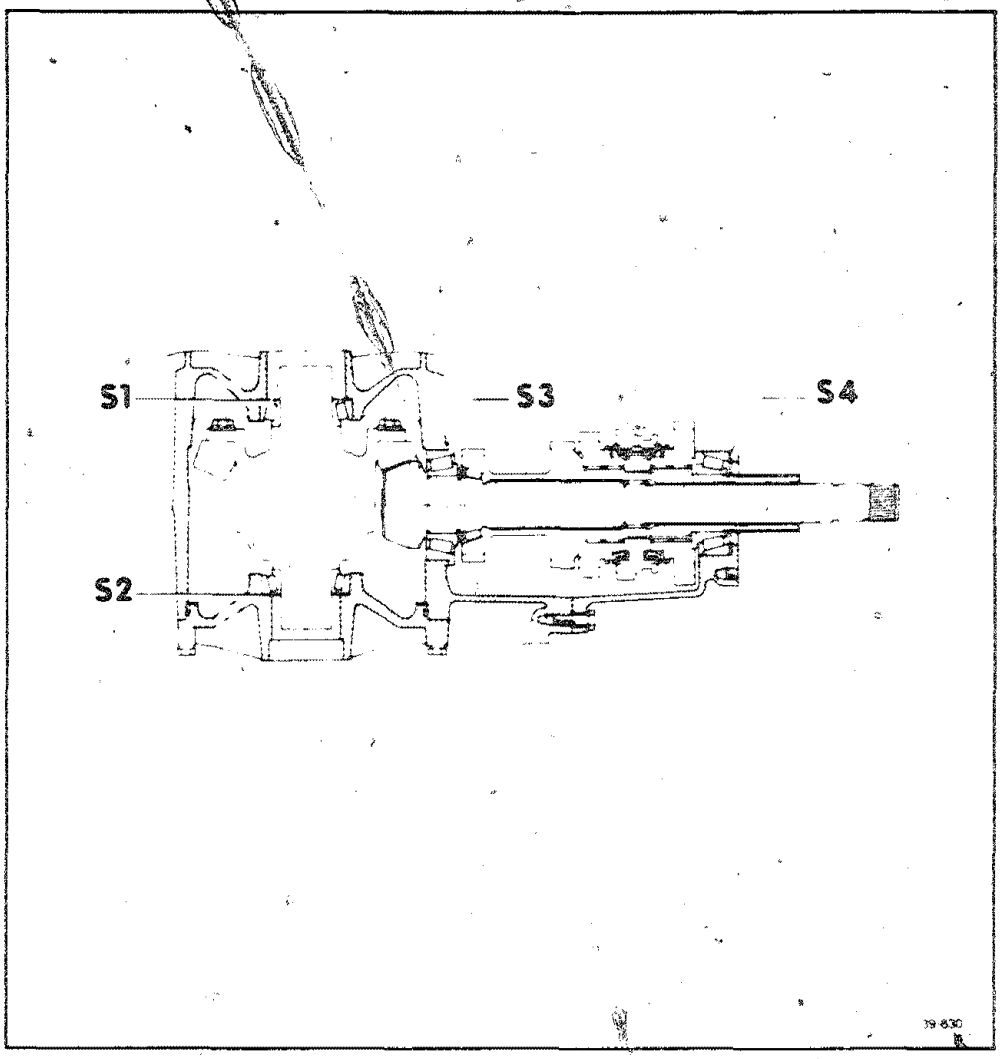
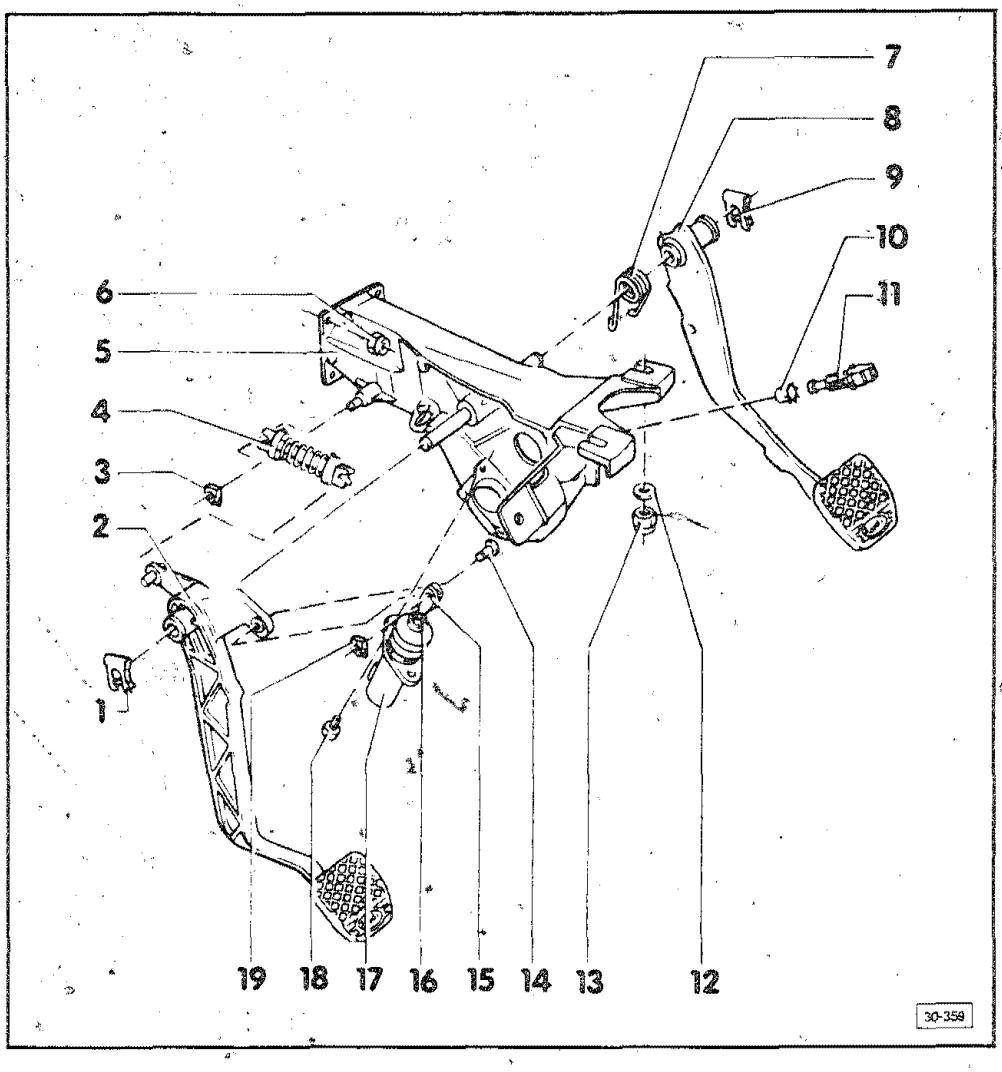


S1 — Shim behind ring gear
S2 — Shim opposite ring gear
S3 — Shim behind pinion head
S4 — Shim for pinion preload



CAUTION

Brake pedal path must not be shortened by additional carpeting.

Hose for master cylinder must not touch return spring.

If clutch pedal does not return properly, even though clevis is set correctly, condition may be due to:
- air in hydraulic system
- stiffness in pedal bushings or return springs

Clutch pedal must not touch bracket in rest position or clutch will wear prematurely.

Note

Lubricate all contact surfaces before assembly with white lubricating grease. **Part No. AOS 126 000 05.**

1 — **Clip**
always replace

2 — **Clutch pedal**
- positioned by adjusting clevis
- bushing cannot be replaced

3 — **Clip**
always replace

4 — **Return spring**
lubricate with white grease

5 — **Pedal bracket**

6 — **25 Nm (18 ft lb)**
always replace

7 — **Return spring**
for brake pedal

8 — **Brake pedal**

9 — **Clip**
always replace

10 — **Clip**
for brake light switch

11 — **Brake light switch**
adjusting, Repair Group 46

12 — **Washer**

13 — **25 Nm (18 ft lb)**
always replace

14 — **Pin**
can also be installed 180° from direction illustrated

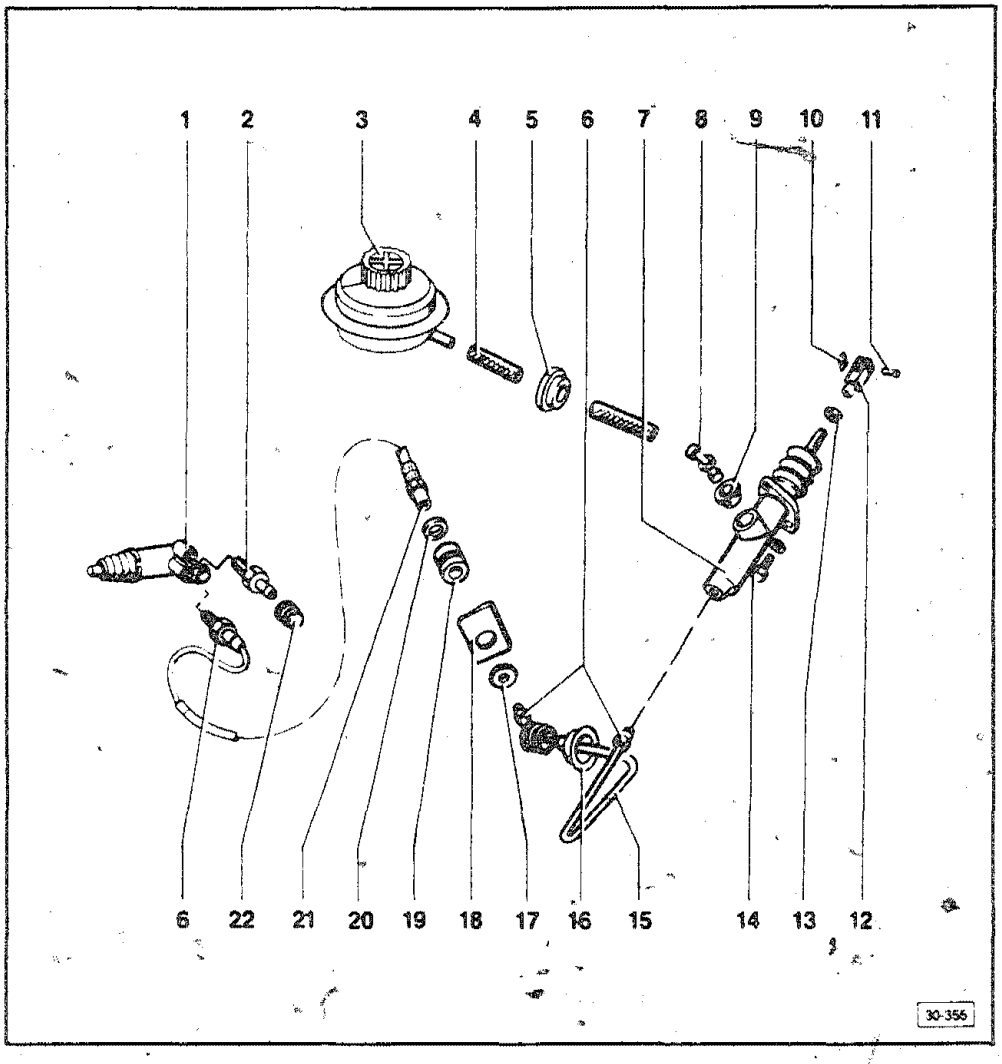
15 — **Clevis**
- adjust so that clutch pedal is approximately 10 mm (3.8 in.) higher than brake pedal
- be sure that spring returns clutch pedal (see **CAUTION** in this section)

16 — **Lock nut**
tighten after adjusting clevis

17 — **Master cylinder**

18 — **20 Nm (14 ft lb)**

19 — **Clip**
always replace



CAUTION

Do not operate clutch pedal if slave cylinder is removed

1 — **Slave cylinder**
- installing, section 30-40
- remove/install along with pressure hose (item **21**)
- cap off pressure line (item **15**) after removing hose
- bleed slave cylinder after installing clutch controls

2 — **Bleeder valve**
bleeding clutch system, section 30-30

3 — **Brake fluid reservoir**

4 — **Return hose**

5 — **Grommet**

6 — **15 Nm (11 ft lb)**

7 — **Clutch master cylinder**

8 — **Connector**

9 — **Plug**
lubricate with brake fluid before installing

10 — **Clip**

11 — **Pin**

12 — **Clevis**
adjusting, section 30-10

13 — **Lock nut**

14 — **20 Nm (14 ft lb)**

15 — **Pressure line**

16 — **Grommet**

17 — **Washer**
small inside diameter

18 — **Bracket**

19 — **Bushing**

20 — **Washer**
large inside diameter

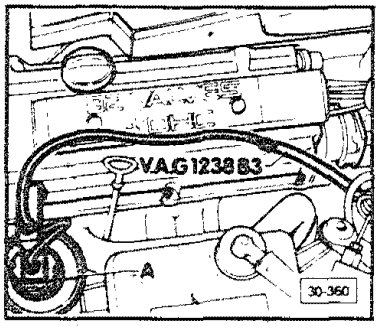
21 — **Pressure hose**
must not contact other components

22 — **Dust cap**

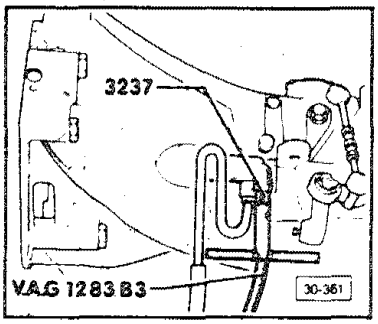
Clutch system, bleeding

CAUTION

Before bleeding the clutch system, fill the brake fluid reservoir to the **MAX** line with brake fluid.



- bleed clutch system, as follows:
  - use brake bleeder device with maximum operating pressure of 2.5 bar (36.3 psi). See Repair Group 47
  - use bleeder wrench **3237** and 670 mm bleeder hose **VAG 1238 B3**
- connect bleeder hose to pressure hose of receiving bottle **A**, as shown
- connect bleeder hose to bleeder wrench
- remove left air intake pipe
- guide bleeder wrench/hose between left ignition distributor and top of strut, over to slave cylinder on transmission

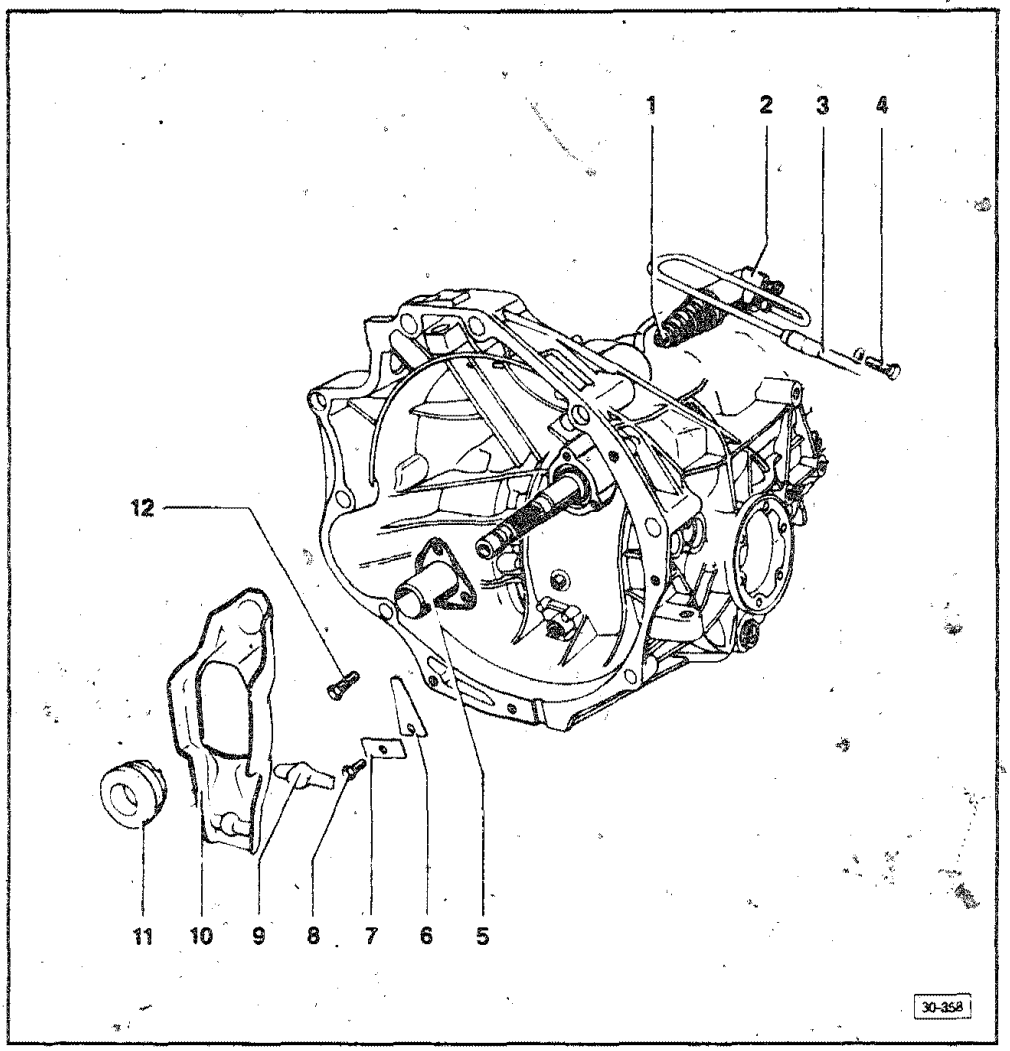


- attach bleeder wrench/hose to bleeder valve. Open valve

CAUTION

During this procedure, be sure all bleed connections remain sealed.

- operate clutch pedal several times when bleeding is complete



1 — **Push rod**
grease end lightly with MoS_2 grease

2 — **Clutch slave cylinder**
- remove/install along with pressure hose (item 3)
- install only when transmission is installed
- after slave cylinder is installed, connect pressure line and bleed clutch system, section 30-30

3 — **Pressure hose**
must not contact other components

4 — **25 Nm (18 ft lb)**

5 — **Guide sleeve**

6 — **Leaf spring**

7 — **Holding plate**

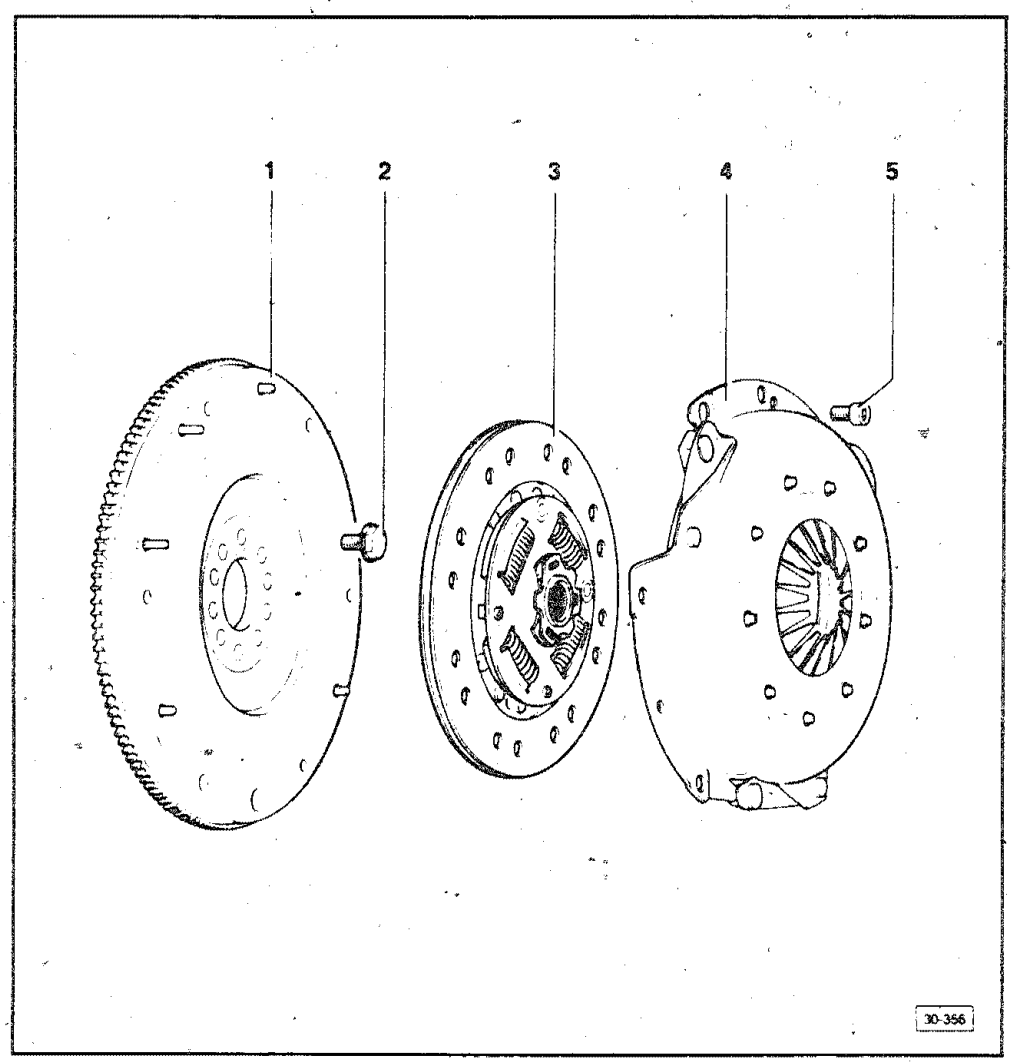
8 — **15 Nm (11 ft lb)**

9 — **Spacer**

10 — **Clutch release lever**

11 — **Clutch release bearing**
- **DO NOT** wash bearing; wipe off
- replace noisy bearings
- apply MoS_2 grease to contact surfaces of release lever
- to secure at lever, rotate 45° from installation position and turn to engage

12 — **15 Nm (11 ft lb)**



Note

Remove transmission to repair clutch.

CAUTION

Pressure plates are treated against corrosion, and greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably shortened.

Remove corrosion and grease residue from the input shaft splines, and also from the hub teeth if the disc is to be reused. Grease hub lightly with **G 000 100**, then move clutch disc back and forth on input shaft until hub slides easily. Remove **all** excess grease.

1 — Flywheel
- check dowel pins for wear, tightness
- clutch lining contact surface must be free of grooves, oil and grease
- for removing/installing, use **10-201**

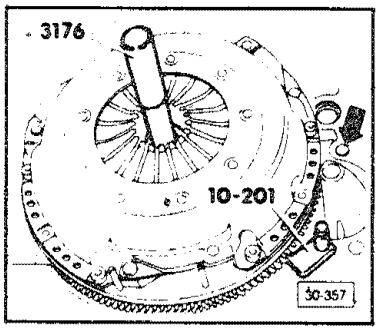
2 — 85 Nm (63 ft lb)
- always replace
- install with locking compound, **Part No. D 000 600**

3 — Clutch disc
- centering, section 30-60
- spring cage faces pressure plate
- clutch disc diameter, see Technical Data, Repair Group 34

4 — Pressure plate
- removing/installing, section 30-60
- checking, section 30-60

5 — 25 Nm (18 ft lb)

Clutch pressure plate, replacing/checking



Replacing

- lock flywheel in position
- loosen/tighten bolts diagonally and evenly
  - tightening torque – 25 Nm (18 ft lb)

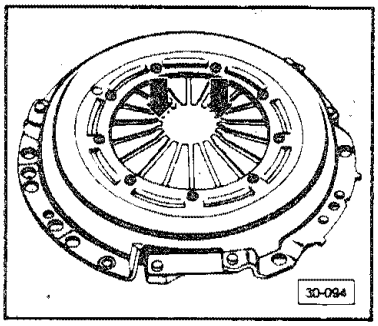
Note

Reposition holder **10-201** during tightening sequence.

CAUTION

Pressure plate must make complete contact with flywheel before installing the mounting bolts.

Never force the pressure plate. Dowel pins/holes could deform.



Checking

- check ends of diaphragm spring (**arrows**)
  - maximum wear allowed: up to half the thickness of each spring

CAUTION

Select replacement clutch pressure plate and disc using parts catalog, engine code letters, and engine numbers.

Complaint	Possible cause	Corrective action
Clutch pedal does not return to original position (hydraulic clutch)	Air in hydraulic system, brake fluid level too low	Replenish brake fluid; bleed hydraulic system
	Piston seizes in master or slave cylinder	Replace defective part; bleed hydraulic system
	Hydraulic system, or master and slave cylinder leaking	
(mechanical clutch)	Clutch cable hard to operate	Replace clutch cable
	Self-adjusting mechanism (if equipped) defective	Replace clutch cable
(all vehicles)	Return spring (if equipped) defective	Replace return spring
	Clutch pedal hard to operate	Clean pivot points, lubricate. If necessary, replace bushing
	Linkage on transmission hard to operate	Clean pivot points, lubricate. Make necessary repairs
	Mechanical components in clutch housing binding or dragging	Clean pivot points, lubricate. Make necessary repairs
	Clutch release bearing twisted on guide sleeve, seized	Replace guide sleeve and clutch release bearing
	Diaphragm spring of pressure plate broken	Replace pressure plate
Excessively hard clutch pedal (mechanical clutch)	Clutch cable binds or drags. Cable corroded in guide. Self-adjusting mechanism defective (if equipped)	Replace clutch cable
	Linkage on transmission binding or dragging	Clean pivot points, lubricate. Replace bushing
(manual transmission — 020 only)	Pushrod and pressure plate bind or drag	Lubricate contact points lightly with **G 000 100** Lubricate clutch pushrod lightly
(all vehicles)	Clutch pedal binding or dragging **Note:** Prior to checking, disconnect master cylinder and/or clutch cable from clutch pedal	Clean pivot points, lubricate. If necessary, replace bushing
	Over-center spring action drags or binds. Over-center spring defective	Clean pivot points, lubricate. If necessary, replace over-center spring
	Return springs (if equipped) too strong/wrong return spring	Replace with correct return spring

Complaint	Possible cause	Corrective action
Excessively hard clutch pedal (all vehicles) — continued	Clutch release force increased due to wear of clutch linings	Inform customer: release force becomes higher with increasing wear Replace clutch disc if lining/rivet distance is below 0.1 mm
	Mechanical components in clutch housing bind or drag	Clean pivot points, lubricate. If necessary, replace pivot bushings
	Release bearing twisted on guide sleeve, seized	Replace defective parts
	Contact surface release bearing release lever worn	Replace defective parts
	Pressure plate with wrong spring	Replace with correct part no.
	Clutch disc binds or drags on, gears	Check gears of hub for defects (burrs). If necessary, replace clutch disc Clean corrosion and lubricant from gears of hub and input shaft. Lubricate input shaft splines with extremely light coating of grease, **G 000 100**. Move clutch disc back and forth; remove surplus grease

Complaint	Possible cause	Corrective action
Noises during clutch operation (mechanical clutch)	Transmission noises enter passenger compartment via clutch cable	Replace or add insulating components as necessary
	Clutch cable creaks, binds or drags	Replace clutch cable
	On full pedal application, diaphragm spring rubs against clutch disc (insufficient clutch free play)	Adjust clutch free play
	Self-adjusting mechanism (if equipped) defective	Replace clutch cable
	Release plate contact points and diaphragm spring need lubricating	Lightly grease contact points with **G 000 100**. Replace worn parts.
(manual transmission — 020 only)	Contact points, pushrod, release plate need lubricating	Lightly grease contact points with **G 000 100**
(all vehicles)	Clutch pedal binds or drags/ pivot points misaligned	Clean pivot points, lubricate. If necessary, replace bushing
	Pivot of over-center spring dry, dragging, misaligned	
	Return spring (if equipped) noisy	Lubricate pivot points
	Release bearing or release bearing guide defective, contact surface worn (shrunk?)	Generally, replace noisy release bearing. Replace damaged guide sleeves
	Contact surface (diaphragm spring tips) of pressure plate defective (bent, broken). Release bearing off-center in contact area	Replace pressure plate. Check release bearing and guide sleeve; replace if necessary. Check adaptor sleeves.
	Pilot bearing (if equipped) in crankshaft defective, engine/ transmission offset from center	Replace, lubricate with MoS_2 grease. Check adaptor sleeves
	Clutch disc installed improperly	Correct installation
	Wrong clutch disc installed	Replace with correct clutch disc

Complaint	Possible cause	Corrective action
Grinding noises when engaging a forward or the reverse gear, shift mechanism binds, drags; shifting not possible, clutch inoperative (hydraulic clutch)	Brake fluid level too low	Check system. Replenish brake fluid, bleed system
	Air in system; clutch does not disengage completely	
	Master/slave cylinder leaking, aged, hose is too elastic	Replace defective part. Replenish brake fluid, bleed system
	Adjustment of clevis not correct	Correct adjustment
(mechanical clutch)	Mechanical components misaligned	Replace mechanical components
	Clutch free play excessive	Check clutch free play, adjust if necessary
	Wrong clutch cable installed (too long)	Replace with correct clutch cable
	Clutch cable defective; binds or drags	Replace clutch cable
	Self-adjusting mechanism (if equipped) defective	
(manual transmission — 020 only)	Pushrod too short due to wear	Replace pushrod, check release bearing. Lightly lubricate pushrod/release bearing contact points with **G 000 100** grease
(all vehicles)	Clutch pedal travel insufficient (carpet, floor mat beneath pedal). Clutch not being fully depressed	Inform customer
	Only reverse gear grinds when engaged	Inform customer. Depending on clutch diameter, wait approximately 3-6 seconds after depressing clutch before engaging reverse gear. Input shaft with clutch disc must first come to a stop
	Adjustment of shifting mechanism	Check, correct if necessary
	Bearing for shift lever and shift operation not lubricated; misaligned	Lubricate shift mechanism, replace defective parts

Complaint	Possible cause	Corrective action
Grinding noises when engaging a forward or the reverse gear, shift mechanism binds, drags; shifting not possible, clutch inoperative (all vehicles) — continued	Clutch disc binds or drags on gears. Hub corroded, or was damaged during installation. Hub misaligned on one side	Check gears of hub for damage, replace clutch disc if necessary. Remove corrosion and grease residue from hub and shaft. Grease input shaft splines with extremely light coating of **G 000 100**. Move clutch disc back and forth; remove surplus grease. When hub is misaligned, check position of adaptor sleeves. Check release bearing, guide sleeve, pressure plate and pilot bearing. Replace if necessary
	Pressure plate lift-off too slight (wrong pressure plate installed)	Replace with correct pressure plate
	Pilot bearing on crankshaft defective. Input shaft still driven when clutch disengaged	Replace pilot bearing and lubricate with MoS_2. Check adaptor sleeves. Replace if necessary. Check shaft
	Engine/transmission offset too large (adaptor sleeves missing), thus support plate of clutch disc bent	Install adaptor sleeves prior to transmission installation. Check clutch disc, pressure plate and pilot bearing (if equipped) for damage; replace if necessary
	Pilot bearing in crankshaft defective	
	Lining worn due to excessive rpms: down-shifting at too fast a speed	Replace clutch disc; inform customer
	Lining worn from riding the clutch when accelerating	
	Synchronizing system and/or shifting mechanism in transmission defective	Repair transmission

Complaint	Possible cause	Corrective action
Grinding noises when engaging a forward or the reverse gear, shift mechanism binds, drags; shifting not possible, clutch inoperative (all vehicles) — continued	Pressure plate uneven due to wrong installation. Clutch disc distorted due to improper handling	Check parts, replace if necessary. Observe position of locating pins If grinding occurs thereafter, check splines on clutch disc hub and shaft for ease of operation, check pilot bearing (if equipped) in crankshaft. If necessary, repair transmission
	2nd gear grinds only when cold	Inform customer. If necessary, replace transmission oil with oil of different viscosity (see specs/ procedures in this manual)
	Diaphragm spring tips broken or bent (installation error: release bearing runs off center)	Replace pressure plate. Check guide sleeve; replace if necessary. Check adaptor sleeves
	Clutch disc too thick	Replace with correct clutch disc
	Lining rusted onto flywheel (long periods of disuse, high relative humidity)	Lightly sand friction surfaces. Replace parts when corrosion is severe

Complaint	Possible cause	Corrective action
Clutch slips; little or no clutch action (hydraulic clutch)	Master/slave cylinder piston does not return to rest position.	Replace master/slave cylinder. Change brake fluid, bleed system.
(mechanical clutch)	Clutch cable improperly adjusted (insufficient clutch free play). Wrong clutch cable	Correct adjustment. Replace with correct cable, if necessary
	Self-adjusting mechanism (if equipped) defective	Replace clutch cable, if necessary
	Clutch cable binds or drags	Replace clutch cable, if necessary
(manual transmission — 020 only)	Clutch release pushrod oil seal in input shaft leaks	Replace oil seal, clutch disc. Clean pressure plate and flywheel
(all vehicles)	Wrong clutch disc, wrong pressure plate installed	Replace with correct clutch disc or pressure plate
	Clutch disc worn, burnt pressure plate, overheated grooves, pressure plate distorted due to wrong installation, pressing force of pressure plate too low. Driving errors, normal wear	Replace clutch disc, pressure plate. Instruct customer
	Mechanical components of transmission drag, pedal linkage binds	Clean pivot points, lubricate; repair if necessary
	Clutch disc, pressure plate, flywheel oil-contaminated. Crankshaft oil seal defective. Grease on contact surfaces from over-lubrication of hub	Replace clutch disc. Clean contact surfaces of pressure plate and flywheel. Replace crankshaft oil seal, remove surplus grease from input shaft
	Clutch disc installed from wrong side	Correct installation. Check clutch disc; replace if necessary
	Flywheel too thick; excessive wear on contact surfaces	Replace with correct flywheel. Check disc and pressure plate; replace if necessary

Complaint	Possible cause	Corrective action
Clutch pulls, power train rattles (hydraulic clutch)	Adjustment on clevis not correct	Correct adjustment
	Air in the system; master cylinder/slave cylinder defective	Replace defective part. Check brake fluid level, bleed system, check for leaks
(mechanical clutch)	Master cylinder/slave cylinder pushrod does not return to rest position	Replace defective part. Change brake fluid, if necessary. Bleed system
	Clutch cable binding	Replace clutch cable
	Clutch pedal binding **Note:** Prior to checking, disconnect clutch pedal from clutch cable.	Clean pivot points, lubricate if necessary. Replace bushing if necessary
	Linkage on transmission binds or drags	Clean pivot points, lubricate. Replace bushing if necessary
(all vehicles)	Engine runs unevenly	Check engine adjustment; correct if necessary
	Driving errors: acceleration rpm too low	Instruct customer
	Wrong clutch disc installed	Replace with correct clutch disc
Noises in idle (manual transmission — 020 only)	Clutch lining, contact surface of pressure plate and flywheel oil-contaminated (oil seeps out of clutch housing)	Check clutch release pushrod oil seal; replace if necessary. Replace clutch disc; clean pressure plate and flywheel
(all vehicles)	Torsion spring broken	Replace clutch disc
	Clutch disc installed without spring cage (rattling in idle)	Install clutch disc with spring cage
	Pressure plate distorted, broken, out-of-round	Replace pressure plate
	Engine runs unevenly	Check engine adjustment; correct if necessary

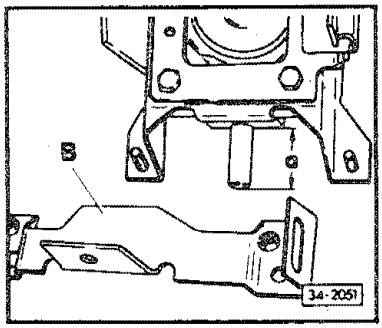
Complaint	Possible cause	Corrective action
Noises in idle (all vehicles) — continued	Engine mounts are too "soft"; misaligned	Check contact points. Replace if necessary, with correct engine mounts
	Shock absorbers defective	Replace shock absorbers
	Clutch lining, contact surface of pressure plate and flywheel oil-contaminated	Locate cause of contamination; repair as necessary. Replace clutch disc; clean pressure plate and flywheel
	Release bearing twisted on guide sleeve, seized (presses from one side on diaphragm spring of the pressure plate)	Replace release bearing and guide sleeve. Check mechanical components and pivot points
	Contact surface of pressure plate has lift on one side only, due to twisted release bearing	Check contact surface for clutch lining on flywheel pressure plate and diaphragm spring; if necessary replace pressure plate. Replace release bearing and guide sleeve.
	Housing of pressure plate warped during assembly. Contact surface of pressure plate has lift on one side only	
	Input shaft greased excessively (traces of grease on clutch disc, pressure plate and flywheel)	Clean grease from pressure plate and flywheel. Replace if damaged (i.e., scoring, signs of overheating, grooves). Remove all lubricant from hub and input shaft, lubricate input shaft lightly with **G 000 100**. Move clutch disc back and forth; remove excess grease.

Index

016 5-speed

★ ALL NEW INFORMATION since last filming

Pin at gearshift lever housing, adjusting length



- adjust bearing pin length, after installing push rods
  - dimension a = 17 mm (43/64 in.)

Note

Bracket B, if present, can be removed to adjust housing pin. Position carpet aside, if necessary.

Technical data, 5-speed transmission 016

Note

For location of transmission codes, see Repair Group 00.

Code		AWW
Production	from	1/90
	to	
Application	type	Audi V8 Quattro
	engine	3.61 liter — 184 kW
Rear final drive		AXZ
Ratio	final	37:9 = 4.111
	1st gear	35:10 = 3.500
	2nd gear	34:18 = 1.889
	3rd gear	32:26 = 1.231
	4th gear	28:31 = 0.903
	5th gear	27:37 = 0.730
	reverse gear	38:11 = 3.455
Speedometer		electronic
Lubricant capacity		3.0 liters (3.2 U.S. qt)
Lubricant type		Transmission oil G50 (synthetic oil) SAE 75 W 90
Clutch actuation		hydraulic
Clutch disc diameter		240 mm
Drive flange diameter		108 mm
Speed in highest gear at 1000 RPM		38 km/h (23.6 mph)

Gearshift lever, checking adjustment

- shift into 1st gear
- push gearshift lever to left stop
- release lever
  - lever must spring back at least 5 mm (1/4 in.) to right

- shift into 5th gear
- push gearshift lever to right stop
- release lever
  - lever must spring back at least 5 mm (1/4 in.) to left

If **NO**

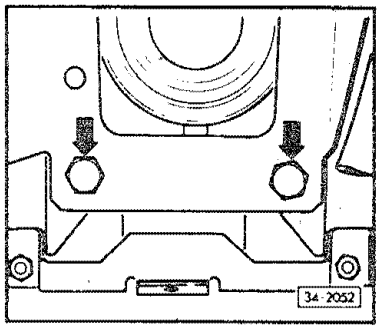
- adjust gearshift lever, section 34-120

Note

Spring path length from right stop (in 5th gear) should slightly exceed spring path length from left stop (in 1st gear).

Gearshift lever, adjusting

- place transmission in Neutral



- loosen stop assembly mounting bolts (arrows)
- move stop assembly laterally
- tighten bolts

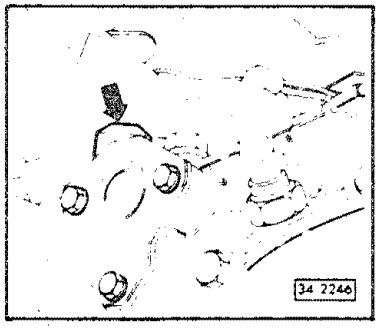
Gearshift linkage, adjusting

Note

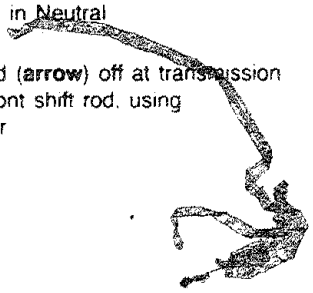
Adjust linkage in the following cases only:
- if further alignment is needed following gearshift lever adjustment (section 34-120)
- if clamp between front/rear shift rods has been loosened during repair procedures

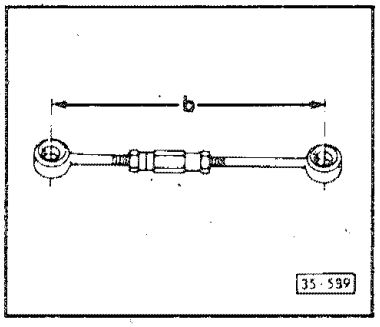
In addition to components removed previous to this procedure:

- remove front wheels
- place transmission in Neutral

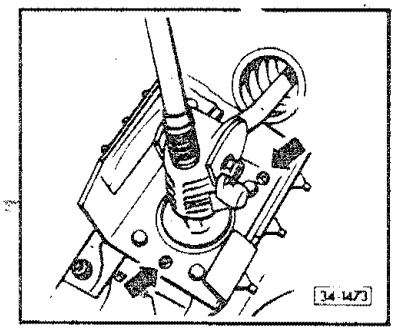


- press adjusting rod (**arrow**) off at transmission ball stud and at front shift rod, using suitable-sized lever

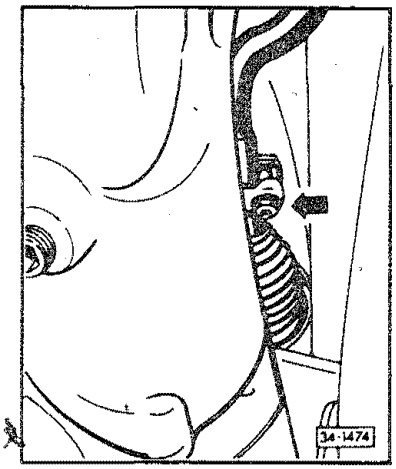




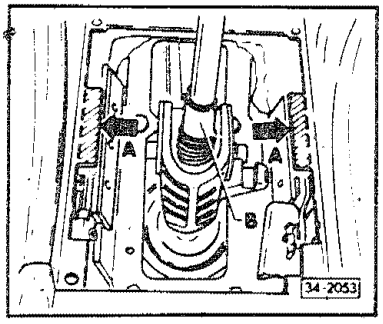
- adjust adjusting rod
  - b = 134 mm (5-1/4 in.)
- press adjusting rod on
  - guide lever through wheel well openings at axle shafts



- align slotted holes of stop assembly/cover plate and tighten bolts



- loosen clamp (**arrow**) between front/rear shift rods
  - rear shift rod must move freely

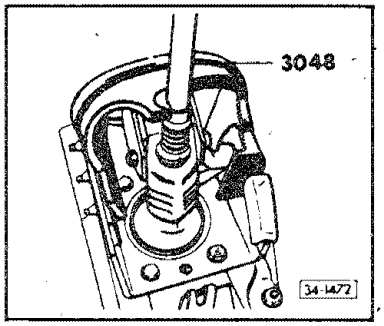


- look for projections (**arrow A**) on shifter console
  - if present, remove by sawing off along dotted line (see illustration)

CAUTION

Cover gearshift mechanism with an oily rag to catch shavings that might fall into the gearshift housing.

- remove spacer sleeve **B** and spring
- pull up gearshift lever to stop



- install gearshift linkage gauge **3048**
- tighten clamp nut
- remove gauge

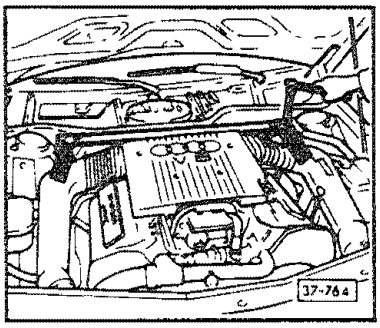
- check gearshift lever adjustment, section 34-110
- adjust gearshift lever if necessary, section 34-120
- shift through all gears, checking for binding condition
  - with special attention to reverse gear lock

- install boot, seating it against shift lever head
- install shift knob

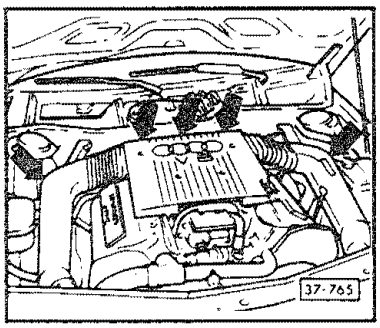
Transmission, removing/installing

Removing

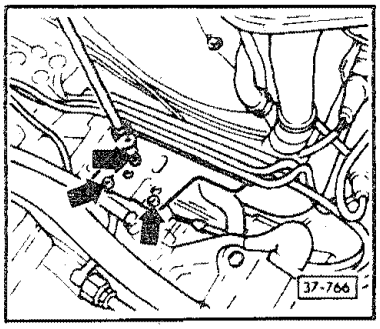
- disconnect battery ground strap
  - located beneath rear seat
- remove front wheels



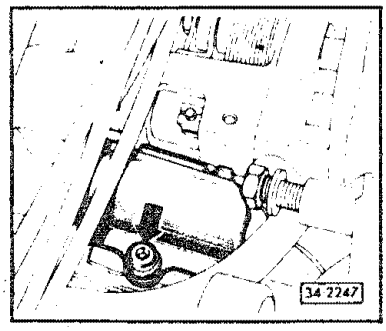
- remove cross brace to suspension strut domes (**arrows**)



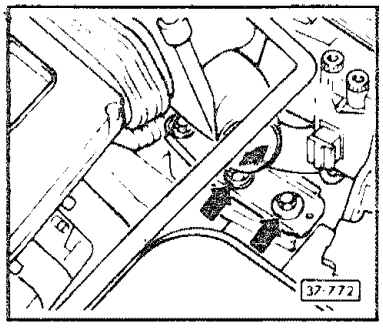
- remove complete air filter/duct assembly (**arrows**)
  - detach lower housing; position rearward, then pull up and out



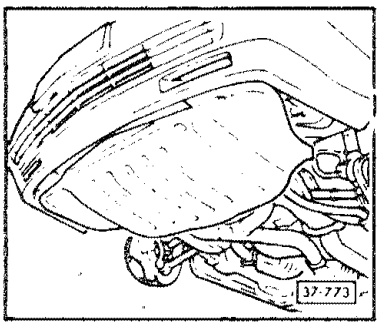
- remove bracket (**upper arrow**) for ignition wire
  - bolts (**lower arrows**) are self-locking; always replace



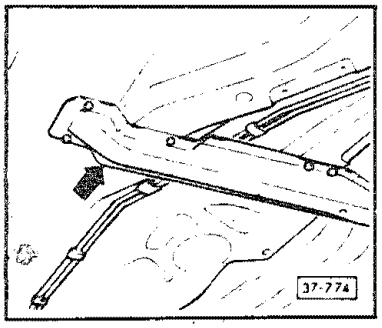
- remove bolt (**arrow**) for engine harness support bracket
- remove all wiring retainers from transmission
- remove engine/transmission connecting bolts (two)



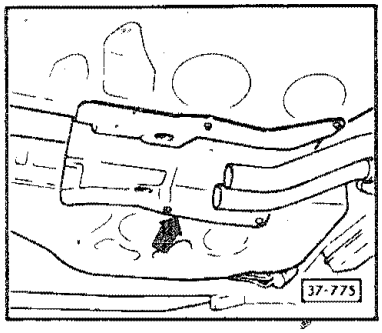
- remove bolts (**arrow**) for right engine mount



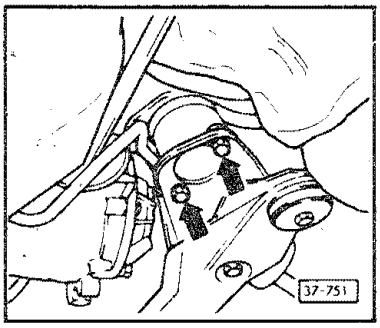
- remove engine lower cover



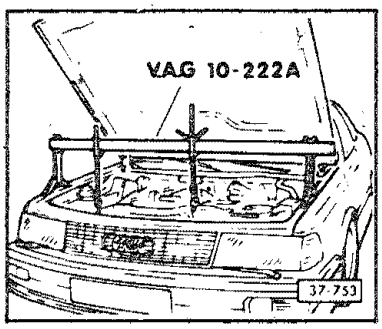
- remove crossmember (**arrow**)
- remove front exhaust pipe with catalytic converter, Repair Group 26
- remove transmission heat shield



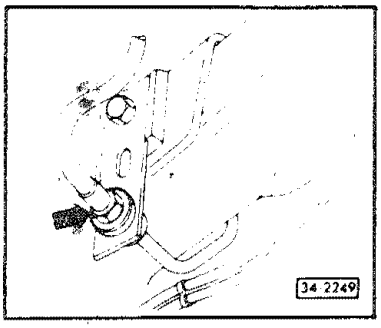
- remove driveshaft heat shield (**arrow**)
- remove driveshaft, Repair Group 39



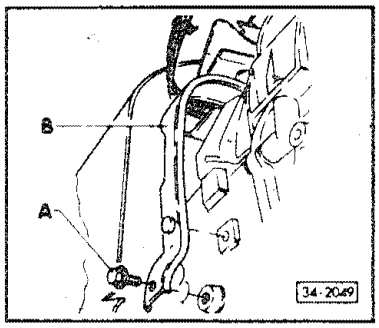
- remove bolts for transmission mounts (right side shown)



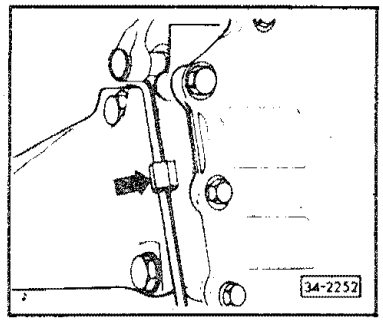
- install engine support bridge **10-222A** in left engine mount
  - raise engine slightly
- remove axle shaft shields
- disconnect axle shafts from transmission and position them on subframe



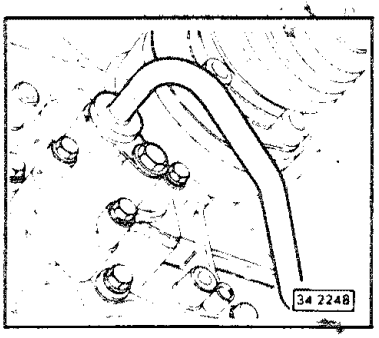
- disconnect pressure line from pressure hose (**arrow**) at clutch slave cylinder
  - plug hydraulic openings
  - clutch slave cylinder remains on transmission
- disconnect front/rear shift rods, section 34-80, and front/rear push rods, section 34-90
- disconnect backup light
- disconnect speedometer sensor connector
- remove wiring retainers from transmission



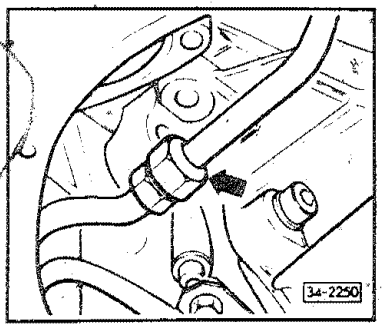
- remove cable guide **B** for seat belt tensioning system. Position guide/cable assembly upward and out of the way
  - **A** = 40 Nm (30 ft lb)



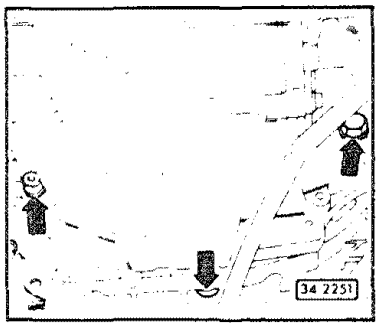
- release oxygen sensor wire at left transmission mount, by carefully prying wiring retainer open



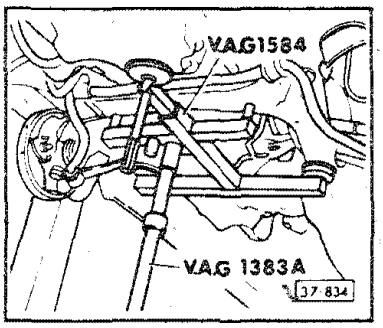
- detach oil pressure supply line from oil pump
  - plug hydraulic openings



- disconnect front/rear oil pressure return lines (**arrow**)
  - plug hydraulic openings
- detach oil pressure supply and return lines at A/C compressor



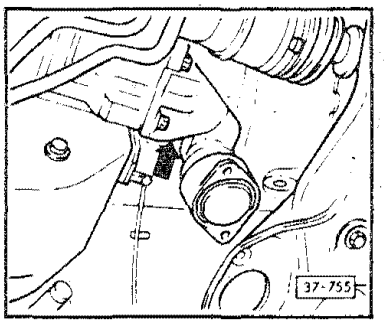
- remove engine/transmission mounting bolts, except for 3 shown (**arrows**)



- support subframe with transmission jack and adaptor, **VAG 1383/A** and **VAG 1584**, or equivalent
- remove subframe mounting bolt
- lower subframe carefully to give adequate clearance, then tie subframe to body
- secure axle shafts to subframe
- be sure radiator fan turns without interference

If **NO**

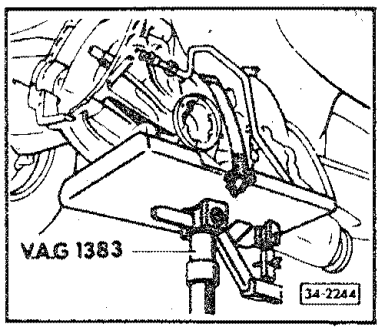
- loosen engine mount slightly, then check again
- support transmission with jack **VAG 1383/A** and adaptor, or equivalent



- remove transmission right/left mounts, along with transmission support (left side shown – **arrow**)
- remove remaining engine/transmission connecting bolts, from underneath
- push transmission back

CAUTION

Be sure the axle shafts move freely. Check that all wiring retainers at the transmission are loosened. The cable guide for the seat belt tensioning system must be positioned as far back as possible over the cable bracket.



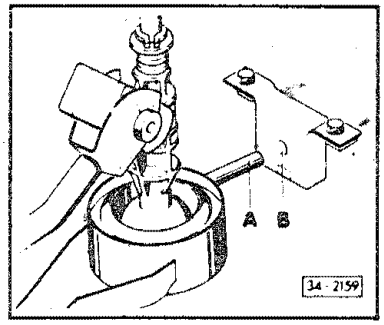
- lower transmission carefully

Note

Following transmission removal, the clutch slave cylinder should be taken off. It can be reinstalled during transmission assembly. See clutch bleeding, Repair Group 30.

Installing

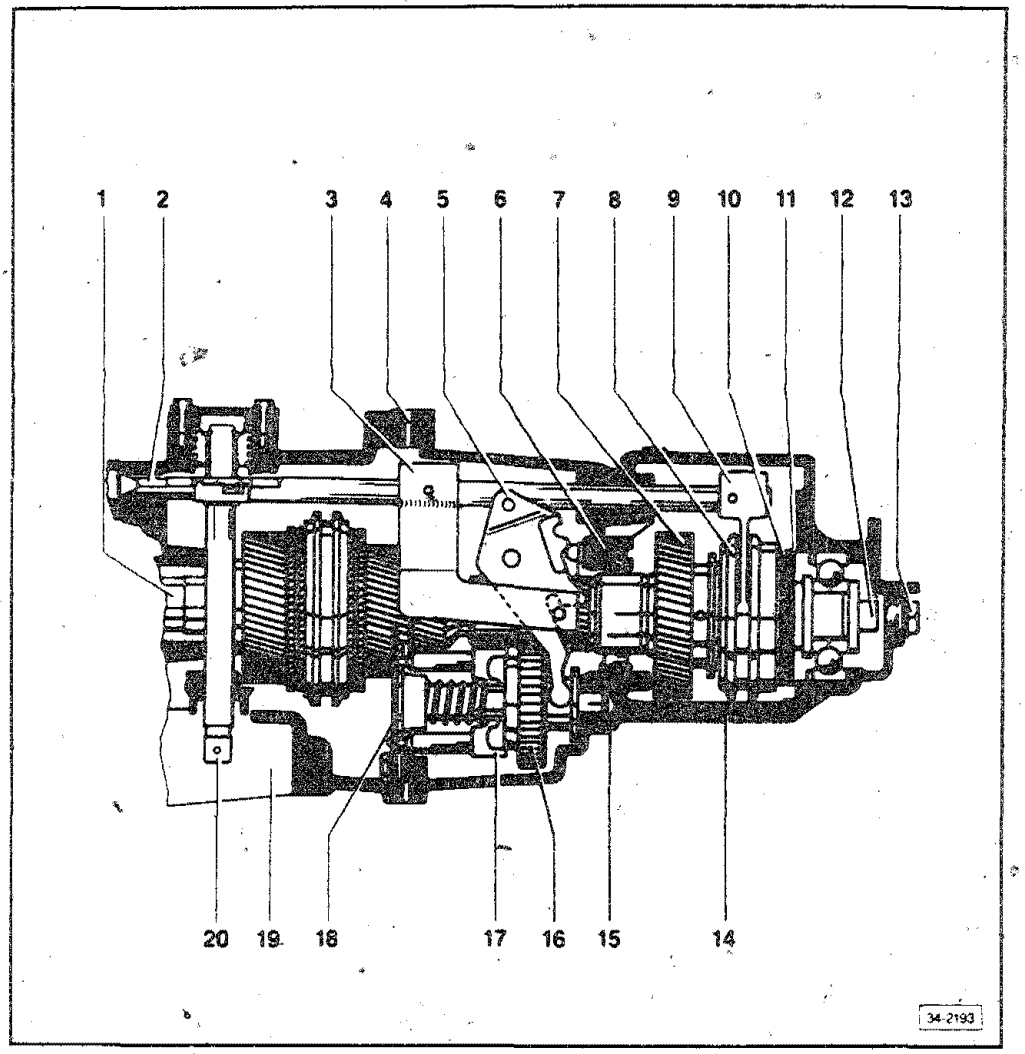
- install transmission in reverse order of removal and note the following:
  - install engine/transmission mountings and exhaust system, without tension. See Repair Group 26 for exhaust system tightening torques
  - clean grease and corrosion from driveshaft splines, and lubricate with a thin coating of **G 000 100**
  - check for presence/condition of dowel sleeves in the cylinder block and replace if necessary
  - bleed clutch, Repair Group 30
  - lubricate crankshaft bearing with MoS_2 grease



  - when installing push rods, check that pin **A** on the gearshift lever housing is inserted in rubber block **B**. Adjust pin length, section 34-100
  - check/adjust gearshift lever/linkage, sections 34-110, 34-120, and 34-130

Tightening torques

Transmission to engine (M12)	65 Nm (48 ft lb)
(M10)	45 Nm (32 ft lb)
(M8)	20 Nm (18 ft lb)
Axle shaft to transmission	80 Nm (58 ft lb)
Crossmember to body	10 Nm (89 in. lb or 102 cm kg)
Cross brace to suspension strut domes	25 Nm (18 ft lb)
Engine mounting to body	40 Nm (30 ft lb)
Transmission mounting to subframe	40 Nm (30 ft lb)
Transmission support for mounting to transmission	40 Nm (30 ft lb)
Subframe to body	65 Nm (48 ft lb) and turn an additional 90° or 1/4 turn
Driveshaft to transmission	55 Nm (41 ft lb)
Driveshaft to body	20 Nm (15 ft lb)
Support at transmission for seat belt tensioning cables	40 Nm (30 ft lb)
Clutch slave cylinder to transmission	25 Nm (18 ft lb)
Clutch slave cylinder pressure line to hose	15 Nm (11 ft lb)
Oil pressure feed line at oil pump	25 Nm (18 ft lb)
Oil pressure return lines (front to rear connection)	40 Nm (30 ft lb)
Oil pressure line bracket at A/C pump	25 Nm (18 ft lb)
Axle shaft heat shield at transmission	25 Nm (18 ft lb)



Note

The gearshift lever operates as follows
- moves shift lever out of 3rd and 4th gear gate
- moves shift lever out of 5th and reverse gear gate
- prevents direct shifting from 5th gear to reverse (lever must first be shifted back to Neutral, then through 3rd and 4th gear gates)

1 — Input shaft

2 — 5th/reverse selector rod

3 — Reverse gear shift fork

4 — Spacer

5 — Reverse gear relay lever

6 — Reverse gear interlock

7 — 5th gear

8 — 5th gear synchronizer sleeve

9 — 5th gear shift fork

10 — 5th gear synchronizer ring

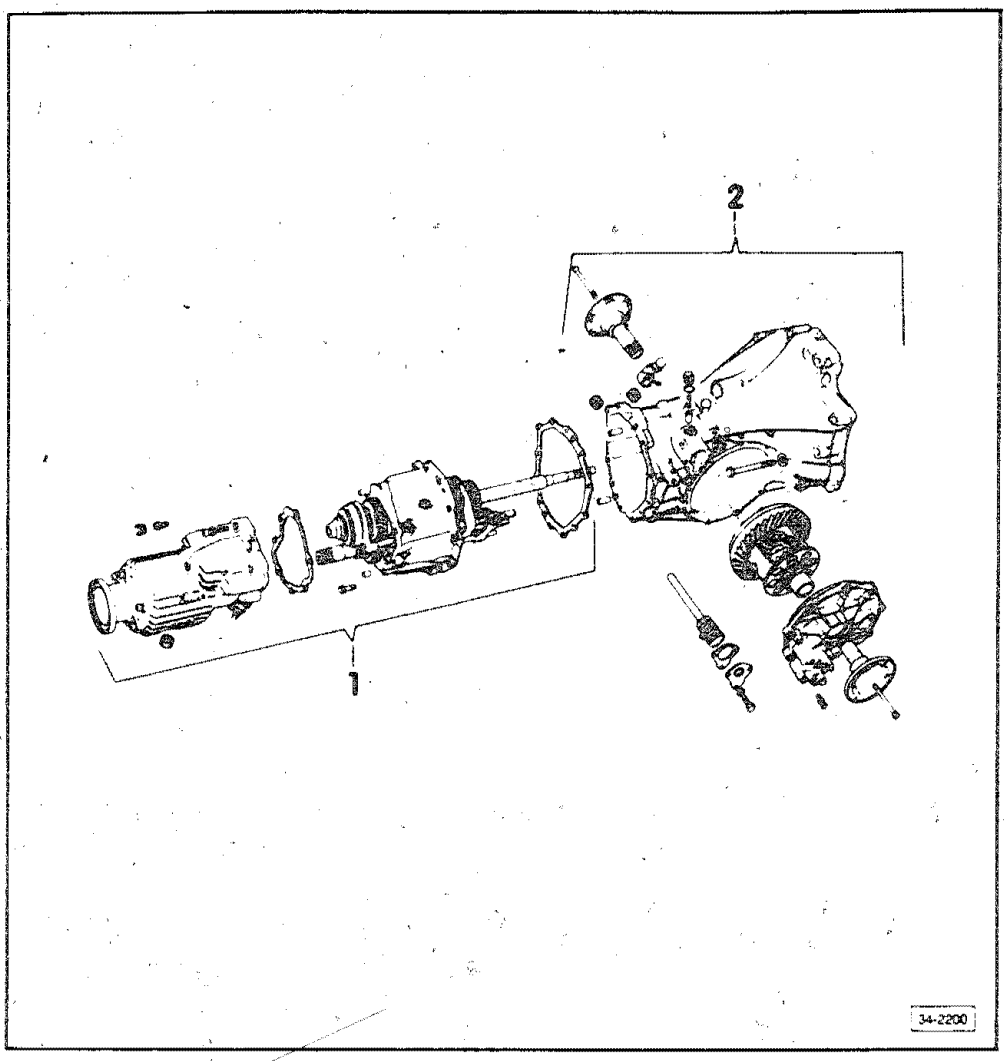
11 — 5th gear synchronizer hub

12 — 50 Nm (37 ft lb) and turn additional 90° (1/4 turn)

13 — 30 Nm (22 ft lb)

14 — End cover

15 — Gear carrier housing
16 — Reverse gear
17 — Reverse gear synchronizer (turned 90°)
18 — Mounting plate
19 — Transmission housing
20 — Gearshift lever shaft

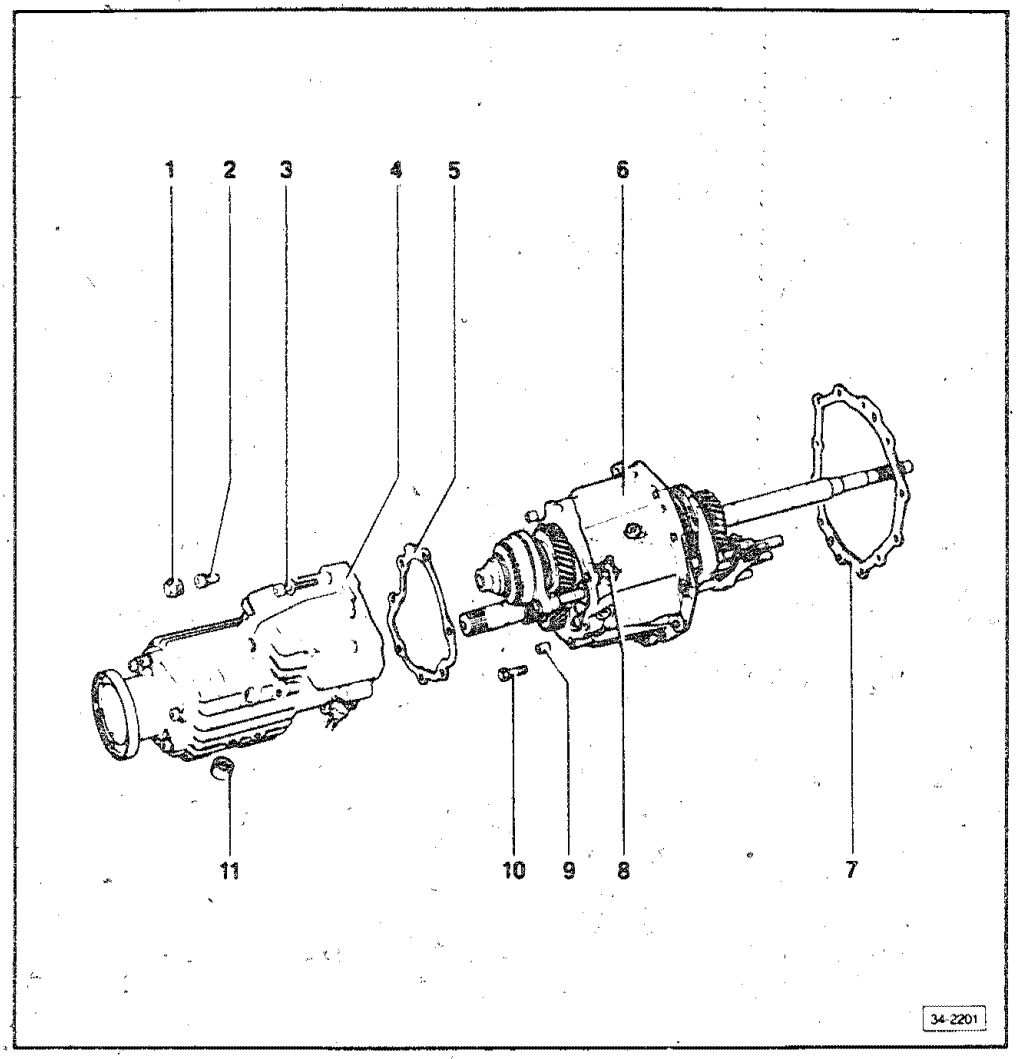


CAUTION

If the shift housing or pinion tapered roller bearing are to be replaced, and the dimension r is not marked on the ring gear, measurement of the pinion position must be made before removal of the gear carrier housing.

1 — **Gear carrier**
- removing installing, section 34-170
- assembly overview, section 34-190
- transmission, disassembling assembling, section 34-220
- housing assembly, section 34-290
- shim S4, section 34-310
- end cover assembly, section 34-370

2 — **Differential gear**
- assembly, section 34-180
- final drive assembly, section 34-230



1 — 30 Nm (22 ft lb)
always replace bolt

2 — 50 Nm (37 ft lb), then turn an additional 90° (1/4 turn)
- always replace
- removing/installing, section 34-220

3 — 25 Nm (18 ft lb)
- M8 x 45
- with washer

4 — End cover
assembly, section 34-370

5 — Gasket

6 — Gear carrier housing
- before removing or assembling: protect input shaft seal from any damage by input shaft teeth. If necessary, cover teeth with insulating sheath (from a wiring harness)
- disassembling/assembling, section 34-370

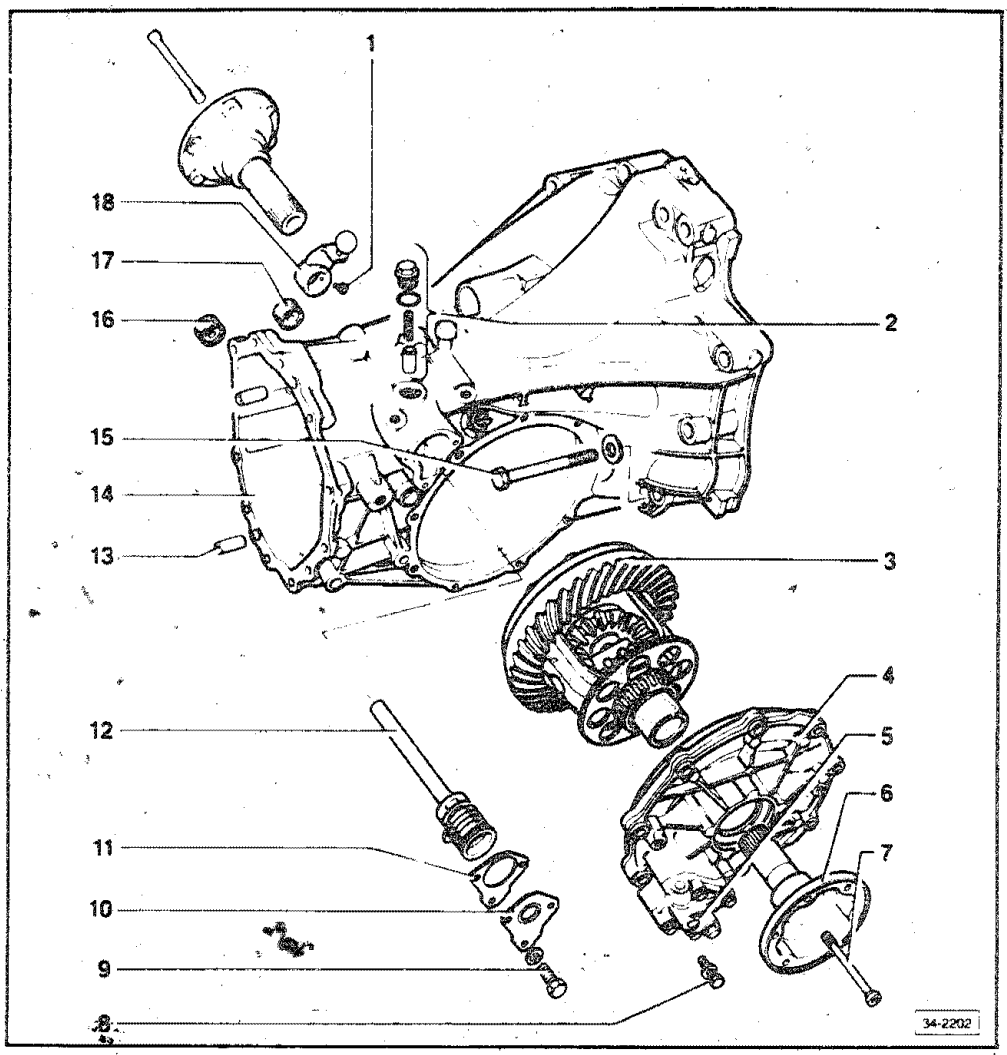
7 — Spacer plate

8 — Screw for 5th/reverse interlock mechanism

9 — Dowel pins

10 — 25 Nm (18 ft lb)
- M8 x 35
- without washer

11 — Oil drain plug — 25 Nm (18 ft lb)



1 — **Center screw**
self-locking

2 — **5th/reverse gear interlock mechanism**
- **30 Nm (22 ft lb)**
- prevents direct shifting from 5th gear into reverse. Lever must be shifted first into Neutral, then into 3rd and 4th gear

3 — **Differential**
- before removing, remove gear carrier housing
- disassembling, assembling, Repair Group 39

4 — **Final drive cover**
- assembly, section 34-230
- installed with magnet downward

5 — **Oil pump**
- integrated in final drive cover
- assembly, section 34-250

6 — **Axle flange**

7 — **10 Nm (89 in. lb or 102 cm kg),**
then turn additional 90° (1/4 turn)

8 — **25 Nm (18 ft lb)**
with washer

9 — **10 Nm (89 in. lb or 102 cm kg)**

10 — **Cover**

11 — **Gasket**

12 — **Selector shaft assembly**

13 — **Dowel pins**

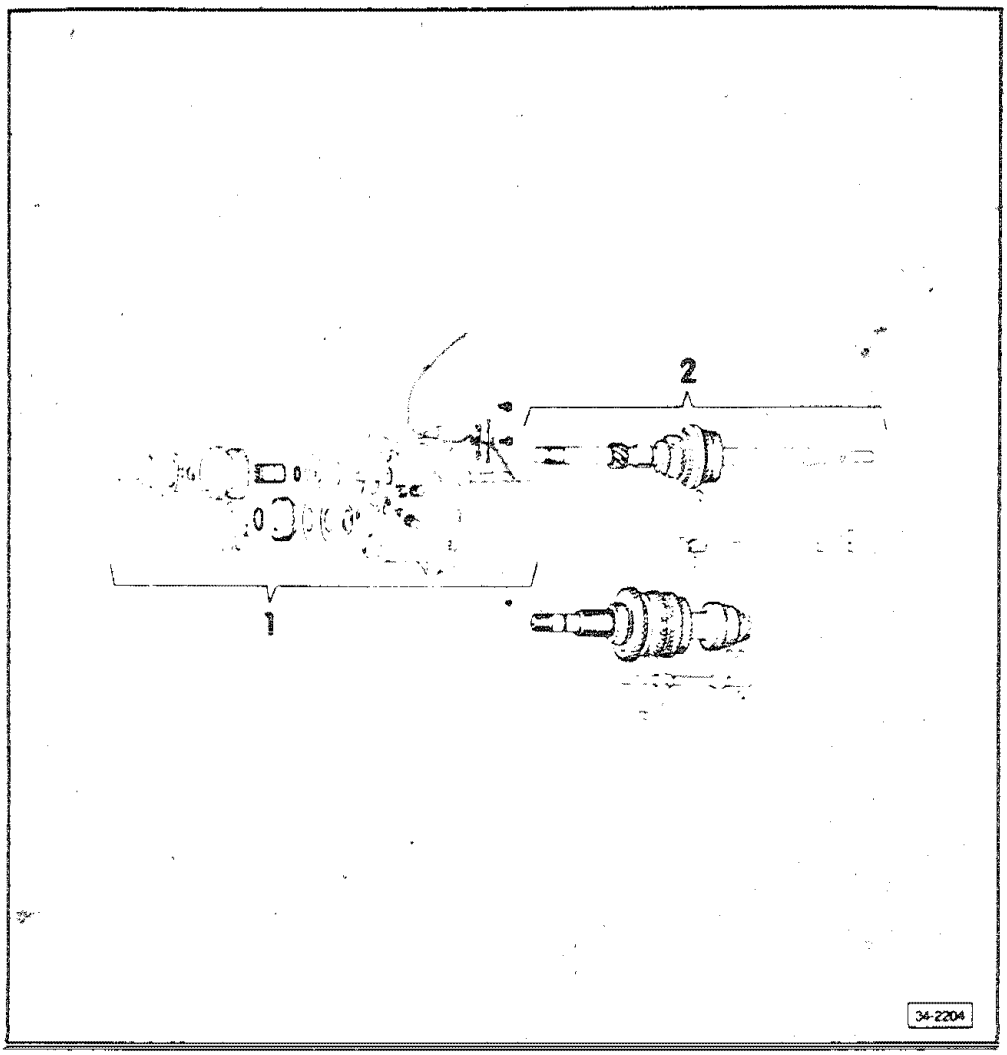
14 — **Final drive housing**
assembly, section 34-230

15 — **Engine/transmission mounting hex bolt**
install, before installing axle flange

16 — **Oil drain plug — 25 Nm (18 ft lb)**

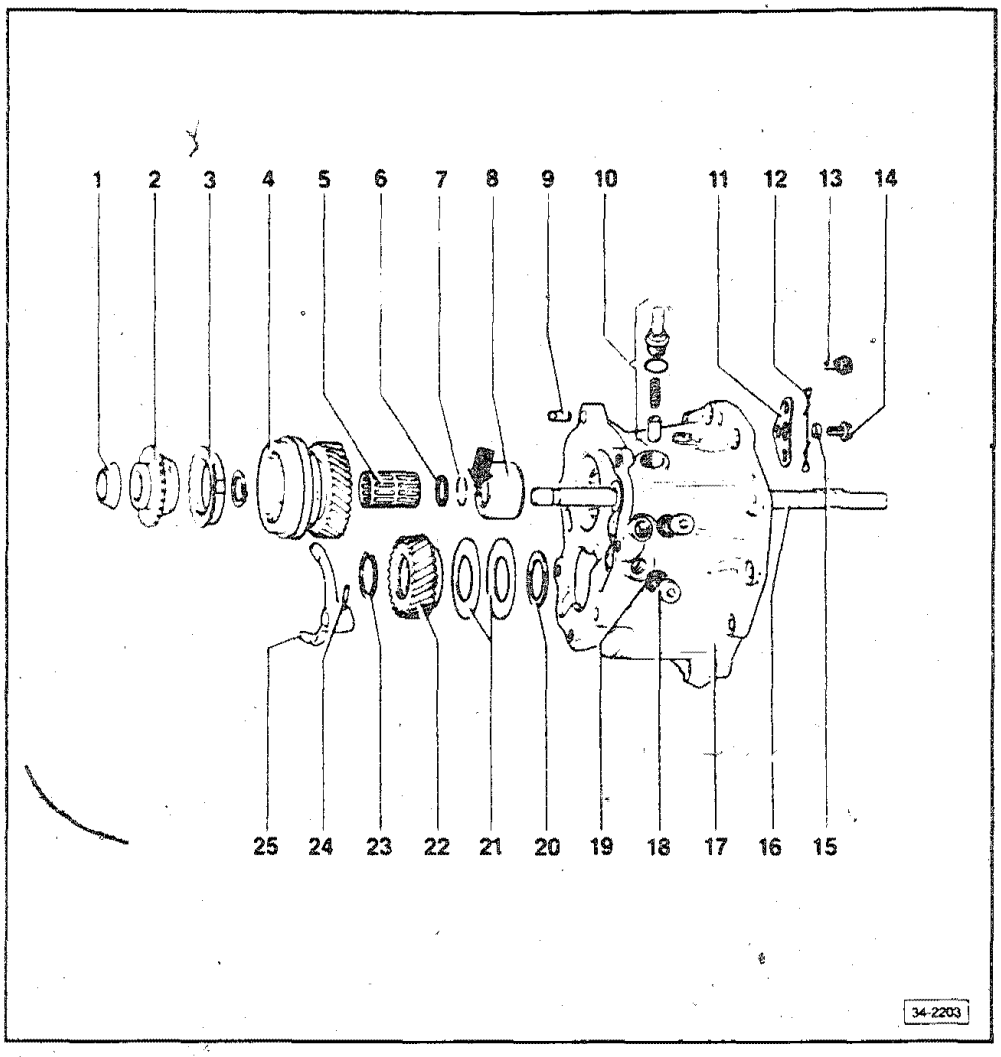
17 — **Oil filler plug — 25 Nm (18 ft lb)**

18 — **Selector shaft lever**
remove install along with front shift rod



1 — Gear carrier housing with 5th gear
[illegible]

2 = Input shaft and selector rods, 1st to 5th gear
assembly, section 34-210



1 — **Inner race (2nd), input shaft bearing**
drive inner race onto input shaft before installing end cover, section 34-220

2 — **5th gear clutch hub**

3 — **5th gear synchronizer ring**
checking for wear, Repair Group 35

4 — **5th gear with synchronizer hub and sleeve**
installing, Repair Group 35

5 — **5th gear needle bearing**

6 — **Thrust washer**

7 — **Circlip**

8 — **Inner race of ball bearing**
installed position, notch (arrow) faces 5th gear

9 — **Dowel pin**

10 — **Detent for 5th/reverse gear — 30 Nm (22 ft lb)**
with pivot pin for push rod

11 — **Mounting plate**
installation position: locking pin chamfers face gear carrier housing

12 — **Spring clip**

13 — **20 Nm (15 ft lb)**

14 — **Shoulder bolt**
used instead of bolt with sleeve

15 — **Sleeve**

16 — **5th/reverse selector rod**

17 — **Gear carrier housing**
assembly, section 34-290

18 — **Stop screw**

19 — **Gasket**

20 — **5th gear shim**
determining new thickness, section 34-220

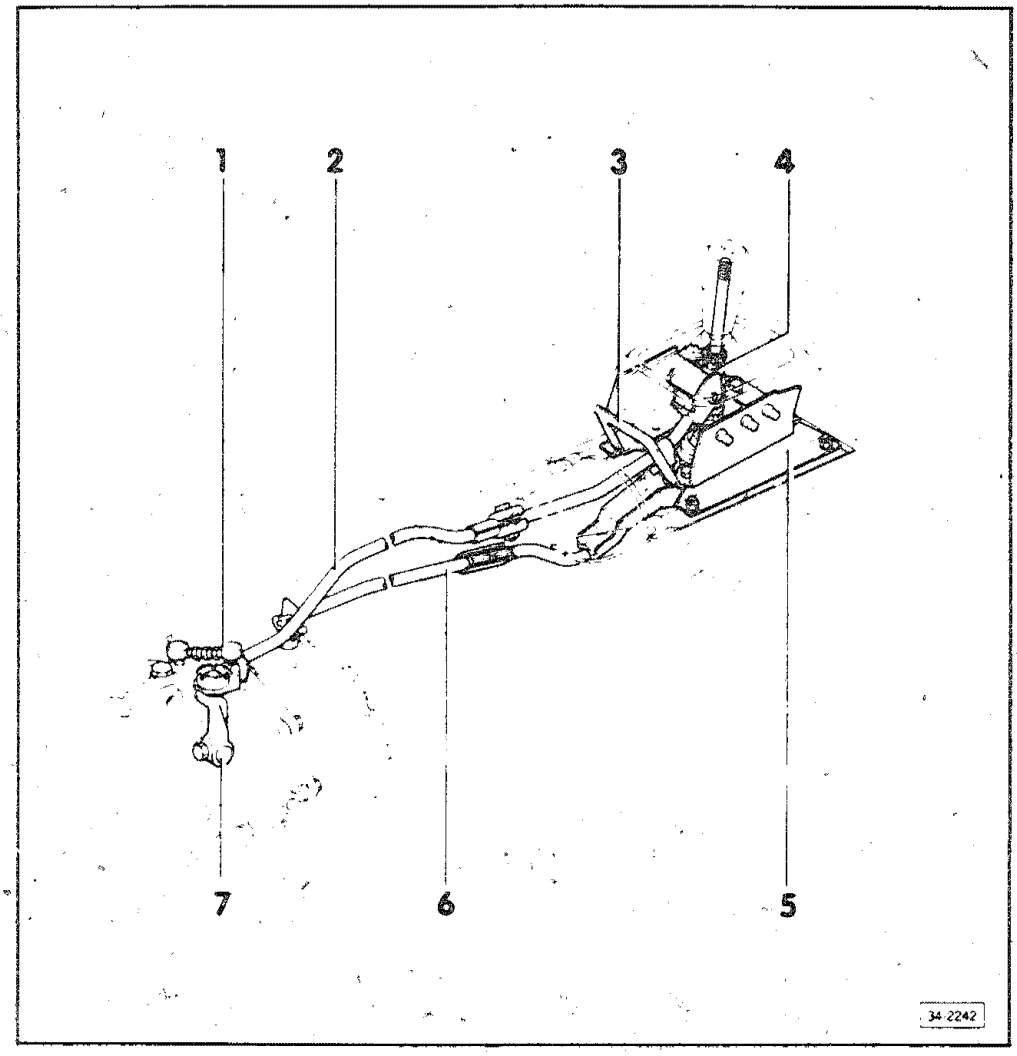
21 — **Concave washers**
installed position, Repair Group 35

22 — **5th gear**

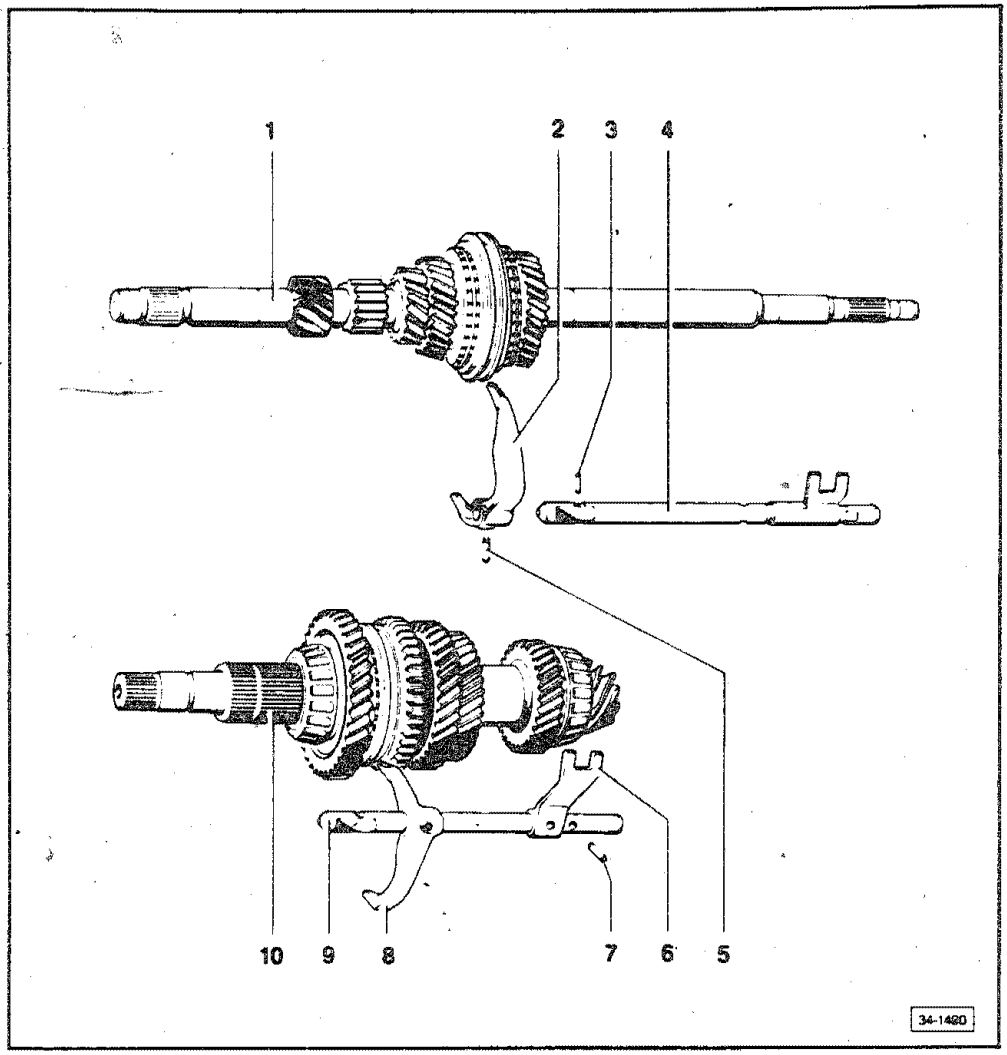
23 — **Circlip**

24 — **Spring pin**

25 — **5th gear shift fork**
only available with 5th gear selector rod



1 — Adjusting rod
2 — Shift rod
3 — Stop assembly
4 — Gearshift lever
5 — Cover plate
6 — Push rod
7 — Transmission selector shaft lever



1 — **Input shaft**
disassembling assembling, Repair Group 35

2 — **3rd 4th gear shift fork**

3 — **Lock pin**
- assemble in 3rd 4th gear selector rod, using grease
- installed position, section 34-29-1

4 — **3rd/4th gear selector rod**

5 — **Spring pin**

6 — **1st/2nd gear selector rod fork**

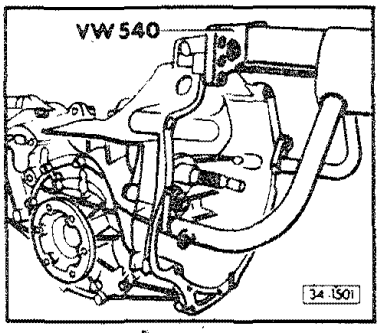
7 — **Spring pin**

8 — **1st/2nd gear shift fork**

9 — **1st/2nd gear selector rod**
supplied along with shift fork and selector rod fork, as an assembly

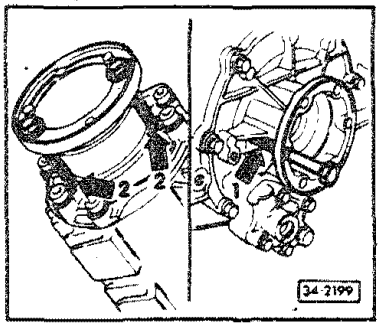
10 — **Pinion and hollow shaft**
disassembling/assembling, Repair Group 35

Transmission, disassembling/assembling



Disassembling

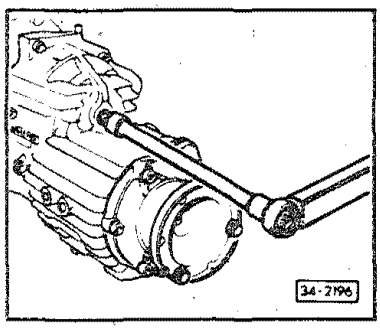
- mount transmission in repair fixture, **VW 540**
- drain transmission oil
- disconnect rear oil pressure return line, section 34-280
- remove cable bracket for seat belt tensioning system
- remove front shift rod along with front push rod and adjusting rod
- remove 5th/reverse gear interlock; section 34-180
- remove selector shaft, complete (do not disassemble)
- remove cap screw for end cover, section 34-170



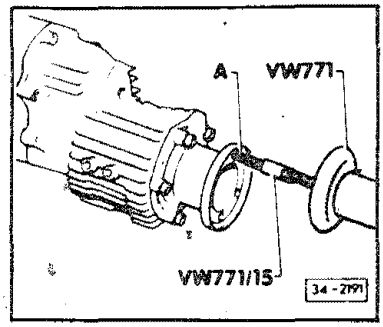
Note

Before removing the input shaft socket head bolts, block input shaft as follows:

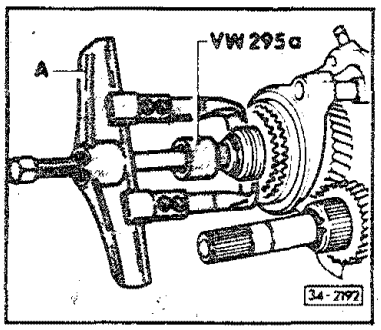
- place transmission in gear
- lock both axle flanges (**arrow 1**)
- lock drive shaft flange, using two bolts (**arrow 2**)



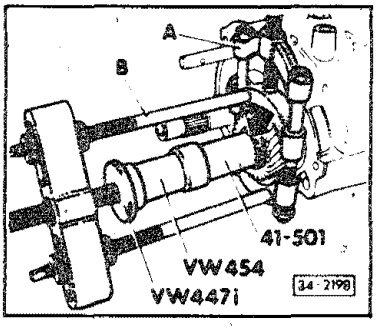
- remove input shaft socket head bolts
- remove end cover bolts
  - bolts are self-locking; always replace



- remove end cover using slide hammer **VW 771/1**, and adaptor **VW 771/15**
  - **A** – threaded pin, **M8** or **M10**



- pull off hubs and bearing 2nd inner race
  - **A** – puller **US 1078** or **Kukko 20/10**
  - **B** – needle bearing drift, **VW 295A**
- remove 5th gear synchronizer ring
- drive out 5th gear shift fork spring pin
- remove synchronizer hub circlip
- remove 5th gear with sleeve, hub, needle bearing, and 5th gear selector fork
  - selector rod should stay in gear carrier housing
- unbolt gear carrier housing and drive out dowel pins
- remove gear carrier housing (with input shaft and pinion)
- remove 5th gear circlip



- pull off 5th gear
  - 12-75 mm separator, **US 1103** (**Kukko 17/1**)
  - two-arm puller, **Kukko 18/0**

Note

Loosen puller spindle after several revolutions so that the separator can be repositioned for better contact with the gear. Repeat this procedure several times.

CAUTION

DO NOT remove the circlip, or the pinion will fall out of the hollow shaft.

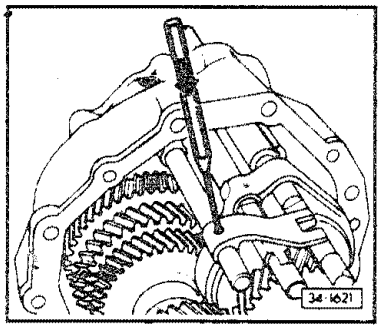
Note

The pinion will move back in the hollow shaft to the circlip stop when the puller is installed.

Sleeve **41-501** is supported by the circlip on the hollow shaft. (Circlip will not be damaged.)

- check condition of gear
  - replace if necessary

- remove concave washers
- remove 5th gear shim
- clamp gear carrier housing in vise with shafts toward front and shift forks pointing upward
  - use soft jaw covers for vise



- drive out spring pin for 1st/2nd gear selector fork

CAUTION

Support the shift rod while driving out the spring pin.

- turn selector fork upwards
- remove selector rod stop screws, section 34-190
- drive out 3rd/4th gear shift fork spring pin
- pull out 3rd/4th gear selector rod
  - shift fork stays in operating sleeve
  - do not lose small interlock piece

- remove thrust washer for 5th gear needle bearing
- remove circlip for ball bearing inner race
- remove inner race (not tightly seated), section 34-190
- remove input shaft with 3rd/4th gear shift fork, section 34-190
- remove reverse gear shaft and take out gear, synchronizer ring and spring
- remove pinion with selector rod and 1st/2nd gear shift fork

Differential, Removing

Note

If only the differential is to be removed, the end cover must first be removed, followed by the complete gear carrier housing.

- remove mounting bolts for both axle flanges
  - use drift to steady

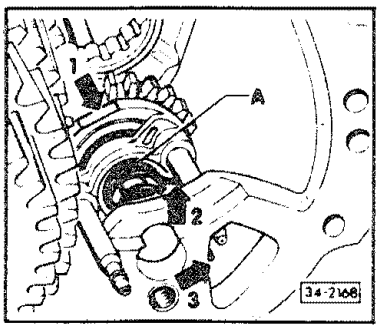
- remove bolts from final drive cover
- press cover off
- remove differential

Differential, installing

Note

Before installing the axle flange, install the hex bolt connecting the engine and transmission.

- install pinion with shift fork and selector rod, section 34-200

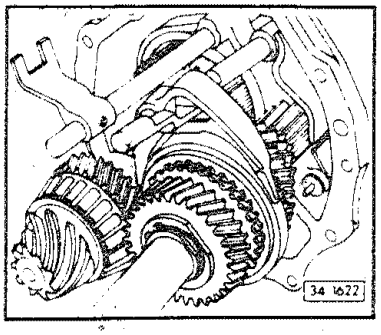


- insert screwdriver **A** from 5th gear side through opening for reverse gear shaft
- install reverse gear and synchronizer ring
  - be sure flat edge of ring (**arrow 1**) points toward pinion and input shaft
- install compression spring
  - attach single angled end in recess on synchronizer ring (**arrow 2**)
  - turn double angled end to left and hook in opening in gear carrier housing (**arrow 3**)

Note

When installing compression spring on synchronizer ring, lift gear and synchronizer ring slightly with screwdriver and push screwdriver slowly through spring. Hook spring end at gear carrier housing opening.

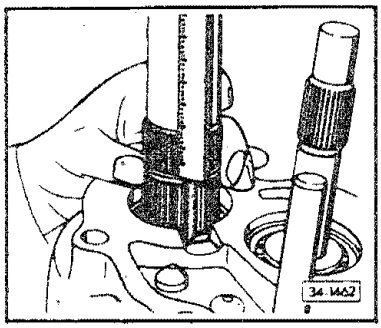
- push gear shaft in
  - pull screwdriver out slowly and note position of compression spring
- install mounting plate
- engage reverse gear and attach spring clip, section 34-290
- remove reverse gear



- install input shaft with 3rd/4th gear shift fork, section 34-210
- install inner race of roller bearing
  - notch points toward 5th gear teeth
- install circlip for inner race, and mount thrust washer
- position selector rods in Neutral and be sure interlock pins are installed correctly, section 34-290
- install 3rd/4th gear selector rod with small interlock pin
  - assemble pin using small amount of grease

- pin together 3rd/4th gear shift fork with selector rod
- install 1st/2nd gear selector fork lock sleeve
- install stop screws with new gaskets, and tighten

5th gear shim thickness, determining

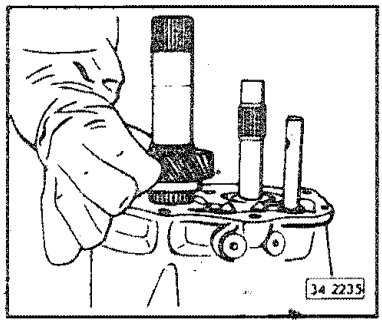


- measure distance between inner race of tapered roller bearing and circlip mounted on it
  - push upward with depth gauge when taking reading
  - determine shim thickness from following chart:

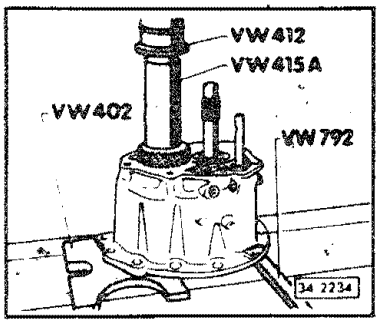
Measuring Range (mm)	Thickness (mm)	Part number
34.75-34.82	3.3	016 311 391 BC
34.83-34.92	3.4	016 311 391 BD
34.93-35.02	3.5	016 311 391 BE
35.03-35.12	3.6	016 311 391 BF
35.13-35.22	3.7	016 311 391 BG

Assembling

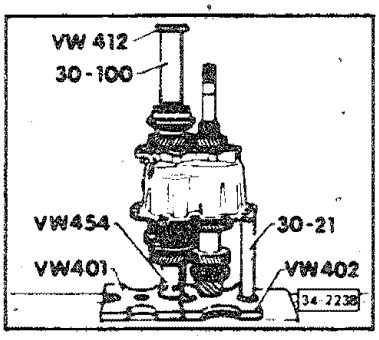
- install concave washers
  - only outer edges touch each other



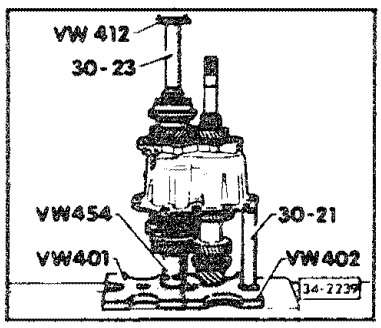
- heat 5th gear to approximately 120°C (250°F) before sliding on
  - gear shoulder faces gear carrier housing
- press 5th gear on until seated



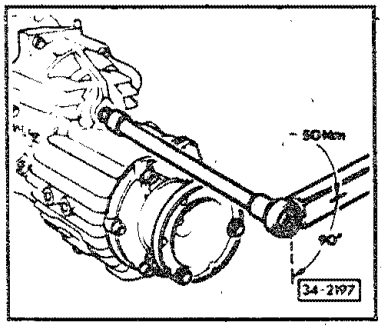
- support 3rd gear of hollow shaft on thrust plate **VW 402**
  - important for determination of circlip
- install 5th gear circlip
- install 5th gear with synchronizer hub and sleeve, needle bearing and shift fork
  - pin shift fork together with selector rod, section 34-200
- install synchronizer hub circlip
- install 5th gear synchronizer ring

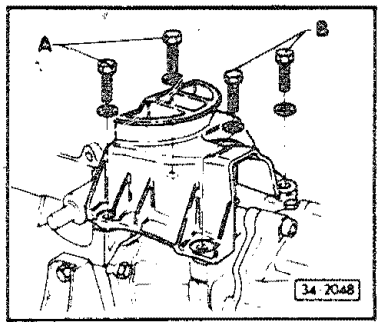


- heat clutch hub to approximately 120°C (250°F) and install
  - if necessary, drive on until seated, using press tube **30-100**



- press on 2nd inner race of ball bearing
- lubricate mating surfaces of spacer plate and gear carrier housing/transmission housing with light application of sealer
- position spacer plate on gear carrier
- install gear carrier (bearing plate, input shaft, pinion) in the transmission housing
- drive in dowel pins and tighten bolts to 25 Nm (18 ft lb)
- install complete selector shaft
- install 5th/reverse gear interlock
- position end cover gasket and install dowel pins
- position end cover and install mounting bolts
- install self-locking bolts for input shaft. Tighten end cover by tightening these bolts
  - during tightening, block input shaft using procedure described earlier in this section
- loosen bolts 1/2 turn, after tightening end cover
- retighten end cover bolts to 25 Nm (18 ft lb)



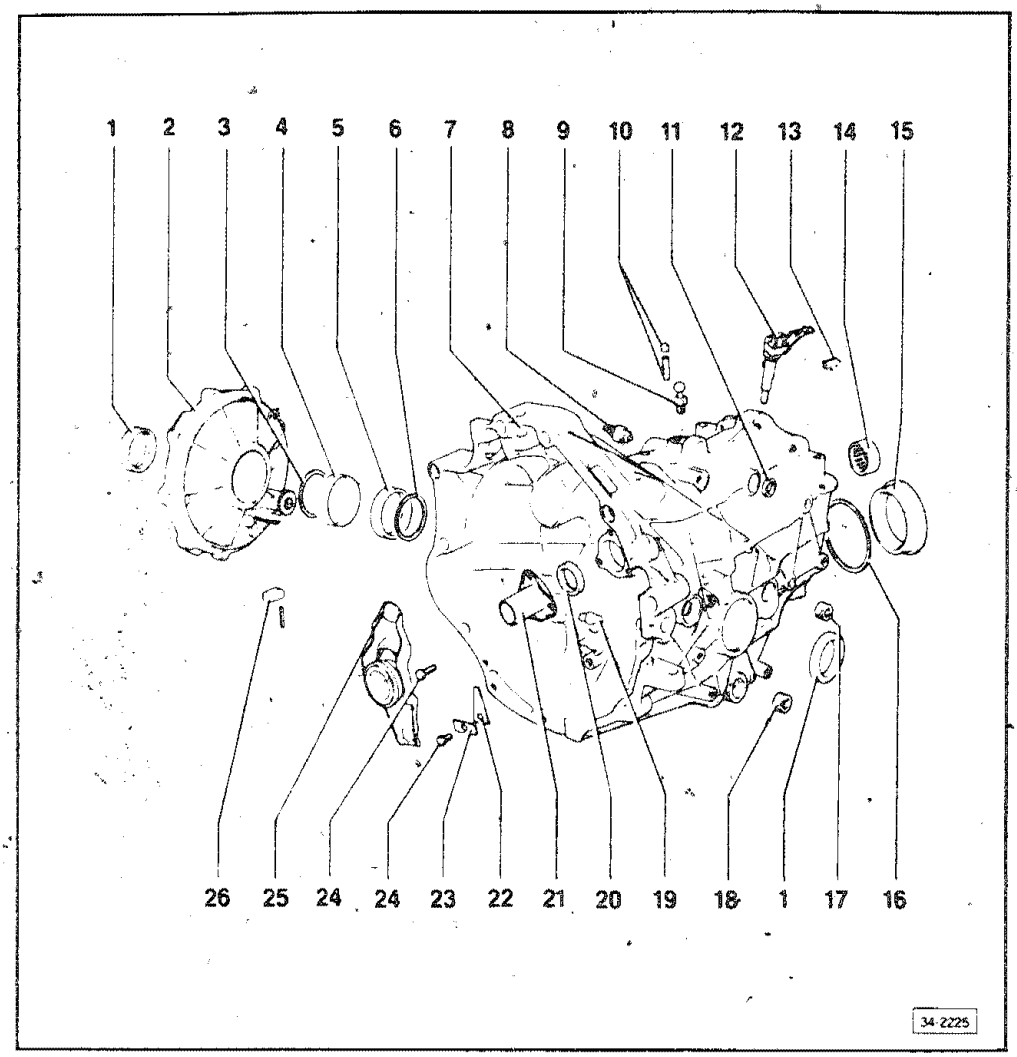


- tighten input shaft bolts to 50 Nm (37 ft lb)
  - block input shaft as described earlier in this section, and tighten bolts an additional 90° (1/4 turn)
- tighten cap screw to 30 Nm (22 ft lb)

Note

Always replace socket head bolts and bolts installed with locking compound.

- install front shift rod and push rod
- install adjusting rod after checking adjustment
- install cable bracket for seat belt tensioning system
  - **A** = 40 Nm (30 ft lb)
  - **B** = 65 Nm (48 ft lb)
- connect rear oil pressure return line, section 34-280



Note

When replacing parts marked with an asterisk (*), further adjustment is necessary. See adjustment overview, Repair Group 39.

1 — **Axle flange seals**
- press off with extractor lever VW 681
- driving in, section 34-240
- replacing with transmission installed, Repair Group 39

2 — **Final drive cover**
- with integral oil pump
- repairing oil pump, section 34-250

3 — **S2 shim**
- note thickness
- see Repair Group 39

*4 — **Small tapered roller bearing, outer race (see Note)**
- for differential gear
- removing installing, Repair Group 39

*5 — **Large tapered roller bearing, outer race (see Note)**
- for differential gear
- removing installing, Repair Group 39

6 — **S1 shim**
- note thickness
- see Repair Group 39

7 — **Final drive housing**
- before removing housing, determine installation position of pinion (actual measurement). See Repair Group 39
- before installing transmission, install cable bracket for seat belt tensioning system

8 — **Back-up light switch — 45 Nm (33 ft lb)**

9 — **Ball stud for adjusting rod**
installed position, section 34-240

10 — **Vent**
note insertion depth, section 34-240

11 — **Selector shaft seal**
- withdraw using extractor lever VW 681
- driving in, section 34-240

12 — **Speedometer sender**
- if the transmission is installed, the speedometer sender can be removed as follows:
  - remove front exhaust pipe, Repair Group 26
  - remove end cover for left axle flange, from transmission
  - disconnect wiring from speedometer sender
  - release speedometer sender and remove

13 — **Retainer for speedometer**

14 — **Input shaft needle bearing**
removing,installing, Repair Group 35

15 — **Large tapered roller bearing, outer race**
- before removing, determine installation position of pinion (actual measurement), Repair Group 39
- removing,installing, Repair Group 35

16 — **S3 shim**
- note thickness
- see Repair Group 39

17 — **Oil filler plug — 25 Nm (18 ft lb)**

18 — **Oil drain plug — 25 Nm (18 ft lb)**

19 — **Spacer**

20 — **Input shaft seal**
- remove with extractor lever VW 681
- installing, section 34-240
- can be replaced with transmission removed, before dissassembly

21 — **Plastic guide sleeve**
do not lubricate

22 — **Spring**

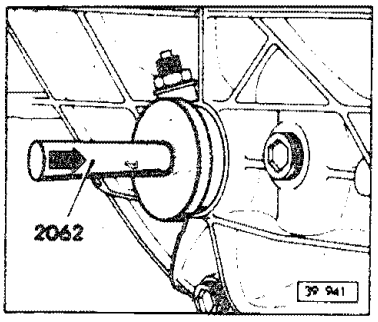
23 — **Retaining plate**

24 — **15 Nm (11 ft lb)**

25 — **Clutch release lever**
lubricate all friction surfaces with MoS_2

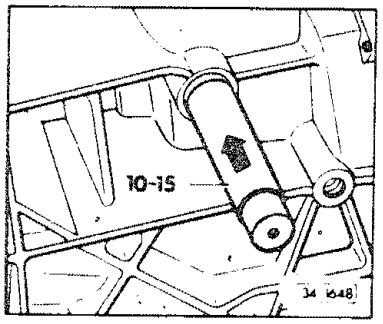
26 — **Magnet**

Transmission seals, vent, and ball stud, installing



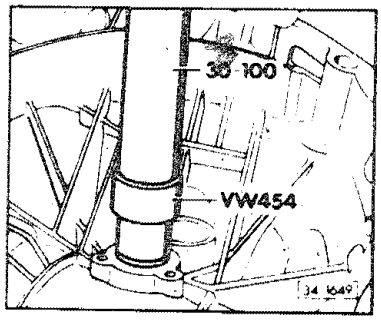
Axle flange seal

- install with driver **2062**, until seated (left side shown)



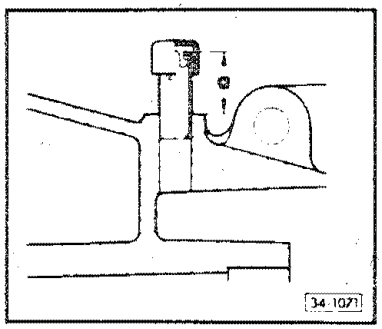
Selector shaft seal

- install with guide pin **10-15**, until seated

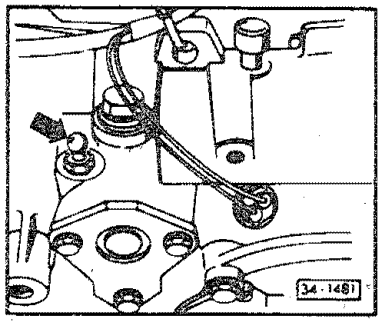


Input shaft seal

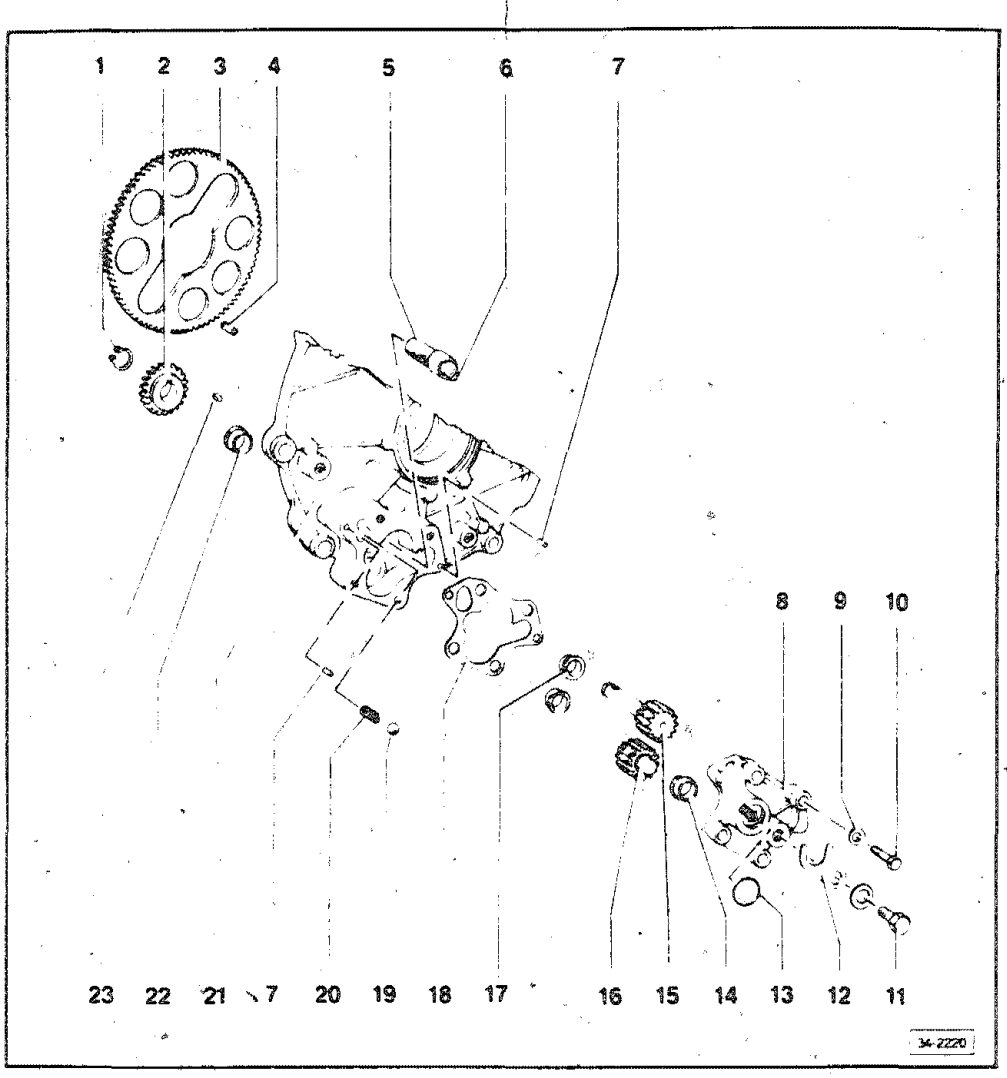
- install with press tube **30-100** and thrust tube **VW 454**, until seated



Vent in final drive housing
- press-in depth a = 21 mm (53/64 in.)



Ball stud for adjusting rod
- installed position, (arrow)



Note

When replacing parts marked with an asterisk (*) check end play of oil pump gears section 34-270

1 — **Circlip**

2 — **Oil pump drive gear (21 teeth)**
- before installing, position alignment springs
- install on gearshaft

3 — **Oil pump drive wheel (82 teeth)** *
- removing from differential gear housing Repair Group 39
- installed position Repair Group 39

4 — **Spring pin**
- drive into differential gear housing
- secures oil pump drive wheel

5 — **Inlet pipe**
with filter screen

6 — **Clamp**

7 — **Pin**

8 — **Oil pump cover**
- replace if there is heavy scoring in area of pump gears
- cover can be removed as follows with transmission installed
  - remove front exhaust system Repair Group 39
  - remove right axle flange end cover

9 — **Washer**

10 — **8 Nm (71 in. lb or 82 cm kg)**

11 — **25 Nm (18 ft lb)**

12 — **Bracket**

13 — **O-ring**
- always replace
- position in pump cover groove (arrow)

14 — **Bearing bushing**
- removing from pump cover, section 34-260
- installing in pump cover, section 34-260
- installed position, section 34-260

*15 — **Oil pump gear/shaft (see Note)**

*16 — **Oil pump gear/shaft (see Note)**

*17 — **Bearing bushings (see Note)**
- removing from pump housing, section 34-260
- installing in pump housing, section 34-260
- installed position, section 34-260

*18 — **Gasket (see Note)**
when removing gasket with transmission installed, remove front exhaust system, Repair Group 26

19 — **Check ball**

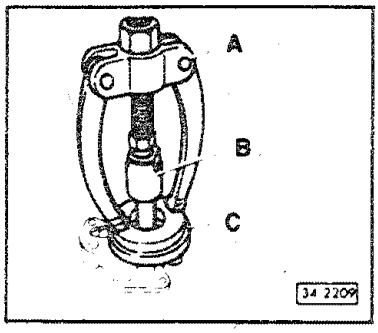
20 — **Compression spring**

21 — **Final drive cover**
with integrated oil pump

22 — **Bearing bushing**
- for gear shaft
- removing, section 34-260
- installing, section 34-260
- installed position, section 34-260

23 — **Alignment springs**

Oil pump bushings, removing/installing

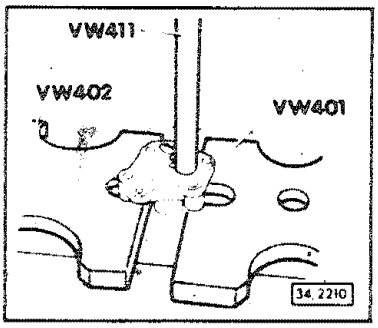


Bearing bushing (in pump cover), removing

- extract bearing bushing, using the following:
  - **A** – puller (12-16 mm), **US 1010 (Kukko 21/1)**
  - **B** – support, **Kukko 22/1**
  - **C** – thrust pad, **30-205**

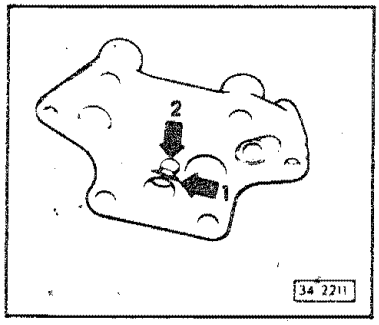
CAUTION

Use thrust pad to prevent damage to sealing surface.



Bearing bushing (in pump cover), installing

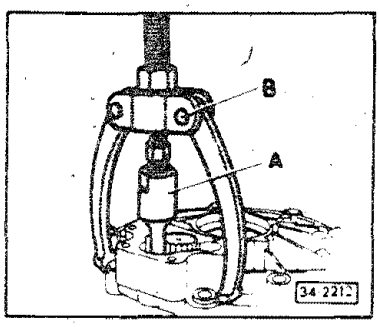
- press bearing bushing in until seated



Bearing bushing (in pump cover), installed position

Note

Flat edge (**arrow 1**) faces recess (**arrow 2**) in pump cover.

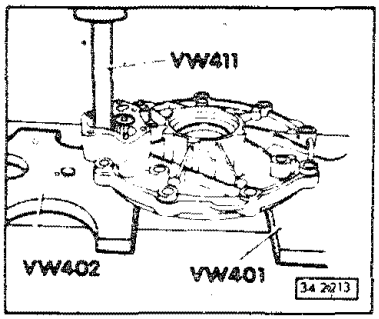


Bearing bushing (in pump housing), removing

- extract bearing bushing, using the following:
  - **A** – puller (12-16 mm), **US 1010 (Kukko 21/1)**
  - **B** – support, **Kukko 22/1**

Note

Follow the same procedure when removing bearing bushing for either oil pump gear.

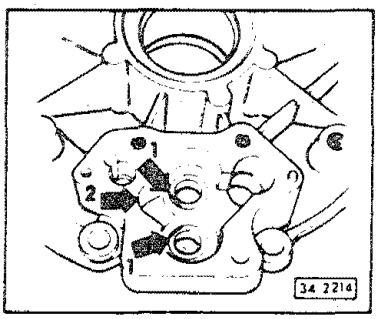


Bearing bushing (in pump housing), installing

- press bearing bushing in until seated

Note

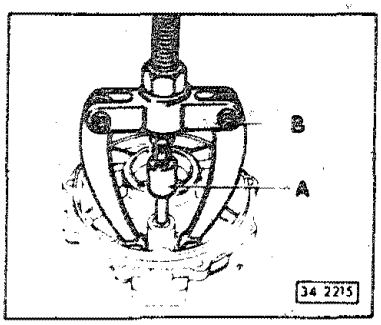
Follow the same procedure when installing bearing bushing for either oil pump gear.



Bearing bushing (in pump housing), installed position

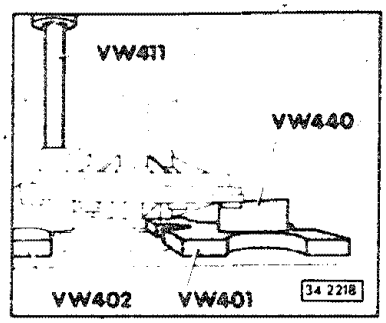
Note

Flat edges (**arrows 1**) face recess in housing (**arrow 2**).



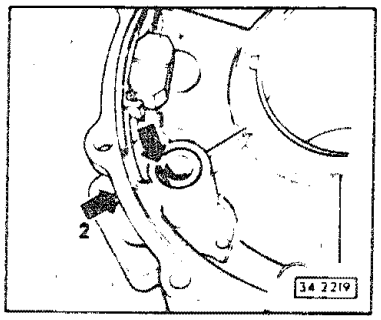
Bearing bushing (for pump gear/shaft), removing

- extract bearing bushing, using the following:
  - **A** – puller (12-16 mm), **US 1010 (Kukko 21/1)**
  - **B** – puller, **US 1039 (Kukko 22/2)**



Bearing bushing (for pump gear/shaft), installing

- press bearing bushing in until seated

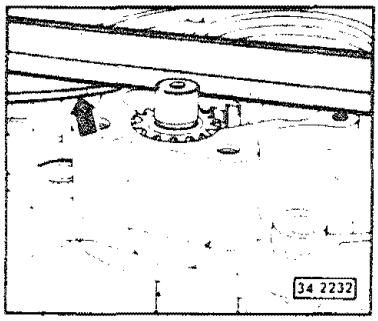


Bearing bushing (in final drive cover), installing

Note

Flat surface (**arrow 1**) faces the outer circumference of the final drive cover (**arrow 2**)

Oil pump gears, checking end play



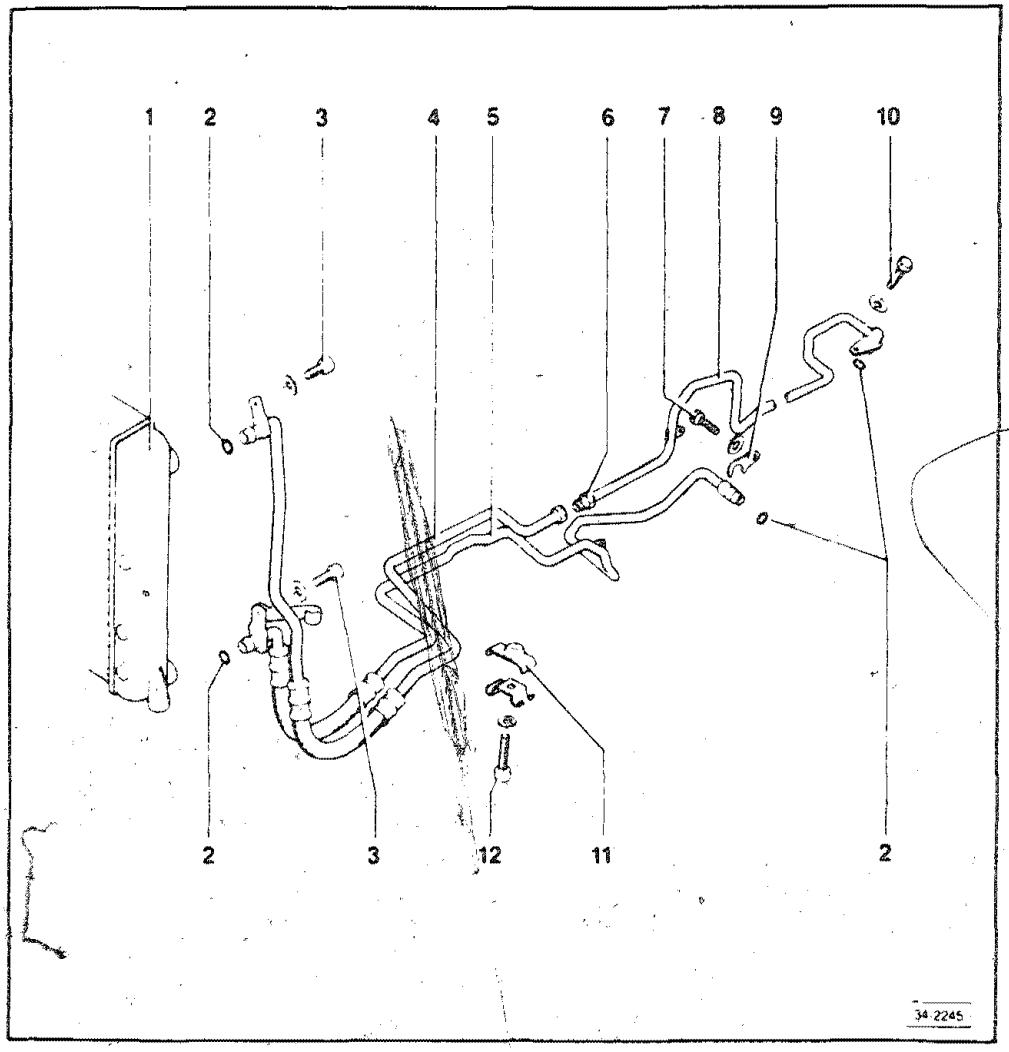
- position straightedge across oil pump gears, as shown
- insert 0.05 mm feeler gauge (**arrow**) between straightedge and housing sealing surface

If feeler gauge **cannot** be inserted

- install gasket (1.50 mm thickness, Part No. **016 115 189**)

If feeler gauge **can** be inserted

- install gasket (2.00 mm thickness, Part No. **016 115 189A**)
- assemble oil pump and be sure that all gears turn easily



1 — **Oil cooler**
- integral with radiator
- removing/installing Repair Group 19

2 — **O-ring**
always replace

3 — **10 Nm (89 in. lb or 102 cm kg)**
bolts attach oil pressure lines to oil cooler

4 — **Oil pressure return line, front**

5 — **Oil pressure supply line**

6 — **40 Nm (30 ft lb)**

7 — **25 Nm (18 ft lb)**
bolt attaches oil pressure line to oil pump

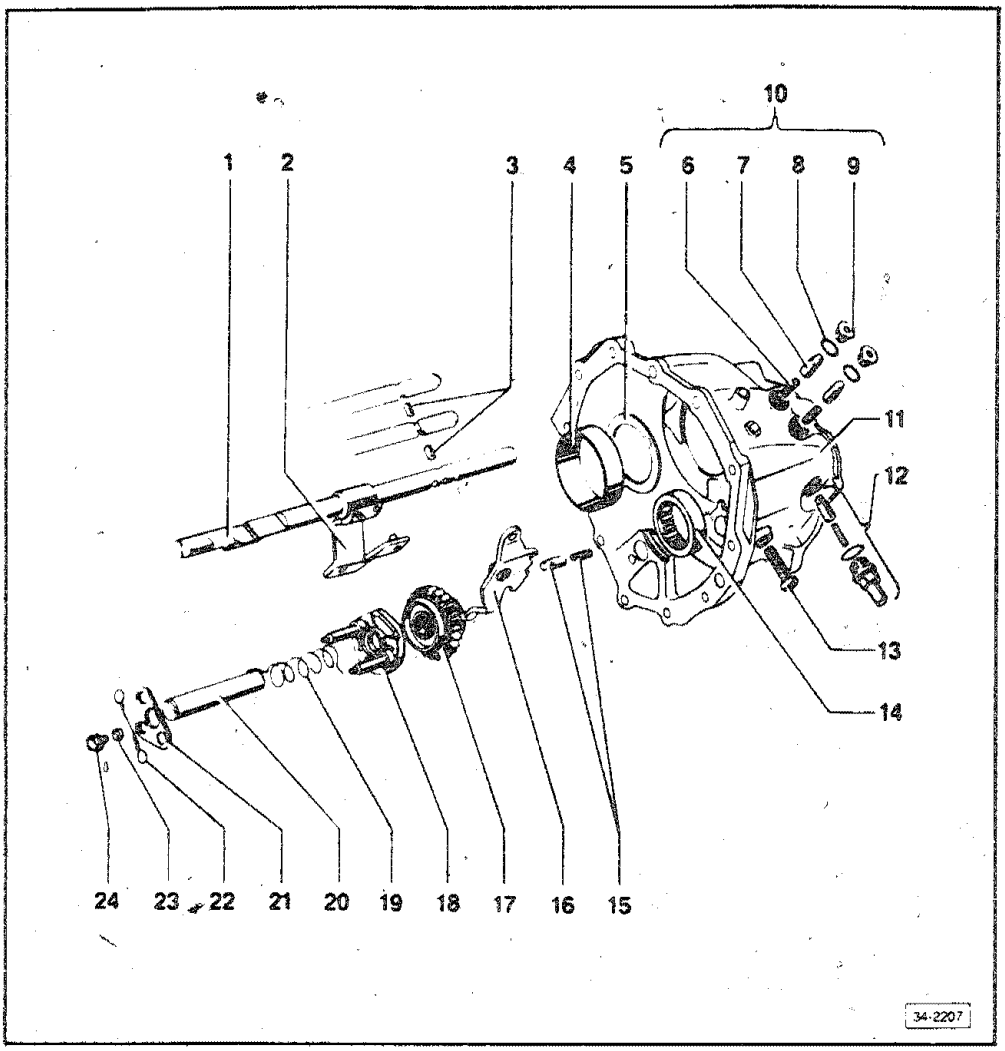
8 — **Oil pressure return line, rear**

9 — **Bracket**

10 — **25 Nm (18 ft lb)**
bolt attaches oil pressure line to end cover

11 — **Bracket**

12 — **25 Nm (18 ft lb)**
bolt attaches oil pressure lines to A C compressor



1 — **5th reverse gear shift rod**

2 — **Reverse gear shift fork**

3 — **Keys**
installed position section 34-300

4 — **Outer race, pinion tapered roller bearing,**
removing installing pinion Repair Group 35

5 — **S4 shim**
adjustment Repair Group 39

6 — **Spring**

7 — **Plunger**

8 — **Gasket**

9 — **Stop screw**

10 — **1st/4th gear interlock**
installed position, section 34-300

11 — **Gear carrier housing**
when replacing, determine S4 shim thickness, section 34-310

12 — **5th gear interlock mechanism**
installed position, section 34-300

13 — **Relay lever bolt — 35 Nm (26 ft lb)**

14 — **Roller bearing**
see input shaft, removing installing, Repair Group 35

15 — **Reverse gear interlock**
installed position, section 34-300

16 — **Reverse gear relay lever**
adjusting, section 34-300

17 — **Reverse gear**
- removing bushing, section 34-300
- installing bushing, section 34-300

18 — **Reverse gear synchronizer**
- checking for wear, section 34-300
- installed position: flat edges face pinion and input shaft

19 — **Pressure spring**
installed position: single-angled end hooks into notch on synchronizer ring. Double-angled end is turned to left and hooked in opening on gear carrier housing

20 — **Reverse gear shaft**

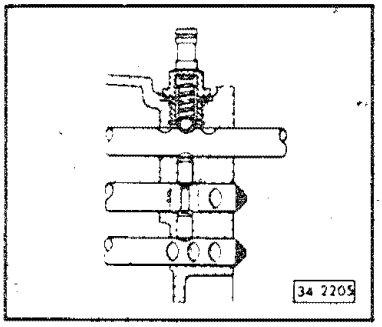
21 — **Mounting plate**
installed position: locking pin chamfers face gear carrier housing

22 — **Spring clip**

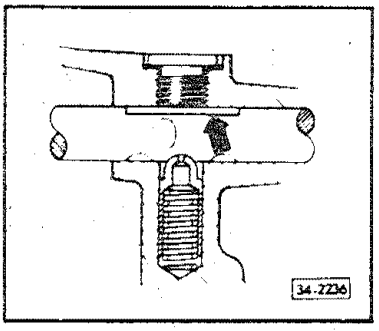
23 — **Sleeve**

24 — **Hex bolt — 20 Nm (15 ft lb)**

Gear carrier housing, disassembling/assembling



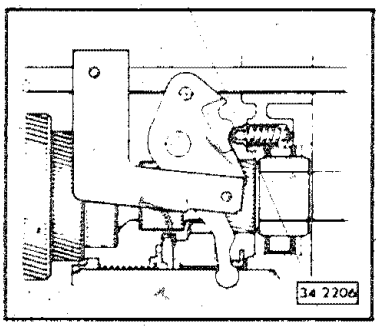
5th gear interlock mechanism, installing



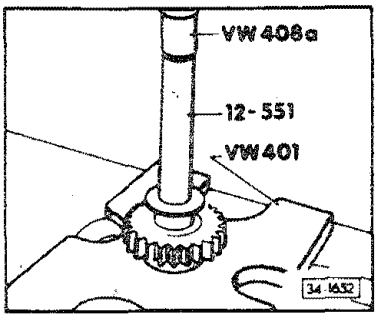
1st/4th gear interlock, installed position

Note

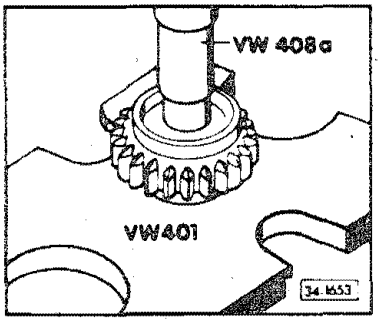
The recess (**arrow**) will not be present when the selector rod is at 3rd/4th gear.



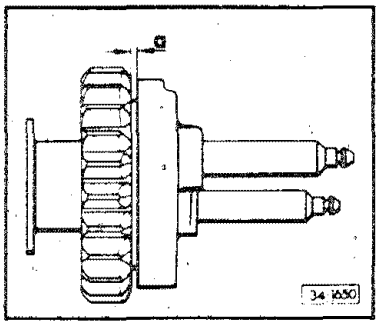
Reverse gear interlock, installed position



Reverse gear bushing, removing

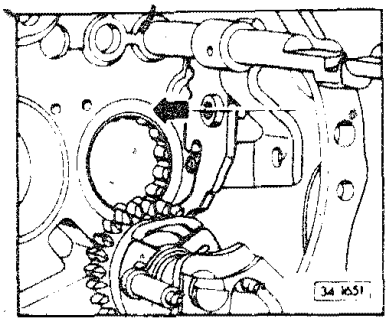


Reverse gear bushing, installing



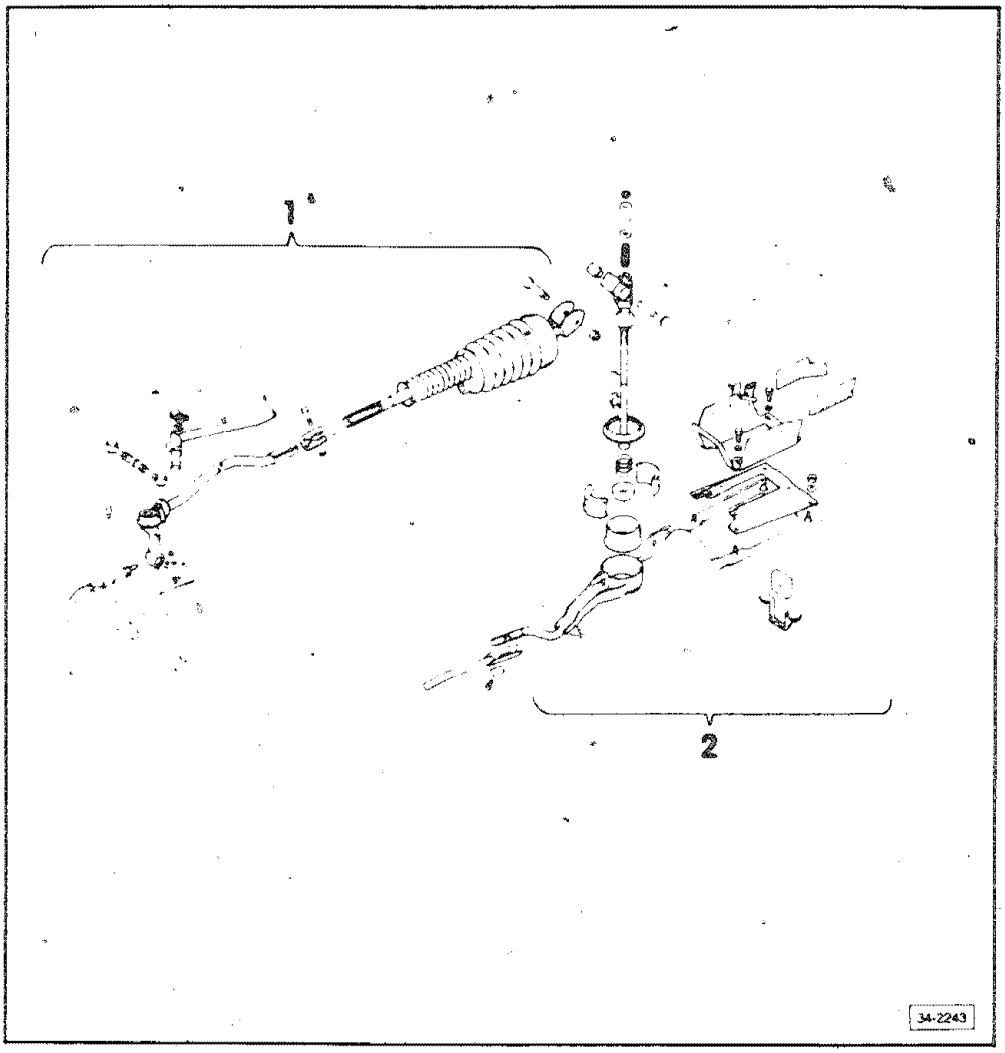
Synchronizer ring, checking

- press synchronizer ring onto gear and measure gap a with feeler gauge
  - a = 0.075-2.3 mm (new)
  - wear limit: 0.2 mm



Reverse lever, adjusting

- install reverse gear and insert relay lever
- install both in gear carrier housing
- push relay lever in direction of **arrow** and thread bolt into relay lever until seated
  - bolt and threaded lever bushing must be aligned
- press lever against bolt and loosen bolt until threads of bolt just touch bushing threads
  - bolt must have been turned back at least 1/4 turn
- tighten bolt to 35 Nm (26 ft lb)
- engage reverse gear several times and check that relay lever moves easily in all positions

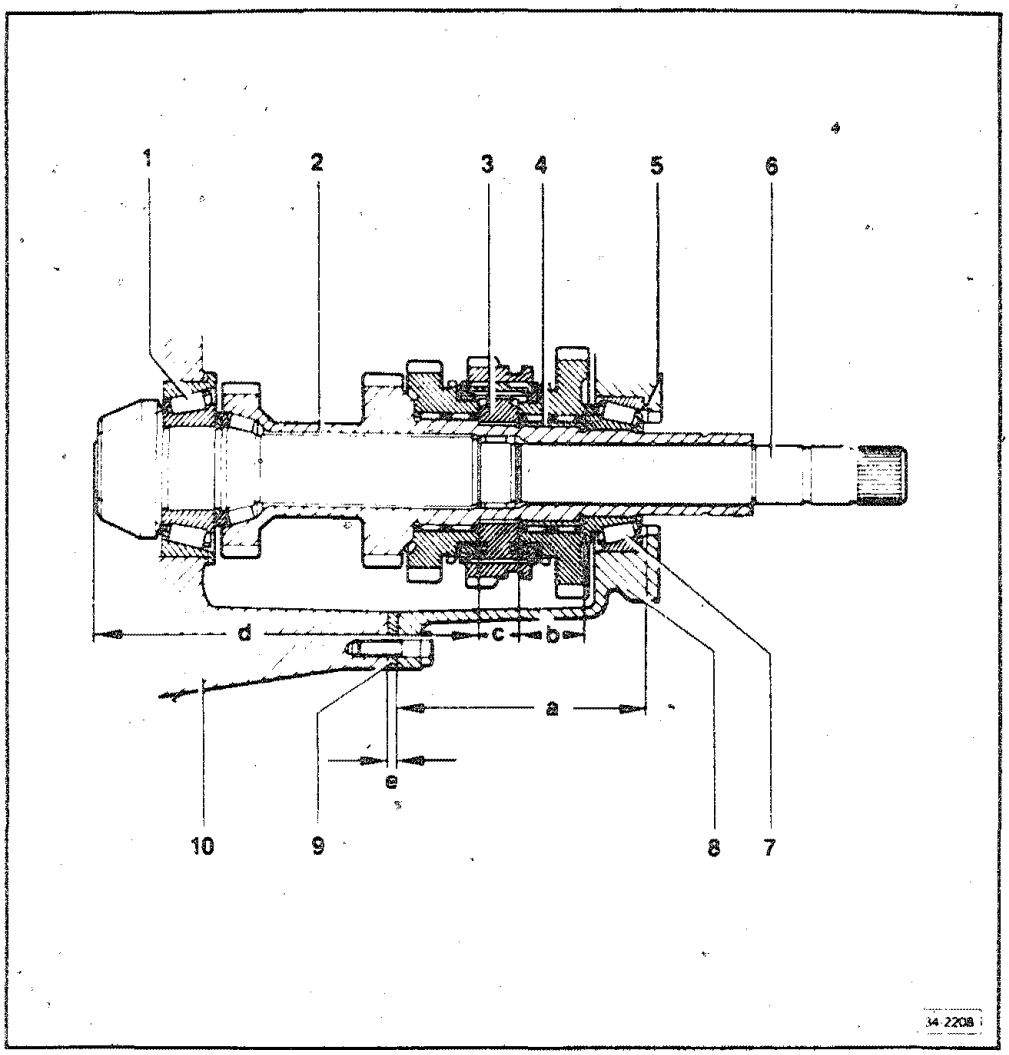


Note

Lubricate all joints and moving parts with white grease Part No **AOS 126 000 05.**

1 — **Shift rods and front push rod**
- assembly, section 34-40
- shift rods, removing/installing, section 34-80
- push rods, removing/installing, section 34-90

2 — **Gearshift lever and rear push rod**
- assembly, section 34-60
- push rods, removing/installing, section 34-90
- gearshift lever linkage, checking adjusting, sections 34-110, 34-120, and 34-130

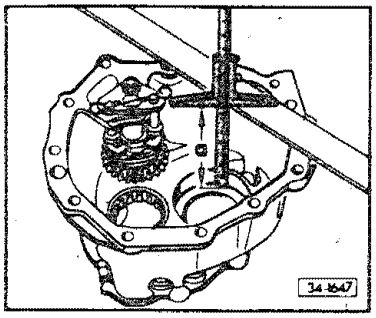


Note

The thickness of the S4 shim must be redetermined if the gear carrier housing, the 1st 2nd gear synchronizer hub, or the hollow shaft and spacer plate, are replaced. This adjustment also changes the preload of the pinion bearing

1 — Large tapered roller bearing
2 — Hollow shaft
3 — 1st/2nd gear synchronizer hub
4 — 1st gear needle bearing
5 — S4 shim
6 — Pinion
7 — Small tapered roller bearing
8 — Gear carrier housing
9 — Spacer plate
10 — Final drive housing
a — Depth of gear carrier housing section 34-320
b — Length of needle bearing inner race section 34-330
c — Length of 1st 2nd gear synchronizer hub section 34-340
d — Measurement from pinion head to contact collar of synchronizer hub on hollow shaft section 34-350
e — Thickness of spacer plate section 34-360

Gear carrier housing replacement and S4 shim determining



- redetermine **S4** shim thickness, as follows:
  - measure depth of both old and new gear carrier housing
  - calculate difference

Example

Old gear carrier housing depth **a**	=	121.60 mm (4.787 in.)
New gear carrier housing depth **a**	=	121.85 mm (4.797 in.)
Difference	=	0.25 mm (0.10 in.)

If the new gear carrier housing is deeper

- install correspondingly thicker **S4**

If the old gear carrier housing is deeper

- install correspondingly thinner **S4**

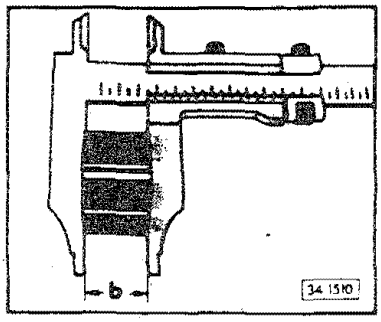
Example

Previous shim		0.95 mm (0.37 in.)
Difference	+	0.25 mm (0.10 in.)
New S4 shim	=	1.20 mm (0.47 in.)

Shims available as replacement parts:

Thickness (mm)	Part number
0.24	016 311 393 BA
0.27	016 311 393 BB
0.30	016 311 393 BC
0.33	016 311 393 BD
0.36	016 311 393 BE
0.39	016 311 393 BF
0.42	016 311 393 BG
0.45	016 311 393 BH
0.88	016 311 393 BJ
0.93	016 311 393 BK
1.17	016 311 393 BL
1.41	016 311 393 BM

1st gear needle bearing replacement and S4 shim determining



- redetermine **S4** shim thickness, as follows
  - measure length **b** for inner race of both old and new needle bearings
  - calculate difference

Example

Old inner race dimension **b**	=	31.95 mm (1.258 in.)
New inner race dimension **b**	=	32.00 mm (1.260 in.)
Difference	=	0.05 mm (0.002 in.)

If the new race is longer

- install correspondingly thinner **S4**

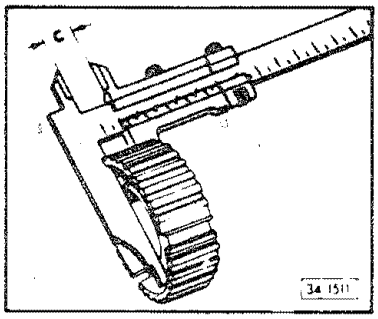
If the old race is longer

- install correspondingly thicker **S4**

Note

Select replacement shims from chart in section 34-320.

1st/2nd gear synchronizer hub replacement and S4 shim determining



- redetermine **S4** shim thickness as follows.
  - measure length **c** on hub of both old/new synchronizer by positioning jaws of Vernier caliper in slots for keys
  - calculate difference

Example

Old synchronizer hub **c**	=	19.65 mm (0.774 in.)
New synchronizer hub **c**	=	19.60 mm (0.772 in.)
Difference	=	0.05 mm (0.002 in.)

If the new synchronizer hub is longer

- install correspondingly thinner **S4**

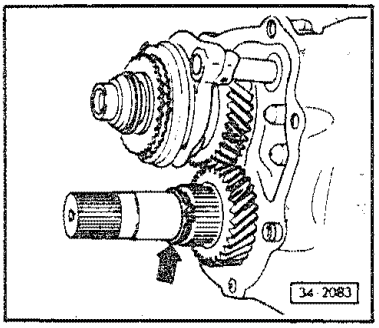
If the old synchronizer hub is longer

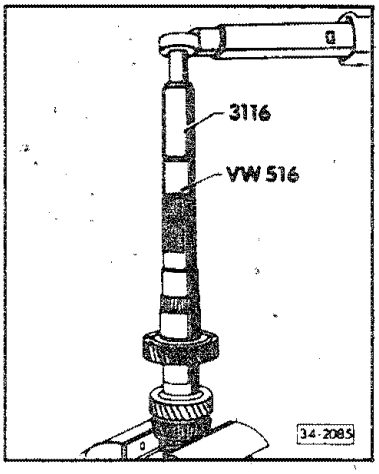
- install correspondingly thicker **S4**

Note

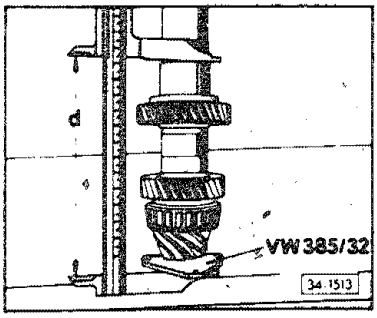
Select replacement shims from the chart in section 34-320.

Hollow shaft replacement and S4 shim determining





- disassemble pinion up to hollow shaft
- remove circlip (**arrow**) for spring pin
- tighten sleeves to exactly 10 Nm (89 in. lb or 102 cm kg)



- set end measuring plate, **VW 385/32**, on pinion head and measure dimension **d**
  - upper measuring point is mating collar for synchronizer hub

Example

d = 198.40 mm (7.811 in.)

- calculate difference

Example

Old hollow shaft **d**	= 198.40 mm (7.811 in.)
New hollow shaft **d**	= 198.55 mm (7.817 in.)
Difference	= 0.15 mm (0.006 in.)

If dimension **d** of the new hollow shaft is larger

- install correspondingly thinner **S4**

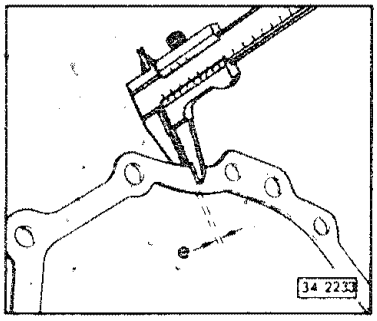
If dimension **d** of the old hollow shaft is larger

- install correspondingly thicker **S4**

Note

Select replacement shims from the chart in section 34-320.

Spacer plate replacement and S4 shim determining



- redetermine thickness of **S4** shim, as follows:
  - measure thickness of old/new spacer plate
  - calculate difference

Example (for hollow shaft d = 198.55 mm)

Old spacer plate **e**	= 3.90 mm (0.15 in.)
New spacer plate **e**	= 4.00 mm (0.16 in.)
Difference	= 0.10 mm (0.39 in.)

If new spacer plate is thicker

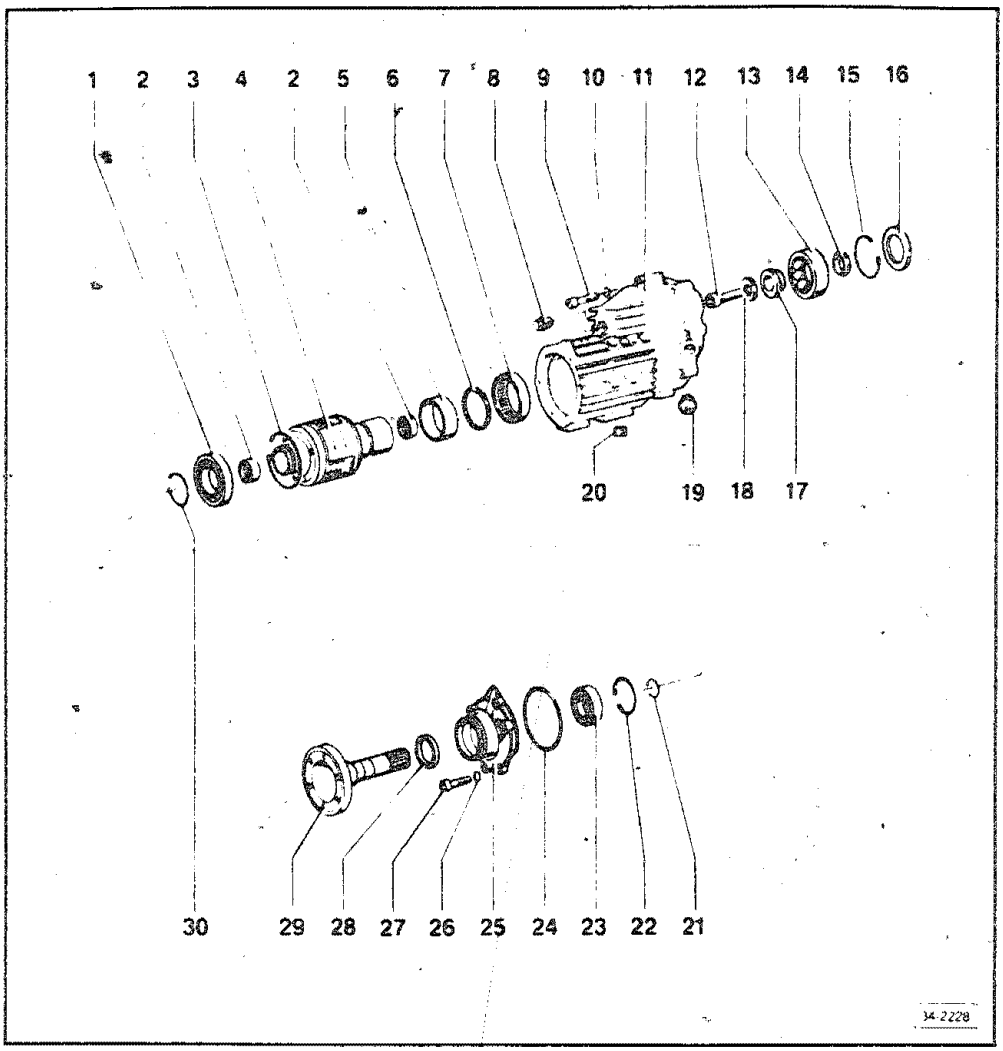
- install correspondingly thinner **S4**

If old spacer plate is thicker

- install correspondingly thicker **S4**

Note

Select replacement shims from the chart in section 34-320.



1 — **Ball bearing**
- for Torsen differential
- removing installing, section 34-380

2 — **Small needle bearing**
removing installing, section 34-380

3 — **Circlip**
- installing, section 34-380
- before installing ball bearing, install circlip on Torsen differential

4 — **Torsen differential**
- DO NOT disassemble
- always replace if damaged
- to separate from bearing housing, first remove circlip
- installing, section 34-380

5 — **Needle bearing, large — inner race**
- removing installing, section 34-380
- only replace together with outer race

6 — **Circlip**
for large needle bearing on Torsen differential

7 — **Needle bearing, large — outer race**
- removing installing, section 34-380
- press-in depth, section 34-380
- only replace together with inner race

8 — **Oil filler plug — 30 Nm (22 ft lb)**
always replace

9 — **25 Nm (18 ft lb)**

10 — **Washer**

11 — **End cover — 30 Nm (22 ft lb)**
removing from gear carrier housing, section 34-220

12 — **Socket head bolt — 50 Nm (37 ft lb), plus an additional 90° (1/4 turn)**

13 — **Input shaft bearing**
removing installing, section 34-380

14 — **Inner race (2nd) for input shaft**
drive inner race onto input shaft before assembling end cover, section 34-220

15 — **Circlip**
determining thickness, section 34-380

16 — **Baffle plate**

17 — **Inner race (1st) for input shaft**
installing, section 34-380

18 — **Washer**
installing, section 34-380

19 — **Switch — 45 Nm (33 ft lb)**
- not present on all models
- switches off A/C when 1st gear is engaged

20 — **Oil drain plug (with magnet) — 25 Nm (18 ft lb)**

21 — **Circlip for drive flange**

22 — **Circlip for ball bearing**

23 — **Ball bearing for drive flange**
- before removing, separate only bearing housing from Torsen differential, section 34-380
- removing installing, section 34-380

24 — **O-ring**
- always replace
- position in bearing housing groove

25 — **Bearing housing**
- can be removed with transmission installed
- Repair Group 39
- removing from end cover, section 34-380

26 — **Washer**

27 — **15 Nm (11 ft lb), plus an additional 90° (1/4 turn)**
- always replace
- clean threads in end cover

28 — **Seal**
- before removing, separate only bearing housing from Torsen differential, section 34-380, then press off drive flange
- pry out with screwdriver
- installing, section 34-380

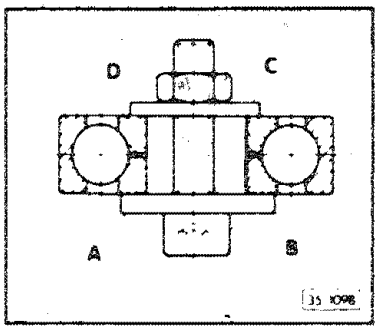
29 — **Drive flange**
- remove along with bearing housing from Torsen differential, section 34-380
- removing from bearing housing, section 34-380
- installing, section 34-380

CAUTION

Before bolting the driveshaft to the flange, be sure that the drive flange threads are free of locking compound. If not, clean the flange thoroughly with a thread cleaner.

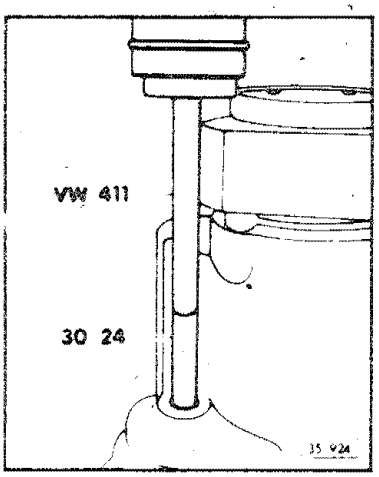
30 — **Circlip**

End cover assembly, disassembling/assembling



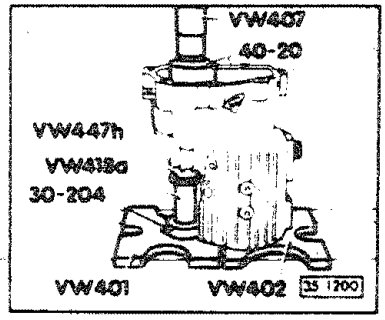
Input shaft ball bearing, preparing to press in

- sub-assemble as shown
  - A - original washer
  - B - socket head bolt
  - C - washer
  - D - inner race (2nd)



Ball bearing and drive flange shaft, removing from end cover

- remove baffle plate and circlip
- rework bearing seat in area of crimp marks, using 3-sided file
- press bearing out of end cover



Ball bearing and drive flange shaft, installing in end cover

> **CAUTION**
>
> Support end cover as shown.
>
> A misaligned bearing will catch in the groove for the circlip.

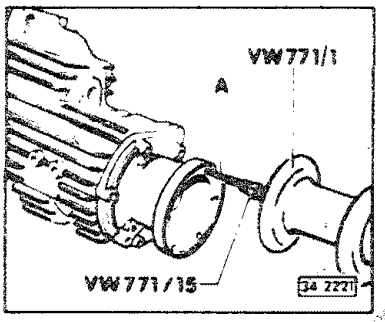
Note

After pressing the bearing in, remove the 2nd inner race (illustration 35-1098 in this section, item D).

- determine circlip thickness, as follows
  - first, try inserting a 2.90-2.98 mm circlip
  - use a thinner circlip (2.83-2.89 mm), if necessary. See chart which follows

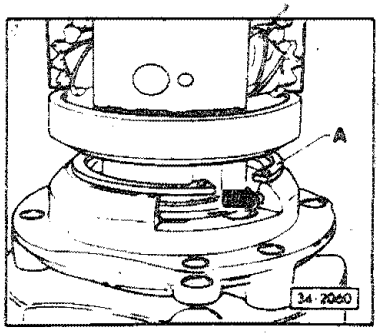
Circlips available as replacement parts:

Thickness (mm)	Part number
2.83-2.89	N 900 608 01
2.90-2.98	N 900 608 02



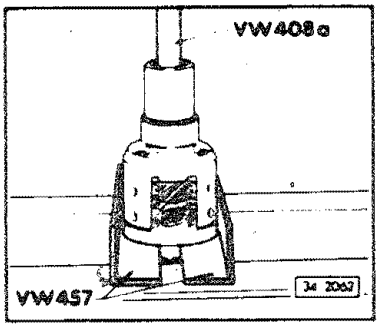
Bearing housing, removing from end cover

A – threaded pin M8 or M10

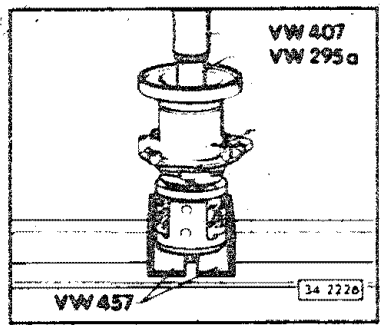


Circlip at Torsen differential, installing

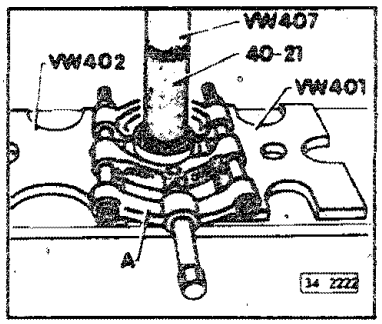
- seat circlip **A** along entire circumference of groove (**arrow**)



Torsen differential, separating from bearing housing

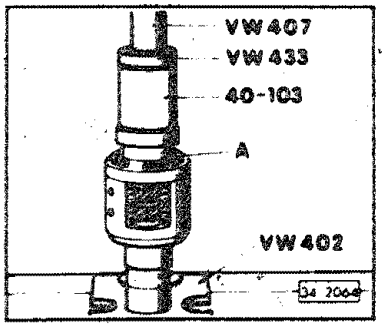


Torsen differential, installing in bearing housing



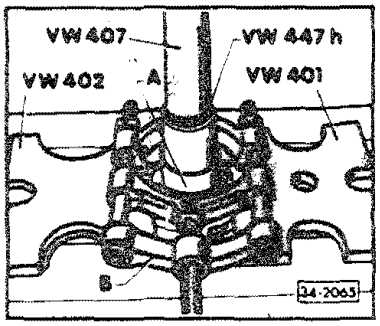
Ball bearing for Torsen differential, removing

A – separator (22-115 mm), Kukko 17-2



Ball bearing for Torsen differential, installing

- install circlip A before installing bearing

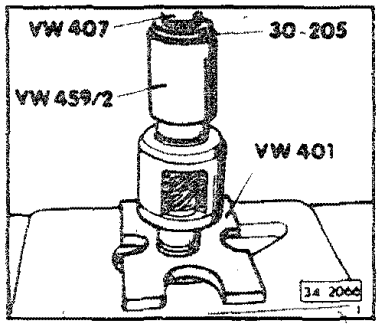


Large needle bearing inner race A for Torsen differential, removing

B – separator (22-115 mm), Kukko 17/2

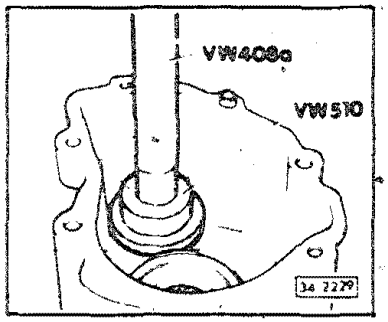
CAUTION

Press off carefully.

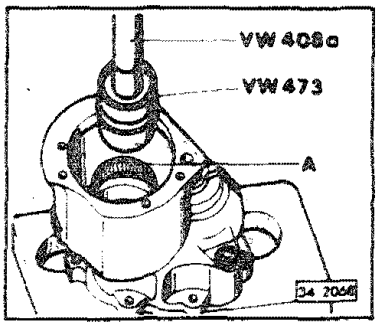


Large needle bearing inner race for Torsen differential, installing

≡ press on with graduated side of VW 459/2

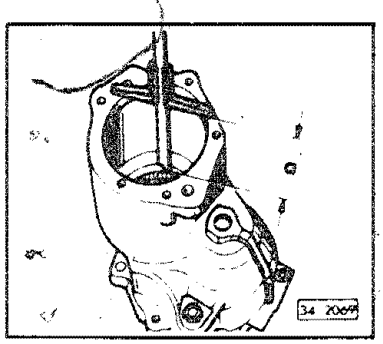


Large needle bearing outer race, removing from end cover



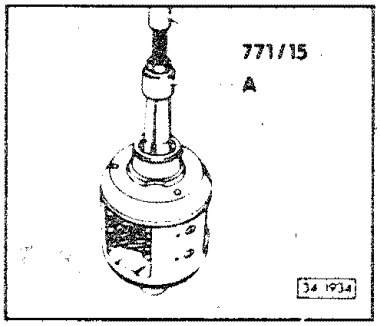
Large needle bearing outer race, installing in end cover

A – large needle bearing outer race



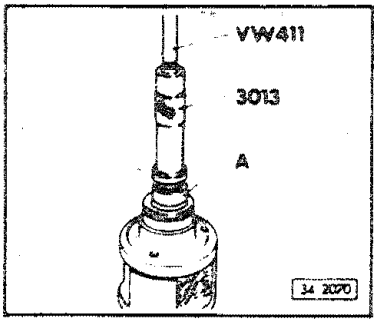
Large needle bearing outer race, press-in depth

a 130 mm (5.1 in.)



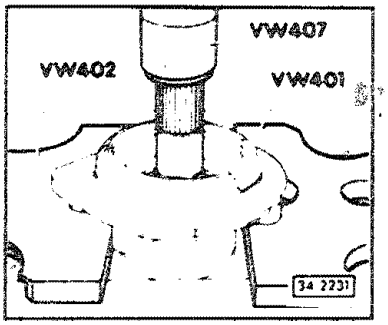
Small needle bearing, removing

- A puller (23.5-30.0 mm). Kukko 21/4
- always replace needle bearing if damaged

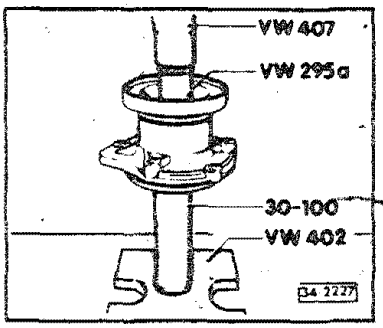


Small needle bearing, installing

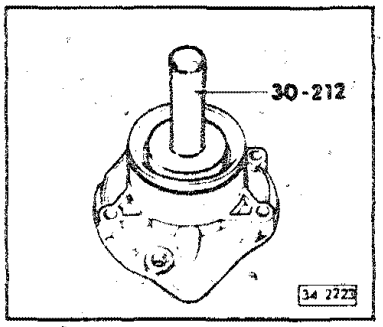
- A small needle bearing
- press in until seated



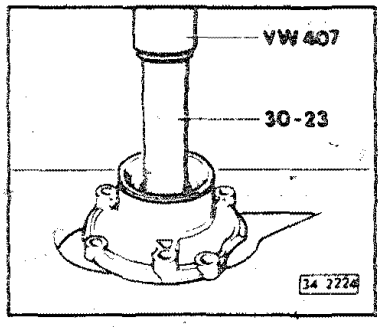
Flange shaft, removing



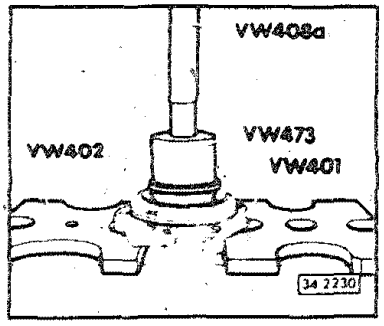
Flange shaft, installing



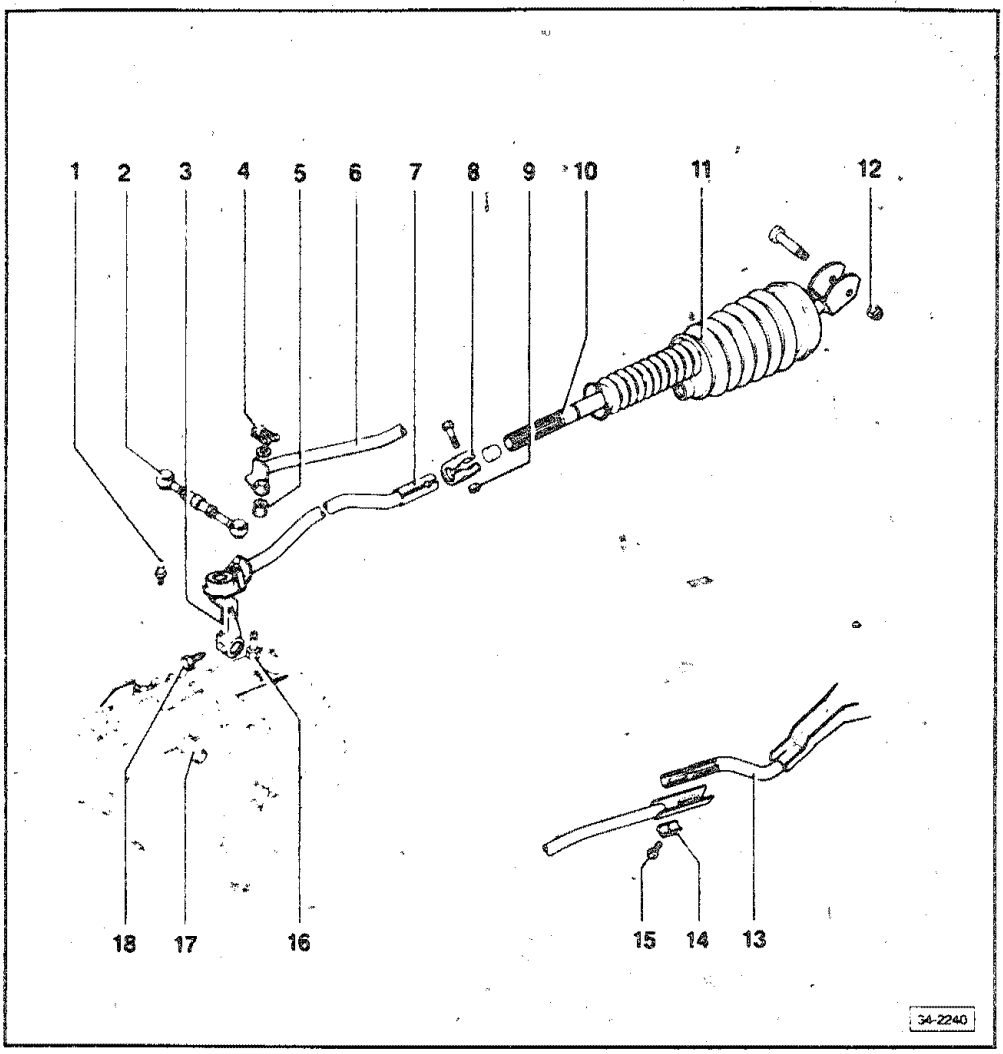
Flange shaft seal, installing



Flange shaft, removing ball bearing



Flange shaft, installing ball bearing



1 — **Ball stud**
installed position, section 34-240

2 — **Adjusting rod**
adjusting, section 34-130

3 — **Selector shaft lever**
- on transmission
- remove along with front shift rod

4 — **Clip**

5 — **Bushing**

6 — **Front push rod**
- remove only with transmission lowered
- lowering transmission, section 34-140
- installing, section 34-50

7 — **Front shift rod**
- remove only with transmission lowered
- lowering transmission, section 34-140
- remove along with transmission selector shaft lever. Do not pry rod off lever

8 — **Clamp**

9 — **25 Nm (18 ft lb)**

10 — **Rear shift rod**

11 — **Boot**

12 — **10 Nm (89 in. lb or 102 cm kg)**

13 — **Rear push rod**
removing, installing, section 34-90

14 — **Lock sleeve**

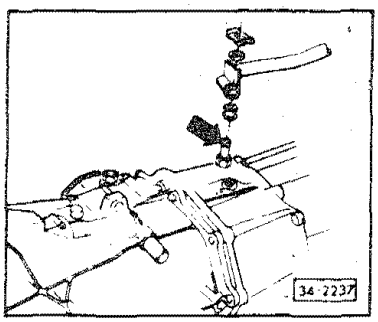
15 — **20 Nm (15 ft lb)**

16 — **Detent for 5th/reverse gear**
- with pivot pin for push rod
- mounted at gear carrier, section 34-50

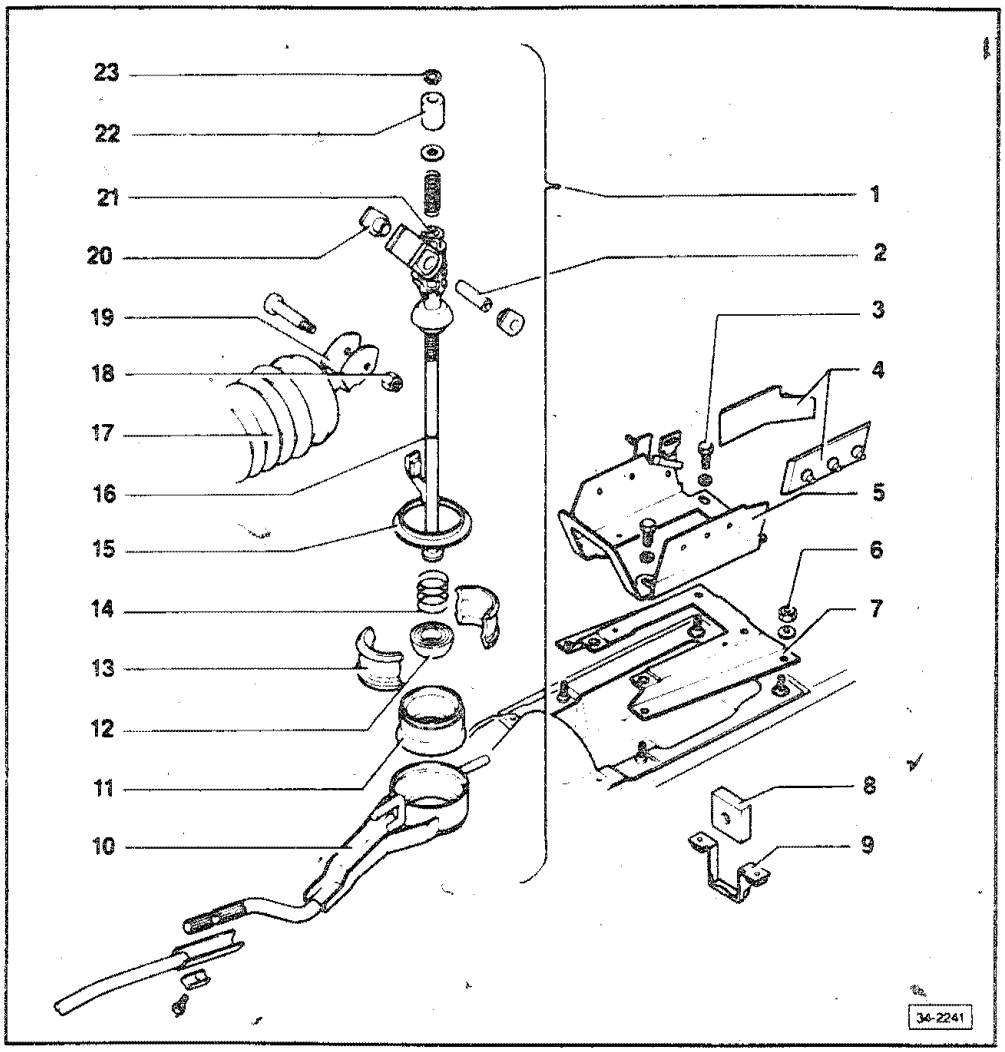
17 — **Shift fork**

18 — **Self-locking bolt — 20 Nm (15 ft lb)**

Front push rod, installing



- mount front push rod on pivot pin (arrow) at gear carrier



1 — **Gearshift lever assembly**
- disassemble only to lubricate
- pre-assemble rubber ring, bearing shells and lower ball halves
- install gearshift lever with spring, cover plate, and upper ball half into bearing shells
- press rubber ring into gearshift lever housing
- install metal ring and crimp housing at three points, section 34-70

2 — **Tube**

3 — **10 Nm (89 in. lb or 102 cm kg)**

4 — **Stop buff**

5 — **Stop plate**

6 — **10 Nm (89 in. lb or 102 cm kg)**

7 — **Cover plate**

8 — **Rubber bushing**

9 — **Bracket**

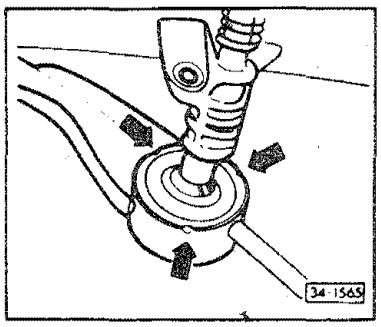
10 — **Rear push rod**
- with lever housing and pin
- pin length adjusting, section 34-100

11 — **Rubber ring**
install with collar up

12 — **Lower ball half**

13 — Bearing shells
14 — Spring
15 — Metal ring
16 — Gearshift lever
17 — Boot
18 — 10 Nm (89 in. lb or 102 cm kg)
19 — Rear shift rod
20 — Bushing
21 — Gearshift lever guide with upper ball half
22 — Bushing
23 — Circlip

Gearshift lever housing, crimping

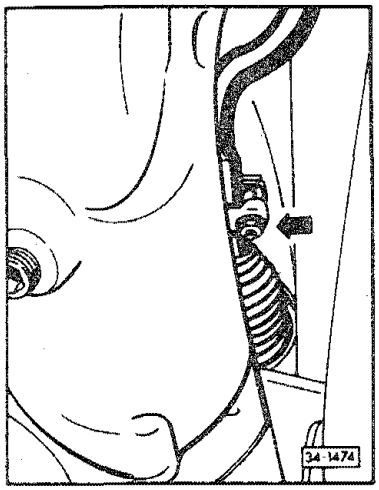


Shift rods, removing/installing

Removing

CAUTION

Before removing the front shift rod, lower the transmission and subframe, section 34-140.



- loosen clamp (**arrow**) between front/rear shift rods
  - it may first be necessary to remove catalytic converter and heat shield
- disconnect rear shift rod from gearshift lever
- remove rear shift rod from the top
- press off front shift rod at shift fork
  - shift rod should remain attached to transmission selector shaft lever
- remove adjusting rod
- slide shift rod/selector lever forward, under seat belt tensioning cable bracket
- remove rod/lever assembly

Installing

Note

Install in the reverse order of removal, noting the following:

- tightening torque for clamp bolt – 25 Nm (18 ft lb)
- checking/adjusting gearshift lever/linkage, sections 34-110, 34-120, and 34-130
- when installing rear shift rod, be sure boot is seated correctly

Push rods, removing/installing

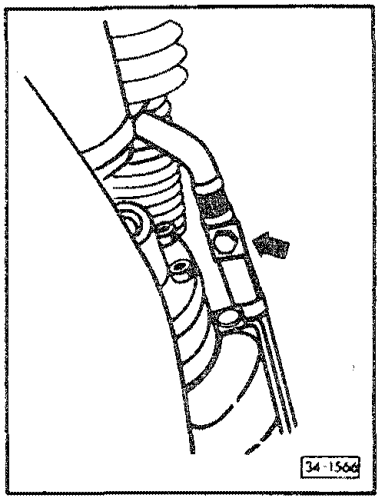
Removing

Note

The rear push rod should be removed complete with the gearshift lever and rear shift rod.

Before removing the front push rod, lower the transmission, section 34-140.

- loosen clamp between front/rear shift rods
  - it may first be necessary to remove catalytic converter and heat shield



- remove lock sleeve (**arrow**),
- remove center trim panel from center console, Repair Group 70
- remove stop assembly
- remove rear push rod, gearshift lever, and rear shift rod/boot, from top
- remove front push rod after removing circlip

Installing

- install in reverse order of removal

Note

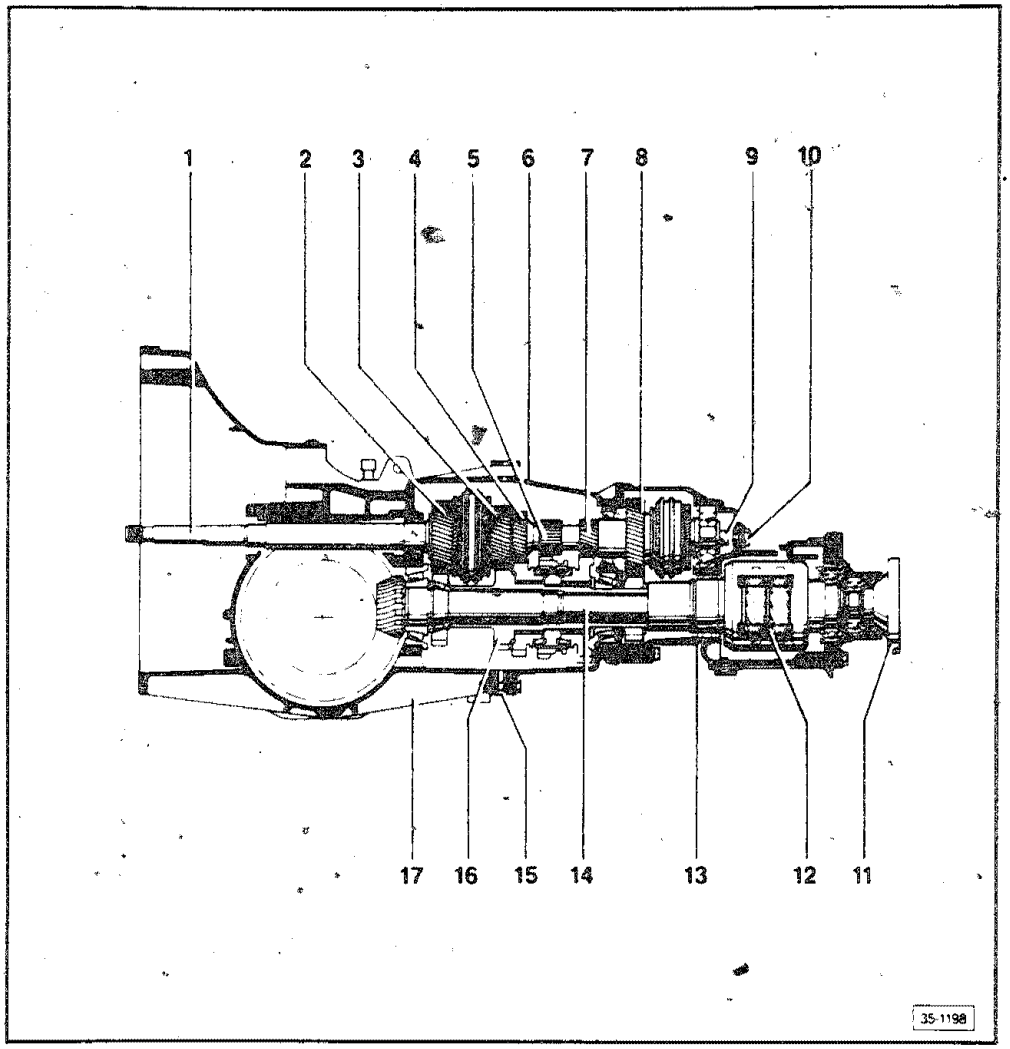
Be sure to seat the following correctly:
- circlip for front push rod
- boot for rear shift rod
- clamp between front/rear shift rods

- adjust length of pin at gearshift housing, section 34-100
  - check/adjust gearshift lever/linkage, sections 34-110, 34-120, and 34-130

Index

016 5-speed

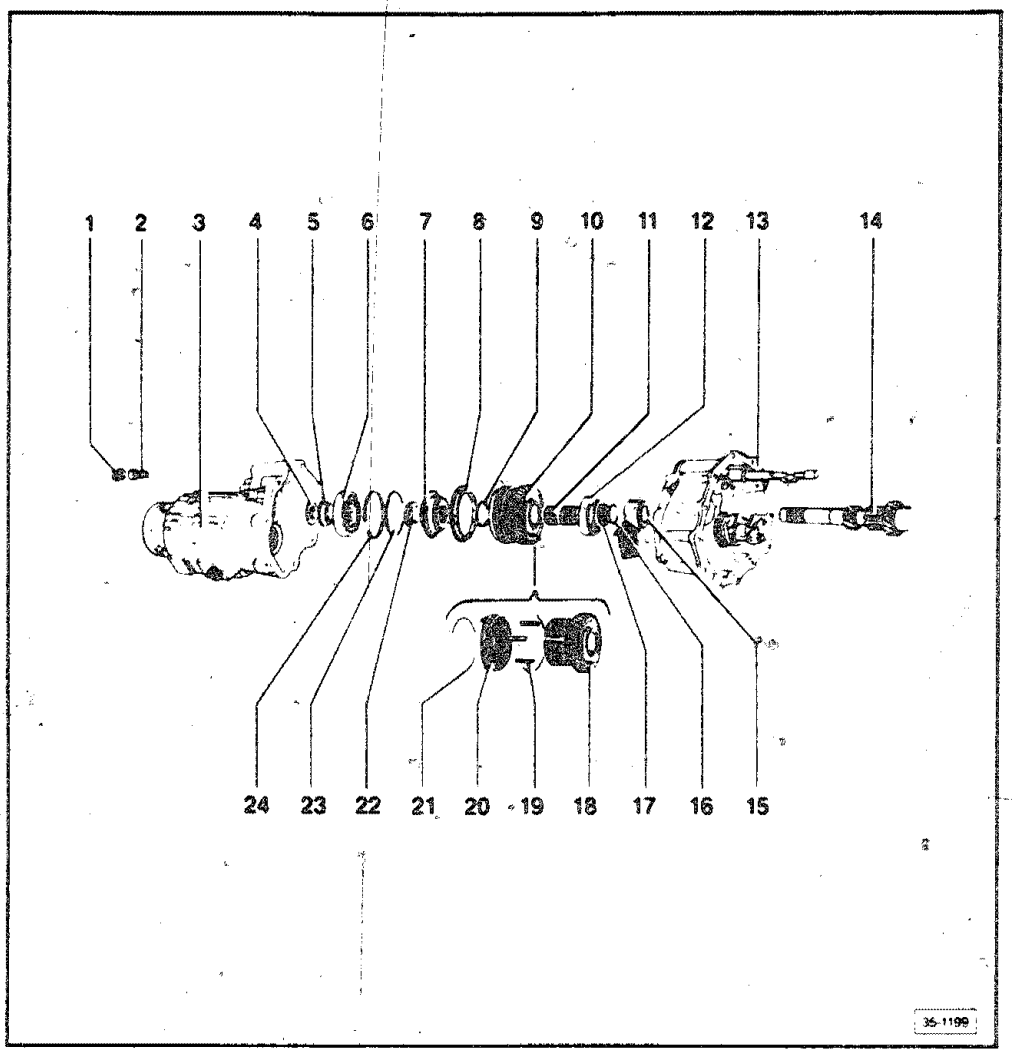
★ALL NEW INFORMATION since last filming



1 — **Input shaft**
assembling disassembling, section 35-30
2 — **4th gear**
3 — **3rd gear**
4 — **2nd gear**
5 — **Reverse gear**
6 — **Gear carrier housing**
7 — **1st gear**
8 — **5th gear**
9 — **Socket head bolt**
- tighten to **(37 ft lb)** plus 1/4 turn (90°) further
- always replace

10 — **Plug**
30 Nm (22 ft lb)
11 — **Driveshaft flange**
12 — **Torsen differential**
- do not disassemble
- removing/installing, see Repair Group 34

13 — **End cover**
14 — **Pinion**
assembling disassembling, section 35-50
15 — **Spacer plate**
16 — **Hollow shaft**
assembling disassembling, section 35-50
17 — **Transmission housing**



1 — 30 Nm (22 ft lb)

2 — 50 Nm (37 ft lb) plus an additional 1/4 turn (90°)

3 — End cover

4 — Washer

5 — Ball bearing 1st inner race

6 — Input shaft ball bearing
removing/installing: section 35-30

7 — 5th gear hub

8 — 5th gear synchronizer ring
checking for wear: section 35-30

9 — Circlip

10 — 5th gear with sleeve and synchronizer hub
installing: section 35-30

11 — 5th gear needle bearing

12 — Input shaft roller bearing
- pressing out: section 35-30
- note insertion depth when pressing in: section 35-30

13 — Gear carrier housing

14 — Input shaft

15 — Roller bearing inner race
installation position: notch (arrow) points toward 5th gear

16 — Circlip

17 — Thrust washer

18 — 5th gear with synchronizer hub

19 — Keys

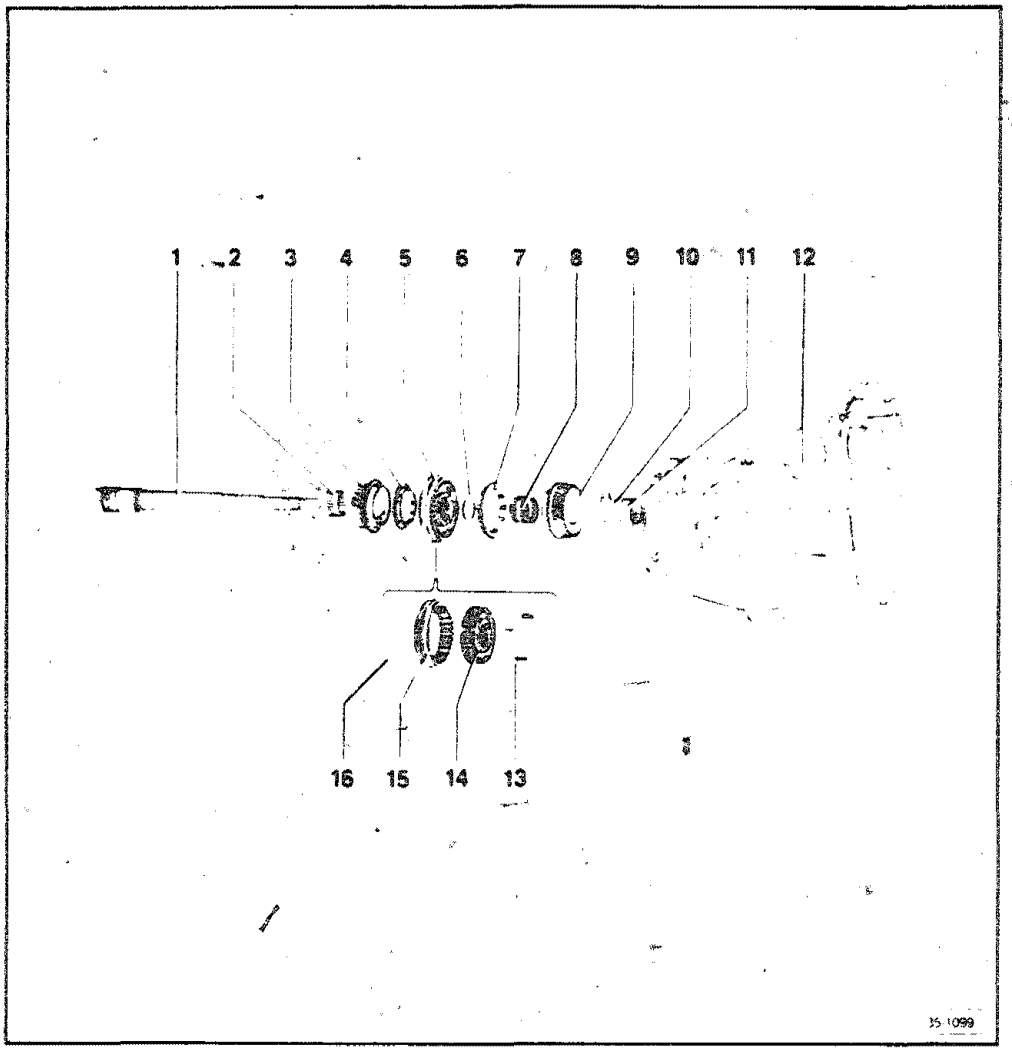
20 — Synchronizer sleeve

21 — Spring

22 — Ball bearing 2nd inner race
before assembling end cover, drive race onto shaft

23 — Baffle plate
always replace

24 — Circlip
determining thickness, section 35-30



1 — **Input shaft**

2 — **3rd gear needle bearing**

3 — **3rd gear**

4 — **3rd gear synchronizer ring**
- top angle 115
- friction surface coated with molybdenum
- checking for wear section 35-30

5 — **3rd 4th gear synchronizer gear assembly**
- removing installing section 35-30
- note position when removing section 35-30

6 — **Circlip**
determining thickness section 35-30

7 — **4th gear synchronizer ring**
- top angle 115
- friction surface coated with molybdenum
- checking for wear section 35-30

8 — **4th gear needle bearing**

9 — **4th gear**

10 — **Circlip**

11 — **Input shaft needle bearing**
removing installing section 35-30

12 — **Transmission housing**

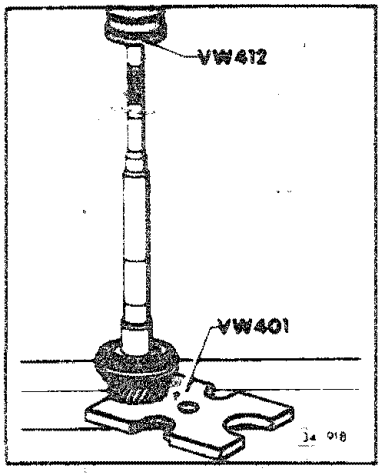
13 — **Keys**

14 — **Synchronizer hub**

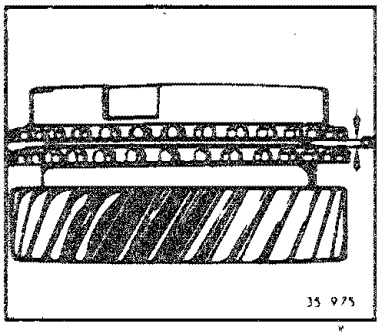
15 — **Synchronizer sleeve**

16 — **Spring**

Input shaft, disassembling/assembling



3rd gear, removing



Synchronizer rings, checking

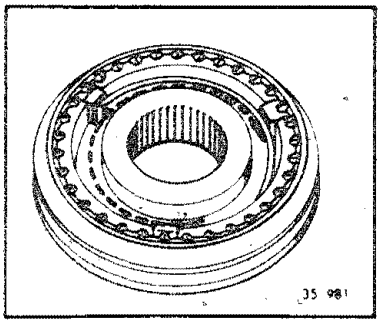
- press synchronizer rings on gear cones and measure slot dimension "a" with feeler gauge
  - 3rd and 4th gears

    a new part 1.0-1.7 mm (0.039-0.067 in.)

    wear limit 0.5 mm (0.020 in.)
  - 5th gear

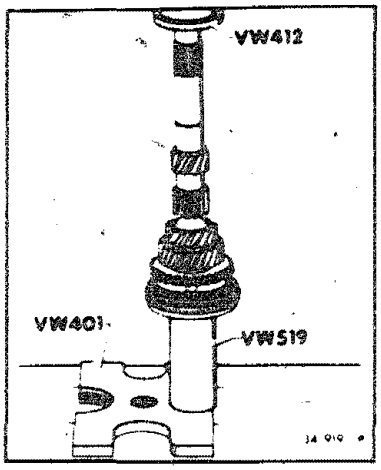
    a new part 1.0-1.9 mm (0.039-0.075 in.)

    wear limit 0.5 mm (0.020 in.)



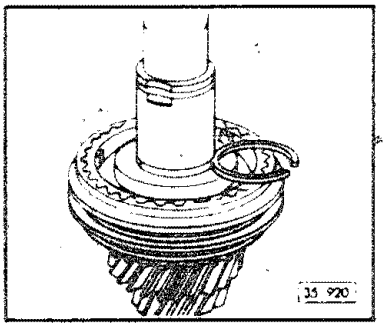
Synchronizer sleeve/hub, assembling

- push sleeve over synchronizer body
- insert keys and mount springs with ends staggered 120° apart
  - spring bent end must engage in hollow key



Synchronizer sleeve/hub, installing

- turn synchronizer rings until grooves are aligned with keys
- install with wider collar of hub facing 4th gear

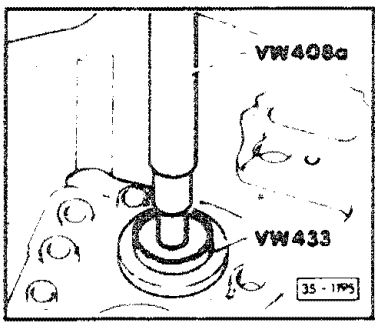


Synchronizer end play, adjusting

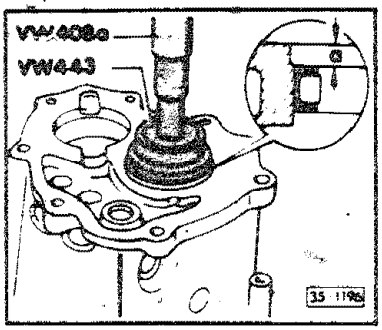
- determine thickest circlip that will fit and install circlip

The following circlips are available

Thickness (mm)	Part number
1.50	088 311 317
1.56	088 311 317 B
1.62	088 311 317 C

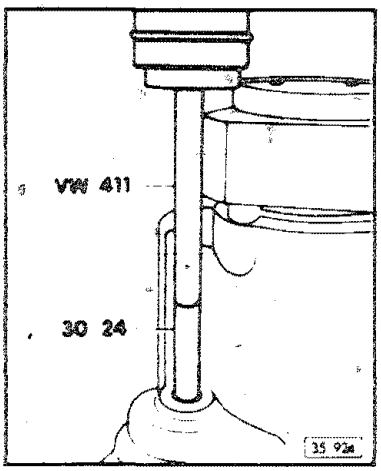


Roller bearing in gear carrier housing, pressing out



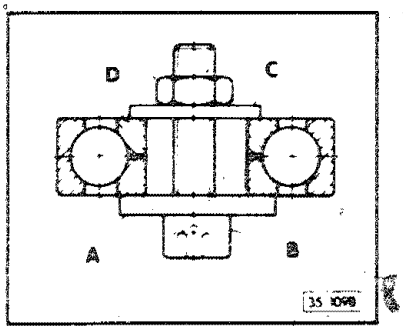
Roller bearing in gear carrier housing, pressing in

- a = 8.5-9.0 mm



Input shaft ball bearing, pressing out of end cover

- remove baffle plate and circlip
- rework bearing seat in area of crimps marks with three-sided file
- press bearing out of end cover



Input shaft ball bearing, preparing to press in

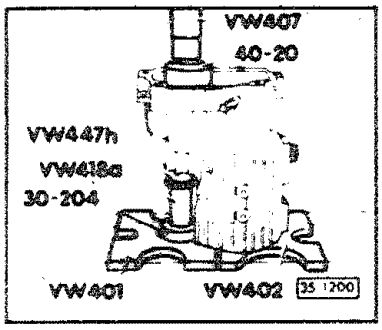
- sub-assemble as shown

A original washer

B socket head bolt

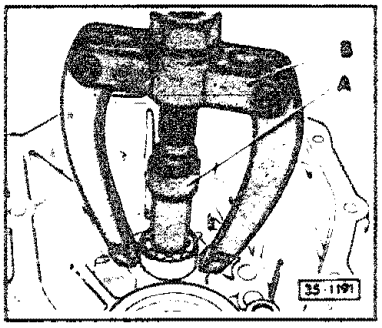
C washer

D 2nd inner race



Input shaft ball bearing, pressing in

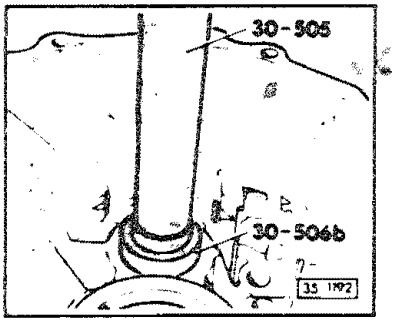
- support end cover on sides
- after installing bearing, remove 2nd inner race and drive onto main shaft, see Repair Group 34
- determine circlip thickness, see Repair Group 34
- install circlip
- press in baffle plate and crimp
- remove bolt, nut and washer



Needle bearing in transmission housing, removing

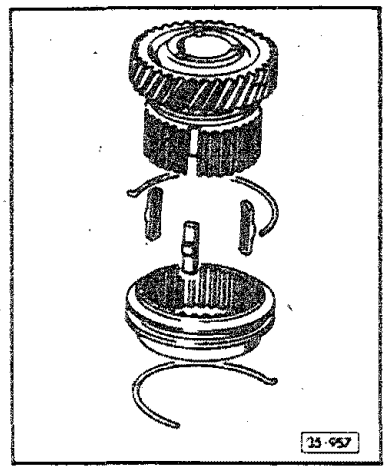
A puller 30-37 mm, e.g. **Kukko 21/5**

B support, e.g. **Kukko 22/2**



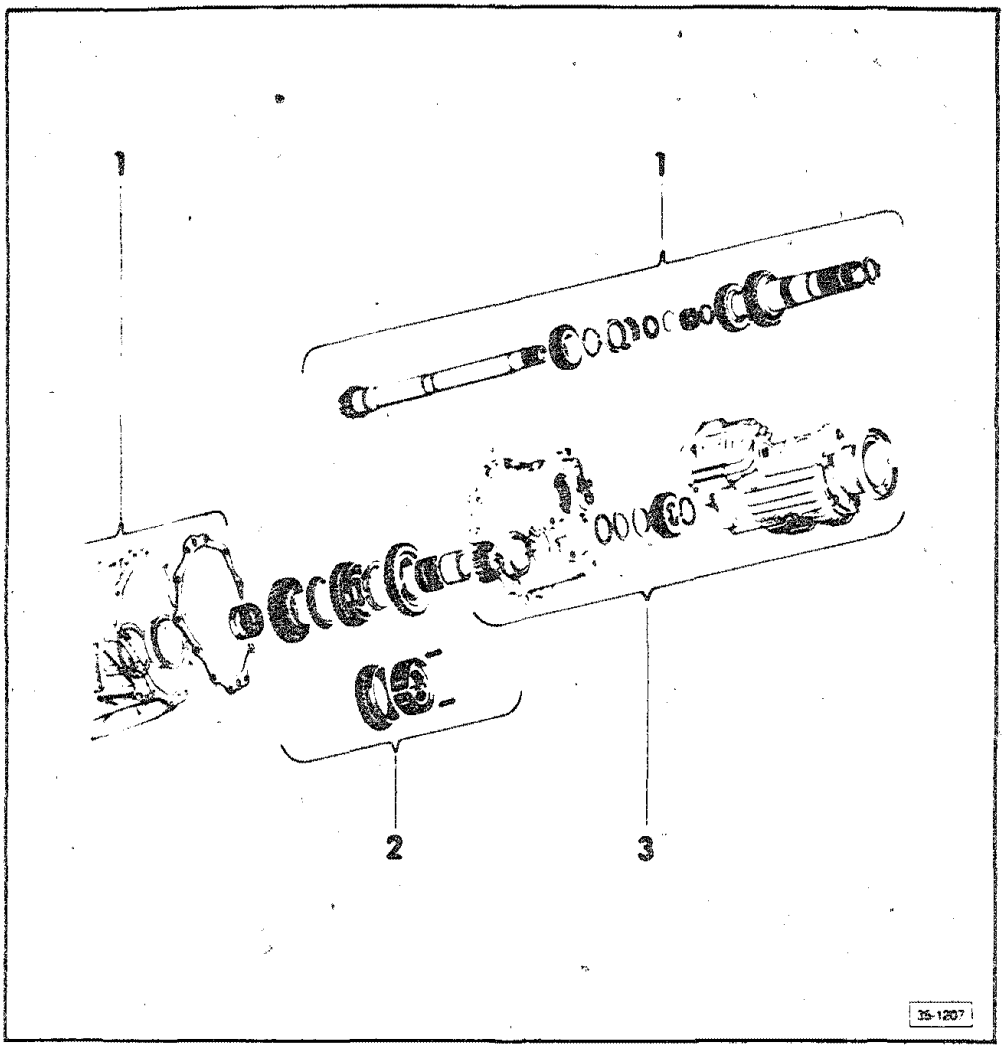
Needle bearing in transmission housing, installing

- drive in flush
  - stepped side of 30-506b must be toward 30-505



5th gear with synchronizer sleeve and hub, assembling

- push sleeve over hub with short collar toward gear and insert keys
- hook spring into first key on gear side
- pull 2nd and 3rd keys back slightly, press in spring with screwdriver and push keys over spring
- insert second spring with end offset 120° from first spring



CAUTION

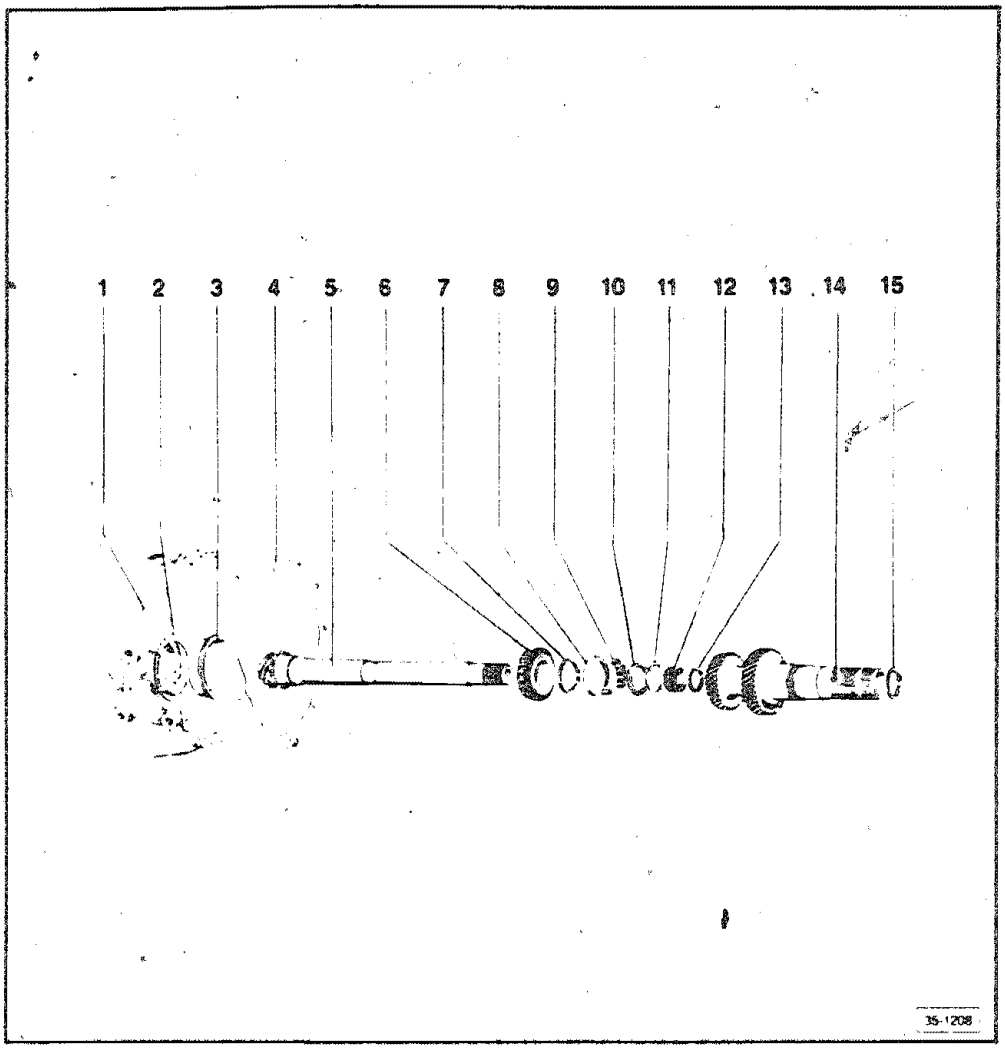
When replacing pinion bearings prior to disassembling, determine the installation position of the pinion through actual measurement. See Repair Group 39.

Replace both taper roller bearings of the pinion together. When possible use products from the same manufacturer.

1 — Pinion/hollow shaft assembly
section 35-50

2 — Hollow shaft assembly
section 35-60

3 — Gear carrier housing/end cover
section 35-70



Note

When installing new gears see Technical Data

- When replacing these parts adjustments are necessary — see adjustment overview Repair Group 39

1 — **Transmission housing***

2 — **Adjusting shim***
see adjustment overview Repair Group 39

3 — **Large bearing outer race***
removing installing, section 35-80

4 — **Spacer plate***

5 — **Pinion***
ring gear and pinion come as matched set

6 — **Large bearing inner race***
- removing installing, section 35-80
- adjusting end play, section 35-80

7 — **Circlip**
- available in various thicknesses
- measuring, section 35-80

8 — **Spacer ring**
installed position section 35-80

9 — **Tapered rollers**
- quantity 23
- installing, section 35-80

10 — Support ring
installed position, section 35-80

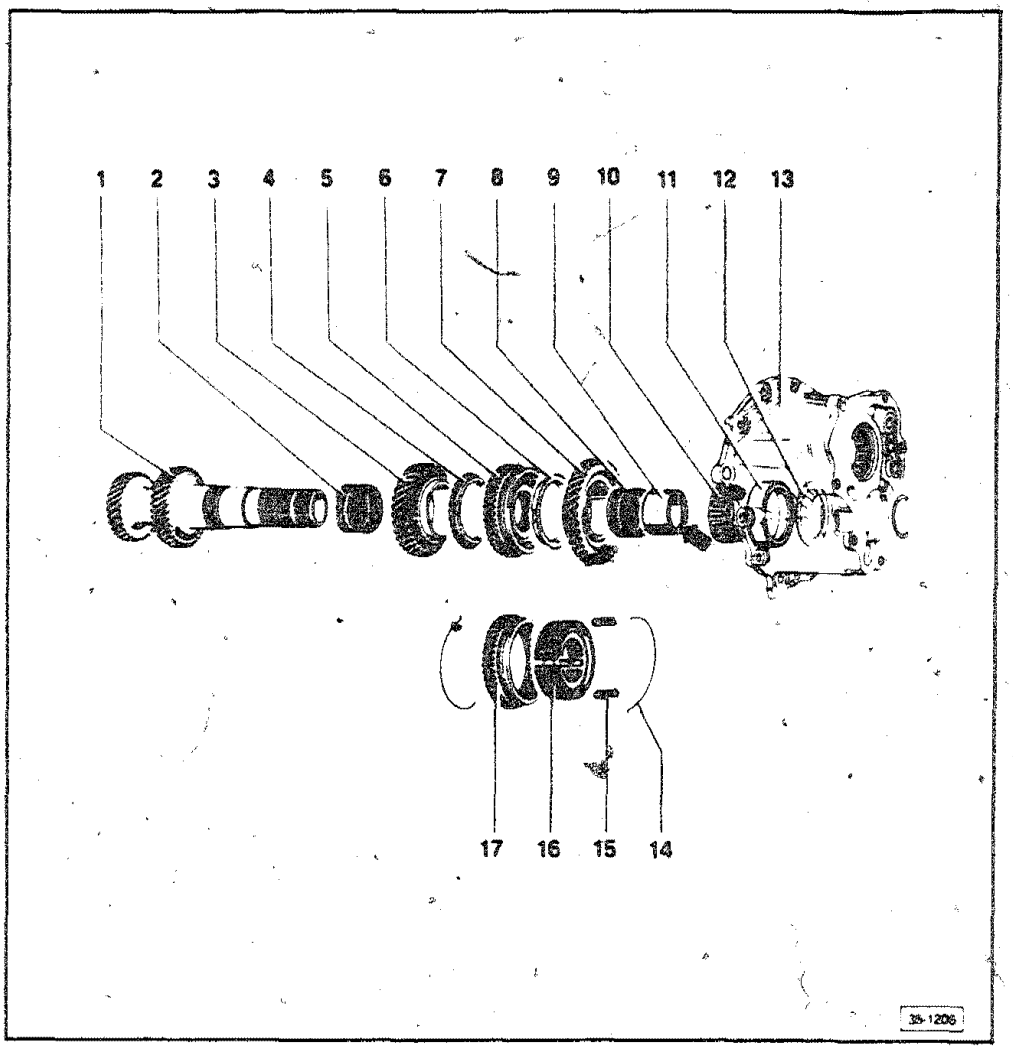
11 — Wavy spring

12 — Needle bearing

13 — Circlip

14 — Hollow shaft*
with 3rd/4th gears

15 — Circlip
- prevents pinion from falling out of hollow shaft when removing gear carrier housing
- remove only when removing pinion



Note

*When these parts are replaced, adjustments are necessary — see adjustment overview, Repair Group 39

1 — Hollow shaft*
with 3rd 4th gears

2 — 2nd gear needle bearing

3 — 2nd gear

4 — 2nd gear synchronizer ring
- top angle = 115°
- friction surface (with oil groove) coated with molybdenum
- checking for wear, section 35-80

5 — 1st/2nd gear synchronizer sleeve/hub*
- removing/assembling/installing, section 35-80

6 — 1st gear synchronizer ring
- top angle = 110°
- for 1st/4th gear, only synchronizer rings with 150° top angle and with molybdenum coated friction surface (with oil groove) are supplied as replacement parts
- checking for wear, section 35-80

7 — 1st gear

8 — 1st gear needle bearing*

9 — 1st gear needle bearing inner race*
installed position - ridge (arrow) faces small bearing inner race

10 — Small bearing inner race*
removing installing, section 35-80

11 — Small bearing outer race*
removing installing, section 35-80

12 — Adjusting shim S4*
see adjustment overview, Repair Group 39

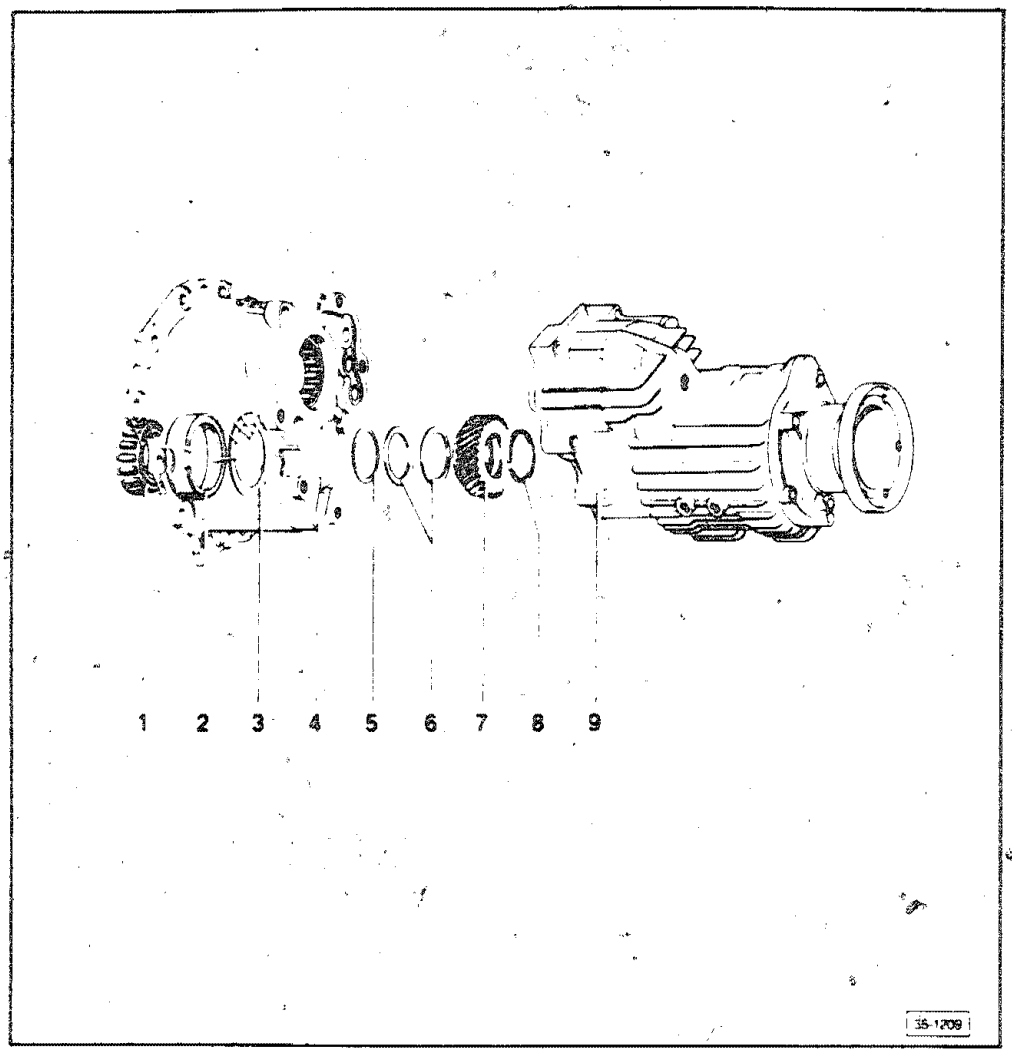
13 — Gear carrier housing*

14 — Spring

15 — Keys

16 — Synchronizer hub

17 — Synchronizer sleeve



Note

*When replacing these parts, adjustments are required — see adjustment overview, Repair Group 39

1 — **Small bearing inner race***
removing/installing, section 35-80

2 — **Small bearing outer race***
removing/installing, section 35-80

3 — **Adjusting shim S4***
see adjustment overview, Repair Group 39

4 — **Gear carrier housing***

5 — **5th gear adjusting shim**
determining thickness, section 35-80

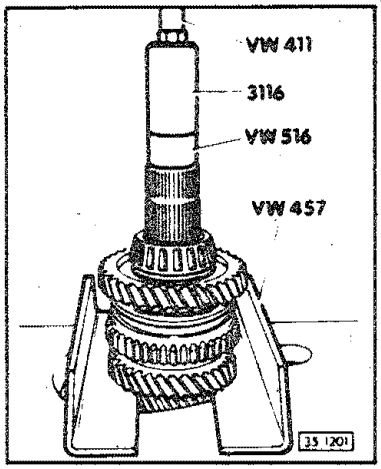
6 — **Spring washers**
installed position, section 35-80

7 — **5th gear**
removing, section 35-80

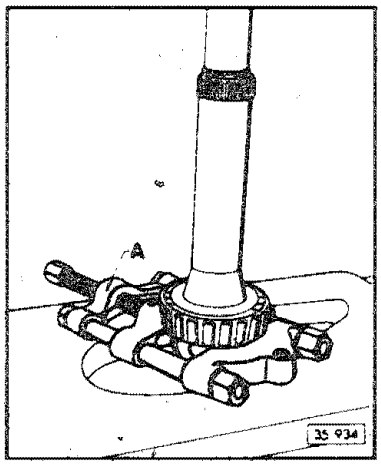
8 — **Circlip**

9 — **End cover**

Pinion/hollow shaft, disassembling/assembling

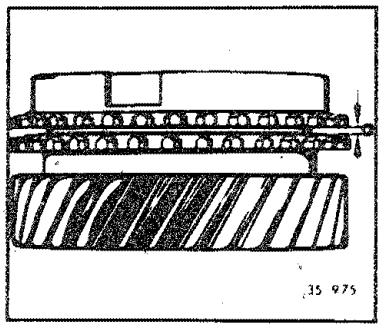


Small bearing inner race/1st gear/synchronizer sleeve and hub/2nd gear, removing



Large bearing inner race, removing

A separating fixture, 12-75 mm, e.g. **Kukko 17/1**

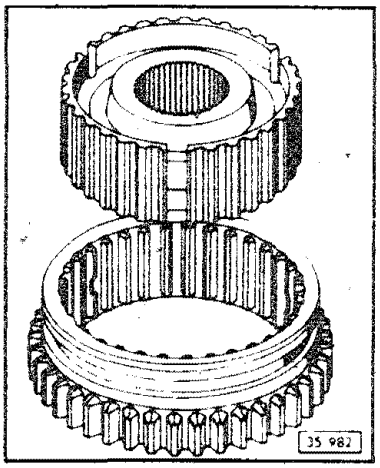


Synchronizer rings, checking

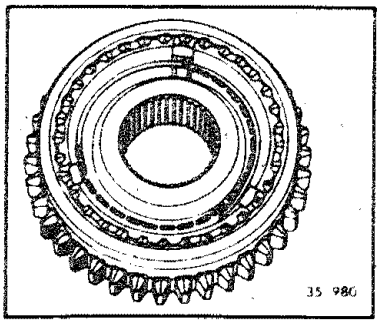
- press synchronizer rings onto gear cones and measure gap a with feeler gauge
  - **1st/2nd gear**

    a new part: 1.0-1.7 (0.039-0.067 in.)

    wear limit: 0.5 mm (0.020 in.)

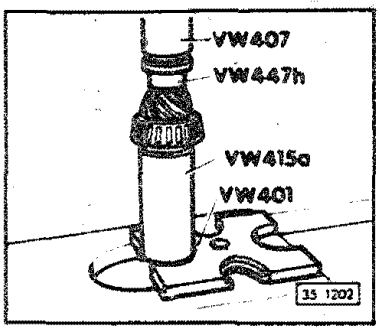


1st/2nd gear synchronizer sleeve/hub, assembling

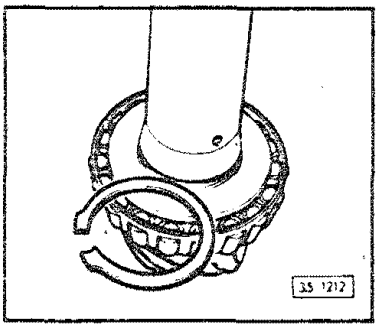


Synchronizer sleeve/hub, assembling

- push sleeve over synchronizer hub (recesses must align)
- insert keys and install springs
  - springs must be staggered 120
  - angled ends of spring must engage in hollow key



Large bearing inner race, installing

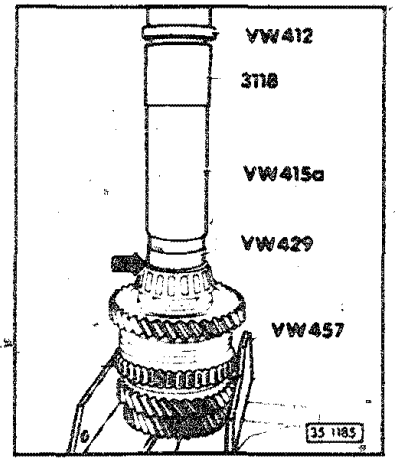


Large bearing inner race end play, adjusting

- determine and install thickest circlip that will fit

The following circlips are available:

Thickness (mm)	Part number
2.34	N 901 080 01
2.36	N 901 081 01
2.38	N 901 082 01
2.40	N 901 083 01
2.42	N 901 084 01
2.44	N 901 085 01
2.46	N 901 086 01
2.48	N 901 087 01
2.50	N 901 088 01



Small bearing inner race/1st gear/synchronizer sleeve and hub/2nd gear, installing

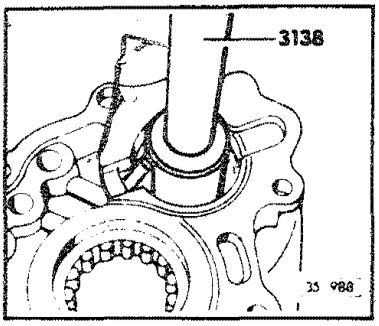
CAUTION

Before pressing, the 5th gear shim must be installed on the small bearing inner race (**arrow**) or bearing will be damaged.

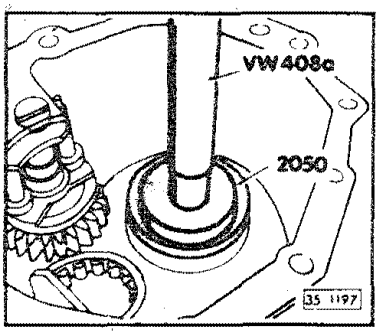
Always replace the shim.

Note

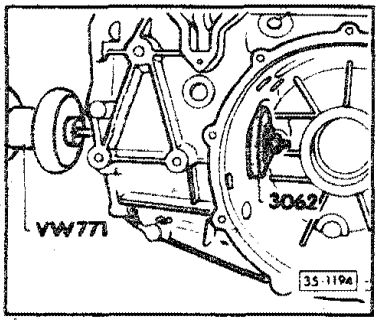
The pinion remains in the hollow shaft when pressing on.



Small bearing outer race, removing

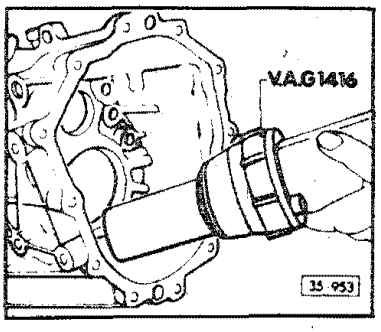


Small bearing outer race, installing



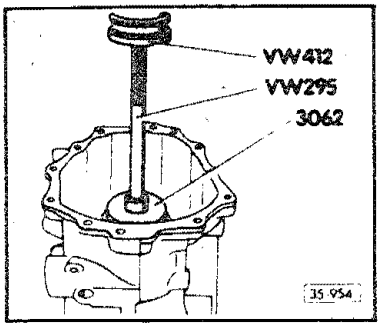
Large bearing outer race, removing

- stepped side of tool 3062 faces tool **VW771/1**



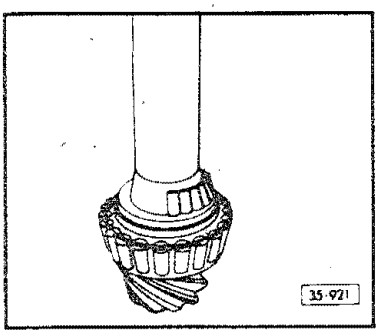
Large bearing outer race, installing

- heat housing to 100 °C (212 °F) using hot air gun (heat for approximately 15 minutes)



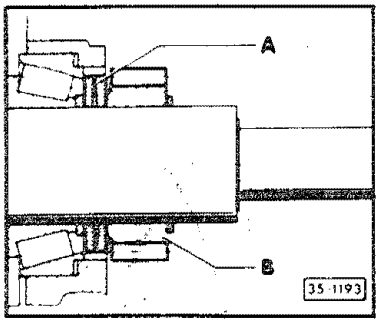
Large bearing outer race, installing

- install outer race only after housing has been heated
- hold parts in press for two minutes to allow heat exchange



Tapered rollers, installing

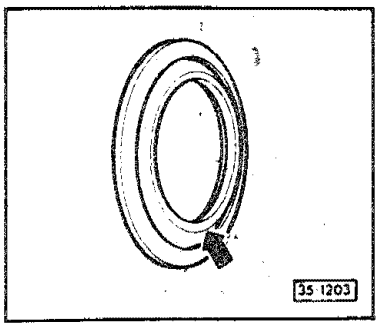
- grease rollers and install with depression facing pinion head



Spring washers, installed position

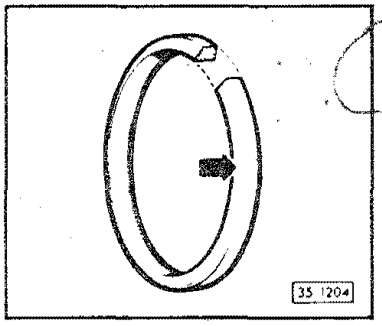
A - springs

B - 5th gear



Spacer ring, installed position

- install spacer ring with cone (**arrow**) facing tapered rollers



Support ring; installed position

- install support ring with cone (**arrow**) facing tapered rollers

Index

5-speed 016

★ ALL NEW INFORMATION since last filming

Pinion, adjusting

Output shaft, adjusting

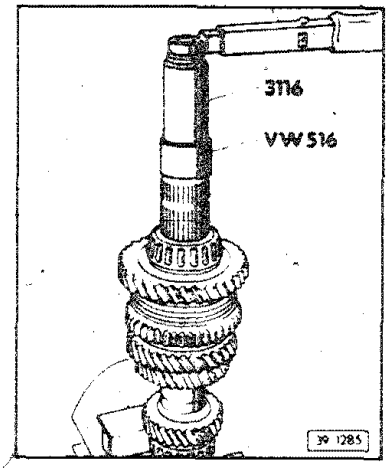
Note

It is only necessary to readjust the pinion as shown below, when the ring gear and pinion are being replaced. If other parts which affect the position of the pinion are replaced, reset the pinion to its original position, section 39-90

See Adjustment Overview, section 39-70

Pinion bearing preload, adjusting

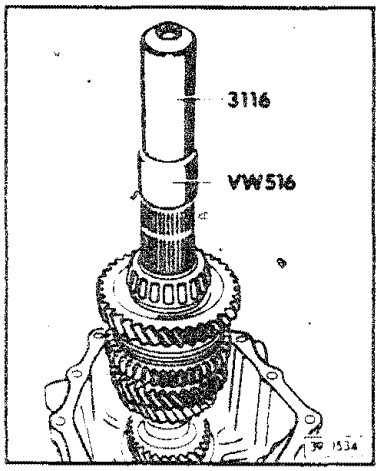
- Install bearing outer races in final drive housing gear carrier housing without shims, Repair Group 35
- Assemble pinion



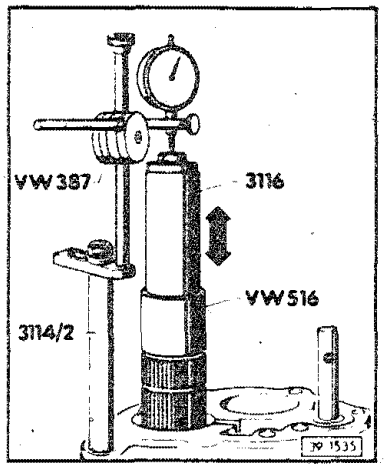
- Install sleeve **3116** and tube **VW 516**
  - Tighten bolt to 10 Nm (89 in. lb or 102 cm kg)
  - Use jaw covers on vise

Note

Before tensioning the pinion and hollow shaft, the pinion circlip must be installed so that it is not damaged



- install pinion in housing without shift forks and selector rod
- remove reverse sliding gear shaft from gear carrier housing
- remove reverse gear
- install gear carrier housing and spacer plate
  - tighten bolts to 25 Nm (18 ft lb)



- install measuring tools
  - zero dial indicator (3 mm range) with 1 mm preload
- move pinion up and down (**arrow**)
  - note reading

Example

Reading = 1.30 mm

CAUTION

While taking measurements do not turn the pinion, or the bearings will settle, resulting in an incorrect reading.

- remove gear carrier housing

S_{total} (S3 + S4), determining

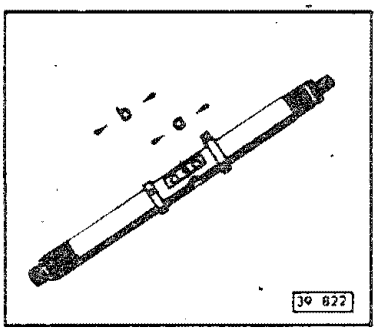
S_{total} = measured reading - preload

Example

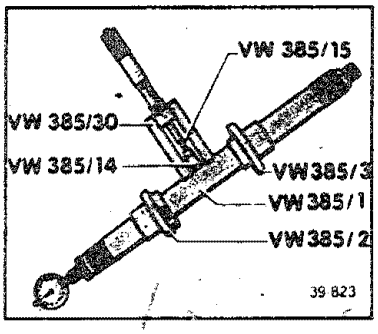
Preload (constant value)	0.30 mm
Reading (example)	1.30 mm
S_{total}	1.60 mm

Dimension e, determining

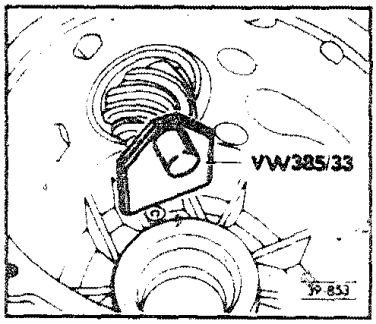
- install appropriate shims (example 1.60 mm) behind the bearing outer race in gear carrier housing (**S4** side)
- install gear carrier housing
- turn pinion in both directions several times to seat bearings



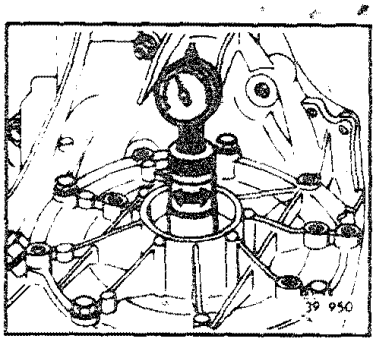
- set universal measuring bar **VW 385.1** to dimension **a** 35 mm
- set sliding ring to dimension **b** 75 mm



- assemble bar as shown
  - indicator extension **VW 385 15** 9.3 mm long
- set universal master gauge **VW 385 30** to R_e 59.65 mm
- place master gauge on measuring bar and set dial indicator (3 mm range) to 0 with 1 mm preload



- place end plate **VW 385/33** on pinion end face
- remove master gauge and install measuring bar in housing
  - centering disc **VW 385/2** faces final drive cover
- install cover for final drive housing and tighten four bolts
- pull 2nd centering ring outward over sliding ring until measuring bar can just be turned by hand

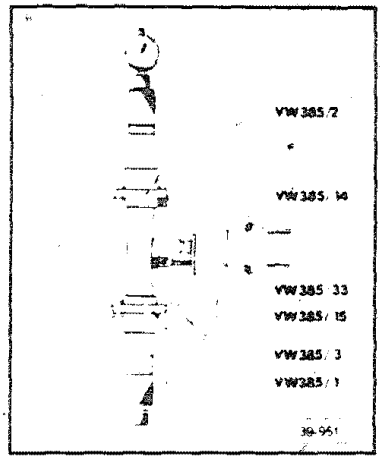


Dimension e, measuring

- turn measuring bar until dial indicator contacts end face of pinion and indicates maximum deflection (return point)
  - measured reading (black number range) dimension e

Example

e = 0.46 mm



S3 shim, determining thickness

S3 = e - r

Note

e = dial indicator reading (maximum deflection)

r = deviation (marked on ring gear in 1/100 mm or determined by actual measurement)

Example

Dial indicator reading e	0.46 mm
Deviation r on ring gear	- 0.18 mm
S3 shim thickness	0.64 mm

Note

The following shims are available:

Thickness (mm)	Part number
0.20	016 311 391 E
0.25	016 311 391 F
0.30	016 311 391 G
0.35	016 311 391 H
0.40	016 311 391 J
0.65	016 311 391 K
0.90	016 311 391 L
1.15	016 311 391 M

Note

Due to varying tolerances, check all shims with a micrometer for correct thickness. Exact shim thickness can be attained by using shims that are thicker or thinner than specifications.

S4 shim, determining thickness

S4	S_{total}	**S3**

Example

Total shim thickness	1.60 mm
S3 shim thickness	0.64 mm
S4 shim thickness	0.96 mm

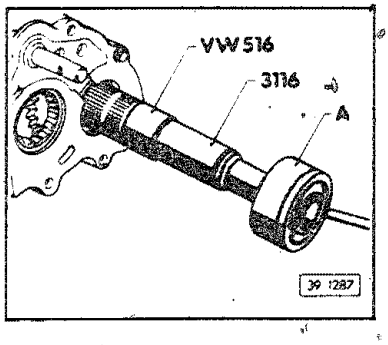
Note

The following shims are available:

Thickness (mm)	Part number
0.24	016 311 393 BA
0.27	016 311 393 BB
0.30	016 311 393 BC
0.33	016 311 393 BD
0.36	016 311 393 BE
0.39	016 311 393 BF
0.42	016 311 393 BG
0.45	016 311 393 BH
0.69	016 311 393 BJ
0.93	016 311 393 BK
1.17	016 311 393 BL
1.41	016 311 393 BM

Measurements, checking

- install pinion with correct shims **S3** and **S4**
- turn pinion in both directions several times
- install universal measuring bar and check measurements
  - shims have been selected correctly if the dial indicator shows deviation ± within tolerance of ± 0.04 mm, reading counterclockwise on red scale



Pinion bearing preload, checking

- measure turning torque

  A – commercial torque wrench, suitable range

- check turning torque and compare with specifications:
  - new bearings 250-350 Ncm (22.1-31.0 in. lb)
  - used bearings 30-60 Ncm (2.7-5.3 in. lb)

Axle flange oil seal, removing/installing (transmission installed)

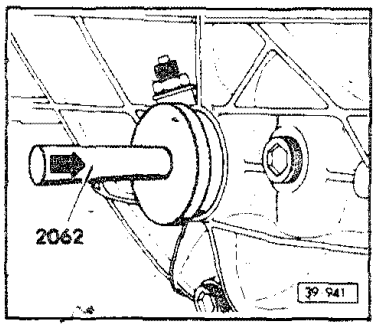
Removing

- remove front exhaust pipe. Repair Group 26
- remove axle shaft cover plate (right side)
- disconnect axle shaft
- remove axle flange bolt
  - hold flange stationary with drift
- place drip tray underneath and withdraw flange
- pry out oil seal with extractor lever **VW 681**

Installing

Note

Install in the reverse order of removal, noting the following:



- drive oil seal in, to stop
  - on right side, use sleeve **30-20** if necessary

Tightening torques

Axle flange to transmission	10 Nm (89 in. lb or 102 cm kg), plus an additional 90° (1/4 turn)
Axle shaft to axle flange M10 bolts	80 Nm (59 ft lb)

Ring gear, adjusting

Differential, adjusting

Note

The ring gear must be adjusted if any of the following parts are replaced:

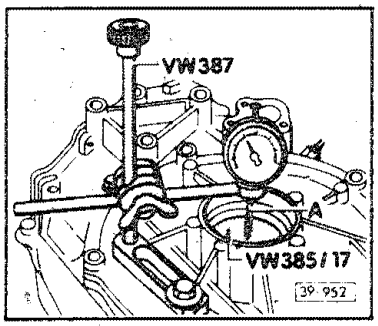
- final drive housing
- final drive cover
- differential bearings
- differential gear housing
- ring and pinion set
- oil pump drive wheel

See Adjustment Overview, section 39-70.

Differential bearings preload

(pinion removed)

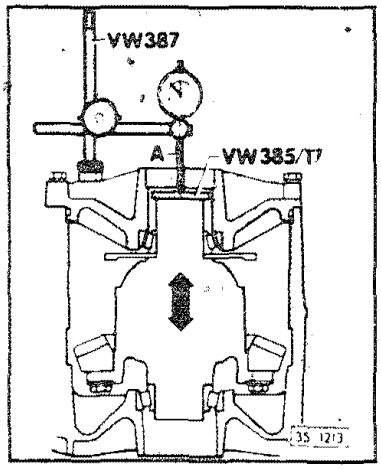
- remove oil seals and outer races of differential bearings
- remove shims, section 39-40
- install bearing outer races without shims and drive home fully, section 39-40
- install differential into housing without speedometer gear
  - ring gear positioned on left side, opposite final drive cover
- install cover on wheel shaft, without oil pump drive wheel
  - tighten bolts to 25 Nm (18 ft lb)



- attach measuring equipment
- zero dial indicator (3 mm range) with a 1 mm preload

  A – dial indicator extension, 30 mm long

- move differential up and down



- read end play from dial indicator
  - A – dial indicator extension, 30 mm long
- note reading

Example

Reading = 1.42 mm

CAUTION

Do not turn differential while taking measurements, or bearings will settle, resulting in an incorrect reading.

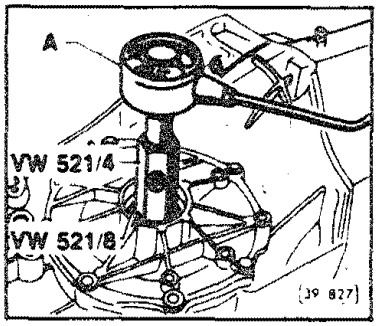
S_{total} (S1 + S2), determining

S_{total} = dial indicator reading + preload

Example

Preload (constant value)		0.50 mm
Reading (example)	+	1.42 mm
S_{total}	=	1.92 mm

- install shim of appropriate thickness (e.g. 1.92 mm) behind bearing outer race in final drive cover (S2 side)



Turning torque, measuring

- lubricate bearings with hypoid oil before installing

  A – commercial torque wrench, suitable range

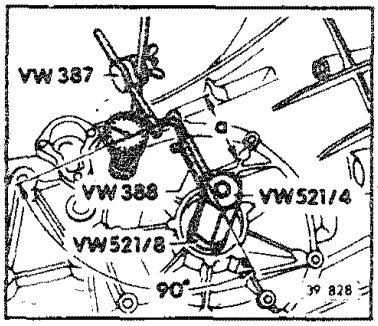
- check turning torque and compare with specifications
  - new bearings - 250-350 Ncm (22.1-31.0 in. lb)
  - used bearings - 30-60 Ncm (2.7-5.3 in. lb)

Note

If the ring gear and pinion are to be adjusted, the pinion should now be adjusted and the setting checked, section 39-60.

Backlash, adjusting

- install pinion with shims **S3** and **S4** installed
- install S_{total} shim thickness on cover side of differential
- turn differential several times to seat bearings



- attach measuring equipment
- use dial indicator extension **VW 382/10** (6 mm flat)
- adjust measuring lever **VW 388** to a = 79 mm
- hold pinion to prevent it from moving, while turning ring gear up to stop, and zeroing dial indicator
- turn ring gear back and note backlash
- rotate ring gear 90°, tighten lock bolt, and measure backlash again
- repeat above procedures at least two more times
- add all four readings together and divide by four to determine average backlash

Average backlash, calculating

Example

1st measurement		0.84 mm
2nd measurement		0.85 mm
3rd measurement		0.84 mm
4th measurement	+	0.83 mm
Total	=	3.36 mm
Average backlash = 3.36 mm : 4	=	0.84 mm

Note

If measurements differ by more than 0 06 mm from each other, ring gear/pinion installation is incorrect. Check ring gear and pinion; if necessary, replace them (as a matched set)

S2 shim, determining thickness

(opposite ring gear)

$$S2 = S_{total} - \text{average backlash} - \text{lift (constant value)}$$

Note

Lift (constant value) 0 15 mm

Example

S_{total}	1 92 mm
Average backlash	0 84 mm
	1 08 mm
Lift	0 15 mm
S2	1 23 mm

Note

The following shims are available

Thickness (mm)	Part number
0 15	113 517 201 A
0 20	113 517 202 A
0 30	113 517 203 A
0 40	113 517 204 A
0 50	113 517 205 A
0 60	113 517 206 A
0 70	113 517 207 A
0 80	113 517 208 A
0 90	113 517 209 A
1 00	113 517 210 A
1 20	113 517 211 A

Note

Due to varying tolerances, check all shims with a micrometer for correct thickness. Exact shim thickness can be attained by using shims that are thicker or thinner than specifications

S1 shim, determining thickness

(ring gear side)

S1	S_{total}	S2

Example

S_{total}	1 92 mm
S2	1 23 mm
S1	0 69 mm

Note

The following shims are available

Thickness (mm)	Part number
0 15	018 409 381
0 20	018 409 383
0 25	018 409 385
0 50	018 409 387
0 80	018 409 389
1 00	018 409 391
1 50	018 409 393

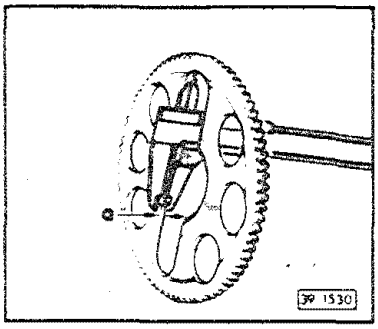
Note

Due to varying tolerances, check all shims with a micrometer for correct thickness. Exact shim thickness can be attained by using shims that are thicker or thinner than specifications

- install appropriate **S1** shim on ring gear side
- install appropriate **S2** shim on side opposite ring gear

Measurement, checking

- make four backlash measurements around circumference
  - backlash **must not** deviate by more than 0 05 mm
- check that average backlash 0 12-0 22 mm



S2 shim only, determining

(during oil pump drive gear replacement)

- measure thickness **a** in area of bearing seat
- calculate difference in thickness between old and new drive gear

Example

Old drive wheel thickness **a**	2.90 mm
New drive wheel thickness **a**	3.00 mm
Difference	0.10 mm

Note

If the new drive wheel is thinner

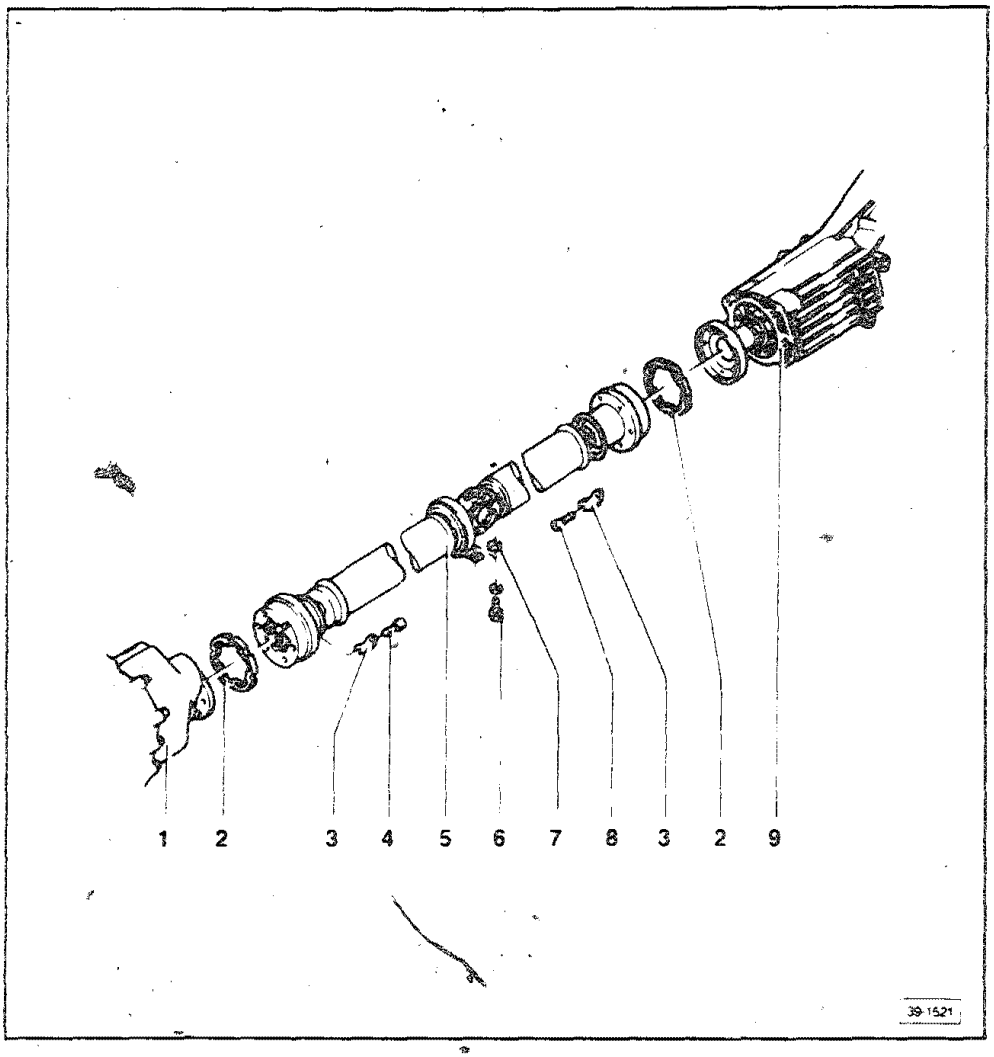
- install a thicker **S2**

If the new drive wheel is thicker

- install a thinner **S2**

CAUTION

Once the differential gear has been installed, check the turning torque, as described earlier in this section. The oil pump gear must not be engaged, during the checking procedure



CAUTION

Do not allow driveshaft to pivot during handling. Maintain it in a linear (extended) position.

Store or transport driveshaft only in a linear (extended) position.

When working on driveshaft, vehicle should be raised on a two-pillar hoist.

1 — **Transmission**

2 — **Gasket**
- always replace
- peel off film protecting the adhesive before installing

3 — **Plate**

4 — **55 Nm (41 ft lb)**

5 — **Driveshaft**
- removing, installing: section 39-140
- adjusting: section 39-150

6 — **20 Nm (15 ft lb)**

7 — **Adjustment washers**
see section 39-150

8 — **55 Nm (41 ft lb)**

9 — **Rear final drive**

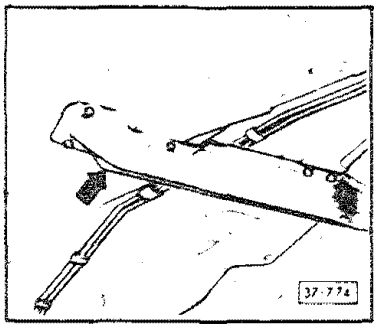
Driveshaft, repairing

Note

Driveshafts can only be removed, installed or adjusted. A damaged driveshaft cannot be repaired, it must be replaced. Universal joints and bearings cannot be changed. The front and rear driveshaft cannot be replaced individually.

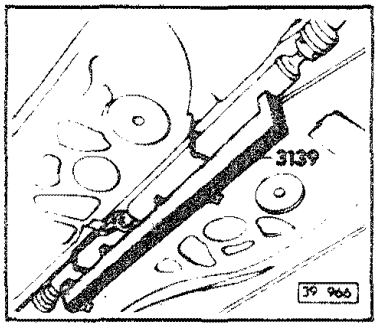
For noise and vibration complaints, check the driveshaft alignment. If careful adjustment does not eliminate the problem, the entire driveshaft must be replaced.

Driveshaft, removing/installing



Removing

- remove crossmember (**arrow**)
- remove catalytic converter(s) and main muffler from retainer. Repair Group 26
- remove transmission heat shield
- remove heat shield above driveshaft
- loosen bolts securing driveshaft to transmission, rear final drive and body



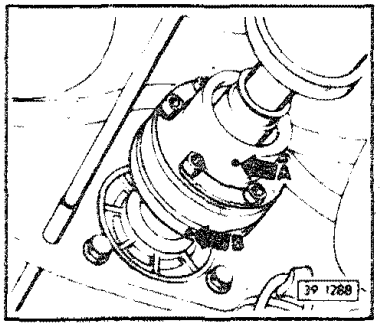
- install alignment tool **3139** and tighten plastic nuts
- mark rear driveshaft and final drive flanges, for realignment (if not pre-marked)
- remove bolts at transmission and rear final drive
- support driveshaft and alignment tool and remove mounting bolts from body
- remove driveshaft and alignment tool
  - if necessary, position main muffler aside

Note

After removing the driveshaft, inspect the mating drive flange threads for locking compound residue, which can cause bolts to seize and strip during subsequent replacement. Remove any residue with a thread cleaner

CAUTION

Do not allow driveshaft to pivot after removal. Maintain it in a linear (extended) position.



Installing

- install in reverse order of removal

CAUTION

The rear driveshaft flange may be marked with a white dot (**arrow A**) and the rear final drive flange, with a black dot (**arrow B**). During installation, align these dots, or align hand-made marks made during removal, in order to maintain driveshaft balance.

Tightening torques	
Driveshaft to transmission	55 Nm (41 ft lb)
Driveshaft to rear final drive	55 Nm (41 ft lb)
Center bearing to body	20 Nm (15 ft lb)

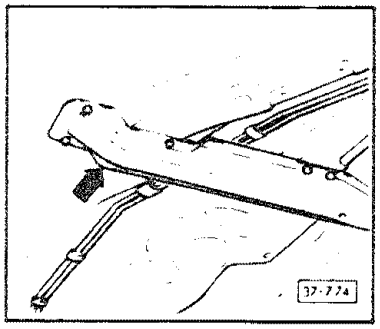
Note

Adjust driveshaft after installing, section 39-150

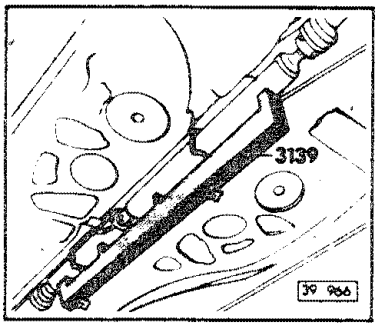
Driveshaft, adjusting

Note,

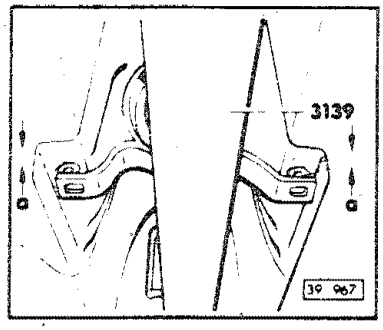
Precise adjustment is mandatory for smooth, quiet operation



- remove crossmember (**arrow**)
- remove catalytic converter(s) and main muffler from retainer, Repair Group 26
- remove transmission heat shield
- remove heat shield above driveshaft
- loosen bolts securing driveshaft to body



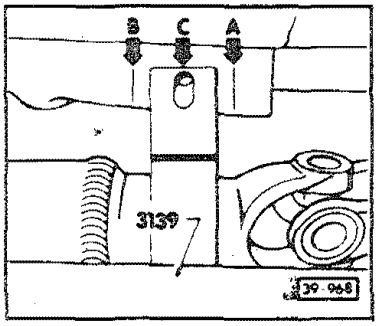
- install alignment tool **3139** and tighten plastic nuts
- remove driveshaft fasteners/spacers at body



- measure gap a on both sides
  - dimensions on both sides must be equal
- select the appropriate spacers from the following chart

Gap a (mm)	Spacer thickness (mm)	Spacer part number
0 — 3	—	
3.1 — 5	2	857 521 143
5.1 — 7	4	857 521 143 A
7.1 — 9	6	857 521 143 B
9.1 — 11	8	857 521 143 C
11.1 — 13	10	857 521 143 D

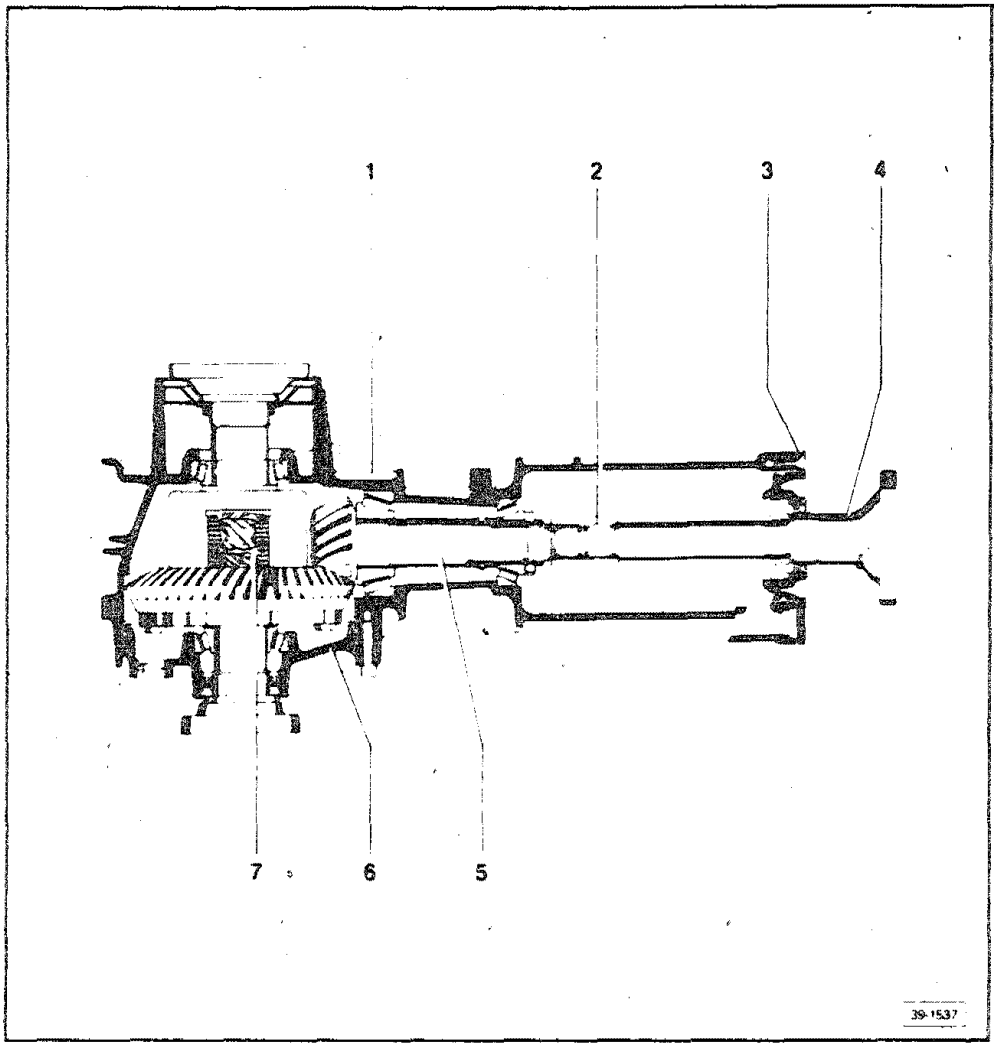
Driveshaft, aligning longitudinally



- use installation tool to push driveshaft fully to rear

- mark position of center bearing on body (**arrow A**)
- use installation tool to push driveshaft to front
- mark position of center bearing on body (**arrow B**)
- center driveshaft
  - the center bearing must be positioned between the two marks (**arrow C**)

- insert bolts and spacers and tighten to 20 Nm (15 ft lb)
- remove installation tool
- install transmission heat shield
- install driveshaft heat shield
- install main muffler and catalytic converter(s), Repair Group 26
- install crossmember



Note

The Torsen differential should not be disassembled

1 — **Final drive housing**

2 — **Sleeve**

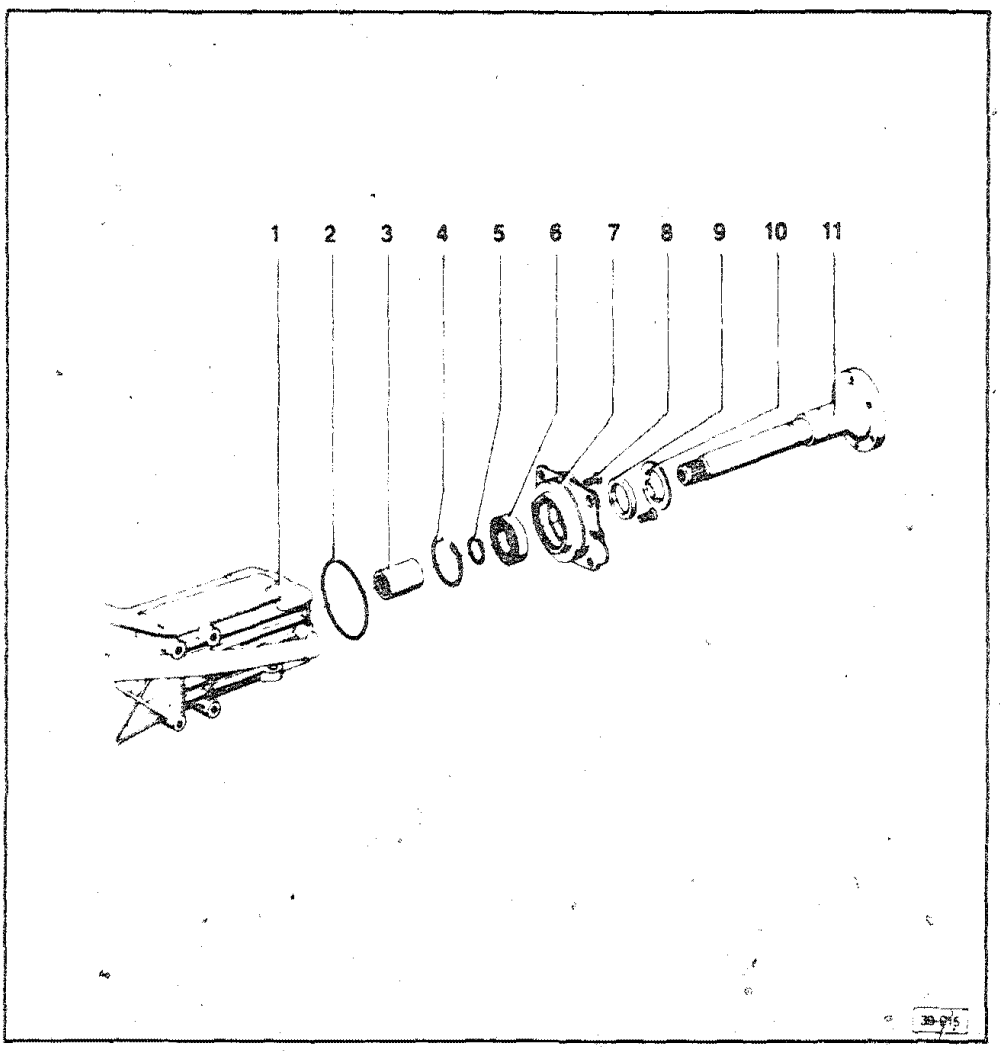
3 — **Final drive cover**
disassembling assembling section 39-180

4 — **Flange for driveshaft**

5 — **Pinion**
assembly section 39-260

6 — **Final drive cover**

7 — **Torsen differential**
removing installing section 39-220



1 — **Final drive**
removing installing section 39-210

2 — **O-ring**

3 — **Sleeve**

4 — **Large circlip**

5 — **Small circlip**

6 — **Bearing**

7 — **Cover**
clean seal for oil seal but do not use solvent

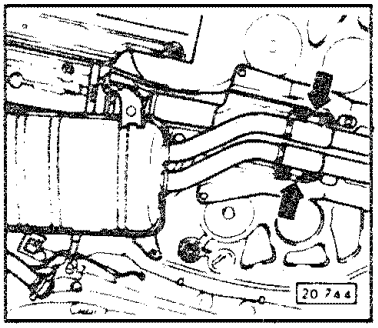
8 — **25 Nm (18 ft lb)**

9 — **Oil seal**
- always replace
- pack area between seal lips with multi-purpose grease
- open side of oil seal faces final drive

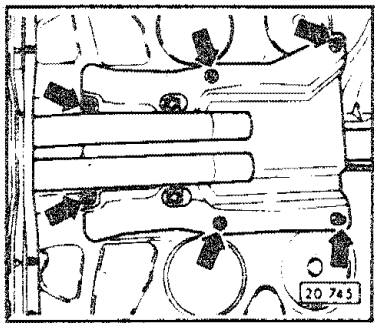
10 — **Plastic washer**

11 — **Flange for driveshaft**
- if alignment dots are not present mark flange in relation to driveshaft
- replace gasket between flange and driveshaft peel off film that protects adhesive and apply

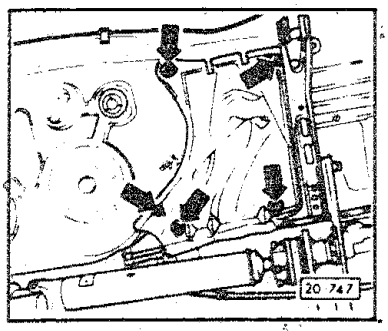
Driveshaft flange oil seal and bearing, replacing



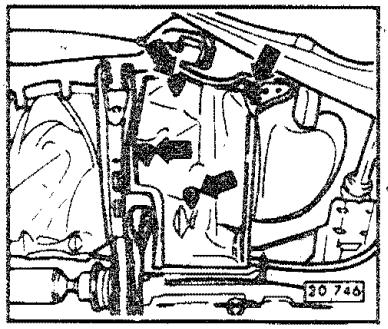
- remove main rear muffler system and retainers (**arrows**)



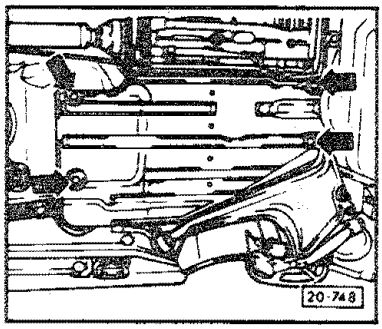
- remove heat shield (**arrows**)



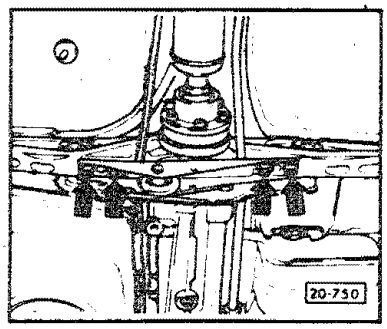
- remove heat shield (**arrows**) in front of crossmember I



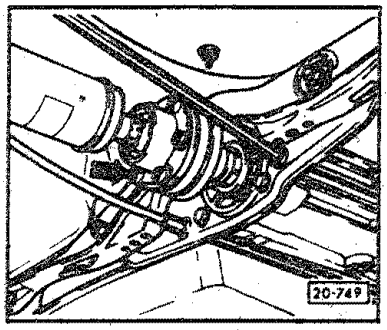
- remove heat shield (**arrows**) behind crossmember I



- remove fuel tank cover (**arrows**)
- place drip tray underneath final drive, and drain oil



- remove support for exhaust system (**arrows**)

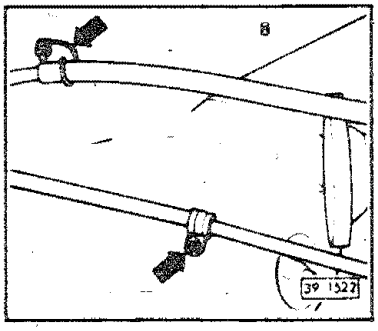


- mark position of drive flange at final drive, if no alignment dots are present
- remove driveshaft mounting bolts (**arrow**) at final drive
- raise driveshaft upward and tie in position

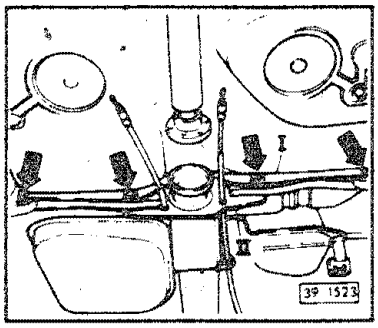
CAUTION

Position driveshaft only high enough for removing drive flange, to prevent damage to driveshaft universal joint.

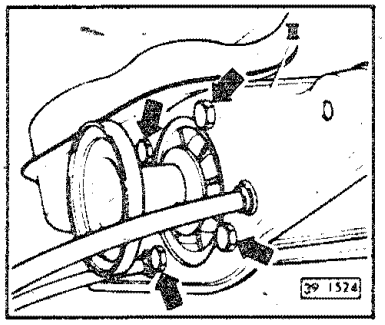
- disconnect front cable for parking brake



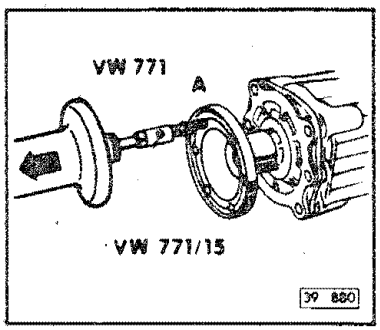
- remove parking brake cable bracket (**arrows**)
- support final drive with transmission jack **VAG 1383/A** (or equivalent)



- remove crossmember I (**arrows**)
- lower final drive, supported on transmission jack

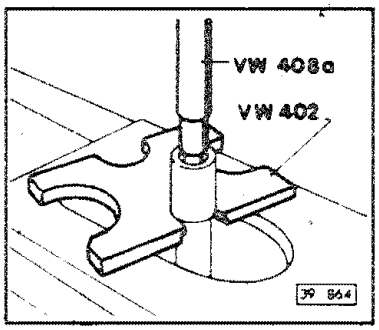


- remove crossmember II (**arrows**) from final drive

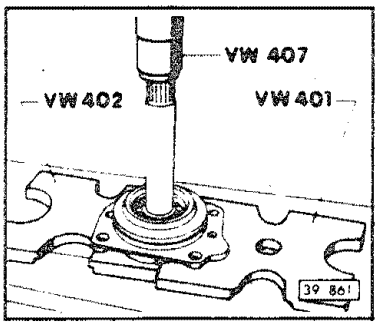


- remove final drive cover bolts
- remove cover

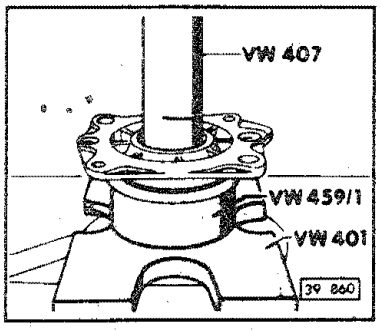
A – M8/M10 bolt



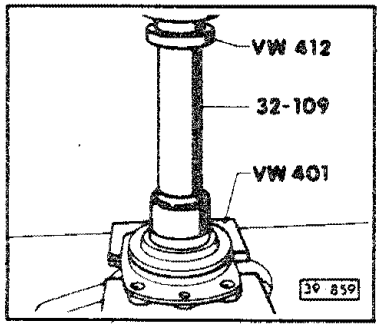
- press sleeve off
- remove small circlip



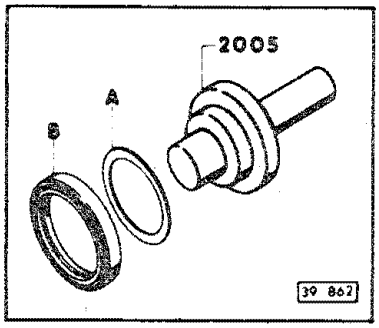
- press flange off
- pry out oil seal with extractor lever **VW 681**
- clean seat for oil seal
  - do not use solvent



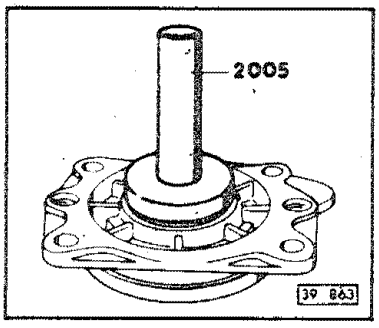
- remove large circlip, only if removing bearing
- press bearing out



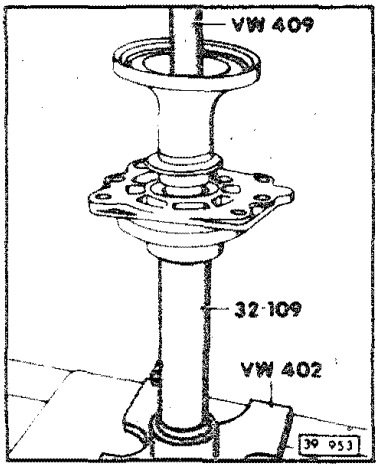
- press bearing in
- install large circlip



- install oil seal **B** with washer **A** onto drift **2005**
  - washer **A** part numbers:
    020 311 391 F
    016 311 391 P (1.05 thickness)
  - fill space between oil seal lips with multi-purpose grease
  - open side of oil seal faces final drive



- drive oil seal in until seated
- remove drift and washer



- press flange in, with plastic washer
- install small circlip
- install sleeve by driving on with a plastic hammer
  - if necessary, press on with punch **VW 407**

- install cover (with new O-ring) and flange; tighten
- install crossmember II on final drive
- bolt crossmember I to crossmember II and to body
  - installed position of crossmember I: edge with flange faces forward

- install parking brake cable bracket
- attach front parking brake cable and adjust parking brake, Repair Group 46
- install support for exhaust system
- add oil, if necessary
- install fuel tank cover
- bolt driveshaft on, aligning markings on driveshaft flange and rear final drive, section 39-140
- adjust driveshaft, section 39-150
- install heat shield at crossmember I
- install heat shield above muffler/catalytic converter junction
- install main/rear muffler system

Note

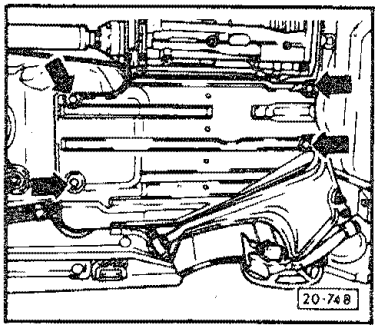
When aligning the exhaust system, be sure that no parts are installed under tension.

Tightening torques

Cover to final drive	25 Nm (18 ft lb)
Crossmember II to final drive	45 Nm (32 ft lb)
Crossmember I to crossmember II and body • replace self-locking nuts	45 Nm (32 ft lb)
Driveshaft to final drive flange • bolts are self-sealing • always replace bolts • clean drive flange threads with thread cleaner	55 Nm (41 ft lb)
Exhaust system support to crossmember I	55 Nm (41 ft lb)

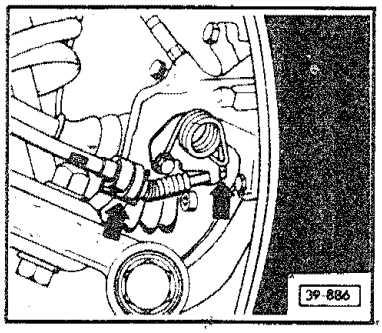
Rear axle flange oil seals, replacing

(final drive installed)



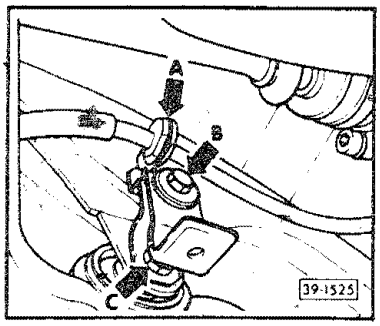
Right oil seal, replacing

- remove fuel tank cover (**arrows**)



- disconnect parking brake cable (**arrows**) from right caliper

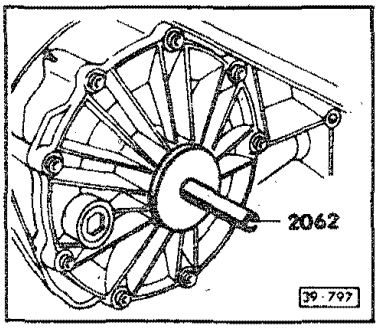
> **CAUTION**
>
> When detaching the parking brake cable, be careful not to damage the plastic cable shroud.



- press parking brake cable out of bracket (**arrow A**)
- remove bracket for fuel tank cover (**arrow B**)
- disconnect trapezoidal arm from crossmember and lower (**arrow C**)
- remove axle shaft and lower
- remove axle flange bolt
  - during removal, hold flange stationary with drift
- place drip tray underneath
- remove axle flange by hand
  - if necessary, loosen with two tire irons

> **CAUTION**
>
> When prying out axle flange, do not damage collar on shaft housing.

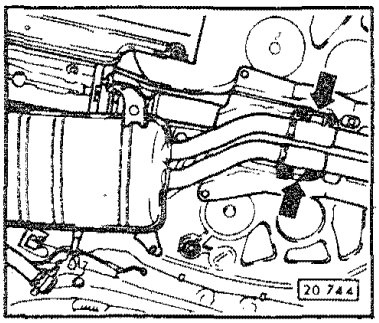
- remove oil seal and discard
  - pry out with suitable-sized screwdriver
- clean seat for oil seal
  - do not use solvent



- drive in new oil seal until seated, using driver 2062
  - pack space between oil seal lips with multi-purpose grease
  - open-side of oil seal faces final drive
- install axle flange with socket head bolt
- replace gasket between axle shaft and axle flange
  - peel off film protecting gasket adhesive
- install axle shaft
- attach trapezoidal arm to crossmember
- install bracket for fuel tank cover
- connect parking brake cable at brake caliper and at fuel tank bracket
- install fuel tank cover
- add oil to final drive, if necessary

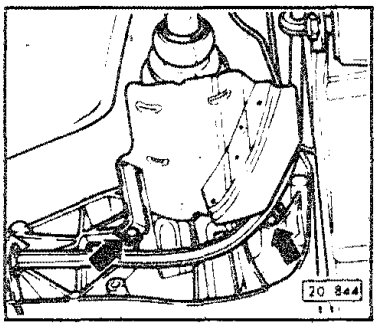
Tightening torques

Socket head bolt to flange shaft	10 Nm (89 in. lb or 102 cm kg) plus an additional 90° (1/4 turn)
Axle shaft to axle flange	80 Nm (60 ft lb)
Trapezoidal arm to crossmember • replace self-locking nut	85 Nm (63 ft lb)

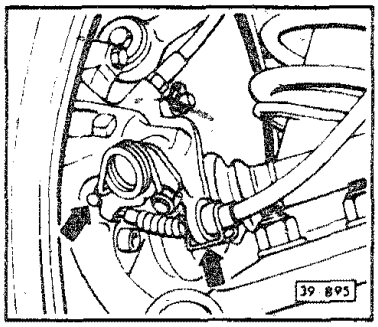


Left oil seal, replacing

- remove main/rear muffler system (arrows)



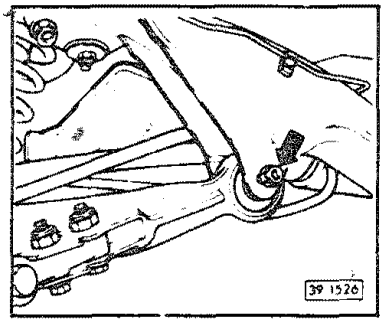
- remove axle shaft cover plate (**arrows**)



- disconnect parking brake cable (**arrows**)

CAUTION

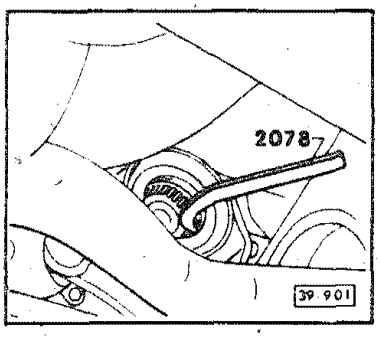
When detaching the parking brake cable, do not damage the plastic cable shroud



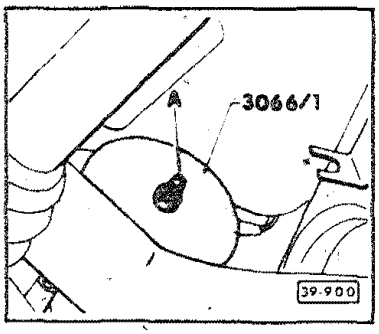
- disconnect trapezoidal arm from crossmember (**arrow**), and lower
- detach axle shaft, and lower
- place drip tray underneath
- remove axle flange

Note

Partially thread two bolts into flange, positioned opposite each other. Place suitable-sized thrust pads under bolts, between flange and housing. Turn bolts alternately and evenly, to press flange off



- remove oil seal and discard
  - pry out with **2078**
- clean seat for oil seal
  - do not use solvent



- install threaded shaft A of seal installer **3066**, into differential gear
- place oil seal onto thrust washer **3066/1**, and tighten to stop with hex head nut
  - pack space between seal lips with multi-purpose grease
  - open-side of oil seal faces final drive
- install axle flange with socket head bolt
- replace gasket between axle shaft and flange
  - peel off film that protects adhesive, and apply
- install axle shaft
- install trapezoidal arm at crossmember
- connect parking brake cable to brake caliper
- install axle shaft cover plate
- install main/rear muffler system

Note

When aligning the exhaust system, be sure that no parts are installed under tension.

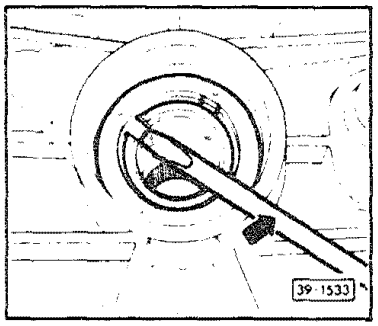
- check final drive oil level

Tightening torques

Axle flange socket head bolt	10 Nm (89 in. lb or 102 cm kg) plus an additional 90° (1/4 turn)
Axle shaft to axle flange	80 Nm (60 ft lb)
Trapezoidal arms to crossmember • replace self-locking nuts	85 Nm (63 ft lb)

Speedometer gear, replacing (transmission installed)

- remove left side axle flange. from flange on transmission
- remove axle shaft and oil seal

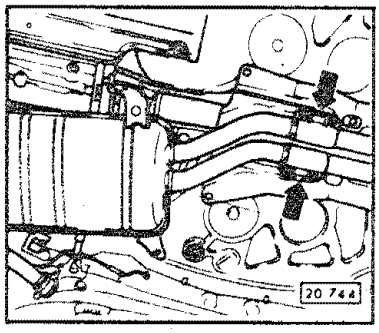


- remove speedometer gear by prying out. as shown
- press in new speedometer gear
- drive in new seal
- install axle flange and axle shaft

Tightening torques

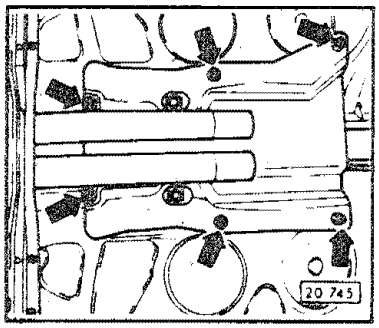
Axle flange to transmission	10 Nm (89 in. lb or 102 cm kg), plus an additional 90° (1 4 turn)
Axle shaft to axle flange M10 bolts	80 Nm (59 ft lb)

Rear final drive, removing/installing

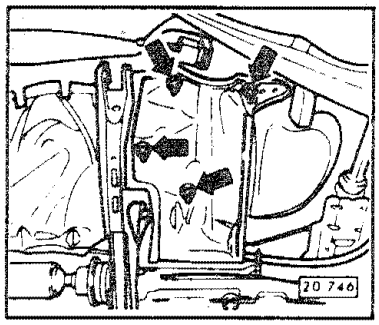


Removing

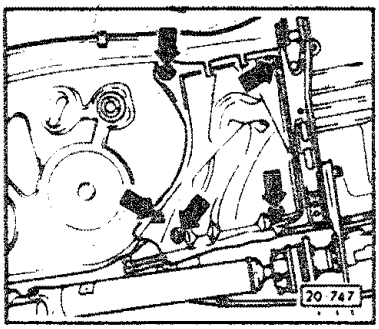
- remove rear wheels
- remove main/rear muffler system (**arrows**)



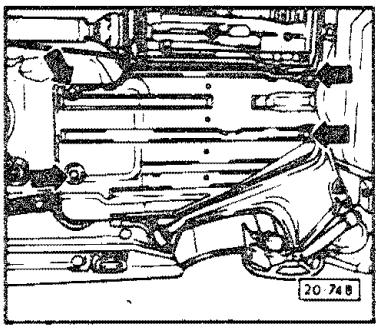
- remove heat shield (**arrows**)



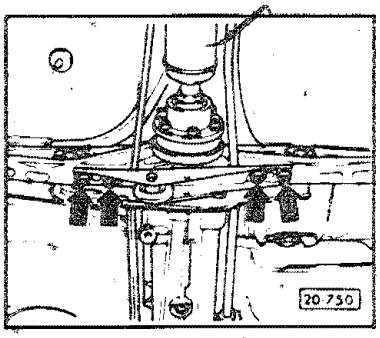
- remove heat shield (**arrows**) behind crossmember I



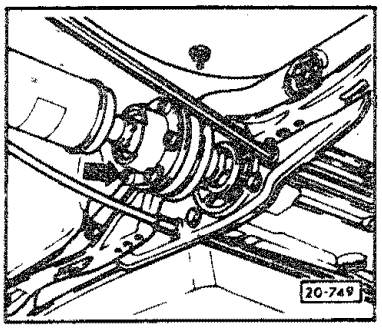
- remove heat shield (**arrows**) in front of crossmember



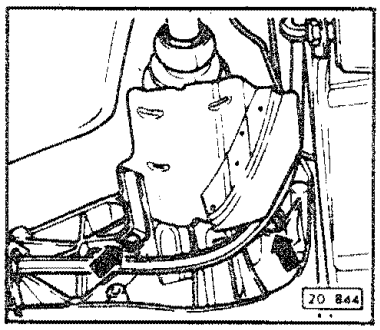
- remove fuel tank cover (**arrows**)
- disconnect parking brake cable at crossmember



- remove exhaust system support (**arrows**)



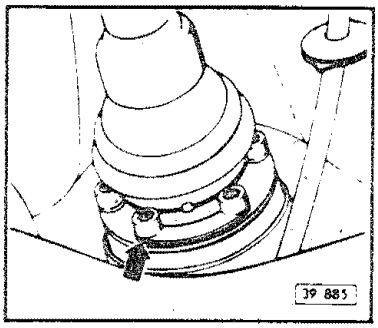
- mark rear driveshaft and final drive flanges for realignment, if not previously marked
- remove driveshaft mounting bolts (**arrow**) at final drive
  - raise driveshaft upward and tie into position



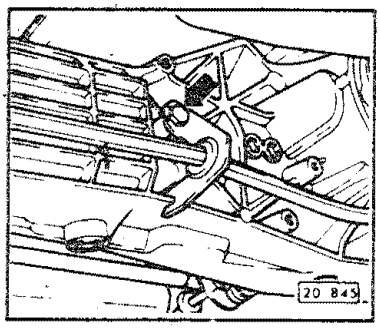
CAUTION

Position driveshaft only high enough for removing final drive, to prevent damage to driveshaft universal joint.

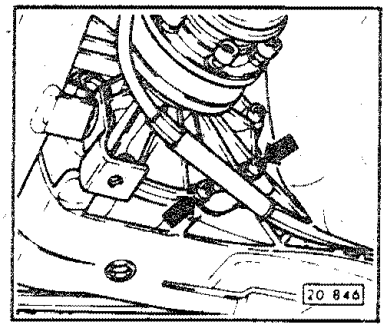
- remove left axle shaft cover plate (**arrows**)



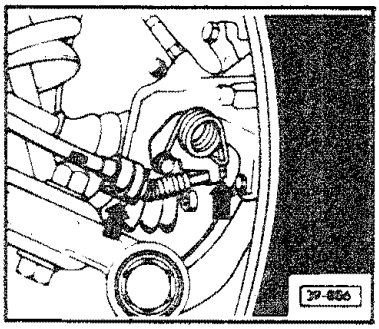
- unbolt (**arrow**) both left/right axle shafts, position aside, and tie up



- detach left parking brake cable bracket (**arrow**) from final drive



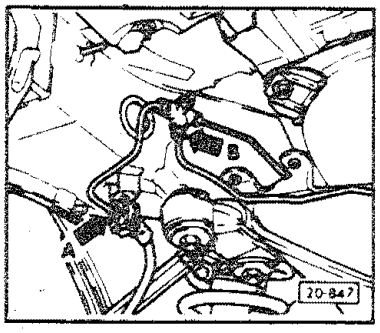
- detach right parking brake cable bracket (**arrows**) from final drive



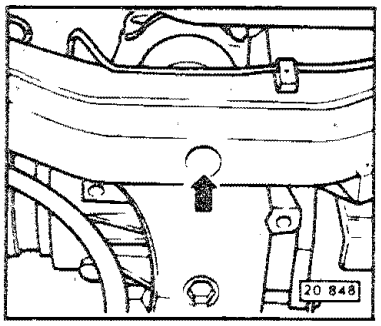
- disconnect parking brake cable from left/right brake calipers (**arrows**)

CAUTION

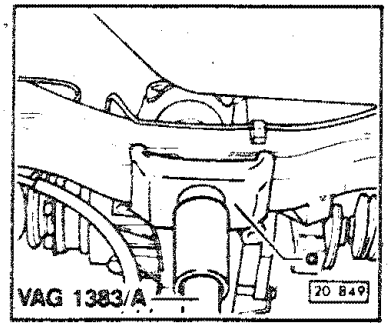
When disconnecting the parking brake cables, do not damage the plastic cable shrouds.



- disconnect brake lines (**arrow A**), on right/left side
- disconnect brake line (**arrow B**) at brake distributor valve, left side

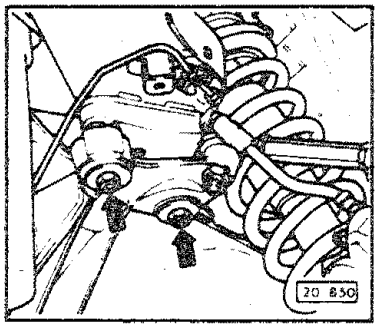


- remove final drive mounting nut (**arrow**)
  - use 15 mm socket

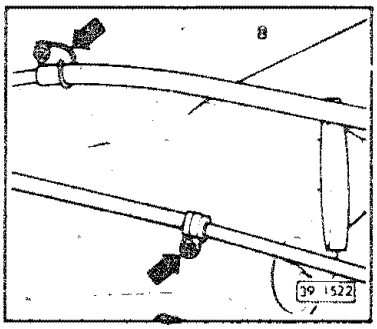


- support crossmember with transmission jack **VAG 1383/A** (or equivalent)

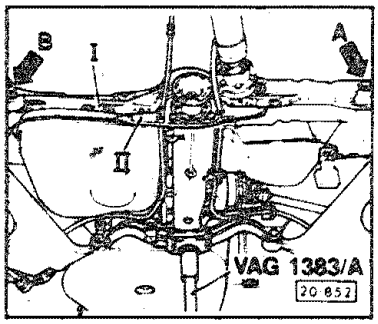
  a – jack stand



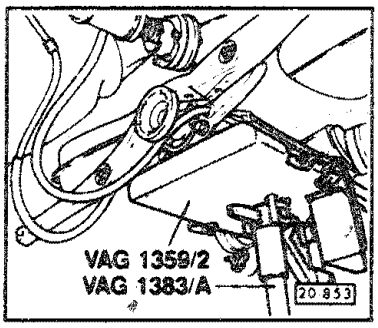
- remove mounting nuts (**arrows**) from rear crossmember



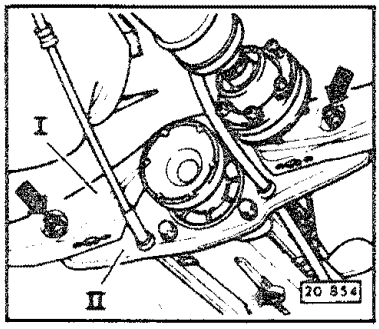
- remove bracket (**arrows**) for parking brake cable



- loosen bolt (**arrow A**) at crossmember I
- remove bolt (**arrow B**), and carefully lower crossmember I on right side
- reposition parking brake cables, routing them toward the front, through eyes in crossmember II



- support final drive with transmission jack and adaptor, **VAG 1383/A** and **VAG 1359/2**, (or equivalents)
  - strap final drive securely to jack



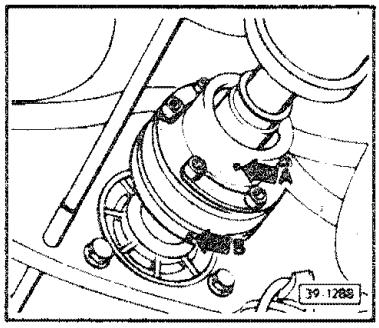
- separate crossmember I from crossmember II (**arrows**)
- separate final drive from rear crossmember
  - carefully lower final drive

Installing

Note

Install in the reverse order of removal, noting the following:

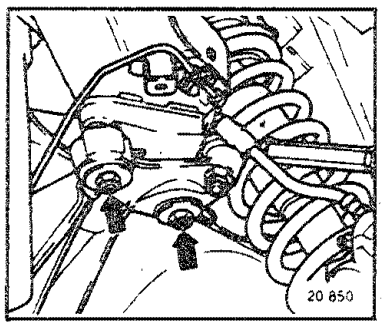
- replace self-locking nuts

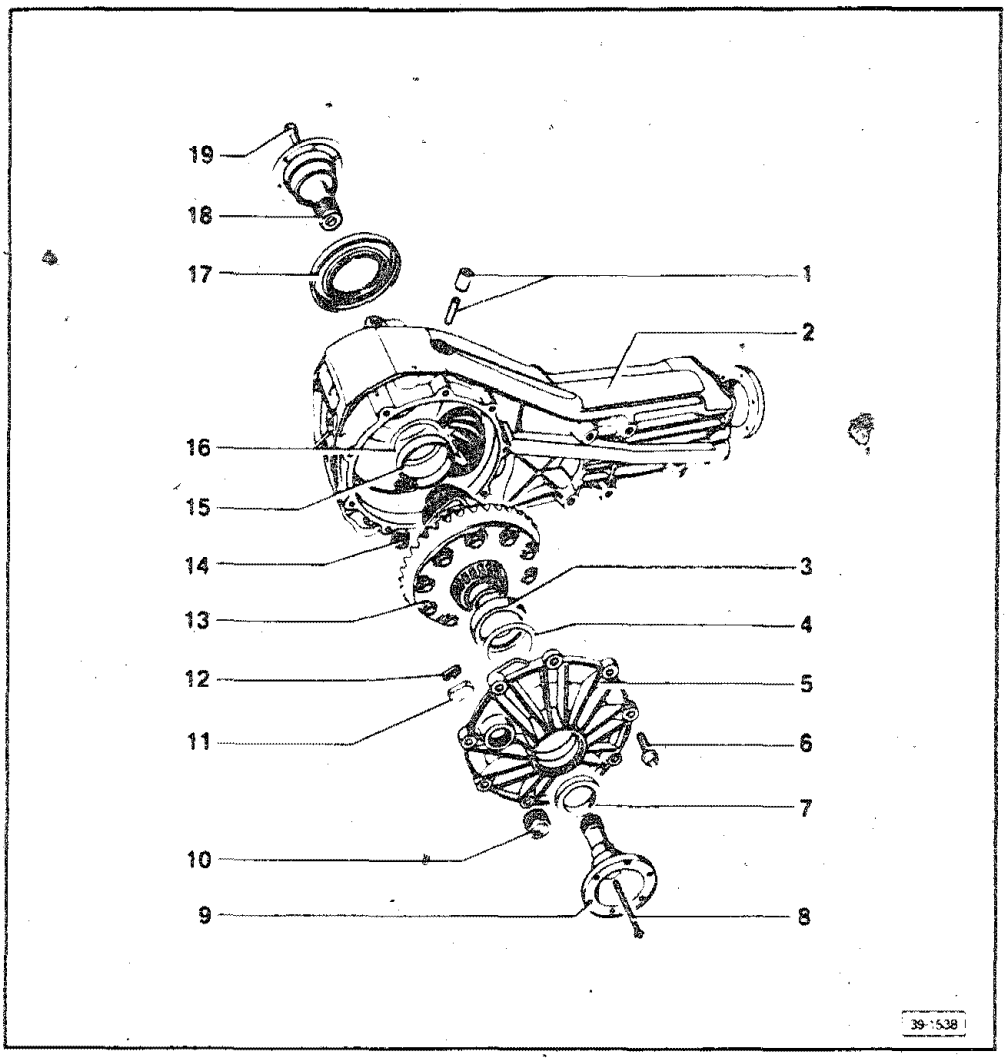


- align markings (**arrow A**) on the driveshaft made before disassembly, with markings (**arrow B**) on the final drive
- align the four bolts for crossmember I, as centrally as possible in crossmember bolt holes
- before installing exhaust system and heat shields, adjust driveshaft, section 39-150
- align exhaust system (Repair Group 26) so that parts are free of tension, before tightening
- bleed brake system, Repair Group 47
- check/refill transmission oil in final drive
- measure rear axle, Repair Group 44

Tightening torques

Crossmember II to final drive	45 Nm (33 ft lb)
Crossmember I to crossmember II and body	45 Nm (33 ft lb)
Rear crossmember to rear suspension	50 Nm (37 ft lb)
• nuts (**arrows**) at studs which mount through rubber bushings in crossmember	
Final drive to crossmember	45 Nm (33 ft lb)
Axle shaft to final drive	80 Nm (60 ft lb)
Driveshaft to final drive	55 Nm (40 ft lb)
• bolts are self-sealing; always replace	
• clean threads thoroughly in drive flange, using thread cleaner	
Exhaust system support to crossmember	55 Nm (40 ft lb)





Note

When parts marked with an asterisk (*) are replaced adjustment is required. See Adjustment Overview, section 39-290.

1 — **Breather**
installed position, section 39-230

2 — **Final drive housing*** (see Note)
pinion assembly, section 39-260

3 — **Taper roller bearing outer race*** (see Note)
removing installing, section 39-250

4 — **Shim S1**
- note thickness
- adjustment overview, section 39-290

5 — **Final drive cover*** (see Note)
- seal with **AMV 188 000 02**
- installed position, magnet faces down

6 — **25 Nm (18 ft lb)**

7 — **Seal**
pry out with lever, drive in to stop with **2062**

8 — **10 Nm (89 in. lb or 102 cm kg)**
plus an additional 1/4 turn (90°)

9 — **Drive flange**

10 — **Oil filler plug — 25 Nm (18 ft lb)**

11 — **Magnet**
installed position, section 39-230

12 — **Magnet clamp**
always replace

13 — **Torsen differential**
- do not disassemble
- removing ring gear, section 39-250
- removing bearing inner races, section 39-250

14 — **Oil drain plug — 25 Nm (18 ft lb)**

15 — **Taper roller bearing outer race*** (see Note),
removing/installing, section 39-250

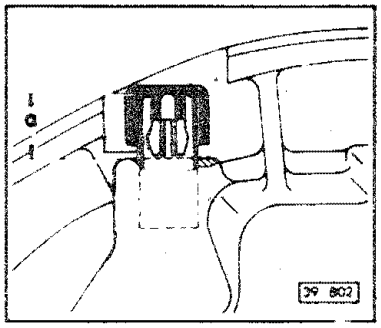
16 — **Shim S2**
- note thickness
- adjustment overview, section 39-290

17 — **Seal**
removing/installing, section 39-200

18 — **Drive flange**

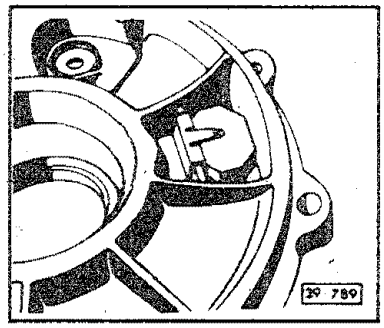
19 — **10 Nm (89 in. lb or 102 cm kg), plus an additional 1/4 turn (90°)**

Final drive housing magnet/breather sleeve, installed position



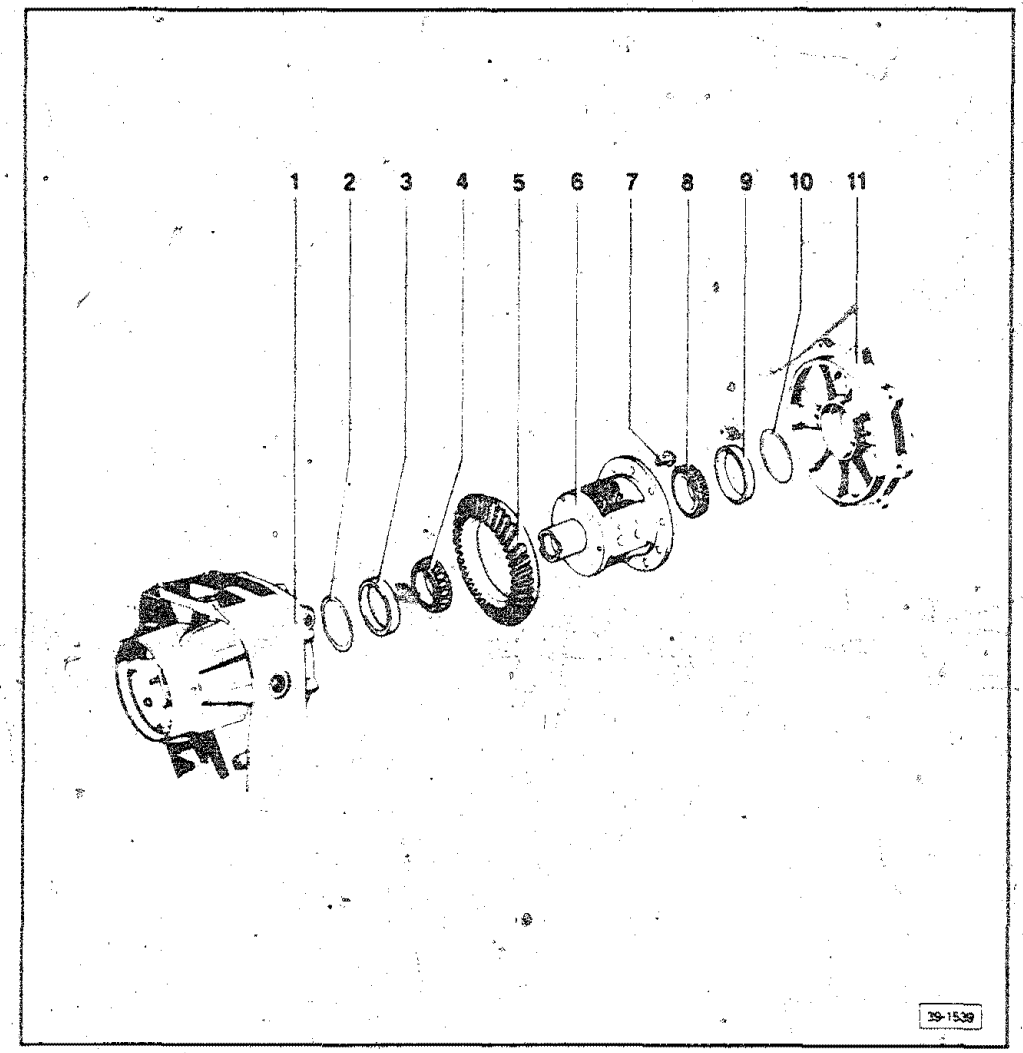
Breather sleeve, installed position

a – 13 mm



Magnet, installed position

- always replace clamp when installing magnet



Note

When parts marked with an asterisk (*) are replaced, adjustments are required. See adjustment overview, section 39-290.

Note

Replace both differential taper roller bearings together. Use parts from the same manufacturer, if possible.

1 — **Final drive housing*** (see Note)

2 — **Shim S1**
- note thickness
- adjustment overview, section 39-290

3 — **Taper roller bearing outer race*** (see Note)
removing, installing, section 39-250

4 — **Taper roller bearing inner race*** (see Note)
removing, installing, section 39-250

5 — **Ring gear*** (see Note)
- matched with pinion (pinion set)
- removing, installing, section 39-250

6 — **Torsen differential housing*** (see Note)
do not disassemble

7 — **Ring gear bolt**
- only use bolts of correct specification
- tighten slightly, then continue tightening to 90 Nm (66 ft lb), in diagonal sequence

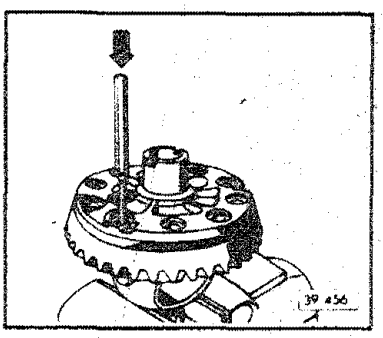
8 — Taper roller bearing inner race* (see Note)
removing/installing, section 39-250

9 — Taper roller bearing outer race* (see Note)
removing/installing, section 39-250

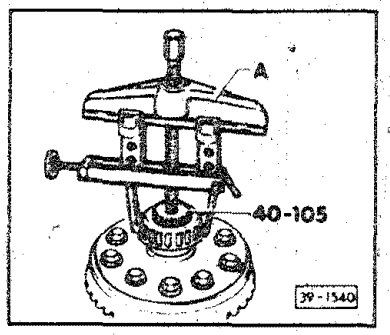
10 — Shim S2
- note thickness
- adjustment overview, section 39-290

11 — Final drive cover* (see Note)

Rear final drive, disassembling/assembling differential



Ring gear, removing

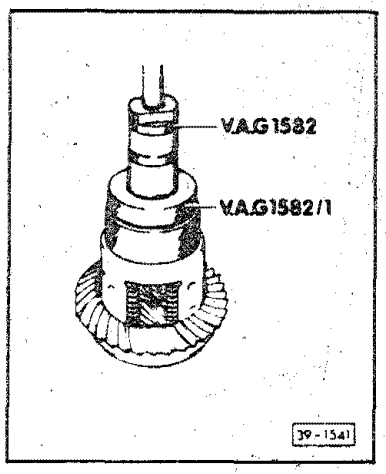


Taper roller bearing inner race, removing

A – two-arm puller, e.g. **US 1078 (Kukko 20/10)** with **Matra V70** hooks

CAUTION

Always replace bearing if removed

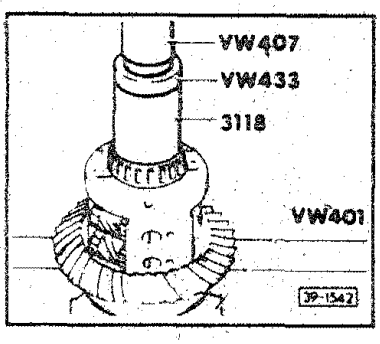


Taper roller bearing inner race, removing

- before installing puller **VAG 1582**, place thrust piece **40-105** on housing

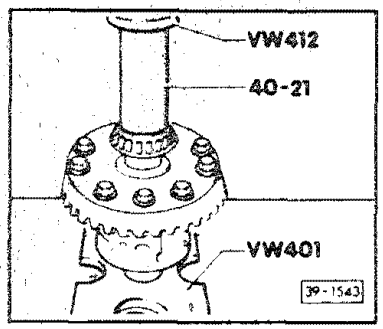
CAUTION

Always replace bearing if removed.



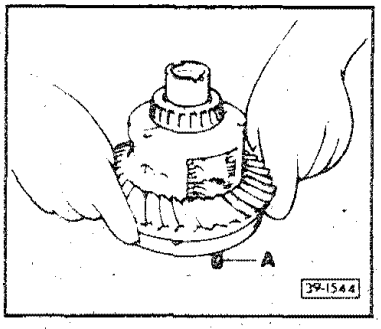
Taper roller bearing inner race, installing

- heat bearing to approximately 100°C (212°F) and press on



Taper roller bearing inner race, installing

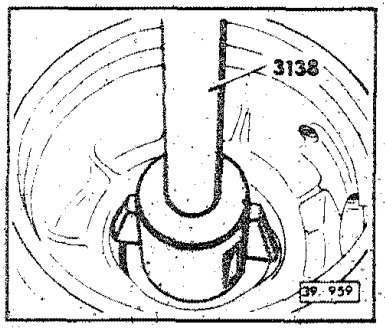
- heat bearing to approximately 100 C (212 F) and press on



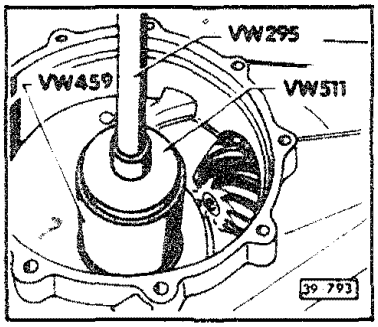
Ring gear, installing

- heat ring gear to approximately 100 C (212 F) and install

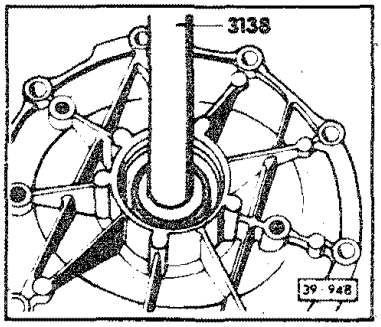
  A – centering pin (make in-shop)



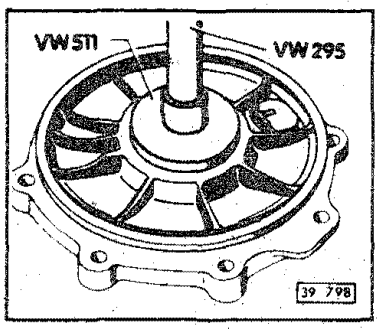
Taper roller bearing outer race, removing from housing



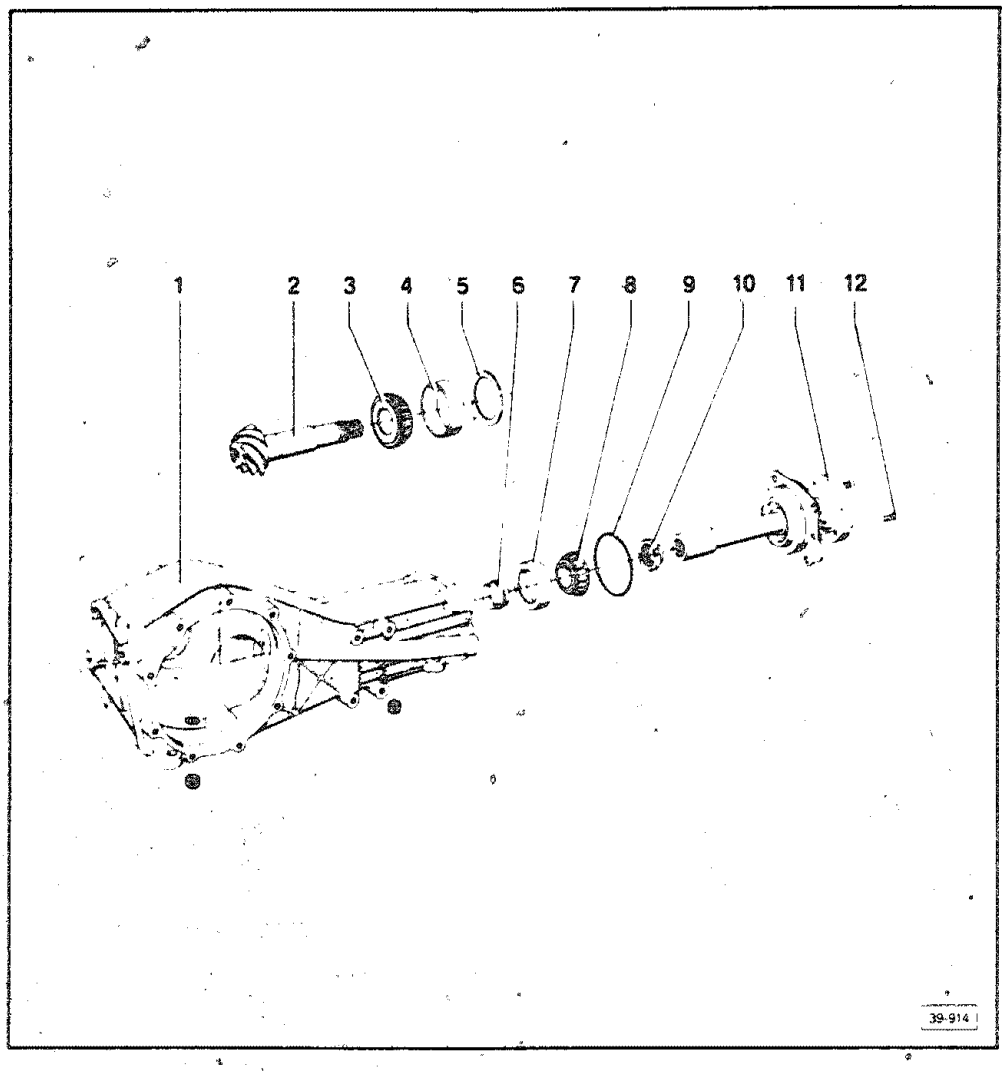
Taper roller bearing outer race, installing in housing



Taper roller bearing outer race, removing from cover



Taper roller bearing outer race, installing in cover



Note

When parts marked with an asterisk (*) are replaced, adjustments are required. See adjustment overview, section 39-290.

Replace both taper roller bearings of the pinion together. Use parts from the same manufacturer if possible.

1 — **Final drive housing*** (see Note)
mount housing to repair stand, section 39-270

2 — **Pinion*** (see Note)
matched with ring gear (pinion set)

3 — **Large taper roller bearing inner race*** (see Note)
removing, installing, section 39-270

4 — **Large taper roller bearing outer race*** (see Note)
removing, installing, section 39-270

5 — **Shim S3**
- note thickness
- adjustment overview, section 39-290

6 — **Spacer sleeve**
always replace

7 — **Small taper roller bearing, outer race*** (see Note)
removing, installing, section 39-270

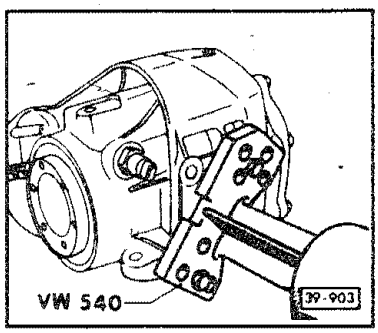
8 — **Small taper roller bearing, inner race*** (see Note)
removing/installing, section 39-270

9 — **Seal**

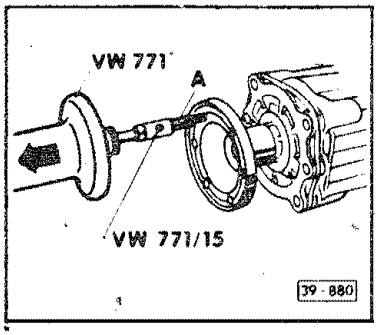
10 — **Pinion nut**
- pry off circlip before removing
- removing/installing, section 39-270
- measuring turning torque, section 39-270
- securing, section 39-270

11 — **Drive flange shaft/cover**
- removing, section 39-270
- disassembling/assembling, section 39-190

Rear final drive, disassembling/assembling pinion

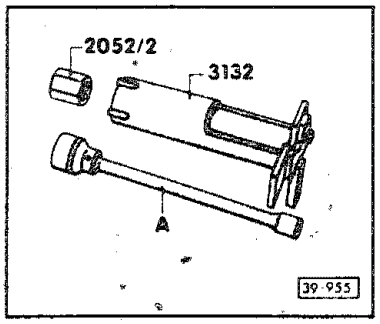


Rear final drive, mounting to repair stand



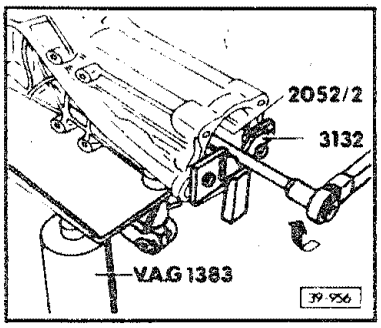
Rear final drive cover, removing

A – two-size threaded pin, M8/M10, Part No. 113 101 399 B



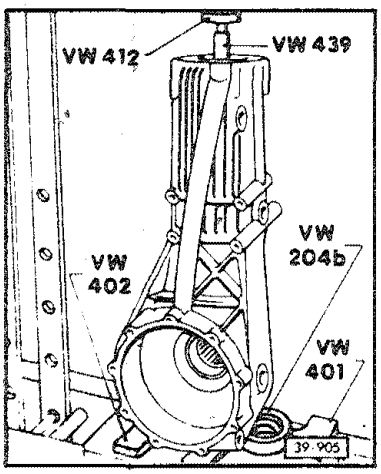
Pinion nut, loosening

A – extension and 32 mm socket

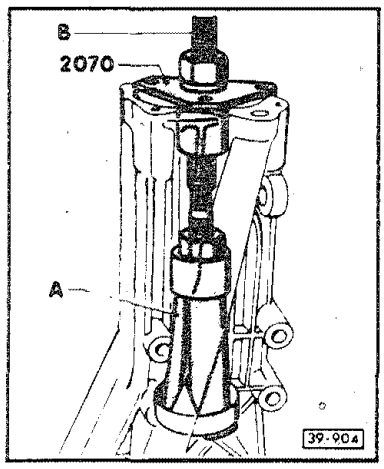


Pinion nut, loosening

- support rear final drive (e.g. with **VAG 1383**) to prevent damage to threads in housing



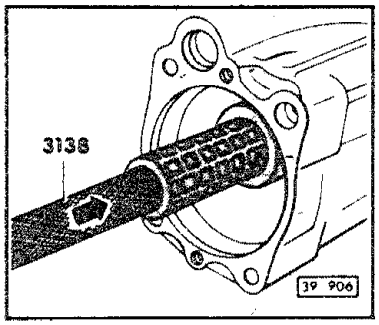
Pinion, pressing out of small taper roller bearing



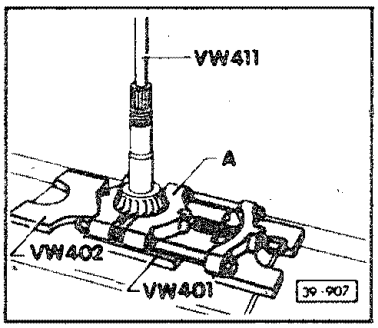
Small taper roller bearing outer race, removing

A – 46-56 mm commercial extractor, e.g. **U.S. 1037 (Kukko 21/7)**

B – spindle from **Kukko 22/1**

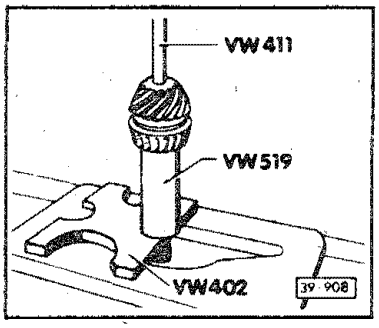


Large taper roller bearing outer race, removing



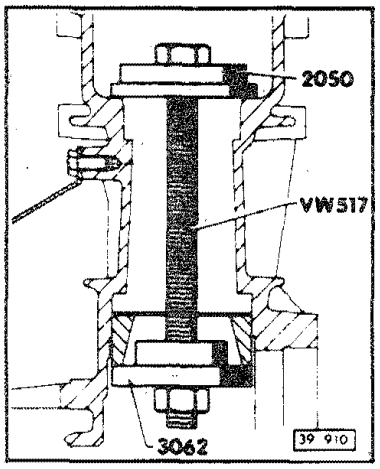
Large taper roller bearing inner race, removing

A – separator, e.g. **Kukko 17/2** (22-115 mm)



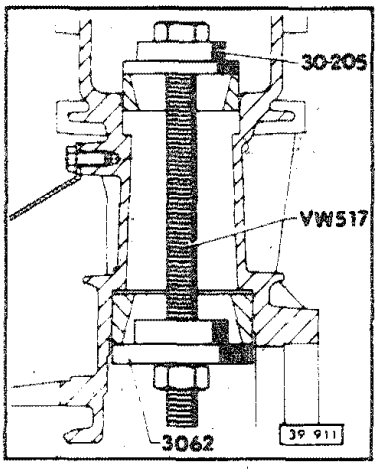
Large taper roller bearing, installing

- heat bearing to approximately 120°C (248°F) before pressing on

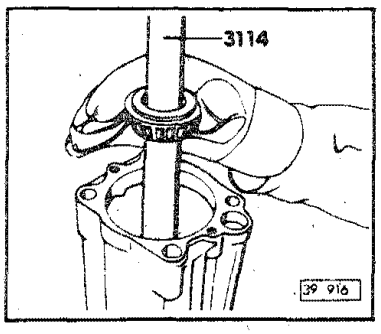


Large taper roller bearing outer race, installing

- place required shim behind race before installing

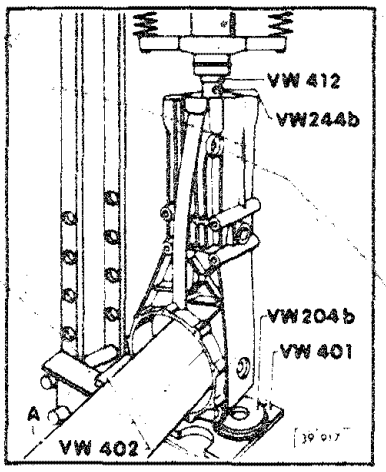


Small taper roller bearing outer race, installing



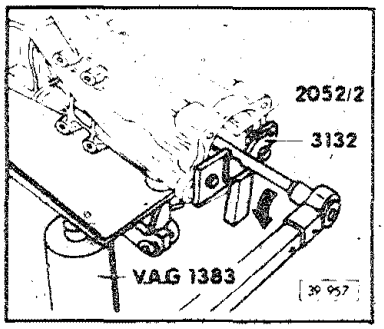
Small taper roller bearing inner race, installing

- install pinion and new spacer sleeve
- heat bearing to approximately 120°C (248°F)
- center rod **3114** on pinion and install bearing



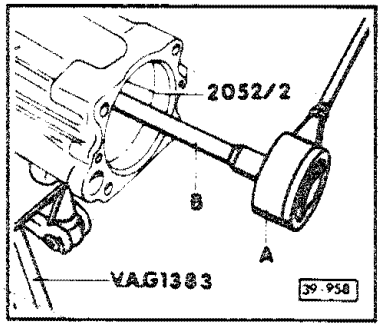
Small taper roller bearing inner race, installing

A – wood support for pinion



Pinion nut, tightening

- support rear final drive (e.g. with **VAG 1383/A**) to prevent damage to threads in housing



Turning torque, measuring

A – commercial torque gauge, suitable range

B – extension with 32 mm socket

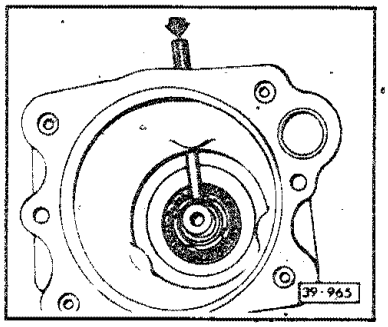
CAUTION

Tighten pinion nut a little at a time, and read turning torque frequently. If turning torque exceeds specifications the spacer will have to be replaced and the adjustment repeated. Once the spacer sleeve has been compressed it cannot be used again.

Turning torque specifications

New bearings	Used bearings*
280-320 Ncm (25-28 in. lb)	30-60 Ncm (2.7-5.3 in. lb)

*bearings with at least 50 km (30 miles) service



Pinion nut, securing

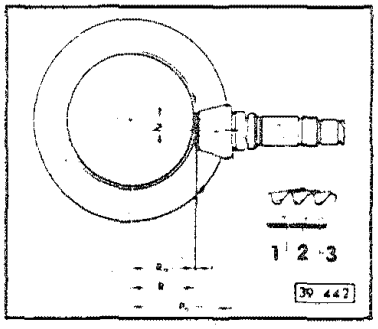
- insert drift through oil drain hole and crimp nut

Ring gear/pinion, adjusting

General notes

Careful adjustment of the ring gear and pinion is important to ensure that the final drive runs quietly and has a long service life. During manufacture, the ring gear and pinion are a matched set and are run on special testing machines to ensure a correct mesh pattern and silent running in both directions. The quietest running position is determined by moving the pinion axially and lifting the ring gear away from the no-play meshing position, maintaining the backlash within specified tolerance.

The deviation r from the master gauge R_o is measured for the ring gear/pinion sets supplied as replacement parts and marked on the outer face of the ring gear. Ring gear and pinion must always be replaced as a matched set.



Service pinion sets

1 – Identification **0937** means Oerlikon pinion set with 9.37 ratio

2 – Matching number **(312)** of gear set

3 – Deviation r, related to the master gauge of the test machine used in production. The deviation r is always given in 1/100 mm.

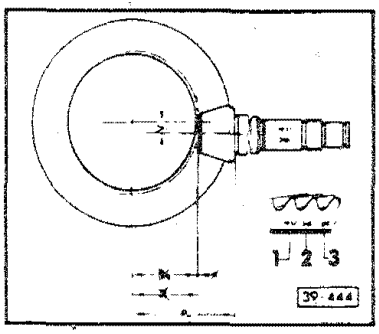
Example

"25" means r = 0.25 mm

R_o – Length of master gauge used in production = 53.15 mm

R – Actual dimension between ring gear center and end face of pinion in position for quietest running of gear set

V_o – Hypoid offset = 35 mm



Production pinion sets

X – This data not given for production gears

P_o – Adjustment dimension used in production

CAUTION

The position of the pinion in production is determined by the dimension P_o (ring gear centerline to back of pinion head). The marking of deviation r and the matching number on the ring gear has been eliminated. It is therefore necessary to measure the position of the pinion before removing it when parts that affect the position of the pinion are to be replaced. See Adjustment Overview, section 39-290.

Adjustment overview

When assembling the final drive, it is only necessary to adjust the ring gear or pinion, or both, if parts have been replaced which directly affect the final drive setting. Use the following table to determine the necessary adjustments.

To be adjusted / Replaced part	Ring gear (S1 + S2) Section 39-340	Pinion (S3) using deviation r Section 39-330	Pinion (S3) using actual measurement Section 39-300
Final drive housing	X		X
Torsen differential		X	
Pinion bearings			X
Differential bearings	X		
Ring gear and pinion	X	X	
Final drive cover	X		
Flange shaft	X		
Differential pinion gears			

Pinion, determining position (actual dimension)

This operation is only necessary if deviation r is not marked on the ring gear, and both pinion bearings or the final drive housing have to be replaced. These parts directly affect the position of the pinion.

- remove differential
- assemble measuring bar (see section 39-330)
- install measuring bar into housing

- measure deviation from R_o (read maximum deflection in red number range)
  - reading corresponds to deviation r

- record measurement

Note

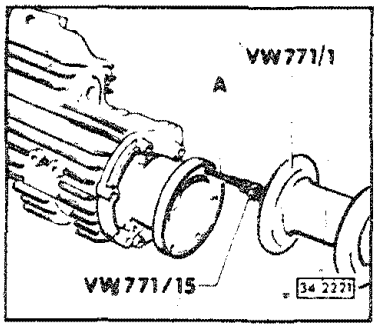
After replacing pinion bearings or housing, or both, adjust pinion, section 39-330. The measurement recorded for deviation r is used to determine the thickness of shim S3.

Driveshaft flange bearing and oil seal, replacing

Pre-removal procedures

Note

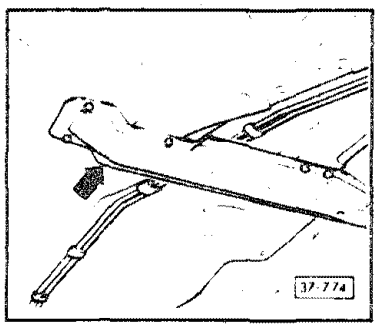
Before removing the oil seal and ball bearing, the bearing housing must be removed from the end cover. See Repair Group 34



A – threaded stud (**M8/M10**)

Note

Before disassembling the bearing housing, remove the following



- remove crossmember (**arrow**)
- remove catalytic converter. Repair Group 26
- remove heat shield from transmission
- remove driveshaft heat shield
- disconnect main muffler from retainer and position aside
- remove driveshaft, section 39-140

Installing

Note

Installation is in the reverse order of removal

After installing the oil seal, check transmission fluid and fill to specifications. Repair Group 34

Ring gear/pinion, adjusting

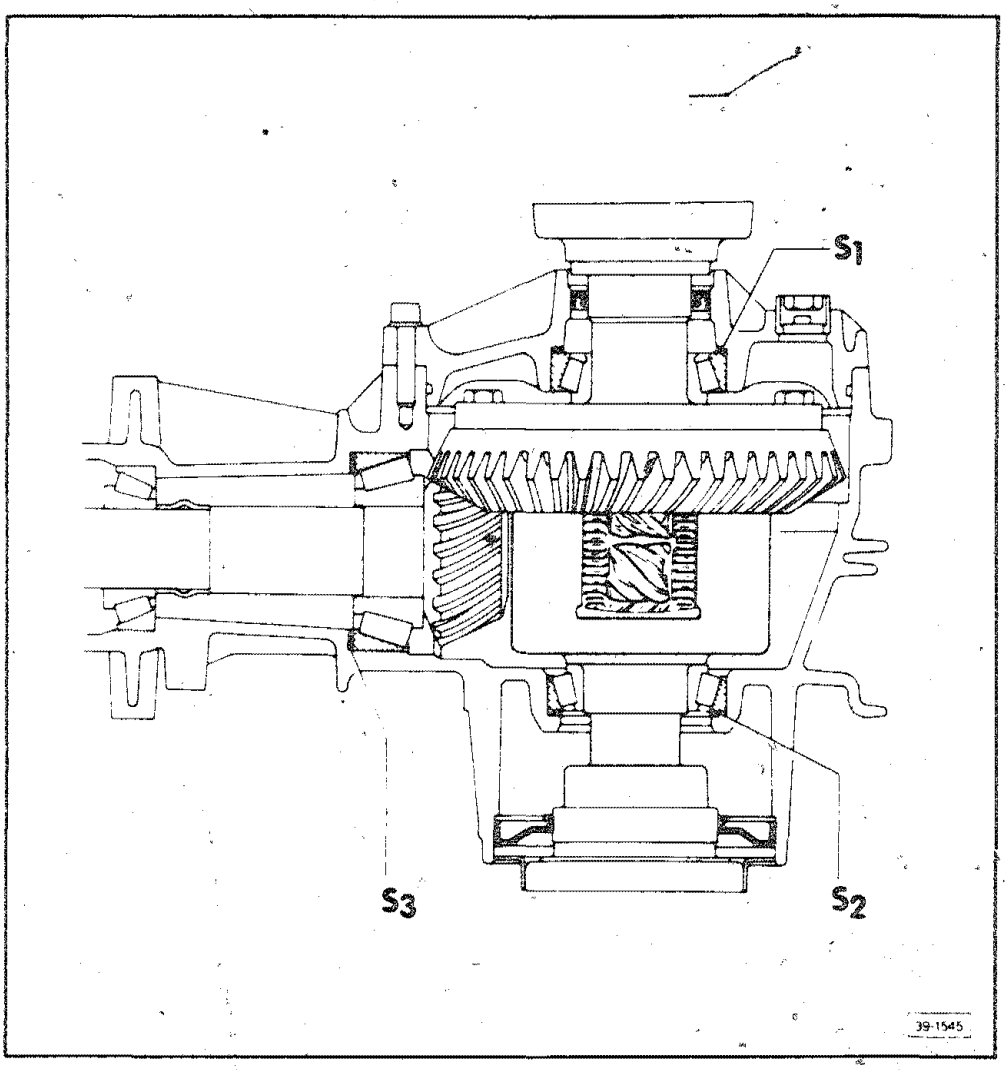
When pinion and ring gear have to be adjusted, follow the sequence below:

- determine total shim thickness (S_{total} = S1 + S2) needed to provide specified preload of differential bearings
- determine **S3** shim thickness needed to install pinion in the position determined in production
- distribute total shim thickness (S_{total}) between **S1** and **S2** to obtain specified backlash between ring gear and pinion

Note

The objective in ring gear/pinion adjustment is to attain the same quiet running position that was determined on the test machine used in production.

> **CAUTION**
>
> All assembly operations and measurements require great care and absolute cleanliness to produce accurate results.



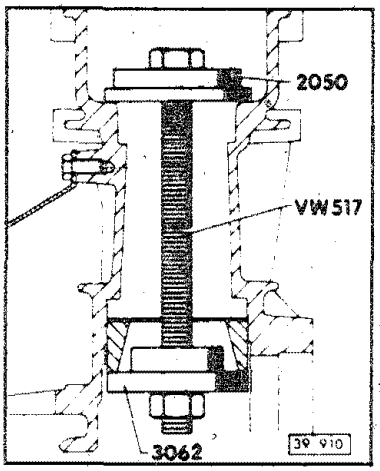
S1 — Shim behind ring gear

S2 — Shim opposite ring gear

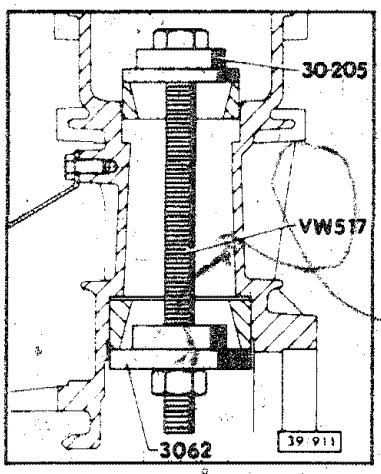
S3 — Shim behing pinion head

Pinion, adjusting

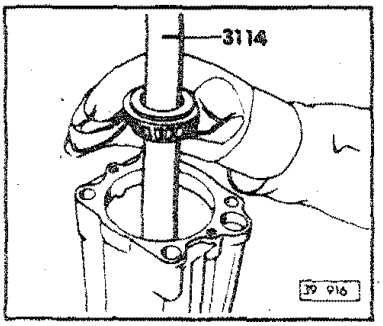
It is only necessary to readjust the pinion as shown below when the pinion set (ring gear/pinion) is replaced. See Adjustment Overview, section 39-290.



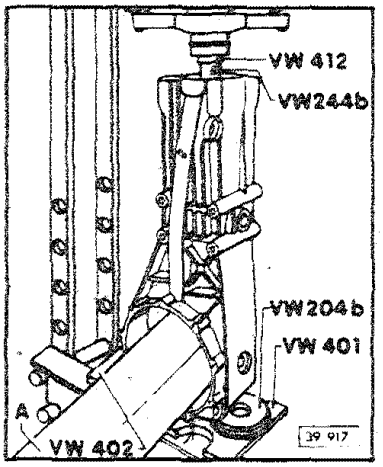
- mount final drive to holding fixture
- install large bearing outer race into housing without shims



- install small bearing outer race into housing

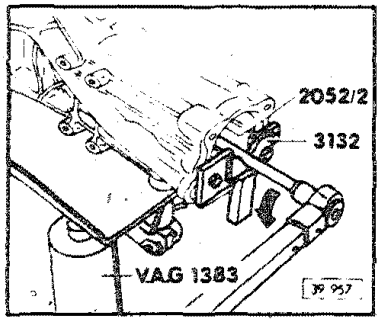


- install pinion
- heat small bearing inner race to approximately 120°C (248°F) and slide onto pinion without spacer sleeve

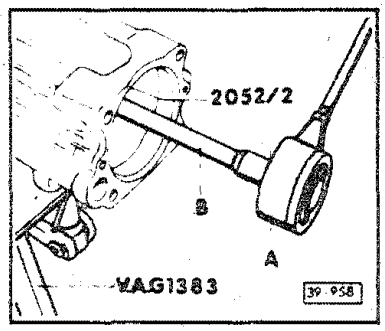


- press small bearing inner race onto pinion

A – wood support

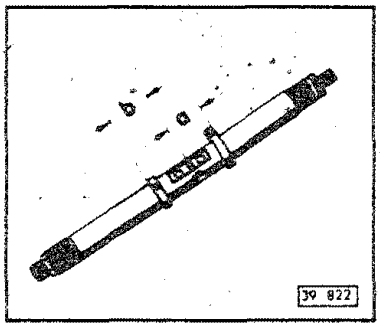


- tighten pinion nut until turning torque equals 280-320 Ncm (25-28 in. lb)

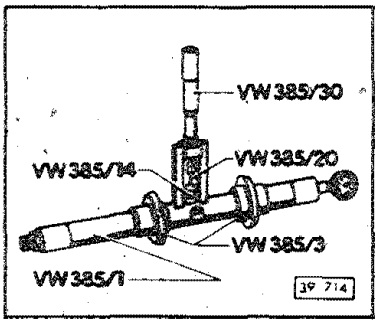


A – commercial torque gauge, suitable range

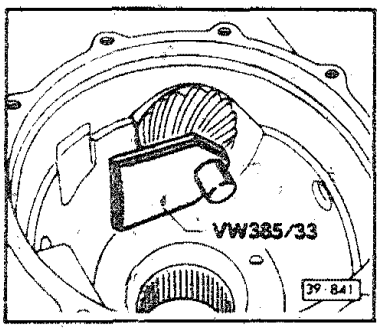
B – extension with 32 mm socket



- set centering ring of universal measuring bar **VW 385/1** to dimension **a** = 60 mm
- set sliding ring to dimension **b** = 50 mm

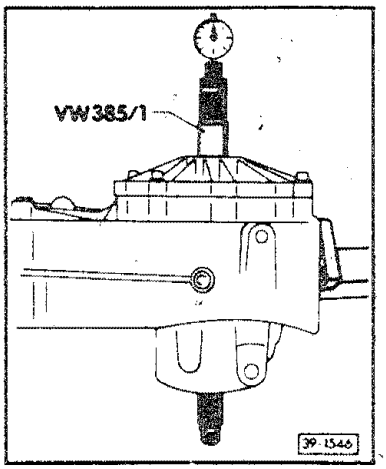


- assemble universal measuring bar as shown
  - dial indicator extension **VW385/20** - 3 mm long
- set adjustable master gauge **VW 385/30** to
  - R_o - 53.15 mm
- place master gauge on measuring bar and set dial indicator to 0 with 3 mm preload



- mount end plate **VW 385/33** on pinion head
- remove master gauge **VW 385/30** and install measuring bar in housing
- install final drive cover and tighten four bolts to secure

- pull 2nd centering ring outward until measuring bar can just be turned by hand



- measure dimension "e" as follows:
- turn measuring bar until dial indicator pin contacts end plate on pinion and indicates maximum deflection (return point)
- measured reading is dimension "e"

Example

e = 1.60 mm

CAUTION

When the measuring bar has been removed, check that dial indicator zeros with a 3 mm preload when master gauge **VW 385/30** is mounted. If not, repeat measurement.

S3 shim, determining

S3 = e + r

e – dial indicator reading (maximum deflection)

r – deviation (marked on ring gear in 1/100 mm or determined by actual measurement)

Example

Dial indicator reading e	1.60 mm
Deviation r	+ 0.42 mm
Shim thickness **S3**	1.18 mm

The following shims are available:

Thickness (mm)	Part number
0.95	183 525 231
1.00	183 525 231 A
1.05	183 525 231 B
1.10	183 525 231 C
1.15	183 525 231 D
1.20	183 525 231 E
1.25	183 525 231 F
1.30	183 525 231 G
1.35	183 525 231 H
1.40	183 525 231 J
1.45	183 525 231 K
1.50	183 525 231 L
1.55	183 525 231 M

Note

Shims can have varying tolerances. Check all shims for accurate thickness with a micrometer. Exact shim thickness for **S3** can be attained by using shims that are thicker or thinner than specified by part number.

- remove measuring bar
- remove pinion and reinstall with determined shim, spacer sleeve and seal
- tighten pinion nut until the specified turning torque is attained

CAUTION

Tighten pinion nut a little at a time while reading turning torque frequently. If turning torque exceeds specifications the spacer will have to be replaced before proceeding. Once the spacer has been compressed it cannot be used again.

Turning torque specifications

New bearings	Used bearings*
280-320 Ncm (25-28 in. lb)	30-60 Ncm (2.7-5.3 in. lb)

Checking

- turn pinion several times in each direction
- install measuring bar and check measurement
  - shims are correct if dial indicator shows deviation r within tolerance of ± 0.04 mm

Ring gear, adjusting

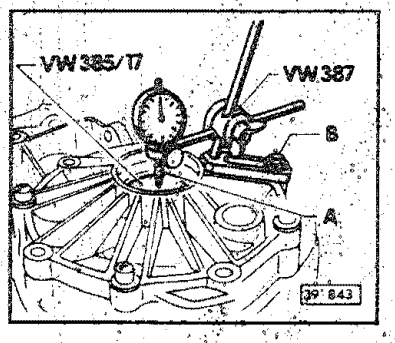
Adjust the ring gear if any of the following parts are replaced:

- Final drive housing
- Final drive cover
- Differential bearings
- Torsen differential
- Pinion set

See Adjustment Overview, section 39-290

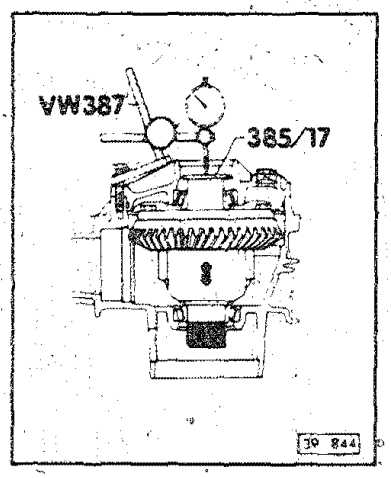
Differential bearing preload, adjusting (Pinion removed)

- remove seals and outer races of differential bearings
- remove shims
- install bearing outer races without shims
- install differential into housing without speedometer gear
  - ring gear goes on right side (cover side) in housing
- install cover and tighten bolts to 25 Nm (18 ft lb)
- set up measuring equipment and zero dial indicator with 1 mm preload



A – dial indicator extension, approximately 30 mm long

B – bolt, M8 x 45



- move differential up and down, read measurement on dial indicator and record

Example

Dial indicator reading = 1.60 mm

CAUTION

Do not turn differential when measuring.

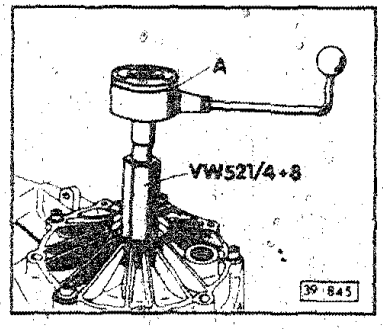
S total, (S1 - S2), determining

S_{total} = dial indicator reading + preload

Example

Preload (constant value)	0.40 mm
Dial indicator reading	+ 1.60 mm
S_{total}	= 2.00 mm

- install shim of appropriate thickness (2.00 mm in example) behind bearing outer race in final drive housing (S2 side)



Turning torque, measuring

A – commercial torque gauge, 0-600 Ncm

New bearings	Used bearings
250-320 Ncm (25-28 in. lb)	30-60 Ncm (2.7-5.3 in. lb)

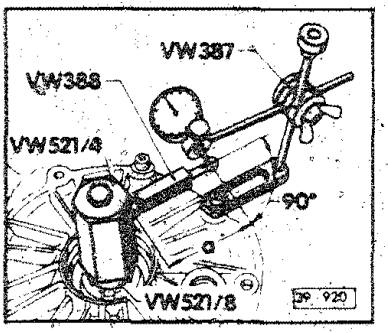
Note

If the ring gear and pinion are to be adjusted, the pinion should now be adjusted and the setting checked. See section 39-330.

Backlash, adjusting

The backlash adjustment is conducted
- with pinion installed
- with **S3** shim in place
- with S_{total} **(S1 and S2)** installed in housing side of differential

- turn differential gear several times in each direction to seat bearings



- set up measuring equipment
  - dial indicator extension = **VW 392/10** (6 mm flat)
- adjust measuring lever **VW 388** to dimension a = 79 mm
- while holding pinion so it does not move, turn ring gear to stop and zero indicator
- turn ring gear back and record backlash

- loosen lock bolt on locking sleeve
- rotate ring gear 90°, tighten lock bolt and measure backlash again
- repeat above procedures two more times

- add all four readings together and divide by four to determine average backlash

CAUTION

If any of the measurements differs more than 0.06 mm from the others, the ring gear/pinion installation is incorrect. Check and replace ring gear/pinion if necessary.

Average backlash, calculating

Example

1st measurement	0.68 mm
2nd measurement	0.70 mm
3rd measurement	0.70 mm
4th measurement	0.68 mm
Total	2.76 mm
Average backlash = 2.76 mm 4	0.69 mm

S1 shim, determining thickness from table

- choose appropriate **S1** shim from following table depending on average backlash calculated.

Average backlash (mm)	Shim thickness S1 (mm)
0.62	0.67
0.63	0.69
0.64	0.70
0.65	0.72
0.66	0.73
0.67	0.75
0.68	0.76
0.69	0.78
0.70	0.80
0.71	0.81
0.73	0.83
0.73	0.84
0.74	0.86
0.75	0.87
0.76	0.89
0.77	0.91
0.78	0.92
0.79	0.94
0.80	0.96
0.81	0.97
0.82	0.99
0.83	1.00
0.84	1.01
0.85	1.03
0.86	1.04
0.87	1.06
0.88	1.07
0.89	1.09
0.90	1.10
0.91	1.12
0.92	1.13
0.93	1.15
0.94	1.16
0.95	1.18
0.96	1.19
0.97	1.21

Average backlash (mm)	Shim thickness S1 (mm)
0.98	1.23
0.99	1.24
1.00	1.25
1.01	1.27
1.02	1.28
1.03	1.30
1.04	1.32
1.05	1.33
1.06	1.35
1.07	1.36
1.08	1.38
1.09	1.39
1.10	1.41
1.11	1.42
1.12	1.43
1.13	1.45
1.14	1.46
1.15	1.48

Example

Average backlash = 0.69 mm
S1 shim from table = 0.78 mm

The following shims are available:

Thickness (mm)	Part number
0.15	005 409 385
0.20	005 409 385 A
0.25	005 409 385 B
0.50	005 409 385 C
0.80	005 409 385 D
1.00	005 409 385 E
1.50	005 409 385 F

S2 shim, determining thickness

$S2 = S_{total} - S1$

Example

S_{total}	2.00 mm
S1	− 0.78 mm
S2	= 1.22 mm

The following shims are available:

Thickness (mm)	Part number
0.15	005 409 381
0.20	005 409 381 A
0.25	005 409 381 B
0.55	005 409 381 C
0.60	005 409 381 D
0.65	005 409 381 E
0.80	005 409 381 F
1.35	005 409 381 G
1.50	005 409 381 H
1.65	005 409 381 J

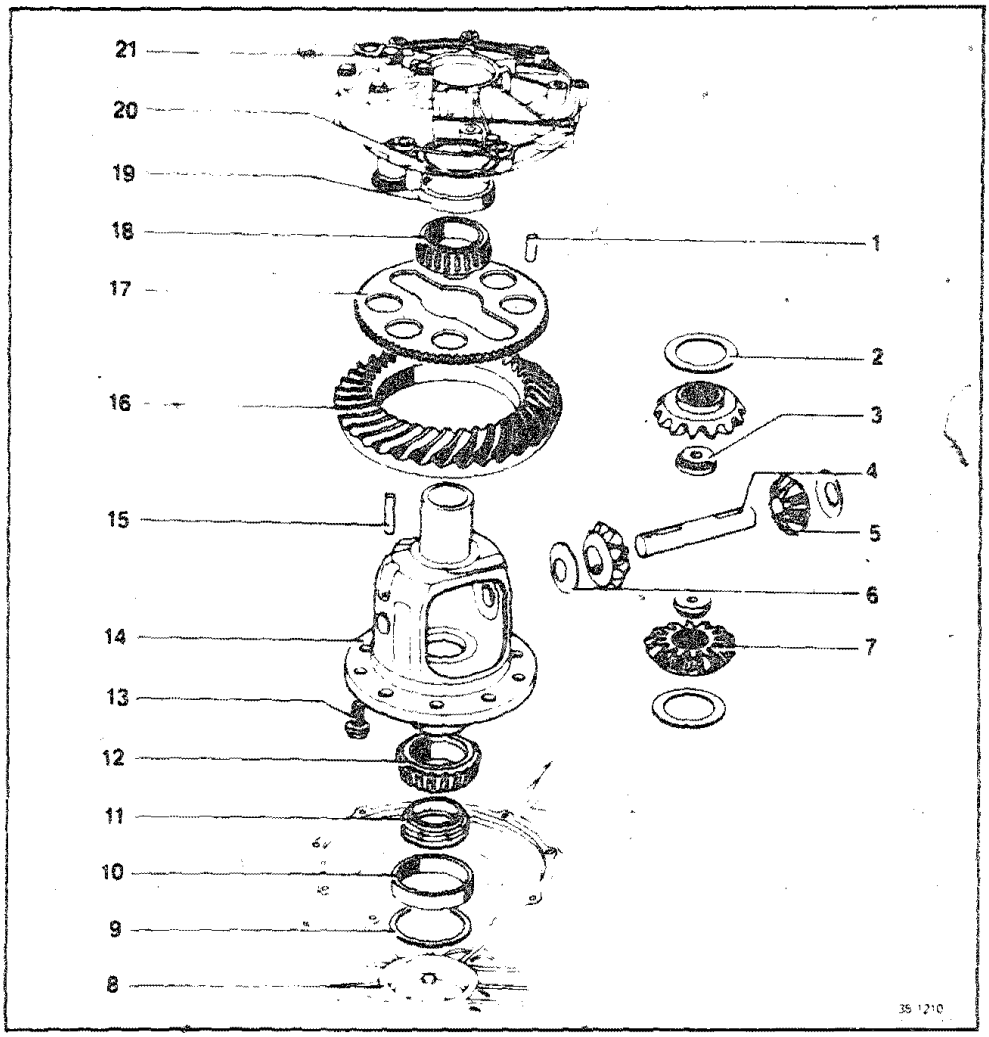
- install **S1** shim behind ring gear
- install **S2** shim on side opposite ring gear

Backlash measurement, checking

- measure backlash at four locations around ring gear
  - backlash must be: 0.12 - 0.22 mm

CAUTION

Backlash must not deviate more than 0.05 mm between readings.



CAUTION

When replacing bearings, adjust ring gear, section 39-110. Replace both bearings together.

Note

When replacing parts marked with an asterisk (*), additional adjustments are required. See adjustment overview, section 39-70.

* 1 — **Spring pin**
- secures oil pump drive wheel
- drive into differential gear housing

2 — **Shims**
determining thickness, section 39-50

3 — **Axle flange nut**

4 — **Differential pinion shaft**
- drive out with drift
- drive in carefully to avoid damaging thrust washers
- secure with spring pin

5 — **Differential pinion gears**
installing, section 39-50

6 — ***Thrust washer***
check for cracks and pits

7 — **Differential side gears**
adjusting section 39-50

*8 — **Final drive housing** (see Note)

9 — **S1 shim**
- record thickness
- adjustment overview section 39-70

*10 — **Large bearing, outer race** (see Note)
removing installing section 39-50

11 — **Speedometer drive gear**
replacing with transmission installed section 39-20

*12 — **Large bearing, inner race** (see Note)
removing installing section 39-50

13 — **90 Nm (66 ft lb)**
- use only specified bolts
- tighten bolts diagonally in sequence

*14 — **Differential housing** (see Note)

15 — **Spring pin**
drive in flush

*16 — **Ring gear** (see Note)
- drive pinion and ring gear must be replaced as matched set
- removing installing section 39-50

*17 — **Oil pump drive wheel** (see Note)
- installed position section 39-50
- after replacing drive wheel redetermine S2 shim thickness section 39-110

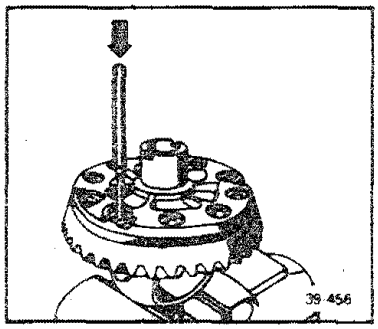
*18 — **Small bearing, inner race** (see Note)
removing installing section 39-50

*19 — **Small bearing, outer race** (see Note)
removing installing section 39-50

20 — **S2 shim**
- note thickness
- adjustment overview section 39-70

*21 — **Final drive cover** (see Note)

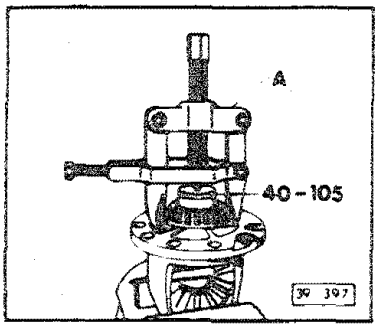
Differential, disassembling/assembling



Ring gear, removing from housing

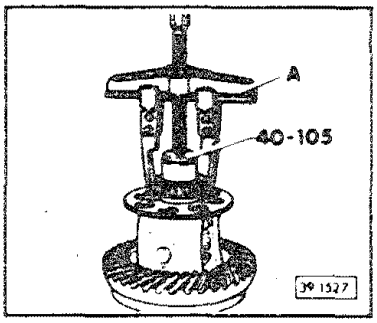
Note

Remove oil pump drive wheel before removing ring gear



Large bearing inner race, removing from housing

A – 2-arm puller (commercial), **Kukko 204/2**

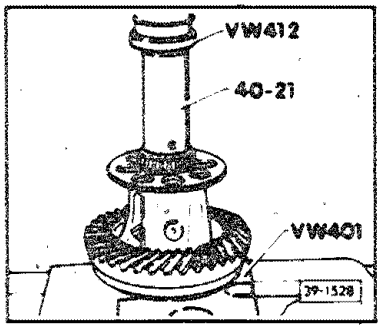


Small bearing inner race, removing from housing

A – 2-arm puller (commercial), **US 1078 (Kukko 20/10)**, with **Matra V/170** hook

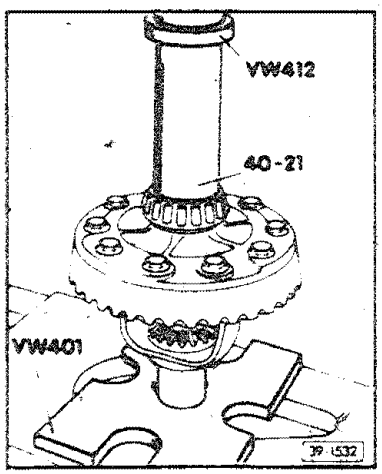
Note

Matra V/170 hook can be tightened, if necessary, with accompanying tensioner



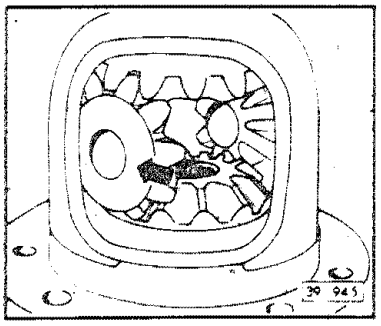
Small bearing inner race, installing

- heat bearing inner race to approximately 100°C (212°F), and press on



Large bearing inner race, installing

- heat bearing inner race to approximately 100°C (212°F), and press on

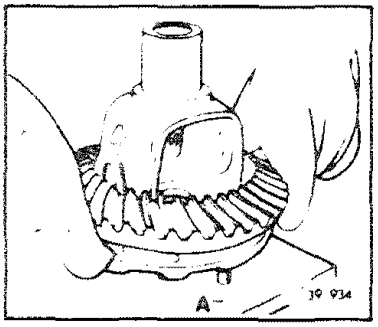


Pinion gears, installing

Note

Before assembling, lubricate parts with hypoid transmission oil

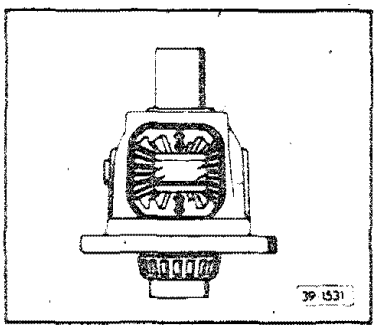
- insert differential side gears along with the correct adjustment shims (see illustrations 39-1531 and 35-1211, in this section)
- insert differential pinion gears approximately 180° apart
  - assemble thrust washers, using small amount of grease
- rotate gears into position (**arrow**)
- insert axle flange nuts
- align thrust washers
- drive in differential pinion shaft
- secure shaft with spring pin



Ring gear, installing

- heat gear to approximately 100 C (212 F), and install

  A – alignment pin, suitable size



Differential pinion gears, adjusting

- insert side gears along with the thinnest shims available (0 5 mm)
- insert pinion gears with thrust washers and drive in differential pinion shaft

> **CAUTION**
>
> Do not interchange differential pinion gears and thrust washers

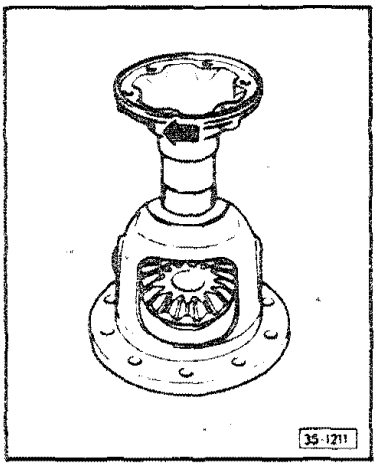
- hold small differential pinion gears outward and check the clearance of the differential side gears by hand (**arrows**)
- adjust clearance by changing the adjustment shims so maximum clearance is 0 10 mm (0.004 in)

Note

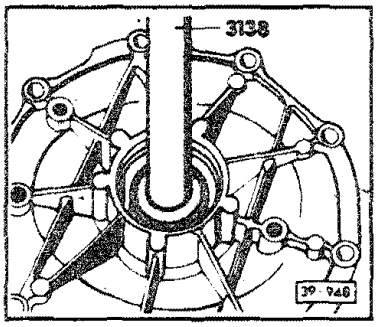
The clearance is correct if you feel no play and the differential pinion gears can be turned slightly, without catching (see illustration 35-1211, in this section)

The following adjustment shims are available.

Thickness (mm)	Part number
0 5	011 519 215
0 6	088 409 249
0 7	088 409 249 A
0 8	088 409 249 B
0 9	088 409 249 C
1 0	088 409 249 D

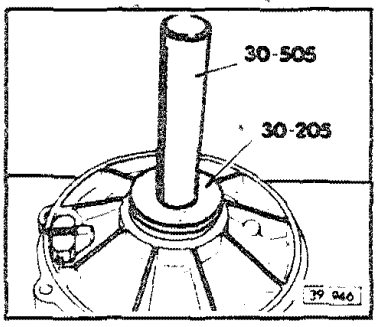


Differential gears, turning



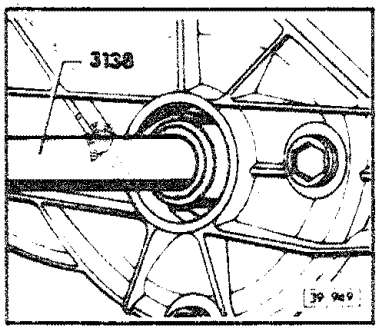
Small bearing outer race, removing

- drive race out of final drive housing cover
  - use suitable-sized base, e.g. **VW 470**



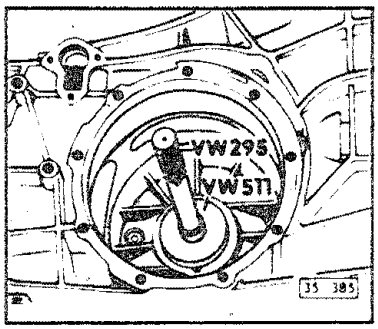
Small bearing outer race, installing

- drive race into final drive housing cover



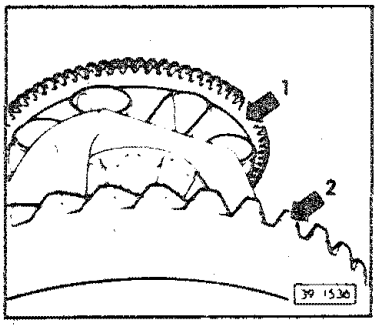
Large bearing outer race, removing

- drive race out of final drive housing



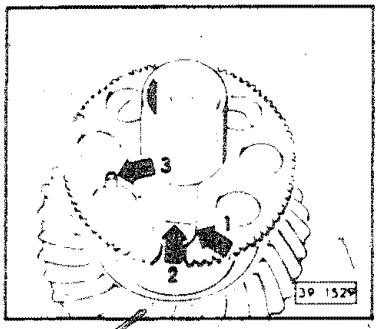
Large bearing outer race, installing

- drive race into final drive housing



Drive wheel for oil pump, installed position

- be sure notch (**arrow 1**) faces ring gear (**arrow 2**)



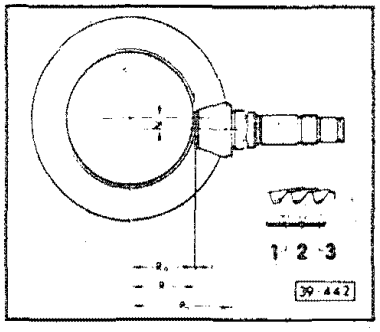
- be sure long notches (**arrow 1**) face housing opening (**arrow 2**) and spring pin (**arrow 3**) secures drive wheel

Ring gear/pinion, adjusting

Note

Careful adjustment of the ring gear and pinion is important to ensure that the final drive runs quietly and has a long service life. During manufacture, the ring gear and pinion are matched as a set, and run on special testing machines to ensure a correct mesh pattern and silent running in both directions. The quietest running position is determined by moving the pinion axially and lifting the ring gear away from the the no-play meshing position, maintaining the backlash within specified tolerance.

The deviation r from the master gauge R_o is measured for the ring gear/pinion sets supplied as replacement parts, and is marked on the outer face of the ring gear. The ring gear and pinion must always be replaced as a matched set.



Service gears

1 – The code **0937** identifies an Oerlikon gear set with a 9:37 ratio.

2 – The matching number (e.g. **312**) is stamped on both the ring gear and pinion, to identify a set.

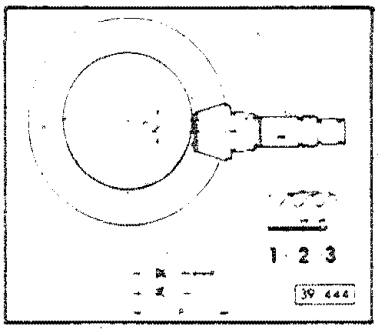
3 – The deviation r (i.e. pinion deviation) is measured against the master gauge of the testing machine used in production. The deviation r is always given in 1/100 mm (e.g. 25 means r = 0.25 mm).

R_o – Length of master gauge used in production.

R_o = 59.65 mm

R – Actual dimension found between the ring gear center and the end face of the pinion while at the quietest running position of a particular gear set.

V_o – Hypoid offset = 12 mm



Standard-production gear sets

X – Codes shown X d out, are not marked on production gears

$\mathbf{P_o}$ – The measurement used for setting ring gears and pinions in production.

CAUTION

In production, the position of the pinion is determined by dimension $\mathbf{P_o}$ (measured from ring gear centerline to back of pinion head). The marking of deviation r on the ring gear, and the matching number, have been eliminated. It is therefore necessary to measure the position of the pinion before removing it when parts that affect the position of the pinion are to be replaced. See Adjustment Overview, section 39-70.

Adjustment overview

Note

When assembling the final drive, it is only necessary to adjust the ring gear or pinion, or both, if parts have been replaced which directly affect the final drive setting. The following chart should be used to avoid carrying out unnecessary adjustments.

To be adjusted / Replaced part	Ring Gear (S1 + S2) Section 39.33	Ring Gear only, Shim S2 Section 39.42	Pinion (S3 + S4) using tolerance r Section 39.24	Pinion (S3 + S4) using actual measurement Section 39.21	Pinion only, Shim S4 Repair Group 34
Final drive housing	X			X	
Gear carrier housing					X
Differential housing	X				
Pinion bearings				X	
Differential bearings	X				
Ring gear and pinion	X		X		
Final drive cover	X				
1st 2nd gear synchronizer hub					X
1st gear needle bearing					X
Hollow shaft					X
Spacer plate					X
Oil pump drive gear		X			

Pinion, determining position (by actual measurement)

Note

This operation is only necessary if deviation r is not marked on the ring gear, and if both pinion bearings and or the final drive housing have to be replaced. These parts directly affect the position of the pinion

Differential, removing

- assemble measuring bar, section 39-100
- install measuring bar into final drive housing
- measure the deviation from R_o (maximum deflection in the red range)
  - this reading corresponds with deviation r
  - note reading

Note

After replacing pinion bearings and/or final drive housing

- adjust pinion, section 39-100
  - the reading obtained for r is used to determine the thickness of shim **S3**

Ring gear/pinion, adjusting

- determine total shim thickness, S_{total} (i.e **S1** + **S2**) to give specified preload of differential bearings
- determine total shim thickness, S_{total} (i.e **S3** + **S4**) to give specified preload of pinion bearings
- distribute S_{total} between **S3** and **S4** so dimension between ring gear centerline and pinion end face corresponds to installation dimension **R** determined in production
- distribute S_{total} between **S1** and **S2** to obtain specified backlash between ring gear and pinion

Note

Always try to adjust the ring gear and pinion to obtain the same quiet running position determined on the special test machine used in production

All assembly operations and measurements require great care and absolute cleanliness to produce accurate results

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016 5-speed

★ALL NEW INFORMATION since last filming