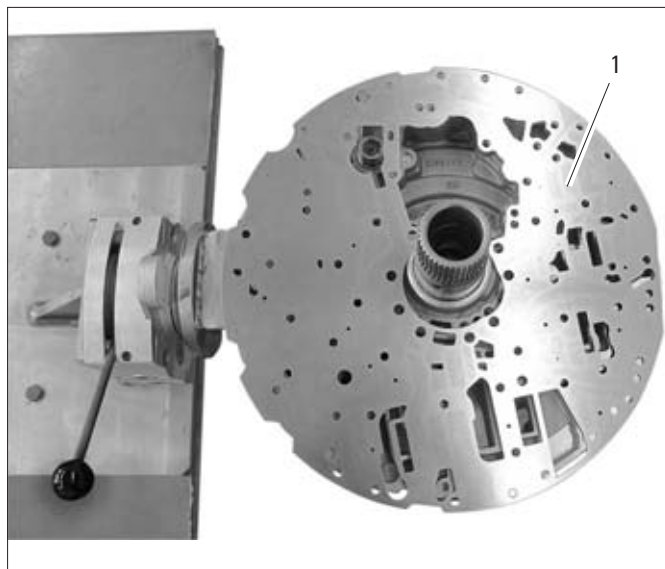
030109

- 19 Take off the pump (1).



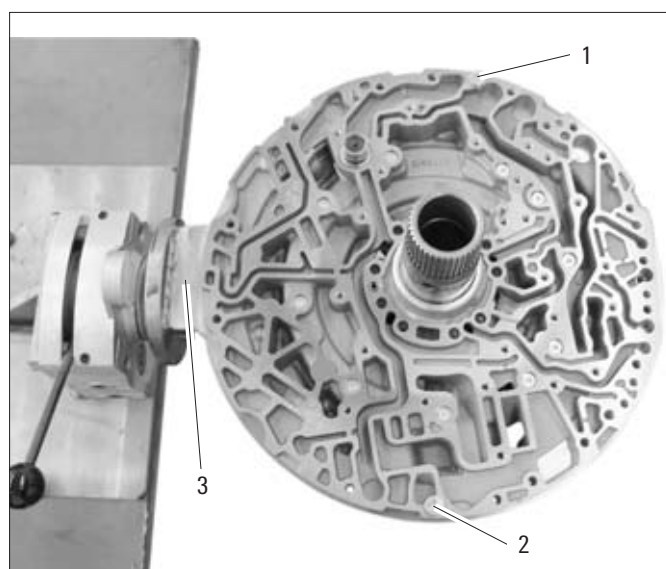
025738

- 20 Take off the intermediate plate (1).



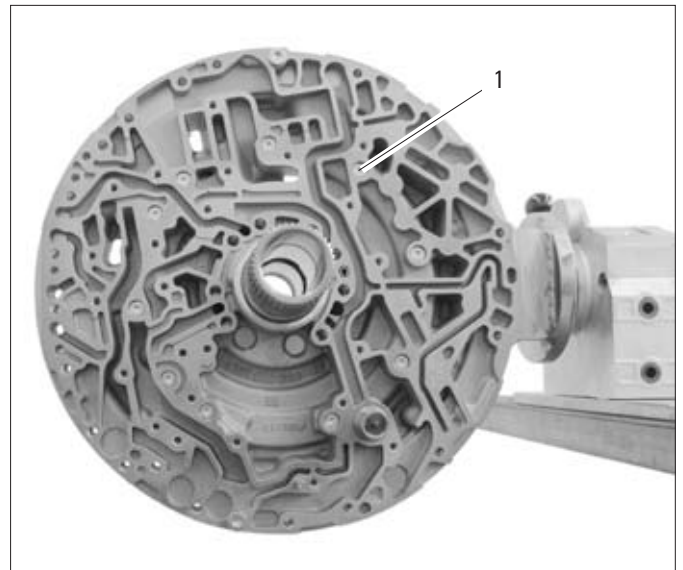
030110

- 21 Screw in the screws/bolts (1, 2) for securing the duct plate.
- 22 Turn the indexable tip with the control unit (3) (position vertically).



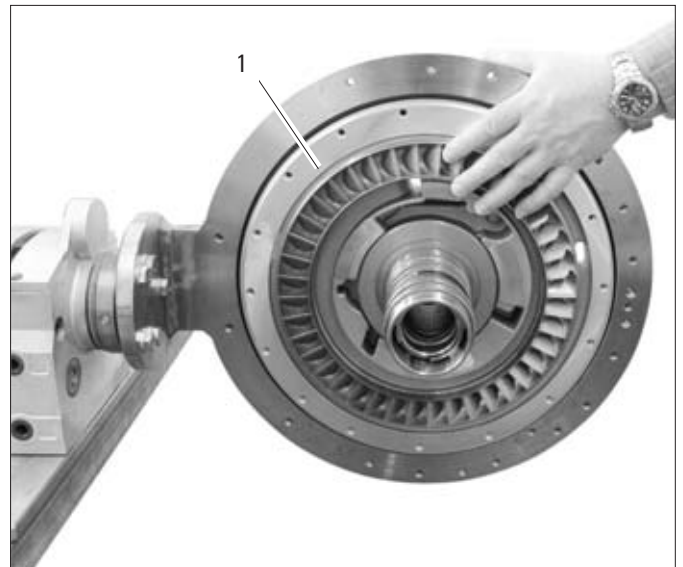
030111

- 23 Unscrew ten TORX screws (1).



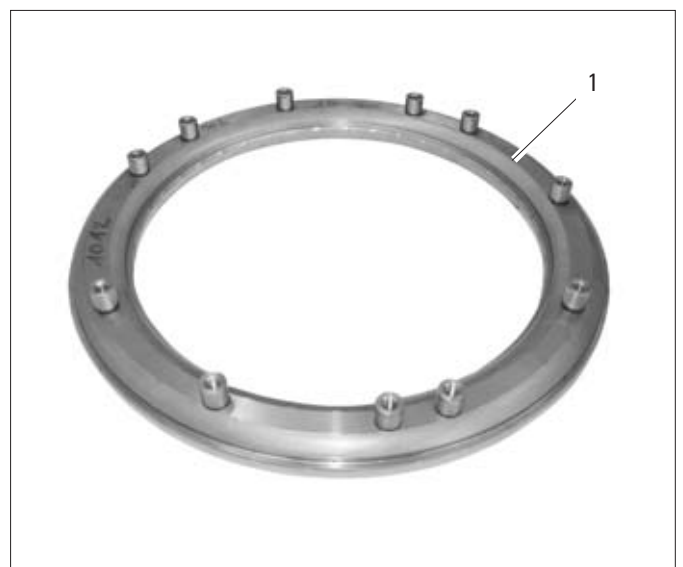
030112

- 24 Hold onto the stator ring (1) when unscrewing the last screw/bolt.



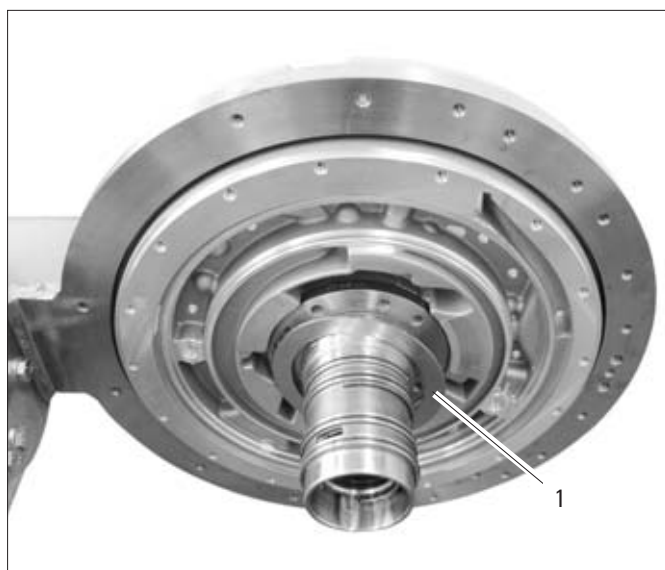
030113

- 25 Take out the stator ring (1).



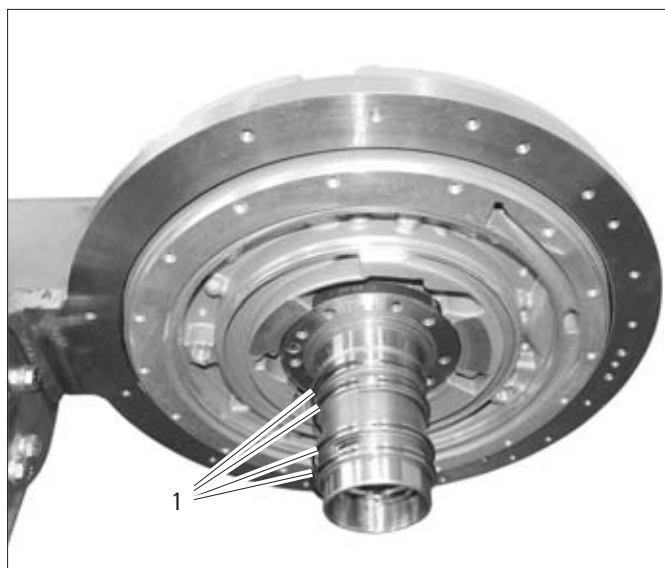
025741

- 26 Take off the disk/washer (1).



030114

- 27 Take out the four rectangular rings (1).



030115

- 28 Press out the stator quill shaft (2) with a suitable thrust piece (1).

CAUTION

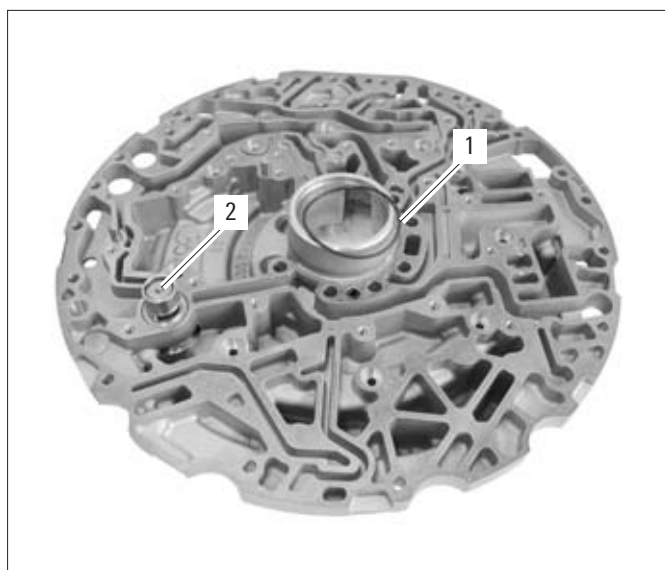
Cushion stator quill shaft with soft material so that the unit will not be damaged when falling out.



025744

29 Take out the O-ring (1).

30 Take out the valve (2).



025746

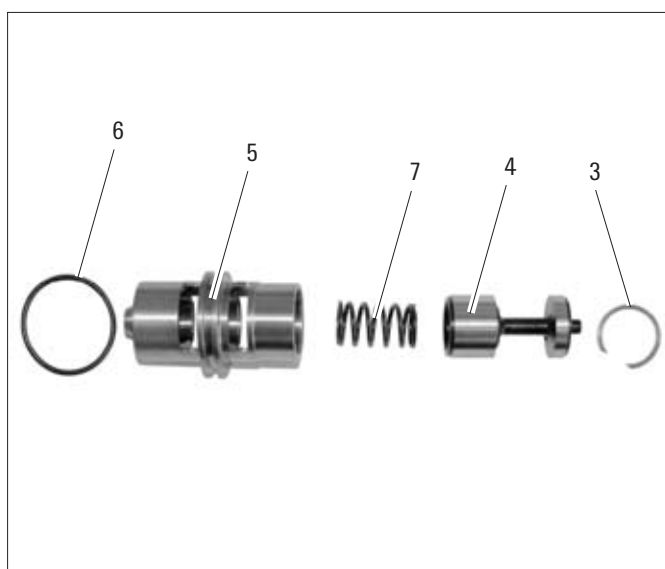
31 Unsnap the securing ring (3).



025747

32 Take out the piston (4) and the spring (7) from the valve housing (5).

33 Take off the O-ring (6).



030406

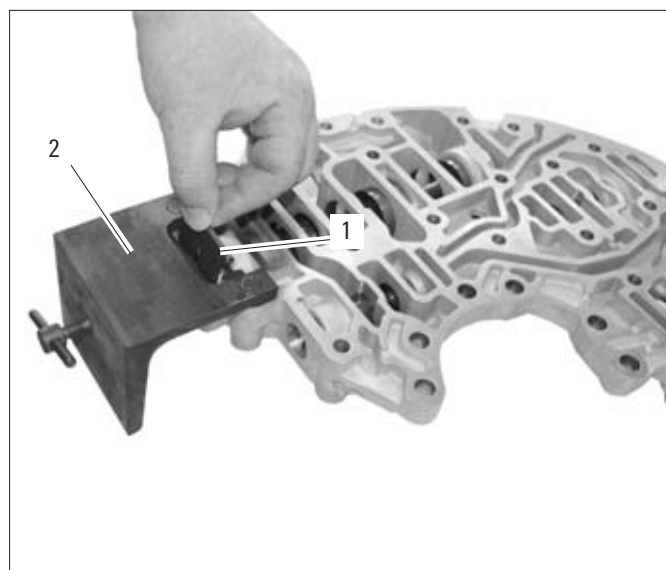
15.3 Dismantle the Valve Housing

15.3.1 Cooler Change-Over Valve

- 1 Relieve the valve locking device (1) with the tool no.: 1X56 138 557 (2) and pull out the valve locking device towards the top.

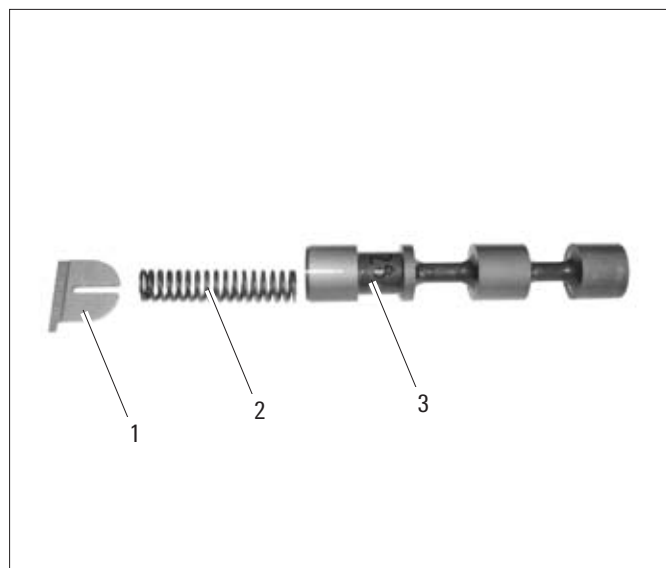
CAUTION

Unit is under tension! The spring may jump out.



025773

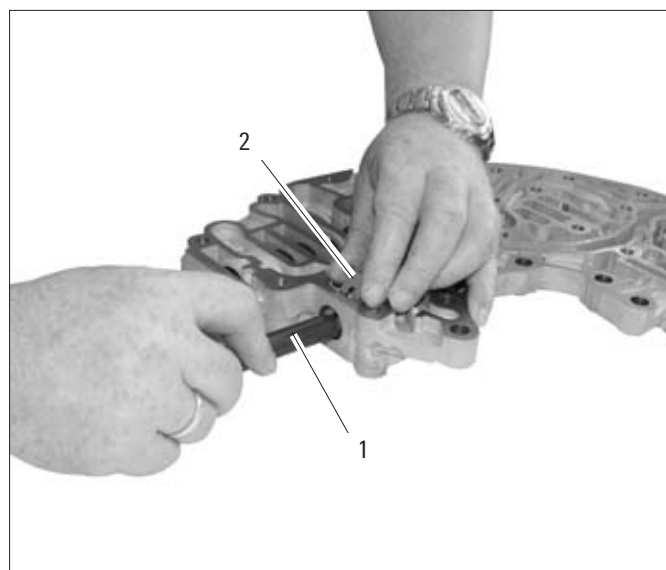
- 2 Take out the valve locking device (1).
- 3 Take out the spring (2).
- 4 Take out the piston (3).



025756

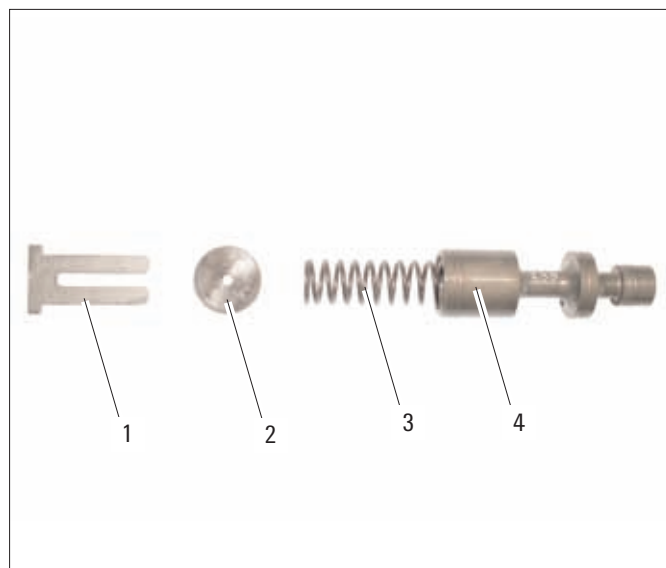
15.3.2 Converter Counter-Pressure Valve

- 1 Valve locking device **(2)** with the tool **1X56 138 652 (1)** to be relieved (press towards the inside) and push towards the top.



025758

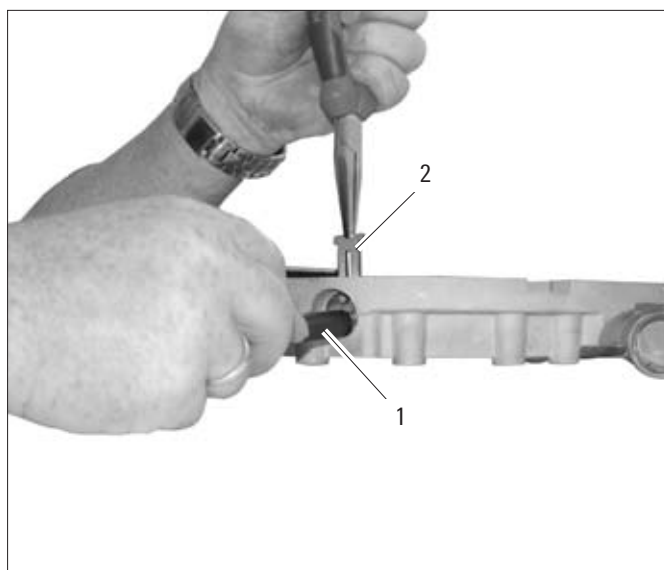
- 2 Take out the valve locking device **(1)**.
- 3 Take out the thrust piece **(2)**.
- 4 Take out the spring **(3)**.
- 5 Take out the piston **(4)**.



030407

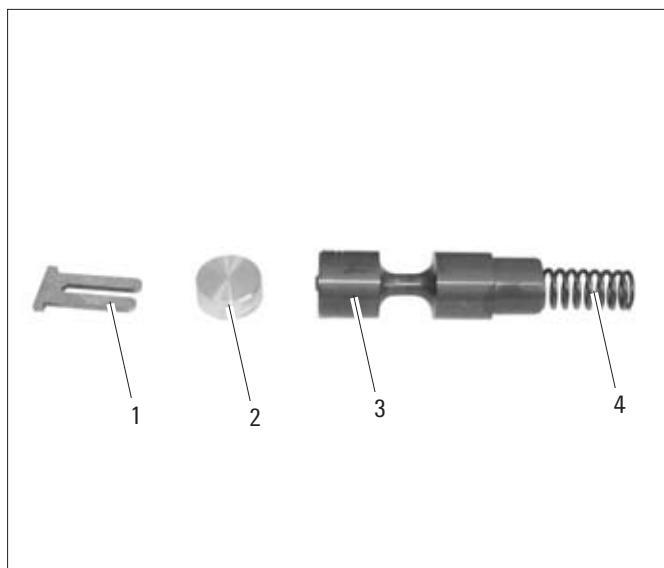
15.3.3 Retarder Control Valve

- 1 Valve locking device **(2)** with the tool **1X56 138 652 (1)** to be relieved (press towards the inside) and push to the top.



025761

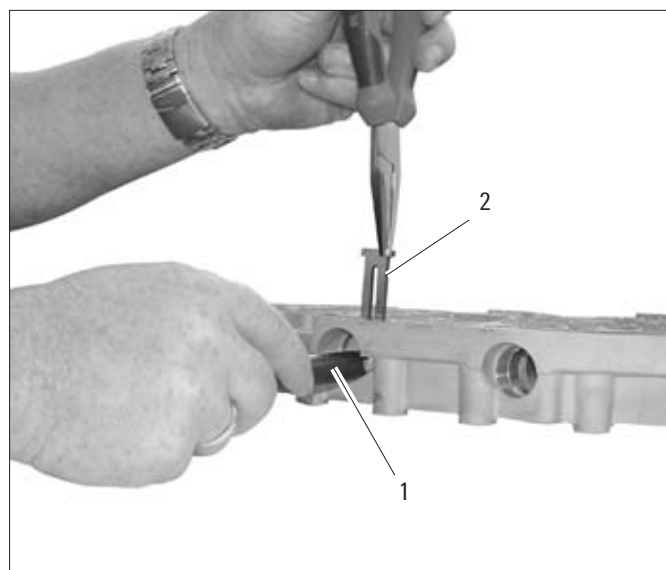
- 2 Take out the valve locking device **(1)**.
- 3 Take out the thrust piece **(2)**.
- 4 Take out the piston **(3)**.
- 5 Take out the spring **(4)**.



025762

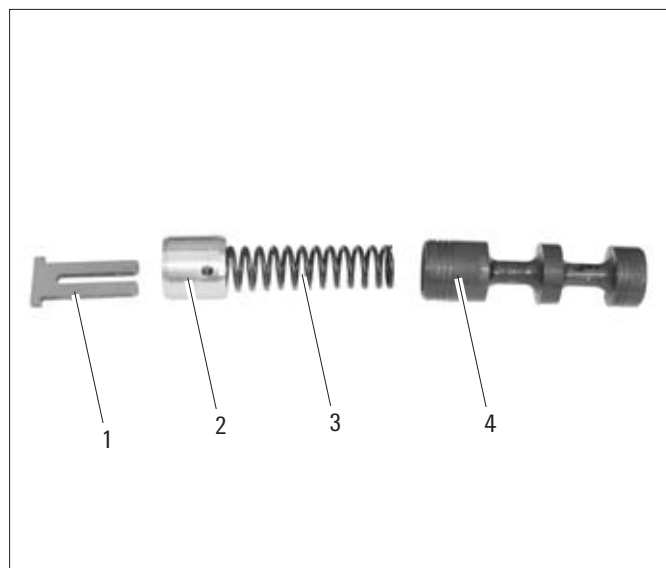
15.3.4 Main Pressure Valve

- 1 Valve locking device **(2)** with the tool **1X56 138 652 (1)** to be relieved (press towards the inside) and push to the top.



025764

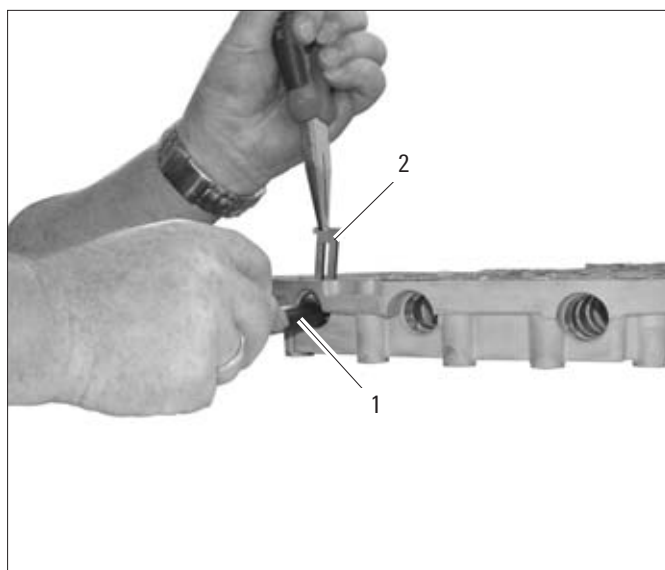
- 2 Take out the valve locking device **(1)**.
- 3 Take out the thrust piece **(2)**.
- 4 Take out the spring **(3)**.
- 5 Take out the piston **(4)**.



025765

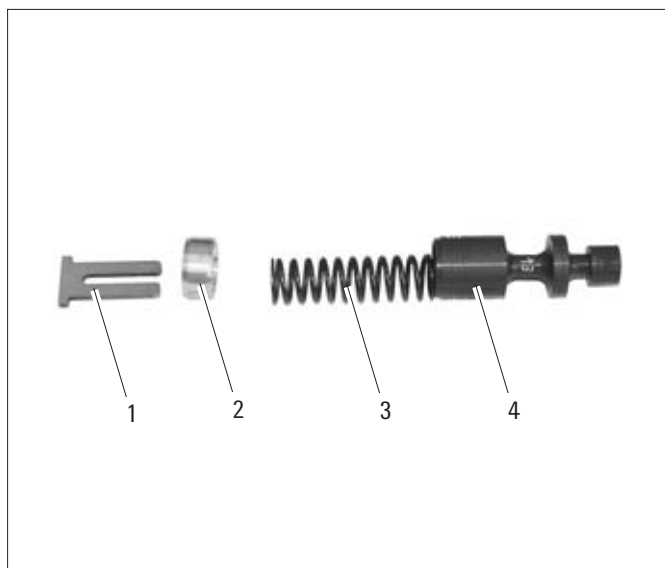
15.3.5 Torque Converter Safety Valve

- 1 Valve locking device **(2)** with the tool **1X56 138 652 (1)** to be relieved (press towards the inside) and push to the top.



025767

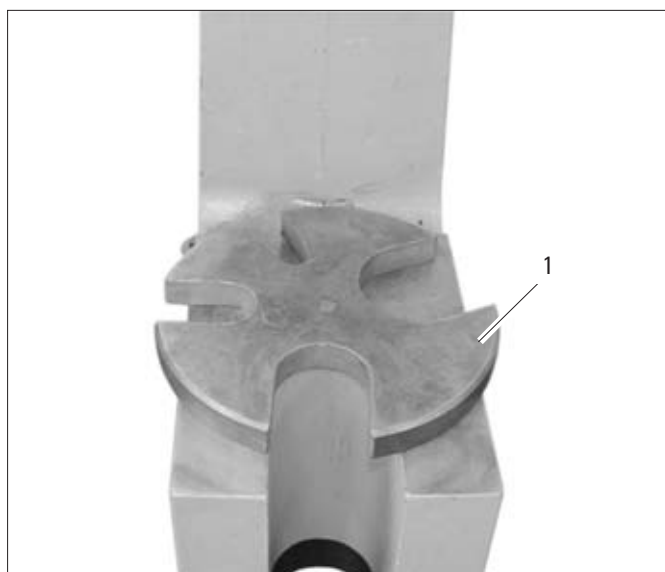
- 2 Take out the valve locking device **(1)**.
- 3 Take out the thrust piece **(2)**.
- 4 Take out the spring **(3)**.
- 5 Take out the piston **(4)**.



025768

15.4 Dismantle the Clutch Carrier

- 1 Apply a suitable support **(1)** for the clutch carrier at the press.

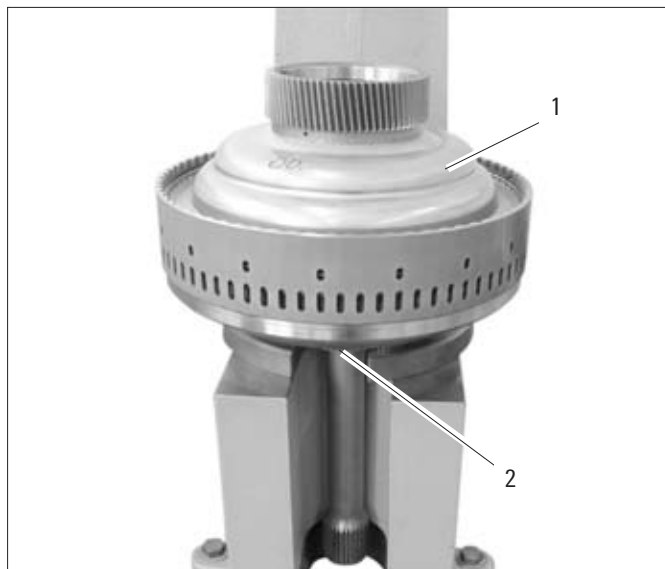


030123

- 2 Put the clutch carrier **(1)** onto the press.

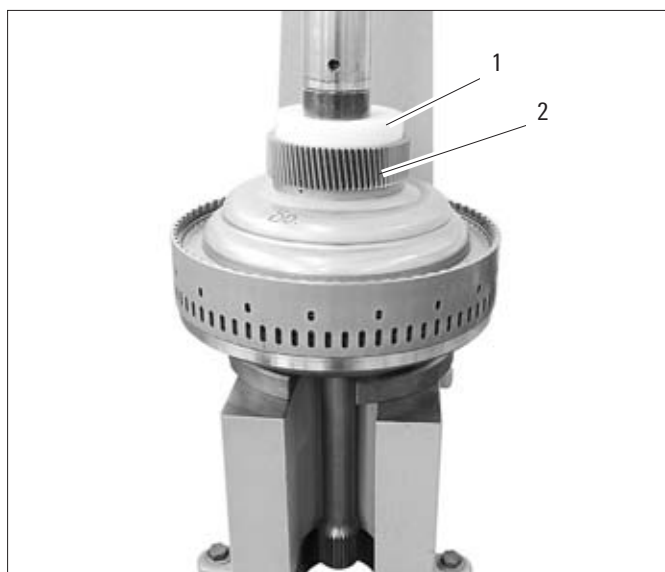
CAUTION

It must be ensured that the teeth **(2)** are not damaged.



030116

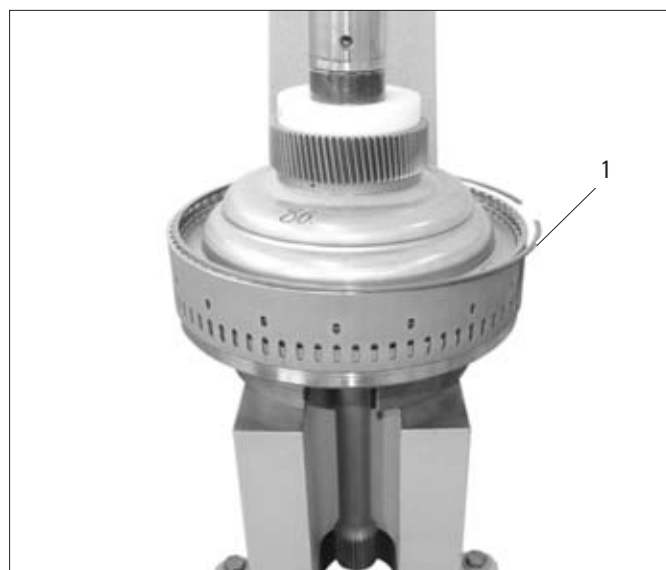
- 3 Put a suitable thrust piece **(1)** on the sun gear I **(2)**.



030117

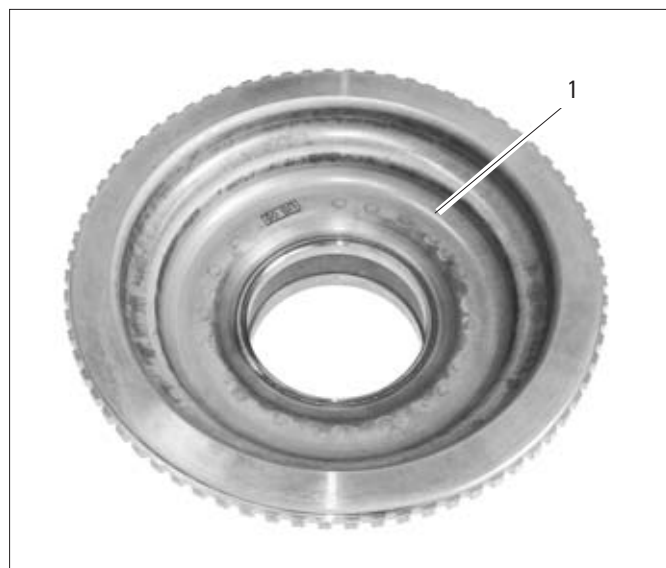
4 Push the sun gear I towards the bottom and relieve the securing ring **(1)**. The securing ring **(1)** must be from stress.

5 Unsnap the securing ring **(1)**.



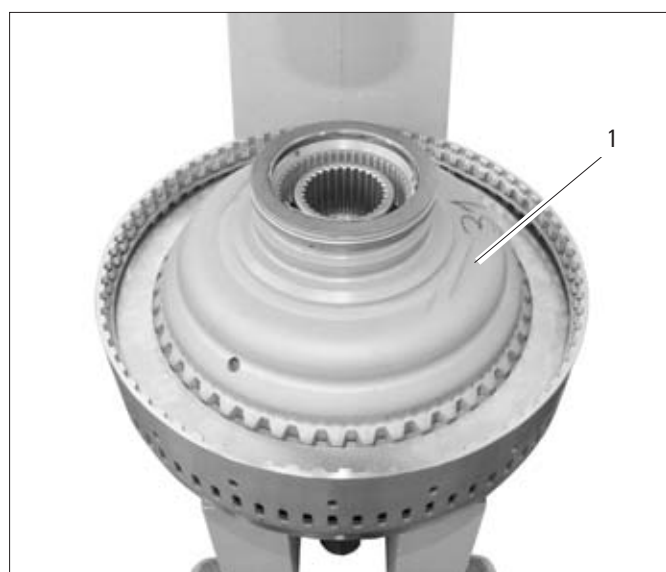
030118

6 Take off the sun gear I **(1)**.



025675

7 Take off the multidisk carrier B **(1)**.

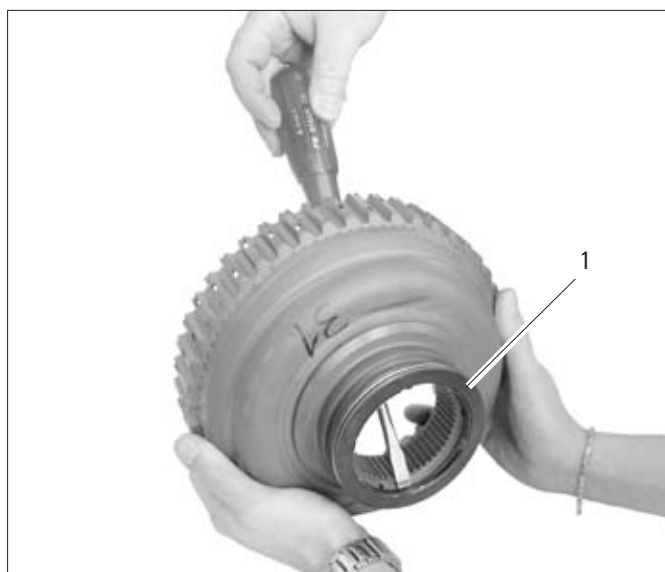


030119

- 8 Disassemble the axial bearing (1).

NOTE

In the case of disassembly, the bearing must be replaced.

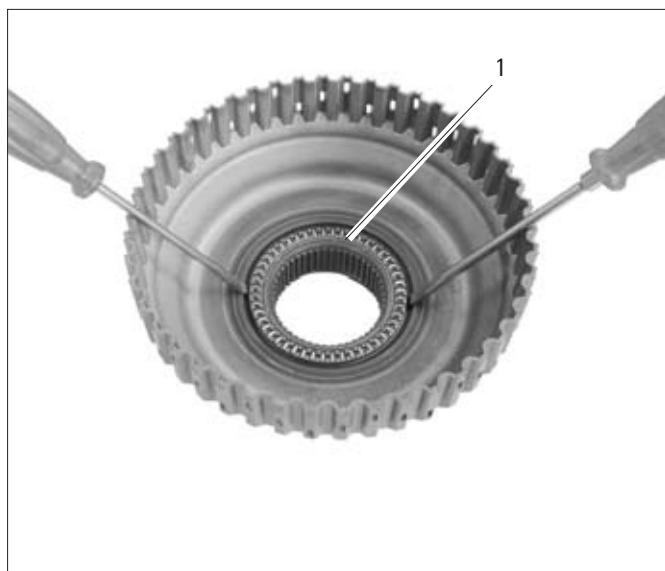


030161

- 9 If necessary the axial bearing (1).

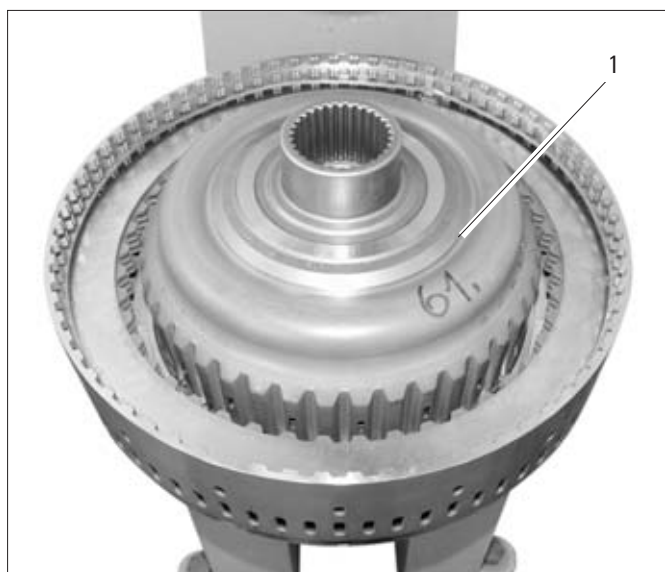
NOTE

In the case of disassembly, the bearing must be replaced.



030159

- 10 Take off the multidisk carrier "A" (1).



030120

- 11 Take off the axial bearing **(1)**.

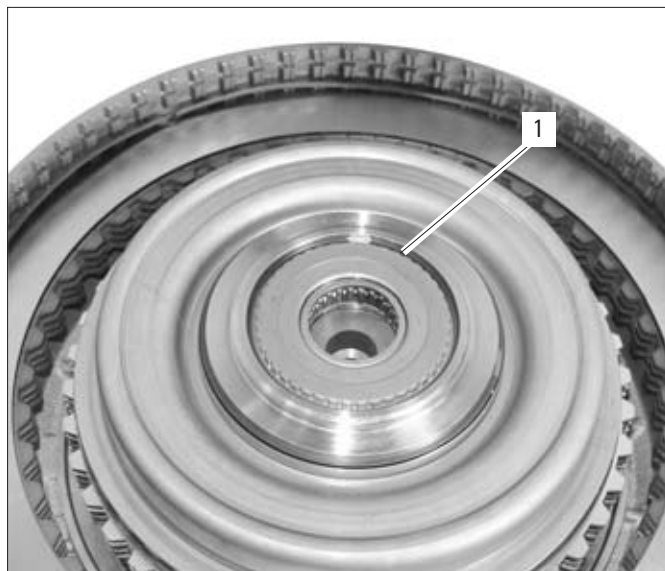
NOTE

In the case of disassembly, the bearing must be replaced.



025678

- 12 Unsnap the securing ring **(1)**.



025679

- 13 Take out the turbine shaft **(1)** out of the clutch carrier towards the top.



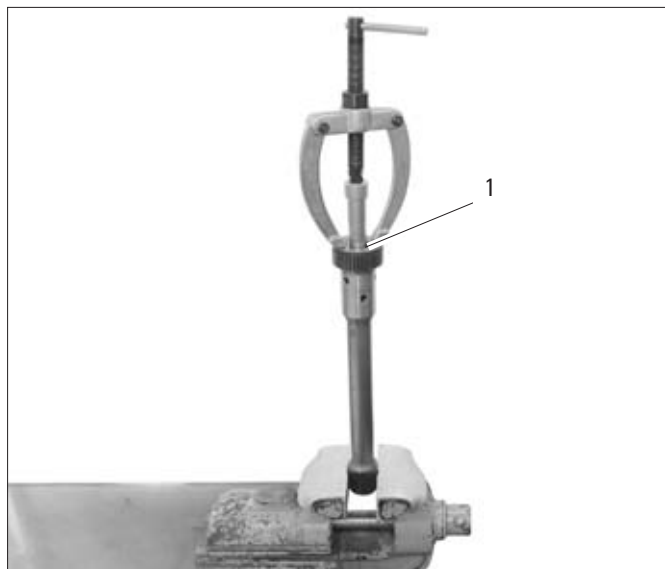
030121

- 14 Take off the split ring **(1)** from the turbine shaft.



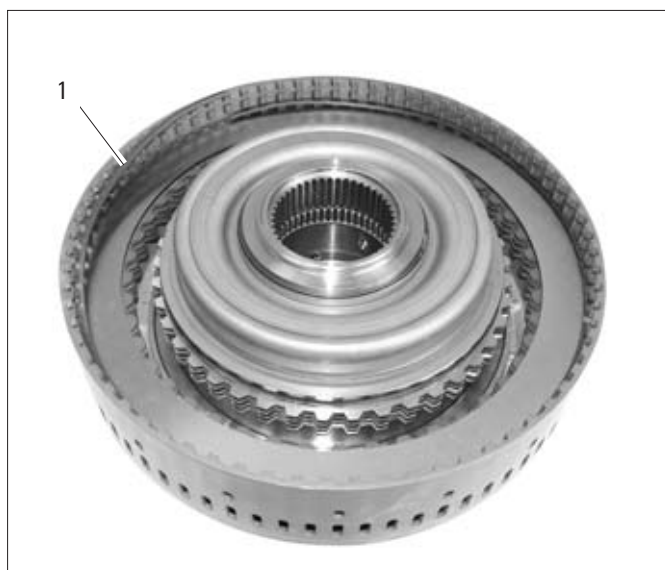
025680

- 15 If necessary, the bearing **(1)** with the tool no.: **1X56 122 207** in conjunction with the basic tool no.: **1X56 122 227** is to be removed from the turbine shaft.



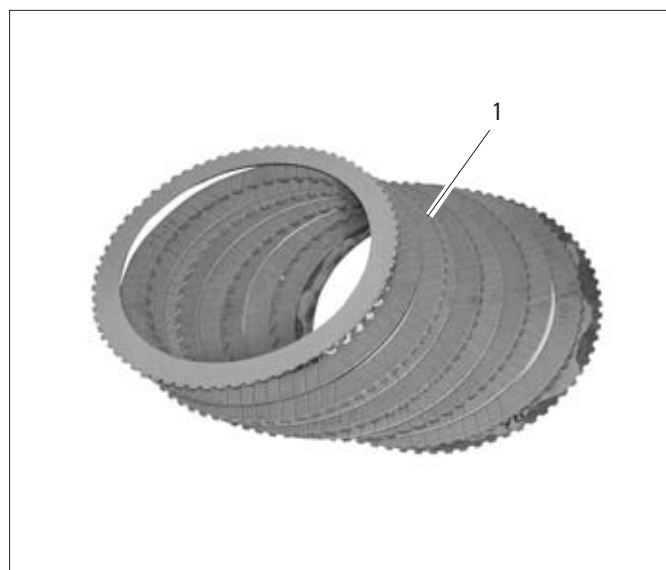
030122

- 16 Unsnap the corrugated securing ring **(1)**.



025682

- 17 Take out the multidisk clutch B (1).



025683

- 18 Put the clutch carrier (2) on the press.

- 19 Put on the tool no.: 1X56 138 655 (1).

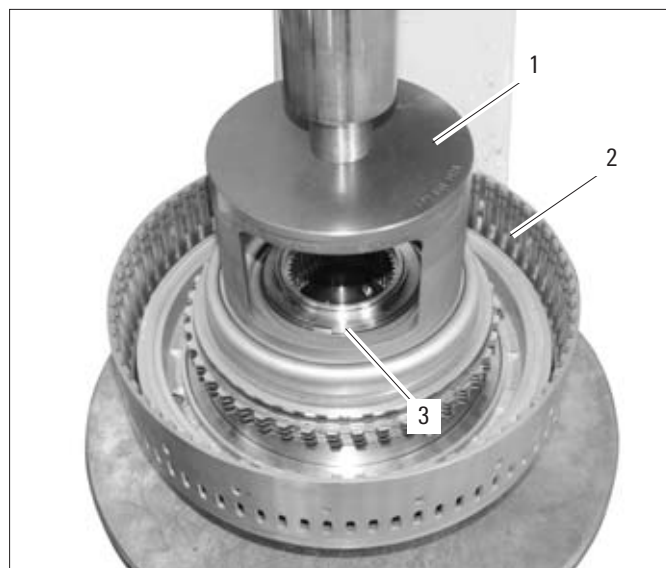
**DANGER**

- Risk of injury
- Securing ring is under tension!

- 20 Relieve the securing ring (3) with the press and unsnap.

- 21 Slowly release the spring prior to taking off the tool.

- 22 Take off the tool no.: 1X56 138 655 (1) once again.

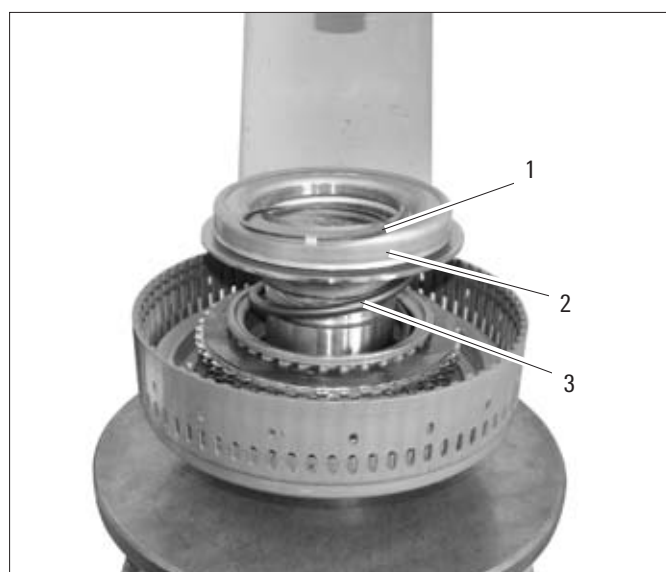


025684

- 23 Take off the securing ring (1).

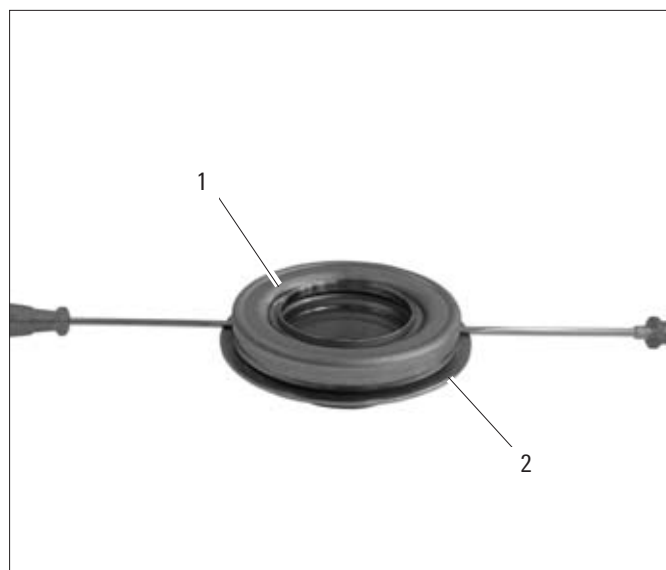
- 24 Take off the end disk "A" (2).

- 25 Take off the spring (3).



025685

- 26 Separate the end disk "A" **(1)** from the piston "A" **(2)** by means of two screw drivers.



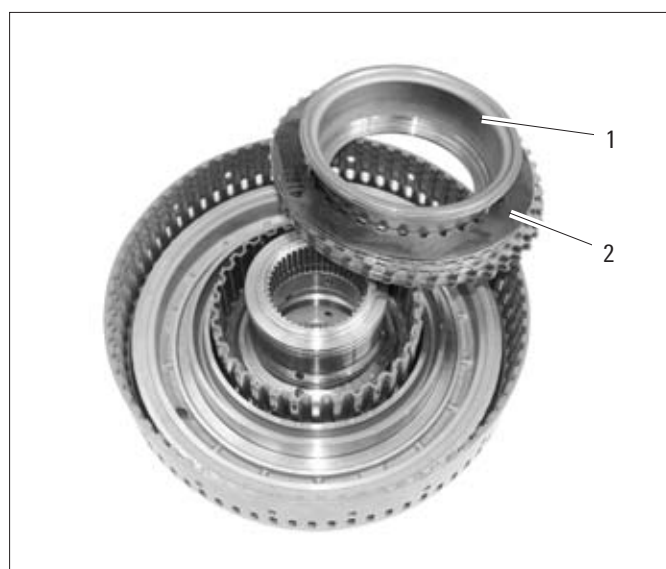
030125

- 27 Take out the sealing ring **(1)**.



030126

- 28 Take out all multidisks from the clutch "A" **(2)** and the spring seat **(1)**.



025686

- 29 Take out the lipped seal ring **(1)**.



025687

- 30 Unscrew 16 TORX screws M8 **(1)**.



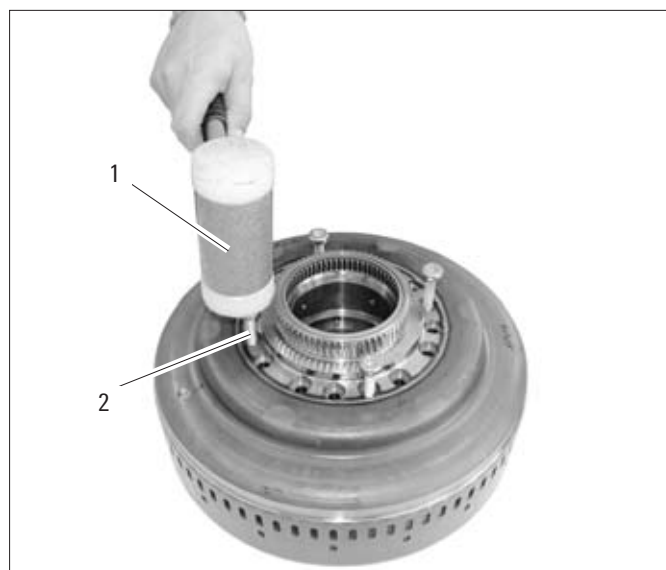
030128

- 31 Screw in four long M8 screws/bolts **(1)**.



030129

- 32 Cautiously and evenly hammer in the screws/bolts **(2)** by means of a plastic hammer **(1)** and thus, drive out the multidisk carrier "A".



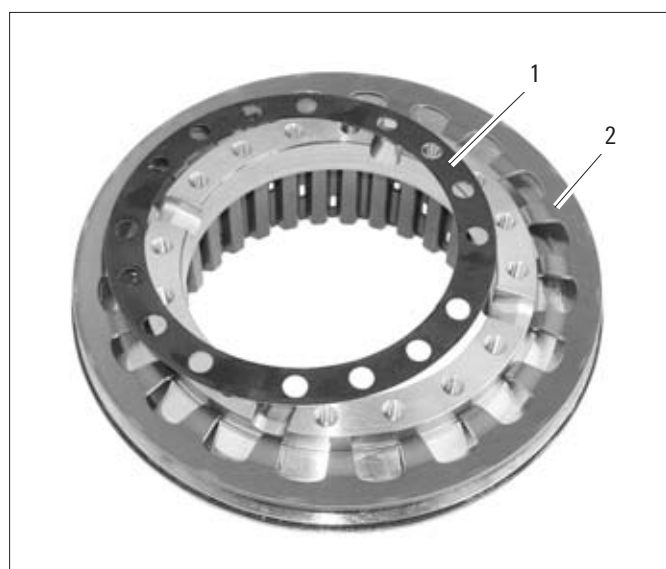
030130

- 33 Remove the screws/bolts; lift off the clutch carrier **(1)**.



030131

- 34 Take off the shim **(1)** and the readjusting spring **(2)**.



030132

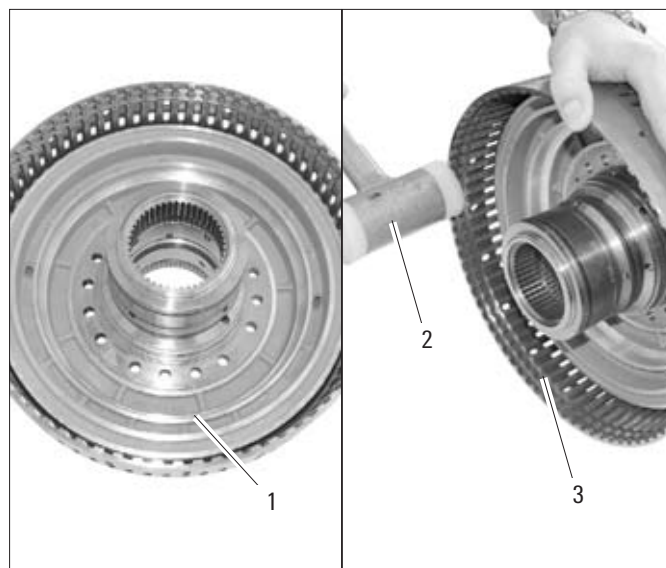
- 35 Take off the lipped seal ring **(1)**.



025693

- 36 Loosen piston "B" **(1)** by means of light blows with the plastic hammer **(2)** onto the clutch carrier **(3)**.

- 37 Take out the piston "B" **(1)** from the clutch carrier.



030133/030134

- 38 Take out the sealing ring **(1)** from the piston "B".



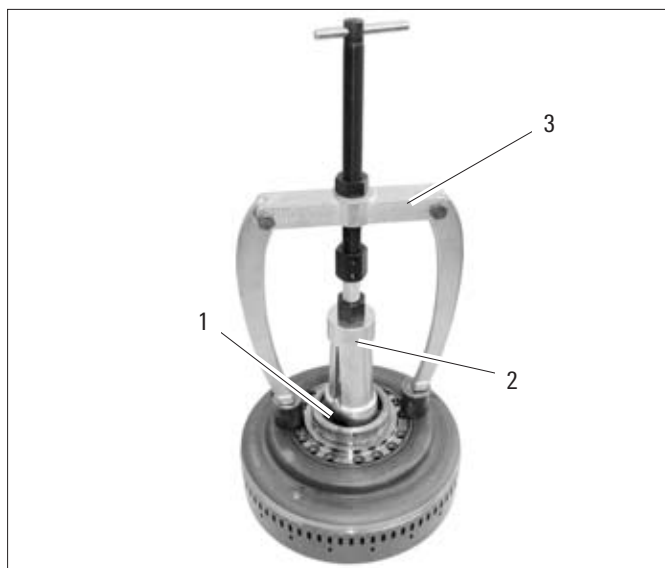
025696

- 39 Take out the O-ring (1).
- 40 Take out the two sealing rings (2).



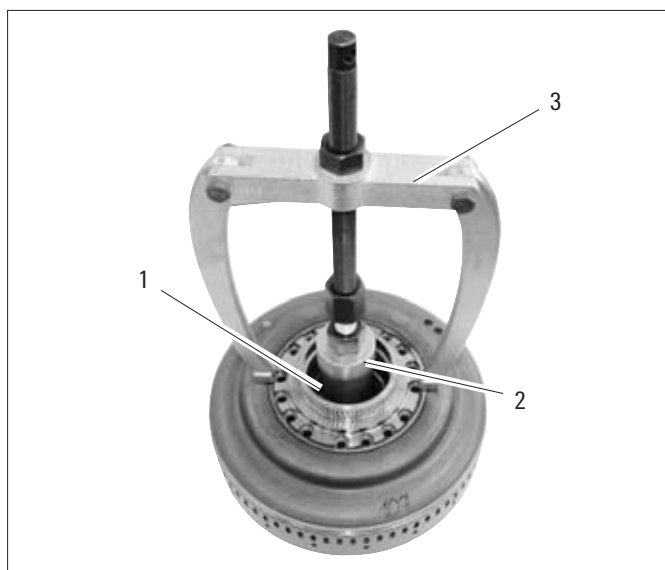
030135

- 41 Disassemble the upper needle bearing (1), if necessary by means of an inside bearing extracting tool no.: **1X56 122 211 (2)** in conjunction with **1X56 122 228 (3)**.



030154

- 42 Disassemble the lower needle bearing (1), if necessary by means of an inside bearing extracting tool no.: **1 X 56 122 211 (2)** in conjunction with **1 X 56 122 228 (3)**.



030155

15.5 Assemble the Clutch Carrier

- 1 Press in the lower needle bearing by means of the tool no.: **1X56 138 651 (1)**.

NOTE

Place bearing with shoulder flat on tool.

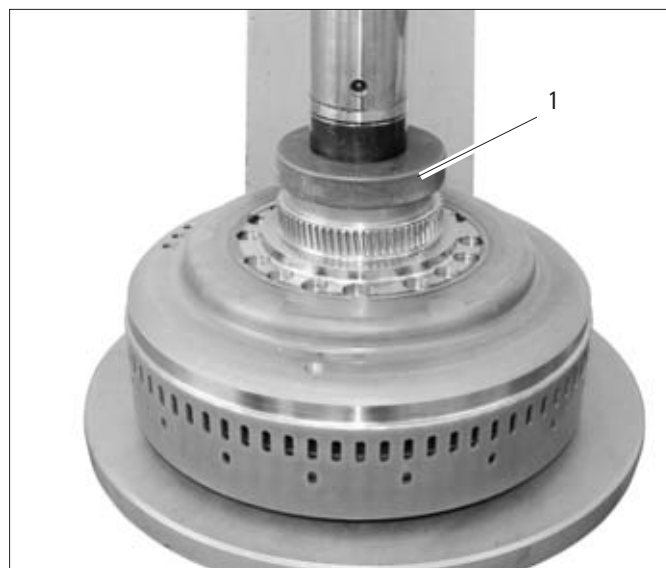


030156

- 2 Upper needle bearing with tool no.: **1X56 138 649 (1)** to be pressed in.

NOTE

Place bearing with shoulder flat on tool.



030157

- 3 Coat O-ring (1) with technical Vaseline.
- 4 Insert the O-ring (1) in the lower of the two grooves.
- 5 Coat two sealing rings (2) with technical Vaseline.
- 6 Insert the two sealing rings (2).



030136

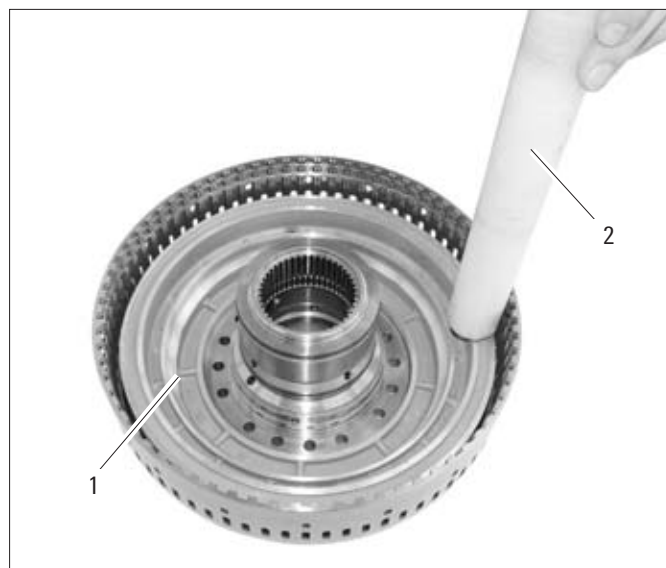
7 Coat the sealing ring **(1)** with technical Vaseline.

8 Insert the sealing ring **(1)** in the piston "B".



025696

9 Cautiously and evenly drive in the piston "B" **(1)** by means of a plastic punch **(2)**.



030137

10 Insert the shim **(1)**.

11 Put in the readjusting spring **(2)**.



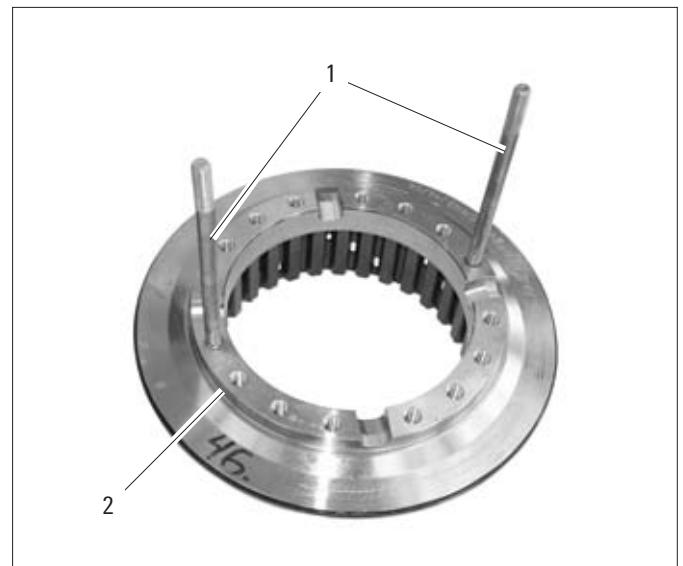
030138

- 12 Coat the lipped seal ring **(1)** with technical Vaseline and insert the item.



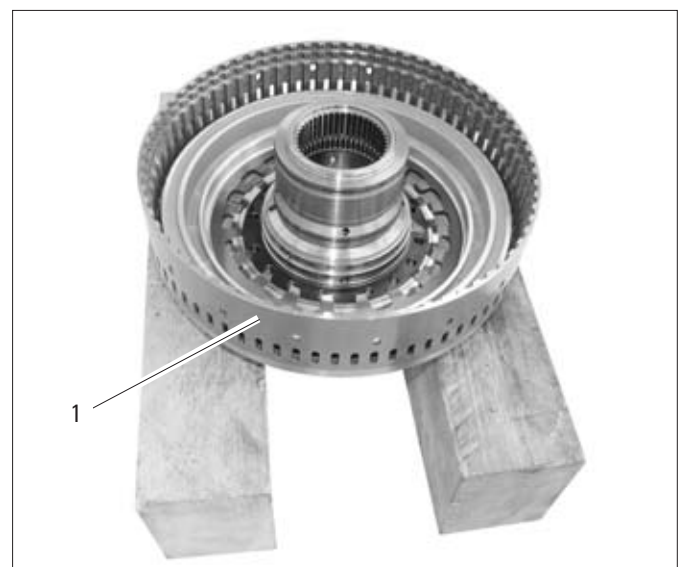
025693

- 13 Screw in the M8 guide screws **(1)** in the multi-disk carrier "A" **(2)**.



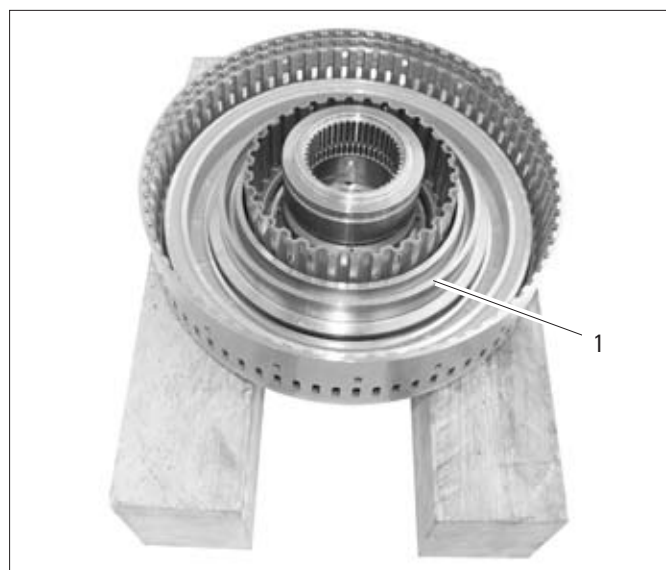
030139

- 14 Place the clutch carrier **(1)** on the skids.



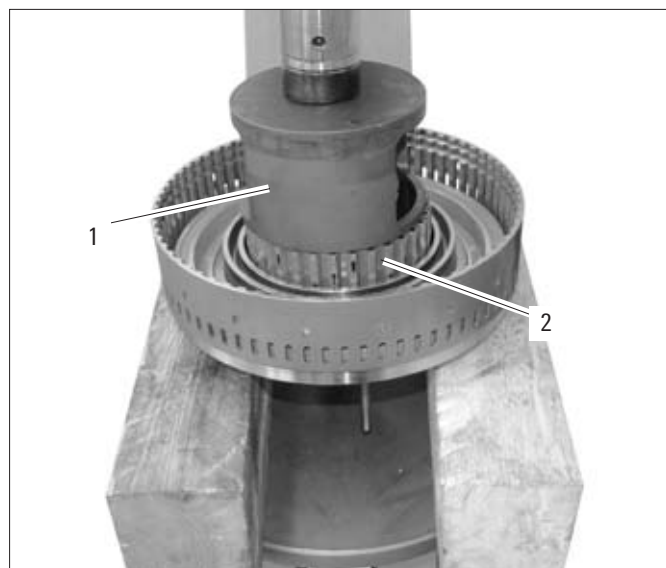
030140

- 15 Insert the multidisk carrier "A" **(1)**.



030141

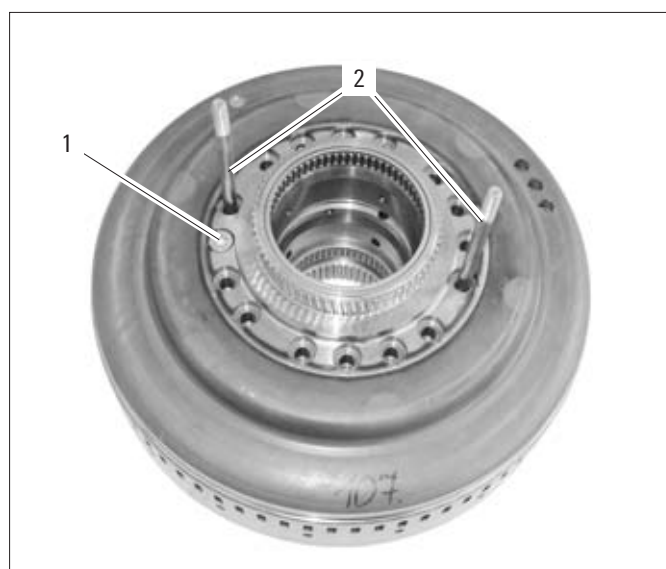
- 16 Press in the multidisk carrier "A" **(2)** with the tool no.: **1X56 138 655 (1)**.



030142

- 17 Apply one screw/bolt **(1)** at the press from the bottom side.

- 18 Unscrew the guide screws **(2)**.



030143

- 19 Screw in 16 TORX screws M8 **(1)** from the bottom side and tighten.
Tightening torque: 23 Nm

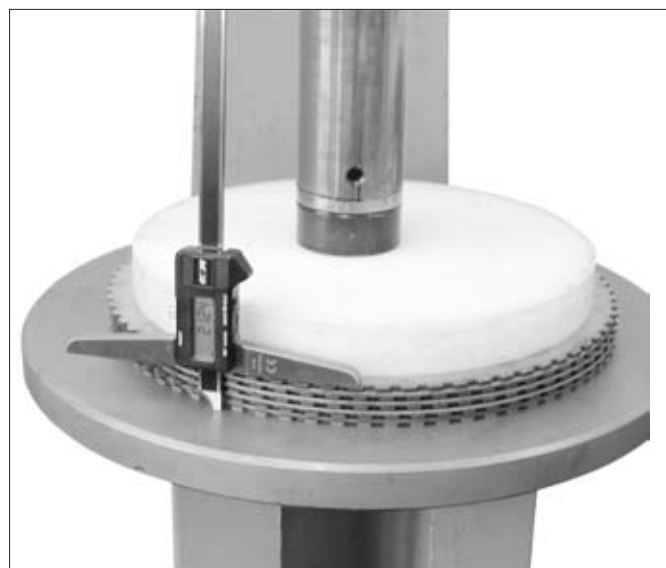


030144

- 20 Clamp in the multidisk package "A" with approx. 200 N on the press.
- 21 Measure the thickness of the multidisk package. The nominal dimension can be taken from the parts list (BoM). If the measure/dimension is not correct, then compensate the difference by means of another end disk (refer to the parts list).

NOTE

Always measure the multidisk packages without the ondular washer.



030153

- 22 Insert the end disk "A", the lined clutch disks "A", and the ondular washer "A" **(1)** in accordance with the parts list (BoM).



025704

23 Coat the lipped seal ring **(1)** with technical Vaseline.

24 Insert the lipped seal ring **(1)** in the spring seat.

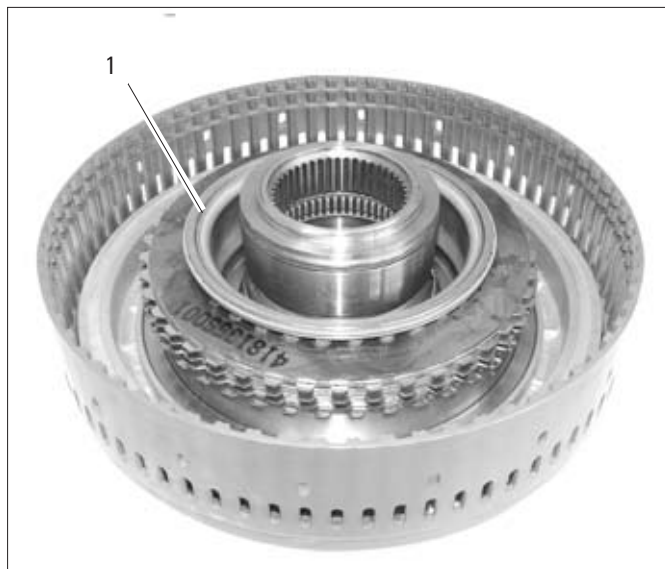
NOTE

The groove of the lipped seal ring must point upwards.



025687

25 Insert the spring seat **(1)**.



025705

26 Insert the readjusting spring **(1)**.



025706

27 Coat O-ring **(1)** with technical Vaseline.

28 Insert the O-ring **(1)** in the piston "A".



030126

29 Put the piston "A" and the end disk "A" together.



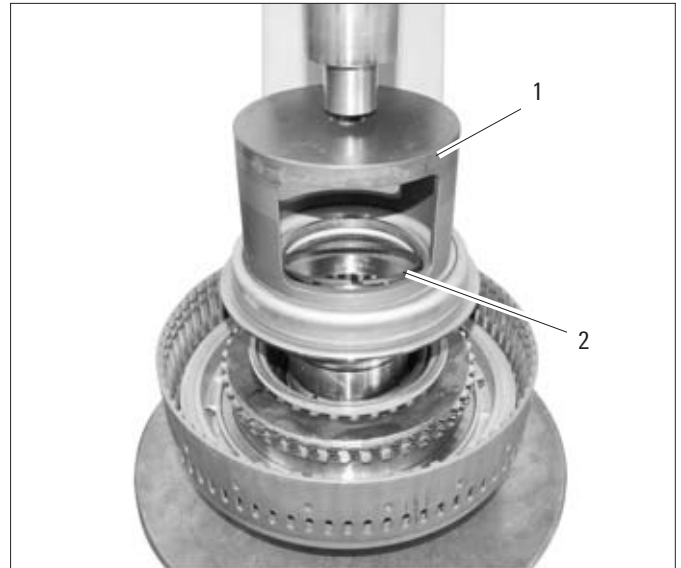
030127

30 Put on the end disk "A" **(1)**.



025707

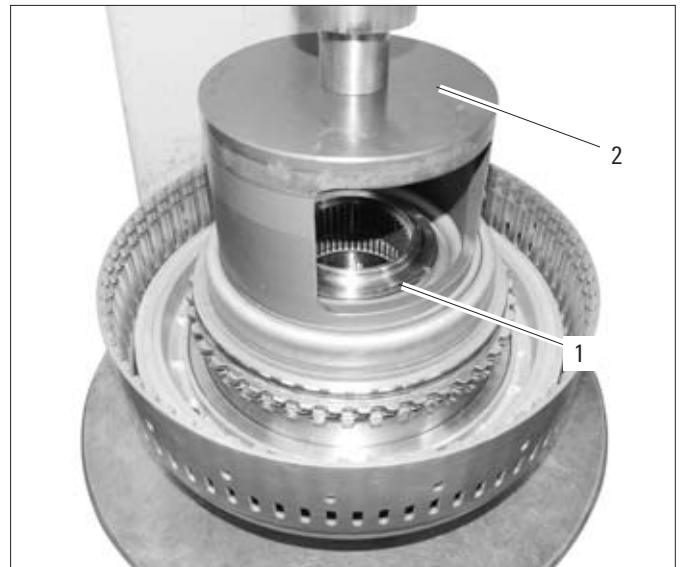
- 31 Put on the tool no.: **1X56 138 655 (1)** and push downwards by means of a press until the securing ring (2) can be inserted.



025708

**DANGER****Risk of injury!****Securing ring (1) is under tension once relieved.****Securing ring (1) must be properly inserted.**

- 32 Snap in the securing ring (1).
- 33 Take off the tool no.: **1X56 138 655 (2)**.



025709

- 34 Clamp in the multidisk package "B" with approx. 200 N on the press.
- 35 Measure the thickness of the multidisk package. The nominal dimension can be taken from the parts list (BoM). The nominal dimension can be taken from the parts list (BoM).

NOTE

Always measure the multidisk packages without the ondular washer.



030153

- 36 Insert the ondular washer "B", the lined clutch disks "B", and the end disk "B" (1) in accordance with the parts list (BoM).

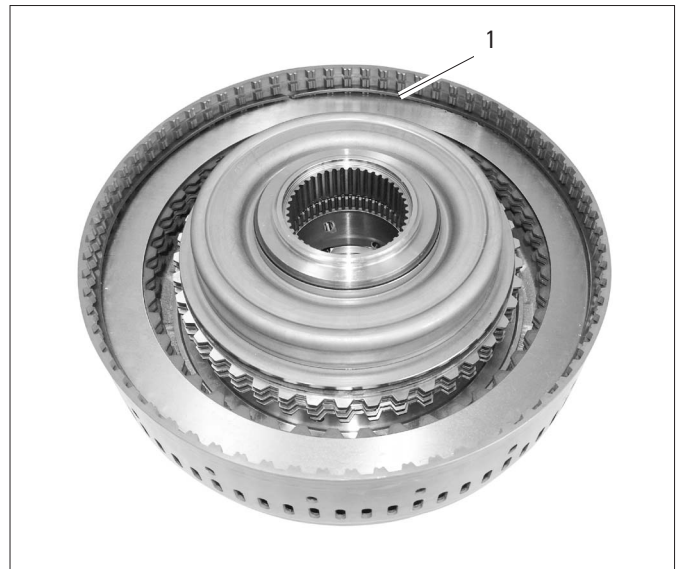


025712

- 37 Snap in the corrugated securing ring (1).

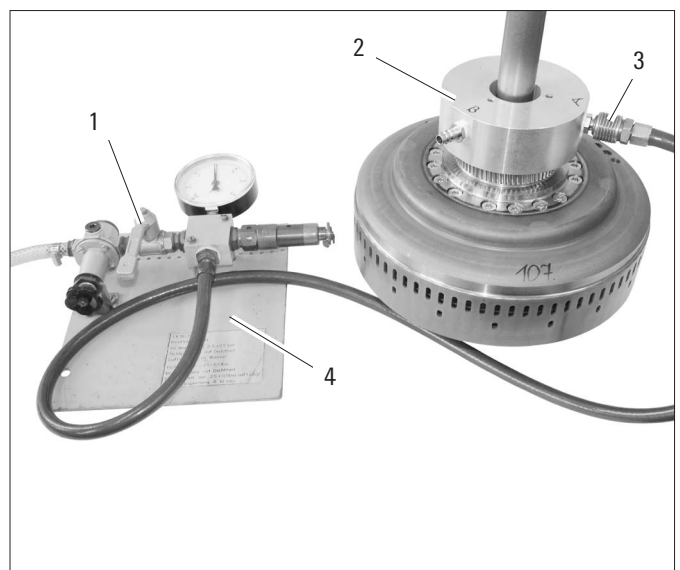
CAUTION

Pay explicit attention to the fact that the securing ring with its entire circumference is firmly home with the groove's base.



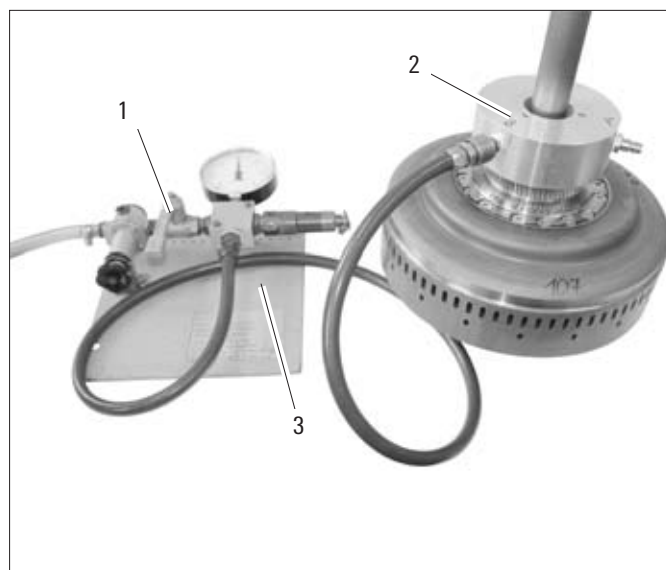
025713

- 38 Insert the pressing-off fixture no.: **1X56 138 562 (2)** for the pistons "A" and "B".
- 39 Set the pressure of the compressed-air reservoir no.: **1X56 137 130 (4)** to 3 bar.
- 40 Connect the compressed-air reservoir no.: **1X56 137 130 (4)** at the connection (3) for the piston "A".
- 41 Close the cut-off cock (1). Pressure drops are not permissible.



030392

- 42 Set the pressure of the compressed-air reservoir no.: **1X56 137 130 (3)** to 3 bar.
- 43 Connect the compressed-air reservoir no.: **1X56 137 130 (3)** at the connection **(2)** for the piston "A".
- 44 Close the cut-off cock **(1)**. Pressure drops are not permissible.



030393

- 45 Put on the axial bearing **(1)**. The bearing must fully engage.

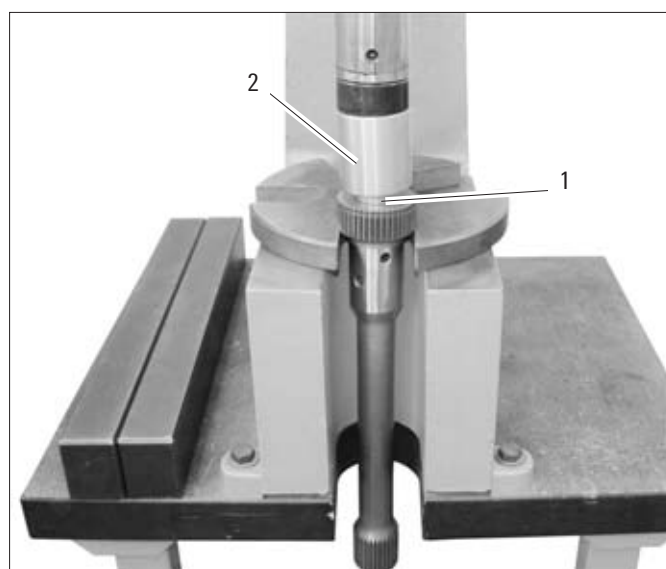


025716

- 46 Press in the needle bearing **(1)** with the tool no.: **1X56 138 552 (2)** into the turbine shaft.

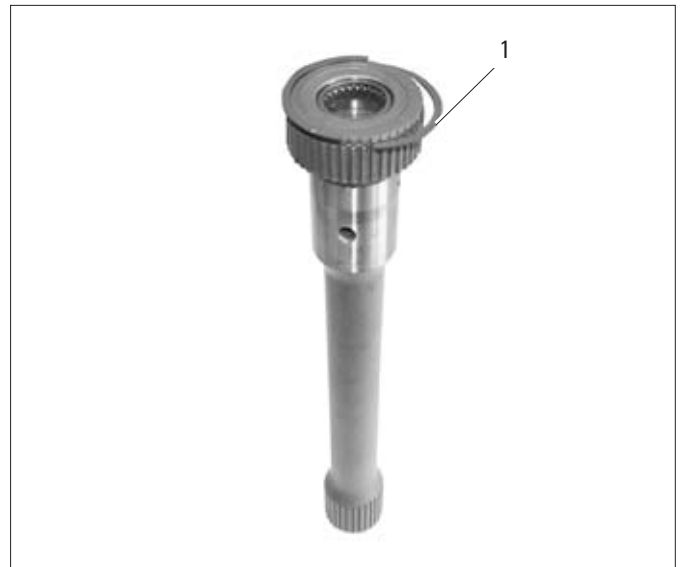
NOTE

Use a needle bearing with a stable shoulder for the fixture.



030124

- 47 Insert the split ring **(1)** in the turbine shaft.



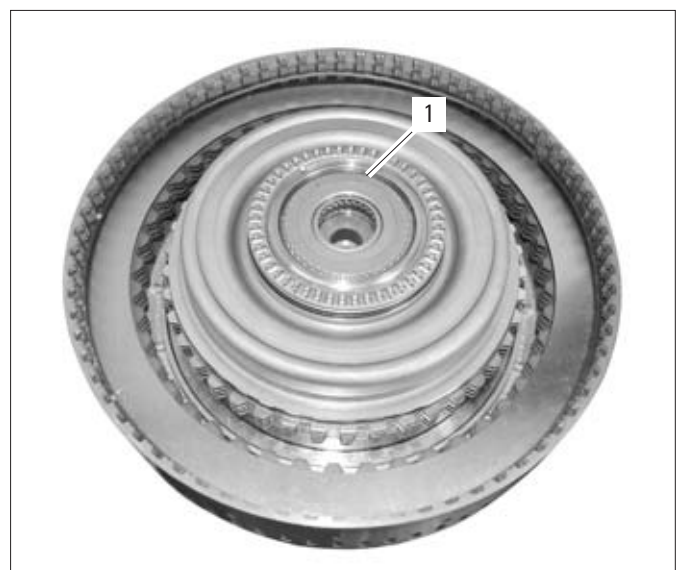
025680

- 48 Insert the turbine shaft **(1)** from the top into the clutch carrier.



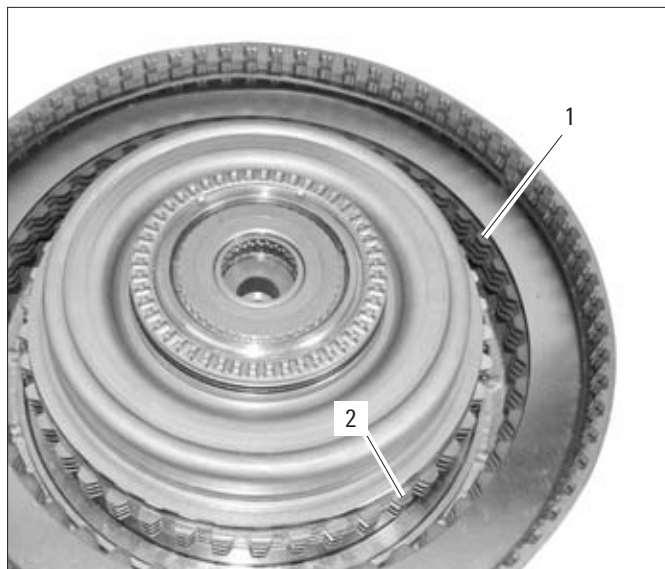
030121

- 49 Snap in the securing ring **(1)**.



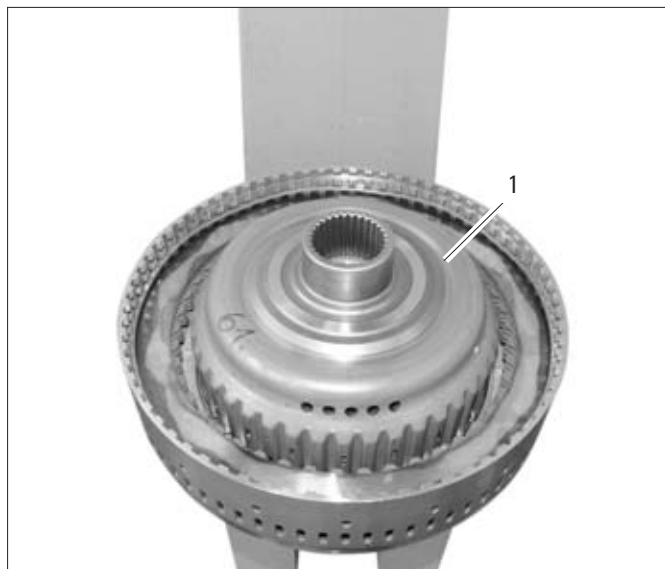
025720

- 50 Put the multidisks **(1, 2)** on top of each other. Ensure that the teeth are aligned.



025720

- 51 Insert the multidisk carrier "A" **(1)**.



030158

- 52 Insert the multidisk carrier "B" **(1)**. The bearing must fully engage.



030160

- 53 Mount the axial bearing **(1)** to the multidisk carrier "B". The bearing must fully engage.



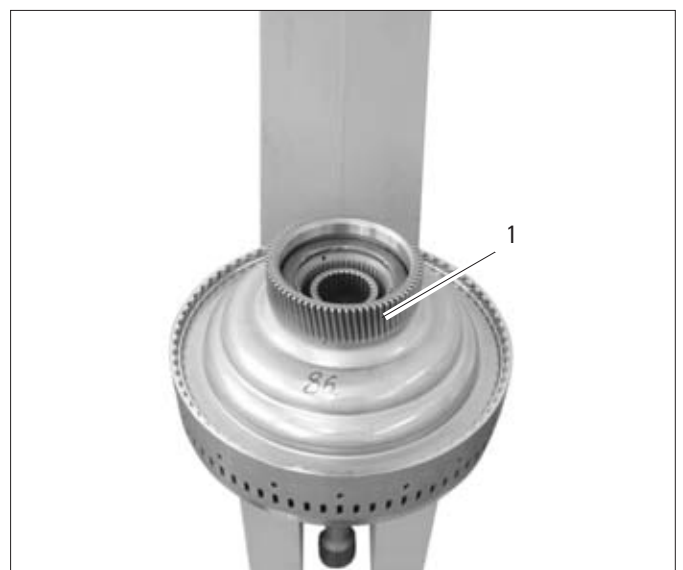
030162

- 54 Insert the multidisk carrier "B" (1).



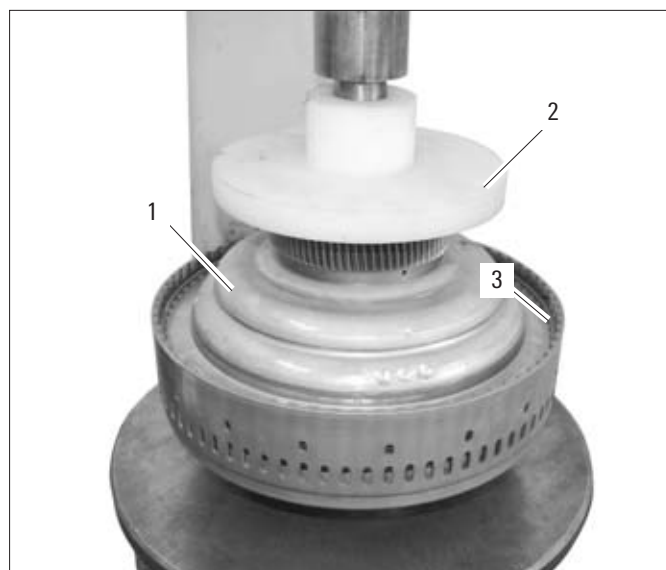
030163

- 55 Mount the sun gear I **(1)**.



030164

- 56 Push the sun gear I **(1)** with a suitable thrust piece **(2)** and the press downwards until the securing ring **(3)** can be snapped in.
- 57 Snap in the securing ring **(3)**.



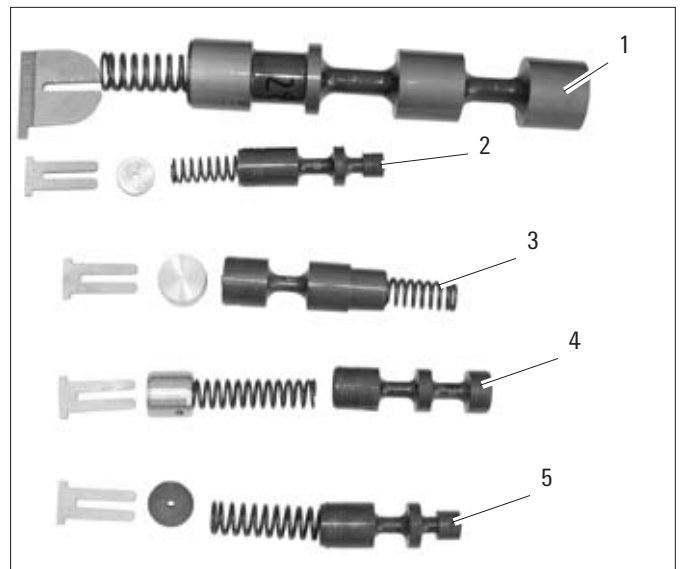
025718

15.6 Assemble the Valve Housing

15.6.1 Overview on Single Parts and the Installation Position

1 Overview on the Single Parts of the Control Valves:

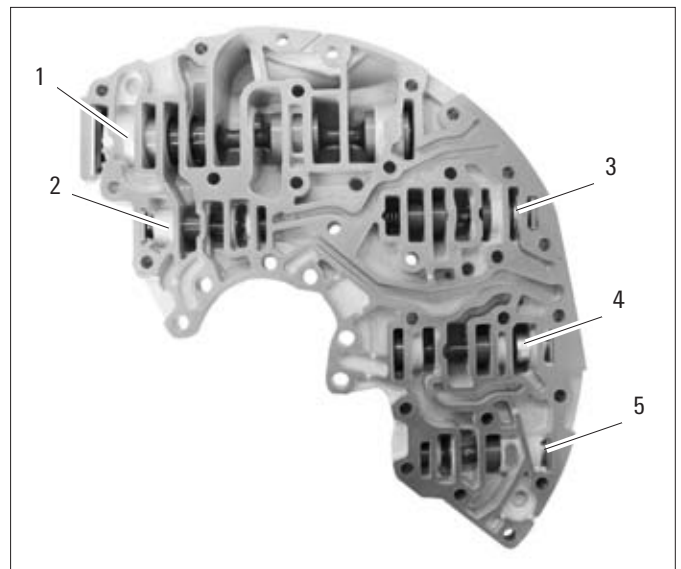
- Cooler change-over valve **(1)**
- Converter counter-pressure valve **(2)**
- Retarder control valve **(3)**
- Main pressure valve **(4)**
- Torque converter safety valve **(5)**



030408

2 Installation position of the control valves:

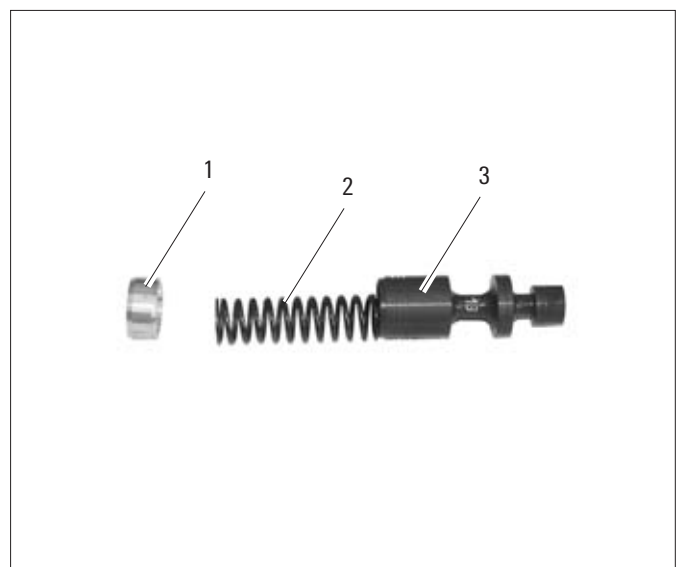
- Cooler change-over valve **(1)**
- Converter counter-pressure valve **(2)**
- Retarder control valve **(3)**
- Main pressure valve **(4)**
- Torque converter safety valve **(5)**



025743

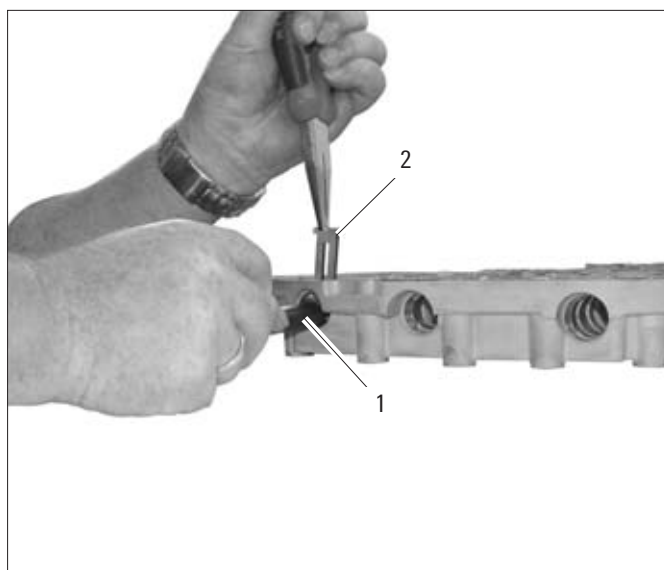
15.6.2 Torque Converter Safety Valve

- 1 Insert the pistons **(3)** in the corresponding bores at the valve housing.
- 2 Insert the spring **(2)** in the corresponding bore at the valve housing.
- 3 Insert the thrust piece **(1)** in the corresponding bore at the valve housing.



025769

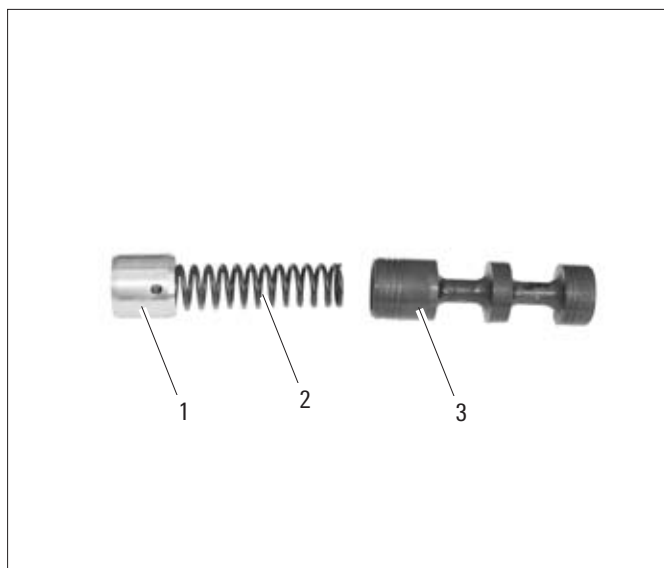
- 4 Press in the thrust piece with the tool no.: **1X56 138 652 (1)** and push in the valve locking device **(2)** from above.



025767

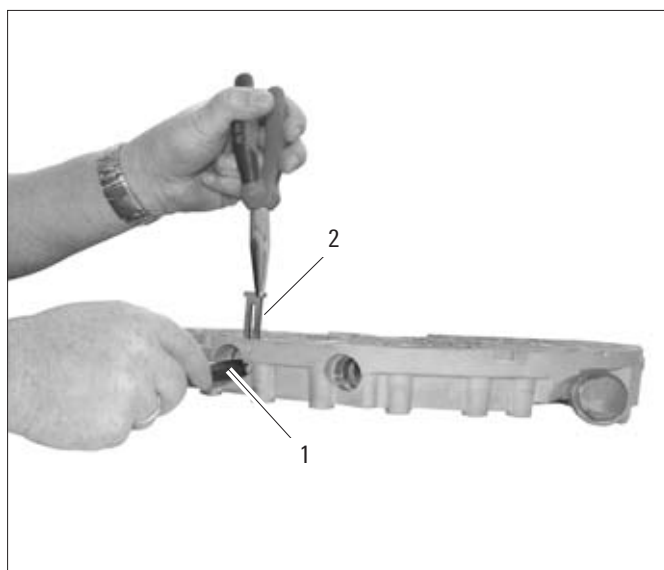
15.6.3 Main Pressure Valve

- 1 Insert the pistons **(3)** in the corresponding bores at the valve housing.
- 2 Insert the spring **(2)** in the corresponding bore at the valve housing.
- 3 Insert the thrust piece **(1)** in the corresponding bore at the valve housing.



025766

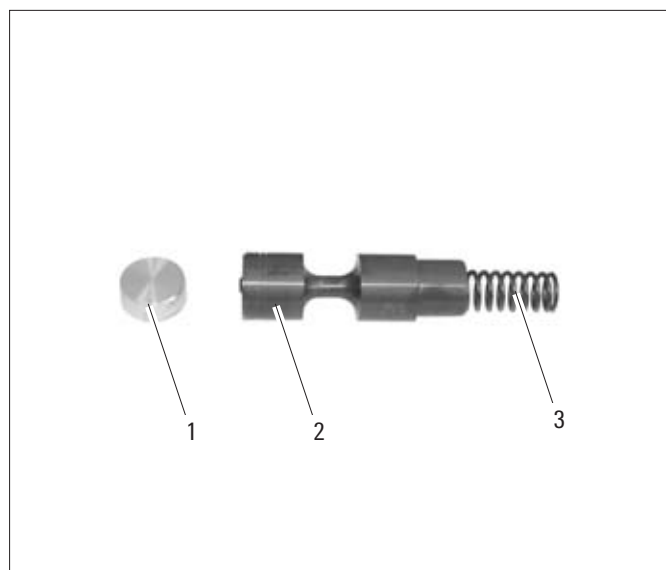
- 4 Press in the thrust piece with the tool no.: **1X56 138 652 (1)** and push in the valve locking device **(2)** from above.



025764

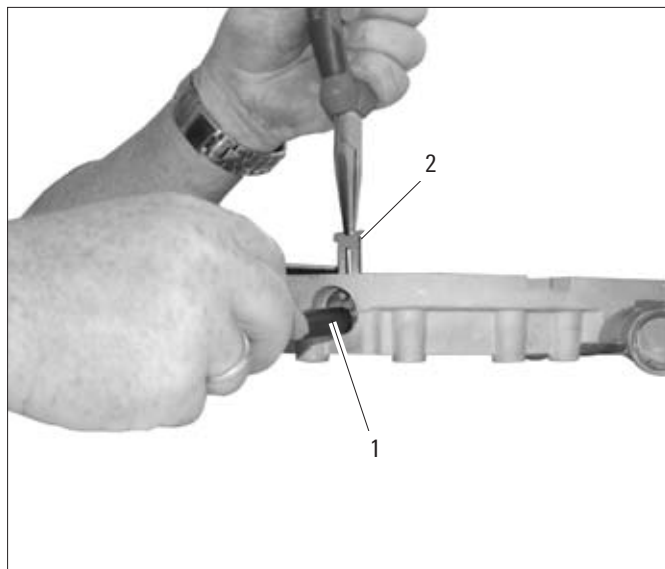
15.6.4 Retarder Control Valve

- 1 Insert the spring **(3)** in the corresponding bore at the valve housing.
- 2 Insert the piston **(2)** in the corresponding bore at the valve housing.
- 3 Insert the thrust piece **(1)** in the corresponding bore at the valve housing.



025763

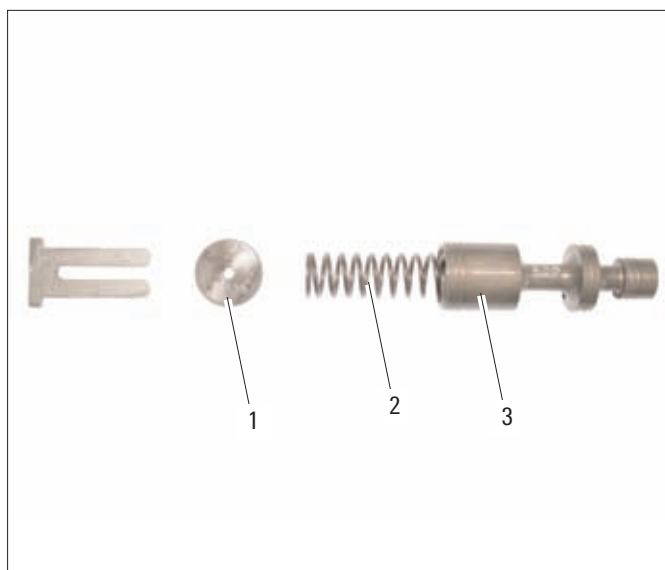
- 4 Press in the thrust piece with the tool no.: **1X56 138 652 (1)** and push in the valve locking device **(2)** from above.



025761

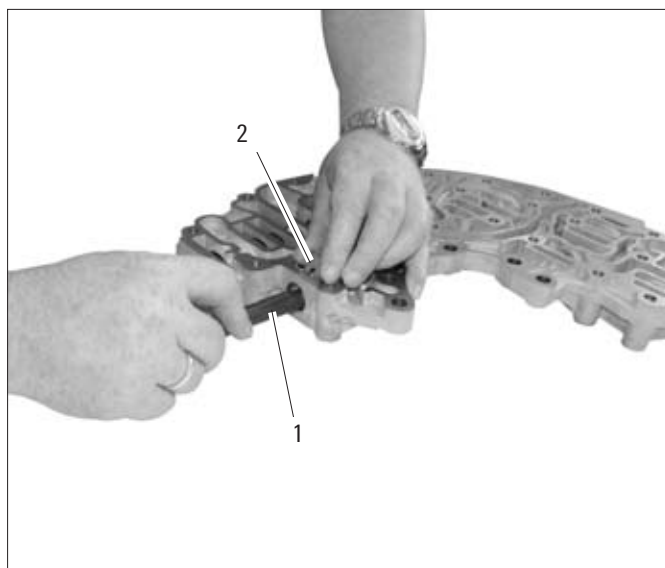
15.6.5 Converter Counter-Pressure Valve

- 1 Insert the piston **(3)**, spring **(2)**, and thrust piece **(1)** in the corresponding bores at the valve housing.



030407

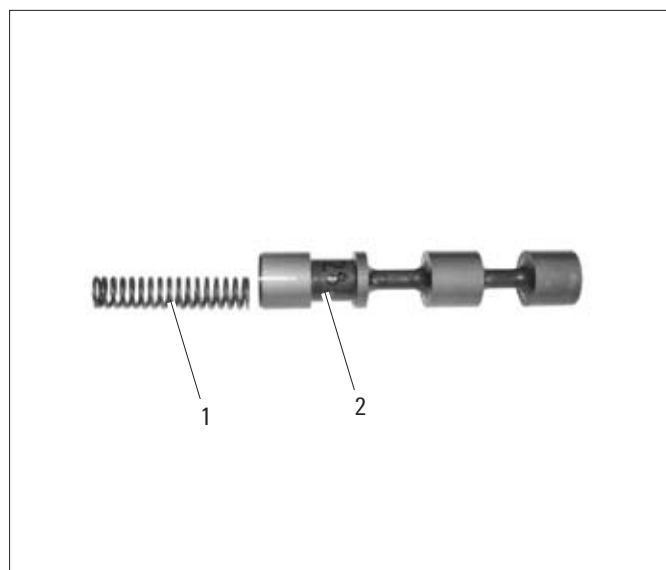
- 2 Press in the spring with the tool no.: **1X56 138 652 (1)** and push in the valve locking device **(2)** from above.



025758

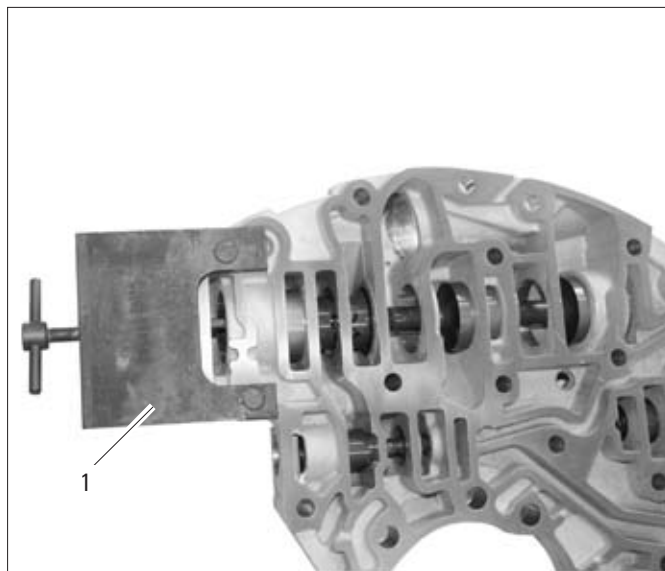
15.6.6 Cooler Change-Over Valve

- 1 Insert the pistons **(2)** in the corresponding bores at the valve housing.
- 2 Insert the spring **(1)** in the corresponding bore at the valve housing.



025757

- 3 Mount the tool no.: **1X56 138 557 (1)** and thus preload the spring.



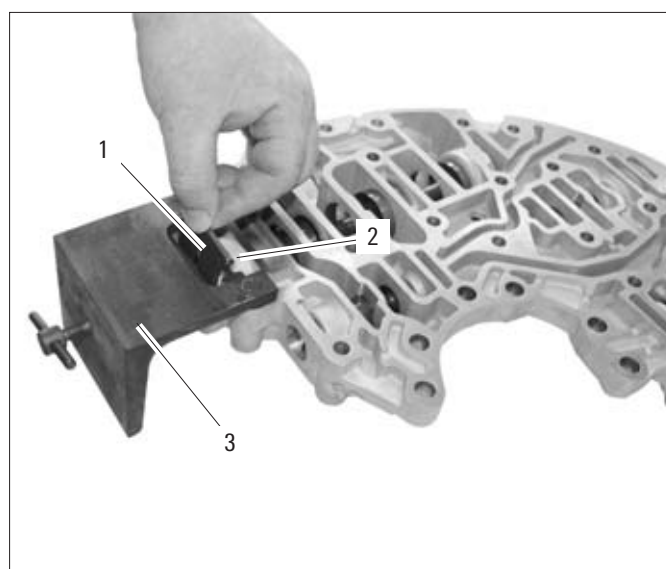
025772

- 4 Insert the valve locking device **(1)** from above.

CAUTION

Pay due attention to the correct position of the lug **(2)** at the valve locking device **(1)**.

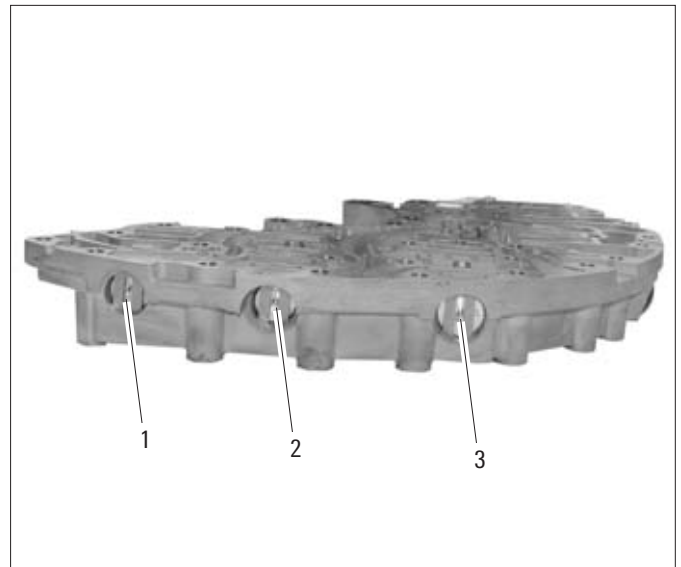
- 5 Disassemble the tool no.: **1X56 138 557 (3)**.



025773

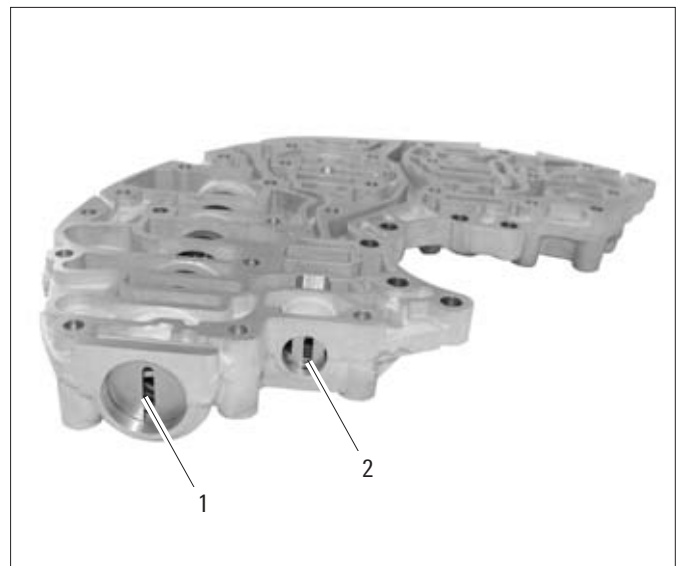
15.6.7 Installation position of the control valves

- Torque converter safety valve **(1)**
- Main pressure valve **(2)**
- Retarder control valve **(3)**



025771

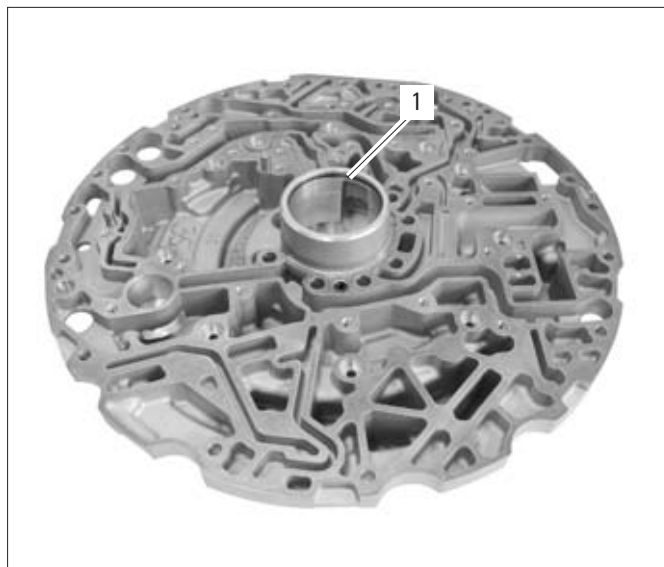
- Cooler Change-Over Valve **(1)**
- Converter counter-pressure valve **(2)**



025774

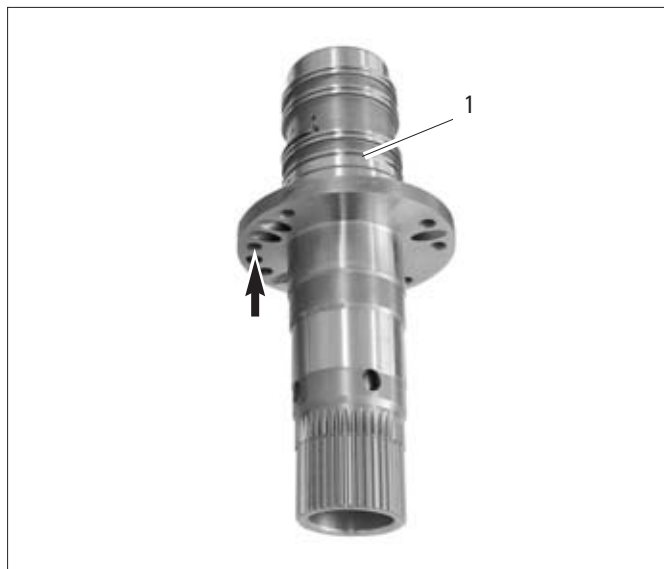
15.7 Assemble the Control Unit

- 1 Coat O-ring **(1)** with technical Vaseline and insert the item.



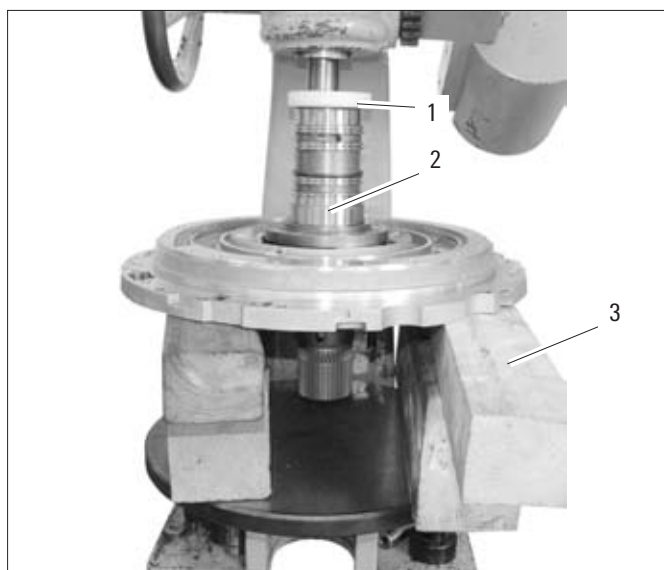
025748

- 2 Screw in the guide screw M10 into the stator quill shaft **(1)** (arrow).



025745

- 3 Generate a suitable sub-structure from skids **(3)** for pressing in the stator quill shaft **(2)**.
- 4 Press in the stator quill shaft **(2)** with a suitable thrust piece **(1)**.



025749

- 5 Unscrew the M10 guide screw **(1)**.



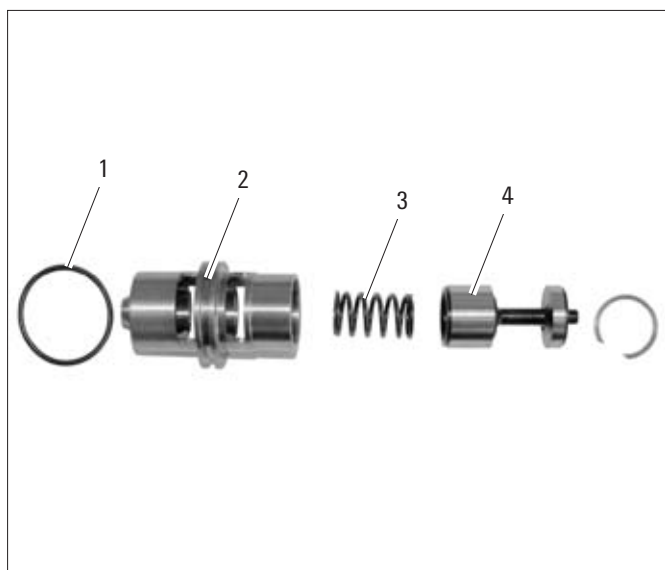
025750

- 6 Drive in the dowel pin **(1)** with a suitable mandrel.



025751

- 7 Coat O-ring **(1)** with technical Vaseline and insert it in the valve housing **(2)**.
- 8 Insert the piston **(4)** and the spring **(3)** in the valve housing **(2)**.



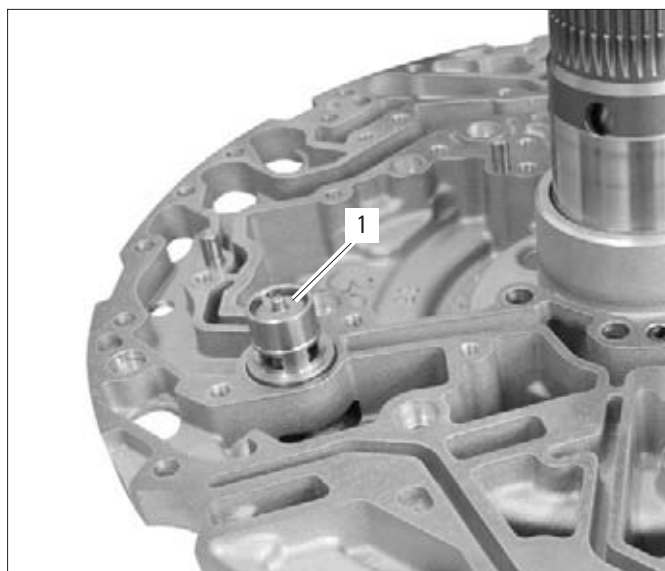
030406

- 9 Snap in the securing ring **(1)**.



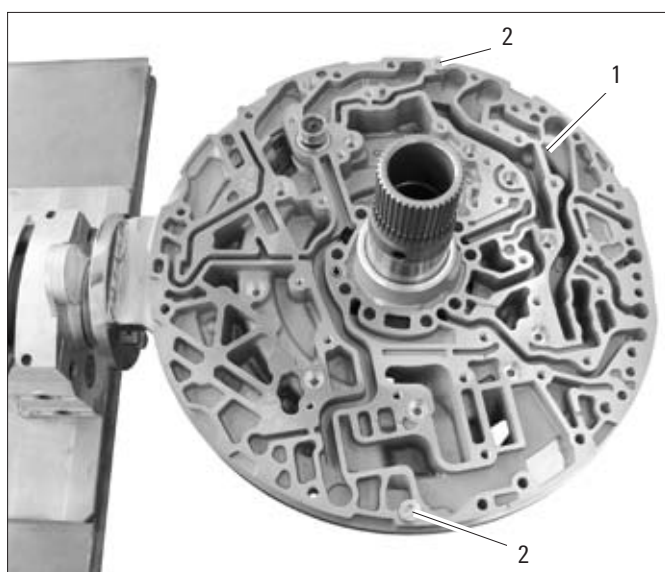
025747

- 10 Insert the valve **(1)** and cautiously drive it in by means of a plastic hammer until firmly home.



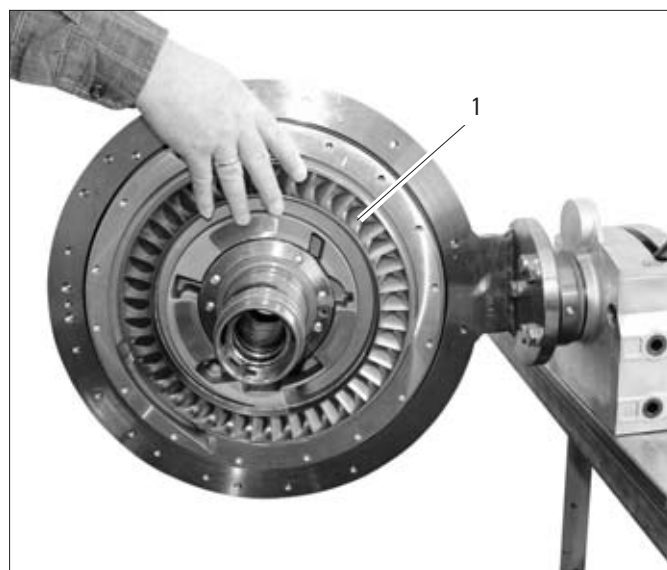
025752

- 11 Insert the control unit **(2)** in the indexable tip.
- 12 Mount the oil feed flange **(1)** by means of two screws/bolts **(2)** to the indexable tip.
- 13 Turn the indexable tip with the control unit (position vertically).



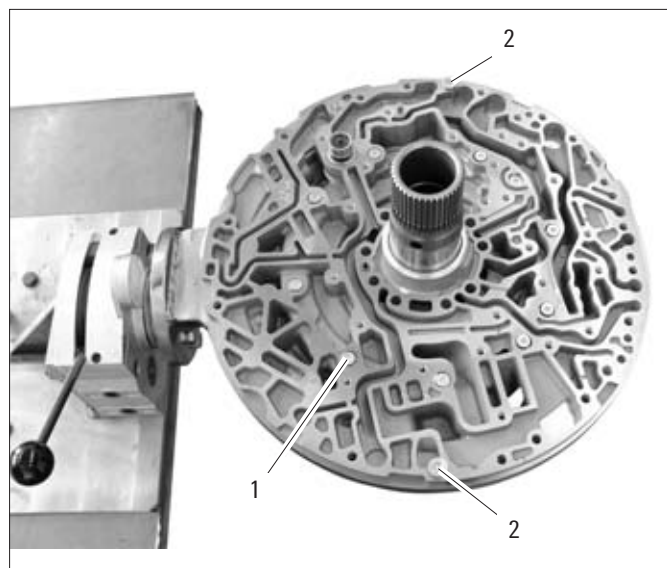
030165

- 14 Insert the stator **(1)** and hold onto the unit.
- 15 Fix the stator **(1)** by means of a TORX screw.



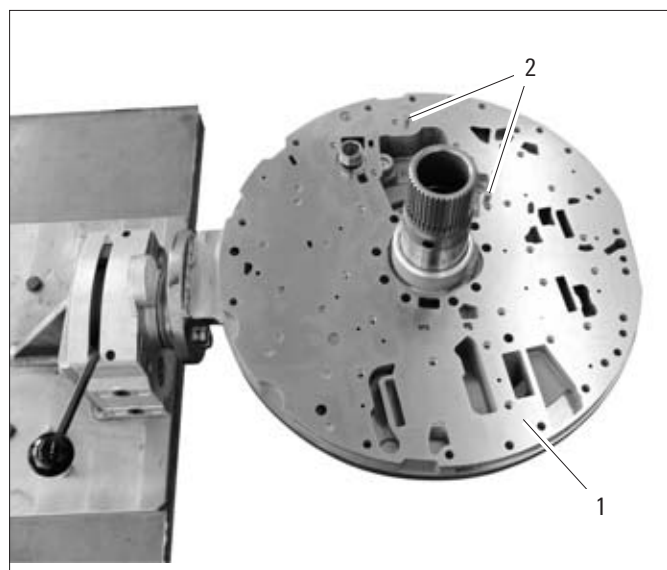
030411

- 16 Turn the indexable tip (horizontal).
- 17 Screw in ten M6x25 TORX screws **(1)** for mounting the stator and tighten these. Tightening torque: 9.5 Nm
- 18 Unscrew two fixing screws **(2)**.



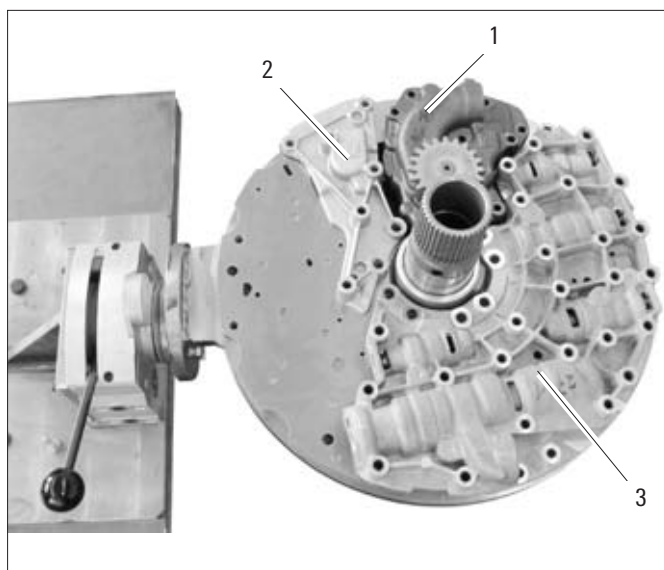
030412

- 19 Put on the intermediate plate **(1)**.
- 20 If necessary, mount two dowel pins **(2)** for the pump.



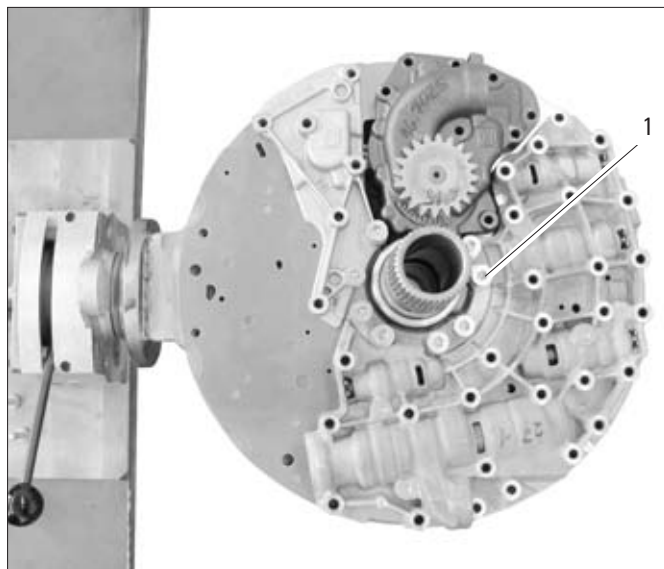
030413

- 21 Put the pump **(1)** on the dowel pins. Use a plastic hammer in order to drive in the pump with light blows until firmly home.
- 22 Put on the cover **(2)**.
- 23 Put on the valve block **(3)**.



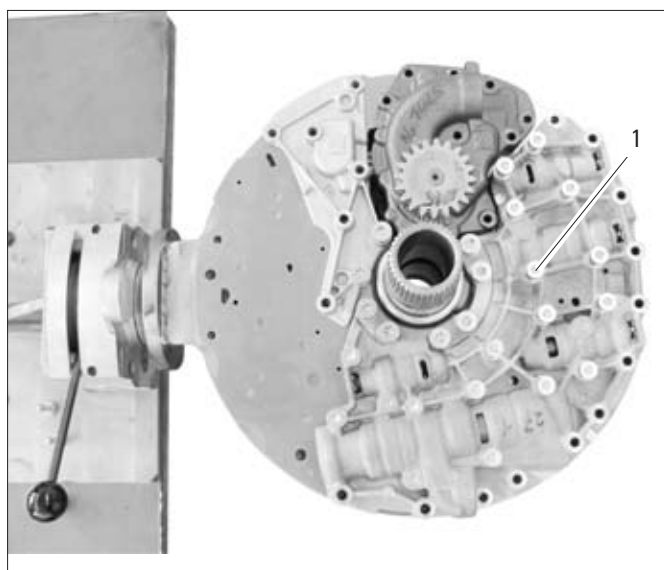
030166

- 24 Manually screw in eight TORX screws M10x60 **(1)** - but do not tighten yet.



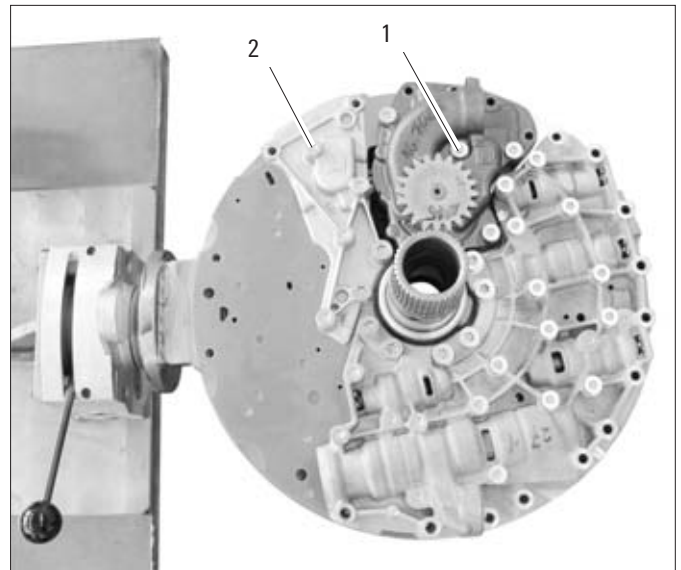
030167

- 25 Manually screw in 16 TORX screws M8x60 **(1)** into the valve housing - but do not tighten yet.



030168

- 26 Manually screw in eight TORX screws M8x50 **(1, 2)** into the pump and the cover - but do not tighten yet.



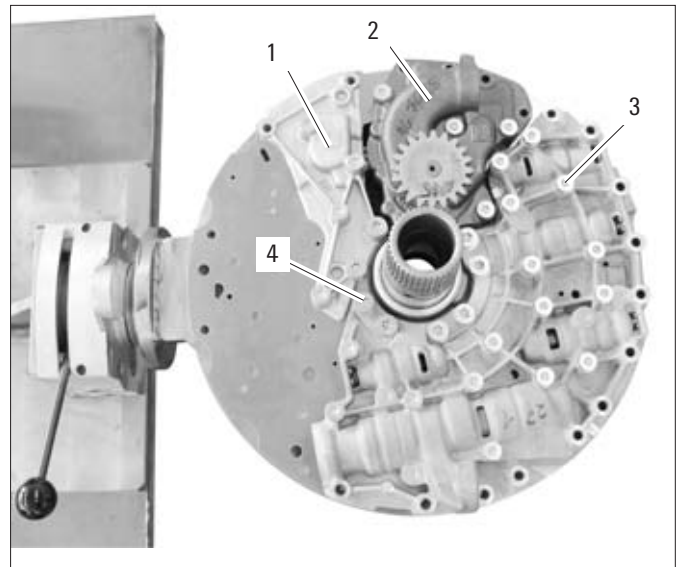
030169

- 27 Align valve housing prior to tightening the screws in such a way so that the through holes are aligned with the outside.

- 28 Tighten all TORX screws in order to fasten the valve block, pump, and cover:

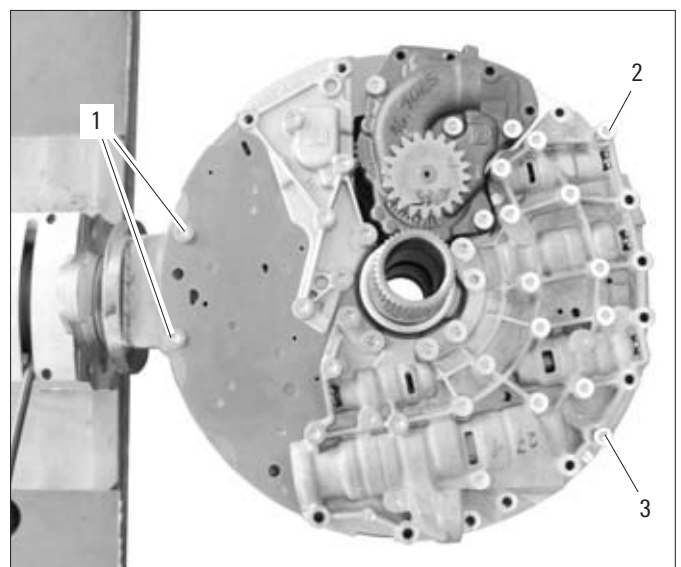
Tightening torques:

- M8x50 pump **(2)** and cover **(1)**: 20 Nm
- M8x60 valve block **(3)**: 23 Nm
- M10x60 **(4)**: 46 Nm



030169

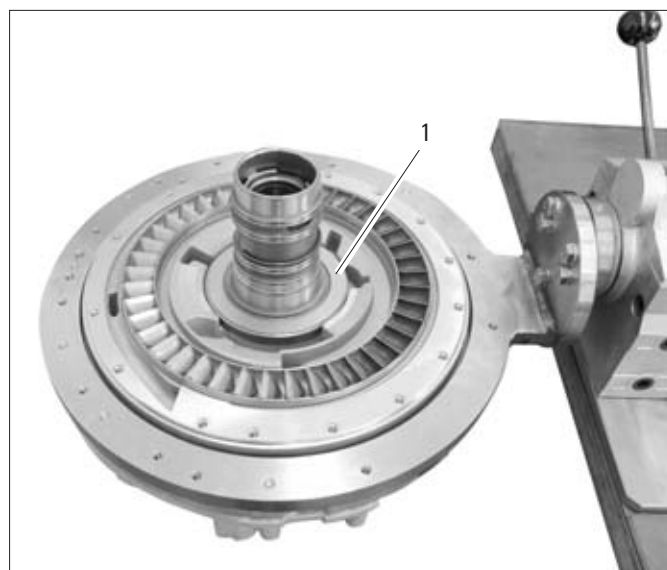
- 29 Fix the control unit with some TORX screws **(1, 2, 3)** at the circumference.



030170

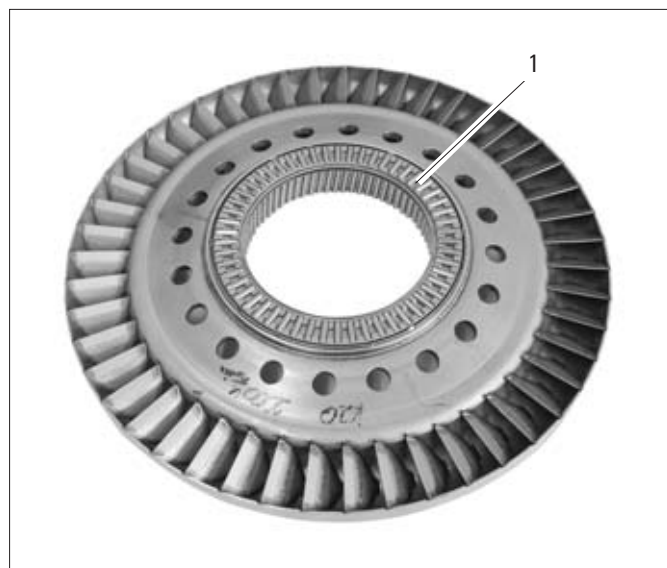
30 Turn the control unit around.

31 Add on the washer (1).



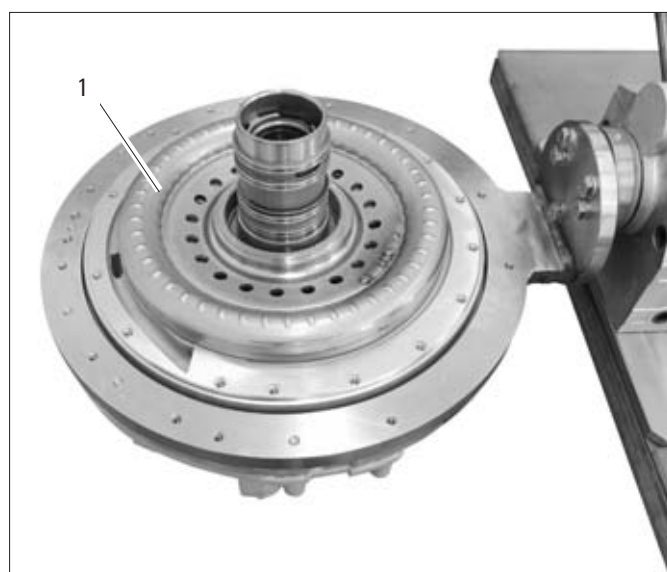
025785

32 Mount the axial bearing (1) onto the rotor.



025732

33 Put on the rotor (1).

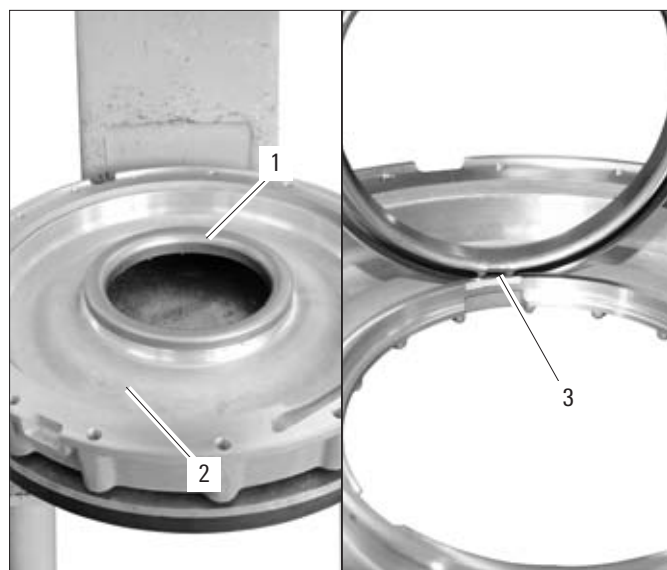


025786

- 34 Put the sealing disk (2) onto the press.
- 35 Put the new piston ring insert (1) on the sealing disk (2). Here, the position of the fixing straps (3) must be considered.

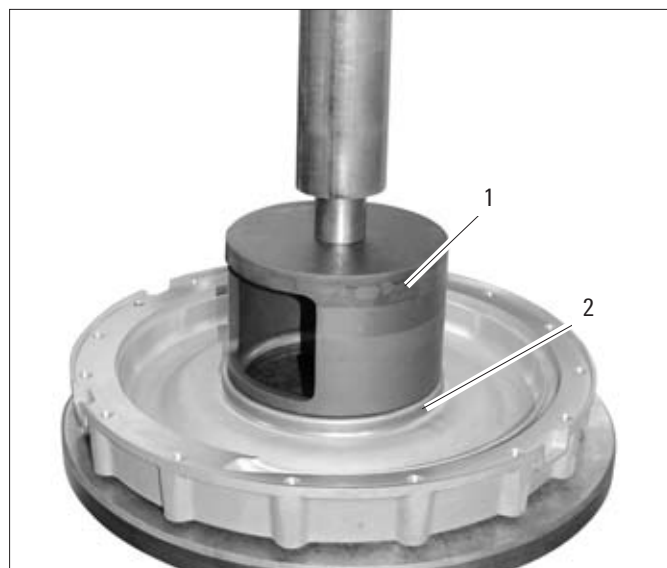
NOTE

Only one new piston ring insert must be used.



030404/030403

- 36 Press in the piston ring insert (2) with a suitable thrust piece (1).



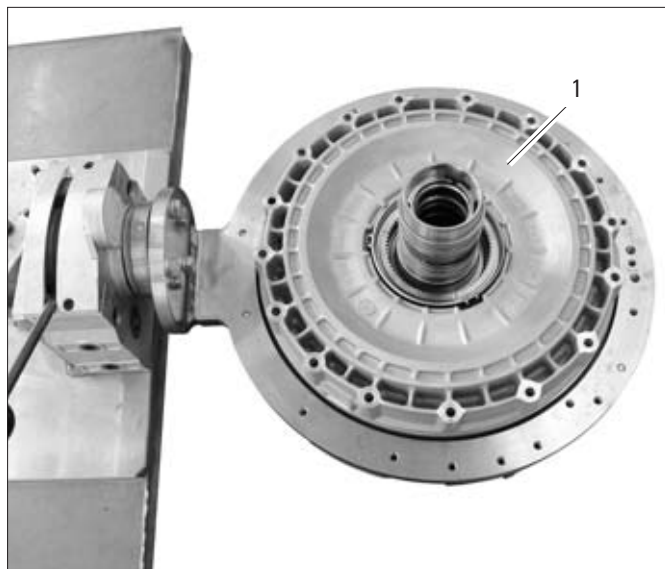
030405

- 37 Check the straps at the pressed-in piston ring insert (1). Bend three straps to the outside in order to secure the piston ring insert.



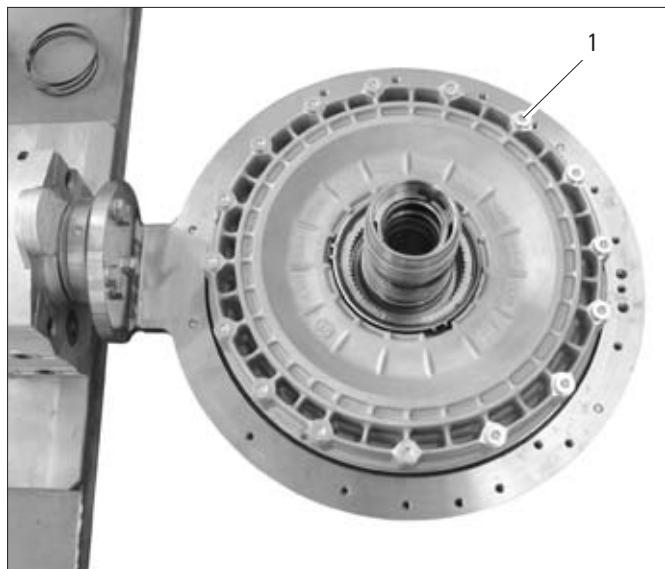
030171

- 38 Put on the sealing disk **(1)**.



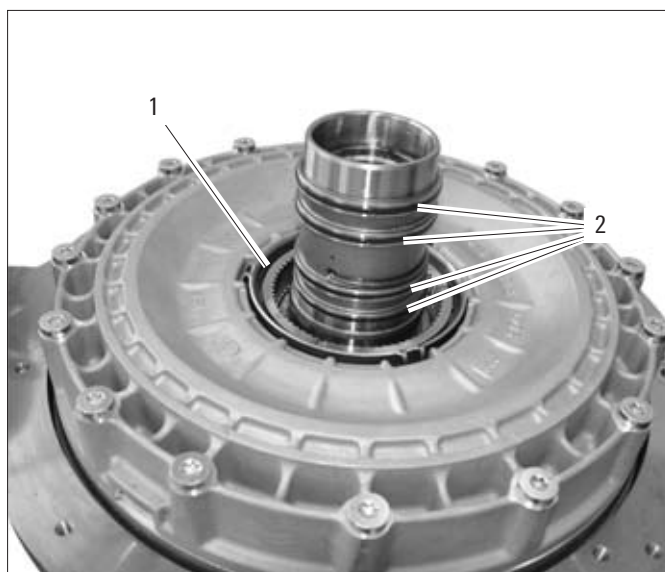
030414

- 39 Screw in 16 TORX screws M8x60 **(1)** and tighten.
Tightening torque: 23 Nm



030172

- 40 Insert the rectangular ring **(1)**.
- 41 Insert four rectangular rings **(2)** and hook them in.

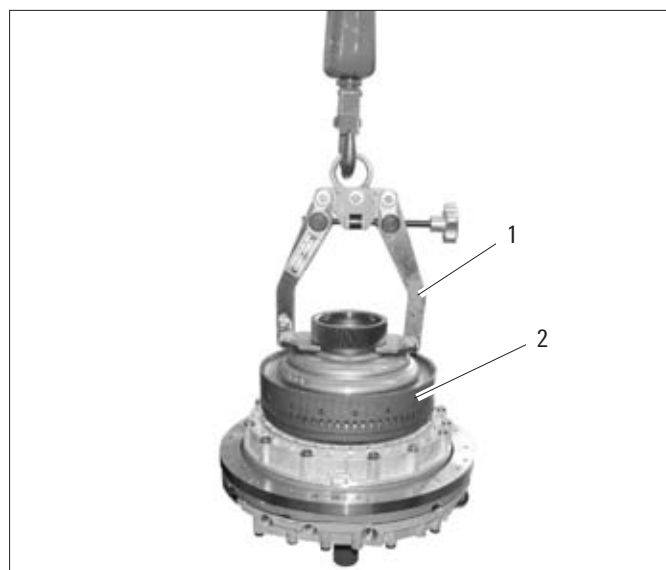


030173

- 42 Cautiously apply the clutch carrier (2) by means of the spindle tongs 1T66 153 417 (1) on the crane so that the inner and outer piston rings are not damaged.

NOTE

The spline of the piston ring insert must mesh with the rotor.



025791

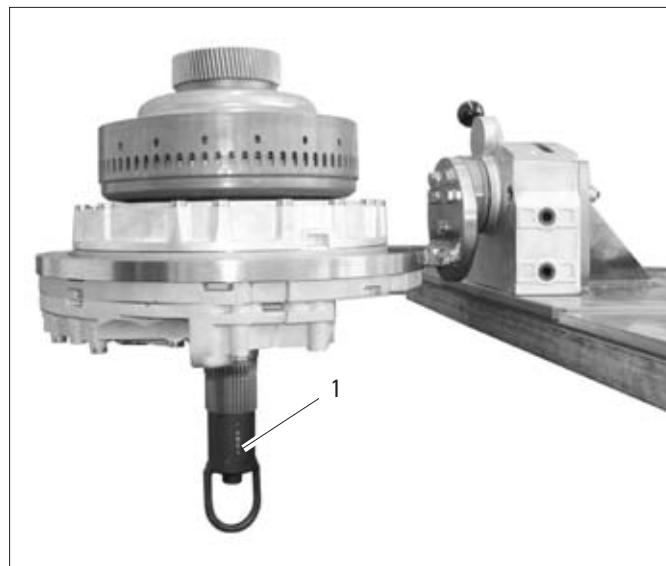
**DANGER**

When turning, the clutch carrier may fall out of the turning equipment.

Risk of injury!

By means of the lifting device, the clutch carrier 1T66 156 231 (1) must be protected from falling down.

- 43 Screw in the lifting device no.: 1T66 156 231 (1) from the bottom side onto the turbine shaft in order to secure the clutch carrier.

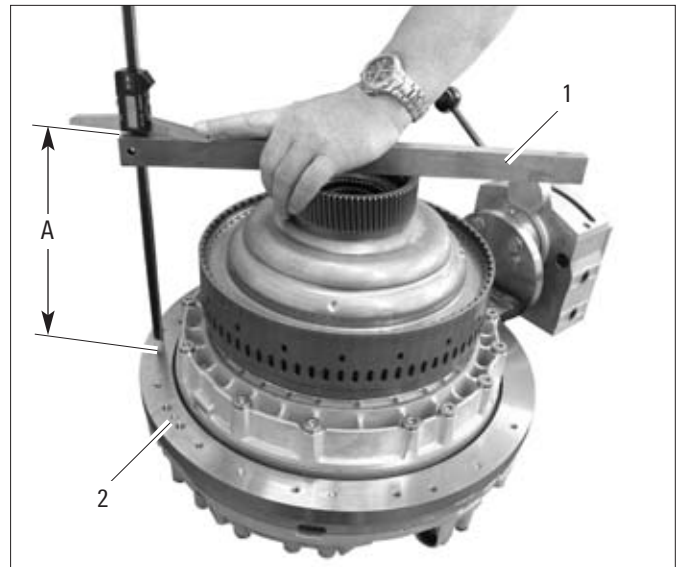


025792

15.8 Install the Control Unit

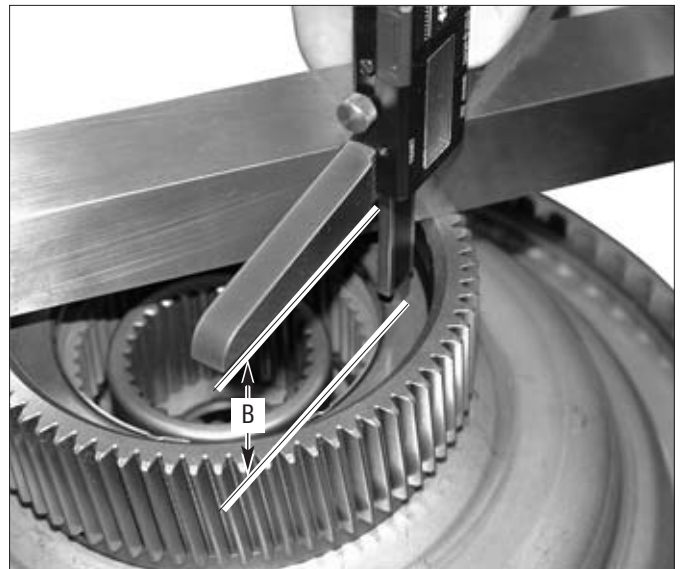
15.8.1 Measurement of the Central Play

- 1 Put on the measuring caliper (1).
- 2 Measure the distance between the measuring caliper (1) and the assembly ring of the turning equipment (2): **Dimension A**



025793

- 3 Measure the distance between the measuring caliper and the bearing roller of the axial bearing: **Dimension B**



030362

- 4 Read off the data on the strength of the assembly ring of the turning equipment (1): **Dimension M**

Dimension C = dimension A - dimension B

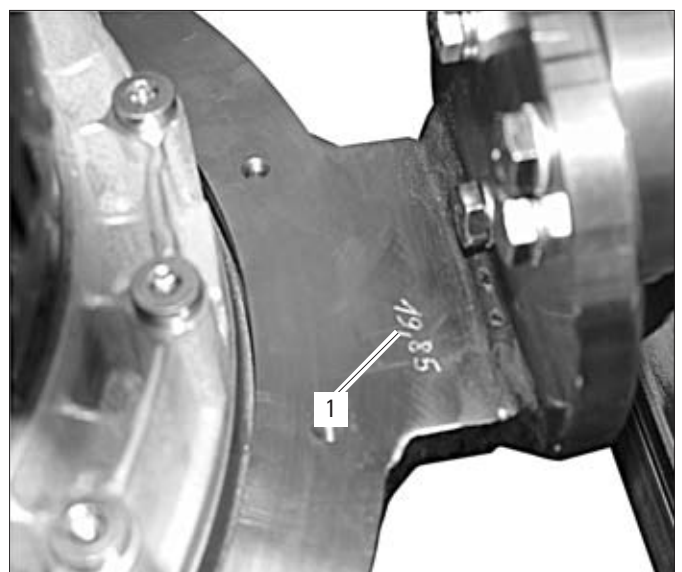
Dimension D = dimension C + dimension M

Example:

Dimension M = 19.85 mm

Dimension C = 212.00 mm

Dimension D = 212.00 mm + 19.85 mm
= 231.85 mm



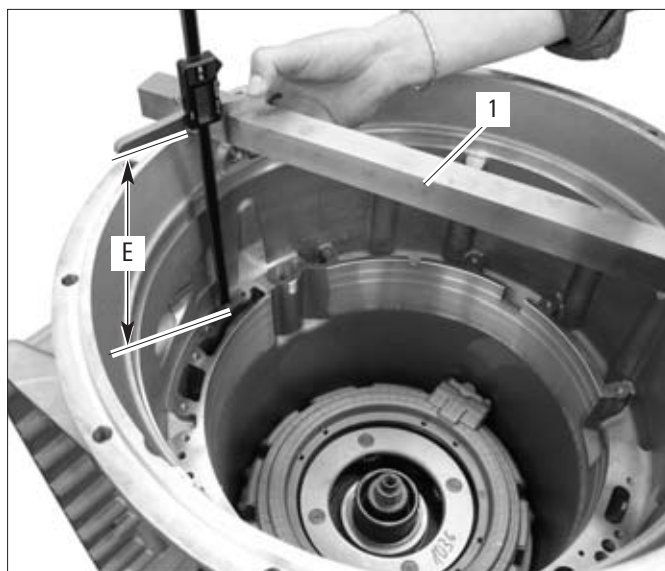
025795

- 5 Remove the fixture no.: **1X56 138 556 (1)**.



030363

- 6 Put on the measuring caliper (1) onto the transmission housing.
- 7 Measure the distance between the measuring caliper and the contact surface of the control unit: **Dimension E**



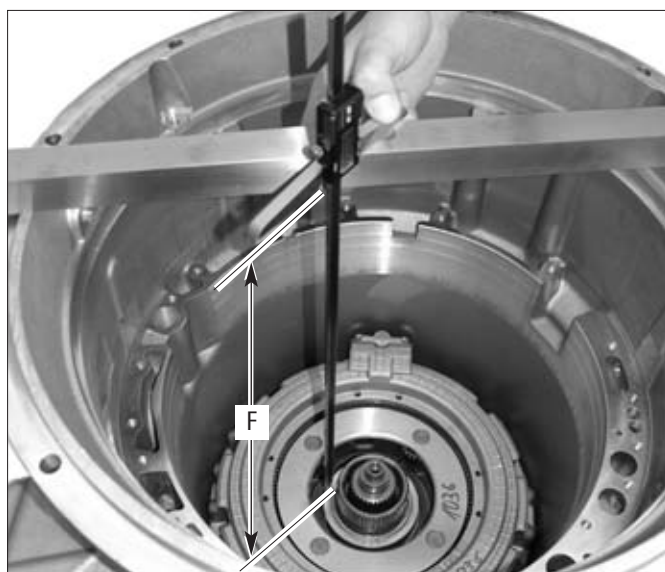
030364

- 8 Measure the distance between the measuring caliper and the shoulder of the bearing: **Dimension F**

Dimension G = dimension F - dimension E

Example:

Dimension G = 236.10 mm



030365

9 Calculating the shim's thickness:

S = thickness of the shim

Axial play, nominal value = 0.6 mm up to
0.8 mm

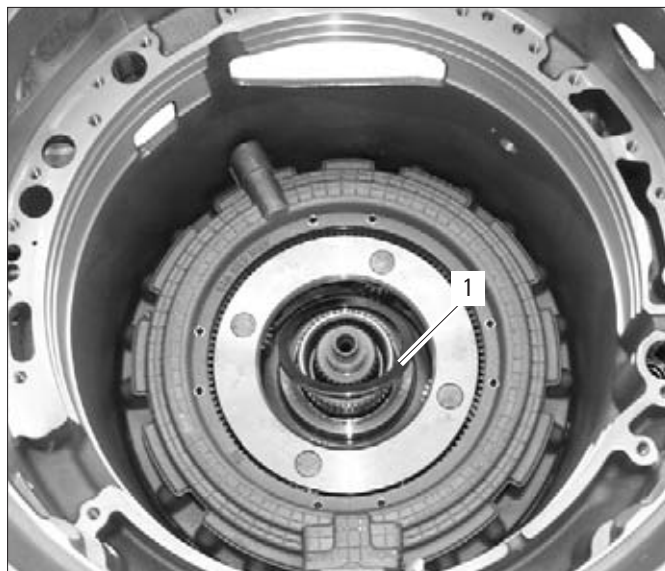
**S = dimension G - dimension D - axial play,
nominal value**

Example:

$S = 236,10 \text{ mm} - 231,85 \text{ mm} - 0,7 \text{ mm}$

$S = 4,25 \text{ mm}$

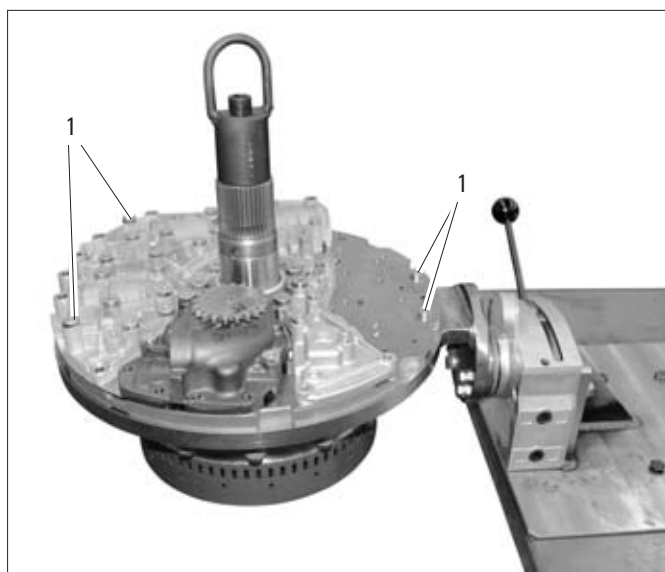
10 Insert a shim (1) with the calculated thickness S .



025798

15.8.2 Insert the control unit in the transmission

- 1 Turn the control unit around (upside).
- 2 Remove all TORX screws (1) from the circumference of the control unit.



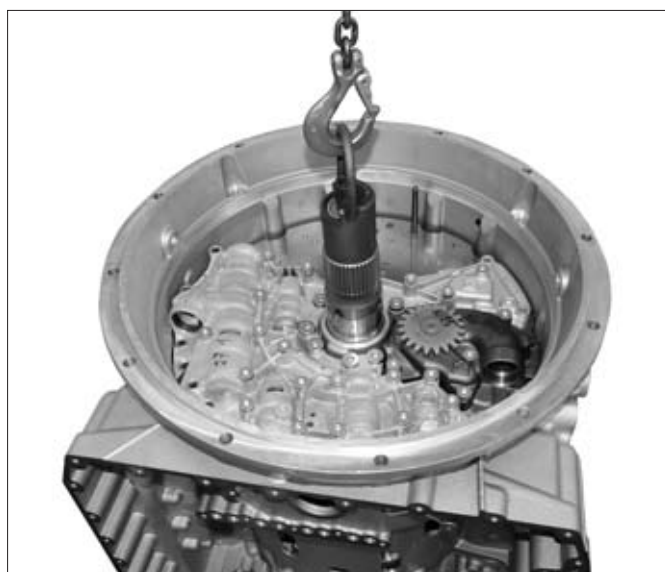
030424

- 3 Screw in the M8 guide screw (1) into the transmission housing.



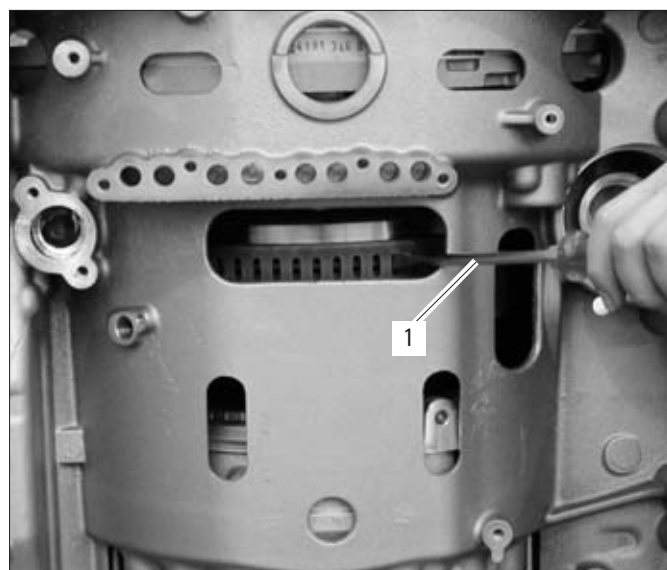
030366

- 4 Insert the control unit with a crane in the transmission housing. Here, ensure that the control unit is correctly positioned.



030367

- 5 If necessary, use a screw driver **(1)** in order to turn the clutch carrier in such a way that the spline of the sun gear I and the multidisk carrier are properly aligned with one another.



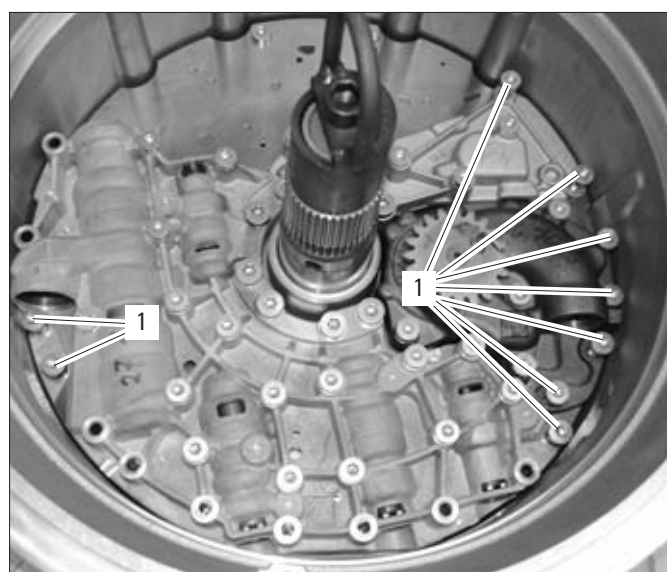
030368

- 6 Remove the guide screw.
- 7 Manually screw in two M8x36 **(1)** TORX screws - but do not tighten yet.



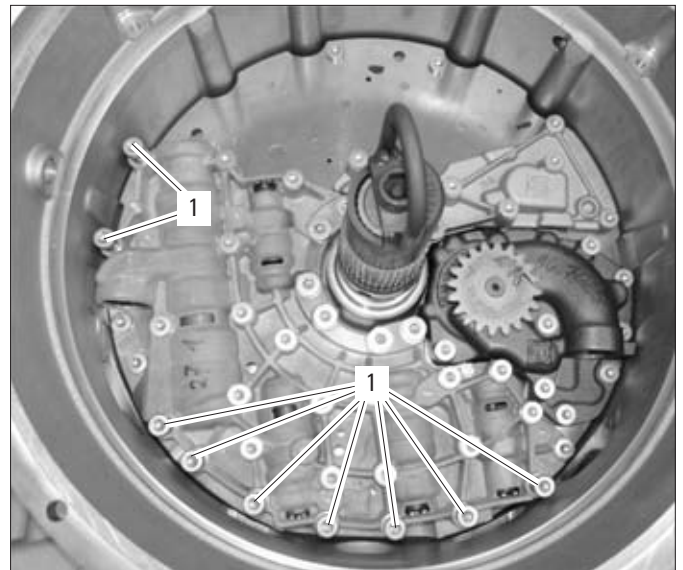
030369

- 8 Manually screw in nine TORX screws M8x50 **(1)** - but do not tighten yet.



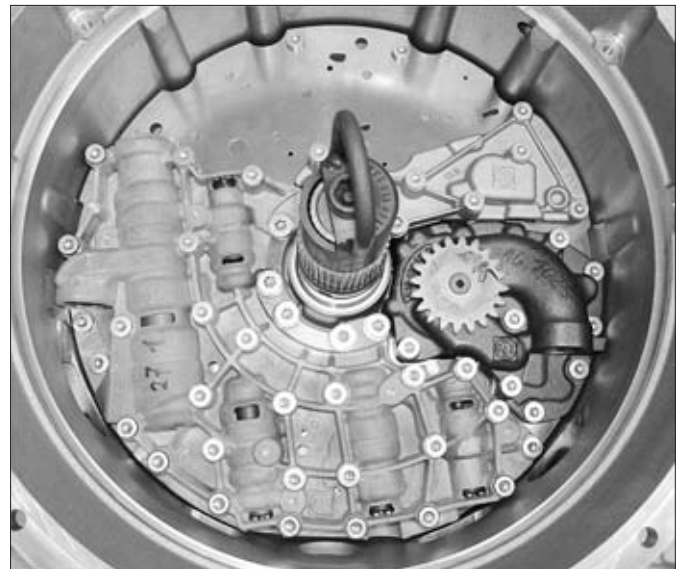
030370

- 9 Manually screw in nine TORX screws M8x85 **(1)** - but do not tighten yet.



030371

- 10 Tighten all 20 TORX screws.
Tightening torque: 20 Nm



030372

15.9 Control Measurement of the Turbine Shaft's Axial Play

- 1 Establish a measurement setup as shown in the illustration.
- 2 Loosen the lifting device no.: **1T66 156 231 (1)**.
- 3 Measure the distance between the measuring caliper and the front face of the turbine shaft:
Dimension A
- 4 Tighten the lifting device no.:
1T66 156 231 (1).
- 5 Measure the distance between the measuring caliper and the front face of the turbine shaft:
Dimension B
- 6 Calculate the play:

Play = dimension A - dimension B

Example:

Play = 154,09 mm - 153,43 mm = 0,66 mm

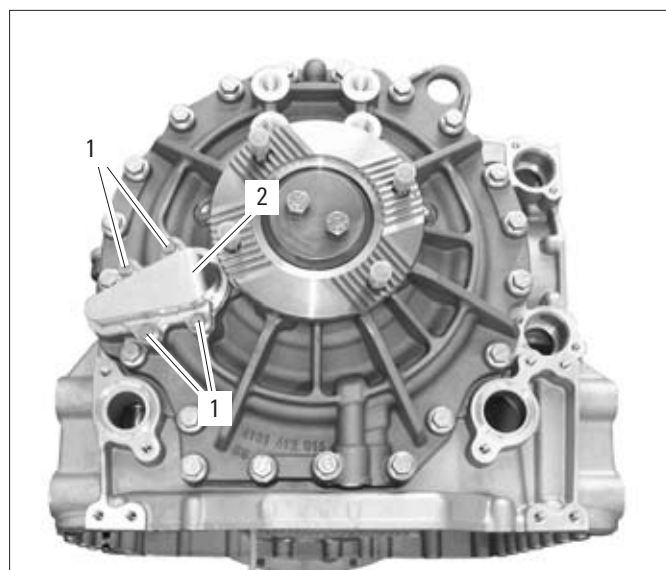


030373

16 Installing, Removing, Dismantling, and Assembling the Output Cover (Coaxial Transmission)

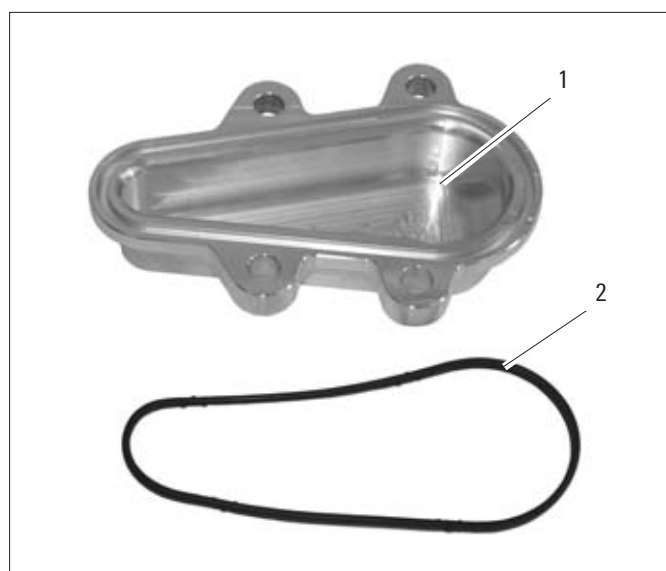
16.1 Removing the Output Cover

- 1 Unscrew four hex head bolts/screws **(1)** at the inductive sensor cover **(2)**.
- 2 Take off the cover inductive sensor **(2)**.



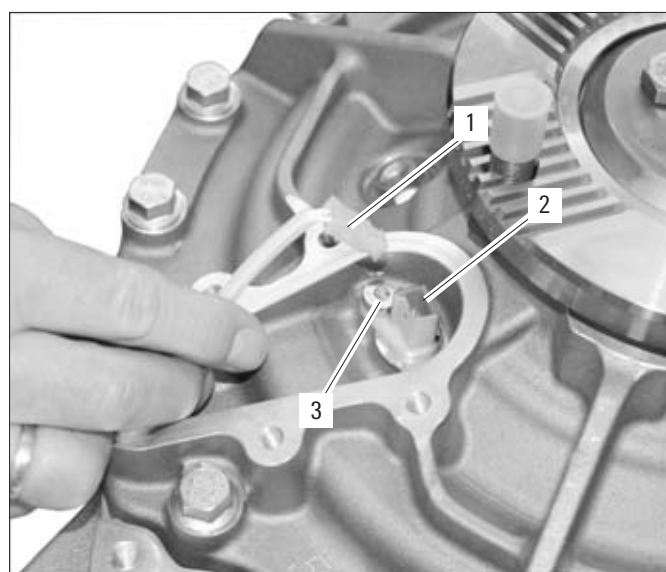
025362

- 3 Take out the seal/gasket **(2)** from inductive sensor cover **(1)**.



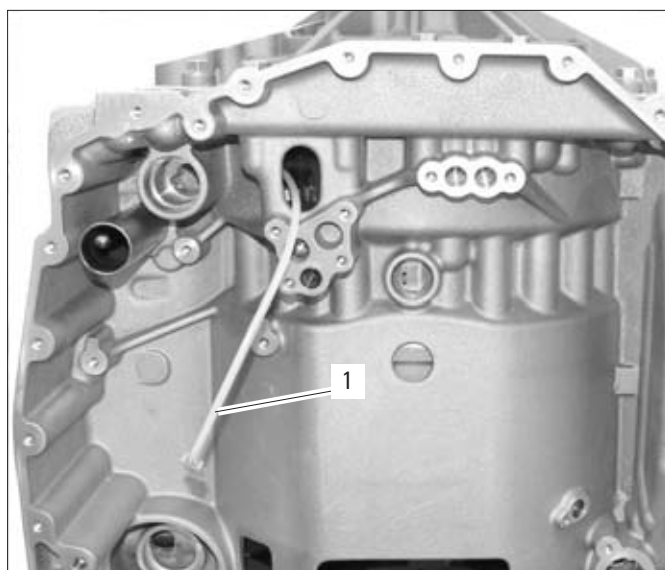
024189

- 4 Unplug the connector **(1)** at the inductive sensor output.
- 5 Unscrew the M6 TORX screw **(3)**.
- 6 Take out the inductive sensor output **(2)**.



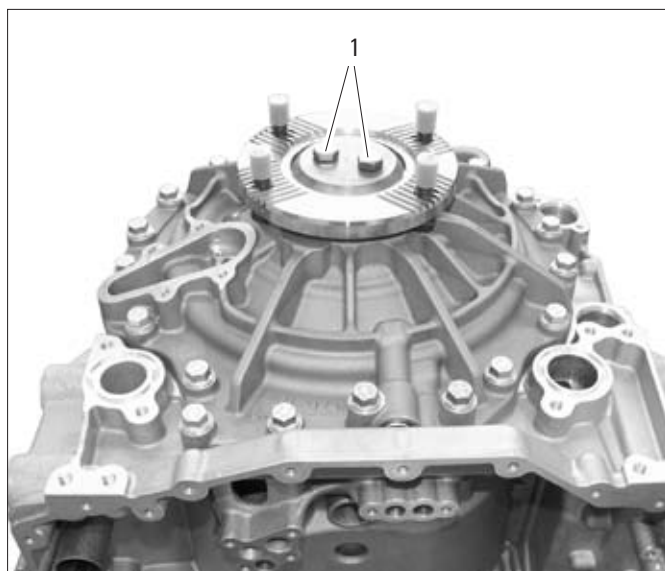
025363

- 7 Pull out the cable **(1)** of the inductive sensor.



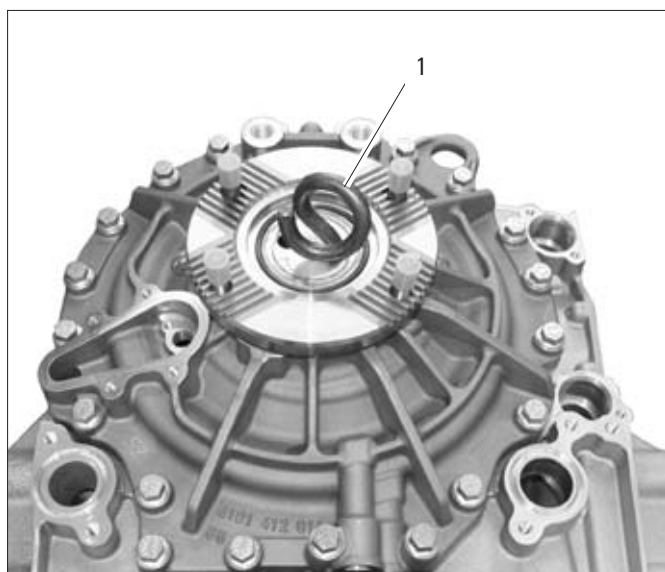
025364

- 8 Unscrew the two hexagon head screws/bolts **(1)** at the output cover flange.



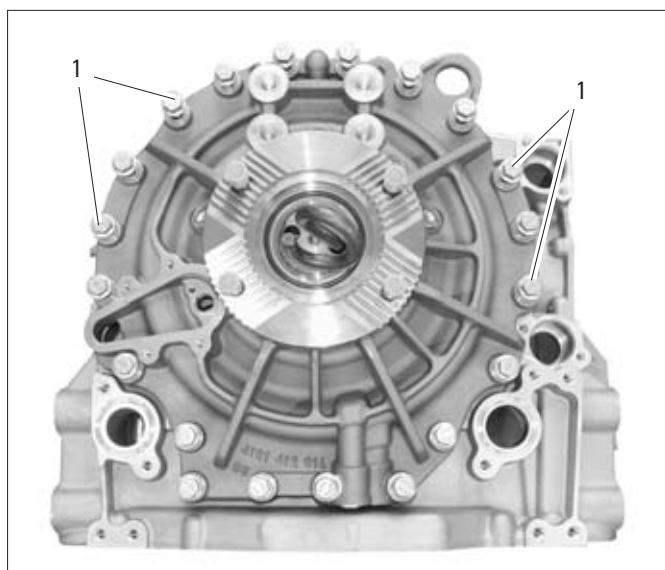
025365

- 9 Screw in the hook M12 **1X56 136 599 (1)**.



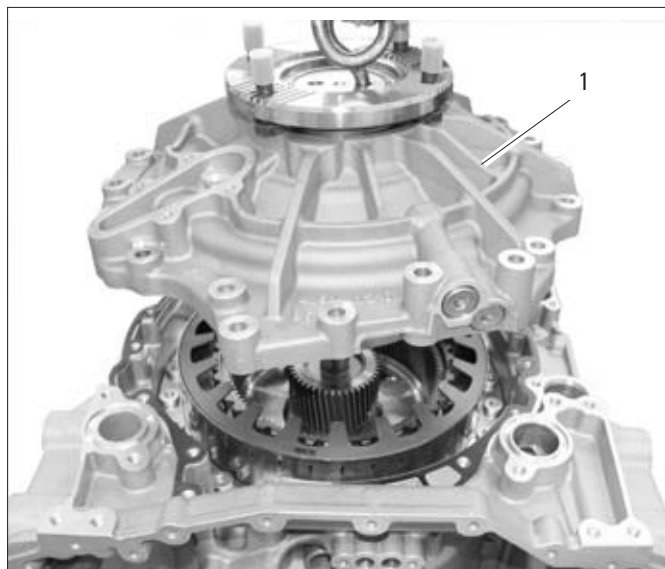
025366

- 10 Unscrew all screws/bolts **(1)** at the circumference of the output cover.



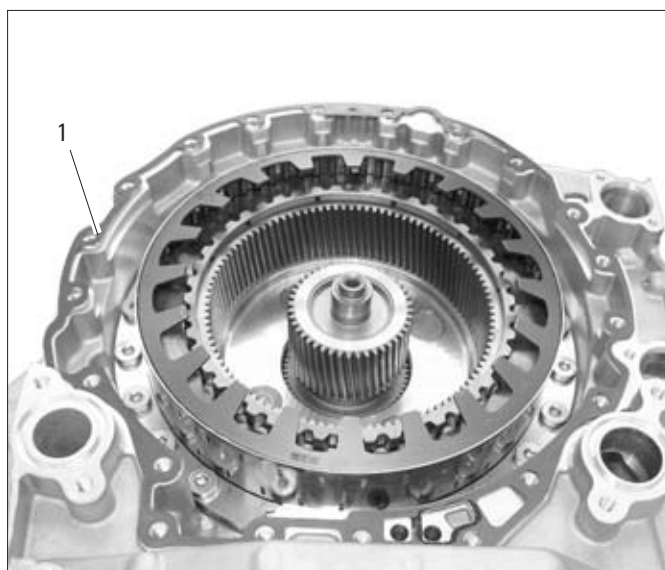
025367

- 11 Attach the lifting equipment.
- 12 Lift off the output cover **(1)** with the crane.



025368

- 13 Take off the seal/gasket **(1)**.



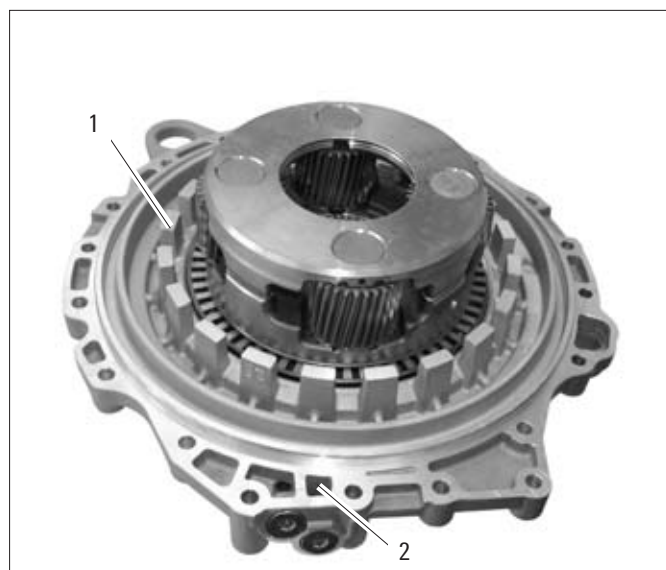
025369

16.2 Dismantling the Output Cover

- 1 In order to loosen the piston F (1), blow in minor quantities of compressed air via the orifice (2).

CAUTION

Oil may spray out. Cover up the compressed-air pistol with a cloth.



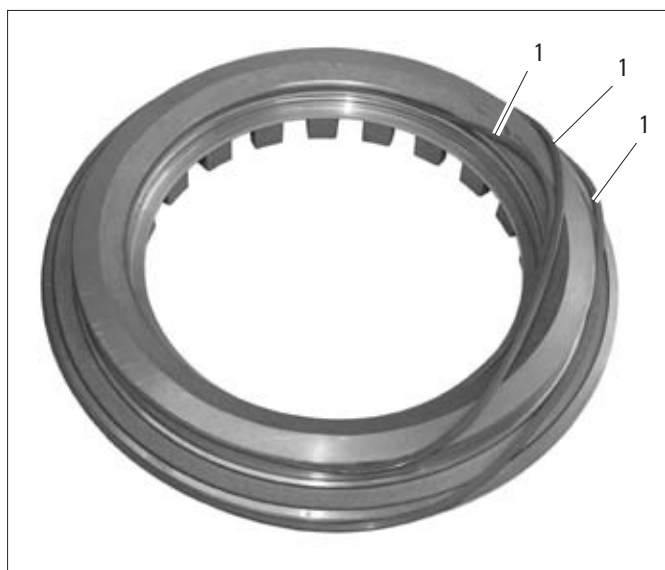
025466

- 2 Cautiously remove the F piston (1) by means of suitable pliers.



025467

- 3 Take off the three sealing rings (1, 2, 3).

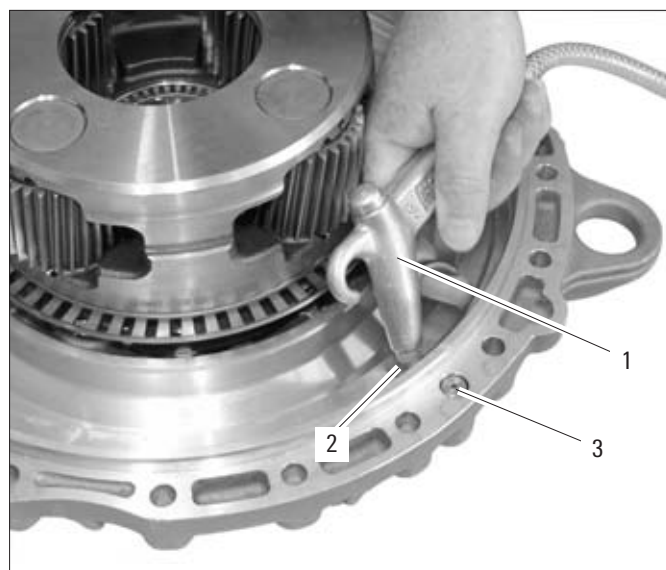


025468

- 4 Lightly inject air in the orifice (2) by means of the compressed-air pistol (1) in order to release the vent valve "F" (3).

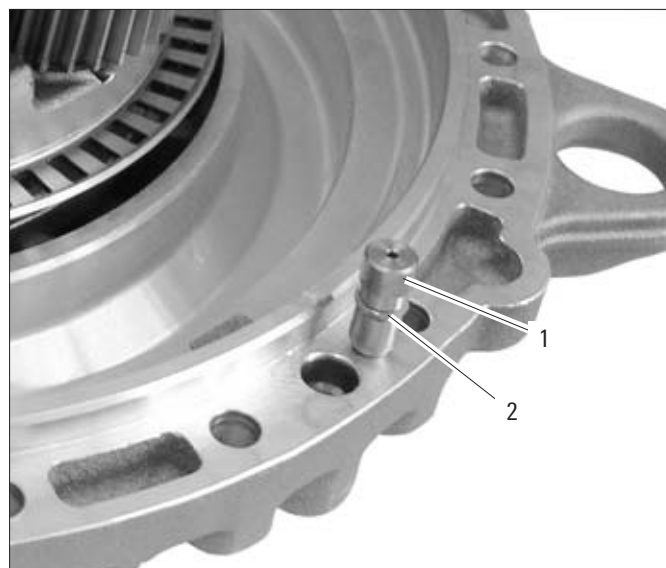
CAUTION

Oil may spray out. Cover up the compressed-air pistol with a cloth.



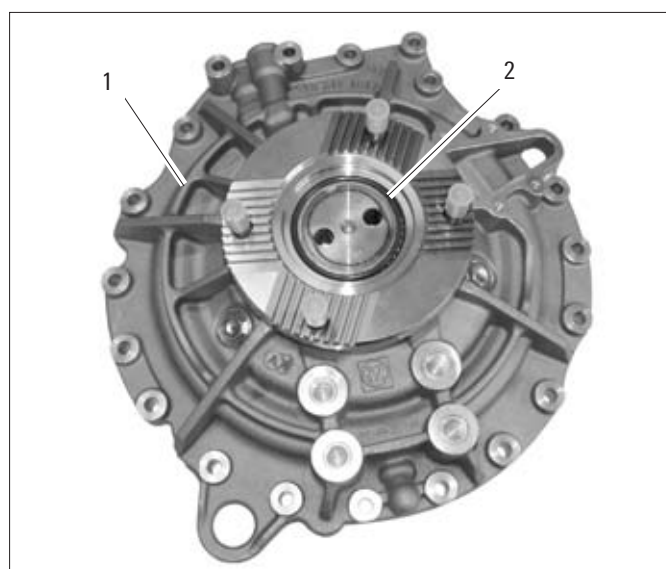
025520

- 5 Take out the vent valve "F" (1).
- 6 Take off the O-ring (2) from the vent valve "F" (1).



025521

- 7 Turn the output cover (1) around.
- 8 Take out the O-ring (2).



025469

- 9 Remove the output flange (1).

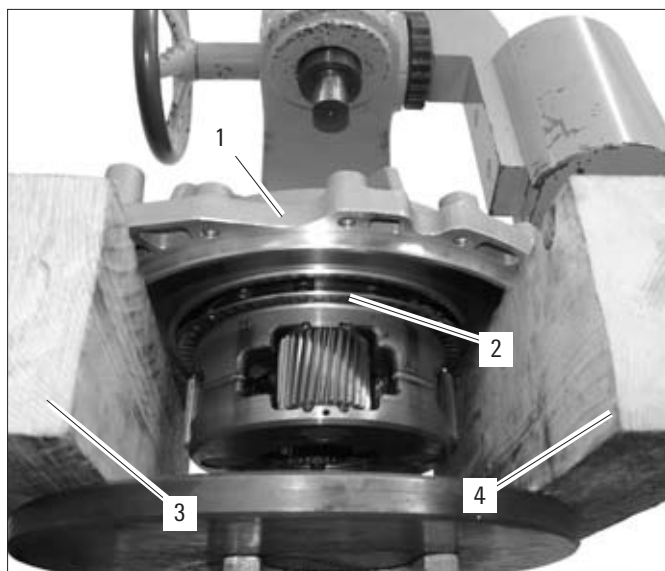


025470

- 10 Provide cushioning for the output cover (1) on the press by means of suitable square skids (3, 4).

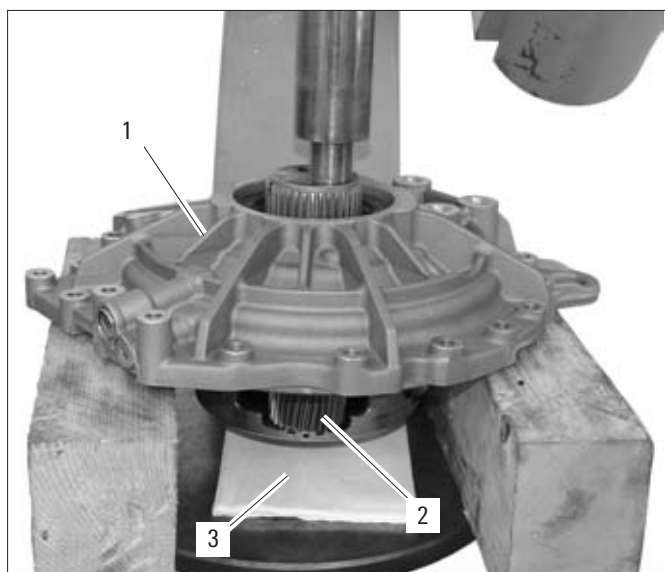
CAUTION

The inductive sensor ring (2) must not be damaged during the process.



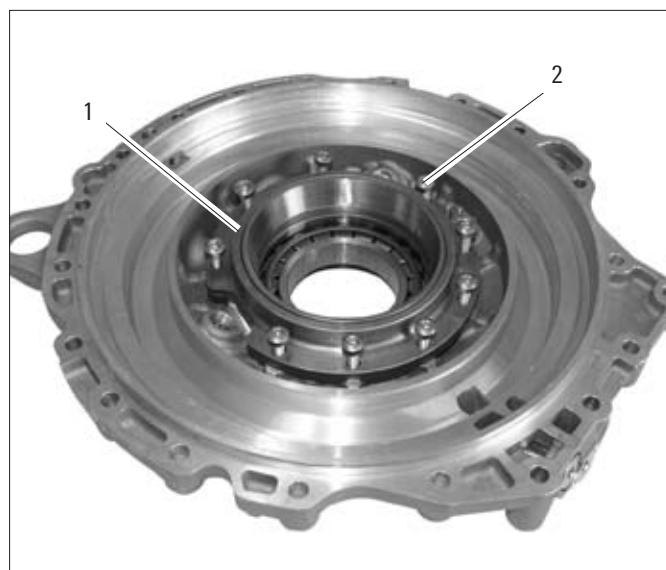
025471

- 11 Provide a soft cushioning base (3).
- 12 Press out the planet carrier III (2) from the output cover (1).



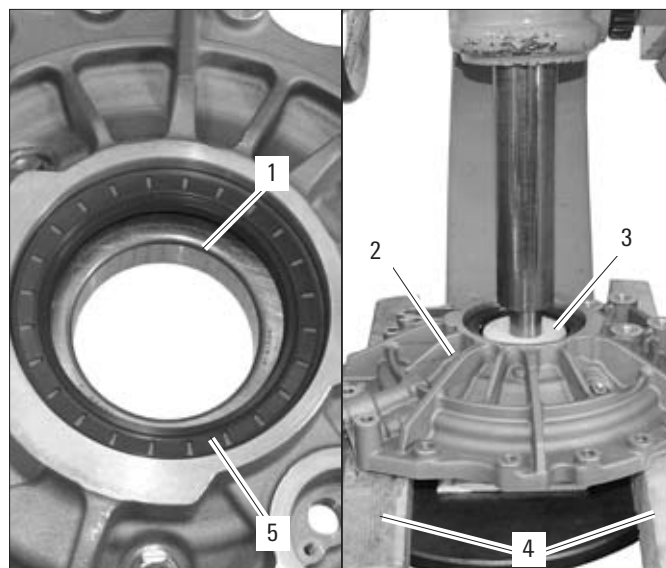
025472

- 13 Unscrew nine M8 TORX screws **(2)** from the bearing holder **(1)**.



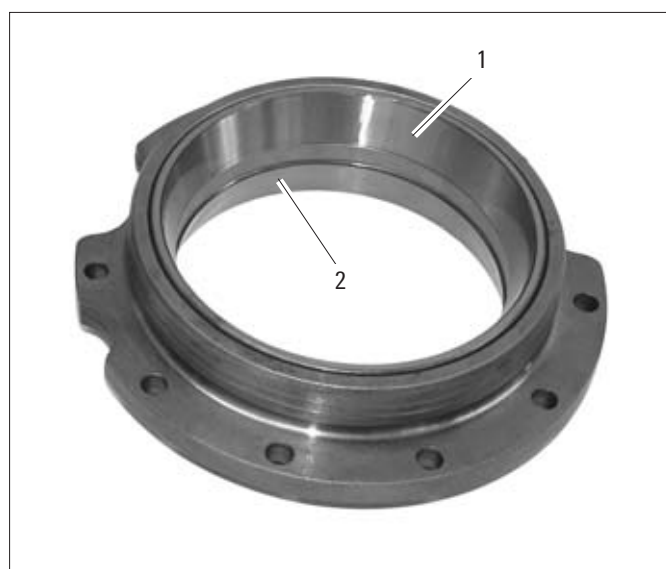
025473

- 14 Provide cushioning for the output cover **(2)** on the press by means of suitable square skids **(4)**.
- 15 Press out the bearing **(1)** by means of a suitable thrust piece **(3)**.
- 16 Remove the shaft sealing ring **(5)** from the output cover.



025474/025475

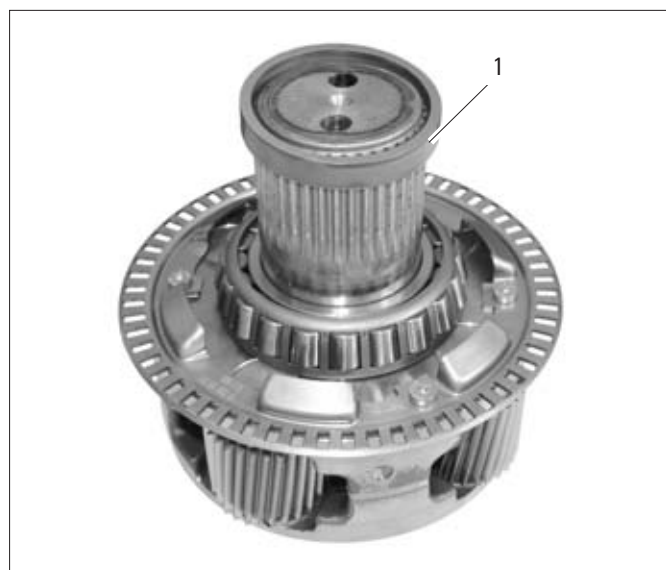
- 17 Drive out the bearing rings **(1, 2)** by means of a suitable mandrel.



025478

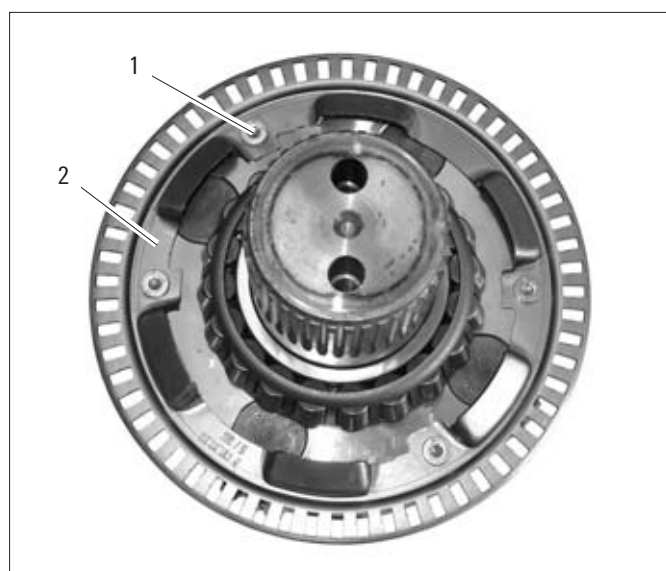
16.3 Dismantle the Planet Carrier III

- 1 Take off the ring **(1)** from the output shaft.



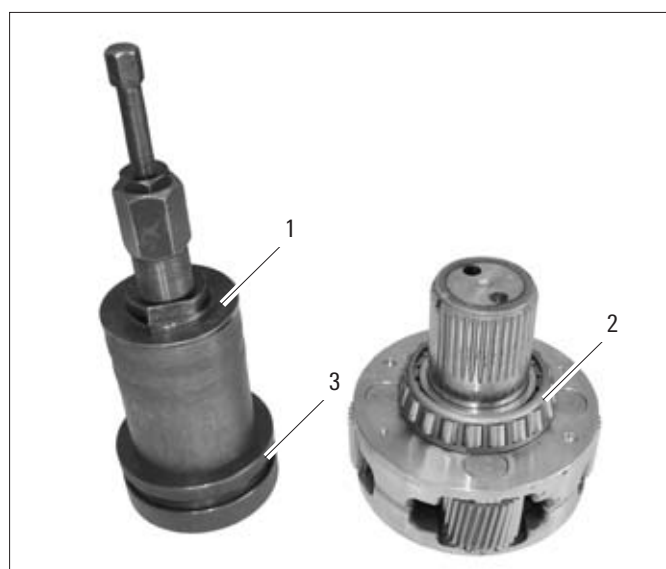
025479

- 2 Unscrew four TORX screws **(1)** at the inductive sensor ring **(2)**.
- 3 Take off the inductive sensor ring **(2)**.



025480

- 4 Pull off the taper roller bearing **(2)** with the basic unit no.: **1X56 122 306** in conjunction with no.: **1X56 138 596 (1)**.

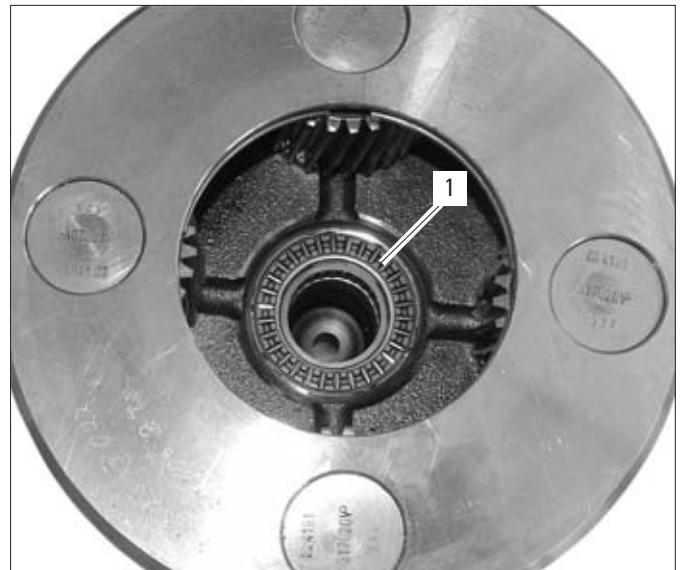


025482

- 5 If necessary, take out the axial bearing (1).

NOTE

A new bearing must be installed if the bearing was disassembled.

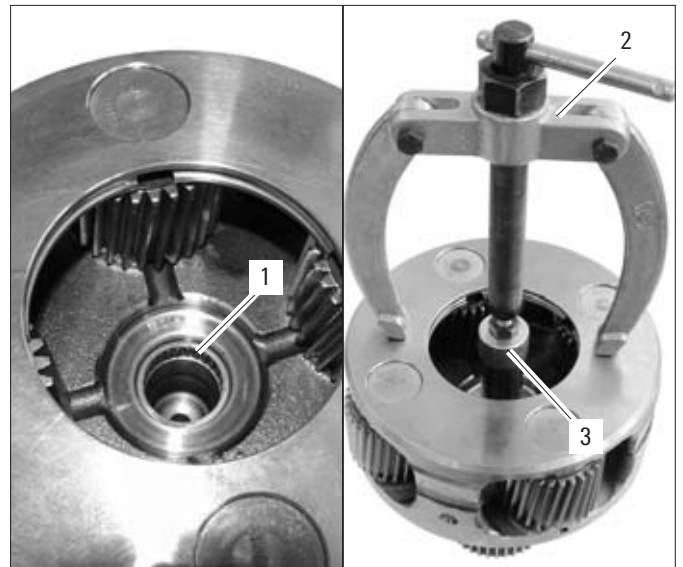


030316

- 6 If required, pull out the needle bearing (1) by means of the internal withdrawal tool (3) and the two-armed extractor no.: 1X56 122 227 (2).

NOTE

A new bearing must be installed if the bearing was disassembled.

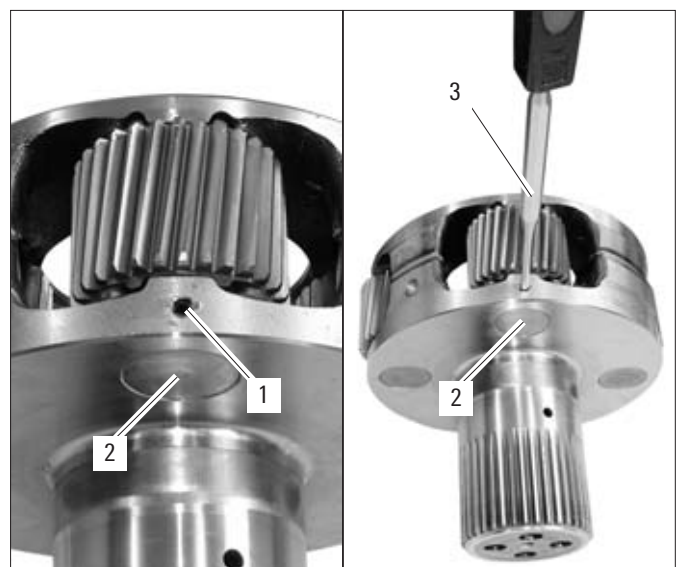


030312/030313

- 7 Release the planetary-gear shaft (2). To this end, cautiously drive in the centering pin (1) by means of a suitable mandrel (3) at the center of the planetary-gear shaft (2).

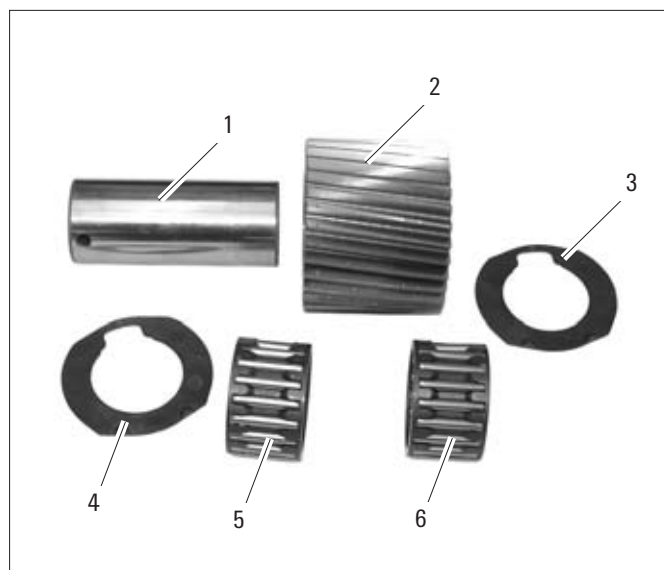
CAUTION

Never drive in centering pins until firmly home.



030317/030318

- 8 Press out the planetary-gear shaft (1) from the planet carrier.
- 9 Take out the planet gear (2).
- 10 Take out the two stop disks (3, 4).
- 11 Take out the two needle bearings (5, 6) from the planet gear.



025485

- 12 Clamp the planetary-gear shaft (2) into a vise.

NOTE

Use protective chucks made from aluminum.

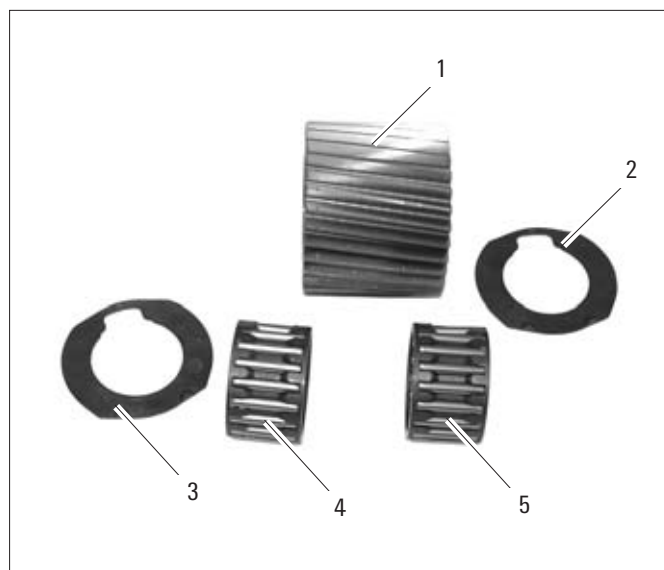
- 13 Drive out the centering pin (1) by means of a suitable mandrel from the planetary-gear shaft (2).
- 14 Repeat the working steps 6 to 12 for the remaining planet gears.



025487

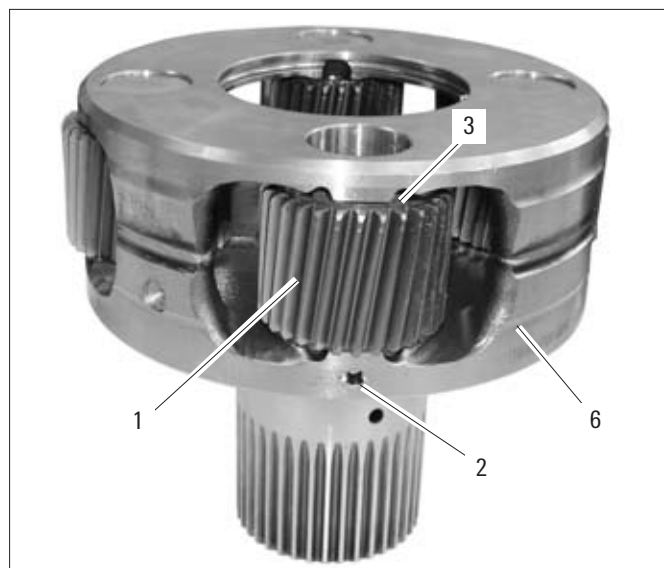
16.4 Assemble the Planet Carrier III

- 1 Insert two needle bearings (4, 5) in the planet gear (1).



025486

- 2 Insert the planet gear (1) with the upper and lower stop disks (2, 3) in the planet carrier (6).



030319

- 3 Insert the planetary-gear shaft (7). Here, make sure that the bores for the centering pin in the planetary-gear shaft and in the planet carrier are respectively aligned (arrow).

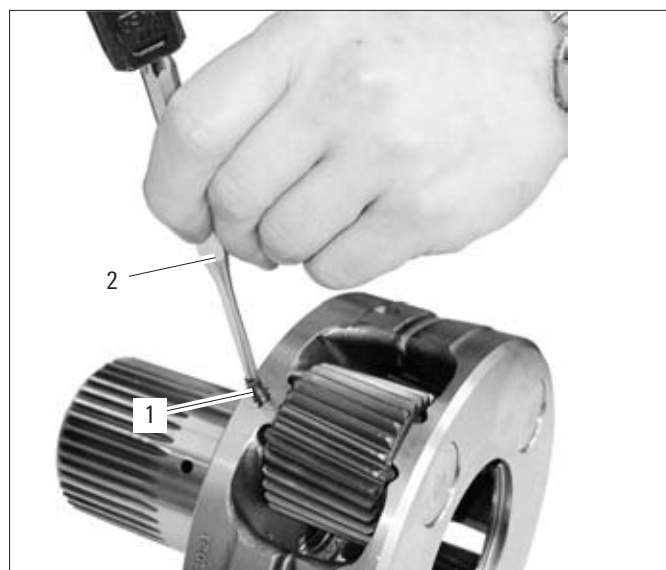


030320

- 4 Drive in the centering pin (1) with a suitable mandrel (2).

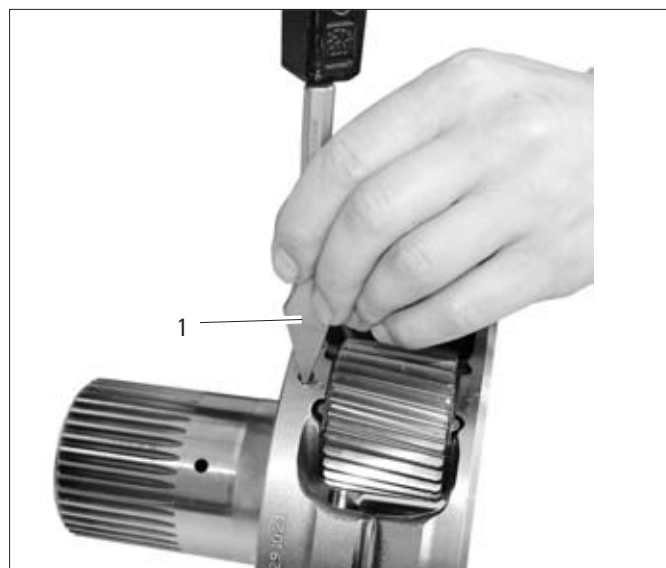
CAUTION

In order to avoid damage at the planet carrier and the planet gear, do not drive in the centering pin directly with a hammer.



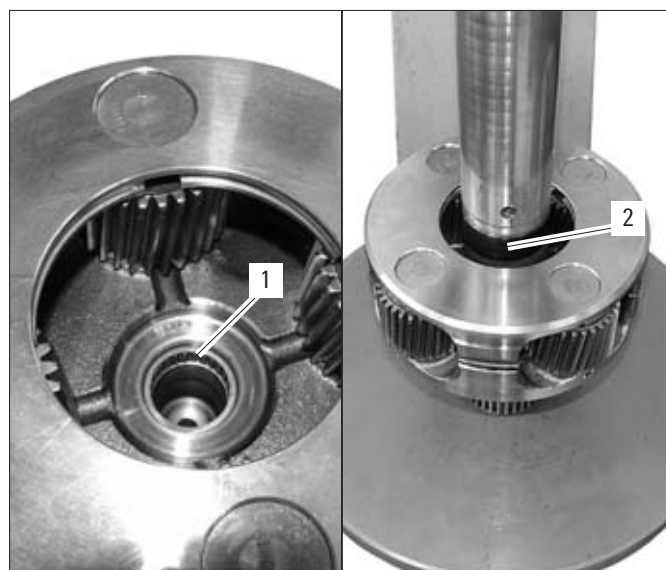
030321

- 5 Caulk the centering pin at its to ends respectively with a suitable chisel (1).



030322

- 6 The needle bearing (1) with the tool no.: 1X56 138 559 (2) must be pressed in.



030312/030315

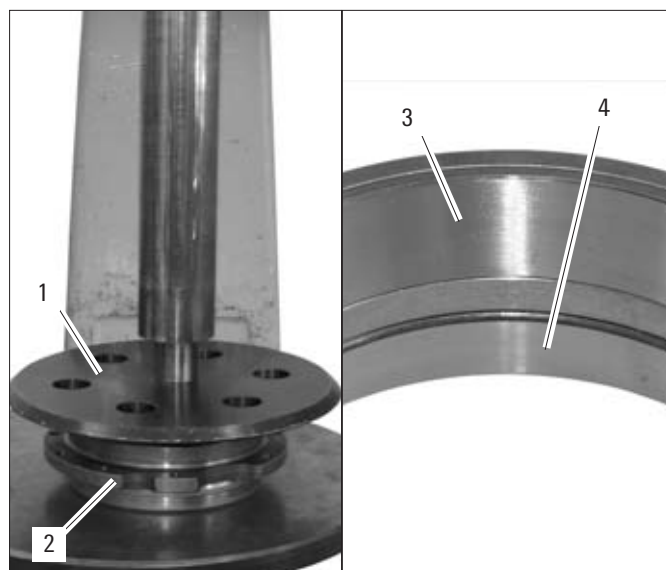
- 7 If required, insert a new axial bearing **(1)** and engage it. Engagement of the unit must be audible (click sound!).



030316

16.5 Assembling the Output Cover

- 1 Press in two bearing outer rings (**3, 4**) with a suitable thrust piece (**1**) in the bearing bush (**2**) until firmly home.



025495/025496

- 2 Screw two guide screws M8 (**1**) into the output cover.



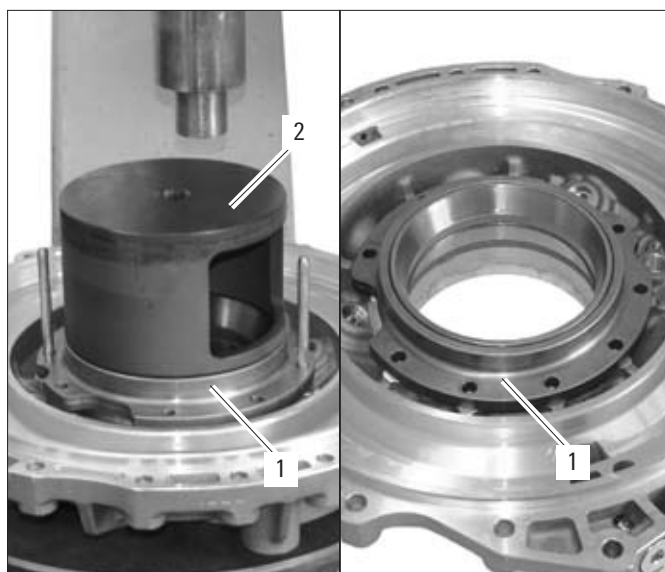
025497

- 3 Put on the bearing bush (**1**).



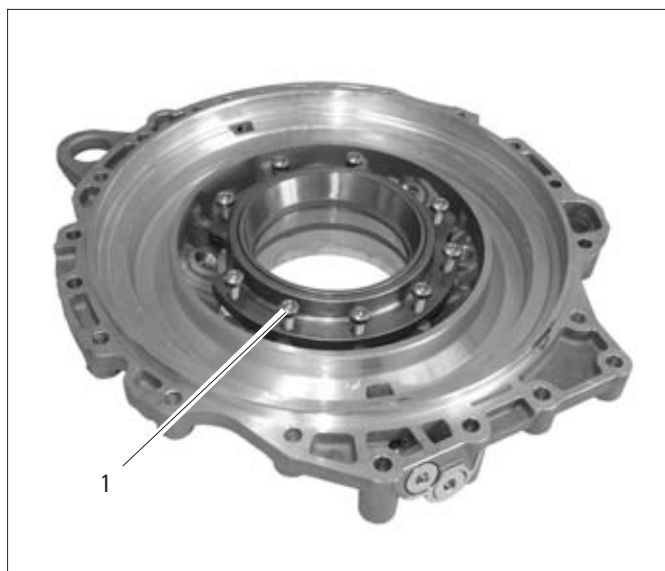
025498

- 4 Press in the bearing bush (1) with the tool no.: **1X56 138 655 (2)**.



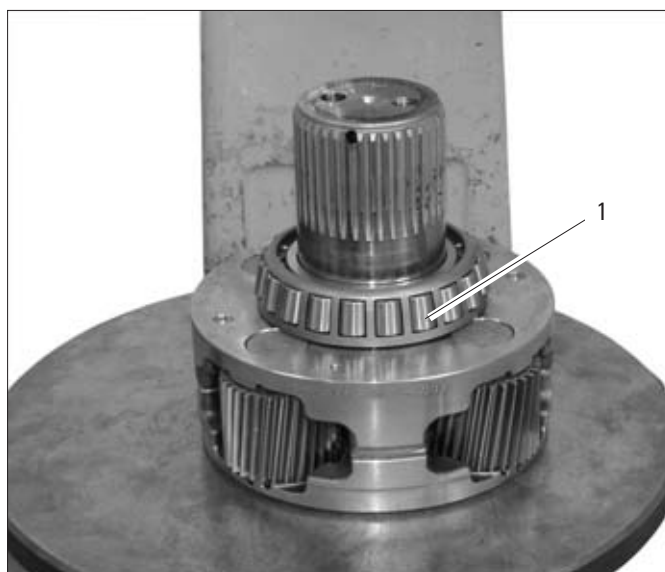
025499/025500

- 5 Screw in nine TORX screws M8x28 (1) and tighten.
Tightening torque: 23 Nm



025501

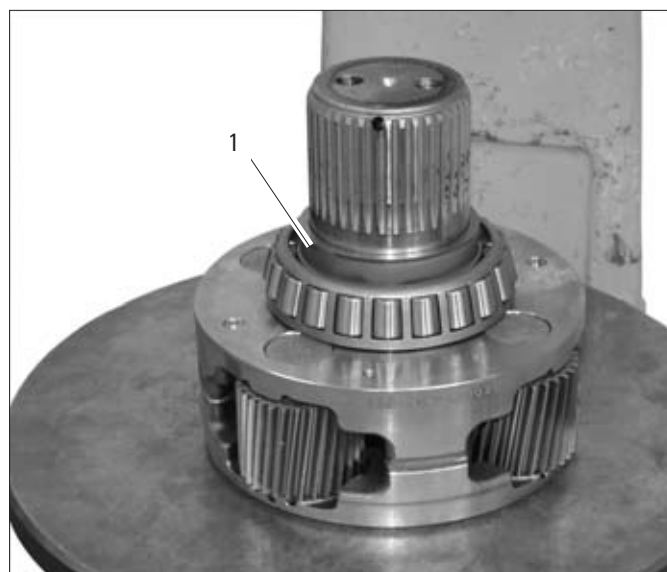
- 6 Press on the taper roller bearing (1) by means of a suitable thrust piece onto the planet carrier III.



025502

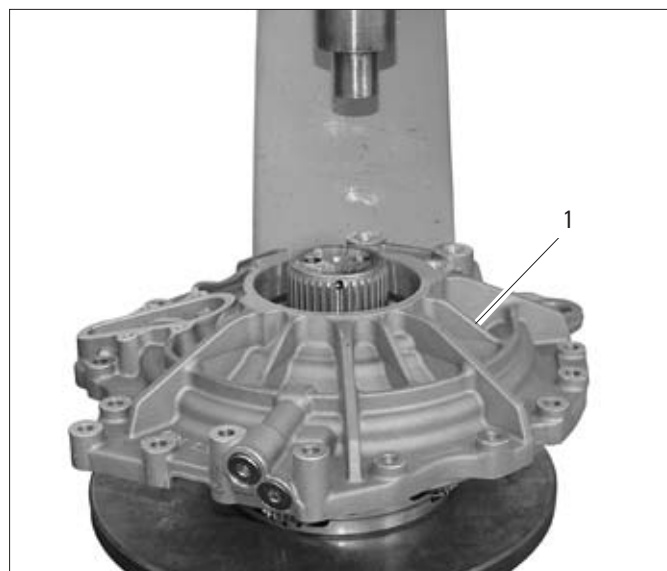
7 Put on an oversize setting ring gage (1).

8 Note the height of the setting ring:
Dimension A (e.g. 14.63 mm)



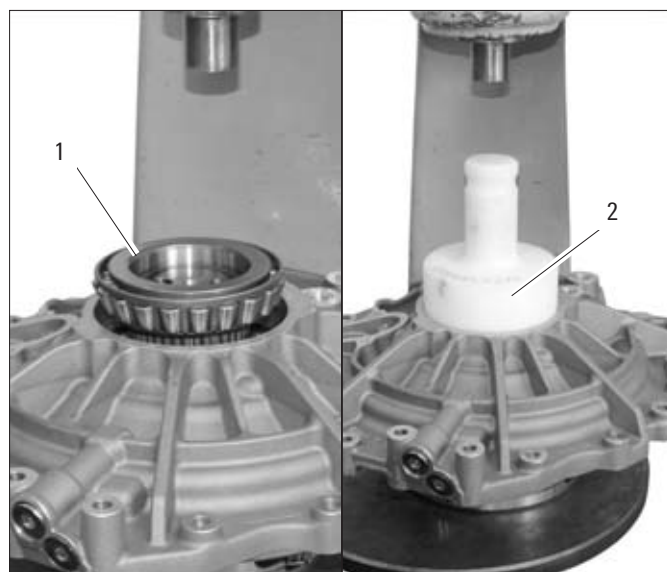
025503

9 Put on the output cover (1).



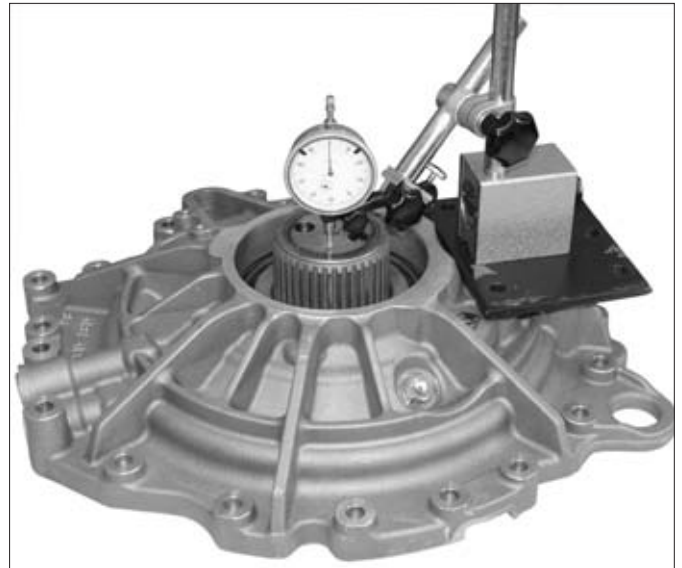
025504

10 Press on the taper roller bearing (1) by means of a suitable thrust piece (2).



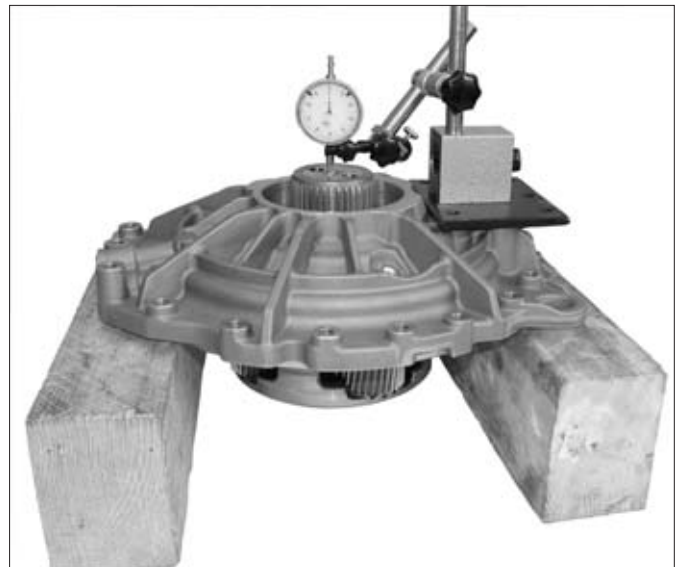
025505/025506

- 11 Prepare measurement setup. To this end, the planet carrier must have contact. Ensure that the output cover is freely moving/accessible. The measurement probe abuts with the output shaft's front face.
- 12 Set the dial gage to zero.



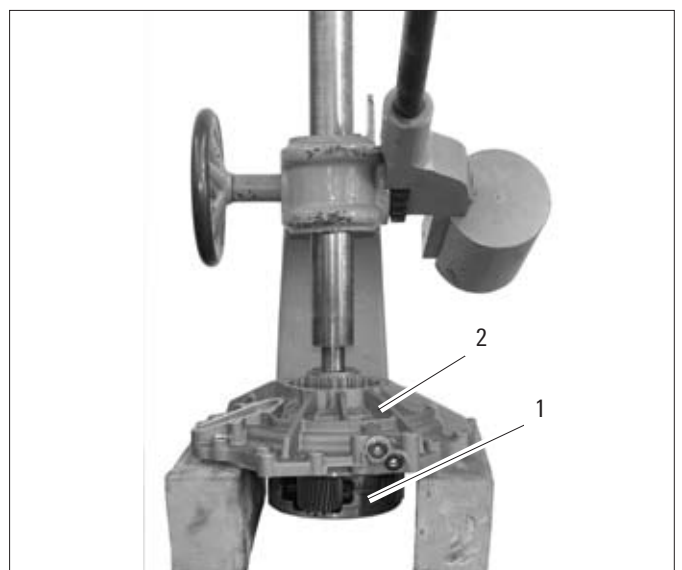
025507

- 13 Prepare measurement setup for measurement II on square skids. Ensure that the output cover has contact with the skids at both ends. The planet carrier must not have ground contact. The position of the dial gage and its support/bracket must not be changed.
- 14 Now, the dial gage shows the axial clearance of the output shaft:
Dimension B (e.g. 0.15 mm)



025508

- 15 Press out the planet carrier (1) once again from the output cover (2).



025509

- 16 Calculation of the preload:

V_{Soll} = nominal dimension of preload

= 0,02 up to 0,07 mm

S = thickness of the shim, adjusting disk

Dimension C = dimension A - dimension B

S = dimension C - V_{Soll}

Example:

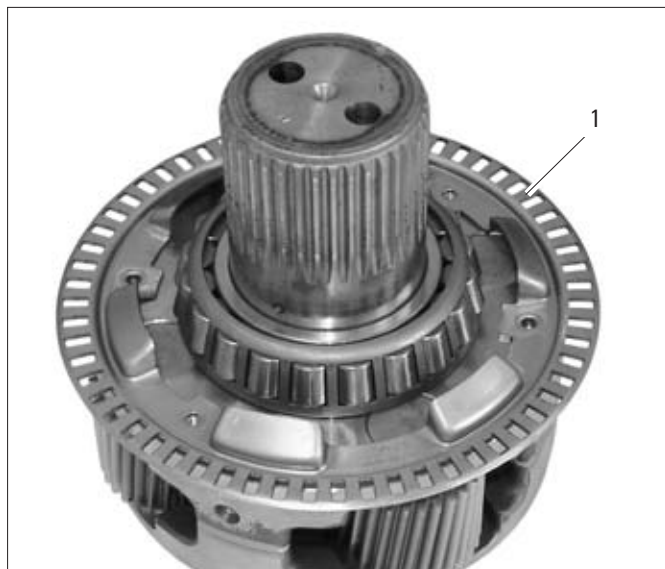
Dimension C = 14,63 mm - 0,15 mm

= 14,48 mm

S = 14,48 mm - 0,05 mm

S = 14,43 mm

- 17 Put on the inductive sensor ring (1).



025510

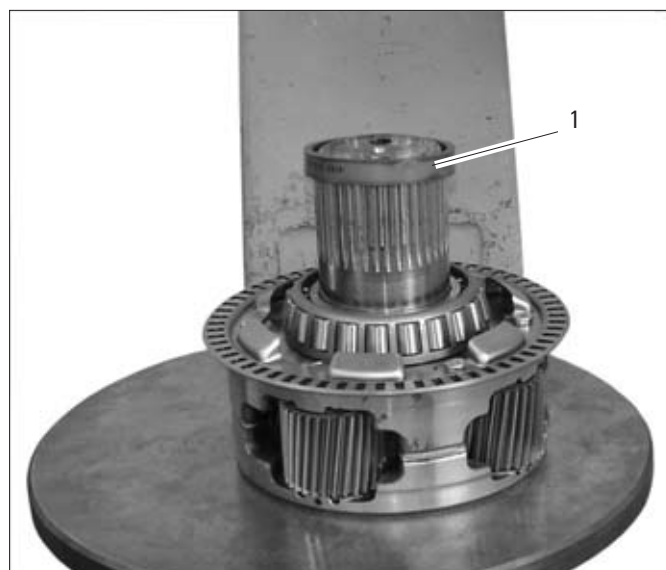
- 18 Screw in four M6x12 TORX screws (1) and tighten.

Tightening torque: 9.5 Nm



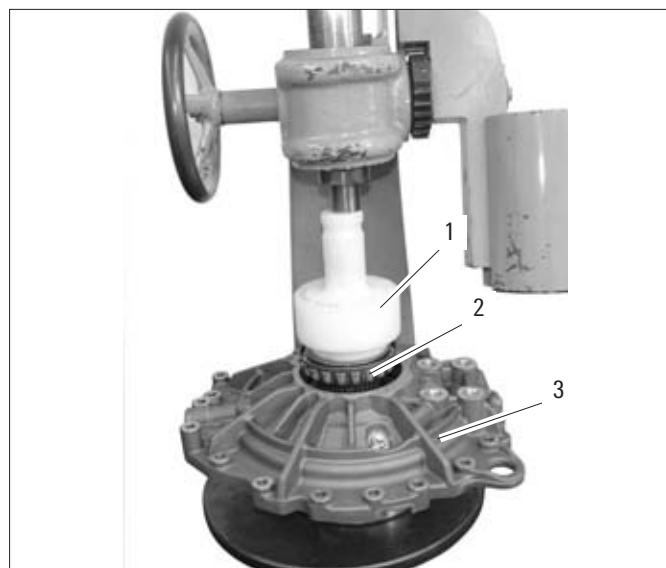
025511

- 19 Put on the standard distance disk **(1)** and the distance disk from OTK no.: **0730 113 417** with the calculated shim thickness "S".



025512

- 20 Put on the output cover **(3)**.
- 21 Insert the taper roller bearing **(2)** and press in with a suitable thrust piece no.: **1X56 138 654 (1)**.

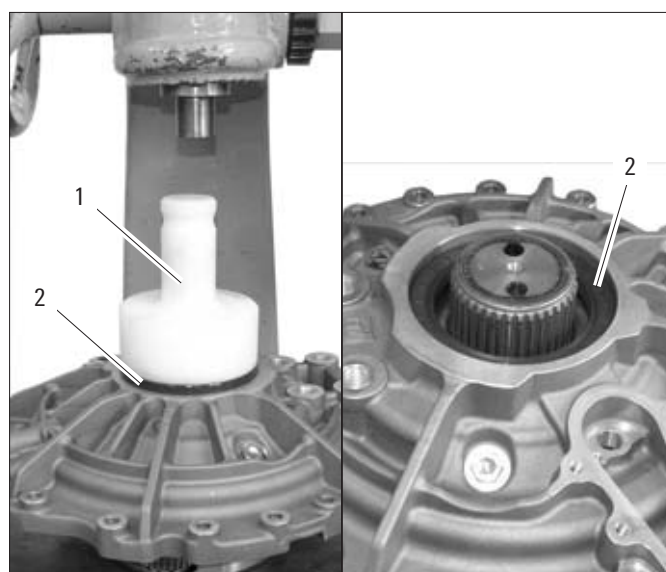


025513

- 22 Coat the shaft sealing ring **(2)** with washing-up liquid.
- 23 Press in the shaft sealing ring **(2)** with the thrust piece no.: **1X56 138 625 (1)**.

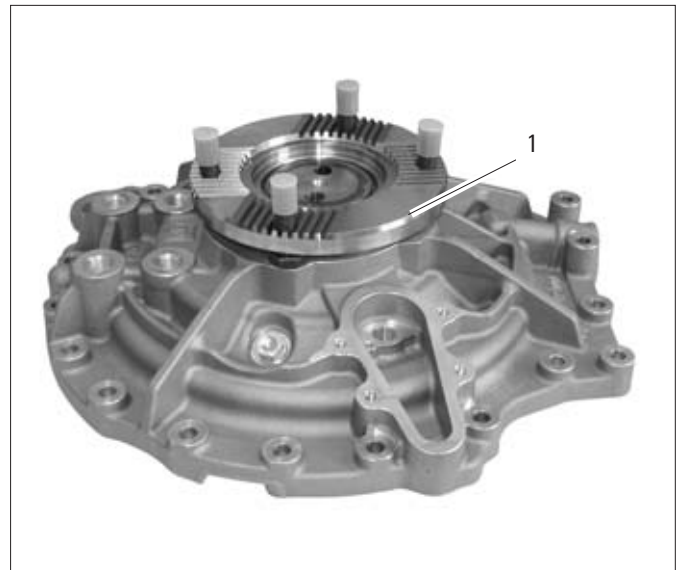
NOTE

The installation dimension is pre-determined by the tool.



025514/025515

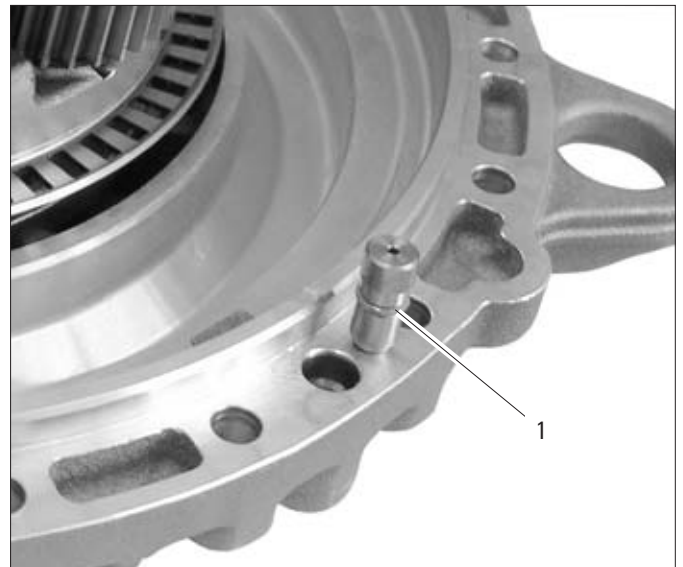
- 24 Insert the output flange (1).



025516

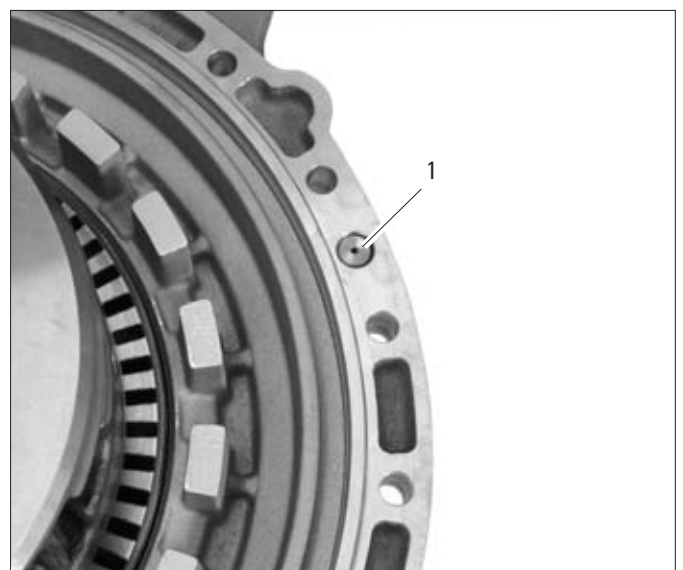
- 25 Coat O-ring (1) with technical Vaseline.

- 26 Mount the O-ring (1) on the vent valve "F".



025521

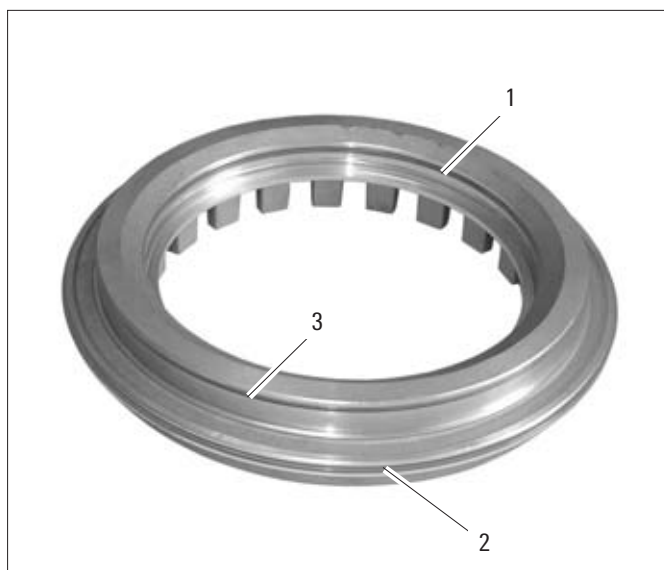
- 27 Insert the vent valve "F" (1).



025519

28 Coat three sealing rings **(1, 2, 3)** of the piston F with technical Vaseline.

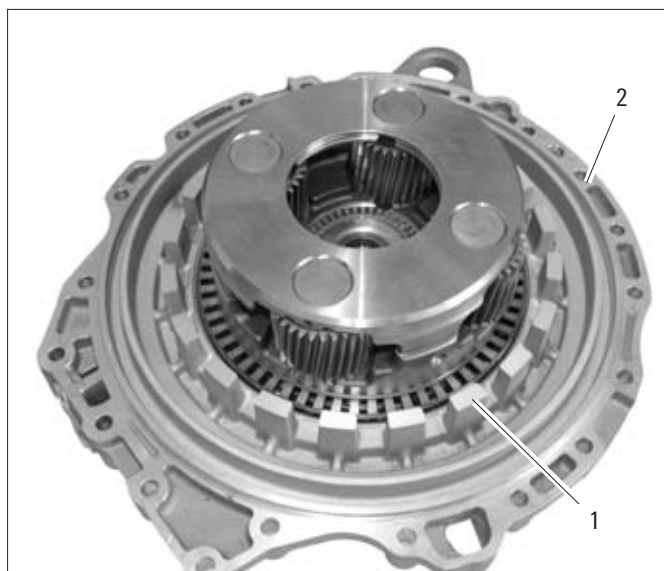
29 Insert the three sealing rings **(1, 2, 3)** in the piston "F".



025517

30 Coat the piston races of the piston "F" with technical Vaseline.

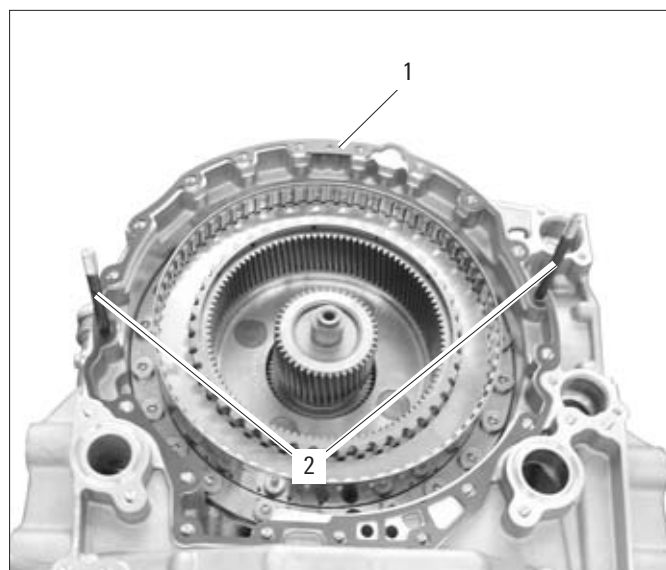
31 Insert the piston "F" **(1)** in the output cover **(2)** and cautiously drive it in by means of light plastic hammer blows until firmly home.



025518

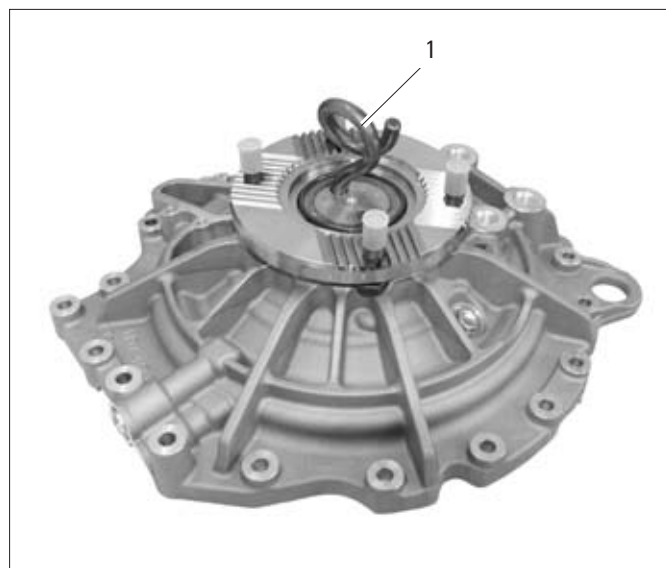
16.6 Installing the Output Cover

- 1 Put on the seal **(1)**.
- 2 Screw in the two M10 guide screws **(2)**.
- 3 Screw in the lifting equipment no.: M12 **1X56 136 599 (1)** in the output flange at the output cover.

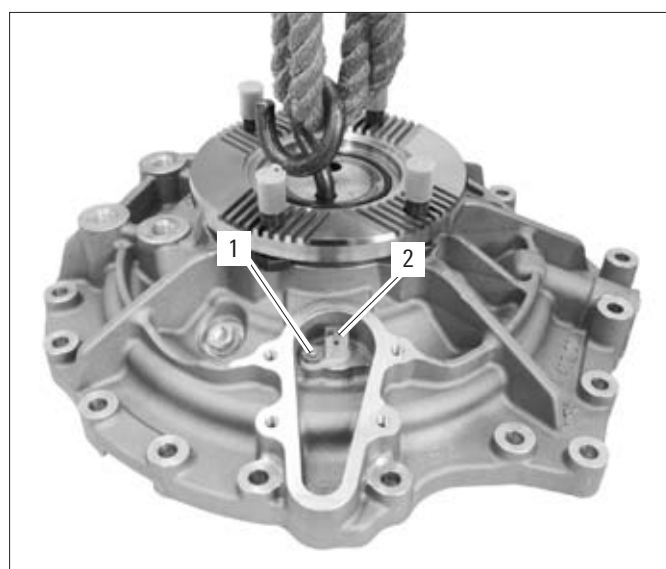


025575

- 4 Insert the inductive sensor output **(2)**.
- 5 Screw in the M6x17 TORX screw **(1)** and tighten.
Tightening torque: 9.5 Nm

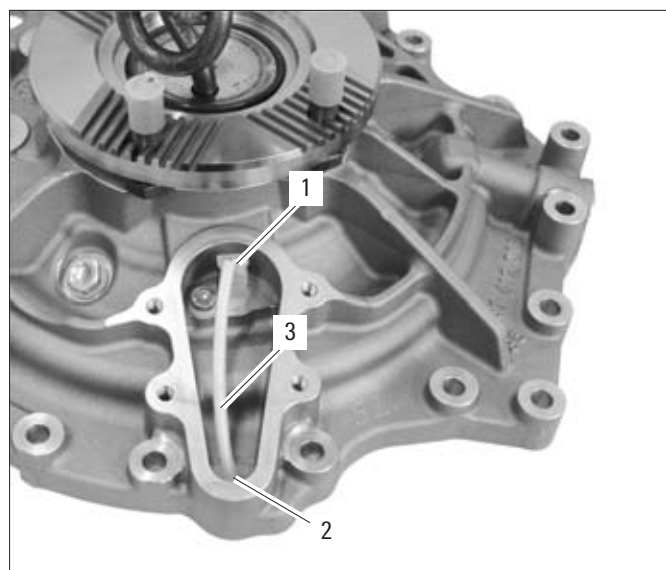


025579



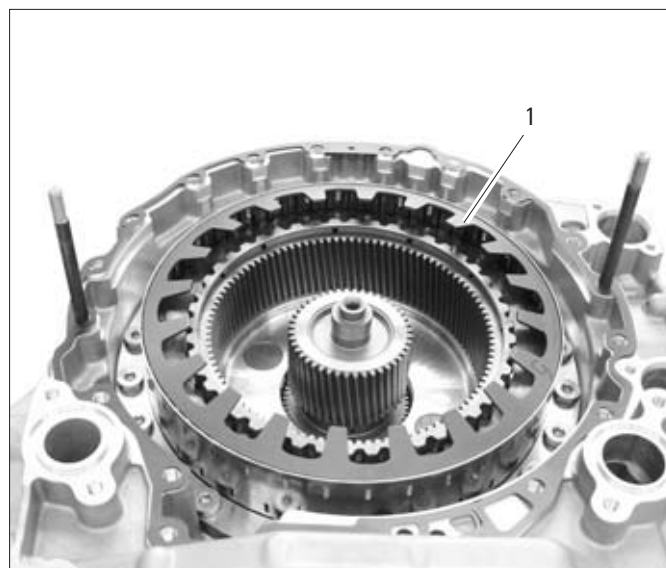
025581

- 6 Route the cable of the inductive sensor **(3)** through the existing orifice **(2)** at the output cover.
- 7 Plug in the connector **(1)** at the inductive sensor.



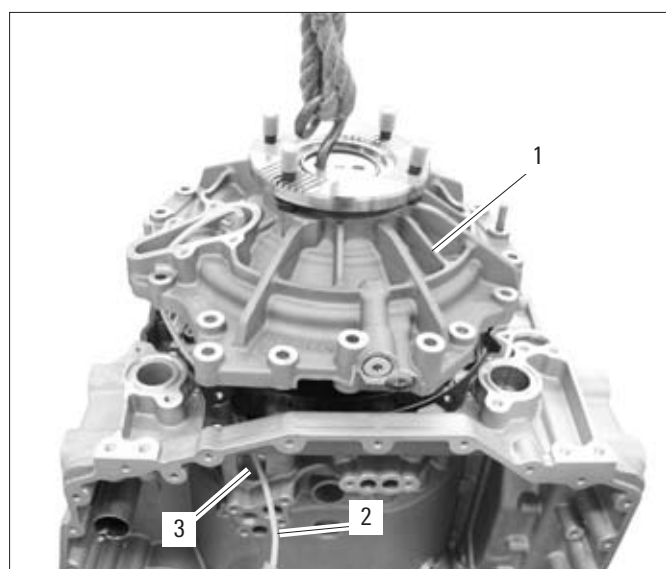
025582

- 8 Insert the readjusting spring **(1)**.



025580

- 9 Lift up the output cover **(1)** by means of a crane and position on top of the transmission housing.
- 10 Guide the cable of the inductive sensor **(3)** through the existing orifice **(2)** at the transmission housing.



025583

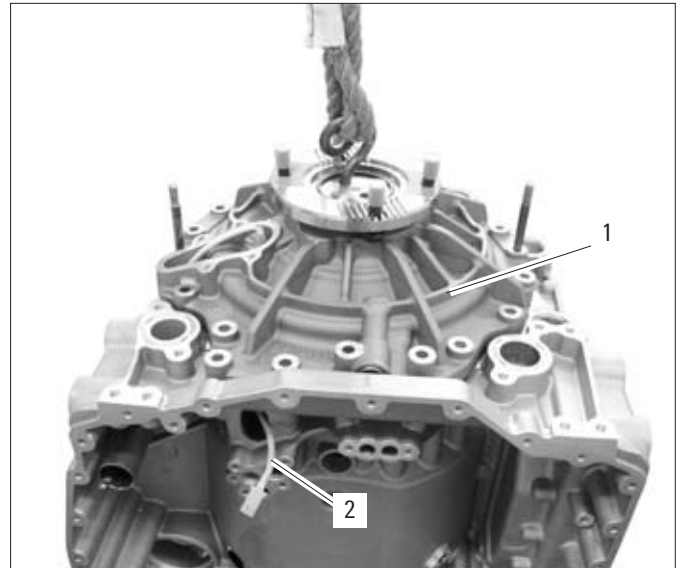
- 11 Lower the output cover (1) and insert it in the transmission housing.

CAUTION

When lowering the output cover, ensure that the cable of the inductive sensor (2) is not damaged.

NOTE

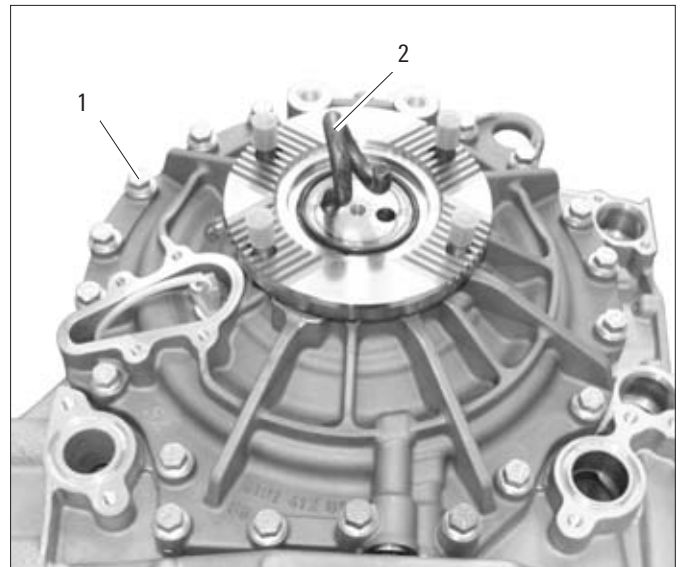
When lowering the output cover, turn the flange so that the planet gears can engage with the sun gear and the internal ring gear.



025584

- 12 Screw in the M10x53 and M10x73 hex head screws/bolts (1) in the output cover and tighten.
Tightening torque: 46 Nm

- 13 Unscrew the lifting equipment no.:
1X56 136 599 (2).



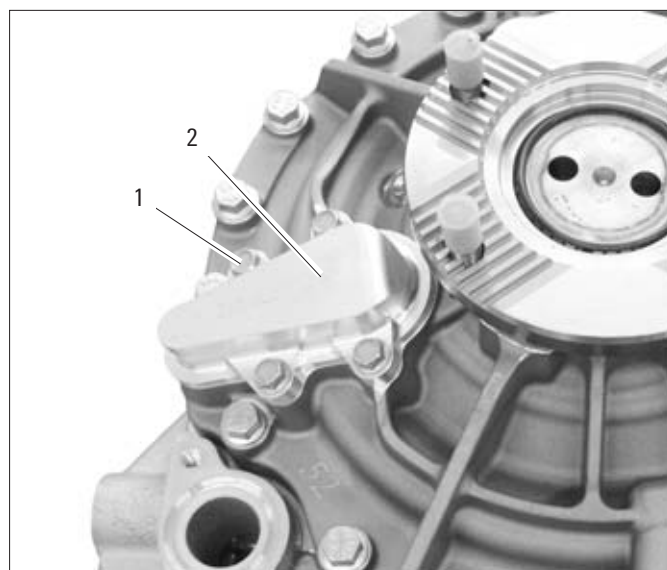
025585

- 14 Insert the form ring (1) in the cover of the inductive sensor (2).



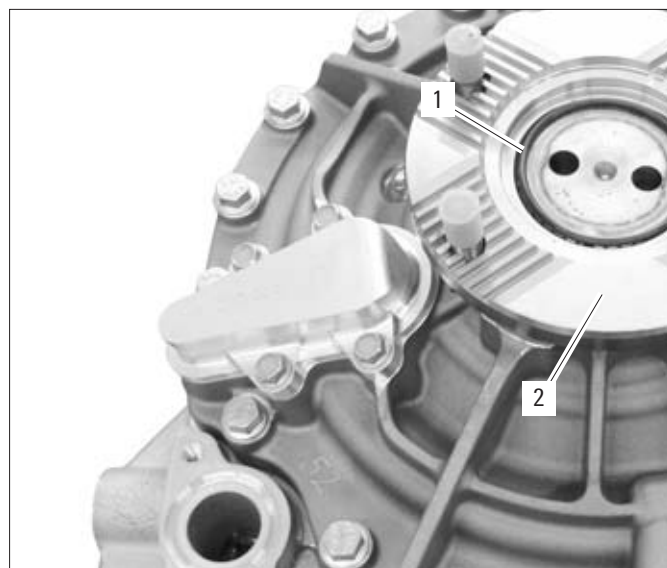
024190

- 15 Put the cover of the inductive sensor **(2)** on the output cover.
- 16 Screw in four M8x30 hex head screws/bolts **(1)** and tighten.
Tightening torque: 23 Nm



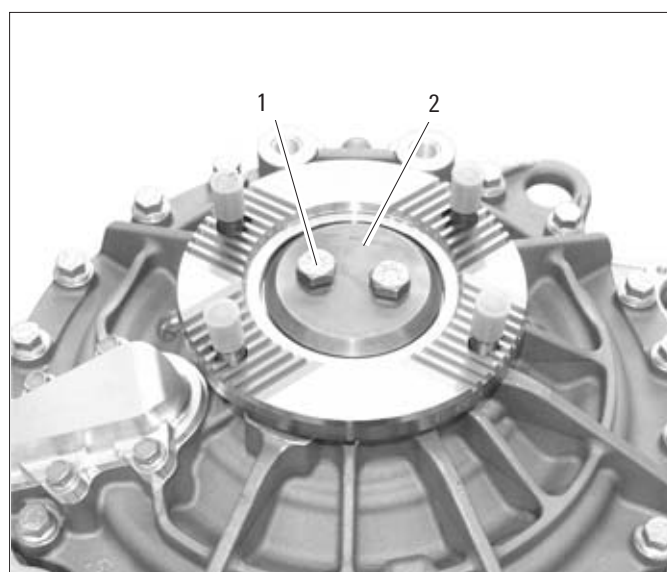
025586

- 17 Insert the O-ring **(1)** in the output flange **(2)**.



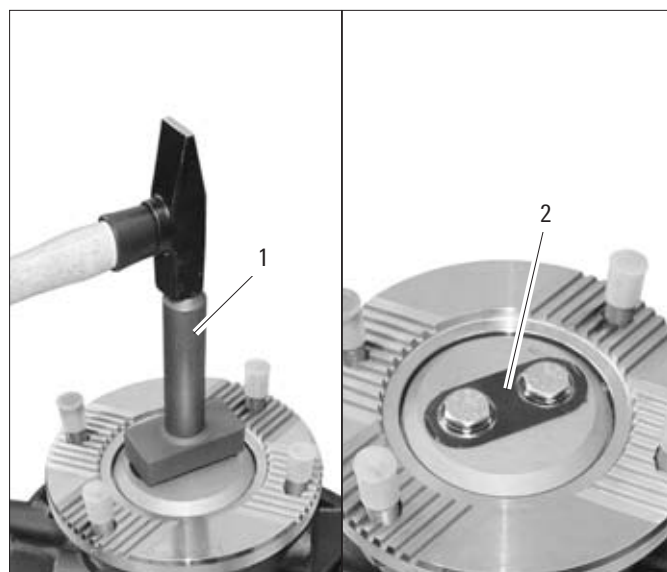
025586

- 18 Put on the bolster plate **(2)**.
- 19 Screw in two hex head screws/bolts M12x60 **(1)** and tighten.
Tightening torque: 80 Nm



025587

- 20 Drive on the locking plate **(2)** (part number: 4132 304 015) with the tool no.: **1X56 137 452 (1)**.

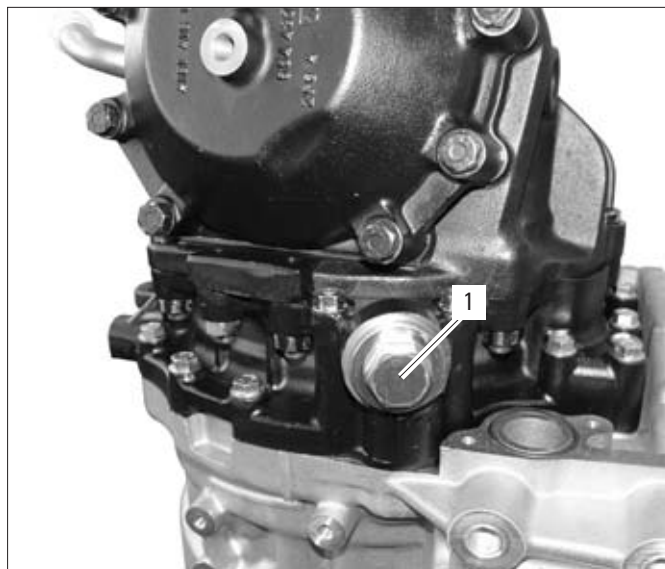


030310/030311

17 Installing, Removing, Dismantling, and Assembling the Angle Drive

17.1 Removing the Angle Drive From the Transmission

1 Unscrew the screw plug (1).



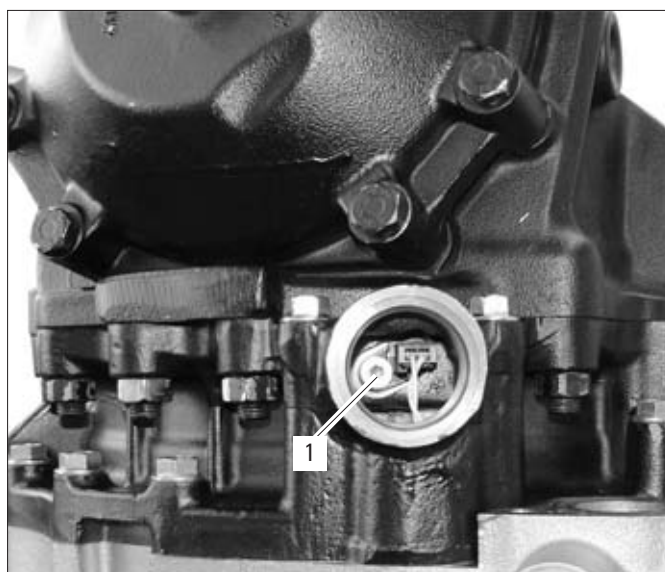
030145

2 Take off the O-ring (2) from the screw plug.



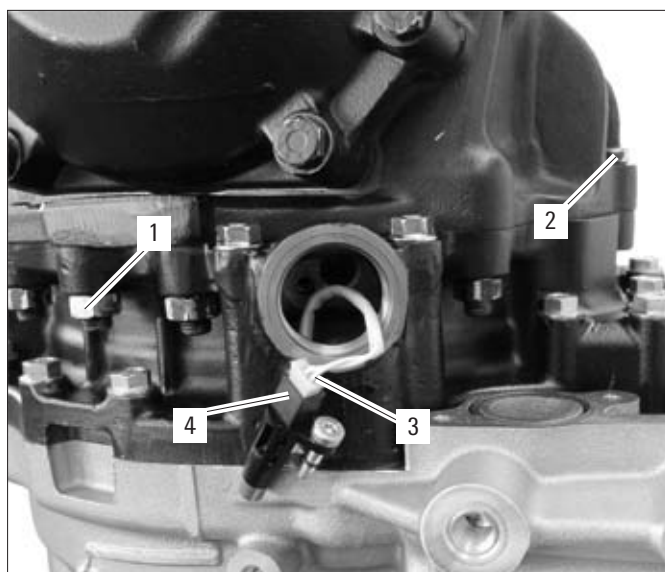
030146

3 Unscrew the TORX screw M6 (1).



030147

- 4 Take out inductive sensor output (4) with the cable.
- 5 Unplug the connector (3).
- 6 Loosen five screws/bolts (2) and seven M14 nuts (1) - but do not unscrew yet.



030148

- 7 Unscrew 18 M10 hex head screws/bolts (1) at the circumference.



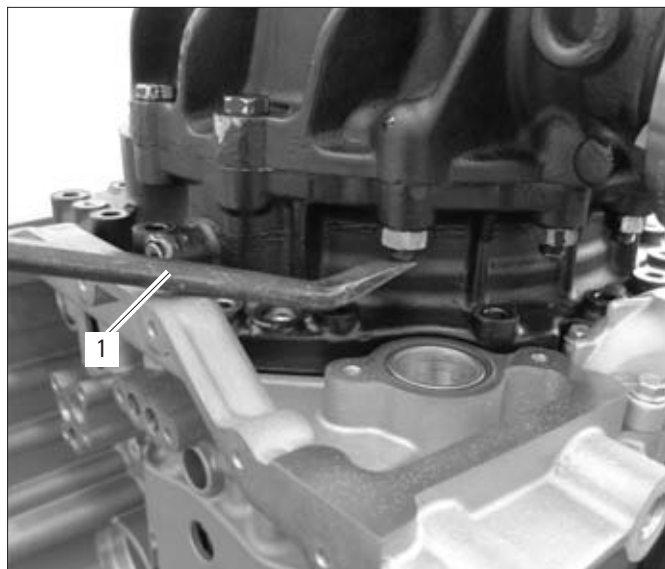
030149

- 8 Unscrew two M10 hexagon nuts (1).



030150

- 9 Mount the lifting equipment at the angle drive and use crane to apply load.
- 10 Cautiously loosen the angle drive by means of an iron (rim tool) **(1)** and slowly lift off from the transmission by means of a crane.
- 11 Take off the cable from the inductive sensor output.
- 12 Release the angle drive by means of a crane at a suitable location.



030151



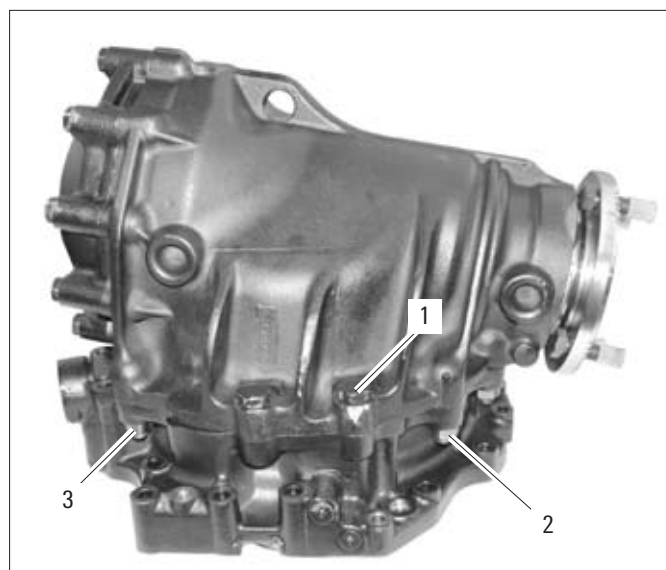
030152

17.2 Dismantling the Angle Drive and the Connecting Housing

17.2.1 Dismantling the Angle Drive

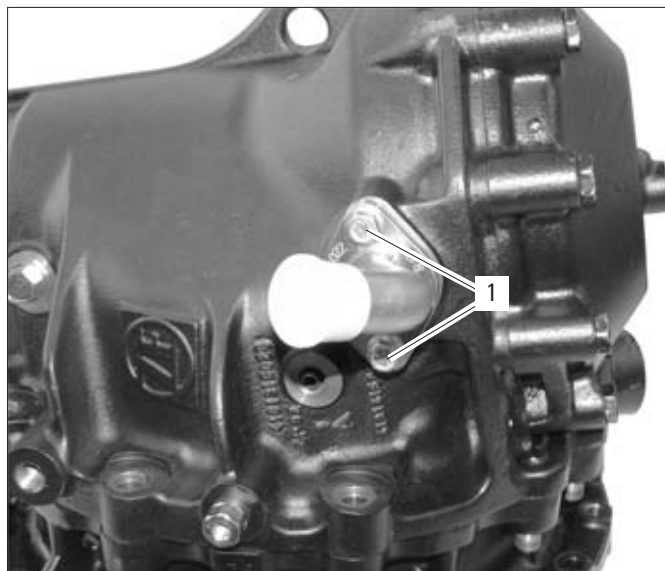
- 1 Disconnect all screwed connections **(1, 2, 3)** between the connecting housing and the angle drive:

- Five M14x1.5 screws/bolts
- Seven M14x1.5 nuts



030221

- 2 Unscrew the two hexagon head screws/bolts **(1)** at the oil filler tube.



030222

- 3 Pull out the oil filler tube and take out the O-ring **(1)**.



030223

- 4 Unscrew the two hexagon head screws/bolts **(1)** at the output flange.
- 5 Take off the bolster plate **(2)**.



030224

- 6 Remove the output flange **(2)**.
- 7 Take off the O-ring **(1)**.



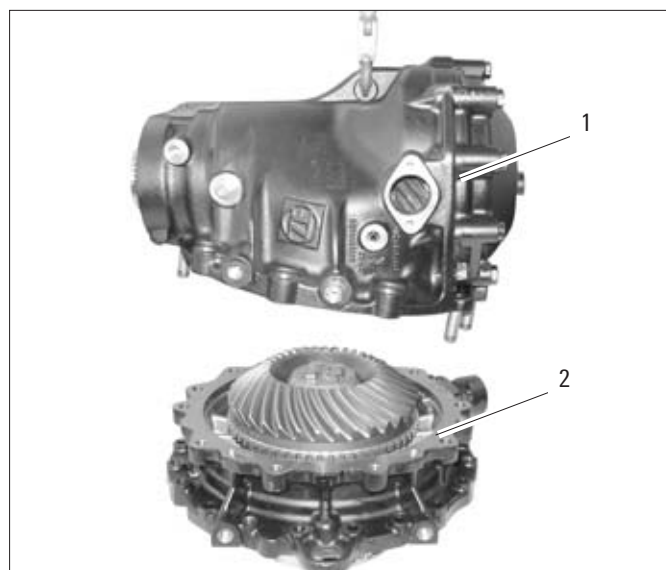
030225

- 8 Take out the spacer bush **(1)**.



030226

- 9 Attach the lifting equipment.
- 10 Take off the angle drive (1) with a crane from the connecting housing (2).



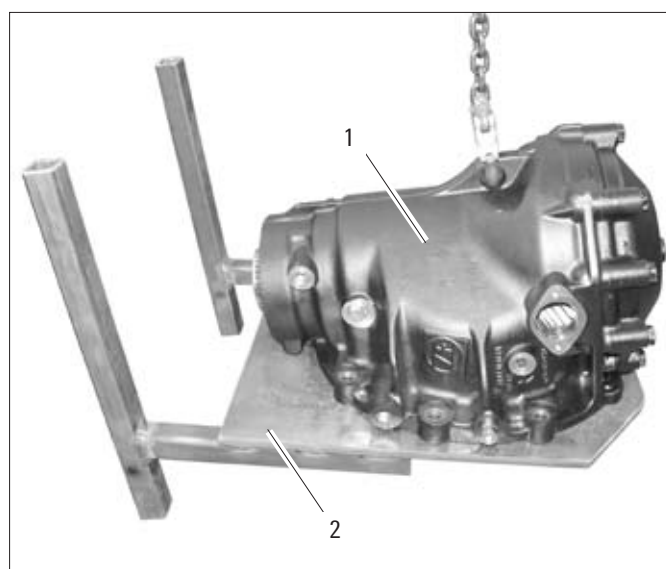
030227

- 11 Take out the O-ring (1) from the angle drive's housing.



030353

- 12 Put the angle drive (1) on the assembly support no.: 1X56 138 647 (2) and fasten from below by means of two nuts.



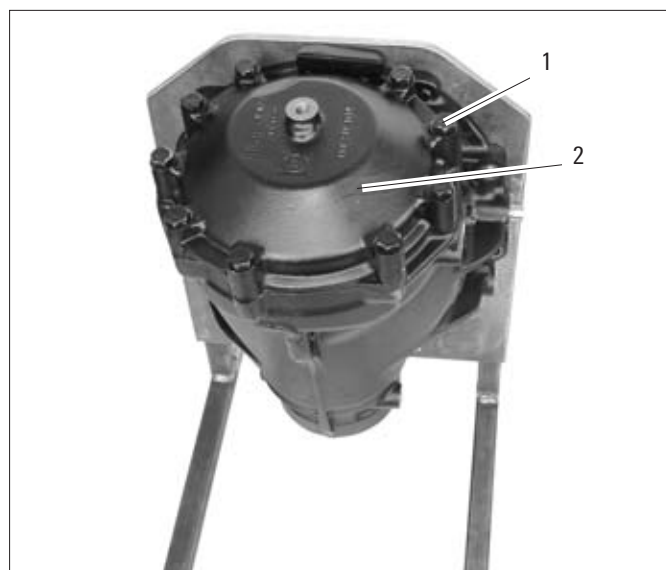
030228

13 Unscrew nine M12 hex head screws/bolts (1).

14 Take off the cover (2).

NOTE

If required, loosen the cover with the aid of a plastic hammer.



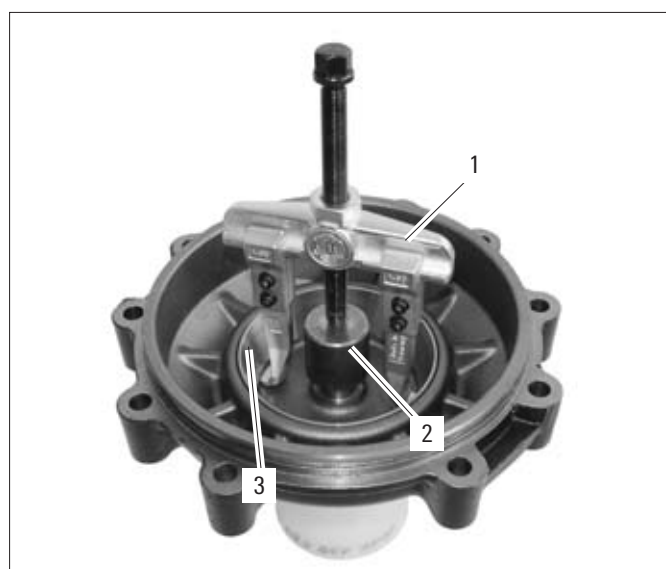
030229

15 Remove the O-ring (1).



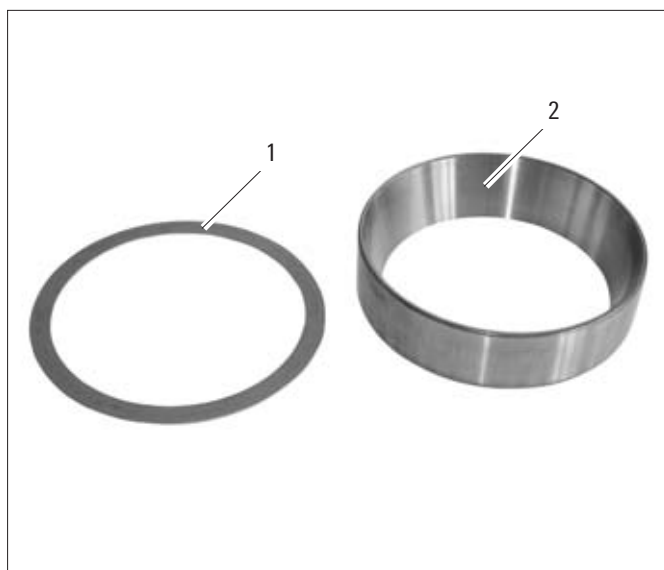
030230

16 Pull off the bearing shell (3) by means of a suitable two-armed extractor (1) and a suitable thrust piece (2).



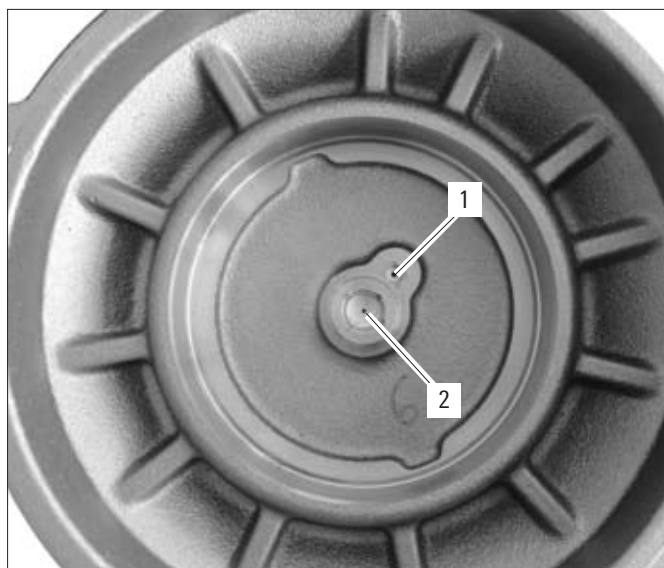
030231

- 17 Take out the bearing shell (2) and the adjusting disk (1).



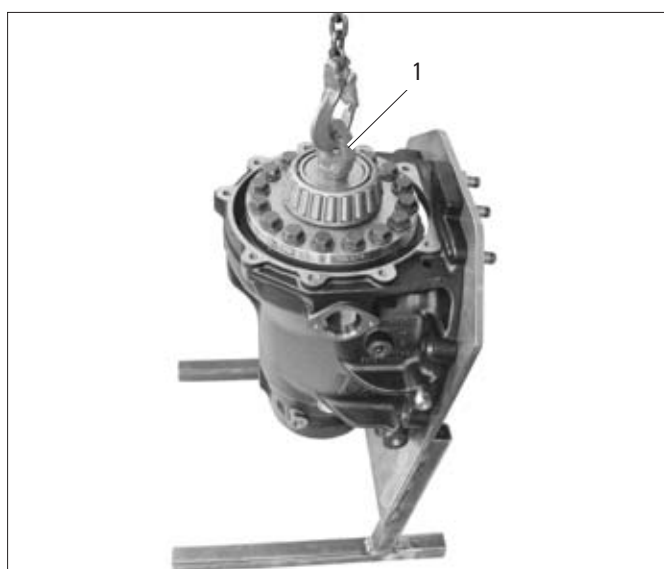
030232

- 18 Check whether the apertures (1) and (2) the cover are freely moving/freely accessible, if necessary, clean these.



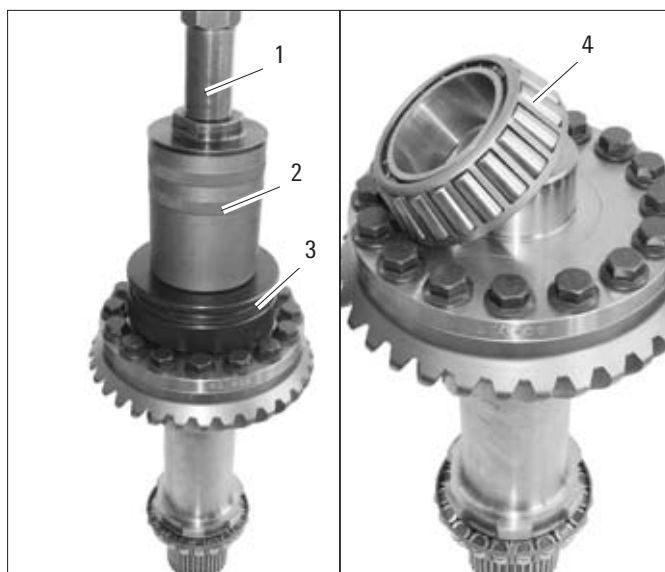
030233

- 19 Screw in the lifting equipment no.: **1T66 160 889 (1)**.
- 20 Mount the lifting equipment.
- 21 Lift out the shaft from the angle drive by means of a crane.



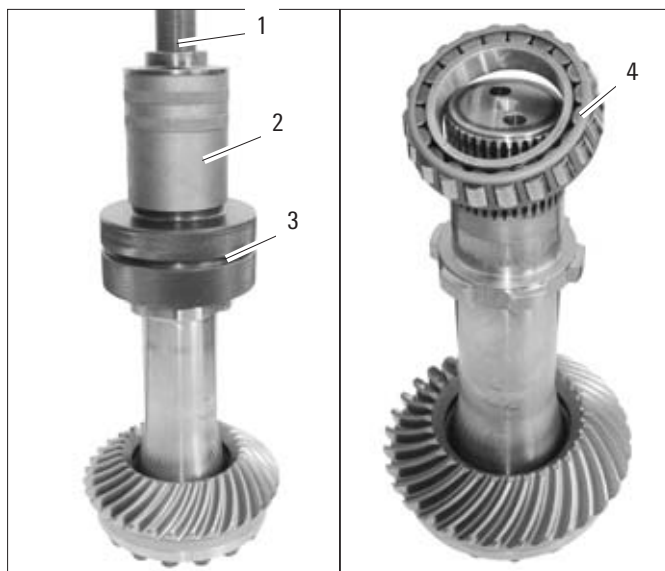
030234

- 22 Remove the tapered roller bearings **(4)** with the extractor no.: **1X56 136 705 (3)**, the basic device no.: **1X56 122 306 (2)**, and the hydraulic spindle no.: **1X56 122 292 (1)**.



030235/030236

- 23 Remove the tapered roller bearings **(4)** with the extractor no.: **1X56 138 596 (3)**, the basic device no.: **1X56 122 306 (2)**, and the hydraulic spindle no.: **1X56 122 292 (1)**.



030237/030238

- 24 Unscrew 16 M12 hex head screws/bolts **(1)**.

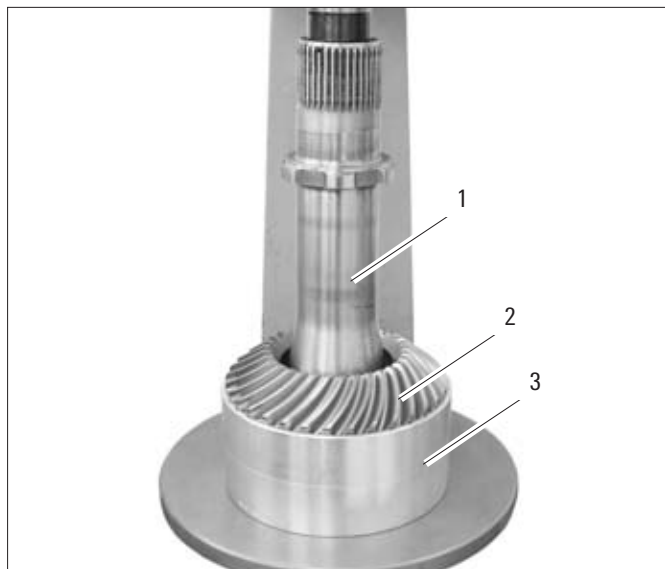


030275

25 Put the tool no.: **1X56 138 622 (3)** on the press.

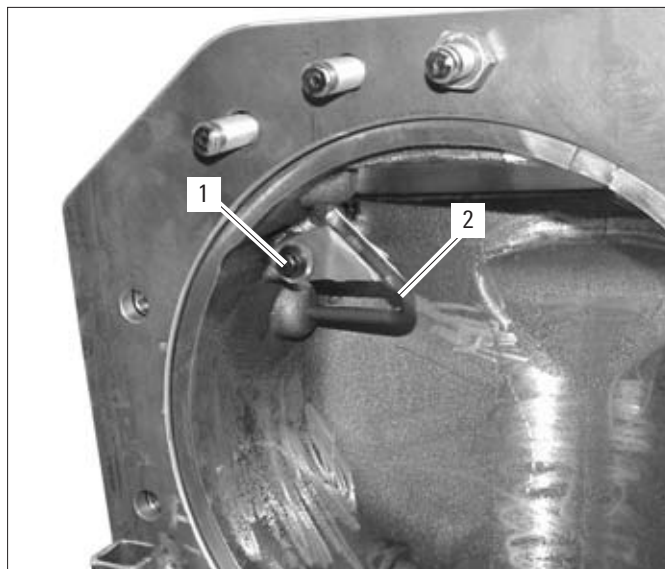
26 Put the shaft **(1)** on the tool no.:
1X56 138 622 (3).

27 Press out the shaft **(1)** from the bevel gear **(2)**.



030239

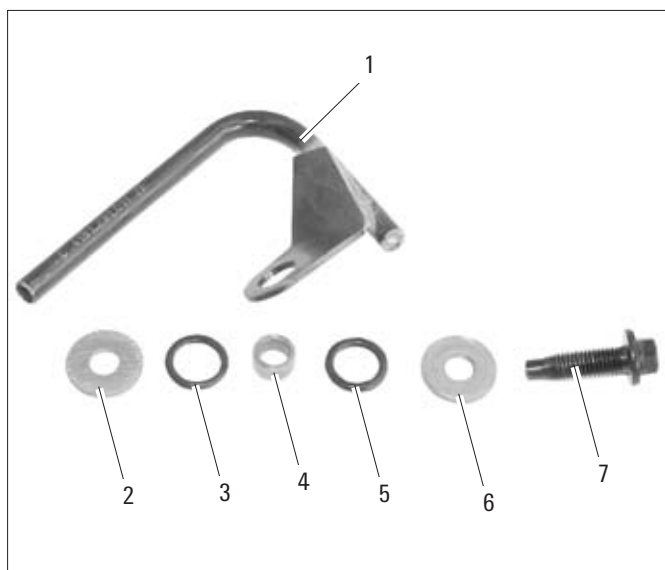
28 Unscrew the M8 hex head screw/bolt **(1)** from the spray tube **(2)**.



030240

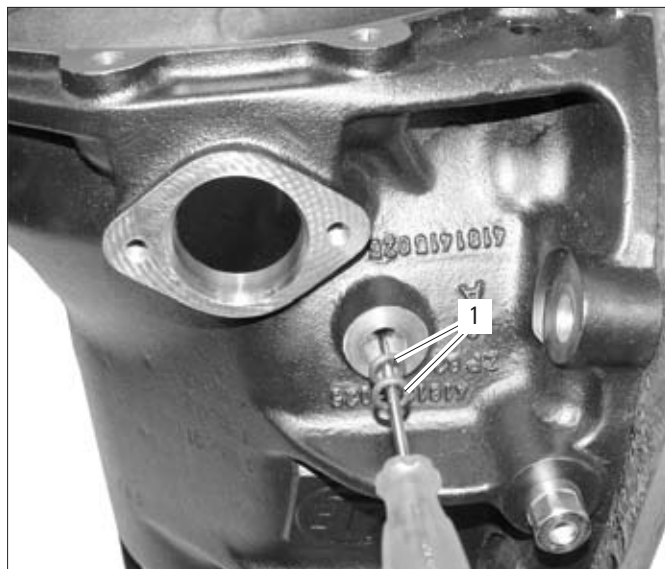
29 Take off the spray tube **(1)** with the add-on parts:

- Two disks/shims **(2, 6)**
- Two O-rings **(3, 5)**
- Spacer piece **(4)**
- Hex head screw/bolt **(7)**



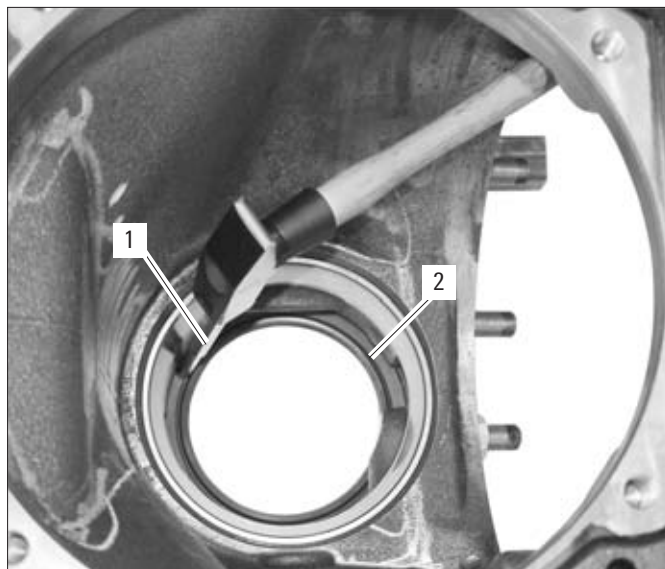
030241

- 30 Remove two O-rings at the outer sides (1).



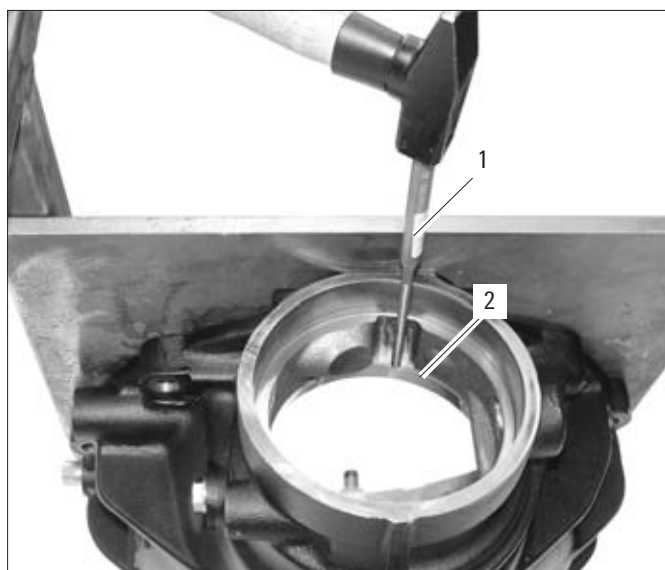
030242

- 31 Drive out the shaft sealing ring (2) with a suitable mandrel (1).



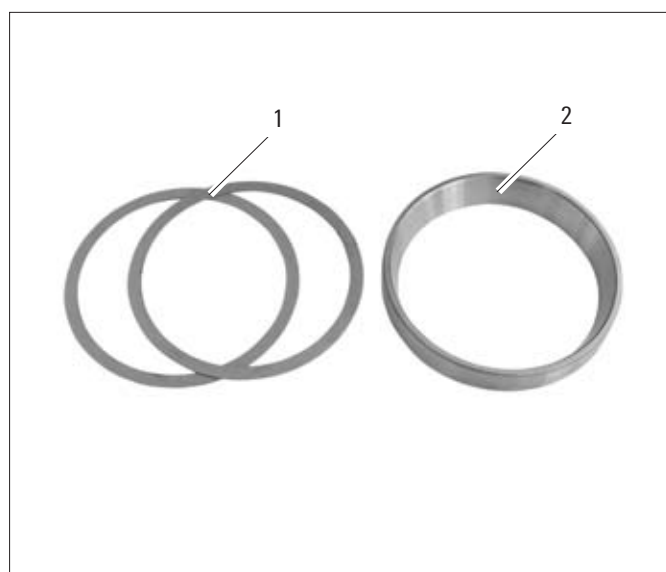
030243

- 32 Drive out the outer bearing ring (2) from the housing by means of a suitable mandrel (1).



030299

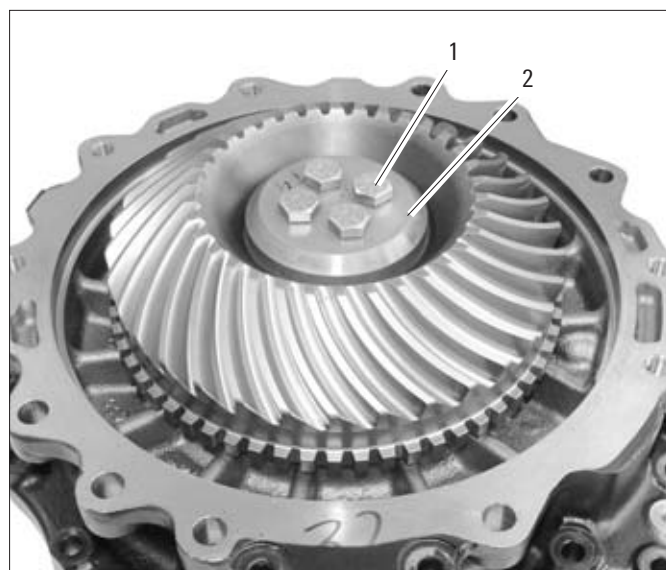
- 33 Take out the outer bearing ring **(2)** with the two adjusting disks **(1)**.



030244

17.2.2 Unscrew the four M12 hex head bolts/screws

- 1 Unscrew the four M12 hex head bolts/screws (1).
- 2 Take off the bolster plate (2).



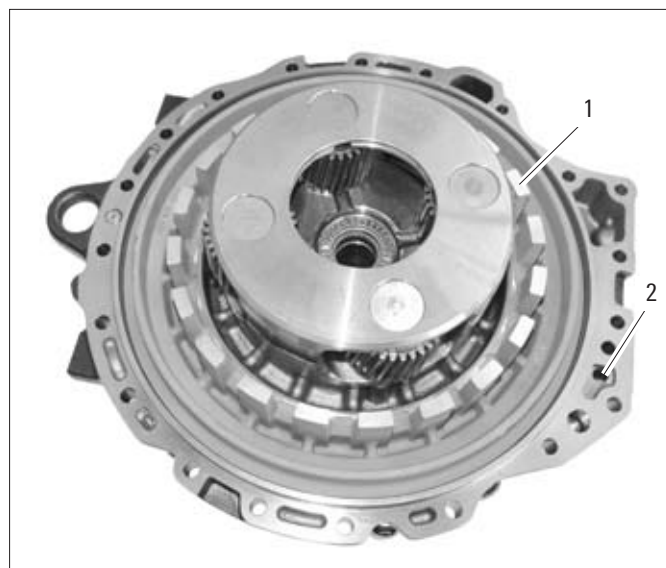
030245

- 3 Insert compressed air in the duct (2) in order to loosen up the piston "F" (1).

CAUTION

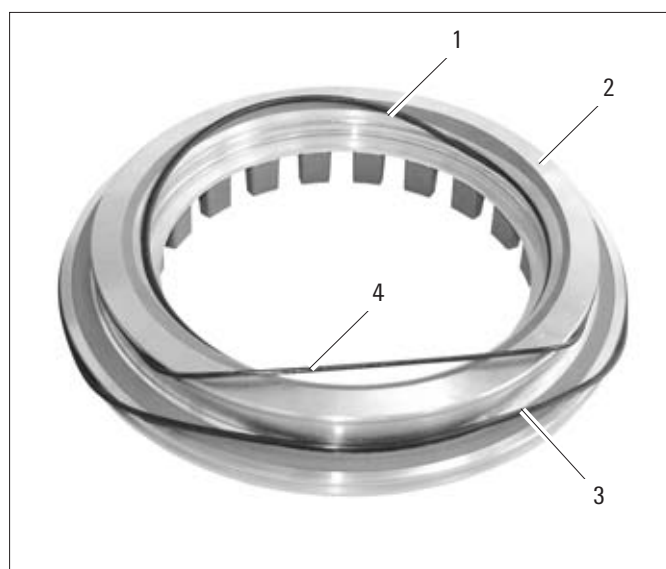
Oil may spray out. Cover up the compressed-air pistol with a cloth.

- 4 Take out the piston "F" (1).



030247

- 5 Take off the three sealing rings (1, 3, 4) from the piston "F" (2).

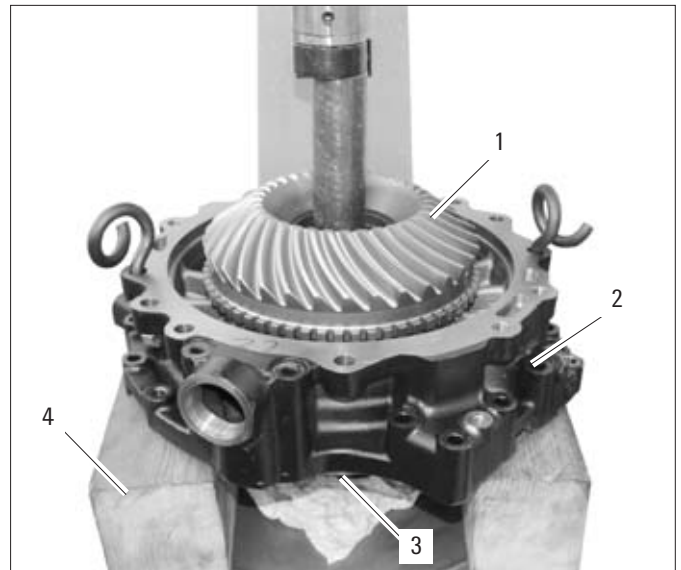


030248

- 6 Cushion the connecting housing (2) on the press with square skids (4) in accordance with the illustration.
- 7 Press out the planet carrier III (3) from the input gear (1).

CAUTION

Ensure that you furnish soft material for cushioning purposes in order to avoid damage.

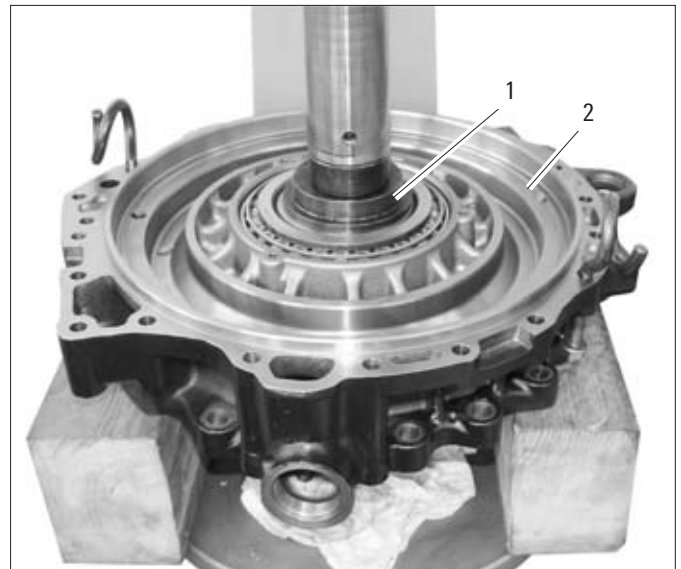


030249

- 8 Turn the connecting housing (2) around.
- 9 Press out the input gear of the angle drive with a suitable thrust piece (1).

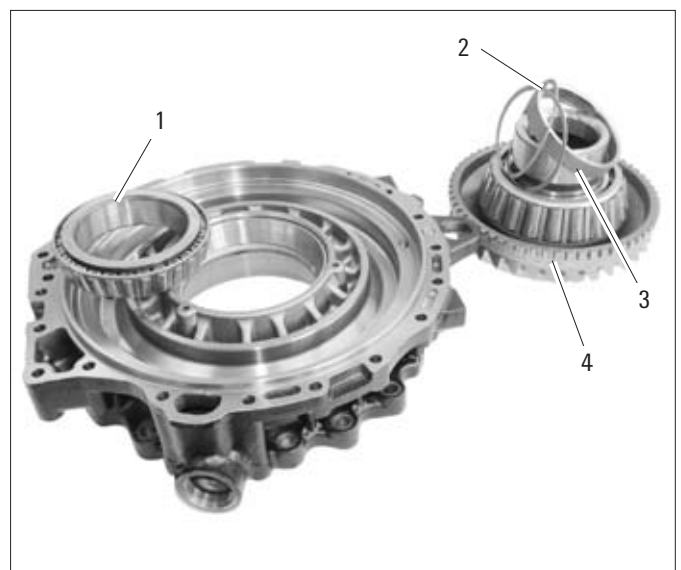
CAUTION

Ensure that you furnish soft material for cushioning purposes in order to avoid damage.



030250

- 10 Take out the input gear (4), the tapered roller bearing (1), the bush (3), and the two adjusting disks (2).



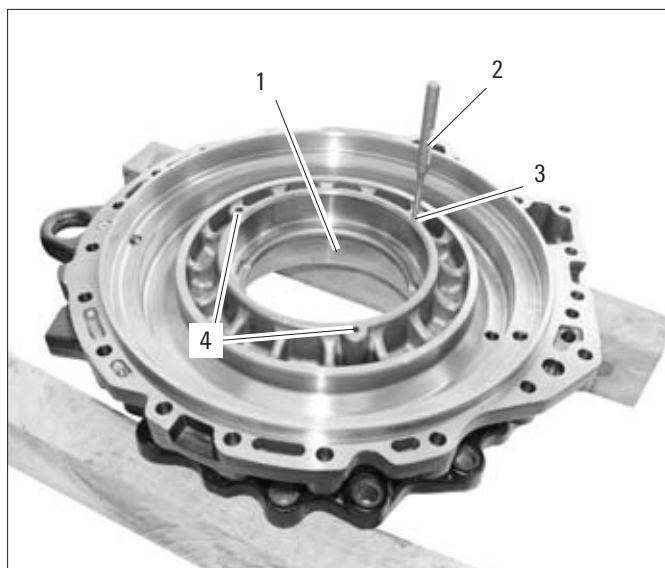
030251

- 11 Drive out the outer bearing ring (2) by means of a suitable mandrel (1).



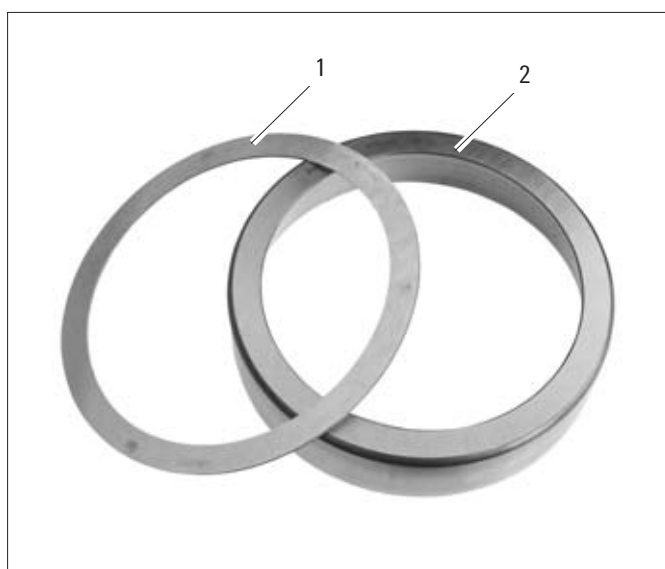
030252

- 12 Drive out the outer bearing ring (1) through the bores (3, 4) from the back by means of a suitable mandrel (2).



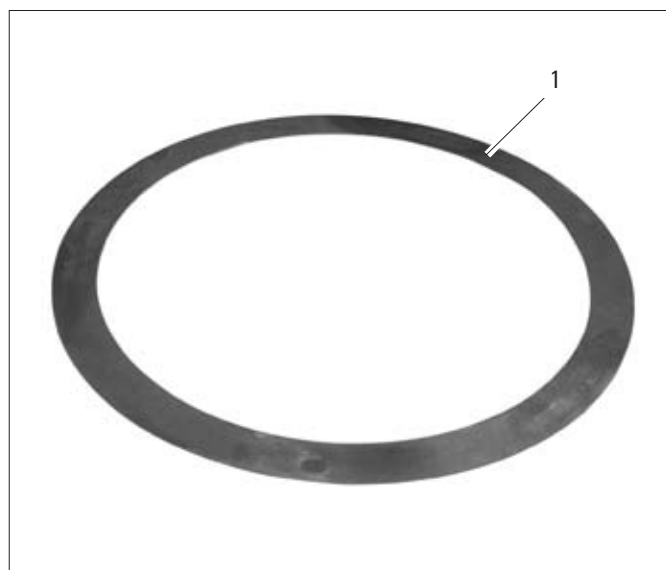
030253

- 13 Take out the outer bearing ring (2) and the adjusting disk (1).



030254

- 14 Remedy possible damage at the adjusting disk **(1)** by means of an oil stone which may have been caused during the press-out process.



030267

- 15 Lightly inject air in the orifice **(1)** by means of the compressed-air pistol in order to release the vent valve "F" **(2)**.

CAUTION

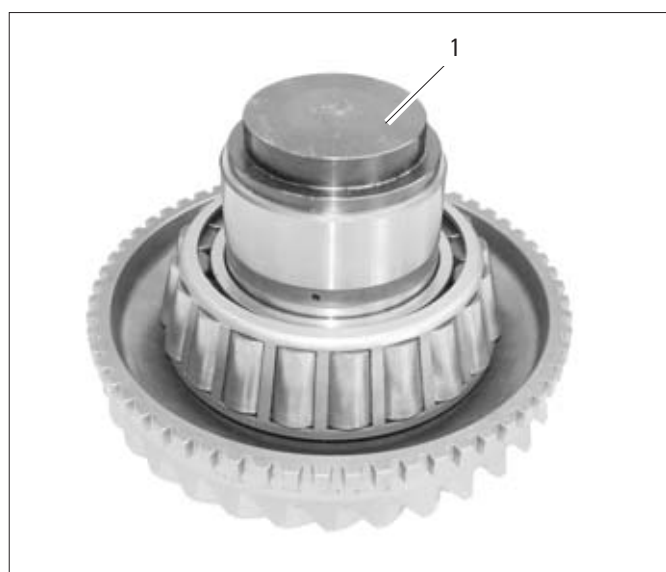
Oil may spray out. Cover up the compressed-air pistol with a cloth.

- 16 Take out the vent valve "F" **(2)**.



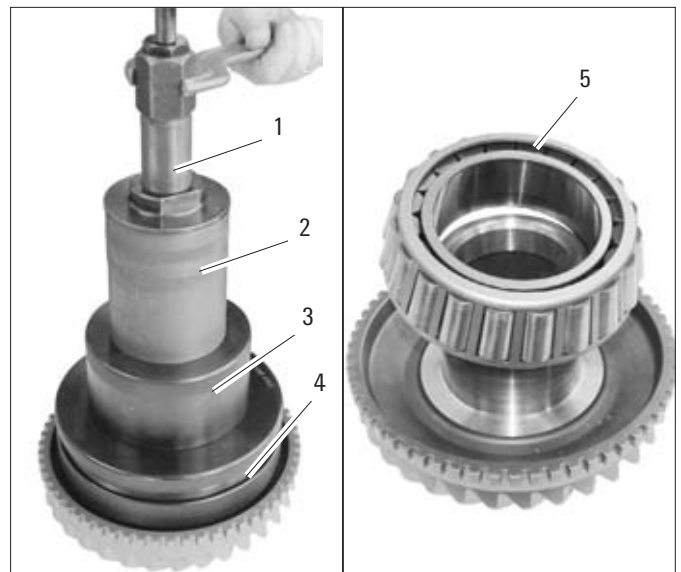
030255

- 17 Put on a suitable thrust piece **(1)**.



030257

- 18 Remove the tapered roller bearings (5) with the extractor no.: **1X56 138 643 (4)**, the reducer no.: **1X56 138 130 (3)**, the basic device no.: **1X56 138 130 (2)**, and the hydraulic spindle no.: **1X56 122 292 (1)**.



030258/030259

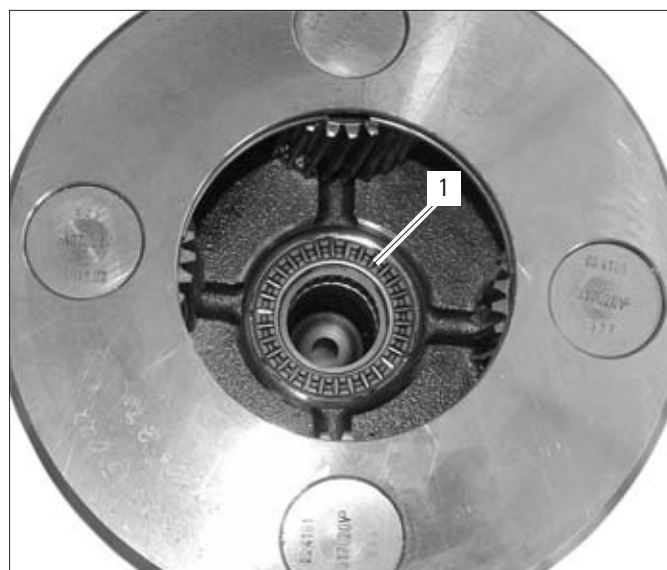
17.3 Assemble and Dismantle the Planet Carrier III

17.3.1 Dismantling the Planet Carrier III

- 1 If required, take out the axial bearing (1).

NOTE

A new bearing must be installed if the bearing was disassembled.

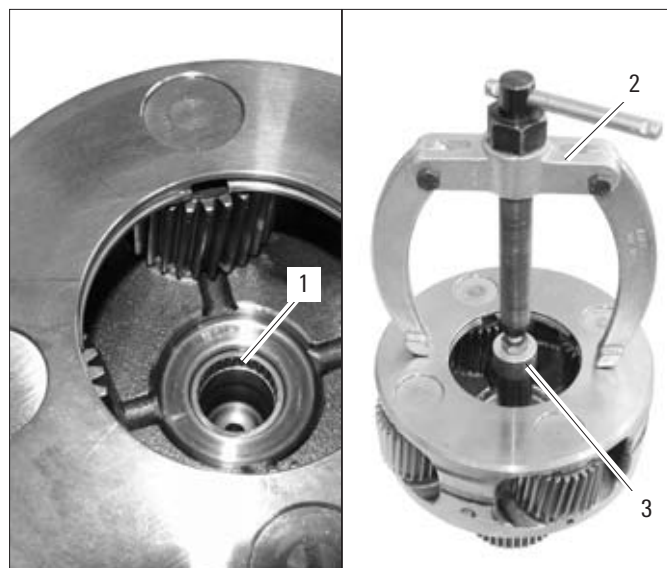


030316

- 2 If required, pull out the needle bearing (1) by means of the internal withdrawal tool no.: **1X56 122 207 (3)** and the two-armed extractor no.: **1X56 122 227 (2)**.

NOTE

A new bearing must be installed if the bearing was disassembled.

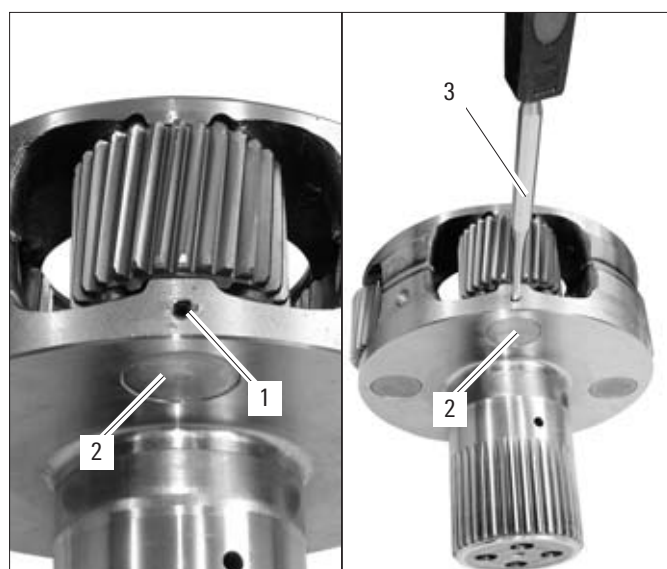


030312/030314

- 3 Release the planetary-gear shaft (2). To this end, cautiously drive in the centering pin (1) by means of a suitable mandrel (3) at the center of the planetary-gear shaft (2).

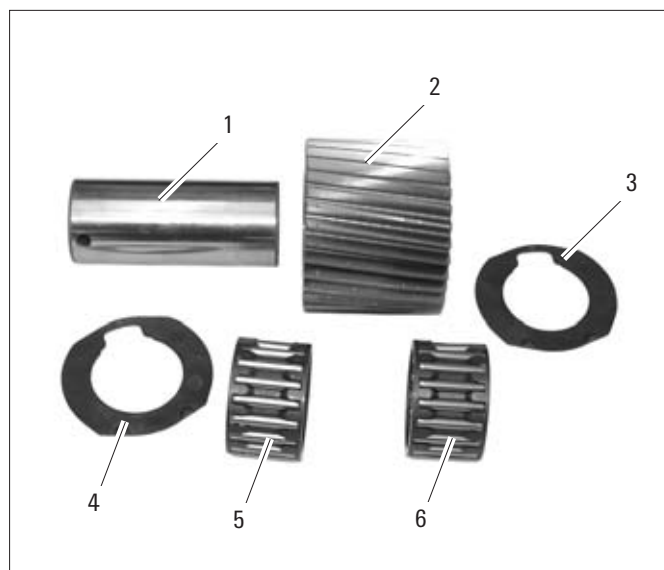
CAUTION

Never drive in centering pins until firmly home.



030317/030318

- 4 Press out the planetary-gear shaft (1) from the planet carrier.
- 5 Take out the planet gear (2).
- 6 Take out the two stop disks (3, 4).
- 7 Take out the two needle bearings (5, 6) from the planet gear.



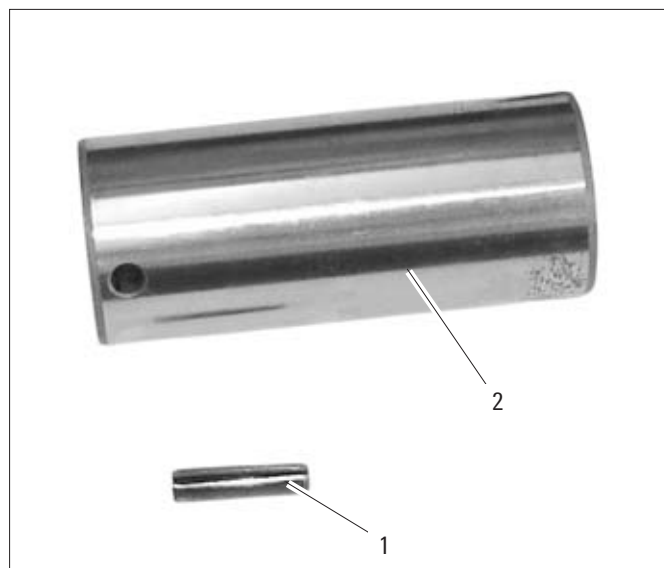
025485

- 8 Clamp the planetary-gear shaft (2) into a vise.

NOTE

Use protective chucks made from aluminum.

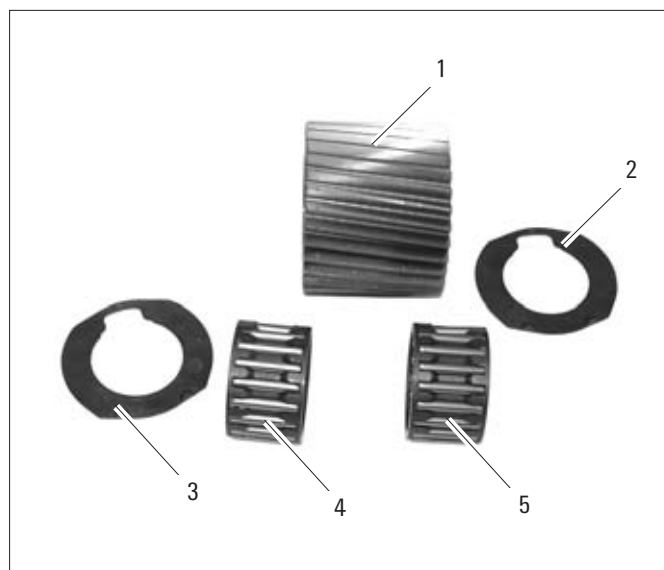
- 9 Drive out the centering pin (1) by means of a suitable mandrel from the planetary-gear shaft (2).
- 10 Repeat the working steps 3. to 9. for the remaining planet gears.



025487

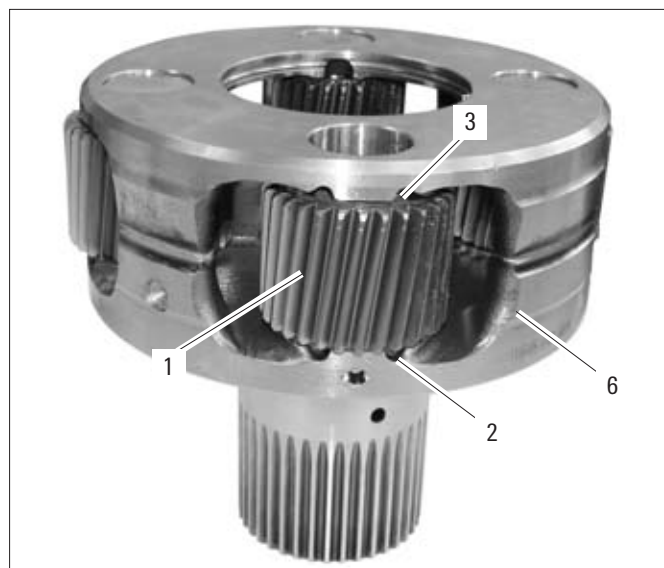
17.3.2 Assemble the Planet Carrier III

- 1 Insert two needle bearings **(4, 5)** in the planet gear **(1)**.



025486

- 2 Insert the planet gear **(1)** with the upper and lower stop disks **(2, 3)** in the planet carrier **(6)**.



030319

- 3 Insert the planetary-gear shaft **(7)**. Here, make sure that the bores for the centering pin in the planetary-gear shaft and in the planet carrier are respectively aligned (arrow).

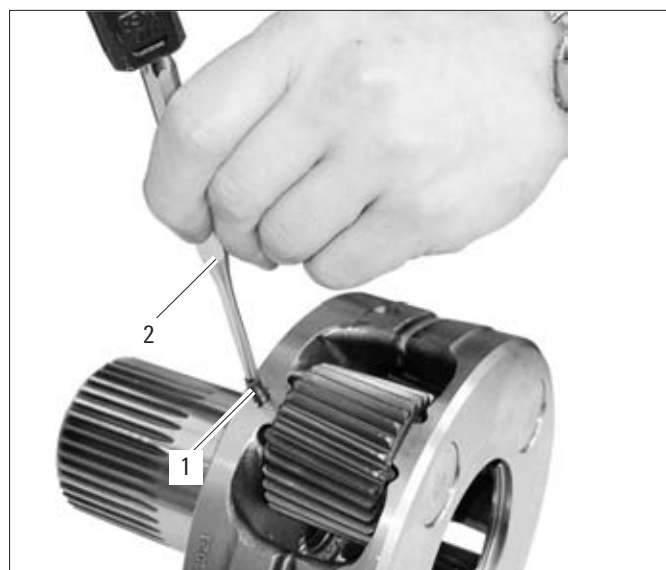


030320

- 4 Drive in the centering pin (1) with a suitable mandrel (2).

CAUTION

In order to avoid damage at the planet carrier and the planet gear, do not drive in the centering pin directly with a hammer.



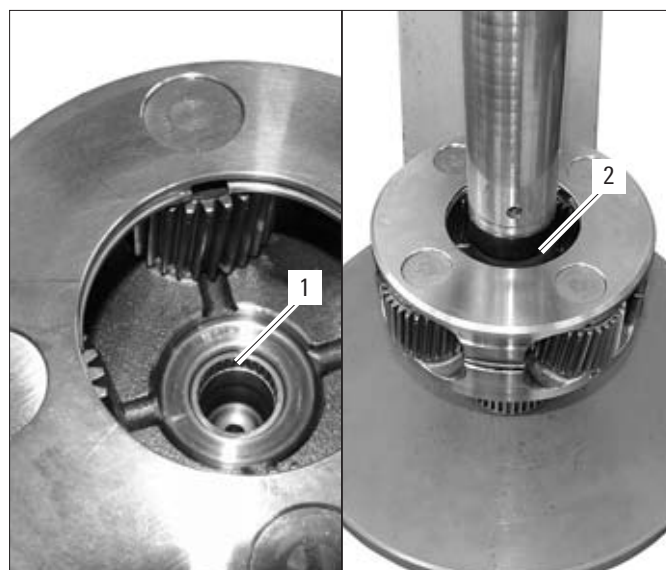
030321

- 5 Caulk the centering pin at its to ends respectively with a suitable chisel (1).



030322

- 6 If required, press in the needle bearing (1) with the tool no.: 1X56 138 559.



030312/030315

- 7 If required, insert a new axial bearing **(1)** and engage it. Engagement of the unit must be audible (click sound!).

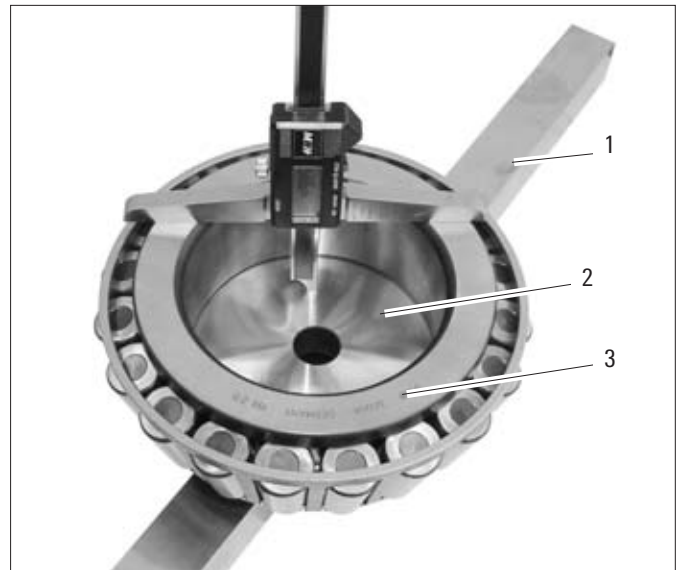


030316

17.4 Assembling the Angle Drive and the Connecting Housing

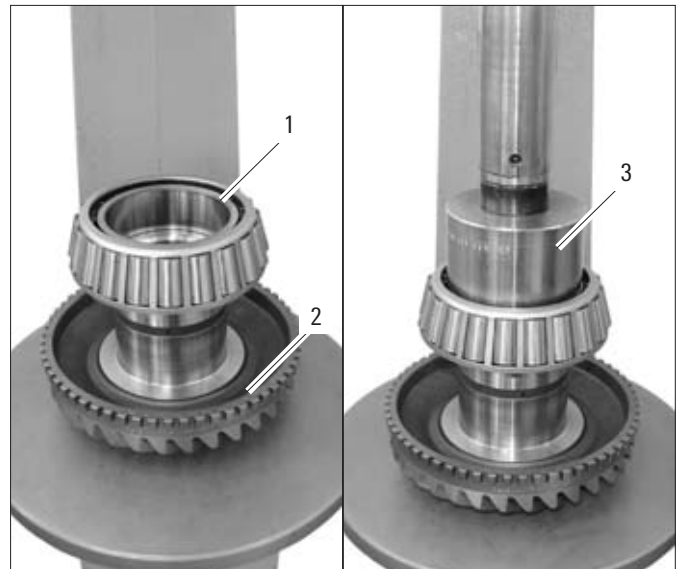
17.4.1 Assembling the Angle Drive

- 1 Put the tool no.: **1X56 138 658/2 (2)** on the measuring caliper **(1)**.
- 2 Put on the bearing inner ring B01 **(3)** on the tool no.: **1X56 138 657/1 (2)**.
- 3 Measure the height of the bearing inner ring of the bearing B01 by means of a depth gage:
Dimension 1
e.g.: 49,84 mm



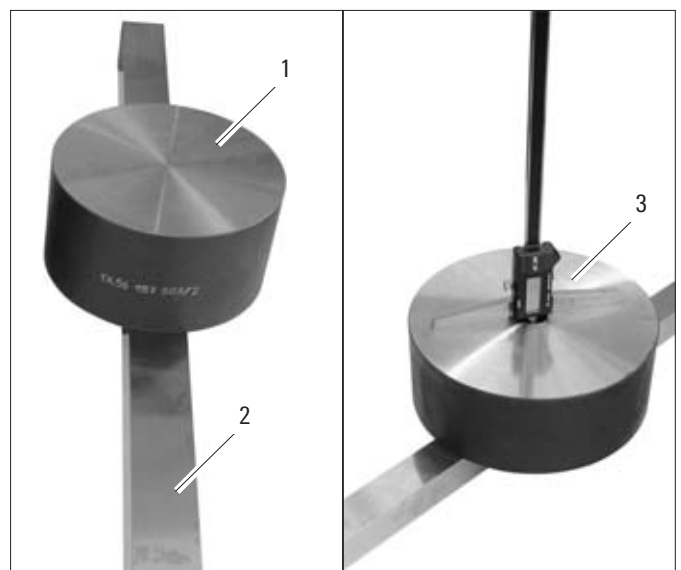
030260

- 4 Put the bearing inner ring **(1)** on the input gear **(2)**.
- 5 Press the bearing inner ring **(1)** with the tool no.: **1X56 138 638 (3)** on the input gear **(2)** until firmly home.



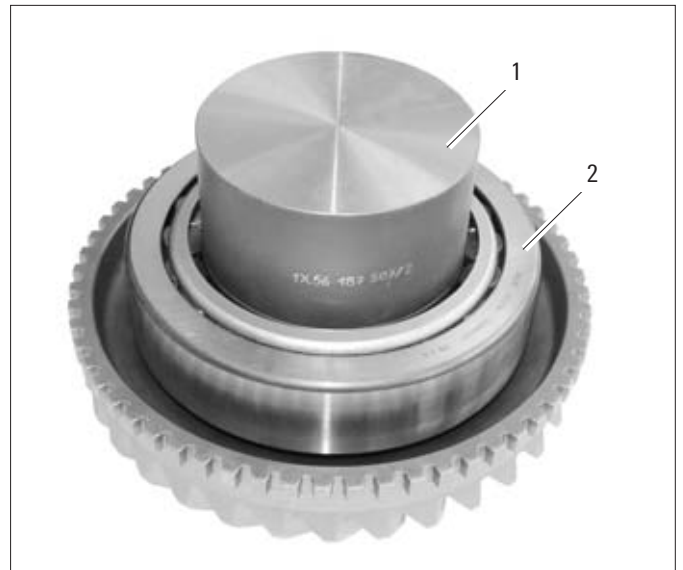
030261/030262

- 6 Put the tool no.: **1X56 138 658/2 (1)** on the measuring caliper **(2)** or a flat, even support.
- 7 Put the tool no.: **1X56 138 658/1 (3)** on top of the tool no.: **1X56 138 658/2 (1)**.
- 8 Put the depth gage on the surface of the tool no.: **1X56 138 658/1 (3)**.
- 9 Push the sliding caliper downwards onto the surface of the tool no.: **1X56 138 658/2 (1)** until firmly home.
- 10 Set the depth gage to zero.



030263/030264

- 11 Put on the bearing outer ring (2).
- 12 Put on the tool no.: **1X56 138 658/2 (1)**.



030265

- 13 Put on the tool no.: **1X56 138 658/1 (1)**.
- 14 Roll in the bearing.
- 15 Use the depth gage to measure the distance to the surface of the tool no.: **1X56 187 507/2: Dimension 2** e.g.: 3,19 mm
- 16 Calculation of the CT value (also refer to the sectional drawing of the angle drive in the annex):

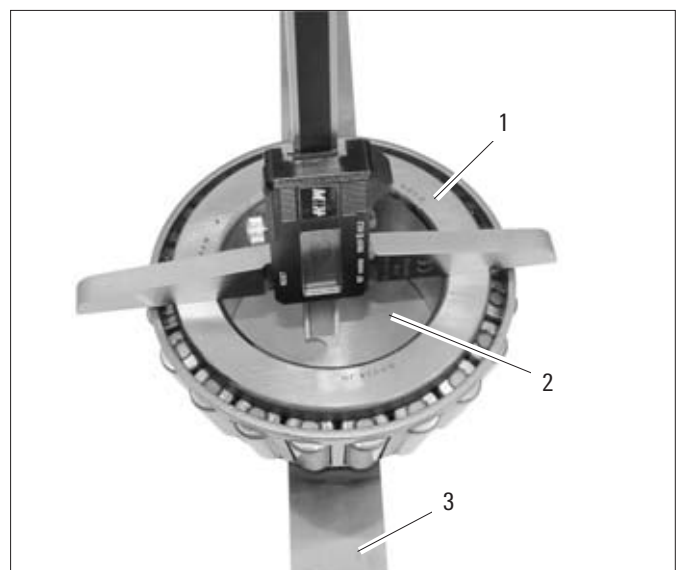
$$CT = \text{Dimension 1} + \text{Dimension 2}$$

$$CT = 49,84 \text{ mm} + 3,19 \text{ mm} = 53,03 \text{ mm}$$



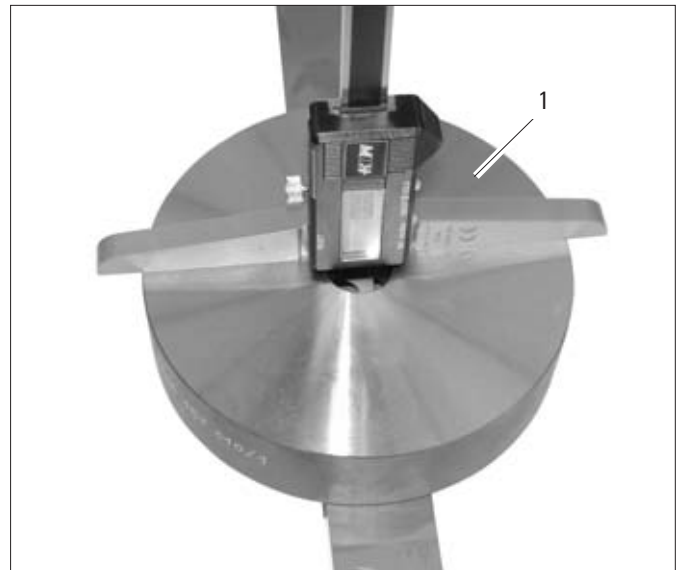
030266

- 17 Put the tool no.: **1X56 138 657/2 (2)** on the measuring caliper (3).
- 18 Put the B02 tapered roller bearing (1) on the tool no.: **1X56 138 657/2 (2)**.
- 19 Measure the height of the bearing inner ring of the bearing B02 by means of a depth gage: **Dimension 3**
e.g.: 40,92 mm
- 20 Take off the tapered roller bearing (1).



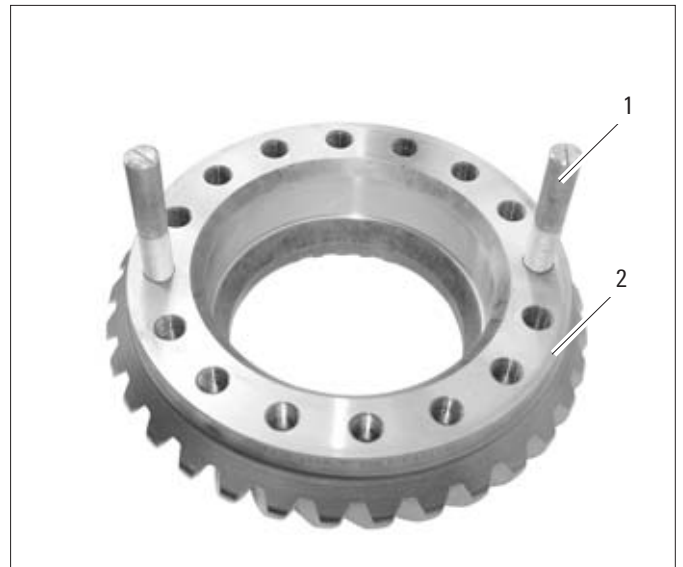
030271

- 21 Put on the tool no.: **1X56 138 657/1 (1)**.
- 22 Put the depth gage on the surface of the tool no.: **1X56 138 657/1 (1)**.
- 23 Push the sliding caliper downwards onto the surface of the tool no.: **1X56 138 657/2 (1)** until firmly home.
- 24 Set the depth gage to zero.



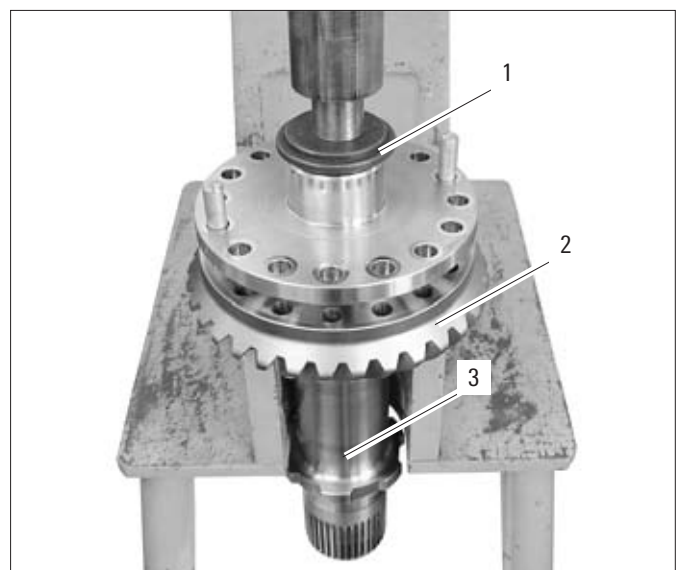
030272

- 25 Screw in two M14 guide pins **(1)** in the bevel gear **(2)**.



030273

- 26 Put the bevel gear **(2)** on the press.
- 27 Insert the output shaft **(3)**.
- 28 Put on the thrust piece **(1)**.
- 29 Press the output shaft **(3)** in the bevel gear **(2)**.



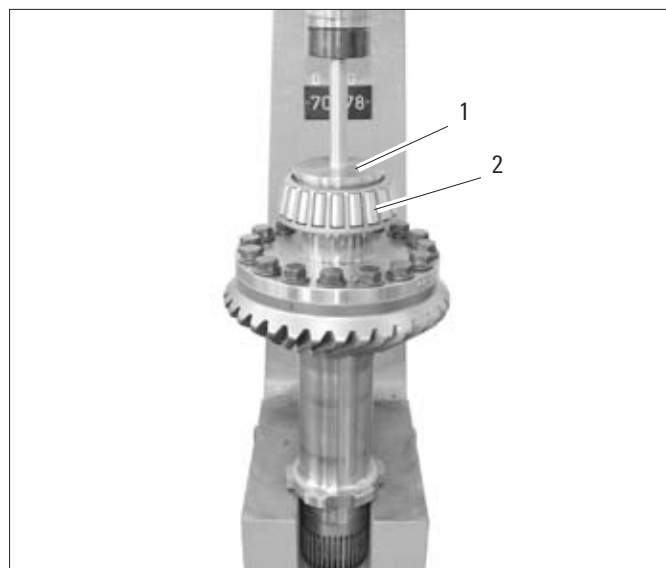
030274

- 30 Screw in 16 M14x30 hex head screws/bolts **(1)**.
Tightening torque: 250 Nm



030275

- 31 Press in the tapered roller bearing **(2)** with the tool no.: **1X56 138 624 (1)**.



030276

- 32 Put on the bearing outer ring **(1)**.



030277

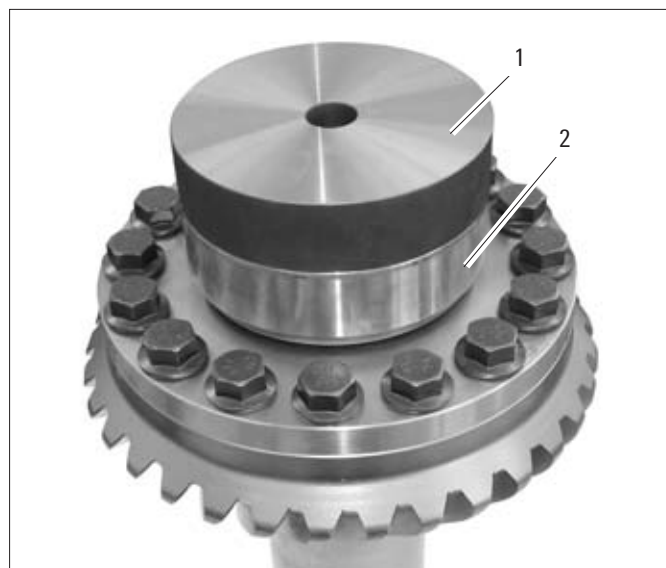
- 33 Put on the tool no.: **1X56 138 657/2 (1)**.



030423

- 34 Put on the tool no.: **1X56 138 657/1 (1)**.

- 35 Roll in the tapered roller bearing **(2)**.



030278

- 36 Use the depth gage to measure the distance to the surface of the tool no.: **1X56 138 657/2:**

Dimension 4

e.g.: 0,2 mm

- 37 Calculation of the CR value (also refer to the sectional drawing of the angle drive in the annex):

CR = dimension 3 + dimension 4

CR = 40,92 mm + 0,20 mm = 41,12 mm



030279

- 38 **Dimension D** (also refer to the sectional drawing of the angle drive in the annex) cannot be detected in the case of a painted cover and, if required, must be measured.

Measure the distance between the measuring caliper and the cover's abutment face:

Dimension 5



030280

- 39 Measure the distance between the measuring caliper and the inner ring's abutment face:

Dimension 6

- 40 Calculation of **dimension D**:

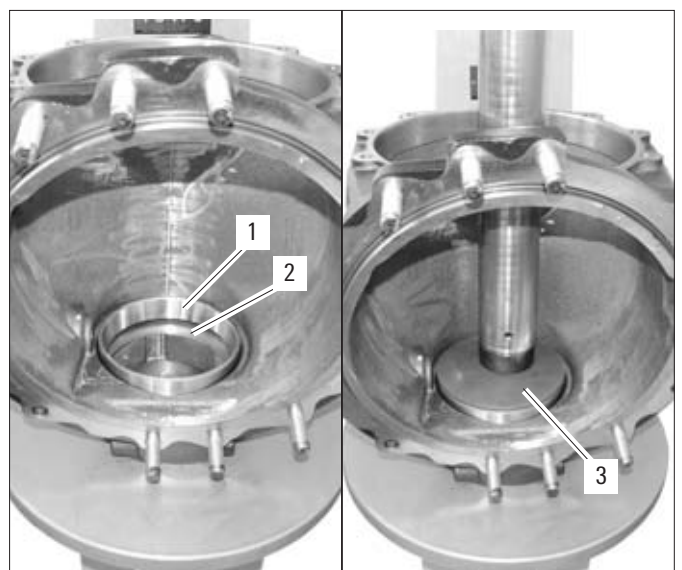
$$\text{Dimension D} = \text{dimension 6} - \text{dimension 5}$$

e.g.: Dimension D = 55.46 mm



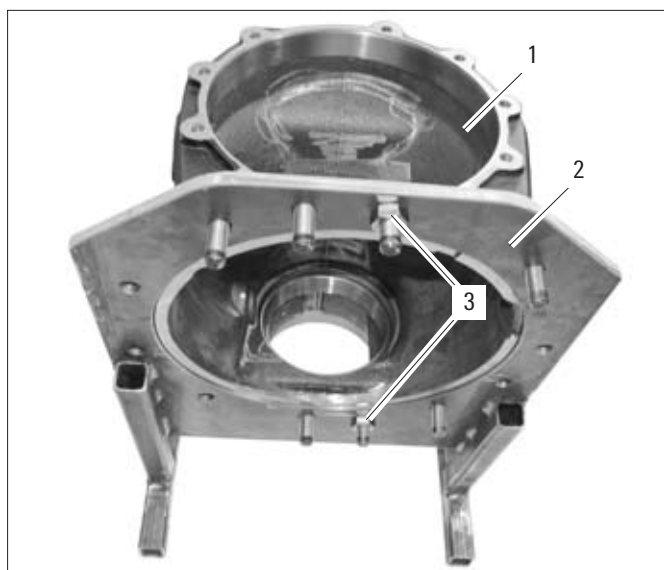
030281

- 41 Insert an adjusting disk (2) for measurement purposes which is thinner than the original version.
- 42 Insert the bearing shell (1) in the A02 bearing and press in with the tool no.: **1X56 138 659 (3)**.



030284/030285

- 43 Insert the housing angle drive (1) once again in the assembly support no.: **1X56 138 647 (2)** and fix by means of two nuts (3).

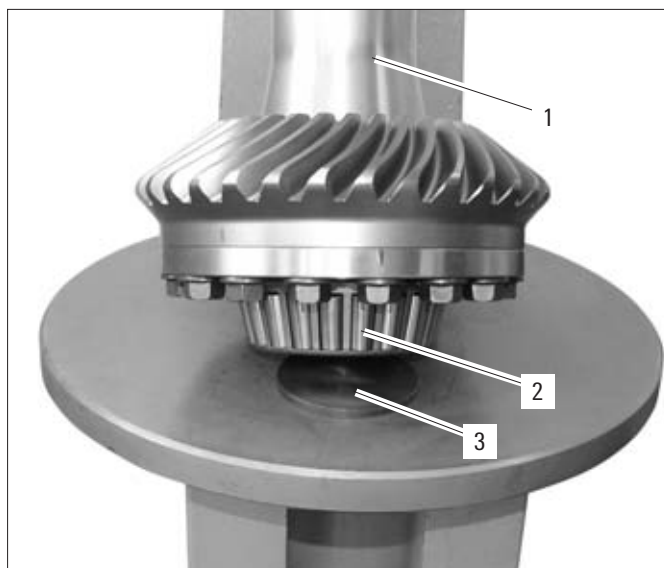


030286

- 44 Put the shaft (1) on the press. To this end, provide support for the tapered roller bearing's bearing inner ring (2) by means of a suitable shim/disk (3).

CAUTION

Make sure that the shaft does not abut with the bearing cage of the tapered roller bearing (2).



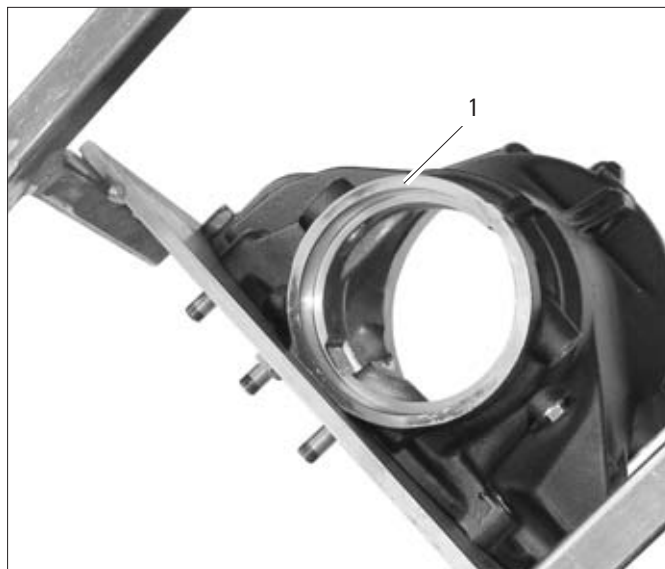
030287

- 45 Press in the A02 tapered roller bearing (2) with the tool no.: **1X56 138 623 (1)**.



030288

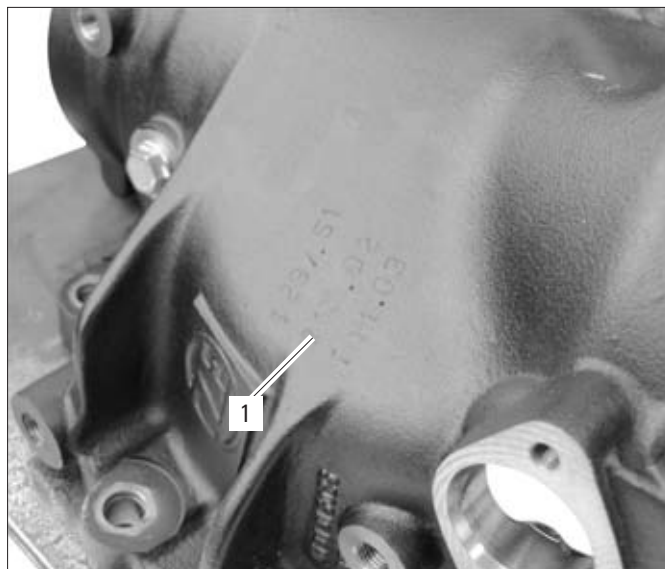
- 46 Clean the face **(1)** at the angle drive's housing with an oil stone prior to inserting the shaft.



030293

- 47 Read off the dimension R **(1)** at the angle drive housing (also refer to the sectional drawing of the angle drive in the annex).

e.g: 129,02



030268

- 48 Read off the "AR" **(1)** value at the bevel gear (also refer to the sectional drawing of the angle drive in the annex).

e.g.: 127,00 mm



030282

- 49 Read off the "BR" (1) value at the shaft (also refer to the sectional drawing of the angle drive in the annex).

e.g.: 14,502 mm



030283

- 50 Determine the thickness of the SR adjusting disk (also refer to the sectional drawing of the angle drive in the annex):

$$SR = R + D + KD - (AR + BR + CR + KR)$$

NOTE

The values "KD" and "KR" are stated in the sectional drawing of the angle drive in the annex.

Example:

$$\begin{aligned} SR &= 129,02 \text{ mm} + 55,46 \text{ mm} + 0,03 \text{ mm} \\ &\quad - (127,00 \text{ mm} + 14,50 \text{ mm} + 41,12 \text{ mm} \\ &\quad + 0,06 \text{ mm}) = 1,83 \text{ mm} \end{aligned}$$

- 51 Screw in the lifting device no.: **1T66 160 889 (1)** on the shaft.



030289

52 Insert the shaft by means of a crane in the angle drive housing.

53 Remove the lifting equipment.



030290

54 Insert the determined "SR" adjusting disk (1) in the cover (2).



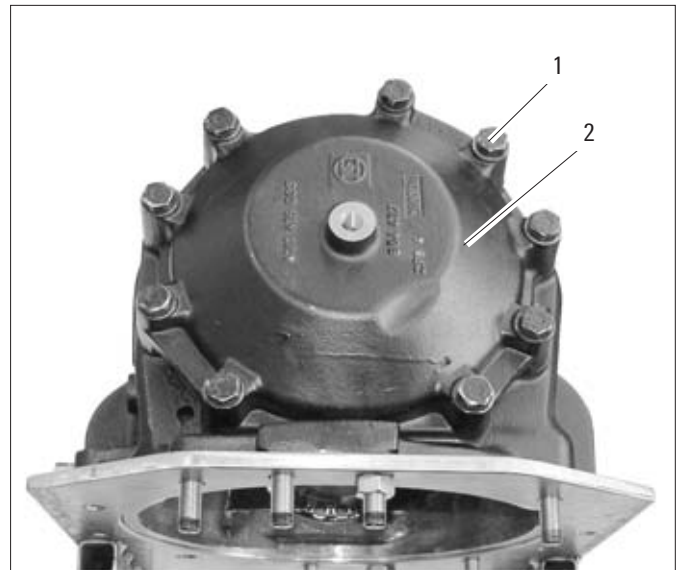
030291

55 Press in the B02 bearing shell (2) with the tool no.: 1X56 138 645 (1) in the cover (3).



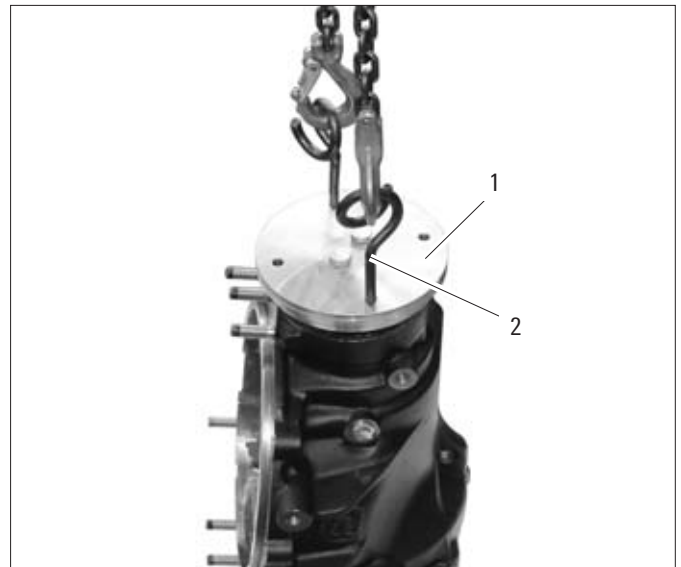
030292

- 56 Put on the cover **(2)**.
- 57 Screw in nine hex head screws/bolts M12x1.5x55 **(1)**.
Tightening torque: 100 Nm



030294

- 58 Remove the angle drive from the assembly support no.: **1X56 138 647**.
- 59 Mount the tool no.: **1X56 138 646 (1)**.
- 60 Screw in two hooks **(2)**.
- 61 Mount the lifting equipment.
- 62 Suspend the housing of the angle drive by means of a crane.
- 63 Turn the housing around in order to roll in the bearing.



030295

- 64 Mount the dial gage **(1)**.

NOTE

Ensure that the measuring probe **(2)** of the dial gage **(1)** is in contact with the housing.

- 65 Set the dial gage **(1)** to zero.
- 66 Remove the dial gage **(1)**.



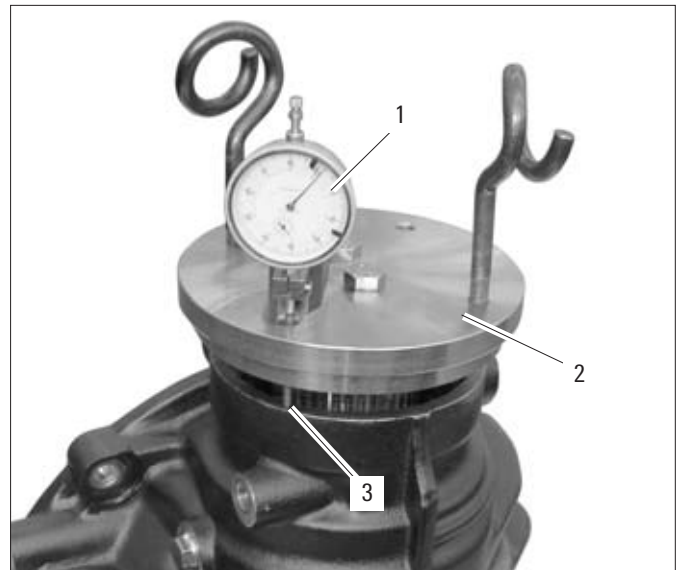
030296

- 67 Put the housing of the angle drive on a suitable, flat base.
- 68 Remove the lifting equipment.
- 69 Roll in the bearing while applying minor loads.
- 70 Mount the dial gage (1) and read off the axial play.
e.g.: 0.91 mm

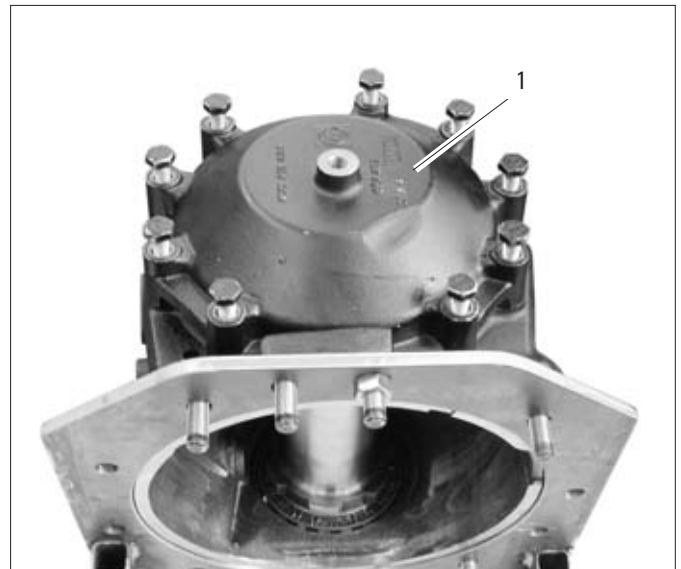
NOTE

Ensure that the measuring probe (3) of the dial gage (1) is in contact with the housing.

- 71 Disassemble the tool no.: **1X56 138 646 (2)**.
- 72 Mount the angle drive to the assembly support no.: **1X56 138 647**.
- 73 Disassemble the housing cover (1).

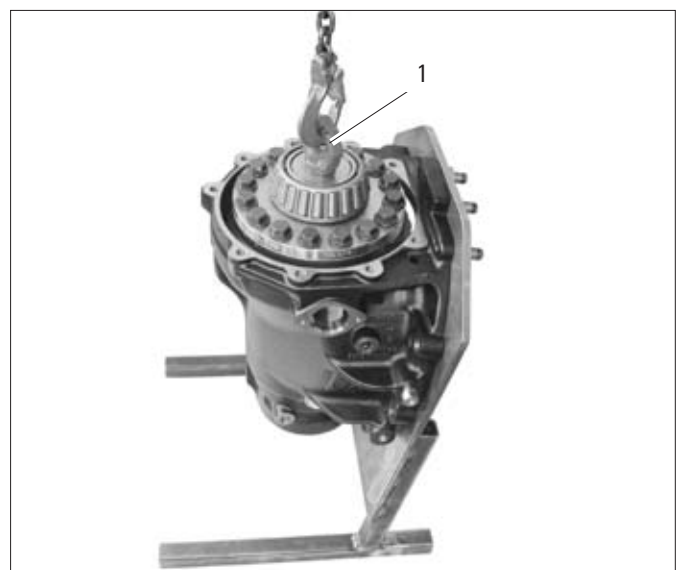


030297



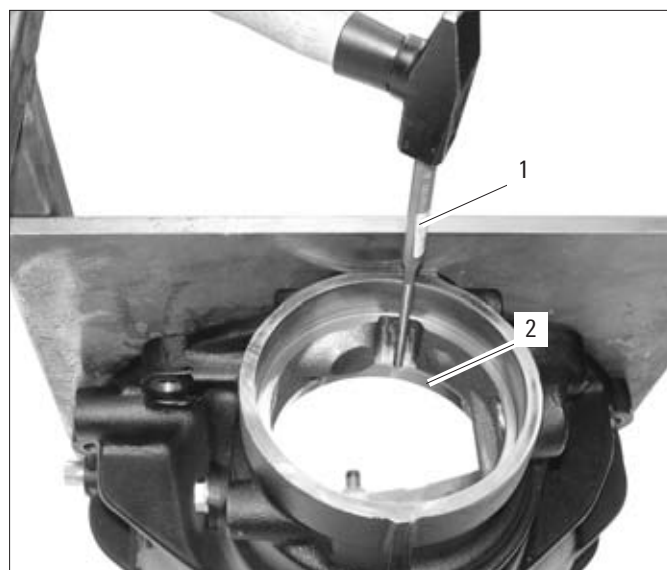
030298

- 74 Screw in the lifting equipment no.: **1T66 160 889 (1)**.
- 75 Mount the lifting equipment.
- 76 Lift out the shaft from the angle drive by means of a crane.



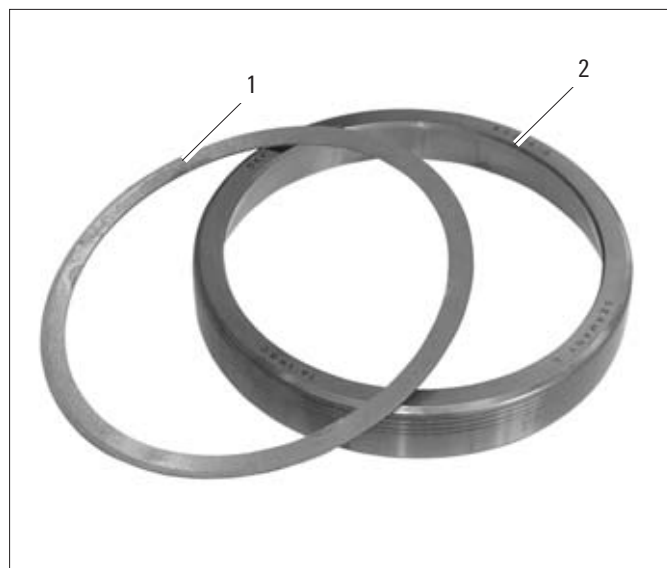
030234

- 77 Drive out the outer bearing ring (2) from the housing by means of a suitable mandrel (1).



030299

- 78 Take out the outer bearing ring (2) with the adjusting disk (1).



030300

- 79 Calculating the shim's thickness:

S: Shim/Disk thickness adjusting disk

$S_{\text{Measurement}}$: Shim/Disk thickness of the adjusting disk which has been used for the measurement.

V: Preload
Nominal value 0.02 mm up to 0.07 mm

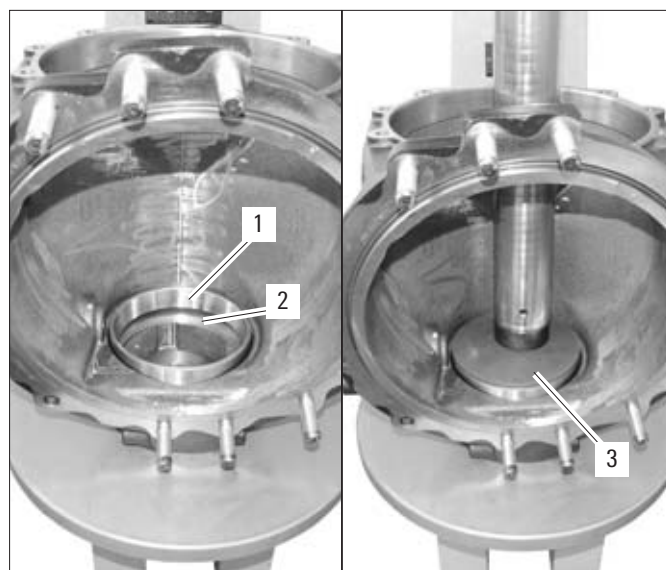
$$S = \text{Axialspiel} + V + S_{\text{Mess}}$$

Example:

$$S_{\text{min}} = 0,91 \text{ mm} + 0,02 \text{ mm} + 0,9 \text{ mm} = 1,83 \text{ mm}$$

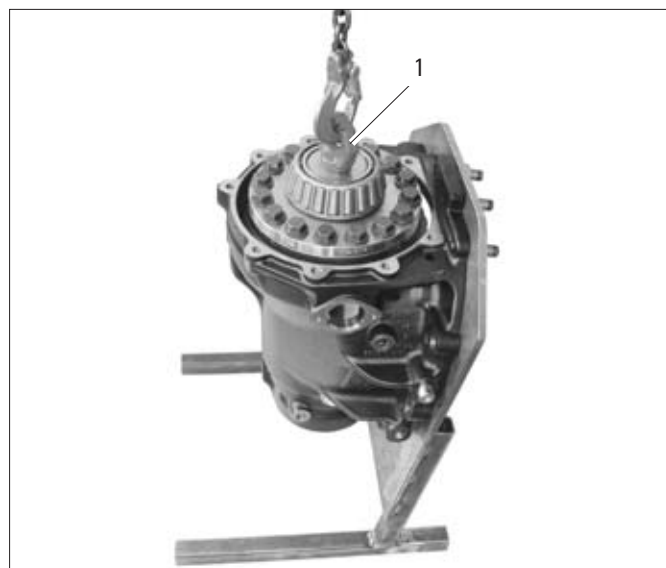
$$S_{\text{max}} = 0,91 \text{ mm} + 0,07 \text{ mm} + 0,9 \text{ mm} = 1,88 \text{ mm}$$

- 80 Insert the determined adjusting disk **(2)**.
- 81 Insert the bearing shell **(1)** in the A02 bearing and press in with the tool no.: **1X56 138 659 (3)**.



030284/030285

- 82 Screw in the lifting equipment no.: **1T66 160 889 (1)** in the shaft.
- 83 Mount the lifting equipment.
- 84 Insert the shaft in the angle drive by means of a crane.
- 85 Remove the lifting equipment.



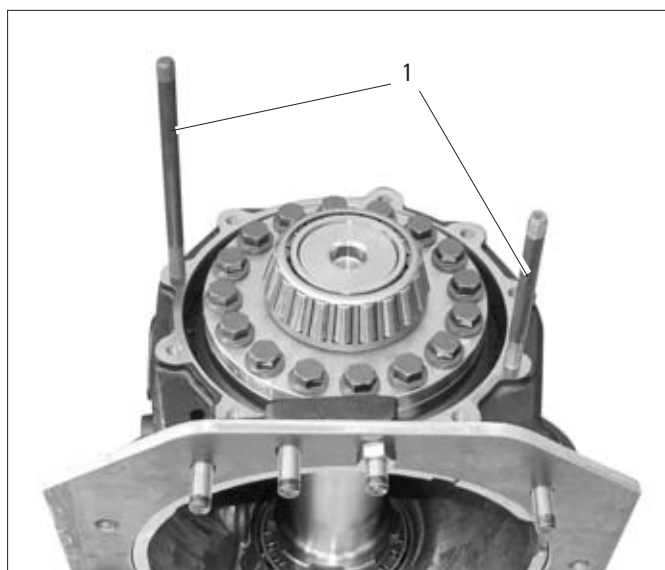
030234

- 86 Coat O-ring with technical Vaseline.
- 87 Insert the O-ring **(1)**.



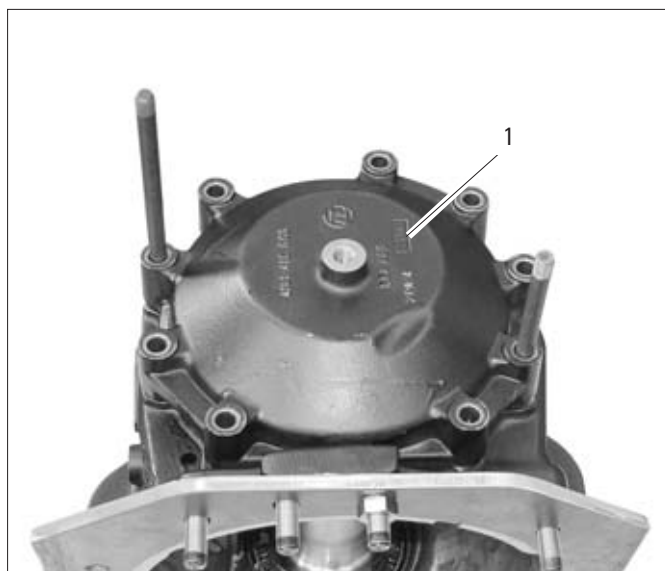
030301

- 88 Screw in two guide screws M12 **(1)**.



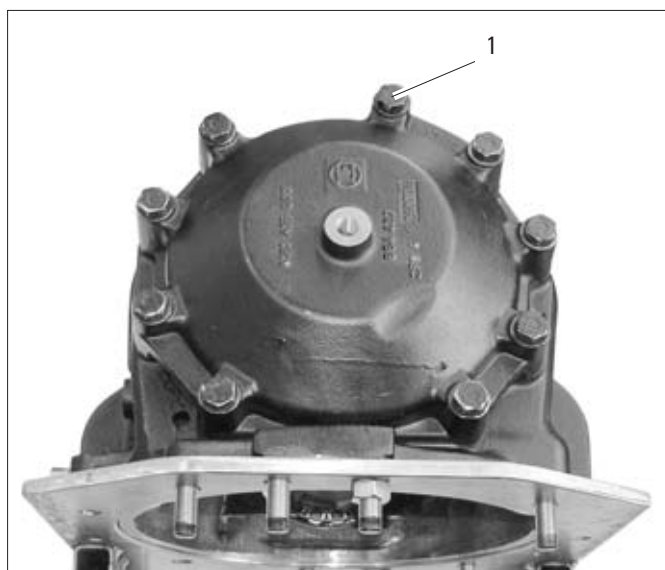
030302

- 89 Put on the cover **(1)** and drive in by means of a plastic hammer until firmly home.



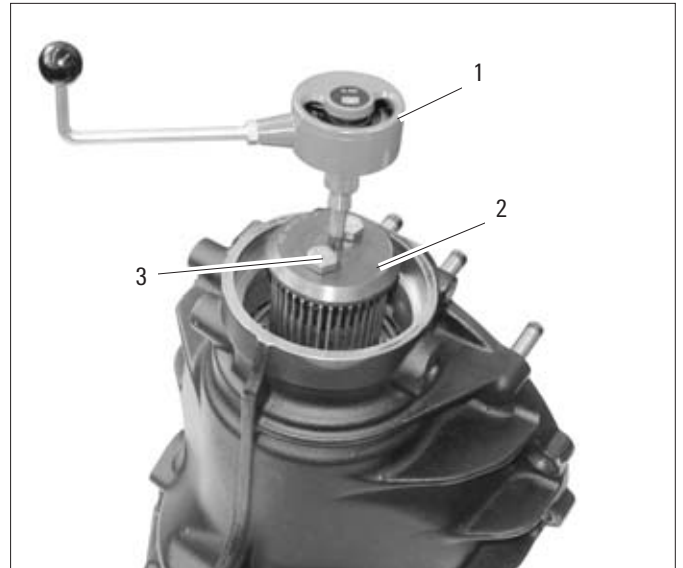
030303

- 90 Screw in nine hex head screws/bolts M12x1.5x55 **(1)** and insert the guide screws.
Tightening torque: 100 Nm



030294

- 91 Put housing in vertical position on a suitable base.
- 92 Mount the tool no.: **1X56 138 644 (2)** by means of two hex head screws/bolts **(3)**.
- 93 Put on the tool for the rolling moment measurement no.: **1X56 186 359 (1)**.
- 94 Roll in the bearing at a consistent test speed of approx. 25 revolutions for a period of at least 25 seconds until the measurement value remains constant. The rolling moment must be between 0.6 Nm and 1.7 Nm. The measurement must be implemented without the shaft sealing ring. The bearing must be lubricated with an ATF oil.



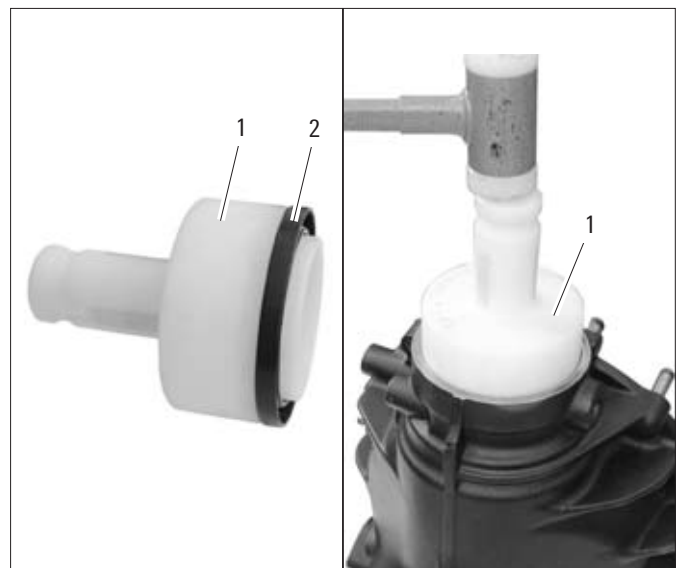
030304

- 95 Insert the bush (1).



030305

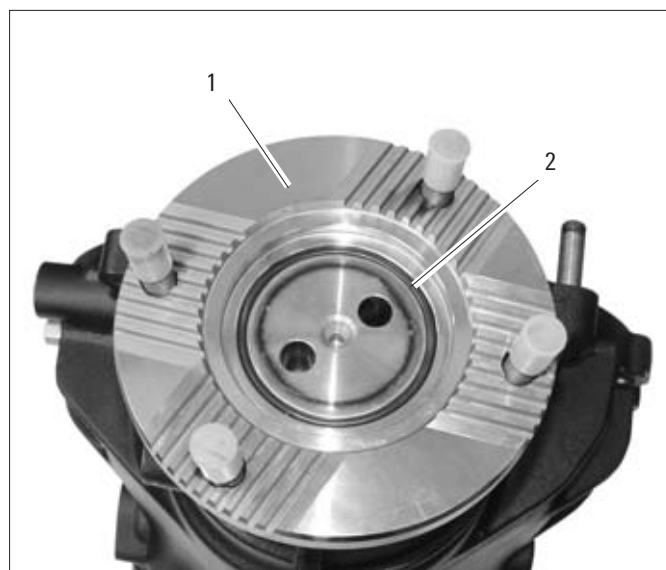
- 96 Drive in the shaft sealing ring (2) by means of the tool no.: **1X56 138 654 (1)**. The installation dimension is determined by the tool.



030306/030307

97 Slide on the output flange **(1)**.

98 Insert the O-ring **(2)**.



030308

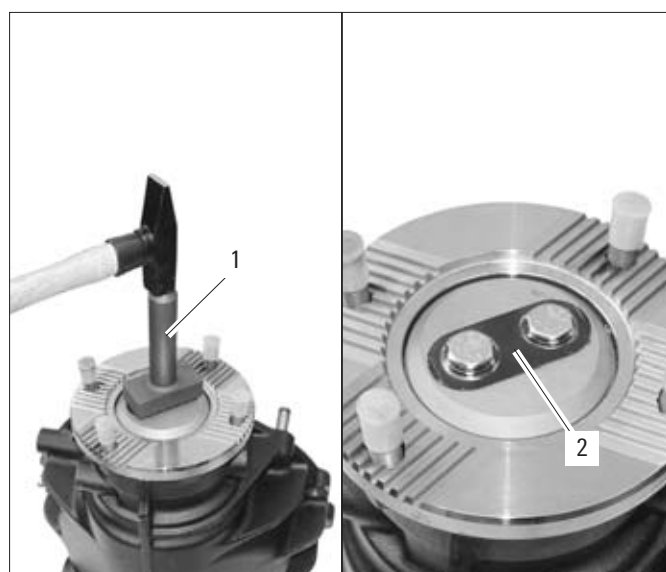
99 Put on the bolster plate **(2)**.

100 Screw in two hex head screws/bolts **(1)**.
Tightening torque: 80 Nm



030309

101 Drive up the locking plate **(2)** (part number:
4132 304 015) with the tool no.:
1X56 137 452 (1).



030310/030311

17.4.2 Assembling the Connecting Housing

- 1 Read off the **dimension T (1)** at the angle drive housing (also refer to the sectional drawing of the angle drive in the annex).

e.g.: 111,03 mm



030268

- 2 Read off the **dimension L (1)** at the connecting housing (also refer to the sectional drawing of the angle drive in the annex).

e.g.: 50.49 mm



030270

- 3 Read off the **dimension AT (1)** at the bevel gear (also refer to the sectional drawing of the angle drive in the annex).

e.g.: 106,45 mm



030269

- 4 Determine the thickness of the ST adjusting disk (also refer to the sectional drawing of the angle drive in the annex):

$$ST = T + L + KG - (AT + CT + KT)$$

NOTE

The values "KG" and "KT" are stated in the sectional drawing of the angle drive in the annex.

Example:

$$\begin{aligned} ST &= 111,03 \text{ mm} + 50,49 \text{ mm} + 0,03 \text{ mm} \\ &\quad - (106,45 \text{ mm} + 53,03 \text{ mm} + 0,07 \text{ mm}) \\ &= 2,00 \text{ mm} \end{aligned}$$

- 5 Insert the determined adjusting disk ST (1).



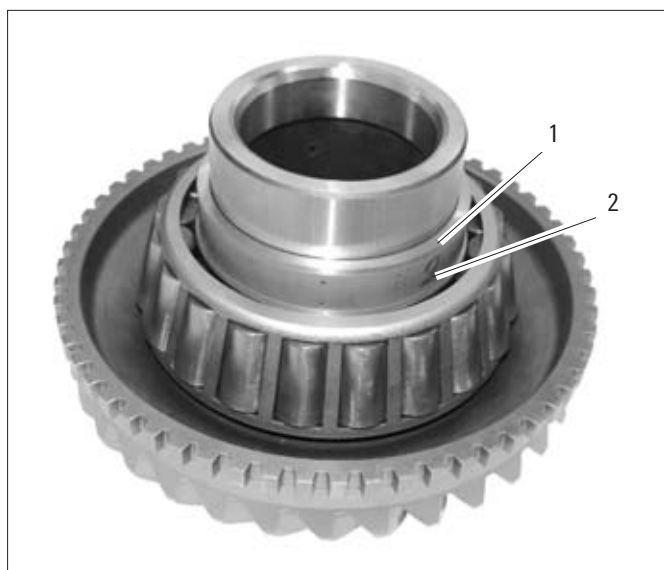
030323

- 6 Press in the B01 bearing outer ring (1) with a suitable thrust piece.



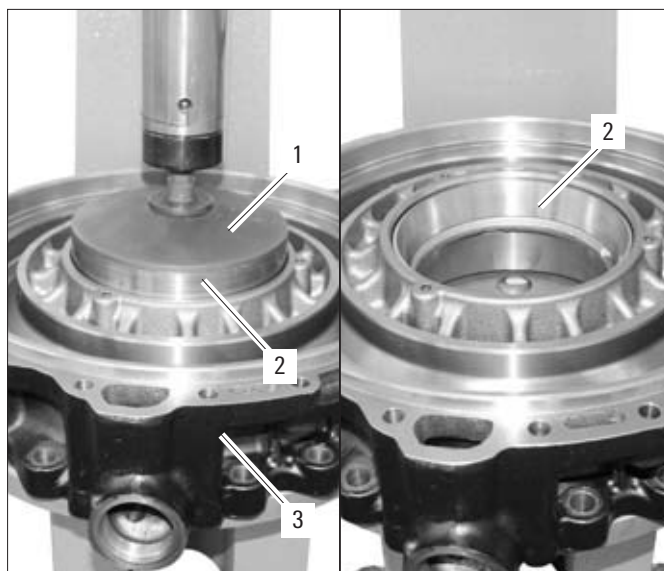
030324

- 7 Insert the distance ring **(2)**.
- 8 Insert a thicker adjusting disk **(1)** for the measurement, not the thickness of the original adjusting disk.



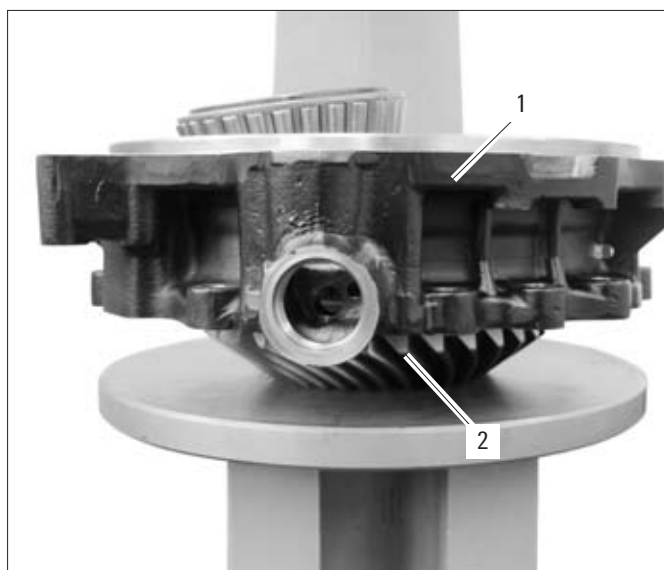
030325

- 9 Put the connecting housing **(3)** on the press.
- 10 The bearing outer ring A01 **(2)** with the tool no.: **1X56 138 660 (1)** in the connecting housing must be pressed in.



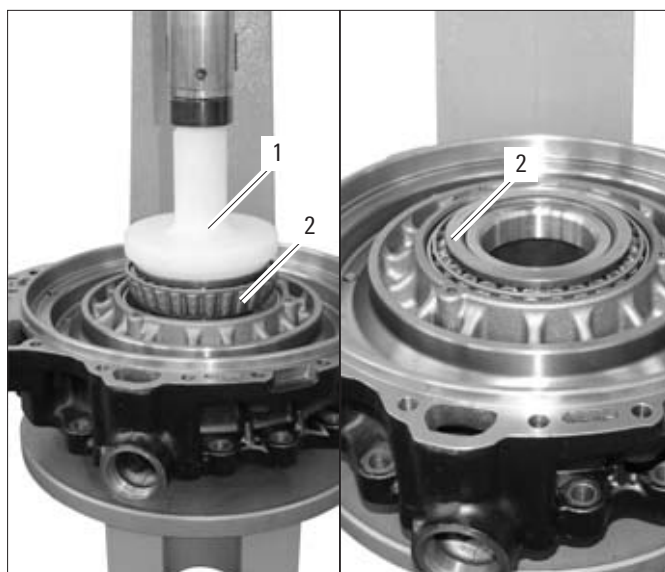
030326/030327

- 11 Put the bevel gear **(2)** on the press.
- 12 Put the connecting housing **(1)** on the bevel gear **(2)**.



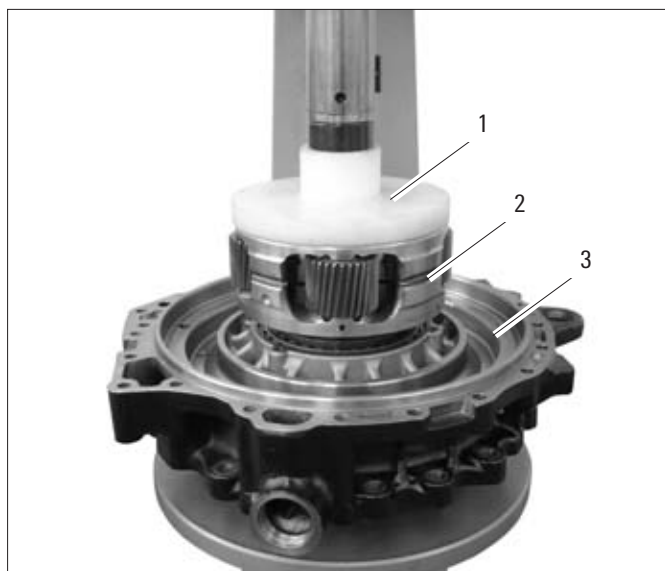
030328

- 13 Press in the A01 taper bearing (2) with a suitable thrust piece (1).



030329/030330

- 14 Insert the planet carrier III (2) in the connecting housing (3).
- 15 Press in the planet carrier III (2) by means of a suitable thrust piece (1) in the connecting housing (3).

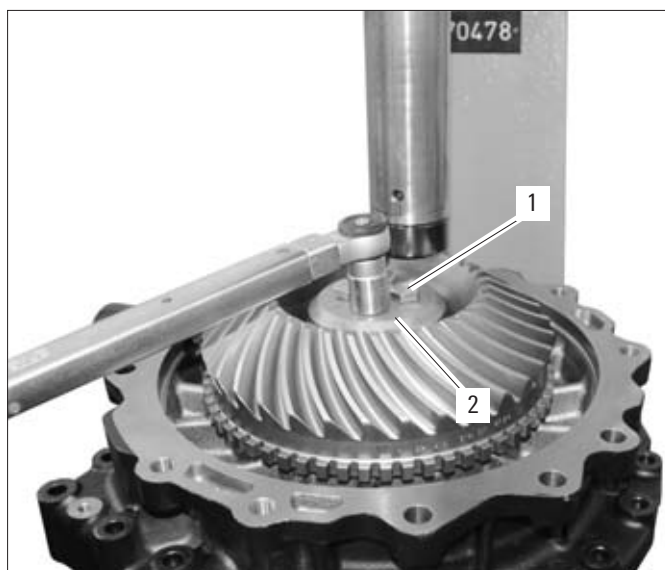


030331

- 16 Turn the connecting housing around.
- 17 Put on the bolster plate (2).
- 18 Screw in four hex head screws/bolts (1) and tighten crosswise. To this end, ensure that you hold onto the bevel gear by means of the press. Tightening torque: 80 Nm

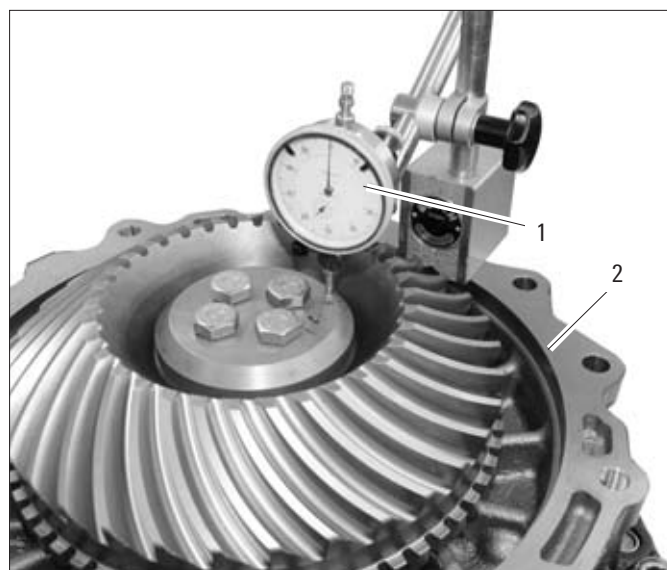
NOTE

Tighten all screws/bolts twice crosswise.



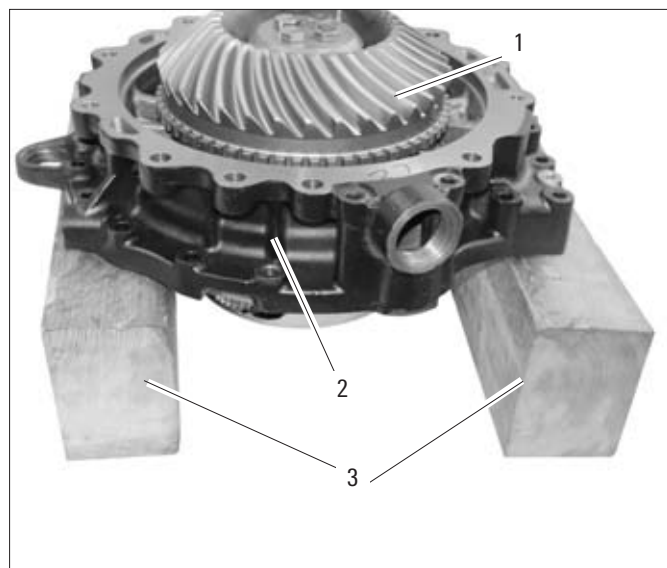
030332

- 19 In order to roll in the bearings, turn the connecting housing (2) with light force applied downwards (couple of rotations).
- 20 Mount the dial gage (1) and set to zero.
- 21 Remove the dial gage (1).



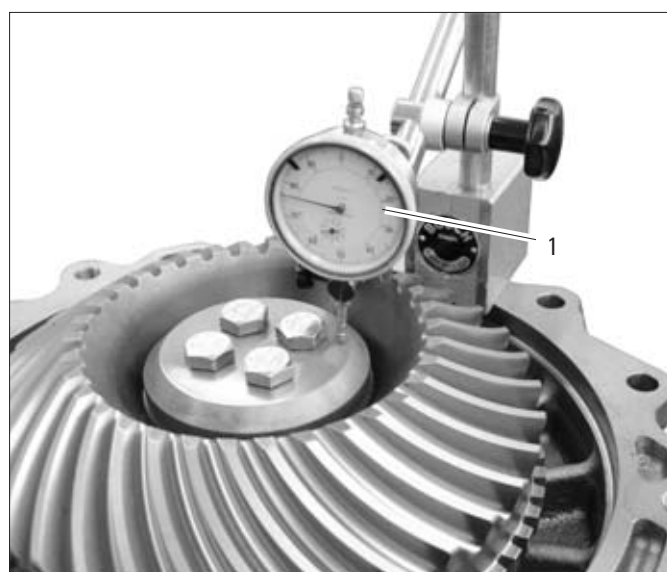
030333

- 22 Cushion the connecting housing (2) with square skids (3).
- 23 In order to roll in the bearings, turn the bevel gear (2) with light force applied downwards (couple of rotations).



030334

- 24 Mount the dial gage (1).
- 25 Read off the axial play from the dial gage (1).



030335

26 Calculating the shim's thickness:

S: Shim/Disk thickness adjusting disk

$S_{\text{Measurement}}$: Shim/Disk thickness of the adjusting disk which has been used for the measurement.

V: Preload
Nominal value: 0.02 mm up to 0.05 mm

L: Bearing clearance

$$S = S_{\text{Measurement}} - L - V$$

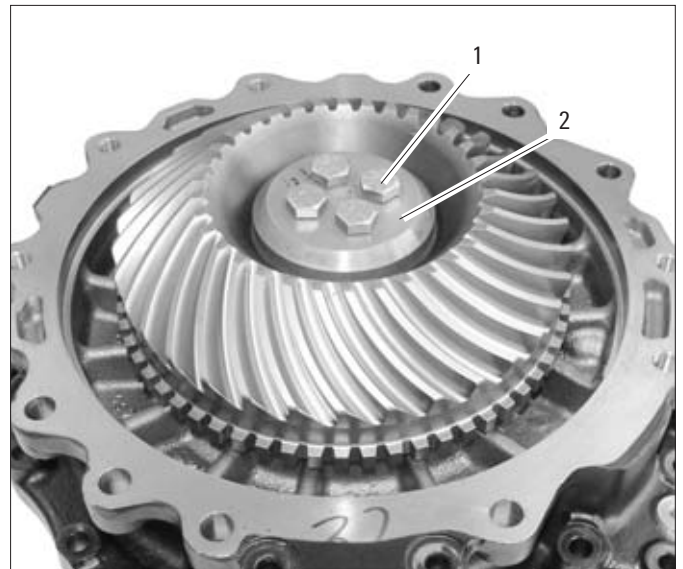
Example:

$$S_{\text{min}} = 3,0 \text{ mm} - 1,23 \text{ mm} - 0,02 \text{ mm} = 1,75 \text{ mm}$$

$$S_{\text{max}} = 3,0 \text{ mm} - 1,23 \text{ mm} - 0,05 \text{ mm} = 1,72 \text{ mm}$$

27 Unscrew the four M12 hexagon head screws/bolts (1).

28 Take off the bolster plate (2).



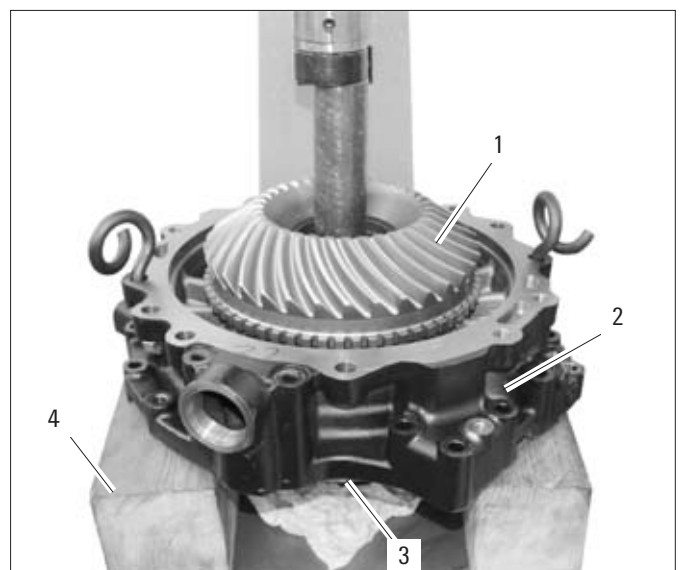
030245

29 Cushion the connecting housing (2) on the press with square skids (4) in accordance with the illustration.

30 Press out the planet carrier III (3) from the input gear (1).

CAUTION

Ensure that you furnish soft material for cushioning purposes in order to avoid damage.



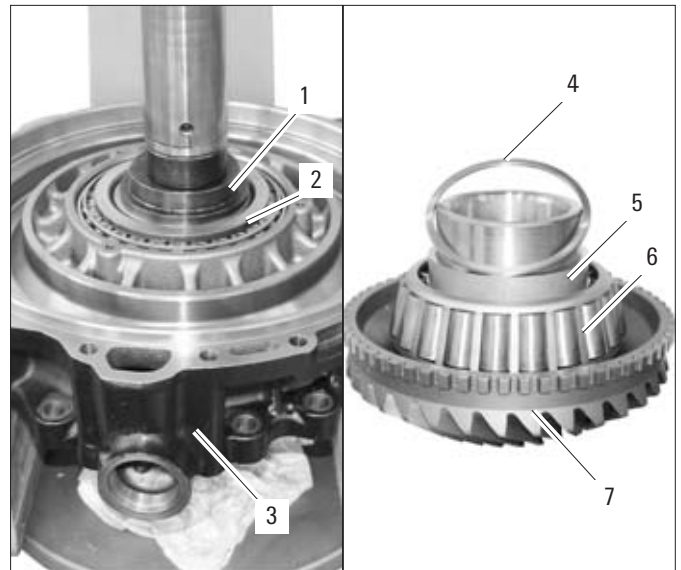
030249

- 31 Turn the connecting housing (3) around.
- 32 Press out the bevel gear (7) by means of a suitable thrust piece (1).

CAUTION

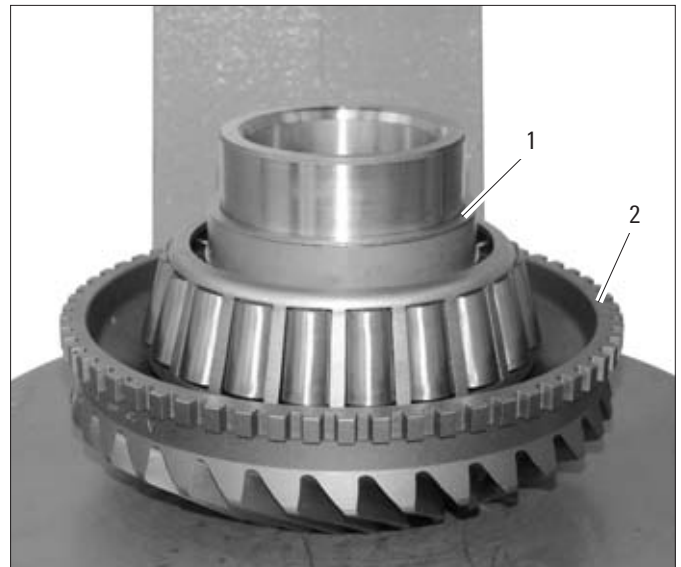
Ensure that you furnish soft material for cushioning purposes in order to avoid damage.

- 33 Take out the bevel gear (7) with the tapered roller bearing (6), bush (5), and adjusting disk (4).
- 34 Take out the tapered roller bearing (2).



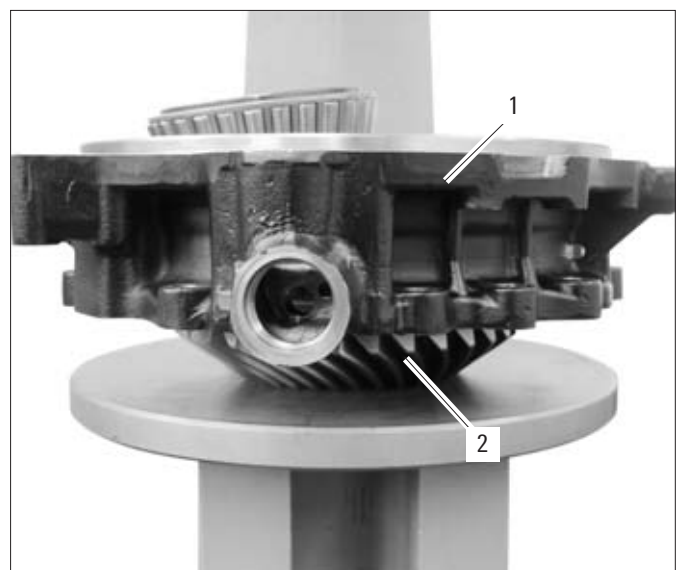
030250/030336

- 35 Put the bevel gear (2) on the press.
- 36 Replace the measurement disk with an adjusting disk (1) of a specific, calculated thickness.
- 37 Lubricate the bearing with an ATF oil.



030337

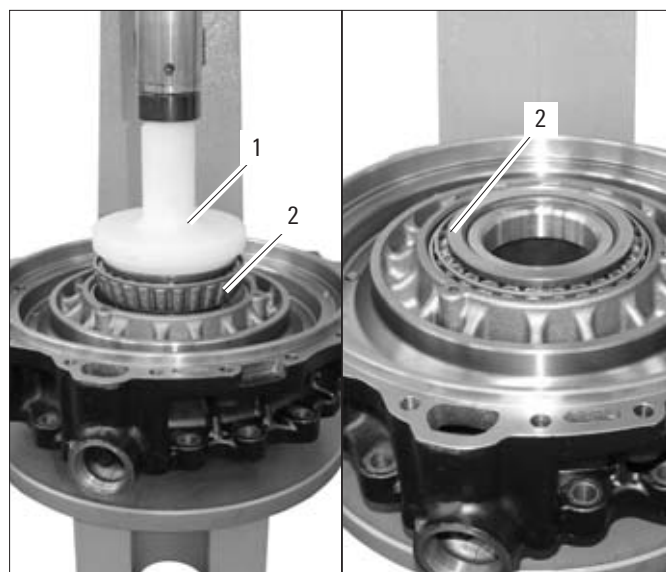
- 38 Put the connecting housing (1) on the bevel gear (2).



030328

39 Press in the taper bearing **(2)** with a suitable thrust piece **(1)**.

40 Lubricate the taper bearing **(2)** with an ATF oil.



030329/030330

41 Insert the planet carrier III **(2)** in the connecting housing **(3)**.

42 Press in the planet carrier III **(2)** by means of a suitable thrust piece **(1)** in the connecting housing **(3)**.

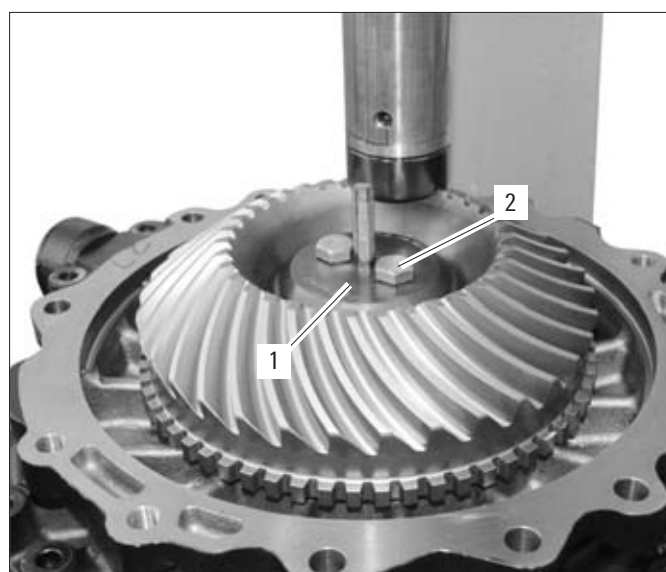
43 Turn the connecting housing **(3)** around.



030331

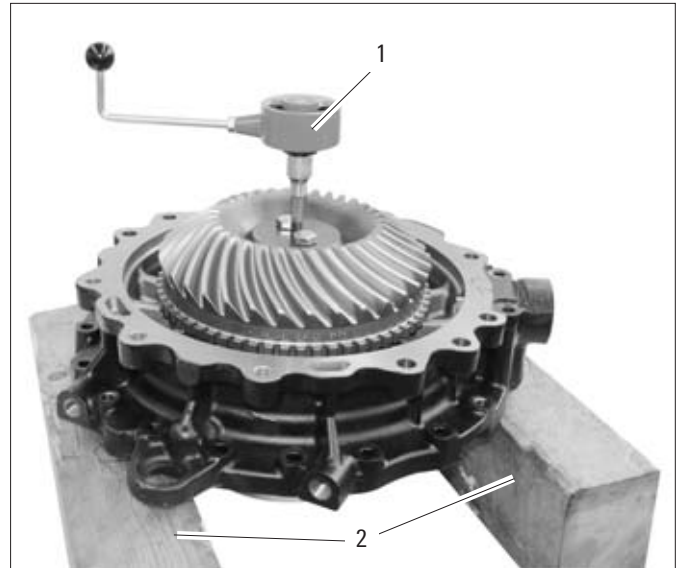
44 Put on the tool no.: **1X56 138 644 (1)**.

45 Screw in two M12 hex head screws/bolts **(2)**.
Tightening torque: 80 Nm



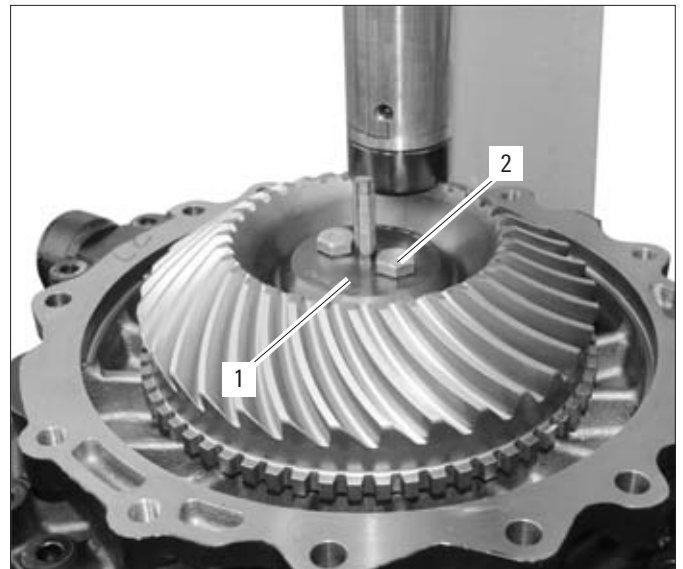
030338

- 46 Cushion the connecting housing with square skids **(2)**.
- 47 Put on the tool for the rolling moment measurement no.: **1X56 186 359 (1)**.
- 48 Roll in the bearing at a consistent test speed of approx. 25 revolutions for a period of at least 25 seconds until the measurement value remains constant. The rolling moment must be between 0.7 Nm and 1.6 Nm.



030339

- 49 Unscrew the two M12 hex head screws/bolts **(2)**.
- 50 Take off the tool no.: **1X56 138 644 (1)**.

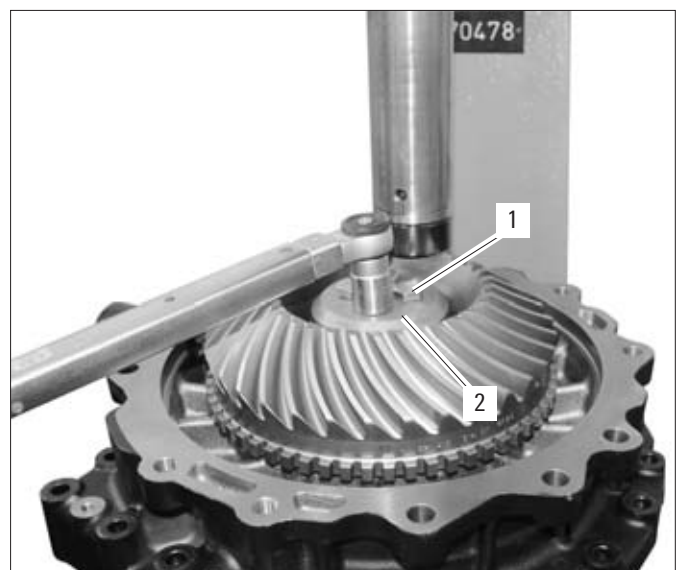


030338

- 51 Put on the bolster plate **(2)**.
- 52 Screw in four M12 hex head screws/bolts **(1)** and tighten crosswise. To this end, ensure that you hold onto the bevel gear by means of the press.
Tightening torque: 80 Nm

NOTE

Tighten all screws/bolts **twice** crosswise.

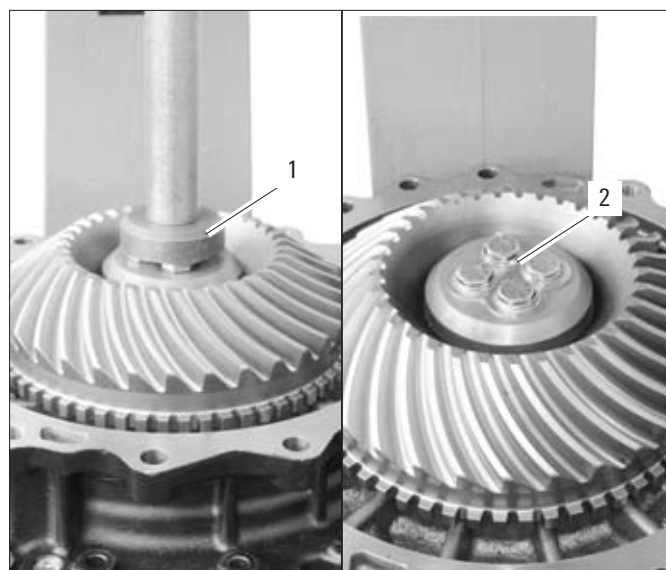


030332

- 53 Press on the locking plate (part no.: 4139 349 202) **(2)** with the tool no.: 1X56 138 067 **(1)**.

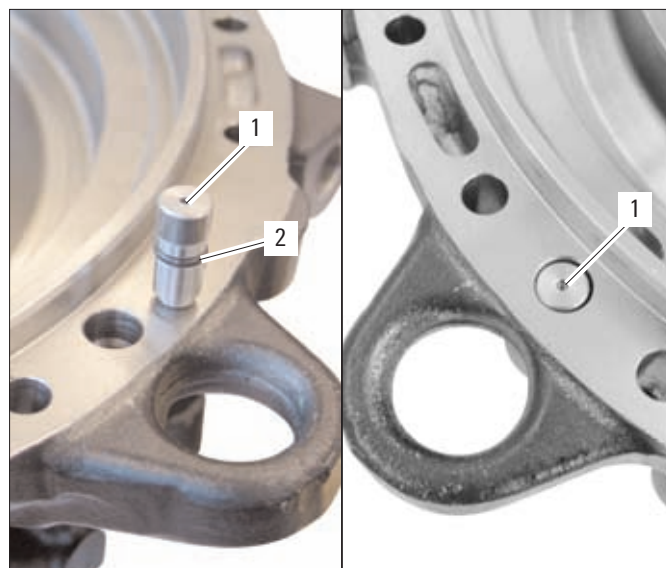
CAUTION

Chips that may have been produced in the course of the process must be removed in order to avoid damage at the angle drive.



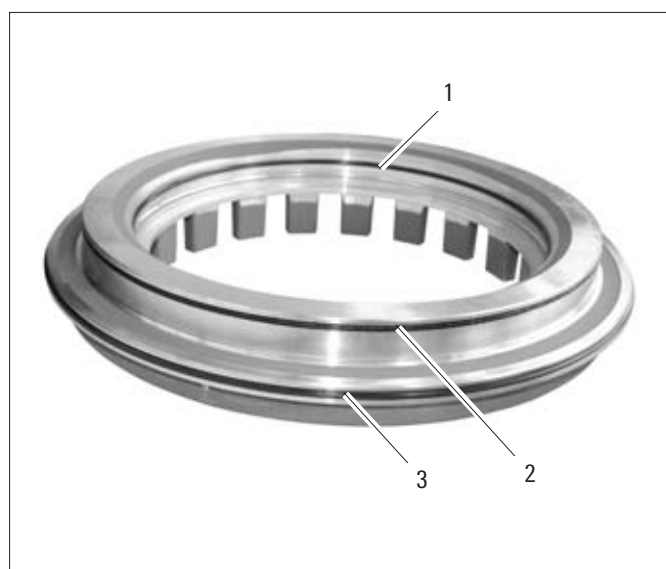
030340/030341

- 54 Coat O-ring **(2)** with technical Vaseline.
- 55 Mount the O-ring **(2)** on the vent valve "F" **(1)**.
- 56 Insert the vent valve "F" **(1)**.



030256/030342

- 57 Coat the three O-rings **(1, 2, 3)** of the piston "F" with technical Vaseline.
- 58 Insert the three O-rings **(1, 2, 3)** in the piston "F".



030343

- 59 Insert the piston "F" **(1)** and drive it in by means of a plastic hammer until firmly home.



030344

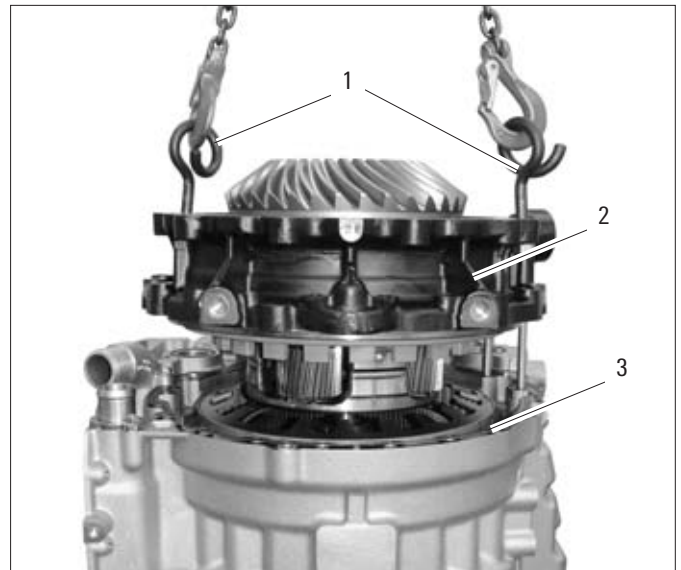
17.5 Mounting the Angle Drive and the Connecting Housing to the Transmission

17.5.1 Mount the Connecting Housing to the Transmission

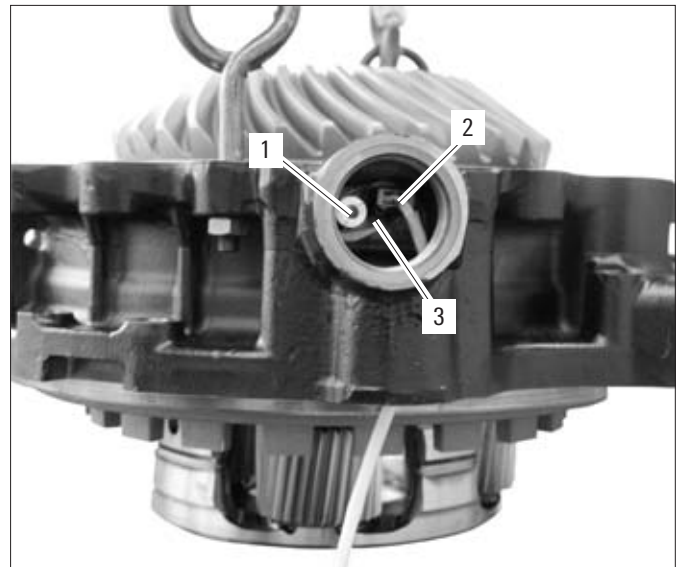
- 1 Put on the seal (3).
- 2 Mount two hooks (1) to the connecting housing.
- 3 Mount the lifting equipment.
- 4 Suspend the connecting housing (2) by means of a crane and swivel over the transmission housing.
- 5 Mount the inductive sensor output (3) with the M6 TORX screw (1).
Tightening torque: 8.5 Nm
- 6 Route the connector of the inductive sensor output (2) through the connecting housing and plug in.
- 7 Insert the cable (3) in the transmission housing.
- 8 Put the connecting housing on the transmission by means of a crane. Here, ensure that the piston (1) meshes with the disk spring (2).

CAUTION

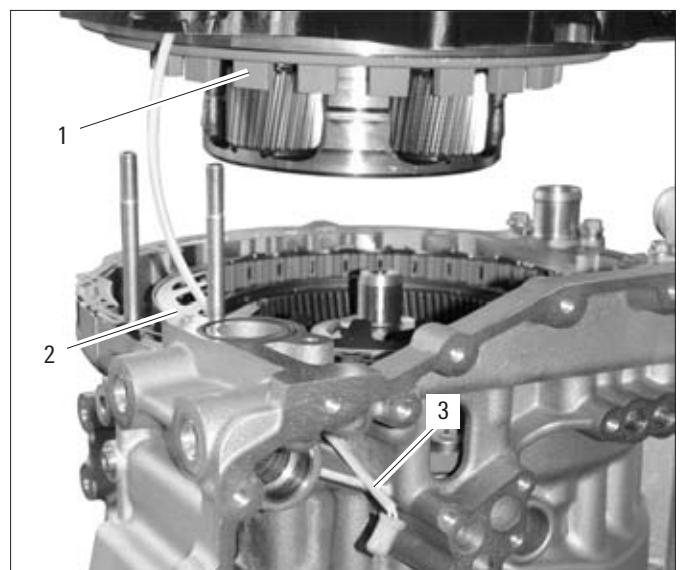
Pay attention to the fact that the cable (3) is not damaged during the process.



030345

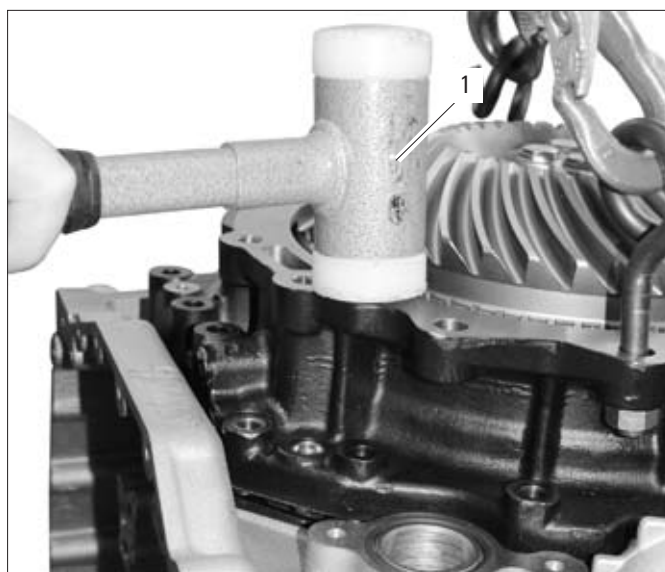


030358



030359

- 9 Use a plastic hammer **(1)** in order to drive in the connecting housing with light blows until firmly home.



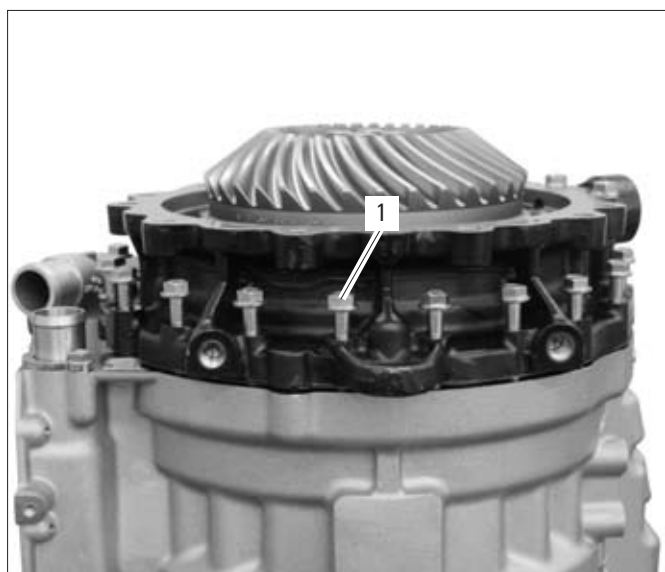
030346

- 10 Screw on two M10 nuts **(1)**.
Tightening torque: 46 Nm



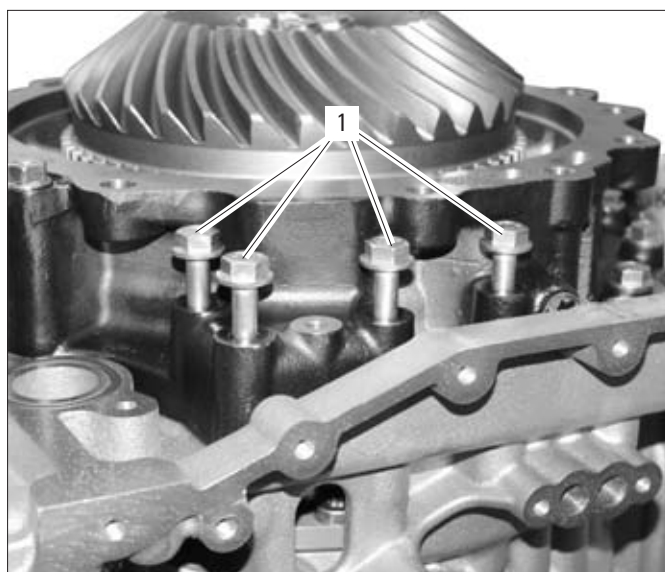
030347

- 11 Screw in 14 M10x53 hex head screws/bolts **(1)**.
Tightening torque: 46 Nm



030348

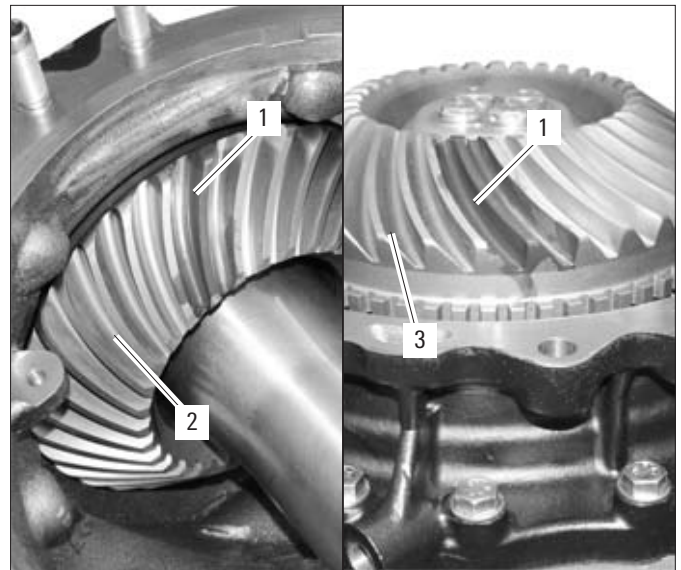
- 12 Screw in four M10x73 hex head screws/bolts **(1)**.
Tightening torque: 46 Nm



030349

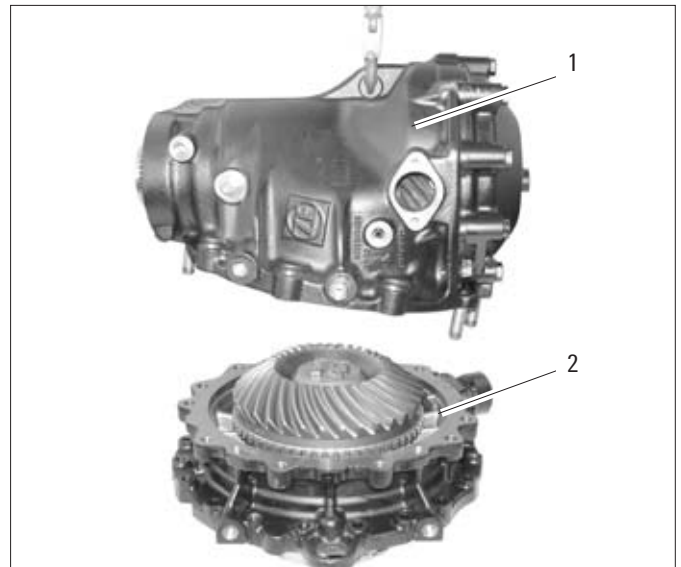
17.5.2 Mounting the Angle Drive to the Connecting Housing

- 1 Clean the teeth of the bevel gears Z33 **(2)** and Z34 **(3)** for the bearing pattern check so that they are free from grease.
- 2 Apply touch-up color **(1)** to the two bevel gears.



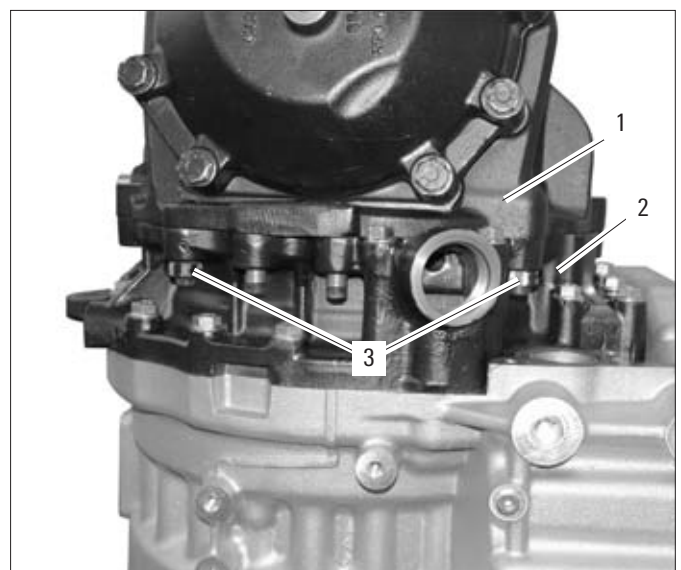
030350/030351

- 3 Put the angle drive **(1)** with the crane onto the connecting housing **(2)**.



030227

- 4 Tighten angle drive **(1)** with four nuts **(3)**.
- 5 Turn the angle drive through - for a couple of rotations - at the output flange in both directions.
- 6 Remove the four nuts **(3)** once again.
- 7 Take off the angle drive **(1)** with a crane from the connecting housing **(2)**.
- 8 Check the contact patterns of Z33 and Z34 in accordance with the illustrations shown in the sectional drawing of the angle drive (left bottom side) in the annex and, if necessary, correct these (for instructions see annex).



030352

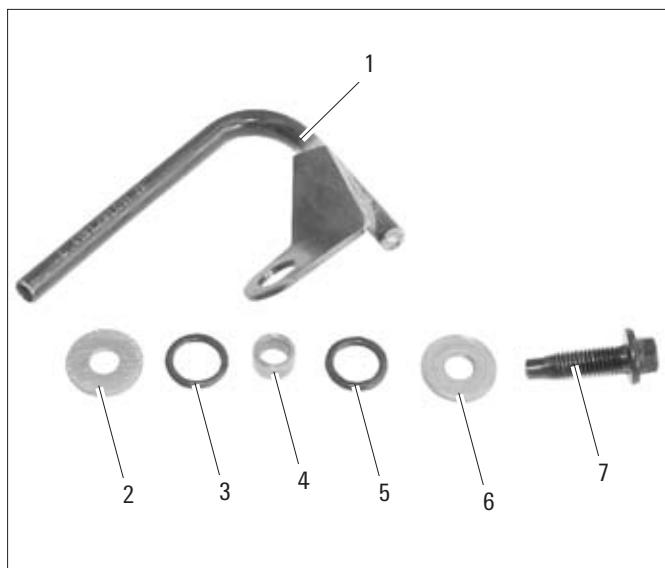
- 9 Insert the O-ring (1).



030353

- 10 Spray tube (1) with the add-on parts:

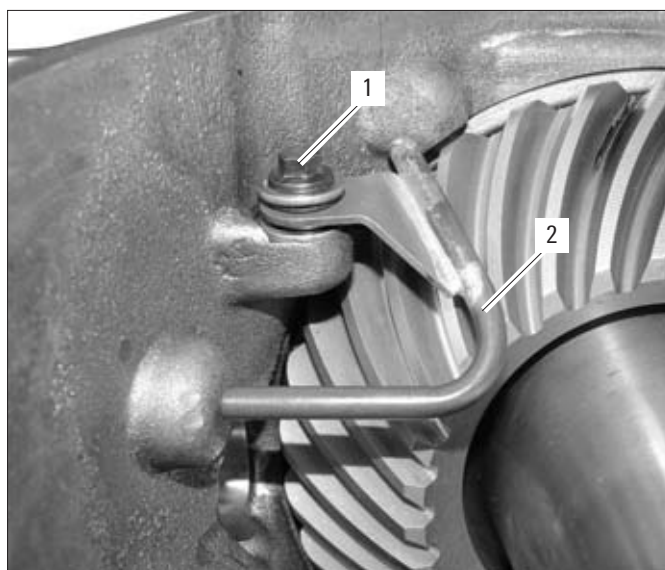
- Two disks/shims (2, 6)
- Two O-rings (3, 5)
- Spacer piece (4)
- Hex head screw/bolt (7)



030241

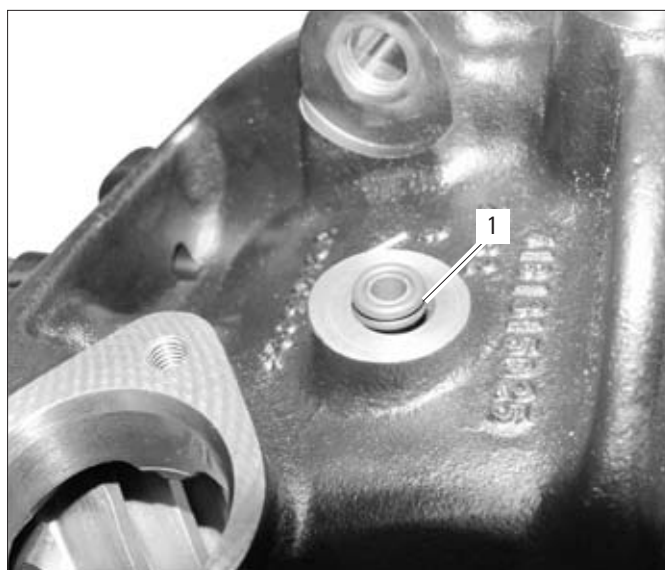
- 11 Fasten/Tighten the spray tube (2) with the add-on parts and the hex head screw/bolt (1). The hex head screw/bolt (1) must always be replaced.

Tightening torque: 34 Nm



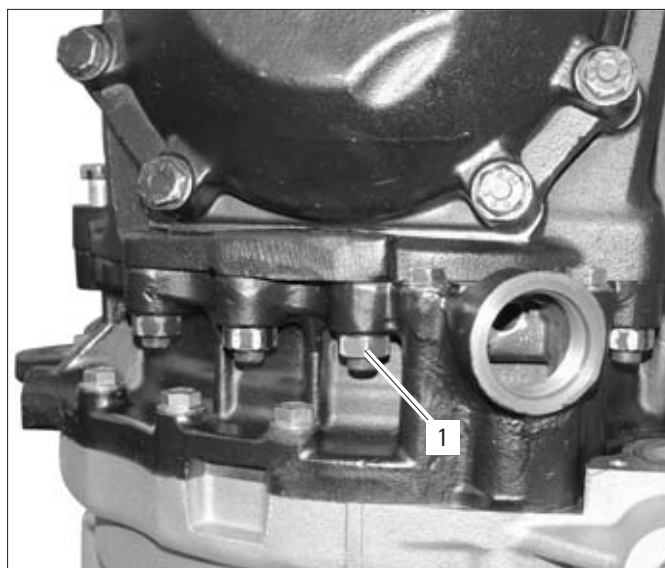
030354

- 12 Coat two O-rings **(1)** with technical Vaseline.
- 13 Slide on two O-rings **(1)** on the spray tube from the outside.



030355

- 14 Suspend the angle drive with a crane and put the unit onto the connecting housing.
- 15 Screw on seven M14 nuts **(1)**.
Tightening torque: 170 Nm



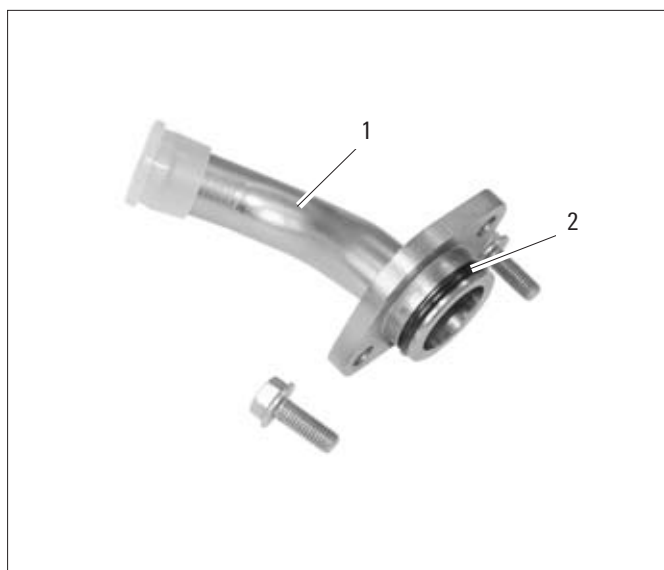
030356

- 16 Screw in five M14x1.5x45 hex head screws/bolts.
Tightening torque: 170 Nm



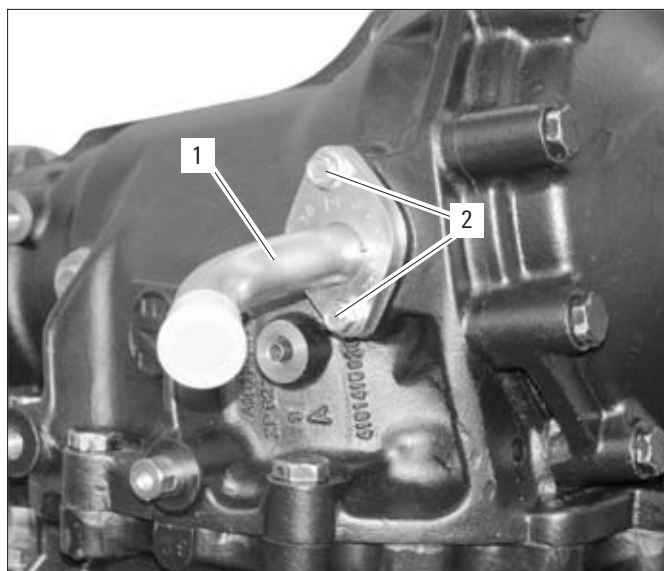
030357

- 17 Coat O-ring **(2)** with technical Vaseline.
- 18 Mount the O-ring **(2)** on the oil filler tube **(1)**.



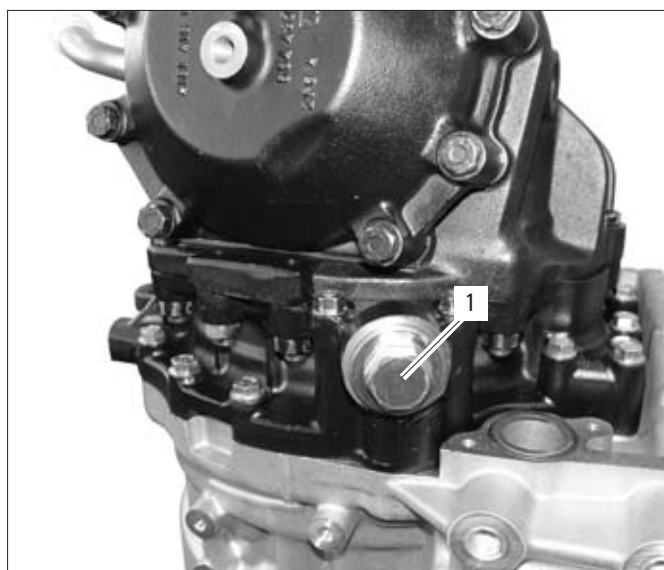
030360

- 19 Use two hex head screws/bolts **(2)** in order to tighten the oil filler tube **(1)**.



030361

- 20 Screw in the M42x1.5 screw plug **(1)** with the O-ring.
Tightening torque: 120 Nm

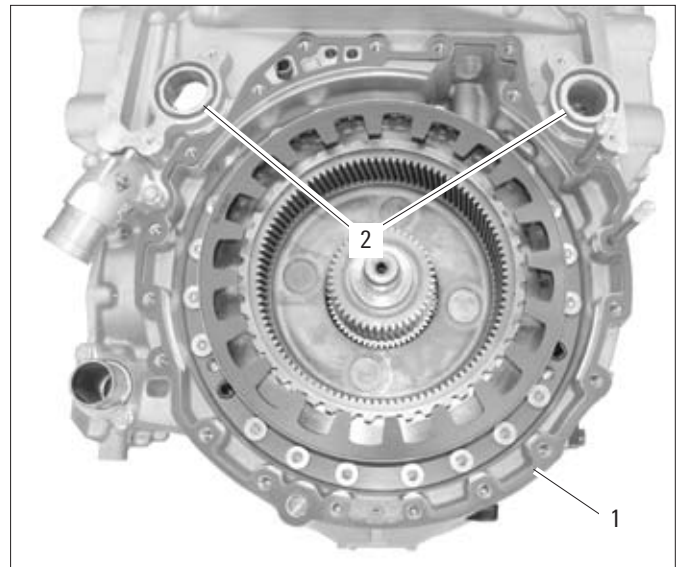


030145

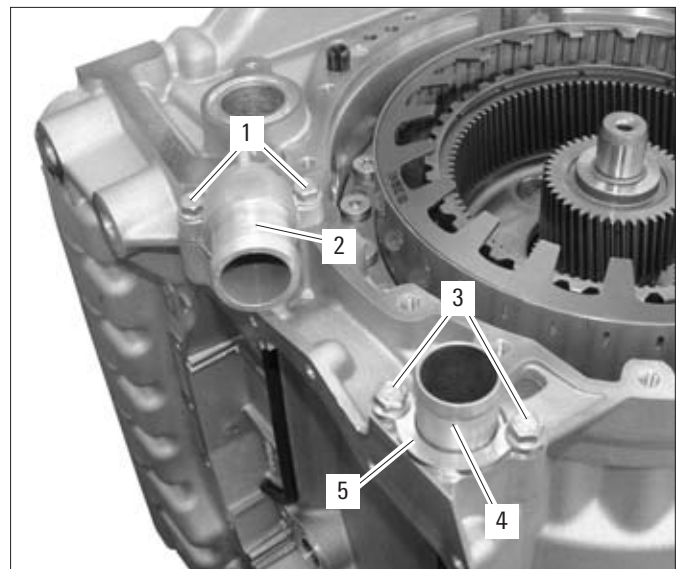
18 Installing, Removing, Dismantling, and Assembling the Mechanical Transmission Part

18.1 Removing the Mechanical Transmission Part

- 1 Remove the seal **(1)**.
- 2 Take out the two O-rings **(2)**.
- 3 Unscrew the two hexagon head screws/bolts **(1)**.
- 4 Take off the angle flange **(2)**.
- 5 Unscrew the two hex head bolts/screws **(3)**.
- 6 Take off the connecting pipes **(4)** with the retaining plate **(5)**.
- 7 Take off the two O-rings **(1)** from the connecting pipes.
- 8 Take off one O-ring **(2)** from the angle flange.



030174

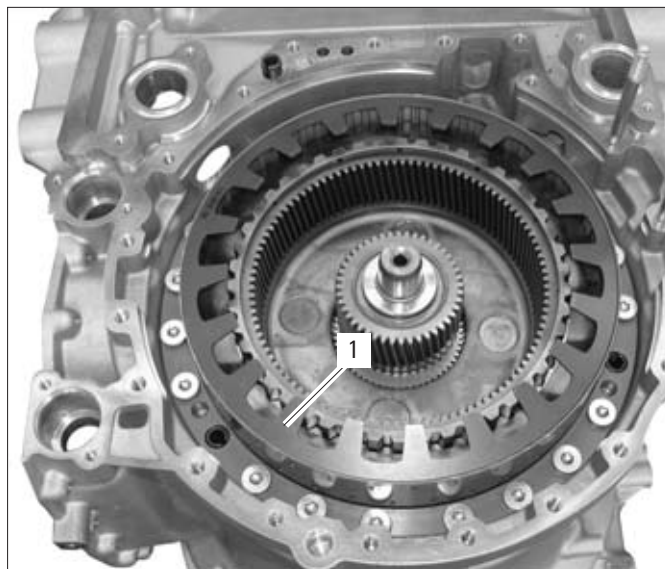


030175



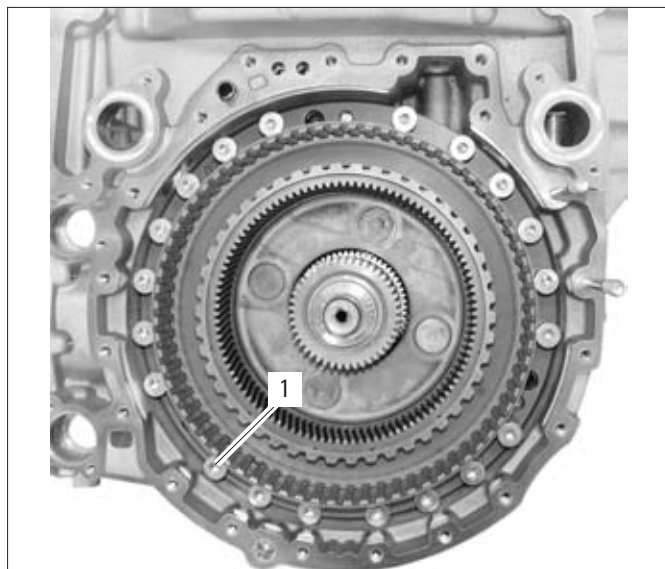
030176

- 9 Take off the readjusting spring F (1).



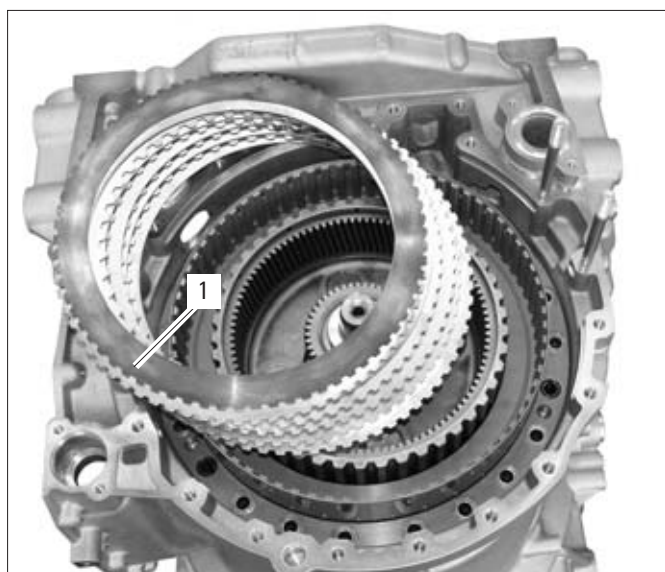
030177

- 10 Unscrew all TORX screws M10 (1) from the retaining ring of the multidisk carrier F.



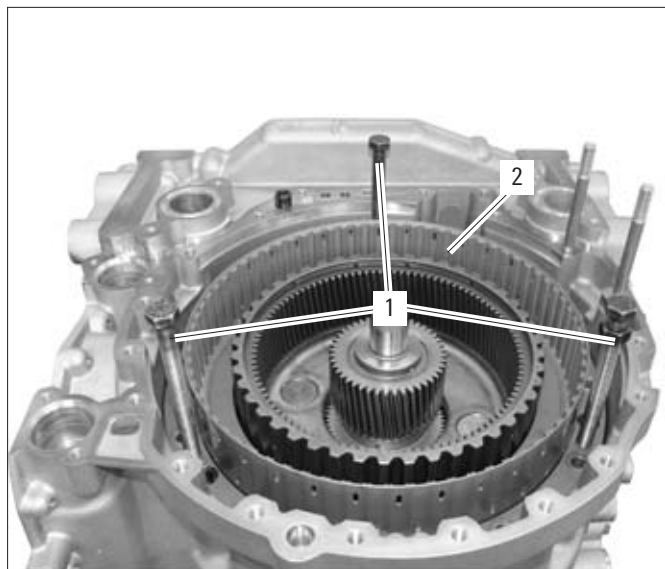
030178

- 11 Take out the multidisks F (1).



030213

- 12 Screw in three packing screws M12 **(1)** in the multidisk carrier F **(2)**.
- 13 Evenly press off the multidisk carrier F **(2)** by means of the packing screws **(1)**.
- 14 Take off the multidisk carrier F **(2)**.
- 15 Unscrew the packing screws **(1)**.



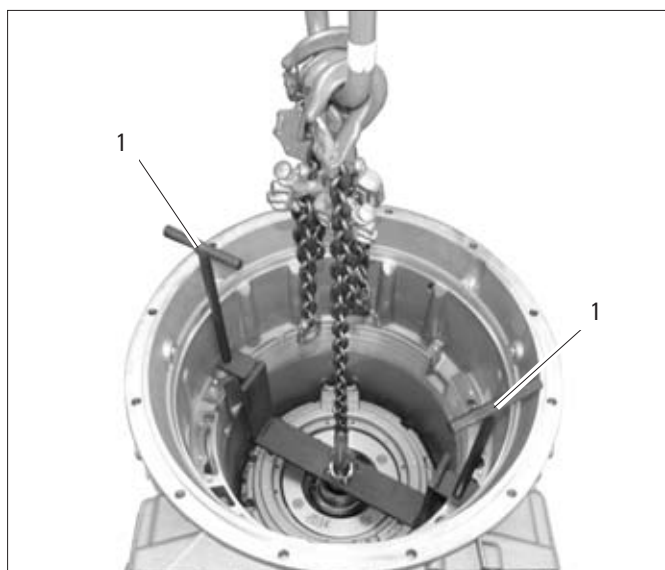
030179

- 16 Take off the abrasive wear protection **(1)**.



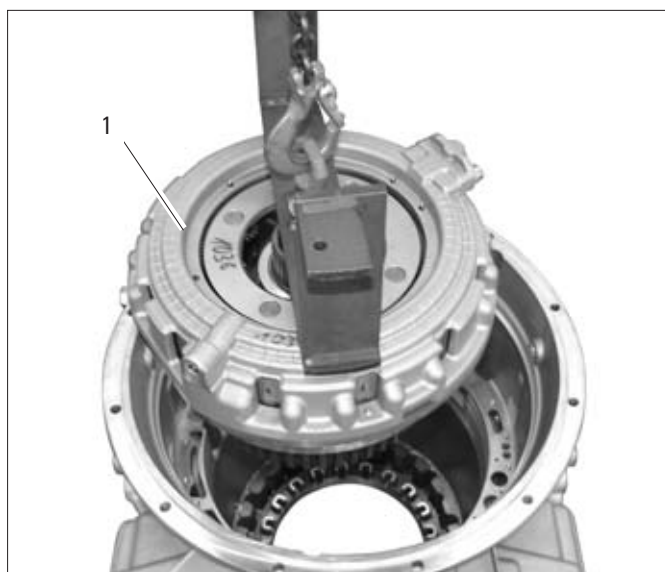
030180

- 17 Remove the two fixing screws **(1)** from the bracket no.: **1X56 138 556**.
- 18 Mount the lifting equipment for the crane.



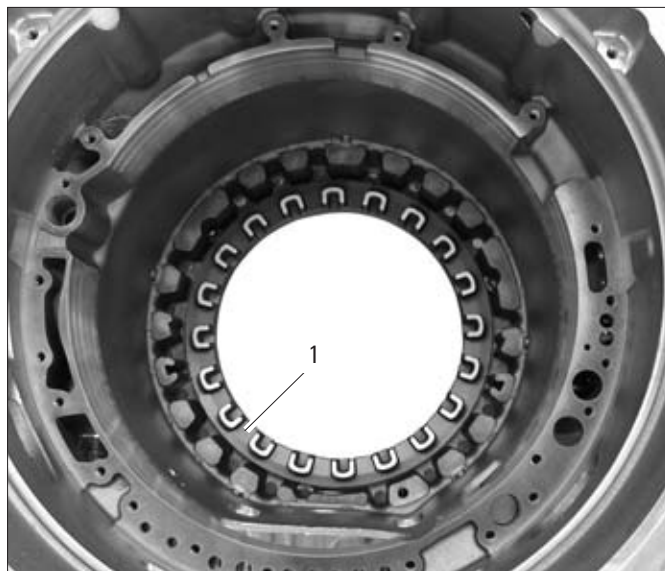
030182

- 19 Lift out the assembly group (1) with a crane.



030183

- 20 Take out the cup spring E (1).

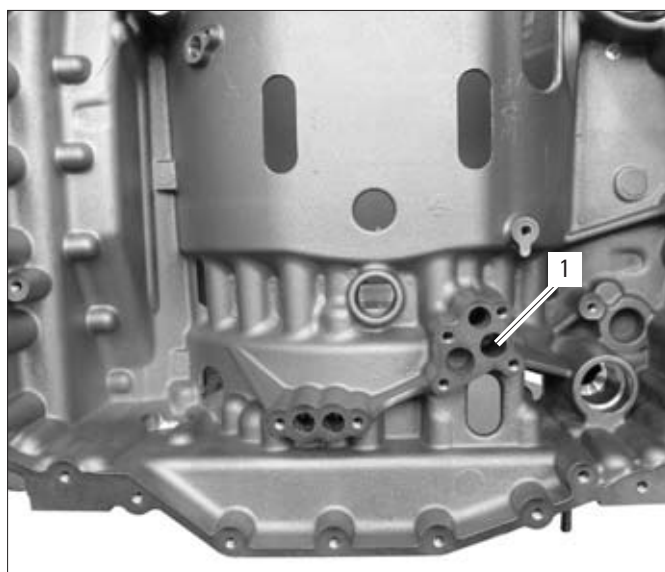


030184

- 21 In order to loosen the piston E, blow in minor quantities of compressed air via the orifice (1).

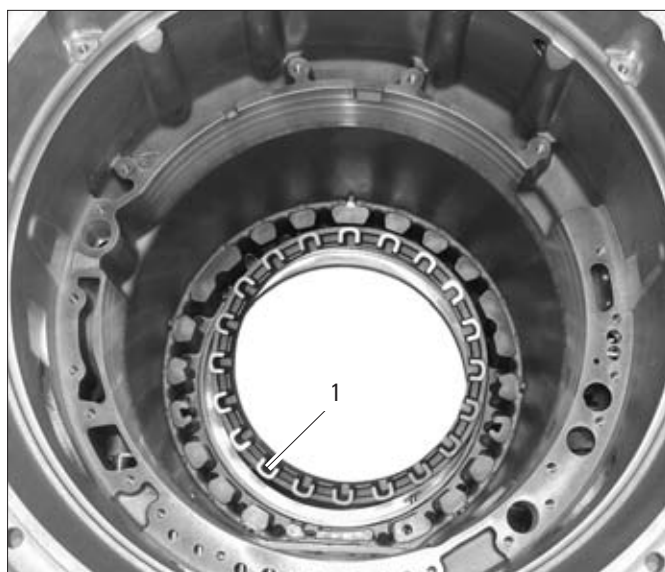
CAUTION

Oil may spray out. Cover up the compressed-air pistol with a cloth.



030185

- 22 Take out the piston E (1).



030186

- 23 Take out the two sealing rings (1, 2) from the piston E.



030187

18.2 Dismantle the Multidisk Carrier D/E and the Planet Carrier I/II

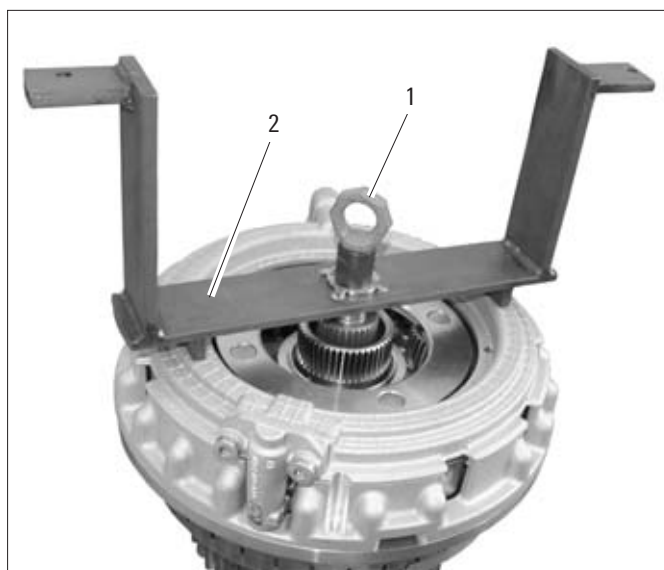
- 1 Unscrew the lifting device no.: **1T66 160 645 (1)**.



DANGER

Risk of injury
Shaft falls out.
Hold onto shaft.

- 2 Take off the bracket no.: **1X56 138 556 (2)**.



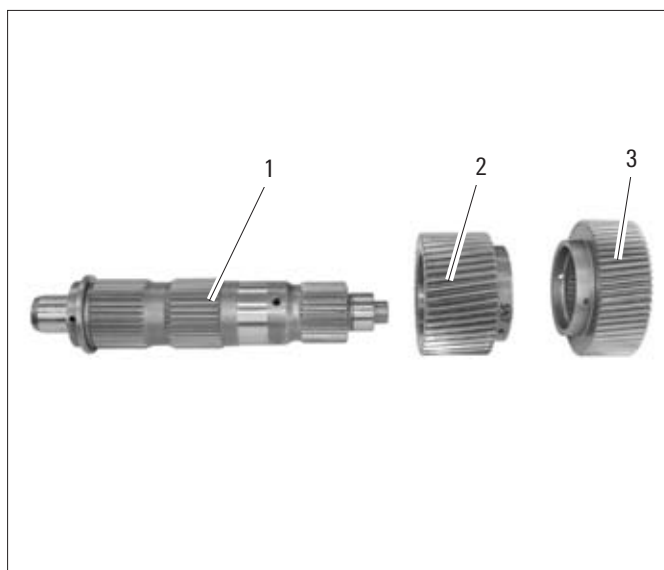
025383

- 3 Take out the shaft together with the sun gear **(1)** from the planet carrier.



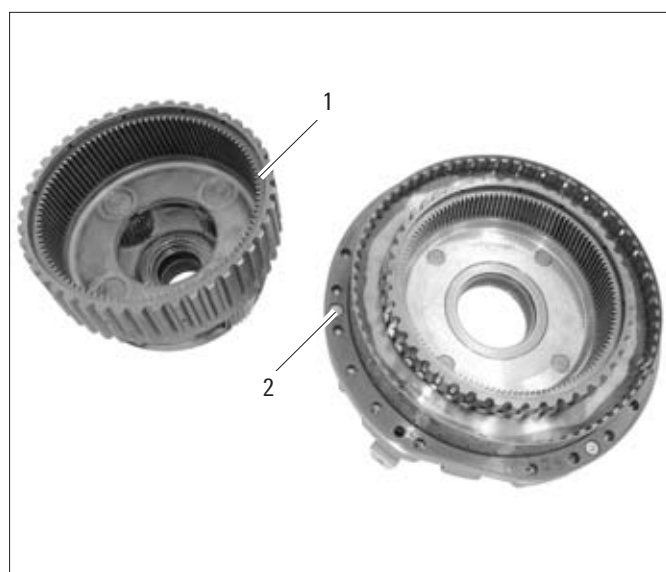
030189

- 4 Take out the two sun gears **(2, 3)** from the input shaft **(1)**.



030188

- 5 Take off the planet carrier II **(1)**.
- 6 Unscrew the three TORX screws M6 **(2)**.



030190

18.2.1 Dismantle the Multidisk Carrier D/E

- 1 Take off the housing (1).

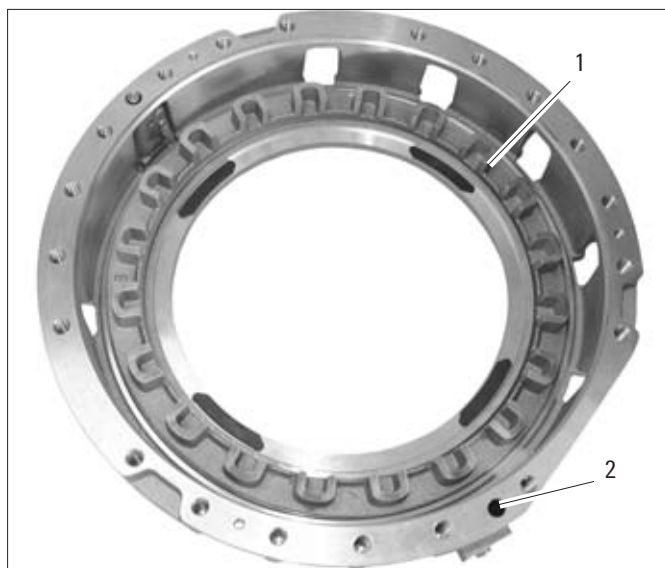


030191

- 2 In order to loosen the piston D (1), blow in minor quantities of compressed air via the orifice (2).

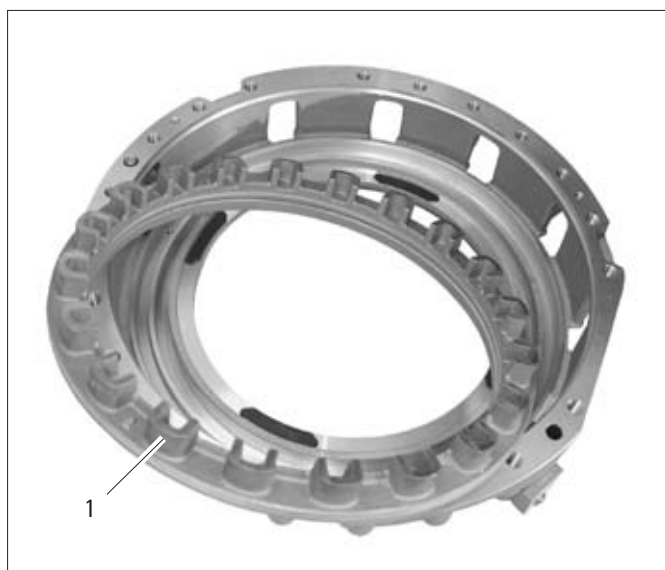
CAUTION

Oil may spray out. Cover up the compressed-air pistol with a cloth.



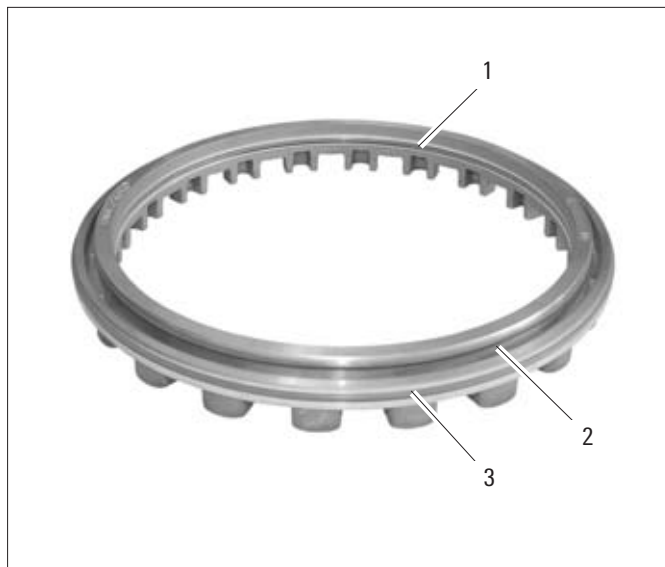
025387

- 3 Take out the piston D (1).



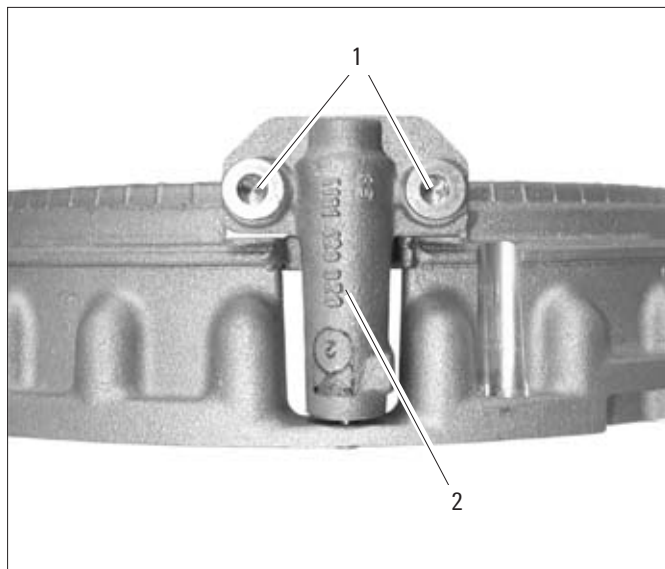
025389

- 4 Take out the three sealing rings **(1, 2, 3)** from the piston D.



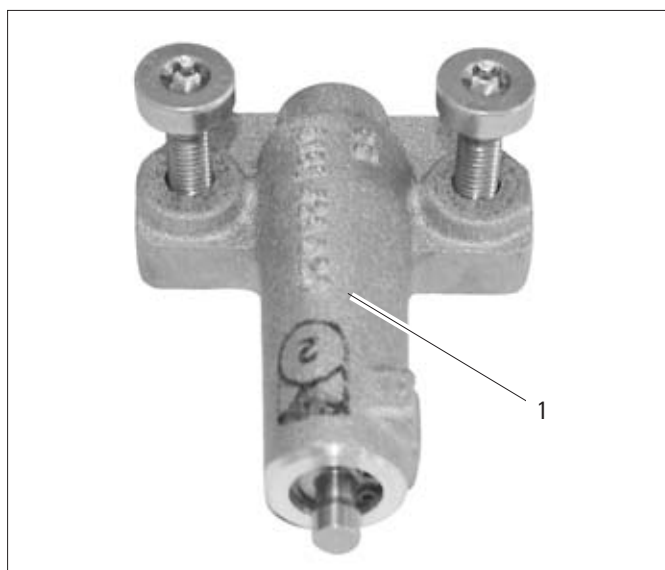
025390

- 5 Unscrew two TORX screws M8 **(1)** from the change-over valve **(2)**.



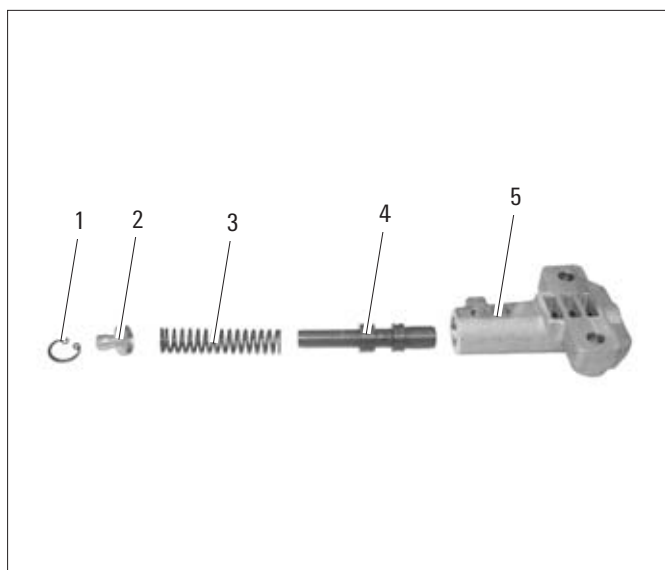
025391

- 6 Take off the change-over valve **(1)**.



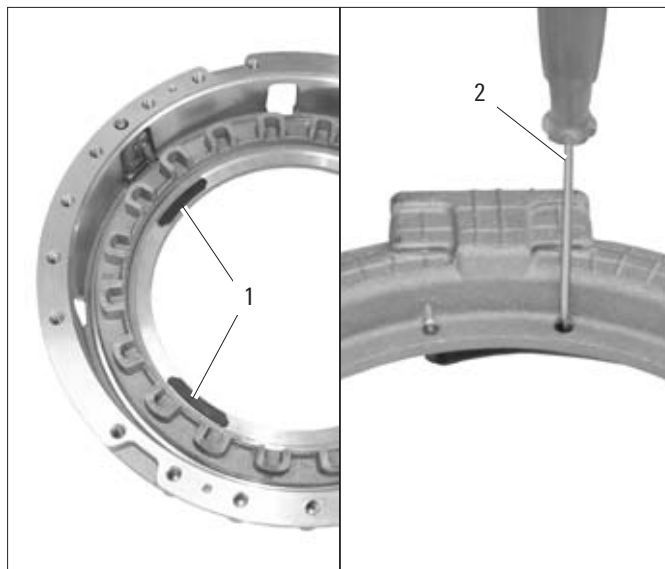
025392

- 7 Unsnap the securing ring **(1)**.
- 8 Take out the thrust piece **(2)**, spring **(3)**, and piston **(4)** from the change-over valve's housing **(5)**.



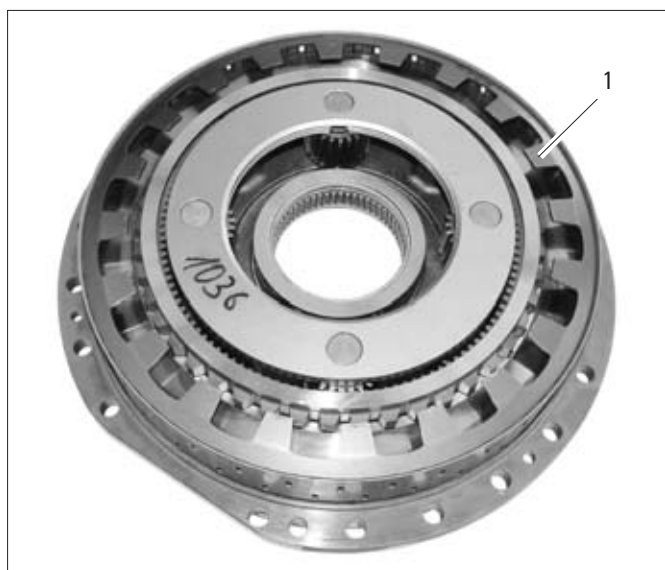
025393

- 9 Press out four stop pieces **(1)** from the rear side by means of a suitable screw driver **(2)**.



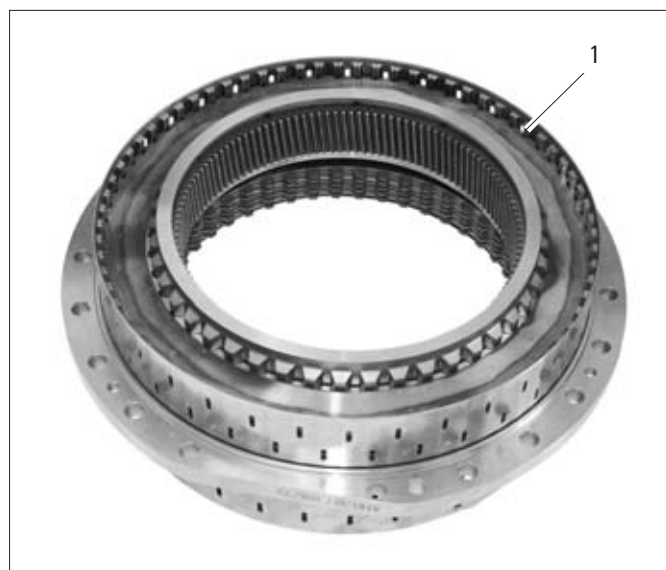
025388/025394

- 10 Take out the cup spring D **(1)**.



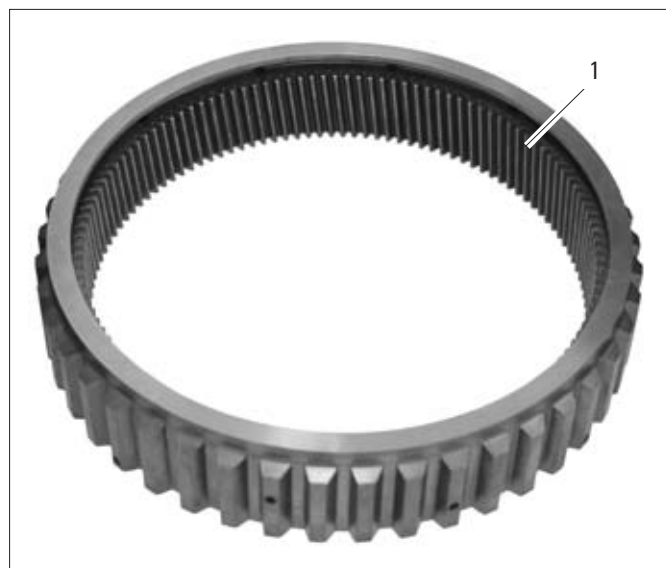
030192

- 11 Take off the multidisk carrier D/E **(1)**.



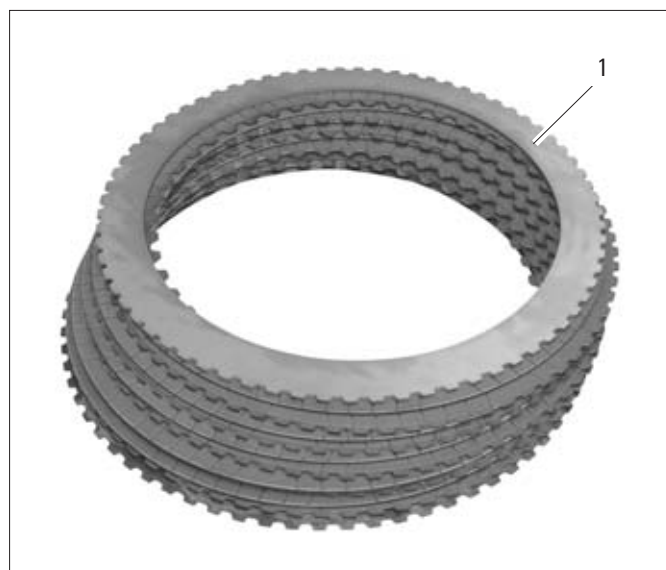
025396

- 12 Take out the (internal) ring gear **(1)**.



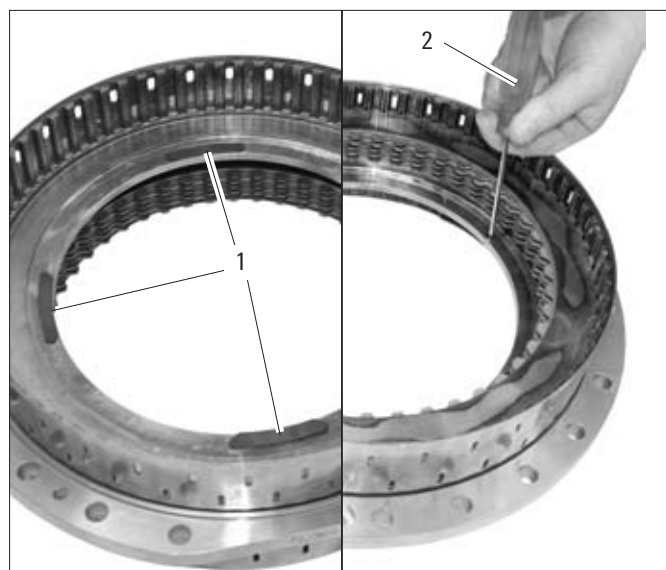
025397

- 13 Take out the multidisk package D **(1)**.



025398

- 14 Press out four stop pieces **(1)** from the rear side by means of a screw driver **(2)**.



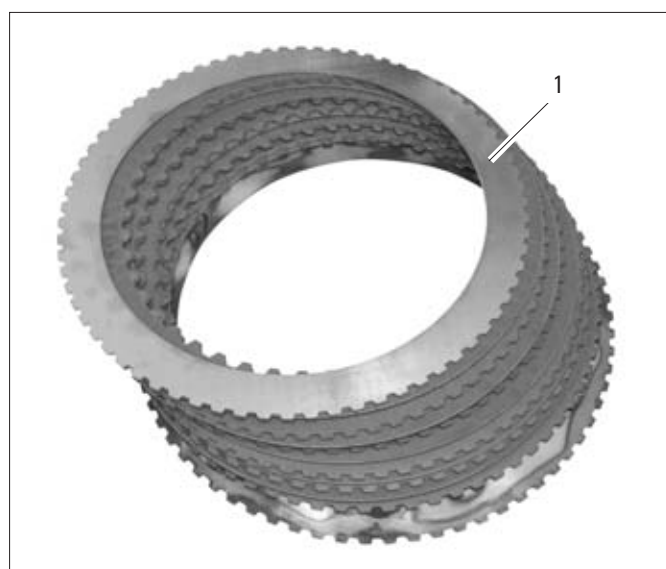
025399/025400

- 15 Take out the two holding plates **(1)**.



030410

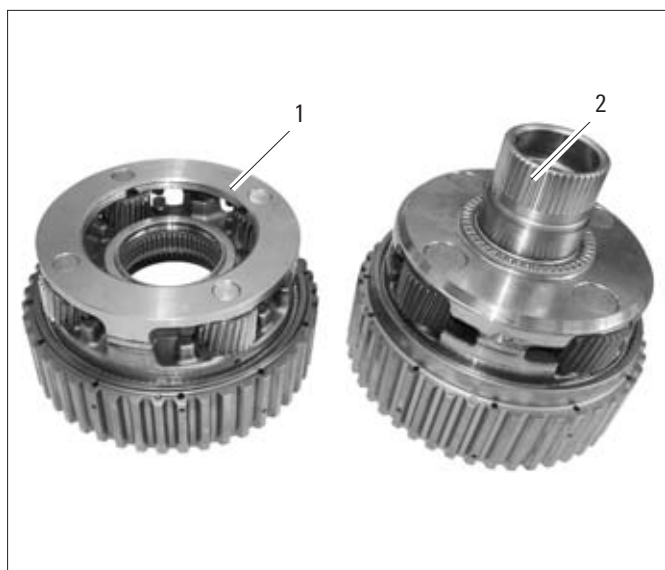
- 16 Take out the multidisk package E **(1)**.



025402

18.2.2 Dismantle the Planet Carrier I/II

- 1 Planet carrier I **(1)** and II **(2)**.



025403

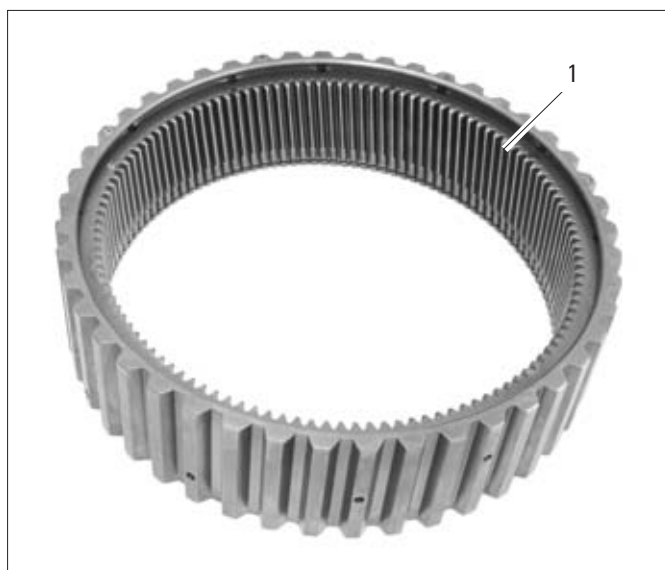
18.2.2.1 Dismantle the Planet Carrier I

- 1 Unsnap the securing ring **(1)** by means of a suitable screw driver.



025404

- 2 Take off the internal ring gear **(1)**.



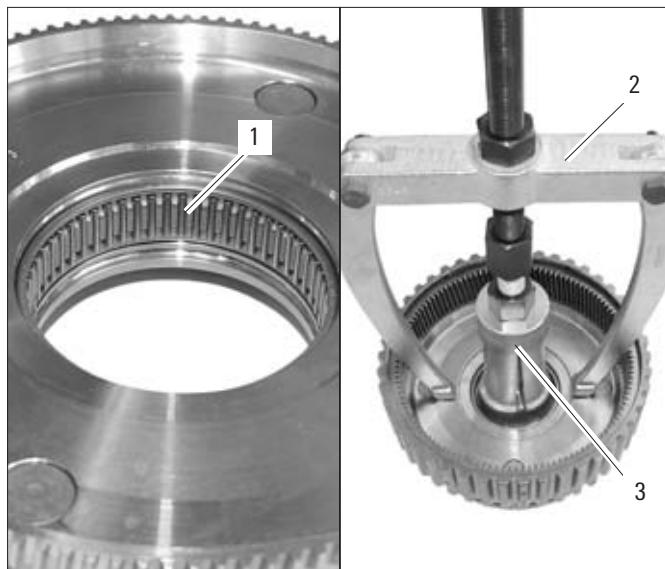
025405

- 3 Take out the stop disk (1) from the planet carrier.



025406

- 4 In the case of damage, remove the needle bearing (1) with the tool no.: **1X56 122 211 (3)** in conjunction with the basic device no.: **1X56 122 228 (2)** and replace with a new one.

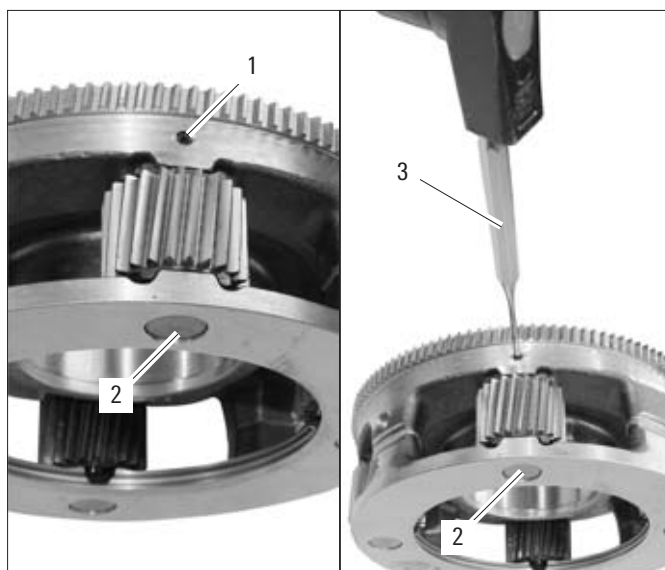


025407/030193

- 5 Release the planetary-gear shaft (2). To this end, cautiously drive in the centering pin (1) by means of a suitable mandrel (3) at the center of the planetary-gear shaft (2).

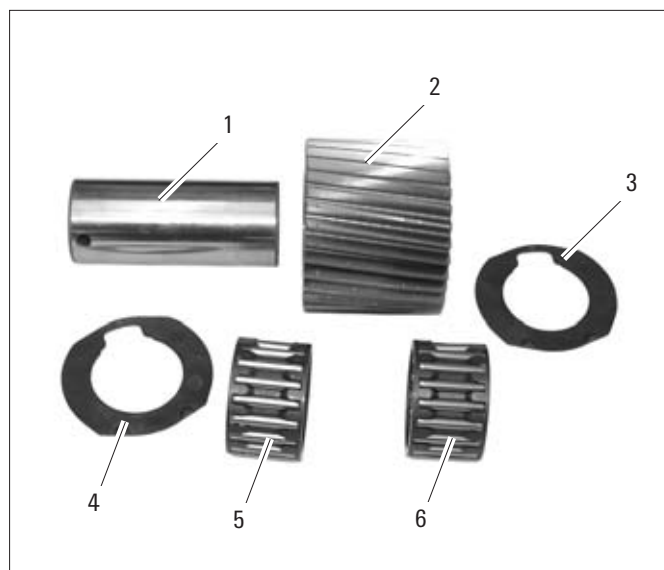
CAUTION

Never drive in centering pins until firmly home.



030194/030195

- 6 Press out the planetary-gear shaft (1) from the planet carrier.
- 7 Take out the planet gear (2).
- 8 Take out the two stop disks (3, 4).
- 9 Take out the two needle bearings (5, 6) from the planet gear.



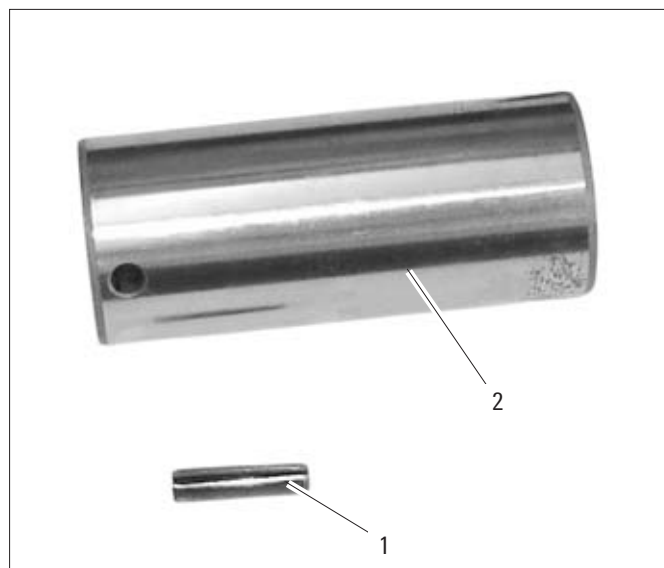
025485

- 10 Clamp the planetary-gear shaft (2) into a vise.

NOTE

Use protective chucks made from aluminum.

- 11 Drive out the centering pin (1) by means of a suitable mandrel from the planetary-gear shaft (2).
- 12 Repeat the working steps 6 to 12 for the remaining planet gears.



025487

18.2.2.2 Dismantle the Planet Carrier II

- 1 If required, take off the axial bearing (1).

NOTE

In the case that the axial bearing is disassembled, then the unit must be renewed.



025408

- 2 If necessary, disassemble the axial bearing (1).

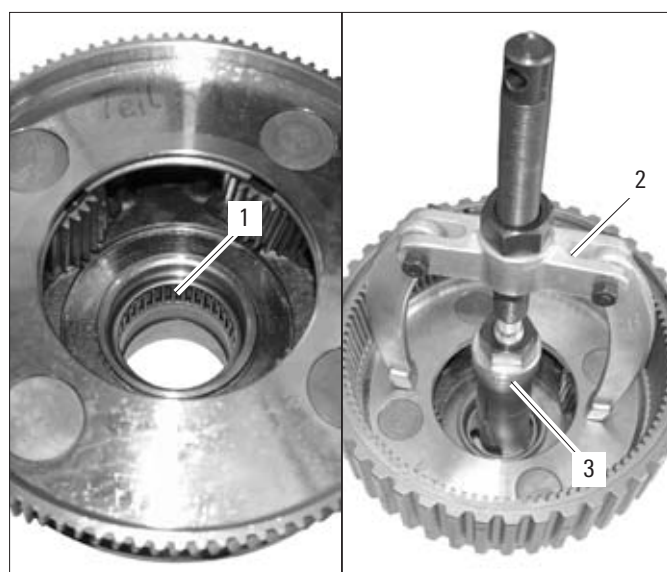
NOTE

In the case that the axial bearing is disassembled, then the unit must be renewed.



025411

- 3 If required, remove the needle bearing (1) with the tool no.: **1X56 122 209 (3)** in conjunction with the basic device no.: **1X56 122 227 (2)** and replace with a new one.



025412/025553

- 4 Unsnap the securing ring **(1)** by means of a suitable screw driver.



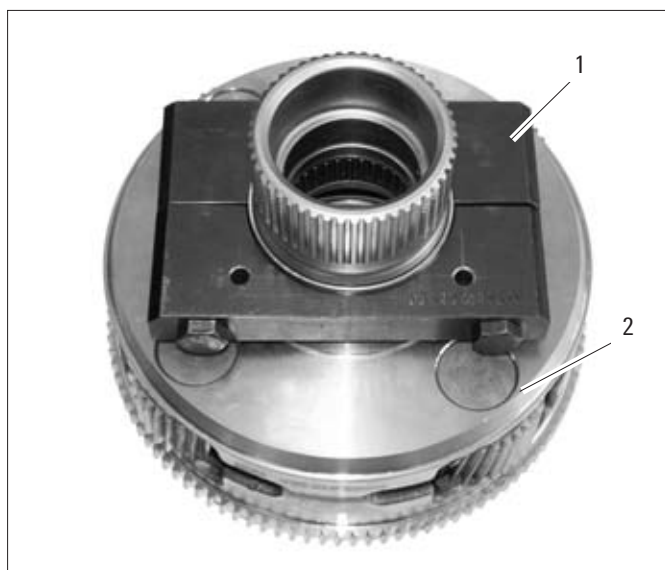
025409

- 5 Take off the internal ring gear **(1)**.



025410

- 6 If required, use the tool no.: **1X56 124 659** and mount it to the inner bearing ring of the planet carrier II **(2)**.



025545

- 7 Pull off the inner bearing ring (1) by means of a suitable two-armed extractor (2).

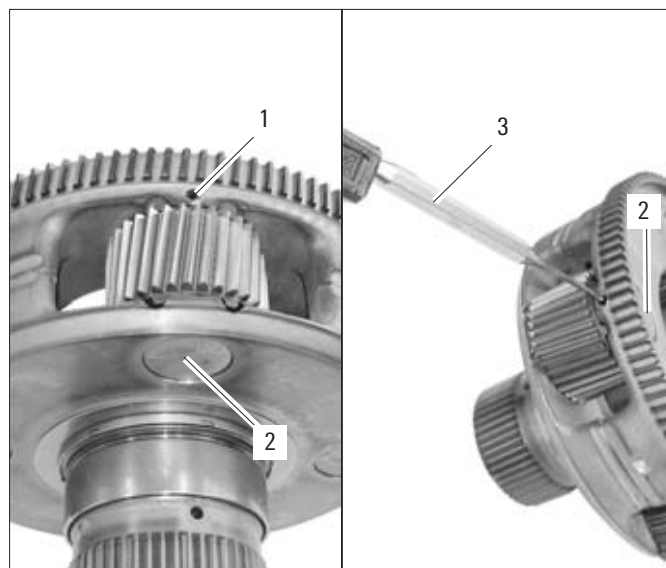


025546/025547

- 8 Release the planetary-gear shaft (2). To this end, cautiously drive in the centering pin (1) by means of a suitable mandrel (3) at the center of the planetary-gear shaft (2).

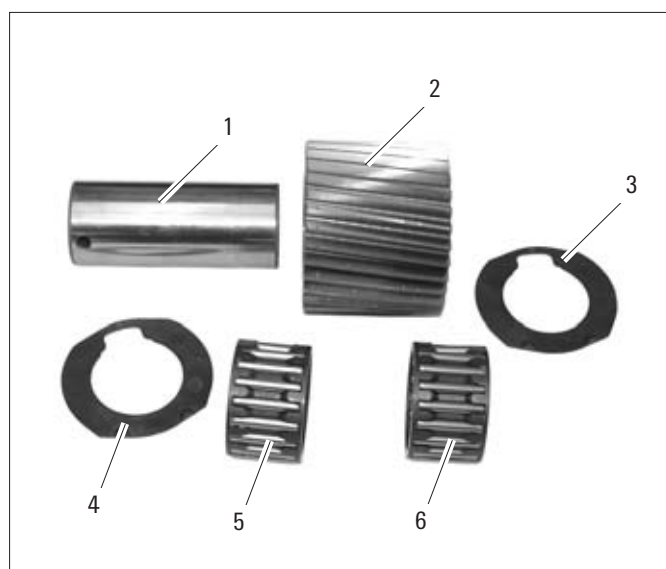
CAUTION

Never drive in centering pins until firmly home.



030198/030197

- 9 Press out the planetary-gear shaft (1) from the planet carrier.
- 10 Take out the planet gear (2).
- 11 Take out the two stop disks (3, 4).
- 12 Take out the two needle bearings (5, 6) from the planet gear.



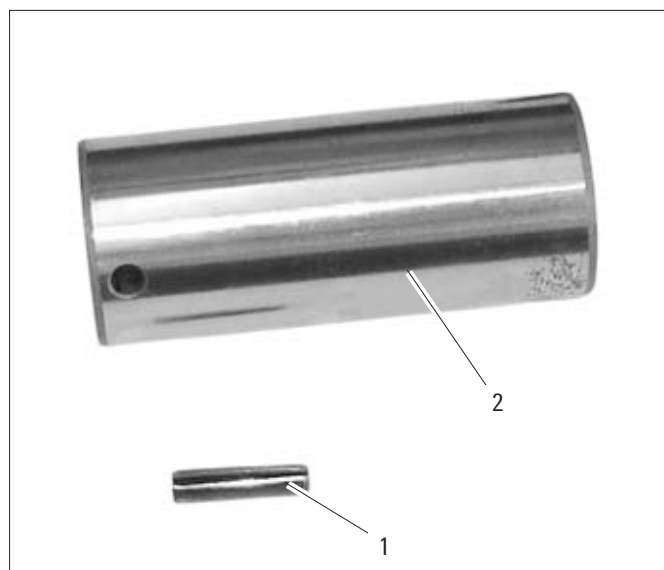
025485

- 13 Clamp the planetary-gear shaft **(2)** into a vise.

NOTE

Use protective chucks made from aluminum.

- 14 Drive out the centering pin **(1)** by means of a suitable mandrel from the planetary-gear shaft **(2)**.
- 15 Repeat the working steps 6 to 12 for the remaining planet gears.



025487

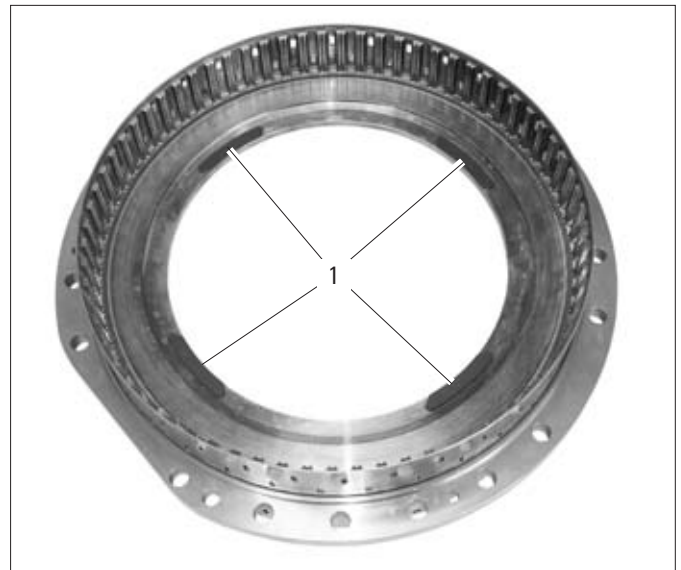
18.3 Assemble the Multidisk Carrier D/E and the Planet Carrier I/II

18.3.1 Assemble the Multidisk Carrier D/E

- 1 Insert four stop disks (1) for the ring gear at the side "D".

CAUTION

In the case that the stop disks are installed at the wrong side, then, the transmission will be damaged.



025522/

- 2 Clamp in the multidisk package "D" with approx. 200 N on the press.
- 3 Measure the thickness of the multidisk package. The nominal dimension can be taken from the parts list (BoM). The nominal dimension can be taken from the parts list (BoM).

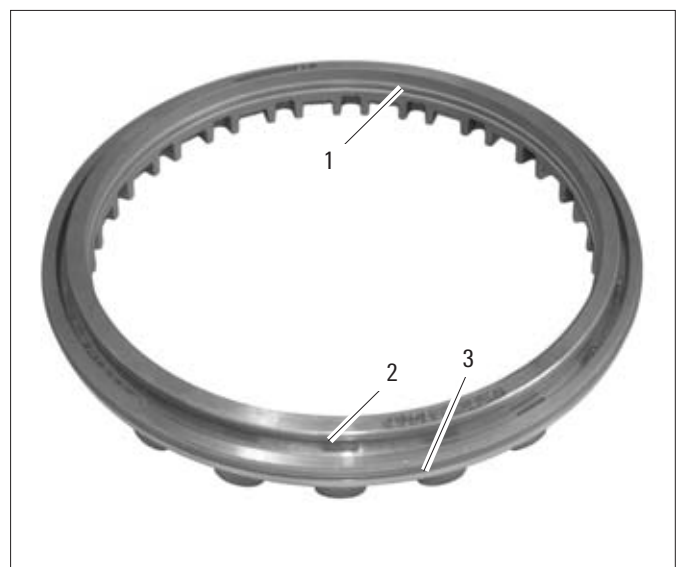
NOTE

Always measure the multidisk packages without the ondular washer.



030153

- 4 Coat three sealing rings (1, 2, 3) with technical Vaseline.
- 5 Insert the three sealing rings (1, 2, 3) in the piston "D".



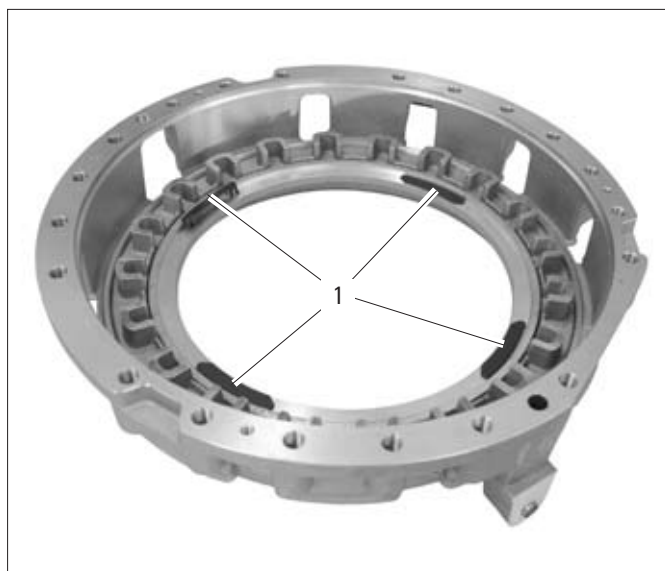
025529

- 6 Insert the piston "D" **(1)**.
- 7 Use a plastic hammer in order to drive in the piston "D" **(1)** with light blows until firmly home.



025530

- 8 Insert the four stop segments **(1)** for the internal ring gear.

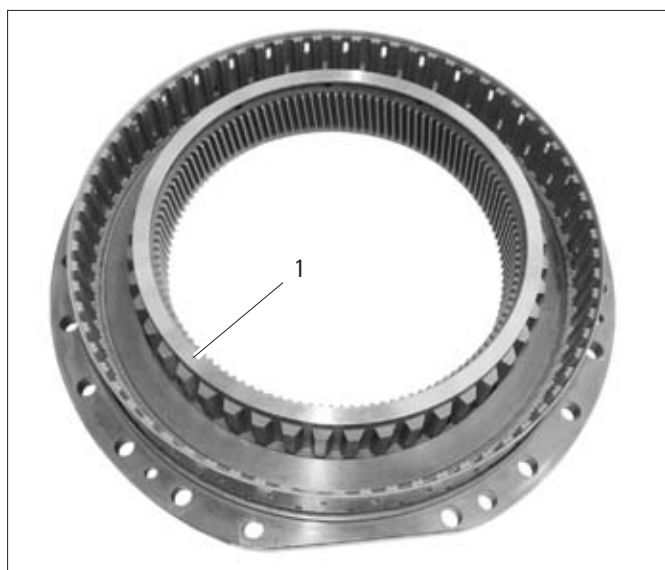


025531

- 9 Insert the internal ring gear **(1)**.

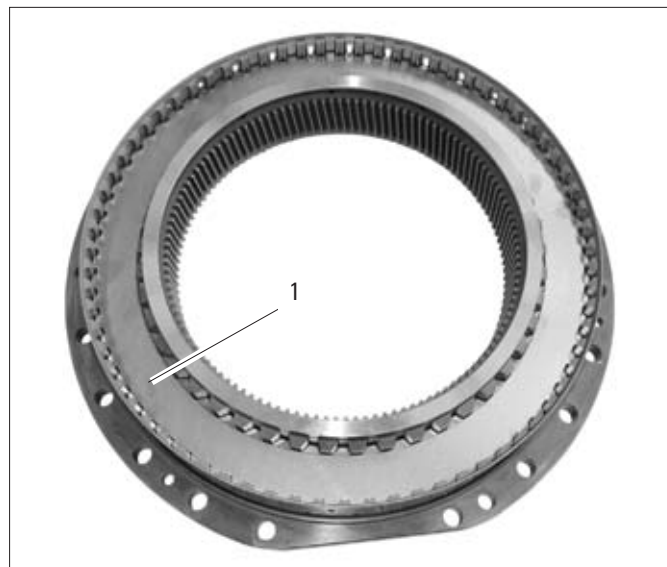
NOTE

Insert the internal ring gear with the collar facing upwards.



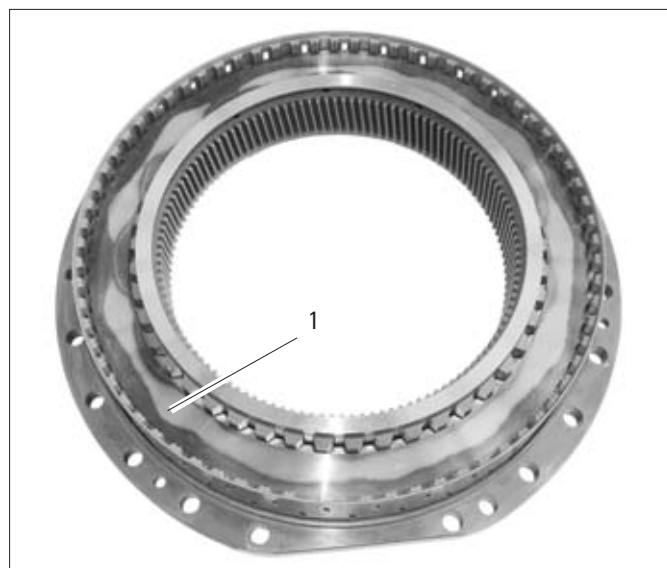
030199

- 10 Insert the end disk "D" and the lined clutch disks "D" **(1)** in accordance with the parts list (BoM).



030200

- 11 Insert the ondular washer **(1)**.



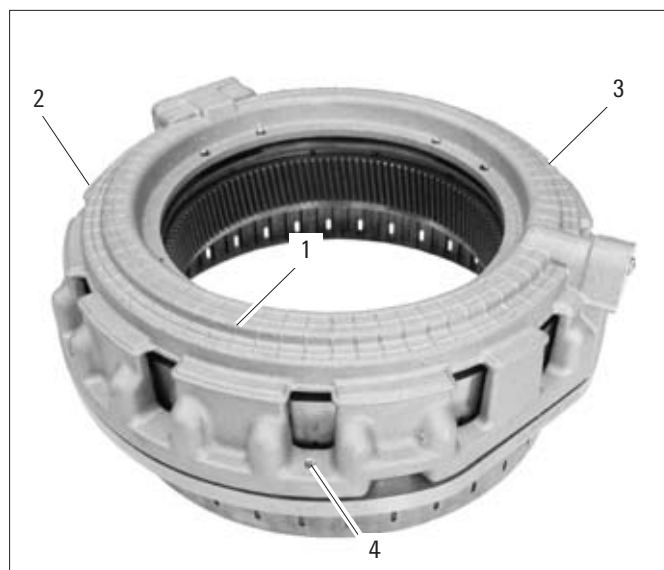
030201

- 12 Insert the readjusting spring **(1)**.



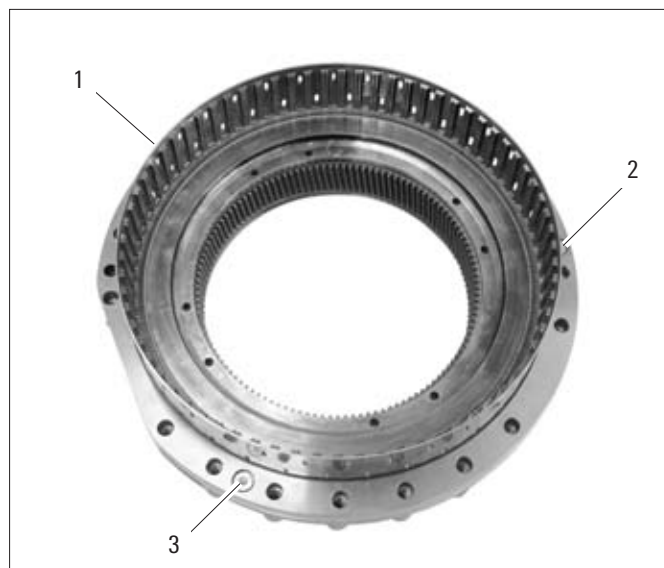
025534

- 13 Put on the piston support "D" (1).
- 14 Screw in four TORX screws M6 (2, 3, 4) from below.



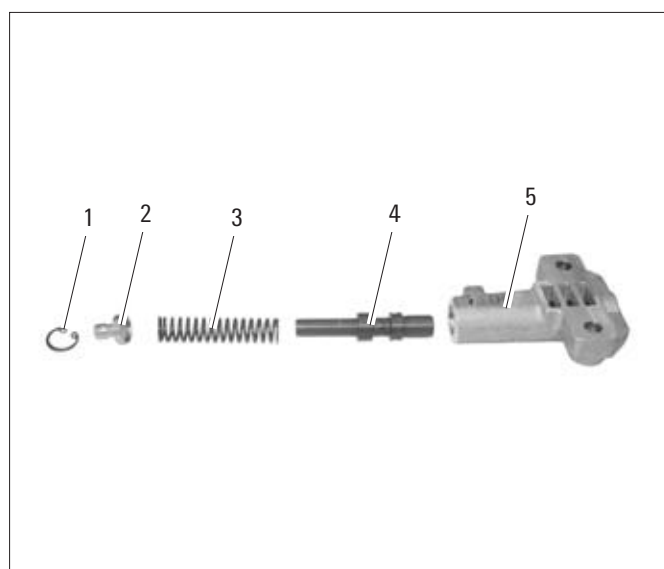
025535

- 15 Turn the assembly group around.
- 16 Tighten the three TORX screws M6x25 (1, 2, 3).
Tightening torque: 9.5 Nm



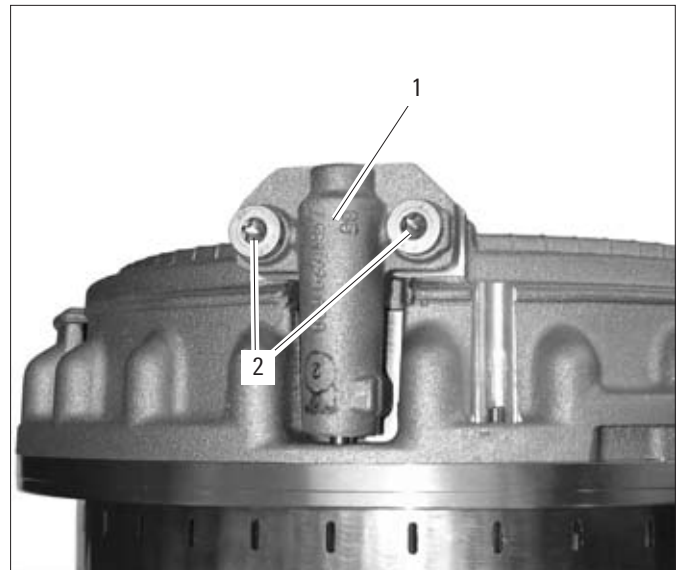
025536

- 17 Assemble the change-over valve.
- 18 Insert the thrust piece (2), spring (3), and piston (4) in the change-over valve's housing (5).
- 19 Snap in the securing ring (1).



025393

- 20 Put on the change-over valve **(1)**.
- 21 Screw in two TORX screws M8x36 **(2)** and tighten.
Tightening torque: 20 Nm



025537

- 22 Clamp in the multidisk package "E" with approx. 200 N on the press.
- 23 Measure the thickness of the multidisk package. The nominal dimension can be taken from the parts list (BoM). The nominal dimension can be taken from the parts list (BoM).

NOTE

Always measure the multidisk packages without the ondular washer.



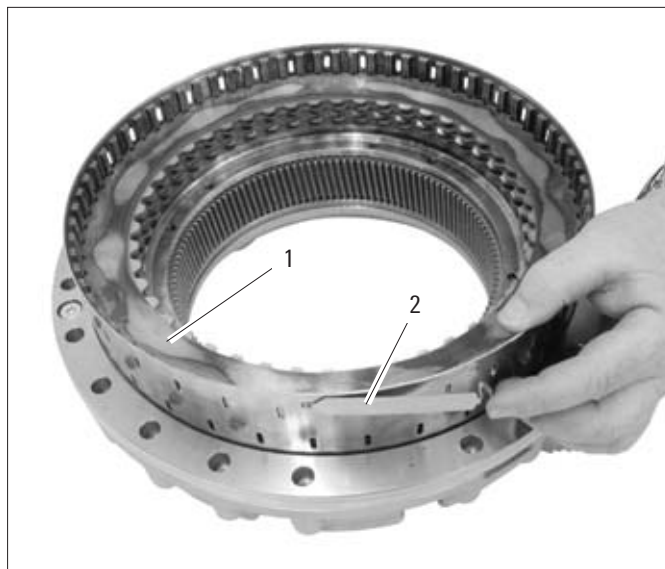
030153

- 24 Insert the end disk brake "E" in the multidisk carrier.
- 25 All outer and inner multidisks of the brake "E" must be inserted in accordance with the parts list (BoM) in the multidisk carrier.
- 26 Insert the ondular washer **(1)** in the brake "E".



025541

- 27 Secure the multidisks **(1)** by means of two holding plates **(2)**.

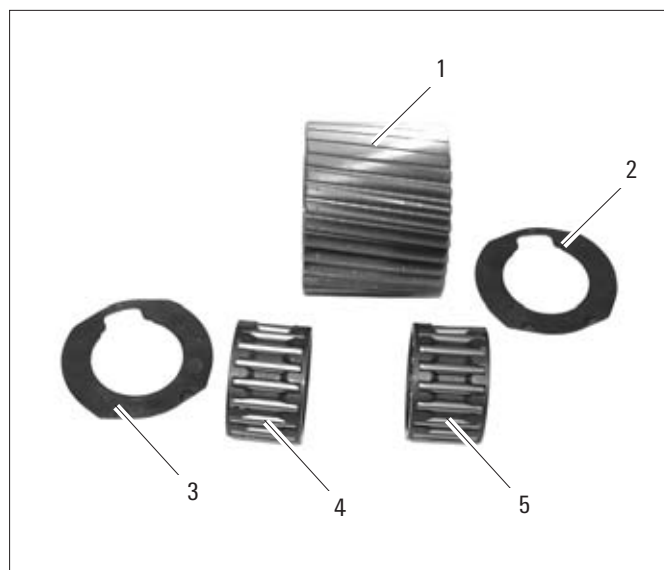


025549

18.3.2 Assemble the Planet Carrier I/II

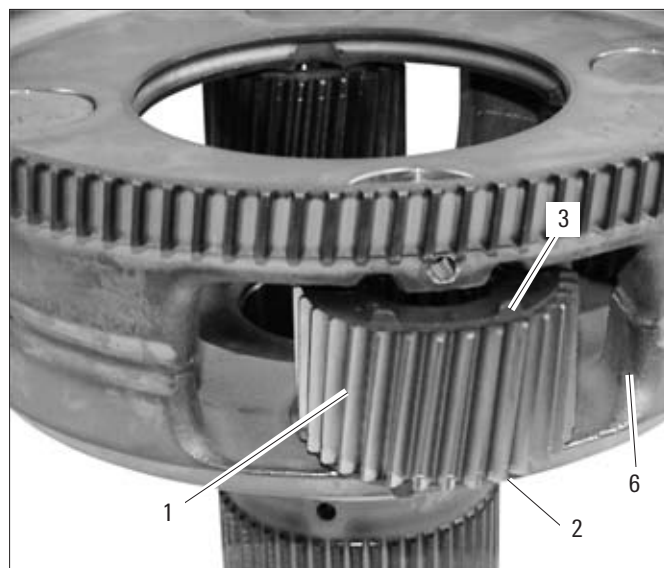
18.3.2.1 Assemble the Planet Carrier II

- 1 Insert two needle bearings (**4, 5**) in the planet gear (**1**).



025486

- 2 Insert the planet gear (**1**) with the upper and lower stop disks (**2, 3**) in the planet carrier (**6**).



030419

- 3 Insert the planetary-gear shaft (**7**). Here, make sure that the bores for the centering pin in the planetary-gear shaft and in the planet carrier are respectively aligned (arrow).

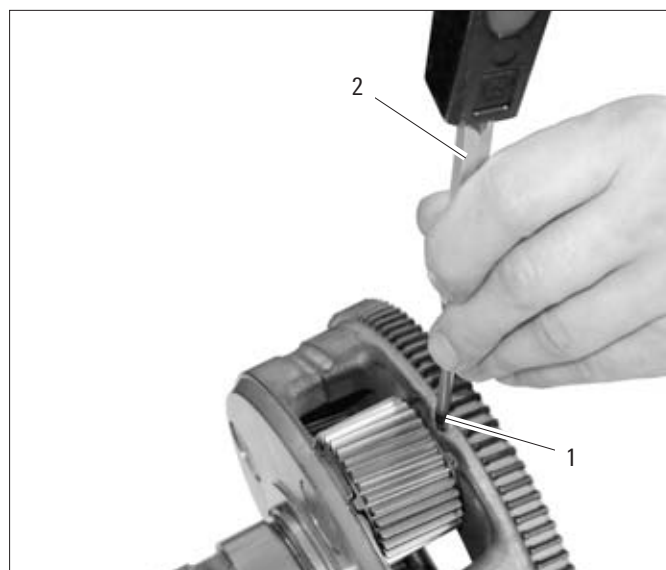


030420

- 4 Drive in the centering pin (1) with a suitable mandrel (2).

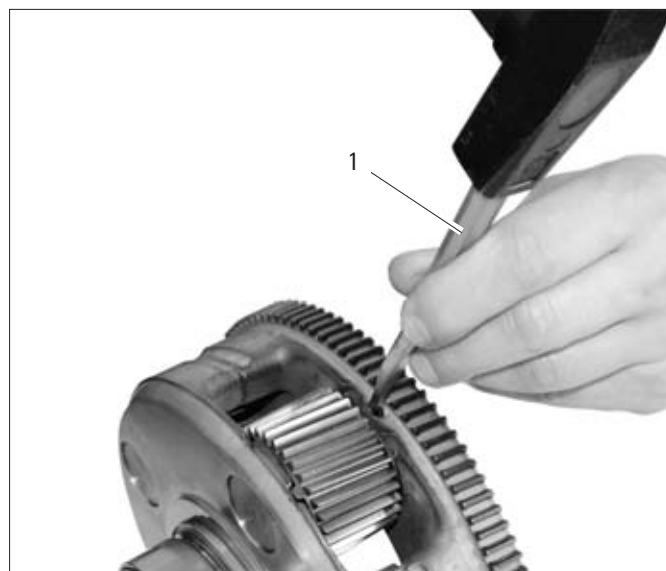
CAUTION

In order to avoid damage at the planet carrier and the planet gear, do not drive in the centering pin directly with a hammer.



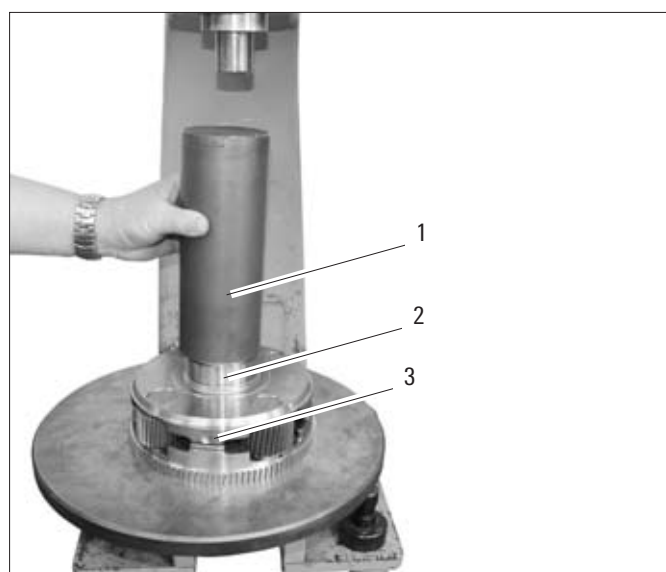
030421

- 5 Caulk the centering pin at its to ends respectively with a suitable chisel (1).



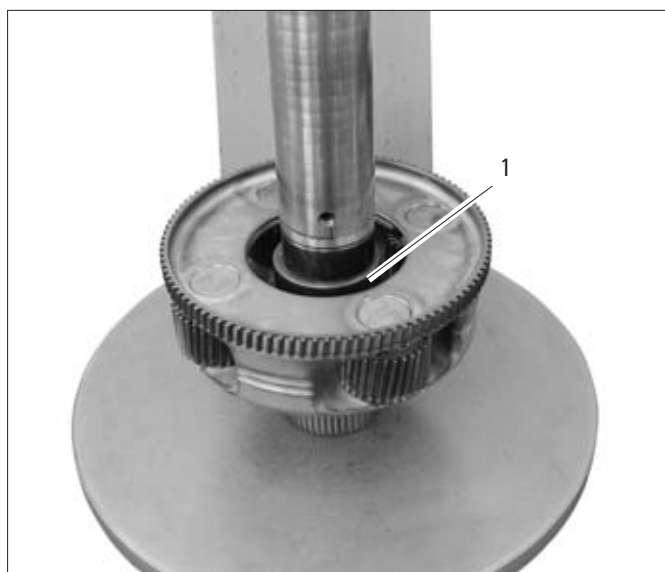
030422

- 6 The bearing inner ring (2) with the thrust piece no.: 1X56 138 558 (1) on the planet carrier II (3) is to be pressed on.



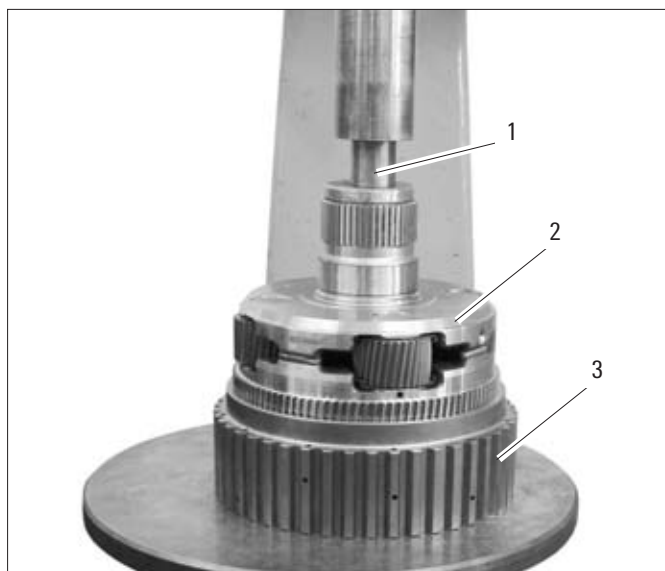
025548

- 7 Press the needle bearing with the tool no.: **1X56 138 560 (1)** into the planet carrier II. The even, flat shoulder must point towards the tool.



030202

- 8 Press on the internal ring gear (3) by means of a suitable thrust piece (1) onto the planet carrier II (2).



025550

- 9 Snap in the securing ring (1) for the internal ring gear.



025551

- 10 Put the axial bearing **(1)** on the planet carrier II.



025552

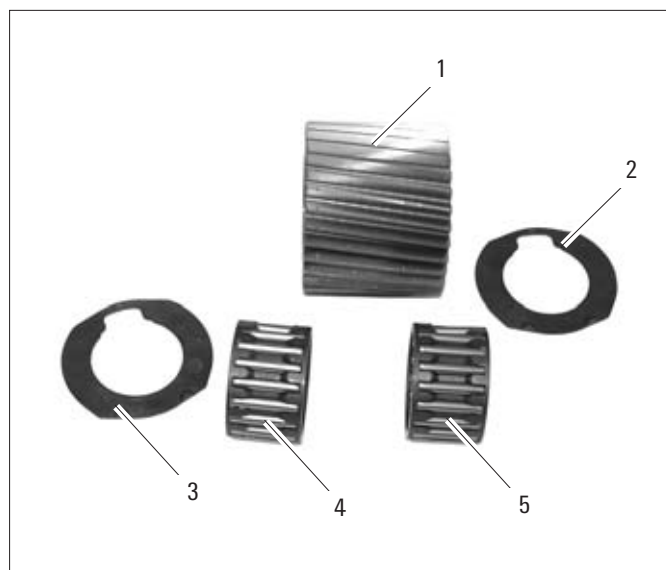
- 11 Insert the axial bearing **(1)**.



025554

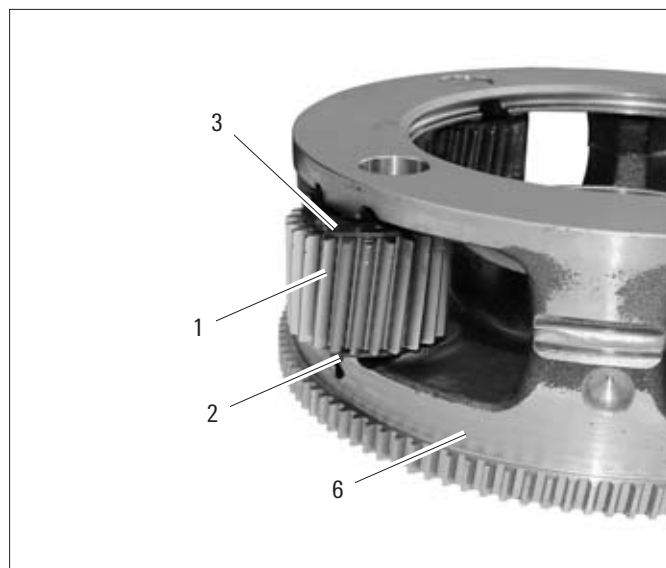
18.3.2.2 Assemble the Planet Carrier I

- 1 Insert two needle bearings (**4, 5**) in the planet gear (**1**).



025486

- 2 Insert the planet gear (**1**) with the upper and lower stop disks (**2, 3**) in the planet carrier (**6**).



030415

- 3 Insert the planetary-gear shaft (**7**). Here, make sure that the bores for the centering pin in the planetary-gear shaft and in the planet carrier are respectively aligned (arrow).

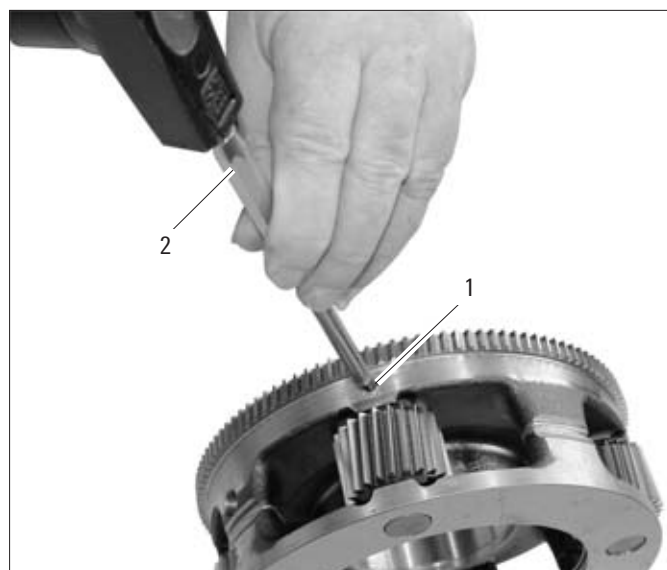


030416

- 4 Drive in the centering pin (1) with a suitable mandrel (2).

CAUTION

In order to avoid damage at the planet carrier and the planet gear, do not drive in the centering pin directly with a hammer.



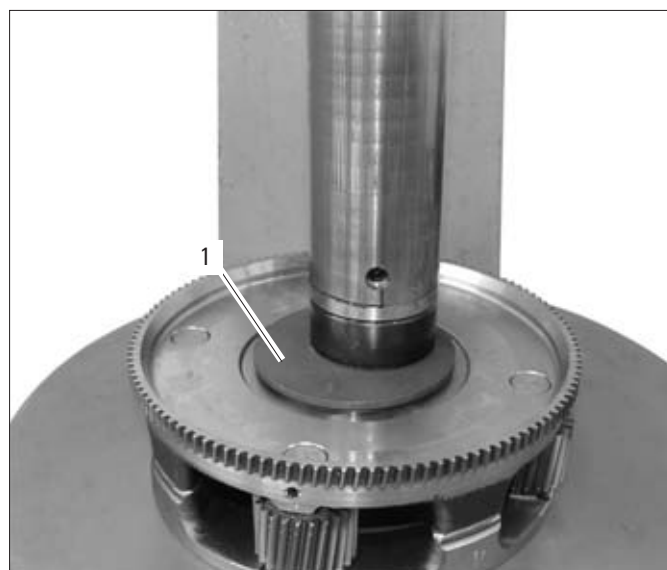
030417

- 5 Caulk the centering pin at its to ends respectively with a suitable chisel (1).



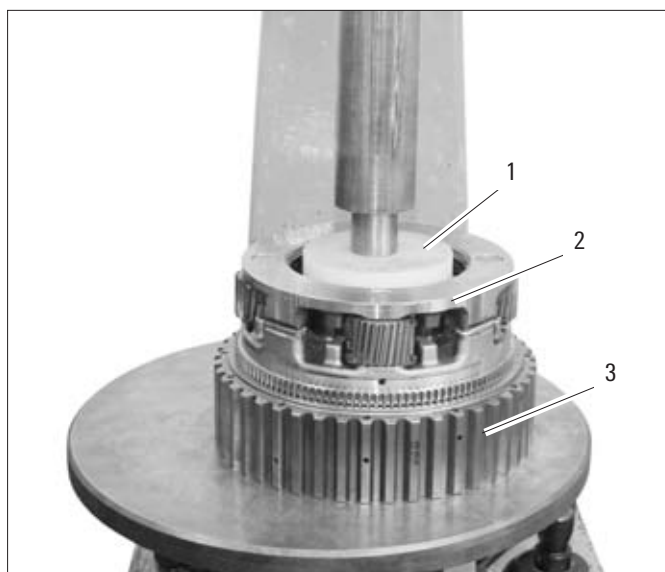
030418

- 6 Press in the needle bearing with the tool no.: 1X56 138 551 (1). The even, flat shoulder must point towards the tool.



030203

- 7 Press on the internal ring gear **(3)** by means of a suitable thrust piece **(1)** onto the planet carrier I **(2)**.



025555

- 8 Snap in the securing ring **(1)** for the internal ring gear.



025556

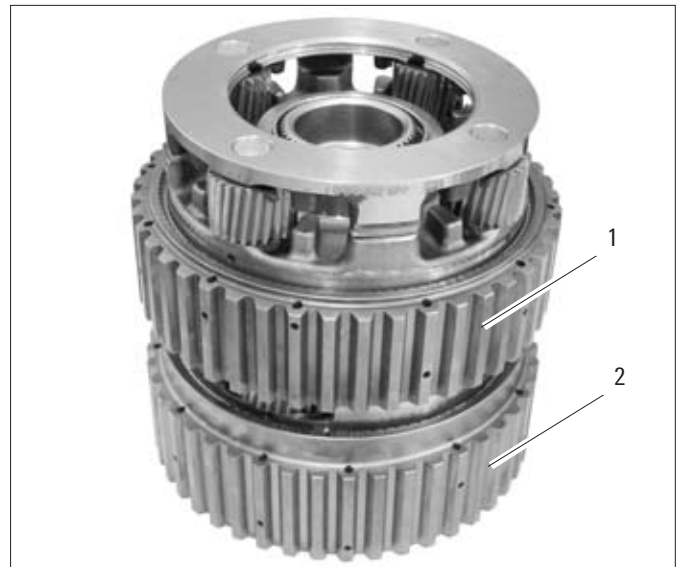
- 9 If required, insert a new bearing disk **(1)** in the planet carrier I.



025557

18.3.3 Assemble the Planet Carrier I and II

- 1 Put the planet carrier I (1) onto the planet carrier II (2).



025558

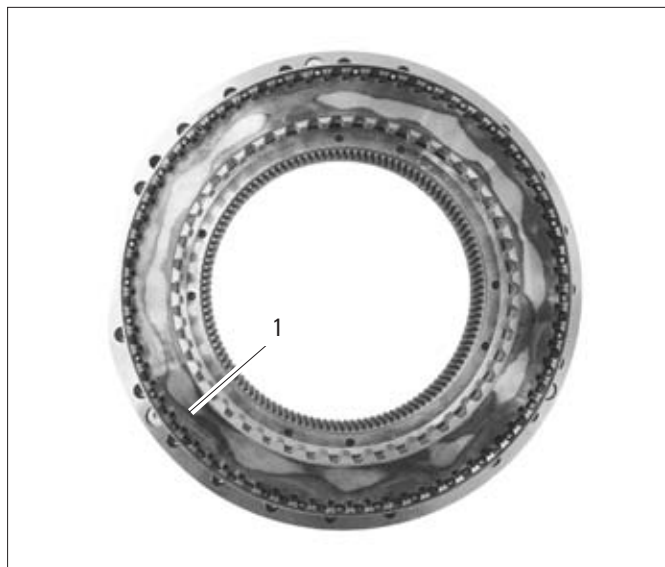
- 2 Insert the input shaft together with the sun gear II (1).
 - Mount the sun gear.
 - Insert the securing ring.
 - Insert the axial bearing.



030204

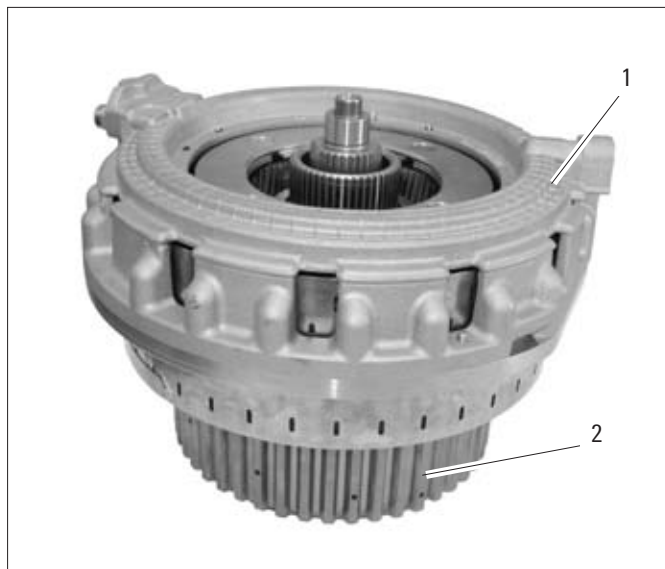
18.3.4 Assemble the Multidisk Carrier D/E and the Planet Carrier I/II

- 1 Align the multidisks (1).



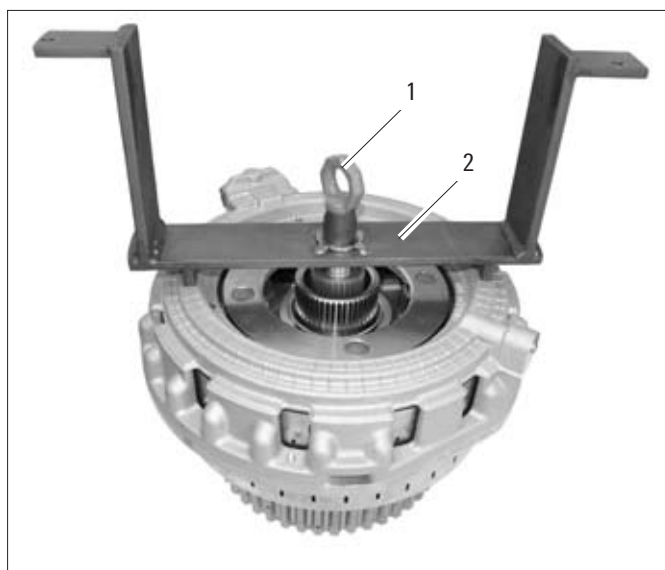
025561

- 2 The multidisk carrier D/E (1) is to be put onto the planet carrier I/II (2).



025562

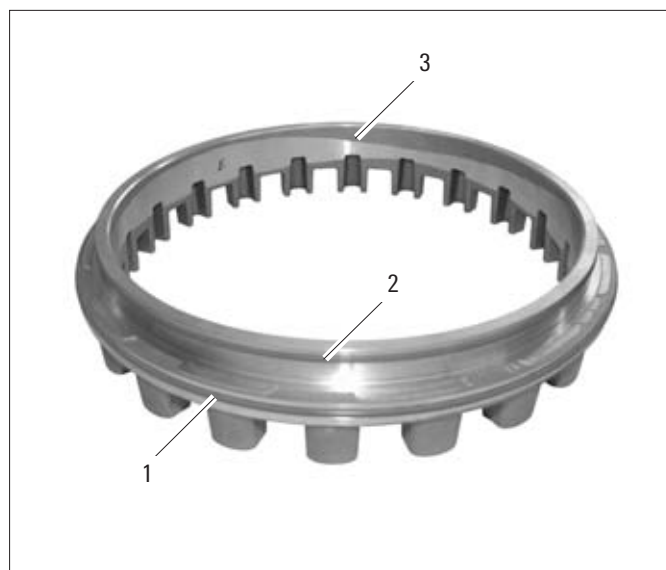
- 3 Put on the tool no.: **1X56 138 556 (2)**.
- 4 Screw in the lifting equipment no.: **1T66 160 645 (1)**.



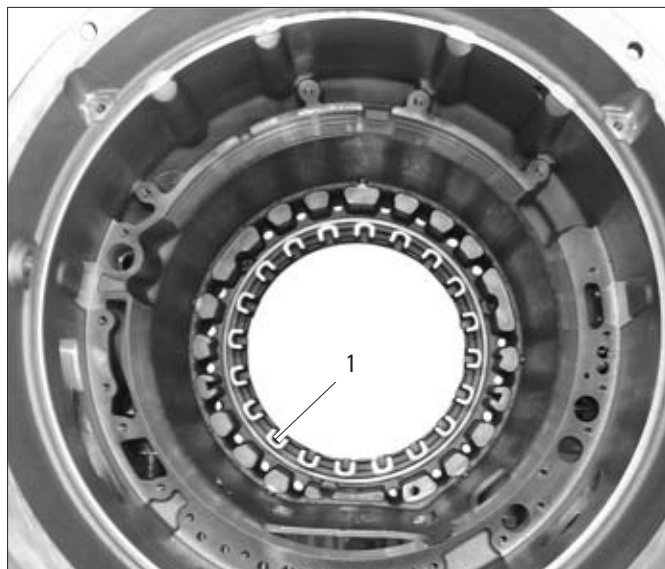
025563

18.4 Install the Mechanical Transmission Part

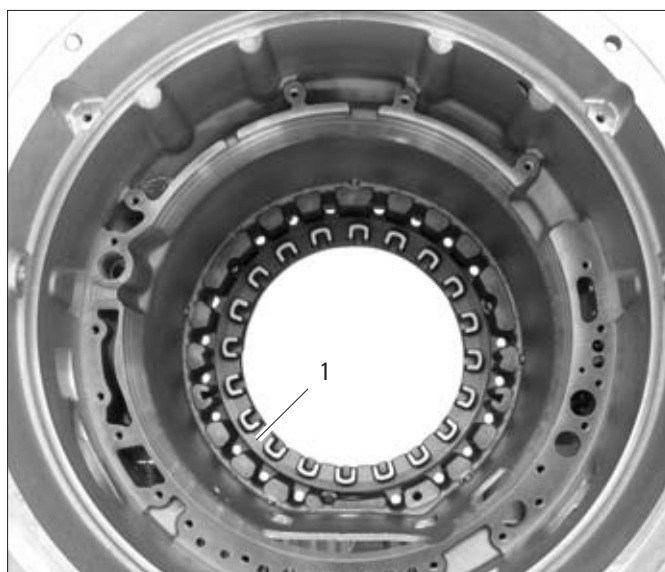
- 1 Coat two sealing rings **(1, 2)** with technical Vaseline.
- 2 Insert the two sealing rings **(1, 2)** in the piston E **(3)**.
- 3 Insert the piston E **(2)** in the transmission housing.
- 4 Use a plastic punch and a plastic hammer in order to drive in the piston E **(2)** with light blows until firmly home.
- 5 Insert the readjusting spring **(1)**.



025538

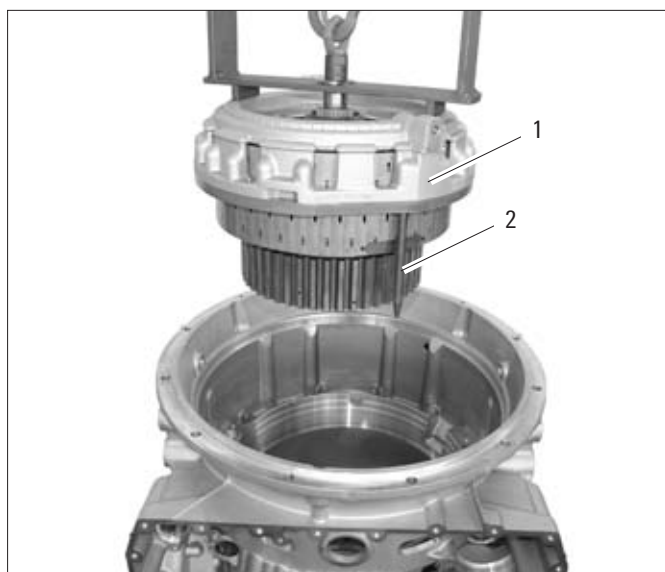


030205



030206

- 6 Lift the multidisk carrier (1) with the planet carriers I and II by means of a crane and position above the transmission.
- 7 Insert two guide pins (2) from the tool no.: **1X56 138 556**.



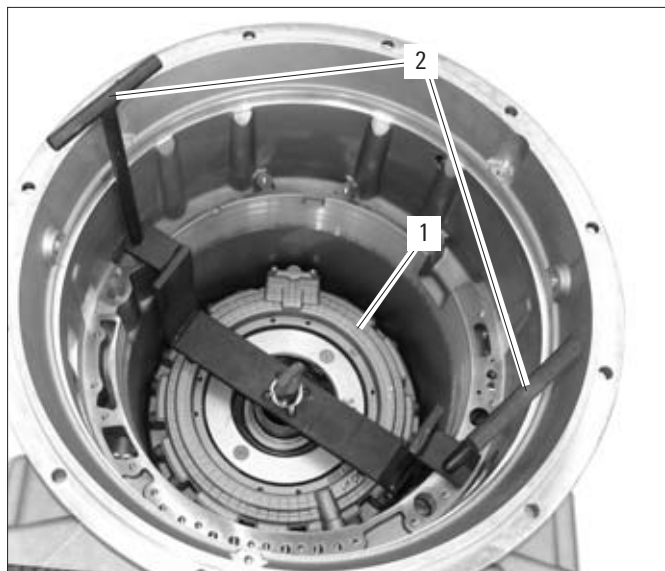
030207

- 8 Insert the multidisk carrier (1) with the planet carriers I and II by means of a crane in the transmission housing.
- 9 Center the readjusting spring with the multidisk carrier.

CAUTION

Pay attention to correct positioning.

- 10 Screw in the retaining bolt (2) of the tool no.: **1X56 138 556** and tighten manually.
- 11 Turn the transmission around and, once again, unscrew the guide pins (1) of the tool no.: **1X56 138 556**.

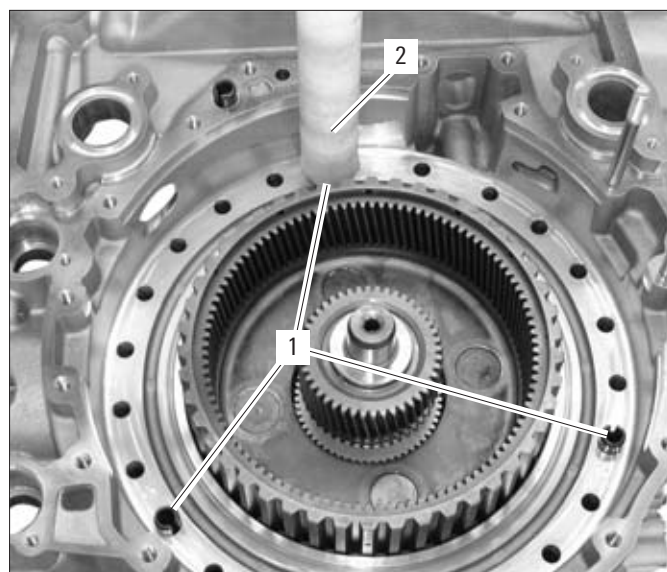


030208



030209

- 12 If required, cautiously drive in three centering pins **(1)** by means of a plastic punch **(2)** into the transmission housing.



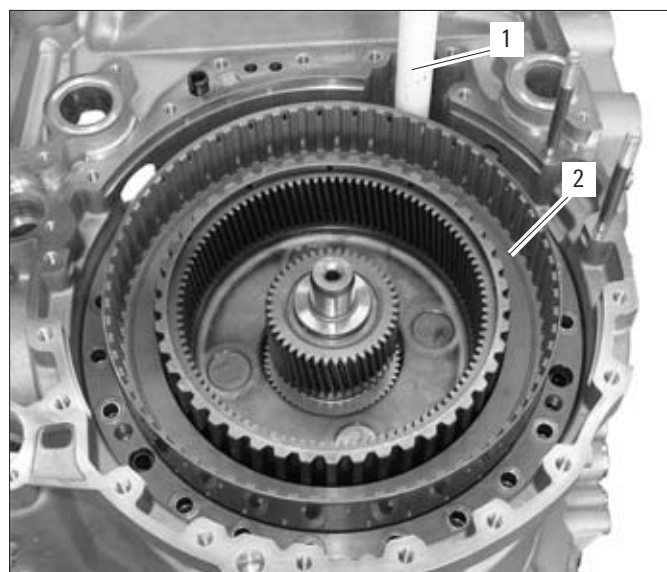
030210

- 13 Insert the abrasive wear protection **(1)**.



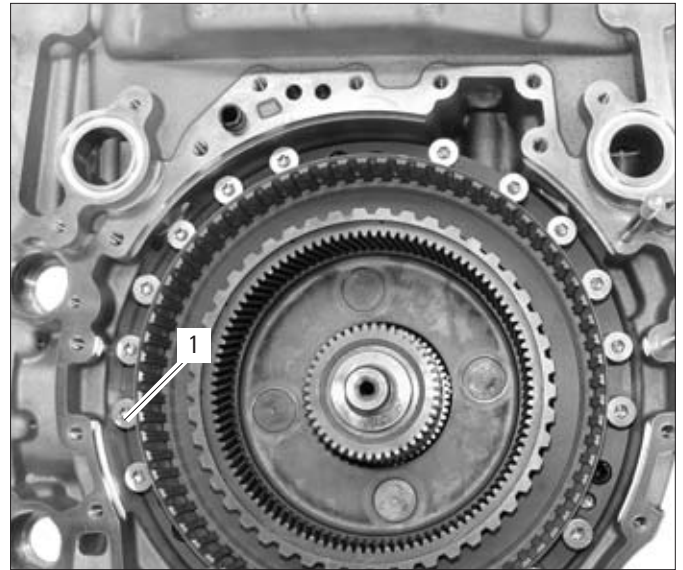
030211

- 14 Insert the multidisk carrier F **(2)**. Cautiously drive in the multidisk carrier by means of a plastic punch **(1)** until firmly home.



030212

- 15 Screw in all the TORX screws M10x135 (1) of the multidisk carrier's outer ring.
- 16 Tighten all the TORX screws M10 (1). Tightening torque: 50 Nm

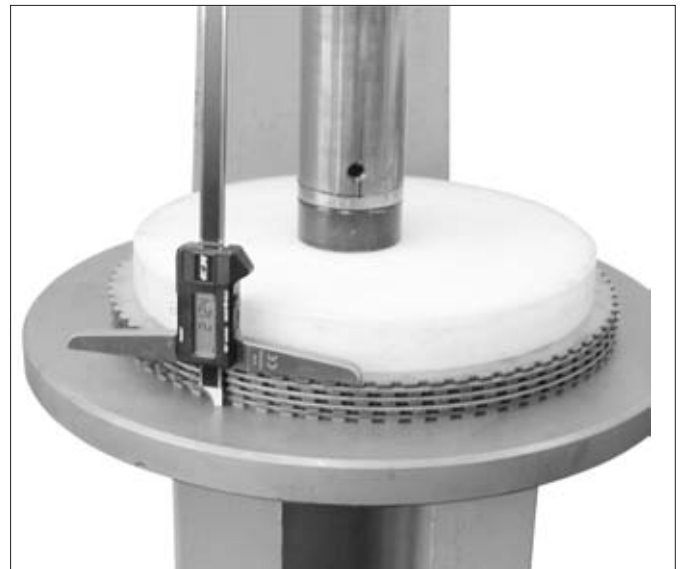


030214

- 17 Clamp in the multidisk package "F" with approx. 200 N on the press.
- 18 Measure the thickness of the multidisk package. The nominal dimension can be taken from the parts list (BoM). The nominal dimension can be taken from the parts list (BoM).

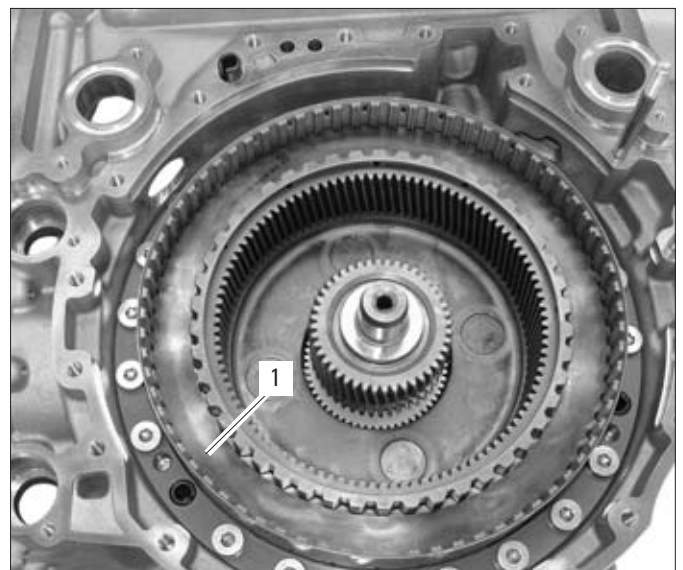
NOTE

Always measure the multidisk packages without the ondular washer.



030153

- 19 Insert the end disk "F", the lined clutch disks "F", and the ondular washer "F" (1) in accordance with the parts list (BoM).



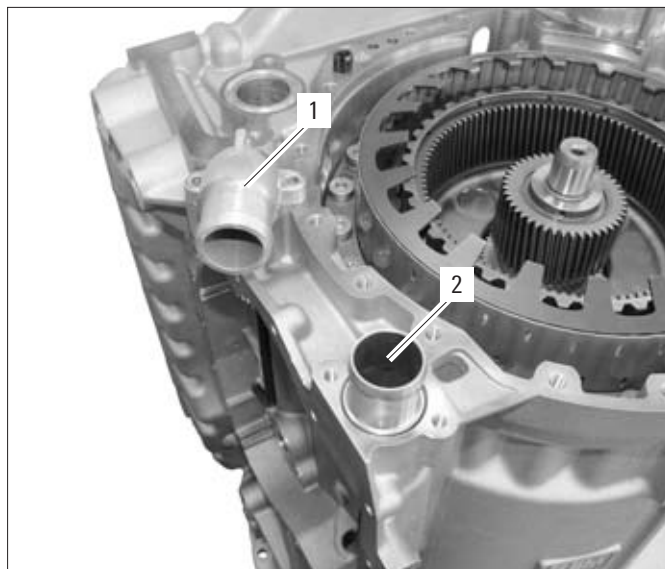
030215

- 20 Put on the readjusting spring (1).



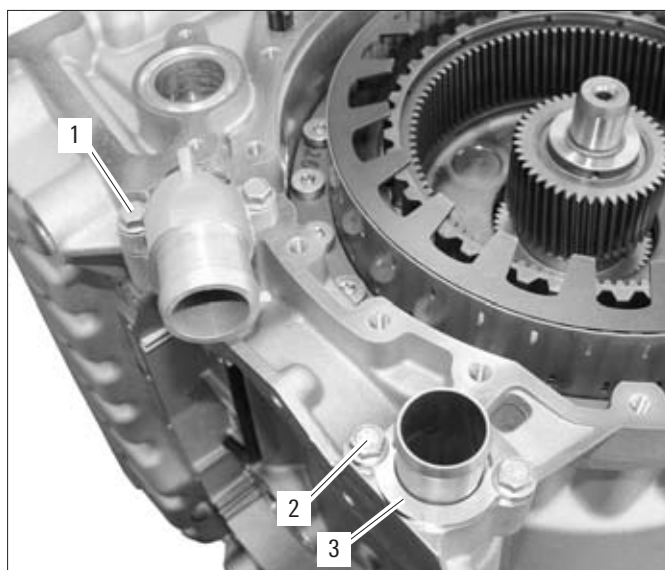
030216

- 21 Coat two O-rings of the connecting pipes (2) with technical Vaseline and insert in the connecting pipes (2).
- 22 Insert the connecting pipes (2) in the transmission housing.
- 23 Coat the O-ring of the angle flange (1) with technical Vaseline and insert the angle flange (1).
- 24 Insert the angle flange (1) in the transmission housing.



030217

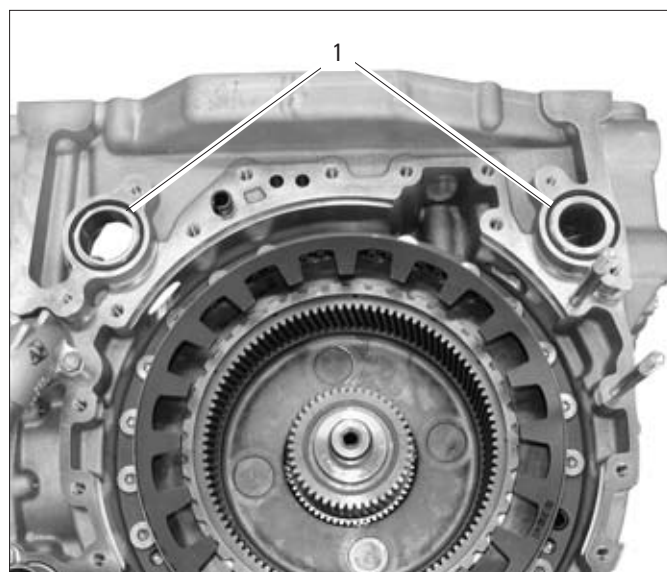
- 25 Fit fixing plate (3).
- 26 Screw in two hex head screws/bolts (2). Tightening torque: 23 Nm
- 27 Screw in two hex head screws/bolts (1). Tightening torque: 23 Nm



030218

28 Coat two O-rings **(1)** with technical Vaseline.

29 Insert the two O-rings **(1)** in the transmission housing.



030219

30 Put the seal **(1)** onto the transmission housing.



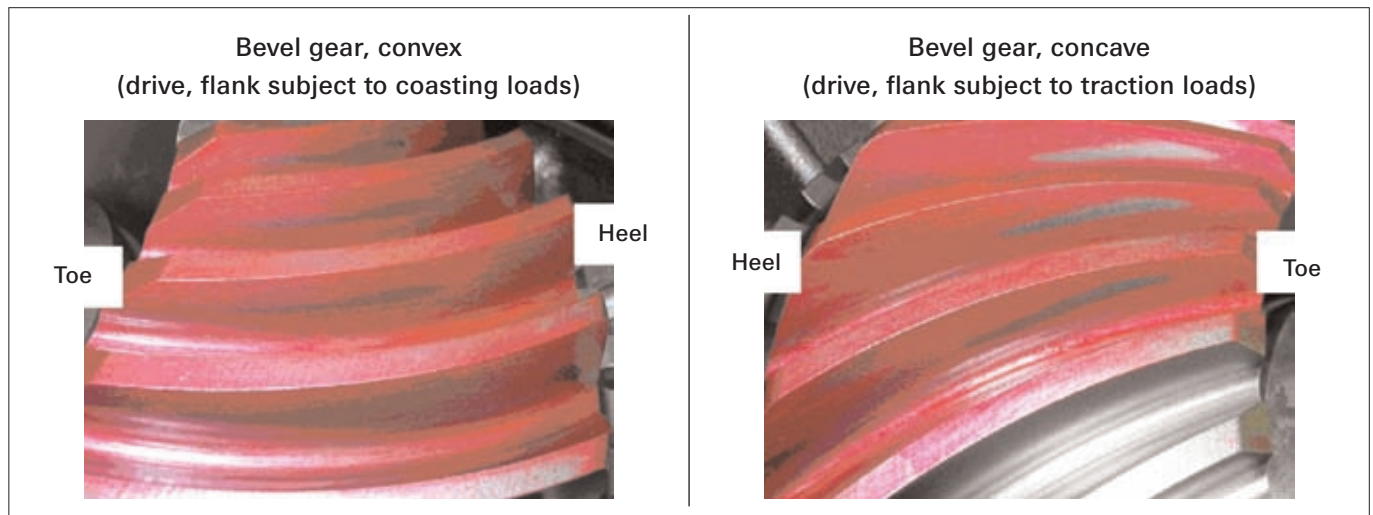
030220

19 Annex

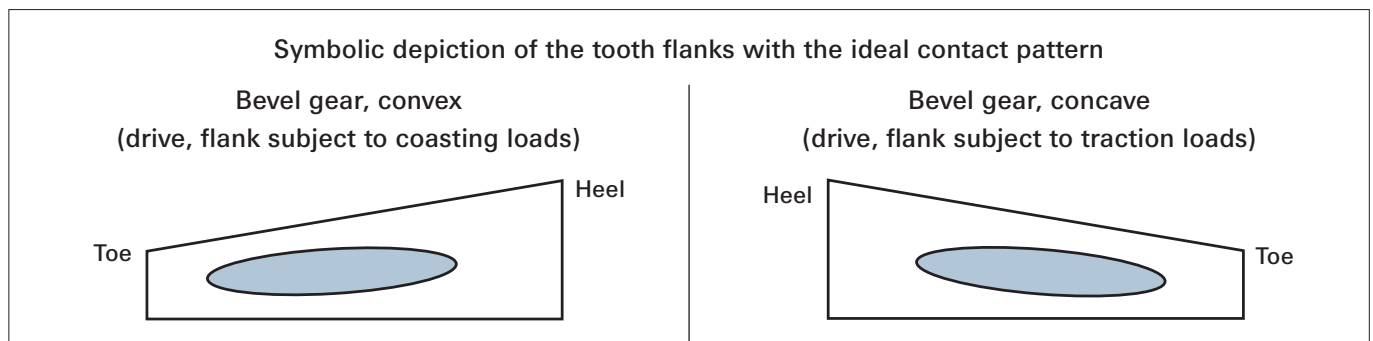
19.1 Measures/Actions for Contact Pattern Correction at the EcoLife WTR RHD 4181 114 009

Nominal specification: Nominal contact pattern at the input gear (bevel gear) (depiction of the ideal contact pattern, see below)

Contact pattern position / size, also refer to assembly specification no.: 4181 701 018



029470 / 029471



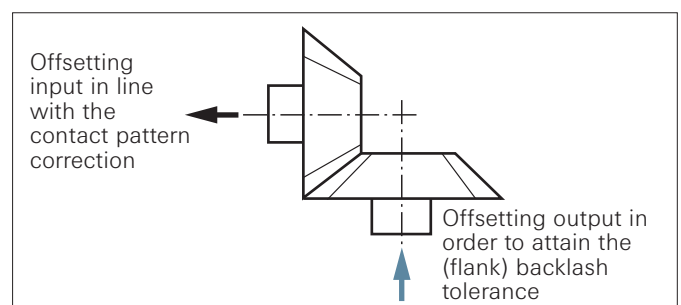
029472

After the correction of the contact pattern and/or distancing corrections, the tooth backlash (German abbrev.: ZFS) must be within the tolerance (0.16 - 0.26 mm). For the measurement of WTR tooth backlash, please refer to the inspection specification no.: 4181 701 019.

In the case that the tooth backlash is outside of the tolerance, then the mating gear must be offset correspondingly (also refer to example).

All corrective actions may be derived on the basis of the symbolic depiction of the bevel gears.

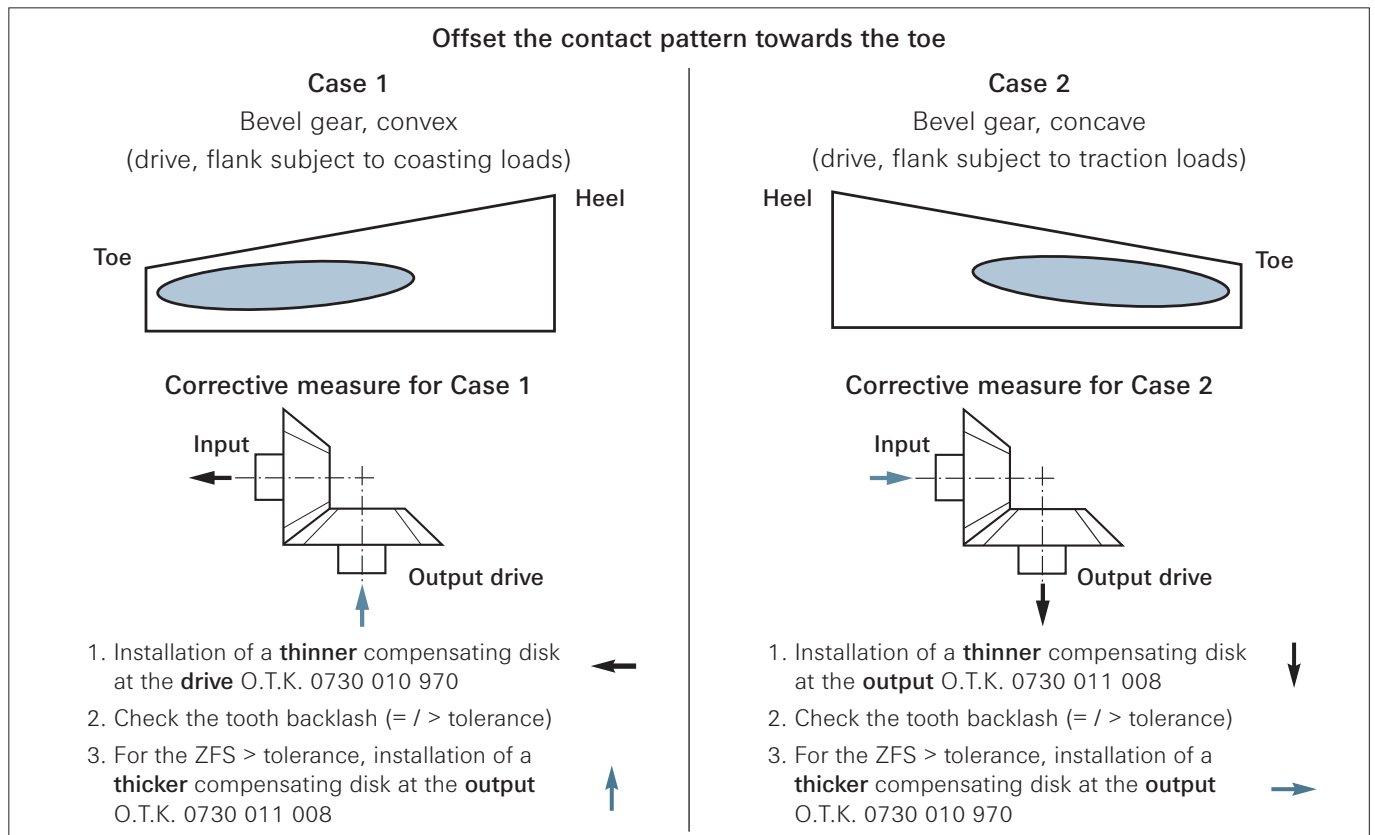
The direction of the arrow indicates the direction for offsetting the respective gear.



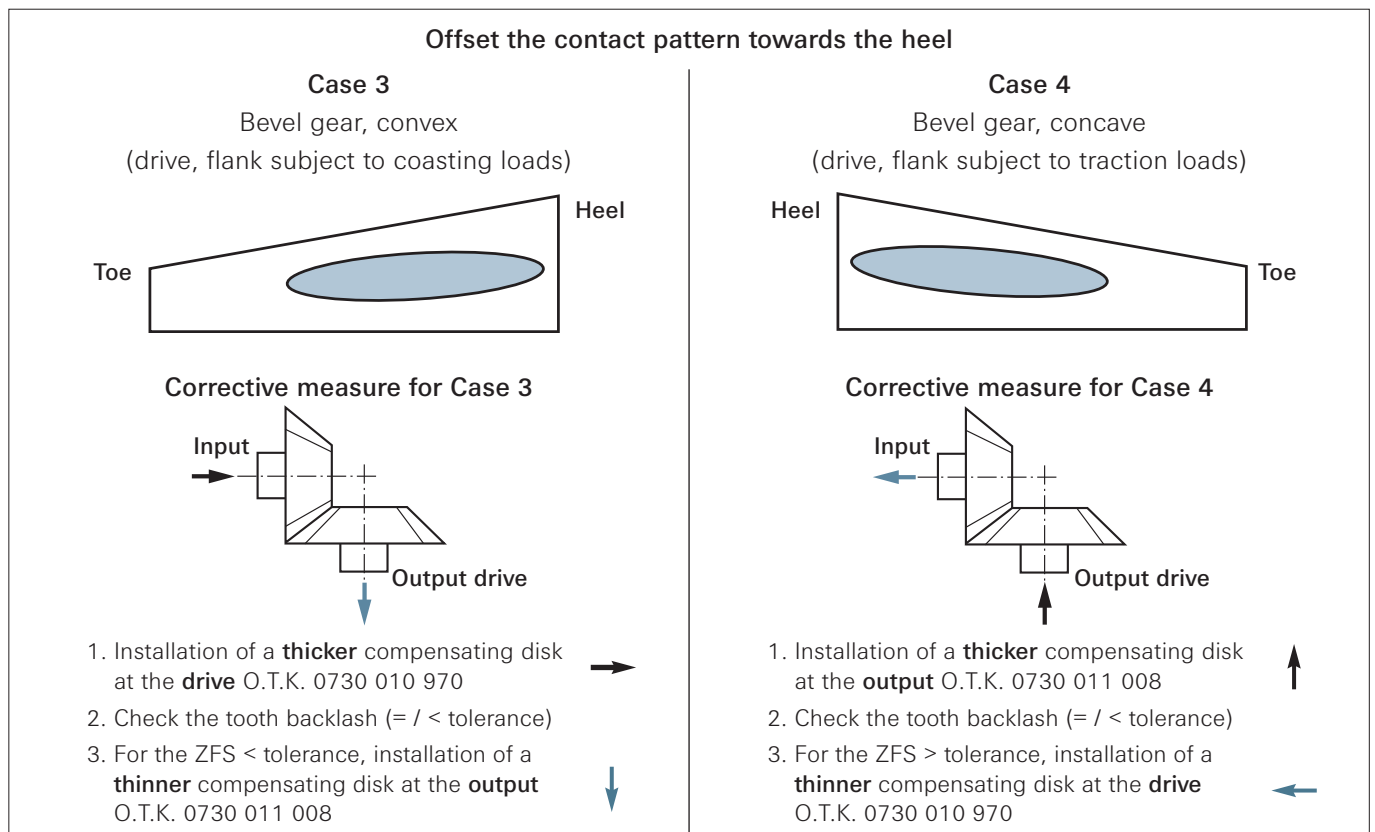
Example: Correction of contact pattern + adaptation of tooth backlash

029473

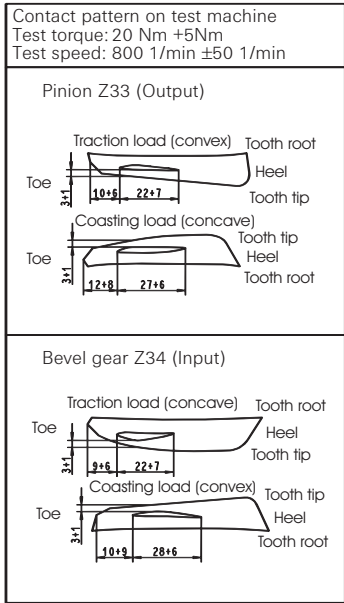
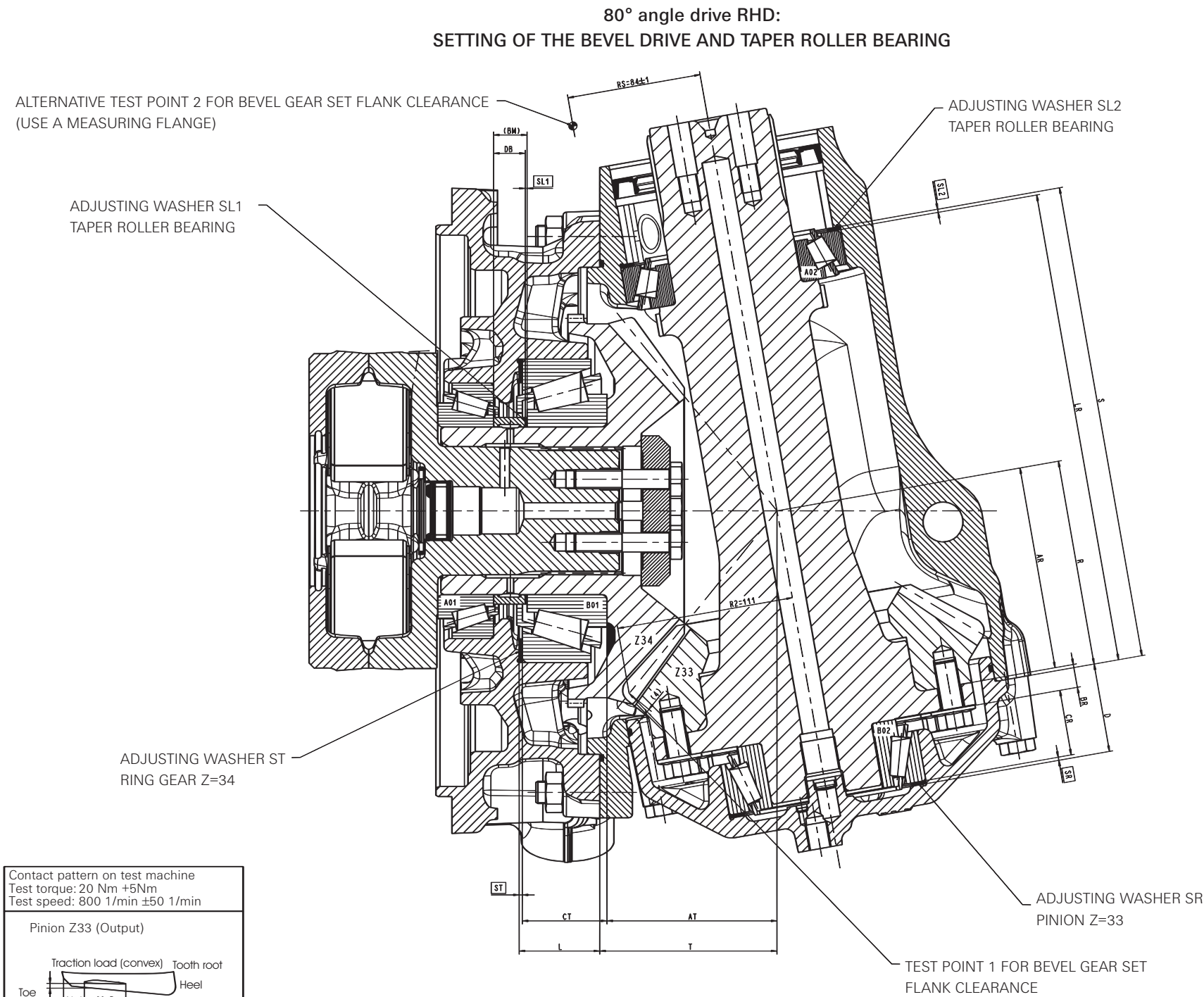
19.1.1 Deviations and Corrective Measures



029474 / 029473 / 029475



029476 / 029477 / 029478



- 5) INSPECTION
- a) FLANK CLEARANCE (TARGET VALUE 0.16 TO 0.26);
MEASUREMENT ACC. TO SPECIFICATION 4181 701 019
 - b) CONTACT PATTERN (TARGET VALUE: SPECIFIED CONTACT PATTERNS)
 - c) INPUT AND OUTPUT BEARING ROLL MOMENT
MEASUREMENT ACC. TO SPECIFICATION 4181 701 020
TARGET VALUES: INPUT BEARING $T_R = 0.7$ TO 1.6 NM
OUTPUT BEARING $T_R = 0.6$ TO 1.7 NM (WITHOUT SHAFT SEALING RING)

ASSEMBLY PROCESS

- 1) SPACER RING GEAR Z34 (INPUT)
THICKNESS OF THE ADJUSTING WASHER $ST = T + L + KG - (AT + CT + KT)$
- 2) BEARING SETTING RING GEAR Z34 (INPUT)
THICKNESS OF THE ADJUSTING WASHER $SL1 = BM - DB - VS - VL1$
- 3) SPACER PINION Z33 (OUTPUT)
THICKNESS OF THE ADJUSTING WASHER $SR = R + D + KD - (AR + BR + CR + KR)$
- 4) BEARING SETTING PINION Z33 (OUTPUT)
THICKNESS OF THE ADJUSTING WASHER $SL2 = S - LR - KL2 + VL2$

AT = BEVEL GEAR INSTALLATION DIMENSIONS
(MARKED ON THE RING GEAR)

CT = BEARING WIDTH B01 ACTUAL DIMENSION
(MEASUREMENT ± 0.01 ; INNER RING ASSEMBLED)

KT = TAPER ROLLER BEARING B01 CORRECTION VALUE
($K = 0.07$ mm, DETERMINED IN TESTS)

T = ACTUAL DIMENSION OF THE OUTPUT HOUSING
DISTANCE OF CONNECTING AREA - BEVEL DRIVE CENTER
(MARKED AT THE HOUSING CONNECTION)

L = ACTUAL DIMENSION OF THE HOUSING CONNECTION
DISTANCE OF CONNECTION AREA - BEARING BORE SUPPORT FACE
(MARKED AT THE HOUSING CONNECTION)

AR = PINION INSTALLATION DIMENSION
(MARKED ON THE PINION)

BR = FLANGE WIDTH OF OUTPUT SHAFT
(MARKED ON THE OUTPUT SHAFT)

CR = BEARING WIDTH B02 ACTUAL DIMENSION
(MEASUREMENT ± 0.01 ; INNER RING ASSEMBLED)

KR = TAPER ROLLER BEARING B02 CORRECTION VALUES
($K = 0.06$ mm, DETERMINED IN TESTS)

R = ACTUAL DIMENSION OF THE OUTPUT HOUSING
DISTANCE OF CONNECTING AREA COVER - BEVEL DRIVE CENTER
(MARKED ON THE OUTPUT HOUSING)

D = ACTUAL DIMENSION OF THE COVER
DISTANCE OF CONNECTING AREA COVER - BEARING BORE MOUNTING FACE
(MARKED ON THE OUTPUT HOUSING)

LR = DISTANCE OF CONNECTING AREA COVER FACE OF TAPER ROLLER BEARING A02
(MEASURED ON INSTALLATION; TOLERANCE ± 0.01)

S = ACTUAL DIMENSION OF THE OUTPUT HOUSING
DISTANCE OF CONNECTING AREA COVER BEARING BORE MOUNTING FACE
(MARKED ON THE OUTPUT HOUSING)

KL2 = TAPER ROLLER BEARING A02 CORRECTION VALUE
($K = 0.035$, DETERMINED IN TESTS)

VL1 = BEARING PRELOAD INPUT GEAR (ENTER A POSITIVE VALUE)
(SPECIFICATIONS IN THE PARTS LIST)

VL2 = OUTPUT SHAFT BEARING PRELOAD (ENTER A POSITIVE VALUE)
(SPECIFICATIONS IN THE PARTS LIST)

KG = CORRECTION VALUE OF HOUSING DEFORMATION
($K = 0.03$ mm, DETERMINED IN TESTS)

KD = CORRECTION VALUE OF THE COVER DEFORMATION
($K = 0.03$ mm, DETERMINED IN TESTS)

DB = WIDTH OF THE SPACER BUSH (POS. 0110 - 0150)
(MEASUREMENT ± 0.01)

BM = REFERENCE WIDTH OF MEASURING SLEEVE; (e.g. BM = 22.60)

VS = BEARING CLEARANCE WITH ASSEMBLED MEASURING SLEEVE
(MEASUREMENT ± 0.01)