Differential
Manual Transmission

Quick Data

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Technical data

- code letters
- application
- gear ratios

Front final drive code letters	ACU	
date of manufacture from to	10/85	
Application vehicle	Vanagon Syncro	
engine	2.1 Liter 70 kw (95 bhp SAE net)	
manual transmission	AAK	AAN
Ratio	34 : 7 = 4.86	
Capacity	1.6 US qt (1.5 Liters)	
Lubricant specification	Gear oil GL-4 SAE 80	
Axle shaft flange	100 mm	

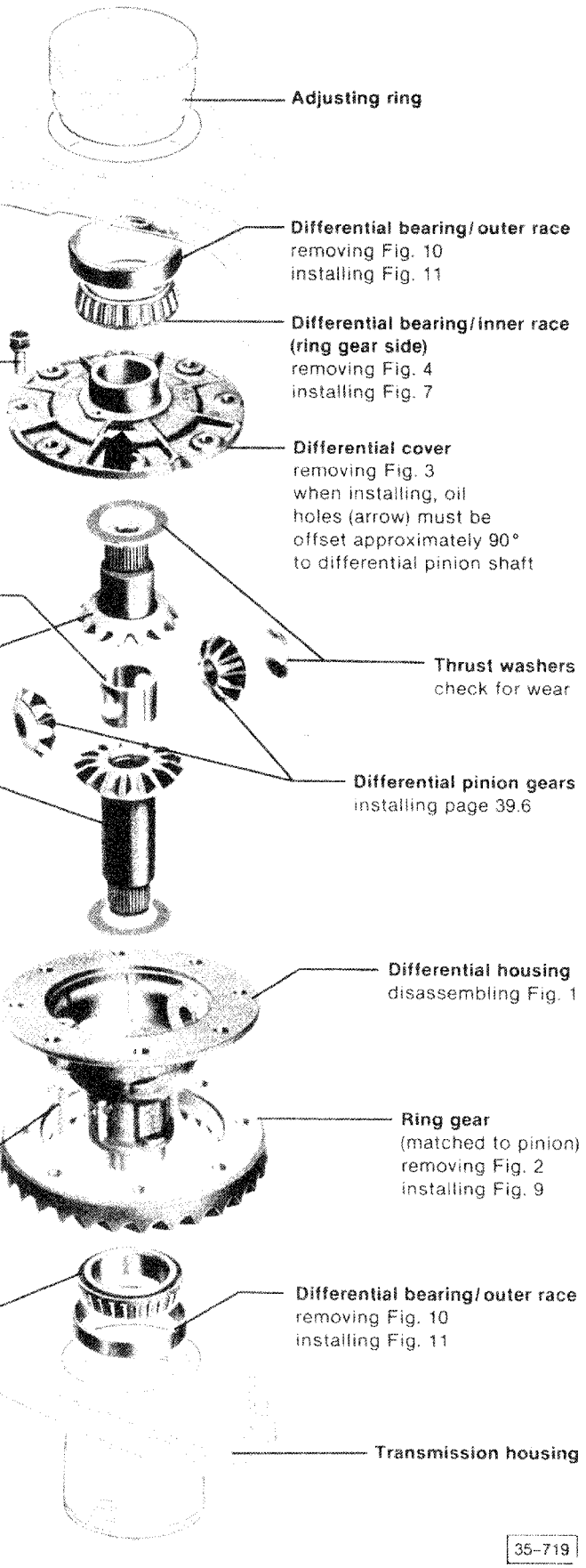
CAUTION

Inner and outer races of tapered roller bearings are matched and must not be interchanged. Replace both bearings at same time. Ring gear/pinion must be adjusted after replacing differential housing, cover or bearings. Side gear end play must be adjusted if differential housing, cover or side gears have been replaced

Note

Drive flange oil seal can be replaced with final drive installed, see Repair Group 34

Ring gear/pinion adjusting,
page 39.7-39.14
backlash adjusting, page 39.13



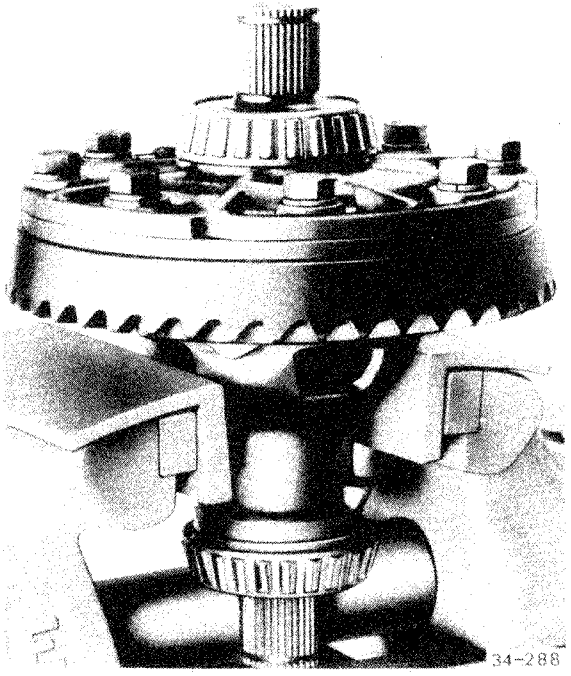


Fig. 1 Differential housing, disassembling
— use jaw covers on vise

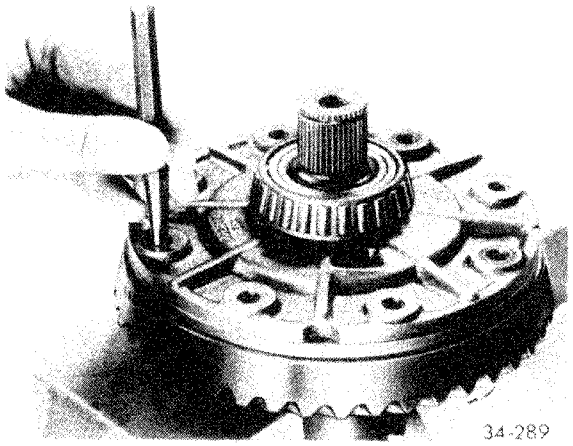


Fig. 2 Ring gear, removing
(matched to pinion)
— use drift to separate ring gear from housing

CAUTION
Do not damage threads in ring gear

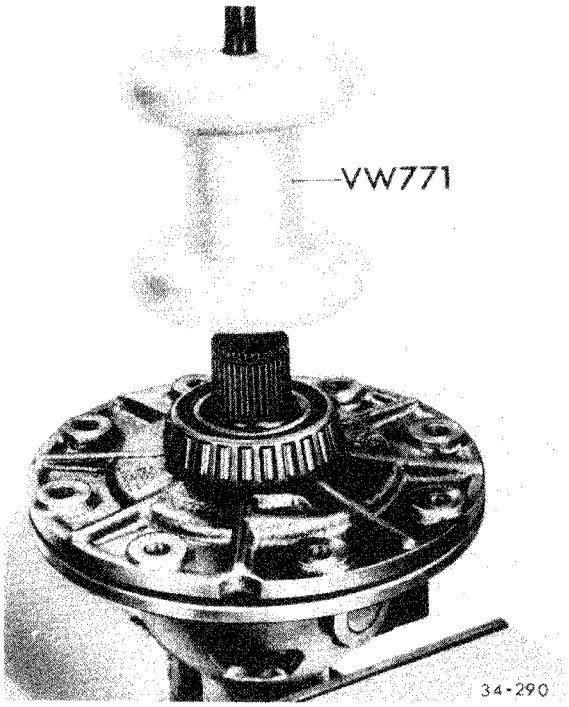


Fig. 3 Differential cover, removing

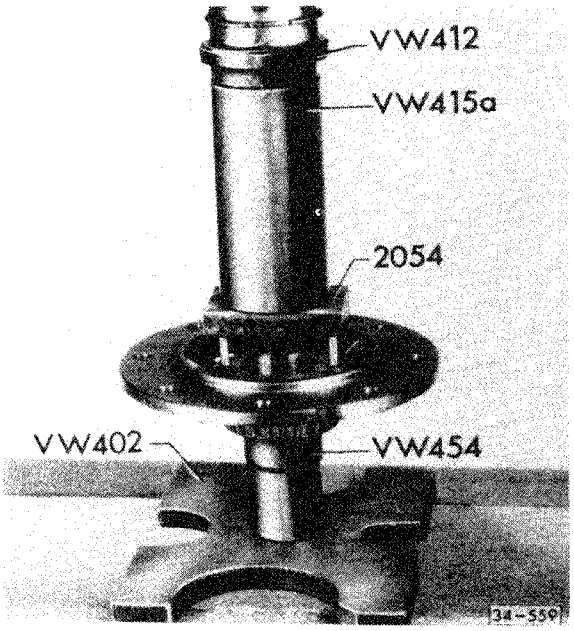


Fig. 4 Differential bearing/inner race (ring gear side), removing

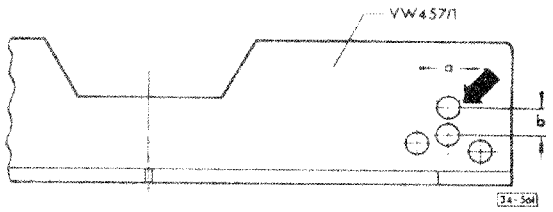


Fig. 5 **Differential bearing/inner race (housing side), removing**

— drill hole in VW 457/1 as shown above (arrow)
- **a** = 8 mm (5/16 in.)
- **b** = 9.5 mm (3/8 in.)

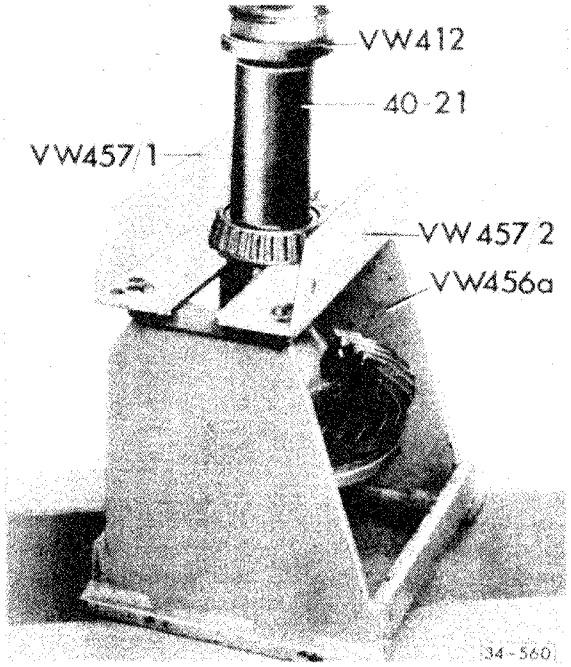


Fig. 6 **Differential bearing/inner race (housing side), removing**

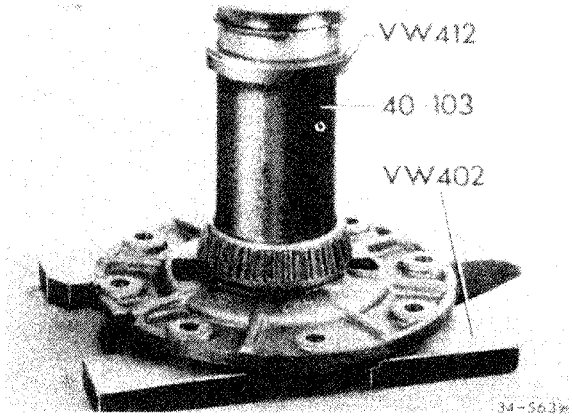


Fig. 7 **Differential bearing/inner race (ring gear side), installing**

— heat to approx. 100°C (212°F) and press on

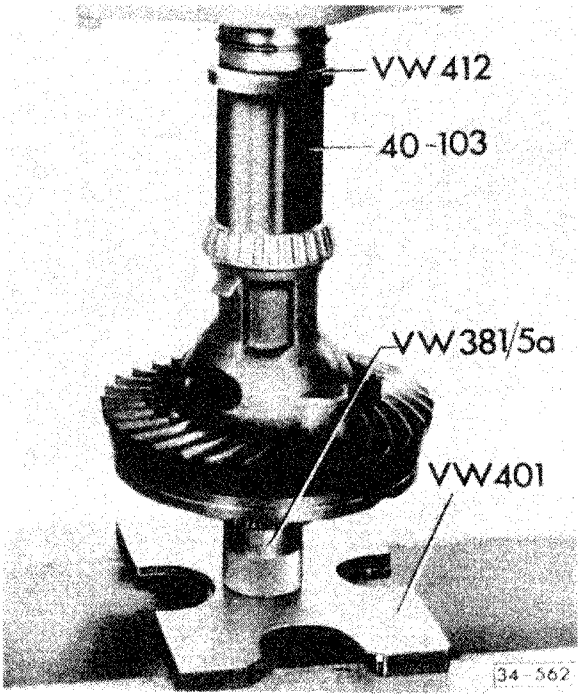


Fig. 8 **Differential bearing/inner race (housing side), installing**

— heat to approx. 100°C (212°F) and press on

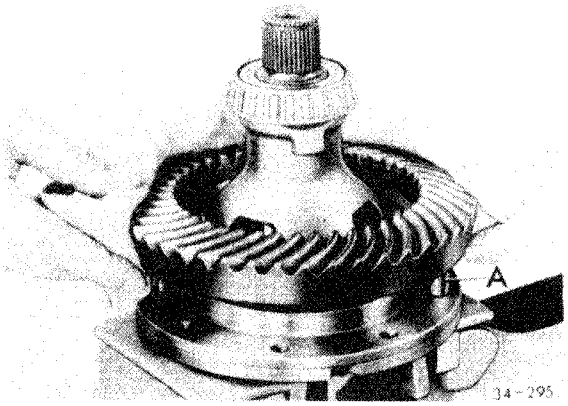


Fig. 9 **Ring gear, installing**

CAUTION

Clean contact surfaces are essential to ensure that ring gear, differential housing, and cover fit properly. Remove all burrs and pressure marks with oil stone

— heat ring gear to approx. 100°C (212°F) and install
- **A** = centering pins (local manufacture)

Note

If ring gear/pinion are replaced, readjustment is necessary

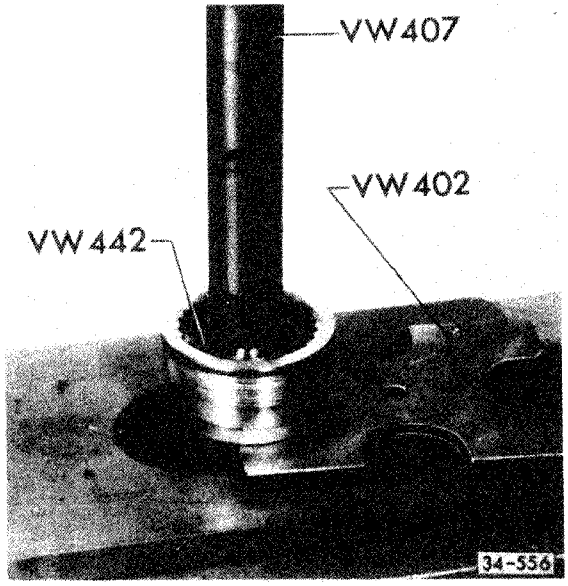


Fig. 10 Differential bearing/outer race, removing

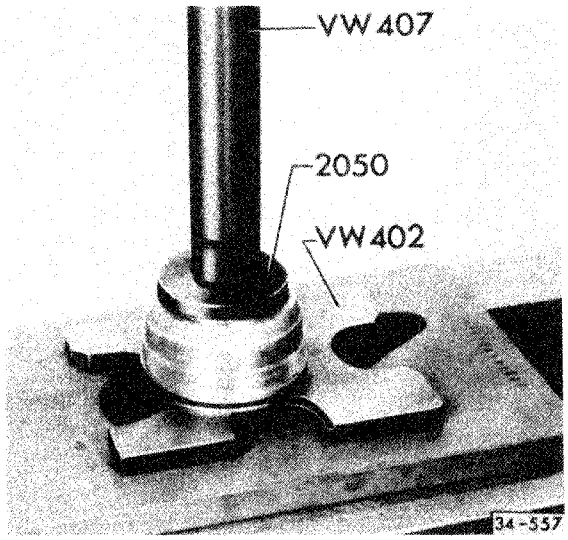


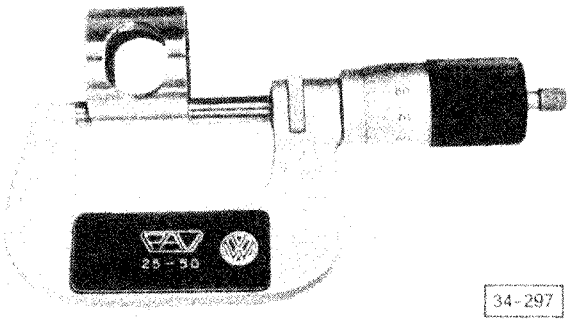
Fig. 11 Differential bearing/outer race, installing

— press race in until seated

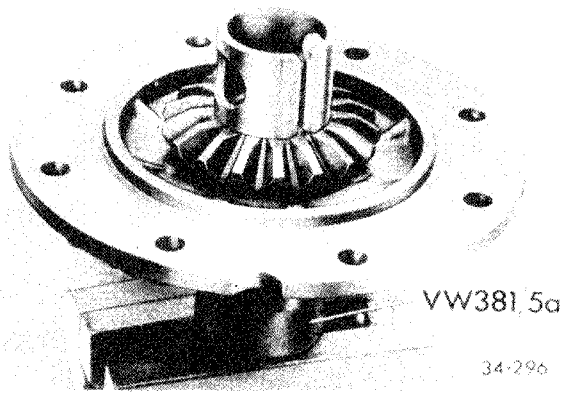
Differential pinion/side gears, adjusting end play

Note

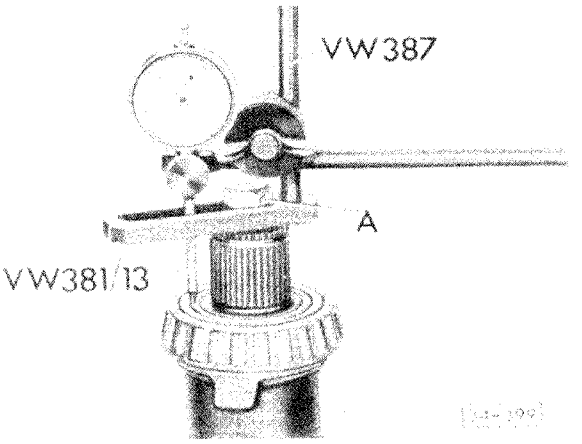
Spacer sleeve ensures adequate backlash between side gears and differential pinion gears even when there is axial pressure on side gears. If differential housing, cover, side gear or spacer sleeve is replaced, size of spacer sleeve must be determined again



— measure shortest spacer sleeve, Part No. 002 517 241, with micrometer and mark dimension on sleeve with electric marker or similar device. Sleeve should then always be used as measuring sleeve



— place side gear (with short shaft) and both thrust washers in cover
— attach clamping sleeve VW 381/5a and clamp gear tightly against cover
— place side gear (with long shaft) in differential housing
— insert measuring sleeve, and bolt housing and cover together with 4 M8 x 20 bolts



— install dial indicator with 3 mm range
  • **A** = M10 x 25 bolt
  • VW 381/13 = 52 mm
— zero dial indicator with 2 mm preload
— find end play by moving side gear up and down
— add measured play and length of measuring sleeve together. Find this figure in table under **x** range and select proper sleeve

x range	Sleeve length	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

— disassemble differential and remove measuring sleeve
— install sleeve selected from above table and assemble differential **without** differential pinion shaft
— recheck play. Play should be
  • 0.03-0.17 mm

Ring gear/pinion, adjusting

Note

Ring gear/pinion must **always** be replaced as matched set, never individually

Ring gear/pinion markings

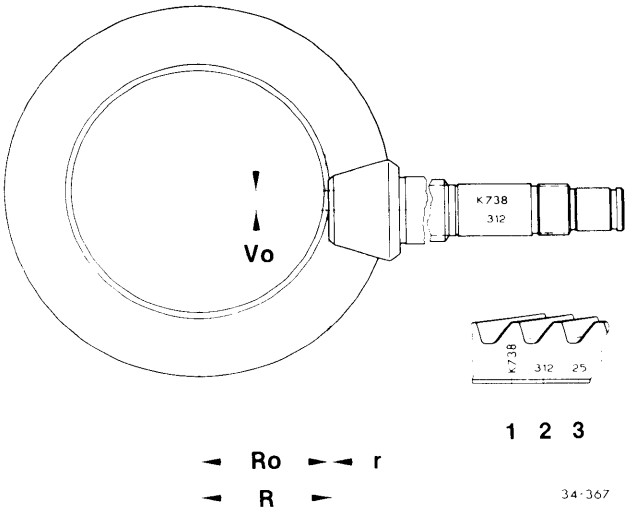


Fig. 1 Service gears

1 = Marking **K 738** means Klingelnberg gear set with ratio of 7:38 teeth

2 = Matching number of gear set **312**

3 = Deviation **r** based on master gauge used in special test machine in production. Deviation **r** is always given in 1/100 mm. **25** shown in example means that **r** = 0.25 mm

Ro = Length of master gauge in production: **Ro** = 63 mm

R = Actual dimension between ring gear centerline and end face of pinion at quietest running point for this gear set

Vo = Hypoid offset = 10 mm

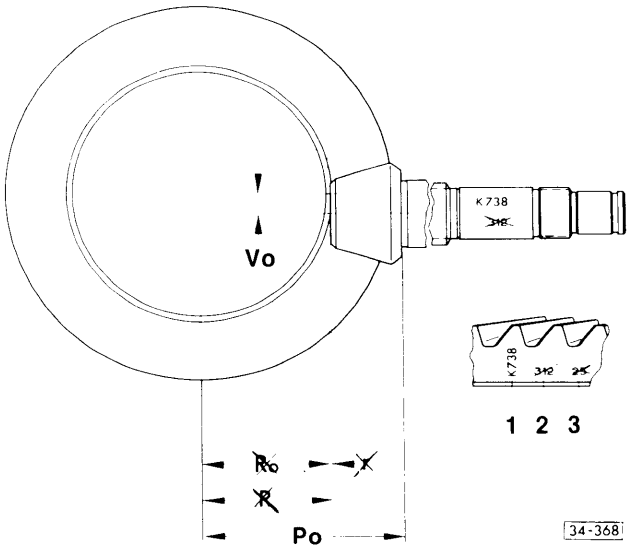


Fig. 2 Production gears

X = Markings x'ed-out are not shown on production gears

Po = Setting dimension for production gears

CAUTION

In production, position of pinion is determined by dimension **Po** (ring gear centerline to back of pinion head)

Marking of deviation **r** on ring gear and matching number have been discontinued. It is therefore necessary to measure position of pinion **before** removing it when parts which affect position of pinion are to be replaced. See page 39.9

Ring gear/pinion, adjusting

CAUTION

Maximum possible care and cleanliness during all assembly and measuring operations are essential for satisfactory results

Note

Ring gear/pinion must be adjusted if gears themselves have been replaced. If other parts which affect position of pinion are to be replaced, pinion depth **R** must be measured **before** disassembling, and pinion set to this dimension when assembling. See page 39.9

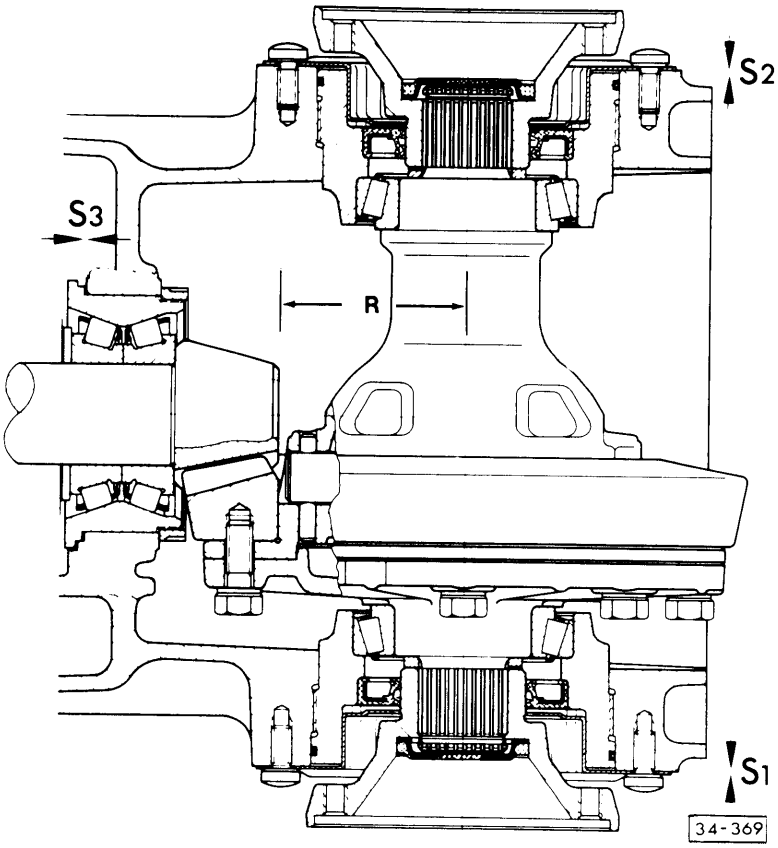


Fig. 3 Ring gear/pinion adjustment points

- S_1 = Screw-in depth of adjusting ring (ring gear side)
- S_2 = Screw-in depth of adjusting ring (housing side)
- S_3 = Shim for pinion

Ring gear/pinion adjustment procedure

Work sequence

— find screw-in depth S_1 and S_2
  • tapered roller bearing preload is determined by ring gear turning torque
— adjust pinion and check S_3
  • adjust pinion with shims so that correct dimension **R** is attained
— adjust backlash

Ring gear/pinion, adjusting

Note

It is only necessary to adjust pinion, ring gear, or both, or shift forks if parts which directly influence setting have been replaced. See table to avoid unnecessasry adjustments

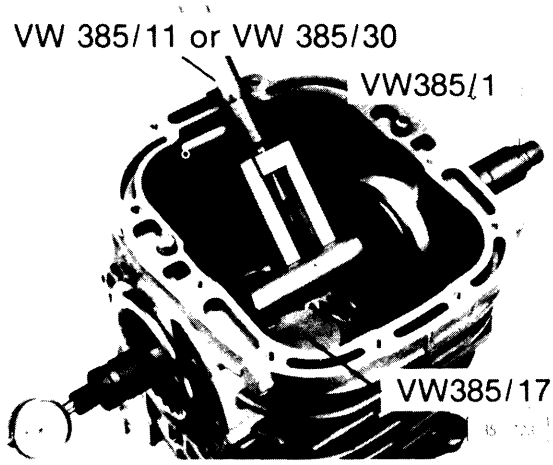
To be adjusted / Parts replaced	Shift forks see Repair Group 35	Pinion S_3 from actual dimension R see page 39.9	Pinion S_3 from deviation r see page 39.10	Ring gear S_1 and S_2 see page 39.12
Transmission case	X	X		X
Adjusting ring for final drive				X
Differential housing				X
Cover for differential housing				X
Differential tapered roller bearings				X
Double tapered roller bearing for pinion	X	X		
Ring gear/pinion	X		X	X
Ball bearing for drive shaft	X			

Finding position of pinion
(actual dimension)

Finding position of pinion is only necessary when deviation **r** is not marked on ring gear, and parts are to be replaced which directly influence position of pinion. These are: **both pinion bearings and transmission housing.**

Work sequence

— remove differential housing
— assemble measuring bar as described on page 39.10 and place it in transmission housing



— set gauge VW 385/30 to **Ro** = 63.00 mm, place on bar and zero dial indicator (3 mm range) with 1 mm preload
— measure difference from **Ro.** This measurement corresponds to deviation **r.** Note reading
Example: r = 0.25 mm
— after installing new parts, adjust pinion. See pages 39.10-39.11. Deviation **r** is used to determine thickness of shim S_3

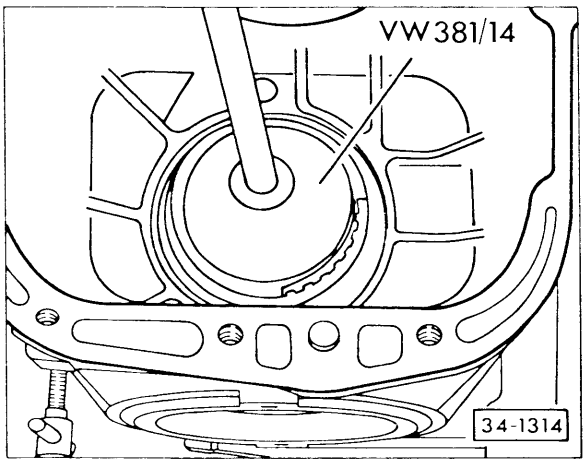
Pinion, adjusting

Note

Ring gear/pinion need adjusting if gears themselves have been replaced. If other parts which affect position of pinion are to be replaced, setting must be measured **before** disassembling and pinion set to this dimension when assembling. See page 39.9

Work sequence

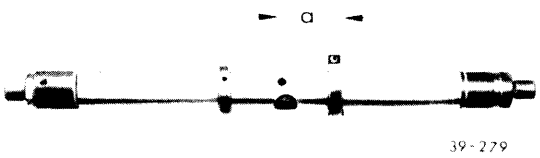
— install tapered roller bearing and needle bearing inner race for 1st gear on pinion shaft
— torque needle bearing inner race to 210 Nm (152 ft lb)



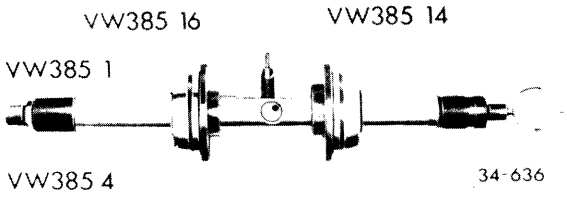
— install pre-assembled pinion in transmission housing **without** shim S_3
— install retaining ring and tighten with VW 381/14 to 225 Nm (162 ft lb)
— back off and retighten to 225 Nm (162 ft lb)

Finding dimension e

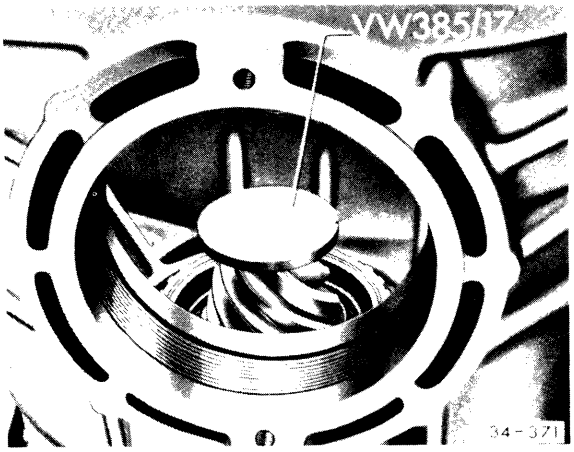
— screw in one adjusting ring until flush with transmission housing



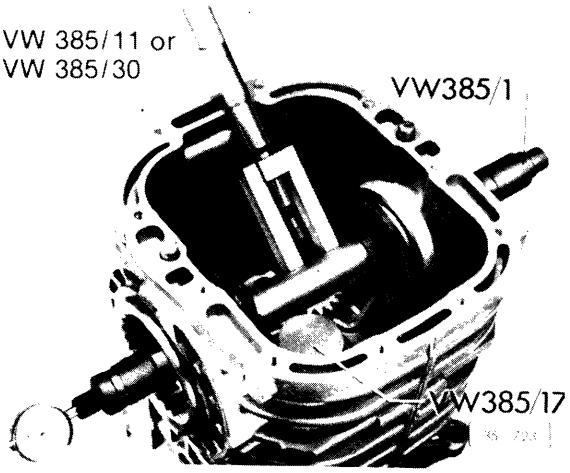
— adjust setting ring on measuring bar VW 385/1 to dimension **a**
• **a** = approx. 75 mm



— assemble measuring bar as shown
• dial gauge extension VW 385/16 = 12.3 mm



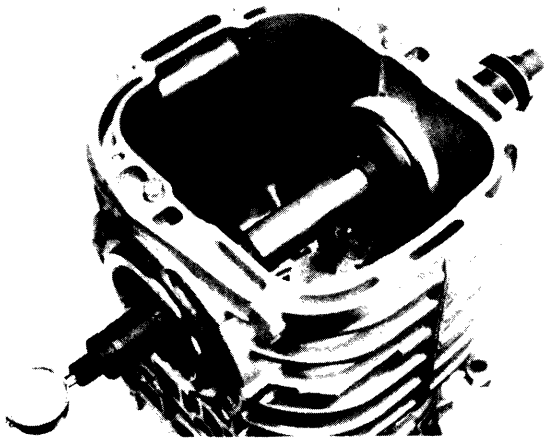
— place measuring disc VW 385/17 on end of pinion
— place measuring bar in housing and screw 2nd adjusting ring in until flush with housing
— move 2nd centering ring VW 385/4 outward with movable setting ring on measuring bar until bar can just be turned by hand



— set universal gauge VW 385/30 to **Ro** = 63.00 mm and place it on measuring bar
— zero dial gauge (3 mm range) with 1 mm preload

Note

Gauge VW 385/11 can be used instead of universal gauge VW 385/30



— turn bar until measuring pin touches measuring disc on end of pinion, and needle shows maximum deflection. This is dimension **e**
Example: **e** = 0.40 mm

Shim S_3, determining thickness

$$S_3 = e + r$$

e = measured figure (max. deflection)
r = deviation (marked on ring gear in 1/100 mm or found by actual measurement)

Example

Dial gauge reading for **e**	0.40 mm
Deviation **r**	+ 0.25 mm
S_3 shim thickness	= 0.65 mm

S_3 shims available

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

Note

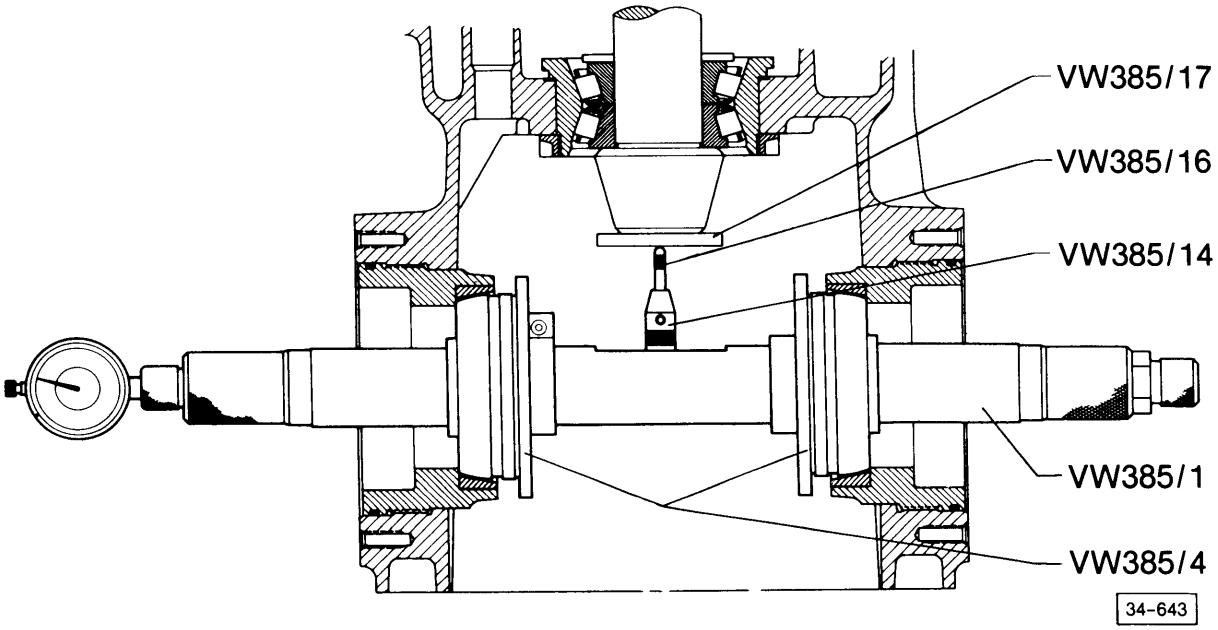
Shim tolerances make it possible to select any required thickness for S_3

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

Use only shims which are in good condition

Adjustment (dimension r), checking

— install pinion with measured shims S_3 and turn several times in both directions
— place measuring bar in position and check measurements
• if shims have been selected correctly, dial gauge (reading counterclockwise), should show deviation **r** within tolerance of 0.04 mm



Ring gear, adjusting
(pinion removed)

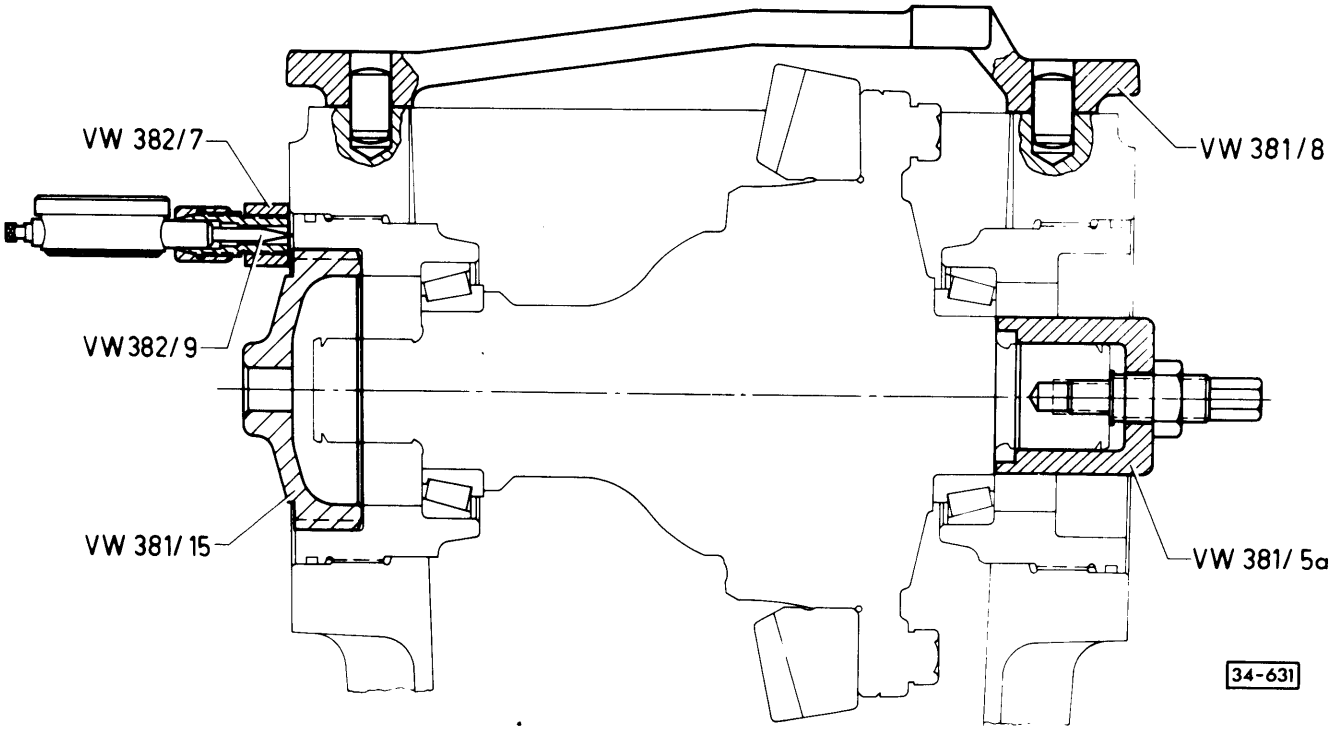
Note

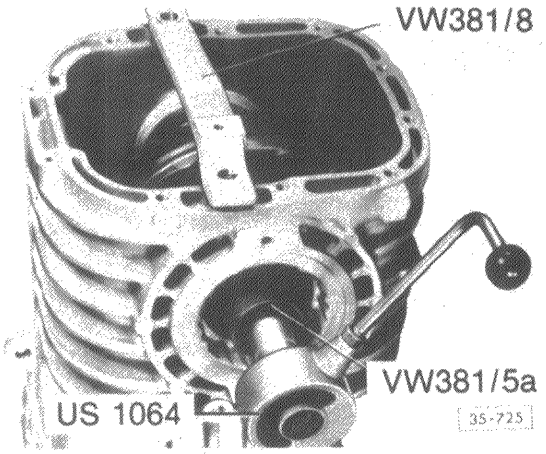
Ring gear must be adjusted if transmission housing, differential bearings, differential housing/cover, adjusting rings or ring gear/pinion have been replaced. Also see table on page 39.9

Work sequence

> **CAUTION**
>
> Differential bearing outer races must be fully seated in adjusting rings

— install differential with ring gear on driver's side
— install dial indicator (3 mm range) with extension VW 382/9 into bar VW 382/7
— zero dial indicator with 1 mm preload
— turn in adjusting ring on ring gear side with VW 381/15 until upper edge is approximately 0.20 mm below surface of housing
— turn in adjusting ring on other side with VW 381/15 until differential is free of play and without preload
— attach VW 381/5a to ring gear side and lock with hex nut
— turn transmission housing so differential is at top and attach bridge VW 381/8 on dowel pins



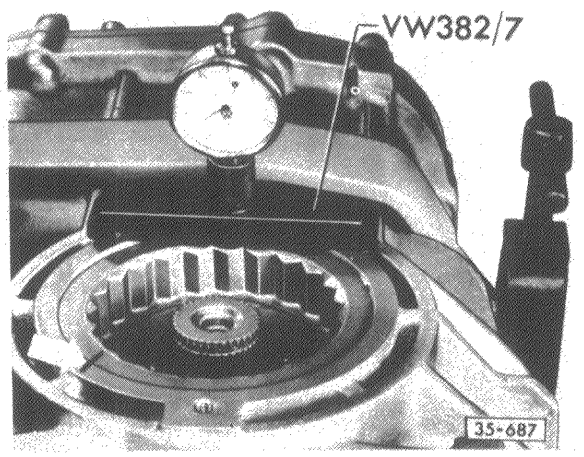


— attach torque gauge US 1064
— turn differential in both directions while oiling bearings with transmission oil
— increase bearing preload slowly by turning in adjusting ring on side opposite ring gear with VW 381/15 while turning differential with US 1064 until specified turning torque is reached

Turning torque

New bearings	Used bearings*
300–350 Ncm (27–31 in. lb.)	30–70 Ncm (2.7–6.2 in. lb.)

*after running at least 30 miles



— measure screw-in depth of adjusting rings and note readings S_1 and S_2
— mark adjusting rings and do not interchange

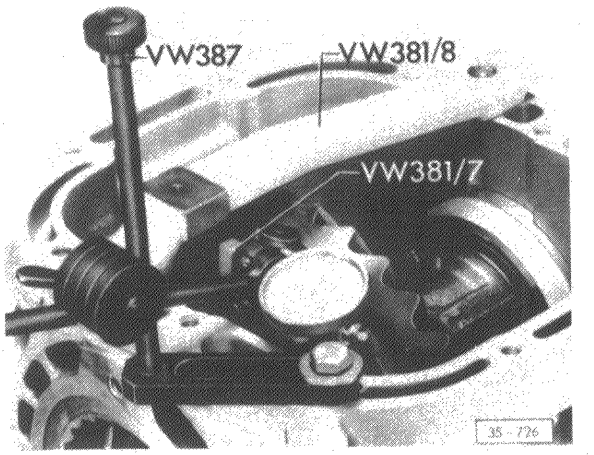
Note

If ring gear is being readjusted, check pinion adjustment, see page 39.10

Backlash, adjusting

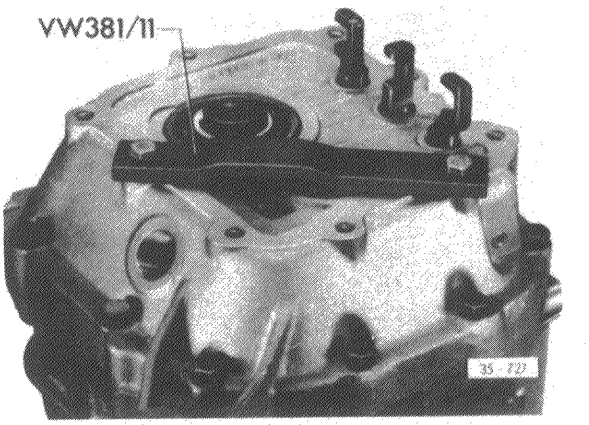
Work sequence

— install pinion with shim S_3
— install differential with adjusting rings on correct sides
— attach bridge VW 381/8
— turn in adjusting rings while turning differential until measured screw-in depths S_1 and S_2 have been reached



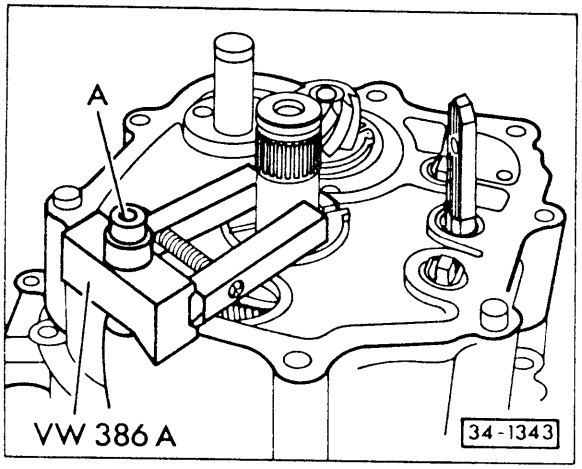
— attach measuring tools as shown

4–speed 091



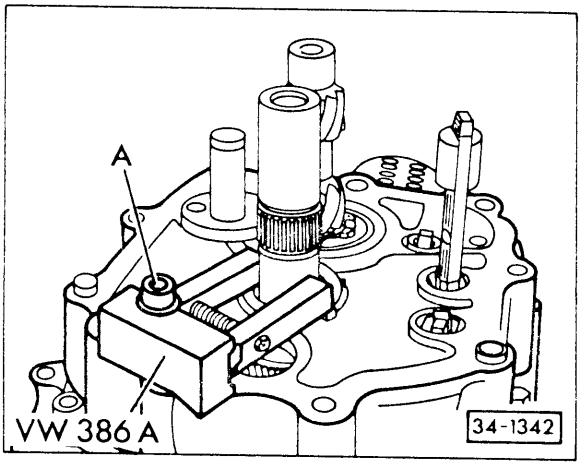
— lock pinion with bar VW 381/11

4–speed 091/1



– lock pinion with clamp
  • A = bolt M8 x 125

5–speed 094



– lock pinion with clamp
  • A = bolt M8 x 125
— turn ring gear to stop and set dial indicator to zero
— turn ring gear in opposite direction and read backlash
— check backlash each 1/4 turn
  • backlash should be 0.15–0.25 mm (0.006–0.010 in.)

Note

Individual readings must not differ from one another by more than 0.05 mm

CAUTION

If backlash readings vary by more than 0.06 mm from one another, there is something wrong with installation of ring gear or gear set itself. Check all assembling operations and replace gear set if necessary

— to adjust backlash, proceed as follows
— turn adjusting ring on side opposite ring gear **out**
— turn adjusting ring on ring gear side **in** by same amount
— continue adjusting until backlash is 0.15–0.25 mm (0.006–0.010 in.)

Note

Keep within tolerance of ± 0.01 mm

Backlash, checking

— check backlash each 1/4 turn
  • backlash should be 0.15–0.25 mm (0.006–0.010 in.)

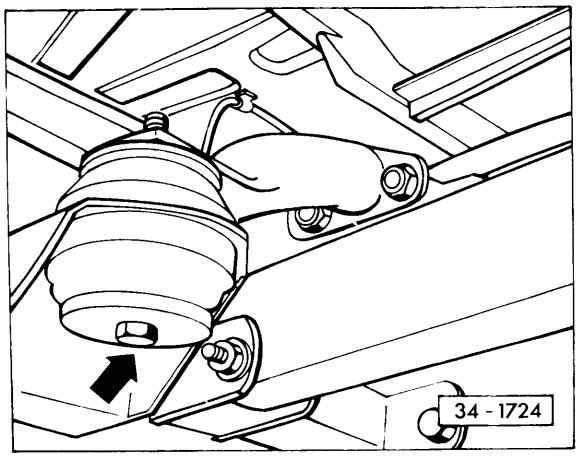
Note

Individual readings must not differ by more than 0.05 mm

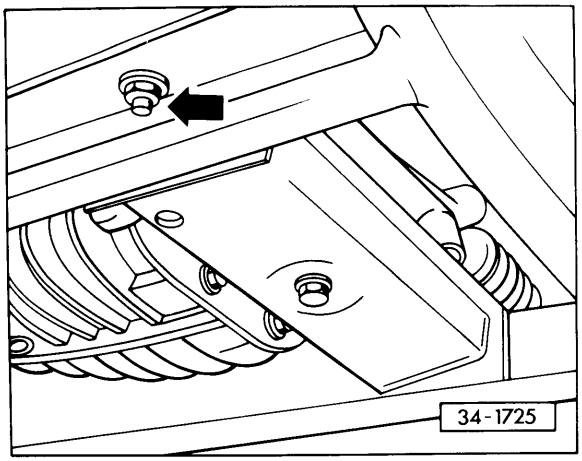
Driveshaft, removing/installing

Work sequence

Removing



— loosen mounting bolt of front final drive (arrow) Do **NOT** remove bolt.



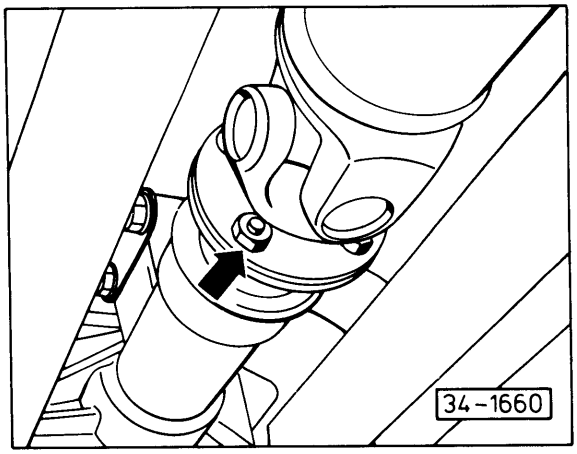
— loosen side bolts of front final drive mounting bracket (arrow) Do **NOT** remove bolts.

CAUTION

Front final drive mounts **MUST** be loosened to prevent damage to the driveshaft universal joints when removing driveshafts.

Note

The universal joints cannot be replaced using standard workshop tools and are not available as replacement parts.



— remove bolts (arrow) at front and rear driveshaft flanges and remove driveshaft

Installing

— install driveshaft and tighten bolts to 35 Nm (26 ft lb)
— align front final drive in longitudinal direction and tighten mounting bolts

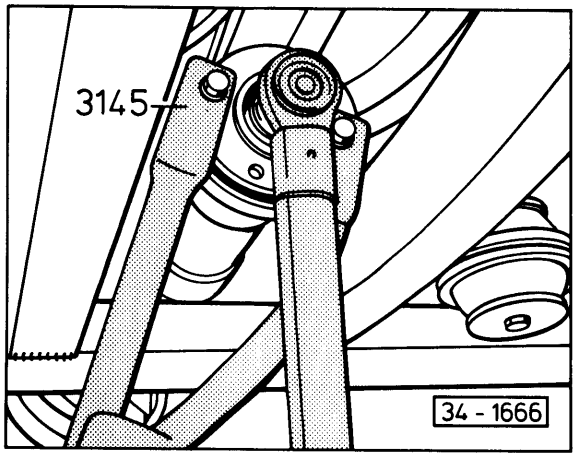
CAUTION

Front final drive alignment must be done to ensure driveshaft is installed without distortion.

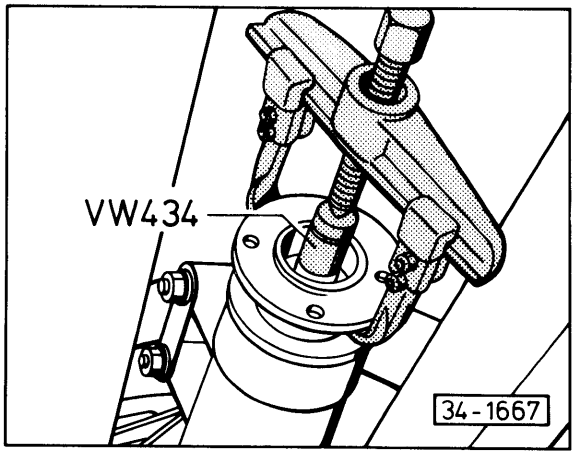
Driveshaft flange oil seal, replacing
(on front final drive or transmission)

Work sequence

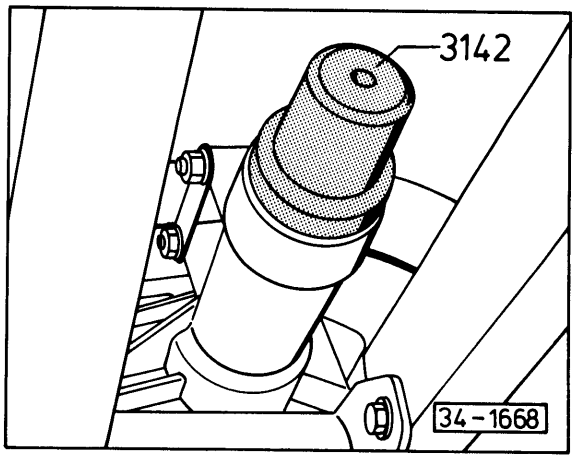
— remove driveshaft (see page 39.15)



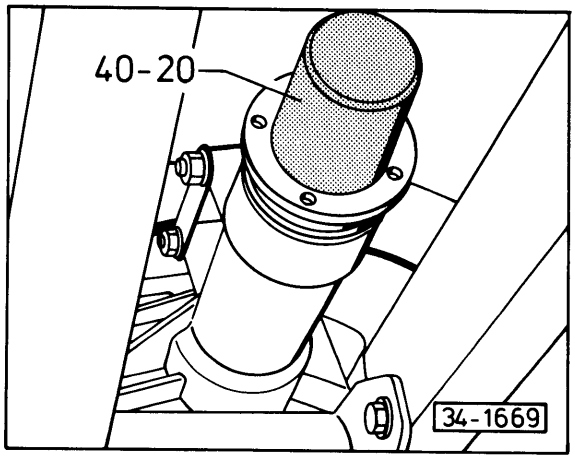
— mount handle on flange and remove flange shaft nut



— remove driveshaft flange. Use two-arm puller if necessary
— remove oil seal with VW 681 or similar tool



— drive in new seal to stop



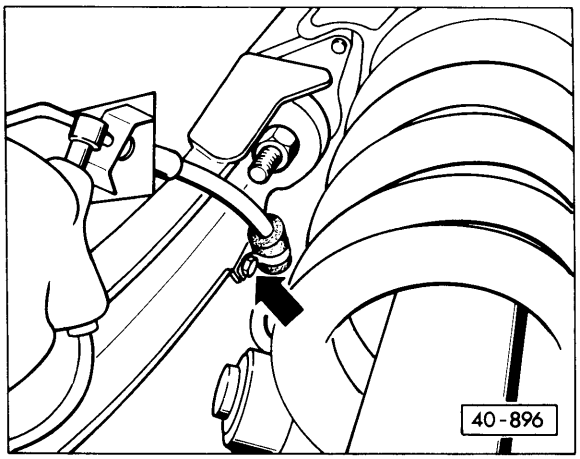
— drive in flange
— mount handle 3145 and tighten flange shaft nut to 160 Nm (118 ft lb)
— install driveshaft and tighten bolts to 35 Nm (26 ft lb)

Front final drive axle flange oil seals, replacing

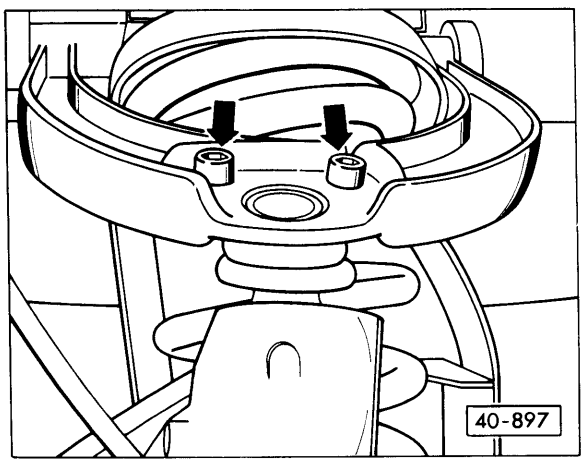
If both left and right oil seals are to be replaced, remove front final drive (see page 39.19)
If the oil seal is to be replaced on one side only, remove suspension as described below.

Work sequence

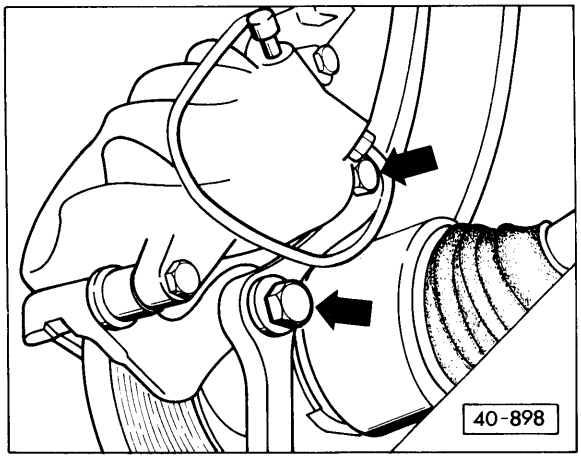
— remove bolts connecting axle shaft to flange
— remove spacer ring



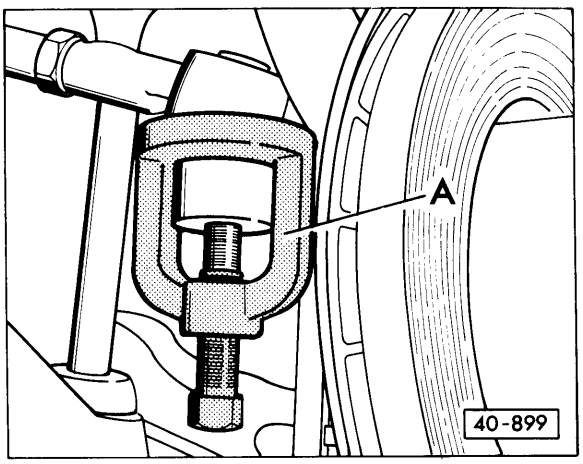
— remove brake line bracket from wheel bearing housing (arrow)



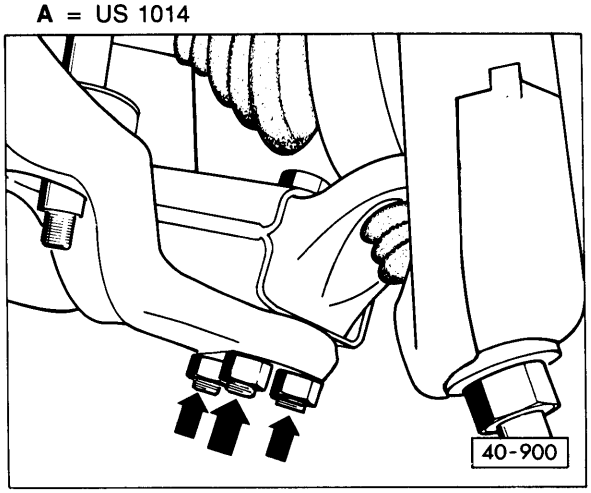
— remove ball joint from upper control arm by removing bolts (arrows)



— remove brake caliper (arrows) and tie to body with wire



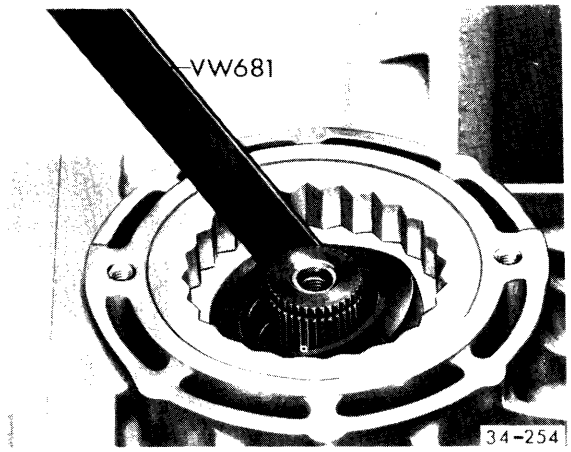
— press tie rod end out
A = US 1014



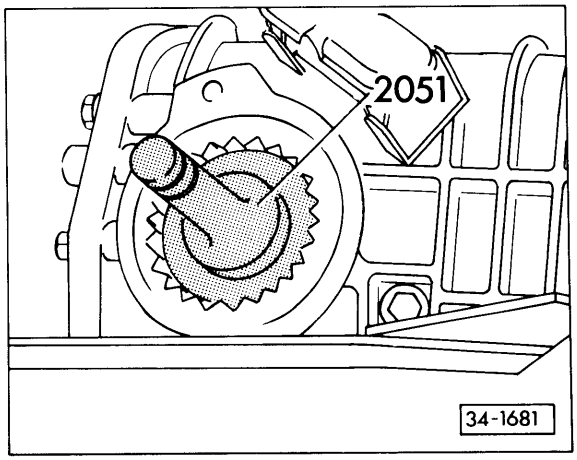
— remove bolts (arrows) and separate radius rod, wheel bearing housing and lower control arm

more

— remove wheel bearing housing complete with axle shaft
— pierce cap in drive flange with screwdriver and pry out
— remove circlip and wave washer
— remove drive flange with VW 391
— remove lock ring



— pry out oil seal



— drive in new oil seal to stop
— install lock ring
— install drive flange with VW 391
— install wave washer
— press circlip into groove with VW 454 and at same time check that washer is centered
— replace cap
— install wheel bearing housing with axle shaft
— install bolts for radius rod, wheel bearing housing and lower control arm

CAUTION

Do **not** damage axle shaft boot.

— install tie rod, brake caliper and upper ball joint
— install brake hose bracket
— bolt axle shaft flange with spacer washer to drive flange

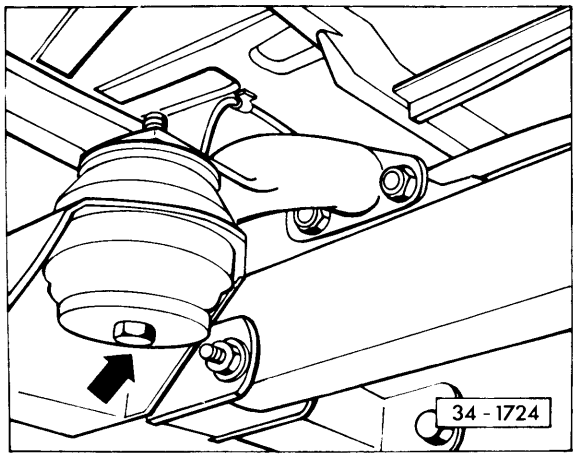
Tightening torques

radius rod/wheel bearing housing on control arm	100 Nm (73 ft lb)
brake caliper to housing	240 Nm (177 ft lb)
wheel bolts	180 Nm (132 ft lb)
axle shaft to drive flange	35 Nm (26 ft lb)
ball joint to upper control arm	60 Nm (44 ft lb)

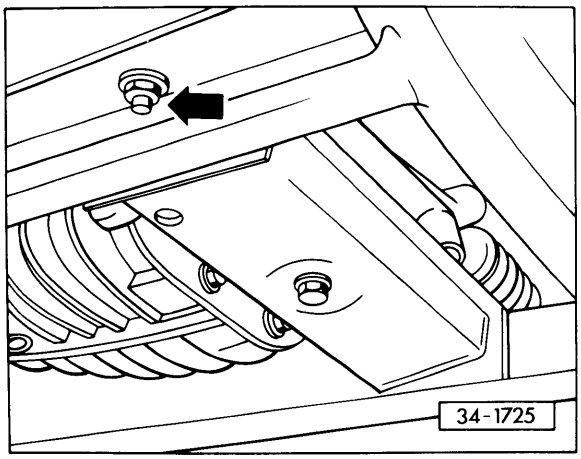
Front final drive, removing/installing

Work sequence

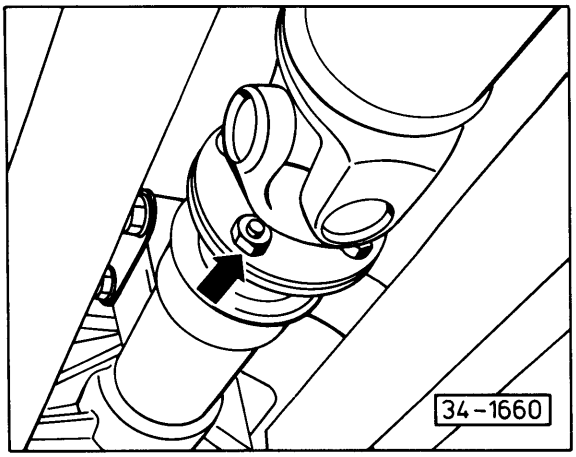
Removing



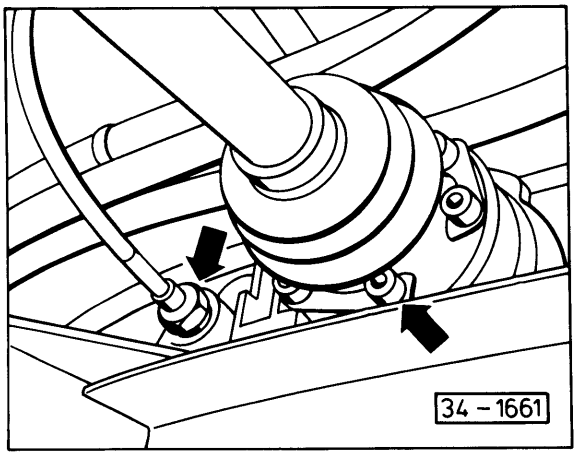
— loosen mounting bolt of front final drive (arrow). Do **NOT** remove bolt.



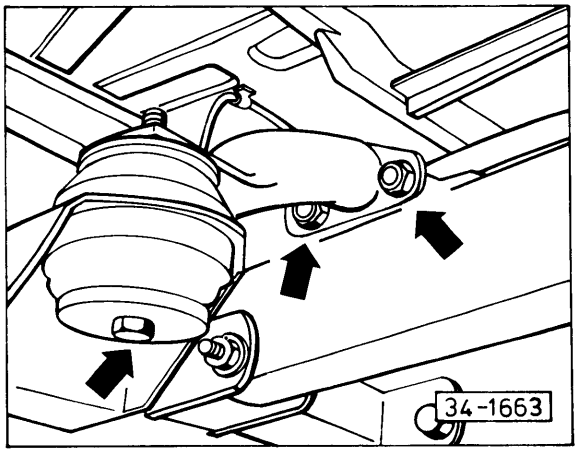
— loosen side bolts of front final drive mounting bracket (arrow). Do **NOT** remove bolts.



— remove bolts at front driveshaft flange (arrow) and tie driveshaft end to skid plate



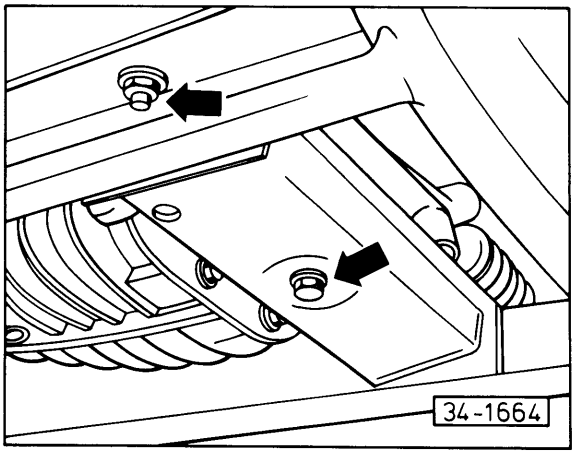
— remove right side axle shaft from final drive (right arrow) and disconnect speedometer cable (left arrow)
— remove left side axle shaft from final drive
— remove vent hose



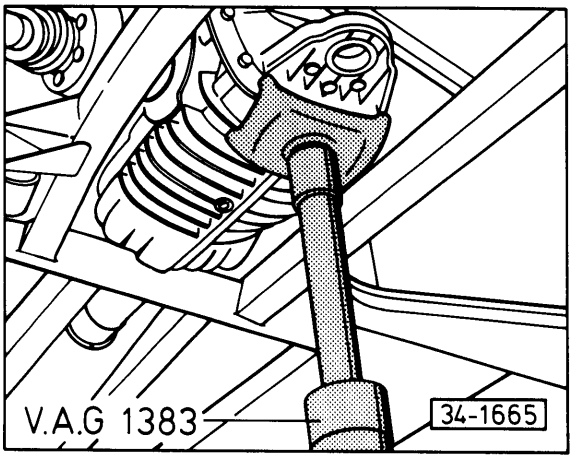
— remove rear mounting bracket (arrows)

more

— support final drive with transmission jack and small adapter



— remove bolts from front mounting (arrows) and take bracket out by pulling forward



— lower final drive and remove from vehicle (2 mechanics required)

Installing

Proceed in reverse order of removal and note the following:

— tighten mounting bolts of front and rear brackets last

Tightening torques

axle shaft to final drive	35 Nm (26 ft lb)
driveshaft to final drive	35 Nm (26 ft lb)

Differential
Automatic Transmission

Quick Data

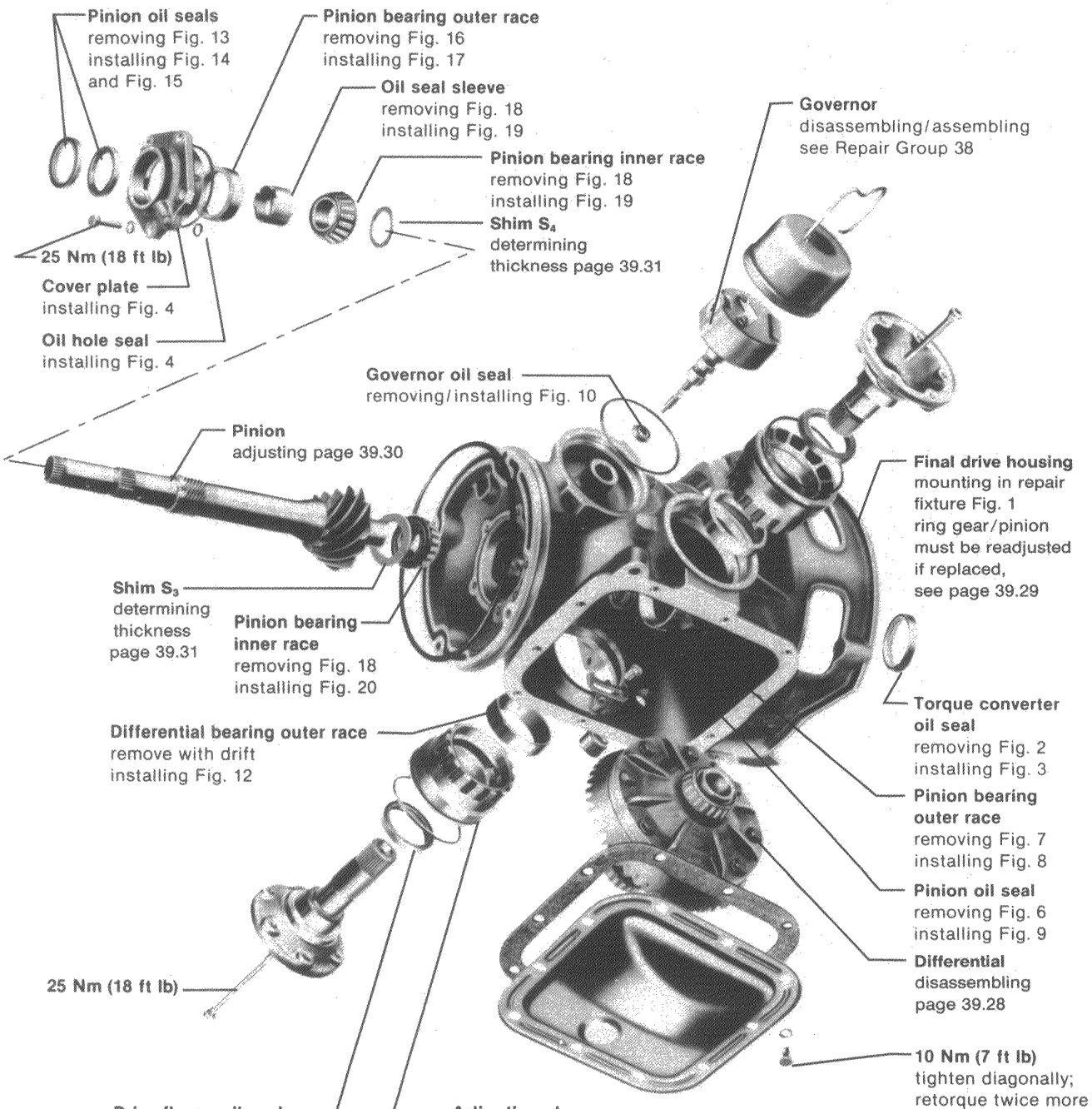
lubricant capacity .....1.25 US qt (1.3 ltr)
viscosity .....SAE 90
type .....hypoid, MIL-L-2105B; API/GL-5

Index

Final drive ratio:
4.09:1
Final drive lubricant:
Hypoid oil SAE 90, Mil-L2105 B
Capacity:
1.25 ltr (1.3 US qt)

CAUTION

If ring gear/pinion bearings can be reused it is necessary to measure backlash (page 39.33) and turning torque on pinion (page 39.34) **before** disassembling final drive. Note these measurements and adjust during reassembly to obtain same settings



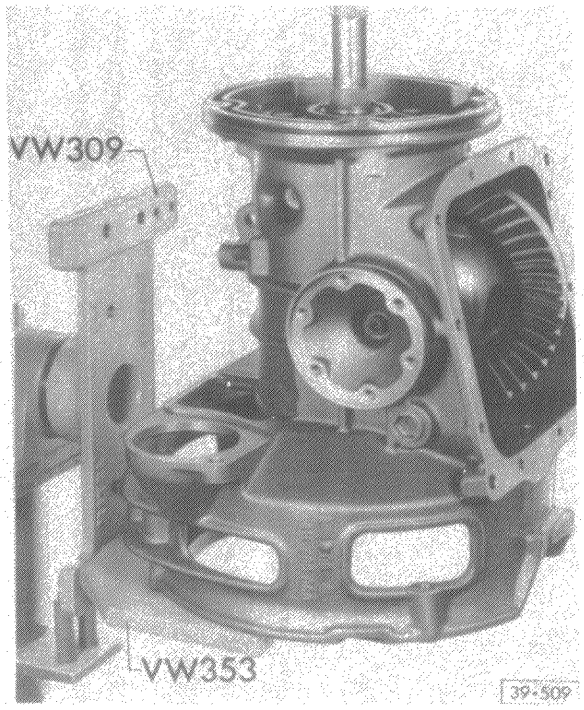


Fig. 1 Final drive housing, mounting

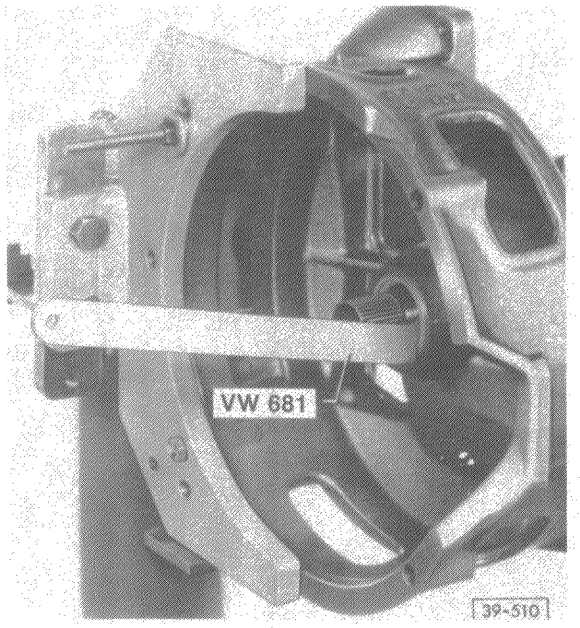


Fig. 2 Torque converter oil seal, removing

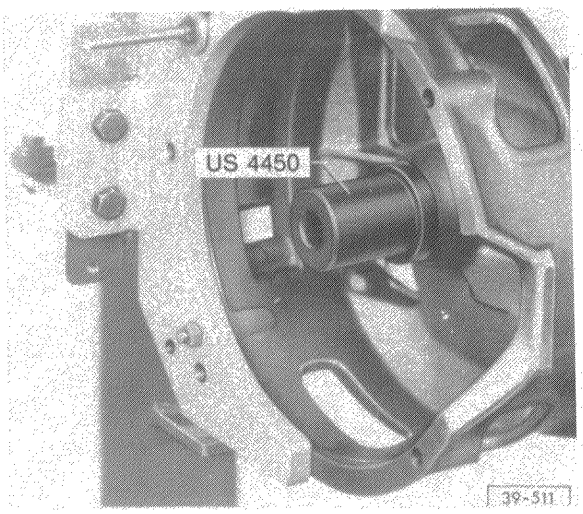


Fig. 3 Torque converter oil seal, installing

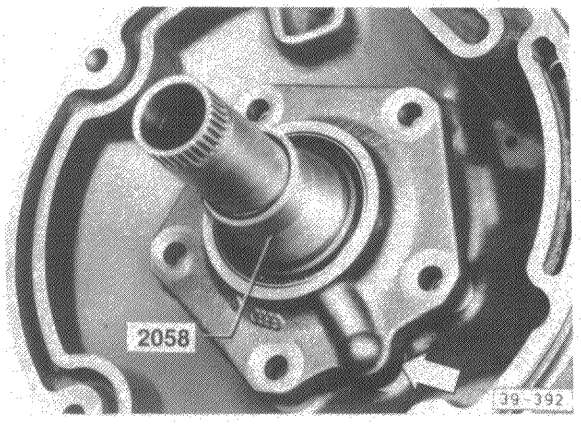


Fig. 4 Cover plate/Oil hole seal, installing

— first insert seal (arrow) for oil hole
— install cover plate and tighten to 25 Nm (18 ft lb). Use sleeve 2058 when installing cover

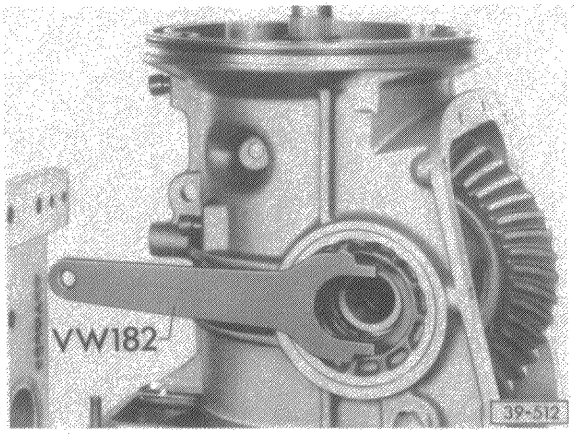


Fig. 5 Adjusting ring, removing/installing

— when reusing ring, mark position **before** removing

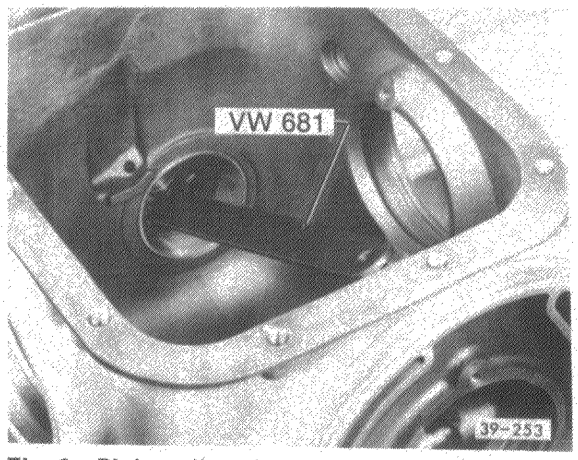


Fig. 6 Pinion oil seal, removing

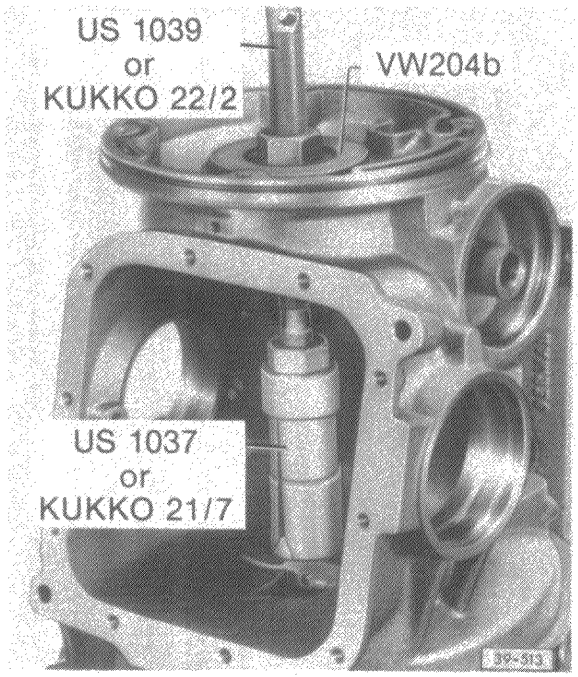


Fig. 7 Pinion bearing outer race, removing

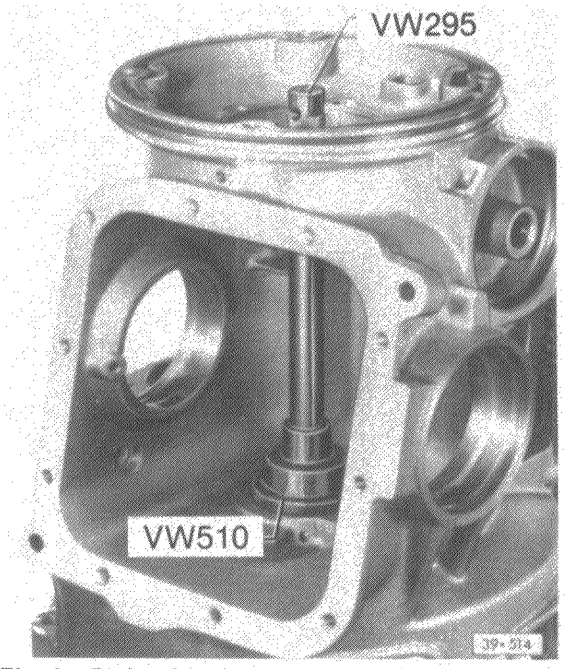


Fig. 8 Pinion bearing outer race, installing

— drive in until seated

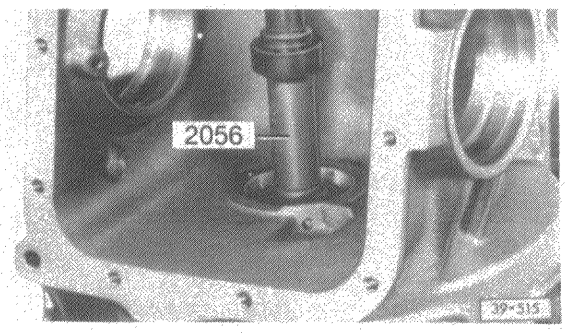


Fig. 9 Pinion oil seal, installing

• seal lip faces converter

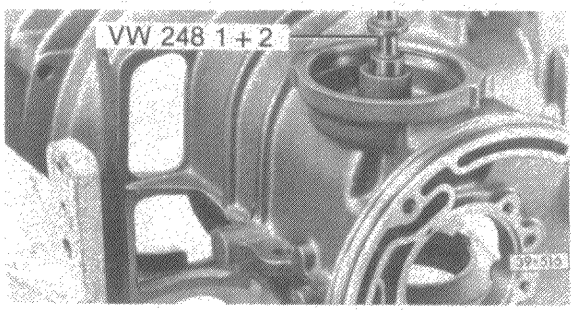


Fig. 10 Governor oil seal, removing/installing

— remove seal with VW 248/1 together with adapter 248/2
— drive in oil seal until seated using VW 248/1 without adapter (seal lip faces governor)

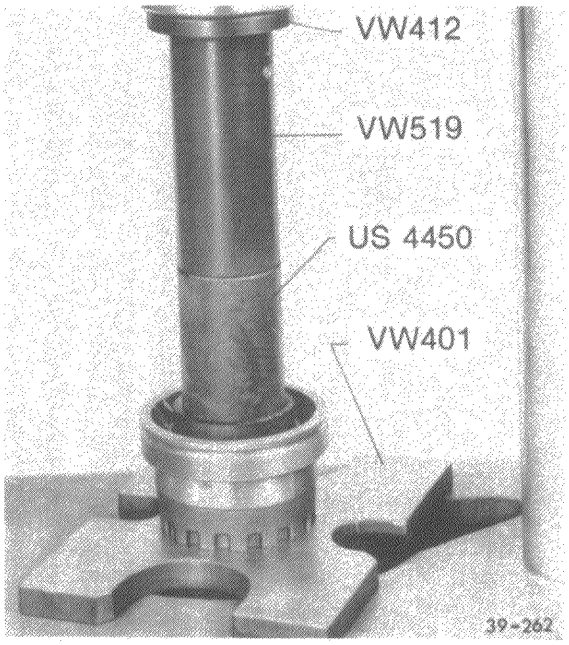


Fig. 11 Drive flange oil seal, installing

— fill space between lips with multi-purpose grease and press in flush

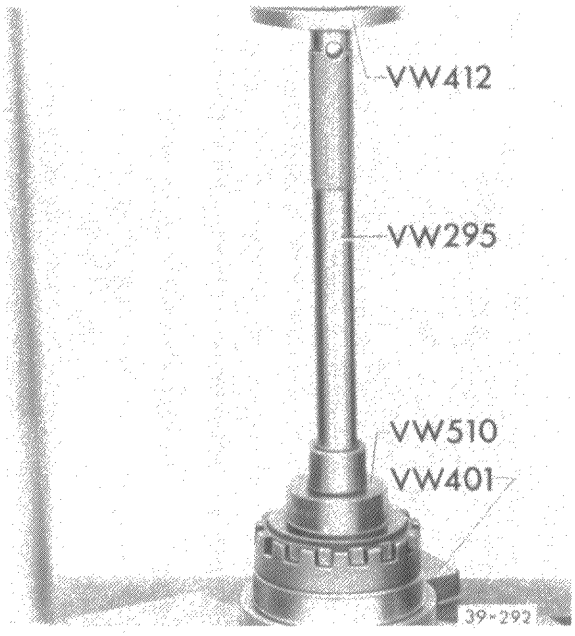


Fig. 12 Differential bearing outer race, installing

— press in until seated

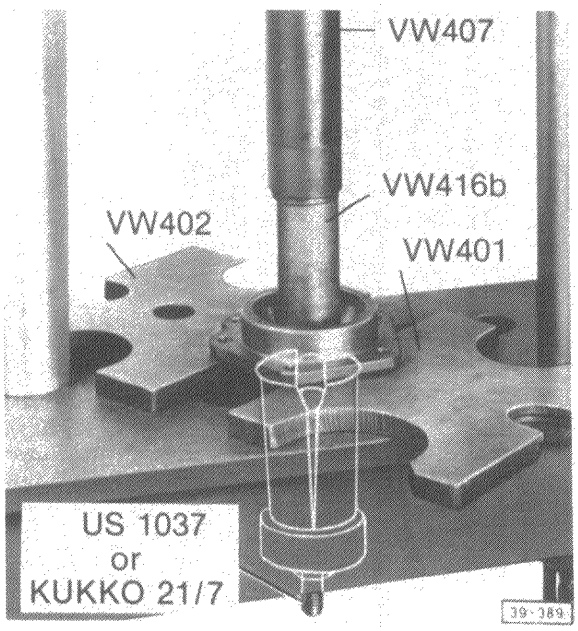


Fig. 13 Pinion oil seals in cover plate, removing

— press out seals individually

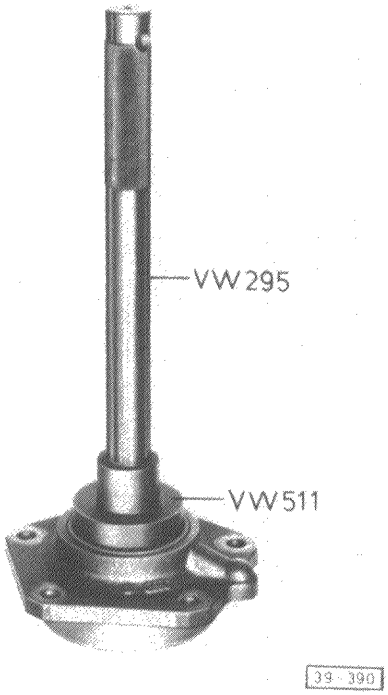


Fig. 14 Pinion oil seal (inner) in cover, installing

— drive seal into cover until seated. Open side of seal faces final drive

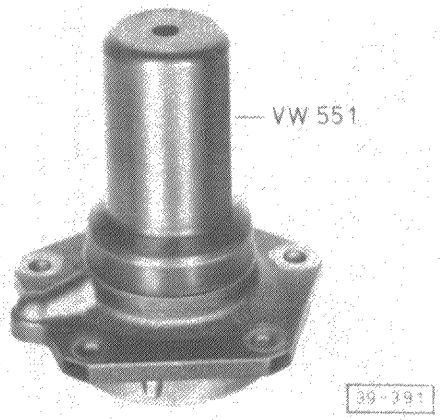


Fig. 15 Pinion oil seal (outer) in cover, installing

— drive seal into cover until flush. Open side of seal faces transmission

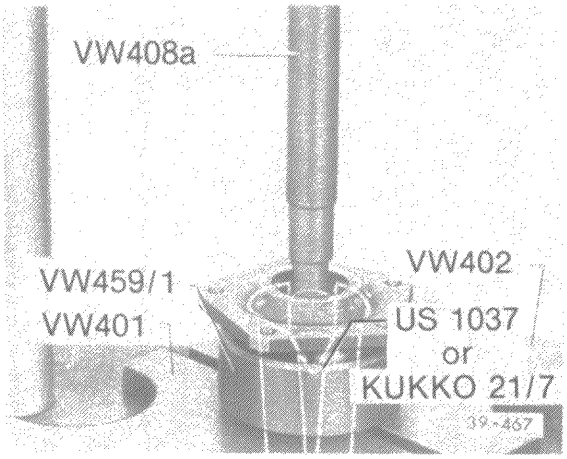


Fig. 16 Pinion bearing outer race in cover, removing

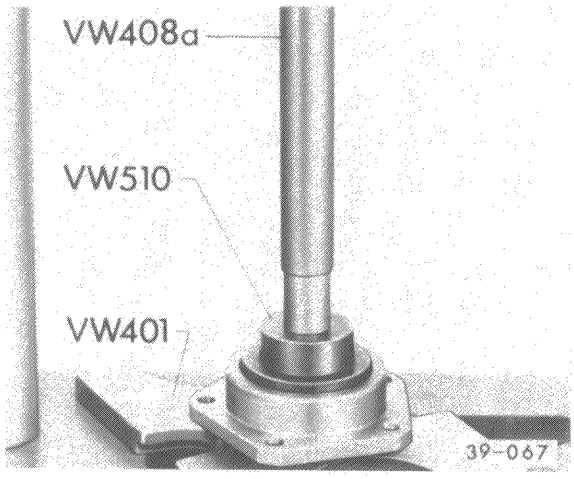


Fig. 17 Pinion bearing outer race in cover, installing

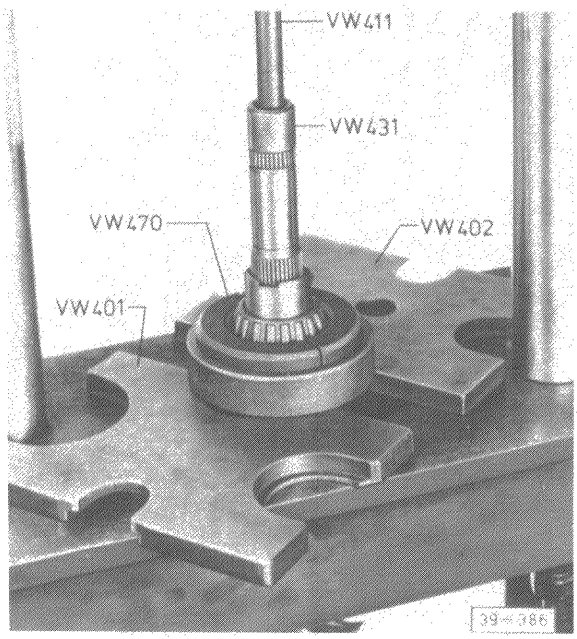


Fig. 18 Pinion bearing inner race/Oil seal sleeve, removing

— press off bearing together with seal sleeve (tool US 1103 can be used)

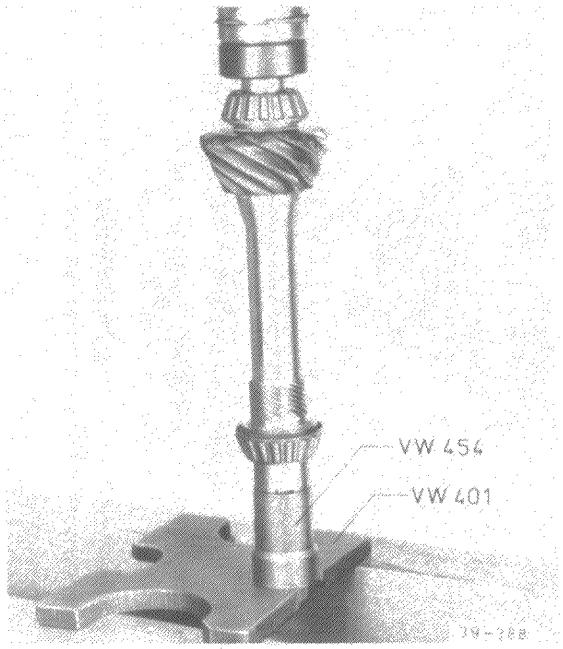


Fig. 19 Pinion bearing inner race/Oil seal sleeve, installing

— heat bearing and sleeve to approx. 100°C (212°F)
— press onto pinion shaft

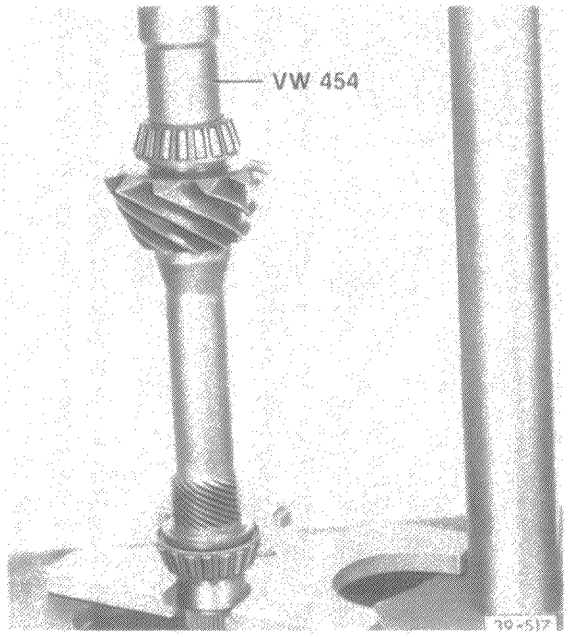
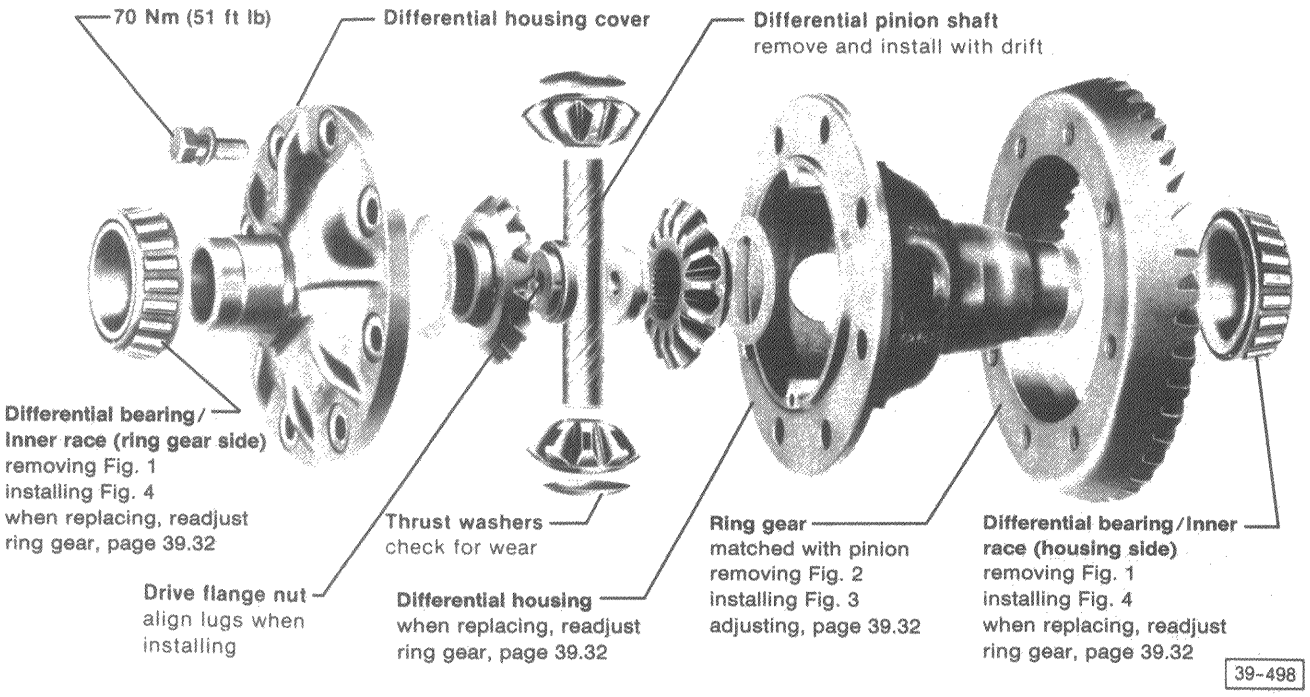


Fig. 20 Pinion bearing inner race, installing

— heat inner race to approx. 100°C (212°F) and press into shaft



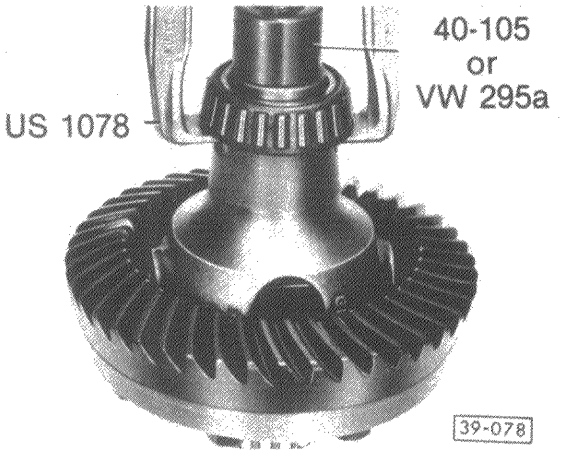


Fig. 1 Differential bearing/Inner race, removing

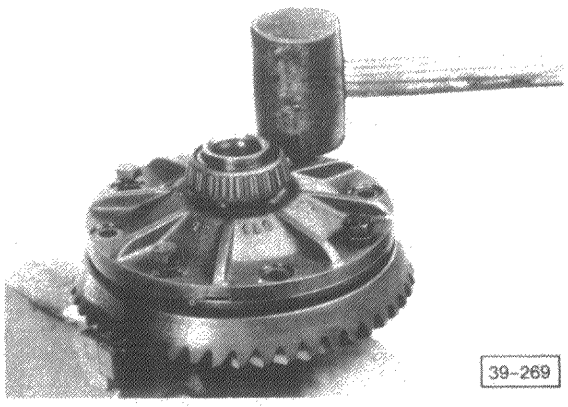


Fig. 2 Ring gear, removing

— mount differential in vise
— loosen bolts and tap lightly on bolt heads

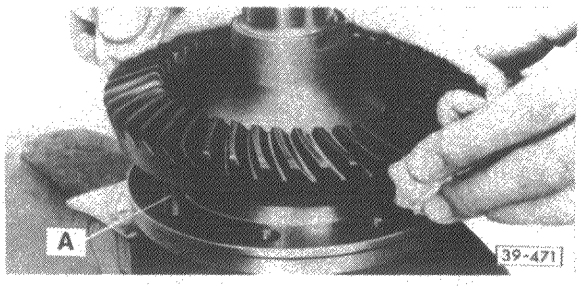


Fig. 3 Ring gear, installing

— heat ring gear to approx. 100 °C (212 °F)
• A = centering pins (local manufacture)

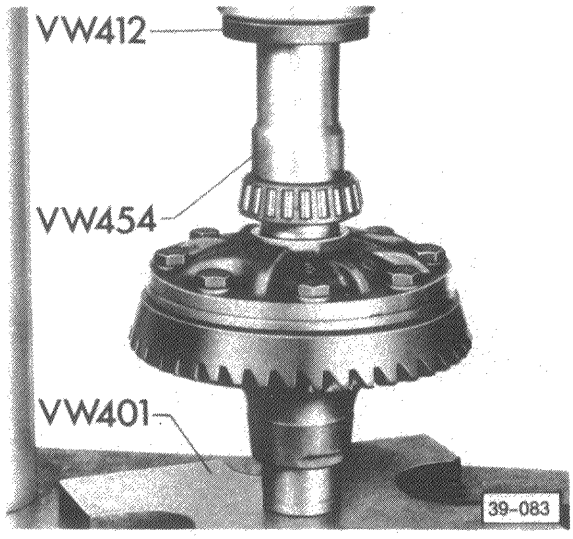


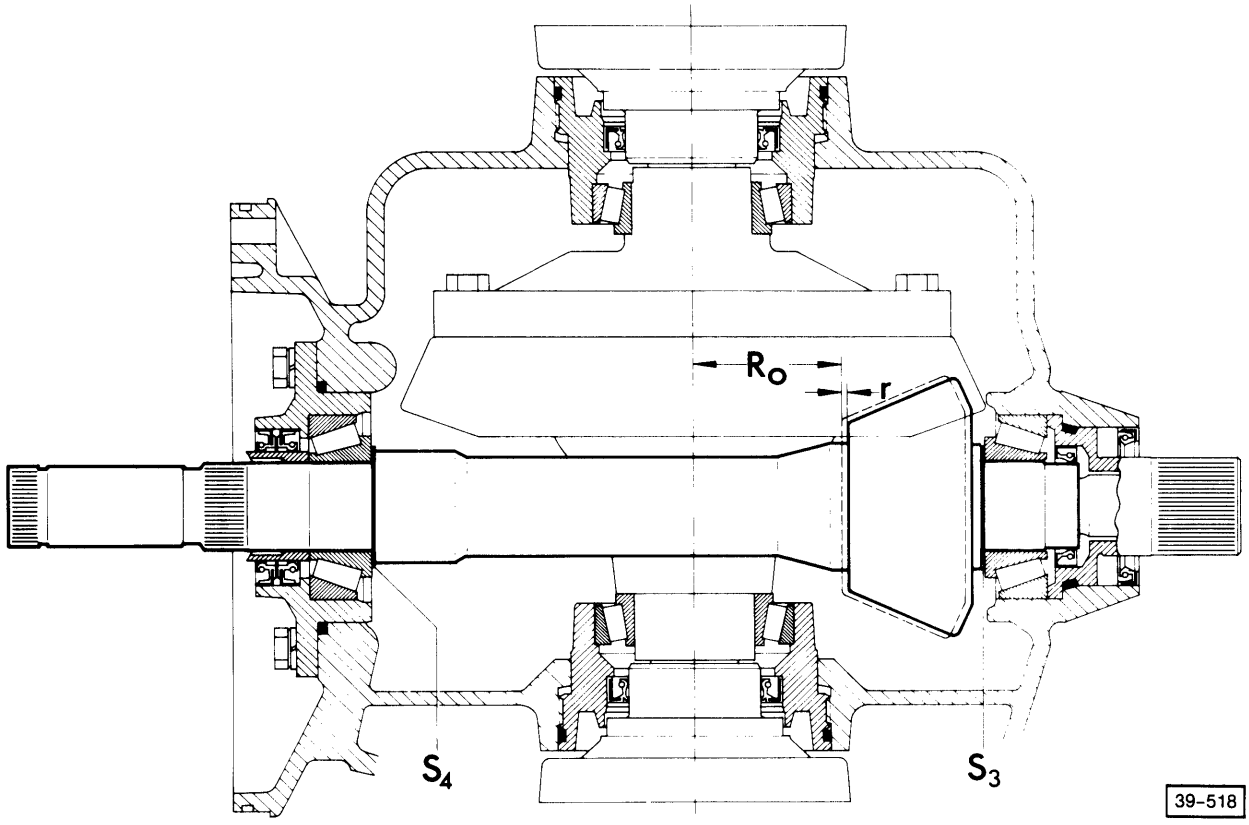
Fig. 4 Differential bearing/Inner race, installing

— heat bearing to approx. 100 °C (212 °F) and press on

Ring gear/Pinion, adjusting

Note

Ring gear/Pinion may only be replaced as matched set



Position of shims S_3/S_4

Ro = Length of master gauge used in factory testing machine. **Ro** = 52.60 mm

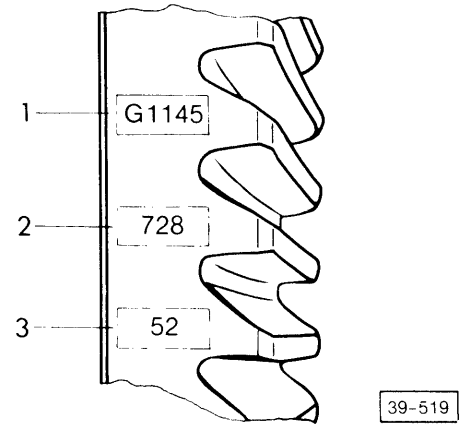
r = Deviation measured against master gauge of testing machine used in production. Deviation **r** is always given in 0.01 mm. For example 52 means **r** = 0.52 mm

S_3 = Shim for bearing preload (behind pinion head)

S_4 = Shim for pinion position (opposite end)

Note

If pinion bearings will not be changed, measure turning torque of pinion **before** disassembly and adjust to same turning torque during assembly



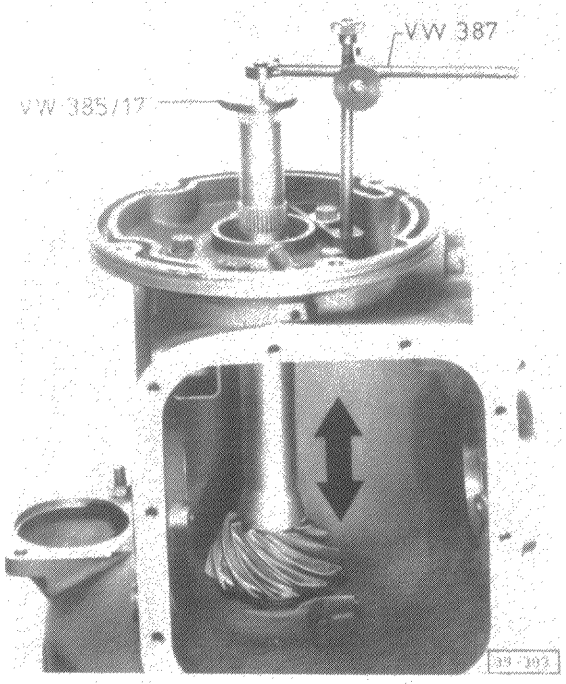
Marks on ring gear

1 = Identification G 1145 refers to Gleason gear set with ratio of 11:45
2 = Serial number of matched gear set
3 = Deviation **r**

Pinion, adjusting

Work sequence

— install bearing outer race into cover plate and housing
— heat pinion bearing inner races to approx. 100°C (212°F)
— press inner bearing races, without shim, on pinion shaft with approx. 3 tons pressure
— insert pinion in housing, install cover plate and tighten to 25 Nm (18 ft lb)



— install dial gauge holder VW 387 on housing
— place measuring plate VW 385/17 on pinion shaft
— install dial gauge and set to zero with 1 mm preload
— move pinion up and down without turning and note measurement

CAUTION

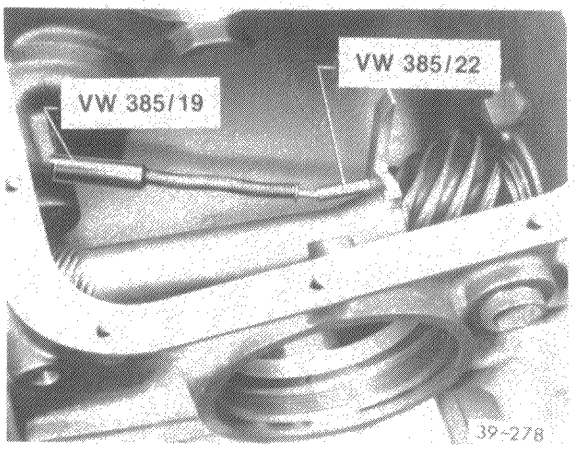
Measurement will be inaccurate if pinion turns

— add 0.10 mm for bearing preload and 0.10 mm for bearing settling to reading. Result is **S total**

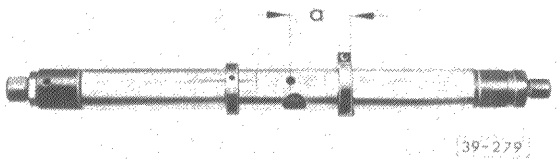
Example

measured reading	2.46 mm
bearing preload	+ 0.10 mm
settling allowance (constant)	+ 0.10 mm
Total shim thickness (**S total**)	= 2.66 mm

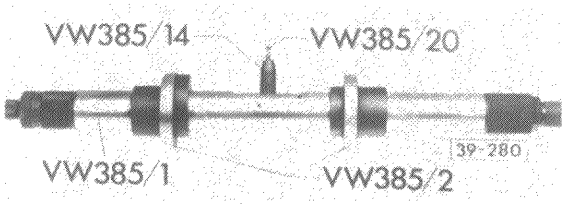
— remove pinion shaft
— install shims corresponding to total shim thickness **S total** on end opposite pinion head
— reinstall pinion
— turn pinion several times in both directions



— attach measuring plate VW 385/22 with support VW 385/19 to pinion

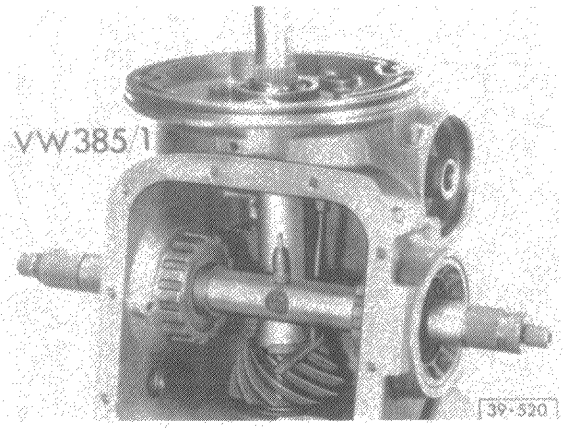


— set clamping ring on universal measuring bar
• **a** = approx. 74 mm (2.913 in.)

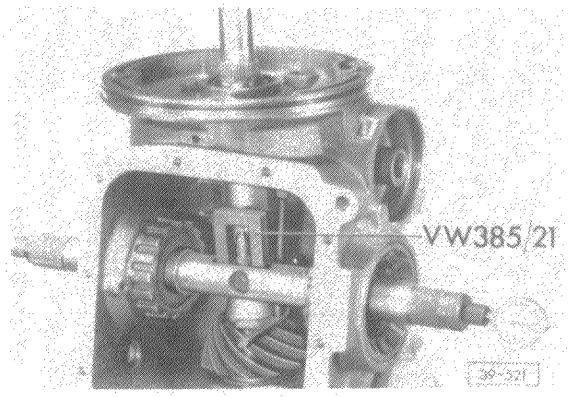


— assemble measuring bar with dial indicator extension VW 385/20
— turn adjusting ring on left side into housing until flush

— insert measuring bar into housing and screw in adjusting ring



— move centering disc outward with movable setting ring until measuring bar can just be turned by hand



— place master gauge VW 385/21 on measuring bar and zero dial indicator with 3 mm preload
— turn measuring bar until dial indicator pin contacts end plate and gauge shows maximum deflection (return point)
— note reading **e** (example: 1.72 mm) and determine thickness of shims S_3 and S_4

Note

Master gauge VW 385/30 can be used instead of VW 385/21. Set **Ro** to 52.60 mm

Shim S_3, determining thickness

$$S_3 = e - r$$

Example

dial indicator reading **e**	1.72 mm
deviation **r** marked on ring gear	– 0.42 mm
S_3 thickness	= 1.30 mm

— select shims from table

Shim S_4, determining thickness

$$S_4 = S \text{ total} - S_3$$

Example

total shim thickness	2.66 mm
S_3 thickness	– 1.30 mm
S_4 thickness	= 1.36 mm

— select shims from table below

Shims available

Shim thickness range in mm	Shim to be installed	Part No.
1.050–1.100	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
1.155–1.575	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

Note

Measure shims at several points with micrometer. Check for burrs and damage. Use only good shims

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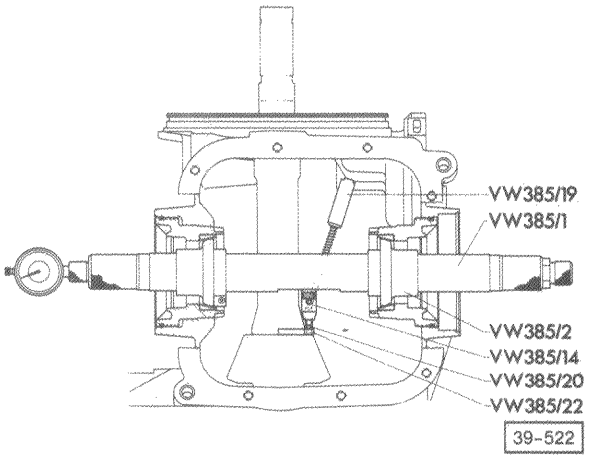
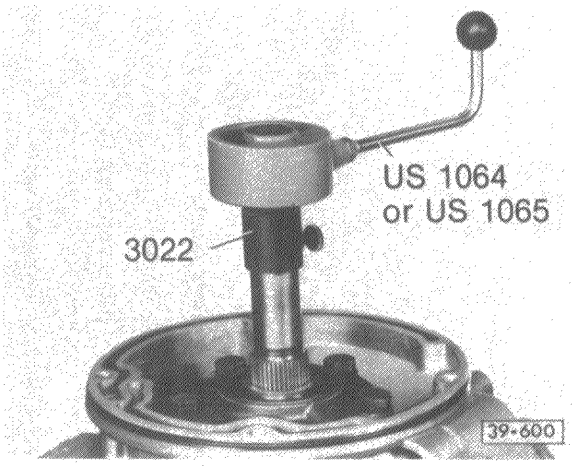


— install shims selected from table
  • S_3 behind pinion
  • S_4 opposite pinion
— install pinion
— lubricate bearings with hypoid gear oil

— turn pinion several times in both directions
— install universal measuring bar
— zero dial indicator with 1 mm preload
— check that indicator reading equals recorded deviation r within a tolerance of ± 0.04 mm



— after installing selected shims and pinion shaft, check that turning torque is at least **140 Ncm (12.4 in. lb)**

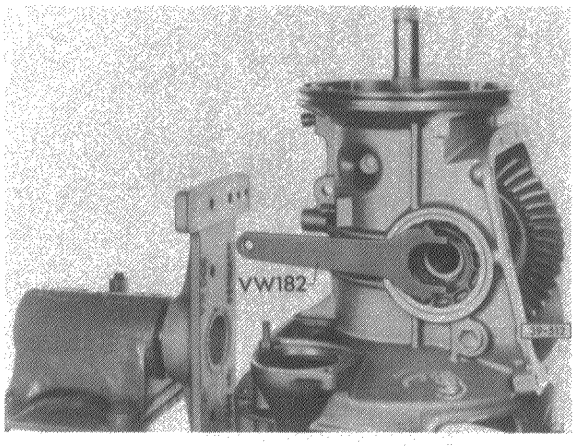
Note

This figure is for new bearings. If bearings are to be reused, turning torque should be measured before disassembly. When replacing parts that affect ring gear/pinion setting, check page 39.9 to determine which parts need to be adjusted

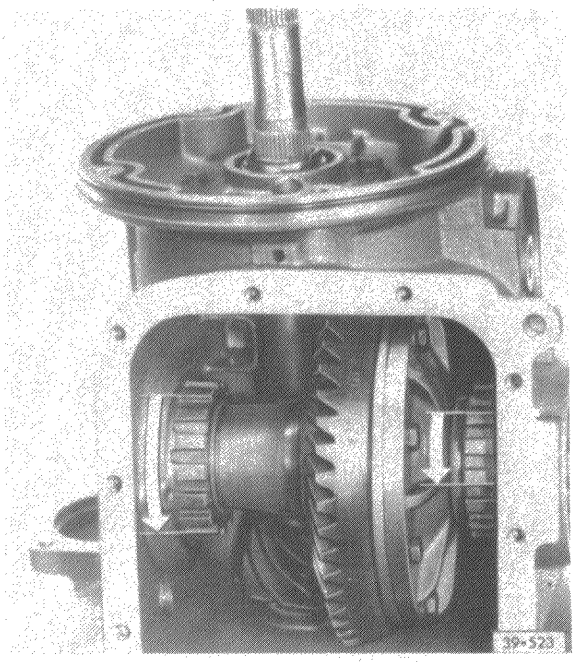
Ring gear, adjusting

Work sequence

— install differential and pinion
— coat O-rings and threads of adjusting rings lightly with multi-purpose grease
— lubricate bearings lightly with hypoid gear oil
— screw in both adjusting rings until outer surface is flush with housing surface



— carefully turn adjusting ring behind ring gear until ring gear meshes with pinion with no backlash
— screw in adjusting ring opposite ring gear as far as possible and preload slightly so that there is no bearing play

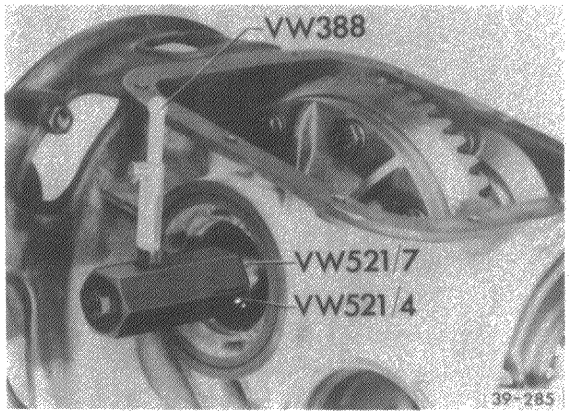


— turn adjusting ring behind ring gear 2 1/2 tooth divisions **out** (right arrow)
— turn adjusting ring opposite ring gear 5 tooth divisions **in** (left arrow). This correctly sets bearing preload and gear backlash

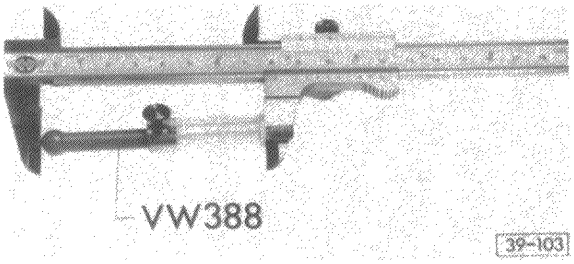
Backlash, checking

Work sequence

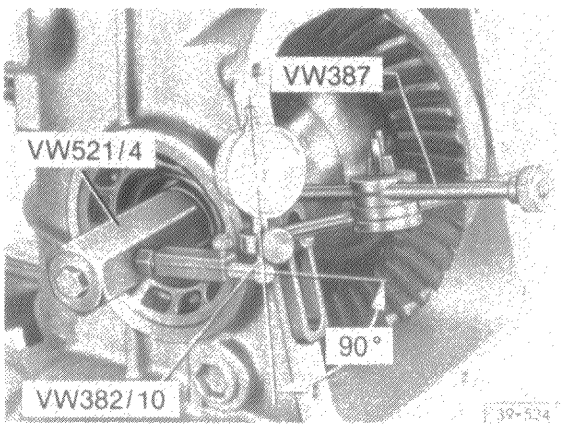
— turn pinion several times in both directions



— attach measuring tools as shown



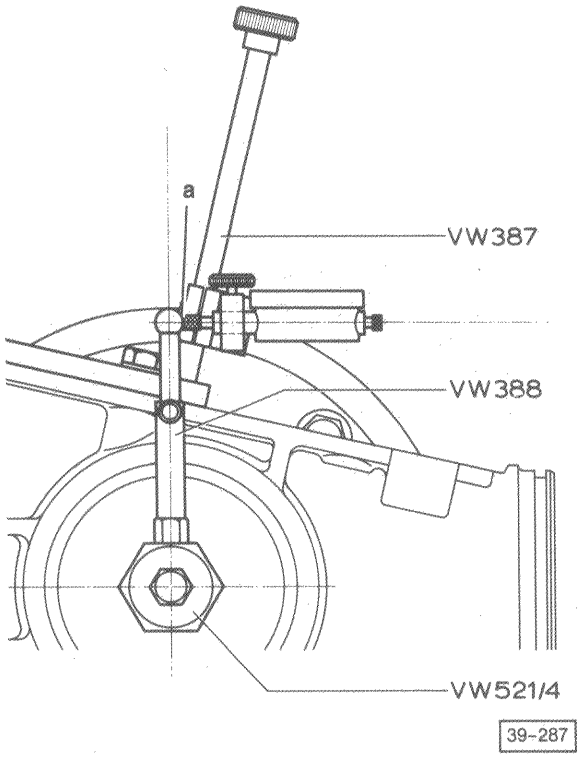
— set measuring lever to 80 mm and place on VW 521/4



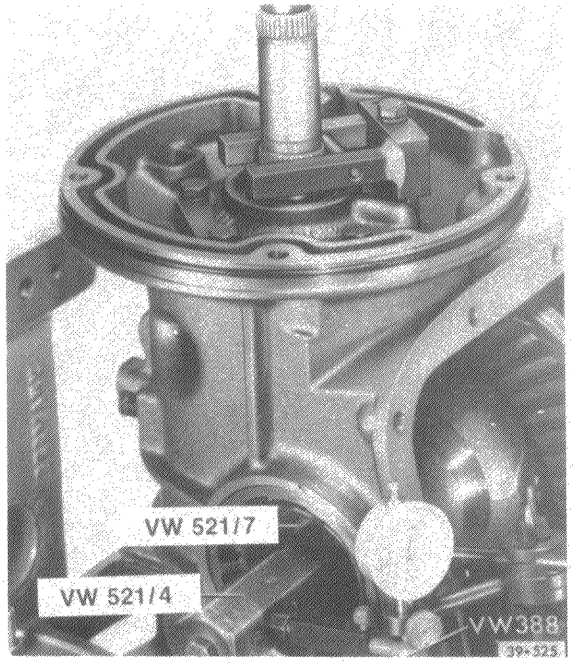
— install dial indicator (3 mm range) with extension VW 382/10 (6 mm flat end) in holder VW 387 and bolt holder to transmission housing

Note

Dial indicator must be located at right angle to measuring bar



— turn ring gear until measuring lever contacts pin of dial indicator **a** and preloads it to 1.0 mm. Reset dial indicator to zero



— attach clamp VW 386 to cover plate and lock pinion with clamping screw

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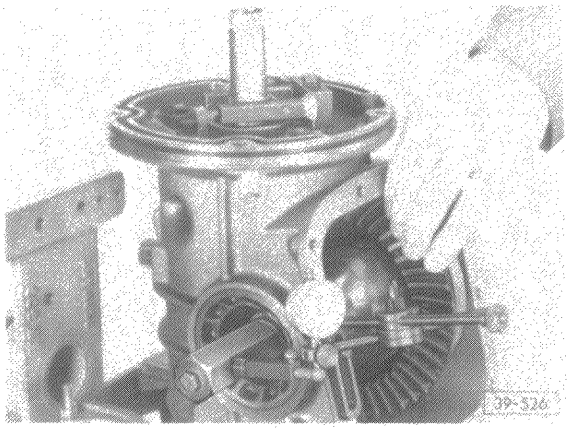


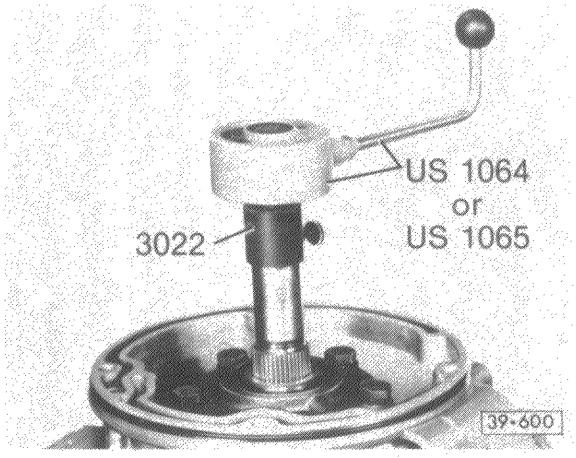
— check backlash at four positions
  • backlash should be: 0.15–0.25 mm

CAUTION

Individual readings must not differ by more than 0.05 mm. Backlash figure given above only aplies to new ring gear/pinion.
If used set of gears is reinstalled, they should be set to give same backlash with which they were running before they were removed

Note

If backlash of new ring gear/pinion is outside tolerance, it must be corrected by turning **both** adjusting rings by same amount (in opposite directions) so that bearing preload is not changed



— measure total turning torque of all 4 bearings with torque wrench on pinion shaft
— total turning torque must be at least **20 Ncm (1.8 in. lb)** more than turning torque of pinion shaft alone. If necessary, increase turning torque by screwing in both adjusting rings by same amount