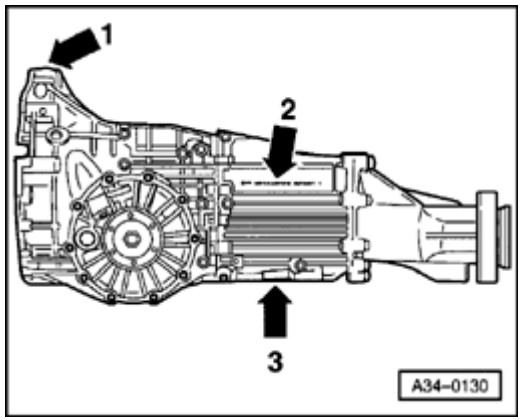
00-1

Transmission identification

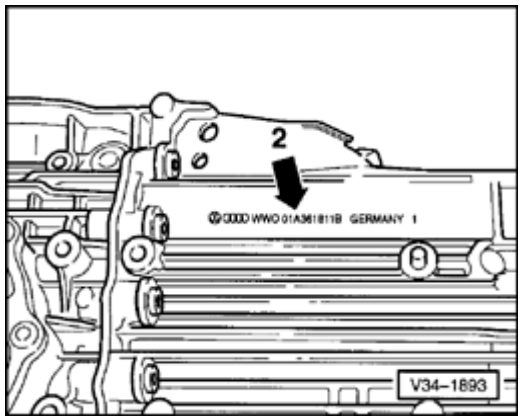
The manual transmission 01A AWD is installed in the Audi A4 1998 ➢as a 5-speed transmission in conjunction with the 4-cylinder turbo engine or 6-cylinder engine.

Applications ⇒ Page 00-3 .



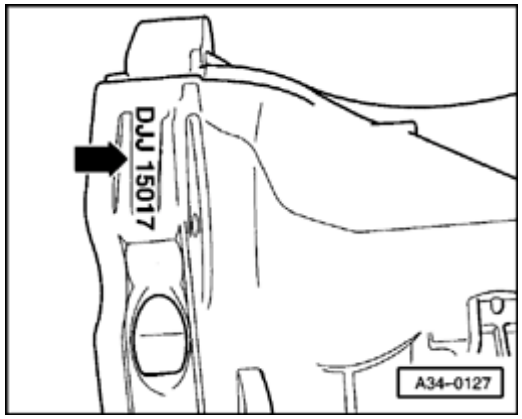
➢ Locations on transmission

- Code letters and date of manufacture (arrow -1-).
- Manual transmission 01A (arrow -2-).
- Code letters (arrow -3-).



➢ Manual transmission 01A (arrow -2-)

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Code letters and date of manufacture (arrow -1-)

Example:	DJJ	15	01	7
	I	I	I	I
	I	I	I	I
	Transmission code letters	Day	Month	Year
		Date (e.g. 15 Jan. 1997)		

Additional data is pre-production related.

Note:

The code letters of the transmission are engraved on the lower part of the transmission cover and are also engraved on the vehicle data plates.

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00-3

Code letters, engine/transmission applications, ratios, capacities

Transmission 01A all-wheel-drive **Code letters**		**CTF**	**DJJ**	**CXF**	**CXW**
Manufactured	from:	11.94	07.96	11.94	11.94
	to:	07.96	-	11.94	07.96
Application	Model	**Audi A4 1996**	**Audi A4 1996**	**Audi A41996**	**Audi A4 1996**
	Engine	1.8 ltr - 110 kW (150 hp)	1.8 ltr - 110 kW (150 hp)	2.8 ltr -128 kW (172 hp)	2.8 ltr -128 kW (172 hp)
Ratios	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
Z2 : Z1 = i	1st gear	34 : 9 = 3.778	34 : 9 = 3.778	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	37 : 17 = 2.176	37 : 17 = 2.176	35 : 18 = 1.944	35 : 18 = 1.944
	3rd gear	40 : 28 = 1.429	40 : 28 = 1.429	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	30 : 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

Continued on next Page

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Transmission 01A all-wheel-drive **Code letters**	**CTF**	**DJJ**	**CXF**	**CXW**
Speedometer	Electronic			
Capacity	2.75 liter (2.91 qt.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)			
Clutch mechanism	Hydraulic			
Clutch plate diameter	228 mm (8.98 in.)	228 mm (8.98 in.)	240 mm (9.45 in.)	240 mm (9.45 in.)
Drive shaft flange diameter	100 mm (3.94 in.)			
Overall ratio iov in top gear	3.258	3.258	3.070	3.070
Application: rear final drive **(code letters)**	CKH DAJ	DAJ	CKH	CKH

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00-5

Transmission 01A all-wheel-drive **Code letters**		**DJP**	**DDL**	**DJR**
Manufactured	from:	07.96	03.96	07.96
	to:	07.97	07.96	-
Application	Model	**Audi A4 1996** ➢	**Audi A4 1996** ➢	**Audi A41996** ➢
	Engine	2.8 ltr - 128 kW (172 hp)	2.8 ltr - 142 kW (190 hp)	2.8 ltr -142 kW (190 hp)
Ratios	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
Z2 : Z1 = i	1st gear	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
	3rd gear	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
	5th gear	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
Continued on next Page				

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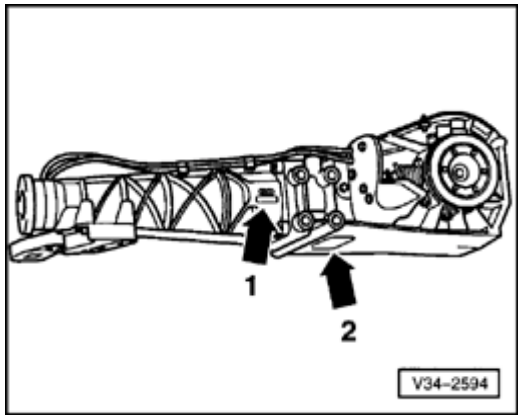
Transmission 01A all-wheel-drive **Code letters**	**DJP**	**DDL**	**DJR**
Speedometer	Electronic		
Capacity	2.75 liter (2.906 qt.)		
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)		
Clutch mechanism	Hydraulic		
Clutch plate diameter	240 mm (9.45 in.)	240 mm (9.45 in.)	240 mm (9.45 in.)
Drive shaft flange diameter	100 mm (3.94 in.)		
Overall ratio iov in top gear	3.070	3.070	3.070
Application: rear final drive (code letters)	DAJ	CKH DAJ	DAJ

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Rear final drive identification

Rear final drive O1H is installed in combination with manual transmission 01A for AWD vehicles.

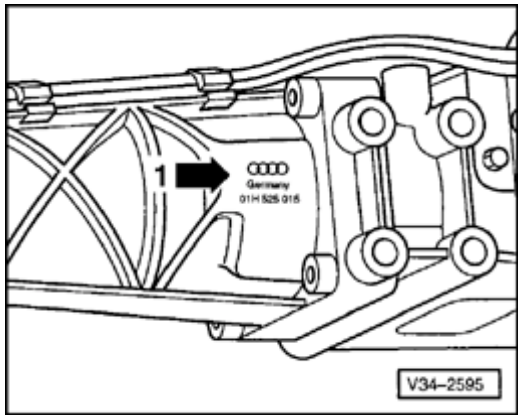
Applications ⇒ Page 00-9 .



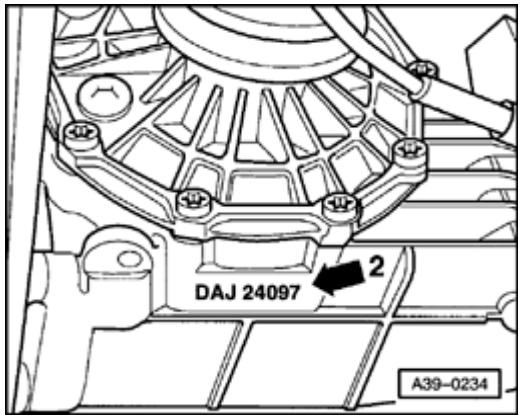
Location on rear final drive

- Rear final drive 01H (arrow -1-).
- Code letters and date of manufacture (arrow -2-).

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➢ **01H rear final drive (arrow -1-)**



➢ Code letters and date of manufacture (arrow -2-)

Example:	**DAJ**	**24**	**09**	**7**
	I	I	I	I
	I	I	I	I
	Transmission code letters	Day	Month	Year
		Date (e.g. 24 Sep. 1997)		

Note:

The code letters of the rear final drive are also listed on the vehicle data stickers.

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Code letters, engine/transmission applications, ratios, capacities

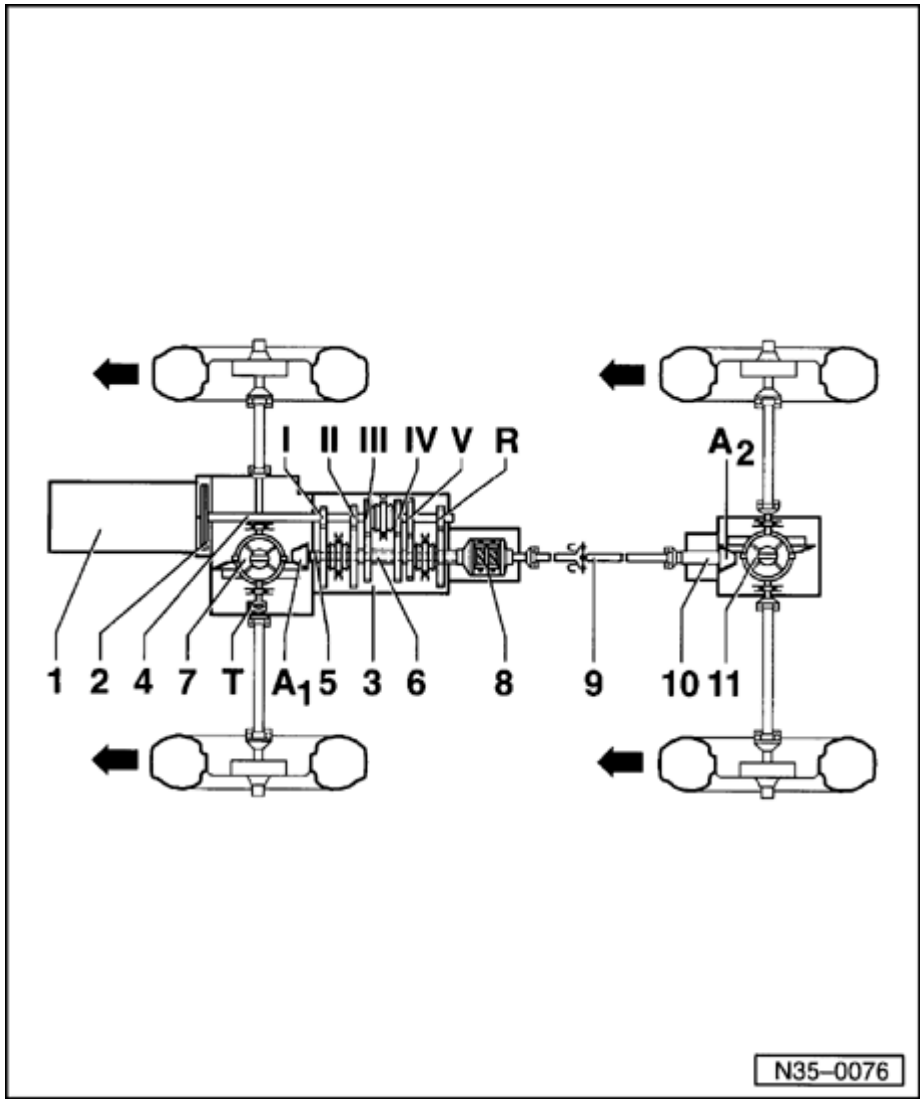
Rear final drive **Code letters**		**CKH**	**DAJ**
Manufactured	from	07.94	05.96
	to	06.96	
Application	Model	Audi A4 1996 ➢	Audi A4 1996 ➢
	Engine	1.8 ltr - 110 kW (150 hp)	1.8 ltr - 110 kW (150 hp)
		2.8 ltr - 128 kW (172 hp)	2.8 ltr - 128 kW (172 hp)
		2.8 ltr - 142 kW (190 hp)	2.8 ltr - 142 kW (190 hp)
Ratios	Rear final drive	35 : 9 = 3.889	35 : 9 = 3.889
Capacity		1.9 liter (2.01 qt.)	
Specification		Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)	
Drive shaft flange diameter		100 mm (3.94 in.)	
Application: manual transmission (code letters)		CTF CXF	CTF DJJ

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	CXW DDL	DJP DDL DJR

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00-10

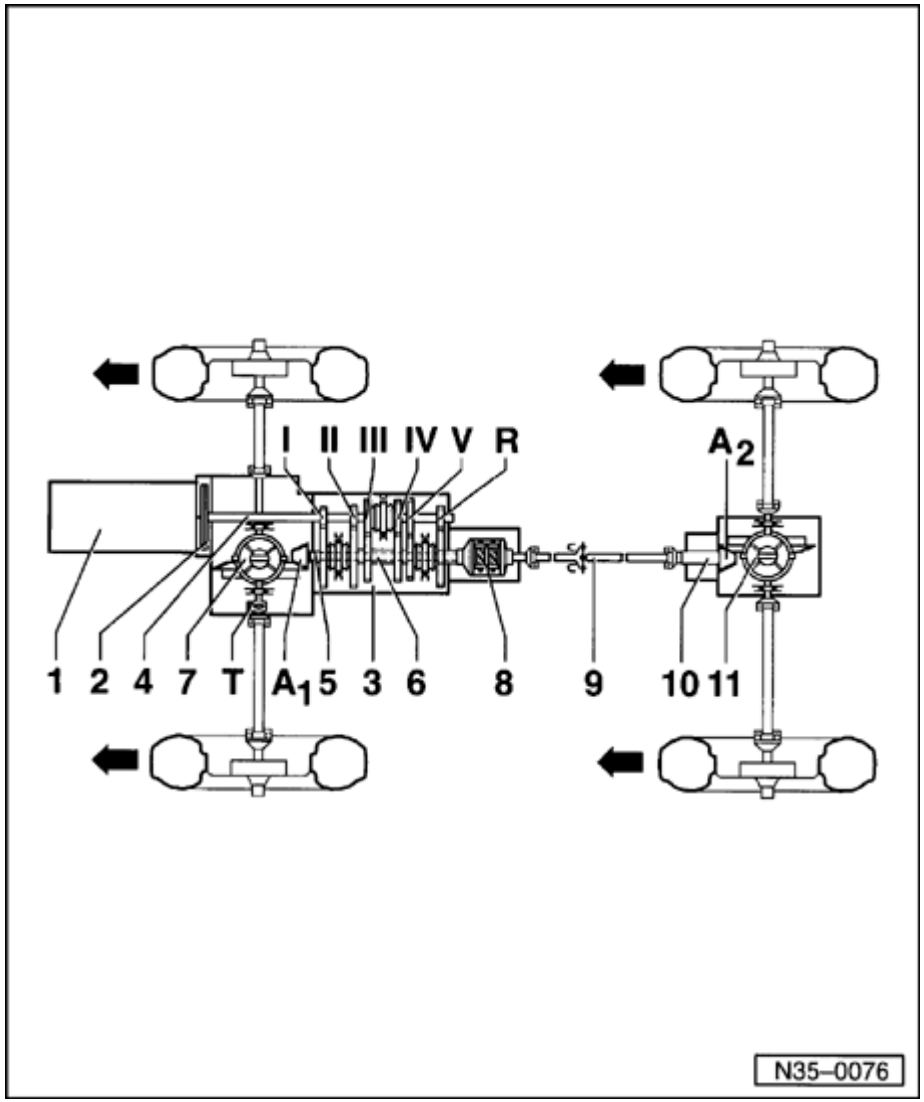


Transmission layout

1 - Engine
2 - Clutch
3 - Transmission
4 - Input shaft (main shaft)
5 - Front drive pinion (output shaft)
6 - Hollow shaft
7 - Front differential
8 - Torsen differential
9 - Driveshaft
10 - Rear drive pinion
11 - Rear differential

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00-11



I - 1st gear

II - 2nd gear

III - 3rd gear

IV - 4th gear

V - 5th gear

R - Reverse gear

A1 - Front final drive

A2 - Rear final drive

T - Speedometer drive (electronic)

Note:

Arrows point in direction of travel.

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Calculations

Ratio i, calculating

Transmission ratio

Transmission ratio	=	No. of teeth driven gear	:	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 = 37	ZA1 = 9
Driven gear	ZG2 = 31	ZA2 = 35

Calculations:

iG = 31 : 37 = 0.838

iA = 35 : 9 = 3.889

iov = (31 : 37) x (35 : 9) = 0.838 x 3.889 = 3.259

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00-13

Vehicle speed V, calculating

V	**=**	**n : iov x UA x 0.06**
n	=	Engine speed (RPM)
iov	=	Overall ratio
UA	=	Dynamic rolling circumference of tires (m)
V	=	Vehicle speed (km/h)

Example:

V = 1000 : 3.100 x 1.93 x 0.06 = 37 km/h

At an engine speed of 1000 RPM, the vehicle road speed in 5th gear is 37 km/h.

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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

- After replacing the transmission or rear final drive, check oil level and top-up if necessary ⇒ Page 34-38 and ⇒ Page 39-84 .
- Capacities and specifications ⇒ Page 00-3 and ⇒ Page 00-9 .
- Thoroughly clean all connections and the surrounding area before disconnecting.

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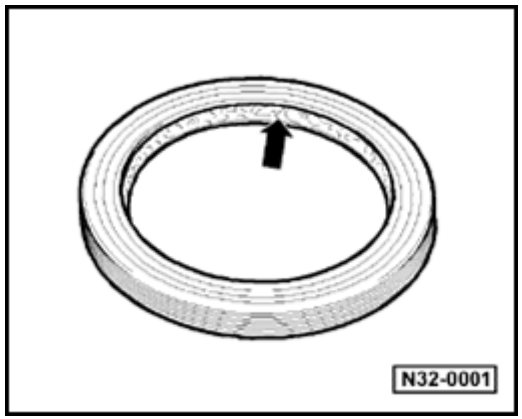
- When installing transmission, make sure dowel sleeves for aligning the engine and transmission are correctly seated.

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00-15

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.



- Before installing radial shaft seals, lightly oil outer edge and fill space between sealing lip and dust lip (arrow) with oil.
- The open side of the seals face 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 when inserting.
- Check oil level after replacing gaskets and seals ⇒ Page 34-38 or ⇒ Page 39-84 .

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00-16

Sealants

- Thoroughly clean housing joint surfaces before applying sealing paste.

CAUTION!

- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

- Apply sealing paste AMV 188 200 03 or AMV 188 001 02 evenly and not too thick. Do not use sealing paste AMV 188 001 02 on a transmission with magnesium housing.

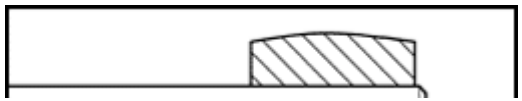
- Breather holes must remain free of sealing paste.

Circlips

- Always replace

- Do not over-stretch circlips.

- Circlips must be fully seated in the groove.



Roll pins

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

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Nuts, bolts

- Always replace self-locking nuts and bolts.
- Loosen nuts or bolts, opposite to tightening sequence.
- Tighten and loosen bolts and nuts for securing covers and housings in a diagonal sequence.
- Especially delicate parts, such as clutch pressure plates, must not be canted. Loosen and tighten bolts and nuts in stages 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.

CAUTION!

- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

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- ***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.***

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00-18

WARNING!

- ***Do not re-use any fasteners that are worn or deformed in normal use.***

- ***Some fasteners are designed to be used only once, and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual-replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.***

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Bearings

- Install needle bearings with the lettering on the bearing (the side with thicker metal) facing the drift or other installation tool.
- Grease needle bearing for the input shaft in the crankshaft.
- Lubricate all bearings in transmission with gear oil before installing.
- Always replace tapered roller bearings on one shaft together and use new bearings from the same manufacturer.
- Heat tapered roller bearing inner races to approx. 100 ° C (212 ° F) before installing. Press in until stop is reached so there is no axial play.
- Do not interchange inner and outer bearing races with those from other bearings of the same size.
- The tapered roller bearings for the output shaft and the differential in the transmission are low-friction bearings. Do not additionally oil new tapered roller bearings when measuring friction torque. The bearings are pre-treated at the

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factory with a special type of oil for this purpose.

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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.
- Only install shims that are in perfect condition.

Gears, synchro-hubs, inner races for sliding gears

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

Sliding gears

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After assembling, check axial play of 1st to 5th sliding gears and reverse sliding gear (0.15-0.35 mm .006-.014 in.) and check for free movement.

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Synchronizer rings

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

Clutch mechanism

- When removing transmission, remove clutch slave cylinder without opening hydraulic lines.

CAUTION!

Do not depress the clutch pedal after removing the slave cylinder. 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.
- To reduce odor caused by a burnt clutch, thoroughly clean the bellhousing, flywheel and

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the side of the engine facing the transmission.

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30-1

Clutch mechanism, servicing

CAUTION!

Before disconnecting the battery:

- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

Notes:

- *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*

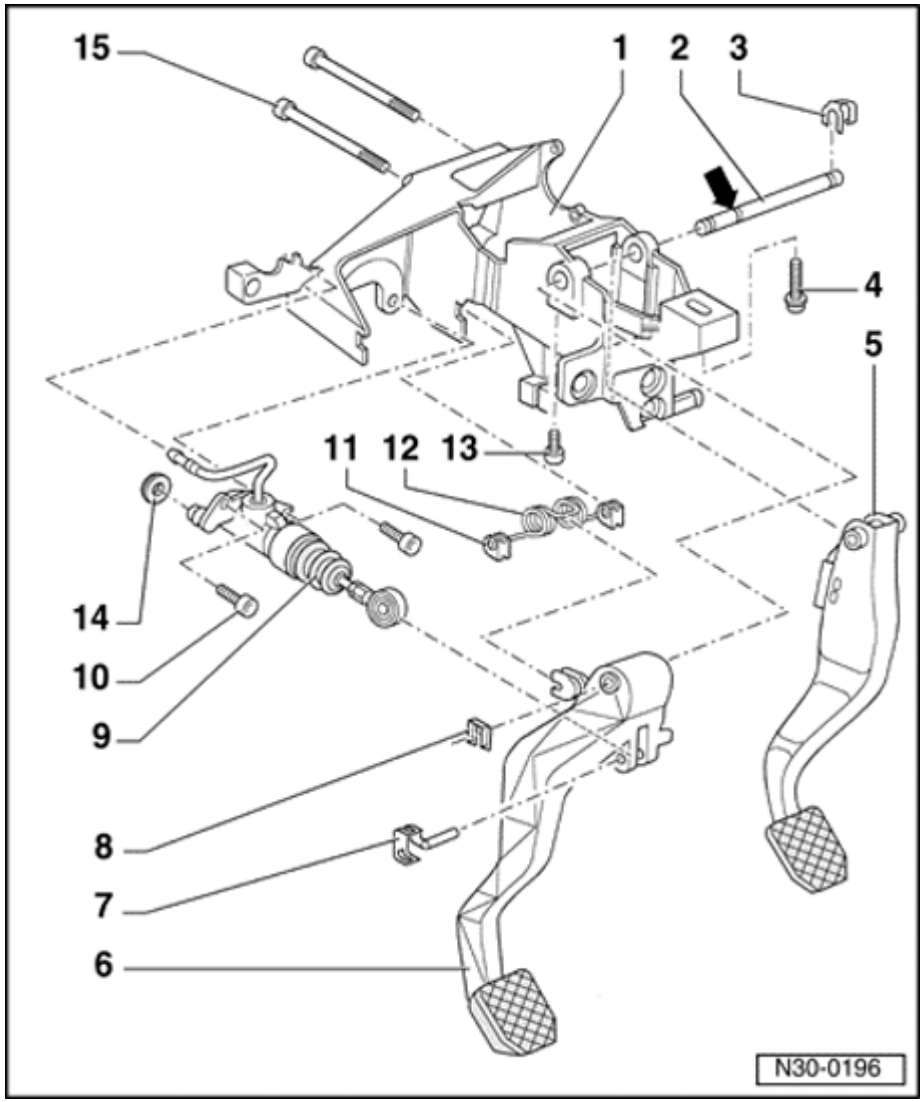
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⇒ *Repair Manual, Body Interior, Repair Group 68*

- *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.*

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30-2



Clutch pedal and clutch control overview

WARNING!

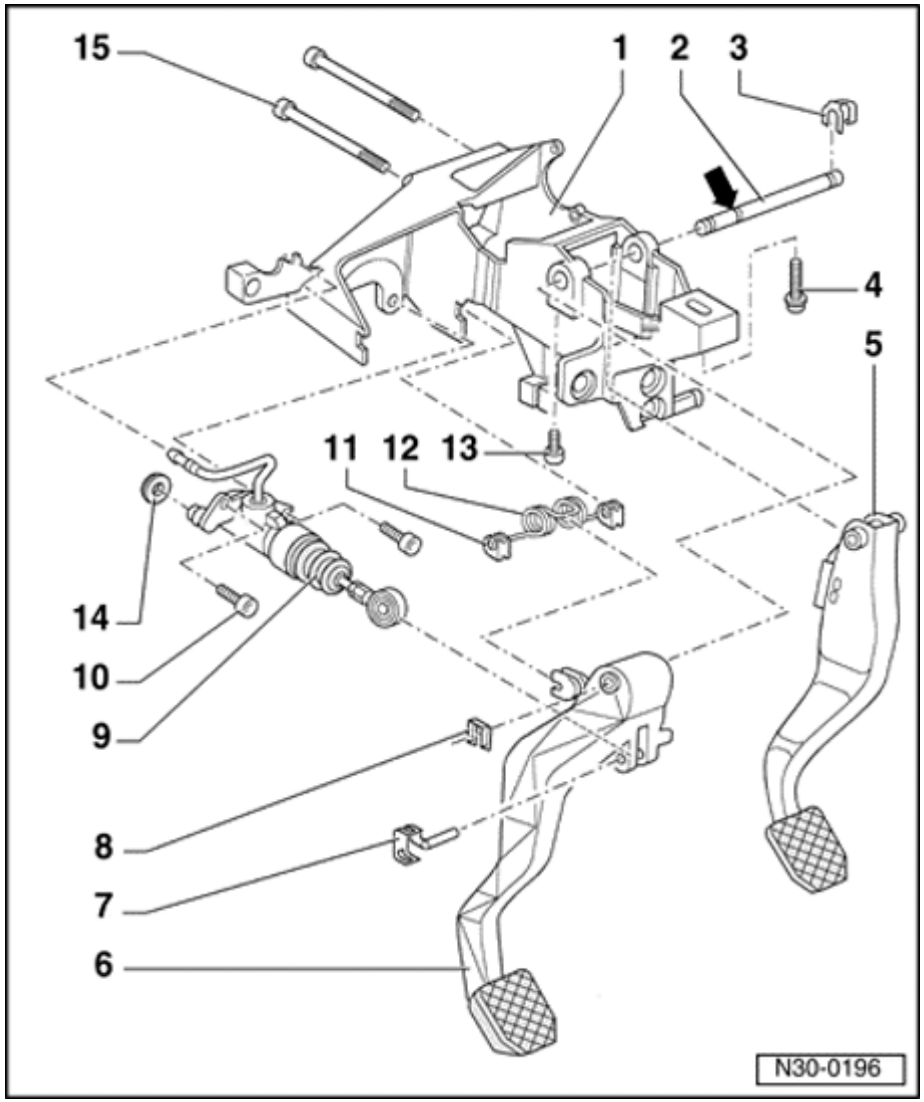
- ***Clutch pedal travel must not be restricted by extra carpets or floor mats.***
- ***Do not re-use fasteners that are worn or deformed in normal use.***
- ***Some fasteners are designed to be used only once, and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow recommendations in this manual-replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.***

1 - Mounting bracket

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

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30-3



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 30-5

7 - 8Pin and locking plate

- Clip onto clutch pedal

9 - Locking clip

10 - Clutch master cylinder

- Removing and installing ⇒ Page 30-13

CAUTION!

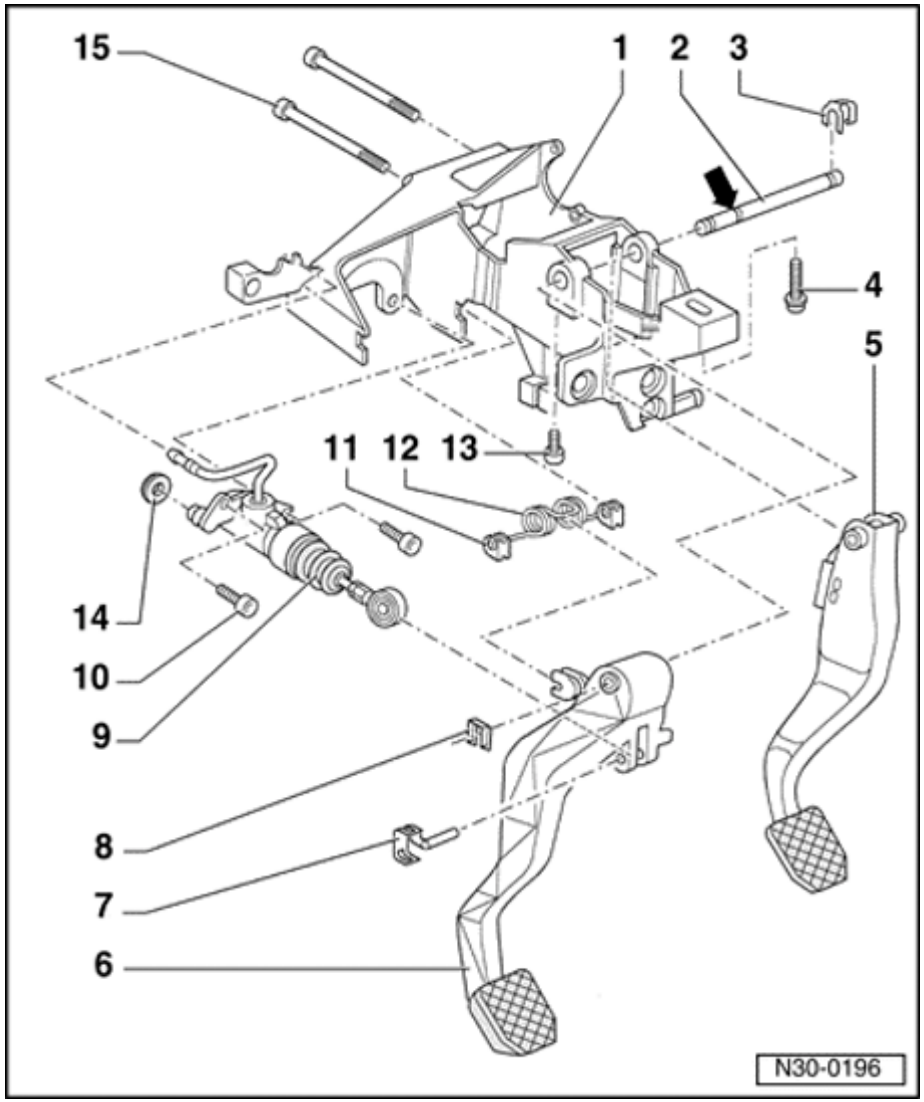
Do not operate after the clutch pedal has been removed.

11 - Socket-head bolt

- 20 Nm (15 ft lb)

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30-4



12 - Mount

- Insert in mounting bracket with over-center spring

13 - Over-center spring

- Application ⇒ Parts catalog microfiche
- Remove and install together with clutch pedal ⇒ Page 30-5

14 - Socket-head bolt

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

15 - Seal

16 - Torx® bolt

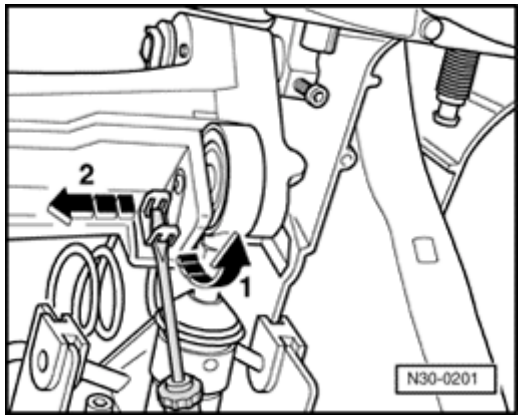
- 25 Nm (18 ft lb)
- Also secures brake master cylinder to brake servo

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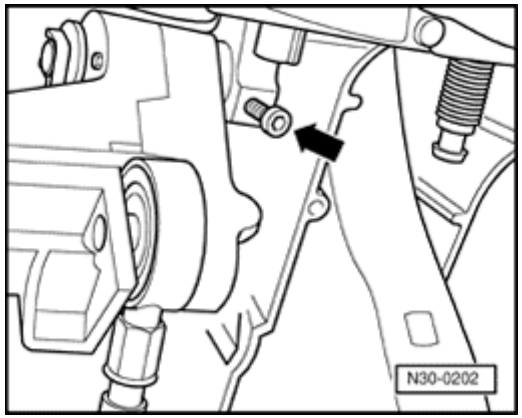
30-5

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.

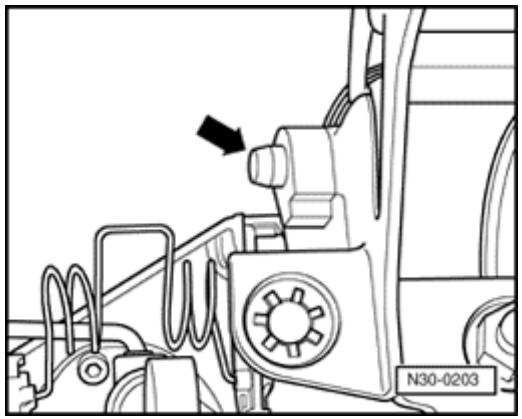


- Remove bolt (arrow).
- Press clutch and brake pedal pivot pin out toward right, until clutch pedal can be removed.
- If necessary, press locking clip for brake pedal off pivot pin using screwdriver.
- Remove clutch pedal and over-center spring.

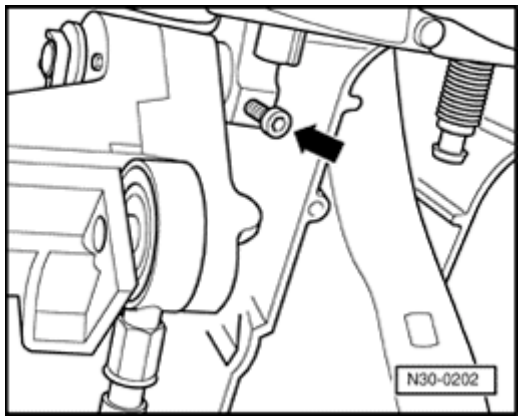
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Installing

Installation is the reverse of removal, note the following:



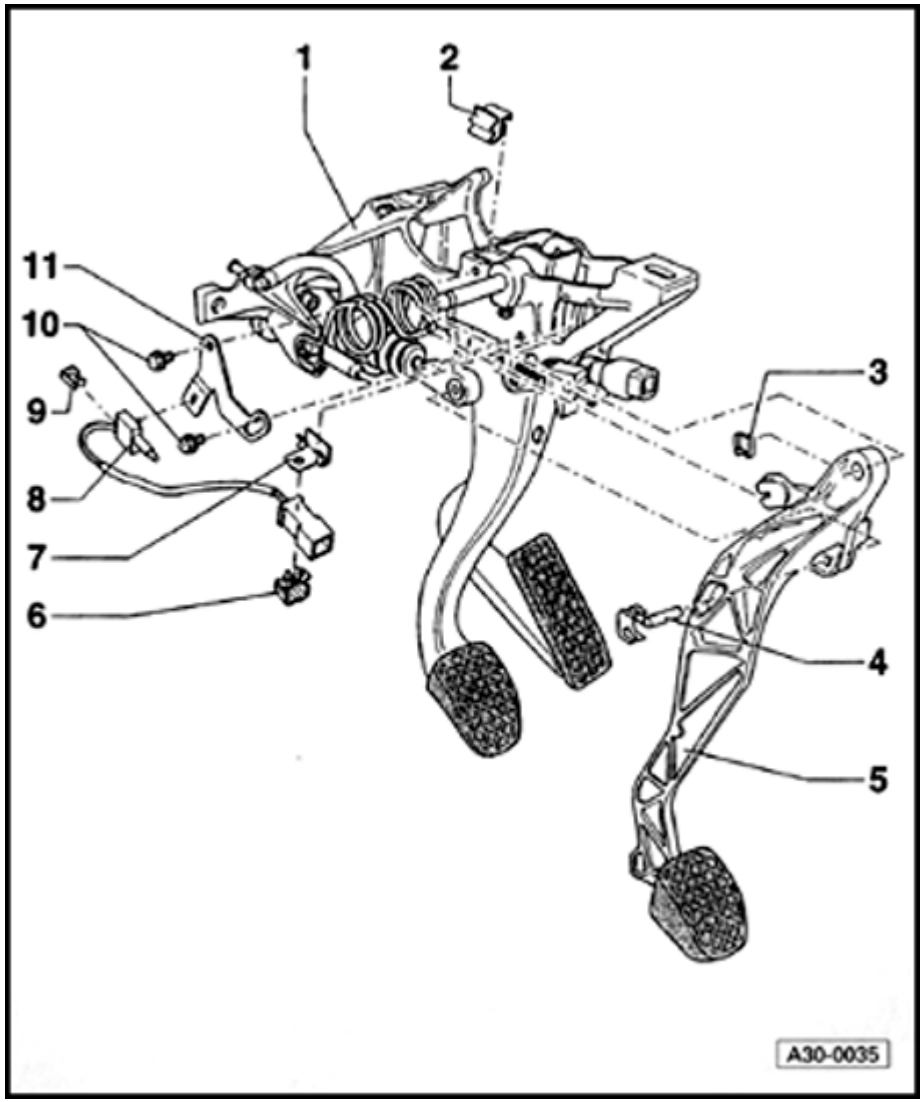
- Align pivot pin so that it protrudes out of mounting bracket on clutch pedal side (arrow).
- Hook clutch pedal into over-center spring, then install onto pivot pin.
- Connect clutch pedal to master cylinder. Clip locking pin onto clutch pedal.



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

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30-7



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

Note:

The clutch pedal position switch -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 - Pin and locking plate

- Latched in clutch pedal

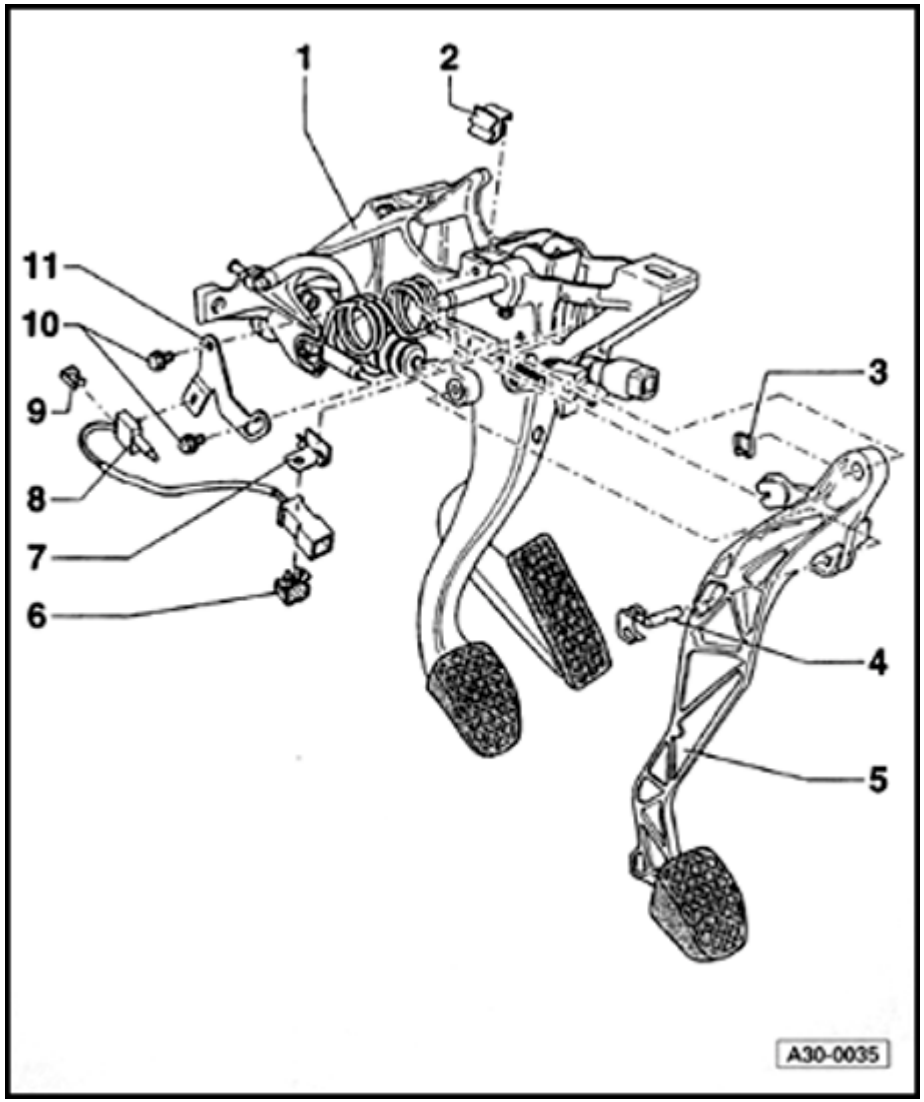
5 - Clutch pedal

- Removing and installing ⇒ Page 30-5

6 - Clip

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30-8



7 - Bracket for harness connector

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

- Adjusting ⇒ Page 30-9

9 - Clip

10 - Screw and washer assembly

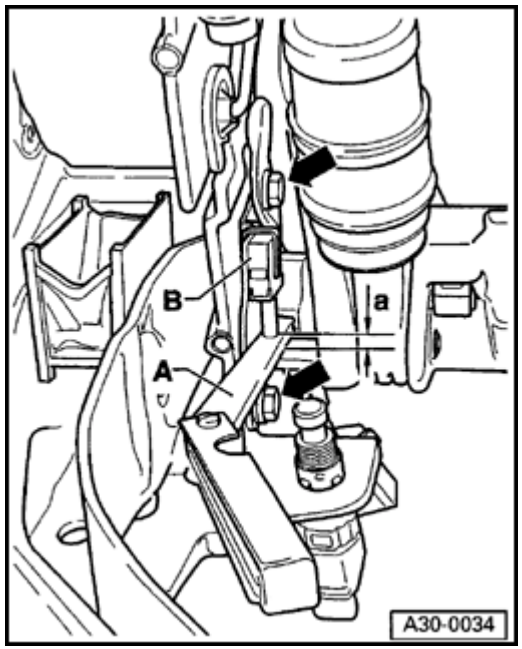
- 8 Nm (71 in. lb)

11 - Mounting plate

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30-9

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

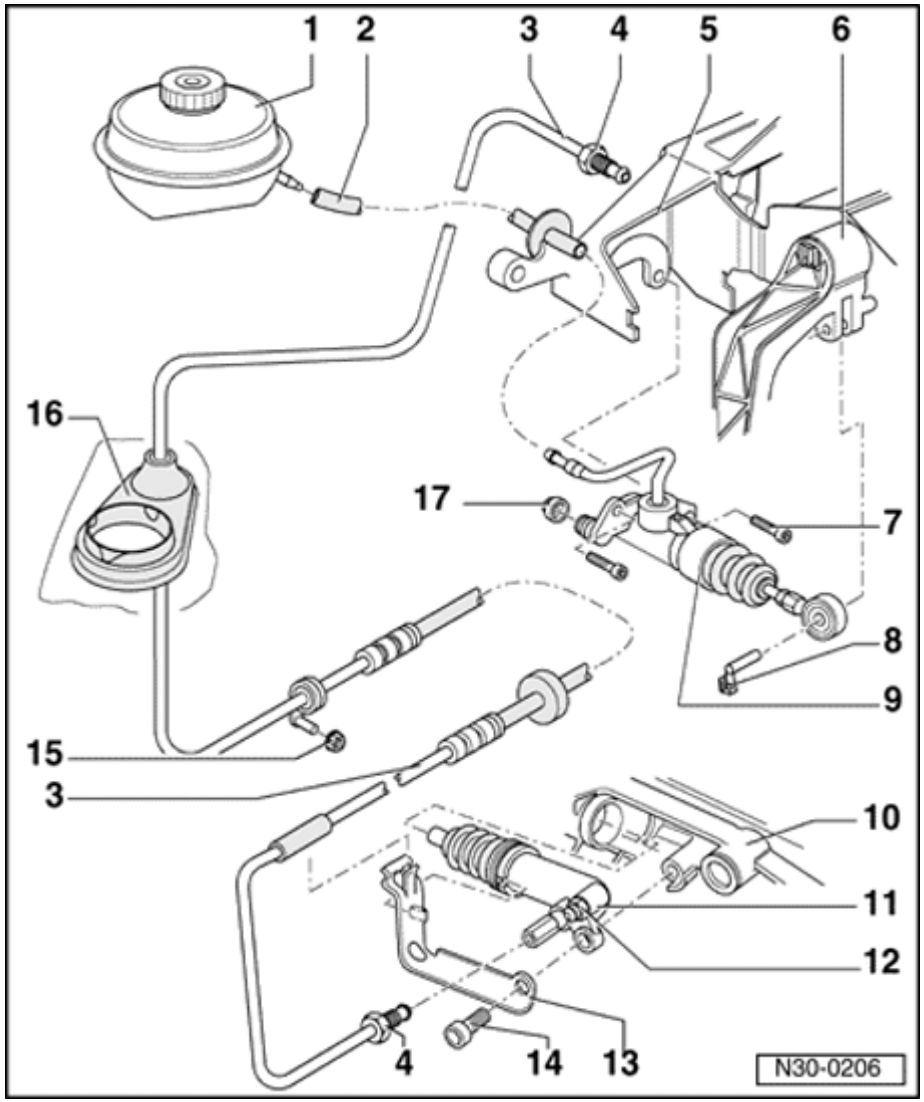


- Loosen two bolts slightly (arrows).
- Have second technician fully depress clutch pedal up to stop.
- Place feeler gauge -A- with specific dimension -a- 3.2 mm (0.126 in.) between operating surface of clutch pedal and switch cam.

  Thickness -a- of feeler gauge: 3.2 mm (0.126 in.)
- Move switch -B- toward gauge -A- until stop, and tighten two mounting bolts (arrows) to 8 Nm (71 in. lb).

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30-10



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

- 15 Nm (11 ft lb)

5 - Mounting bracket

6 - Clutch pedal

- Removing and installing ⇒ Page 30-5

7 - Socket-head bolt

- 20 Nm (15 ft lb)

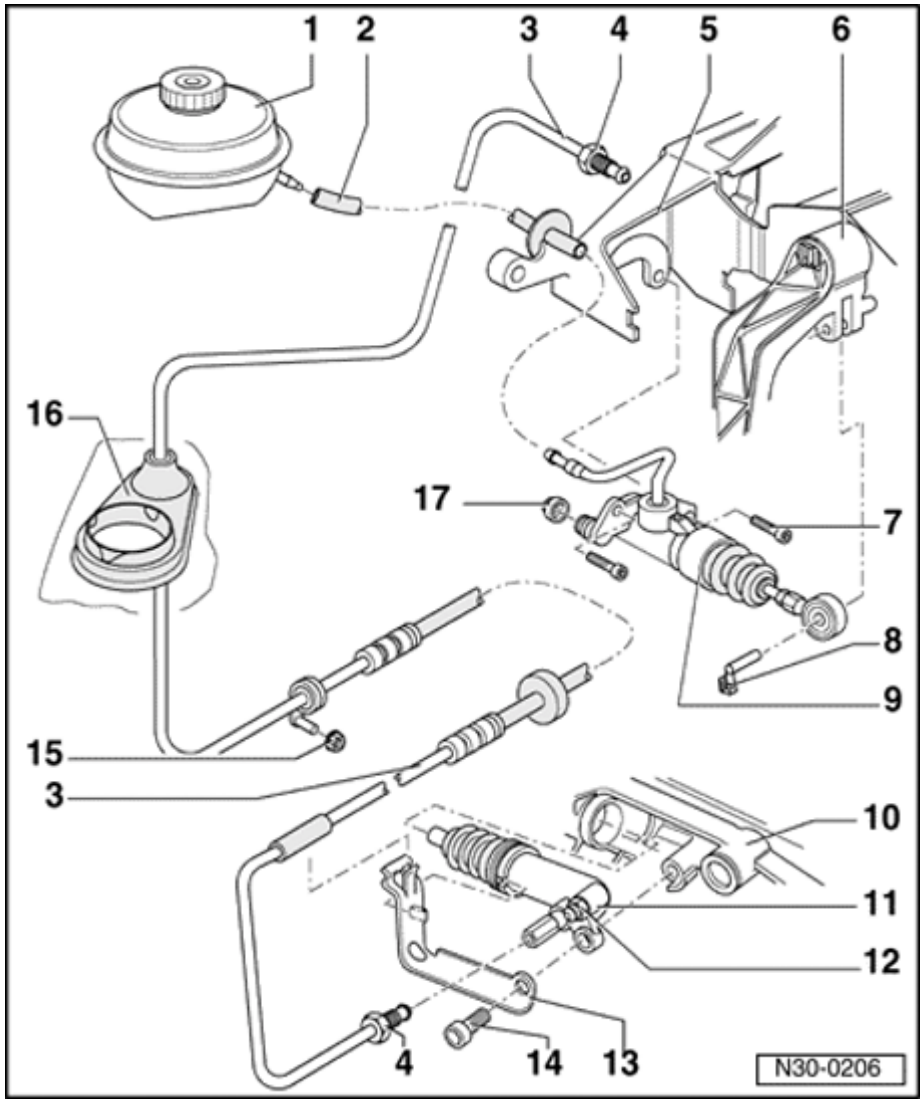
8 - 9Pin and locking plate

10 - Clutch master cylinder

- Removing and installing ⇒ Page 30-13

11 - Transmission

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12 - Clutch slave cylinder

CAUTION!

Do not operate after the clutch pedal has been removed.

Brake fluid must not be allowed to get onto the transmission.

- Coat plunger of clutch slave cylinder with copper grease e.g. Z381 351 TE
- For clutch slave cylinders with plastic support ring, lightly lubricate outer surface of ring before installing
- When installing, push in until bolt can be installed

13 - Bleeder valve

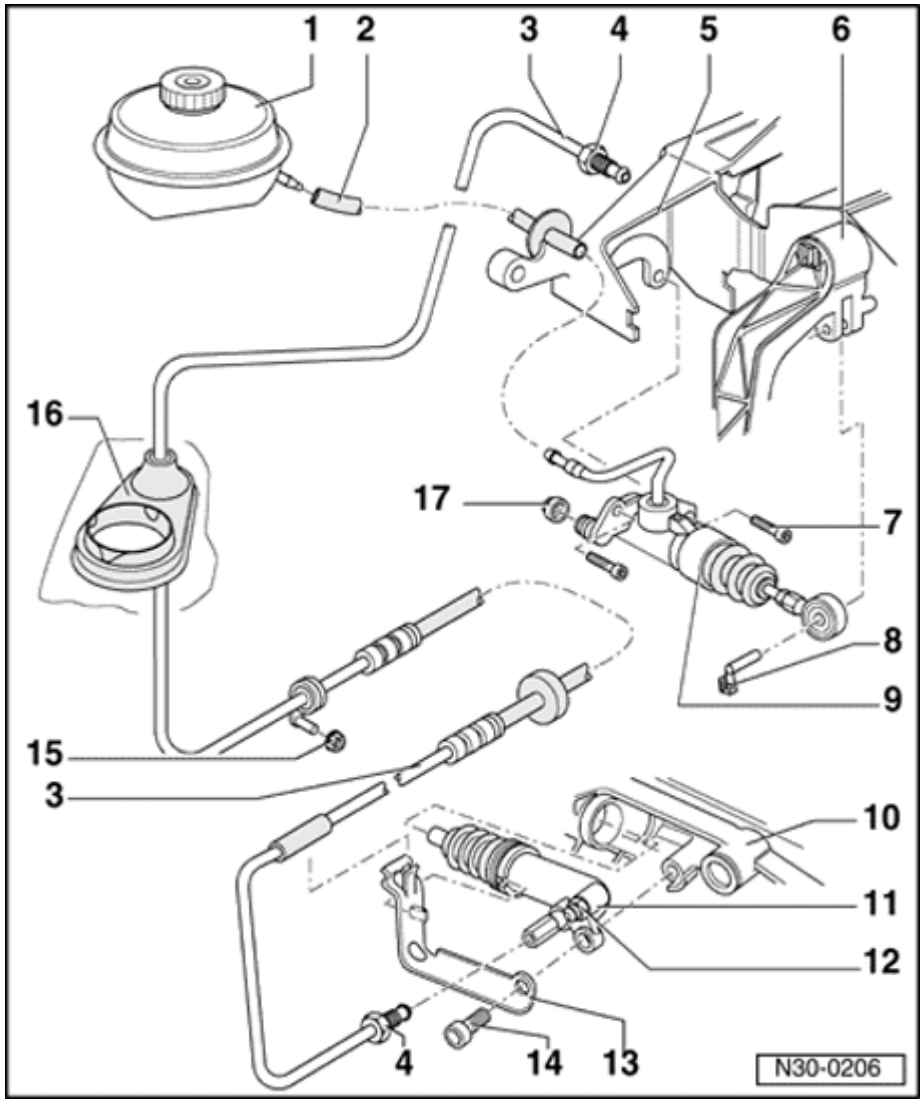
- 4.5 Nm (40 in. lb)
- Observe all CAUTIONS, WARNINGS, Notes and procedures when bleeding ⇒ Page 30-17

CAUTION!

Fill the brake fluid reservoir up to the "max" marking with brake fluid before bleeding the hydraulic clutch system with the brake bleeder.

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30-12



14 - Bracket

- Mounted to transmission

15 - Bolt

➢ 8DVA 000 504 bolt:

- 25 Nm (18 ft lb)

8DVA 000 505 ➢ socket-head bolt:

- 20 Nm (15 ft lb)

16 - Nut

- 2 Nm (18 in. lb)

17 - Seal

18 - Seal

- Must not be removed

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30-13

Clutch master cylinder, removing and installing

Special tools and equipment

3094 hose clamp

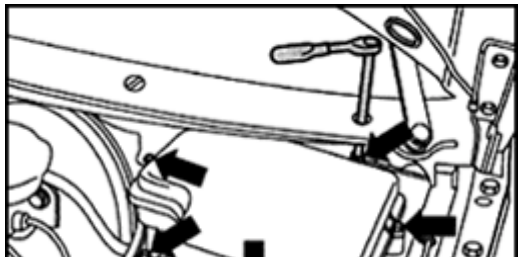
Removing

CAUTION!

Before working on the electrical system:

- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Disconnect the battery Ground (GND) strap.***

To remove E-box from plenum chamber:



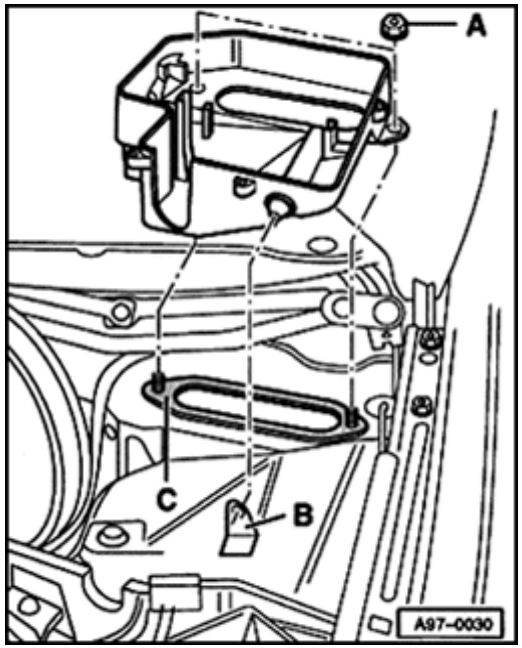
- Remove bolts (arrows) and remove cover.
- Remove Engine Control Module (ECM); if necessary remove 8-pin relay support ⇒ *Repair Manual, Electrical Equipment, Repair Group 97*
- Disconnect harness connectors at connector station.

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- Remove engine wiring harness together with rubber grommet from opening in E-box.

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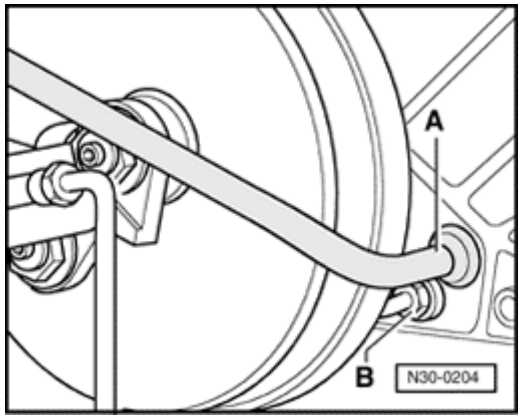
30-14



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

CAUTION!

- ***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 area of the footwell, make sure to protect the carpeting from brake fluid which may run out.***



- 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.

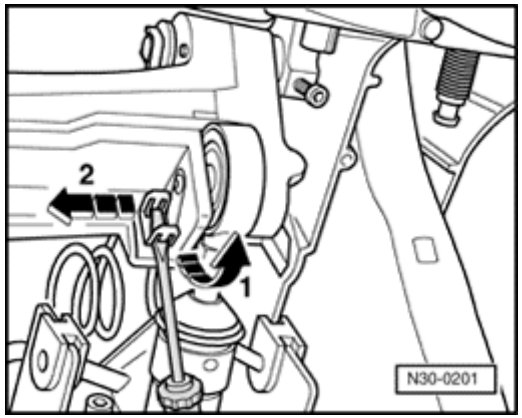
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30-15

- Remove driver's side storage compartment

  ⇒ *Repair Manual, Body Interior, Repair Group 68*

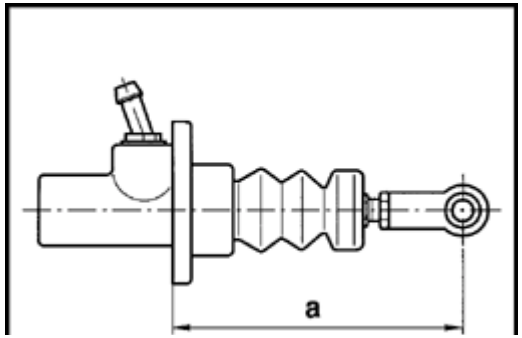
- Remove switch above clutch pedal if installed ⇒ Page 30-7



- 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:

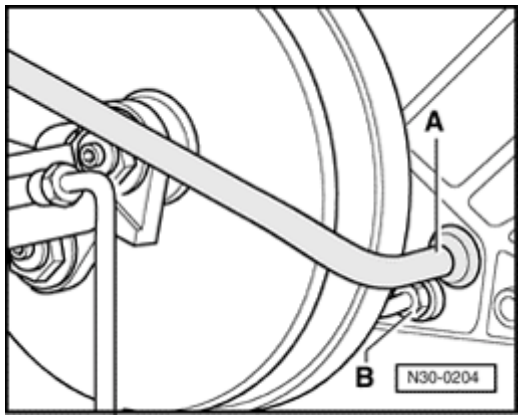


- When replacing clutch master cylinder, check dimension -a- on ball head and adjust if necessary.

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

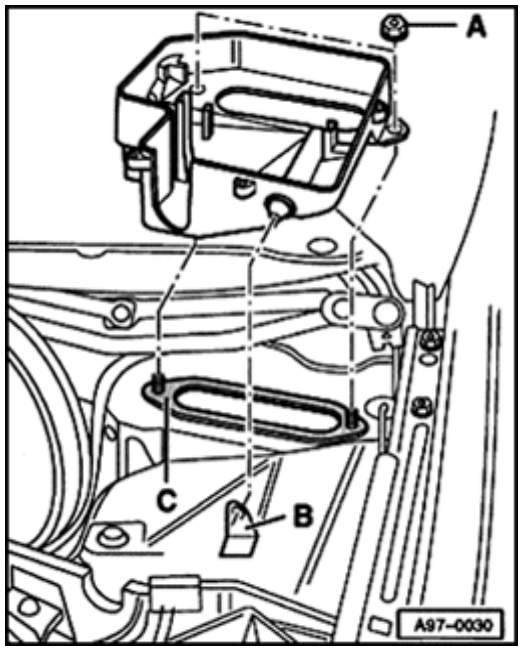
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- Connect clutch master cylinder to clutch pedal.
  Secure pin and locking plate on clutch pedal.



- 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 30-17 .

To install E-box in plenum chamber:



- Always replace seal -C-.
- Make sure seal is positioned properly, and does not cover opening or stepped metal edge.
- Install E-box by hand and evenly tighten nuts -A- to 4 Nm (35 in. lb) (i.e. imprint on E-box cover).

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30-17

Clutch system, bleeding

Special tools and equipment

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

WARNING!

Brake fluid is poisonous.

- ***It must NEVER be removed by siphoning with your mouth.***
- ***If brake fluid contacts skin or eyes, flush or wash adequately to prevent irritation. Get medical attention immediately if necessary.***
- ***Brake fluid must be disposed of properly.***

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CAUTION!

- ***Use only fresh brake fluid conforming to US standard FMVSS 116 DOT 4. Genuine VW/Audi brake fluid conforms to this specification.***
- ***Brake fluid must never be brought into contact with liquids containing mineral oil (gasoline, cleaning agents). Mineral oil damages the pistons and cups in the braking system.***
- ***Brake fluid must not be allowed to come into contact with paintwork because of its caustic effect.***
- ***Brake fluid is hygroscopic (i.e. it absorbs moisture from the surrounding air) and should therefore always be kept in airtight containers.***
- ***When carrying out the following steps, make sure that no brake fluid escapes onto the transmission.***

Notes:

- *The clutch system must be bled after carrying out work on the hydraulic clutch mechanism.*

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- *Top-off brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.*

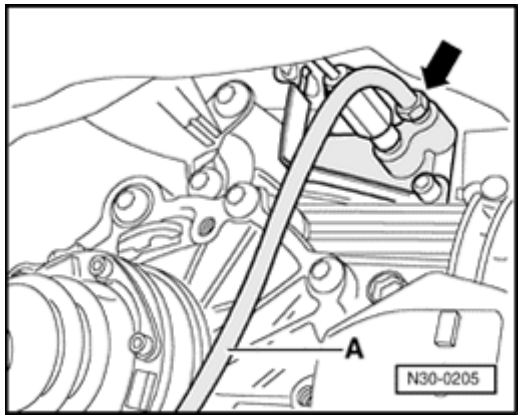
- Pull clutch pedal back to rest position.

- Connect VAG1238B brake filling and bleeding appliance or VAG1869 but do not switch on.

- If necessary, remove noise insulation panel under transmission.

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30-19



- 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.

CAUTION!

Always comply with disposal regulations.

Work pressure 2.5 bar (36 psi)

Note:

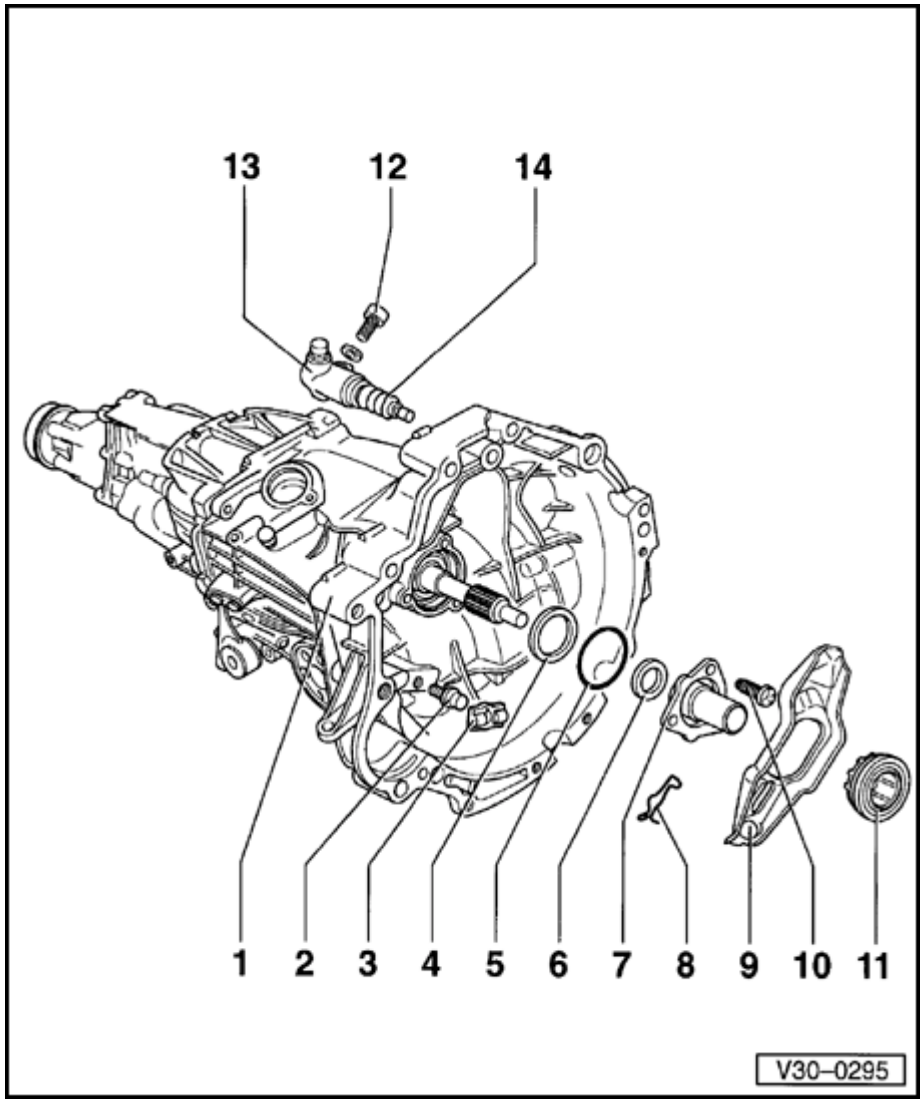
While bleeding, make sure bleeder hose remains correctly routed.

- 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.

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30-20



Clutch release mechanism, servicing

1 - Transmission

2 - Ball pivot pin

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

3 - Intermediate piece

4 - Dished washer

- Smaller diameter (rounded side) faces guide sleeve

5 - O-ring

- Always replace

6 - Seal for input shaft

- Pull out of guide sleeve using VW681 extractor lever
- Drive in onto stop using VW192 fitting sleeve

7 - Guide sleeve

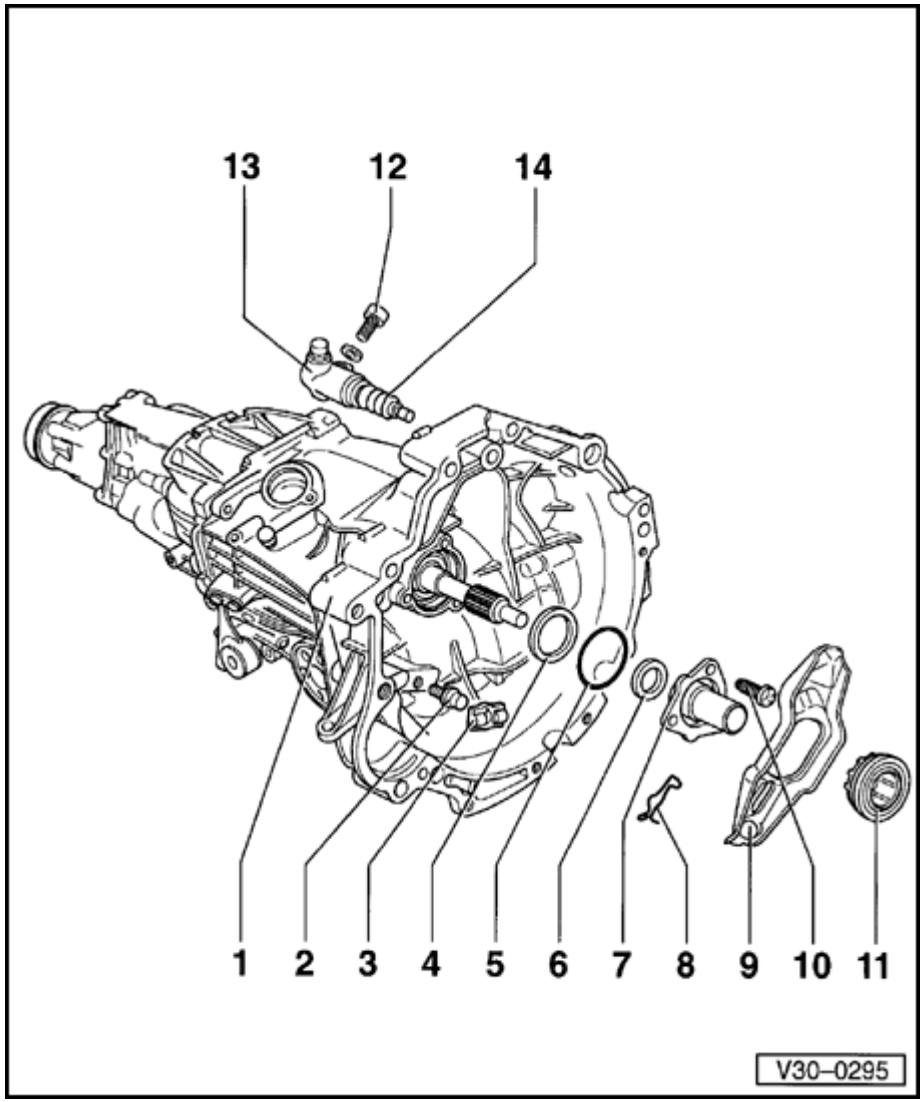
- Before removing and installing, cover input shaft splines with shrink-tube to protect seal

8 - Retaining spring

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- Secure to clutch release lever

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9 - Clutch release lever

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

10 - Torx® bolt

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

11 - Release bearing

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

12 - Bolt

➢ 8DVA 000 504 socket-head bolt

- 25 Nm (18 ft lb)

8DVA 000 505 ➢ socket-head bolt

- 20 Nm (15 ft lb)

13 - Clutch slave cylinder

- Tension clutch slave cylinder enough, so that mounting bolts can be easily installed.
- Do not operate after clutch pedal has been removed

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14 - Plunger

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

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30-22

Clutch, servicing

Special tools and equipment

- 3067 flywheel retainer
- 3176 centering mandrel

Notes:

- *Observe general repair instructions ⇒ Page 00-14 .*
- *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

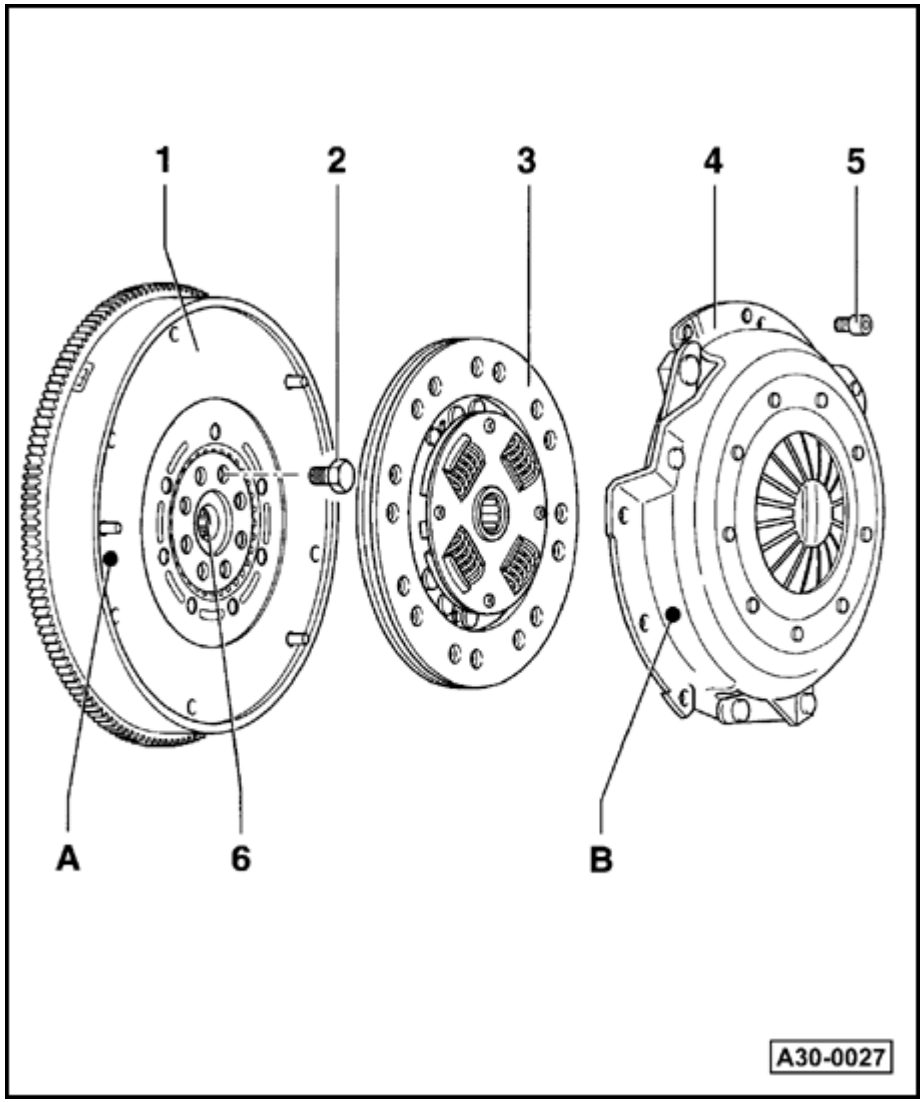
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- *and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.*

- *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.*

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30-23



- Remove transmission to work on clutch ⇒ Page 34-18 .

CAUTION!

Clutch plates or pressure plates with loose or damaged rivets must be replaced.

A - Color marking on dual-mass flywheel

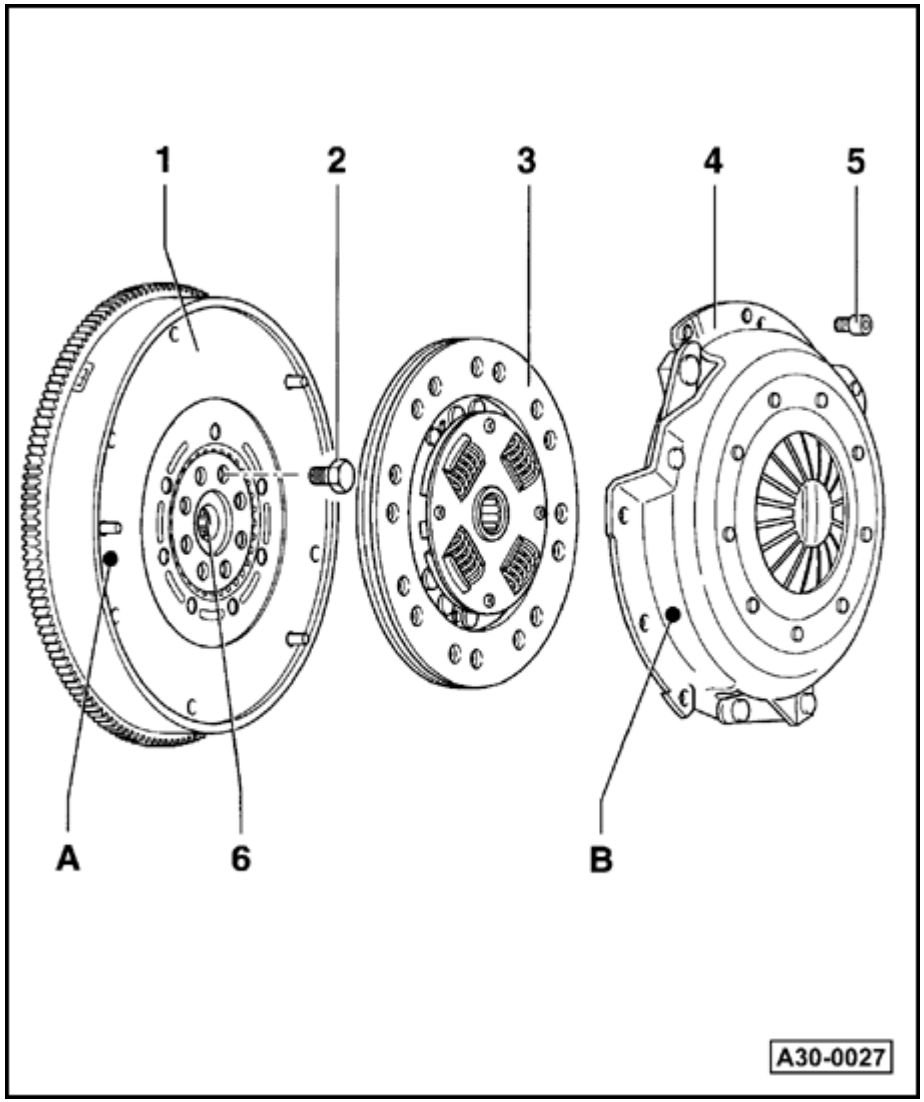
- White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate

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

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30-24



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

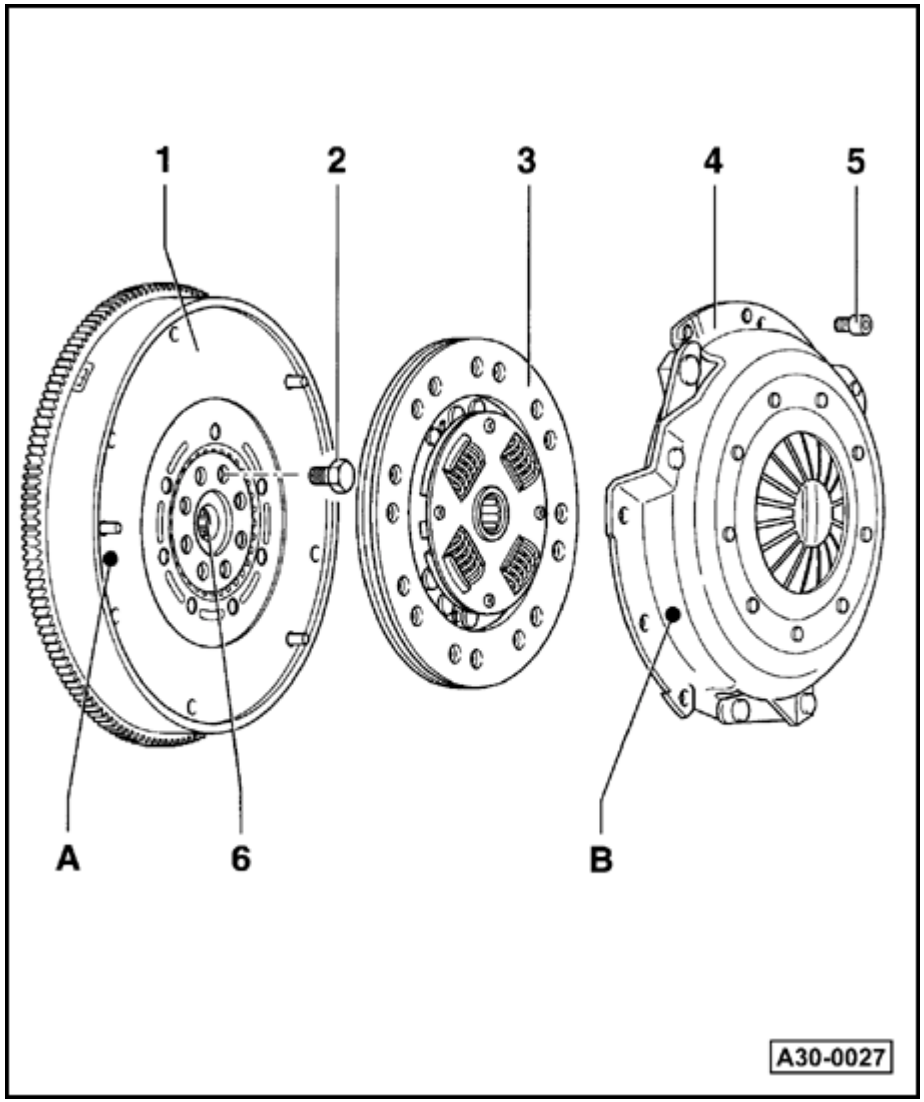
⇒ Repair Manual, Engine Mechanical, Repair Group 13

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°)

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30-25



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

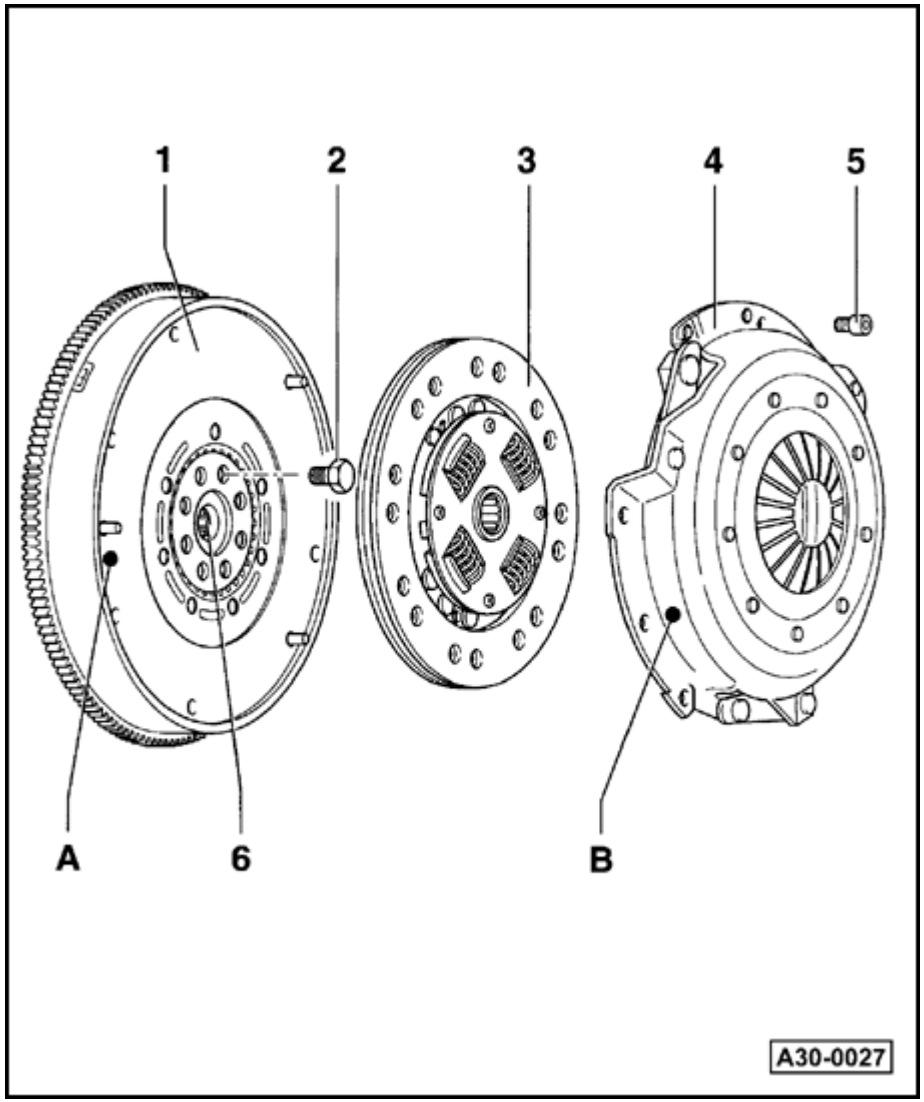
- Removing and installing ⇒ Fig. 1
- Checking ends of diaphragm spring
- Checking spring connection and rivets ⇒ Fig. 3

CAUTION!

The pressure plate is treated against corrosion and greased. Only the friction surface should be cleaned, otherwise the service life of the clutch will be considerably reduced.

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30-26



5 - Bolt

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

6 - Needle roller bearing

Removing and installing

- Repair Manual, Engine Mechanical, Repair Group 13

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30-27

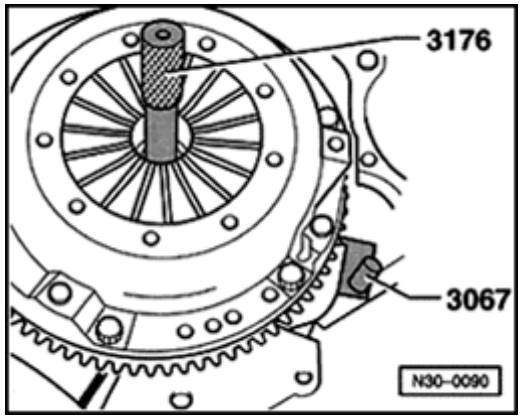


Fig. 1 Centering clutch plate and removing and installing pressure plate

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

CAUTION!

- ***Clutch lining and contact surface of pressure plate must make full contact with flywheel before bolts are inserted.***
- ***Tighten bolts evenly and in diagonal sequence to avoid damaging centering holes in the pressure plate and centering pins on the flywheel.***

- Make sure white color marking on dual-mass flywheel lines up with white color marking on pressure plate when assembling.
- Loosen and tighten bolts in stages and in diagonal sequence.

  Final tightening torque: 25 Nm (18 ft lb)
- Reverse position of 3067 flywheel retainer when removing.
- Use 3176 centering mandrel to center clutch plate.

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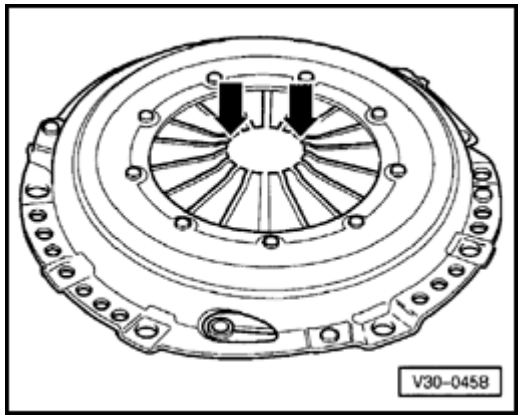


Fig. 2 Checking ends of the diaphragm spring

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

CAUTION!

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

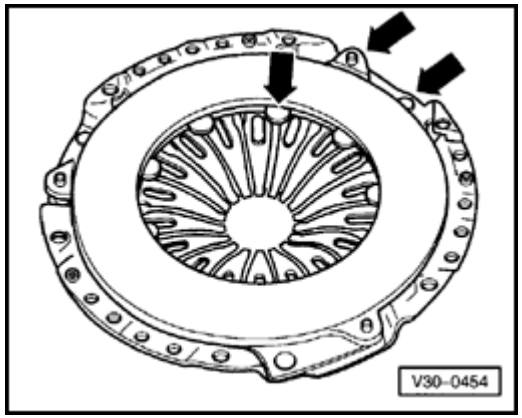


Fig. 3 Checking spring connection and rivets

- 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).

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34-1

Shift linkage, servicing

Notes:

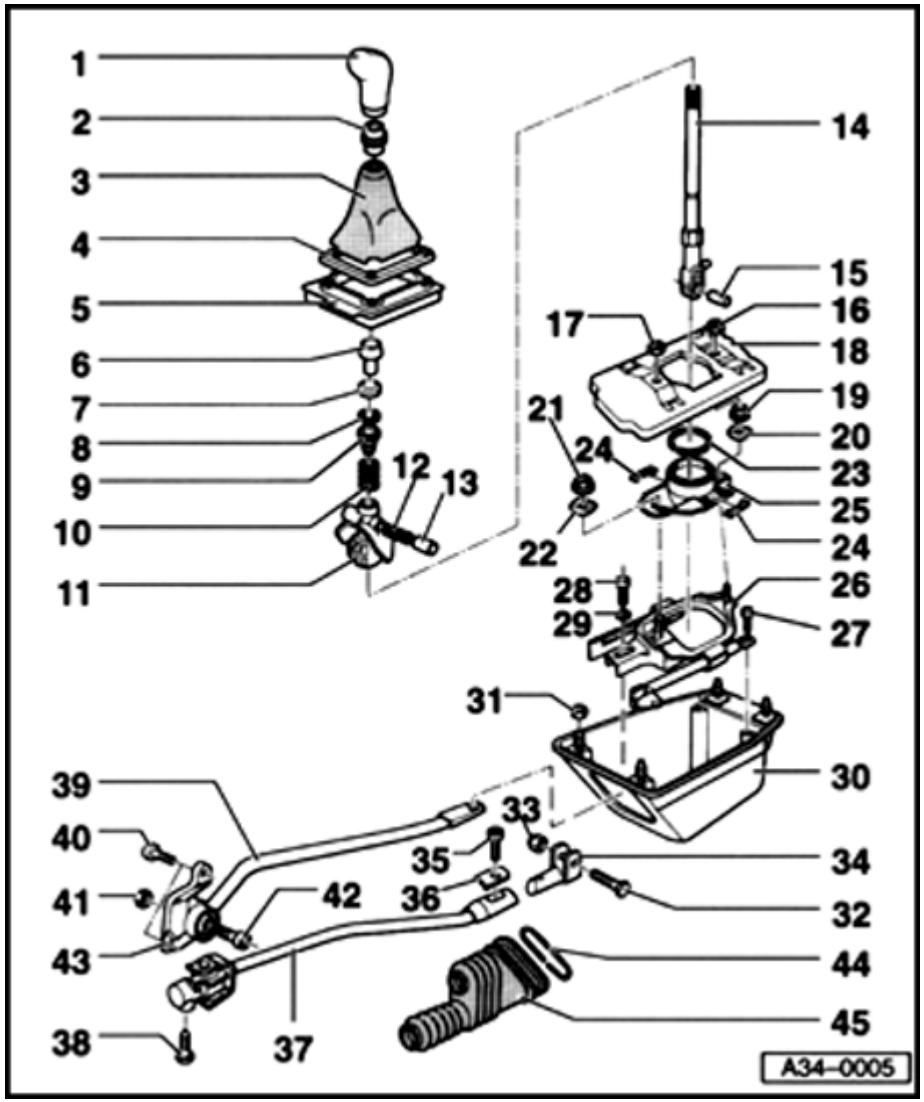
- *Adjusting ⇒ Page 34-12 .*
- *To remove the complete shift linkage, remove the exhaust system.*

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- *To disassemble the shift linkage in the installation position, the shift mechanism housing must be lowered.*

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34-2



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

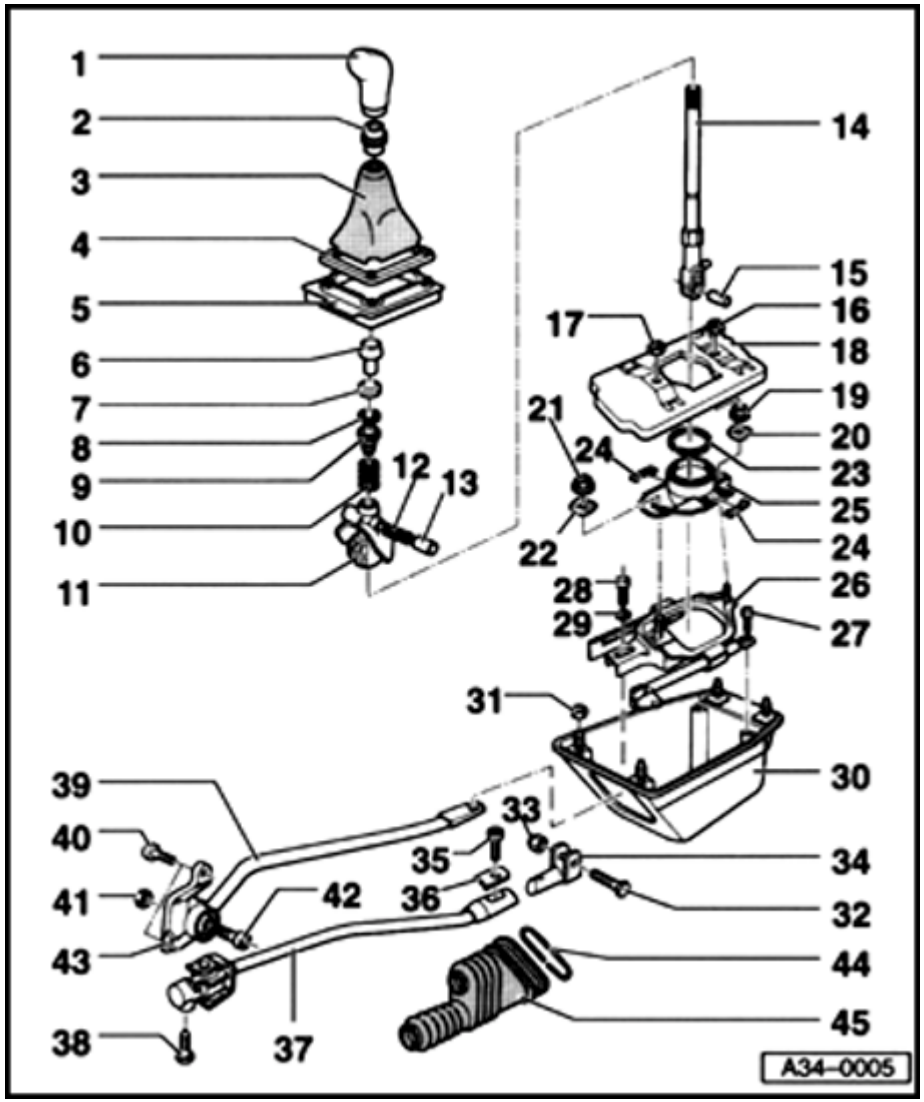
10 - Compression spring

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

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34-3



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

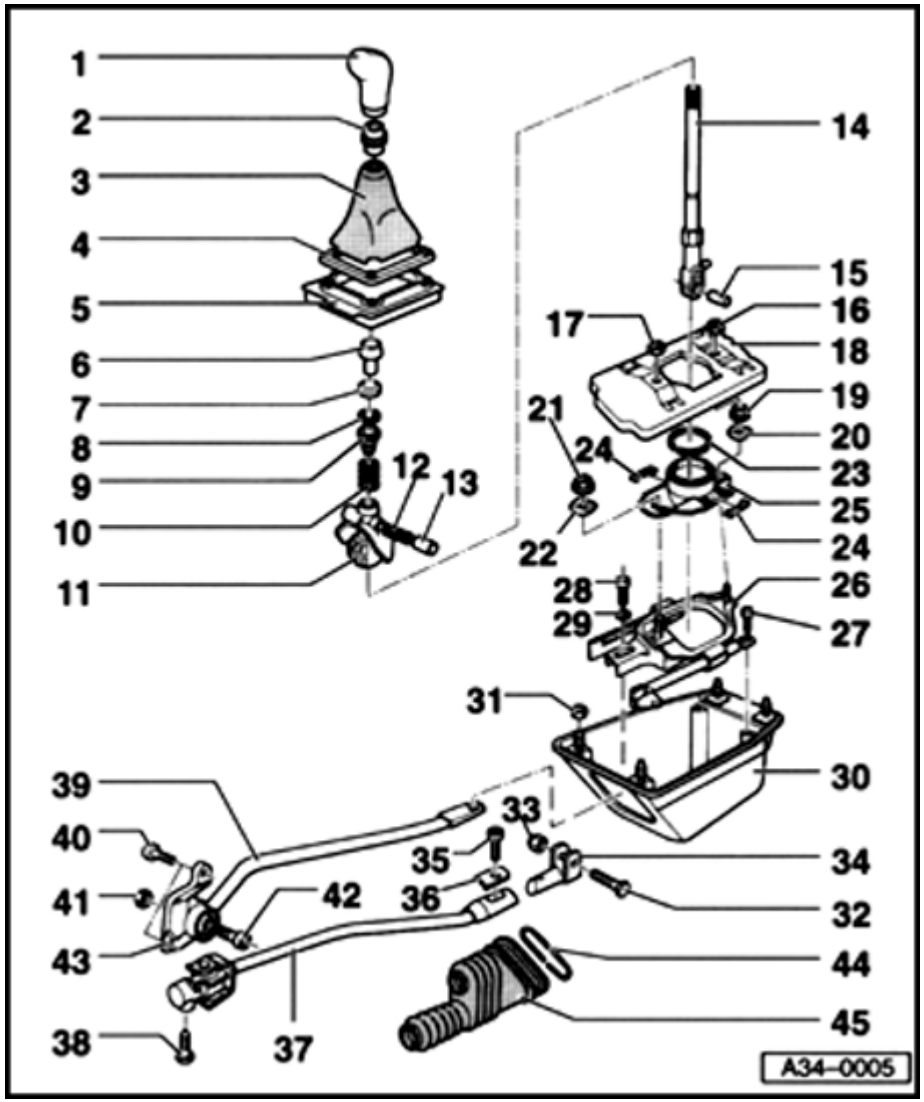
21 - Nut

- 23 Nm (17 ft lb)

22 - Connecting piece

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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

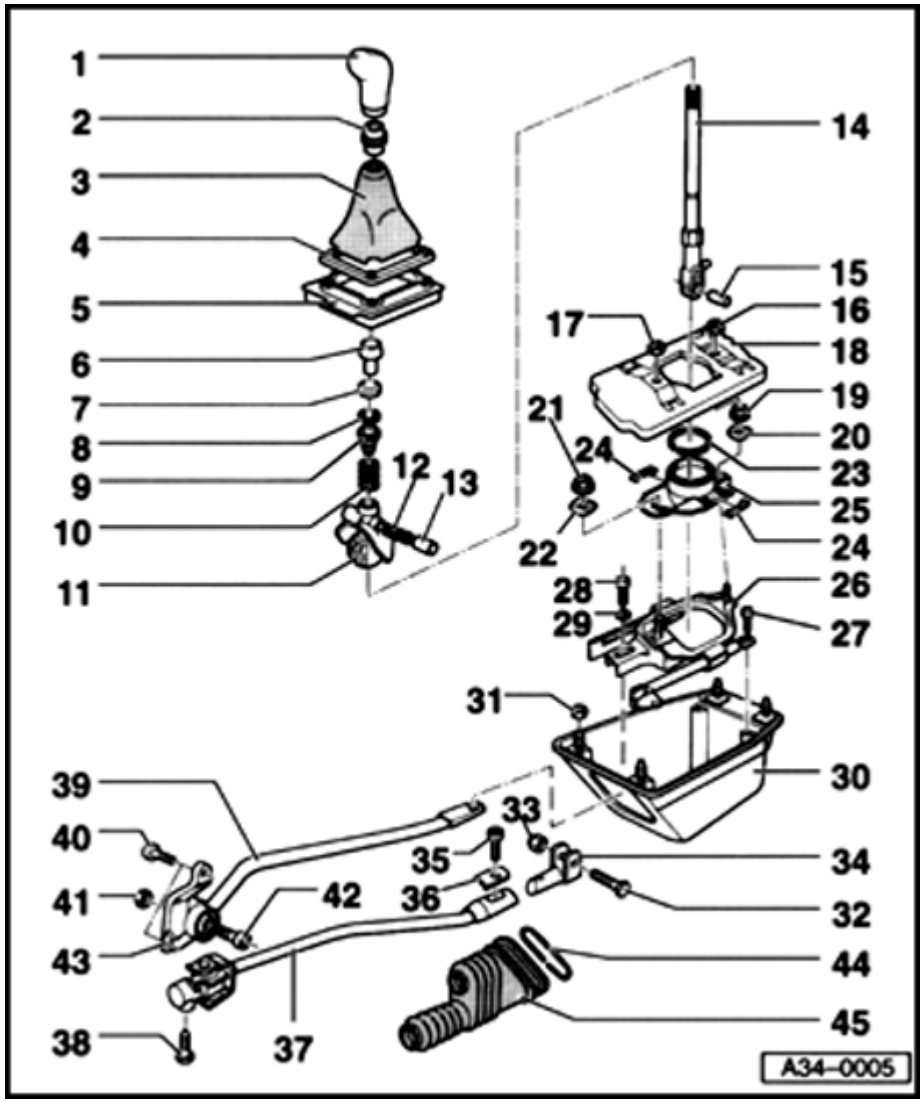
31 - Nut

- 10 Nm (7 ft lb)

32 - Bolt

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34-5



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

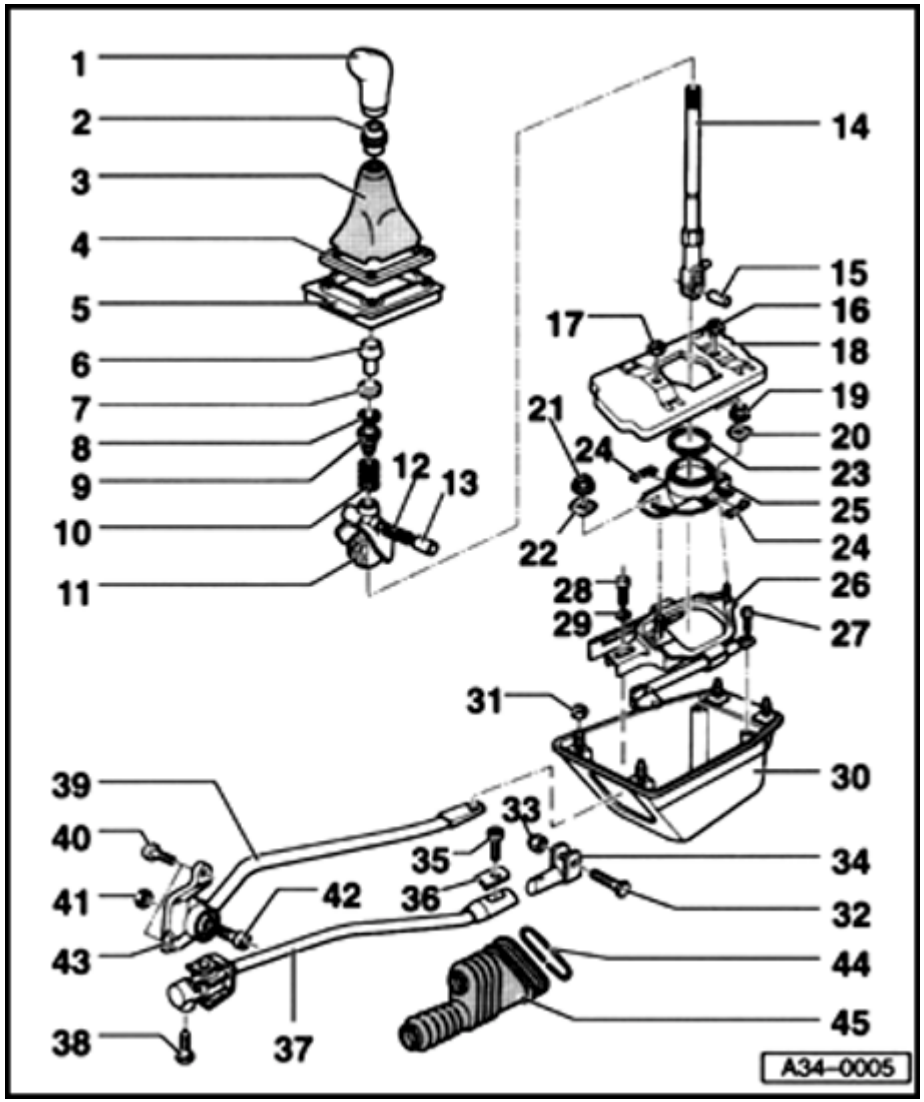
38 - Bolt

- 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

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40 - Bolt

- 40 Nm (30 ft lb)

41 - Nut

- 40 Nm (30 ft lb)

42 - Bolt

43 - 4546Mounting bracket for pivot rod

- Revised after 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
- Pivot rod, fastening 06.96 ⇒ Fig. 1

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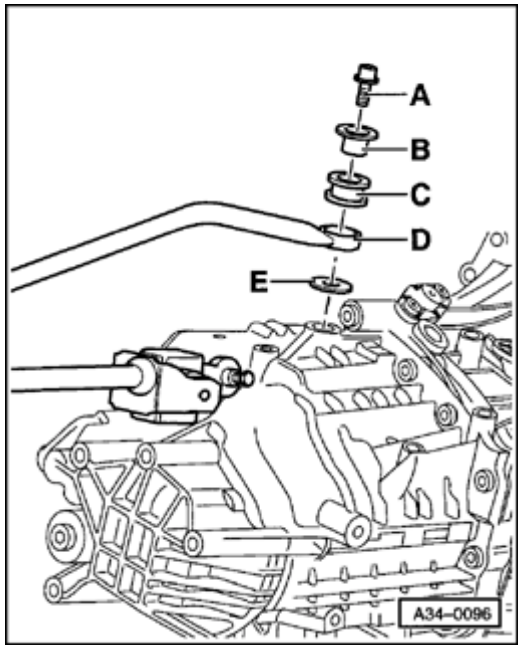


Fig. 1 Pivot rod fastening to transmission 06.96

As of 06.96 the pivot rod is bolted directly to the transmission cover. The additional mounting bracket (item -43-, ⇒ Page 34-6) 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

Note:

Illustration shows manual transmission 012.

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34-8

Shift mechanism, removing and installing

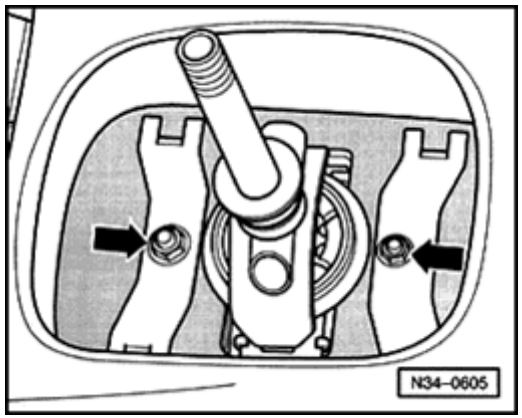
Removing

- Remove shift knob and housing cover.

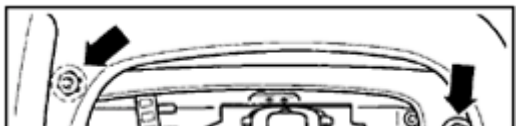
- Remove center console

  ⇒ *Repair Manual, Body Interior, Repair Group 70*

- Remove cover.



- Remove cover for shift mechanism housing (arrows).



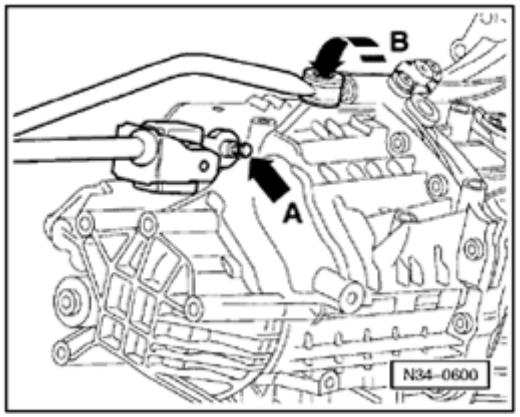
- Remove nuts securing shift mechanism housing (arrows).

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- 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 driveshaft ⇒ Page 39-71 .



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

Note:

Illustration shows manual transmission 012.

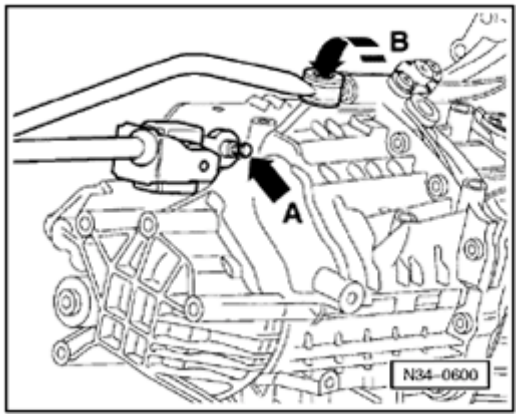
- Swing shift mechanism housing together with shift rod and pivot rod downward and remove.

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Installing

Install in reverse order of removal, note the following:

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



- Secure shift rod (arrow -A-).
- Secure pivot rod to transmission (arrow -B-).
- Adjust shift linkage ⇒ Page 34-12 .
- Install driveshaft ⇒ Page 39-71 .
- Adjust driveshaft ⇒ Page 39-79 .
- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

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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	

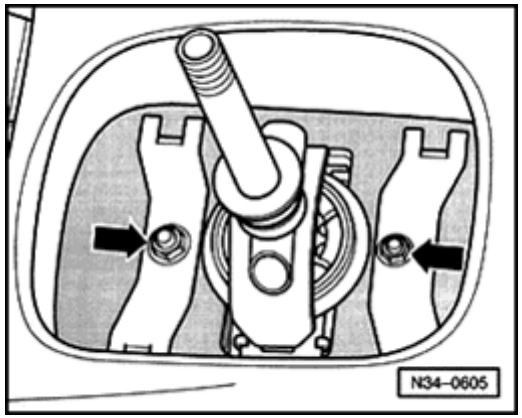
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Shift linkage, adjusting

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

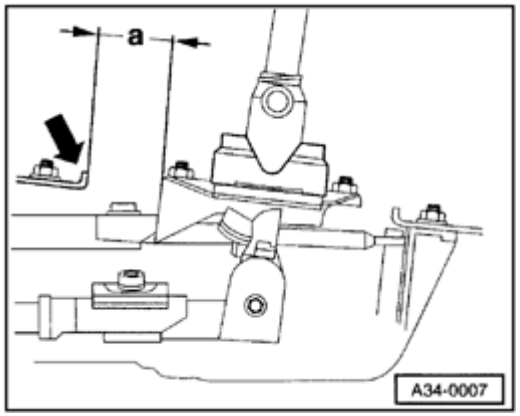
- Remove shift knob and housing cover.



- Remove cover for shift mechanism housing (arrows).

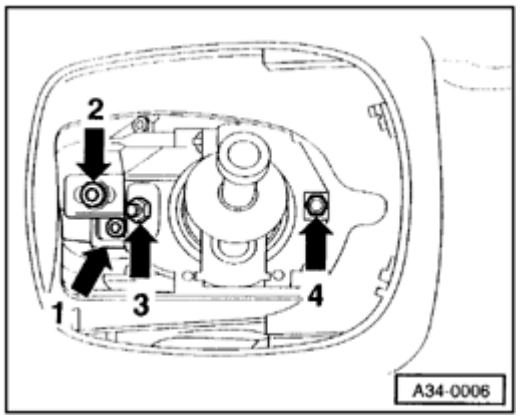
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- Measure dimension between body opening and rear shift rod (in shift mechanism).



Dimension -a-: 37 mm (1.456 in.)

If dimension -a- is not attained



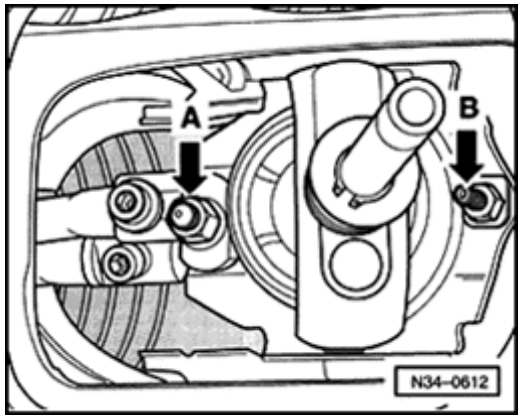
- Loosen bolt for pivot rod (arrow -2-).

  Rear pivot rod (in shift mechanism) should move freely in both directions on slide.

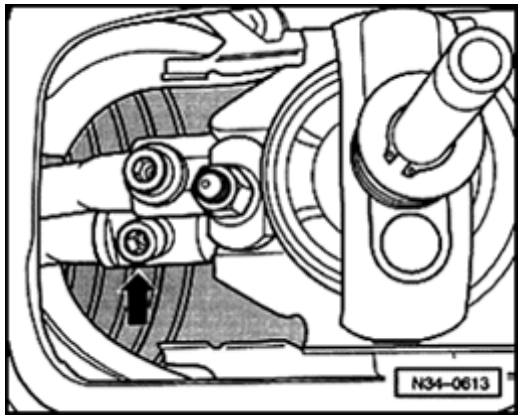
- Adjust dimension -a- by moving pivot rod.
- Tighten pivot rod bolt.

  Tightening torque: 23 Nm (17 ft lb)

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

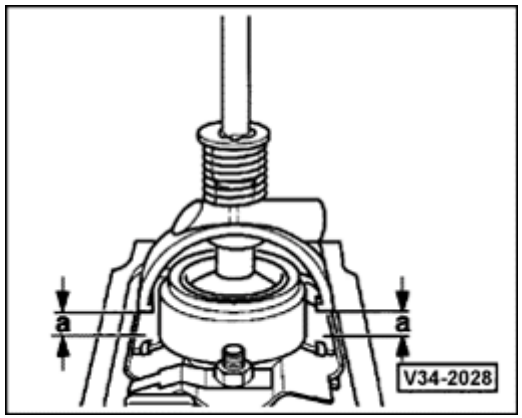


- Loosen bolt for shift rod (arrow).

  Connection between shift rod and shift mechanism must move freely.

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34-15



- 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.

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Shift mechanism adjustment, checking

Requirement

- Shift lever must rest in 3rd/4th gear 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 (0.196-0.394 in.) (measured at shift knob).

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

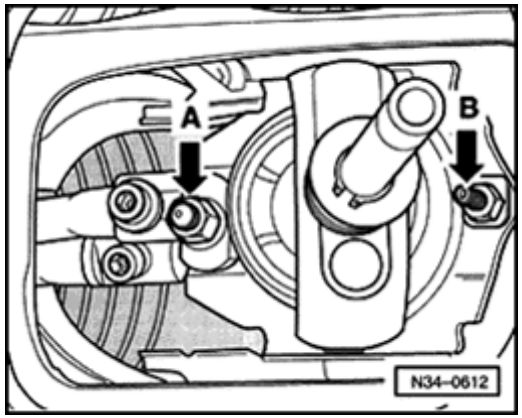
  Shift lever should return by itself from the 5th/reverse gear gate and move into 3rd/4th gear gate.

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- Check fine adjustment if necessary ⇒ Page 34-17 .

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34-17



Fine adjustment

If shift adjustment is not OK, proceed as follows:

- 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 34-86* .

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Transmission, removing and installing

Special tools and equipment

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

Removing

CAUTION!

Before disconnecting the battery:

- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***

- Disconnect battery

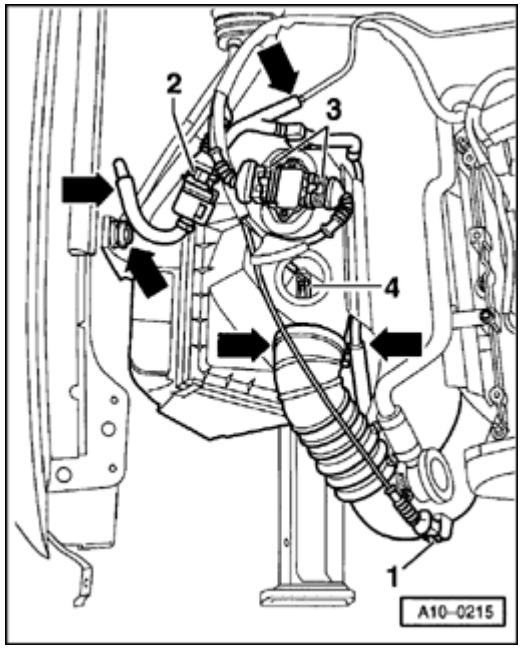
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- Remove driveshaft ⇒ Page 39-71 .

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34-19

4-cylinder engine



- Disconnect wires/and harness connectors as follows:

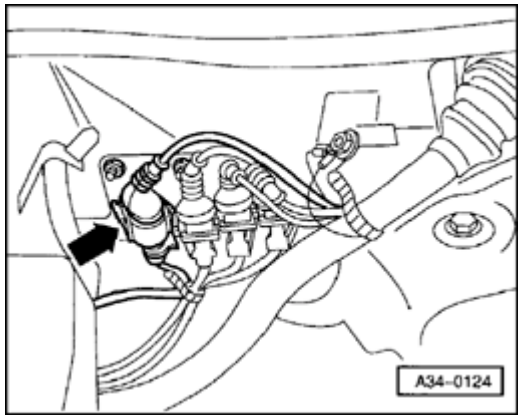
1 - At solenoid valve for wastegate bypass regulator valve -N75-

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 and lay to one side.



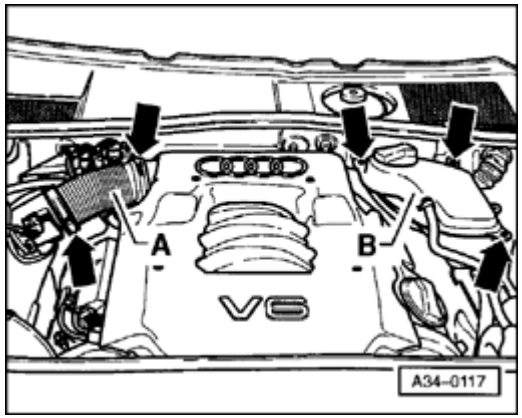
- Remove harness connector for Heated Oxygen Sensor (HO2S) (arrow) and move wiring clear.
- Remove nuts securing turbocharger to front exhaust pipe.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Note:

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

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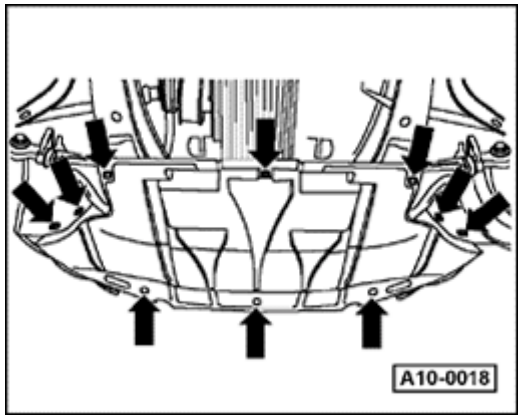


6-cylinder engine

- 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.

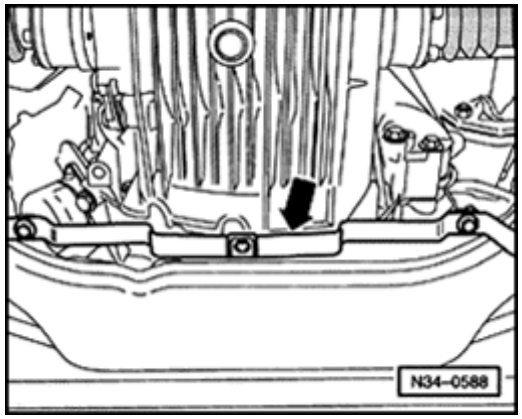
All models

- Remove engine/transmission mounting bolts accessible from above.



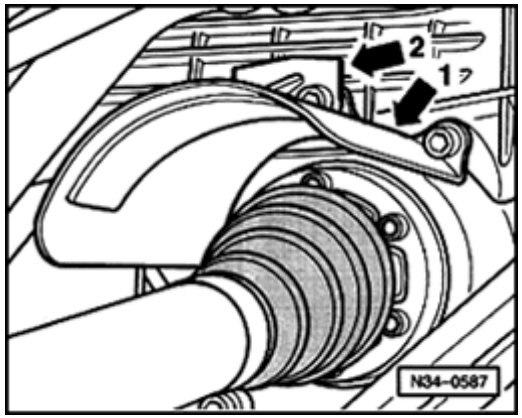
- Remove noise insulation panel (arrows).

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- Remove bracket for noise insulation panel (arrow).

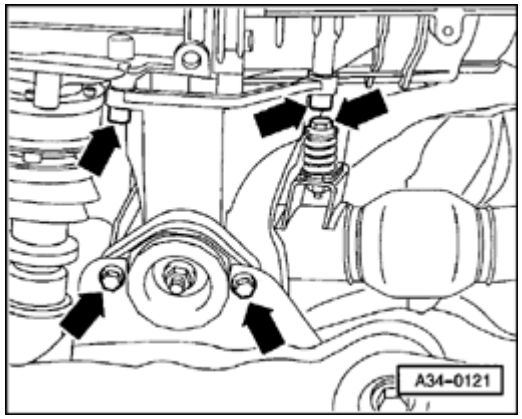
4-cylinder engine



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

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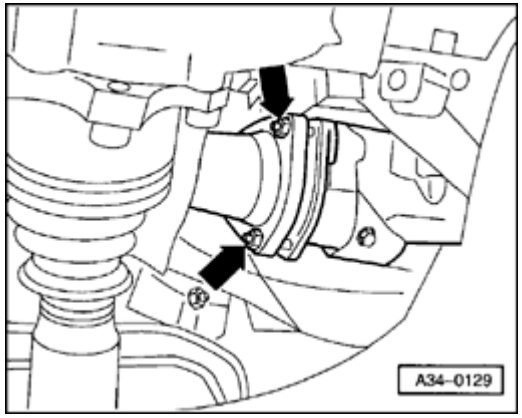
34-22



- 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.



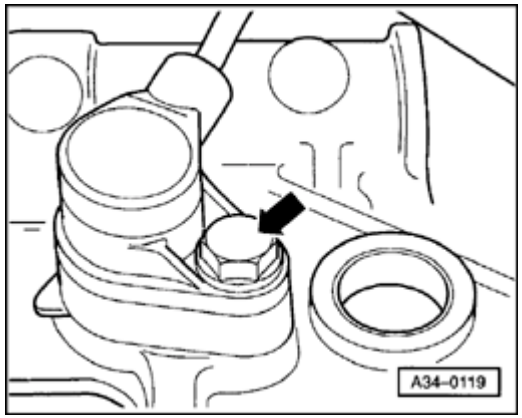
- Unbolt front exhaust pipes together with Three Way Catalytic Converters (TWCs) from left and right exhaust manifolds (3 nuts on each side) (arrows).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

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34-23

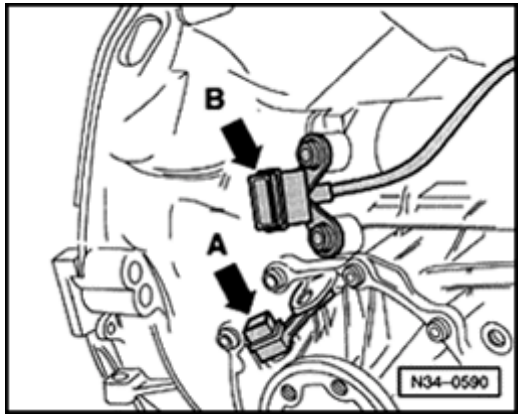
All models



- Remove engine speed (RPM) sensor -G28- on left of transmission (arrow) and move clear to side.
- Disconnect drive axles from flange shafts and rest them on suspension links.

Note:

Take care not to damage protective coating on drive axles.

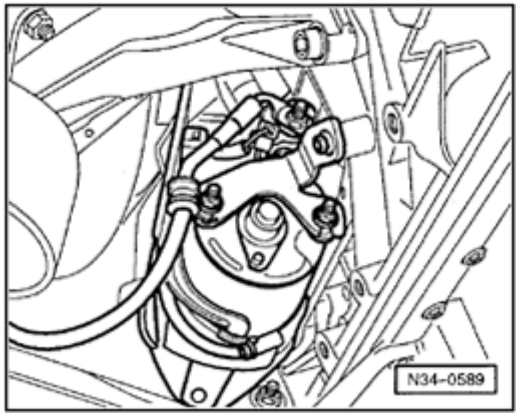


- Disconnect harness connector off Vehicle Speed Sensor -VSS- (arrow -A-).

- Disconnect back-up light connector (multi-function sensor) (arrow -B-).
- Disconnect all other electrical connections and ground wires from transmission and from engine/transmission mounting bolts.

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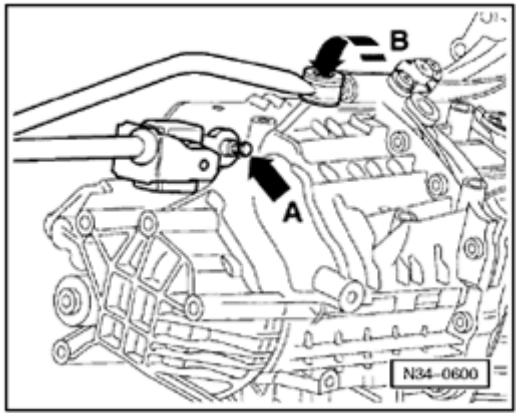
34-24



- Remove starter from engine/transmission and secure if necessary ⇒ *Repair Manual, Electrical Equipment, Repair Group 27*

Notes:

Starter cables do not have to be disconnected.



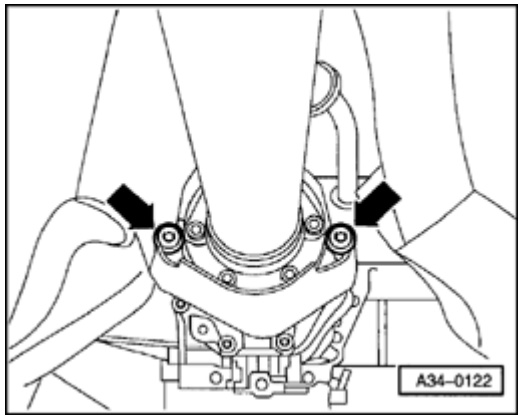
- Disconnect shift rod (arrow -A-).
- Remove socket-head bolt from pivot rod (arrow -B-).

Note:

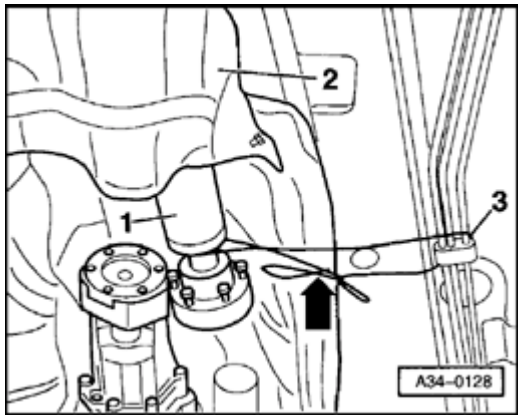
Illustration shows manual transmission 012.

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34-25



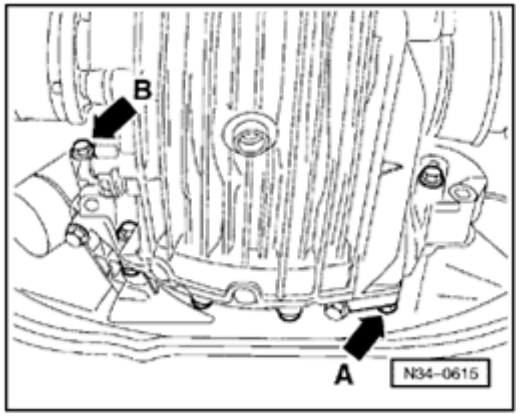
- Remove heat shield for driveshaft from Torsen differential cover (arrows).



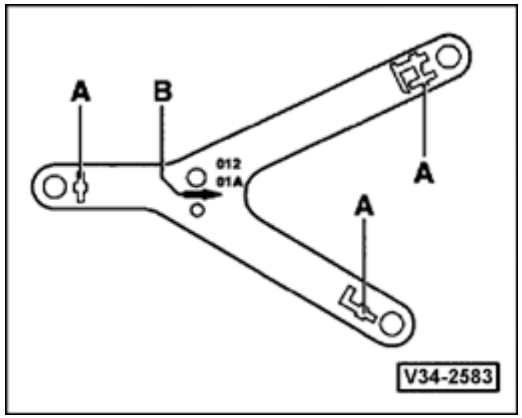
- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrow).

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34-26



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



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

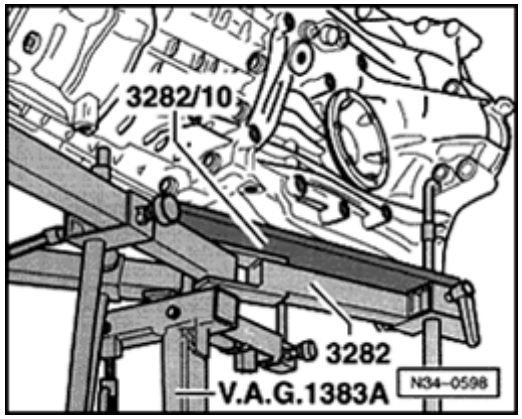
A - Attachments

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.*

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34-27

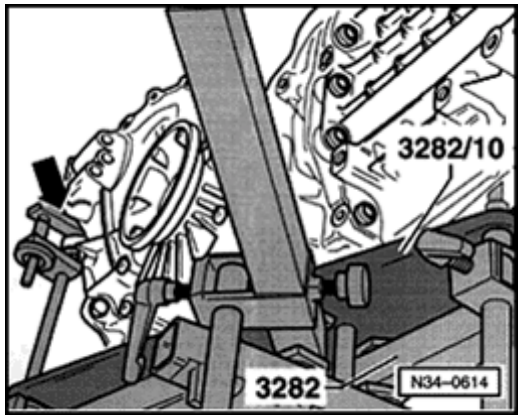


- Roll VAG1383A transmission jack with 3282 transmission support under transmission and support transmission.

Note

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

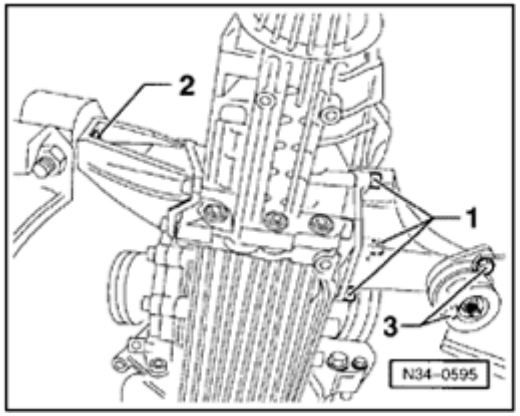
- Support transmission using VAG1383A transmission jack.



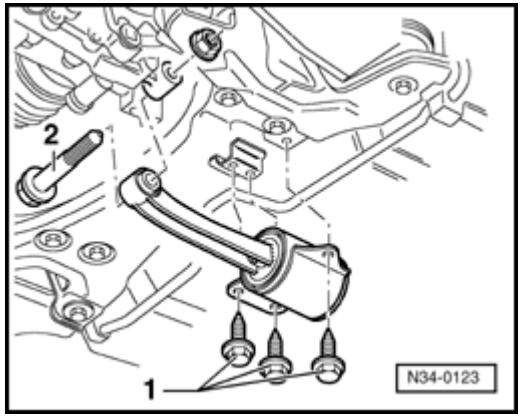
- Align adjustment plate parallel to transmission and lock safety support (arrow) on transmission.

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4-cylinder engine



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



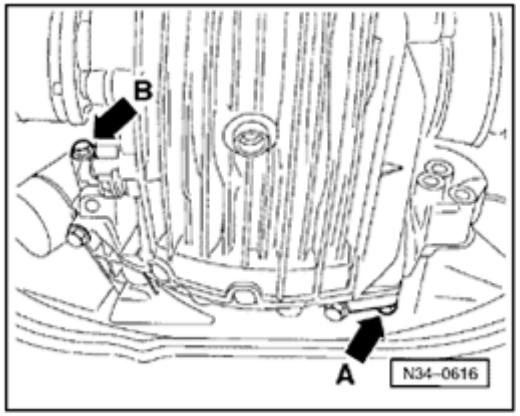
6-cylinder engine

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

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34-29

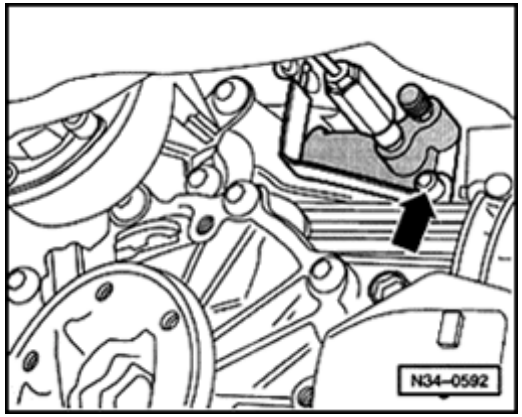
All models



- 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.

CAUTION!

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



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

CAUTION!

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

Make sure there is sufficient clearance of the flange shafts when lowering the transmission.

- Lower transmission completely.

Note:

Make sure drive axles have sufficient clearance when lowering transmission.

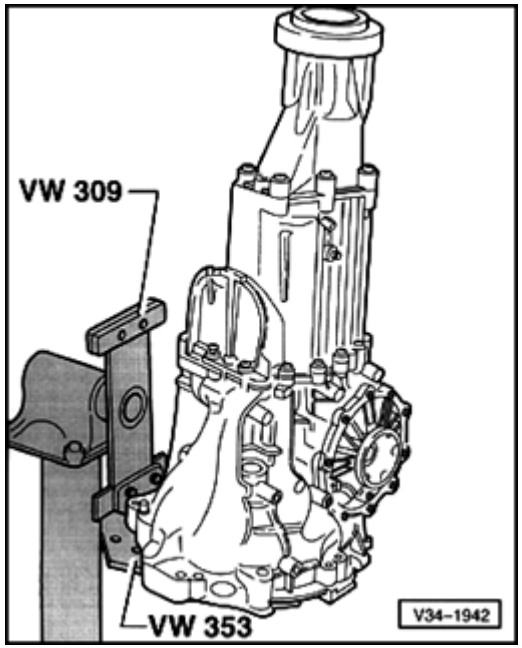
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34-30

Securing transmission to assembly stand

Special tools and equipment

- VW309 holding plate
- VW353 transmission support



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

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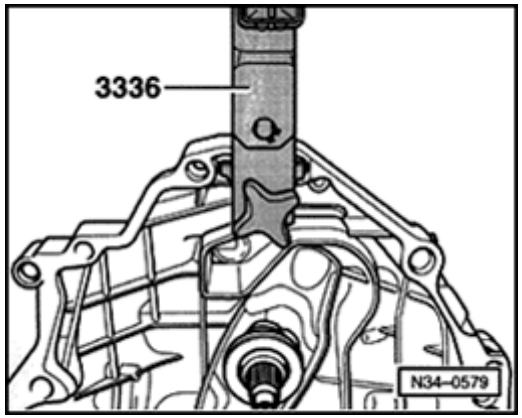
34-31

Transporting the transmission

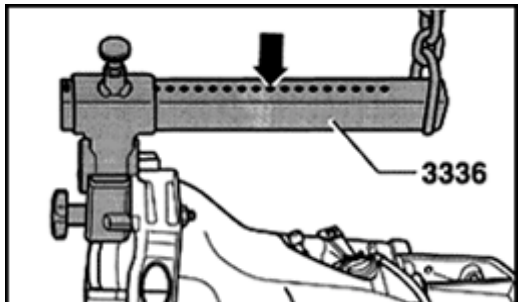
Special tools and equipment

- 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.



- Bolt 3336 transmission support jig to transmission housing.



- Adjust support jig on sliding piece using locking pin.

  Number of holes visible (arrow): 17

- Lift transmission using workshop crane and 3336 transmission support jig.

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Installing

Install in 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 very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.

- Check clutch release bearing for wear, replace if necessary.

- Coat contact surface of clutch slave cylinder pivot rod with thin layer of copper grease, e.g. 381 351 TE.

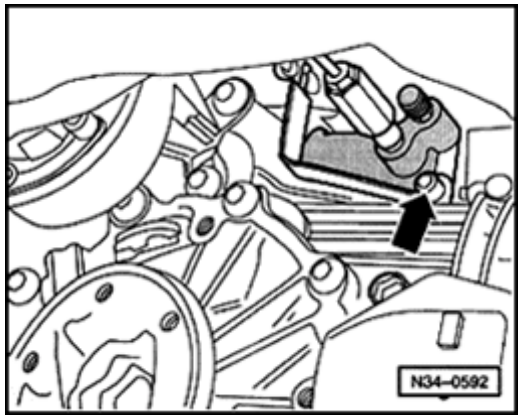
- Threaded holes for mounting clutch slave cylinder to transmission and shift lever to shift rod must be cleaned of locking compound residue using thread tap before installation .

- Make sure dowel sleeves for aligning engine/transmission are installed in cylinder block, install if necessary.

- Always replace self locking nuts.

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34-33



- Lift up transmission until clutch slave cylinder with mounting bracket for line/hose can be installed (arrow).
- Install intermediate plate (if applicable) between transmission and engine onto appropriate engine dowel sleeves.
- Make sure intermediate plate is correctly positioned on engine.
- Install lower engine/transmission and starter mounting bolts, and install starter ⇒ *Repair Manual, Electrical Equipment, Repair Group 27*
- Before installing, use tap to clean threads in flange shaft for driveshaft on transmission to remove traces of locking compound.
- Replace gaskets on drive axles and on front of driveshaft ⇒ Page 39-69 .
- Install driveshaft ⇒ Page 39-71 .
- Check adjustment of shift rod and pivot rod, re-adjust if necessary ⇒ Page 34-12 .

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- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Check transmission oil level ⇒ Page 34-38 .

- After connecting battery, enter anti-theft code for radio

⇒ *Repair Manual, Electrical Equipment, Repair Group 91*

- Run power windows fully up by pressing switches.

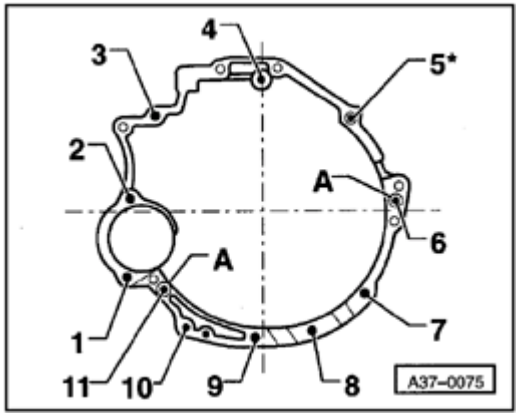
- Operate all power window switches again and hold for at least one second in "close" position to activate automatic one-touch function.

- Set clock to correct time.

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34-35

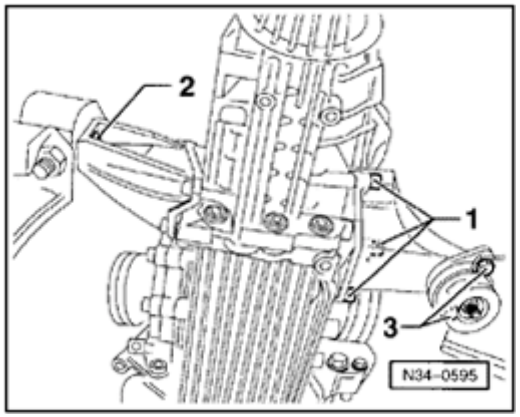
Tightening torques



➢ 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

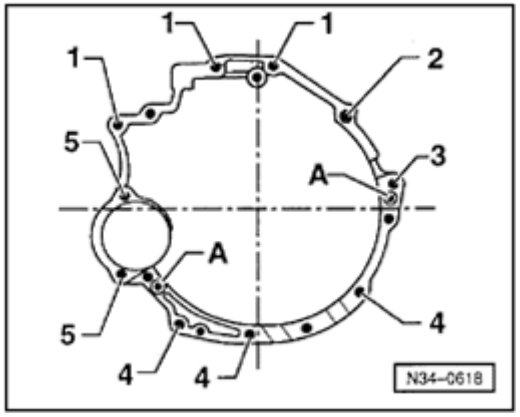


➢ Transmission/engine assembly mount (4-cylinder)

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)

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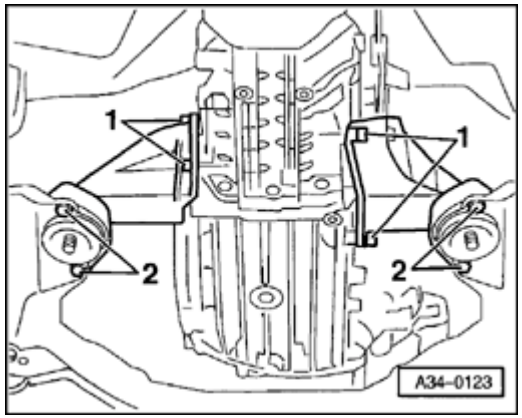
34-36



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)

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Component	Nm	ft lb
Drive axle to flange shaft M8	40	30
Drive axle to flange shaft M10	80	59
Engine speed sensor -G28-	10	7
Clutch slave cylinder to transmission	20	15
Heat shields over drive axles on transmission	23	17
Shift rod to transmission	23	17
Pivot rod to transmission	40	30
Driveshaft to transmission	55	41
Heat shield for driveshaft to cover of Torsen differential	25	18
Three Way Catalytic Converter (TWC) to mounts	25	18
Front exhaust pipe to turbocharger or exhaust manifold	25	18
Clamp for exhaust pipe	40	30
Bracket for noise insulation panel to body	25	18

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34-38

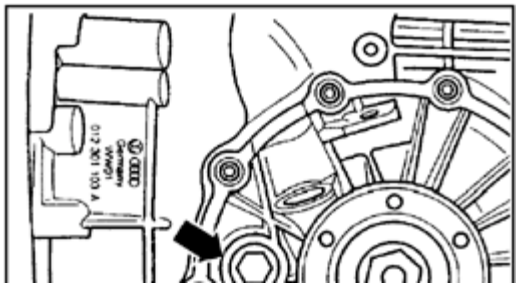
Transmission oil level, checking

Special tools and equipment

- 17 mm wrench insert hex socket or
- 3357 triple square socket driver

Notes:

- *The oil filler plug is on the left of the transmission below the speedometer vehicle speed sensor and may be concealed by the heat shield for the drive axle.*
- *Depending on the version installed, use either 3357 triple square socket driver or a 17 mm to loosen the oil filler plug.*
- *Use 3357 triple square socket driver to loosen the oil drain plug.*



- To check oil level, remove oil filler plug (arrow).

  Specification: Oil level up to bottom of filler hole
- Top off transmission oil if necessary.

  Specification ⇒ Page 00-3

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- Install oil filler plug.

  Tightening torque: 25 Nm (18 ft lb)

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34-39

Cover with Torsen differential, removing and installing

- Transmission installed

Special tools and equipment

- 3337 ring spanner 7-piece set (only for vehicles with 6-cylinder engine)
- VAG1306 drip tray

Removing

4-cylinder engine

- Remove rear section of exhaust system (rearward of exhaust pipe clamp).

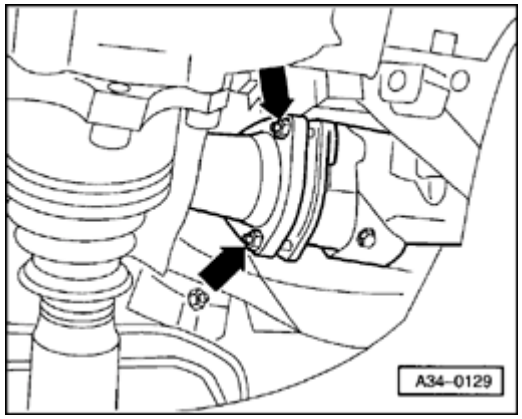
⇒ Repair Manual, Engine Mechanical, Repair Group 26

6-cylinder engine

- Remove Heated Oxygen Sensor (HO2S) from right exhaust pipe using 3337 ring spanner 7-piece set, and move clear to side.
- Remove heat shield above right drive axle.

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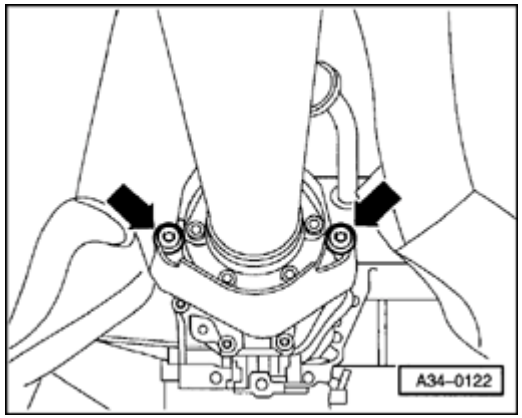
34-40



- Remove front exhaust pipe together with Three Way Catalytic Converter (TWC) (right side) from exhaust manifold (arrows) (3 nuts).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

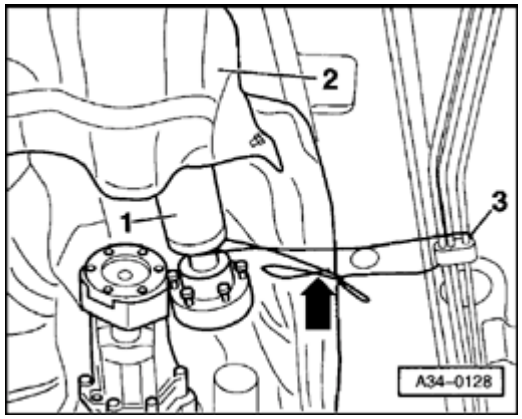
All models



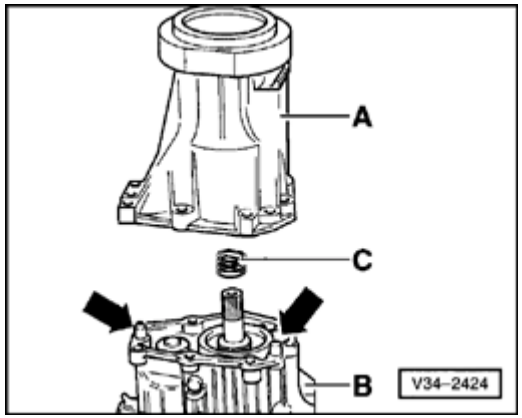
- Remove heat shield for driveshaft from Torsen differential cover (arrows).

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34-41



- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrow).
- Place VAG1306 underneath and drain gear oil.



- Remove cover -A- together with Torsen differential from transmission cover -B-.

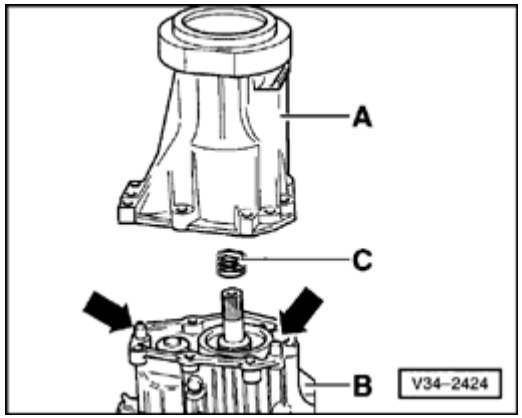
Note:

Illustration is shown with transmission removed.

- Remove compression spring -C- from drive pinion.

Torsen differential cover, servicing, removing and installing ⇒ Page 34-68

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Installing

Install in reverse order of removal, note the following:

- Clean sealing surfaces and coat with AMV 188 000 02.

- Make sure dowel sleeves for Torsen differential cover -A- are installed in transmission cover -B- (arrows).
- Install compression spring -C- over drive pinion onto hollow shaft
- Install driveshaft ⇒ Page 39-71 .
- Check oil level in transmission and top up if necessary ⇒ Page 34-38 .
- Align exhaust system free of stress.

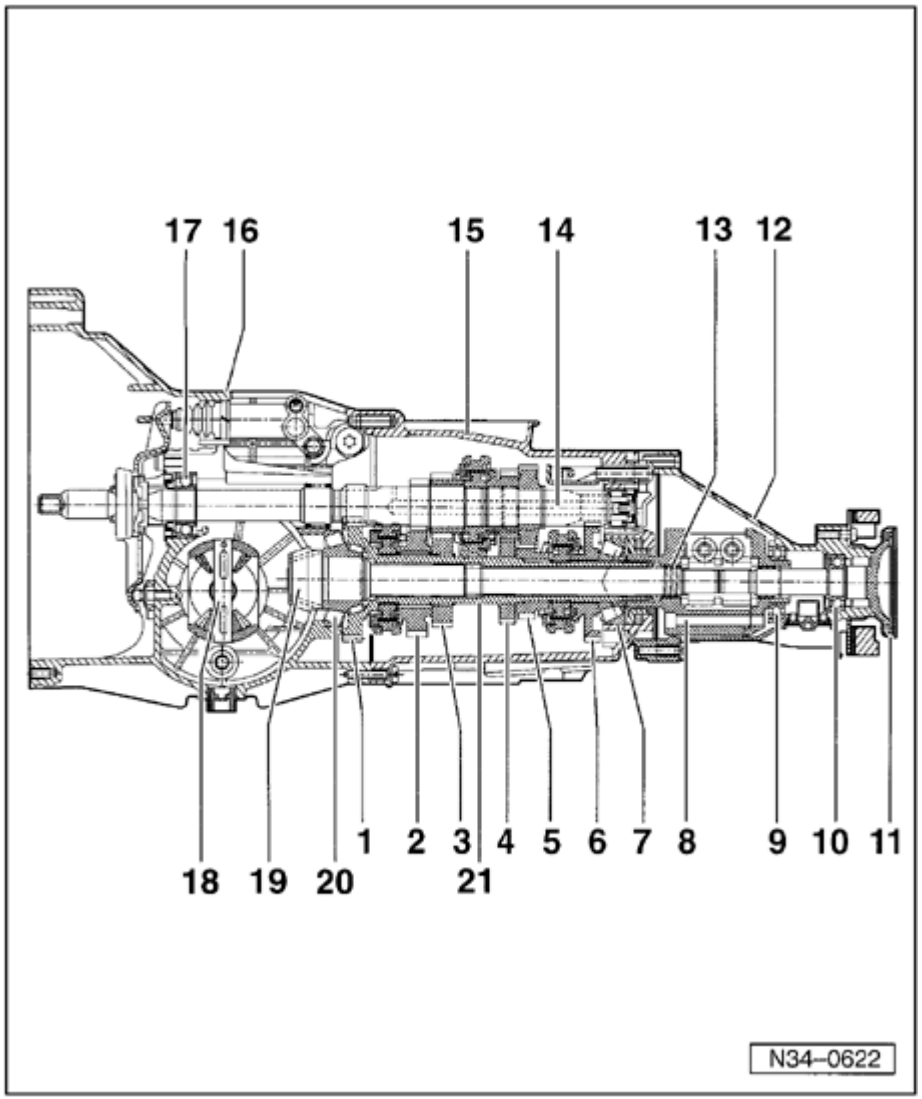
⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torque

Component	Tightening torque
Cover with Torsen differential to transmission	25 Nm (18 ft lb)
Driveshaft to transmission	55 Nm (41 ft lb)
Heat shield for driveshaft to Torsen differential cover	25 Nm (18 ft lb)

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34-43



Transmission, disassembling and assembling

Disassembly sequence ⇒ Page 34-55 .

Transmission overview

1 - 1st gear

2 - 2nd gear

3 - 3rd gear

4 - 4th gear

5 - 5th gear

6 - Reverse gear

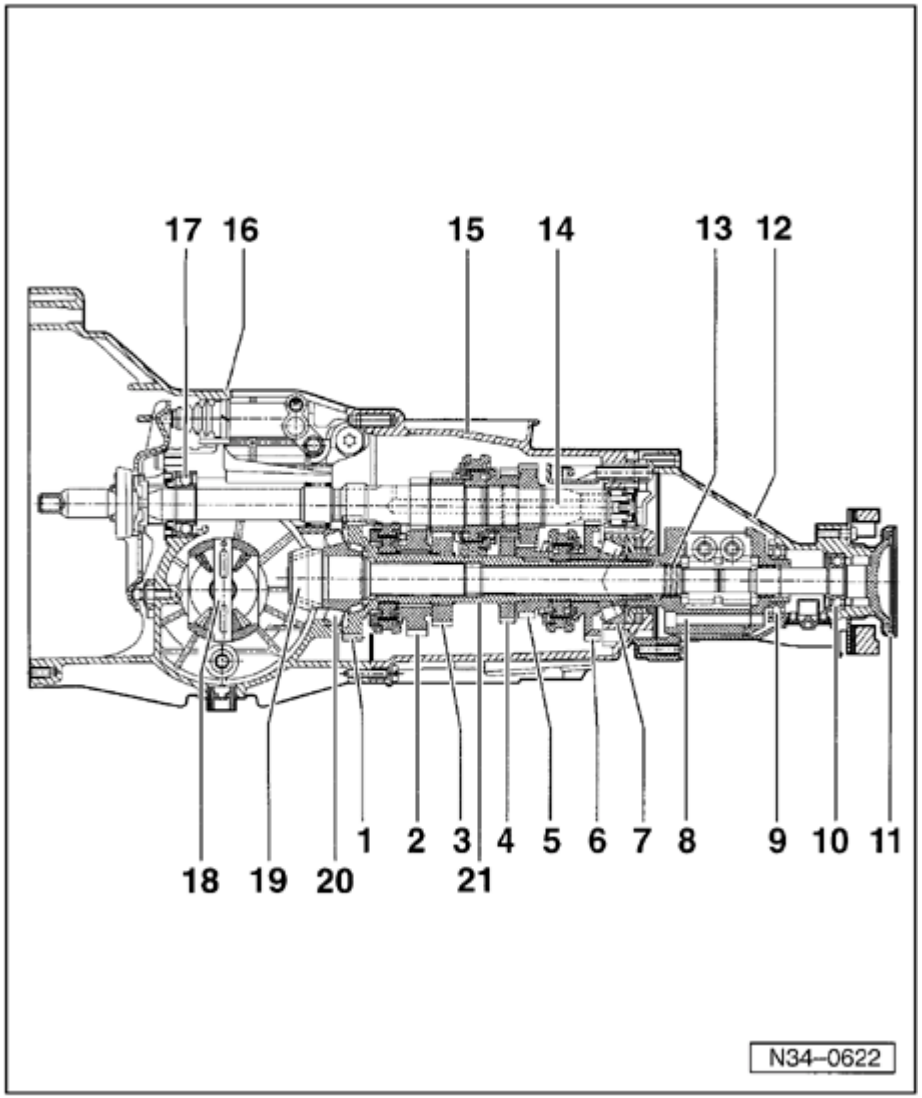
- Removing and installing reverse idler gear ⇒ Page 35-44

7 - Tapered roller bearing

- Adjusting ⇒ Page 39-39

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34-44



8 - Torsen differential

- Can only be serviced by manufacturer
- Removing and installing together with cover ⇒ Page 34-39

9 - Bearing

10 - Bearing

11 - Flange shaft

12 - Torsen differential cover

13 - Compression spring

- Between Torsen differential and hollow shaft

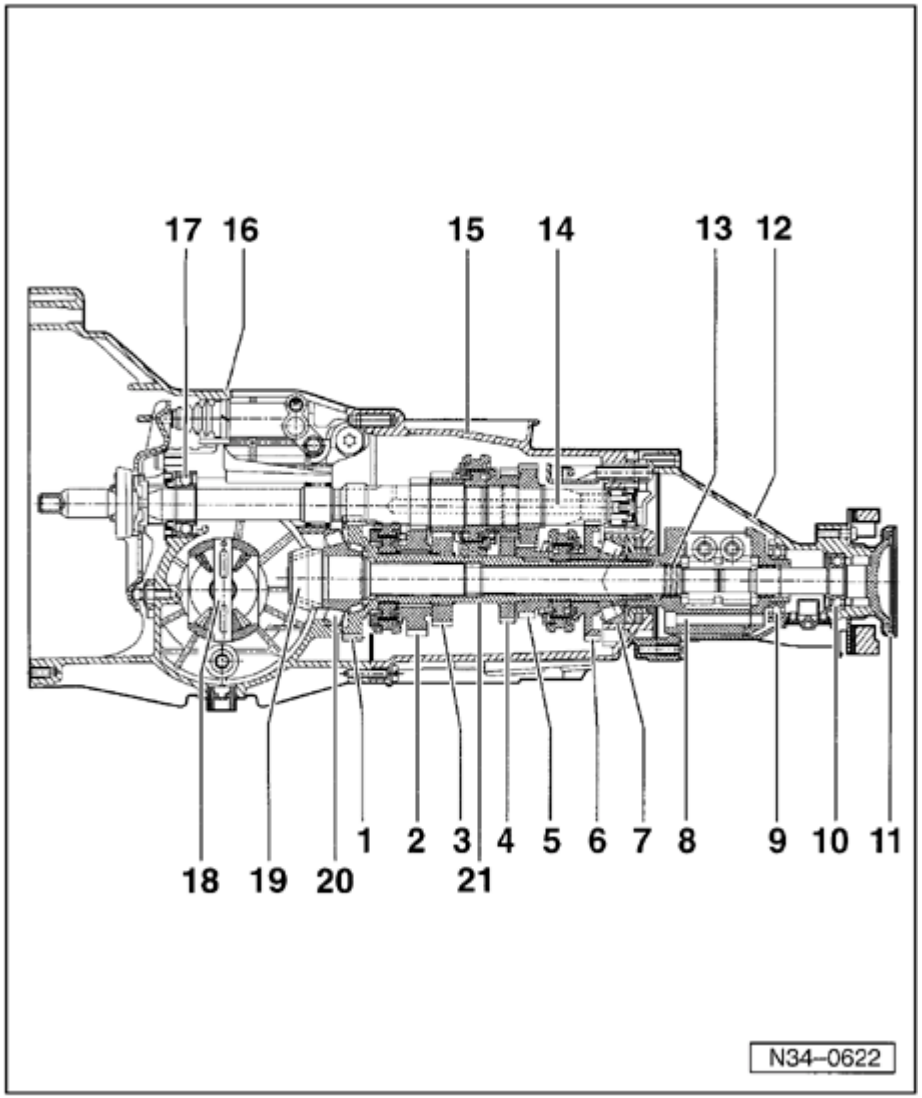
14 - Input shaft

- Disassembling and assembling ⇒ Page 35-1

15 - Transmission cover

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34-45



16 - Transmission housing

17 - Ball bearing

- Adjusting thickness ⇒ Input shaft, adjusting ⇒ Page 35-17

18 - Differential

- Removing and installing ⇒ Page 39-16
- Disassembling and assembling ⇒ Page 39-21

19 - Drive pinion

- Disassembling and assembling drive pinion and hollow shaft ⇒ Page 35-21

20 - Radial tapered roller bearing

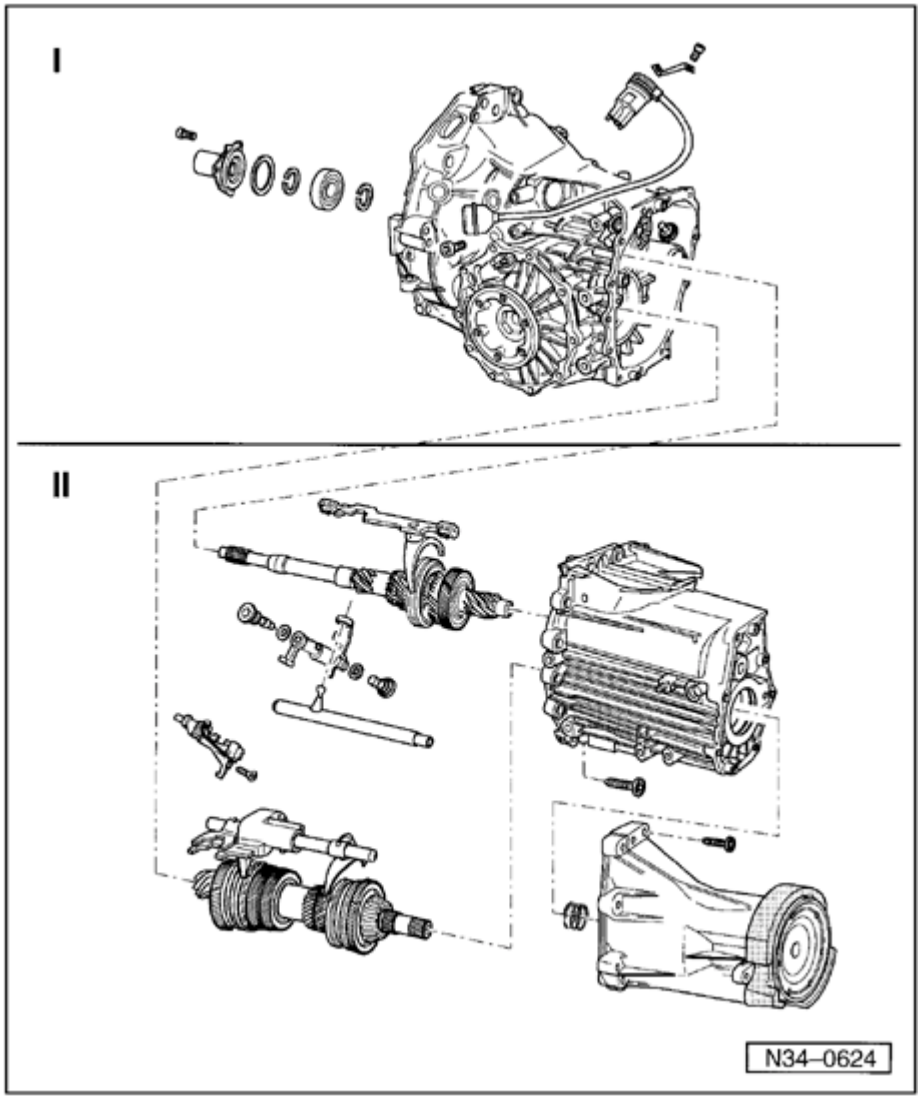
- Adjusting ⇒ Page 39-39

21 - Hollow shaft

- Disassembling and assembling drive pinion and hollow shaft ⇒ Page 35-21

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34-46



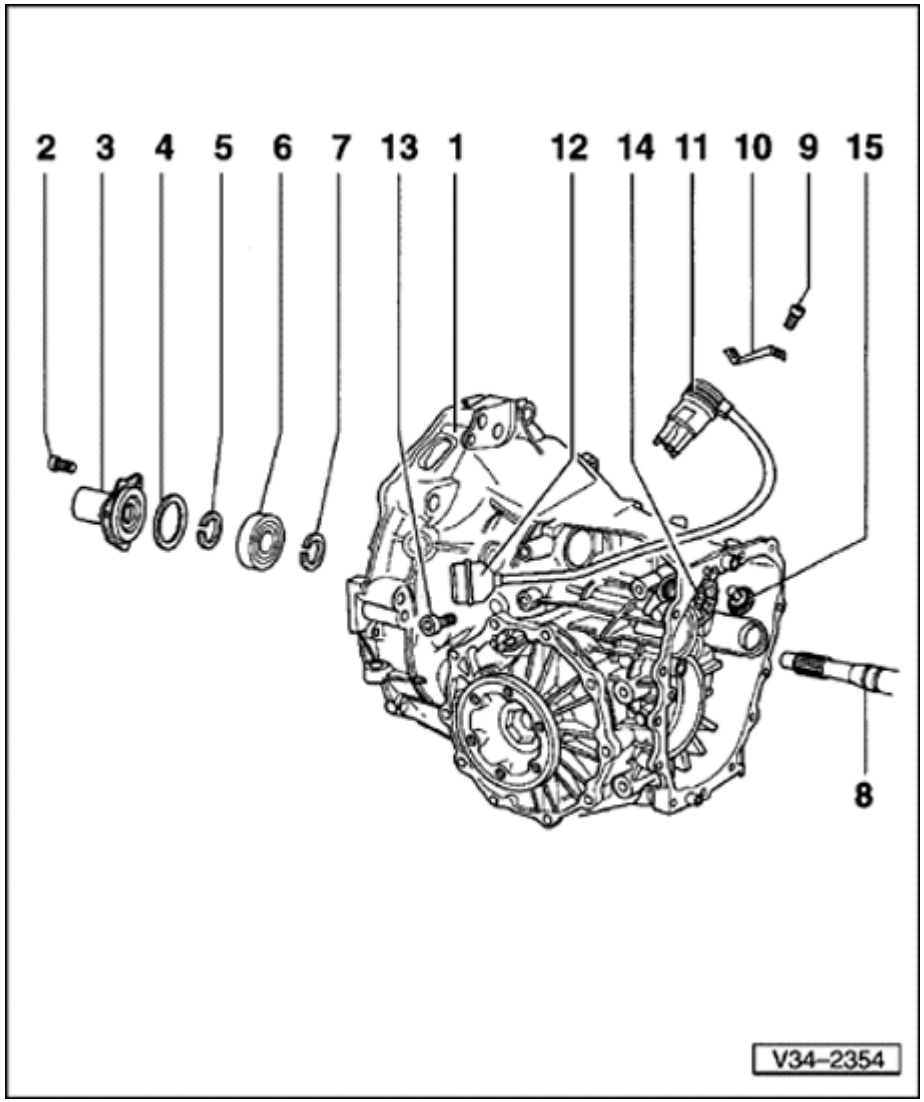
Assembly overview

I - Input shaft ball bearing and multi-function switch, removing and installing ⇒ Page 34-47

II - Input shaft, drive pinion, hollow shaft, selector rods, transmission cover and Torsen differential cover, removing and installing ⇒ Page 34-51

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34-47



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 39-16
- Removing and installing speedometer Vehicle Speed Sensor (VSS) ⇒ Page 39-13
- Removing and installing speedometer drive gear ⇒ Page 39-14
- 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 30-20

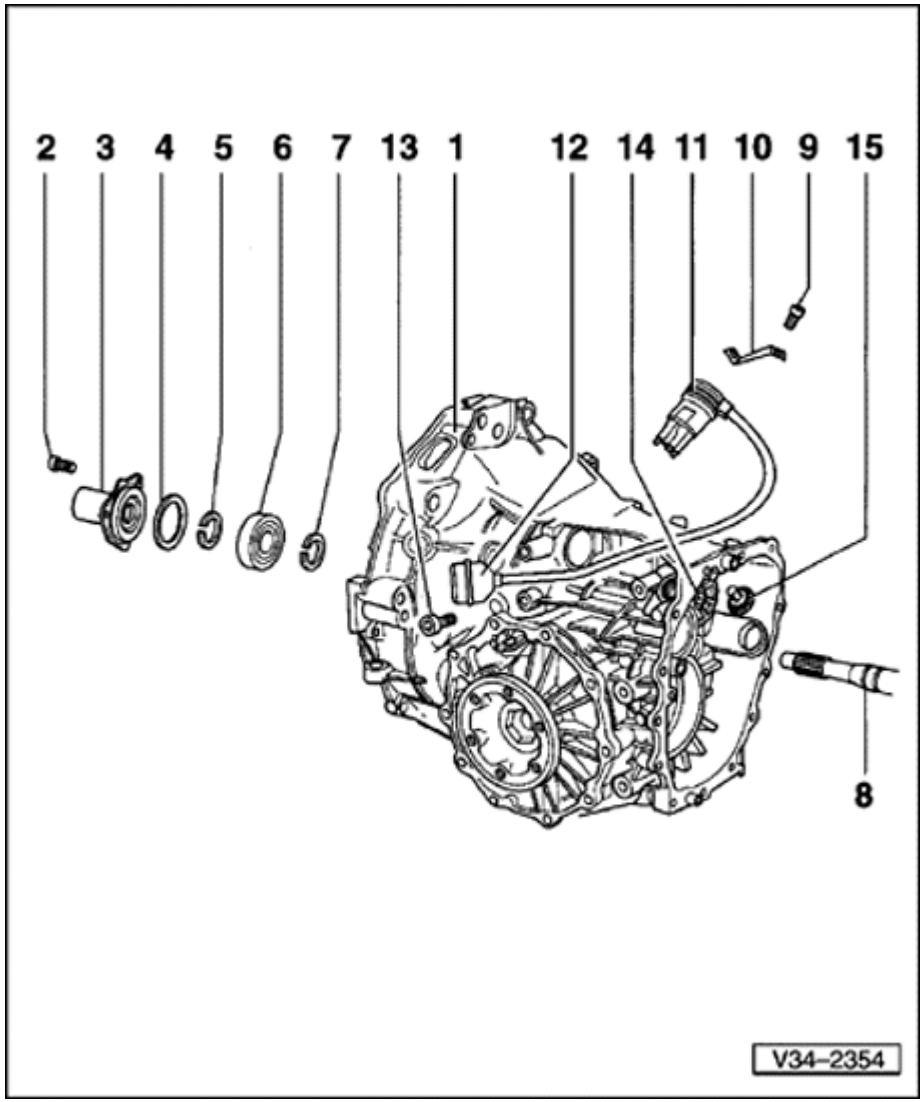
4 - Dished washer

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- Smaller diameter (convex side) faces guide sleeve

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34-48



5 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

6 - Input shaft ball bearing

- Removing and installing ⇒ Page 34-55

7 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

8 - Input shaft

- Removing and installing ⇒ Page 34-51
- 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)

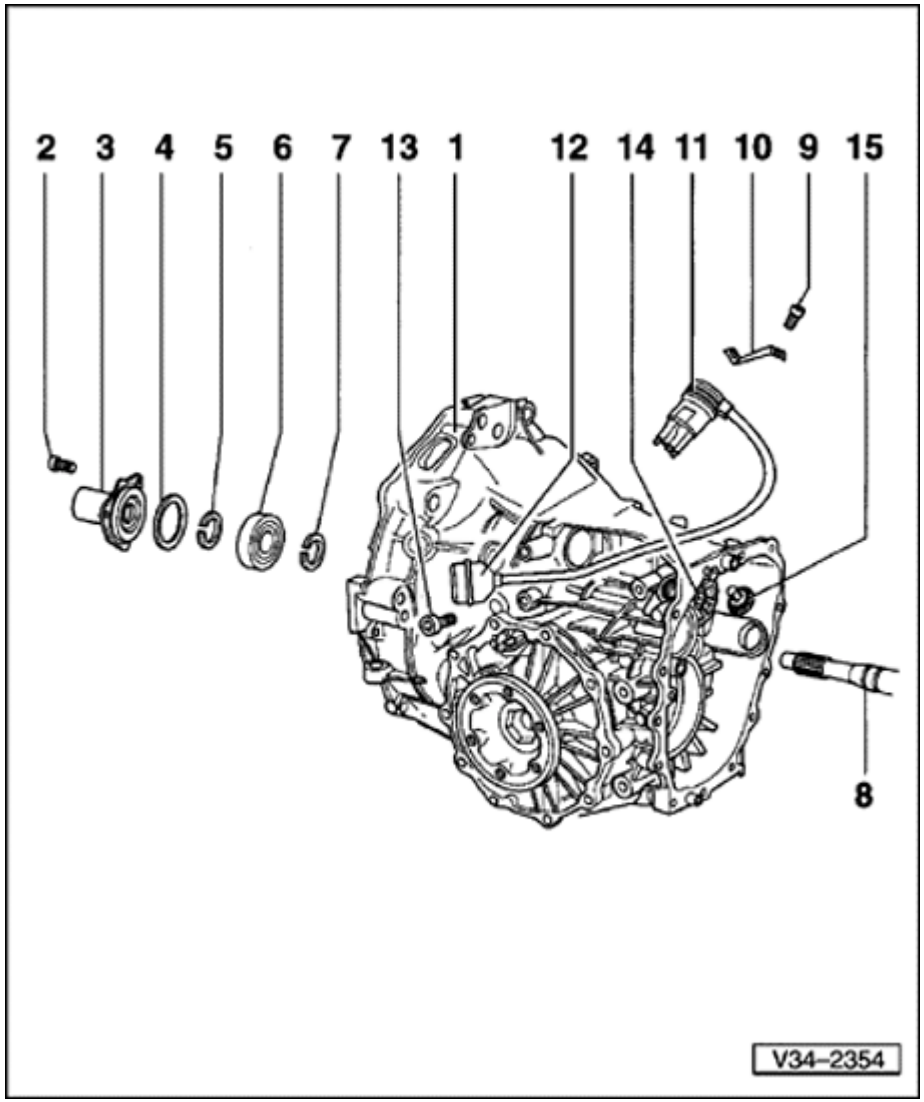
10 - Locking plate

- For multi-function switch

11 - Multi-function switch

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34-49



12 - Multi-function switch harness connector

13 - Socket-head bolt

- 10 Nm (7 ft lb)

14 - Cover for shift rod

- Removing and installing ⇒ Page 34-79

15 - Gear lock for 5th and reverse gear

- Removing and installing ⇒ Page 34-86

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34-50

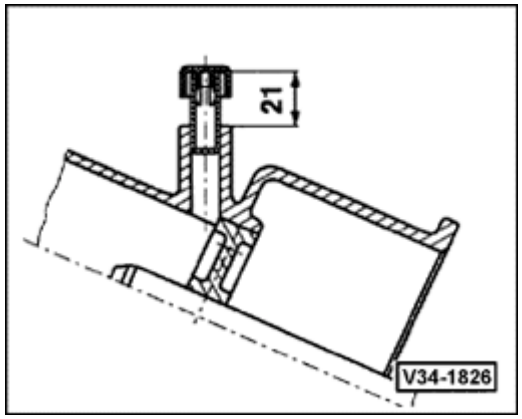
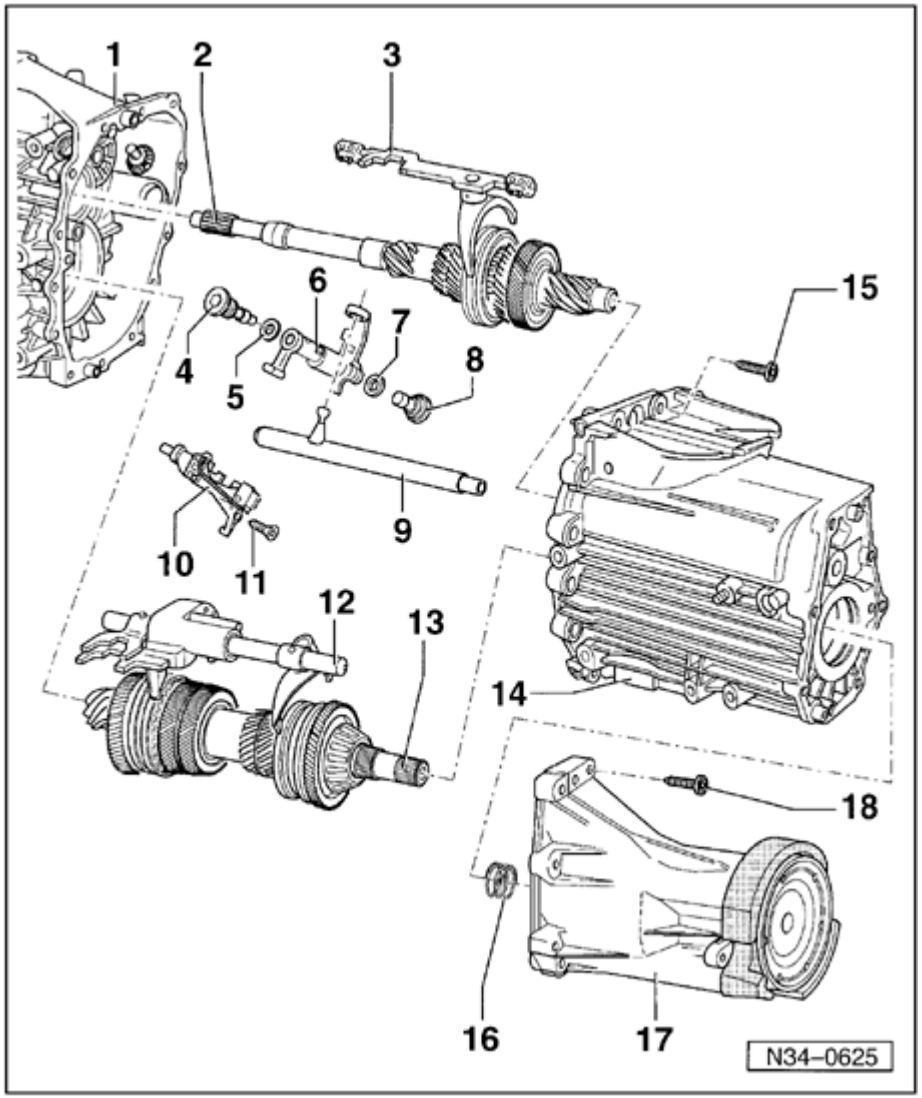


Fig. 1 Breather installation position

After pressing in, the breather must project 21 mm (0.827 in.) out of the housing .

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34-51



Input shaft, drive pinion, hollow shaft, shift rods, transmission cover and Torsen differential cover, removing and installing

1 - Transmission housing

2 - Input shaft

- Disassembling and assembling ⇒ Page 35-1
- Adjusting ⇒ Page 35-17
- Servicing input shaft bearings ⇒ Page 35-1

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

- Disassembling and assembling ⇒ Page 34-79
- Replacing bushings ⇒ Page 34-84

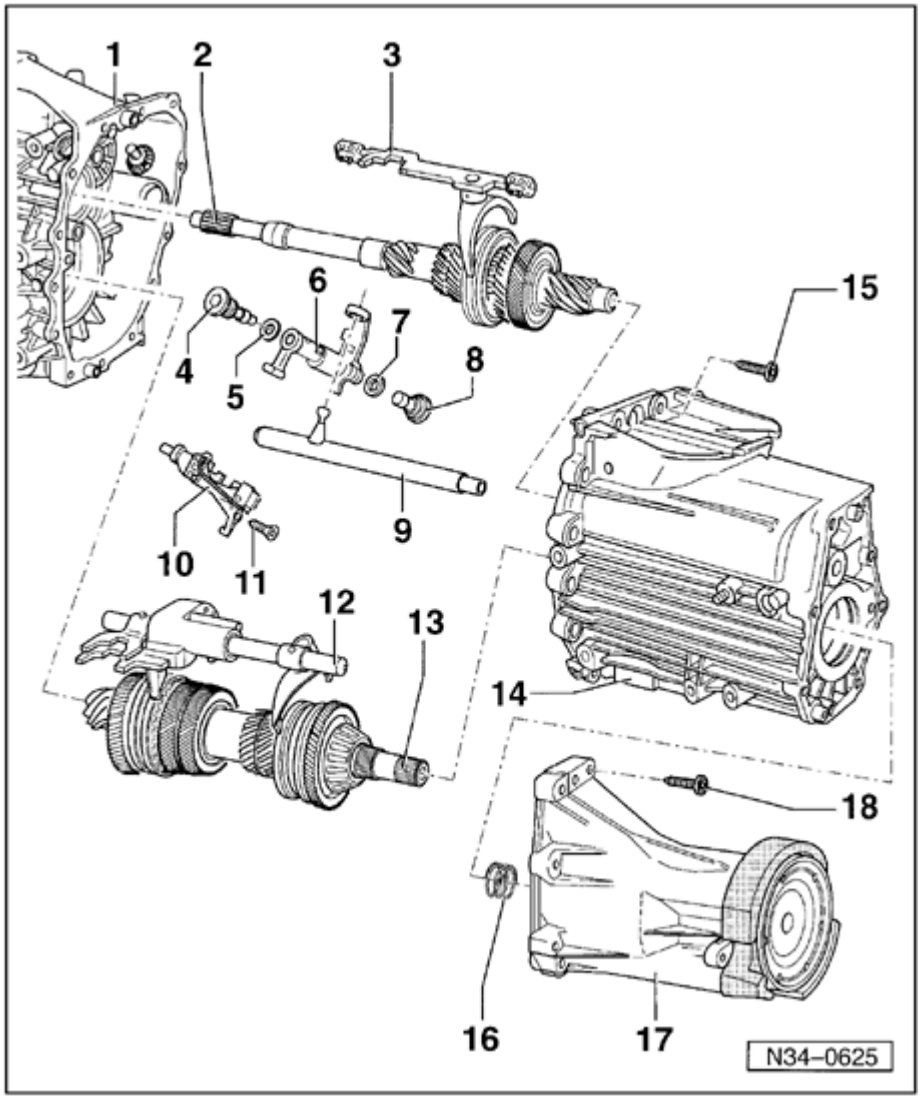
4 - Left stop bolt

- 40 Nm (30 ft lb)

5 - Sealing washer

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34-52



6 - Relay shaft

- Installation position ⇒ Page 34-79

7 - Sealing washer

8 - Right stop bolt

- 40 Nm (30 ft lb)

9 - Shift rod

- Installation position ⇒ Page 34-79
- Replacing shift rod sealing washer ⇒ Page 34-79

10 - Shift detent

- Installation position ⇒ Page 34-79

11 - Torx® bolt

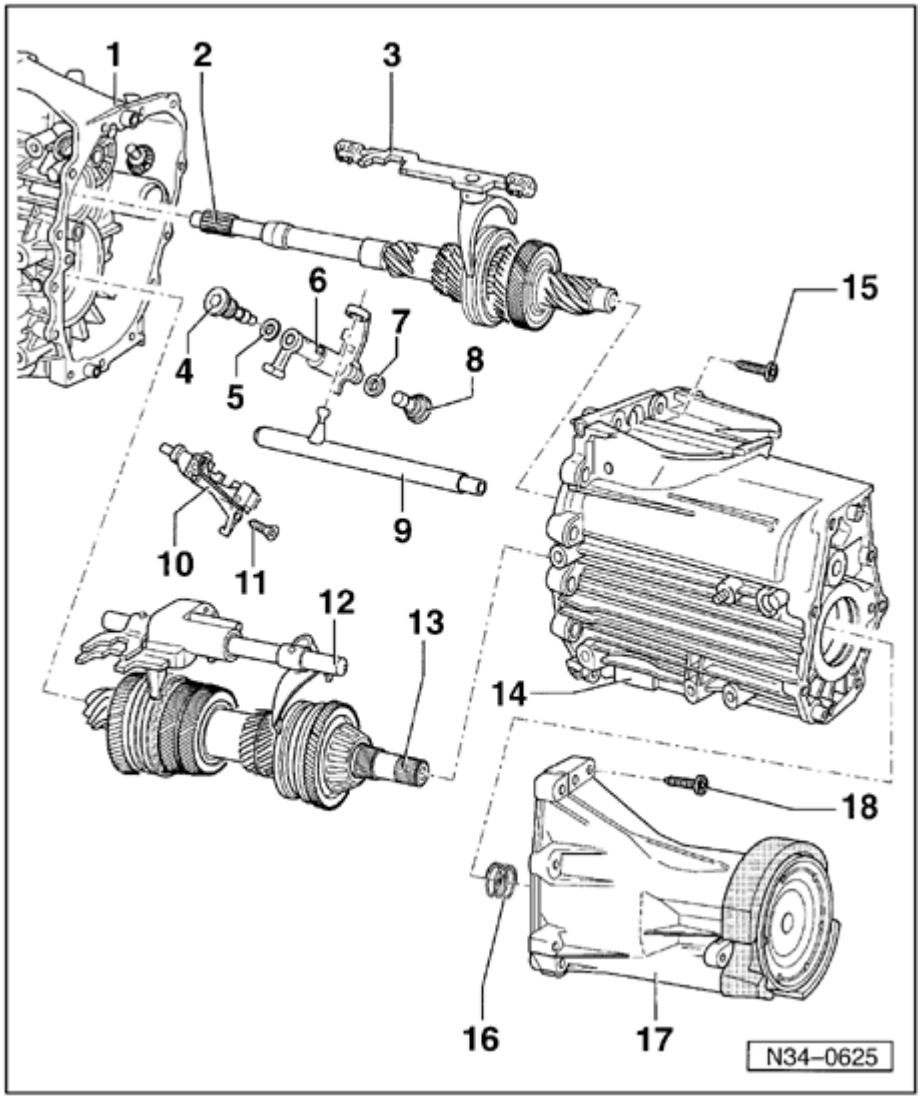
- 25 Nm (18 ft lb)
- With shoulder to secure shift detent spring

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

- Disassembling and assembling ⇒ Page 34-79
- Removing and installing ball sleeve ⇒ Page 34-83

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34-53



13 - Drive pinion with hollow shaft

- Disassembling and assembling ⇒ Page 35-21
- Adjusting ⇒ Page 39-34
- Servicing drive pinion and hollow shaft bearings ⇒ Page 35-21

14 - Transmission cover

- Removing and installing oil collector tray ⇒ Fig. 1

15 - Torx® bolt

- 22 Nm (16 ft lb)

16 - Compression spring

17 - Torsen differential cover

- Removing and installing with transmission installed ⇒ Page 34-39
- Removing and installing Torsen differential from cover ⇒ Page 34-68
- Servicing cover ⇒ Page 34-68

18 - Torx® bolt

- 22 Nm (16 ft lb)

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34-54

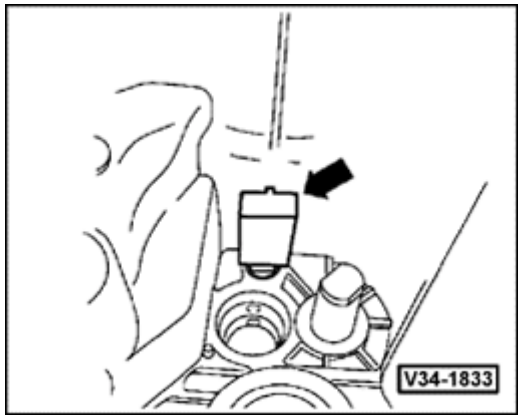


Fig. 1 Removing and installing oil collector tray

Removing

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

Installing

- Push oil collector tray into transmission, until it snaps in.
  Oil collector tray faces upward in transmission cover.

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34-55

Input shaft ball bearing, multi-function switch, input shaft, drive pinion, shift rods, transmission cover and Torsen differential 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 39-37* , *list of adjustments*

Special tools and equipment

- VW309 holding plate
- VW353 transmission support
- 3235 press device
- VAG1306 drip tray
- VAG1582 taper roller bearing puller

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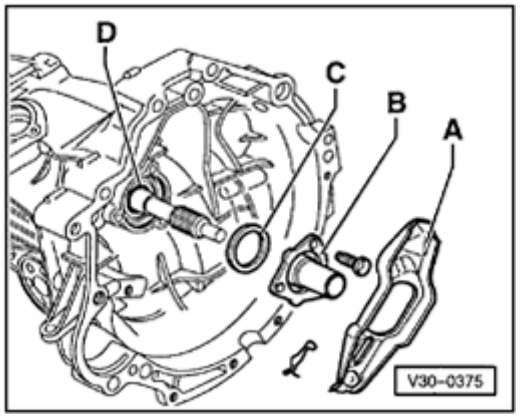
- VAG1582/3 attachment to VAG1582

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34-56

Removing

- Place drip tray below transmission.
- Drain gear oil.
- Secure transmission to assembly stand ⇒ Page 34-30 .



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

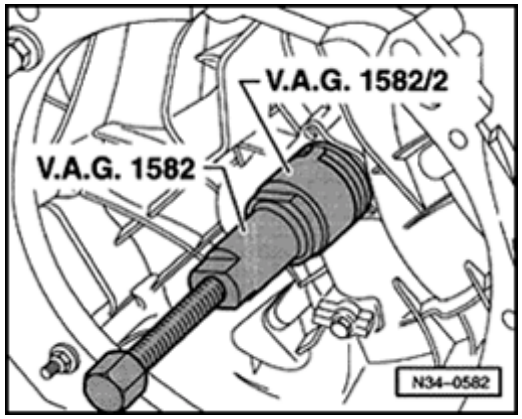
Notes:

- *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 30-20 .*

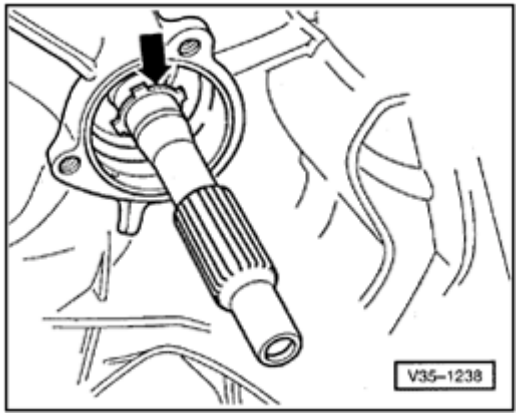
- Remove guide sleeve -B-.
- Remove dished washer -C-.
- Remove circlip -D- in front of input shaft ball bearing.
- Note thickness of circlip, if ball bearing, drive axle or transmission housing is not replaced.

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34-57



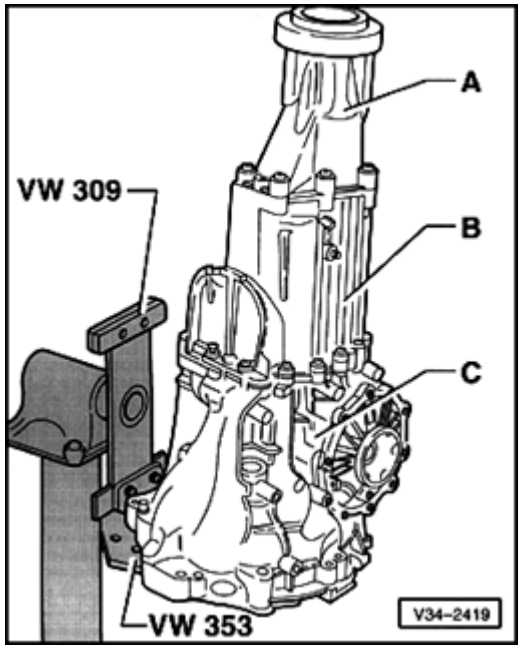
- Pull input shaft ball bearing out of transmission housing.



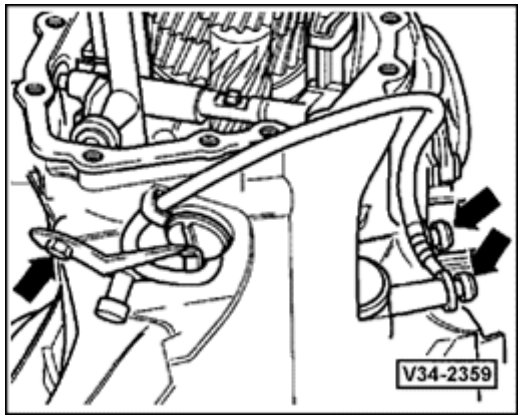
- Remove circlip (arrow) behind input shaft ball bearing.
- Note thickness of circlip, if ball bearing, drive axle or transmission housing are not replaced.

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34-58



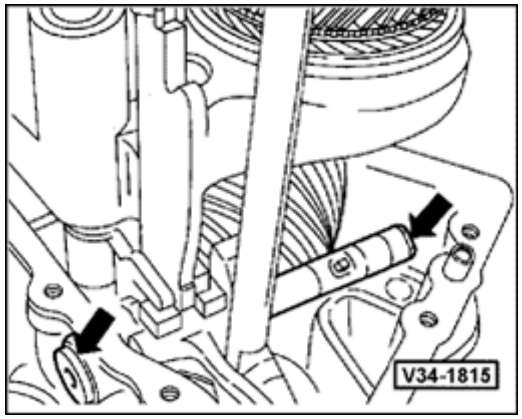
- Remove cover -A- together with Torsen differential from transmission cover -B-.
- Remove compression spring from drive pinion.
- Remove transmission cover -B- from transmission housing -C-.



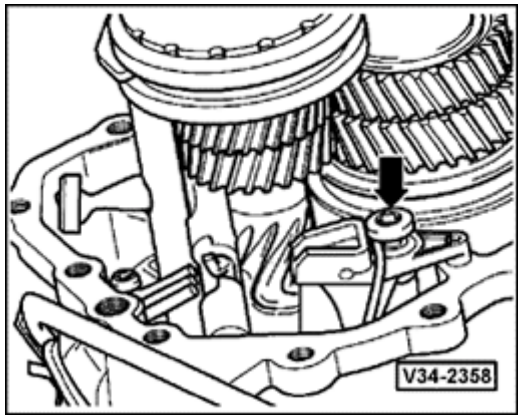
- Remove bolts (arrows) and pull out multi-function switch.

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34-59



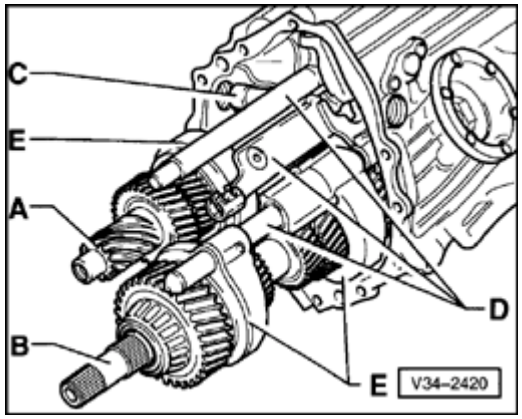
- Remove relay shaft stop bolts (arrows) items 4, 8 ⇒ Page 34-51 , and ⇒ Page 34-52 .



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

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34-60



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

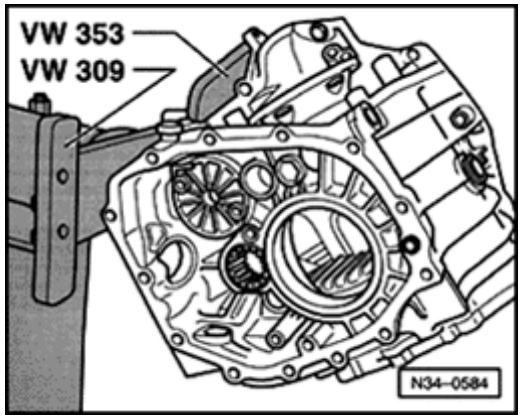
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34-61

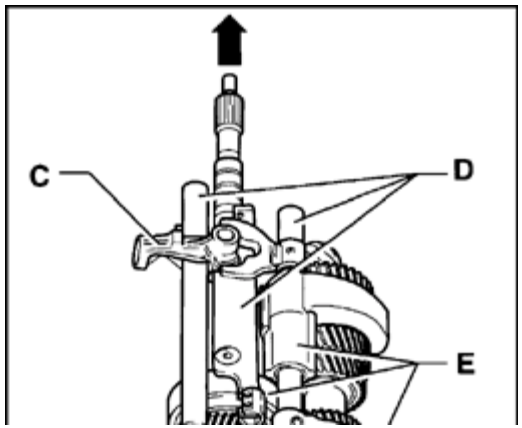
Installing

Note:

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



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



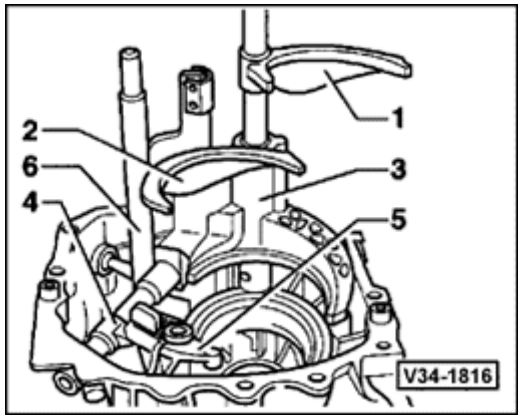
- Assemble input shaft -A-, drive pinion -B-, relay shaft -C-, selector rods -D- with shift rod and selector forks -E-.
- Install these components into transmission housing as a set.

Note:

The relay shaft -C- and the shift rod can also be installed later if necessary ⇒ *Page 34-62* , *Illustration V34-1816 and* ⇒ *Page 34-63* , *illustration V34-2120*

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34-62



➢ 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

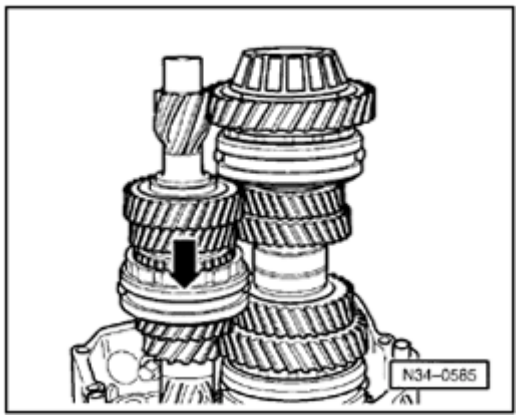
4 - Relay shaft

5 - Shift detent

6 - Shift rod

Note:

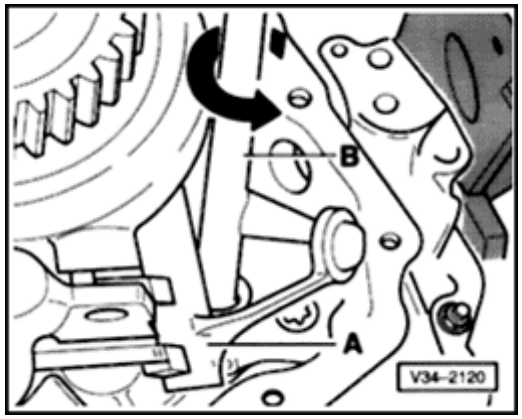
Illustration is shown without the drive axle and pinion.



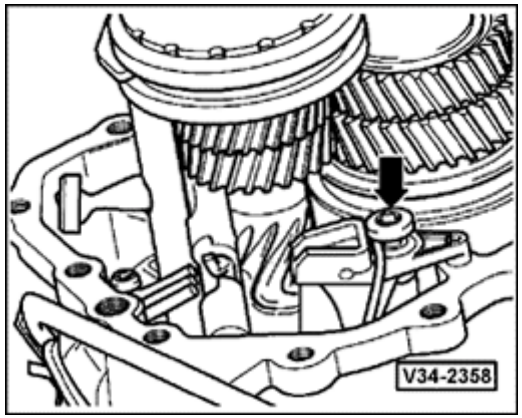
➢ - Move transmission housing and engage 3rd gear (direction of arrow).

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34-63



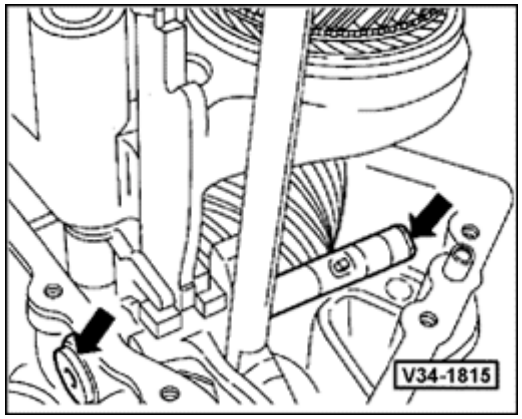
- Install relay shaft -A-.
- Place inner shift rod -B- sideways into mounting hole in transmission housing and assemble into mounting eye.
- Carefully turn shift rod in direction of arrow.



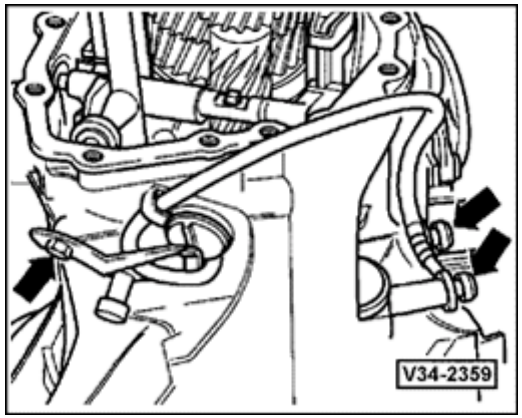
- Insert shift detent and tighten bolt (arrow) securely.

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34-64



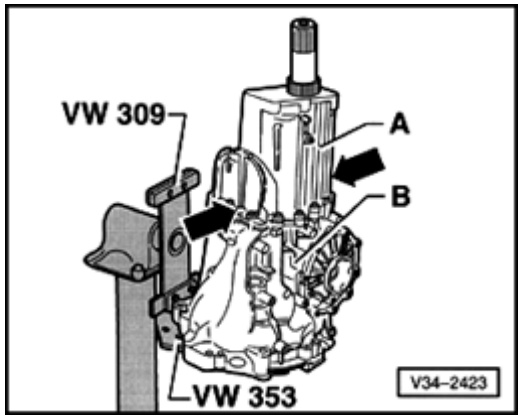
- Install relay shaft stop bolts (arrows).
- Replace O-ring for multi-function switch.



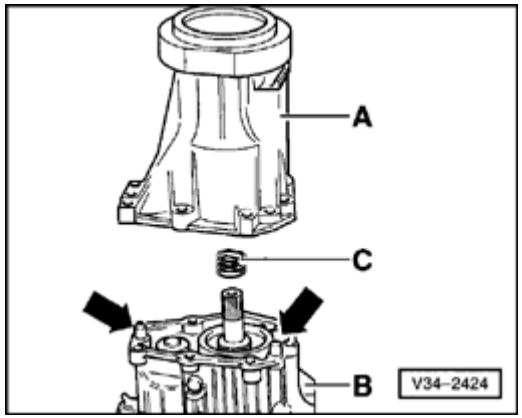
- Carefully insert multi-function switch and tighten (arrows).

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34-65



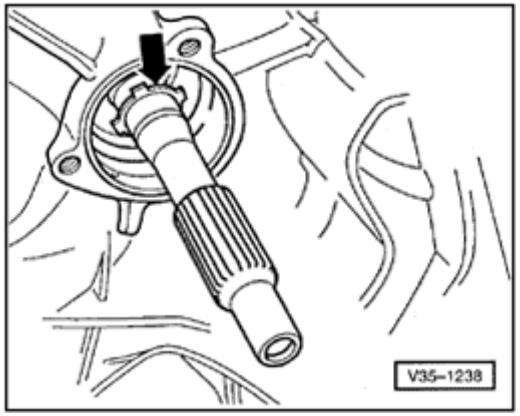
- Make sure dowel sleeves for transmission cover -A- are installed in transmission housing -B- (arrows).
- Install transmission cover onto transmission housing.



- Make sure dowel sleeves for cover -A- are installed in transmission cover -B- (arrows).
- Install compression spring -C-.
- Install Torsen differential cover -A- onto transmission cover -B-.

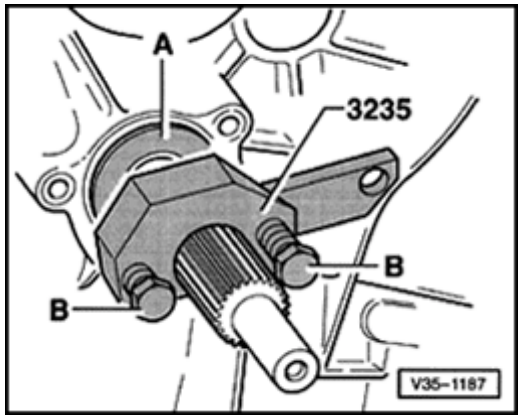
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34-66



- Install rear circlip (arrow) for ball bearing onto input shaft.
- Slide ball bearing onto input shaft.

  Closed side of ball cage faces toward transmission housing.

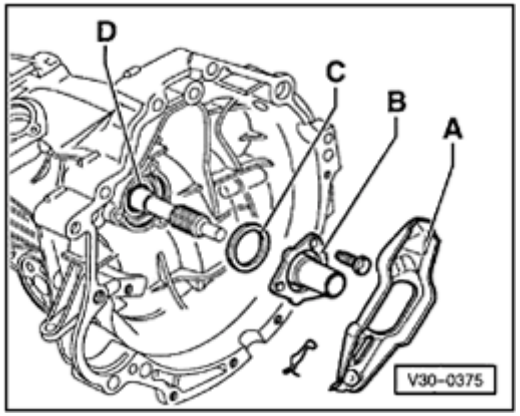


- Press in ball bearing.
- Slide thrust piece -A- of press device onto input shaft.
- Position press device behind splines for clutch plate.
- Screw in bolts -B- and tighten slightly.

  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.

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34-67



- Install front circlip -D- for input shaft ball bearing.
- Install dished washer -C-.

  Position: convex side faces guide sleeve -B-.

Notes:

- *Before installing guide sleeve, cover splines on input shaft with a shrink-fit hose to protect the seal.*
- *Installing seal in guide sleeve* ⇒ *Page 30-20* .

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

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Torsen differential, disassembling and assembling

Special tools and equipment

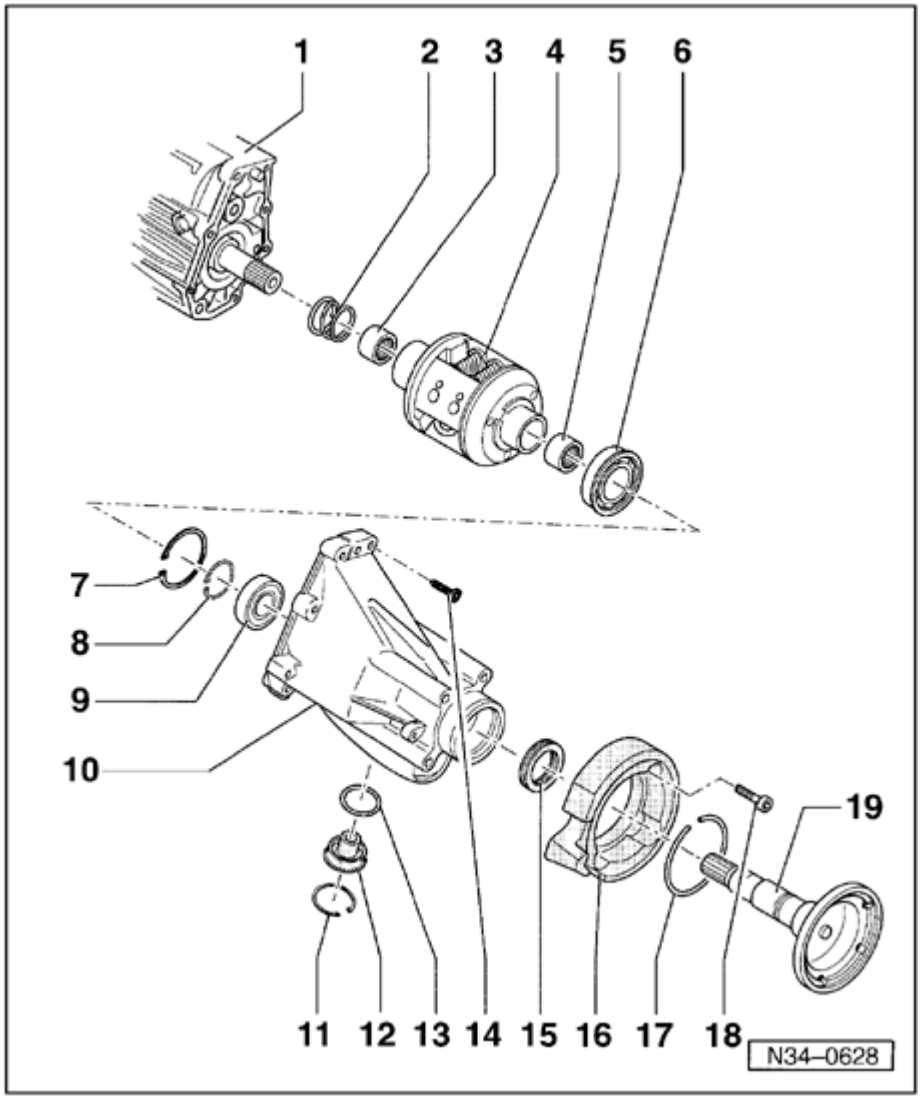
- VW401 and VW402 thrust plate
- VW407 punch
- VW412 punch
- VW416B tube
- VW421 tube
- VW439 guide pin
- VW519 sleeve
- VW681 extractor lever
- VW771/15 threaded piece from VW771 slide hammer-complete set
- 40-21 sleeve

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- 2040 press tube
- 3002 pressure piece
- Kukko 17/2 separating tool
- Kukko 21/4 extractor

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34-69



1 - Transmission housing

2 - Spring

3 - Front needle bearing

- Pulling out ⇒ Fig. 8
- Installation position ⇒ Fig. 9
- Pressing in ⇒ Fig. 11

4 - Torsen differential

- Do not disassemble
- Press out after removing flange shaft ⇒ Fig. 3
- Replace if damaged
- Pressing in ⇒ Fig. 12

5 - Rear needle bearing

- Pulling out ⇒ Fig. 8
- Installation position ⇒ Fig. 10
- Pressing in ⇒ Fig. 11

6 - Ball bearing

- For Torsen differential
- Pressing off ⇒ Fig. 4
- Pressing on ⇒ Fig. 5

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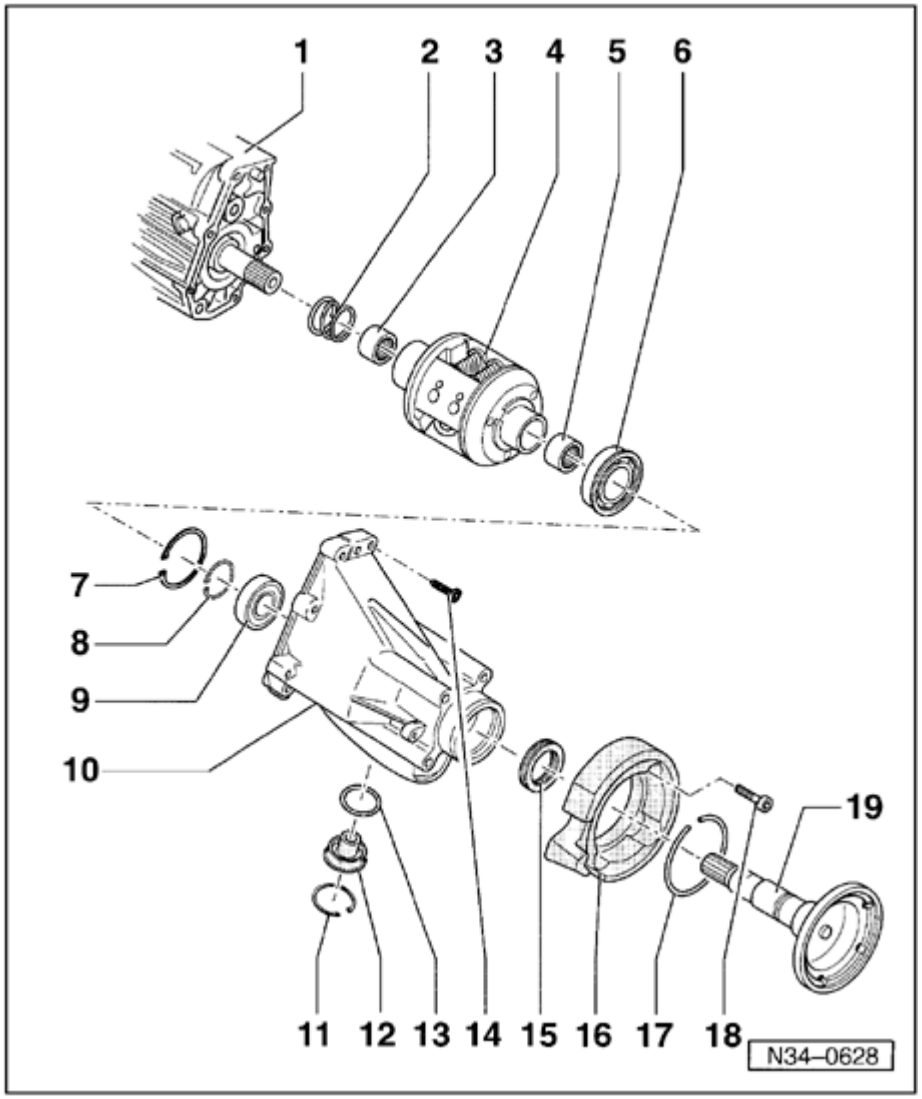
7 - Circlip

8 - Circlip

- Remove and install together with flange shaft ⇒ Fig. 2

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34-70



9 - Ball bearing

- For flange shaft
- Pressing out ⇒ Fig. 6
- Pressing in ⇒ Fig. 7

10 - Torsen differential cover

11 - Circlip

12 - Plug

- Removing ⇒ Fig. 1

13 - O-ring

- Always replace
- Lubricate before installing

14 - Torx® bolt

- 22 Nm (16 ft lb)

15 - Seal

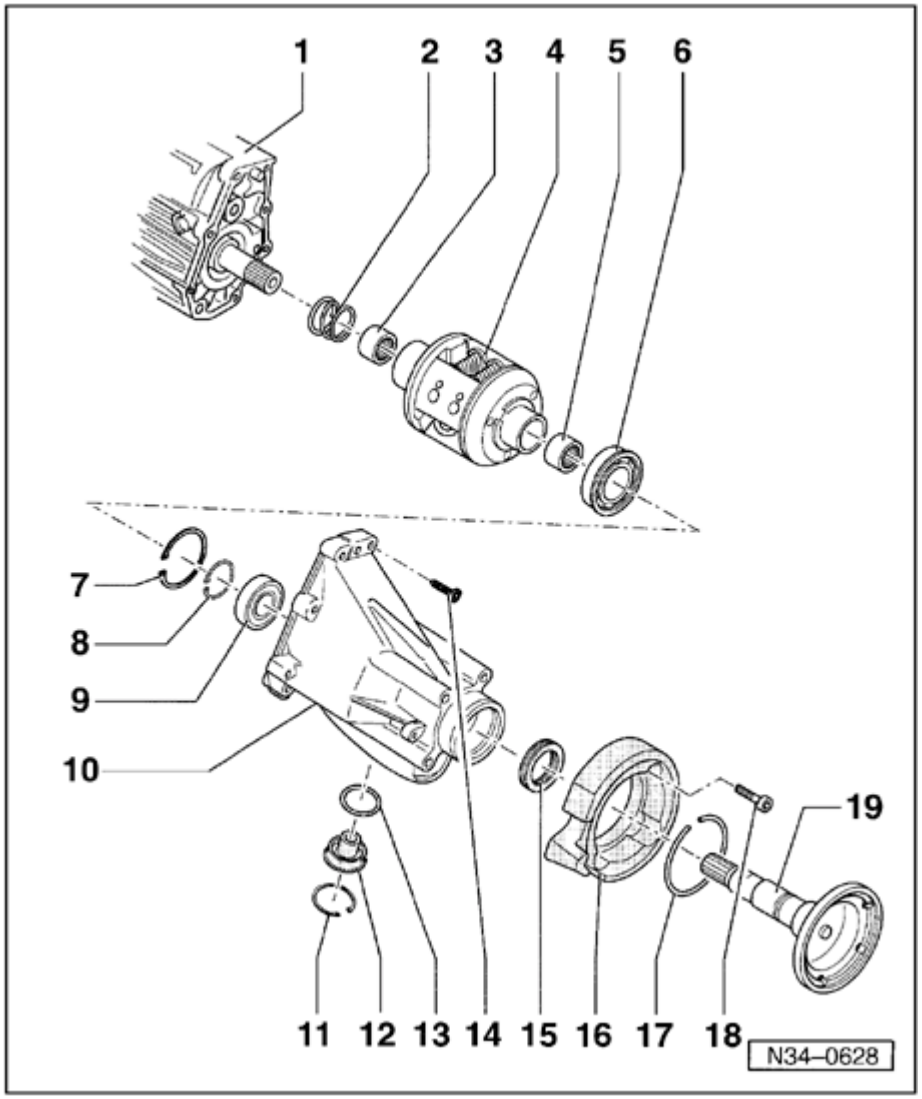
- Pull out using VW681 extractor lever
- Driving in ⇒ Fig. 13

16 - Vibration dampener

17 - Circlip

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34-71



18 - Torx® bolt

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

19 - Flange shaft

- Removing and installing ⇒ Fig. 2

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34-72

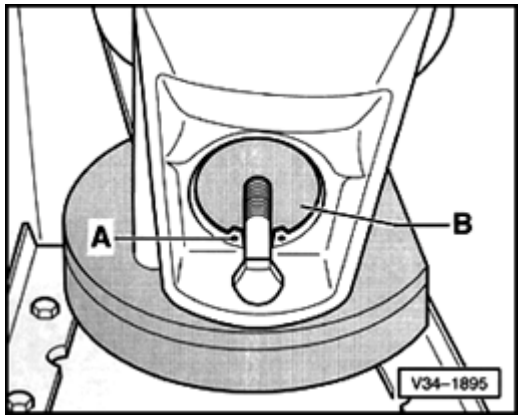


Fig. 1 Removing plug

- Remove circlip -A-.
- Screw M8 bolt into thread of plug -B-.
- Remove plug -B- using bolt.

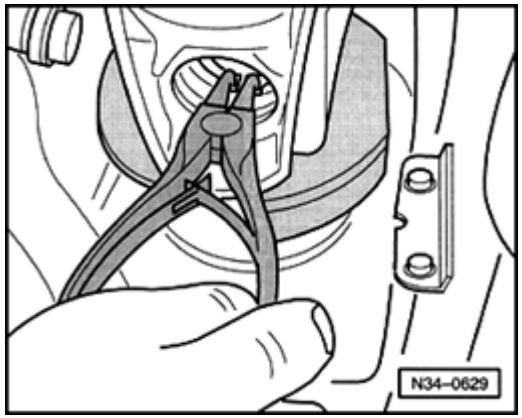


Fig. 2 Removing and installing flange shaft

- Spread circlip and pull out flange shaft.
- When installing flange shaft, circlip must be installed at same time.

  The circlip must be fully seated in the base of the groove.

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34-73

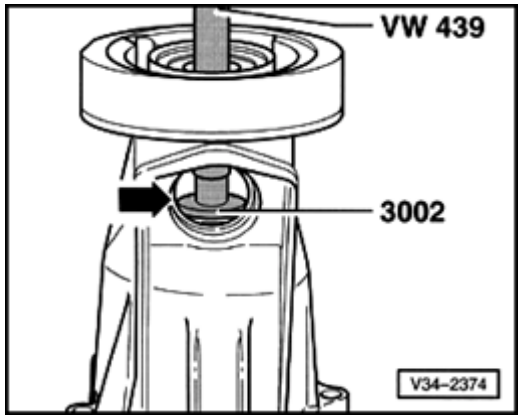


Fig. 3 Removing Torsen differential

- Position 3002 thrust piece directly on Torsen differential through opening (arrow).

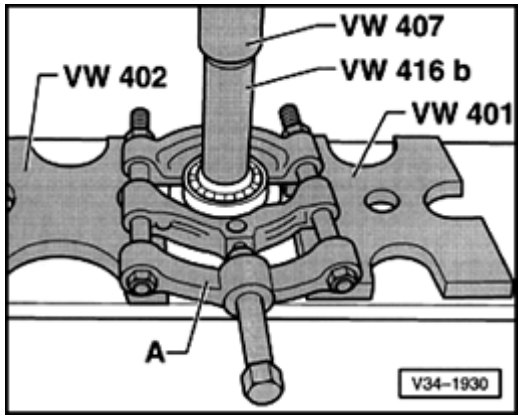


Fig. 4 Pressing off ball bearing from Torsen differential

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

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34-74

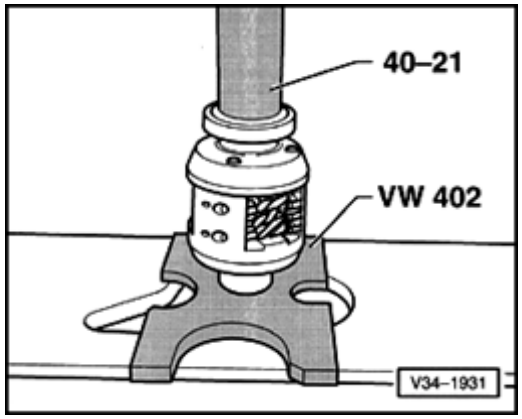


Fig. 5 Pressing ball bearing onto Torsen differential

- Press ball bearing on until stop is reached.

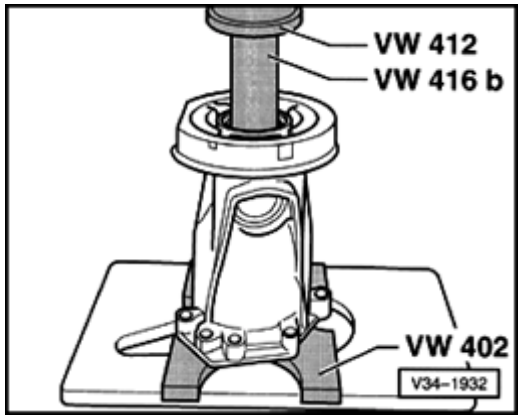


Fig. 6 Pressing out ball bearing for flange shaft

- Remove circlip before pressing out bearing.

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34-75

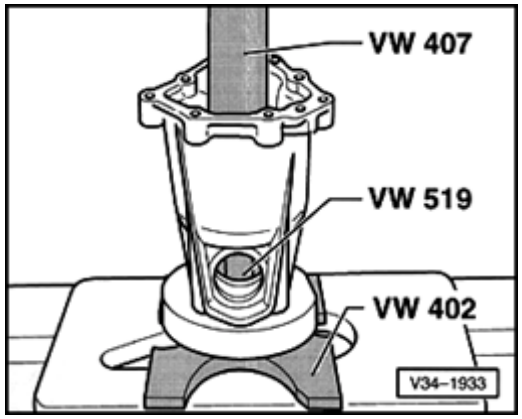


Fig. 7 Pressing in ball bearing for flange shaft

- Install circlip after pressing in ball bearing.

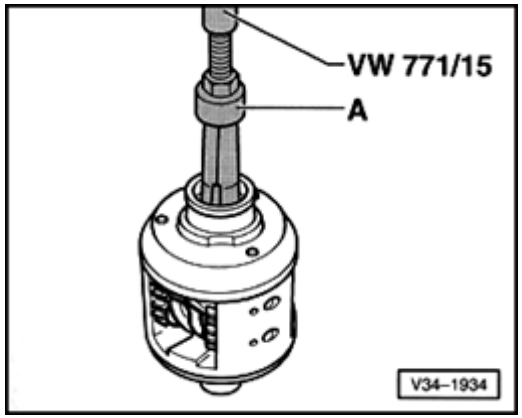


Fig. 8 Pulling out needle bearing

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

Both needle bearings in the Torsen differential are removed using the same puller.

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34-76

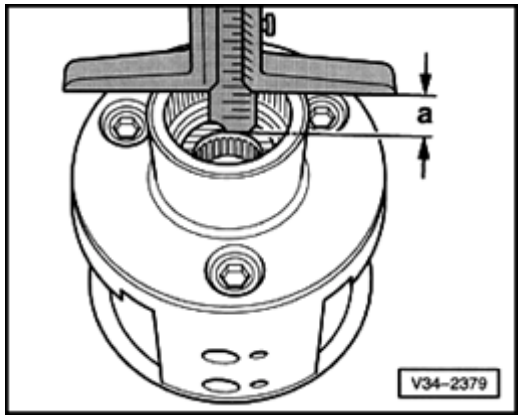


Fig. 9 Installation position of front needle bearing

Dimension -a-: 32.5 mm (1.279 in.)

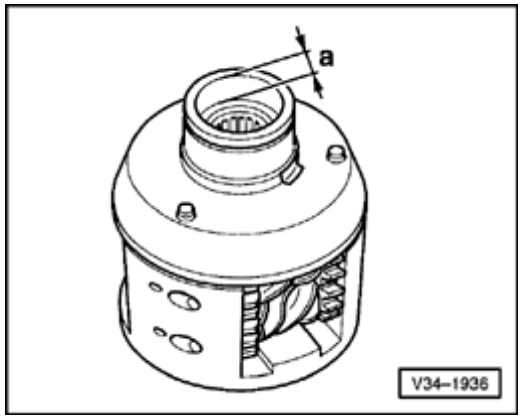


Fig. 10 Installation position of rear needle bearing

Dimension -a-: 14 mm (0.551 in.)

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34-77

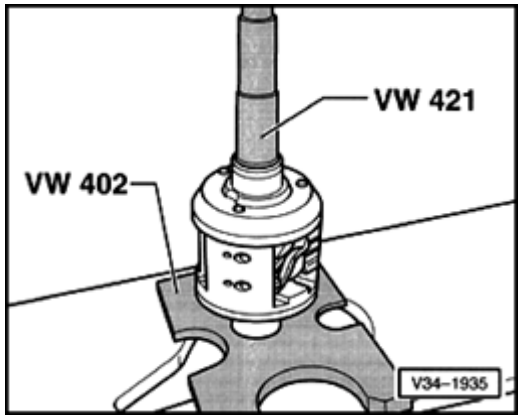


Fig. 11 Pressing in needle bearing

Both needle bearings in the Torsen differential are pressed in using the same special tool.

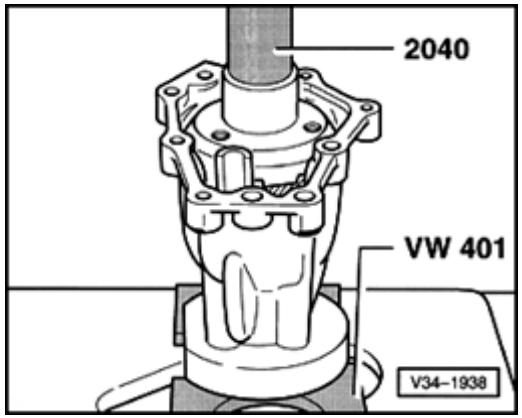


Fig. 12 Pressing in Torsen differential

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34-78

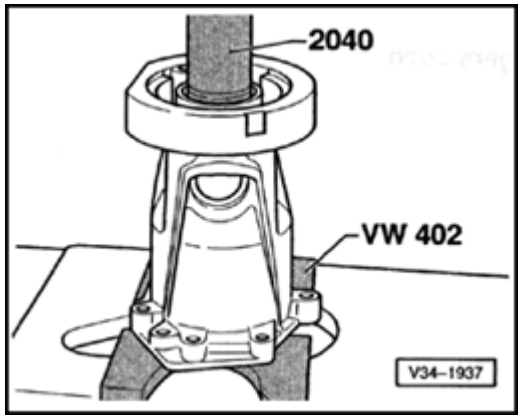


Fig. 13 Driving in seal

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

  Installation position: 2 mm (0.078 in.) below surface of cover

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34-79

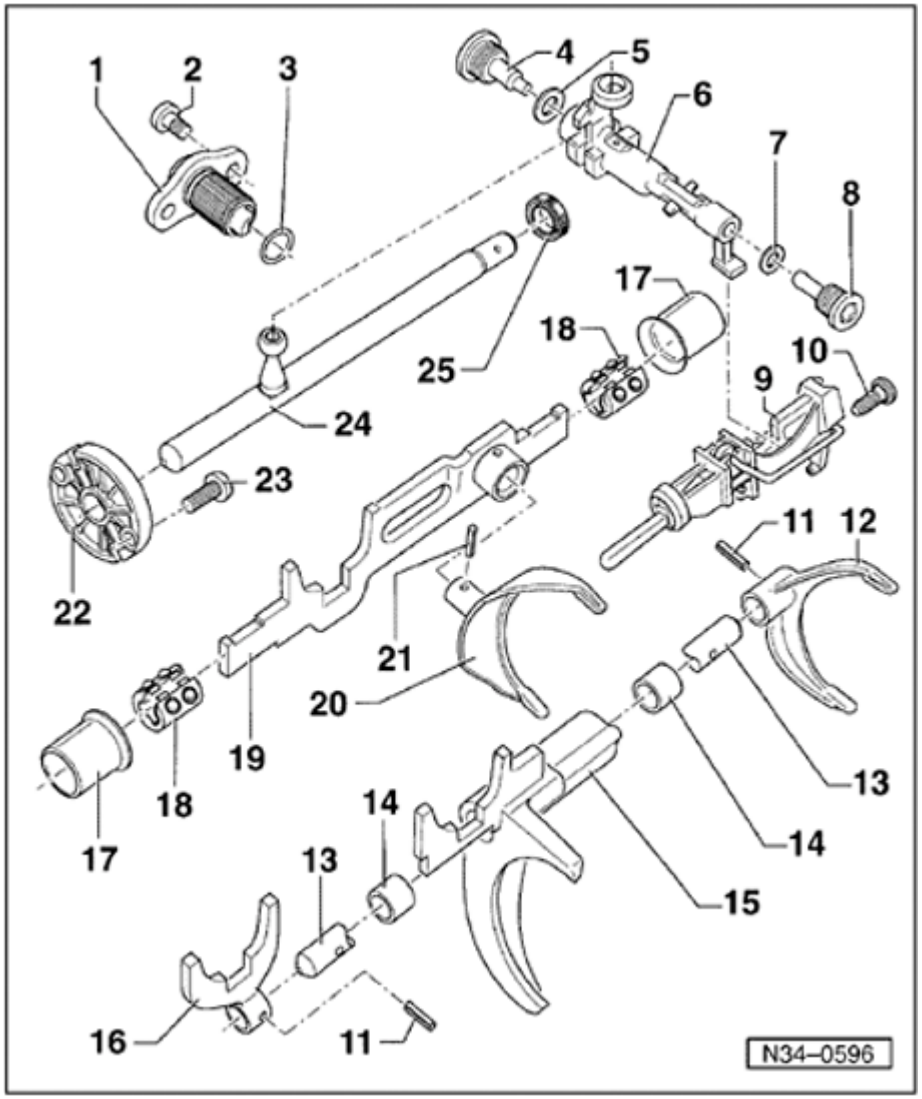
Transmission selector mechanism, disassembling and assembling

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

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34-80



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 34-86

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 - Relay shaft

7 - Sealing washer

8 - Left stop bolt

- 40 Nm (30 ft lb)

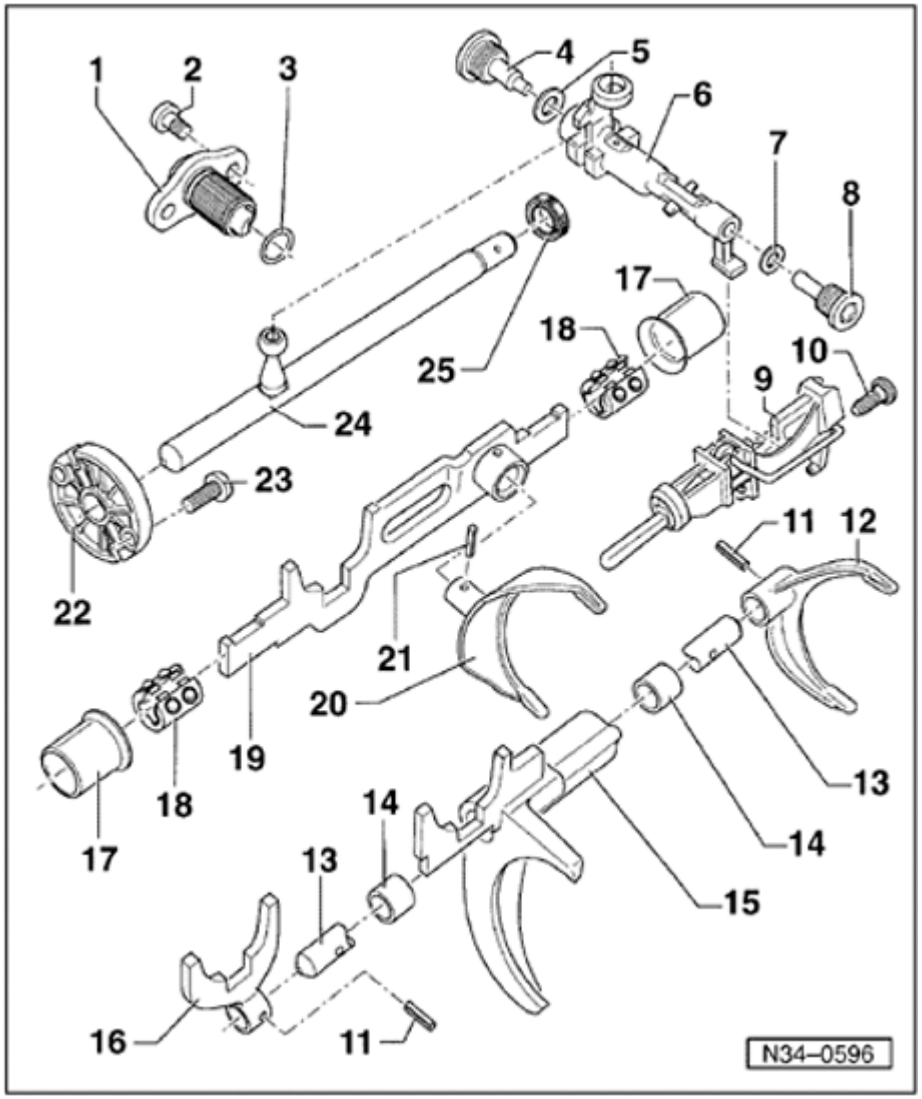
9 - Shift detent

10 - Torx® bolt

- 25 Nm (18 ft lb)

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34-81



11 - Roll pin

12 - 5th and reverse gear shift fork

- Installation position ⇒ Fig. 1

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

14 - Ball sleeve

- Removing and installing ⇒ Fig. 2

15 - Shift fork for 1st and 2nd gear

16 - Coupling plate

- Installation position ⇒ Fig. 1

17 - Bushing for 3rd and 4th gear

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

18 - Ball sleeve

- Pry off selector rod using screwdriver
- Press onto selector rod

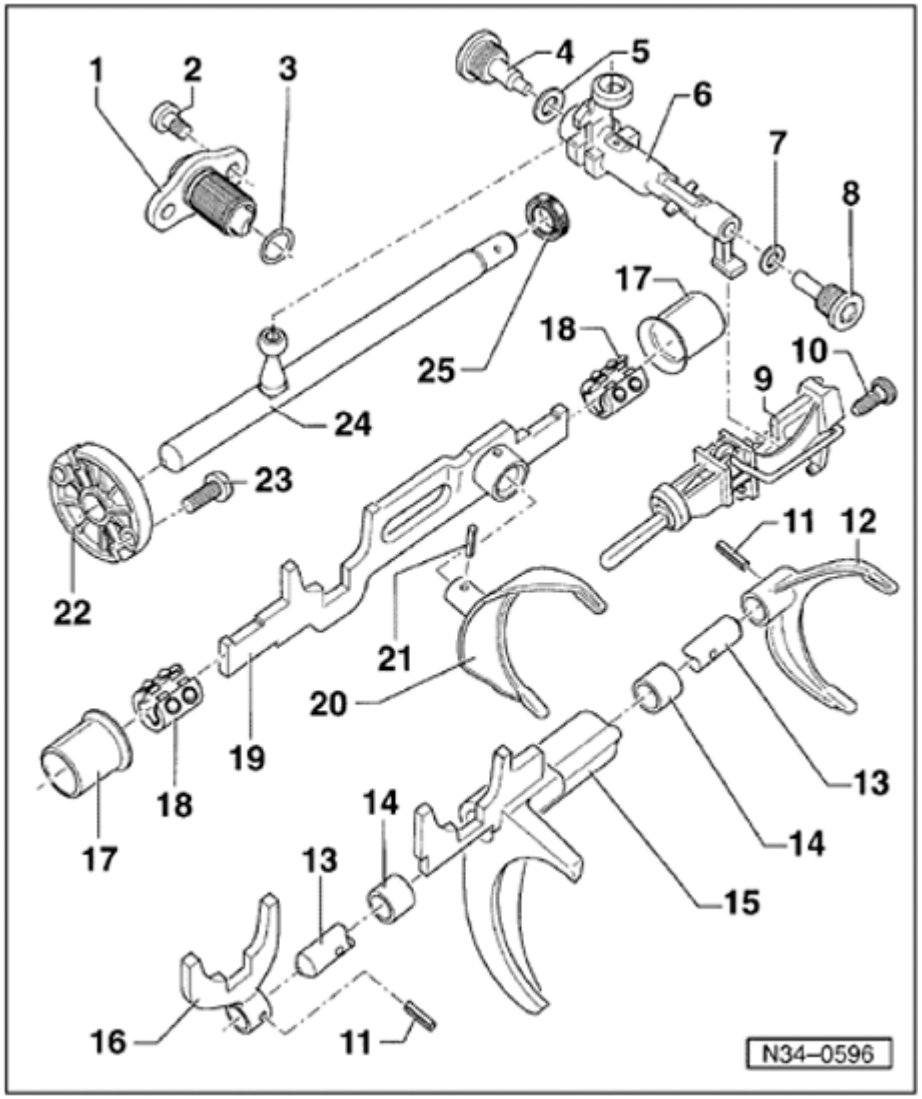
19 - Shift rod for 3rd and 4th gear

20 - Shift fork for 3rd and 4th gear

21 - Roll pin

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34-82



22 - Cover

- For shift rod

23 - Torx® bolt

- 20 Nm (15 ft lb)

24 - Shift rod

25 - Sealing washer

- Pry out using screwdriver
- Installation position ⇒ Fig. 5

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34-83

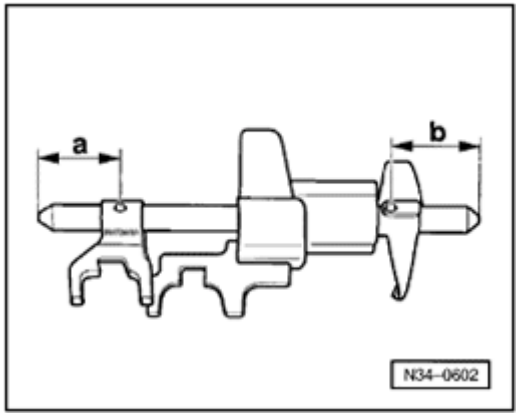


Fig. 1 Installation position of 5th and reverse gear shift fork and coupling plate for shift rod

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

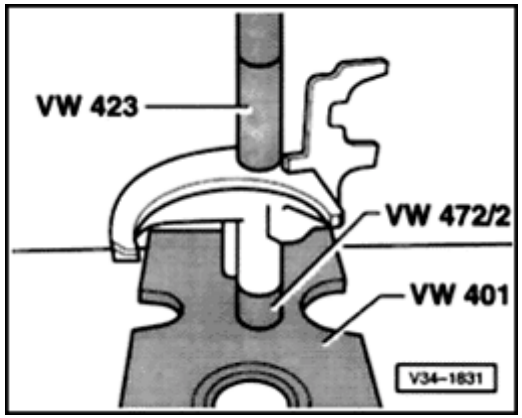


Fig. 2 Removing and installing ball sleeve

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34-84

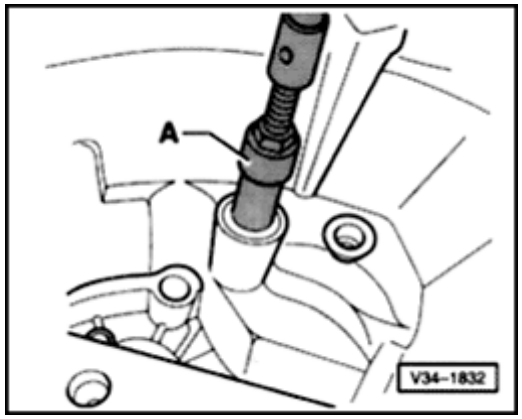


Fig. 3 Removing bushing for 3rd and 4th gear shift rod

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

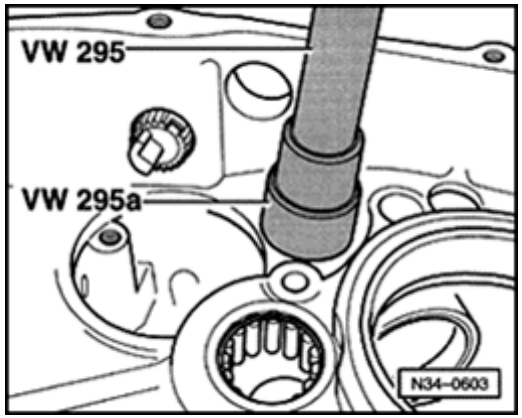


Fig. 4 Driving in bushing for 3rd and 4th gear shift rod onto stop

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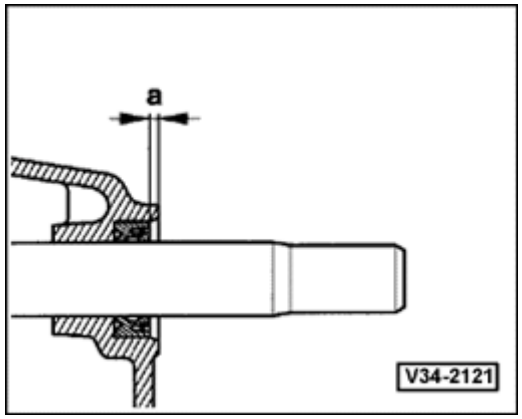


Fig. 5 Installation position of sealing washer

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

Dimension -a- : 1 mm (0.039 in.)

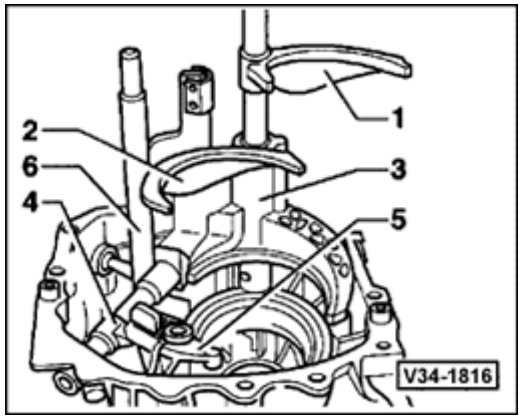


Fig. 6 Installation position of complete selector mechanism in transmission

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

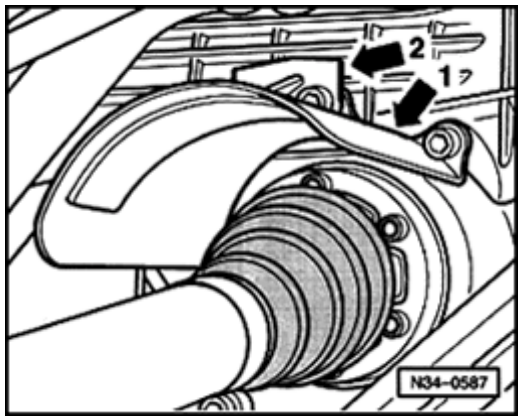
5 - Shift detent

6 - Shift rod

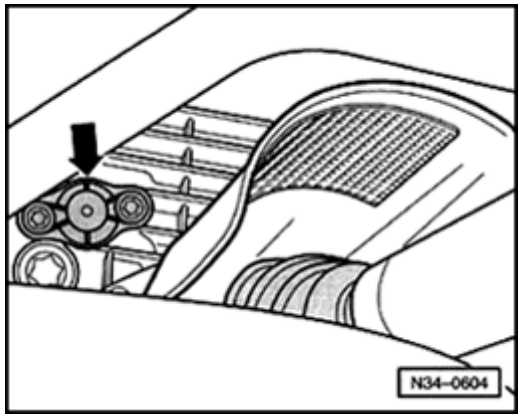
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34-86

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.

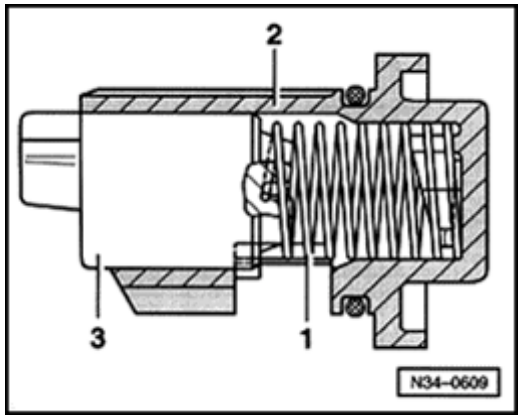


- Remove gear lock (arrow).

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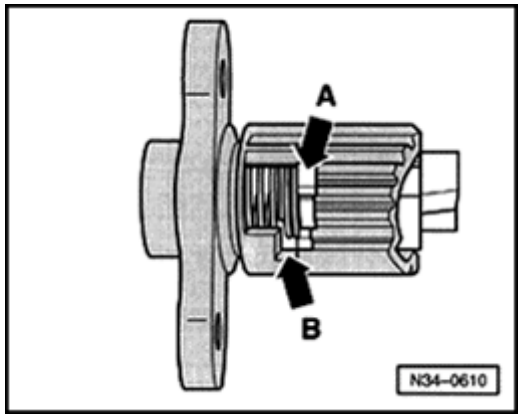
34-87

Assembling gear lock



- 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 approx. 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



Installation position of bushing:

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

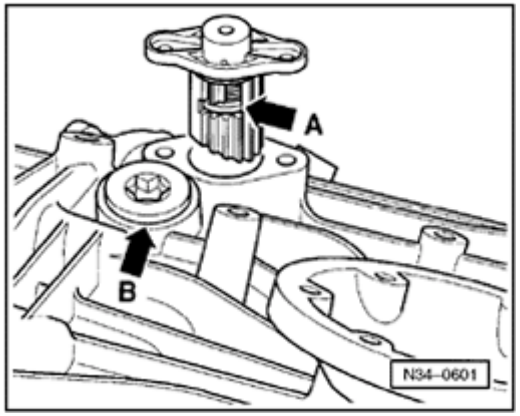
Checking installation position:

- 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-)

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34-88



➢ Installation position of complete gear lock in transmission:

The recess (arrow -A-) faces bolt (arrow -B-)

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Input shaft, disassembling and assembling

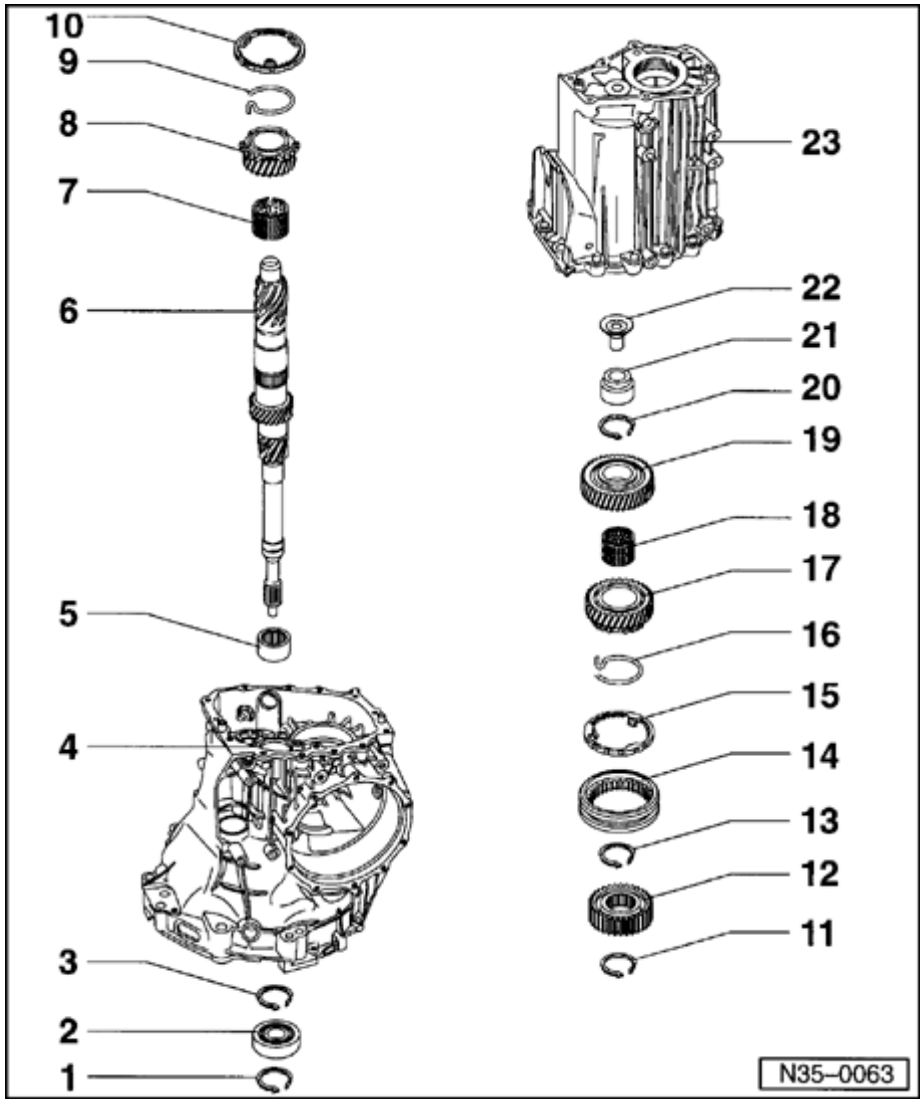
Special tools and equipment

- 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 416B tube
- VW447I thrust pad
- VW771 slide hammer-complete set
- 30-24 drift
- 30-100 press tube

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

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Notes:

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

1 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -1-
- Determining thickness ⇒ Page 35-17 , input shaft, adjusting

2 - Ball bearing for input shaft

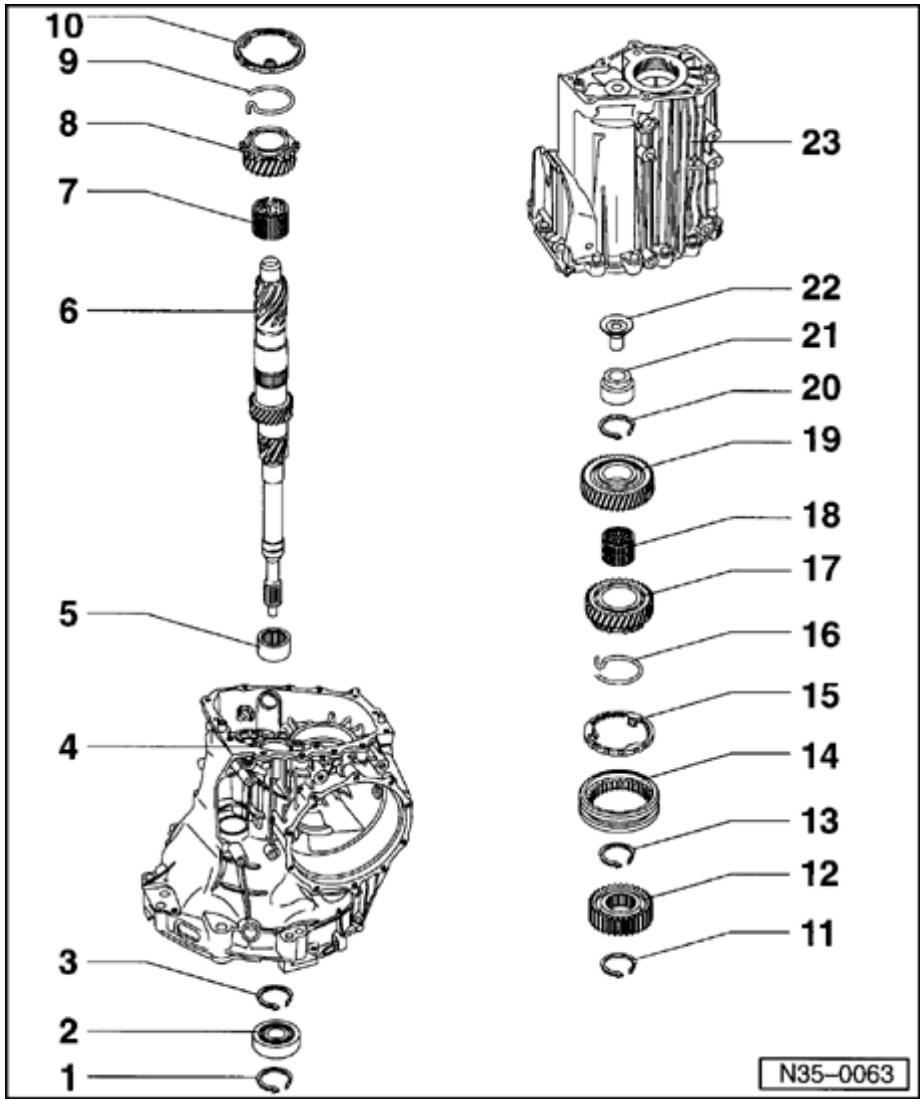
- Removing and installing ⇒ Page 34-55

3 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -2-
- Determining thickness ⇒ Page 35-17 , input shaft, adjusting

4 - Transmission housing

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5 - Needle bearing for input shaft

- Secured with bolt ⇒ Fig. 1
- Driving out ⇒ Fig. 2
- Application of input shaft/needle bearing ⇒ Fig. 3
- Allocation ⇒ Fig. 4
- Pressing in ⇒ Fig. 5

6 - Input shaft

- With oiling sleeve
- Driving in oiling sleeve ⇒ Fig. 6
- Application of input shaft/needle bearing ⇒ Fig. 3
- Adjusting ⇒ Page 35-17

7 - Needle bearing for 3rd gear

8 - 3rd gear

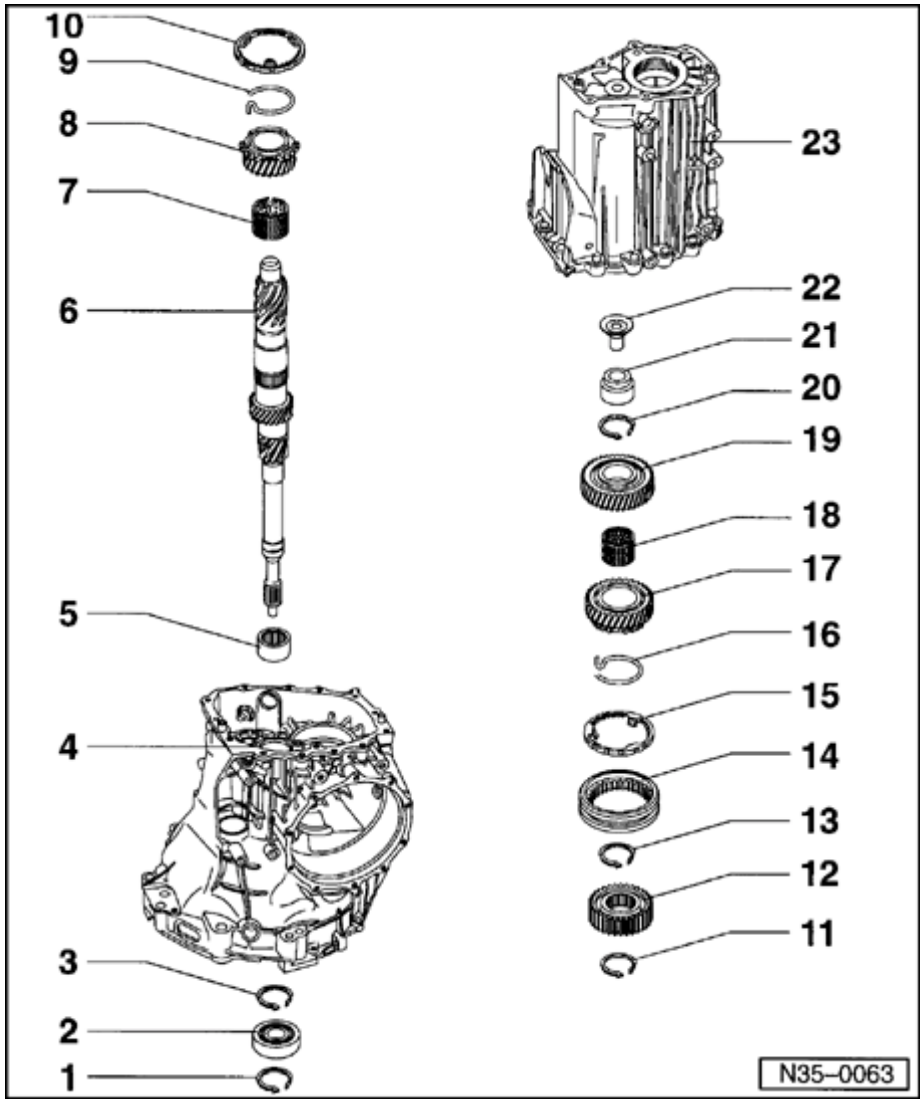
9 - Spring

- Inserting in 3rd gear ⇒ Fig. 12
- Application of spring to gear ⇒ Parts catalog

10 - Synchronizer ring for 3rd gear

- Checking for wear ⇒ Fig. 13

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11 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -3-

12 - Synchronizer hub for 3rd and 4th gears

- Shoulder faces 3rd gear
- Pressing off ⇒ Fig. 11
- Pressing on ⇒ Fig. 16

13 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -4-
- Re-determining thickness when replacing synchronizer body ⇒ Fig. 13

14 - Operating sleeve for 3rd and 4th gears

- Allocation ⇒ Fig. 17

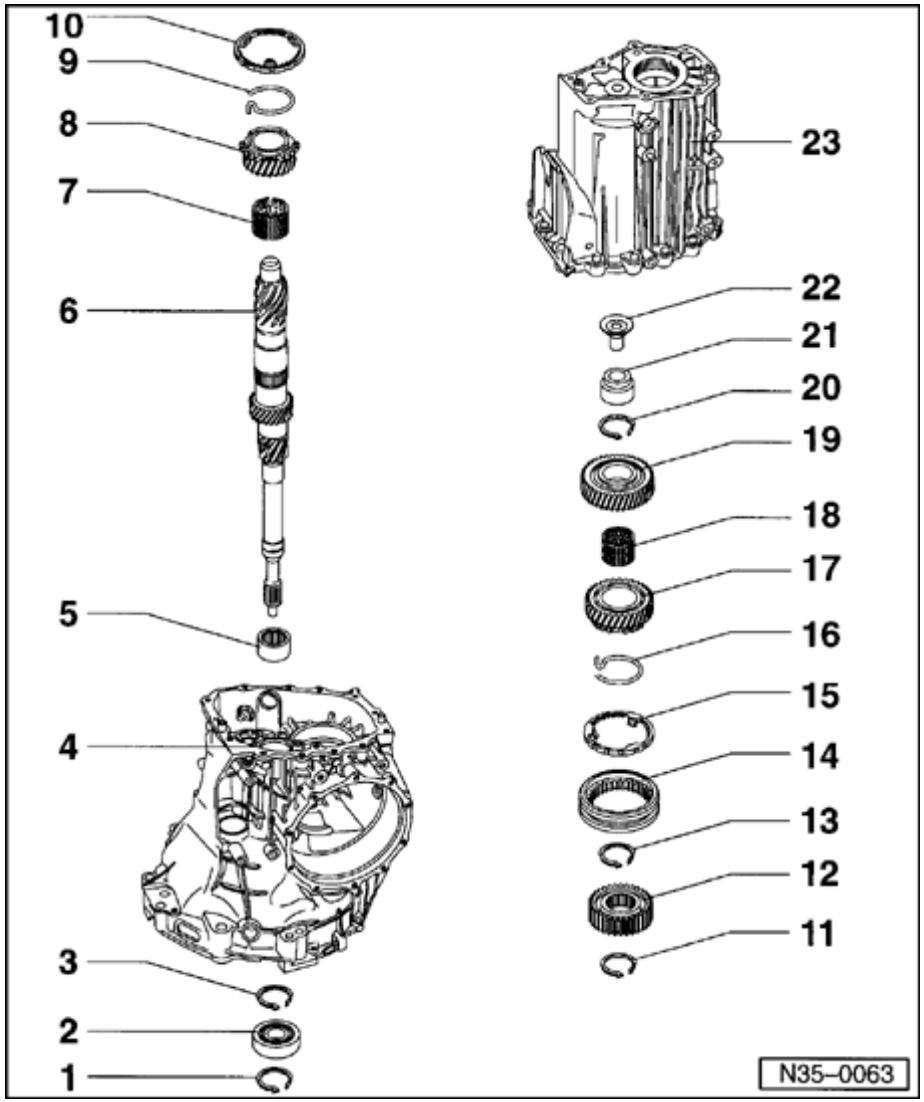
15 - Synchronizer ring for 4th gear

- Checking for wear ⇒ Fig. 13

16 - Spring

- Inserting in 4th gear ⇒ Fig. 12
- Application of spring to gear ⇒ Parts catalog

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17 - 4th gear

18 - Needle bearing for 4th gear

19 - 5th gear

- Pressing off ⇒ Fig. 10
- Pressing on ⇒ Fig. 18

20 - Circlip

- Identification
- Allocation ⇒ Fig. 14 item -5-
- If 5th gear is replaced, re-determine thickness of circlip ⇒ Fig. 15

21 - Needle bearing for input shaft

- Always replace
- Damaged when removed
- Pulling out ⇒ Fig. 7
- Allocation ⇒ Fig. 8
- Driving in ⇒ Fig. 9

22 - Plastic sleeve

- Made of plastic

23 - Transmission cover

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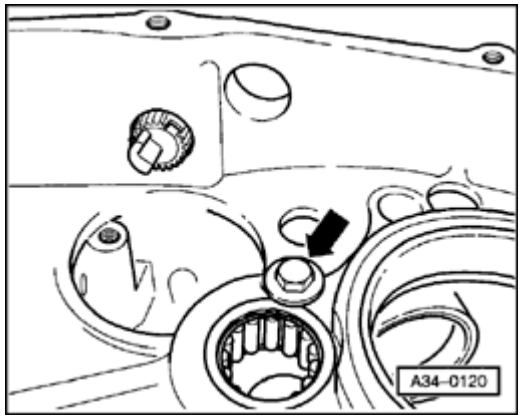


Fig. 1 Securing bolt for needle bearing

- Remove securing bolt (arrow).

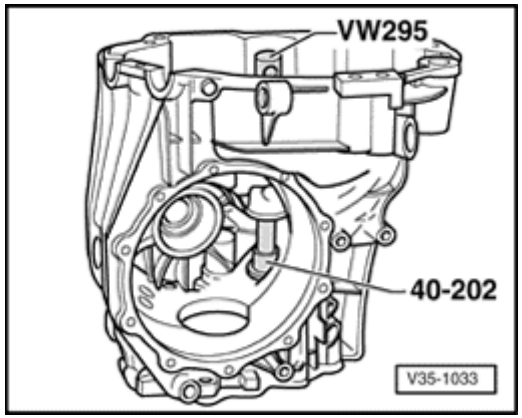


Fig. 2 Driving out needle bearing

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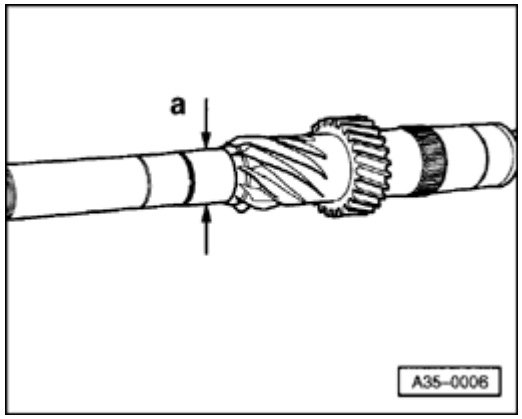


Fig. 3 Allocation of input shaft/needle bearing

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

CAUTION!

Part numbers are listed here for reference only. Always check with your Parts department for the latest information.

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

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

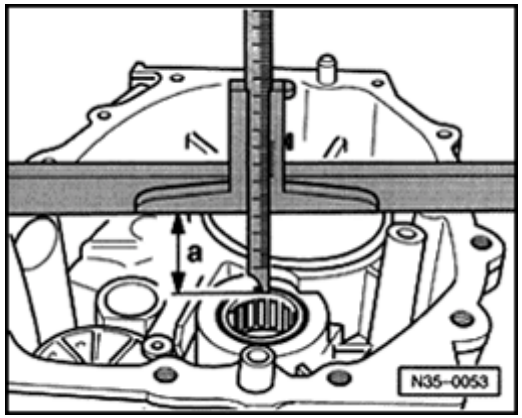


Fig. 4 Allocation of needle bearing

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.

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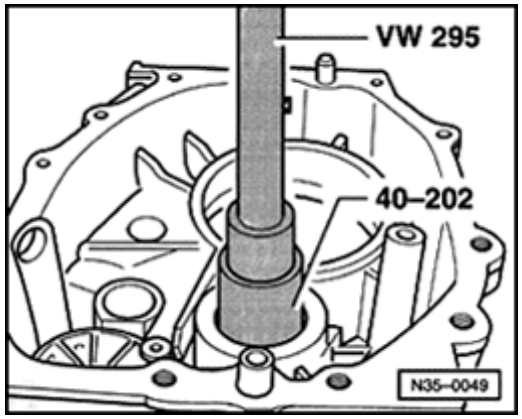


Fig. 5 Pressing in needle bearing

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

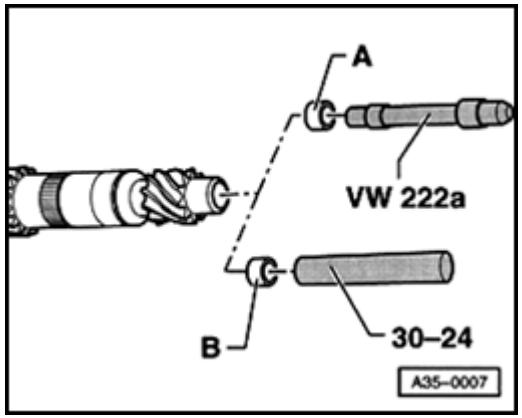


Fig. 6 Driving in oiling sleeve into input shaft

Item	Dia. 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 installation tool
- Allocation: 3.5 mm (0.138 in.) below upper edge

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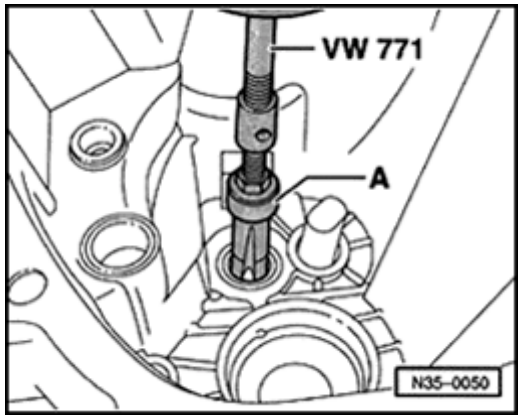


Fig. 7 Pulling out needle bearing

A - Internal puller 22-28 mm (0.866-1.102 in.), e.g. Kukko 21/4 extractor

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

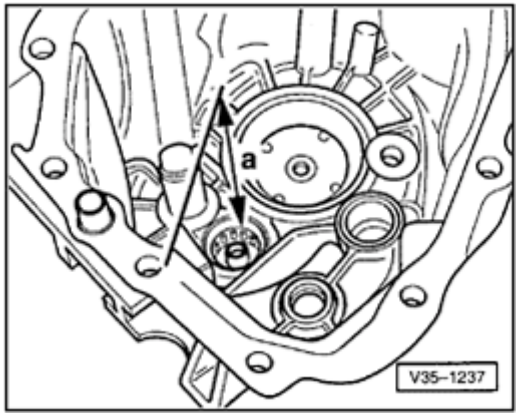


Fig. 8 Allocation of needle bearing

Dimension a: 216 mm (8.503 in.)

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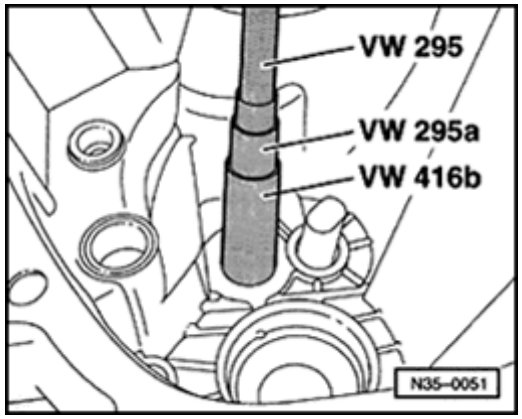


Fig. 9 Driving in roller sleeve

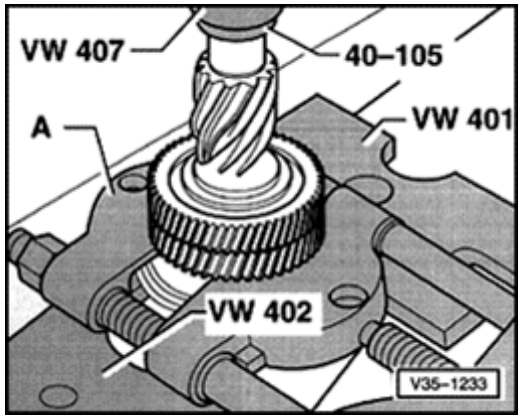


Fig. 10 Pressing off 5th gear

- Remove circlip before pressing off.

A- Separating device 22-115 mm (0.866-4.527 in.), e.g. Kukko 17/2 separating tool

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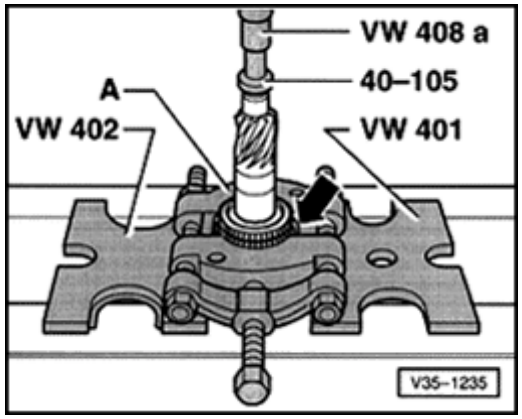


Fig. 11 Pressing off synchronizer hub for 3rd and 4th gears

- 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 (0.866-4.527 in.), e.g. Kukko 17/2 separating tool

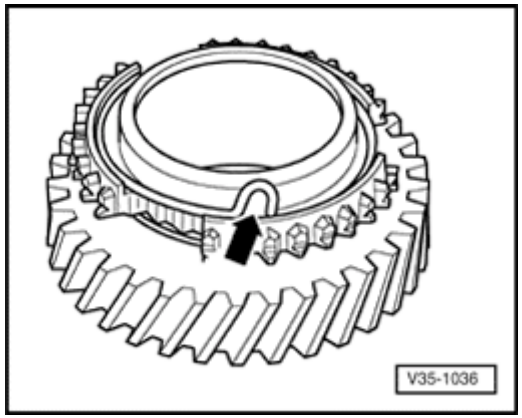


Fig. 12 Inserting spring in gear

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

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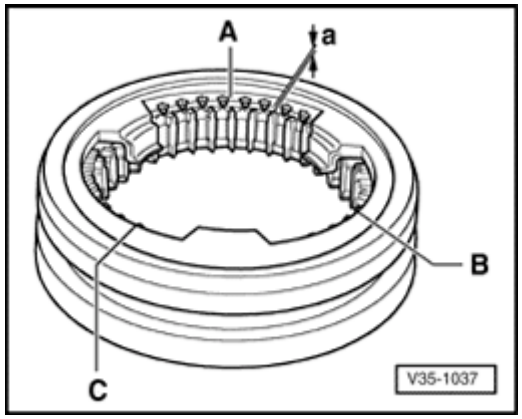


Fig. 13 Checking synchronizer-ring for wear

- Press synchronizer-ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add measured values and divide by 3 to calculate average.

The calculated gap must not be less than 0.5 mm (0.019 in.).

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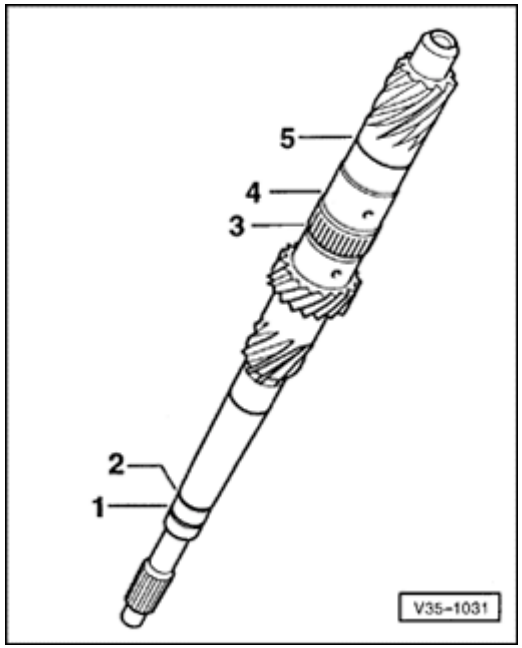


Fig. 14 Allocation of circlips

The circlips -1- and -2- secure the input shaft ball bearing.

Determining thickness ⇒ Page 35-17 , input shaft, adjusting

The circlip -3- secures the 3rd and 4th gear synchronizer hub.

Thickness: 2.00 mm (0.078 in.)

Identification: brown color

The circlip -4- secures the 3rd and 4th gear synchronizer hub.

Determining thickness ⇒ Page 35-14 , table

Identification: blue color

The circlip -5- secures the 5th gear.

Determining thickness ⇒ Page 35-14 , table

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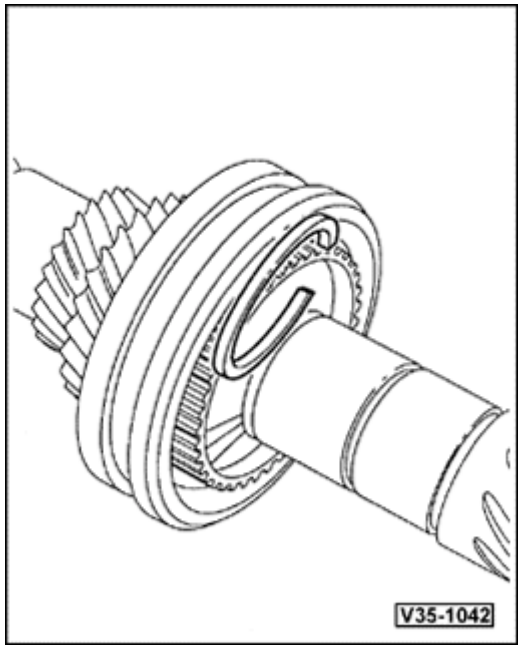


Fig. 15 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Determine circlip according to table. Part number ⇒ 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	

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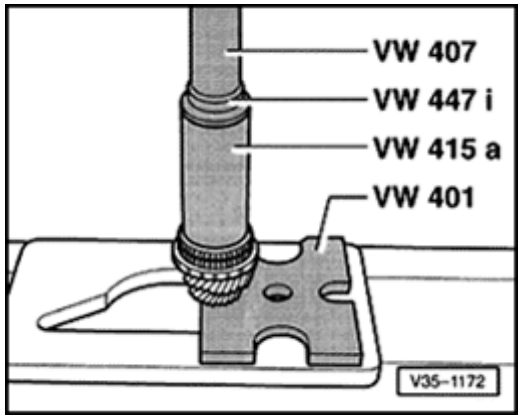


Fig. 16 Pressing on synchronizer hub for 3rd and 4th gears

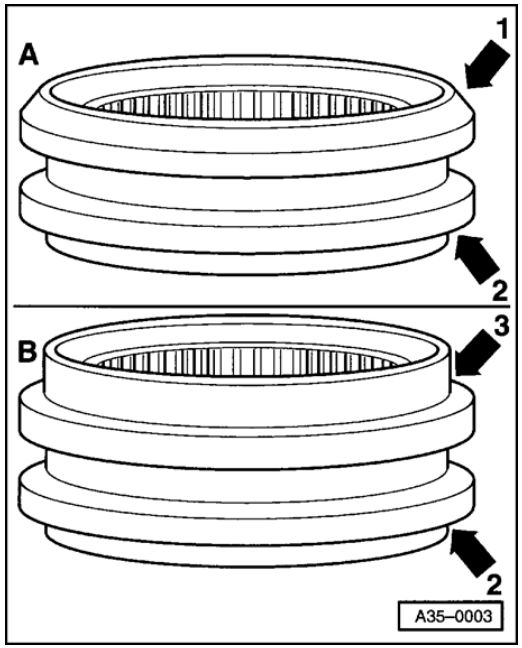


Fig. 17 Allocation of operating sleeve

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

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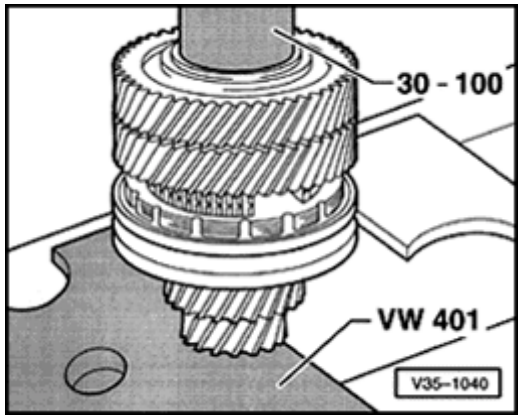


Fig. 18 Pressing on 5th gear

WARNING!

Wear protective gloves.

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

Allocation: wider collar faces reverse gear.

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35-17

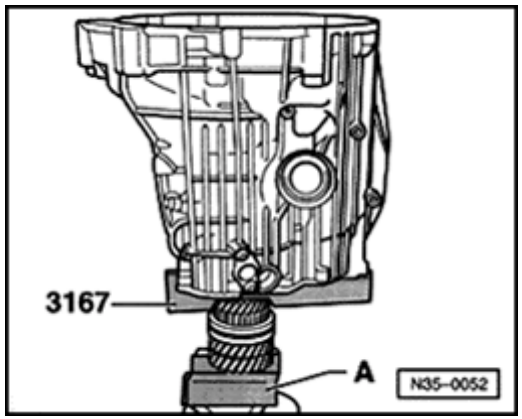
Input shaft, adjusting

Note:

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

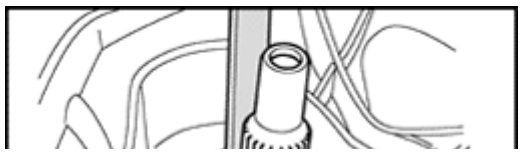
Special tools and equipment

- 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-

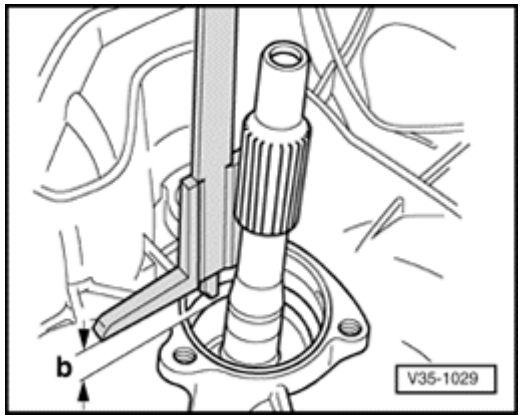


- Place depth gauge onto transmission housing and measure to lower circlip groove of input shaft.

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

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- 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 according to table ⇒ Page 35-19 . For part number ⇒ parts catalog

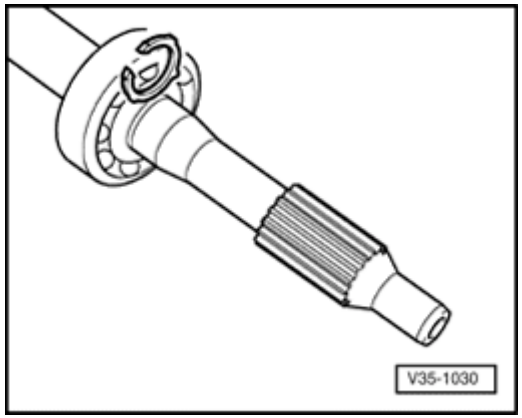
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Available circlips

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

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35-20



Determining the circlip in front of input shaft ball bearing

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

- Determine thickest circlip which can still just be installed.
- Determine circlip 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

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Drive pinion and hollow shaft, disassembling and assembling

Special tools and equipment

- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW411 punch
- VW412 thrust disc
- 415A tube
- 416B tube
- 418A tube
- 429 thrust ring
- VW4471 thrust pad

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- VW454 thrust tube
- VW519 sleeve
- VW771 slide hammer-complete set

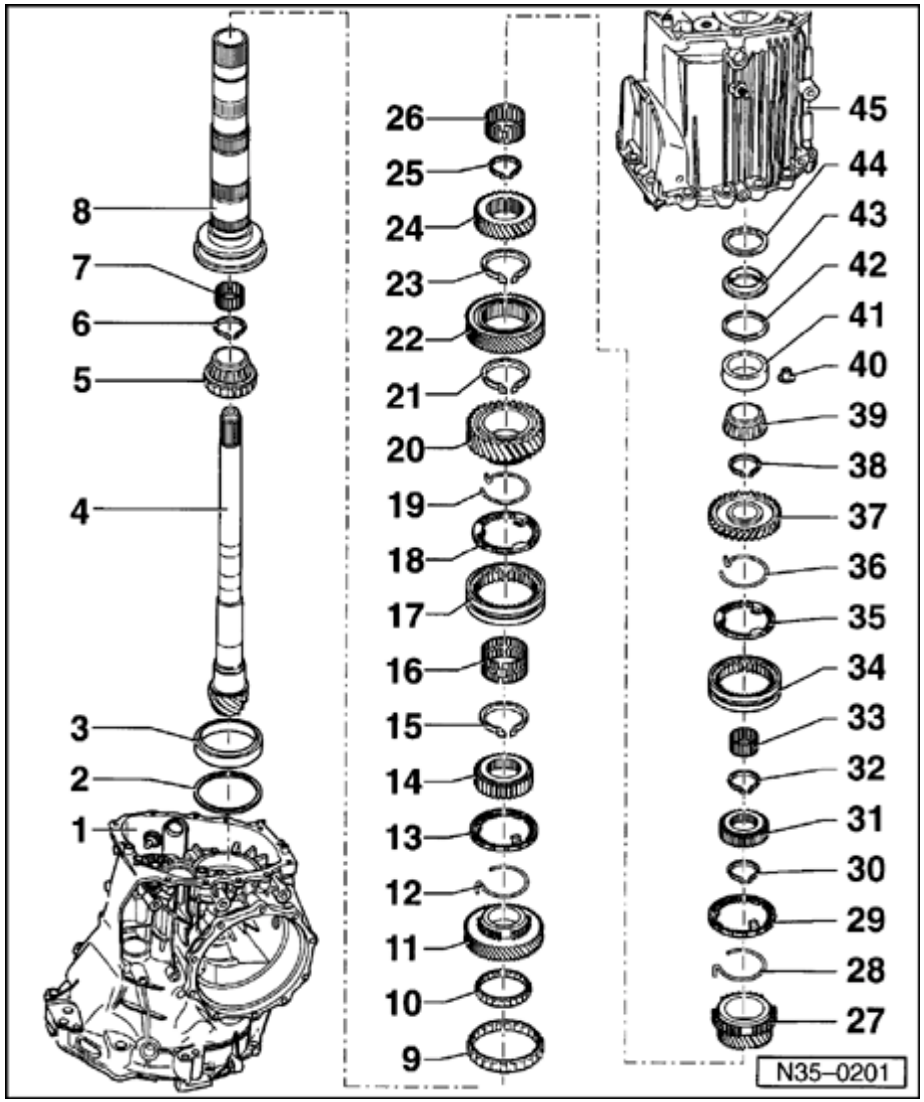
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35-22

- 40-103 sleeve
- 2010 sleeve
- 3062 thrust pad
- 3128 bushing puller
- Kukko 17/2 separating tool
- Kukko 21/1 puller

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35-23



Notes:

- *When installing new gears or the final drive set, consult technical data ⇒ Page 00-3 .*
- *Adjustments are required when replacing components marked by1) ⇒ Page 39-37 , List of adjustments*

1 - Transmission housing

2 - Shim S3

- List of adjustments overview ⇒ Page 39-37

3 - Double tapered roller bearing outer race1)

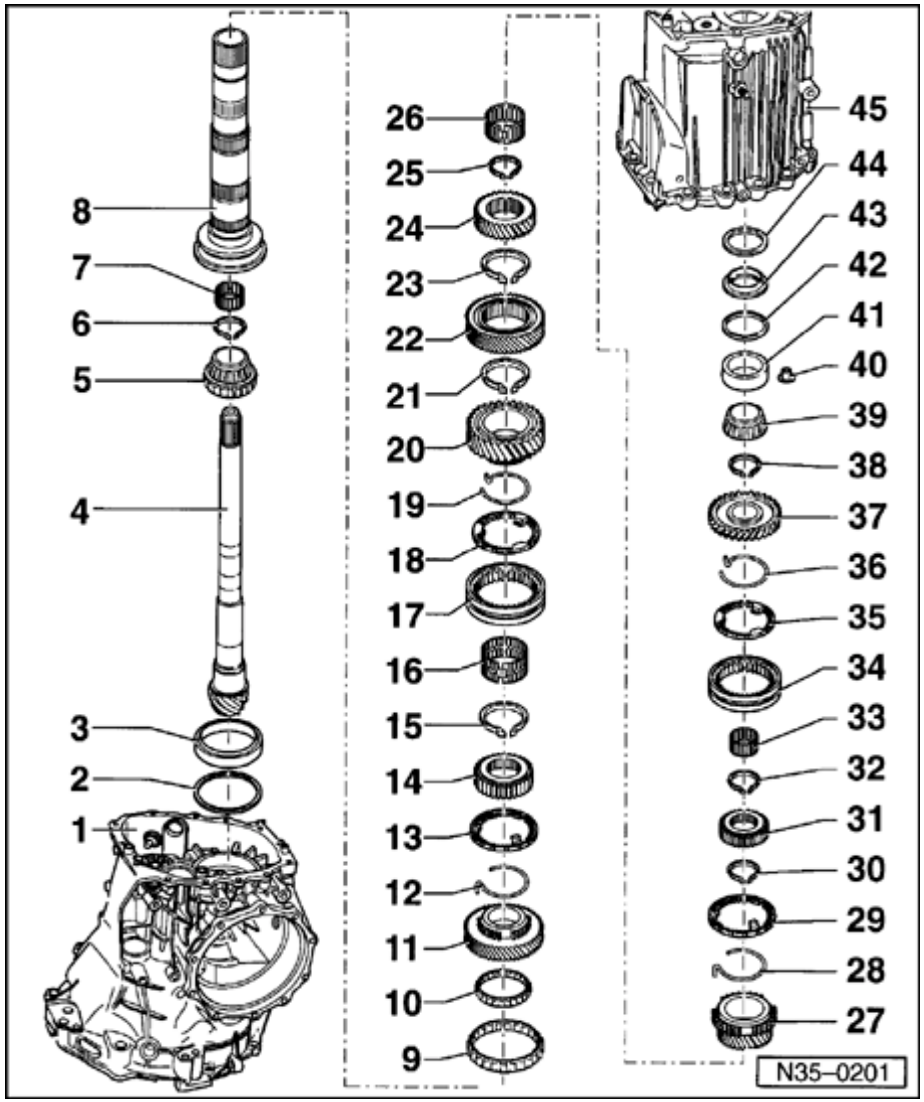
- Replace together with item - 5 -
- Pulling out ⇒ Fig. 1
- Pressing in ⇒ Fig. 3

4 - Drive pinion

- Matched to ring gear, always replace together as a set
- Adjusting drive pinion and ring gear ⇒ Page 39-34

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35-24



5 - Double tapered roller bearing inner race1)

- Always replace
- Damaged when removed
- Pressing off ⇒ Fig. 2
- Pressing on ⇒ Fig. 4

6 - Circlip

- Re-determine thickness if double roller bearing is replaced ⇒ Fig. 5

7 - Needle bearing for hollow shaft1)

- For drive pinion in hollow shaft
- Lubricate with MOS2 grease

8 - Hollow shaft1)

9 - Needle bearing for 1st gear

10 - Needle bearing for 1st gear

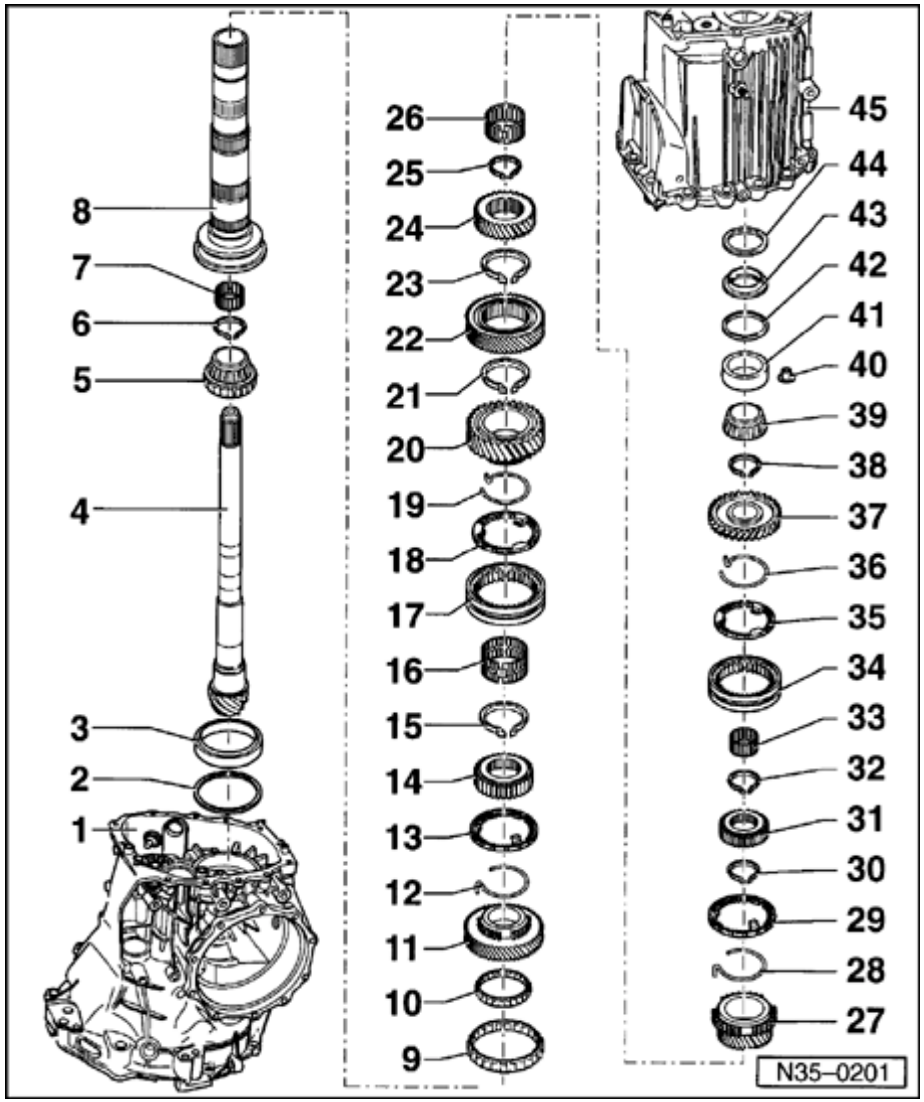
11 - 1st gear

12 - Spring

- Inserting in 1st gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

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35-25



13 - Synchronizer ring for 1st gear

- Checking for wear ⇒ Fig. 17

14 - Synchronizer hub for 1st and 2nd gear

- Pressing off ⇒ Fig. 14
- Pressing on ⇒ Fig. 18

15 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -1-
- Re-determining thickness if synchronizer hub is replaced ⇒ Fig. 5

16 - Needle bearing for 2nd gear

17 - Operating sleeve for 1st and 2nd gear

- Allocation ⇒ Fig. 19

18 - Synchronizer ring for 2nd gear

- Checking for wear ⇒ Fig. 17

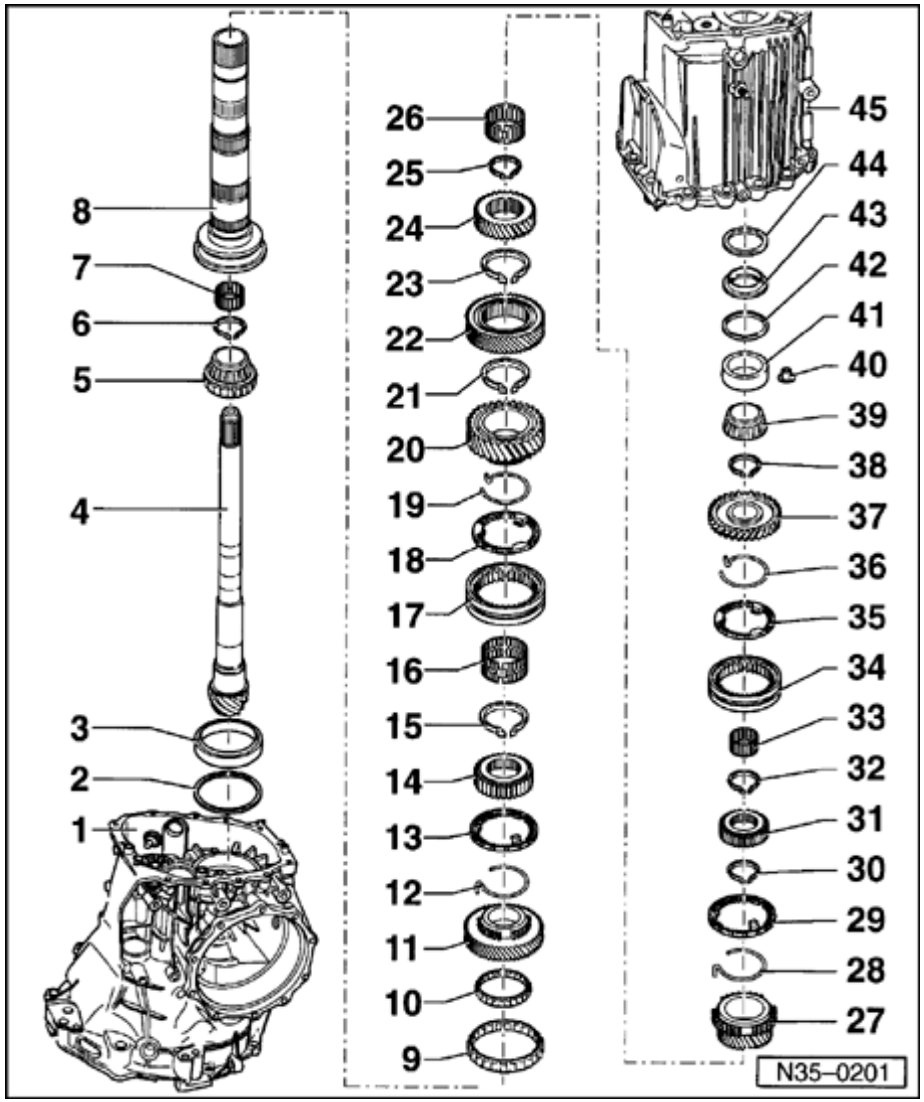
19 - Spring

- Inserting in 2nd gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

20 - 2nd gear

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35-26



21 - Circlip

- Identification
- Allocation ⇒ Fig. 15 item -2-

22 - 3rd gear

- Pressing off ⇒ Fig. 13
- Pressing on ⇒ Fig. 20

23 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -3-
- Re-determining thickness if 3rd gear is replaced ⇒ Fig. 5

24 - 4th gear

- Pressing off ⇒ Fig. 12
- Pressing on ⇒ Fig. 21

25 - Circlip

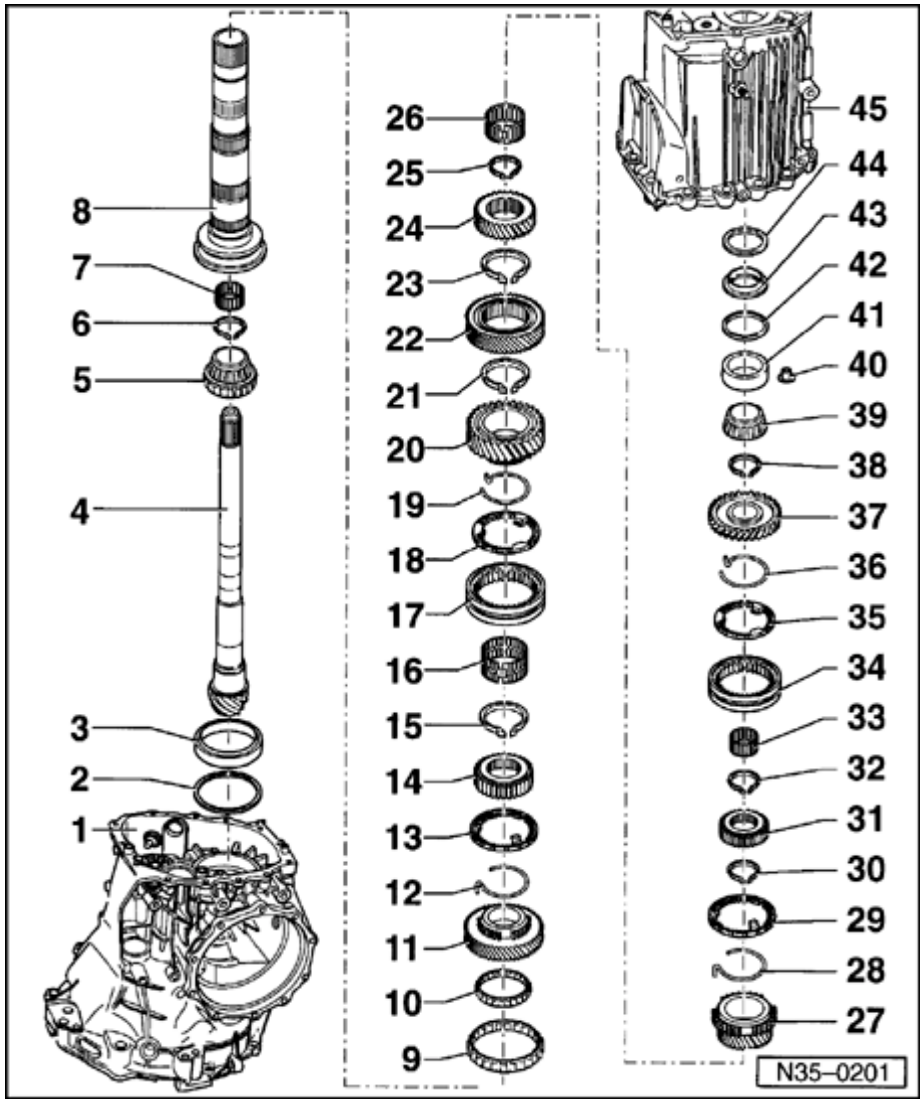
- Identification
- Allocation ⇒ Fig. 15 , item -4-
- Re-determining thickness if 4th gear is replaced ⇒ Fig. 5

26 - Needle bearing

27 - 5th gear

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35-27



28 - Spring

- Inserting in 5th gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

29 - Synchronizer ring for 5th gear

- Checking for wear ⇒ Fig. 17

30 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -5-

31 - Synchronizer hub for 5th gear and reverse gear

- Pressing off ⇒ Fig. 11
- Pressing on ⇒ Fig. 22

32 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -6-
- Re-determining thickness if synchronizer hub is replaced ⇒ Fig. 5

33 - Needle bearing

- For reverse gear

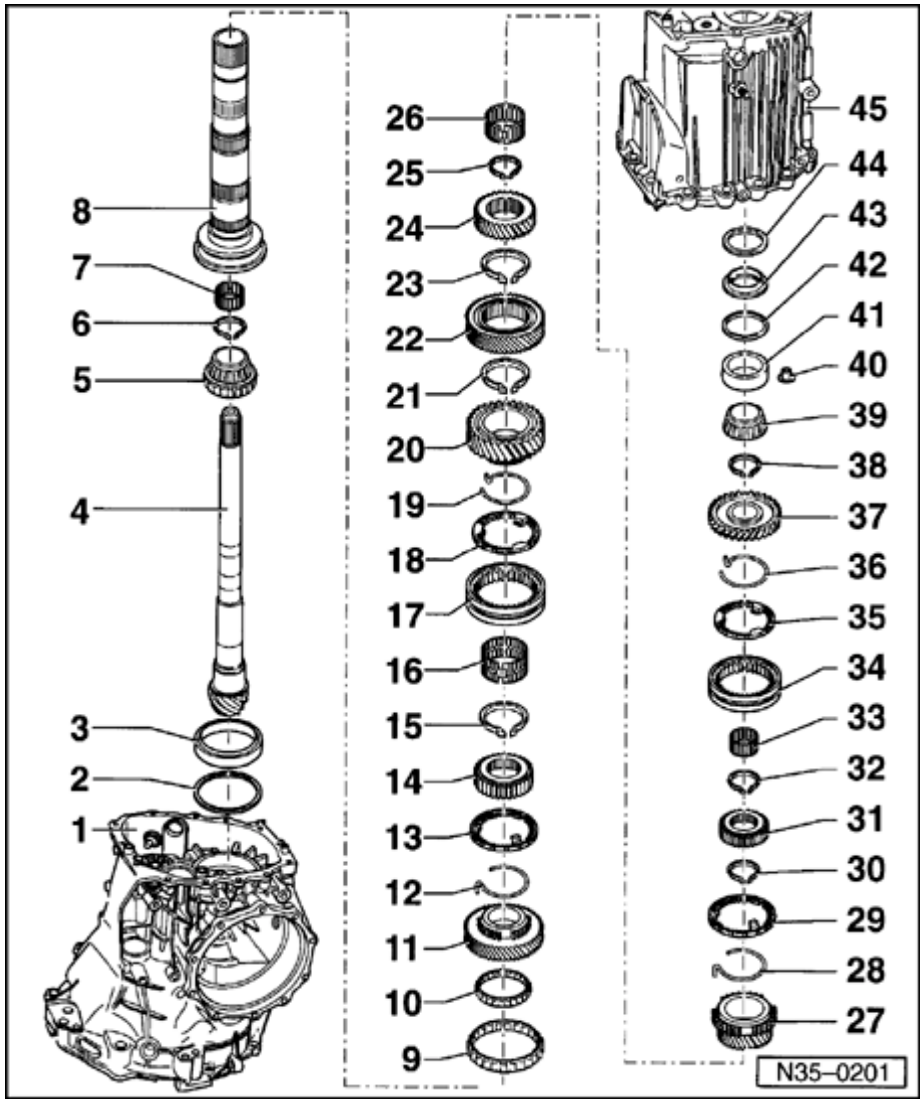
34 - 5th and reverse gear operating sleeve

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♦ Allocation ⇒ Fig. 23

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35-28



35 - Synchronizer ring for reverse gear

- Checking for wear ⇒ Fig. 17

36 - Spring

- Insert in reverse gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

37 - Reverse gear

38 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -7-

39 - Tapered roller bearing inner race1)

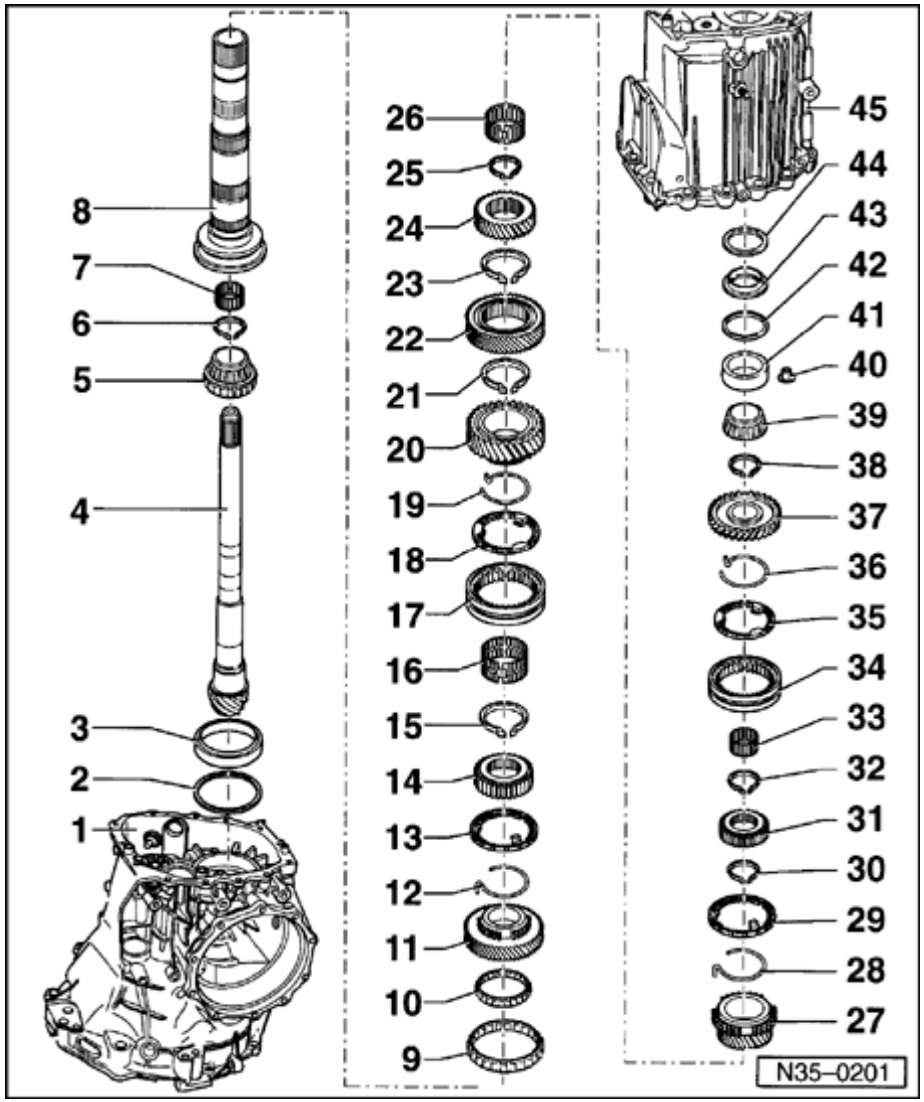
- Pressing off ⇒ Fig. 9
- Pressing on ⇒ Fig. 10

40 - Bushing

- To secure small tapered roller bearing outer race
- Pulling out ⇒ Fig. 6
- Does not need to be installed after small tapered roller bearing has been replaced

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35-29



41 - Tapered roller bearing outer race1)

- Pressing out ⇒ Fig. 7
- Pressing in ⇒ Fig. 8

42 - Shim S4

- List of adjustments ⇒ Page 39-37

43 - Ring

- Holds rubber washer
- Application ⇒ Parts catalog

44 - Rubber washer

- Compensates length variations
- Application ⇒ Parts catalog

45 - Transmission cover

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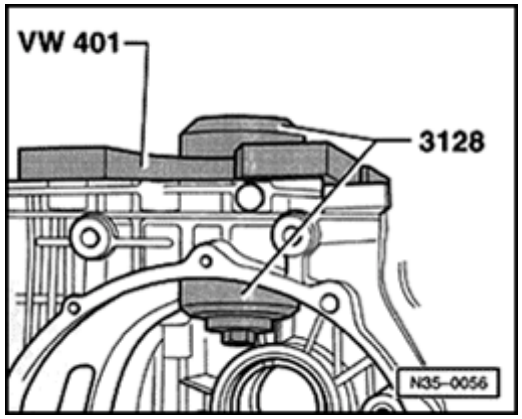


Fig. 1 Pulling out double tapered roller bearing outer race

- Remove differential ⇒ Page 39-16 .
- Place pressure piece of 3128 bushing puller below outer race.
- Install threaded part of 3128 bushing puller using VW401 thrust plate onto transmission housing.

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

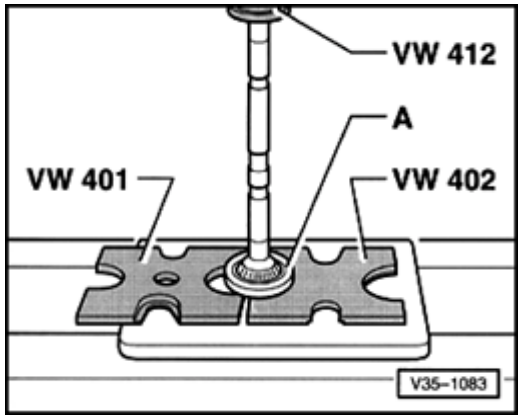


Fig. 2 Pressing off double tapered roller bearing inner race

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

Note:

When pressing off, the inner ring of the double tapered roller bearing is damaged.

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35-31

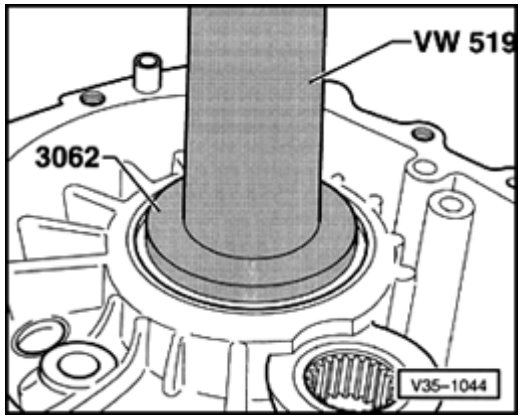


Fig. 3 Pressing in double tapered roller bearing outer race

The smaller diameter of 3062 thrust pad faces outer race.

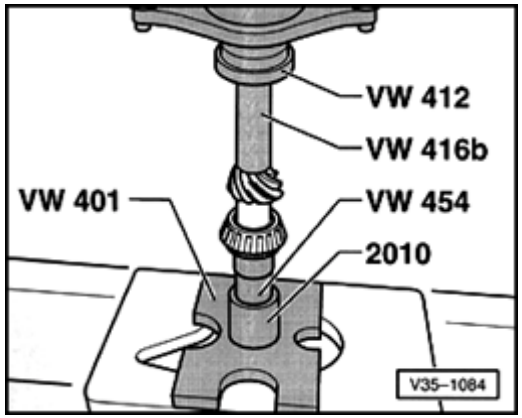


Fig. 4 Pressing on double tapered roller bearing inner race

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35-32

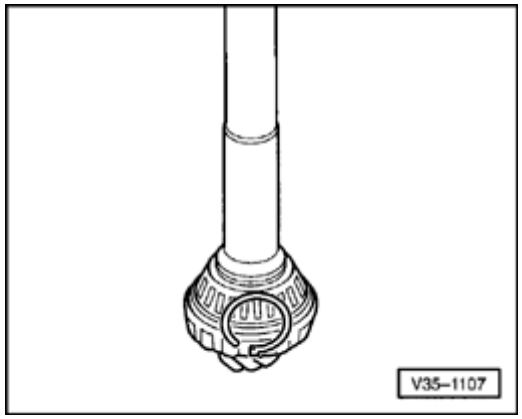


Fig. 5 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Circlips for synchronizer hubs, needle bearings and individual gears should be determined as for double tapered roller bearing shown.

  Available circlips and part numbers ⇒ Parts catalog

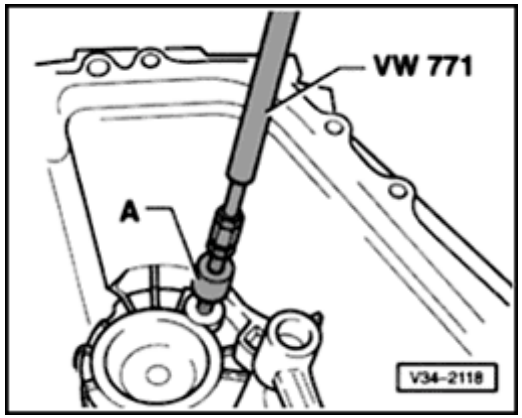


Fig. 6 Pulling out securing bushing for small tapered roller bearing outer race

A - Puller 12-14.5 mm (0.472-0.570 in.), e.g. Kukko 21/1 puller

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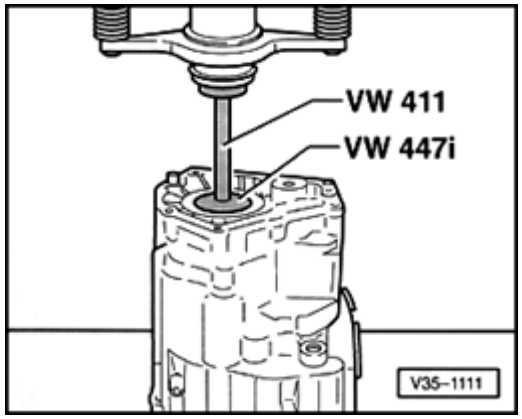


Fig. 7 Pressing out tapered roller bearing outer race

The outer race is pressed out together with pressure plate (item - 43 -), ⇒ Page 35-29 , shim S4 (item -42-) ⇒ Page 35-29 and the rubber washer for compensating length variations (item 44), ⇒ Page 35-29 .

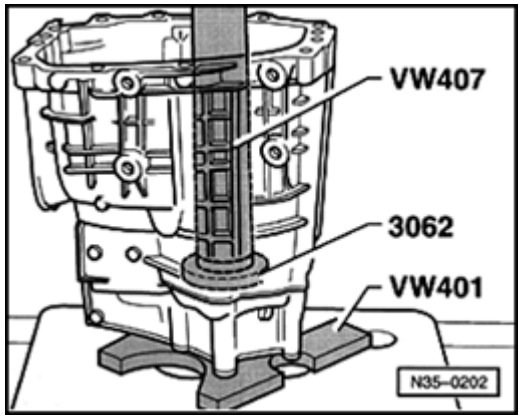


Fig. 8 Pressing in tapered roller bearing outer race

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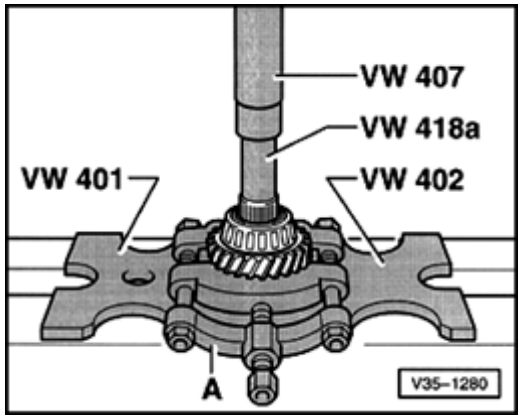


Fig. 9 Pressing off tapered roller bearing inner race

- Press off inner race together with reverse gear.

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

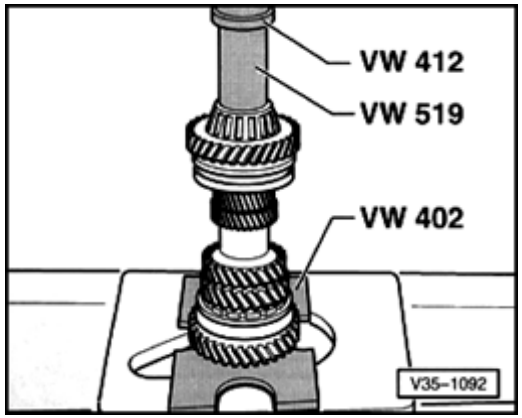


Fig. 10 Pressing on tapered roller bearing inner race

- Install circlip before pressing on inner race.

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35-35

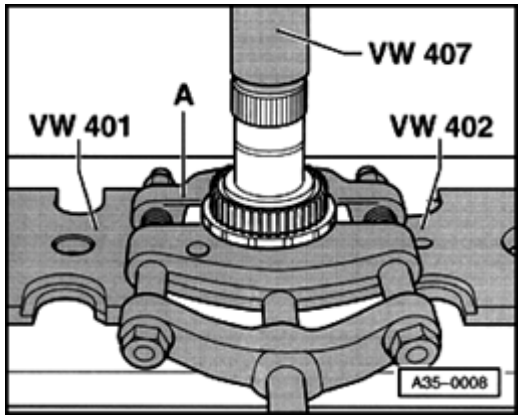


Fig. 11 Pressing off synchronizer hub for 5th gear and reverse idler gear

- Remove circlip before pressing off.
- Press off synchronizer hub together with 5th gear.

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

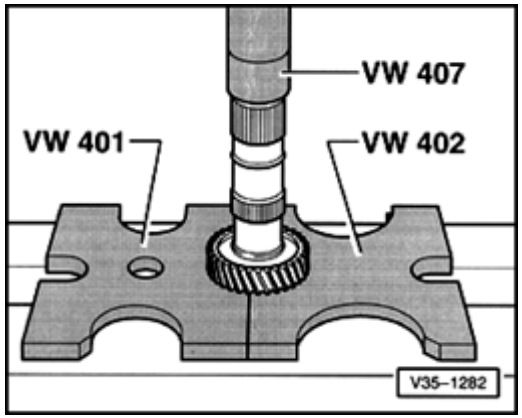


Fig. 12 Pressing off 4th gear

- Remove circlip before pressing off.

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35-36

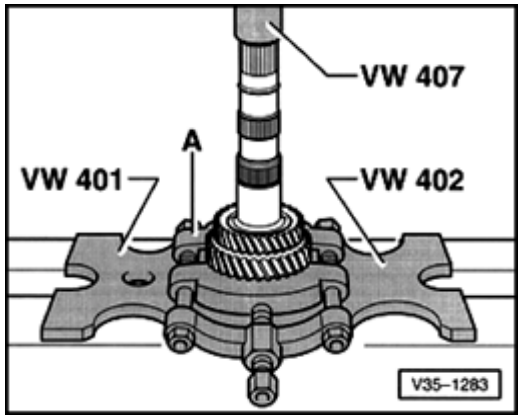


Fig. 13 Pressing off 3rd gear

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

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

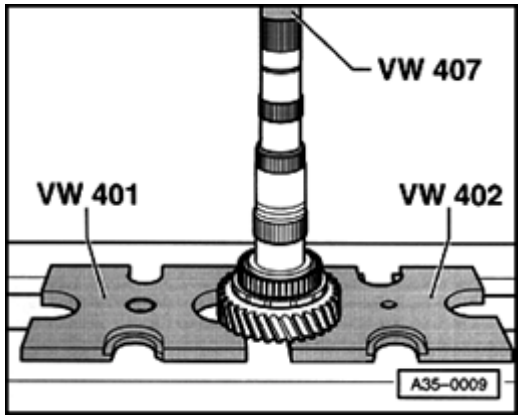


Fig. 14 Pressing off 1st and 2nd gear synchronizer hub

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

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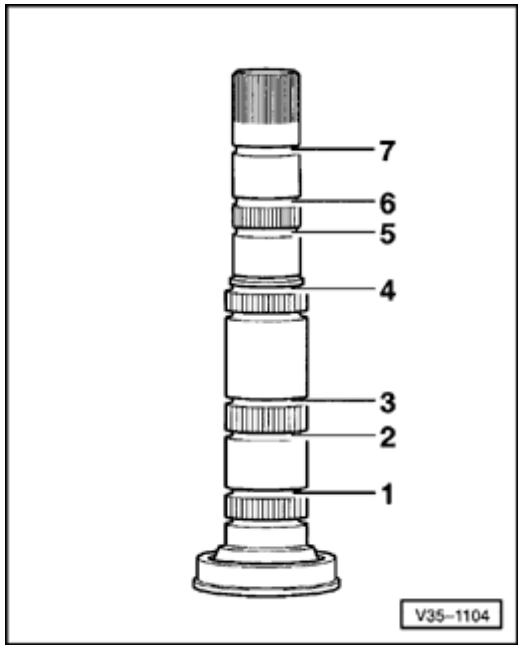


Fig. 15 Allocation of circlips

- Circlips for synchronizer hubs, needle bearings and individual gears should be determined according to Fig. ⇒ 5 .

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

Identification: color blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

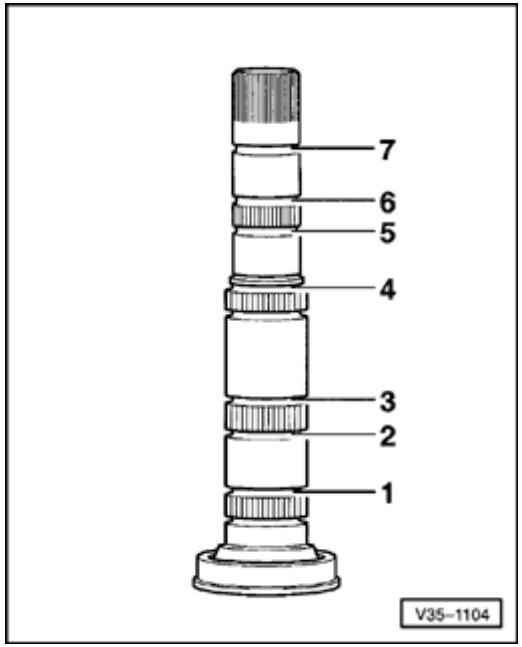
Circlip 2- secures the needle bearing/ 2nd gear

Thickness: 2.00 mm (0.078 in.). Identification: color blue

Circlip 3- secures the 3rd gear

Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	

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Circlip -4- secures the 4th gear.

Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	

Circlip -5- secures the needle bearing/ 5th gear

Thickness 2.00 mm (0.078 in.)

Identification: color brown

Circlip -6- secures the synchronizer hub for 5th and reverse gear

Identification: color blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

Circlip -7- secures needle bearing for reverse gear

Thickness 2.50 mm (0.098 in.)

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

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35-39

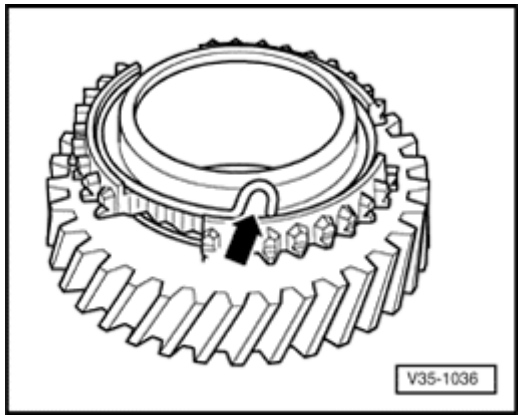


Fig. 16 Inserting spring in gear

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

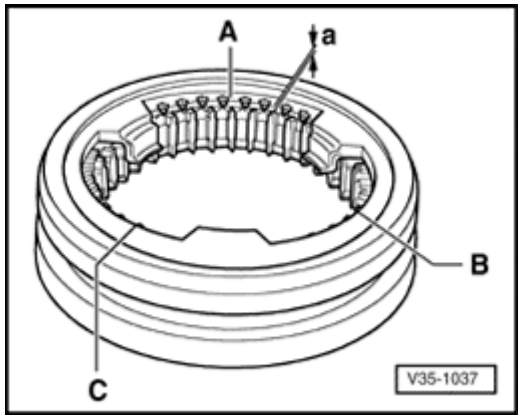


Fig. 17 Checking synchronizer ring for wear

- Press synchronizer-ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add calculated measurements and divide by 3.

The average gap must not be less than 0.5 mm (0.019 in.).

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35-40

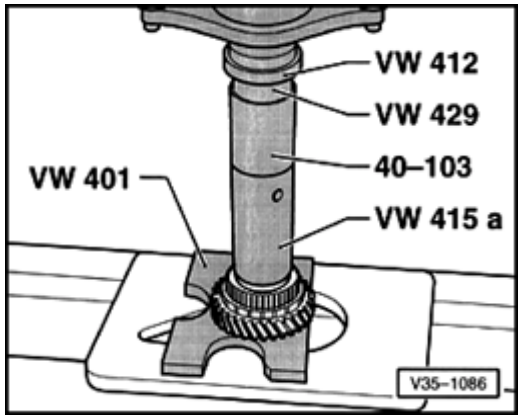


Fig. 18 Pressing on 1st and 2nd gear synchronizer hub

Allocation: higher inner collar faces 2nd gear.

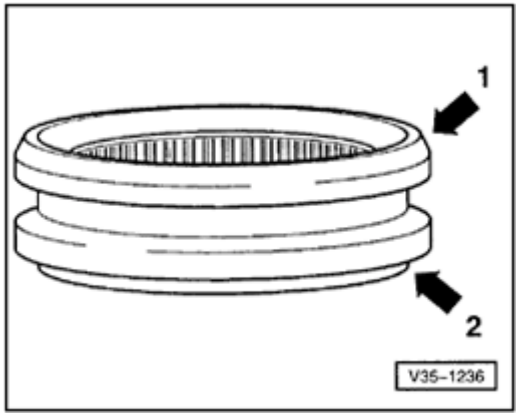


Fig. 19 Allocation of 1st and 2nd gear operating sleeve

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

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35-41

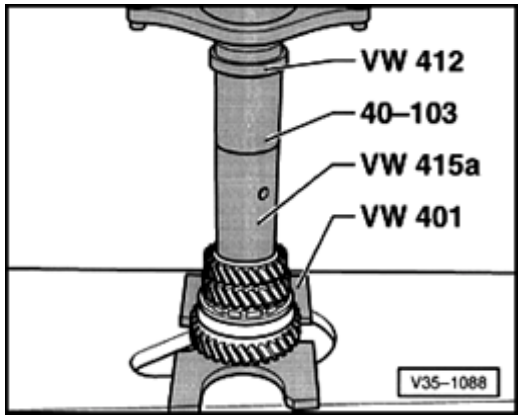


Fig. 20 Pressing on 3rd gear

Allocation: the groove on the gear faces 4th gear.

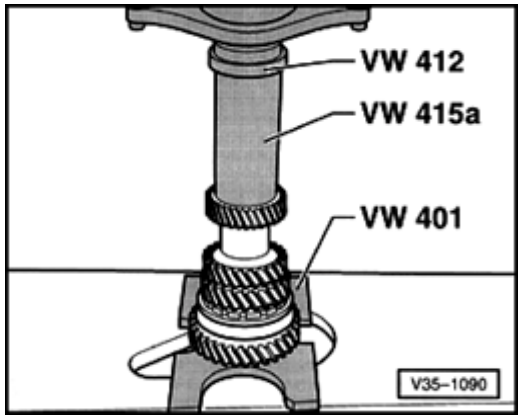


Fig. 21 Pressing on 4th gear

Allocation: higher inner collar faces 3rd gear.

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35-42

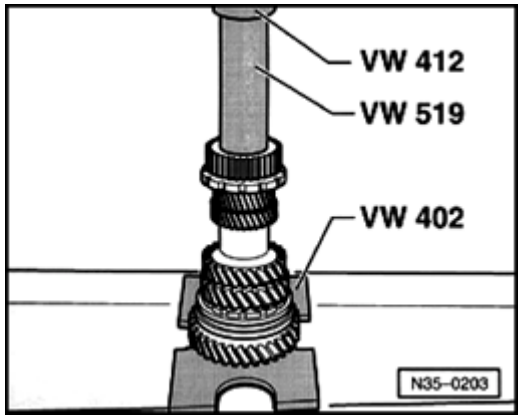


Fig. 22 Pressing on 5th and reverse gear synchronizer hub

Allocation: higher inner collar faces 5th gear.

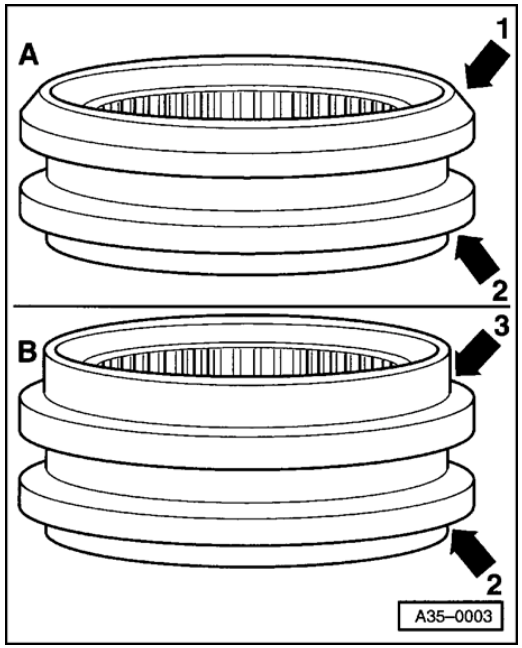


Fig. 23 Allocation of operating sleeve for 5th and reverse gears

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

Note the location of operating sleeve to reverse idler gear ⇒ Fig. 24 .

Allocation:

- Chamfer (arrow -1-) faces reverse idler gear
- Smaller offset (arrow -2-) faces 5th gear
- Larger offset (arrow -3-) faces reverse idler gear

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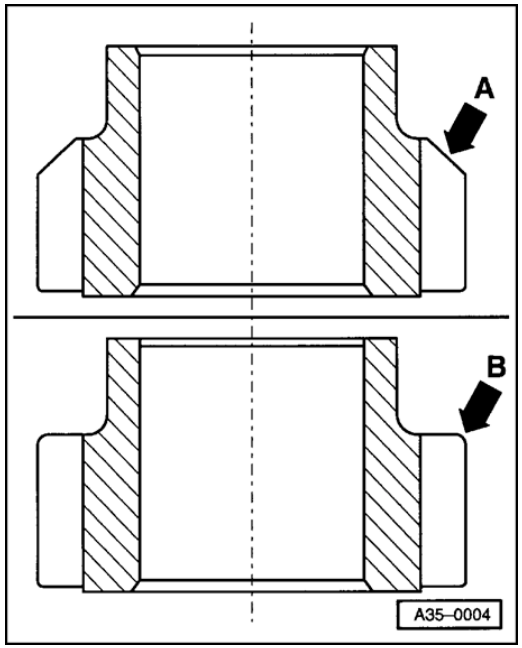


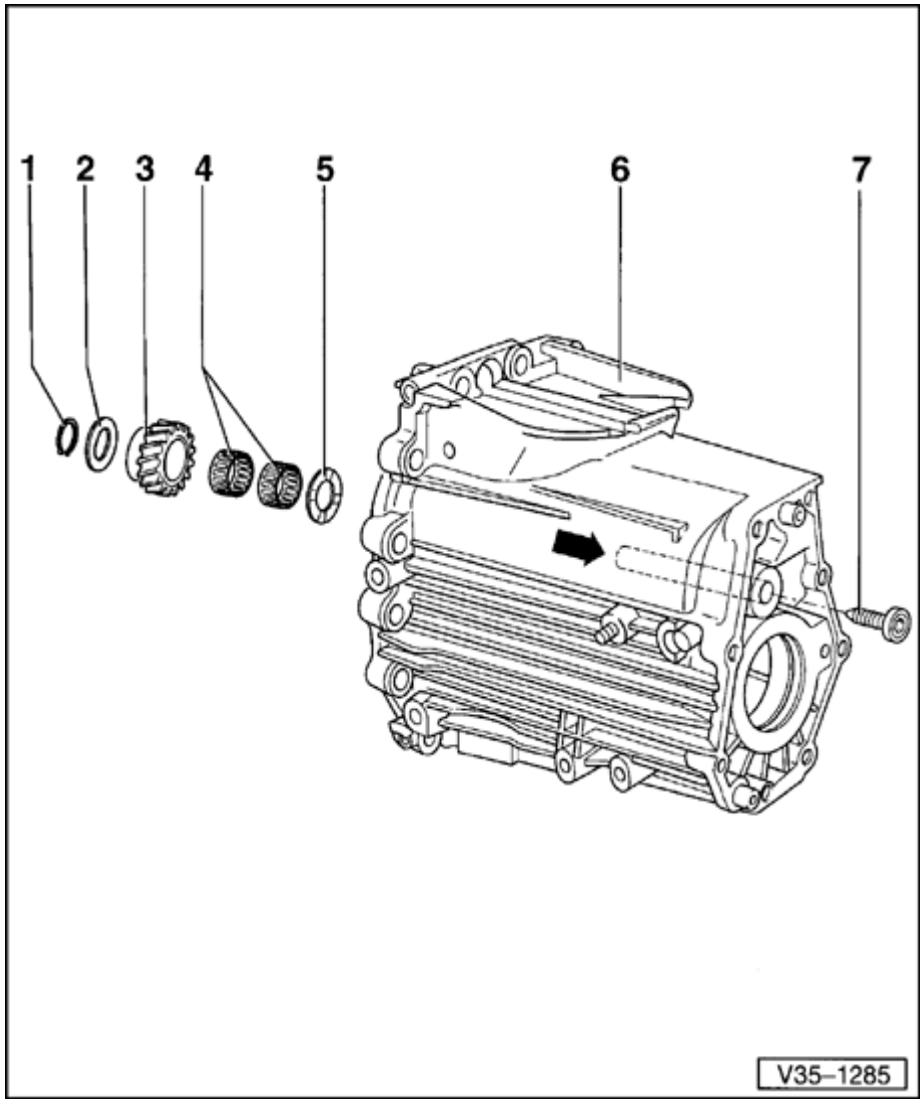
Fig. 24 Allocation of operating sleeve to reverse idler gear

On the reverse idler gear -A- both types of operating sleeves (with chamfer or with large offset) can be installed.

On reverse idler gear -B- without chamfer only operating sleeves with large offset can be installed. Do not install operating sleeves with chamfer.

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35-44



Reverse idler gear, removing and installing

1 - Circlip

2 - Washer

3 - Reverse idler gear

- Different versions, allocation ⇒ Fig. 24, Page 35-43

4 - Needle bearings for reverse idler gear

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 replacement part

7 - Torx® bolt

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

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39-1

Drive flange seal, replacing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

Special tools and equipment

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

Notes:

- *Removal and installation of the left seal is shown in the following illustration.*
- *The procedure for left and right seal is the same.*
- *The exhaust system does not need to be removed.*

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- *Transmission code CXF: drive flanges are installed without polygon bearings.*

- *For drive flanges with a gear diameter of 30 mm (1.181 in.) a spacer ring is installed between the polygon bearing and the tapered bearing ⇒ Page 39-4 .*

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39-2

Removing

- Remove heat shield for drive axle.

- Remove drive axle from transmission drive flange.

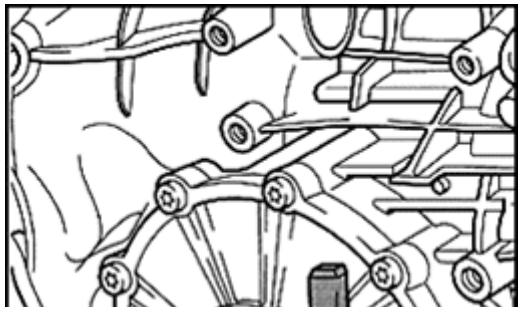
⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40.*

- 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 underneath transmission.

- Place chisel or spacer -A- under drive flange.



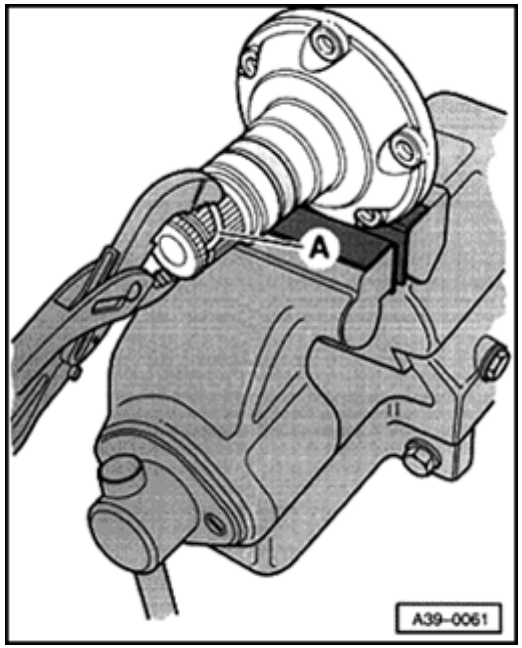
- Turn bolt -B- to pull drive flange out of differential bevel gears.

Note:

If the drive flange does not come out easily, turn the drive flange and insert a bolt in the hole on the opposite side to assist removal.

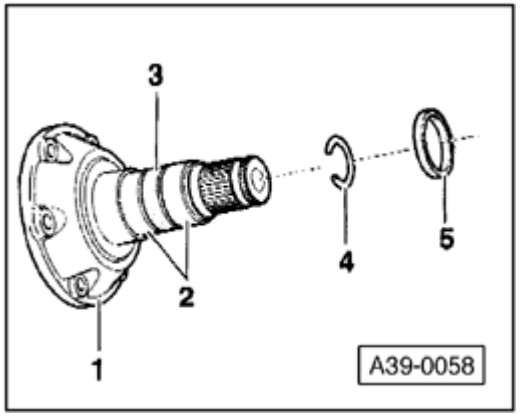
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39-3



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

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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 or 1.181 in.)

Notes:

- The rough surface of the polygon bearings 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 rings).
- Polygon bearings can only be replaced together with the drive flanges.
- For drive flanges with a spline diameter of 30 mm (1.181 in.) a spacer ring -5- is installed between the polygon bearing and the tapered bearing.

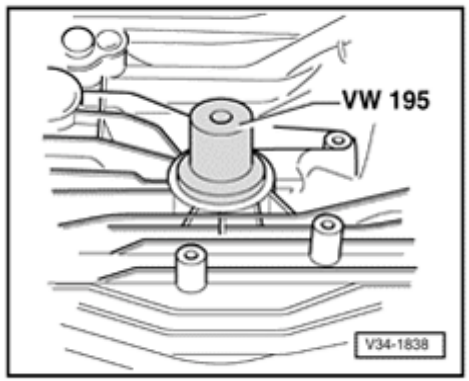
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39-5

Installing

- Fill space between sealing lip and dust lip with gear oil.

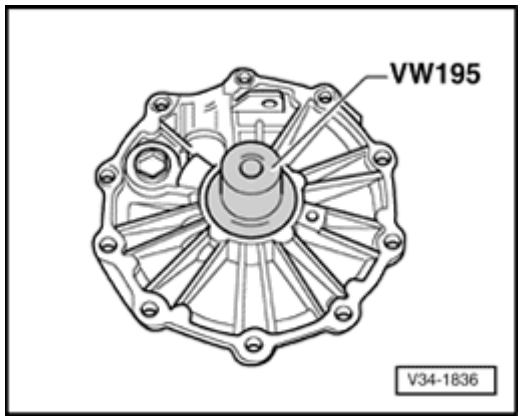
- Lightly oil outer circumference of seal.



- Drive in right-hand drive flange seal 5.5 mm (0.216 in.) below outer transmission housing surface using VW195 arbor, without canting.

Note:

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



- Drive in left drive flange seal 5.5 mm (0.216 in.) below outer transmission housing surface using VW195, without canting.

Note:

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

- Install drive flange using VW295 needle bearing drift.
- Bolt drive axle on drive flange.

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- Install drive axle heat shield.

- Check transmission oil level ⇒ Page 34-38 .

Tightening torques

Component		Nm (ft lb)
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)
Heat shields for drive axles		23 Nm (17 ft lb)

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Drive flange and driveshaft seals, replacing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

Special tools and equipment

- VW681 extractor lever
- 30-505 mandrel
- 30-506B press support
- 3337 ring spanner 7-piece set for heated oxygen sensor
- VAG1306 drip tray

Removing

4-cylinder engine

- Remove rear section of exhaust system located rearward of exhaust pipe clamp.

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⇒ Repair Manual, Engine Mechanical, Repair Group 26

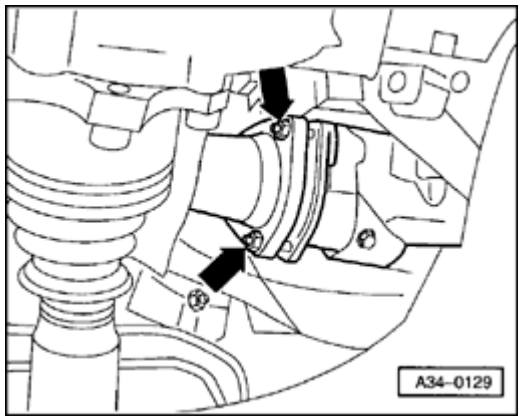
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39-8

6-cylinder engine

- Remove Heated Oxygen Sensor (HO2S) from right exhaust pipe using 3337 ring spanner 7-piece set and move clear to side.

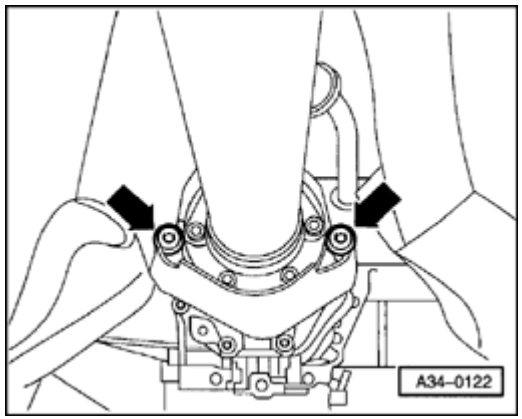
- Remove heat shield above right drive axle.



- Remove right front exhaust pipe with Three Way Catalytic Converter (TWC) from exhaust manifold (3 nuts, arrows).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

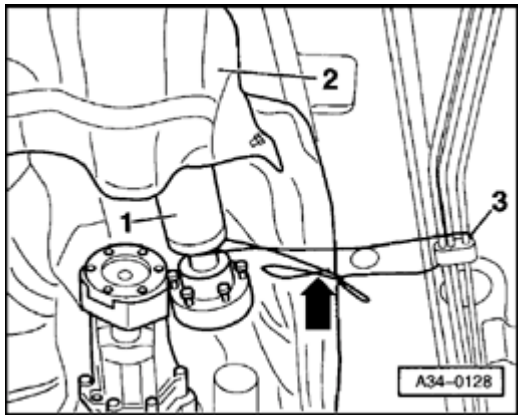
All models



- Remove heat shield for driveshaft from Torsen differential cover (arrows).

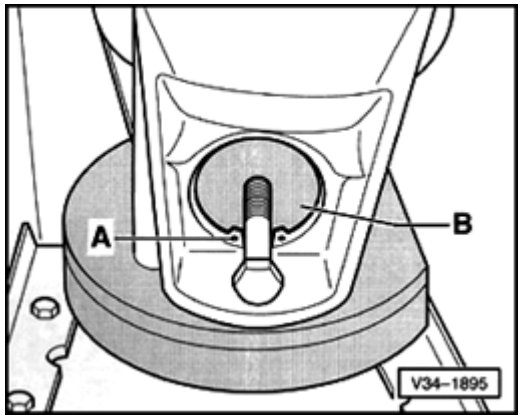
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39-9



- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrows).
- Place VAG1306 drip tray underneath and drain transmission oil.
- Place VAG1306 drip tray underneath end cover.

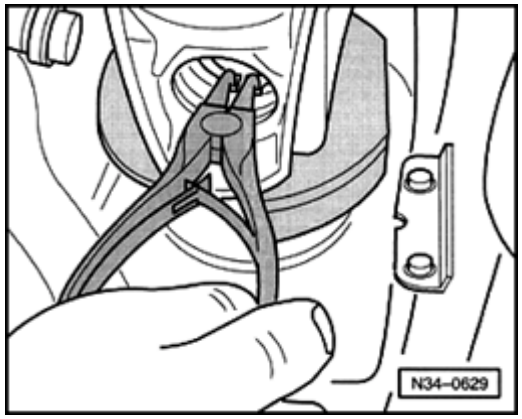
Note:



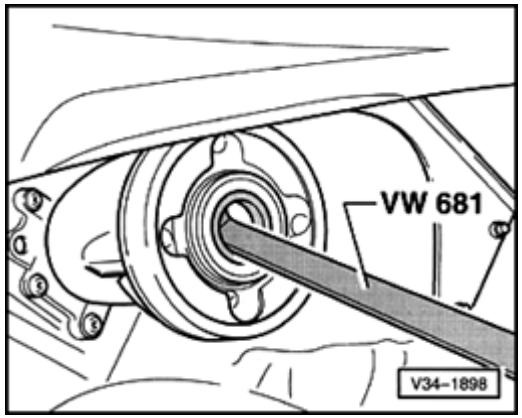
Oil will run out when removing cap -B-

- Remove circlip -A-.
- Screw M8 bolt into thread of cap -B-.
- Pull out cap -B- using bolt.

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- Expand circlip and pull out drive flange.



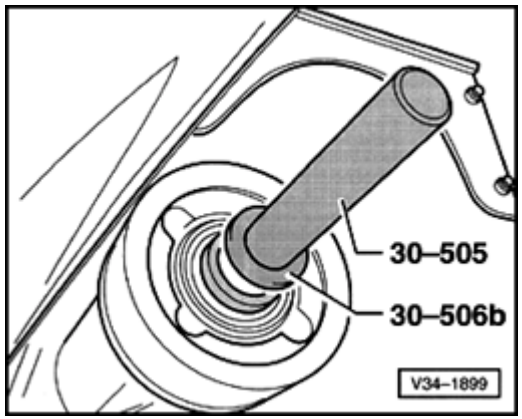
- Remove drive flange oil seal using VW681 extractor lever.

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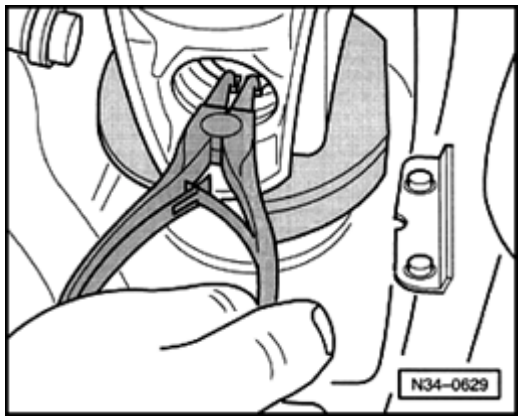
Installing

- Fill space between sealing lip and dust lip with gear oil.

- Lightly oil outer circumference of seal.



- Drive in drive flange seal 2 mm (0.079 in.) below outer housing surface, without canting.
- Install drive flange.



- While inserting drive flange, install circlip at same time.

The circlip must be seated in the base of the groove.

- Replace O-ring for cap.
- Install cap and secure in position.
- Install driveshaft ⇒ Page 39-71 .

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- Top off and check transmission oil level ⇒ Page 34-38 .

- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component		Tightening torque
Driveshaft to transmission		55 Nm (41 ft lb)
Heat shield for driveshaft to Torsen differential cover		25 Nm (18 ft lb)

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Speedometer Vehicle Speed Sensor (VSS), removing and installing

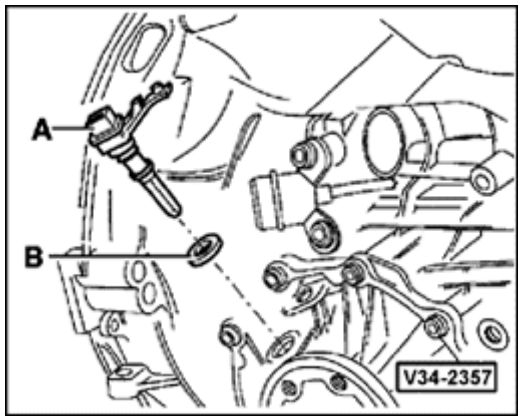
- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

CAUTION!

Handle sensor carefully. If damaged it may not indicate speed accurately.

Removing



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

Installing

- Replace seal -B-.
- Install sensor and lock in place.

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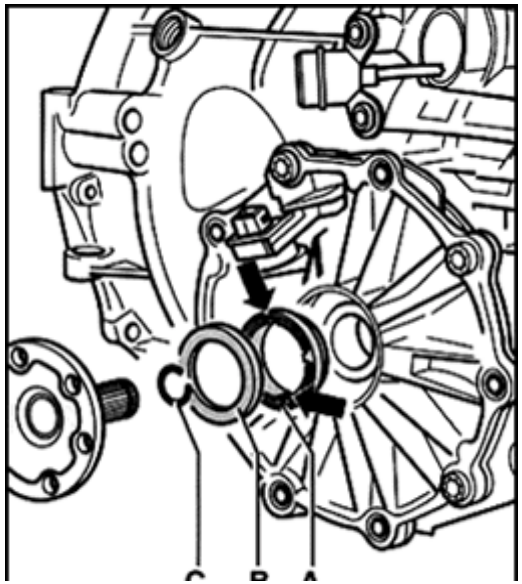
39-14

Speedometer drive gear, removing and installing

Special tools and equipment

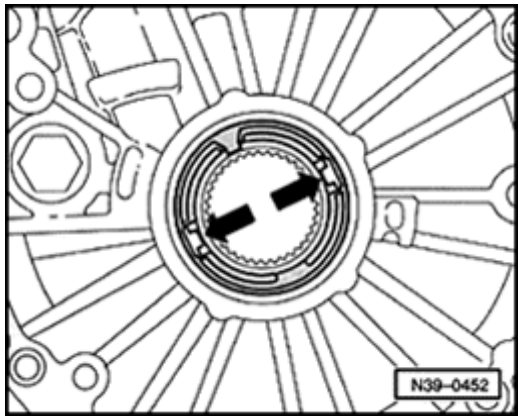
- VW195 arbor
- VW295 needle bearing drift
- VW681 extractor lever
- VAG1306 drip tray

Removing



- Remove left drive flange and seal -B- ⇒ drive flange seal, replacing, ⇒ Page 39-1 .
- Remove speedometer vehicle speed sensor ⇒ Page 39-13 .

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

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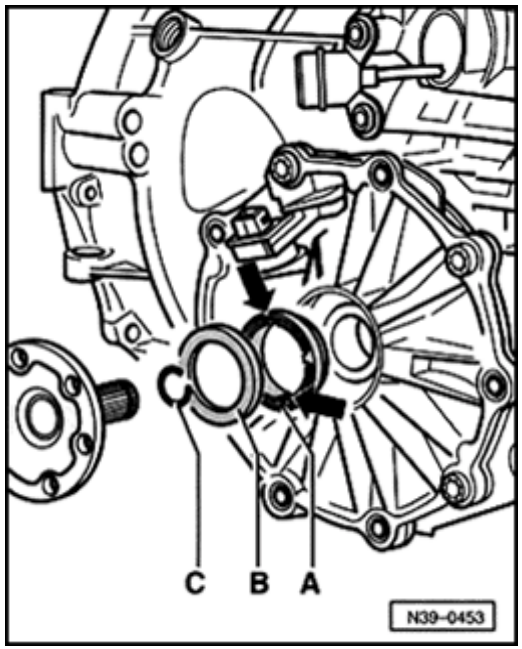
Installing

Installation is the reverse of removal, note the following:

CAUTION!

Install the drive gear carefully onto the 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 locates in the groove of the differential.

Retaining clips (arrows) locate in circumferential groove in differential.

- Always replace seal -B- and circlip -C- ⇒ Page 39-3 .
- Install drive flange using VW295 needle bearing drift.
- Top off and check transmission oil level ⇒ Page 34-38 .

Tightening torques

Component		Tightening torque
Driveshaft to drive flange	M 8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)
Heat shields over drive axles on transmission		23 Nm (17 ft lb)

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39-16

Differential, removing and installing

Special tools and equipment

- VW771 slide hammer-complete set
- 3257 plug insert 27 mm
- 21/3 Kukko extractor

Notes:

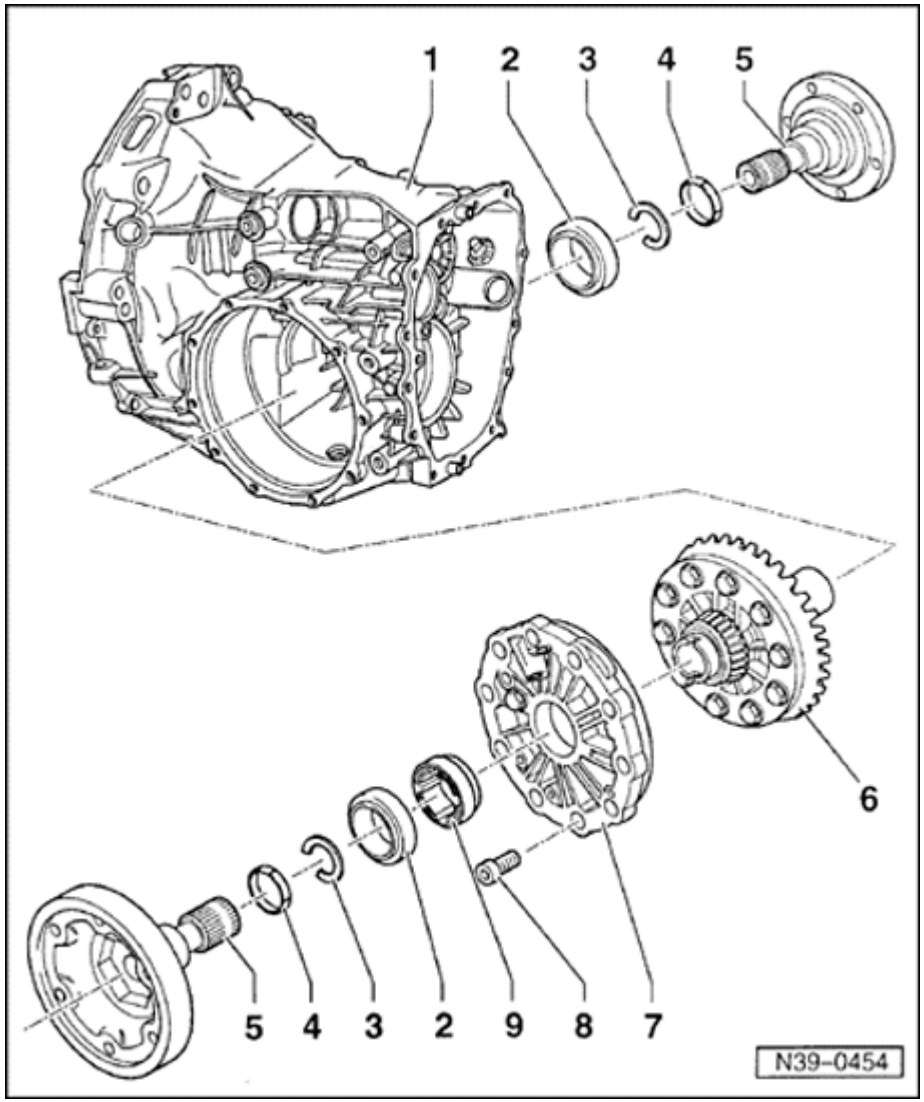
- *Removing and installing the differential is possible with the transmission installed.*
- *The differential can be removed and installed without disassembly of the shift mechanism, drive axle, pinion shaft, and cover. Disassembly of the above mentioned parts is necessary, if the differential needs to be adjusted.*
- *Transmission code CXF: drive flanges are installed without polygon bearings.*
- *Polygon bearing can be replaced only with the drive flange.*

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- *Check for visible damage to polygon bearing.*
- *The rough surface of the polygon bearing (with drive flange not installed) is not an indication that the bearing is defective. An acoustic test is possible only when installed.*
- *For drive flanges with a spline diameter of 30 mm (1.181 in) a spacer ring is installed between polygon bearing and tapered bearing ⇒ Page 39-20 , ⇒ Fig. 4 , item -5-.*
- *When replacing the parts identified with1), adjustment work is required ⇒ List of adjustments, ⇒ Page 39-39 .*

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39-17



1 - Transmission housing1)

2 - Seal

- Always replace ⇒ Page 39-1

3 - Circlip

- Always replace
- Removing and installing ⇒ Fig. 1

4 - Spacer ring

- Only installed on drive axles with polygon seals and spline diameter of 30 mm (1.181 in)
- Removing ⇒ Fig. 2
- Installing ⇒ Fig. 3

5 - Drive flange

- Removing and installing ⇒ Page 39-1
- Assembly ⇒ Fig. 4

6 - Differential with ring gear1)

- Disassembling and assembling ⇒ Page 39-21

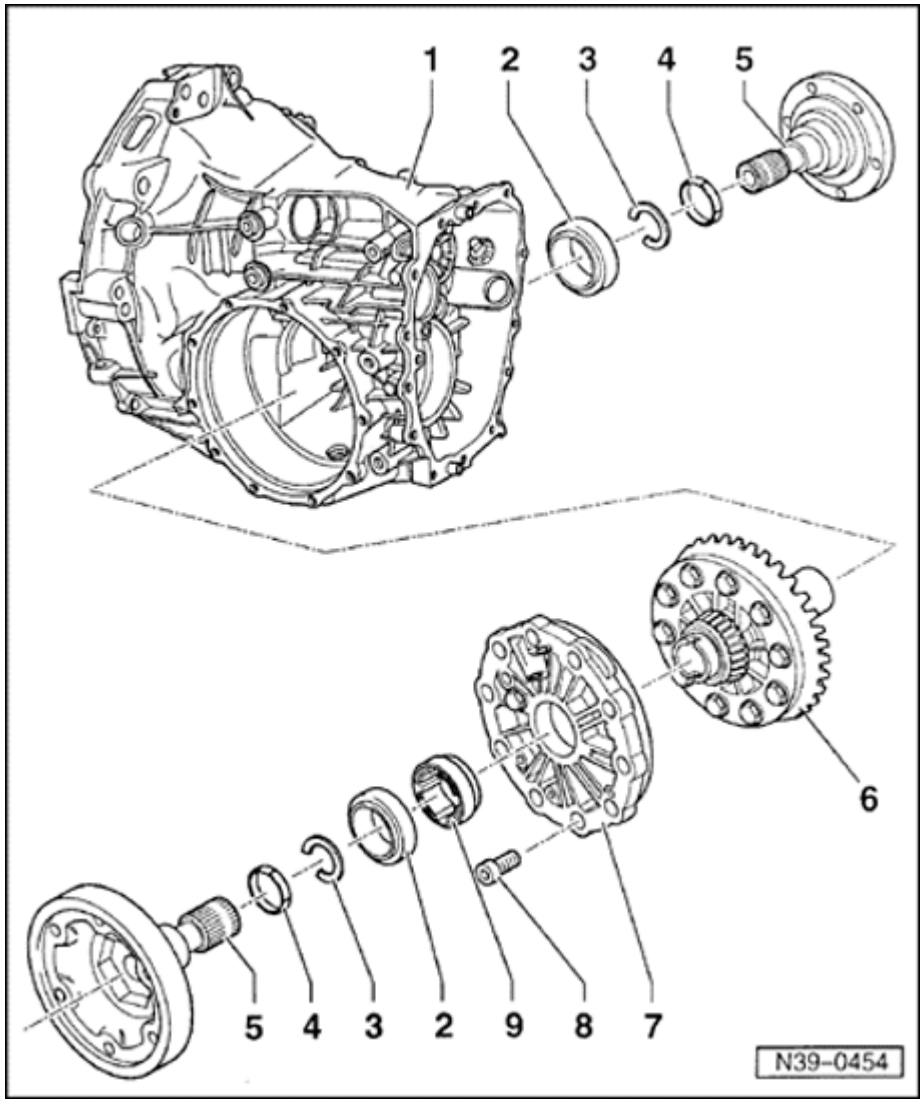
7 - Cover for final drive1)

8 - Torx® bolt

- 25 Nm (18 ft lb)

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39-18



9 - Speedometer drive gear

- Removing and installing ⇒ Page 39-14

CAUTION!

Install the drive gear carefully onto the differential without canting. Do not use force, the drive gear can break easily.

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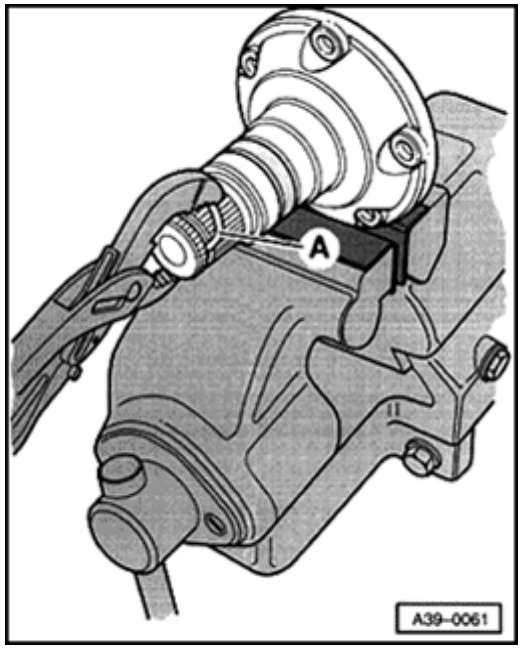


Fig. 1 Removing and installing circlip

- Clamp drive flange in vise using protective jaws and remove circlip by pressing new circlip -A- into groove.

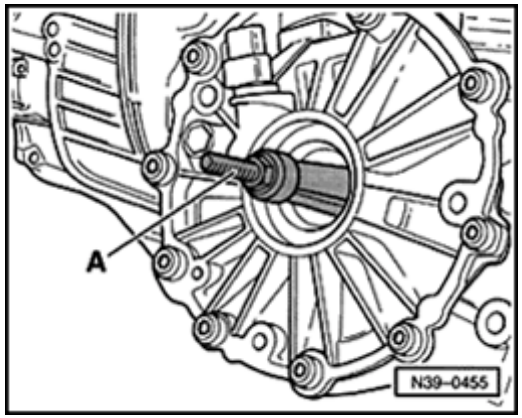


Fig. 2 Removing spacer ring

A - Internal puller 18.5-23.5 mm, e.g. 21/3 Kukko extractor

- If spacer ring is tight, pull out using multi-purpose tool VW771 slide hammer-complete set.

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39-20

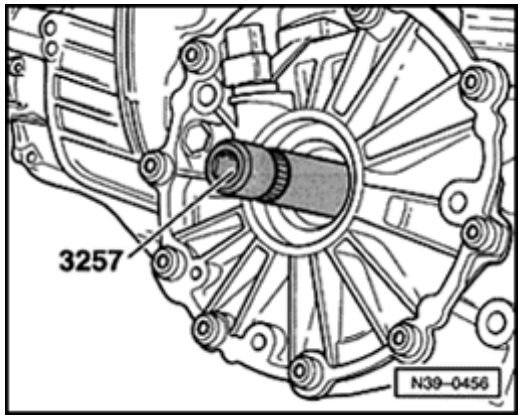


Fig. 3 Installing spacer ring

- Drive in spacer ring up to stop, without canting.

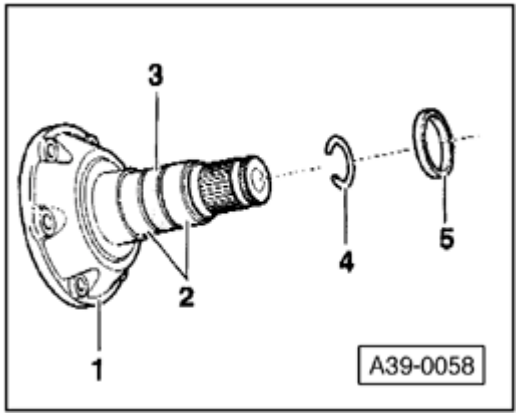


Fig. 4 Drive flange assembly

1 - Drive flange

2 - Needle bearing (polygon bearing)

3 - Spacer ring

4 - Spacer ring

Installed on shafts with 30 mm (1.181 in.) spline diameter

5 - Circlip

Note:

The needle bearings (polygon bearings) do not turn easily when the drive flanges are removed. This does not indicate that the bearings are defective.

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Front final drive 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

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- 30-205 thrust pad
- 40-21 sleeve

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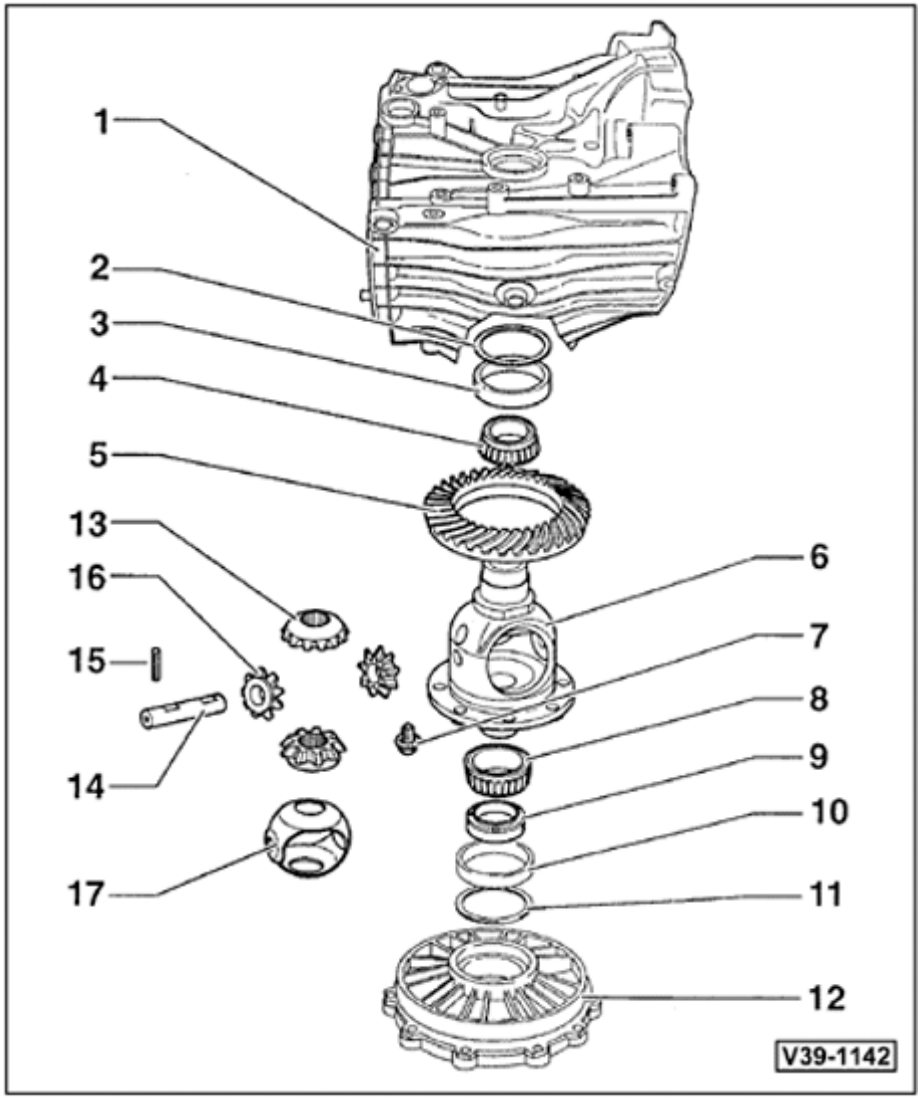
- 40-105 thrust piece
- 3138 drift
- 3144 press support
- 3296 tube
- Sealant AMV 188 000 02
- Kukko 20/10 two-arm puller or Kukko 44/2 puller
- Kukko 204/2 two-arm puller

Notes:

- *Differential, removing and installing ⇒ Page 39-16 .*
- *Replace both tapered roller bearings together.*
- *When replacing parts identified with(*), adjustment work is required ⇒ List of adjustments, ⇒ Page 39-37 .*

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39-23



1 - Transmission housing*

2 - Adjustment shim S2

- Note thickness
- List of adjustments ⇒ Page 39-37

3 - Right tapered roller bearing outer race*

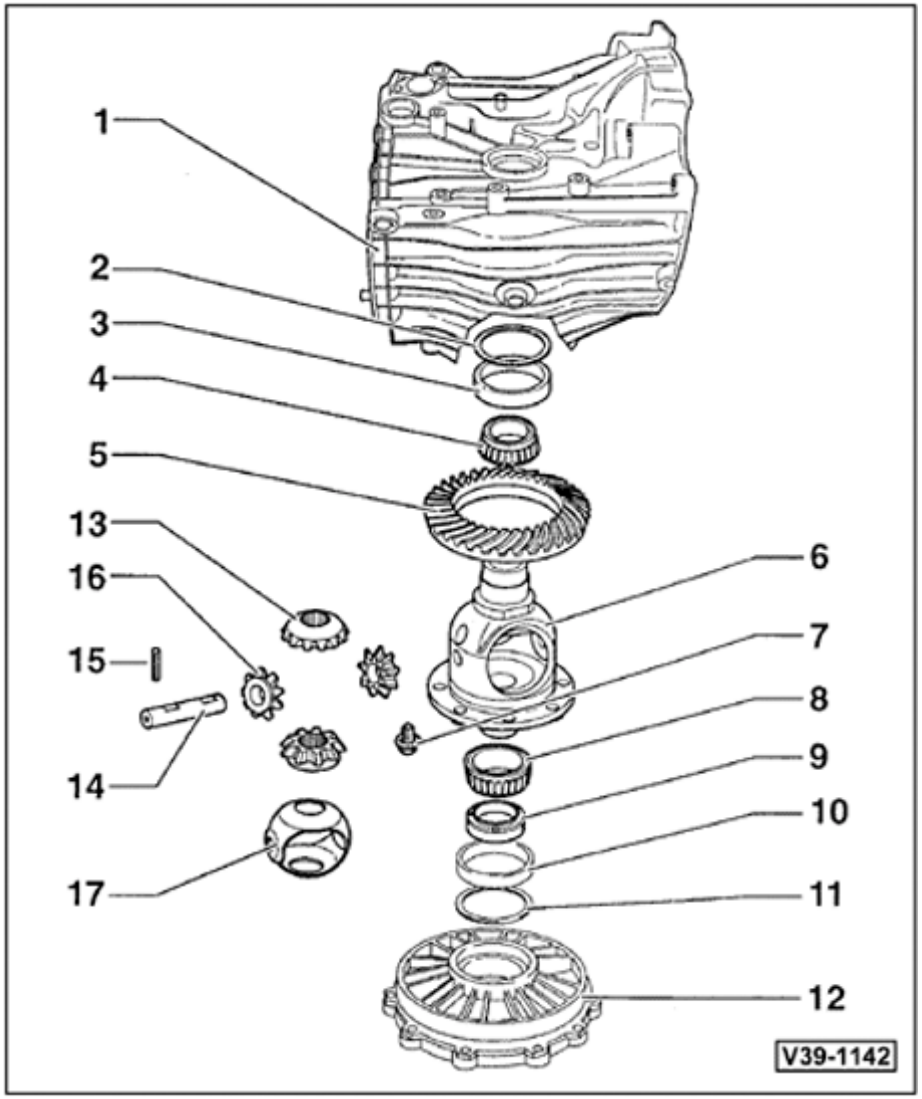
- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 1
- Pressing in using VW472/1 special tool and VW408A punch ⇒ Fig. 2
- Install using VW295 needle bearing drift and 30-205 thrust pad (transmission code CXF)

4 - Right tapered roller bearing inner race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing using 3296 tube ⇒ Fig. 3
- Installing ⇒ Fig. 4
- Transmission code CXF: installl using 40-21 sleeve

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39-24



5 - Ring gear*

- Is matched to pinion shaft (gear set)
- Allocate by transmission code ⇒parts catalog, ⇒ Page 00-3
- Remove from differential housing using a drift ⇒ Fig. 9
- Installing on differential housing ⇒ Fig. 10

6 - Differential housing*

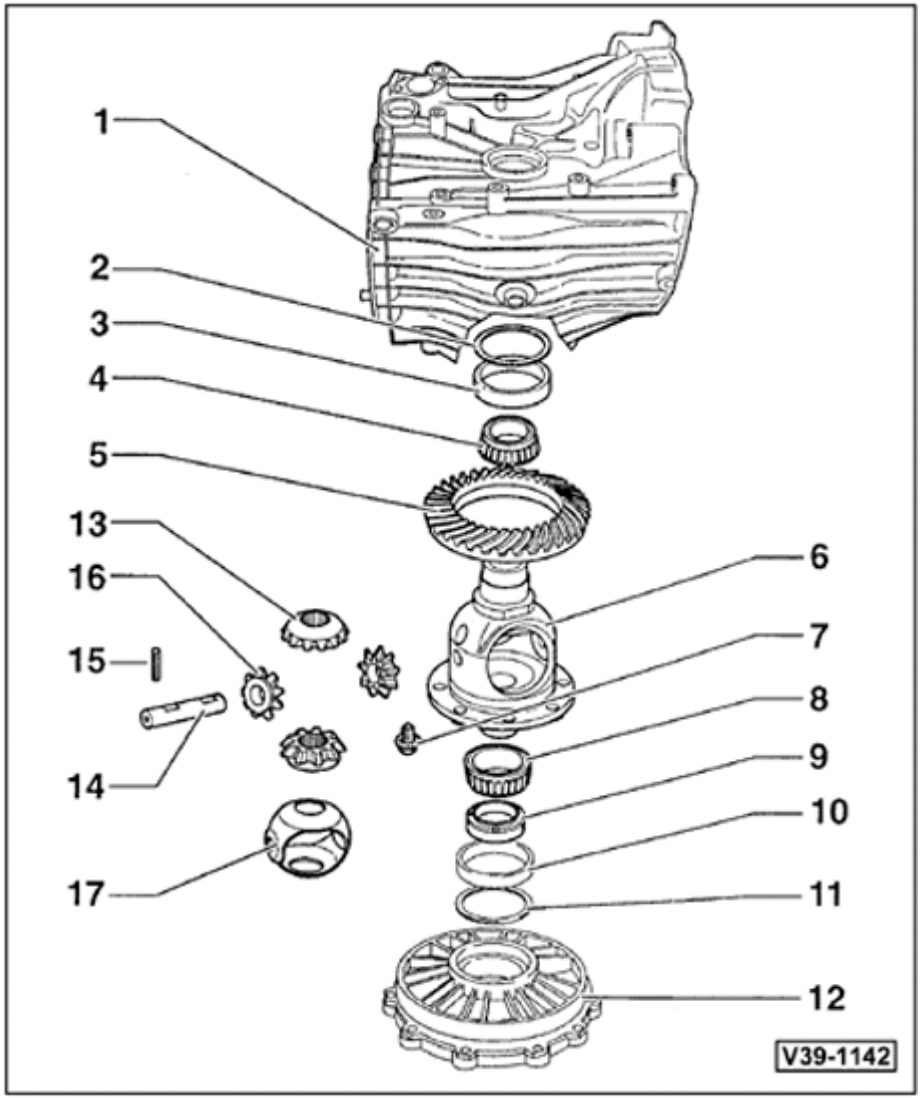
- Allocate by transmission code ⇒parts catalog
- Transmission identification ⇒ Page 00-3

7 - Ring gear bolt

- Always replace
- Lightly tighten bolts, then tighten diagonally to correct torque
- 60 Nm (44 ft lb) + 1/4-turn (90 °)

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39-25



8 - Left tapered roller bearing inner race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 5
- Installing using 3296 tube ⇒ Fig. 6
- Transmission code CXF: install using 40-21 sleeve

9 - Speedometer drive gear

- Removing and installing ⇒ Page 39-14

CAUTION!

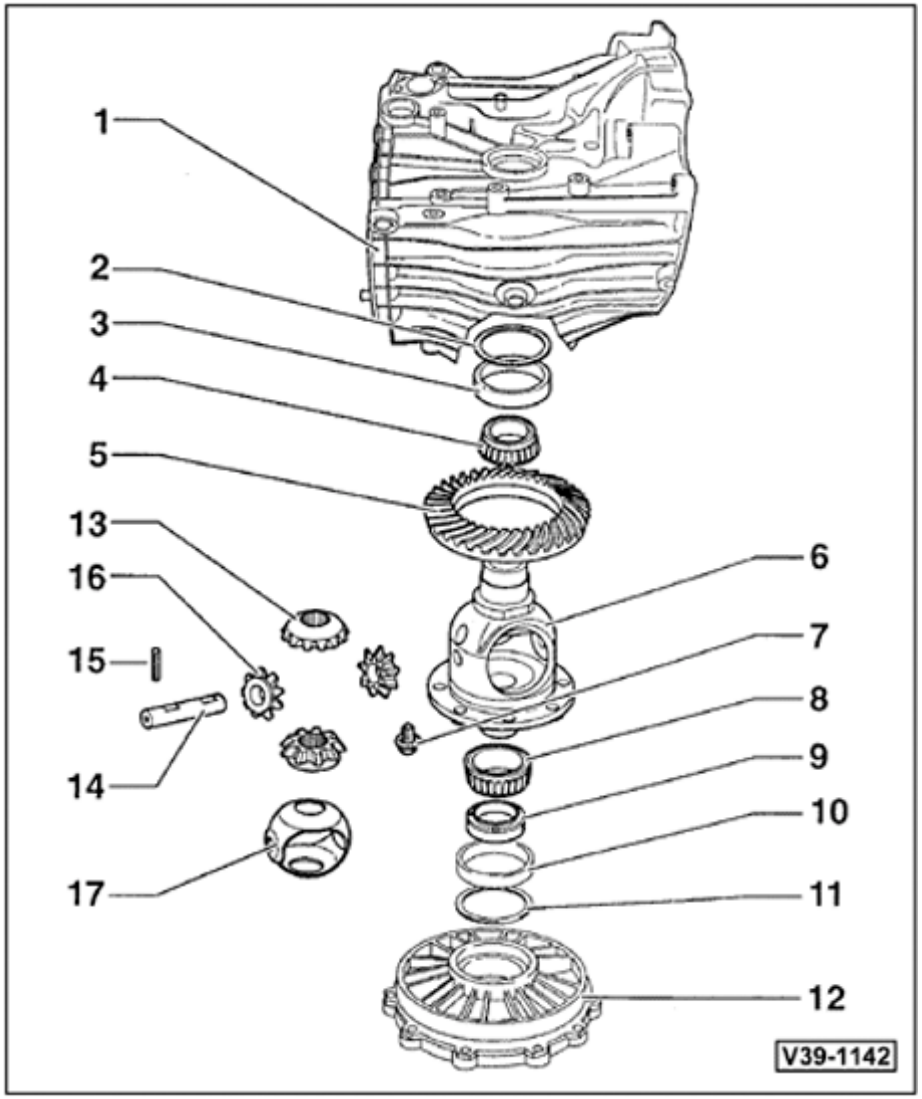
Install drive gear carefully onto differential, without canting. Do not use force, the drive gear can break easily.

10 - Left tapered roller bearing outer race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 7
- Pressing in using VW472/1 special tool and VW408A punch ⇒ Fig. 8
- Press in using 40-21 sleeve (transmission code CXF)

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39-26



11 - Adjustment shim S1

- Note thickness
- List of adjustments ⇒ Page 39-37

12 - Differential cover*

13 - Large differential bevel gear

- Installing ⇒ Fig. 11

14 - Differential bevel gear shaft

- Drive out using drift, after removing roll pin

15 - Roll pin

- For securing differential bevel gear shaft
- Version with annular groove, removing and installing ⇒ Fig. 12
- Version without annular groove, drive out using drift

16 - Small differential bevel gears

- Installing ⇒ Fig. 11

17 - Thrust washer assembly

- Coat with transmission oil when installing

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39-27

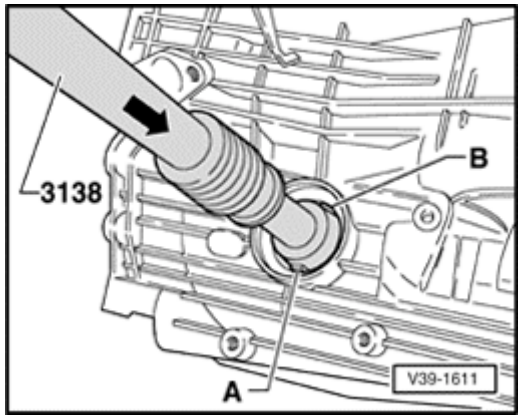


Fig. 1 Removing small tapered roller bearing outer race from transmission housing

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

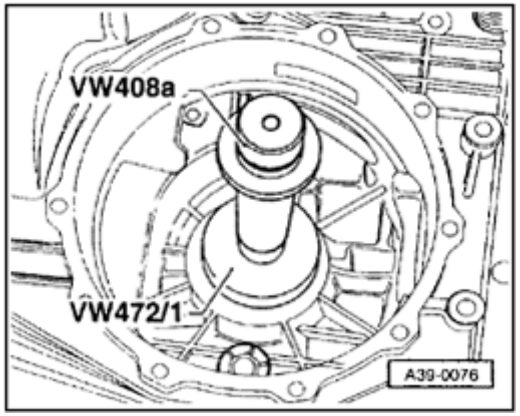


Fig. 2 Installing right tapered roller bearing outer race into transmission housing

- VW472/1 pressure piece is installed with cone in outer race.

Note:

Transmission code CXF: use 30-205 thrust pad and VW295 needle bearing drift.

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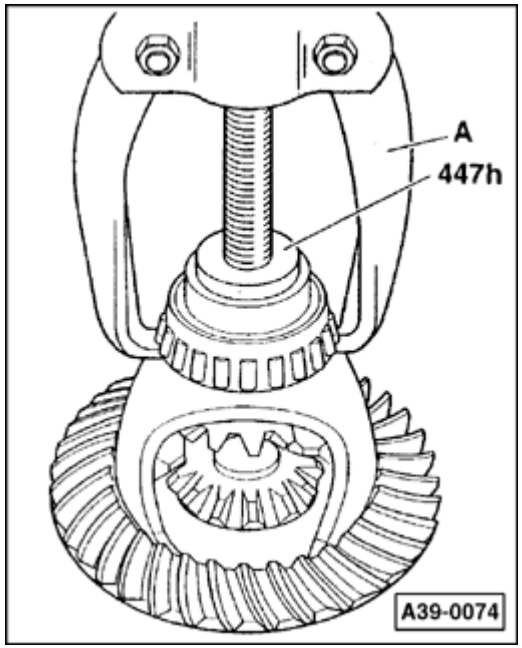


Fig. 3 Removing right tapered roller bearing inner race

A - Kukko 20/10 two-arm puller, e.g. Kukko 44/2

Notes:

- *Pullers with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and the puller.*
- *Transmission code CX: use 40-105 thrust piece.*
- *The differential housing has a notch under the bearing seat to install puller -A-.*

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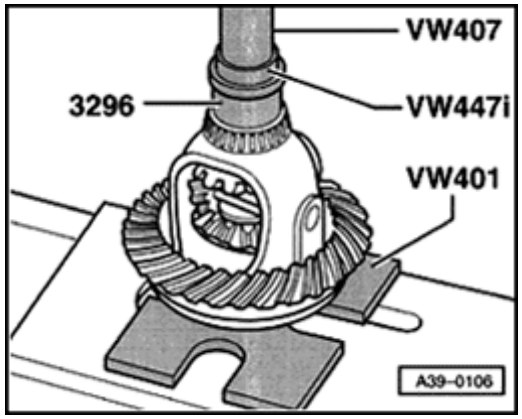


Fig. 4 Installing right tapered roller bearing inner race

WARNING!

Wear protective gloves.

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

Note:

Transmission code CXF: use 40-21 sleeve.

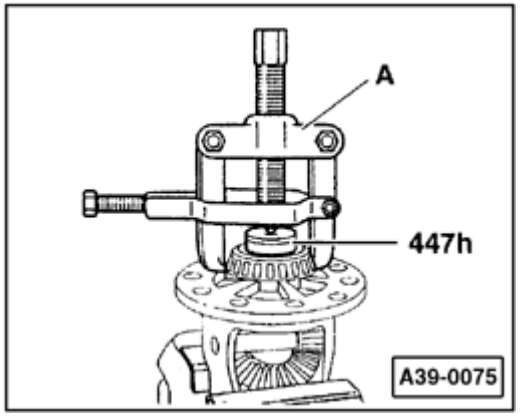


Fig. 5 Removing left tapered roller bearing inner race

A - Two-arm puller, e.g. Kukko 204/2

Notes:

- *On a puller with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and THE puller.*
- *Transmission code CXF: use 40-105 thrust piece.*
- *The differential housing has a notch under the bearing seat to install puller -A-.*

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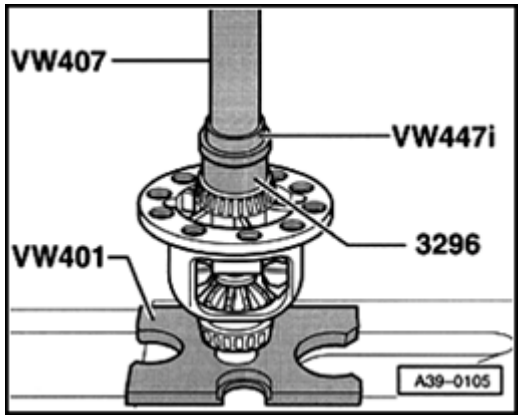


Fig. 6 Installing left tapered roller bearing inner race

WARNING!

Wear protective gloves.

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

Note:

transmission code CX: , use 40-21 sleeve.

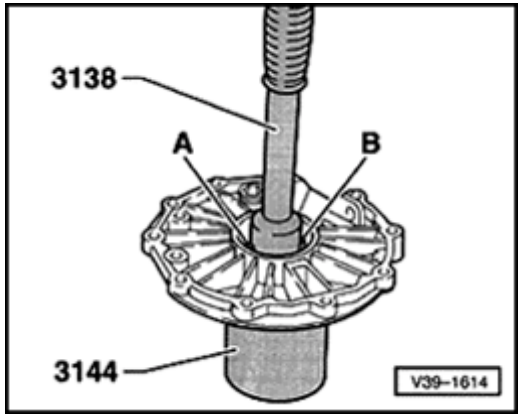


Fig. 7 Removing left tapered roller bearing outer race from differential cover

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

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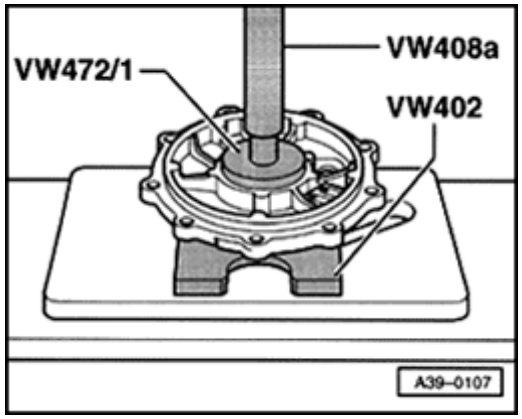


Fig. 8 Installing left tapered roller bearing outer race into differential cover

- VW 472/1 pressure piece is installed with cone in outer race.

Note:

Transmission code CXF: use VW511 thrust pad and VW295 needle bearing drift.

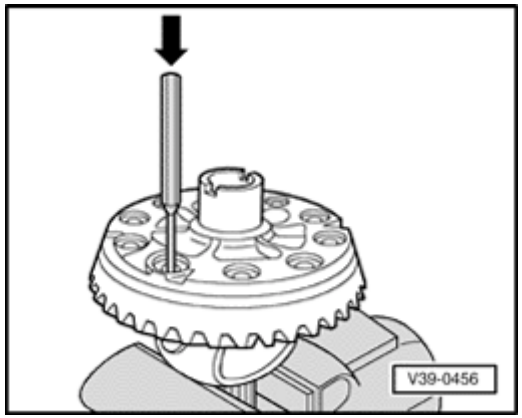


Fig. 9 Removing ring gear from differential housing

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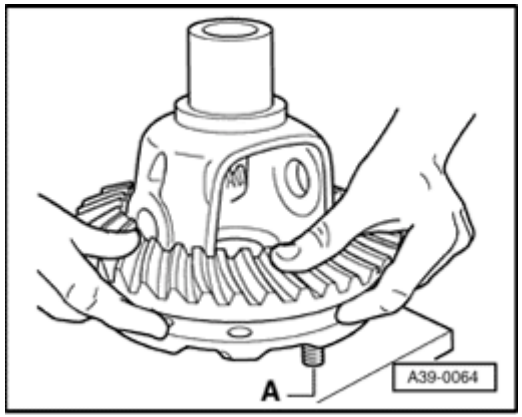


Fig. 10 Installing ring gear

WARNING!

Wear protective gloves.

- When installing ring gear, guide with centering pins -A- (local manufacture).
- Heat ring gear to approx. 100 ° C (212 ° F) and install.
- Allow ring gear to cool off slightly before inserting bolts.
- Tighten to specified torque.

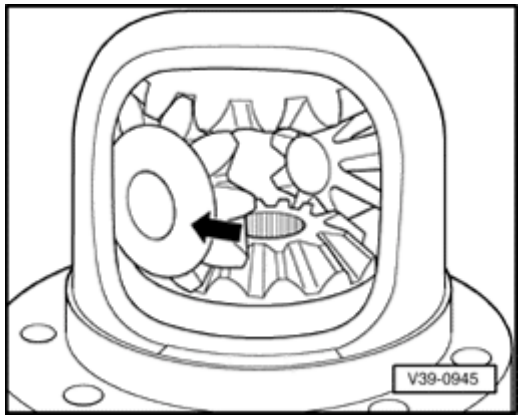


Fig. 11 Installing differential bevel gears

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

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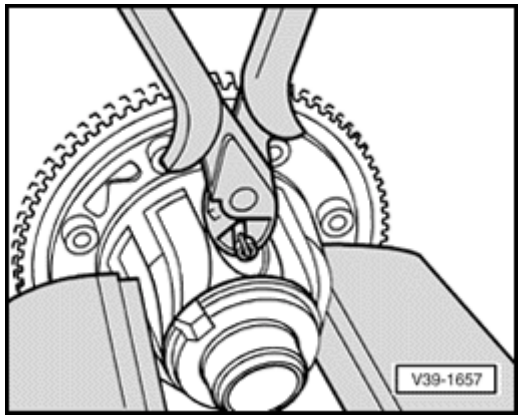


Fig. 12 Removing and installing roll pin

Removing

Roll pin with annular groove:

- Remove using diagonal-cutting pliers.

Roll pin without annular groove:

- Remove from behind, using punch.

Installing

- Install roll pin until stop is reached.

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39-34

Front final drive ring gear and pinion shaft, 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 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 objective of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine during production.*

- *The deviation, or tolerance "r", which is based on the master gauge "Ro", 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*

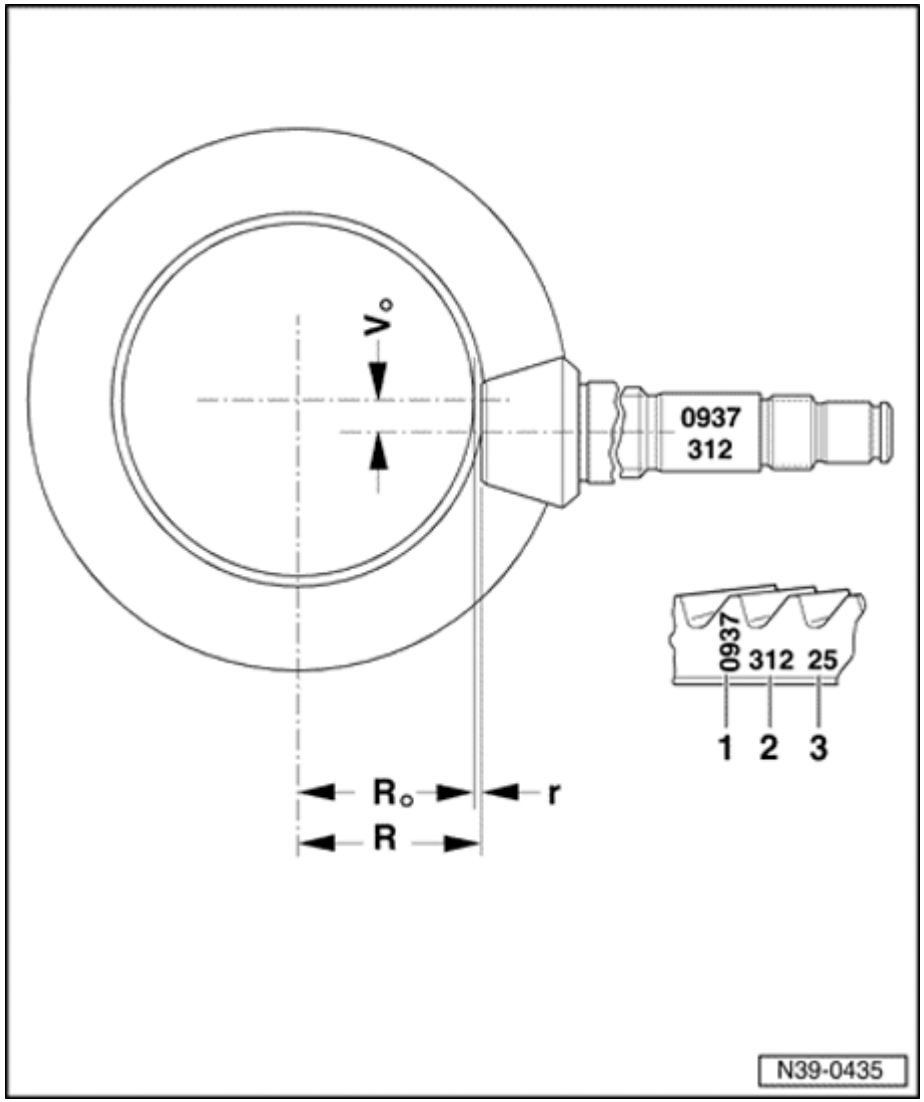
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tapered roller bearings and shims.

- *The friction torque measurement only serves to give a final check of the adjustment.*

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39-35



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

Ro - Length of test machine master gauge used

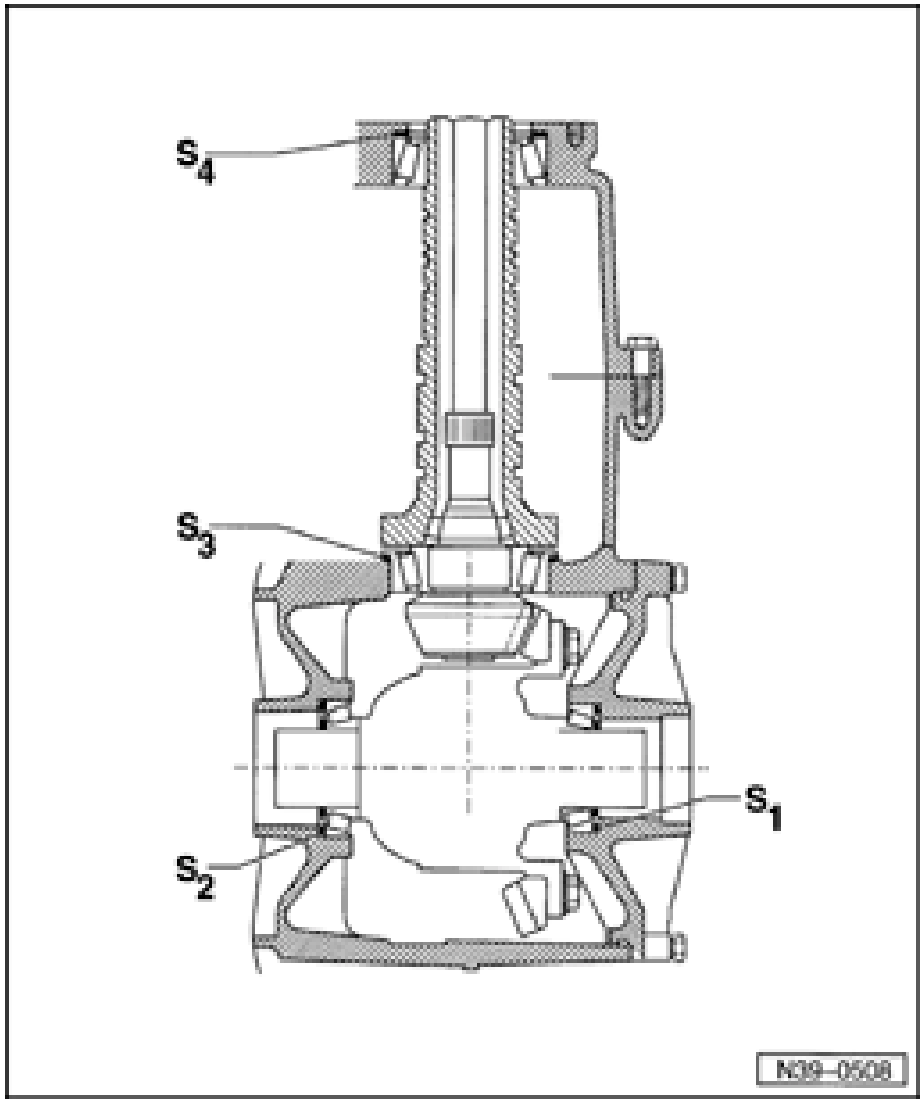
Ro - For 170 mm (6.69 in.) diameter ring gear = 54.95 mm (2.16 in.)

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

Vo - Hypoid offset

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39-36



Installation position of shims

Note:

List of adjustments when replacing individual components of transmission ⇒ *Page 39-37* .

S1 - Shim for ring gear in differential cover

S2 - Shim for ring gear in transmission housing

S3 - Shim for pinion shaft in transmission housing

S4 - Shim for pinion shaft in transmission cover

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39-37

List of adjustments

Note:

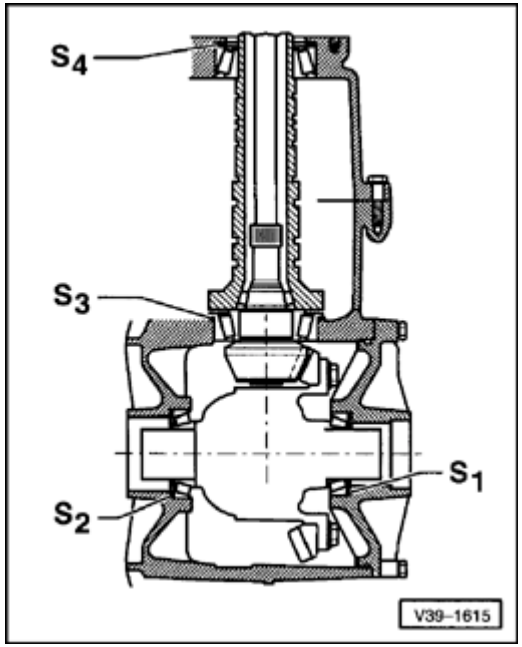
If repairs have been carried out on the transmission, it is only necessary to adjust the pinion shaft, ring gear or final drive set if components have been replaced that have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:

Component to be adjusted: **Component to be adjusted:**	Ring gear (S1 + S2)1) ⇒ Page 39-57	Pinion shaft (S3 + S4)1) via deviation "r" ⇒ Page 39-39	Pinion shaft (Shim S4)1) ⇒ Page 39-54	Backlash measurement ⇒ Page 39-63
Transmission housing3)	X	X		X
Transmission cover			X	
Differential housing	X			X
Double tapered roller bearing for pinion shaft and hollow shaft		X		X
Tapered roller bearing for differential	X			X
Final drive set2)	**X**	X		X
Differential cover	X			X

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1) Shims, installation position ⇒ Page 39-36 .
2) Pinion shaft and ring gear, only replace together.
3) If the transmission housing is replaced, the input shaft must also be adjusted ⇒ input shaft, adjusting, ⇒ Page 35-17 .

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Final drive gear set, recommended sequence for re-adjusting

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

1.) Determine total shim thickness Stotal for S1 + S2 (adjusting preload for tapered roller bearings for differential) ⇒ Page 39-58 .

2.) Determine total shim thickness Stotal for S3 + S4 (preload for tapered roller bearings for pinion shaft) ⇒ Page 39-41 .

3.) Distribute total shim thickness Stotal for S3 + S4 so that the dimension from center of ring gear to face of pinion shaft is the same as dimension "r" which was determined during production ⇒ Page 39-49 .

4.) Distribute total shim thickness Stotal for S1 + S2 so that the specified backlash between ring gear and pinion shaft is maintained ⇒ Page 39-65 .

Note:

Overview of components and shims ⇒ Page 39-36 .

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Pinion shaft, adjusting

(Adjusting pinion shaft and hollow shaft)

Adjustment of the pinion shaft is only necessary if the gear set, tapered roller bearing for the pinion shaft, or the transmission housing has been replaced ⇒ table, ⇒ Page 39-37 .

Special tools and equipment

- VW296 removal tool
- VW385/1 measuring bar
- VW385/3 centering disc (2x)
- VW385/14 measuring rod
- VW385/17 magnetic plate
- VW385/30 master gauge-adjustable
- VW385/33 end gauge
- VW387 dial indicator holder

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- VW401 thrust plate
- VW407 punch
- VW519 sleeve

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39-40

- VW792 installation arbor
- 3062 thrust pad
- 3182 sleeve
- Torque gauge 0-600 Ncm (53 in. lb)
- Dial indicator
- Dial indicator extension 6.5 mm
- Dial indicator extension 30 mm

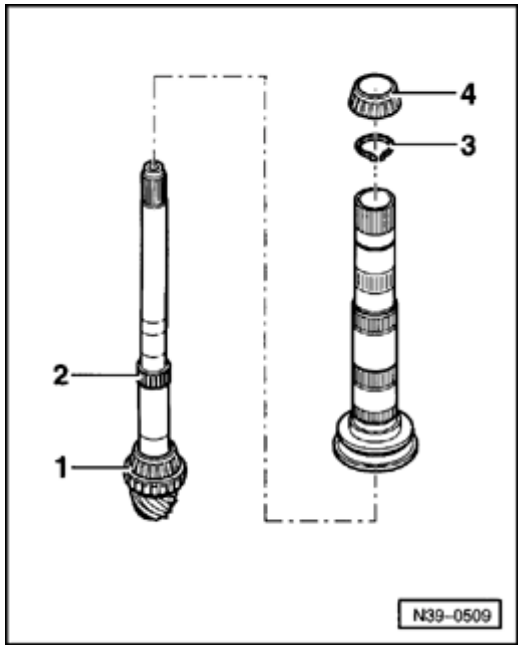
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Speedometer Vehicle Speed Sensor (VSS), removing and installing

Total shim thickness Stotal for shim S3 + S4, determining

Adjust preload of tapered roller bearings for pinion shaft with hollow shaft

- Differential removed



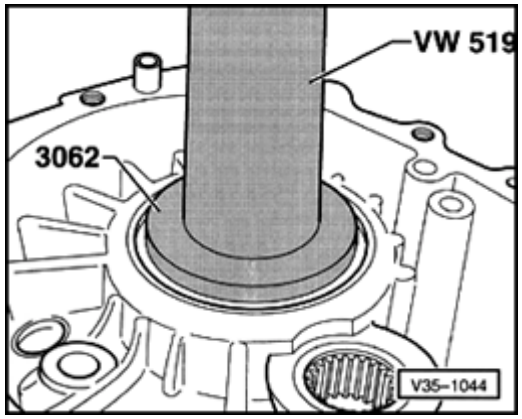
- Press inner race -1- for double tapered roller bearing onto pinion shaft and secure ⇒ Page 35-21 .
- Position needle bearing -2-.
- Install circlip 3 onto hollow shaft and press on inner race for tapered roller bearing -4- ⇒ Page 35-21 .
- Insert pinion shaft in hollow shaft.

Note:

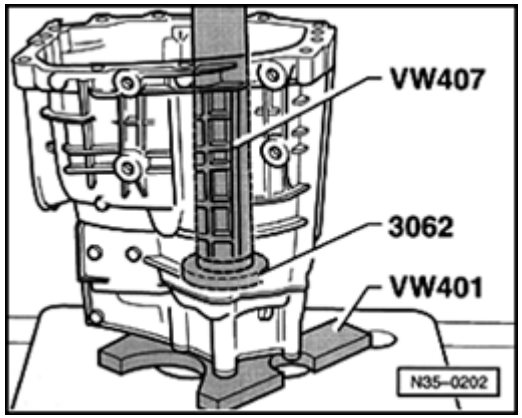
Illustration shows hollow shaft without gears. The adjustment of the pinion shaft can be done with or without gears.

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39-42



- Install double tapered roller bearing outer race for pinion shaft in transmission housing without shims ⇒ Fig. 3, Page 35-31 .



- Install tapered roller bearing outer race for pinion shaft in transmission cover together with shim S4* (1.0 mm thick) ⇒ Fig. 8, Page 35-33 .

Notes:

- *A shim S4 with a thickness of 1.0 mm is installed for initial measurement. It is referred in the following text as S4*. After determining measurement "e", S4* is replaced with the appropriate shim S4.*
- *When taking measurements, always install the rubber washer together with the pressure plate for the rubber washer ⇒ Page 35-29 .*

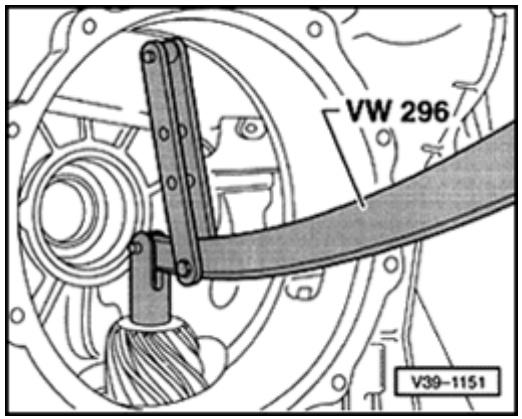
- Install fully assembled pinion shaft with hollow shaft into transmission housing.

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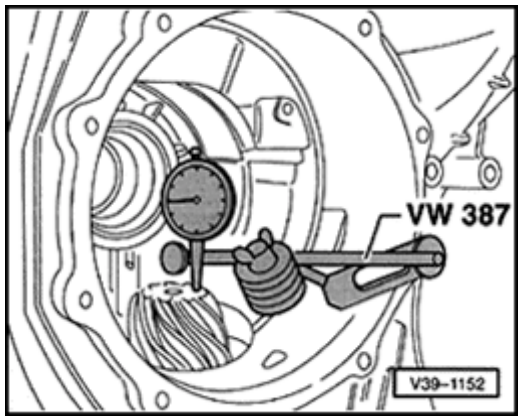
39-43

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

- Turn transmission so transmission cover faces downward.



- Press down on face of pinion shaft using VW296 removal tool until tapered roller bearing outer race contacts transmission cover.
- While still maintaining pressure, rotate pinion shaft 5 turns in each direction opposite hollow shaft to settle double tapered roller bearing.
- Rotate pinion shaft together with hollow shaft 5 turns in each direction to settle tapered roller bearing.



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

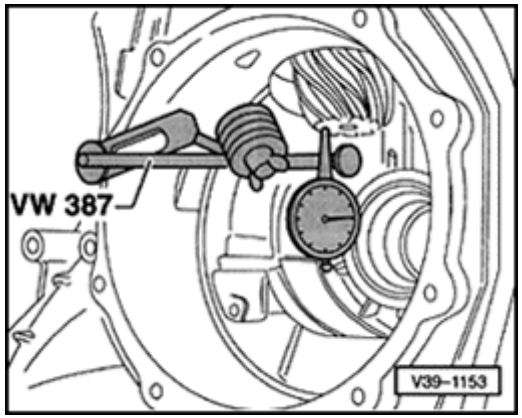
Note:

The dial indicator extension must contact the machined surface on the face of the pinion shaft.

- Turn transmission 180° so transmission cover faces upward.

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- Rotate pinion shaft together with hollow shaft 5 turns in each direction to settle tapered roller bearing. Otherwise measurement will not be correct.



- Read off and note play indicated on dial indicator.

  Measurement in example: 0.45 mm

Note:

If the measurement has to be repeated, first rotate the pinion shaft with hollow shaft again 5 turns in each direction to settle the tapered roller bearing. Then set the dial indicator to "0" again with 1 mm preload.

Formula:

Stotal = S4* + measurement + bearing preload

Example:

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

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Determining thickness of shim S3*

Formula:

S3* = Stotal - S4*

Example:

	Total shim thickness Stotal for S3 + S4	1.60 mm
-	Inserted shim S4*	1.00 mm
=	Thickness of shim S3*	0.60 mm

- Remove double tapered roller bearing outer race, install shim S3* in transmission housing and re-install outer race ⇒ Fig. 3, Page 35-31 .

- Insert fully assembled pinion shaft into transmission housing again.

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

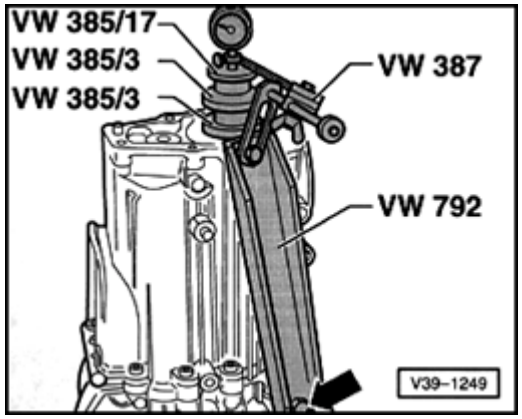
- Rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft

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separately in relation to hollow shaft 5 turns in each direction, to settle tapered roller bearings.

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39-46



- Install measuring tools and secure to transmission housing using bolt (arrow).
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft several times.
- If correct shims have been selected, dial indicator will now indicate the following value:

  0.05-0.15 mm
- Tighten transmission cover bolts again to 22 Nm (16 ft lb).
- Remove measuring tools.
- To settle tapered roller bearings, rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft separately in relation to hollow shaft 5 turns in each direction.

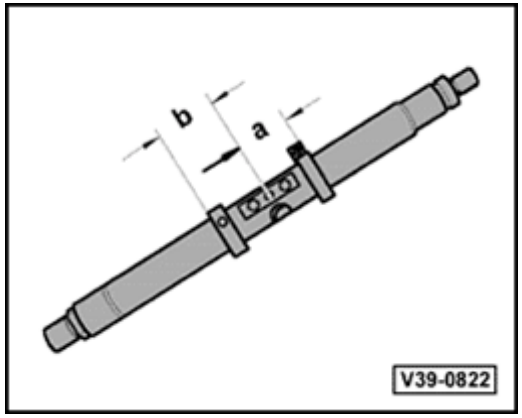
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39-47

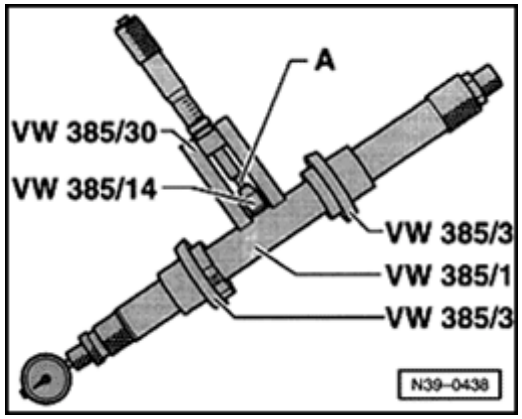
Determining measurement "e"

Note:

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



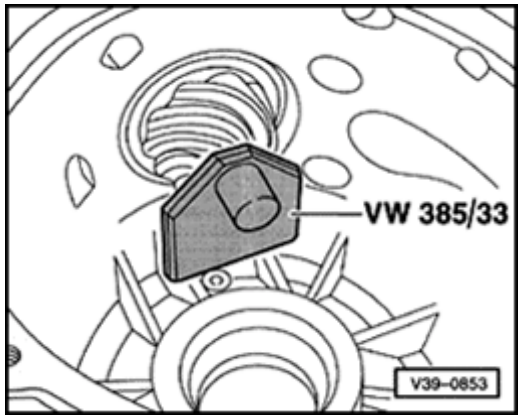
- Set adjustment rings of universal mandrel using VW385/1 measuring bar to the following measurements:
  - Dimension a: 35 mm (1.378 in.)
  - Dimension b: 75 mm (2.953 in.)



- Assemble VW385/1 measuring bar as illustrated:
  - Dial indicator extension -A-, 6.5 mm long
  - VW385/30 master gauge-adjustable
- Set VW385/30 master gauge to Ro = 54.95 mm (2.163 in.)for 170 mm (6.693 in.) diameter ring gear and install on universal mandrel.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.

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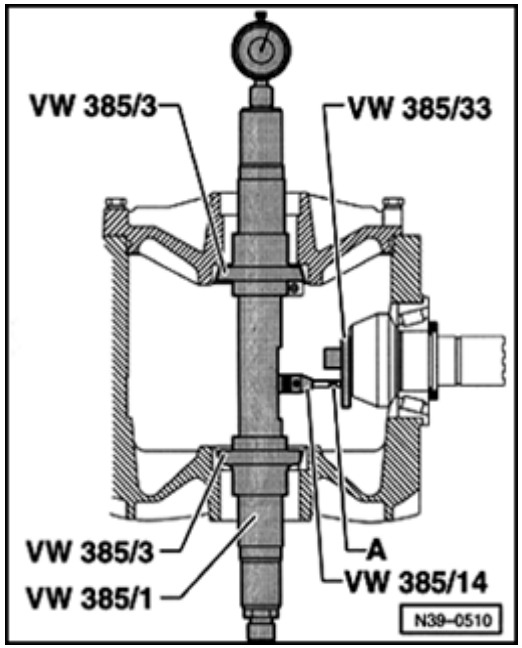
39-48



- Place end gauge on face of pinion shaft.

Note:

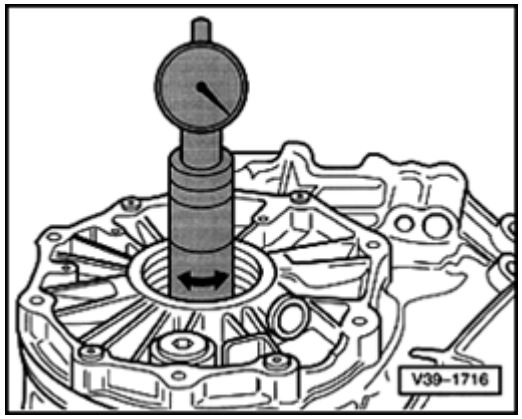
Make sure gauge contact surface is precisely installed and free of oil.



- Remove master gauge and install measuring mandrel into transmission housing.
  - Dial indicator extension -A- = 6.5 mm long must be installed.
  - The 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.

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39-49



- 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.

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- 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 ⇒ 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

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0.50	0.65	

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

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39-51

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 ⇒ parts catalog

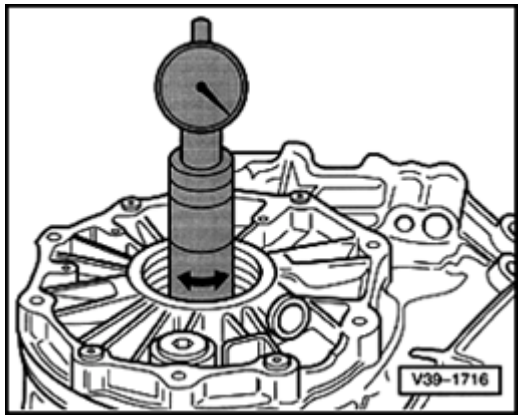
Available shims for "S4"

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

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

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Checking measurement

Checking dimension "r"

- Install pinion shaft/hollow shaft with measured shims S3 and S4.

- Turn hollow shaft against pinion shaft 5 turns in both directions, so tapered roller bearing can settle.

- Insert universal mandrel ⇒ determining measurement "e", ⇒ Page 39-47 and perform check measurement.
- Read off dial indicator counterclockwise (red scale).

  If the shims have been correctly selected, deviation "r" (marked on outer circumference of ring gear) must be displayed - within a tolerance of ± 0.04 mm

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.

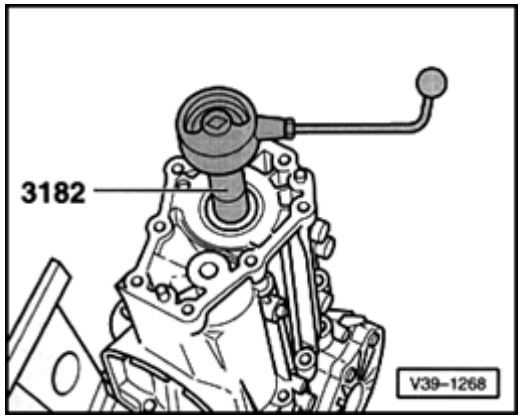
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Measuring friction torque

Notes:

- *Pinion shaft/hollow shaft tapered roller bearings are low friction bearings. Therefore the friction torque has only a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings to perform the friction torque measurement. These bearings have already been treated with a special oil by the manufacturer.*



- Install torque gauge, 0-600 Ncm (53 in. lb) on pinion shaft.
- Read off friction torque.

Friction torque specification:

New bearings	Used bearings
150-250 Ncm (13-22 in. lb)	30-60 Ncm (3-5 in. lb)

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39-54

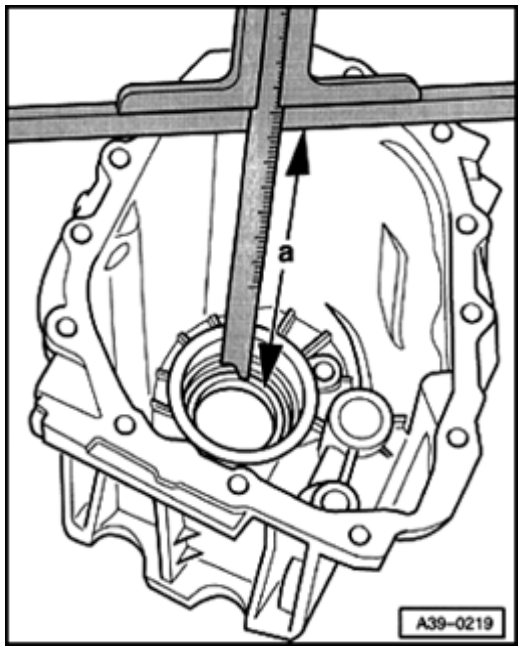
Transmission cover, replacing (re-calculating shim S4

Special tools and equipment

- VW385/3 centering disc (2x)
- VW385/17 magnetic plate
- VW387 dial indicator holder
- VW792 installation arbor
- Dial indicator
- Dial indicator extension
- Depth gauge with minimum 5/100 mm precision

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39-55



- Clean housing mating surfaces.

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

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 if old transmission cover is deeper.

Example:

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

Available shims ⇒ table, ⇒ Page 39-51 .

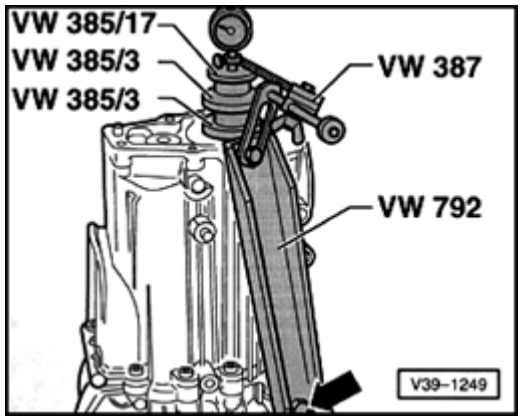
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- Press tapered roller bearing outer race with shim S4 into transmission cover ⇒ Fig. 8, Page 35-33 .

- Reinsert assembled pinion shaft into transmission housing fully.

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

- To settle tapered roller bearings, rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft separately in relation to hollow shaft 5 turns in each direction.



- Install measuring tools and secure with bolt (arrow) to transmission housing.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft several times.

If correct shims have been selected, dial indicator will now indicate following value:

0.05-0.15 mm

If this reading is not obtained the adjustment must be corrected.

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Ring gear, adjusting

Adjusting differential

For a list of the repairs which will require the ring gear to be adjusted ⇒ table, ⇒ Page 39-37 .

Special tools and equipment

- VW382/10 extension pin
- VW385/17 magnetic plate
- VW386A clamping piece
- VW387 dial indicator holder
- VW388 measuring lever
- VW402 thrust plate
- VW408A punch
- VW472/1 pressure piece
- VW521 adjustment tool

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- Torque gauge 0-600 Ncm (53 in. lb)
- Dial indicator
- Dial indicator extension

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39-58

Determining total shim thickness "Stotal" (S1 + S2)

Adjusting preload of tapered roller bearings for differential

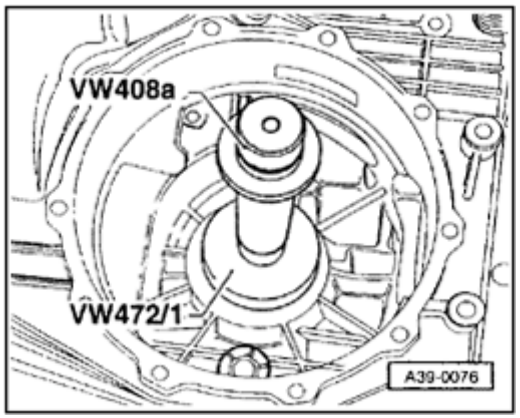
- Pinion shaft removed

Note:

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

- Remove seals and outer races of both tapered roller bearings for differential.

- Remove shims ⇒ Page 39-21 .



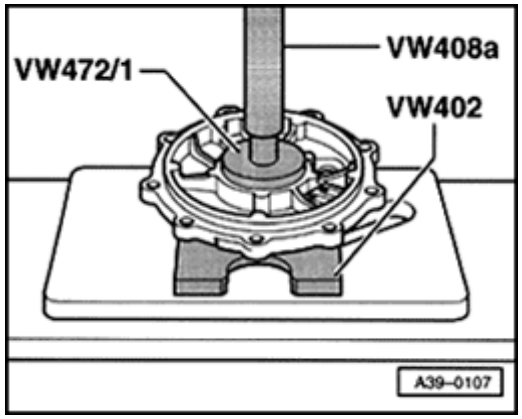
- Press right tapered roller bearing outer race with shim S2 into transmission housing ⇒ Fig. 2, Page 39-27 . Shim S2* with thickness of 1.20 mm (two 0.60 mm shims) is used for initial measurement.

Note:

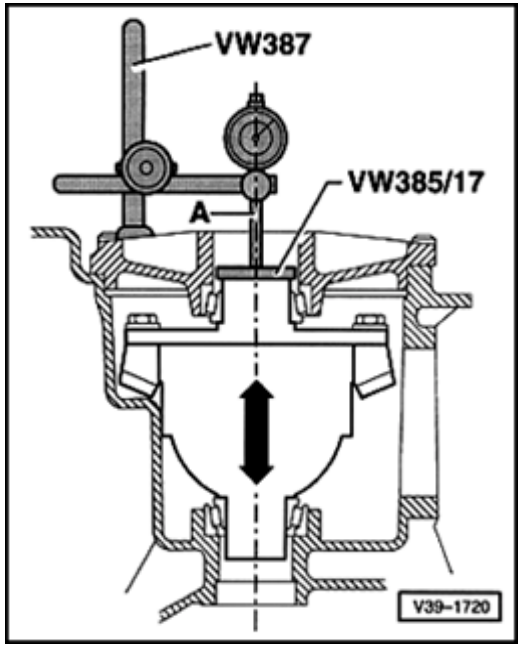
For measurement purposes, a shim S2 of 1.20 mm is initially inserted and referred to as S2 in the following text. After determining backlash, S2* will be replaced by the correct shim S2.*

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39-59



- Press tapered roller bearing outer race into differential cover without shim S1 ⇒ Fig. 8, Page 39-31 .
- Insert differential without speedometer gear drive into transmission housing. Ring gear is positioned on left-hand side infront of final drive cover.
- Install differential cover with 4 bolts and tighten to 25 Nm (18 ft lb).
- Position transmission so differential cover faces upward.
- Turn differential 5 turns in both directions so tapered roller bearings settle.



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

Note:

The tip of the dial indicator must be positioned on the center of the differential.

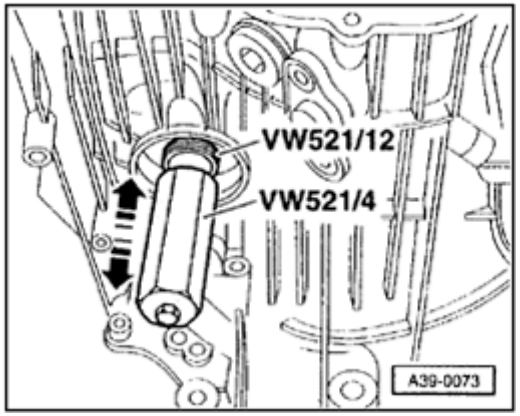
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39-60

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

- Measurement in following example: 0.62 mm

Notes:



- *To lift the differential, attach VW521/4 locking sleeve and VW521/12 on the right of the differential (housing side).*
- *If the measurement has to be repeated, the pinion shaft with hollow shaft must be turned 5 turns in each direction first to settle the tapered roller bearing.*

Formula:

Stotal = S2*- + measurement + bearing preload

Example

	Inserted shim(s) S2*	1.20 mm
+	Measured value	0.62 mm
+	Bearing preload (constant value)	0.30 mm
=	Total thickness Stotal for S1 + S2	2.12 mm

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39-61

Determining thickness of shim "S1*"

Notes:

- *The preliminary adjustment shim S1* will be replaced with the final shim S1 after determining the backlash.*
- *The total shim thickness Stotal remains unchanged.*

Formula:

S1* = Stotal - S2*

Example:

	Total thickness Stotal for S1 + S2	2.12 mm
-	Inserted shim(s) S2*	1.20 mm
=	Thickness of shim S1*	0.92 mm

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39-62

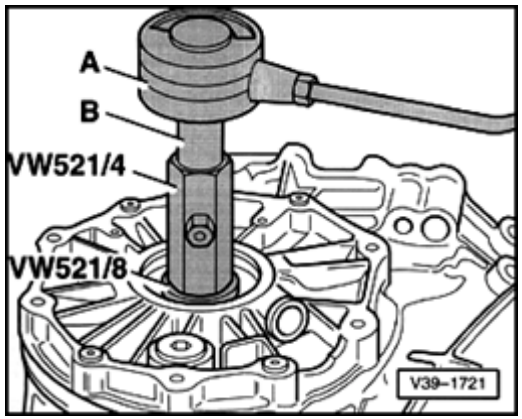
Measuring friction torque

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- Pinion shaft removed



- Install torque gauge 0-600 Ncm (53 in. lb) -A- onto differential.

B - Socket

- Read friction torque.

Friction torque specifications:

New bearings	Used bearings
150-350 Ncm (13-31 in. lb)	30-60 Ncm (3-5 in. lb)

Note:

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For a readjustment of the final drive gear set (pinion shaft and ring gear), the pinion shaft adjustment should now be checked ⇒ Page 39-39 .

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39-63

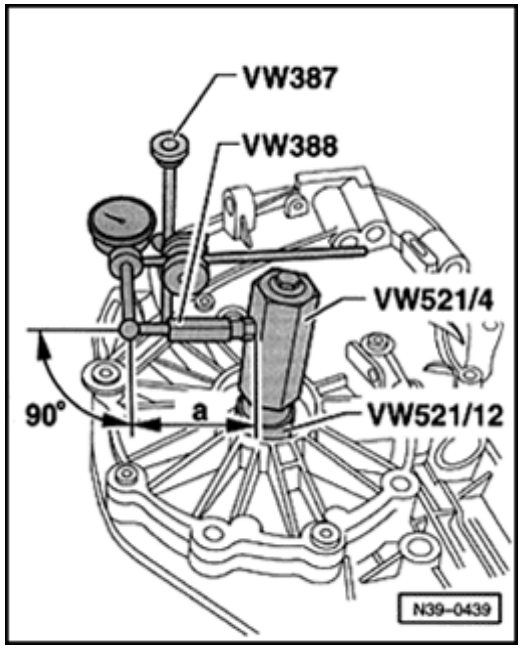
Measuring backlash

Position of ring gear in transmission housing

- Pinion shaft with shims S3* and S4* installed

- Install differential.

- Turn differential 5 turns in each direction to settle tapered roller bearings.



- Secure VW387 dial indicator holder onto housing.
- Attach VW521/4 locking sleeve and VW521/12.
- Install dial indicator and VW382/10 extension pin (6 mm flat).
- Adjust VW388 measuring lever to dimension -a-:

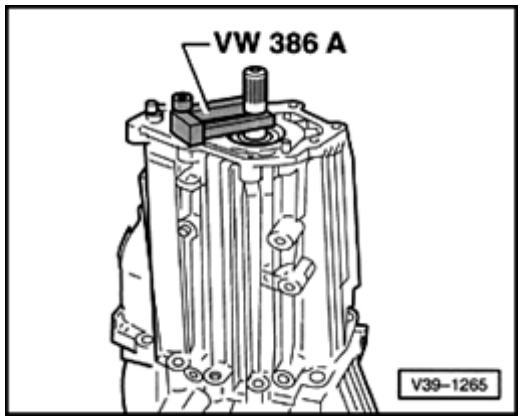
  Distance -a-: 67 mm (2.637 in.) for 170 mm (6.693 in.) diameter ring gear.
- Determine play between teeth flanks as follows:
  - Turn ring gear until it makes contact with tooth flank (end of backlash travel).
  - Set dial indicator to "0" with 2 mm preload.
  - Turn ring gear back against opposite tooth flank (backlash).

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- Recording (backlash) indicated on gauge.

- Turn ring gear 90° further each time and repeat measurement 3 times.

Notes:



- *Install VW386A clamping piece if the pinion shaft rotates when the differential is turned. This way the exact backlash can be measured.*
- *Loosen clamping piece in order to turn the ring gear further.*

Determining average backlash

- Add four measured values together and divide by four.

Example:

	1st measurement	0.28 mm
+	2nd measurement	0.30 mm
+	3rd measurement	0.30 mm
+	4th measurement	0.28 mm
=	Sum of measured values	1.16 mm

- Result: the average backlash is 1.16 mm ÷ 4 = 0.29 mm

CAUTION!

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive gear set

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itself is not correct. Check installation, replace final drive gear set if necessary.

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Determining thickness of shim S2

Formula:

S2 = S2* - backlash + lift

Example:

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

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available 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) By using shim tolerances it is possible to find exact shim thickness required, insert two shims if necessary.

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Determining thickness of shim "S1"

Formula:

S1 = Stotal - 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 ⇒ parts catalog

The following shims are available for S1

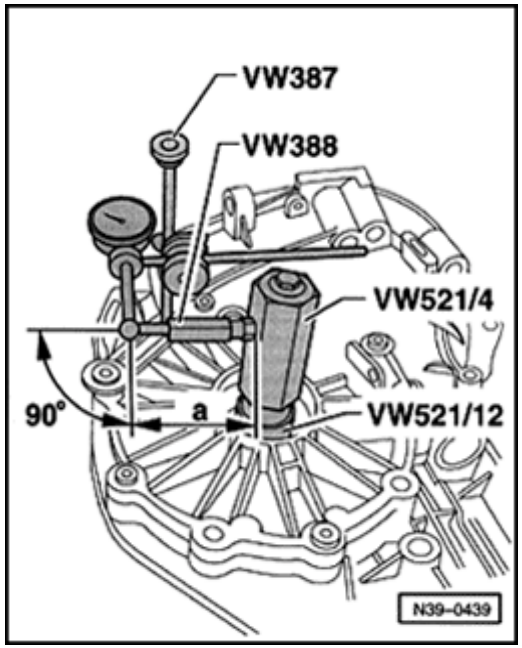
Shim thickness (mm)1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) By using shim tolerances it is possible to find the exact shim thickness required, insert two

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shims if necessary.

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Checking measurement

- After installing shims S1 and S2, turn differential 5 turns in both directions so that tapered roller bearings settle.
- Measure backlash four times on circumference.

  Specifications: 0.12-0.22 mm

Notes:

- *If the backlash lies outside the tolerances, the adjustments must be repeated. The total shim thickness Stotal must remain the same.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

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39-68

Driveshaft, servicing

CAUTION!

- ***Refer to general repair instructions ⇒ Page 00-14 .***
- ***Do not bend the driveshaft more than 25° at the center universal joint, otherwise the universal joint could be damaged.***
- ***Only store and transport the driveshaft extended.***
- ***No repair work can be carried out on the driveshaft with the exception of removing, installing and adjusting.***
- ***If the driveshaft is only detached at the transmission or from the rear final drive, it must be tied up or supported at the constant velocity joints.***
- ***Before removing, mark the position of the joint to flange. Reinstall in the same position otherwise imbalance will be excessive, the mountings could be damaged causing rumbling noises.***

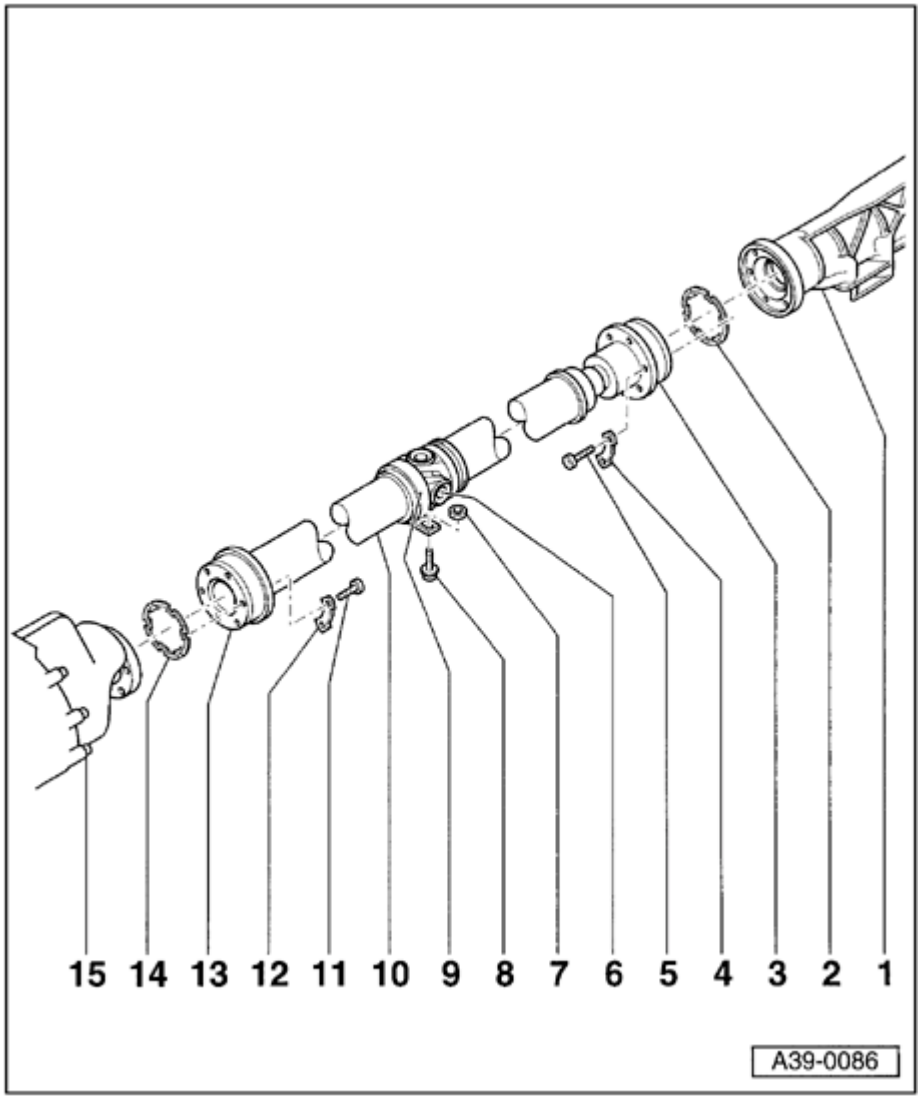
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- ***For complaints (noise or vibrations), first check whether correct adjustment of the driveshaft resolves the problem before replacing the driveshaft.***

- ***After removing the driveshaft from the rear final drive, do not reinstall additional balance disc (thicker washer) which may have been installed between base plate and bolt head.***

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39-69



1 - Final drive

2 - Gasket

- Always replace
- Pull off backing foil, and attach self-adhesive side of gasket to drive flange.
- De-grease drive flange

3 - Constant Velocity (CV) joint

- Maximum permissible bend angle 8°

4 - Backing plate

5 - Socket-head bolt

- Always replace
- Self-locking
- 55 Nm (41 ft lb)
- Bolt threads in drive flanges must always be cleaned (e.g. with thread tap)

6 - Universal joint

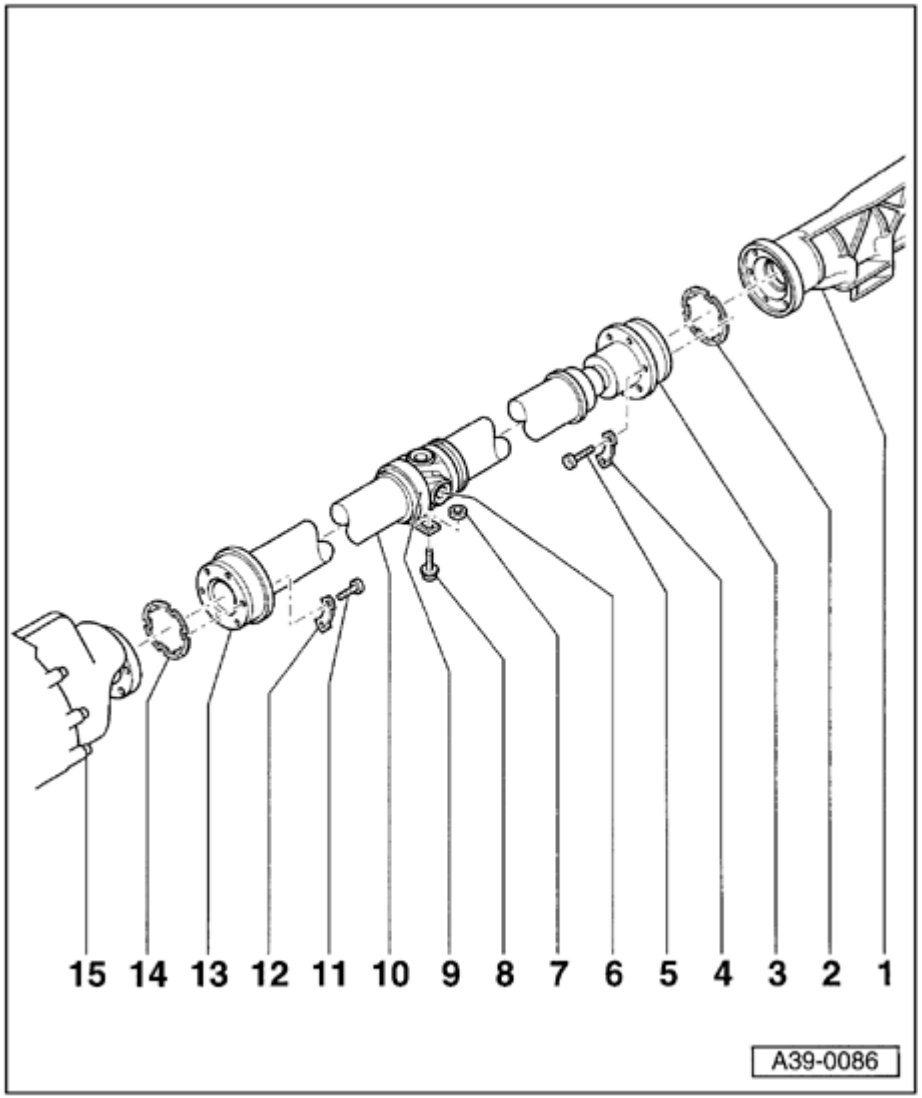
- Max permissible bend angle 25°

7 - Shim

- Determining thickness ⇒ Page 39-79

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39-70



8 - Hex bolt

- 23 Nm (17 ft lb)

9 - Driveshaft center bearing

10 - 14Driveshaft

- Adjusting ⇒ Page 39-79

11 - 16Socket-head bolt

- Always replace
- Self-locking
- 55 Nm (41 ft lb)
- Bolt threads in drive flanges must always be cleaned (e.g. with thread tap)

12 - Backing plate

13 - Constant Velocity (CV) joint

- Max. permissible bend angle 8°

14 - Gasket

- Always replace
- Pull off backing foil, and attach self-adhesive side of gasket to drive flange.
- De-grease drive flange

15 - Transmission

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39-71

Driveshaft, removing and installing

Special tools and equipment

- 3298 alignment fixture for all wheel drive driveshaft
- 3139/2 adapter

- Observe all cautions ⇒ Page 39-68 .

Removing

- Remove crossmember under exhaust system (if installed).
- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

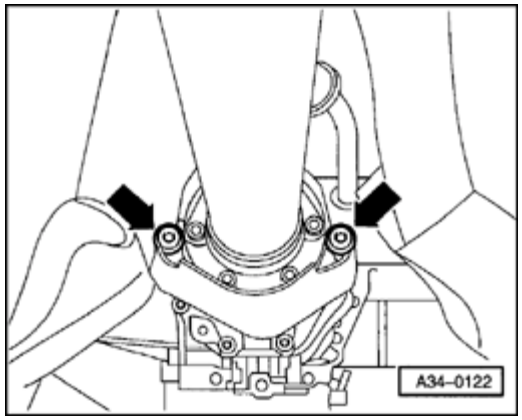
⇒ Repair Manual, Engine Mechanical, Repair Group 26

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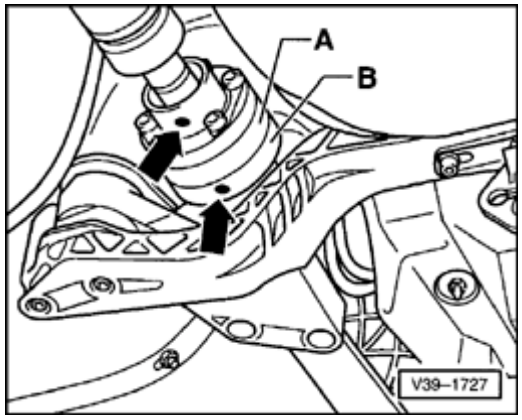
39-72

Removing

- Remove heat shield above driveshaft.



- Remove heat shield for driveshaft from cover of Torsen differential (arrows).



- Check for factory color markings marked on driveshaft and driveshaft/flange at rear final drive drive flange. If not, mark position of driveshaft flange (arrow -A-) in relation to drive flange final drive (arrow -B-) with paint.

Note:

Marking the shaft is only necessary if the same driveshaft will be re-installed.

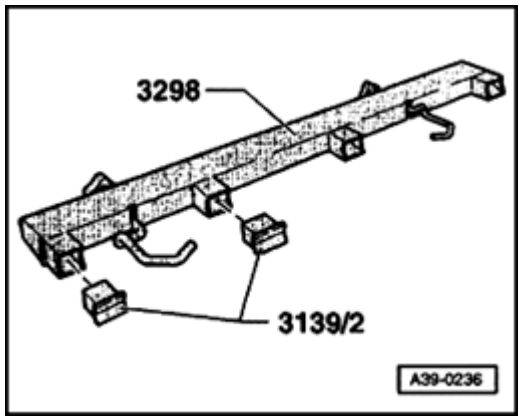
- Loosen mounting bolts of both driveshaft flanges.

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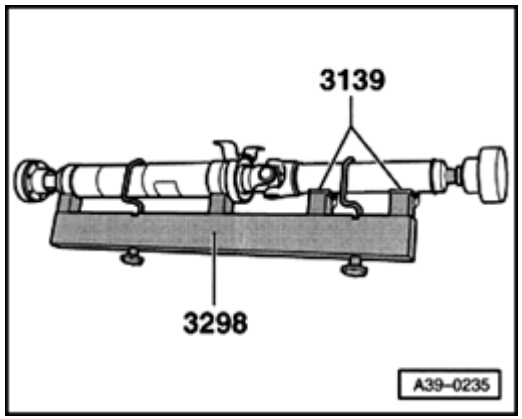
39-73

- Remove three upper mounting bolts on each driveshaft constant velocity joint.

- Loosen mounting bolts of center bearing slightly.



- Install two 3139/2 adapters, in 3298 alignment fixture.



- Mount 3298 alignment fixture with both 3139/2 adapters and tighten plastic nuts.

Note:

Never install alignment fixture onto balance plates.

- Remove mounting bolts of flanges to transmission and to final drive as well as mounting bolts for center bearing.
- Push driveshaft together toward final drive. CV joints can be moved axially.

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- Remove driveshaft at transmission drive flange using assembly tool.

Note:

Driveshaft must always be kept in extended position for transportation and storage.

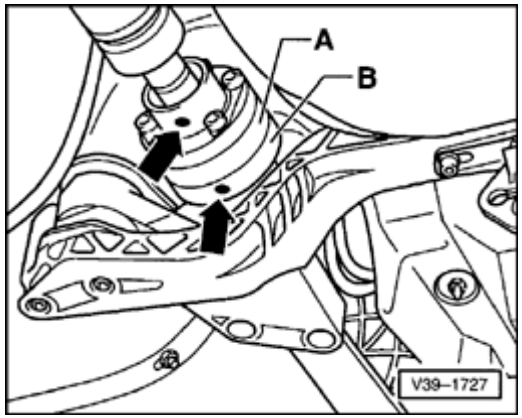
Installing

Installation is the reverse of removal, note the following:

Notes:

- *The threaded holes on the drive flange of the transmission and the final drive should be cleaned of all locking compound residue after the driveshaft has been removed. Otherwise there is a risk of seizing a bolt when tightening and subsequently break off at the next disassembly.*
- *Clean by using a thread tap.*
- *Replace seals on drive flanges. Pull off backing foil, and attach self-adhesive side of gasket to drive flange. Adhesive bonding surface must be free of grease.*

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Notes continued:

- *To prevent imbalance, the flanges of the driveshaft (arrow -A-) and of the final drive (arrow -B-) must be installed so that the factory color markings (or the markings made during removal) are aligned.*
- *If a new driveshaft is being installed and the factory color marking on the rear final drive flange is no longer visible, the radial deviation at the flange for the driveshaft must be measured ⇒ Page 39-77 and the color marking on the driveshaft must be aligned with the color marking on the flange.*
- *After removing the driveshaft from the final drive, additional balance disc (thicker washer) which may have been installed between base plate and bolt head may not be re-installed.*
- *Always replace self-locking driveshaft bolts.*

- After installing, adjust driveshaft ⇒ Page 39-79 .

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- Align exhaust system free of stress.

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Tightening torques

Component		Tightening torque
Driveshaft to transmission		55 Nm (41 ft lb)
Driveshaft to final drive		55 Nm (41 ft lb)
Center driveshaft bearing to body		23 Nm (17 ft lb)
Heat shield for driveshaft to transmission		23 Nm (17 ft lb)
Front cross-piece below exhaust system to body		25 Nm (18 ft lb)
Nuts for exhaust pipe clamp		40 Nm (30 ft lb)

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Drive flange/driveshaft radial deviation, measuring and identifying

Special tools and equipment

- VW38 universal measurement bracket
- 2024A engine sling
- Dial indicator
- Bolt M10 x 85

Notes:

- *Radial deviation must always be measured, when the torque tube is removed. Apply a new color marking and remove the old one.*
- *If a new driveshaft is installed and the color marking on the drive flange of the final drive is no longer visible, the location of the largest radial deviation must be determined and identified with a color marking.*
- *This color marking is then matched with the color marking on the driveshaft* ⇒ *Page 39-74* .

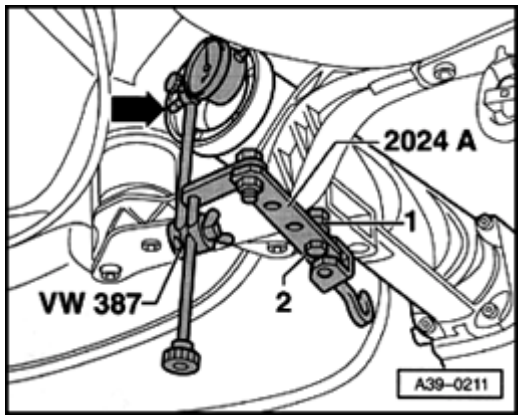
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- *The radial deviation can also be measured with final drive installed, by separating driveshaft at final drive. Notes ⇒ Page 39-68 .*

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39-78

- Remove front left bolt at crossmember for final drive.



- Remove strap from 2024A engine sling and tighten with bolt -2- (M10 x 85 mm) at open bore. Position strap using approx. 5 nuts (M12) for backing -1-.
- Secure VW387 dial gauge holder onto strap mounted in this position.
- Place dial indicator on inside machined surface of drive flange (arrow) and set to "0" with with 1 mm preload.
- Turn differential simultaneously in one direction by turning rear wheels (drive flanges right and left), until drive flange makes complete rotation.
- Identify greatest radial deviation on outer drive flange with color marking (corresponds to largest dimension from pivot axis).
- Remove old color marking on drive flange.
- Install driveshaft ⇒ Page 39-74 .

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Driveshaft, adjusting

Special tools and equipment

- 3298 alignment fixture for all wheel drive driveshaft
- 3139/2 spacer

- Observe all cautions ⇒ Page 39-68

Adjustments should be carried out carefully, because a badly adjusted driveshaft is often the cause of vibration and droning noises.

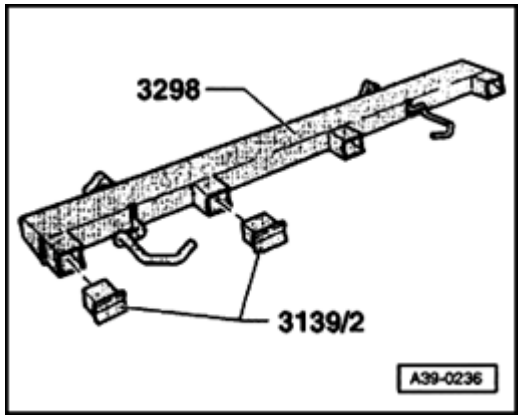
- Remove crossmember below exhaust system, if installed.

- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

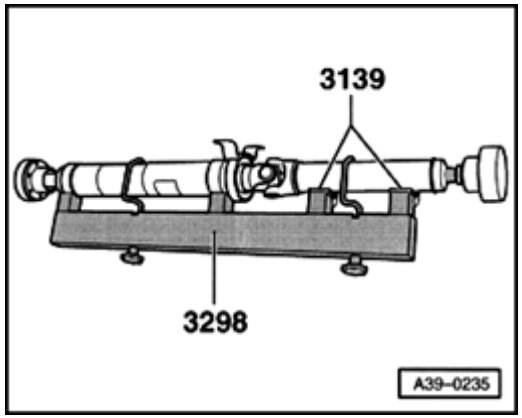
⇒ Repair Manual, Engine Mechanical, Repair Group 26

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39-80



- Place two 3139/2 spacers in 3298 assembly tool.

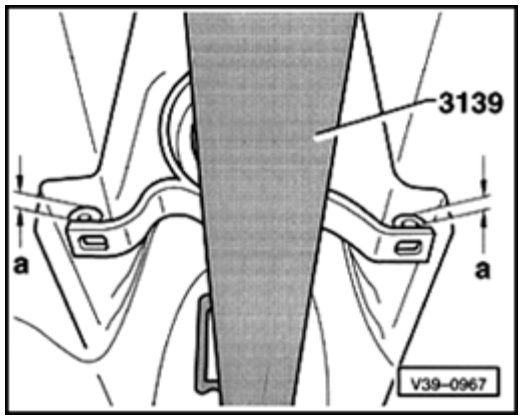


- Mount 3298 assembly tool with two 3139/2 spacers and tighten plastic nuts.

Note:

Never install alignment fixture onto balance plates.

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- Remove mounting bolts and shims of center bearing.

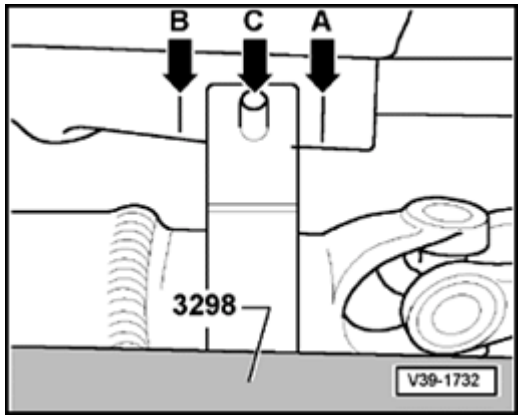
- Align center driveshaft bearing so that dimensions -a- are same on both sides.
- Measure dimensions -a-.
- Identify shims according to table. Part numbers ⇒ parts catalog

The following shims are available

Dimension -a- (mm)	Shim thickness (mm)
0-3.0	-
3.1-5.0	2
5.1-7.0	4
7.1-9.0	6
9.1-11.0	8
11.1-13.0	10

- Install selected shims on both sides.

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Aligning driveshaft longitudinally

- Push driveshaft with alignment fixture toward rear as far as possible.
- Mark position of center bearing on body (arrow -A-).
- Push driveshaft with alignment fixture toward front as far as possible.
- Mark position of center bearing on body (arrow -B-).
- Align driveshaft (arrow -C-).

The center bearing must be aligned centrally between markings -A- and -B-.

- Install mounting bolts for center driveshaft bearing together with previously selected shims, and tighten.
- Remove alignment fixture.
- Install heat shield above driveshaft.

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Installation is the reverse of removal, note the following:

- Align exhaust system free of stress.

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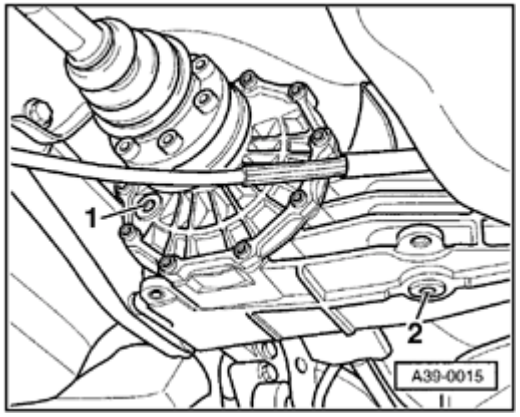
Tightening torques

Component		Tightening torque
Center bearing to body		23 Nm (17 ft lb)
Front cross-member below exhaust system to body		25 Nm (18 ft lb)
Nuts on exhaust pipe clamp		40 Nm (30 ft lb)

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39-84

Oil level in rear final drive, checking



- Remove oil filler plug -1- (arrow) to check oil

Specification: oil level up to lower edge of filler hole

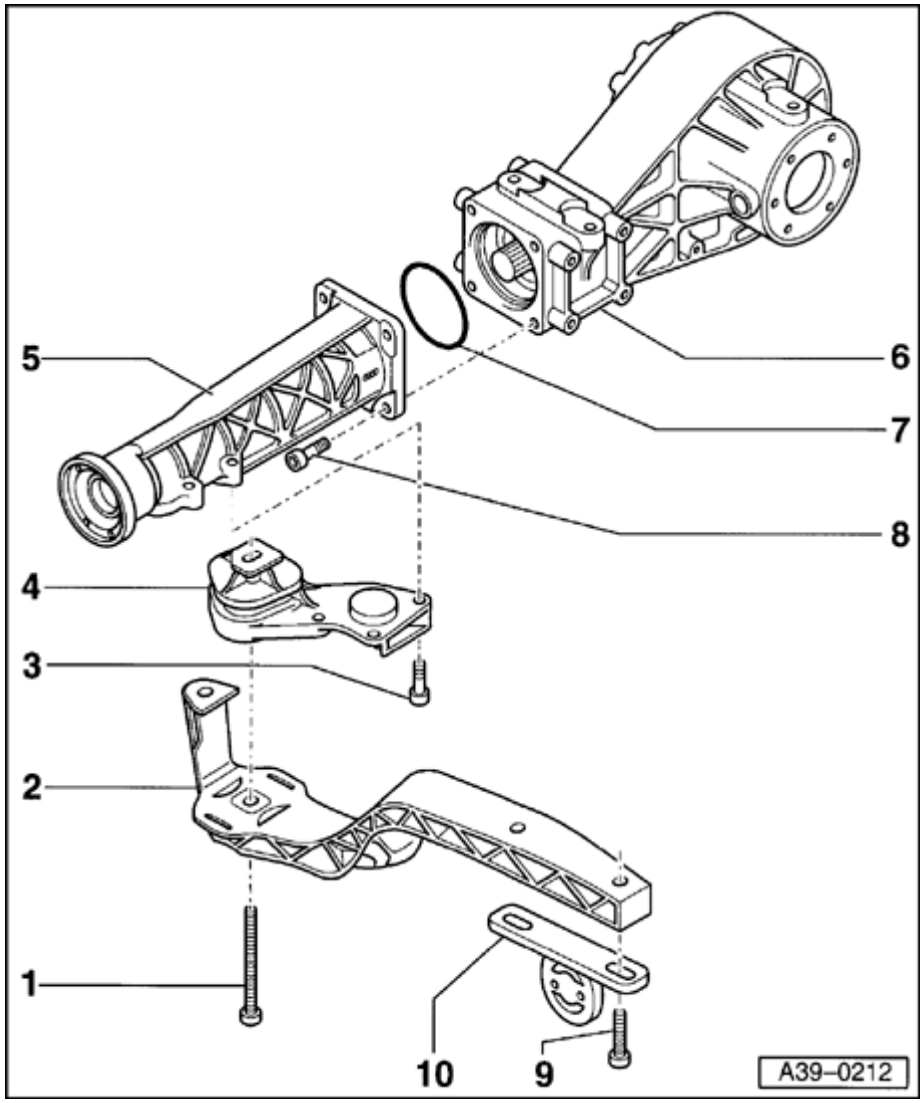
- Top off gear oil if necessary, specification ⇒ Page 00-9 .
- Install oil filler plug.

Tightening torque

Component	Tightening torque
Oil filler plug	35 (26 ft lb)

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39-85



Drive flange housing, removing and installing

Assembly overview

1 - Bolt

- 40 Nm (30 ft lb)

2 - Front crossmember

3 - Bolt

- 40 Nm (30 ft lb)

4 - Transmission support

5 - Drive flange housing

6 - Final drive housing

7 - O-ring

8 - Bolt

- 35 Nm (26 ft lb)

9 - Bolt

- 23 Nm (17 ft lb)

10 - Mounting bracket

- For exhaust system

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Removing

- Rear differential installed

Special tools and equipment

- VW771 with 771/15 multi-purpose tool
- VAG1306 drip tray
- VAG1359/2 universal mounting
- VAG1383A engine-/transmission hoist

- Place VAG1306 drip tray underneath transmission and drain fluid.

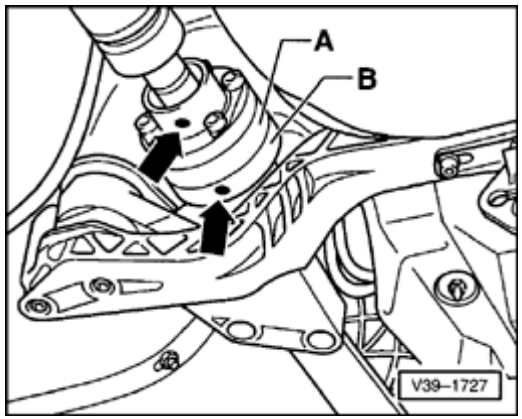
- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

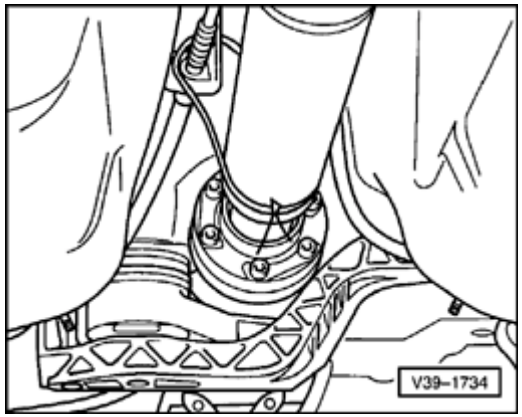
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- Remove heat shield above driveshaft.

- Remove heat shield next to rear differential.



- Check for factory color marking on driveshaft. If not, mark position of driveshaft flange -A- to drive flange in rear differential -B- with color marking.
- Remove mounting bolts from driveshaft flange.



- Tie driveshaft to mount for parking brake cable using wire.

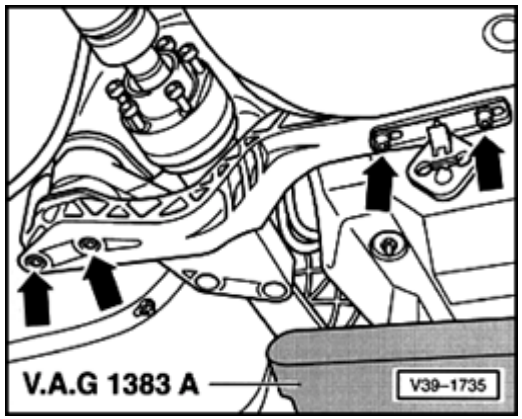
Note:

If driveshaft cannot be pushed upward past flange, tie up driveshaft after lowering the differential. When lowering driveshaft, protect it from dropping and note the permissible bend angle of driveshaft ⇒ Notes, ⇒ Page 39-68 .

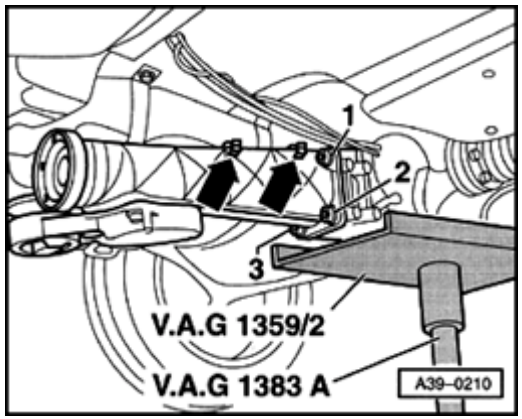
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39-88

- Support final drive using VAG1383A.



- Remove bolts (arrows) from front crossmember for final drive.
- Remove crossmember front.
- Lower final drive approx. 10 cm (4 in.).



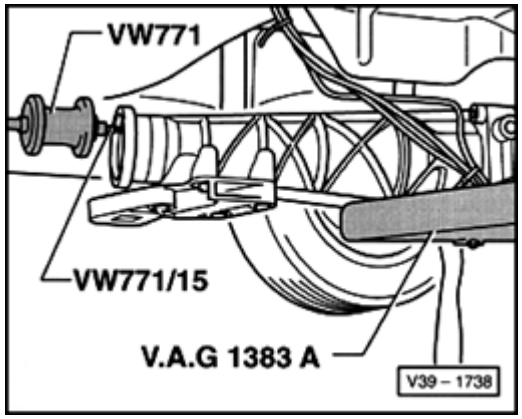
- Remove 4 bolts for drive flange housing -1-, -2- and -3-.

Note:

The 4th bolt is not visible in the illustration.

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39-89



- Pull off drive flange together with housing.

Installing

Installation is the reverse of removal, note the following:

Notes:

- *The threaded bores in the drive flanges of the transmission and the final drive should be cleaned of all locking compound residue after driveshaft has been removed. Otherwise there is a risk of seizing the bolt when tightening and break off at next disassembly.*
- *Clean by using a thread tap.*
- *Replace seals between driveshaft and drive flange (Remove protective film and bond seal to drive flange. Adhesive bond surface must be free of grease.*
- Always replace self-locking driveshaft bolts.

- If driveshaft has factory color marking, determine radial deviation on flange/driveshaft ⇒ Page 39-77 and align color marking on driveshaft to new color marking on drive flange.

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- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

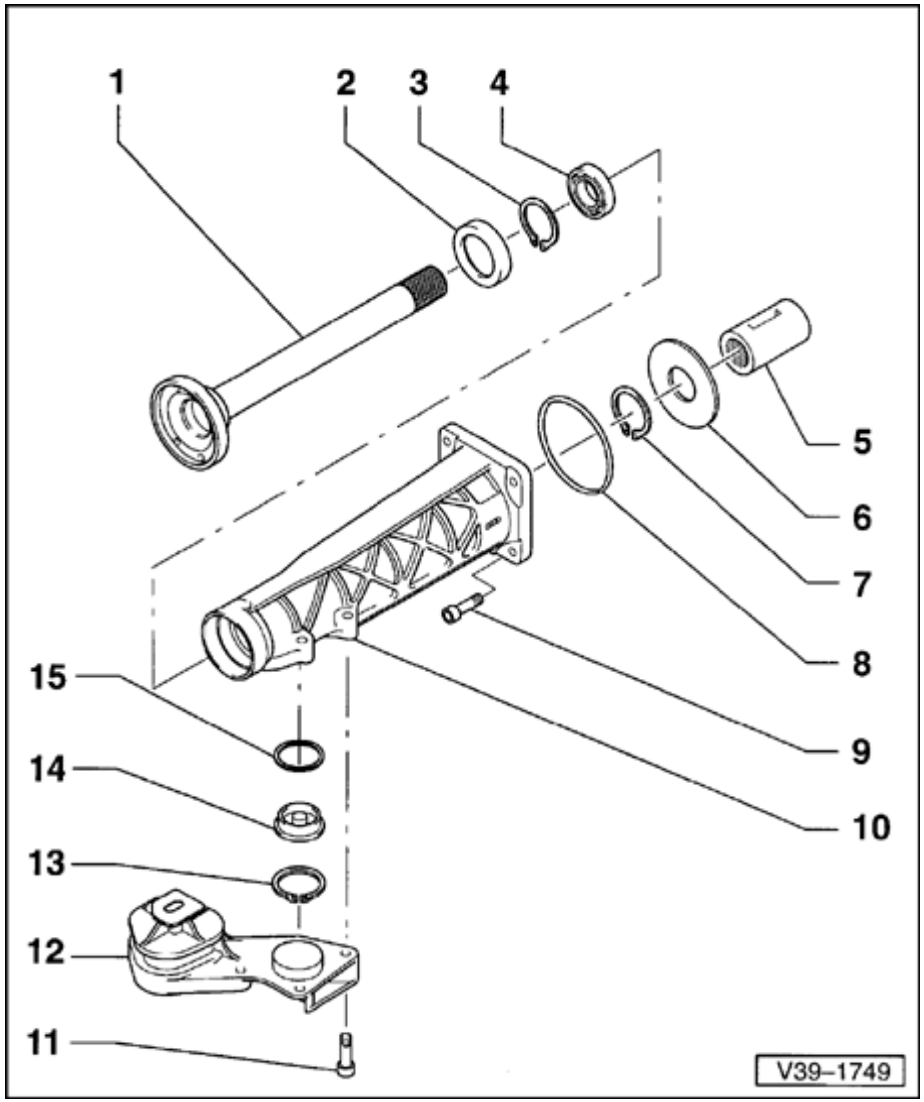
- Top off transmission oil for final drive and check oil level ⇒ Page 39-84 .

Tightening torques

Component	Tightening torque
Drive flange housing to final drive	35 Nm (26 ft lb)
Driveshaft to final drive	55 Nm (41 ft lb)
Front crossmember for final drive to body	40 Nm (30 ft lb)
Front crossmember for final drive with mounting bracket for exhaust system to body	23 Nm (17 ft lb)
Oil filler plug	35 Nm (26 ft lb)
Nuts for clamping sleeve	40 Nm (30 ft lb)

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39-91



Drive flange housing

Note:

Drive flange housing, removing and installing ⇒ *Page 39-85* .

1 - Drive flange

- Disassembling ⇒ Page 39-94
- When installing, circlip item -7- must be simultaneously installed through hole in housing ⇒ Page 39-99

2 - Seal

- Prying out ⇒ Page 39-96
- Driving in ⇒ Page 39-98

3 - Circlip

- Removing ⇒ Page 39-96

4 - Grooved ball bearing for drive flange

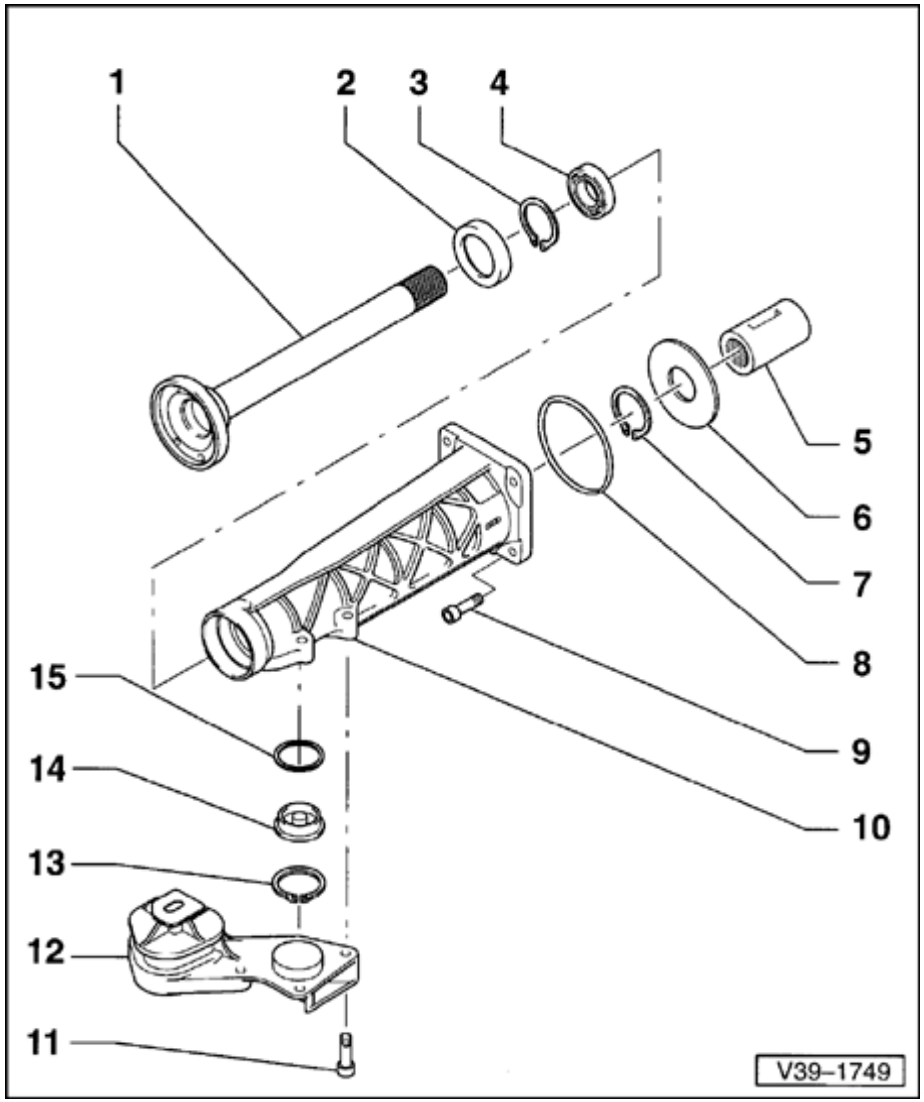
- Removing ⇒ Page 39-97
- Assembling ⇒ Page 39-98

5 - Sleeve

- Removing ⇒ Page 39-94
- Pressing on ⇒ Page 39-99

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39-92



6 - Washer

- Press out only if damaged
- Installing ⇒ Page 39-97

7 - Circlip

- Expand to remove drive flange ⇒ Page 39-95

8 - O-ring

- Always replace

9 - Bolt

- 35 Nm (26 ft lb)
- For mounting drive flange housing to final drive housing

10 - Drive flange housing

11 - Bolt

- 40 Nm (30 ft lb)
- For fastening transmission support to drive flange housing

12 - Transmission support

13 - Circlip

- Removing ⇒ Page 39-94

14 - Cap

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- Removing ⇒ Page 39-94

15 - O-ring

- Always replace

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39-93

Drive flange housing, disassembling and assembling

Special tools and equipment

- VW402 thrust plate
- VW409 punch
- VW412 thrust disc
- VW433 thrust pad
- VW771 slide hammer-complete set with VW771/15 threaded piece
- 2051 arbor
- 2062 driver
- 2078 tappet tensioner
- Kukko 21/5 extractor

Note:

Drive flange housing removing and installing ⇒

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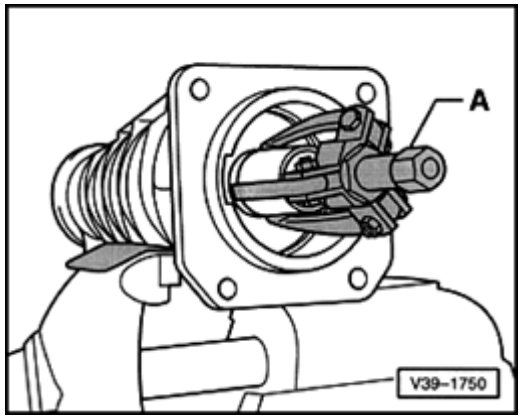
Page 39-85

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39-94

Disassembling

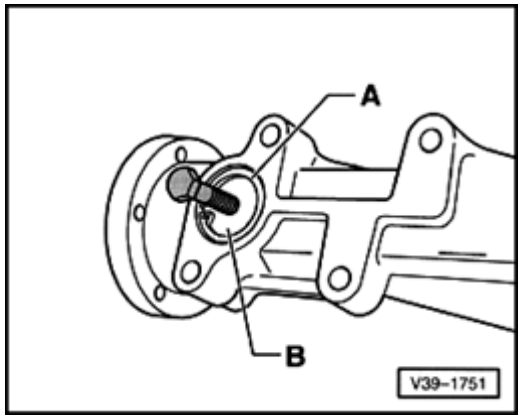
- Clamp drive flange housing in vise using protective jaws.



- Remove sleeve.

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

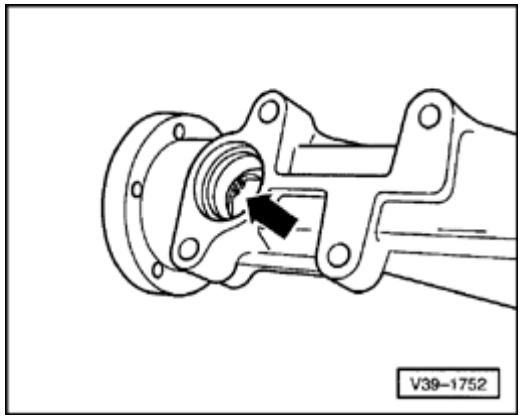
- Remove transmission support.



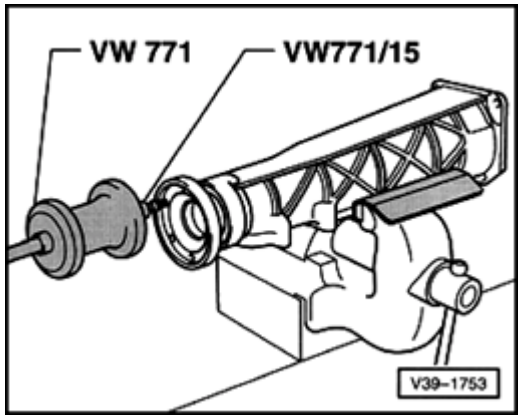
- Remove circlip -A-.
- Screw M8 bolt into thread bore of cap -B- and remove cap.

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39-95



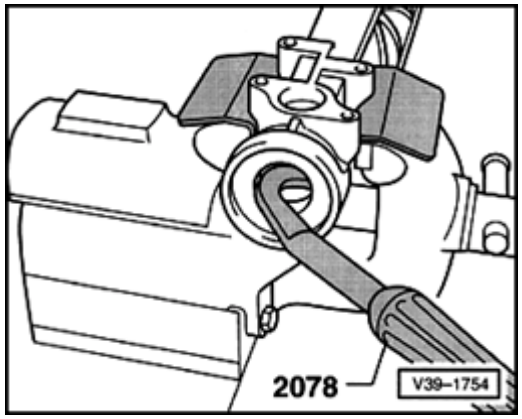
- Expand circlip (arrow) on drive flange and slide in direction of notched splining.



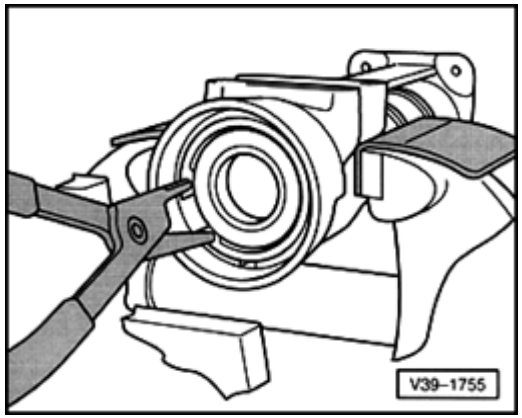
- Remove drive flange.
- Remove circlip from drive flange housing.

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39-96



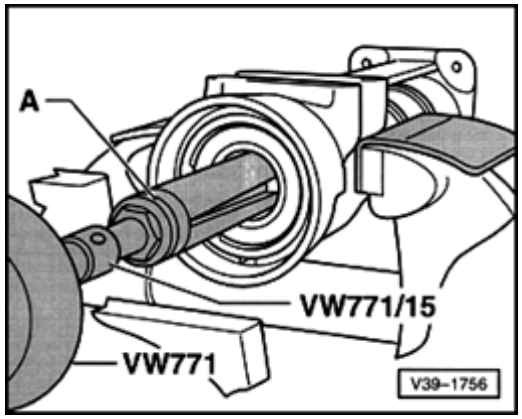
- Pry out seal.



- Remove circlip.

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39-97



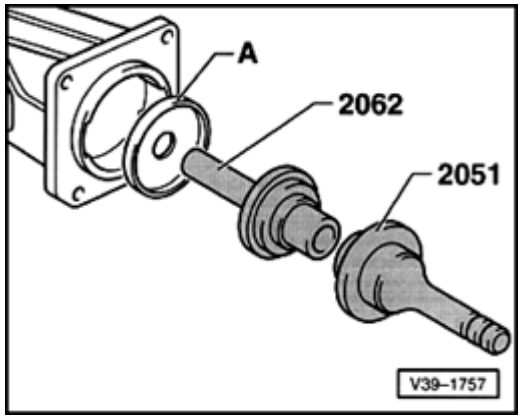
- Remove grooved ball bearing from drive flange.

A- Puller 30-37 mm, e.g. Kukko 21/5 extractor

Note:

The bearing is damaged when removed.

Only if washer is damaged

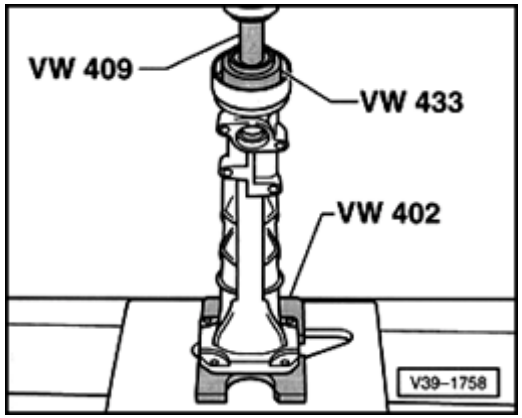


- Push out damaged washer with drive flange.
- Install washer -A- until stop is reached.

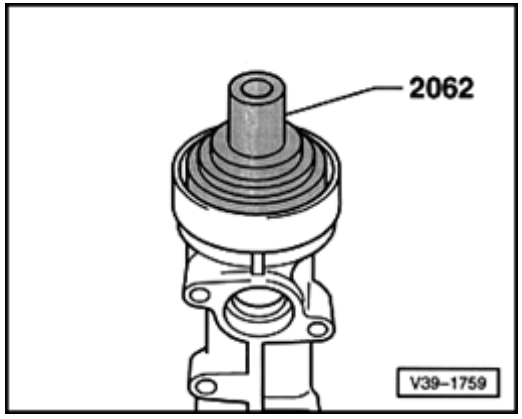
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39-98

Assembly



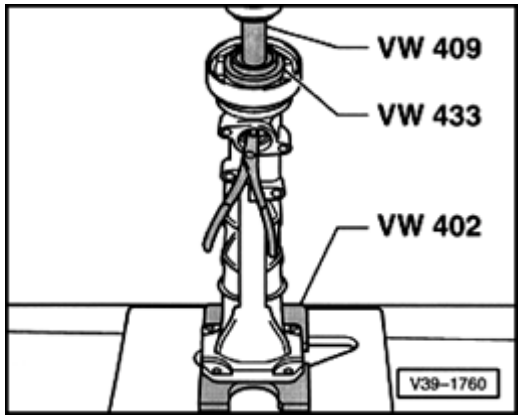
- Press grooved ball bearing into drive flange housing.
- Insert circlip outside.



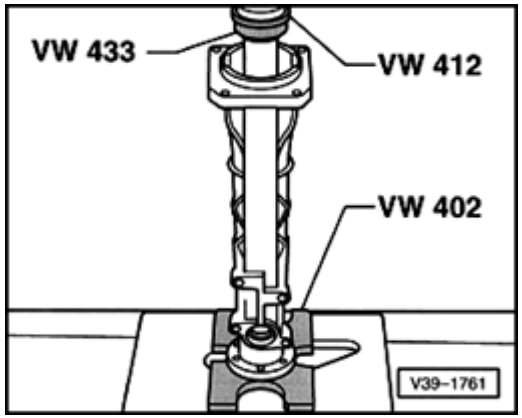
- Fill seal between sealing lip and dust lip with gear oil.
- Drive in O-ring until stop is reached.

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39-99



- Insert circlip into drive flange housing and hold with pliers.
- Press in drive flange.
- Insert circlip in groove.



- Press sleeve onto drive flange until stop is reached.
- Install cap with O-ring.
- Install circlip.
- Install transmission support.
- Place O-ring on drive flange housing.

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39-100

Drive flange seals, replacing

- Final drive installed

- Refer to general repair instructions ⇒ Page 00-14 .

Note:

The exhaust system needs to be removed only if the left seal is replaced.

Special tools and equipment

- 2062 driver
- 3066 seal installer set
- VAG1306 drip tray
- VAG1359/2 universal mount
- VAG1383A engine/transmission hoist

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39-101

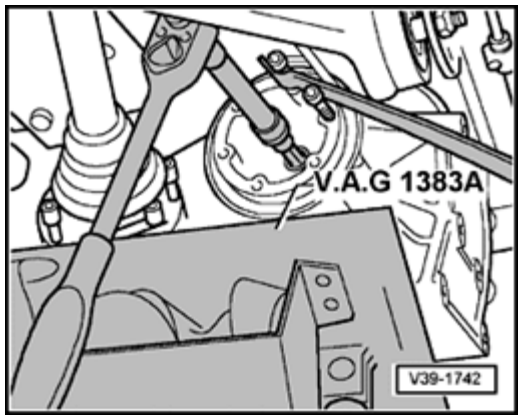
Removing

- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

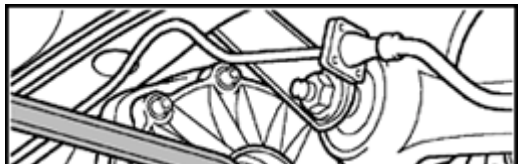
⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Unbolt driveaxles on left and right from rear final drive and place to side.

⇒ *Repair Manual, Suspension, Wheels, Brakes, Steering, Repair Group 42*



- To loosen mounting bolts, screw two bolts into drive flange and counterhold using pry bar.
- Place VAG1306 drip tray underneath and drain oil.
- Remove drive flange using screwed in bolts.



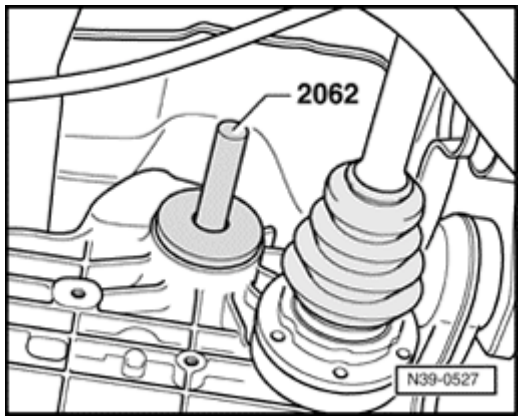
- Pry out drive flange seal using pry bar.

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Installing

Installation is the reverse of removal, note the following:

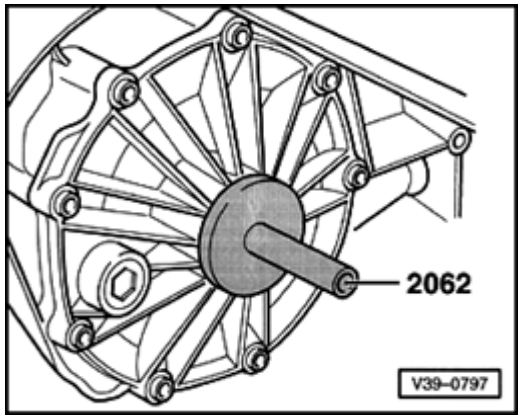
- Clean seat for O-ring.
- Lightly oil outer circumference of seal.
- Fill space between sealing lip and dust lip with gear oil.



- Install seal for left drive flange using 2062 driver until stop is reached, without canting seal.

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39-103



- Install seal for right drive flange using 2062 driver until stop is reached, without canting seal.
- Bolt on driveshaft.
- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Top off gear oil in final drive and check oil level ⇒ Page 39-84 .

Tightening torques

Component	Tightening torque
Drive flange to final drive	25 Nm (18 ft lb)

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Rear final drive, removing and installing

Special tools and equipment

- VAG1359/2 universal transmission attachment
- VAG1383A transmission jack

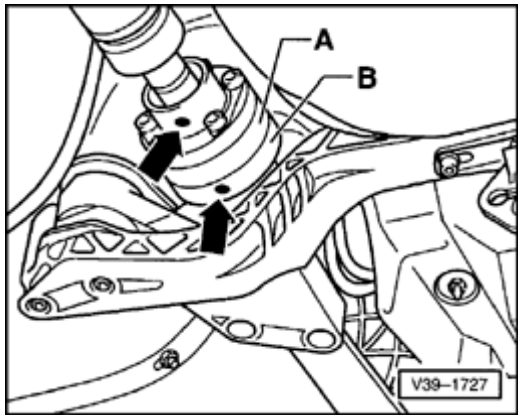
Removing

- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

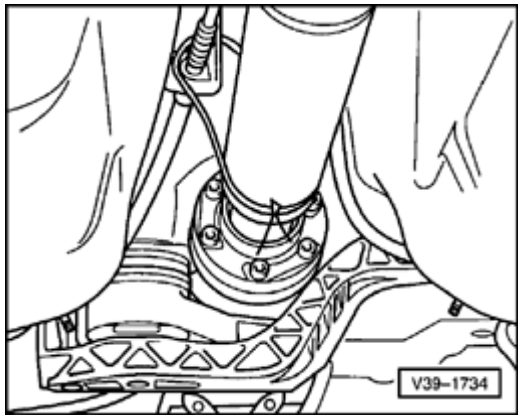
⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Remove heat shield above driveshaft.

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- Check for factory color marking on driveshaft. If not, mark position of driveshaft flange (arrow -A-) in relation to drive flange in rear final drive (arrow -B-) with color marking.
- Remove mounting bolts from driveshaft flange.



- Tie driveshaft to parking brake cable using wire.

Note:

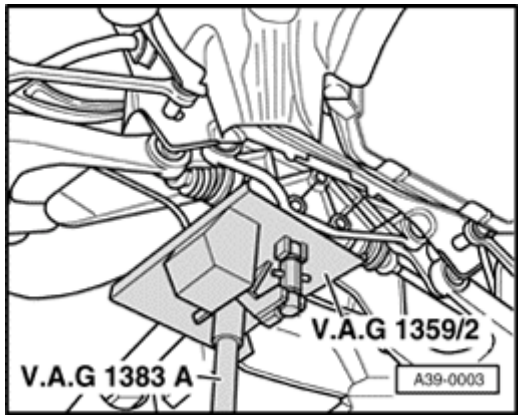
If the driveshaft cannot be pushed up past the flange, tie up the driveshaft after lowering the differential. When lowering the driveshaft, protect it from dropping and note permissible bend angle of the driveshaft ⇒ Notes, ⇒ Page 39-68 .

- Disconnect left and right driveaxles from final drive.

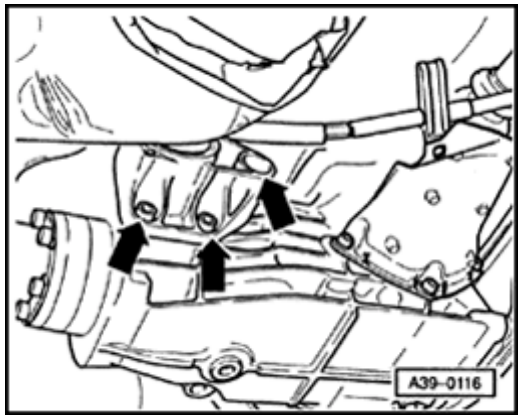
⇒ *Repair Manual, Suspension, Wheels, Brakes, Steering, Repair Group 42*

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39-106



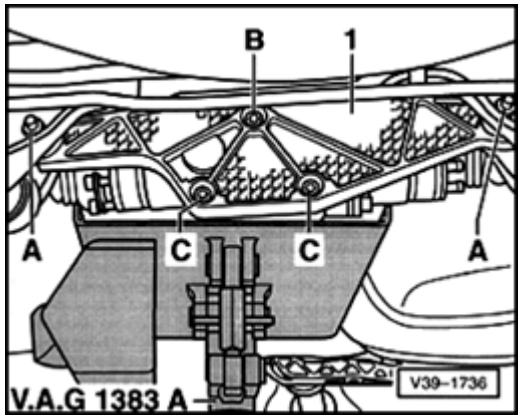
- Place VAG1383A transmission jack with 1359/2 universal transmission attachment under final drive and support weight of final drive.
- Fasten final drive using belt.



- Remove mounting bolts (arrows) of front crossmember for final drive.
- Remove front crossmember.

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39-107



- Remove mounting bolts -B- and -C- from rear crossmember at final drive.
- Lower final drive using transmission hoist.

WARNING!

For sefety reasons, two persons are required for lowering the final drive, and raising it again for installation.

Note:

Crossmember -1- does not need to be removed.

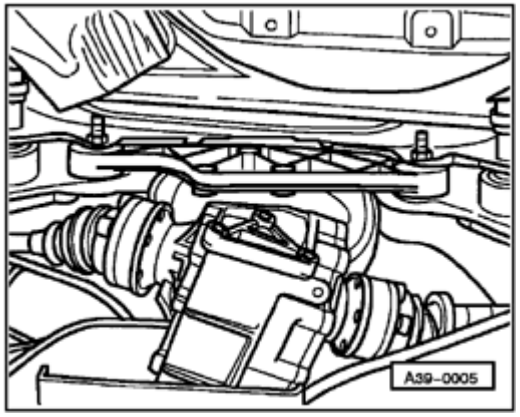
Installing

Installation is the reverse of removal, note the following:

Notes:

- *Always replace self-locking nuts.*
- *Always replace self-locking driveshaft bolts.*
- *The threaded holes on the drive flange on the final drive should be cleaned of all locking compound residue after driveshaft has been removed. Otherwise there is a risk of seizing the bolt when tightening and subsequently breaking off at the next disassembly.*
- *The threads can be cleaned using a thread tap.*
- *Replace seals between driveshaft and drive flange (remove protective film and bond seal to drive flange. Adhesive bond surface must be free of grease.*

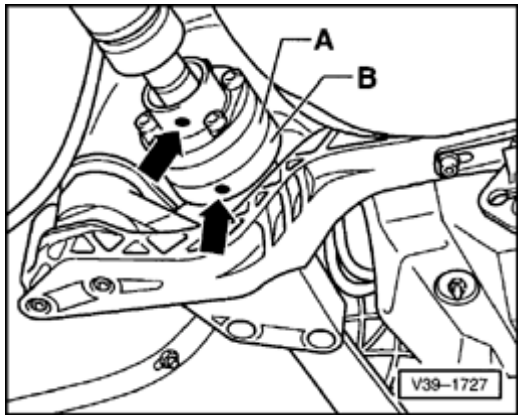
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- Use transmission hoist, to raise final drive far enough until both drive axles can be installed.
- Tighten drive axle bolts slightly.
- Raise final drive and bolt to crossmember and transmission support.
- Install drive shaft ⇒ Page 39-74 .

Notes:

- *Always replace self-locking bolts for driveshaft.*



- *To prevent imbalance, the flanges of the driveshaft (arrow -A-) and of the final drive (arrow -B-) must be installed so that the factory color markings (or the color markings made during removal) are aligned.*
- *After removing driveshaft from final drive, additional balance disc (thicker washer) which may have been installed between base plate and bolt head may not be re-installed.*
- Check oil level in final drive ⇒ Page 39-84 .

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- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component		Tightening torque
Driveshaft to final drive		55 Nm (41 ft lb)
Front crossmember for final drive to body		40 Nm (30 ft lb)
Front crossmember for differential with mounting bracket for exhaust system to body		23 Nm (17 ft lb)
Rear crossmember for final drive to subframe		50 Nm (37 ft lb)
Rear crossmember to final drive		55 Nm (41 ft lb)
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)

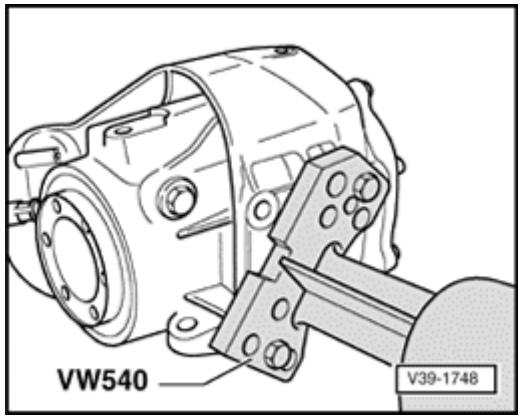
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39-110

Rear final drive to repair stand, mounting

Special tools and equipment

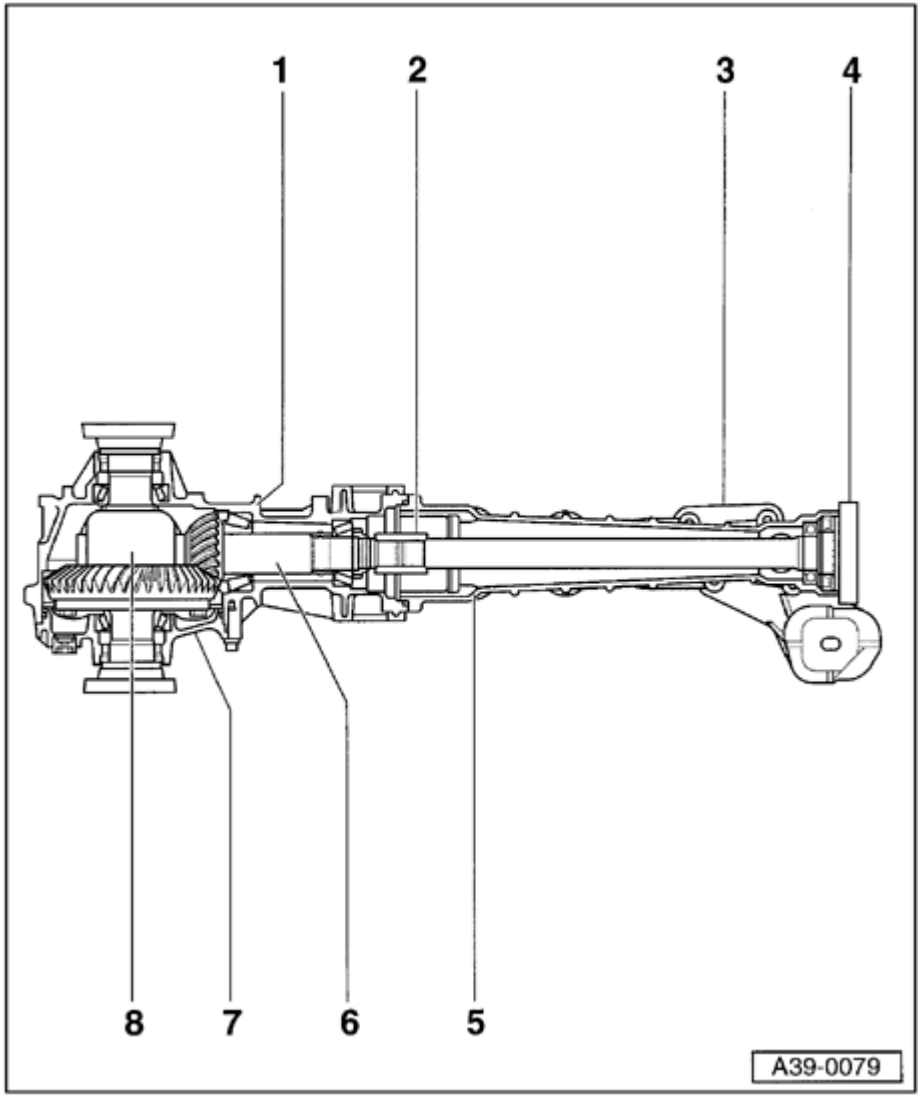
VW540 holding fixture



- Mount complete final drive to repair stand using VW540 holding fixture.

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39-111



Rear final drive, disassembling and assembling

Assembly overview

Notes:

- *Separating drive flange housing from final drive with the final drive installed* ⇒ *Page 39-85*
- *Separating drive flange housing from final drive with the final drive removed* ⇒ *Page 39-113*

1 - Final drive housing

2 - Sleeve

3 - Transmission support

4 - Drive flange

- Removing ⇒ Page 39-93

5 - Drive flange housing

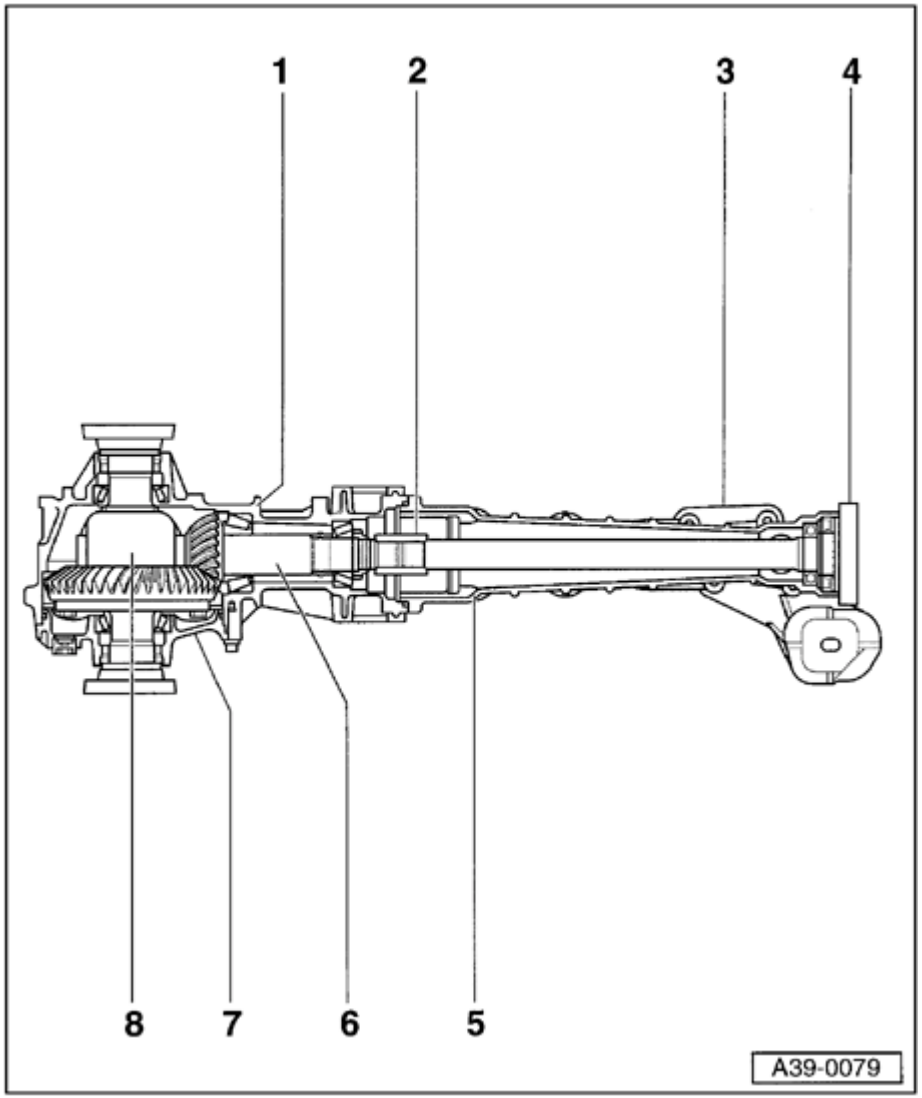
- Removing and installing ⇒ Page 39-85

6 - Pinion shaft

- Is matched with ring gear, always replace together as a set.
- Removing and installing ⇒ Page 39-134

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39-112



7 - Final drive cover

8 - Differential

- Must be removed before removing pinion shaft
- Removing and installing ⇒ Page 39-114
- Disassembling and assembling ⇒ Page 39-121

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39-113

Drive flange housing, removing from final drive housing

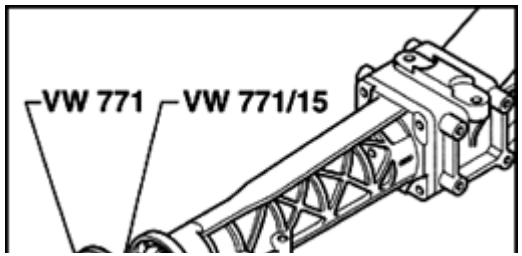
- Final drive removed.

Special tools and equipment

- VW771 slide hammer-complete set with 771/15 threaded piece
- VW1306 drip tray

Removing

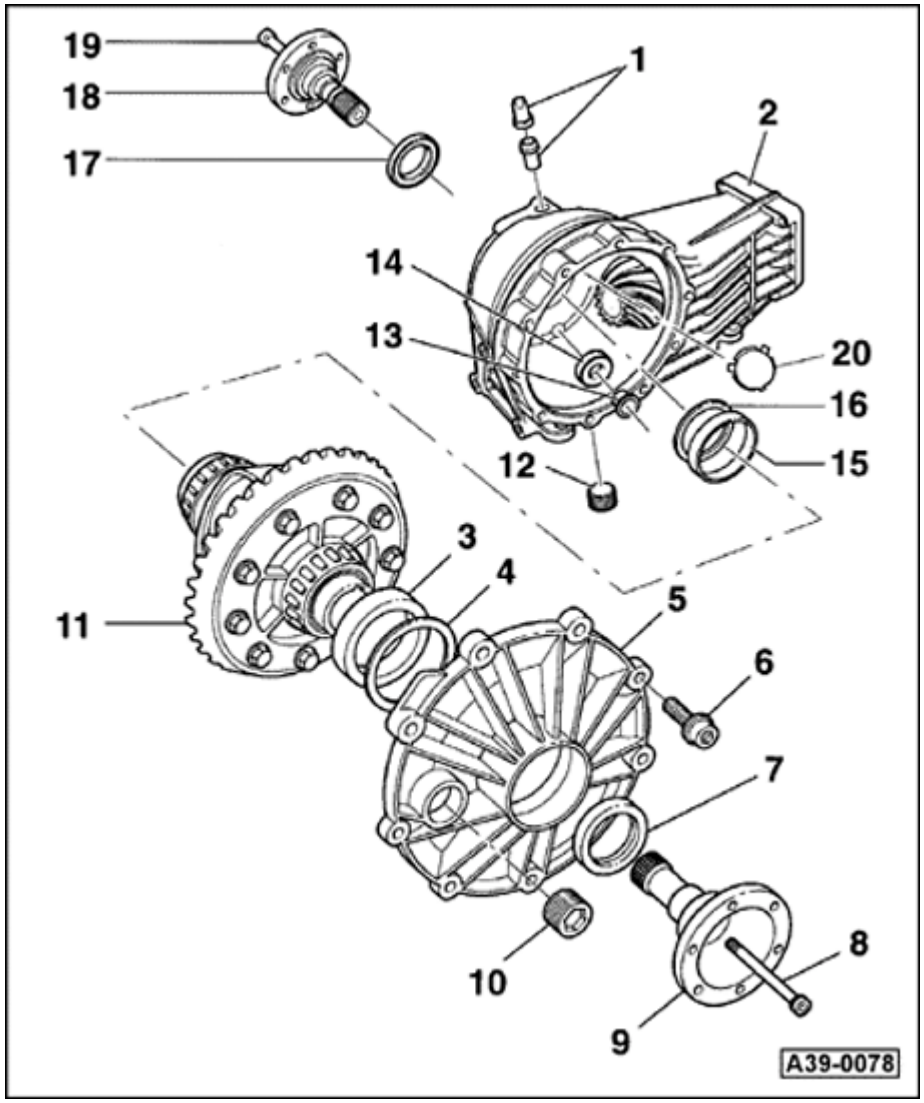
- Mount final drive on repair stand ⇒ Page 39-110 .
- Place VAG1306 drip tray under final drive and drain gear oil.
- Remove bolts from drive flange housing to final drive housing.



- Remove drive flange housing by pulling on drive flange, and support drive flange housing.

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39-114



Differential, removing and installing

Notes:

- *Refer to general repair instructions ⇒ Page 00-14 .*
- *Mounting final drive to repair stand ⇒ Page 39-110 .*
- *Adjustments are required when replacing components marked with 1) ⇒ List of adjustments, ⇒ Page 39-149 .*

1 - Breather sleeve

- With rubber valve
- Installation position ⇒ Fig. 3

2 - Final drive housing1)

- With pinion shaft
- Removing and installing drive pinion ⇒ Page 39-134

3 - Large tapered roller bearing outer race1)

- Removing ⇒ Page 39-129, Fig. 7
- Pressing in ⇒ Page 39-130, Fig. 8

4 - Shim S1

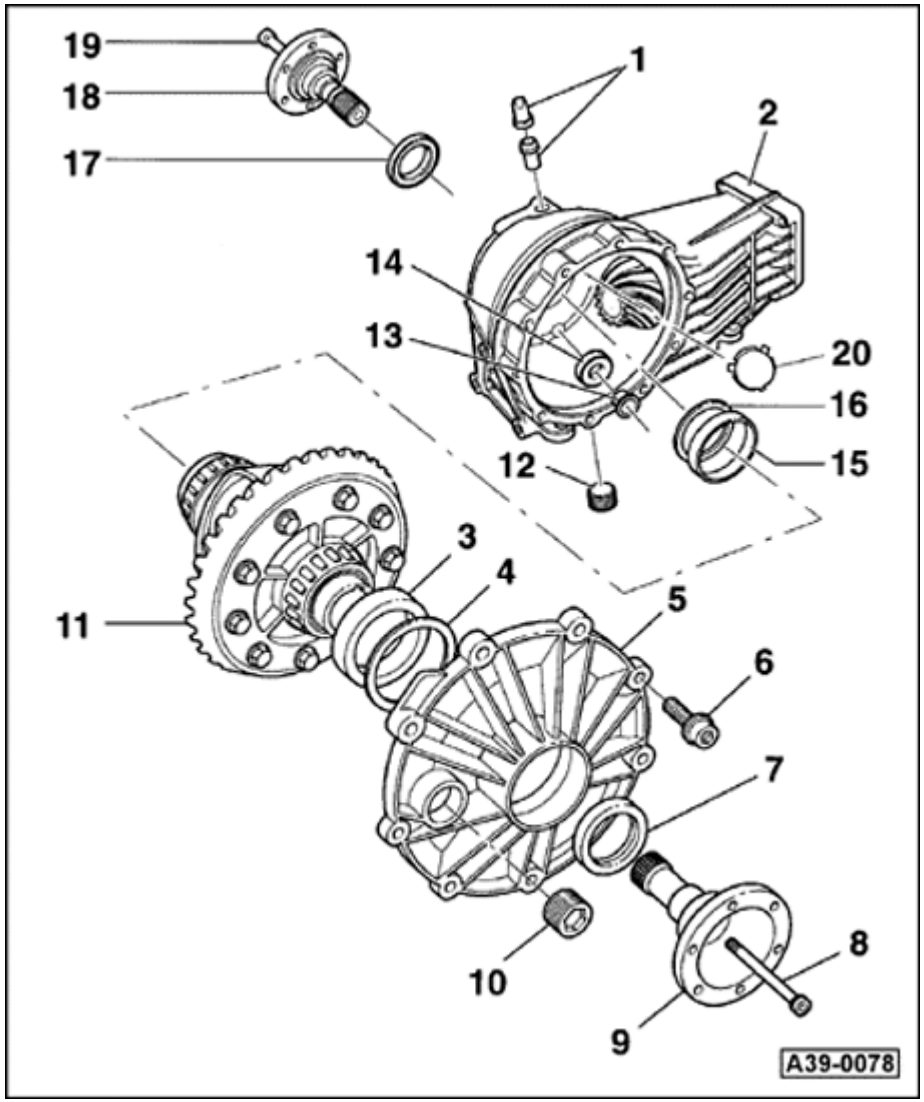
- Note thickness

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♦ List of adjustments ⇒ Page 39-149

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39-115



5 - Final drive cover1)

- Always replace O-ring
- With O-ring
- Lubricate O-ring with oil when installing

6 - Torx® bolt

- 25 Nm (18 ft lb)

7 - Right seal

- Replacing ⇒ Page 39-100

8 - Socket-head bolt

- 25 Nm (18 ft lb)

9 - Drive flange, right

- Removing and installing ⇒ Fig. 1

10 - Oil filler plug

- 35 Nm (26 ft lb)

11 - Differential with ring gear1)

- Disassembling and assembling ⇒ Page 39-121

12 - Oil drain plug

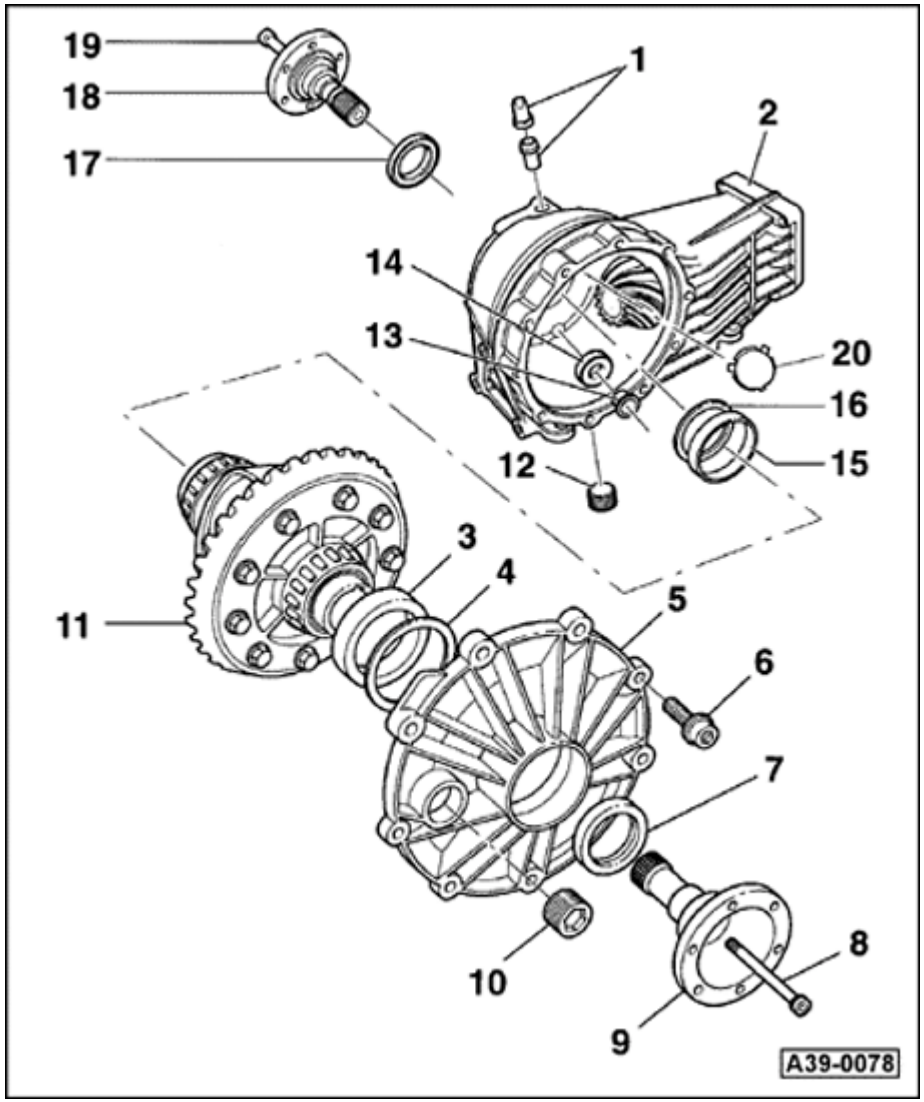
- 35 Nm (26 ft lb)

13 - Bushing

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- Holds magnet in position
- Drive in onto stop

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14 - Magnet

15 - Small tapered roller bearing outer race 1)

- Removing ⇒ Page 39-126, Fig. 1
- Installing ⇒ Fig. 2, Page 39-126

16 - Shim S2

- Note thickness
- List of adjustments ⇒ Page 39-149

17 - Left seal

- Replacing ⇒ Page 39-100

18 - Drive flange, left

- Removing and installing ⇒ Fig. 1

19 - Socket-head bolt

- 25 Nm (18 ft lb)

20 - Cover

- Installing ⇒ Fig. 2

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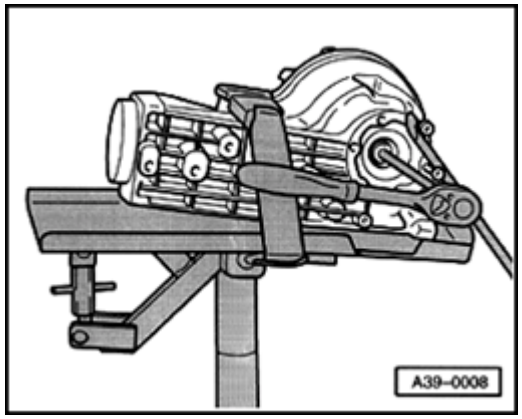


Fig. 1 Removing and installing drive flange

- To loosen mounting bolt, screw in 2 bolts in drive flange and counter-hold using pry bar.
- Pull out drive flange using screwed in bolts.

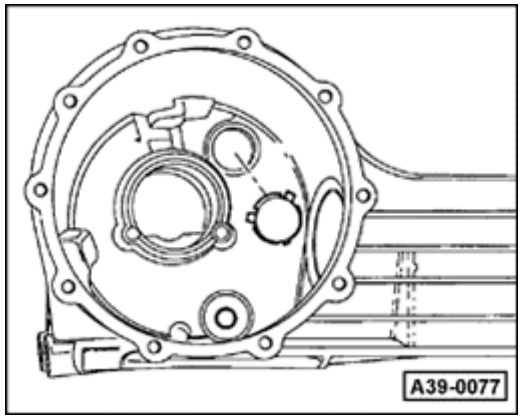


Fig. 2 Press in cover onto stop

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39-118

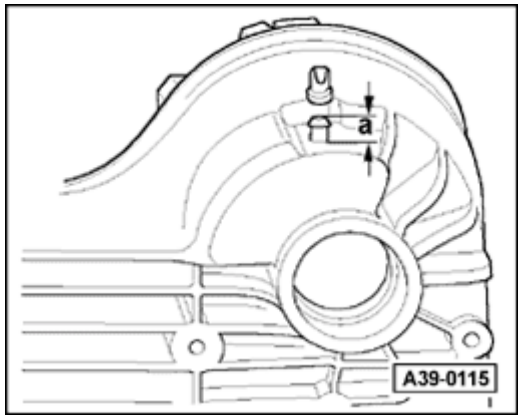


Fig. 3 Position of breather sleeve

The breather sleeve should project 13 mm (0.512 in.) dimension -a- out of final drive housing after pressing in.

The slot in the rubber valve should be in line with the direction of travel.

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Removing

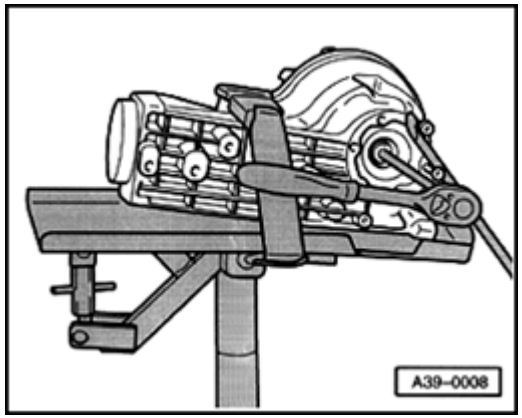
- Final drive removed

Special tools and equipment

VAG1306 drip tray

Secure complete final drive to repair stand using VW540 bracket ⇒ Page 39-110 .

Place drip tray under final drive and drain gear oil.



- Remove left and right drive flanges:
- To loosen mounting bolt, screw two bolts into drive flange and counter-hold with pry bar.
- Mark drive flanges (left and right).
- Pull out drive flange using screwed in bolts.
- Remove mounting bolts from final drive cover.
- Remove final drive cover from final drive housing and remove differential.

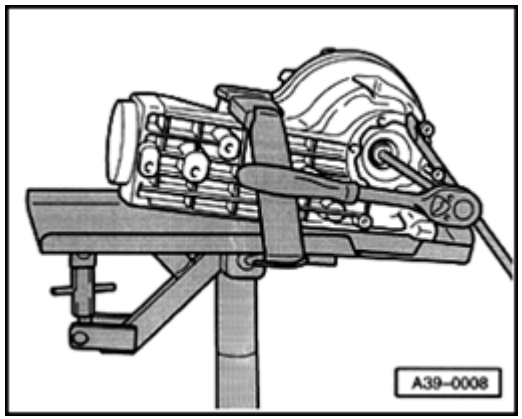
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39-120

Installing

Install in reverse order of removal, note the following:

- Install differential.
- Replace O-ring for final drive cover and lubricate before installing.
- Install final drive cover on final drive housing and tighten in diagonal sequence to 25 Nm (18 ft lb).
- Replace seals for drive flange ⇒ Page 39-100 .
- Fill space between sealing lip and dust lip with gear oil



- Install drive flanges and tighten 25 Nm (18 ft lb).
- Top off gear oil in final drive and check oil level ⇒ Page 39-84 .

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Differential, disassembling and assembling

Special tools and equipment

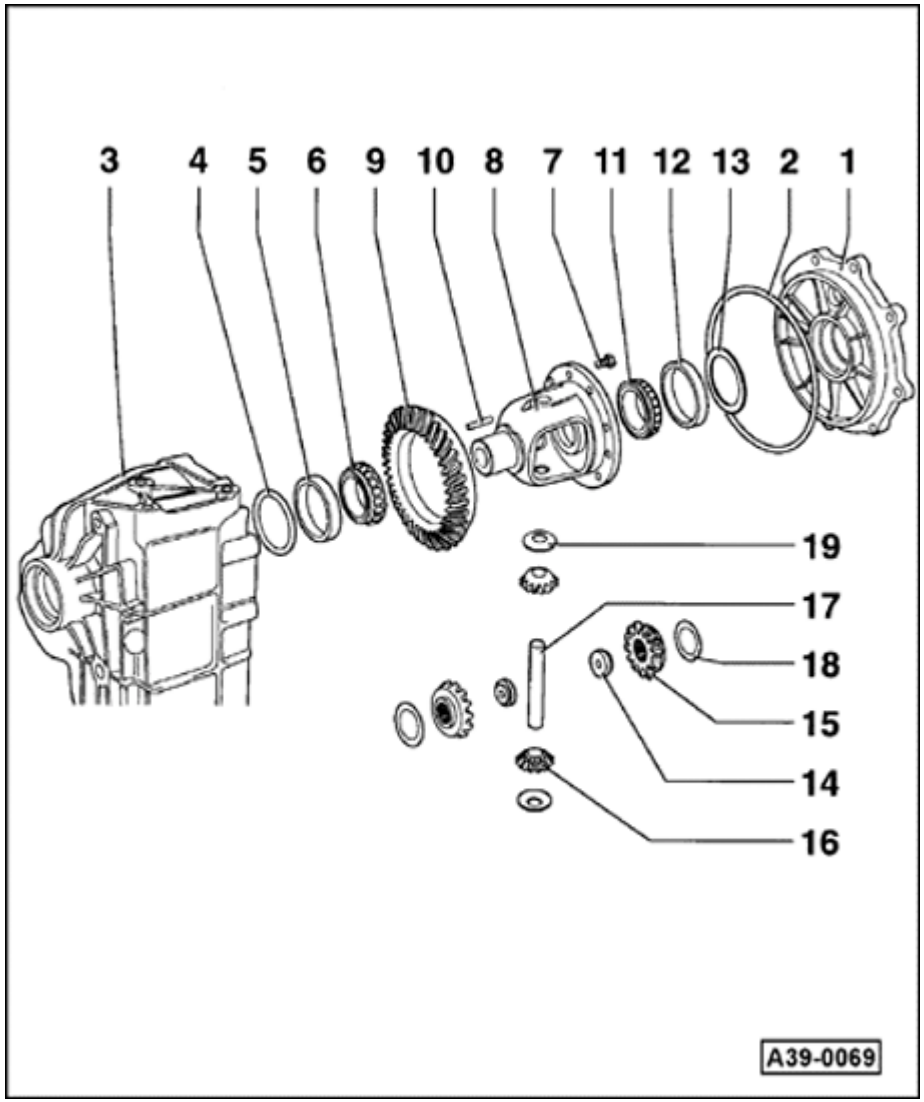
- VW295 needle bearing drift
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 thrust disc
- VW442 thrust pad
- 40-21 sleeve
- 40-105 thrust piece
- 2050 thrust plate

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- 3138 drift
- VAG1582 tapered roller bearing puller with VAG1582/6 attachment
- Kukko 44/2 two arm puller

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39-122



Notes:

- *Observe general repair instructions ⇒ Page 00-14 .*
- *Replace both tapered roller bearings together. If possible use same manufacturer.*
- *Adjustments are required when replacing components marked with 1) ⇒ List of adjustments, ⇒ Page 39-149 .*

1 - Cover for final drive1)

2 - O-ring

- Always replace
- Lubricate with oil before installing

3 - Final drive housing1)

4 - Shim S2

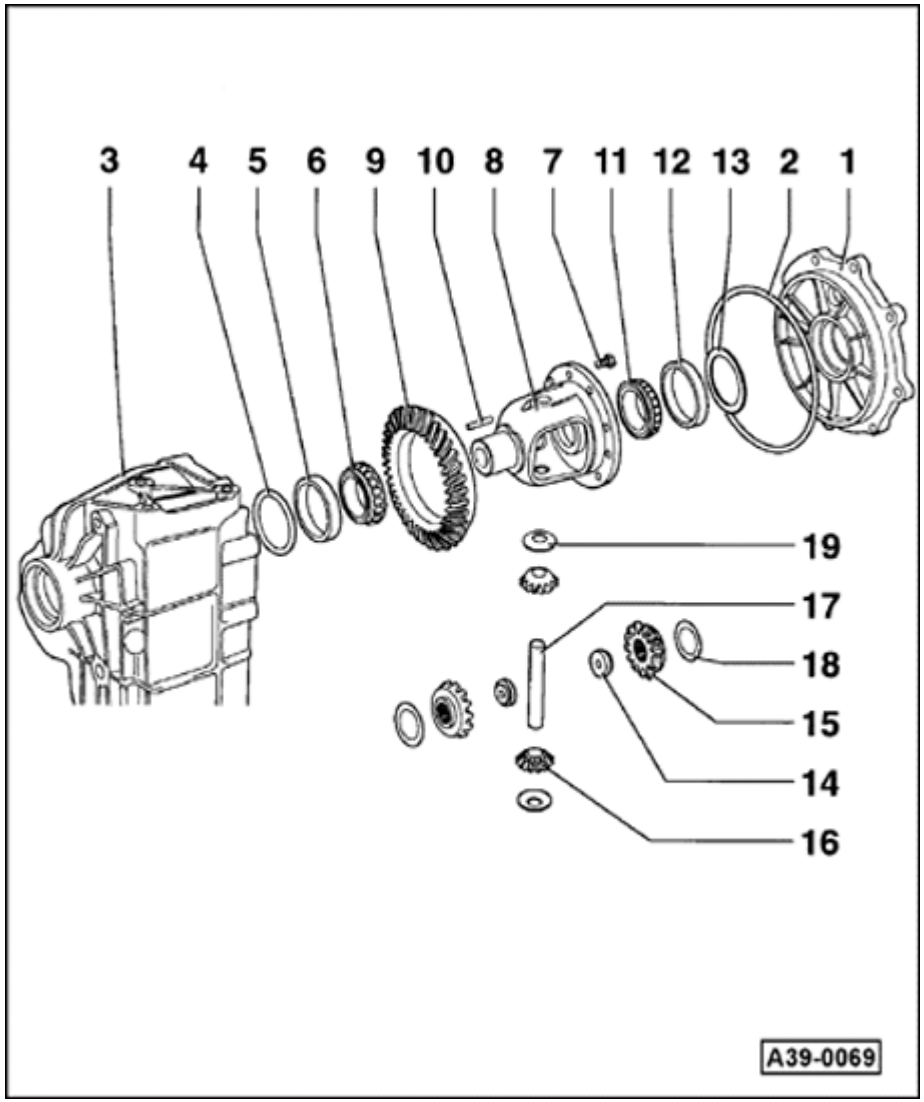
- Note thickness
- List of adjustments ⇒ Page 39-149

5 - Small tapered roller bearing outer race1)

- Removing ⇒ Fig. 1
- Pressing in ⇒ Fig. 2

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39-123



6 - Small tapered roller bearing inner race1)

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

7 - Bolt

- Always replace
- Lightly tighten bolts, then tighten diagonally to correct torque
- 60 Nm (44 ft lb) + 1/8 turn (45°)
- Allocation ⇒ parts catalog

8 - Differential housing1)

9 - Ring gear1)

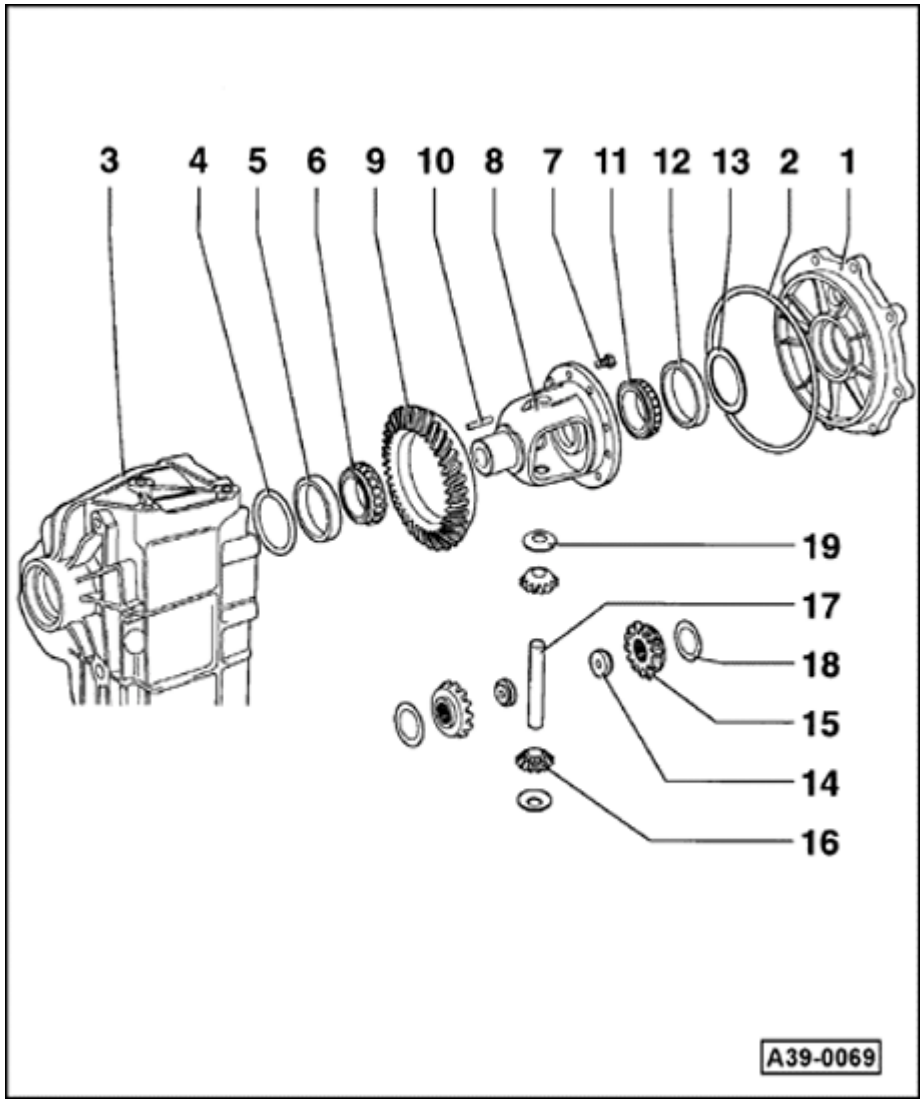
- Matched with pinion shaft (in ring gear and pinion set)
- Select correct version according to code letters ⇒ parts catalog
- Remove differential housing using mandrel ⇒ Fig. 9
- Installing on differential housing ⇒ Fig. 10

10 - Roll pin

- For securing differential bevel gear shaft for differential bevel gears
- Drive in flush

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39-124



11 - Large tapered roller bearing inner race1)

- Removing ⇒ Fig. 5
- Installing ⇒ Fig. 6

12 - Large tapered roller bearing outer race1)

- Removing ⇒ Fig. 7
- Installing ⇒ Fig. 8

13 - Shim S1

- Note thickness
- List of adjustments ⇒ Page 39-149

14 - Threaded piece

15 - Differential bevel gears, large

- Installing ⇒ Fig. 11
- Adjusting ⇒ Fig. 12

16 - Differential bevel gears, small

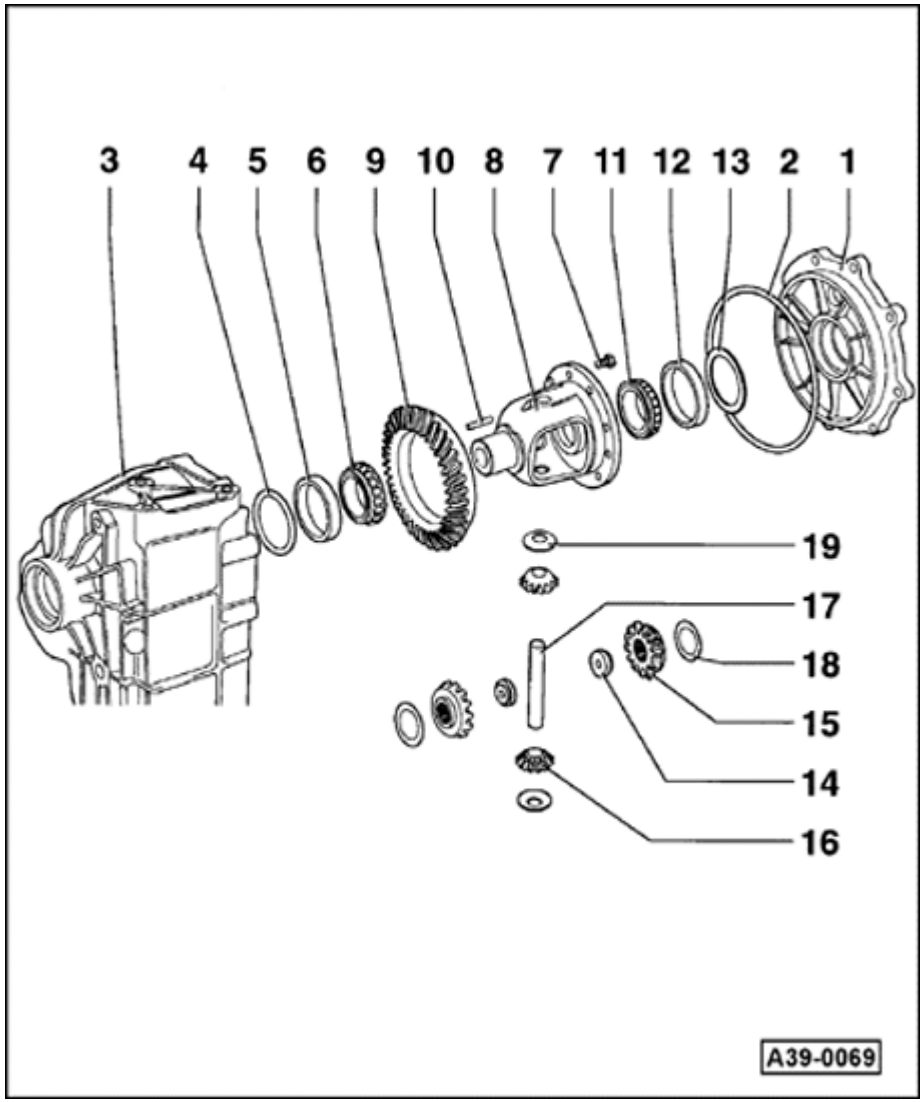
- Installing ⇒ Fig. 11

17 - Differential bevel gear shaft

- Drive out using drift
- Carefully drive in, so that thrust washer is not damaged
- Secure with roll pin (item -10-)

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39-125



18 - Shim

- Re-determining thickness ⇒ Fig. 12

19 - Thrust washer

- Check for cracks

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39-126

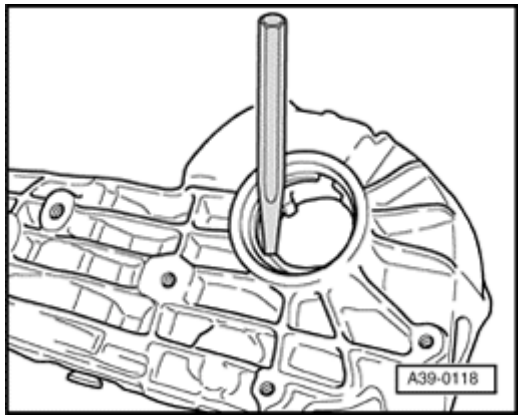


Fig. 1 Removing small tapered roller bearing outer race from final drive housing

- After removing, check shims for damage.

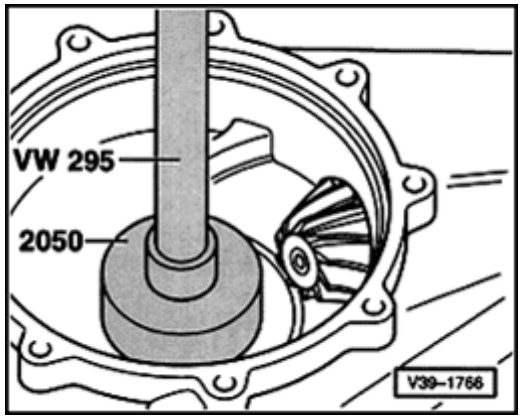


Fig. 2 Pressing small tapered roller bearing outer race into rear final drive housing (drive in to stop)

- Using VW295 needle bearing drift, lightly tap outer race into place.
- Drive in until stop is reached as shown in illustration.

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39-127

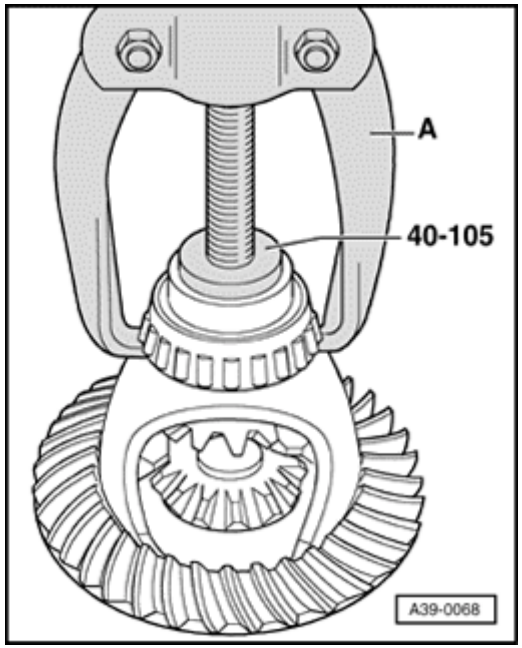


Fig. 3 Removing small tapered roller bearing inner race

A - Two arm puller, e.g. Kukko 44/2

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39-128

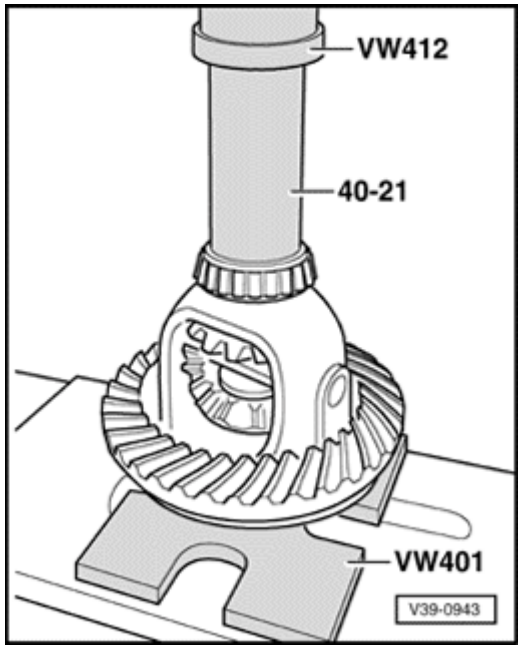


Fig. 4 Installing small tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

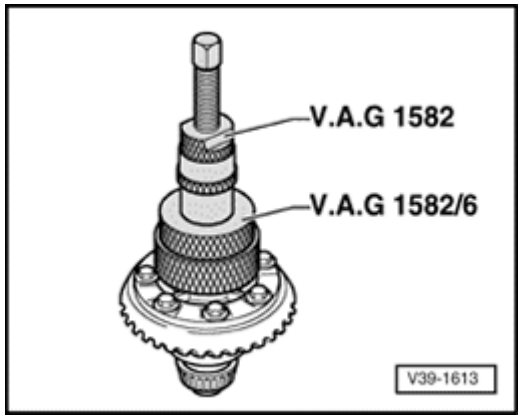


Fig. 5 Removing large tapered roller bearing inner race

- Before installing extractor, position 40-105 thrust piece on differential housing.

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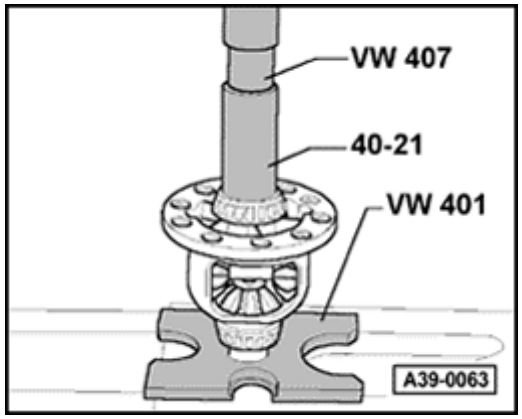


Fig. 6 Installing large tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

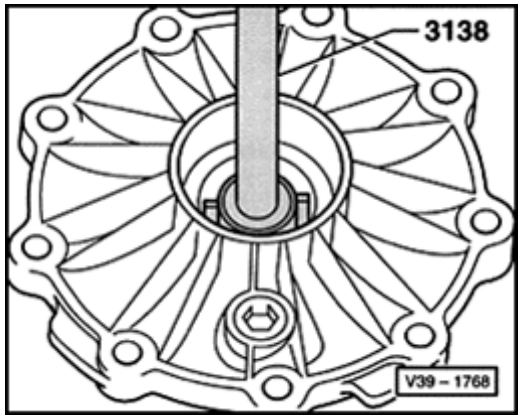


Fig. 7 Removing large tapered roller bearing outer race from final drive cover

- After removing, check shims for damage.

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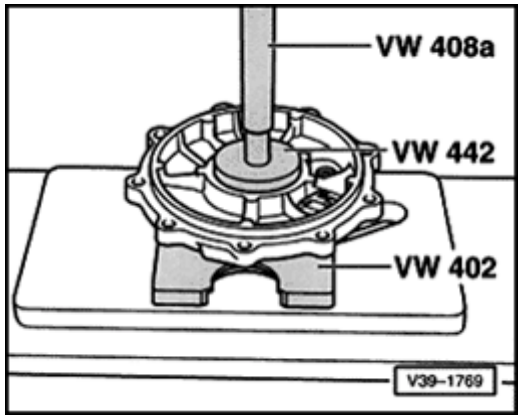


Fig. 8 Installing large tapered roller bearing outer race into final drive cover

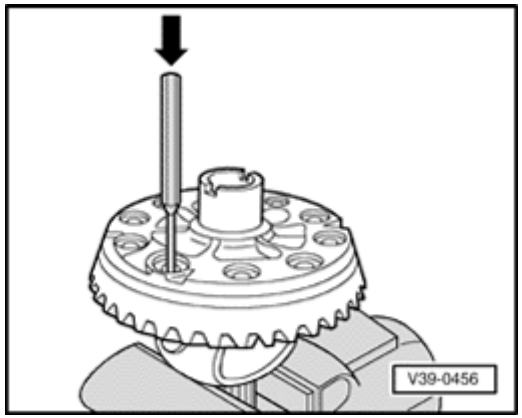


Fig. 9 Removing ring gear from differential housing

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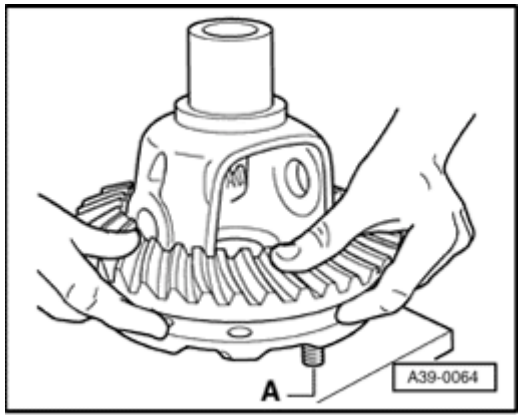


Fig. 10 Installing ring gear

- Use 2 centering pins -A- (locally available) as guides.

WARNING!

Wear protective gloves.

- Heat ring gear to approx. 100 ° C (212 ° F) and install.

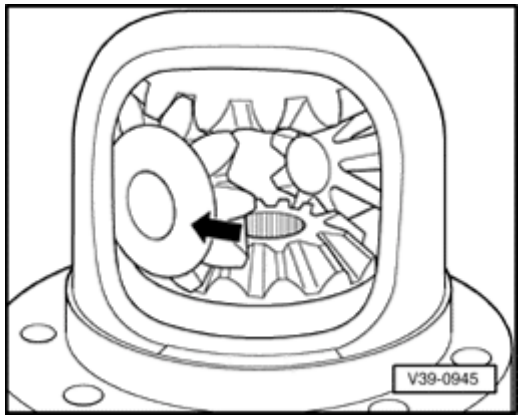


Fig. 11 Installing differential bevel gears

- If large differential bevel gears have been replaced, measure and select new shims ⇒ Fig. 12 .
- Insert large differential bevel gears with measured shims.
- Install small differential bevel gears (turned 180 °) from their final position, and rotate into place (arrow).
- Install and align thrust washers.
- Insert threaded pieces.
- Drive differential gear shaft for bevel gears in to stop and secure with roll pin.

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39-132

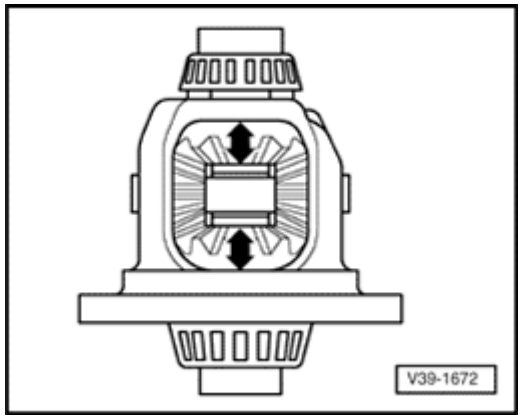


Fig. 12 Adjusting differential bevel gears

- Insert large differential bevel gears with thinnest shims (0.5 mm).
- Insert small differential bevel gears (turned 180°) together with thrust washers.

Note:

From this point on, do not interchange differential bevel gears and their respective thrust washers.

- Drive in differential bevelgear shaft.
- Press small differential bevel gears outward.
- Press large differential bevel gears in direction indicated (arrows), and check play.
- Determine thickest shims for large differential bevel gears (on each side) which still just fits.
- Shims for both sides should be of equal thickness.
- Identify shims according to table. Part numbers ⇒ parts catalog

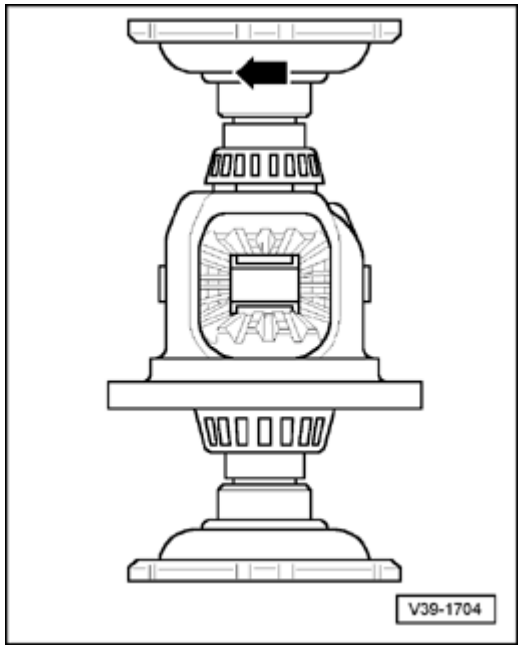
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The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

Note:

The adjustment is also correct if no further play is perceptible, as long as the differential bevel gears can still be turned (arrow).



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Pinion shaft, removing, installing and servicing

Special tools and equipment

- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 thrust disc
- VW457 support channels
- VW460/2 mandrel
- VW519 sleeve
- VW540 engine/transmission support
- 30-205 thrust pad

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- 2003/3 seal installer
- 2052/2 assembly tool for pinion shaft
- 3005 thrust pad

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39-135

- 3062 thrust pad
- 3138 drift
- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 bracket
- VAG1383A engine/transmission support
- VAG1359/2 universal mount
- Kukko 17/2 separating tool
- Kukko 21/7 extractor
- Kukko 22/2 support
- Torque gauge 0-600 Ncm (0-53 in. lb)
- 32 mm socket

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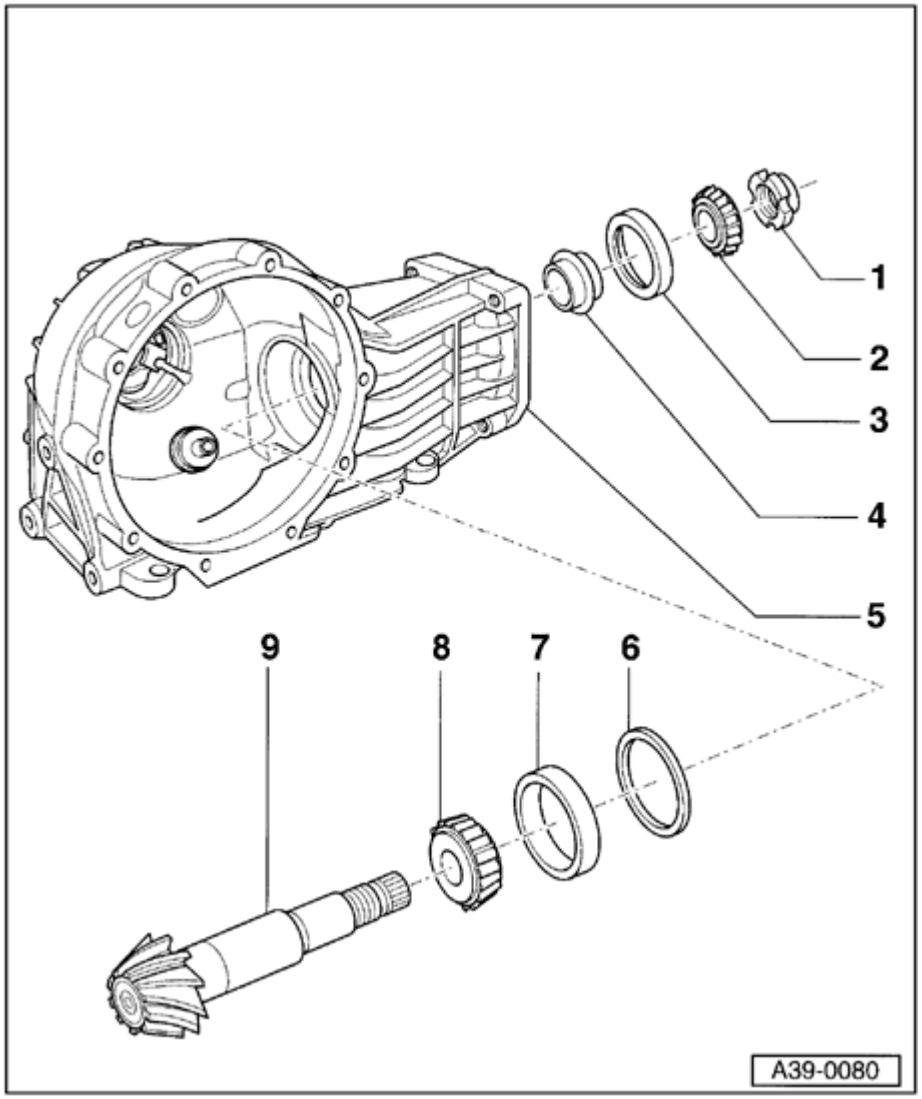
39-136

Notes:

- *Observe general repair instructions ⇒ Page 00-14 .*
- *With the final drive installed, remove the drive flange housing from the rear final drive ⇒ Page 39-86 .*
- *With the final drive removed, remove the drive flange housing from the rear final drive ⇒ Page 39-119 .*
- *Always replace both tapered roller bearings together as a set. If possible, use same manufacturer.*
- *Do not oil new tapered roller bearings for the friction torque measurement. The bearings are already factory treated with a special oil.*
- *Remove differential ⇒ Page 39-114 .*
- *Adjustments are required when replacing components marked with "1)" ⇒ List of adjustments, ⇒ Page 39-149 .*

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39-137



1 - Pinion shaft nut

- Always replace
- Removing ⇒ Figs. 1 and ⇒ 2
- Installing ⇒ Fig. 1
- Measuring friction torque ⇒ Fig. 12
- Securing ⇒ Fig. 13

2 - Small tapered roller bearing inner race1)

- Removing pinion shaft ⇒ Fig. 3
- Installing ⇒ Fig. 10

3 - Small tapered roller bearing outer race1)

- Removing ⇒ Fig. 4
- Installing ⇒ Fig. 9

4 - Spacer sleeve1)

- Always replace

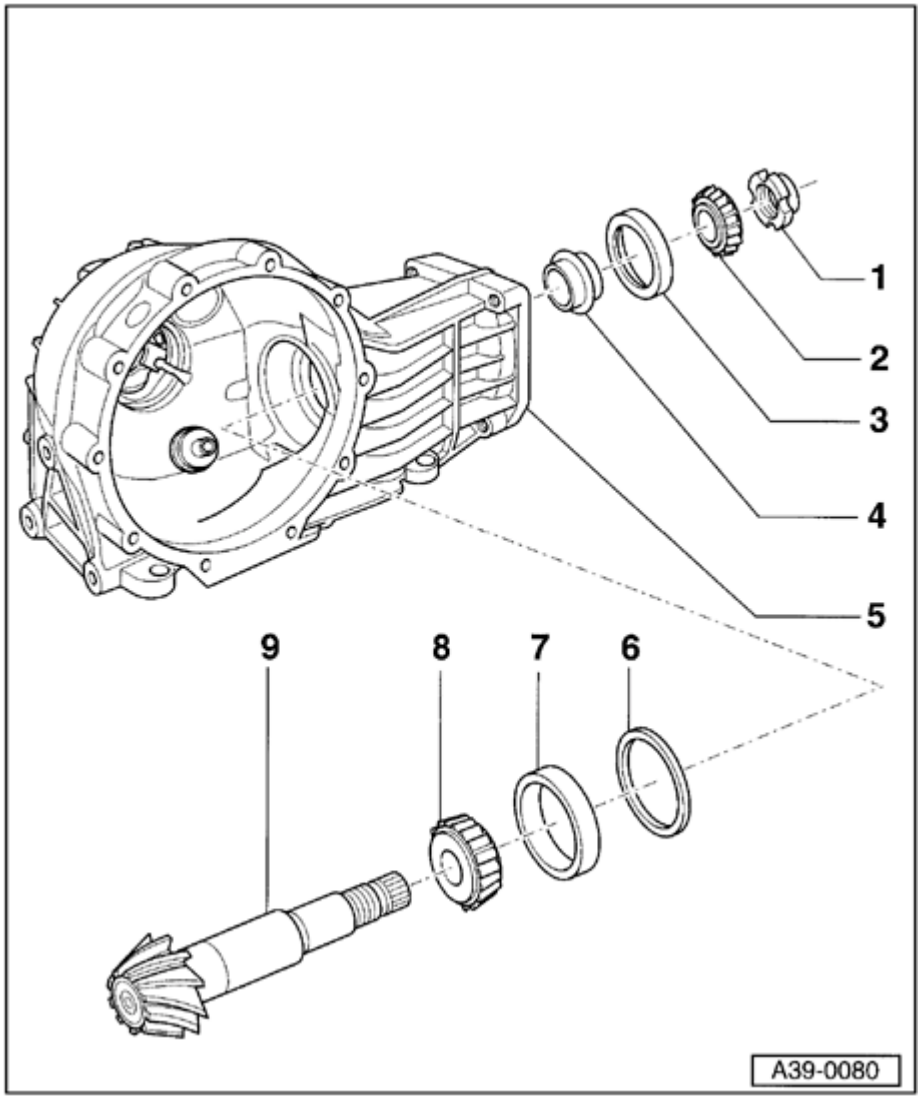
5 - Final drive housing1)

6 - Shim S3

- Note thickness
- List of adjustments ⇒ Page 39-149

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39-138



7 - Large tapered roller bearing outer race1)

- Removing ⇒ Fig. 5
- Installing ⇒ Fig. 8

8 - Large tapered roller bearing inner race1)

- Removing ⇒ Fig. 6
- Installing ⇒ Fig. 7

9 - Pinion shaft1)

- Is matched with ring gear, always replace as a set

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39-139

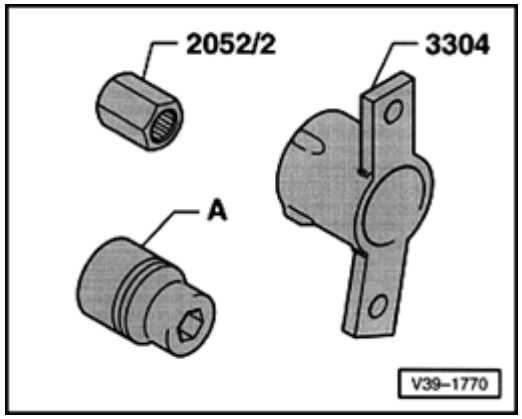


Fig. 1 Tool to loosen and tighten pinion shaft nut

A- 32 mm socket

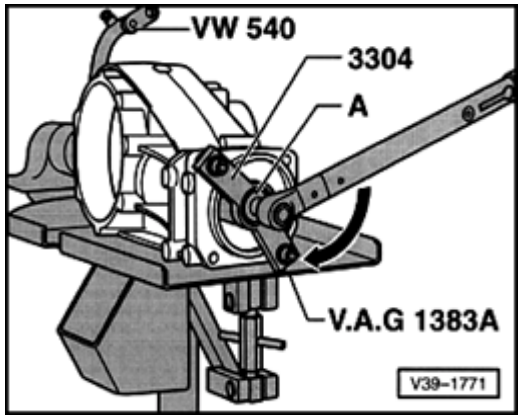


Fig. 2 Removing pinion shaft nut

- Screw 3304 bracket on using two M8 x 30 hex-head bolts.
- Final drive must be supported when loosening nut (e.g. using VAG1359/2 universal transmission attachment in combination with VAG1383A transmission jack).

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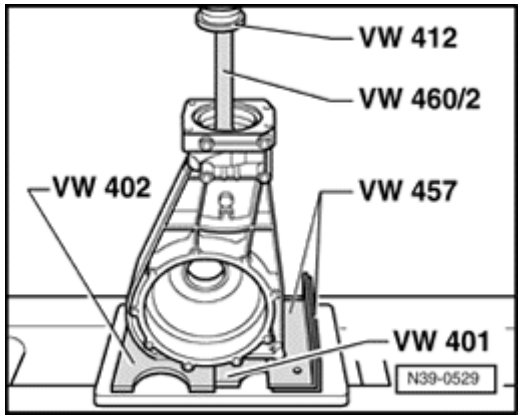


Fig. 3 Removing pinion shaft from small tapered roller bearing inner race

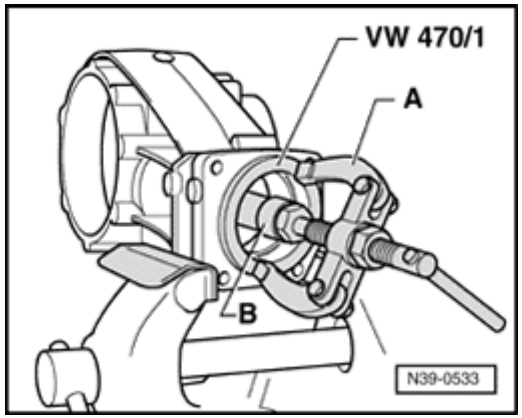


Fig. 4 Removing small tapered roller bearing outer race

A - Counter support e.g. Kukko 22/2

B - Internal puller 46-58 mm, e.g. Kukko 21/7

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39-141

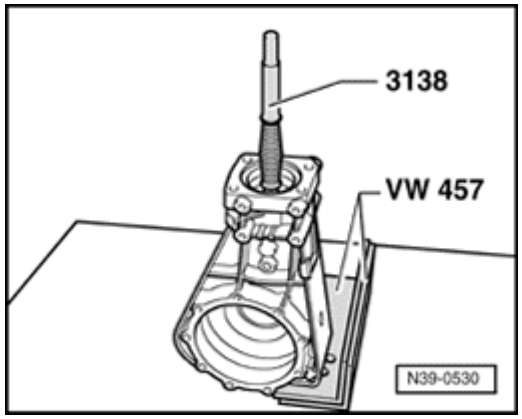


Fig. 5 Removing large tapered roller bearing outer race

- After removing, check shims for damage.

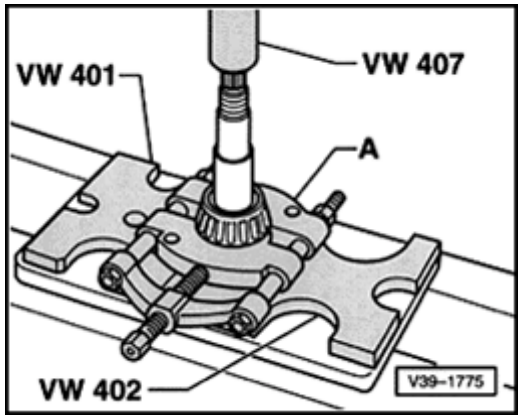


Fig. 6 Removing large tapered roller bearing inner race from pinion shaft

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

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39-142

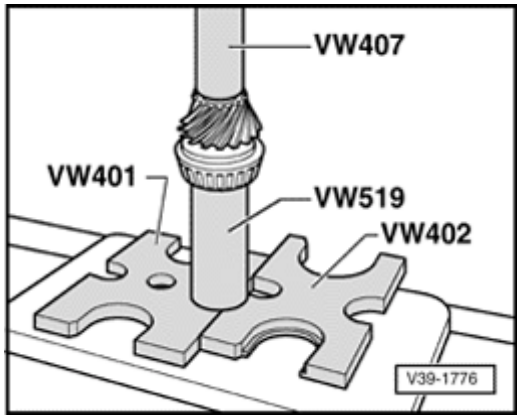


Fig. 7 Installing large tapered roller bearing inner race onto pinion shaft

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

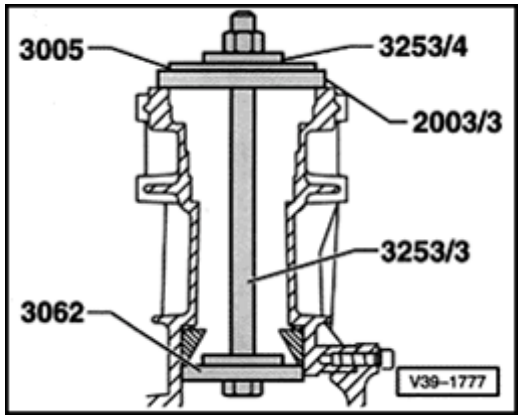


Fig. 8 Installing large tapered roller bearing inner race onto pinion shaft

- First insert predetermined shim S3 for pinion shaft ⇒ Page 39-149 .

Note:

The marking "Oben" on 3253/4 thrust piece faces the nut of the puller.

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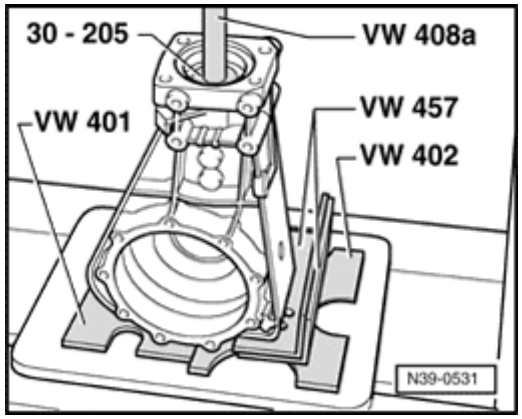


Fig. 9 Installing small tapered roller bearing outer race

- Oil outer race, and position using VW408A punch and 30-205 thrust pad.

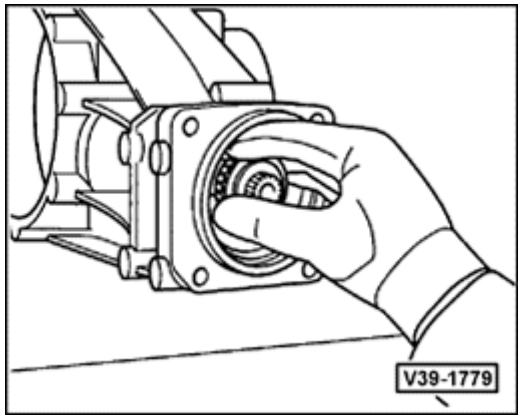


Fig. 10 Installing small tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Insert pinion shaft with new spacer sleeve.
- Heat small tapered roller bearing inner race to approx. 100 ° C (212 ° F) and install onto pinion shaft.
- Lift up pinion shaft and press bearing using 40-21 sleeve up to stop.

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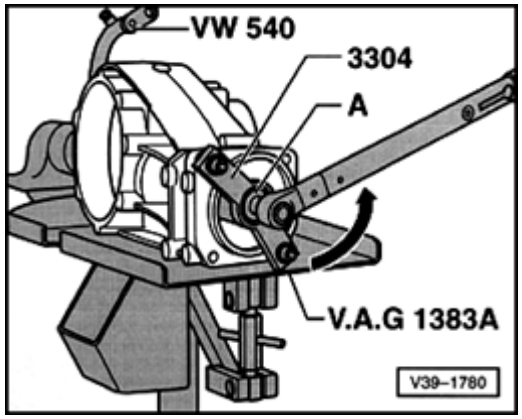


Fig. 11 Tightening nut for pinion shaft and measuring friction torque

- Attach 3304 using two M8 x 30 hex-head bolts.
- Final drive must be supported when tightening nut (e.g. using VAG1359/2 universal transmission attachment in combination with VAG1383A transmission jack).
- Replace nut for pinion shaft.
- Tighten nut for pinion shaft, until no more play can be felt on pinion shaft.
- Increase tightening torque until specified friction torque is attained, measuring friction torque several times during this process ⇒ Fig. 12 .

Note:

If the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.

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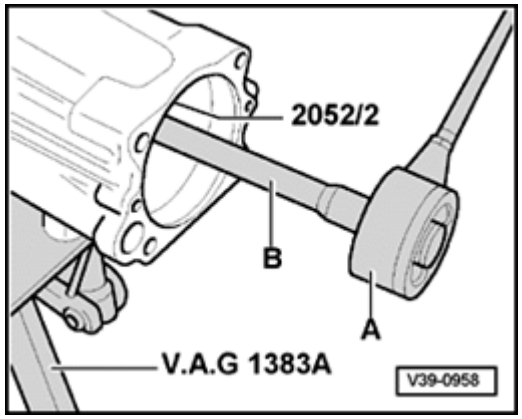


Fig. 12 Measuring friction torque

A - Torque gauge, 0-600 Ncm (53 in. lb) (commercially available)

B - Socket attachment, 32 mm

- Following friction torque should be set:

New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

1) Must have run at least 50 km (30 miles)

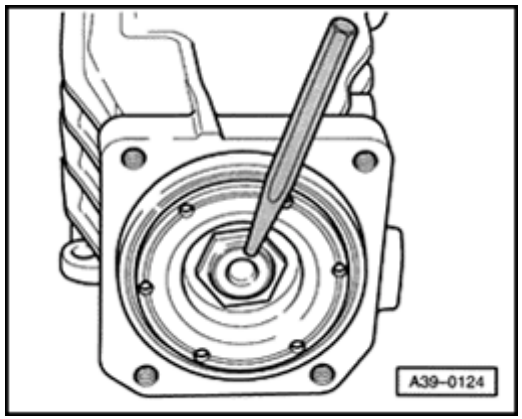


Fig. 13 Securing pinion shaft nut

- Secure pinion shaft nut using mandrel.

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39-146

Pinion shaft and ring gear, adjusting

Notes:

- *Careful adjustment of the pinion shaft and ring gear is important for the service life and smooth running of the final drive. For this reason, the pinion shaft and 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 attained 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 objective of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine during production.*

- *The deviation, or tolerance "r", which is related to the master gauge-adjustable "Ro" 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) may only be replaced together as a matched pair.*

- *Observe general repair instructions for tapered*

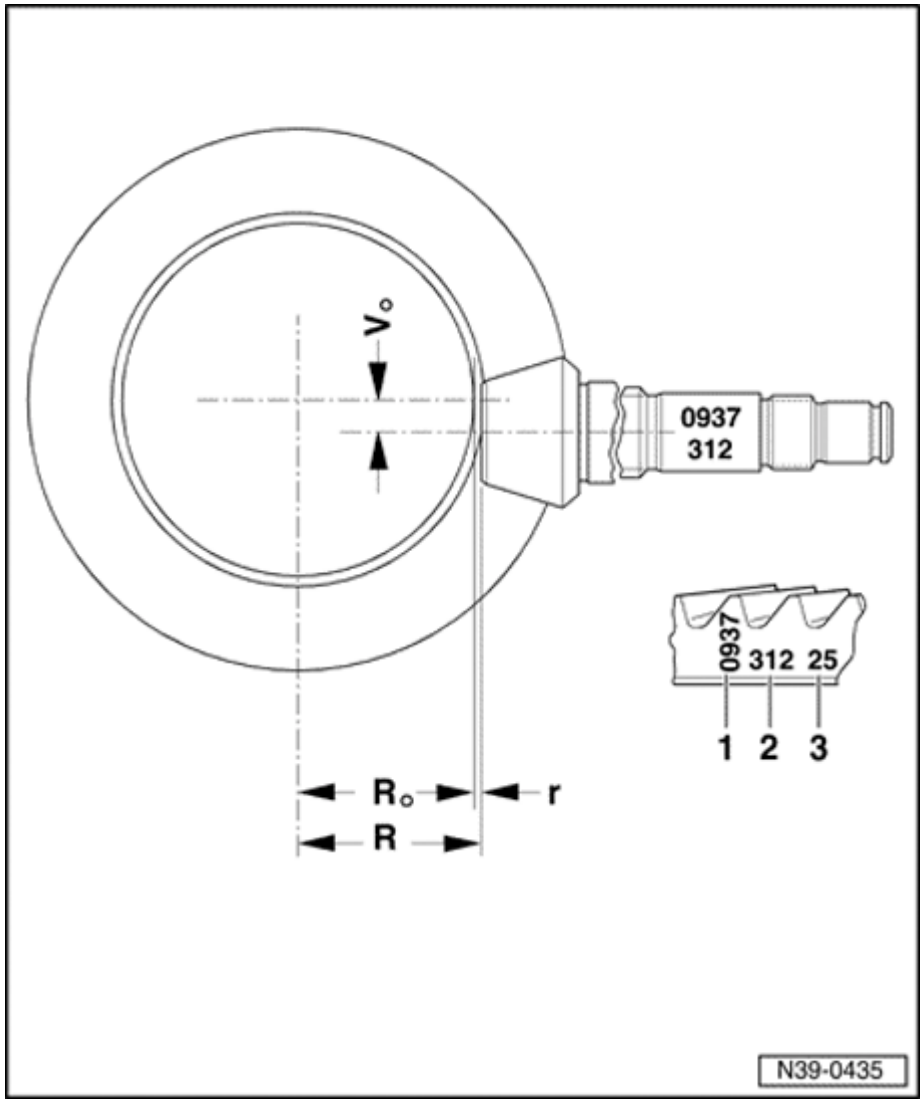
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roller bearings and shims.

- *Maximum care and cleanliness are essential for achieving good results during repairs and taking measurements.*

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39-147



Adjustment and marking of gear sets

1 - Identification "0937" signifies an Oerlikon gear set with a ratio of 37:9

2 - Gear set pairing number (312)

3 - Deviation (tolerance) "r" is based on the test machine master gauge-adjustable used during production. Deviation "r" is always given in 1/100 mm. Example: 25 signifies "r" = 0.25 mm

Ro - Length of master gauge-adjustable used on test machine "Ro"

Ro - Ring gear = 57.50 mm (2.263 in.)

R - Actual dimension between center axis of ring gear and face of pinion shaft at point with quietest running for this gear set. R = Ro + r

Vo - Hypoid offset

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Final drive gear set, recommended sequence for adjusting

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

1.) Determine total shim thickness Stotal for S1 + S2 for the specified tension of the tapered roller bearing for differential.

2.) Determine total shim thickness S3, so that pinion shaft obtains the specified installed position determined by the test machine in production.

3.) Split up total shim thickness Stotal for S1 + S2, so that the specified torsional backlash exists between ring gear and pinion shaft.

Note:

Overview of components and shims ⇒ *Page 39-149* .

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39-149

List of adjustments

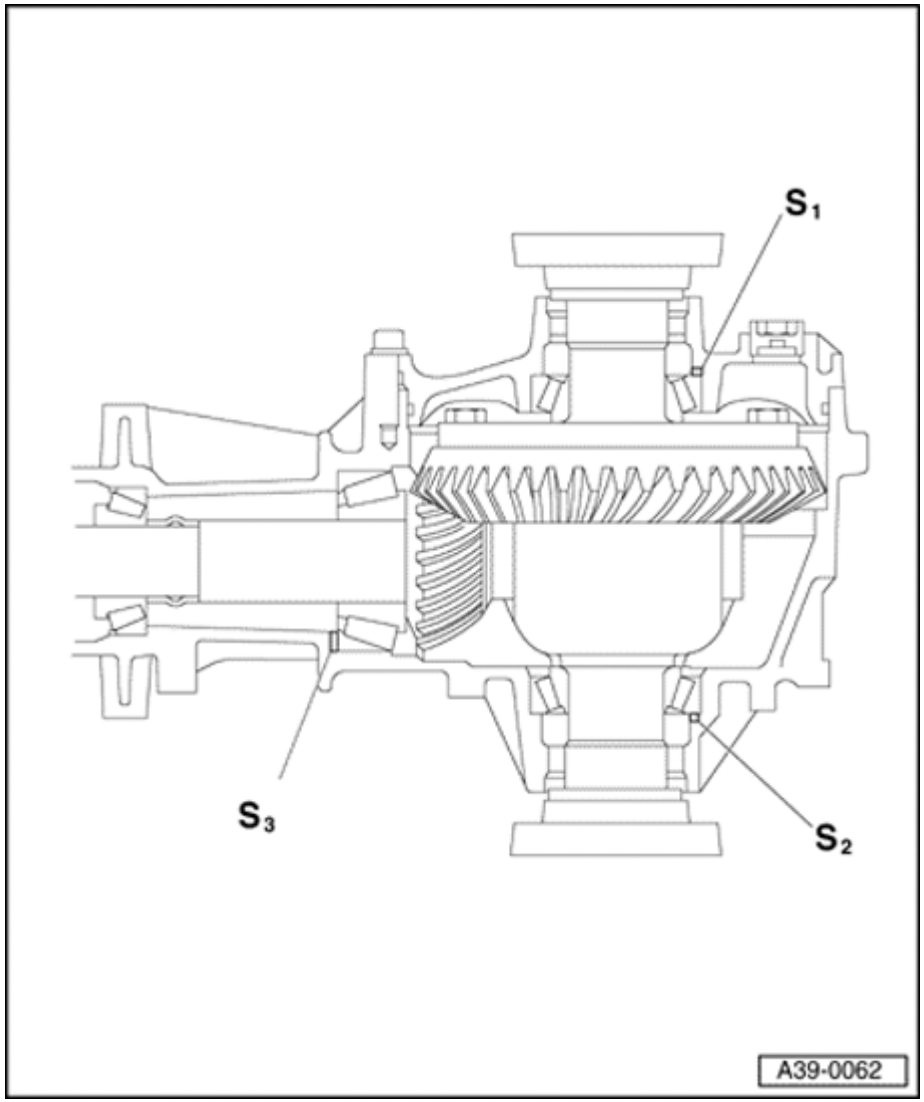
Note:

If repairs have been carried out on the final drive, it is only necessary to adjust the pinion shaft or final drive set if components which have a direct effect on the adjustment of the final drive have been replaced. Observe the following table to avoid unnecessary adjustments:

Component to be adjusted: **Component being replaced:**	Ring gear (S1 + S2)1) ⇒ Page 39-162	Pinion shaft (S3)1) via deviation "r" ⇒ Page 39-153	Backlash checking ⇒ Page 39-168
Final drive housing	X	X	X
Differential housing	X		X
Tapered roller bearing for pinion shaft		X	X
Tapered roller bearing for differential	X		X
Final drive gear set2)	X	X	X
Final drive cover	X		X
1) Shims, installation position ⇒ Page 39-150 .			
2) Pinion shaft and ring gear, only replace together.			

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39-150



Position of shims

Note:

List of adjustments when replacing individual components of final drive ⇒ *Page 39-149* .

S1 - Shim for ring gear in final drive cover

S2 - Shim for ring gear in final drive housing

S3 - Shim for pinion shaft in final drive housing

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39-151

Special tools and equipment

- VW382/10 extension pin
- VW385/1 universal mandrel
- VW385/2 centering disc
- VW385/3 centering disc
- VW385/14 measuring rod
- VW385/15 extension pin
- VW385/17 measuring plate
- VW385/30 master gauge-adjustable
- VW385/33 end dimension plate
- VW387 dial indicator holder
- VW388 measuring lever
- VW401 thrust plate

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- VW402 thrust plate
- VW408A punch
- VW457 support channels

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39-152

- VW521/4 adjustment for ring gear
- VW521/8 adjustment for ring gear
- VW540 engine and transmission support
- 30-205 thrust pad
- 2003/3 mounting ring
- 2052/2 assembly tool for pinion shaft
- 3005 thrust pad
- 3028 retainer
- 3062 thrust pad
- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 bracket
- VAG1383A engine/transmission

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- VAG1359/2 universal mount
- Dial indicator extension 30 mm
- Dial indicator
- Torque gauge 0-600 Ncm (53 in. lb)

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39-153

Pinion shaft, adjusting

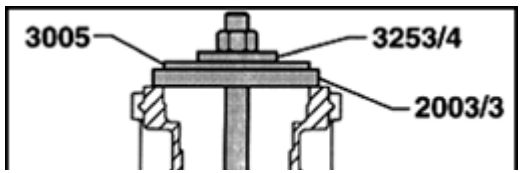
Notes:

- *Adjust the ring gear before adjusting the pinion shaft (determine total shim thickness Stotal for shims S1 + S2)* ⇒ *Page 39-162* .
- *The pinion shaft only has to be readjusted if the final drive gear set (pinion shaft and ring gear), tapered roller bearings for pinion shaft or the final drive housing are replaced. List of adjustments* ⇒ *Page 39-149* .
- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determine thickness of shim "S3"

Setting preload of tapered roller bearing for pinion shaft

- Mount rear final drive to repair stand ⇒ Page 39-110 .



- Install large tapered roller bearing outer race into housing without shim.

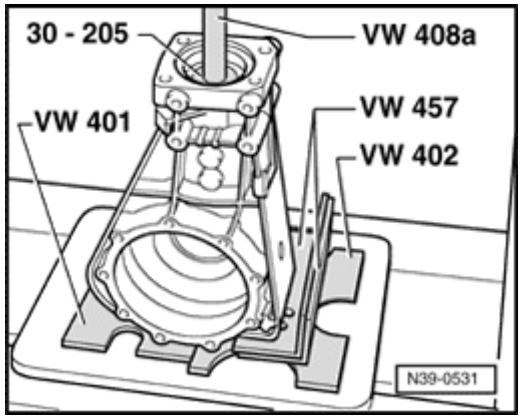
Note:

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The marking "Oben" on 3253/4 thrust piece faces the nut of the puller.

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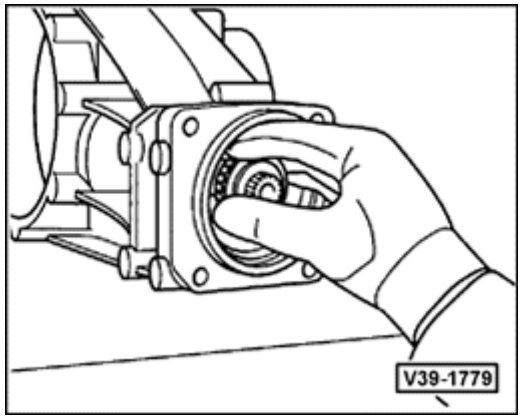
39-154



- Install small tapered roller bearing outer race into housing.
- Lubricate outer race with oil and install using VW408A punch and 30-205 thrust pad.
- Insert pinion shaft without spacer sleeve.

WARNING!

Wear protective gloves.

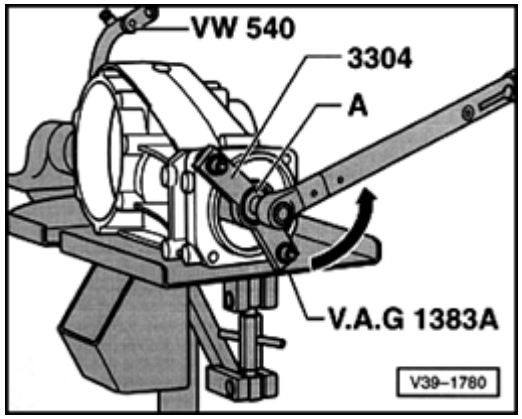


- Heat tapered roller bearing inner race to approx. 100 ° C (212 ° F) and install onto pinion shaft.

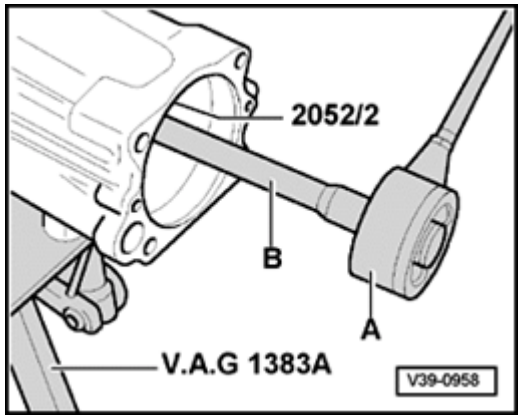
Notes:

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *Install spacer sleeve only for final friction torque measurement (after determining shim S3).*

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- Bolt on 3304 bracket with two hex-head bolts M8 x 30.
- Differential must be supported when tightening nut (e.g. using VAG1359/2 universal mount and transmission hoist VAG1383A).
- Replace pinion shaft nut.
- Tighten pinion shaft nut, until no play can be felt on pinion shaft.
- Increase tightening torque until specified friction torque is attained, measuring friction torque several times during this process.



A - Torque gauge, 0-600 Ncm (commercially available)

B - Socket extension, 36 mm

- Adjust friction torque as follows:

New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

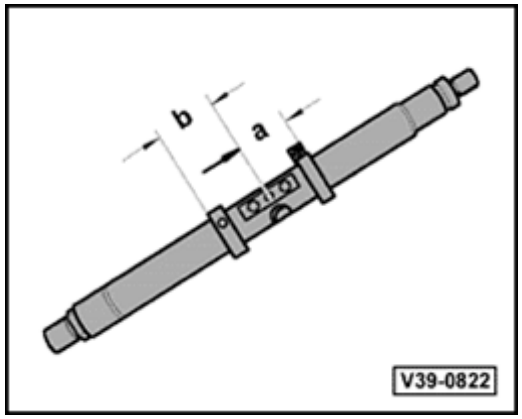
1) Must have run at least 50 km (30 miles)

Note:

If the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.

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39-156

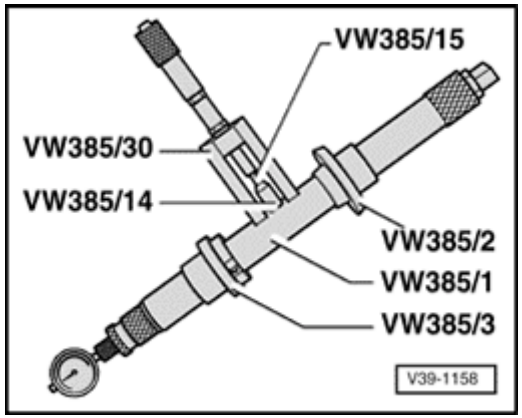


- Set adjustment ring of VW385/1 universal mandrel.

Dimension -a-: 60 mm (2.36 in.)

- Set sliding adjustment ring.

Dimension b: 55 mm (2.16 in.)



- Assemble universal mandrel as illustrated:

VW385/15 dial indicator extension = 9 mm long

- Set VW 385/30 master gauge-adjustable.

Ro = 57.50 mm (2.266 in.)

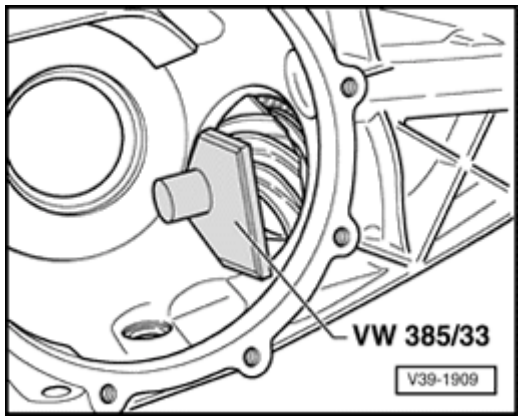
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.

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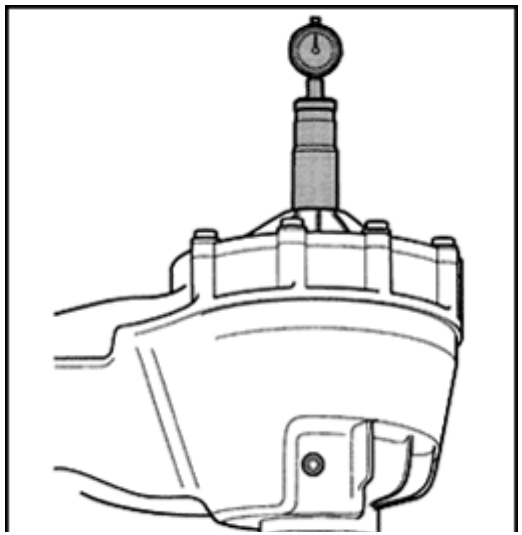
39-157

Note:

Before carrying out following measurements turn pinion shaft at least five turns in both directions, so that the tapered roller bearings settle. Otherwise a false reading will be obtained.



- Place VW 385/33 end dimension plate onto pinion shaft head.



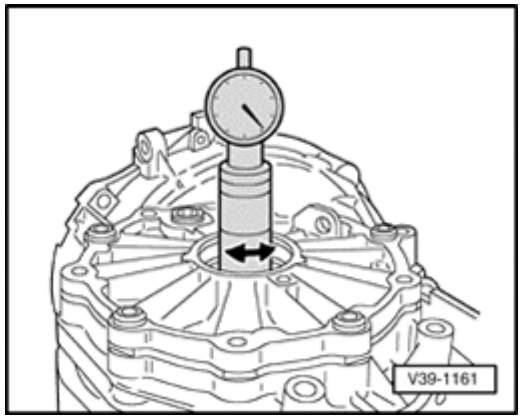
- Remove master gauge-adjustable and insert measuring mandrel in housing.

  385/3 centering disc faces final drive cover

- Install final drive cover and tighten 4 bolts.
- By turning adjustable ring, move 2nd centering disc out until mandrel can still just be turned by hand.

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39-158



Determining measurement "e"

- Turn mandrel until dial indicator point touches end measuring plate on pinion shaft head, then measure maximum runout (return point). Measured value is dimension"e"(red scale).

Measurement in following example: e = 1.60 mm

Note:

Dimension "e" is required to determine thickness of shim S3.

- After removing universal mandrel, and with VW385/30 master gauge-adjustable in place, check once again whether dial indicator reads "0" with 2 mm preload, otherwise repeat measurement.

Determining shim thickness "S3"

Formula:

S3 = e - r

e = Measured value

r = Deviation (tolerance): marked on ring gear in 1/100 mm

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Example:

	Measured value e	1.60 mm
-	Deviation r	0.42 mm
=	Thickness of shim S3	1.18 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S3"

Shim thickness (mm)1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	

1) By using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

- Remove universal mandrel.

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- Remove pinion shaft and large tapered roller bearing outer race and install together with measured shims S3 and spacer sleeve ⇒ Page 39-139 .

- Install small tapered roller bearing inner race and tighten nut for pinion shaft until specified friction torque is obtained ⇒ Page 39-144, Fig. 11 .

Notes:

- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- *Increase tightening torque gradually and check friction torque at regular intervals, if the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.*

- Adjust to following friction torques:

New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

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[1)] Must have run at least 50 km (30 miles)

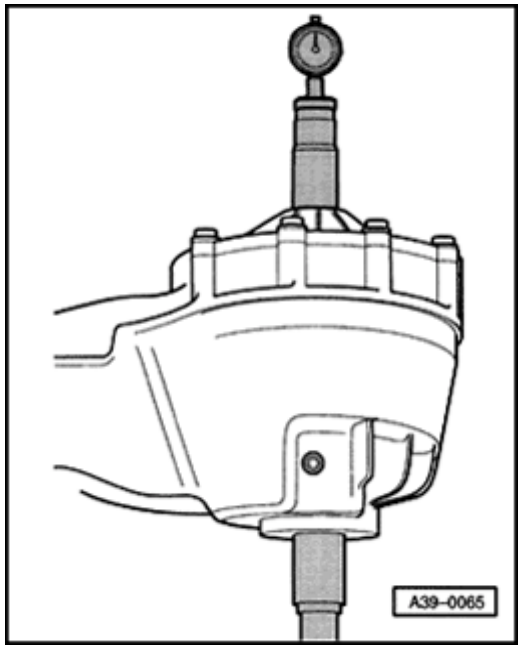
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39-161

Checking measurements

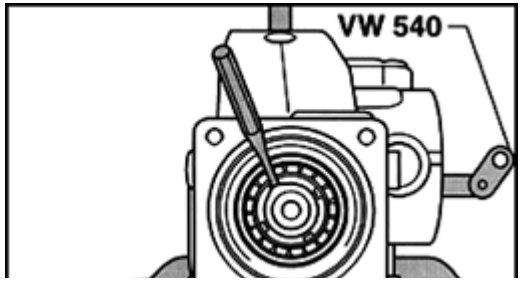
Checking dimension "r"

- Turn pinion shaft at least 5 turns in both directions.



- Insert universal mandrel and carry out check measurement.

If the shims have been correctly selected, the dial indicator should now display the value of "r" as marked on the ring gear, reading counterclockwise (red scale), within a tolerance of ± 0.04 mm.



- Secure pinion shaft nut using mandrel.

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Ring gear, adjusting

Adjusting differential

The ring gear must be adjusted if any of the components have been replaced ⇒ table, ⇒ Page 39-149 .

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determining total shim thickness "Stotal" for shims S1 + S2

(Setting preload of tapered roller bearing for differential)

- Pinion shaft removed or ring gear removed from differential housing.

- Pry out drive flange seal using pry bar.

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- Remove differential tapered roller bearing outer races and remove shims ⇒ Page 39-121 .

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- Press left tapered roller bearing outer race for differential (housing side) with shim S2 into housing ⇒ Page 39-126, Fig. 2 . To perform the measurement use shim S2* with thickness of 1.00 mm (one 0.80 mm shim and one 0.20 mm shim).

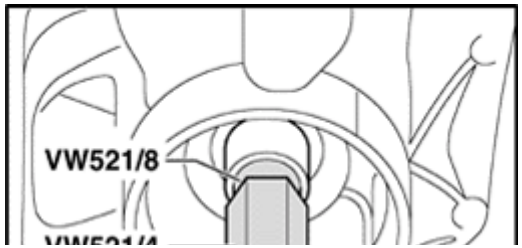
Note:

For measurement specification, a shim S2 of 1.0 mm thickness is initially inserted which will be designated S2 in the following. After determining the backlash S2* will be replaced by the correct shim S2.*

- Press in right tapered roller bearing outer race for differential (final drive cover side) without shims, until stop ⇒ Fig. 8, Page 39-130 .

- Insert differential into housing. Ring gear is positioned on right side (cover side).

- Install final drive cover and tighten bolts to 25 Nm (18 ft lb).

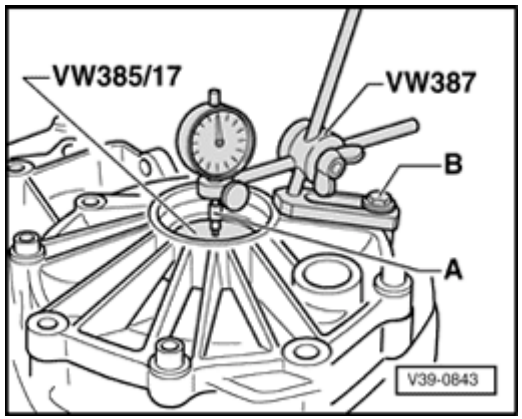


- Install special tools VW521/4 locking sleeve and 521/8 bushing on housing side into differential housing.
- Turn final drive housing so final drive cover faces upward.

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- Turn differential 5 turns in both directions to settle tapered roller bearing.

- Place VW385/17 magnetic plate onto differential.

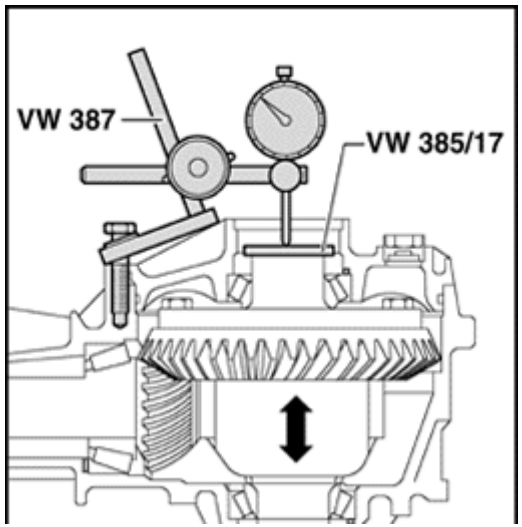


- Install measuring tools.

A - Dial indicator extension approx. 30 mm long

B - Hex-head bolt M8 x 45

- Place dial indicator extension on center of VW385/17 magnetic plate.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.



- Lift up differential without turning; read off play on dial indicator and note.

  Measurement in following example: 0.50 mm

Note:

If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the tapered roller bearing.

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Formula:

Stotal = S2* + measurement + bearing preload

Example:

	Inserted shim(s) S2*	1.00 mm
+	Measured value	0.50 mm
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness Stotal for shims S1 + S2	1.80 mm

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39-166

Determining thickness of shim "S1*"

Notes:

- *The preliminary shim S1* will be replaced with the final shim S1 after determining the backlash.*
- *The total shim thickness Stotal remains unchanged.*

Formula:

S1* = Stotal - S2*

Example:

	Total shim thickness Stotal for shims S1 + S2	1.80 mm
-	Inserted shim(s) S2*	1.00 mm
=	Thickness of shim S1*	0.80 mm

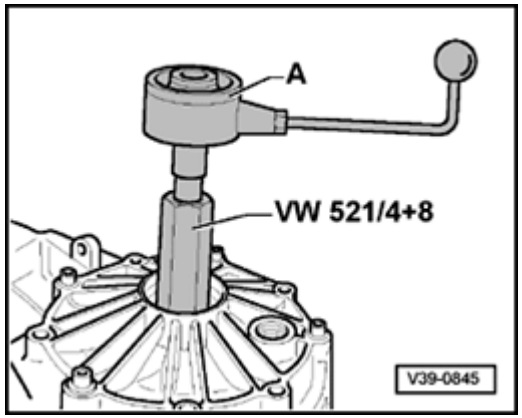
- Determine shim(s) according to table ⇒ Page 39-171 .

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39-167

Measuring friction torque

- Pinion shaft removed
- Differential with shims S1* and S2* installed



- Install torque gauge, 0-600 Ncm (53 in. lb)-A- onto differential.
- Read value of dial indicator.

Friction torque specifications:

New bearings	Used bearings1)
150-300 Ncm (13-27 in. lb)	30-60 Ncm (3-5 in. lb)
1) Must have run at least 50 km (30 miles)	

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*
- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *If the final drive gear set (pinion shaft and ring gear) is being re-adjusted, the adjustment of the pinion shaft should be checked* ⇒ *Page 39-153* *.*

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39-168

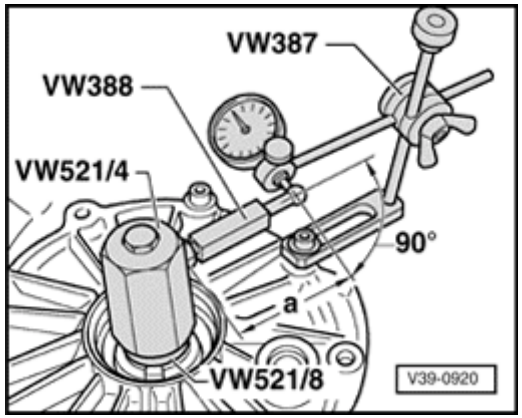
Adjusting backlash

Position of ring gear in final drive housing

- Pinion shaft with shim S3 installed
- Differential with shims S1* + S2* installed

- Insert differential into final drive housing, install final drive cover and tighten all bolts to 25 Nm (18 ft lb).

- Turn differential 5 turns in both directions to settle tapered roller bearings.



- Assemble measuring equipment.
- Use VW382/10 dial indicator extension (6 mm flat).
- Set VW388 measuring lever to dimension -a-

  Dimension -a-: 60 mm.
- Determine play between teeth flanks as follows:
  - Turn ring gear until it makes contact with tooth flank (end of backlash travel).
  - Set dial indicator to "0"with 1 mm preload.

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- Turn ring gear back until contact is made against opposite tooth flank (backlash).

- Read value of dial indicator and note.

- Turn ring gear 1/2-turn (90 °) each time and repeat measurements 3 times.

CAUTION!

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

Determining average backlash

Example:

	1st measurement	0.28 mm
+	2nd measurement	0.30 mm
+	3rd measurement	0.30 mm
+	4th measurement	0.28 mm
=	Sum of measured values	1.16 mm

- Result: the average backlash is 1.16 mm ÷ 4 = 0.29 mm

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Determining thickness of shim "S2"

Formula:

S2 = S2* - backlash + lift

Example:

	Inserted shim S2*	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim S2	0.86 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S2"

Shim thickness (mm)1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

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Determining thickness of shim "S1"

Formula:

-S1- = Stotal - S2

Example:

	Total shim thickness Stotal for S1 + S2	1.80 mm
-	Thickness of shim S2	0.86 mm
=	Thickness of shim S1	0.94 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog.

The following shims are available for "S1"

Shim thickness (mm)1)		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20
0.40	0.80	

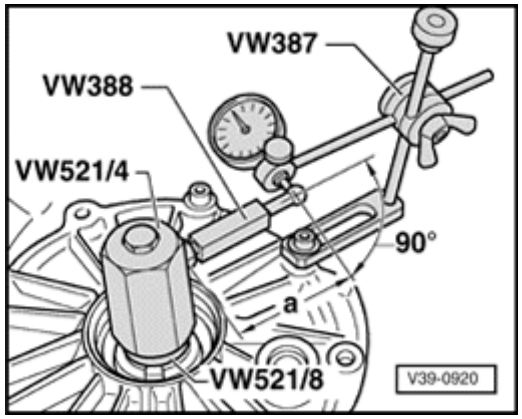
1) Using the shim tolerance variations it is possible to find the exact shim thickness required,

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insert two shims if necessary.

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39-172



Checking measurements

- Pinion shaft with shim S3 installed
- Differential with shims S1 + S2 installed

- Turn differential 5 turns in both directions to settle tapered roller bearings.
- Measure backlash four times on circumference.

  Specifications: 0.12-0.22 mm

Notes:

- *If the backlash lies outside the tolerance, the adjustment must be repeated, but the total shim thickness Stotal must remain unchanged.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

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