V.A.G Service.

Workshop Manual Volkswagen Transporter.

Four-wheel drive 5-speed manual gearbox 094 and final drive.

July 1986 Edition.

V·A·G

Service Department.

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Replaces advance information bulletin issued in March 1985.

The manual is divided into separate booklets which can be ordered individually and allocated on the shop floor as required.

This manual is valid for the new Volkswagen Transporter syncro from the start of production. It describes all the operations which require special instructions to ensure satisfactory work.

Layout of booklets

Each booklet has the contents listed according to repair operations and items to make it easier to find the information required.

The technical data is followed by a description of the repair operations. Where practical, each operation is preceded by an exploded view which also contains all the main repair instructions. This is supplemented, where necessary, by photographs – which are referred to in the exploded views – giving details of the fitting positions of parts or showing special tools in use. If a definite sequence has to be followed when dismantling and assembling a component, the exploded view is followed by a description of the main steps of the work sequence. Any adjustments required are also explained.

Workshop Bulletins

Workshop bulletins will be allocated to the individual booklets and should be filed at the back of the booklet concerned. To remind you that bulletins have been published, the manual pages should be marked by hand with the bulletin number as explained in the bulletin heading.

Fault finding

All fault finding instructions are given in the appropriate sections.

Instructions on the elimination of current defects are given in the "Fault finding handbook".

Technical information should always be made available to all foremen and mechanics because compliance with the instructions given is essential to ensure vehicle roadworthiness and safety. In addition, the normal safety precautions to be observed when working on motor vehicles are also applicable.

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TECHNICAL DATA

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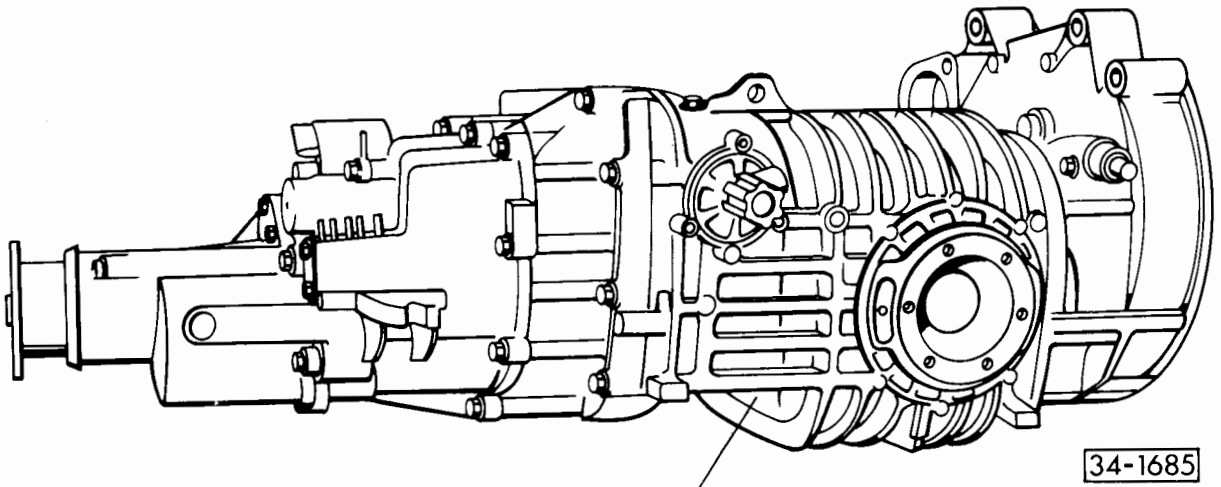
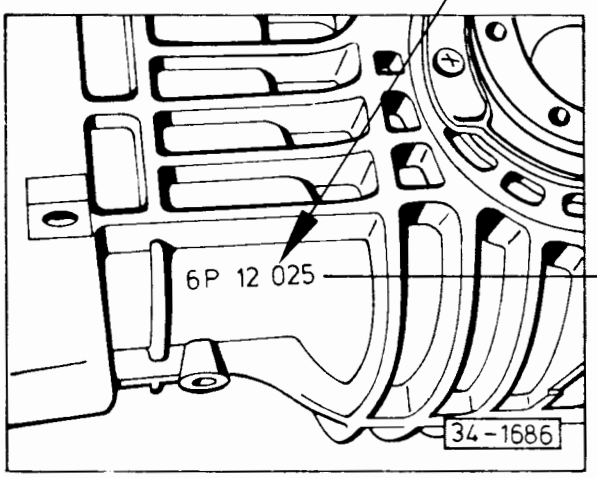
39 Final Drive, Differential

GEARBOX IDENTIFICATION



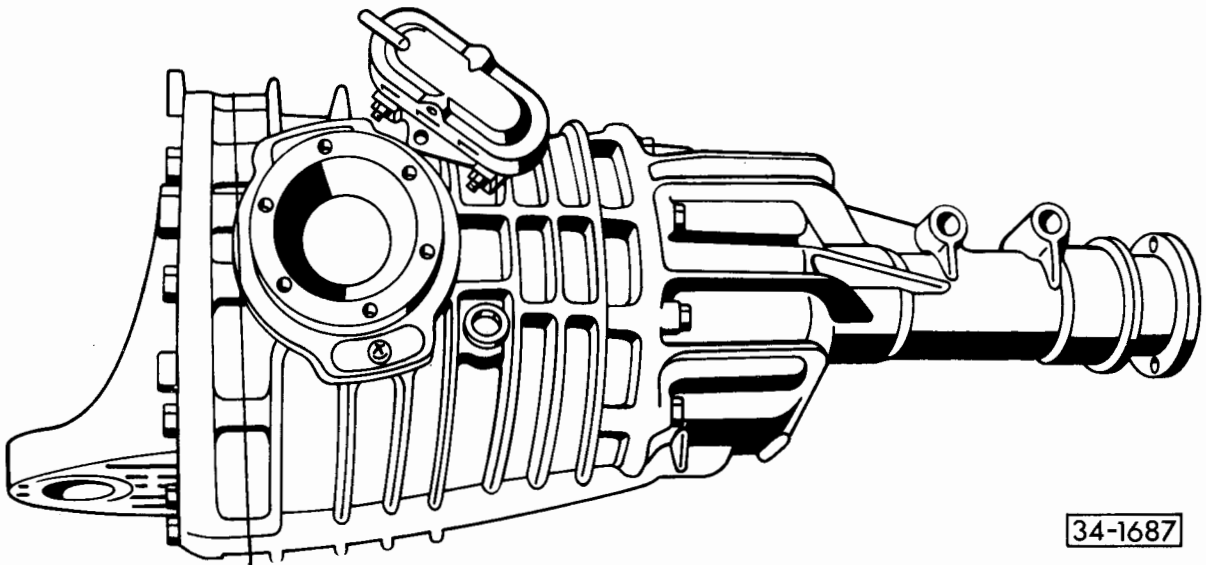


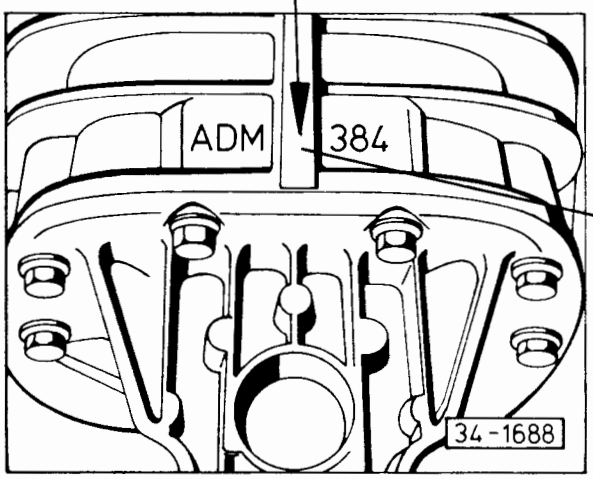
Gearbox code letters and date of manufacture:

Example: GP 12 02 5

- GP: Code letters
- 12: Day of manufacture
- 02: Month
- 5: Year (85)

FRONT FINAL DRIVE IDENTIFICATION





Front final drive code letters and date of manufacture

Example: ADM — Code letters; 384 — Manufacturer's consecutive no.

CODE LETTERS, GEARBOX ALLOCATION, RATIOS, OIL CAPACITIES

Manual gearbox permanent 4WD

Code letters		**6P**	**6PA**	**AAK**	**AAN**
Manufactured	from: to:	2.85	2.85	2.85	2.85
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro			
	Engine	1.9 l 57 kW, 2.1 l 70 kW, 2.1 l 82 kW			
	Front final drive	6 N	ADM*	ACU	ADH*, ACU
Ratios $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43		34 : 7 = 4.86	
	1st gear	34 : 9 = 3.78			
	2nd gear	33 : 16 = 2.06			
	3rd gear	49 : 40 = 1.225			
	4th gear	41 : 48 = 0.85			
	Cross-country gear	31 : 9 x 28 : 16 = 6.03			
	Reverse gear	31 : 9 x 28 : 16 = 6.03			
Capacity		4.5 Ltrs.[1)]			
Specification		Gear oil GL 4 SAE 80			
Clutch mechanism		Hydraulic			
Clutch disc dia.		228 mm			
Drive shaft flange dia.		100 mm			
Tyres: dynamic circumference		approx. 2.00 m			
i overall in top gear		4.64		4.15	
Speed in top gear at n = 1000 rpm		26 km/h		29 km/h	
Remarks: * Front final drive with differential lock (M 210) M 220: Rear differential lock			M 220		M 220

[1)] When changing the oil or assembly, only pour in approx. 3.0 litres (up to edge of filler hole), because approx. 1.5 litres cannot be drained off.

Code letters		AGZ	AHA
Manufactured	from: to:		
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro	
	Engine	1.6 l 51 kW	
	Front final drive	6 N	ALM
Ratios $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43	35 : 6 = 5.83
	1st gear	34 : 9 = 3.78	
	2nd gear	33 : 16 = 2.06	
	3rd gear	49 : 40 = 1.225	
	4th gear	39 : 50 = 0.78	
	Cross-country gear	31 : 9 x 28 : 16 = 6.03	
	Reverse gear	31 : 9 x 28 : 16 = 6.03	
Capacity		4.5 Ltrs.[1)]	
Specification		Gear oil GL 4 SAE 80	
Clutch mechanism		Hydraulic	
Clutch disc dia.		228 mm	
Drive shaft flange dia.		100 mm	
Tyres: dynamic circumference		approx. 2.00 m	
i overall in top gear		4.23	4.55
Speed in top gear at n = 1000 rpm		28 km/h	26 km/h
Remarks: M 220: Rear differential lock			M 220

[1)] When changing the oil or assembly, only pour in approx. 3.0 litres (up to edge of filler hole), because approx. 1.5 litres cannot be drained off.

CODE LETTERS, GEARBOX ALLOCATION, RATIOS, OIL CAPACITIES

Front final drive permanent 4WD

Code letters		**6 N**	**ADM**	**ACU**	**ADH**
Manufactured	from: to:	2.85	2.85	2.85	2.85
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro			
	Engine	1.9 l 57 kW			
	Manual gearbox	6 P	6 PA*	AAK	AAN*
Ratio $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43		34 : 7 = 4.86	
Capacity		1.5 Ltrs.			
Specification		Gear oil GL 4 SAE 80			
Drive shaft flange dia.		100 mm			
Remarks: * Manual gearbox with differential lock (M 220) M 210: Front axle differential lock			M 210		M 210

Code letters		6 N	ALM
Manufactured	from: to:	2.85	
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro	
	Engine	1.6 l 51 kW	
	Manual gearbox	AGZ	AHA*
Ratio $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43	35 : 6 = 5.83
Capacity		1.5 Ltrs.	
Specification		Gear oil GL 4 SAE 80	
Drive shaft flange dia.		100 mm	
Remarks: * Manual gearbox with differential lock (M 220) M 210: Front axle differential lock			M 210

CODE LETTERS, GEARBOX ALLOCATION, RATIOS, OIL CAPACITIES

Manual gearbox selectable 4WD

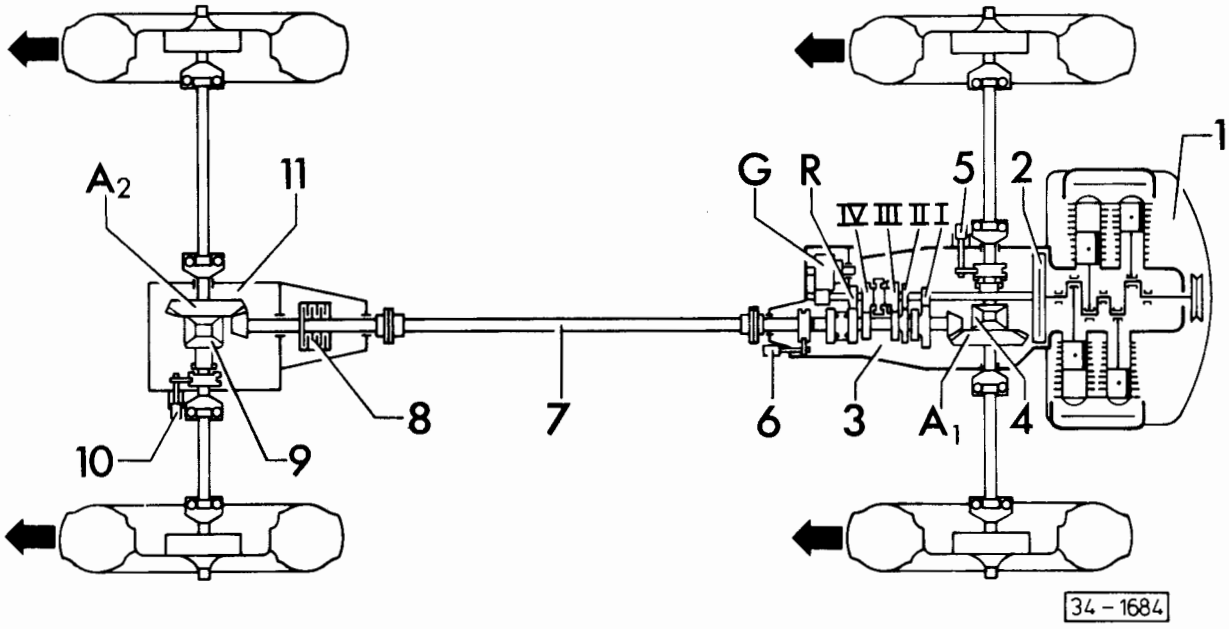
Code letters		**6 ZA**
Manufactured	from: to:	2.85
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro
	Engine	1.9 l 57 kW, 2.1 l 70 kW, 2.1 l 82 kW
	Front final drive	ADN*
Ratios $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43
	1st gear	34 : 9 = 3.78
	2nd gear	33 : 16 = 2.06
	3rd gear	49 : 40 = 1.225
	4th gear	41 : 48 = 0.85
	Cross-country gear	31 : 9 x 28 : 16 = 6.03
	Reverse gear	31 : 9 x 28 : 16 = 6.03
Capacity		4.5 Ltrs.[1)]
Specification		Gear oil GL 4 SAE 80
Clutch mechanism		Hydraulic
Clutch disc dia.		228 mm
Drive shaft flange dia.		100 mm
Tyres: dynamic circumference		approx. 2.00 m
i Overall in top gear		4.64
Speed in top gear at n = 1000 rpm		26 km/h
Remarks: * Front final drive with differential lock (M 210) M 220: Rear differential lock		M 220 1) When changing the oil or assembly, only pour in approx. 3.0 litres (up to edge of filler hole), because approx. 1.5 litres cannot be drained off.

CODE LETTERS, GEARBOX ALLOCATION, RATIOS, OIL CAPACITIES

Manual gearbox selectable 4WD

Code letters		**ADN**
Manufactured	from: to:	2.85
Gearbox allocation	Type	Volkswagen Transporter, Caravelle syncro
	Engine	1.9 l 57 kW, 2.1 l 70 kW, 2.1 l 82 kW
	Manual gearbox	6 ZA*
Ratio $Z_2 : Z_1 = i$	Final drive	38 : 7 = 5.43
Capacity		1.5 Ltrs.
Specification		Gear oil GL 4 SAE 80
Drive shaft flange dia.		100 mm
Remarks: * Manual gearbox with differential lock (M 220) M 210: Front axle differential lock		M 210

TRANSMISSION LAYOUT



Designation

1 – Engine
2 – Clutch
3 – Manual gearbox
4 – Rear differential
5 – Rear differential lock
6 – 4WD shift element
- Only on vehicles with selectable 4WD

7 – Propshaft
8 – Viscous coupling
- Only on vehicles with permanent 4WD

9 – Front differential
10 – Front differential lock
11 – Front final drive

Ratios

I – 1st gear
II – 2nd gear
III – 3rd gear
IV – 4th gear
R – Reverse
A_1 – Rear final drive
A_2 – Front final drive

CALCULATING RATIO "I"

Z_1 = No. of teeth, driving gear
Z_2 = No. of teeth, driven gear

$$\frac{\text{No. of teeth, driven gear}}{\text{No. of teeth, driving gear}} = i$$

$$Z_2 : Z_1 = i$$

Example	4th gear	Final drive
Driving gear:	$Z_{G1} = 48$	$Z_{A1} = 7$
Driven gear:	$Z_{G2} = 41$	$Z_{A2} = 38$

Gear ratio

$Z_{G2} : Z_{G1} = i_G$

$41 : 48 = 0.85$

Axle ratio

$Z_{A2} : Z_{A1} = i_A$

$38 : 7 = 5.43$

Overall ratio "i overall"

$$\frac{Z_{G2}}{Z_{G1}} \cdot \frac{Z_{A2}}{Z_{A1}} = i_{overall}$$

$$\frac{41}{48} \cdot \frac{38}{7} = 4.64$$

CALCULATING SPEED "V"

$$V = \frac{n}{i_{overall}} \cdot U_A \cdot 0.06$$

n = Engine speed (rpm)
$i_{overall}$ = Overall ratio
U_A = Dynamic circumference of tyres (m)
V = Speed (km/h)

Example:

$$V = \frac{1000}{4.64} \cdot 2.00 \cdot 0.06 = 25.88 \text{ km/h}$$

The speed of the vehicle is 26 km/h in 4th gear at an engine speed 1000 rpm.

INSTRUCTIONS REGARDING PERFORMANCE TEST, BRAKE TEST AND TOWING

A – Selectable 4WD

When the selectable 4WD is not engaged, the vehicle can be operated in the same manner as a normal two-wheel-drive Transporter.

> **Important**
>
> When carrying out tests, or when towing the vehicle, ensure that the four-wheel drive is not engaged, either by the switch or by engaging the cross-country gear.

B – Permanent 4WD

Performance test

If a performance test is to be carried out on a roller-type dynamometer, the only type of dynamometer permitted, without carrying out alterations to the vehicle, is one suited for four-wheel operation.

If a two-wheel-type dynamometer is used, the propshaft must be removed prior to testing.

Brake test

When carrying out brake tests on a roller-type dynamometer, the only type of dynamometer permitted, without alterations being made to the vehicle, is one suitable for four-wheel operation. If a two-wheel-type dynamometer is used, the propshaft must be removed prior to carrying out the test.

During brake tests, the differential locks must **not** be engaged.

Towing

If the vehicle is towed with the front or rear axle lifted, and the wheels of the raised axle are not free to turn, the propshaft must be removed prior to moving off. The differential locks must **not** be engaged. If the wheels on the raised axle are free to turn, no special rules have to be observed. The differential locks must **not** be engaged.

REPAIR INSTRUCTIONS

Essential prerequisites for proper and successful repairs are great attention to care and cleanliness and the use of the correct, serviceable tools. The basic rules regarding safety are also applicable when carrying out repairs.

A number of general rules applicable for individual repair processes – which under normal circumstances are repeated at various locations in the Workshop Manual – have been summarized here. They apply to this Workshop Manual only.

Gaskets, seals

- Renew paper gaskets
- Renew O-rings
- Oil seals

  Before installation:
  - lightly oil the outer edge
  - fill the gap between the sealing lips with grease

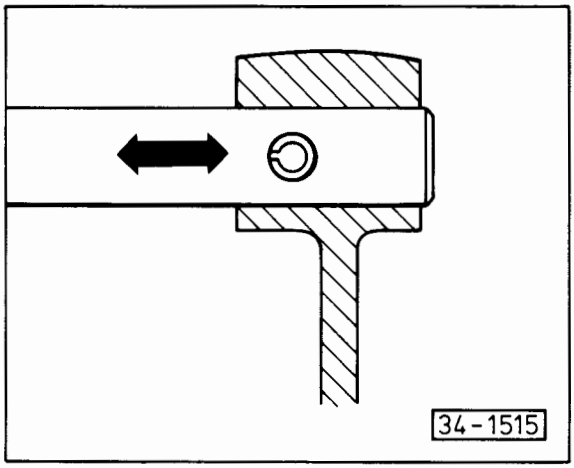
  After installation:
  - Check gearbox oil level and, if necessary, top up to the edge of the filler plug hole
- Thoroughly clean joint surfaces
- Apply sealing compound evenly – not too thick – and ensure breather holes are clear

Clutch mechanism

On vehicles with an hydraulically operated clutch mechanism, the clutch pedal must not be depressed once the engine and gearbox have been removed. Otherwise the piston will be forced out of the operating cylinder and the clutch operating system must be bled.

Locking components

- Renew circlips
- Do not twist circlips
- Circlips must always fit tightly in the groove



- Renew spring pins
  Fitting position: The slot must be in line with the thrust direction.

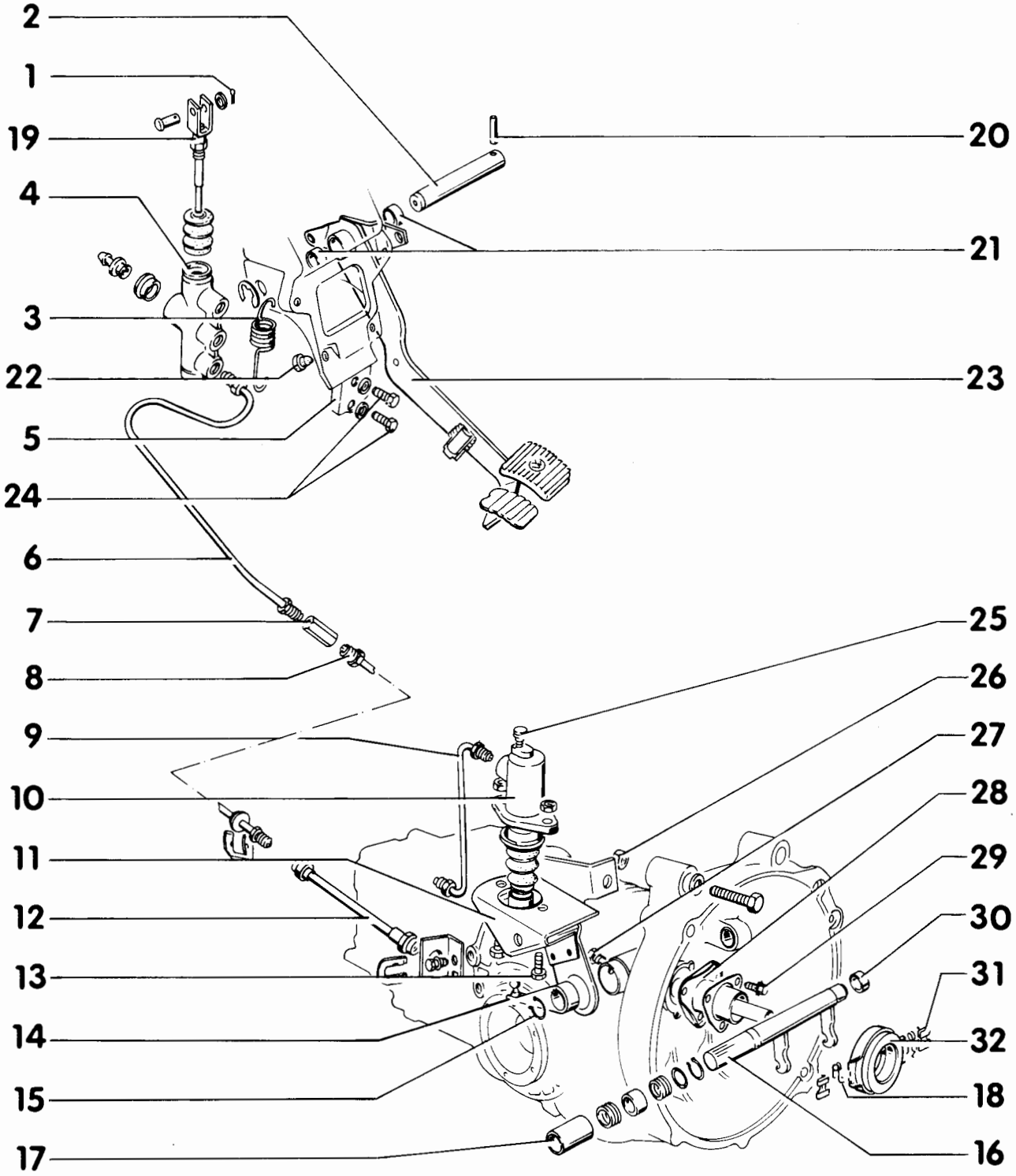
- Always use a hammer as a support when driving the selector fork spring pins out and in to prevent the selector fork rod holes becoming enlarged.

Bolts, nuts

- The bolts and/or nuts used for securing covers and housings must always be slackened off and tightened diagonally.
  – Parts which are particularly sensitive – e.g. clutch pressure plates – should not be tilted in any way and they should be loosened off and tightened **in diagonal stages.**
- The tightening torques for unoiled bolts and nuts are shown.
- Self-locking bolts and nuts must always be renewed.

Bearings

- Install needle bearings with the lettered side (thicker material) towards the fitting tool.
- The crankshaft needle bearing for the gearbox input shaft must be greased.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SERVICING HYDRAULIC CLUTCH CONTROLS

Note

When work is required on release bearing or release shaft, gearbox must be removed. For work on pedal, remove instrument panel. See booklet "General Body Repairs".

Bleeding clutch

Connect brake bleeding appliance VW 1238/1 (also see "Bleeding brakes" in the "Running Gear" booklet). Working pressure 2 – 2.5 bar gauge pressure.

Open bleeder valve until brake fluid issues free of bubbles.

1 Split pin
- Renew

2 Pin
- Lubricate with multi-purpose grease

3 Return spring

4 Clutch master cylinder

5 Bracket

6 Pressure line, front

7 Connecting piece

8 Pressure line, centre

9 Pressure line, rear

10 Clutch operating cylinder
- Install rear screw before fitting

11 Bracket for operating cylinder

12 Pressure hose

13 Hexagon head bolt 25 Nm

14 Clutch lever
- Lubricate ball pin lightly

15 Circlip
- Renew

16 Release shaft
- Lubricate with multi-purpose grease

17 Bush for release shaft

18 Spring
- Insert in retaining clip and then fit on shaft together with release bearing and clip

19 Clevis
- Adjust so that there is a maximum of 0.5 mm play between push rod and piston in master cylinder

20 Spring pin
- Fitting position – Fig. 1

21 Bushes
- Knock out with VW 207
- Drive in flush

22 Rubber stop

23 Clutch pedal

24 Hexagon head bolt 25 Nm

25 Bleeder valve
- Open only for bleeding purposes
- Hydraulic system should only be bled with bleeding appliance

26 Hex nut 45 Nm

27 Retaining screw 15 Nm
- Secure to release shaft

28 Guide sleeve
- Lubricate metal sleeve with MOS_2 grease
- Do not grease plastic sleeve

29 Hexagon head bolt 15 Nm

30 Bush
- Removing – Fig. 2
- Installing – Fig. 3

31 Retaining clip

32 Release bearing
- Wipe only, do not wash; lubricate working surfaces with MOS_2

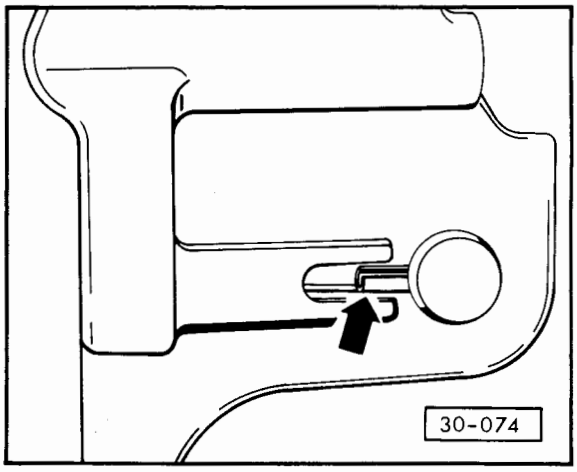


Fig. 1 Fitting position for spring pin

Spring pin must be located in recess (arrow) on the side of the bracket.

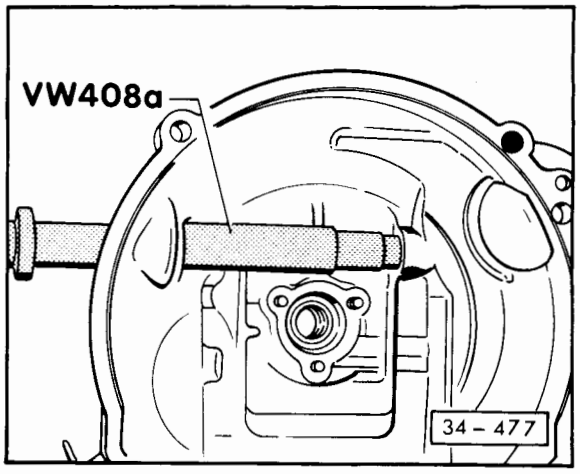


Fig. 3 Installing bush for release shaft flush

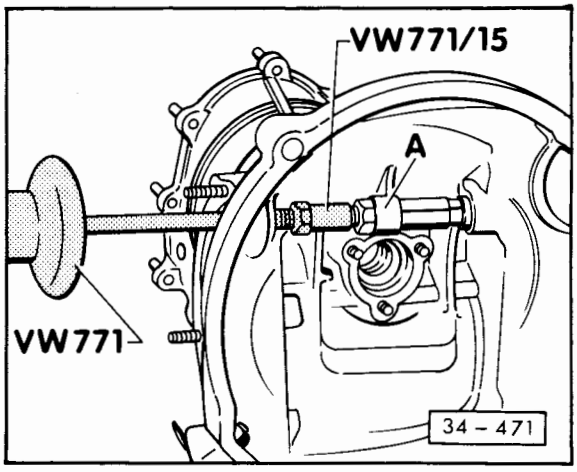
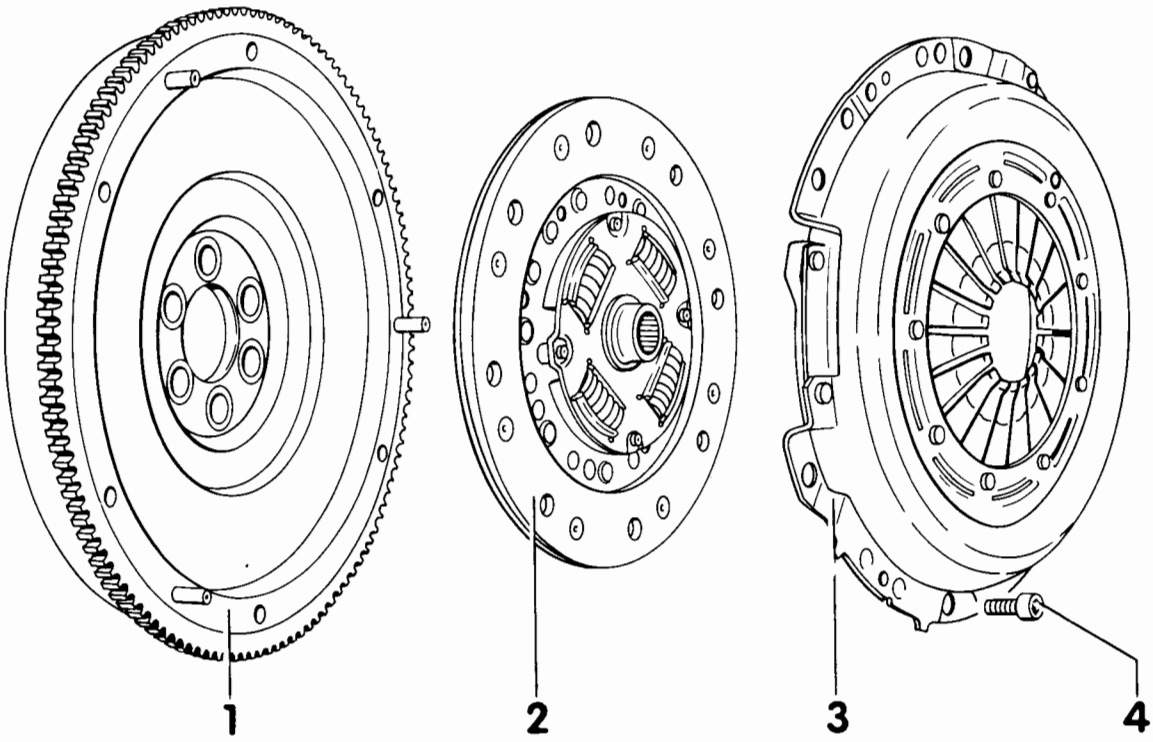


Fig. 2 Removing bush for release shaft

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



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CLUTCH REPAIRS

Removing, installing and checking clutch

Note

When work is to be done on clutch, gearbox must be removed.

> **Important**
>
> Clutches with damaged or loose riveted connections should be renewed.

> **Important**
>
> When renewing engines, gearboxes or clutches, it should be ensured that the diameters of release bearing and diaphragm spring correspond.

1 Flywheel
- Check for firm fit on centering pins; contact surface for clutch lining must be free of grooves, oil and grease.

2 Clutch disc
- Centering – Fig. 1
- Checking lateral runout – Fig. 5
- Lubricate splines slightly with Moly-paste or Moly-spray.
- Watch installation position: spring cage points towards pressure plate.

3 Pressure plate
- Removing and installing – Fig. 1
- Checking for wear and distortion – Figs. 2, 3 and 4

4 Hexagon head or socket-head bolt 25 Nm
- Loosen and tighten diagonally in stages

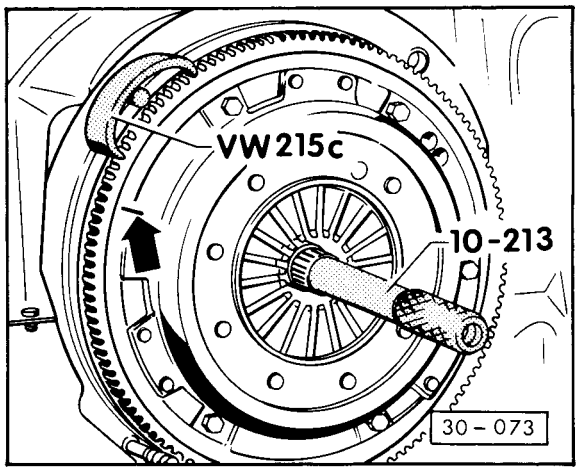


Fig. 1 Removing and installing clutch

Use holder 3067 instead of VW 215c on Diesel engine.
Mark position (arrow).

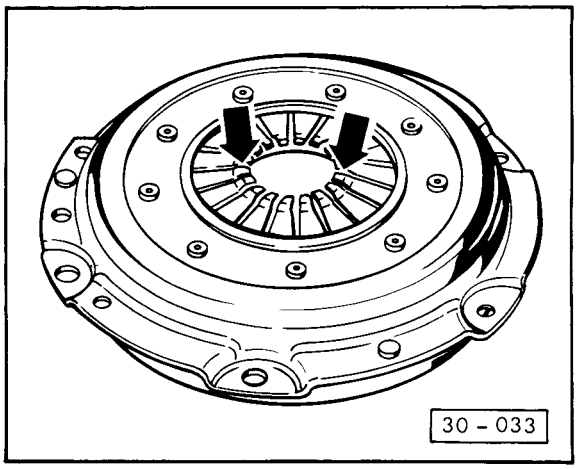


Fig. 2 Checking diaphragm spring fingers

Scoring up to 0.3 mm deep is acceptable.

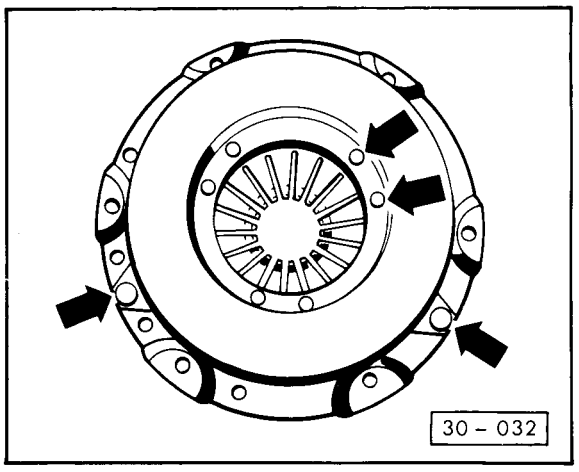


Fig. 3 Checking the spring connections between pressure plate and cover for cracks, tightness of rivets and firm fitting

Clutches which have damaged or loose rivets should be renewed.

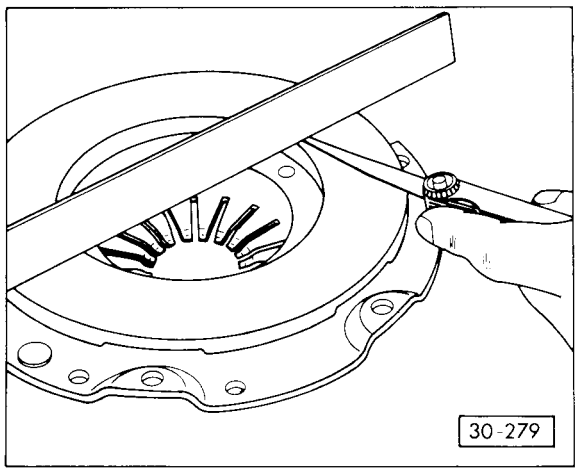


Fig. 4 Checking the contact surface for cracks, signs of burning and distortion

Inward distortion of pressure plate: max. 0.3 mm.

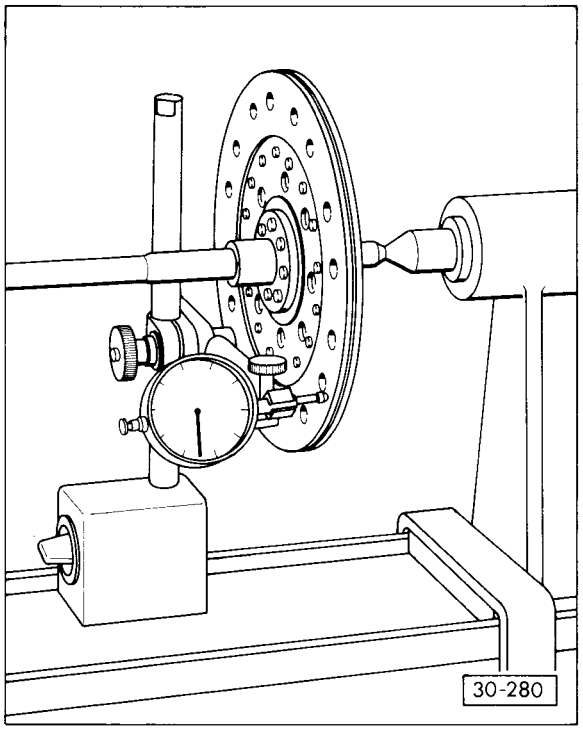
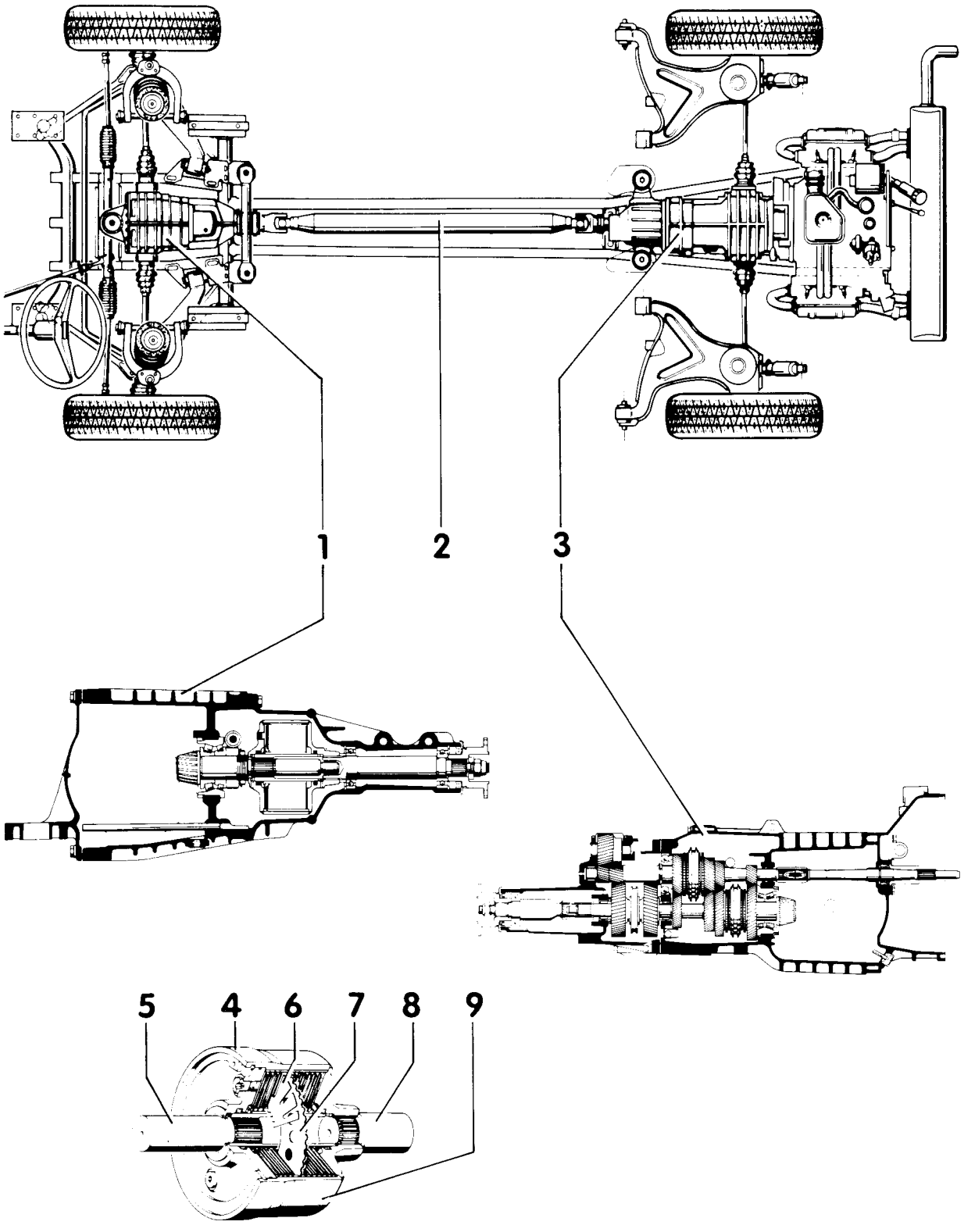


Fig. 5 Checking clutch plate lateral runout

Wear limit: max. 0.5 mm
Measure 2.5 mm from outer edge.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PERMANENT FOUR-WHEEL DRIVE

Exploded view

1 **Front final drive with viscous coupling**
- Removing and installing – page 42

2 **Propshaft**
- Removing and installing – page 44

3 **Manual gearbox**
- Removing and installing – page 39

4 **Viscous coupling**
- Checking operation – page 38

5 **Pinion**

6 **Internally splined plates**

7 **Externally splined plates**

8 **Flanged shaft**

9 **Housing**

Note

The connection of power to the front wheels is brought about every time a speed difference occurs between the front and rear wheels, e.g. when the rear wheels slip.

This type of 4WD system is always in action, only the amount of drive being transmitted to the front wheels changes, as required.

Drive to the front wheels is through a viscous coupling which is located in the front final drive.

This viscous coupling contains internally and externally splined plates.

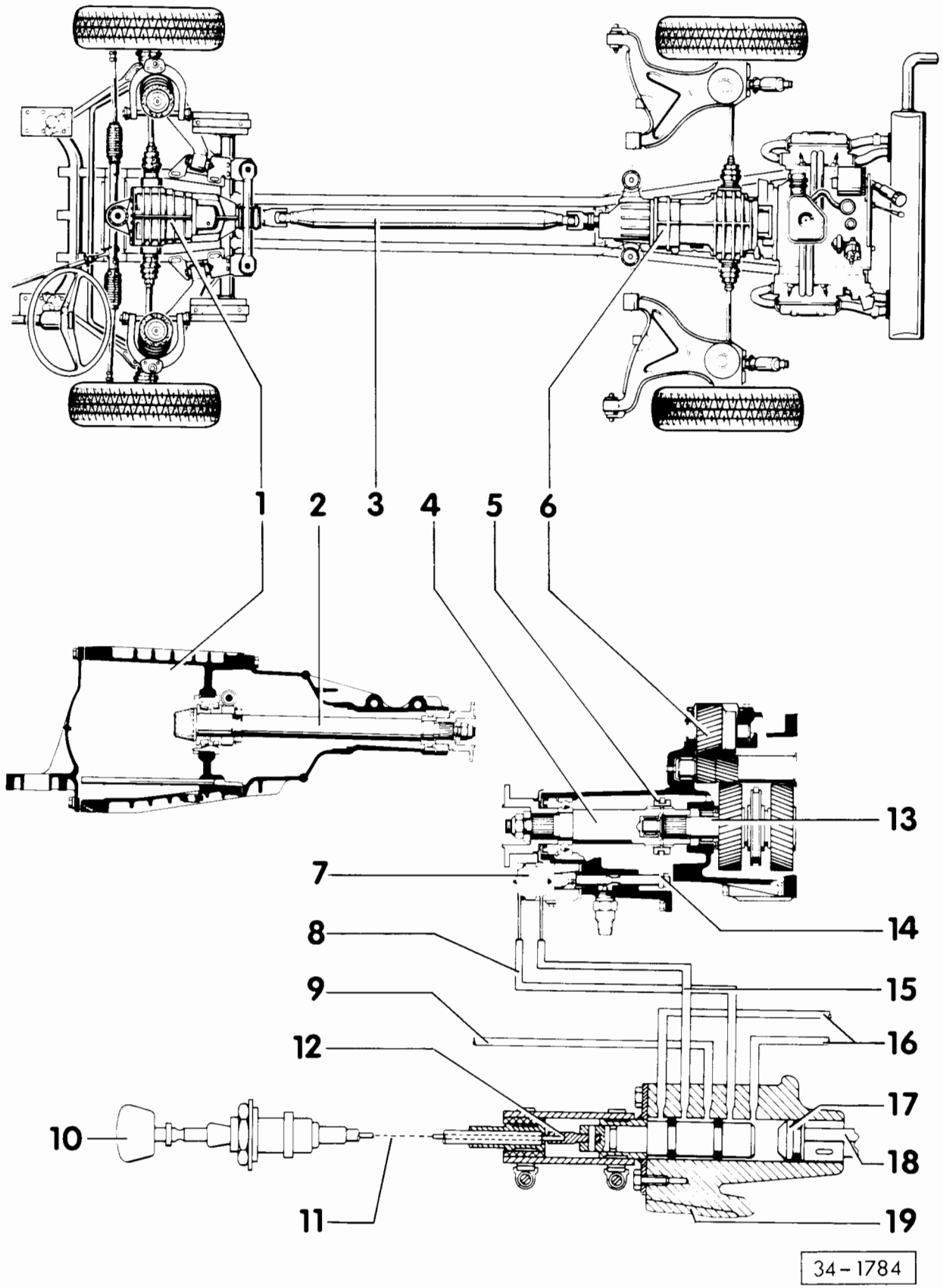
The externally splined plates are connected to the viscous coupling housing and thereby to the flanged shaft, the propshaft, the gearbox and finally to the rear road wheels.

The internally splined plates are joined to the front road wheels through the pinion shaft and the front final drive.

The viscous coupling is filled with a silicone paste which becomes viscous when the front and rear wheels rotate at different speeds (this means the externally and internally splined plates also) thus building up a high shear force. The viscous coupling starts to lock up and then transfers the driving force to the front wheels as well.

When driving round bends, where small speed differences between front and rear wheels take place, the viscous coupling absorbs these relatively small movements **without** locking up.

In a case such as this, the viscous coupling works as a type of differential.



26 **Selectable 4WD**
Exploded view and vacuum pipe layout

SELECTABLE FOUR-WHEEL DRIVE

Exploded view and vacuum pipe layout

1 **Front final drive without viscous coupling**

2 **Front pinion**

3 **Propshaft**
- Removing and installing – page 44

4 **Output shaft**

5 **Operating sleeve**

6 **Manual gearbox**
- Removing and installing – page 39

7 **Shift element**
- Removing and installing – page 37

8 **Disengaging line (brown)**
- Renewing – page 37

9 **Vacuum line (orange) from intake manifold**
- Renewing – page 37

10 **Control knob for 4WD**
(illustrated in engaged position)

11 **Bowden cable**

12 **Control plunger**
- Adjusting – page 38

13 **Rear pinion**

14 **Selector fork**

15 **Engagement line (light green)**
- Renewing – page 37

16 **Ventilating pipes**
- Renewing – page 37

17 **Piston**

18 **Shift rod for cross-country gear**

19 **Housing for cross-country gear**

Note

In the case of selectable 4WD only the rear wheels are driven during normal operation.

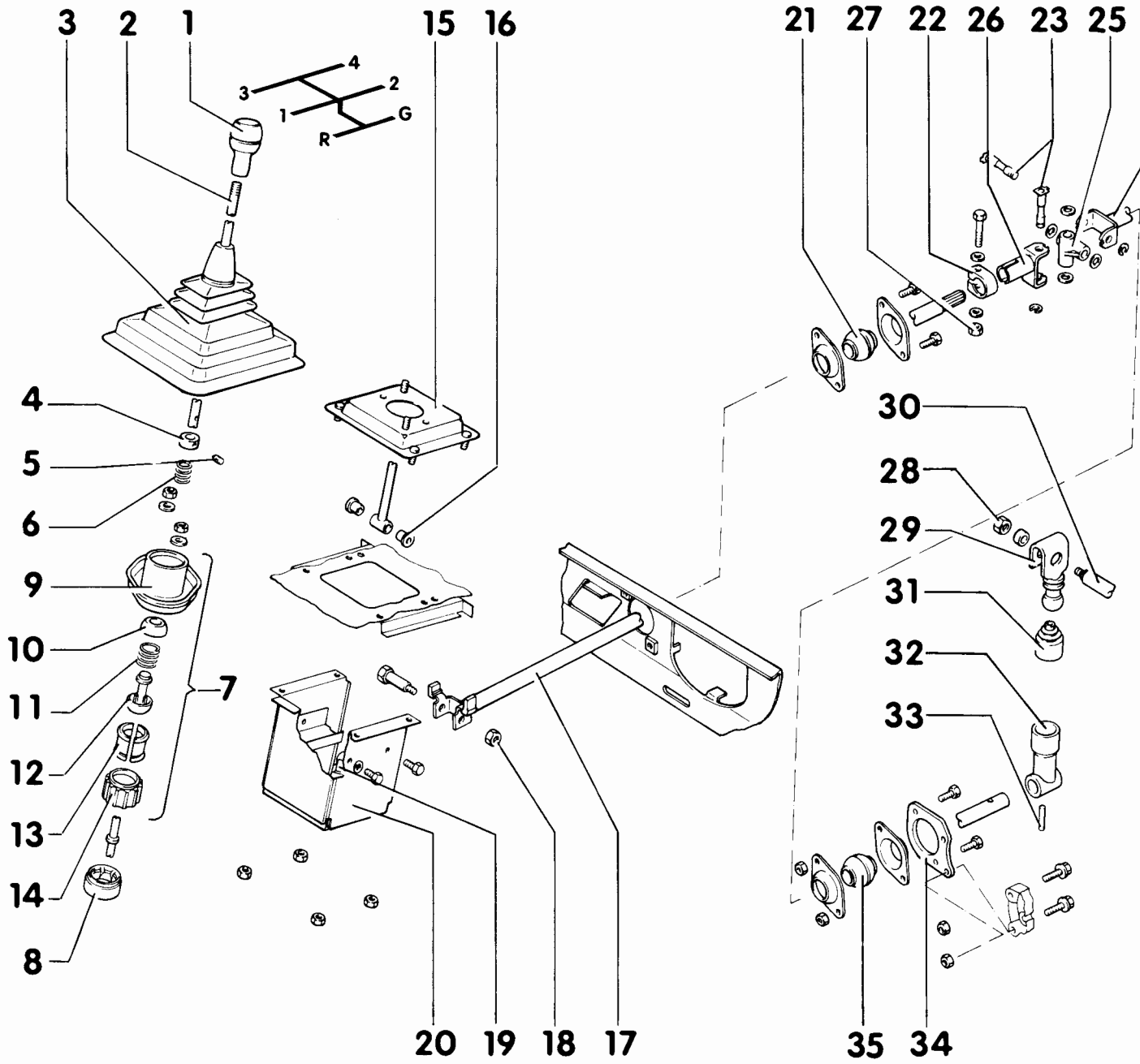
The 4WD can be engaged by either one of two methods:

A – By pulling the control knob in the passenger compartment (in all gears)

When this is done, a control plunger in the bearing carrier of the manual gearbox is operated by means of a Bowden cable. This control plunger opens the appropriate vacuum line for the shift element. The shift element moves the operating sleeve by means of a shift fork which is mounted on a rod. The operating sleeve joins the pinion and gearbox output shaft together, thus enabling the drive to be transmitted to the front final drive, and therefore to the front wheels, via the propshaft and front axle pinion.

B – By engaging the cross-country gear

When the cross-country gear is engaged, the inner shift rod with the piston once again operates the control plunger. Further movement takes place in the same manner as when engaging by hand, i.e. via the shift element and operating sleeve. The 4WD is **not** automatically disengaged when changing into another gear. The 4WD must then be disengaged with the knob in the passenger compartment.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REPAIRING GEARSHIFT MECHANISM

Adjusting gearshift linkage – page 32

Important

Lubricate all joints and friction surfaces with special lubricant, Part No. AOS 126 000 05.

1 **Knob**

2 **Gear lever**
- Adjusting – page 32

3 **Boot**

4 **Bush**

5 **Grub screw M 5 × 8**

6 **Spring**

7 **Gear lever bearing**
- Assembling: Insert shells in rubber bush, press lower ball half in shells (the shoulder of rubber bush must be upwards), insert spring and install upper ball half by pressing shells apart. Press complete rubber bush fully into lever bracket.

8 **Spacer**
- Position: Shoulder upwards

9 **Lever bracket**

10 **Upper ball half**

11 **Spring**

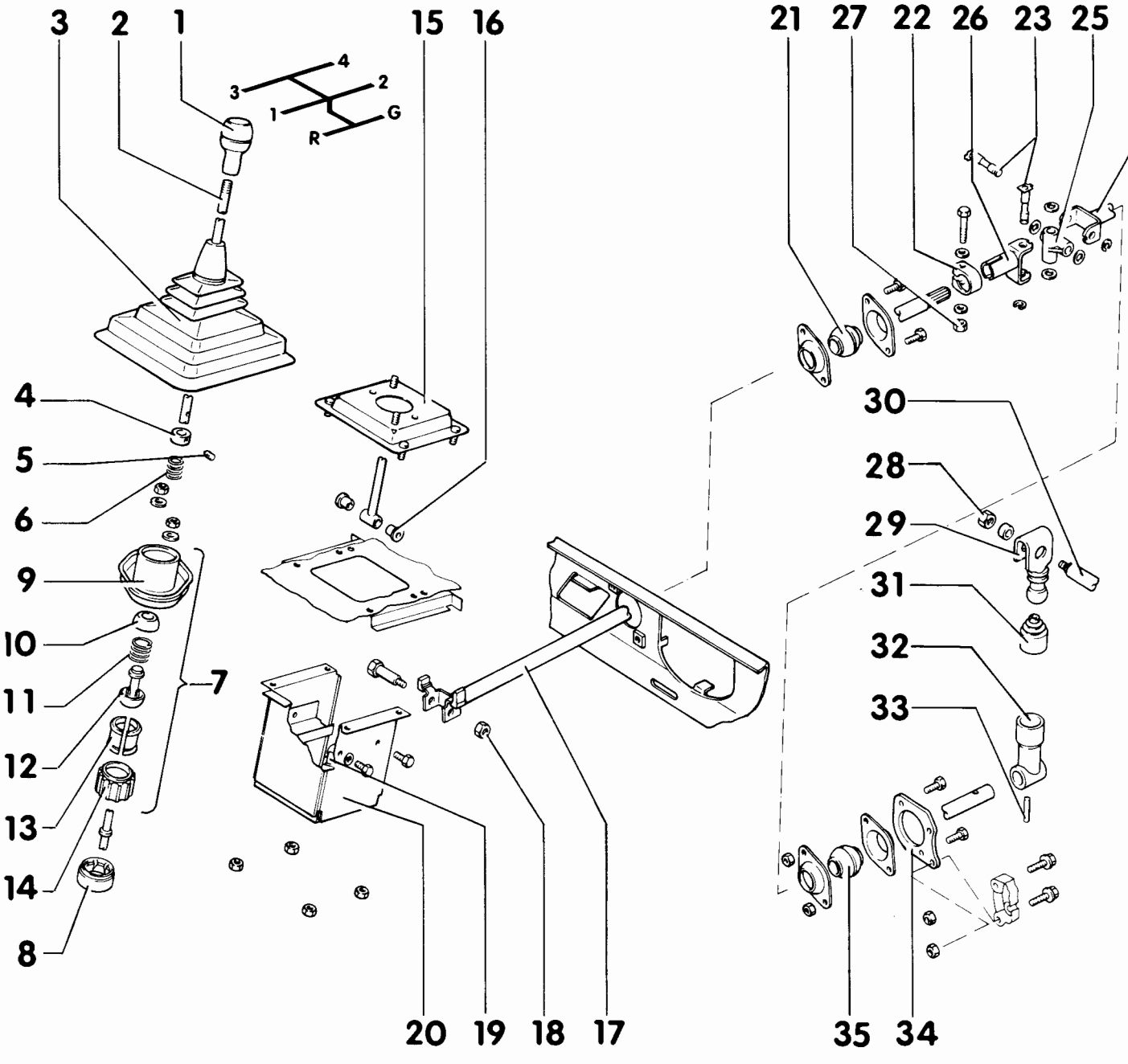
12 **Lower ball half**

13 **Shells**

14 **Rubber guide**

15 **Mounting plate**

16 **Mounting bush**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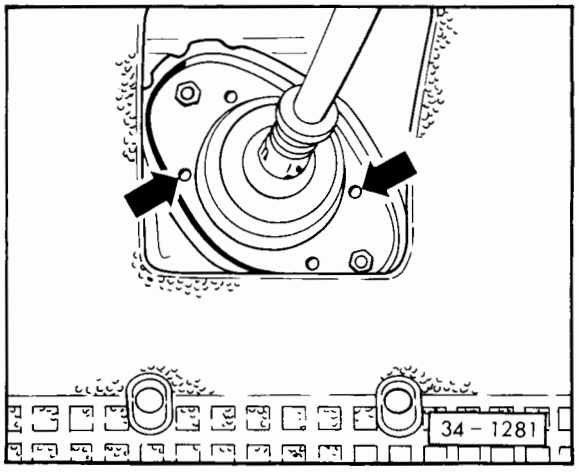
17 Front shift rod
18 Hex nut 10 Nm
19 Selector stop
20 Shift linkage housing
21 Front bush
22 Clip
23 Pin
24 Rear shift rod
25 Universal joint
26 Forked element
27 Hex nut 25 Nm
28 Hex nut 28 Nm
29 Lever
- Fits onto gearshift shaft in only one position

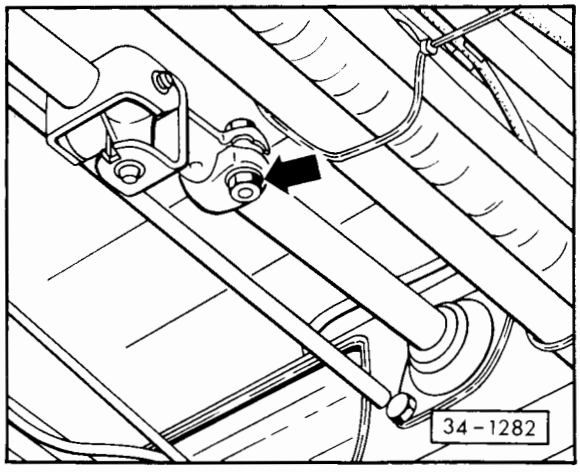
30 Gearshift shaft
31 Boot
32 Selector lever
33 Spring pin
34 Support plate
35 Rear bush

Adjusting gearshift linkage

– Gearbox must be in neutral.

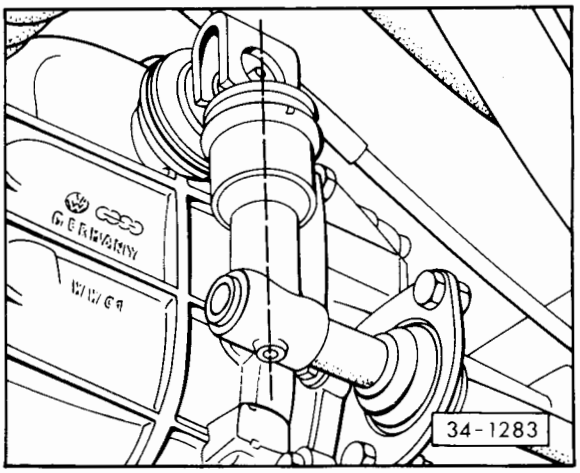


– Align centering holes (arrows) in lever bearing and mounting plate.



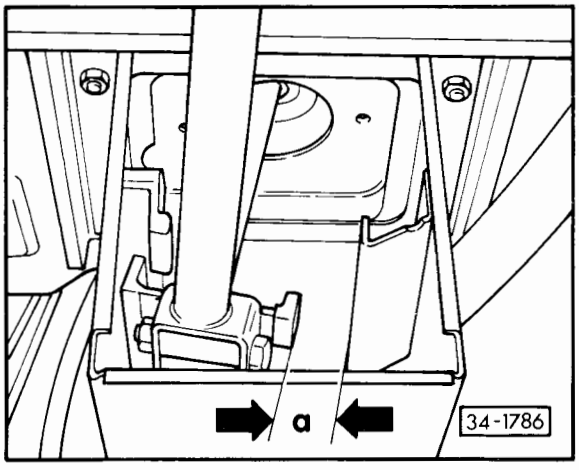
– Loosen clip. The shift rods must move easily.

– Remove guard plate.



– Set lever on gearbox vertical.

– Set right-hand stop finger of front shift rod in centre of stop plate in housing.



– Adjust gap "a" to 23 mm with locally made gauge.

Important

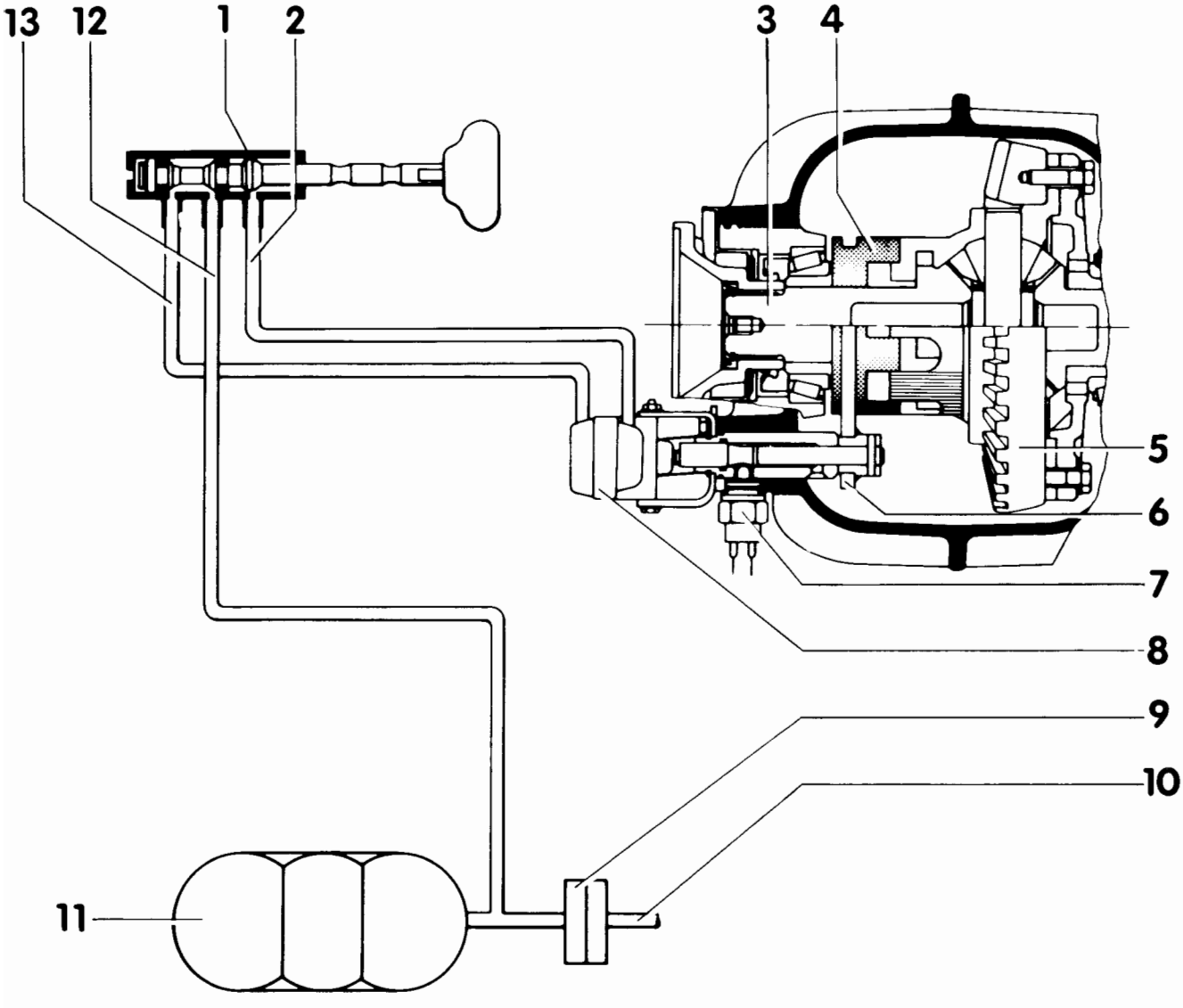
Gearbox in neutral. Lever on gearbox must be vertical.

– Secure clip in this position.

– Select all gears and check that they engage easily and without jamming. Check also that reverse catch is effective.

Note

When 1st gear is engaged, there must be a gap of at least 15 mm between gear lever and heater trim near boot.



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DIFFERENTIAL LOCK OPERATION

Exploded view and vacuum pipe layout

1 Differential lock control valve
Illustrated in disengaged position

2 Engagement line
Front lock — grey
Rear lock — white
● Renewing – page 37

3 Large differential bevel gear

4 Dog clutch

5 Differential

6 Selector fork

7 Switch for warning lamp 20 Nm

8 Shift element

9 Non-return valve

10 Vacuum from intake manifold

11 Vacuum reservoir
Mounted on vehicle floor

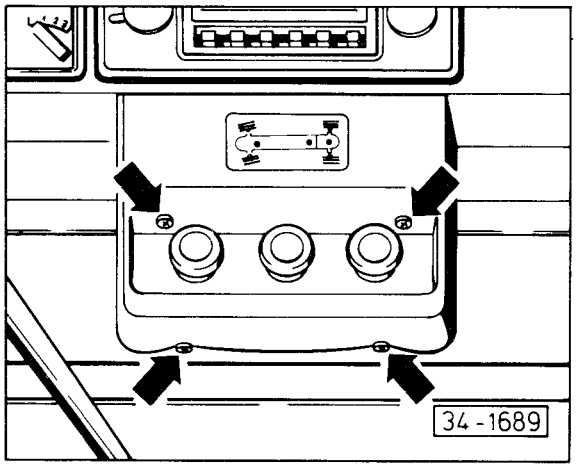
12 Vacuum line
Black

13 Disengagement line
Front lock — red
Rear lock — blue
● Renewing – page 37

By pulling the shift valve for the appropriate front or rear differential lock, intake manifold vacuum is transferred to the engagement line. The shift element diaphragm pushes the dog clutch into engagement with teeth on the large differential gearshift via a rod-mounted selector fork. This movement blocks the differential action. If the locking mechanism becomes "tooth-to-tooth" the differential can only be locked when the large bevel gear has rotated far enough for the dog clutch to engage.

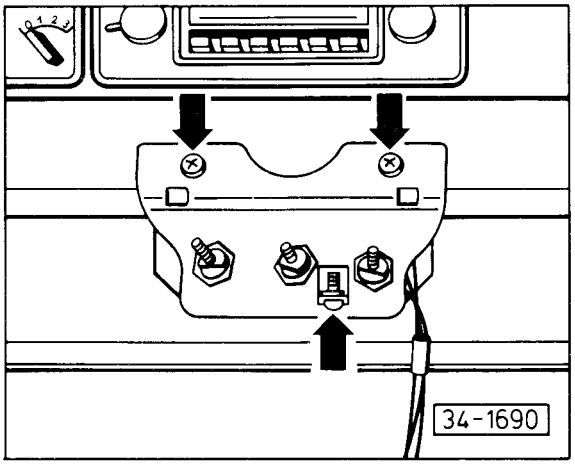
REPAIRING DIFFERENTIAL LOCK MECHANISM

Removing and installing lock controls

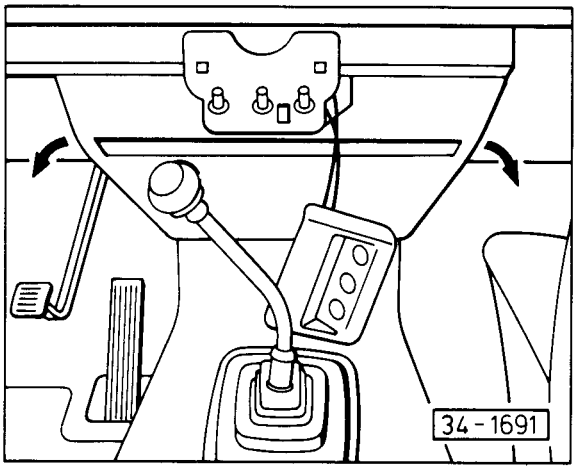


– Unscrew knobs, if necessary hold the valve plungers with long-nosed pliers.

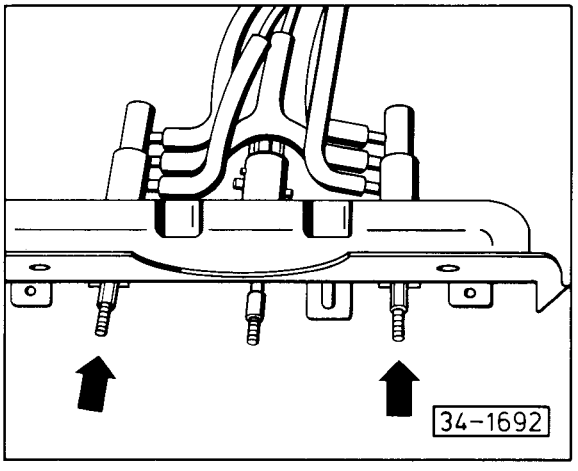
– Remove trim (arrows).



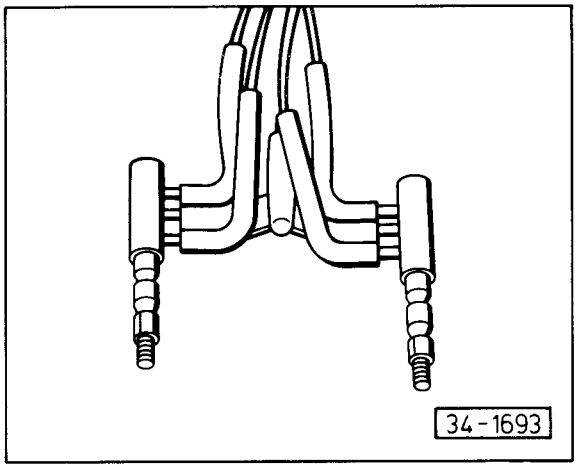
– Unscrew bracket.



– Detach trim and take off.



– Press plungers out of the guide sleeve.

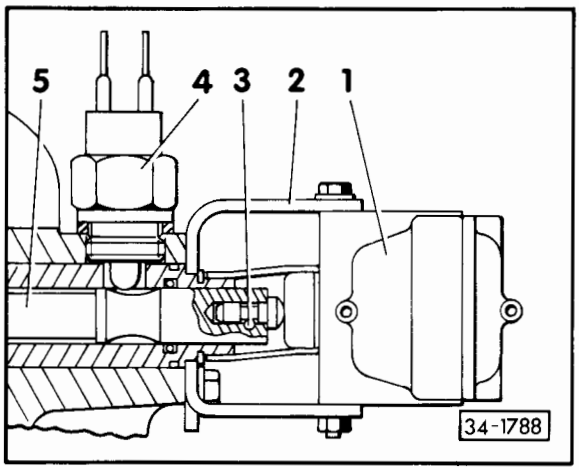


– Pull off vacuum line. When assembling, pay attention to layout shown on page 27.

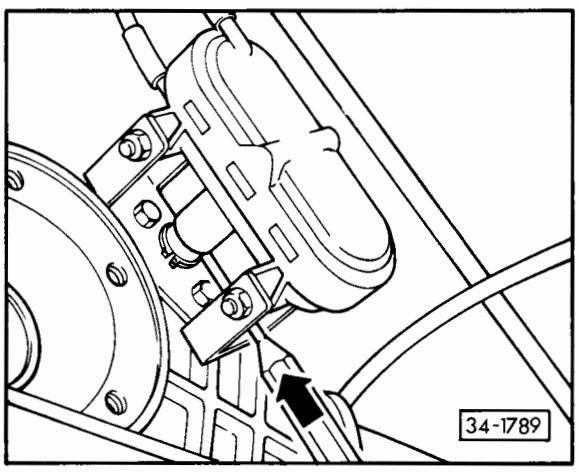
REPAIRING DIFFERENTIAL LOCK MECHANISM

Removing and installing shift element
Renewing vacuum lines

The shift elements are secured to the gearbox and front final drive with brackets. The shift element diaphragm pin is secured in the shift rod with a spring pin.



1 – Shift element
2 – Bracket
3 – Spring pin 3 × 8
4 – Warning lamp switch
5 – Shift rod



– Push the protective boot back and drive spring pin out.

– Detach vacuum lines.

– Remove bolts securing shift element to bracket.

Note

When reinstalling, note the colour code for vacuum lines shown on page 27.

Renewing vacuum lines

– Pull vacuum lines off shift element.

– Remove differential lock mechanism bracket and trim – see page 36.

– Pull vacuum line off differential lock control valve.

Note

In service, only white vacuum lines are supplied (Part No. N 20.139.1). When installing, cut the pipes to the required length and stick on an appropriate coloured piece of adhesive tape for identification purposes.
Colour code – page 27.

CHECKING THE VISCOUS COUPLING FUNCTION

– Position the vehicle so that the rear wheels are on a roller-type dynamometer.

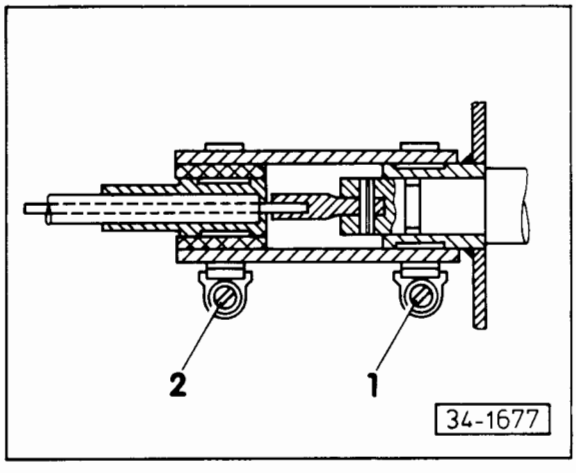
Important

Ensure that the area in front of the vehicle is clear. To avoid damage, proceed very carefully during the test.

– Engage cross-country gear and take up drive slowly.

– Because the rear wheels are being driven and the front wheels are stationary, the viscous coupling locks immediately. This means that the front wheels are also being driven and the vehicle will immediately be pulled off the dynamometer. The viscous coupling can allow for speed differences without locking if the cross country gear is engaged and the engine speed is only just above idling.
If the vehicle is not pulled off the dynamometer when the engine speed is between 2000 and 3000 rpm, the viscous coupling must be renewed.

REMOVING AND INSTALLING THE SELECTABLE 4WD BOWDEN CABLE

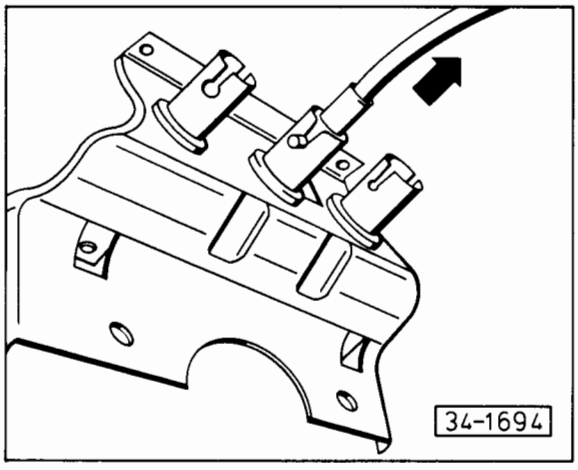


– Remove the clips 1 and 2 on the manual gearbox and push the sleeve back.

– Drive out spring pin.

– Detach Bowden cable from gearbox.

– Remove control trim and bracket in passenger compartment – page 36.



– Press Bowden cable out of bush.

Installing:

– First attach Bowden cable at passenger compartment end.

– Drive in spring pin on gearbox.

– Push sleeve into position and tighten clip 1. Engage 4WD at control knob and on gearbox (pull control plunger out).

– Pull Bowden cable out of sleeve until slight resistance is felt (the knob in passenger compartment must not be pulled in).

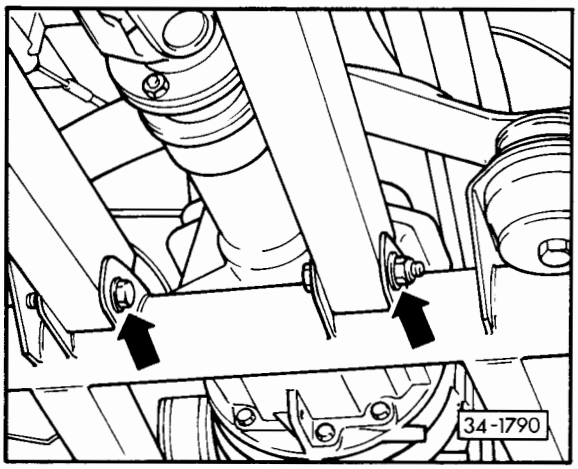
– Tighten clip 2.

REMOVING AND INSTALLING MANUAL GEARBOX

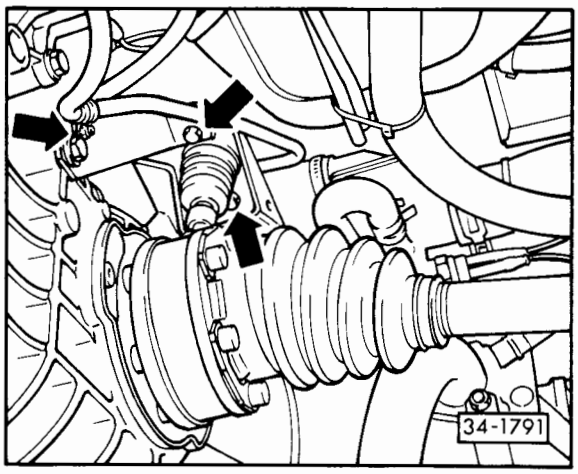
The gearbox can be removed without removing the engine.

Removing

- Detach battery earthing strap at battery.
- Remove upper engine/gearbox connecting bolt.
- Remove rear skid rail (under engine and gearbox).



- Unscrew the two front bolts securing the middle skid rail braces and fold braces down.
- Detach propshaft at gearbox and tie up to bodywork.

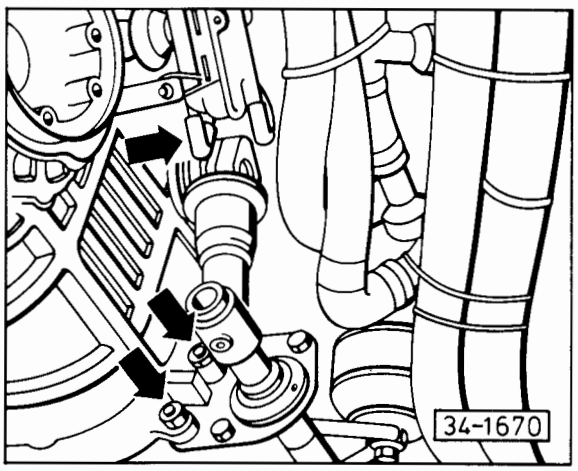


- Detach left-hand drive shaft from gearbox.
- Detach clutch line bracket from gearbox.
- Remove clutch operating cylinder from bracket and tie up.

Note:

Hydraulic pipes remain attached.

- Pull off cable for reversing lights.
- Detach front right-hand drive shaft at gearbox.

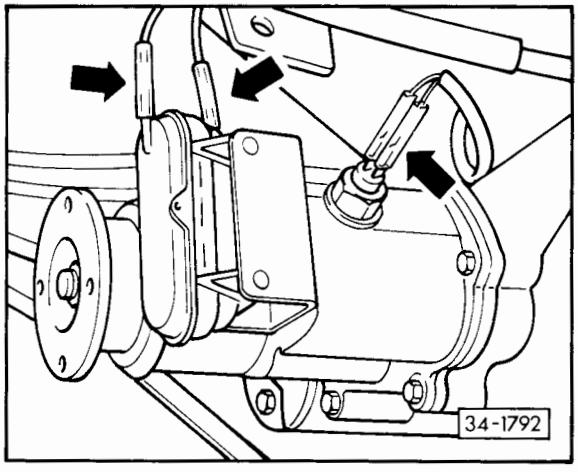


- Detach shift linkage from gearbox.

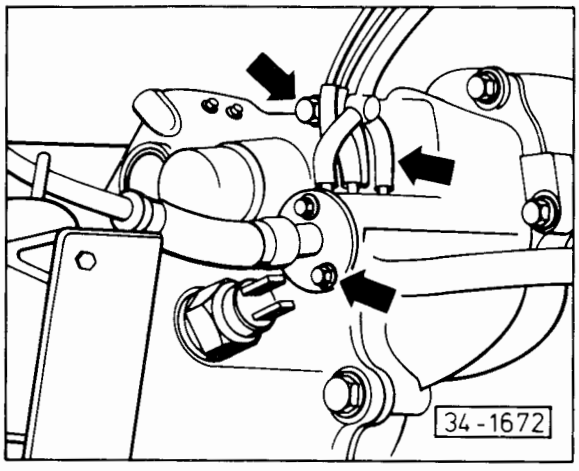
Vehicles with rear differential lock

- Detach vacuum hoses from shift element and wire for warning lamp switch.

Vehicles with selectable 4WD



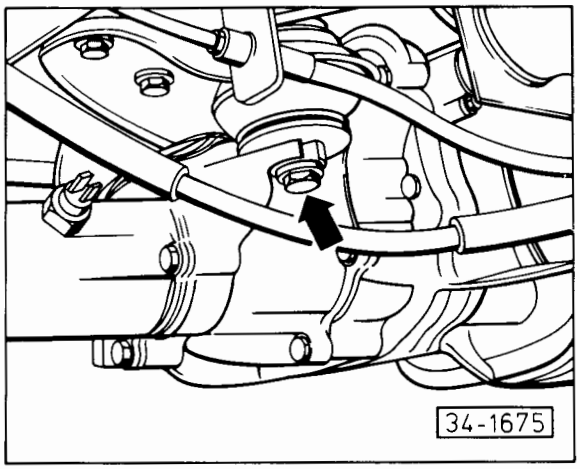
- Pull vacuum hoses off shift element and wire for warning lamp.
- Detach earth cable from bodywork.
- Support gearbox with jack V.A.G 1383.



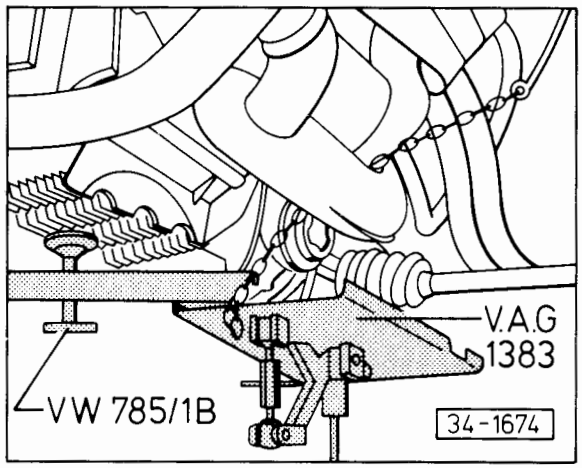
- Detach breather hose.

Vehicles with selectable 4WD

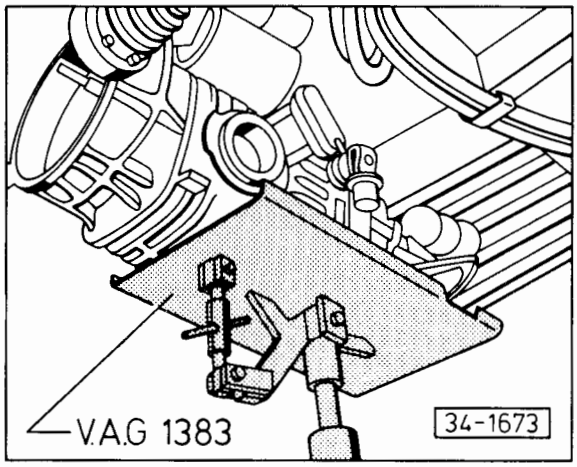
- Pull vacuum hoses off gearbox.
- Detach Bowden cable and pull out complete with control plunger. Protect parts from dirt.



- Detach front gearbox mounting.
- Lower the gearbox slightly at front (approx. 15 cm at propshaft flange).
- Detach starter cable.



- Support engine with VW 785/1B.
- Remove lower engine/gearbox connecting bolts.



– Pull gearbox off engine studs and take out.

Installing

Install in reverse order.

Notes:

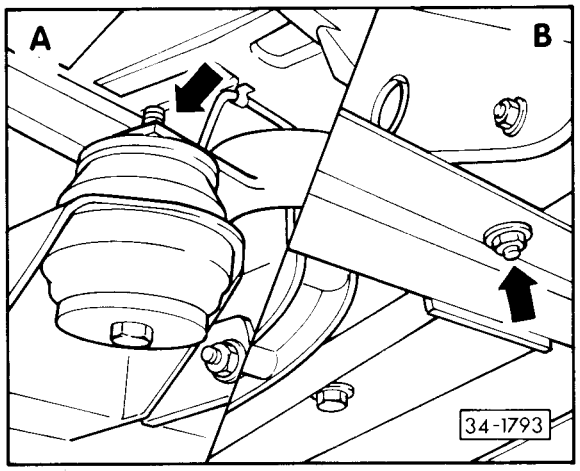
Clean engine and gearbox connecting surfaces and apply a thin coat of silicone adhesive sealant, Part No. AMV 176 005 05, to engine surface.

– Clean the input shaft splines and lubricate lightly with Moly-paste or Moly-spray.
– Grease crankshaft needle roller bearing.
– When fitting the vacuum lines, pay attention to colour code; see page 27.
– Tighten the front securing bolts of the middle skid rail braces last.

Tightening torques

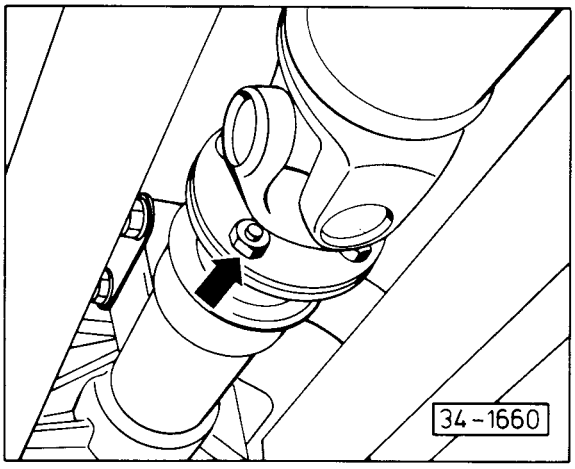
Gearbox to engine (M 10)	30 Nm
Drive shaft to gearbox	35 Nm
Propshaft to gearbox	35 Nm

REMOVING AND INSTALLING FRONT FINAL DRIVE

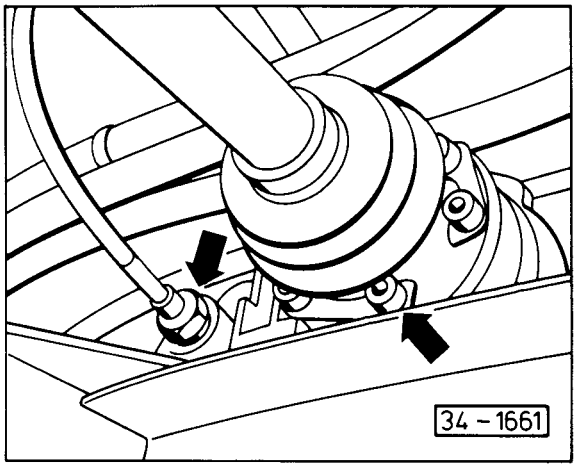


A – Slacken off the rear mounting bolts of front final drive but do not remove.

B – Slacken off the bolts at side of front final drive front mounting but do not remove.

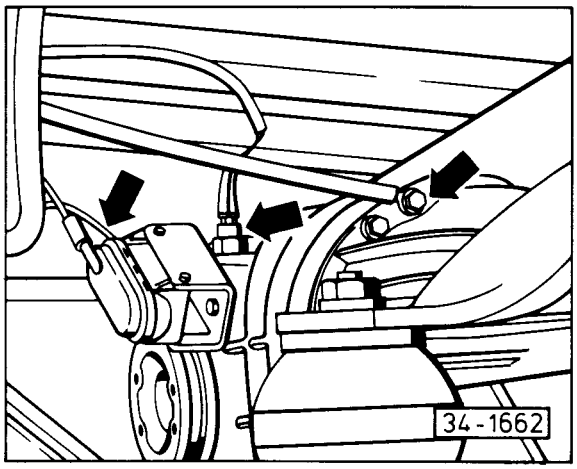


– Detach propshaft at front and tie up to skid rail.



– Detach right-hand drive shaft and speedo drive cable.

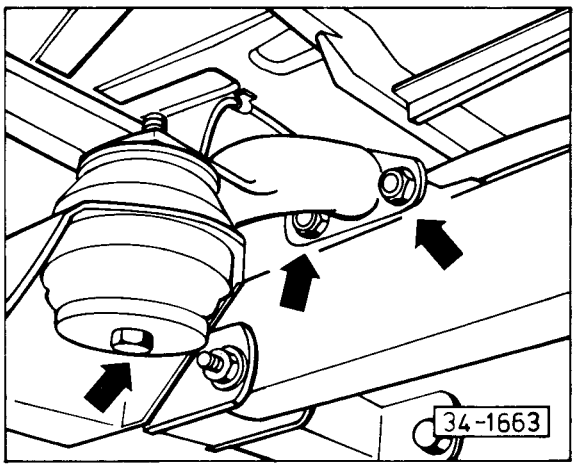
– Detach left-hand drive shaft.



– Detach gearbox breather.

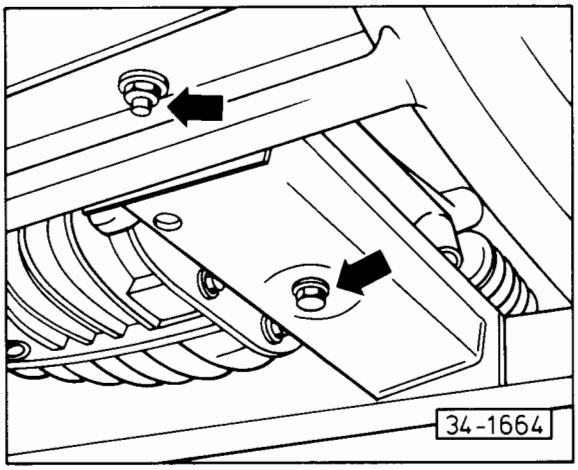
Vehicles with front differential lock

- Pull off wire for warning lamp switch.
- Pull vacuum lines off shift element.

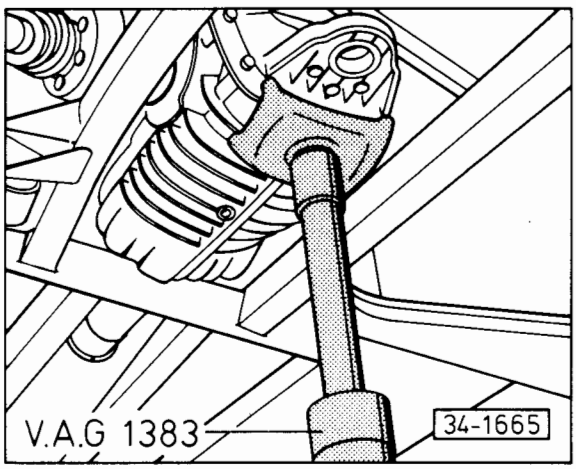


– Detach rear mounting and take off bracket.

– Place gearbox jack V.A.G 1383 with small adapter plate in position.



– Detach front mounting. Take mounting bearer out towards the front.



– Lower front final drive.

Vehicles with front differential lock

- Turn final drive so that shift element is clear of skid rail.
- Take final drive out.
  (2 mechanics required)

Installing

Install in reverse sequence.

Note:

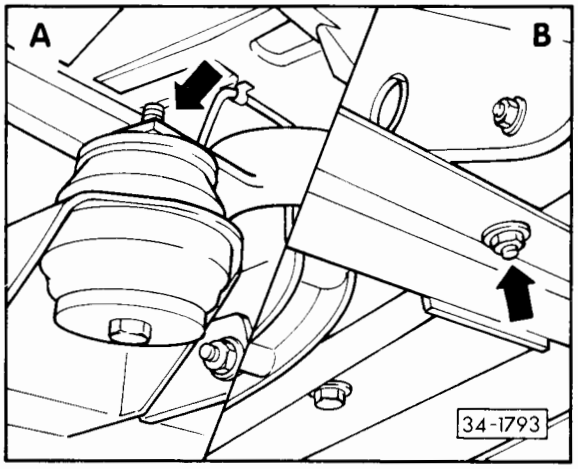
Tighten the front and rear mounting bolts last. When installing the vacuum line, pay attention to the colour code shown on page 27.

Tightening torques:

Drive shaft to final drive	35 Nm
Propshaft to final drive	35 Nm
Gearbox mounting	45 Nm

REMOVING AND INSTALLING PROPSHAFT

Removing

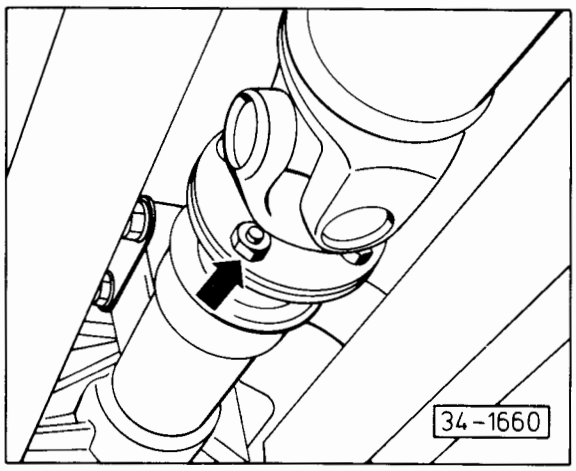


A – Slacken off the rear mounting bolts of front final drive but do not remove.

B – Slacken off the bolts at side of the front final drive front mounting but do not remove.

Important

This operation is of great importance as otherwise the universal joint could become damaged when removing the propshaft.



– Detach propshaft at front and rear flanges and take off.

Installing

– Install propshaft.

– Align the front final drive in a longitudinal direction and tighten securing bolts.

Only by doing this can one guarantee that the propshaft is not installed under strain.

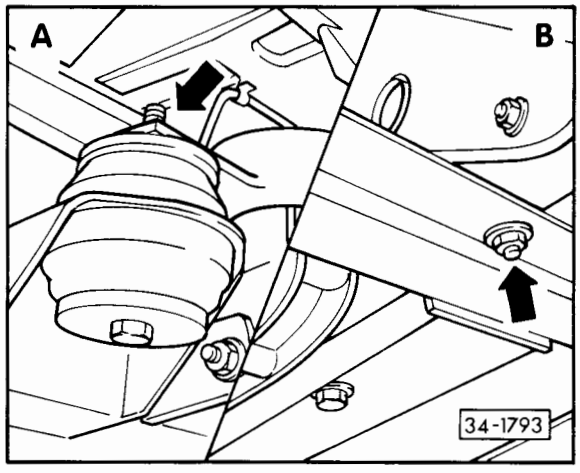
Note:

The universal joints cannot be exchanged using normal workshop tools and, for this reason, they are not available as service parts.

Tightening torques:

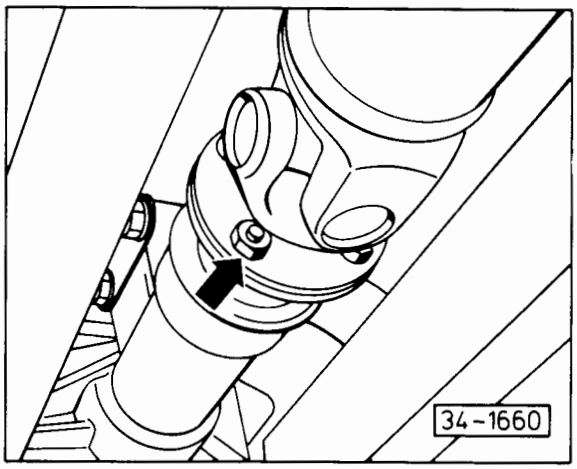
Gearbox mounting	45 Nm
Propshaft hexagon nut	35 Nm

RENEWING PROPSHAFT FLANGE OIL SEALS ON FRONT FINAL DRIVE OR GEARBOX

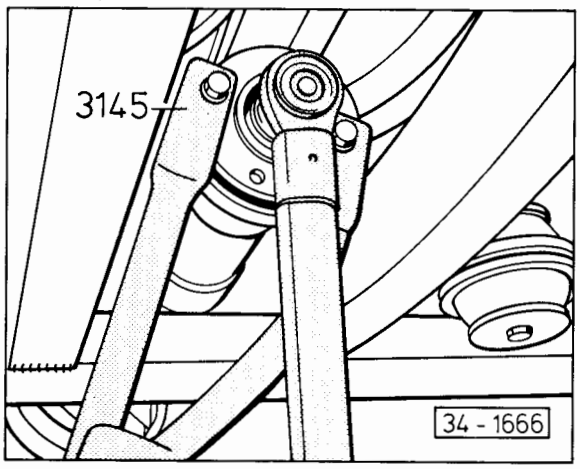


A – Slacken off the rear mounting bolts of front final drive but do not remove.

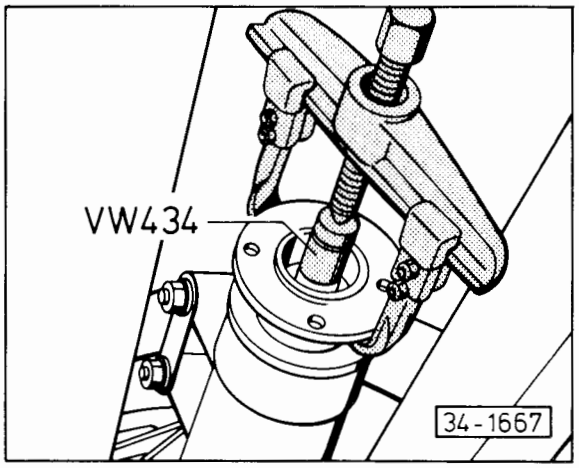
B – Slacken off the bolts at side of front final drive front mounting but do not remove.



– Detach propshaft at front/rear flange and tie up to skid rail.

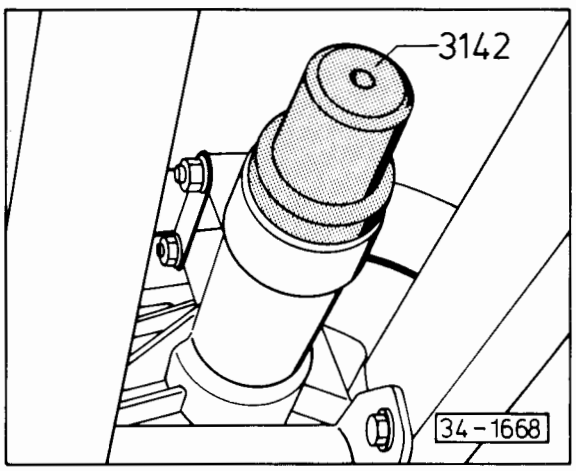


– Fit retainer on flange and remove hexagon nut.

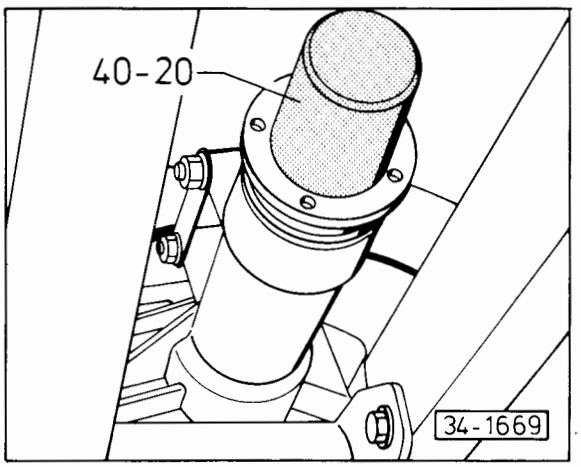


– If necessary, remove flange with two-arm puller.

– Lever out seal with VW 681.



– Drive seal in as far as possible.



– Drive flange into position.

– Install disc coupling.

- Fit retainer and tighten nut to 160 Nm.
- Reconnect propshaft and tighten nuts to 35 Nm.
- Tighten front final drive securing bolts to 45 Nm.
- Top up gearbox oil.

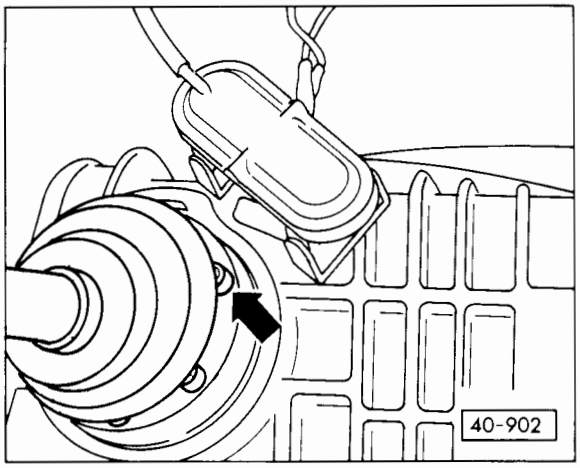
Tightening torques

Flange nut	160 Nm
Propshaft to gearbox	35 Nm
Gearbox mounting	45 Nm

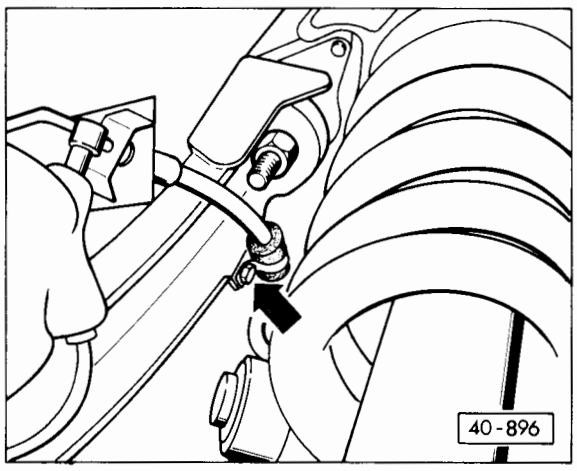
RENEWING DRIVE FLANGE OIL SEAL ON FRONT FINAL DRIVE

When both seals require renewing, it is advisable to remove and install the seals with the front final drive removed.
Removing and installing front final drive – see page 42.

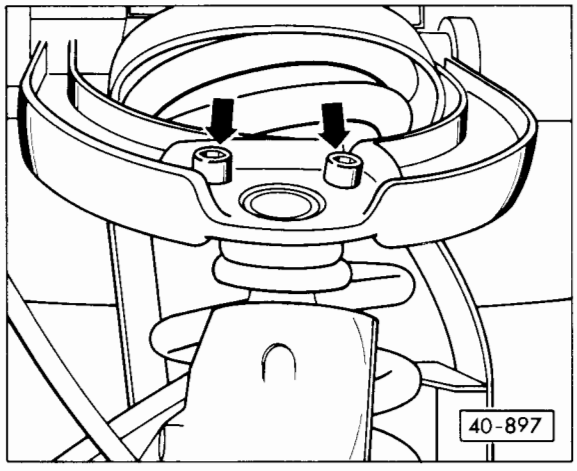
If only one seal has to be renewed, the front wheel suspension should be removed first as follows:



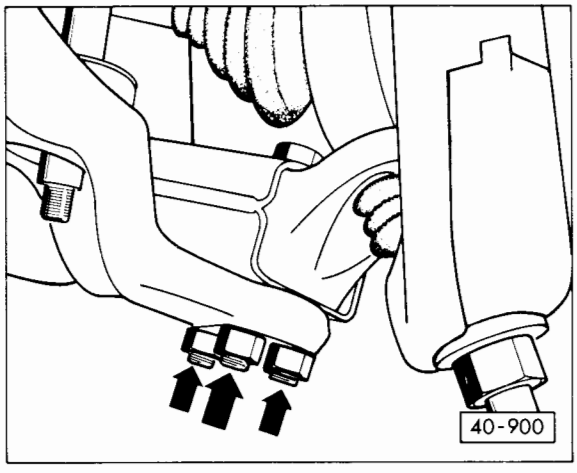
- Detach drive shaft from flange.
- Remove spacer.



- Detach brake hose bracket from wheel bearing housing.



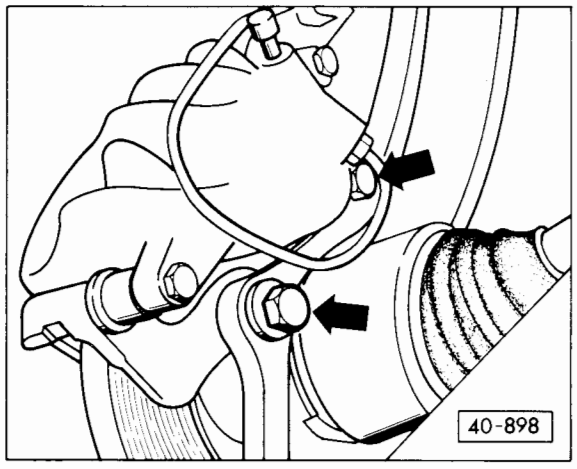
– Detach ball joints from wishbone.



– Separate radius rod, wheel bearing housing and wishbone connection.

– Take bolts out.

– Pull wheel bearing housing out complete with drive shaft.

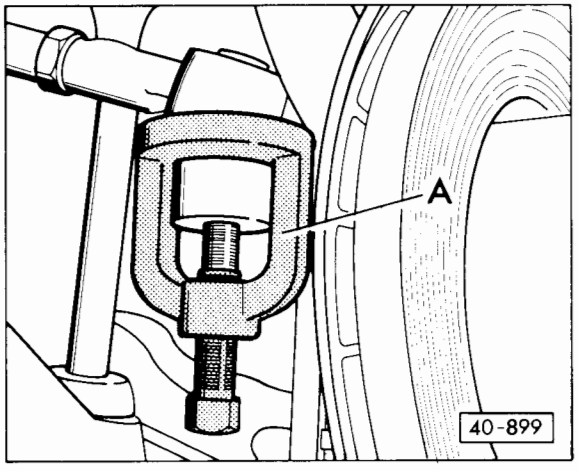


– Detach brake capliper and tie up to body-work with wire.

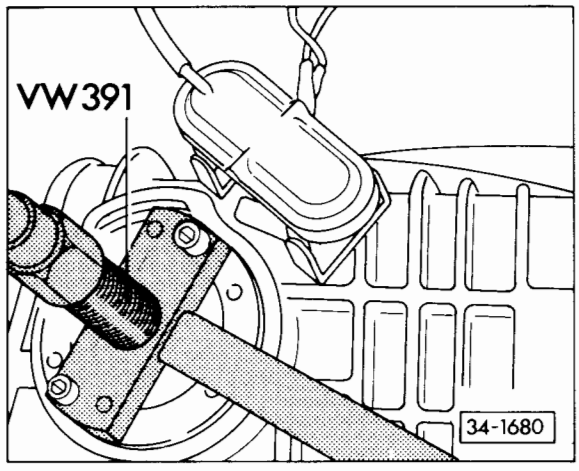
Removing oil seal

– Pierce cap in drive flange with screwdriver and lever out.

– Remove locking ring and dished washer.

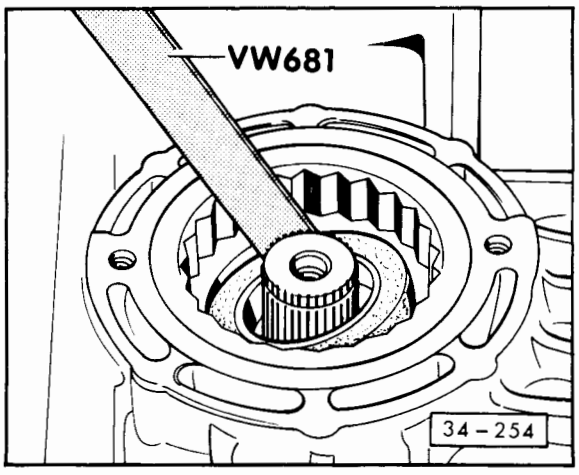


– Press off tie rod ball joint.
A = Tie rod puller, normal type, e. g. Kukko 128-0.



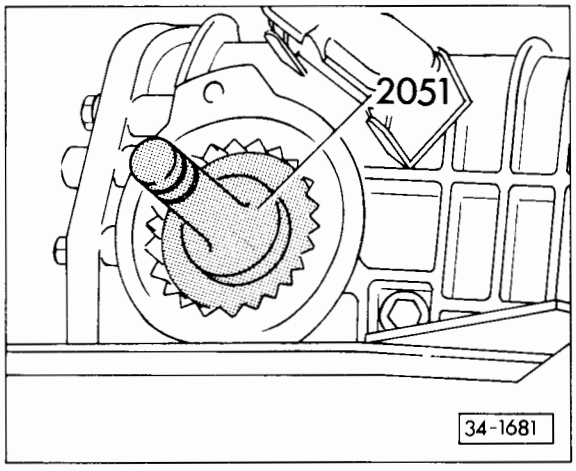
– Pull off drive flange.

– Unscrew locking cap.

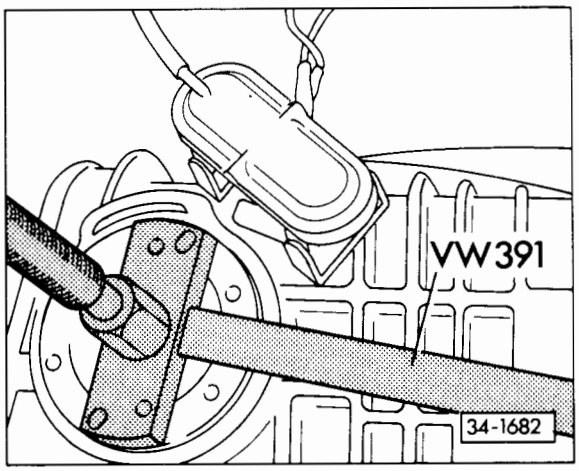


– Remove oil seal.

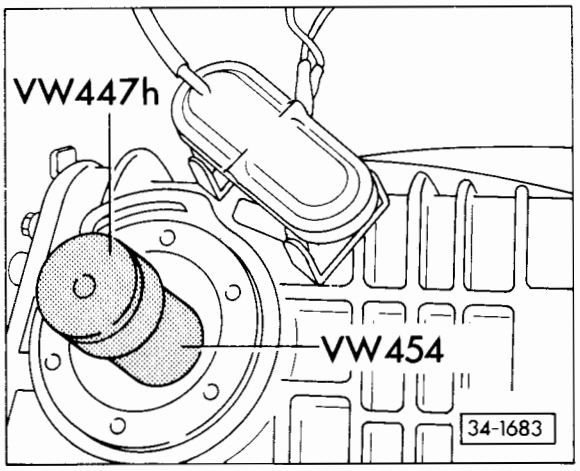
Installing seal



– Drive in new seal as far as possible.
– Install locking cap.



– Pull in drive flange.
– Install dished washer and locking ring.



– Press locking ring into groove, ensuring central location of dished washer.
– Press in new locking cap.

Installing suspension unit

– Install wheel bearing housing complete with drive shaft.
– Fit bolts for radius rod, wheel bearing housing and wishbone connection.

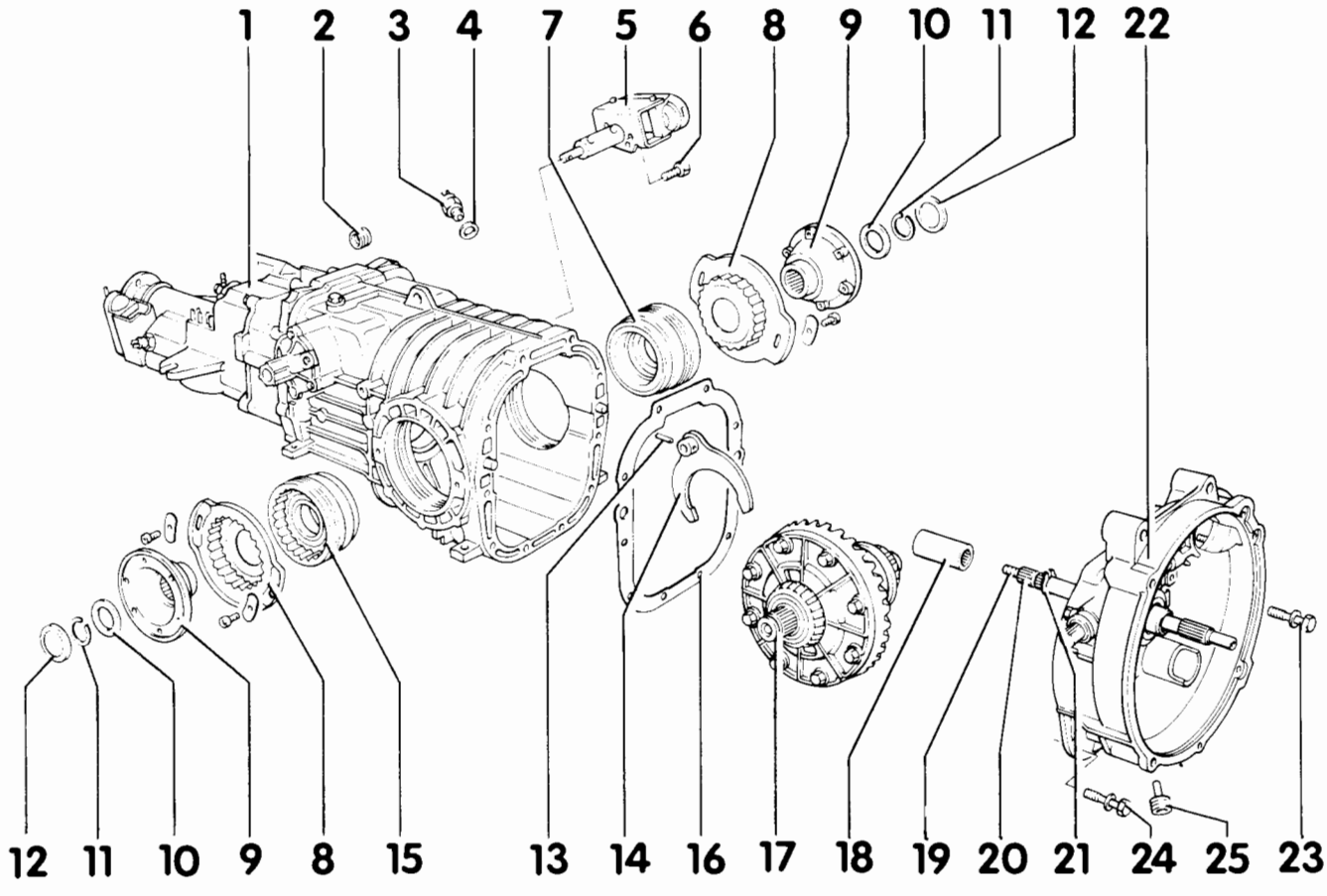
Important

Do not damage drive shaft boot.

– Install tie rod and brake caliper.
– Install upper ball joint on wishbone.
– Install brake hose bracket.
– Install drive shaft with spacer.
– Fit wheel.

Tightening torques

Radius rod, wheel bearing housing to wishbone	100 Nm
Brake caliper to wheel bearing housing	240 Nm
Wheel bolts	180 Nm
Drive shaft to gearbox	35 Nm
Ball joints to wishbone	60 Nm



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DISMANTLING AND ASSEMBLING GEARBOX

Removing and installing clutch housing/differential

Note:

Before starting the dismantling work, mount gearbox in repair stand (Fig. 1) and drain oil.

Important

Before removing and installing clutch housing, protect input shaft seal from damage by shaft splines. To do this, fit a piece of sleeving over the shaft.

1 **Gearbox housing with gear train, cross-country gear housing and output shaft housing**
- Removing and installing gear train – page 60

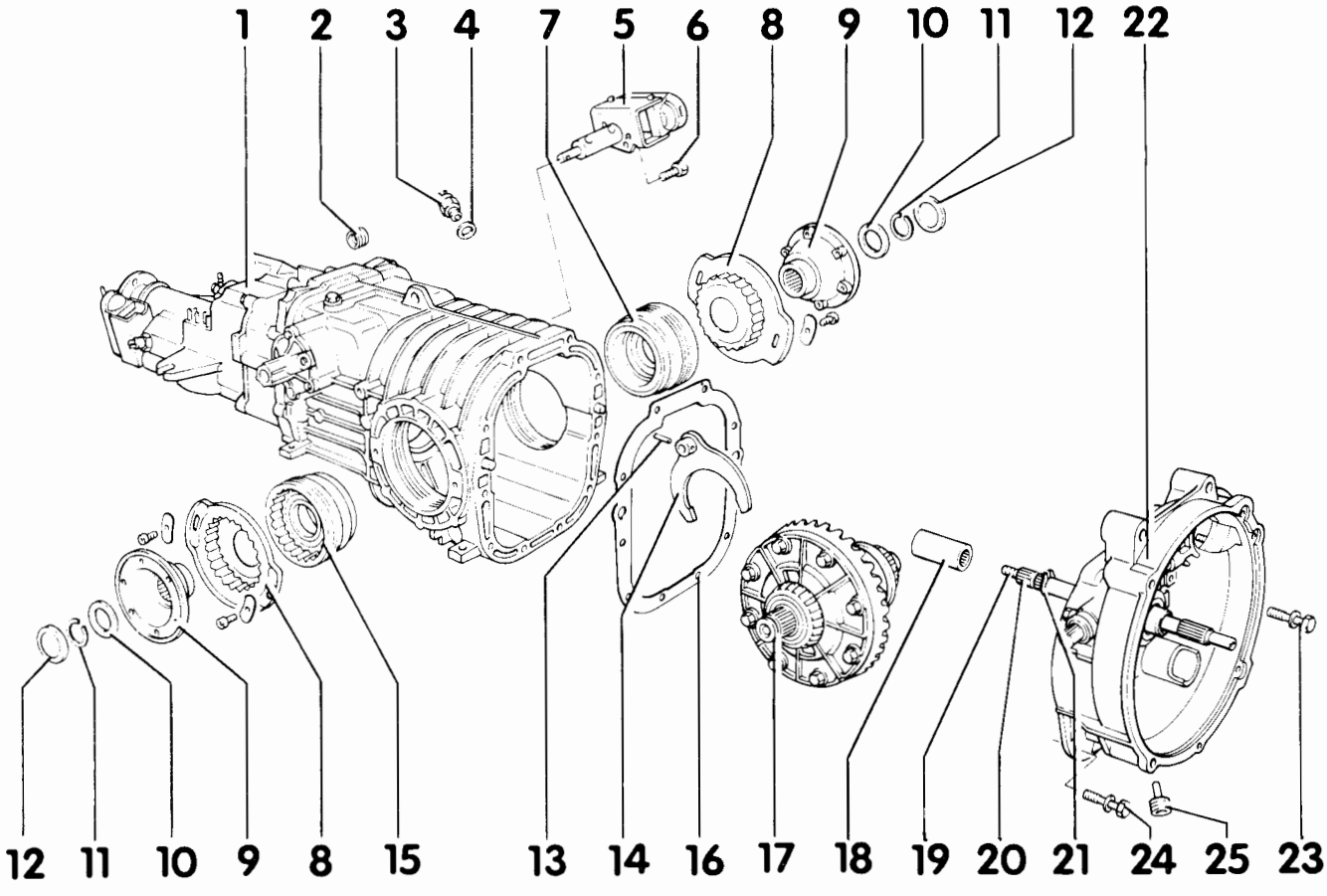
2 **Oil filler plug 20 Nm**

3 **Switch for warning lamp**

4 **O-ring**
- Renew
- Note thickness of O-ring

5 **Shift element**
- Installation position: Drilled hole points to switch for warning lamp
- Can be changed in situ

6 **Hexagon head bolt**



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7 Adjusting ring, right
- Mark before removing – Fig. 3
- Removing – Fig. 4
- Installing – Fig. 6
- Coat thread with MOS_2 grease
- Dismantling and assembling – pages 108 and 114
- Renew seal

8 Locking plate

9 Drive flange
- Pulling off – Fig. 2
- Installing – Fig. 7

10 Dished washer

11 Circlip
- Renewing, Installing – Fig. 8

12 Cap
- Renew

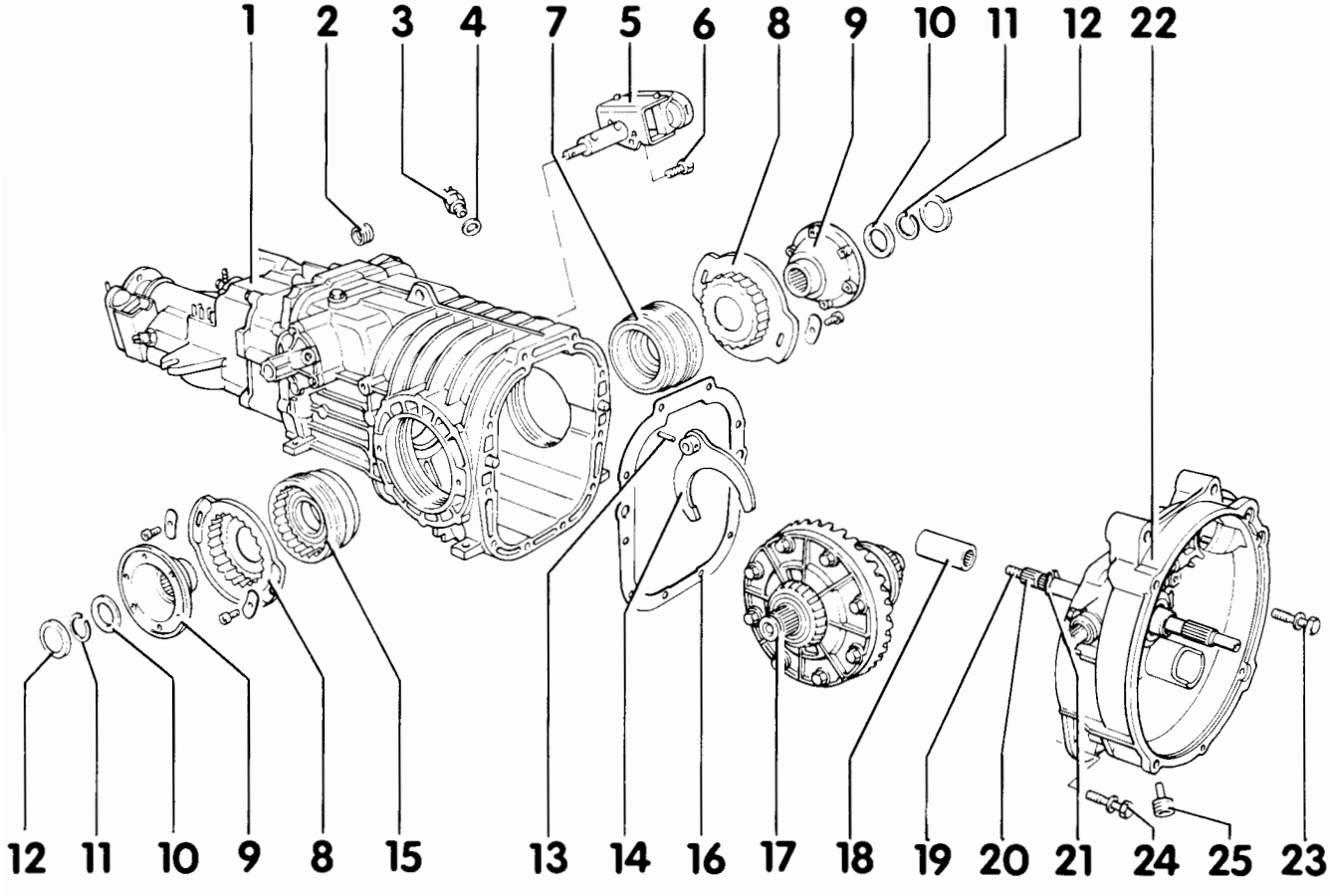
13 Spring pin
- Driving off – Fig. 5
- Renew

14 Selector fork

15 Adjusting ring, left
- Mark before removing – Fig. 3
- Removing – Fig. 4
- Installing – Fig. 6
- Coat thread with MOS_2 grease
- Dismantling and assembling – pages 108 and 114
- Renew seal

16 Gasket
- Renew

17 Differential
- **Before removing:** Remove adjusting rings, rear input shaft and selector fork for differential lock
- Dismantling and assembling with differential lock - page 114
- Dismantling and assembling without differential lock – page 106



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18 Connecting sleeve

19 Stud

20 Rear input shaft
- **Removing:** Remove circlip, push connecting sleeve back and screw shaft out
- **Installing:** Screw front and rear shafts together, then release one spline; push connecting sleeve on and fit new circlip in circular groove
- Watch different lengths – Fig. 9

21 Circlip
- Renew

22 Clutch housing
- **Before removing:** Loosen left final drive adjusting ring to relieve preload in gearbox housing. Mark position of adjusting ring beforehand – Fig. 3
  Repairing – page 80

23 Hexagon head bolt M 8 x 46
with washer (6)
20 Nm

24 Hexagon head bolt M 8 x 28
with washer (4)
20 Nm

25 Drain plug 20 Nm

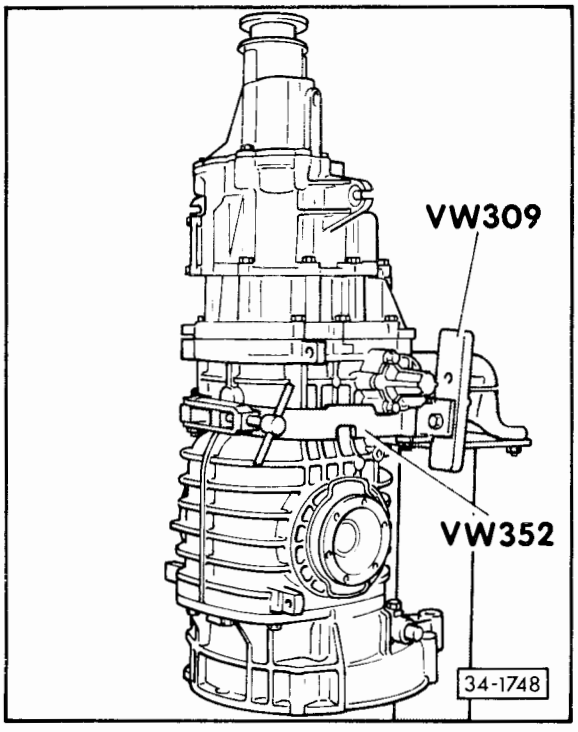


Fig. 1 Mounting gearbox in repair stand

Beforehand: Remove gearshift lever and switch for reversing light.

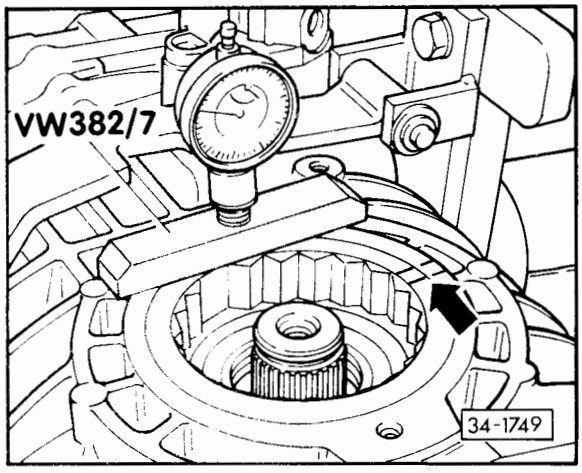


Fig. 3 Determining and marking position of adjusting ring

Before starting repair work which does not require the differential to be adjusted again afterwards, use a marking tool to mark the position (arrow) of the adjusting rings in the gearbox housing and measure the depth to which they are screwed in with VW 382/7 and record the readings.

Make one mark on the left side (crown wheel side) and two marks on right side.

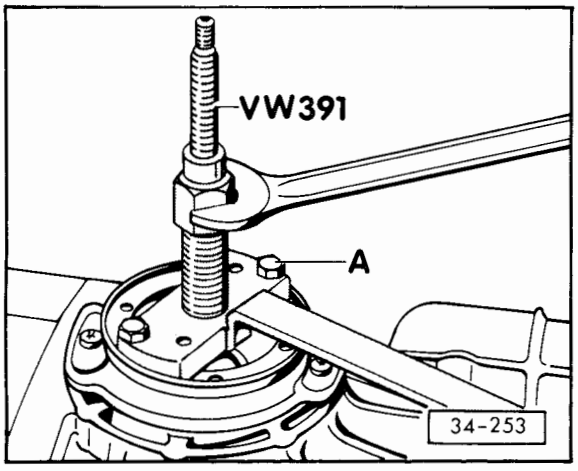


Fig. 2 Pulling drive flange out

A = Screw 2 bolts (M 8 × 30) through the slots into the flange.

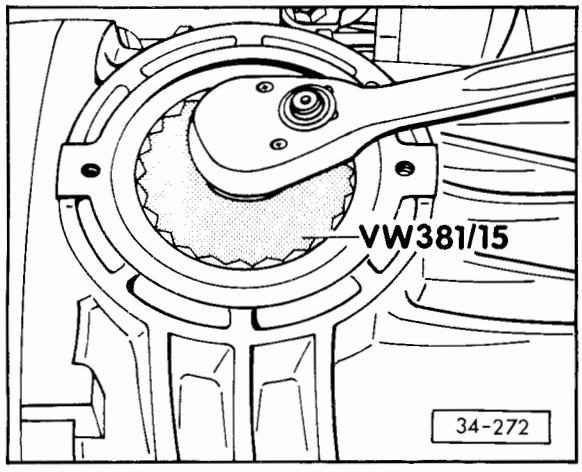


Fig. 4 Removing adusting rings

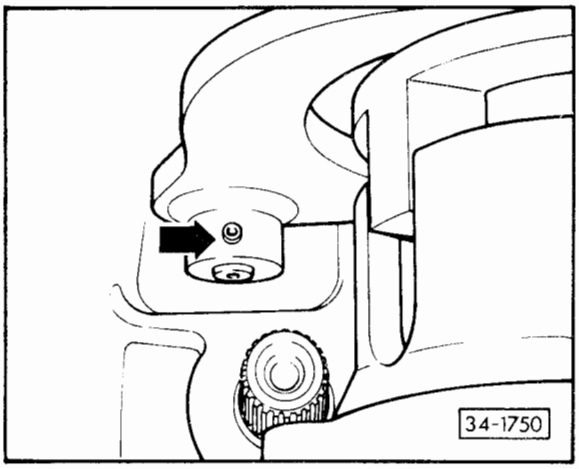


Fig. 5 Drive out spring pin on selector fork and pull shift element completely out of the selector fork

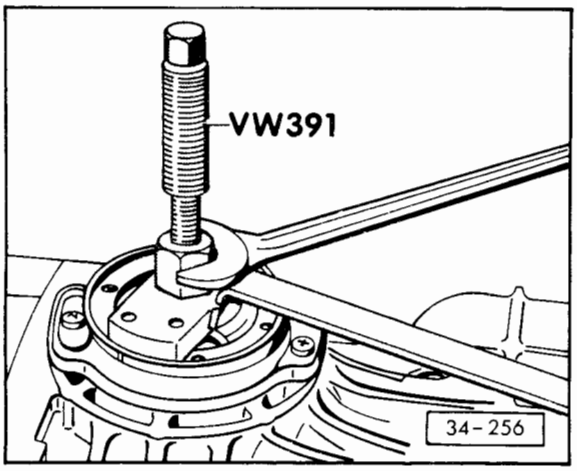


Fig. 7 Installing drive flange

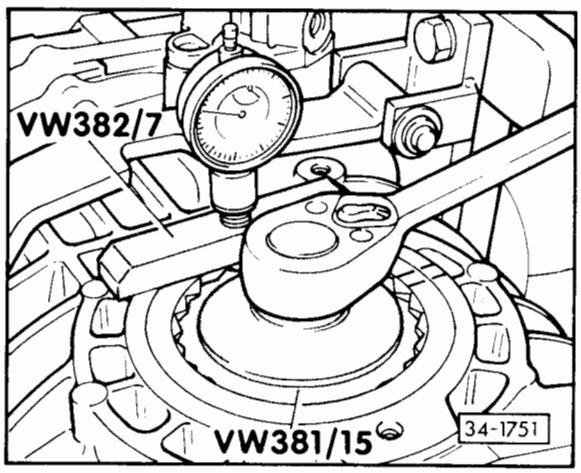


Fig. 6 Installing adjusting rings

Screw adjusting rings into gearbox housing **as previously marked** and set them to the marks made when removing and to the depth measured.

Important

Do not tighten the left-hand ring until the clutch housing has been fitted and the nuts tightened.

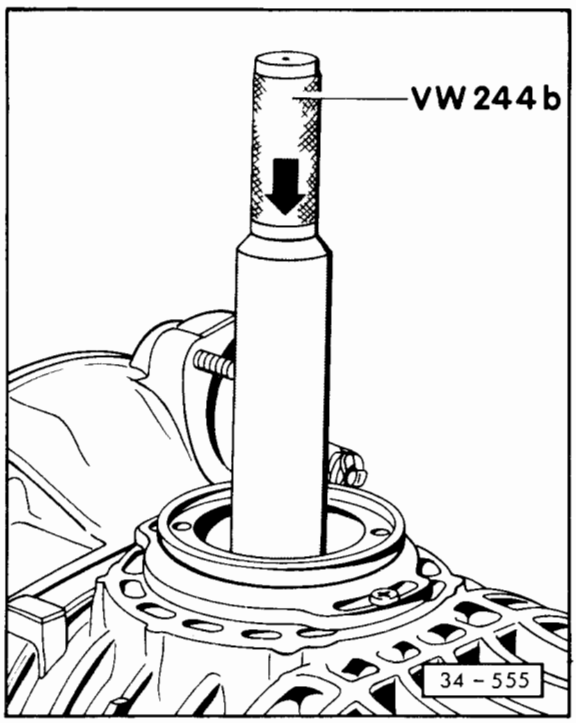


Fig. 8 Installing circlip

Install dished washer and circlip. Press circlip into groove and ensure that washer is central.

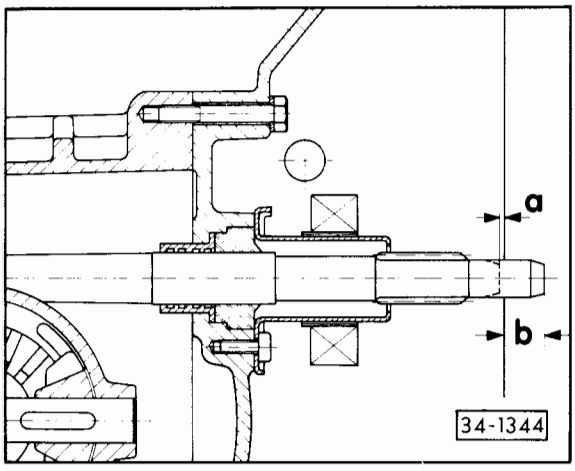
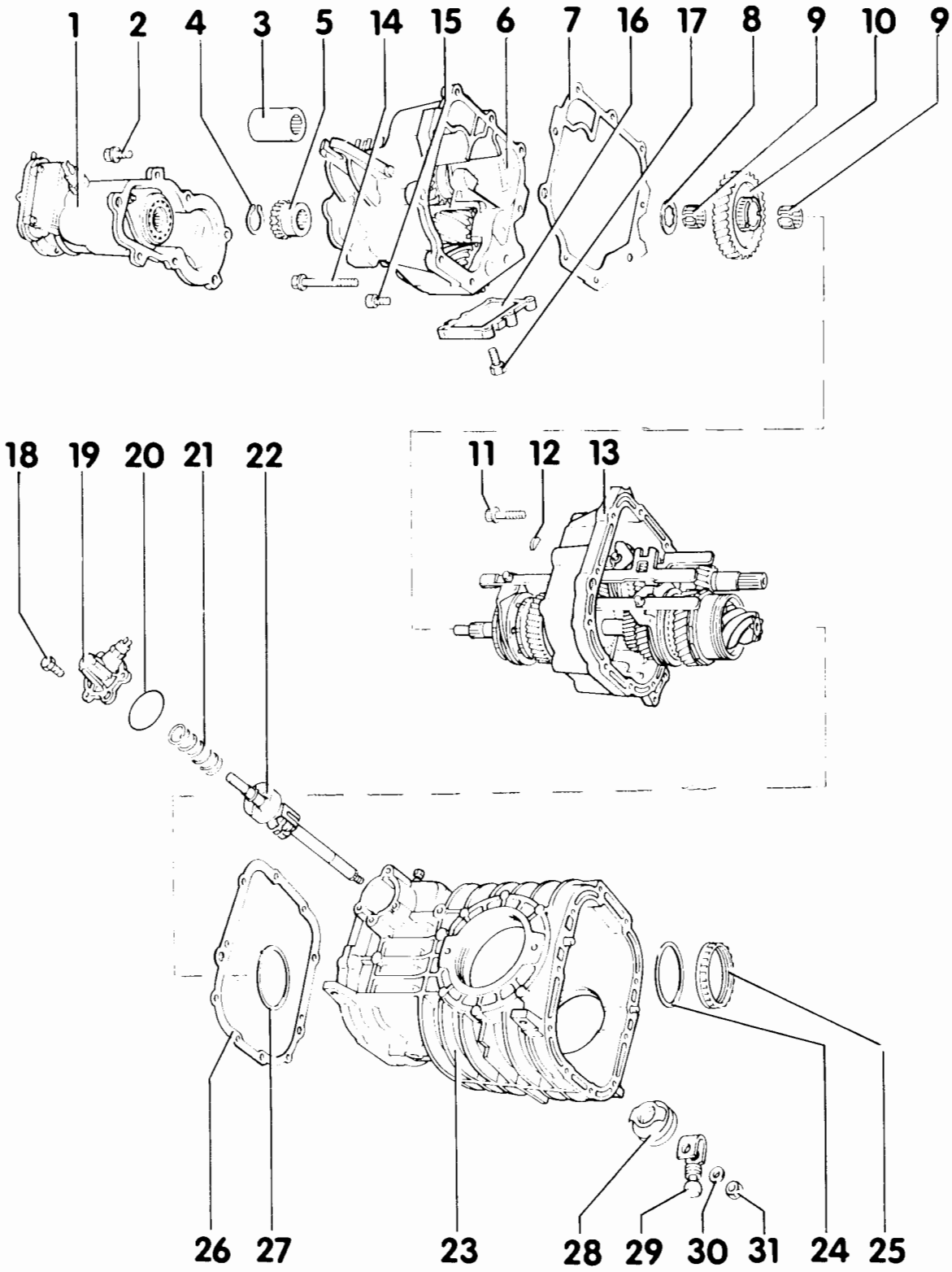


Fig. 9 Identification of rear input shaft

	Dim. a	Dim. b	Total length
Diesel engine	3 mm		287 mm
Petrol engine		27 mm	298 mm


1
2
4
3
5
14
15
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DISMANTLING AND ASSEMBLING GEARBOX

Removing and installing gear train

Important

If the double tapered roller bearing and/or the gearbox housing are to be replaced and deviation "r" is not marked on the crown wheel, the position of the pinion in relation to the housing must be measured and noted before the gear train is removed (actual dimension). On assembly the parts must be installed in the same position. Finding fitting position of pinion (actual dimension) – page 125

1 **Output shaft housing**
- Dismantling and assembling – page 66

2 **Hexagon head bolt** with washer **20 Nm**

3 **Connecting sleeve** (1)

4 **Circlip** (2)

5 **Synchronizer hub** (2)

6 **Cross-country gear housing**
- Dismantling an assembling – page 70

7 **Gasket**
- Renew

8 **Shim for cross-country gear**
- Determine thickness – page 64

9 **Needle bearing**
- Insert with gearbox oil

10 **Gear wheel for cross-country gear**

11 **Hexagon head bolt** with washer **20 Nm**

12 **Anti-rotation fitting for deep-groove ball bearing**
- To install, stick onto deep-groove ball bearing with grease

13 **Gear train**
- Dismantling and assembling – page 74

14 **Hexagon head bolt** with washer **20 Nm**

15 **Socket head bolt 20 Nm**

16 **Cover**

17 **Hexagon head bolt 10 Nm**

18 **Hexagon head bolt 15 Nm**

19 **Cover for gearshift shaft**

20 **Oil seal**
- Renew

21 **Spring**

22 **Gearshift shaft**
- Installation position: Slotted side of bracket towards differential

23 **Gearbox housing**
- Repairing – page 84

24 **Washer**

25 **Retaining ring**

26 **Gasket**
- Renew

27 **Shim S_3**
- Note thickness
- Adjustment table – page 125

28 **Boot**

29 **Lever for gearshift shaft**

30 **Washer**

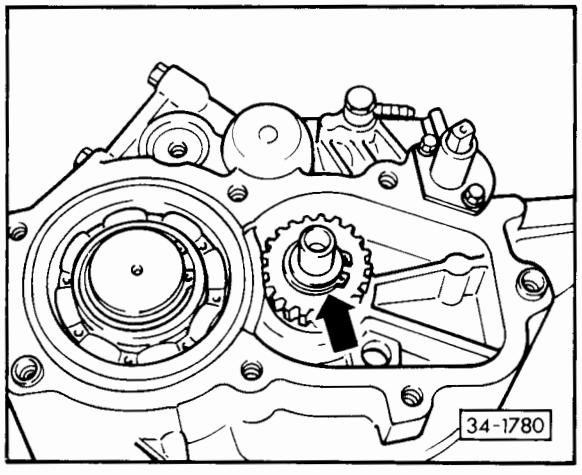
31 **Hex nut 25 Nm**

(1) Only on permanent 4WD
(2) Only on selectable 4WD

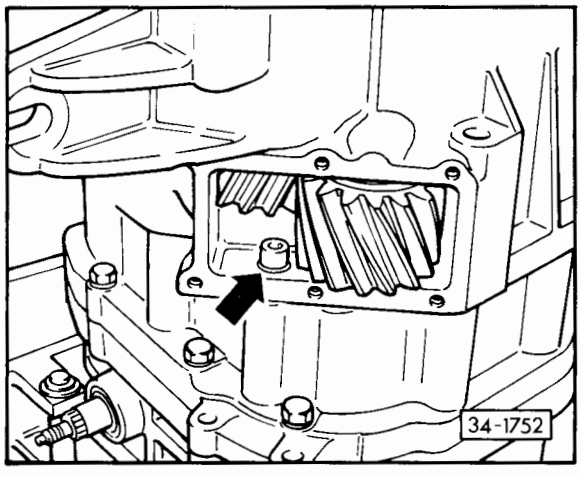
DISMANTLING AND ASSEMBLING GEARBOX

Dismantling

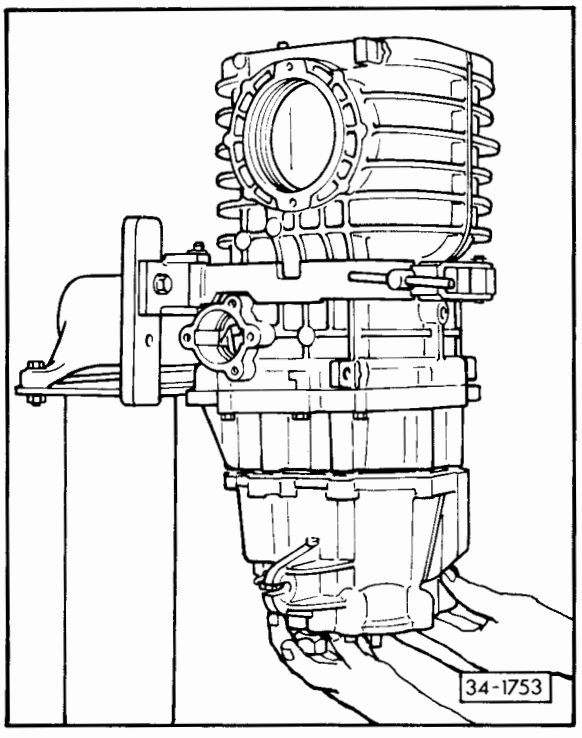
- Remove hexagon head bolts for output shaft housing.
- Remove housing.
- Take off connecting sleeve on gearbox with permanent 4WD



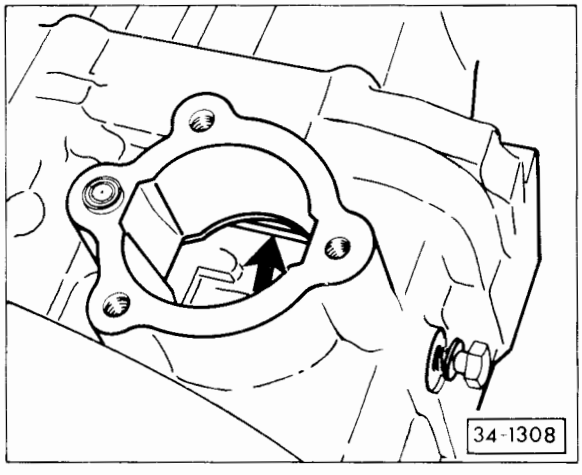
- On gearboxes with selectable 4WD, lift out circlip and remove synchronized hub from pinion.
- Remove cover for reverse idler gear.



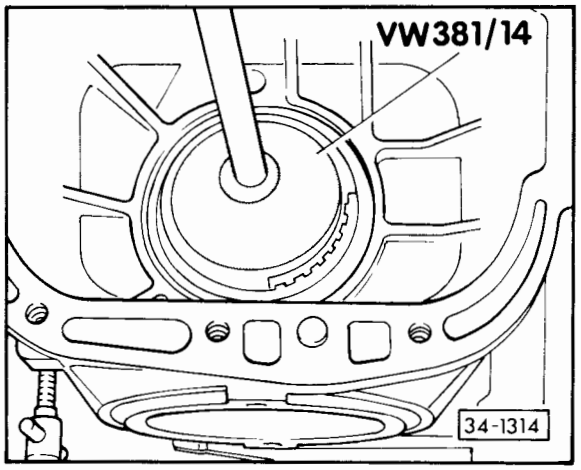
- Unscrew socket head bolt (arrow) and all hexagon head bolts on cross-country gearbox.



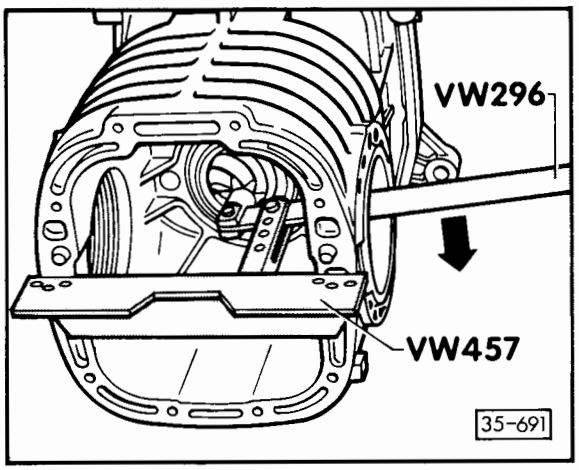
- Rotate gearbox 180 degrees and remove cross-country gear housing with gear wheel for cross-country gear, needle bearing and shim.
- Unscrew cover for gearshift shaft and remove gearshift shaft.



- Turn out screw until the relay lever (arrow) can be pulled against the housing.
- Turn in screw by hand and thus lock relay lever in position.



– Unscrew retaining ring.
– Unscrew bearing carrier from gearbox housing.



– Press out gear train.
Secure VW 457 with two bolts (M 8 × 20).
– Remove shim "S_3". Note thickness.

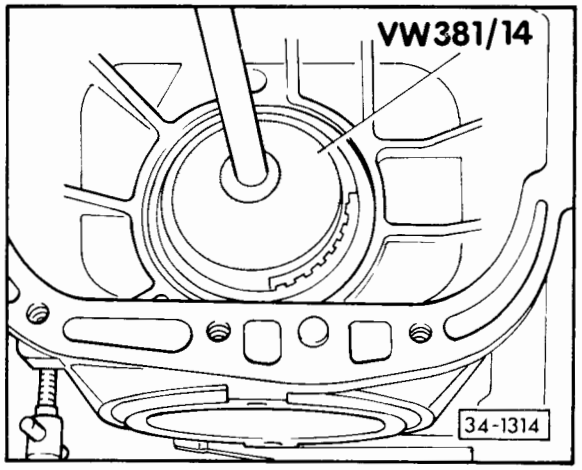
Assembling

Beforehand: Fit shim "S_3" and new seal. Align gearshift rails. Align double hex of double tapered roller bearing with recess in housing.

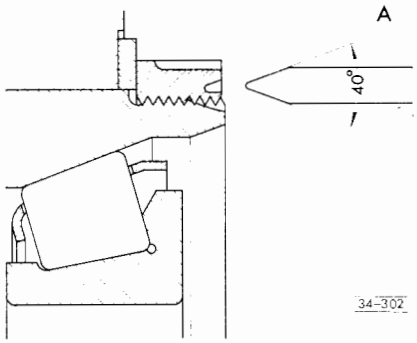
Before fitting the gear train, heat bearing seat of double taper roller bearing on gearbox housing to 40–60° C.

Drive gear train onto pinion by striking with a plastic hammer. Check free movement of parts.

– Fit washer and screw on retaining ring.

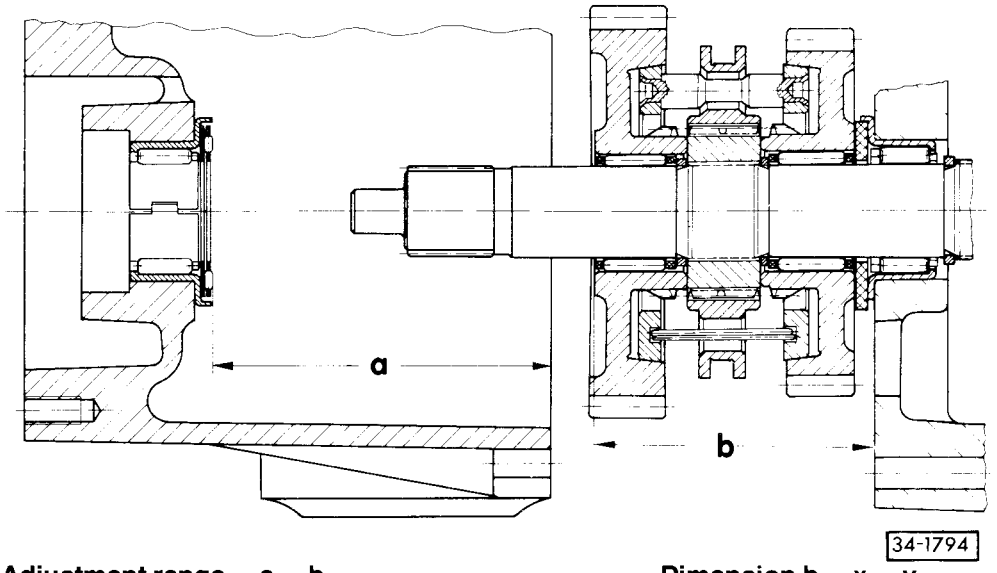


– Tighten retaining ring to 225 Nm, loosen and then finally tighten to 225 Nm.



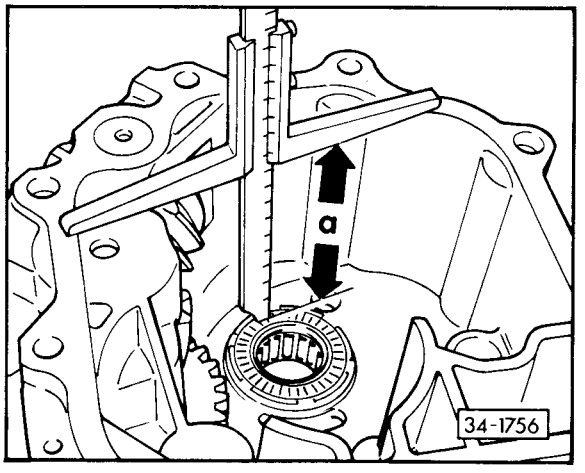
– Secure retaining ring at two points by peening.
A – Locally manufactured peening tool.
– Screw bearing carrier to gearbox housing.
– Loosen screw for relay lever, push relay lever in and tighten screw to 20 Nm.
– Install gearshift shaft.
Installation position: slotted side of bracket towards differential.
– Press new oil seal into the profile of the cover, place cover in position with spring and tighten screws to 15 Nm.

Determining thickness of shim for cross-country gear

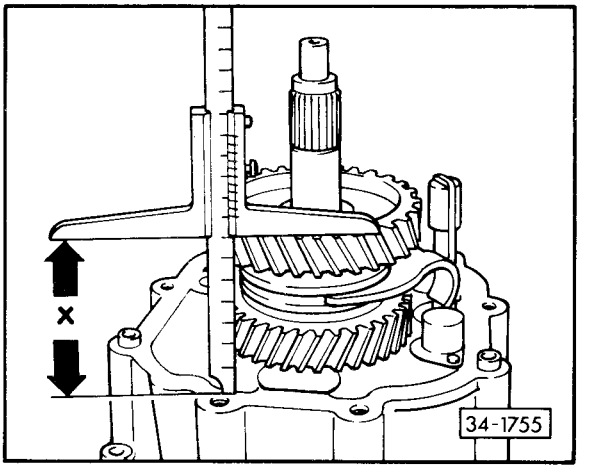


Adjustment range = a – b

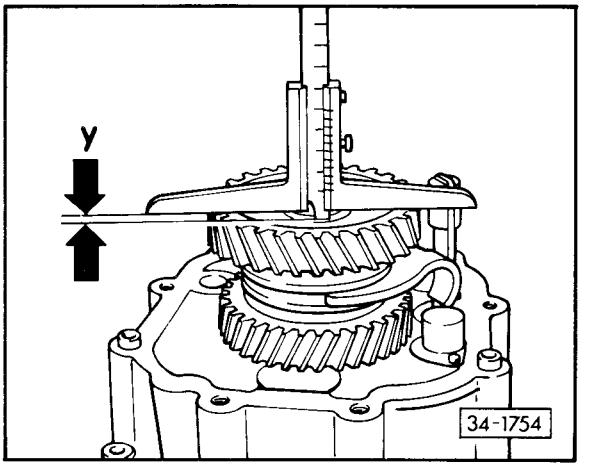
Dimension b = x – y



– Measure dimension "a".
Example: a = 77.8 mm



– Measure dimension "x".
Example: x = 77,6 mm



– Measure dimension "y".
Example: y = 1,0 mm

b = x – y

Example:

x = 77.6 mm
–y = 1.0 mm

76.6 mm

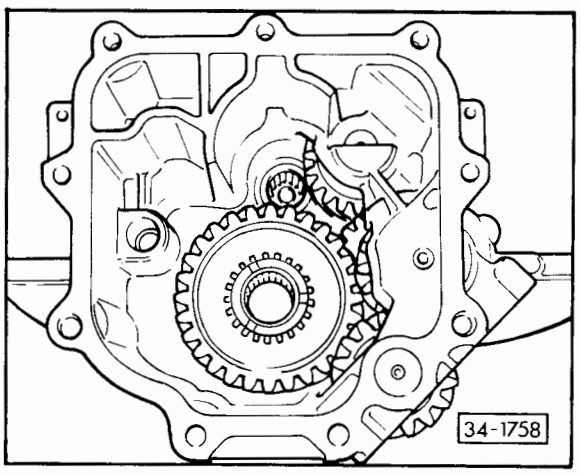
Adjustment range = a – b

a = 77.8 mm
–b = 76.6 mm

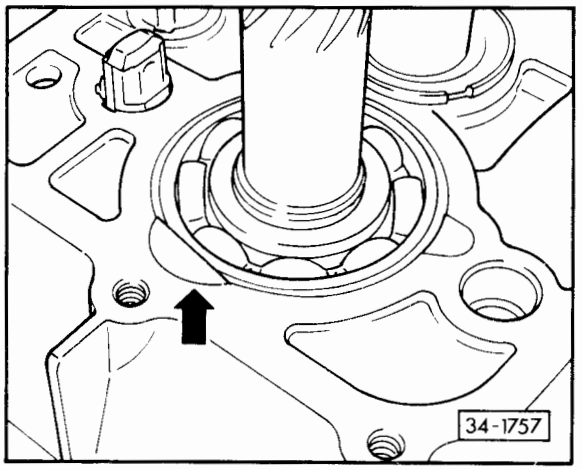
1.2 mm

Determining shim from table.

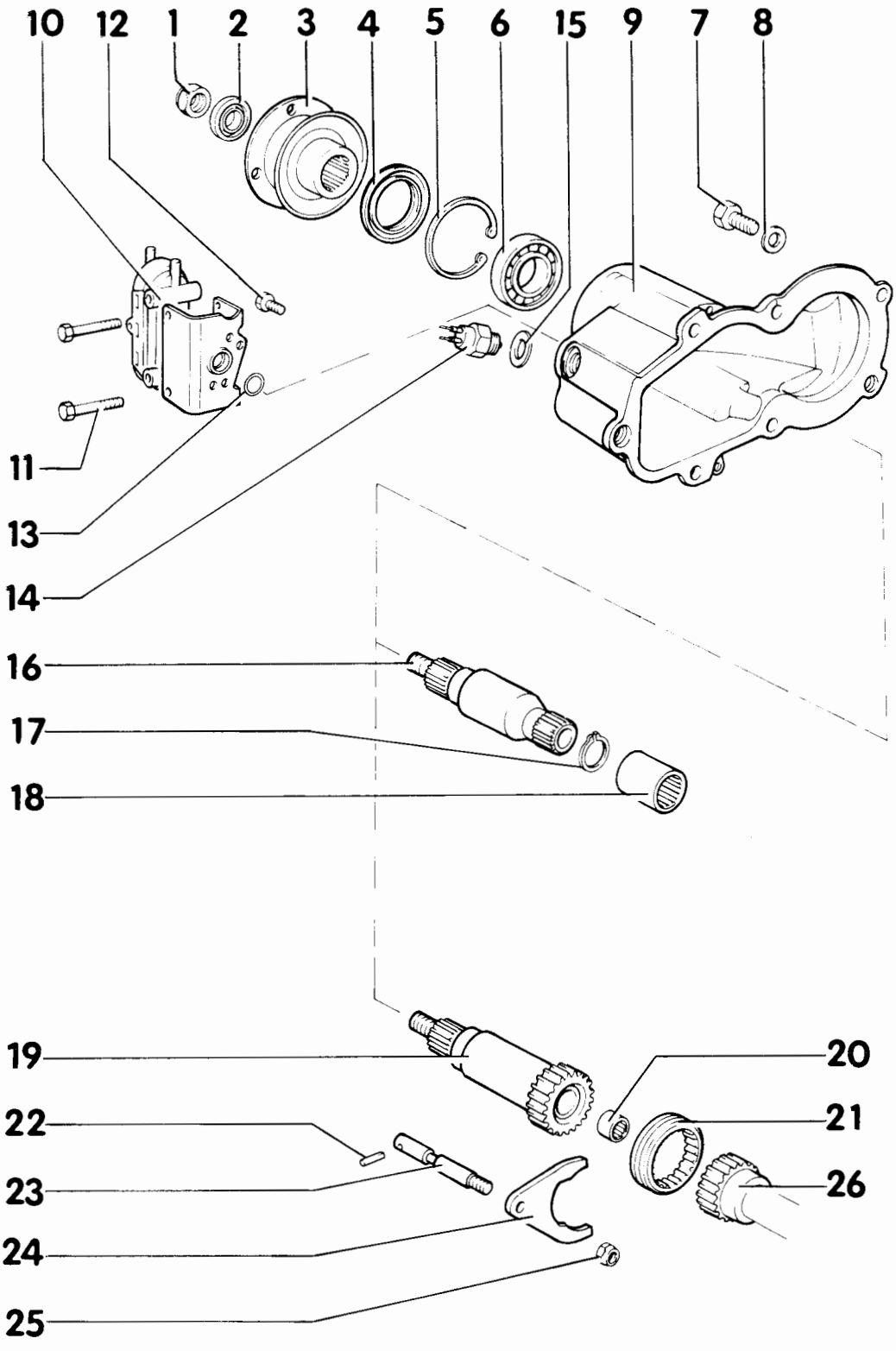
Adjustment range (mm)	Shim	Part No.
0.95 . . . 1.14	0.6	094 311 379
1.15 . . . 1.34	0.8	094 311 379A
1.35 . . . 1.54	1.0	094 311 379B
1.55 . . . 1.74	1.2	094 311 379C
1.75 . . . 1.94	1.4	094 311 379D
1.95 . . . 2.14	1.6	094 311 379E
2.15 . . . 2.47	1.8	094 311 379F



– Fit shim as calculated together with gear wheel for the cross-country gear with needle bearings into cross-country gear housing.
– Fit new oil seal.



– Before installing, grease anti-rotation fitting for input shaft deep-groove ball bearing.
– Turn gearbox through 180°.
– Slide on cross-country gearbox from below by guiding gear wheel and shim onto pinion.
– Screw on mounting nuts and tighten to 20 Nm.
– Install cover for reverse idler gear.
– On vehicles with permanent 4WD, push connecting sleeve onto pinion.
– Install output shaft housing and tighten bolts to 20 Nm.
– Fit switch for reversing lights and lever for gearshift shaft after releasing gearbox from repair stand.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34 - 1781

DISMANTLING AND ASSEMBLING GEARBOX

Dismantling and assembling output shaft housing

Note:

To take out cross-country gear housing, remove output shaft housing complete.

1 Hex nut 160 Nm
- Slackening and tightening – Fig. 2

2 Thrust washer

3 Flange for propshaft
- Removing – Fig. 3

4 Radial seal
- Renew
- Installing – Fig. 4

5 Circlip

6 Deep-groove ball bearing
- Press fully home – page 84

7 Hexagon head bolt 20 Nm

8 Washer

9 Output shaft housing

10 Shift element(2)
- Removing – Fig. 1

11 Hexagon head bolt (2)

12 Hexagon head bolt (2)

13 Oil seal (2)
- Renew

14 Switch for warning lamp (2)

15 Oil seal (2)
- Renew
- Note thickness

16 Input shaft (1)

17 Circlip (1)

18 Connecting sleeve (1)

19 Input shaft(2)

20 Needle bearing (2)
- Removing – Fig. 5
- Installing – Fig. 6

21 Shift sleeve (2)
- Installation position – Fig. 7

22 Spring pin (2)
- Renew

23 Shift rod (2)

24 Selector fork (2)

25 Hex nut 25 Nm (2)

26 Pinion

(1) Only on permanent 4WD
(2) Only on selectable 4WD

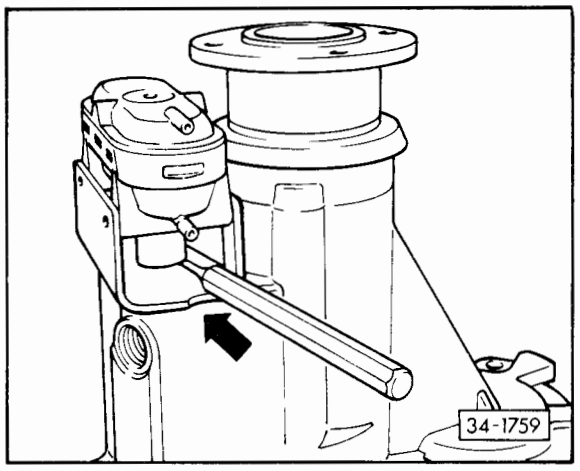


Fig. 1 Removing shift element

Push back shift element with hose and drive out spring pin.

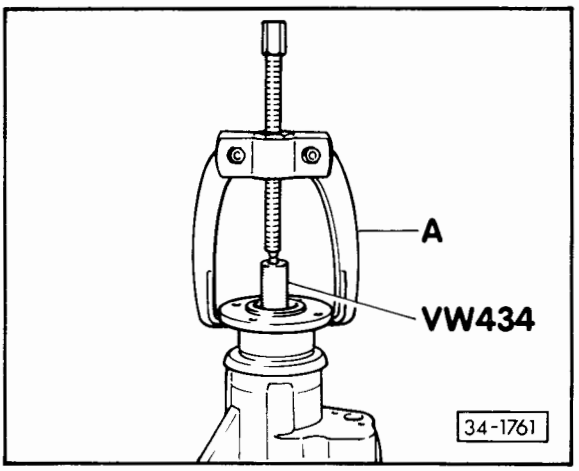


Fig. 3 Removing propshaft flange

If necessary, use two-arm puller to remove.

A – Two-arm puller, commercially available, e. g. Kukko 44-2.

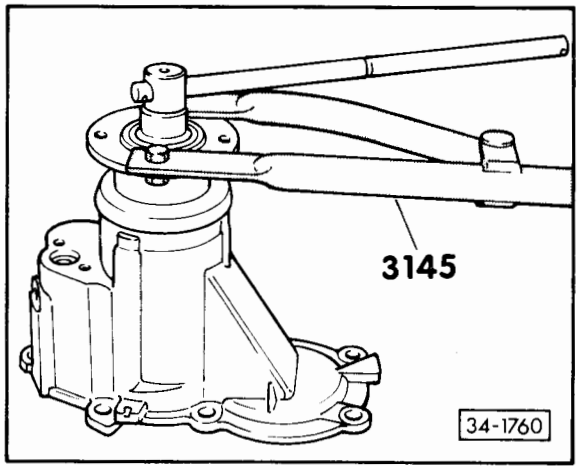


Fig. 2 Slackening and tightening hex nut

Hold flange with countering tool and unscrew/ tighten hex nut (160 Nm).

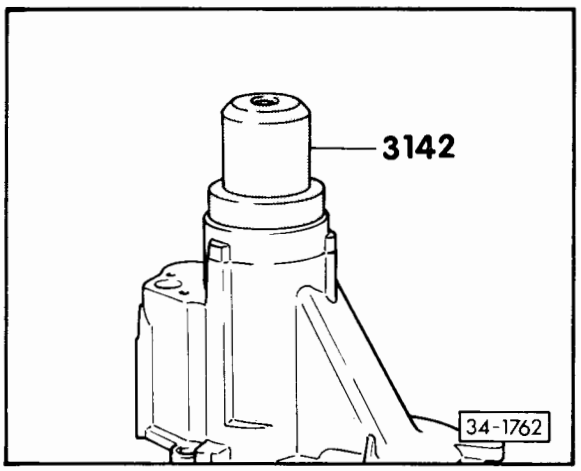


Fig. 4 Pressing radial seal fully home

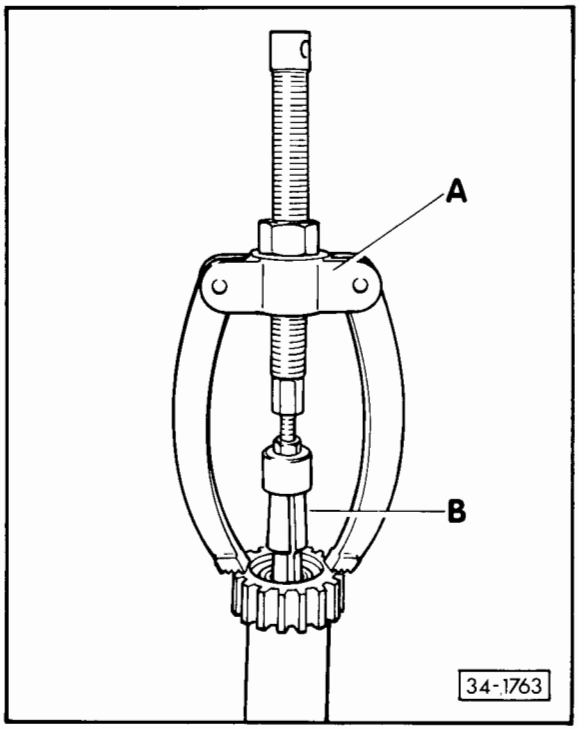


Fig. 5 Removing needle bearing

Pull out needle bearing.

A – Holder, e. g. Kukko 22-1
B – Internal puller 12–14.5 mm, e. g. Kukko 21/1

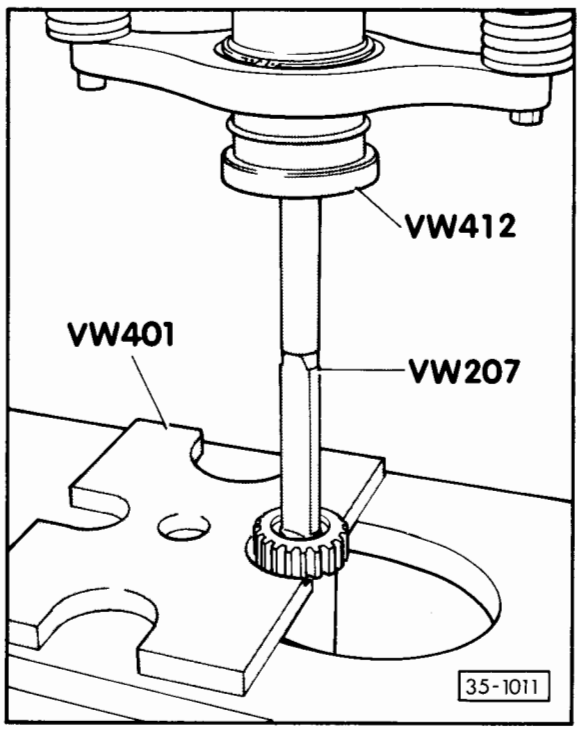


Fig. 6 Installing needle bearing

Press needle bearing fully home.

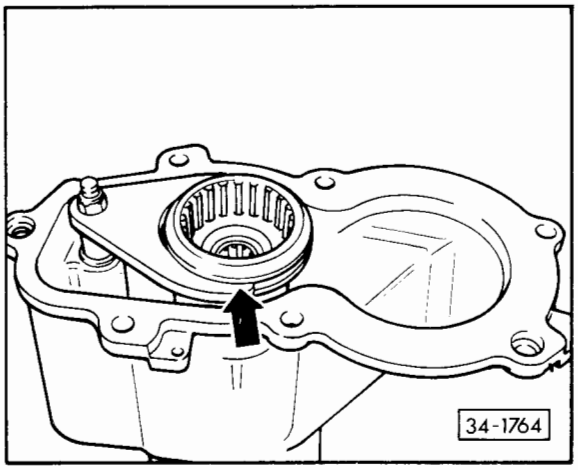
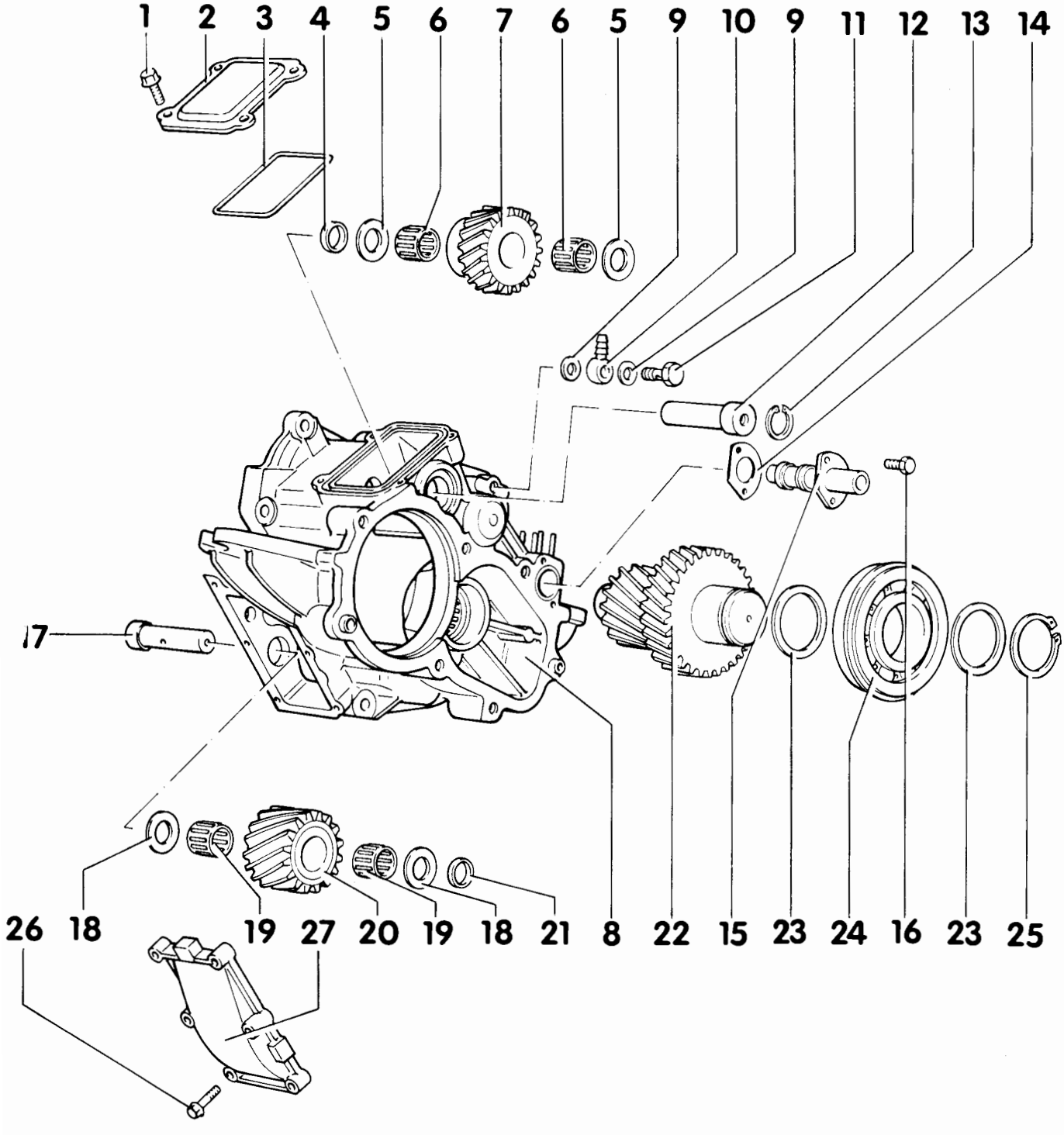


Fig. 7 Installation position of shift sleeve

The chamfer on the shift sleeve points upwards.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34 – 1782

DISMANTLING AND ASSEMBLING GEARBOX

Dismantling and assembling cross-country gear housing

1 **Hexagon head bolt 10 Nm**

2 **Cover**

3 **Gasket**
- Renew

4 **Rectangular ring**

5 **Thrust washer**

6 **Needle cage**
- Moisten with gear oil before fitting

7 **Idler gear for cross-country gear**
- Removing – Fig. 1

8 **Cross-country gear housing**
- Repairing – page 84

9 **0-ring**
- Renew

10 **Bleeder nozzle**

11 **Banjo bolt**

12 **Shaft for idler gear**

13 **Circlip**

14 **Oil seal**
- Renew

15 **Control plunger for selectable 4WD**
- Installation position of sealing diaphragms – Fig. 5
- Renew oil ring and sealing diaphragms

16 **Hexagon head bolt**

17 **Shaft for reverse idler gear**

18 **Thrust washer**

19 **Needle cage**
- Moisten with gear oil before fitting

20 **Reverse idler gear**
- Removing – Fig. 2
- Installing – Fig. 3

21 **Rectangular ring**

22 **Shaft gear**
- Driving out

23 **Supporting ring**

24 **Deep-groove ball bearing with circlip**
- Pressing off – Fig. 4

25 **Circlip**

26 **Hexagon head bolt 10 Nm**

27 **Cover**

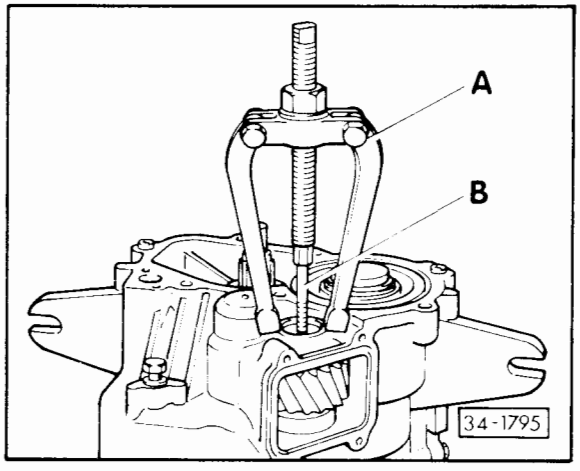


Fig. 1 Removing idler gear for cross-country gear

Pull out idler gear shaft.

A – Holder, e. g. Kukko 22-1 with
B – Reducing stud bolt M 5

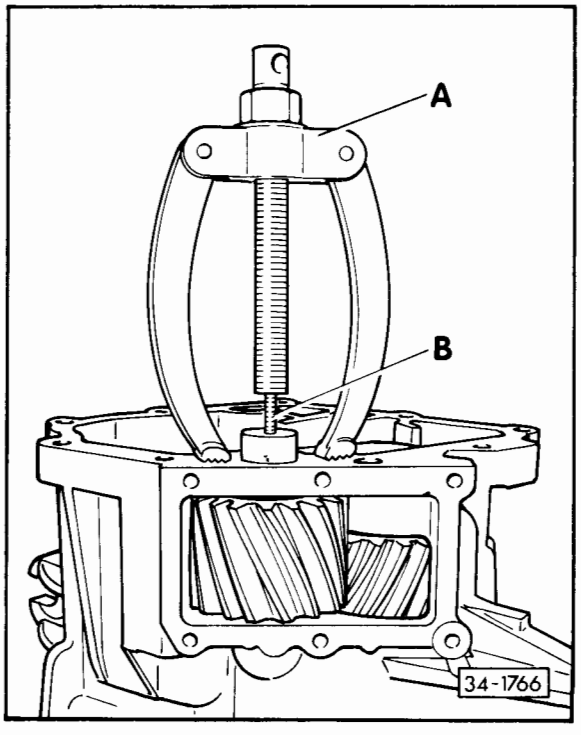


Fig. 2 Removing reverse idler gear

Pull out reverse idler gear shaft.

A – Holder, e. g. Kukko 22-1 with
B – Reducing stud bolt M 5

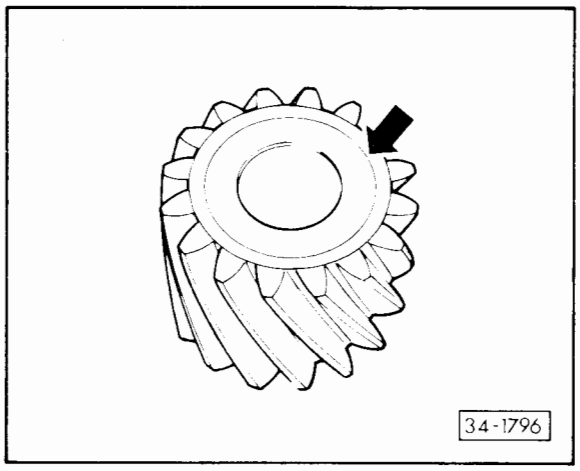


Fig. 3 Installing reverse idler gear

Installation position: Groove faces upwards

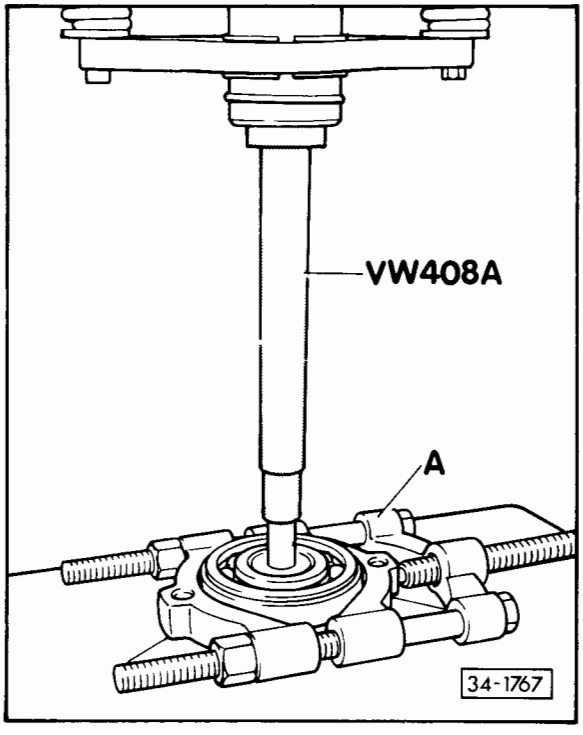


Fig. 4 Pressing off deep-groove ball bearing for shaft gear

Fit parting tool securely behind deep-groove ball bearing.

A – Parting tool, e. g. Kukko 15-15, size 2

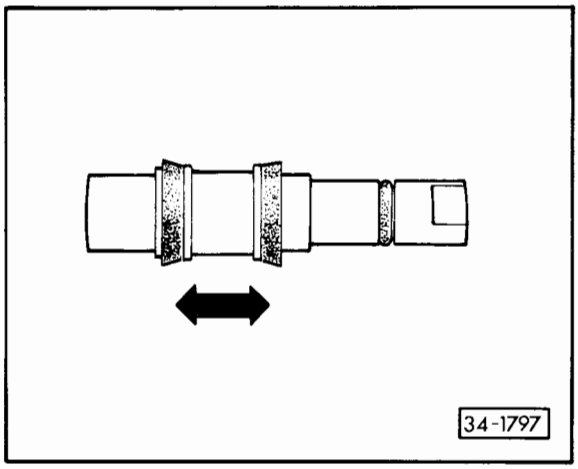
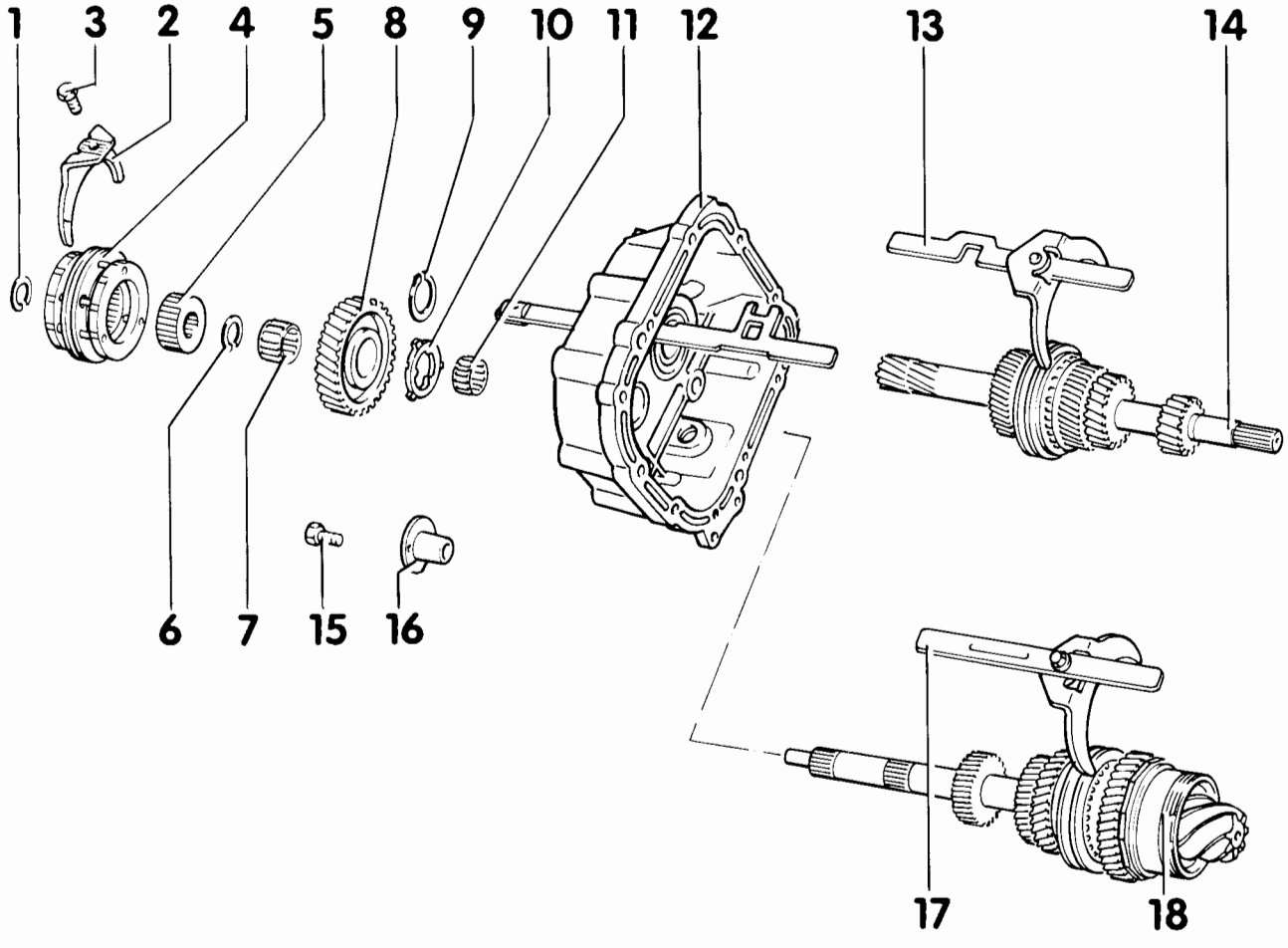


Fig. 5 Control valve for selectable 4WD

Installation position of diaphragms:
Sealing lips facing upwards in each case.



34 -1777

DISMANTLING AND ASSEMBLING GEARBOX

Dismantling and assembling gear train

1 **First circlip**
- Renew

2 **Selector fork**

3 **Hexagon head bolt 20 Nm**

4 **Synchronization for cross-country and reverse gears**
- Installation position: Molybdenum-coated synchronizer ring to gear wheel for cross-country gear

5 **Synchronizer hub**

6 **Second circlip**
- Renew

7 **Needle bearing**
- Moisten with gear oil before fitting

8 **Gear wheel for reverse gear**

9 **Circlip**

10 **Thrust washer**
- Calculate thickness – page 78

11 **Needle bearing**
- Moisten with gear oil before fitting

12 **Bearing carrier**
- Repairing – page 84

13 **Gearshift rail for 3rd and 4th gears**

14 **Input shaft**
- Dismantling and assembling – page 90

15 **Hexagon head bolt**

16 **Ball valve**

17 **Gearshift rail**
- For 1st and 2nd gears

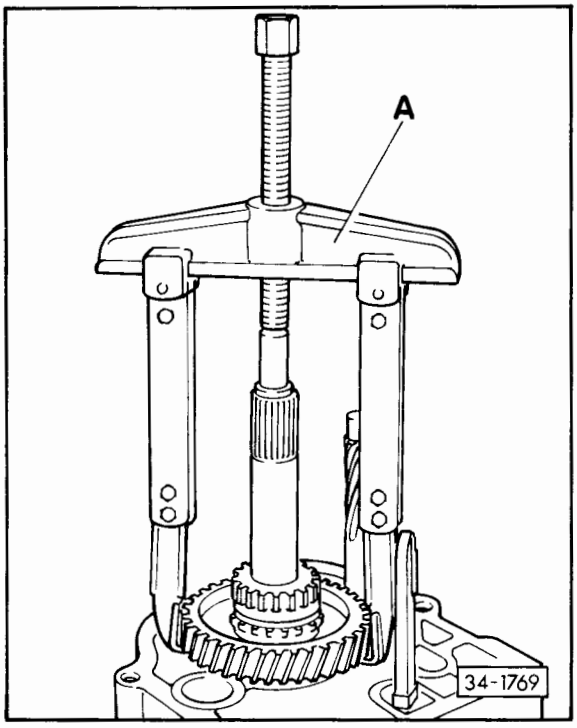
18 **Pinion**
- Dismantling and assembling – page 96

DISMANTLING AND ASSEMBLING GEARBOX

Dismantling and assembling gear train

Dismantling

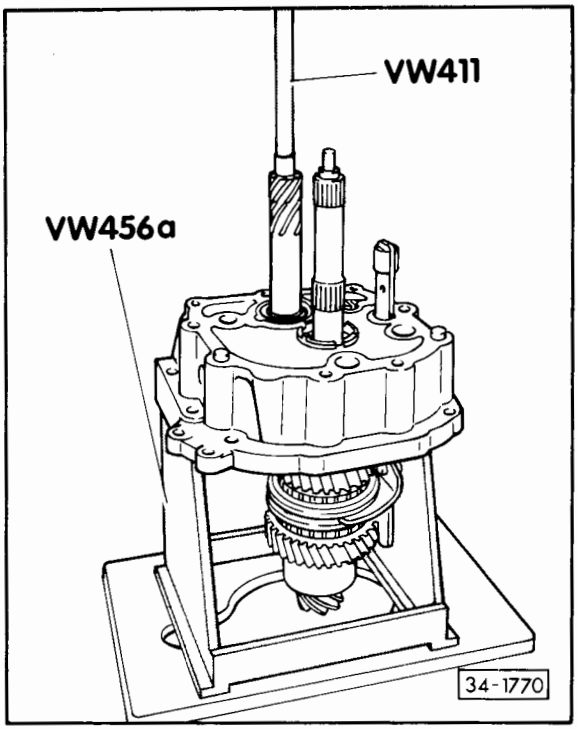
- Remove selector forks for cross-country and reverse gears.
- Take off synchronization for cross-country and reverse gears.
- Remove first circlip for synchronizer hub.



- Remove synchronizer hub with gear wheel for reverse gear.

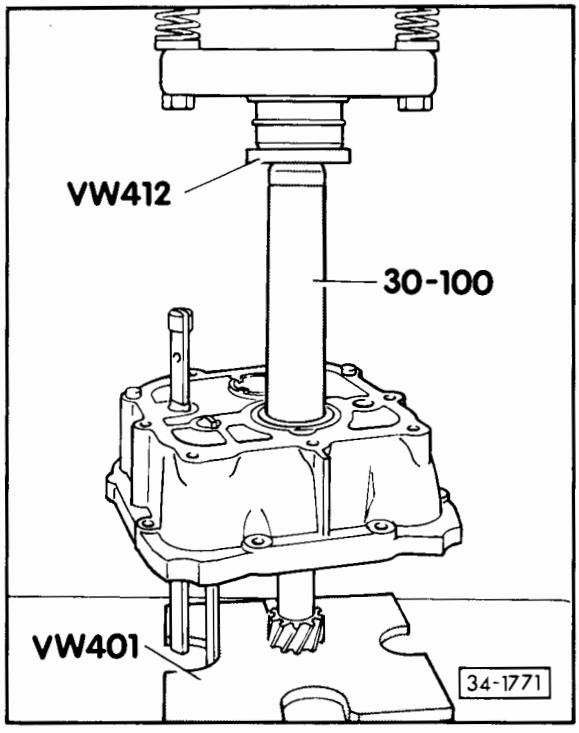
  A – Two-armed extractor, commercially available, e. g. Kukko 20/10.

- Remove second circlip, thrust washer and needle bearing.
- Remove circlip for input shaft.

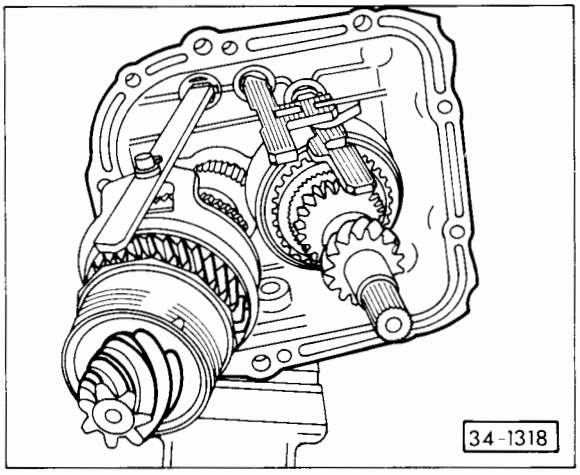


- Press out input shaft with pinion and gear-shift rails.

Assembling



- Press in input shaft with gearshift rails.

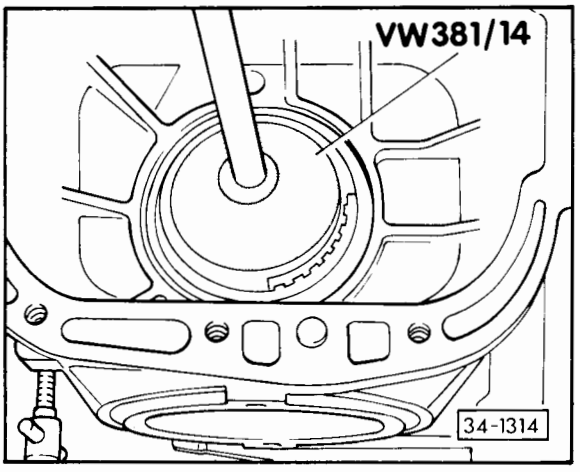


- Fit pinion with gearshift rail. To do this, engage 3rd gear.
- Put gearbox into neutral and fit needle bearing for pinion.
- Place circlip for input shaft in position.
- Install gear train.

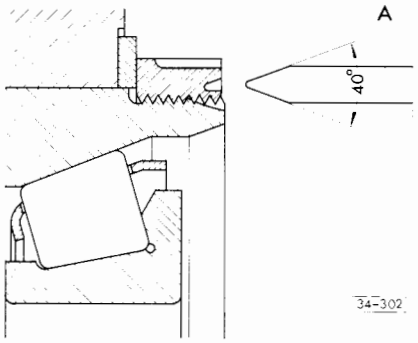
  Beforehand: Fit shim "S_3" and new gasket. Align gearshift rails. Align double hex of the double tapered roller bearing with recess in gearbox housing.

  Before fitting pinion, heat double tapered roller bearing seat to 40–60° C in gearbox housing.

  Drive gear train onto pinion by hitting with a plastic hammer. Check free movement of parts.

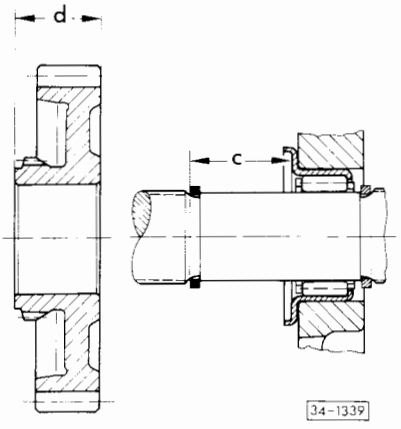


- Tighten retaining ring to 225 Nm, slacken and then finally tighten to 225 Nm.



- Secure retaining ring at two points by peening.
  A – Self-produced peening tool.
- Screw bearing carrier to gearbox housing.

Determining the thickness of thrust washer for reverse gear



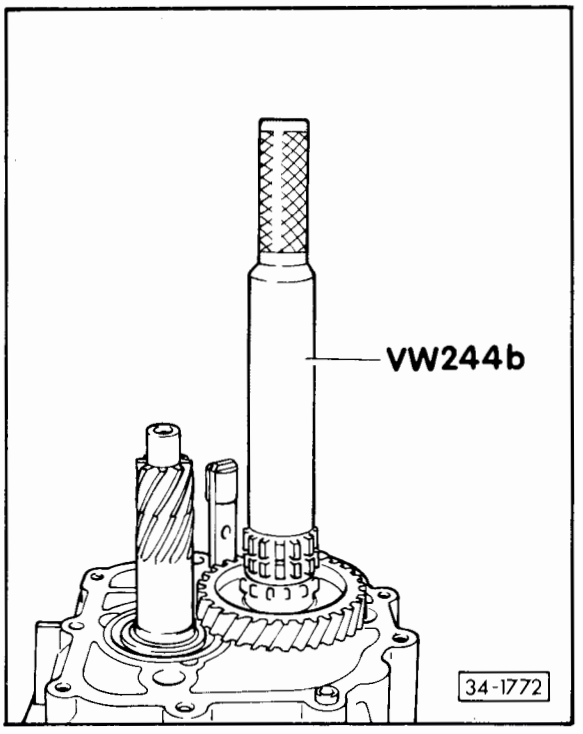
- Fit circlip and measure dimension "c". Example 29.1 mm.
- Measure dimension "d". Example 24.7 mm.

Dimension c	c = 29.1 mm
– Dimension d	– d = 24.7 mm
= Adjustment range	4.4 mm

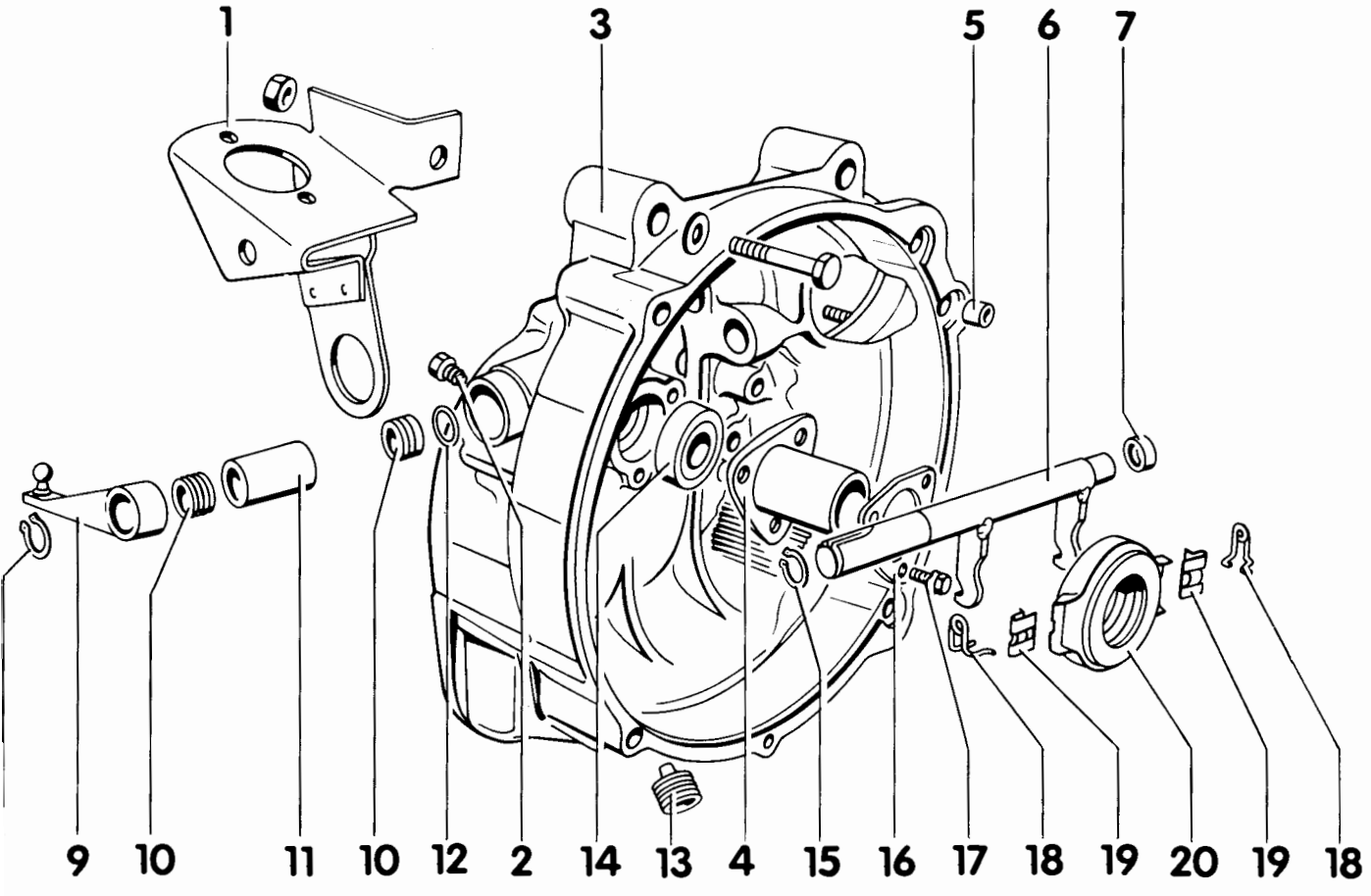
Determining thrust washer from table

Adjustment range (mm)	Part No.	Colour
3.97 . . . 4.19	091 311 379	white
4.20 . . . 4.39	091 311 379A	black
4.40 . . . 4.59	091 311 379B	green
4.60 . . . 4.90	091 311 379C	red

- Fit thrust washer determined, gear wheel for reverse gear with needle bearing and second circlip.



- Push on synchronizer hub.
- Fit first circlip.
- Fit synchromesh unit for cross-country and reverse gears with selector forks.
  Installation position: The molybdenum-coated synchronizer ring to gear wheel for cross-country gear.
- Secure selector fork on gearshift rail. Coat screw with D 6 and tighten to 20 Nm.



35 -1013

DISMANTLING AND ASSEMBLING GEARBOX

Repairing clutch housing

1 **Operating cylinder bracket**

2 **Retaining screw 15 Nm**

3 **Clutch housing**

4 **Guide sleeve**
- Lubricate metal sleeve with MOS_2 grease
- Do not grease plastic sleeve

5 **Starter bush**
- Pulling out – Fig. 3
- Driving in – Fig. 4
- Can be renewed with gearbox installed

6 **Release shaft**
- Lubricate with multi-purpose grease

7 **Bush**
- Removing and installing – page 16

8 **Circlip**

9 **Clutch lever**
- Lightly grease ball

10 **Rubber bush**

11 **Bearing sleeve**

12 **Washer**

13 **Drain plug 20 Nm**

14 **Input shaft oil seal**
- Pulling out – Fig. 1
- Driving in – Fig. 2
- Fill space between lips with multi-purpose grease

15 **Circlip**
- Renew

16 **Metal ring**
(only on plastic sleeve)

17 **Hexagon head bolt 15 Nm**

18 **Retaining spring**

19 **Retaining clip**

20 **Release bearing**
- Do not wash, only wipe with dry cloth

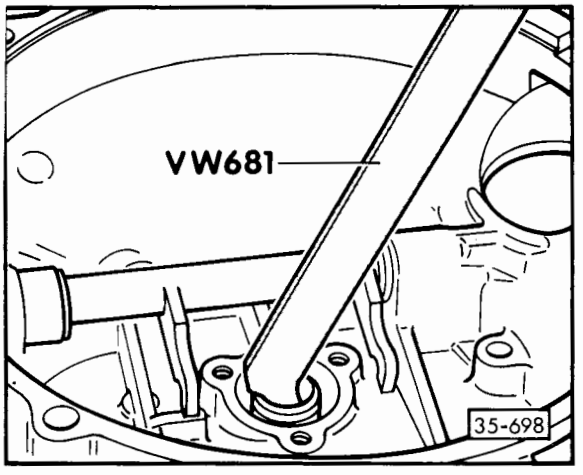


Fig. 1 Removing input shaft oil seal

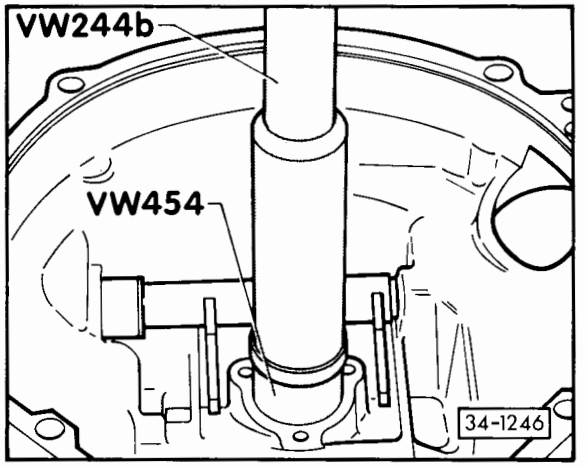


Fig. 2 Knocking input shaft oil seal in

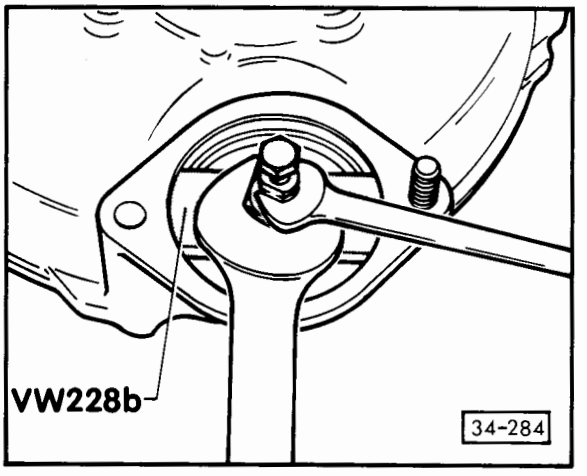


Fig. 3 Removing starter bush (gearbox installed)

When gearbox has been removed, use drift VW 222a.

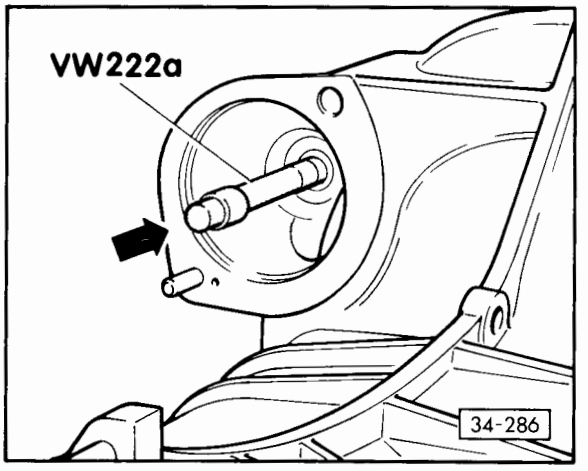
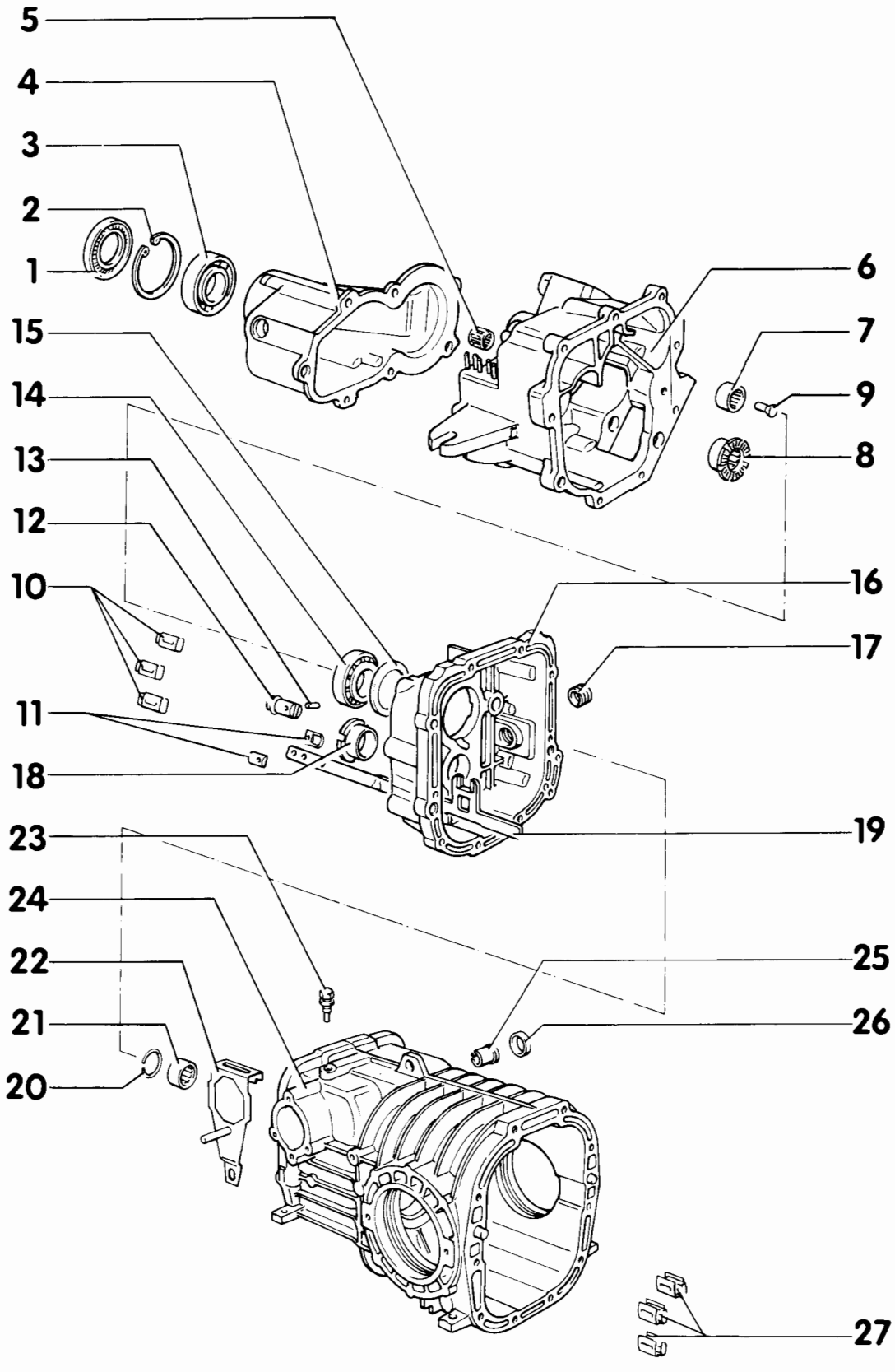


Fig. 4 Knocking in starter bush flush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DISMANTLING AND ASSEMBLING GEARBOX

Repairing housing

1 **O-ring**
- Installing – Fig. 7

2 **Circlip**

3 **Deep-groove ball bearing**
- Removing – Fig. 1
- Installing – Fig. 2

4 **Output shaft housing**

5 **Needle bearing for shaft gear**
- Removing – Fig. 8
- Installing – Fig. 9

6 **Cross-country gear housing**

7 **Needle bearing for input shaft**
- Removing and installing – page 90

8 **Bearing for pinion**
- Removing and installing – page 96

9 **Rivet**

10 **Gearshaft rail bearing**
- Removing and installing – Fig. 5

11 **Bearing shells**
(Only on permanent 4WD)
- Unclip to remove the gearshift rail

12 **Bearing piston**
(Only on selectable 4WD)
- To remove gearshift rail, drive out spring pin
- Note installation position of sealing diaphragm – Fig. 6

13 **Spring pin**
- Renew

14 **Deep-groove ball bearing for input shaft**
- Removing and installing – page 90

15 **L-ring**

16 **Bearing carrier**

17 **Oil filler plug 20 Nm**

18 **Bearing outer race/needle bearing for pinion**
- Removing and installing – page 96

19 **Gearshift rail for cross-country and reverse gears**

20 **Circlip for needle bearing**

21 **Needle bearing for input shaft**
- Removing and installing – page 90

22 **Relay lever for 2nd and 3rd gears**

23 **Retaining screw for relay lever 20 Nm**

24 **Gearbox housing**
- If renewed: adjust pinion to position measured before removal (actual dimension) – page 125
- Adjusting crown wheel – page 129

25 **Bush**
- Installation position: Lug to bearing carrier

26 **Oil seal for gearshift shaft**
- Removing – Fig. 3
- Pressing in – Fig. 4
- Can be renewed with gearbox installed

27 **Gearshift rail bearing**
- Removing and installing – Fig. 5

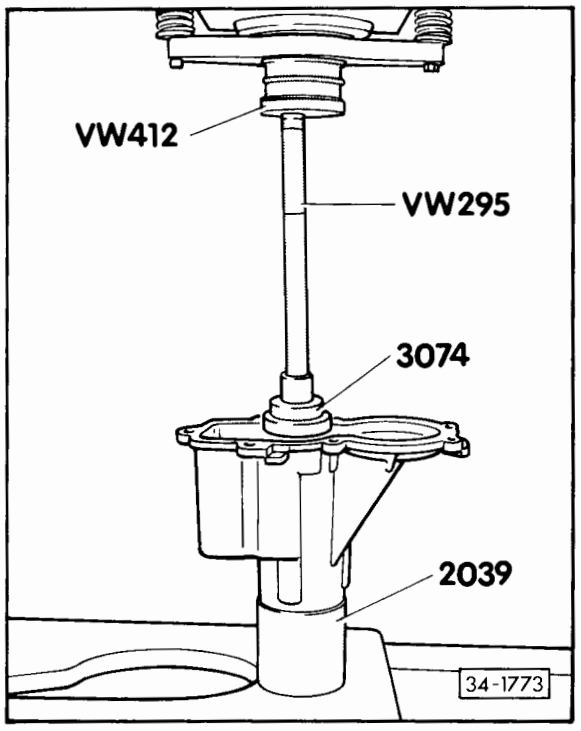


Fig. 1 Pressing out deep-groove ball bearing

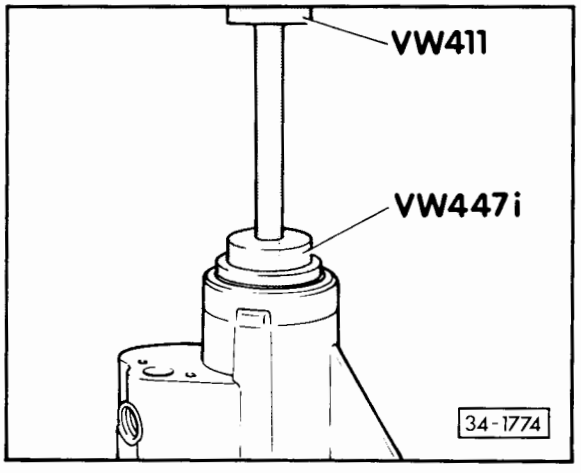


Fig. 2 Pressing deep-groove ball bearing fully home

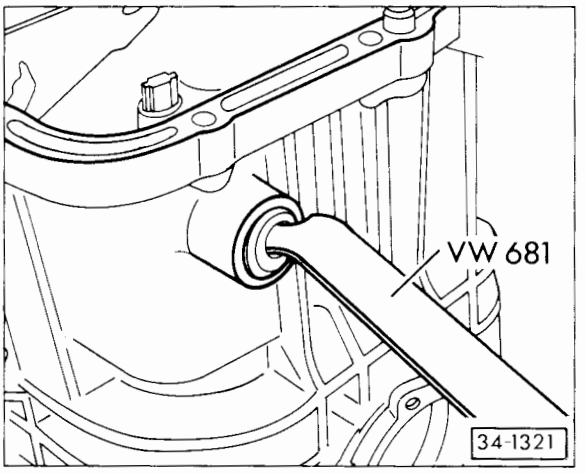


Fig. 3 Pulling out oil seal for gearshift shaft

Beforehand: Remove gearshift shaft.

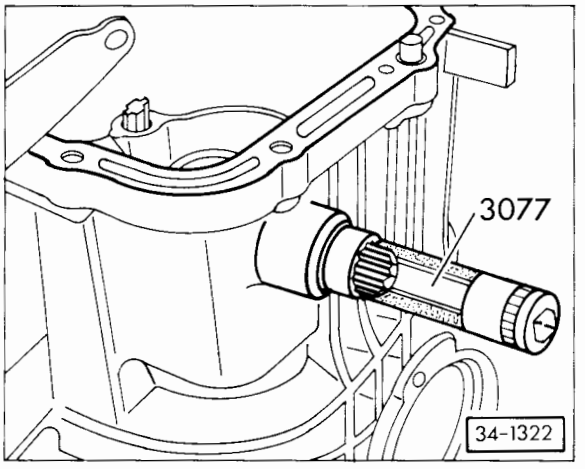


Fig. 4 Knocking in oil seal for gearshift shaft

- Remove wire ring.
- Knock in oil seal with 3077.
- Re-fit wire ring.

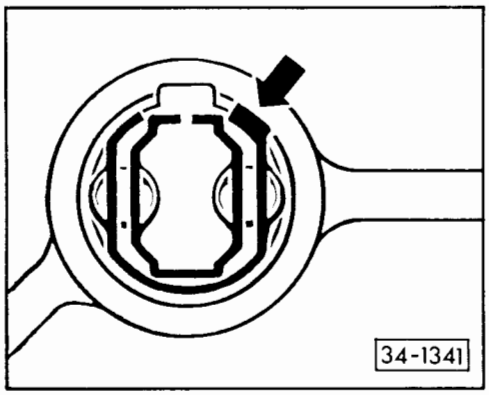


Fig. 5 Removing and installing gearshift rail bearing

In order to remove, turn gearshift rail bearing so that the lug (arrow) is above the recess in the housing. Press out gearshift rail bearing.

When installing, align the gearshift rail bearing with the gearshift rail.

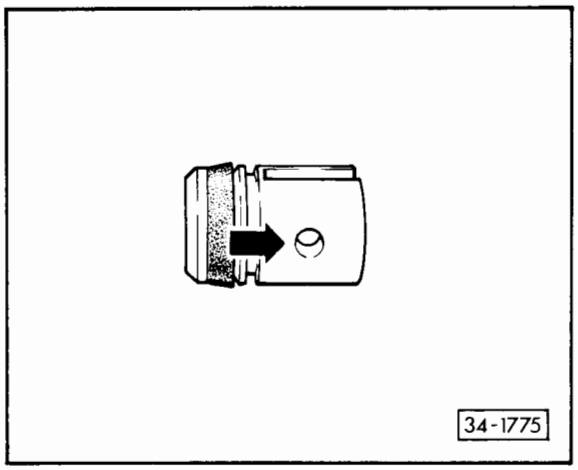


Fig. 6 Bearing position

Installation position of sealing diaphragm: Sealing lip pointing towards spring pin hole.

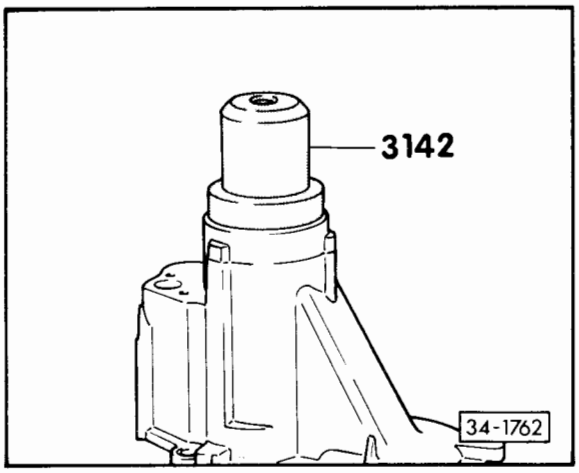


Fig. 7 Pressing radial seal fully home

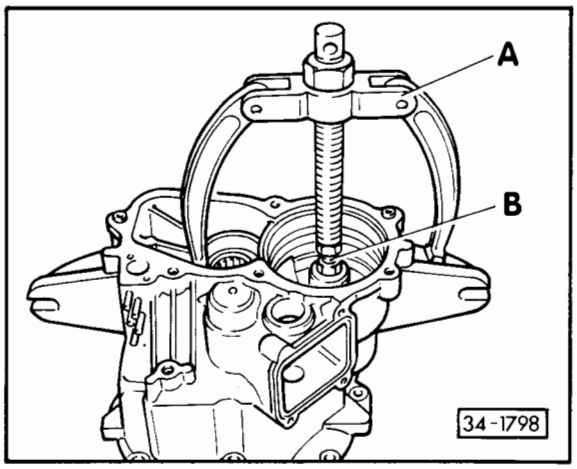


Fig. 8 Removing needle bearing

Remove needle bearing
A – Holder, e.g. Kukko 22-2
B – Internal puller 31 – 37 mm, e.g. Kukko 21/5

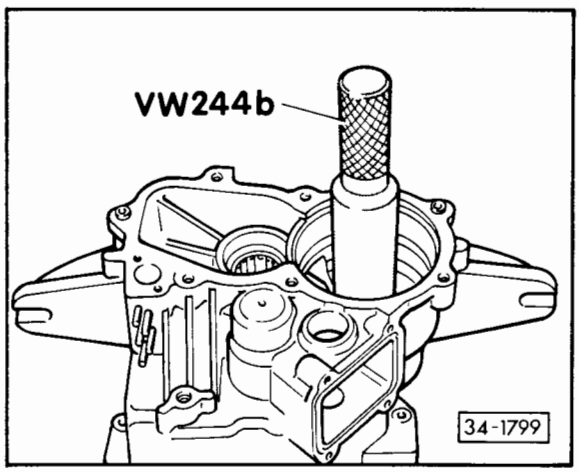
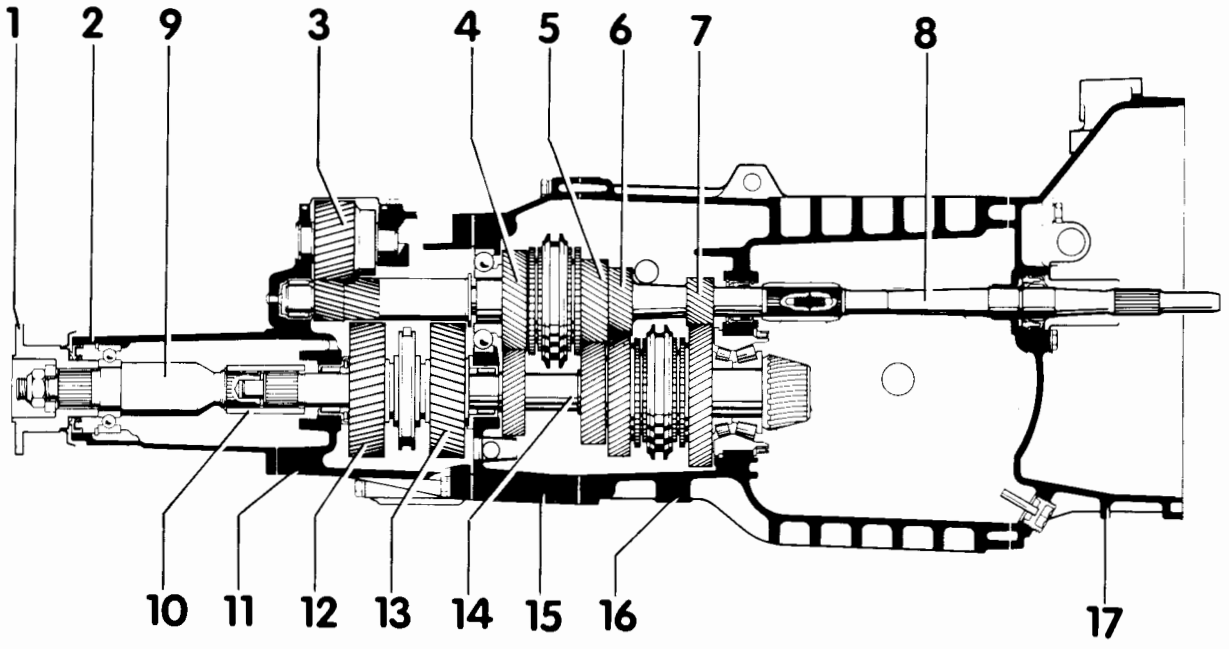
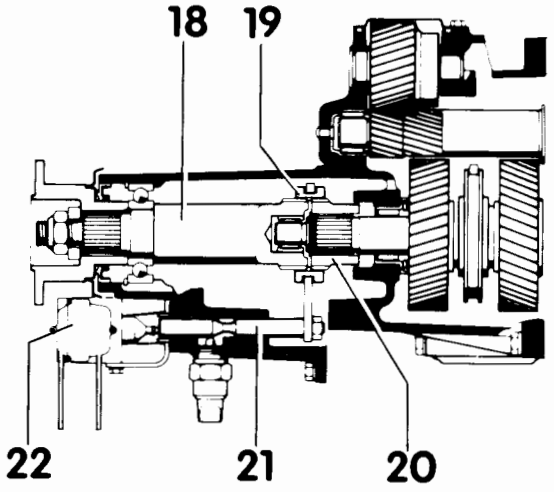


Fig. 9 Pressing needle bearing in

Use VW 244b to press needle bearing onto contact surface.





34 – 1800

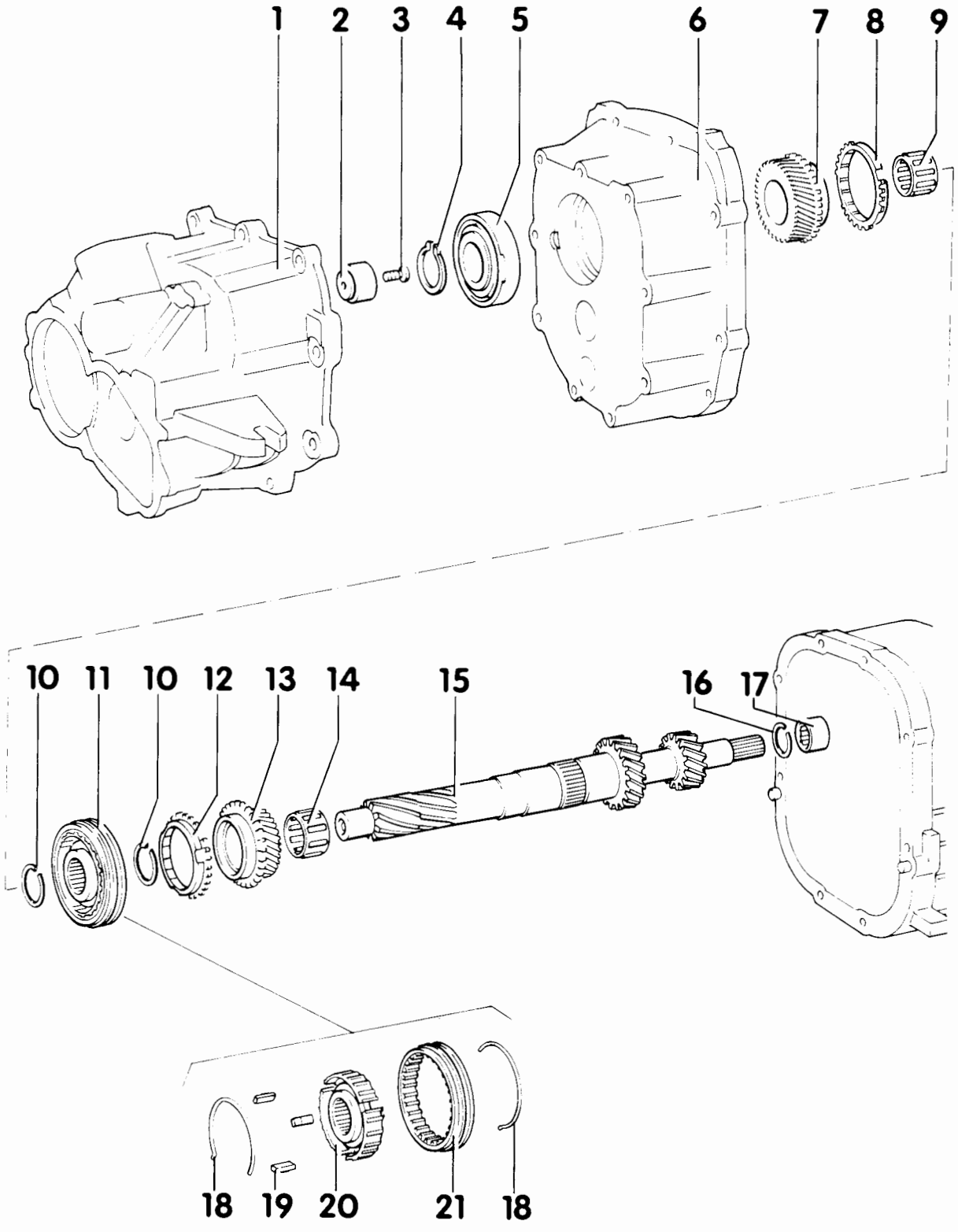
GEAR TRAIN

Exploded view

1 **Output flange**
2 **Output shaft housing**
3 **Idler gear**
4 **4th gear**
5 **3rd gear**
6 **2nd gear**
7 **1st gear**
8 **Input shaft**
● Dismantling and assembling – page 90
9 **Output shaft**
10 **Connecting sleeve**
11 **Cross-country gear housing**
12 **Cross-country gear**
13 **Reverse gear**
14 **Pinion**
● Dismantling and assembling – page 96
15 **Bearing carrier**
16 **Gearbox housing**
17 **Clutch housing**

– Only on selectable 4WD –

18 **Output shaft**
19 **Shift sleeve**
20 **Synchronizer hub**
21 **Shift actuator**
22 **Shift element**



35 - 1012

DISMANTLING AND ASSEMBLING INPUT SHAFT

Note:

When installing new gears or pairs of gears, see Technical Data on pages 4–9.

1 **Cross-country gear housing**

2 **Needle bearing**
- To take out, remove idler gear for cross-country gear 70
- Removing – Fig. 10
- Installing – Fig. 11

3 **Rivet**

4 **Circlip**

5 **Deep-groove ball bearing**
- Pressing out – Fig. 6
- Pressing in – Fig. 7

6 **Bearing carrier**

7 **Gear wheel for 4th gear**

8 **Synchronizer ring for 4th gear**
- Checking for wear – Fig. 2
- Identification – page 105

9 **Needle bearing for 4th gear**
- Lubricate with gear oil before installing

10 **Circlip for synchronizer hub**
- Renew

11 **Shift sleeve/synchronizer hub for 3rd and 4th gears**
- Pressing off – Fig. 1
- Assembling – Figs. 3 and 4
- Note installation position when pressing on – Fig. 5

12 **Synchronizer ring for 3rd gear**
- Checking for wear – Fig. 2
- Identification – page 105

13 **Gear wheel for 3rd gear**

14 **Needle bearing for 3rd gear**
- Lubricate with gear oil before installing

15 **Input shaft**

16 **Circlip**

17 **Needle bearing**
- Driving off – Fig. 8
- Driving in – Fig. 9
- Lubricate with gear oil before installing

18 **Spring/wire 1.6 mm dia.**

19 **Locking key**

20 **Synchronizer hub**

21 **Shift sleeve**

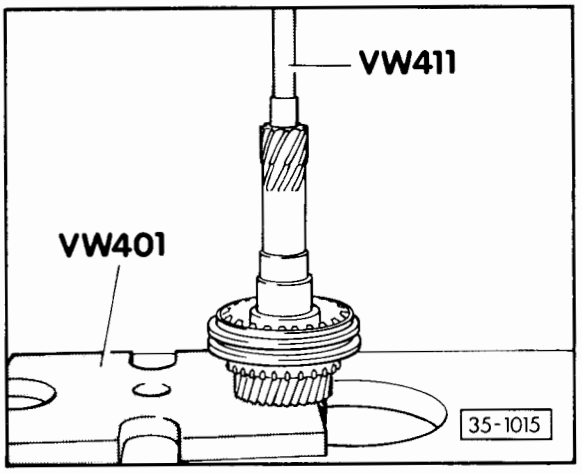


Fig. 1 Pressing sleeve and synchronizer hub off together with 3rd gear wheel

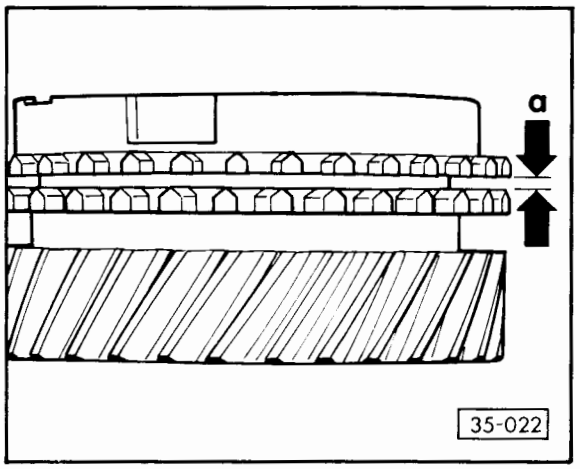


Fig. 2 Checking synchronizer rings

Press rings onto cones of gears and measure gap "a" with feelers.

Gap "a"	New	Wear limit
3rd gear	1.25 – 1.95 mm	0.5 mm
4th gear	1.0 – 1.7 mm	0.5 mm

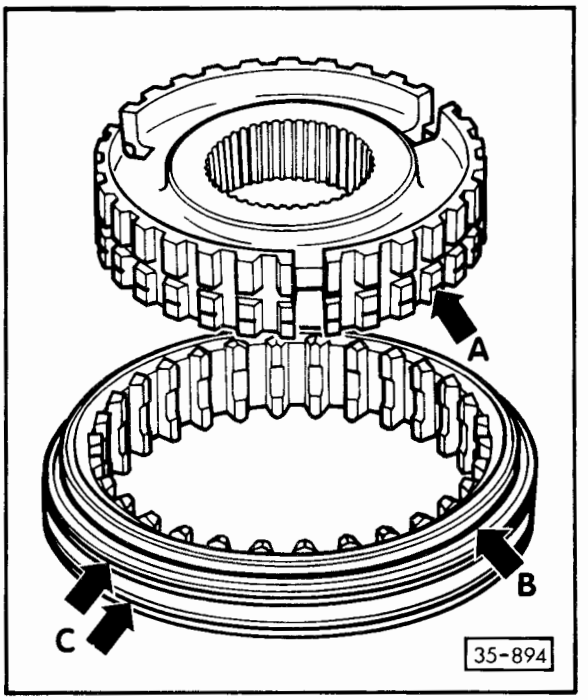


Fig. 3 Assembling sleeve and synchronizer hub for 3rd and 4th gears

Position: The identification grooves (arrows A + B) of sleeve and synchronizer hub lie in opposite positions. The groove on the sleeve (arrow B) towards 4th gear wheel. The grooves (arrow C) serve to distinguish between the sleeves for 1st and 2nd gears (one groove) and 3rd and 4th gears (two grooves).

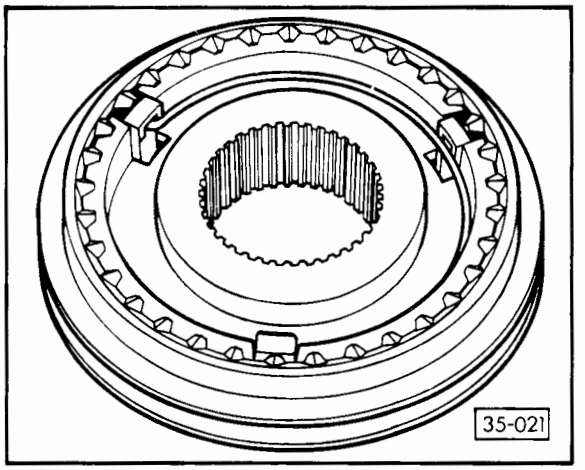


Fig. 4 Assembling sleeve and synchronizer hub

- Slide sleeve over synchronizer hub in any position.
- Fit locking keys and springs with ends offset 120°. The angled end must fit in the hollow key.

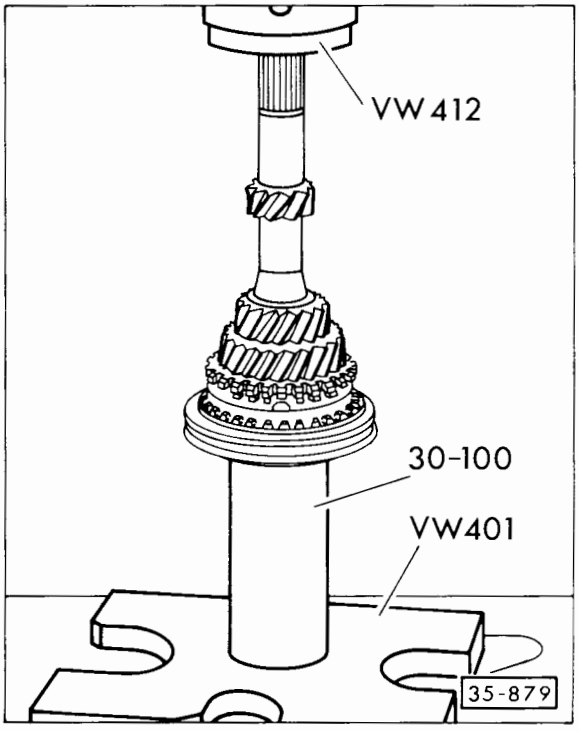


Fig. 5 Pressing on sleeve with synchronizer hub

Turn synchronizer rings so that the grooves are aligned with the locking keys.

Position: The identification groove on the sleeve (Fig. 3, arrow B) towards 4th gear wheel.

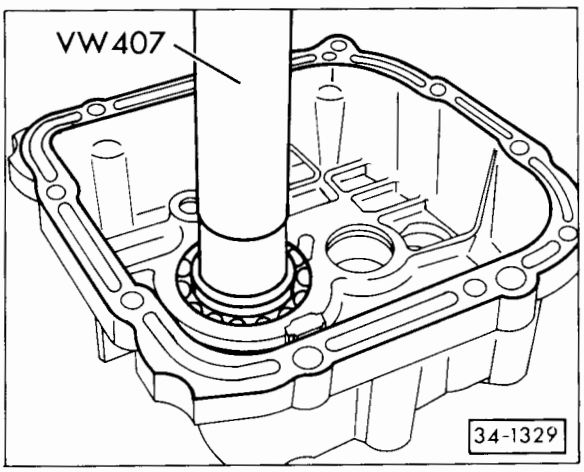


Fig. 6 Pressing deep-groove ball bearing out of bearing carrier

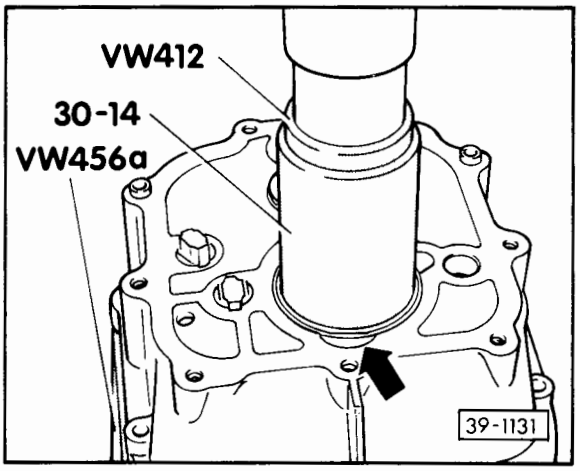


Fig. 7 Pressing deep-groove ball bearing fully home into bearing carrier

Press in so that the milled edge of bearing aligns with recess in bearing carrier (arrow).

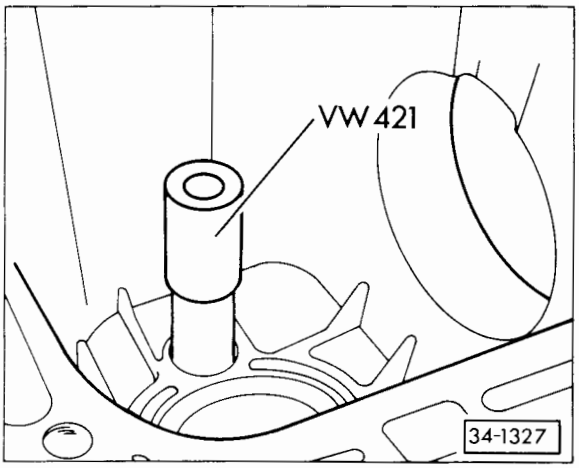


Fig. 8 Driving needle bearing out of gearbox housing

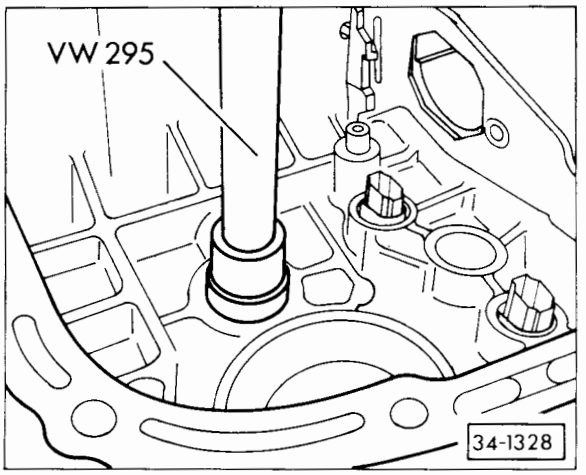


Fig. 9 Driving needle bearing into gearbox housing as far as it will go

Important

When driving the needle bearing in, it is important to apply the drift VW 295 on the **lettered side of bearing** (thicker metal).

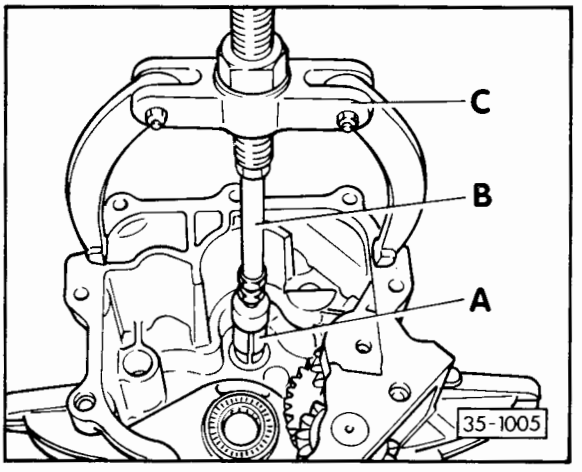


Fig. 10 Removing needle bearing from cross-country gear housing

First cut off rivet head.

A – Internal puller 18.5 – 23.5 mm, e.g. Kukko 21/3.
B – Threaded adapter, e.g. Kukko.
C – Holder, e.g. Kukko 22/2.

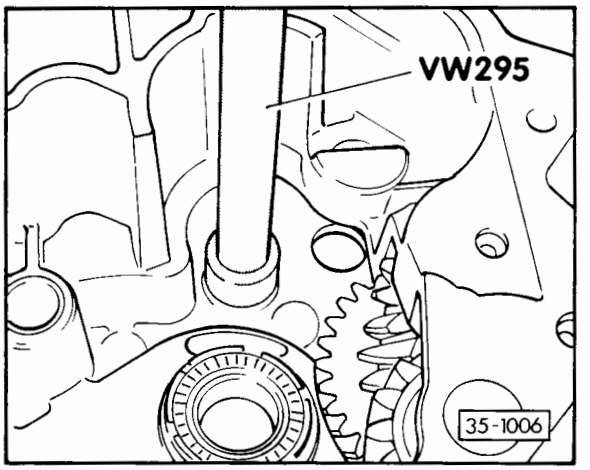
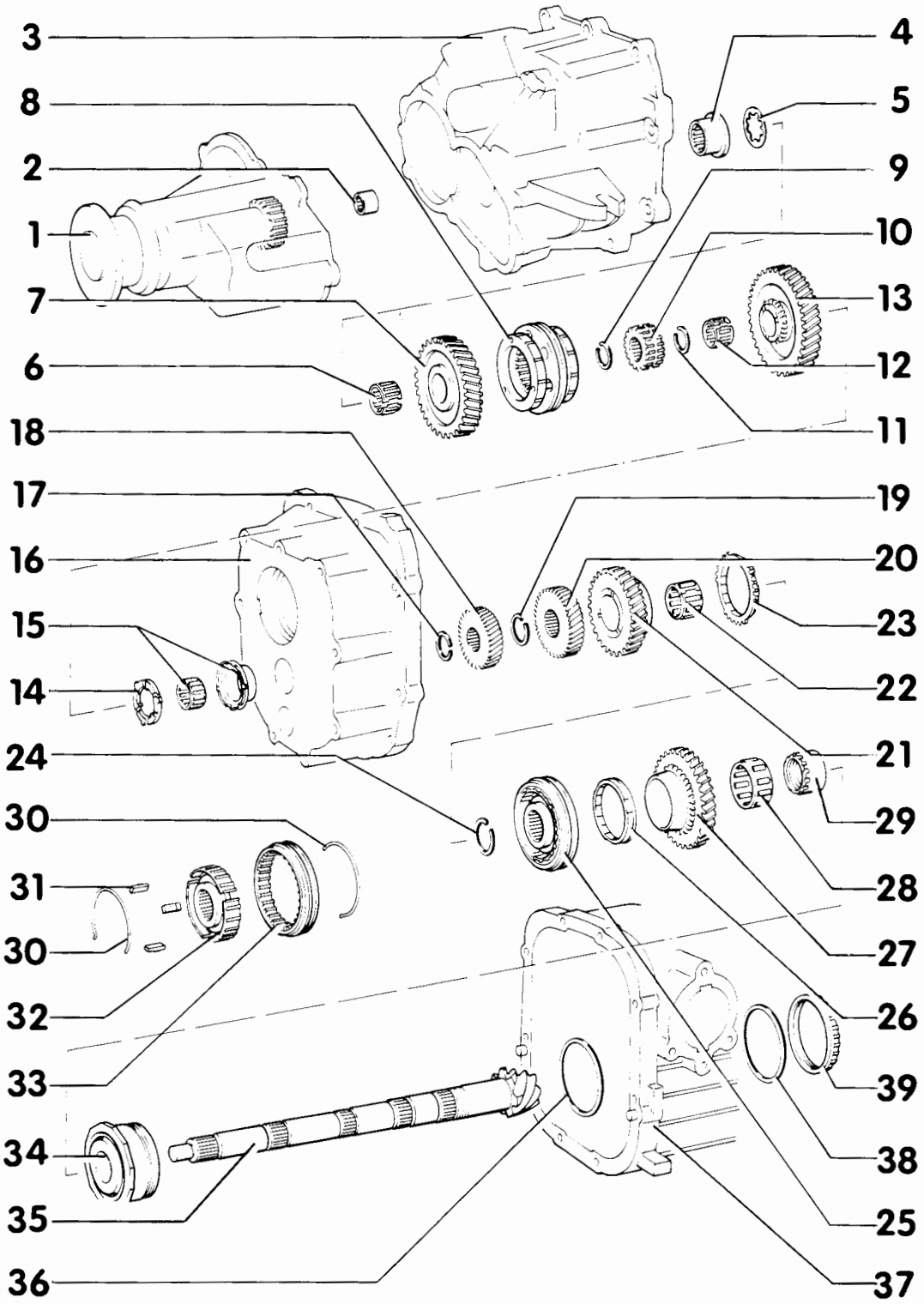


Fig. 11 Driving needle bearing into cross-country gear housing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GEAR TRAIN

Dismantling and assembling pinion

Note:

When installing new gears or pairs of gears, see technical data on pages 4–9.

1 **Output shaft housing**

2 **Needle bearing**
- Removing – Fig. 19
- Installing – Fig. 20

3 **Cross-country gear housing**

4 **Pinion bearing**
- Pressing out – Fig. 17
- Pressing in – Fig. 18

5 **Shim**
- Calculating thickness – page 64

6 **Needle bearing**
- Apply gear oil before installing

7 **Gear wheel for cross-country gear**

8 **Synchronization for cross-country and reverse gears**
- Installation position: Molybdenum-coated synchronizer ring to gear wheel for cross-country gear

9 **First circlip for synchronizer hub**
- Renew

10 **Synchronizer hub for cross-country and reverse gears**

11 **Second circlip for synchronizer hub**
- Renew

12 **Needle bearing**
- Lubricate with gear oil before installing

13 **Gear wheel for reverse gear**

14 **Thrust washer for gear wheel/reverse gear**
- Calculating thickness – page 78

15 **Needle bearing**
- Driving out – Fig. 15
- Driving in – Fig. 16

16 **Bearing carrier**

17 **Circlip**
- Renew; must be firmly seated in groove

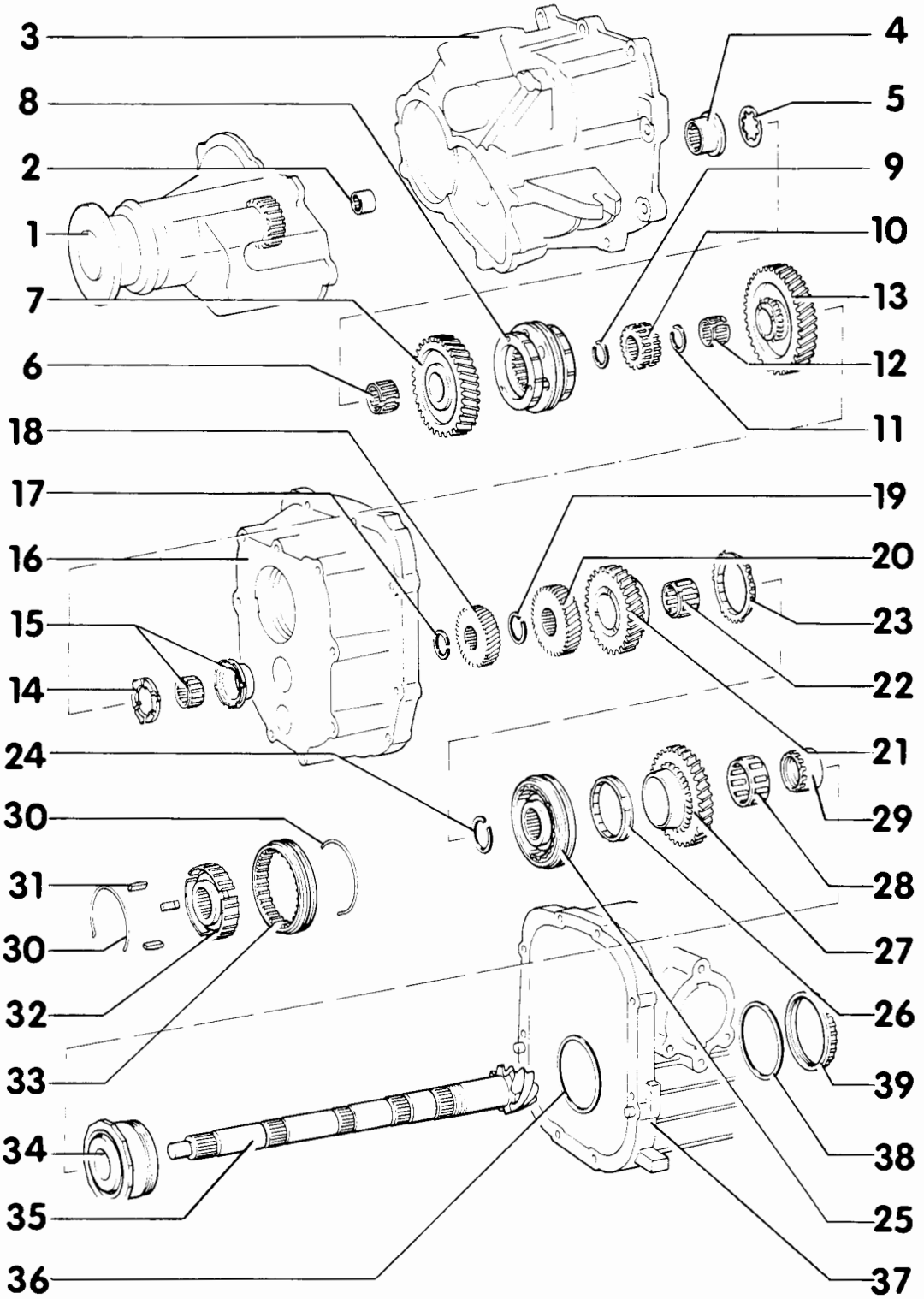
18 **Gear wheel for 4th gear**
- Installation position: All-round groove pointing towards bearing carrier

19 **Circlip for 3rd gear wheel**
- Renew; must be firmly seated in groove
- Calculating thickness – Fig. 14

20 **Gear wheel for 3rd gear**
- Pressing off – Fig. 1
- Pressing on – Fig. 13
- Installation position: Shoulder facing gear wheel for 2nd gear

21 **Gear wheel for 2nd gear**

22 **Needle bearing for 2nd gear**
- Lubricate with gear oil before installing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23 Synchronizer ring for 2nd gear
- Checking for wear – Fig. 9
- Identification – page 105

24 Circlip
- For synchronizer hub, must be seated firmly in groove
- Renew

25 Shift sleeve/synchronizer hub for 1st and 2nd gear
- Pressing off – Fig. 2
- Assembling – Figs. 10 and 11
- Pressing on – Fig. 12

26 Synchronizer ring for 1st gear
- Checking for wear – Fig. 9
- Identification – page 105

27 Gear wheel for 1st gear

28 Needle bearing for 1st gear
- Lubricate with gear oil before installing

29 Inner race/needle bearing for 1st gear
- Slackening and tightening – Fig. 6
- Prevented from turning by a collar on the hub of the synchronizer hub

30 Spring
- Wire, 1.6 mm dia.

31 Locking key

32 Synchronizer hub
- Secures inner race/needle bearing for 2nd gear

33 Shift sleeve

34 Double tapered roller bearing
- Pressing off – Figs. 3 and 4
- Fit warm and press home – Fig. 5
- If renewed, measure position of pinion before dismantling (actual dimension) – see page 125
- Checking turning torque – Figs. 7 and 8

35 Pinion
- Matched to crown wheel (gear set)
- If gear set is renewed, adjust pinion and crown wheel – page 123

36 Shim S_3
- Note thickness
  Adjustment table – page 125

37 Gearbox housing

38 Washer

39 Retaining ring
- Screwing on and off – page 77

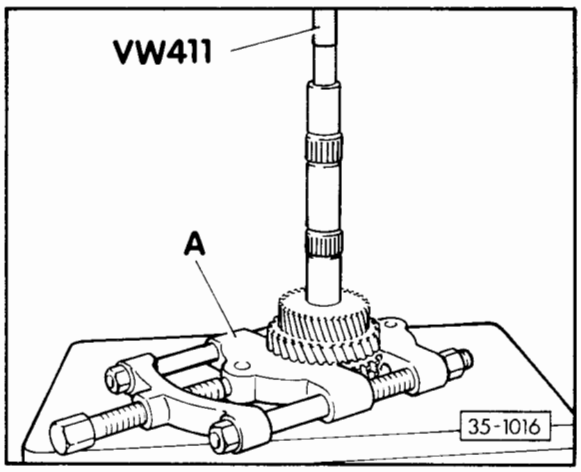


Fig. 1 Pressing off 3rd gear with 2nd gear wheel

A – Parting tool 22–115 mm, e.g. Kukko 17/2.

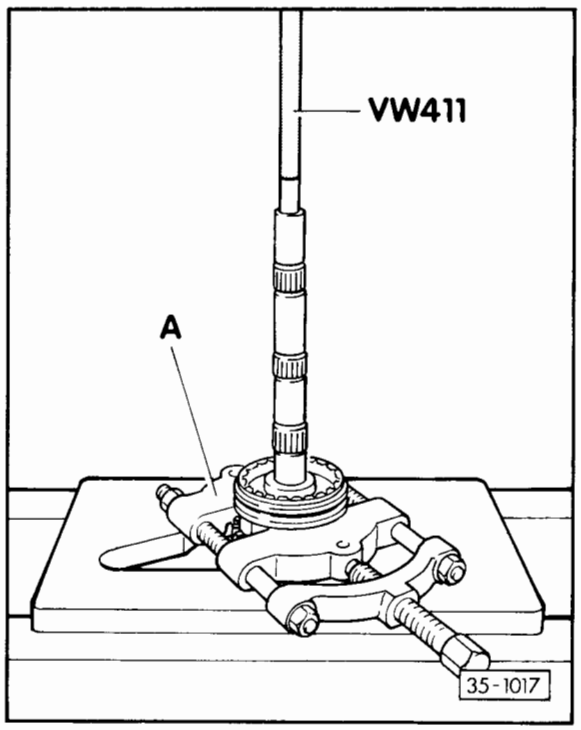


Fig. 2 Pressing off sleeve/synchronizer hub with 1st gear wheel

A – Parting tool 22–115 mm, e.g. Kukko 17/2.

Secure parting tool behind coupling teeth of gear wheel.

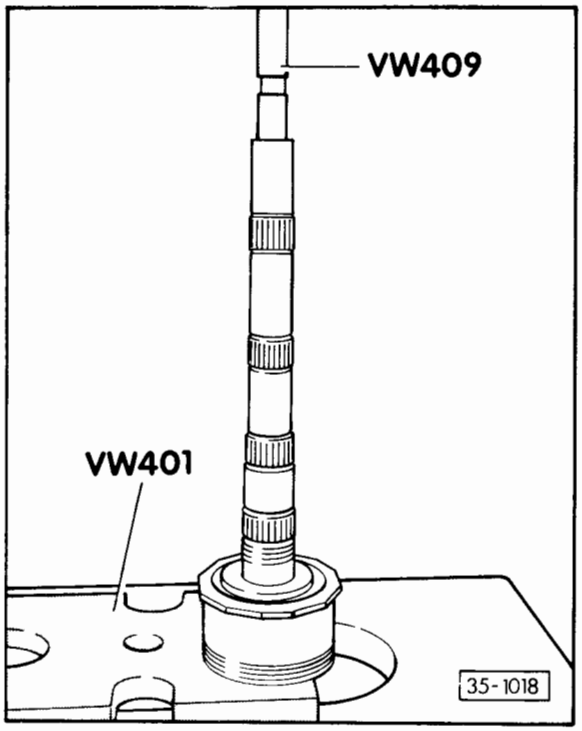


Fig. 3 Pressing double tapered roller bearing off via outer race

First unscrew inner race/needle bearing – see Fig. 6.

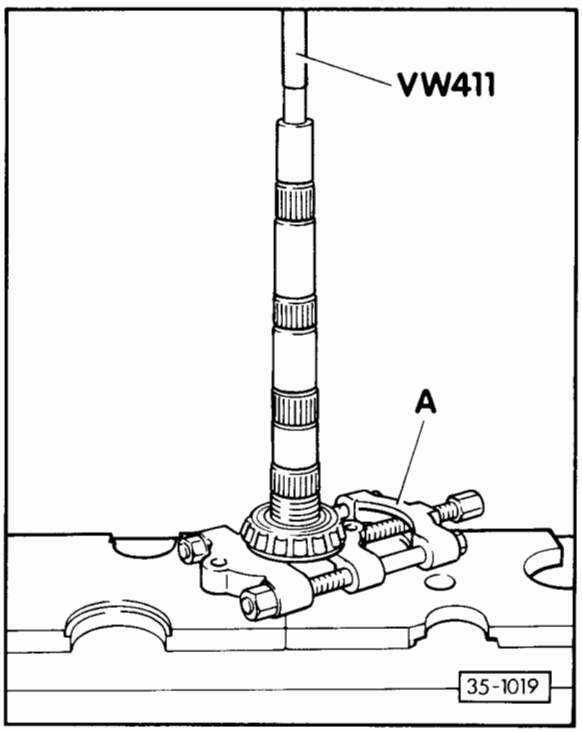


Fig. 4 Pressing off 2nd inner race

A – Parting tool 12–175 mm, e.g. Kukko 17/1.

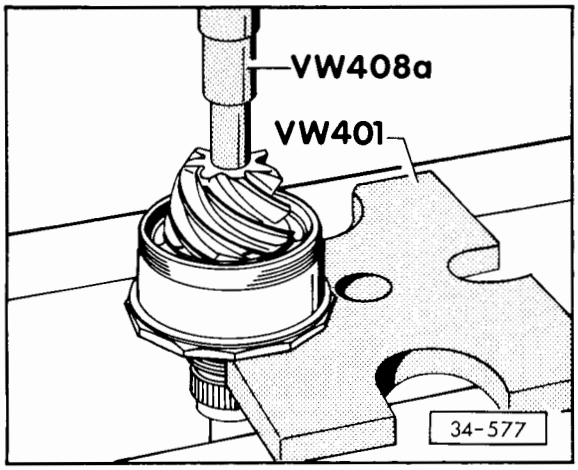


Fig. 5 Heat inner races of double tapered roller bearing to about 100° C, install and press home

Before tightening the needle bearing inner race, allow double tapered roller bearing to cool to room temperature.

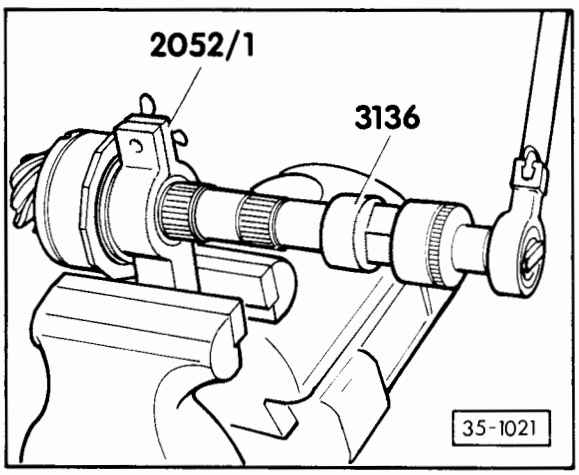


Fig. 6 Loosening or tightening needle bearing inner race

Tightening: Heat inner race to about 60° C and screw on as far as possible by hand.
Place pinion in appliance 2052 and tighten wing bolt slightly.

Tighten inner race to 210 Nm and then check turning torque of double tapered roller bearing.

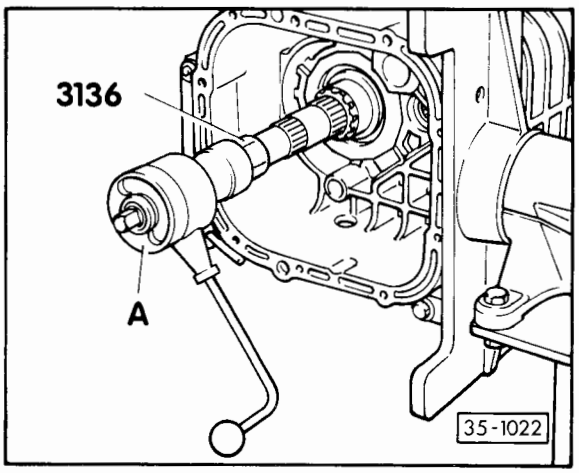


Fig. 7 Checking turning torque of double tapered roller bearing

A = Normal torque gauge
(0–600 Ncm)
Oil bearing beforehand with hypoid gear oil and tighten retaining ring as specified.
First turn pinion rapidly in both directions about 15–20 times, then read the torque while still turning.

Test values

	New bearings	Used bearings*)
Torque up to 210 Ncm		up to 70 Ncm

*) After running at least 50 km

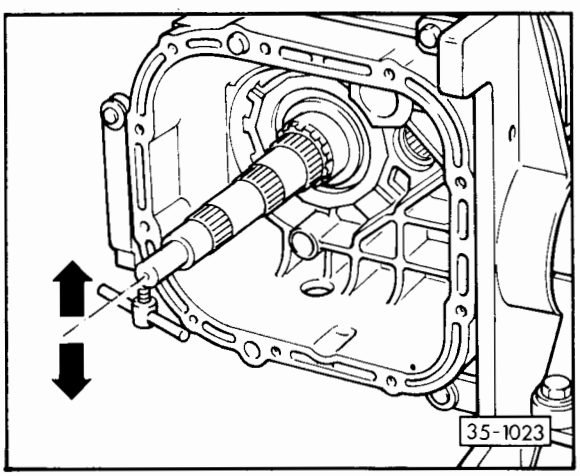


Fig. 8 Checking rock

If there is no torque, check for rock in bearing at end of pinion shaft. There must **not be any** detectable rock otherwise a new bearing must be fitted.

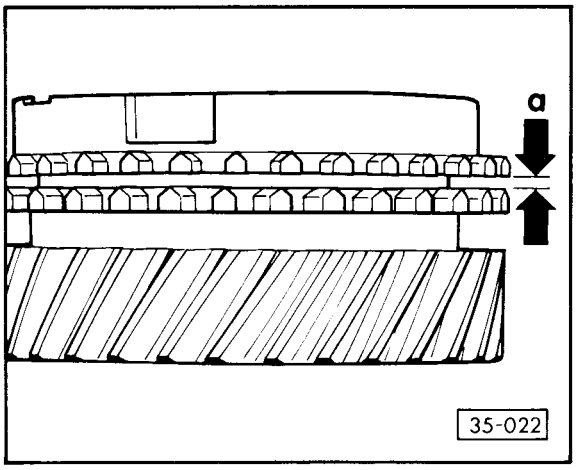


Fig. 9 Checking synchronizer rings

Press rings onto cones of gears and measure gap "a" with feelers.

Gap "a"	New	Wear limit
1st + 2nd gears	1.3–1.9 mm	0.5 mm

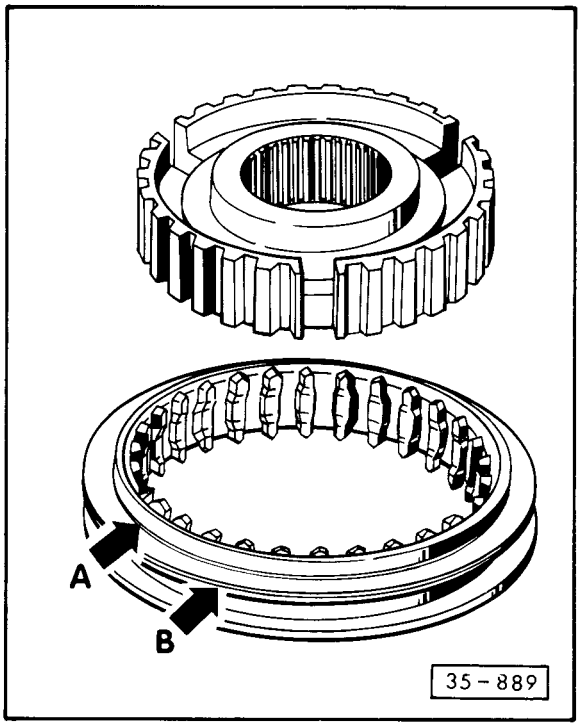


Fig. 10 Assembling sleeve and synchronizer hub for 1st and 2nd gears

Fitting position:

Groove (arrow A) towards 2nd gear wheel. Synchronizer hub collar (anti-rotation fitting for inner race/needle bearing) towards 1st gear wheel. Turn synchronizer hub so that the old pressure marks on the hub are opposite a tooth gap on the bearing inner race.
Groove (arrow B) serves to distinguish between the sleeves for 1st and 2nd gears (one groove) and 3rd and 4th gears (two grooves).

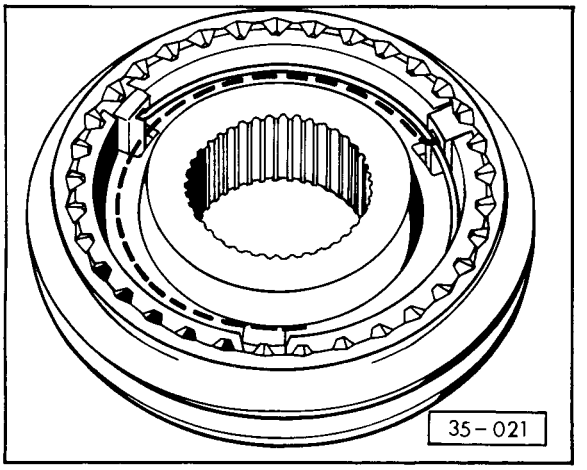


Fig. 11 Assembling sleeve and sychronizer hub

- Slide sleeve over synchronizer hub in any position.
- Insert locking key and install springs with ends offset 120°. The angled end must fit in the hollow key.

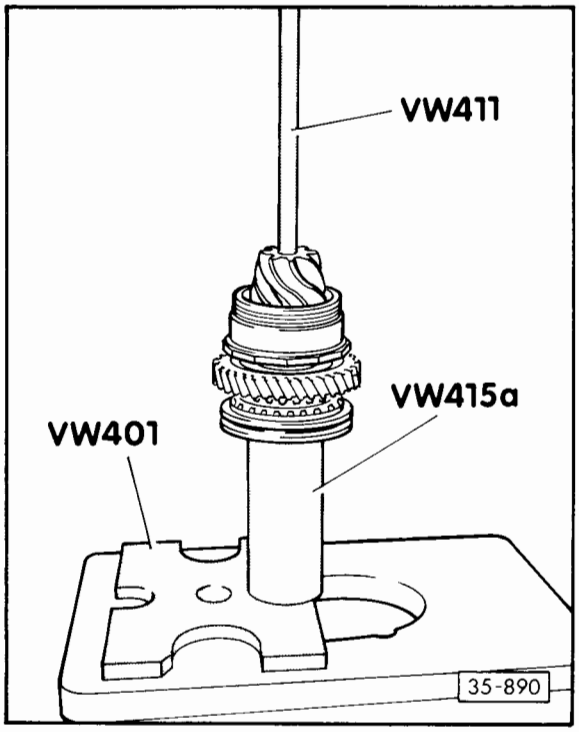


Fig. 12 Pressing sleeve/synchronizer hub on

Turn synchronizer ring so that the grooves align with keys.

Fitting position: See Fig. 10.

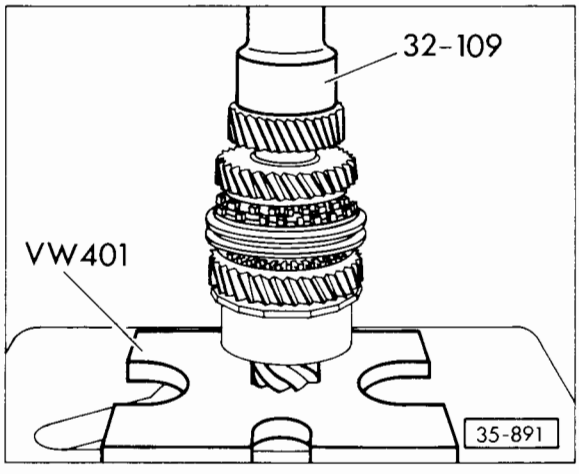


Fig. 13 Pressing on 3rd gear wheel

Fitting position: Shoulder towards 2nd gear wheel.

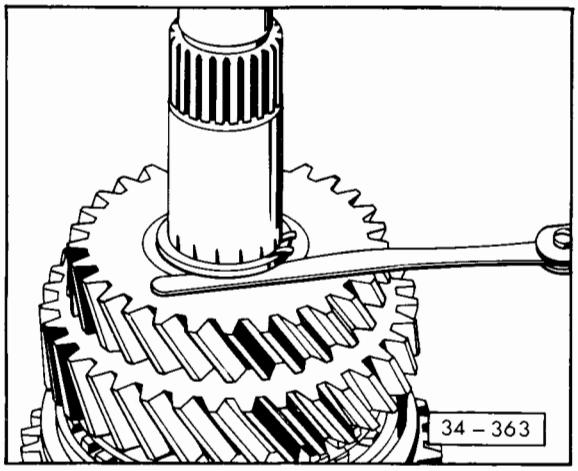


Fig. 14 Adjusting 3rd gear wheel axial play

Measure the axial play of the 3rd gear wheel with a feeler gauge and adjust it by selecting a suitable circlip. The play should be between **0.05 and 0.20 mm** with lower limit being preferred.

The following circlips are available:

Thickness (mm)	Part No.	Colour
2.20	113 311 386	copper
2.30	113 311 387	brass

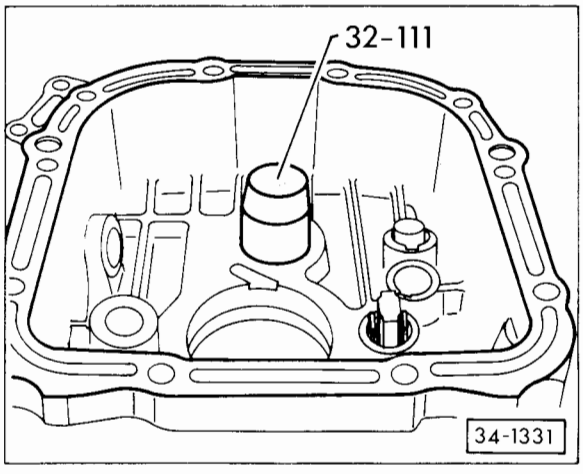


Fig. 15 Driving outer race/needle bearing out of the bearing carrier

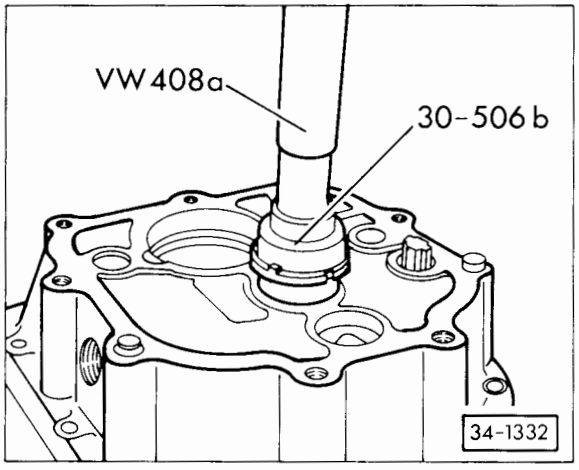


Fig. 16 Pressing outer race/needle bearing into bearing carrier

VW 447h can also be used instead of 30-506b.

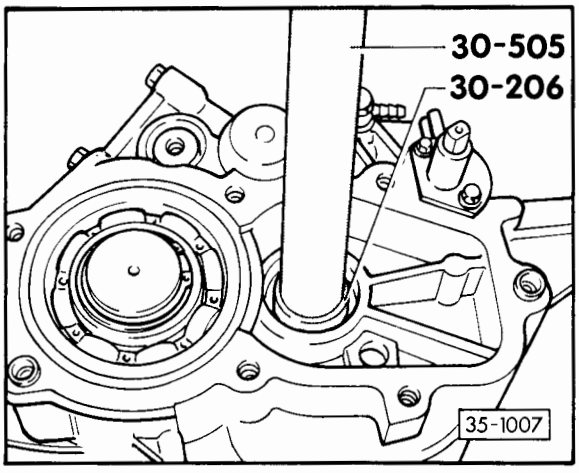


Fig. 17 Pressing bearing out of cross-country gear housing

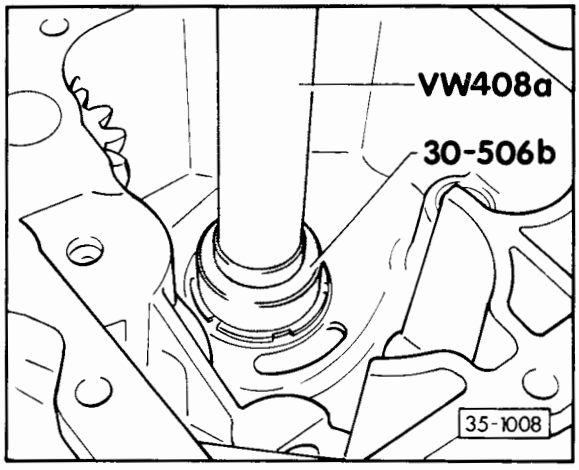


Fig. 18 Pressing complete bearing into bearing carrier cover

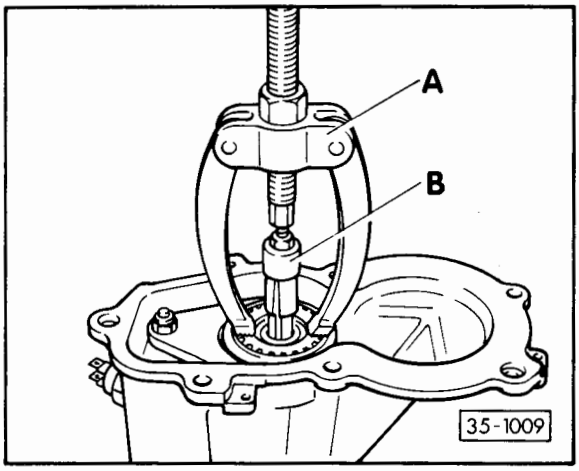


Fig. 19 Removing needle bearing for output shaft

Pull out needle bearing.

A – Holder, e.g. Kukko 22-1

B – Internal puller 12 – 14.5 mm, e.g. Kukko 21/1

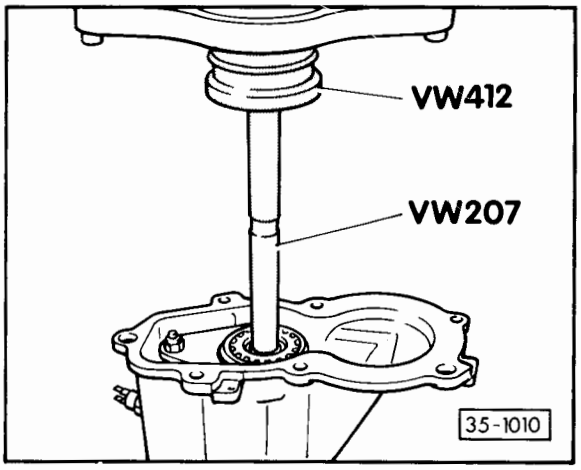


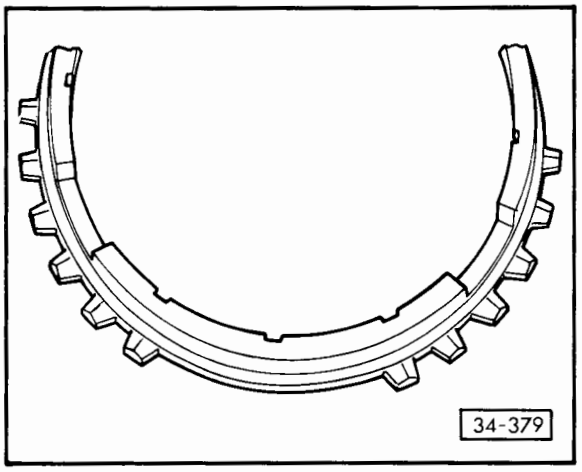
Fig. 20 Installing needle bearing

Press needle bearing fully home.

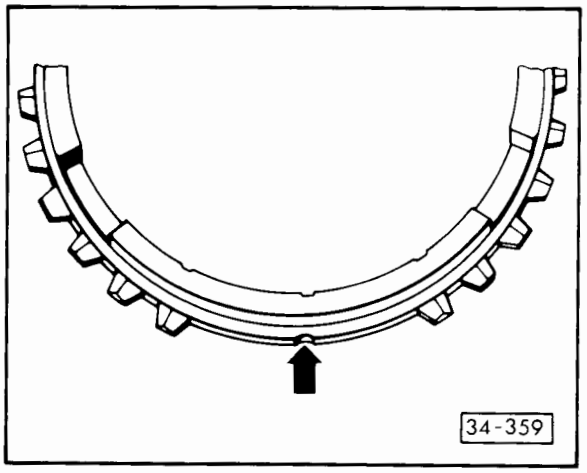
Identification of synchronizer rings

If synchronizer rings are not renewed, they must be refitted in the same position.

Standard fitted synchronizer rings

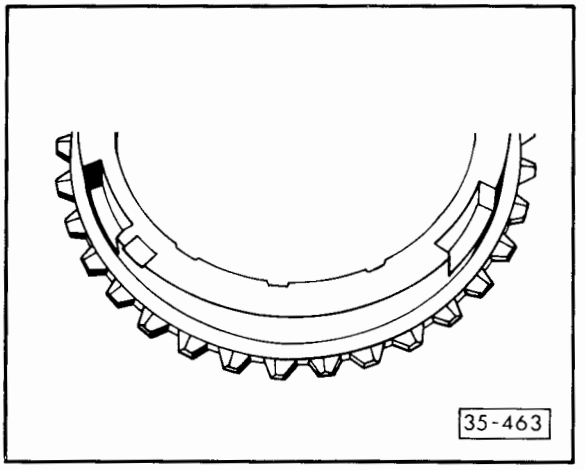


1st gear: Brass ring, sprayed with molybdenum, 3 x 6 teeth, without identification



2nd gear: Brass ring, sprayed with molybdenum, 3 x 8 teeth, identification 3 notches

4th gear: Brass ring, 3 x 8 teeth, identification 3 notches



3rd gear: Special brass ring, sprayed with molybdenum. Full outer toothing.

Synchronizer rings supplied as replacement parts

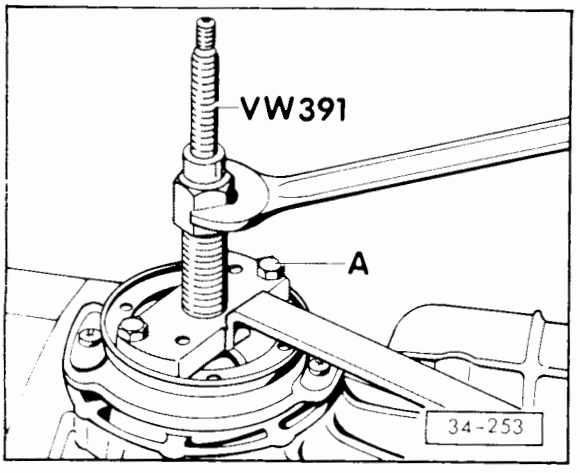
091 311 295 A (standard on 3rd gear) is supplied as a replacement part for all gears.

RENEWING DRIVE FLANGE OIL SEAL (Gearbox installed)

Changing the seal is only justified if drops of oil have already collected on the seal and on the gearbox housing. A film of oil on the seal and the adjacent area does not justify a change. On the contrary, this "sweating" has been incorporated in the design as it prevents the sealing lips from becoming dry.

Removing

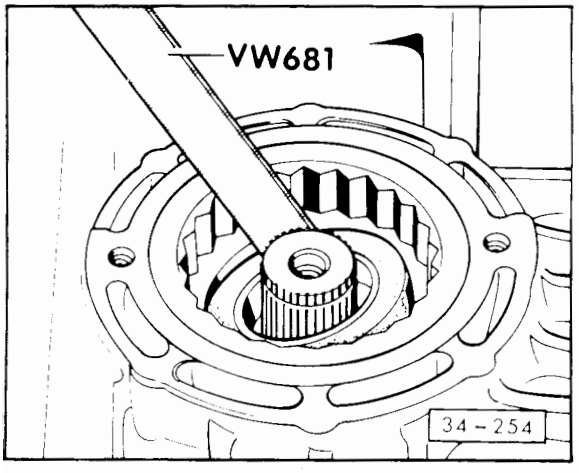
- Remove socket head bolts on drive shaft, press drive shaft upwards and secure with wire hook.
- Pierce cap in drive flange with screw driver and lever out.



- Remove circlip and pull off drive flange!

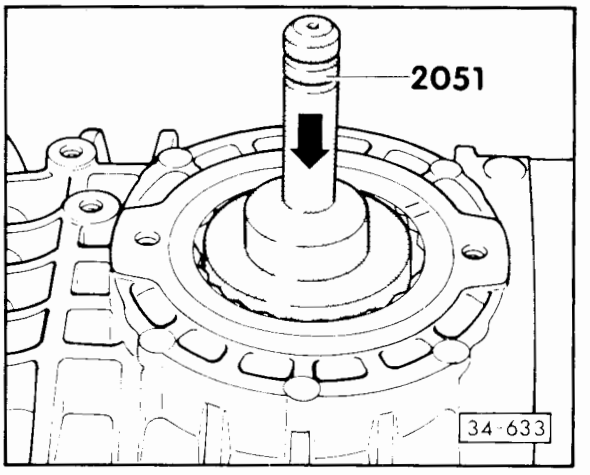
A – Screw two hexagon head bolts (M 8 x 30) through slots into drive flange.

- Unscrew lock plate.

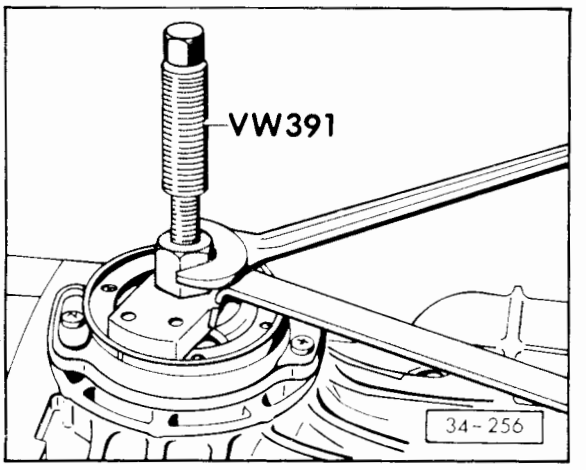


- Pull out seal.

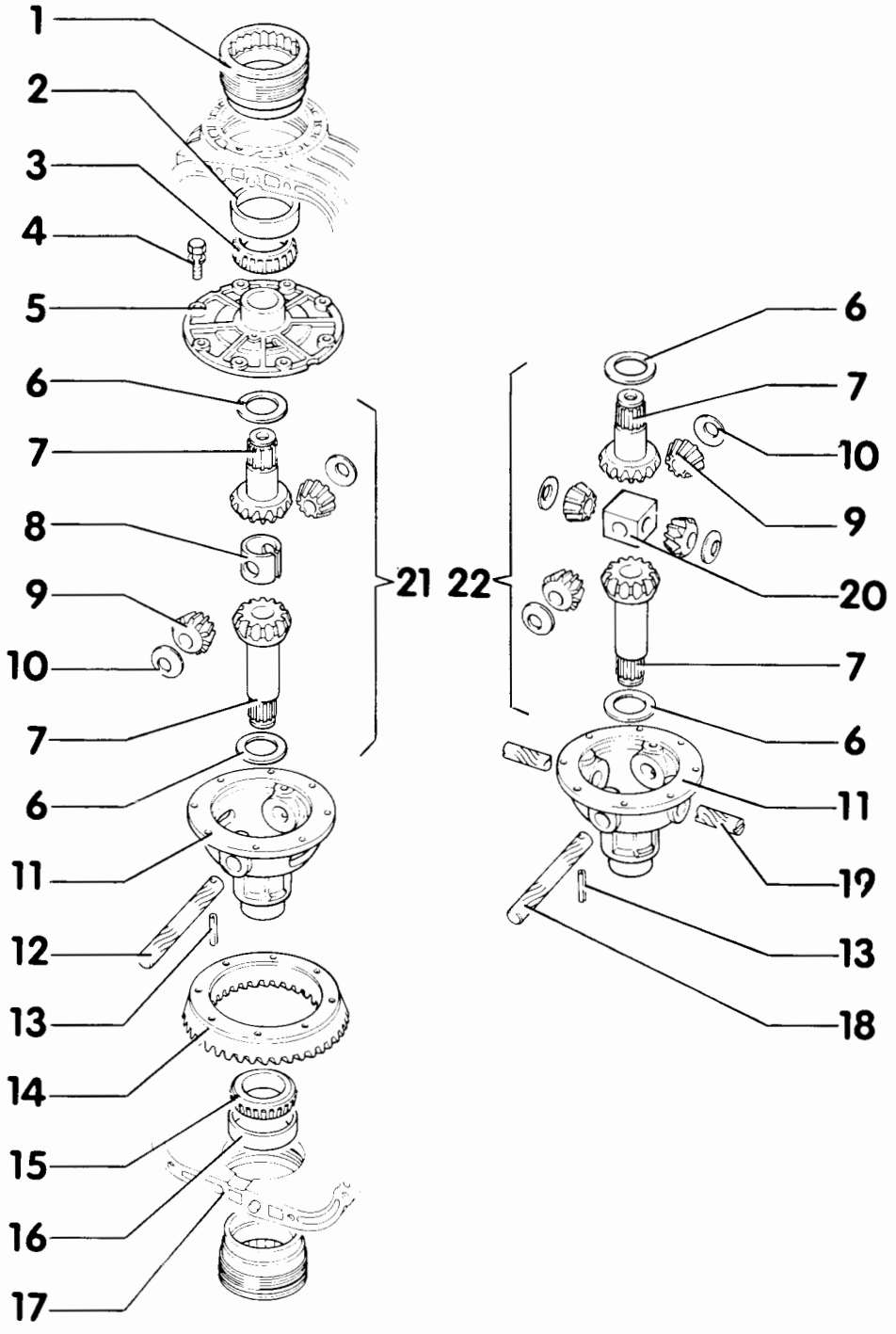
Installing



- Drive new seal in as far as it will go.
- Pack space between sealing and dust lips with multi-purpose grease.
- Unscrew lock plate.



- Pull in drive flange.
- Fit dished washer and circlip. Use VW 244b to press circlip into groove, making sure dished washer is seated centrally.
- Press in new cap.
- Install drive shaft and tighten socket head bolts to 45 Nm.
- Top up gearbox oil.



39 –1133

DISMANTLING AND ASSEMBLING DIFFERENTIAL WITHOUT DIFFERENTIAL LOCK

Important

If tapered roller bearings are renewed, adjust crown wheel – page 123.

Renew both tapered roller bearings at the same time.

Note:

Clamp differential in vice to dismantle – Fig. 1.

1 Adjusting ring

2 Outer race/tapered roller bearing
(Crown wheel side)
- Pressing out – Fig. 13
- Pressing in – Fig. 14

3 Inner race/tapered roller bearing
(Crown wheel side)
- Pressing off – Fig. 4
- Pressing on – Fig. 10

4 Crown wheel bolts
- Only use correct bolts.
  Pull all bolts down first, then tighten diagonally to **50 Nm.**

5 Differential cover
- Pulling off – Fig. 3
- Installation position: Oil holes must be approx. 90° offset to pinion shaft
- If renewed, adjust axial play (page 122) and crown wheel (page 123)

6 Thrust washers
- Check for cracks and chips

7 Differential gears, large
- Long shaft in housing,
  short shaft in cover
- If renewed, adjust axial play – page 122

8 Spacer sleeve
- Measure length – page 122

9 Differential gears, small

10 Thrust washers
- Check for cracks and chips

11 Differential housing
- If renewed, adjust axial play (page 122) and crown wheel (page 123)

12 Differential pinion shaft
- Drive out with drift. Drive in carefully to avoid damaging thrust washers

13 Spring pin
- Drive in flush

14 Crown wheel
- Is matched to pinion (gear set)
- Removing – Fig. 2
- Installing – Fig. 12
- If gear set is renewed, adjust pinion and crown wheel – page 123

15 Inner race/tapered roller bearing
(Opposite crown wheel)
- Pressing out – Fig. 5
- Pressing in – Fig. 11

16 Outer race/tapered roller bearing
(Opposite crown wheel)
- Pressing out – Fig. 13
- Pressing in – Fig. 14

17 Gearbox housing

18 Differential pinion shaft (long)
- Driving out – Fig. 6
- Drive in carefully to avoid damaging thrust washers

19 Differential pinion shaft (short)
- Pressing out – Fig. 7
- Pressing in – Figs. 8 and 9

20 Spacer
- Installation position – Fig. 8

21 Differential gear set
With two small differential pinions

22 Differential gear set
With four small differential pinions

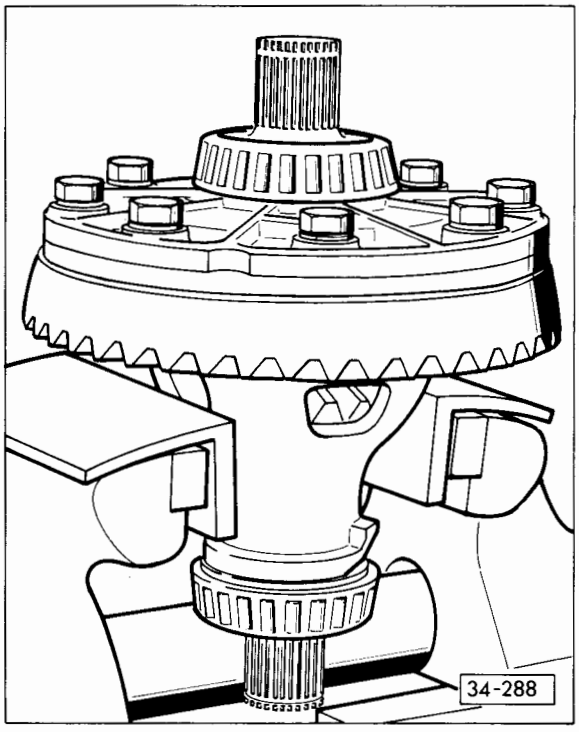


Fig. 1 Clamping differential in vice

Use vice clamps.

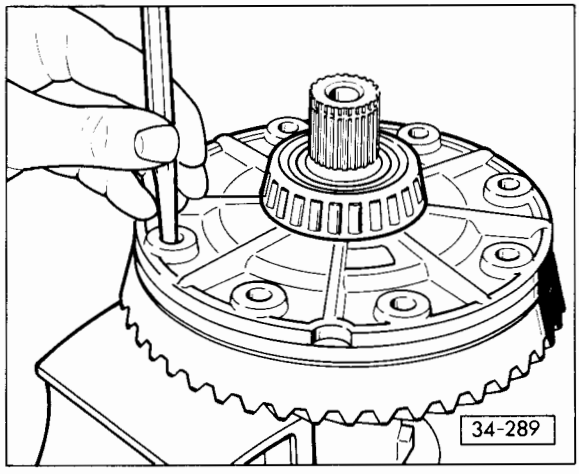


Fig. 2 Knocking crown wheel off housing

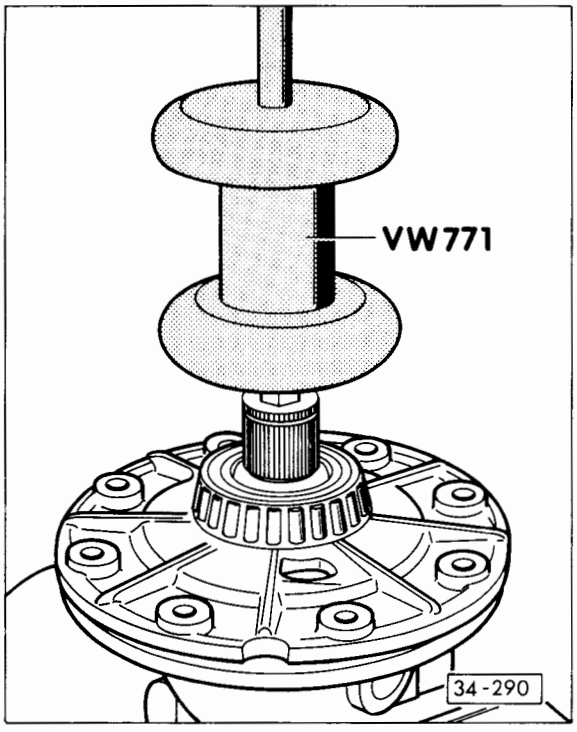


Fig. 3 Pulling cover off differential housing

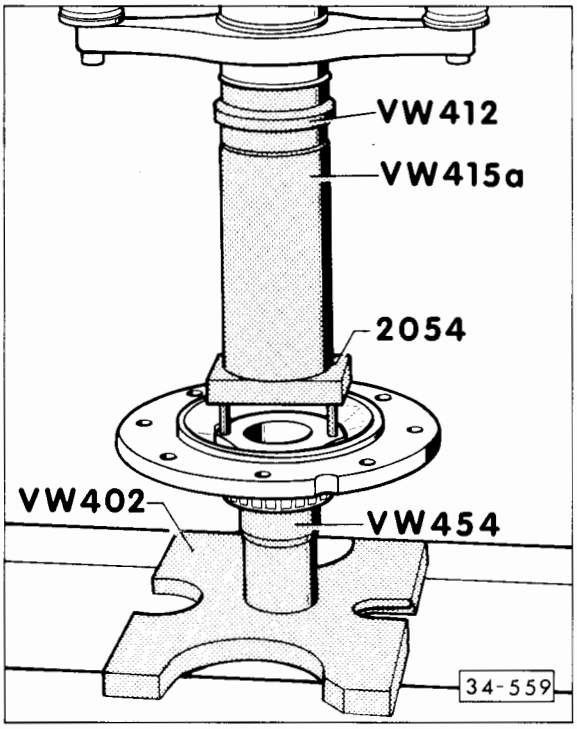


Fig. 4 Pressing inner race/tapered roller bearing off cover

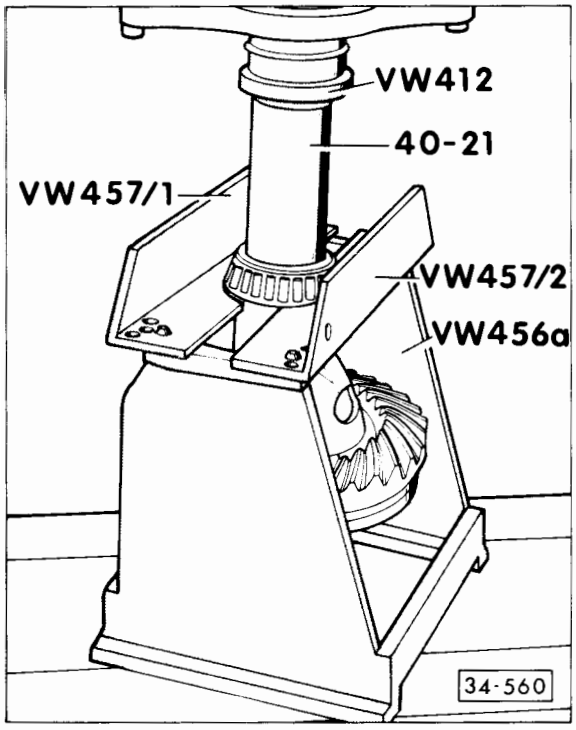


Fig. 5 Pressing inner race/tapered roller bearing off housing

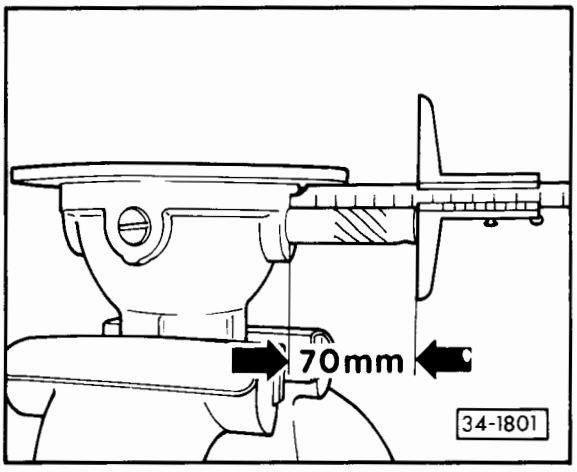


Fig. 6 Driving out differential pinion shaft (long)

Drive out shaft until it projects 70 mm on one side.

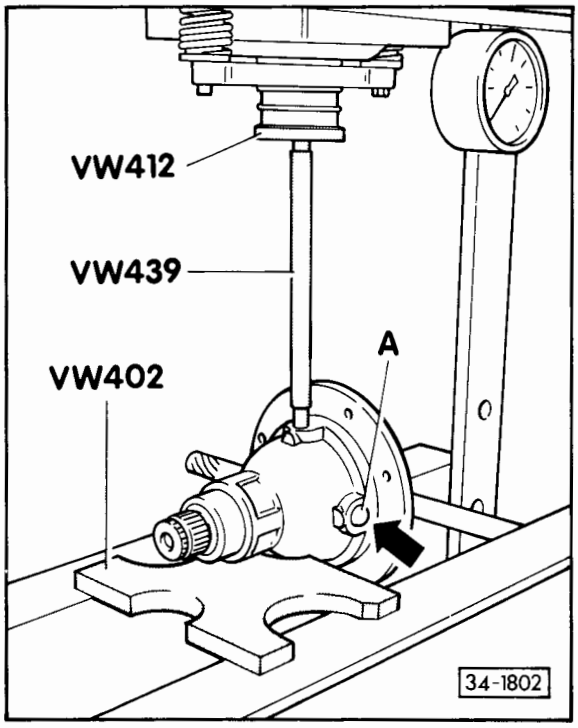


Fig. 7 Pressing out differential pinion shafts (short)

To assist this operation, insert greased ball (17 mm dia.) as far as it will go into the spacer hole and hold in position.
Press out shaft. A – Ball, 17 mm dia.

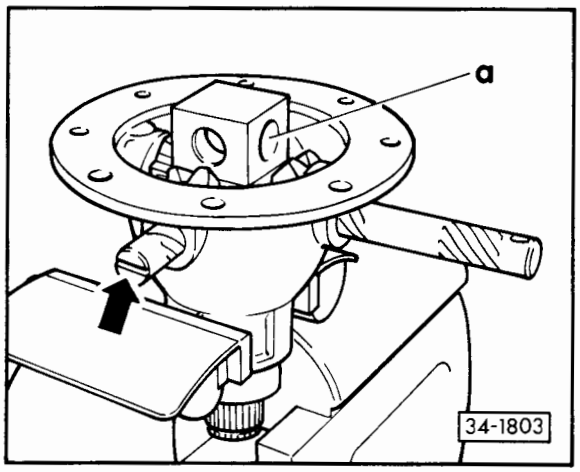


Fig. 8 Installing differential pinion shafts

Position short shafts so that the slots are parallel to the flange. Drive in all shafts until the thrust washers and differential pinions can be fitted. Fit spacer so that the larger hole (a) points to the through shaft. Drive in large shaft until it aligns with hole for spring pin.

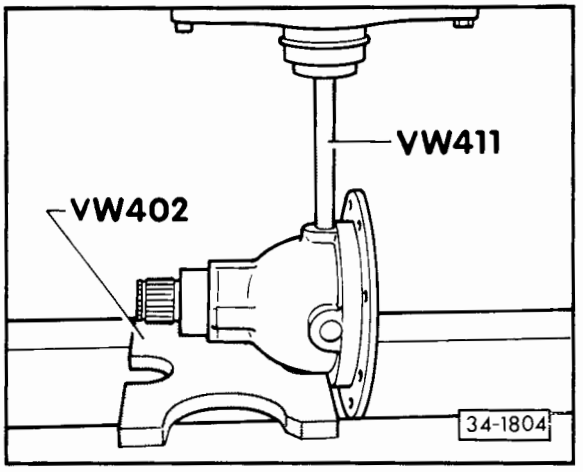


Fig. 9 Pressing in shafts

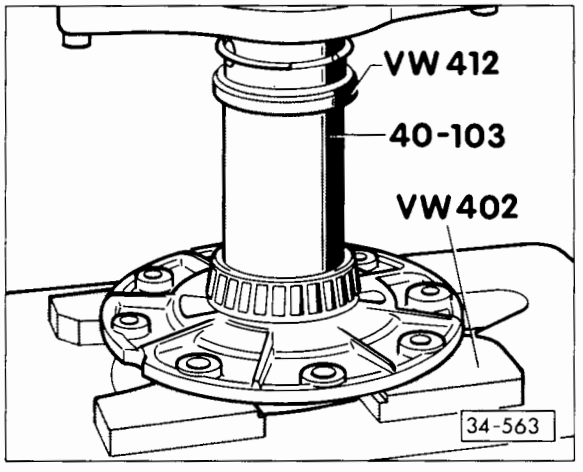


Fig. 10 Heat inner race of tapered roller bearing to about 100° C, install and press home

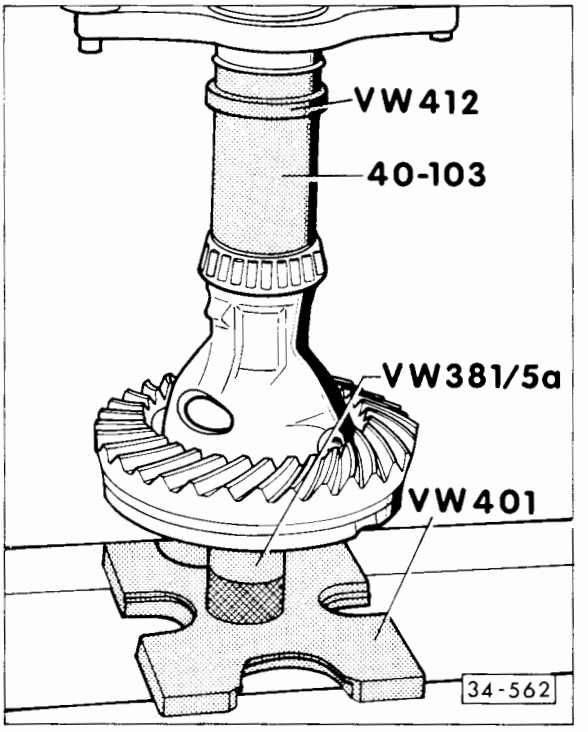


Fig. 11 Heat inner race of tapered roller bearing to about 100° C, install and press home

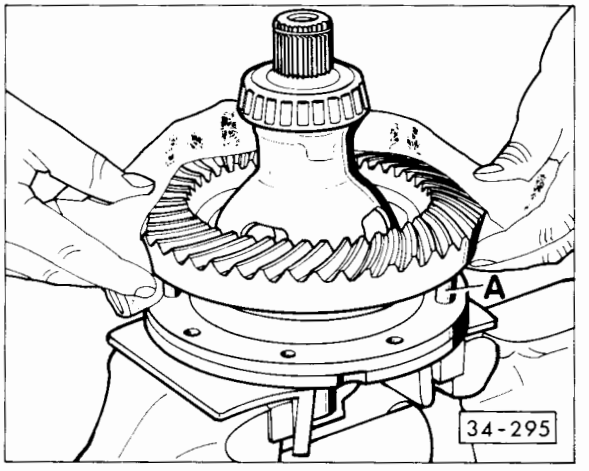


Fig. 12 Heat crown wheel to approx. 100° C and install

A – Centering pins (locally manufactured).

Important

Clean contact surfaces are essential to ensure that the crown wheel, differential housing and cover fit properly. Remove all burrs and pressure marks.

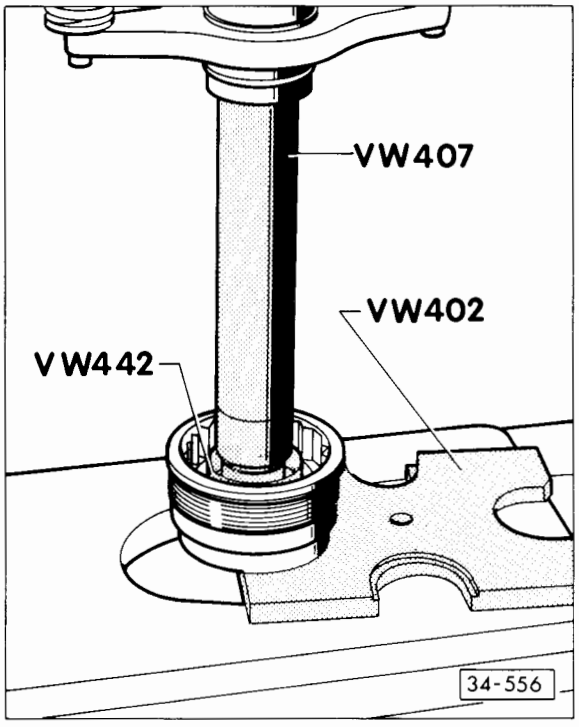


Fig. 13 Pressing outer race/tapered roller bearing out of adjusting ring

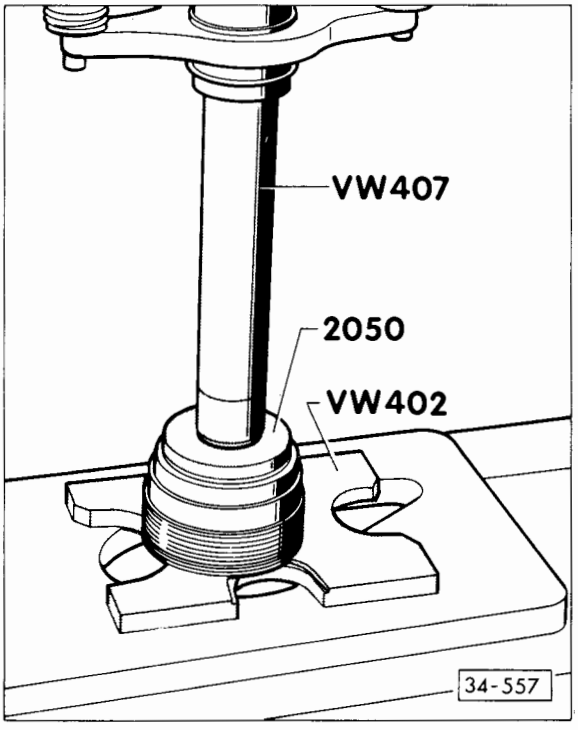
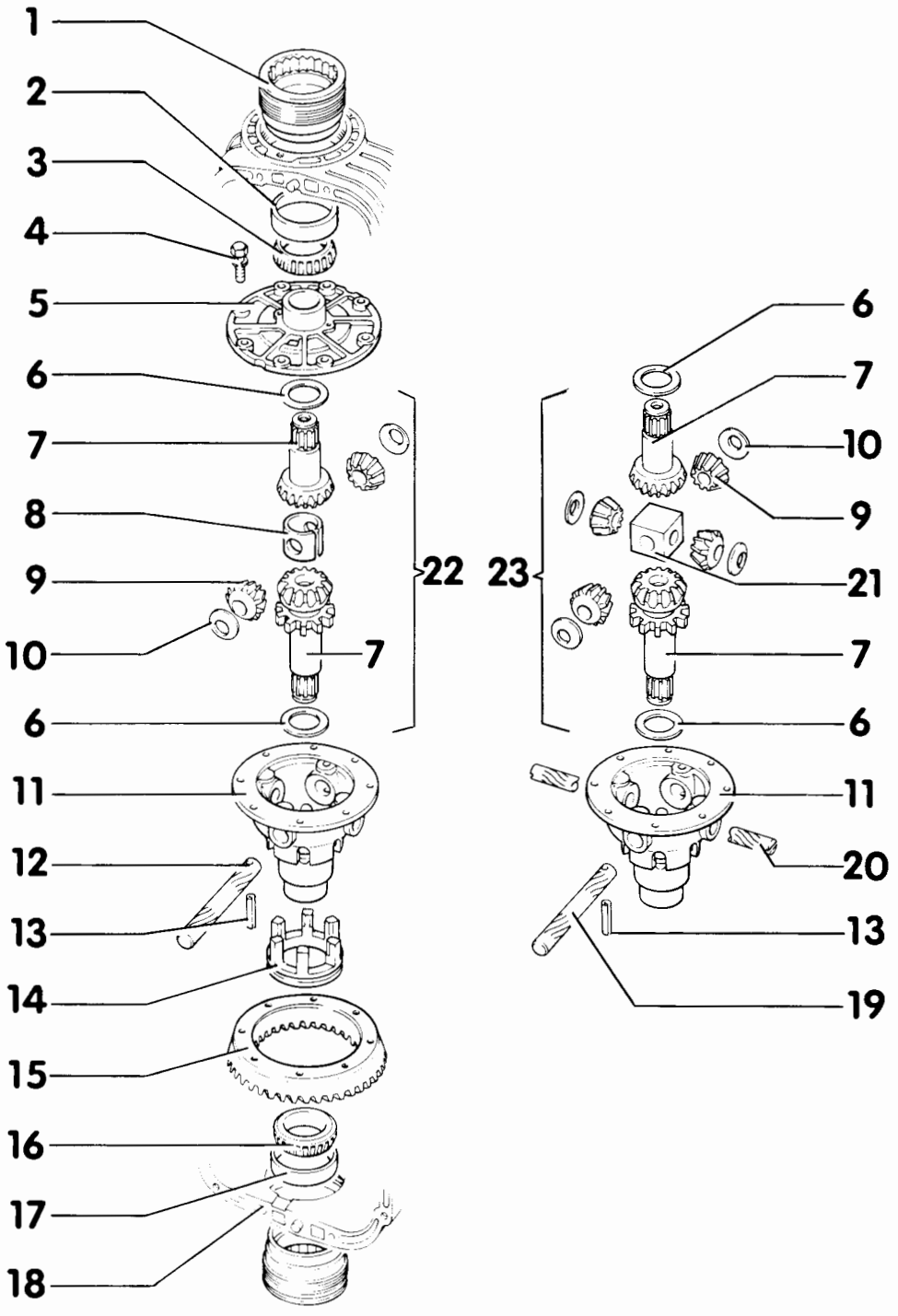


Fig. 14 Pressing outer race/tapered roller bearing into adjusting ring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39 – 1134

DISMANTLING AND ASSEMBLING DIFFERENTIAL WITH DIFFERENTIAL LOCK

Important

If tapered roller bearings are renewed, adjust crown wheel – page 123. Renew both bearings at the same time.

Note:

Clamp differential in vice to dismantle – Fig. 1

1 Adjusting ring

2 Outer race/tapered roller bearing
(Crown wheel side)
- Pressing out – Fig. 13
- Pressing in – Fig. 14

3 Inner race/tapered roller bearing
(Crown wheel side)
- Pressing off – Fig. 4
- Pressing on – Fig. 10

4 Crown wheel bolts
- Only use correct bolts. Pull all bolts down first, then tighten diagonally to **50 Nm.**

5 Differential cover
- Pulling off – Fig. 3
- Installation position: Oil holes must be approx. 90° offset to pinion shaft
- If renewed, adjust axial play (page 122) and crown wheel (page 123)

6 Thrust washers
- Check for cracks and chips

7 Differential gears, large
- Long shaft in housing, short shaft in cover
- If renewed, adjust axial play – page 122

8 Spacer sleeve
- Measure length – page 122

9 Differential gears, short

10 Thrust washers
- Check for cracks and chips

11 Differential housing
- If renewed, adjust axial play (page 122) and crown wheel (page 123)

12 Differential pinion shaft
- Drive out with drift. Drive in carefully to avoid damaging thrust washers

13 Spring pin
- Drive in flush

14 Shift sleeve for differential lock dog clutch

15 Crown wheel
- Is matched to pinion (gear set)
- Removing – Fig. 2
- Installing – Fig. 12
- If gear set is renewed, adjust pinion and crown wheel – page 123

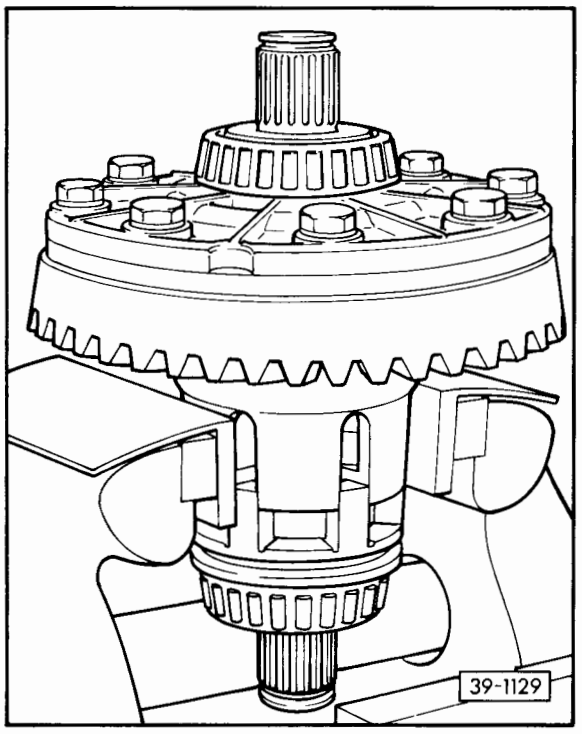


Fig. 1 Clamping differential in vice

Use vice clamps.

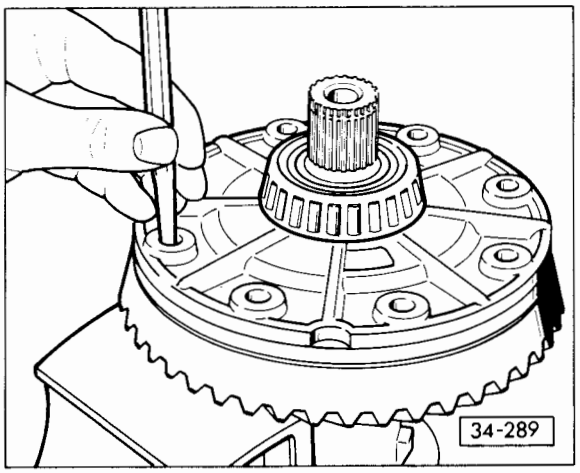


Fig. 2 Knocking crown wheel off housing

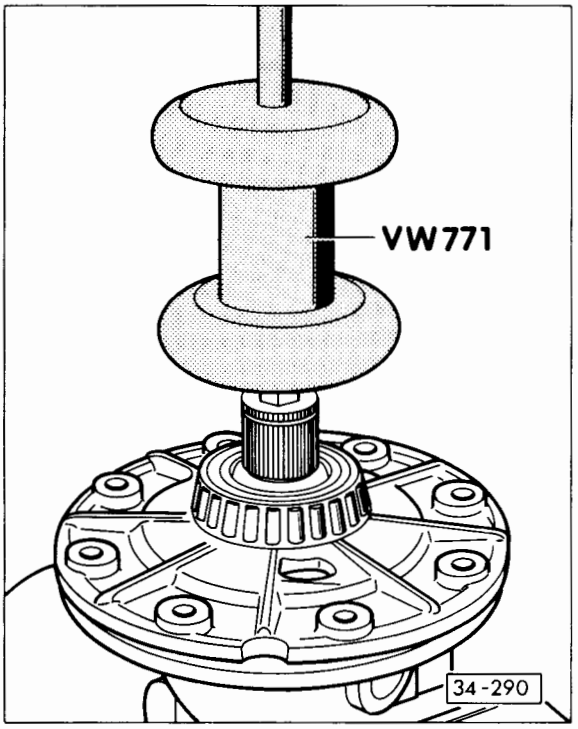


Fig. 3 Pulling cover off differential housing

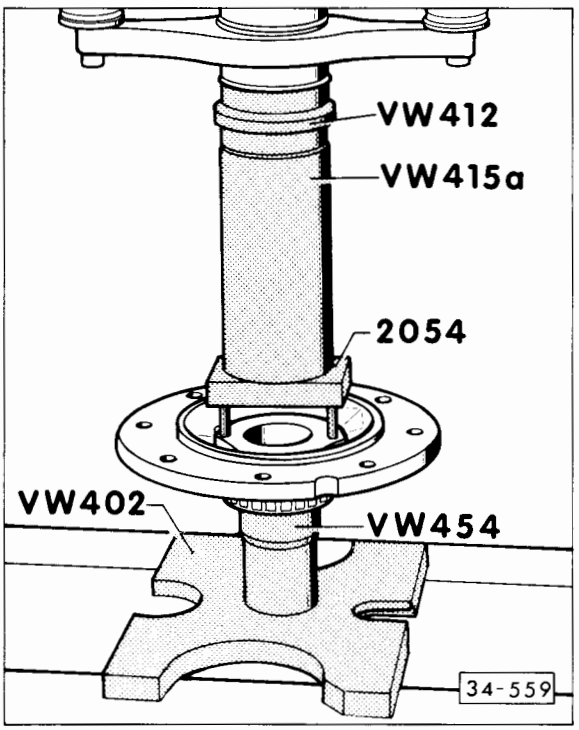


Fig. 4 Pressing inner race/tapered roller bearing off cover

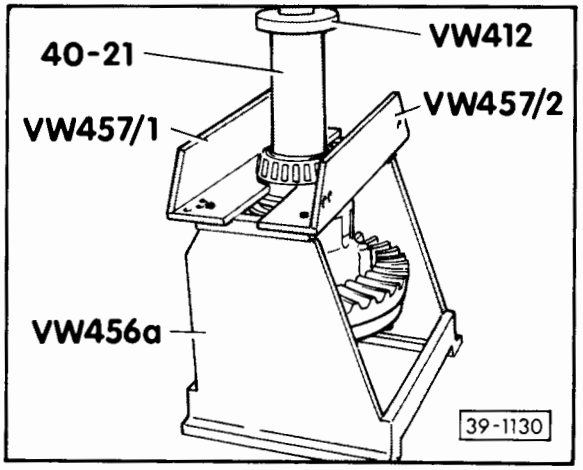


Fig. 5 Pressing inner race/ tapered roller bearing off housing

Remove shift sleeve for differential lock dog clutch.

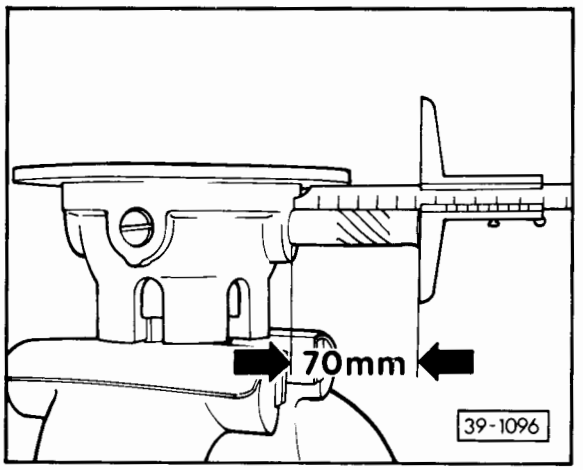


Fig. 6 Driving out differential pinion shaft

Drive out shaft until it projects 70 mm on one side.

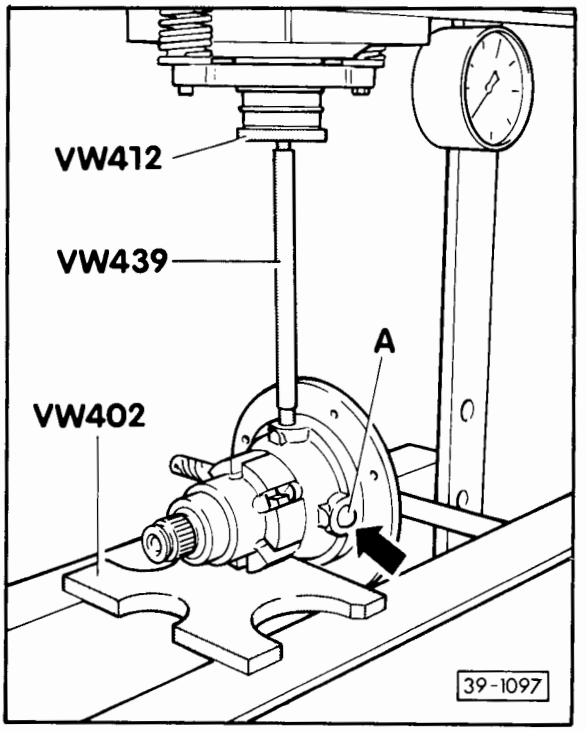


Fig. 7 Pressing out differential pinion shafts

To assist this operation, insert greased ball (17 mm dia.) as far as it will go into the spacer hole and hold in position.
Press out shaft. A – Ball, 17 mm dia.

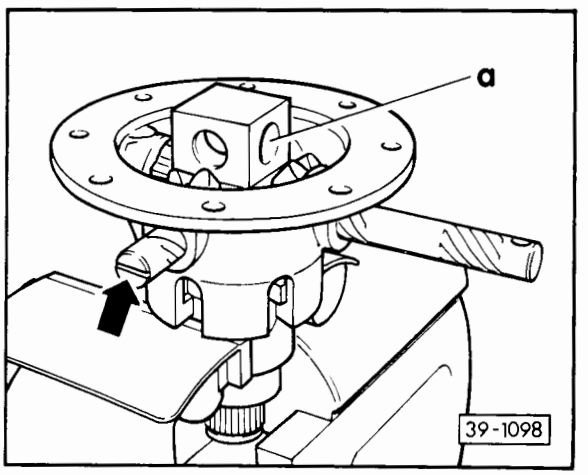


Fig. 8 Installing differential pinion shafts

Position short shafts so that the slots are parallel to the flange. Drive in all shafts until the thrust washers and differential pinions can be fitted. Fit spacer so that the larger hole (a) points to the through shaft. Drive in large shaft until it aligns with hole for spring pin.

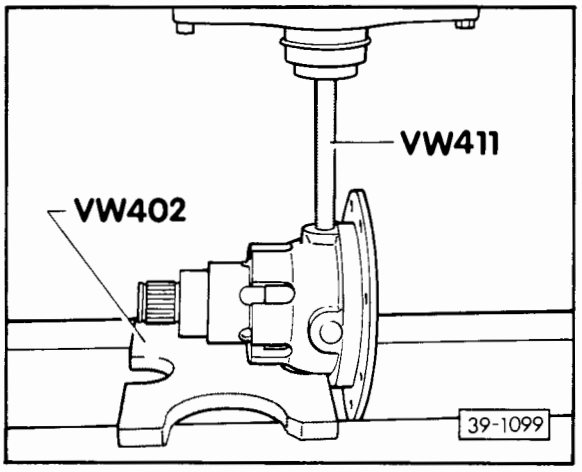


Fig. 9 Pressing in shafts

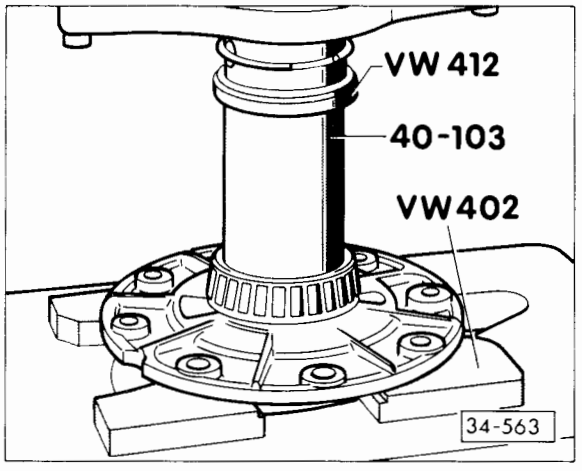


Fig. 10 Heat inner race of tapered roller bearing to about 100° C, install and press home

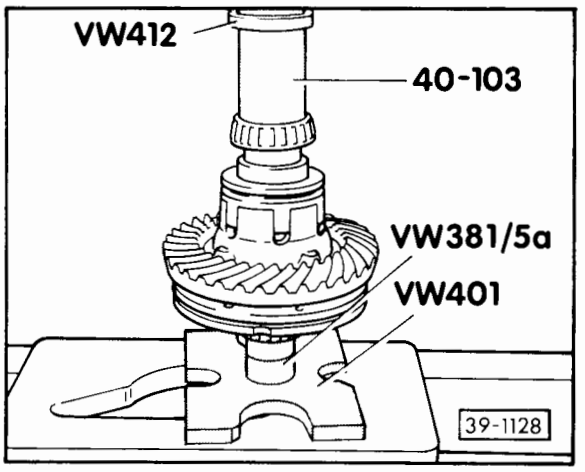


Fig. 11 Heat inner race of tapered roller bearing to about 100° C, install and press home

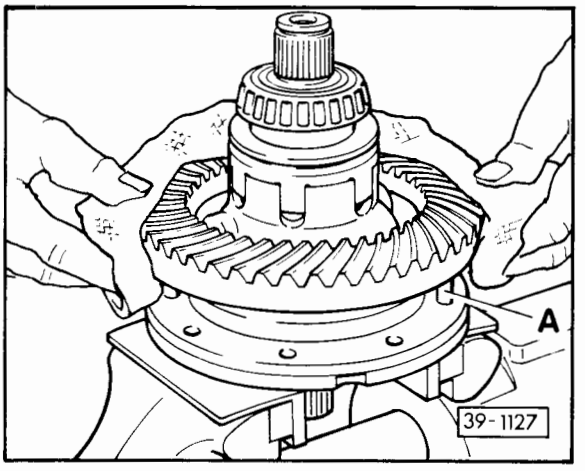


Fig. 12 Heat crown wheel to approx. 100° C and install

A – Centering pins (locally manufactured).

Important

Clean contact surfaces are essential to ensure that the crown wheel, differential housing and cover fit properly. Remove all burrs and pressure marks.

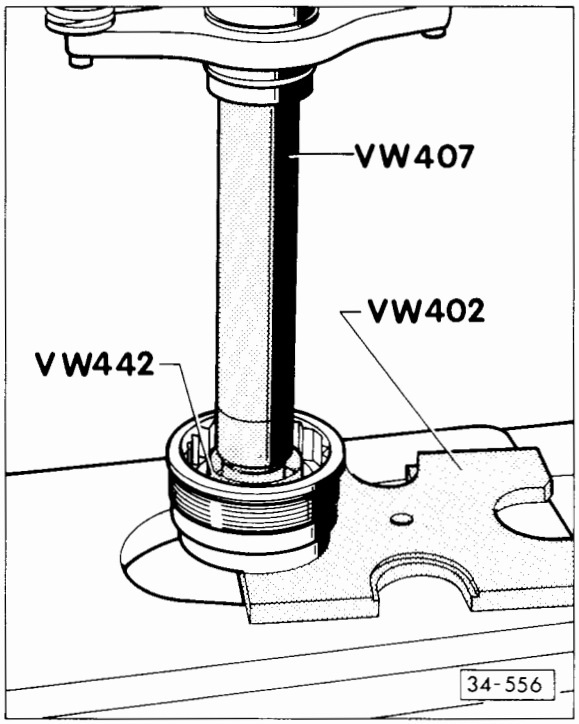


Fig. 13 Pressing outer race/tapered roller bearing out of adjusting ring

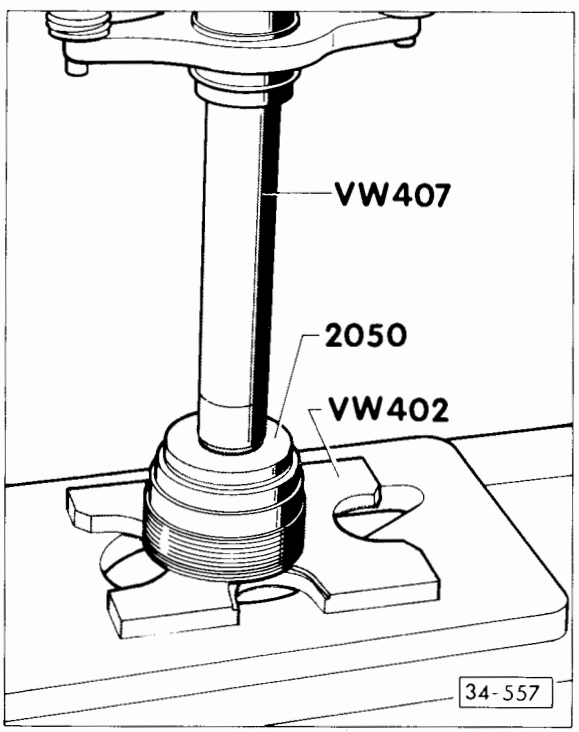
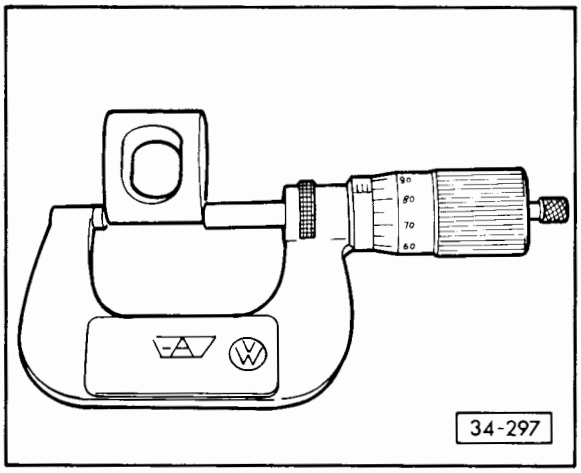


Fig. 14 Pressing outer race/tapered roller bearing into adjusting ring

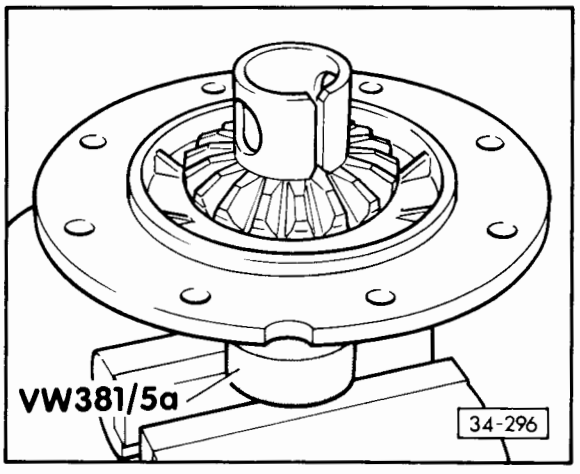
ADJUSTING AXIAL PLAY OF DIFFERENTIAL GEARS

Differential with and without differential lock

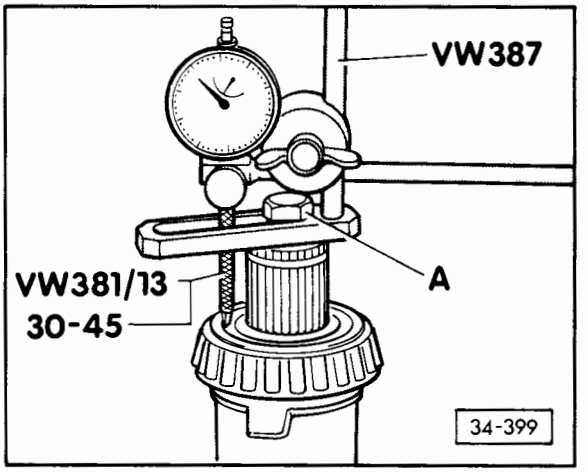
The spacer sleeve ensures that the backlash between the bevel gears is adequate even when there is axial pressure on the differential side gears. If the housing, the cover, one of the side gears or the spacer sleeve is replaced, the length of the spacer sleeve for the new assembly must be worked out again.



Measure the shortest spacer sleeve (Part No. 002 517 241) with a micrometer and mark the actual dimension on the sleeve with an electric marker or similar device. The sleeve should then always be used as a measuring sleeve and should be kept with the measuring device.



- Place side gear (short shaft) and **both** thrust washers in the cover, fit clamping sleeve VW 381/5a and clamp bevel gear hard against the cover.
- Place side gear (long shaft) in the differential housing.
- Insert sleeve and bolt housing and cover together with four M 8 × 20 bolts.



A – M 10 × 25 bolts

Dial gauge extension:
30–45 = 76 mm long
381/13 = 52 mm long

- Install dial gauge (3 mm range) and zero with 2 mm preload.
- Ascertain axial play by moving the side gear up and down (red figures).
- Add the measured play and length of sleeve together. Find this figure in the table under "x" range to obtain correct sleeve.

"x" range	Sleeve length (mm)	Part No.
31.87–31.95	31.84	002 517 241
31.96–32.04	31.93	002 517 242
32.05–32.13	32.02	002 517 243
32.14–32.22	32.11	002 517 244
32.23–32.33	32.20	002 517 245

- Take differential apart, remove measuring sleeve, fit correct sleeve as determined above, assemble differential again (without shaft) and recheck the play.

  If the sleeve has been selected correctly, the play should be
  from 0.03 to 0.17 mm.

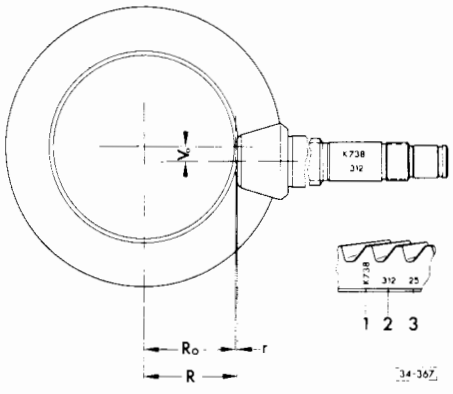
ADJUSTING CROWN WHEEL AND PINION

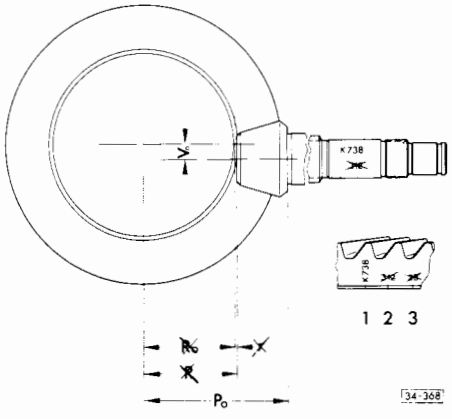
General instructions

Careful adjustment of crown wheel and pinion is essential to ensure long final drive service and silent running. For this reason the crown wheel and pinion are matched during manufacture on special testing machines to check the contact pattern and silent running in both directions. The position for the quietest running is obtained by moving the pinion axially with the crown wheel lifted so far out of the no-play meshing position that the backlash is within the specified tolerance range.

On gear sets delivered as spare parts, the deviation "r" for master gauge "Ro" is measured and recorded on the outer face of the crown wheel. Each gear set (pinion and crown wheel) may only be replaced together.

Crown wheel and pinion marks:





Service gears

1 – The marking "K 738" means a Klingelnberg gear set with a ratio of 7 : 38.

2 – Matching number of gear set (312).

3 – Deviation "r" based on the master gauge used in the special test machine in production. The dimension "r" is always given in 1/100 mm.
Example: "25" means that r = 0.25 mm

Ro – Length of master gauge used in production "Ro" = 63.00 mm

R – Actual dimension between crown wheel centre-line and end face of pinion at the quietest running point for this gear set.

Vo – Hypoid offset = 10 mm

Production gears

X – This detail is not required in production.

Po – Setting dimension for production.

Important

In production the position of the pinion is determined by dimension Po (crown wheel centre-line to back of pinion head). The marking of the deviation "r" on the crown wheel and the matching number have been discontinued. It is therefore necessary to measure the position of the pinion before removing it when parts which affect the position of the pinion are to be replaced. See adjustment table on page 125.

When repairing the final drive, the gears usually only need readjusting when parts which directly influence the adjustment have been replaced. When fitting new parts, see table on page 125.

The object of the adjustment is to set the gear to the same quiet running position as was obtained on the special test machine in production.

Maximum possible care and cleanliness during all assembly and measuring operations are essential if the results are to be satisfactory.

Practical working sequence for adjustment of gears:

If pinion and crown wheel must be adjusted, the following sequence should be observed to ensure rational working:

1 – **Find total screw-in depth "S_{total}" (S_1 plus S_2)**

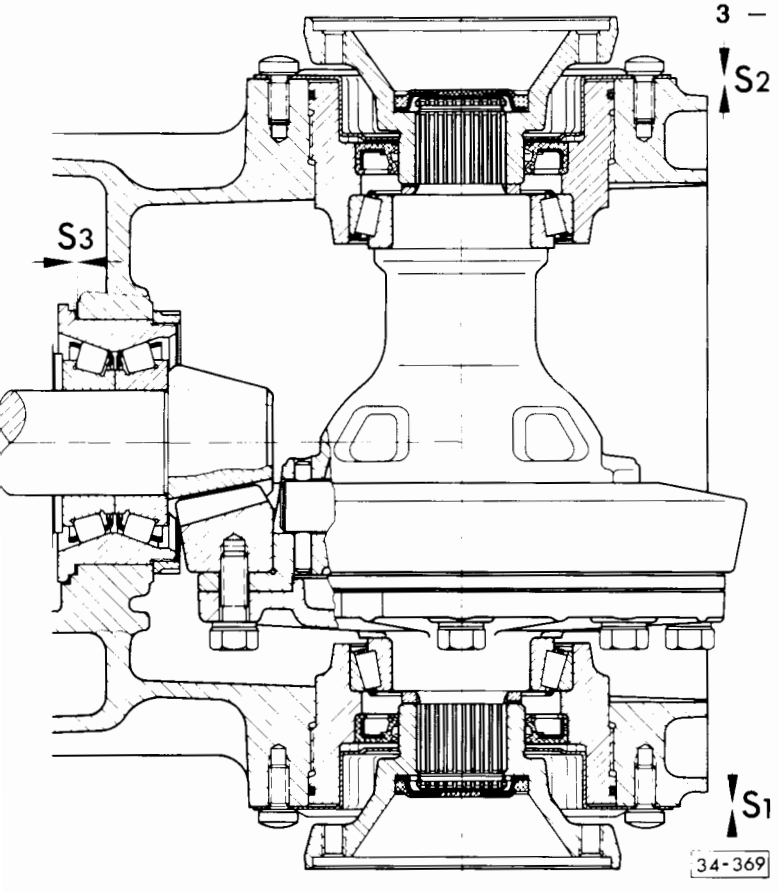
The correct bearing preload is obtained by measuring the torque required to turn the differential.

2 – **Adjusting pinion (S_3) and check**

Adjust position of pinion by placing shims between double tapered roller bearing and contact surface on the gearbox housing so that the dimension from crown wheel centre-line to pinion end face corresponds as closely as possible to the fitting dimension "R".

3 – **Adjust backlash**

Divide "S_{total}" into S_1 and S_2 so that there is a specified amount of backlash between crown wheel and pinion.



S_1 = Screw-in depth of adjusting ring (crown wheel end)
S_2 = Screw-in depth of adjusting ring (opposite end)
S_3 = Shim for pinion

ADJUSTMENT TABLE

When working on the final drive, it is only necessary to adjust the pinion, crown wheel or both if parts which **directly** influence the setting of the transmission have been replaced.

The following table should be noted in order to prevent unnecessary adjustments being carried out.

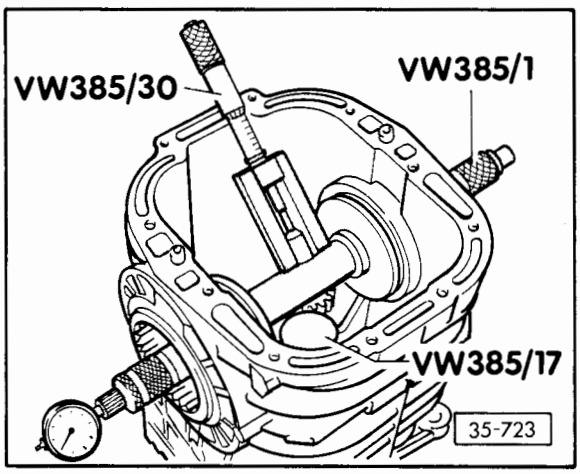
To be adjusted: Part renewed	Pinion (S_3) from actual dimension Page 125	Pinion (S_3) from deviation "r" Page 126	Crown wheel (S_1 and S_2) Page 129
Gearbox housing	X		X
Adjusting ring for final drive			X
Differential housing			X
Cover for differential housing			X
Differential tapered roller bearing			X
Double tapered roller bearing for pinion	X		
Gear set (crown wheel and pinion)		X	X

FINDING POSITION OF PINION (ACTUAL DIMENSION)

This work need only be carried out if deviation "r" is not given on crown wheel and parts which affect the pinion position are to be renewed. **These are:**

Double tapered roller bearing for pinion and gearbox housing

- Take differential out.
- Assemble measuring bar as described on page 126 and place it in gearbox housing.



- Set universal gauge VW 385/30 to **Ro** = **63.00 mm** and place it on bar. Zero dial gauge (3 mm) with 1 mm preload.
- Measure difference from "Ro" (max. deflection, reading red figures). The measured value = deviation "r". Note value.

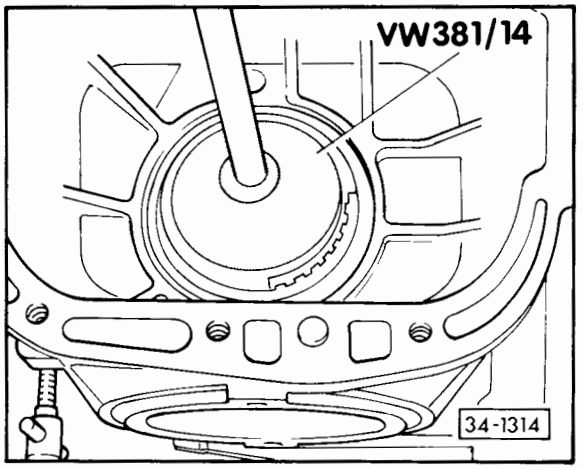
  Example: 0,25 mm.

When parts have been renewed, the pinion should be adjusted as described on pages 126 and 128. The deviation "r" as measured is then used when determining the thickness of shim "S_3".

ADJUSTING PINION
(Adjusting output shaft)

The pinion only needs adjusting as described here if the gears themselves have been renewed. If other parts which affect the position of the pinion are to be renewed, the setting must be measured before dismantling and set to this dimension on assembly. See page 125 for table of adjustments.

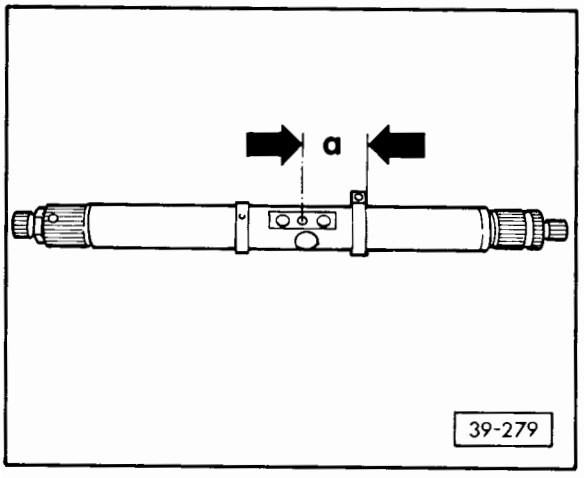
– Assemble pinion up to needle bearing for 1st speed gear wheel. Tighten needle bearing inner race to 210 Nm.



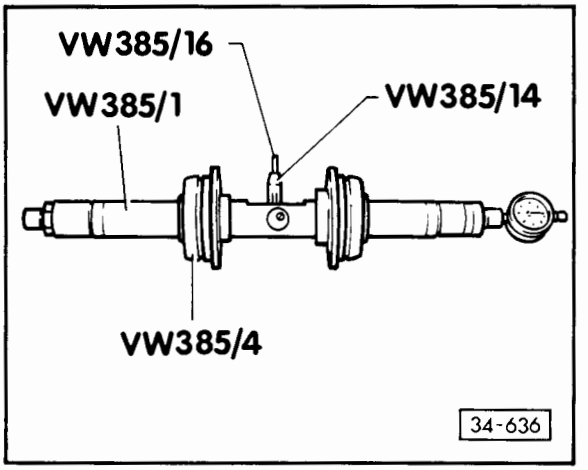
– Install pre-assembled pinion in the gearbox housing **without** shim "S_3". Install retaining ring and **tighten to 225 Nm first, then back it off and tighten to 225 Nm again.**

Finding dimension "e"

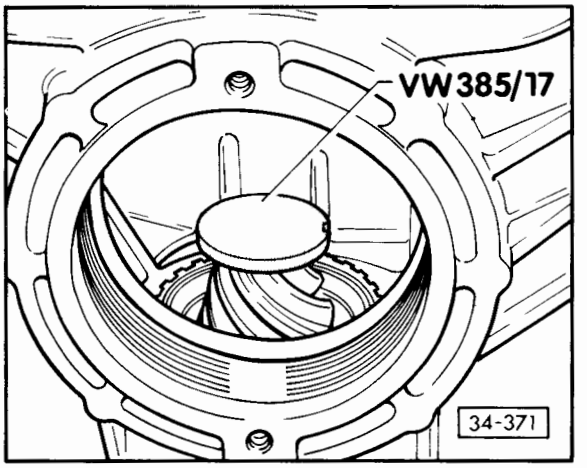
– Screw adjusting ring into gearbox housing until it is flush with housing.



– Adjust setting ring on universal measuring bar VW 385/1 to dimension "a".
a = approx. 75 mm



– Assemble bar as shown. Dial gauge extension VW 385/16 = 12.3 mm long.

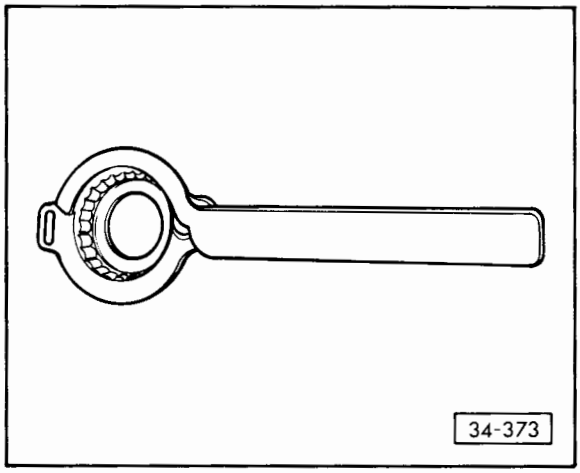


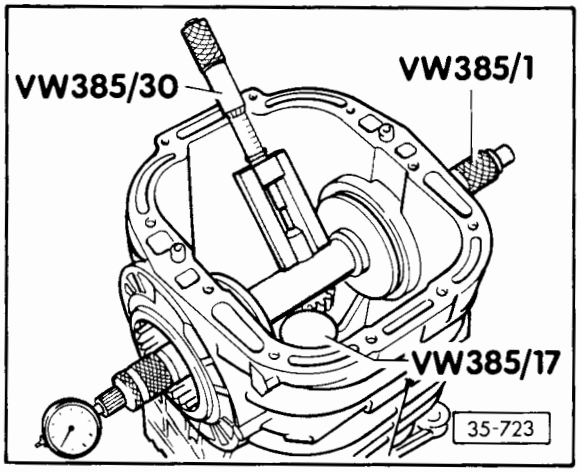
– Place measuring plate VW 385/17 on end of pinion.

– Place bar in housing and screw second adjusting ring in until it is flush with housing. Move the second centering ring outwards with the movable setting ring until the bar can just be turned by hand.

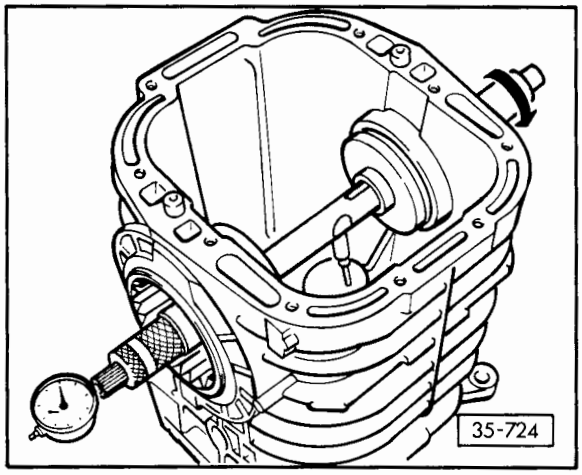
Note:

To screw the second ring in, a wrench can be made from a lock plate and a piece of strip metal, as shown in illustration.





– Set universal gauge VW 385/30 to **Ro** = **63.00 mm** and place it on the bar. Zero dial gauge (3 mm) with 1 mm preload.



– Turn bar until measuring pin touches plate on end of pinion and needle deflects to return point.
The reading is dimension "e".
Example: 0.40 mm.

Finding thickness of shim "S_3"

$$S_3 = e + r$$

e = Measured figure (max. deflection)
r = Deviation (marked on crown wheel in 1/100 mm or found by actual measurement)

Example:

Dial gauge reading "e"	0.40 mm
Deviation "r" marked on crown wheel	+0.25 mm
Thickness of shim "S_3"	=0.65 mm

Shims available as spare parts

Part No.	Thickness (mm)
001 311 391	0.15
001 311 392	0.20
001 311 393	0.30
001 311 394	0.40
001 311 395	0.50
001 311 396	0.60

The shim tolerances make it possible to select any required thickness for "S_3".

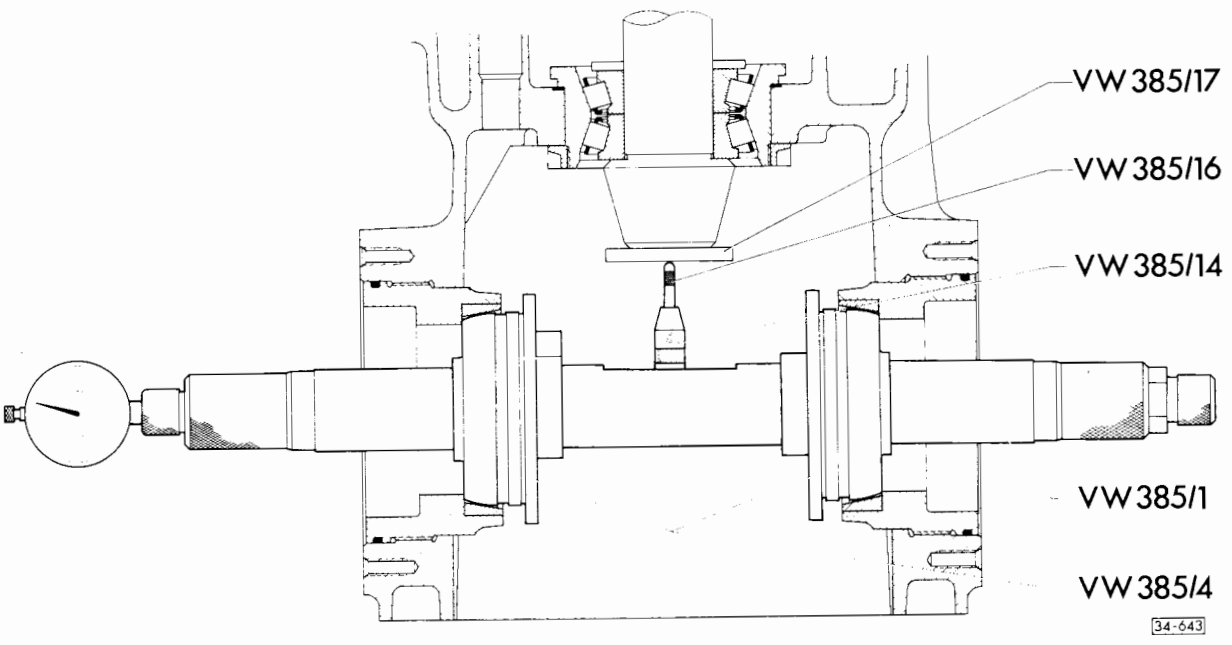
Measure shims at several points with a micrometer and check for burrs and damage.

Use only shims which are in good condition.

Checking adjustment

Install pinion with measured shim "S_3" and check the setting.

If the shim "S_3" has been selected correctly, the dial gauge reading (read anticlockwise, red figures) should now **show deviation "r" within a tolerance of ± 0.04 mm.**



Arrangement of measuring tools for finding dimension "e".

ADJUSTING CROWN WHEEL
(Adjusting differential)

The crown wheel only needs adjusting if

adjusting rings
gearbox housing
differential housing cover
differential tapered roller bearings
differential housing or
crown wheel and pinion (gear set)

have been renewed.

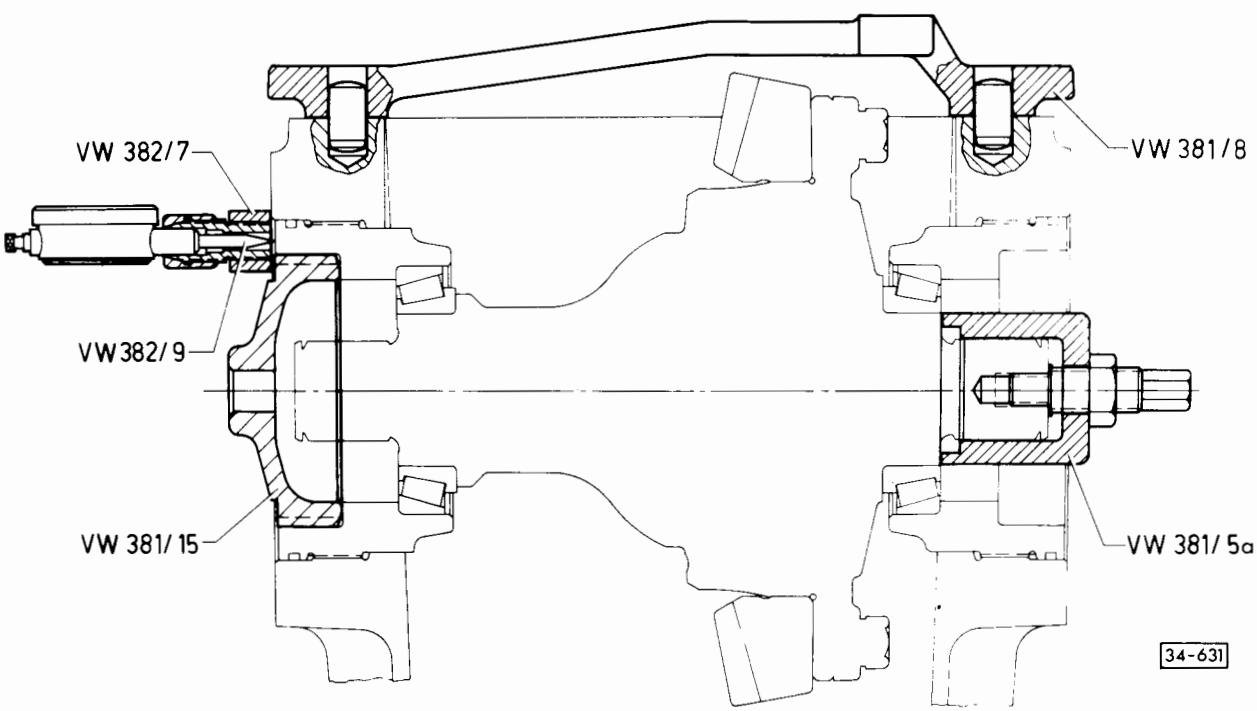
Adjustment table, page 125.

Finding total screw-in depth "S_{total}".
(Adjusting bearing preload).

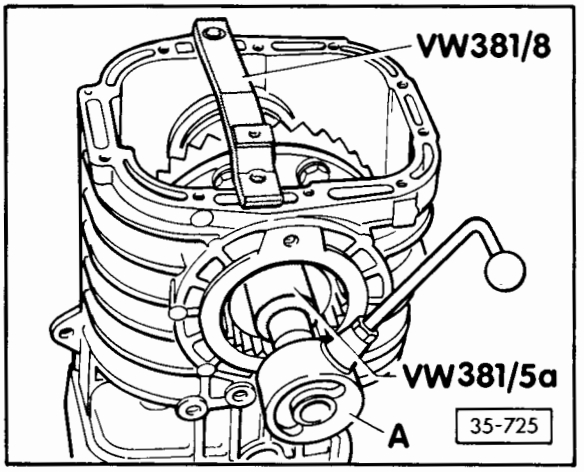
Pinion removed.

> **Important**
>
> It is essential to the measurements that the tapered roller bearing outer races are pressed fully home. Press home if necessary.

- Install differential complete with crown wheel in housing. The crown wheel is on the left.
- Fit dial gauge (3 mm) in **bar VW 382/7** with an 18 mm long **extension VW 382/9** and **zero with 3 mm preload.**
- Screw adjusting ring at crown wheel end in with **socket spanner VW 381/15** until its upper edge is **0.20 mm** below surface of housing.
- Screw other ring in with **socket spanner VW 381/15** until the differential is held free of play and without preload.
- Fit **sleeve VW 381/5a** on crown wheel side and lock it with hexagon nut.
- Turn gearbox so that differential is at the top and place **bridge VW 381/8** on the dowel pins.



Arrangement of tools when adjusting bearing preload



A = Torque gauge (commercially available) (0–600 Ncm)

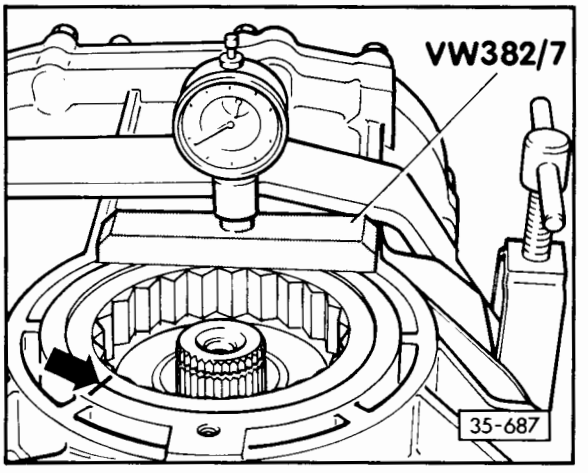
– Install torque gauge with a 19 mm socket. Turn differential in both directions while **oiling the tapered roller bearings with hypoid gearbox oil.**

– Increase the bearing preload slowly by screwing in the adjusting ring (opposite end to crown wheel) with **socket spanner VW 381/15** while turning the differential rapidly, and continue until the specified turning torque is reached.

Adjust as follows:

	New bearings	Used bearings *
Torque	300–350 Ncm	30–70 Ncm

* After running at least 50 km



– Measure provisional depth in relation to measuring surface of housing to which the adjustment rings are screwed in – "S_1 and S_2" (S_{total}). Note the readings.

– Mark adjusting rings (arrow) and do not interchange them.

Note:

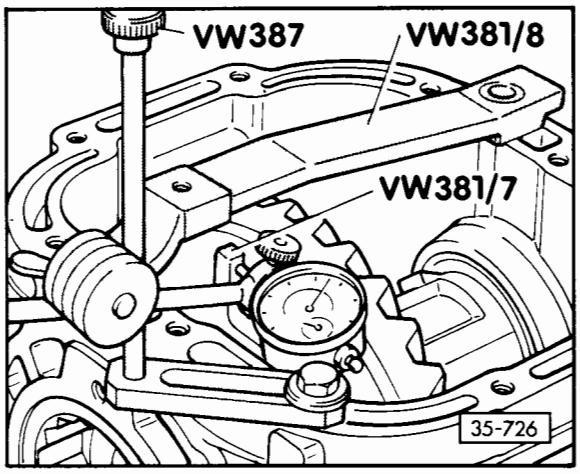
If crown wheel and pinion are being reset, the pinion adjustment and check should now be carried out (see page 126). Differential must be removed to do this.

Adjusting backlash

Pinion with S_3 installed.

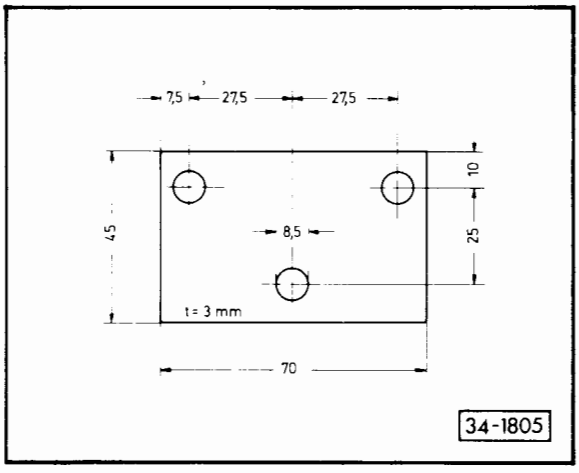
– Install differential and screw in adjusting rings on **correct sides.**

– Fit spacer bridge VW 381/8 again. Turn the differential and at the same time screw the adjusting rings in until the provisional screw-in depth S_1 and S_2 is obtained again. In this way, the turning torque on the bearings which was obtained by the turning torque test is obtained again (S_{total}).



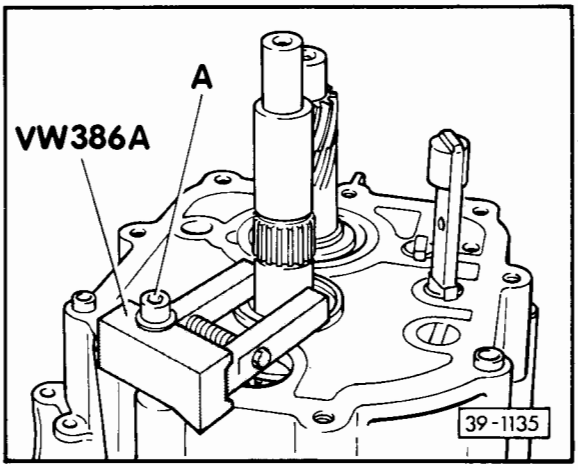
– Install measuring tools.
– Press bracket VW 381/7 onto two crown wheel bolts as far as it will go.

Fixing pinion, front final drive



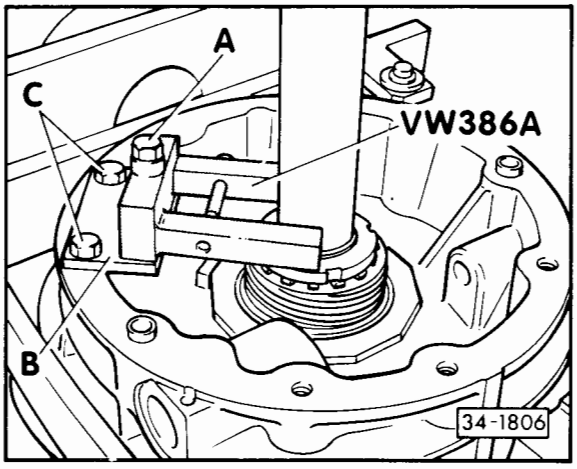
– Construct a retaining plate out of 3 mm thick sheet metal as shown in drawing to secure the special tool VW 386/A to the final drive housing.

Fixing pinion, manual gearbox



– Fix pinion.

A = M 8 x 125 bolt



– Fix pinion.

A = M 8 x 60 bolt with M 8 nut
B = Retaining plate (manufactured in-house)
C = M 8 x 20 bolt

– Turn crown wheel to stop, set dial gauge to zero. Turn crown wheel in opposite direction and read off the blacklash. Note the figure.
– Take bracket off.
– After turning crown wheel 90° each time, take three more readings.

Important

If the readings obtained vary by more than 0.06 mm from one another, there is something wrong with the installation of the crown wheel or the gears themselves. Check all assembly operations and renew crown wheel and pinion if necessary.

– Screw adjusting ring at opposite end to crown wheel **out from the provisional screw-in depth "S_2"** and adjusting ring at ring gear end **in by the same amount.** The position of the adjusting ring at opposite end to crown wheel must be **rectified** after screwing in adjusting ring at crown wheel end because of the preload. Keep within a tolerance of ± **0.01 mm** when doing this.

Important

$S_1 + S_2$ must always add up to S_{total} otherwise the bearing preload has been altered.

– Keep adjusting the rings until the backlash is **0.15–0.25 mm.**

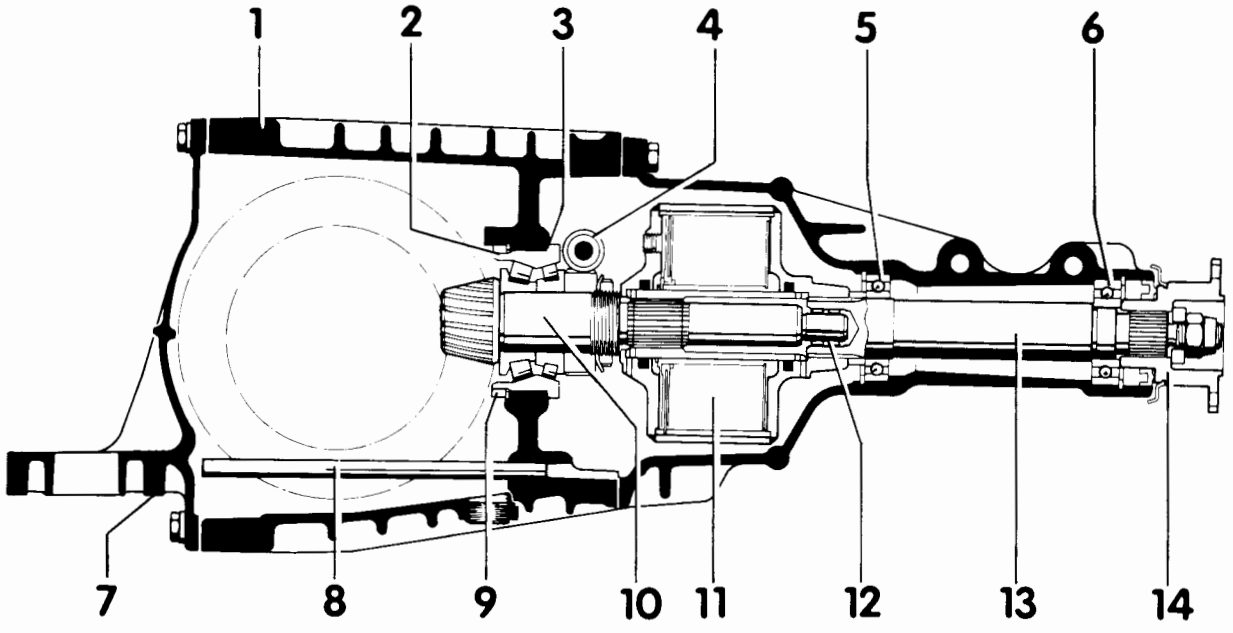
Note:

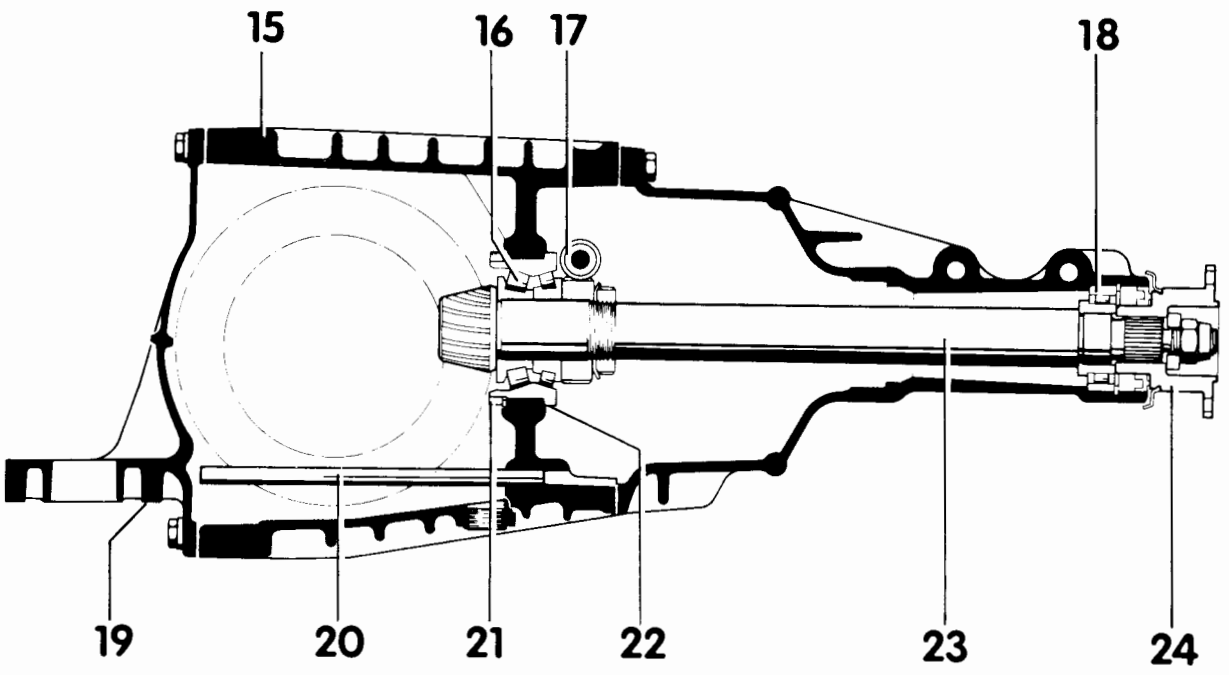
In order to obtain the required backlash quickly, the measured backlash minus 0.20 mm can be assumed for the first setting of adjusting rings.

– **Checking backlash.**
It must be measured at four points 90° apart and should be
0.15–0.25 mm.

Important

The individual readings must not differ from one another **by more than 0.05 mm.**



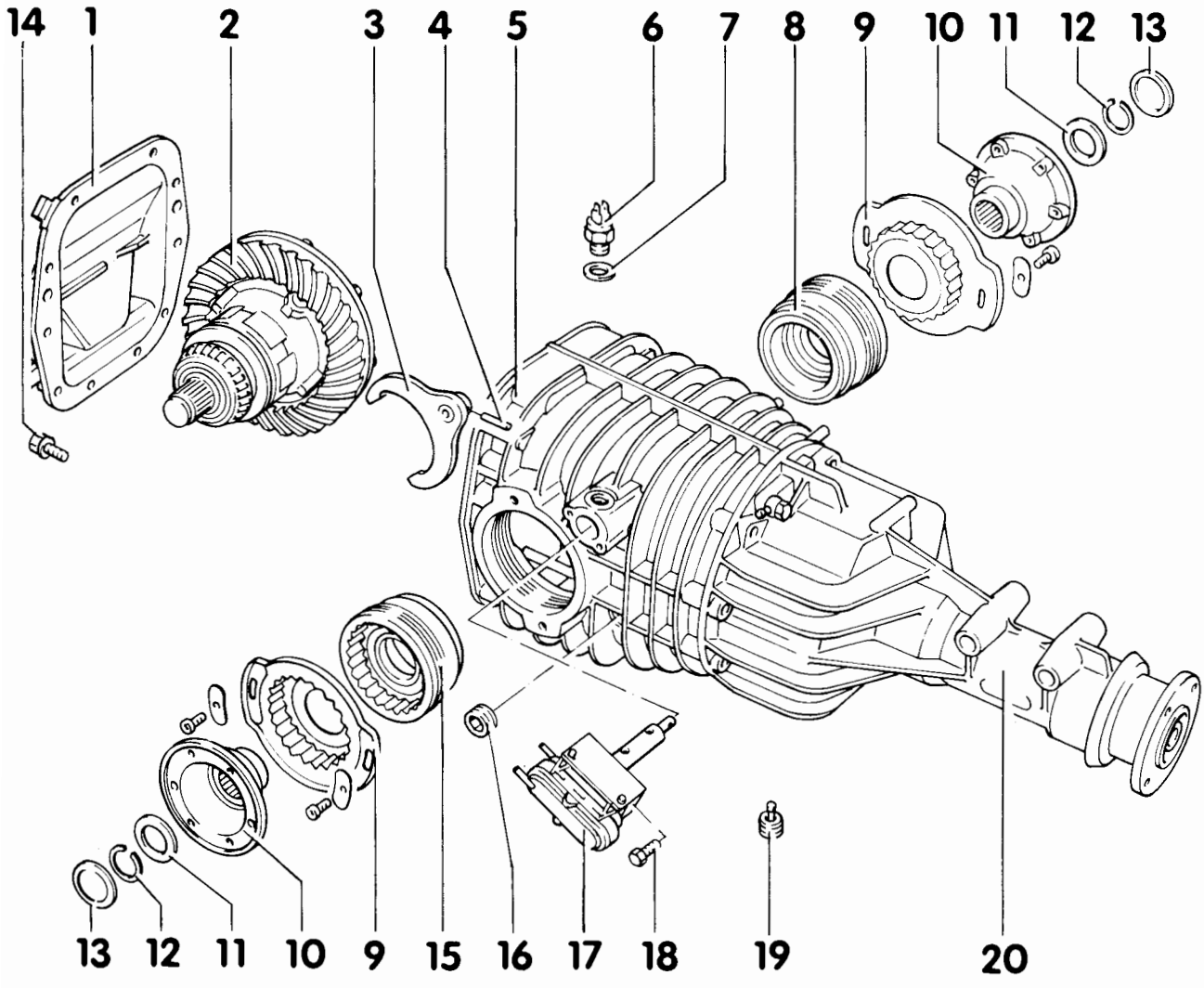


34-1807

FRONT DIFFERENTIAL

Exploded view

1 Front final drive, with viscous coupling for permanent 4WD
2 Double tapered roller bearing
3 Shim S_3
4 Speedometer drive
5 Deep-groove ball bearing
6 Deep-groove ball bearing
7 Axle casing cover
8 Oil pipe
9 Retaining ring
10 Pinion
11 Viscous coupling
12 Needle bearing
13 Flange shaft
14 Flange
15 Front final drive for selectable 4WD
16 Double tapered roller bearing
17 Speedometer drive
18 Cylindrical roller bearing
19 Axle casing cover
20 Oil pipe
21 Retaining ring
22 Shim S_3
23 Pinion
24 Flange



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DISMANTLING AND ASSEMBLING FRONT FINAL DRIVE

Removing and installing differential

Note:

Clamp final drive in vice to dismantle (Fig. 1) and drain gear oil.

1 Cover
- Before removing, loosen left-hand final drive adjusting ring to relieve the preload on the gearbox housing. Mark position of adjusting ring beforehand – Fig. 3.

2 Differential
- Before removing, take out adjusting rings and selector fork for differential lock
- Dismantling and assembling – pages 108 to 121

3 Selector fork

4 Spring pin
- Renew
- Driving out – Fig. 5

5 Final drive casing
- Dismantling and assembling final drive with viscous coupling – page 142
- Dismantling and assembling final drive with selectable 4WD – page 142

6 Switch for warning lamp

7 0-ring
- Renew
- Note 0-ring thickness

8 Adjusting ring, right
- Mark before removing – Fig. 3
- Removing – Fig. 4
- Installing – Fig. 7
- Coat thread with MOS_2 grease
- Dismantling and assembling – pages 108 and 114
- Renew seal

9 Locking cap

10 Drive flange
- Removing – Fig. 2
- Installing – Fig. 8

11 Dished washer

12 Circlip
- Renew
- Installing – Fig. 9

13 Cap
- Renew

14 Hexagon head bolt with washer **20 Nm**

15 Adjusting ring, left
- Mark before removing – Fig. 4
- Removing – Fig. 5
- Installing – Fig. 7
- Coat thread with MOS_2 grease
- Dismantling and assembling – pages 108 and 114
- Renew seal

16 Oil filler plug 20 Nm

17 Shift element

18 Hexagon head bolt

19 Oil drain plug 20 Nm

20 Input shaft housing
- Repairing – page 143

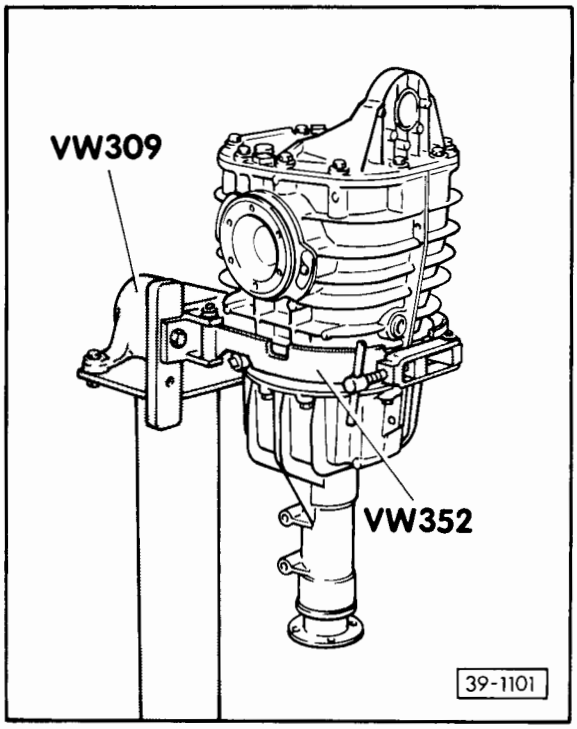


Fig. 1 Clamping final drive in vice

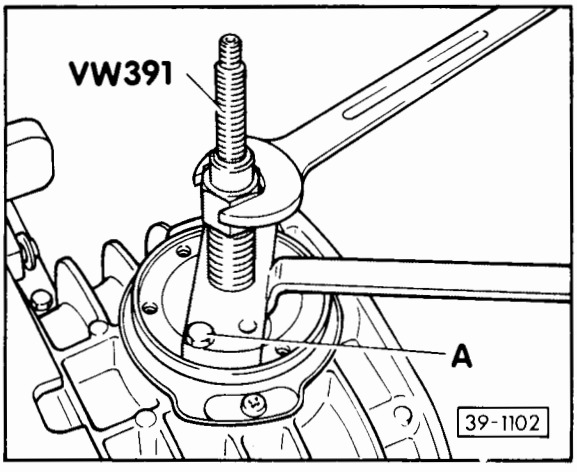


Fig. 2 Removing drive flange

A = Screw 2 bolts (M 8 × 30) through the slots into the drive flange.

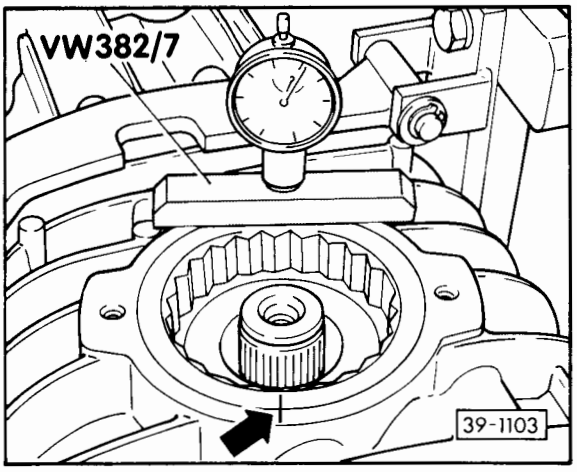


Fig. 3 Determining and marking position of adjusting ring

Before starting repair work which does not require the differential to be adjusted again afterwards, use a marking tool to mark the position (arrow) of the adjusting rings in the gearbox housing and measure the depth to which they are screwed in with VW 382/7 and record the readings.

Make one mark on the left side (crown wheel side) and two marks on right side.

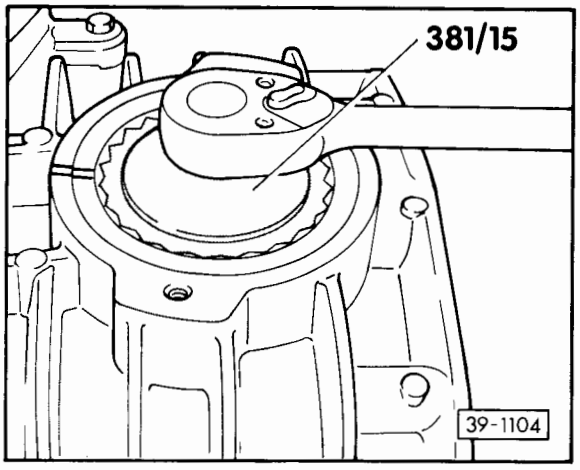


Fig. 4 Removing adjusting rings

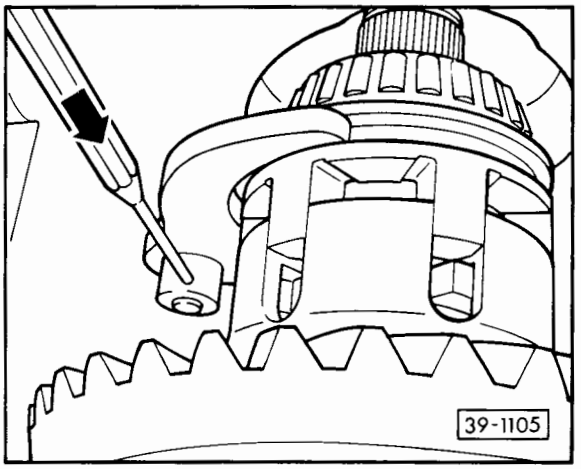


Fig. 5 Driving out spring pin for selector fork

Pull shift element complete out of selector fork.

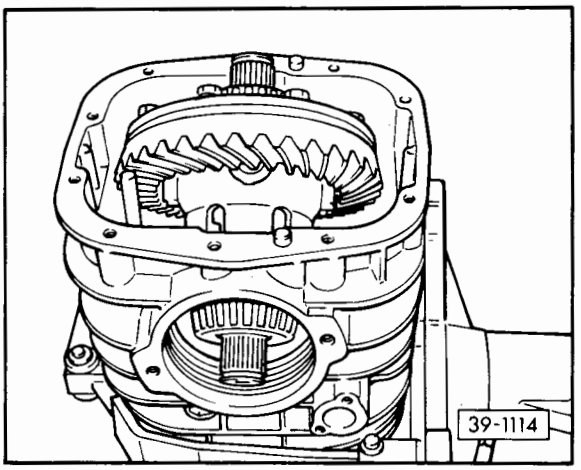


Fig. 6 Swivelling out differential

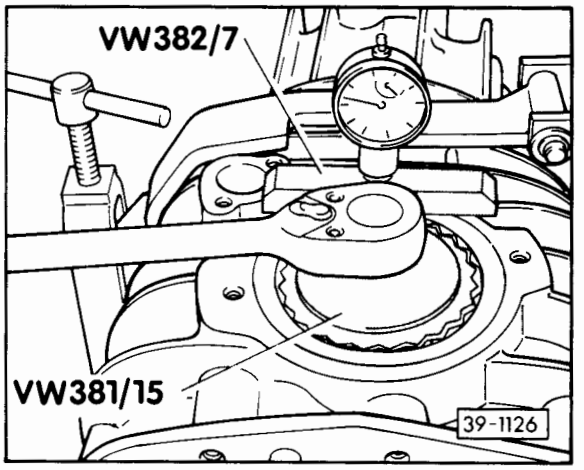


Fig. 7 Installing adjusting rings

Screw adjusting rings into gearbox housing **as previously marked** and set them to the marks made when removing and to the depth measured.

Important

Do not tighten the left-hand ring until the gearbox cover has been fitted and the nuts tightened.

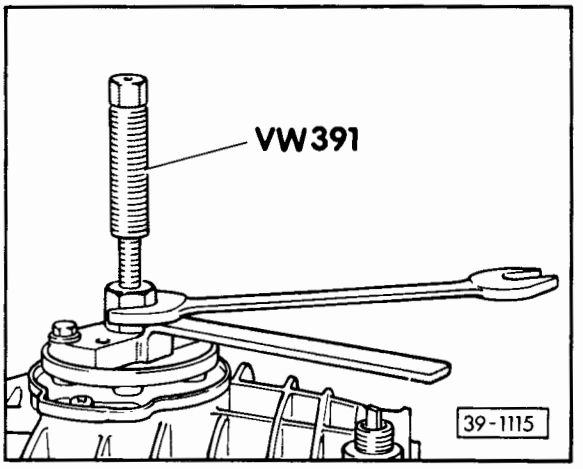


Fig. 8 Installing drive flange

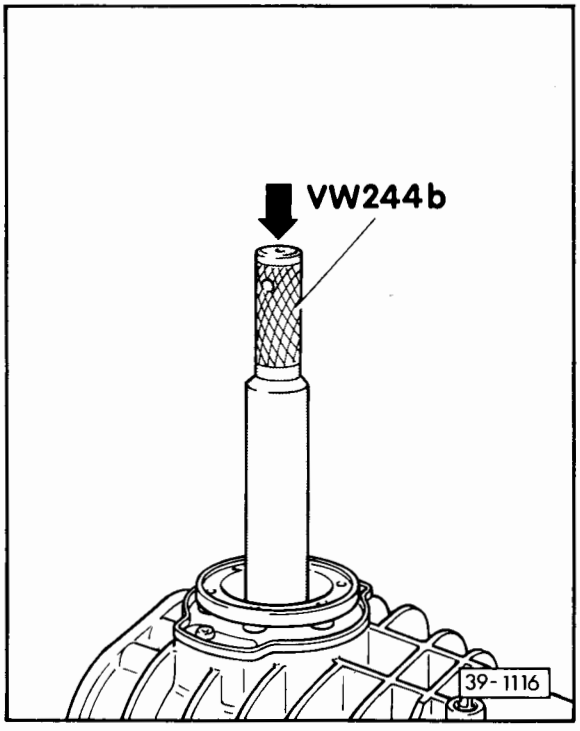
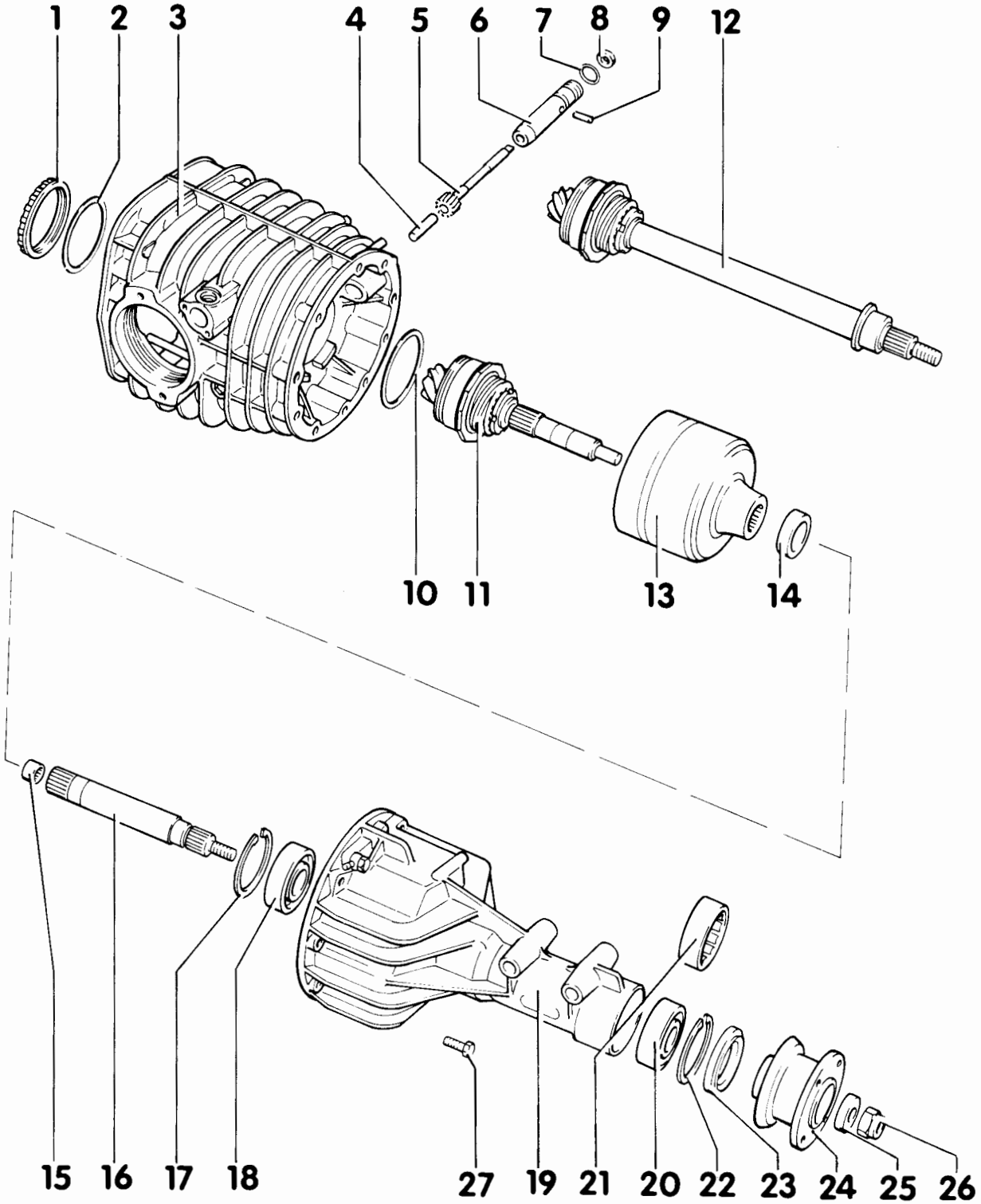


Fig. 9 Installing circlip

Install dished washer and circlip. Press circlip into groove and ensure that washer is central.



39–1137

DISMANTLING AND ASSEMBLING FINAL DRIVE CASING

- Final drive with viscous coupling – page 144
- Final drive with selectable 4WD – page 146

1 Retaining ring
- Screwing on and off – pages 144 and 148

2 Washer

3 Casing for final drive

4 Straight pin

5 Pinion for speedometer drive

6 Guide for pinion

7 O-ring
- Renew

8 O-ring
- Renew

9 Spring pin
- Renew

10 Shim S_3
- Note thickness
- Adjustment table – page 125

11 Pinion for final drive with viscous coupling
- Dismantling and assembling – page 152

12 Pinion for final drive with selectable 4WD
- Dismantling and assembling – page 152

13 Viscous coupling (1)

14 Spacer ring (1)

15 Needle bearing (1)
- Oil with gear oil before installing

16 Flanged shaft (1)

17 Circlip (1)

18 Deep-groove ball bearing (1)

19 Rear cover

20 Deep-groove ball bearing (1)

21 Outer race of cylindrical roller bearing (2)
- Removing inner race of bearing – page 152

22 Circlip

23 Oil seal
- Can also be replaced with gearbox in situ

24 Flange for propshaft

25 Washer

26 Hex nut 160 Nm

27 Hexagon head bolt with washer **20 Nm**

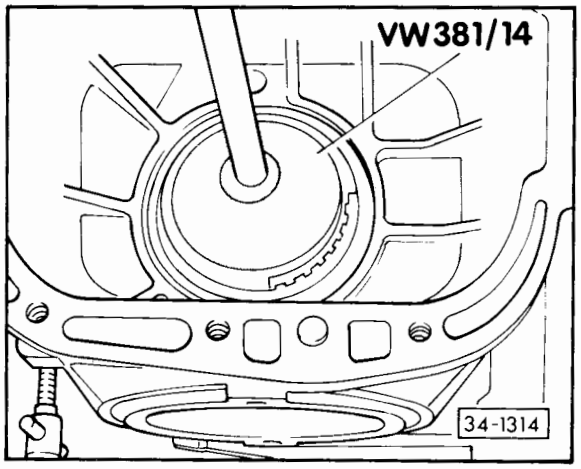
(1) Only on final drive with viscous coupling
(2) Only on final drive with selectable 4WD

DISMANTLING AND ASSEMBLING FRONT FINAL DRIVE

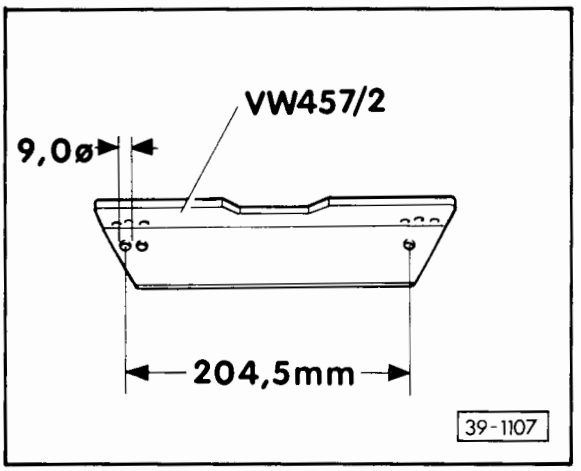
Dismantling and assembling final drive casing with viscous coupling

Dismantling

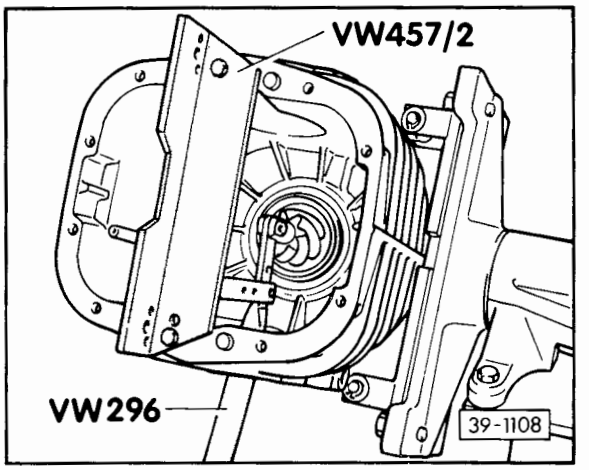
- Unscrew hexagon head bolts for rear cover.
- Remove cover complete.
- Remove spacer ring and viscous coupling.
- Drive out spring pin for speedometer drive.
- Pull out speedometer drive.



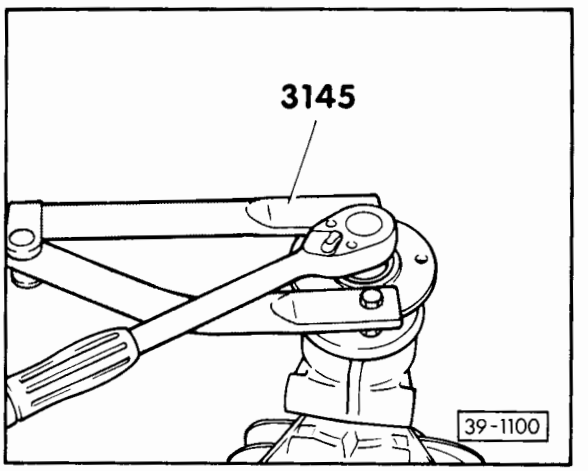
- Unscrew retaining ring.



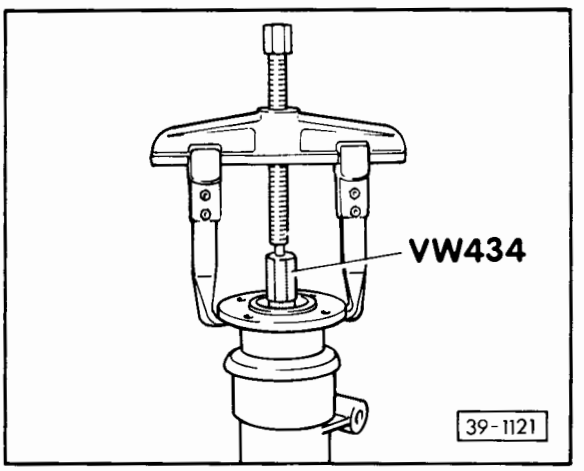
- Drill an additional hole (9.0 mm dia.) in bracket VW 457/2.



- Press out pinion. Secure VW 457 with two bolts M 8 × 20.
- Take out shim "S_3". Note thickness.

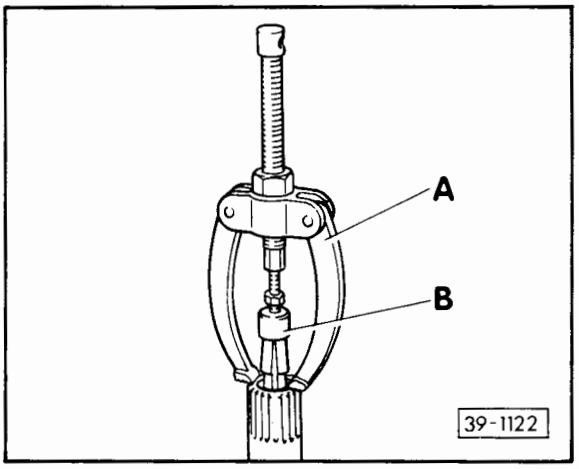


- Mount holder on flange and unscrew hex nut.



- Pull off flange with two-arm puller, if necessary.

– Pull out flanged shaft.

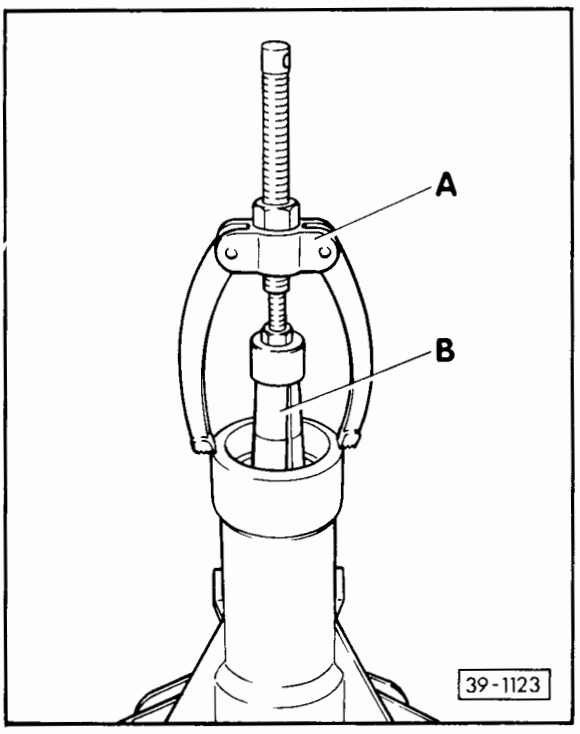


– Pull needle bearing out of flanged shaft.

A – Holder, e. g. Kukko 22-1
B – Internal puller 12–14.5 mm, e. g. Kukko 21/1

– Lever oil seal out of rear cover.

– Remove circlips for outer and inner deep-groove ball bearings.



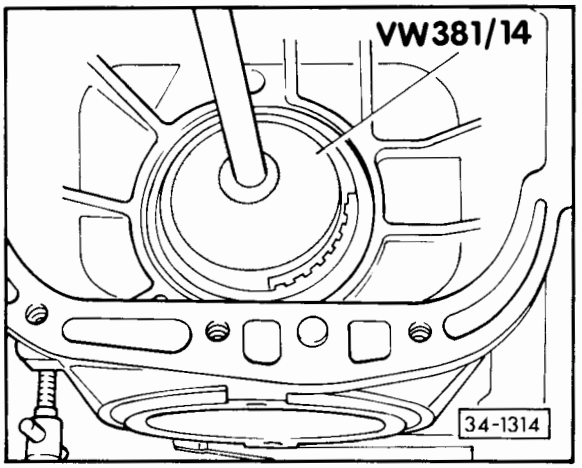
– Pull out both deep-groove ball bearings.

A – Holder, e. g. Kukko 22-2
B – Internal puller 30–37 mm, e. g. Kukko 21/5

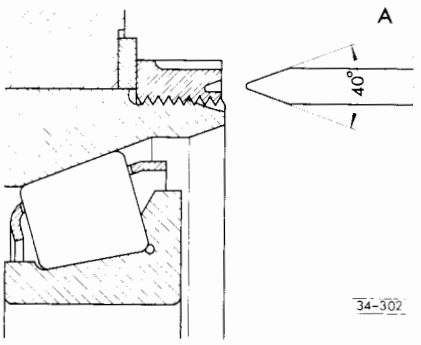
Installing

Beforehand: Fit "S_3" shim. Align double hex of the double tapered roller bearing with recess in casing. Before fitting pinion, warm bearing seat of double tapered roller bearing in gear-box housing to 40–60° C. Drive in pinion by hitting with a plastic hammer.

– Fit washer and screw on retaining ring.



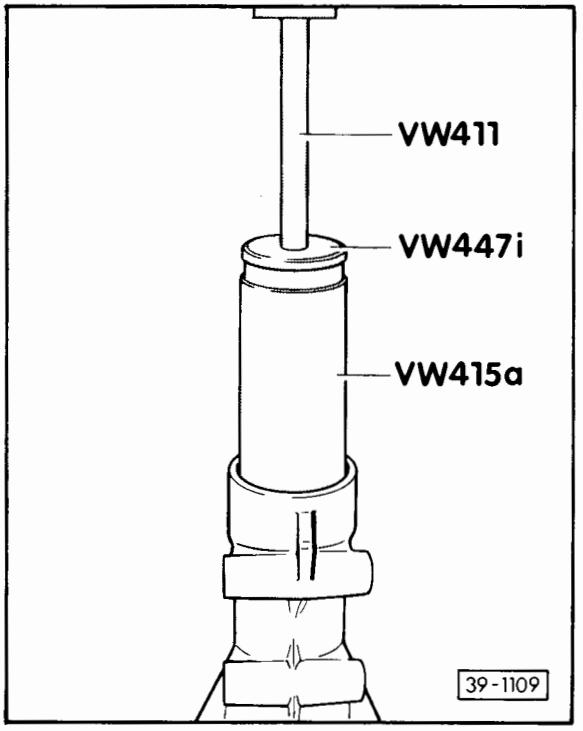
– Tighten retaining ring to 225 Nm, loosen and then finally tighten to 225 Nm.



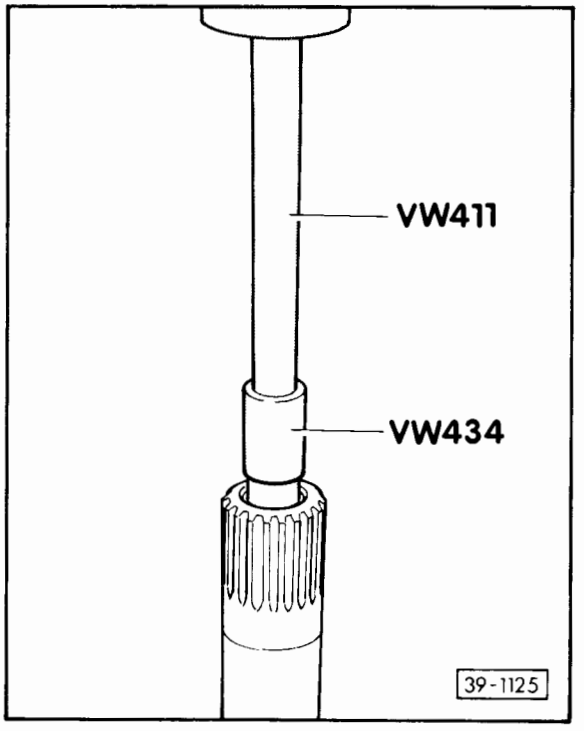
– Secure retaining ring at two points by peening.

A – Self-produced peening tool

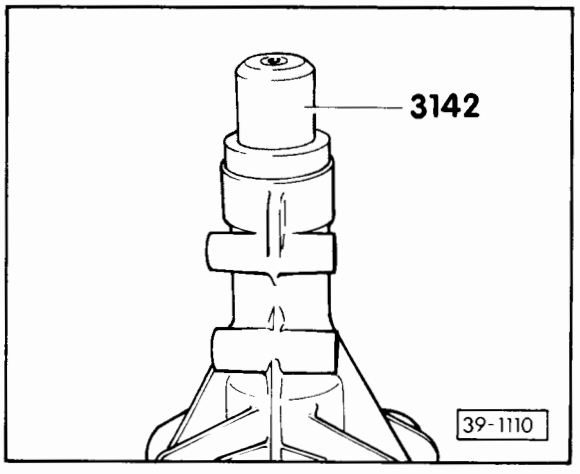
– Install speedometer drive.



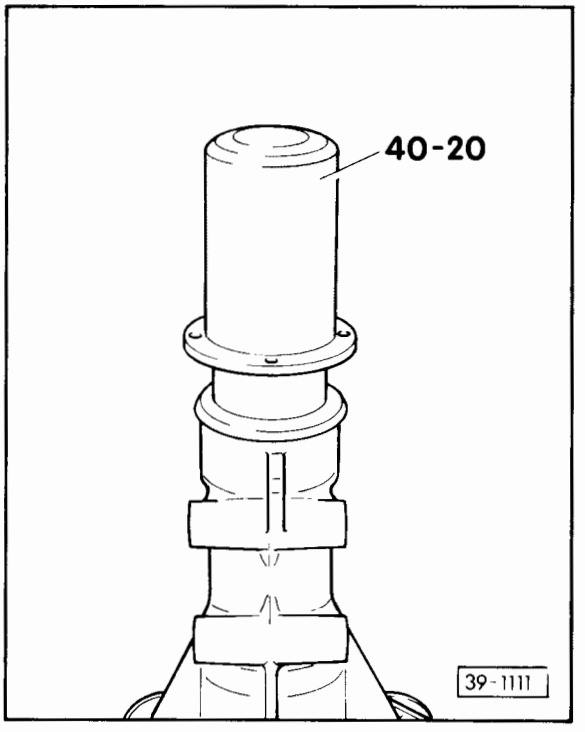
– Press deep-groove ball bearings as far as they will go into into rear cover.
– Fit circlips.



– Press needle bearing into flanged shaft
– Insert flanged shaft into rear cover.

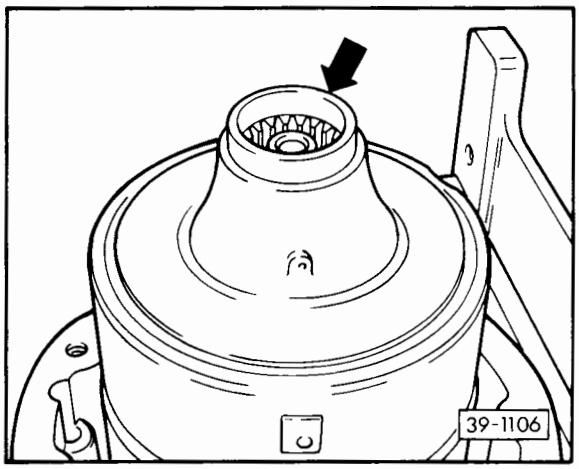


– Drive oil seal fully home.



– Fit flange for propshaft and, if necessary, drive on.
– Fit washer.
– Mount holder and tighten hex nut to 160 Nm.

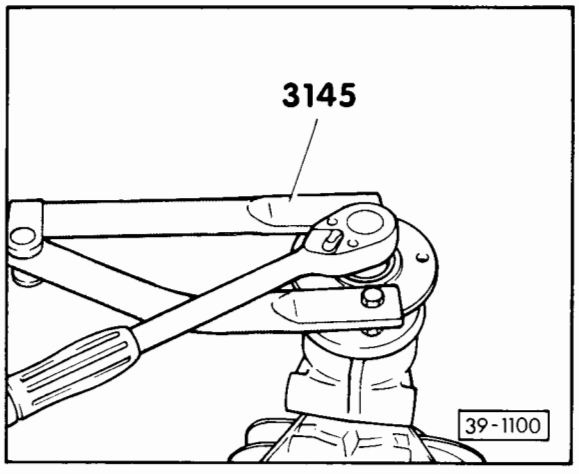
– Fit viscous coupling onto pinion.



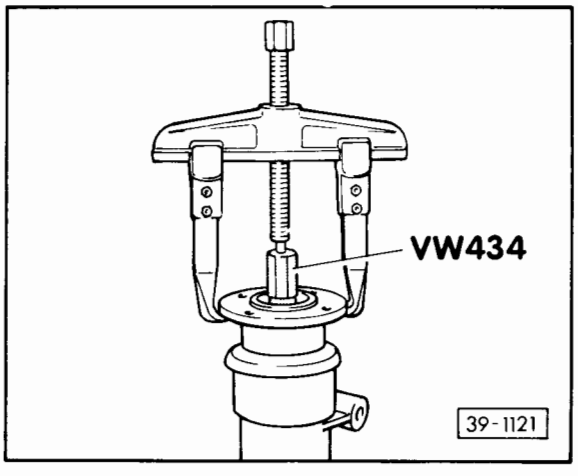
– Grease spacer ring and install aligned with viscous coupling.
– Install cover complete.
– Screw down cover.

Dismantling and assembling final drive casing with selectable 4WD

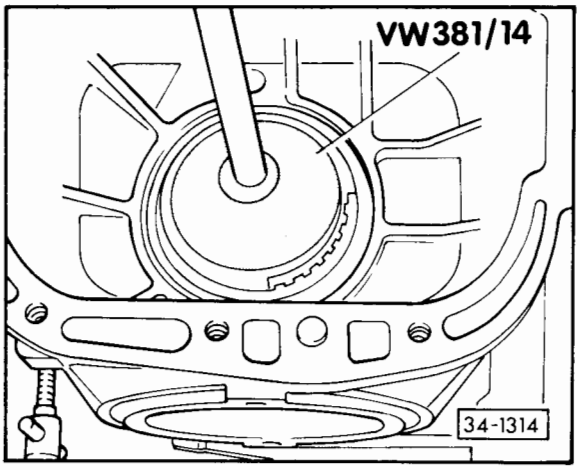
Dismantling



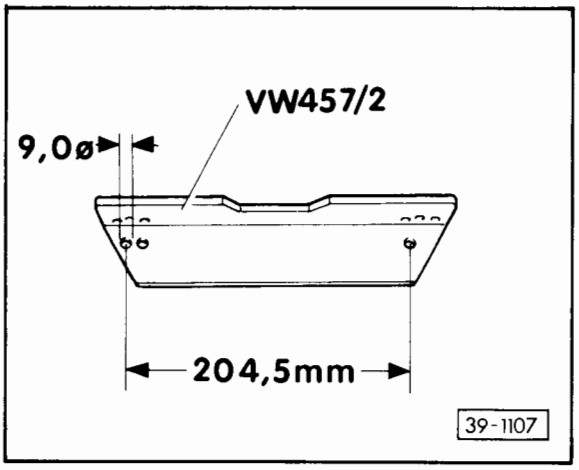
– Mount holder on flange for propshaft and unscrew hex nut.



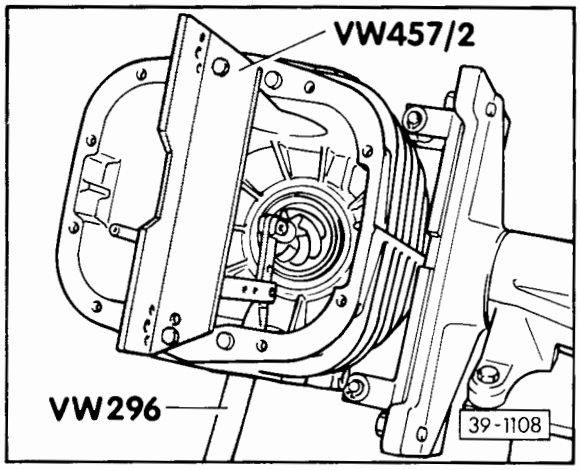
– Pull flange off with two-arm puller, if necessary.
– Unscrew hexagon head bolts.
– Remove rear cover.
– Drive out spring pin for speedometer drive.
– Remove speedometer drive.



– Unscrew retaining ring.
– Remove washer.



– Drill an additional hole (9.0 mm dia.) in bracket VW 457/2.



– Press pinion out. Secure VW 457/2 with two bolts M 8 × 20.

– Remove "S_3" shim. Note thickness.

– Lever oil seal out of rear cover.

– Remove circlip in front of roller bearing outer race.

– Drive out cylindrical roller bearing outer race with drift.

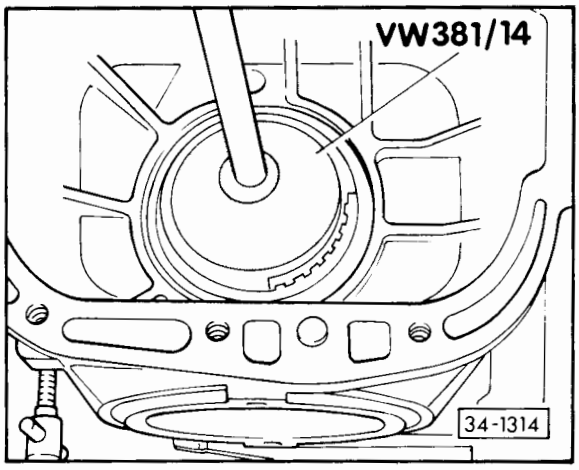
– Pull off inner race of cylindrical roller bearing – page 152.

Assembling

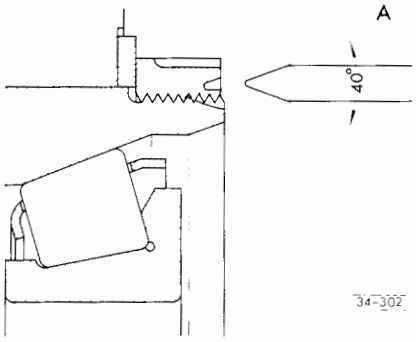
Beforehand: Fit "S_3" shim. Align double hex of the double tapered roller bearing with recess in casing. Before fitting pinion, warm bearing seat of double tapered roller bearing in gearbox housing to 40–60° C.

Drive in pinion by hitting with a plastic hammer.

– Fit washer and screw on retaining ring.



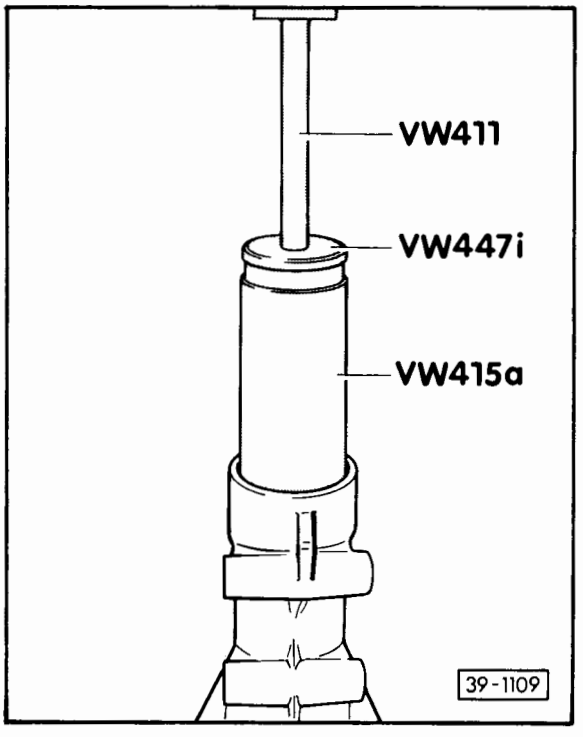
– Tighten retaining ring to 225 Nm, loosen and then finally tighten to 225 Nm.



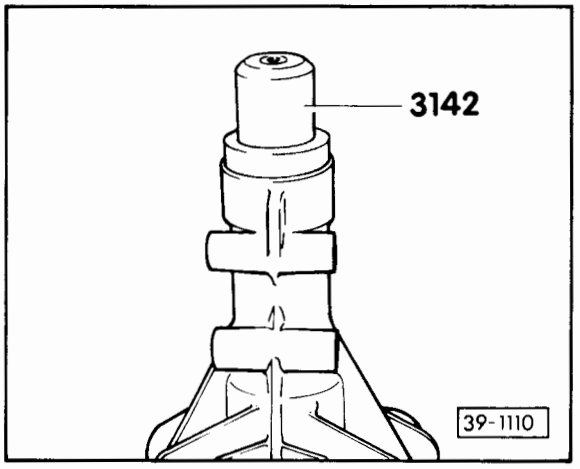
– Secure retaining ring at two points by peening.

A – Self-produced peening tool.

– Install speedometer drive.

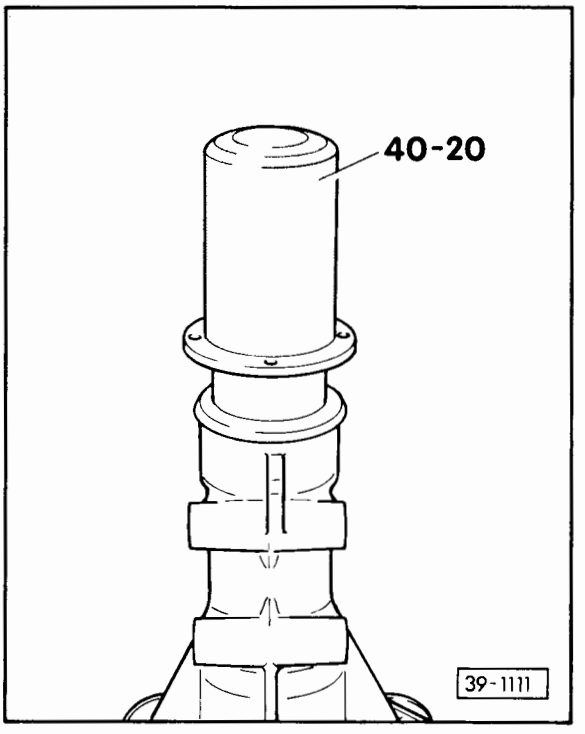


– Press outer race of cylindrical roller bearing into rear cover as far as it will go.
– Fit circlip.

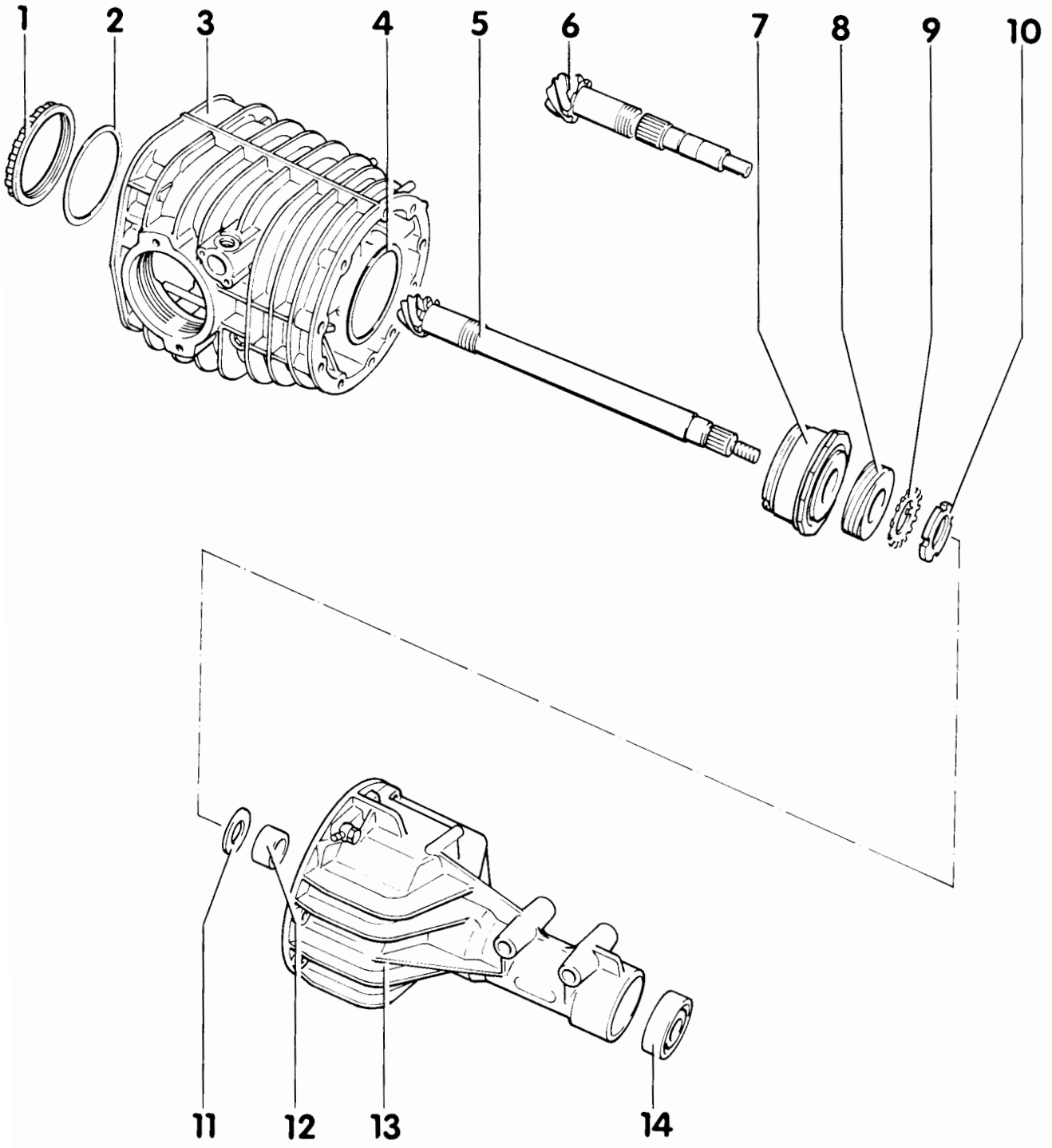


– Drive oil seal fully home.

– Mount rear cover



– Fit flange for propshaft and, if necessary, drive on.
– Fit washer.
– Mount holder and tighten hex nut to 160 Nm.



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DISMANTLING AND ASSEMBLING FRONT PINION

1 Retaining ring
- Screwing on and off – pages 144 and 148

2 Washer

3 Final drive casing

4 Shim S_3
- Note thickness
- Adjustment table – page 125

5 Pinion for final drive with selectable 4WD
- Is matched to crown wheel (gear set)
- If gear set is renewed, adjust pinion and crown wheel – pages 126 and 129

6 Pinion for final drive with viscous coupling
- Is matched to crown wheel (gear set)
- If gear set is renewed, adjust pinion and crown wheel – pages 126 and 129

7 Double tapered roller bearing
- Pressing off – Fig. 4
- Fit warm and press home – Fig. 5
- If renewed, measure position of pinion before dismantling (actual dimension) – page 125
- Checking turning torque – Figs. 6, 7 and 8

8 Driving wheel for speedometer drive
- Install with turned groove pointing outwards

9 Lock plate
- Renew

10 Slotted nut 210 Nm
- Unscrewing, final drive with selectable 4WD – Fig. 2
- Unscrewing, final drive with viscous coupling – Fig. 3
- With chamfer pointing towards lock plate

11 Washer
(only on final drive with selectable 4WD)
- Removing – Fig. 1

12 Inner race for cylindrical roller bearing
(only on final drive with selectable 4WD)
- Only replace with outer race of cylindrical roller bearing
- Removing – Fig. 1

13 Rear cover

14 Outer race of cylindrical roller bearing
- Removing – page 148
- Installing – page 148

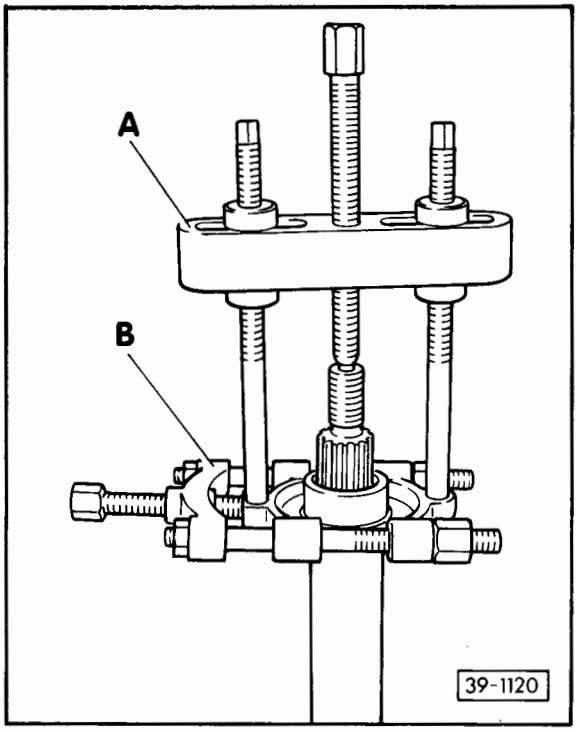


Fig. 1 Removing washer and inner race of cylindrical roller bearing
(Only on final drive with selectable 4WD)

A – Puller, e.g. Kukko
B – Parting tool 5–60 mm, e.g. Kukko 17/0

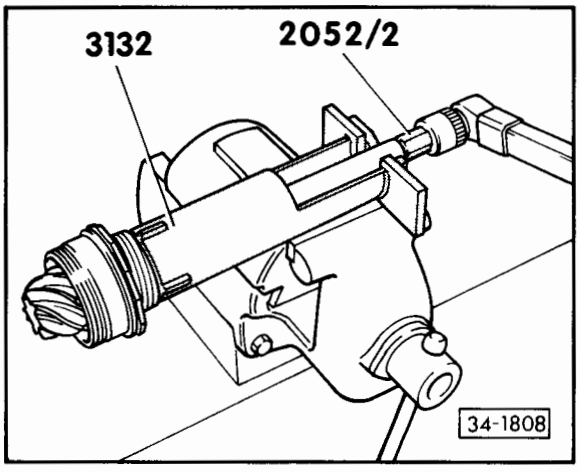


Fig. 2 Unscrewing and tightening slotted nut
(On final drive with selectable 4WD)

Tighten slotted nut to 210 Nm and secure. Then check turning torque of double tapered roller bearing.

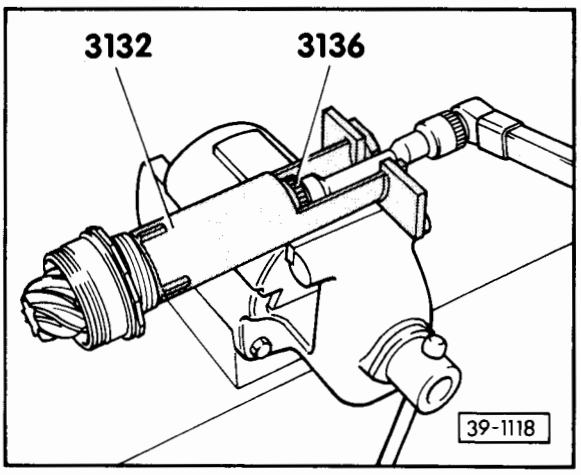


Fig. 3 Unscrewing and tightening slotted nut
(Only on final drive with viscous coupling)

Tighten slotted nut to 210 Nm and secure. Then check turning torque of double tapered roller bearing.

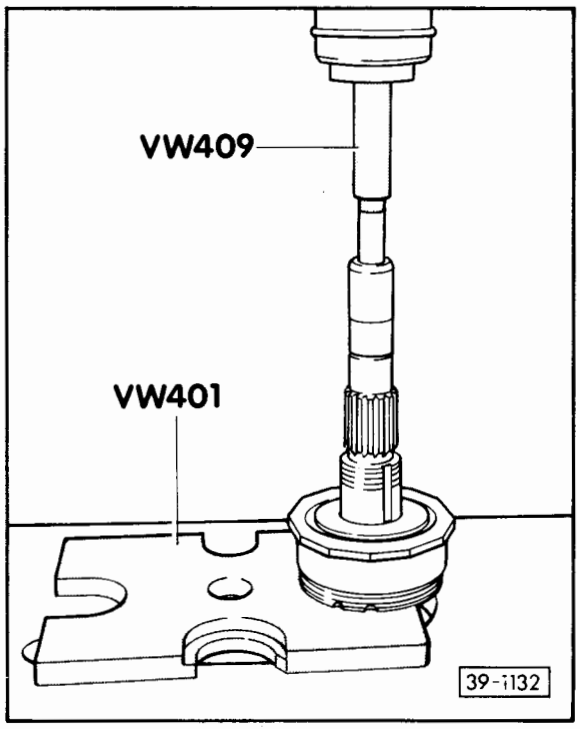


Fig. 4 Pressing off double tapered roller bearing

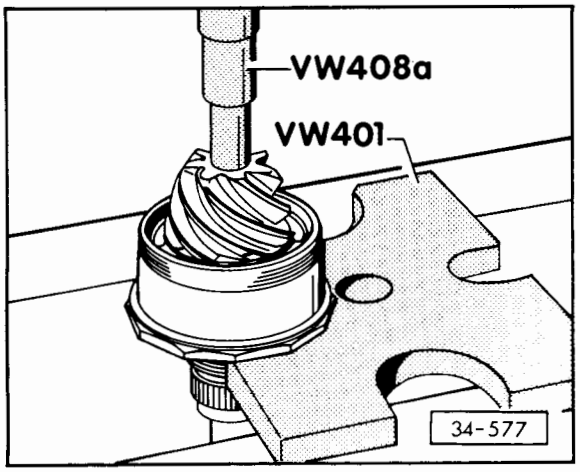


Fig. 5 Heat inner races of double tapered roller bearing to about 100° C, install and press home

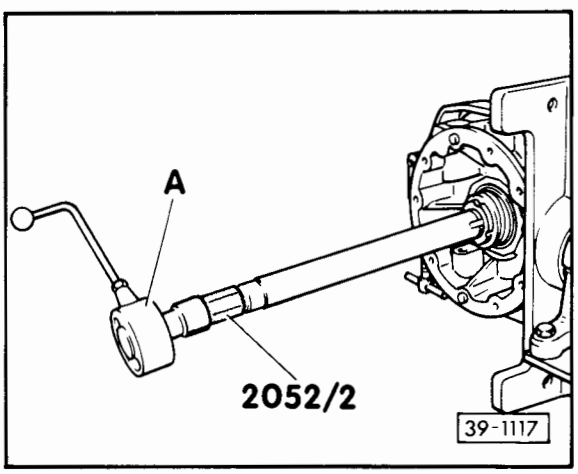


Fig. 6 Checking turning torque of double tapered roller bearing

(On final drive with selectable 4WD)

A – Normal torque gauge (0 – 600 Ncm)

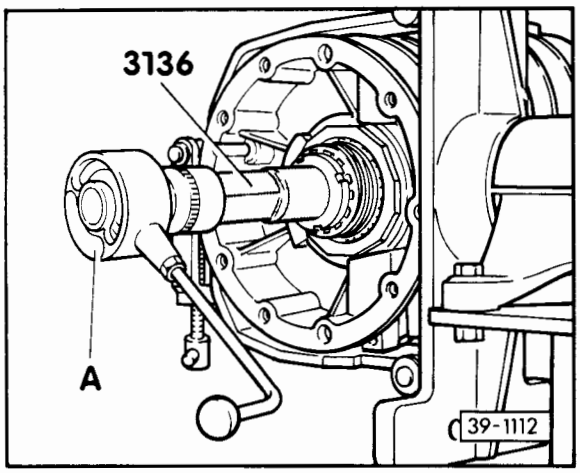


Fig. 7 Checking turning torque of double tapered roller bearing

(On final drive with viscous coupling)

A – Normal torque gauge (0 – 600 Ncm)

Oil bearing beforehand with hypoid gear oil and tighten retaining ring as specified.

First turn pinion rapidly in both directions about 15–20 times, then read the torque while still turning.

Test values

	New bearings	Used bearings*)
Turning torque	up to 210 Ncm	up to 70 Ncm

*) After running at least 50 km

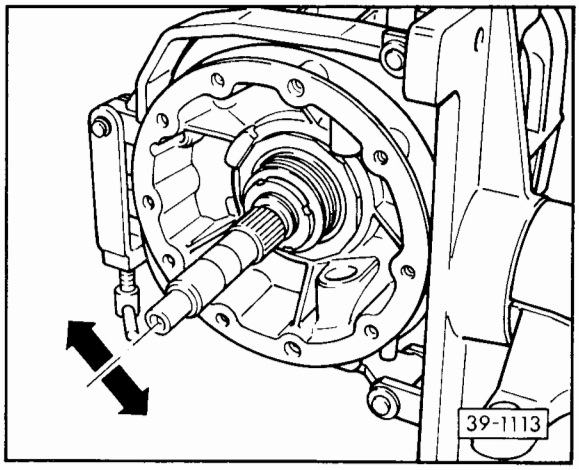


Fig. 8 Checking rock

If there is no torque, check for rock in double tapered roller bearing at end of pinion shaft. There must **not be any** detectable rock otherwise a new bearing must be fitted.

Workshop Bulletin.

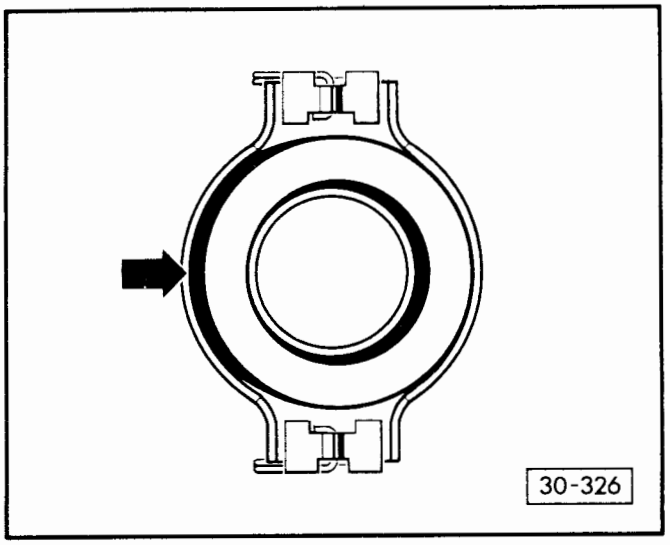
Volkswagen Transporter

File in booklet: 5 speed manual gearbox 094 4WD and final drive - July 1986 Edition

Page to be marked: 16

No. 1 of 02.88

Self-centering release bearing



We have reason to point out that new release bearings, on which the thrust ring is not centrally positioned to the housing (arrow), can still be installed without giving any cause for concern.

The thrust ring centralises itself automatically, after the first operation of the clutch pedal.

V.A.G Service.

Workshop Bulletin. Volkswagen Transporter

To be marked in Manual:	5-Speed Manual Gearbox 094 4-Wheel Drive and Final Drive - July 1986 Edition	No. **2** of 10.88
Pages:	21, 28, 32, 44, 101	

Printed in Germany

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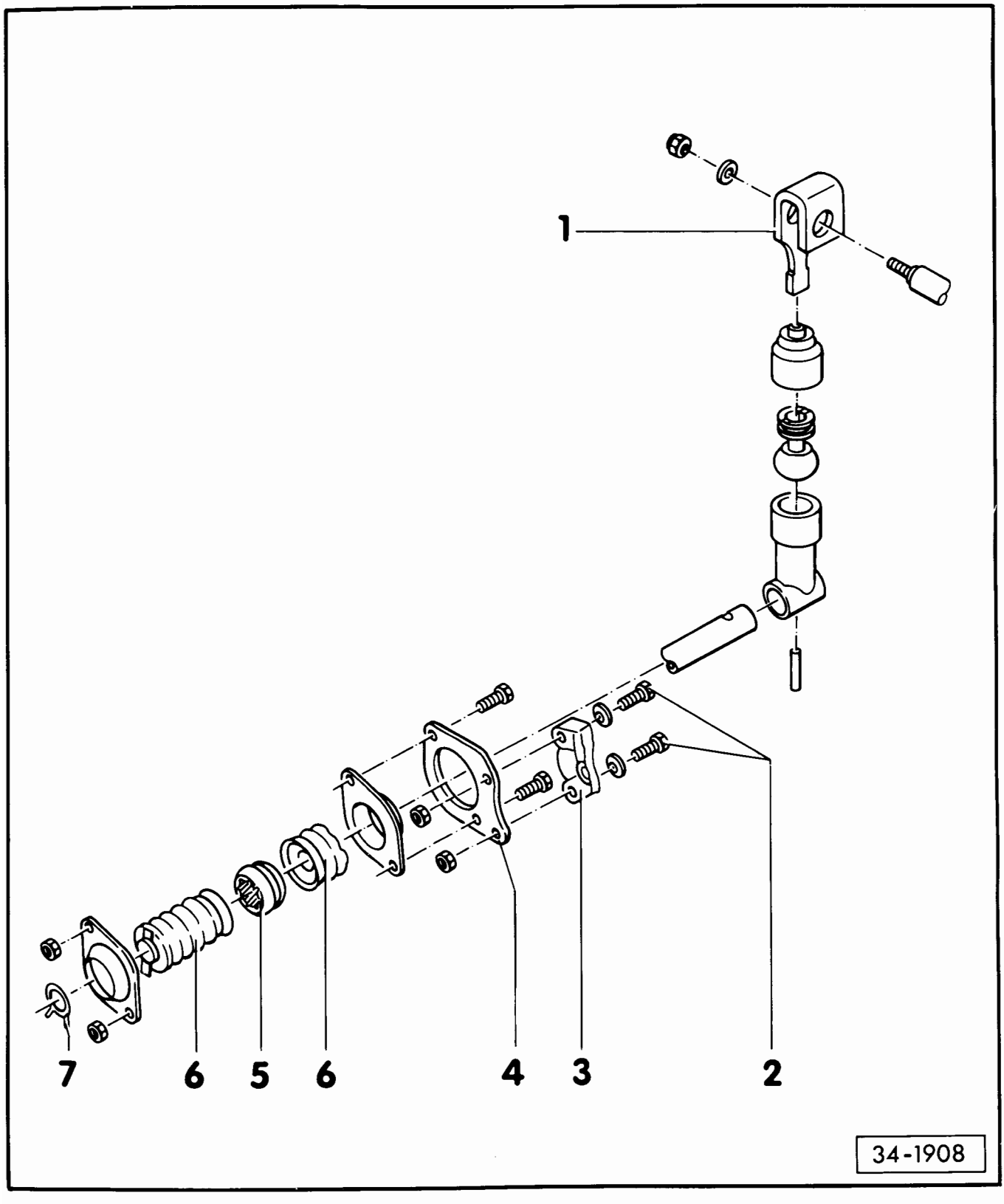
A - Modified rear selector rod bearing

A bellows to prevent washing out of the bearing bush is situated in front of and behind the rear selector rod bearing bush. The bellows were introduced gradually from 06.87.



1 - Lever
o (wrongly illustrated on pages 28 and 30 of the Workshop Manual).

2 - Hexagonal bolt M 8 x 40

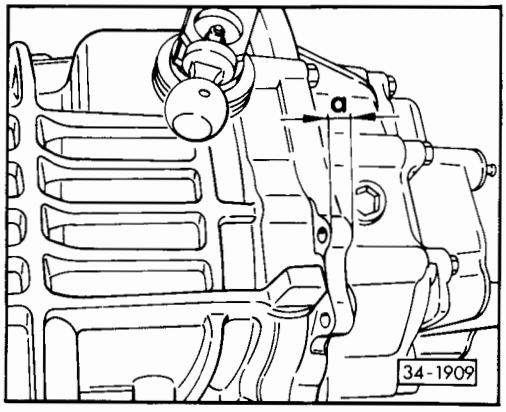
3 - Flange on end shield for mounting carrying plate
o Fig. 1

4 - Carrying plate

5 - Selector rod bush
o with slot for mounting bellows

6 - Bellows
o adjusting - Fig. 2

7 - Hose clamp
o install so that bellows sits correctly
at the front - Fig. 2



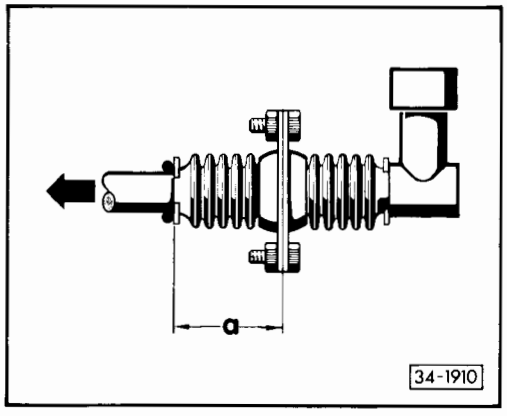
◄ Fig. 1 - Previous dimension of flange on end shield a = 14.5 mm

Modified dimension of flange on end shield a = 21 mm

The flange on the end shield for mounting the carrying plate has been increased to 21.0 mm.

This means that the position of the selector rod bush is now 6.5 mm further forwards. This prevents the rear bellows being too firmly compressed and causing gear jumps.

For repair work, the modified end shield can be installed from 02.85.

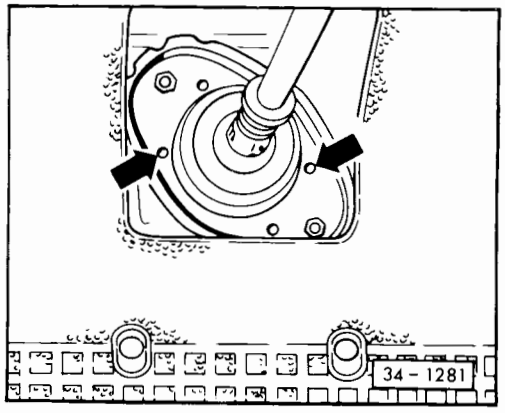


◄ Fig. 2 Adjusting front bellows

At idle revs
Distance a = 56 mm
Arrow points in direction of travel

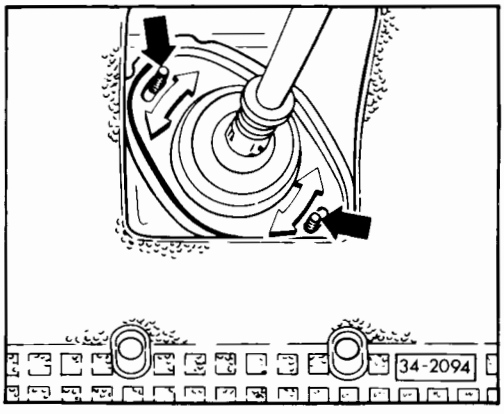
Note:
The modified selector rod bearing can be installed with the previous end shield by inserting a nut M 8 x 6.5 - N 011 008 18 - between the flange and carrying plate. At the same time, the hexagonal bolt M 8 x 40 - N 010 340 4 - should be used.

B - Modified gear lever bearing



◄ From 06.88, there are no location bores (arrows) in the gear lever bearing (gear lever bracket). The modified gear lever bearing was introduced gradually.

Adjusting the modified gear lever bearing

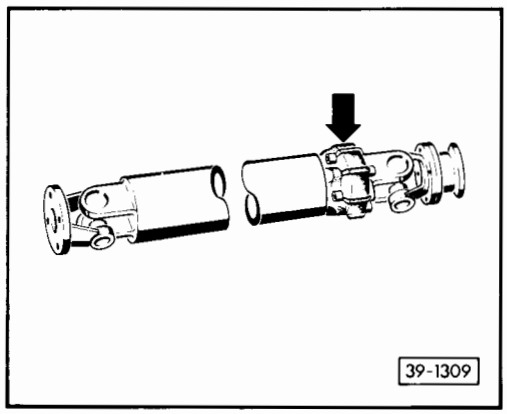


◄ After loosening the retaining nuts (not illustrated), twist gear lever bearing to the right or left until the retaining pins on the mounting plate touch the slots on the opposite side of the gear lever bearing (arrows). Tightening torque of retaining nuts 10 Nm.

The remainder of the adjusting procedure is to be performed as described in the Workshop Manual.

Note:
The modified gear lever bearing can be installed in vehicles from 10.82.

C - Propshaft with rubber element



◄ The propshaft of vehicles with turbo-diesel or fuel-injection engines is fitted with a sound-proofing rubber element (arrow).

Location

- Vehicles with turbo-diesel engine: the rubber element points towards the front axle drive.

- Vehicles with fuel-injection engine: the rubber element points towards the manual transmission.

Important
During repair work, always ensure correct location of propshaft. Incorrectly installed propshaft can cause vibrations leading to splitting of the gearbox housing or engine block.

D - Amendments

1 - Greasing of joints and sliding surfaces in selector mechanism
To grease the joints and sliding surfaces in the selector mechanism, Molycote grease - Part No. G 000 602 should be used instead of white solid lubricant paste - Part No. 126 000 005. Before applying the Molycote grease, the white solid lubricant paste should be removed from joints and sliding surfaces.

2 - Repairing clutch

- Removing and installing clutch:

  When working on the clutch, the engine should be removed not the gearbox as indicated in the Workshop Manual. This reduces the work to be performed on syncro vehicles.

- Greasing of gear teeth on drive shaft and clutch plate hub:

  The gear teeth of the clutch plate hub are not to be greased with Moly lubricant or Moly spray, as previously described in the Workshop Manual, but with grease Part No. G 000 100.

  - Remove corrosion and abrasion from gear teeth of drive shaft and clutch hub.

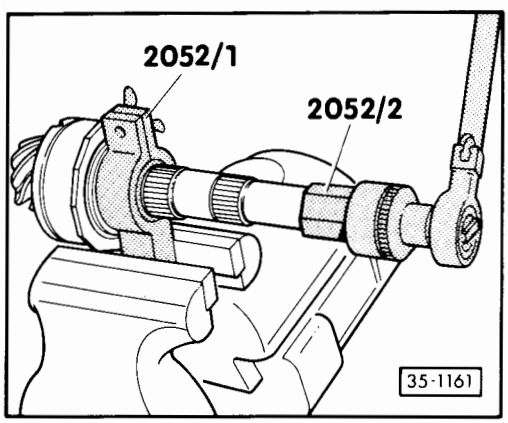
  - Thinly coat gear teeth with grease.

  - Lock drive shaft by selecting a gear and reseat clutch plate on drive shaft and check that it can move freely.

  - Always remove excess grease to prevent it coming into contact with the clutch lining.

3 - Dismantling and assembing differential pinion of gearbox

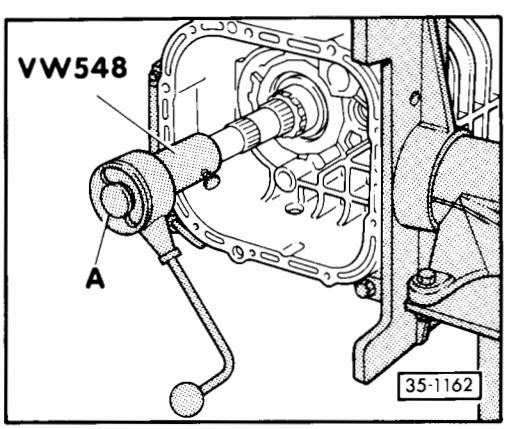
- Loosen/tighten inner race/needle bearing:



◄ Instead of special tool 3136, special tool 2052/2 should be used to loosen/ tighten the inner race for the needle bearing.

Tightening torque as before: 250 Nm

- Checking friction torque of the double-taper roller bearing:



◄ To measure the friction torque of the double-taper roller bearing, the special tool VW 548 should be used instead of special tool 3136 as indicated in the Workshop Manual. The remainder of the assembly should be performed as described in the Workshop Manual.

A = Commercially available torque gauge (0 - 600 Ncm).