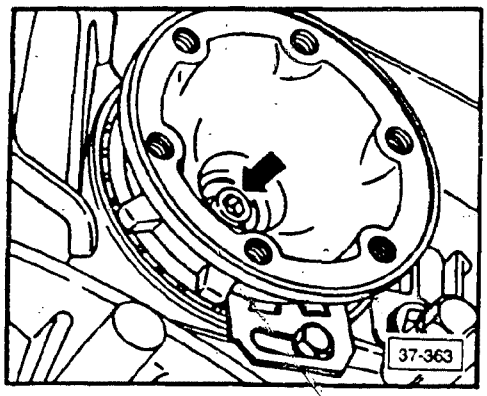
# Index

Automatic 089



Automatic Trans. 087




**Drive flange oil seal, removing (Transmission in vehicle)**

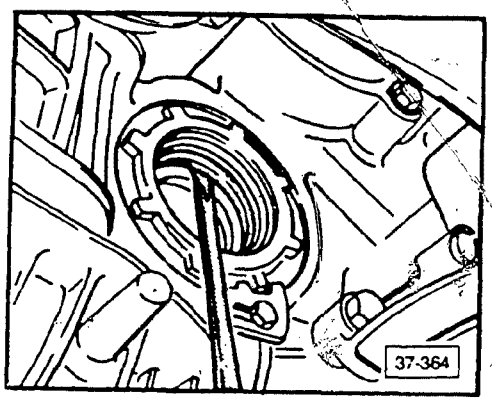
**Note**

Remove splash shield to replace right hand oil seal.

- remove axle shaft from drive flange

▶

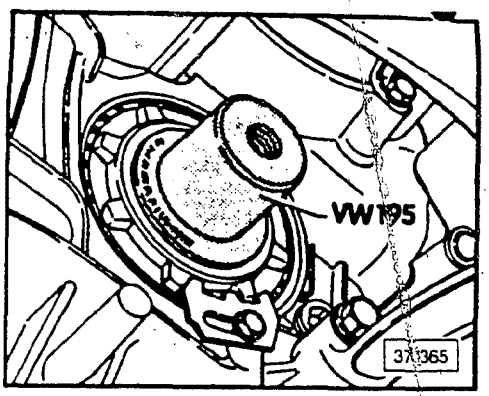
- remove drive flange bolt (**arrow**), hold flange with a drift
- place drip tray in position
- remove drive flange




▶

- remove oil seal

**Drive flange oil seal, installing**



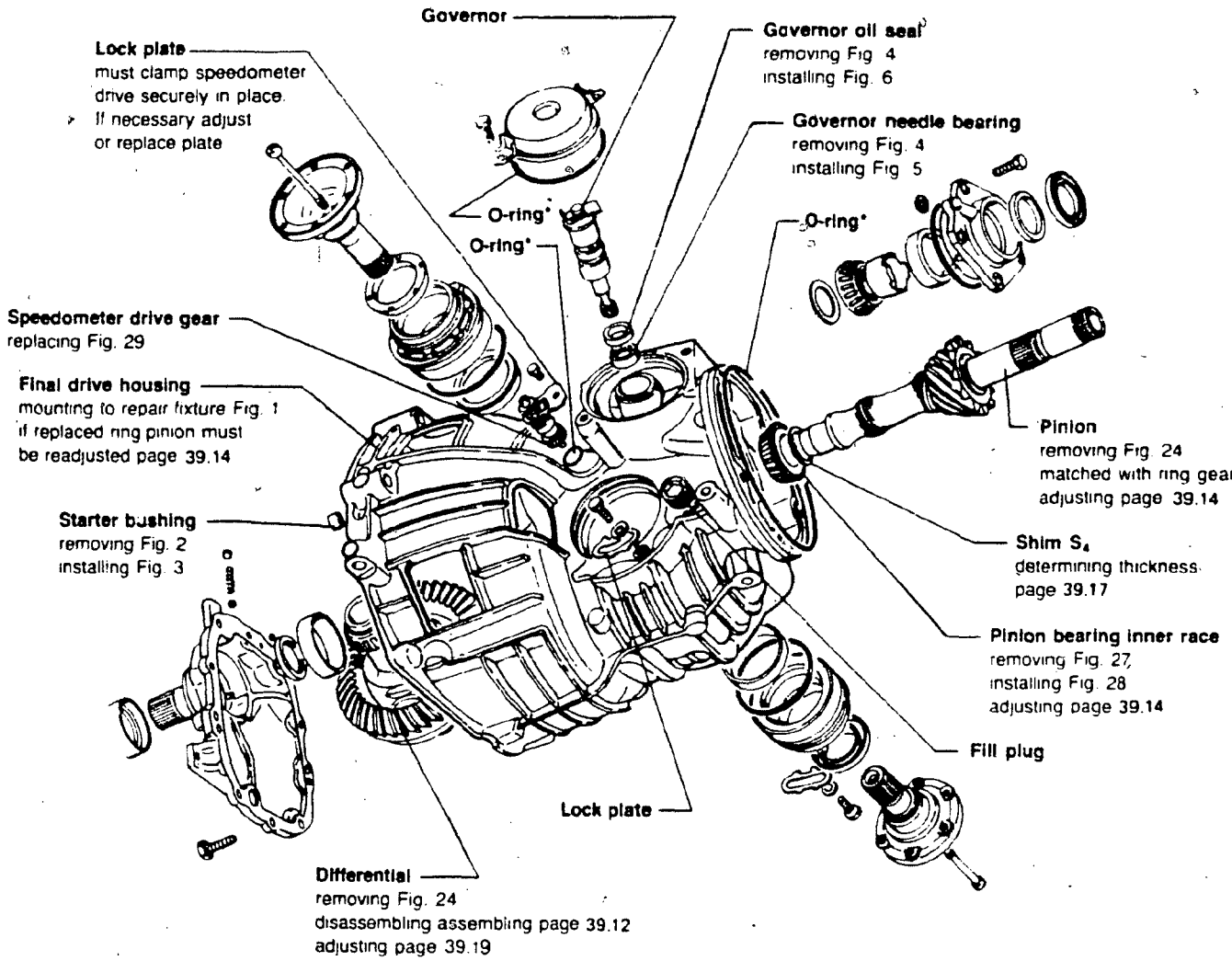

▶

- drive oil seal into stop
- lubricate sealing lips with multi-purpose grease
- install drive flange, tighten flange bolt to 25 Nm (18 ft lb)
- install axle shaft to drive flange, tighten bolts to 45 Nm (32 ft lb)

## Final drive, disassembling/assembling

**CAUTION**

If ring gear pinion and bearings will be reused, first measure backlash (page 39.21) and total pinion turning torque (page 39.19) **before disassembling** final drive. Use these measurements for adjustments during reassembly.




**CAUTION**

If ring pinion, bearing or bearing cover are replaced, the ring and pinion gears must be readjusted.

*always replace O-rings when removed

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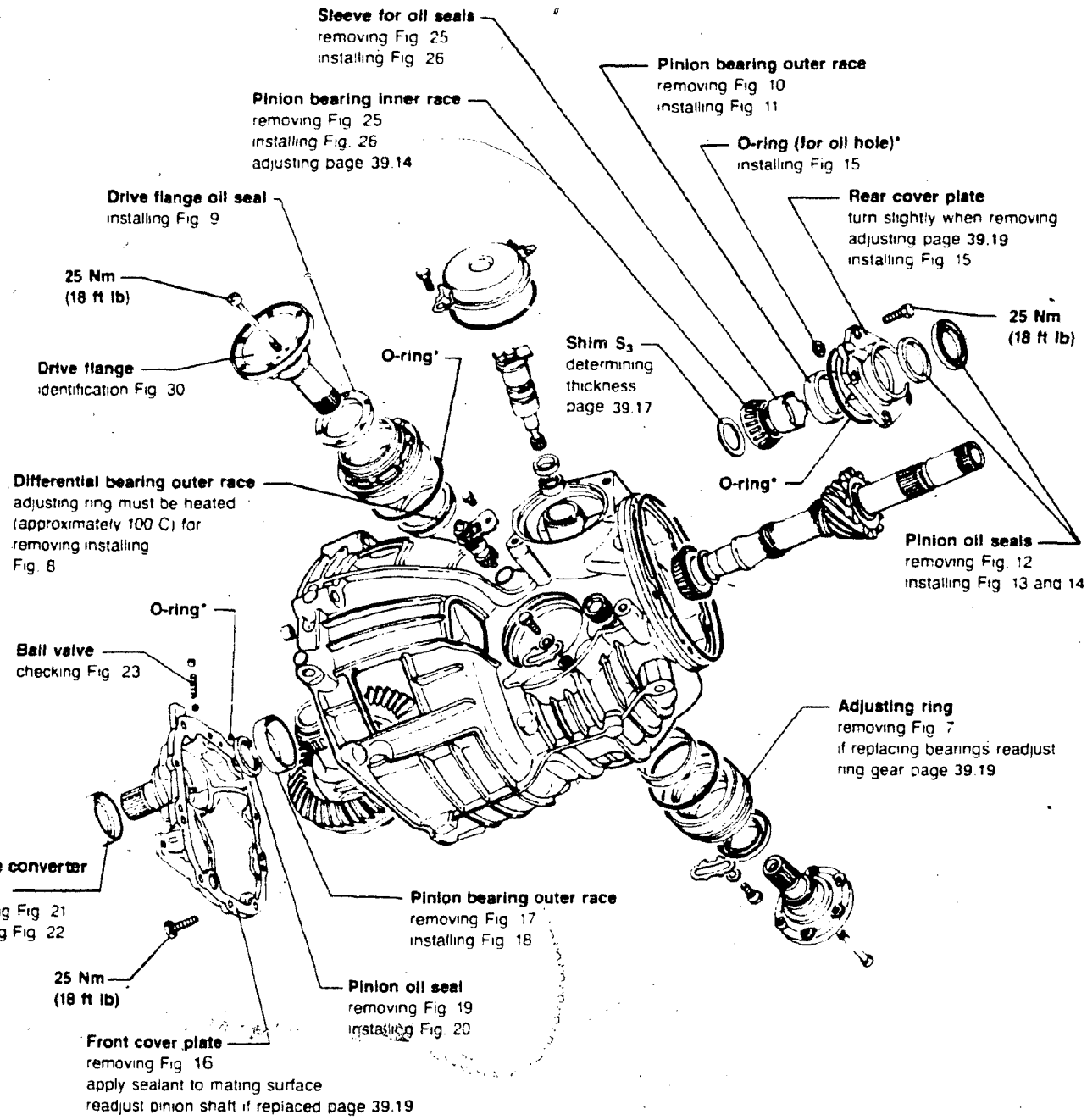
## Final drive, disassembling/assembling




**CAUTION**

If ring gear pinion and bearings will be reused, first measure backlash (page 39.21 ) and total pinion turning torque (page 39.19 ) **before disassembling** final drive. Use these measurements for adjustments during reassembly.

**CAUTION**

If ring pinion, bearing or bearing cover are replaced, the ring and pinion gears must be readjusted.

*always replace O-rings when removed

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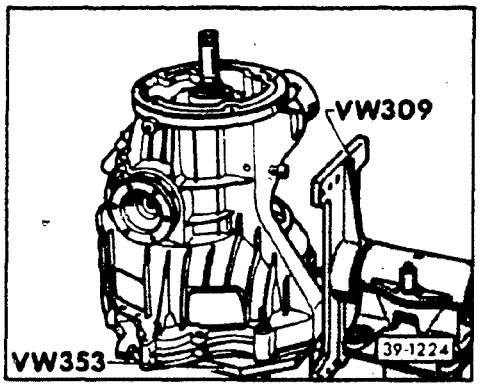
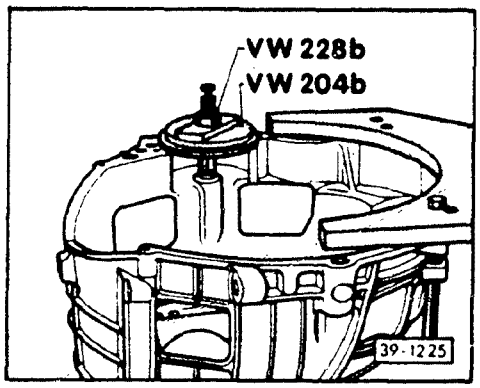
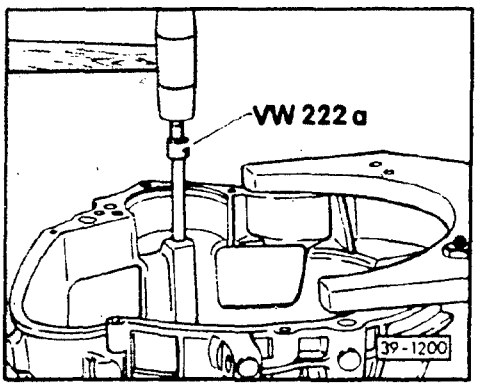


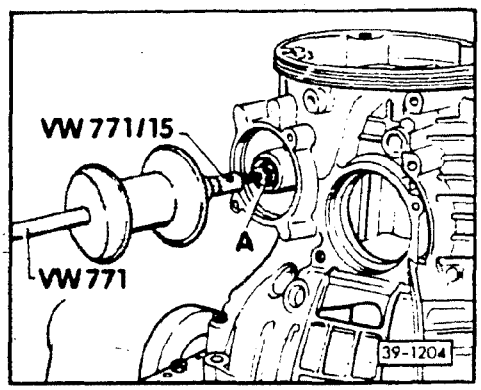

▶ Fig. 1 Final drive housing, mounting




▶ Fig. 2 Starter bushing, removing

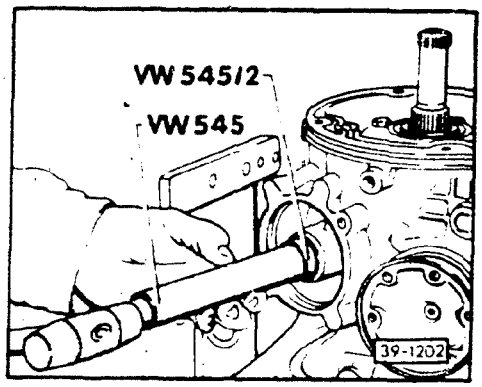



▶ Fig. 3 Starter bushing, installing



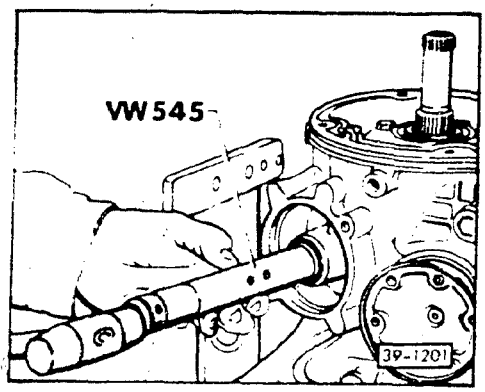

▶ Fig. 4 Governor needle bearing/oil seal, removing

- remove needle bearing together with oil seal
  - **A** = Kukko puller 21 3 (18.5-23.5mm)



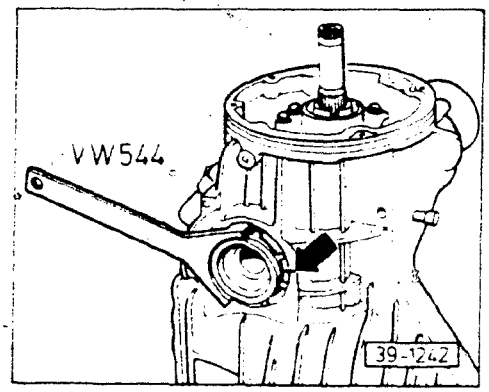

▶ **Fig. 5 Governor needle bearing, installing**

- drive in until seated



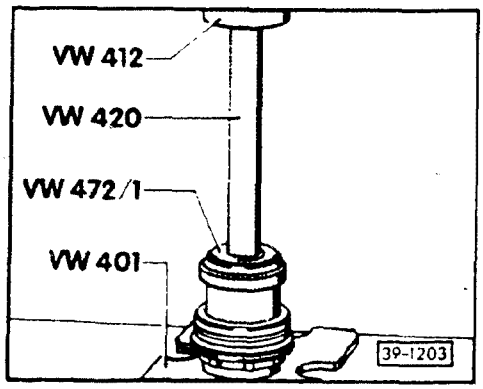

▶ **Fig. 6 Governor oil seal, installing**

- sealing lip faces governor
- drive in until seated




▶ **Fig. 7 Adjusting ring, removing/installing**

- mark position of adjusting ring **before** removing

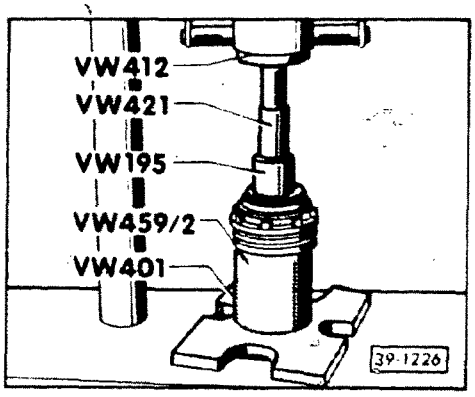



▶ **Fig. 8 *Differential bearing outer race, installing***

- heat adjusting ring to approximately 100°C (212°F)
- press race in until seated

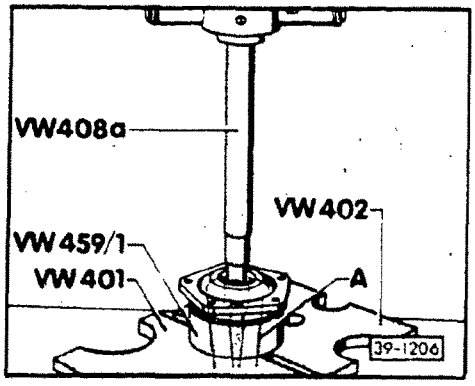
**CAUTION**

Do not remove or install bearing race without heating the adjusting ring. Cold removal will damage the adjusting ring.



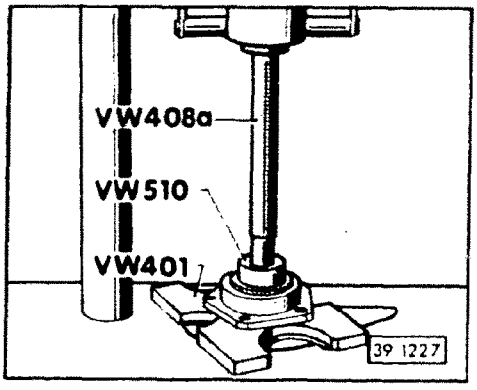

▶ **Fig. 9 Drive flange oil seal, installing**

- coat seal lips with multi purpose grease and press in

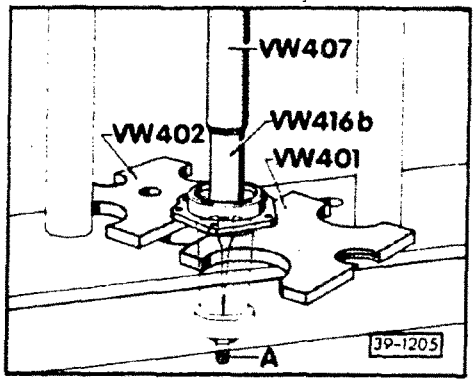



▶ **Fig. 10 Pinion bearing outer race, removing**

- **A** = Kukko 21-7 (46-56 mm)

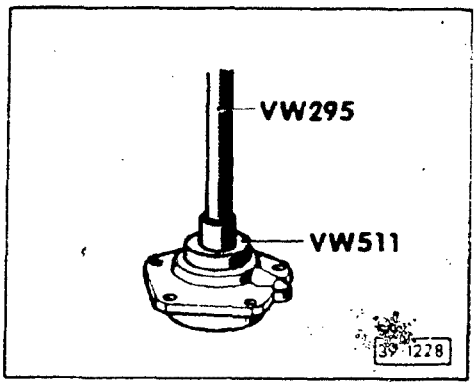



▶ **Fig. 11 Pinion bearing outer race, installing**



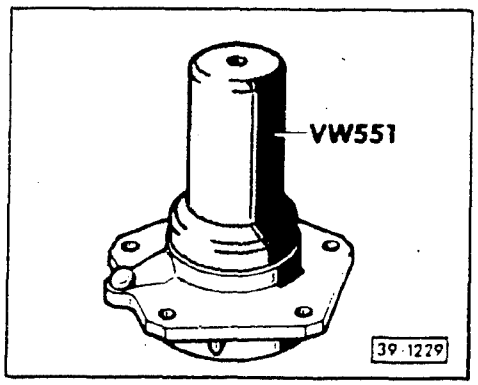

▶ **Fig. 12 Pinion oil seals, removing**

- **A** = Kukko 21-6 (37-46 mm)
- press both seals out together



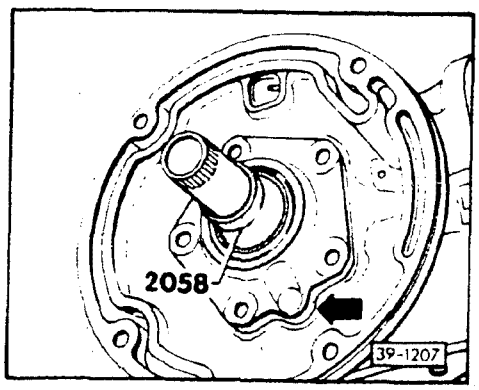

▶ **Fig. 13 Pinion oil seal, installing**

- open side of seal faces final drive



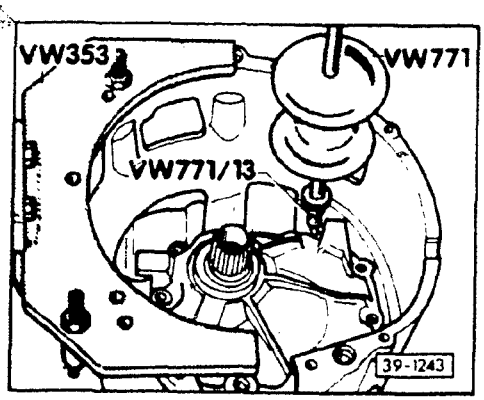

▶ **Fig. 14 Pinion oil seal, installing**

- open side of seal faces transmission
- drive seal in until flush

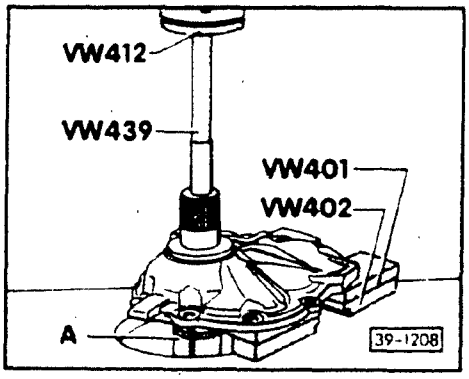



▶ **Fig. 15 Rear cover plate, installing**

- place sleeve on pinion to protect seal
- install oil hole O-ring (**arrow**)

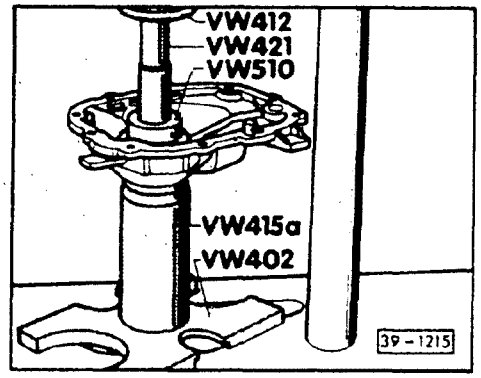



▶ **Fig. 16 Front cover plate, removing**

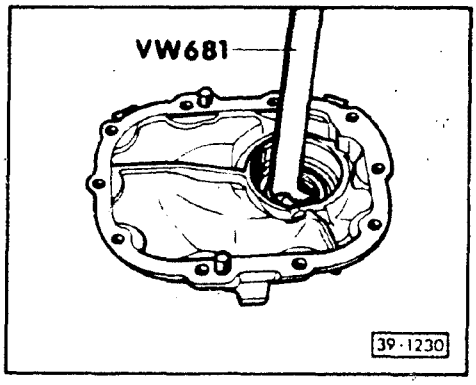



▶ **Fig. 17 Pinion bearing outer race, removing**

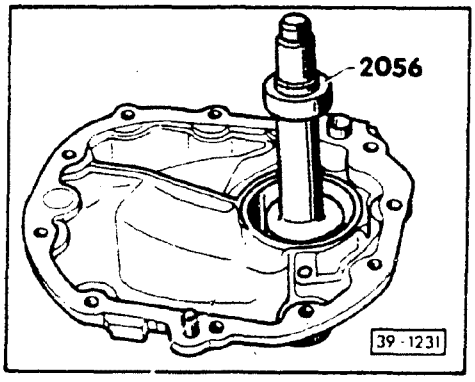
- **A** = Kukko 21/7 (46-56 mm)




▶ **Fig. 18 Pinion bearing outer race, installing**

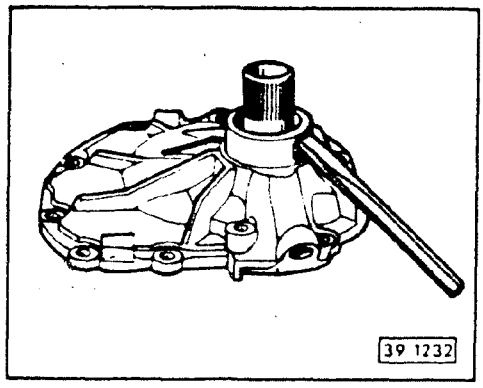



▶ **Fig. 19 Pinion oil seal, removing**

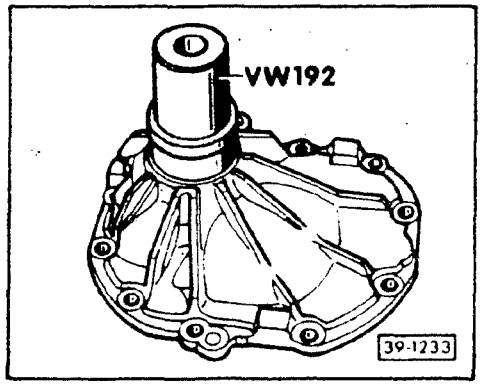



▶ **Fig. 20 Pinion oil seal, installing**

- drive in to stop



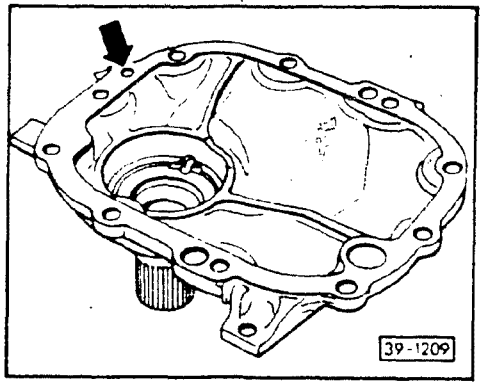

▶ **Fig. 21 Torque converter oil seal, removing**




▶ **Fig. 22 Torque converter oil seal, installing**

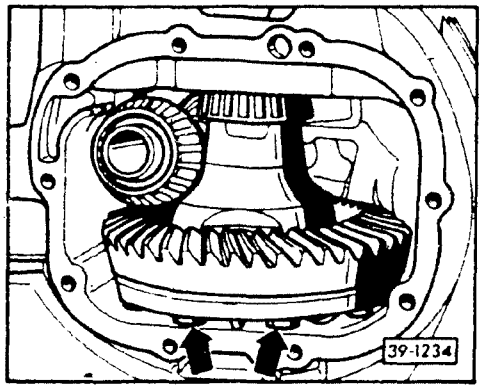
**CAUTION**

Be careful when installing seal, it is easily damaged. Silicone seals must not contact gasoline or similar cleaning solutions.



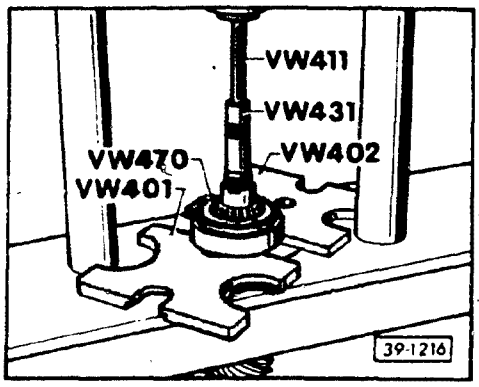

▶ **Fig. 23 Ball valve, checking**

- check that hole is clear
- check ball valve operation by sucking at hole (**arrow**) with a hose



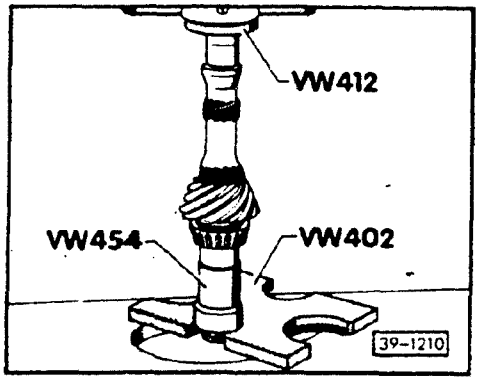

▶ **Fig. 24 Pinion, removing**

- turn differential so that two ring gear bolts (**arrows**) are parallel to housing surface



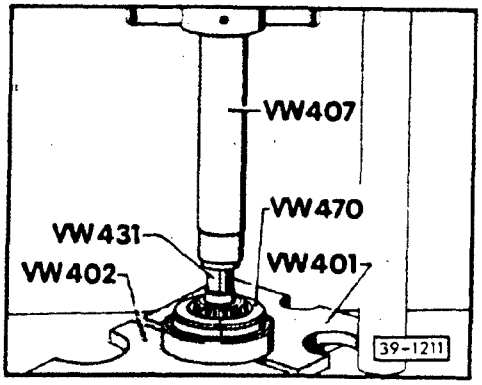

▶ **Fig. 25 Sleeve for oil seals and bearing inner race, removing**

- press off together

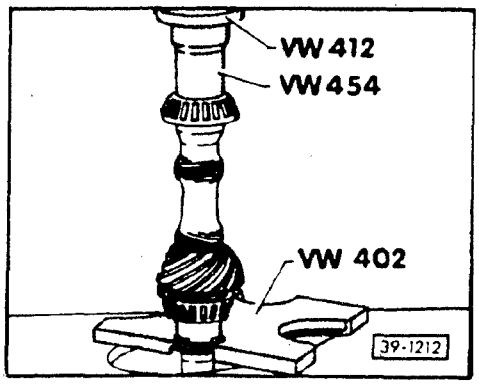



▶ **Fig. 26 Pinion bearing inner race and sleeve for oil seals, installing**

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

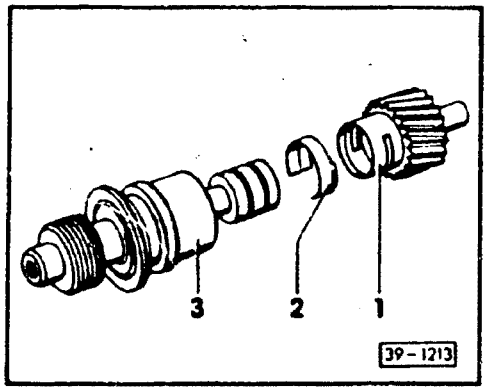



▶ **Fig. 27 Pinion bearing inner race, removing**



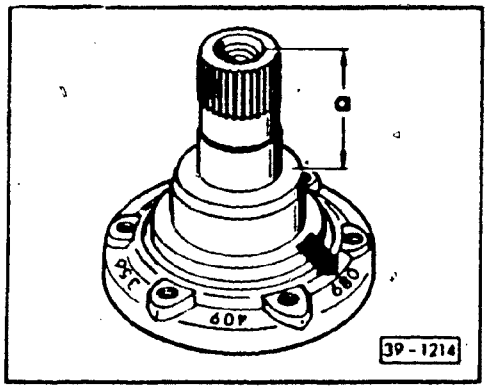

▶ **Fig. 28 Pinion bearing inner race, installing**

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




▶ **Fig. 29 Speedometer drive gear, replacing**

- remove clip (**2**) with 2 screwdrivers and remove gear (**1**) from pinion seat (**3**)




▶ **Fig. 30 Drive flange, identification (arrow)**

- **a** = 49.05 mm (1-15 16 in) right flange
  73.5 mm (2-7 8 in) left flange

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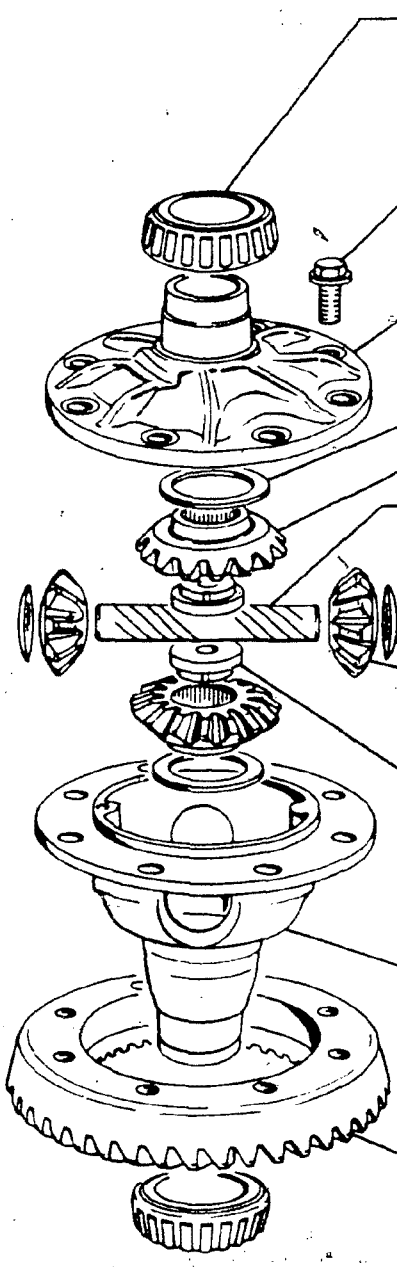

**Differential bearing, inner race**
if replaced, readjust ring gear
removing Fig. 1
installing Fig. 4

**70 Nm**
**(52 ft lb)**

**Differential housing cover**
pry off housing with screwdriver

**Thrust washer***

**Differential side gear***

**Differential shaft**
drive out with a drift
check for wear

**Thrust washer***

**Differential**
**pinion gear***

**Drive flange**
**bolt retainer**
small shoulder fits
into side gear

**Differential housing**

**Ring gear**
matched with pinion
removing Fig. 2
installing Fig. 3

*check thrust washers for cracks and fractures, check gears for wear

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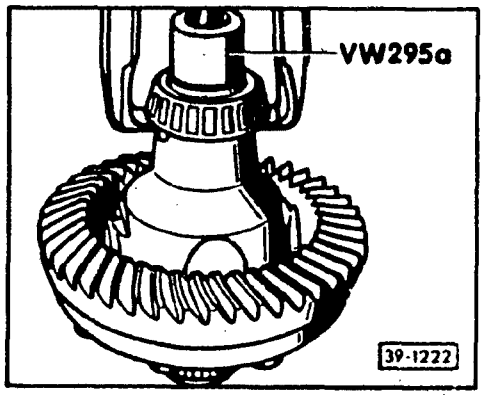
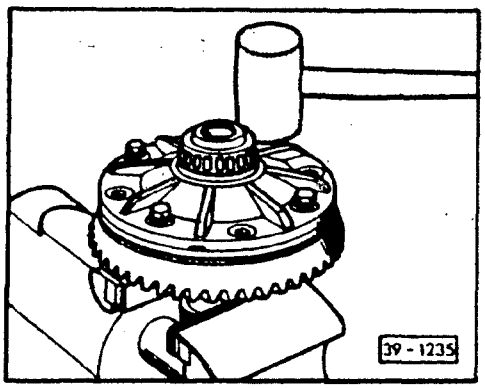


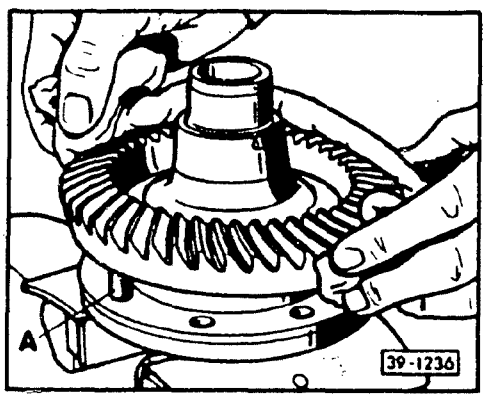

▶ **Fig. 1 Differential bearing, inner race, removing**

- do not interchange side to side



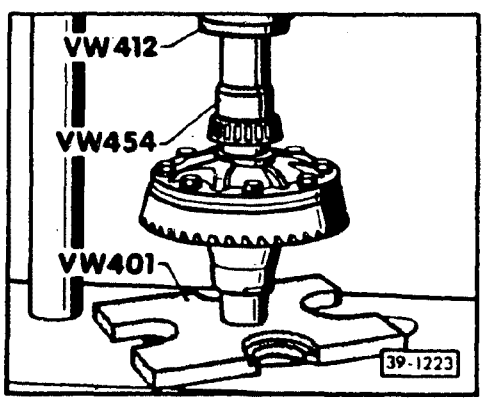

▶ **Fig. 2 Ring gear, removing**

- loosen bolts and remove gear by tapping on bolt heads



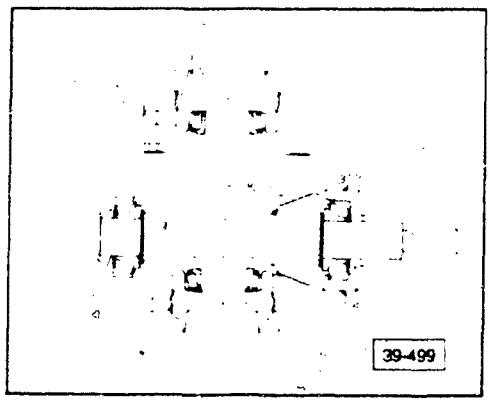

▶ **Fig. 3 Ring gear, installing**

- **A** = Centering pins (Qty. 2, local manufacture)
- heat gear to approximately 100°C (212°F)




▶ **Fig. 4 Differential bearing, inner race, installing**

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




## Ring gear/pinion, adjusting

**Note**

Careful adjustment of the ring gear and pinion is important to ensure that the final drive gives long service and runs silently. The ring gear pinion may only be replaced as a matched set.

**Position of shims $S_3$, $S_4$**

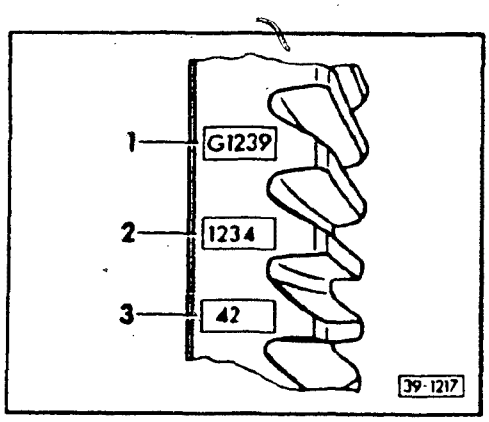
**Ro** — length of master gauge used in factory testing machine. **Ro** = 40.55 mm

**r** — ring and pinion deviation measured against master gauge used in production. Deviation **r** is always given in 0.01 mm. For example 42 means **r** = 0.42 mm

$S_3$ — shim behind pinion head provides bearing preload

$S_4$ — shim opposite pinion head determines pinion position

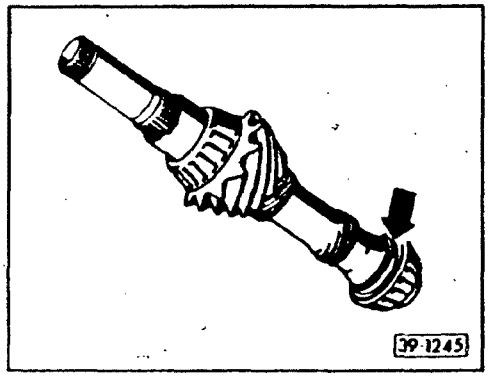
## Ring gear, identification




**1** — gleason gear set, ratio = 12:39
**2** — serial number of matched gear set
**3** — deviation, **r** = 0.42 mm

**Pinion, adjusting**

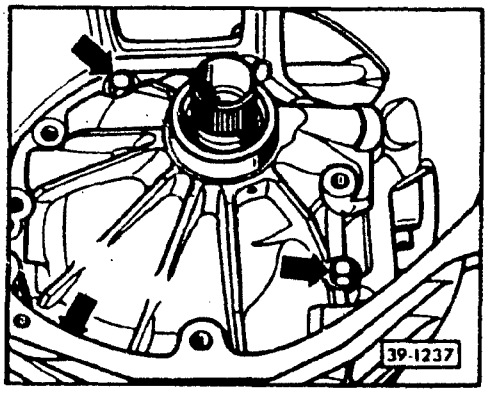
- heat bearing behind pinion head to approximately 100°C (212°F), install on pinion shaft **without shim.** Press onto seat with approximately 3 tons pressure



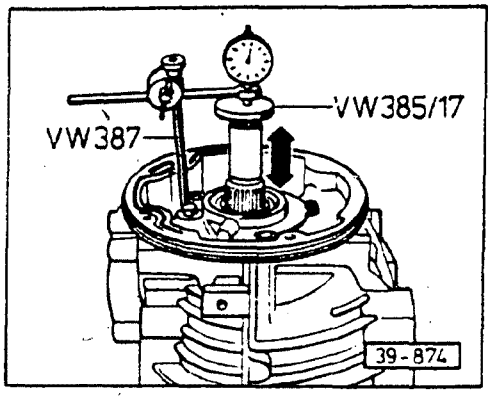

- heat bearing opposite pinion head to approximately 100°C (212°F), install on pinion with a 1.1 mm test shim (**arrow**). Press onto seat with approximately 3 tons pressure

**CAUTION**

Pinion **must** be installed with test shim. If not, the pinion shaft could touch housing and give incorrect results.




- install front cover plate with 4 bolts, tighten to 25 Nm (18 ft lb)
- insert pinion shaft and install rear cover plate with 5 bolts. Tighten bolts to 25 Nm (18 ft lb).




- install dial gauge holder **VW 387** on housing, place end plate **VW 385/17** on pinion shaft. Install dial gauge and set to zero
- move pinion up and down without turning it and note reading

**CAUTION**

Measurement will be incorrect if the pinion is turned.

- add 1.1 mm for test shim already installed, 0.15 mm for bearing preload and 0.10 mm for bearing settling to this reading. The result is **S total**

**Example**

| | |
|---|---|
| Measured reading | 1.48 mm |
| Shim already installed | + 1.10 mm |
| Bearing preload | + 0.15 mm |
| Settling allowance | + 0.10 mm |
| Total shim thickness (**S total**) | = 2.83 mm |

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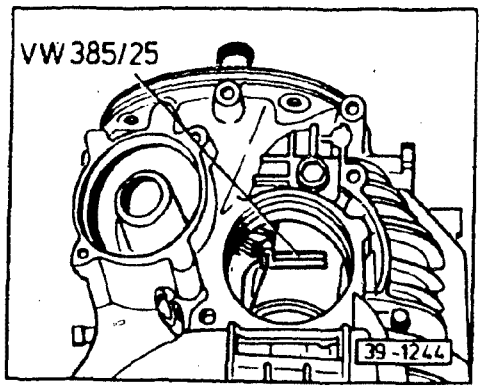
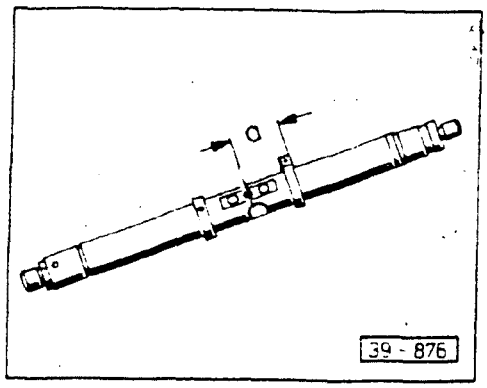
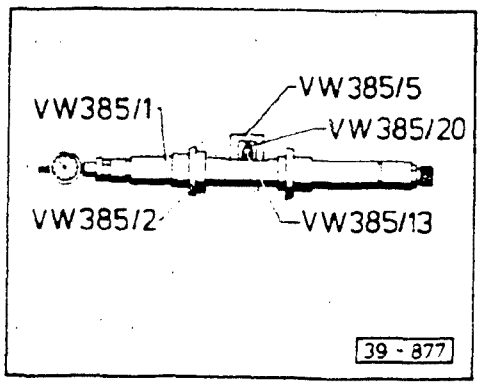
- remove pinion
- remove shim already installed (1.1 mm) and then install shims corresponding to total shim thickness — 2.83 mm in the example — at the bearing opposite pinion head
- reinstall pinion for measuring dimension **e**. **e** = the amount by which the setting of the pinion deviates from **Ro** with shims installed in their present position
- turn pinion several times in both directions




- place gauge **VW 385/25** on pinion shaft



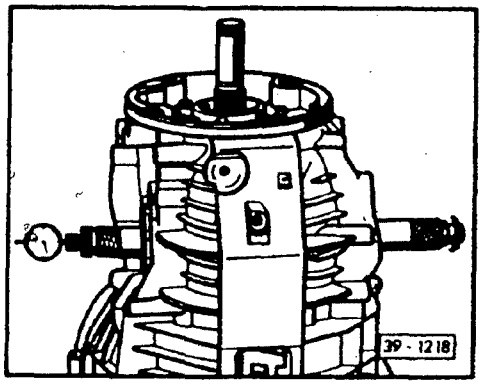

- adjust setting ring of universal measuring bar **VW 385/1**
  - **a** = 58 mm




- assemble measuring bar with dial gauge extension **VW 85/20** = 3 mm long
- place master gauge **VW 385/5** on bar and zero dial indicator with 3 mm preload

**Note**

Adjustable master gauge **VW 385/30** can be used instead of master gauge **VW 385/5**. Set **Ro** to 40.55 mm.




- screw in adjusting ring (opposite ring gear) until it is flush with housing
- insert measuring bar into housing and screw in adjusting ring (behind ring gear). Do not let dial gauge pin contact end plate
- move 2nd centering disc outwards with moveable setting ring until measuring bar can just be turned by hand
- turn measuring bar until dial gauge pin touches end plate and gauge shows maximum deflection **e** (return point)
- note reading **e** (example 2.20 mm) and determine thickness of shims $S_3$ and $S_4$

**Shim $S_3$, determining thickness**

$S_3 = e - r$

**Example**

| | |
|---|---|
| Dial indicator reading **e** | 2.20 mm |
| Deviation r marked on ring gear | – 0.42 mm |
| $S_3$ thickness | = 1.78 mm |

- select shims from chart

**Shim $S_4$, determining thickness**

$S_4 = S\ total - S_3$

**Example**

| | |
|---|---|
| Total shim thickness | 2.83 mm |
| $S_3$ thickness | – 1.78 mm |
| $S_4$ thickness | = 1.05 mm |

- select shims from chart

**Note**

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

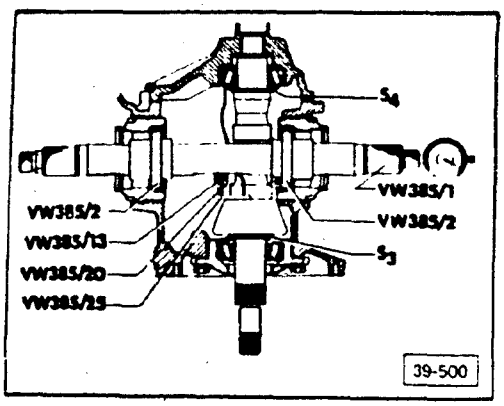
- remove **S total** shims
- install selected shims
  - $S_3$ behind pinion head
  - $S_4$ on opposite end
- install pinion and lubricate bearings with hypoid transmission oil

**CAUTION**

Part numbers are for reference only. Always consult your Parts Department for latest information.

## Shims available

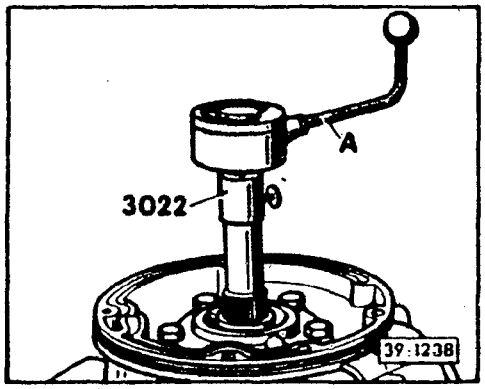
| Shim thickness range (mm) | Shim to be installed | Part No. |
|---|---|---|
| 1.05 -1.100 | 1.100 | 082 519 141 AE |
| 1.105-1.125 | 1.125 | 082 519 141 AF |
| 1.130-1.150 | 1.150 | 082 519 141 AG |
| 1.155-1.175 | 1.175 | 082 519 141 AH |
| 1.180-1.200 | 1.200 | 082 519 141 AJ |
| 1.205-1.225 | 1.225 | 082 519 141 AK |
| 1.230-1.250 | 1.250 | 082 519 141 AL |
| 1.255-1.275 | 1.275 | 082 519 141 AM |
| 1.280-1.300 | 1.300 | 082 519 141 AN |
| 1.305-1.325 | 1.325 | 082 519 141 AP |
| 1.330-1.350 | 1.350 | 082 519 141 AQ |
| 1.355-1.375 | 1.375 | 082 519 141 AR |
| 1.380-1.400 | 1.400 | 082 519 141 AS |
| 1.405-1.425 | 1.425 | 082 519 141 AT |
| 1.430-1.450 | 1.450 | 082 519 141 BA |
| 1.455-1.475 | 1.475 | 082 519 141 BB |
| 1.480-1.500 | 1.500 | 082 519 141 BC |
| 1.505-1.525 | 1.525 | 082 519 141 BD |
| 1.530-1.550 | 1.550 | 082 519 141 BE |
| 1.555-1.575 | 1.575 | 082 519 141 BF |
| 1.580-1.600 | 1.600 | 082 519 141 BG |
| 1.605-1.625 | 1.625 | 082 519 141 BH |
| 1.630-1.650 | 1.650 | 082 519 141 BJ |
| 1.655-1.675 | 1.675 | 082 519 141 BK |
| 1.680-1.700 | 1.700 | 082 519 141 BL |
| 1.705-1.725 | 1.725 | 082 519 141 BM |
| 1.730-1.750 | 1.750 | 082 519 141 BN |
| 1.755-1.775 | 1.775 | 082 519 141 BP |
| 1.780-1.800 | 1.800 | 082 519 141 BQ |
| 1.805-1.825 | 1.825 | 082 519 141 BR |
| 1.830-1.850 | 1.850 | 082 519 141 BS |
| 1.855-1.875 | 1.875 | 082 519 141 BT |
| 1.880-1.900 | 1.900 | 082 519 141 CA |




### Pinion setting, checking

- arrangement of measuring tools

- install universal measuring bar
- zero dial indicator with 1 mm preload
- check that indicator reading equals recorded deviation **r** within tolerance of ± 0.04 mm




### Turning torque, checking

- check turning torque
  - 250-550 Ncm (23-50 in lb)
  - **A** = Ncm or in lb torque wrench

**Note**

This figure is for new bearings. If used bearings are reinstalled the preload must be the same as measured before disassembling.

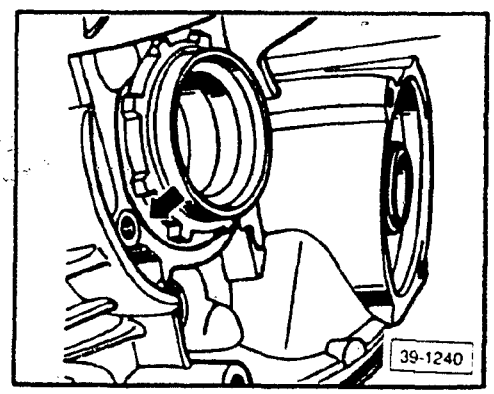
**Note**

After adjusting pinion, remove front and rear cover plates and take out pinion.

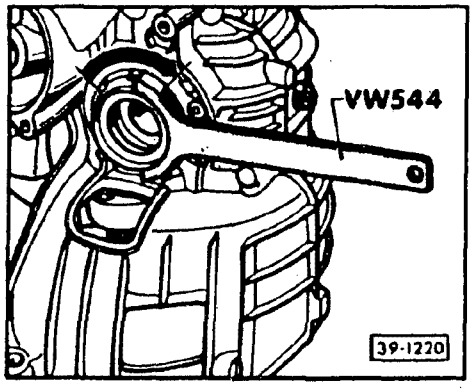
### Ring gear, adjusting

- lightly coat front cover plate sealing surface with **VW D 000 300** sealing compound
- install differential and pinion. Install both cover plates
- tighten bolts of both cover plates to 25 Nm (18 ft lb)

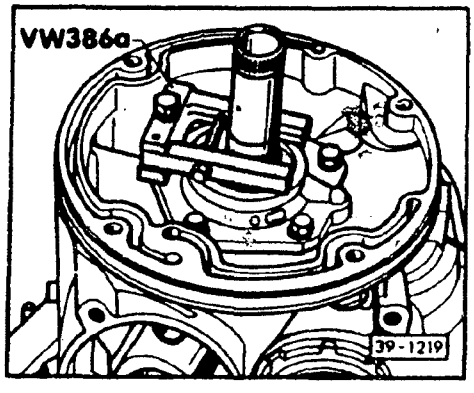
- lightly coat O-rings and threads of adjusting rings with multipurpose grease.
- lubricate bearings with hypoid gear oil




- screw in both adjusting rings until surfaces between teeth are flush with housing surface (**arrow**)
- carefully turn right adjusting ring (behind ring gear) until ring gear meshes with pinion with no backlash
- screw in left adjusting ring (opposite ring gear) and preload slightly so that there is no play in the bearings

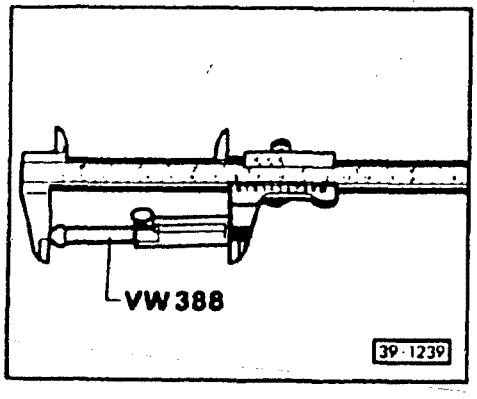



- turn right adjusting ring (behind ring gear) 1/2 tooth division **out**
- turn left adjusting ring **in** 2 tooth divisions (**arrow**). This correctly sets bearing preload and gear backlash

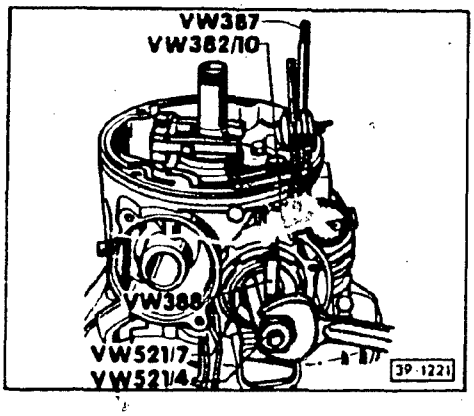



**Backlash, checking**

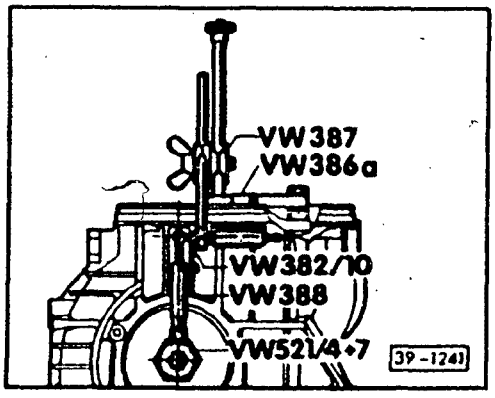
- turn pinion several times in both directions
- install clamp **VW 386** to rear cover plate and lock pinion with clamping screw

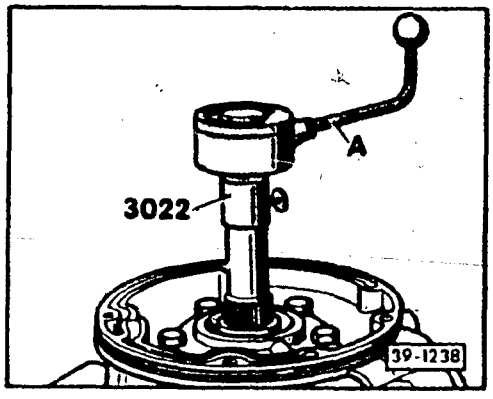


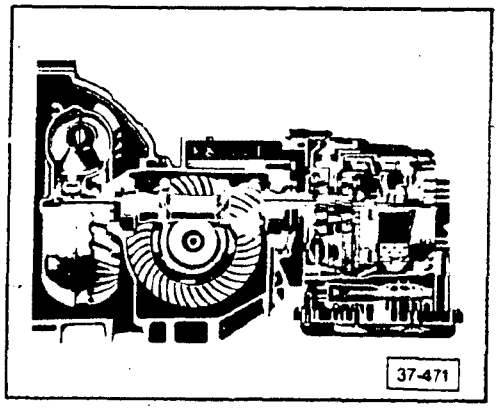

- set measuring lever **VW 388** to 62 mm and screw into clamping sleeve **VW 521/4**




- install dial gauge with flat-ended extension **VW 382/10** in holder **VW 387**
- install clamping sleeve **VW 521/4** with sleeve **VW 521/7**. Install dial gauge holder **VW 387**
- measure backlash at four positions
  - **backlash should be 0.15 - 0.25 mm**




**Backlash, checking**
**(Tool usage)**

**CAUTION**

Individual readings must not differ by more than **0.05 mm**.

The backlash figure given above only applies to a new ring gear/pinion. If a used set of gears is reinstalled they should be set to give the same backlash with which they were running **before** they were removed.

**Note**

If the backlash of new ring gear/pinion is outside tolerance it must be corrected by turning both adjusting rings the same amount so that the bearing preload is not changed.

- measure the total turning torque of all 4 bearings with a torque wrench on the pinion shaft
  - **A** = Ncm or in lb torque wrench
  - total turning torque must be at least 40 Ncm (3.4 in lb) more than the turning torque of the pinion shaft alone. If necessary increase the turning torque by screwing in both adjusting rings the same amount.

**Component exchange**

Automatic transmission/Final drive

**1** = torque converter
**2** = final drive
**3** = transmission

- remove and clean complete transmission
- drain hypoid oil or ATF from defective component
- separate transmission and final drive

- where applicable, measure end play between transmission and final drive and select and install shims before installing new component
- install gaskets and oil seals supplied
- if only final drive is replaced, remove governor from old assembly and install in new final drive (check governor drive)
- join transmission and final drive
- install complete transmission
- fill with hypoid oil or ATF as required

| Model | Engine | | Transmission | | | Code letters |
|---|---|---|---|---|---|---|
| | Liter | KW | Manufactured | | Part no. (complete) | |
| | | | From | To | | |
| Audi 80 | 2.0 | 83 | 07/87 | | 089 300 037 CX | KAU |

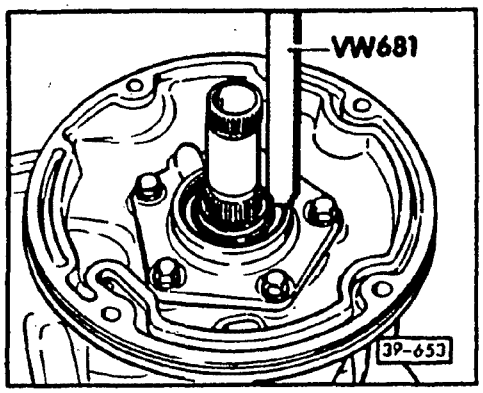
| Code letters | Components | | | | |
|---|---|---|---|---|---|
| | Transmission part no. | Final drive part no. | Code letters | Converter part no. | Code letter |
| KAU | 089 321 023 X | 089 409 506 X | K* | 089 323 571 X | Y |

*These final drives can be installed with various transmissions and therefore have only one letter code. The rest of the code can be taken from the transmission it is installed with.

**CAUTION**

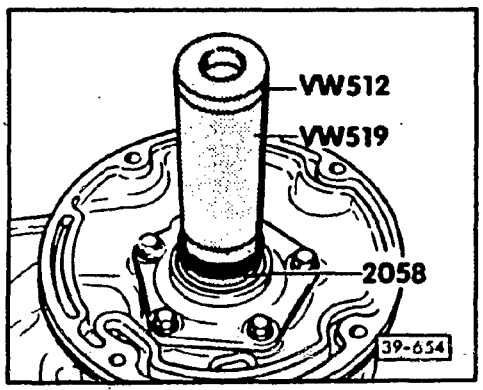
Part numbers are for reference only. Always check with your Parts Department for latest information.

## Transmission/Final drive oil seals, removing/installing



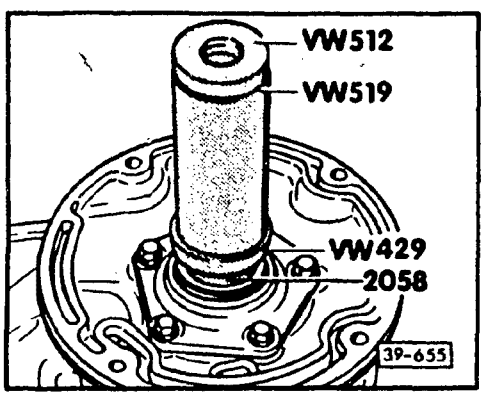

▶ **Fig. 1 Oil seals, removing**

- remove seals one after the other



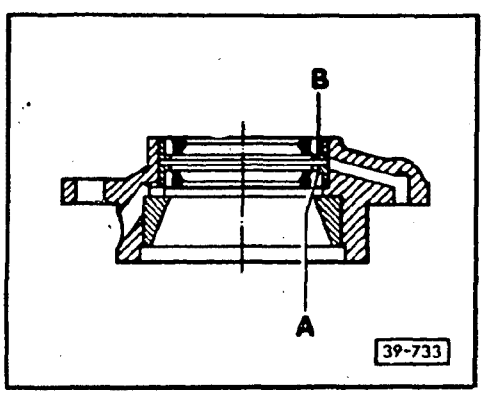

▶ **Fig. 2 Final drive oil seal, installing**

- drive in until seated
  - open side of lip faces final drive



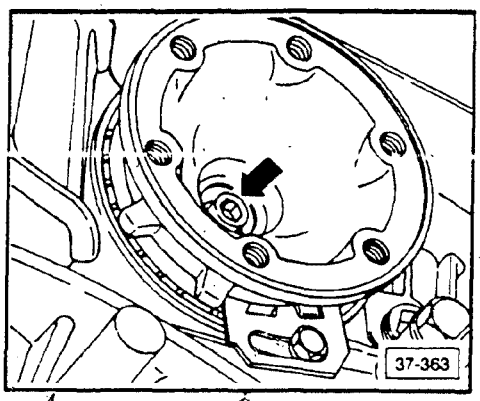

▶ **Fig. 3 Transmission oil seal, installing**

- drive in until flush
  - open side of lip faces transmission



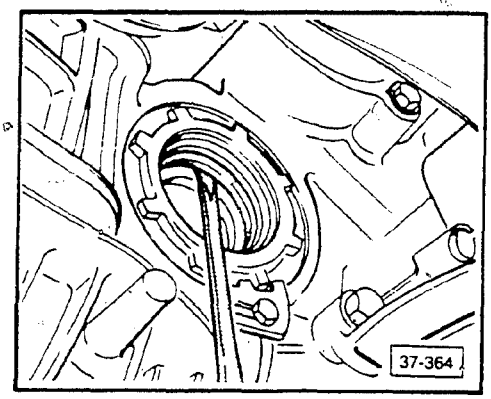

▶ **Fig. 4 Transmission/Final drive oil seals, installation position**

A = final drive seal
B = transmission seal

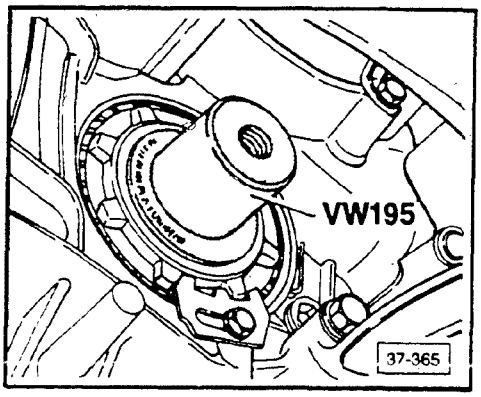



## Axle flange oil seal, removing/ installing (transmission installed)

- remove axle shaft from flange
- remove bolt (**arrow**)
- hold from turning with drift
- place oil pan under vehicle
- remove axle flange




- pry out oil seal




- drive in oil seal until seated

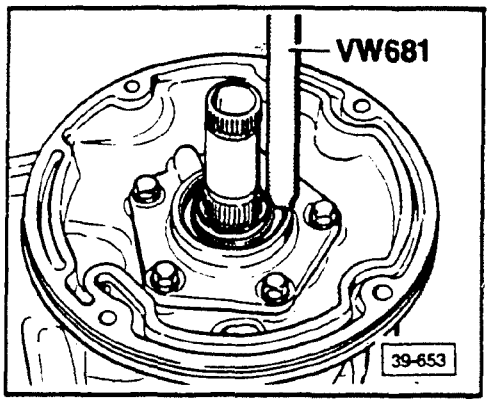
**Note**

Fill space between seal lips with multi-purpose grease.

- install axle flange
- install axle shaft to flange

**Tightening torque**

| | |
|---|---|
| Axle flange to transmission | 25 Nm (18 ft lb) |
| Axle shaft to flange | 80 Nm (59 ft lb) |

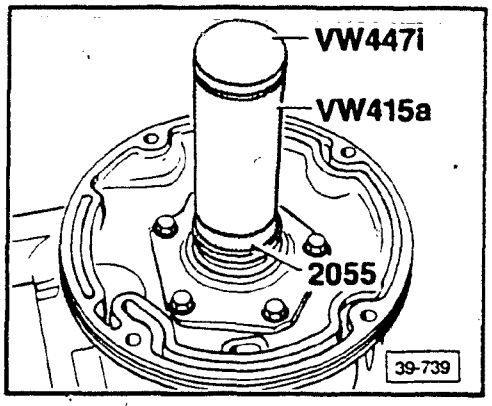



## Transmission/final drive oil seal, removing/installing

When replacing the transmission, check oil seals in final drive (Fig. 3), replace if necessary.

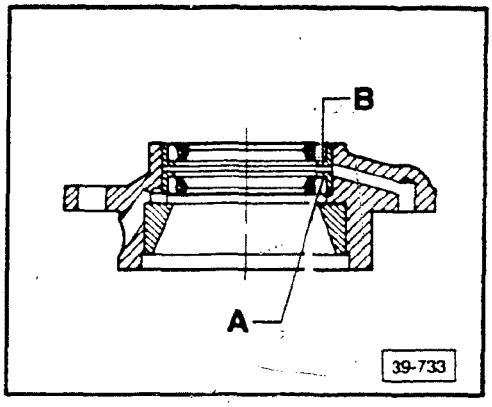
▶ **Fig. 1 Oil seal, removing**

- pry out one oil seal after another




▶ **Fig. 2 Final drive oil seal, installing**

- install sleeve **2055**
- replace first oil seal (open side facing final drive Fig. 3 **A**)
- drive in oil seal until seated
- install second oil seal (open side facing transmission Fig. 3 **B**)
- drive in seal flush




▶ **Fig. 3 Oil seals, installation position**

**A** — final drive oil seal

**B** — transmission oil seal