



MVG 1600 Series Service Manual

Pro Gear's Harmon-Herrington MVG 1600 Series Service manual to assist in identifying the parts for your Harmon-Herrington transfer case unit.

If you need any assistance identifying the correct transfer case unit for your truck and equipment, contact your Harmon-Herrington replacement part specialists at Pro Gear and Transmission.

Pro Gear Transmission has same day shipping and 1000's of products in stock and ready to ship internationally for your next project.

For parts or service contact the Harmon-Herrington specialists at Pro Gear & Transmission, Inc.

1 (877) 776-4600
(407) 872-1901
parts@eprogear.com



**REPAIR MANUAL
TRANSFER CASE
MVG-1600**

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PREFACE

The present document gives directions to the trained personnel to repair the

MARMON-HERRINGTON Transfer Case MVG 1600 300/396

Customary tools and devices, which are workshop standard, are supposed to be available.

Required special tools are listed in an overview chart.

Special tool are kept at the necessary level, they bear a tool number and can be purchased from Marmon-Herrington.

Disassembly and assembly of one version only is explained in this document. Differing working sequences of other possible versions can easily be recognised by the skilled professional. For such jobs see enclosed sectional and perspective views.

The repair of the component may require changed working sequences or/and differing adjustment or checking data, according to the technical development of the product over the years.

Therefore, we recommend rendering your Marmon-Herrington Product only to the hands of periodically trained personnel.

Damages caused by improperly or unprofessionally executed repair work through untrained personnel and the resulting consequences are excluded from any contractual liability.

This also applies when NON-ORIGINAL-PARTS are being used.

The After Sales Service of MARMON-HERRINGTON,

Fax : (502) 253-0317 Tel : (502) 253-0277

is at your disposition to consult and to assist.



GENERAL WORKING DIRECTIONS

The company repairing Marmon-Herrington Components is in any case responsible for all aspects of safety.

The valid safety regulations and legal directives have to be obeyed to avoid injury of persons and damage of the product during maintenance and repair.

The proper repair of the Marmon-Herrington Product requires adequately trained personnel. To undergo training is the obligation of the repairer.

Always assure professional and clean working conditions. Components shall always be cleaned before disassembly.

The use of indicated special tools is a precondition.

After disassembly, all parts have to be cleaned. This applies in particular to corners, nooks and oil catchers in housings and covers.

Carefully remove old sealing compound.

Clean surfaces thoroughly before sealing.

Lubrications bores, grooves and pipes are to be checked to be free from obstructions. They must be free from deposits, contamination and preservatives. The latter applies particularly for new parts.

Parts that are being damaged during disassembly are to be replaced by new ones.

E.g.: radial oil seals, o-rings, groove-rings, seal cups, protection caps a. s. o.

Parts as bearings, thrust washers, synchromesh parts etc., which are liable to normal wear have to be checked by the skilled professional. He judges if a part can be reused or not.

Parts, which have a shrink fit, must be driven to their end position after cooling down to assure perfect seating. Before pressing-in parts like shafts, bearings etc. both contact surfaces must be oiled.

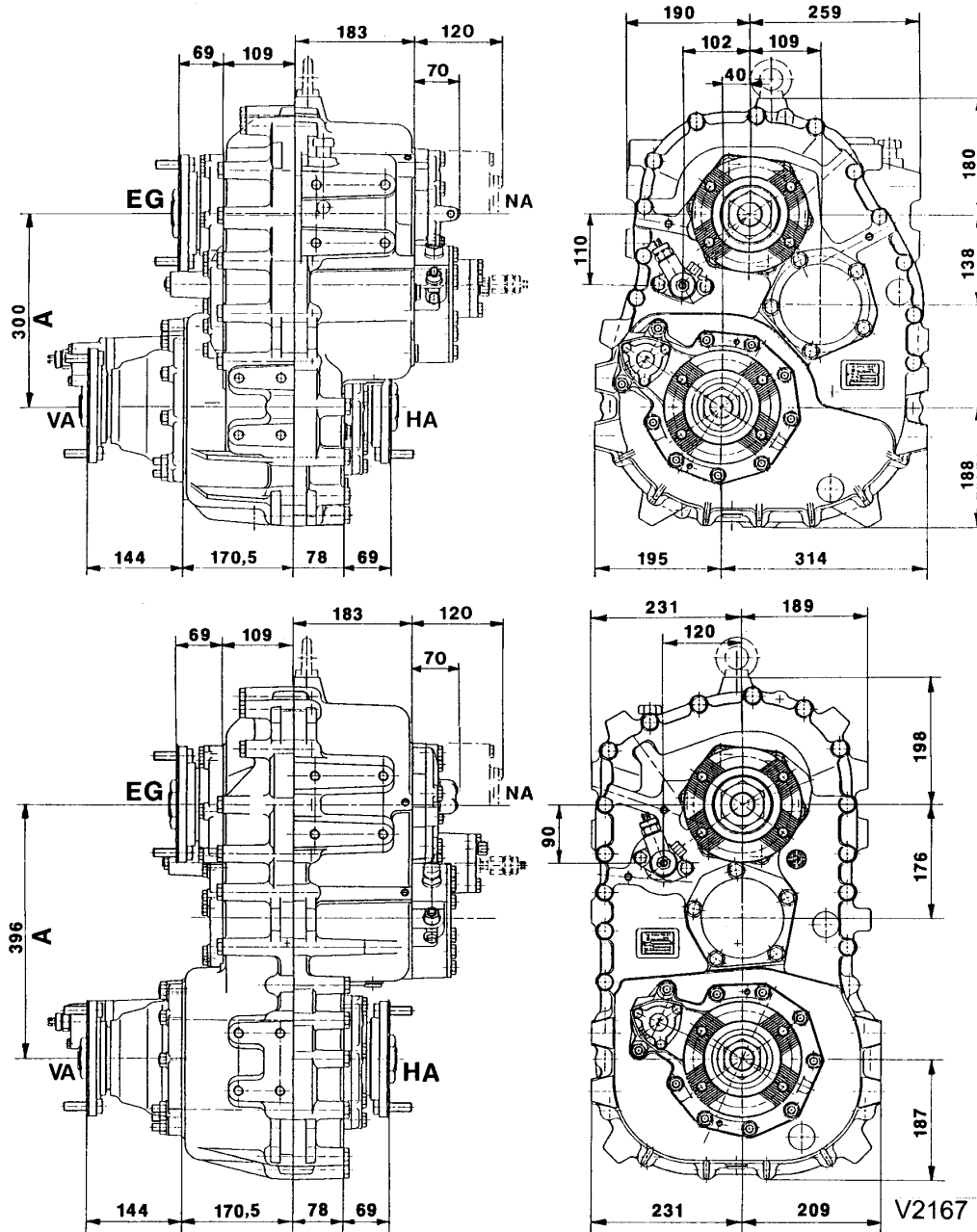
On the assembly all given adjustment tolerances, check data and tightening torques have to be observed. Marmon-Herrington Components are to be filled with lubricant after the repair. Observe filling instructions and lubrication chart. After filling, the oil drain plugs and oil level plugs must be tightened to correct torque.

Use Original - Marmon-Herrington Parts only!

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Technical Data

MVG 1600	A = 300 mm	A = 396 mm
Max. input torque	18 000 Nm (13 275 lbft)	18 000 Nm (13 275 lbft)
Max. input speed	2800 rpm	2800 rpm
Ratios	on-road 1:0,890	off-road 1:1,536
Weight including interaxle diff.	appr. 315 kg	appr. 300 kg
Weight without interaxle diff.	appr. 305 kg	appr. 290 kg
Amount of oil needed	with diff. appr. 7,2 l without diff. appr. 7,8 l	with diff. appr. 6,5 l without diff. appr. 7,5 l
Oil quality	SAE 90 according to MIL-L-2105-API-GL 4	SAE 90 according to MIL-L-2105-API-GL 4

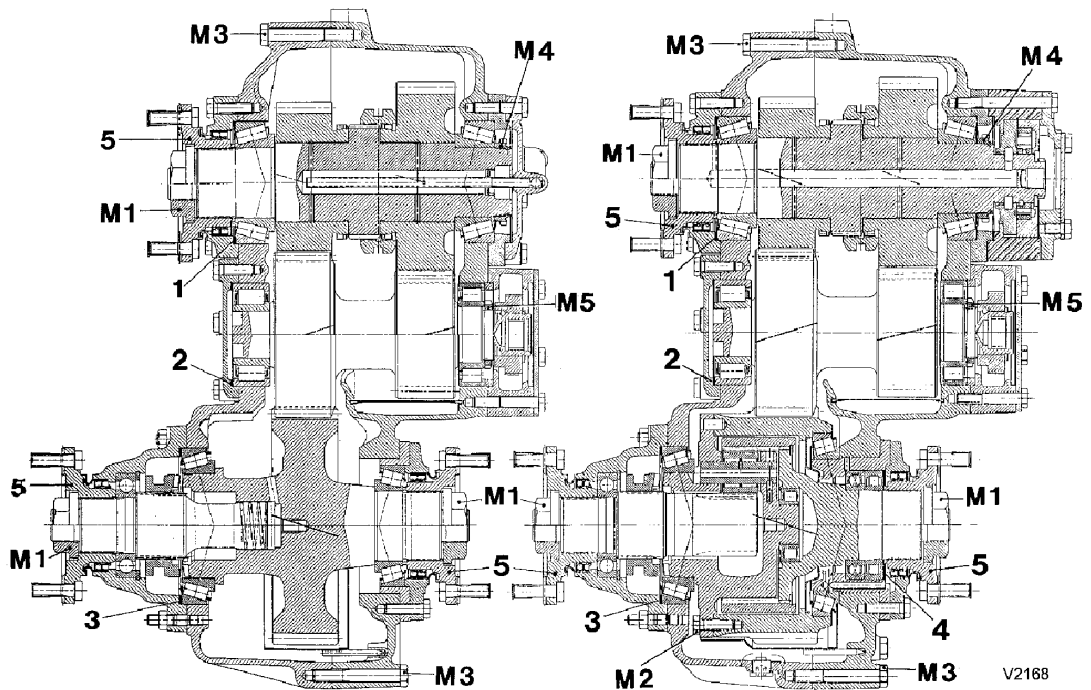


Adjustment

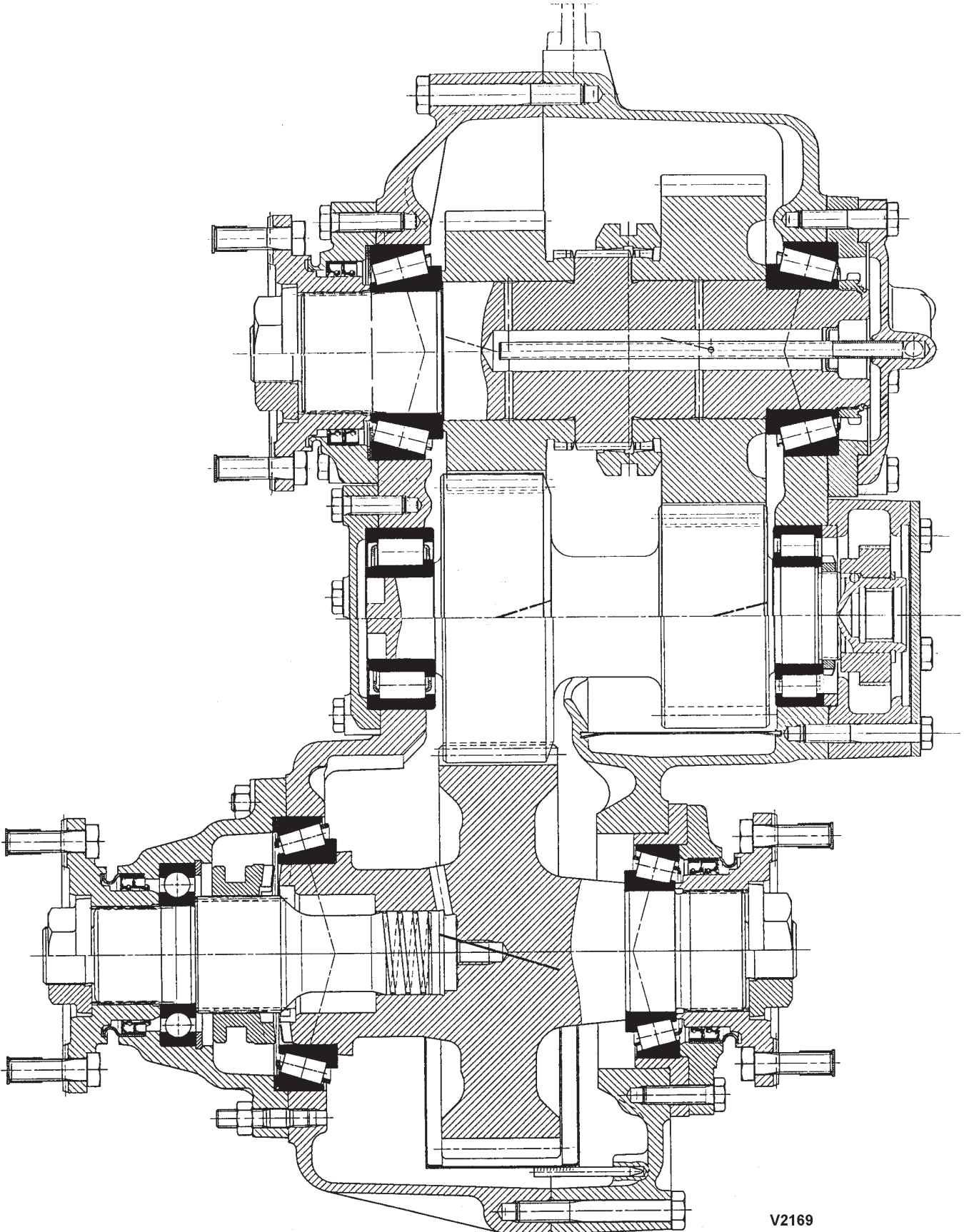
Item	Designation	Dimensions	Remarks
1	End play of drive shaft bearings	0.06-0.12 mm	to be adjusted with shims
2	End play of Intermediate shaft	0.4 - 0.6 mm	to be adjusted with shims
3	End play of output shaft bearings front	0.02 - 0.08	to be adjusted with shims
4	Preload of output shaft bearings, rear (only for the VG 1600 with interaxle differential)	0.0 - 0.05 mm	to be adjusted with shims
5	Flange temperature for assembly	heat to 120° C	

Tightening Torques

Item	Designation	Nm	Remarks
M1	Collar nuts for flanges	1080 Nm	to be held with holding device TS 215 W
M2	Fastening bolts for planetary carrier	30 Nm + 90° ± 5°	
M3	Housing bolts	195	
M4	Slotted nut (Input shaft)	600 Nm +/-60	lock by driving-in locking collar
M5	Slotted nut (Intermediate shaft)	600 Nm +/-60	lock by LOCTITE 243



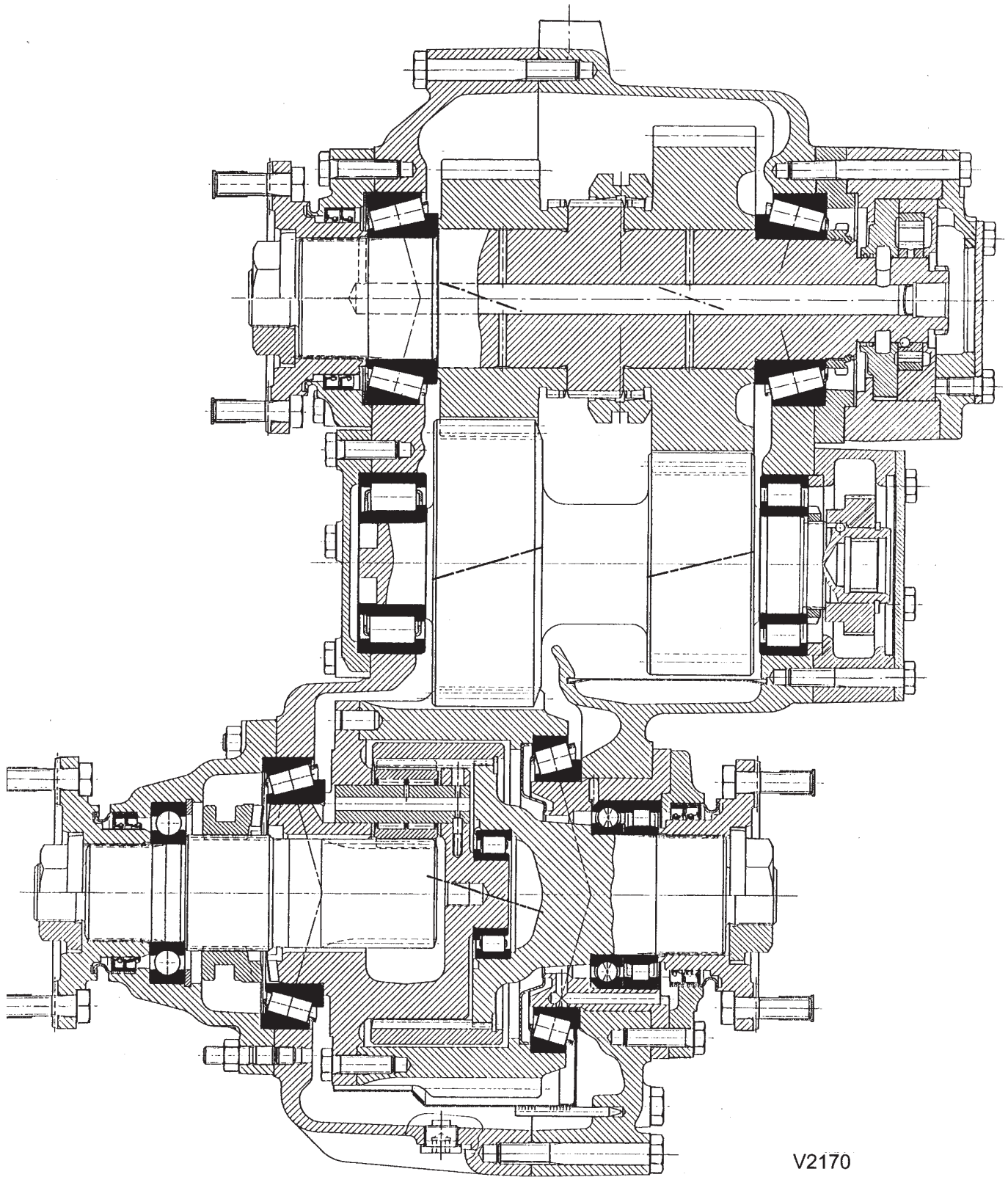
MVG 1600 (without interaxle differential)



V2169



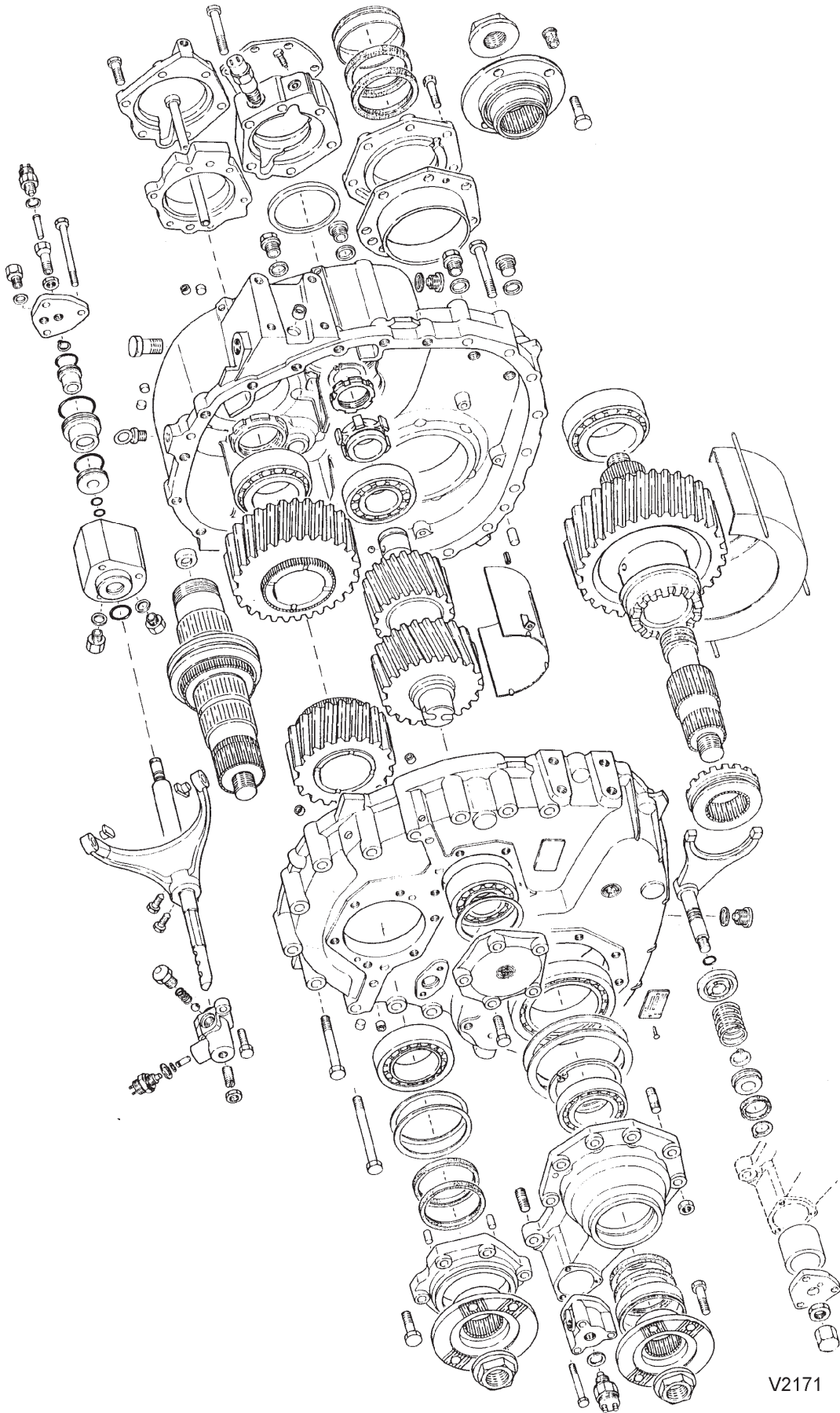
MVG 1600 (with interaxle differential and oil pump)



V2170



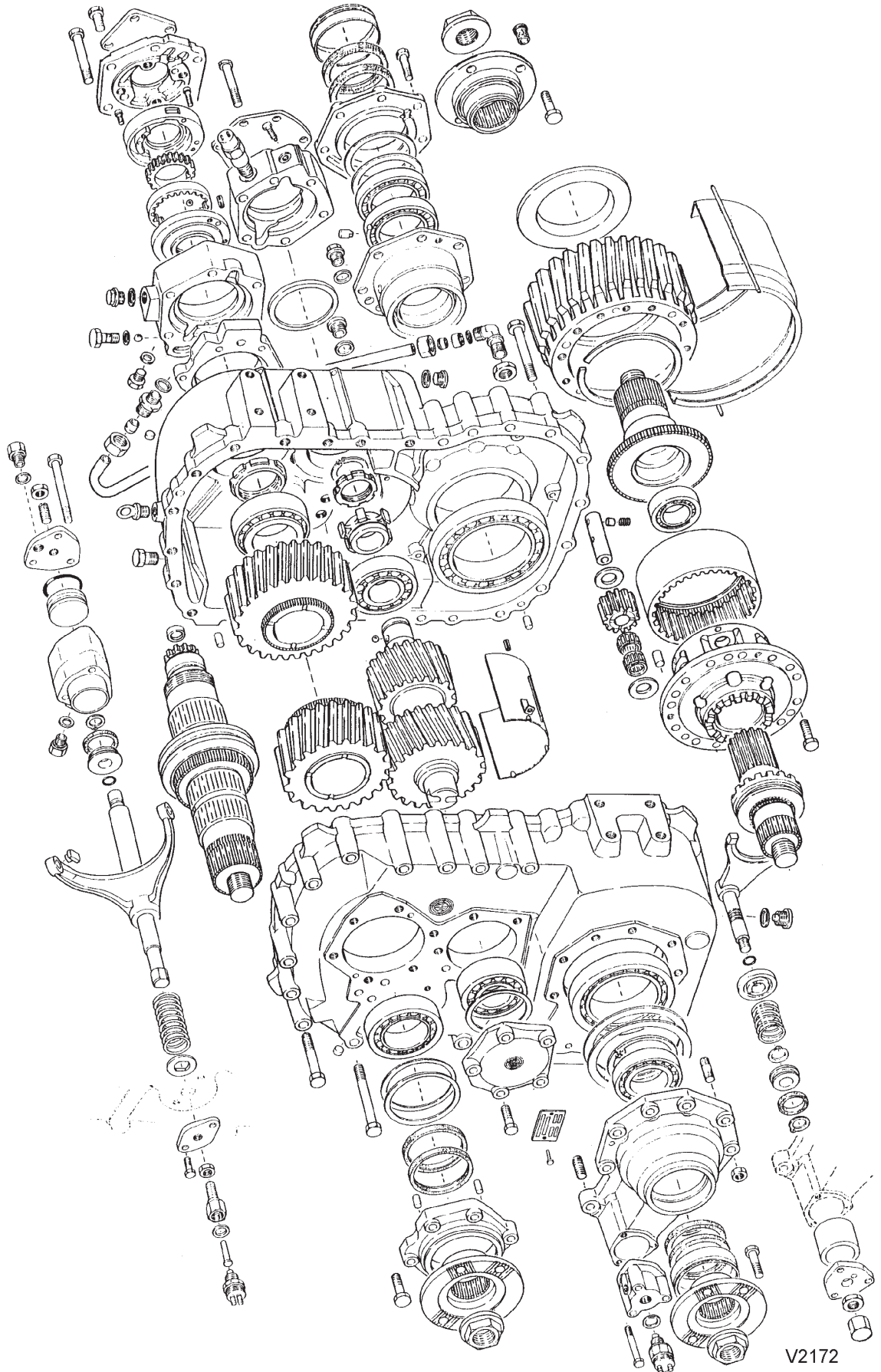
MVG 1600 / 300 (without interaxle differential)



V2171



MVG 1600 / 396 (with interaxle differential and oil pump)



V2172



Consumables

Consumables for repair of a transfer case are lubricants, slip additives, sealants, locking adhesives, preservatives and cleaning agents.

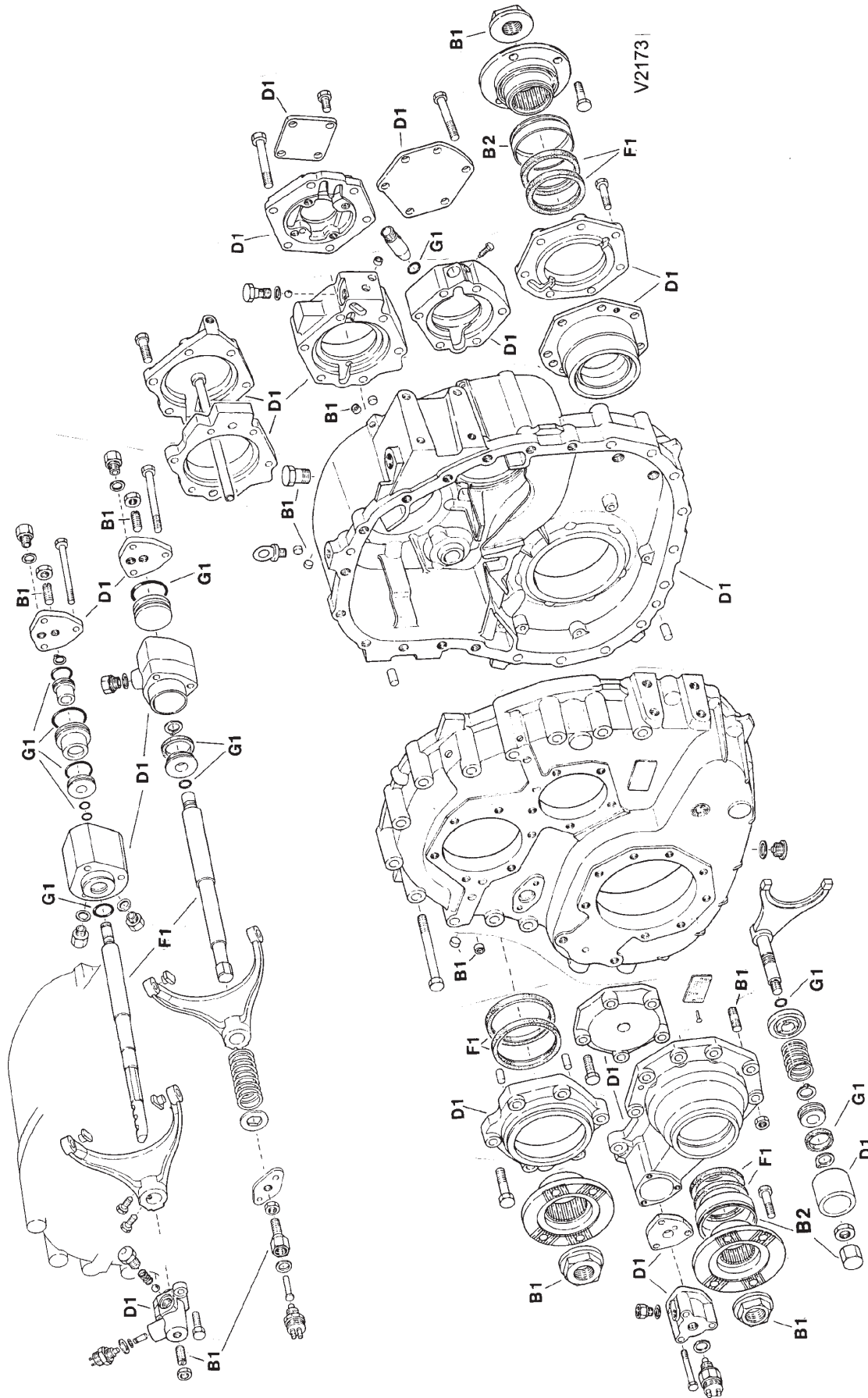
Table of consumables for unit repair.

Symbol	Designation of compound	Product name
F1	Standard grease	STABUTHERM-GH 461
G1	sliding additive	MOLYCOTE M55
D1	Sealing compound	DIRKO
B1	Locking adhesive	LOCTITE 243 (blue)
B2		LOCTITE 638 (green)
R1	Cleaning agent	Loctite sealant remover

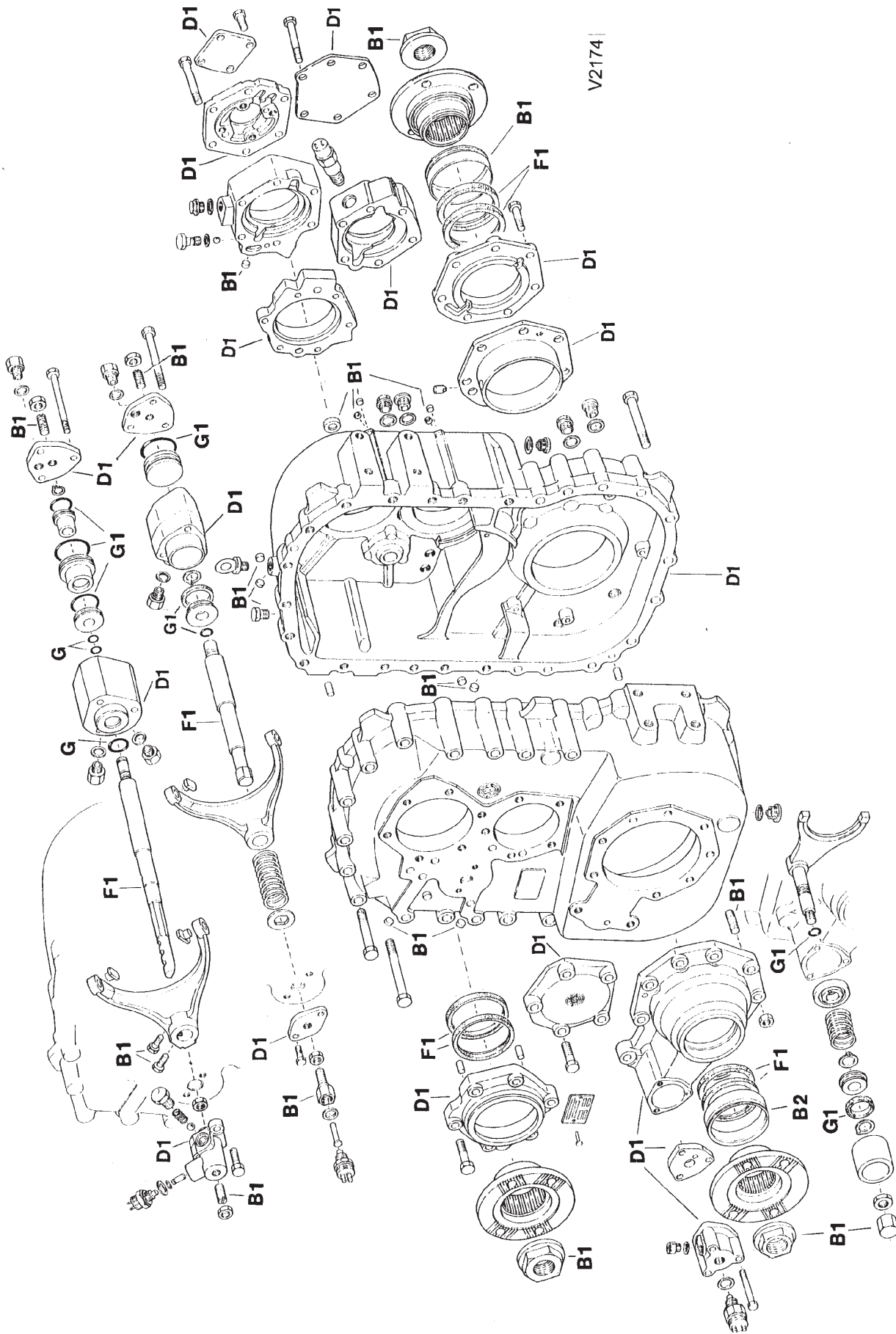
In the following diagram grease, sliding additive, sealing compounds and locking adhesives are indicated with their symbol and point to the components to be treated.



Consumables MVG 1600 / 300

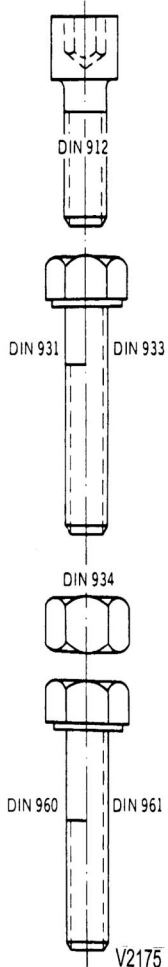


Consumables MVG 1600 / 396



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Tightening Torques Standard

Screws and Nuts										
surface condition μ total ¹⁾		zinc plated		0,125 •		bright		0,14 •		
class of resistance	used	6 G	8 G	10K	12K	6G	8G	10K	12K	
	new	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9	
	dimension	metric regular thread								
	M 4		2,7	3,8	4,6		2,9	4,1	4,9	
	M 5		5,5	8,0	9,5		6,0	8,5	10	
	M 6		9,5	13	16		10	14	17	
	M 8		23	32	39		25	35	41	
	M10		46	64	77		49	69	83	
	M12		80	110	135		86	120	145	
	M14		125	180	215		135	190	230	
	M16		195	275	330		210	295	355	
	M18		270	390	455		290	405	485	
	M20		385	540	650		410	580	690	
	M22		510	720	870		550	780	930	
	M24		660	930	1100		710	1000	1200	
	M27		980	1400	1650		1050	1500	1800	
	M30		1350	1850	2250		1450	2000	2400	
			metric fine thread							
	M 8x1		25	35	42		27	38	45	
	M10x1.25		49	68	82		52	73	88	
	M12x1.25		88	125	150		95	135	160	
	M12x1.5		83	115	140		90	125	150	
	M14x1.5		140	195	235		150	210	250	
	M16x1.5		210	295	350		225	315	380	
	M18x1.5		305	425	510		325	460	550	
	M20x1.5		425	600	720		460	640	770	
	M22x1.5		570	800	960		610	860	1050	
	M24x2		720	1000	1200		780	1100	1300	
	M27x2		1050	1500	1800		1150	1600	1950	
	M30x2		1450	2050	2500		1600	2250	2700	

¹⁾ • μ total is the total of friction coefficients for thread, screw head or nut (contact surface)

ATTENTION ! Using cadmium or copper plated screws, the tightening torque has to be reduced by 25%.

Threaded studs are being tightened into their bore by half the above listed torque.



DESCRIPTION OF REPAIR WORKS

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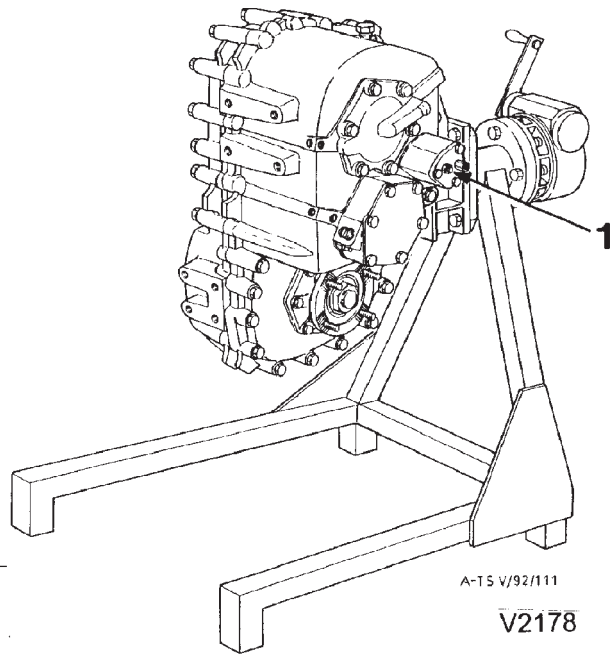
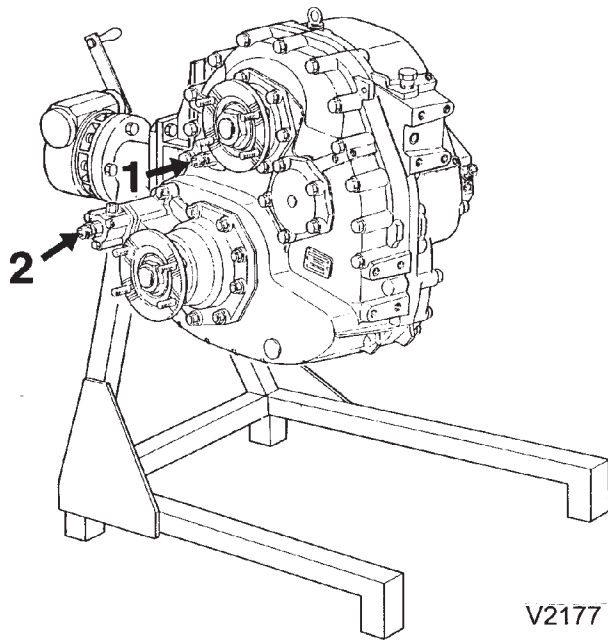


1. Working on the transfer case unit

1.1 Disassembly of transfer case

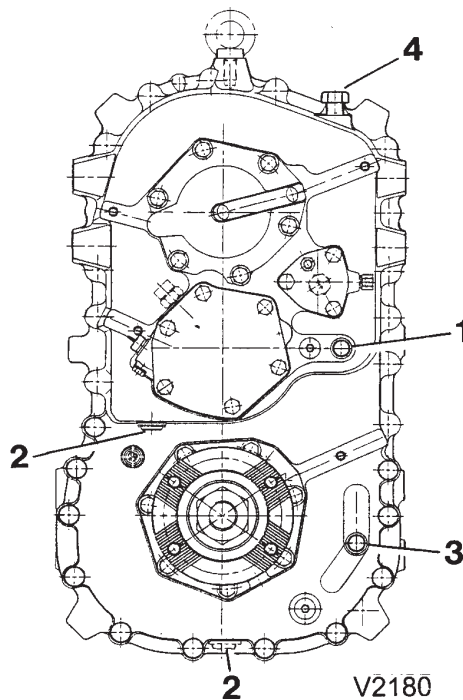
1.2 Assembly of transfer case

- Contains:** Setting of transfer case shifting system 1
Setting of interaxle differential lock 2



Additional work: Oil change
(changing of oil only when transfer case is warm)

- 1 Oil filling plug
- 2 Oil drain plug
- 3 Oil level plug
- 4 Breather

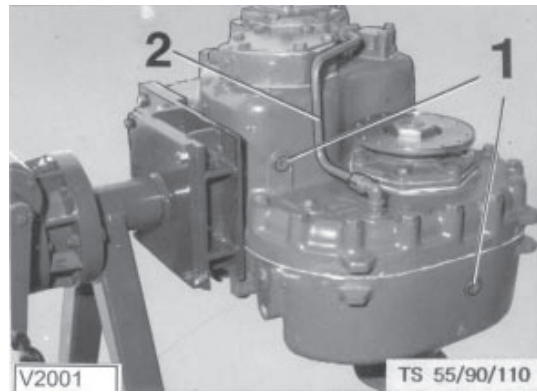


Drain oil by unscrewing both oil drain plugs (2)
Install oil drain plugs (2) with new seals
Fill oil through oil filling bore (1) until it starts to overflow at oil level bore (3)
After setting of correct oil quantity Install oil level plug (3) with new seal
Clean and install breather (4)

1.1 Disassembly of transfer case

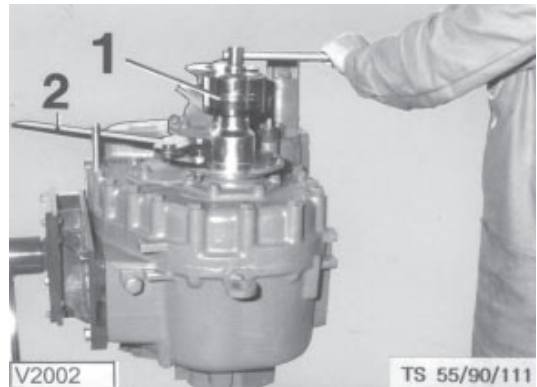
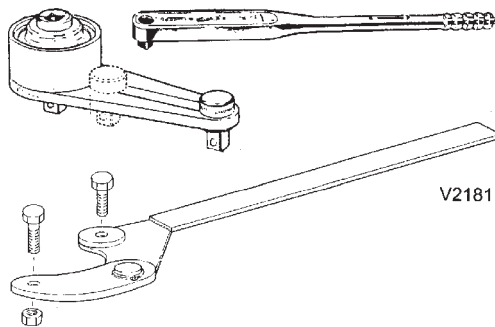
- 1 Remove drain plugs (1/1) and drain oil. Reinstall oil pipe (1/2)

1.1.1 Pull-off flanges, deinstall bearing covers, shifting cylinder, and front axle output shaft dismount housing



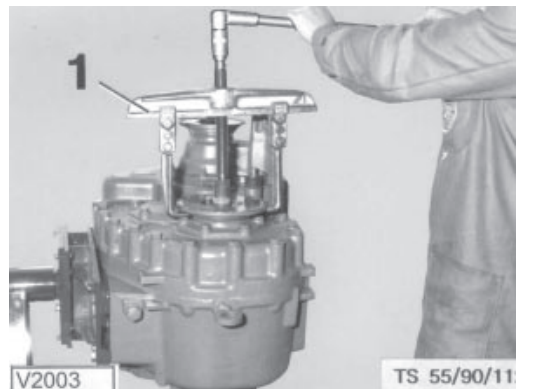
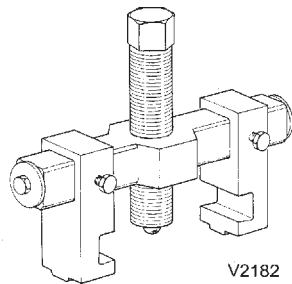
Pic. 1

- 2 Loosen flange nuts with a torque multiplier (2/1). Use holding device TS 215W (2/2)



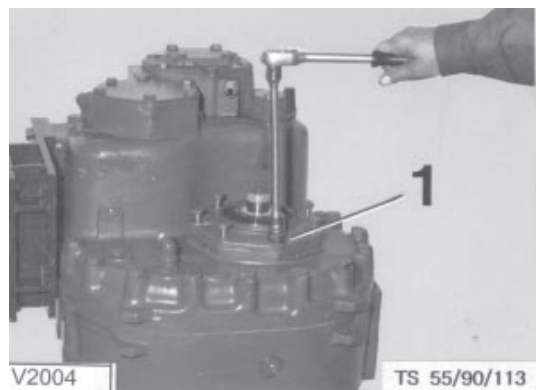
Pic. 2

- 3 Pull-off flanges from the shafts with extractor A/VG 2000-05 (3/1).



Pic. 3

- 4 Remove bearing cover (4/1) from the rear axle drive shaft (take out setting shims).

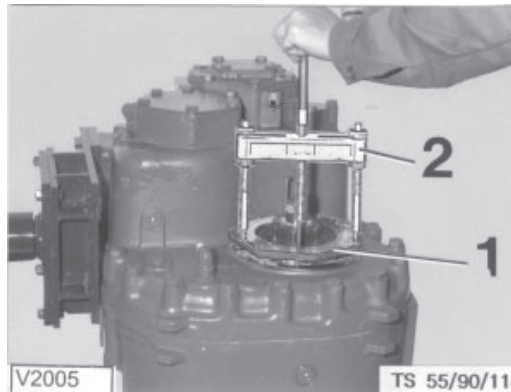


Pic. 4



1.1.1

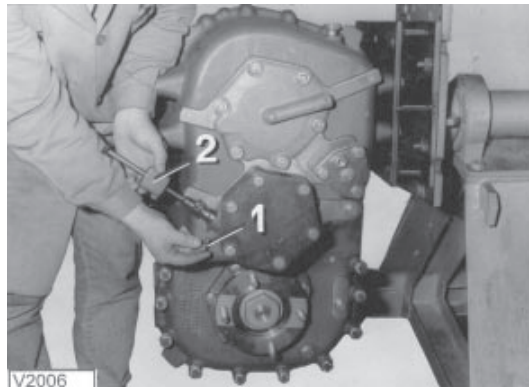
- 5 Press out bearing carrier (5/1) at rear axle shaft from housing with extractor (KUKKO & screws M8) (5/2).



Pic. 5

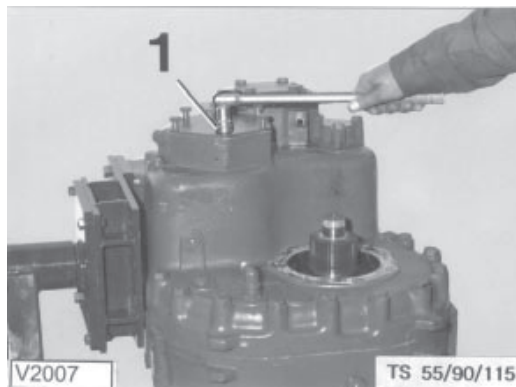
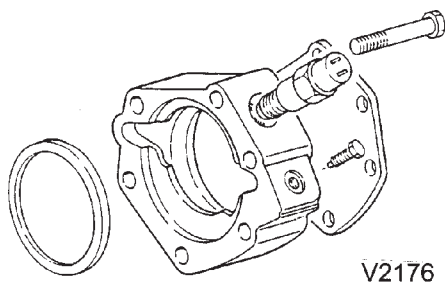
- 6 Unscrew the clamping screw (6/1) of the speedometer shaft.

Mount striking weight SK 17828/A (6/2) and lightly knock the speedometer shaft out of the housing.



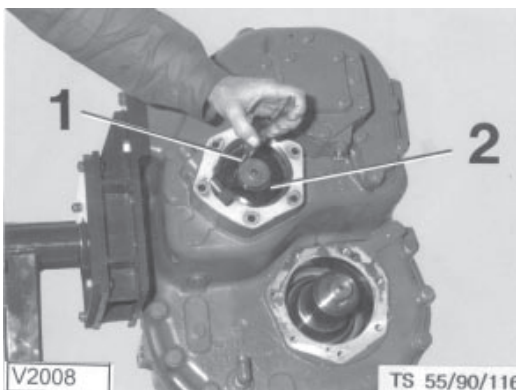
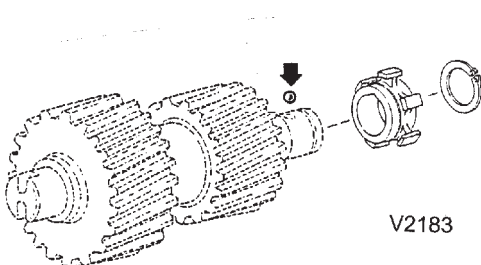
Pic. 6

- 7 Remove the lid (7/1) of the speedometer housing.



Pic. 7

- 8 Remove the retaining ring (8/1) and speedometer gear (8/2) from the intermediate shaft. Pay attention to the driver ball.

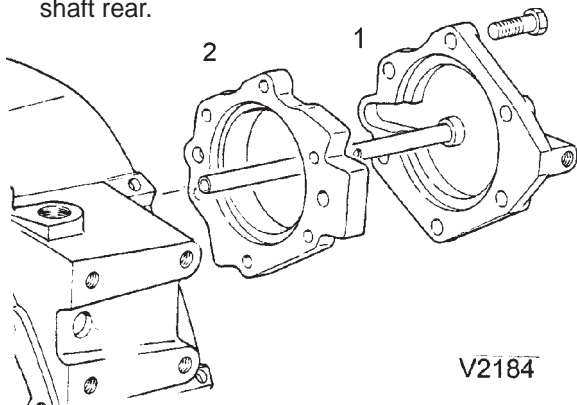


Pic. 8

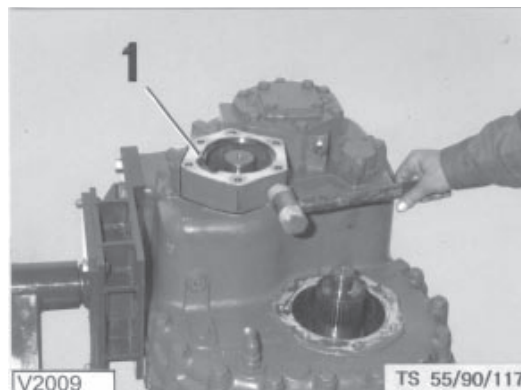
9 Remove speedometer housing (9/1).

10.1 Without oil pump:

Unscrew cover (1) and intermed. plate (2) of drive shaft rear.



V2184

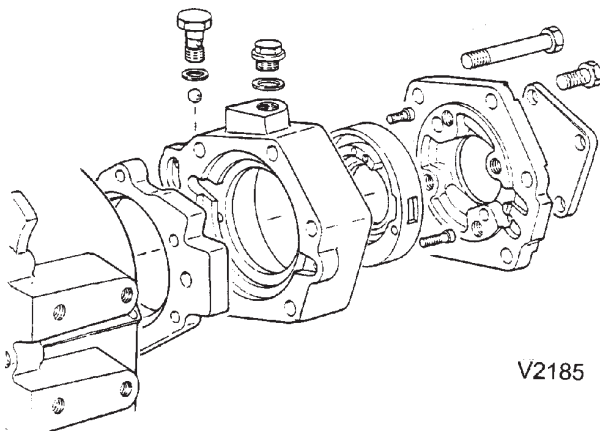


V2009 TS 55/90/117

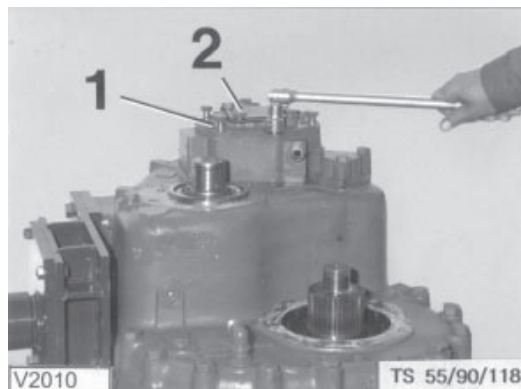
Pic. 9

10.2 With oil pump:

Remove cover (10/1) of oil pump housing at rear of drive shaft. Remove lid of PTO interface (10/2). Remove hollow screw and driver ball.



V2185

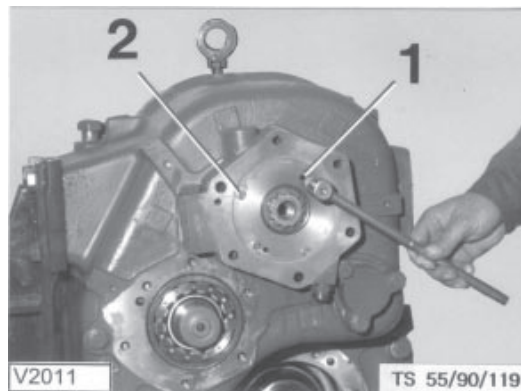


V2010 TS 55/90/118

Pic. 10

11 Unscrew cylinder screws

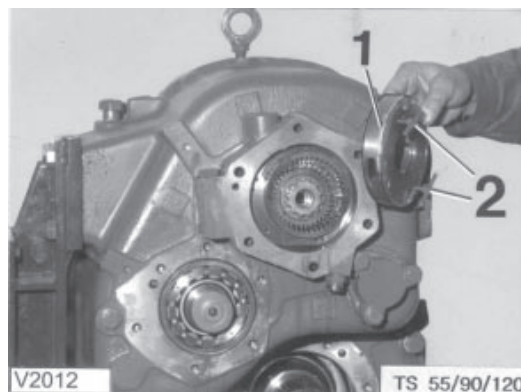
- 1) M6 x 35 (11/1)
- M6 x 30 (11/2).



V2011 TS 55/90/119

Pic. 11

12 Pull off the oil pump housing (12/1) with 2 screws (12/2) M6x60.



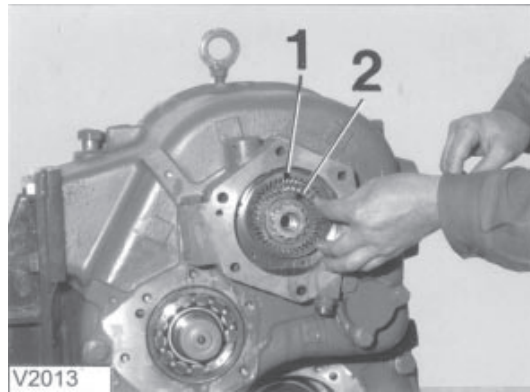
V2012 TS 55/90/120

Pic. 12



1.1.1

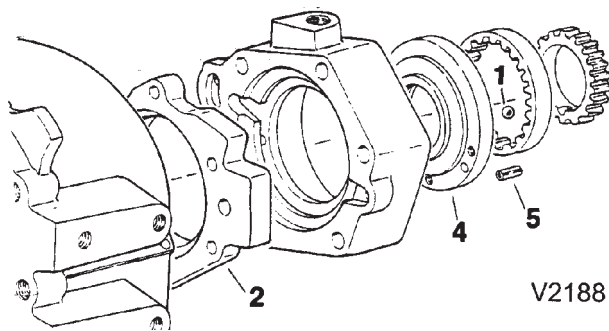
- 13 Remove oil pump ring gear (13/1) and inner gear (13/2).



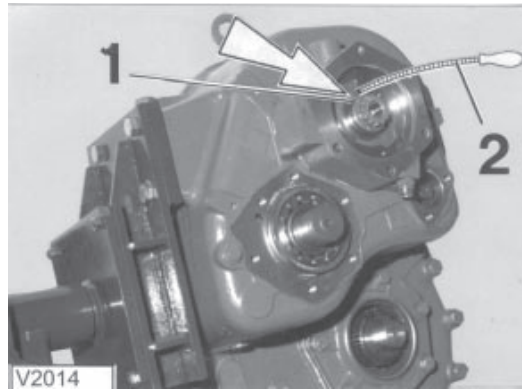
V2013

Pic. 13

- 14 Remove driver ball (14/1) with magnetic rod (14/2).



V2188

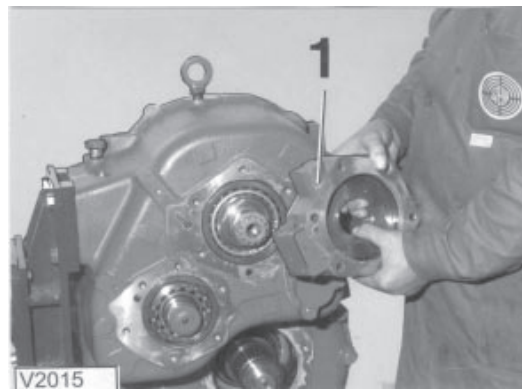


V2014

Pic. 14

- 15 Remove oil pump housing (15/1) with spacer plate from rear side the drive shaft.

Dismount oil pump cover (4) inside oil pump housing and remove spring pin (5).

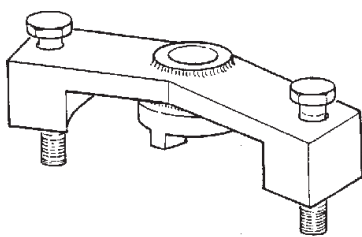


V2015

Pic. 15

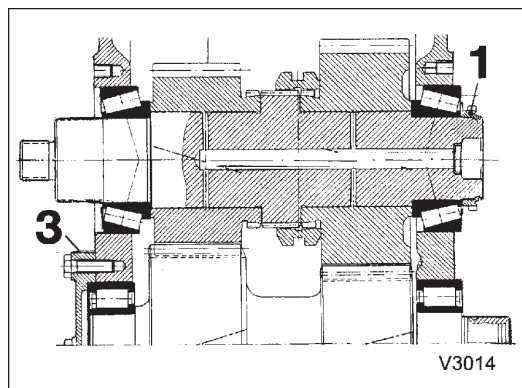
Turn transfer case

- 16 Remove front bearing cover (16/3) from drive shaft (remove setting shims).
Block intermediate shaft with device A-VG 1600-03.



V2189

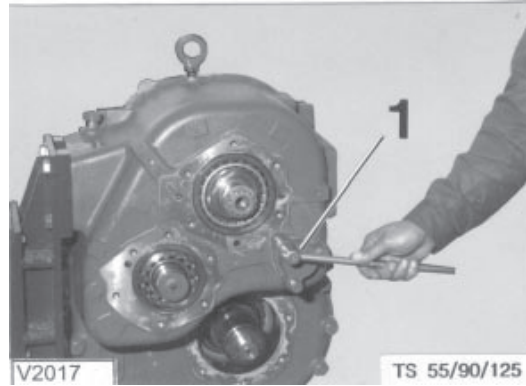
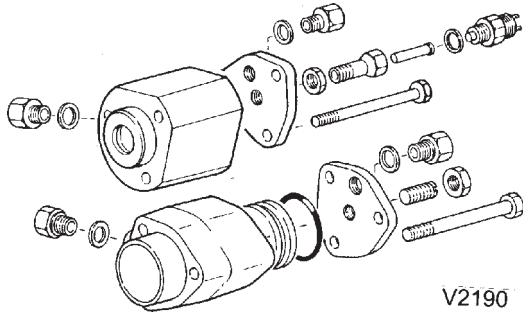
Unscrew grooved nut (16/1) of drive shaft with wrench 1 SKO-100-20
Unscrew grooved nut (16/2) of drive shaft with wrench 1 VOZ 006920



V3014

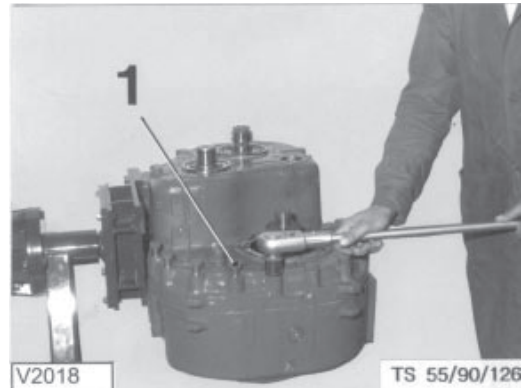
Pic. 16

17 Remove lid and cylinder (17/1) from shift rod



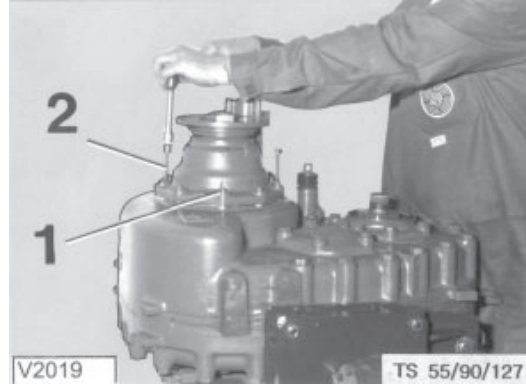
Pic. 17

18 Unscrew rear housing bolts (18/1) M16 x 100 (10 pieces).



Pic. 18

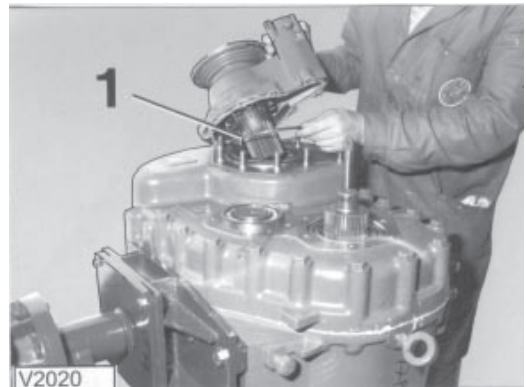
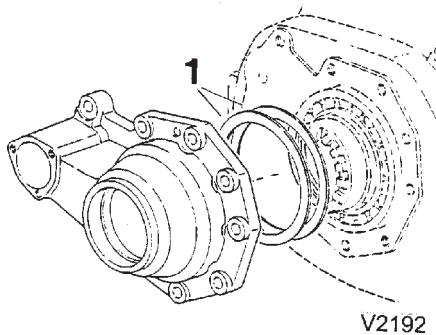
19 Turn transfer case over



Pic. 19

20 Unscrew fastening nuts (19/1) and pull off front axle drive complete with 2 screws (19/2) M8 x 40.

21 Remove shims (20/1) from the front axle drive shaft.

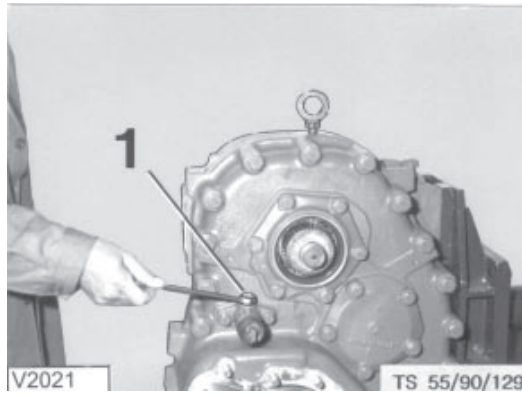
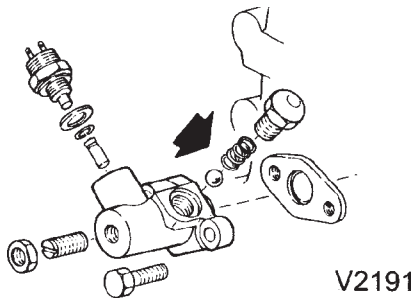


Pic. 20

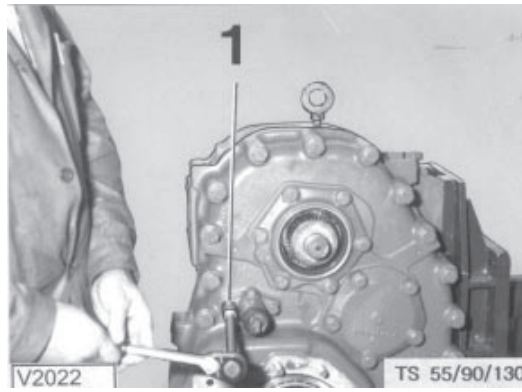


1.1.1

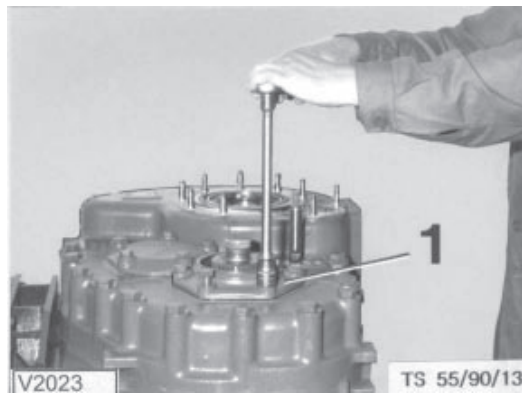
- 22 Unscrew retaining ball guide (21/1).
(Pay attention to spring and ball)



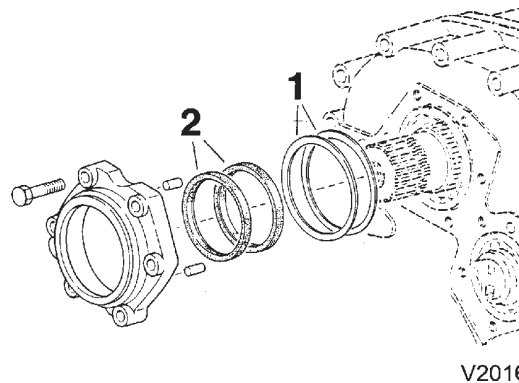
- 23 Remove shift stopper (22/1).



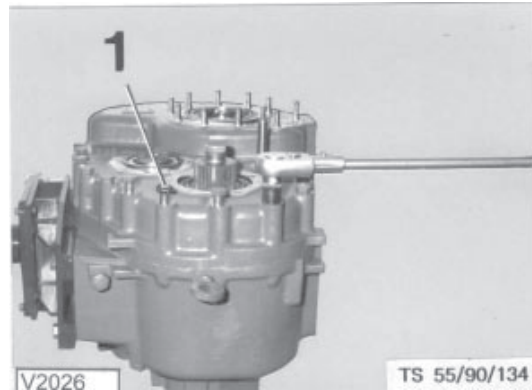
- 24 Remove front bearing cover (23/1) from drive shaft.



- 25 Remove shims (24/1).
Remove sealing rings (24/2).

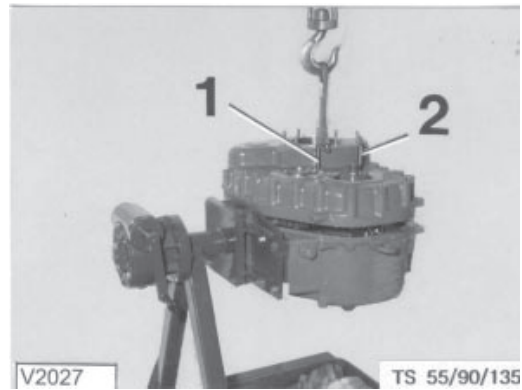


- 26 Unscrew housing screws (26/1) M16x130 (12 pieces).



Pic. 26

- 27 Lift off housing cover with lifting device (27/1) M12. (do not incline or rock). Do not jam shifting rod (27/2).

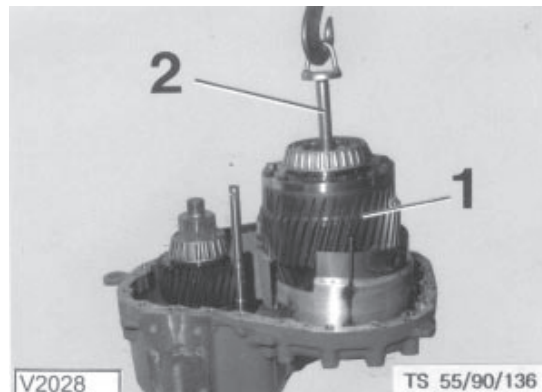
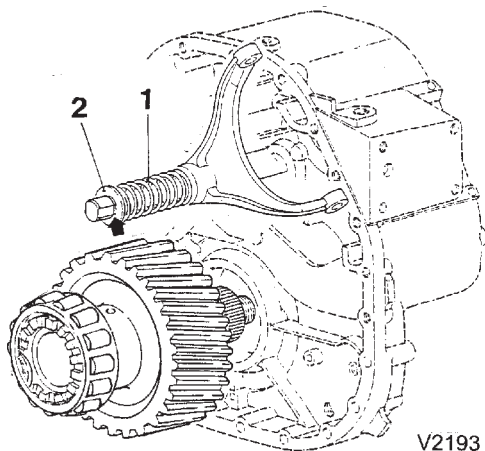


Pic. 27

1.1.2 Dismounting of drive shaft, intermediate shaft, and differential gear or output shaft

- 1 Lift out interaxle differential gear (28/1) with lifting device TS 211 W (28/2). Remove retaining washer (2) and spring.

CAUTION: Pressure spring is compressed.

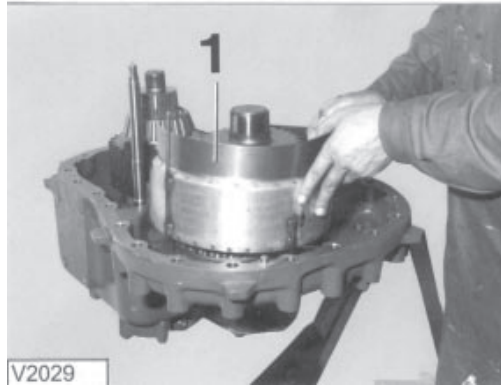


Pic. 28



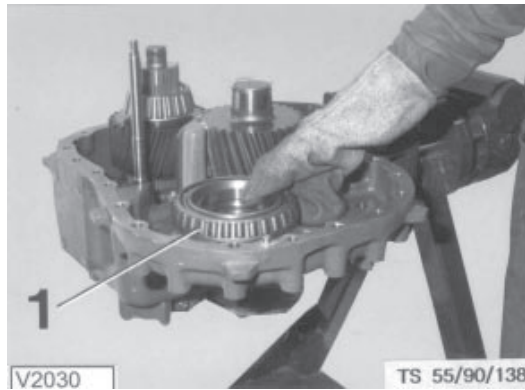
1.1.2

- 2 Remove oil guide panel (29/1).



Pic. 29

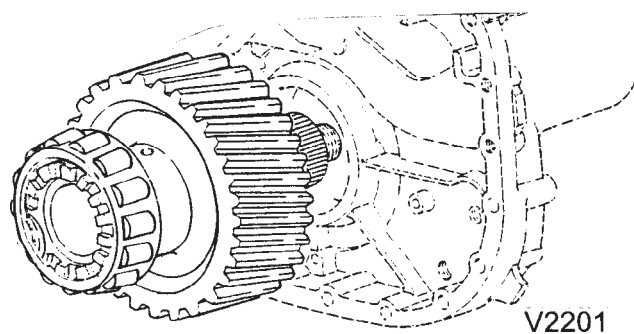
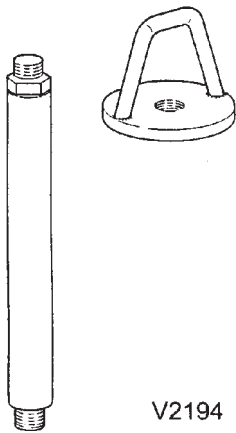
- 3 Remove roller bearings (30/1).



Pic. 30

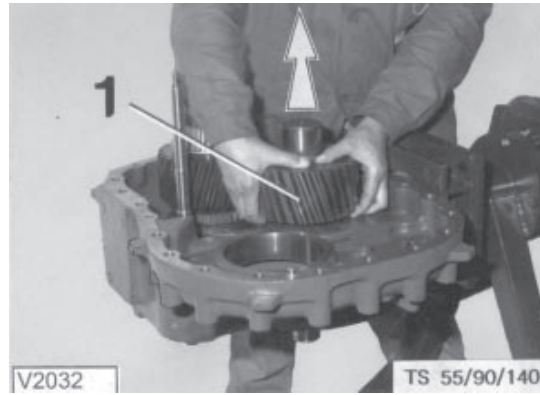
Without interaxle differential

- 4 Lift out rear axle output shaft (1) from housing.
Use lifting device TS 211W



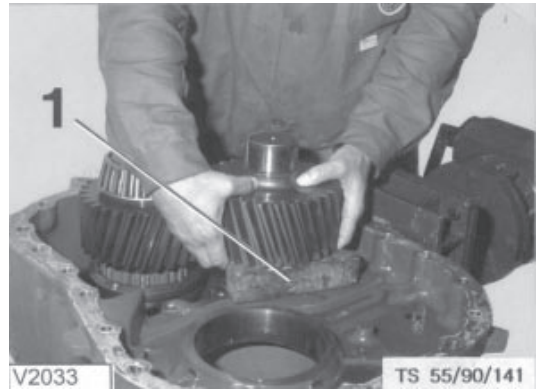
Deinstall drive shaft and intermediate shaft

- 5 Lift-up interm. shaft (32/1) approx. 45 mm.



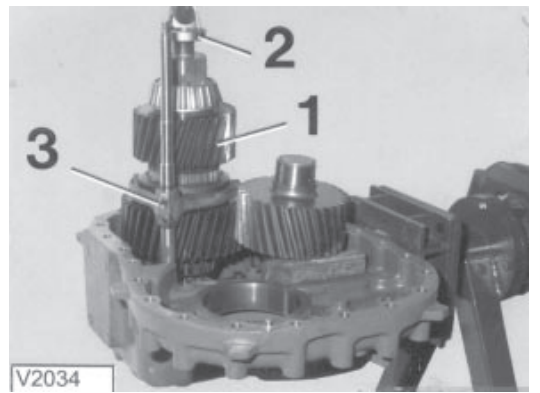
Pic. 32

- 6 Set interm. shaft sideways on support (33/1)



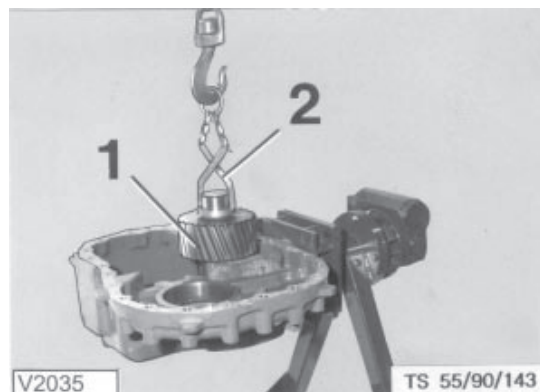
Pic. 33

- 7 Lift out drive shaft complete (34/1) with shifting rod, shifting sleeve and shifting fork (34/3) use tool TS 212 W (33/2).



Pic. 34

- 8 Lift out interm. shaft (35/1) using lifting device TS 222 W (35/2).

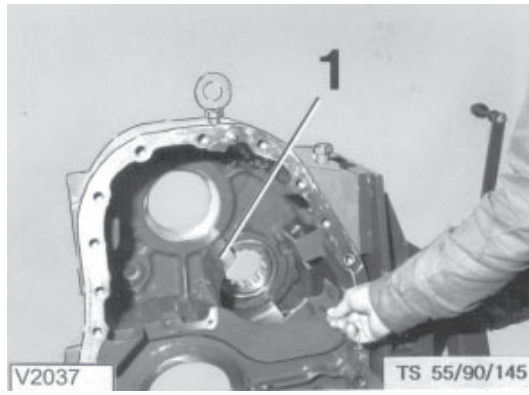
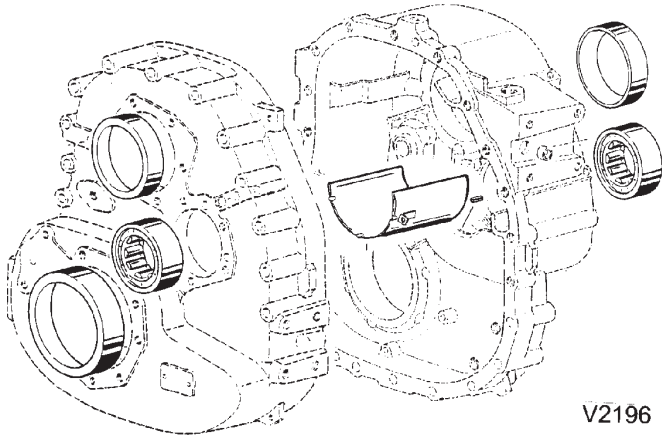


Pic. 35



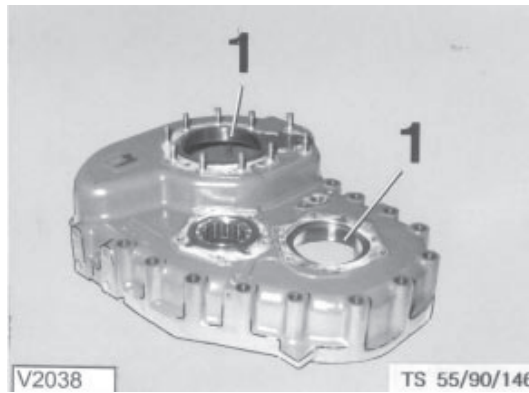
1.1.2

- 9 Knock retainer spring pin (36/1) out of housing.
- 10 Remove oil guide panel (37/1) from housing by turning it.



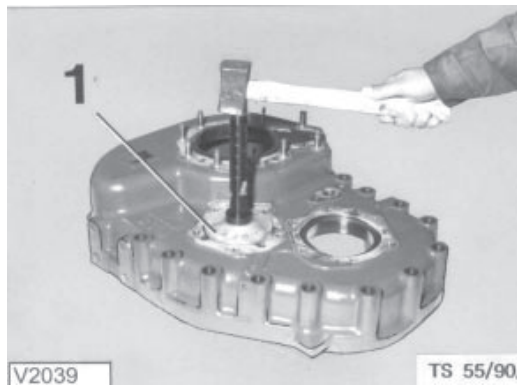
Pic. 37

- 11 Remove all bearing rings (38/1) from both housing halves.



Pic. 38

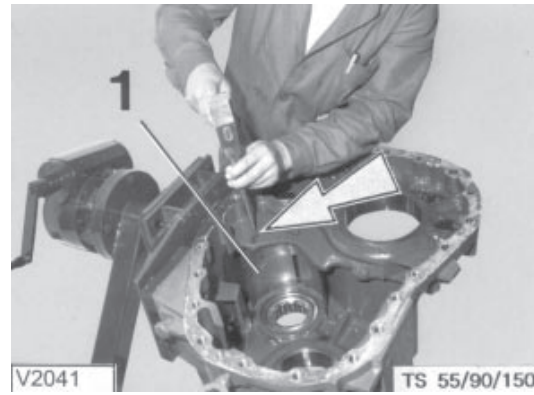
- 12 Remove front and rear bearing (39/1) from housing halves (Setting tool TS 223 W).



Pic. 39

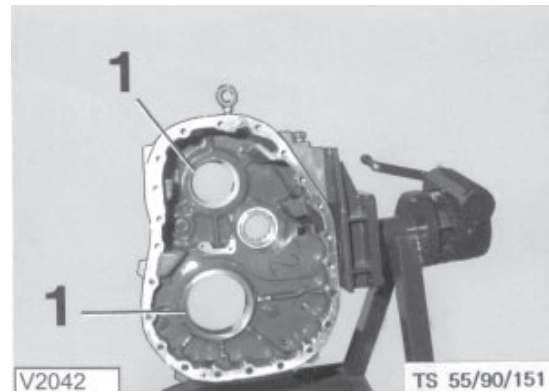
1.2 Assembly of transfer case

- 1 Install oil panel (41/1) for interm. shaft and fix with spring pin.



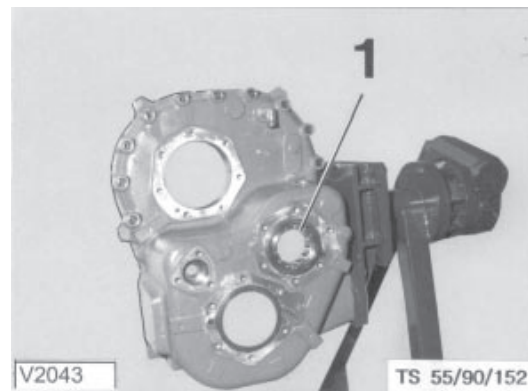
Pic. 41

- 2 Install bearing rings (42/1) in front housing.

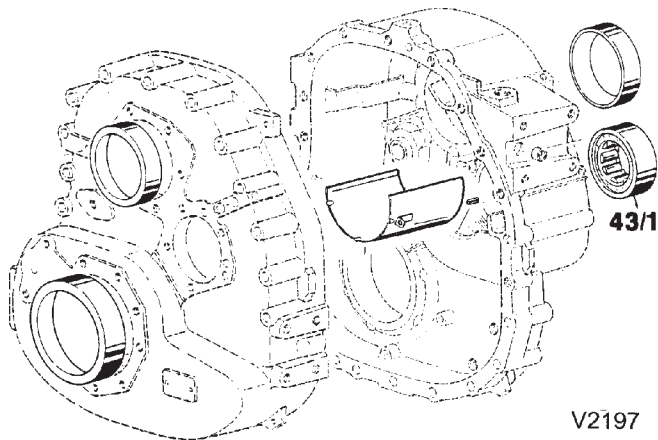


Pic. 42

- 3 Install rear roller bearing (43/1) for intermed shaft. Use setting tool TS 223 W.



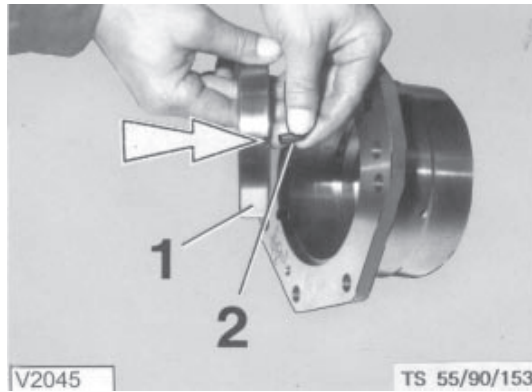
Pic. 43



1.2.1

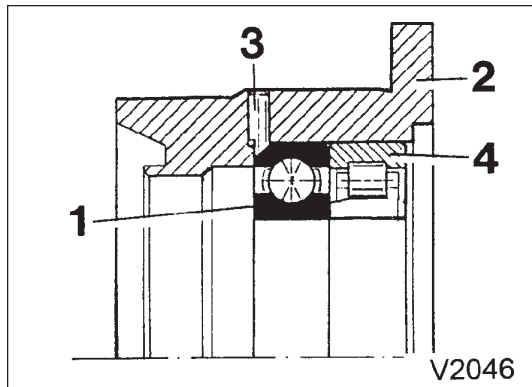
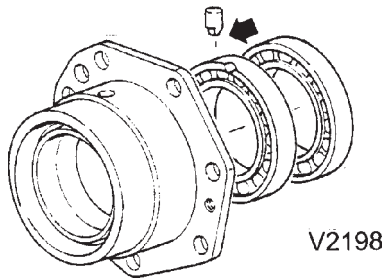
1.2.1 Installing bearing carrier, determining shim thickness and installing bearing covers

- 1 Insert the four-point bearing (45/1), with the notches for the locking pin (45/2) pointing inward, into the bearing carrier (46/2).



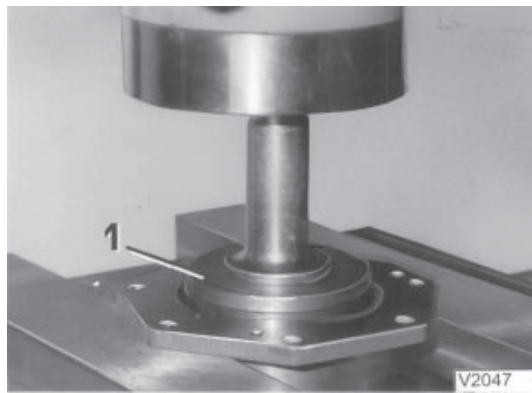
Pic. 45

- 2 Push the locking pins (46/3), with the inclined surface pointing to the four-point bearing, flush into the holes in the bearing carrier (46/2).



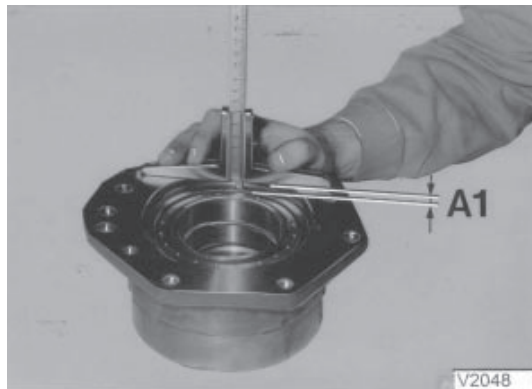
Pic. 46

- 3 Press roller bearing (46/4) into the bearing carrier with support disk TS 213 W (47/1).



Pic. 47

- 4 Measure distance from bearing support surface to roller bearing surface (A1).



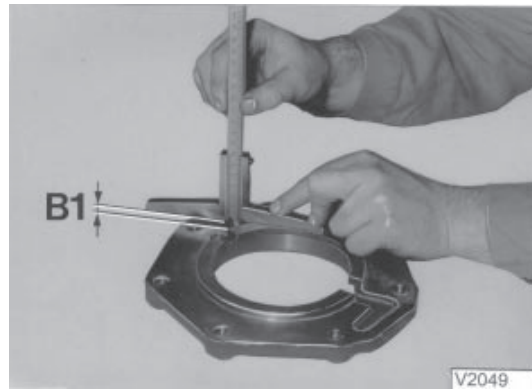
Pic. 48

- 5 Measure projection of bearing seat on the bearing cover for rear axle output shaft (**B1**).
- 6 Determine thickness (**X1**) of shim.
Bearing adjustment: 0.0 - 0,05 mm pretension (**P**)

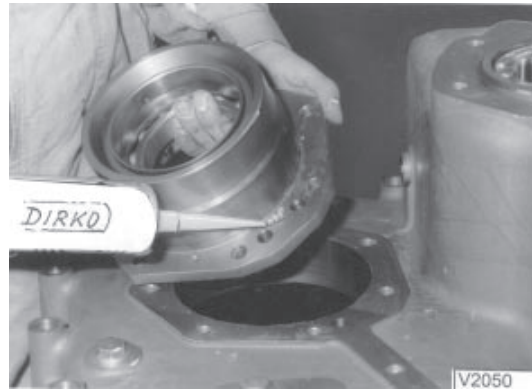
$$X_1 = A_1 - B_1 + P$$

- Shim thickness S = 0.75 mm
- S = 0.80 mm
- S = 0.90 mm
- S = 1.00 mm
- S = 1.25 mm

- 7 Apply sealant DIRKO to bearing support



Pic. 49

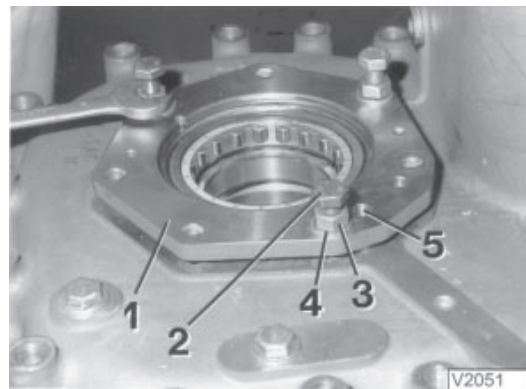


Pic. 50

- 8 Press bearing support (**51/1**) into the rear housing, use screws M12x90 (**51/2**), nuts (**51/3**) and washers (**51/4**).

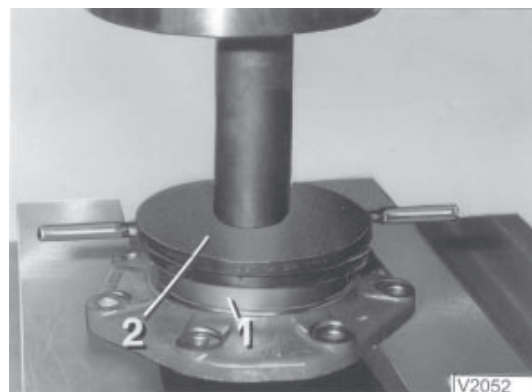
ATTENTION: After assembly remove excess sealant from the lube oil bore hole (**51/5**).

Unscrew auxiliary bolts.



Pic. 51

- 9 Apply LOCTITE 638 to seal carrier with seal rings (**52/1**) and press into bearing cover with setting tool (**52/2**) SKO-026494.



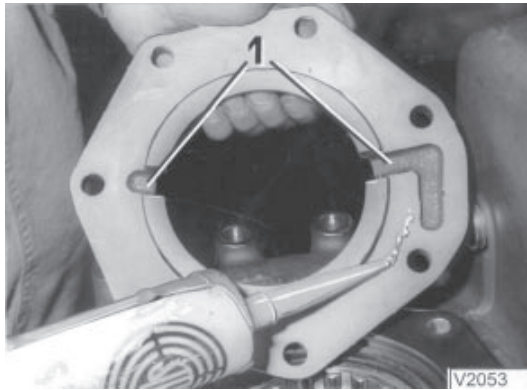
Pic. 52



1.2.1

- 10 Apply DIRKO sealant to bearing cover of the rear axle output shaft.

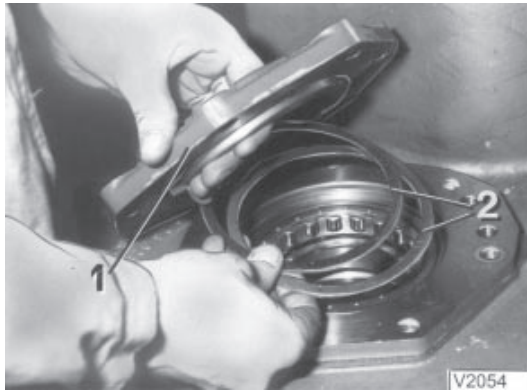
ATTENTION: Make sure that no sealant enters the lube oil ducts (53/1).



Pic. 53

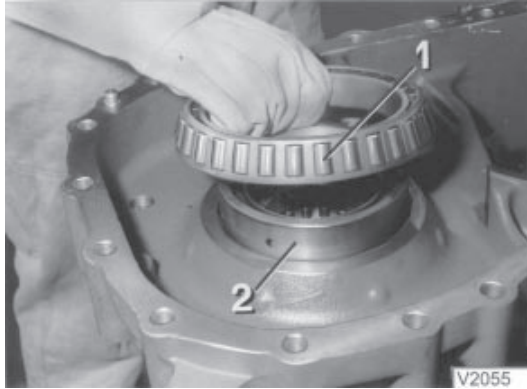
- 11 Install bearing cover (54/1) with the correct shims X1 (54/2).

Turn transfer case over.

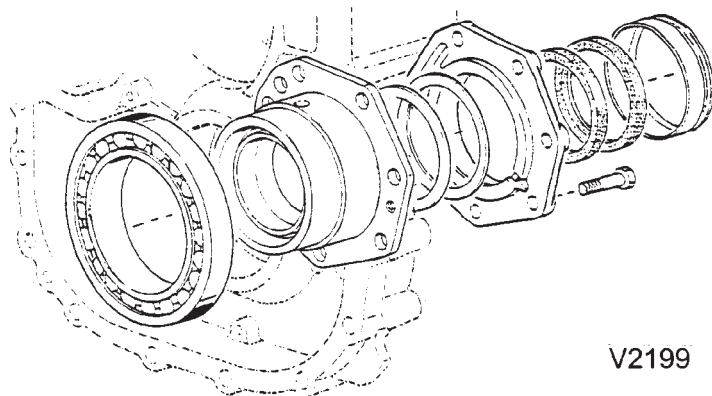


Pic. 54

- 12 Heat bearing (55/1) to 80°C and push onto the bearing seat of the bearing carrier (55/2).

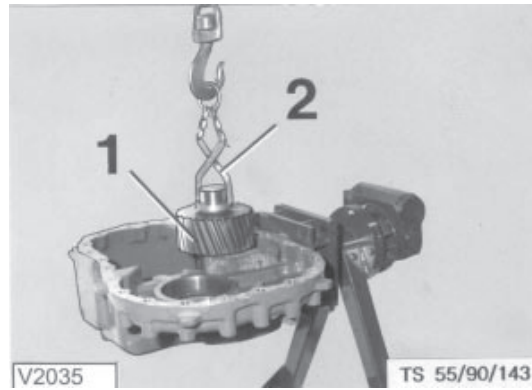


Pic. 55



1.2.2 Installing drive shaft, intermediate shaft, and differential gear or output shaft

- 1 Temporarily install interm. shaft (56/1) with lifting device (TS 222 W) (56/2).



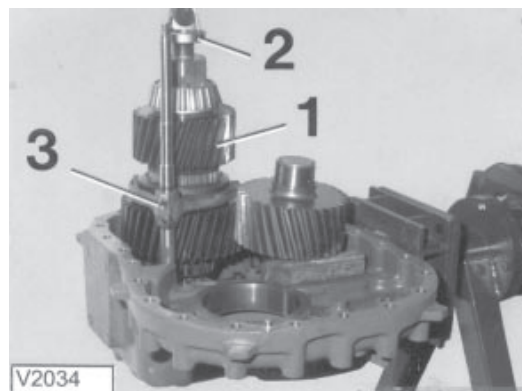
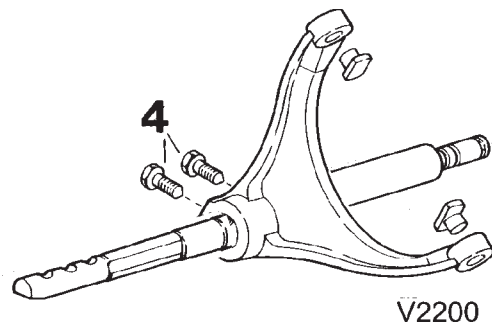
Pic. 56

- 2 Set intermed. shaft aside on the 45 mm support. (57/1)



Pic. 57

- 3 Install drive shaft (58/1) with shifting fork (partnumber on top) and shifting rod (58/3). Use tool TS 212 W (58/2). Tighten clamping screws (4), lock with LOCTITE 243. Tightening torque: 50 Nm

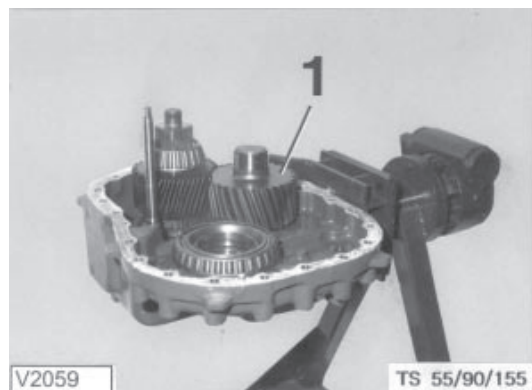


Pic. 58

- 4 Bring interm. shaft (59/1) into installation position.

ATTENTION:

When installing the interm. shaft, make sure that the roller bearing does not incline or jam.



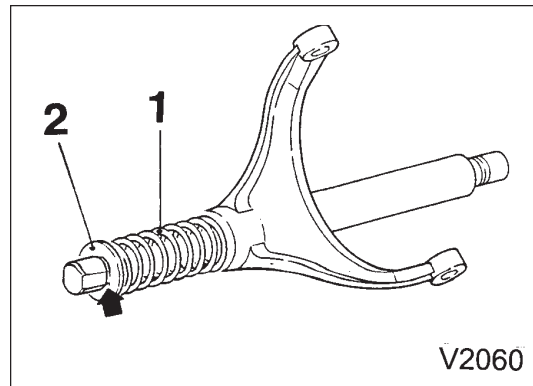
Pic. 59



1.2.2

Shifting system with spring

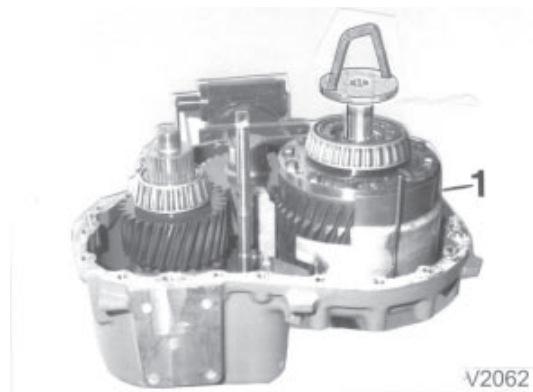
- 5 Compress pressure spring (60/1) and retaining washer (60/2) together and lock by turning washer a 1/4 turn.



Pic. 60

Version with differential

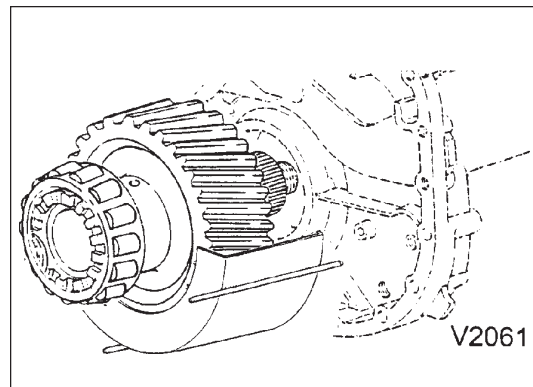
- 6 Install oil panel (61/1) with differential gear. Use lifting device TS 211W.



Pic. 61

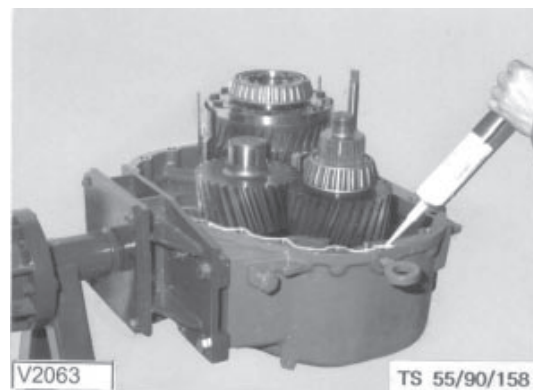
Version without differential

- 7 Install rear axle output shaft with oil panel. Use lifting device TS 211 W.



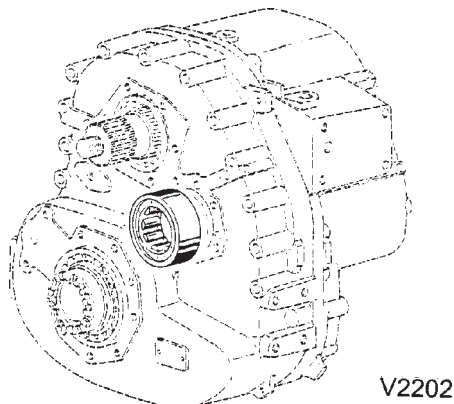
Pic. 62

- 8 Apply DIRKO sealant to the contact surface of the housing.



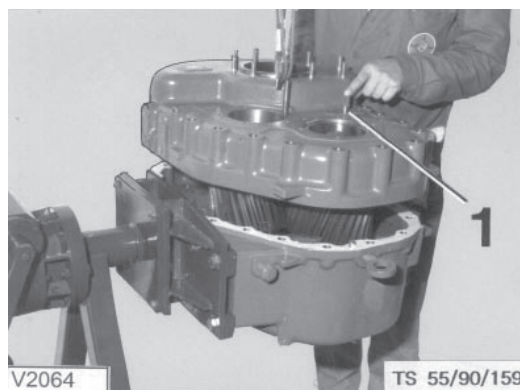
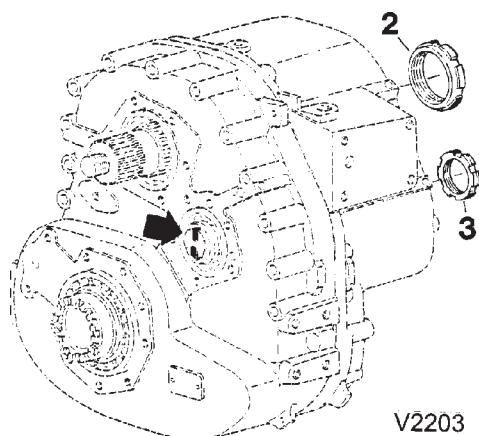
Pic. 63

- 9 Slip-in shifting rod (64/1) in and install housing half.
- 10 Tighten 2nd housing half with screws to 125 Nm. Install studs (65/2) with LOCTITE 243.
- 11 Install front bearing for interm. shaft with setting tool (66/1) A-VG-1600-01 and centering tool A-VG-1600-02.

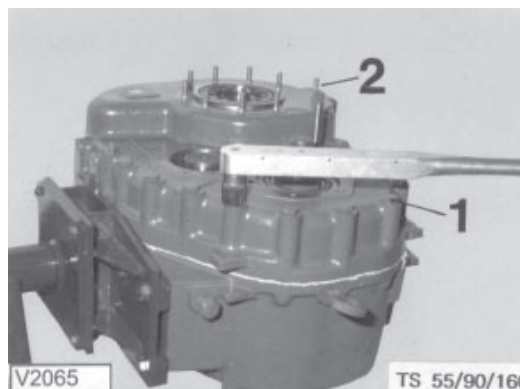


Turn over transfer case.

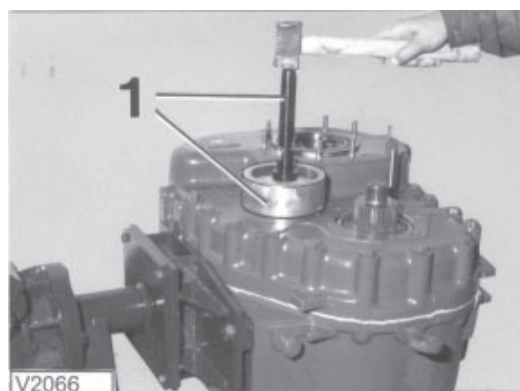
- 12 Tighten remaining housing bolts (67/1) to 125 Nm.
- 13 Block intermediate shaft with device A-VG1600-03
Tighten grooved nut (2) of drive shaft with wrench 1 SKO 400720.
Tightening torque: 600Nm, lock by driving-in locking collar 2 times.
Tighten grooved nut (3) of intermed. shaft with wrench 1 VOZ 006920 (chamfered side of nut towards exterior). Torque 600Nm. Secure with LOCTITE 243).



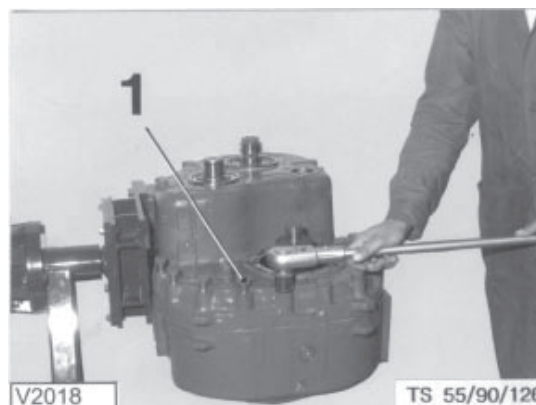
Pic. 64



Pic. 65



Pic. 66



Pic. 67

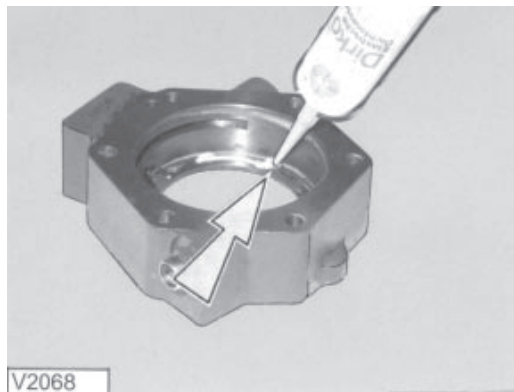
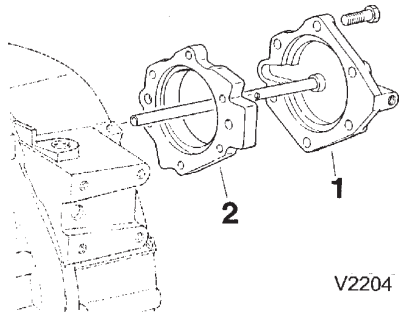


1.2.3

1.2.3 Installing bearing housing, bearing cover and speedometer housing

Without oil pump

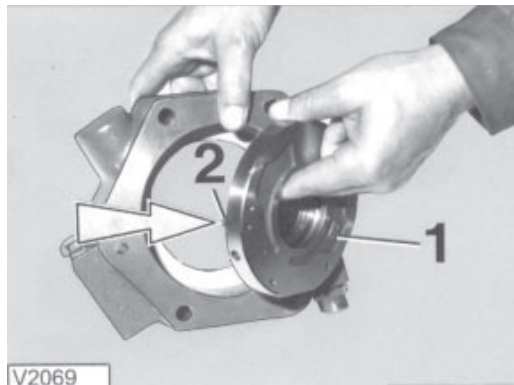
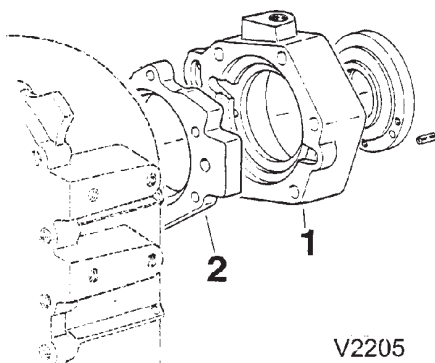
- 1 Apply DIRKO sealant to oil pump / bearing housing (2) and intermediate plate (1) and install.



Pic. 68

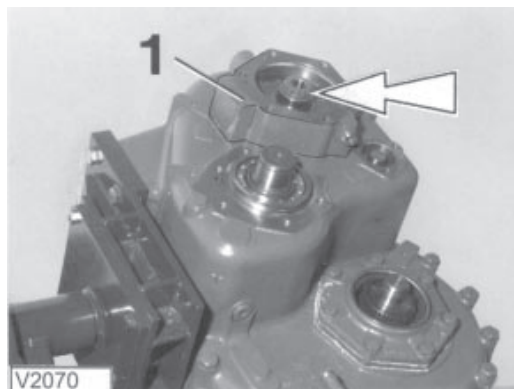
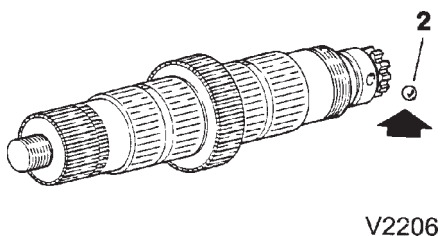
With oil pump

- 2 Apply DIRKO sealant to bearing / oil pump housing. Insert rear oil pump lid (69/1) into housing. Install spring pin (69/2) to prevent turning.



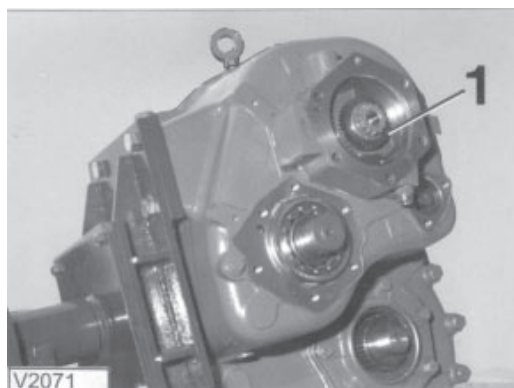
Pic. 69

- 3 Mount bearing housing (70/1), with intermediate plate (2). Put driver ball (70/1) into dead end bore of drive shaft with grease.



Pic. 70

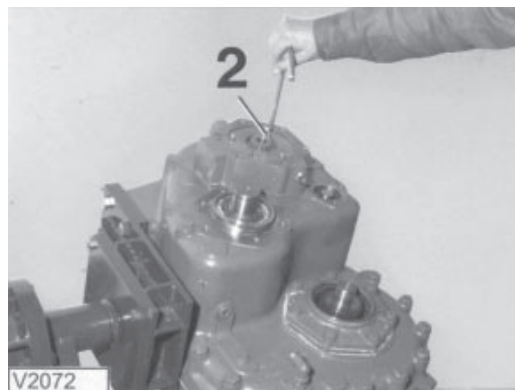
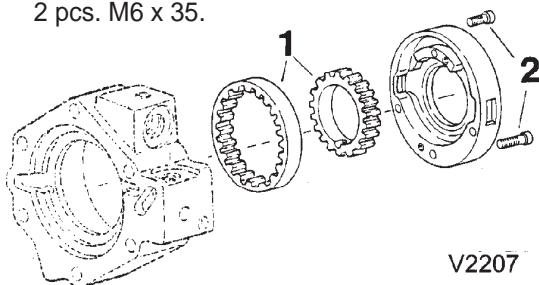
- 4 Slide inner oil pump gear (71/1) onto drive shaft.



Pic. 71

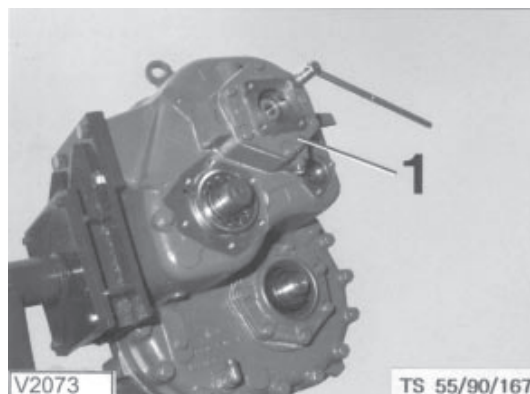
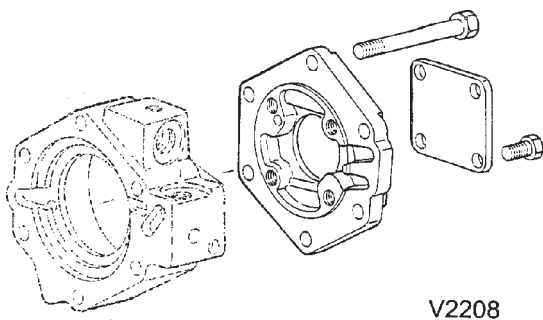
- 5 Install oil pump ring gear (72/1) in oil pump housing and tighten with cylinder bolts (72/2)

2 pcs. M6 x 30
2 pcs. M6 x 35.



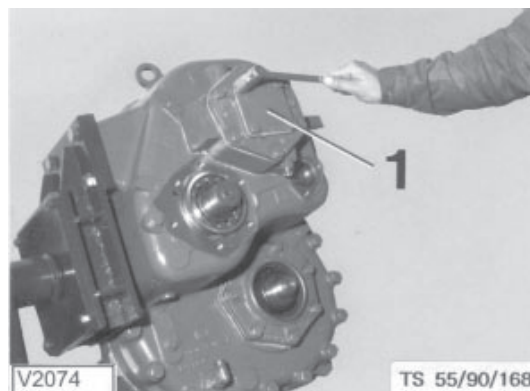
Pic. 72

- 6 Mount rear bearing housing lid (73/1) (on bearing housing) with DIRKO sealant.



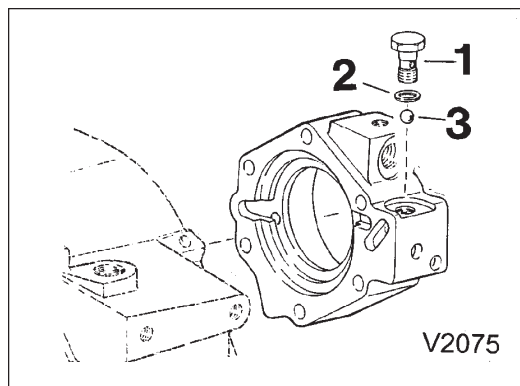
Pic. 73

- 7 Mount sealing lid (74/1) with DIRKO (seal screws too).



Pic. 74

- 8 Install hollow screw (75/1), sealing ring (75/2), and ball (75/3) in bearing / oil pump housing.

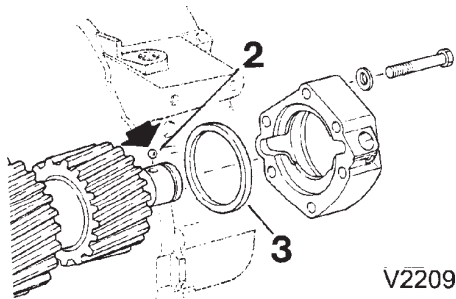


Pic. 75

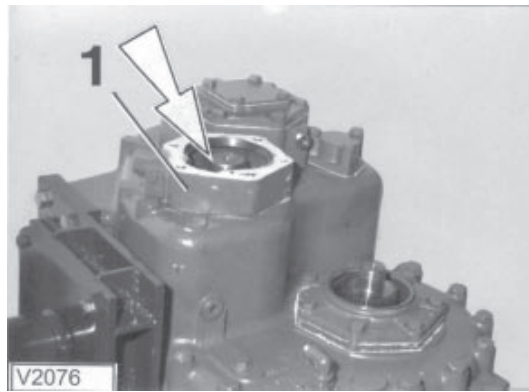


1.2.3

- 9 Install intermediate ring (3).
Mount speedometer housing (76/1) with DIRKO sealant. Fix with 3 auxiliary screws.

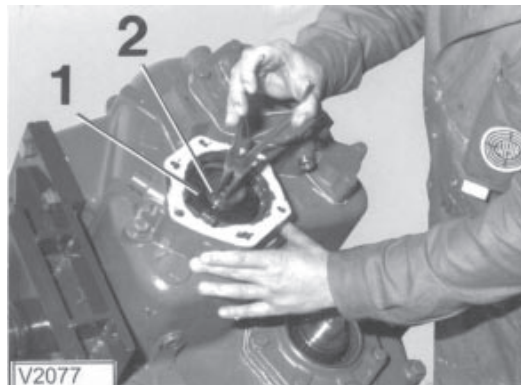
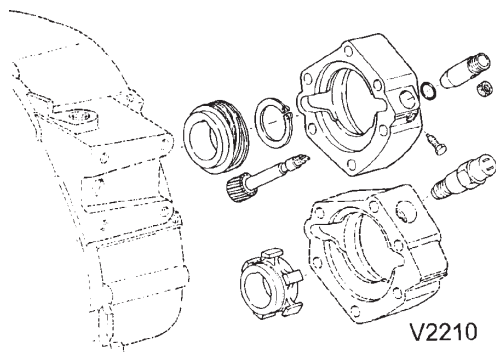


Set driving ball (76/2) into bore of interm. shaft.



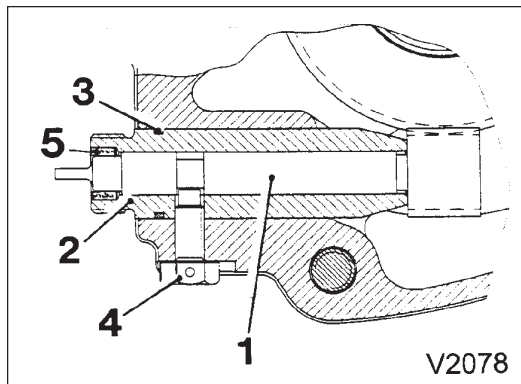
Pic. 76

- 10 Push speedometer drive gear (or pulse wheel)(77/1) over the driving ball on the intermed. shaft and secure with circlip (77/2).



Pic. 77

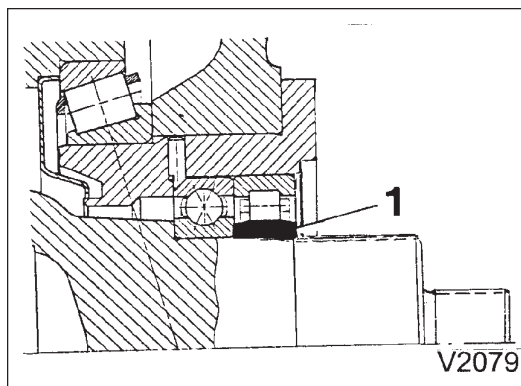
- 11 Push speedometer pinion (78/1) into the guide sleeve (78/2). Set o-ring (78/3) into groove of sleeve and grease. Push speedometer drive into speedometer housing. Coat threads of clamping bolt (78/4) with LOCTITE 243 and fix speedometer drive.



Pic. 78

- 12 Heat up inner ring (79/1) of cylindrical roller bearing to approx. 80° C and slide it on output shaft.

Turn transfer case over.

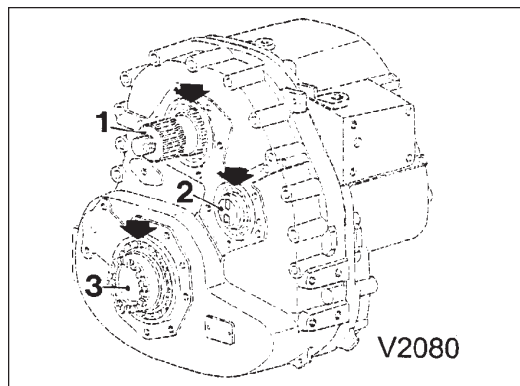


Pic. 79

1.2.4 Setting end play of drive shaft, intermed. shaft, and differential gear or output shaft

- 1 Set drive shaft (81/1), intermediate shaft (81/2) and interaxle differential (81/3) to the rear.

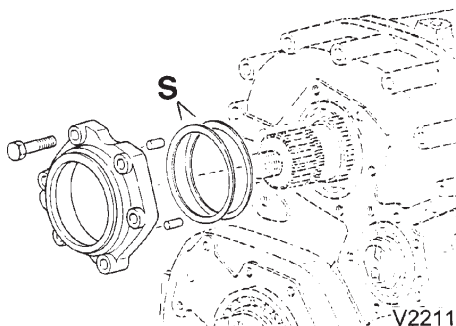
Set back outer bearing rings. Free all bearings by means of light blows, while turning shafts.



Pic. 80

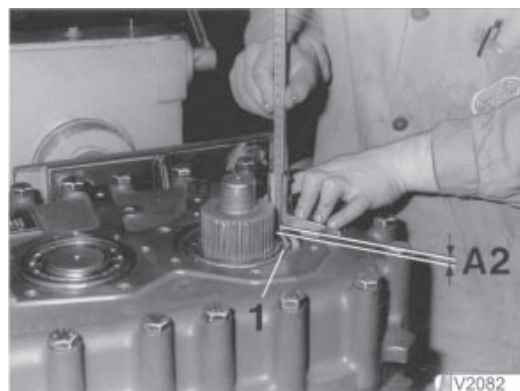
Endplay of drive shaft

- 2 Measure projection of drive shaft bearing (82/1) from the main housing surface (A2).



Pic. 81

- 3 Measure the distance of bearing seat at bearing cover (83/2) of drive shaft (B2).



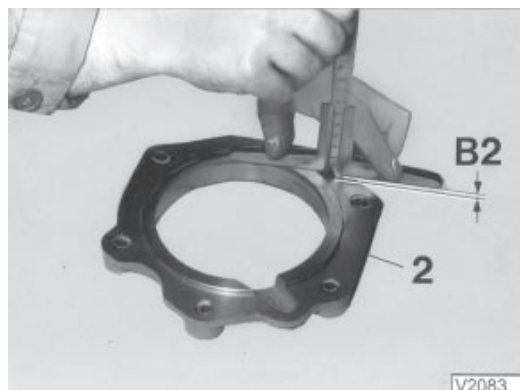
Pic. 82

- 4 Determine shim thickness, X2
Bearing adjustment 0.06 - 0.12 mm end play (a)

$$X2 = A2 - B2 - a$$

- Shim thickness (s):
- s = 1.25 mm
 - s = 1.30 mm
 - s = 1.40 mm
 - s = 1.50 mm
 - s = 1.60 mm
 - s = 1.70 mm
 - s = 1.80 mm
 - s = 1.85 mm

Note: Recommended end play up to 0.80 mm



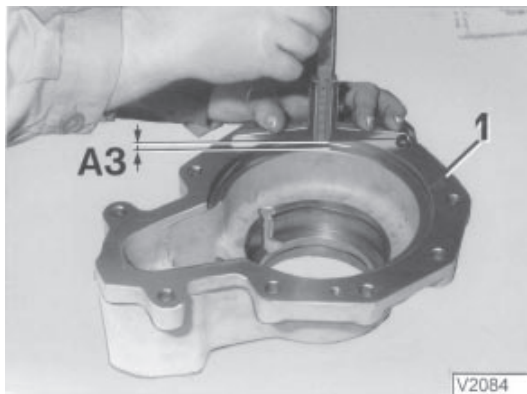
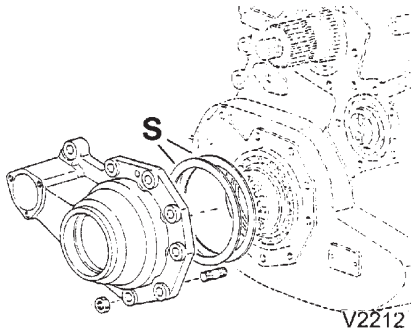
Pic. 83



1.2.4

End play of differential gear - output shaft

- 5 Measure depth of bearing seat in housing (84/1) of front axle output drive (A3).



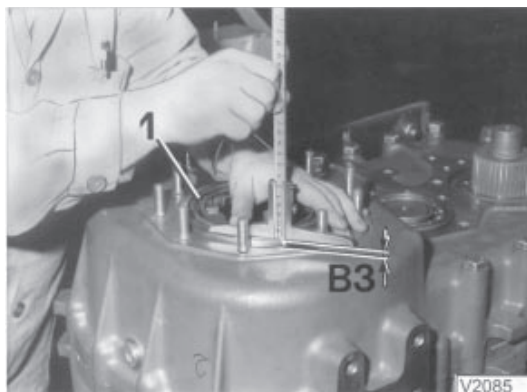
Pic. 84

- 6 Measure projection of front roller bearing (85/1) from differential gear or output shaft (B3).
- 7 Determine shim thickness X
Bearing adjustment 0.02 - 0.08 mm end play (a)

$$X3 = A3 - B3 - a$$

Shim thickness (s):

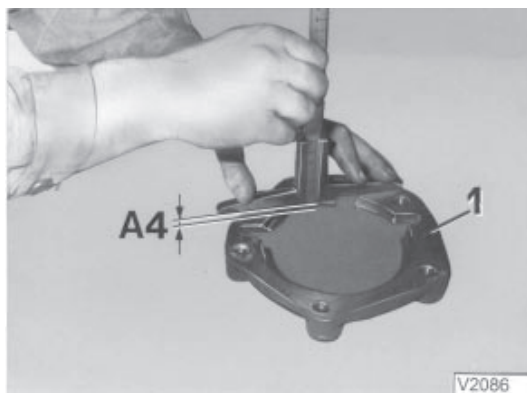
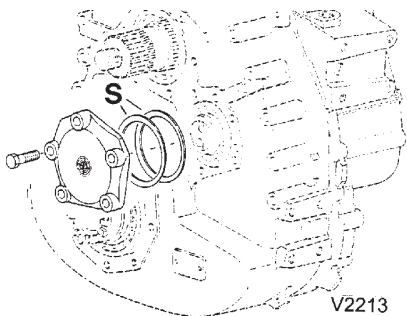
s = 1.25 mm	s = 1.60 mm
s = 1.30 mm	s = 1.70 mm
s = 1.40 mm	s = 1.80 mm
s = 1.50 mm	s = 1.85 mm



Pic. 85

End play of intermediate shaft

- 8 Measure depth of bearing seat in front bearing cover (86/1) of interm. shaft (A4).

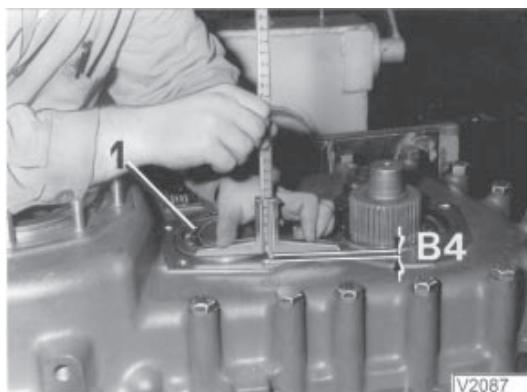


Pic. 86

- 9 Measure projection of front roller bearing (87/1)(B4).
- 10 Determine shim thickness X 4
Bearing adjustment 0.4 - 0.6 mm end play (a)

$$X4 = A4 - B4 - a$$

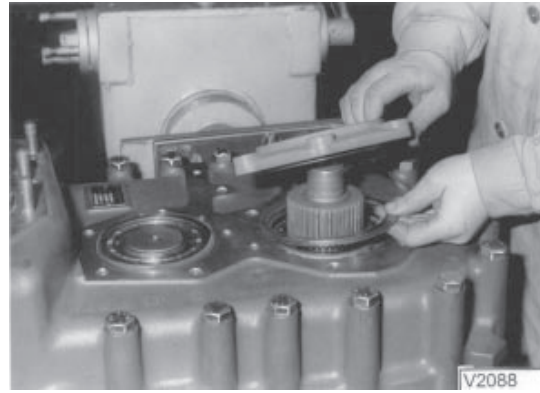
Shim thickness (s) = 0.6 mm, 0.8 mm, 1.0 mm



Pic. 87

1.2.5 Check of the end play of drive shaft and differential gear or output shaft

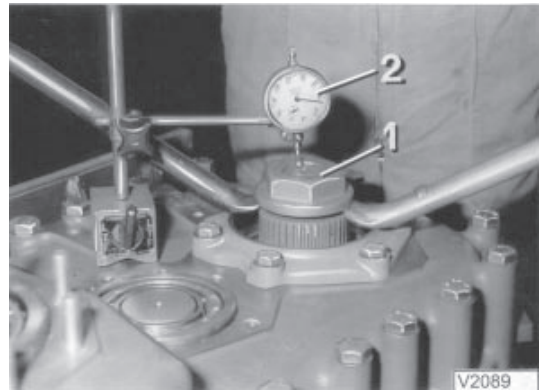
- 1 Mount bearing cover of drive shaft with the determined shims.
- 2 Shift drive shaft to the back with light blows while turning shaft.



Pic. 88

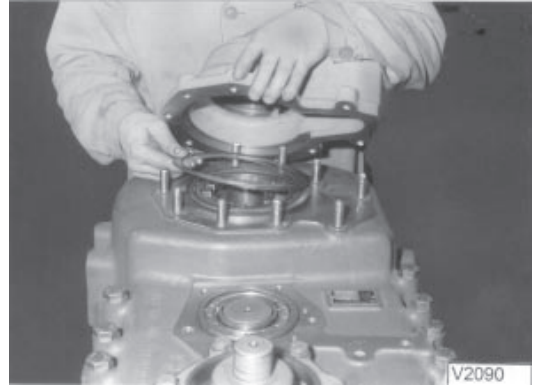
- 3 Screw collar nut (89/1) on drive shaft.
- 4 Set dial gauge (89/2) on the drive shaft.

Lift drive shaft and read endplay on dial gauge.
 Endplay too large: Increase shim thickness accordingly.
 Endplay too small: Decrease shim thickness accordingly.



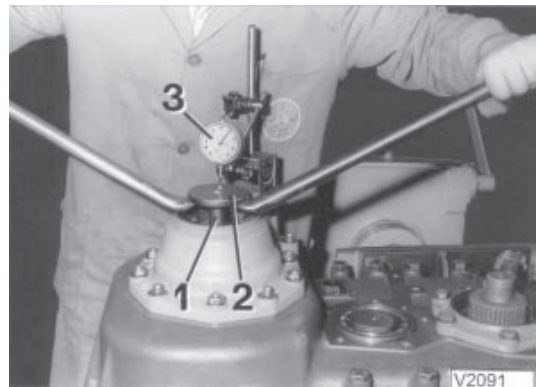
Pic. 89

- 5 Mount bearing housing of front axle output shaft with the determined shims.
- 6 Set differential gear or output shaft to the rear with light blows while turning shaft.
- 7 Screw lifting device TS 211 W (91/1) in lifting thread of differential gear or output shaft and tighten. Screw plate (91/2) on lifting device.



Pic. 90

- 8 Place dial gauge (91/3) on lifting device TS 211 W and planetary gear or output shaft. Lift output shaft. Read endplay on dial gauge.
 Endplay too large: Increase shim thickness accordingly.
 Endplay too small: Decrease shim thickness accordingly.



Pic. 91

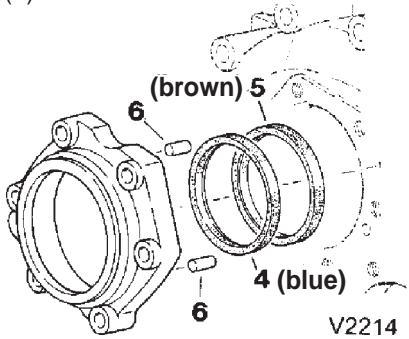
- 9 Remove bearing lid of drive shaft and bearing housing of front axle.



1.2.6

1.2.6 Installing front drive bearing cover, front axle output shaft and shifting cylinder

- 1 Press-in blue seal ring (92/4) and press into bearing with tool (92/1) 1 SKO 100721. Press-in brown seal ring (92/5) with tool (92/1) 1 SKO 100721 and spacer ring (92/2). Use tool SKO-026494 (92/3) as support. Install both dowel pins (6).



- 2 Apply DIRKO sealant to bearing cover (93/2) and install with correct shims.

ATTENTION: Take care that no sealant enters lube oil passage (93/1).

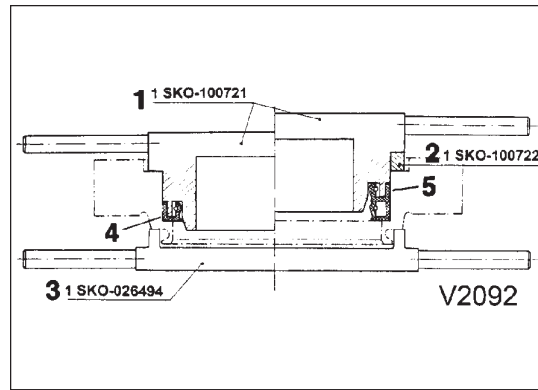
- 3 Apply DIRKO sealant to front cover of intermediate shaft and install with correct shims.

ATTENTION: Take care that no sealant enters lube oil passages (94/1) and (94/2).

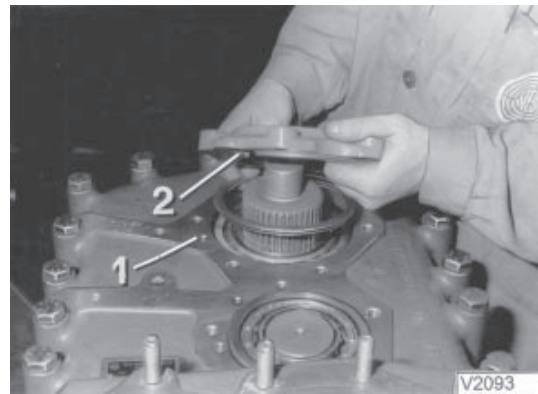
For assembly of front axle drive, see chapter 1.3.2

- 4 Apply DIRKO sealant to front axle drive and install it with correct shims.

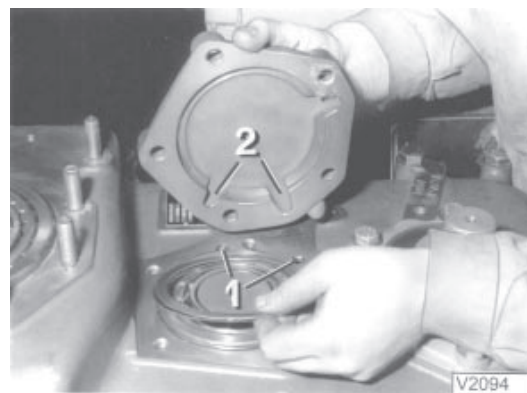
ATTENTION: Take care that no sealant enters lube oil passage (95/1).



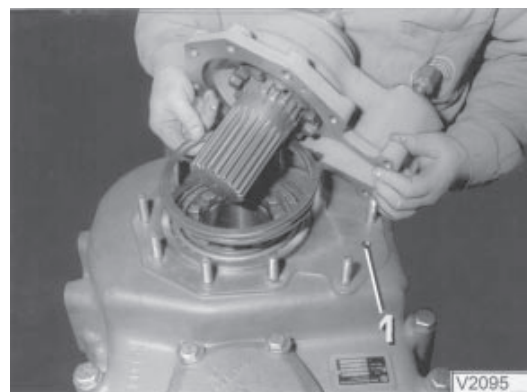
Pic. 92



Pic. 93

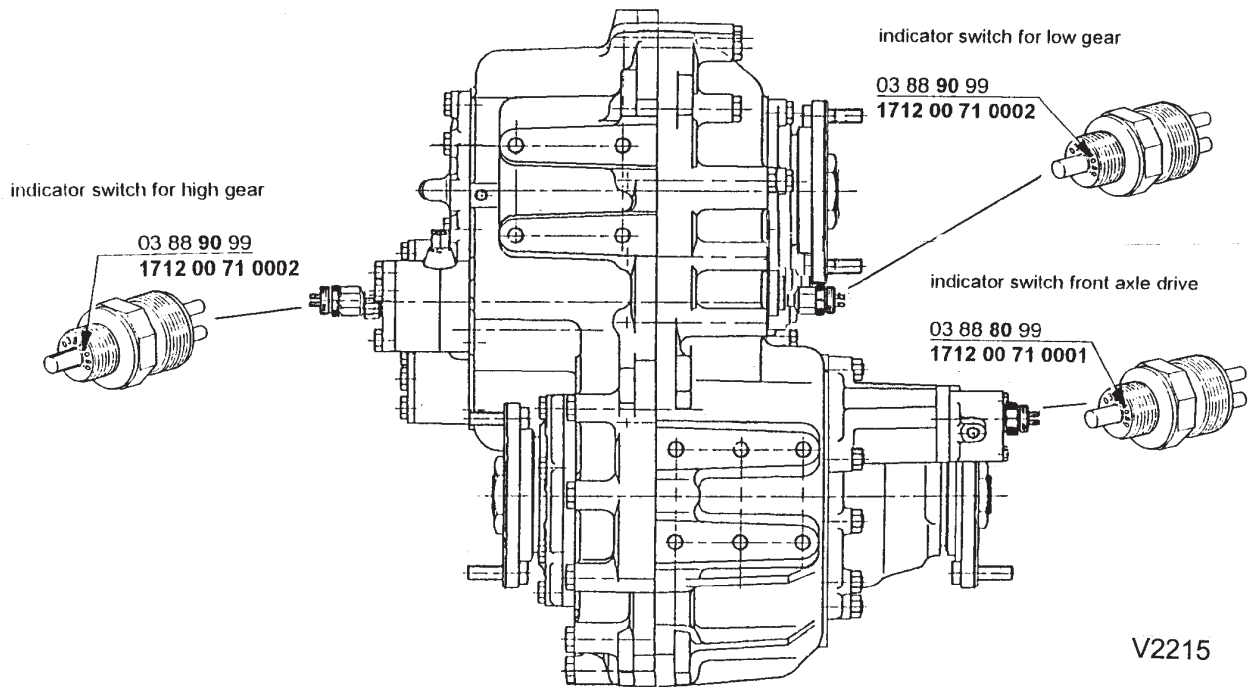


Pic. 94

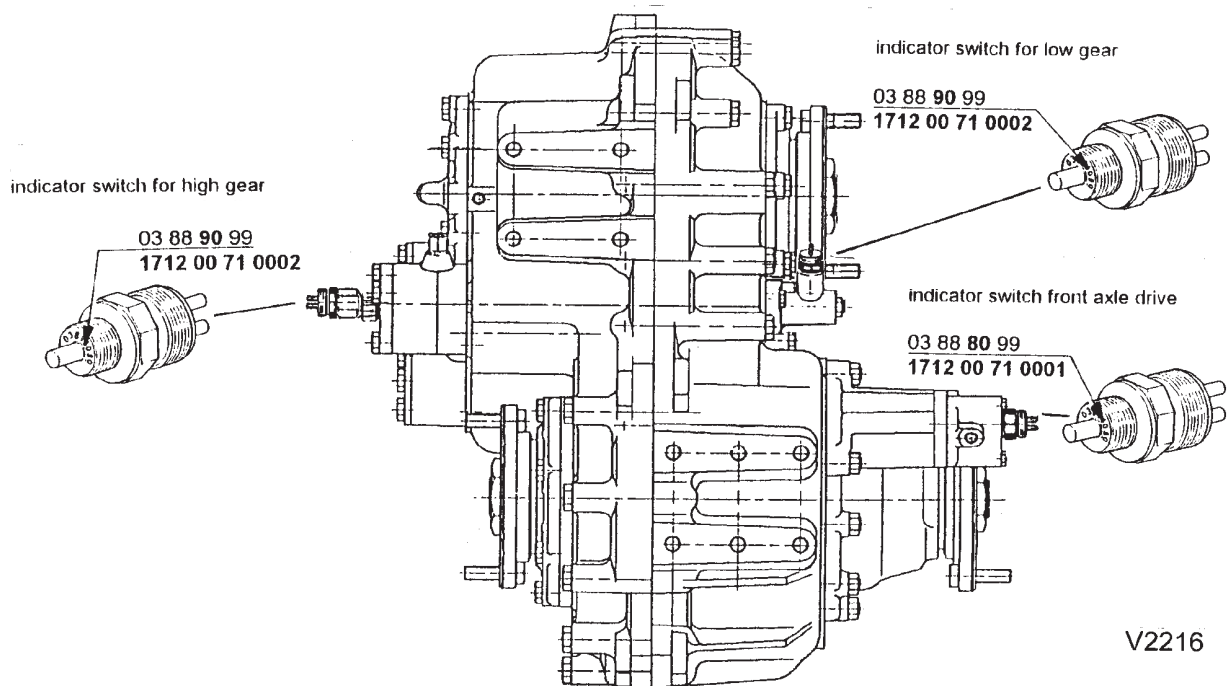


Pic. 95

1.2.7 Shifting system (with spring)

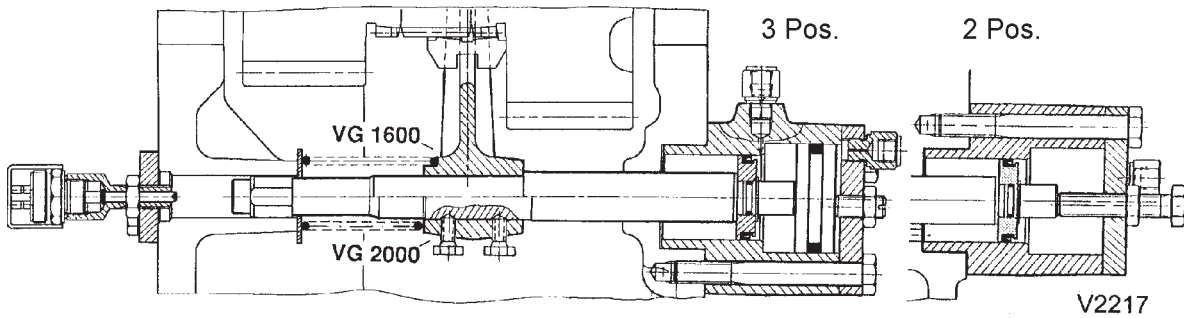


1.2.8 Shifting system (without spring)



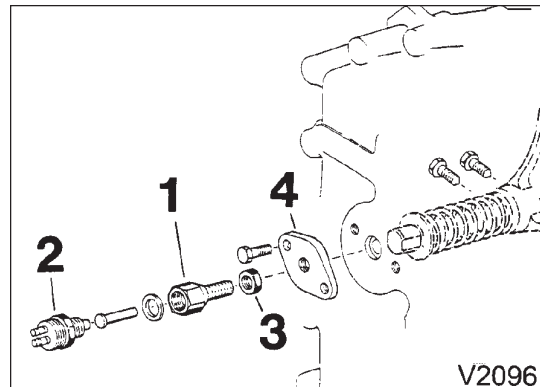
1.2.7.1

1.2.7.1 Shifting system (pneumatic, with spring) deinstall / install



Deinstall

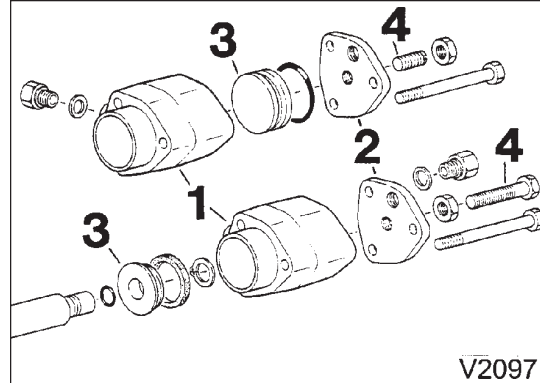
- 1 Adjusting screw (160/1)
Pressure switch (160/2)
Counter nut (160/3).
Plate (160/4)
- 2 Shift cylinder (161/1)
Cover (161/2)
Piston (161/3)
Setting screw (161/4).



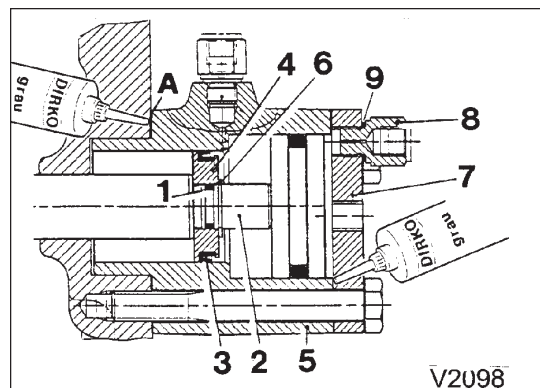
Pic. 160

Install

- 3 Push O-Ring (162/1) into groove on shifting rod (162/2) and grease.
- 4 Install seal (162/3) on piston (162/4) with open side toward the smaller piston diameter and grease it.
- 5 Apply DIRKO sealant to sealing surface of the shift cylinder (162/5) and install the shift cylinder on the gear housing.
- 6 Push piston (162/4) with the open side of the seal (162/3) facing outward, over the shifting rod (162/2) and fix with circlip (162/6).
- 7 Apply DIRKO sealant to cover (162/7) and install.
- 8 Screw in and tighten reduction union (162/8) along with copper seal ring (162/9).

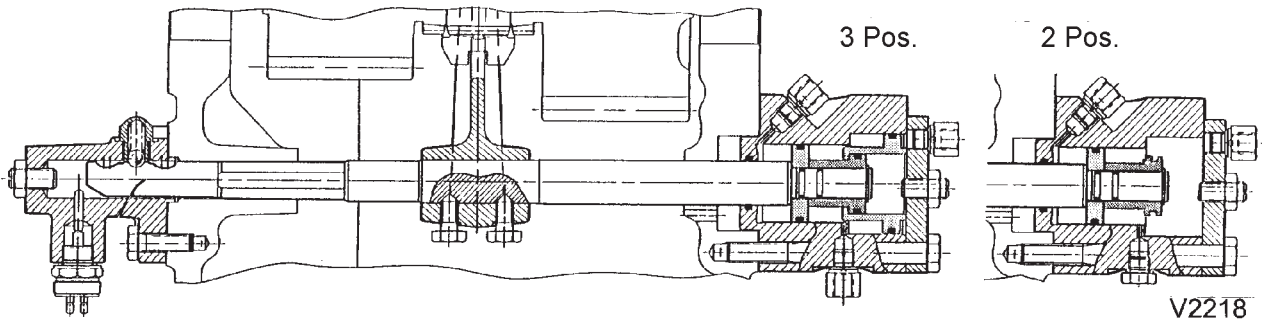


Pic. 161



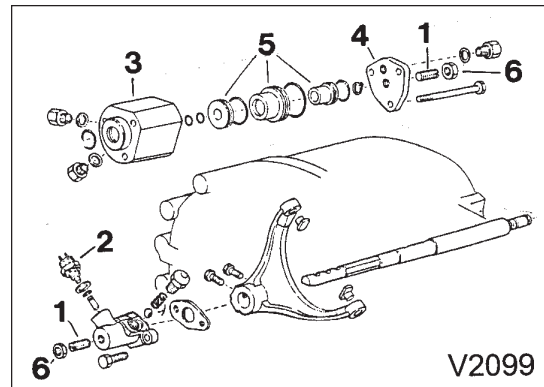
Pic. 162

1.2.8.1 Shifting system (pneumatic, without spring) deinstall / install



Deinstall

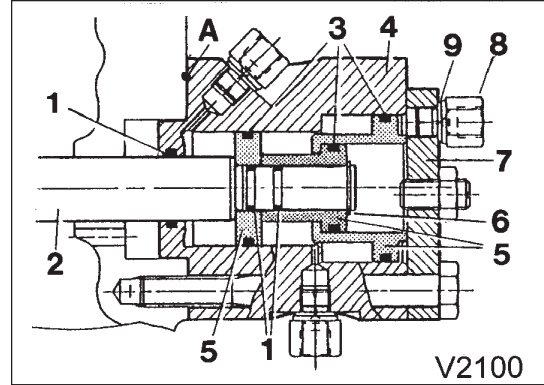
- 1 Set screw (163/1)
- Pressure switch (163/2)
- Operating cylinder (163/3)
- Cover (163/4)
- Piston (163/5)
- Counter nut (163/6)
- Clamping screws (163/7)
- Sliders (163/8)



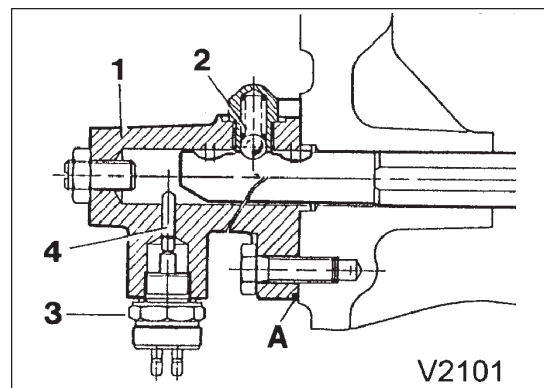
Pic. 163

Install

- 2 Push O-Rings (164/1) into the groove of the operating shifting rod (164/2) and grease.
- 3 Install O-Rings (164/3) on pistons and grease.
- 4 Cover sealing surface of the operating cylinder (164/4) with DIRKO sealant and install onto the main housing.
- 5 Push piston (164/5) over the operating rod (164/2) and secure with circlip (164/6).
- 6 Put DIRKO onto cover (164/7) and assemble.
- 7 Mount reduction piece (164/8) with copper-seal ring (164/9) into the cover and tighten
- 8 Put DIRKO onto the sealing surface A of flange (165/1) and assembly onto the main housing.
- 9 Mount locking ball guide (165/2).
- 10 Mount pressure switch (165/3) and pin (165/4). Check function of switch.



Pic. 164

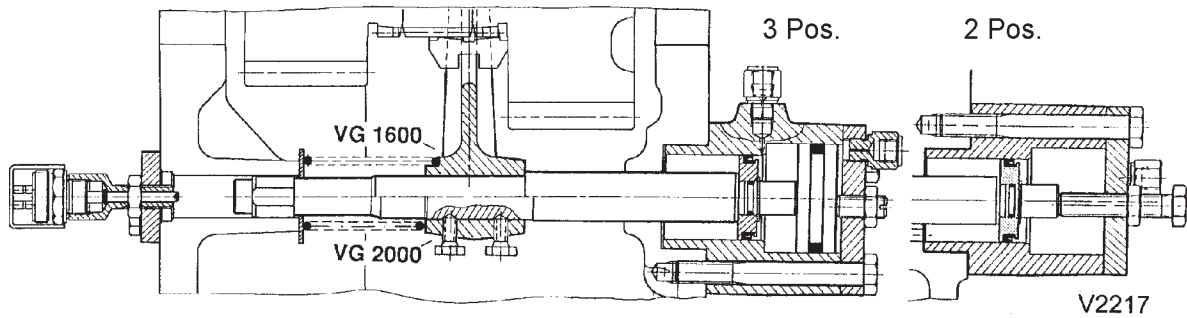


Pic. 165



1.2.7.2

1.2.7.2 Setting of transfer case shifting system (pneumatic with spring) two and three position



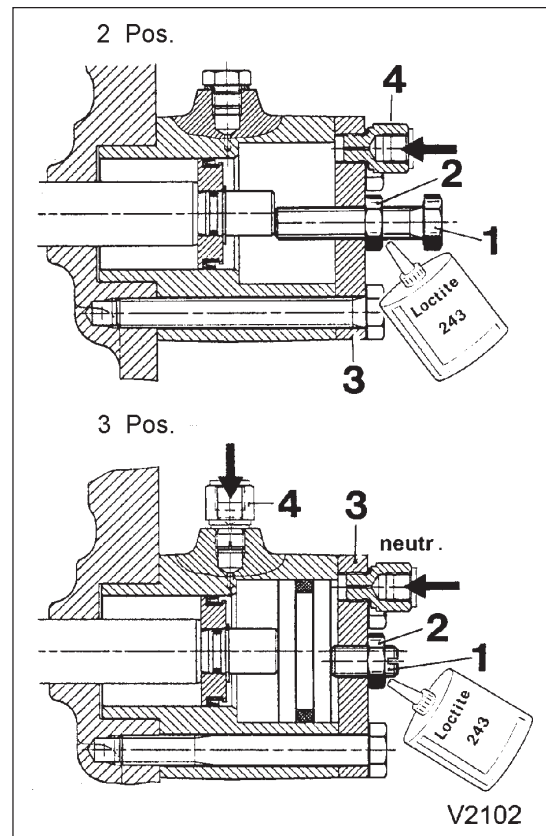
- 1 Unscrew set screw (166/1) with counter nut (166/2) in operating cylinder and remove remainders of LOCTITE.
- 2 Remove set screw (167/1) together with pressure switch (167/2) and counter nut (167/3) from the front main housing and clean off remainders of LOCTITE.
- 3 Remove remaining sealant from the threaded bores with tap M12 x 1.5.

Adjustment of "High"-gear

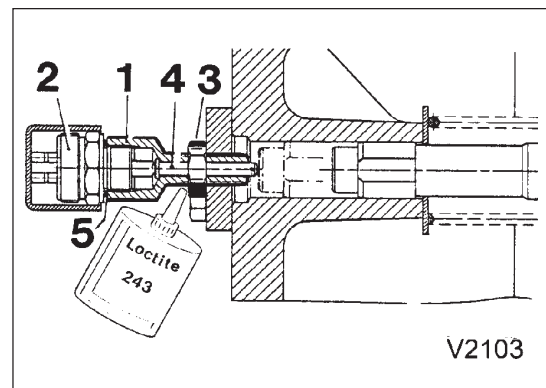
- 4 Let engage high-gear by spring force. Ensure that dog clutch is engaged, by turning the input shaft at the flange.
- 5 Coat thread of set screw (166/1) and counter nut (166/2) with LOCTITE 243 and screw into cover (166/3) of the operating cylinder until set screw touches the piston/piston rod noticeably. Then turn set screw 1/3 to 1/2 turn further and lock with counter nut.

Adjustment of low-gear

- 6 Engage low-gear by applying compressed air ($P = 7 \pm 1$ bar) through the connecting union (166/4) in the cover of the operation cylinder. Ensure engagement can by turning the input shaft at the flange.
- 7 Coat thread of set screw (167/1) and of counter nut (167/3) with LOCTITE 243 and screw into the front main housing until set screw touches the piston rod noticeably. Then turn set screw 1/3 to 1/2 turn and lock with counter nut.
- 8 Push pin (167/4) into the set screw (167/1) and mount pressure switch (167/2) with copper seal ring (167/5). Check function of switch.

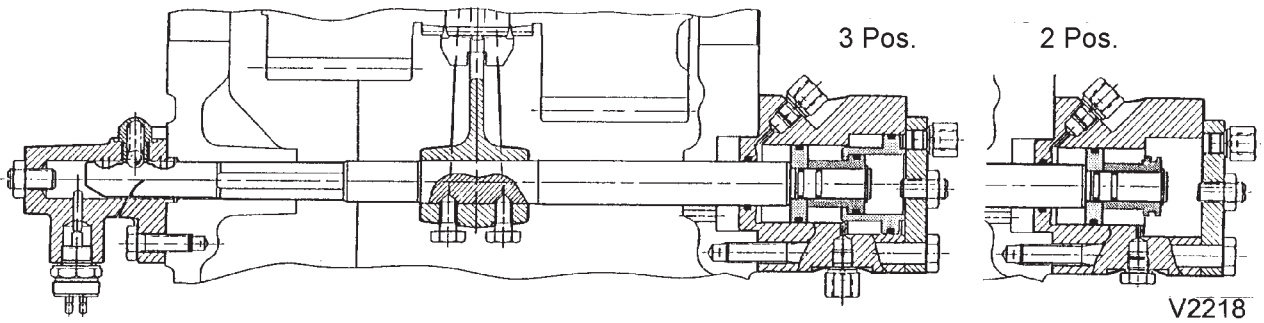


Pic. 166



Pic. 167

1.2.8.2 Setting of transfer case shifting system (pneumatic without spring) two and three position

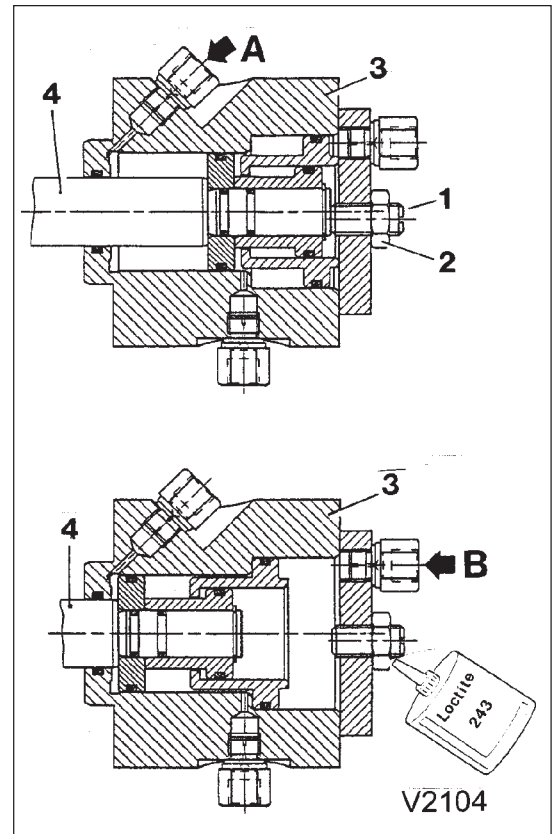


- 1 Unscrew set screw (168/1) with counter nut (168/2) of the shifting cylinder and remove LOCTITE residues.
- 2 Dismount set screw (170/1), pressure switch (170/3) and counternut (170/2), from the flange (170/4) and remove LOCTITE residues.
- 3 Remove sealant from the threaded bores with tap M12 x 1.5.
- 4 Coat threads of set screws (168/1 - 170/1) and counter nuts (168/2 - 170/2) with LOCTITE 243 and install into shifting cylinder (168/3) and into flange (170/4).

Adjustment of high-gear

- 5 Engage high-gear by application of compressed air (P = 7 +/- 1 bar) through the connection union (168/A) of the shifting cylinder (168/3). Ensure engagement by turning the input shaft at the flange.

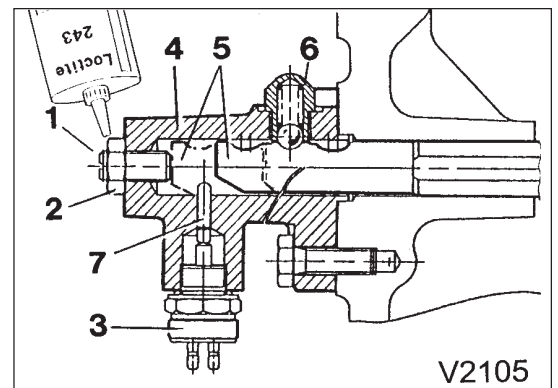
Turn set screw (168/1) into the shifting cylinder until it touches the piston rod (168/4) noticeably. Then turn set screw 1/3 until 1/2 turn further and lock with counter nut (168/2) - LOCTITE 243.



Pic. 168

Adjustment of low-gear

- 6 Engage low-gear by applying compressed air (P = 7 +/- 1 bar) through the connection union (168/B) of the operating cylinder (168/3). Ensure engagement by turning the input shaft at the flange. Turn set screw (170/1) into the flange (170/4) until it touches the shifting rod (170/5) noticeably. Then turn set screw 1/3 to 1/2 turn further and lock with counter nut (170/2).
- 7 Install locking ball guide (170/6). Use LOCTITE 243.
- 8 Install pressure switch (170/3) and pin (170/7). Check function of switch.



Pic. 169



1.2.9

1.2.9 Install and adjust shifting system for interaxle differential lock or frontwheel drive

3 auxiliary screws M8x25 DIN 933 needed.

Note: If the differential locking mechanism (MVG 1600 with interaxle differential) or front wheel drive shift is adjusted on a installed transfer case, then the external cover (99/1), cap nut (99/2), setting nut (99/3) and inner cover (99/4) must be removed.

- 1 Remove LOCTITE residues from shift fork (99/5), cap nut, and setting nut threads. Remove sealant residue from the sealing surface of both covers and bearing housing.
- 2 Screw down inner cover with auxiliary screws (100/1).
- 3 Apply LOCTITE 243 to threads of setting nut and cap nut.
- 4 Insert shifting fork until it stops. Shift dogs must be securely engaged. Screw counter nut (99/3) onto shifting fork until it sits on the inner cover (99/4). Turn setting nut 1/3 to 1/2 turn further and lock with cap nut (99/2).
- 5 Unscrew auxiliary bolts (100/1).
- 6 Apply DIRKO sealant to contact surface of the front wheel drive housing and outer cover and install (99/1).
- 7 Screw in pressure switch (99/6) and copper seal ring (99/7) and tighten.

Adjusting Instructions ADM

Apply air pressure (7±1Bar) to connection of shift cylinder. Turn flange of front axle output shaft until dog clutch engages fully. Turn shaft further by hand, at the same time turn in adjusting screw (100a/1) slowly until turning of shaft becomes harder (shift fork presses onto dog sleeve and friction brakes shaft).

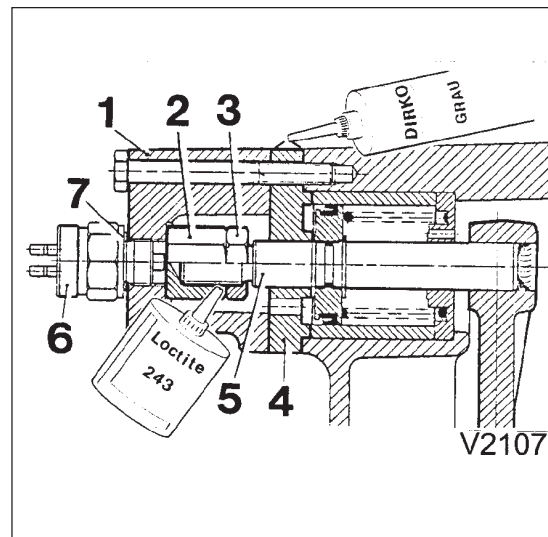
Turn back adjusting screw 1/3 to 1/2 a turn and tighten lock nut (100a/2).

Checks: When shift cylinder is evacuated dog clutch must not grind (for this check transfer case must be in horizontal position with front axle output shaft showing upwards, allowing dog sleeve to be suspended by the shift fork).

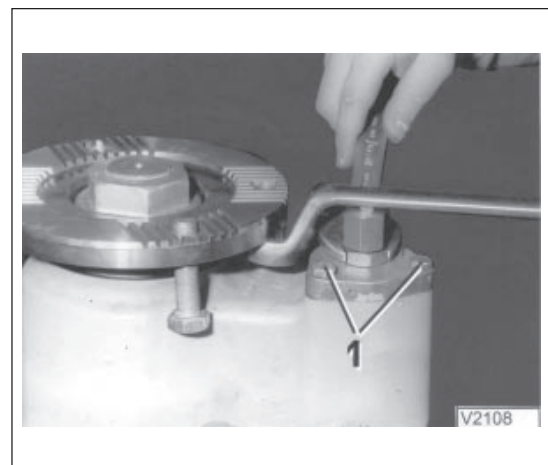
Apply air pressure (7±1Bar) to connection of shift cylinder. Within 10 seconds the air pressure must not drop noticeably.

Check of indication switch:

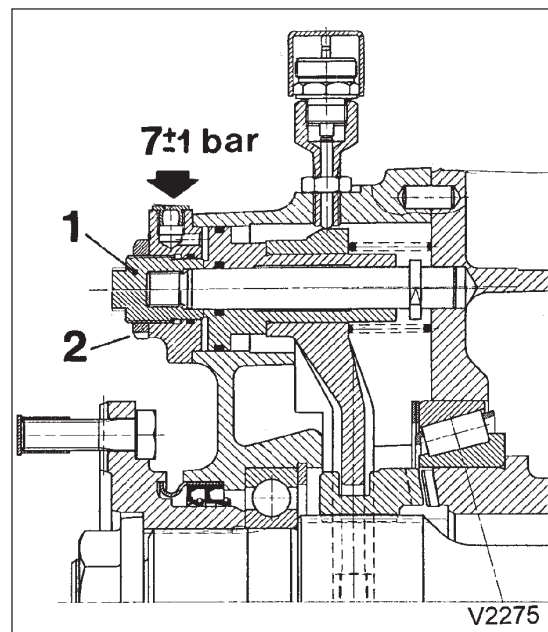
When dog clutch is in "tooth to tooth position", switch must not give any reading, only when dog clutch is fully engaged, switch must be closed.



Pic. 99



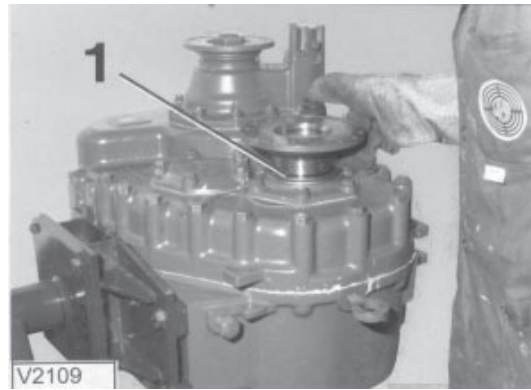
Pic. 100



Pic. 101

1.2.10 Installing flanges oil pipe and breather

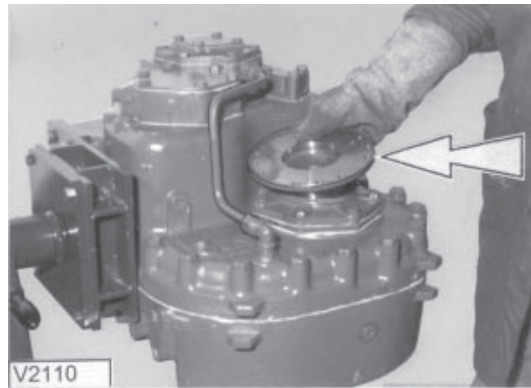
- 1 Apply grease to oil seals (**101/1**) on the input and output shafts.



Pic. 101

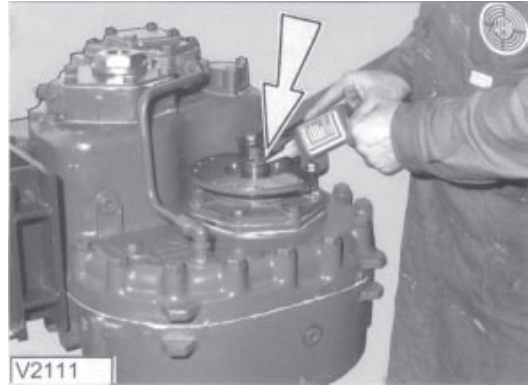
- 2 Heat flanges to approx. 120°C and install.

Attention: Install drive flange with groove in flange aligned with oil bore in the drive shaft.



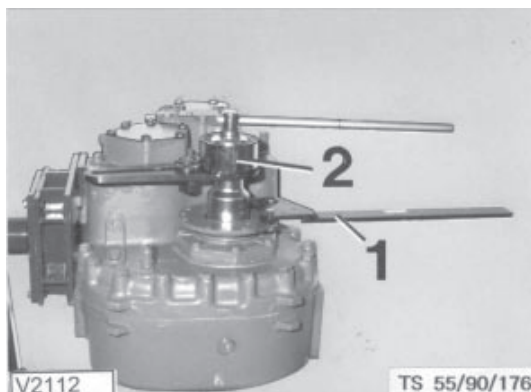
Pic. 102

- 3 Apply LOCTITE 243 to threads on input and output shafts.



Pic. 103

- 4 Tighten collar nuts to 1080 Nm. Use device TS 215 W (**104/1**) and torque multiplier (**104/2**)



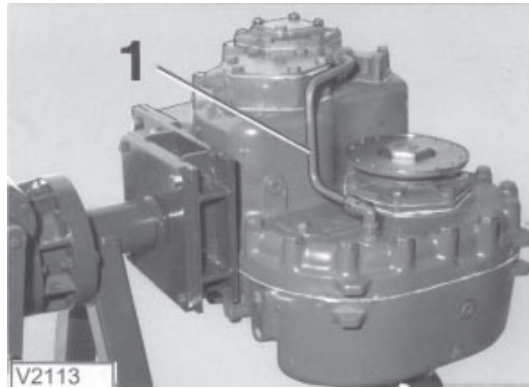
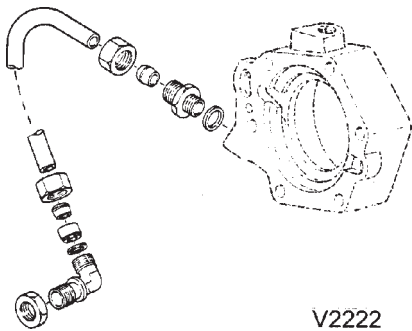
Pic. 104



1.2.10

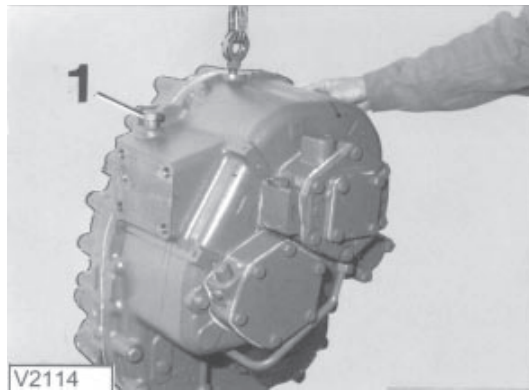
Installing oil pipe and breather

- 1 Install oil pipe (105/1).

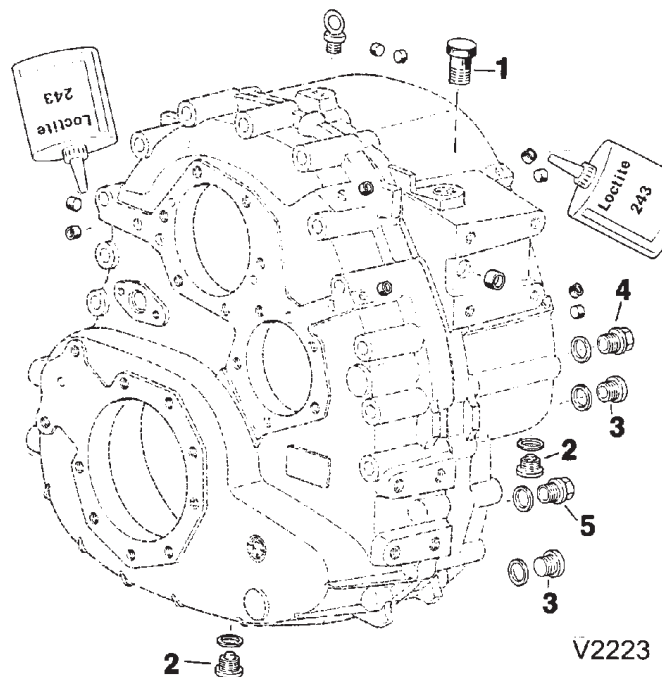


Pic. 105

- 2 Apply LOCTITE 243 to threads of the breather and install into transfer case housing (106/1).
- 3 Install all core plugs coated with LOCTITE 243.
- 4 Install oil drain plugs (2) and other screw plugs (3) with copper seal ring.
- 5 Fill gear oil at filling bore (4) until it flows over at level bore (5). Install level plug with copper seal ring.



Pic. 106



1.3 Work on transfer case components

1.3.1 Checking and measuring transfer case housing parts

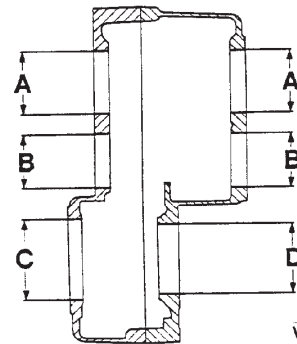
- 1 Visually check bearing bore holes for damage or wear marks.
- 2 Measure main housing bore holes with internal measuring instrument and micrometer.

A 139.975 - 140.000

B 119.978 - 120.000

C 179.975 - 180.000

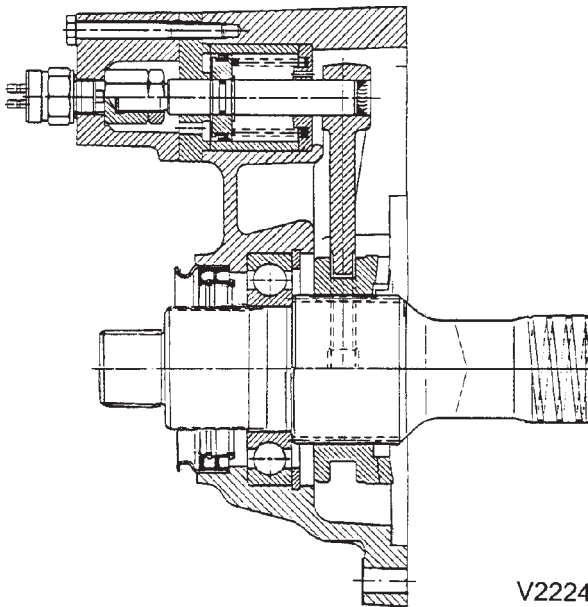
D 154.975 - 155.000



V2115

Pic. 110

1.3.2 Assembly and disassembly of front axle output drive

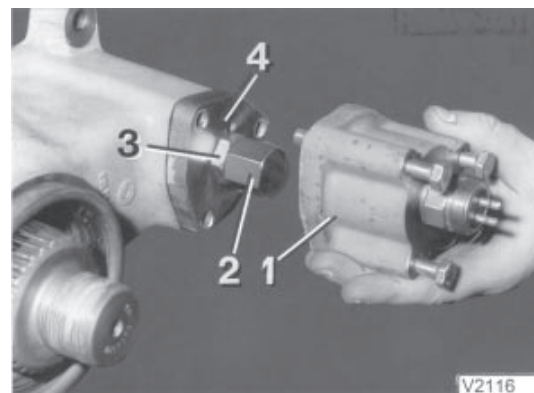


V2224

Disassembly:

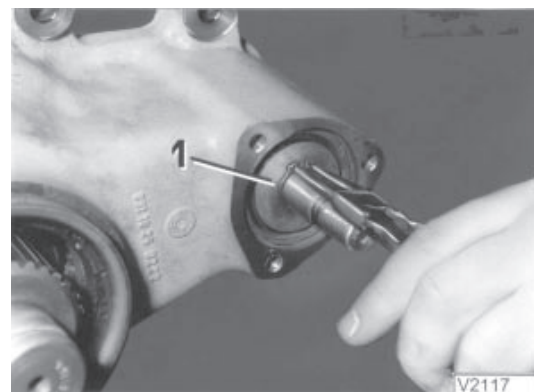
- 1 Deinstall outer cover (111/1), cap nut (111/2) and setting nut (111/3). Remove inner cover (111/4).
- 2 Remove circlip from shifting fork.

CAUTION: The piston (112/1) is pressed against the circlip by a spring.
- 3 Remove piston and pressure spring. Remove seal from piston.
- 4 Remove O-ring and internal circlip from the shifting fork.



V2116

Pic. 111



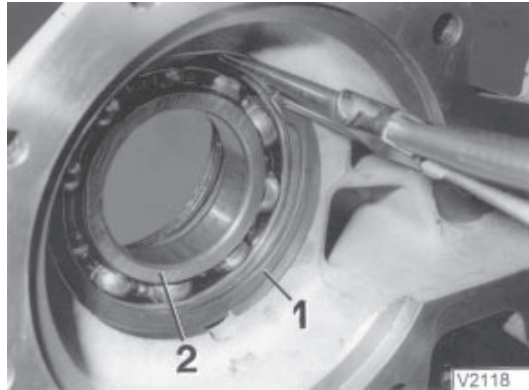
V2117

Pic. 112



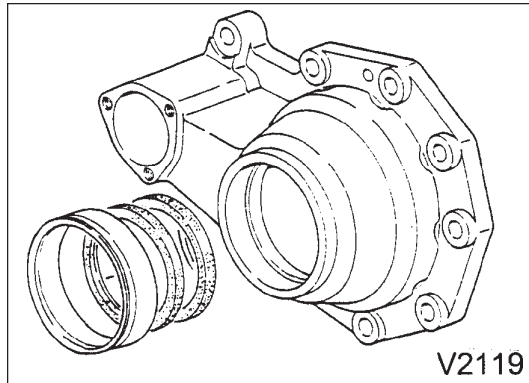
1.3.2

- 5 Press out front axle output shaft. Make sure that shifting sleeve and shifting fork don't jam.
- 6 Remove retaining ring (113/1) and press ball bearing (113/2) out of housing.



Pic. 113

- 7 Remove seal (114/1) and seal rings from front axle drive housing.

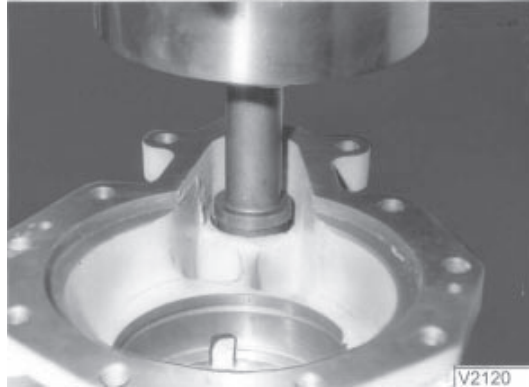


Pic. 114

- 8 Press out disk and bushing of the shifting cylinder.

CHECK

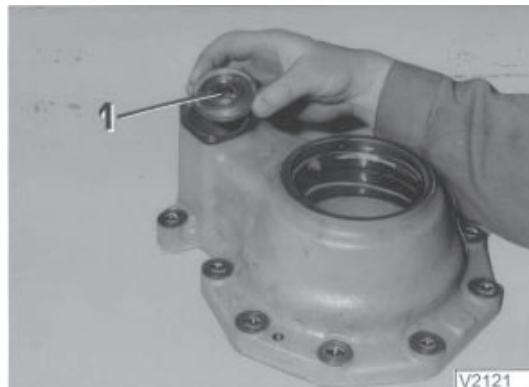
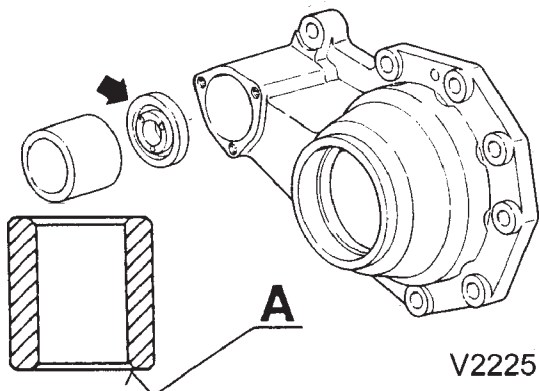
- 9 Visually check bearing housing, output shaft, shifting sleeve, and shifting fork for damage and wear marks.



Pic. 115

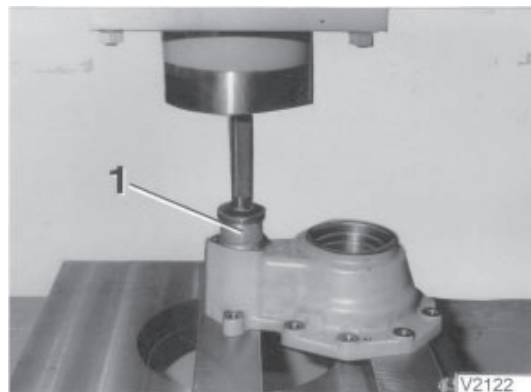
ASSEMBLY

- 10 Insert disk (116/1) into the bearing housing, with the the spring seat groove facing upward.



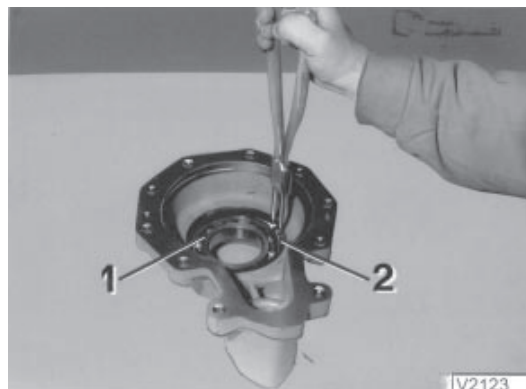
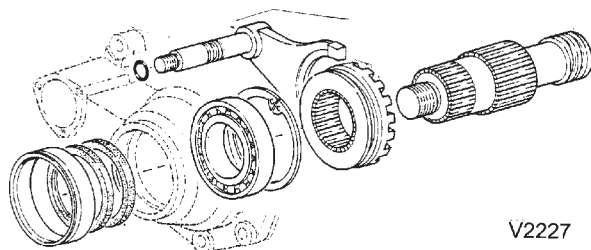
Pic. 116

- 11 Apply DIRKO sealant to the unchamfered face A of the bushing (117/1) and press it in, face A pointing inward.



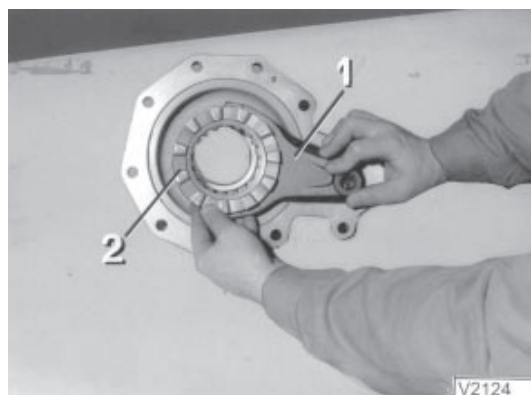
Pic. 117

- 12 Insert ball bearing (118/1) into housing, pressing on the outer ring, and install circlip (118/2).



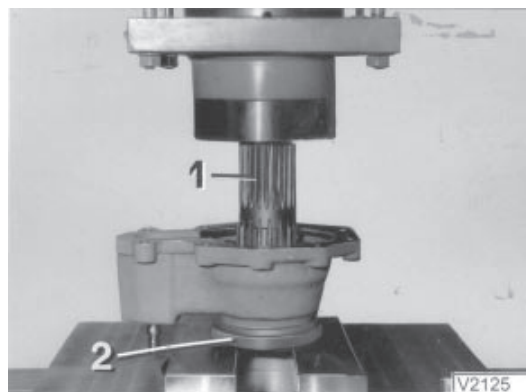
Pic. 118

- 13 Install shifting fork (119/1) and shifting sleeve (119/2), into the housing with the shift dogs facing up.



Pic. 119

- 14 Press in front axle output shaft (120/1). While doing this, support inner ring of the ball bearing with base SKO-026530 (120/2). Take care shifting sleeve and shifting fork don't jam.



Pic. 120

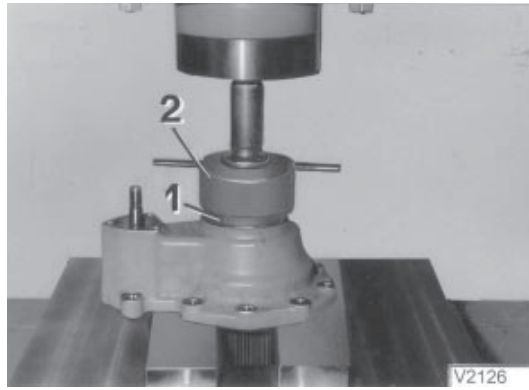


1.3.2

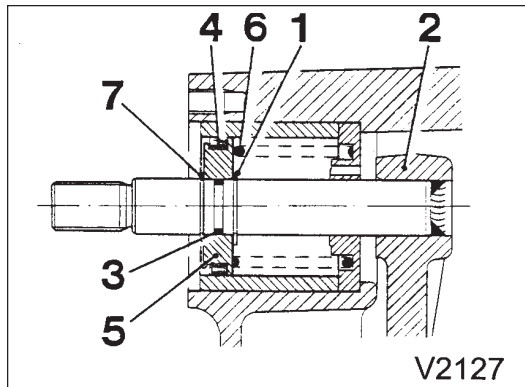
- 15 Apply LOCTITE 638 to sealing carrier with seal rings (121/1) and press it into housing with setting tool SKO-026526 (121/2).
- 16 Install inner retaining ring (122/1) on the shifting fork (122/2). Push O-ring (122/3) into groove on the shifting fork and grease.
- 17 Set seal (122/4), open side facing smaller piston diameter, in the groove of piston (122/5) and grease.
- 18 Set pressure spring (122/6) over shifting fork into the cylinder and press together with piston and circlip until circlip locks with a click (122/7).

Note: Open side of seal ring (122/4) must face out.

- 19 Further assembly explained in chapter 1.2

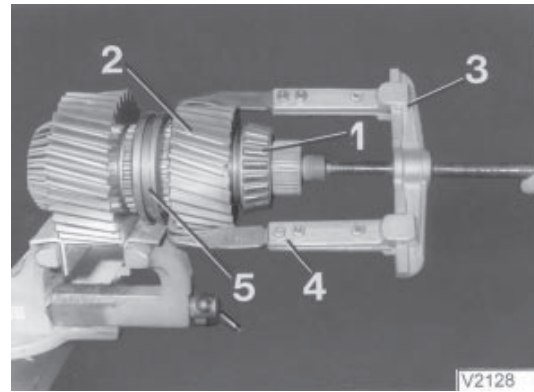
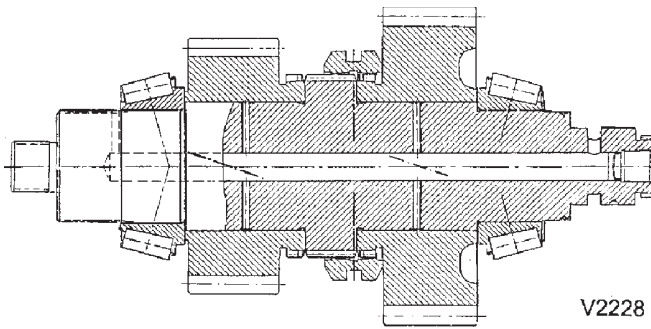


Pic. 121



Pic. 122

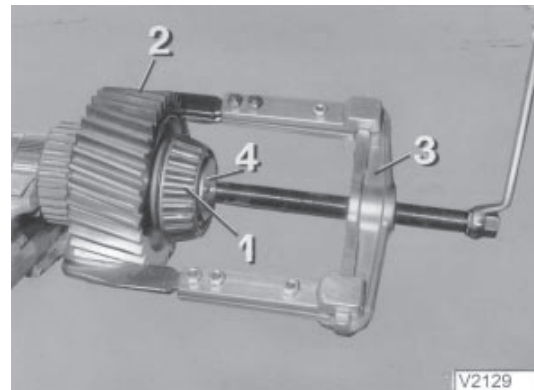
1.3.3 Assembly, disassembly of drive shaft



Pic. 123

DISASSEMBLY

- 1 Pull off roller bearing (123/1) and small drive gear (123/2) from drive shaft with two-arm puller KUKKO 20-3 (123/3) and puller hook KUKKO-3-300P (123/4). Remove shifting sleeve (123/5).
- 2 Pull roller bearing (124/1) and big drive gear (1242) from drive shaft with two-arm puller KUKKO 20-3 (124/3) and support disk TS 214 W (124/4).

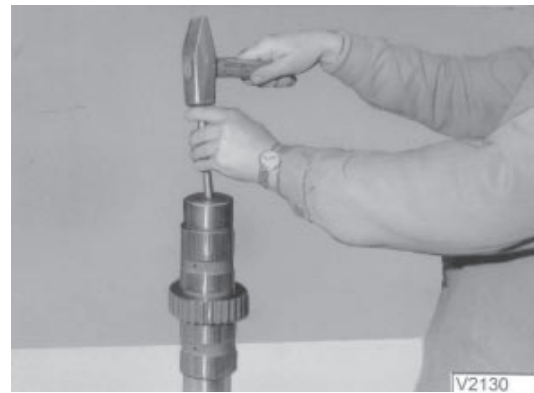


Pic. 124

CHECK

- 3 Visually check shaft and drive gears for damage, scratches and wear marks.

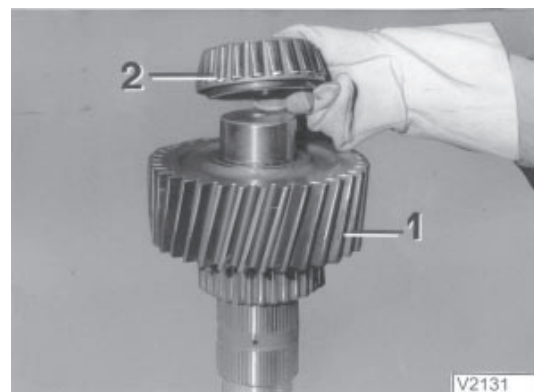
Note: If a new shaft is used, set baffle washer into the shaft. Use LOCTITE 243 (125).



Pic. 125

ASSEMBLY

- 4 Oil sliding surface of big drive gear (126/1) and push onto drive shaft. Heat roller bearing (126/2) to 80°C and install.

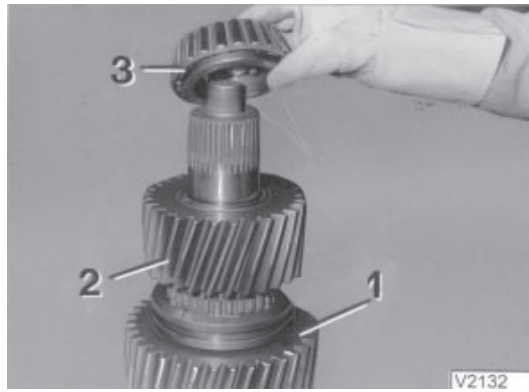


Pic. 126



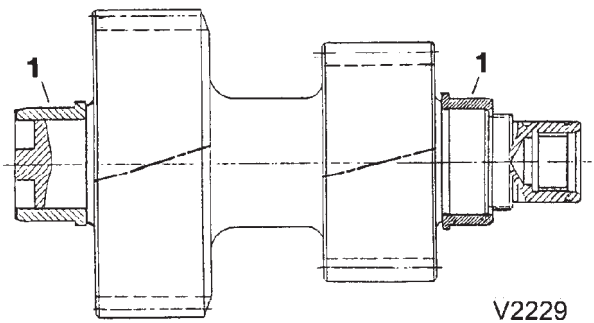
1.3.4

- 5 Push on shifting sleeve (127/1). Oil sliding surface of small drive gear (127/2) and push onto drive shaft. Heat roller bearing (127/3) to 80°C and install.



Pic. 127

1.3.4 Assembly, disassembly of intermediate shaft

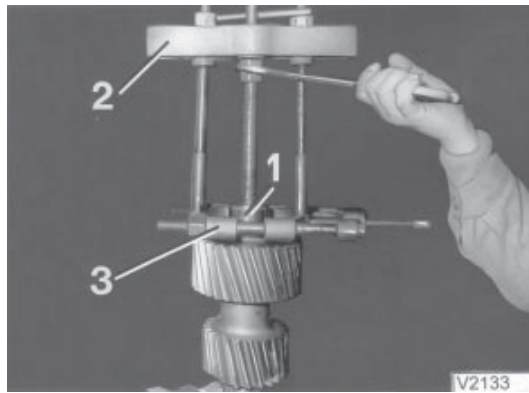


DISASSEMBLY

- 1 Pull inner bearing rings (128/1 and above) with tool KUKKO 18-2 (128/2) and separator KUKKO 17-2 (128/3) from intermediate shaft.

CHECK

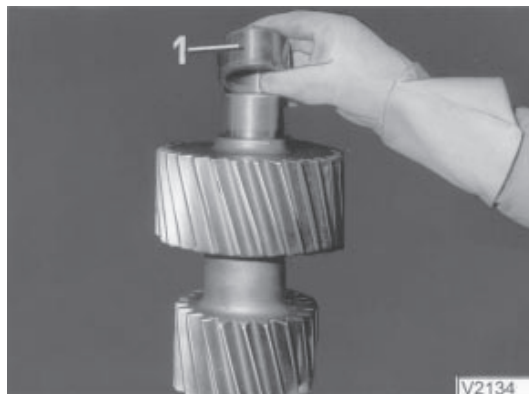
- 2 Check bearing points and gear teeth for damage, wear, and cracks.



Pic. 128

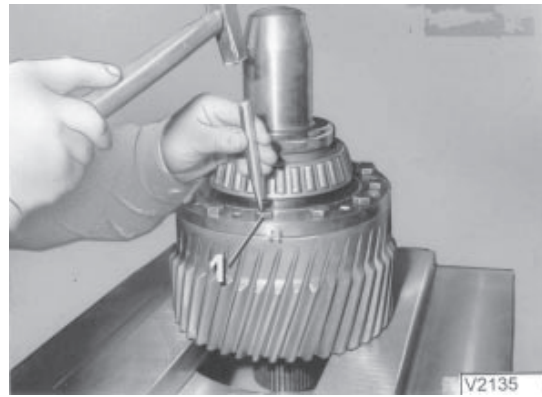
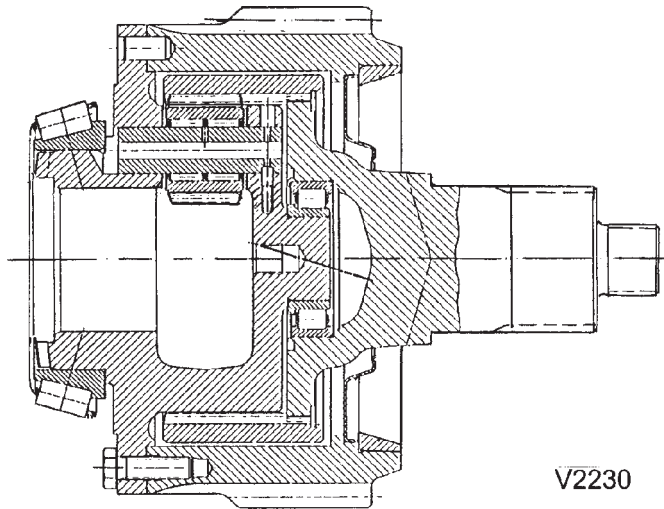
ASSEMBLY

- 3 Heat inner bearing (129/1) to 80°C and push onto the interm. shaft.

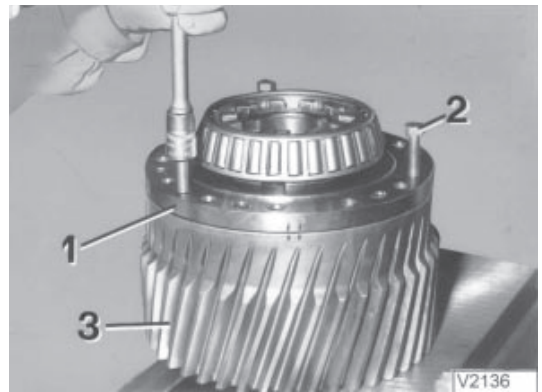


Pic. 129

1.3.5 Assembly, disassembly of differential gear



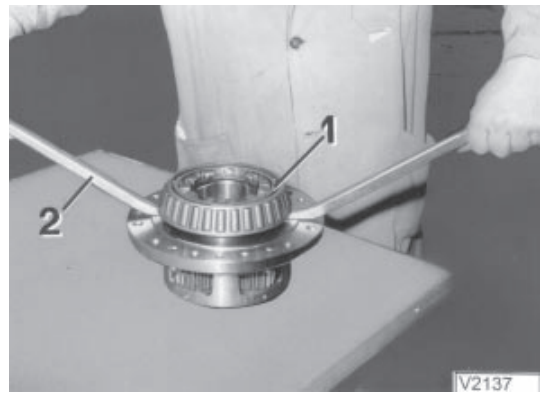
Pic. 130



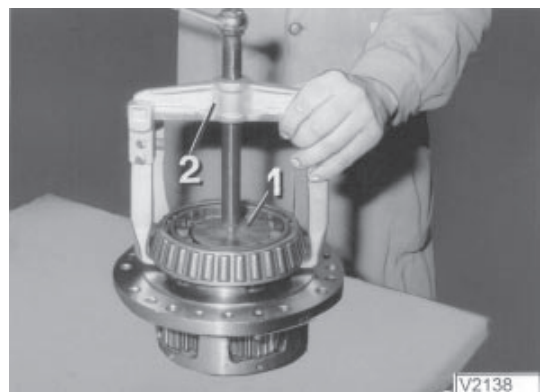
Pic. 131

DISASSEMBLY

- 1 Punch mark fastening screws (130/1) before unscrewing. If screws are already marked, then do not reuse them.
- 2 Press planetary carrier (131/1) off the gear (131/3) with 3 auxiliary screws M 10 x 55 (131/2).
- 3 Lift up roller bearing (132/1) with 2 prybars 2165-2 (132/2).
- 4 Completely remove roller bearing from planetary carrier with support disc TS 213 W (133/1) and double-arm extractor KUKKO 20-2 (133/2).



Pic. 132

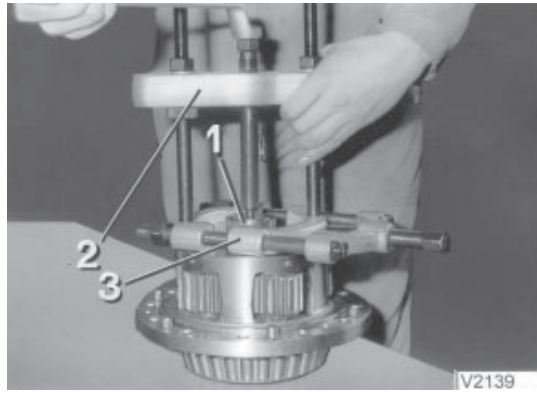


Pic. 133



1.3.5

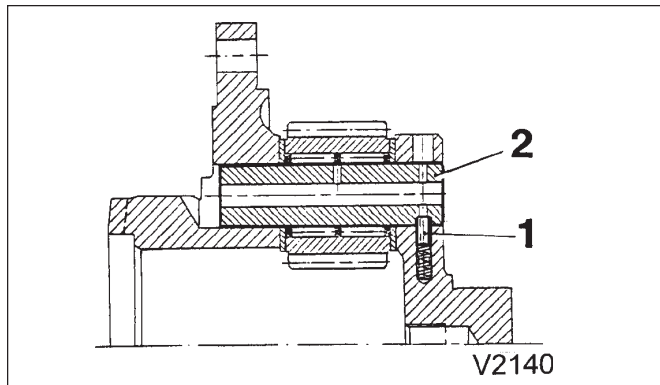
- 5 Remove inner bearing ring (134/1) with puller KUKKO 18-2 (134/2) and separator KUKKO 17-2 (134/3).



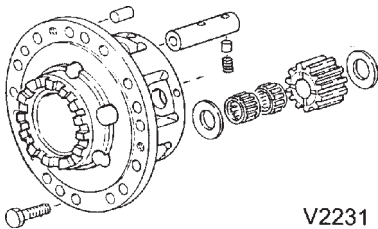
Pic. 84

- 6 Push in spring-loaded dowel pins (135/1) and push out planetary axle (135/2).

Note: Cover the bore hole in planetary carrier before pulling planetary axle completely out, because cylindrical pin and pressure spring will jump out.



Pic. 85

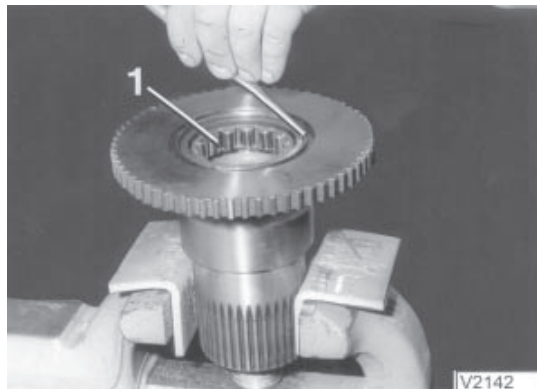
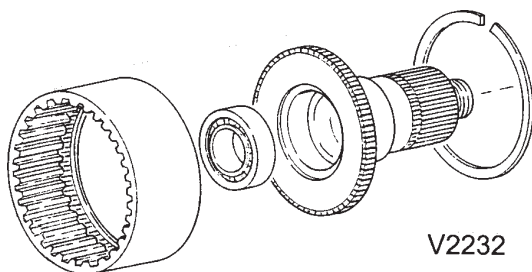


- 7 Separate rear axle output shaft (136/1) from ring gear (136/2) by removing retaining ring (136/3).



Pic. 86

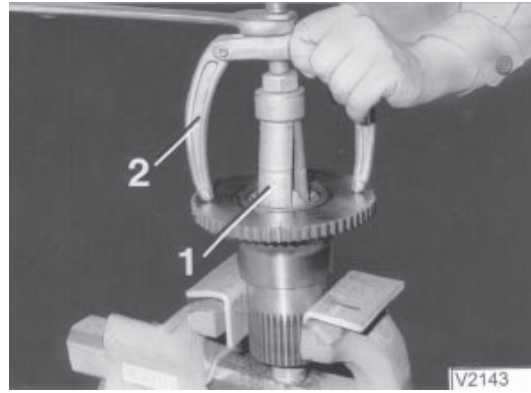
- 8 Straighten locked parts of rim by punch (137/1).



Pic. 87

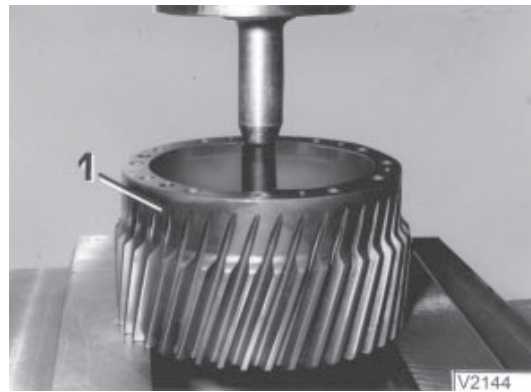
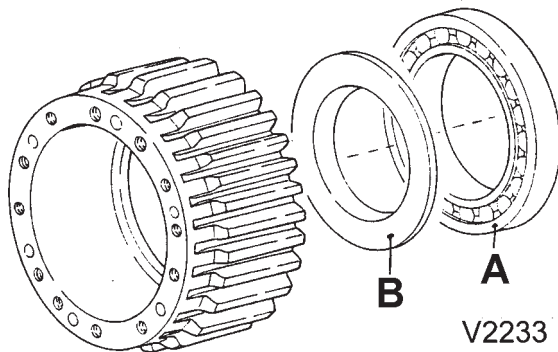
- 9 Pull out roller bearing (137/1) with inside extractor KUKKO 21-7 (138/1) and counter support KUKKO 22-2 (138/2).

Note: This will damage the roller bearing. It may not be reused.



Pic. 138

- 10 Press outer bearing ring A and oil baffle B out of the drive gear (139/1).



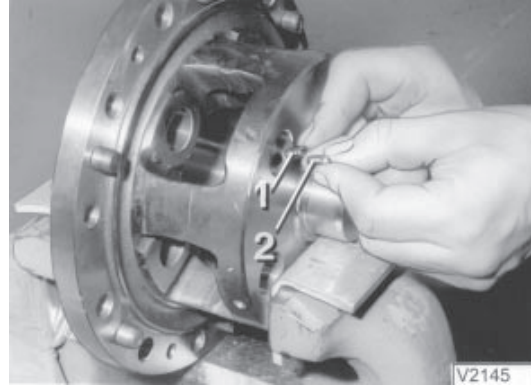
Pic. 139

CHECK

- 11 Visually check bearing points, tooth profiles, and drive shaft for damage, wear, and scratches.

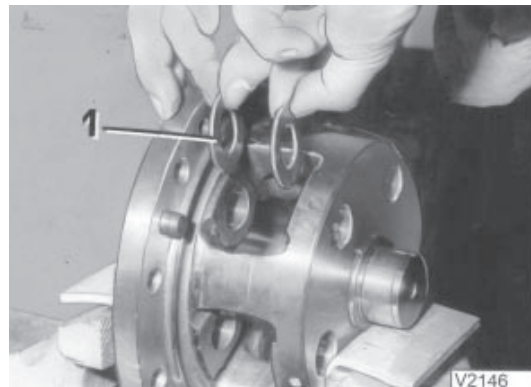
ASSEMBLY

- 12 Insert pressure spring (140/1) and dowel pin (140/2) into planetary carrier.



Pic. 140

- 13 Affix thrust washers (141/1) to planetary carrier with grease.

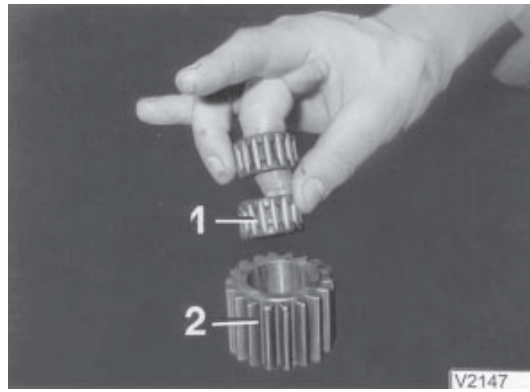


Pic. 141



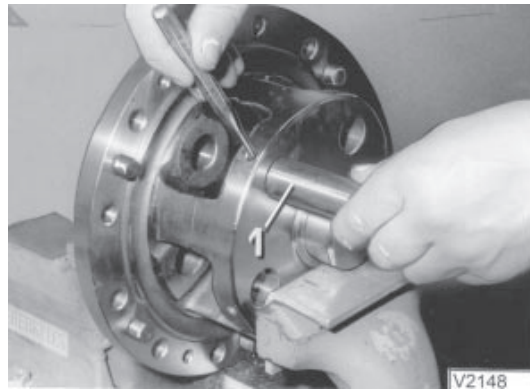
1.3.5

- 14 Oil needle cages (142/1) and push into planetary gears (142/2).



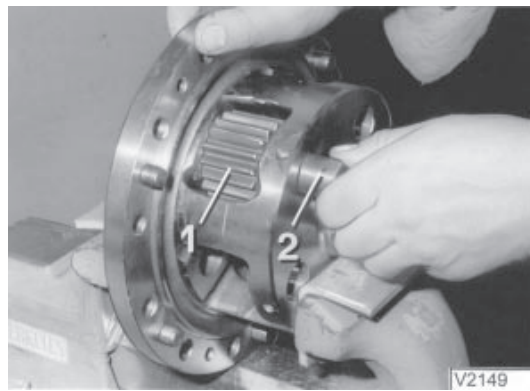
Pic. 142

- 15 Press spring loaded dowel pin (143/2) into planetary carrier and push in planetary axle (143/1).



Pic. 143

- 16 Insert the planetary gears (144/1) with needle cages (142/1) and push in planetary axle (144/2) until cylindrical pin audibly clicks into bore on the planetary axle.



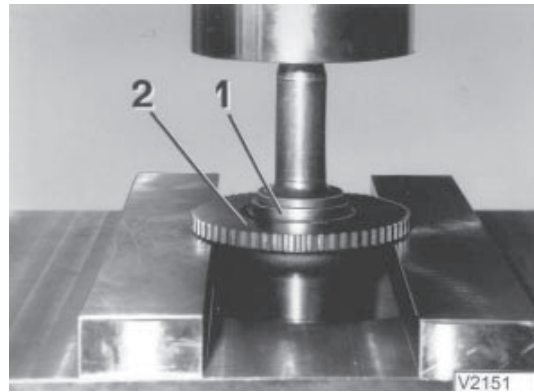
Pic. 144

- 17 Heat inner bearing ring (145/1) to 80°C and push onto rear stub of the planetary carrier.



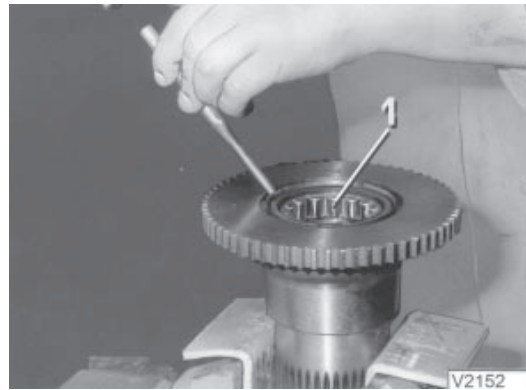
Pic. 145

- 18 Press roller bearing (147/1) into rear axle drive shaft 146/2) with supporting disk TS 214 W (146/1).



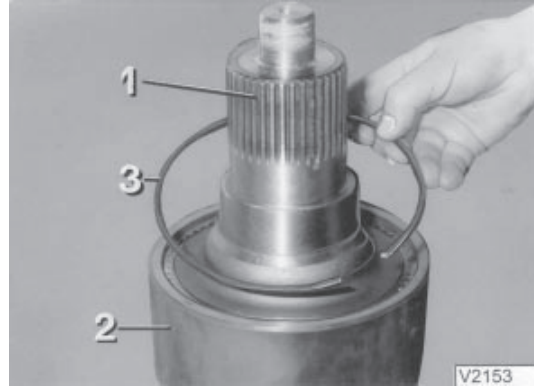
Pic. 146

- 19 Punch in rim at 3 places for locking (147/1) roller bearing.



Pic. 147

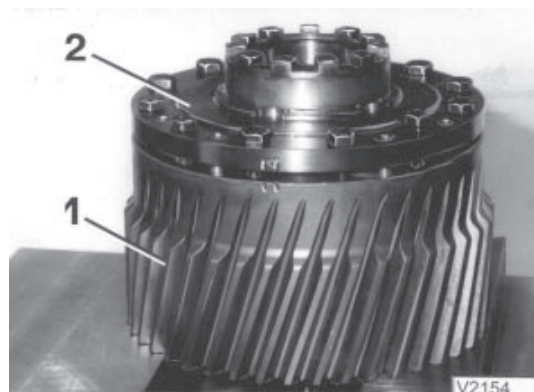
- 20 Set rear axle drive shaft (148/1) into the ring gear (148/2) and fasten with retaining ring (148/3).



Pic. 148

- 21 Set rear axle drive shaft with ring gear into the drive wheel (149/1).

- 22 Oil roller bearing (147/1) and planetary gears. Set planetary carrier (149/2) onto the drive wheel (149/1) so that the marks on planetary carrier and drive wheel align.

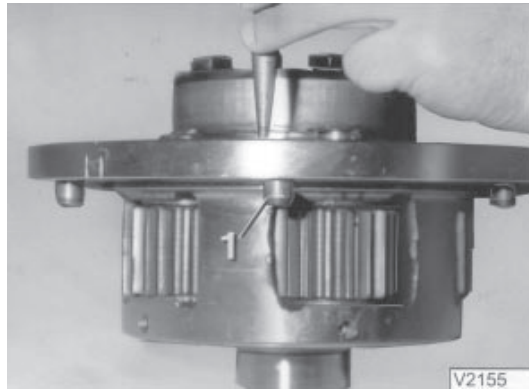


Pic. 149



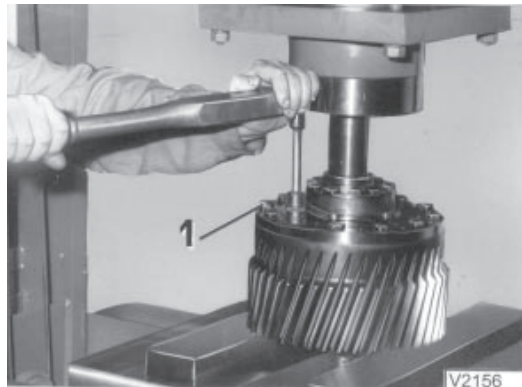
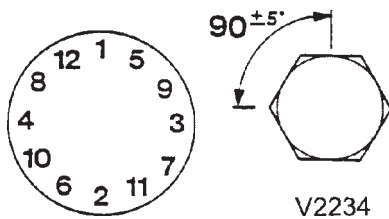
1.3.5

Note: Planetary carrier and drive gear can only be replaced together. In this case, install dowel pin (150/1) in planetary carrier and secure against displacement with 2 punch marks.



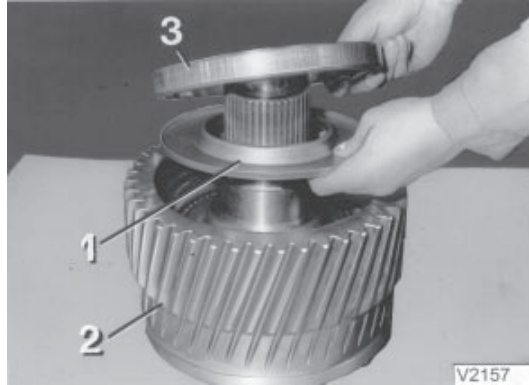
Pic. 150

- 23** Oil fastening bolts (151/1) and, using the tightening diagram, tighten to 30 ± 5 Nm. Mark the position of the bolts and tighten them further according to tightening diagram with an angle of $90^\circ \pm 5^\circ$



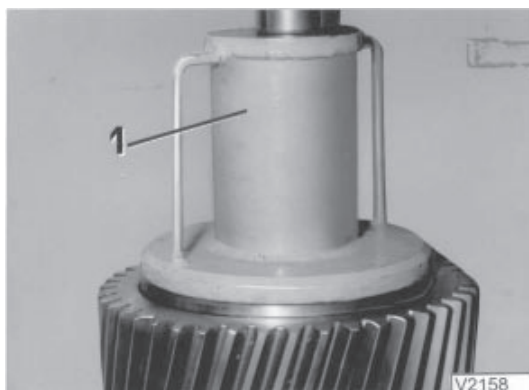
Pic. 151

- 24** Insert oil baffle (152/1) in drive wheel (152/2) and press in with setting tool SKO-026506 (153/1).



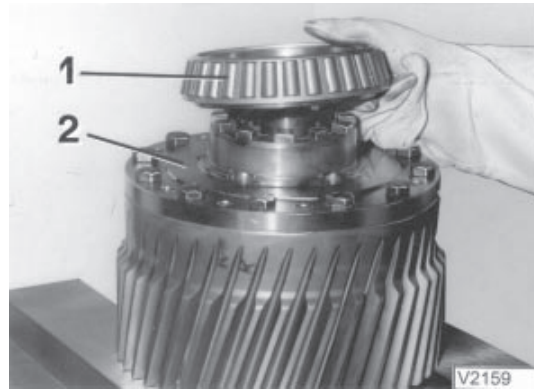
Pic. 152

- 25** Press outer bearing ring (152/3) into drive gear (152/2) with setting tool SKO-026506 (153/1).



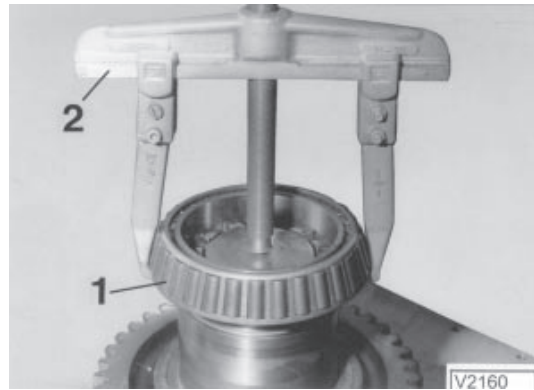
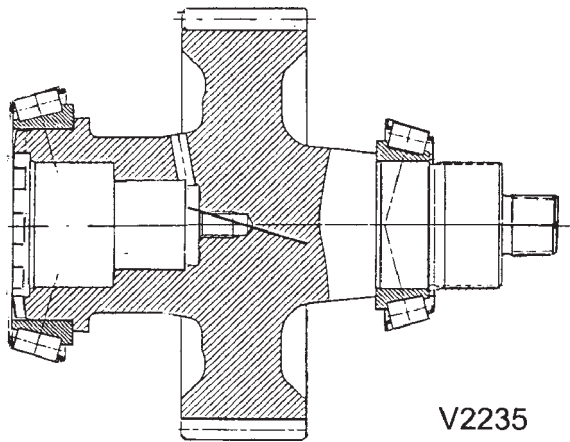
Pic. 153

- 26 Heat bearing (154/1) to 80°C and slide onto the front bearing seat of planetary carrier (154/2).



Pic. 154

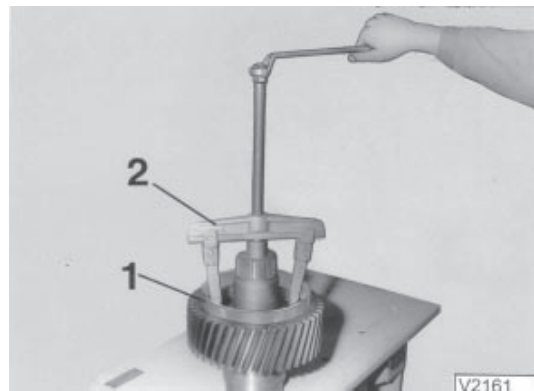
1.3.6 Assembly, disassembly of output shaft Without interaxle differential



Pic. 155

DISASSEMBLY

- 1 Pull bearing (155/1) from the output shaft with two-arm extractor KUKKO 20-2 (155/2).
- 2 Pull outer bearing ring (156/1) out of output shaft with two-arm extractor KUKKO 20-2 (156/2).



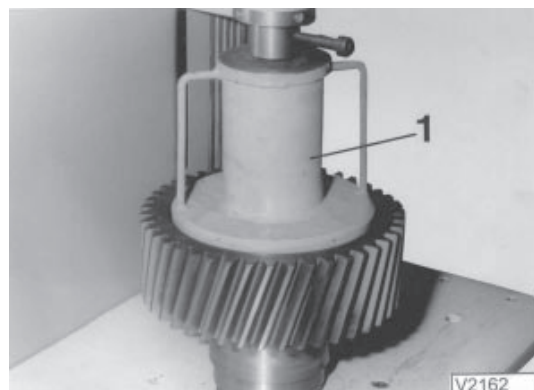
Pic. 156

CHECK

- 3 Check bearing points and gear teeth for damage, wear, and cracks.

ASSEMBLY

- 4 Press outer bearing ring into output shaft with setting tool SKO-026506 (157/1).

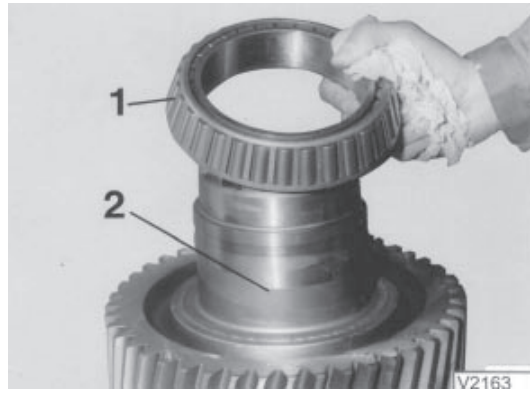


Pic. 157



1.3.6

- 5 Heat roller bearing (158/1) to 80°C and push onto front bearing seat of the output shaft (158/2).



Pic. 158



