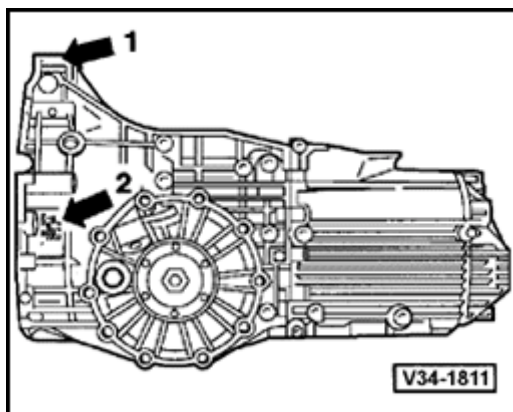


Transmission, identification

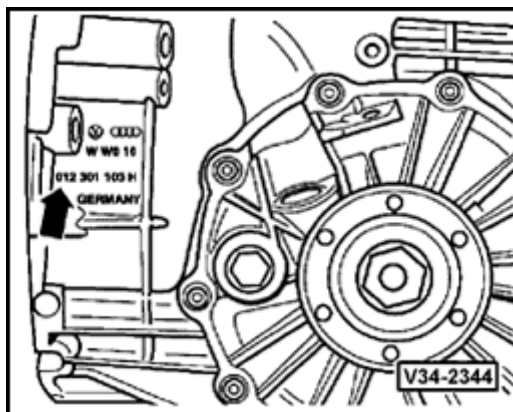


Location on transmission

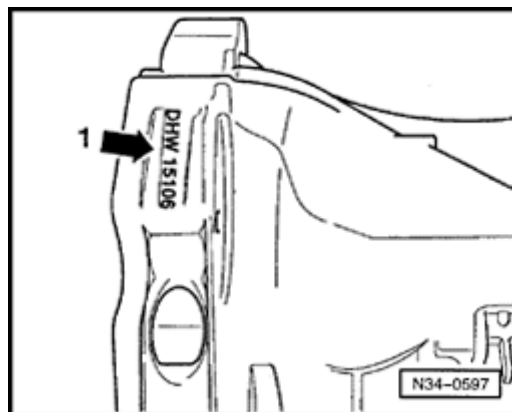
- ◆ Code letters and date of manufacture (arrow -1-)
- ◆ Manual transmission 012/01W (arrow -2-)

Note:

For organizational reasons, code "012" has been expanded to include code "01W." Both codes refer to the same transmission type.



Manual transmission 012/01W (arrow -2-)



Transmission code letters and date of manufacture (arrow -1-)

Example:	DHW	15	10	6
	Code letters	Day	Month	Year (1996) of manufacture

Additional information depends on manufacturing.

Note:

The transmission code letters are also listed on the vehicle data plates.

Code letters, transmission application, ratios, capacities

Manual transmission		5-speed 012 front wheel drive			
Code letters		CTE	DHW 1)	CTJ	CWY
Manufactured	from	11.94	07.96	11.94	11.94
	to	07.96		03.95	03.95
Application	Model	Audi A4 1996 ➤	Audi A4 1996 ➤	Audi A4 1996 ➤	Audi A4 1996 ➤
	Engine	1.8 L - 110 kW (150 hp)	1.8 L - 110 kW (150 hp)	2.8 L - 128 kW (172 hp)	2.8 L - 128 kW (172 hp)
Ratio: Z2 : Z1 = i	Final drive	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700
	1st Gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd Gear	36 : 17 = 2.118	36 : 17 = 2.118	35 : 19 = 1.842	35 : 18 = 1.944
	3rd Gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th Gear	35 : 34 = 1.029	35 : 34 = 1.029	33 : 35 = 0.943	33 : 35 = 0.943
	5th Gear	31 : 37 = 0.838	31 : 37 = 0.838	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse Gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444
1) Modified transmission housing; transmission code DHW replaces CTE.					

00-4

Code letters	CTE	DHW 1)	CTJ	CWY
Speedometer	electronic			
Capacity	2.25 liters (2.38 qts.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part number G 005 000 (1 liter)			
Clutch control	hydraulic	hydraulic	hydraulic	hydraulic
Clutch plate diameter	228 mm	228 mm	240 mm	240 mm
Drive shaft flange diameter	108 mm	108 mm	130 mm 2)	130 mm 2)
Polygon bearing	Yes	Yes	no	no
Overall ratio in high gear	3.100	3.100	2.921	2.921
2) Drive axle with triple rotor joint.				

00-5

Manual transmission		5-speed 012/01W front wheel drive			
Code letters		CWZ	DHX 3)	DDK	DHY 4)
Manufactured	from	01.95	07.96	03.96	07.96
	to	07.96		07.96	
Application	Model	Audi A4 1996 ➤	Audi A4 1996 ➤	Audi A4 1996 ➤	Audi A4 1996 ➤
	Engine	2.8 L - 128 kW (172 hp)	2.8 L - 128 kW (172 hp)	2.8 L - 142 kW (191 hp)	2.8 L - 142 kW (191 hp)
Ratio: Z2 : Z1 = i	Final drive	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700
	1st Gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd Gear	35 : 18 = 1.944	35 : 18 = 1.944	35 : 18 = 1.944	35 : 18 = 1.944
	3rd Gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th Gear	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943
	5th Gear	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse Gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444
³⁾ Modified transmission housing; transmission code DHX replaces CWZ. ⁴⁾ Modified transmission housing; transmission code DHY replaces DDK.					

Code letters	CWZ	DHX 3)	DDK	DHY 4)
Speedometer	electronic			
Capacity	2.25 liters (2.38 qts.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part number G 005 000 (1 liter)			
Clutch control	hydraulic	hydraulic	hydraulic	hydraulic
Clutch plate diameter	240 mm	240 mm	240 mm	240 mm
Drive shaft flange diameter	130 mm 2)	130 mm 2)	130 mm 2)	130 mm 2)
Polygon bearing	Yes	Yes	Yes	Yes
Overall ratio in high gear	2.921	2.921	2.921	2.921
2) Drive axle with triple rotor joint. 3) Modified transmission housing; transmission code DHX replaces CWZ. 4) Modified transmission housing; transmission code DHY replaces DDK.				

00-7

Calculations

Transmission ratio "i," computing

Transmission ratio

Transmission ratio = $\frac{\text{No. of teeth driven gear}}{\text{No. of teeth drive gear}}$

Ratios	Formula
iG = gear ratio	ZG2 : ZG1
iA = axle ratio	ZA2 : ZA1
iov = overall ratio	iG x iA

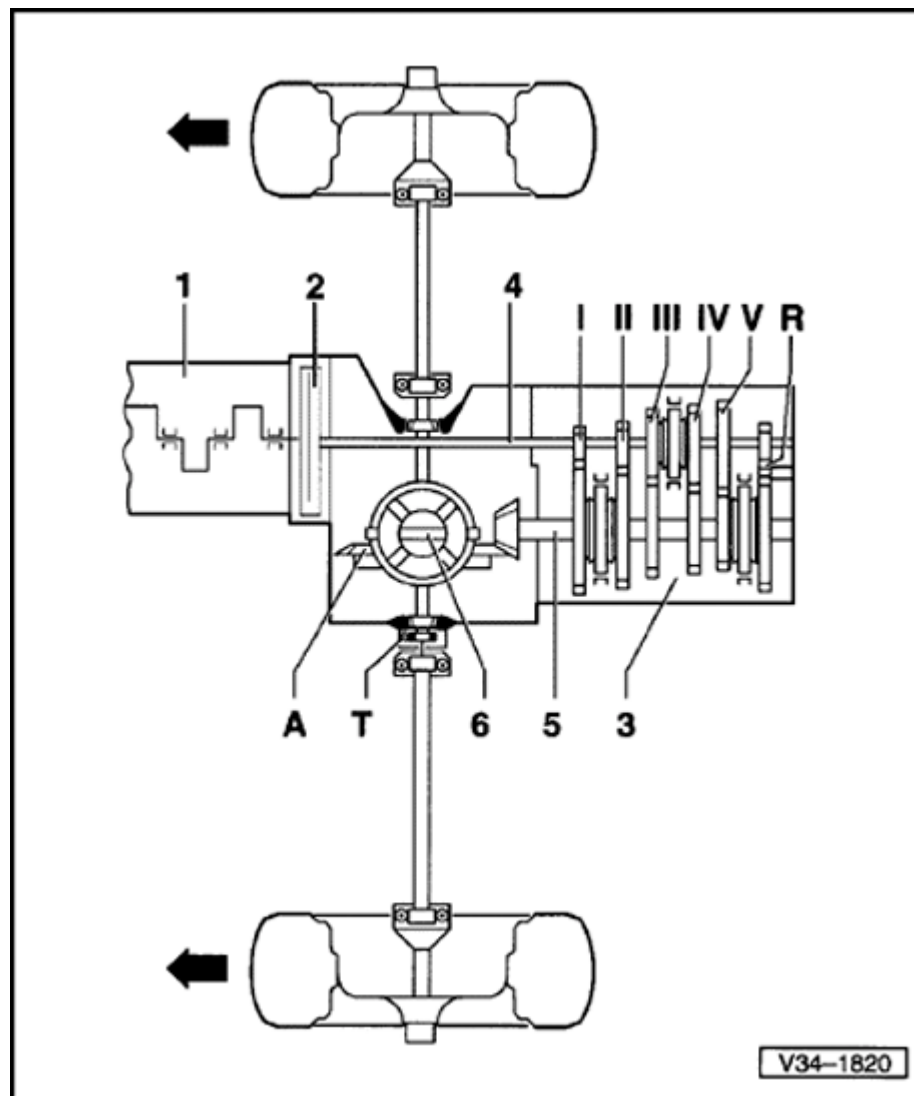
Example:

	5th Gear	Final drive
Drive gear	ZG1 = 38	ZA1 = 10
Driven gear	ZG2 = 30	ZA2 = 37

Calculating:

$$\begin{aligned} \mathbf{iG} &= 30 : 38 = 0.789 \\ \mathbf{iA} &= 37 : 10 = 3.700 \\ \mathbf{iov} &= (30 : 38) \times (37 : 10) = 0.789 \times 3.700 = 2.921 \end{aligned}$$

00-8



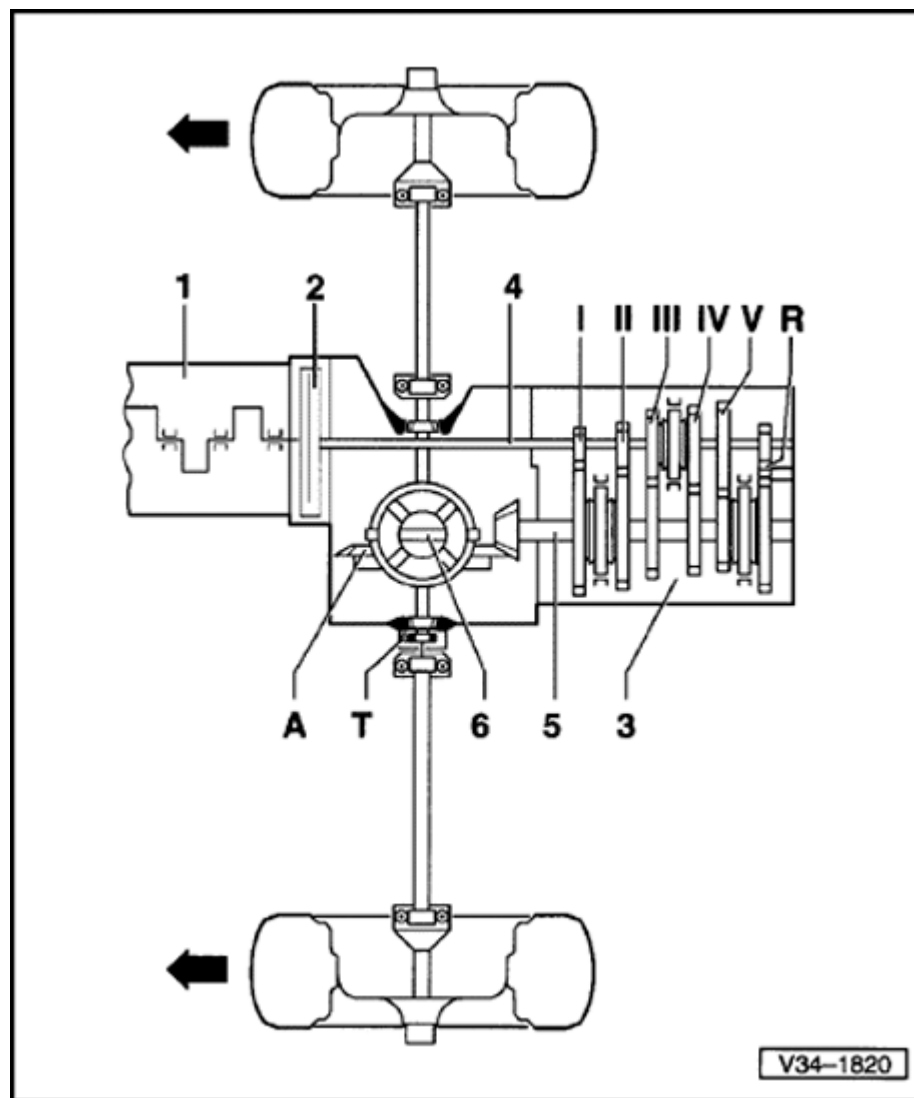
Drivetrain, overview

- 1 - Engine
- 2 - Clutch
- 3 - Manual transmission
- 4 - Input shaft (main shaft)
- 5 - Pinion shaft (output shaft)
- 6 - Differential

Note:

Arrows point in direction of travel.

00-9



I - 1st Gear

II - 2nd Gear

III - 3rd Gear

IV - 4th Gear

V - 5th Gear

R - Reverse Gear

A - Final drive

T - Speedometer drive (electronic)

Note:

Arrows point in direction of travel.

General repair instructions

The maximum possible care, cleanliness and proper tools are essential to ensure satisfactory and successful transmission repairs. The usual basic safety precautions also apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Repair Manual, are summarized here. They apply to this Repair Manual.

Special tools and equipment

For a complete list of special tools and equipment used in this repair manual ⇒ "Special tools catalog."

Transmission

- ◆ Using parts catalog microfiche, match bolts and other components according to transmission codes ⇒ [Page 00-3](#) .
- ◆ After replacing the manual transmission , check oil level and top-up if necessary ⇒ [Page 34-36](#) .
- ◆ Capacities and specifications ⇒ [Page 00-3](#) .

- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.
- ◆ When installing transmission, make sure centering sleeves for aligning engine and transmission are correctly seated.

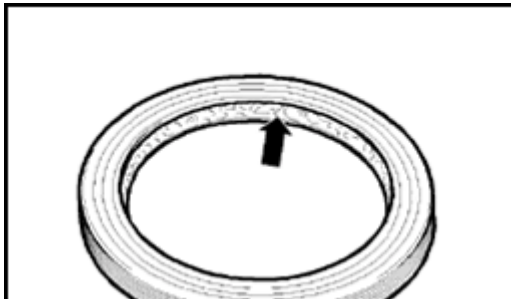
00-11

Sealants

- ◆ Thoroughly clean housing joint surfaces before applying sealant.
- ◆ Apply sealant AMV 188 000 02 or AMV 188 001 02 evenly and not too thick.
- ◆ Breather holes must be free of sealant.

O-rings, gaskets, seals

- ◆ Always replace O-rings, gaskets and seals.
- ◆ After removing gaskets and seals, always inspect the contact surfaces on the housing or shaft for burrs resulting from removal, or for other signs of damage.
- ◆ Thoroughly clean housing joint surfaces before assembling.



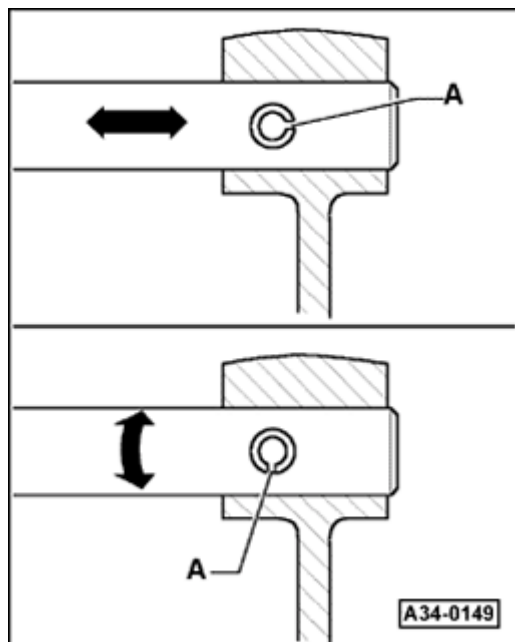
A

- ◆ Before installing radial shaft seals, lightly oil outer edge and fill space between sealing lip and dust lip (arrow) with oil.
- ◆ Open side of the seal faces toward the side containing the oil.
- ◆ When replacing seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).

- ◆ Lightly lubricate O-rings before installing. This prevents the rings from being pinched while being inserted.
- ◆ Check transmission oil level after replacing gaskets and seals ⇒ [Page 34-36](#) .

Circlips

- ◆ Do not over-stretch circlips.
- ◆ Always replace.
- ◆ Circlips must be fully seated in groove.



4

- ◆ Always replace roll pins.
- ◆ Installed position: slot -A- is longitudinal to line of force (arrow).

Nuts, bolts

- ◆ Always replace self-locking nuts and bolts.
- ◆ Loosen nuts or bolts opposite to torque sequence.
- ◆ Tighten and loosen bolts or nuts for securing covers and housings in a diagonal sequence.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.
- ◆ The threads of bolts which are secured by a locking compound should be cleaned using a wire brush. Then apply AMV 185 101 A1 when installing.
- ◆ Threaded holes for self-locking bolts or bolts coated with locking fluid must be cleaned with tap. Otherwise there is a danger of bolts shearing when subsequently being removed.

Bearings

- ◆ Install needle bearings with the lettering on the bearing (the side with thicker metal) facing the drift.
- ◆ Mark needle bearings of drive gears for first through fifth sliding gears when removing to ensure the same installed position when installing.
- ◆ Grease needle bearing for input shaft in flywheel.
- ◆ Lubricate all bearings in transmission with transmission fluid before installing.
- ◆ Heat tapered roller bearing inner races to approx. 100 ° C (212 ° F) before installing. Press in to stop so that there is no axial play.
- ◆ Do not interchange inner and outer bearing races with those from other bearings of the same size.
- ◆ Always replace tapered roller bearings on one shaft together and use new bearings from the same manufacturer.

- ◆ The tapered roller bearings for the output shaft and the differential in the manual transmission are low-friction bearings. Do not additionally oil new tapered roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.

00-14

Shims

- ◆ Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- ◆ Check for burrs and signs of damage.

Sliding Gears

- ◆ After assembling, check axial play of 1st to 5th sliding gears (0.15-0.35 mm) and check for free movement.

Synchronizer rings

- ◆ Do not interchange. When re-using, install synchronizer rings with the same gear with which they were matched.
- ◆ Check for signs of wear; replace if necessary.
- ◆ Lubricate with transmission fluid before installing.

Gears, synchro-hubs, inner races for sliding gears

- ◆ Heat gears and synchro-hubs to approx. 100 ° C (212 ° F) before installing. Press into stop so there is no axial play.
- ◆ Heat inner races for sliding gears to approx. 100 ° C (212 ° F) before installing.
- ◆ The temperature can be checked using VAG1558 temperature tester.
- ◆ Note installation position.

00-15

Clutch mechanism

- ◆ When removing transmission, remove clutch slave cylinder without disconnecting lines.
- ◆ Do not depress the clutch pedal after removing the slave cylinder if the hydraulic line is still connected. Otherwise the piston will be pressed out of the slave cylinder.
- ◆ Do not cant clutch pressure plate; loosen and tighten in a diagonal sequence and in stages.
- ◆ If the clutch has burnt out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission in order to reduce the smell of burnt linings.

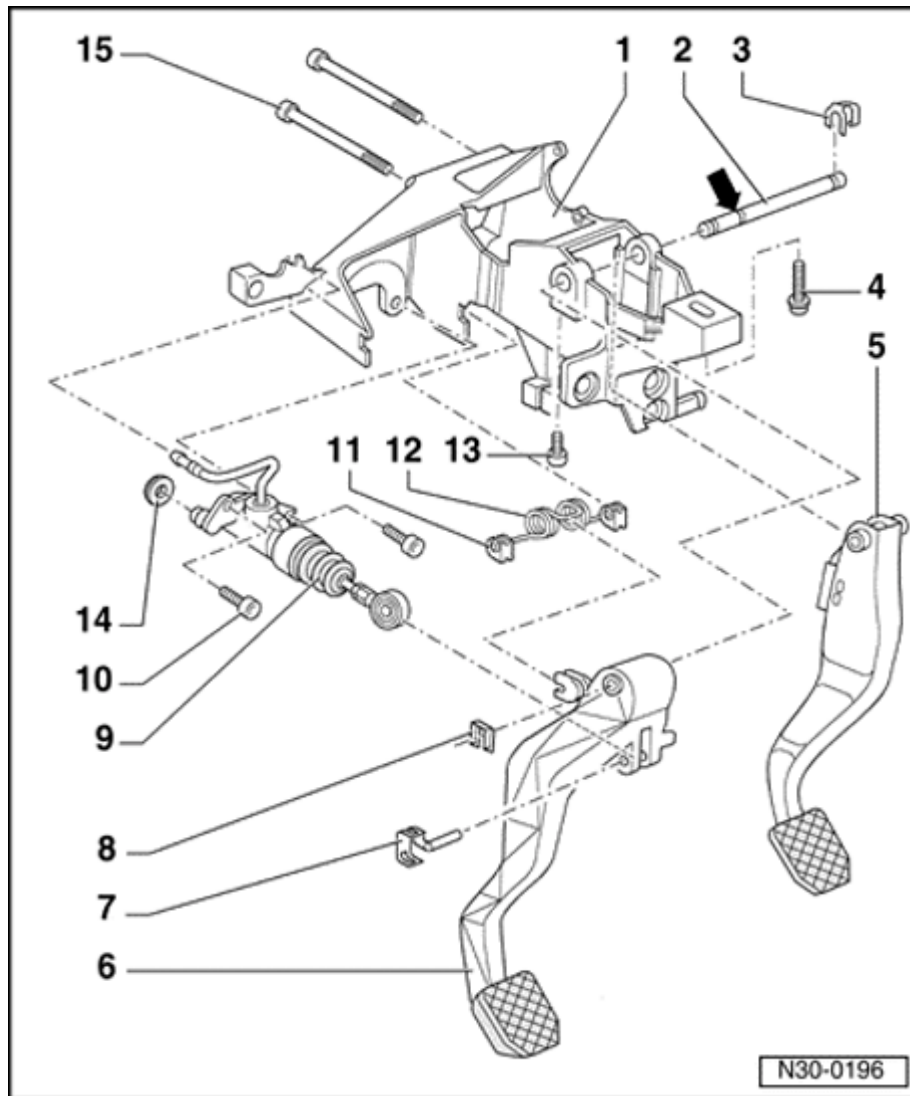
Clutch mechanism, servicing

Notes:

- ◆ *Determine the correct coding for the anti-theft radio (if equipped).*
- ◆ *Switch the ignition off and disconnect battery Ground (GND) strap.*
- ◆ *Lubricate all bearings and contact surfaces with G 052 142 A 2 polycarbamide grease.*
- ◆ *Before working on the pedal cluster, remove the driver's side storage compartment*

⇒ [Repair Manual, Body Interior, Repair Group 68.](#)

- ◆ *Make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does happen, clean the affected areas thoroughly.*
- ◆ *When working in the floor area, cover the carpet with a cloth to protect against any leaking brake fluid.*



Clutch pedal and clutch control overview

1 - Mounting bracket

- ◆ Removing and installing ⇒ Repair Manual, Brake System, Repair Group 46

2 - Pivot pin

- ◆ For clutch and brake pedals
- ◆ Installation position: groove (arrow) facing clutch pedal

3 - Locking clip

4 - Socket-head bolt

- ◆ 25 Nm (18 ft lb)

5 - Brake pedal

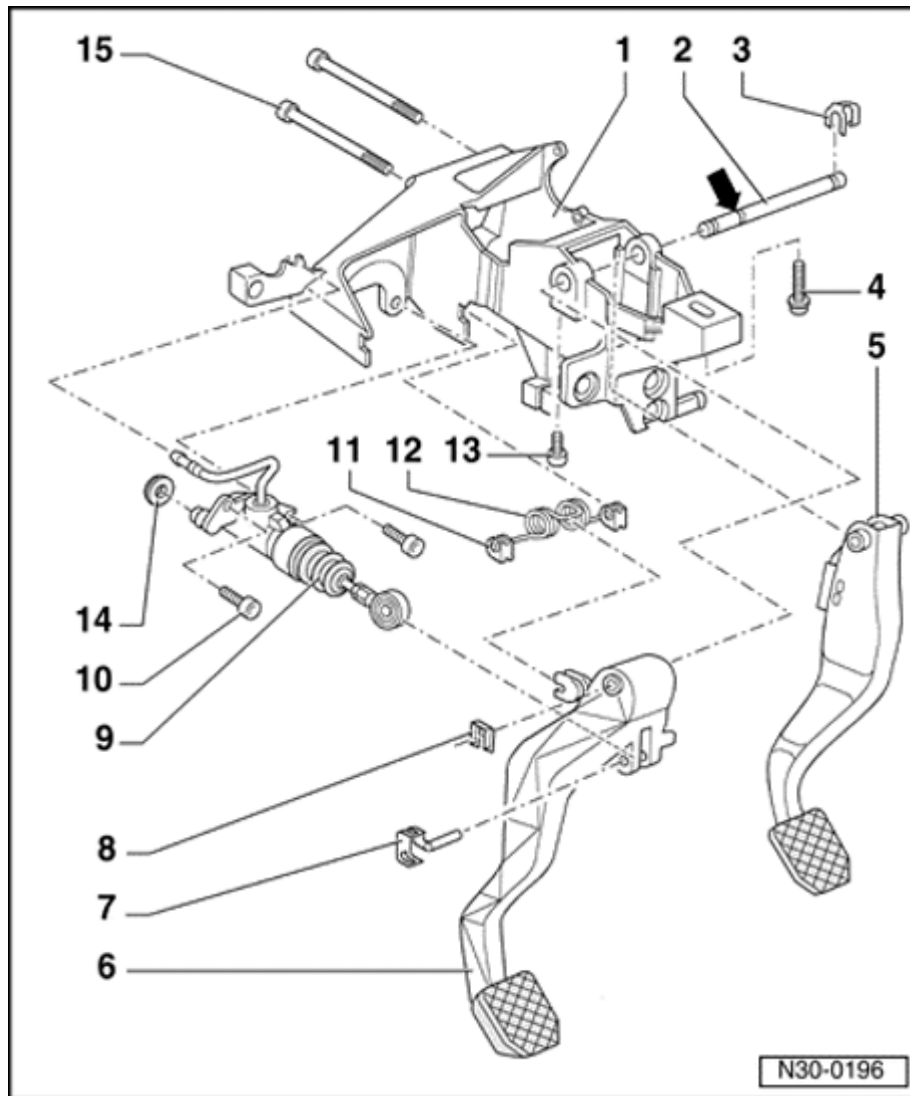
6 - Clutch pedal

- ◆ Removing and installing ⇒ [Page 30-4](#)

7 - Pin and locking plate

- ◆ Clip onto clutch pedal

8 - Locking clip

**9 - Clutch master cylinder**

- ◆ Removing and installing ⇒ [Page 30-11](#)
- ◆ Do not operate after clutch pedal has been removed

10 - Socket-head bolt

- ◆ 20 Nm (15 ft lb)

11 - Mount

- ◆ Insert in mounting bracket with over-center spring

12 - Over-center spring

- ◆ Application ⇒ parts catalog
- ◆ Remove and install together with clutch pedal ⇒ [Page 30-4](#)

13 - Socket-head bolt

- ◆ 5 Nm (44 in. lb)
- ◆ Secures pivot pin for clutch and brake pedal

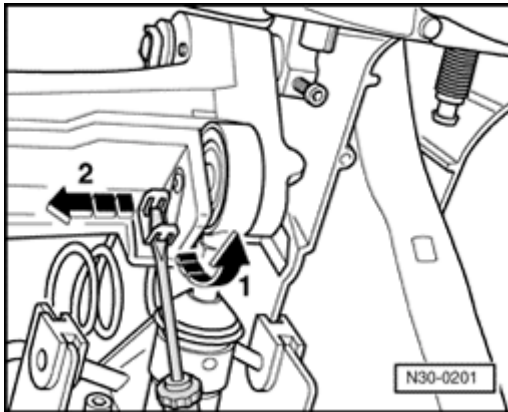
14 - Seal**15 - Torx® bolt**

- ◆ 25 Nm (18 ft lb)
- ◆ Also secures brake master cylinder to brake servo

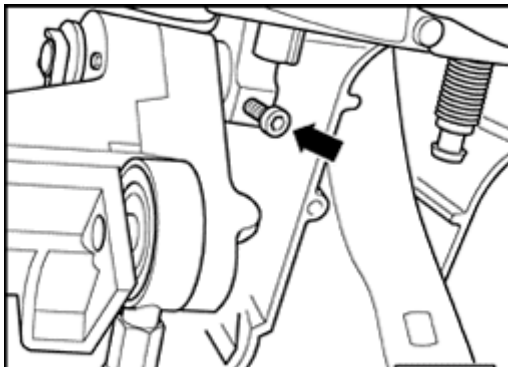
Clutch pedal and over-center spring, removing and installing

Removing

- Remove driver's side storage compartment ⇒ Repair Manual, Body Interior, Repair Group 68.
- If installed, remove switch above clutch pedal.



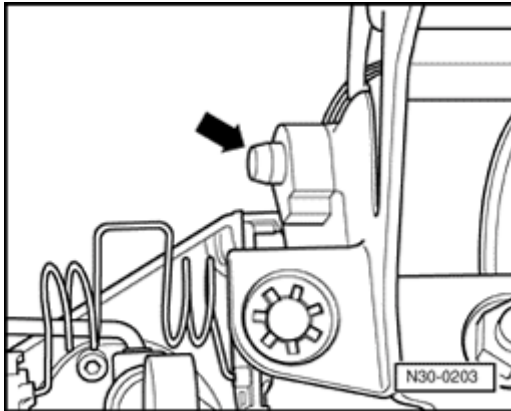
- Unclip pin and locking plate using screwdriver (arrow -1-), remove pin and locking plate (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Press locking clip for clutch pedal off pivot pin using screwdriver.



- Remove bolt (arrow).
- Press clutch and brake pedal pivot pin out toward right, until clutch pedal can be removed.
- If necessary, press locking clip for brake pedal off pivot pin using screwdriver.
- Remove clutch pedal and over-center spring.

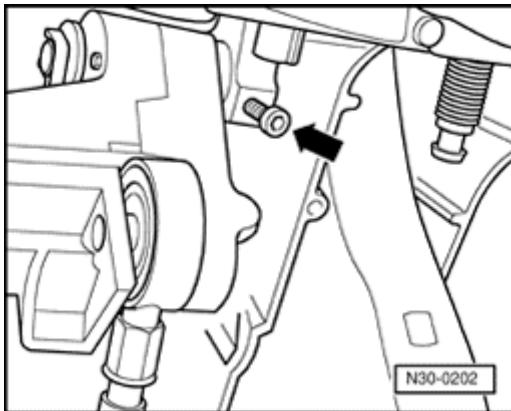
Installing

Installation is the reverse of removal, note the following:



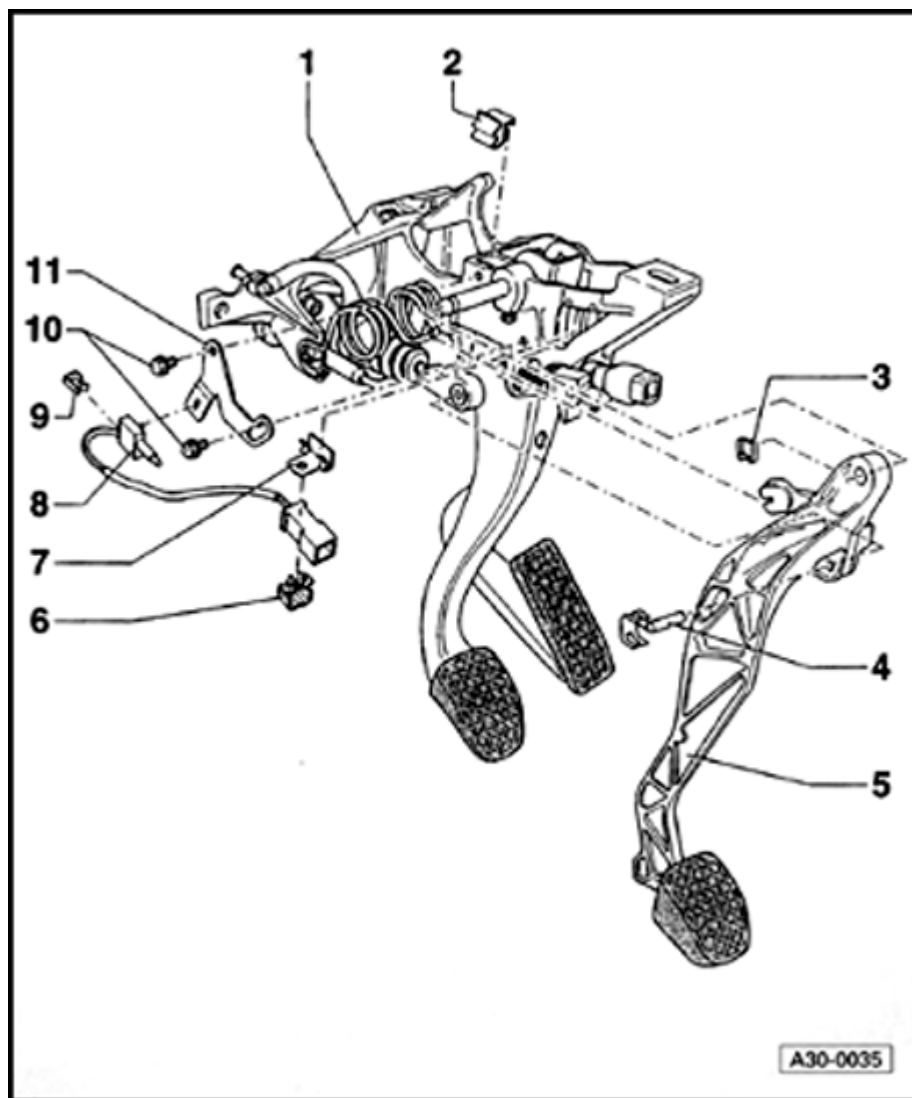
A

- Align pivot pin so that it protrudes out of mounting bracket on clutch pedal side (arrow).
- Hook clutch pedal into over-center spring, then install onto pivot pin.
- Connect clutch pedal to master cylinder. Clip locking pin onto clutch pedal.



A

- Do not tighten bolt (arrow) until both securing clips have been installed on pivot pin.



Clutch Pedal Position (CPP) switch -F194-, removing and installing

Note:

The Clutch Pedal Position Switch (CCP) -F194- allows the engine to be started only with the clutch pedal depressed. Introduction 05.97 ➤.

1 - Mounting bracket

- ◆ Before removing, remove steering column from steering gear ⇒ Repair Manual, Suspension, Wheels, Steering, Repair Group 48

2 - Cable bracket

3 - Locking clip

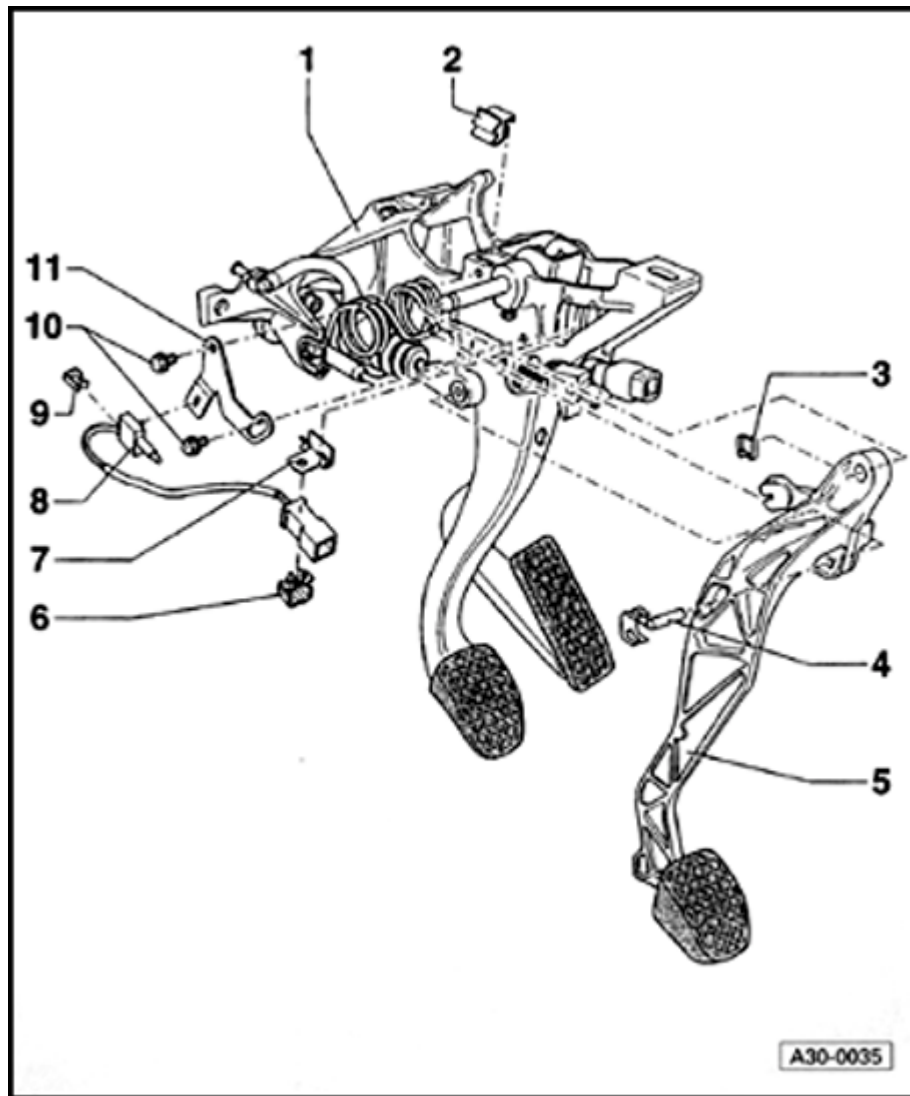
4 - 5Pin and locking plate

- ◆ Latched in clutch pedal

6 - Clutch pedal

- ◆ Removing and installing ⇒ [Page 30-4](#)

7 - Clip



8 - Bracket for harness connector

9 - Clutch Pedal Position (CPP) switch -F194-

◆ Adjusting ⇒ [Page 30-8](#)

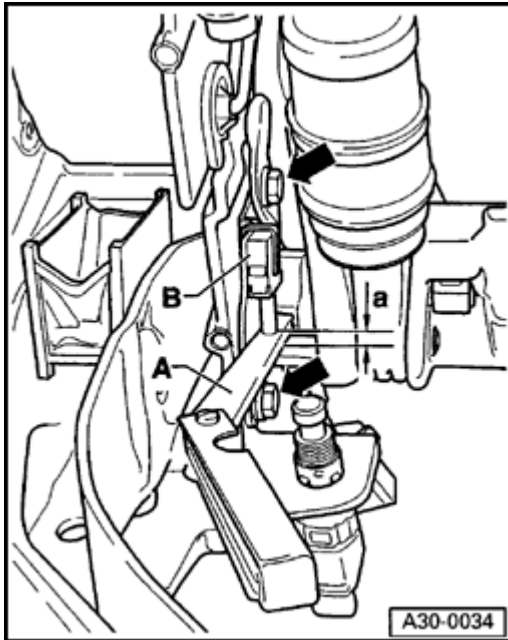
10 - Clip

11 - Screw and washer assembly

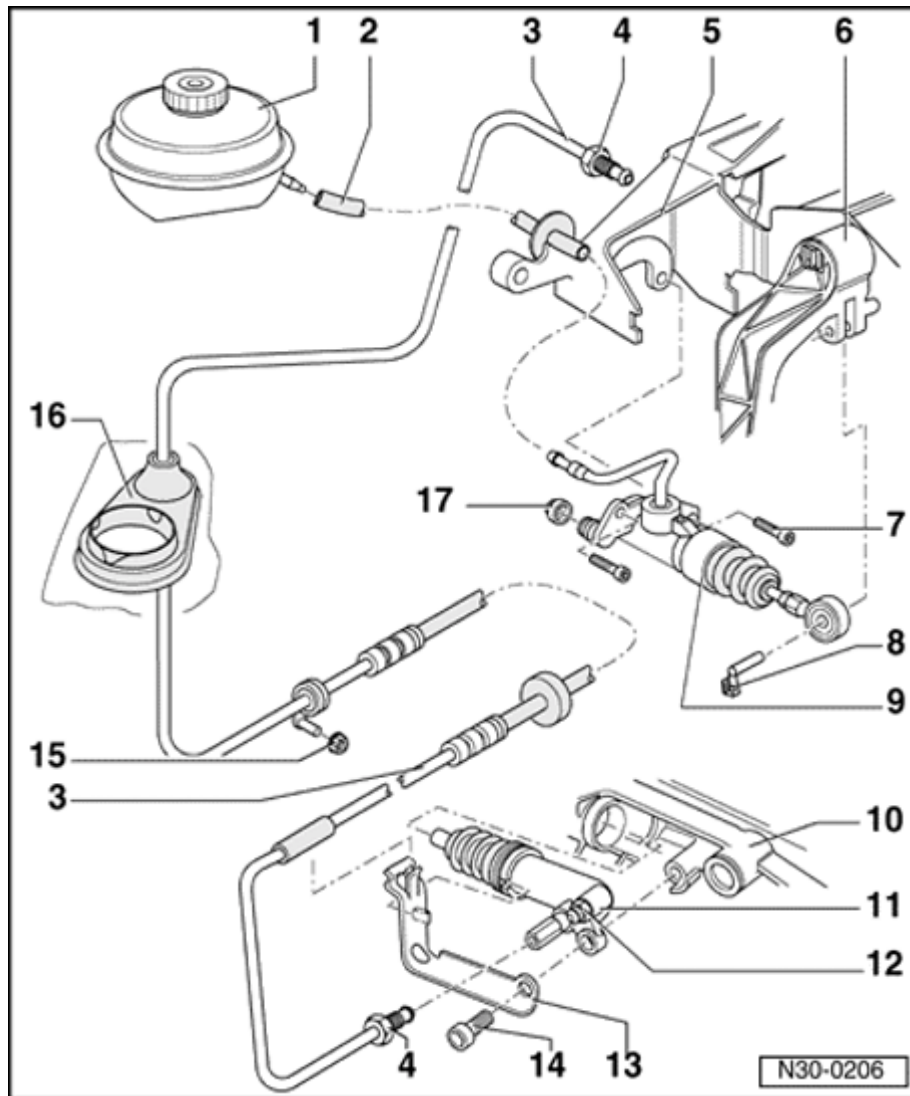
◆ 8 Nm (71 in. lb)

12 - Mounting plate

Clutch Pedal Position (CPP) switch - F194-, adjusting

**A**

- Loosen two bolts slightly (arrows).
- Have second technician fully depress pedal up to stop.
- Place feeler gauge -A- with specific dimension -a- 3.2 mm +/- 0.2 mm (0.126 in. +/- 0.008 in.) between operating surface of clutch pedal and switch cam.
- Move switch -B- toward gauge -A- until stop, and tighten two mounting bolts (arrows) to 8 Nm (71 in. lb).



Clutch hydraulic system, servicing

1 - Brake fluid reservoir

2 - Supply hose

◆ For clutch master cylinder

3 - Hose/line assembly

◆ With threaded connections on clutch master cylinder and clutch slave cylinder

4 - Line fitting nut

◆ 15 Nm (11 ft lb)

5 - Mounting bracket

6 - Clutch pedal

◆ Removing and installing ⇒ [Page 30-4](#)

7 - Socket-head bolt

◆ 20 Nm (15 ft lb)

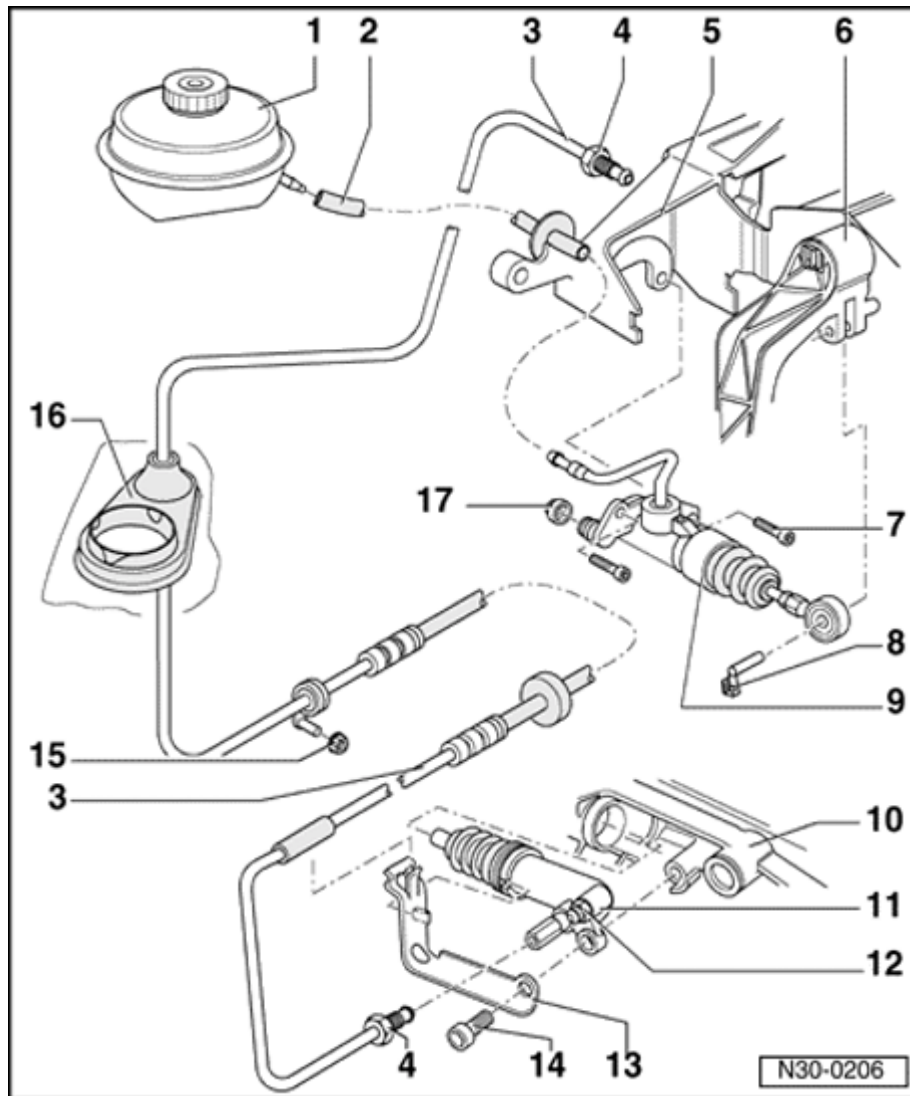
8 - Pin and locking plate

9 - Clutch master cylinder

◆ Removing and installing ⇒ [Page 30-11](#)

10 - Transmission

30-10

**11 - Clutch slave cylinder**

- ◆ Installing ⇒ [Page 30-20](#)
- ◆ After working on hydraulic clutch mechanism, bleed clutch slave cylinder ⇒ [Page 30-15](#)
- ◆ Do not press clutch pedal after clutch slave cylinder has been removed

12 - Bleeder valve

- ◆ 4.5 Nm (40 in. lb)
- ◆ Observe all CAUTIONS, WARNINGS, Notes and procedures when bleeding ⇒ [Page 30-15](#)

13 - Bracket

- ◆ Mounted to transmission

14 - Bolt

- ◆ 25 Nm (18 ft lb)

15 - Nut

- ◆ 2 Nm (18 in. lb)

16 - Seal**17 - Seal**

- ◆ Must not be removed

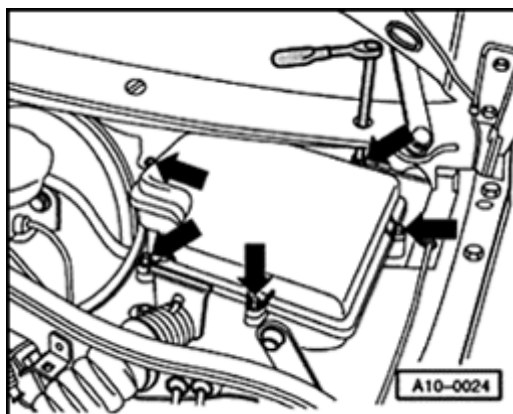
Clutch master cylinder, removing and installing

Special tools and equipment

3094 hose clamp

Removing

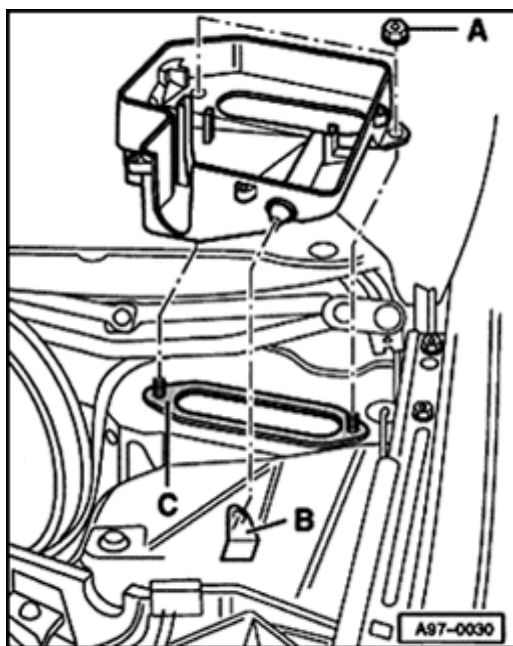
To remove E-box from plenum chamber:



A

- Remove bolts (arrows) and remove cover.
- Remove Engine Control Module (ECM); if necessary, remove 8-pin relay support ⇒ Repair Manual, Electrical Equipment, Repair Group 97.
- Disconnect harness connectors at connector station.
- Remove engine wiring harness together with rubber grommet from opening in E-box.

30-12

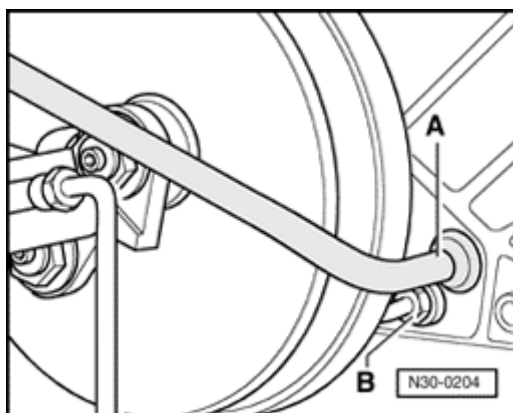


A

- Remove both nuts -A-.
- Lift E-box out at rear of threaded bolt and remove from mounting point -B-.

Notes:

- ◆ When carrying out the following steps, make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does occur, clean thoroughly.
- ◆ When working in the floor area cover the carpet with a cloth to protect against any leaking brake fluid.

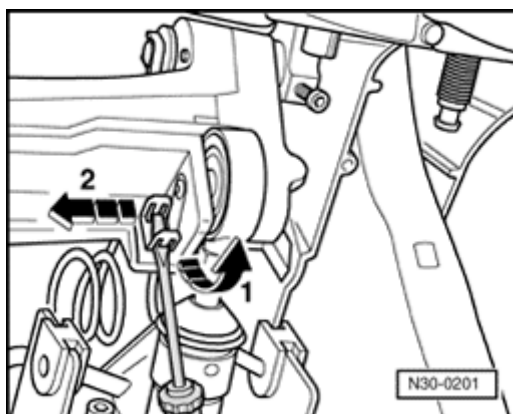


A

- Clamp supply hose -A- from brake fluid reservoir using 3094 hose clamp. Pull hose off clutch master cylinder and plug hose.
- Disconnect line -B- from clutch master cylinder and seal.

- Remove driver's side storage compartment ⇒ Repair Manual, Body Interior, Repair Group 68.

- Remove clutch pedal position switch if installed ⇒ [Page 30-6](#).

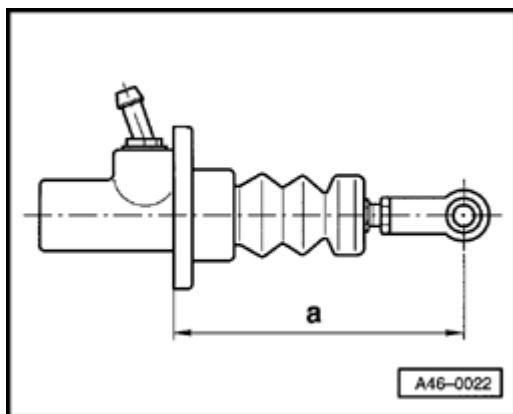


A

- Unclip pin using screwdriver (arrow -1-), pull out pin (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Unbolt clutch master cylinder from passenger compartment.

Installing

Installation is the reverse of removal, note the following:

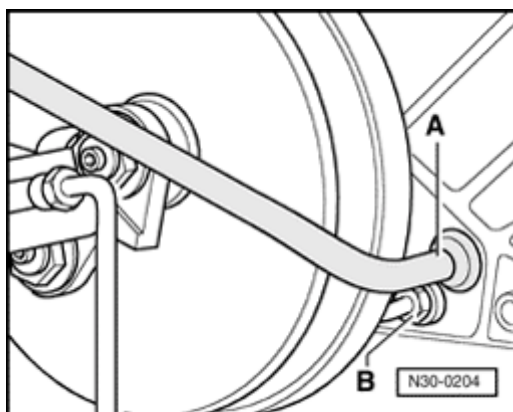


A

- When replacing clutch master cylinder, check dimension -a- on ball head and adjust if necessary.

Dimension -a- = 165 ± 0.5 mm (6.496 ± 0.020 in.)

30-14

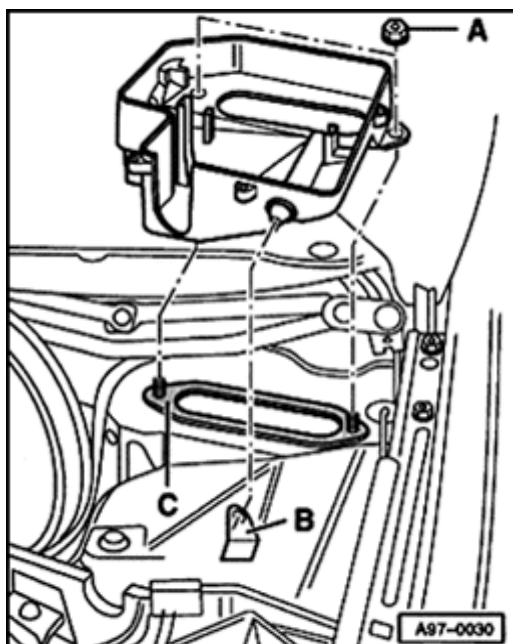


- Connect clutch master cylinder to clutch pedal.
Secure pin and locking plate on clutch pedal.

A

- Tighten line fitting -B- to clutch master cylinder to 15 Nm (11 ft lb).
- Slide hose -A- onto brake fluid reservoir up to stop.
- Bleed hydraulic clutch system after installing clutch master cylinder ⇒ [Page 30-15](#).

To install E-box in plenum chamber:



A

- Always replace seal -C-.
- Make sure seal is positioned properly, and does not cover opening or stepped metal edge.
- Install E-box into mounting point -B-.
- Tighten nuts -A- to 4 Nm (35 in. lb).
- Install cap and hand tighten in diagonal sequence to 4 Nm (35 in. lb) ⇒ imprint on E-box cover.

Clutch system, bleeding

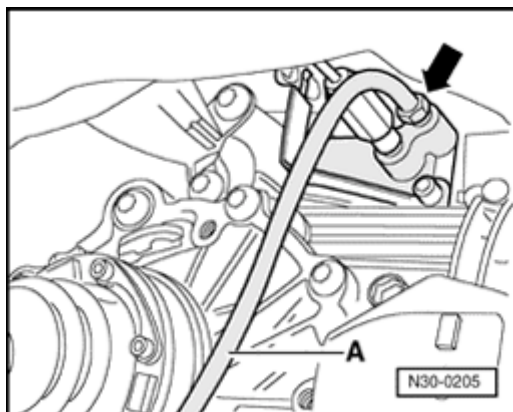
Special tools and equipment

- ◆ VAG1238B brake filling and bleeding appliance
or
- ◆ VAG1869 brake filling and bleeding appliance

Notes:

- ◆ *When carrying out the following steps, make sure that no brake fluid escapes onto the transmission.*
- ◆ *The clutch system must be bled after carrying out work on the hydraulic clutch mechanism.*
- ◆ *Top off brake fluid reservoir to "MAX." mark with brake fluid before bleeding clutch system.*
- Pull clutch pedal back to rest position.
- Connect VAG1238B brake filling and bleeding appliance or VAG1869 but do not switch on.

30-16

**A**

- Connect bleeder hose -A- to clutch slave cylinder (arrow) and open bleeder valve.
- Connect bleeder hose with pressure hose to collector bottle.
- Switch on bleeding appliance and let approx. 100 cm³ (approx. 3.4 fl. oz) brake fluid flow into suitable collection reservoir.

Work pressure: 2.5 bar (36 psi)

Note:

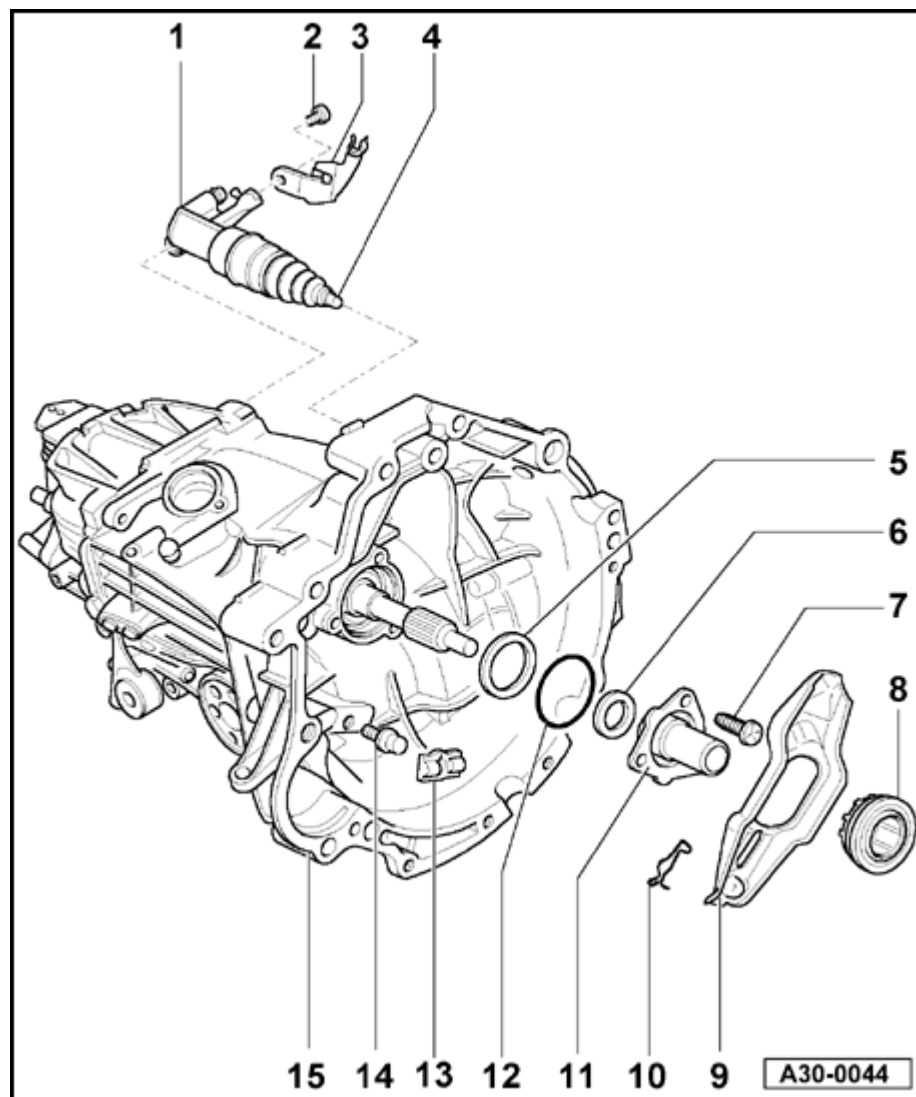
While bleeding, make sure bleeder hose remains correctly routed.

- Close bleeder valve.

Tightening torque: 4.5 Nm (40 in. lb).

- Depress clutch pedal several times after completion of bleeding process.
- Bleed system again if necessary.

30-17



Clutch release mechanism, servicing

1 - Clutch slave cylinder

- ◆ Do not press clutch pedal after clutch slave cylinder has been removed
- ◆ Installing ⇒ [Fig. 1](#)
- ◆ Tension clutch slave cylinder enough so that mounting bolts can be easily installed

2 - Bolt

Hex bolt:

- ◆ Before installing, coat with D 185 400 A2 locking fluid
- ◆ Tightening torque: 25 Nm (18 ft lb)

Socket-head bolt:

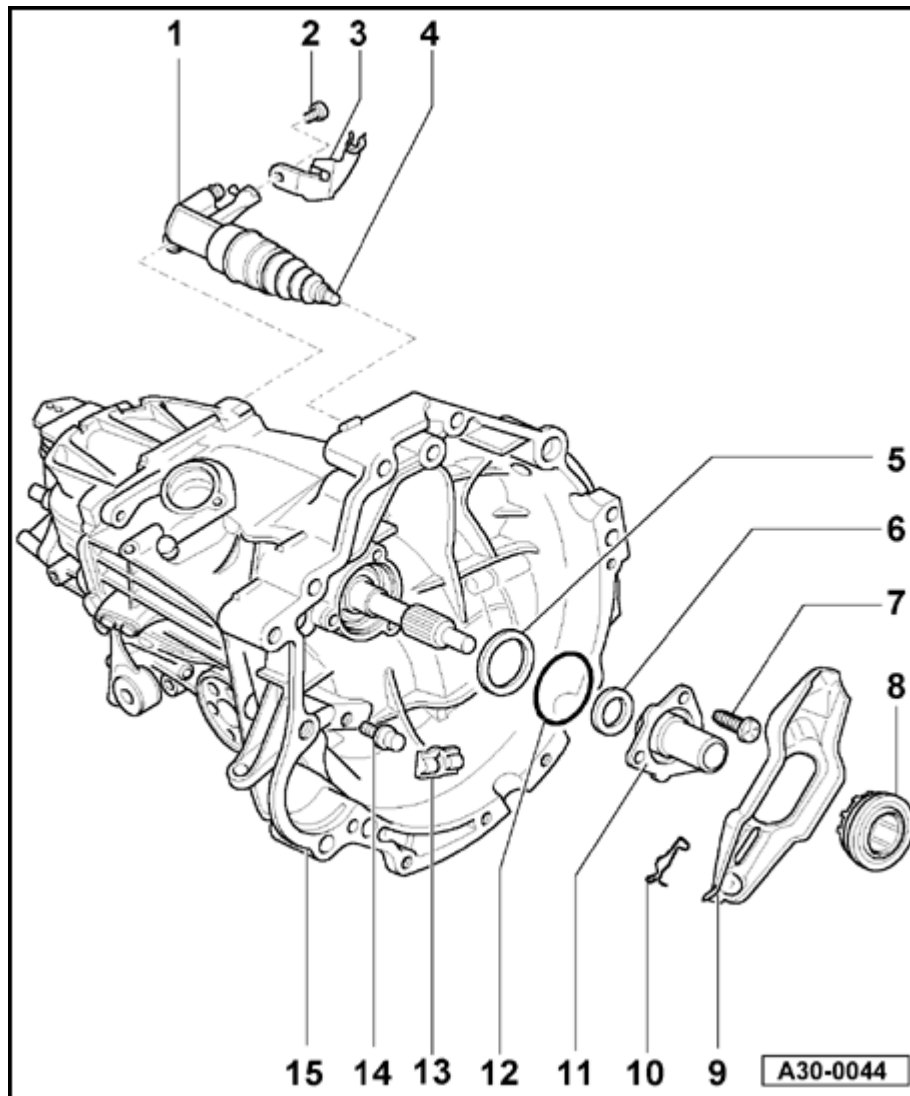
- ◆ Always replace
- ◆ Self-locking
- ◆ Tightening torque: 20 Nm (15 ft lb)

3 - Bracket for hose/line assembly

- ◆ Attach to clutch slave cylinder
- ◆ Not always present

4 - Plunger

- ◆ Lubricate end of plunger with copper grease, e.g. 381 351 TE

**5 - Spring washer**

- ◆ Small diameter facing guide sleeve (convex side)

6 - Input shaft seal

- ◆ Use VW681 extractor lever to remove from guide sleeve
- ◆ Use VW192 arbor to drive in to stop

7 - Torx® bolt

- ◆ Always replace
- ◆ 35 Nm (26 ft lb)
- ◆ Self-locking

8 - Throwout bearing

- ◆ Do not rinse out bearing, wipe clean only
- ◆ Replace noisy bearings

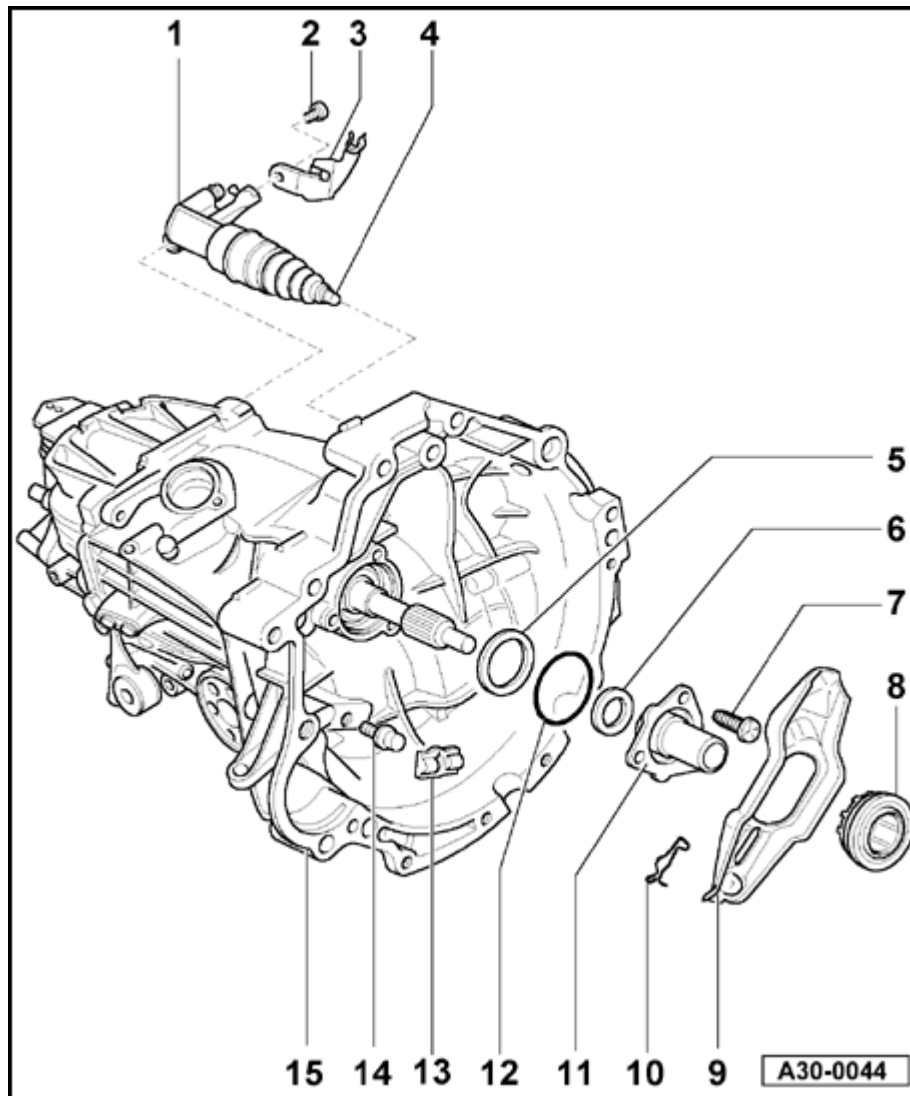
9 - Clutch release lever

- ◆ Before installing, coat contact surface of clutch slave cylinder plunger with layer of copper grease, e.g. Z 381 351 TE

10 - Retaining spring

- ◆ Secure to clutch release lever

30-19

**11 - Guide sleeve**

- ◆ Before removing and installing, cover input shaft splines with shrink-tube to protect seal

12 - O-ring

- ◆ Always replace

13 - Intermediate piece**14 - Ball pivot pin**

- ◆ 25 Nm (18 ft lb)
- ◆ Lubricate with MoS2 grease

15 - Transmission

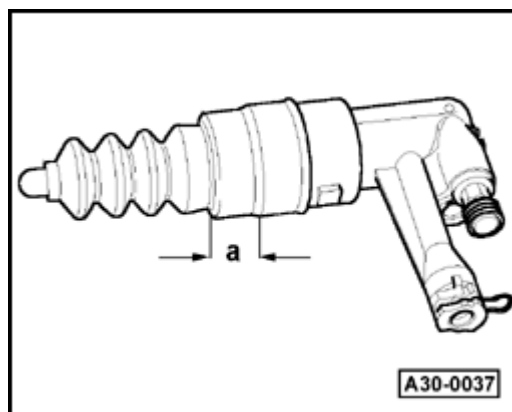
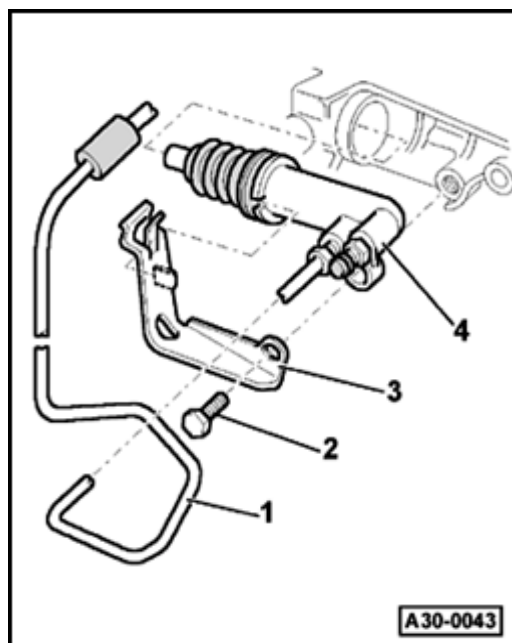


Fig. 1 Installing clutch slave cylinder

- Before installing, coat contact surface of clutch release lever plunger with thin layer of copper grease, e.g. Z 381 351 TE.
- Before installing clutch slave cylinder in transmission, coat boot area - a- with G 052 150 A2 lithium grease.
- Guide clutch slave cylinder into bore of transmission housing without large sideways deviation from direction of motion of plunger.



- Attach bracket -3- for pressure line -1-.

Notes:

- ◆ *If clutch slave cylinder -4- is inserted crooked, there is a possibility that the plunger will be inserted past the clutch release lever.*
 - ◆ *Pre-load the clutch slave cylinder enough so that the mounting bolt can be easily installed.*
 - Install mounting bolt -2-.
 - Install hex bolt with D 185 400 A2 locking fluid and tighten to 25 Nm (18 ft lb).
- If socket-head bolt is used, it is self-locking: always replace and tighten to 20 Nm (15 ft lb).

Clutch, servicing

Special tools and equipment

- ◆ 3067 flywheel retainer
- ◆ 3176 centering mandrel

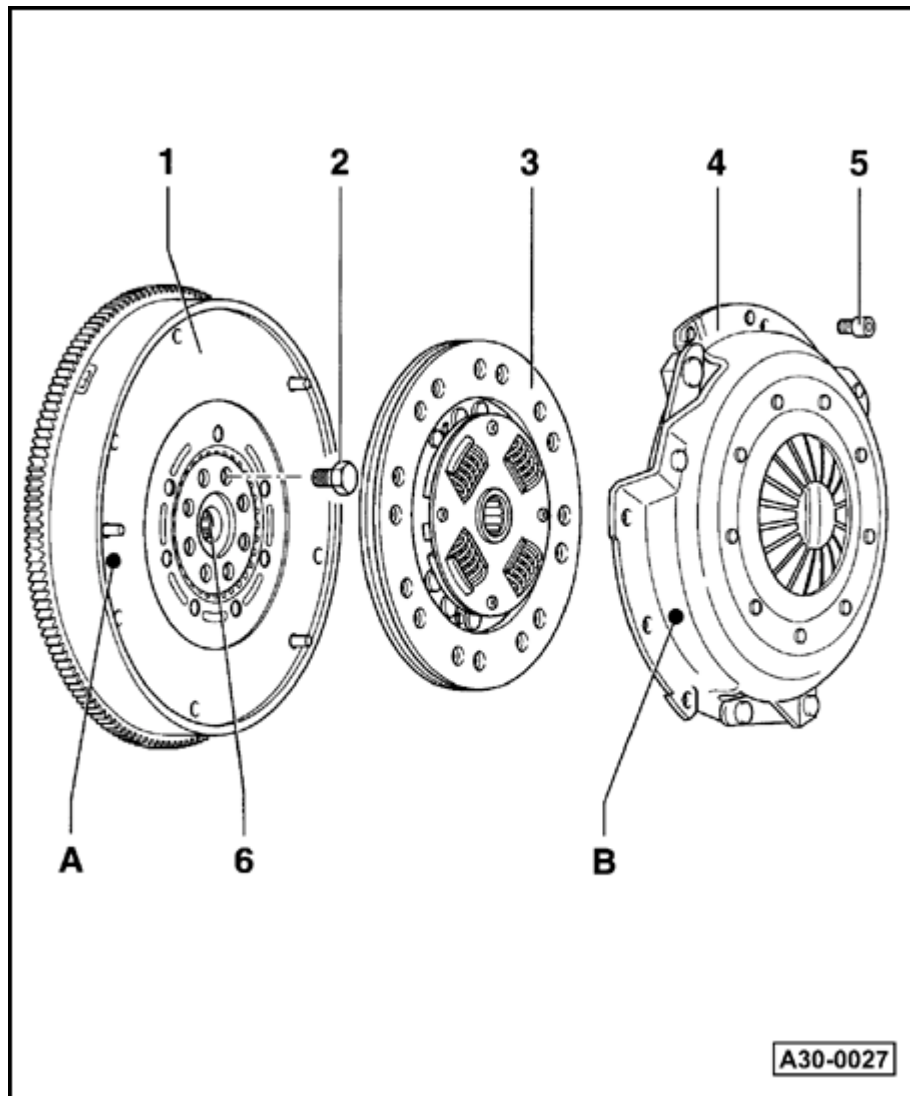
Notes:

- ◆ *Observe general repair instructions ⇒ [Page 00-10](#).*
- ◆ *Replace clutch plates and pressure plates which have damaged or loose rivets.*
- ◆ *Select the correct clutch plate and pressure plate according to the engine code ⇒ parts catalog.*
- ◆ *Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 to the splines. Then move clutch plate back and forth on input shaft until hub moves freely on shaft. Excess grease must be removed.*

Pressure plates have an anti-corrosion coating

- ◆ *and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.*
- ◆ *If the clutch has been burned out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission to reduce the smell of burnt clutch.*

30-22



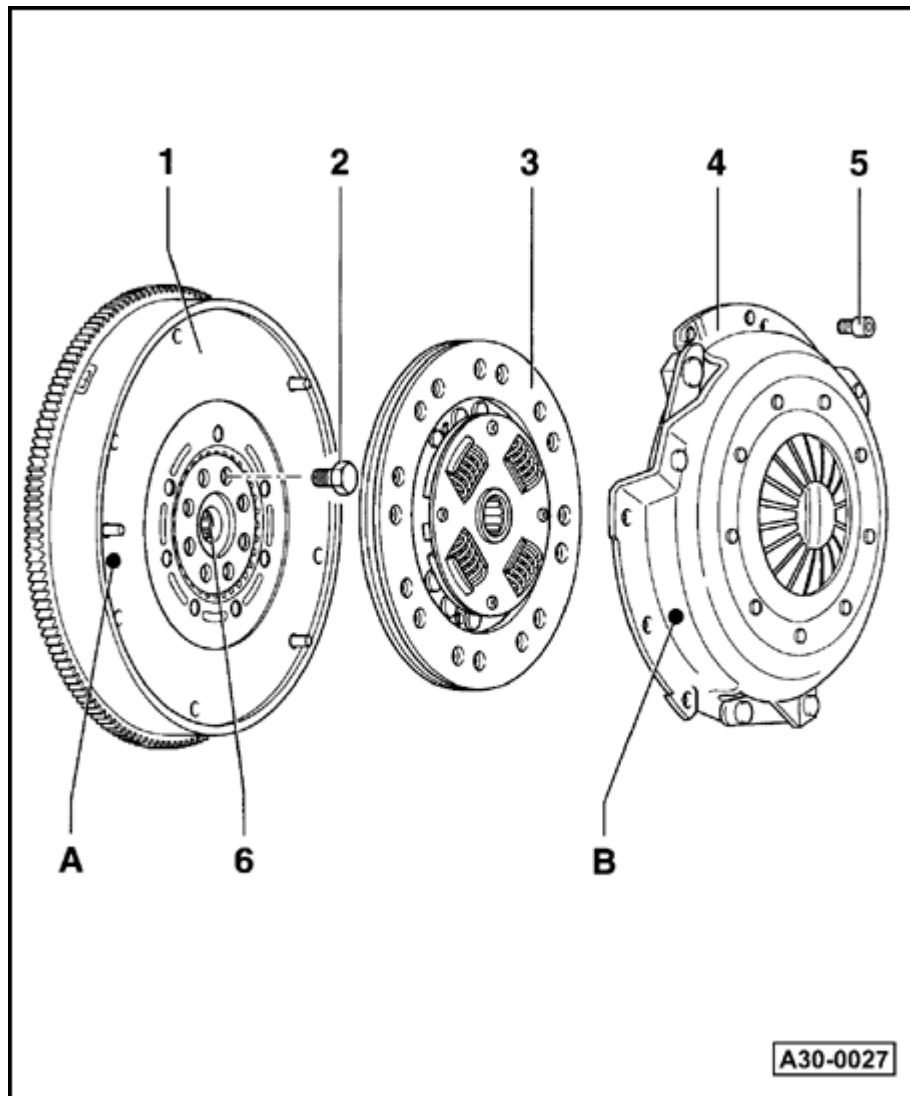
- Remove transmission to work on clutch ⇒ [Page 34-18](#).

A - Color marking on dual-mass flywheel

- ◆ White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate (if present)

B - Color marking on pressure plate

- ◆ White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate (if present)



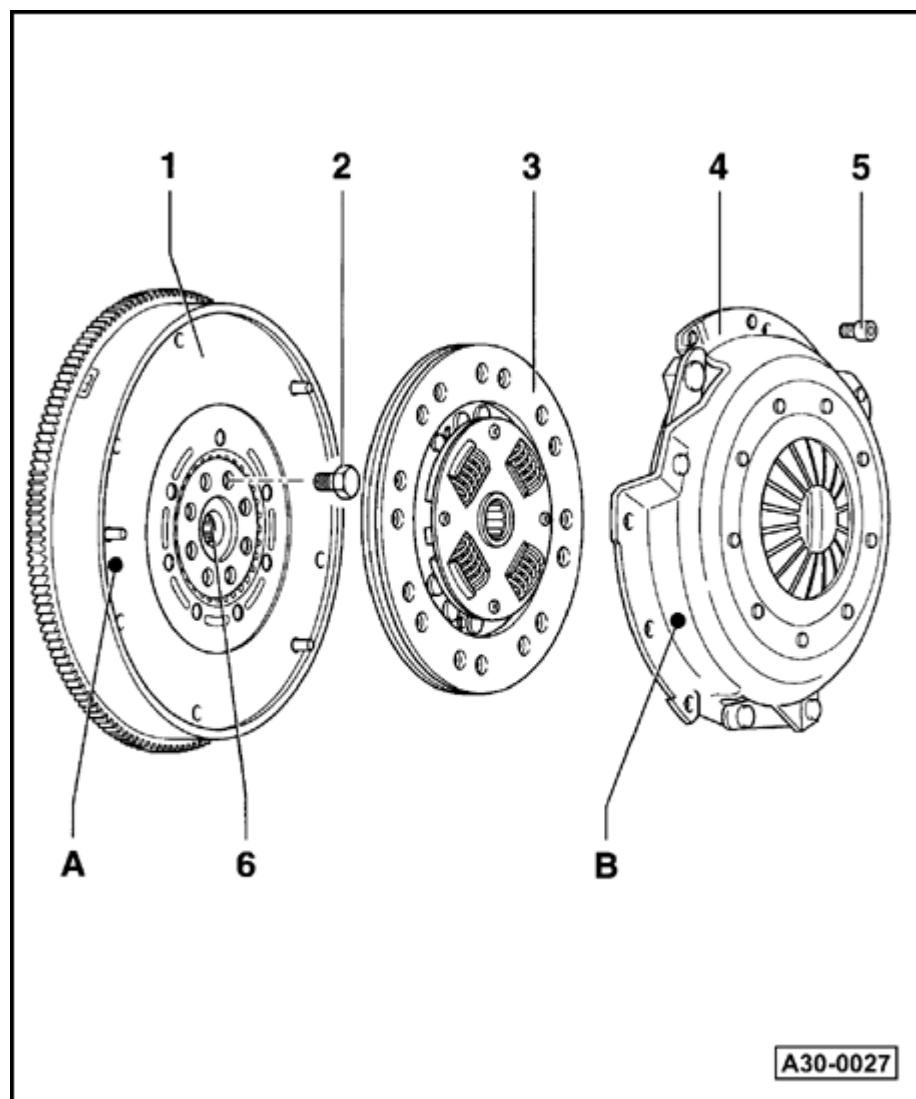
1 - Dual-mass flywheel

- ◆ Make sure centering pins are in place and seated correctly
- ◆ Contact surface for clutch lining must be free of dirt, oil and grease
- ◆ Removing and installing:

⇒ *Repair Manual, Engine Mechanical, Repair Group 13*

2 - Bolt

- ◆ Always replace
- ◆ With dual-mass flywheel: 60 Nm (44 ft lb) + 1/2 turn (180°)
- ◆ Without dual-mass flywheel: 60 Nm (44 ft lb) + 1/4-turn (90°)



3 - Clutch plate

- ◆ Installation position: Spring pack (coil springs) facing pressure plate. Clutch lining must make full contact with flywheel. Marking "Getriebeseite" (if provided) faces pressure plate
- ◆ Do not lubricate
- ◆ Clutch plate diameter ⇒ [Page 00-3](#)
- ◆ Centering ⇒ [Fig. 1](#)
- ◆ Lightly lubricate splines

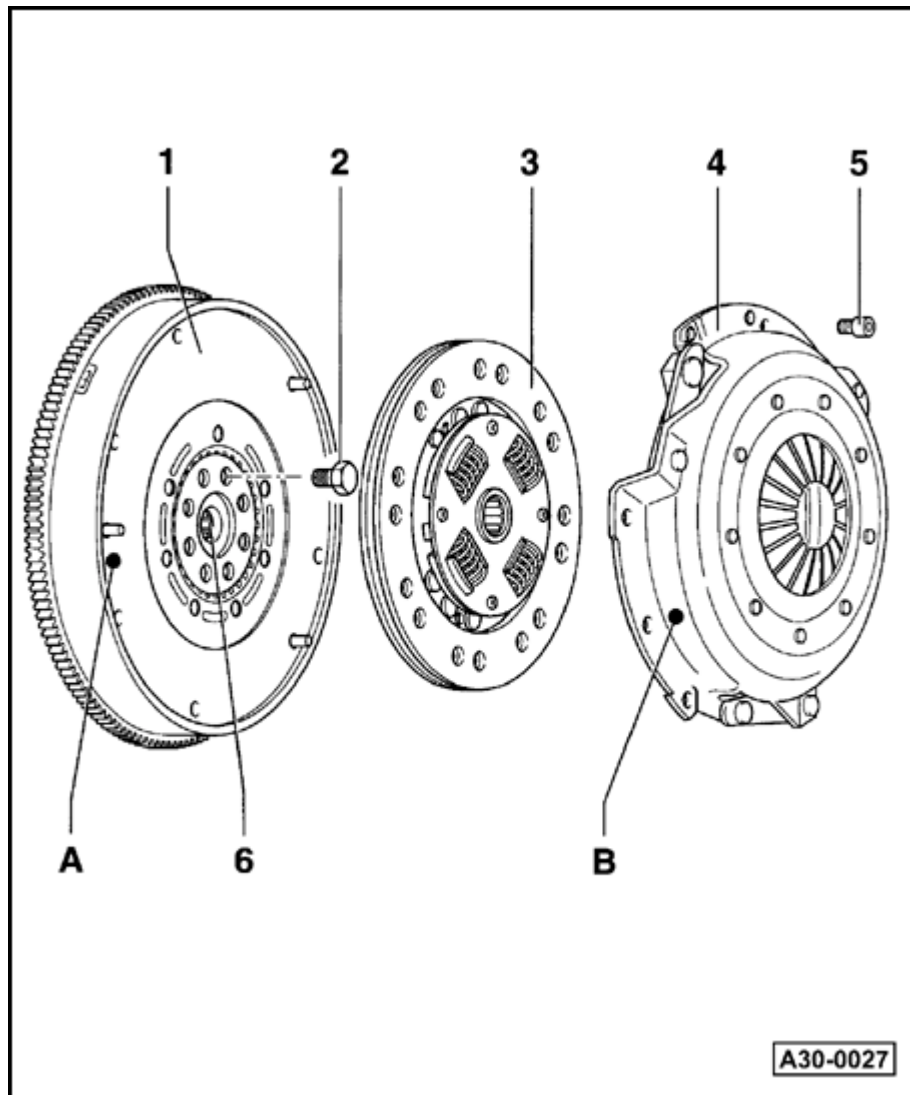
4 - Pressure plate

- ◆ Removing and installing ⇒ [Fig. 1](#)
- ◆ Checking ends of diaphragm spring ⇒ [Fig. 2](#)
- ◆ Checking spring connection and rivets ⇒ [Fig. 3](#)

5 - Bolt

- ◆ 25 Nm (18 ft lb)
- ◆ Loosen and tighten in stages and in diagonal sequence

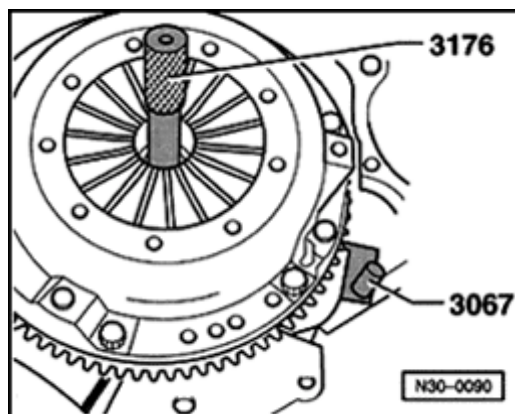
30-25



6 - Needle roller bearing

◆ Removing and installing

⇒ *Repair Manual, Engine Mechanical, Repair Group 13*



A

Fig. 1 Centering clutch plate and removing and installing pressure plate

Special tools and equipment

- ◆ 3067 flywheel retainer
- ◆ 3176 centering mandrel

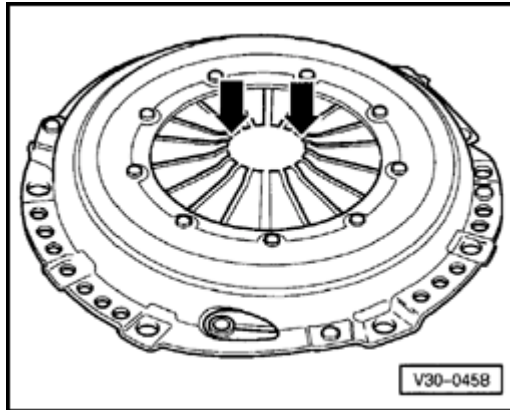
Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" facing pressure plate and transmission.

- When installing on 2.8 Liter 5V 142 kW engine (or 2.8 Liter 128 kW engine if installed), make sure white color marking on dual-mass flywheel lines up with white color marking on pressure plate when assembling.

Clutch lining and contact surface of pressure plate must make full contact with flywheel before bolts are inserted.

- Loosen and tighten bolts in stages and in diagonal sequence.
Final tightening torque: 22 Nm (16 ft lb).
- Reverse position of 3067 flywheel retainer when removing.
- Use 3176 centering mandrel to center clutch plate.

30-27



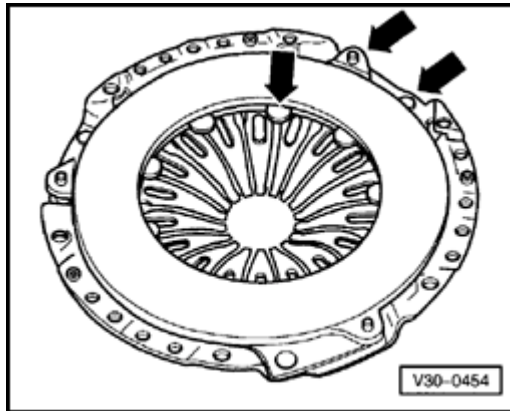
A

Fig. 2 Checking ends of the diaphragm spring

Wear up to half the thickness of the diaphragm spring is permitted.

Note:

For repairs, it is essential to match the clutch pressure plate and the clutch disc according to the engine code letters using the parts catalog microfiche.



A

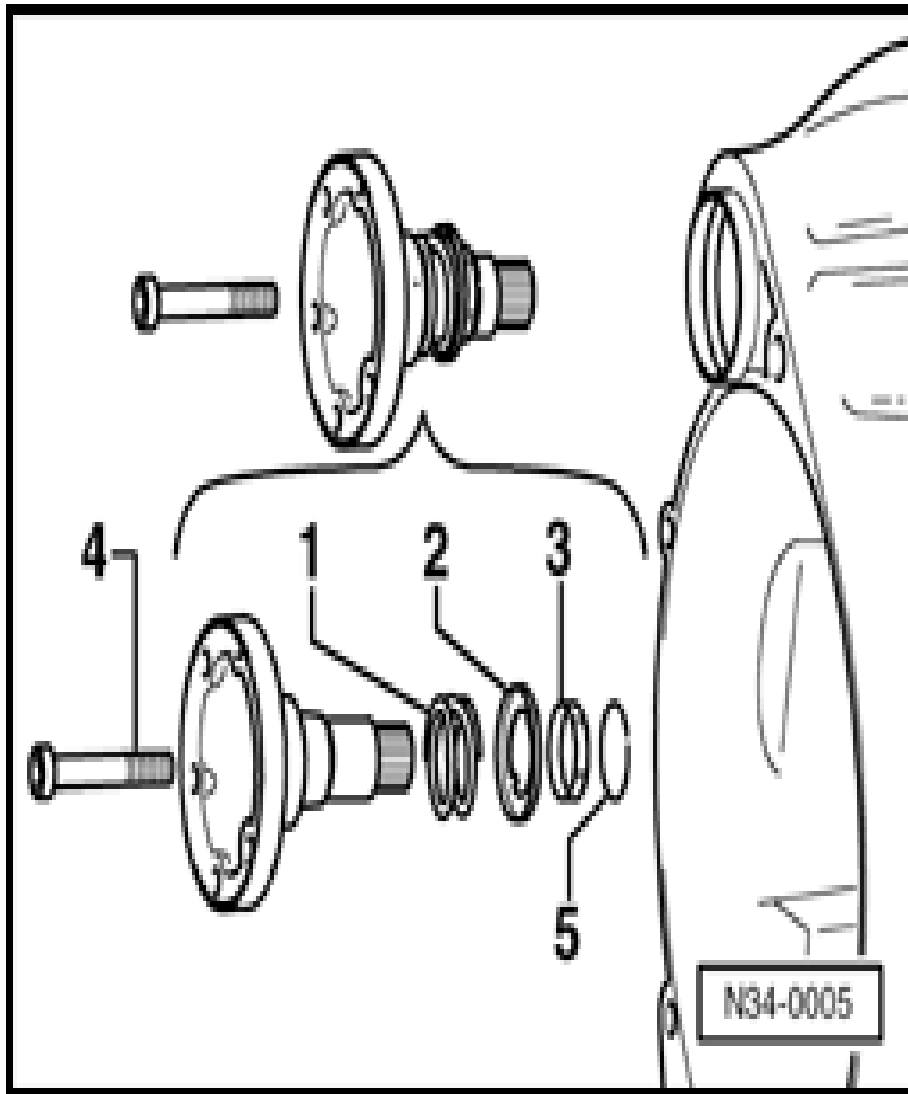
Fig. 3 Checking spring connection and rivets

- Check spring connection between pressure plate and cover for cracks and make sure rivets are seated tightly.
- Replace clutches with damaged springs or loose rivets (arrows).

Shift linkage, servicing

Notes:

- ◆ *Lubricate bearing areas and slide surfaces with Polyuric grease G 052 142 A2.*
 - ◆ *Adjusting shift linkage ⇒ [Page 34-12](#) .*
 - ◆ *To remove the complete shift linkage, remove the exhaust system.*
- ⇒ *Repair Manual, Engine Mechanical, Repair Group 26*
- ◆ *To disassemble the shift linkage in the installation position, the shift mechanism housing must be lowered.*



1 - Shift knob

2 - Bushing

3 - Housing cover

- ◆ Carefully pry out latch in rear section of center console

4 - Top part of retaining frame

5 - Bottom part of retaining frame

6 - Bushing

7 - Sleeve

8 - Circlip

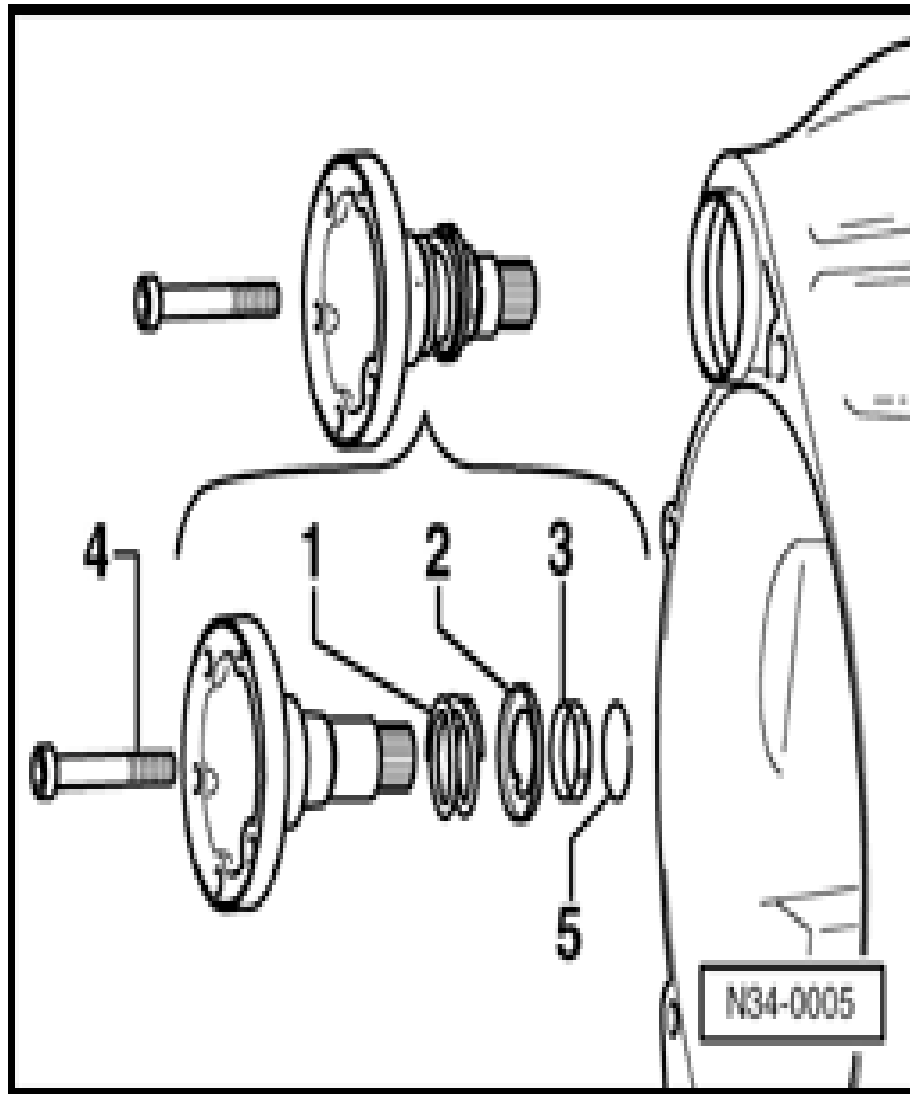
- ◆ Do not over-stretch when installing

9 - Spacer bushing

10 - Compression spring

11 - Ball stop

- ◆ Insert compression spring and bushing into the ball stop and assemble on shift mechanism so that compression spring and bushing are on right (direction of travel)
- ◆ Install circlip (item - 23 -) before installing

**12 - Compression spring****13 - Bushing**

- ◆ Rounded side faces shift lever

14 - Shift lever

- ◆ Can be installed into ball housing in one position only

15 - Spacer tube**16 - Nut**

- ◆ 8 Nm (71 in. lb)

17 - Nut

- ◆ 8 Nm (71 in. lb)

18 - Cover**19 - Nut**

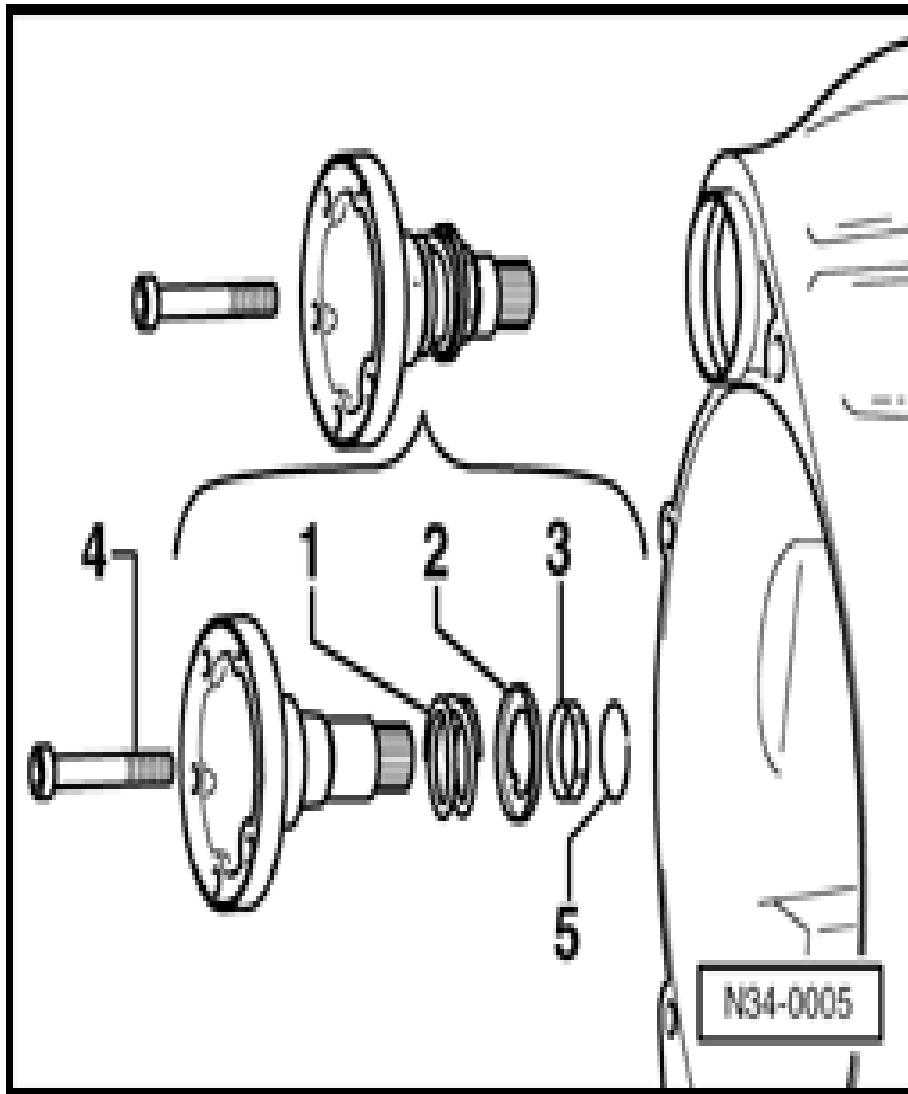
- ◆ 10 Nm (7 ft lb)

20 - Connecting piece**21 - Nut**

- ◆ 23 Nm (17 ft lb)

22 - Connecting piece

34-4

**23 - Circlip**

- ◆ Always replace
- ◆ Remove before removing ball stop
- ◆ Rounded side faces ball housing (item - 25 -)

24 - Buffer**25 - Ball housing**

- ◆ Buffers for ball stop on left and right must be in place
- ◆ Insert so that shift detent for reverse gear faces toward left

26 - Rear shift rod**27 - Bolt**

- ◆ 10 Nm (7 ft lb)

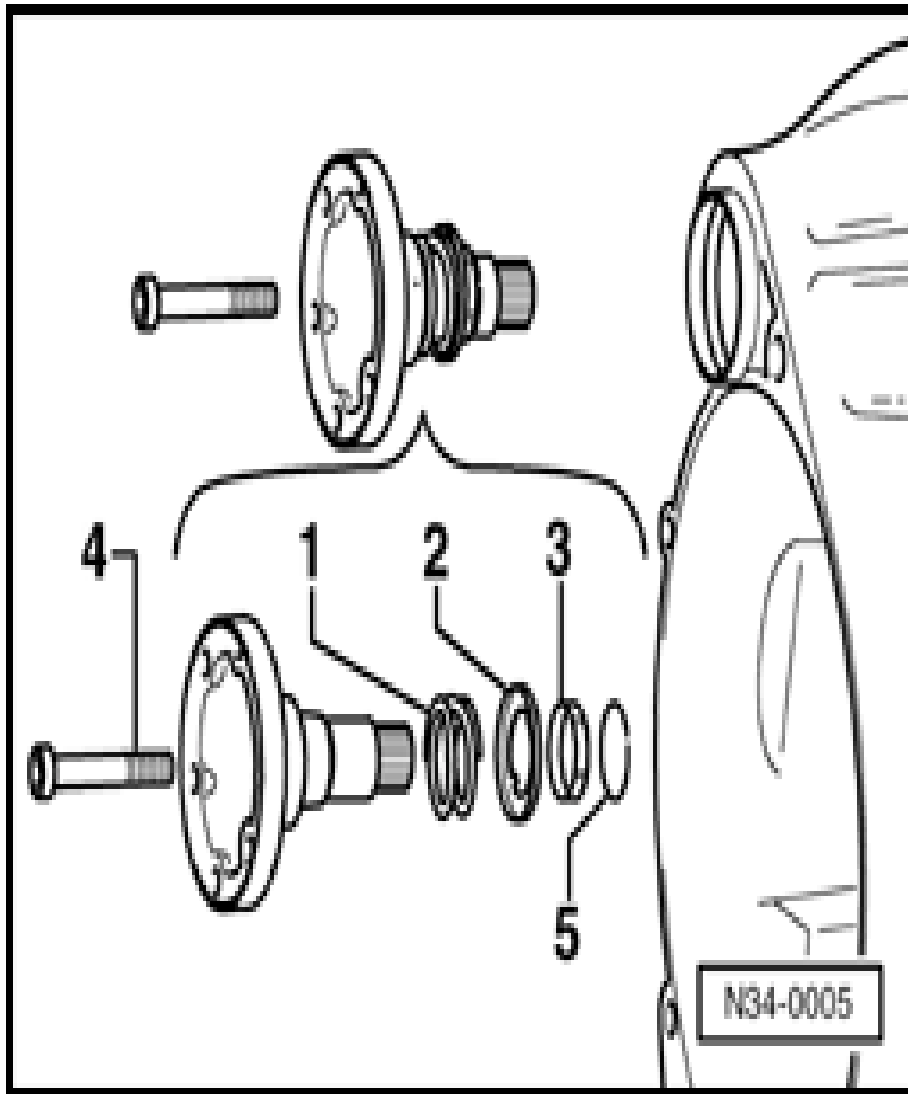
28 - Bolt

- ◆ 23 Nm (17 ft lb)

29 - Washer**30 - Shift mechanism housing****31 - Nut**

- ◆ 10 Nm (7 ft lb)

32 - Bolt

**33 - Nut**

- ◆ Always replace
- ◆ 10 Nm (7 ft lb)
- ◆ Self locking

34 - Shift fork**35 - Bolt**

- ◆ 23 Nm (17 ft lb)

36 - Clamp**37 - Shift rod**

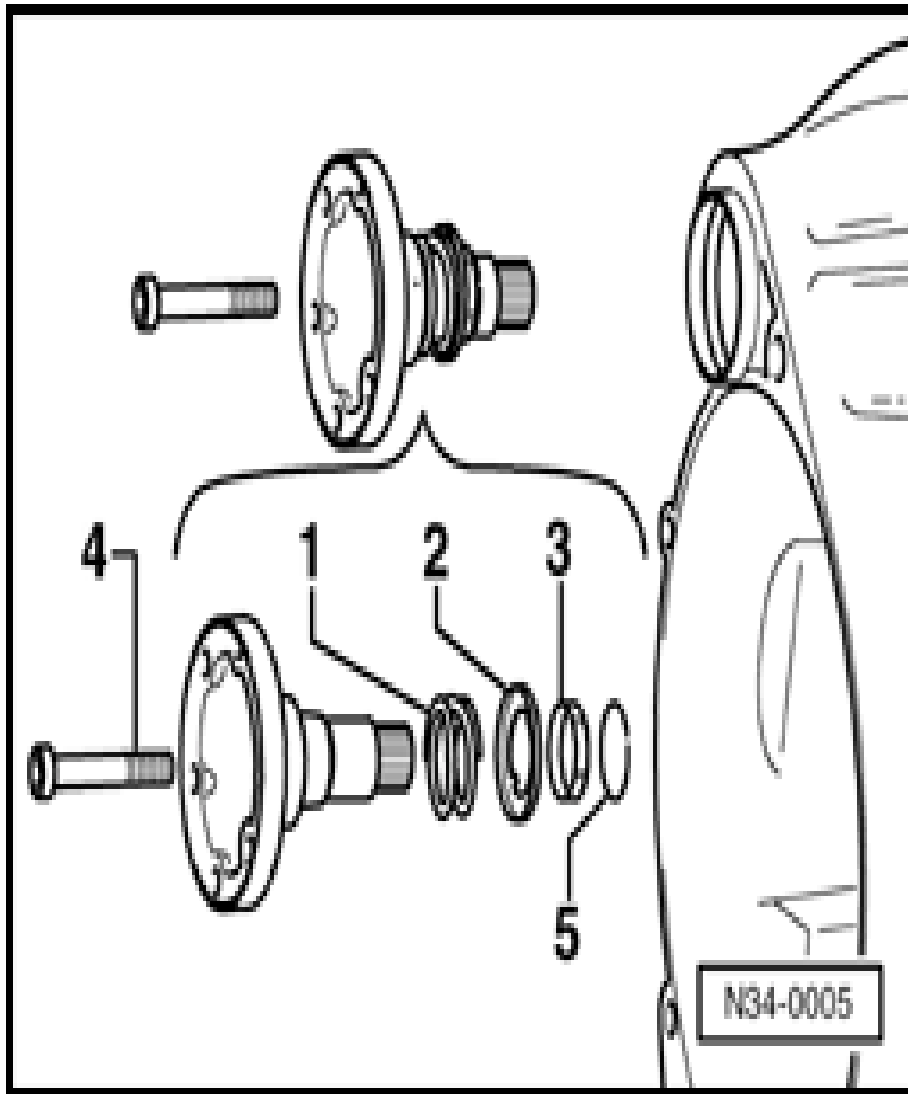
- ◆ With shift coupling

38 - Bolt

- ◆ Always replace
- ◆ 23 Nm (17 ft lb)
- ◆ Self locking

39 - Pivot rod

- ◆ Avoid tension by first connecting pivot rod to shift mechanism housing and rear shift rod
- ◆ Hold bolt (item -42-) in place when tightening nut (item -41-)
- ◆ Pivot rod, fastening 06.96 ➤ ⇒ [Fig. 1](#)

**40 - Bolt**

- ◆ 40 Nm (30 ft lb)

41 - Nut

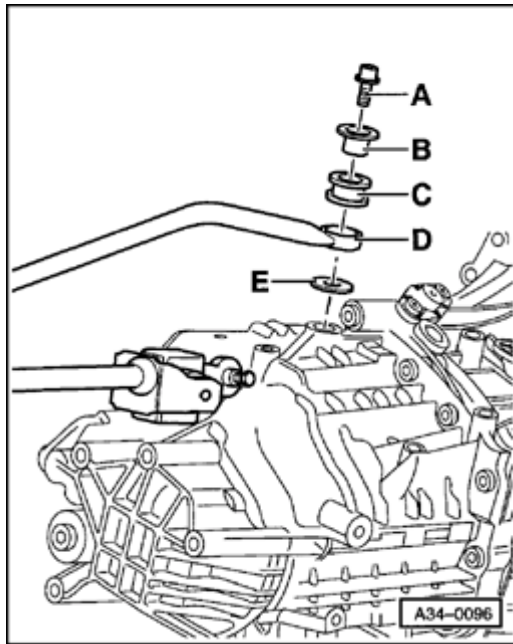
- ◆ 40 Nm (30 ft lb)

42 - Bolt**43 - Mounting bracket for pivot rod**

- ◆ Revised after 06.96 ⇒ [Fig. 1](#)
- ◆ Mounting bracket shown used ➤ 05.96
- ◆ Pivot rod, fastening 06.96 ➤ ⇒ [Fig. 1](#)

44 - Tensioning ring**45 - Boot**

- ◆ To remove and install, remove Three Way Catalytic Converter (TWC) and heat shield
- ◆ Carefully pull over shift rod and pivot rod
- ◆ When installing, place on markings of shift rod and pivot rod



A

Fig. 1 Pivot rod fastening to transmission 06.96 ➤

As of 06.96 the pivot rod is bolted directly to the transmission cover. The additional mounting bracket (⇒ [Page 34-6](#), item -43-) and its bolts are deleted. For this reason the transmission cover was revised and equipped with an additional mounting point.

A - Socket-head bolt

40 Nm (30 ft lb)

B - Washer

Rounded side faces pivot rod

C - Rubber bushing

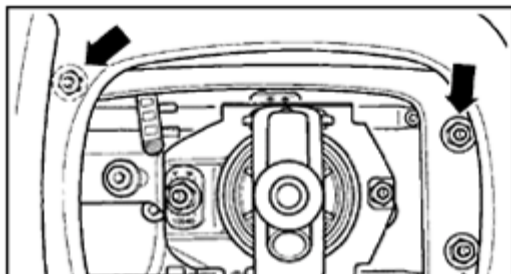
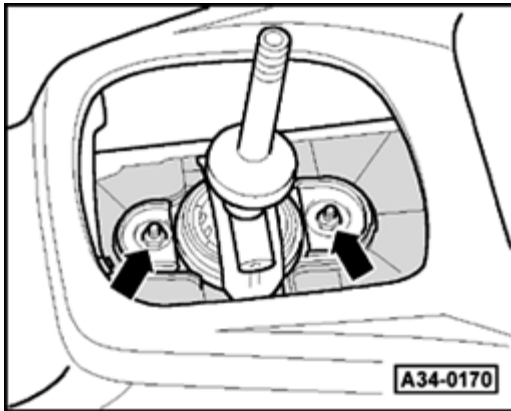
D - Pivot rod

E - Washer

Shift mechanism, removing and installing

Removing

- Remove shift knob and housing cover.
- Remove center console ⇒ Repair Manual, Body Interior, Repair Group 70.
- Remove cover.
- - Remove cover for shift mechanism housing (arrows).

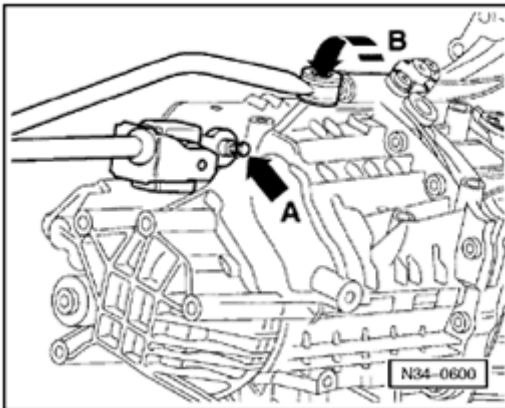


- - Remove nuts securing shift mechanism housing (arrows).

- Separate exhaust system behind Three Way Catalytic Converter (TWC); if necessary remove front exhaust system together with Three Way Catalytic Converter (TWC).

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

- Remove heat shield.



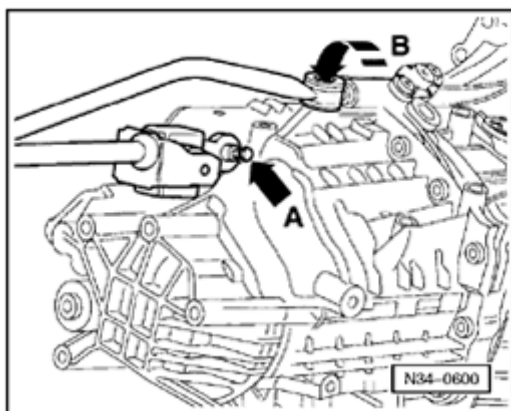
4

- Remove shift rod (arrow -A-).
- Remove socket-head bolt on pivot rod (arrow -B-).
- Swing shift mechanism housing together with shift rod and pivot rod downward and remove.

Installing

Install in reverse order of removal, noting the following:

- Push shift rod on so that securing bolt fits into recess of shift rod.



A

- Secure shift rod (arrow -A-).
- Secure pivot rod to transmission (arrow -B-).
- Adjust shift linkage ⇒ [Page 34-12](#) .
- Install heat shield.
- Align exhaust system free of stress.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

34-11**Tightening torques**

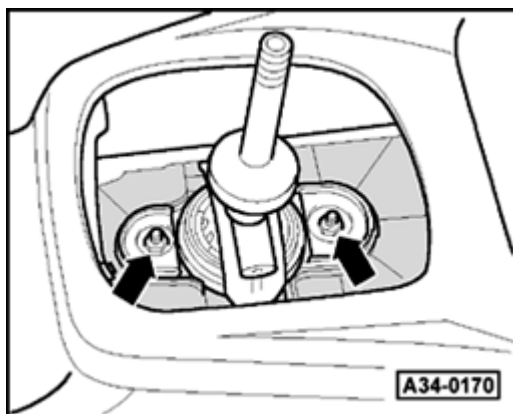
Component	Tightening torque
Shift mechanism housing to body	10 Nm (7 ft lb)
Shift rod to transmission	23 Nm (17 ft lb) ¹⁾
Pivot rod to transmission	40 Nm (30 ft lb)
¹⁾ Always replace bolt.	

Shift linkage, adjusting

Requirements

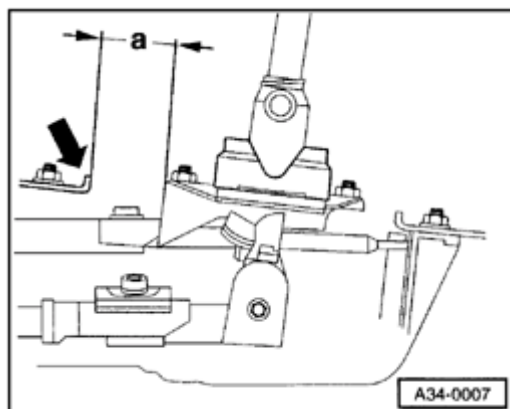
- Components of shift mechanism and linkage must be in proper working condition
- Shift mechanism must move freely
- Transmission, clutch and clutch assembly must be in proper working condition
- Transmission in neutral

- Remove shift knob and housing cover.
- 4 - Remove cover for shift mechanism housing (arrows).



34-13

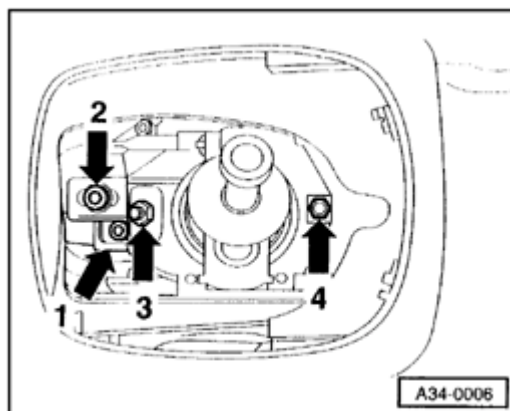
- Measure dimension between body opening and rear shift rod (in shift mechanism).



A

Dimension -a-: 37 mm (1.46 in.).

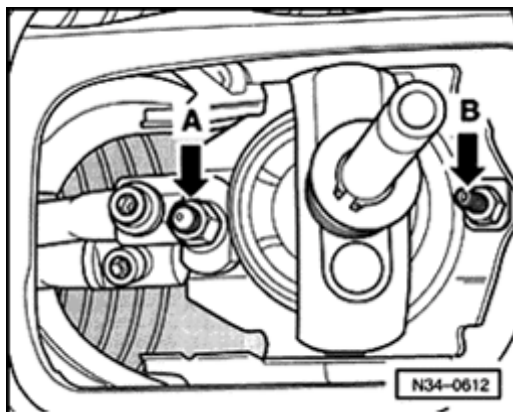
If dimension -a- is not attained:



A

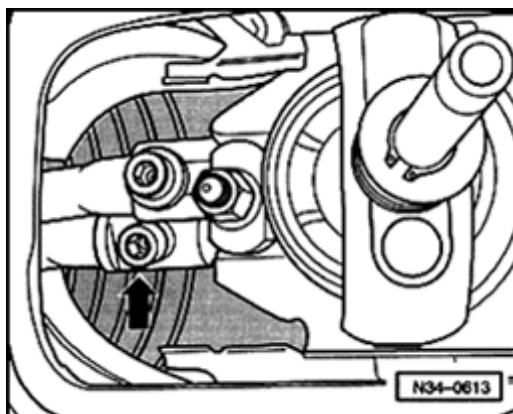
- Loosen bolt for pivot rod (arrow -2-).
Rear pivot rod (in shift mechanism) should move freely in both directions on slide.
- Adjust dimension -a- by moving pivot rod (in shift mechanism).
- Tighten pivot rod bolt.
Tightening torque: 23 Nm (17 ft lb).

34-14



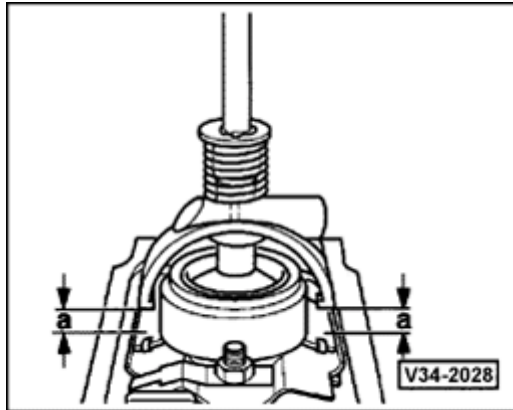
A

- Loosen ball housing nuts (arrows -A- and -B-).
- Align ball housing horizontally ⇒ [Page 34-4](#) , item 25
- Tighten ball housing nuts (arrows -A- and -B-).
 - ◆ Arrow -A-: 25 Nm (18 ft lb)
 - ◆ Arrow -B-: 10 Nm (7 ft lb)



A

- Loosen bolt for shift rod (arrow).
Connection between shift rod and shift mechanism must move freely.



- Align shift lever so it is positioned slightly toward rear.



Dimension -a- between ball stop buffers and ball housing should be equal on both sides.

- Have second technician hold shift lever.
- Tighten bolt for shift rod.

Tightening torque: 23 Nm (17 ft lb).

Note:

The position of the shift lever should not change when bolt is tightened.

Shift mechanism adjustment, checking

- Shift lever must rest in 3rd/4th shift gate when transmission is in neutral.
- Operate clutch.
- Make sure all gears can be engaged properly.
- Check operation of reverse gear lock.
- Move shift mechanism into 5th/reverse gear gate and move in direction of reverse gear (do not push shift lever too hard).

The movement up to stop reverse gear lock must be 5-10 mm (0.20-0.40 in.) (measured at shift knob).

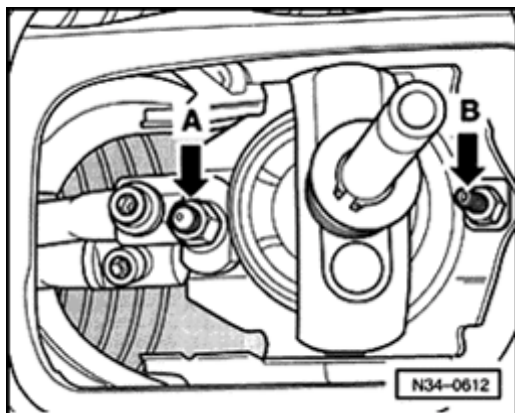
- Reduce pressure on shift lever, so it can move back.

Shift lever should return by itself from the 5th/reverse gear gate and move into 3rd/4th gear gate.

- Check fine adjustment if necessary ⇒ [Page 34-17](#) .

Fine adjustment

If shift adjustment is not OK, proceed as follows:



A

- Loosen nuts for ball housing (arrows -A- and -B-).
- Move shift lever together with ball housing to right toward 5th/reverse gear gate up to stop in transmission and hold in position.
- Press ball housing to left against shift lever.
- Hold shift lever and ball housing in position and tighten ball housing nuts.
 - ◆ Arrow -A-: 25 Nm (18 ft lb)
 - ◆ Arrow -B-: 10 Nm (7 ft lb)
- Install covers and shift knob.

Note:

If only 5th gear and reverse gear cannot be engaged, the 5th and reverse gear lock must be checked and replaced if necessary ⇒ [Page 34-69](#) .

Transmission, removing and installing

Removing

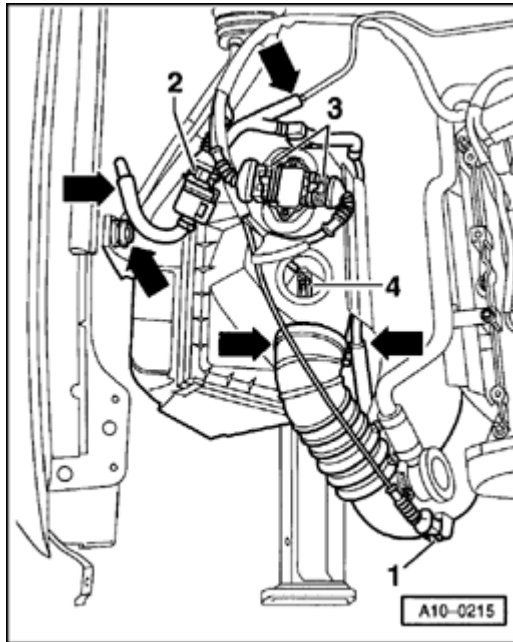
Special tools and equipment

- ◆ 3282 transmission support
- ◆ 3282/10 adjustment plate
- ◆ 3337 ring spanner 7-piece set
- ◆ VAG1383A engine/transmission hoist

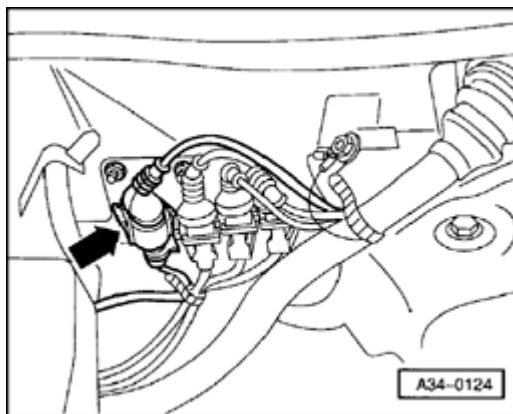
Notes:

- ◆ *Determine the correct coding for the anti-theft radio (if equipped).*
- ◆ *Switch the ignition off and disconnect battery Ground (GND) strap.*

Vehicles with 1.8T four-cylinder engine



- ✦ - Disconnect wires/and harness connectors as follows:
 - 1 - At solenoid valve for wastegate bypass regulator valve -N75-
 - 2 - At Evaporative Emission (EVAP) canister purge regulator valve -N80-
 - 3 - At power output stage -N122-
 - 4 - At Mass Air Flow (MAF) sensor -G70-
- Disconnect hoses and remove air cleaner housing (arrows).
- Remove coolant expansion tank from bracket and lay to side.

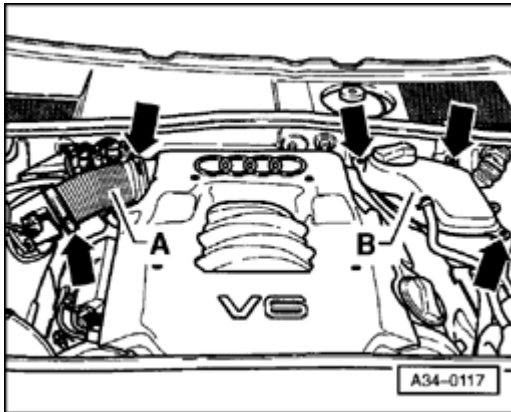


- ✦ - Disconnect harness connector for Heated Oxygen Sensor (HO2S) (arrow) and move wiring clear.
- Remove nuts securing turbocharger to front exhaust pipe.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

Note:

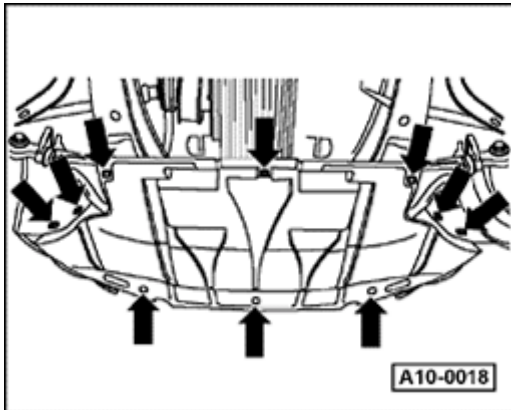
Do not bend flex pipe on front exhaust pipe more than 10° .

Vehicles with 2.8 liter six-cylinder engine**A**

- Remove intake air duct -A- (arrows).
- Unbolt coolant expansion tank -B- (arrows) and lay to one side.
- Remove Heated Oxygen Sensors (HO2S) on left and right exhaust pipes using 3337 ring spanner 7-piece set and move clear to side.

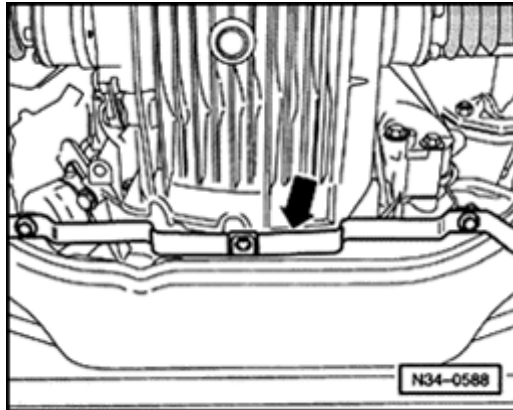
All models

- Remove engine/transmission mounting bolts accessible from above.

**A**

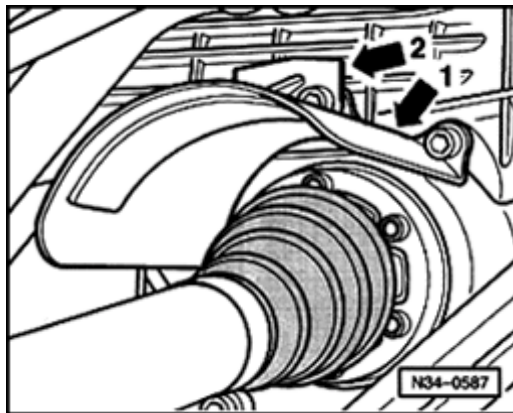
- Remove noise insulation panel (arrows).

34-21



A

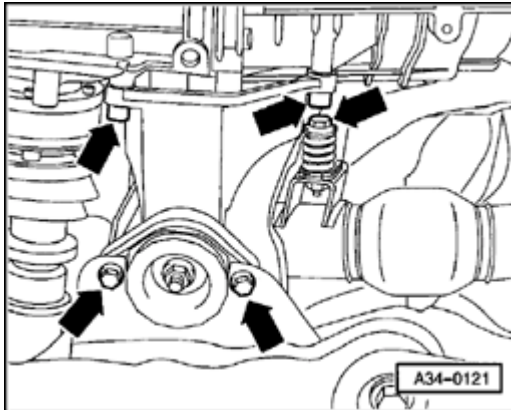
- Remove bracket for noise insulation panel (arrow).

4-cylinder engine

A

- Remove heat shield (arrows -1- and -2-) above right drive axle.

34-22

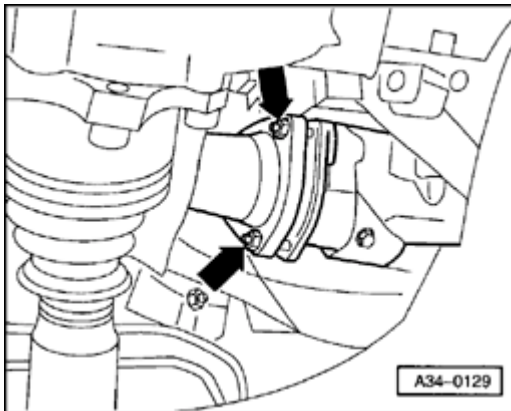


A

- Unbolt right transmission support together with bonded rubber mount (arrows).
- Loosen clamping sleeves of exhaust system and slide toward Three Way Catalytic Converter (TWC).
- Remove Three Way Catalytic Converter (TWC) together with exhaust pipe from below.

6-cylinder engine

- Remove heat shields above left and right drive axles.

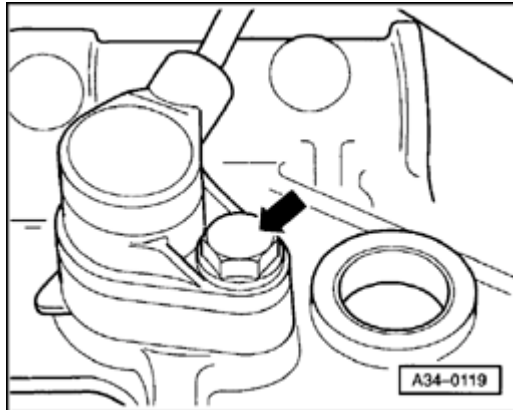


A

- Unbolt front exhaust pipes together with Three Way Catalytic Converters (TWCs) from left and right exhaust manifolds (3 nuts on each side) (arrows).

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

34-23



A

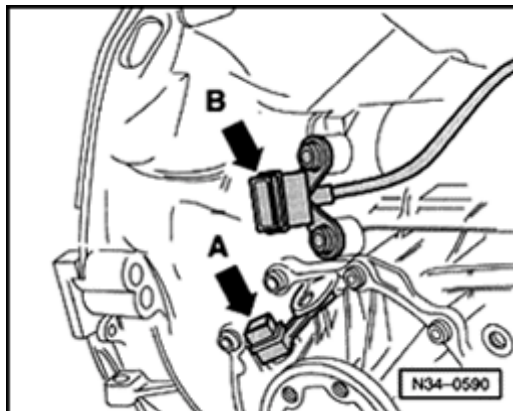
- Remove engine speed (RPM) sensor -G28- on left of transmission (arrow) and move clear to side.

All models

- Disconnect drive axles from flange shafts and rest them on suspension links.

Note:

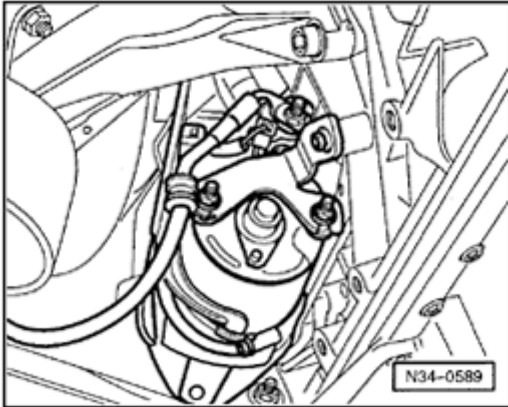
Take care not to damage protective coating on drive axles.



A

- Disconnect harness connector from Vehicle Speed Sensor (VSS) (arrow -A-).
- Disconnect back-up light harness connector (multi-function switch) (arrow -B-).
- Disconnect all other electrical connections and Ground (GND) wires from transmission and from engine/transmission mounting bolts.

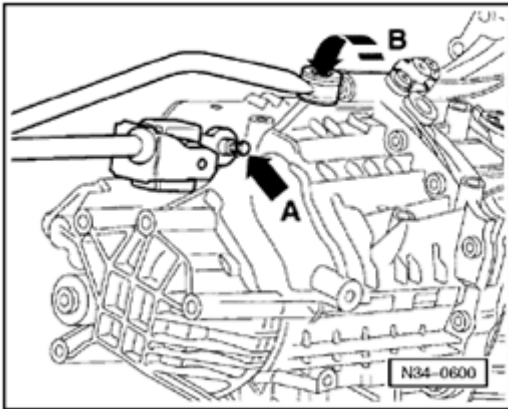
34-24

**A**

- Remove starter from engine/transmission and secure if necessary ⇒ [Repair Manual, Electrical Equipment, Repair Group 27](#) .

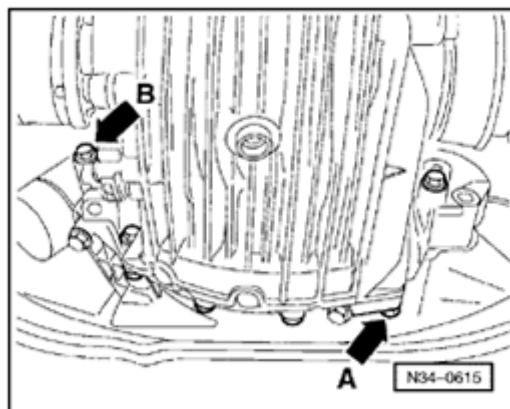
Note:

Starter cables do not have to be disconnected.

**A**

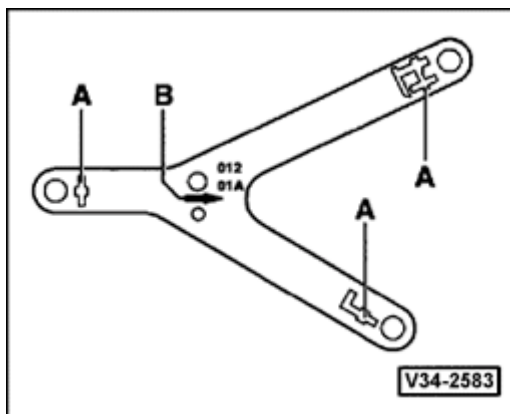
- Disconnect shift rod (arrow -A-).
- Remove socket-head bolt from pivot rod (arrow -B-).

34-25

All models

A

- Remove bottom engine/transmission mounting bolts, except for bolts indicated by arrows -A- and -B-.



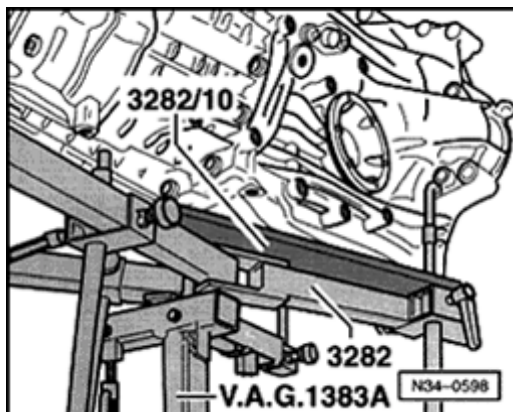
A

- Set up 3282 transmission support for removing manual transmission 01A (all wheel drive) using 3282/10 adjustment plate and place on VAG1383A transmission jack.

A - Attachments

Notes:

- ◆ Attachments -A- are shown in schematic form.
- ◆ Arrow -B- points in the direction of travel.
- ◆ 3282/10 adjustment plate only fits in one position.



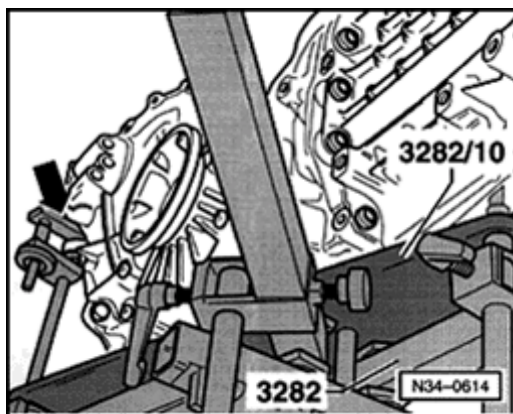
A

- Roll VAG1383A transmission jack with 3282 transmission support under transmission and support transmission.

Note:

If 3282 transmission support is not available, the transmission can be removed and installed using the VAG1383A transmission jack and the VAG1359/2 universal mount.

- Support transmission using VAG1383A transmission jack.



A

- Align adjustment plate parallel to transmission and lock safety support (arrow) on transmission.

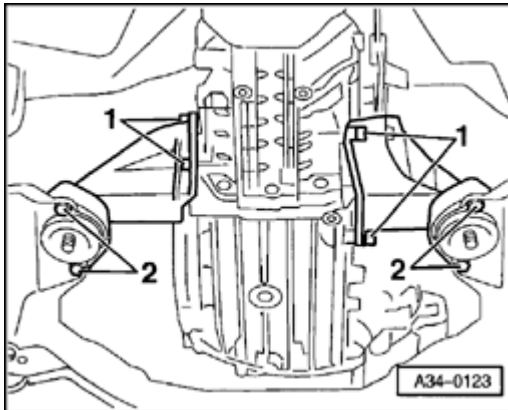
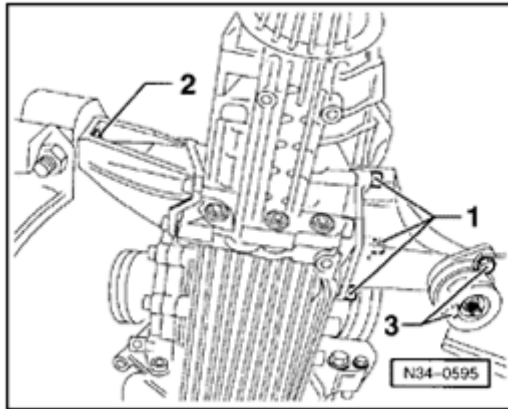
34-27

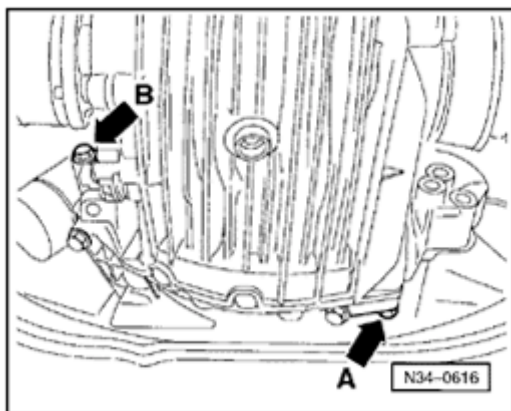
4-cylinder engine

- Remove left transmission support from bonded rubber mount -2-.

6-cylinder engine

- Remove left and right transmission supports complete with bonded rubber mounts from transmission and subframe -1- and -2-.

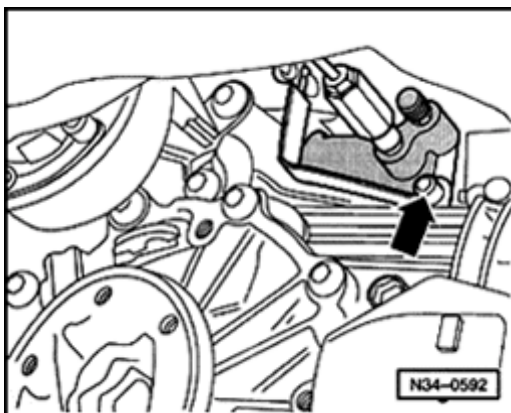


All models**A**

- Remove remaining engine/transmission mounting bolts (arrows -A- and -B-).
- Press transmission off dowel sleeves and lower carefully using VAG1383A transmission jack just far enough for access to slave cylinder.

Note:

When lowering the transmission, make sure the hydraulic line/hose to clutch slave cylinder is not damaged.

**A**

- Remove clutch slave cylinder (arrow) and secure using wire; do not disconnect line.

Note:

After removing the clutch slave cylinder, do not operate the clutch pedal.

- Lower transmission completely.

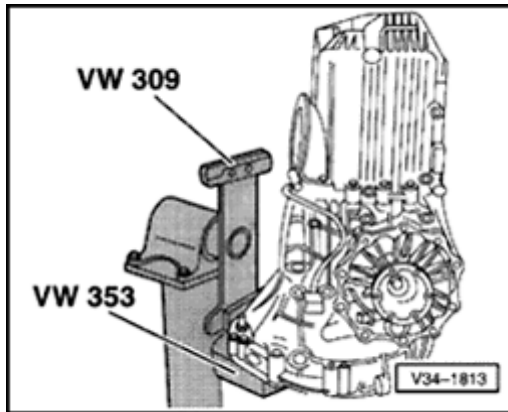
Note:

Make sure drive axles have sufficient clearance when lowering transmission.

Securing transmission to assembly stand

Special tools and equipment

- ◆ VW309 holding plate
- ◆ VW353 transmission support



A

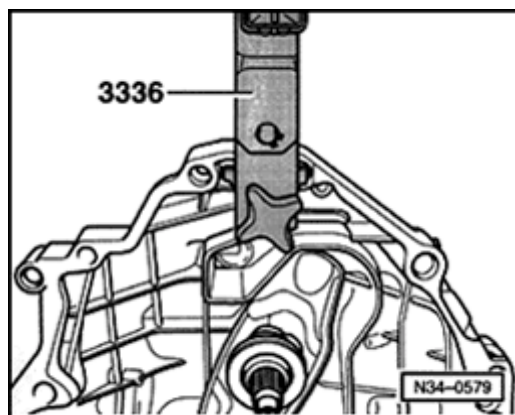
- Secure transmission to assembly stand using VW353 transmission support and VW309 holding plate when working on transmission.

Transmission, transporting

Special tools and equipment

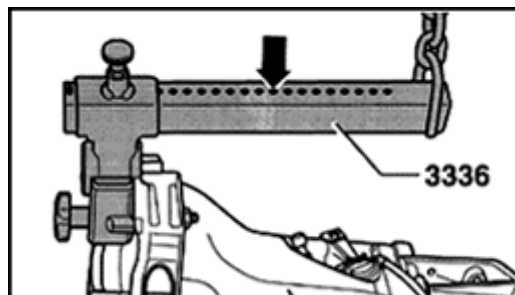
- ◆ 3282 transmission support
- ◆ 3336 transmission support jig

The transmission support jig can be used when transporting the transmission and for setting up 3282 transmission support.



A

- Bolt 3336 transmission support jig to transmission housing.



A

- Adjust support jig on sliding piece using locking pin (arrow).
Number of visible holes = 17
- Lift transmission using workshop crane and 3336 transmission support jig.

Installing

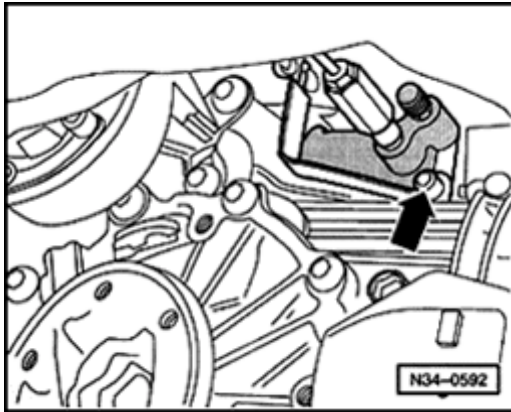
Installation is the reverse order of removal, note the following:

- Clean input shaft splines and (in case of used clutch plates) hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.
- Check throwout bearing for wear and replace if necessary.
- Before installing, coat contact surface of clutch release lever plunger with thin layer of copper grease, e.g. Z 381 351 TE.
- Threaded holes for mounting clutch slave cylinder to transmission and shift lever to shift rod must be cleaned of locking compound residue using threaded tap before installation.
- Make sure centering sleeves for engine to transmission are installed correctly in cylinder block. Install or replace if necessary.
- Always replace self-locking nuts.
- Install engine/transmission intermediate plate (if

present) onto engine centering sleeves.

- Make sure intermediate plate is correctly seated on engine.

34-32



A

- Lift transmission until clutch slave cylinder with mounting bracket for line/hose can be installed (arrow).
- Install lower engine/transmission and starter mounting bolts and install starter.

⇒ [Repair Manual, Electrical Equipment, Repair Group 27](#)

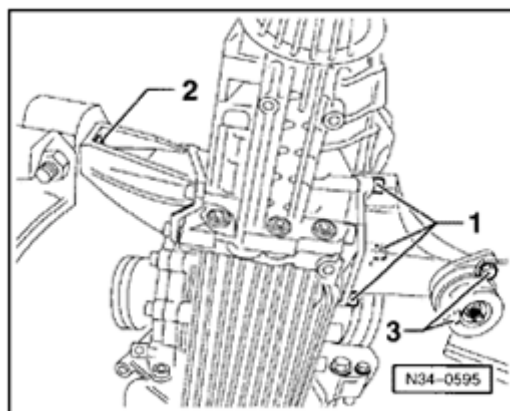
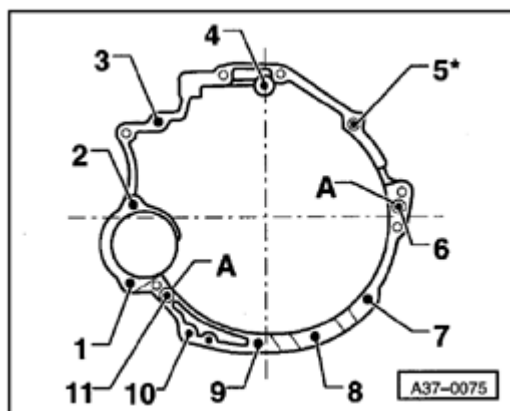
- Check adjustment of shift mechanism and adjust if necessary ⇒ [Page 34-12](#) .
- Align exhaust system free of stress.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

- Check transmission oil level ⇒ [Page 34-36](#) .
- After connecting battery, enter anti-theft code for radio.

⇒ *Radio Operating Manual*

- Fully close power windows to stop.
- Then activate all power window switches ("up") for at least a second to activate automatic window raising/lowering.
- Set clock to correct time.



Tightening torques

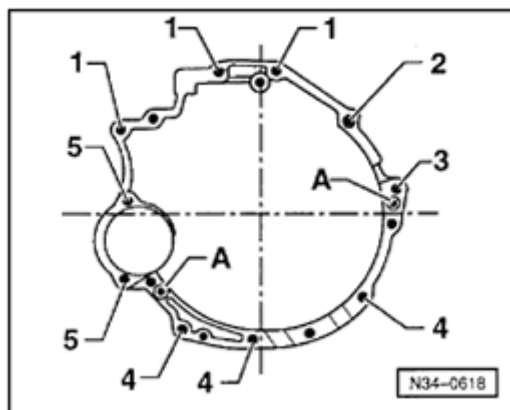
Transmission to engine (4-cylinder)

Item No.	Bolt	Tightening torque
1, 3, 4	M12 x 67	65 Nm (48 ft lb)
2, 6	M12 x 90	65 Nm (48 ft lb)
5, 11	M12 x 110	65 Nm (48 ft lb)
7 - 10	M10 x 45	45 Nm (33 ft lb)

A: Dowel sleeves

Transmission/engine assembly mount (4-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M10 x 30	3	40 Nm (30 ft lb)
2	M10 x 35	1	50 Nm (37 ft lb)
3	M8 x 20	2	23 Nm (17 ft lb)

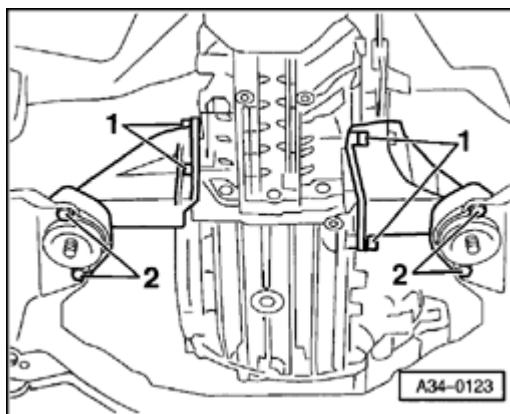


Transmission to engine (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M12 x 67	3	65 Nm (48 ft lb)
2	M12 x 90	1	65 Nm (48 ft lb)
3	M12 x 80	1	65 Nm (48 ft lb)
4	M10 x 45	3	45 Nm (33 ft lb)
5	M10 x 135	1	45 Nm (33 ft lb)
51)	M12 x 130	1	65 Nm (48 ft lb)

1) Upper starter bolt

A: Dowel sleeves



Transmission/engine assembly mount (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M10 x 35	3	40 Nm (30 ft lb)
2	M8 x 20	2	23 Nm (17 ft lb)

34-35

Component		Tightening torque
Drive axle to flange shaft	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Engine Speed (RPM) sensor - G28-		10 Nm (7 ft lb)
Clutch slave cylinder to transmission	Socket-head bolt 1)	20 Nm (15 ft lb)
	Bolt 2)	25 Nm (18 ft lb)
Heat shields over drive axles to transmission		23 Nm (17 ft lb)
Shift rod to transmission 1)		20 Nm (15 ft lb)
Pivot rod to transmission		40 Nm (30 ft lb)
Three Way Catalytic Converter (TWC) to mounts		25 Nm (18 ft lb)
Front exhaust pipe to turbocharger or exhaust		25 Nm (18 ft lb)

manifold	
Clamp for exhaust pipe	40 Nm (30 ft lb)
Bracket for noise insulation panel to body	10 Nm (7 ft lb)

- 1) Always replace bolt.
- 2) Coat with locking fluid D 185 400 A2 before installing.

Transmission oil level, checking

Special tools and equipment

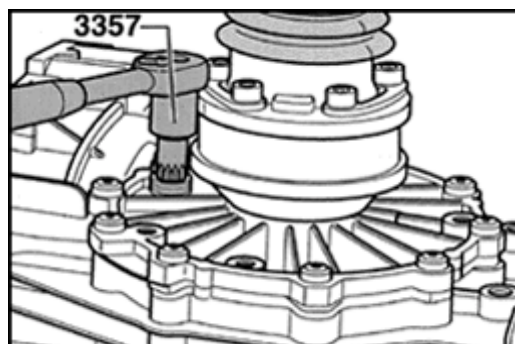
- ◆ 17 mm wrench insert hex socket

or

- ◆ 3357 triple square socket driver

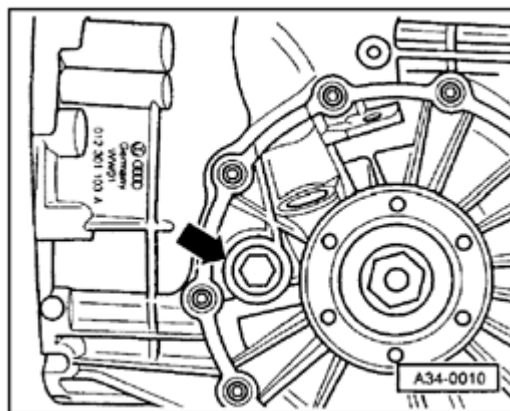
Notes:

- ◆ *Vehicle must be level when checking transmission oil level. This can be achieved using a pit or 4-post lift.*
- ◆ *The oil filler plug is on left side of the transmission underneath the engine speed (RPM) sensor, and may be concealed by a heat shield over the drive axle.*
- ◆ *Depending on the version installed, use either 3357 triple square socket driver or a 17 mm hex socket to loosen the oil drain plug.*



4

34-37



A

- To check oil level, remove oil filler plug (arrow).
- Check oil level with hand-made tool, e.g. bent wire.
Specification: oil 7 mm (0.276 in.) below bottom of filler hole.

Note:

Service departments may fill oil up to bottom of oil filler hole.

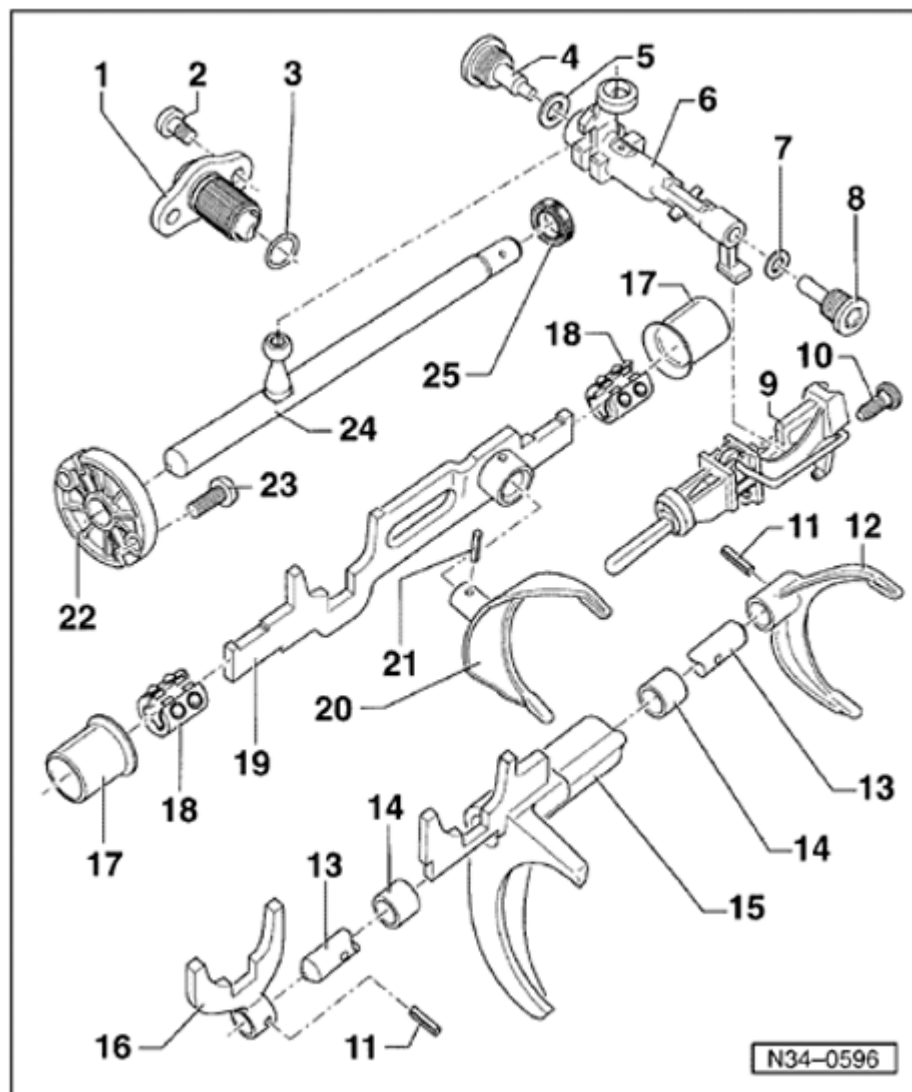
- Top off transmission oil if necessary.
Specification ⇒ [Page 00-3](#).
- Install oil filler plug.
Tightening torque: 25 Nm (18 ft lb).

34-62

Transmission selector mechanism, disassembling and assembling

Special tools and equipment

- ◆ VW295 needle bearing drift
- ◆ VW295A needle bearing drift
- ◆ VW401 thrust plate
- ◆ VW423 sleeve
- ◆ VW472/2 spacer sleeve
- ◆ VW771 peening tool
- ◆ Kukko 21/4 extractor

**Note:**

For the installation position of the complete selector mechanism in transmission ⇒ [Fig. 6](#).

1 - Gear lock 5th and reverse gear

◆ Removing and installing ⇒ [Page 34-69](#)

2 - Torx® bolt

◆ 10 Nm (7 ft lb)

3 - O-ring

◆ Always replace

4 - Right stop bolt

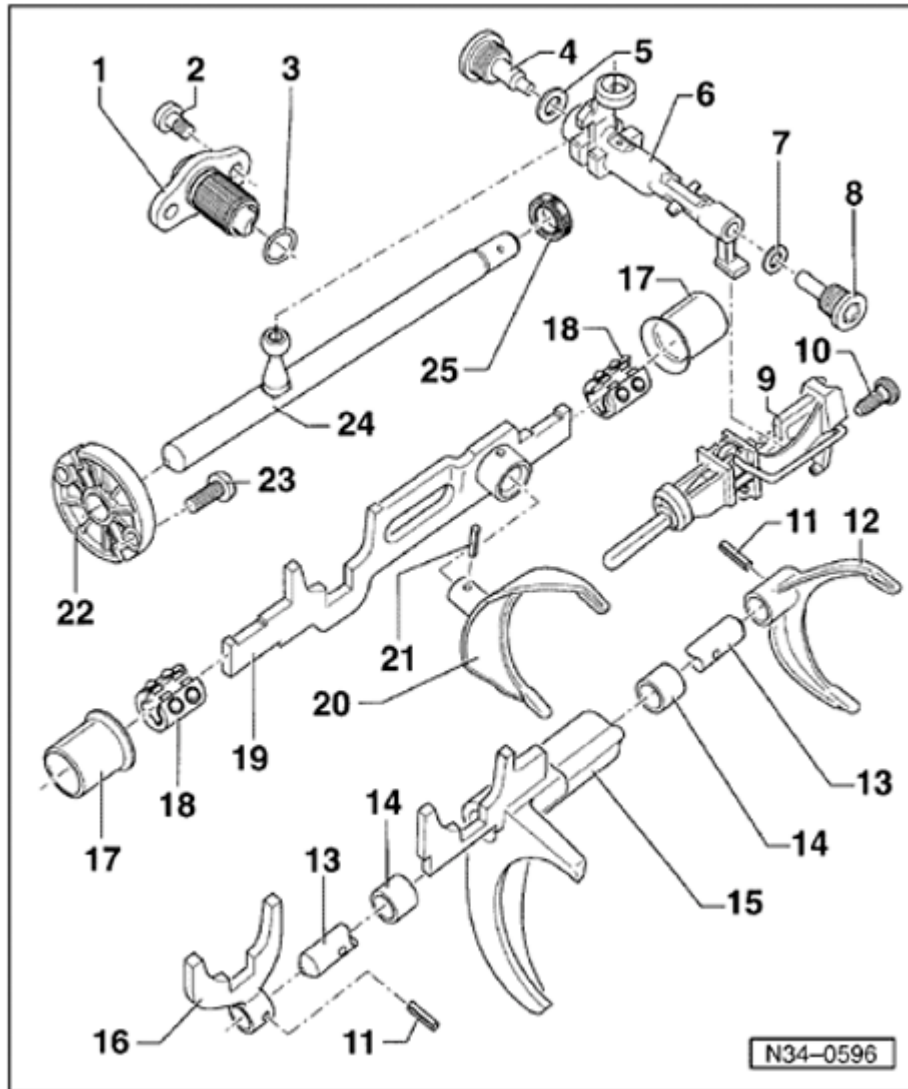
◆ 40 Nm (30 ft lb)

5 - Sealing washer**6 - 7Relay shaft****8 - Sealing washer****9 - Left stop bolt**

◆ 40 Nm (30 ft lb)

10 - Shift detent**11 - Torx® bolt**

◆ 25 Nm (18 ft lb)



12 - Roll pin

13 - 5th and reverse gear shift fork

◆ Installation position ⇒ [Fig. 1](#)

14 - Shift rod for 1st and 2nd gear and for 5th and reverse gear

15 - Ball sleeve

◆ Removing and installing ⇒ [Fig. 2](#)

16 - Shift fork for 1st and 2nd gear

17 - Coupling plate

◆ Installation position ⇒ [Fig. 1](#)

18 - 19 Bushing for 3rd and 4th gear

◆ Removing ⇒ [Fig. 3](#)

◆ Installing ⇒ [Fig. 4](#)

20 - Ball sleeve

◆ Pry off selector rod using screwdriver

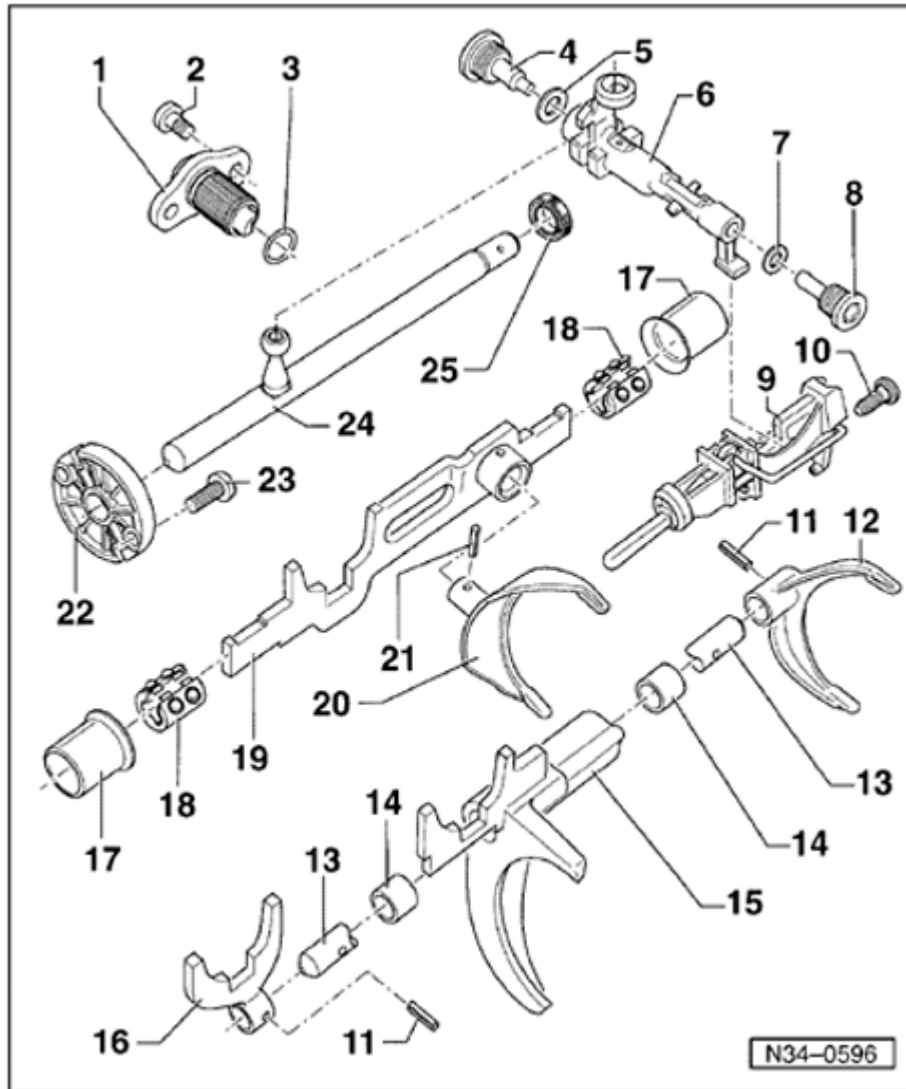
◆ Press onto selector rod

21 - Shift rod for 3rd and 4th gear

22 - Shift fork for 3rd and 4th gear

23 - Roll pin

34-65

**24 - Cover**

- ◆ For shift rod

25 - Torx® bolt

- ◆ 20 Nm (15 ft lb)

26 - Shift rod**27 - Sealing washer**

- ◆ Pry out using screwdriver
- ◆ Installation position ⇒ [Fig. 5](#)

34-66

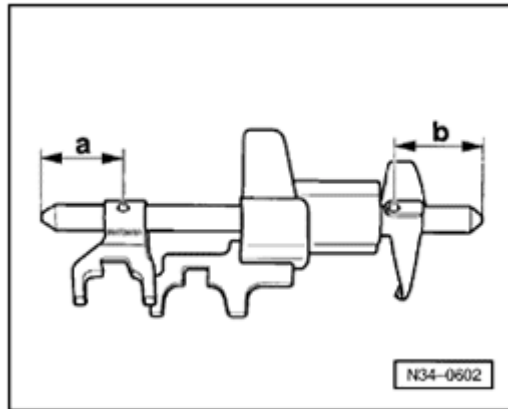


Fig. 1 Installation position of 5th and reverse gear shift fork and coupling plate for shift rod

- ◆ Dimension -a-: 55 mm (2.165 in.)
- ◆ Dimension -b-: 60 mm (2.362 in.)

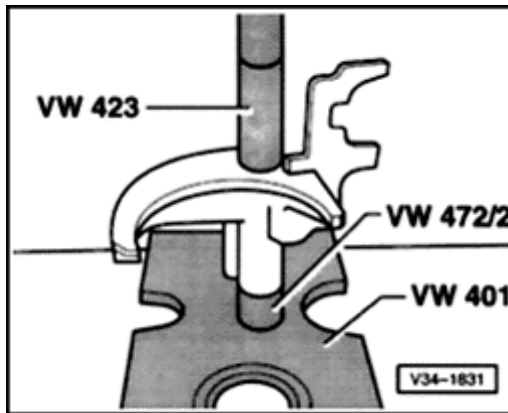
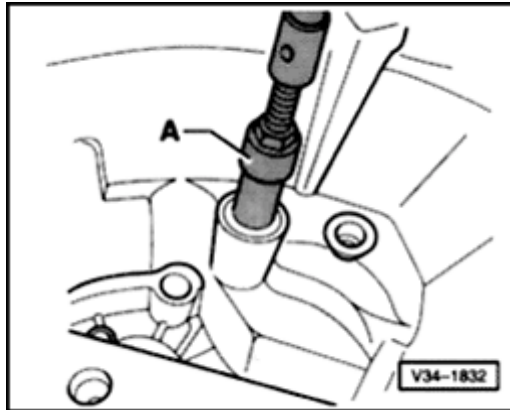


Fig. 2 Removing and installing ball sleeve

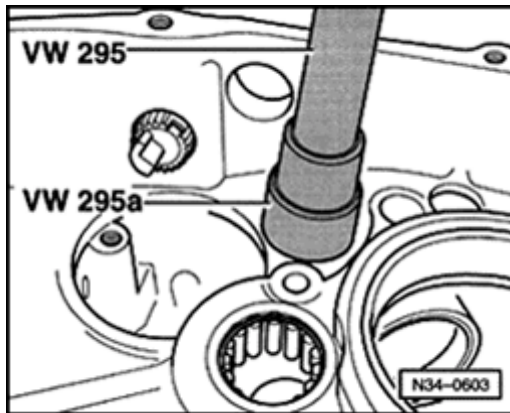
34-67



A

Fig. 3 Removing bushing for 3rd and 4th gear shift rod

A - Internal puller 22-28 mm, e.g. Kukko 21/4 extractor, in conjunction with VW771 slide hammer-complete set.



A

Fig. 4 Driving in bushing for 3rd and 4th gear shift rod onto stop

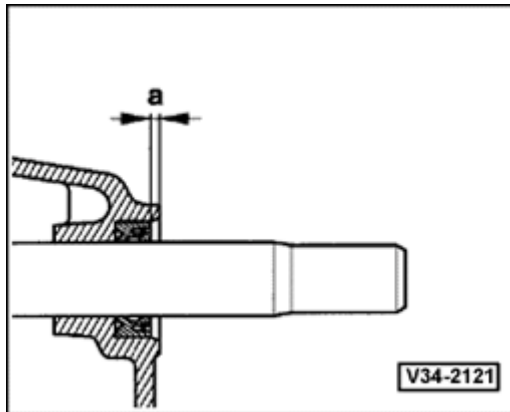


Fig. 5 Installation position of sealing washer

- Lubricate sealing lip and dust lip with gear oil.
- Lightly oil outer circumference of seal.

Dimension -a- : 1 mm (0.04 in.)

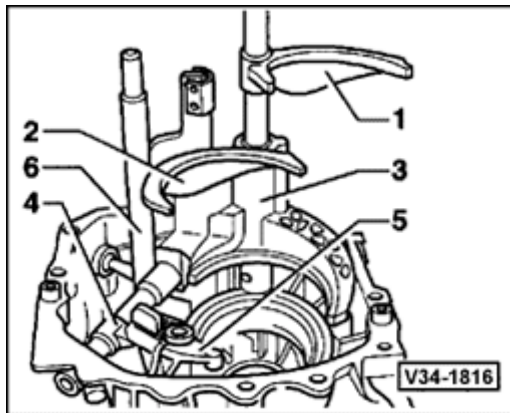
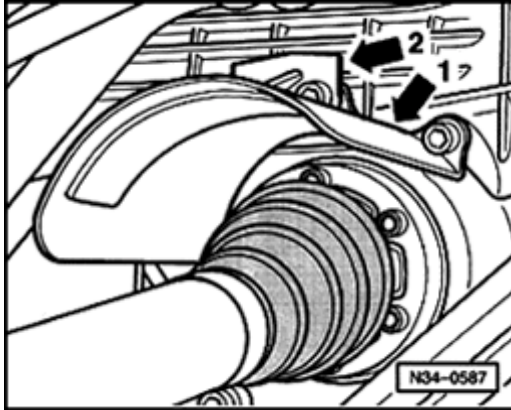


Fig. 6 Installation position of complete selector mechanism in transmission

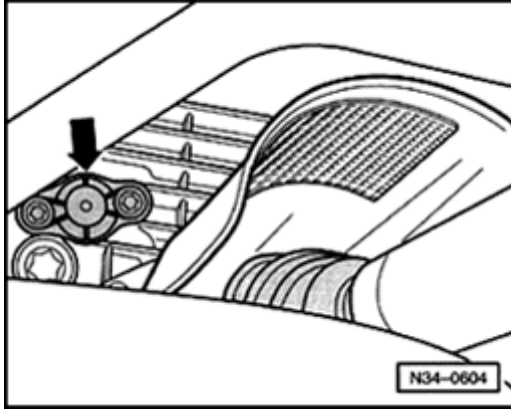
- 1 - Shift fork for 5th and reverse gear
- 2 - Shift fork for 3rd and 4th gear
- 3 - Shift fork for 1st and 2nd gear
- 4 - Relay shaft
- 5 - Shift detent
- 6 - Shift rod

34-69

Removing and installing gear lock for 5th and reverse gear



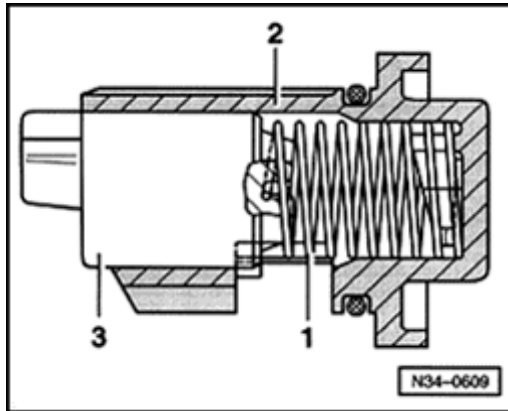
- Remove heat shield (arrow -2-) above right drive axle.
- Detach heat shield (arrow -1-) above right drive axle and pivot downward.



- Remove gear lock (arrow).

34-70

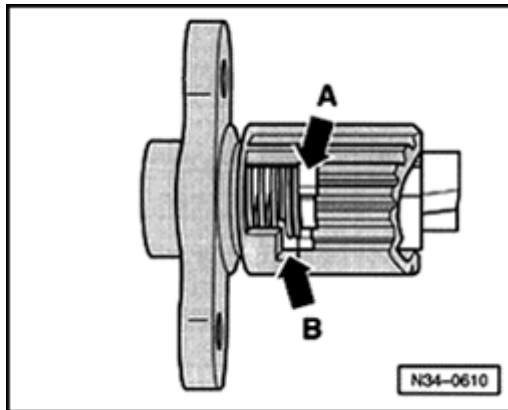
Assembling gear lock



A

- Insert spring -1- into housing -2- and, while applying light pressure, turn spring to left until it locates in base of housing.
- Insert bushing -3- onto spring so bent end of spring locates into groove properly.
- Push bushing against spring and turn approximately one turn to left, until lug on bushing aligns with groove in housing.
- Press lug of bushing into groove in housing onto stop.
- Turn bushing to right and release.

The bushing will spring into the correct position.



A

Installation position of bushing:

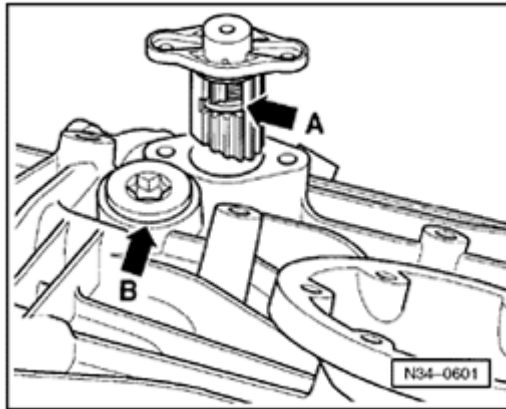
- Lug (arrow -A-) of bushing must always face away from groove in housing (arrow -B-).

Checking installation position:

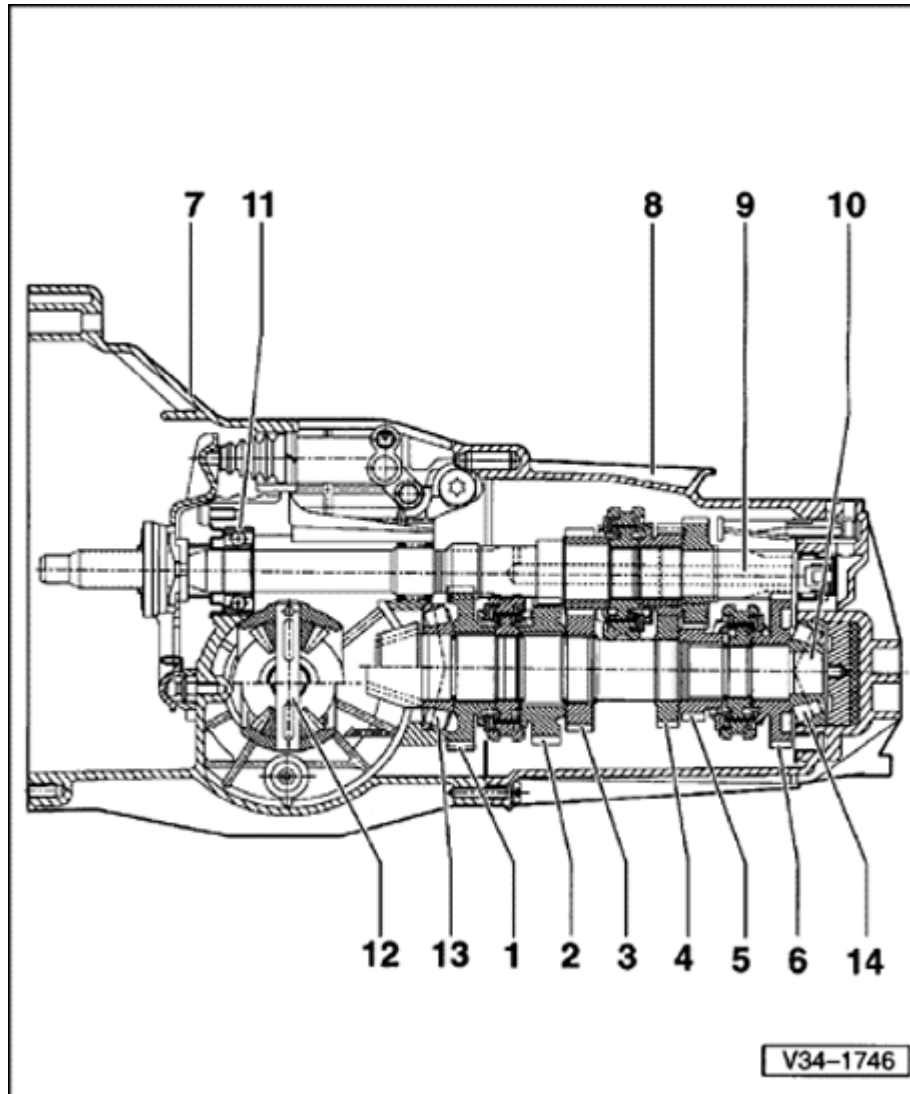
- Turn bushing to left and release.

The bushing should spring back into position; the lug must be against the stop (direction indicated by arrow -A-).

34-71



- ✦ Installation position of complete gear lock in transmission:
The recess (arrow -A-) faces bolt (arrow -B-).



Transmission, disassembling and assembling

Note:

Disassembly sequence ⇒ [Page 34-49](#) .

Transmission overview

1 - 1st gear

2 - 2nd gear

3 - 3rd gear

4 - 4th gear

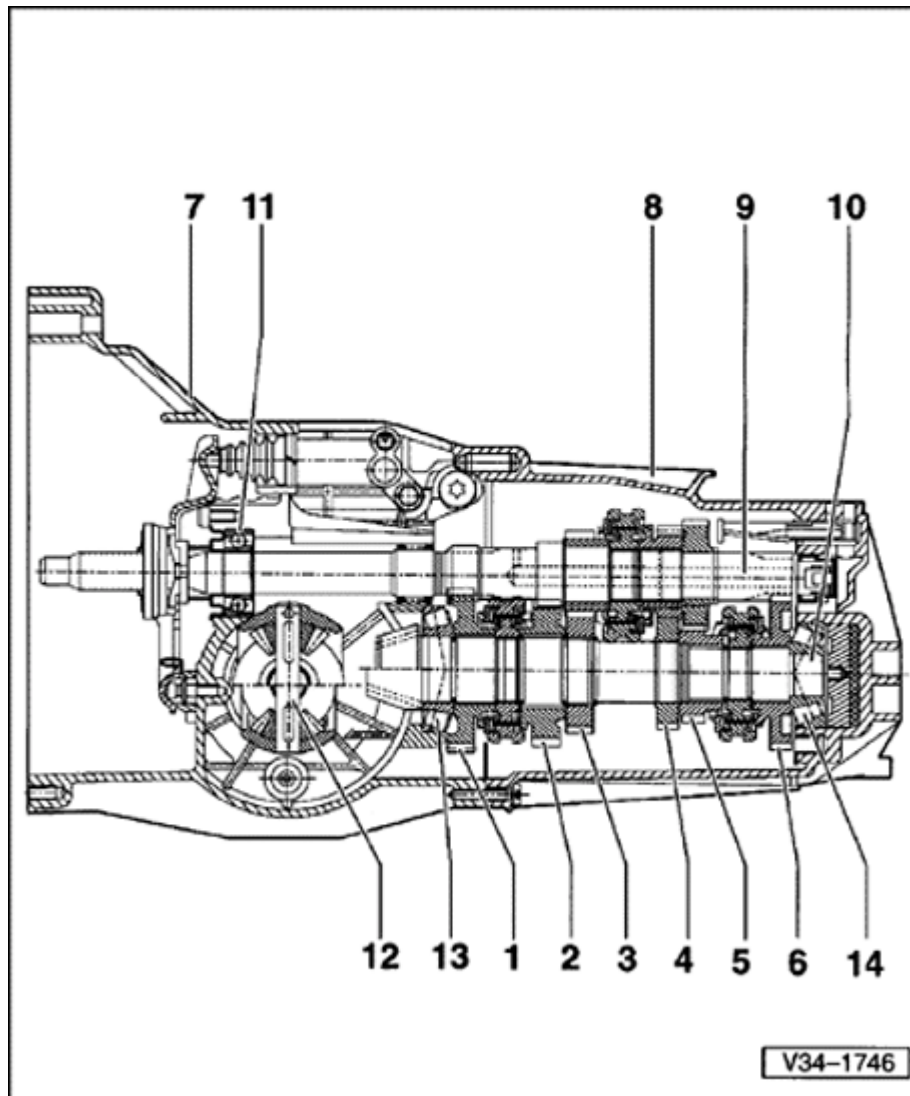
5 - 5th gear

6 - Reverse gear

◆ Removing and installing reverse idler gear
⇒ [Page 35-44](#)

7 - Transmission housing

8 - Transmission cover

**9 - Input shaft**

- ◆ Disassembling and assembling ⇒ [Page 35-1](#)

10 - Pinion shaft

- ◆ Disassembling and assembling ⇒ [Page 35-21](#)

11 - Ball bearing

- ◆ Adjusting ⇒ [Page 35-17](#) , Input shaft, adjusting

12 - Differential

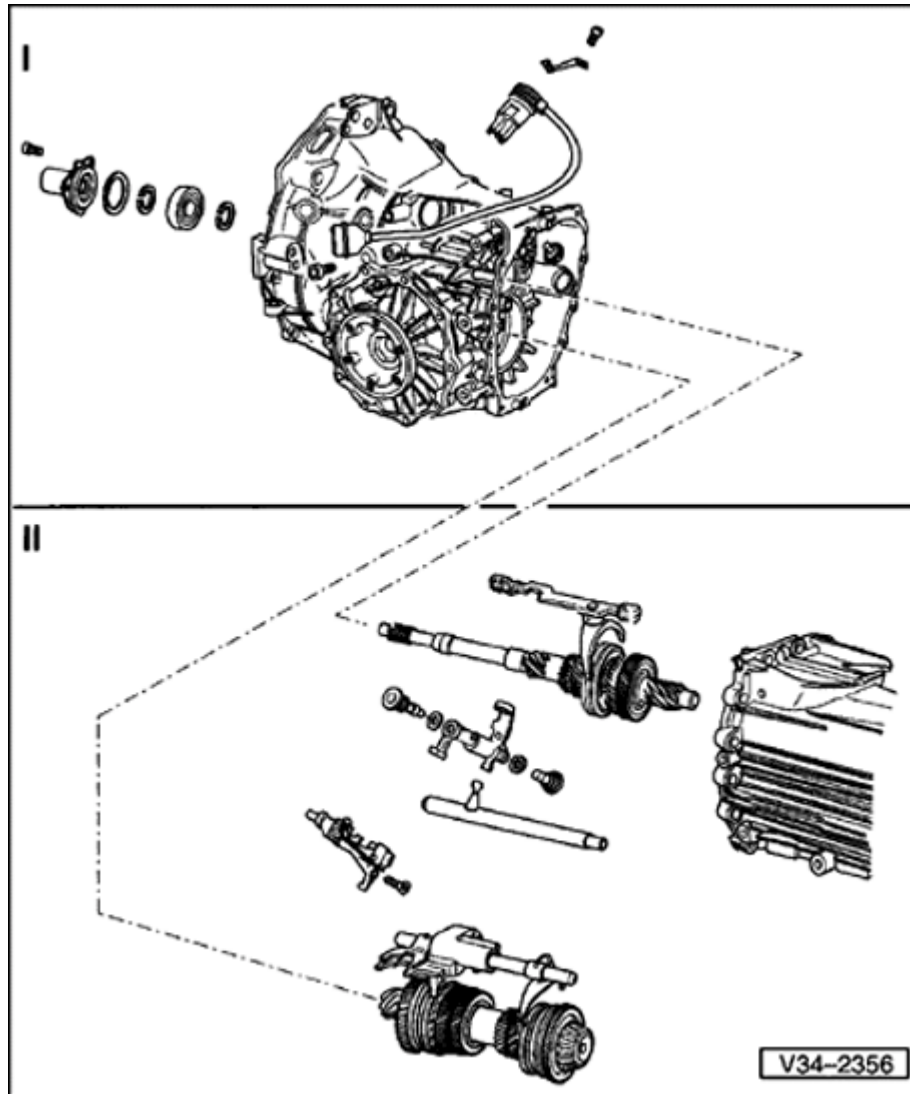
- ◆ Removing and installing ⇒ [Page 39-10](#)
- ◆ Disassembling and assembling ⇒ [Page 39-15](#)

13 - Tapered roller bearing

- ◆ Adjusting ⇒ [Page 39-35](#)

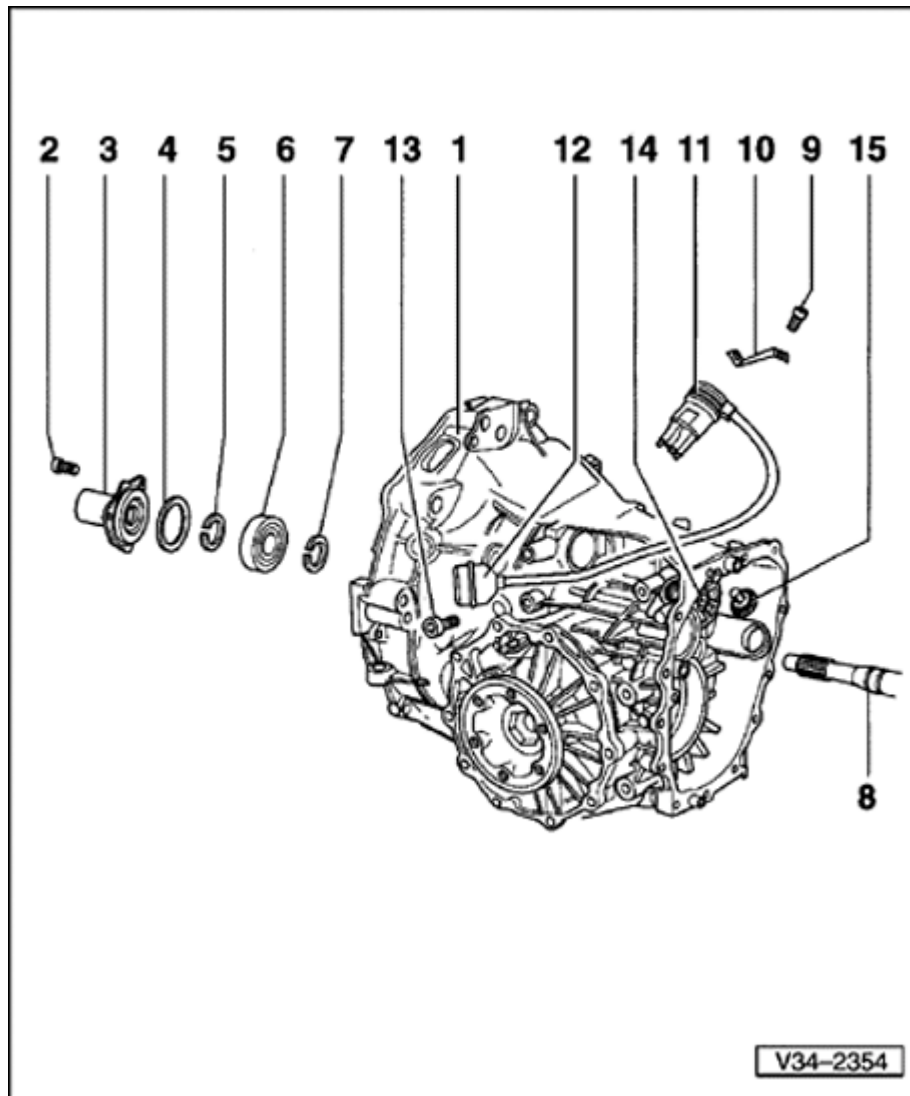
14 - Tapered roller bearing

- ◆ Adjusting ⇒ [Page 39-35](#)



Assembly overview

- I - Input shaft ball bearing and multi-function switch, removing and installing ⇒ [Page 34-41](#)
- II - Input shaft, pinion shaft, selector rods and transmission cover, removing and installing ⇒ [Page 34-45](#)



Input shaft ball bearing and multi-function switch, removing and installing

1 - Transmission housing

- ◆ With differential and flange shafts
- ◆ Removing and installing flange shafts ⇒ [Page 39-1](#)
- ◆ Removing and installing differential ⇒ [Page 39-10](#)
- ◆ Removing and installing speedometer Vehicle Speed Sensor (VSS) ⇒ [Page 39-7](#)
- ◆ Removing and installing speedometer drive gear ⇒ [Page 39-7](#)
- ◆ Breather installation position ⇒ Fig. 1

2 - Torx® bolt

- ◆ Always replace
- ◆ 35 Nm (26 ft lb)
- ◆ Self-locking

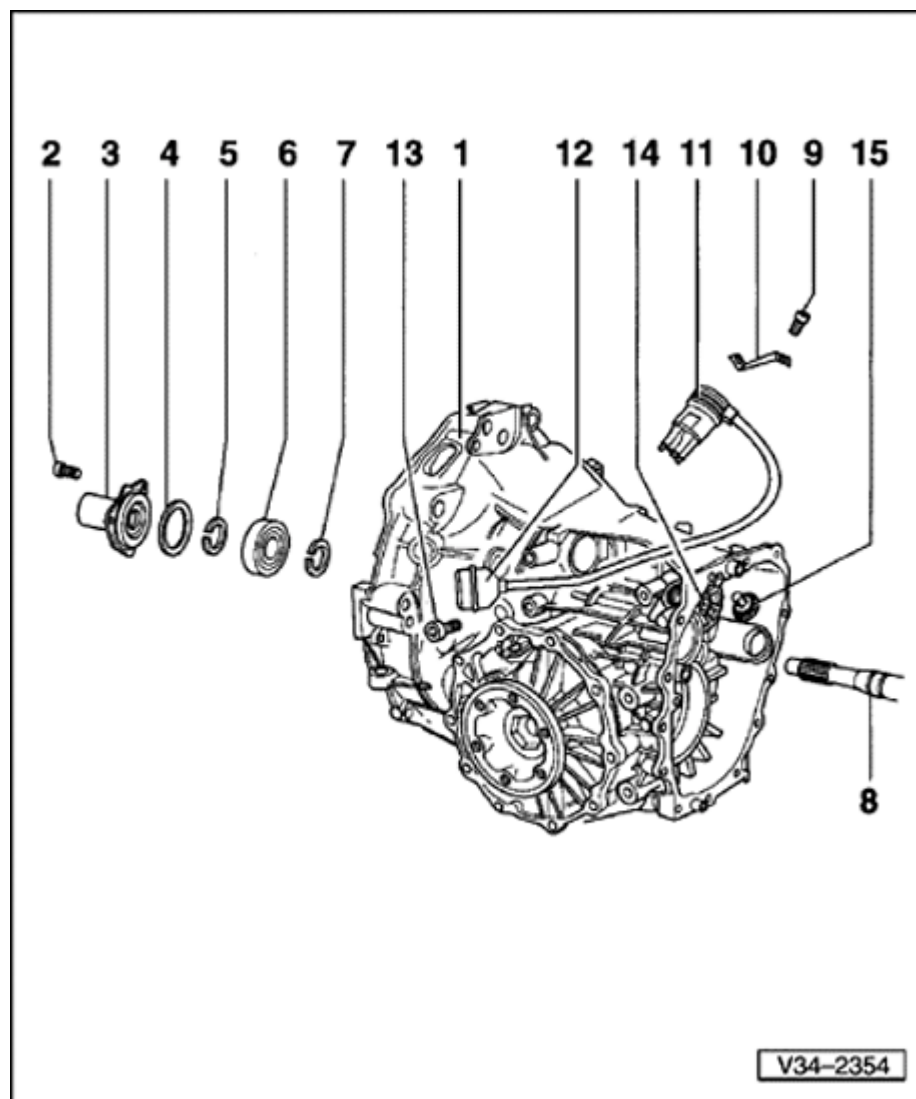
3 - Guide sleeve

- ◆ Installed with O-ring and seal for input shaft ⇒ [Page 30-17](#)

4 - Dished washer

- ◆ Smaller diameter (convex side) faces guide

sleeve

**5 - Circlip**

- ◆ Determining thickness and input shaft, adjusting ⇒ [Page 35-17](#)

6 - Input shaft ball bearing

- ◆ Removing and installing ⇒ [Page 34-49](#)

7 - Circlip

- ◆ Determining thickness and input shaft, adjusting ⇒ [Page 35-17](#)

8 - Input shaft

- ◆ Removing and installing ⇒ [Page 34-45](#)
- ◆ Disassembling and assembling ⇒ [Page 35-1](#)
- ◆ Adjusting ⇒ [Page 35-17](#)
- ◆ Servicing input shaft ball bearing ⇒ [Page 35-1](#)

9 - Socket-head bolt

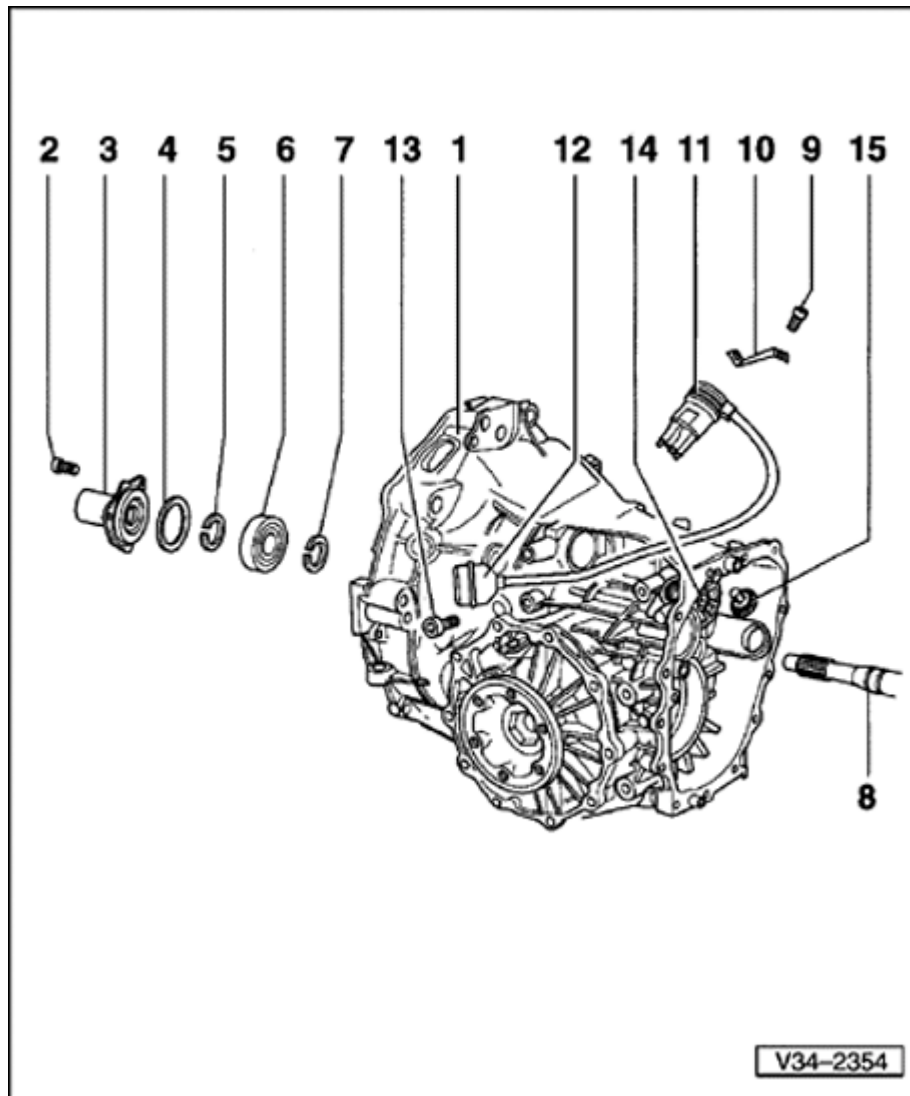
- ◆ 25 Nm (18 ft lb)

10 - Locking plate

- ◆ For multi-function switch

11 - Multi-function switch

34-43



12 - Multi-function switch harness connector

13 - Socket-head bolt

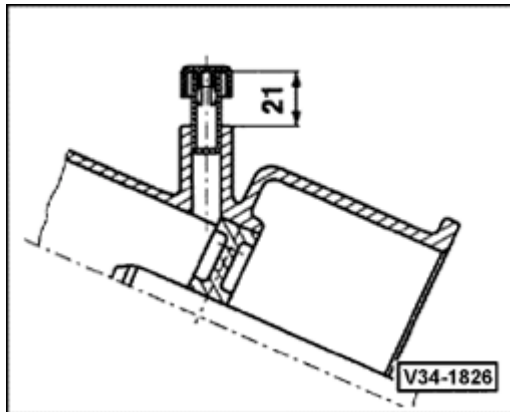
◆ 10 Nm (7 ft lb)

14 - Cover for shift rod

◆ Removing and installing ⇒ [Page 34-62](#)

15 - Gear lock for 5th and reverse gear

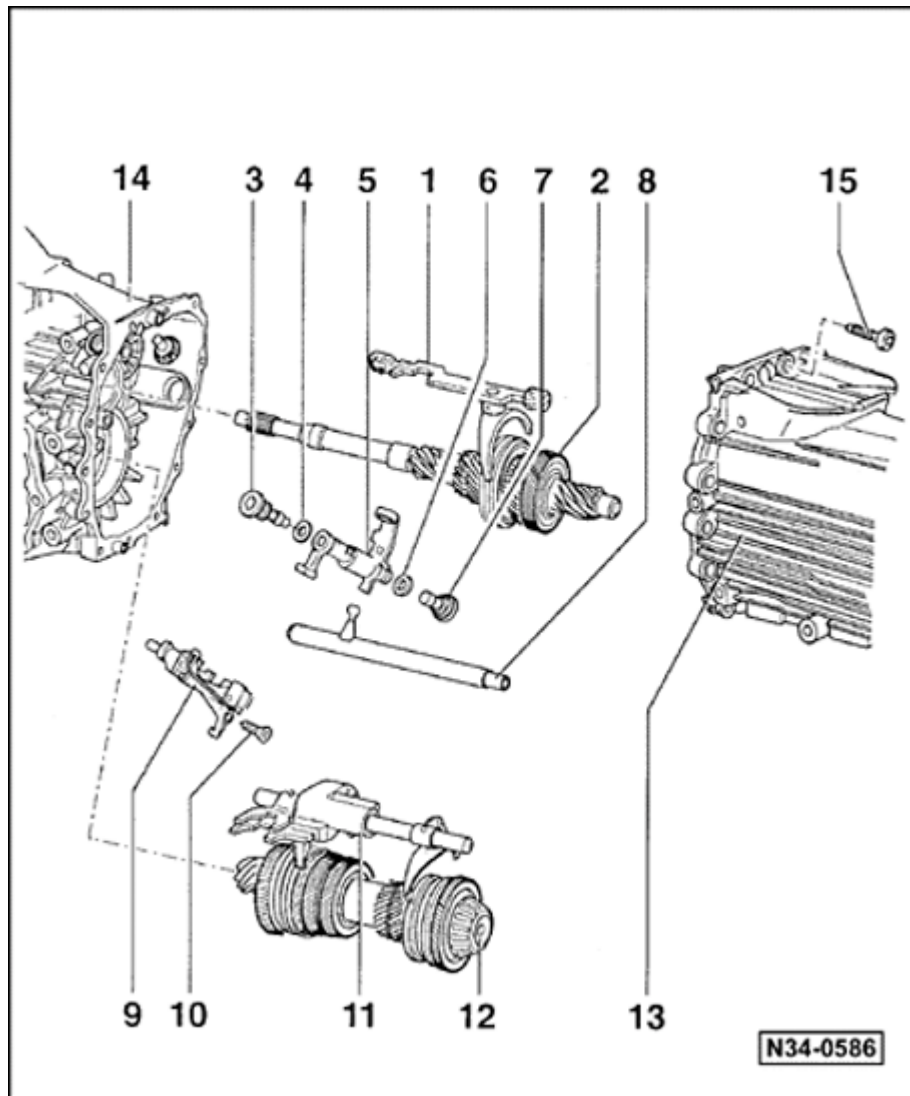
◆ Removing and installing ⇒ [Page 34-69](#)



A

Fig. 1 Breather installation position

After pressing in, the breather must project 21 mm (0.83 in.) out of the housing.



Input shaft, pinion shaft, selector rods and transmission cover, removing and installing

1 - Shift rod with shift fork for 3rd and 4th gear

- ◆ Disassembling and assembling ⇒ [Page 34-62](#)
- ◆ Replacing bushings ⇒ [Page 34-62](#)

2 - Input shaft

- ◆ Disassembling and assembling ⇒ [Page 35-1](#)
- ◆ Adjusting ⇒ [Page 35-17](#)
- ◆ Servicing input shaft ball bearing ⇒ [Page 35-17](#)

3 - Left stop bolt

- ◆ 40 Nm (30 ft lb)

4 - Washer

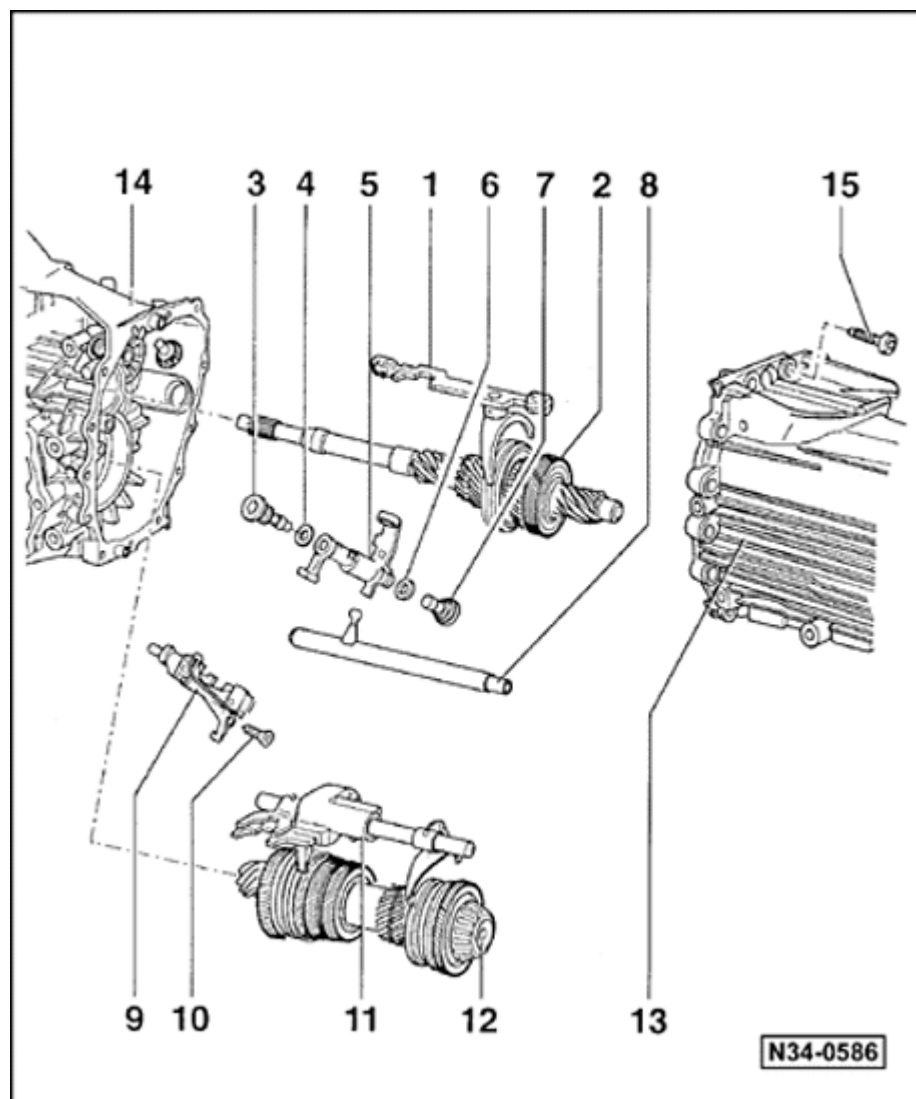
5 - Relay shaft

- ◆ Installation position ⇒ [Page 34-62](#)

6 - Washer

7 - Right stop bolt

- ◆ 40 Nm (30 ft lb)

**8 - Shift rod**

- ◆ Installation position ⇒ [Page 34-62](#)
- ◆ Replacing shift rod sealing washer ⇒ [Page 34-62](#)

9 - Shift detent

- ◆ Installation position ⇒ [Page 34-62](#)

10 - Torx® bolt

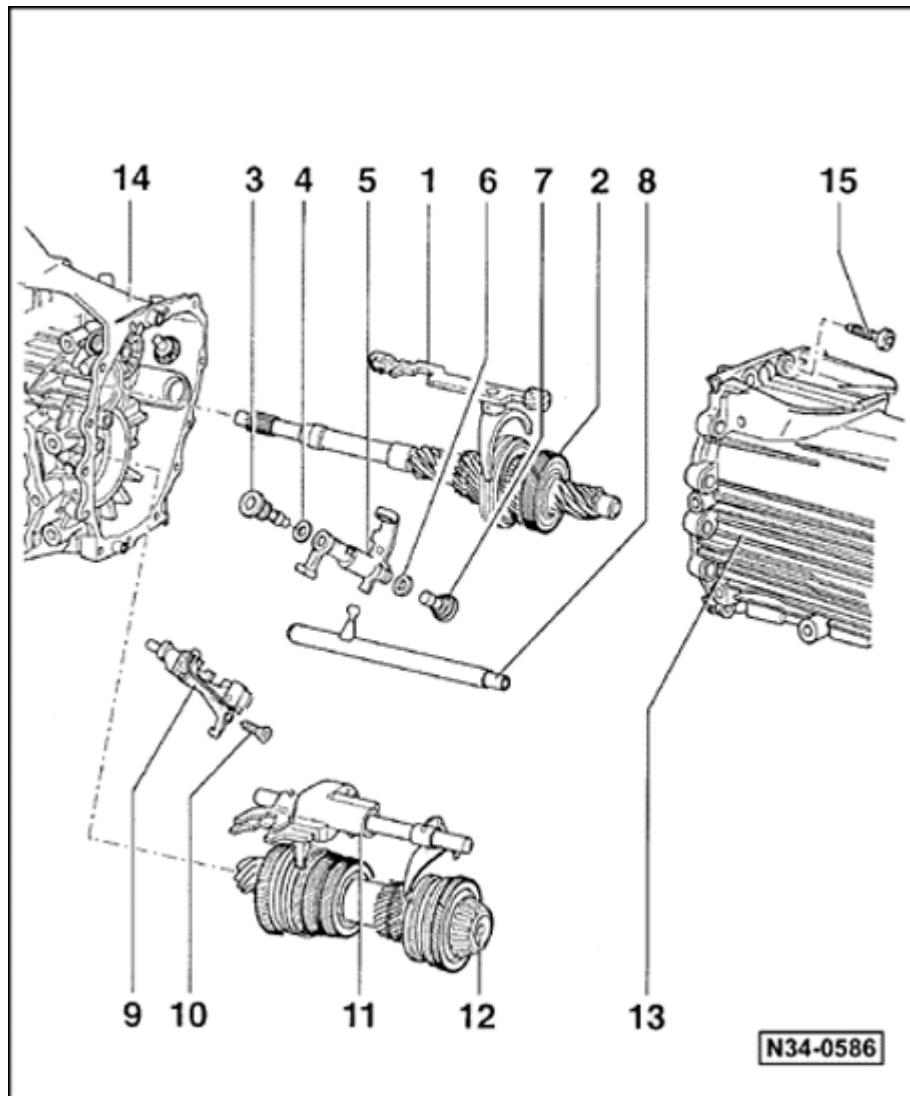
- ◆ 25 Nm (18 ft lb)
- ◆ With shoulder to secure shift detent spring

11 - Shift rod with shift fork for 1st/2nd/5th and reverse gear

- ◆ Disassembling and assembling ⇒ [Page 34-62](#)
- ◆ Removing and installing ball sleeve ⇒ [Page 34-66](#) , ⇒ [Fig. 2](#)

12 - Pinion shaft

- ◆ Disassembling and assembling ⇒ [Page 35-21](#)
- ◆ Adjusting ⇒ [Page 39-35](#)
- ◆ Servicing pinion shaft ball bearing ⇒ [Page 35-21](#)

**13 - Transmission cover**

- ◆ Coat sealing surfaces with thin layer of sealant AMV 188 001 02
- ◆ Removing and installing oil collector tray ⇒ [Page 34-48](#) , ⇒ [Fig. 1](#)

14 - Transmission housing

- ◆ Match components according to transmission code letters found in parts catalog microfiche

15 - Torx® bolt

- ◆ 22 Nm (16 ft lb)

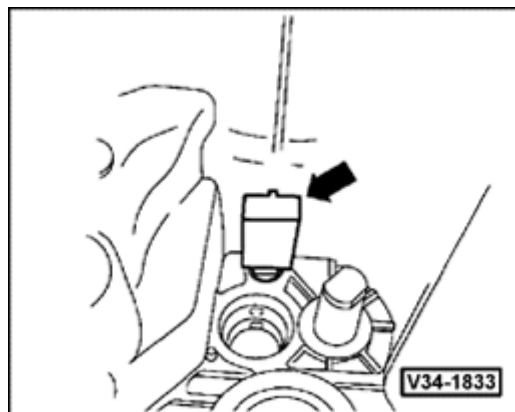


Fig. 1 Removing and installing oil collector tray

Removing

- Turn oil collector tray (arrow) and pull out.

Installing

- Push oil collector tray into transmission, until it snaps in.

Installation position: oil collector tray faces upward in transmission cover.

Input shaft ball bearing, multi-function switch, input shaft, pinion shaft, shift rods and transmission cover, removing and installing

Notes:

- ◆ *To remove the above-mentioned components, it is not necessary to remove the differential.*
- ◆ *Removal is only necessary when adjustments have to be performed ⇒ [Page 39-33](#) , list of adjustments*

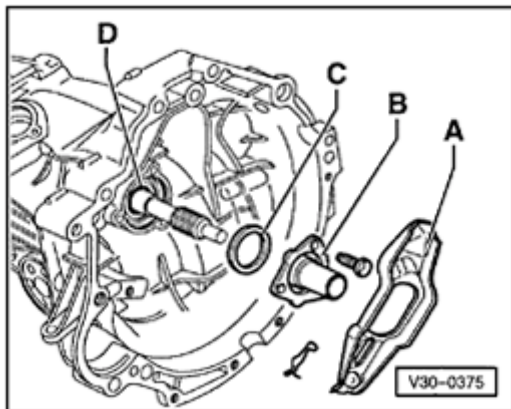
Special tools and equipment

- ◆ VW309 holding plate
- ◆ VW353 transmission support
- ◆ 3235 press device
- ◆ VAG1306 drip tray
- ◆ VAG1582 taper roller bearing puller
- ◆ VAG1582/2 gripping piece

◆ AMV 188 001 02 sealant

Removing

- Place VAG1306 drip tray under transmission.
- Drain transmission oil.
- Secure transmission to assembly stand ⇒ [Page 34-29](#).



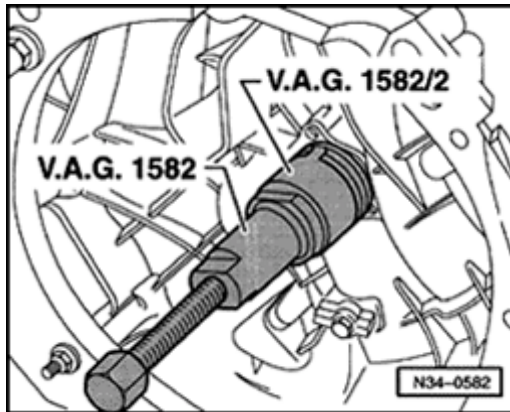
A

- Remove clutch release lever -A- with release bearing.

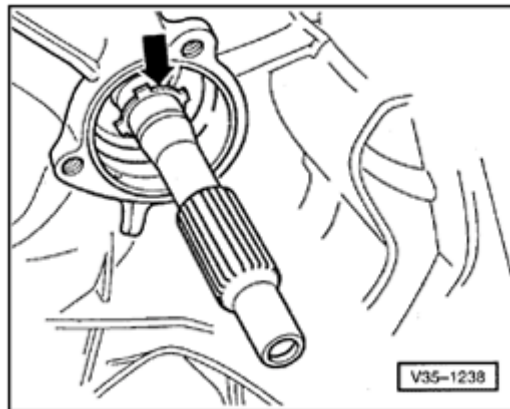
Notes:

- ◆ *Before removing the guide sleeve, slide a shrink tube over the input shaft splines to protect the seal.*
- ◆ *Remove the seal in the guide sleeve ⇒ [Page 30-18](#).*
- Remove guide sleeve -B-.
- Remove spring washer -C-.
- Remove circlip -D- in front of input shaft ball bearing.
- Note thickness of circlip, if ball bearing, input shaft or transmission housing is not replaced.

34-51

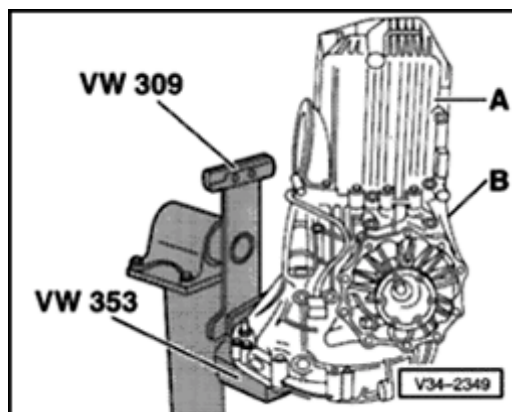


- A
- Pull input shaft ball bearing out of transmission housing.

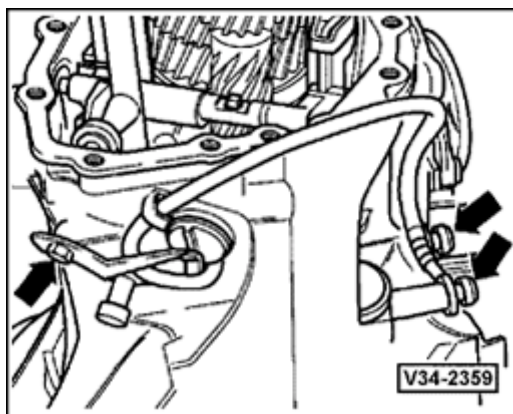


- A
- Remove circlip (arrow) behind input shaft ball bearing.
 - Note thickness of circlip, if ball bearing, input shaft or transmission housing is not replaced.

34-52

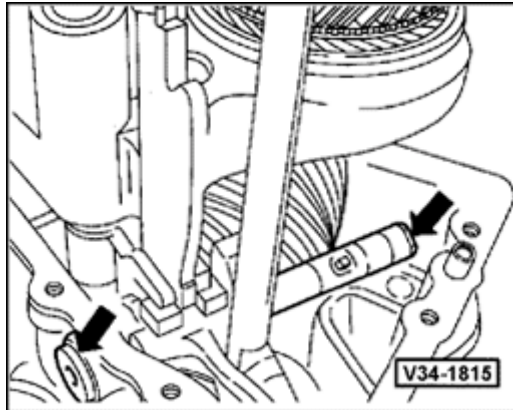


- A**
- Remove transmission cover -A- from transmission housing -B-.

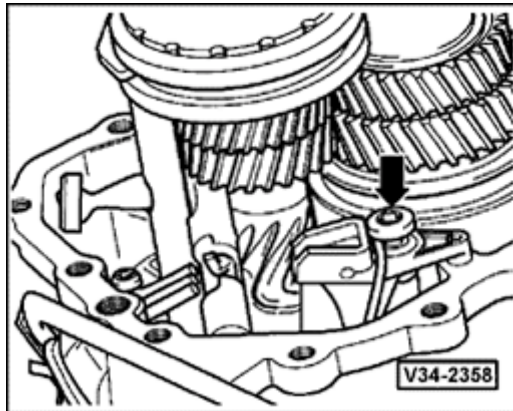


- A**
- Remove bolts (arrows) and pull out multi-function switch.

34-53

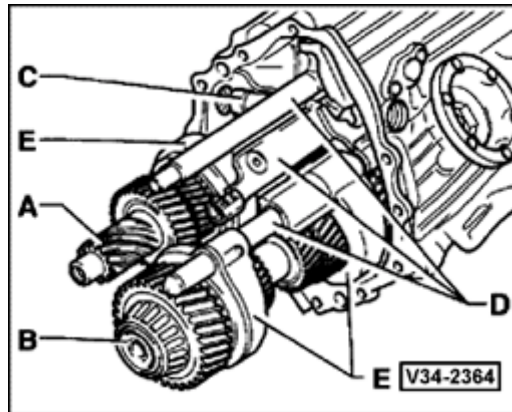


- A
- Remove relay shaft bolts (arrows).



- A
- Unbolt shift detent (arrow) and swing out.

34-54



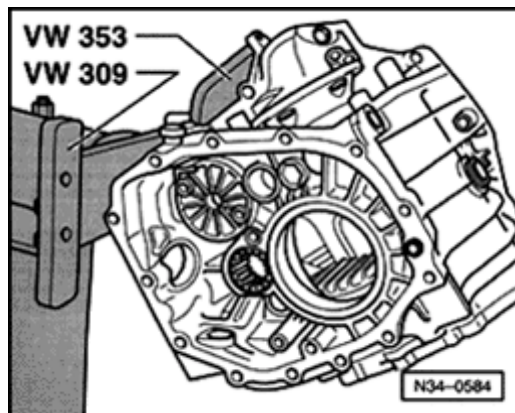
A

- Input shaft -A-, pinion shaft -B-, relay shaft -C-, selector rods -D- with shift rod and shift forks -E- must all be carefully pulled out together.

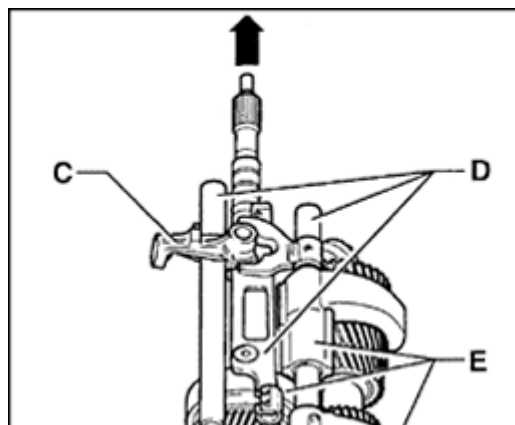
Installing

Note:

If the input shaft ball bearing, the input shaft or the transmission housing is replaced, it is necessary to re-determine the thickness of the circlips for the input shaft first ⇒ [Page 35-17](#) , input shaft adjusting.

**A**

- For easier installation of following components, swing transmission housing into position shown.

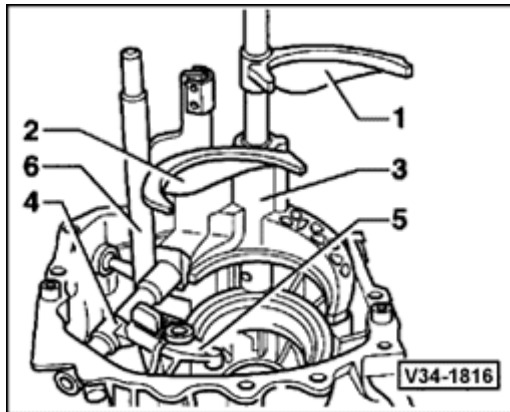
**A**

- Assemble input shaft -A-, pinion shaft -B-, relay shaft -C-, selector rods -D- with shift rod and selector forks -E-.
- Install these components into transmission housing as a set.

Note:

The relay shaft -C- and the shift rod can also be installed later if necessary ⇒ [Page 34-56](#) , Illustration V34-1816 and ⇒ [Page 34-57](#) , illustration V34-2120

34-56

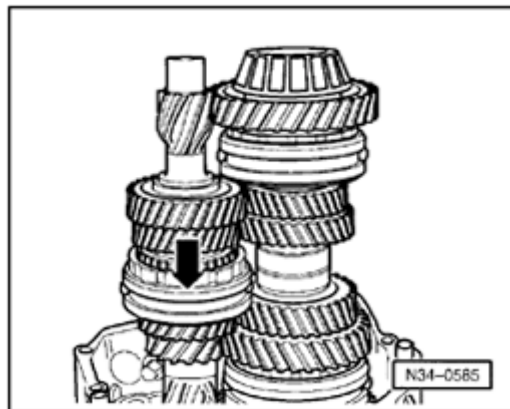


➤ Position of shift mechanism in transmission

- 1 - Shift fork 5th and reverse gears
- 2 - Shift fork 3rd and 4th gears
- 3 - Shift fork 1st and 2nd gears
- 4 - Relay shaft
- 5 - Shift detent
- 6 - Shift rod

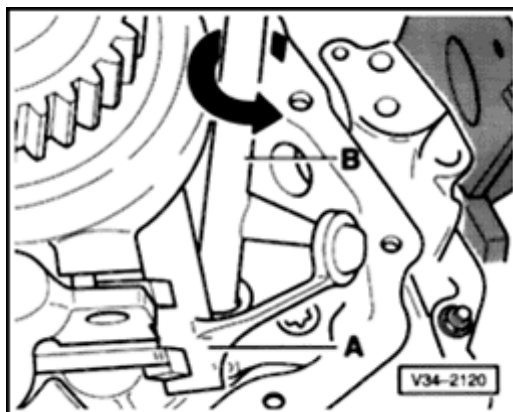
Note:

Illustration is shown without the drive axle and pinion.



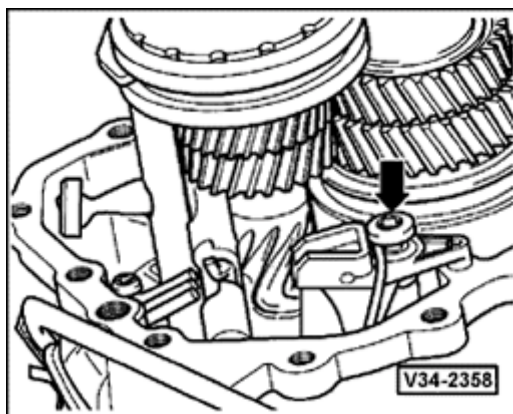
- - Move transmission housing and engage 3rd gear (direction of arrow).

34-57



A

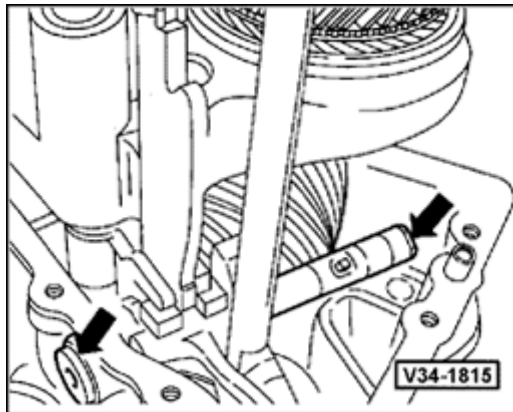
- Install relay shaft -A-.
- Place inner shift rod -B- sideways into mounting hole in transmission housing and assemble into mounting eye.
- Carefully turn shift rod in direction shown (arrow).



A

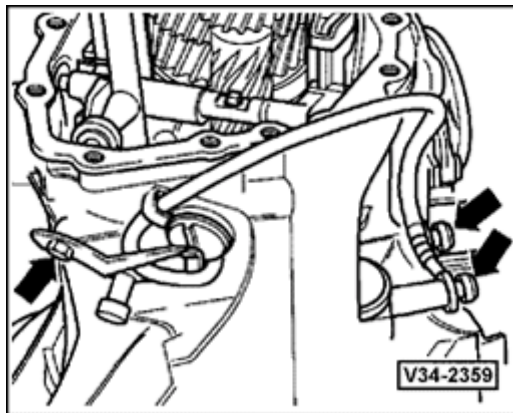
- Insert shift detent and tighten bolt (arrow) securely.

34-58



A

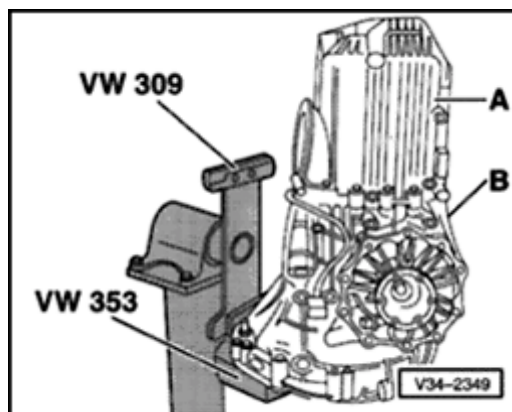
- Install relay shaft stop bolts (arrows).
- Replace O-ring for multi-function switch.



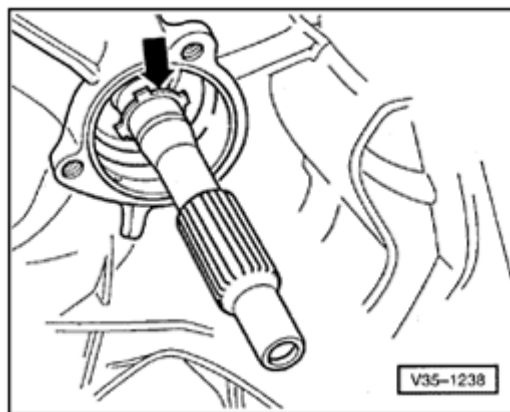
A

- Carefully insert multi-function switch and tighten (arrows).

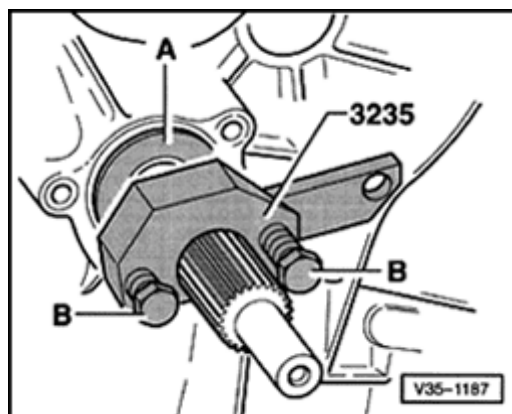
34-59



- A
- Make sure dowel sleeves for transmission cover -A- are installed in transmission housing -B-.
- Coat sealing surfaces with a thin layer of sealant AMV 188 001 02.
 - Install transmission cover onto transmission housing.

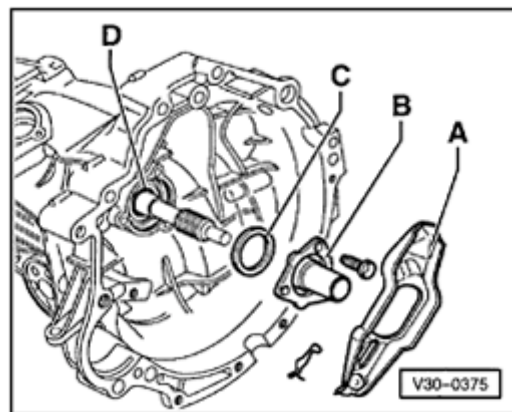


- A
- Install rear circlip (arrow) for input shaft ball bearing.
 - Slide ball bearing onto input shaft.
- Installation position: closed side of ball cage faces toward transmission housing.



A

- Press in ball bearing.
- Slide thrust piece -A- of press device onto input shaft.
- Position press device behind splines for clutch plate.
- Screw in bolts -B- and tighten slightly.
The bolts bear against the indentations in thrust piece -A-.
- Press in ball bearing onto seat by alternately tightening bolts -B- (1/2-turn at a time) until stop is reached.



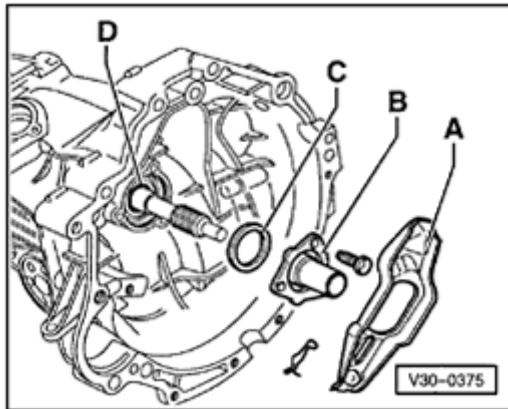
A

- Install front circlip -D- for input shaft ball bearing.
 - Install spring washer -C-.
- Position: convex side faces guide sleeve -B-.

Notes:

- ◆ Before installing guide sleeve, cover splines on input shaft with a shrink tubing to protect the seal.
- ◆ Installing seal in guide sleeve ⇒ [Page 30-18](#).

34-61



A

- Install guide sleeve -B- for throwout bearing.
- Install clutch release lever -A- and throwout bearing.

Input shaft, disassembling and assembling

Special tools and equipment

- ◆ VW222A pilot drift
- ◆ VW295 needle-bearing drift
- ◆ VW295A needle-bearing drift
- ◆ VW401 thrust plate and VW402 thrust plate
- ◆ VW407 punch and VW408A punch
- ◆ VW415A tube and VW416B tube
- ◆ VW447I thrust pad
- ◆ VW771 slide hammer-complete set
- ◆ 30-24 drift
- ◆ 30-100 press tube

- ◆ 40-105 thrust piece
- ◆ 40-202 press-out piece
- ◆ Kukko 17/2 separating tool
- ◆ 21/4 KUKKO extractor



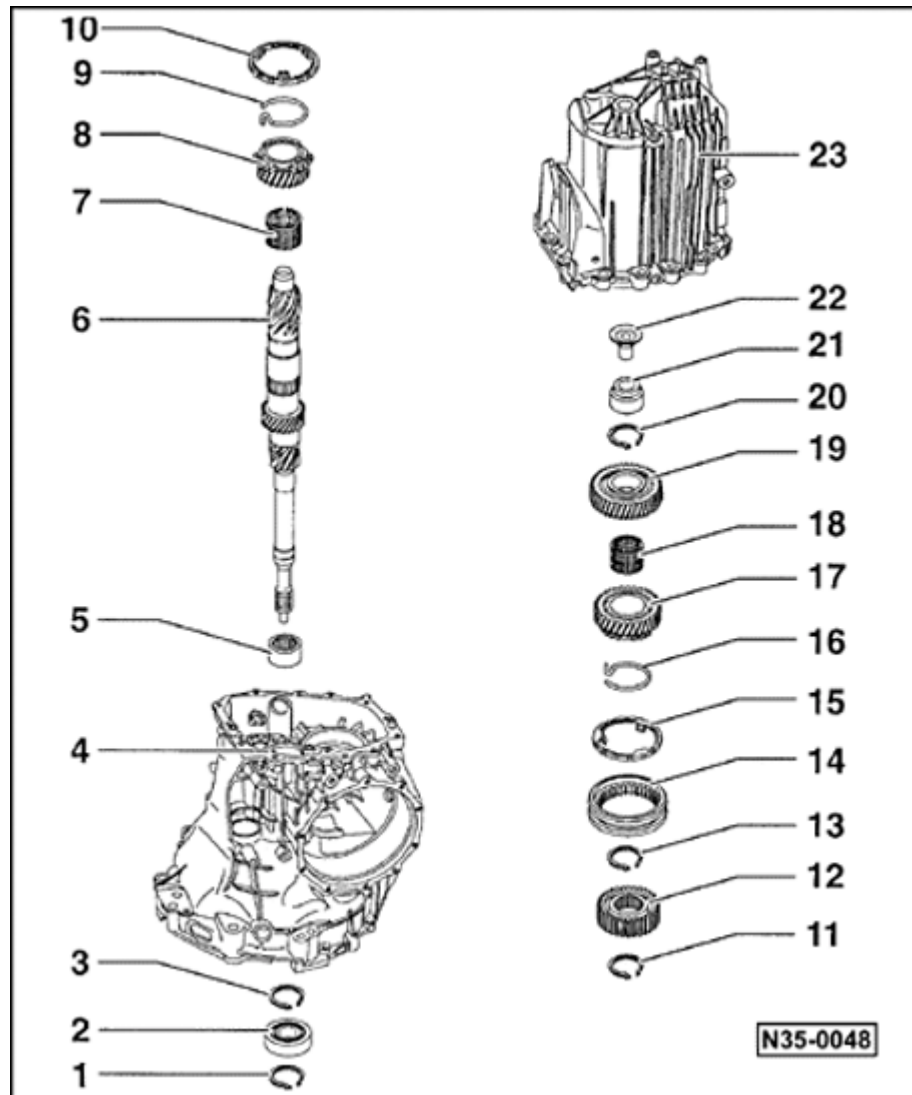
- ◆ *When installing the input shaft or new gears, consult technical data ⇒ [Page 00-3](#) .*
- ◆ *By replacing items - 2 -, - 4 - and/or - 6 -, the position of the ball bearing is influenced. In this case, the input shaft must be re-adjusted ⇒ [Page 35-17](#) .*

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -1-
- ◆ Determining thickness ⇒ [Page 35-17](#)

- ◆ Removing and installing ⇒ [Page 34-49](#)

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -2-
- ◆ Determining thickness ⇒ [Page 35-17](#)

<http://127.0.0.1:8080/audi/servlet/Display?action=Goto&type=repair&id=AUDI.B5.TM01.35.1>



5 - Needle bearing

- ◆ Secured with bolt ⇒ [Fig. 1](#)
- ◆ Driving out ⇒ [Fig. 2](#)
- ◆ Allocation of input shaft/needle bearing ⇒ [Fig. 3](#)
- ◆ Installed position ⇒ [Fig. 4](#)
- ◆ Pressing in ⇒ [Fig. 5](#)
- ◆ Securing ⇒ [Fig. 6](#)

6 - Input shaft

- ◆ With oiling sleeve
- ◆ Driving in oiling sleeve ⇒ [Fig. 7](#)
- ◆ Adjusting ⇒ [Page 35-17](#)
- ◆ Allocation of input shaft/needle bearing ⇒ [Fig. 3](#)

7 - Needle bearing for 3rd gear

- ◆ Identification

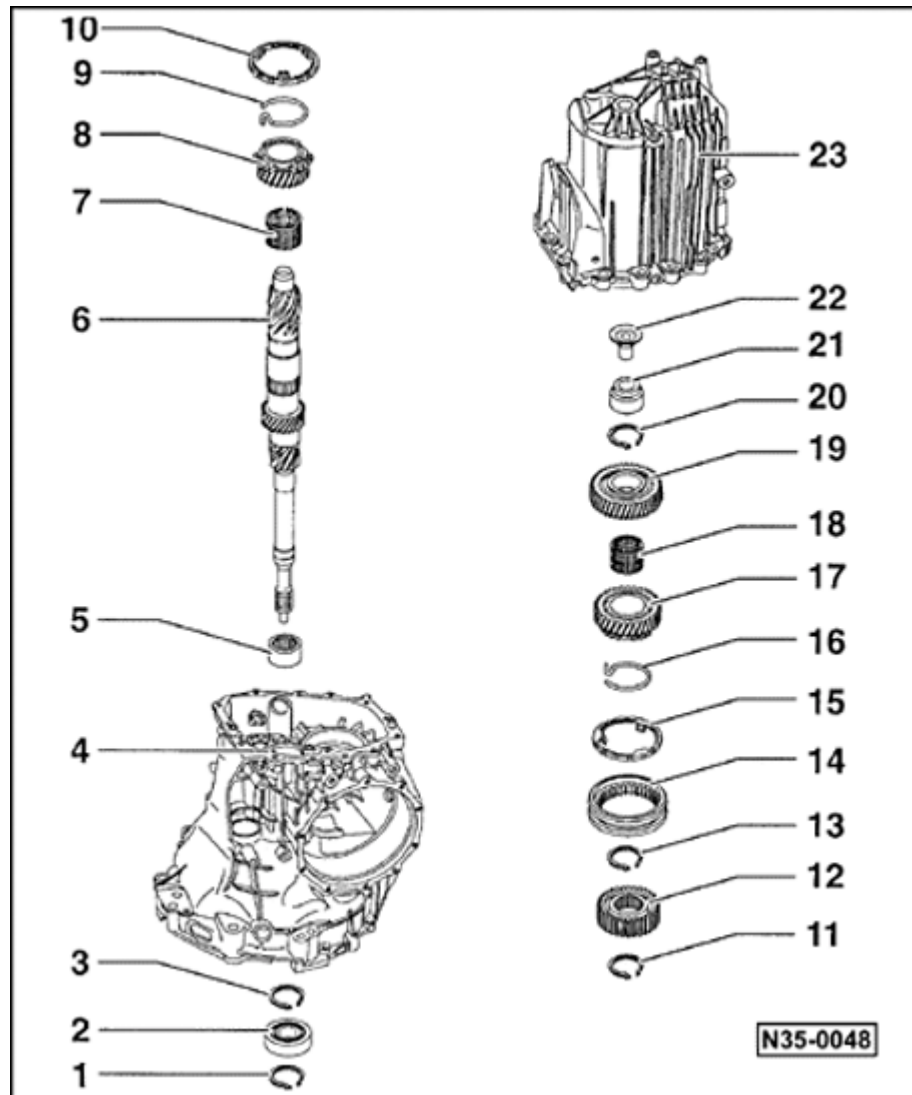
8 - 3rd gear

9 - Spring

- ◆ Inserting in 3rd gear ⇒ [Fig. 13](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

10 - Synchronizer ring for 3rd gear

◆ Checking for wear ⇒ [Fig. 14](#)

**11 - Circlip**

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -3-

12 - Synchronizer hub for 3rd and 4th gears

- ◆ Shoulder faces third gear
- ◆ Pressing off ⇒ [Fig. 12](#)
- ◆ Pressing on ⇒ [Fig. 17](#)

13 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item 4
- ◆ Re-determining thickness when replacing synchronizer body ⇒ [Fig. 16](#)

14 - Operating sleeve for 3rd and 4th gears

- ◆ Installed position ⇒ [Fig. 18](#)

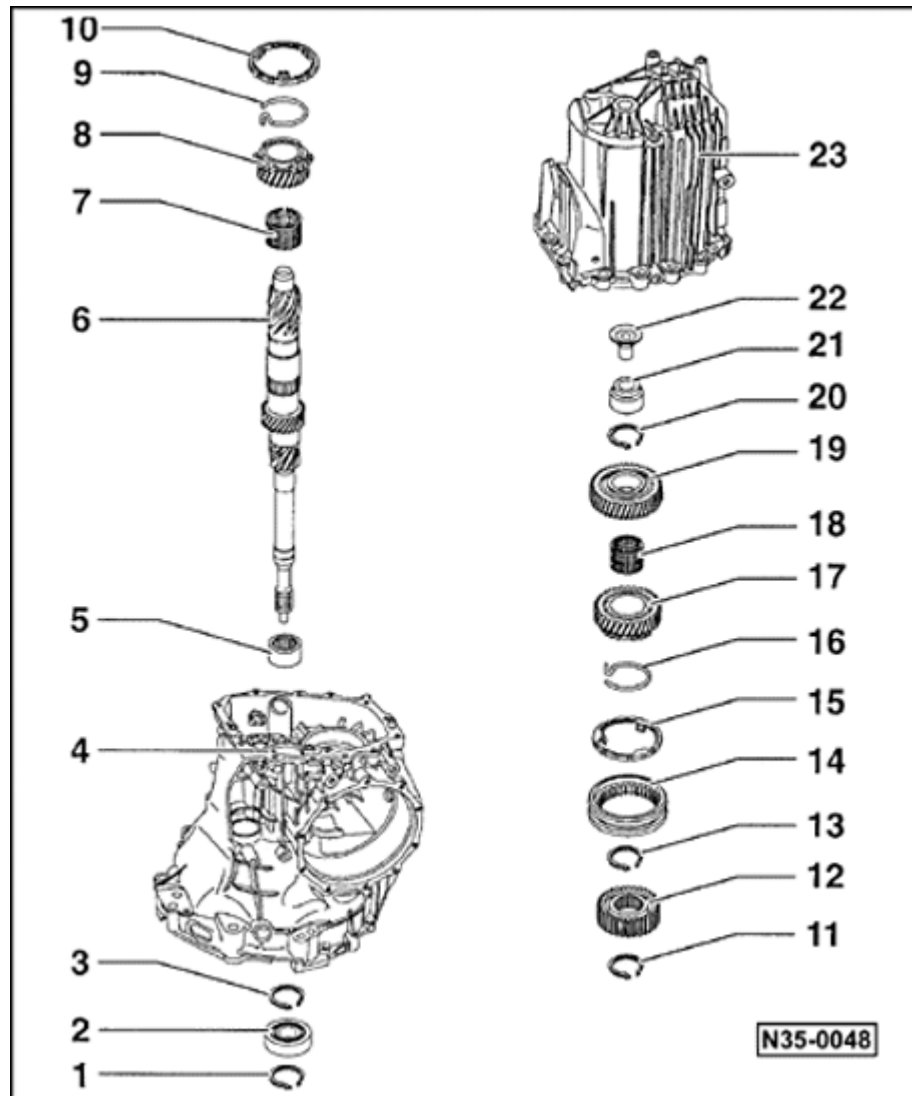
15 - Synchronizer ring for 4th gear

- ◆ Checking for wear ⇒ [Fig. 14](#)

16 - Spring

- ◆ Inserting in 4th gear ⇒ [Fig. 13](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

17 - 4th gear

**18 - Needle bearing for 4th gear**

- ◆ Identification

19 - 5th gear

- ◆ Pressing off ⇒ [Fig. 11](#)
- ◆ Pressing on ⇒ [Fig. 19](#)

20 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -5-
- ◆ If 5th gear is replaced, re-determine thickness of circlip ⇒ [Fig. 16](#)

21 - Roller sleeve

- ◆ Always replace
- ◆ Damaged when removed
- ◆ Pulling out ⇒ [Fig. 8](#)
- ◆ Installed position ⇒ [Fig. 9](#)
- ◆ Driving in ⇒ [Fig. 10](#)

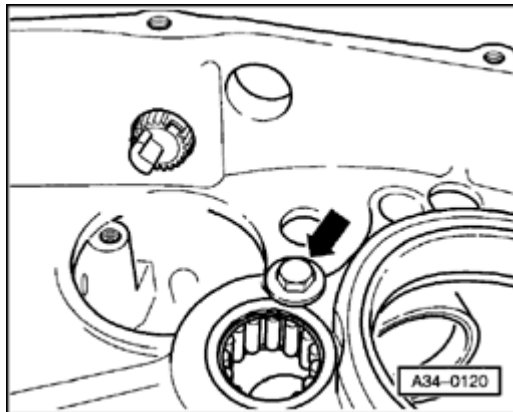
22 - Plastic sleeve

- ◆ Made of plastic

23 - Transmission cover

- ◆ With reverse idler gear ⇒ [Page 35-44](#)

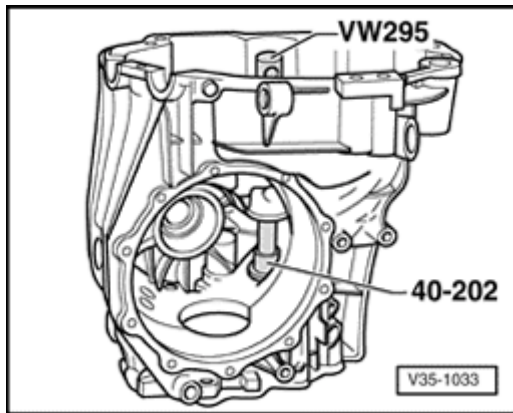
- ◆ Coat sealing surfaces with a thin layer of sealant AMV 188 001 02



A

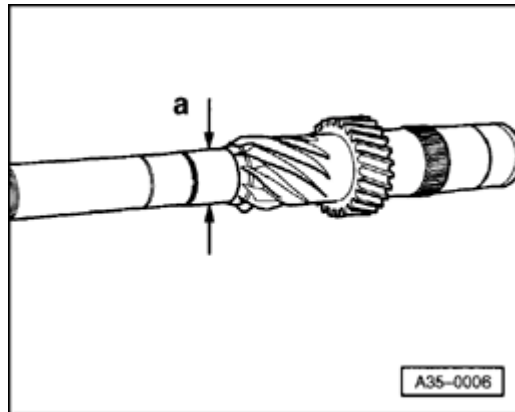
Fig. 1 Securing bolt for needle bearing

- Remove securing bolt (arrow).



A

Fig. 2 Driving out needle bearing



A

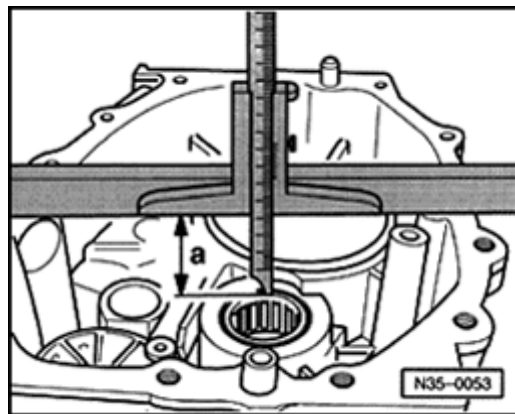
Fig. 3 Allocation of input shaft/needle bearing

Input shaft diameter	Needle bearing part number
a: 27 mm (1.062 in.)	012 311 123 D
a: 29 mm (1.141 in.)	012 311 123

Notes:

To avoid damage due to improper assembly, check the following after replacing the input shaft:

- ◆ *Input shaft must be able to be guided in.*
- ◆ *Input shaft must have no play.*



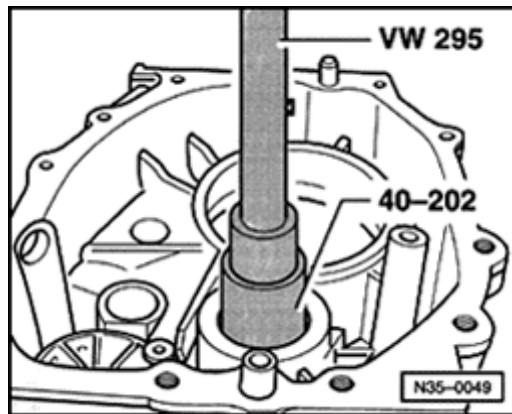
A

Fig. 4 Allocation of needle bearing

Dimension -a- from lower edge of straight-edge to upper edge of needle bearing: 39.5 mm (1.555 in.)

Note:

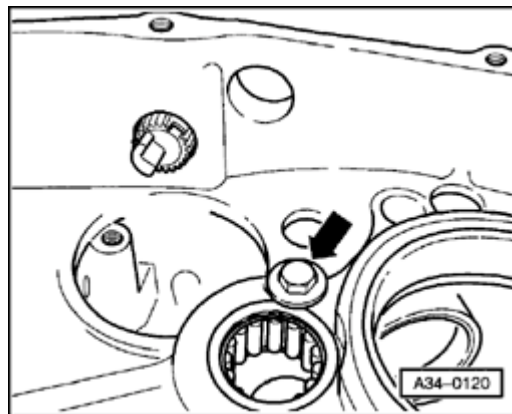
Measure the dimension from the top edge of the straight-edge and subtract the height of the straight-edge from the measured dimension.



A

Fig. 5 Pressing in needle bearing

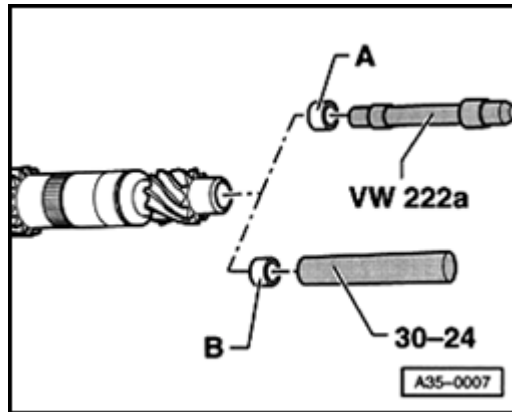
- Install securing bolt and tighten to 25 Nm (18 ft lb).



A

Fig. 6 Installing securing bolt (arrow)

Tightening torque: 25 Nm (18 ft lb).



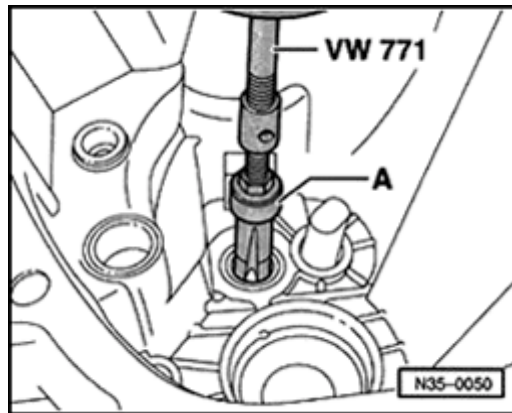
A

Fig. 7 Driving in oiling sleeve into input shaft

Item	Diameter of oiling sleeve	Tool
A	14 mm (0.551 in.)	VW222A pilot drift
B	16 mm (0.629 in.)	30-24 drift

Installed position: Flared edge of oiling sleeve faces tool

Installation depth: 3.5 mm (0.138 in.) below upper edge



A

Fig. 8 Pulling out roller sleeve

A - Internal puller 22-28 mm, e.g. Kukko 21/4

Plastic sleeve inside roller sleeve must be destroyed to install internal puller.

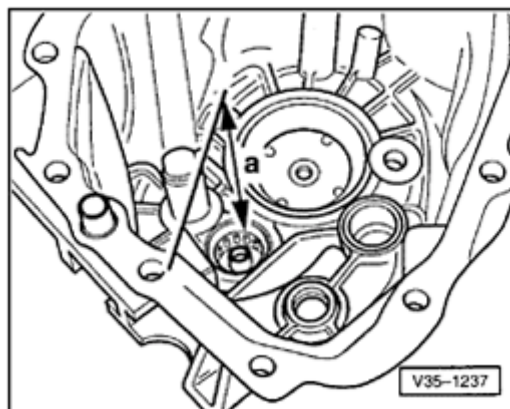


Fig. 9 Installed position of roller sleeve

Dimension -a- = 216 mm (8.5 in.)

Note:

Measure from upper edge of cover to upper edge of bearing.

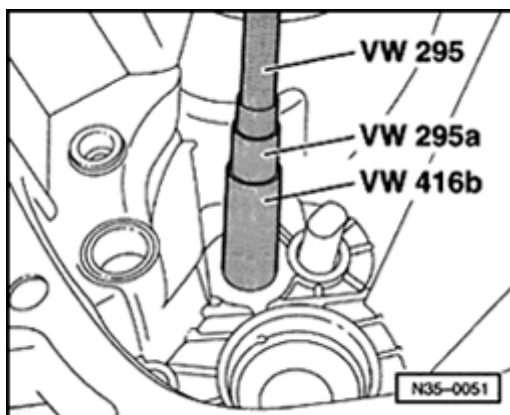
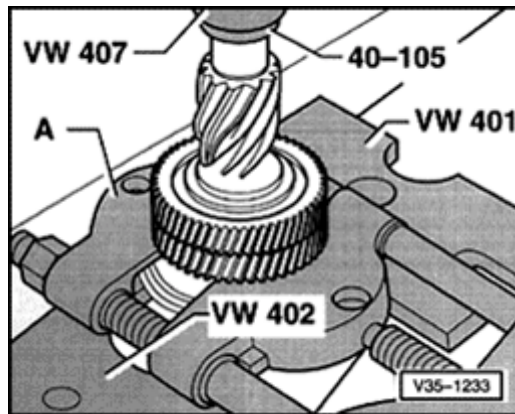


Fig. 10 Driving in roller sleeve

35-11

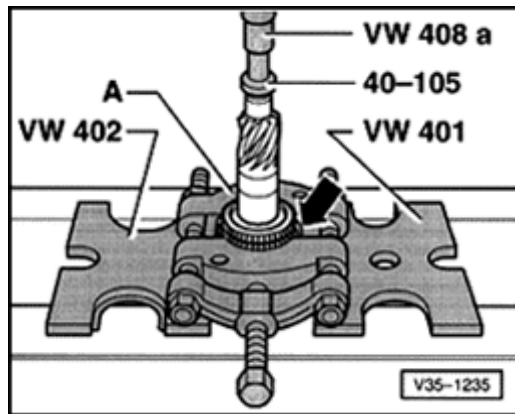


A

Fig. 11 Pressing off 5th gear

- Remove circlip before pressing off.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool



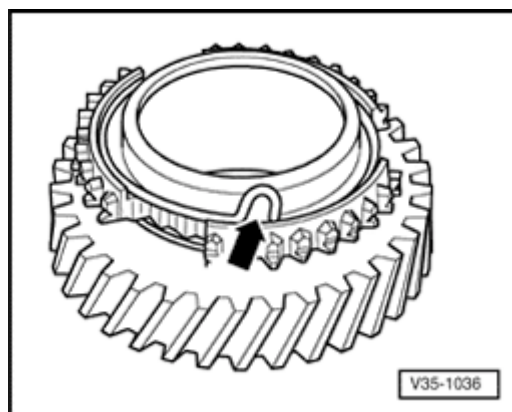
A

Fig. 12 Pressing off synchronizer hub for 3rd and 4th gears

- Remove circlip before pressing off.

- Press 3rd gear synchronizer ring (arrow) toward 3rd gear, and install separating device -A-.

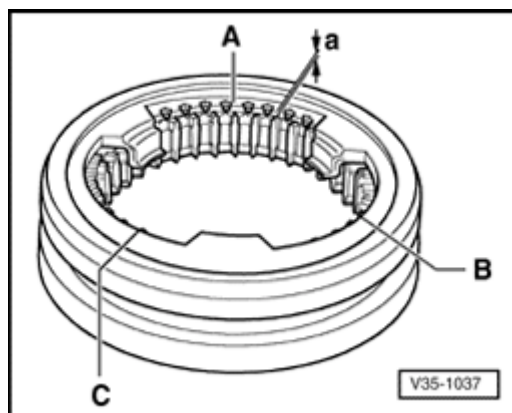
A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool



A

Fig. 13 Inserting spring into gear

The bent end of the spring (arrow) must be hooked into the hole of the gear.



A

Fig. 14 Checking synchronizer ring for wear

- Press synchronizer ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
 - Add measured values and divide total by three to calculate average.
- The calculated gap must not be less than 0.5 mm (0.019 in.).

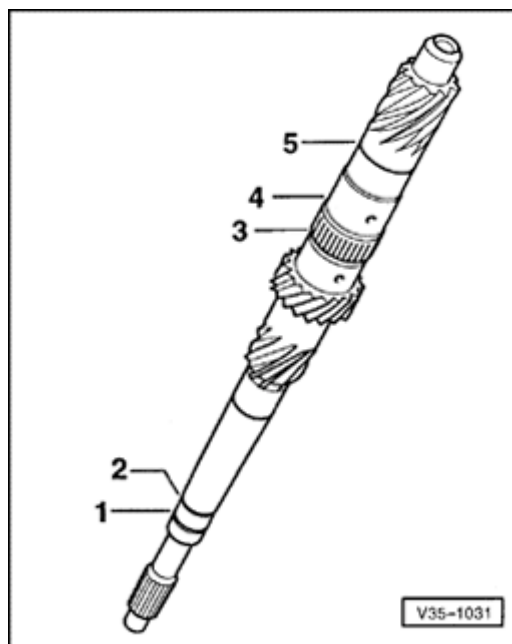
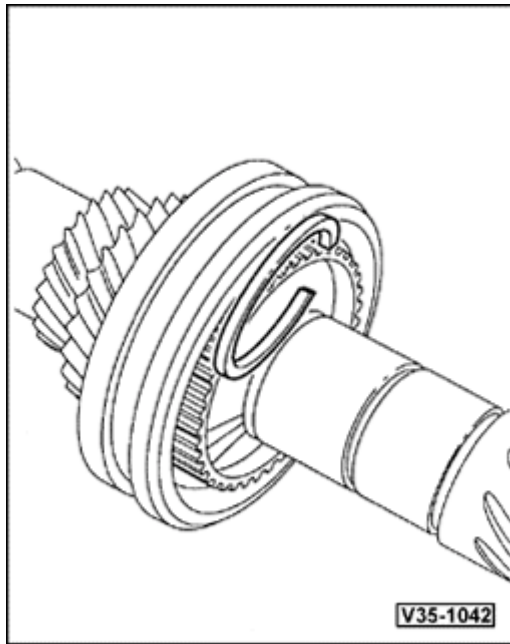


Fig. 15 Allocation of circlips

- ◆ Circlips -1- and -2- secure the input shaft ball bearing.
Determining thickness ⇒ [Page 35-17](#) , input shaft, adjusting
- ◆ Circlip -3- secures the 3rd and 4th gear synchronizer hub.
Thickness: 2.00 mm (0.078 in.).
Identification: brown in color.
- ◆ Circlip -4- secures the 3rd and 4th gear synchronizer hub.
Determining thickness ⇒ [Page 35-14](#) , table
Identification: blue in color.
- ◆ Circlip -5- secures the 5th gear.
Determining thickness ⇒ [Page 35-14](#) , table



A

Fig. 16 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Determine circlip according to table. Part number $\Rightarrow$ parts catalog

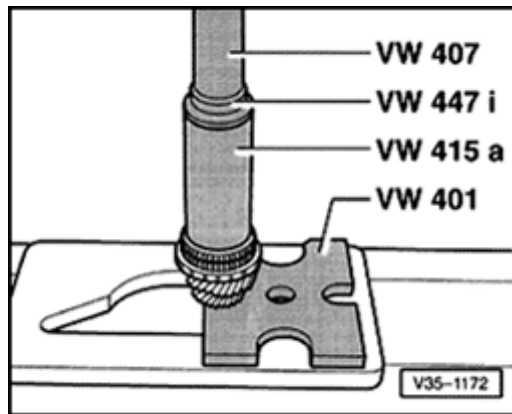
The following circlips are available for synchronizer hub for 3rd and 4th gear

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

The following circlips are available for 5th gear

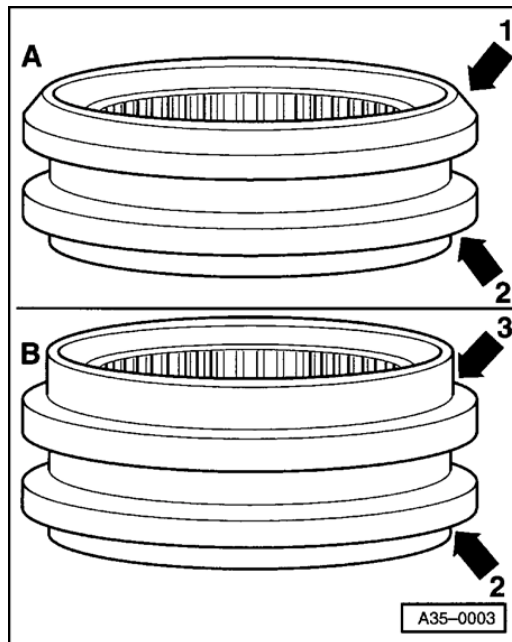
Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

35-15



A

Fig. 17 Pressing on synchronizer hub for 3rd and 4th gears



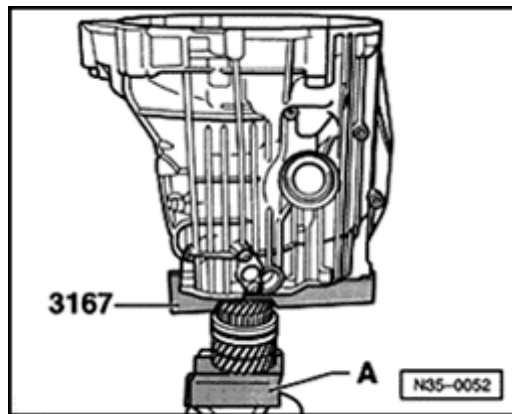
A

Fig. 18 Installation position of operating sleeve

Operating sleeves with chamfer -A- as well as operating sleeves with a large offset -B- are installed.

Installed position:

- ◆ The chamfer (arrow -1-) faces 4th gear
- ◆ The small stepped side (arrow -2-) faces 3rd gear
- ◆ The large stepped side (arrow -3-) faces 4th gear



A

Fig. 19 Pressing on 5th gear

WARNING!

Wear protective gloves!

- Heat 5th gear to approx. 100 ° C (212 ° F) before pressing on.

Installation position: shoulder faces reverse gear.

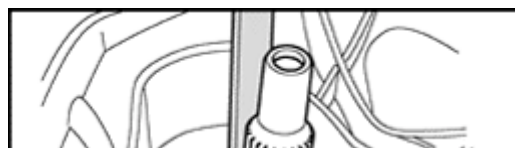
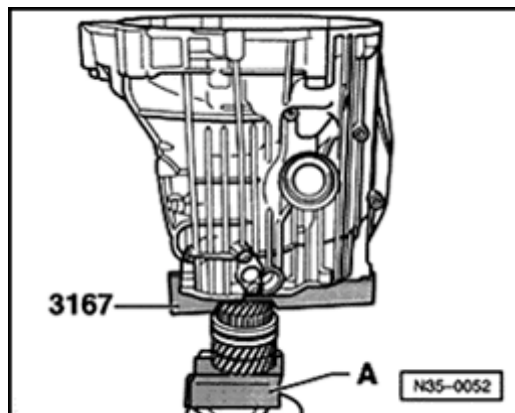
Input shaft, adjusting

Note:

The input shaft must be re-adjusted if the transmission housing, input shaft or ball bearing is replaced.

Special tools and equipment

- ◆ 30-100 press tube
- ◆ 3167 spacer gauge
- ◆ Depth gauge

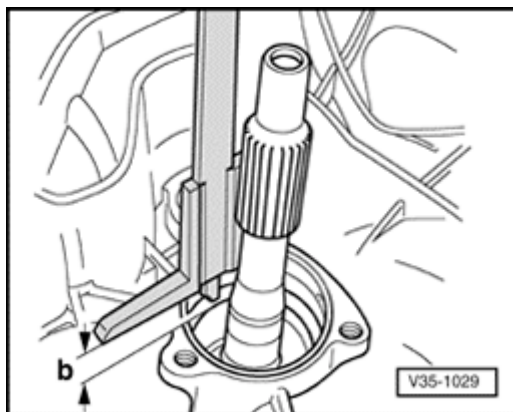


- ▲
 - Clamp input shaft in vice using protective jaws -A-.
 - Place 3167 spacer gauge onto 3rd gear.
 - Place transmission housing over input shaft onto spacer gauge.

Calculating dimension -x-

- ▲
 - Place depth gauge onto transmission housing and measure to lower circlip groove of input shaft.

Dimension in the example: -a- = 28.50 mm (1.122 in.)



A

- Place depth gauge onto transmission housing and measure to seating surface for ball bearing.

Measurement in the following example: -b- = 26.80 mm (1.055 in.)

Determining circlip thickness behind the input shaft ball bearing

Formula:

$$x = a - b$$

Example:

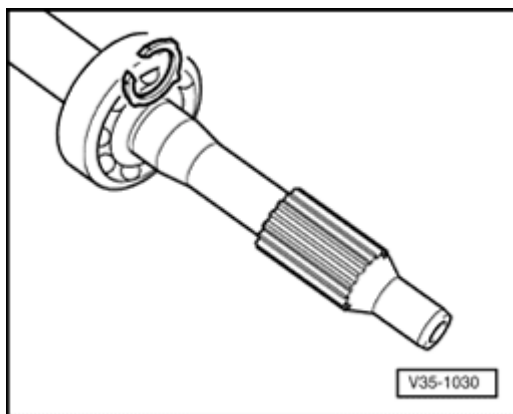
- | | |
|--|----------|
| Dimension -a- | 28.50 mm |
| - Dimension -b- | 26.80 mm |
| = Dimension -x- (thickness of circlip) | 1.70 mm |
- Determine circlip thickness according to table ⇒ [Page 35-19](#) .
- For part number ⇒ parts catalog

Available circlips

Dimension -x- (mm)	Thickness (mm)
1.48 - 1.56	1.54
1.57 - 1.65	1.63
1.66 - 1.74	1.72
1.75 - 1.83	1.81
1.84 - 1.92	1.90
1.93 - 2.01	1.99
2.02 - 2.10	2.08
2.11 - 2.20	2.17

Determining circlip thickness in front of input shaft ball bearing

- Drive rear circlip (as calculated) and ball bearing onto input shaft using 30-100 press tube.



4

- Determine thickest circlip which can still just be installed.
- Determine circlip thickness according to table.

Part number ⇒ parts catalog

Available circlips

Circlip thickness (mm)		
1.45	1.72	1.99
1.54	1.81	2.08
1.63	1.90	2.17

Pinion shaft, disassembling and assembling

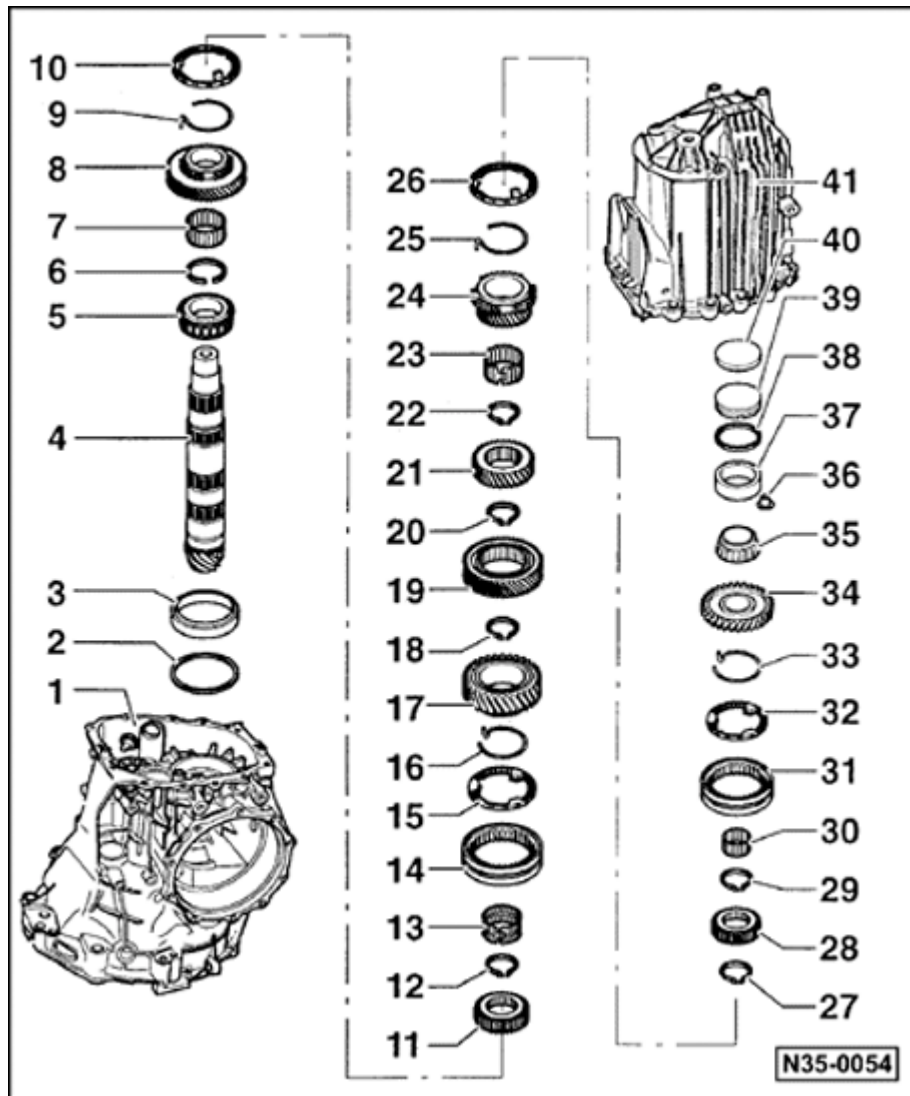
Special tools and equipment

- ◆ 204B installation tool for crankshaft seal
- ◆ VW401 thrust plate
- ◆ VW402 thrust plate
- ◆ VW407 punch
- ◆ VW408A punch
- ◆ VW412 punch
- ◆ VW415A tube
- ◆ VW421 tube
- ◆ VW455 thrust tube
- ◆ VW519 sleeve

◆ VW771 slide hammer-complete set

35-22

- ◆ 2010 sleeve
- ◆ 3062 thrust pad
- ◆ 3118 sleeve
- ◆ 3128 bushing puller
- ◆ Kukko 17/2 separating tool
- ◆ Kukko 21/1 extractor

**Notes:**

- ◆ When installing the input shaft or the final drive set, consult technical data ⇒ [Page 00-3](#).
- ◆ Adjustments are required when replacing components marked with 1): ⇒ [Page 39-33](#), list of adjustments

1 - Transmission housing**2 - Shim S3**

- ◆ List of adjustments ⇒ [Page 39-33](#)

3 - Double tapered roller bearing outer race 1)

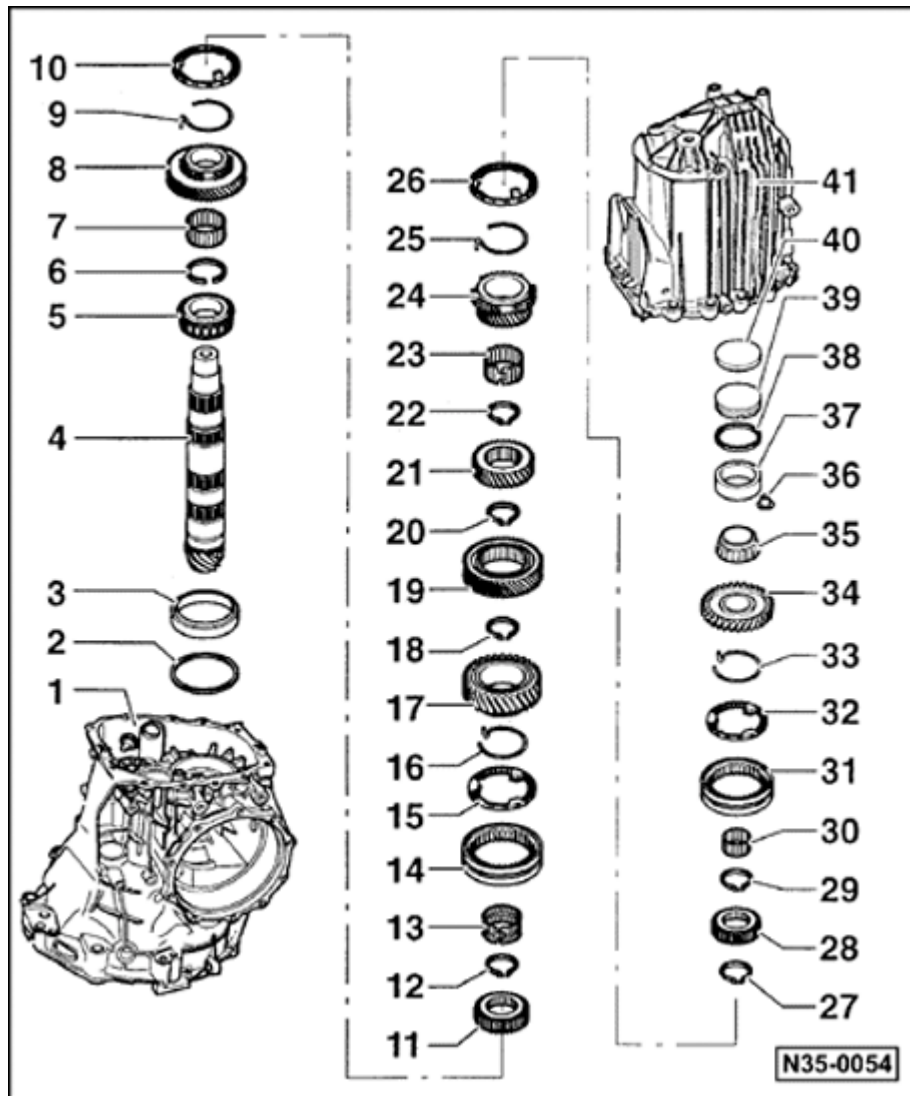
- ◆ Pulling out ⇒ [Fig. 1](#)
- ◆ Pressing in ⇒ [Fig. 3](#)

4 - Pinion shaft 1)

- ◆ Matched to ring gear; always replace together as a set
- ◆ Adjusting pinion shaft and ring gear ⇒ [Page 39-29](#)

5 - Tapered roller bearing inner race1)

- ◆ Always replace
- ◆ Damaged when removed
- ◆ Pressing off ⇒ [Fig. 2](#)
- ◆ Pressing on ⇒ [Fig. 4](#)



6 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -1-
- ◆ Re-determine thickness if double roller bearing is replaced ⇒ [Fig. 5](#)

7 - Needle bearing for for 1st gear

8 - 1st gear

9 - Spring

- ◆ Inserting in 1st gear ⇒ [Fig. 16](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

10 - Synchronizer ring for 1st gear

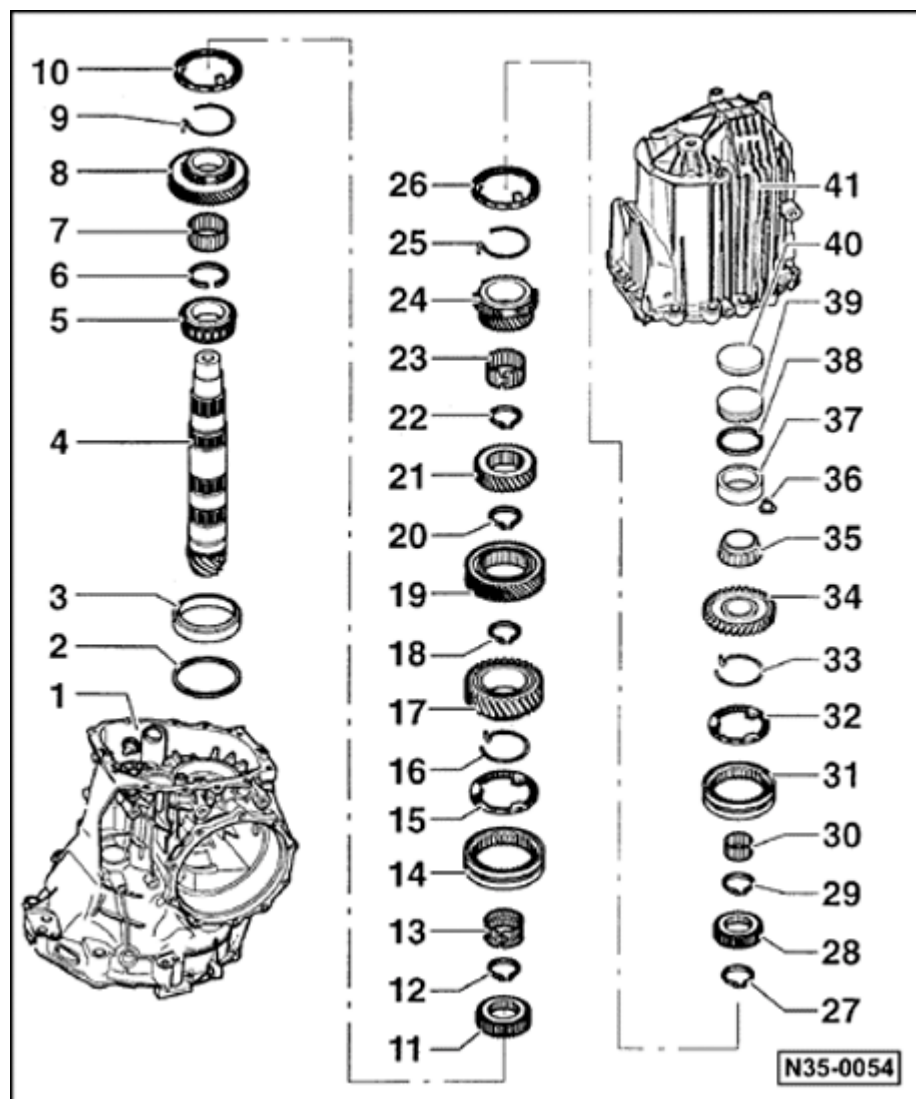
- ◆ Checking for wear ⇒ [Fig. 17](#)

11 - Synchronizer hub for 1st and 2nd gears

- ◆ Pressing off ⇒ [Fig. 14](#)
- ◆ Pressing on ⇒ [Fig. 18](#)

12 - Circlip

- ◆ Identification
- ◆ Installed position Fig. , item -2-
- ◆ Re-determine thickness when replacing synchronizer body ⇒ [Fig. 5](#)

**13 - Needle bearing 2nd gear****14 - Operating sleeve for 1st and 2nd gear**

- ◆ Installed position ⇒ [Fig. 19](#)

15 - Synchronizer ring for 2nd gear

- ◆ Checking for wear ⇒ [Fig. 17](#)

16 - Spring

- ◆ Inserting in 2nd gear ⇒ [Fig. 16](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

17 - 2nd gear**18 - Circlip**

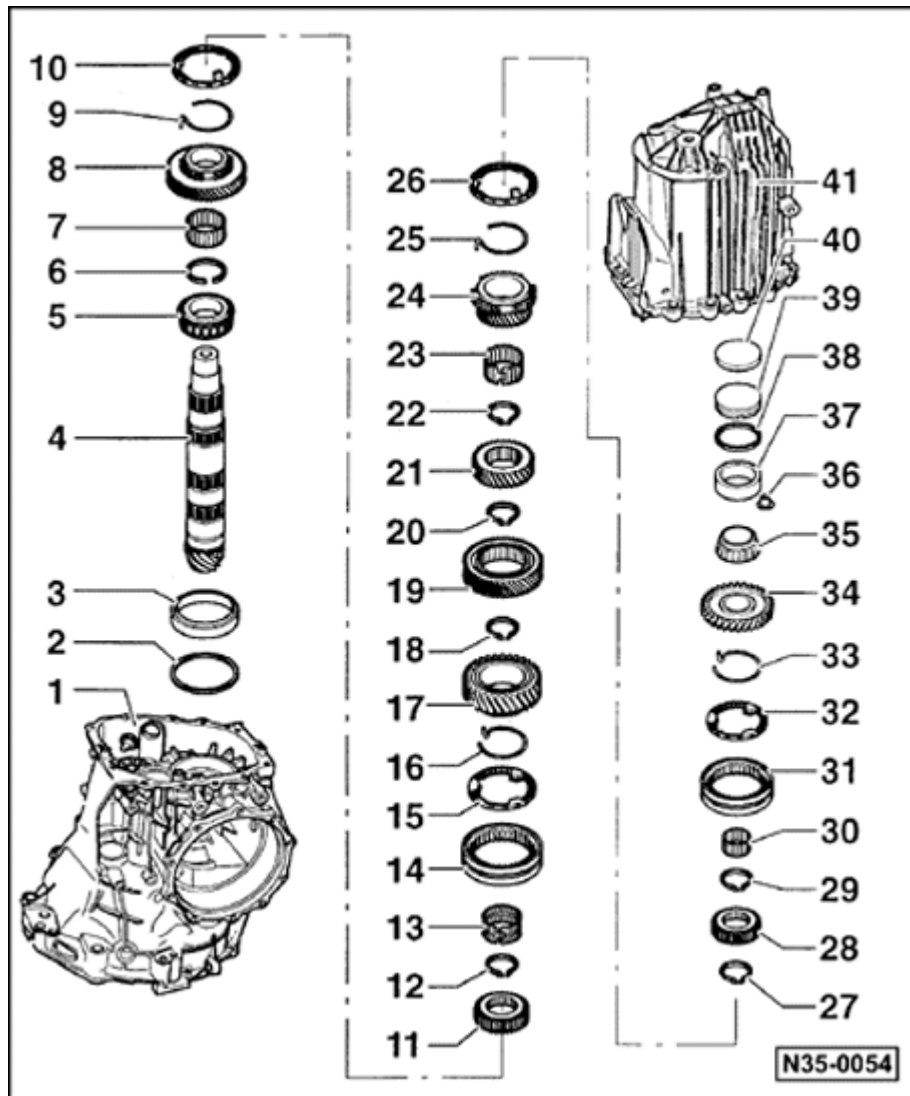
- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -3-

19 - 3rd gear

- ◆ Pressing off ⇒ [Fig. 13](#)
- ◆ Pressing on ⇒ [Fig. 20](#)

20 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -4-
- ◆ If 3rd gear is replaced, re-determine thickness of circlip ⇒ [Fig. 5](#)

**21 - 4th gear**

- ◆ Pressing off ⇒ [Fig. 12](#)
- ◆ Pressing on ⇒ [Fig. 21](#)

22 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -5-
- ◆ If 4th gear is replaced, re-determine thickness of circlip ⇒ [Fig. 5](#)

23 - Needle bearing**24 - 5th gear****25 - Spring**

- ◆ Inserting in 5th gear ⇒ [Fig. 16](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

26 - Synchronizer ring for 5th gear

- ◆ Checking for wear ⇒ [Fig. 17](#)

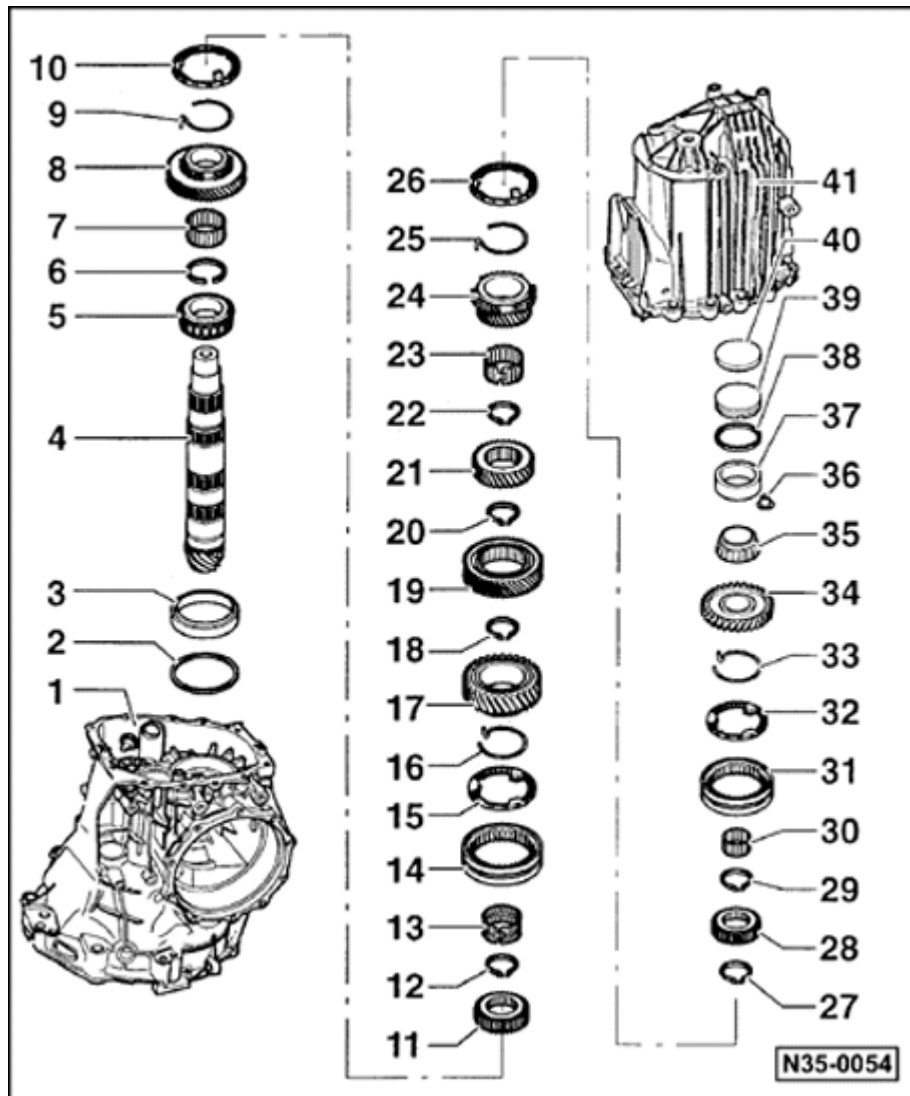
27 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -6-

28 - Synchronizer hub for 5th and reverse gear

- ◆ Pressing off ⇒ [Fig. 11](#)

◆ Pressing on ⇒ [Fig. 22](#)



29 - Circlip

- ◆ Identification
- ◆ Installed position ⇒ [Fig. 15](#) , item -5-
- ◆ Re-determine thickness when replacing synchronizer hub ⇒ [Fig. 5](#)

30 - Needle bearing

- ◆ For reverse gear

31 - Operating sleeve for 5th and reverse gear

- ◆ Installed position ⇒ [Fig. 23](#)

32 - Synchronizer ring for reverse gear

- ◆ Checking for wear ⇒ [Fig. 17](#)

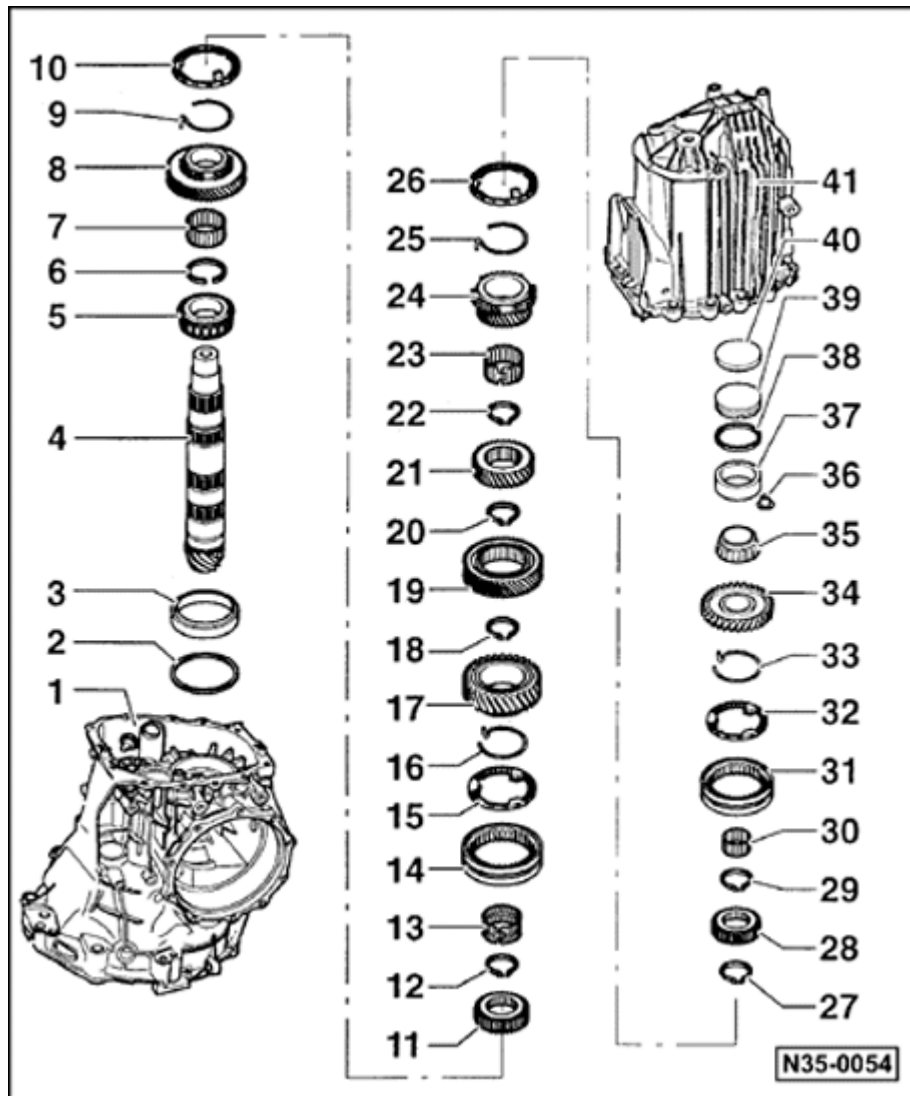
33 - Spring

- ◆ Inserting in reverse gear ⇒ [Fig. 16](#)
- ◆ Allocation of spring to gear ⇒ parts catalog

34 - Reverse gear

35 - Tapered roller bearing inner race1)

- ◆ Pressing off ⇒ [Fig. 9](#)
- ◆ Pressing on ⇒ [Fig. 10](#)



36 - Bushing

- ◆ Secures tapered roller bearing inner race
- ◆ Pulling out ⇒ [Fig. 6](#)
- ◆ Does not need to be installed after tapered roller bearing has been replaced

37 - Tapered roller bearing outer race1)

- ◆ Pulling out ⇒ [Fig. 7](#)
- ◆ Pressing in ⇒ [Fig. 8](#)

38 - Shim S4

- ◆ List of adjustments ⇒ [Page 39-33](#)

39 - Pressure plate

- ◆ Varying thickness ⇒ [Fig. 25](#)

40 - Rubber washer

- ◆ Compensated length variations
- ◆ To remove, install self-tapping screw into center of rubber washer and pull out at screw
- ◆ Thickness: 7.0 mm (0.28 in.)

41 - Transmission cover

- ◆ With reverse idler gear ⇒ [Page 35-44](#)
- ◆ Coat sealing surfaces with thin layer of

sealant AMV 188 001 02

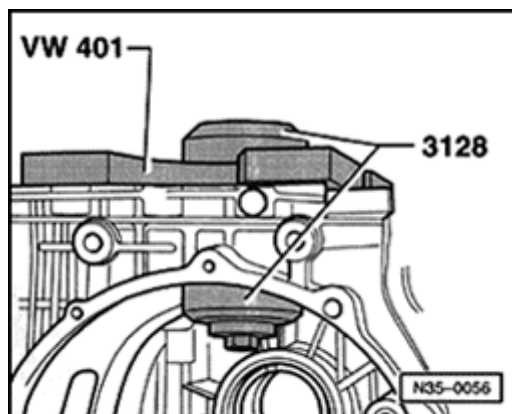


Fig. 1 Pulling out double tapered roller bearing outer race

- Remove differential ⇒ [Page 39-10](#) .
- Place pressure piece from 3128 bushing puller under outer race.
- Install threaded part of 3128 bushing puller onto transmission housing using VW401 thrust plate.

When the bolt is tightened, the outer race will be pulled out of the housing.

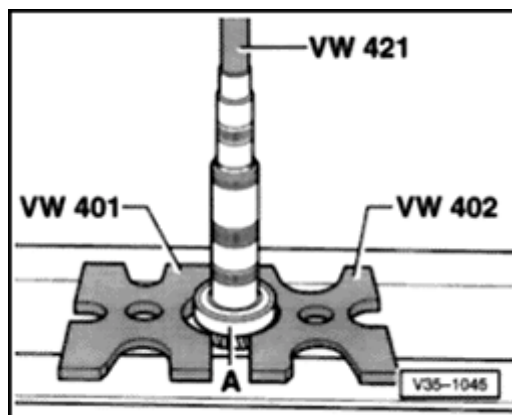
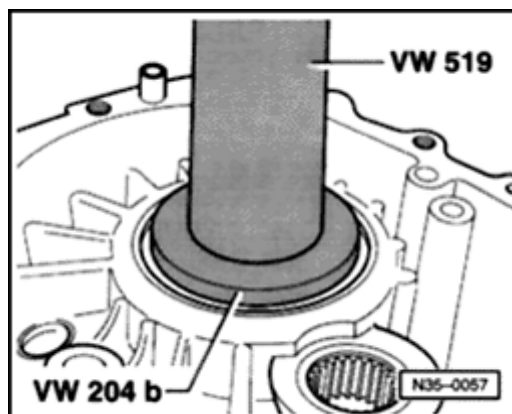


Fig. 2 Pressing off double tapered roller bearing inner race

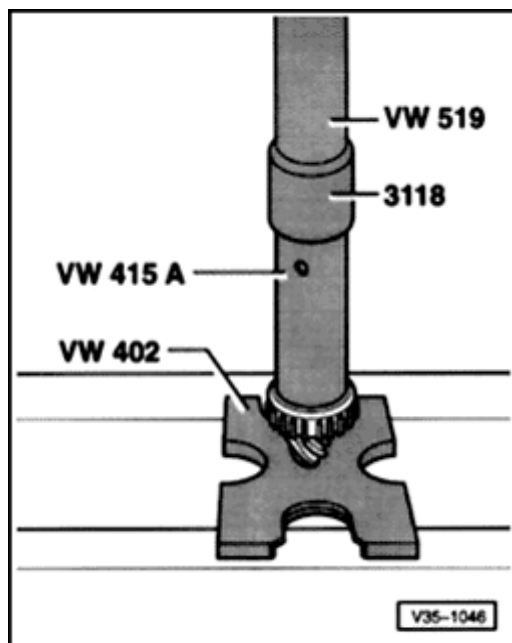
- Remove circlip before pressing off.
- Outer race -A- must be installed to press off inner race.



A

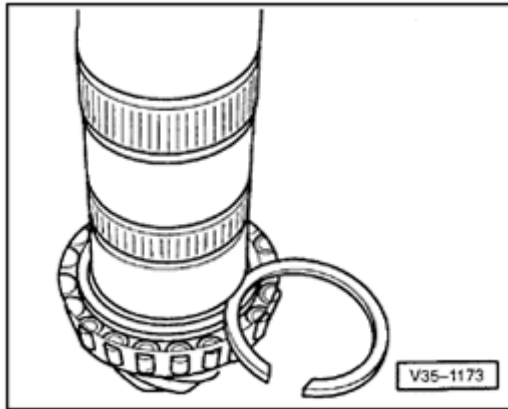
Fig. 3 Pressing in double tapered roller bearing outer race

The smaller diameter of the VW204B arbor faces the outer race.



A

Fig. 4 Pressing on double tapered roller bearing inner race

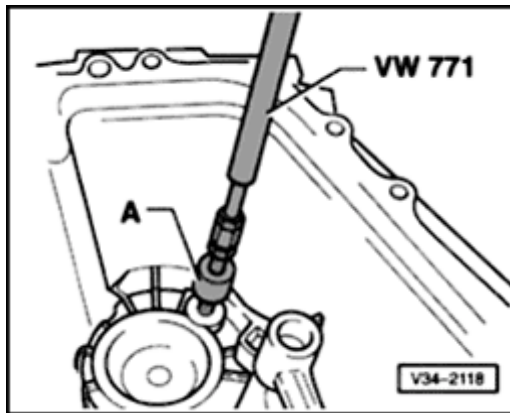


A

Fig. 5 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Circlips for synchronizer hubs and individual gears should be determined using same method as for tapered roller bearing as shown.

Available circlips and part numbers ⇒ parts catalog

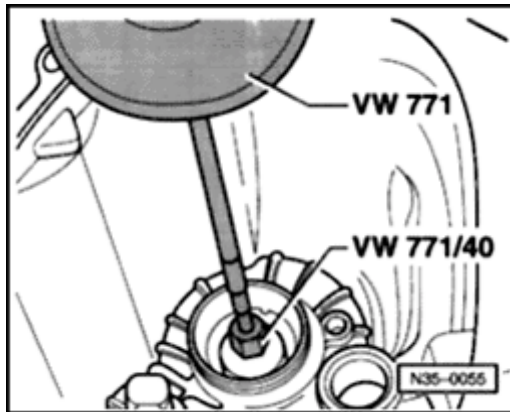


A

Fig. 6 Pulling out bushing securing tapered roller bearing outer race

A - Kukko 21/1 extractor 12-14.5 mm

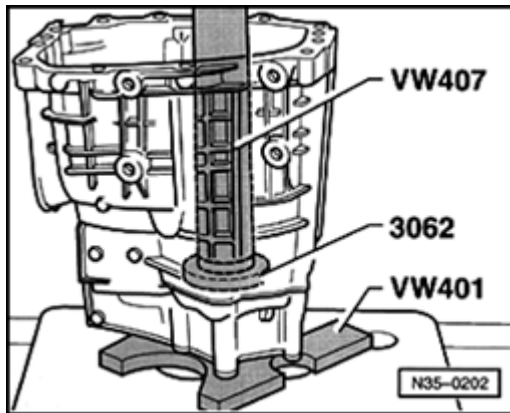
35-32



A

Fig. 7 Pulling out tapered roller bearing outer race

- Install VW771/40 adaptor into pressure plate.
- Install VW771 slide hammer-complete set and pull out outer race over pressure plate.

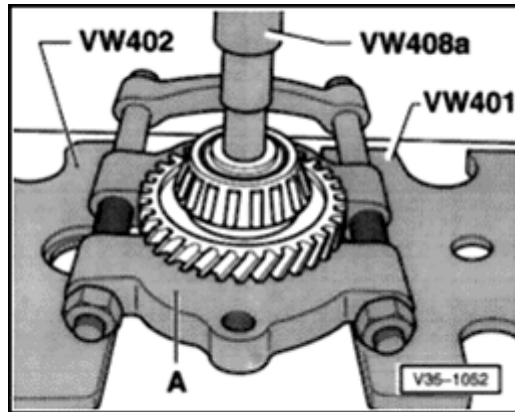


A

Fig. 8 Pressing in tapered roller bearing outer race

- Before pressing on inner race, install circlip.

35-33

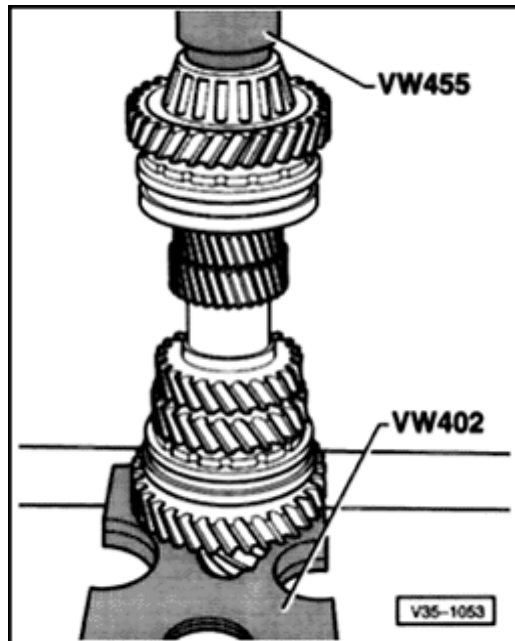


A

Fig. 9 Pressing off tapered roller bearing inner race

- Press off inner race together with reverse gear.

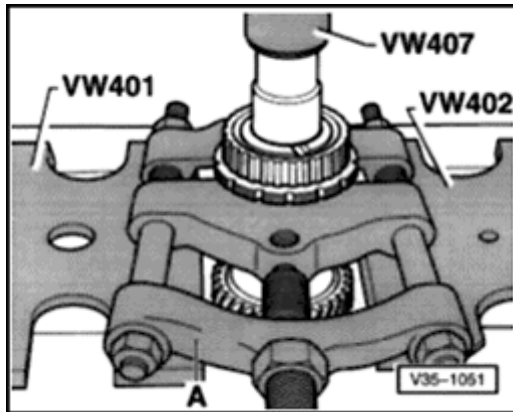
A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool



A

Fig. 10 Pressing on tapered roller bearing inner race

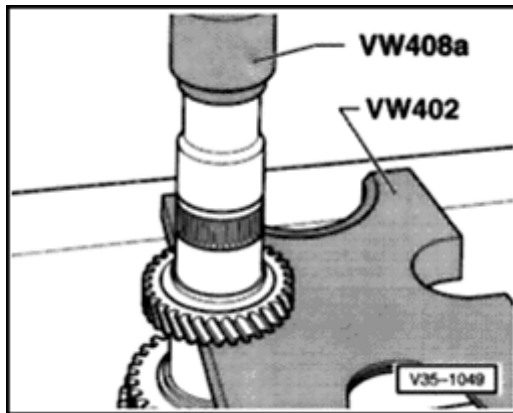
- Before pressing on inner race, install circlip.



A

Fig. 11 Pressing off synchronizer hub for 5th and reverse gear

- Remove circlip before pressing off.
 - Press off synchronizer hub together with 5th gear.
- A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool



A

Fig. 12 Pressing off 4th gear

- Remove circlip before pressing off.

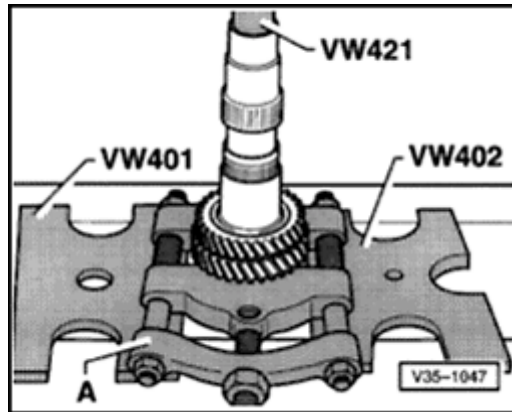


Fig. 13 Pressing off 3rd gear

- Remove circlip before pressing off.
- Press off 3rd gear together with 2nd gear.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

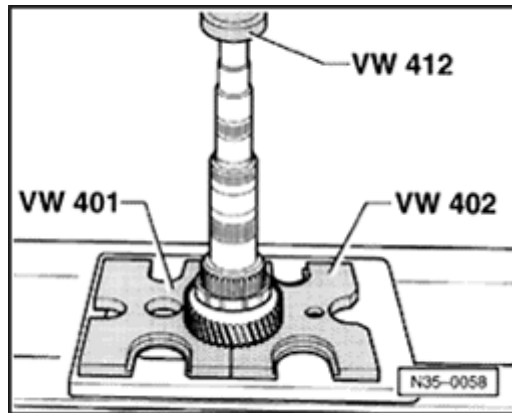


Fig. 14 Pressing off synchronizer hub for 1st and 2nd gears

- Remove circlip before pressing off.
- Press off synchronizer hub together with 1st gear.

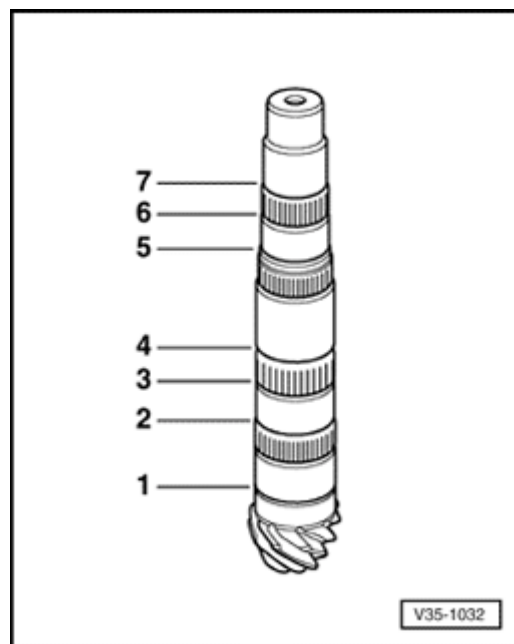


Fig. 15 Installation position of circlips

- Circlips for synchronizer hubs, needle bearings and individual gears should be determined as shown in Fig. ⇒ [5](#).

◆ Circlip -1- secures the tapered roller bearing inner race.

Circlip thickness (mm)		
2.00	2.06	2.12
2.03	2.09	2.15

◆ Circlip -2- secures the synchronizer hub for 1st and 2nd gear.

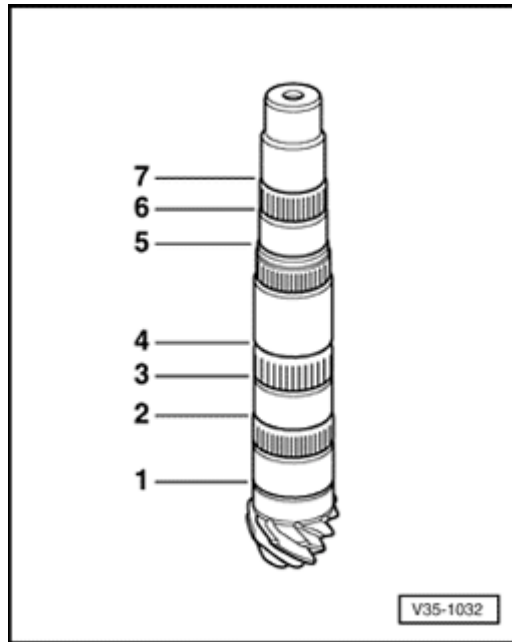
Characteristic: blue in color

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

◆ Circlip -3- secures the needle bearing for 2nd gear.

Characteristic: blue in color

Thickness: 2.50 mm (0.098 in.)



- ◆ Circlip -4- secures the 3rd gear

Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	

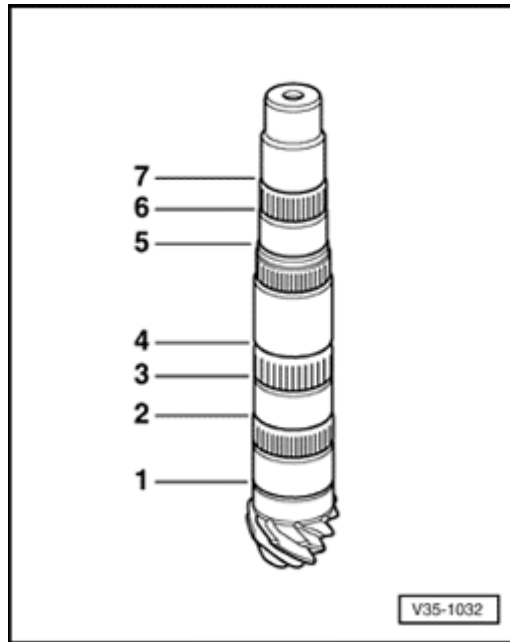
- ◆ Circlip -5- secures the 4th gear

Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	

- ◆ Circlip -6- secures the needle bearing for 5th gear.

Thickness: 2.00 mm (.0787 in.)

Identification: brown in color



- ◆ Circlip -7- secures the synchronizer hub for 5th and reverse gear.

Characteristic: blue in color

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Determine circlips according to table. Part numbers ⇒ parts catalog

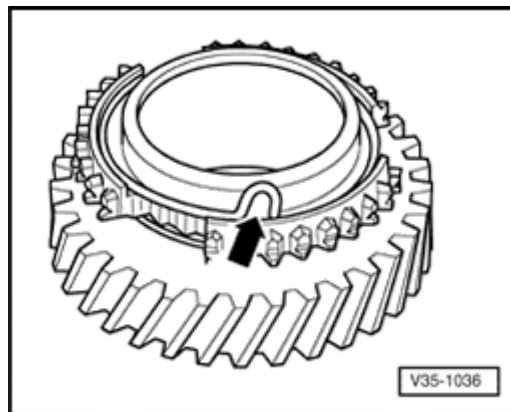


Fig. 16 Inserting spring into gear

The bent end of the spring (arrow) must be hooked into the hole of the gear.

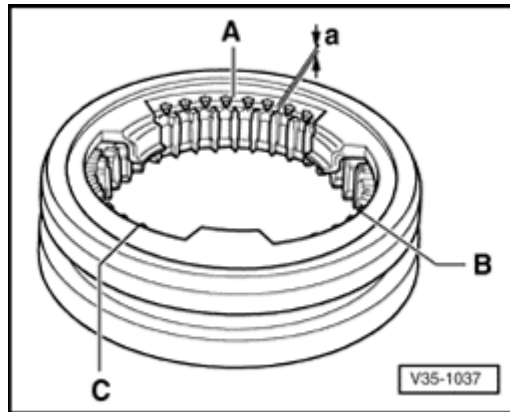


Fig. 17 Checking synchronizer ring for wear

- Press synchronizer ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add measured values and divide total by three to calculate average.
The calculated gap must not be less than 0.5 mm (0.002 in.).

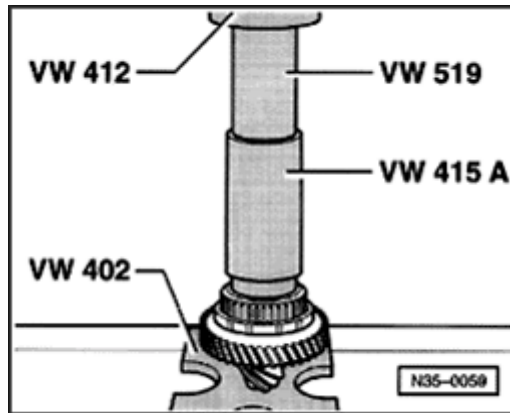


Fig. 18 Pressing on synchronizer hub for 1st and 2nd gears

- ◆ Installation position:
Higher inner collar faces 2nd gear.

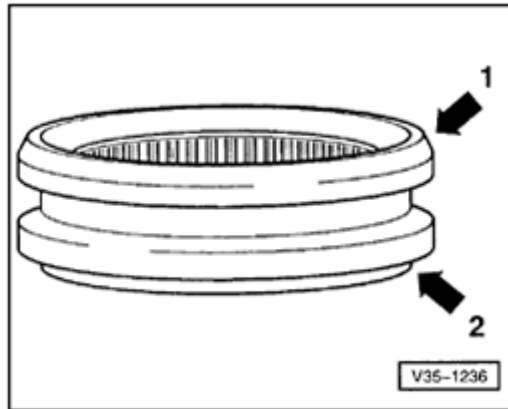


Fig. 19 Installation position of operating sleeve for 1st and 2nd gear

Installation position:

- ◆ Chamfer (arrow -1-) faces 2nd gear
- ◆ Stepped side (arrow -2-) faces 1st gear

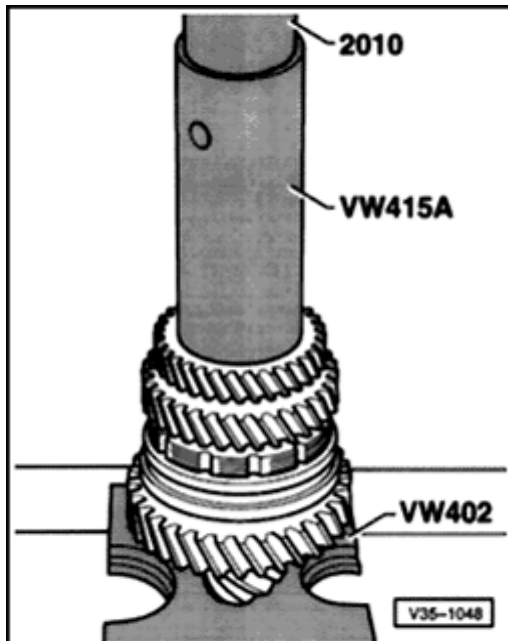
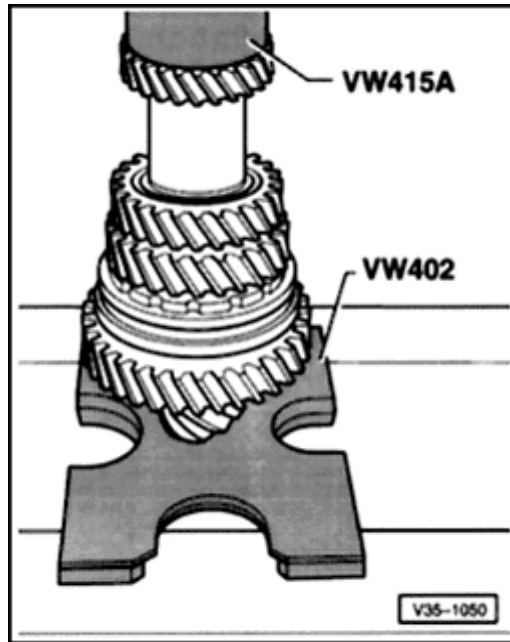


Fig. 20 Pressing on 3rd gear

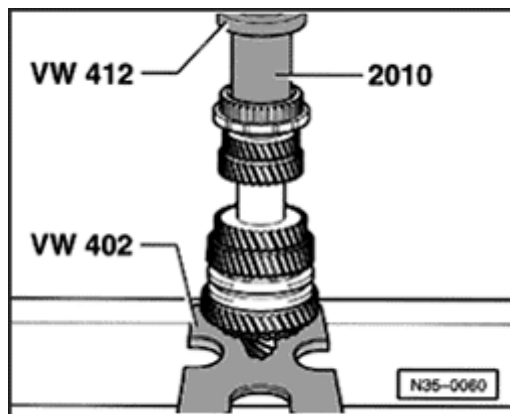
Installation position: the groove on the gear faces 4th gear.



A

Fig. 21 Pressing on 4th gear

Installation position: higher inner collar faces 3rd gear.



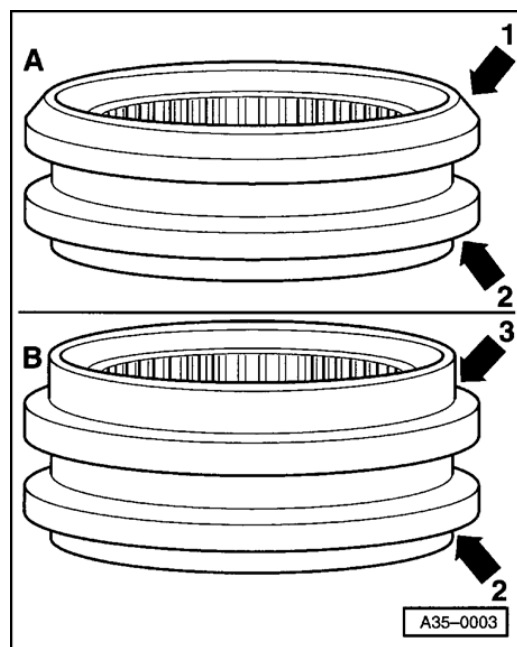
A

Fig. 22 Pressing on synchronizer hub for 5th and reverse gear

Installation position: higher inner collar faces 5th gear.

Note:

The large inner diameter of 2010 sleeve faces the synchronizer hub.



A

Fig. 23 Installation position of operating sleeve for 5th and reverse gear

Operating sleeves with chamfer -A- (arrow -1-), as well as operating sleeves with a large offset -B- (arrow -3-), are installed.

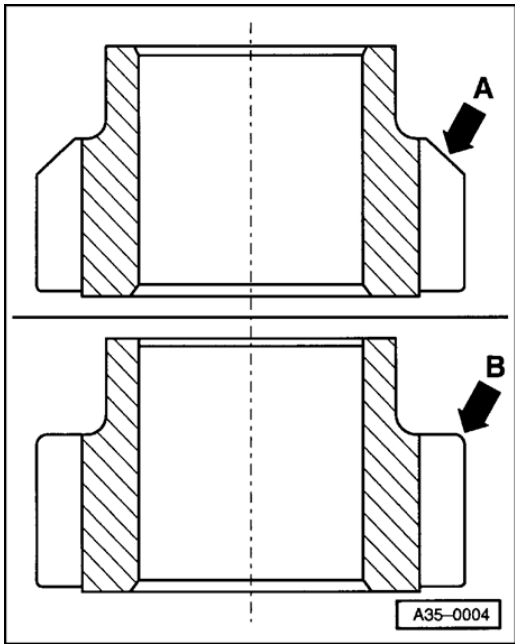
◆ Note the location of operating sleeve to reverse idler gear ⇒ [Fig. 24](#) .

◆ Installation position:

Chamfer (arrow -1-) faces 4th gear.

Small stepped side (arrow -2-) faces 5th gear.

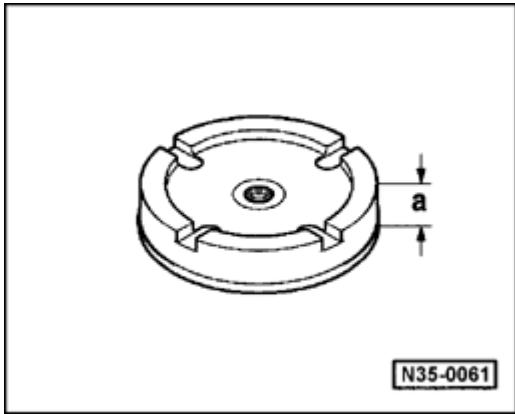
Large stepped side (arrow -3-) faces reverse gear.



A

Fig. 24 Allocation of operating sleeve to reverse idler gear

A Reverse idler gear with chamfer	Both types of operating sleeves (with chamfer or with large offset) can be installed.
B Reverse idler gear without chamfer	Only operating sleeves with large offset can be installed. Do not install operating sleeve with chamfer.

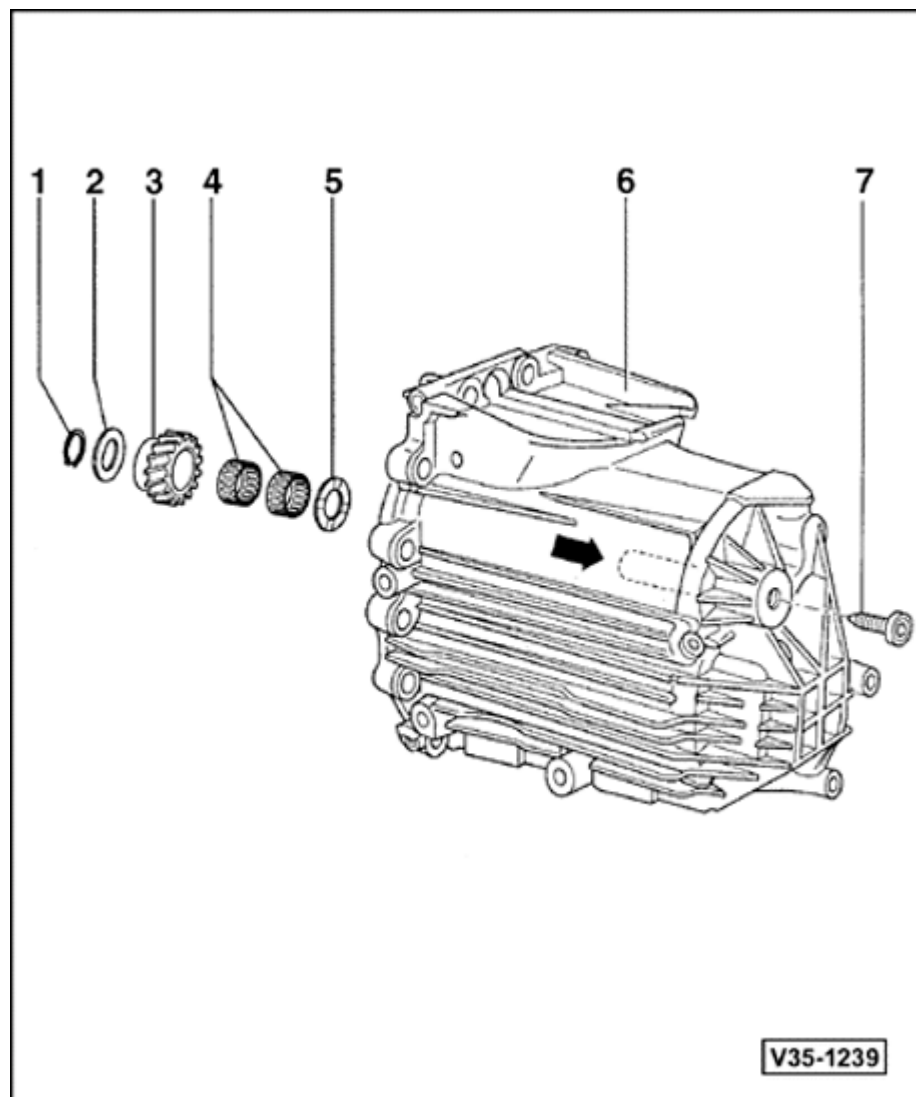


A

Fig. 25 Pressure plate variations

Transmission housing	Dimension -a-
Aluminum	14.8 or 15.3 mm

35-44



Reverse idler gear, removing and installing

1 - Circlip

2 - Brace

3 - Reverse idler gear

- ◆ Different versions, allocation ⇒ Fig. 24, ⇒ [Page 35-43](#)

4 - Needle bearing

5 - Thrust washer

6 - Transmission cover

- ◆ With reverse idler gear shaft (arrow)
- ◆ To remove reverse idler gear it is not necessary to remove reverse idler gear shaft
- ◆ Reverse idler gear shaft is not available as a replacement part
- ◆ Coat sealing surfaces with a thin layer of sealant AMV 188 001 02

7 - Torx® bolt

- ◆ 35 Nm (26 ft lb)
- ◆ Serves as additional method of securing reverse idler gear shaft

Drive flange seal, replacing

- Transmission installed
- Observe general repair instructions ⇒ [Page 00-10](#).

Special tools and equipment

- ◆ VW195 arbor
- ◆ VW295 needle bearing drift
- ◆ VW681 extractor lever
- ◆ VAG1306 drip tray

Notes:

- ◆ *The following illustration shows removal and installation of the left seal.*
- ◆ *The same procedure is used for the left and right seals.*
- ◆ *The exhaust system need not be removed.*

- ◆ *Flanges with and without polygon bearings are used. Application ⇒ [Page 00-3](#) .*

Removing

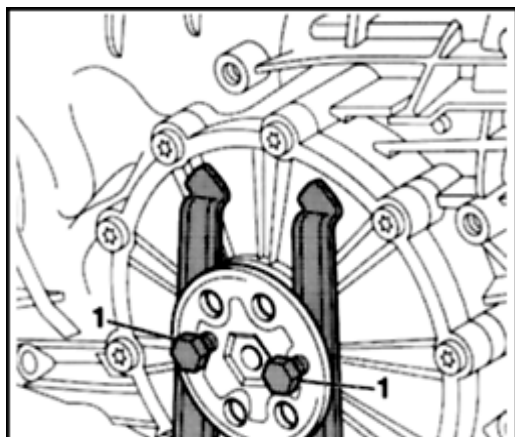
- Remove heat shield for drive axle.
- Remove drive axle from transmission drive flange.

⇒ [Repair Manual, Suspension, Wheels, Steering, Repair Group 40](#)

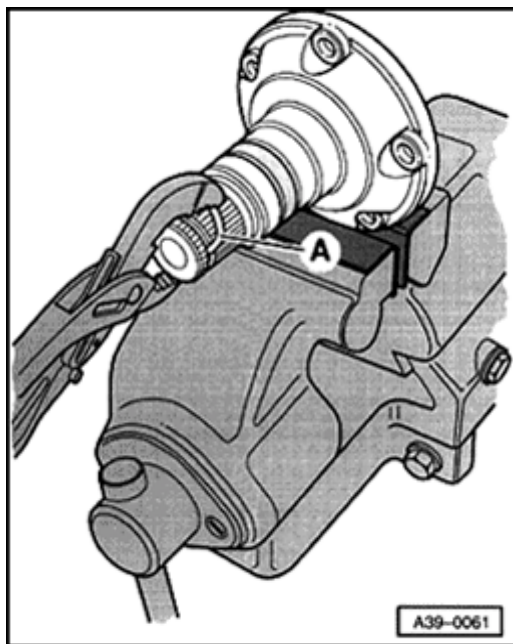
- Turn steering as far to left as possible.
- Tie up drive axle as high as possible. Do not damage paint on drive axle.
- Place VAG1306 drip tray under transmission.
- Have second technician hold two tire irons -2- under drive flange.
- To remove drive flange, install two bolts -1- evenly into two opposite bores in drive flange.

Note:

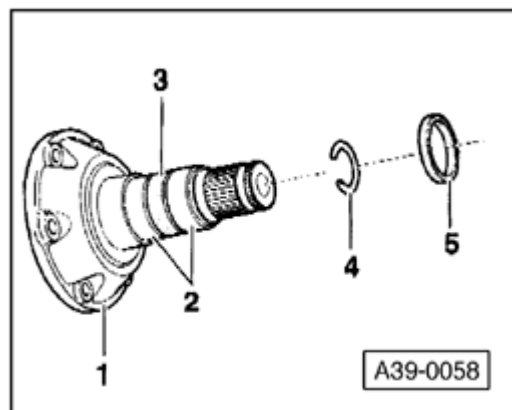
The drive flange must be removed evenly and parallel. If pressure is only applied to one side, the differential may break.



39-3

**A**

- Always replace circlip for drive flange.
- Clamp drive flange into vise using protective jaws. Press circlip out of groove in drive flange by pressing in new circlip -A-.
- Remove drive flange seal using VW681 extractor lever.



Setup of drive flange with polygon bearing

- 1 - Drive flange
- 2 - Needle bearing (polygon bearing)
- 3 - Spacer ring
- 4 - Circlip
- 5 - Spacer ring (is installed additionally if spline diameter is 30 mm)

Notes:

- ◆ *The rough operation of the polygon bearing with the drive flange not installed is not an indication that the bearings are malfunctioning. An acoustic check can only be carried out while installed.*
- ◆ *Watch for damage to the polygon bearings (e.g. cracks in bearing outer ring).*
- ◆ *Polygon bearings can only be replaced together with drive flange.*
- ◆ *A spacer ring -5- is installed between the polygon bearing and differential pinion for drive flanges with a spline diameter of 30 mm (1.2 in.).*

Installing

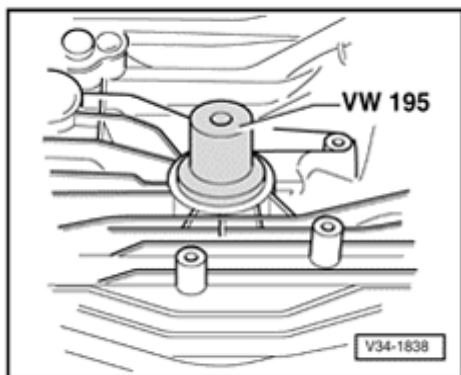
- Lubricate area between sealing lip and dust lip with a thin layer of multi-purpose grease.
- Lightly oil outer circumference of seal.

A

- Drive in new right-hand drive flange seal 5.5 mm (0.217 in.) below transmission housing surface, without canting.

Note:

If reinstalling an old drive flange, the seal must be pressed in approximately 6.5 mm (0.256 in.) so that the new seal does not sit on the running surface of the old seal.

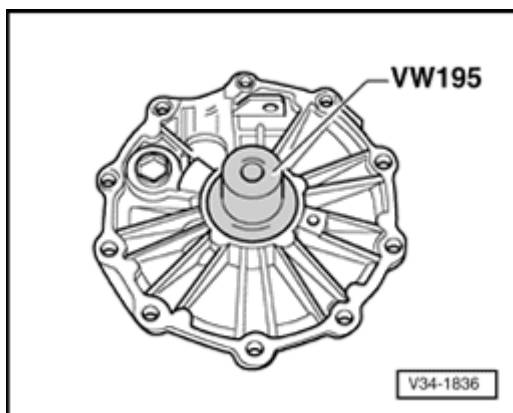


A

- Drive in new left-hand drive flange seal 5.5 mm (0.217 in.) below transmission cover surface, using VW195 arbor, without canting.

Note:

If reinstalling an old drive flange, the seal must be pressed in approximately 6.5 mm (0.256 in.) so that the new seal does not sit on the running surface of the old seal.



- Drive in drive flange using VW295 needle bearing drift.
- Bolt drive axle to drive flange.

- Install heat shield for drive axle.
- Check transmission oil level ⇒ [Page 34-36](#) .

Tightening torques

Component		Tightening torque
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Heat shield for drive axle		23 Nm (17 ft lb)

39-7

Speedometer Vehicle Speed Sensor (VSS) -G22- and sensor drive gear, removing and installing

- Transmission installed
- Observe general repair instructions ⇒ [Page 00-10](#).

Vehicle Speed Sensor (VSS) -G22-, removing and installing

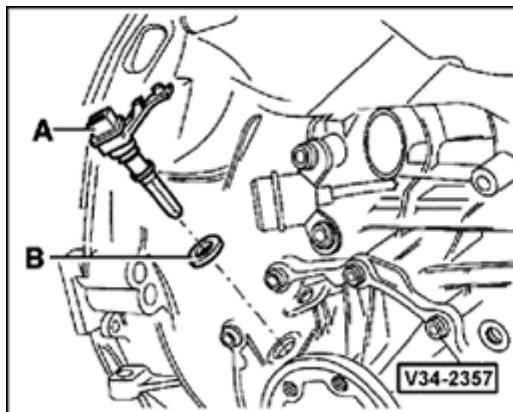
Removing

4

- Disconnect harness connector at Vehicle Speed Sensor (VSS) -A-.
- Press retaining clip down, turn sensor sideways and remove upward.

Installing

- Replace O-ring -B-.
- Install sensor and lock into place.
- Handle sensor carefully. If damaged, speed readings may not be correct.



Speedometer drive gear, removing and installing

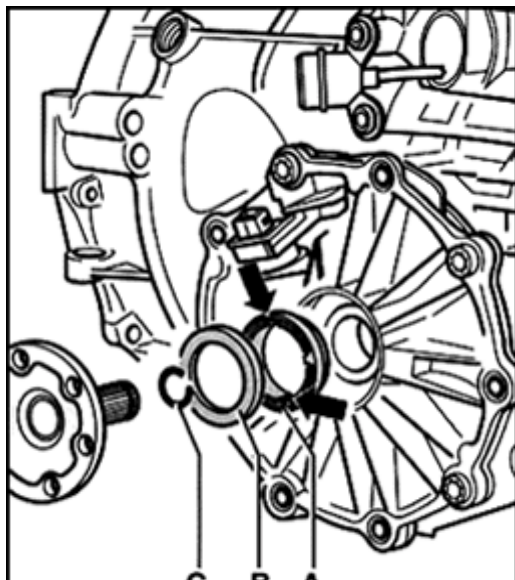
Special tools and equipment

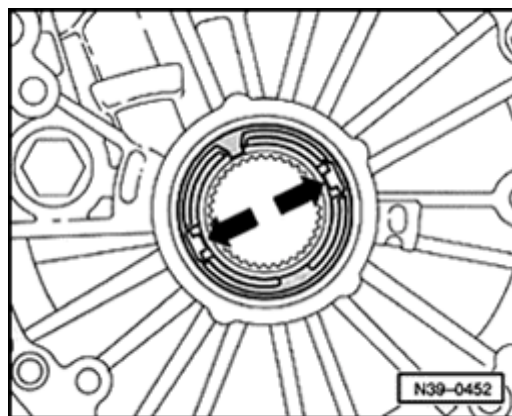
- ◆ VW195 arbor
- ◆ VW295 needle bearing drift
- ◆ VW681 extractor lever
- ◆ VAG1306 drip tray

Removing

A

- Remove left drive flange and seal -B- ⇒ [Page 39-1](#) .
- Remove Vehicle Speed Sensor (VSS) ⇒ [Page 39-7](#) .





A

- Press retaining clips in direction of arrows using screwdriver.
- Remove drive gear by prying out, alternating between sides.

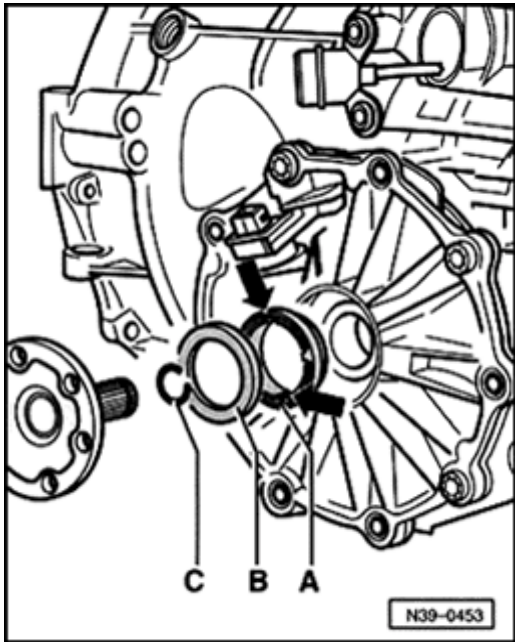
Installing

Installation is the reverse order of removal, note the following:

Note:

Carefully install drive gear onto differential without canting. Do not use force: the drive gear can break easily.

Installation position:



- ⚠ The drive peg of the drive gear -A- faces seal -B- and locks into groove in the differential.

The retaining clips (arrows) lock in the circumferential groove in the differential.

- Always replace seal -B- and circlip -C- ⇒ [Page 39-3](#) .
- Drive in drive flange using VW295 needle bearing drift.
- Top up and check transmission fluid ⇒ [Page 34-36](#) .

Tightening torques

Component		Tightening torque
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Heat shields over drive axles to transmission		

	23 (17 ft lb)
--	---------------

Differential, removing and installing

Special tools and equipment

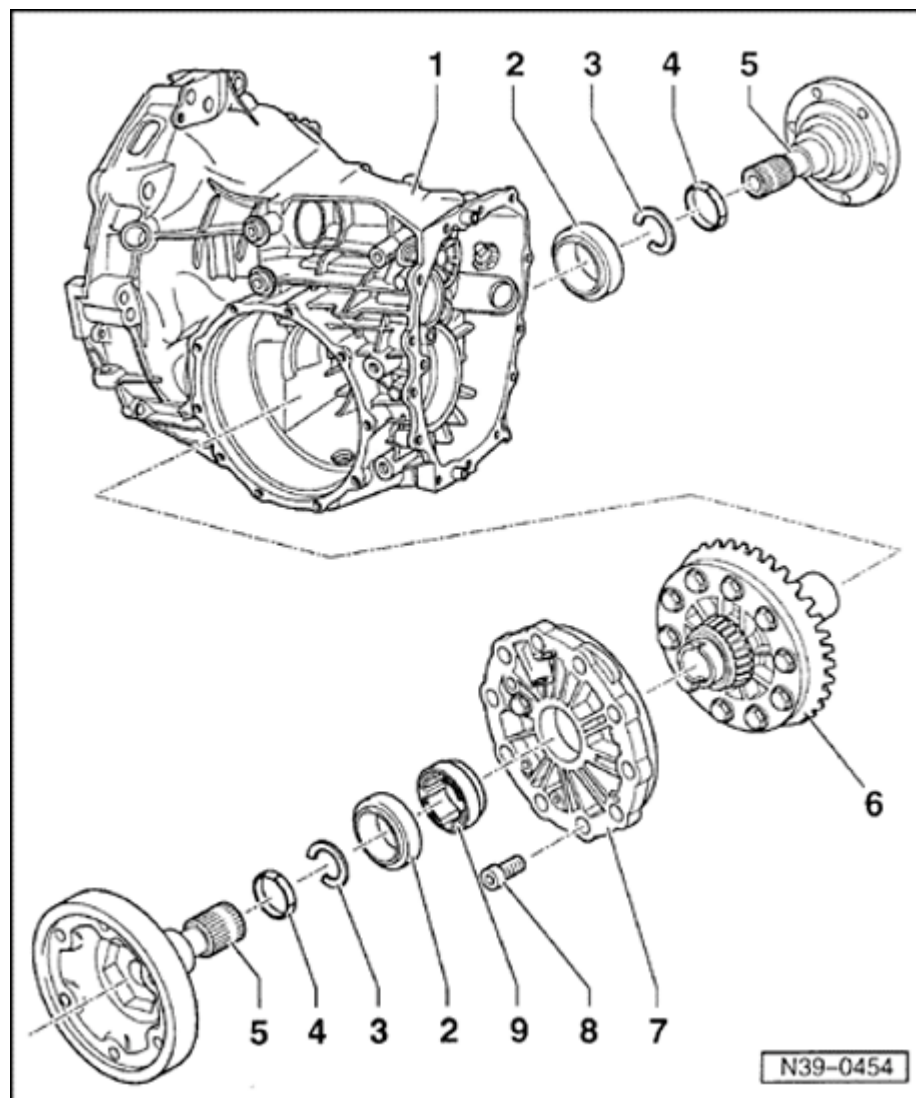
- ◆ VW771 slide hammer - complete set
- ◆ 3257 Puller
- ◆ Kukko 21/3 extractor

Notes:

- ◆ *Removal and installation is also possible with transmission installed.*
- ◆ *The differential can be removed and installed without disassembling shift mechanism, input shaft, pinion shaft or transmission cover. The above components have to be disassembled if the differential needs to be adjusted.*
- ◆ *Flanges with and without polygon bearings are used. Application ⇒ [Page 00-3](#).*
- ◆ *Polygon bearings can only be replaced together with drive flange.*

- ◆ *Look for visible damage to polygon bearings.*
- ◆ *The rough operation of the polygon bearing with the drive flange not installed is not an indication that the bearings are malfunctioning. An acoustic check can only be carried out while installed.*
- ◆ *A spacer ring is installed between the polygon bearing and differential pinion for drive flanges with a spline diameter of 30 mm ⇒ [Page 39-14](#) , ⇒ [Fig. 3](#) and ⇒ [Fig. 4](#) .*
- ◆ *Adjustments are required when replacing components marked with 1): ⇒ [Page 39-33](#) , list of adjustments*

39-11

**1 - Transmission housing 1)****2 - Seal**

- ◆ Always replace ⇒ [Page 39-1](#)

3 - Circlip

- ◆ Always replace
- ◆ Removing and installing ⇒ [Fig. 1](#)

4 - Spacer ring

- ◆ Only for drive flange with polygon bearings and splines with 30 mm diameter ⇒ [Page 00-3](#)
- ◆ Removing ⇒ [Fig. 2](#)
- ◆ Installing ⇒ [Fig. 3](#)

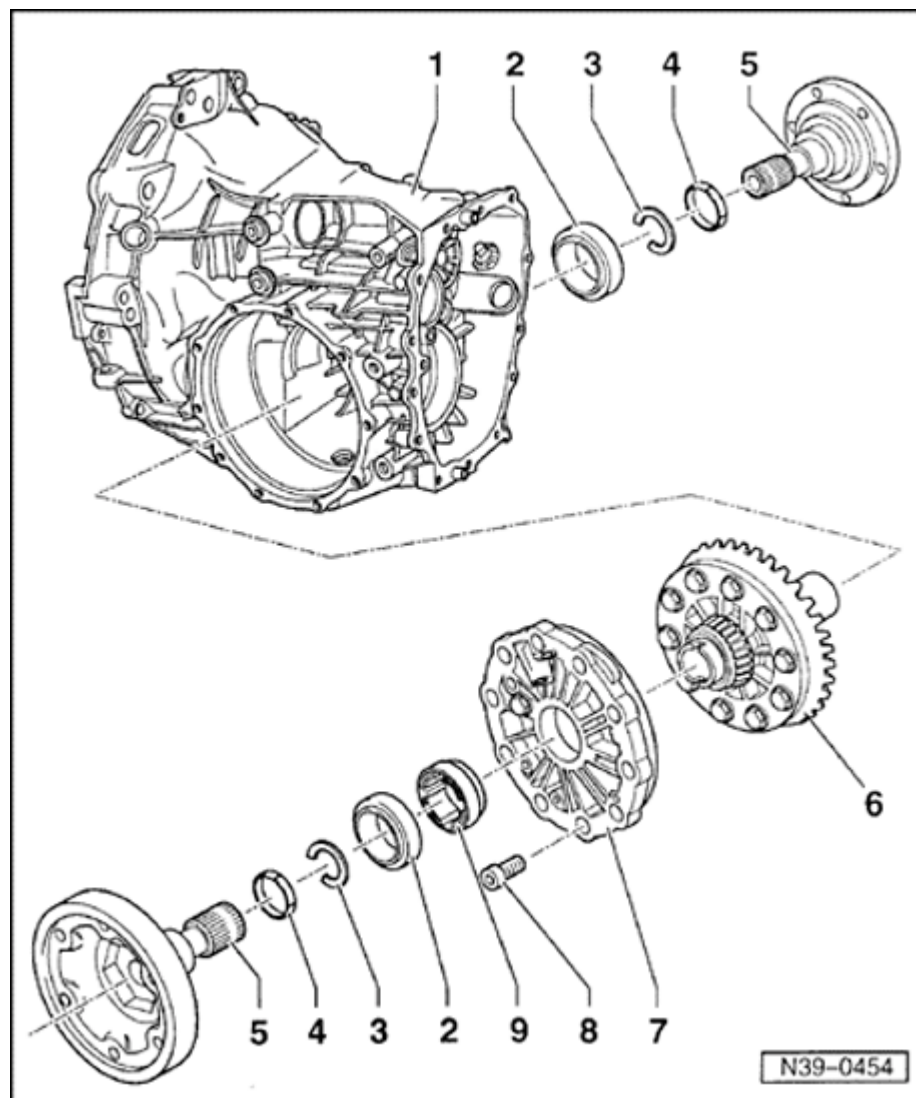
5 - Drive flange

- ◆ Removing and installing ⇒ [Page 39-1](#)
- ◆ Drive flange with polygon bearing assembly ⇒ [Fig. 4](#)

6 - Differential with ring gear 1)

- ◆ Can be installed without removal of transmission
- ◆ Disassembling and assembling ⇒ [Page 39-15](#)

39-12

**7 - Cover for final drive 1)**

- ◆ Coat sealing surfaces with thin layer of sealant AMV 188 001 02

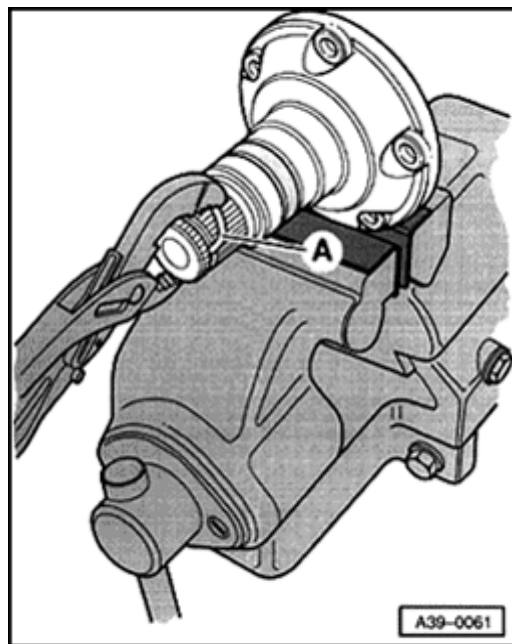
8 - Torx® bolt

- ◆ 25 Nm (18 ft lb)

9 - Drive gear for Vehicle Speed Sensor (VSS)

- ◆ Removing and installing ⇒ [Page 39-8](#)
- ◆ Carefully install onto differential without canting. Do not use force: drive gear can break easily.

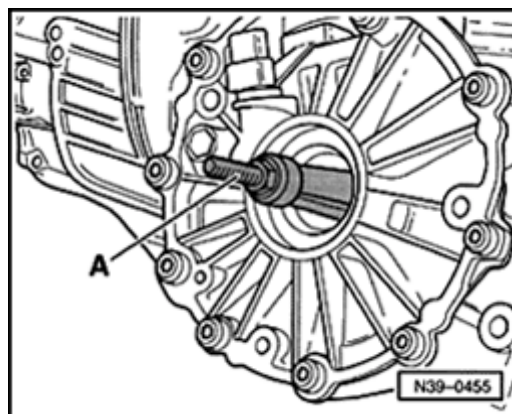
39-13



A

Fig. 1 Removing and installing circlip

- Clamp drive flange into vise using protective jaws. Press circlip out of groove in drive flange by pressing in new circlip -A-.



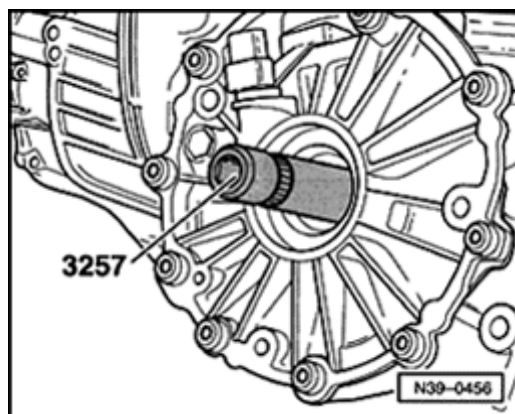
A

Fig. 2 Removing spacer ring

A - Kukko 21/3 extractor 18.5-23.5 mm

- If spacer ring is tight, remove using VW771 slide hammer-complete set.

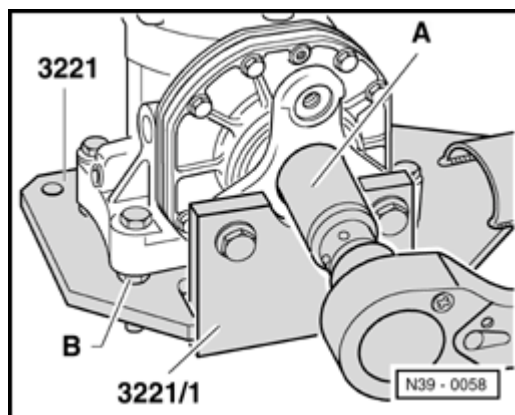
39-14



A

Fig. 3 Installing spacer ring

- Press in spacer ring to stop without canting.



A

Fig. 4 Drive flange with polygon bearing assembly

- 1 - Drive flange
- 2 - Needle bearing (polygon bearing)
- 3 - Spacer ring
- 4 - Circlip
- 5 - Spacer ring (is installed additionally if spline diameter is 30 mm)

Note:

Needle bearings (polygon bearings) do not turn easily with drive flange removed. This does not indicate a bearing is malfunctioning.

Differential, disassembling and assembling

Special tools and equipment

- ◆ VW295 needle bearing drift
- ◆ VW401 thrust plate
- ◆ VW402 thrust plate
- ◆ VW407 punch
- ◆ VW408A punch
- ◆ VW447H thrust pad
- ◆ VW447I thrust pad
- ◆ VW472/1 pressure piece
- ◆ VW511 thrust pad
- ◆ 30-11 thrust pad

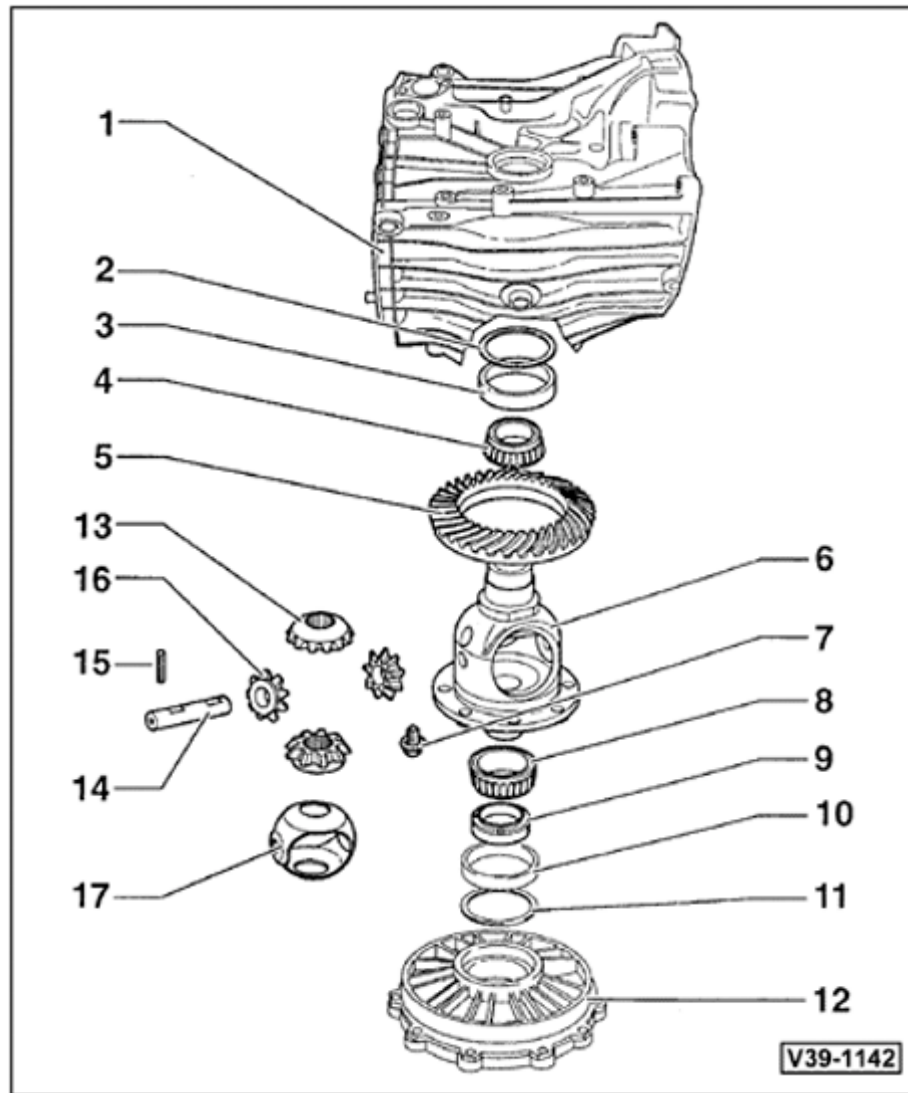
◆ 30-205 thrust pad

◆ 40-21 sleeve

- ◆ 40-105 thrust piece
- ◆ 3138 drift
- ◆ 3144 press support
- ◆ 3296 tube
- ◆ Sealant AMV 188 001 02
- ◆ Kukko 20/10 two-arm puller or Kukko 44/2 puller
- ◆ Kukko 204/2 two-arm puller

Notes:

- ◆ *Removing and installing differential* ⇒ [Page 39-10](#).
- ◆ *Replace both tapered roller bearings together.*
- ◆ *Adjustments are required when replacing components marked with 1) ⇒ [Page 39-33](#), list of adjustments*



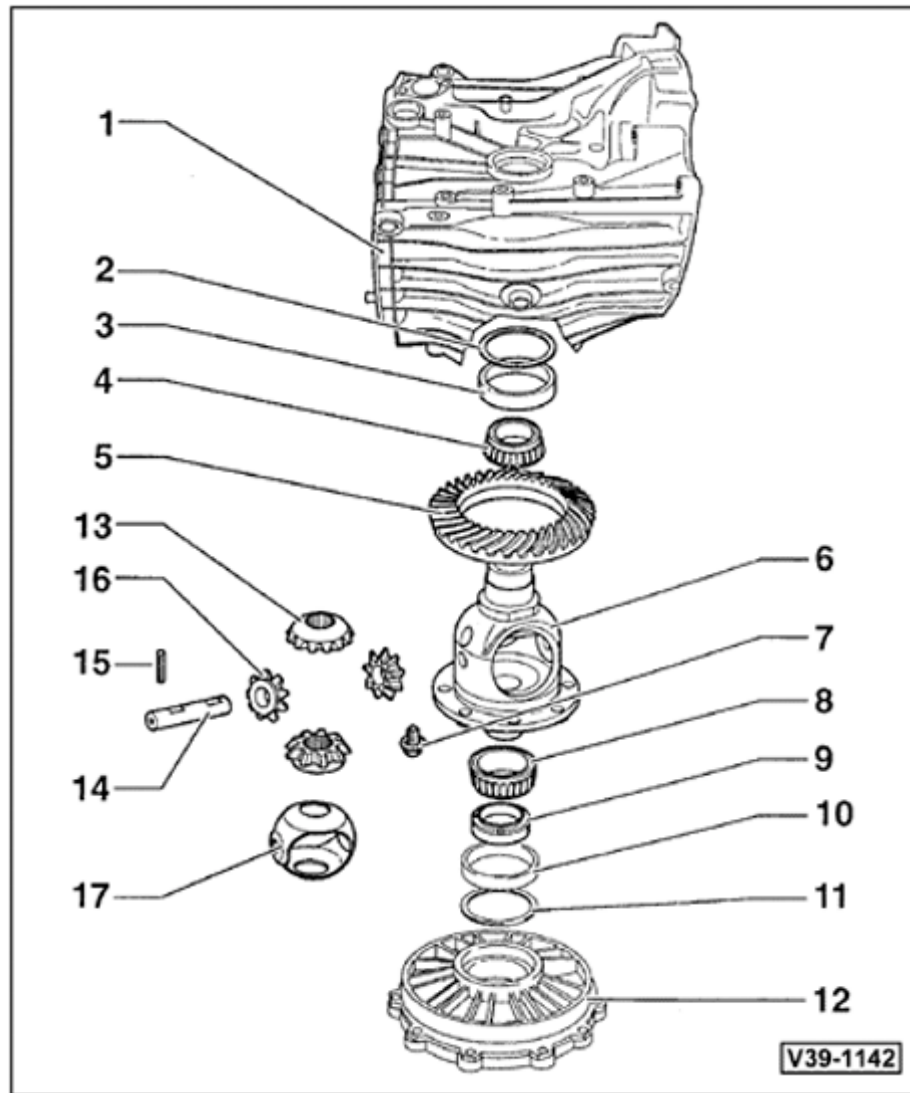
1 - Transmission housing 1)

2 - Shim S2

- ◆ Note thickness
- ◆ List of adjustments ⇒ [Page 39-33](#)

3 - Right tapered roller bearing outer race 1)

- ◆ Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ [Page 00-3](#)
- ◆ Driving out for transmission with polygon bearing ⇒ [Fig. 1](#) , ⇒ [Page 39-22](#)
- ◆ Driving out for transmission without polygon bearing ⇒ [Fig. 2](#) , ⇒ [Page 39-22](#)
- ◆ Driving in for transmission with polygon bearing ⇒ [Fig. 3](#) , ⇒ [Page 39-23](#)
- ◆ Driving in for transmission without polygon bearing using VW295 needle bearing drift and 30-205 thrust pad



4 - Right tapered roller bearing inner race 1)

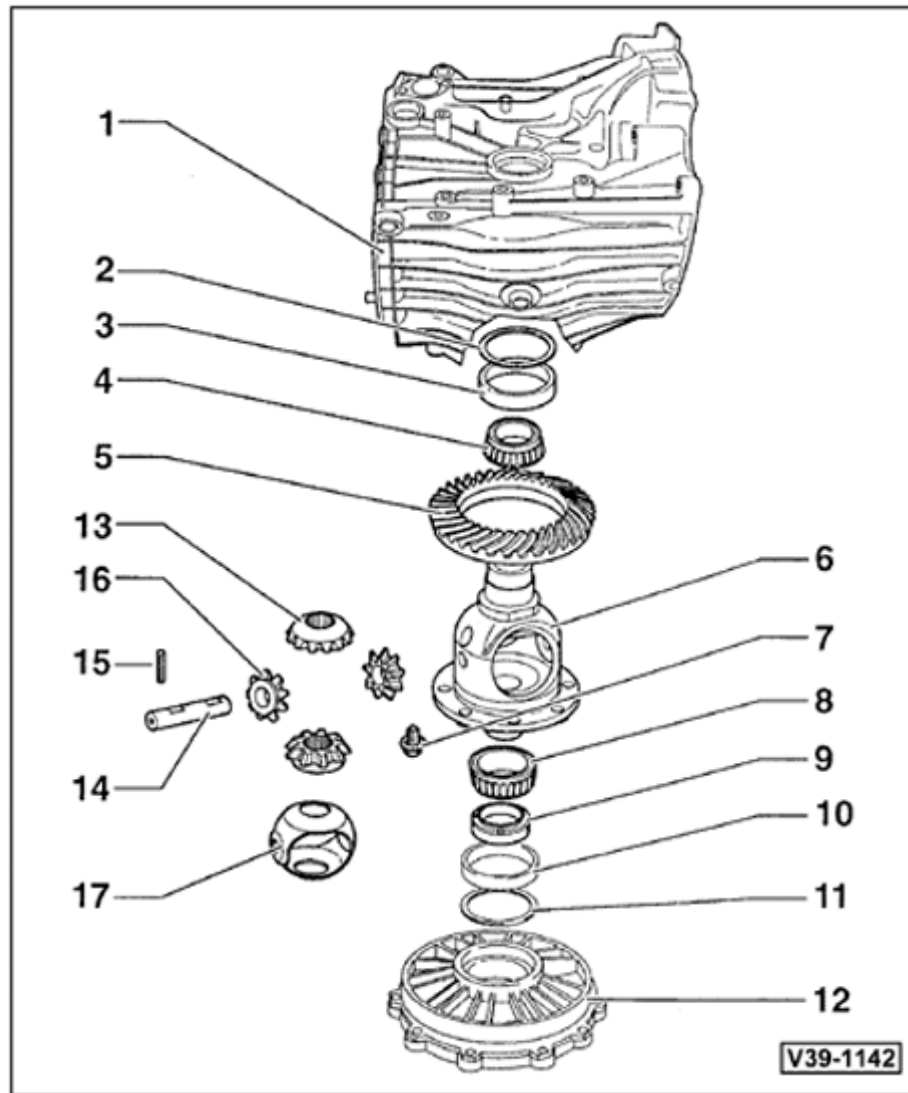
- ◆ Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ [Page 00-3](#)
- ◆ Pull off using 3296 tube ⇒ [Fig. 4](#)
- ◆ Pressing on for transmission with polygon bearing ⇒ [Fig. 5](#) , ⇒ [Page 39-24](#)
- ◆ Pressing on for transmission without polygon bearing using 40-21 sleeve

5 - Ring gear 1)

- ◆ Is matched to pinion shaft (gear set)
- ◆ Allocate according to transmission code letters using parts catalog microfiche ⇒ [Page 00-3](#)
- ◆ Remove from transmission housing using drift ⇒ [Fig. 10](#)
- ◆ Installing on differential housing ⇒ [Fig. 11](#)

6 - Differential housing 1)

- ◆ Allocate according to transmission code letters using parts catalog ⇒ [Page 00-3](#)



7 - Bolt

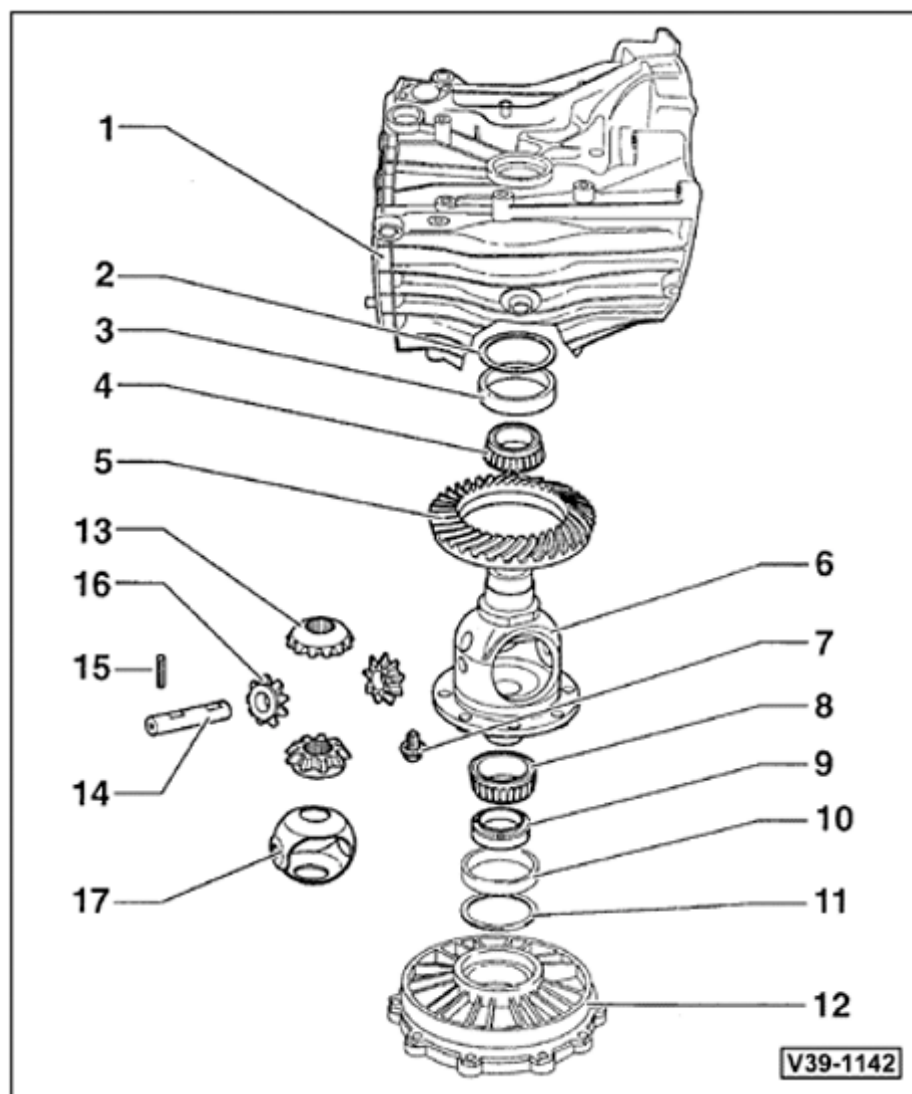
- ◆ Always replace
- ◆ Tighten to 60 Nm (44 ft lb) and then tighten another 45°
- ◆ Lightly tighten bolts then tighten diagonally to correct torque

8 - Left tapered roller bearing inner race 1)

- ◆ Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ [Page 00-3](#)
- ◆ Pulling off ⇒ [Fig. 6](#)
- ◆ Driving in for transmission with polygon bearing ⇒ [Fig. 7](#) , ⇒ [Page 39-25](#)
- ◆ Pressing on for transmission without polygon bearing using 40-21 sleeve

9 - Drive gear for Vehicle Speed Sensor (VSS)

- ◆ Removing and installing ⇒ [Page 39-7](#)
- ◆ Carefully install onto differential without canting. Do not use force: the drive gear can break easily.



10 - Left tapered roller bearing outer race 1)

- ◆ Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ [Page 00-3](#)
- ◆ Driving out ⇒ [Fig. 8](#)
- ◆ Driving in for transmission with polygon bearing ⇒ [Fig. 9](#) , ⇒ [Page 39-26](#)
- ◆ Driving in for transmission without polygon bearing using VW295 needle bearing drift and 511-205 thrust pad

11 - Adjustment shim S1

- ◆ Note thickness
- ◆ List of adjustments ⇒ [Page 39-33](#)

12 - Final drive cover 1)

- ◆ Coat sealing surfaces with a thin layer of sealant AMV 188 001 02.

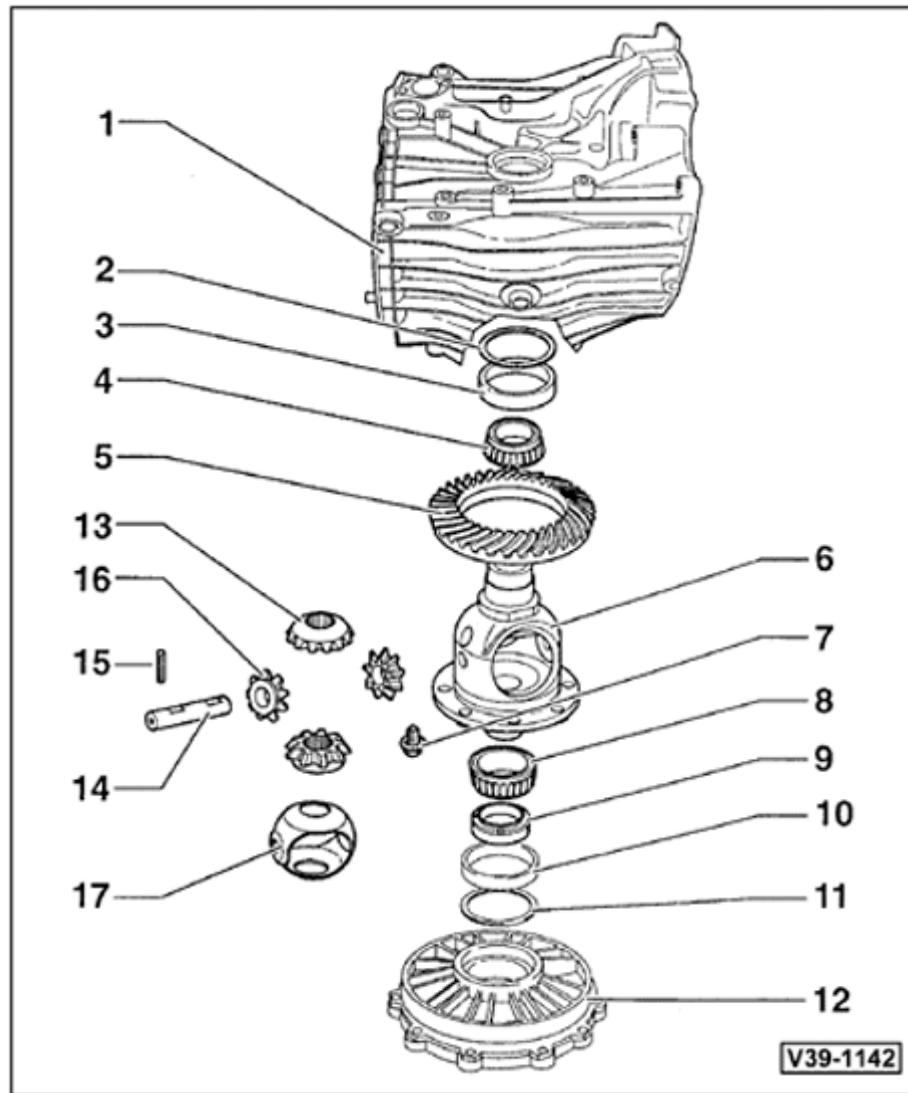
13 - Large differential bevel gear

- ◆ Installing ⇒ [Fig. 12](#)

14 - Differential bevel gear shaft

- ◆ Drive out using drift after removing roll pin

39-21

**15 - Roll pin**

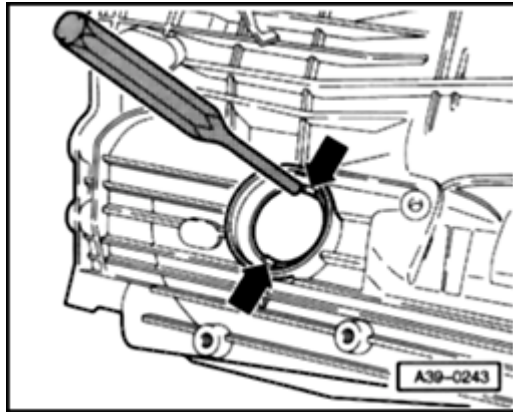
- ◆ For securing differential bevel gear shaft
- ◆ Version with annular groove: Removing and installing ⇒ [Fig. 13](#)
- ◆ Version without annular groove: drive out using drift

16 - Small differential bevel gear

- ◆ Installing ⇒ [Fig. 12](#)

17 - Thrust washer assembly

- ◆ Lubricate with transmission fluid before installing



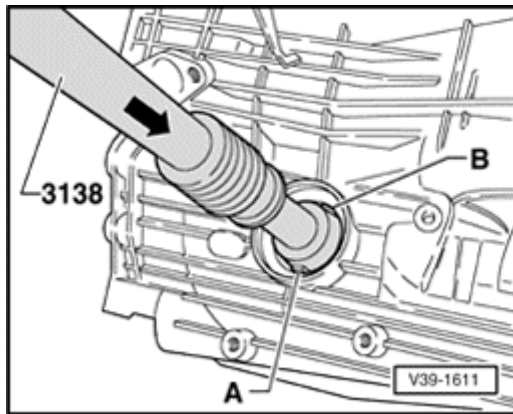
A

Fig. 1 Removing right tapered roller bearing outer race from transmission housing (for transmissions with polygon bearing)

- To drive out, place punch pin alternately on cut-outs (arrows) on bearing seat.

Note:

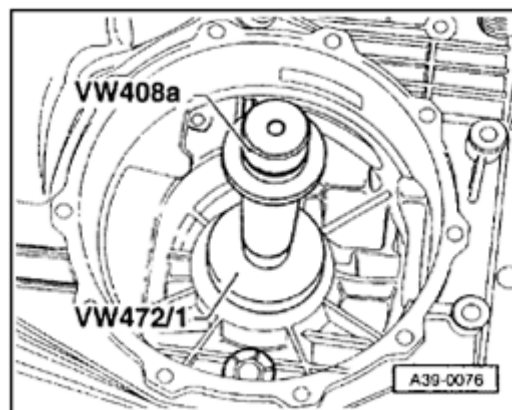
Adjustment shims are damaged when outer race is driven out. Replace adjustment shims.



A

Fig. 2 Removing right tapered roller bearing outer race from transmission housing for transmissions without polygon bearing

- Turn webs -A- and -B- out until they sit on outer race within recess in transmission.
- After removing, check adjustment shims for damage.



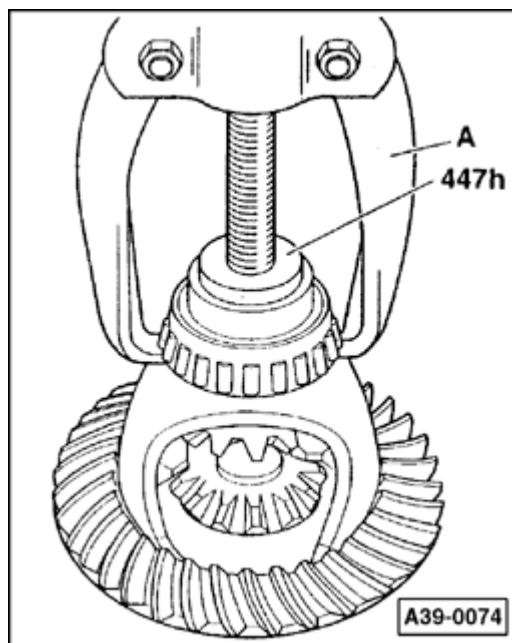
A

Fig. 3 Installing right tapered roller bearing outer race in transmission housing

- Insert VW472/1 pressure piece together with cone in outer race.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use 30-205 thrust pad and VW295 needle bearing drift.



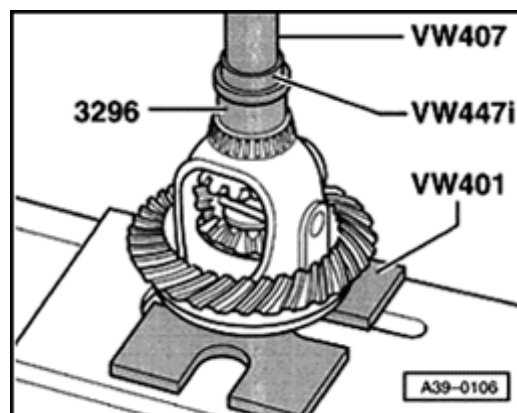
A

Fig. 4 Pulling off right tapered roller bearing inner race

A - Kukko 20/10 two-arm puller or Kukko 44/2 puller

Notes:

- ◆ On a puller with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and the puller.
- ◆ For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use 40-105 thrust piece.
- ◆ The differential has a notch under the bearing seat to install puller -A-.



A

Fig. 5 Pressing on right tapered roller bearing inner race

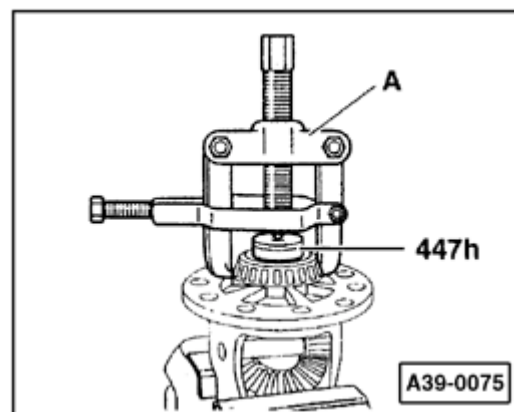
WARNING!

Wear protective gloves!

- Heat inner race to approximately 100 ° C (212 ° F), position and install.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use 40-21 sleeve.



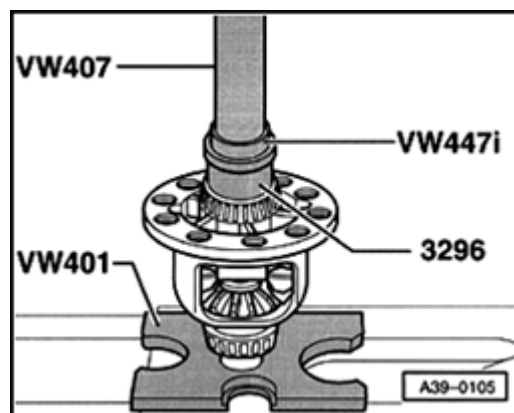
A

Fig. 6 Pulling off left tapered roller bearing inner race

A - Kukko 204/2 two-arm puller

Notes:

- ◆ On a puller with a small spindle diameter, 30-11 must be placed between the 447H pressure washer and the puller.
- ◆ For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use 40-105 thrust piece.
- ◆ The differential has a notch under the bearing seat to install puller -A-.



A

Fig. 7 Installing left tapered roller bearing inner race

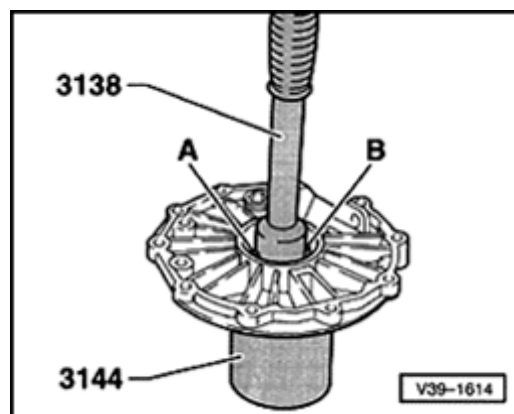
WARNING!

Wear protective gloves!

- Heat inner race to approximately 100 ° C (212 ° F), position and install.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use 40-21 sleeve.



A

Fig. 8 Driving out left tapered roller bearing outer race from cover

- Turn webs -A- and -B- out until they sit on outer race within recess in transmission.
- After removing, check adjustment shims for damage.

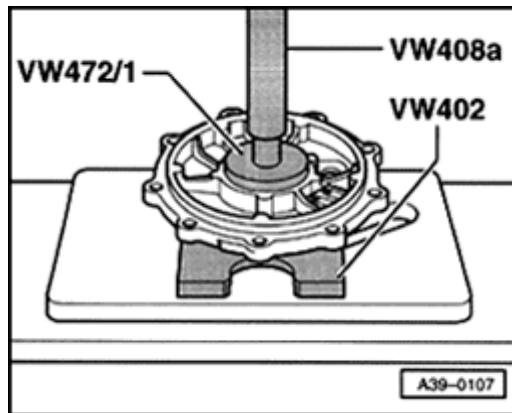


Fig. 9 Driving in left tapered roller bearing outer race into cover

- Insert VW472/1 pressure piece together with cone in outer race.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use VW511 thrust pad and VW295 needle bearing drift.

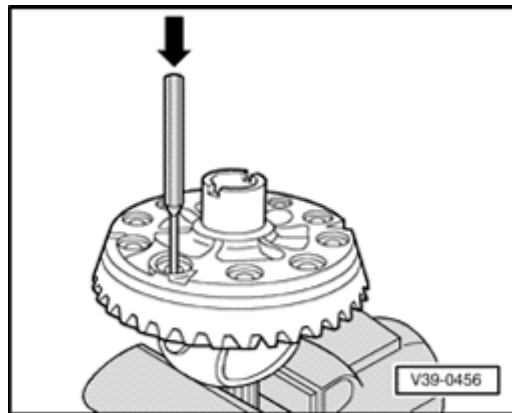
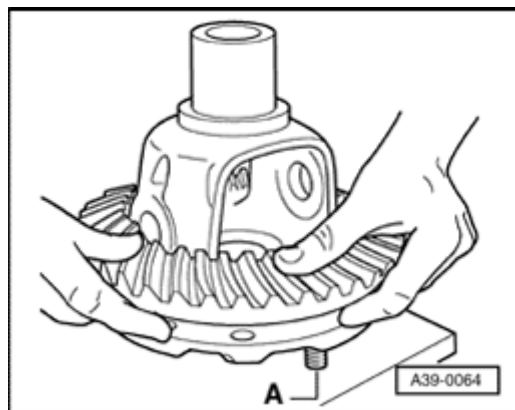


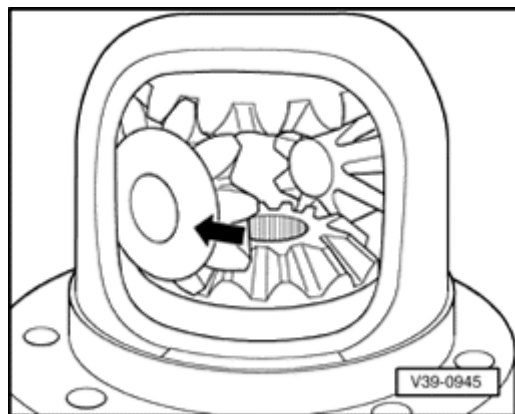
Fig. 10 Driving out ring gear from housing



A

Fig. 11 Installing ring gear***WARNING!******Wear protective gloves!***

- When installing ring gear guide with centering pins -A- (local manufacture).
- Heat ring gear to approximately 100 ° C (212 ° F) and install.
- Before installing bolts, allow ring gear to cool a bit. Then tighten to specified torque.



A

Fig. 12 Installing differential bevel gears

- Lubricate one-piece thrust washer with transmission oil before installing.
- Install large differential bevel gears.
- Install small differential bevel gears at 180 ° from their final position and rotate into place (arrow).
- Drive in differential bevel gear shaft to final position and secure.

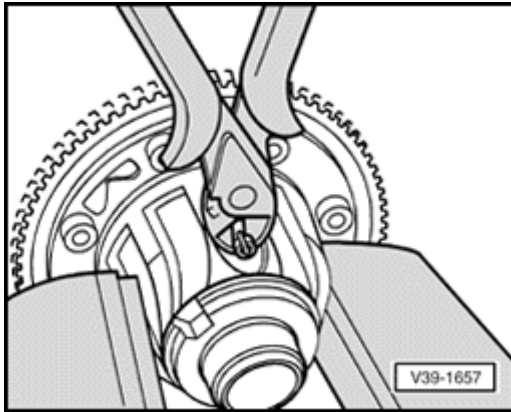


Fig. 13 Removing and installing roll pin

Removing

- Remove roll pin with annular groover using diagonal cutting pliers.
- Remove roll pin without annular groove using punch.

Installing

- Install roll pin to stop.

Pinion shaft and ring gear, adjusting

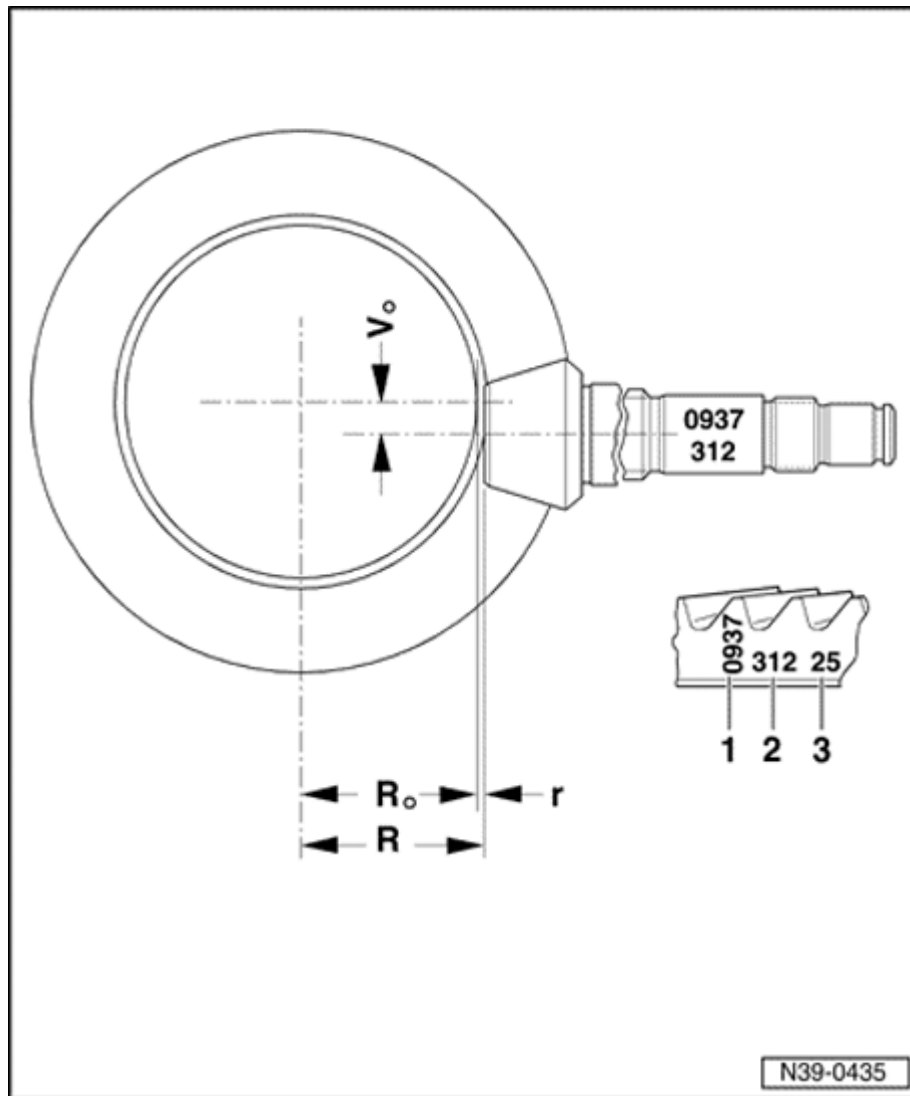
Notes:

- ◆ *Careful adjustment of the pinion shaft and ring gear is essential for the service life and smooth running of the final drive. For this reason, the pinion shaft and the ring gear are matched together during manufacturing and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the pinion shaft in an axial direction, and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*
- ◆ *The goal of the adjustment is to reproduce the setting for the quietest possible running, as obtained on the test machine during production.*
- ◆ *The deviation, or tolerance "r" which is based on the master gauge "R0" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (pinion shaft and ring gear) must only be replaced together as a matched pair.*
- ◆ *Observe the general repair instructions for*

tapered roller bearings and adjustment shims.

- ◆ *The friction torque measurement only serves as a final check of the adjustment.*

39-30



Adjustment and marking of final drive gear sets

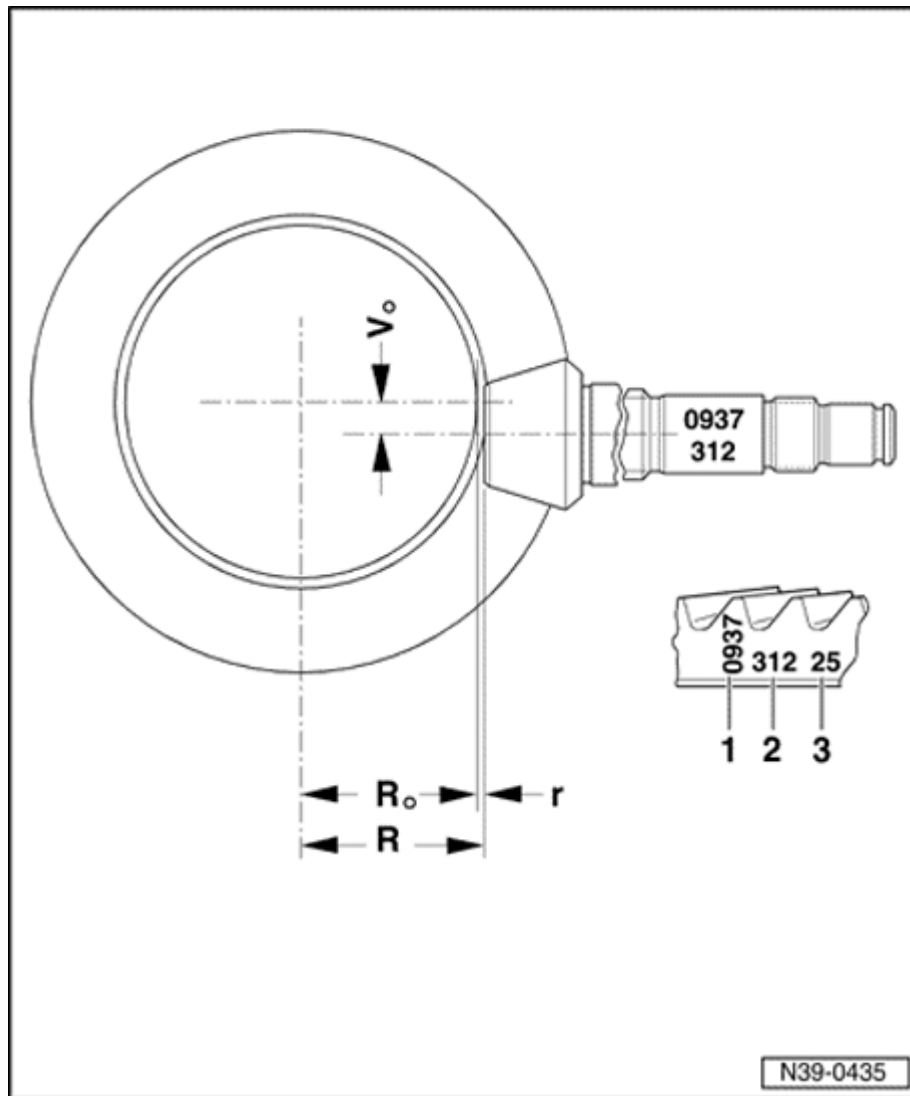
- 1 - Identification "0937" signifies an Oerlikon gear set with a ratio of 37:9
- 2 - Pairing number (312) of final drive gear set
- 3 - Deviation (tolerance) "r" is based on the test machine master gauge used during production. The deviation "r" is always given in 1/100 mm. Example: 25 signifies "r" = 0.25 mm

R_o - Length of test machine master gauge

R_o - Ring gear diameter 170 mm = 54.95 mm

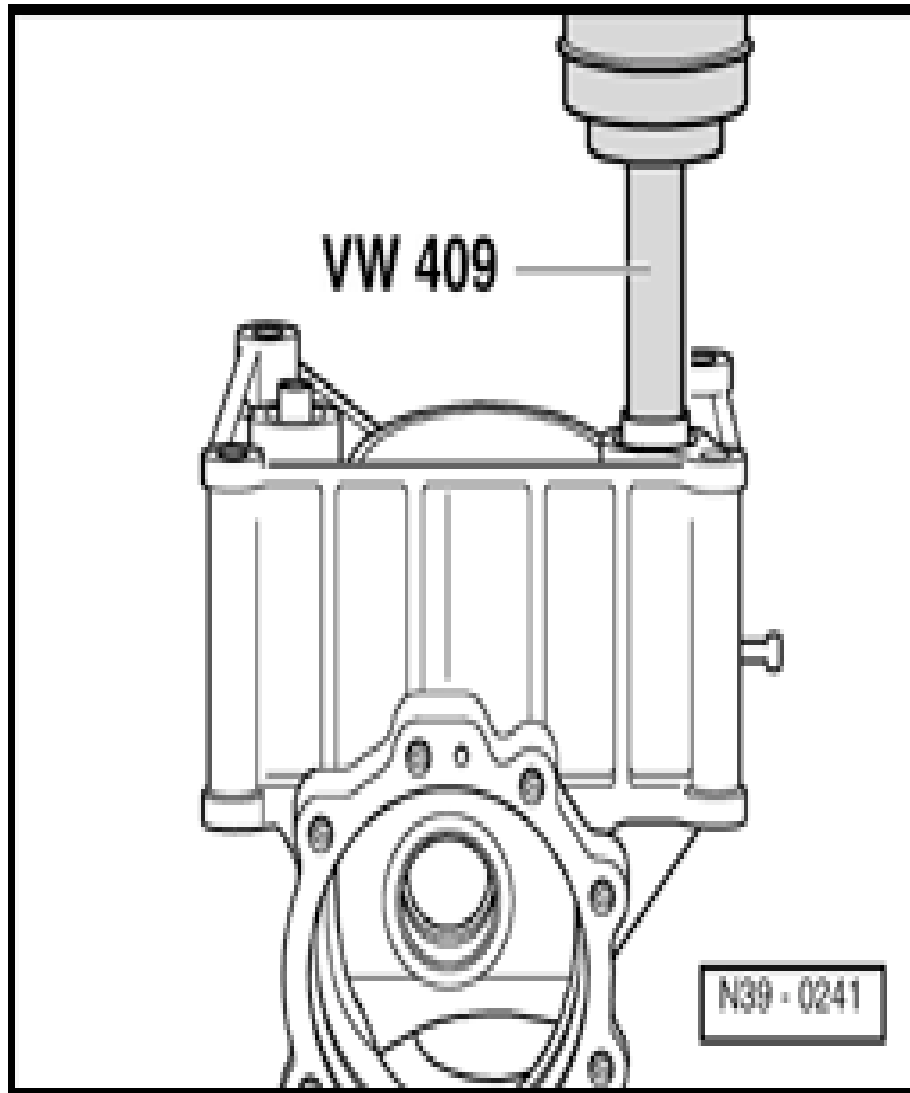
R_o - Ring gear diameter 180 mm = 59.65 mm

39-31



R - Actual dimension between ring gear axis and face of pinion shaft in position of quietest running for this gear set

V_o - Hypoid offset



Installation position of adjustment shims

Note:

List of adjustments when replacing individual components of transmission ⇒ [Page 39-33](#) .

- S1 - Adjustment shim for ring gear in final drive cover**
- S2 - Adjustment shim for ring gear in transmission housing**
- S3 - Adjustment shim for pinion shaft in transmission housing**
- S4 - Adjustment shim for pinion shaft in transmission cover**

List of adjustments

Note:

If repairs have been carried out on the transmission, it is only necessary to adjust the pinion shaft, ring gear or gear set if components have been replaced that directly influence the final drive adjustment. To avoid unnecessary adjustments, refer to the following table:

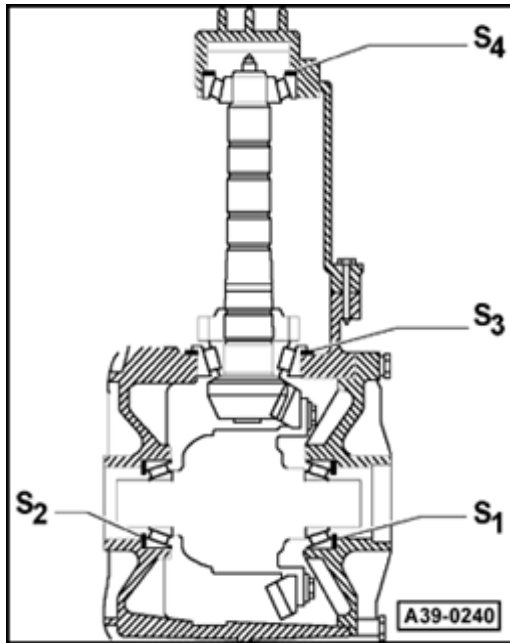
Component replaced: ▼	Component to be adjusted:			
	Ring gear "S1"+ "S2" 1) ⇒ Page 39-52	Pinion shaft "S3"+ "S4" 1) via deviation "r" ⇒ Page 39-35	Pinion shaft "S4" 1) ⇒ Page 39-49	Backlash measurement ⇒ Page ⇒ Page 39-58
Transmission housing 3)	X	X		X
Transmission cover			X	
Differential housing	X			X
Tapered roller bearing for pinion shaft		X		X
Tapered roller bearing for differential	X			X
Gear set 2)	X	X		X
Cover for final drive	X			X

1) Adjustment shims: installation position ⇒ [Page 39-32](#) .

2) Replace pinion shaft and ring gear together as a set only.

- 3) If the transmission housing is replaced, adjust input shaft ⇒ [Page 35-17](#) .

Sequence for adjusting gear set



If pinion shaft and gear ring have to be adjusted, the following sequence is recommended for maximum efficiency:

- 1.) Determine total shim thickness S_{total} for $S1 + S2$ (adjusting preload for tapered roller bearing for differential) ⇒ [Page 39-53](#) .
- 2.) Determine total shim thickness S_{total} for $S3 + S4$ (adjusting preload for tapered roller bearing for pinion shaft) ⇒ [Page 39-37](#) .
- 3.) Distribute total shim thickness S_{total} for $S3 + S4$ so that the dimension between the center of the gear ring and the face of the pinion shaft equals dimension "R" which was determined during production ⇒ [Page 39-45](#) .
- 4.) Distribute total shim thickness S_{total} $S1 + S2$, so that the specified backlash between ring gear and pinion shaft is maintained ⇒ [Page 39-61](#) .

Note:

Overview of components and shims ⇒ [Page 39-32](#) .

Pinion shaft, adjusting

Procedures, after which the pinion shaft must be adjusted ⇒ [Page 39-33](#) , table

Special tools and equipment

- ◆ VW204B installation tool for crankshaft seal
- ◆ VW296 removal tool
- ◆ VW385 universal gauge
- ◆ VW385/1 measuring bar
- ◆ VW385/2 centering disc (for transmissions without polygon bearing)
- ◆ VW383/3 centering disc (2x)
- ◆ VW385/14 measuring rod
- ◆ VW385/15 extension pin
- ◆ VW385/30 master gauge (adjustable)

- ◆ VW385/33 end gauge
- ◆ VW387 Dial Gauge Holder
- ◆ VW401 thrust plate
- ◆ VW407 punch

39-36

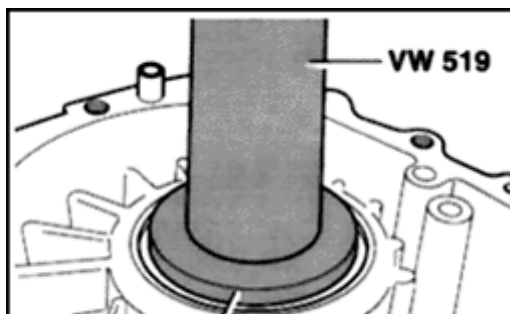
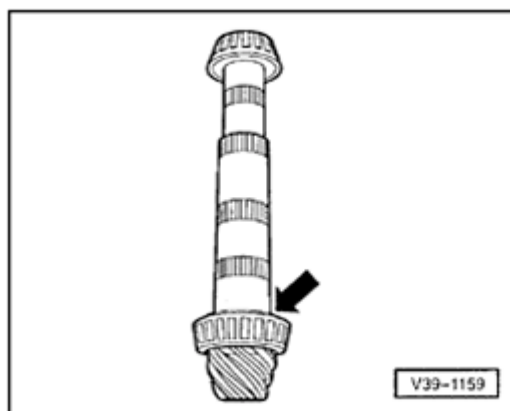
- ◆ VW519 sleeve
- ◆ VW792 installation arbor
- ◆ 3005 thrust pad
- ◆ Torque gauge 0-600 Ncm
- ◆ Dial indicator
- ◆ Dial indicator extension 9.3 mm
- ◆ Dial indicator extension 6.5 mm
- ◆ Dial indicator extension 30 mm

Determining total shim thickness Stotal for shims S3 + S4

- Adjust preload of tapered roller bearing for pinion shaft.
- Differential removed
- Pressing on double tapered roller bearing inner race ⇒ [Page 35-21](#) .
- A
 - Secure lower tapered roller bearing (arrow).

Note:

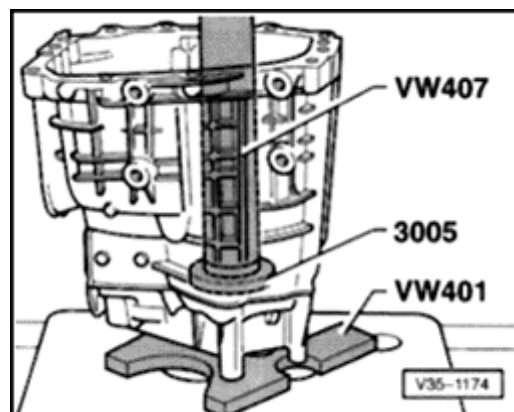
The illustration shows the pinion shaft without gears.



- A
 - Install tapered roller bearing outer race for pinion shaft without shims into transmission housing ⇒ Fig. 3, ⇒ [Page 35-30](#) .
- Install rubber washer (item 40 , Page ⇒ [Page 35-28](#)) and pressure plate (item - 39 -, Page ⇒ [Page 35-28](#)) into transmission cover.

Pressure plates with a thickness of 14.8 mm or 15.3 mm can be installed.

39-38



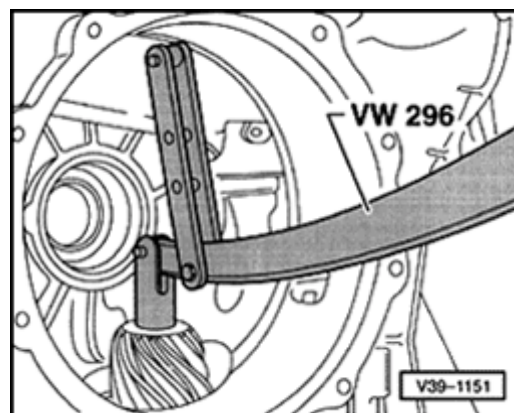
A

- Install tapered roller bearing outer race for pinion shaft with shim S4* (1.0 mm thickness) into transmission cover ⇒ Fig. 8, ⇒ [Page 35-32](#) .

Note:

A shim S4 with a thickness of 1.0 mm is installed for initial measurement. It is referred to in the following text as S4. After determining measurement "e," S4* is replaced with the appropriate shim S4.*

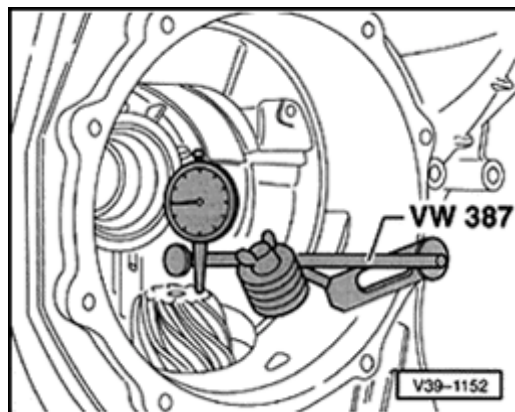
- Install fully assembled pinion shaft into transmission housing.
- Install transmission cover and tighten to 22 Nm (16 ft lb).
- Turn transmission so that the transmission cover points downward.



A

- Press down on face of pinion shaft using VW296 removal tool until tapered roller bearing outer race contacts transmission cover.
- While maintaining pressure, turn pinion shaft by hand to seat tapered roller bearing.

39-39



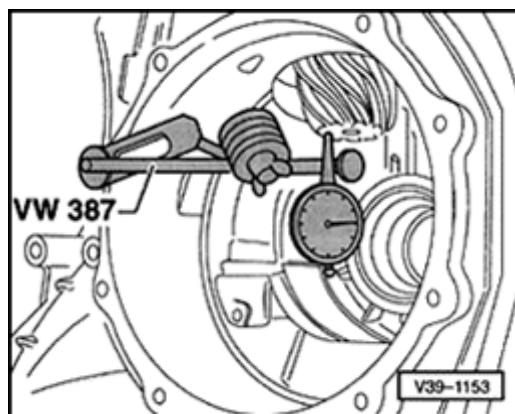
A

- Assemble measuring equipment, use 30mm dial indicator extension.
- Set dial indicator (3 mm measuring range) to 0 with 1mm preload.

Note:

Make sure dial indicator extension contacts machined surface on face of drive shaft.

- Turn transmission 180°, so transmission cover faces upward.
- Turn pinion shaft 5 rotations in each direction to seat the tapered roller bearing.



A

- Read play on dial indicator and note.
Dimension in the following example: 0.45 mm

Note:

If the measurement has to be repeated, first turn pinion shaft 5 rotations in both directions to seat the tapered roller bearing. Set dial indicator to 0 with 2mm preload.

Formula:

$$\text{"Stotal"} = \text{"S4*"} + \text{measured value} + \text{bearing preload}$$

Example:

Installed shim "S4*"	1.00 mm
+ Dimension (example)	0.45 mm
+ Bearing preload (constant)	0.15 mm
= Total shim thickness "Stotal" for "S3 + S4"	1.60 mm

Determining thickness of shim "S3"**Formula:**

$$\text{"S3"} = \text{"Stotal"} - \text{"S4"}$$

Example:

Total shim thickness "Stotal" for "S3
+ S4"

1.60
mm

- Installed shim "S4"
1.00
mm

= Thickness of shim "S3"
0.60
mm

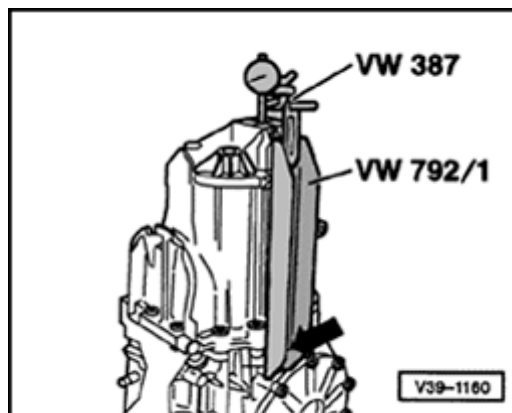
- Remove tapered roller bearing outer race, install shim "S3" into transmission housing and re-install outer race ⇒ Fig. 3, ⇒ [Page 35-30](#) .
- Install fully assembled pinion shaft into transmission housing.
- Install transmission cover and tighten to 22 Nm (16 ft lb).

Checking preload for tapered roller bearing for pinion shaft

- Turn pinion shaft 5 rotations in each direction to seat tapered roller bearing.

Notes:

- ◆ *If the pinion shaft cannot be turned by hand, install a M10 x 20 bolt into face of pinion shaft and turn the pinion shaft at this bolt using tool.*
- ◆ *Remove bolt after turning pinion shaft.*

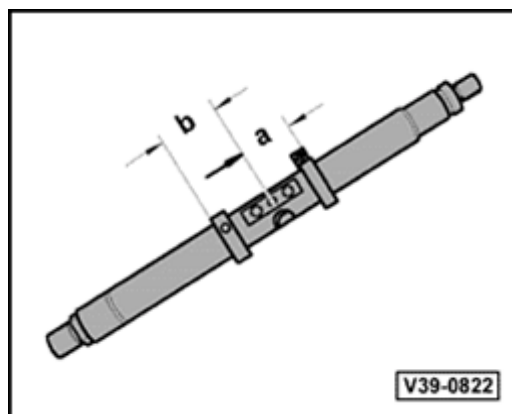


- Install measuring tools and secure to transmission housing with bolt (arrow).
- Attach dial indicator (3mm measuring range) to center of transmission cover and set to 0 with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft.
If correct shims have been selected, dial indicator will now indicate the following value: 0.05-0.15 mm.
- Tighten transmission cover bolts to 22 Nm (16 ft lb).
- Remove measuring tools.
- Turn pinion shaft 5 rotations in each direction to seat tapered roller bearing.

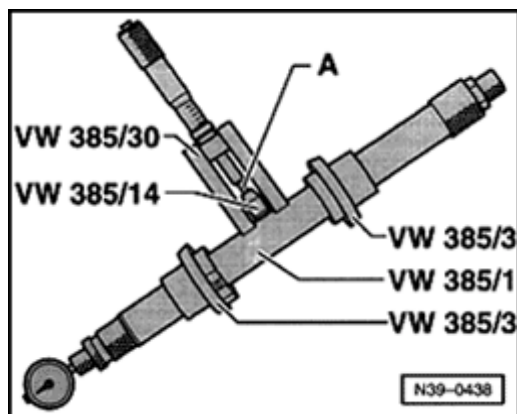
Calculating dimension "e"

Note:

Dimension "e" is required to determine the final shim thickness of S3 and S4.



- Set adjustment rings of universal mandrel using VW385/1 measuring bar to the following measurements:
 - ◆ Dimension -a- = 35 mm
 - ◆ Dimension -b- = 75 mm



- Assemble VW385/1 measured bar as illustrated:

Dial indicator extension A	Ro	Ring gear diameter
6.5 mm for VW385/30 master gauge	54.95	170 mm
9.3 mm for VW385/15 extension pin	59.65	180 mm

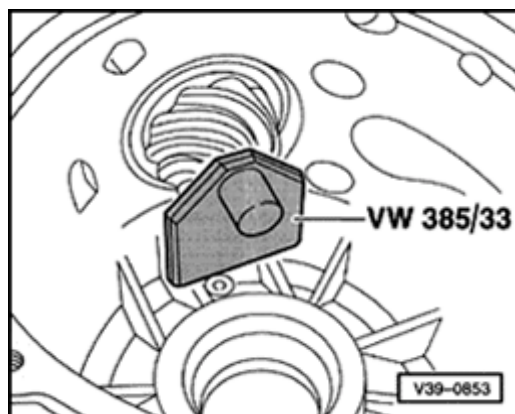
- Set dial indicator (3 mm measuring range) to 0 with 2mm preload.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use VW385/2 centering disc instead of VW385/3 centering disc

opposite dial indicator.

39-44

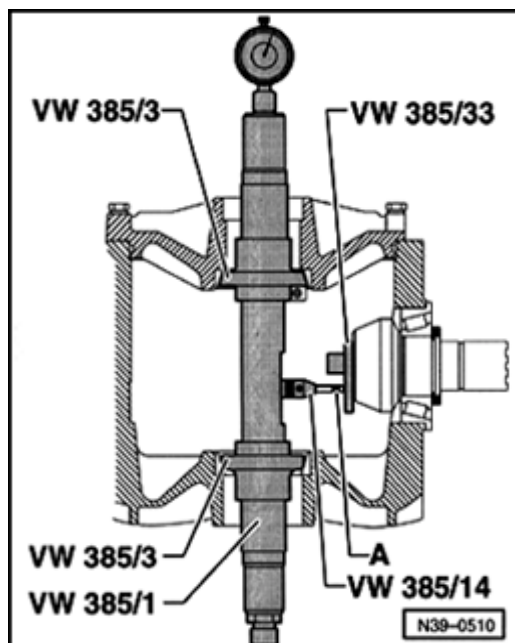


A

- Place end gauge on face of pinion shaft.

Note:

Make sure gauge contact surface is precisely installed and free of oil.



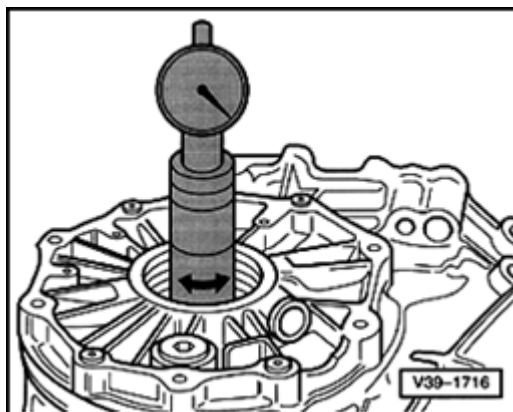
A

- Remove master gauge and install measuring mandrel into transmission housing.
 - Dial indicator extension -A- = 6.5 mm long must be installed
 - VW385/3 centering disc faces cover for final drive
- Install differential cover and tighten 4 bolts to 22 Nm (16 ft lb).
- Using adjustable ring, pull 2nd VW385/3 centering disc out as far as possible, so mandrel can only just be turned by hand.

Note:

For transmissions with drive flange without polygon bearing (⇒ [Page 00-3](#)) use VW385/2 centering disc instead of VW385/3 centering disc opposite dial indicator.

39-45



- Turn mandrel until dial indicator plunger tip touches end gauge on pinion shaft head, measure maximum runout (return point).

Measurement in following example "e" = 0.26 mm (red scale)

Note:

After removing universal mandrel, and with VW385/30 master gauge in place, check dial indicator again to see if it indicates "0" with 2 mm preload, otherwise correct adjustments.

Determining thickness of shim "S3"

Formula:

$$S3 = S3^* + r + e$$

(-e- in black scale)

or

$$S3 = S3^* + r - e$$

(-e- in red scale)

Notes:

- ◆ *The deviation "r" (tolerance) related to the VW385/30 master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear.*
- ◆ *If measurements are based on red scale, subtract value "e."*
- ◆ *If measurements are based on black scale, add value "e."*

Example:

Shim S3* installed	0.60 mm
+ Deviation r	0.38 mm
- Value measured for "e" (in red scale)	0.26 mm
= Thickness of shim S3	0.72 mm

- Determine shim(s) according to table. Part numbers $\Rightarrow$ parts catalog

The following shims are available for "S3"

Shim thickness (mm) ¹⁾		
0.40	0.55	0.70
0.45	0.60	0.75
0.50	0.65	
¹⁾ Using shim tolerances it is possible to find the exact shim thickness required: insert two shims if necessary.		

Determining thickness of shim "S4"**Formula:**

$$S4 = Stotal - S3$$

Example:

Total shim thickness Stotal for S3 +
S4

1.60
mm

- Thickness of shim S3
0.72
mm

= Thickness of shim S4
0.88
mm

- Determine shim(s) according to table. Part numbers $\Rightarrow$ parts catalog

Available shims for S4

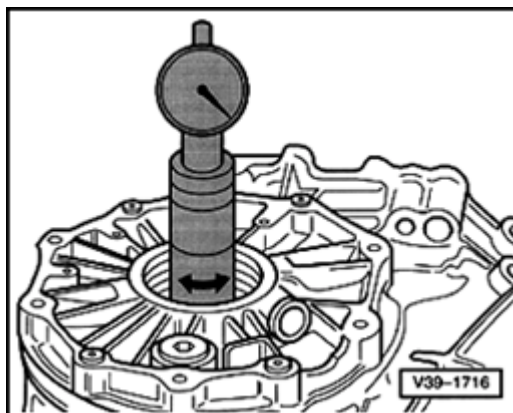
Shim thickness (mm) 1)		
0.49	0.69	0.85
0.57	0.73	0.89
0.61	0.77	
0.65	0.81	

1) Using shim tolerances it is possible to find the exact shim thickness required: insert two shims if necessary.

Checking measurement

Checking dimension "r"

- Install pinion shaft together with measured shims S3 and S4 and turn 5 rotations in both directions.



A

- Install universal mandrel $\Rightarrow$ [Page 39-43](#) , Determining dimension "e"; and perform check measurement.
- Read dial indicator counterclockwise (red scale).
 - ◆ If shims have been determined correctly, deviation "r" (as marked on outer circumference of ring gear) should be indicated on dial within a tolerance of ± 0.04 mm.

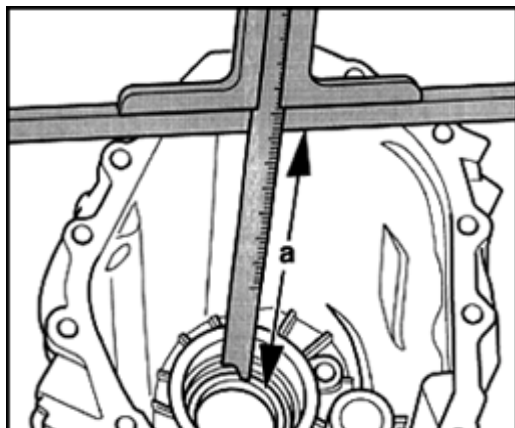
Note:

After removing universal mandrel, and with VW385/30 master gauge or VW385/15 extension pin in place, check dial indicator again to see if it indicates 0 with 2 mm preload. If not, correct adjustments.

Re-determining "S4" after replacing transmission cover

Special tools and equipment

- ◆ VW387 dial gauge holder
 - ◆ VW792/1 assembly tool
 - ◆ Dial indicator
 - ◆ Dial indicator extension
 - ◆ Depth gauge with minimum 5/100 mm precision
- Clean housing mating surfaces.



A

- Measure difference in depth "a" on old and new transmission cover.

Example:

Depth -a- (old transmission cover)	257.40 mm
Depth -a- (new transmission cover)	257.55 mm
= Difference	0.15 mm

- Install thicker shim "S4" if new transmission cover is deeper.
- Install thinner shim "S4" when the old transmission cover is deeper.

Example:

Previous shim "S4"	0.95 mm
+ Difference	0.15 mm
= New shim "S4"	1.10 mm

Available shims ⇒ [Page 39-47](#) , table

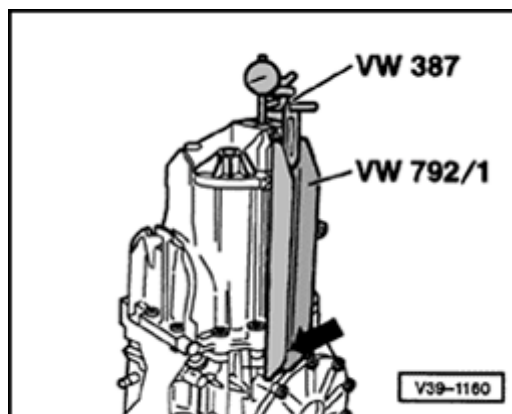
- Install tapered roller bearing outer race with shim "S4" into transmission cover ⇒ [Fig. 8](#) , ⇒ [Page 35-32](#) .
- Install fully assembled pinion shaft into transmission housing.
- Install transmission cover and tighten to 22 Nm (16 ft lb).

Preload for tapered roller bearing for pinion shaft, checking

- Turn pinion shaft 5 rotations in each direction to seat the tapered roller bearing.

Note:

The pinion shaft can be turned by simultaneously turning both drive flanges.



A

- Install measuring tools and secure to transmission housing with bolt (arrow).
- Attach dial indicator (3 mm measuring range) to center of transmission cover and set to 0 with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft.
If correct shims have been selected, the dial indicator will now indicate the following value: 0.05-0.15 mm.
- Remove measuring tools.
- Coat sealing surfaces with thin layer of sealant AMV 188 001 02.
- Tighten transmission cover bolts to 22 Nm (16 ft lb).

Ring gear, adjusting

Adjusting differential

For a list of the repairs which will require the ring gear to be adjusted ⇒ [Page 39-33](#) , List of adjustments

Special tools and equipment

- ◆ VW382/10 dial indicator extension
- ◆ VW385/17 magnetic plate
- ◆ VW387 dial gauge holder
- ◆ VW388 measuring lever
- ◆ VW402 thrust plate
- ◆ VW408A punch
- ◆ VW472/1 pressure piece
- ◆ VW521 adjustment tool
- ◆ 3177 clamp

- ◆ Torque gauge 0-600 Ncm
- ◆ Dial indicator
- ◆ Dial indicator extension 30 mm

Determining total shim thickness Stotal for shims S1 + S2

(Adjust preload of tapered roller bearing for differential)

- Pinion shaft removed

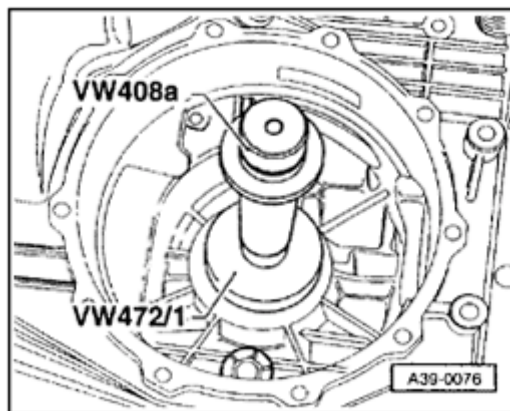
Note:

If only the differential tapered roller bearings are to be replaced, remove ring gear from differential housing. The pinion shaft does not have to be removed.

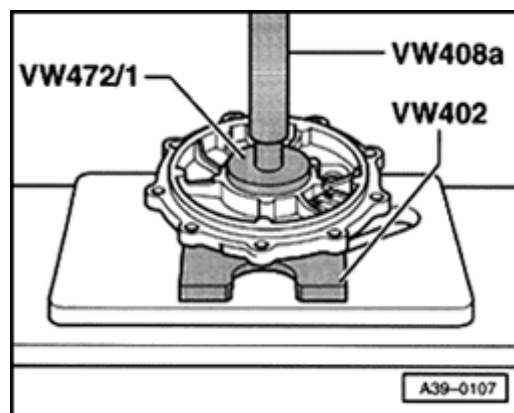
- Remove seals and outer races from both tapered roller bearings for differential.
- Remove shims ⇒ [Page 39-15](#) .
- Drive in tapered roller bearing outer race together with shim S2 into transmission housing ⇒ Fig. 3, ⇒ [Page 39-23](#) . Use shim "S2*" with 1.20 mm thickness for measurement purposes (2 shims with 0.60 mm).

Note:

A shim S2 with a thickness of 1.20 mm is installed for initial measurement. It is referred to in the following text as S2. After determining backlash, S2* is replaced with the appropriate shim S2.*

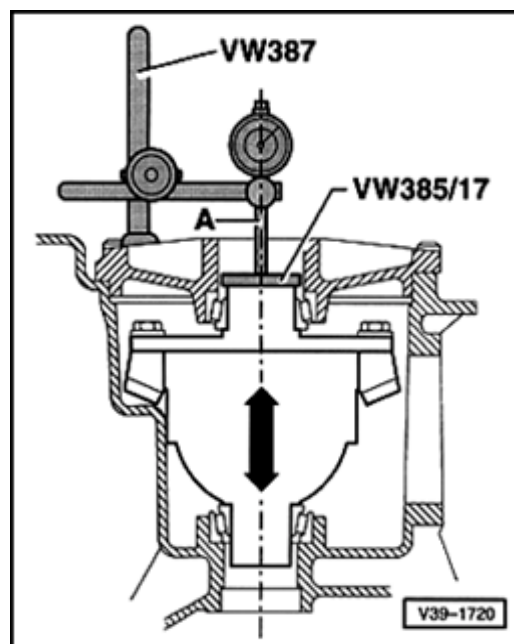


39-54



A

- Press in tapered roller bearing outer race into differential cover without shim S1 ⇒ [Fig. 9](#) , ⇒ [Page 39-26](#) .
- Install differential into transmission housing without Vehicle Speed Sensor (VSS) -G22- gear drive. Ring gear is located on left side in front of final drive cover.
- Install cover for differential and tighten four bolts to 25 Nm (18 ft lb).
- Position transmission so that cover for differential faces upward.
- Turn differential 5 rotations in each direction to seat tapered roller bearing.



A

- Assemble measuring equipment, use 30 mm dial indicator extension.
- Set dial indicator (3 mm measuring range) -A- to 0 with 2mm preload.

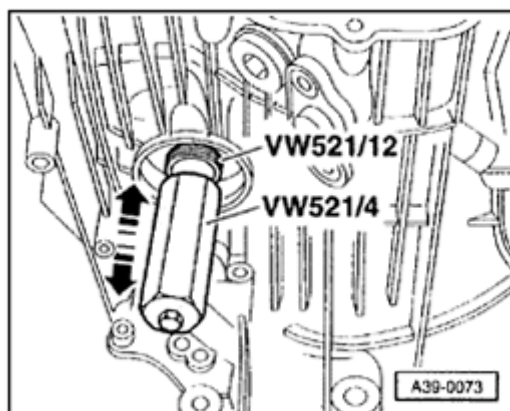
Note:

Tip of dial indicator must be positioned on the center of the differential.

- Lift differential without turning it, read play on dial indicator and note.

Dimension in the following example: 0.62 mm

Notes:



- ◆ To lift differential, secure VW521/4 locking sleeve and VW521/8 bushing (for transmissions without polygon bearing) or VW521/12 (for transmissions with polygon bearing) to right side of differential (housing side).
- ◆ If measurement has to be repeated, turn differential again 5 rotations in both directions to seat tapered roller bearing.

Formula:

"Stotal" = "S2*" + measured value + bearing preload

Example:

Installed shim "S2"	1.20 mm
+ Dimension	0.62 mm
+ Bearing preload (constant)	0.30 mm
= Total shim thickness "Stotal" for "S1 + S2"	2.12 mm

Determining thickness of shim "S1"**Notes:**

- ◆ *"S1" is used for the initial measurement. After determining backlash, "S1" is replaced with final shim "S1."*
- ◆ *The total shim thickness "Stotal" remains unchanged.*

Formula:

$$\text{"S1"} = \text{"Stotal"} - \text{"S2"}$$

Example:

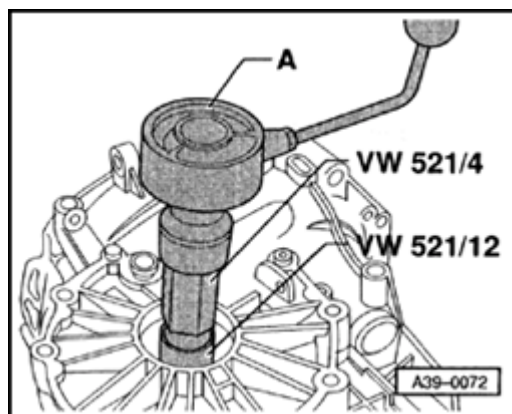
Total shim thickness "Stotal" for "S1"	
+ "S2"	2.12 mm
- Installed shim "S2"	1.20 mm
= Thickness of shim "S1"	0.92 mm

Measuring friction torque (check measurement)

Notes:

- ◆ *Tapered roller bearings for differential are low-friction. Measurement of friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal."*
- ◆ *Do not lubricate new tapered roller bearings for measuring friction torque. The bearings have already been treated by a special oil by the manufacturer.*

- Pinion shaft removed



4

- Install torque gauge 0-600 Ncm -A- on differential.
- Read friction torque.

Friction torque specified values:

New bearings	Used bearings
200 - 350 Ncm	30 - 60 Ncm

Note:

For a readjustment of the gear set, the pinion shaft adjustment should now be checked ⇒ [Page 39-35](#) .

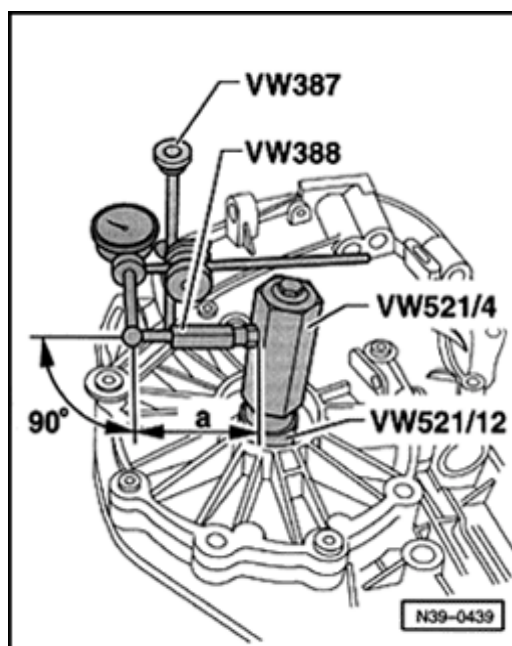
Measuring backlash

(Position of ring gear in transmission housing)

- Pinion shaft with shims "S3*" and "S4*" installed

- Install differential.

- Turn differential 5 rotations in each direction to seat tapered roller bearing.

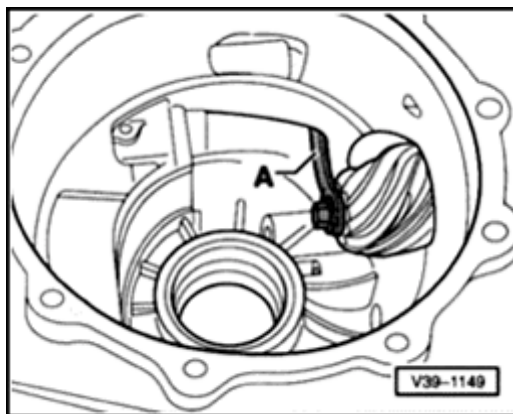


A

- Secure VW387 dial gauge holder on housing.
- Install VW521/4 locking sleeve and VW521/8 bushing (for transmissions without polygon bearing) or VW521/12 (for transmissions with polygon bearings).
- Install dial indicator with VW382/10 extension pin, 6 mm.
- Set VW388 measuring lever to dimension "a:"

Dimension "a"	Ring gear diameter
67 mm	170 mm
72 mm	180 mm

- Determine play between teeth flanks as follows:
- Turn ring gear until it contacts a tooth flank (end of backlash travel).
- Set dial indicator to 0 with 2 mm preload.
- Turn ring gear back until it contacts opposite tooth flank (backlash).
- Read backlash and note.
- Turn ring gear another 90° and repeat measurement 3 times.

Notes:

- ◆ If pinion shaft turns when turning differential, install 3177 clamp -A- so that an exact backlash measurement can be made.
- ◆ Loosen clamping piece to turn the ring gear further.
- ◆ Differential must be installed with cutout for differential bevel gears facing pinion shaft.
- If 3177 clamp is installed, install differential 180° to final position and repeat measurements.

Determining average backlash

- Add four measured values together and divide total by 4 to determine average.

Example:

1st Measurement	0.28 mm
+ 2nd Measurement	0.30 mm
+ 3rd Measurement	0.30 mm
+ 4th Measurement	0.28 mm
= Total of measurements	1.16 mm

- Result: the average backlash is $1.16 \text{ mm} \div 4 = 0.29 \text{ mm}$

Note:

If the measured values differ more than 0.06 mm from each other, the installation of ring gear or gear set itself may not be correct. Check installation and replace gear set if necessary.

Determining thickness of shim "S2"**Formula:**

$$\text{"S2"} = \text{"S2*"} - \text{backlash} + \text{lift}$$

Example:

Installed shim "S2*"	1.20 mm
- Average backlash	0.29 mm
+ Lift (constant)	0.15 mm
= Thickness of shim "S2"	1.06 mm

- Determine shim(s) according to table. Part numbers $\Rightarrow$ parts catalog

Available shims for "S2"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

- 1) Using shim tolerances it is possible to find the exact shim thickness required; insert two shims if necessary.

Determining thickness of shim "S1"**Formula:**

$$\text{"S1"} = \text{"Stotal"} - \text{"S2"}$$

Example:

Total shim thickness "Stotal" for "S1 + S2"	2.12 mm
- Thickness of shim "S2"	1.06 mm
= Thickness of shim "S1"	1.06 mm

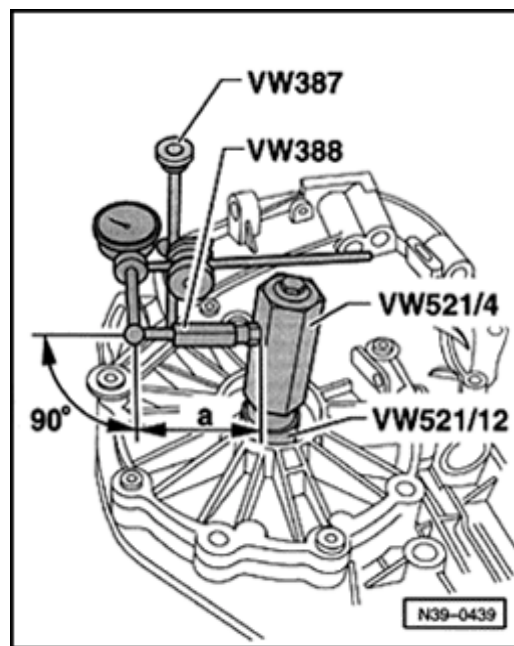
- Determine shim(s) according to table. Part numbers $\Rightarrow$ parts catalog

Available shims for "S1"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

- 1) Using shim tolerances it is possible to find the exact shim thickness required; insert two shims if

necessary.



⚡ Checking measurement

- After installing shims "S1" and "S2," turn differential 5 rotations in each direction to seat tapered roller bearings.

Note:

For transmissions without polygon bearing, use VW521/8 bushing instead of VW521/12 shown.

- Measure backlash 4 times on circumference.

Specification: 0.12-0.22 mm

Notes:

- ◆ *If backlash lies outside tolerance, repeat adjustments. Do not change total shim thickness "Stotal."*
- ◆ *The individual measurements must not vary more than 0.06 mm from each other.*