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5. HYDRAULIC GEARBOX CONTROL (HGS)

5.1 GENERAL

HGS fluid	Brake fluid DOT 3 or DOT 4
Silicone grease that can be used in the system	Gleitmo 750 Klüber Unisilkon L641 Klüber Unisilkon L250L Klüber Unisilkon GLK 112 Klüber Unisilkon GLK 1 Klüber Unisilkon GLK 1 PF Dow Corning MS-4-00 medium Dow Corning SILCOMP 3
Grease for internal stop	Synthetic grease Klüber Syntheso HLR 46-371

5.2 TIGHTENING TORQUES

Gear-shift cylinder	
Clamping block clamp bolt	40 Nm *
Couplings	55 ± 5 Nm

* Loctite 243

5.3 FILLING CAPACITIES

Filling capacity HGS system	approx. 1 litre

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6. PTO

6.1 GENERAL

Axial bearing play

Axial play on gearbox output shaft, in case of attachment of N221/10 PTO on gearbox without intarde	0 - 0.1 mm
Axial play in case of attachment of N353/1 PTO on N221/10 PTO	0 - 0.2 mm

6.2 TIGHTENING TORQUES

Attachment N71/1-/2 and N353/1-/2

Installing attachment studs with a liquid jointing compound	25 Nm
Gearbox fixing nuts	86 Nm

Attachment N221/10

Drive flange	120 Nm
Side cover fixing bolts	23 Nm
Gearbox fixing bolts	79 Nm

6.3 FILLING CAPACITIES

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Check oil level in gearbox after installation of PTO.

Additional filling capacities PTOs

PTO type	Additional filling capacity (litres)
N71/1b	0.2
N71/1c	0.2
N71/2b	0.5
N71/2c	0.5
N221/10	1.0
N353/1b	0.2
N353/1c	0.2
N353/2b	0.5
N353/2c	0.5

7. PNEUMATICALLY ASSISTED GEARBOX CONTROL (SERVO SHIFT)

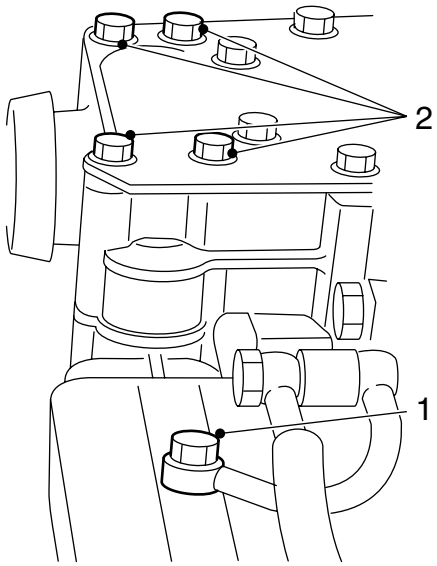
7.1 GENERAL

Servo shift unit

Service pressure	max. 10 bar

7.2 TIGHTENING TORQUES

Servo shift unit fixing bolts (1)	23 Nm
Air line banjo bolt (2)	38 Nm



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8. PNEUMATIC GEARBOX COMPONENTS

8.1 GENERAL

Frequency table

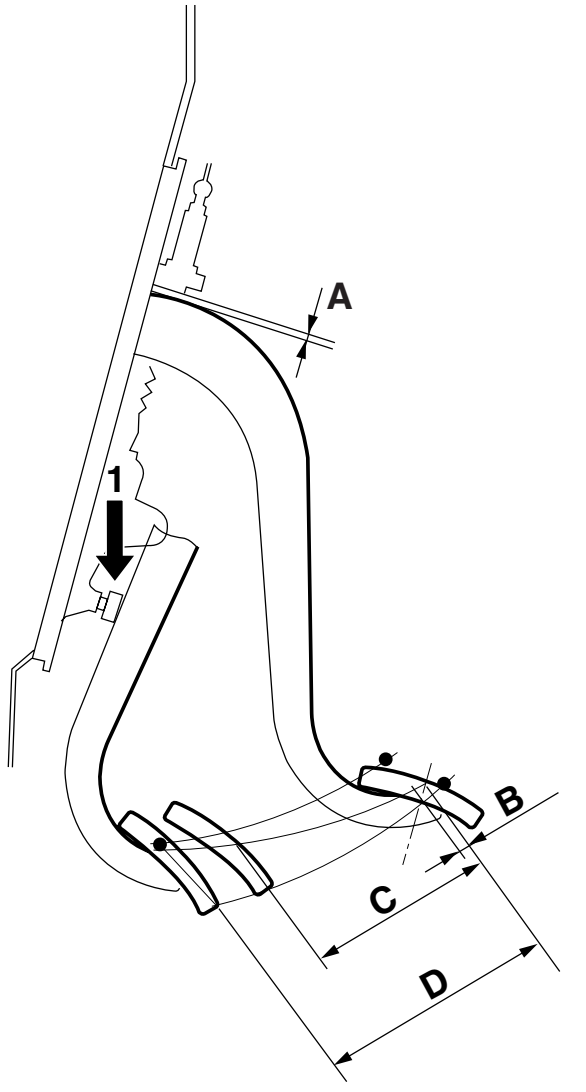
Engine type	Gear-box type	Intarder	Transfer box	Gate safety (Hz)	Speed-range safety (Hz)
VF/XF/XE	16S-181/221 (DD)	--	--	29	57
VF/XF/XE	16S-181/221 (DD)	intarder	--	33	77
VF/XF/XE	16S-181/221 (OD)	--	--	29	68
VF/XF/XE	16S-181/221 (OD)	intarder	--	38	94

GV valve

GV valve starts to open (C)	140 ± 2 mm
Full travel distance clutch pedal (D)	150 ± 2 mm

Neutral position valve

2 x 3/2-way valve	
Service pressure	6.5 to 10 bar
Line connection	M14 x 1.5



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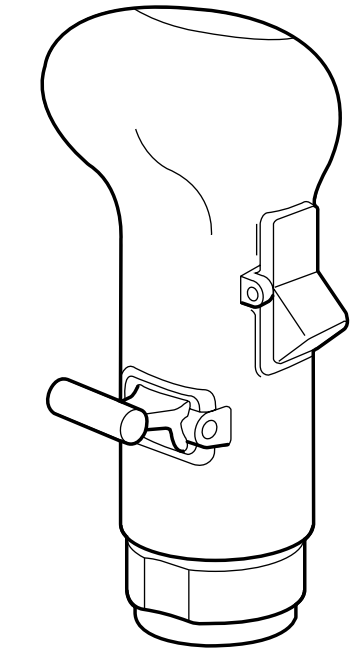
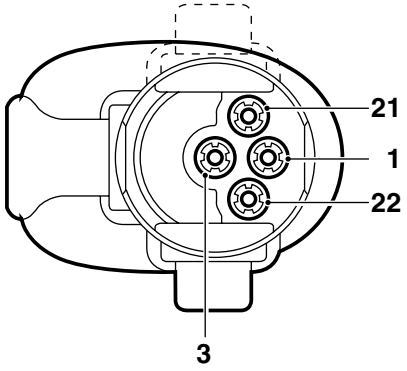
Gear lever shifting valve

Connection point		Colour
1	Supply	Black
3	Exhaust	Red
21	Service line of rear-mounted range unit	White
22	Service line splitter	Yellow





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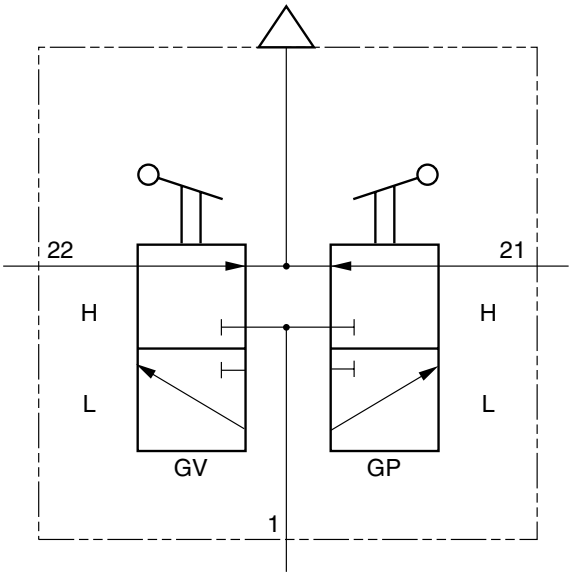
Pneumatic symbol

Position	Function
GP	Rear-mounted range unit
GV	Splitter



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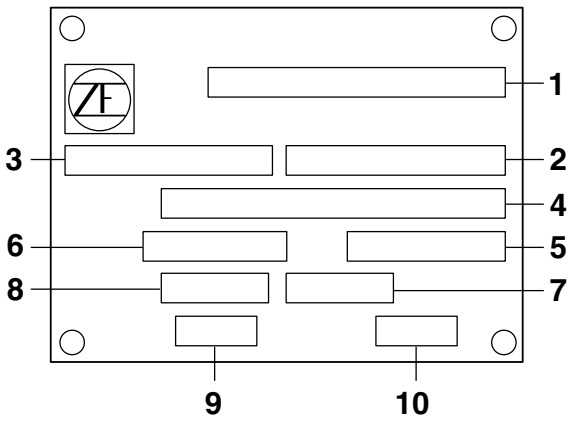
9. GEARBOX, MECHANICAL

9.1 GENERAL

Gearbox type
Each gearbox has a type plate attached to it, indicating the type of gearbox installed. These data can also be found on the vehicle identity card for the vehicle concerned.

1. Type of gearbox
2. Serial No. (ZF)
3. Parts list (ZF)
4. Specification No.
5. Pulse generator ratio
6. Gearbox ratio
7. Engine speed using PTO
8. PTO speed
9. Gear box oil capacity
10. Oil specification



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Axial bearing play

Axial bearing play on gearbox output shaft	0 - 0.1 mm
Axial play input shaft bearing	0 - 0.1 mm

Holding element

Elasticity, standard	168 N
Elasticity, heavier version	191 N

9.2 TIGHTENING TORQUES

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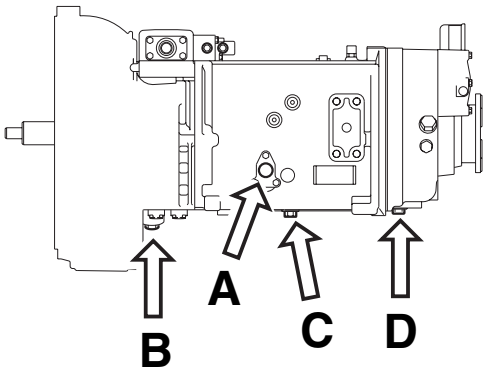
Drive flange	
M12x70 - 8.8	60 Nm
M12x60 - 10.9	120 Nm
M12x70 - 10.9	120 Nm
M12x165 - 10.9	120 Nm
Gearbox	
Sliding bush	46 Nm
Output shaft bearing cover	49 Nm
Control bearing cover	23 Nm
Control housing fixing bolts (servo shift)	23 Nm
Gear shift high/low	
Gear shift fork bolts high/low	180 Nm
Piston gear engaging cylinder lock nut	180 Nm
Lock bolts gear engaging cylinder	50 Nm
Air connection banjo bolt	38 Nm
Rear cover fixing bolts	50 Nm

Plugs

ZF 16S-181/221

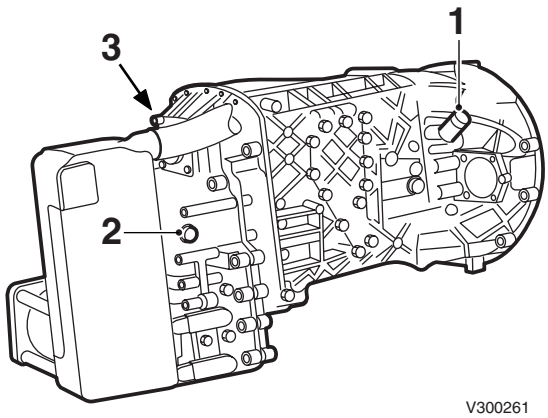
Level/filling plug (A)		60 Nm
Drain plug (B)	M24	60 Nm
	M38	120 Nm
Drain plug (C/D)		60 Nm



M3023

ZF 16S-181/221 with intarder

Drain plug (1)	M24	60 Nm
	M38	120 Nm
Drain plug (2)		60 Nm
Oil filter fixing bolt (3)		23 Nm
Level/filling plug (4)		60 Nm
Level/filling plug (5)		60 Nm



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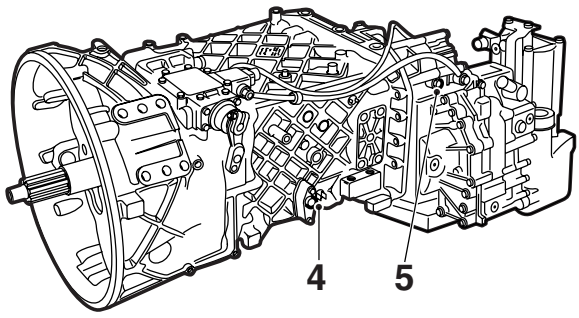

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9.3 FILLING CAPACITIES

Filling capacities, gearboxes without intarder

Gearbox type	Filling capacity, oil change (litres)	First filling, e.g. following repairs (litres)
ZF 16S-181/221	13.0	13.0

Filling capacities, gearboxes with intarder

Gearbox type	Filling capacity, oil change (litres)	First filling, e.g. following repairs (litres)
ZF 16S-181/221	12.0	21.5

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10. CLUTCH

10.1 GENERAL

Clutch release assembly

Engine type	Clutch release assembly type	Release force (N)	Pressing force (N)	Design
VF/XF/XE	MFZ 430	8200	34200-38000	Diaphragm

Clutch plate

Engine type	Clutch plate	Design	Lining	Splines	Thrust bearing
VF/XF/XE	GTZ 430	Single dry plate	Asbestos-free Raybestos B8405	2″	KZIZ-5

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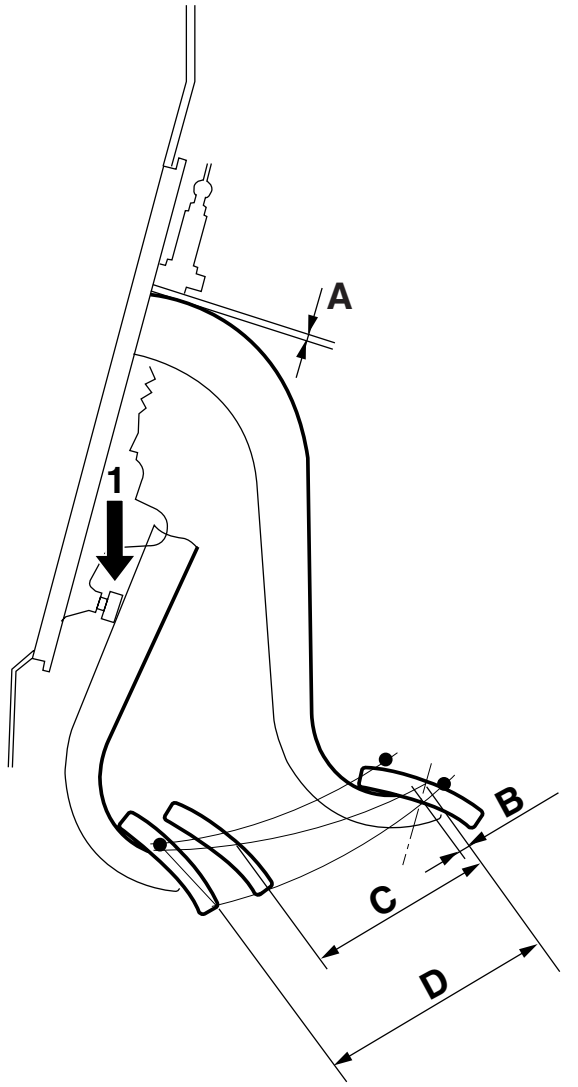
Clutch pedal

E-gas proximity sensor (A)	1 – 0 + 1 mm
Free travel of clutch pedal (B)	approx. 2 - 4 mm
GV valve starts to open (C)	140 ± 2 mm
Full travel distance clutch pedal (D)	150 ± 2 mm



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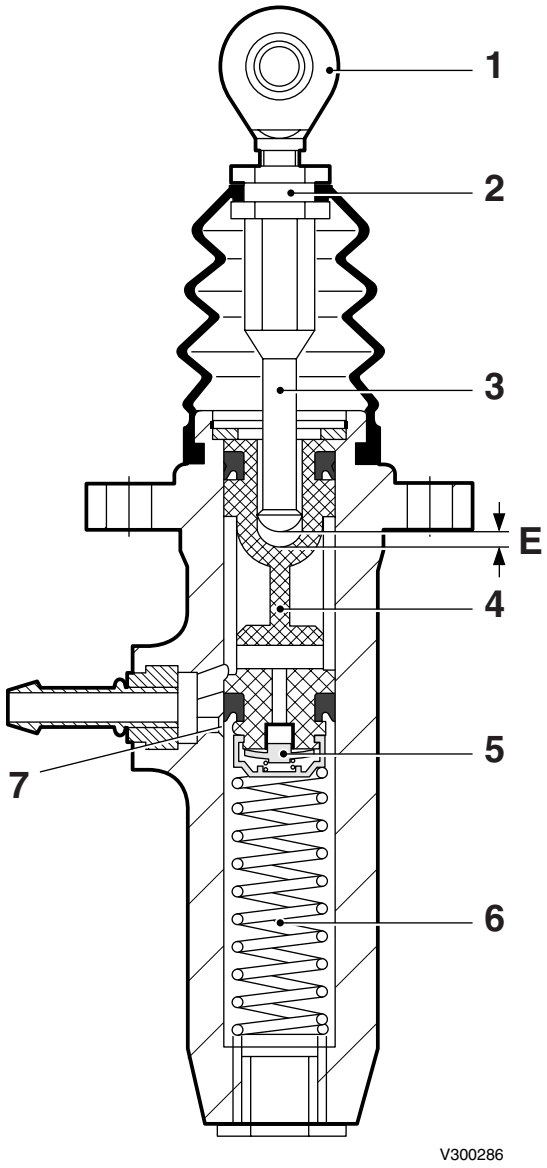
Master cylinder

Maximum piston stroke	34 mm
Pressure pin setting (E)	approx. 0.2 - 0.8 mm
Seals for assembly	Silicone grease



10.2 TIGHTENING TORQUES

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Master cylinder

Pressure pin fixing nut	55 ± 5 Nm
Exhaust port	8 ± 2 Nm
Steel line coupling	40 Nm

Clutch release assembly

ZF 16S-181/221

Fixing bolts clutch release assembly to flywheel	54 ± 4 Nm
Fixing bolts clutch lever to gearbox	27 ± 2 Nm

Clutch housing/flywheel housing

ZF 16S-181/221

Clutch housing to flywheel housing fixing bolts	54 ± 4 Nm

10.3 FILLING CAPACITIES

Clutch

First filling	± 0.4 litre

0

11. DRIVE SHAFTS

11.1 GENERAL

For the vehicle series 95*XF*, DAF has two drive shaft manufacturers,
Gelenk-Wellen-Bau and Klein.
The Gelenk-Wellen-Bau-shafts can be identified by the two welded brackets and the balancing plates with the letters GWB stamped into them.
Klein shafts can be identified by their highly bevelled flanges.

The various components of the shafts are not interchangeable, with the exception of some of the spiders.

Complete shaft assemblies, however, can be exchanged. It is also allowed to install shafts from two different manufacturers in one vehicle.

Inspection:
There must be no clearly noticeable play on universal joints, centre bearing and sliding joint.

Gelenk-Wellen-Bau	
Balancing speed	3000 rpm^{-1} **
Radial play universal joints	0.01 - 0.05 mm
Klein	
Balancing speed	3000 rpm^{-1} **
Radial play universal joints	0.01 - 0.05 mm

Centre bearings
If a lubricating nipple is fitted to the 95*XF*, it must be lubricated.

** Drive shafts with retracted length ≥ 2120 mm	max. 2700 rpm^{-1}

11.2 TIGHTENING TORQUES

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Gelenk-Wellen-Bau

Drive flange fixing bolts	
- M12 property class 8.8	68 ± 11 Nm
- M12 property class 10.9	88 ± 14 Nm
- M14 property class 8.8	108 ± 17 Nm *
Central bolt of centre bearing	350 ± 15 Nm *
Centre bearing fixing bolts	108 ± 17 Nm *

Klein

Drive flange fixing bolts	
- M12 property class 8.8	68 ± 11 Nm
- M12 property class10.9	88 ± 14 Nm
- M14 property class 8.8	108 ± 17 Nm
Central nut of centre bearing	
- M24 x 1,5	250 + 50 Nm
- M40 x 1,5	350 + 50 Nm
- M55 x 1,5	380 + 70 Nm
Centre bearing fixing bolts	108 ± 17 Nm *

* Loctite 243

11.3 FILLING CAPACITIES

Grease must be seen to protrude from the spider, sliding sleeve or centre bearing.

12. ZF INTARDER

12.1 GENERAL

Axial clearances	
Stator	0 ± 0.05 mm
Bearing output shaft	0 - 0.1 mm
External rotor oil pump	0.03 - 0.05 mm
Drive sprocket intarder	
Heat in oven for up to 15 minutes	130° - 150°C

12.2 TIGHTENING TORQUES

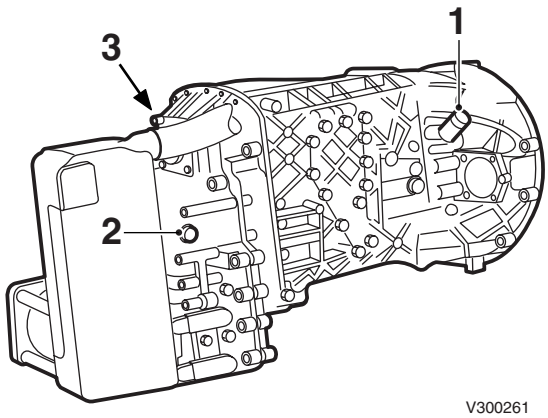
Drive flange fixing bolts	
Fixing bolts, property class 8.8	60 Nm
Fixing bolts, property class 10.9	120 Nm
Gear shift high/low	
Gear shift fork bolts high/low	180 Nm
Piston gear engaging cylinder lock nut	180 Nm
Lock bolts gear engaging cylinder	50 Nm
Air connection banjo bolt	38 Nm
Gear box rear cover fixing bolts	50 Nm
Heat exchanger	
Studs in heat exchanger	18 Nm *
Fixing nuts	62 Nm *
Fixing bolt	23 Nm *
Heat exchanger attachment surfaces	Loctite 574
Hydraulic control unit	
M10 fixing bolts	50 Nm
Gauges and sensors	
Temperature sensor	40 Nm
Air supply valve	23 Nm
Proportional valve	23 Nm
Attachment of intarder to gearbox	
M10 fixing bolts	50 Nm
Oil pump	
Fixing bolts	23 Nm

0

ZF 16S-181/221 gearbox with intarder

Drain plug (1)	M24	60 Nm
	M38	120 Nm
Drain plug (2)		60 Nm
Oil filter fixing bolt (3)		23 Nm
Level/filling plug (4)		60 Nm
Level/filling plug (5)		60 Nm

* Fasten with Loctite 574



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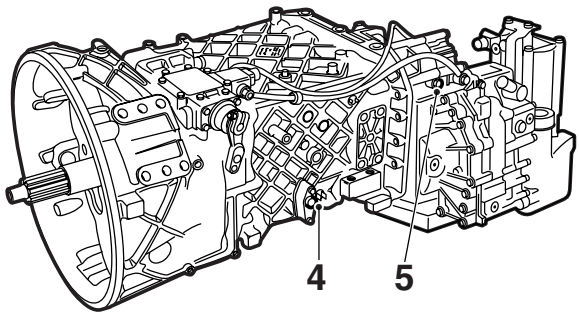

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13. VOITH RETARDER 133-2

13.1 GENERAL

Minimum brake torque		250 Nm
Maximum brake torque		4000 Nm
Service pressure		8 - 10 bar

13.2 TIGHTENING TORQUES

Oil dip stick		80 Nm
Oil-level plug		80 Nm
Oil-filler plug	M24 x 1.5	80 Nm
	M18 x 1.5	50 Nm
Retarder oil-drain plug		150 Nm
Butterfly valve oil-drain plug		65 Nm
Oil-filler plug	M18 x 1.5	50 Nm
	M24 x 1.5	80 Nm
Heat exchanger cooling water drain plug		50 Nm
Adapter plate fixing bolts	M10	45 Nm
	M12	80 Nm
Retarder fixing bolt/nuts		250 Nm
Sealing plate (drive flange) fixing bolts		8 Nm *
Labyrinth cover fixing bolts		45 Nm
Drive flange fixing bolts		110 Nm
Drive shaft bolts	M12	75 Nm
	M14	115 Nm
Heat exchanger/retarder fixing bolts		45 Nm **
Heat exchanger support strip fixing bolts		45 Nm
Heat exchanger cover fixing bolts M6		10 Nm ***
Heat exchanger element fixing bolts M8		25 Nm ***

* Fasten with Loctite 510
** Self-locking
*** Loctite 243

13.3 FILLING CAPACITIES

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Change the oil	8.2 litres
New retarder (first filling)	9.5 litres

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1. HYDRAULIC GEARBOX CONTROL (HGS)

1.1 FAULT-FINDING TABLE

FAULT: GEARS CANNOT BE ENGAGED	
Possible cause	**Remedy**
Fluid level too low	Check for leaks
Use of incorrect hydraulic fluid	Replace by hydraulic fluid with correct specification
Use of mineral oils and/or grease	Change entire system
Air in the system (identified by spongy feeling)	Top up and bleed the system
Cylinders disconnected from gearbox	Check attachment and tighten, if necessary

FAULT: NOT ALL OF THE GEARS CAN BE ENGAGED	
Possible cause	**Remedy**
Fluid level too low	Check for leaks
Air in the system (identified by spongy feeling)	Top up and bleed the system
External leakage	Check for external leakage
Displacement of gear lever because of internal leakage along plungers/pistons	Replace defective cylinder or gear-lever unit
Cylinders disconnected from gearbox	Check attachment and tighten, if necessary

FAULT: DISPLACED POSITION OF GEAR LEVER	
Possible cause	**Remedy**
Internal leakage along plungers/pistons	Replace defective cylinder or gear-lever unit
Displacement of gear lever because of temperature increase	Slowly move gear lever from rear right (4/8 gear) to front left (1/5 gear) a number of times
External leakage	Check for external leakage

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2. MECHANICAL GEARBOX CONTROL (MGS)

2.1 FAULT-FINDING TABLE

FAULT: GEAR LEVER VIBRATES	
Possible cause	**Remedy**
Excessive play at control hinge points	Check/repair all points in the control
Too much play on the silentblock in the control rod (loose or defect)	Check silentblock and replace, if necessary

FAULT: ENGAGING GEARS IS HEAVY	
Possible cause	**Remedy**
Gearbox control pivot and hinge points dry or worn	Check/repair all points in the control
Mechanical problem in gearbox	See fault-finding table “Gearbox, mechanical”

FAULT: GEARS CANNOT BE SHIFTED	
Possible cause	**Remedy**
Gearbox control pivot and hinge points dry or worn	Check/repair all points in the control
Too much play on the silentblock in the control rod	Check silentblock and replace, if necessary
Mechanical problem in gearbox	See fault-finding table “Gearbox, mechanical”

FAULT: GEARBOX JUMPS OUT OF GEAR	
Possible cause	**Remedy**
Incorrect control setting	Check/set all points in the control
Mechanical problem in gearbox	See fault-finding table “Gearbox, mechanical”

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3. PNEUMATICALLY ASSISTED GEARBOX CONTROL (SERVO SHIFT)

3.1 FAULT-FINDING TABLE

FAULT: ENGAGING GEARS IS HEAVY	
Possible cause	**Remedy**
Servo shift unit is not functioning	Check the air pipes
Internal air leak of servo shift unit	Check the air seals in the unit
Mechanical problem	See fault-finding tables “Mechanical gearbox control” and “Gearbox, mechanical”

FAULT: GEARBOX JUMPS OUT OF GEAR	
Possible cause	**Remedy**
Shifting valve in servo shift unit defective	Replace servo shift unit
Mechanical problem	See fault-finding tables “Mechanical gearbox control” and “Gearbox, mechanical”

1

4. PNEUMATIC GEARBOX COMPONENTS

4.1 FAULT-FINDING TABLE

FAULT: HIGH OR LOW GROUP SHIFTING IMPOSSIBLE	
Possible cause	**Remedy**
Air pressure too low	Check air supply of circuit 4
Neutral switch valve defective or incorrectly connected	Connect valve properly or replace
Shift-down safety valve defective	Replace valve
Gear engaging cylinder high/low group defective	Check cylinder and replace, if necessary

FAULT: GEAR ENGAGING CYLINDER HIGH/LOW GROUP SHIFTS WHEN VEHICLE SPEED IS TOO HIGH	
Possible cause	**Remedy**
Incorrect CTE frequency value	Adjust value

FAULT: DELAYED HIGH OR LOW GROUP SHIFTING	
Possible cause	**Remedy**
Air pressure too low	Check air supply of circuit 4
Piping blocked	Check piping and clean, if necessary
Neutral switch valve defective	Replace valve

FAULT: HIGH - LOW SHIFTING OPERATES IN REVERSE MODE	
Possible cause	**Remedy**
Air pipes to high/low group gear engaging cylinder incorrectly connected	Connect gear engaging cylinder air pipes properly

FAULT: LOW GROUP SHIFTING IMPOSSIBLE	
Possible cause	**Remedy**
CTE defective	Check CTE and replace, if necessary
Incorrect vehicle speed signal	Check vehicle speed sensor and replace, if necessary Check vehicle speed signal

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FAULT: SPLITTERING IMPOSSIBLE	
Possible cause	**Remedy**
Air pressure too low	Check pneumatic system
GV valve defective or incorrectly set	Check and adjust/replace, if necessary
Wrong relay valve fitted for splitter	Fit correct relay valve type
Broken or incorrectly connected air pipes	Check air pipes and replace or connect properly, if necessary
Wrong selector switch on gear lever	Fit correct switch type
Wrong bore hole plugged in splitter cylinder	Plug correct bore hole
Splitter cylinder is not functioning	Check cylinder and replace, if necessary

FAULT: SPLITTER CYLINDER OPERATES IN REVERSE MODE	
Possible cause	**Remedy**
Incorrect splitter relay valve fitted	Fit correct relay valve type
Incorrect gear lever shifting valve fitted	Fit correct shift valve type
Air pipes connected incorrectly	Check air pipes and connect properly, if necessary

FAULT: SPLITTERING DELAYED	
Possible cause	**Remedy**
Air pressure too low	Check pneumatic system
Blocked air pipes	Check pipes
GV valve defective or incorrectly set	Check valve and adjust, if necessary

FAULT: GATE 1/2 NOT SAFEGUARDED	
Possible cause	**Remedy**
Leaking or blocked air pipes	Replace air pipes
No air from neutral-position valve in neutral position	Check neutral-position valve and replace, if necessary
Gearbox gate safety valve (B184) defective	Replace gearbox gate safety valve
Electronic unit (D813) of gate safety or CTE not receiving speed signal	Check the speed signal
Electric unit (D813) of gate safety is not earthed	Replace electric unit of gate safety
No output voltage by CTE	Check CTE and replace, if necessary
Low-gear switch (E561) defective	Replace low-gear switch

FAULT: GATES 1/2 AND 5/6 PERMANENTLY BLOCKED	
Possible cause	**Remedy**
Gearbox gate safety valve (B184) defective	Replace gearbox gate safety valve
Gate safety active in both high and low group	Check low-gear switch (E561)

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5. GEARBOX, MECHANICAL

5.1 FAULT-FINDING TABLE

FAULT: ENGAGING GEARS IS HEAVY	
Possible cause	**Remedy**
Gearbox oil level too low	Top up oil level
Use of oil with incorrect specification in the gearbox	Fill gearbox with oil of correct specification
Mechanical problem in gearbox control	See fault-finding table “Mechanical gearbox control”
Clutch plate is not released	See fault-finding table “Clutch”

FAULT: GEARS CANNOT BE SHIFTED	
Possible cause	**Remedy**
Holding element mounted too deep	Check/repair holding element
Mechanical problem in gearbox control	See fault-finding table “Mechanical gearbox control”
Range switch does not work properly	See fault-finding table “Pneumatic gearbox components”

FAULT: GEARBOX JUMPS OUT OF GEAR	
Possible cause	**Remedy**
Adjustment of gear box cover	Mount cover on gearbox without any play
Check whether the right type of components have been fitted	Replace holding element or fit other type of holding element
Mechanical problem in gearbox control	See fault-finding table “Mechanical gearbox control”

FAULT: GEAR LEVER STUCK IN GATE 3/4	
Possible cause	**Remedy**
Oil leak in gate safety piston	Replace the O-ring

FAULT: SINGLE H BECOMES DOUBLE H	
Possible cause	**Remedy**
Locking plate in control cover incorrectly fitted	Check composition of control cover

6. CLUTCH

6.1 FAULT-FINDING TABLE

FAULT: CLUTCH PEDAL FAILS TO RETURN	
Possible cause	**Remedy**
Broken pedal return spring	Replace spring
Worn clutch pedal bearing	Check bearing and replace, if necessary
Dirt in hydraulic system	Clean system and fill with fresh fluid
Incorrect fluid in hydraulic system	Replace by fluid with correct specification
Air in hydraulic system	Bleed the system

FAULT: CLUTCH PEDAL STICKS WHEN DEPRESSED	
Possible cause	**Remedy**
Leak in hydraulic system	Check system
Air in hydraulic system	Bleed hydraulic system
Declutching bearing incorrectly fitted	Fit declutching bearing correctly
Fork hinge points or fork itself pressed in	Check hinge points and fork, replace if necessary
Defective clutch servo	Repair and/or replace clutch servo
Sliding bush pressed in or broken	Check, replace sliding bush

FAULT: PEDAL FORCE TOO HIGH	
Possible cause	**Remedy**
No or insufficient pressure in circuit 4 of the brake system	Check circuit 4 of the brake system
Air pipe kinked	Check pipe and replace, if necessary
Hydraulic line kinked	Check line and replace, if necessary
Worn clutch pedal bearing	Check bearing and replace, if necessary
Defective clutch servo and/or master cylinder	Repair or replace clutch servo and/or master cylinder **Note:** Clean system and fill with fresh fluid in case of a swollen sealing

1

FAULT: RESIDUAL PRESSURE IN CLUTCH SYSTEM	
Possible cause	**Remedy**
Vent opening in reservoir cap blocked	Check reservoir cap vent opening
Balance hole in master cylinder blocked by swollen sealing or insufficient free travel of push rod	Check free travel of push rod or repair or replace master cylinder **Note:** Clean system and fill with fresh fluid in case of a swollen sealing

FAULT: FLUID LEAKAGE VIA VENT OPENING	
Possible cause	**Remedy**
Leakage via piston sealing in clutch servo	Repair or replace clutch servo **Note:** Finding a drop of oil at the ventilation opening is normal and is no reason to replace or repair the clutch servo

FAULT: CLUTCH PLATE SLIPS	
Possible cause	**Remedy**
Worn lining	Replace lining
Oil on lining	Replace lining and check engine and gearbox sealing rings
Dirt on clutch plate and flywheel	Clean plate and surrounding area
Burnt clutch plate	Check entire clutch and replace, if necessary
Clamping force of clutch release assembly too low or absent	Check clutch release assembly and replace, if necessary
Clutch release assembly is not released	Check clutch release assembly

FAULT: CLUTCH RELEASE ASSEMBLY FAILS TO RELEASE	
Possible cause	**Remedy**
Fluid level in hydraulic system too low	Top up fluid
Incorrect pedal setting	Check setting and correct, if necessary
Air in hydraulic system	Bleed hydraulic system
Leak in hydraulic system	Check hydraulic system
Fingers of clutch release assembly broken	Replace clutch release assembly
Wrong clutch release assembly has been fitted	Fit correct clutch release assembly
Clutch fork is broken	Replace fork
Clutch release assembly severely contaminated	Clean entire clutch assembly
Defective clutch servo	Check clutch servo and replace, if necessary
Thrust bearing incorrectly fitted	Fit thrust bearing correctly
Clutch housing disconnected from gearbox	Tighten the clutch housing bolts to the correct torque

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7. DRIVE SHAFTS

7.1 FAULT-FINDING TABLE

FAULT: DRIVE LINE VIBRATION AT LOW VEHICLE SPEED	
Possible cause	**Remedy**
Excessive universal joint angle (for example, caused by excessive caster)	Check the universal joint angle
Play in universal joints	Replace universal joint
Play in centre bearing	Replace centre bearing
Play in sliding joint	Replace drive shaft
Forks not in line	Align forks

FAULT: DRIVE LINE VIBRATION AT HIGH VEHICLE SPEED	
Possible cause	**Remedy**
Drive shaft imbalance	Balance or replace the drive shafts, if necessary

1

8. ZF INTARDER

8.1 FAULT-FINDING TABLE

FAULT: NO BRAKE POWER	
Possible cause	**Remedy**
Oil level too low	Check oil level
Intarder does not contain the specified oil	Check oil change
No pump pressure	Check system
No control pressure	Check system
No intarder pressure	Check system

FAULT: INSUFFICIENT BRAKE PRESSURE	
Possible cause	**Remedy**
Oil level too low	Check oil level
Intarder does not contain the specified oil	Change the oil
Pump pressure too low	See system manual
Control pressure too low	See system manual
Intarder pressure too low	See system manual

FAULT: CONSTANT BRAKE POWER WHEN INTARDER IS SWITCHED OFF	
Possible cause	**Remedy**
Oil level too high	Check oil level
Control pressure is independent of the position of the control lever	Check system

FAULT: DELAYED RESPONSE	
Possible cause	**Remedy**
Air supply absent/too low	Check air supply
Air supply intarder valve is not activated	Check system
Air supply intarder valve does not empty accumulator in spite of activation	Check system
Idle pressure too low	Check system

FAULT: DELAYED SWITCH-OFF	
Possible cause	**Remedy**
Slow decrease of intarder pressure after switch-off	Check system

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FAULT: OIL LEAKAGE	
Possible cause	**Remedy**
Oil level too high	Check oil level
Oil leak between gearbox housing and intarder	Replace gasket
Oil leak in pump	Replace O-ring
Oil leak in proportional valve	Replace O-ring
Oil leak in the accumulator	Replace O-ring
Oil leak in the drive flange	Replace O-ring

FAULT: AIR LEAKAGE	
Possible cause	**Remedy**
Air leakage via air supply intarder valve	Replace O-ring

FAULT: COOLANT TEMPERATURE TOO HIGH	
Possible cause	**Remedy**
Coolant level too high/low	Checking the coolant level
Temperature adjustment	Check system
Intarder pressure after intarder has been switched off	Check system

9. VOITH RETARDER

9.1 FAULT-FINDING TABLE

FAULT: NO/INSUFFICIENT BRAKE POWER	
Possible cause	**Remedy**
Oil level too low	Check oil level
Intarder does not contain the specified oil	Change the oil
Reservoir pressure absent or too low	See “fault: air leakage”
No pneumatic service pressure	Check system
Pneumatic service pressure too low	Check system
No hydraulic service pressure	Check system
Hydraulic service pressure too low	Check system

FAULT: RETARDER REMAINS ENGAGED	
Possible cause	**Remedy**
Oil level too high	Draining and filling
Service pressure is independent of the position of the control lever	Check system

FAULT: DELAYED RESPONSE	
Possible cause	**Remedy**
Air reservoir pressure absent or too low	See “fault: air leakage”
Slow build-up of pneumatic service pressure	Check system
Venting valve remains closed	Check system
Stator valves remain open	Check system
Shifting valve hangs	Check system

FAULT: DELAYED DECREASE OF BRAKE POWER	
Possible cause	**Remedy**
No air escapes when retarder is switched off	Clean silencer

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FAULT: OIL LEAKAGE	
Possible cause	**Remedy**
Oil level too high	Draining and filling
Oil leak between adapter plate and retarder	Systeem controleren
Oil leak between gearbox housing and adapter plate	Check system
Oil leakage at valve exhaust port	Check system
Oil leak in the drive flange	Replace O-ring
Butterfly valve defective	Check system

FAULT: AIR LEAKAGE	
Possible cause	**Remedy**
Air leakage via proportional valve	Replace O-ring

FAULT: OIL LEAKAGE	
Possible cause	**Remedy**
Oil leak in the drive flange	Replace O-ring
Butterfly valve defective	Check system

FAULT: COOLANT TEMPERATURE TOO HIGH	
Possible cause	**Remedy**
Coolant level too low	Checking the coolant level
Oil level too high	Draining and filling
Temperature sensor or control unit defective	See system manual
Retarder service pressure after intarder has been switched off	See system manual

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1. SAFETY INSTRUCTIONS

1.1 SAFETY INSTRUCTIONS

When carrying out welding work on the vehicle, never use components of the HGS system as the “earth”. This could cause internal damage to the aluminium components.

Never fill the system with mineral oils and never use mineral grease for fitting purposes. This causes swelling of the O-rings and sealing rings, resulting in premature breakdown of the HGS system.

Avoid internal contamination of the system.
- Before filling or bleeding the system, always check whether the rubber plugs are still on the nipples. If such is not the case, the nipples must be replaced.
- After filling or bleeding the system, the rubber plugs must be refitted on the nipples.

The screw-in couplings, used to attach the hoses to the cylinders and gear level unit, must not have a resin coating on the inside. With time, resin coating dissolves in the system fluid and may cause internal damage to the system.

Attach no other hoses and/or pipes to the hoses of the HGS system (in the pivoting point and at the side of the gearbox).

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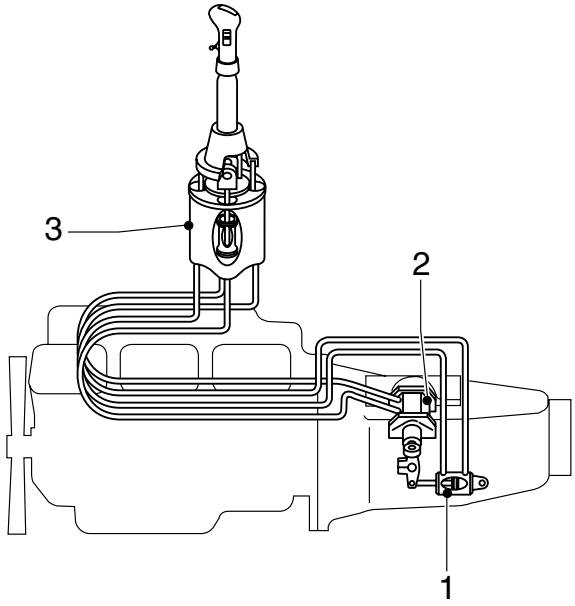
2. GENERAL

2.1 DESCRIPTION HGS SYSTEM

HGS (Hydraulic Gear Shift) is a non-assisted hydraulic shift system for the gearbox.
The system consists of a gear lever unit (3), a gate selection cylinder (2), a gear engaging cylinder (1) and a fluid reservoir.
The gear lever unit is mounted at the base of the gear lever, under the cab floor.
The gate selection cylinder and gear engaging cylinder are mounted on the gearbox, and operate the gear selector shaft.

Gear lever movements are transferred to the gear lever unit. The latter in turn operates the gate selection cylinder and gear engaging cylinder on the gearbox via special hydraulic connections.



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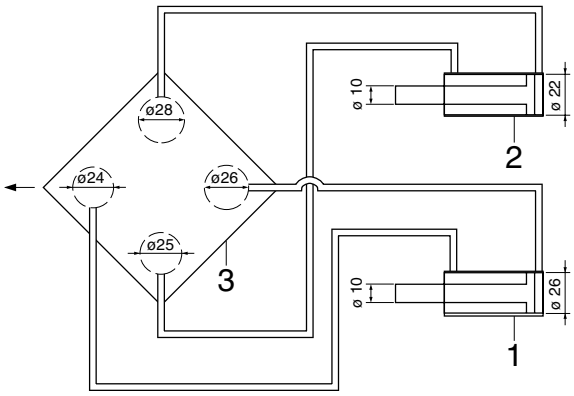
Gate selection
To select the correct gate, move the gear lever to the left or to the right.
In the neutral position, the gear lever is sprung in the 3/4 gate.
In this position of the selector shaft, the gear lever is in the extreme right position, while the left-hand plunger in the gear lever unit (3) is in the high position and the right-hand plunger in the low position. The gate selection cylinder (2) on the gearbox is then fully extended.

If a different gate must be selected, move the gear lever in the neutral position fully to the left. The left-hand plunger then moves down and the right-hand plunger moves up. This creates a fluid flow in the circuit of the gate selection cylinder (2), causing the latter to withdraw. The selector shaft is moved in an axial direction towards the correct position.



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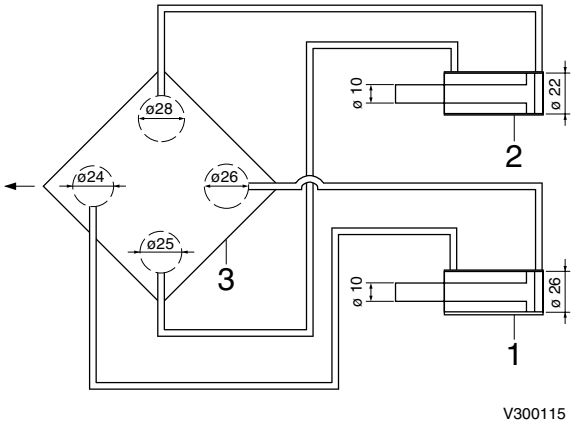
Engaging gears
To engage the gears, move the gear lever forwards or backwards.
In the neutral position, the front and rear plungers in the gear lever unit (3) are in the same position (balanced), while the gear engaging cylinder (1) on the gearbox is also in the central position.
To engage a gear, move the gear lever from the neutral position forwards or backwards.
The front and rear plungers in the gear lever unit (3) then move in opposite directions. This creates a fluid flow in the circuit of the gear engaging cylinder (1).

This fluid flow moves the piston shaft in or out of the gear engaging cylinder, causing the selector shaft to rotate and engaging the correct gear.



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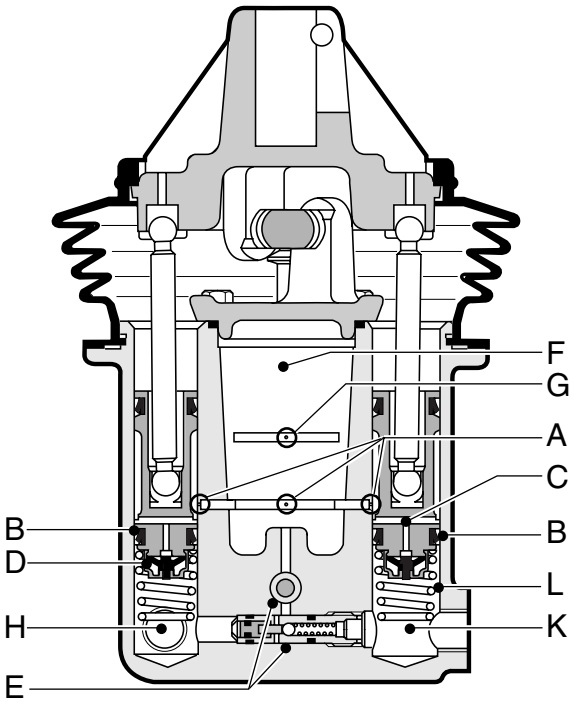
3. DESCRIPTION OF COMPONENTS

3.1 OPERATION OF GEAR LEVER UNIT

General
Inside the gear lever unit you will find four plungers with different diameters to compensate for the varying diameters on the left- and right-hand sides of the plunger in the gate selection and gear engaging cylinders.
As a result of this compensation, the displaced volumes at the gear lever unit and the gate selection and gear engaging cylinders are identical on both sides.
In the central section of the unit, an operating reservoir (F) connected to the cylinders is located. The connector holes (A) have a diameter of 0.6 mm. This diameter has been kept as small as possible in order to reduce wear on the sealing cups (B) of the pistons. These connection holes have a twin function. When a piston moves upwards, any absent liquid is passed on to the piston via a duct (C) and a valve (D).
The other purpose of the holes is to permit air to escape during the filling/bleeding of the system. In the gate selection cylinders, an extra hole (G) has been bored. Via this second hole, fluid can always be topped up, even if the lower hole remains closed by the sealing cup (B). The stroke for gate selection is extremely small (approx. 4 mm). For the gear engaging cylinder operation cylinders, a single hole is enough, because these pistons make a stroke large enough to always free the lower hole.
During the compression stroke, the delivery (C) is blocked by the closure of the duct, by the compression valve (D). If the piston is still located above the lower hole (A), fluid will flow back into the operating reservoir (F). Once the hole has been passed by the rubber sealing cup, pressure will be built up, and the gear engaging or gate selection cylinder will be operated via the pneumatic pipes.



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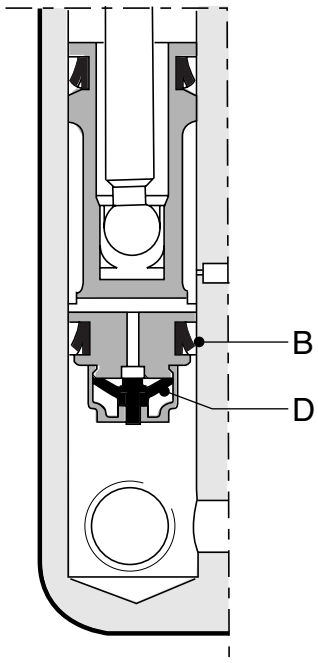

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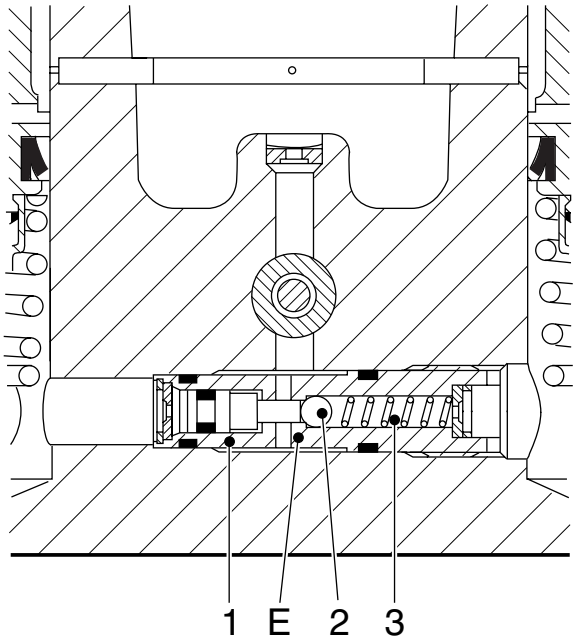
Pressure-relief valve
Inside the gear lever unit, there is a pressure-relief valve (E) for each dual-operation circuit.
These pressure-relief valves prevent an undesirable build-up of pressure within the system as a result of temperature increases.
The pressure-relief valve is located between the two plungers which belong to a single dual-operation circuit.
The connection between the right-hand cylinder and the internal reservoir is closed by a ball.
This ball (2) is pressed into its seat by a spring (3).

The ball will be pressed from its seat if the pressure within the system builds up equally on both sides and exceeds a particular limit.
The piston (1) affected by this pressure will move to the right and press the ball from its seat.

As a result, the fluid can only flow from the right-hand plunger towards the internal reservoir.
This will cause the pressure under the right-hand plunger to drop.
The left-hand plunger will move up and the right-hand plunger down, until the pressures have stabilised.
As a result, the gear lever will be displaced slightly. The pressure-relief valve has been placed in such a position that the gear lever always moves against the weight of the gear lever:
- towards the rear in the gear engaging direction;
- towards the front in the gate selection direction.

The displacement of the lever as a result of the operation of the pressure-relief valves will not be noticed in practice, because the system is self-correcting during gear engaging operations.



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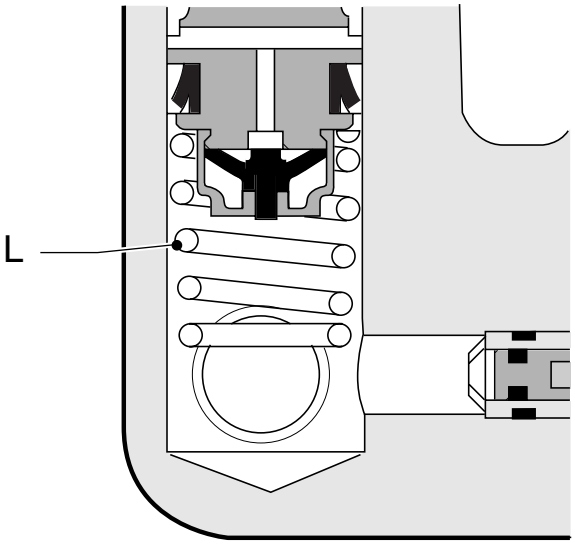
Bottom springs
Underneath the plungers in the gear lever unit, there are coil springs (L) which ensure that the displacement of the gear lever is restricted in the event of internal/external leakage and failure of the internal stops.
The self-correction action of the system will reset the neutral position after a number of gear engaging actions.



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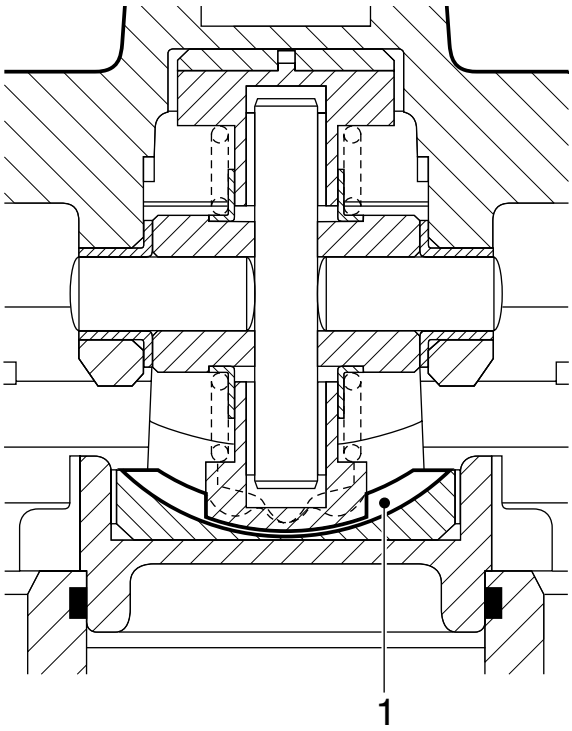
Internal stops
An internal stop (1) has been fitted on top of the gear lever unit.
This stop ensures that the gear lever remains in the desired position in the event of minor internal/external leaks in the system.
This is achieved by means of two plastic blocks with recesses.
These two plastic blocks are separated by a spring-loaded ratchet.

If the internal stop should fail, the movement of the gear lever will be restricted by the bottom springs inside the gear lever unit.



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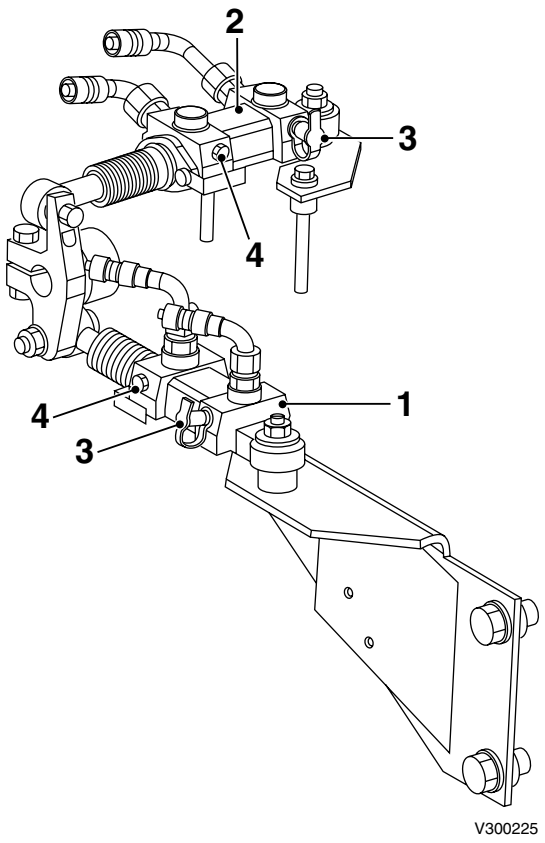
3.2 OPERATION OF GATE SELECTION AND GEAR ENGAGING CYLINDERS

The movement of the gear lever causes fluid to flow through the pipes.
This activates the piston of the gate selection cylinder (2) or gear engaging cylinder (1).
The surface difference, with respect to the piston shaft, of the left-hand and right-hand sides of the piston for the gate selection and gear engaging cylinders is compensated for by the different diameters of the plungers in the gear lever unit.



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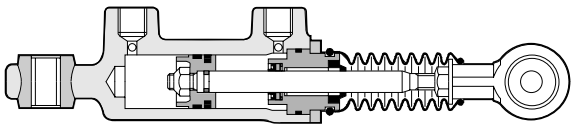
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4. INSPECTION AND ADJUSTMENT

4.1 ADJUSTING GEAR LEVER POSITION

Note:
If the position of the gear lever in neutral on the gearbox deviates from the normal position, this neutral position can be corrected according to the following instructions.

Lever too far left

1. Check at the gearbox whether it is in neutral.
2. Move the lever to the maximum left position, and then backwards (thus changing into 2nd or reverse gear).
3. With the vehicle in gear, force the lever to the right as far as possible. Then return the lever to the neutral position.
4. Repeat points 2 and 3 until the lever no longer deviates to the left.

Lever too far to the right

1. Check at the gearbox whether it is in neutral.
2. Move the lever to the maximum right position, and then backwards (thus changing into 2nd or 4th gear).
3. With the vehicle in gear, force the lever to the left as far as possible. Then return the lever to the neutral position.
4. Repeat points 2 and 3 until the lever no longer deviates to the right.

Lever too far forwards
1. Change into 3rd (7th) gear.

2. Pull the lever back carefully **without disengaging the gear**. The lever will move back slowly, until the correct position of 3rd(7th) gear has been reached.

Lever too far backwards
1. Change into 4th(8th) gear.

2. Pull the lever forwards carefully **without disengaging the gear**. The lever will move forwards, until the correct position of 4th (8th) gear has been reached.

4.2 INSPECTION, FLUID LEVEL

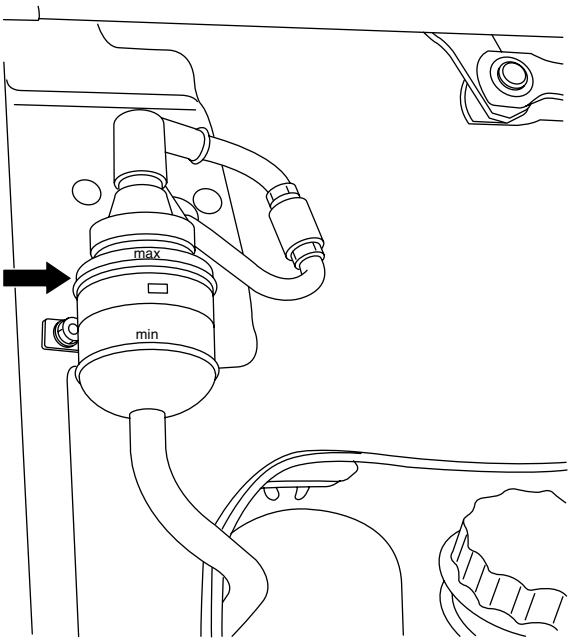
Hydraulic fluid is toxic and can therefore have a damaging effect on your health. So avoid inhaling and direct contact.

As hydraulic fluid is also a corrosive fluid, it might damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of hydraulic systems.

When filling oil, avoid coming into contact with oil (clean hands, clean funnel etc.). Mineral oil will damage the seals in the system.

1. Check whether the fluid level is between the upper and lower mark when the cab is in the driving position.



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5. REMOVAL AND INSTALLATION

5.1 REMOVAL AND INSTALLATION, ENTIRE GEAR LEVER UNIT

Removal, entire gear lever unit

1. Drain the hydraulic fluid.
2. Remove the gear lever from the unit; the pneumatic lines may remain connected to the shifting valve.
3. Disconnect the hydraulic lines from the gear lever unit. Immediately plug the disconnected lines with clean plugs to prevent dirt entering them.
4. Remove the fixing bolts from the gear lever unit and remove the gear lever unit from the cab floor.

Installation, entire gear lever unit

1. Mount the gear lever unit on the cab floor.
2. Connect the hydraulic lines to the gear lever unit.
3. Install the gear lever in the gear lever unit.
4. Fill and bleed the HGS system, see chapter “Draining and filling”.

5.2 REMOVAL AND INSTALLATION, GEAR LEVER

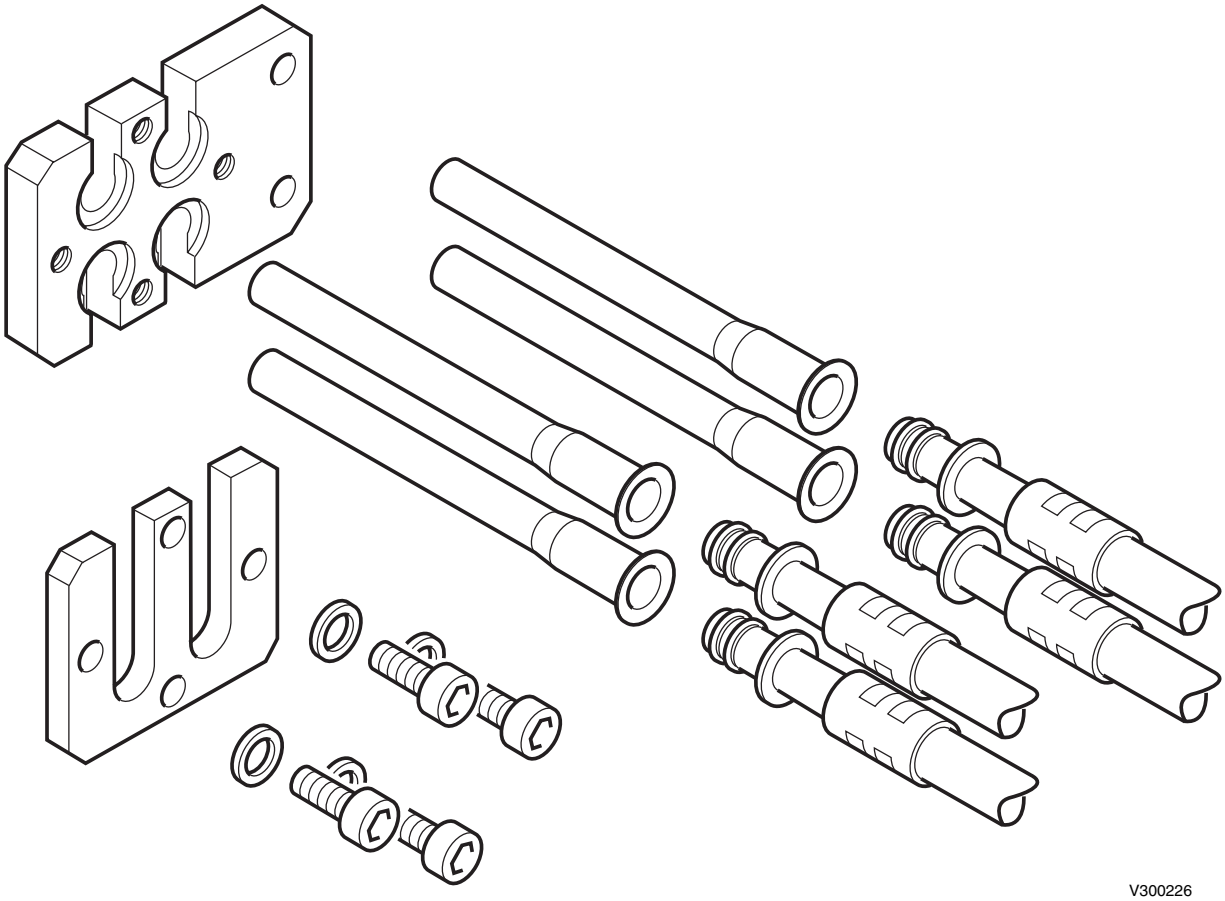
Removal, gear lever

1. Disconnect the gear lever dust cover from the cab floor.
2. Remove the shifting valve with the pneumatic lines.
3. Remove the fixing bolt from the gear lever.
4. Remove the gear lever from the gear lever unit.

Installation, gear lever

1. Install the gear lever in the gear lever unit, using the fixing bolt.
2. Install the pneumatic lines in the gear lever.
3. Install the shifting valve onto the gear lever.
4. Attach the gear lever dust cover to the cab floor.

5.3 REMOVAL AND INSTALLATION, HYDRAULIC LINES



Removal, hydraulic lines

1. Drain the hydraulic fluid.
2. Remove the line supports.
3. Disconnect the lines from the connection block.
4. Disconnect the lines from the gate selection and gear engaging cylinders and from the gear lever unit.
5. Remove the lines.

Installation, hydraulic lines

Note:
Lines must be installed completely free of stress.

1. Provide the lines with new O-rings at the connection block.
2. Connect the lines to the connection block.
3. Connect the lines to the gate selection and gear engaging cylinders and to the gear lever unit.
4. Install the line supports.
5. Fill and bleed the HGS system.

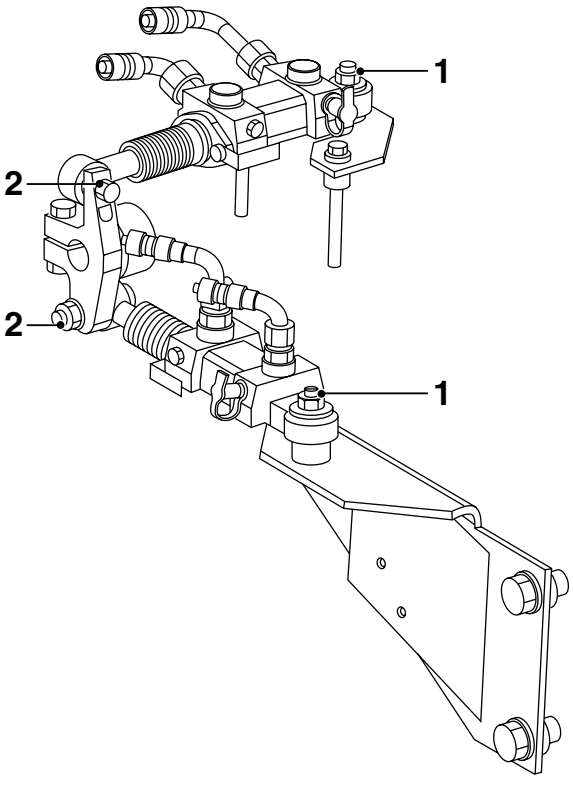
5.4 REMOVAL AND INSTALLATION, GATE SELECTION AND GEAR ENGAGING CYLINDERS

Removal, gate selection and gear engaging cylinders

1. Drain the hydraulic fluid.
2. Disconnect the hydraulic lines from the gate selection and gear engaging cylinders. Immediately plug the disconnected lines with clean plugs to prevent dirt entering them.
3. Remove the fixing bolts (2).
4. Remove the fixing nuts (1) and remove the gate selection and gear engaging cylinders.

Installation, gate selection and gear engaging cylinders

1. Install the gate selection and gear engaging cylinders and the fixing nuts (1).
2. Install the fixing bolts (2).
3. Connect the hydraulic lines to the gate selection and gear engaging cylinders.
4. Fill and bleed the HGS system.



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6. DRAINING AND FILLING

6.1 DRAINING, HGS SYSTEM

Hydraulic fluid is toxic and can therefore have a damaging effect on your health.
Hence avoid any direct or indirect physical contact.

As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

1. Tilt the cab and remove the engine encapsulation. Lower the engine encapsulation onto the engine.

   Note:
   Fluid drained from the HGS system must not be reused.

   The use of pressurised air to empty the system is strictly prohibited. Pressurised air contains water particles which may affect the operation of the HGS system.

2. Disconnect the hydraulic supply line which comes from the reservoir and collect the fluid.

3. Disconnect the lines from the gate selection and gear engaging cylinders.

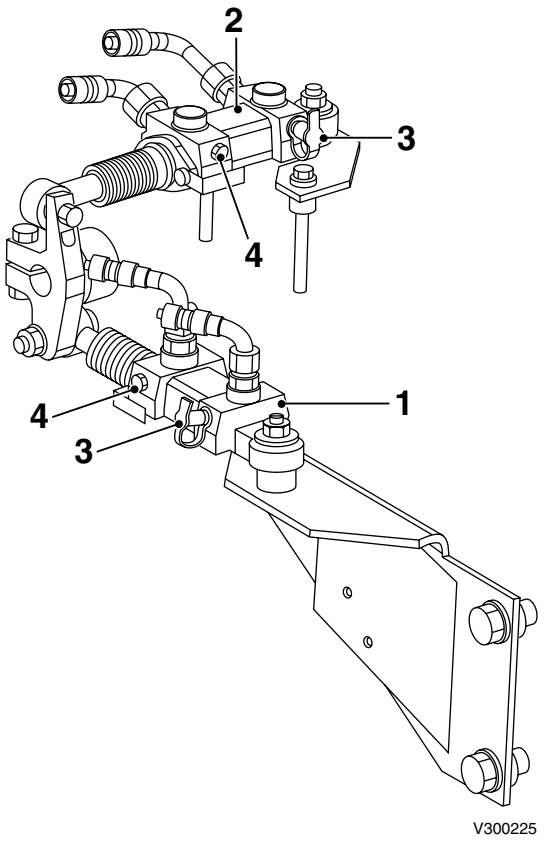
   Note:
   The system can never be fully drained.

4. Slowly move the gear lever in the gate selection and gear engaging directions a number of times, allowing the fluid to be pumped from the system. Then disconnect the lines from the gear lever unit. Collect the fluid.

6.2 FILLING/BLEEDING, HGS SYSTEM

Always first check the nipples for contamination before connecting the filler pipe. Replace contaminated nipples by new ones (to prevent the dirt from entering the system and causing damage to the system).

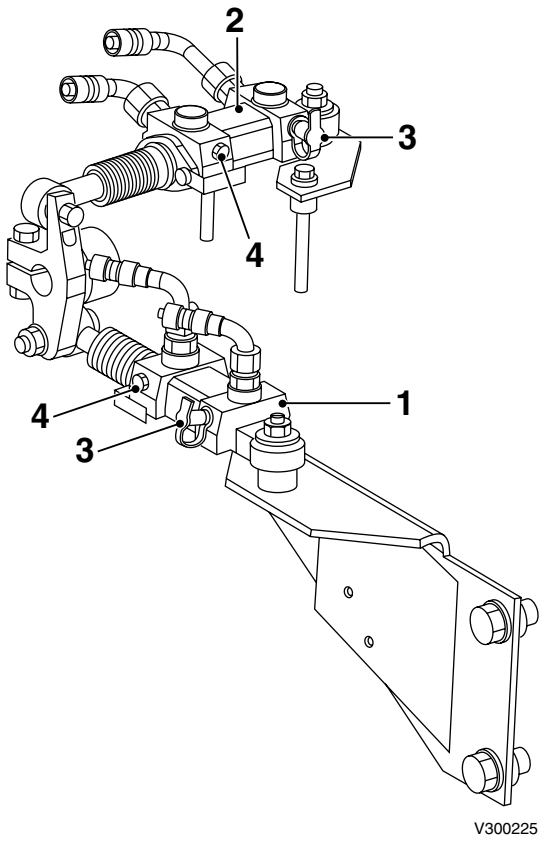
Following filling, the (clean) rubber plugs should be refitted on the nipples.



Note:
Use the connection nipples, special tool (DAF no. 1240116), and a filling/bleeding device, as used for hydraulic brakes. It is advisable to have someone assist you when carrying out this work.

1. Connect the nipples (3) of the gate selection and gear engaging cylinders to the filling/bleeding device. Use a T-piece to connect both nipples.
2. Loosen the nipples (3) and plugs (4) 0.5 to max. 1 turn.
3. Screw a cap with a flexible pipe connection to the reservoir, to capture the flow of fluid.
4. Position the gear lever in the maximum left-hand rear position.
5. Using the pressure vessel, force the liquid fluid into the system.
6. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
7. Switch off the supply pressure, and leave all connections fitted.

8. Slowly move the gear lever to the maximum right-hand front position.
9. Using the pressure vessel, force the liquid fluid into the system.
10. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
11. Close the nipples (3) and plugs (4), and shut off the supply.
12. Remove the cap with flexible pipe connection from the reservoir and top up the fluid to the correct level. Place the cap on the reservoir.
13. Remove the pressure filler pipes from the nipples and place the rubber caps on the nipples.
14. Move the gear lever backwards and forwards and from left to right in order to position the lever in neutral.
15. If too little pressure is built up after filling/bleeding is completed as described above (spongy feeling), repeat the method as described or apply the following method to bleed the gate selection and gear engaging cylinders one by one.



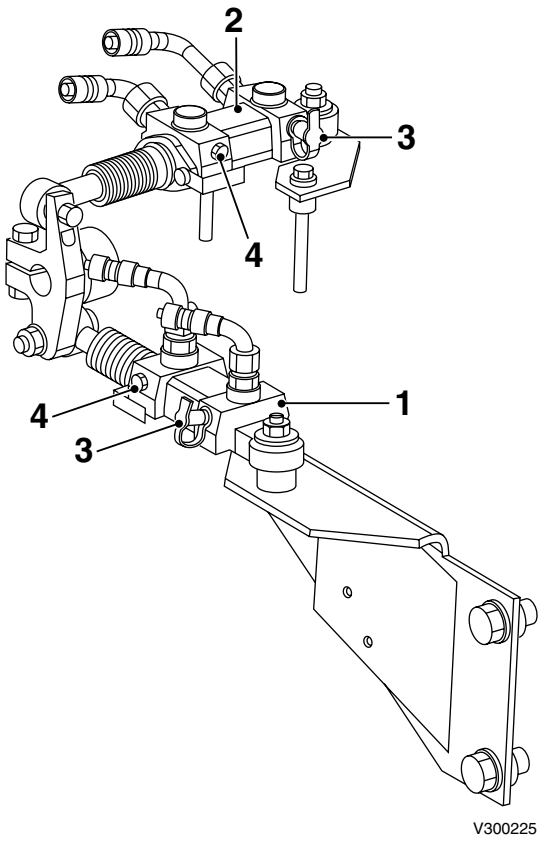
Bleeding the gate selection cylinder

1. Check whether the gearbox is in neutral.
2. Connect a pipe from the pressure filling vessel to the nipple (3) of the gate selection cylinder (2).
3. Loosen the nipple (3) and plug (4) on the gate selection cylinder (2) by 0.5 to 1 turn.
4. Screw a cap with a flexible pipe connection to the reservoir, to capture the flow of fluid.
5. Move the gear lever to the extreme right position and then push it backwards.

6. Using the pressure vessel, force the liquid fluid into the system.
7. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
8. Switch off the supply pressure, and **leave all connections fitted.**
9. **Slowly** move the gear lever to the extreme left position and push it forwards.
10. Using the pressure vessel, force the liquid fluid into the system.
11. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
12. Switch off the supply pressure, and **leave all connections fitted.**
13. **Slowly** move the lever to the right-hand position in neutral.
14. Seal off the nipple (3) and plug (4), and shut off the supply.
15. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.

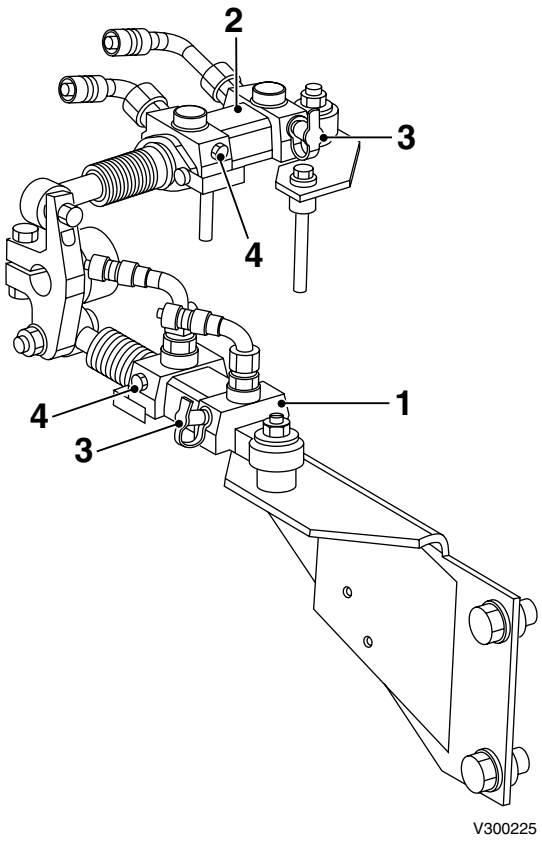
Bleeding the gear engaging cylinder

1. Connect a pipe from the pressure filling vessel to the nipple (3) of the gear engaging cylinder (2).
2. Loosen the nipple (3) and plug (4) on the gear engaging cylinder (2) by 0.5 to 1 turn.
3. Screw a cap with a flexible pipe connection to the reservoir, to capture the flow of fluid.
4. Move the gear lever to the extreme right position and then push it backwards.
5. Using the pressure vessel, force the liquid fluid into the system.



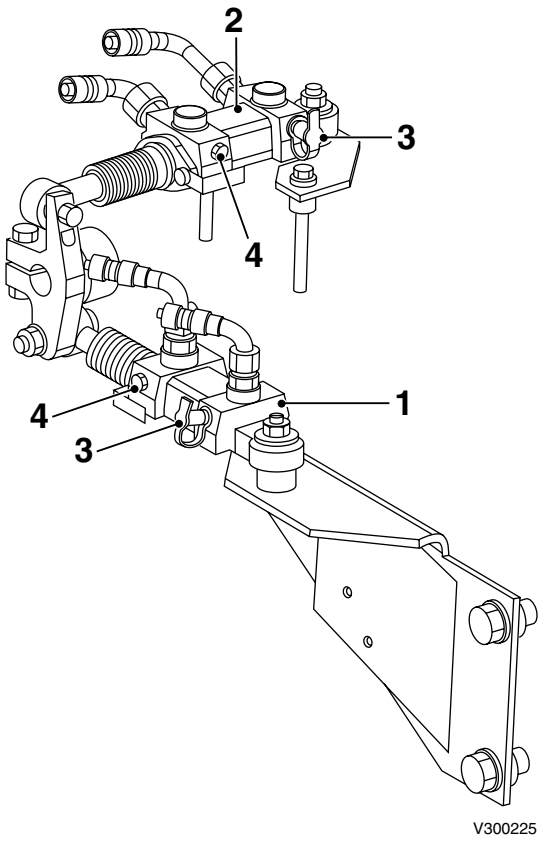
6. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
7. Switch off the supply pressure, and **leave all connections fitted.**
8. **Slowly** move the gear lever to the extreme left position and push it forwards.
9. Using the pressure vessel, force the liquid fluid into the system.
10. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
11. Switch off the supply pressure, and **leave all connections fitted.**
12. **Slowly** move the lever to the right-hand position in neutral.
13. Seal off the nipple (3) and plug (4), and shut off the supply.
14. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.
15. Remove the connection to the reservoir and top up the fluid to the correct level. Place the cover on the reservoir.
16. Engage (forwards/reverse) and select (left/right) several times, so that the gear lever returns to the correct position.
17. If necessary, adjust the position of the gear lever, see chapter “Checking and adjusting”.

Note:
If, following filling and adjustment, no pressure is built up when the lever is moved, the connection must once again be bled/topped up. For each separate situation, the actions to be carried out are described below.



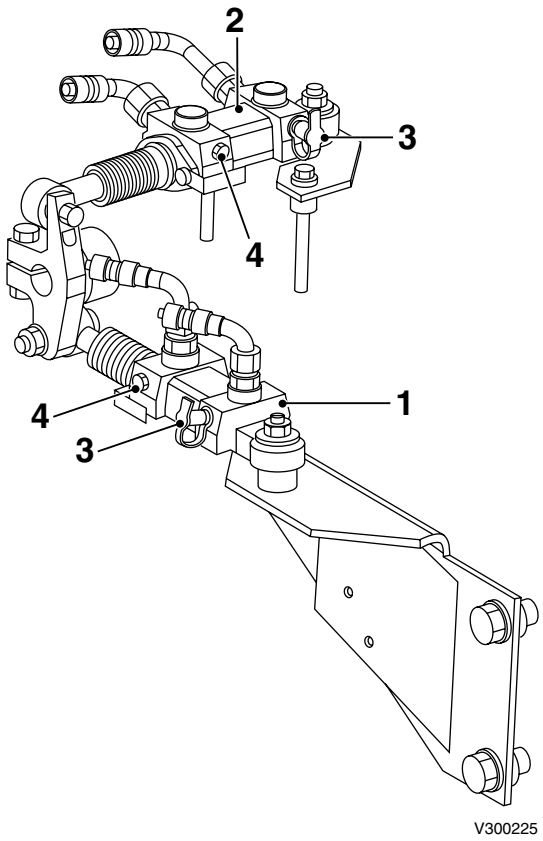
When the gear lever is moved backwards, no pressure is built up

1. Connect the pipe to nipple (3) of the gear engaging cylinder (1).
2. Have an assistant move the gear lever forwards, until pressure is built up.
3. Slacken the plug (4) through half a turn.
4. Have the assistant slowly move the gear lever forwards. **Never move the gear lever backwards when the plug is open.**
5. Retighten the plug (4) once the maximum front position of the gear lever has been reached (the gear lever should be held in this position by the assistant).
6. Open the nipple (3) half a turn and use the pressure tank to force the fluid into the system.
7. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
8. Switch off the supply pressure, and **leave all connections fitted.**
9. **Slowly** move the lever to the right-hand position in neutral.
10. Close the nipple (3) and shut off the supply.
11. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.



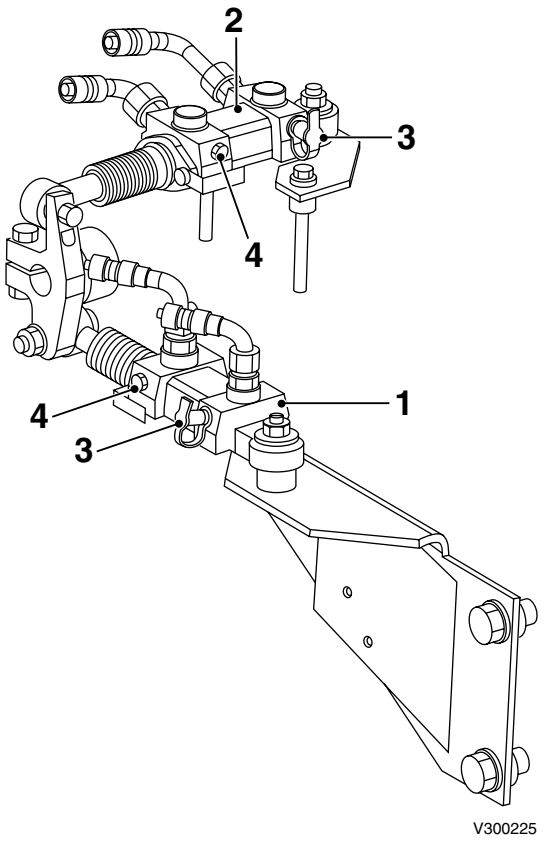
When the gear lever is moved forwards, no pressure is built up

1. Connect the pipe to nipple (3) of the gear engaging cylinder (1).
2. Have an assistant move the gear lever backwards, until pressure is built up.
3. Slacken the nipple (3) through half a turn.
4. Have the assistant slowly move the gear lever backwards. **Never move the gear lever forwards when the nipple is open.**
5. Retighten the nipple (3) once the maximum rear position of the gear lever has been reached (the gear lever should be held in this position by the assistant).
6. Open the plug (4) half a turn and use the pressure tank to force the fluid into the system.
7. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
8. Switch off the supply pressure, and **leave all connections fitted.**
9. **Slowly** move the lever to the right-hand position in neutral.
10. Close the nipple (4) and shut off the supply.
11. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.



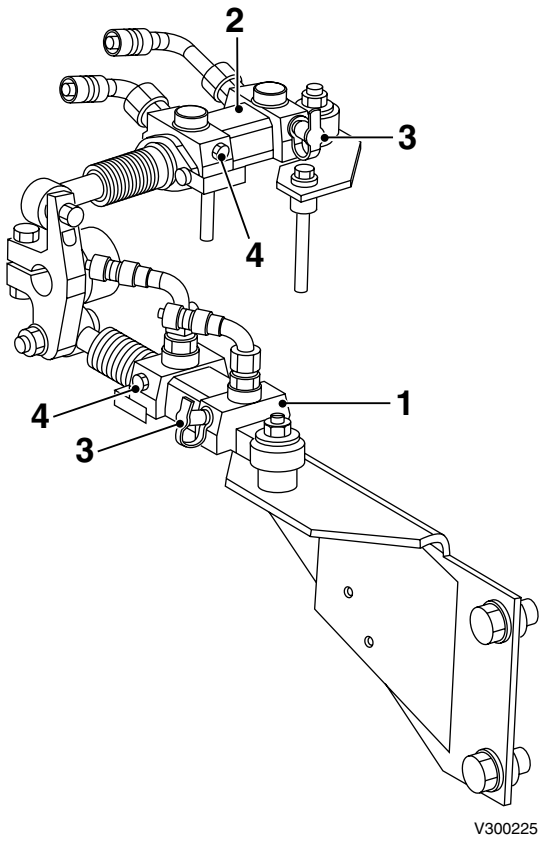
When the gear lever is moved to the right, no pressure is built up

1. Connect the pipe to the nipple (3) of the gate selection cylinder (2).
2. Have an assistant move the gear lever to the left, until pressure is built up.
3. Slacken the plug (4) through half a turn.
4. Have the assistant slowly move the gear lever to the left. **Never move the gear lever to the right when the nipple is open.**
5. Retighten the plug (4) once the maximum left-hand position of the gear lever has been reached (the gear lever should be held in this position by the assistant).
6. Open the nipple (3) half a turn and use the pressure tank to force the fluid into the system.
7. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
8. Switch off the supply pressure, and **leave all connections fitted.**
9. **Slowly** move the lever to the right-hand position in neutral.
10. Close the nipple (3) and shut off the supply.
11. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.



When the gear lever is moved to the left, no pressure is built up

1. Connect the pipe to the nipple (3) of the gate selection cylinder (2).
2. Have an assistant move the gear lever to the right, until pressure is built up.
3. Slacken the nipple (3) through half a turn.
4. Have the assistant slowly move the gear lever to the right. **Never move the gear lever to the left when the nipple is open.**
5. Retighten the nipple (3) once the maximum right-hand position of the gear lever has been reached (the gear lever should be held in this position by the assistant).
6. Open the plug (4) half a turn and use the pressure tank to force the fluid into the system.
7. Permit the fluid to flow, until no more air bubbles are noted in the reservoir.
8. Switch off the supply pressure, and **leave all connections fitted.**
9. **Slowly** move the lever to the right-hand position in neutral.
10. Close the nipple (4) and shut off the supply.
11. Remove the pressure filler pipe from the nipple and place the **clean** rubber cap on the nipple.



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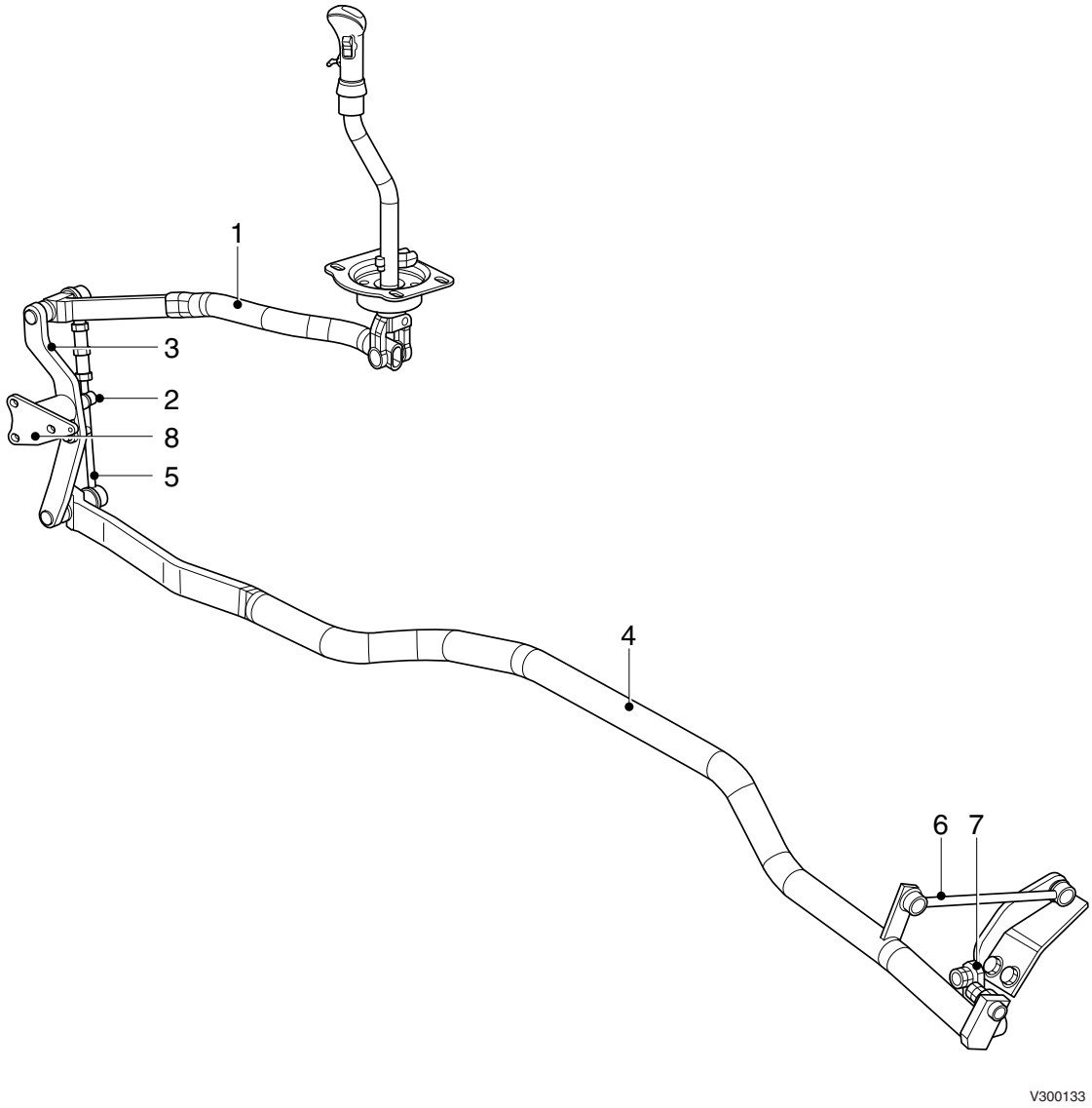
1. GENERAL

1.1 DESCRIPTION OF THE MECHANICAL GEARBOX CONTROL

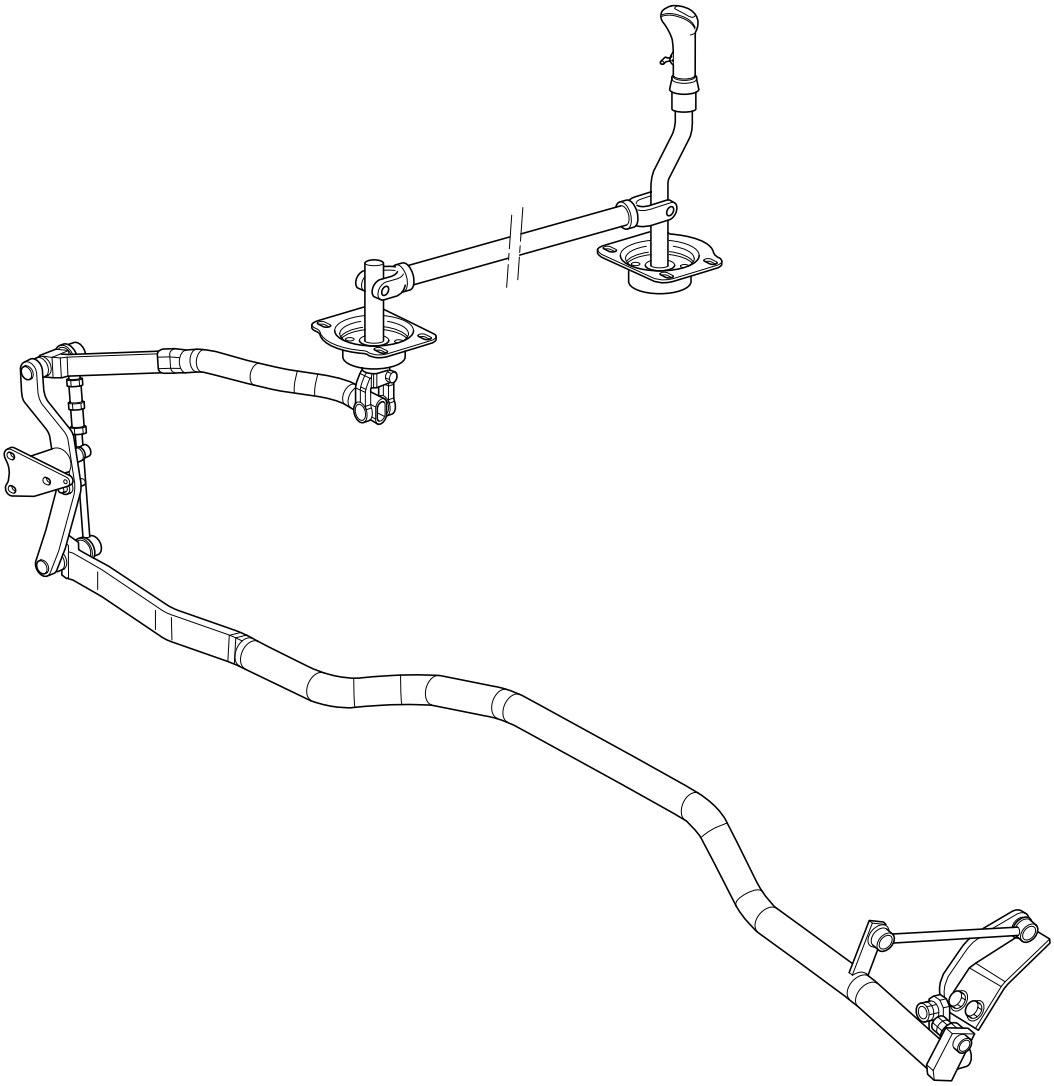


Control mechanism LHD
When the gear lever is moved forwards, the control rod (1) moves backwards. The rocker (3) moves around a shaft (2) connected to the inside of the cab bracket.

The backward movement of the control rod (1) is transferred to the control rod (4) by means of the rocker (3).
The shifting arm (7) connected to the control rod (4) is then moved forwards.

When the gear lever is moved backwards, the shifting arm (7) will also move backwards.

When the gear lever is moved to the left, the control rod (1) will move around its axle.
The ball joint of the control rod (1) rests on the rocker (3). As a result, the control rod (1) will move the torque rod (5) up.
At one side, the control rod (4) is attached to the rocker (3) by means of a ball joint, and at the other side to the torque rod (6) by means of a bracket. The upward movement of the torque rod (5) now also causes the control rod (4) to turn around its axle, thus moving the selector shaft in the gearbox via the shifting arm (7).



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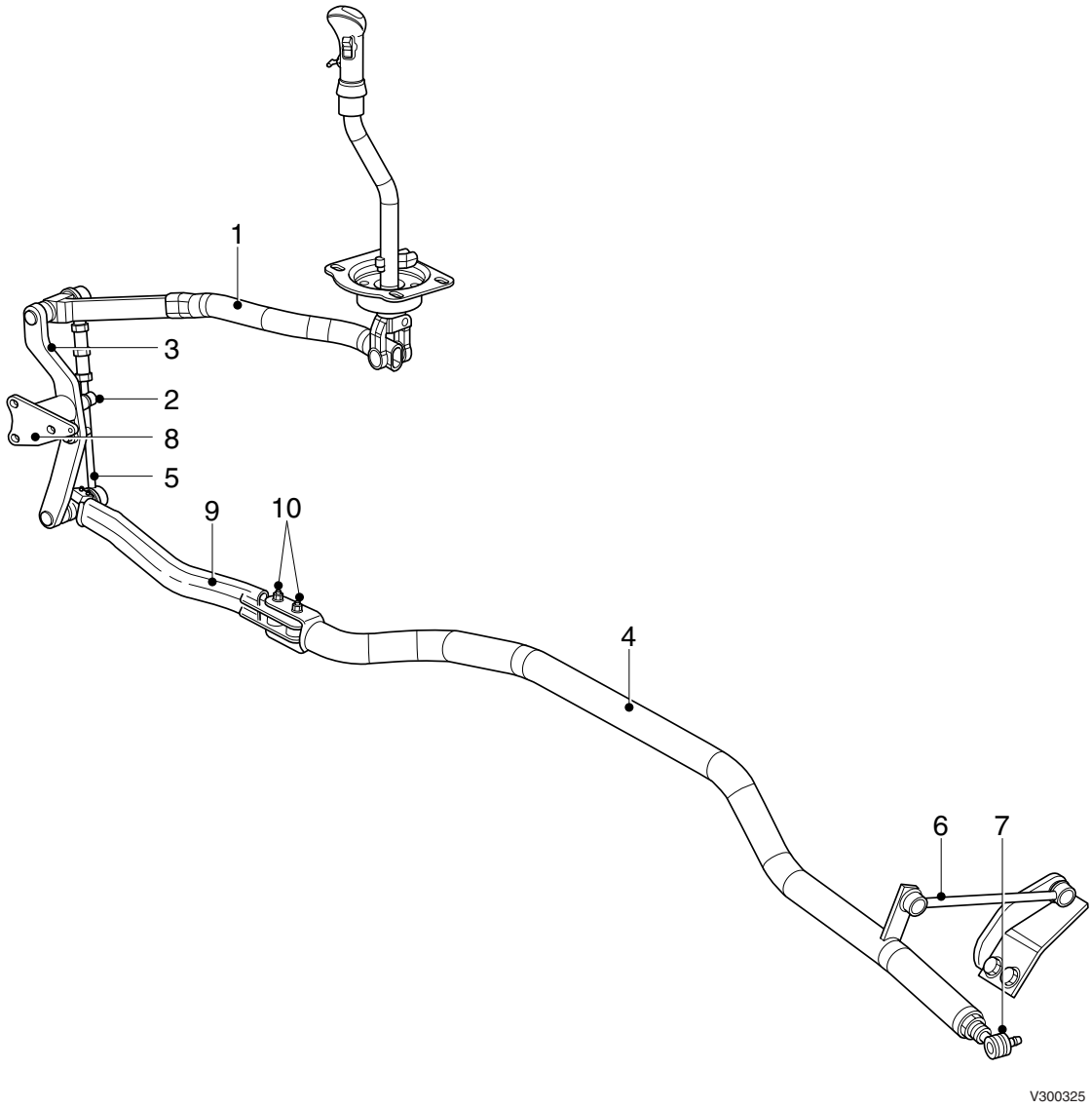
Control mechanism RHD
In the RHD version, the control mechanism remains mounted in place. An additional control rod, passing through a tunnel underneath the cab to the right-hand side of the vehicle, is added to the control mechanism

Tilting the cab
The gear lever must be free when the cab is tilted. The gear lever tilts with the cab.



Control mechanism with silentblocks

1. Gear lever control rod
2. Rocker shaft
3. Rocker
4. Rear control rod part
5. Rocker reaction rod
6. Rocker control rod
7. Ball joint
8. Rocker bracket
9. Front control rod part
10. Silentblocks

The control mechanism with silentblocks is even less sensitive to vibrations. Both MGS and servo shift can be equipped with these silentblocks.

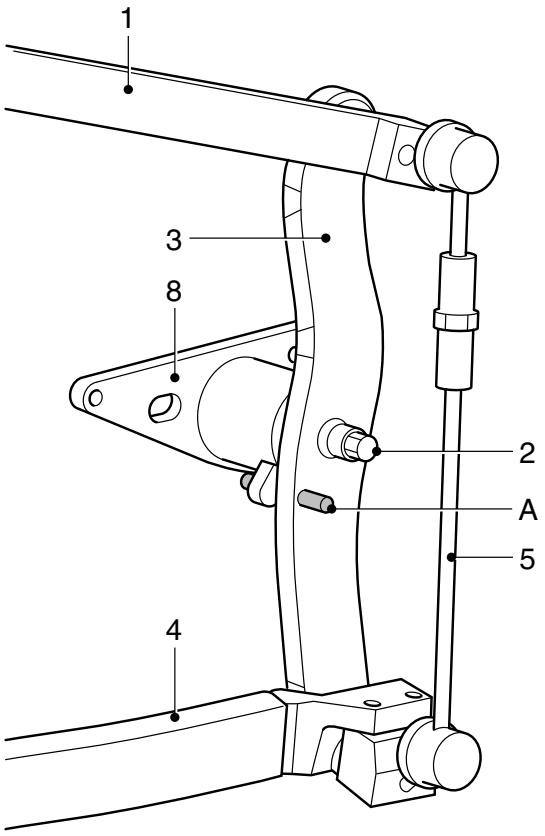
2. INSPECTION AND ADJUSTMENT

2.1 INSPECTION AND ADJUSTMENT, GEARBOX CONTROL LHD

Never tilt the cab with the dowel pins (A) and (B) in place.

Inspection, gearbox control LHD

1. Make sure that the gearbox is in neutral and the cab is **not** tilted.
2. Install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).
3. Push the control against the spring pressure to check whether it can move freely in neutral. The control must spring back independently into the gate 3/4. If this proves impossible, the ball joint and screw-thread insert must be adjusted.



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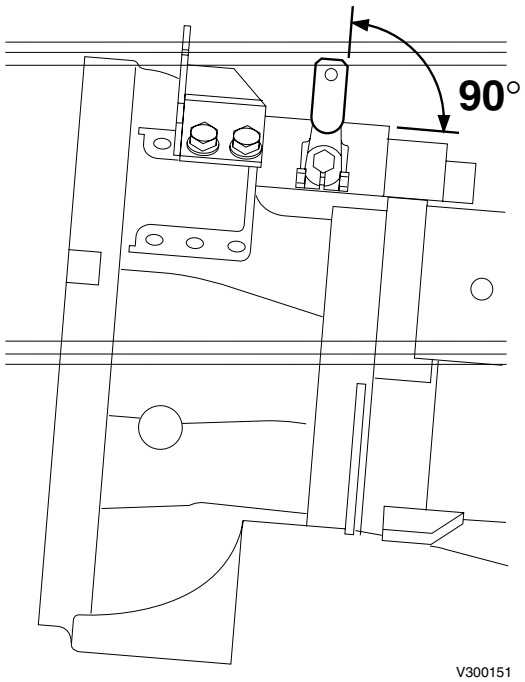
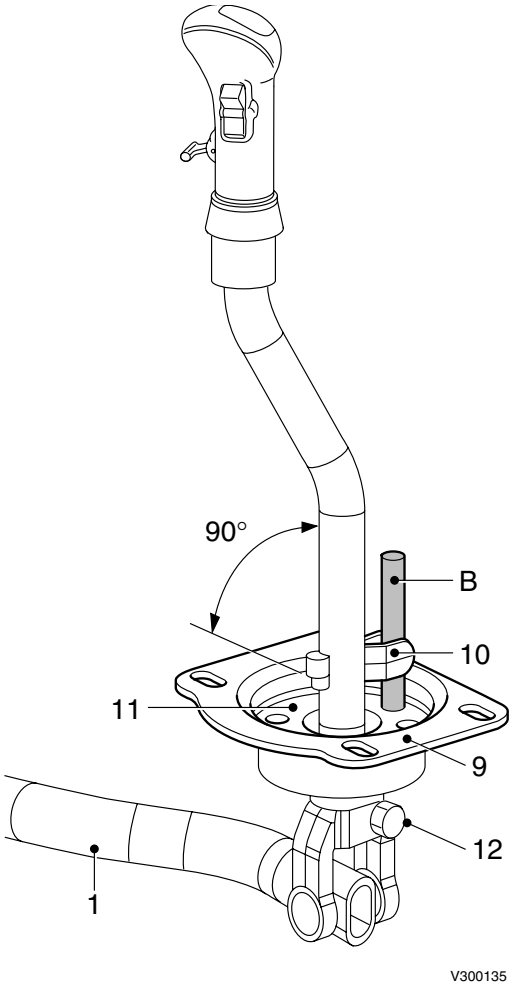
4. Ensure that the lever on the selector shaft is at a 90° angle to the gearbox. If necessary, correct the position of the lever.



5. Install the long dowel pin (B), special tool (DAF no. 1329347) into the guide (10) at the bottom of the gear lever, and into the boring in the bearing housing (11). If this proves impossible, the gear lever must be adjusted.
6. Remove the two dowel pins (A) and (B).
7. Check whether all gears can be engaged without components being hit.



Adjustment, gearbox control LHD

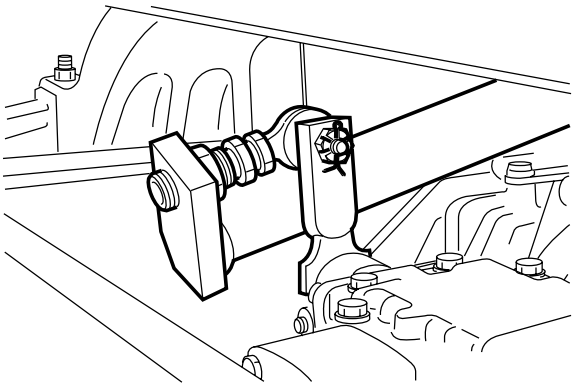
Never tilt the cab with the dowel pins (A) and (B) in place.

1. Remove the castle nut from the ball joint and disconnect the gearbox control from the arm of the gearbox.

   Note:
   The ball joint cannot be removed from the arm. This is not necessary to adjust the control.

2. Tilt the cab.

3. Check whether the fixing bolt (1) is present in the rocker bracket (8).
   If not, slacken the fixing bolts (2) and install the locating bolt (1). Then tighten the fixing bolts.



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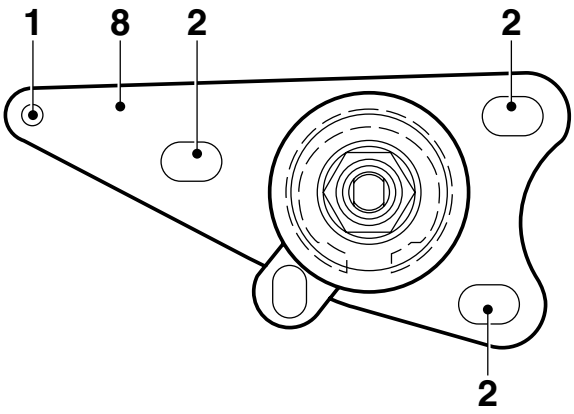

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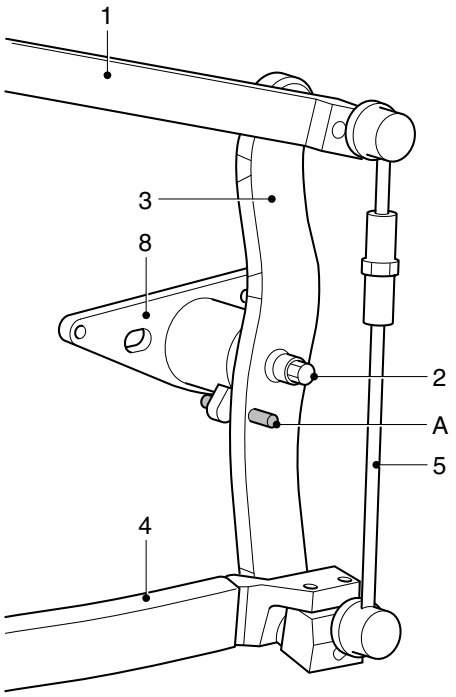
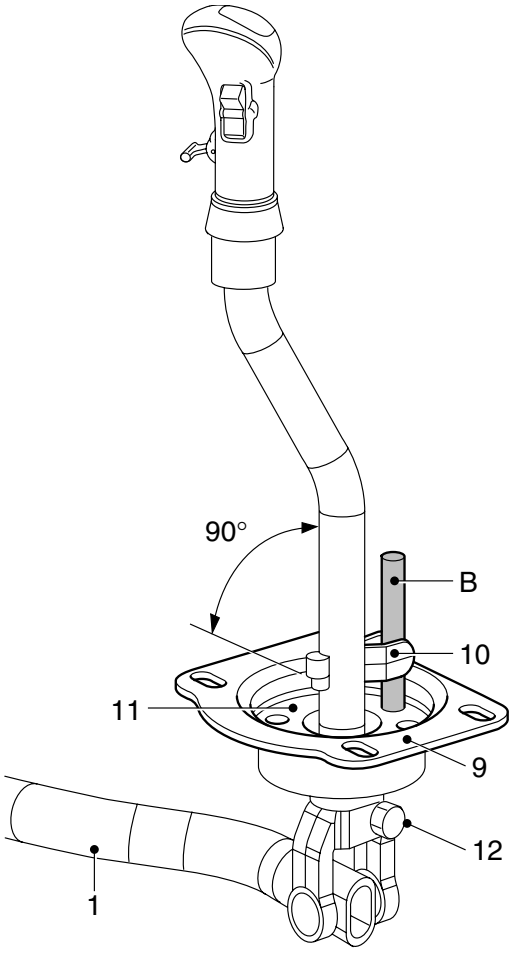
4. Install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).



V300134

5. Loosen the base plate (9) and slide it in towards the front of the vehicle until the long dowel pin (B), special tool (DAF no. 1329347) fits into the guide (10) at the bottom of the gear lever, and into the boring in the bearing housing (11).
6. Fasten the base plate (9), using the guiding pin (B) installed.
7. Remove the two dowel pins (A) and (B).
8. Tilt the cab back to the driving position.



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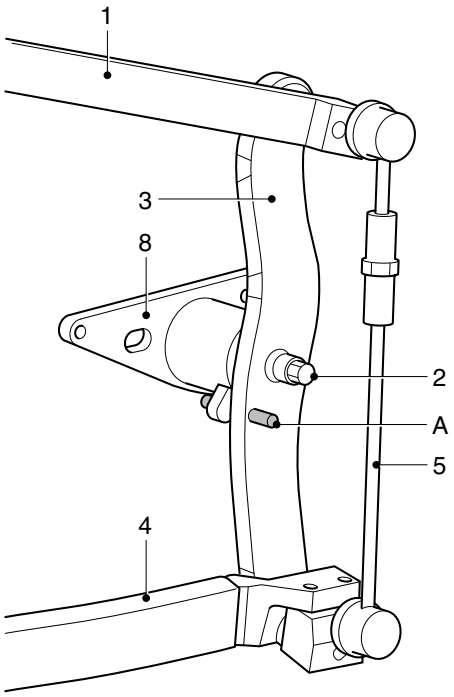
9. Re-install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).



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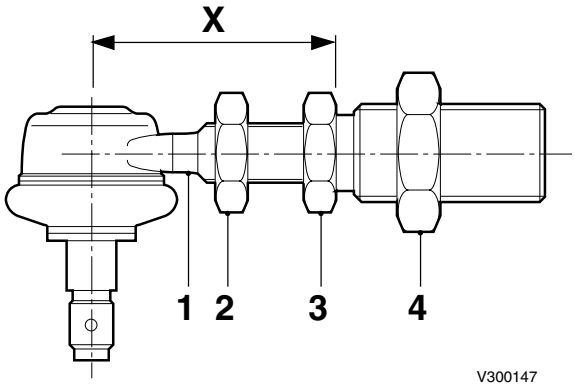
10. Loosen lock nuts (2) and (4) and adjust the length of the ball joint in such a way that, when installed, the control can move freely in neutral by pushing it against the spring pressure. The control must spring back independently in gate 3/4. Install the castle nut and split pin.

Note:
If the ball joint (1) and the screw-thread insert (3) have been separated, the ball joint (1) must first be screwed for its full length (X), (X = 69 mm) into the screw-thread insert (3) before screwing the screw-thread insert (3) into the control rod.

When the ball joint (1) and the screw-thread insert (3) have been installed and adjusted, the distances (D) and (E) must be approximately 68 mm and 27 mm, respectively.



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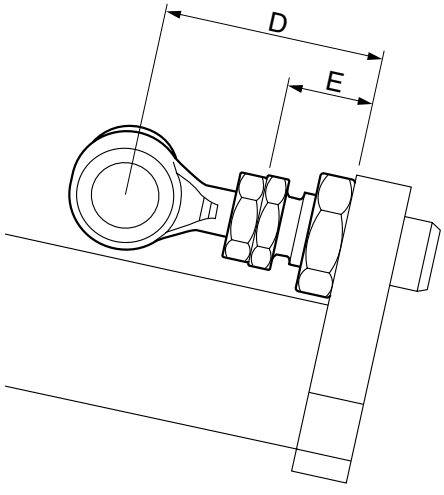
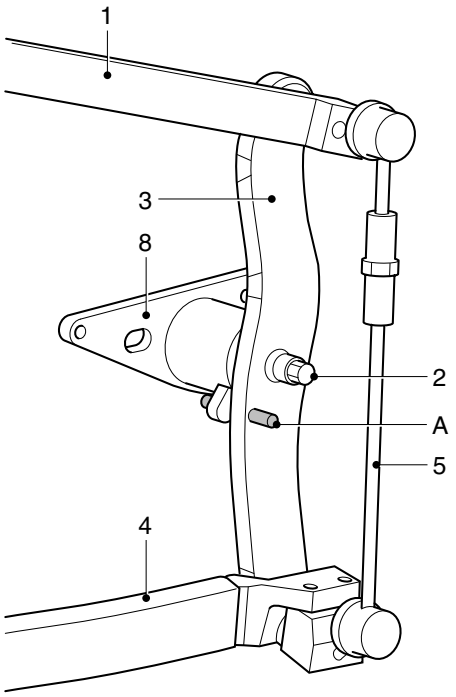


V300136

11. Loosen the lock nuts of the torque rod (5) and adjust the length in such a way that the long guiding pin (B), special tool (DAF no. 1329347) fits into the guide (10) at the bottom of the gear lever, and into the boring in the bearing housing (11). Tighten the lock nuts.
12. Remove the two dowel pins (A) and (B).
13. Check whether all gears can be engaged without components being hit.



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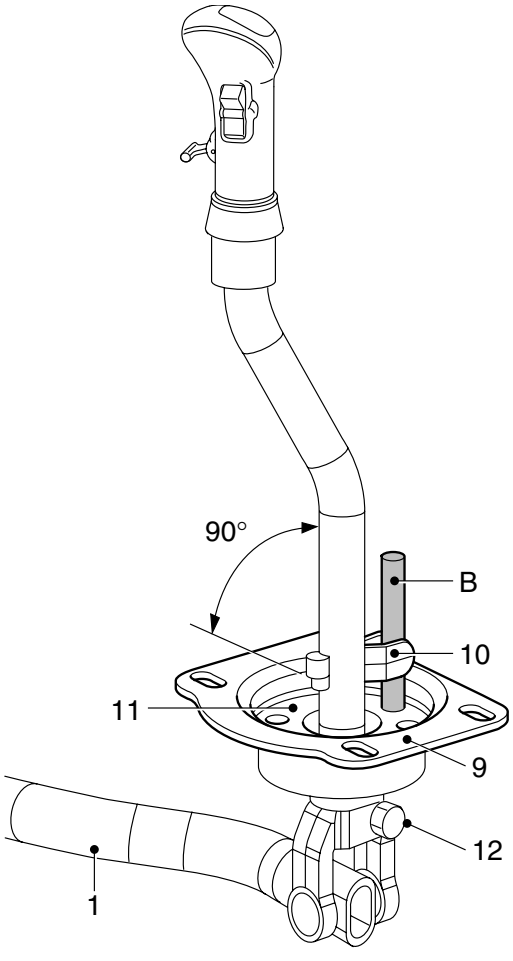

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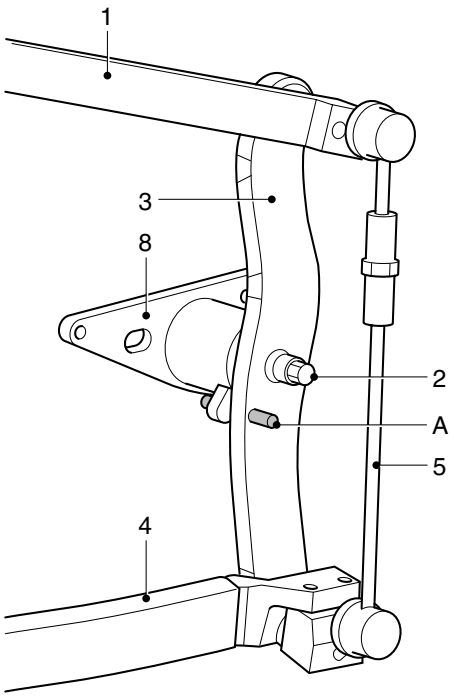
2.2 INSPECTION AND ADJUSTMENT, GEARBOX CONTROL RHD

Never tilt the cab with the dowel pin (A) in place.

Inspection, gearbox control RHD

1. Make sure that the gearbox is in neutral and the cab is **not** tilted.
2. Install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).
3. Push the control against the spring pressure to check whether it can move freely in neutral. The control must spring back independently into the gate 3/4. If this proves impossible, the ball joint and screw-thread insert must be adjusted.



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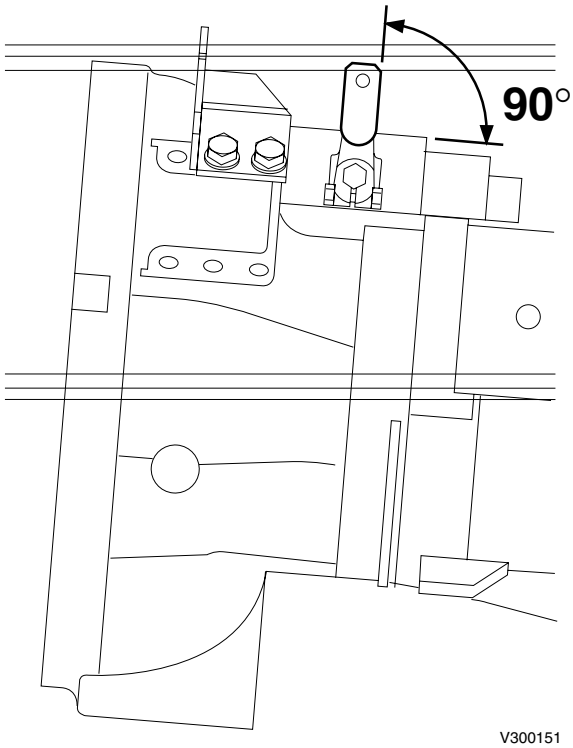
4. Ensure that the lever on the selector shaft is at a 90° angle to the gearbox. If necessary, correct the position of the lever.



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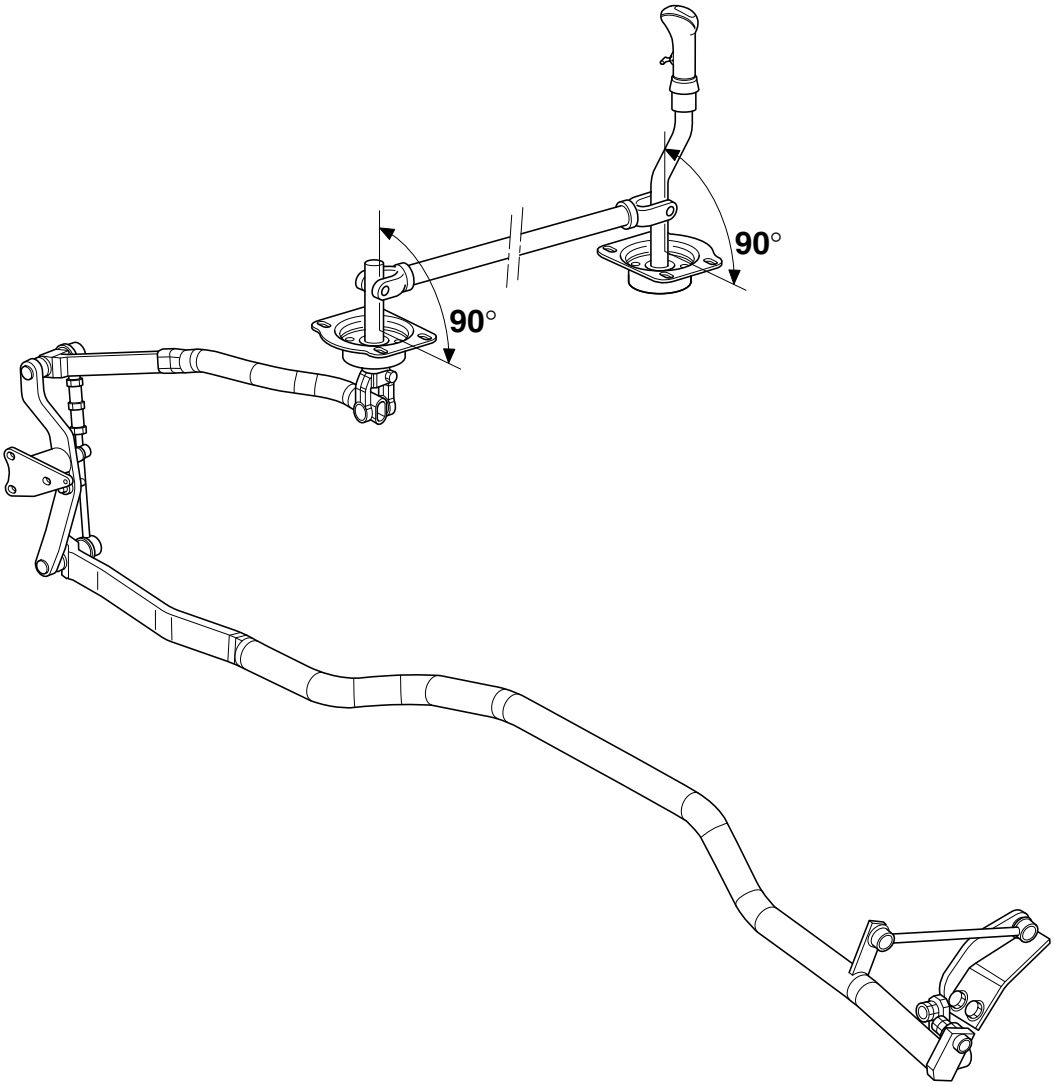


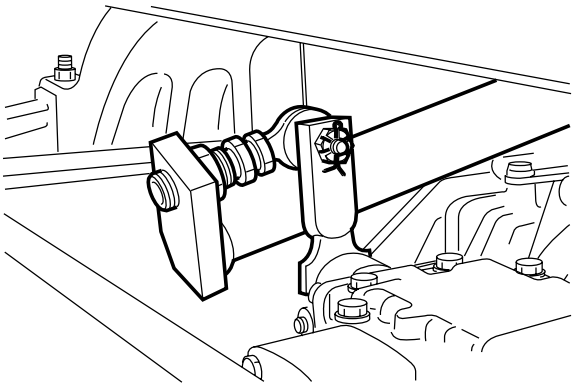
5. Check whether the gear lever and auxiliary control are at an 90° angle. If necessary, adjust the position of the gear lever and auxiliary control.
6. Remove the dowel pin (A).
7. Check whether all gears can be engaged without components being hit.

Adjustment, gearbox control RHD

Never tilt the cab with the dowel pin (A) in place.

1. Remove the castle nut from the ball joint and disconnect the gearbox control from the arm of the gearbox.

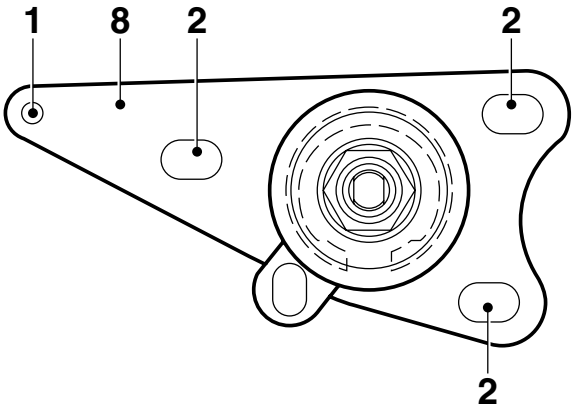
   Note:
   The ball joint cannot be removed from the arm. This is not necessary to adjust the control.



V300138

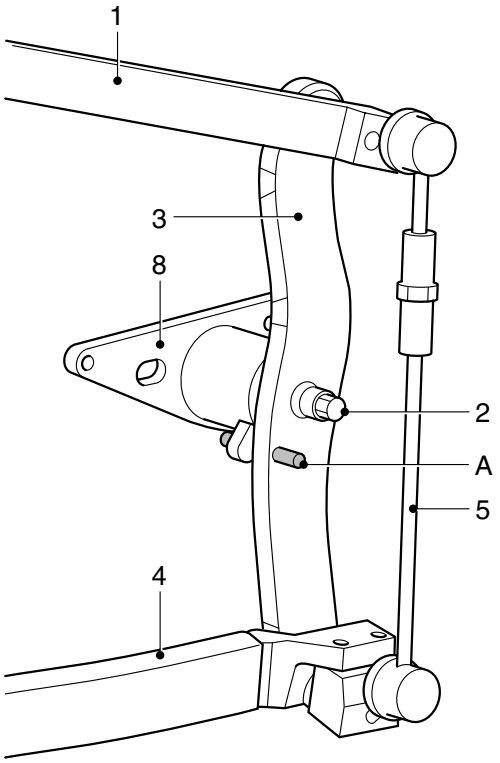
2. Tilt the cab.

3. Check whether the fixing bolt (1) is present in the rocker bracket (8).
   If not, slacken the fixing bolts (2) and install the locating bolt (1). Then tighten the fixing bolts.

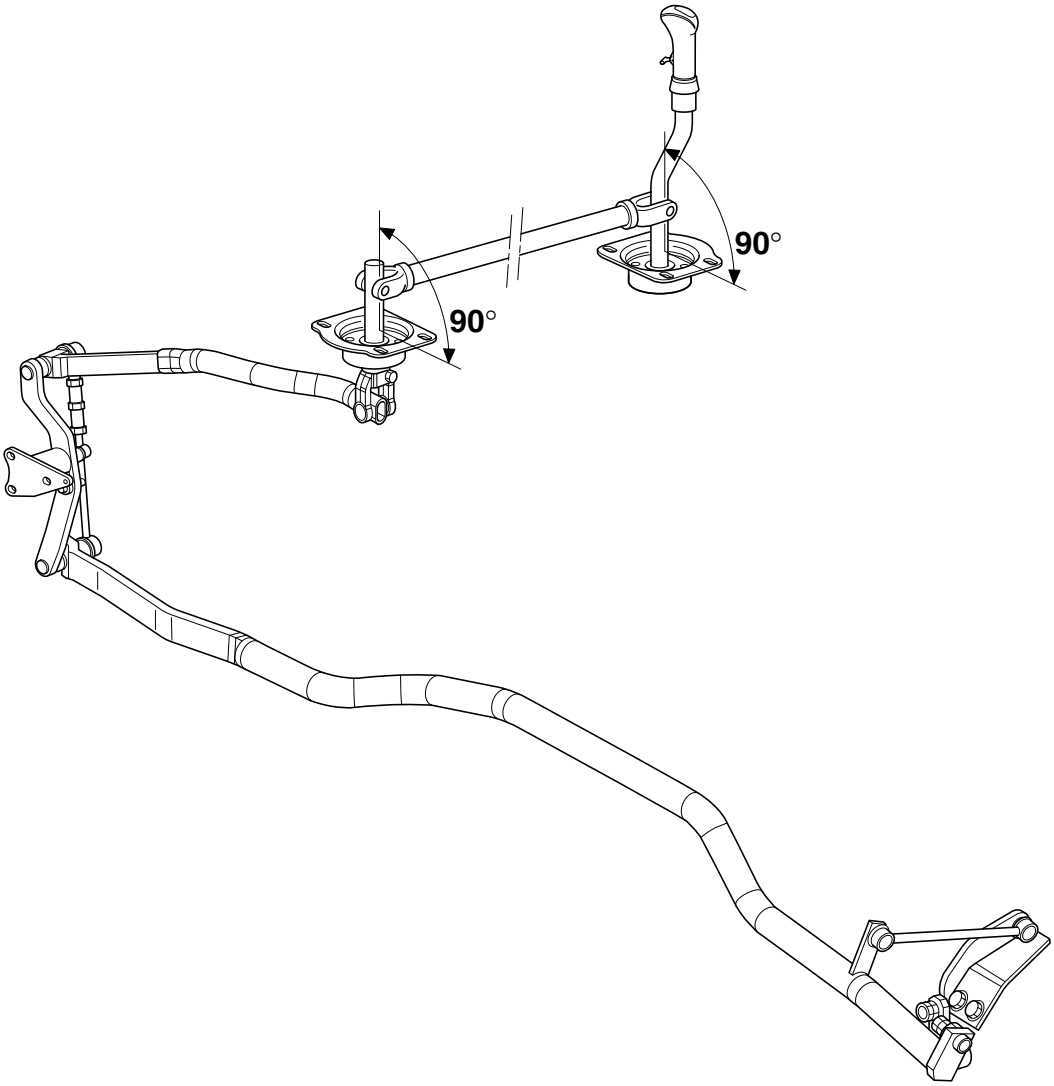


V300148

4. Install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).

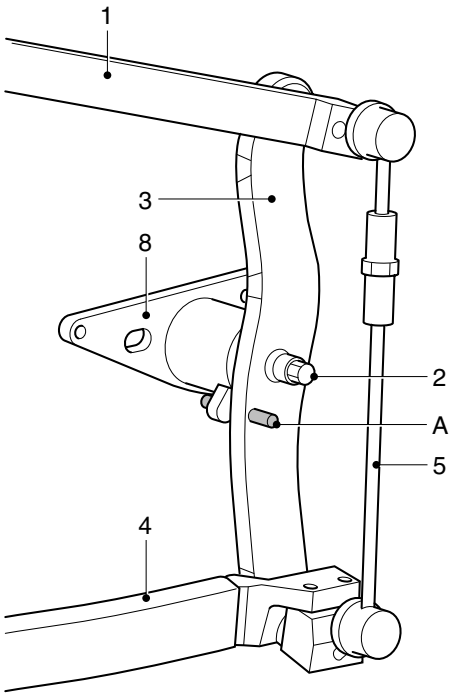


V300134



5. Loosen the base plates and slide them towards the front of the vehicle until the angle of the gear lever and auxiliary control is approximately 90°.
6. Fasten the base plates.
7. Remove the dowel pin (A).
8. Tilt the cab back to the driving position.

9. Re-install the short dowel pin (A), special tool (DAF no. 1329347) into the rocker (3) and rocker bracket (8).

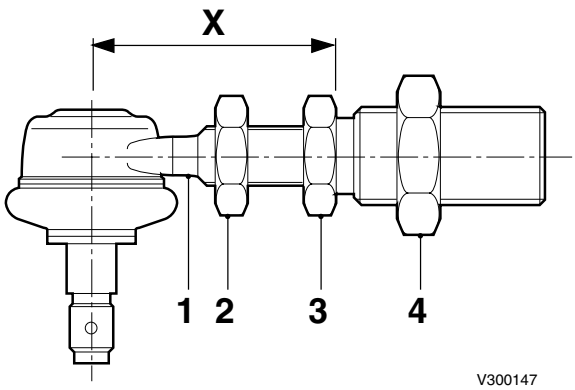


V300134

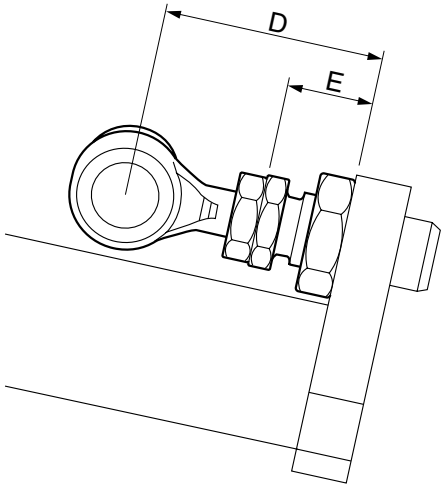
10. Loosen lock nuts (2) and (4) and adjust the length of the ball joint in such a way that, when installed, the control can move freely in neutral by pushing it against the spring pressure. The control must spring back independently in gate 3/4. Install the castle nut and split pin.

Note:
If the ball joint (1) and the screw-thread insert (3) have been separated, the ball joint (1) must first be screwed for its full length (X), (X = 69 mm) into the screw-thread insert (3) before screwing the screw-thread insert (3) into the control rod.

When the ball joint (1) and the screw-thread insert (3) have been installed and adjusted, the distances (D) and (E) must be approximately 68 mm and 27 mm, respectively.

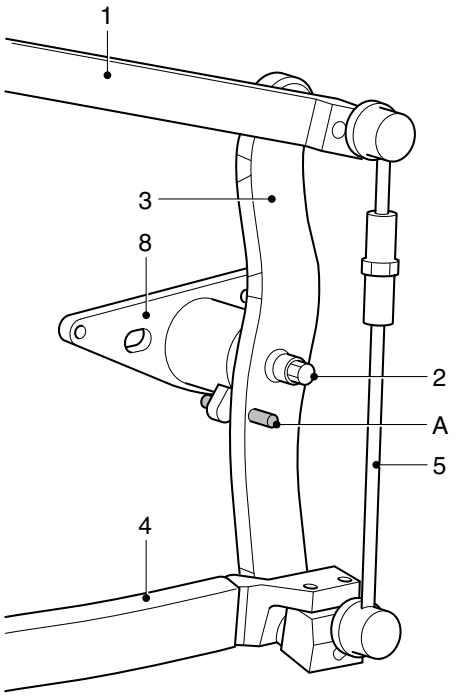


V300147



V300136

11. Loosen the lock nuts of the torque rod (5) and adjust the length in such a way that the gear lever shifting pattern is such that no components are hit. Tighten the lock nuts.
12. Remove the dowel pin (A).
13. Check whether all gears can be engaged without components being hit.



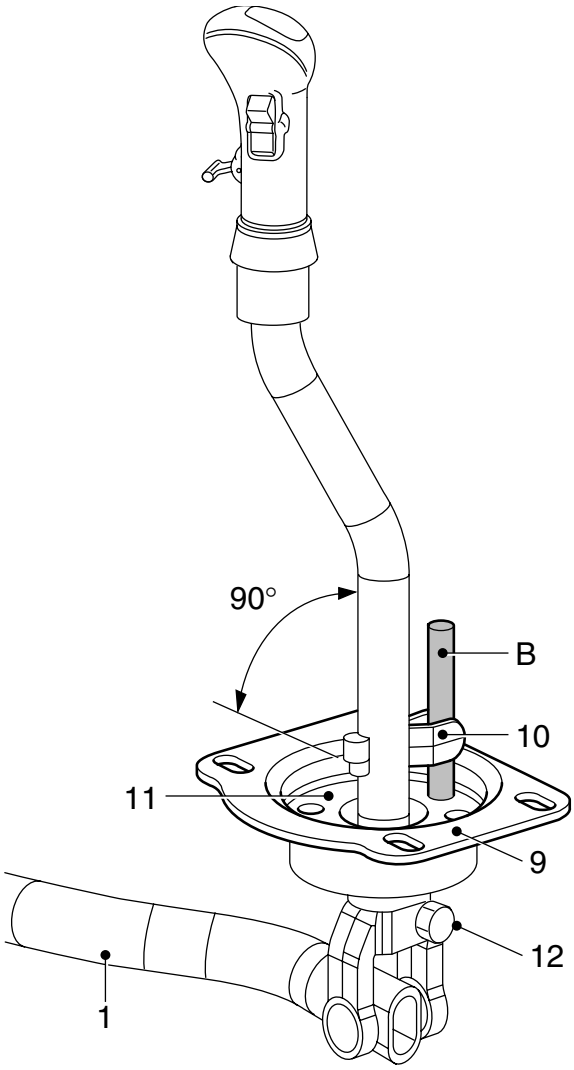
V300134

3. REMOVAL AND INSTALLATION

3.1 REMOVAL AND INSTALLATION, GEAR LEVER LHD

Removal, gear lever LHD

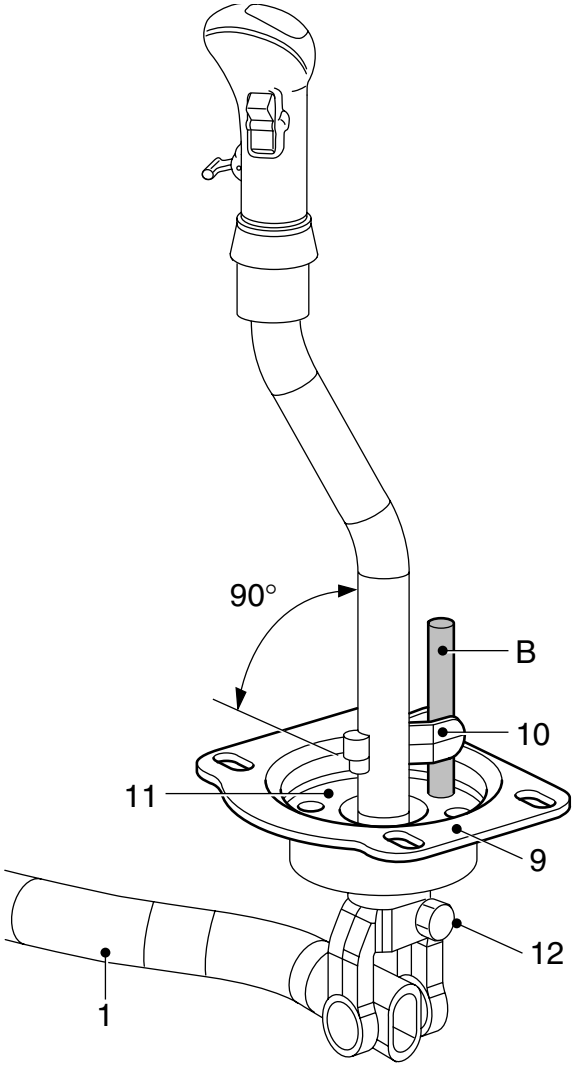
1. Disconnect the gear lever dust cover from the cab floor inside the cab.
2. Remove the shifting valve from the gear lever. Mark the air lines, as necessary.
3. Ensure that the gearbox is in neutral.
4. Tilt the cab.
5. Loosen the engine encapsulation and lower it onto the engine.
6. Remove the clamping bolt (12) and remove the control rod (1) from the gear lever.
7. Remove the fixing bolts from the base plate (9) and remove the entire gear lever unit from the cab floor.



V300135

Installation, gear lever

1. Before inserting the gear lever through the hole in the cab floor, install the control rod (1) onto the gear leaver and hand-tighten the clamping bolt (12).
2. Install the gear lever, including the guiding pin (B), into the cab floor and tighten the fixing bolts to the specified torque, see main group “Technical Data”.
3. Tighten the clamping bolt (12) to the specified torque.
4. Install the air pipes in the gear lever.
5. Install the shifting valve onto the gear lever.
6. Adjust the gearbox control, see chapter “Checking and Adjusting”.
7. Install the engine encapsulation by installing the torque rod fixing bolts to the top of the cab.
8. Install the gear lever dust cover.

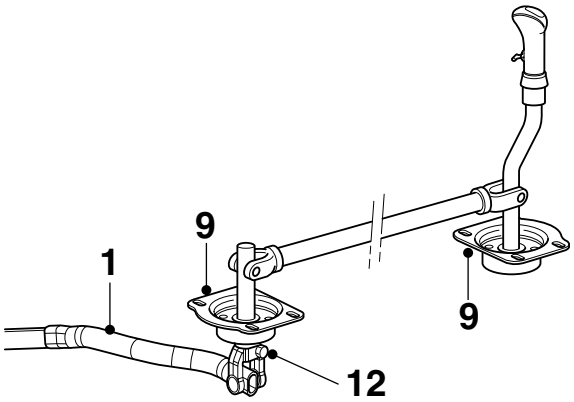


V300135

3.2 REMOVAL AND INSTALLATION OF GEAR LEVER RHD

Removal, gear lever RHD

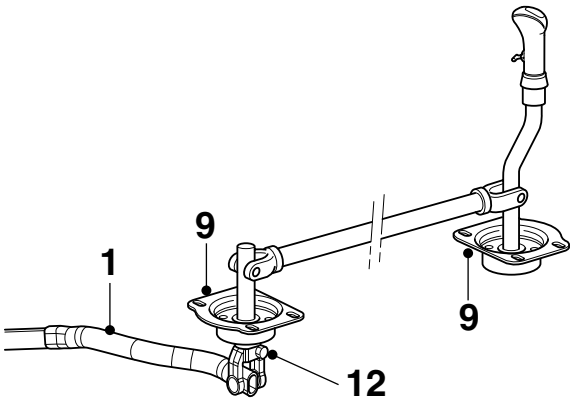
1. Disconnect the gear lever dust cover from the cab floor inside the cab.
2. Remove the shifting valve from the gear lever. Mark the air lines, as necessary.
3. Ensure that the gearbox is in neutral.
4. Tilt the cab.
5. Loosen the engine encapsulation and lower it onto the engine.
6. Remove the clamping bolt (12) and remove the control rod (1) from the gear lever.
7. Remove the shift control cover at the bottom of the cab.
8. Remove the fixing bolts from the base plates (9) and remove the entire gear lever, including connecting rod and auxiliary control, from the cab floor.



V300150

Installation, gear lever RHD

1. Install the gear lever, including connection rod and auxiliary control, onto the cab floor and hand-tighten the fixing bolts.
2. Ensure that the gear lever and auxiliary control are at a 90° angle and tighten the fixing bolts to the specified torque, see main group “Technical Data”.
3. Install the control rod (1) onto the auxiliary control and tighten the clamping bolt (12) to the specified torque.
4. Install the air pipes in the gear lever.
5. Install the shifting valve onto the gear lever.
6. Adjust the gearbox control, see chapter “Checking and Adjusting”.
7. Install the shift control cover at the bottom of the cab.
8. Install the engine encapsulation by installing the torque rod fixing bolts to the top of the cab.
9. Install the gear lever dust cover.

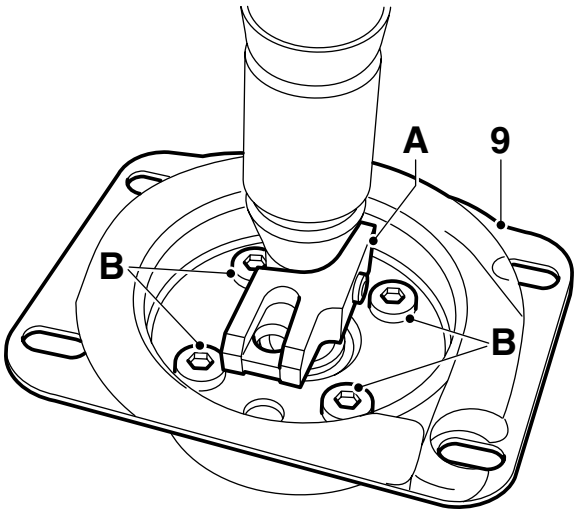


V300150

3.3 REMOVAL AND INSTALLATION, GEAR LEVER BALL

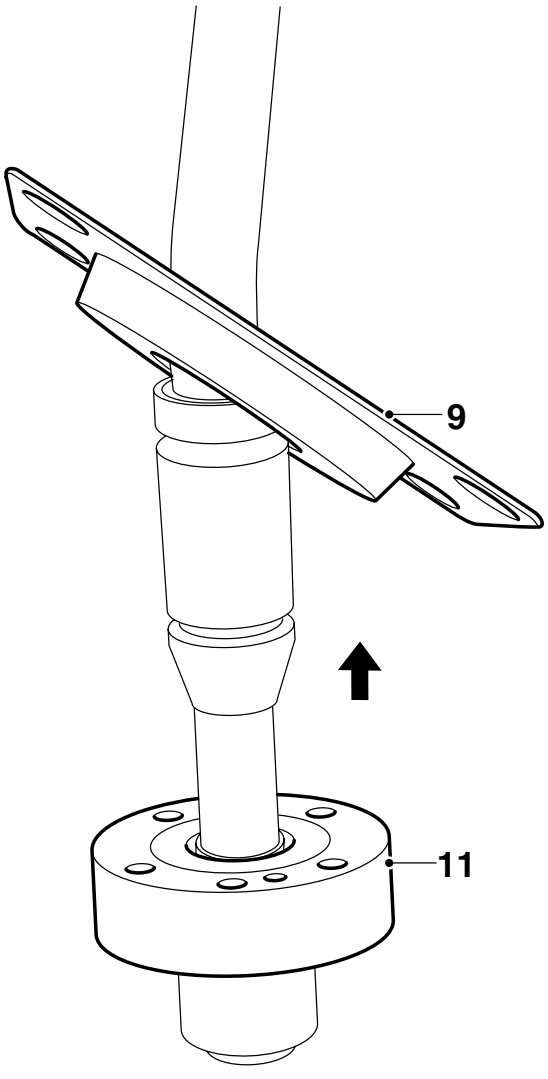
Removal, gear lever ball

1. Remove the entire gear lever.
2. Remove the guide (A) from the gear lever and the fixing bolts (B) from the base plate (9).



V300149

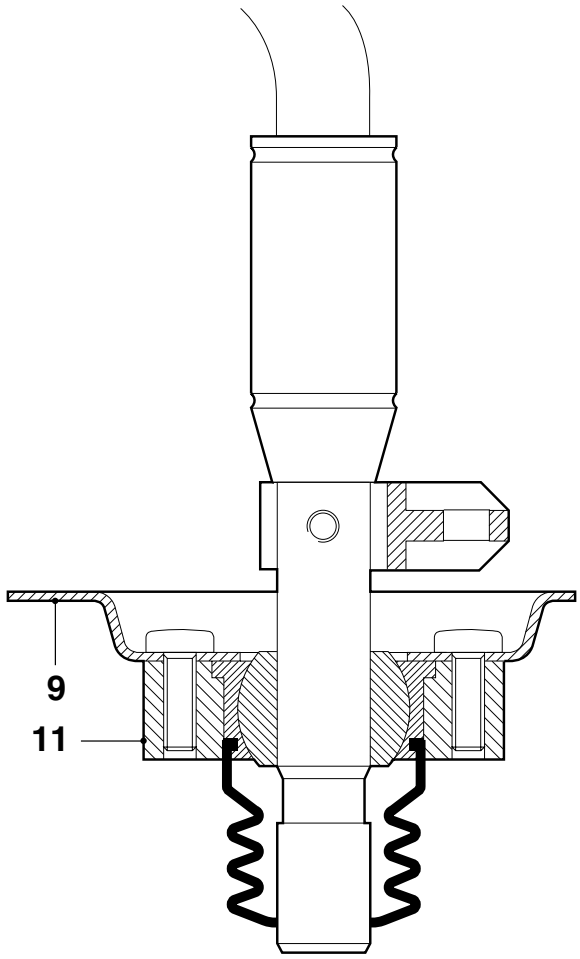
3. Remove the gear lever from the bearing housing (11).
4. Use a press to remove the ball from the gear lever. It may be necessary to heat the ball.



V300152

Installation, gear lever ball

1. Slide the base plate (9) over the gear lever before installing the ball.
2. Apply a degreasing agent to the surfaces of the gear lever and ball that are to be glued, see main group “Technical Data”. Immediately wipe the surfaces with a clean piece of paper or a lint-free cloth.
3. Apply glue all around the gluing surface of the gear lever and the ball, see main group “Technical Data”.
4. Place the lever into the ball and turn it around several times to distribute the glue evenly.
5. Set the gear lever and ball aside in a **vertical** position. Let the assembly set; it may be moved after 1 hour and installed after 3 hours. Maximum shear strength is achieved after 24 hours of setting.
6. Install the gear lever in the bearing housing (11).
7. Attach the base plate (9) to the bearing housing (11).



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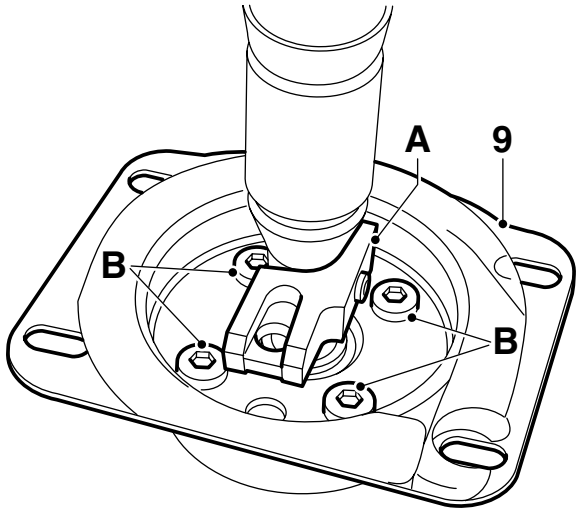
8. Install the guide (A) onto the gear lever.
9. Install the gear lever.



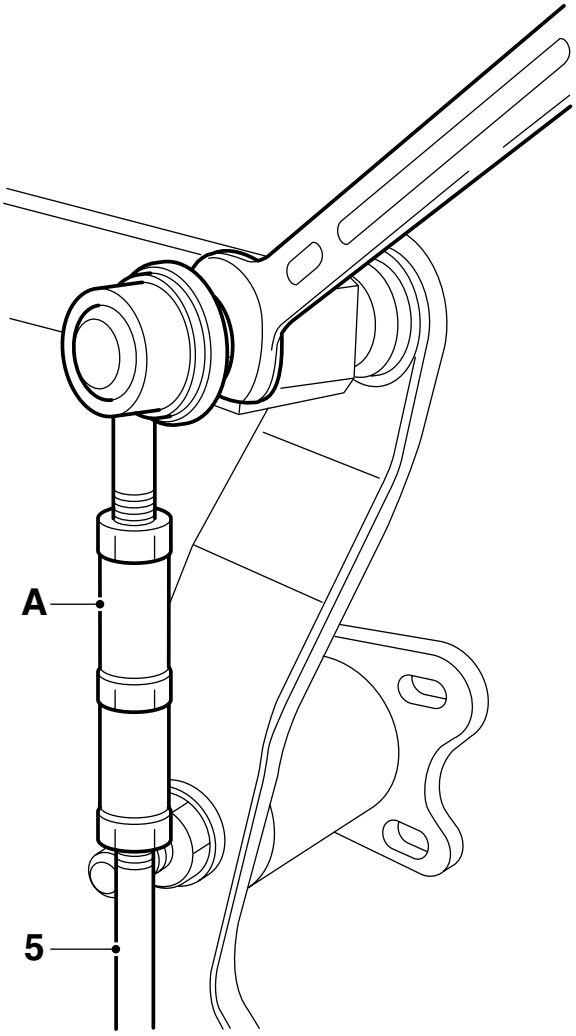
V300149

3.4 REMOVAL AND INSTALLATION, ROCKER TORQUE ROD

Removal, rocker torque rod
1. Remove the lower grille.
2. Loosen the ball joint at the lower and upper ends of the torque rod (5).
3. Remove the torque rod (5).

Installation, rocker torque rod
Note:
Ensure that the adjusting facility (A) of the torque rod (5) is at the top of the control.

1. Install the torque rod (5).
2. Fasten the ball joints.
3. Adjust the gearbox control, see chapter “Checking and Adjusting”.

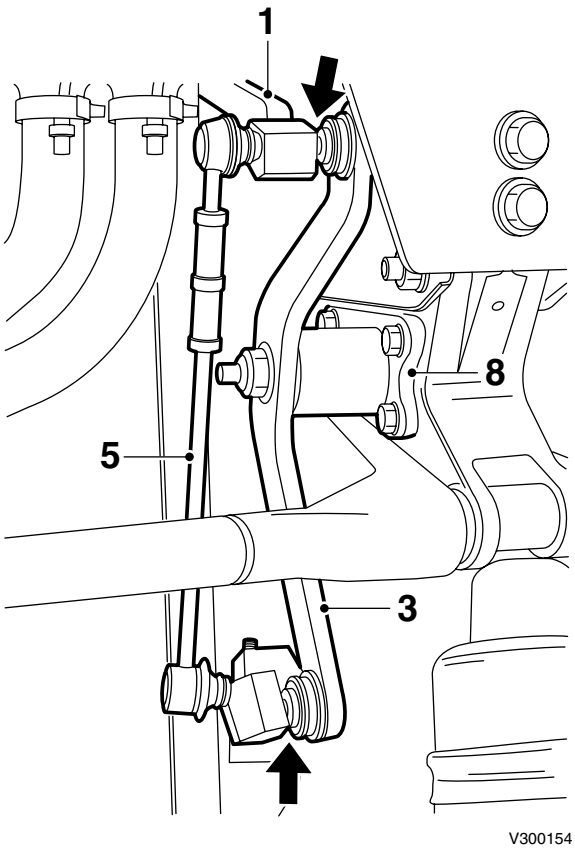


V300153

3.5 REMOVAL AND INSTALLATION, ROCKER

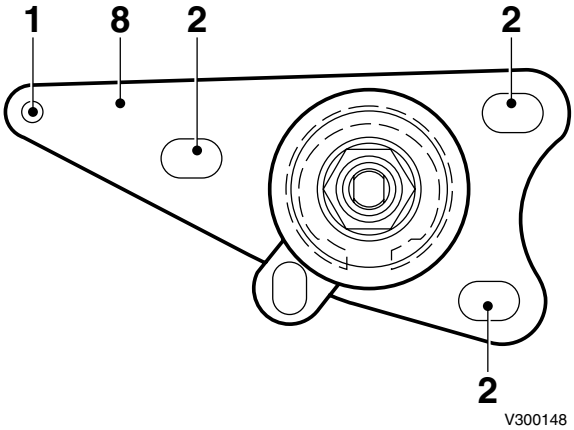
Removal, rocker

1. Ensure that the gearbox is in neutral.
2. Remove the lower grille.
3. At the top, loosen the ball joint of the rocker strip (3) on the control rod (1).
4. At the bottom, loosen the ball joint of the rocker strip (3) from the connection piece.



V300154

5. Remove the fixing bolts (2) and the centring bolt (1) from the rocker bracket (8). Remove the entire rocker.



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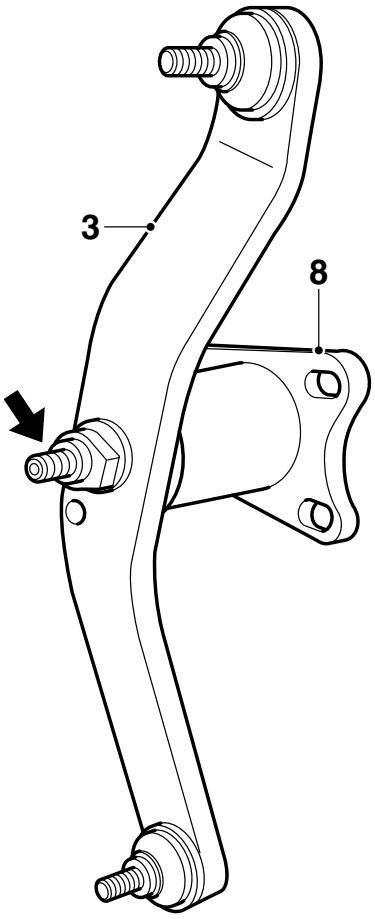
6. Remove the lock nut and remove the rocker strip (3) from the rocker bracket (8).

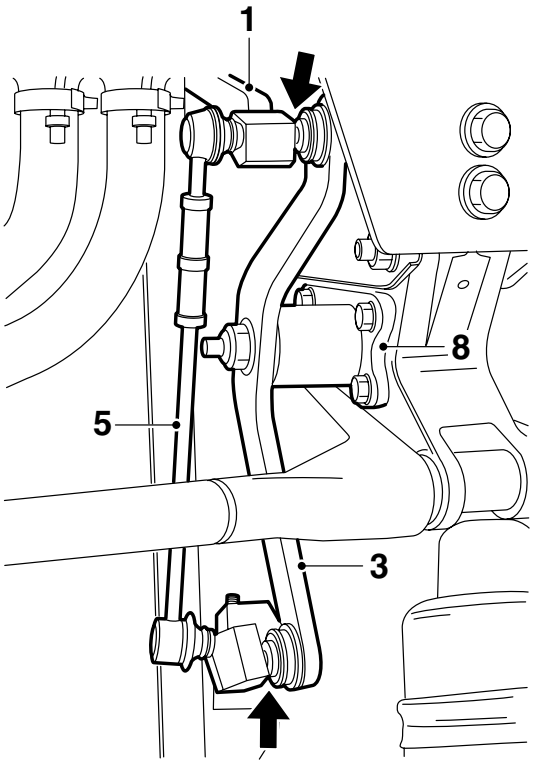
Installation, rocker

1. Install the rocker strip (3) onto the rocker bracket (8) and tighten the lock nut to the specified tightening torque, see main group “Technical Data”.
2. Install the rocker bracket assembly onto the cab bracket.



V300155

3. At the top, install the ball joint of the rocker strip (3) in the control rod (1).
4. At the bottom, install the ball joint of the rocker strip (3) in the connection piece.
5. Adjust the gearbox control, see chapter “Checking and Adjusting”.
6. Install the lower grille.

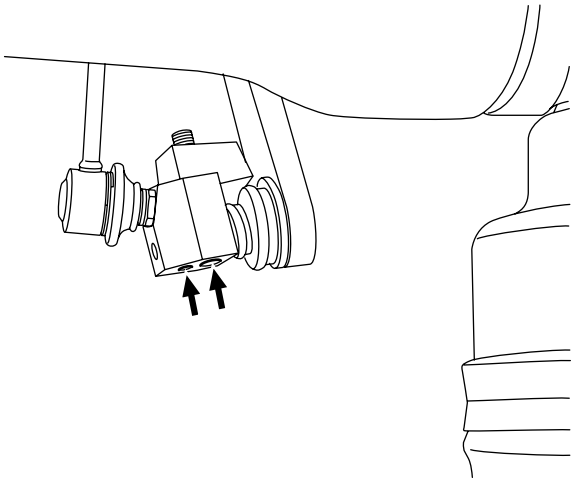


V300154

3.6 REMOVAL AND INSTALLATION, CONTROL ROD

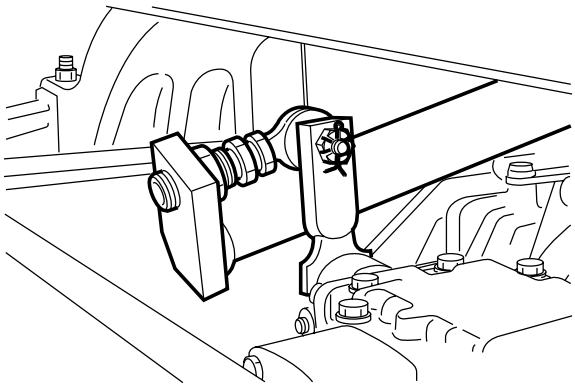
Removal, gearbox/rocker control rod

1. Remove the lower grille.
2. Remove the fixing bolts of the control rod on the connection piece.



V300156

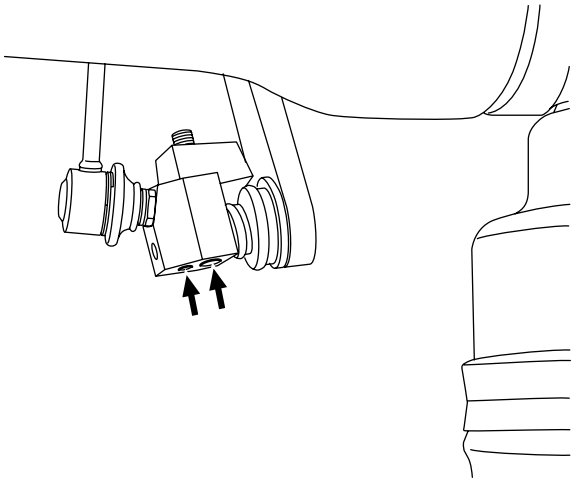
3. Remove the castle nut from the ball joint and disconnect the gearbox control from the arm of the gearbox.
4. Tilt the cab.
5. Loosen the torque rod on the clutch housing.
6. Remove the control rod.



V300138

Installation, gearbox/rocker control rod

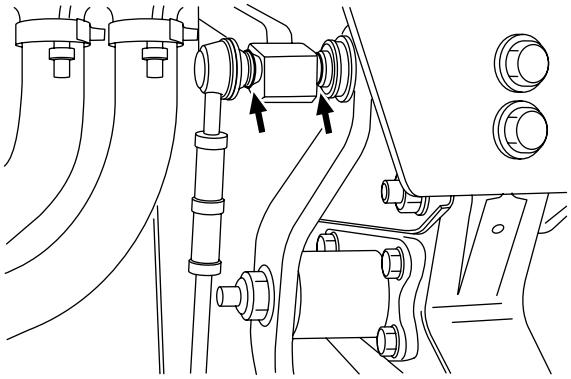
1. Position the control rod.
2. Install the fixing bolts of the control rod on the connection piece.
3. Install the ball joint in the control arm hole, but do not fasten it yet. Install the torque rod onto the clutch housing.
4. Adjust the gearbox control, see chapter “Checking and Adjusting”.
5. Install the lower grille.



V300156

Removal, gear lever/rocker control rod

1. Loosen the ball joint of the torque rod at the upper end of the rocker.
2. Loosen the ball joint of the control rod on the rocker.
3. Tilt the cab.
4. Loosen the engine encapsulation and lower it onto the engine.

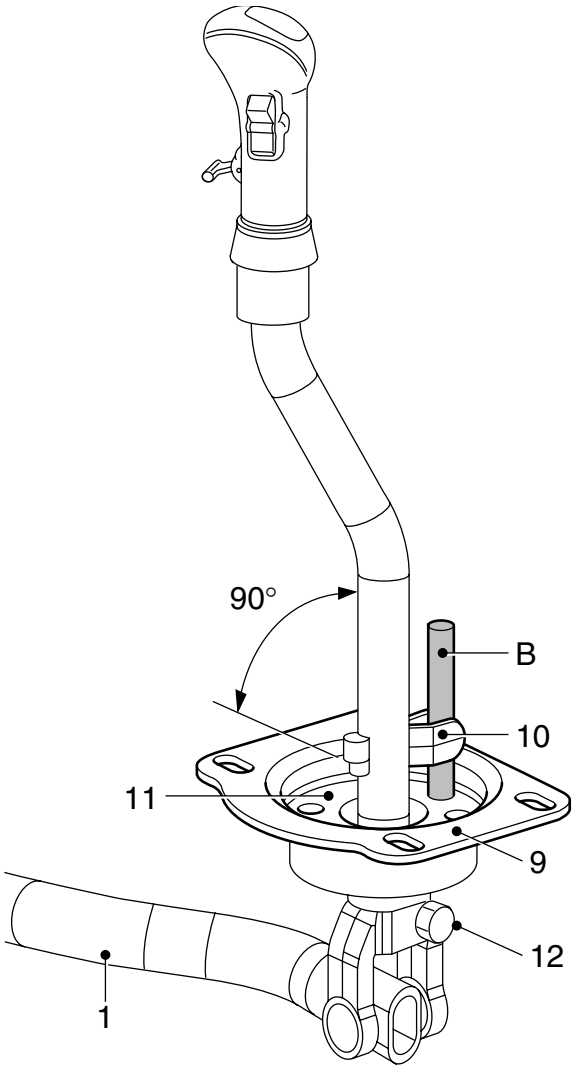


V300157

5. Remove the clamping bolt (12) and remove the control rod (1) from the gear lever.

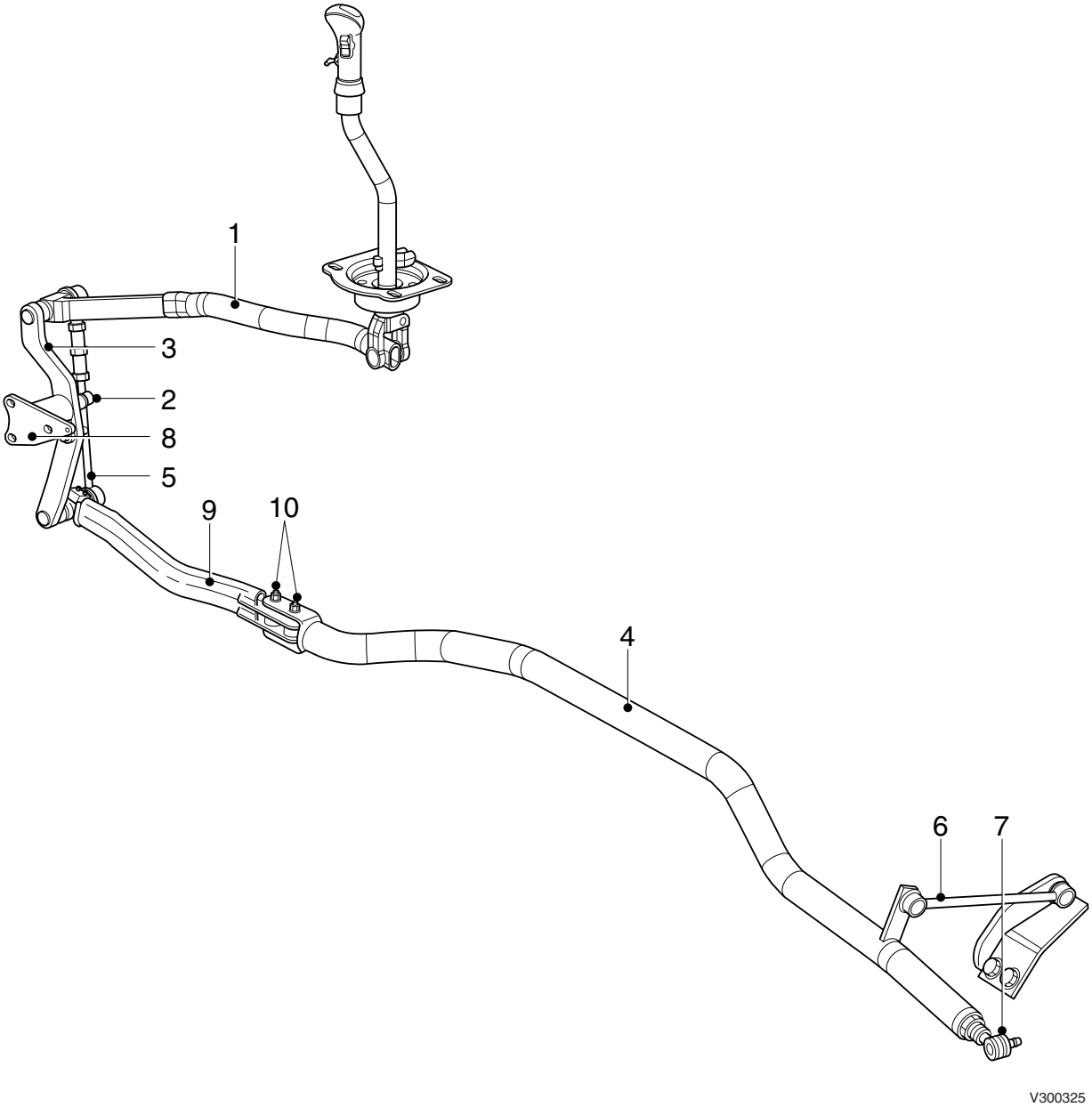
Installation, gear lever/rocker control rod

1. Install the control rod (1) onto the gear lever and hand-tighten the clamping bolt (12).
2. Install the control rod (1) onto the rocker and hand-tighten the ball joint.
3. Install the ball joint of the torque rod.
4. Tighten the clamping bolt (12) to the specified torque.
5. Adjust the gearbox control, see chapter “Checking and Adjusting”.

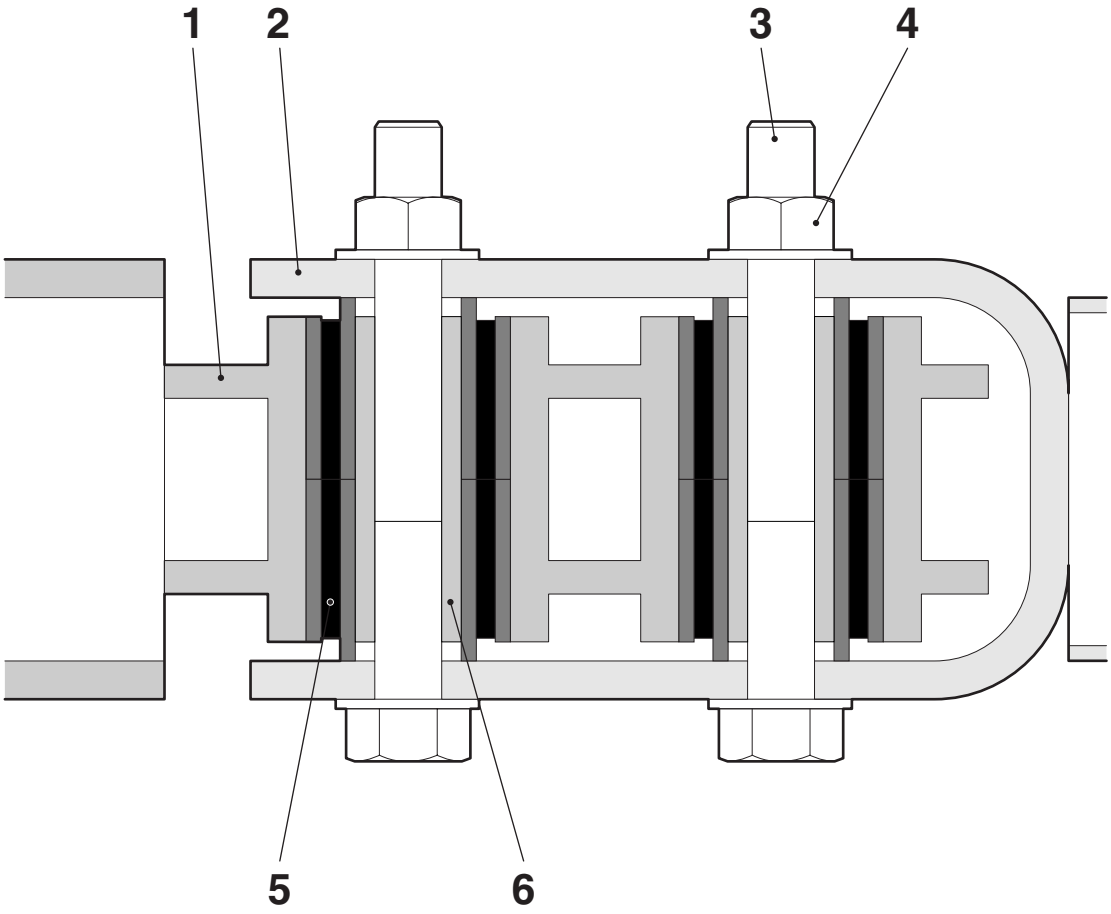


V300135

3.7 REMOVAL AND INSTALLATION, SILENTBLOCKS



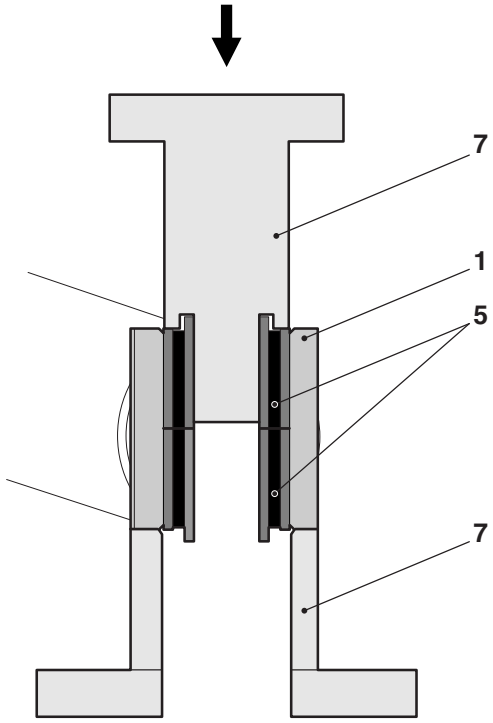
1. Gear lever control rod
2. Rocker shaft
3. Rocker
4. Rear control rod part
5. Rocker reaction rod
6. Rocker control rod
7. Ball joint
8. Rocker bracket
9. Front control rod part
10. Silentblocks



Removal, silentblocks

1. Tilt the cab.
2. Remove the two fixing bolts (3) from the silentblocks (5) and put the rear part of the control rod (2) aside.
3. Remove the two steel bushes (6) inserted into the silentblocks.
4. Remove the two fixing bolts from the front part of the control rod at the rocker.

5. Press both silentblocks (5) on one side from the control rod (1) using a press and special tool (7) (DAF no. 1329449).



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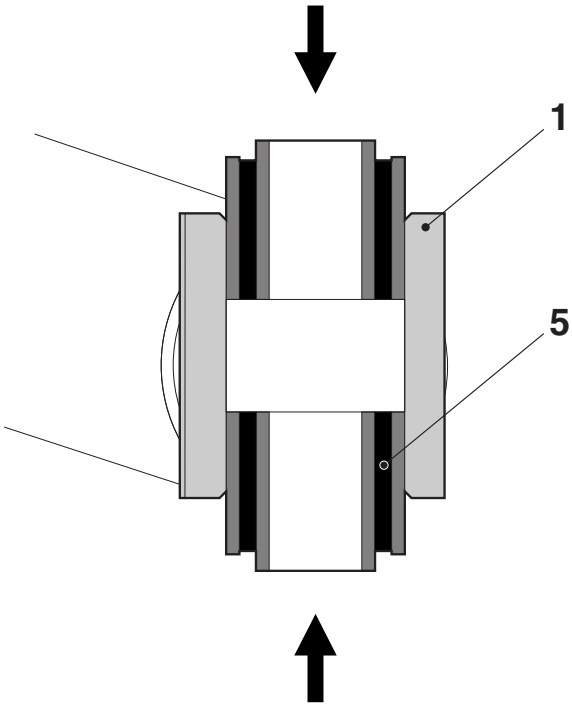
Installation, silentblocks

Note:
Note the correct position of the silentblocks. The protruding bushes must point outward.

1. Press the new silentblocks into the control rod using the special tool (DAF no. 1329449). Press one silentblock (5) from one side and the other silentblock from the other side into the control rod (1).
2. Install the control rod (1) on the rocker.
3. Fit new steel bushes into the silentblocks and fit both control rod parts using new bolts and nuts.
4. Adjust the gearbox control, see chapter “Checking and Adjusting”.



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2.1	Operation of servo shift unit	2-1	0002
2.2	Operation of emergency shifting	2-6	0002
3.	**REMOVAL AND INSTALLATION**	3-1	0002
3.1	Removal and installation of servo shift unit	3-1	0002

4

4

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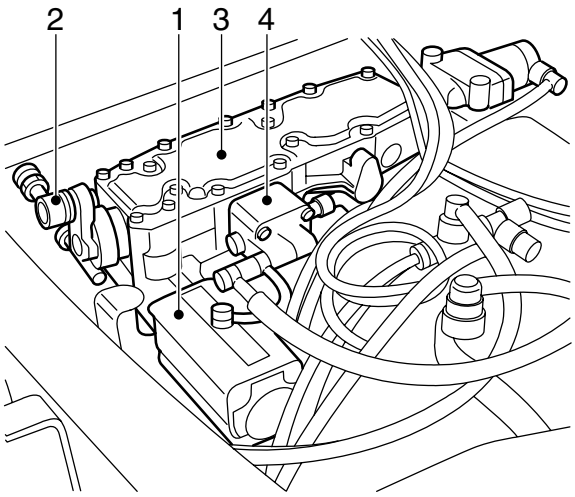
1. GENERAL

1.1 SYSTEM DESCRIPTION OF PNEUMATICALLY ASSISTED GEARBOX CONTROL (SERVO SHIFT)

The pneumatically assisted gearbox control "Servo Shift" is an assisted mechanical/pneumatic shift system for the gearbox.
From the gear lever to the gearbox, this system is identical to the MGS. The gearbox is, however, pneumatically assisted.
That is why you have to refer to the main group "Mechanical gearbox control (MGS)" when carrying out adjustments to the shifting gear.
The servo shift unit is characteristic of the pneumatically assisted gearbox control.

1. Servo shift unit
2. Gearbox rod
3. Gearbox cover
4. Neutral position valve



V300326

Gate selection
Gate selection is done mechanically. To select a gate, move the gear lever to the left or to the right causing the selector shaft to move to the left or to the right.

Engaging gears
To engage the gears, move the gear lever forwards or backwards.

Shifting starts mechanically, with the shifting valve in the servo shift unit being activated. This valve activates the double-acting pneumatic cylinder and shifting is pneumatically assisted.

Emergency shifting
If the reservoir pressure were to drop, shifting would still be possible (unassisted and mechanical).

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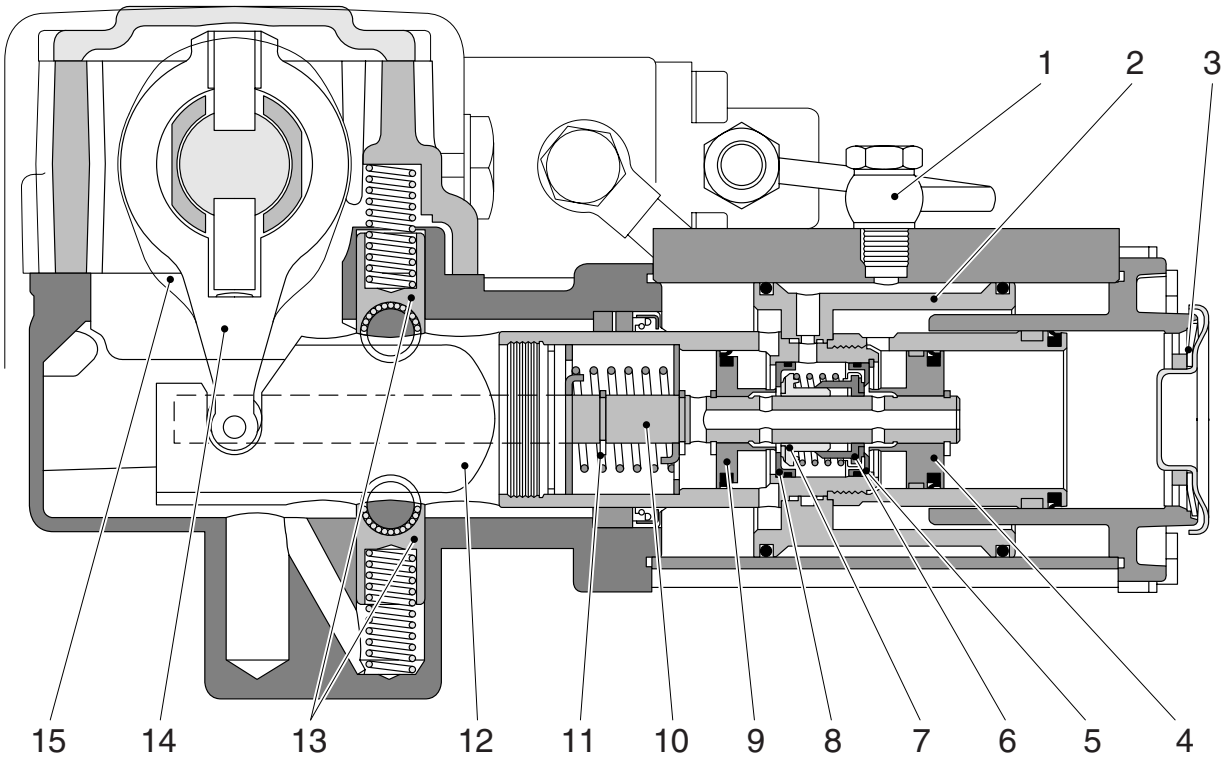
2. DESCRIPTION OF COMPONENTS

2.1 OPERATION OF SERVO SHIFT UNIT



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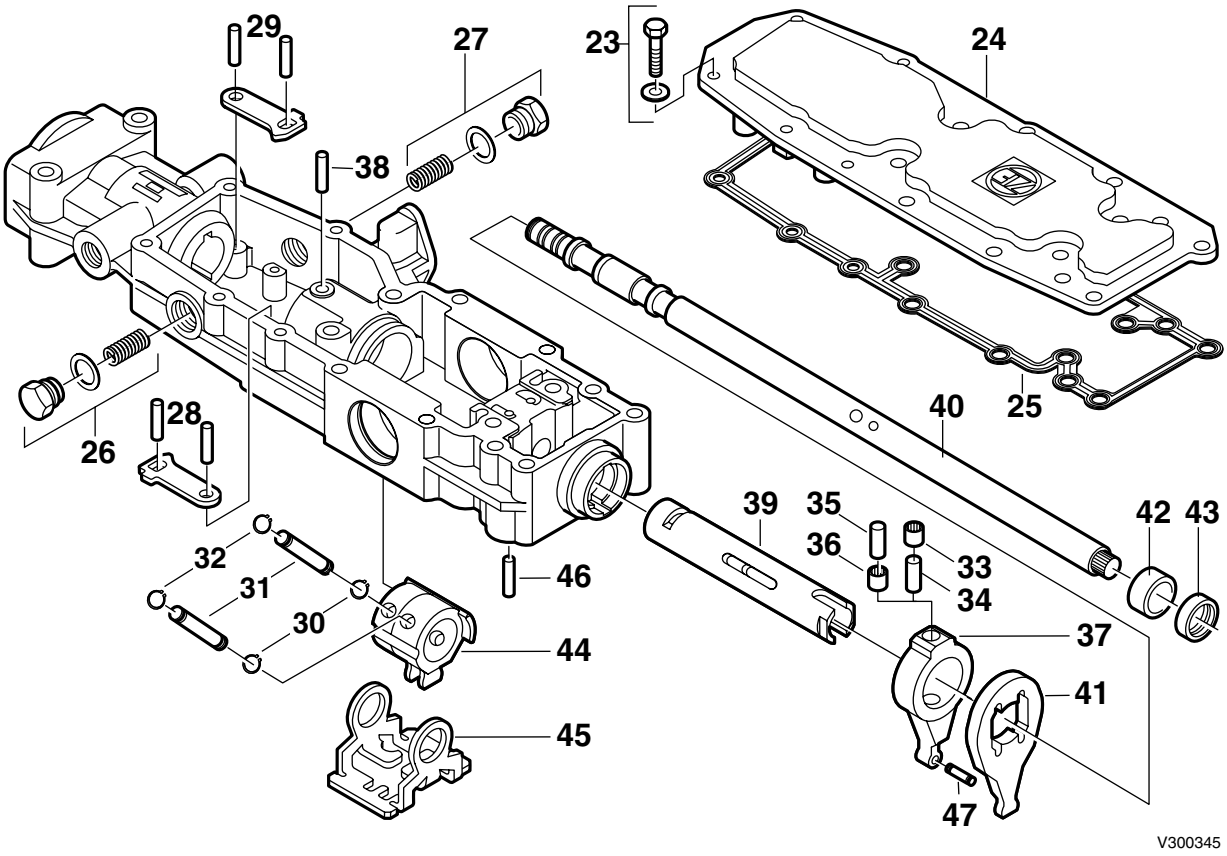
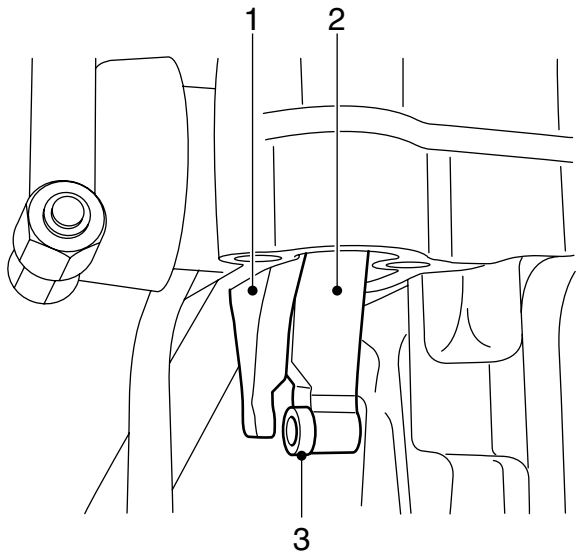
1. Connection for reservoir pressure (circuit 4)
2. Operating piston
3. Venting valve
4. Shifting valve operating piston 1st, 3rd, 5th, 7th gear
5. Valve seat 1st, 3rd, 5th, 7th gear
6. Valve 1st, 3rd, 5th, 7th gear
7. Valve 2nd, 4th, 6th, 8th gear
8. Valve seat 2nd, 4th, 6th, 8th gear
9. Shifting valve operating piston 2nd, 4th, 6th, 8th gear
10. Plunger shifting valve
11. Shifting valve spring
12. Servo control shaft
13. Holding elements
14. Servo lever
15. Shifting valve lever



Servo shift control housing

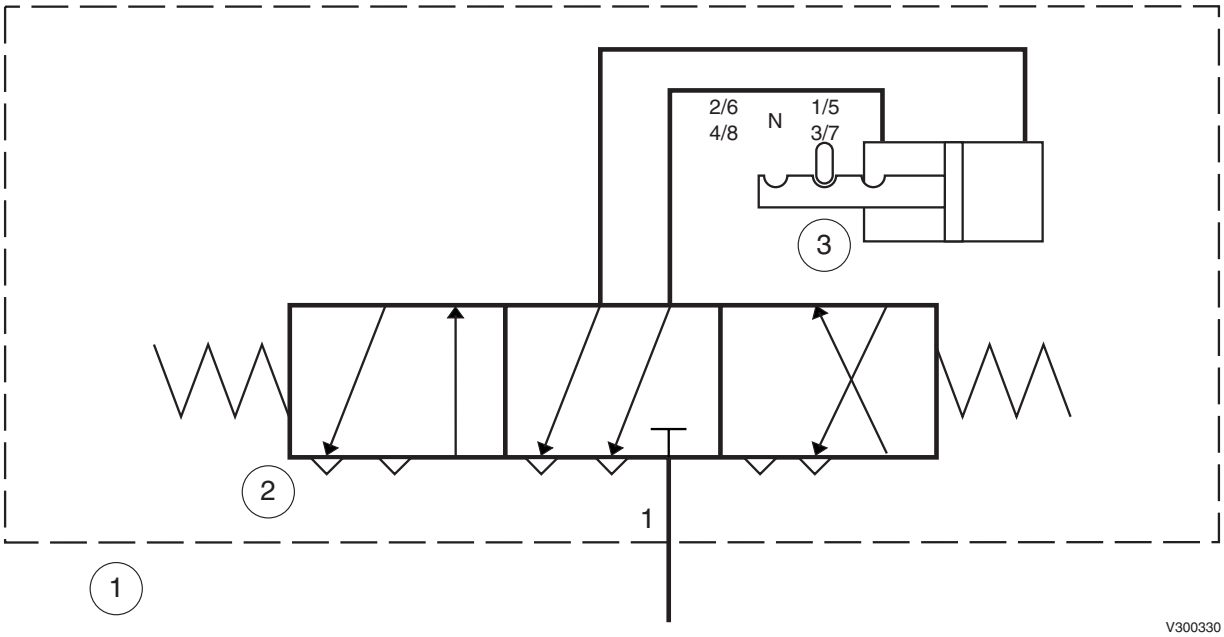
23. Fixing bolt
24. Control housing cover
25. Control housing cover gasket
26. Plug
27. Plug
28. Locking plate
29. Locking plate
30. Circlip
31. Fixing pin
32. Circlip
33. Needle sleeve
34. Pin
35. Pin
36. Needle sleeve
37. Shifting valve lever
38. Pin
39. Hollow shaft (shifting valve lever)
40. Selector shaft
41. Servo lever
42. Bush
43. Selector shaft sealing ring
44. Selector finger
45. Lock piece
46. Pin
47. Fixing pin

General
The servo shift unit consists of a shifting valve and a double-acting control cylinder.
When the control rod is moved forwards or backwards, the shifting valve lever is activated first. This will activate the shifting valve in the servo shift unit, pressurising the piston which will then activate the servo lever (1). The gear is now pneumatically engaged.
If the gear is engaged and the gear lever is no longer activated, the shifting valve is pushed back in neutral by the spring, in which case both sides of the piston are bled.



V300327

Neutral

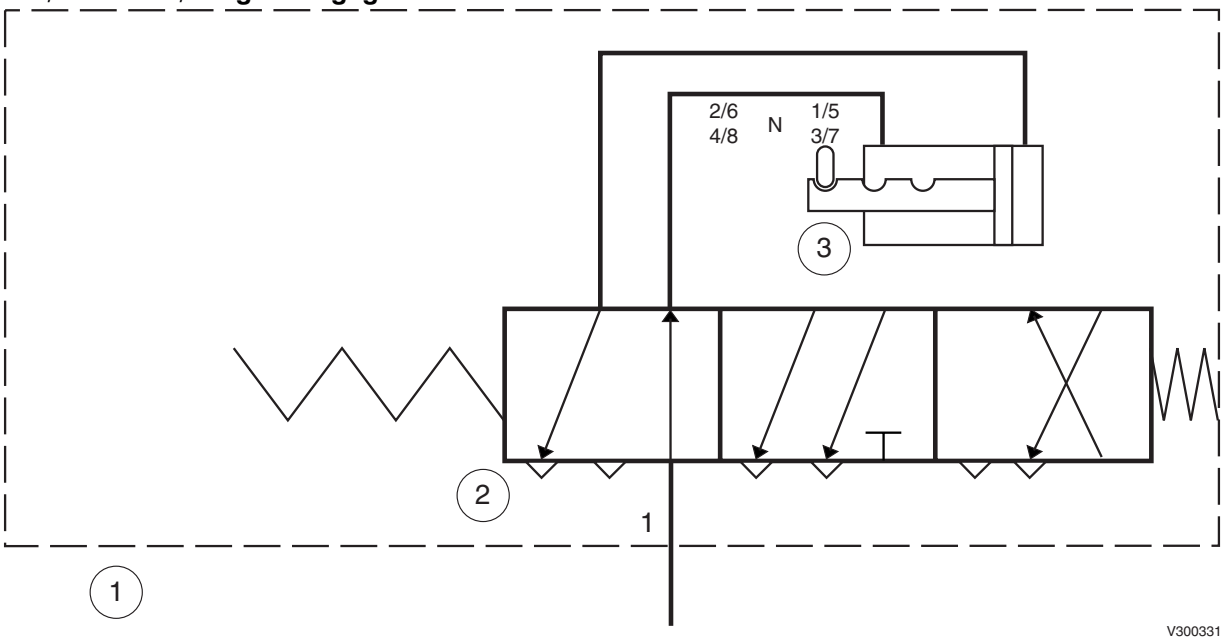


V300330

1. Servo shift unit
2. Shifting valve
3. Control cylinder

If the shifting valve is in the central position, both sides of the cylinder are bled. The shifting valve will not be activated until the gear lever is moved. The shifting valve then admits the reservoir pressure to one side of the cylinder, engaging a gear.

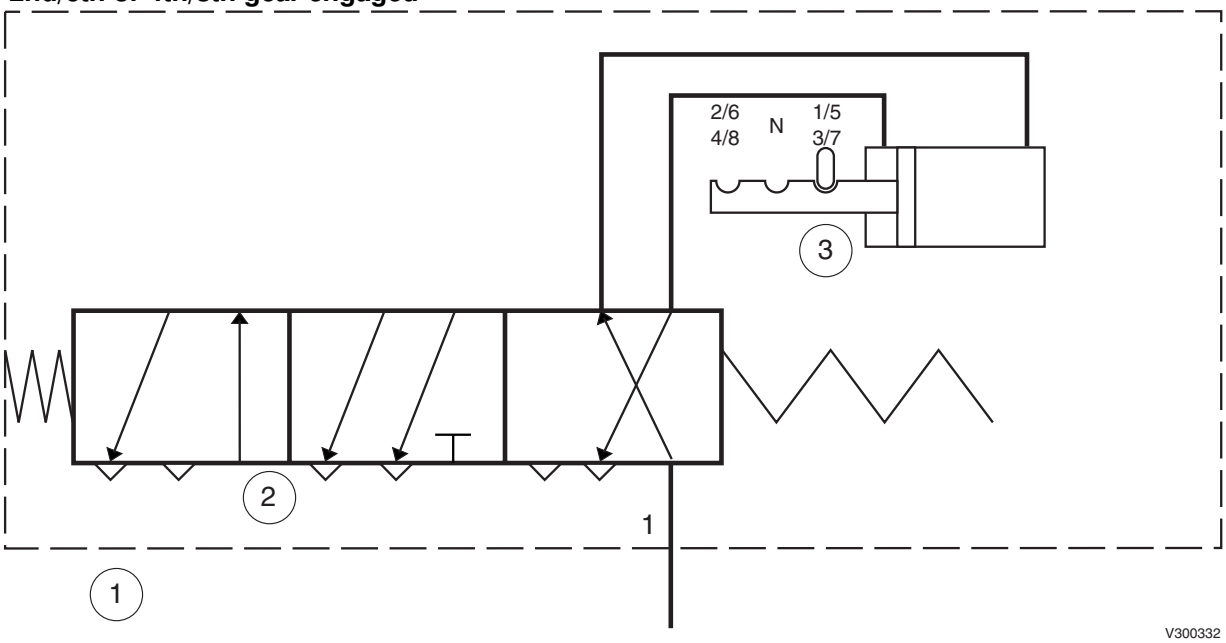
1st/5th or 3rd/7th gear engaged



1. Servo shift unit
2. Shifting valve
3. Control cylinder

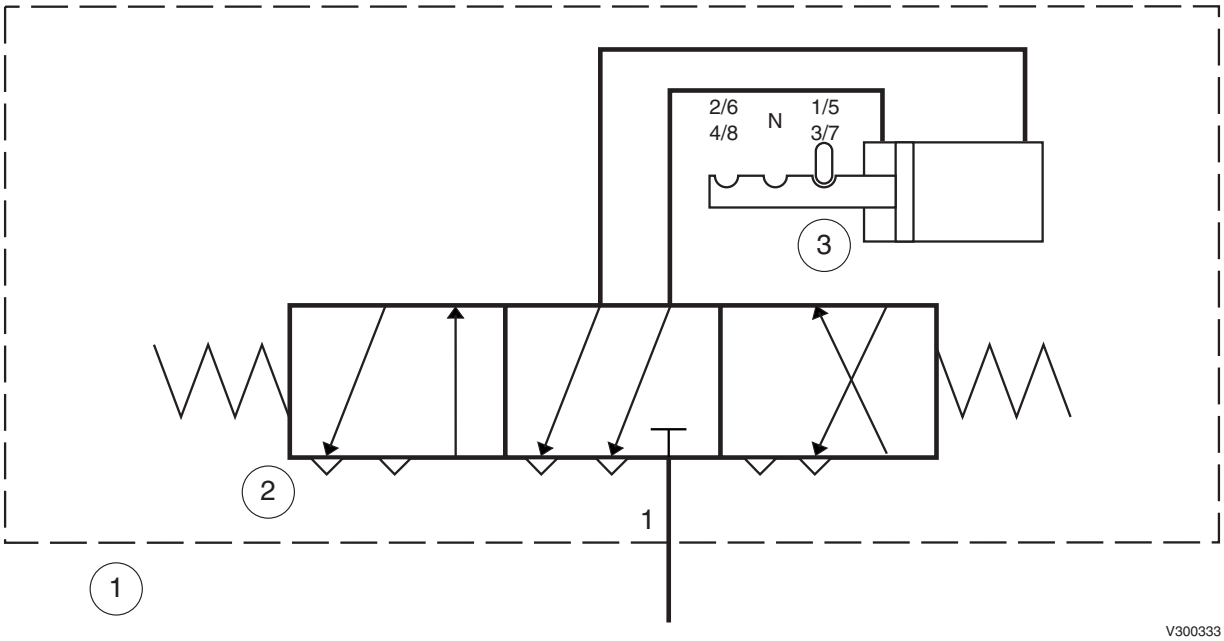
When the gear lever is moved forwards, the shifting valve is moved to the right. The left-hand side of the cylinder is now supplied with reservoir pressure, causing the cylinder to move to the right. The right-hand side is bled at the same time. When the cylinder reaches its end position, it automatically closes off the air supply. The reservoir pressure on the cylinder remains only for as long as the gear lever is activated. If the gear lever is released, the shifting valve will return to the central position and both sides of the cylinder will be bled. The double holding system ensures that the cylinder remains in position.
To engage the 2nd/6th or 4th/8th position, the shifting valve must be moved to the left until the cylinder moves through neutral into the 2nd/6th or 4th/8th position.

2nd/6th or 4th/8th gear engaged



V300332

When the cylinder is in 2nd/6th or 4th/8th position and the gear lever is released again, the shifting valve will return to the central position while the double holding system ensures that the cylinder remains in the engaged position.

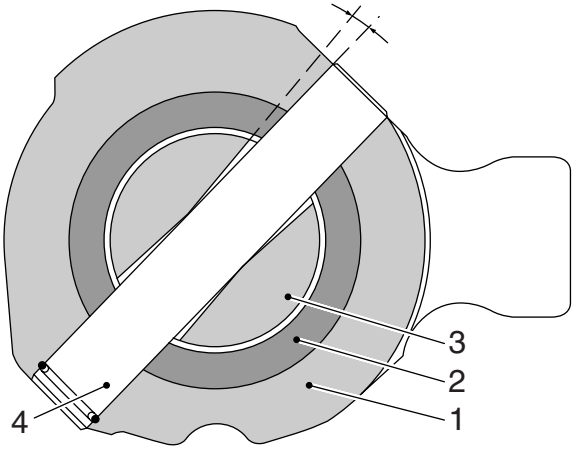


V300333

2.2 OPERATION OF EMERGENCY SHIFTING

If the reservoir pressure were to drop, unassisted engaging of all gears would still be possible.
In that case, a small amount of play between selector shaft (3) and fixing pin (4) needs to be bridged, before the selector finger (1) is activated. If the system is operating correctly, the hollow shaft is activated by the servo shift control cylinder.

1. Selector finger
2. Hollow shaft - assisted
3. Selector shaft activated by gear lever
4. Fixing pin



V300334

3. REMOVAL AND INSTALLATION

3.1 REMOVAL AND INSTALLATION OF SERVO SHIFT UNIT

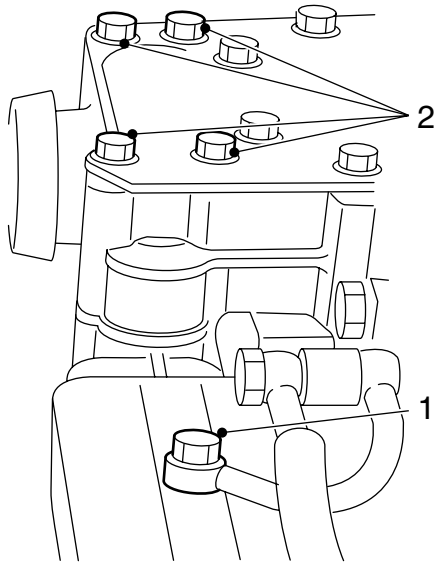
Removing the servo shift unit

1. Make sure that the air line (1) is pressureless before removing the banjo bolt.
2. Remove the banjo bolt from the air line (1) and plug the connection on the unit to prevent the penetration of dirt.

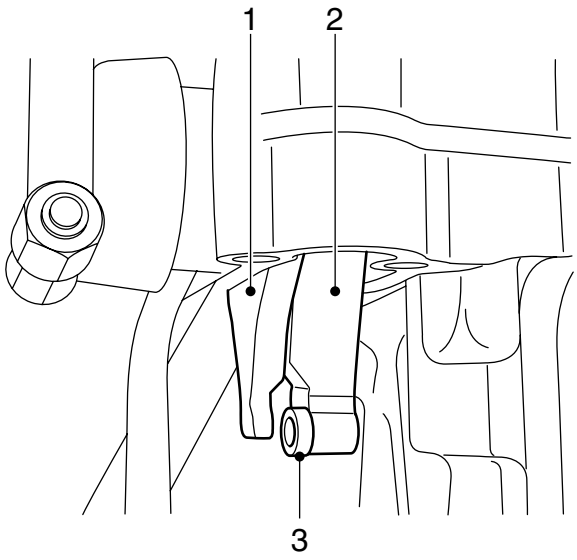
Note
When removing the servo shift unit from the gearbox cover, a small amount of oil will be released.

3. Remove the four fixing bolts (2) from the servo shift unit and remove the unit.

Note
Note the loose ring (3) on the shifting valve lever.



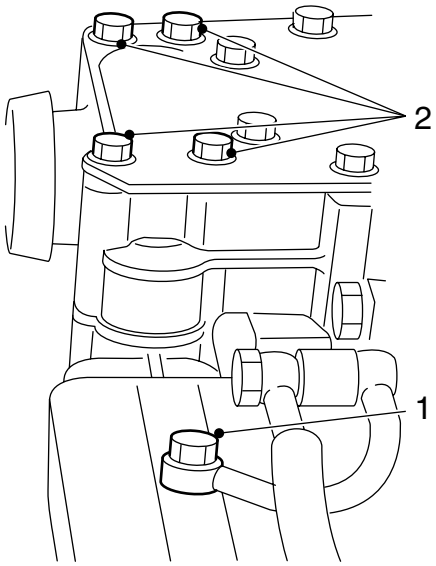
V300328



V300327

Installing the servo shift unit

1. When installing the servo shift unit, use a new gasket.
2. Install the four fixing bolts (2) and tighten them to the specified tightening torque, see main group “Technical Data”.
3. Install the banjo bolt of the air line (1) using new sealing rings and tighten it to the specified tightening torque, see main group “Technical Data”.
4. Repressurise the air circuit and check the operation of the servo shift unit.



V300328

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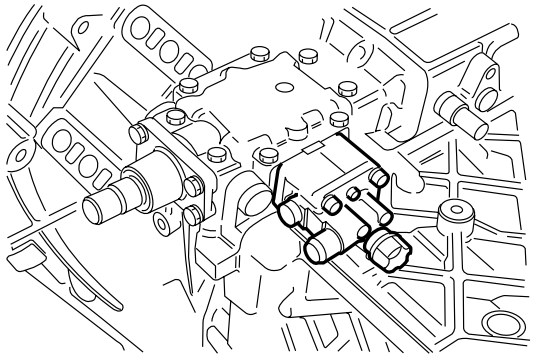
© 0002

1. GENERAL

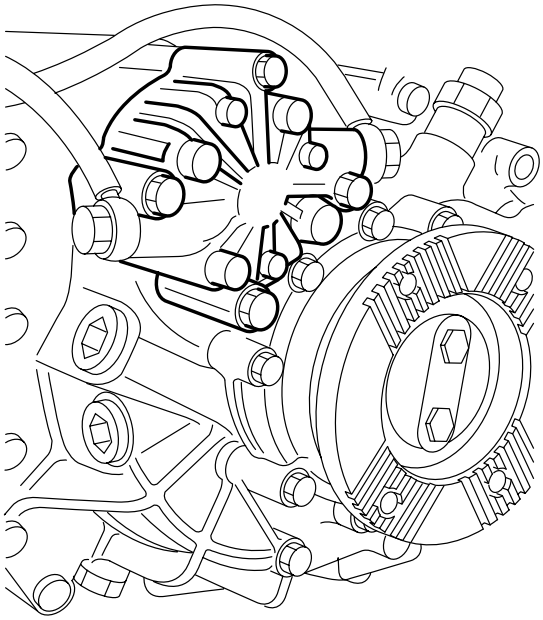
1.1 LOCATION OF SHIFT-DOWN SAFETY COMPONENTS

1. **Neutral position valve**
   At the side of the gearbox cover.



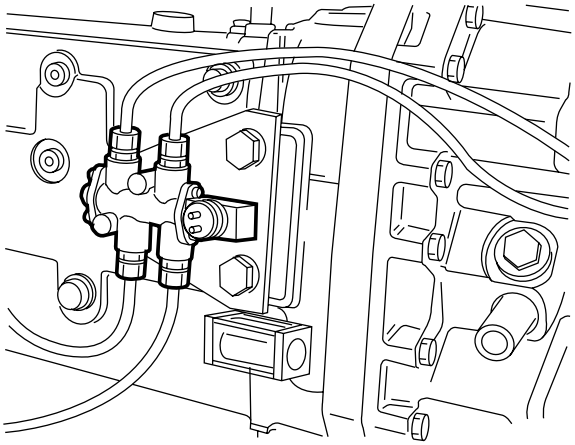
V300140

2. **Gear engaging cylinder high/low group**
   At the back of the gearbox.



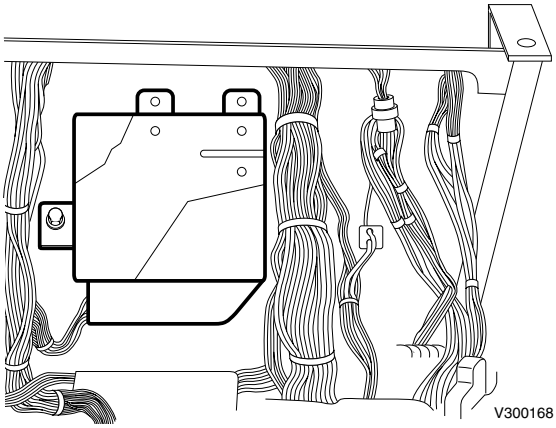
V300141

3. **Shift-down safety valve**
   At the left-hand side of the gearbox.

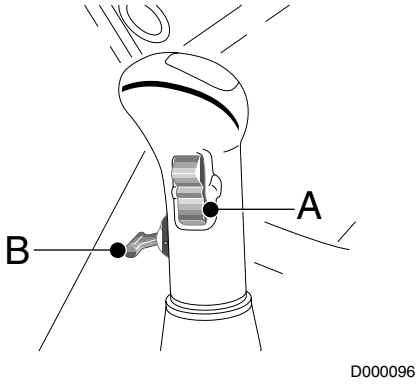


V 300029

4. Electronic unit for CTE-2/CTE-3
In the central cabinet on the co-driver's side.



5. Gear lever range switch
Rocker switch (B) at the front of the gear lever.

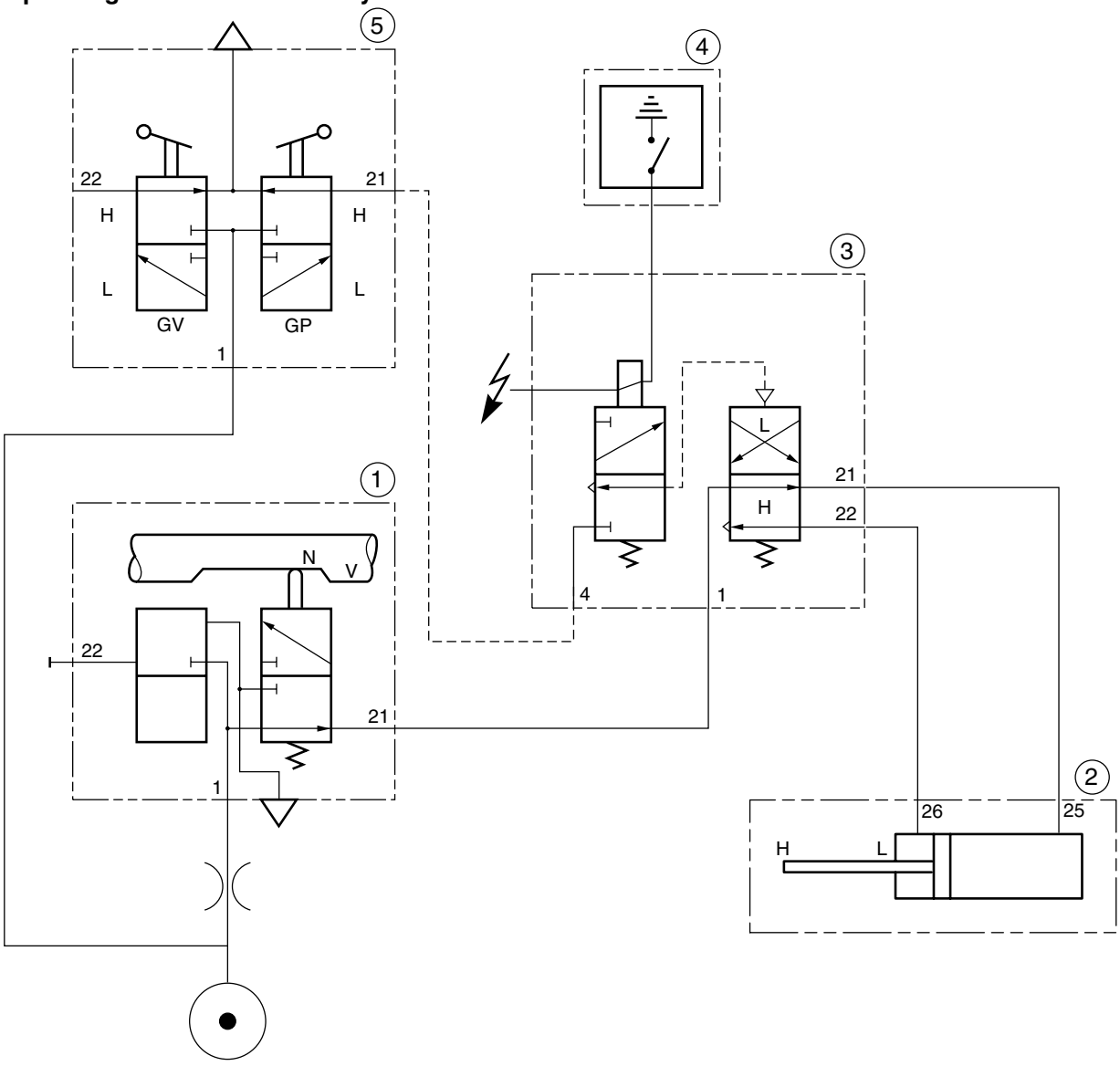


1.2 SYSTEM DESCRIPTION OF THE SHIFT-DOWN SAFETY

The shift-down safety prevents shifting down from the high auxiliary gearbox to the low auxiliary gearbox when the vehicle speed is too high.
Shifting down from the high to the low auxiliary gearbox when the vehicle speed is too high could cause serious damage to the clutch plate, gearbox and engine because of the reduction in the auxiliary gearbox.

The safety is enabled automatically when the vehicle speed (frequency value) exceeds a certain setpoint.
This vehicle speed (frequency signal) is programmed with DAVIE in the CTE.

Operating the shift-down safety



V300118

The following applies to pneumatic diagram V300118

- Vehicle contact switched off
- Gearbox in neutral

1. Neutral position valve
2. Gear engaging cylinder high/low group
3. Shift-down safety valve
4. Electronic unit for CTE
5. Gear lever shifting valve

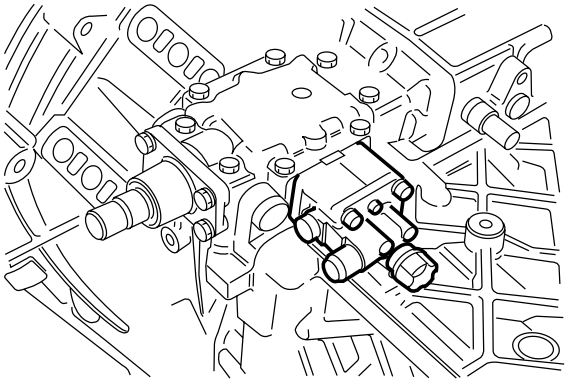
L. Position low auxiliary gearbox
H. Position high auxiliary gearbox
N. Gearbox selector shaft in neutral
V. Gearbox selector shaft engaged

If the vehicle speed exceeds a particular value (frequency value), the electronic unit for CTE (4) interrupts the connection between the shift-down safety valve (3) and the earth. Regardless of any pneumatic activation of the gear lever shifting valve (5), it is now no longer possible to shift down to the lower group.

Note:
The air supply to the shift-down safety valve (3) is only available when the gear lever, and hence also the neutral position valve, are in the neutral position (N).

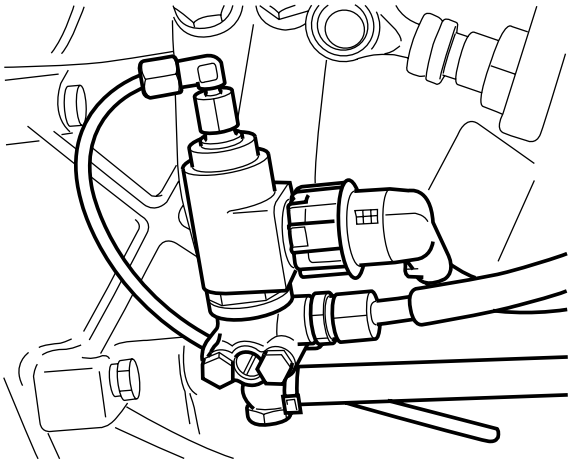
1.3 LOCATION OF THE GATE SAFETY COMPONENTS

1. Neutral position valve
At the side of the gearbox cover.



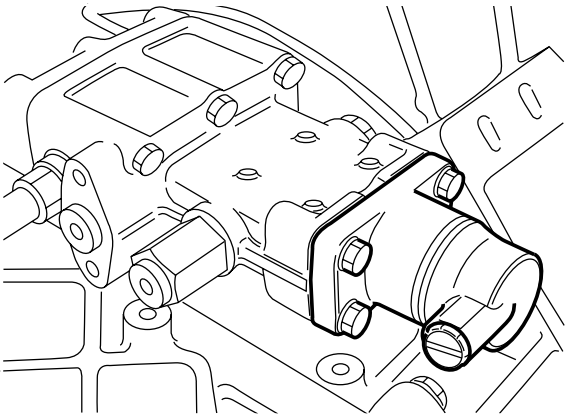
V300140

2. Gate safety valve
At the left-hand or right-hand side of the gearbox (depending on the vehicle type).



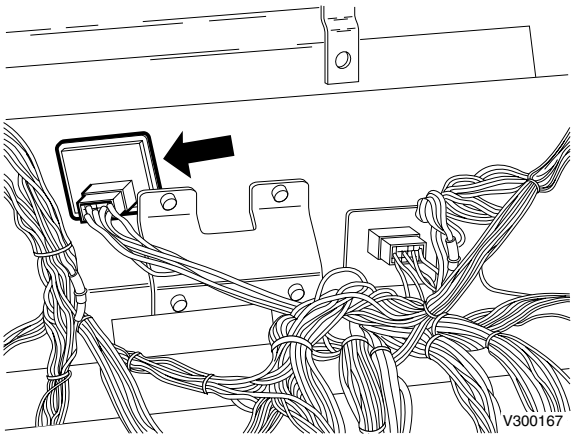
V300006

3. Locking cylinder
At the rear of the gearbox cover.

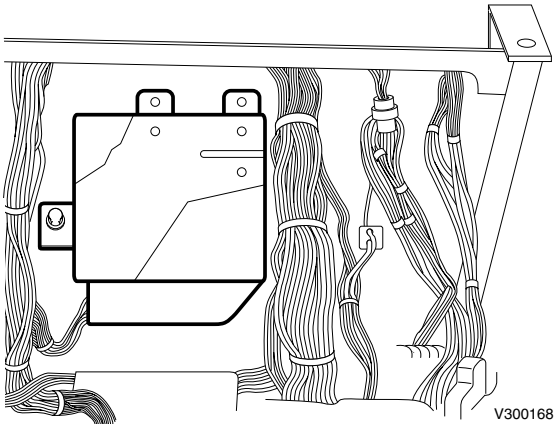


V300002

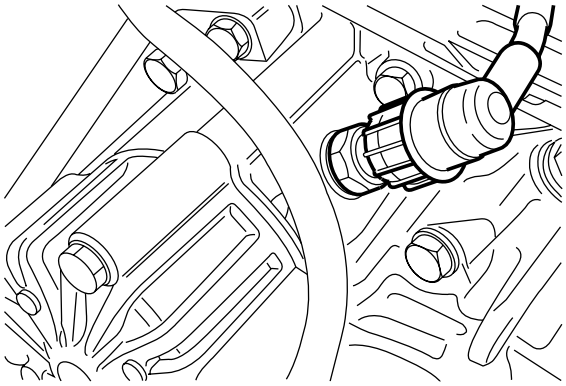
4. Electronic unit for gate safety
In the central cabinet on the co-driver's side.



5. CTE-3
In the central cabinet on the co-driver's side.



6. Low-gear switch
Located at the rear of the gearbox.



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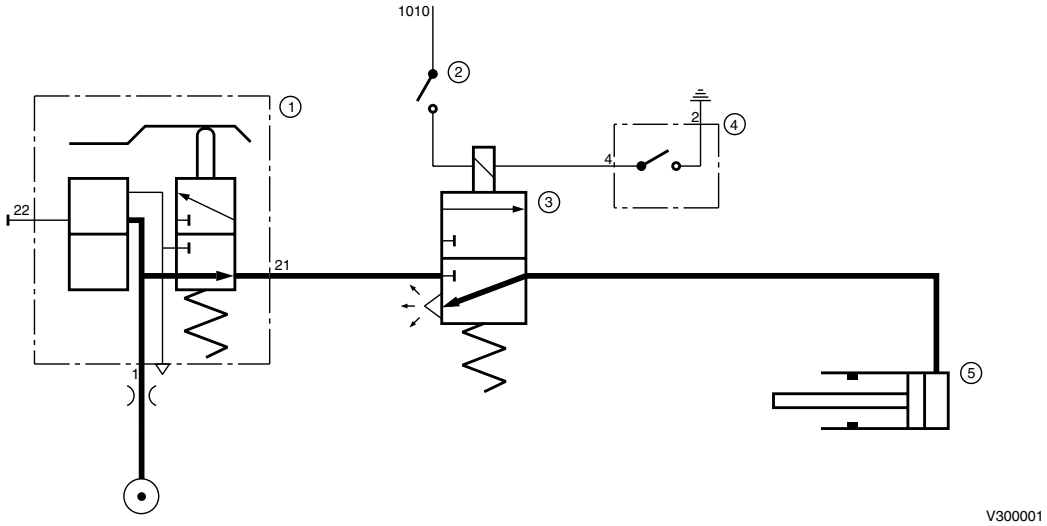
1.4 DESCRIPTION OF THE GATE SAFETY SYSTEM

The gate safety only operates in the low range.
It prevents shifting from third or fourth gear (gate 3-4) to first or second gear (gate 1-2) if the vehicle speed is too high.
This shifting error occurs if the driver fails to use the range switch at the front of the gear lever to shift to the high range before shifting from fourth to fifth gear.
The point at which the safety is engaged is determined by the gate safety's electronic unit or CTE.
The point at which the safety is engaged depends on the vehicle speed (frequency signal).

Operation of gate safety with electronic unit



1. Neutral position valve
2. Low-gear switch
3. Gate safety valve
4. Electronic unit for gate safety
5. Locking cylinder

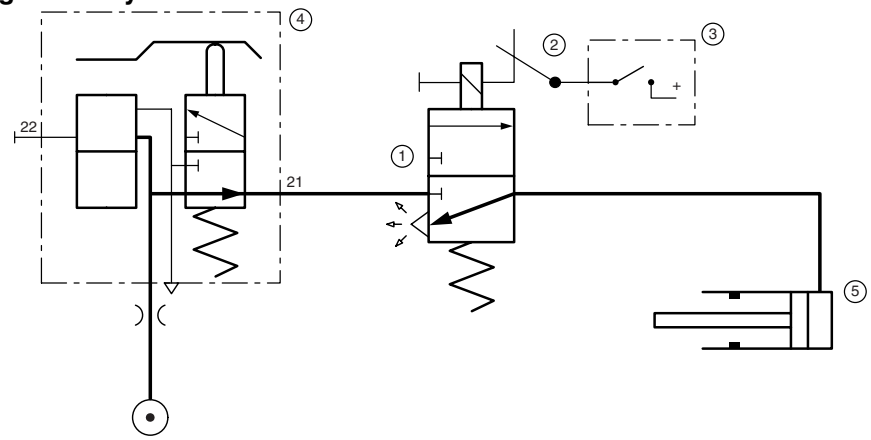
If the vehicle speed exceeds a particular value (frequency value), connector 4 of the gate safety electronic unit (4) will be connected to the earth via connector 2.
If the low group has been selected, the low-gear switch (2) is closed. The electropneumatic valve (3) is activated.

When the gearbox reaches neutral, the neutral position valve will send pressure via the gate-safety valve to the locking cylinder (5) at the rear end of the gearbox cover. As a result, gate 1-2 can no longer be shifted.

If the higher range is selected, however, and switch (2) is opened, the gate safety valve (3) will no longer be activated. Gate 5-6 (1-2) can be activated again.

Note:
For reasons of safety, shifting down must always be possible. Hence, by exerting additional shifting power, it is still possible to reach gate 1-2 against the pressure of the cylinder.

Operation of gate safety with CTE-3



V300279

1. Gate safety valve
2. Low-gear switch
3. CTE-3
4. Neutral position valve
5. Locking cylinder

The gate safety valve (1) is activated if the following conditions are met:
Vehicle speed in excess of the set speed, causing a voltage to be applied to the low-gear switch (2) via the CTE.
The low-gear switch (2) is closed if the gearbox is changed to low gear.

When the gearbox reaches neutral, the neutral position valve (4) will send pressure via the gate-safety valve (1) to the locking cylinder (5) at the rear end of the gearbox cover. As a result, gate 1-2 can no longer be shifted.

If the higher range is selected, however, the gate safety valve (1) will no longer be activated because the low-gear switch (2) is open.
Gate 5-6 (1-2) can be activated again.

© 0002

Note:
For reasons of safety, shifting down must always be possible. Hence, by exerting additional shifting power, it is still possible to reach gate 1-2 against the pressure of the cylinder.

Operation of gate safety in combination with servo shift
The operation of the gate safety in combination with servo shift is similar to the operation of the gate safety with CTE-3, the only difference being the fact that the locking cylinder is now not supplied with air via the neutral position valve, but directly from circuit 4. This is to ensure the possibility of shifting very quickly using servo shift. Otherwise the neutral position valve may be too late in supplying the locking cylinder with air in this situation, so that the locking cylinder will not have built up enough pressure to block gate 1-2.

1.5 PNEUMATIC DIAGRAM OF THE GEARBOX CONTROL

Pneumatic diagram of 16 S direct input shaft

The following applies to pneumatic diagram V300165

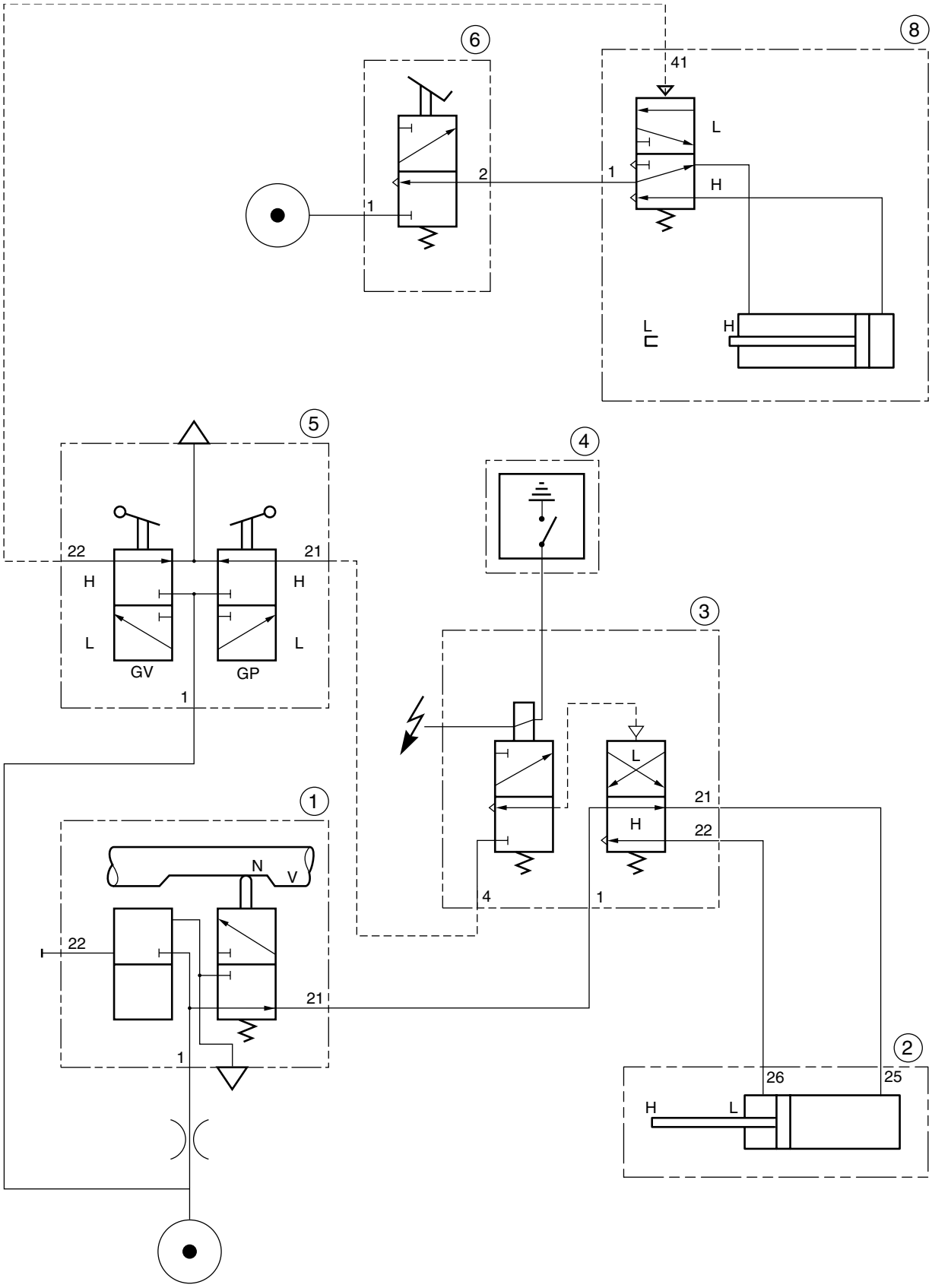
- Vehicle contact switched off
- Gearbox in neutral
- Range switch position “high”
- Splitter switch position “high”
- Clutch pedal not activated

1. Neutral position valve
2. Gear engaging cylinder high/low group
3. Shift-down safety valve
4. Electronic unit for CTE
5. Gear lever shifting valve
6. GV valve
8. Splitter relay valve with splitter cylinder

L Position “low”
H Position “high”
N Gearbox selector shaft in neutral
V Gearbox selector shaft engaged

5

Pneumatic diagram of 16 S direct input shaft



V300165

Pneumatic diagram of 16 S overdrive

The following applies to pneumatic diagram V300166

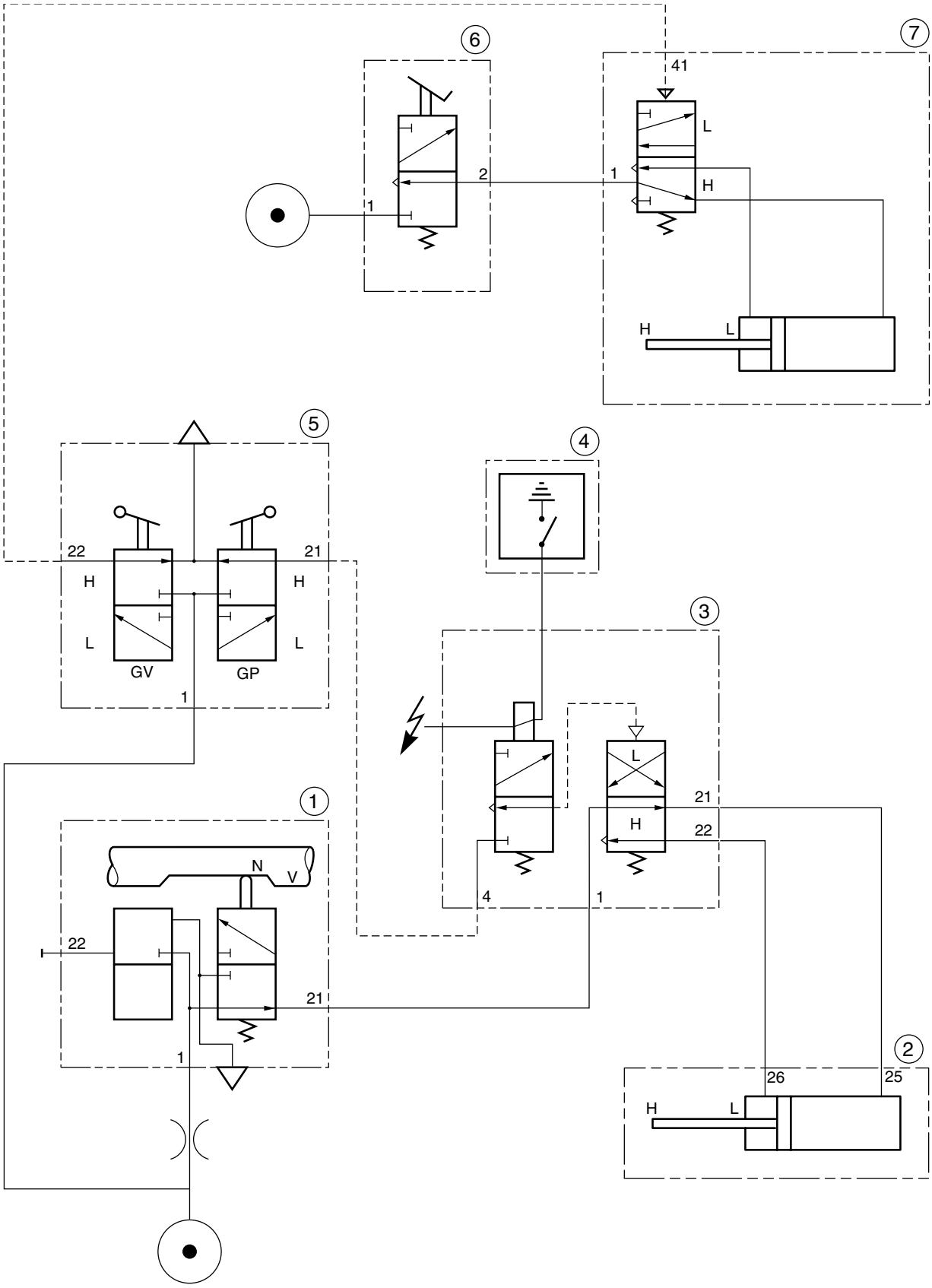
- Vehicle contact switched off
- Gearbox in neutral
- Range switch position “high”
- Splitter switch position “high”
- Clutch pedal not activated

1. Neutral position valve
2. Gear engaging cylinder high/low group
3. Shift-down safety valve
4. Electronic unit for CTE
5. Gear lever shifting valve
6. GV valve
7. Splitter relay valve with splitter cylinder

L Position “low”
H Position “high”
N Gearbox selector shaft in neutral
V Gearbox selector shaft engaged

5

Pneumatic diagram of 16 S overdrive



V300166

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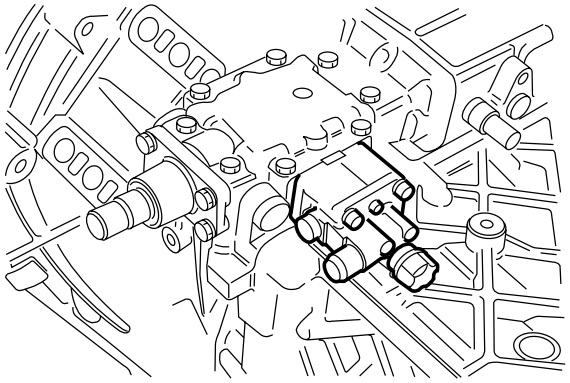
2. DESCRIPTION OF COMPONENTS

2.1 NEUTRAL POSITION VALVE

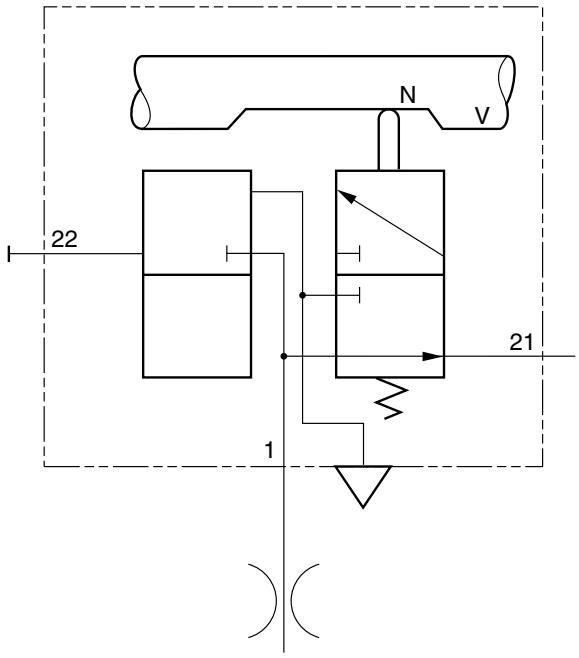


V300140

Pneumatic symbol

Connection point	Function
1	Supply
21	Cut-in pressure of rear-mounted range unit
22	Plugged

Position	Function
N	Gearbox selector shaft in neutral
V	Gearbox selector shaft engaged



V300160

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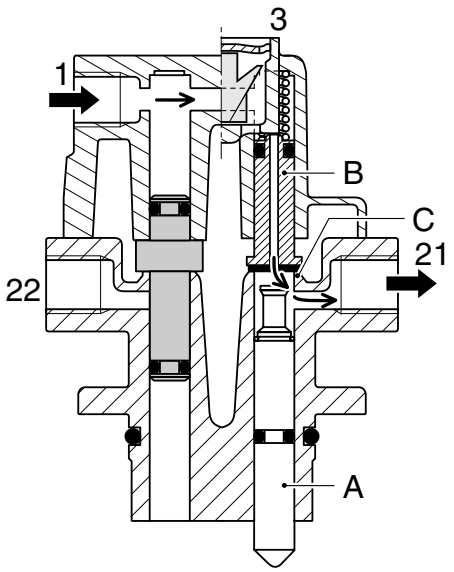
Operation
Gearbox in neutral:
In the neutral position, push rod (A) will be pushed into a recess in the drive shaft by means of the air pressure coming from connection (1) and a bore hole through sealing pin (B). Sealing pin (B) will provide a spring-loaded seal on seat (C). The air flow can now leave the valve via connection point (21) and then activate the high/low group gear engaging cylinder via the shift-down safety valve.



W 3 02 098

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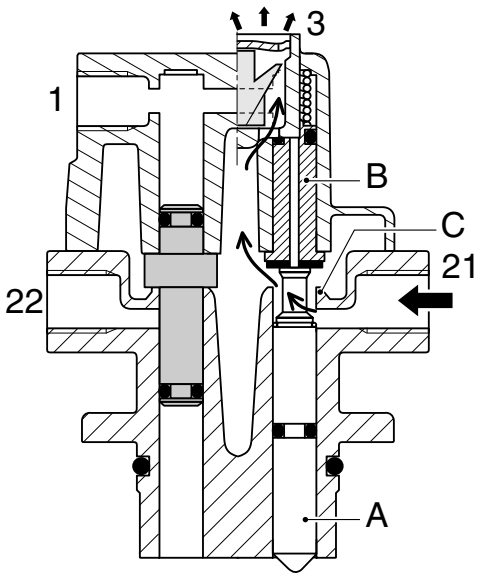
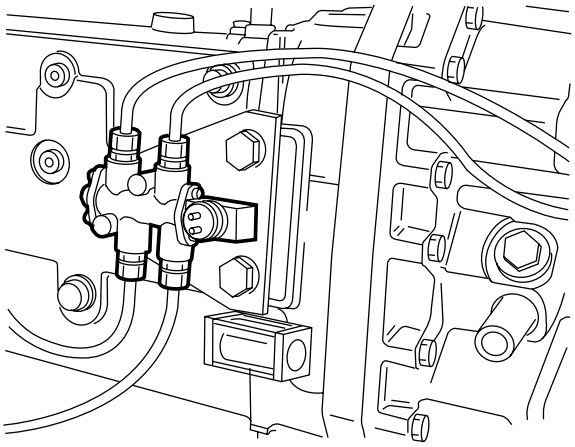
Gearbox engaged:
When a gear has been engaged, the drive shaft will push the push rod (A) up against sealing pin (B). This closes off the bore hole in this pin and causes the pin to be lifted of seat (C) against the spring pressure. The air pressure in the high/low group gear engaging cylinder can now flow back to the neutral position valve via the shift-down safety valve, and leave the valve housing through the vent opening (3).



W 3 02 102

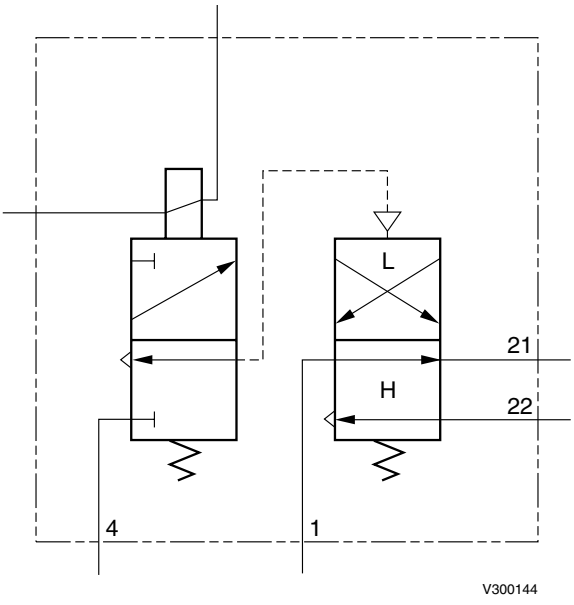
2.2 SHIFT-DOWN SAFETY VALVE



V 300029

Pneumatic symbol

Connection point	Function
1	Supply
4	Control pressure
21	Cut-in pressure high range
22	Cut-in pressure low range

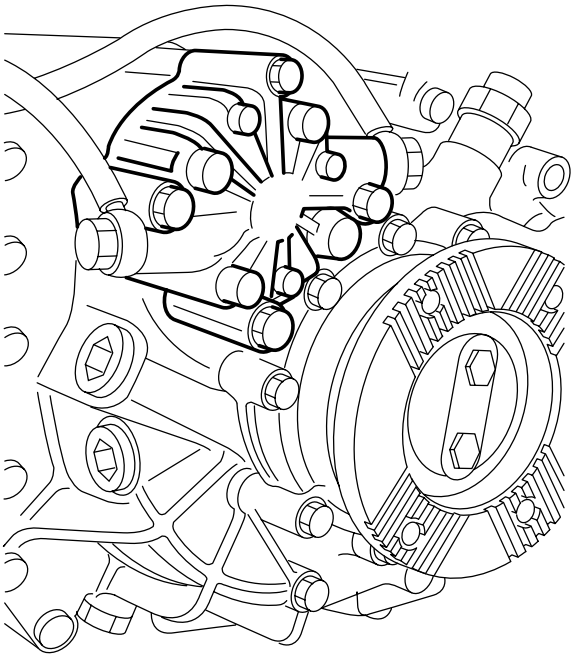


V300144

Operation
If the vehicle speed exceeds a particular value (frequency value), the coil of the shift-down safety valve will be interrupted.
Regardless of any pneumatic command from the gear lever group switch to the connection point (4), it is now no longer possible to shift down to the lower group.

The air supply (1) at the shift-down safety valve is only available when the gear lever, and hence also the neutral position valve, are in the neutral position.

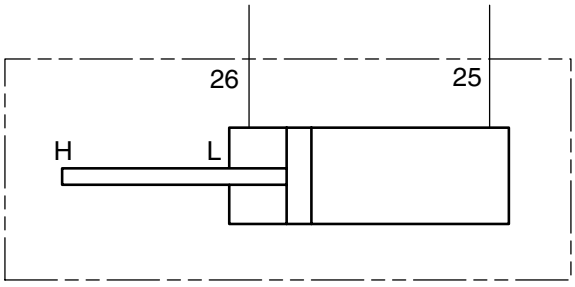
2.3 GEAR ENGAGING CYLINDER HIGH/LOW GROUP



V300141

Pneumatic symbol

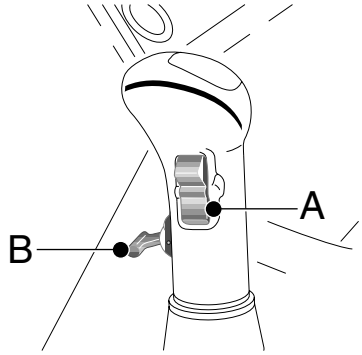
Connection point	Function
25	High rear-mounted range unit
26	Low rear-mounted range unit



V300142

Operation
The gear engaging cylinder responsible for high/low gearbox shifting, is supplied via the shift-down safety valve. This safety valve is operated by the shifting valve on the gear lever. The gear engaging cylinder is located at the rear end of the gearbox.

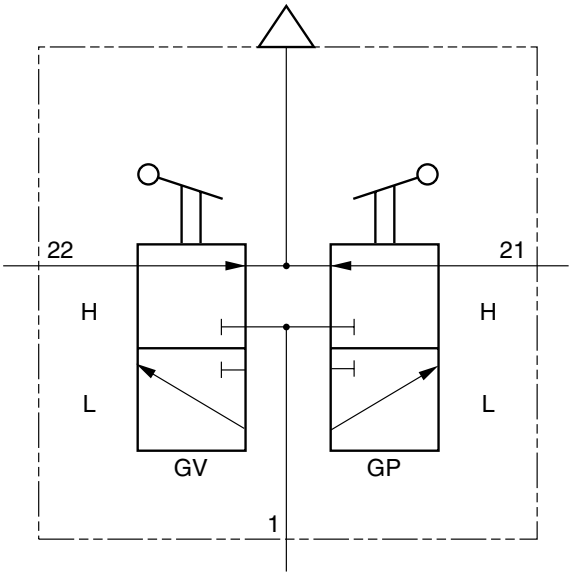
2.4 GEAR LEVER SHIFTING VALVE



D000096

Pneumatic symbol

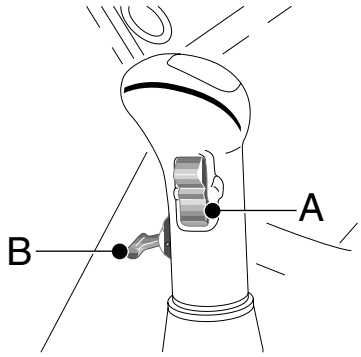
Position	Function
GP	Rear-mounted range unit
GV	Splitter



V300161

Operation of the range switch
Switching tot the lower or the higher range is done by toggling a switch (B) at the front of the gear lever: switch **down**: **low** range, switch **up**: **high** range. Preselection is permitted. Switching itself takes place when the gear lever passes neutral.

Operation of the splitter switch
Switching half gears, the so-called splitting, is done with switch (A) at the side of the gear lever. **Bottom** pressed: **low** gear, **top** pressed: **high** gear.
When the switch has been operated, the clutch pedal must be **fully** depressed, after which the gear-change is made.
Preselection is permitted.
If the **low** splitter mode is engaged, the splitter control light on the instrument panel will light up.



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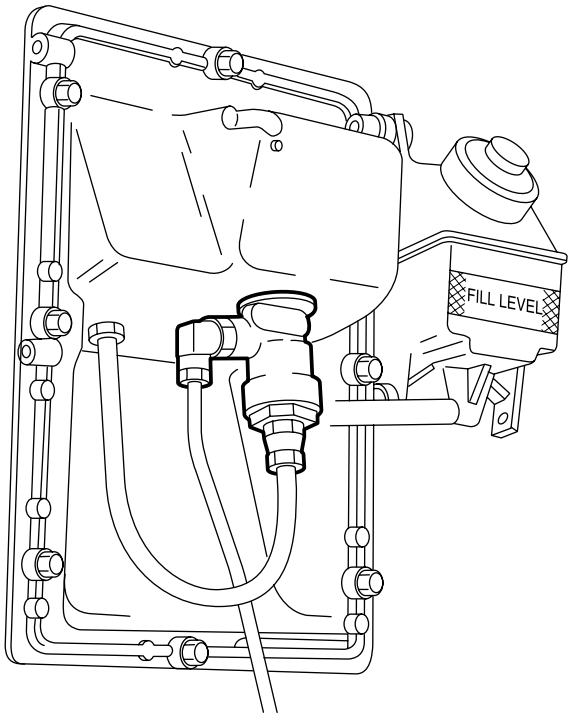
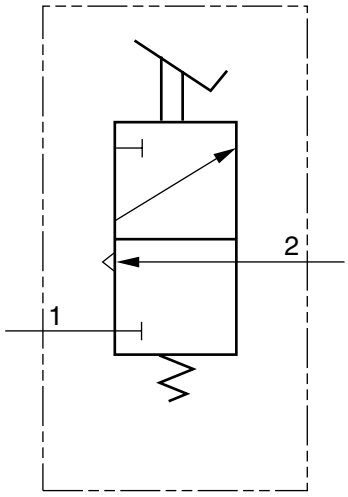
2.5 GV VALVE



V300177

Pneumatic symbol

Connection point	Function
1	Supply
2	Control pressure

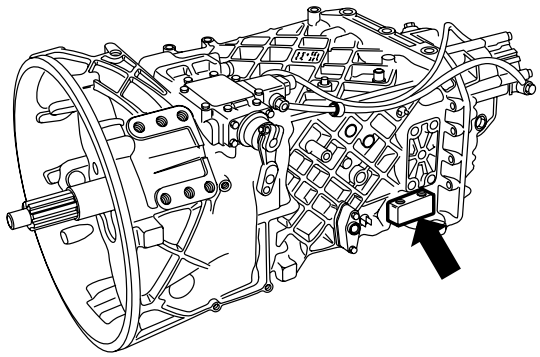


V300164

Operation
The GV (“Getriebe-Vorschalt”) pre-shifting valve ensures that when the clutch pedal is depressed, pressure is supplied to the splitter cylinder via the relay valve.
If the clutch pedal is not depressed, this bleeds the splitter cylinder.
The splitter cylinder will stay in the position in which it was last switched.

2.6 SPLITTER RELAY VALVE

In the 16S gearboxes, the splitter relay valve is located at the left-hand side of the gearbox.
The valve is a 5/2 valve.
Depending on the type of gearbox, either direct input or overdrive, two variants are possible.



V300169

Pneumatic symbol
V300162 overdrive gearbox
V300163 direct input gearbox

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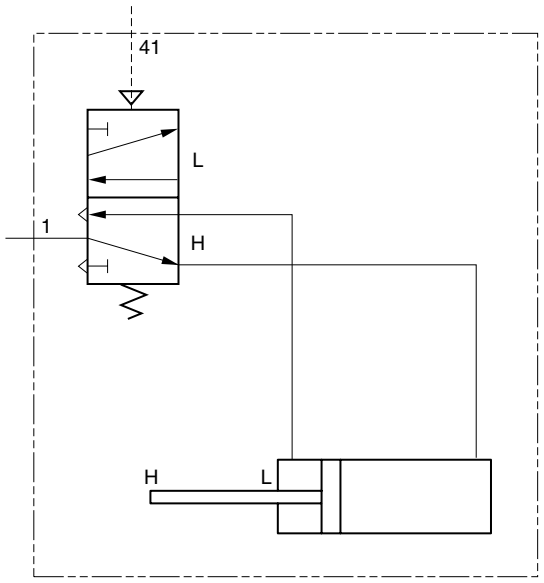
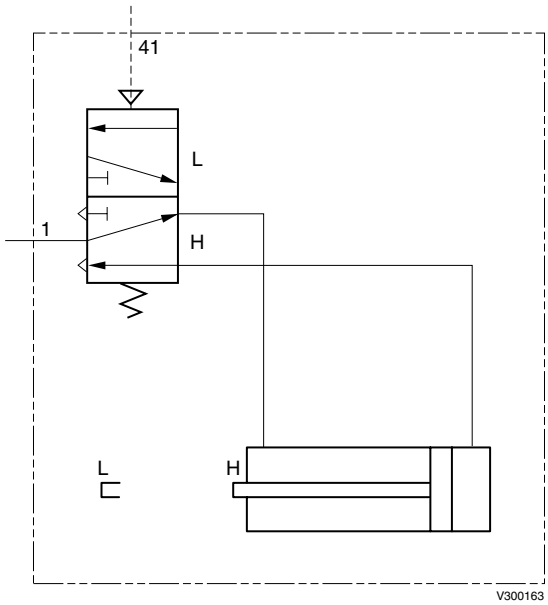
Connection point	Function
1	Supply
41	Control pressure

Position	Function
L	Splitter high
H	Splitter low



V300162



V300163

3. INSPECTION AND ADJUSTMENT

3.1 PROGRAMMING PARAMETERS USING DAVIE

After a gearbox has been replaced by a gearbox which uses a different reduction rate, it will be necessary to reprogram the CTE using DAVIE. This is to ensure that the shift-down safety is activated and deactivated at the correct vehicle speed.
See the system manual “CTE” for information on programming the CTE.
For the correct hertz figure, see main group “Technical Data”.

3.2 INSPECTION OF THE SHIFT-DOWN SAFETY VALVE

Inspecting without vehicle speed signal

1. Ensure there is sufficient air pressure.
2. Position the gear lever in neutral.
3. Switch the vehicle contact on.
4. Use the range switch on the gear lever to select the lower range. The rear-mounted range unit should now switch to the lower range.
5. Switch the vehicle contact off. The rear-mounted range unit should now automatically switch to the higher range.

Inspecting with the vehicle speed signal

1. Ensure there is sufficient air pressure.
2. Connect special tool Delsi (DAF no. 0694941).
3. Position the gear lever in neutral.
4. Switch the vehicle contact on.
5. Use the range switch on the gear lever to select the lower range. The rear-mounted range unit should now switch to the lower range.
6. Use Delsi to increase the simulated vehicle speed steadily to approx. 40 km/hour. The auxiliary gearbox should now automatically switch to the higher range.
7. Use Delsi to slowly decrease the simulated vehicle speed steadily to approx. 0 km/hour. The auxiliary gearbox should now automatically switch to the lower range.

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3.3 INSPECTION AND ADJUSTMENT OF GV VALVE

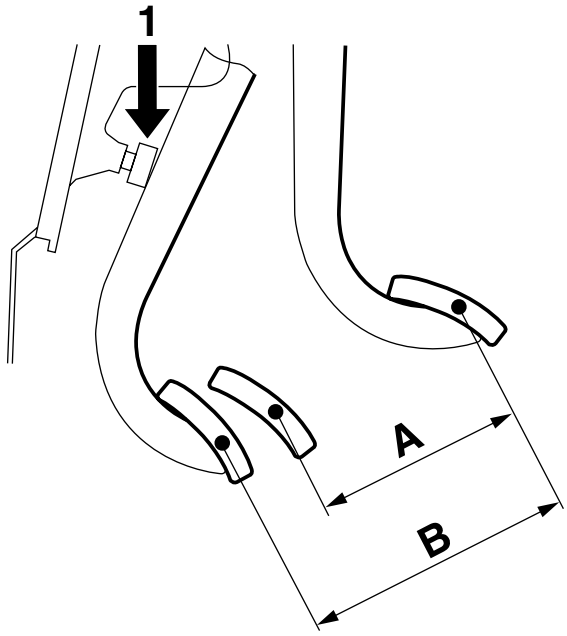
Inspecting the GV valve

1. Make sure that the gearbox is in neutral and the parking brake is engaged.
2. Start the engine, and run it at idling speed.
3. Use the rocker switch on the gear lever to select the other splitter mode **without** depressing the clutch pedal.
4. Carefully push the gear lever in the direction of reverse, until the teeth in the gearbox start to grind.
5. Slowly depress the clutch pedal until the gear can be engaged in a regular fashion (without grinding).

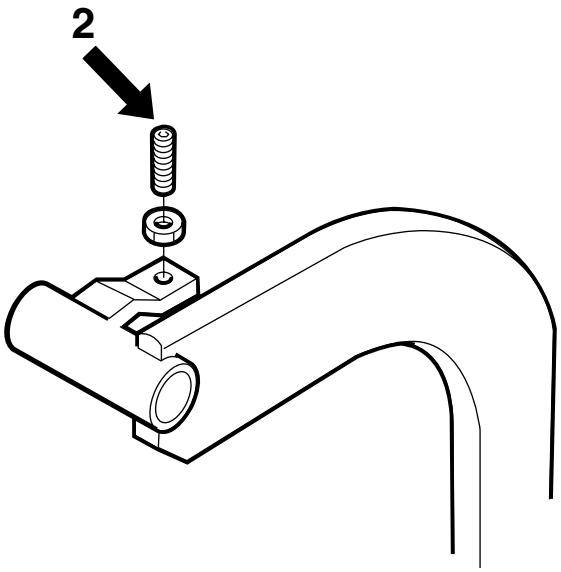
   Note:
   After the gear has been engaged or the grinding has stopped, the splitter must shift to the preselected mode (high or low, depending on the preselected position).

Adjusting the GV valve

1. Use the adjusting screw (2) to adjust the stroke (A) in such a way that the GV valve starts to operate, see main group “Technical Data”.
2. Use the adjusting screw (1) to adjust the stroke (B), see main group “Technical Data”.
3. Check the operation of the GV valve.



V300175



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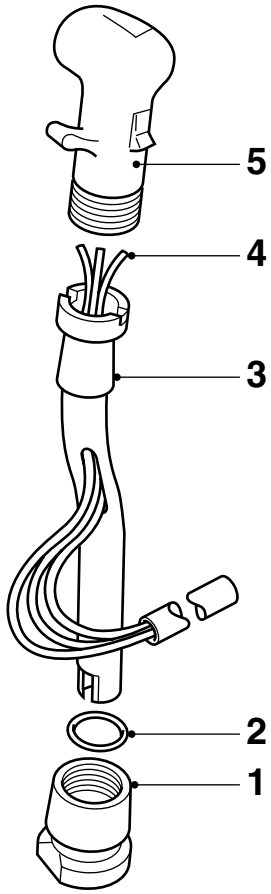
4. REMOVAL AND INSTALLATION

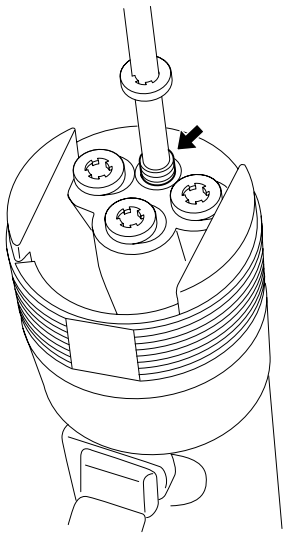
4.1 REMOVAL AND INSTALLATION OF GEAR LEVER SHIFTING VALVE

Removing the gear lever shifting valve

1. Disconnect the dust cover from the cab floor and raise it over the gear lever as high as possible.
2. Loosen the union nut (1) on the shifting valve.
3. Raise the shifting valve (5) slightly from the gear lever (3), far enough to be able to disconnect the air pipes (4).
4. Raise the coloured rings over the air pipes. These coloured rings also serve as markers.
5. Use a small screwdriver to depress the edge of the air connection, after which the pipes can be pulled from the switch button.



V300143



V300159

Installing the gear lever shifting valve

1. Connect the air pipes to the shifting valve by pushing them into the respective connectors as far as possible.
   For the connection points in the shifting valve, see the main group “Technical Data”.
2. Slide the coloured rings back over the connection points.
3. Check whether the pneumatic system has an airtight connection and whether the auxiliary gearbox and the splitter can be operated.
4. Install the shifting valve onto the gear lever and tighten the union nut.
5. Attach the gear lever dust cover to the cab floor.

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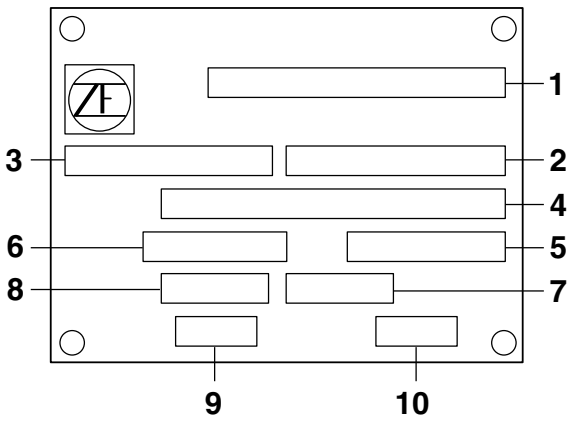
1. GENERAL

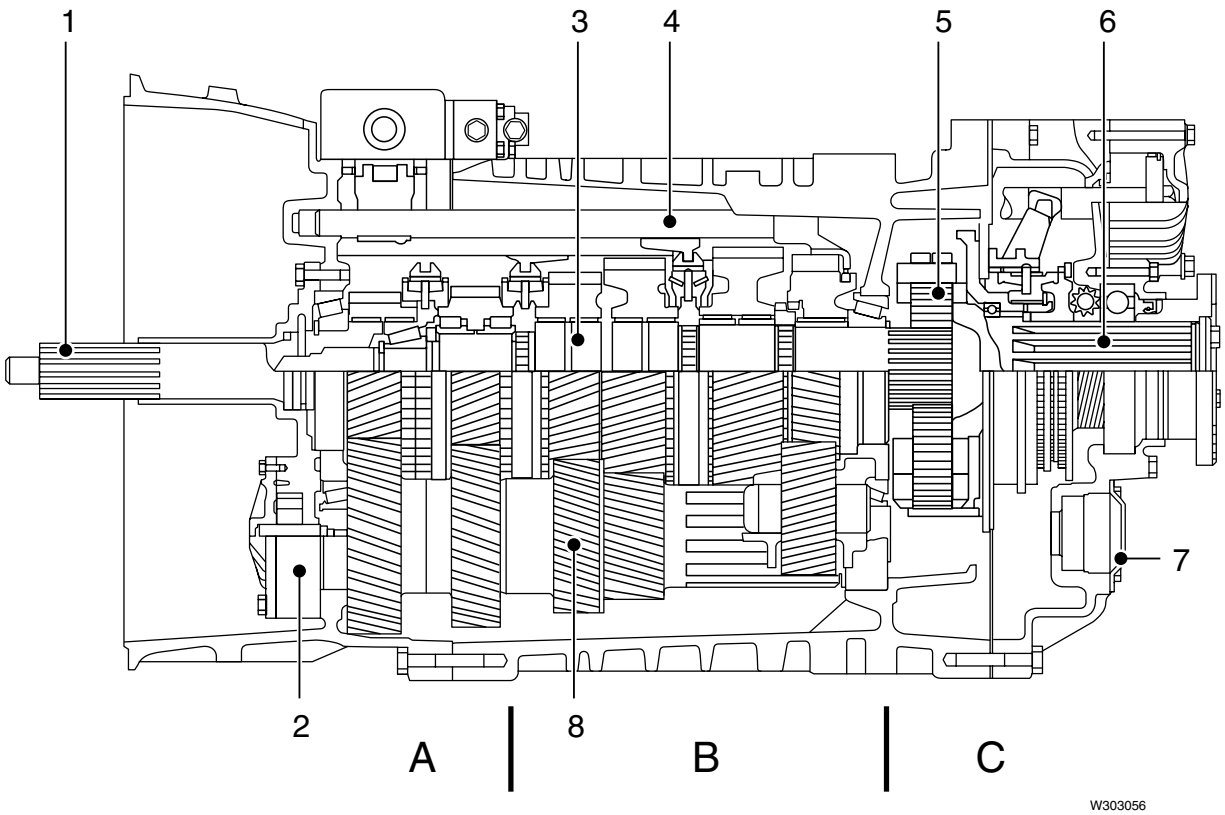
Gearbox type
Each gearbox has a type plate attached to it, indicating the type of gearbox. These data can also be found on the vehicle identity card for the vehicle concerned.

1. Type of gearbox
2. Serial No. (ZF)
3. Parts list (ZF)
4. Specification No.
5. Pulse generator ratio
6. Gearbox ratio
7. Engine speed using PTO
8. PTO speed
9. Gearbox oil capacity
10. Oil specification



V300049

1.1 SYSTEM DESCRIPTION 16S GEARBOXES



A. Integrated front-mounted auxiliary gearbox or splitter gearbox (two gears)
B. Main gearbox with four forward and one reverse gear
C. Auxiliary gearbox or range gearbox (two gears)

1. Input shaft
2. Lubricating oil pump
3. Main shaft
4. Selector shafts with shifting forks
5. Planetary gears for range group
6. Output shaft
7. Connection point for PTO
8. Auxiliary shaft

Example of a type indication 16S-181
16 = 16 gears
S = all forward gears synchronised
181 = mark for the input engine torque

A. Integrated front-mounted auxiliary gearbox
This is an auxiliary gearbox located in the main gearbox housing. Using an additional set of gears, the auxiliary shaft of the main gearbox can be driven by two different ratios. As a result, each gear in the main gearbox can be shifted to a low or a high ratio. This means that it can be split into two parts. Hence, the number of gears of the main gearbox is doubled.

B. Main gearbox
The main gearbox consists of four synchronised forward gears, and one non-synchronised reverse gear.

C. Planetary-type range unit
A gearbox, mounted onto the rear of the main gearbox, consisting of one planetary gear wheel set.

Using this set of gears, all gears of the main gearbox can be used once with the auxiliary gearbox in a low ratio, and once with the auxiliary gearbox in a 1:1 ratio.

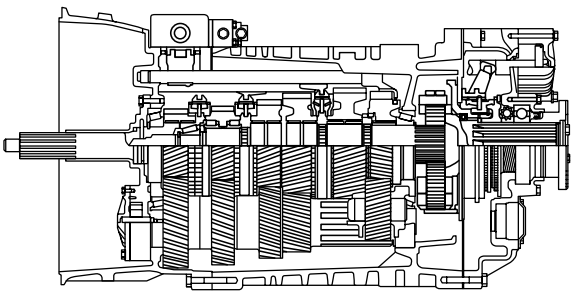
Hence, the number of gears of the main gearbox is doubled.

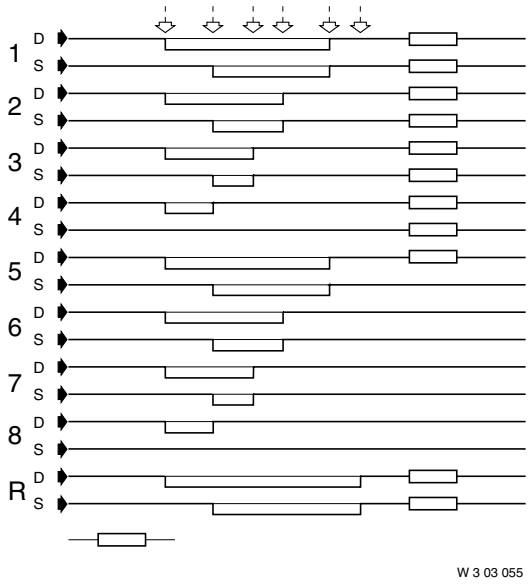
In popular terms, the number of gears in the gearbox is “stacked”. This type of gearbox is called a range gearbox.

16S-181
By means of the gearbox splitter, the four gears in the main gearbox are multiplied by two, while the use of the auxiliary gearbox multiplies this figure by two again, which results in
4 x 2 x 2 = 16 “forward” gears.

The figure opposite shows the power distribution across the individual gear pairs for each gear.

Direct input shaft version of the ZF 16S-181
D = “Direct” splitter
S = “Rapid” splitter





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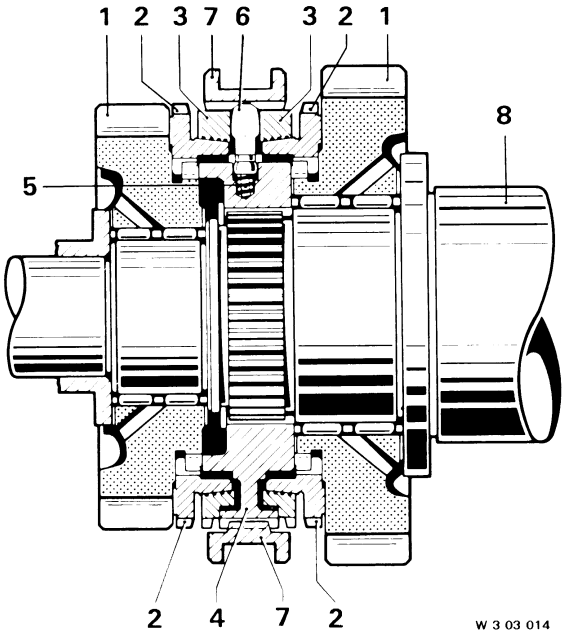
2. DESCRIPTION OF COMPONENTS

2.1 SYNCHRONISER

B-lock synchronisation
The synchroniser consists of the following parts:
1 Gearwheel
2. Switching ring
3. Synchromesh ring
4. Selector sleeve support
5. Pressure spring
6. Thrust piece
7. Selector sleeve
8. Main shaft



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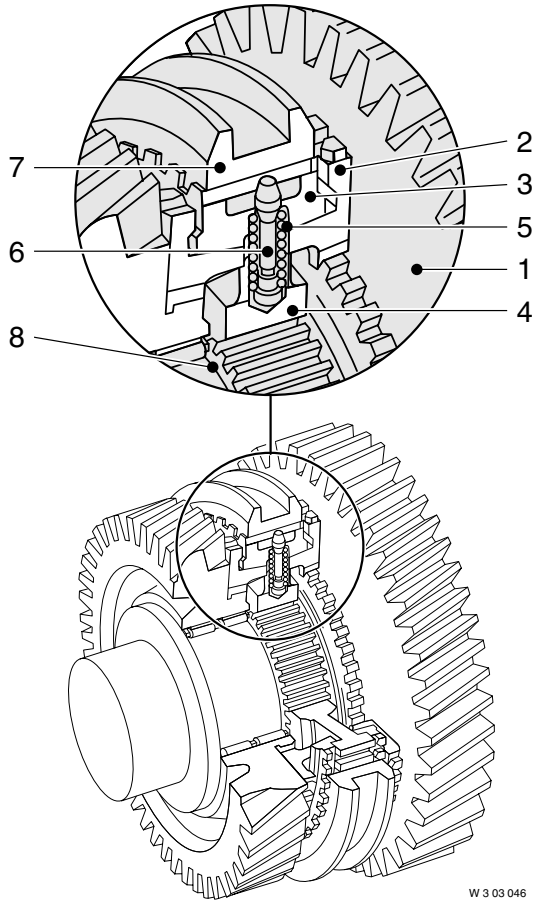
In neutral (Fig. 1, 2), the selector sleeve (7) is in the centre position.

Pressure springs (5) push the thrust pieces (6) into a wedge-shaped recess in the selector sleeve (7).

The gear wheels (1) and corresponding clutch bodies (2) move freely around the main shaft (8).

If the selector sleeve (7) is shifted to the right from the neutral position, the synchromesh ring (3) is pushed against the friction cone of the clutch body (2) by the thrust pieces (6). (See Fig. 2.)

The difference in speed immediately turns the synchromesh ring (3) to a stop on the selector sleeve support (4), which is not in the figure, and thus prevents further movement of the selector sleeve (7).



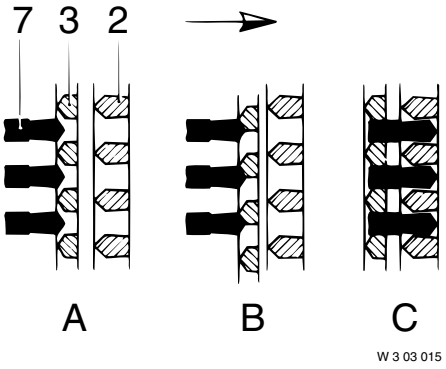
As a result of continued pressure on the selector sleeve (7) (friction), the speed of the gear (1) to be shifted with the clutch body (2) matches the speed of the main shaft (8).

The bevelled sides of the teeth on the synchromesh ring (3) and the selector sleeve (7) cause the synchromesh ring (3) to be turned back slightly after synchronisation.

This releases the lock and allows the selector sleeve (7) to be moved into the teeth of the clutch body (2) (Fig. 2.).

Hence the gear concerned is engaged.

A. Not connected
B. Synchronising
C. Connected

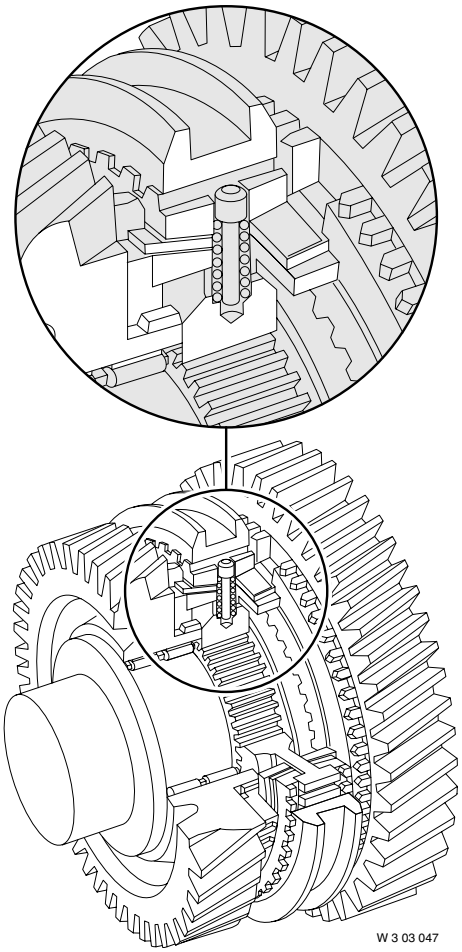


Double-cone synchronisation
As a result of the speed difference to be eliminated in the lower gears, the synchronisation forces may be considerable. In order to achieve effective synchronisation, a synchroniser with a double cone is used.

This synchroniser consists of an outer and an inner ring (synchromesh rings) connected to the main shaft of the gearbox by means of the selector sleeve support.

The ring between the two synchromesh rings is connected to the gear wheel by means of the clutch body.

When the selector sleeve moves into the clutch body, two synchronisation surfaces are active.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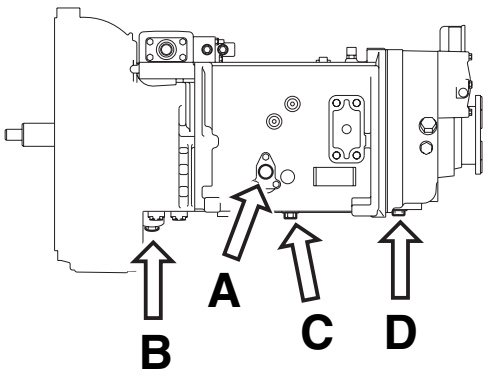
3. INSPECTION AND ADJUSTMENT

3.1 INSPECTION, GEARBOX OIL LEVEL

To prevent skin injury, avoid unnecessary contact with the drained oil.

Gearbox 16S-181/221

1. Place the vehicle on a flat and level surface.
2. Wait for some minutes for the oil to flow back.
3. The oil level must reach the rim of the oil-level/filling opening (A).
4. Tighten the filling/level plug to the specified tightening torque, see main group “Technical Data”.



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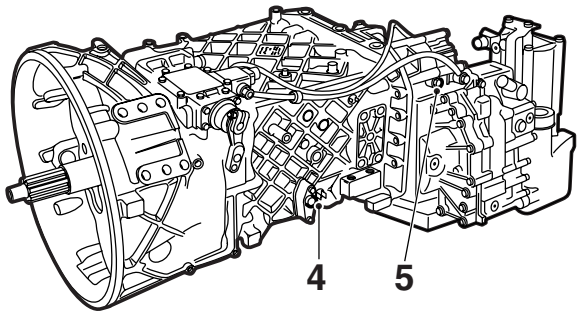
Gearbox 16S-181/221 with integrated ZF retarder

1. Place the vehicle on a flat and level surface. Brake the vehicle without activating the retarder.
2. Wait for some minutes for the oil to flow back.
3. The oil level must reach the rim of the oil-level opening (4).
4. Tighten the filling/level plug to the specified tightening torque, see main group “Technical Data”.



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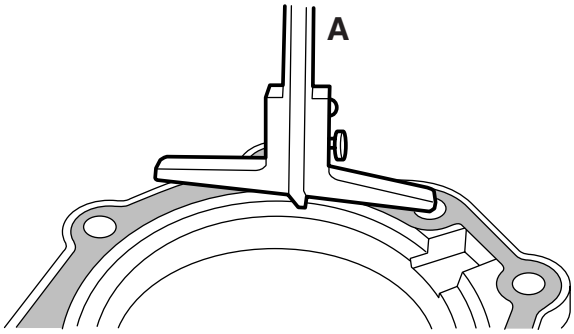
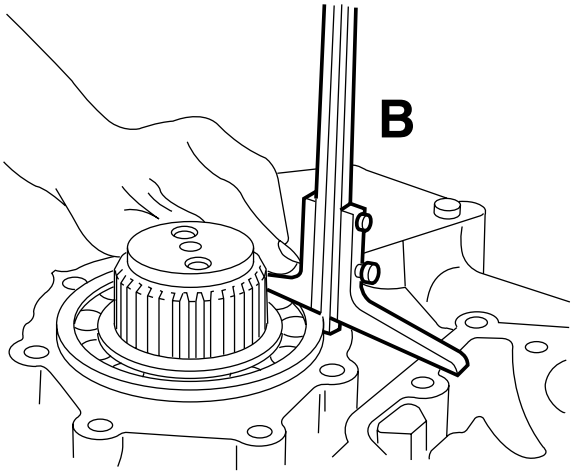
3.2 INSPECTING AND ADJUSTING, AXIAL CLEARANCE OF THE GEARBOX OUTPUT SHAFT BEARING

1. Remove the rear gearbox bearing cover.
2. Install a new gasket on the bearing cover. Use a depth gauge to determine the depth of the bearing cover chamber, distance A.



V300227

3. Use a depth gauge to determine the height of the extension of the ball bearing above the gearbox housing, distance B.
4. Calculate the axial clearance. The axial clearance equals distance A - distance B.
5. Compare the calculated value with the maximum allowable axial clearance, see main group “Technical Data”.
6. If necessary, adjust the axial clearance by means of another adjusting ring.



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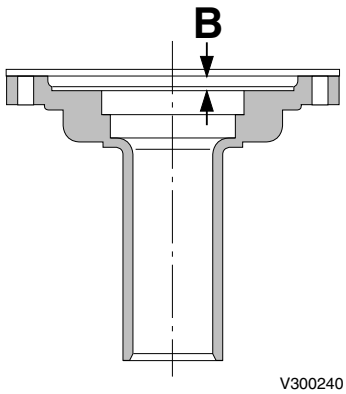
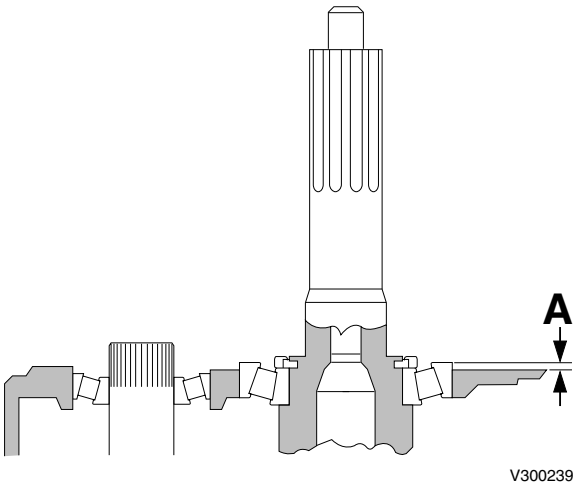
3.3 INSPECTING AND ADJUSTING THE AXIAL CLEARANCE OF THE INPUT SHAFT BEARING

1. Remove the sliding bush.
2. Use a depth gauge to determine the depth of the chamber in the sliding bush, distance B.



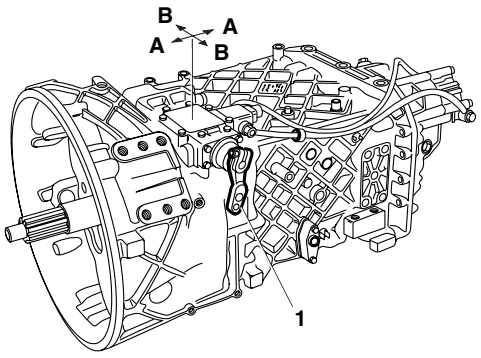
3. Install a new gasket on the gearbox housing.
   Use a depth gauge to determine the height of the extension of the ball bearing above the gearbox housing, distance A.
4. Calculate the axial clearance.
   The axial clearance equals distance B - distance A.
5. Compare the calculated value with the maximum allowable axial clearance, see main group “Technical Data”.
6. If necessary, adjust the axial clearance by means of another adjusting ring.



3.4 INSPECTION AND ADJUSTMENT OF GEARBOX COVER

Inspection of gear box cover

1. Disconnect the shift control from the lever (1).
2. Check in 5th and 6th gear how much farther the lever (1) can be pushed. This travel distance (P) should be equal for both gears.



V300257

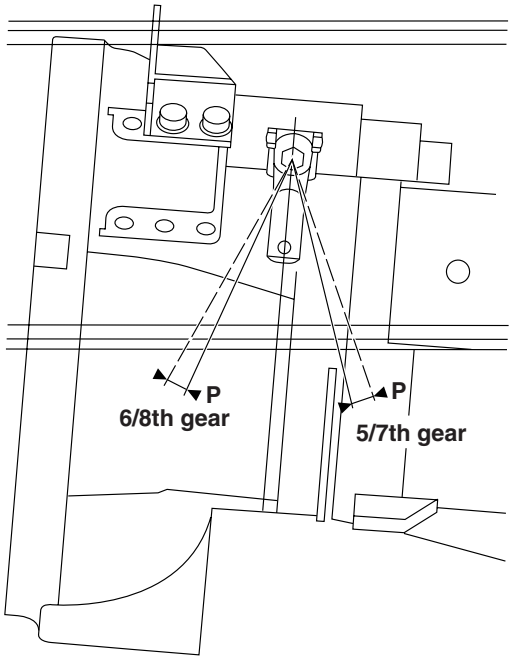
Adjustment of gear box cover

Note:
If the travel distance (P) differs, the following steps must be completed.

1. Slightly loosen the control housing fixing bolts.
2. Move the control housing forward and backward such, that this travel distance is equal for both gears (direction A-A).
3. Repeat step 2 for the 7th and 8th gear.
4. If the 1st and 2nd gears cannot be engaged, move the control housing transversely (direction B-B).
5. Tighten the control housing fixing bolts.
6. Check manually that the selector shaft runs smoothly and returns easily to the rest position.
7. Check whether the travel distance is equal in all gears.
8. If required, repeat the entire procedure.

Note:
To obtain a better stop, fit a tighter stop spring (191N instead of 168N) (DAF no. 1341343).

9. Install the shift control.



V300258

4. REMOVAL AND INSTALLATION

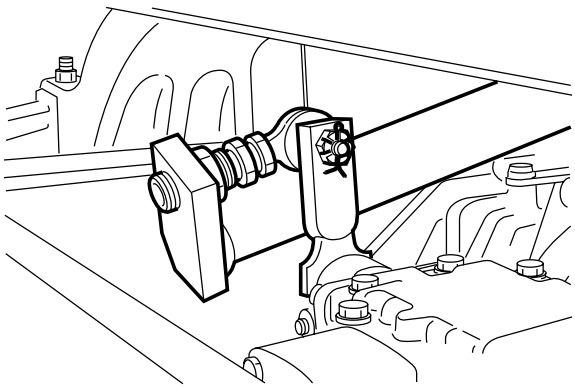
4.1 REMOVAL AND INSTALLATION OF THE GEARBOX

Removing the gearbox

1. Disconnect the earth lead from the battery pole.
2. Remove the insulation at the rear end of the engine and underneath the gearbox.
3. Disconnect the drive shaft from the gearbox flange and suspend the drive shaft from the chassis.
4. Remove the clutch servo without disconnecting the line. Remove the fixing bolts from the clutch servo and suspend the clutch servo assembly from the chassis.
5. Remove the spare wheel, if necessary.
6. Disconnect the connectors of the gearbox wiring harness.
7. Disconnect the air pipes from the central air distribution block at the side of the gearbox.

   Note:
   If the gearbox is equipped with MGS or servo shift, the following steps must be completed.

8. Remove the ball joint from the control rod on the gearbox arm, as well as the torque rod which is mounted on the clutch housing, and suspend the gearbox control from the chassis.



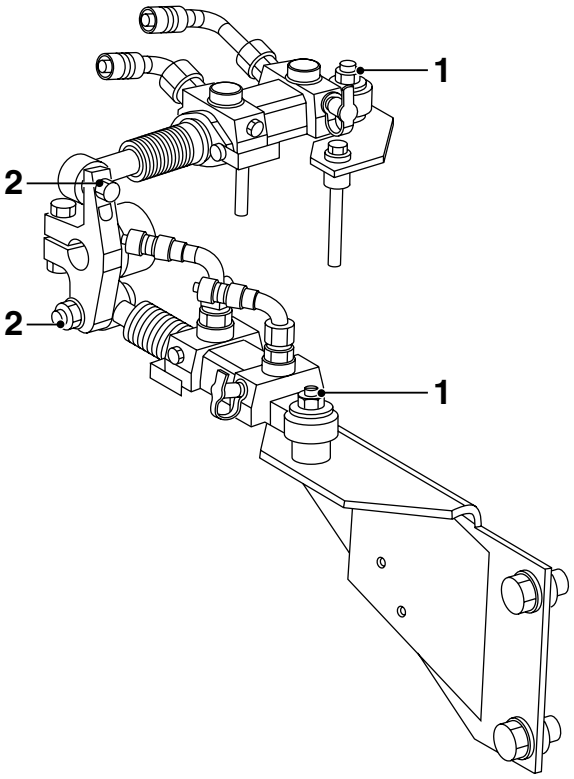
V300138

Note:
If the gearbox is equipped with HGS, the following steps must be completed.

9. Remove the fixing nuts (1) from the gear engaging cylinders mounted on the gearbox brackets on the gearbox, as well as the fixing bolts (2) from the gear engaging cylinders mounted on the gearbox arm, and suspend the cylinder assemblies so that they are entirely separated from the gearbox.
10. If necessary, remove the section of the exhaust pipe underneath the gearbox.
11. Place a jack underneath the gearbox and remove the gearbox fixing bolts around the clutch housing.

Note:
When the gearbox is removed from the engine, the thrust bearing remains in the clutch release assembly.

12. Use the jack to pull the gearbox from the engine and remove the gearbox.



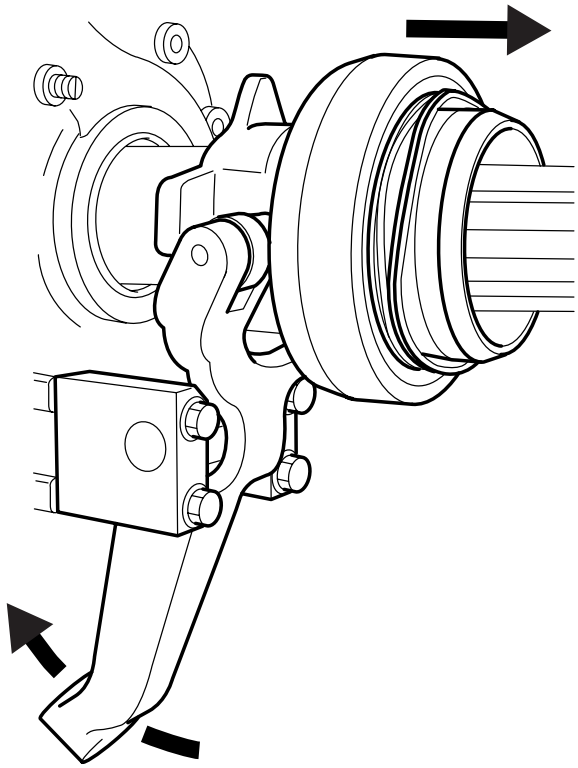
V300193

6

Installing the gearbox

1. Before positioning the gearbox, one gear should be engaged in order to allow the input shaft to slide into the clutch plate during installation.
2. Install the thrust bearing over the sliding bush and check whether the circlip in the clutch release assembly is closed.
3. Use the jack to move the gearbox towards the engine and install the fixing bolts around the gearbox.

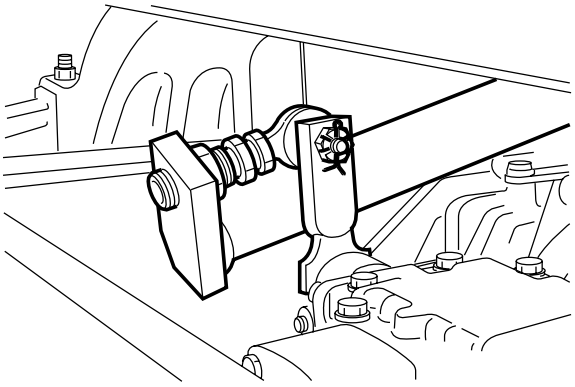
4. Pull on the clutch lever so as to lock the thrust bearing in the clutch release assembly. When the thrust bearing has been installed in the clutch release assembly, the clutch lever can no longer be moved by hand.
5. Install the clutch servo and tighten the fixing bolts.
6. If the exhaust pipe was removed, reinstall it.
7. Connect the connectors of the gearbox wiring harness.
8. Connect the air pipes of the central air distribution block at the side of the gearbox.
9. If the spare wheel was removed, reinstall it.



V300126

Note:
If the gearbox is equipped with MGS or servo shift, the following steps must be completed.

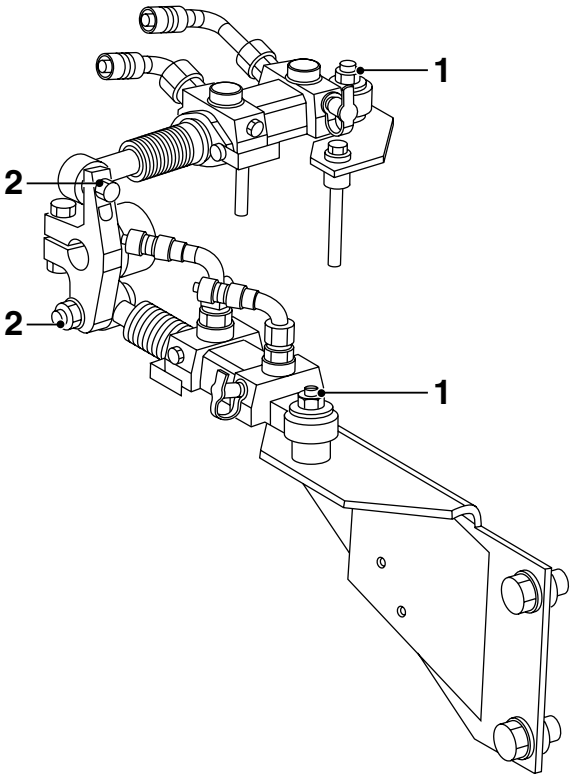
10. Install the ball joint control rod onto the gearbox arm and the torque rod on the clutch housing.
11. Check the setting of the shift control.



V300138

Note:
If the gearbox is equipped with HGS, the following steps must be completed.

12. Install the two gear engaging cylinder assemblies on the gearbox brackets and tighten the fixing bolts (1).
13. Install the fixing bolts (2) of the gearbox arm and the cylinders and tighten them.
14. Check whether all gears can be engaged.
15. Install the insulation at the rear end of the engine and underneath the gearbox.
16. Reconnect the earth lead to the battery pole.
17. If a different gearbox type has been fitted, or a gearbox with a different reduction, the correct data must be re-entered in the CTE using DAVIE.



4.2 REMOVAL AND INSTALLATION OF THE GEARBOX WITH INTEGRATED RETARDER

Removing the gearbox with integrated retarder

1. Disconnect the earth lead from the battery pole.
2. Drain the engine coolant.
3. Remove the coolant hoses from the retarder.
4. Remove the coolant pipes between the retarder and the engine.
5. Remove the electrical connectors and air pipes from the retarder.
6. Remove the gearbox including the retarder.

Installing the gearbox with integrated retarder

1. Install the gearbox.
2. Install the coolant pipes between the retarder and the engine.
3. Connect the coolant hoses to the retarder.
4. Install the electrical connectors and air pipes of the retarder.
5. Check/fill the gearbox and integrated retarder with oil.
6. Fill the engine cooling system.

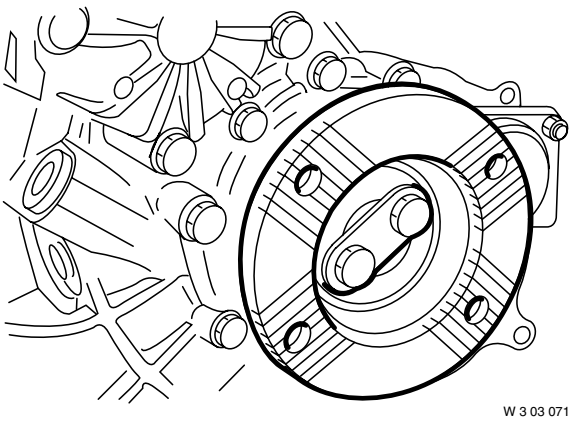
4.3 REMOVAL AND INSTALLATION OF THE DRIVE FLANGE

Removal of the drive flange

1. Remove the drive shaft from the gearbox flange and suspend the drive shaft from the chassis.
2. Remove the lock plate from the bolt heads in the drive flange.

   Note:
   If no lock plate has been fitted, the tapped holes will have been furnished with a locking facility. When reinstalling the drive flange, make sure that the bolts are **always** locked using a lock plate.
3. Remove the bolts and lock plate from the drive flange.

   Note:
   Measure and take note of the distance between the drive flange and the shaft. The same distance must be observed when the drive flange is reinstalled.
4. Remove the drive flange and O-ring using a commercially available tripod puller.



W 3 03 071

Installing the drive flange

1. Slightly grease the oil sealing ring of the bearing cover.
2. Heat the drive flange to 70°C. Slide the drive flange as far as possible onto the output shaft. Use the retainer plate and two standard bolts (M12x75) to pull the drive flange farther onto the shaft.
3. Remove the bolts and measure whether the drive flange has reached the correct position on the output shaft.
4. Fit a new O-ring into the recess between the output shaft and the drive flange.
5. Clean the fixing bolts and oil them slightly.

6. Install the lock plate using the fixing bolts and tighten these to the specified tightening torque, see main group “Technical Data”.

   Note:
   Always install a new lock plate, even if no lock plate has been fitted before. This is to compensate for reduced locking of the self-locking bolt holes which are applied if no lock plate is fitted.

7. Use the special tool (DAF no. 1240460) to drive the new lock plate over the bolt heads.

8. Fit the drive shaft.

4.4 REMOVAL AND INSTALLATION OF THE OUTPUT SHAFT OIL SEAL

Removing the output shaft sealing ring

1. Remove the drive shaft from the gearbox flange and suspend the drive shaft from the chassis.

2. Remove the drive flange.

3. Drill two small holes into the external cover of the oil seal and turn the special tool (DAF no. 0484899) into the oil seal. Pull the sealing ring from the bearing cover using special tool (DAF no. 0694928).

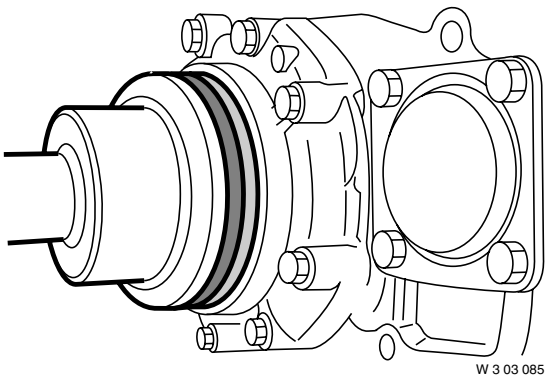
Installing the output shaft sealing ring

1. Apply a thin layer of liquid jointing compound to the outer circumference of steel-jacket sealing rings.
   Apply a thin layer of green soap to the outer circumference of rubber-jacket sealing rings.

2. Install the sealing ring into the rear cover of the gearbox using the special tool (DAF no. 0694780).

3. Fit the drive flange.

4. Fit the drive shaft.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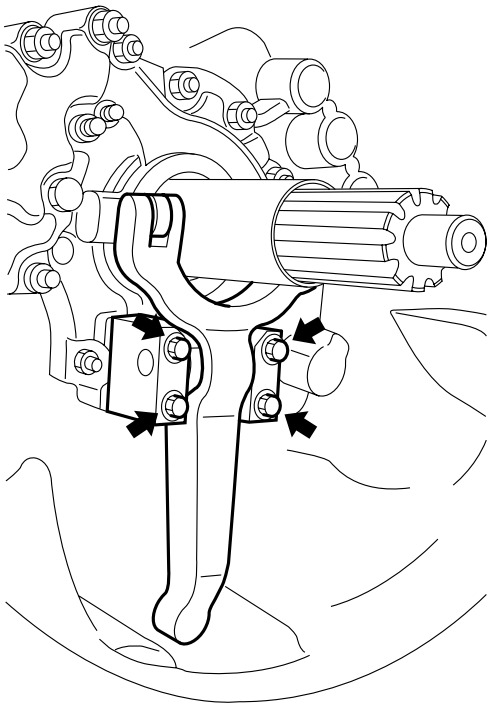
4.5 REMOVAL AND INSTALLATION OF SLIDING BUSH SEALING RING

Removing the sliding bush sealing ring

1. Remove the gearbox.
2. Remove the clutch lever from the clutch housing.
3. Remove the fixing nuts from the sliding bush and remove the sliding bush.
4. Remove the oil seal from the sliding bush.
5. Remove the old gasket from the sliding bush and/or from the gearbox housing.

Installing the sliding bush sealing ring

1. Apply a thin liquid gasket to the outer circumference of the sealing ring and install the sealing ring in the sliding bush using the special tool (DAF no. 0535703).
2. Inspect the axial clearance of the input shaft bearing.
3. Slide the sliding bush over the input shaft and tighten the sliding bush to the specified tightening torque, see main group “Technical Data”.
4. Install the clutch lever into the clutch housing.
5. Install the gearbox.



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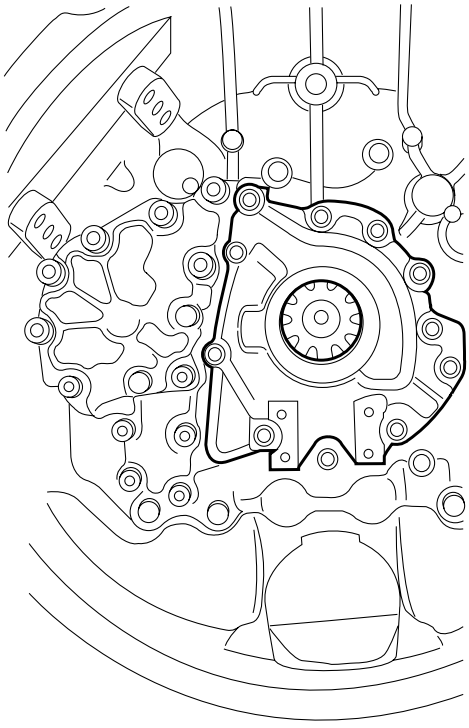

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4.6 REMOVAL AND INSTALLATION OF SELECTOR SHAFT SEALING RING

Removing the selector shaft sealing ring MGS/HGS

1. **Note:**
   If the gearbox is equipped with MGS, the following steps must be completed.

   Remove the ball joint from the control rod on the gearbox arm, as well as the torque rod which is mounted on the clutch housing. Suspend the control rod from the chassis.

2. **Note:**
   If the gearbox is equipped with HGS, the following steps must be completed.

   Remove the two fixing bolts from the gear engaging cylinders mounted to the gearbox arm.

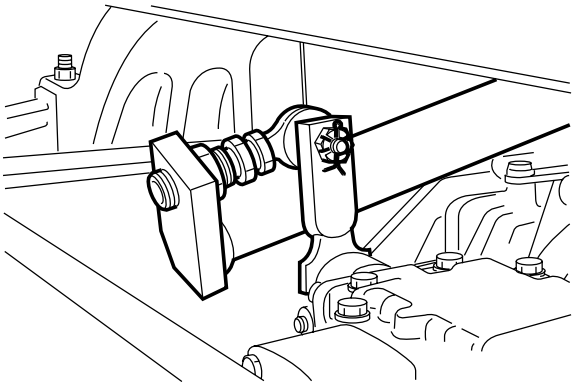
3. Remove the lock bolt and lock ring from the selector shaft and remove the gearbox arm together with the dust cover.

4. Loosen the bolts of the sealing ring cover and remove the cover.

5. Check the selector shaft for damage. If necessary, sand lightly using a fine abrasive cloth.

6. Remove the sealing rings together with the bearing bush from the cover, using the special tool (DAF no. 0535659).

7. Check the bearing bush for damage and replace, if necessary.



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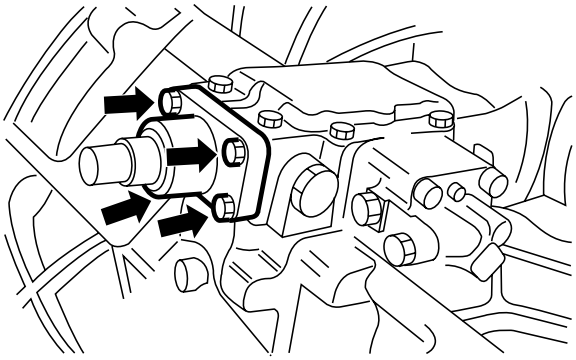

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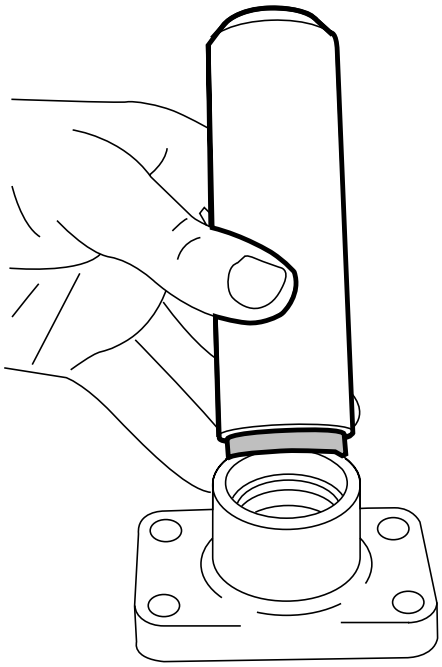
Installing the selector shaft sealing ring MGS/HGS

1. Install the bearing bush in the cover, using special tool (DAF no. 0535659).
2. Apply liquid jointing compound thinly to the outer circumference of the first sealing ring to be installed and install it in the cover, using special tool (DAF no. 0535659).
3. Apply liquid jointing compound thinly to the outer circumference of the second sealing ring to be installed and install it in the cover, using special tool (DAF no. 0535659).
4. Apply a thin layer of grease to the inside of both sealing rings.
5. Install a new gasket, carefully slide the cover over the selector shaft and hand-tighten the bolts. Move the selector shaft from one side to the other several times, allowing the cover to centre itself. Tighten the fixing bolts to the specified tightening torque. See main group “Technical Data”.
6. Install the dust cover and the gear lever. Make sure that there is no clearance between the dust cover and the gear lever, and install the sealing ring and lock bolt.
7. **Note:**
   If the gearbox is equipped with MGS, the following steps must be completed.

   Install the ball joint control rod onto the gearbox arm and the torque rod on the clutch housing.
8. **Note:**
   If the gearbox is equipped with HGS, the following steps must be completed.

   Install the two fixing bolts of the gear engaging cylinders onto the gearbox arm.



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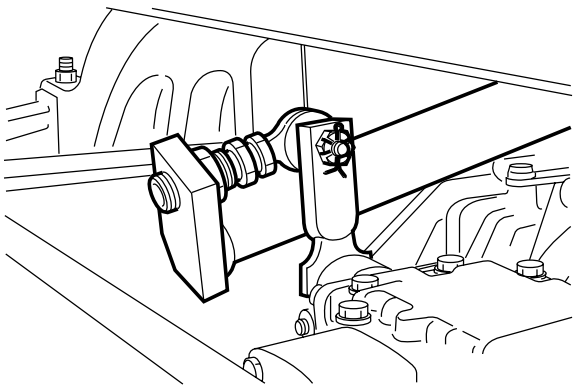
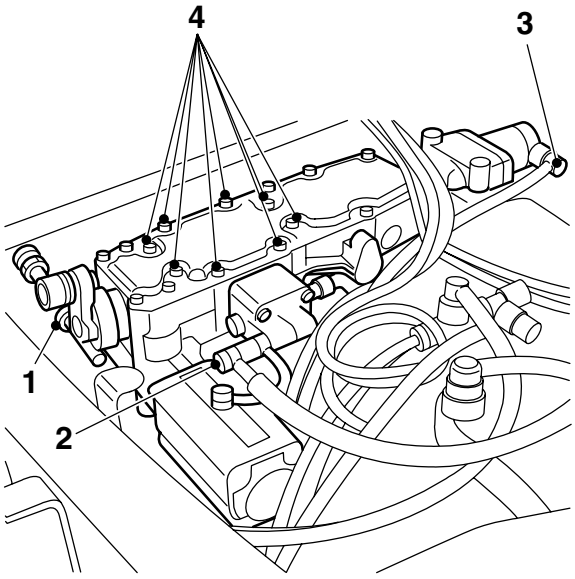


V300138

Removing the servo shift selector shaft sealing ring

1. Loosen the torque rod on the clutch-housing side and loosen the fixing bolt (1) from the selector shaft. Remove the gearbox lever together with the dust cover. Suspend the control rod from the chassis.
2. Having made sure that the servo shift unit's air-supply line (2) is pressureless, remove the banjo bolt.
3. Remove the air line (3) from the gate safety locking cylinder.

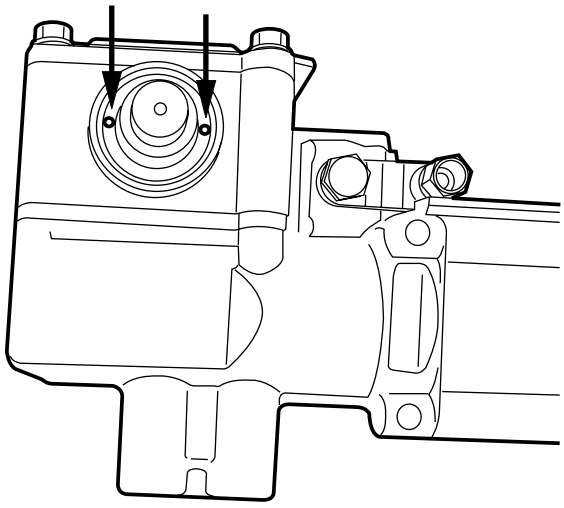
   Note:
   A small amount of oil is released when the control housing is removed.
4. Remove the eight bolts (4) that attach the control housing to the gearbox. Remove the control housing together with the shift unit from the gearbox.



V300341

5. Drill two small holes into the sealing ring and pull, using the special tools (DAF no. 0484899 and DAF no. 0694928), the sealing ring from the control housing.

   Note:
   Check whether the sealing ring has been removed completely. There is always the possibility that during disassembly the sealing ring will be pulled apart and that the rear part will remain in the housing.
6. Check the selector shaft for damage. If necessary, sand lightly using a fine abrasive cloth. Replace the shaft if serious damage is found.
7. Check the control housing for damage. Replace, if required.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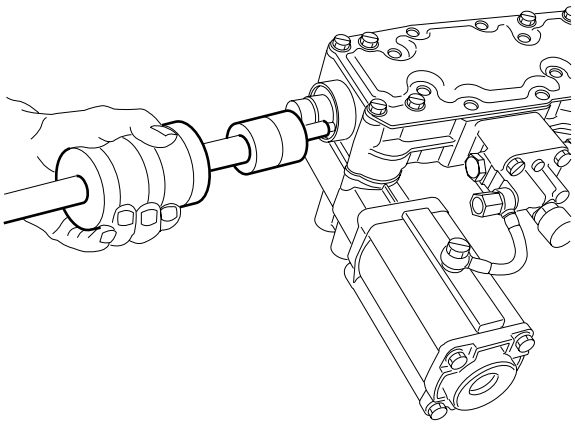
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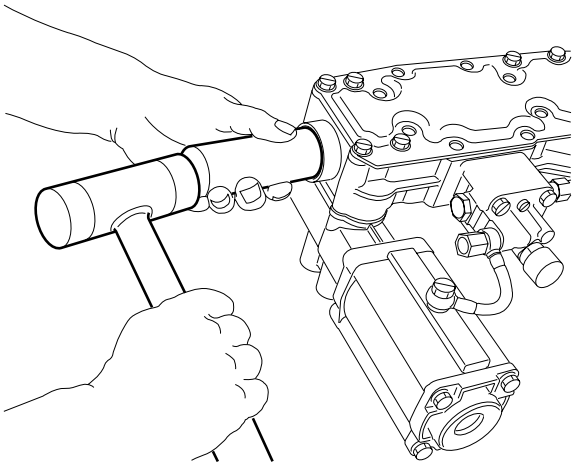
Installing the servo shift selector shaft sealing ring

1. Apply a thin layer of grease to the inside of the sealing ring.
2. Install the sealing ring in the control housing using the special tool (DAF no. 1329450).
3. Install the control housing onto the gearbox using a new gasket and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
4. Install the dust cover and the gear lever onto the selector shaft. Make sure that there is no clearance between the dust cover and the gear lever.
5. Tighten the gear lever lock nut.
6. Install the torque rod onto the clutch housing bracket.
7. Install the servo shift unit’s air-supply lines and the gate safety locking cylinder using new sealing rings.Repressurise the air circuit and check the operation of the servo shift unit.



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5. DRAINING AND FILLING

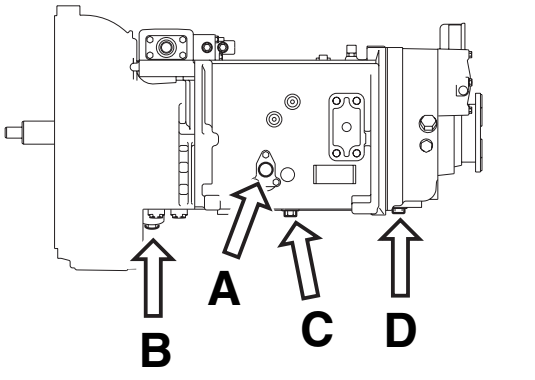
5.1 DRAINING AND FILLING THE GEARBOX

To prevent skin injury, avoid unnecessary contact with the drained oil.

Gearbox 16S-181/221

Draining the gearbox
1. Place the vehicle on a flat and level surface.
2. Drain the gearbox at operating temperature using plugs (B), (C), and (D).

Filling the gearbox
1. Clean the drain plugs and tighten these to the specified tightening torque, see main group “Technical Data”.
2. Fill the oil through filling/level opening (A) until the oil reaches the rim of the filling opening.
3. Tighten the filling/level plug to the specified tightening torque, see main group “Technical Data”.



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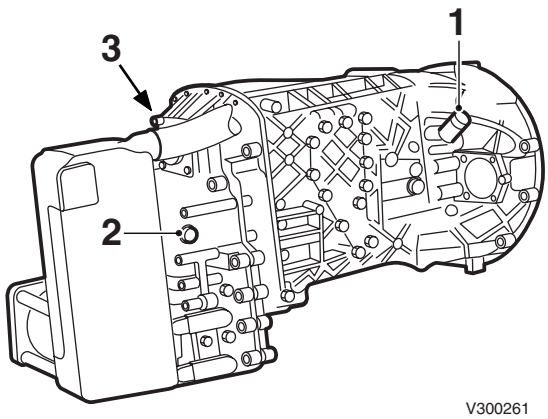
Gearbox 16S-181/221 with integrated retarder

Draining the gearbox
1. Take a test drive before draining. Do **not** activate the retarder during the test drive .
2. Place the vehicle on a flat and level surface.
3. Drain the gearbox at operating temperature using the drain plugs (1) and (2).
4. Replace the oil filter (3), see main group “ZF intarder”.



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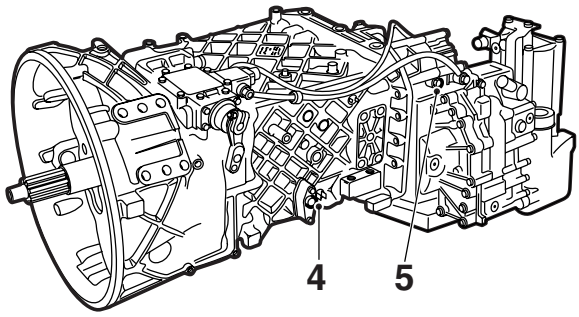
Filling the gearbox (oil change)

1. Clean the drain plugs and tighten these to the specified tightening torque, see main group “Technical Data”.
2. Fill the oil through filling/level opening (4) until the oil reaches the rim of the filling opening (4).
3. Take a short test drive after filling. Do **not** activate the retarder during the test drive.
4. Check the oil level after the test drive. The oil level must reach the rim of the oil-level/filling opening (4).
5. Tighten the oil-level/filling plug to the specified torque, see main group “Technical Data”.

Filling the gearbox (following repair or gearbox replacement)

1. Place the vehicle on a flat and level surface.
2. Fill the oil through filling opening (5) until the oil reaches the rim of the oil-level/filling opening (4).
3. Take a short test drive after filling. Activate the retarder **briefly** to the maximum during the test drive.
4. Check the oil level after the test drive. The oil level must reach the rim of the oil-level/filling opening (4).
5. Tighten the filling plug (5) and the oil-level plug (4) to the specified tightening torque, see main group “Technical Data”.



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1. SAFETY INSTRUCTIONS

1.1 SAFETY INSTRUCTIONS

Hydraulic fluid is toxic and can therefore have a damaging effect on your health.
Hence avoid any direct or indirect physical contact.
As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications.
Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system.
Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

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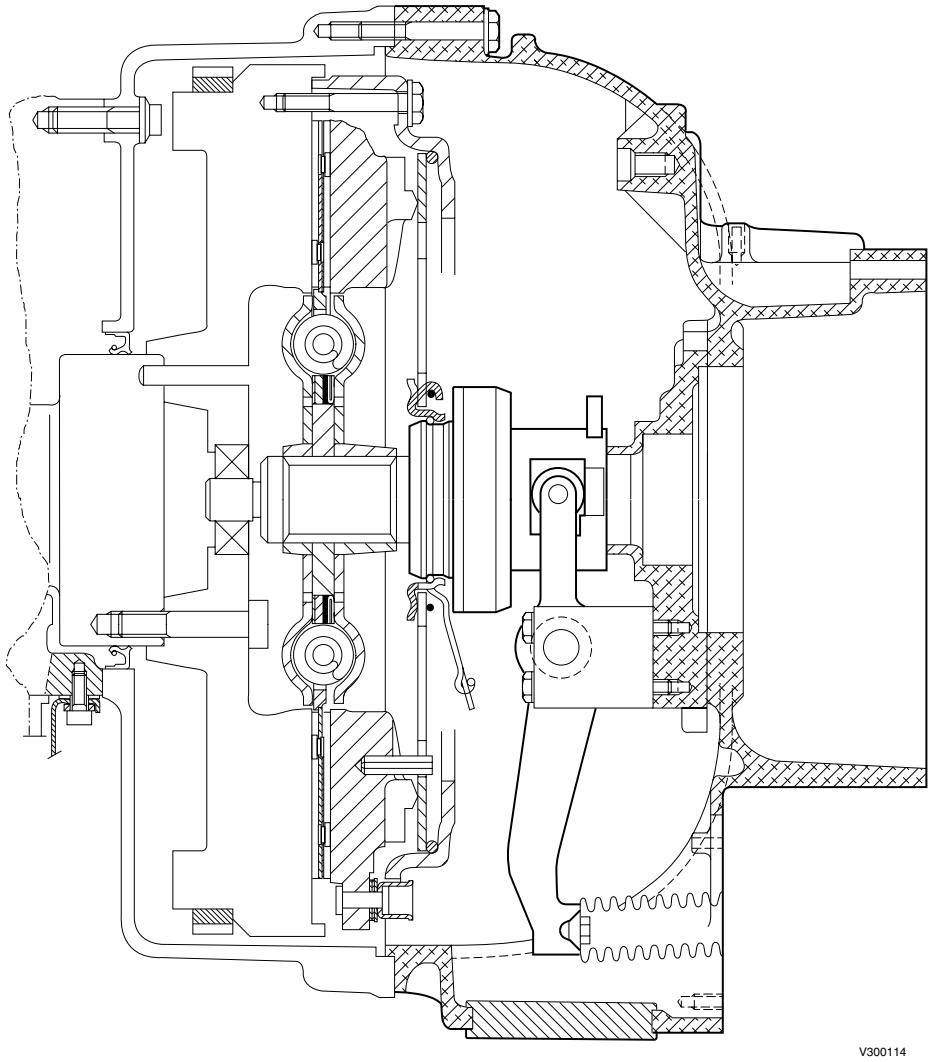
2. GENERAL

2.1 DESCRIPTION OF THE CLUTCH SYSTEM

The “drawn clutch” is a single dry-plate clutch, which is hydraulically operated and pneumatically assisted.

The clutch consists of
- flywheel
- clutch plate
- clutch release assembly

By clamping the clutch plate between the flywheel and the clutch release assembly, a torque can be transferred (by means of friction).



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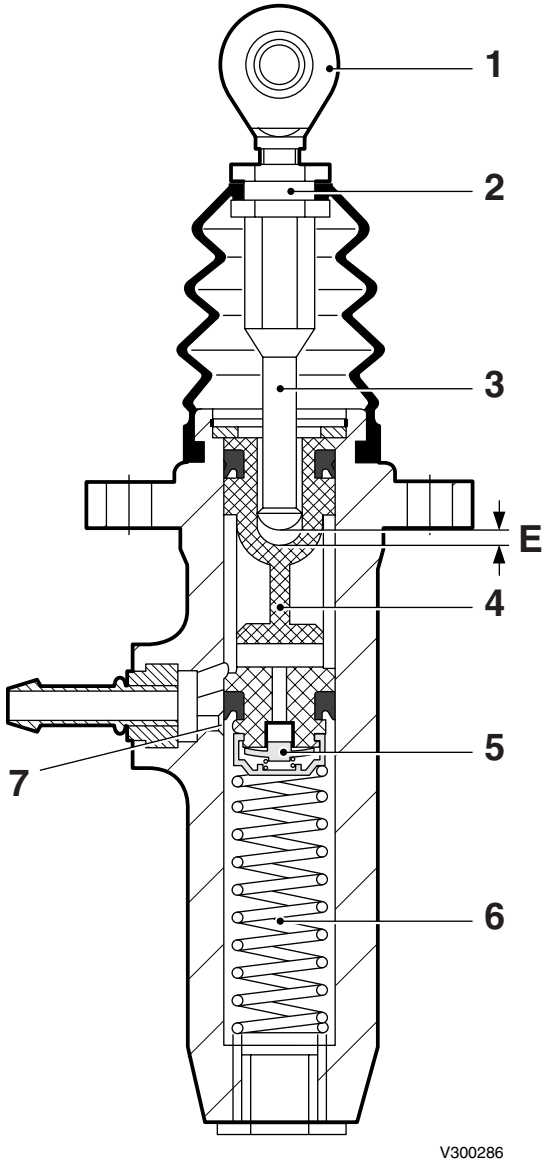
To clamp the clutch plate, a diaphragm spring is used in the clutch release assembly.
A diaphragm spring constitutes a simple, strong and cost-effective construction.
Another advantage of the diaphragm spring is that the pressure exerted on a new clutch plate almost equals the pressure exerted on a worn clutch plate.

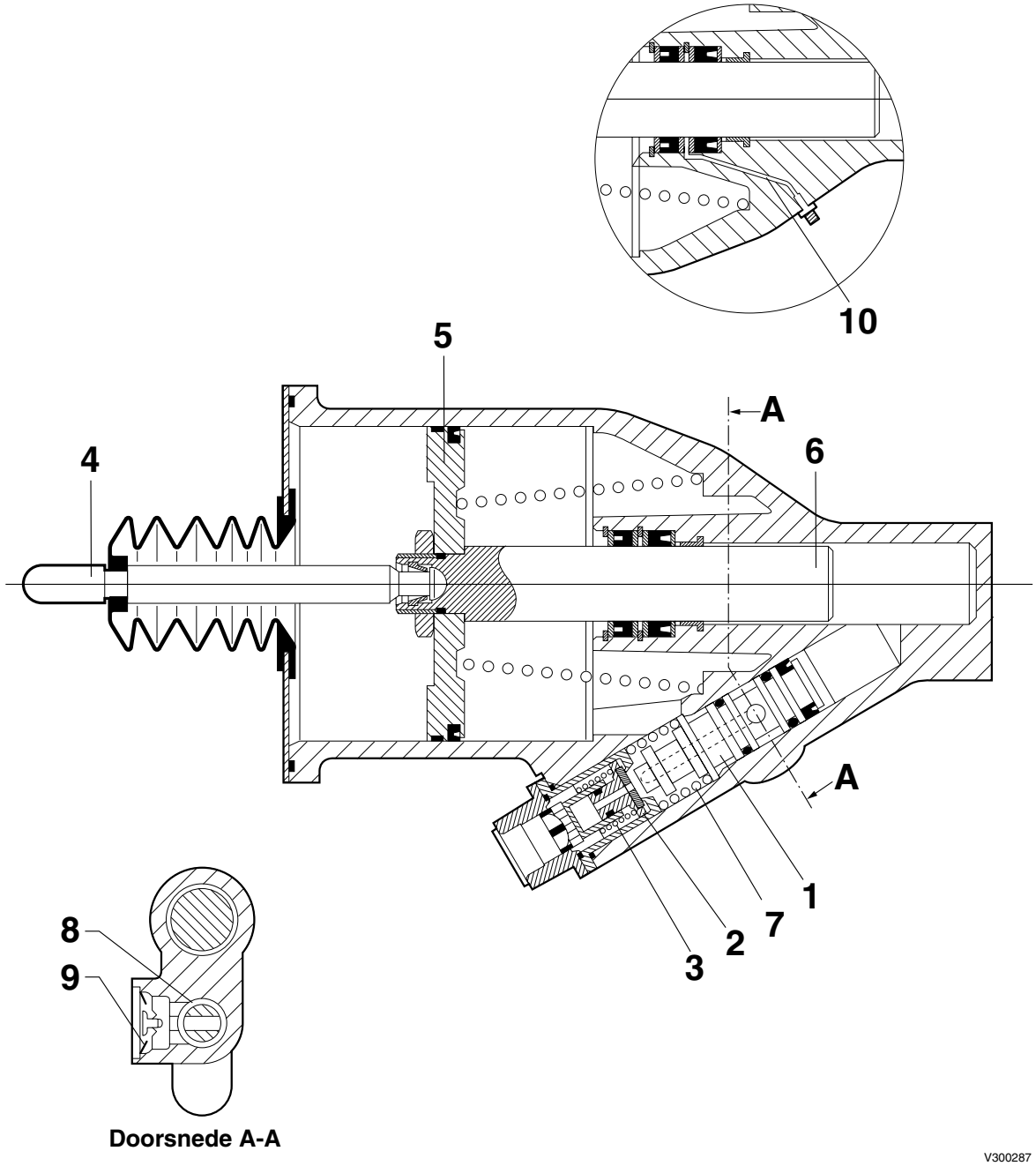
The “drawn clutch” has the following advantages over a “pushed clutch”:
- favourable transfer ratio, resulting in lighter pedal pressure
- lower weight of the clutch release assembly
- simple construction of the clutch release assembly

2.2 OVERVIEW DRAWING OF MASTER CYLINDER

1. Push rod with eye
2. Push rod adjustment
3. Push rod
4. Piston
5. Valve
6. Spring
7. Balance hole



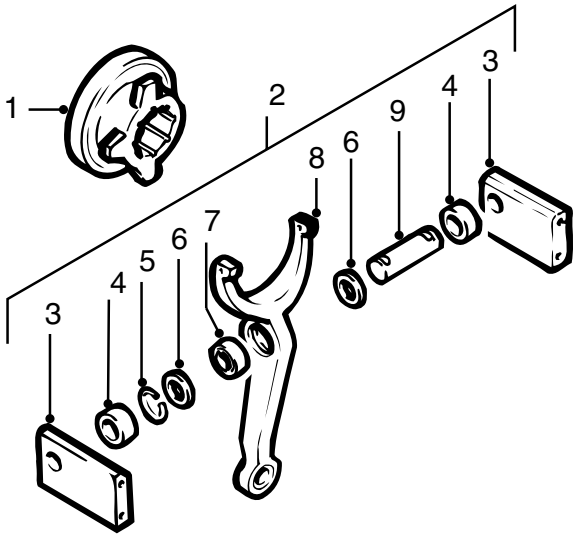
2.3 OVERVIEW DRAWING OF CLUTCH SERVO



1. Servo piston
2. Air valve
3. Spring
4. Pressure pin
5. Air piston
6. Fluid piston
7. Pressure spring
8. Vent bore hole
9. Exhaust
10. Vent opening

2.4 OVERVIEW DRAWING OF CLUTCH LEVER ATTACHMENT

1. Thrust bearing
2. Lever assembly
3. Bracket
4. Bearing bush
5. Circlip
6. Shim
7. Bearing housing lever
8. Lever
9. Axle



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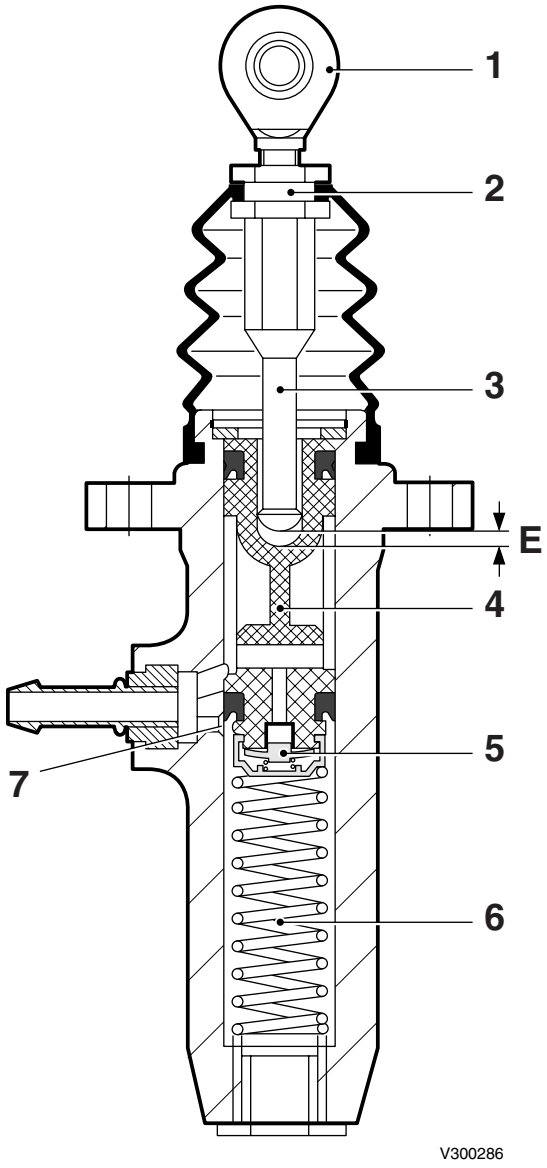
3. DESCRIPTION OF COMPONENTS

3.1 MASTER CYLINDER

When the clutch pedal is depressed, push rod (3) will move the piston (4) down against the spring (6).
As a result, valve (5) will close and start to build up pressure as the sleeve passes the bore hole of the reservoir.

When the clutch pedal is released, spring (6) ensures that piston (4) returns to the initial position.
Any shortage of fluid underneath the piston (4) is refilled via a bore hole in the piston (4) and the valve (5).

It is important that, after you have activated the clutch pedal, the piston (4) fully returns to the initial position, to prevent the 0.6 mm balancing hole (7) from being blocked by the piston sealing (4). If the balancing hole is not fully unblocked, a residual pressure is built up causing excessive wear on the clutch system.
The piston (4) can return fully to its initial position if there is sufficient clearance (E) between the push rod (3) and the piston (4), see main group “Technical Data”.



3.2 CLUTCH SERVO

Declutching
Depressing the clutch pedal results in a hydraulic pressure build-up.

This causes the servo piston (1) to push the air valve (2) away from the valve seat, against the force of spring (3).

Air pressure now flows into the cylinder.

The pressure pin (4) is pushed forward by the air pressure building up on air piston (5) and the hydraulic pressure on fluid piston (6).

The pressure pin (4) pushes against the clutch lever, which results in declutching.

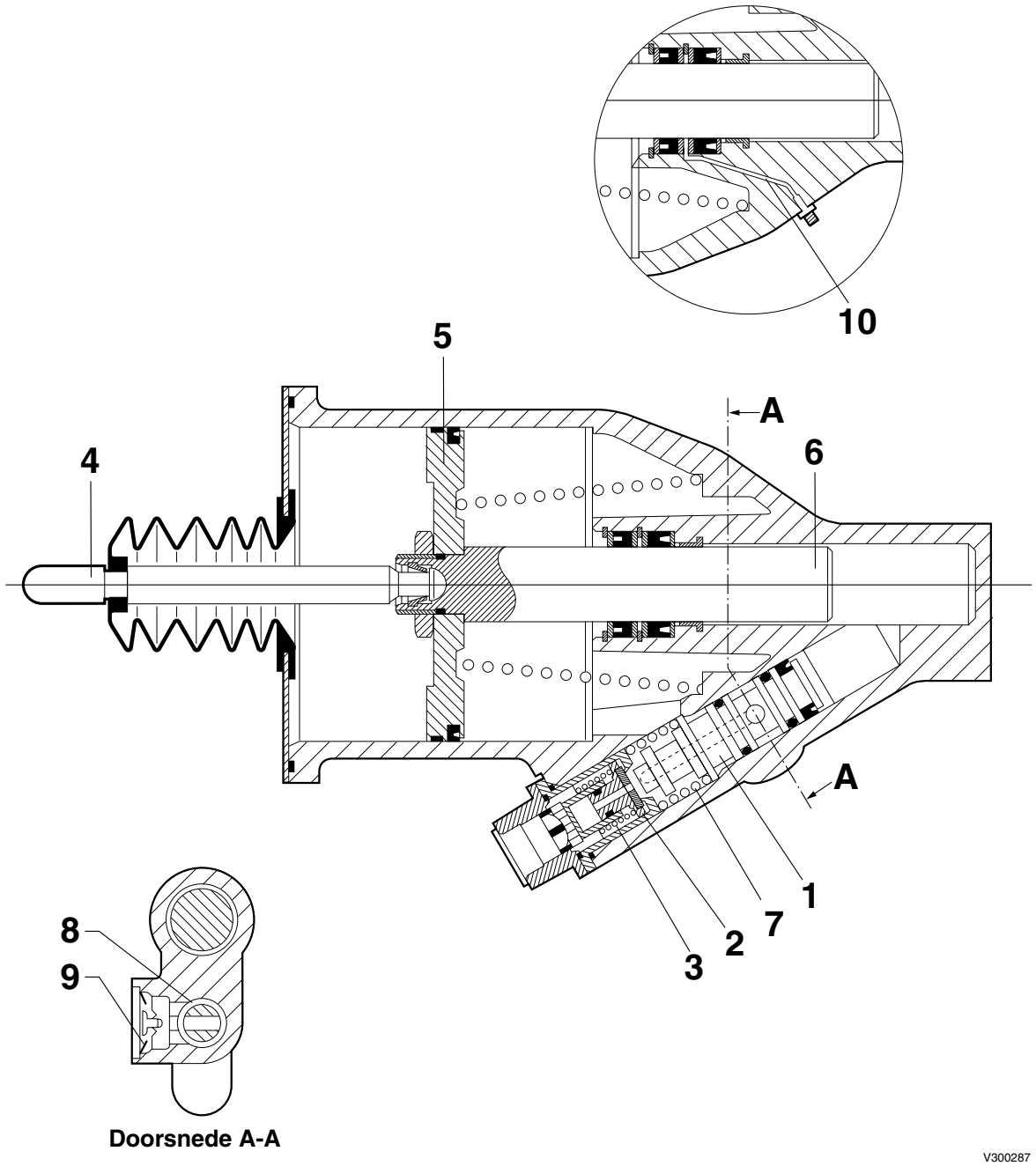
State of balance
When the hydraulic pressure and pneumatic assistance push pressure pin (4) forwards, a state of balance is achieved between the air pressure and hydraulic pressure (status when the clutch pedal is not depressed any further).

The servo piston (1) again seals off against the valve seat, closing the air supply and stopping the build-up of pneumatic pressure.

Clutching
When the clutch pedal is released, there is no longer any hydraulic pressure and the servo piston (1) will be pushed back into its initial position by the pressure spring (7) and any remaining pneumatic support.

As a result, the vent bore hole (8) in the servo piston (1) is no longer closed, and venting takes place via exhaust (9).

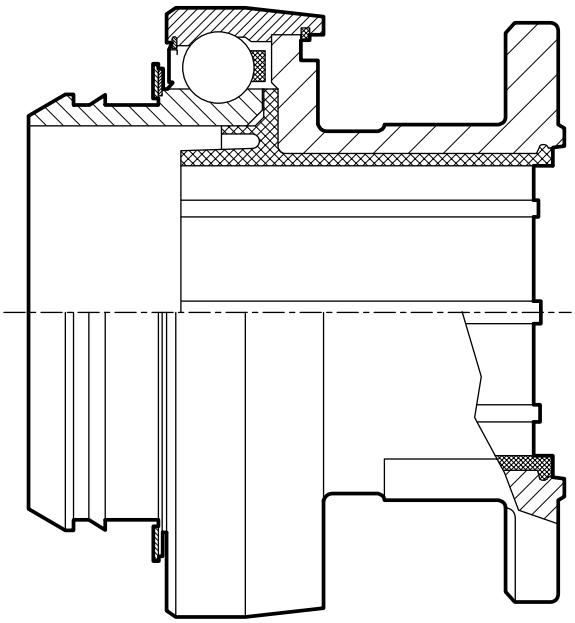
Vent opening
The function of the vent opening (10) is to prevent a pressure build-up between the two piston seals.



1. Servo piston
2. Air valve
3. Spring
4. Pressure pin
5. Air piston
6. Fluid piston
7. Pressure spring
8. Vent bore hole
9. Exhaust
10. Vent opening

3.3 THRUST BEARING OF DRAWN CLUTCH

Thrust bearing of drawn clutch
The thrust bearings used in these vehicles have been specially designed to prevent wear at the tops of the diaphragm fingers.
They are self-centring and have life-long lubrication.

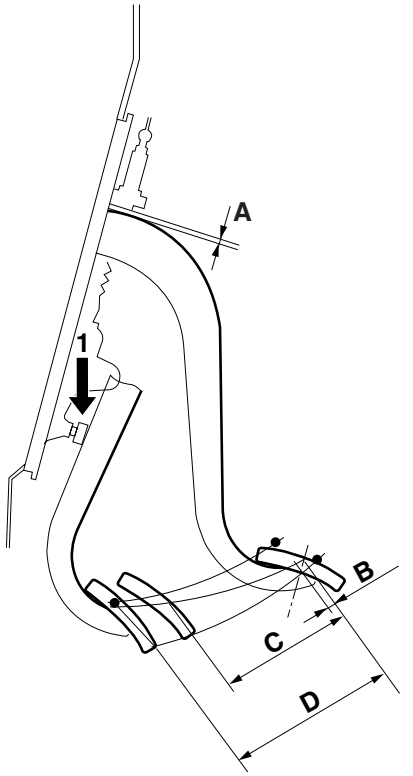

V300173

4. INSPECTION AND ADJUSTMENT

4.1 INSPECTION AND ADJUSTMENT OF THE CLUTCH PEDAL

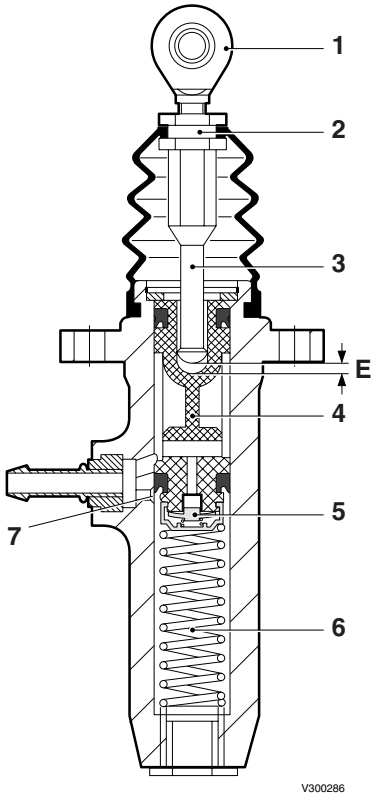
Inspecting the clutch pedal

1. Check the full travel (D) of the clutch pedal, see main group “Technical Data”.
2. Check the free travel (B) of the clutch pedal, see main group “Technical Data”. The free travel (B) can be felt by manually depressing the clutch pedal from its initial position.



Adjusting the clutch pedal

1. Use the adjusting screw (1) to adjust the full travel (D), see main group “Technical Data”.
2. The free travel (B) of the clutch pedal is set indirectly by loosening the lock nut (2) and then turning the ball joint (1) into or out of the push rod (3). This sets the distance (E) between the push rod (3) and the piston (4) in the main cylinder, see main group “Technical Data”.



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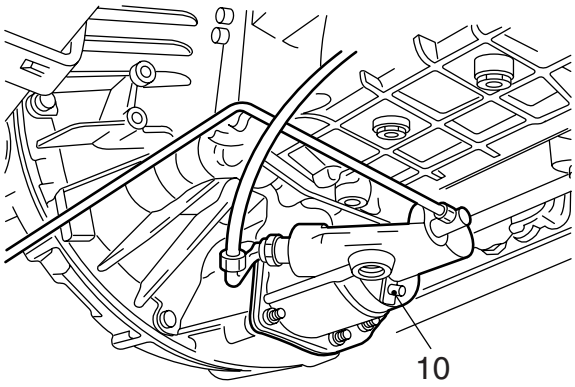
4.2 INSPECTION OF THE CLUTCH SERVO

Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system. Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

1. Pressurise the air system.
2. Check for any air leakage via the exhaust.
3. Depress the clutch pedal and check for any leakage via the exhaust.

   Note:
   When the clutch pedal is released, the clutch servo should vent through this exhaust.
4. Depress the clutch pedal and check for any fluid leakage via the vent opening.



V300289

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5. Check for any oil leakage via the vent opening (10).

   Note:
   Finding a drop of oil at the ventilation opening (10) is normal and is no reason to replace or repair the clutch servo. In the event of constant leaks, the clutch servo should be repaired or replaced. Check the fluid level in the clutch reservoir if you have any doubts about whether or not the situation is normal or the clutch servo is leaking.

6. Depress the clutch pedal and check for any air leakage via the vent opening (10).

4.3 INSPECTION OF CLUTCH FLUID LEVEL

Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

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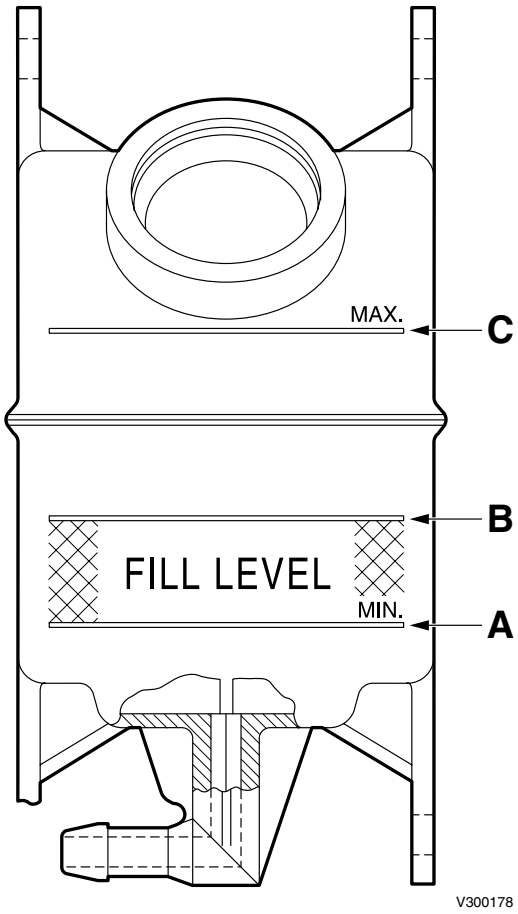
1. Check whether the fluid level is between the (A) and (B) marks when the cab is in the driving position.
2. Mark (C) applies to fully tilted cabs.
3. Always finger-tighten the reservoir cap.

   Note:
   The cap contains an exhaust which may be blocked when the cap is tightened using excessive force. If the exhaust is blocked, a residual pressure will be built up in the system.



5. REMOVAL AND INSTALLATION

5.1 REMOVAL AND INSTALLATION OF THE CLUTCH SERVO

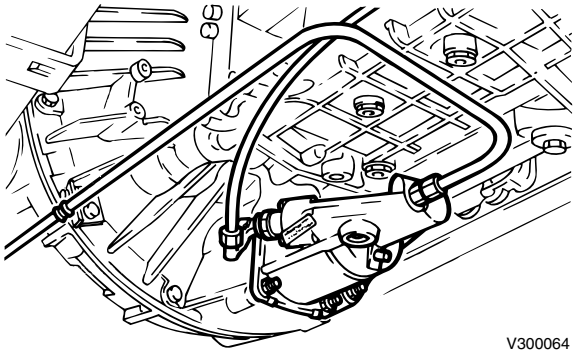
Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system. Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

Removing the clutch servo

1. Remove the air pipe from the clutch servo.
2. Place a container under the clutch servo and remove the fluid pipe. Then plug the pipe.

   Note:
   The clutch servo is mounted on the clutch housing using pre-tension.
3. Remove the fixing nuts from the clutch servo.


V300064

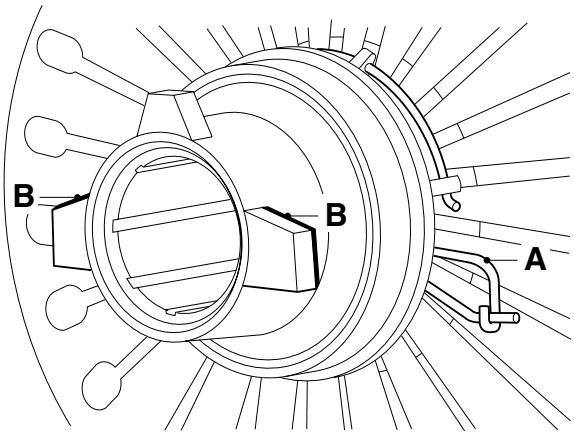
Installing the clutch servo

1. Apply a little anti-seize compound to the pressure side of the push rod.
2. Install the clutch servo. Make sure that the push rod fits into the cup-shaped recess in the clutch lever.
   Then evenly tighten the fixing nuts.
3. Connect the air and fluid pipes.
4. Fill and bleed the clutch system.

5.2 REMOVAL AND INSTALLATION OF THE THRUST BEARING

Removing the thrust bearing

1. Remove the gearbox.
2. Remove the thrust bearing from the clutch release assembly by releasing the circlip (A) from the clutch release assembly.



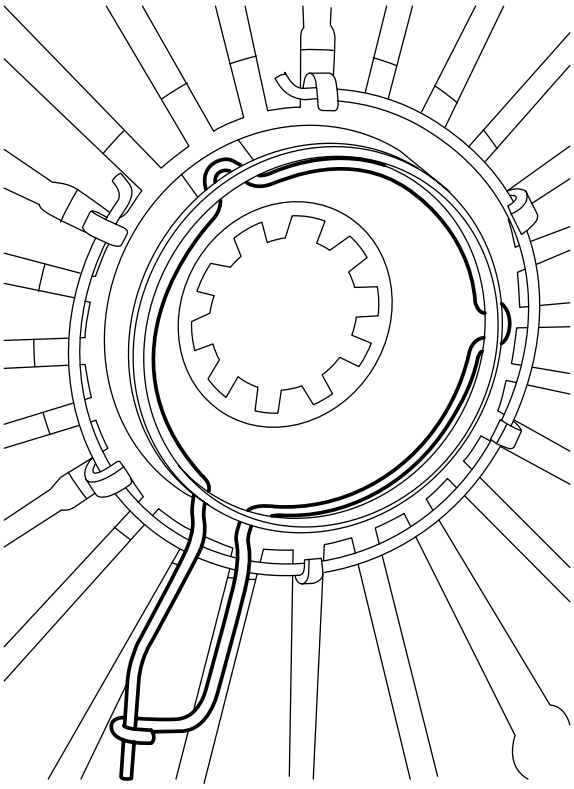
V300059

Installing the thrust bearing

Note:
- Do not use grease when installing the sliding bush.
- The thrust bearing room chamber has life-long lubrication.
- Apply a little grease to all contact points of the declutching fork.
- Apply a little grease to the thrust washer.

1. Install the thrust bearing, the lip pointing up, **dry** onto the sliding bush.
2. Move the clutch lever, causing the thrust bearing to engage behind the rolls of the clutch lever.

   Note:
   Before installing the gearbox, check whether the circlip in the clutch release assembly has been locked.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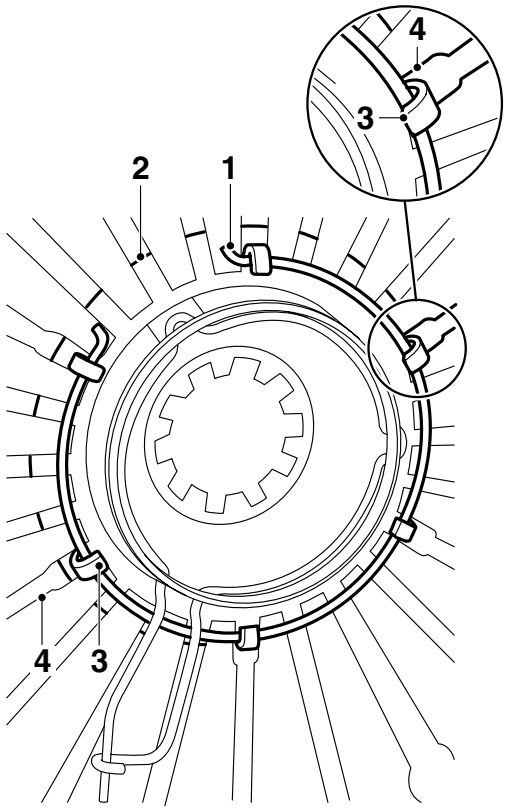
3. Before installing the gearbox, check whether the retainer plate (2) and lock ring (1) and circlip (3) have been fitted in the correct locations. The diaphragm springs (4) have special recesses to accommodate the circlips (3).
4. Install the gearbox.
5. Move the clutch lever so as to lock the thrust bearing in the clutch release assembly.



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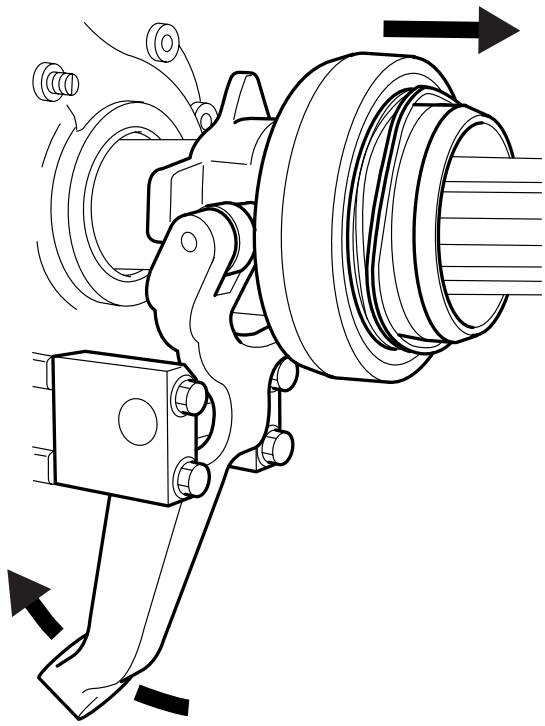
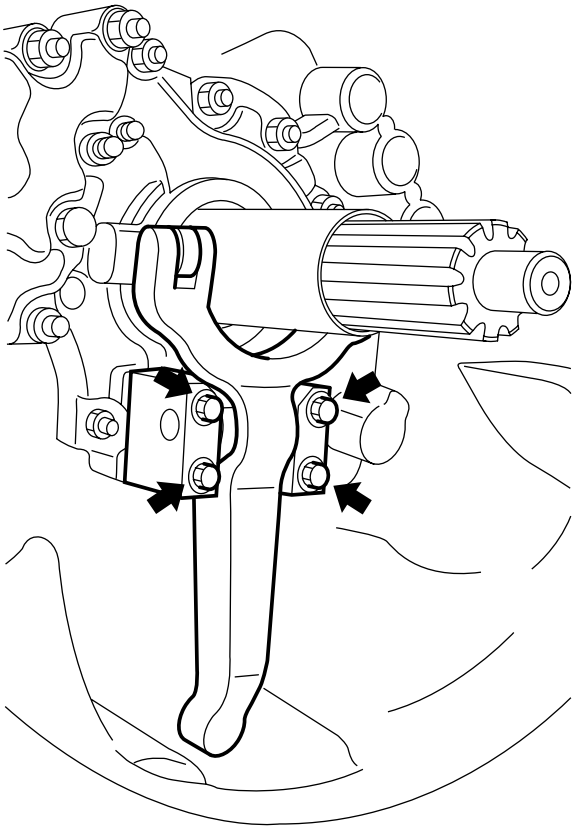

V300126

5.3 REMOVAL AND INSTALLATION OF THE CLUTCH LEVER

Removing the clutch lever
1. Remove the gearbox.
2. Remove the thrust bearing.
3. Remove the fixing bolts from the clutch lever.

Installing the clutch lever
1. Apply a little grease to the moving parts of the clutch lever.
2. Install the clutch lever on the gearbox and tighten the fixing bolts.
3. Install the thrust bearing.
4. Install the gearbox.



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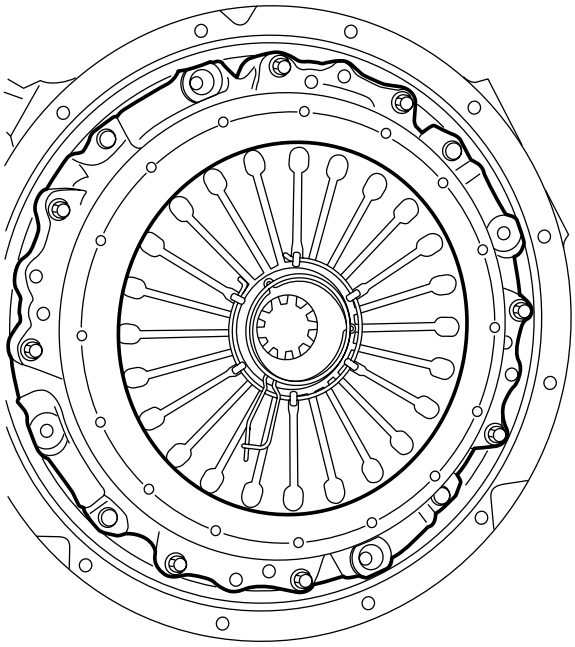
5.4 REMOVAL AND INSTALLATION OF CLUTCH RELEASE ASSEMBLY/CLUTCH PLATE

Removing the clutch release assembly/clutch plate

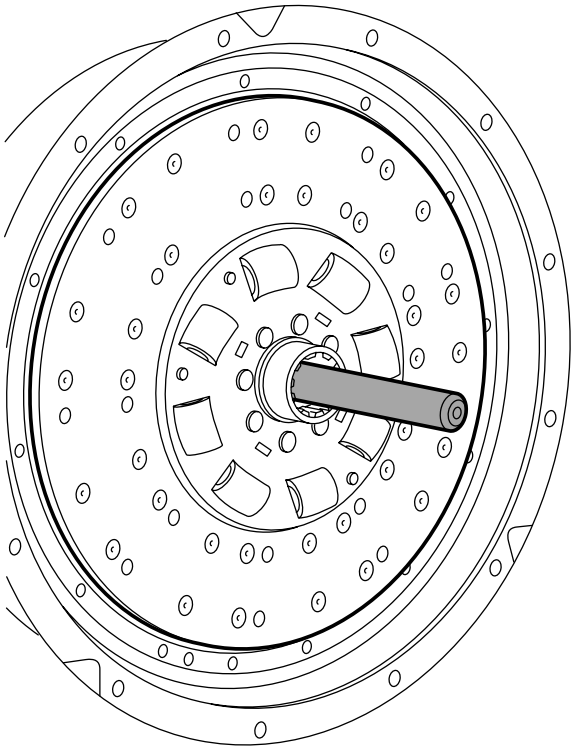
1. Remove the gearbox.
2. Remove the thrust bearing.
3. Insert a dummy input shaft through the hub of the clutch plate in the pilot bearing of the flywheel.
4. Distributed around the circumference, remove four fixing bolts from the clutch release assembly and replace them by studs.
5. Gradually remove the remaining fixing bolts of the clutch release assembly.
6. Remove the clutch release assembly by sliding it from the four studs.
7. Remove the clutch plate with the dummy input shaft.



V300125

Installing the clutch release assembly/clutch plate

1. Apply a little grease to the input shaft and the movement of the clutch plate on the splines of the input shaft.
2. Use the dummy input shaft to position the clutch plate against the flywheel.
3. Install four studs in the flywheel, distributed evenly around the circumference.
4. Support the clutch release assembly and slide it onto the four studs.
5. Install the fixing bolts and tighten them evenly to the specified tightening torque, see main group “Technical Data”.
6. Apply a little grease to all pivoting points of the declutching fork.
7. Install the gearbox.



V300124

5.5 REMOVAL AND INSTALLATION OF THE PILOT BEARING

Removing the pilot bearing

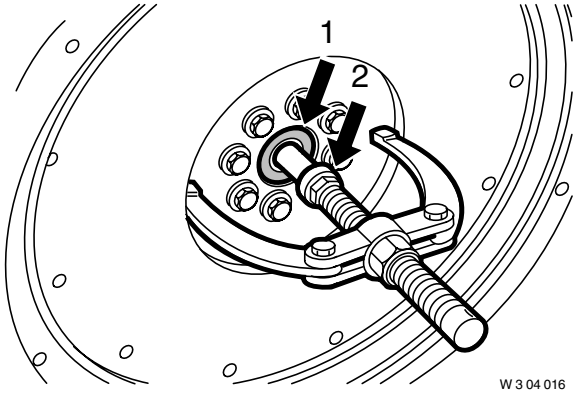
1. Remove the gearbox.
2. Remove the clutch release assembly and the clutch plate.
3. Use an internal puller to remove the pilot bearing from the flywheel.

Installing the pilot bearing

1. Check the flywheel bore for dirt and damage.

   Note:
   The pilot bearing has a grease and dust seal on one side only.
   When the pilot bearing is installed, the grease and dust seal must face the clutch plate.

2. Use a plastic mallet to install the bearing in the flywheel.
3. Install the clutch release assembly and clutch plate.
4. Install the gearbox.



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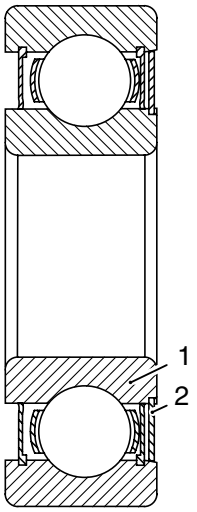

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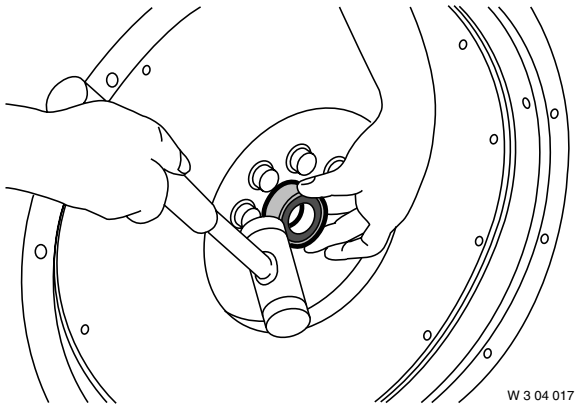
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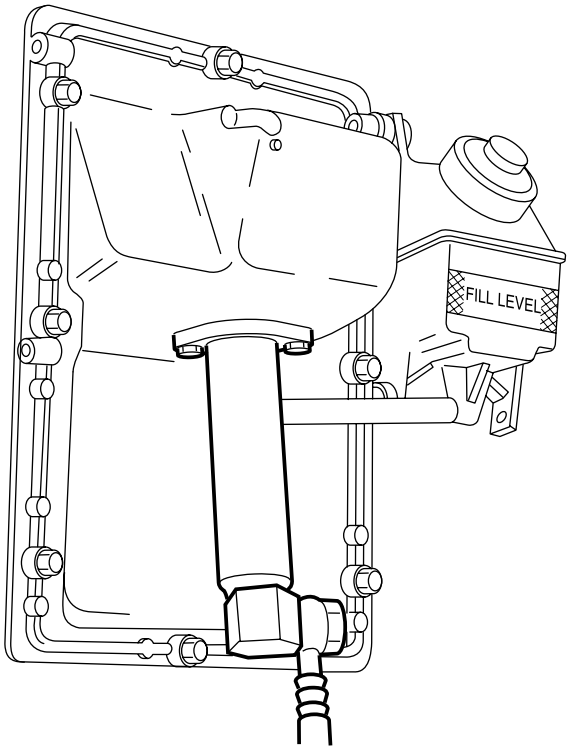
5.6 REMOVAL AND INSTALLATION OF THE MASTER CYLINDER

Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system. Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

Removing the master cylinder

1. Connect a transparent plastic hose to the clutch servo's bleed nipple.
2. Open the bleed nipple (collect the fluid) and drain the system.
3. Remove the clutch spring from the clutch pedal.
4. Remove the fixing bolt from the clutch pedal and the master cylinder.
5. Remove the line between the reservoir and the master cylinder.
6. Disconnect the fluid line at the bottom of the master cylinder.
7. Remove the two fixing bolts from the master cylinder and take the cylinder from the bracket.



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Installing the master cylinder

1. Check the dust cover for wear and replace, if necessary.
2. Install the main cylinder together with the line to the reservoir.
3. Install the connector pipe.
4. Install the master cylinder fixing bolts on the bracket and tighten them.
5. Install the dust cover in the push rod lock ring.
6. Install the clutch pedal fixing bolt and master cylinder.
7. Install the clutch spring of the clutch pedal.
8. Install the clamping bracket bolt of the connection pipe underneath the master cylinder.
9. Fill the clutch system, see chapter “Draining and filling”.
10. Adjust the clutch pedal, see chapter “Inspection and Adjustment”.
11. Bleed the clutch system, see chapter “Draining and filling”.

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6. DRAINING AND FILLING

6.1 DRAINING AND FILLING THE CLUTCH SYSTEM

Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

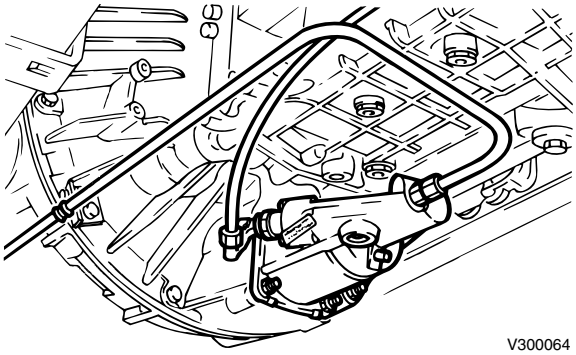
Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system. Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

Draining the clutch system

1. Place a tray beneath the clutch servo.
2. Disconnect the steel supply pipe from the clutch servo and drain the oil from the reservoir by moving the pedal up and down.
3. Reinstall the steel supply pipe.

Filling the clutch system

1. Fill the clutch system with the specified fluid, see main group “Technical Data”.
2. Bleed the clutch system.



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6.2 BLEEDING THE CLUTCH SYSTEM

Hydraulic fluid is toxic and can therefore have a damaging effect on your health. Hence avoid any direct or indirect physical contact. As hydraulic fluid is also a corrosive fluid, it may damage the paintwork of the vehicle. Avoid any contact between hydraulic fluid and paintwork.

Always use new and clean hydraulic fluid which has been kept in a sealed container and complies with the specifications. Hydraulic fluid which has absorbed water (from the ambient air) may have an adverse effect on the operation of the clutch system. Avoid any contact with mineral oil. Even one drop of mineral oil in the system will damage the seals.

Bleeding the clutch system using the "servo" bleed tank

1. Connect the "servo" bleed tank to the reservoir.

   Note:
   Filling too quickly causes foaming, which makes bleeding virtually impossible.

2. Fill the system via the "servo" bleed tank.

3. Connect a transparent hose to the clutch servo's bleed nipple.
   Insert the hose into a jar.

4. Open the bleed nipple two full turns.
   As soon as no more air bubbles escape from the transparent hose, the bleed nipple can be closed again.

5. Check the fluid level, see chapter "Inspection and adjustment".

Bleeding the clutch system by operating the clutch pedal

1. Connect a transparent hose to the clutch servo's bleed nipple.
   Insert the hose into a jar filled with the specified fluid. Ensure that the end is below the fluid level.
2. Open the bleed nipple.
3. Gradually depress the clutch pedal and close the bleed nipple. Gradually release the clutch pedal.
   Repeat this operation. The fluid in the reservoir must be topped up continually.
4. Repeat the pump action with the clutch pedal and topping up the fluid until no more air bubbles escape through the transparent hose.
5. Check the fluid level, see chapter "Inspection and adjustment".

Bleeding the clutch system via the clutch servo

Note:
Sometimes it may be difficult to bleed the clutch system. In such cases, the clutch system can also be bled using a manual pump and the bleed nipple on the clutch servo.
Ensure that the manual pump is thoroughly cleaned inside.

1. Connect a transparent hose to a manual pomp (e.g. oil can) and fill the pump with the specified fluid.

2. Continue pumping until fluid without air bubbles flows from the hose.

3. Then connect the hose to the bleed nipple of the clutch servo and open the bleed nipple.

4. Pump the fluid into the system.
   In doing so, observe the following:
   - Do not depress the clutch pedal.
   - Make sure that no air bubbles are introduced into the system.
   - Monitor the fluid level in the manual pump.
   - Monitor the fluid level in the clutch reservoir.

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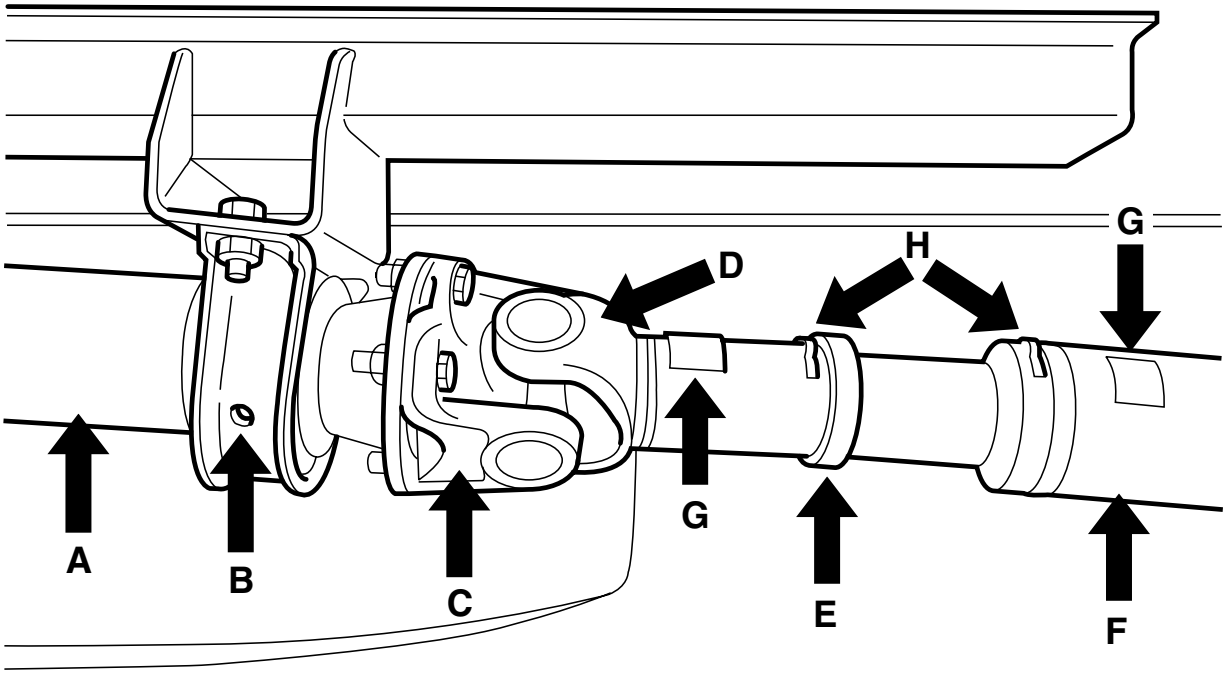
1. GENERAL

1.1 OVERVIEW DRAWING OF DRIVE SHAFT



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A. Auxiliary shaft
B. Centre bearing
C. Drive flange
D. Fork
E. Sliding joint
F. Drive shaft
G. Balancing plates
H. Welded brackets (GWB)

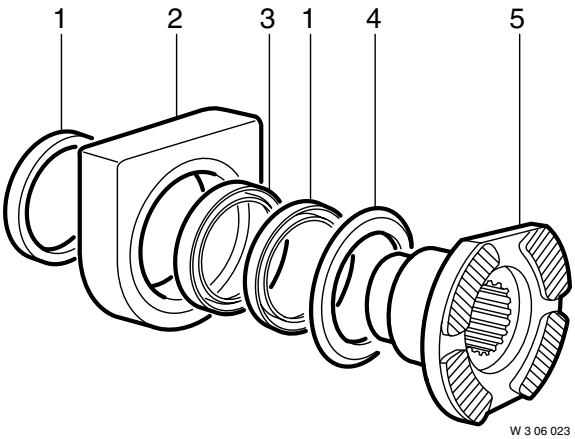
For the vehicle series 95*XF*, DAF has two drive shaft manufacturers, Gelenk-Wellen-Bau and Klein.
The Gelenk-Wellen-Bau-shafts can be identified by the two welded brackets and the balancing plates with the letters GWB stamped into them.
Klein-shafts can be identified by their highly bevelled flanges.

The various components of the shafts are not interchangeable, with the exception of some of the spiders.

Complete shaft assemblies, however, can be exchanged. It is also allowed to install shafts from two different manufacturers in one vehicle.

1.2 OVERVIEW DRAWING OF “KLEIN” CENTRE BEARING

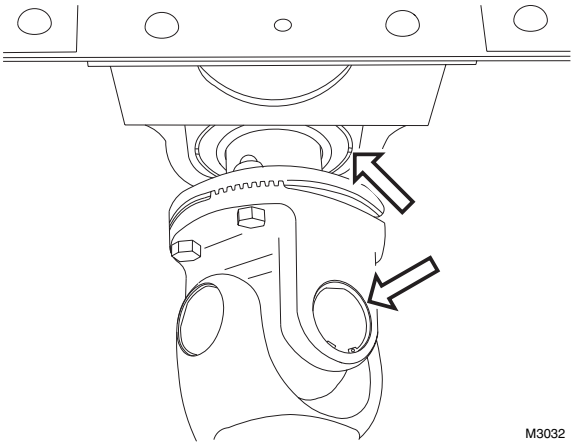
1. Dust rings
2. Rubber block
3. Bearing
4. Dust cover
5. Flange



2. INSPECTION AND ADJUSTMENT

2.1 INSPECTING THE DRIVE SHAFT

1. Check the universal joints and centre bearing for play and damage.



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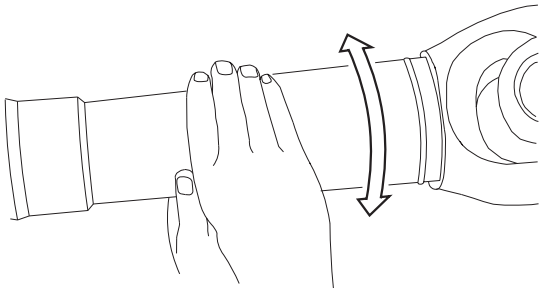
2. Check the sliding joint for axial and radial play.



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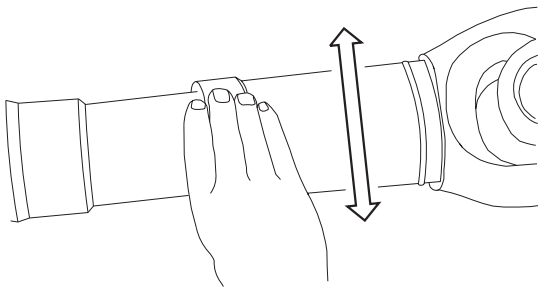
3. There must be no clearly noticeable play on universal joints, centre bearing and sliding joint.



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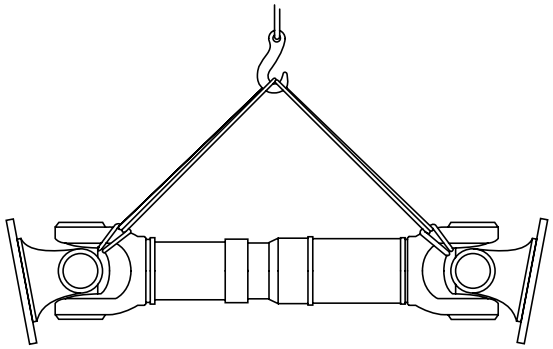
3. REMOVAL AND INSTALLATION

3.1 REMOVAL AND INSTALLATION OF THE DRIVE SHAFT/AUXILIARY SHAFT ASSEMBLY

Removing the drive shaft/auxiliary shaft assembly

1. When removing one of the shafts in vehicles with multiple shafts (drive shaft and auxiliary shafts), the other shaft must be tied to the chassis or auxiliary beam in such a way that it does not obstruct the various activities.
   Note:
   Always transport and store shafts horizontally to avoid damage and subsequent imbalance.
   Support the shaft in at least two places. If possible, hang the shaft in a hoist, using two sturdy ropes.

2. Remove the fixing bolts from the flanges and carefully lower the shaft to the ground. Now remove the shaft from under the vehicle.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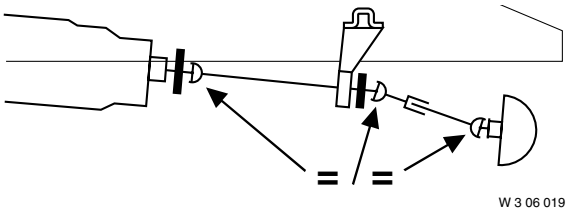
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Installing the drive shaft/auxiliary shaft assembly

Note:
After repairs have been carried out or a shaft has been replaced, the forks of all shafts must be aligned. The universal joints must also be lubricated.

1. Install the shaft under the vehicle. Use a hoist, if possible.

2. Tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.

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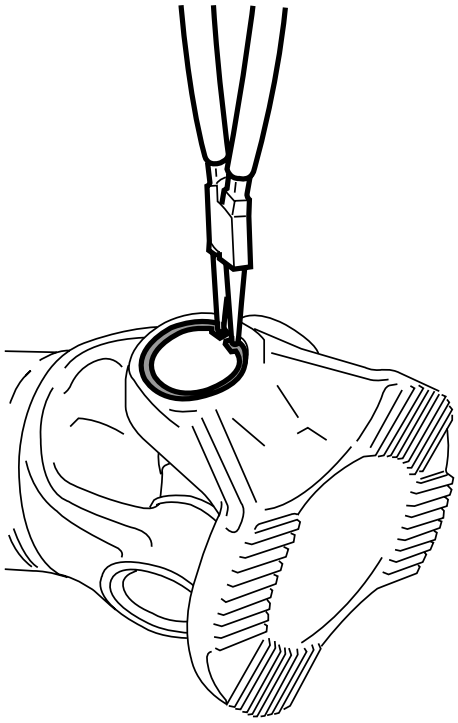
4. DISASSEMBLY AND ASSEMBLY

4.1 DISASSEMBLY AND ASSEMBLY OF THE UNIVERSAL JOINT

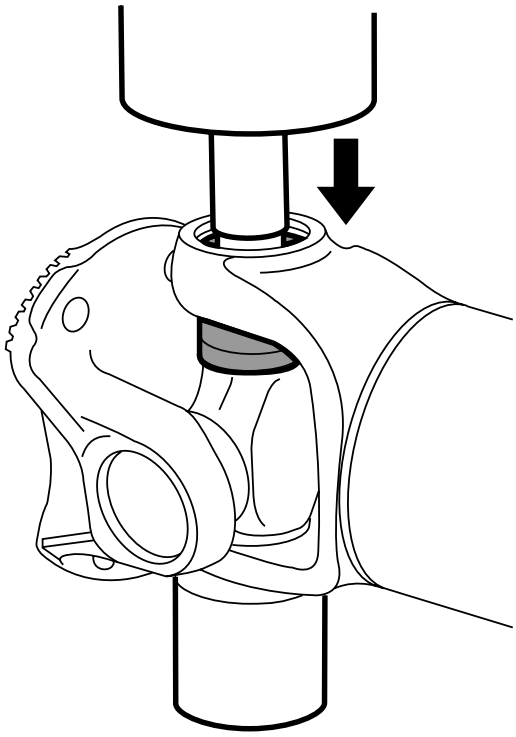
Disassembling the universal joint

1. Remove the entire drive shaft and/or auxiliary shaft.
2. Remove the lubricating nipple and all seeger circlips from the spider to be replaced.



W 3 06 009

3. Place the shaft on a bush using a press, as shown, and press the entire spider including bearings and drive flange down, until the spider touches the fork of the shaft.



W 3 06 010

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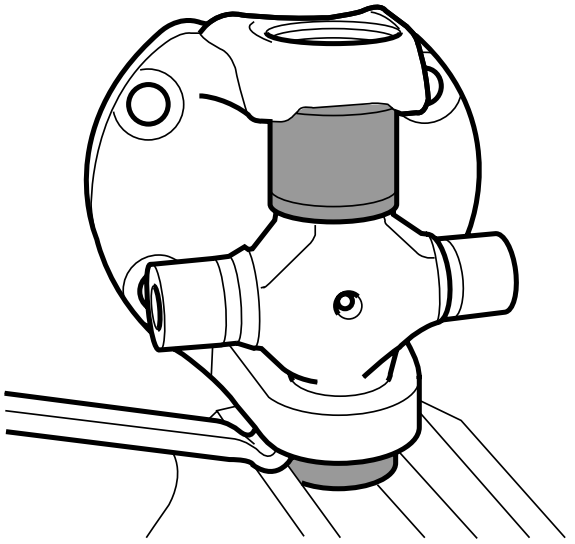
4. Rotate the shaft 180° and remove the bearing that has just been pressed out. If the first bearing to be removed fails to come out of the fork entirely, the bearing can be clamped to enable the fork to be pushed up by means of a lever. Relocate the shaft onto the bush.

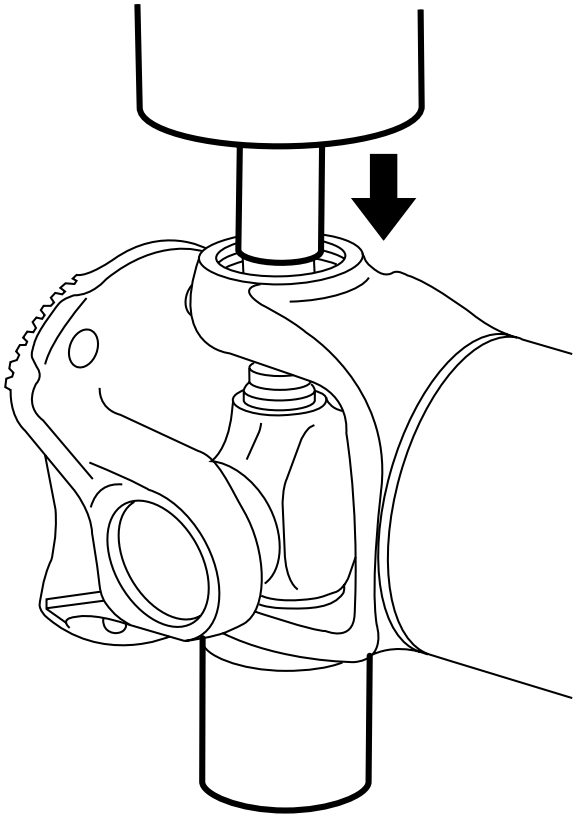


W 3 06 012

5. Push the spider down again in the direction of the shaft fork. Again, continue until the spider touches the fork.
6. The spider and the drive flange can now be tilted from the shaft fork.
7. Place the drive flange on a bush using a press and press the entire spider including bearings and drive flange down, until the spider touches the fork of the drive flange.
8. Rotate the drive flange 180° and remove the bearing that has just been pressed out. Relocate the drive flange onto the bush.
9. Push the spider down again in the direction of the drive flange fork. Again, continue until the spider touches the fork.
10. The spider can now be tilted from the drive flange fork.

    Note:
    When spiders are being replaced, always replace them including their bearings.

11. Check the components to be reused for any cracks and/or damage.

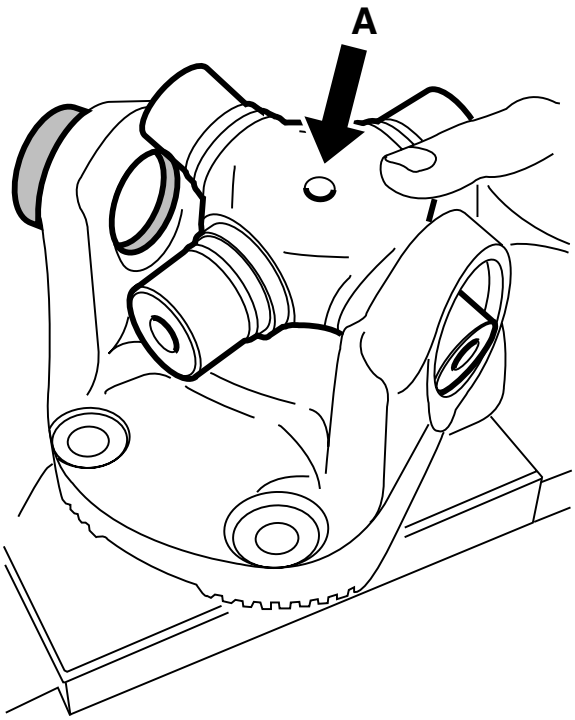


W 3 06 011

Assembling the universal joint

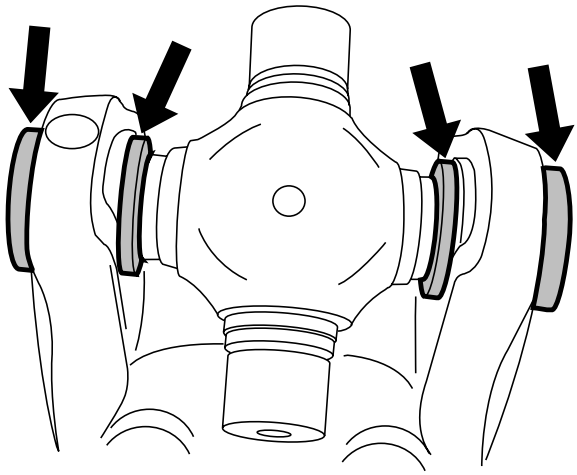
Note:
- After installation, it must be possible to move the drive flanges and spiders by hand.
- Use seeger circlips of the same thickness when installing the spider.

1. Install the sealing rings in their proper positions on the bearings and lubricate them lightly so that the needles remain in place.
2. Press one bearing partly into the drive flange.
3. Tilt the spider into the drive flange, with the hole (A) for the lubricating nipple pointing in the direction of the shaft.



W 3 06 014

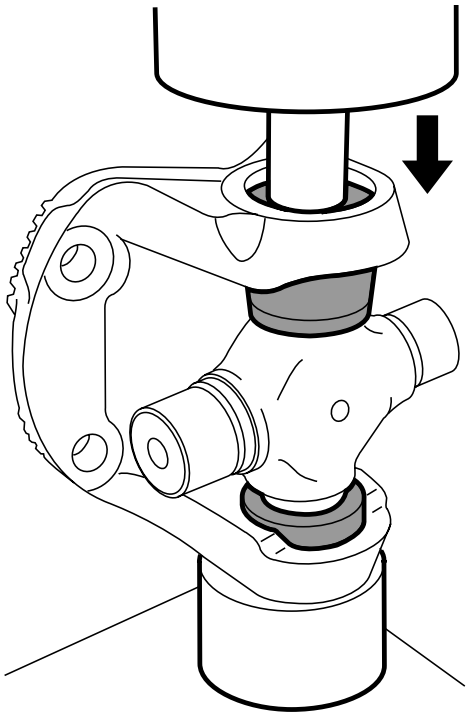
4. Slide the spider a little into the installed bearing and place everything onto a bush using a press. The opposite bearing can now be pressed into the fork, the spider serving as a guide. During the press action, the spider must be able to move freely.


W 3 06 017

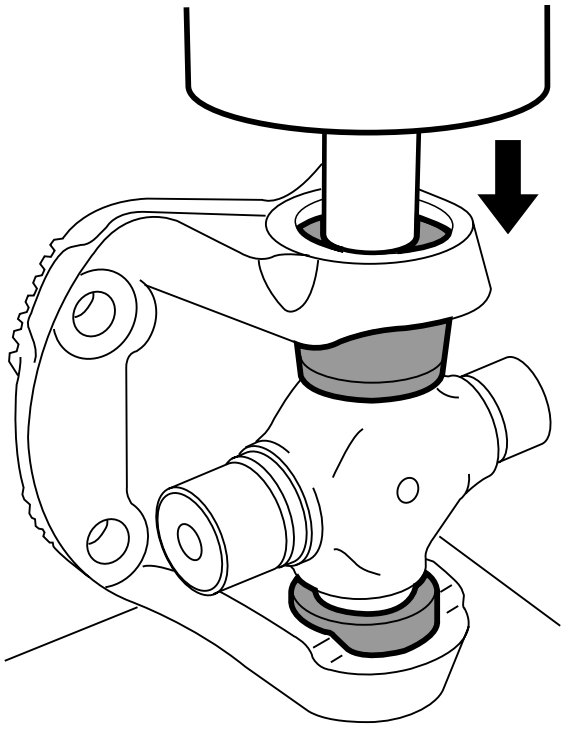
5. Continue to press the bearing until a seeger circlip can be installed on the side that is pressed. Install the seeger circlip and press the opposite bearing farther into the fork. Then also install a seeger circlip here.
6. Install the sealing rings in their proper positions on the drive shaft bearings and lubricate them lightly so that the needles remain in place.
7. Press one bearing partly into the drive shaft.
8. Slide the spider a little into the installed bearing and place everything onto a bush using a press. The opposite bearing can now be pressed into the fork, the spider serving as a guide. During the press action, the spider must be able to move freely.
9. Continue to press the bearing until a seeger circlip can be installed on the side that is pressed. Install the seeger circlip and press the opposite bearing farther into the fork. Then also install a seeger circlip here.
10. Install the lubricating nipple and lubricate the spider.

Note:
- After installation, it must be possible to move the drive flanges and spiders by hand.
- Use seeger circlips of the same thickness when installing the spider.

11. Install the drive shaft and/or auxiliary shaft.



W 3 06 013

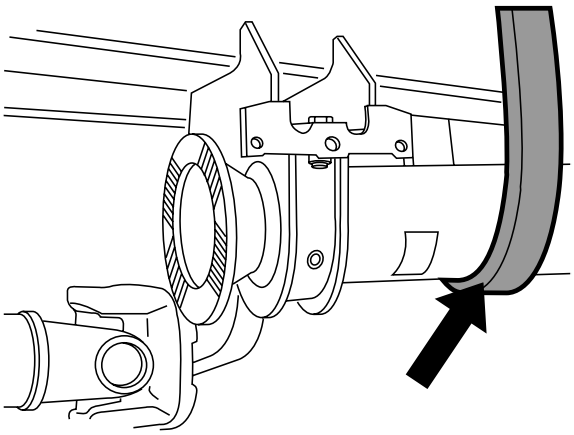


W 3 06 015

4.2 DISASSEMBLY AND ASSEMBLY OF THE "GWB" CENTRE BEARING

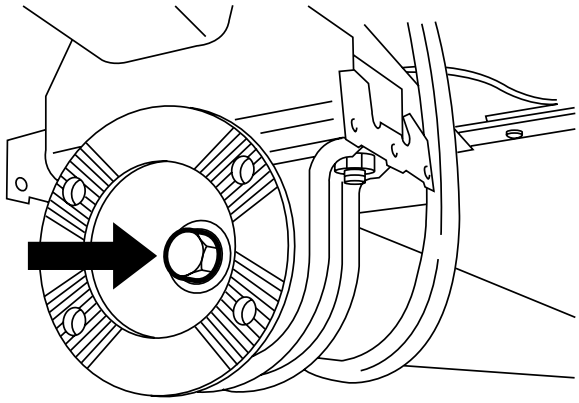
Disassembling the "GWB" centre bearing

1. Secure the auxiliary shaft to the chassis.
2. Remove the drive flange fixing bolts. Suspend the drive shaft correctly from the chassis.



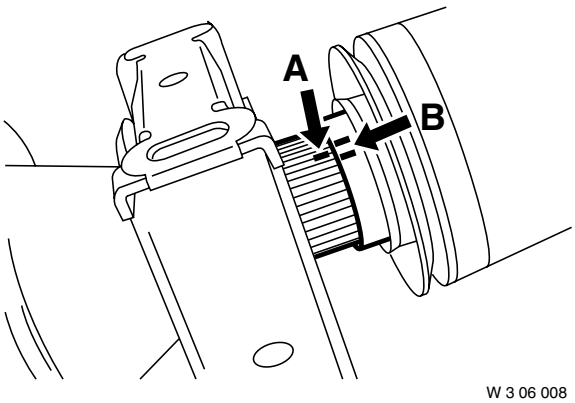
W 3 06 003

3. Remove the central fixing bolt of the centre bearing.
4. Remove the fixing bolts from the centre bearing and the chassis bracket.
5. Install a long bolt (part of special tool DAF no. 1329375 ∅45, DAF no. 1329364 ∅55, or DAF no. 1329376 ∅70) as far as possible into the auxiliary shaft.



W 3 06 002

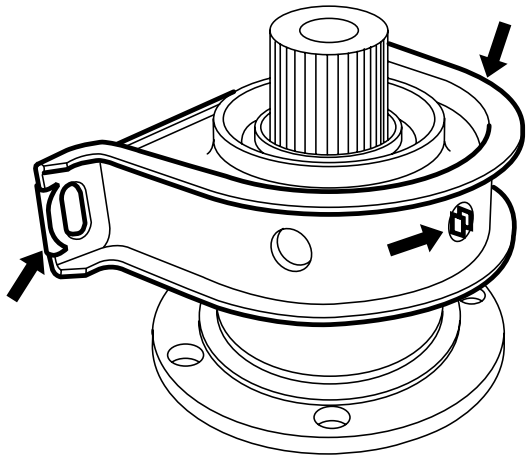
6. Place a commercially available puller on the drive flange.
   Use the puller to pull the drive flange a little from the auxiliary shaft. Before the drive flange and centre bearing are pulled from the shaft, they should be marked. This is to make it possible to reinstall all forks in a straight line.



W 3 06 008

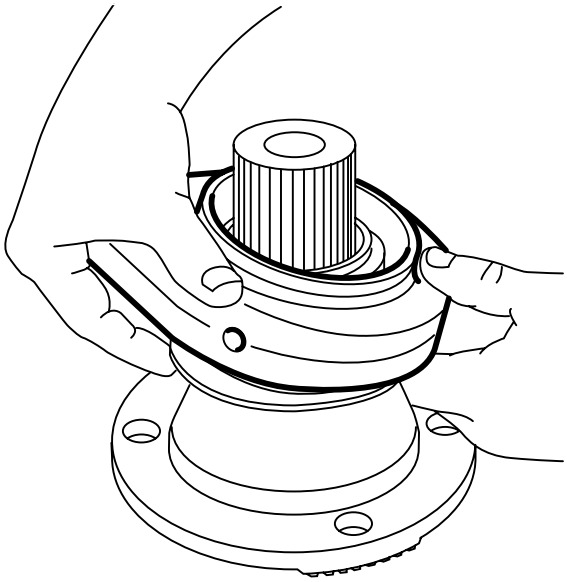
8

7. Remove the steel bracket including the circlip of the silentblock.



W 3 06 007

8. Remove the silentblock from the centre bearing.



W 3 06 006

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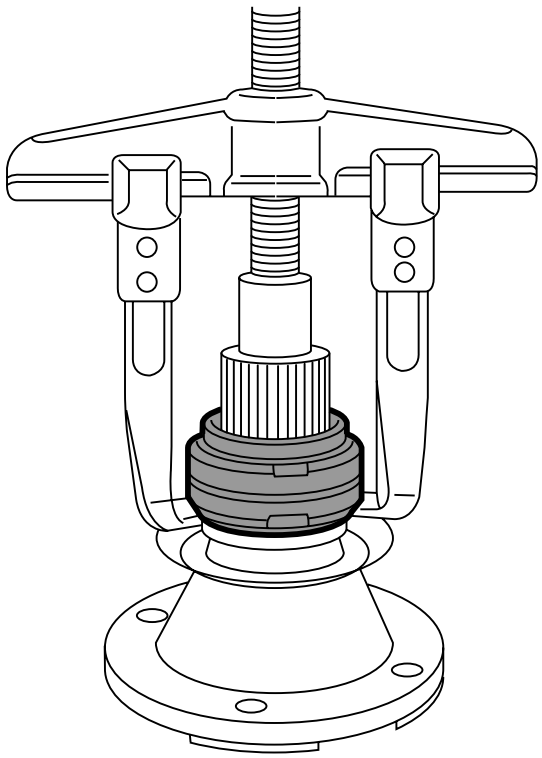
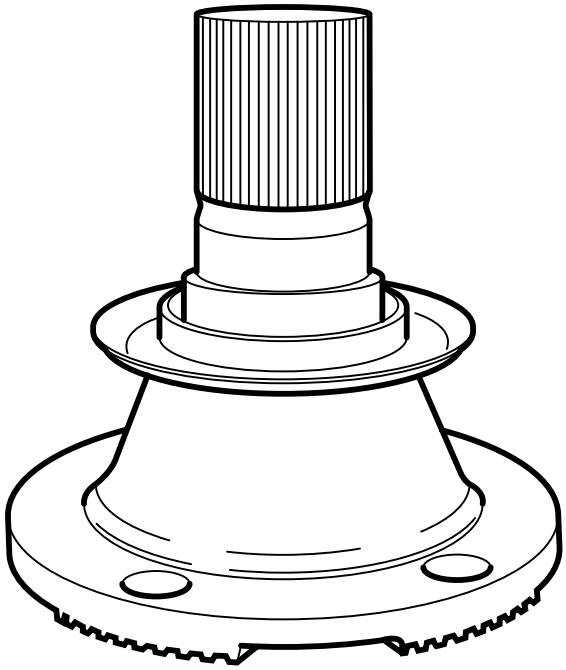
9. Use the puller to pull the bearing from the drive flange.



W 3 06 004

10. Remove the steel dust ring from the drive flange.

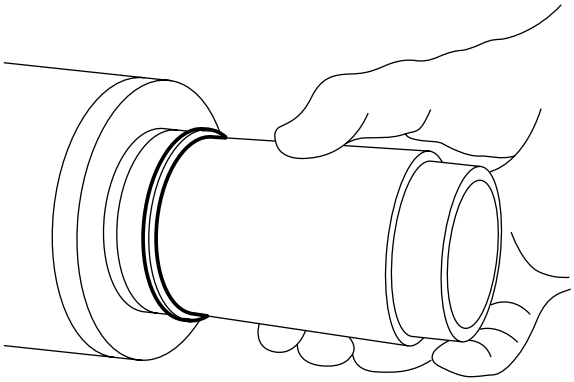


W 3 06 005

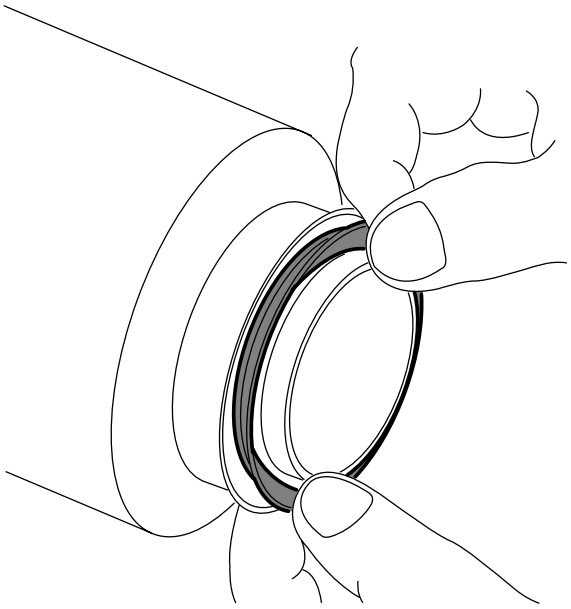
Assembling the "GWB" centre bearing

Note:
In case of damage, always replace the entire centre bearing.

1. Use the special tool (DAF no. 1329375 ∅45, DAF no. 1329364 ∅55, or DAF no. 1329376 ∅70) to install the steel dust rings, without sealing rubber, onto the drive flange and auxiliary shaft.


V300170

2. Install the sealing rubbers into the steel dust rings.


V300171

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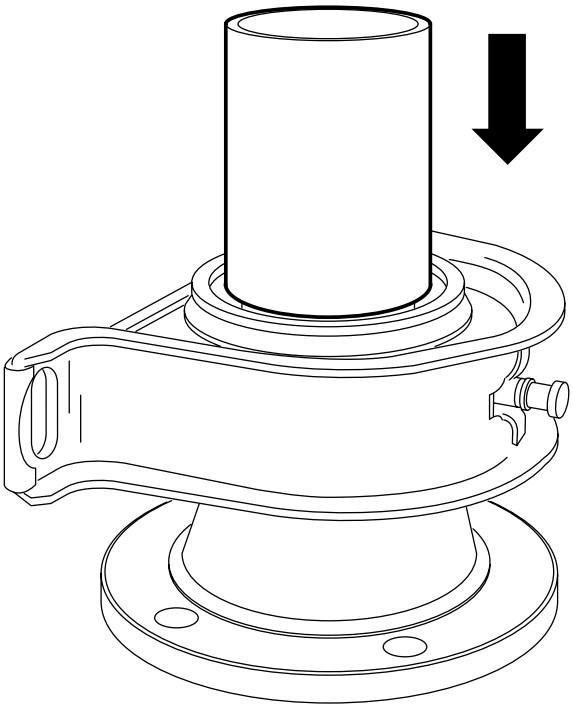
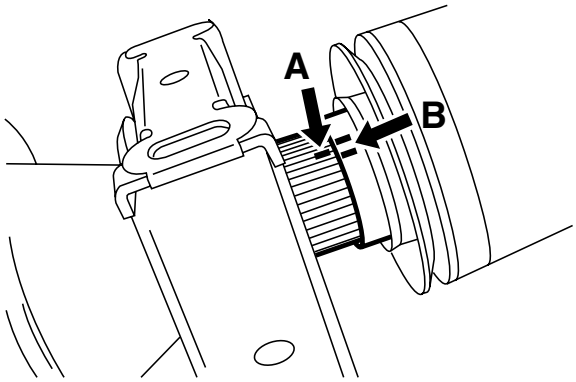
3. Use the special tool (DAF no. 1329375 ∅45, DAF no. 1329364 ∅55, or DAF no. 1329376 ∅70) to install the centre bearing assembly on the drive flange.

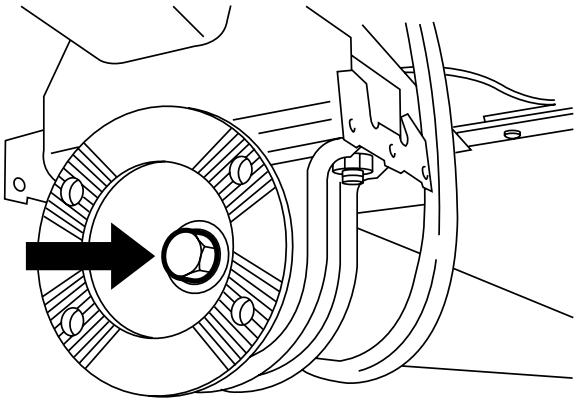


V300172

4. When the drive flange and centre bearing are installed, ensure that the marks you made earlier line up.
5. Install the drive flange and centre bearing in the auxiliary shaft.
6. Hand-tighten the centre bearing to the chassis with the fixing bolts.
7. Tighten the central fixing bolt to the specified tightening torque, see main group “Technical Data”.
8. Tighten the fixing bolts of the centre bearing to the chassis to the specified tightening torque, see main group “Technical Data”.
9. If the centre bearing is provided with a lubricating nipple, it must be lubricated.
10. Fit the drive shaft.



W 3 06 008

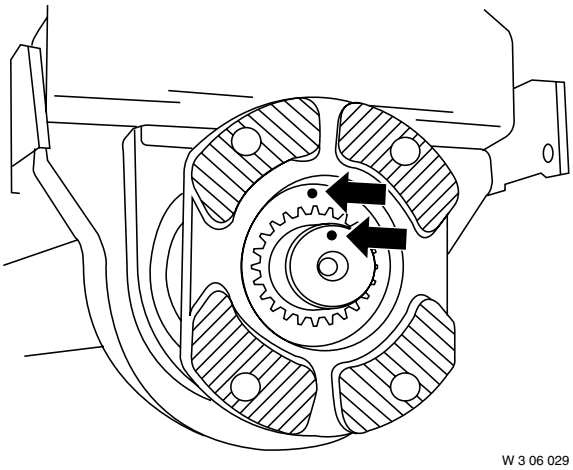


W 3 06 002

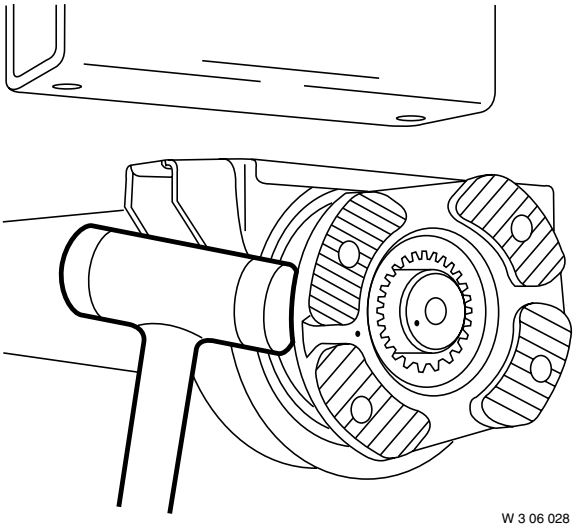
4.3 DISASSEMBLY AND ASSEMBLY OF THE “KLEIN” CENTRE BEARING

Disassembling the “Klein” centre bearing

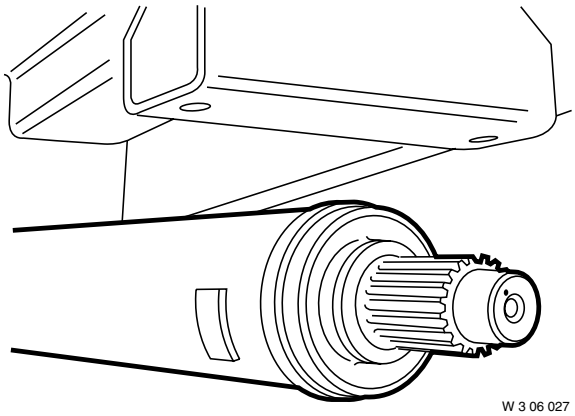
1. Secure the auxiliary shaft to the chassis.
2. Remove the bolts that attach the flange to the drive shaft and the auxiliary shaft. Now also secure the drive shaft to the chassis.
3. Install a flange retainer and remove the central nut and washer.
4. Mark the flange and axle stub with a centre point. This is to make it possible to reinstall all forks in a straight line.
5. Remove the fixing bolts from the centre bearing and the chassis bracket.
6. Use a plastic mallet to tap the flange and the centre bearing from the auxiliary shaft. If necessary, use a puller.



W 3 06 029

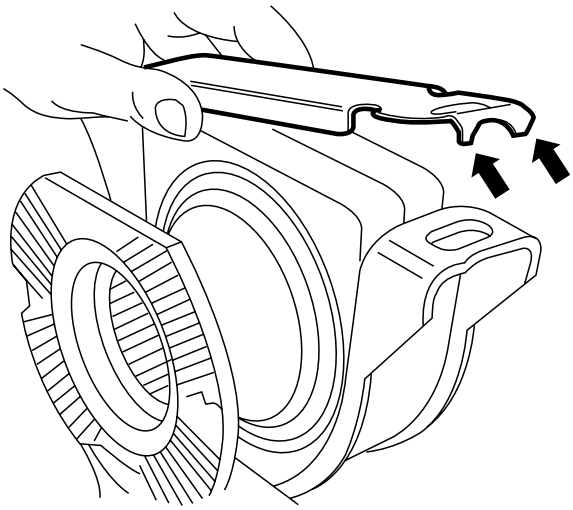


W 3 06 028

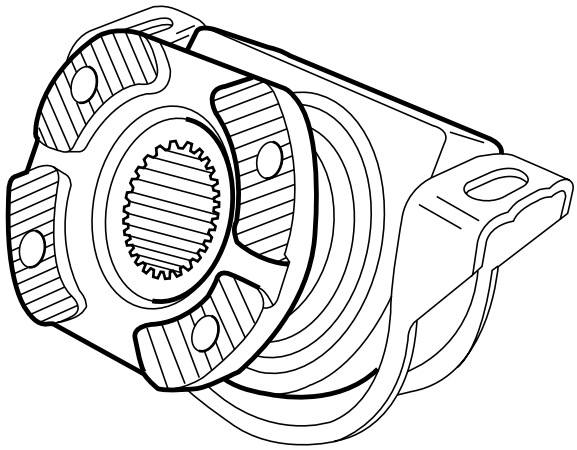


W 3 06 027

7. Remove the lock plate from the support bracket.

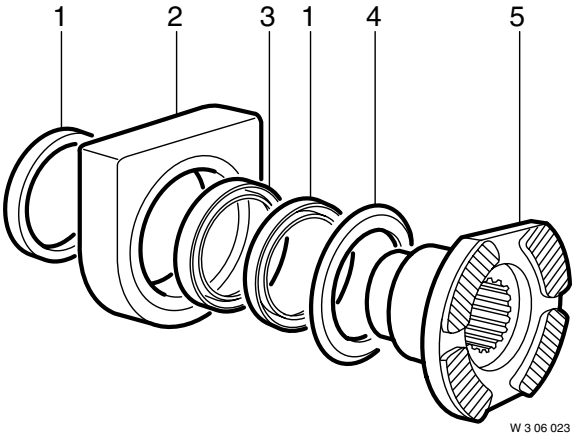

W 3 06 020

8. Turn the flange, including bearing and rubber block (2), from the bracket.


W 3 06 022

9. Press the flange from the bearing using a press.
10. Press the bearing with one dust ring (1) from the rubber block.
11. If necessary, remove the second dust ring (1).

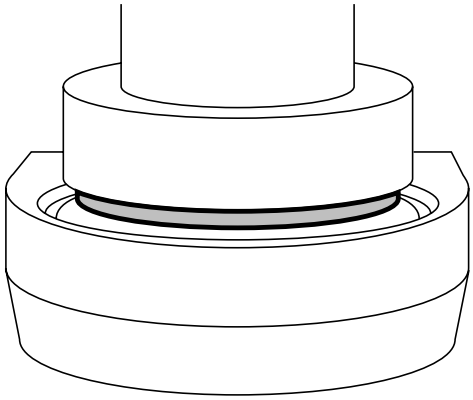
Note:
In case of damage, always replace the entire centre bearing.



W 3 06 023

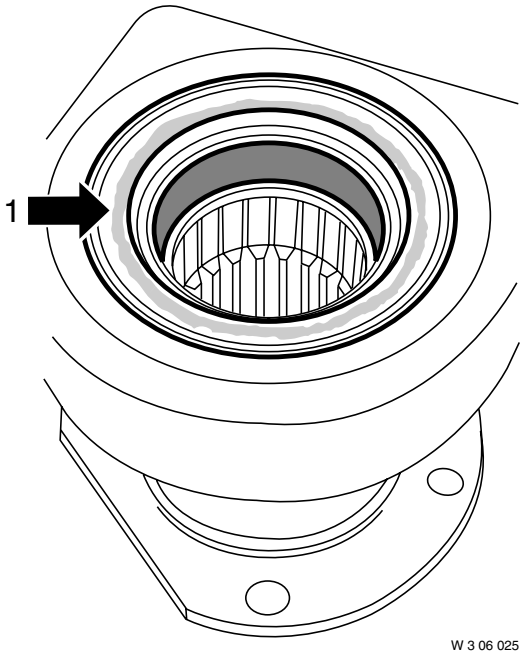
Assembling the "Klein" centre bearing

1. Press the dust ring into the bush of the rubber block until it aligns with the outside of the bush.



W 3 06 021

2. Press the bearing into the bush from the other side. Then press the other dust ring into the bush. Apply grease to the dust rings (1).
3. Press everything onto the flange, the larger space between bearing and dust ring facing the flange.



W 3 06 025

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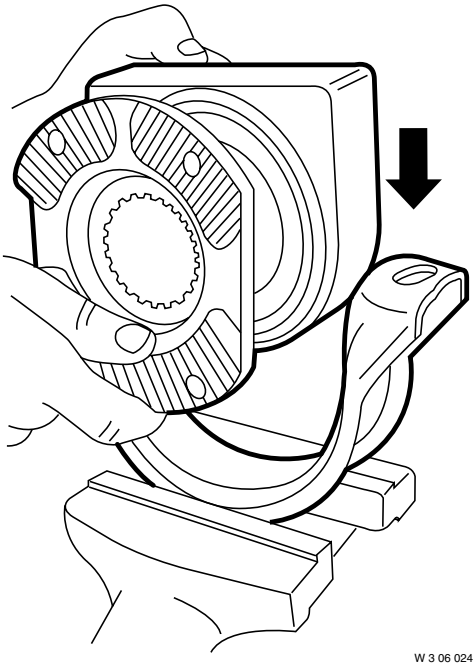
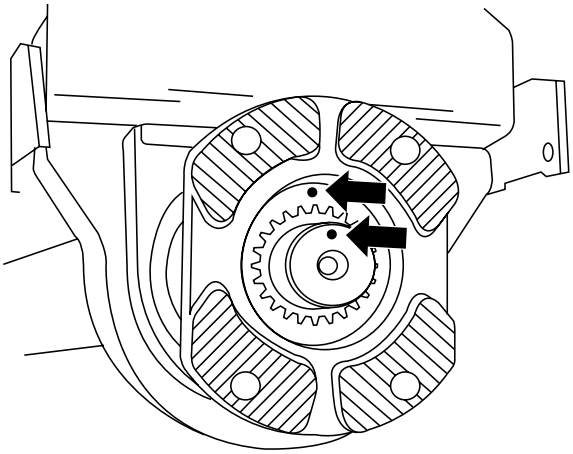
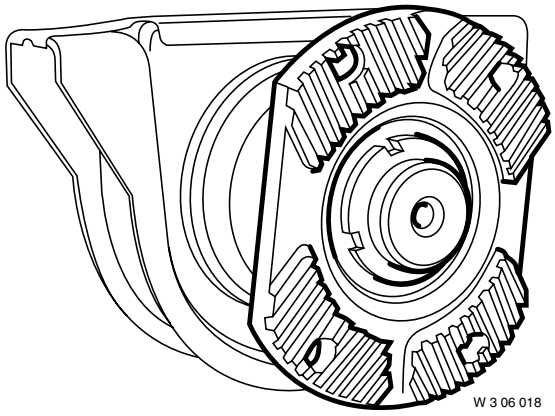
4. Install the centre bearing assembly in the bracket and lock it with the lock plate.


W 3 06 024

5. Install the centre bearing onto the auxiliary shaft. Ensure that the centre marks match. This is to make sure that all forks line up.
6. Attach the centre bearing to the chassis by means of bolts, but do not tighten the bolts yet.
7. Tighten the central nut of the centre bearing to the specified tightening torque, see main group “Technical Data”. Then apply Loctite 243 to the fixing bolts of the centre bearing at the chassis and tighten these to the specified tightening torque, see main group “Technical Data”.


W 3 06 029


W 3 06 018

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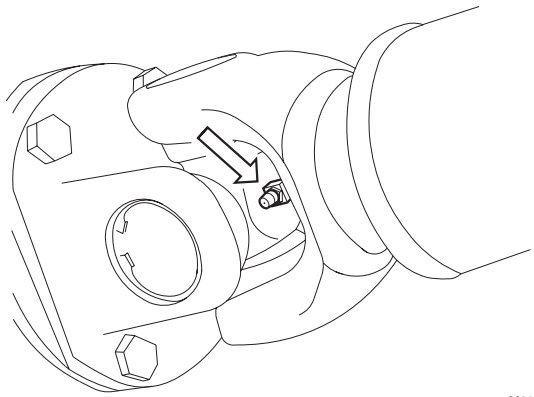
5. LUBRICATING

5.1 LUBRICATING THE CENTRE BEARING, DRIVE SHAFT AND AUXILIARY SHAFT

Note:
Thoroughly clean the lubricating nipples prior to lubricating.

1. Lubricate the drive shaft universal joints, until grease comes out at all four bearing bushes.
   If not, replace the spider, see chapter “Disassembly and assembly”.
2. Lubricate the lubricating nipples on the centre bearings (if present).
3. The maximum lubricating pressure should not exceed 15 bar.


M9030

Note:
Always lubricate centre bearings, drive shafts and/or auxiliary shafts if these have been cleaned using a high-pressure cleaner.

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9

9

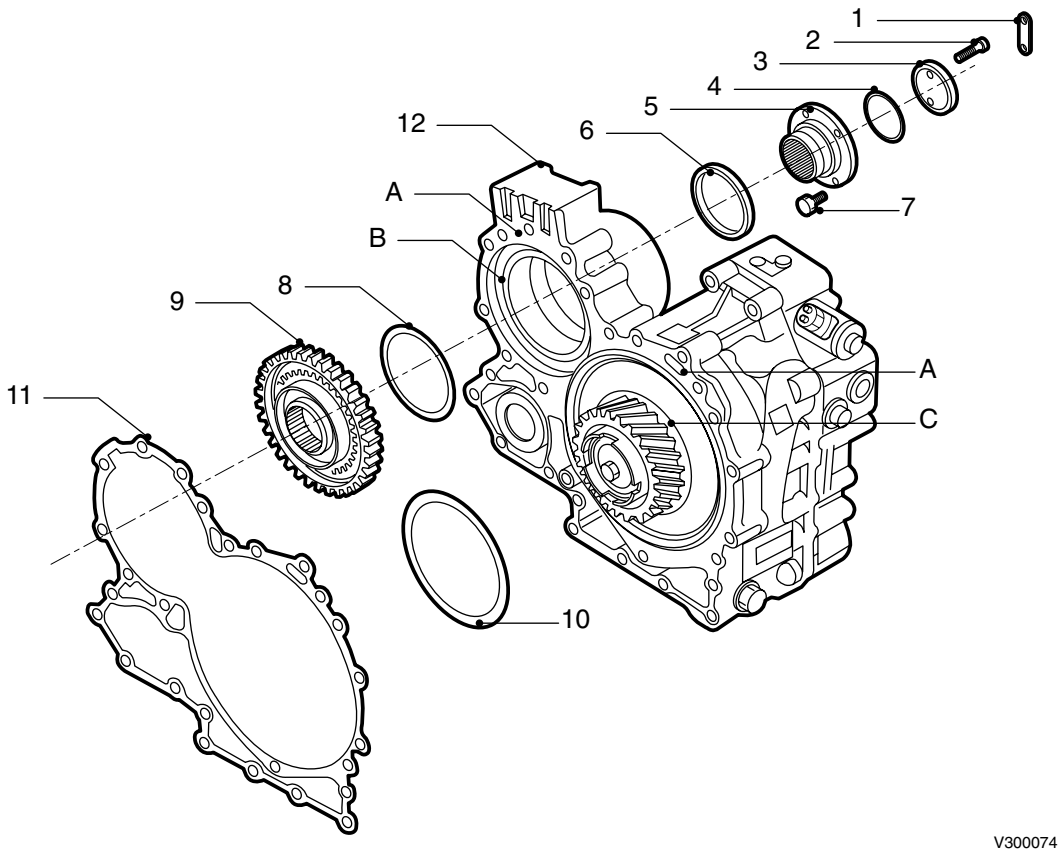
1. SAFETY INSTRUCTIONS

- Be careful when changing the oil. Hot oil may cause serious injuries.
- Avoid unnecessary contact with drained oil. Frequent contact damages the skin.
- Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard.
  This also applies to coolants.
  So avoid inhaling and direct contact.

9

2. GENERAL

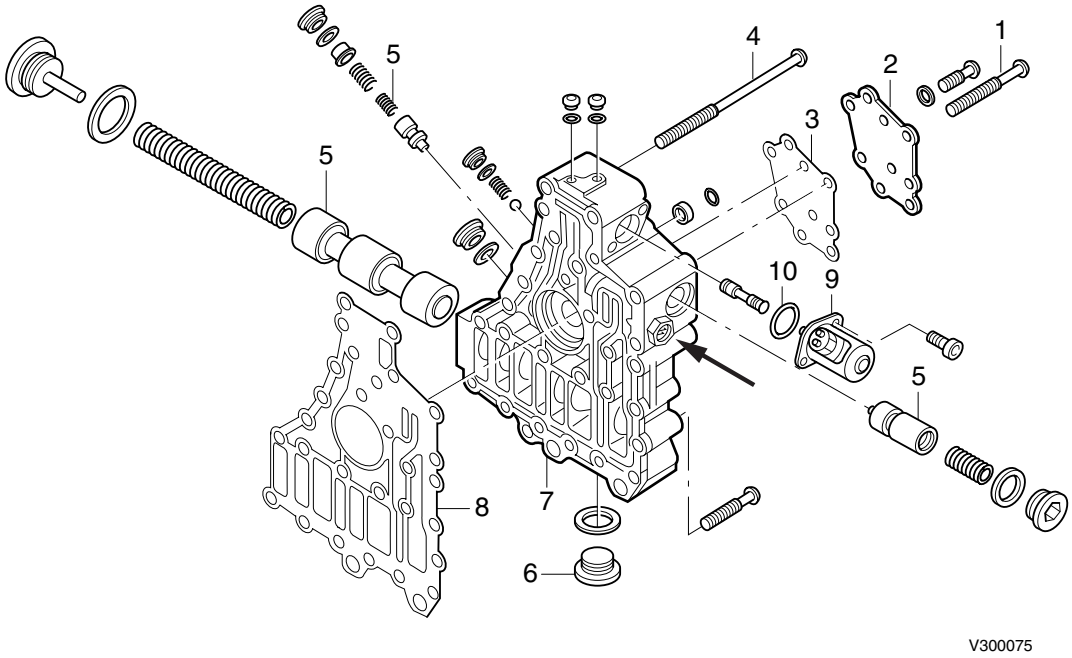
2.1 OVERVIEW DRAWING OF INTARDER



1. Locking plate
2. Bolt
3. Plate
4. O-ring
5. Drive flange
6. Sealing ring
7. Flange bolt
8. Output shaft filler ring
9. Drive sprocket
10. Stator filler ring
11. Gasket
12. Intarder housing

A Sealing surface of intarder housing
B Ball bearing contact surface
C Stator contact surface

2.2 OVERVIEW DRAWING OF HYDRAULIC CONTROL UNIT



1. Fixing bolt
2. Fixing plate
3. Gasket
4. Fixing bolt
5. Plungers and springs
6. Drain plug
7. Control unit housing
8. Gasket
9. Proportional valve
10. O-ring

9

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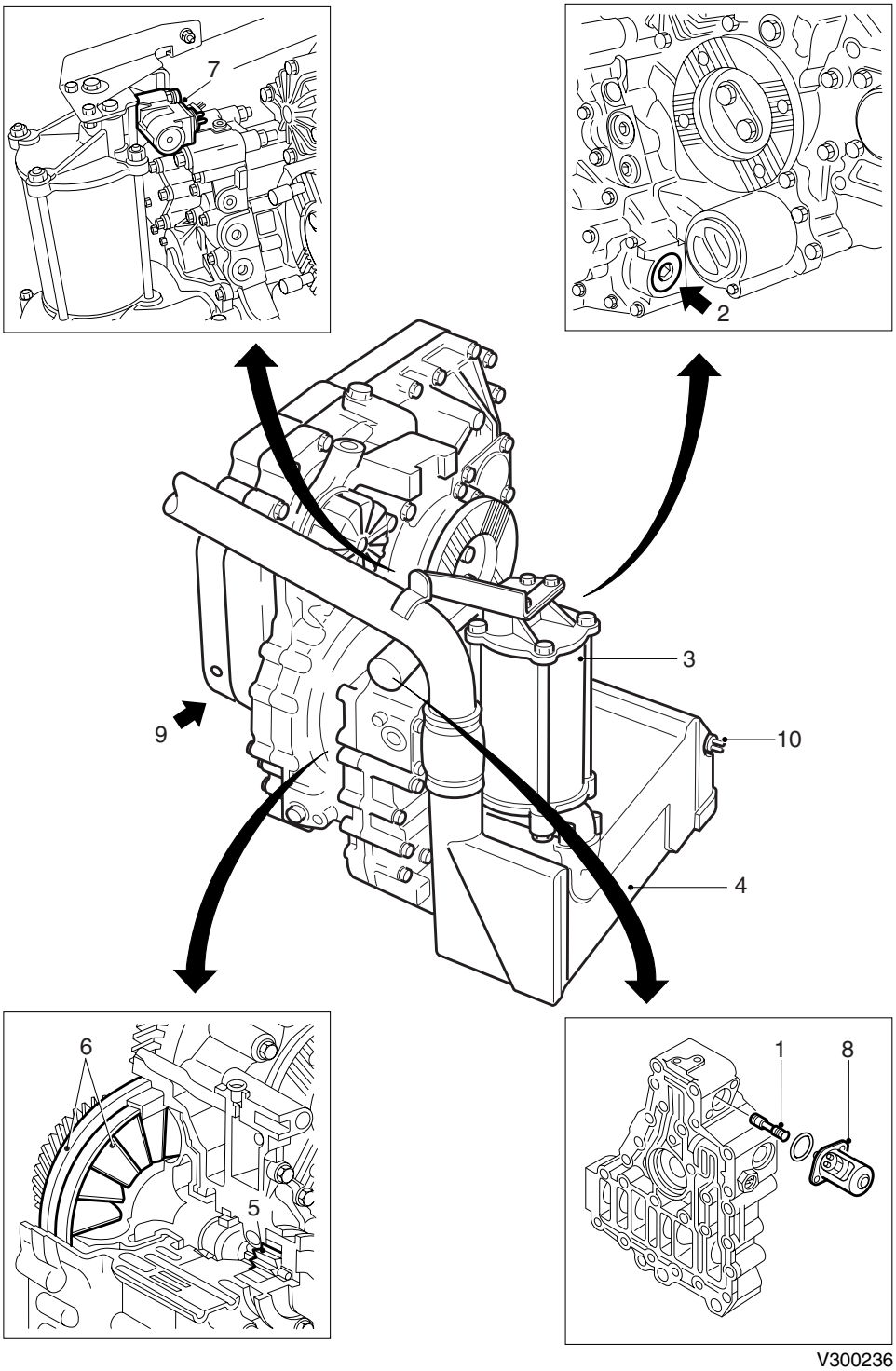
2.3 LOCATION OF MAIN COMPONENTS



1. Control plunger of the proportional intarder valve
2. Sealing plug for the spring of the change-over valve
3. Accumulator
4. Heat exchanger
5. Drive sprockets
6. Stator and rotor
7. Air supply magnetic valve
8. Proportional valve
9. Connection to gearbox
10. Coolant temperature sensor

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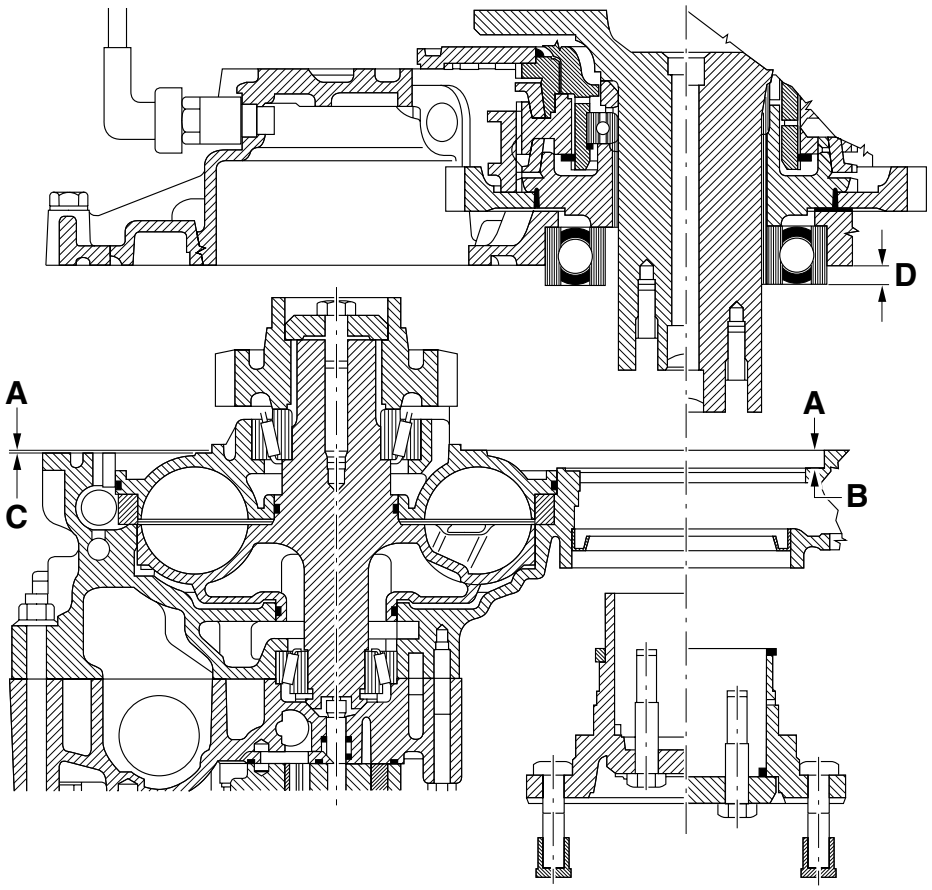
3. INSPECTION AND ADJUSTMENT

3.1 INSPECTING AND ADJUSTING THE AXIAL CLEARANCE OF THE OUTPUT SHAFT BEARING

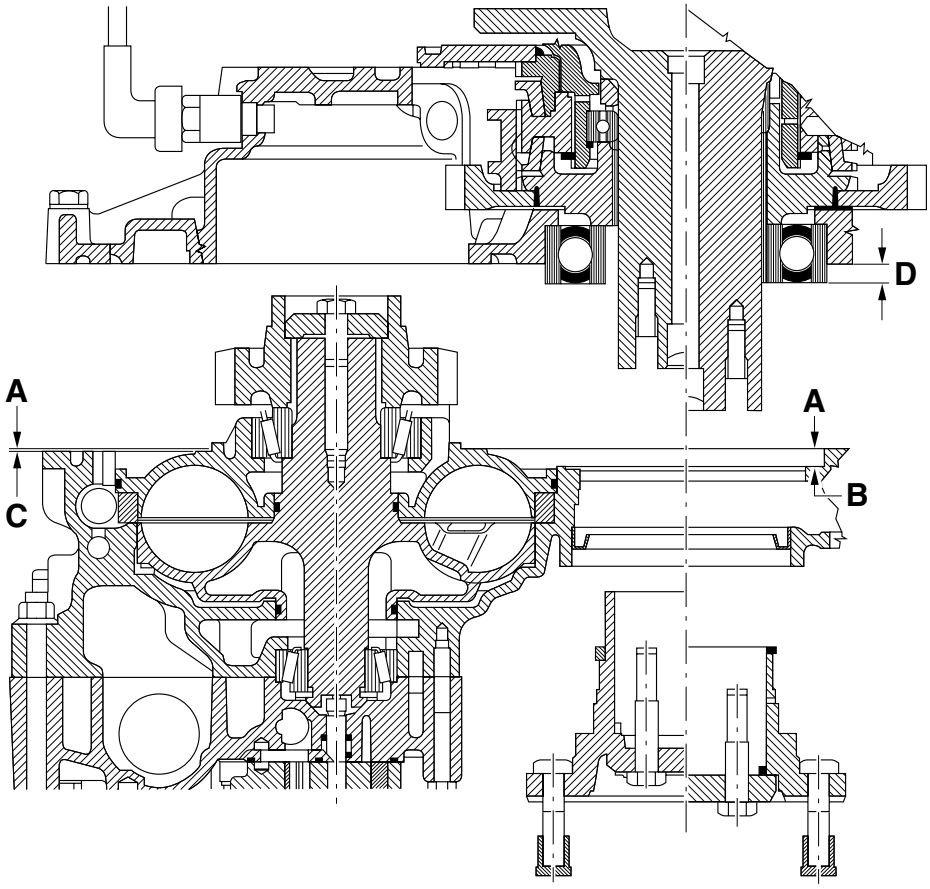


4. Measure and note down distance “A - B” from sealing surface (A) with gasket to contact surface (B).
5. Measure and note down distance “D” from the outer ring of the ball bearing to the gasket on the gearbox.

Example:

Distance A - B	=	10.5 mm
Distance D	=	10.0 mm
Difference	=	0.5 mm
Maximum clearance		0.1 mm
Required thickness of filler ring		0.4 mm

3.2 INSPECTING AND ADJUSTING THE AXIAL CLEARANCE OF THE STATOR



1. Measure and note down distance “A - C” from sealing surface (A) with gasket to contact surface (C).

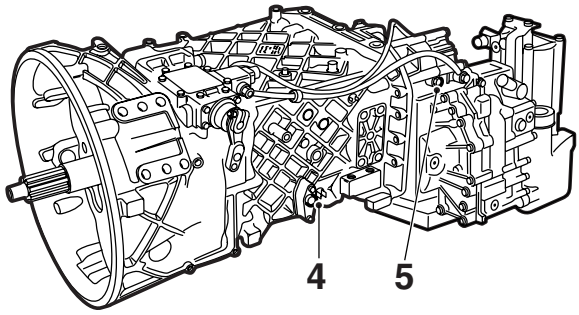
Example:

Distance A - C	=	1.10 mm
Distance A - C should be		± 0.05 mm
Required thickness of filler ring		1.1 ± 0.05 mm

3.3 INSPECTING THE GEARBOX/INTARDER OIL LEVEL

Inspecting the gearbox/intarder oil level

1. Brake the vehicle without activating the retarder and place the vehicle on a flat and level surface.
2. Wait for some minutes for the gearbox oil to flow back.
3. The oil level must reach the rim of the oil-level/filling opening (4).
4. Tighten the oil-level/filling plug (4) to the specified tightening torque, see main group “Technical Data”.



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4. REMOVAL AND INSTALLATION

4.1 REMOVING AND INSTALLING THE ENTIRE INTARDER

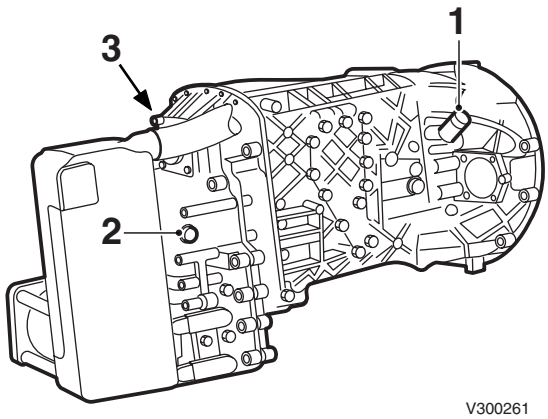
To prevent skin injury, avoid unnecessary contact with the drained oil and coolant.
In the course of the following operations, oil and coolant may spill from the gearbox and intarder.
Collect this oil and coolant.

Removing the entire intarder

1. Remove the drive shaft bolts and suspend the drive shaft to the side in the chassis.
2. Drain the gearbox using the drain plugs (1) and (2).
3. Drain as much coolant and gearbox oil as necessary and collect these in clean containers.
4. Disconnect the water hoses from both sides of the heat exchanger.
5. Remove the air pipe from the magnetic valve of the intarder.
6. Remove all electric wiring from the intarder.
7. Remove the locking plate from the output shaft drive flange, remove the disk with the O-ring, and pull the drive flange from the shaft using a tripod puller.

In the course of the following operations, the intarder is disconnected from the gearbox.
Take measures to prevent the intarder from dropping.

8. Remove the fixing bolts from the intarder and remove the intarder.
9. Remove the gasket and filler rings from the adjustment stator/output shaft.



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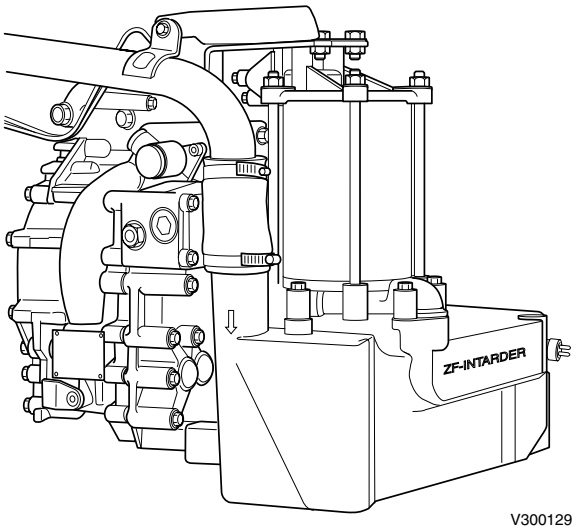

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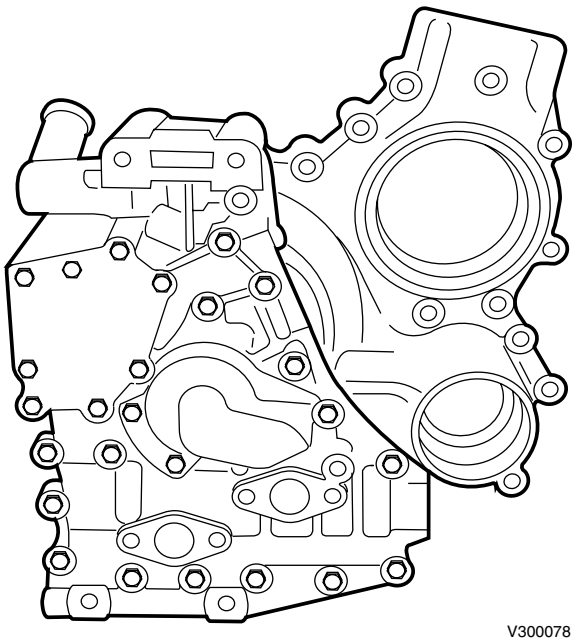
Installing the entire intarder

1. Stick the correct filler rings onto the contact surfaces using a little grease.
2. Fix the gasket in the gearbox with as many long studs as possible. The studs also serve as guiding pins to facilitate mounting of the intarder
3. Carefully position the intarder on the gearbox and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
4. Insert the drive shaft fixing bolts from the correct side into the external drive flange (bolt end faces drive shaft).
5. Install the external drive flange without heating it.
6. Install the O-ring and the disk.
7. Install the fixing bolts and tighten them to the specified tightening torque, see main group “Technical Data”.
   Fit the lock plate using special tool (DAF no. 0694903).
8. Connect the water hoses to the heat exchanger.
9. Connect the air pipe to the magnetic valve.
10. Install all electric connections to the intarder.
11. Install the drive shaft and tighten the drive shaft fixing bolts to the specified tightening torque, see main group “Technical Data”.
12. Fill the coolant system (see Group 2 of the workshop instructions) and fill the intarder and gearbox with oil.
13. Check the operation of the intarder and check for leaks.
14. Check the oil level in the gearbox.



V300078

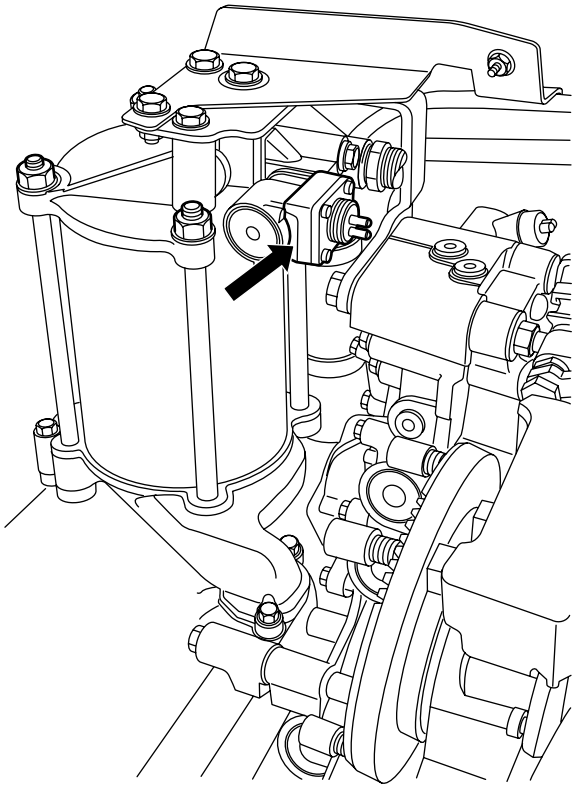
4.2 REMOVING AND INSTALLING THE MAGNETIC VALVE OF THE AIR SUPPLY

Removing the magnetic valve of the air supply

1. Remove the air pipe from the magnetic valve.
2. Remove the electric wiring from the magnetic valve.
3. Remove the fixing bolts from the magnetic valve and remove the magnetic valve.
4. Remove the O-ring.

Installing the magnetic valve of the air supply

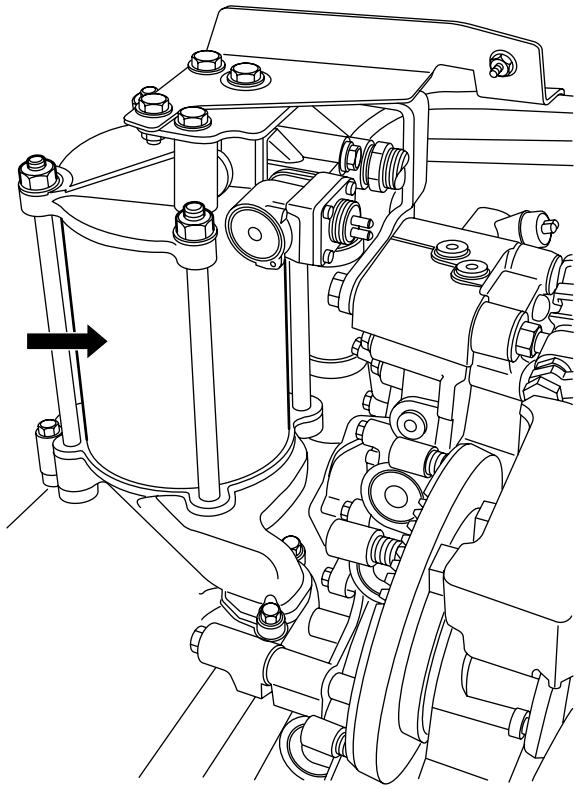
1. Fit a new O-ring in the slot on the magnetic valve.
2. Install the magnetic valve.
3. Connect the electric wiring to the magnetic valve.
4. Connect the air pipe to the magnetic valve.



V300184

4.3 REMOVING AND INSTALLING THE ACCUMULATOR

To prevent skin injury, avoid unnecessary contact with the drained oil and coolant.
In the course of the following operations, oil and coolant may spill from the heat exchanger. Collect this oil and coolant.


V300183

Removing the accumulator
1. Drain as much coolant and oil as necessary.
2. Disconnect the water hose from the left-hand side of the heat exchanger.
3. Remove the air pipe from the magnetic valve.
4. Remove the electric wiring from the magnetic valve.
5. Remove the fixing bolt from the water pipe bracket and the fixing bolts on top of the accumulator bracket.
6. Remove the accumulator fixing bolts on the heat exchanger and remove the accumulator.

Installing the accumulator
1. Fit new O-rings on the accumulator bracket and install the accumulator on the heat exchanger.
2. Install the accumulator bracket fixing bolts at the top.
3. Install the water pipe bracket fixing bolt.
4. Install the magnetic valve.
5. Connect the air pipe to the magnetic valve.
6. Connect the electric wiring to the magnetic valve.
7. Install the water hose on the left-hand side.
8. Fill the cooling system.
9. Fill the gearbox with oil.
10. Check the oil level in the gearbox.

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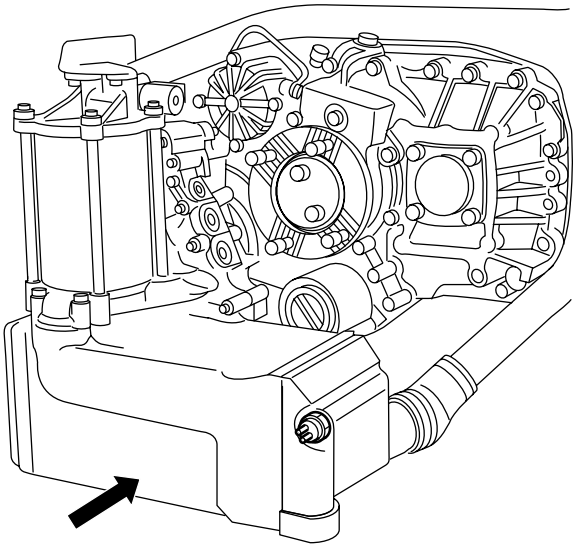
4.4 REMOVAL AND INSTALLATION OF THE HEAT EXCHANGER

In the course of the following operations, oil and coolant will spill from the heat exchanger. Collect this oil and coolant. Take measures to prevent the heat exchanger from falling.

Removing the heat exchanger

1. Drain as much coolant and oil as necessary.
2. Remove the water hoses from the heat exchanger.
3. Remove the air pipe from the magnetic valve.
4. Remove all electric wiring from the intarder.
5. Remove the fixing nuts from the studs attaching the heat exchanger to the hydraulic control unit.
6. Remove a fixing bolt from the oil connector flange of the heat exchanger attached to the rear cover of the gearbox.
7. Remove the heat exchanger together with the accumulator.
8. Remove the two O-rings for the oil ducts of the heat exchanger from the control unit.
9. If necessary, remove the accumulator and the magnetic valve.
10. If the heat exchanger shows any leaks, the heat exchanger must be replaced as it cannot be repaired.



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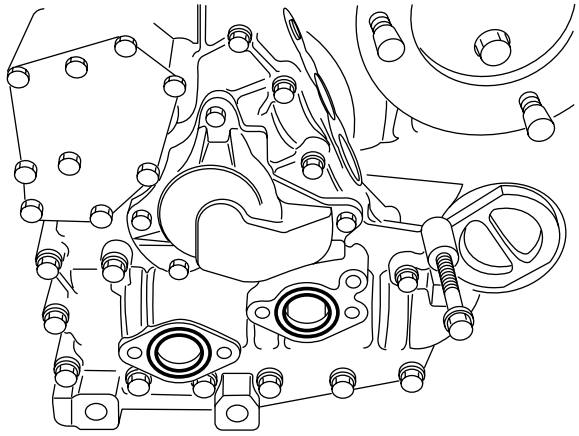

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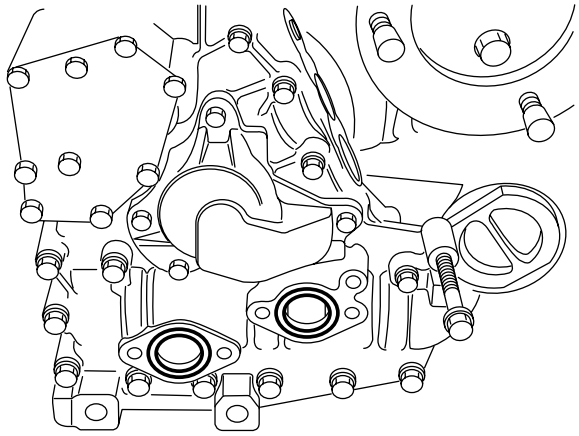
Installing the heat exchanger

1. Insert new O-rings into the circular slots of the control unit.
2. Install the studs in the heat exchanger and tighten them to the specified tightening torque, see main group “Technical Data”.
3. Apply Loctite to the contact surfaces, studs, and fixing nuts/bolt, see main group “Technical Data”.
4. Install the heat exchanger on the control unit and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
5. Install the fixing bolt of the oil connector flange of the heat exchanger, which is attached to the rear cover of the gearbox, and tighten it to the specified tightening torque, see main group “Technical Data”.
6. Connect the water hoses to the heat exchanger.
7. Connect the air pipe to the magnetic valve.
8. Connect the electric wiring to the intarder.
9. Fill the cooling system.
10. Fill the gearbox with oil.
11. Check the oil level in the gearbox.



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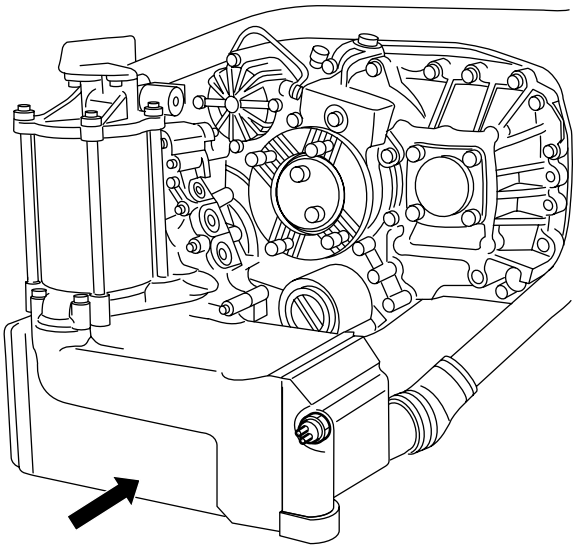

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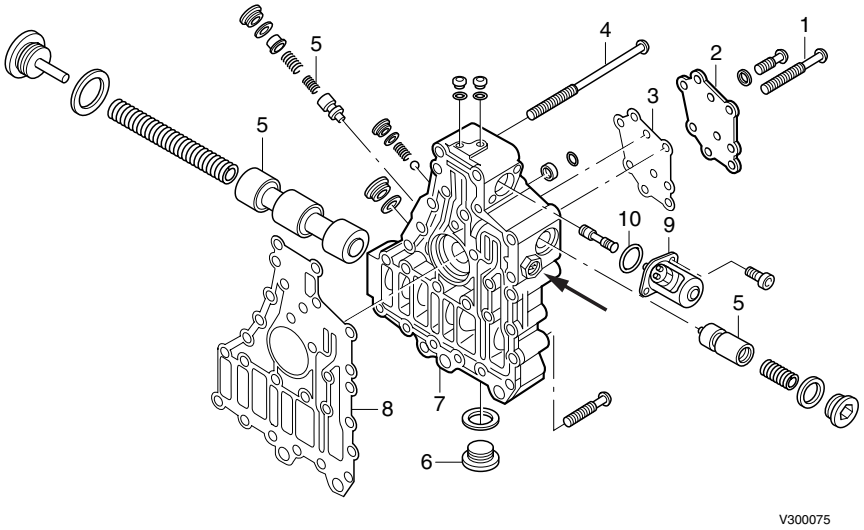
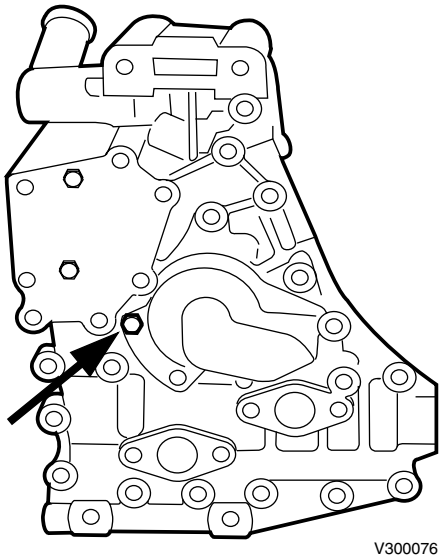
4.5 REMOVAL AND INSTALLATION OF THE HYDRAULIC CONTROL UNIT



In the course of the following operations, oil and coolant will spill from the heat exchanger and control unit. Collect this oil and coolant. Take measures to prevent the heat exchanger from being dropped.

Removing the hydraulic control unit

1. Remove the heat exchanger.
2. Remove the electric wiring from the proportional valve.
3. Remove the fixing bolts from the control unit on the gearbox. Leave one fixing bolt of the oil pump in place, see illustration.
4. Remove the control unit (7) and the gasket (8).
5. Remove and check the plungers and springs (5), if necessary. Avoid damaging the plungers and plunger guides
   Note:
   The sealed plunger (see arrow in illustration) must not be removed; if removed, the intarder would have to be adjusted again on the test bench.



Installing the hydraulic control unit

1. Fix the gasket (8) in the gearbox with as many long studs as possible. The studs also serve as guiding pins to facilitate mounting of the control unit.

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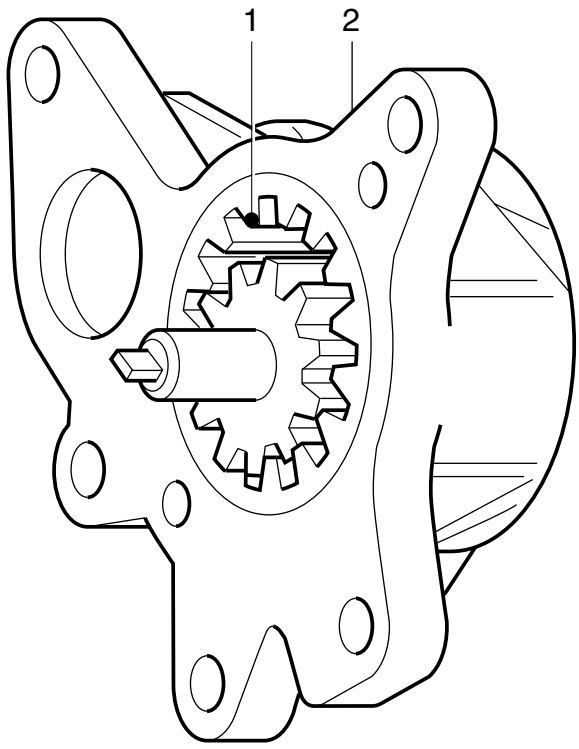
2. Line up the end of the oil pump with the output side of the stator.
3. Install the control unit over the studs and position the control unit carefully against the housing to make sure that the oil pump is in its place in the stator. Tighten the fixing bolts to the specified torque, see main group “Technical Data”.
4. Install the heat exchanger.

4.6 REMOVING AND INSTALLING THE OIL PUMP

Removing the oil pump
1. Remove the heat exchanger.
2. Remove the fixing bolts from the oil pump (2) on the control unit.
3. Remove the entire oil pomp from the control unit and remove the O-ring.
4. Check the axial clearance of the outer rotor, see main group “Technical Data”.
5. Check the pump housing for the presence of grooves. If required, replace the oil-pump assembly.

Installing the oil pump
1. Fit a new O-ring in the slot on the control unit.
2. Install the outer rotor in such a position that the mark (1) is visible.
3. Install the oil-pump assembly (2) onto the control unit. Make sure that the flat end of the internal rotor is in line with the stator.
4. Install the fixing bolts of the oil pump and tighten them to the specified tightening torque, see main group “Technical Data”.
5. Install the heat exchanger.



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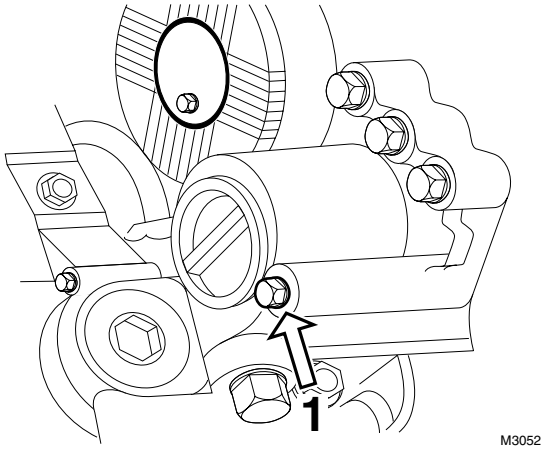
4.7 REMOVING AND INSTALLING THE OIL FILTER

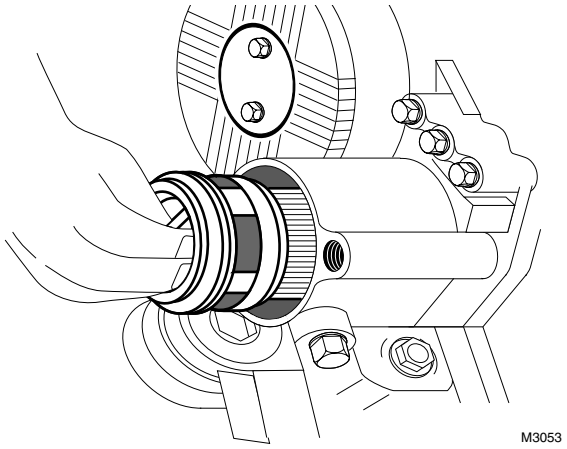
To prevent skin injury, avoid unnecessary contact with the drained oil.

Removal of the gearbox oil filter

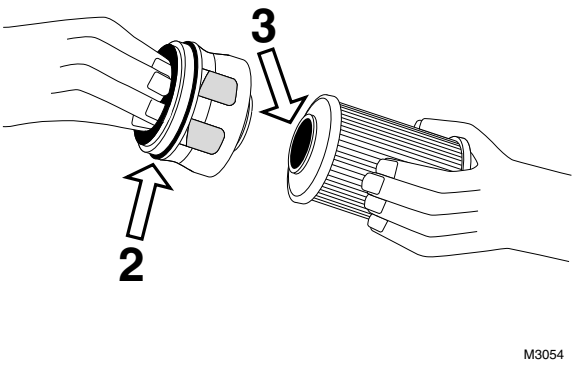
1. Remove the fixing bolt (1) of the oil filter.



2. Pull the filter cover with the filter from the filter housing.



3. Remove the filter (3) from the filter cover (2). Do not clean the filter. Filters must always be replaced.
   Note:
   If the magnetic disk is still attached to the back of the filter, separate it from the filter element and install it on the new filter element.



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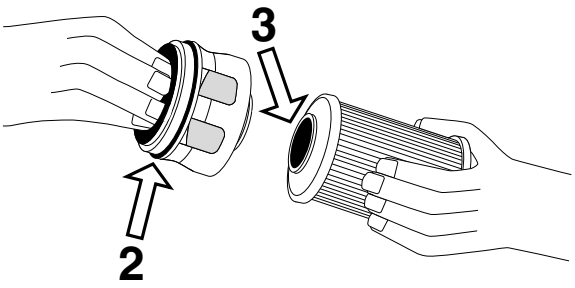
Installing the oil filter of the gearbox

1. Check the O-ring of the filter cover (2) for any damage. Replace the O-ring, if necessary. Grease the O-ring.
2. Grease the O-ring of the new filter (3) and place the filter on the filter cover. Then insert the filter and the filter cover into the filter housing.
3. Use a plastic mallet to tap the filter cover into the filter housing.
4. Tighten the fixing bolt (1) to the specified tightening torque, see main group “Technical Data”.



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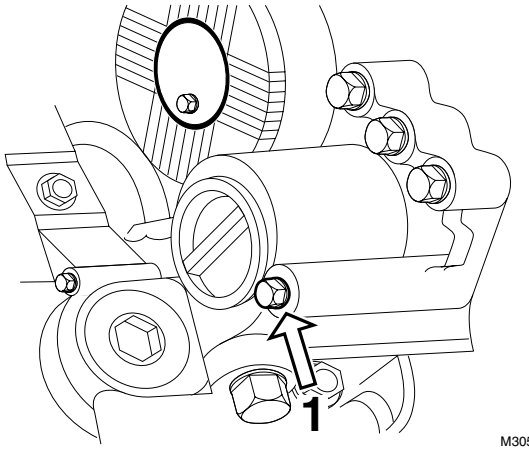

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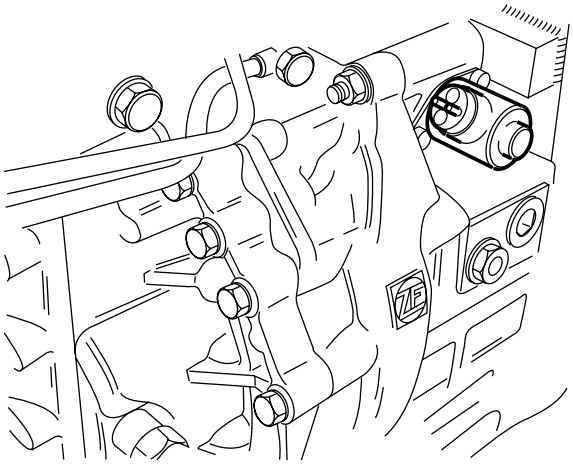
4.8 REMOVING AND INSTALLING THE PROPORTIONAL VALVE

Removing the proportional valve

1. Remove the electric wiring from the valve.
2. Remove the fixing bolts and remove the proportional valve.
3. Remove the O-ring.

Installing the proportional valve

1. Install a new O-ring on the proportional valve and lightly grease the O-ring.
2. Install the proportional valve and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
3. Connect the electric wiring to the valve.



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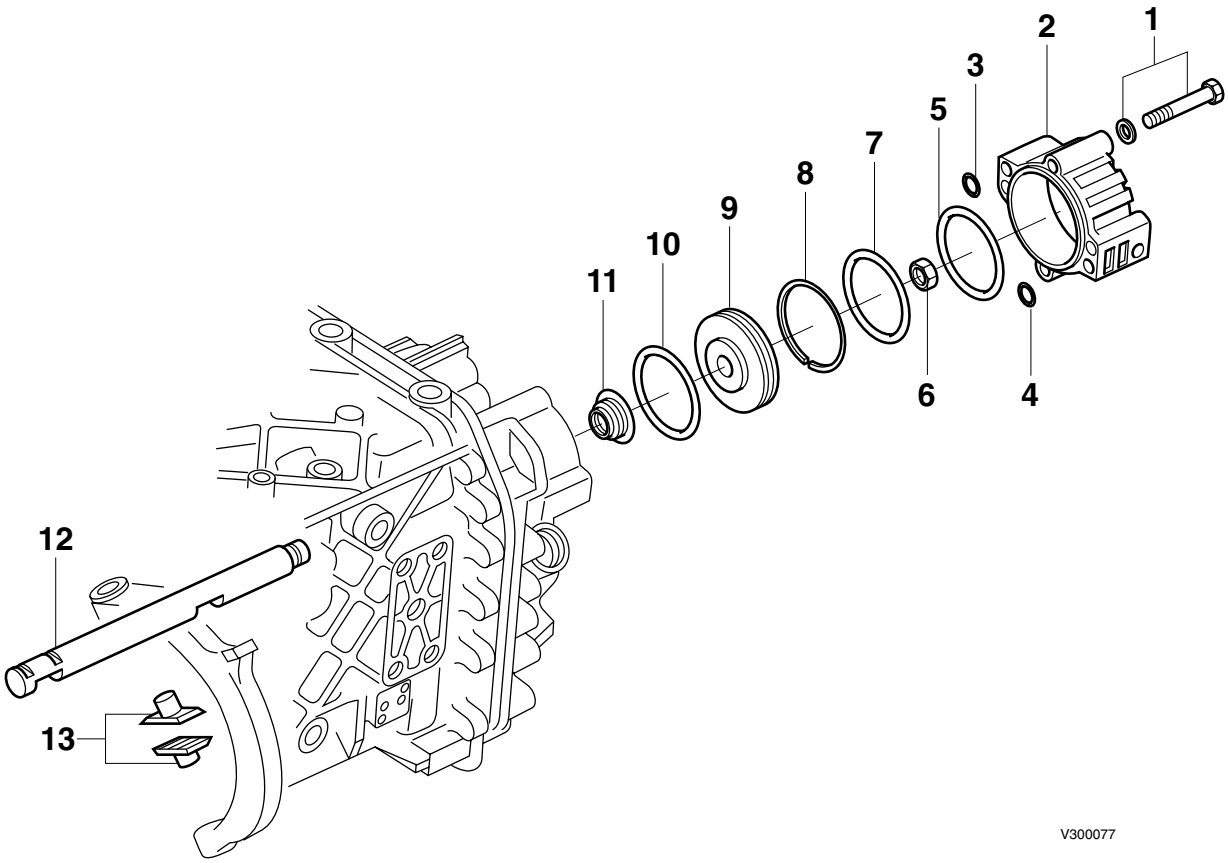
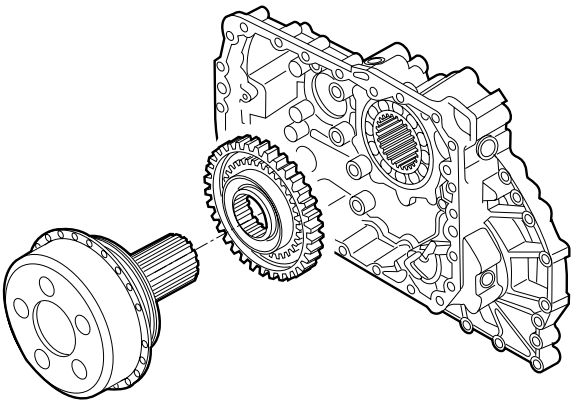
4.9 REMOVING AND INSTALLING THE INTARDER DRIVE



Removing the intarder drive

1. Remove the intarder.
2. Remove the air connectors of the high/low shift control on the cylinder (2).
3. Remove the fixing bolts (1) of the cylinder (2) and remove the cylinder.
4. Remove the lock nut (6) of the piston (9) and remove the piston and its O-rings.
5. Remove the two locking bolts of the high/low shifting fork.

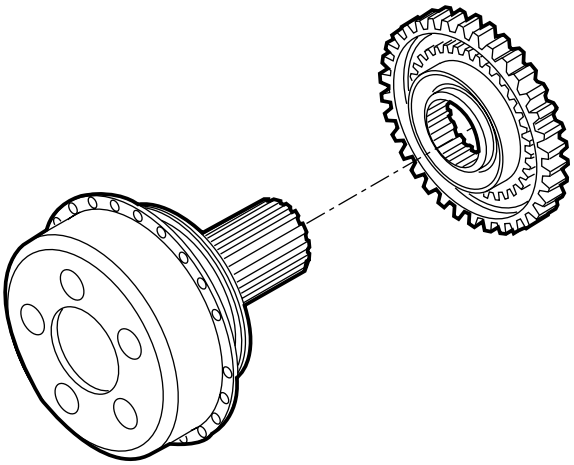
6. Remove the fixing bolts from the rear cover and remove the rear cover. Make sure the intarder remains in place.
7. Remove the gearbox gasket.


V300081

8. If necessary, use a tripod puller to remove the drive sprocket from the intarder.

Installing the intarder drive

1. Heat the drive sprocket, see main group “Technical Data”, and install the drive sprocket onto the intarder.
2. Install the gasket on the gearbox housing.
3. Install the rear cover over the dowel pins. Note the shifting fork when doing so. Insert the locking bolts of the shifting fork into the rear cover and finger-tighten them.
4. Install the fixing bolts of the rear cover and tighten them to the specified tightening torque, see main group “Technical Data”.
5. Tighten the lock bolts of the shifting fork to the specified tightening torque, see main group “Technical Data”.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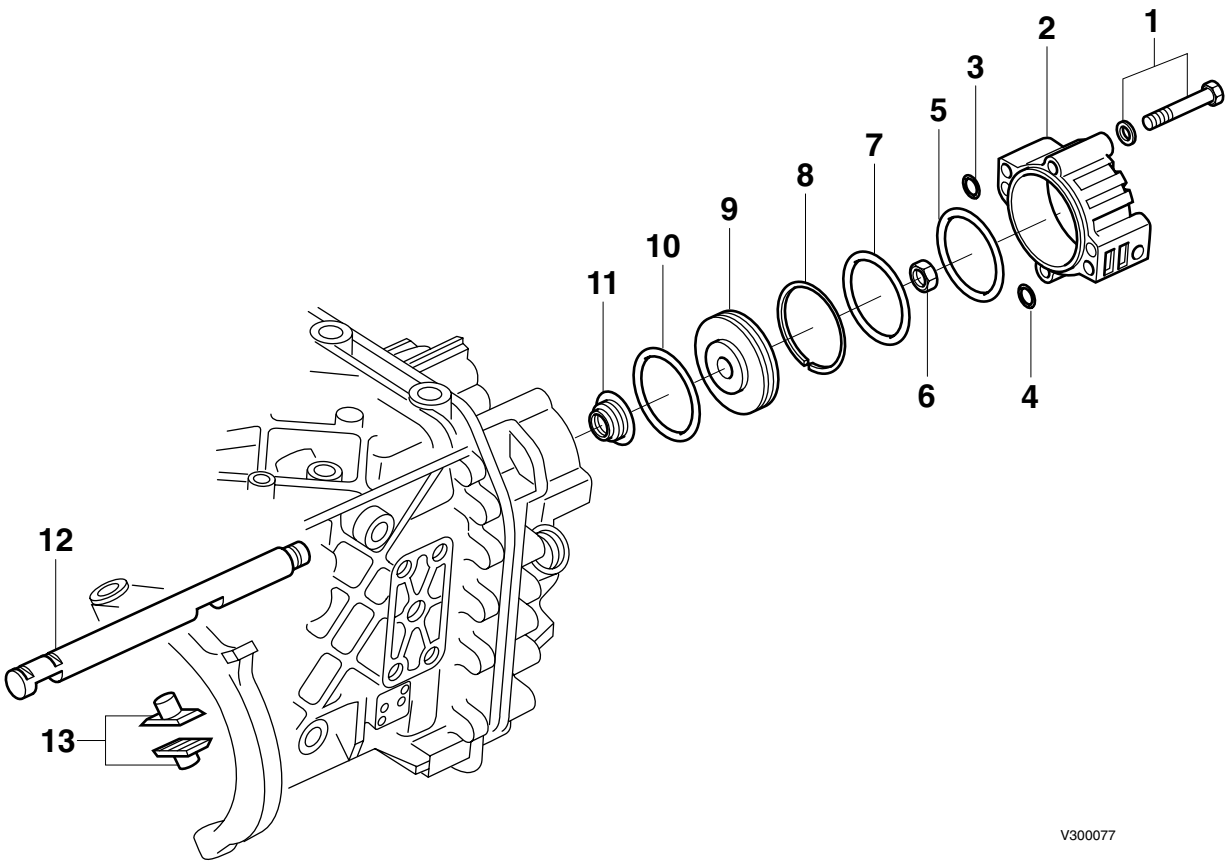

6. Install the piston (9) on the shifting shaft and tighten the lock nut (6) to the specified tightening torque, see main group “Technical Data”.
7. Install the cylinder (2) and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
8. Connect the air supply.
9. Install the intarder.

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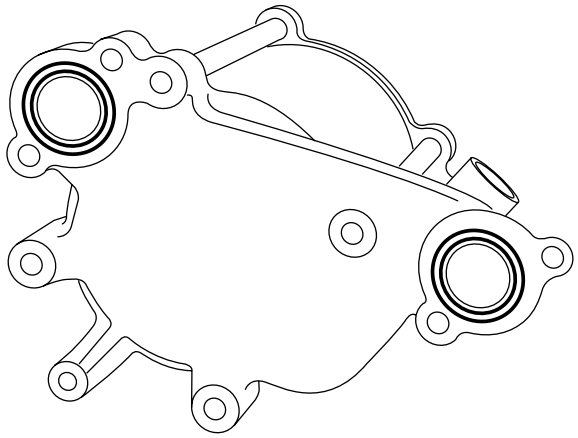
5. DISASSEMBLY AND ASSEMBLY

5.1 DISASSEMBLING AND ASSEMBLING THE ACCUMULATOR

Disassembling the accumulator

1. Remove the fixing bolts and/or the fixing nuts from the cylinder to the accumulator bracket, and remove it.
2. Remove the two O-rings at the bottom of the sealing surfaces of the accumulator/heat exchanger.
3. Remove the O-rings from the accumulator cylinder.
4. Remove the piston and sleeves from the cylinder.
5. Remove the sleeves from the piston and the scrapers from the middle of the piston.
6. Check the cylinder for damage.



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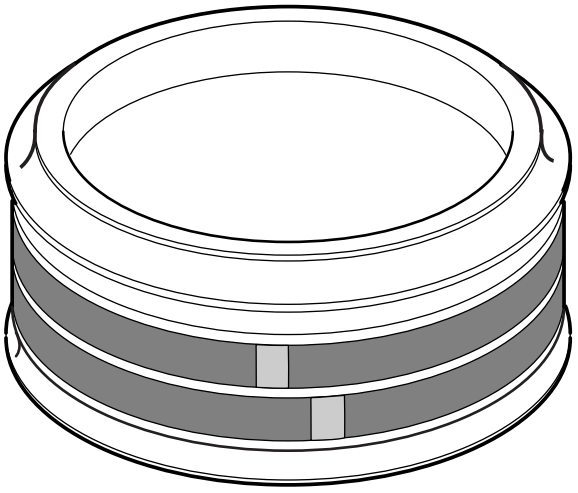

V300196

Assembling the accumulator

1. Install the central scrapers on the piston.
   Note:
   There are two different types of sleeves: one with a steel inner spring and one without a steel inner spring.
2. Install the sleeve with the steel inner spring at the oil side of the piston.
3. Install the sleeve without the steel inner spring at the air side of the piston.
4. Thoroughly cover the piston and cylinder with grease and install the piston in the cylinder.
5. Install the two O-rings at both sides of the cylinder.
   Apply grease to the O-rings to make sure they remain in position.

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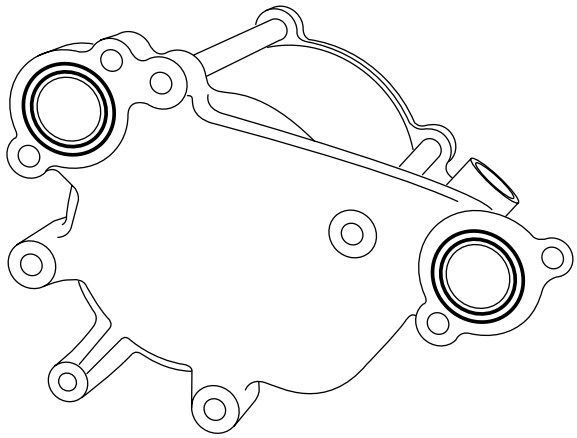
6. Install the cylinder on the accumulator bracket.
7. Install new O-rings at the bottom of the accumulator/heat exchanger and install the accumulator.



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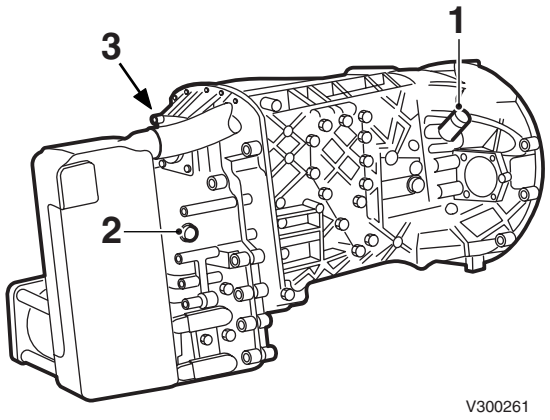
6. DRAINING AND FILLING

6.1 DRAINING AND FILLING THE GEARBOX/INTARDER

Draining the gearbox/intarder

1. Take a test drive before draining. During the test drive the intarder must **not** be activated.
2. Place the vehicle on a flat and level surface.
3. Drain the gearbox at operating temperature using the drain plugs (1) and (2).
4. Remove the fixing bolt (3).



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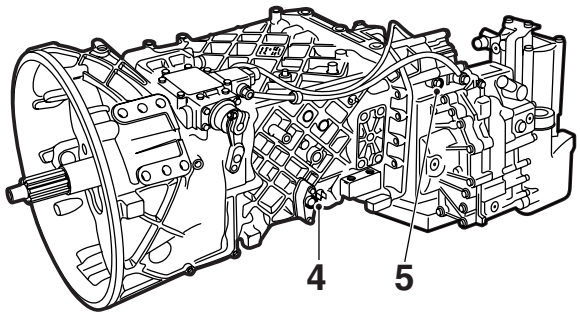
Draining the gearbox/intarder (oil change)

1. Clean the drain plugs and tighten these to the specified tightening torque, see main group “Technical Data”.
2. Fill the oil through filling/level opening (4) until the oil reaches the rim of the filling opening (4).
3. Take a short test drive after filling. During the test drive the intarder must **not** be activated.
4. Check the oil level after the test drive. The oil level must reach the rim of the oil-level/filling (4) opening.
5. Tighten the oil-level/filling plug (4) to the specified tightening torque, see main group “Technical Data”.



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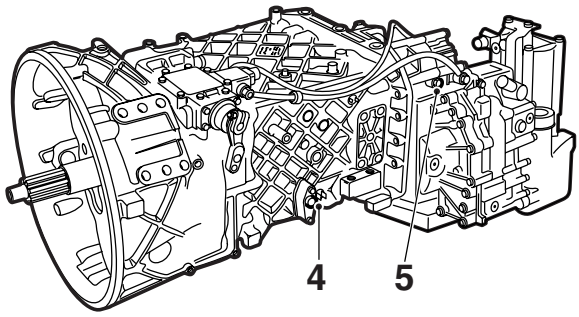
Filling the gearbox/intarder (following repair or gearbox replacement)

1. Place the vehicle on a flat and level surface.
2. Fill the oil through filling opening (5) until the oil reaches the rim of the oil-level/filling opening (4).
3. Take a short test drive after filling. During the test drive the intarder must be activated to the maximum **shortly**.
4. Check the oil level after the test drive. The oil level must reach the rim of the oil-level/filling opening (4).
5. Tighten the filling plug (5) and the oil-level plug (4) to the specified tightening torque, see main group “Technical Data”.



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1. SAFETY INSTRUCTIONS

- Be careful when changing the oil. Hot oil may cause serious injuries.
- Avoid unnecessary contact with drained oil. Frequent contact damages the skin.
- Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard.
  This also applies to coolants.
  So avoid inhaling and direct contact.

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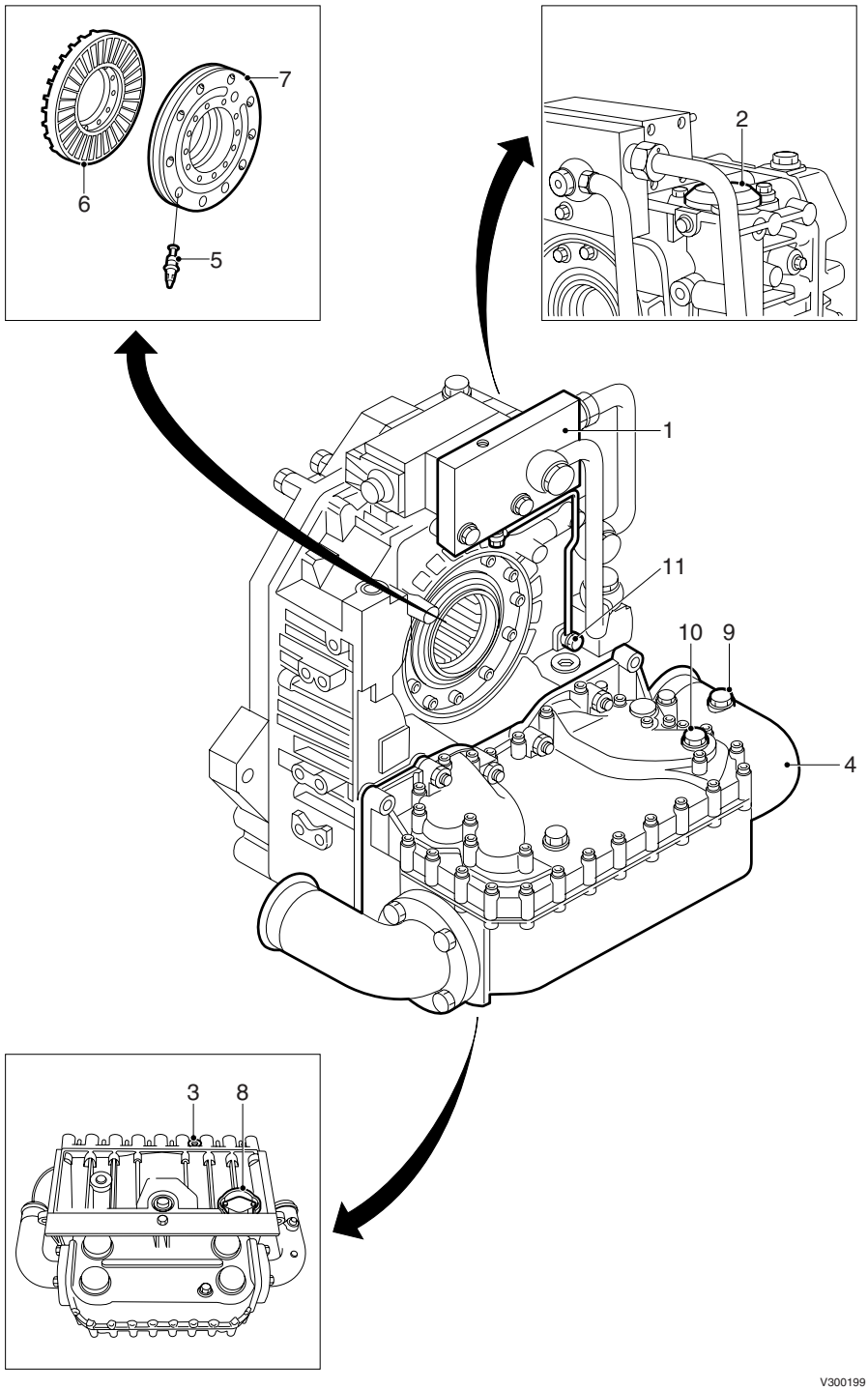
2. GENERAL

2.1 LOCATION OF MAIN COMPONENTS



1. Proportional valve
2. Venting valve
3. Butterfly valve
4. Heat exchanger
5. Stator valves
6. Rotor
7. Stator
8. Oil sump shut-off valve
9. Coolant temperature sensor
10. Oil temperature sensor
11. Shifting valve

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3. INSPECTION AND ADJUSTMENT

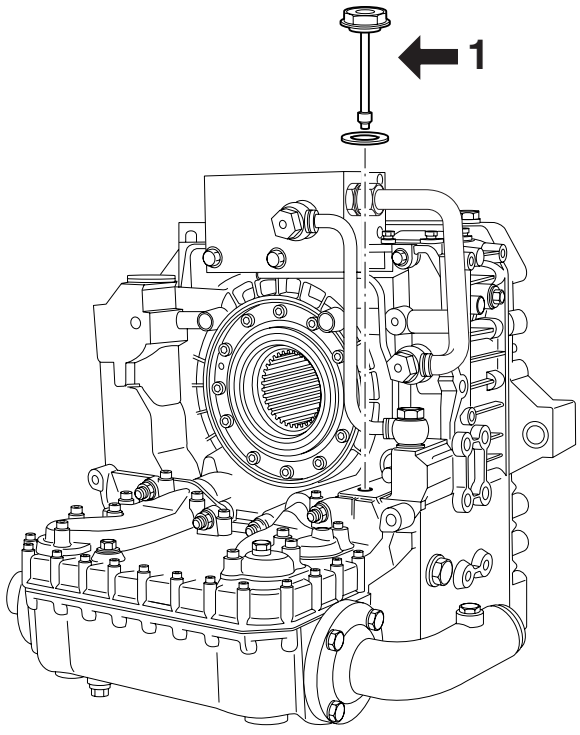
3.1 INSPECTION, RETARDER OIL LEVEL

To prevent skin injury, avoid unnecessary contact with the drained oil.

Note:
Depending on accessibility, oil level checks can be carried out using the oil dip stick or via the oil-level plug.

Inspecting the oil level with the oil dip stick

1. Checking must be done with the retarder at operating temperature.
2. Place the vehicle on a flat and level surface.
3. Pressurise the compressed-air braking system (pressure regulator should cut out).
4. Fully activate the retarder and switch off after 5 seconds.
   Repeat this operation twice.
5. After five minutes, take the oil dip stick (1) from the retarder housing, clean the oil dip stick, and replace it in the threaded hole (do not turn).



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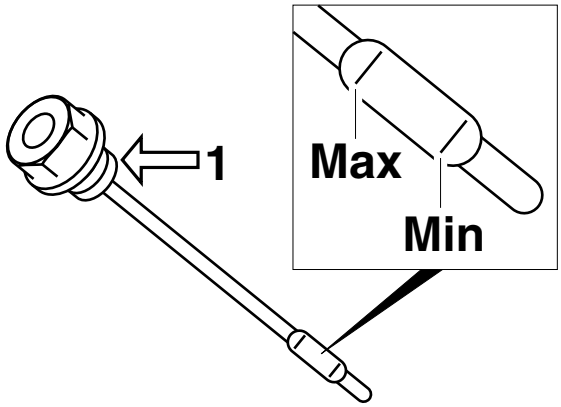
6. Then check the oil level.
   The oil level should be between the minimum and maximum mark on the oil dip stick.



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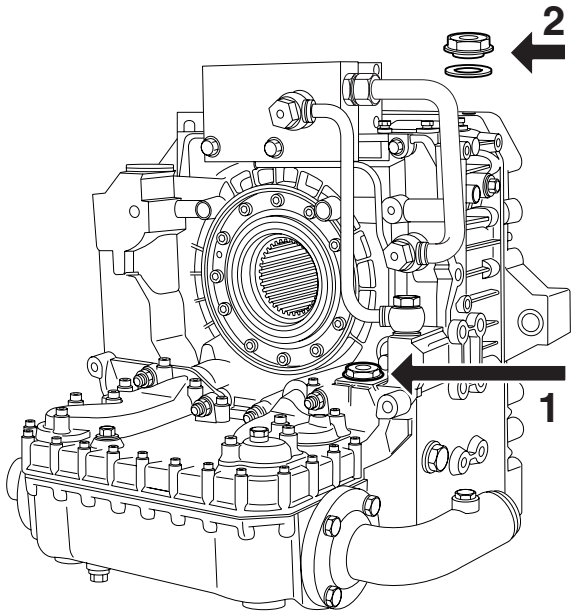
7. Top up if necessary via the bore hole of the oil dip stick (1) or via the filler plug (2).
   If you use the filler plug (2), top up the oil slowly to prevent leakage via the bleeding facility.
8. Then tighten the oil dip stick and filler plug, with new sealing rings in place, to the specified torques, see main group "Technical Data".



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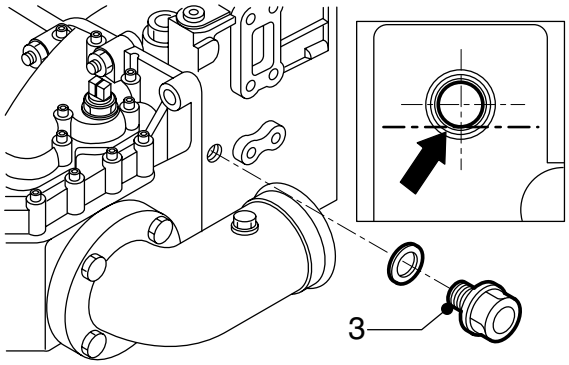
Checking the oil level with the oil-level plug

1. Checking must be done with the retarder at operating temperature.
2. Place the vehicle on a flat and level surface.
3. Pressurise the compressed-air braking system (pressure regulator should cut out).
4. Fully activate the retarder and switch off after 5 seconds.
   Repeat this operation twice.
5. After five minutes, remove the oil-level plug (3) from the retarder housing and check the level.
   The oil level must reach the bottom of the bore hole.



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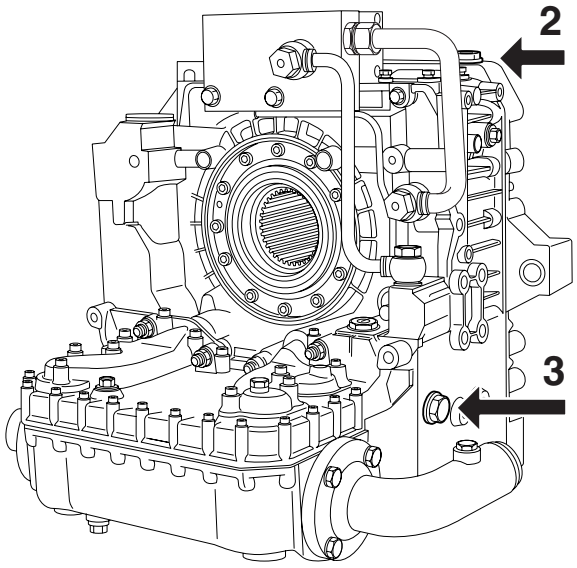
6. Top up, if necessary, via the bore hole of the dip stick (3) or via the filler plug (2).
   If you use the filler plug (2), top up the oil slowly to prevent leakage via the bleeding facility.
7. Then tighten the oil level plug and filler plug, with new sealing rings in place, to the specified torques, see main group “Technical Data”.



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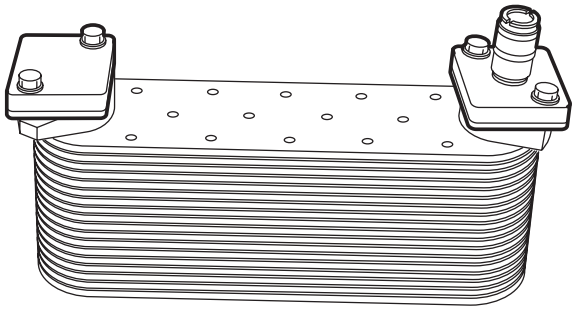
3.2 INSPECTION, HEAT EXCHANGER

1. Remove the heat exchanger.
2. Remove the oil elements from the heat exchanger.
3. Install the pressure plates on the oil element, using special tool (DAF no. 1240476 and 1240477).
4. Connect an air pipe to the proper plate, using special tool (DAF no. 1240476). The pressure may be approx. 8 bar.
5. Submerge the oil element in warm water (approx. 50°C) and check for visible leaks.
6. If the oil element shows any leaks, it must be replaced as it cannot be repaired.



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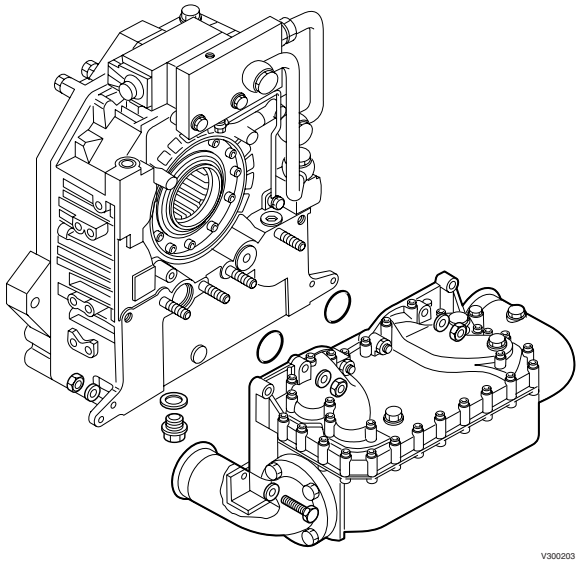
4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF THE HEAT EXCHANGER

To prevent skin injury, avoid unnecessary contact with the drained oil.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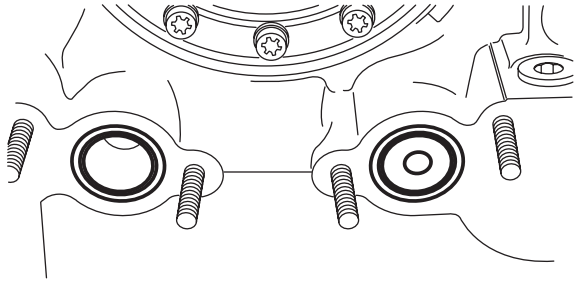
Removing the heat exchanger

1. Drain the oil and coolant from the retarder and the heat exchanger.
2. Remove the flexible coolant pipes from the heat exchanger.
3. Remove the connector from the coolant and oil sensor on the heat exchanger.
4. Remove the fixing bolts and nuts from the heat exchanger and remove the heat exchanger from the retarder.
5. Remove the O-rings and the throttle disk in the retarder housing.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Installing the heat exchanger

1. Thoroughly clean the contact surfaces between the heat exchanger and the retarder, and replace the O-rings.
2. Install the throttle disk into the retarder housing.
3. Install the heat exchanger and tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
4. Install the connector on the coolant and oil sensor.
5. Install the flexible coolant pipes of the heat exchanger.
6. Fill the coolant system and fill the retarder with oil.
7. Inspect the operation of the retarder and check for leaks.

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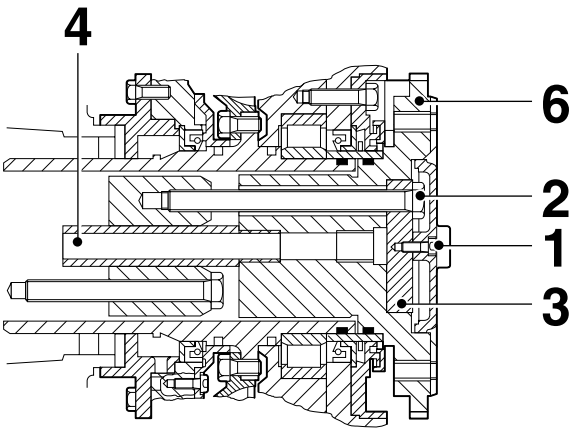
4.2 REMOVAL AND INSTALLATION, OUTPUT SHAFT DRIVE FLANGE

Removing the output shaft drive flange

1. Apply the parking brake.
2. Remove the drive shaft bolts and suspend the drive shaft to the side in the chassis.
3. Remove the fixing bolts (1) from the cover plate and remove the cover plate without damaging the O-ring (beware of oil spillage).
4. Remove the locking plate, fixing bolts (2) and retaining plate (3) from the drive flange (6).
5. Remove the drive flange. Use a tripod puller to do so.
6. If the oil pipe (4) remains in the output shaft of the gearbox when the drive flange is removed, thread must be cut in the oil pipe (M16) in order to be able to remove the oil pipe with an impact puller.



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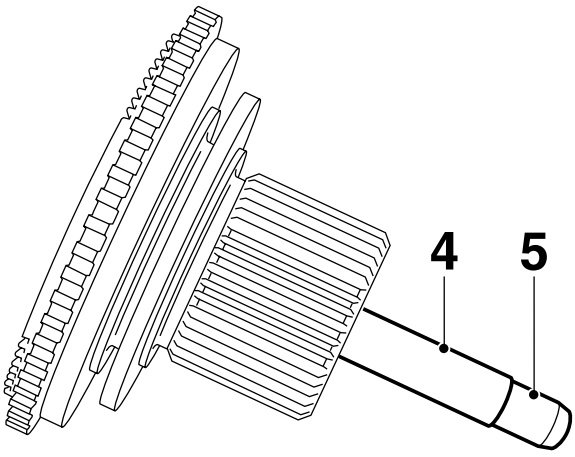
Installing the output shaft drive flange

Note:
An oil pipe (4) has been press-fitted in the drive flange. Note the position of the tapered leading edge (5).

1. Check the drive flange for damage. Always replace the O-ring on the drive flange.
2. Check whether the oil pipe can be inserted smoothly in the bore hole of the gearbox output shaft.



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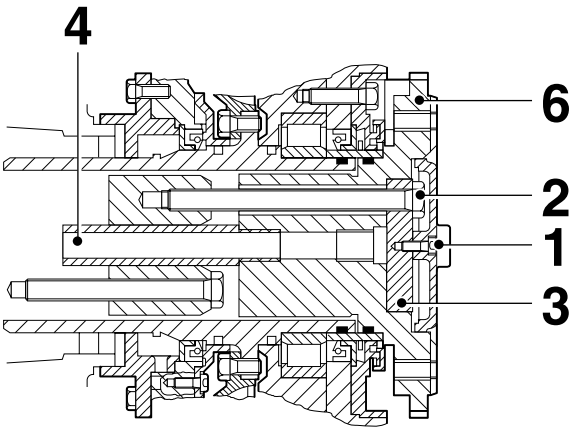
3. Install two studs in the gearbox output shaft to make it possible to install the drive flange in the correct position (6).
4. Lightly grease the splines of the drive flange, the end of the oil pipe (4), and the O-ring, and install the drive flange.
5. Remove the studs and install the two fixing bolts (1) and retainer plate (3). Tighten these evenly to the specified tightening torque, see main group “Technical Data”.
6. Fit a new locking plate.
7. Always replace the O-ring of the cover plate and lightly grease it before installation.
8. Apply a sealing compound (Loctite 510) to the fixing bolts and install the cover plate. Tighten the fixing bolts evenly to the specified tightening torque, see main group “Technical Data”.
9. Install the drive shaft and tighten the drive shaft fixing bolts to the specified tightening torque, see main group “Technical Data”.



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4.3 REMOVAL AND INSTALLATION, ENTIRE RETARDER

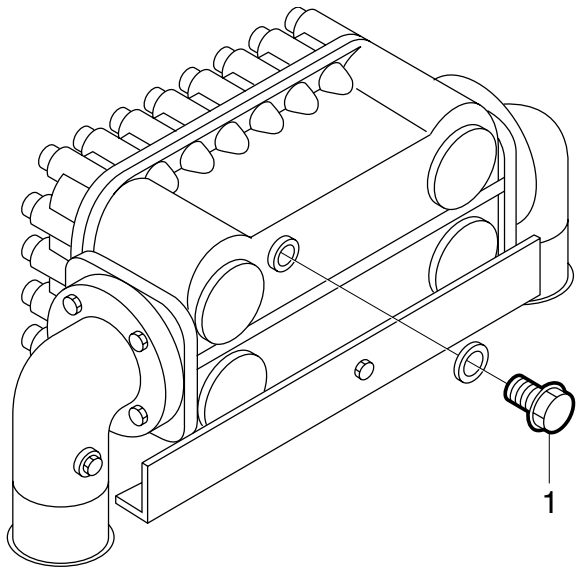
When the coolant is hot, there is an overpressure in the cooling system. Carefully remove the filler cap, to release the overpressure.

Coolant is a noxious fluid. Contact with the skin should therefore be avoided.

Removing the entire retarder

Note:
The retarder **must** be removed with the prescribed special tool to prevent damage to the rotor and/or stator during removal.

1. Apply the parking brake.
2. Remove the spare wheel, if applicable.
3. Remove the filler cap of the cooling system and drain the coolant via the drain plug (1) at the bottom of the heat exchanger.
4. Drain as much oil from the retarder and gearbox as is necessary.



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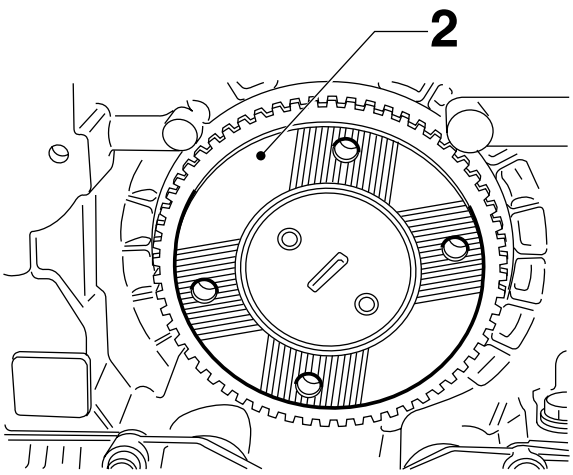
5. Remove the drive flange (2).
6. Remove the bolt of the water channel fixing bracket on the adapter plate.
7. Remove the flexible coolant pipes from the heat exchanger.
8. Bleed the brake system, mark and remove the air pipes.



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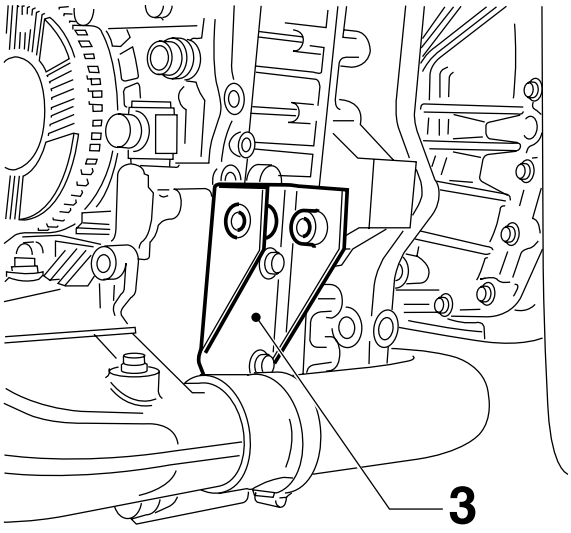
9. Remove the shock absorbers from the fixing brackets. Then remove the shock absorber fixing brackets (3) from the retarder.



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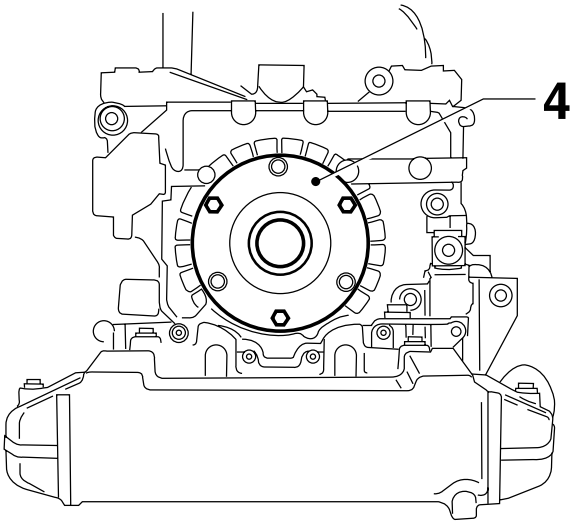
10. Remove the three fixing bolts from the labyrinth cover and install the fixing plate (4), special tool (DAF no. 0694993), using three fixing bolts (M10x60).
Tighten the three fixing bolts evenly to make sure the centring ring is properly positioned all around.
11. Support the retarder or suspend it in the hoist by means of a lifting eye, and remove the fixing bolt with spacer and the fixing nuts of the retarder.
12. Remove the retarder and the spacers behind it (beware of oil and coolant spillage).



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Note:
Perform the following two measurements before installing the retarder:
Measurement 1
Determine the thickness of spacers “5”, see example.

Measurement 2
Determine distance “C”. This will allow you to determine later whether the retarder has been installed correctly.

Measurements
1. Install the measuring gauge (6) special tool (DAF no. 0694997) using two fixing bolts (tightening torque 60 Nm) onto the gearbox output shaft.

Measurement 1
1. Determine the distance to the three contact points on the adapter plate using a straightedge (7) and a depth gauge (8). Then determine the average value of the distances measured.

2. Measured value - straightedge value = distance “A”

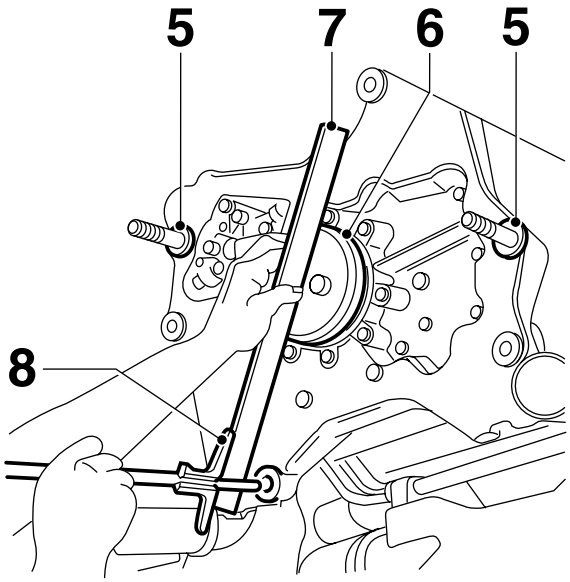
3. Spacer thickness = (“A” - 30 mm) - 0.2 mm. Where 30 mm is a fixed value and -0.2 mm is the allowable tolerance.

Measurement 2
1. Use a straightedge (7) and a depth gauge (8) in the bore hole of the measuring gauge (6) to determine the distance to the front of the gearbox output shaft.

2. Measured value - straightedge value = distance “D”.

3. Distance “C” = 82 mm - “D”. Where 82 mm is a fixed value.

4. Remove the measuring gauge.



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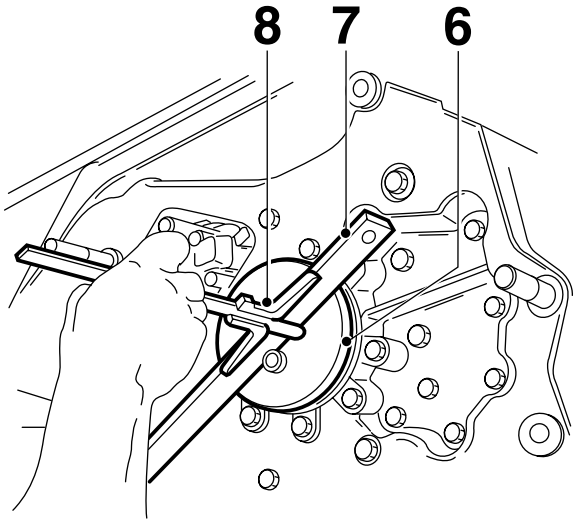

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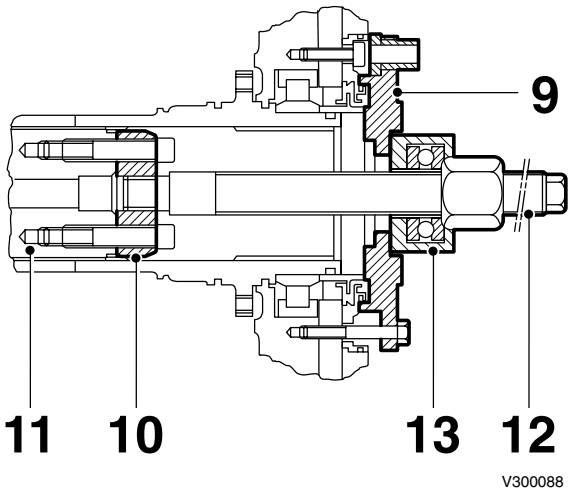
Installing the entire retarder

Note:
It is advisable to replace the sealing rings in the adapter plate before installing the retarder.

1. Remove the three fixing bolts from the labyrinth cover and install the fixing plate (4), special tool (DAF no. 0694993), using three fixing bolts (M10x60). Tighten the three fixing bolts evenly to make sure the centring ring is properly positioned all around.
2. Install the centring plate (10), special tool (DAF no. 0694994), onto the gearbox output shaft (11).
3. Lightly grease the external circumference of the hollow spline shaft in the area where the sealing rings make contact, and install the spacers and retarder onto the adapter plate studs.
4. Install the spindle (12) with the thrust bearing (13), using special tools (DAF no. 0694990 and 0694992), and turn the spindle nut to press the retarder onto the output shaft of the gearbox.
5. Install the fixing bolt with spacer and tighten the fixing bolt and fixing nuts to the specified tightening torque, see main group “Technical Data”.
6. Remove the fixing plate and tighten the three fixing bolts of the labyrinth cover to the specified tightening torque, see main group “Technical Data”.
7. Remove the centring plate.



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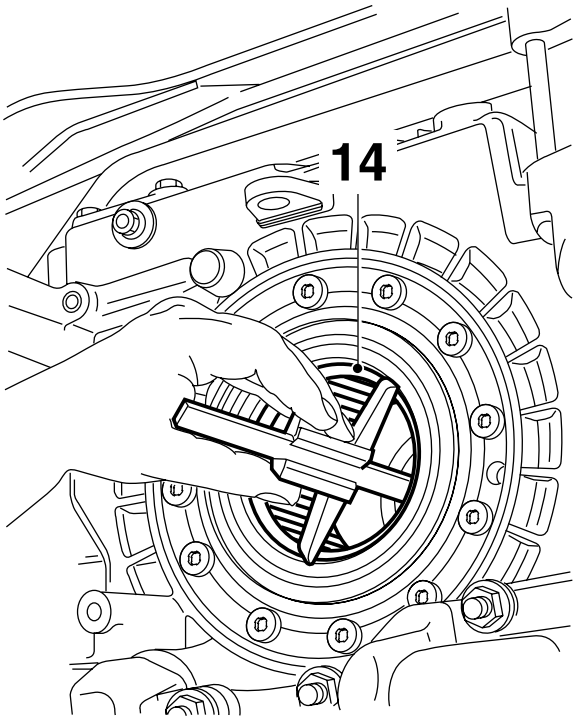
8. Use a depth gauge to determine the distance between the hollow spline shaft (14) of the retarder and the front of the gearbox output shaft.
   The measured value is distance “B”.
   Distance “B” should correspond to:
   (208 mm - “C”) ± 0.2 mm.
   Where 208 mm is a fixed value, “C” is a value determined by measurement 2, and 0.2 mm is the allowable tolerance.

   Note:
   If the measured value “B” deviates from the calculated value, the retarder must be removed and measurements 1 and 2 must be repeated.

9. Fit the drive flange.
10. Install the bolt of the water channel fixing bracket on the adapter plate.
11. Install the air pipes.
12. Install the shock absorber fixing brackets.
13. Install the retarder shock absorbers.
14. Install the connectors on the coolant and oil sensors.
15. Install the flexible coolant pipes of the heat exchanger.
16. Fill the coolant system and fill the retarder and gearbox with oil.
17. Inspect the operation of the retarder and check for leaks.



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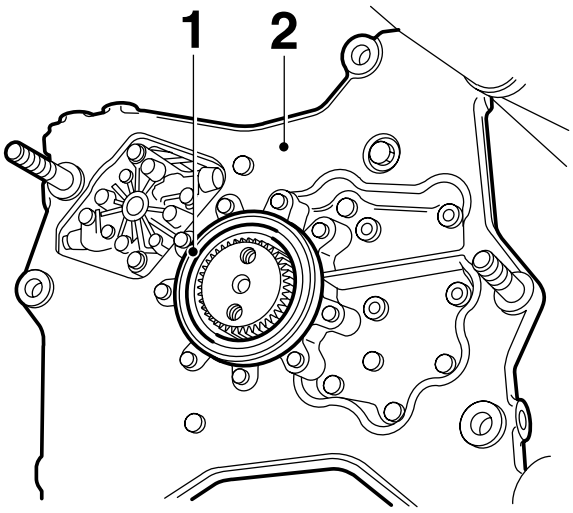
4.4 REMOVAL AND INSTALLATION OF THE GEARBOX OUTPUT SHAFT

To prevent skin injury, avoid unnecessary contact with the drained oil.

Removing the output shaft sealing ring

1. Remove the retarder.
2. Remove the sealing rings (1) from the adapter plate (2). The following method can be used to remove the sealing rings: Drill two little holes in the sealing ring, in opposite directions, and use the adapter and the impact puller of special tools (DAF no. 0484899 and 0694928), to turn the sealing ring from the adapter plate.



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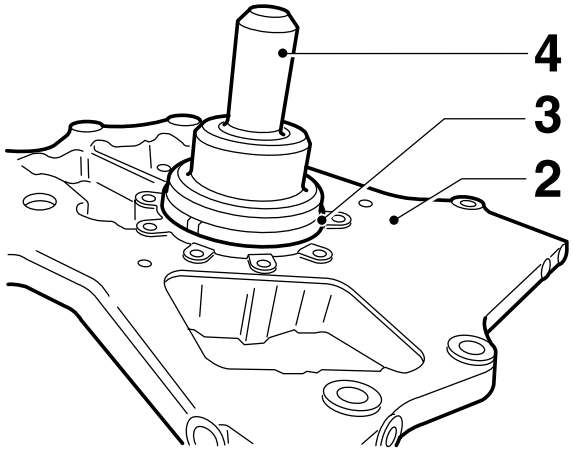
Installing the output shaft sealing ring

Note:
If sealing rings with an external steel cover are used, liquid jointing compound must be applied.
If sealing rings with an external rubber cover are used, a lubricant such as soap, must be applied.

1. Slide the adapter ring (3) onto the driving tool (4), see special tool (DAF no. 0694780), and use the stamp to install the front sealing ring in the adapter plate (2).
2. Remove the adapter ring from the driving tool and use the driving tool to install the rear sealing ring in the adapter plate.
3. Install the retarder.
4. Fill the coolant system and fill the retarder and gearbox with oil.
5. Check the oil level in the retarder and the gearbox.
6. Inspect the operation of the retarder and check for leaks.



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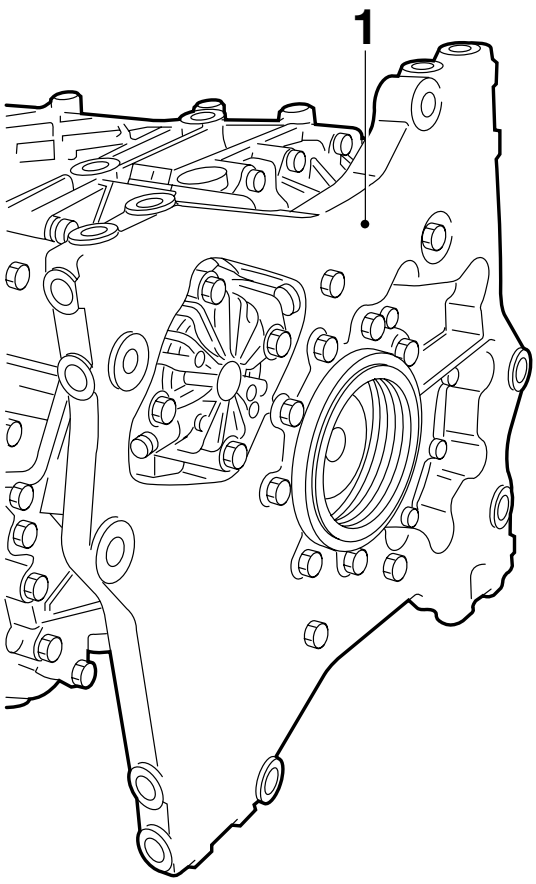
4.5 REMOVAL AND INSTALLATION, ADAPTER PLATE/ADAPTER GASKET

To prevent skin injury, avoid unnecessary contact with the drained oil.

Removing the adapter plate/adapter gasket

1. Remove the retarder.
2. Remove the adapter plate fixing bolts (1).
3. Insert two guide bolts in the adapter plate and remove the adapter plate.
4. Remove the filler ring and the gasket.



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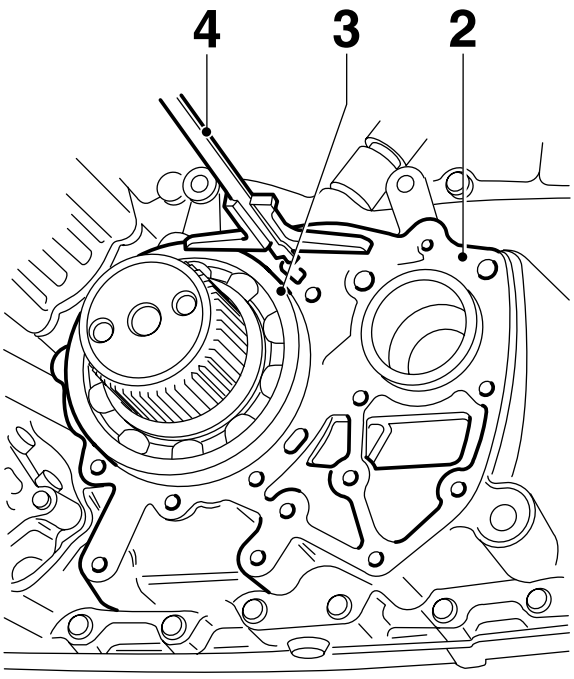
Installing the adapter plate/adapter gasket

1. Clean the contact surfaces of the adapter plate (1) and gearbox housing (2).
2. Lightly grease the new gasket and install it on the gearbox housing.
3. Ensure that the ball bearing (3) is properly situated in the gearbox housing and use a depth gauge (4) to determine the distance from the ball bearing to the gasket on the gearbox housing (distance “A”).



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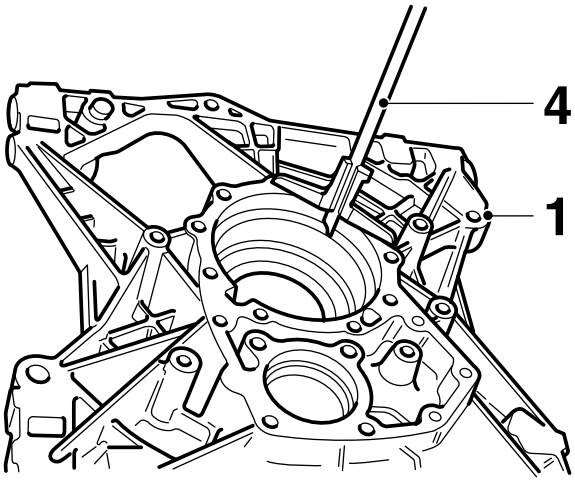
4. Use a depth gauge (4) to determine the depth of the ball bearing chamber in the adapter plate (1), (distance “B”).
5. Thickness of the filler ring = (“B” - “A”) - 0.05 mm.
   Where 0.05 mm is a value for gasket setting.

   Note:
   Installation tolerance of the bearing must be between 0 and 0.1 mm.
6. Replace the sealing ring in the adapter plate.
7. Install the adapter plate. Tighten the fixing bolts to the specified tightening torque, see main group “Technical Data”.
8. Install the retarder.
9. Fill the coolant system and fill the retarder and gearbox with oil.
10. Check the oil level in the retarder and the gearbox.
11. Inspect the operation of the retarder and check for leaks.



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5. DISASSEMBLY AND ASSEMBLY

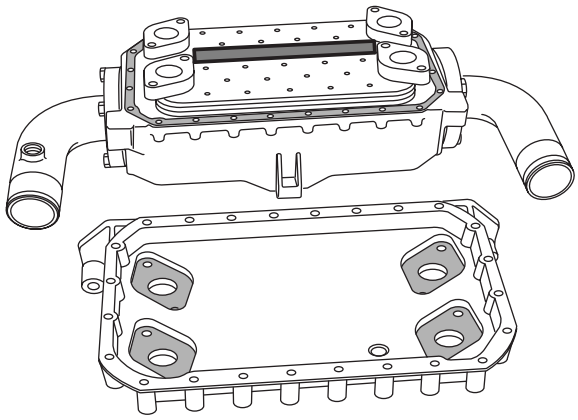
5.1 DISASSEMBLY AND ASSEMBLY, HEAT EXCHANGER

Disassembling the heat exchanger

1. Remove the top cover from the heat exchanger.
2. Remove the fixing bolts of the heat exchanger elements and remove the heat exchanger elements.
3. Remove all gaskets, O-rings and the rubber plate between the heat exchanger elements.

Installing the heat exchanger

1. Fit two new O-rings to the underside of the heat exchanger elements and install the heat exchanger elements in the heat exchanger housing.
2. Install the rubber plate between the two heat exchanger elements.
3. Fit new gaskets to both the heat exchanger elements and the heat exchanger housing.
4. Tighten the fixing bolts to the specified tightening torque. See main group “Technical Data”.



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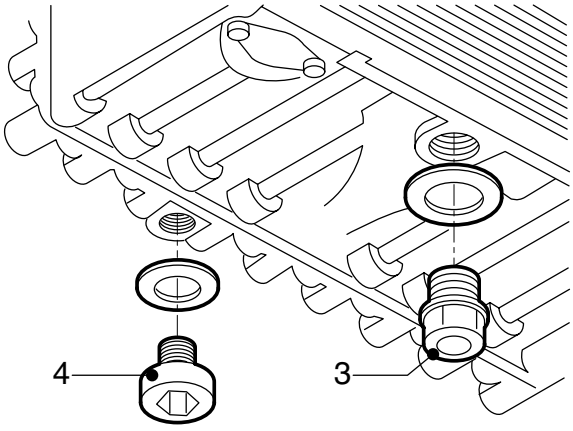
6. DRAINING AND FILLING

6.1 DRAINING AND FILLING, RETARDER OIL

To prevent skin injury, avoid unnecessary contact with the drained oil.

Draining the retarder

1. Drain off the oil when the retarder is at operating temperature.
2. Place the vehicle on a flat and level surface.
3. Pressurise the compressed-air braking system (pressure regulator should cut out).
4. Fully activate the retarder and switch off after 5 seconds. Repeat this operation twice.
5. Remove the retarder oil drain plug (3) and drain off the oil.
6. Remove the butterfly valve oil drain plug (4) and drain the leak-off oil.
7. Install the drain plugs with new sealing rings and tighten them to the specified tightening torque, see main group “Technical Data”.



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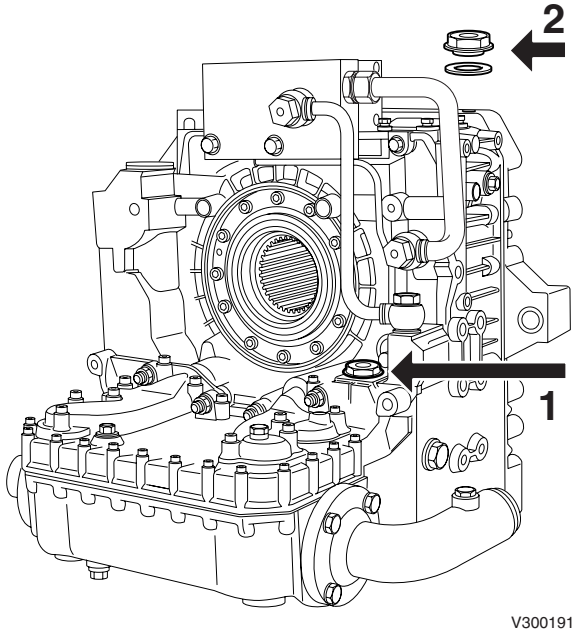
Filling the retarder

1. Fill the retarder with the prescribed amount of oil, either through the oil dip stick bore hole (1) or through the filler plug (2). If you use the filler plug (2), top up the oil slowly to prevent leakage via the bleeding facility.
2. Then tighten the plugs with new sealing rings in place, to the specified torques, see main group “Technical Data”.
3. Then check the oil level, see chapter “Inspection and adjustment”.



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1. SAFETY INSTRUCTIONS

To prevent skin injury, avoid unnecessary contact with the drained oil.
During work on the PTO, oil may flow from the gearbox. Collect this oil.

Never park a vehicle with the PTO engaged. In the case of air leakage, the pressure in the air system may drop, causing the PTO to switch off. During the gradual build-up of pressure in the air system, the PTO will also be re-engaged, which may result in the shifting teeth on the auxiliary gearbox shaft and the selector sleeve of the PTO being damaged beyond repair.

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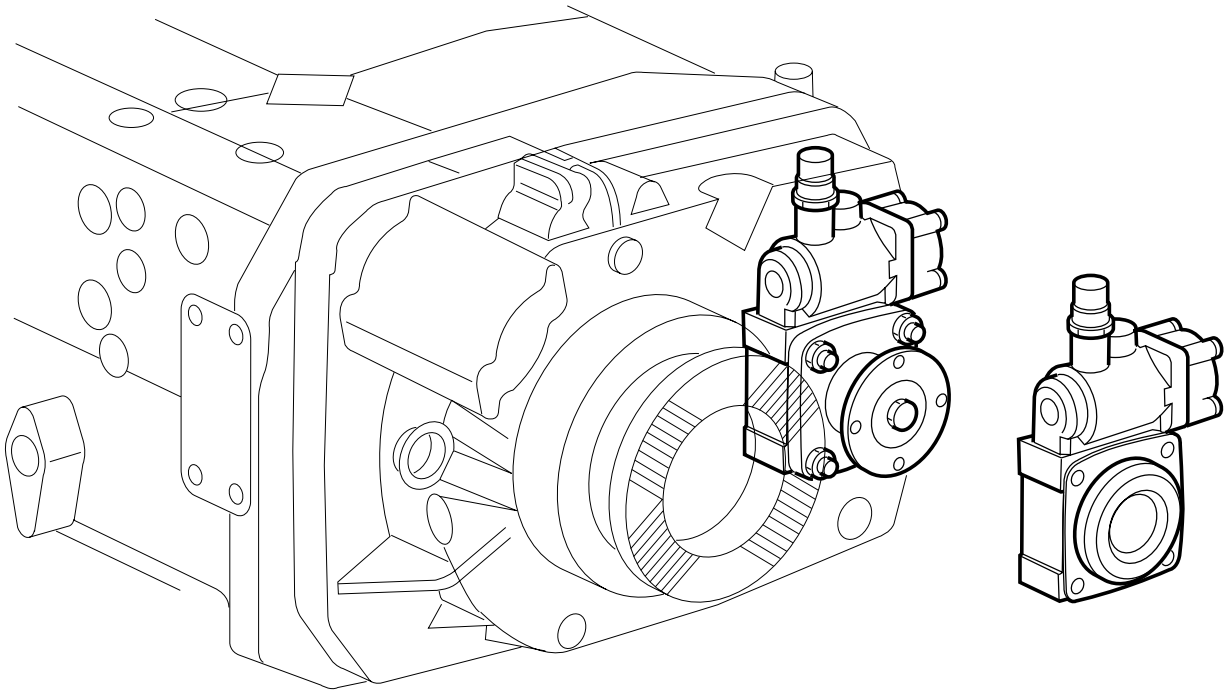
2. GENERAL

2.1 OVERVIEW DRAWINGS PTO VERSIONS

N71/1 - N353/1 VERSION



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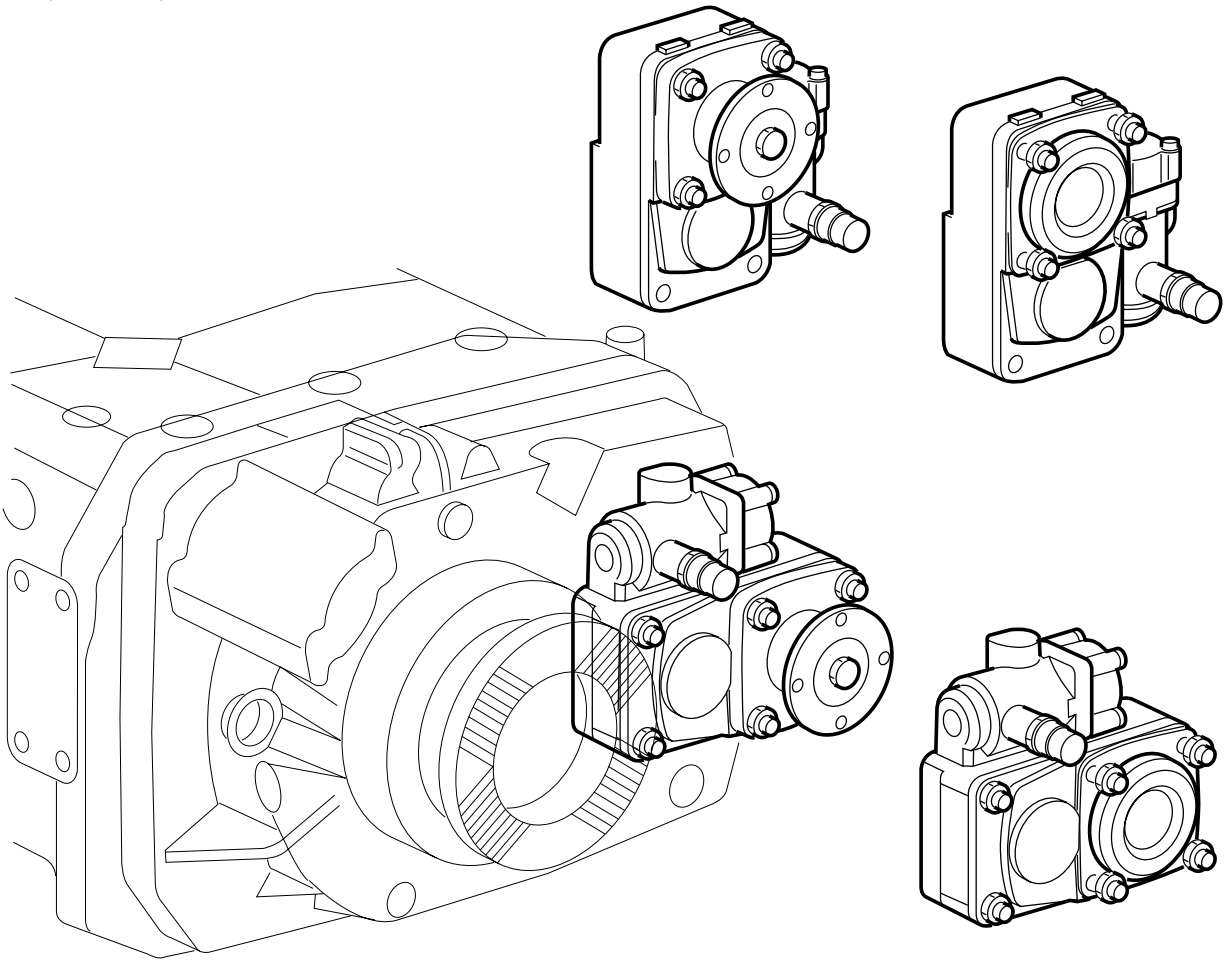
N71/2 - N353/2 VERSION



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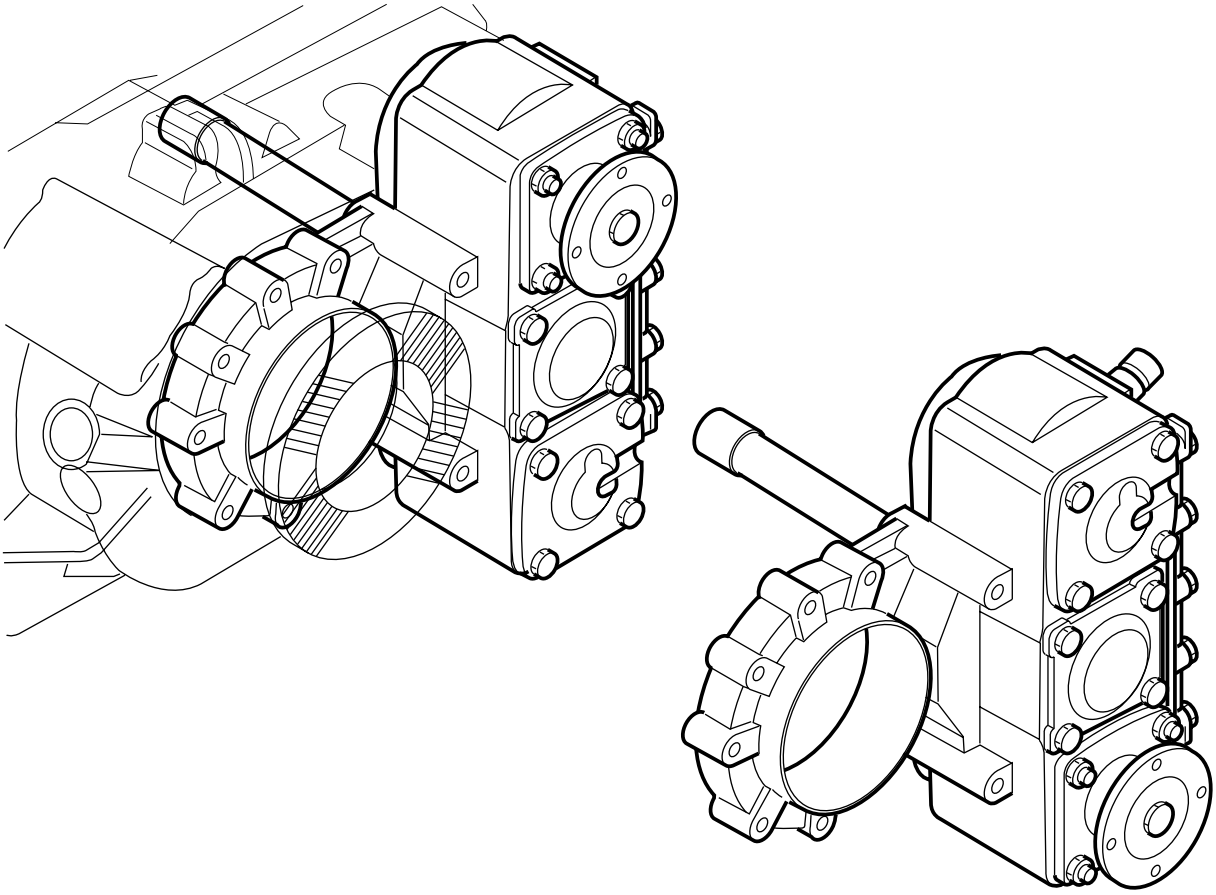
N221/10 VERSION FOR GEARBOX WITHOUT INTARDER



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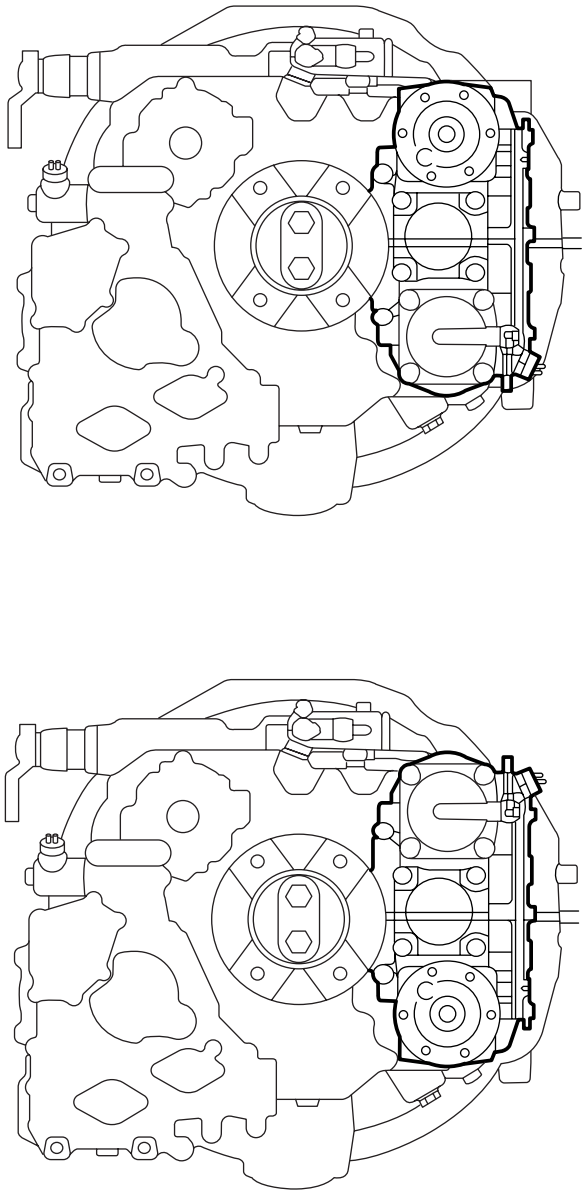
N221/10 VERSION FOR GEARBOX WITH INTARDER



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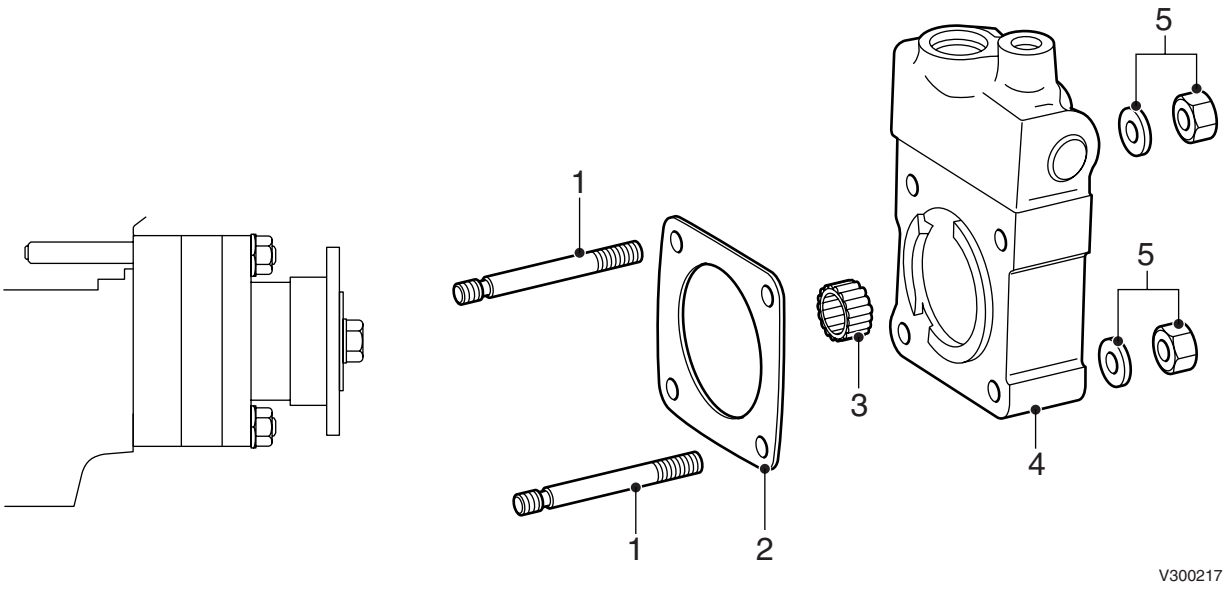
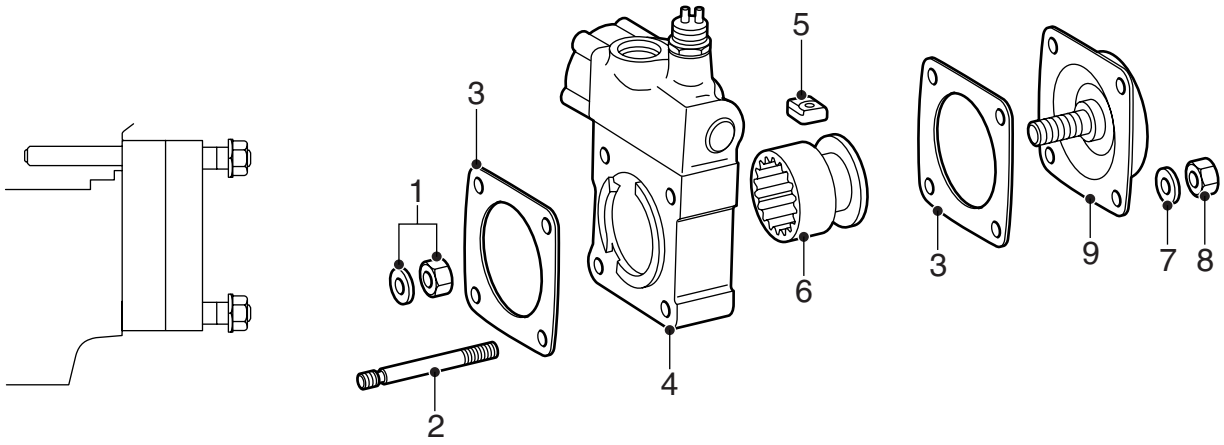
2.2 OVERVIEW DRAWING N71/1 AND N353/1 PTO, B-VERSION



1. Studs
2. Gasket
3. N71/1 needle bearing width 16 mm
   N353/1 needle bearing width 12 mm
4. PTO housing
5. Lock washer and nut

2.3 OVERVIEW DRAWING N71/1 AND N353/1 PTO, C-VERSION



1. Lead screw/ring
2. Studs
3. Gasket
4. PTO housing
5. Selector block
6. Selector sleeve
7. Lock washer
8. Nut
9. Lead cover

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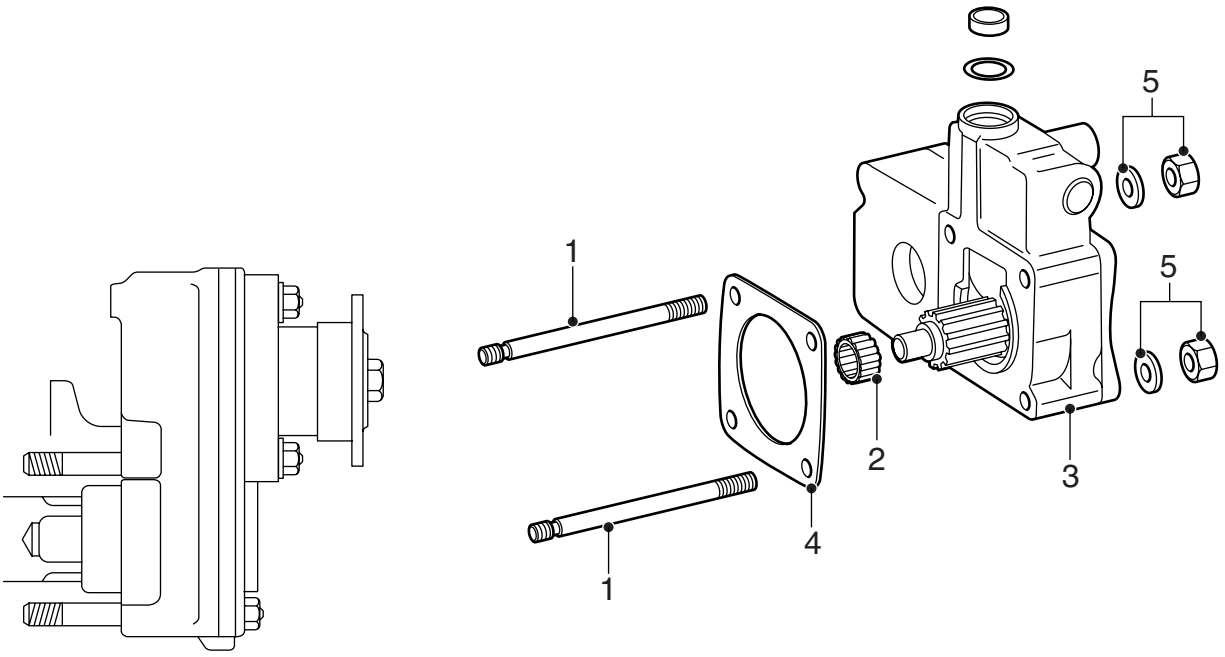
2.4 OVERVIEW DRAWING N71/2 AND N353/2 PTO, B-VERSION



1. Studs
2. Needle bearing
3. PTO housing
4. Gasket
5. Lock washer and nut

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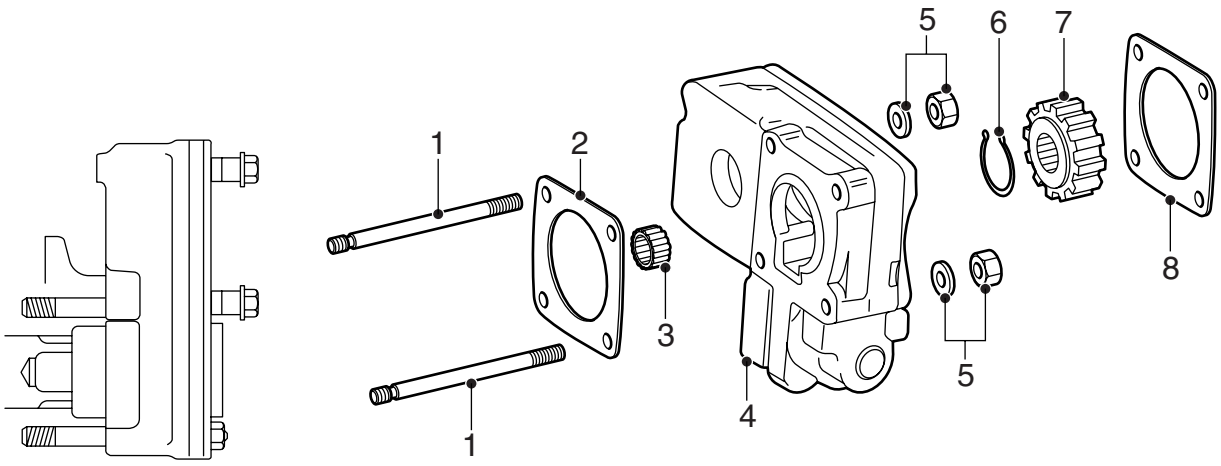
2.5 OVERVIEW DRAWING N71/2 AND N353/2 PTO, C-VERSION



1. Studs
2. Gasket
3. Needle bearing
4. PTO housing
5. Lock washer and nut
6. Circlip
7. Gearwheel
8. Gasket

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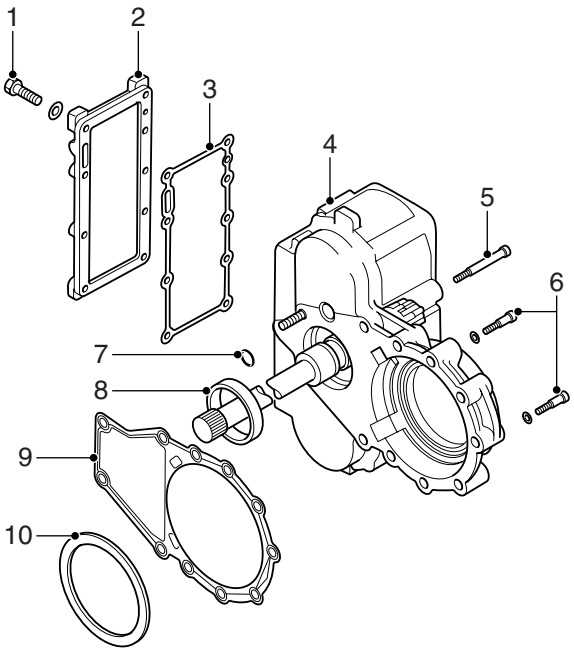
2.6 OVERVIEW DRAWING N221/10 PTO ON GEARBOX WITHOUT INTARDER

1. Side cover fixing bolts
2. Side cover
3. Gasket
4. PTO housing
5. Long fixing bolts
6. Short fixing bolts
7. O-ring
8. Centring ring
9. Gasket
10. Adjusting ring



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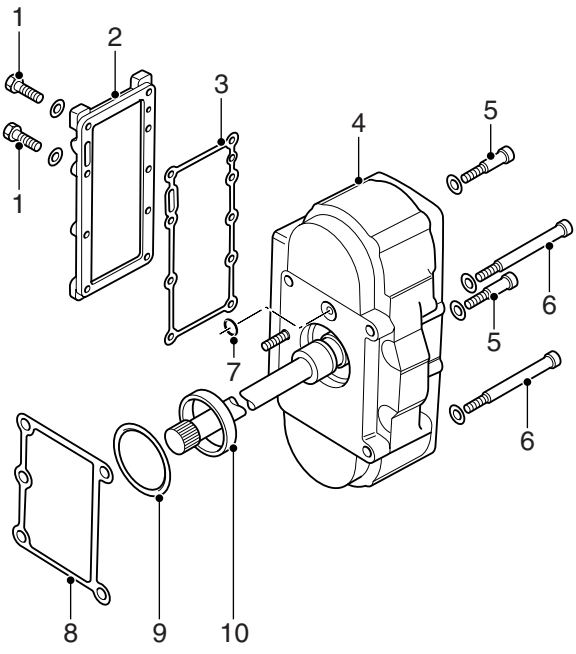
2.7 OVERVIEW DRAWING N221/10 PTO ON GEARBOX WITH INTARDER

1. Side cover fixing bolts
2. Side cover
3. Gasket
4. PTO housing
5. Short fixing bolts
6. Long fixing bolts
7. O-ring
8. Gasket
9. O-ring
10. Centring ring



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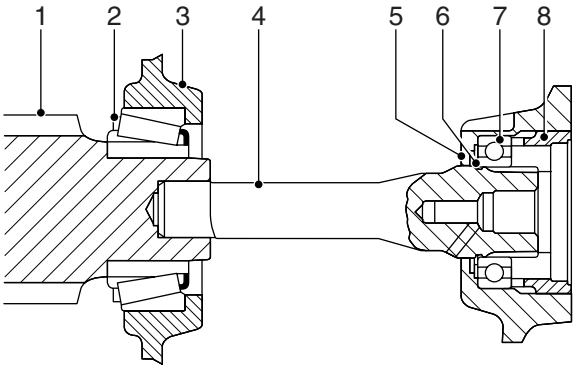
2.8 OVERVIEW DRAWING PTO AUXILIARY SHAFT FOR GEARBOX VERSION WITHOUT INTARDER

1. Auxiliary shaft
2. Taper roller bearing
3. Gearbox housing
4. Auxiliary shaft
5. Rear gearbox cover
6. Circlip
7. Ball bearing
8. Centring sleeves



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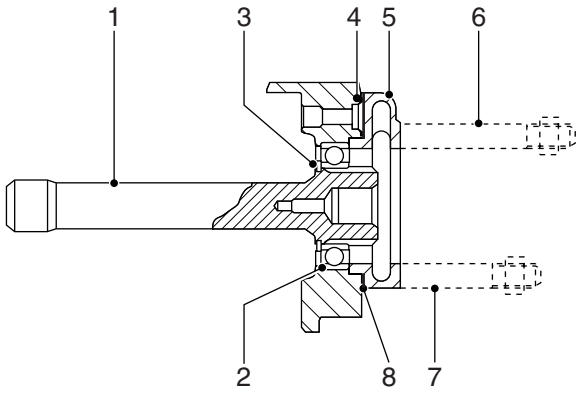
2.9 OVERVIEW DRAWING PTO AUXILIARY SHAFT FOR GEARBOX VERSION WITH INTARDER

1. Auxiliary shaft
2. Ball bearing
3. Circlip
4. O-ring
5. Intermediate housing
6. Long fixing bolt
7. Short fixing bolt
8. Gasket



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2.10 PNEUMATIC DIAGRAM PTO CONTROL

DESCRIPTION
Depending on the version, the electropneumatic valve (1) is controlled by a switch or a combination of a switch and GV pressure sensor located in the cab.
Upon activation of the electropneumatic valve (1), there is system pressure on the PTO connection, causing the PTO (2) to be activated.

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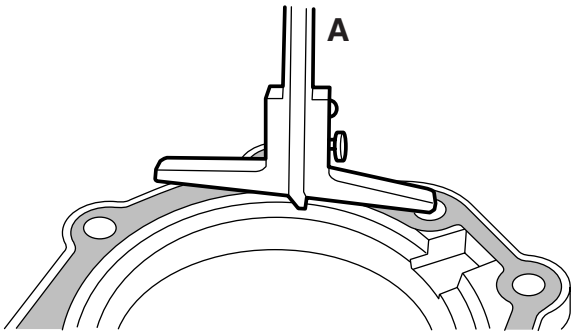
3. INSPECTION AND ADJUSTMENT

3.1 INSPECTION AND ADJUSTMENT, AXIAL PLAY ON GEARBOX OUTPUT SHAFT N221/10 PTO ON GEARBOX WITHOUT INTARDER

1. Removing the gearbox output shaft bearing cover.
2. Install a new gasket on the bearing cover of the PTO housing. Use a depth gauge to determine the depth of the bearing cover chamber, distance A.



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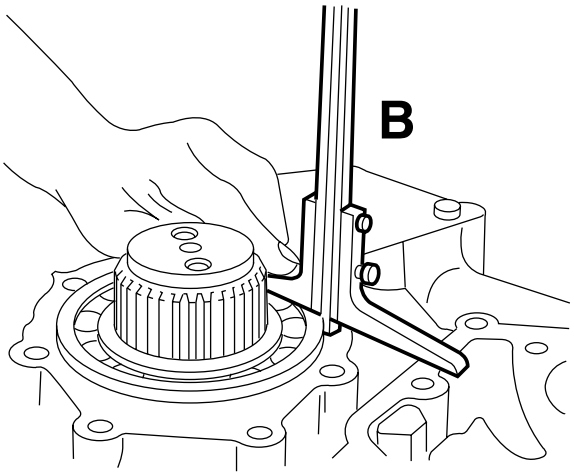
3. Use a depth gauge to determine the height of the extension of the ball bearing above the gearbox housing, distance B.
4. Calculate the axial play. The axial play equals distance A - distance B.
5. Compare the calculated value with the maximum allowable axial play, see main group “Technical Data”.
6. If necessary, adjust the axial play by means of another adjusting ring.



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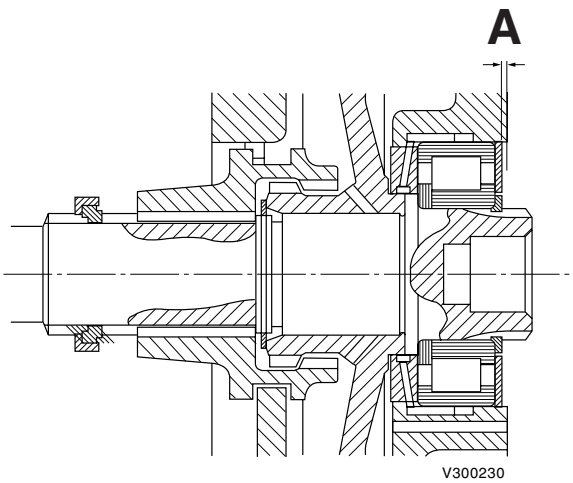
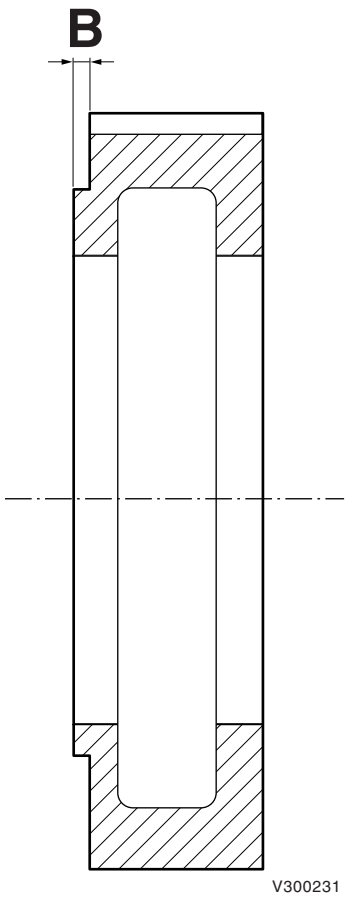
3.2 INSPECTION AND ADJUSTMENT, AXIAL CLEARANCE OF N353/1 PTO ON N221/10 PTO

1. Remove the cover and spacer of the N221/10 PTO.
2. Use a depth gauge to measure the depth down to the outer bearing race, distance A.



3. Install a new gasket on the intermediate housing and use a depth gauge to measure the distance from the centring ring, distance B.
4. Calculate the axial play. The axial play equals distance A - distance B.
5. Compare the calculated value with the maximum allowable axial play, see main group “Technical Data”.
6. If necessary, adjust the axial play by means of another adjusting ring.



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4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION, N71/1 AND N353/1 PTO, B-VERSION

Removal, N71/1 and N353/1 PTO, B-version

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing nuts of the PTO to the gearbox and remove the PTO including needle bearing and gasket.
5. If necessary, remove the auxiliary shaft.

Installation, N71/1 and N353/1 PTO, B-version

1. If necessary, install the auxiliary shaft.
2. Install the gasket over the studs.
3. Install the PTO with needle bearing onto the gearbox.
4. Install the fixing nuts onto the studs of the gearbox and the PTO.
5. Connect the electrical connector and air pipe to the PTO.
6. Install the drive flange against the PTO flange.
7. Check the oil level in the gearbox.

4.2 REMOVAL AND INSTALLATION, N71/1 AND N353/1 PTO, C-VERSION

Removal, N71/1 and N353/1 PTO, C-version

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing nuts of the PTO to the gearbox and remove the PTO including selector sleeve, selector block and gasket.
5. If necessary, remove the auxiliary shaft.

Installation, N71/1 and N353/1 PTO, C-version

1. If necessary, install the auxiliary shaft.
2. Install the gasket over the studs.
3. Install the PTO with selector sleeve and selector block onto the gearbox.
4. Install the fixing nuts onto the studs of the gearbox and the PTO.
5. Connect the electrical connector and air pipe to the PTO.
6. Install the drive flange against the PTO flange.
7. Check the oil level in the gearbox.

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4.3 REMOVAL AND INSTALLATION, N71/2 AND N353/2 PTO, B-VERSION

Removal, N71/2 and N353/2 PTO, B-version

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing nuts of the PTO to the gearbox and remove the PTO including needle bearing and gasket.
5. If necessary, remove the auxiliary shaft.

Installation, N71/2 and N353/2 PTO, B-version

1. If necessary, install the auxiliary shaft.
2. Install the gasket over the studs.
3. Install the PTO with needle bearing onto the gearbox.
4. Install the fixing nuts onto the studs of the gearbox and the PTO.
5. Connect the electrical connector and air pipe to the PTO.
6. Install the drive flange against the PTO flange.
7. Check the oil level in the gearbox.

4.4 REMOVAL AND INSTALLATION, N71/2 AND N353/2 PTO, C-VERSION

Removal, N71/2 and N353/2 PTO, C-version

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing nuts of the PTO to the gearbox and remove the PTO including selector sleeve, selector block and gasket.
5. If necessary, remove the auxiliary shaft.

Installation, N71/2 and N353/2 PTO, C-version

1. If necessary, install the auxiliary shaft.
2. Install the gasket over the studs.
3. Install the PTO with selector sleeve and selector block onto the gearbox.
4. Install the fixing nuts onto the studs of the gearbox and the PTO.
5. Connect the electrical connector and air pipe to the PTO.
6. Install the drive flange against the PTO flange.
7. Check the oil level in the gearbox.

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4.5 REMOVAL AND INSTALLATION, N221/10 PTO ON GEARBOX WITHOUT INTARDER

Removal, N221/10 PTO without intarder

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing bolts from the PTO side cover and remove the side cover with the gasket.
5. Remove the gearbox drive shaft and hang the drive shaft on the side of the chassis.
6. Remove the lock plate from the bolt heads in the drive flange.
7. Remove the bolts and lock plate from the drive flange.
8. **Note:**
   Measure the distance between the drive flange to the shaft and make a note of this. The same distance must be observed when the drive flange is reinstalled.

   Remove the drive flange and O-ring using a commercially available flange holder and tripod puller.
9. Remove the fixing bolts from the bearing cover of the PTO and the two fixing bolts located on the inside of the PTO. Remove the entire PTO.
10. Remove the gasket, O-ring, centring ring and spacer ring from the bearing of the output shaft.

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Installation, N221/10 PTO without intarder

1. Check bearing clearance on the gearbox output shaft and adjust, if necessary.
2. Install the O-ring and centring ring in the rear cover of the gearbox.
3. Install a new gasket and spacer ring in the rear cover of the PTO.
4. Install the PTO on the gearbox and install the fixing bolts.
5. Install a new gasket on the side cover of the PTO and install the side cover.
6. Heat the gearbox drive flange to approximately 70°C. Slide the drive flange as far as possible onto the output shaft. Use a lock plate and two standard bolts (M12x75) to pull the drive flange further onto the shaft. Check the position of the drive flange on the basis of the above-mentioned measurement. Remove the lock plate and bolts again.
7. Fit a new O-ring into the recess between the output shaft and the drive flange.
8. Restrain the drive flange with a flange holder.
9. Tighten the lock plate with the bolts (M12x75) to the specified tightening torque, see main group “Technical Data”.
10. Install a new lock plate using special tool (DAF no.1240460).
11. Fit the drive shaft.
12. Connect the electrical connector and air pipe to the PTO.
13. Install the drive flange against the PTO flange.
14. Check the oil level in the gearbox.

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4.6 REMOVAL AND INSTALLATION, N221/10 PTO ON GEARBOX WITH INTARDER

Removal, N221/10 PTO with intarder

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing bolts from the PTO side cover and remove the side cover with the gasket.
5. Remove the PTO fixing bolts on the rear cover of the gearbox and the two fixing on the inside of the PTO. Remove the entire PTO.
6. Remove the gasket, O-ring and centring ring from the rear cover of the gearbox.

Installation, N221/10 PTO with intarder

1. Install a new O-ring and centring ring in the rear cover of the gearbox.
2. Install a new gasket and in the rear cover of the gearbox.
3. Install the PTO.
4. Install a new gasket on the side cover of the PTO and install the side cover.
5. Connect the electrical connector and air pipe to the PTO.
6. Install the drive flange against the PTO flange.
7. Check the oil level in the gearbox.

4.7 REMOVAL AND INSTALLATION, N353/1 PTO ON N221/10 PTO

Removal, N353/1 PTO on N221/10 PTO

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the electrical connector and air pipe from the PTO.
3. Remove the drive flange, mounted against the PTO flange.
4. Remove the fixing bolts from the N353/1 PTO on the N221/10 PTO.
5. Remove the PTO, gasket and intermediate housing.

Installation, N353/1 PTO on N221/10 PTO

1. Check and adjust the axial play before attaching the N353/1 PTO to the N221/10 PTO.
2. Install a new gasket and install the intermediate housing.
3. Install the PTO.
4. Connect the electrical connector and air pipe to the PTO.
5. Install the drive flange against the PTO flange.
6. Check the oil level in the gearbox.

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4.8 REMOVAL AND INSTALLATION, PTO AUXILIARY SHAFT FOR GEARBOX VERSION WITHOUT INTARDER

Removal, auxiliary shaft without intarder

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the PTO.
3. Remove the centring sleeve.
4. Remove the auxiliary shaft with bearing and lock ring from the rear cover of the gearbox.
5. Remove the lock ring and the auxiliary shaft bearing, if necessary.

Installation, auxiliary shaft without intarder

1. **Note:**
   The auxiliary shaft can be installed without any measurements being taken.

   Install the bearing and the lock ring on the auxiliary shaft.
2. Install the auxiliary shaft in the rear cover of the gearbox.
3. Install the centring sleeves on the rear cover of the gearbox.
4. Install the PTO.
5. Check the oil level in the gearbox.

4.9 REMOVAL AND INSTALLATION, PTO AUXILIARY SHAFT FOR GEARBOX VERSION WITH INTARDER

Removal, auxiliary shaft with intarder

1. Drain as much gearbox oil as necessary and collect it in a clean container.
2. Remove the PTO.
3. Remove the intermediate housing from the rear cover of the gearbox.
4. Remove the O-ring and the gasket.
5. Remove the auxiliary shaft with bearing and lock ring from the rear cover of the gearbox.
6. Remove the lock ring and the auxiliary shaft bearing.

Installation, auxiliary shaft with intarder

1. **Note:**
   The auxiliary shaft can be installed without any measurements being taken.

   Install the bearing and the lock ring on the auxiliary shaft.
2. Install the auxiliary shaft in the rear cover of the gearbox.
3. Install the intermediate housing with O-ring and gasket onto the rear cover of the gearbox.
4. Install the PTO.
5. Check the oil level in the gearbox.

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