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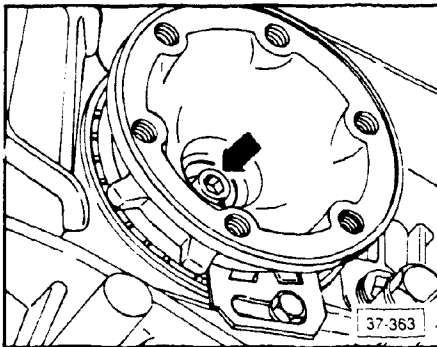
Transmission/final drive oil seal

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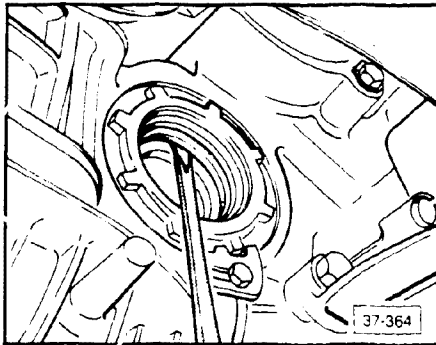
- checking 39.24

Differential – Automatic Transmission

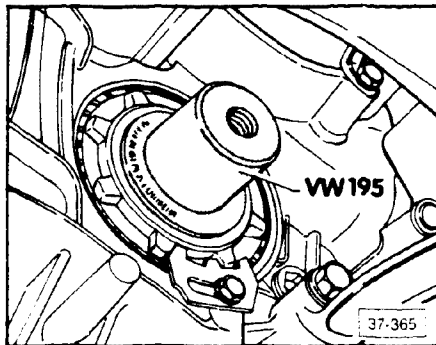


Axle flange oil seal, removing/ installing (transmission installed)

- 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

Note

When replacing the right oil seal, remove heat shield.

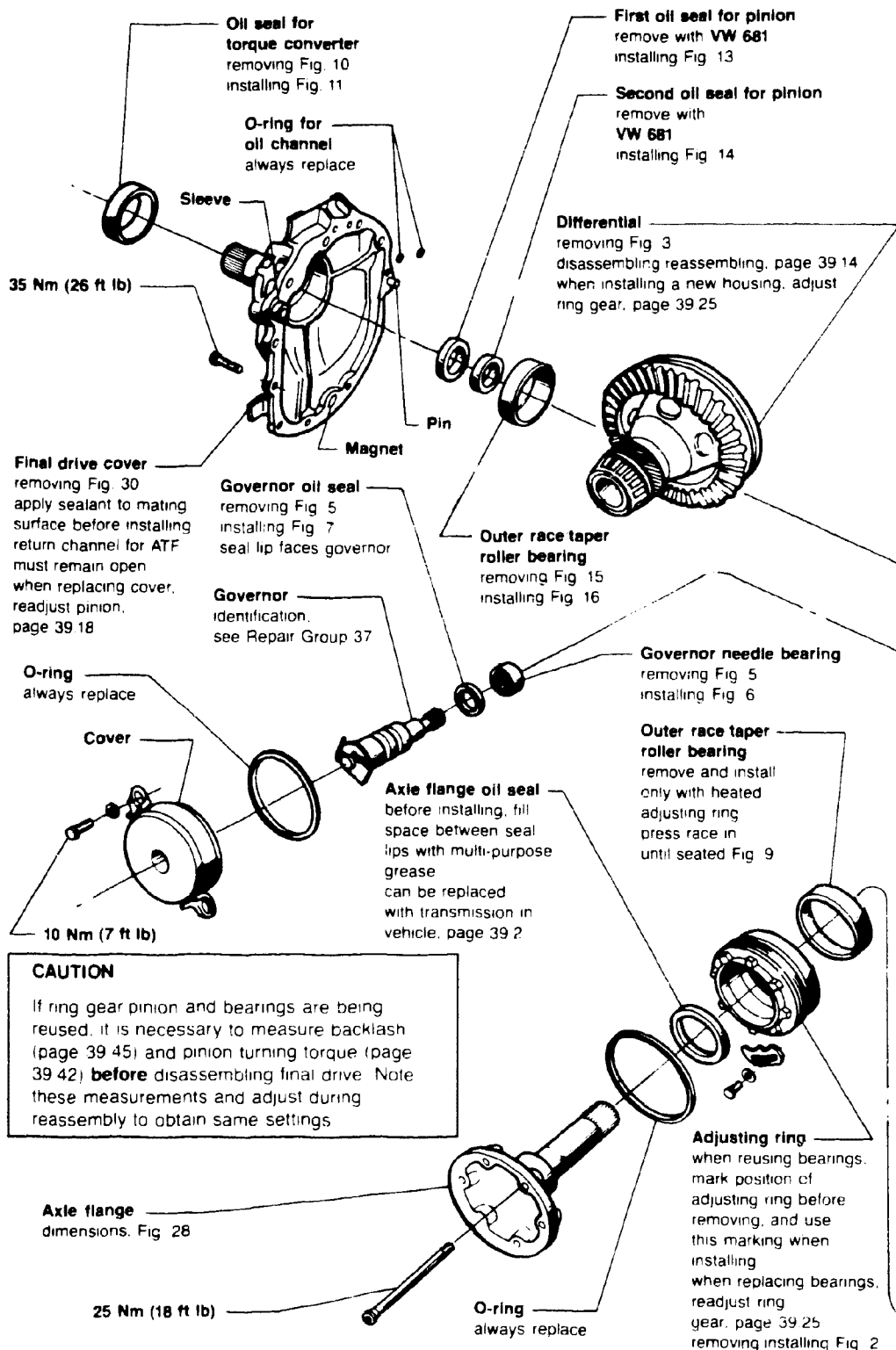
Tightening torque

Axle flange to transmission	25 Nm (18 ft lb)
Axle shaft to flange	45 Nm (33 ft lb)

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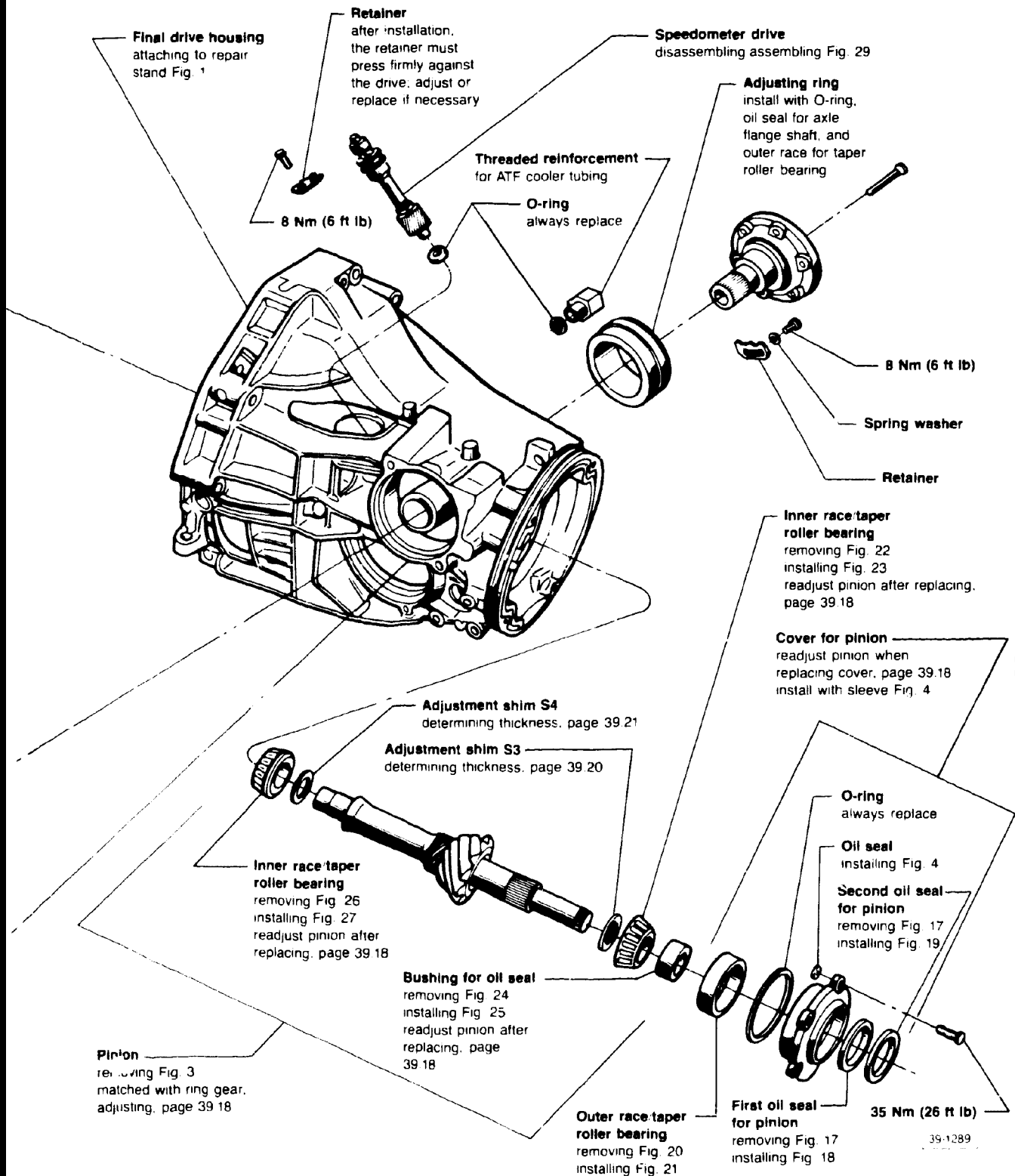
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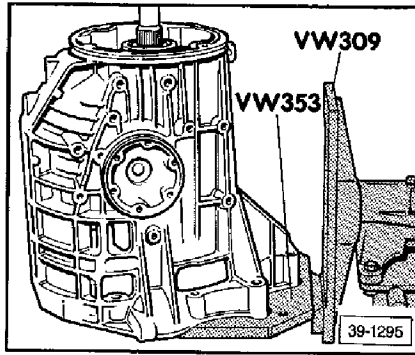
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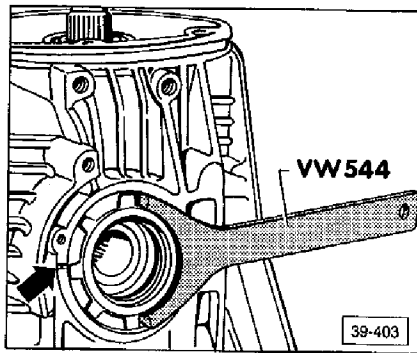
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Differential – Automatic Transmission



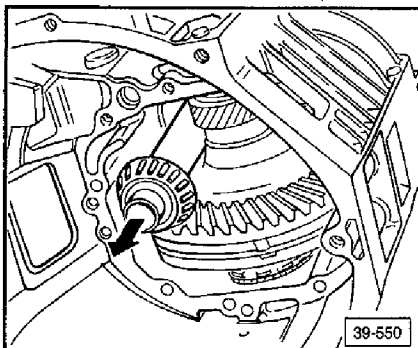


► Fig. 1 Final drive, attaching to repair stand



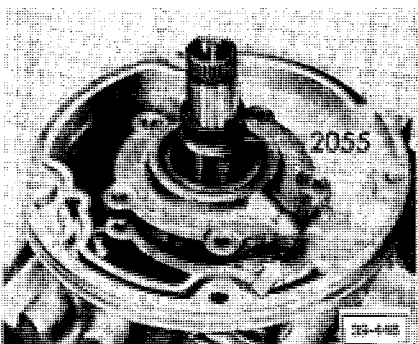
► Fig. 2 Adjusting ring, removing/installing

- when reusing parts, mark position of adjusting ring



► Fig. 3 Differential and pinion, removing/installing

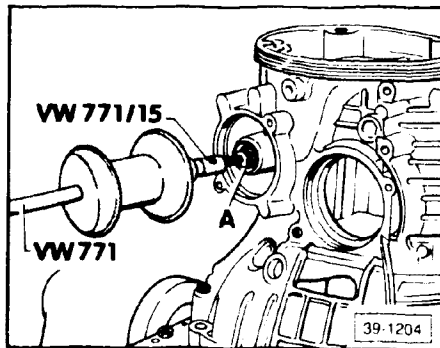
- remove both covers, remove adjusting rings, and slightly pull pinion out of large opening
- tilt out differential carefully and remove pinion
- install in reverse order



► Fig. 4 Pinion cover and oil seal, installing

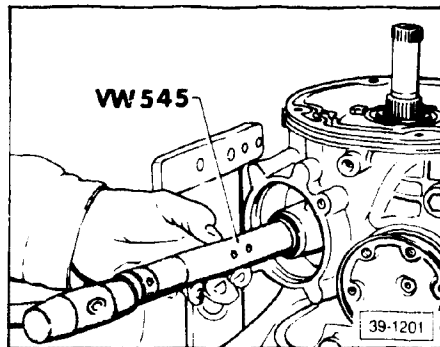
- use sleeve 2055 to prevent seal damage

Differential – Automatic Transmission



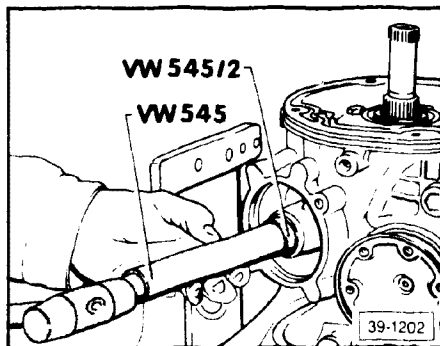
► Fig. 5 Governor needle bearing and oil seal, removing

A — commercial puller, e.g. Kukko 21/3 (18.5 - 23.5 mm)



► Fig. 6 Governor needle bearing, installing

■ drive in until seated



► Fig. 7 Governor oil seal, installing

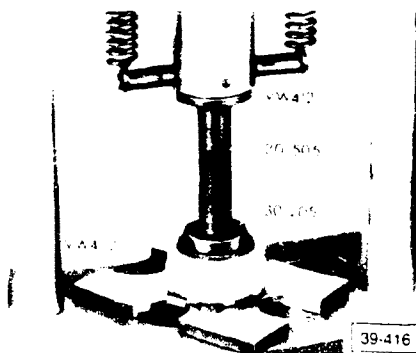
■ drive in until seated
● seal lip faces governor



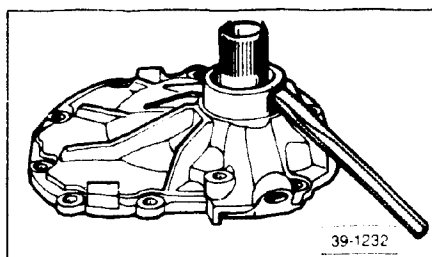
► Fig. 8 Axle flange oil seal, installing

■ drive into adjusting ring until seated

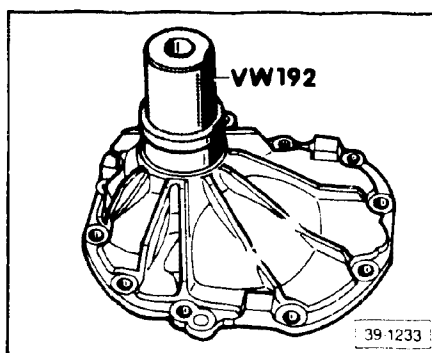
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► Fig. 9 Outer race taper roller bearing, installing



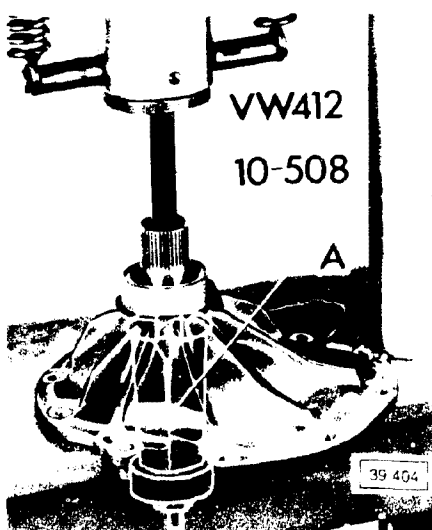
► Fig. 10 Torque converter oil seal, removing



► Fig. 11 Torque converter oil seal, installing

CAUTION

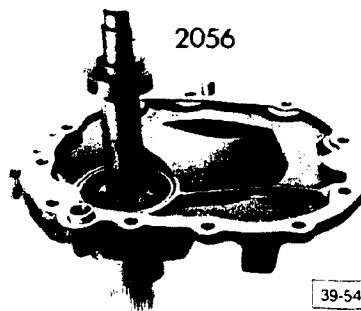
Install oil seal very carefully. Seal is soft and can be damaged easily. Seals must not come into contact with gasoline or cleaning solutions.



► Fig. 12 Final drive cover oil seals, removing

A — commercial puller, e.g. Kukko 21/5 (30 - 37 mm)

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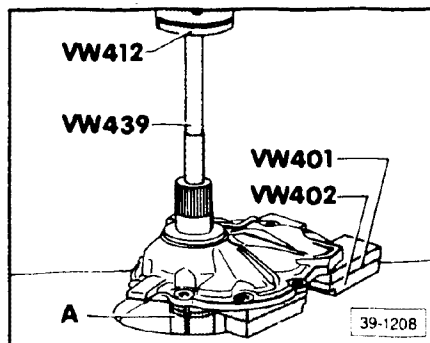
► Fig. 13 First oil seal, installing

- drive into cover until seated
- open side of seal faces torque converter, small collar on drift pointing down



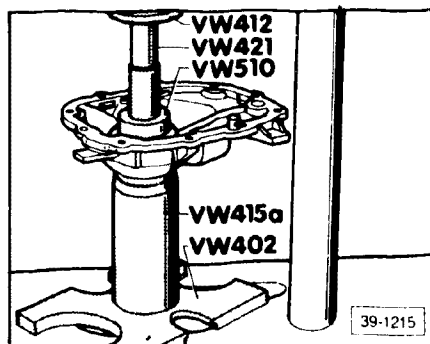
► Fig. 14 Second oil seal, installing

- drive into cover
- open side of seal faces transmission, large collar on drift serves as stop



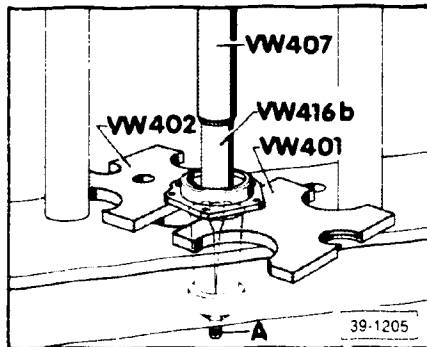
► Fig. 15 Outer race/taper roller bearing, removing

- A — commercial puller, e.g. Kukko 21/7 (46 - 56 mm)



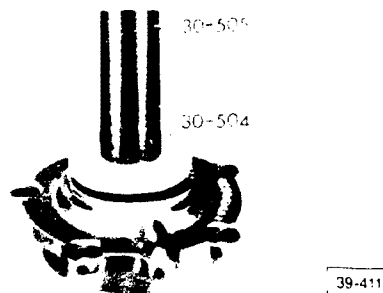
► Fig. 16 Outer race/taper roller bearing, installing

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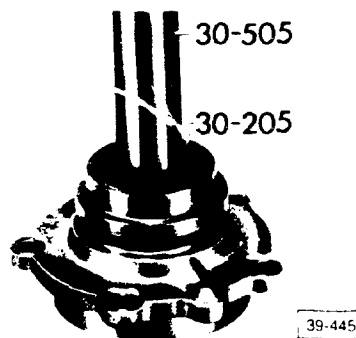
► Fig. 17 Oil seals, removing

- press out of cover one after another
- A — commercial puller, e.g. **Kukko 21/7** (46 - 56 mm)



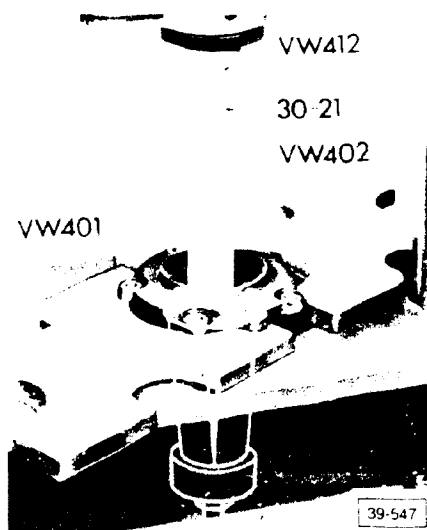
► Fig. 18 Pinion first oil seal, installing

- drive in until seated
- open side of oil seal faces final drive



► Fig. 19 Pinion second oil seal, installing

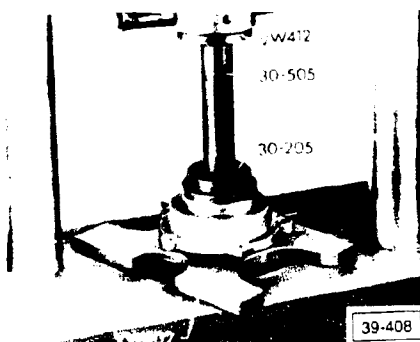
- drive flush into pinion cover
- open side of seal faces transmission



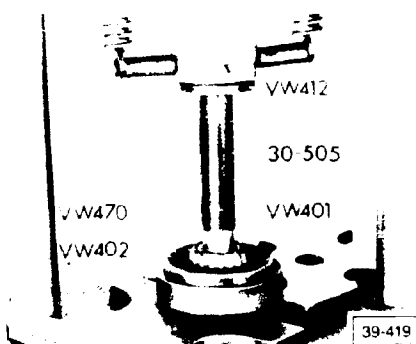
► Fig. 20 Outer race/taper roller bearing, removing

- A — commercial puller, e.g. **Kukko 21/7** (46 - 56 mm)

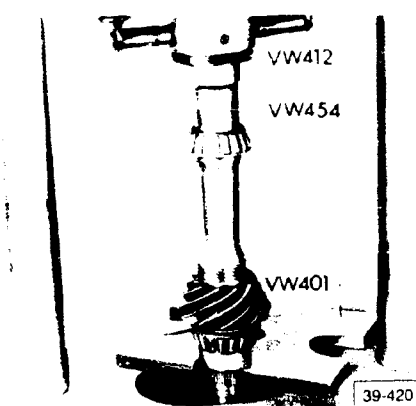
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► Fig. 21 Outer race/taper roller bearing, installing

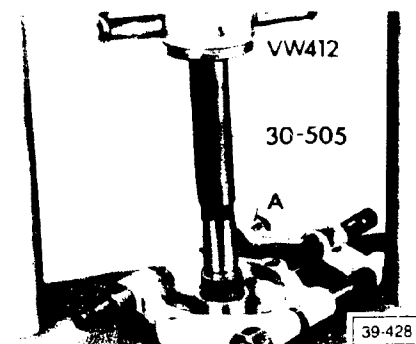


► Fig. 22 Inner race/small taper roller bearing, removing



► Fig. 23 Inner race/small taper roller bearing, installing

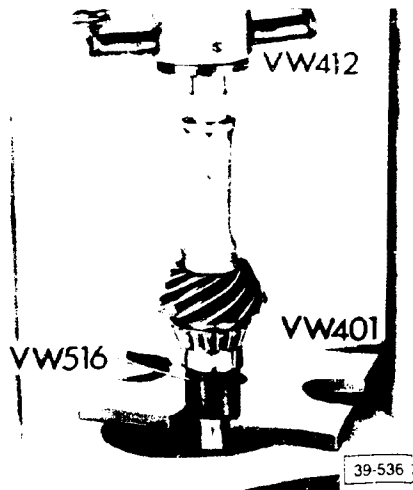
- heat bearing to approximately 100 C (212 F)



► Fig. 24 Oil seal bushing, removing

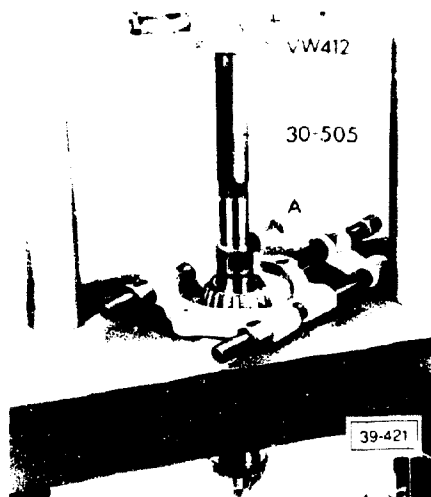
- A -- commercial device, e.g. Kukko 15/17 size 2

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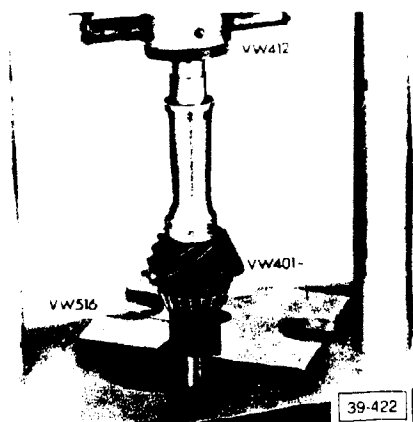
► Fig. 25 Oil seal bushing, installing

- heat bushing to approximately 100 C (212 F)



► Fig. 26 Inner race/large taper roller bearing, removing

- A — commercial device, e.g. Kukko 15/17 size 2



► Fig. 27 Inner race/large taper roller bearing, installing

- heat bearing to approximately 100 C (212 F)

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Thread
diameter dimension **b** = 10 mm



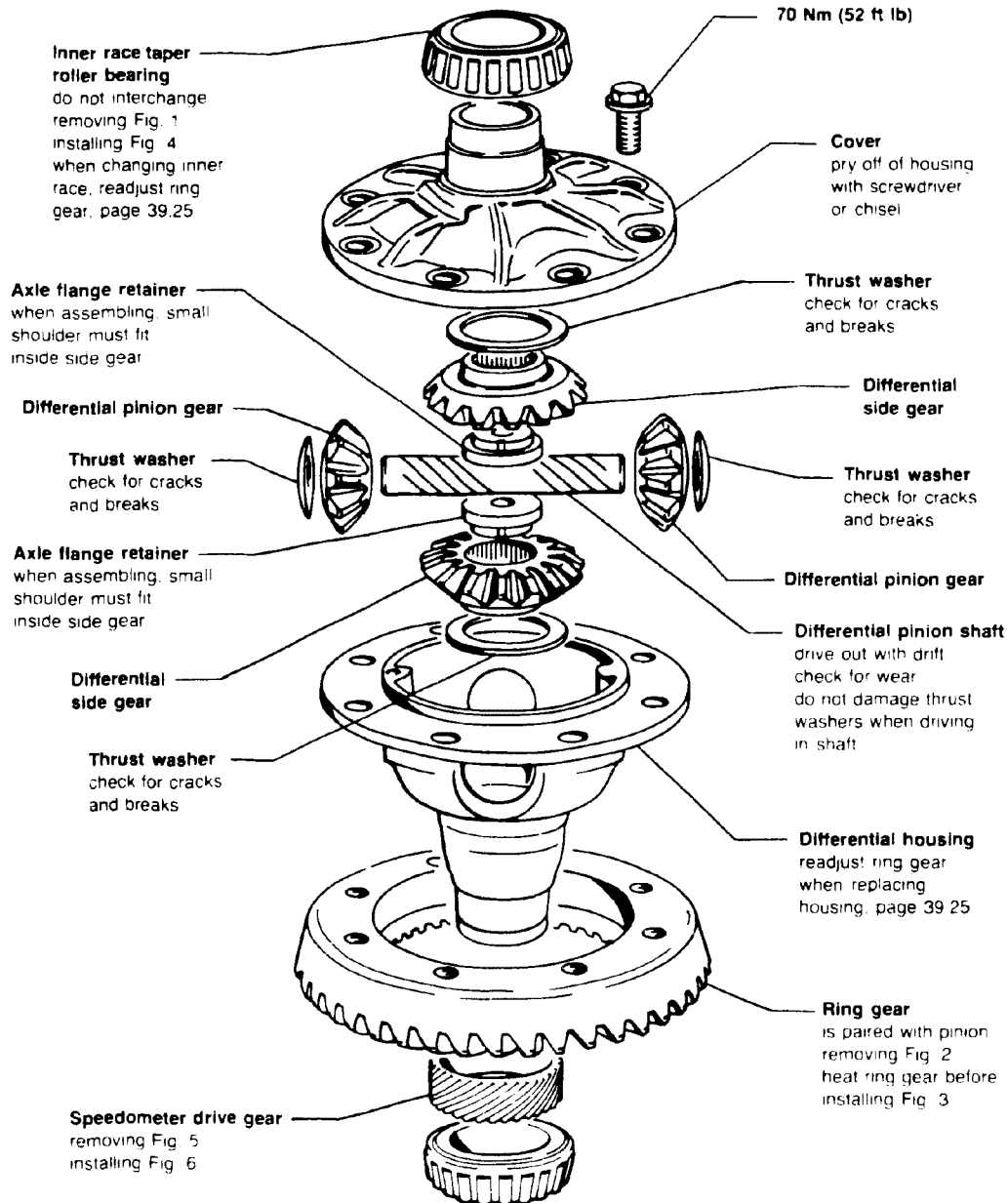
-
- VW353
- VW771
- VW771/13
- 39-1243

► **Fig. 30 Final drive cover, removing**

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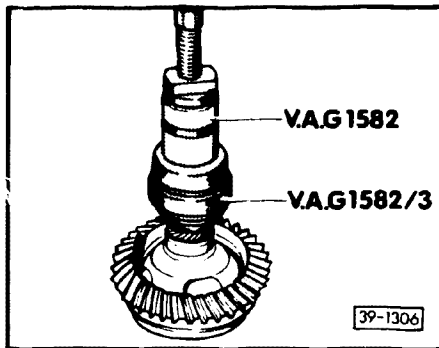
Note

Heat inner race taper roller bearing to 100 C (212 F) before installing



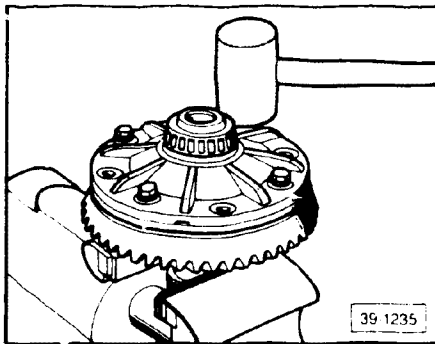
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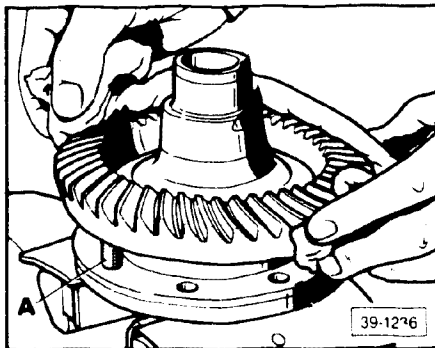
► Fig. 1 Inner race/taper roller bearing, removing

- before installing puller, install 30-11 on differential housing
- can also be removed with commercial puller, e.g. Kukko 20/10



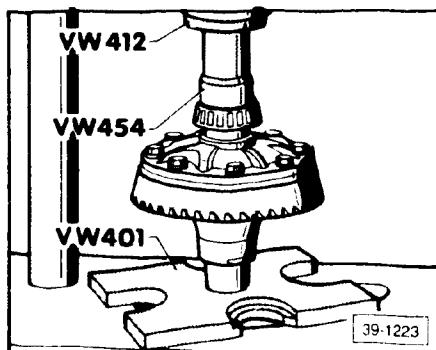
► Fig. 2 Ring gear, removing

- loosen bolts and remove ring gear from housing by tapping lightly on bolt heads



► Fig. 3 Ring gear, installing

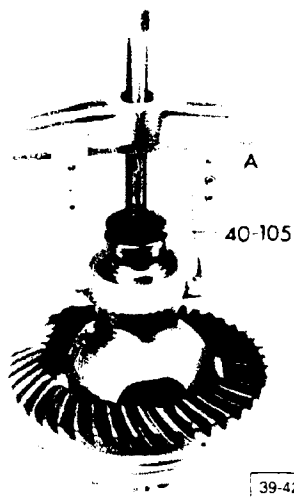
- heat ring gear to approximately 100°C (212 F) before installing
- A — centering pin (2 pins, local manufacture)



► Fig. 4 Inner race/taper roller bearing, installing

- heat to approximately 100 C (212 F) before installing

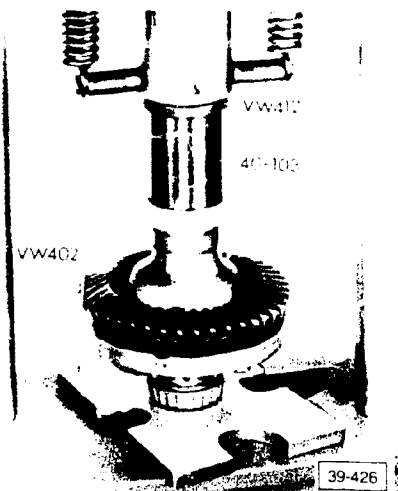
Differential – Automatic Transmission



► Fig. 5 Speedometer drive gear, removing

- gear must be replaced if removed

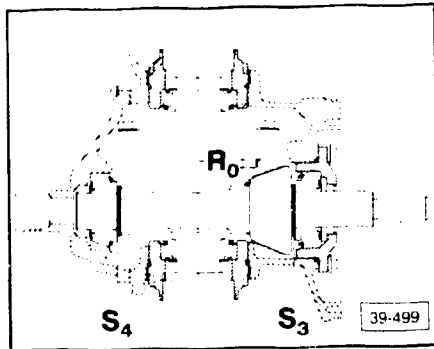
A — commercial puller, e.g. **Kukko**
20-10



► Fig. 6 Speedometer drive gear, installing

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Ring gear/pinion, adjusting

General instructions

Careful adjustment of the pinion and ring gear is important to ensure that the final drive has a long service life and runs quietly. Pinions and ring gears are manufactured as a matched set, and are checked with special testing machines for gear mesh and low noise.

Deviation r (measured against master gage length R_0) is measured for the ring gear pinion supplied as a replacement set and is marked on the ring gear. The ring gear pinion set may only be replaced as a matched set.

R_0 — Length of master gage used in factory testing machine **R_0** = 46.60 mm

r — Deviation measured against master gage of testing machine used in production. Deviation r is always given in 0.01 mm

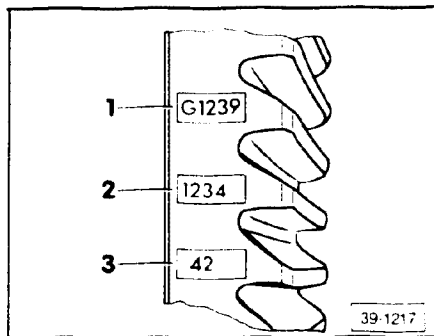
Example: "42" means r = 0.42 mm

S3 — Shim behind pinion head

S4 — Shim for pinion position (opposite end)

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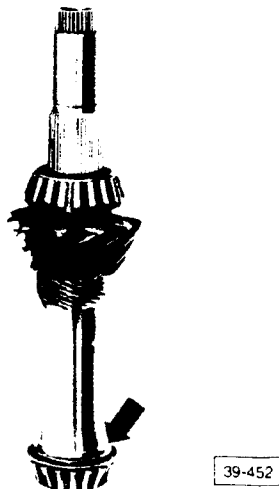


Marks on ring gear

- 01 — "Gleason" gear set with ratio of 12:39
- 02 — Serial number of matched gear set
- 03 — Deviation r

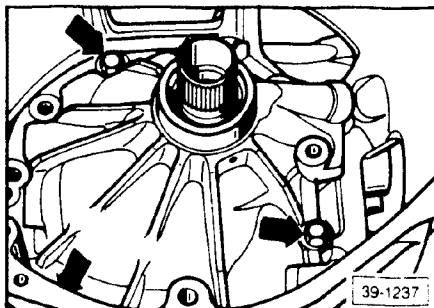
Pinion, adjusting

- heat pinion bearing inner race (behind pinion head) to approximately 100 C (212 F)
- install bearing on pinion **without shim**, and press onto seat with approximately 3 tons pressure
- heat inner race for pinion bearing (opposite pinion head) to approximately 100 C (212 F)
- with one 1.1 mm shim (**arrow**), install on pinion, and press onto seat with approximately 3 tons pressure

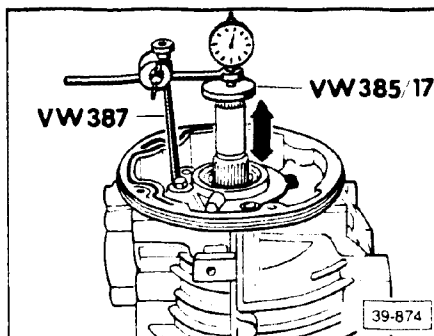


CAUTION

Pinion must be installed with shim. If not, pinion shaft could touch housing, which will produce incorrect results.



- install final drive cover with 4 bolts
- tighten bolts to specified torque
- insert pinion and attach cover with 5 bolts, and tighten to specified torque



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

Differential – Automatic Transmission

CAUTION

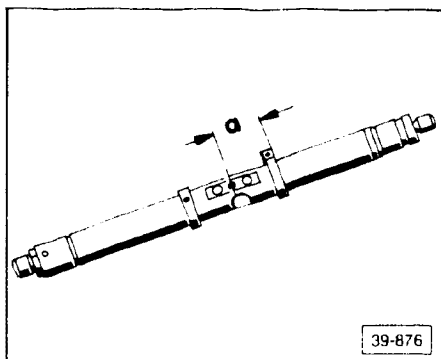
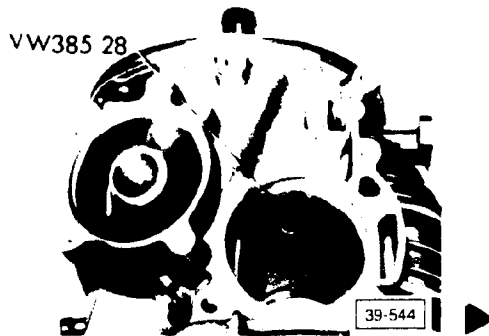
Measurement will be incorrect if pinion is turned.

Add 0.15 mm for bearing preload, 1.1 mm for shim, and 0.10 mm for bearing settling to the reading. The sum equals **S total**.

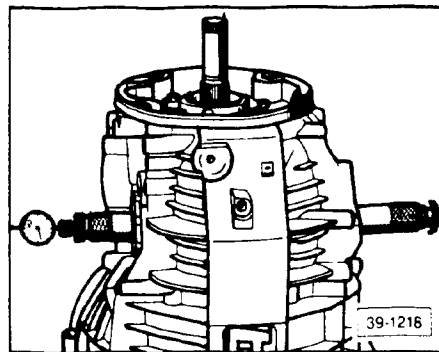
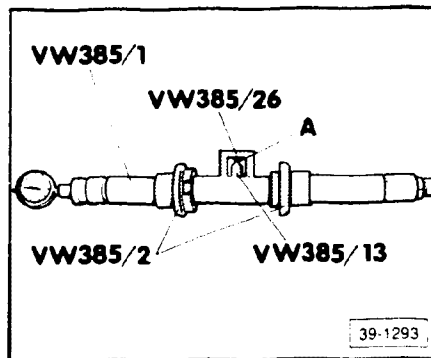
Example

Measured reading	1.48 mm
Shim installed	+ 1.10 mm
Bearing preload	+ 0.15 mm
Settling allowance	+ 0.10 mm
Total shim thickness	= 2.83 mm

- remove pinion
- remove shim (1.1 mm) and install shims corresponding to total shim thickness (example = 2.83 mm) to small bearing
- reinstall pinion and measure dimension **e**. Dimension **e** is the amount by which setting of pinion deviates from **Ro** with currently installed shims
- turn pinion several times in both directions
- place **VW 385/28** on pinion
- set adjusting ring on universal measuring bar **VW 385/1** to dimension **a**
a = 82 mm



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- assemble universal measuring bar as shown.
 - dial indicator extension **a** = 9.3 mm long
- place master gage **VW 385/26** on measuring bar and zero dial indicator with 3 mm preload

Note

Universal master gage **385/30** can be used instead of master gage **VW 385/26**. Set to **Ro** = 46.60 mm.

- screw in adjusting ring opposite ring gear until ring is flush with housing
- insert measuring bar into housing and screw in adjusting ring behind ring gear
 - do not place dial indicator pin on end plate
- move 2nd centering disc outward with movable setting ring until measuring bar can just be turned by hand
- turn measuring bar until dial indicator pin contacts end plate and gage shows maximum deflection (return point)
 - take reading from red number range of dial indicator
- note reading **e** (example 2.20 mm) and determine thickness of shims **S3 + S4**

Shim S3, determining thickness

$$S3 = e - r$$

Example

dial indicator reading e	2.20 mm
deviation r marked on ring gear	0.42 mm
shim thickness S3	1.78 mm
select shims from table	

Differential – Automatic Transmission

Shim S4, determining thickness

$$S4 = S \text{ total} - S3$$

Example

total shim thickness	2.83 mm
shim thickness S3	– 1.78 mm
shim thickness S4	<u> </u> = 1.05 mm
■ select shims from table	

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Adjustment shim table

S3 shims available

Shim thickness range in mm	Shim to be installed	Part no.
1.05 -1.100	1.100	087 409 641 D
1.105-1.125	1.125	087 409 641 E
1.130-1.150	1.150	087 409 641 F
1.155-1.175	1.175	087 409 641 G
1.180-1.200	1.200	087 409 642 H
1.205-1.225	1.225	087 409 641 J
1.230-1.250	1.250	087 409 641 K
1.255-1.275	1.275	087 409 641 L
1.280-1.300	1.300	087 409 641 M
1.305-1.325	1.325	087 409 641 N
1.330-1.350	1.350	087 409 641 P
1.355-1.375	1.375	087 409 641 Q
1.380-1.400	1.400	087 409 641 R
1.405-1.425	1.425	087 409 641 S
1.430-1.450	1.450	087 490 641 T
1.455-1.475	1.475	087 409 641 AA
1.480-1.500	1.500	087 409 641 AB
1.505-1.525	1.525	087 409 641 AC
1.530-1.550	1.550	087 409 641 AD
1.555-1.575	1.575	087 409 641 AE
1.580-1.600	1.600	087 409 641 AF
1.605-1.625	1.625	087 409 641 AG
1.630-1.650	1.650	087 409 641 AH
1.655-1.675	1.675	087 409 641 AJ
1.680-1.700	1.700	087 409 641 AK
1.705-1.725	1.725	087 409 641 AL
1.730-1.750	1.750	087 409 641 AM
1.755-1.775	1.775	087 409 641 AN
1.780-1.800	1.800	087 409 641 AP
1.805-1.825	1.825	087 409 641 AQ
1.830-1.850	1.850	087 409 641 AR
1.855-1.875	1.875	087 409 641 AS
1.880-1.900	1.900	087 409 641 AT

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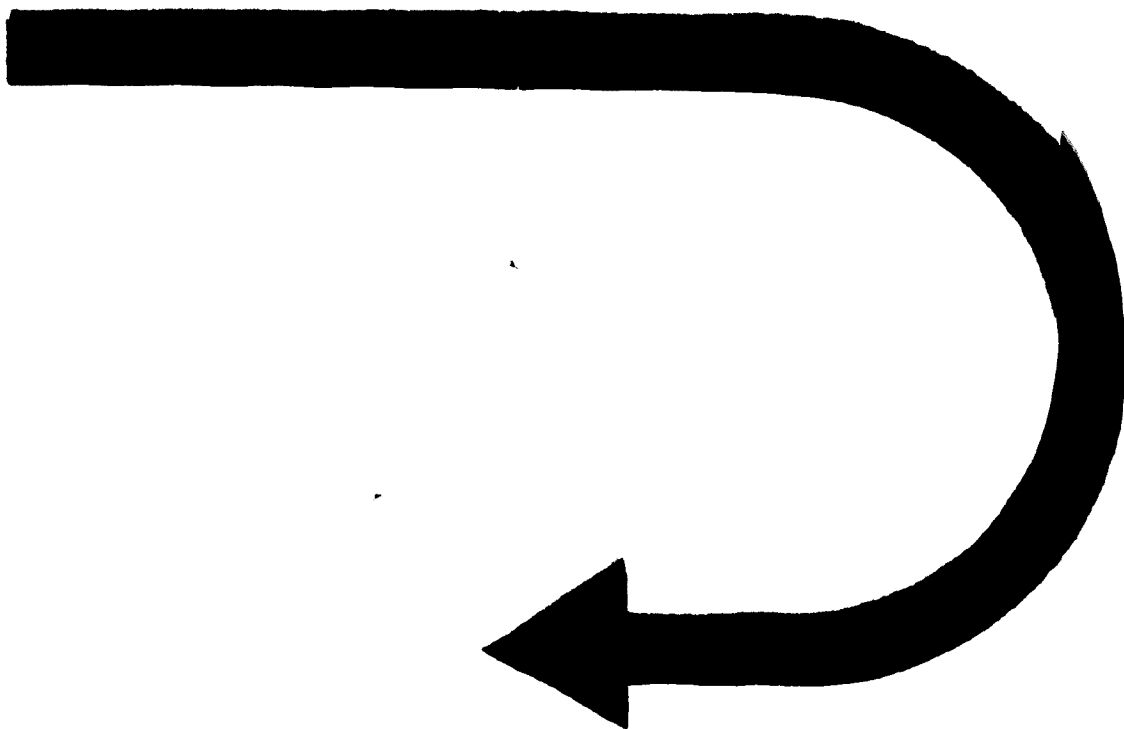
Adjustment shims table

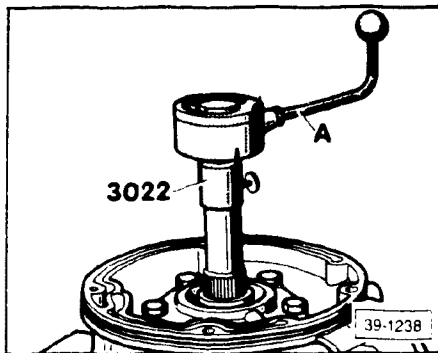
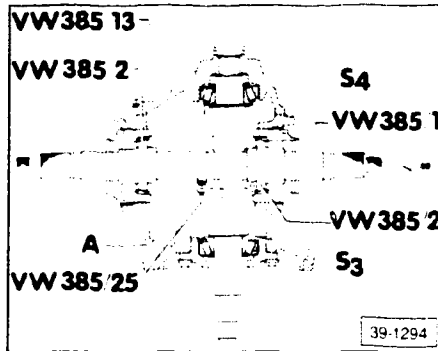
S4 shims available

Shim thickness range in 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

■ install selected shims

CONTINUED IN THE
BEGINNING OF NEXT ROW





Pinion, measuring

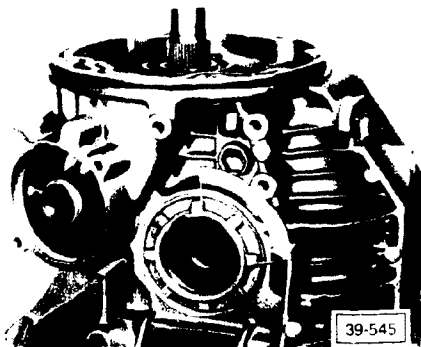
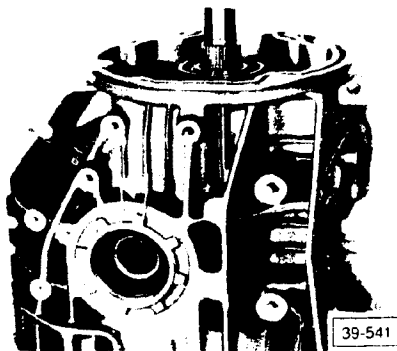
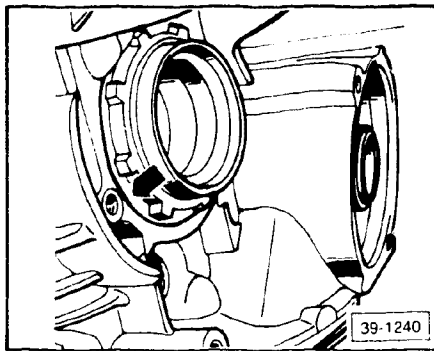
- location of measuring devices
 - A — dial indicator extension 9.3 mm long
- installation position of shims
 - S3 behind pinion head
 - S4 opposite pinion head
- install universal measuring bar. Zero dial indicator with 1 mm preload
- check that dial indicator reading equals recorded deviation r within tolerance of ± 0.04 mm

Turning torque, checking

- after measurement is taken, turning torque must be checked
 - turning torque must be between 250-550 Ncm (22-49 in. lb)

250-550 Ncm value applies to new bearings. If used bearings are reinstalled, turning torque should be the same as that measured before disassembly.

Differential – Automatic Transmission

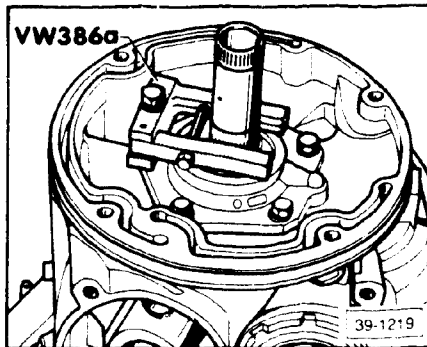


Ring gear, adjusting

- after adjusting pinion remove final drive cover and pinion cover
- take out pinion
- install differential gear and pinion, and final drive cover
- coat front cover sealing surface lightly with sealing compound **D 000 300**
- install pinion cover and tighten all bolts of both covers to specified torque
- coat O-rings and threads of adjusting rings lightly with multi-purpose grease and screw on both adjusting rings until surfaces between teeth are flush with housing surface (**arrow**)
- carefully turn adjusting ring behind ring gear (right adjusting ring) until ring gear meshes with pinion with no backlash
- screw in adjusting ring opposite ring gear (left adjusting ring) as far as possible and preload slightly so that there is no bearing play
- turn adjusting ring behind ring gear 1 2 tooth division out (direction of **arrow**)
- turn adjusting ring opposite ring gear 2 tooth divisions in (direction of **arrow**)
 - this correctly sets bearing preload and gear backlash

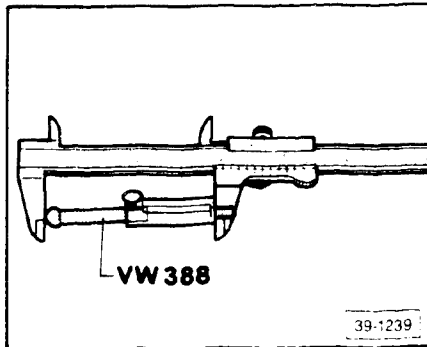
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Differential – Automatic Transmission

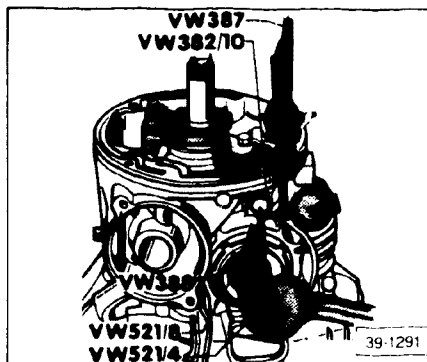


Backlash, checking

- turn pinion several times in both directions
- attach clamp **VW 386** to pinion cover



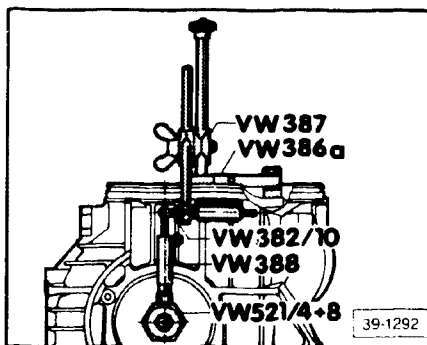
- set measuring lever **VW 388** to dimension **a** = 68 mm, and place in clamp **VW 521/4**



- install dial indicator with square-ended extension in holder **VW 387**
- insert clamping sleeve **VW 521/4** with sleeve **VW 521/8** and holder **VW 387**
- check backlash at four positions

Specified value : 0.15 - 0.25 mm

Differential – Automatic Transmission



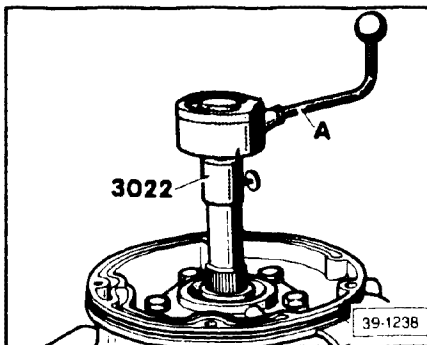
► Measuring tools for checking backlash, location

CAUTION

Individual readings must not differ by more than 0.05 mm.

The above value applies only to new ring gear pinion; if used set of gears is reinstalled, they should be set to give the same backlash with which they were running before they were removed.

- if backlash of new ring gear pinion is outside of tolerance, it must be corrected by turning both adjusting rings by same amount, so that bearing preload is not changed

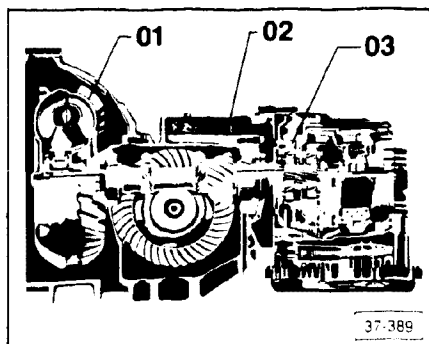


- measure total turning torque of all 4 bearings

A — torque wrench 0 - 600 Ncm

The total turning torque must be at least 40 Ncm more than turning torque of pinion shaft alone; if necessary, increase turning torque by screwing in both adjusting rings the same amount.

Differential – Automatic Transmission



Note

Exchange components are available for repairing automatic transmissions.

The automatic transmission consists of the following 3 components:

01 — Torque converter

02 — Final drive

03 — Transmission

Guide to component exchange

If there is a complaint, the cause of the problem can be determined with the aid of the troubleshooting table, drive line, no. 3, which is oriented to component exchange. Determine the required component using the replacement part list, page 39.31, and the transmission code letters stamped in the final drive.

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Differential – Automatic Transmission

Component exchange

- note details in repair manual, see informational guide, page 39.32
- remove and clean complete transmission
- drain hypoid oil or ATF from component being replaced
- separate transmission from final drive
- where applicable, measure end play between transmission final drive and select and install shims before installing new component
- install gaskets and oil seals supplied
- if only the final drive is replaced, remove governor from old assembly and install in new final drive (check governor drive)
- install transmission
- install complete transmission in vehicle
- fill with hypoid oil or ATF according to specification and check
- always leave ATF cooler attached to transmission
- a new ATF cooler is always attached to a new component

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Differential – Automatic Transmission

Transmission overview and application

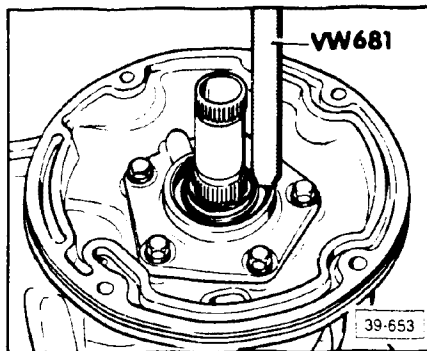
Type	Engine			Transmission	
	liter	kW	Date of manufacture from to	Part no. complete	Code letters
Audi 100	2.3	100	11-87	087 300 041HX	REH
Audi 200	2.22	121	11-87	087 300 041EX	REE

Transmission code letters — component code letters

Transmission	Planetary gear	Components		Converter	Code letters
		Final drive	Code letters		
REH	087 321 023 P	087 409 508 N	R*	087 323 571 LX	Q
REE	087 321 023 M	087 409 508 L	R*	087 323 571 EX	N

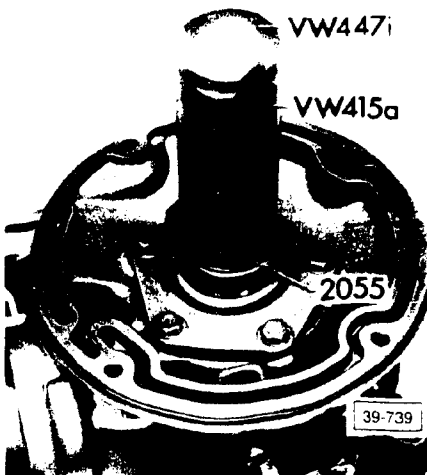
*These final drives can be installed in various transmissions, and therefore have only one letter code. The rest of the code can be taken from the removed transmission and is to be stamped on the new final drive.

Differential – Automatic Transmission



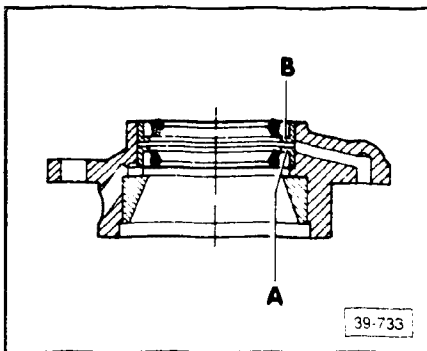
► Fig. 1 Oil seal, removing

- 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