

# Service Manual

## Repairs and maintenance

*Section*

**6**

*Group*

**64**

**Power steering  
gears**

**1979—**

# VOLVO



# Introduction

This joint manual is designed to cover markets speaking "UK-English" and "American-English".

It is released to English speaking countries outside North America and to North American countries. In order to accomodate certain linguistic differences both terminologies are shown, e.g. wrench/spanner, etc.

It contains repair instructions for three new power steering gears:

**ZF power steering gear with fixed valve housing**

**ZF power steering gear with removable valve housing**

**Cam gear with aluminium housing**

It is produced as a supplement to the steering manual Section 6, group 64 (English edition TP 30026, US-edition TP 30001)

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## Specifications

### ZF power steering gear with fixed valve housing



131 215

Type .....	Rack and pinion	
No. of turns from lock to lock .....	3.5	
Ratio .....	17.2:1	
Pinion:		
Pre-tension pinion to rack, without seals .....	15–25 Ncm	1.3–2.2 in.lbs
Spacer washers available in thicknesses .....	1.91–2.45 mm	—
in increments of .....	0.01 mm	—
Clearance between pre-tensioning piston and cover .....	0.1–0.15 mm	—
Spacer washers available in thicknesses .....	2.10–2.90 mm	—
in increments of .....	0.05 mm	—
Lubricant for rack and pinion .....	Volvo P/N 1 161 001-1	
Lubricant for tube nuts .....	Volvo P/N 1 161 006-0 (or suitable if not available in USA or Canada)	
Lubricant quantity for rack and pinion .....	100 grams	3.5 oz.
Fluid for hydraulic system .....	Automatic Transmission Fluid (ATF)	
Quantity, hydraulic system .....	0.7 litres	24 Fluid ounces
Sealant .....	Volvo P/N 281 145-3 (or suitable if not available in USA or Canada)	
Checking balance:		
— Power pump pressure .....	2.0 MPa	285 psi
— at torque reading .....	4–5.5 Nm	35–40 in.lb.
Difference between sides must not exceed .....	0.5 Nm	4.4 in.lb.
<b>Tightening torques</b>	<b>Nm</b>	<b>ft.lbs.</b>
Pinion cover .....	10	7
Tube nuts .....	120	88
Cover for pre-tensioning device .....	22	15
Pipe fittings .....	20	14

ZF power steering gear with removable valve housing

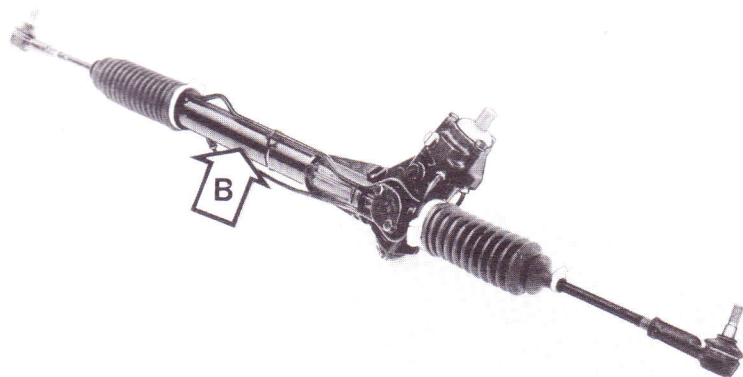


The valve assembly is a separate unit attached to the steering gear housing by two screws (A).

Type .....	Rack and pinion	
No. of turns from lock to lock .....	3.5	
Ratio .....	17.2:1	
Clearance between pre-tensioning piston and cover .....	0.1–0.15 mm	
Spacer washers available in thicknesses .....	2.10–2.90 mm	
in increments of .....	0.05 mm	
Lubricant for rack and pinion .....	Volvo P/N 1 161 001-1	
Lubricant for tube nuts .....	Volvo P/N 1 161 006-0	
	(or suitable if not available in USA or Canada)	
Lubricant quantity for rack and pinion .....	100 grams	3.5 oz.
Fluid for hydraulic system .....	Automatic Transmission Fluid (ATF)	
Quantity, hydraulic system .....	0.7 litres	24 fluid ounces
Sealant .....	Volvo P/N 281 145-3	
	(or suitable if not available in USA or Canada)	
Checking balance:		
– Power pump pressure .....	2.0 MPa	285 psi
– at torque reading .....	4–5.5 Nm	35–40 in.lb.
Difference between sides must not exceed .....	0.5 Nm	4.4 in. lb.
<b>Tightening torques</b>	<b>Nm</b>	<b>ft.lbs.</b>
Inhex screws for valve housing .....	25	18
Tube nuts .....	120	88
Cover for pre-tensioning device .....	22	15
Pipe fittings .....	20	14



## Cam Gear power steering gear with aluminium housing



Repair instructions for Cam Gear power steering gear with cast iron housing are included in an earlier Manual.

Most visible difference between the two power steering gears is that the new type with aluminium housing has a non-detachable tube (B).

131 213

Type.....	Rack and pinion	
No. of turns from lock to lock.....	3.5	
Ratio.....	17.2:1	
<b>Pinion</b>		
Gaskets, to adjust pinion pre-tension.....	Volvo P/N 1272975, 1272976	
Clearance between pre-tensioning piston and cover.....	0.05–0.15 mm	
Spacer washers available.....	0.05 mm	
	0.127 mm	
	0.254 mm	
Pre-tension pinion to rack.....	0.9–1.7 Nm	8–15 in.lbs.
Lubricant for rack and pinion.....	Volvo P/N 1 116 001–1	
Quantity.....	100 grams	3.5 oz.
Fluid for hydraulic system.....	Automatic Transmission Fluid (ATF)	
<b>Quantity</b>		
integrated oil reservoir.....	0.7 litres	24 fluid ounces
separate oil reservoir.....	1.2 litres	41 fluid ounces
<b>Checking balance</b>		
— Power pump pressure.....	1.2 MPa	170 psi
— at torque reading.....	3.5–5.0 Nm	30–40 in.lbs.
Difference between sides must not exceed.....	1 Nm	8 in.lbs
<b>Tightening Torques</b>		
	<b>Nm</b>	<b>ft.lbs.</b>
Pinion cover.....	19	14
Cover for pre-tensioning device.....	17	12.6

## Special tools

### 1801 Standard handle

Used with drifts 5184, 5226 and 5227. Illustrated with 5184.

### 1819 Extractor

For seals.

### 2520 Repair stand

Alternative: 5154.

### 2863 Drift

Seal in steering gear cover.

### 4078 Puller

For valve unit. Used with socket 5179.

### 5046 Fixture

For all steering gears. Used with stands 2520 and 5154. Illustrated with 5154.

### 5049 Sleeve

For installing pinion gear inner race. Cam Gear.

### 5154 Repair stand

Alternative: 2520.

### 5178 Wrench/spanner

For tube nuts.

### 5179 Socket

For pinion shaft. Illustrated with 9177.

### 5182 Sleeve

Installing steering gear cover.

### 5184 Drift

Installing seal and bearing.

### 5226 Drift

Installing seal in valve unit. ZF.

### 5227 Drift

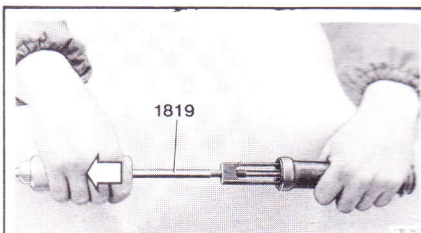
Installing roller bearing in valve unit. ZF.

### 5865 Press Tool

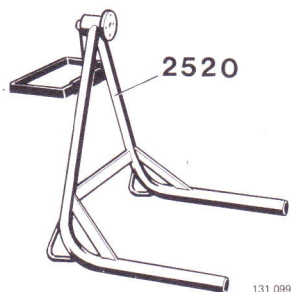
For pre-tensioning piston. ZF.

### 9177 Torque gauge

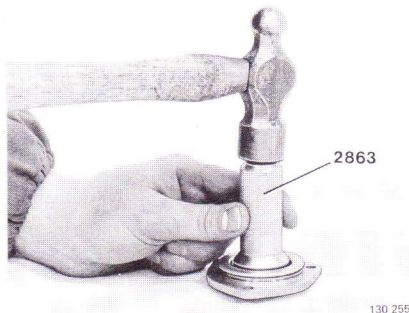
For steering gear torque. Cam Gear.



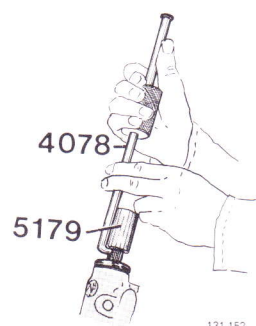
**1819 Extractor**  
For seals.



**2520 Repair stand**  
(Alternative: 5154.)

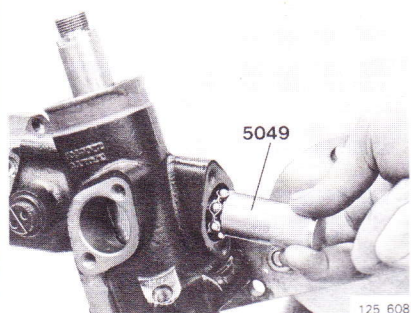


**2863 Drift**  
Seal in steering gear cover.



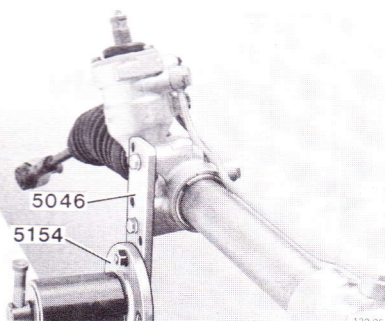
**4078 Puller**  
For valve unit. Used with socket 5179.





**5049 Sleeve**

For installing pinion gear inner race.  
Cam Gear

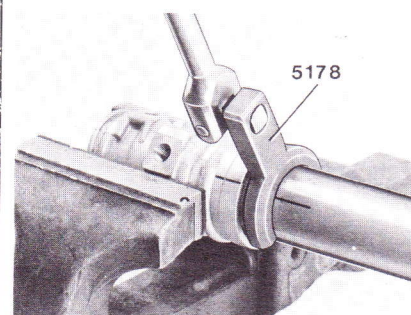


**5046 Fixture**

For all steering gears. Used with stands 2520 and 5154.

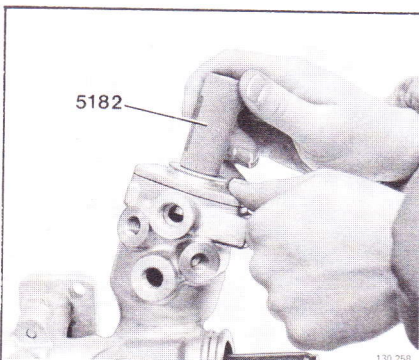
**5154 Repair stand**

(Alternative: 2520).



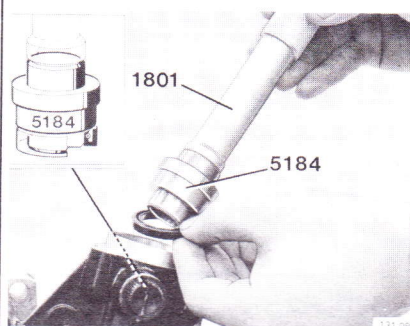
**5178 Wrench/spanner**

For tube nuts.



**5182 Sleeve**

Installing steering gear cover.

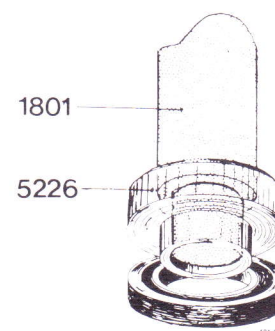


**1801 Standard handle**

Used with drifts 5184, 5226 and 5227.

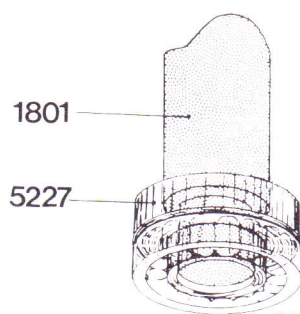
**5184 Drift**

Installing seal and bearing.



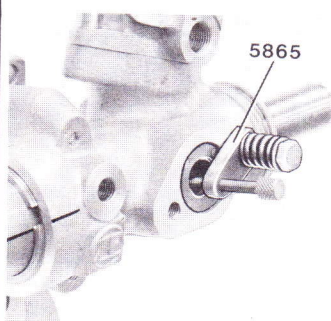
**5226 Drift**

Installing seal in valve unit.  
ZF



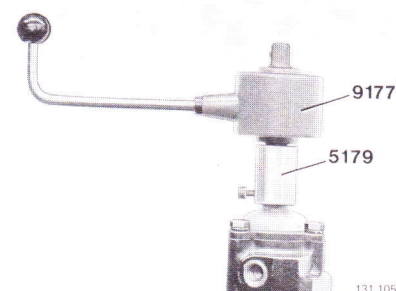
**5227 Drift**

Installing roller bearing in valve unit.  
ZF



**5865 Press tool**

For pre-tensioning piston.  
ZF



**5179 Socket**

For pinion shaft.

**9177 Torque gauge**

For steering gear torque.  
Cam Gear.

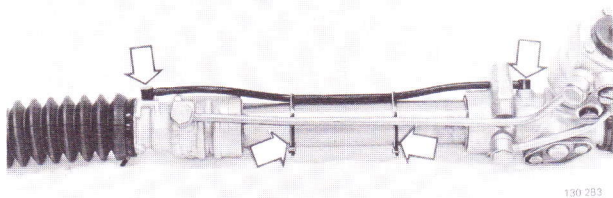
## ZF power steering gear with fixed valve housing

### Disassembly

#### Special tools:

1819 **Extractor**, for seals  
2520 **Repair stand**  
5046 **Fixture**

5154 **Fixture**  
5178 **Wrench**, tube nuts



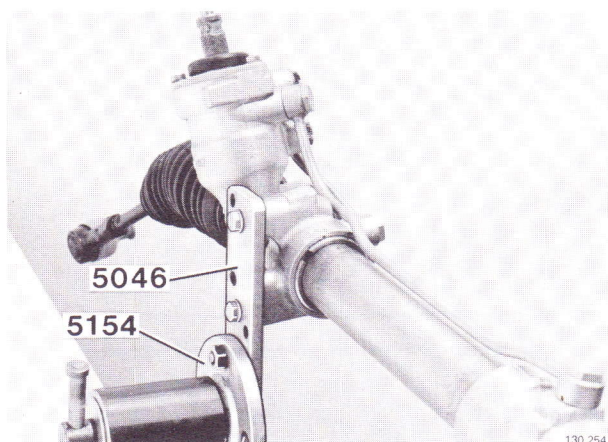
A1

**Clean exterior of steering gear**

A2

**Remove equalizer tube**

Cut plastic clamps holding equalizer tube and remove tube.

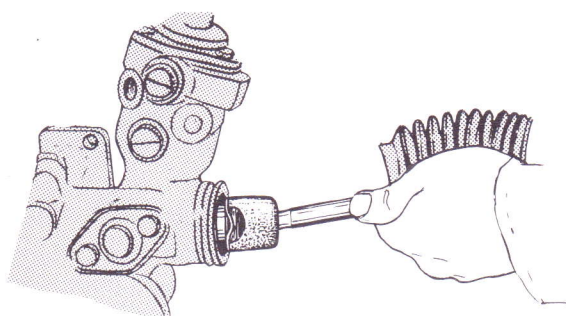


A3

**Attach steering gear to fixture 5046**

A4

**Install steering gear and fixture assembly on repair stand 2520 or 5154**



A5

**Disconnect rubber bellows at steering gear to gain access to steering rods**

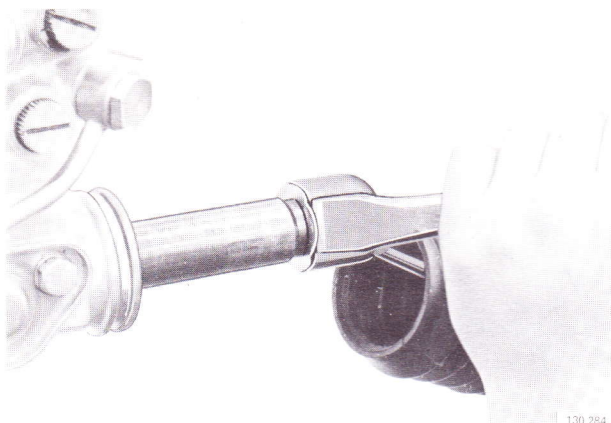
Remove all grease.

A6

**Check inner and outer ball joints for wear**



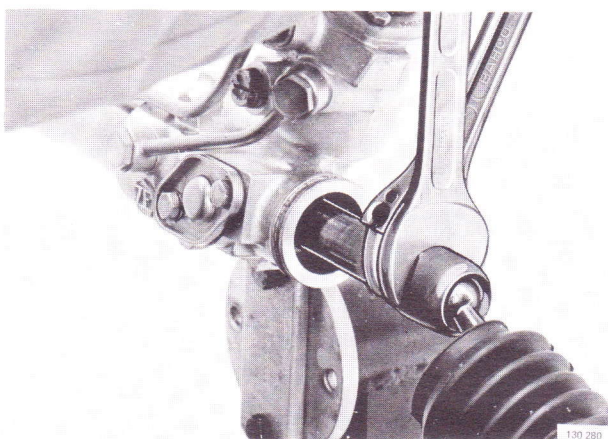
A7



### Unfold tab on lock washer

130 284

A8



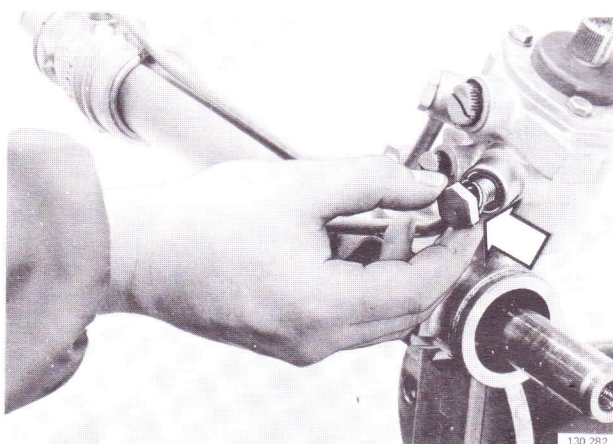
### Remove steering rod

Use a 27 mm (1 1/16") open end wrench on ball joint, and a large adjustable wrench as a counterhold on rack. Position adjustable wrench as close as possible to ball joint.

A counter hold must be used on rack, or damage may occur to the rack or pinion teeth.

130 280

A9



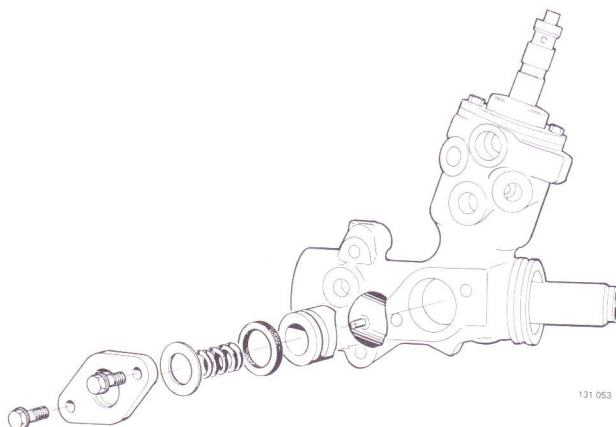
### Remove pressure pipes and O-rings. Drain lubricant

Place drip tray under pipe fittings. Turn pinion to move rack in and out to pump out oil.

Use socket **5179** to turn pinion gear.

130 282

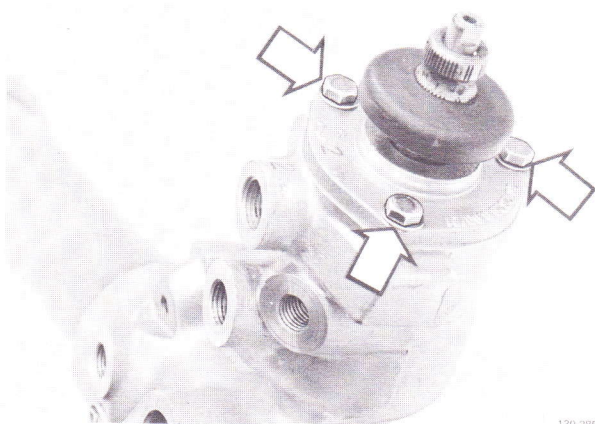
A10



131 053

### Remove pre-tensioning piston

- Remove
- Cover
- Washer
- Spring
- Piston

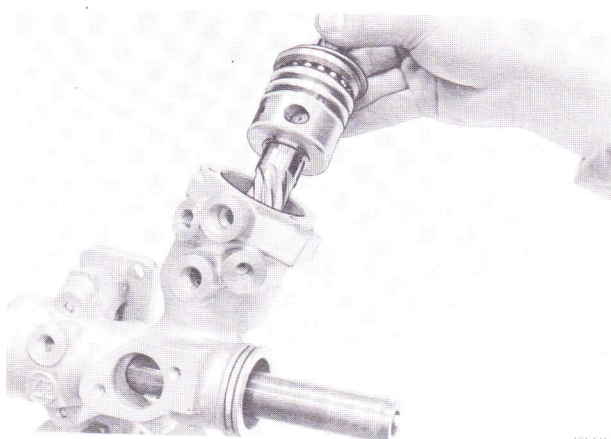


130 285

A11

### Remove pinion housing cover

Remove rubber dust protector from shaft.  
Remove pinion housing cover with seal and O-ring.

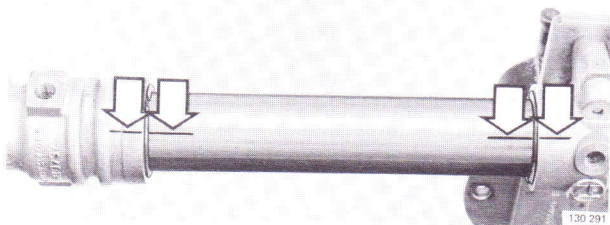


131 145

A12

### Remove pinion

Carefully lift out pinion with upper roller bearing, then remove lower washer and needle bearing.



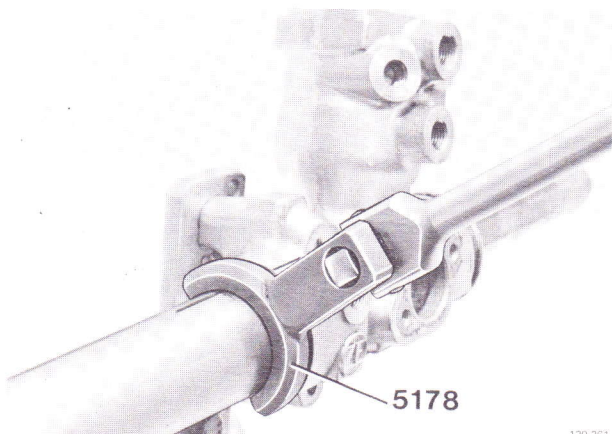
130 291

A13

### Disassembling centre tube

Identify position of the two end housings on center tube by scribe marks as shown.

**CAUTION:** Do not use punch and hammer.



130 261

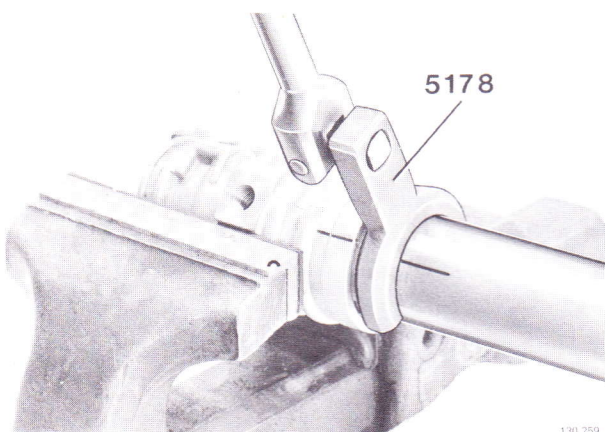
A14

### Remove tube

First loosen locking collar next to the pinion housing, using tool **5178** with suitable handle.



A15



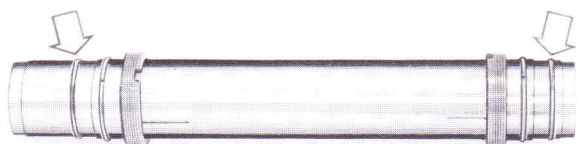
### Remove right hand housing

Place right housing in a vice (using soft metal jaw protectors as shown).

Use tool **5178**, to slacken lock collar.

**CAUTION:** Do not place centre tube in vice.

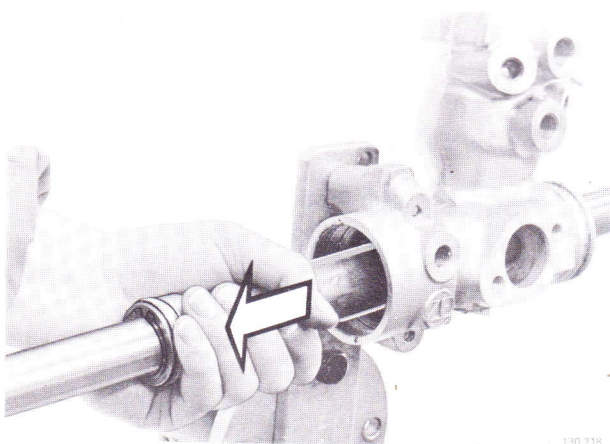
A16



### Remove O-rings from centre tube

**NOTE:** Lock rings need only be removed should the locking collar have to be replaced.

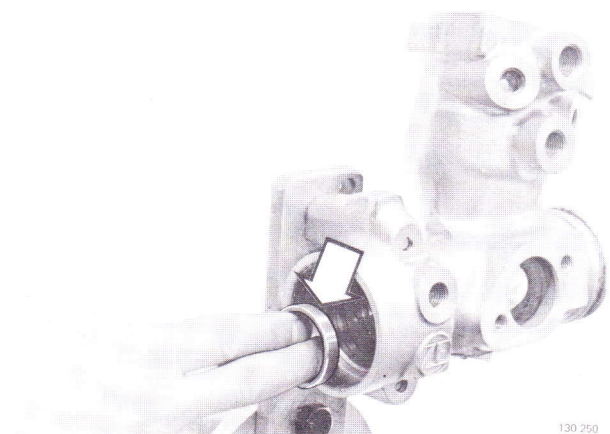
A17



### Pull out rack and spacer (inner) tube

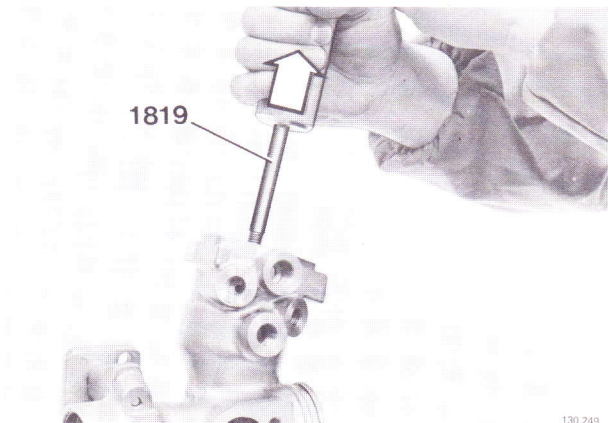
The two components should be pulled out as one unit.

A18



### Remove thrust washer from right side of pinion housing

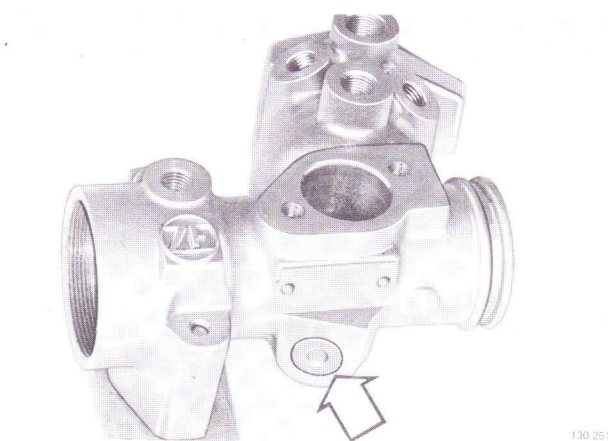
(Use tool **1819** if necessary.)



A19

### Remove seal and needle bearing from pinion housing

Use tool **1819** to remove seal.

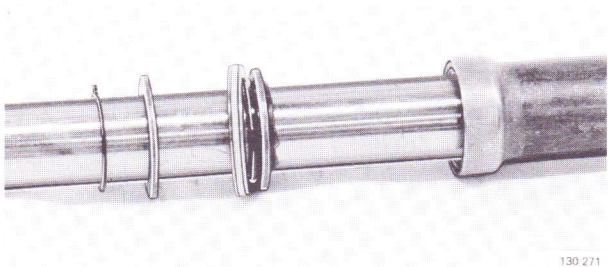


A20

### Remove needle bearing

Tap out needle bearing using a long punch from inside of housing.

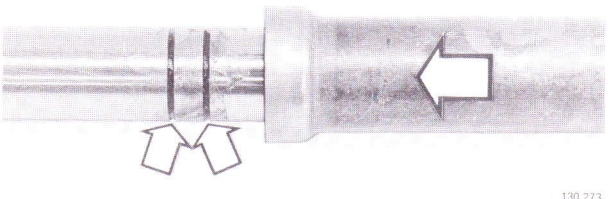
**NOTE:** Bearing should only be removed if it has to be replaced.



A21

### Remove spacer (inner) tube

Remove lock rings, thrust washers and piston from rack.

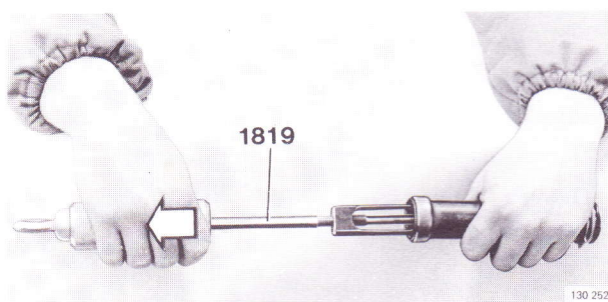


A22

Fill lock ring grooves with grease, then slide off tube towards opposing end of rack teeth.



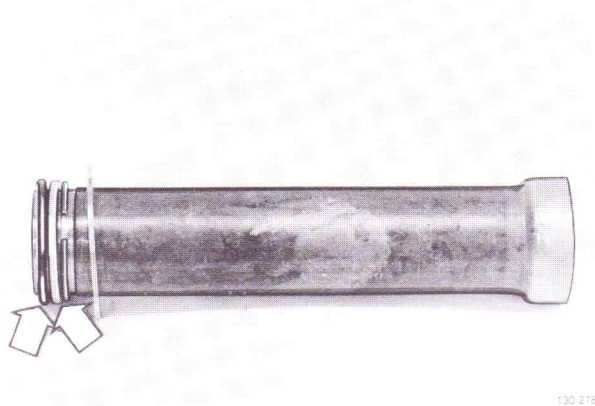
A23



### Remove seal and bushing

Use tool **1819** to remove inner tube seal and narrow brass bushing.

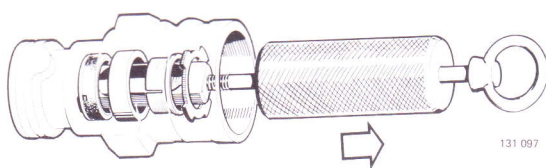
A24



### Remove O-ring and teflon ring from spacer (inner) tube

**NOTE:** Lock ring and thrust washer shall only be removed should they have to be replaced.

A25

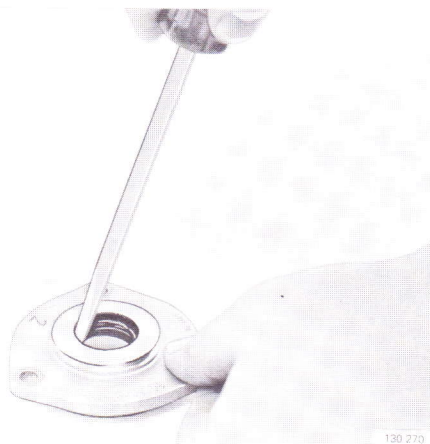


### Remove from right hand housing: Teflon bushing, seal and star washer

Use tool **1819** supported underneath washer.

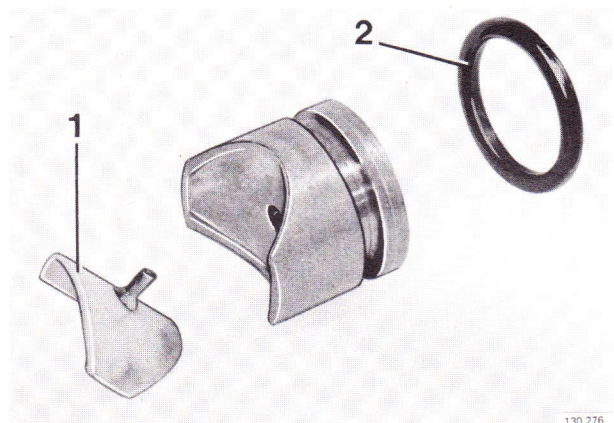
**NOTE:** Washer seal and bushing can also be removed from the other end of housing using a suitable driver.

A26



### Remove seal and O-ring from top cover

Use a screwdriver to press out seal.

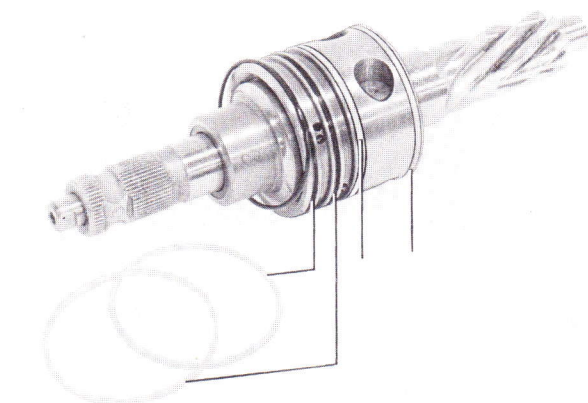


130 276

A27

### Remove from pre-tension piston

- Depressor
- O-ring



130 277

A28

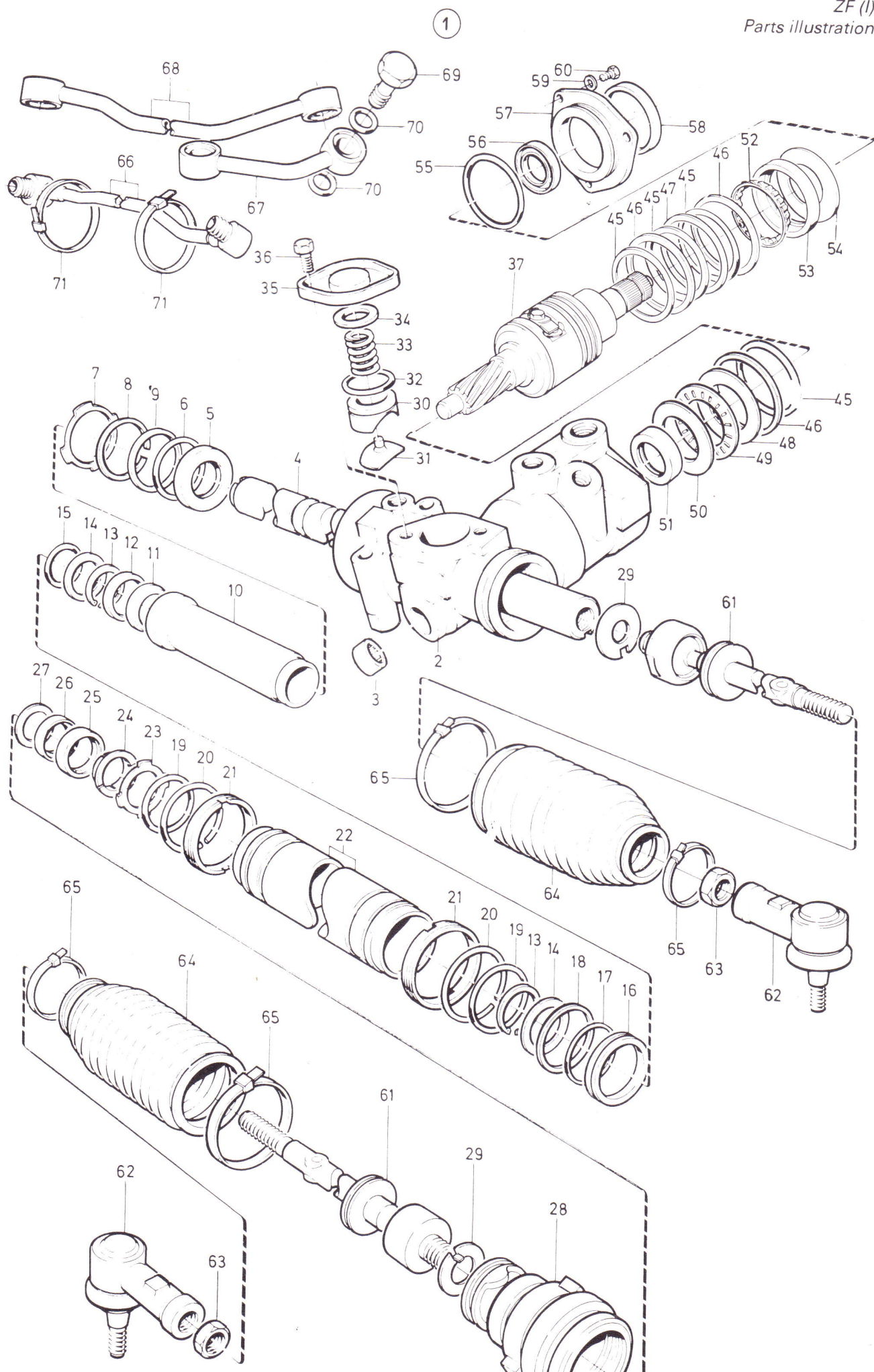
### Remove teflon seal rings from pinion valve assembly

Use a small screwdriver, taking care not to scratch pinion surface.

### Key to illustration

2 Pinion housing	23 Star Washer	51 Seal
3 Needle bearing	24 Bearing	52 Roller cage
4 Rack	25 Bearing	53 Race
5 Ring	26 Seal	54 Spacer washer
6 O-ring	27 Washer	55 O-ring
7 Spacer ring	28 Right end housing	56 Seal
8 Lock ring	29 Lock washer	57 Cover
9 Washer	30 Pre-tensioning piston	58 Dust seal
10 Spacer (inner) tube	31 Depressor	59 Washer
11 Ring	32 O-ring	60 Screw
12 Seal	33 Spring	61 Steering rod
13 Lock ring	34 Spacer washer	62 Ball joint
14 Washer	35 Cover	63 Nut
15 O-ring	36 Screw	64 Rubber bellow
16 Piston	37 Valve unit	65 Clamp
17 O-ring	45 O-ring	66 Pipe
18 Piston ring	46 Seal	67 Pipe
19 O-ring	47 Seal	68 Pipe
20 Lock ring	48 Washer	69 Pipe fitting
21 Lock ring	49 Thrust bearing	70 O-ring
22 Centre tube	50 Washer	71 Clamp





## ZF power steering gear with fixed valve housing

### Assembly

#### Special tools:

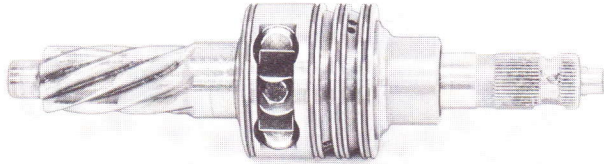
- 1801 **Standard handle**
- 2863 **Drift**, for seal in pinion cover
- 5178 **Wrench**, for tube nuts
- 5179 **Adapter**, steering gear torque
- 5182 **Adapter**, installing pinion cover
- 5184 **Drift**, bearing and seal
- 5865 **Press tool**, pre-tensioning device

#### Lubricants:

- Volvo P/N 1 161 001-1
- Volvo P/N 161 006-0 (or suitable if not available in USA and Canada)
- Automatic Transmission Fluid (ATF)

#### Sealant:

- Volvo P/N 281 145-3 (or suitable if not available in USA and Canada)

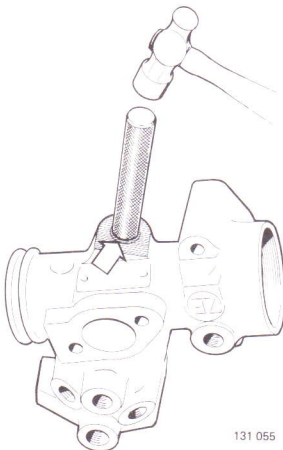


B1

#### Clean/inspect/replace

Clean all parts. Inspect for wear and damage. Replace as necessary.

Valve housing **must not** be disassembled. Replace if defective.



B2

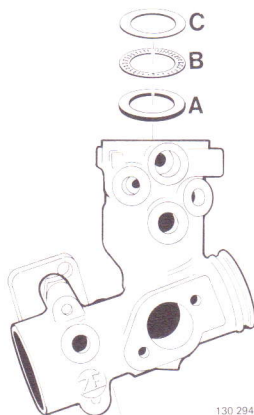
#### Install needle bearing (if removed)

Lubricate needle bearing with Volvo lubricant P/N 1 161 001-1.

Use drift to install bearing.

Bearing bottom should be flush with housing.

**NOTE:** If bearing is set in too far it will affect pinion preload.



B3

#### Before installing any seals preload of pinion bearings must be checked or adjusted

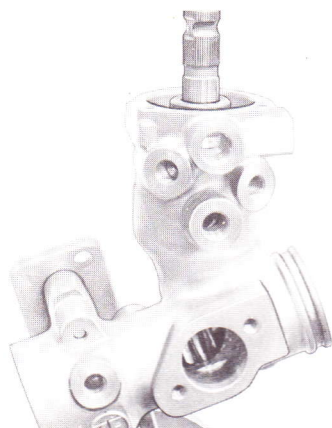
##### Install

- Bearing race A, bevelled edge down.
- Needle bearing B.
- Bearing race C.

DO NOT lubricate any parts at this time.



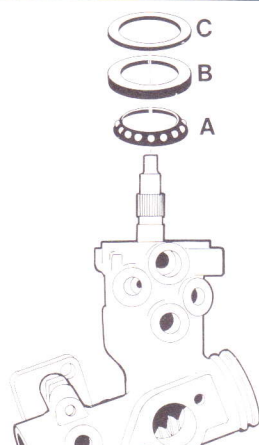
B4



### Install pinion assembly

Pinion assembly must be inserted **without** any seals installed on either pinion or in the housing.

B5

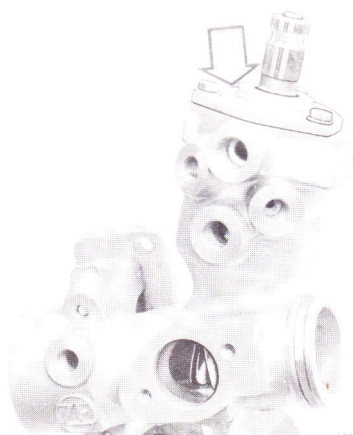


### Install

- Bearing A
- Race B
- Spacer washer C

DO NOT lubricate parts.

B6



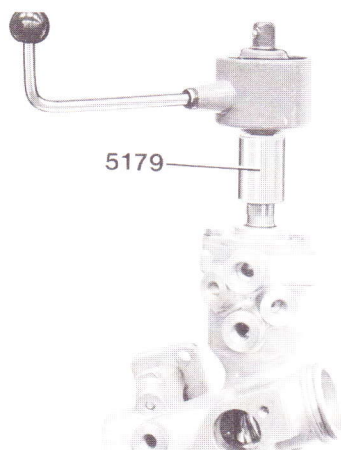
### Install pinion housing cover

Do not install seal and O-ring.

Torque cover bolts to:

**10 Nm = 7 ft.lbs.**

B7



### Adjust pinion, method 1

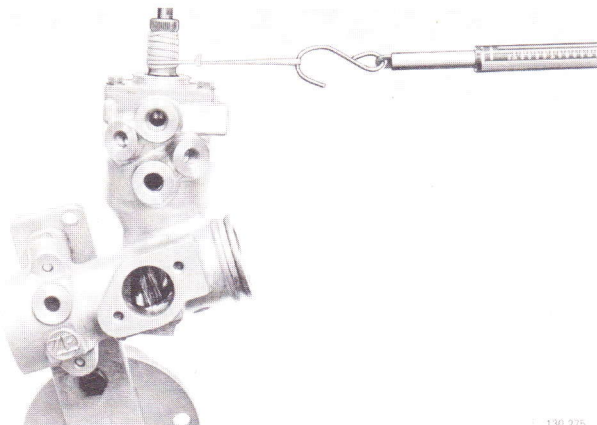
Pinion should have no play. Bearings should be set to yield a certain torque.

Use adapter **5179** and torque meter / wrench.

Torque should be 15–25 Ncm = 1.3–2.2 in.lbs.

To adjust, replace spacer washer (C in op. B5). These are available in increments of 0.01 mm from 1.91 mm to 2.45 mm thickness.

B8



130 275

### Adjust pinion, method 2

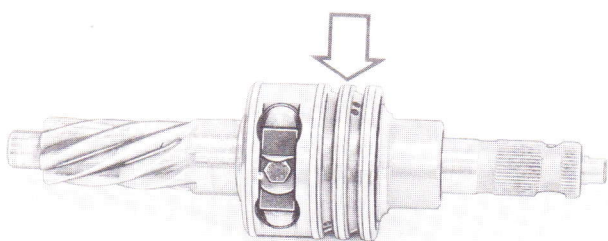
Tie a string round shaft. Attach a spring gauge/balance to string.

Force should be:

**1.7–2.9 kp** = 3.7–6.4 lbs

Assembling continued

B9



130 264

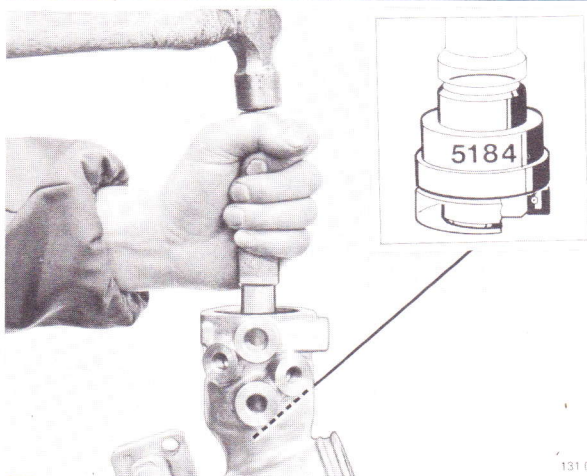
### Remove the pinion assembly bearings and spacers

Install the 4 rubber O-rings in the valve body grooves.

Install the 4 teflon rings over the rubber O-rings.

**NOTE:** One teflon ring is tinted green. This ring must be installed at the point indicated by the arrow.

B10



131 059

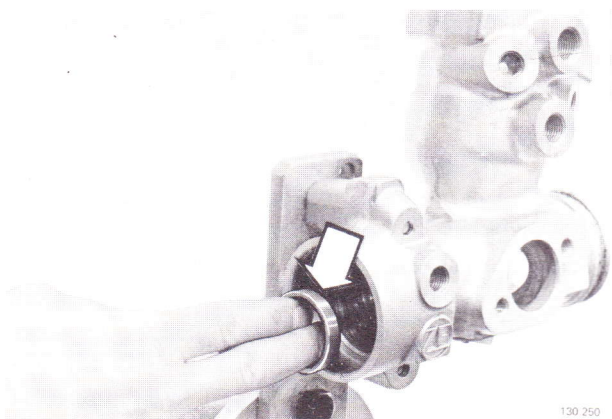
### Install seal in pinion housing

Fill lubricant, Volvo P/N 1 161 001-1, in space between seal lips.

Install seal in pinion housing, lips UP.

Use drift **5184** and handle **1801** as shown.

B11



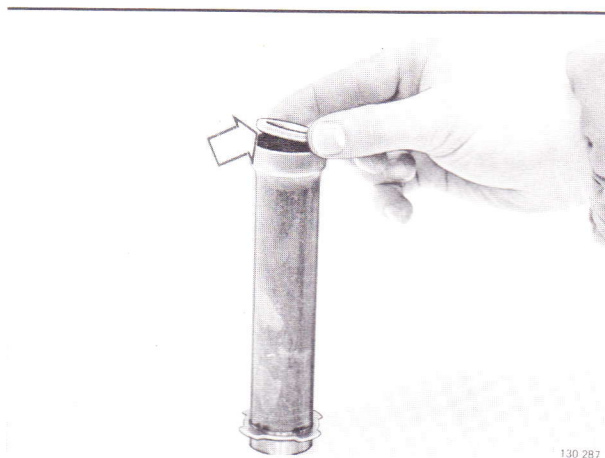
130 250

### Install spacer ring

Grooved end should face outwards, cone end into the housing.



B12

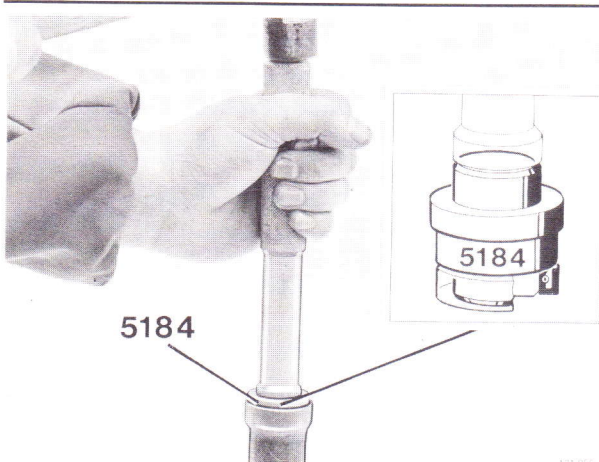


### Install bronze bushing in spacer (inner) tube

Chamfered side DOWN.

130 287

B13



### Install seal in spacer (inner) tube

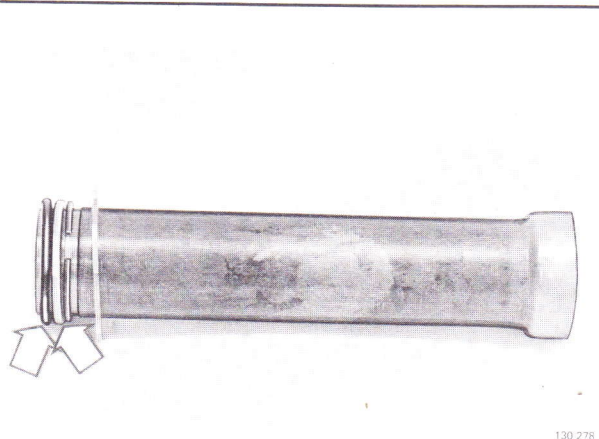
Fill lubricant, Volvo P/N 1 161 001-1, in space between seal lips.

Install seal in spacer tube, lips UP.

Use drift **5184** and handle **1801** applied as shown.

131 956

B14

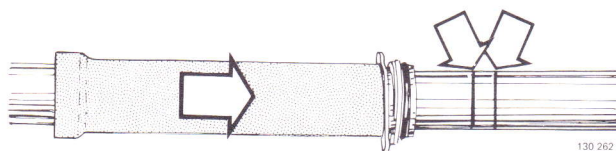


### Install

- Spacer washer (if replaced)
- Lock ring (if replaced)
- Teflon ring
- O-ring

130 278

B15

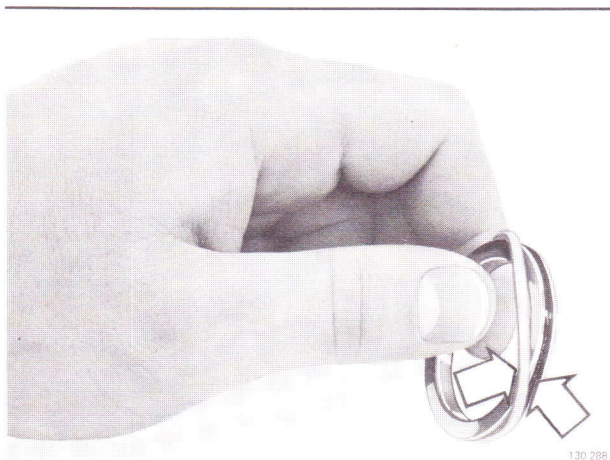


### Install spacer (inner) tube on rack

Fill snap ring grooves and coat surrounding area (indicated by double arrows) with a thick heavy grease such as wheel bearing grease.

Slide spacer tube into steering rack from smooth end and pass it quickly over snap ring grooves to prevent seal damage.

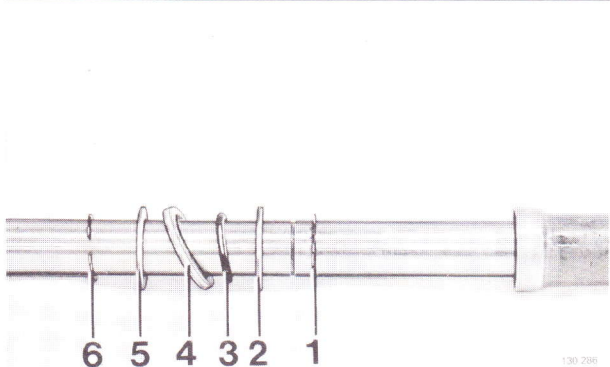
130 262



B16

### Install piston ring on piston

First install O-ring, then piston ring



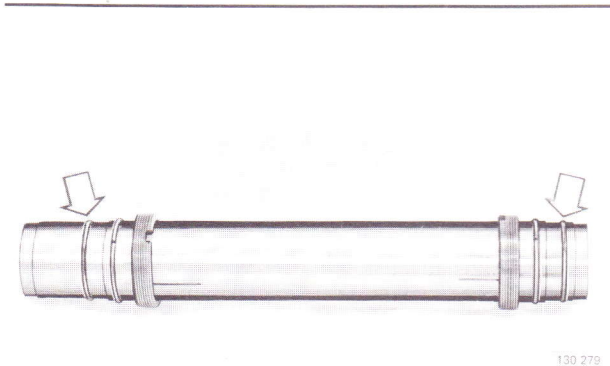
B17

### Install piston with spacer washers and lock rings

Install in order:

- Inner lock ring
- Spacer washer
- O-ring
- Piston with rings
- Second spacer washer
- Lock ring

Lock rings with chamfered side facing piston.



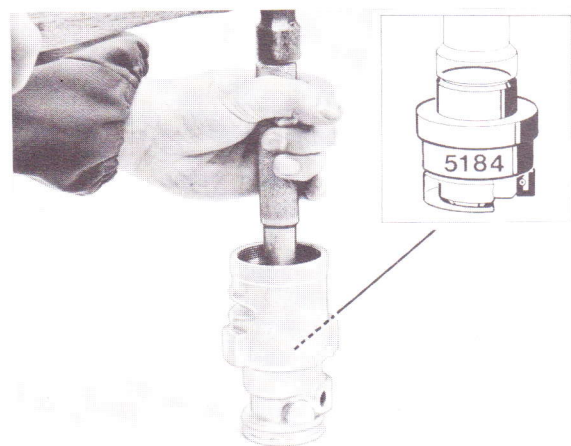
B18

### Install tube locking collars and lock rings

If tube collars have been removed, install on the centre tube with recesses for wrench facing centre of the tube.

Apply lubricant Volvo P/N 1 161 006-0 on collar threads and lock rings.

Install O-rings.



B19

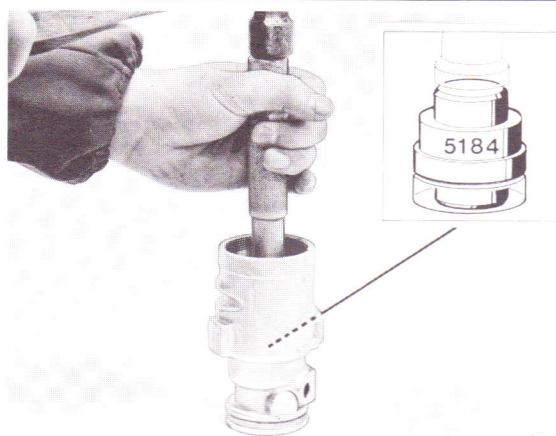
### Install seals in right side housing

Install bottom washer. Apply lubricant, Volvo P/N 1 161 001-1, on seal lips. Install seal with lips UP.

Use drift **5184** and handle **1801** applied as shown.



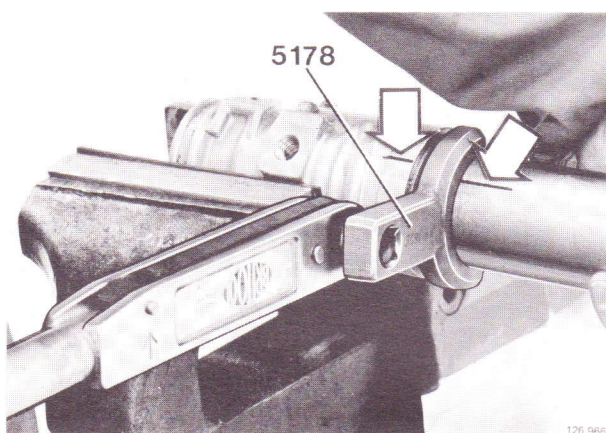
B20



### Install metal bushing, teflon bushing and star washer

Use drift **5184** and handle **1801** applied as shown. Install metal bushing (with recessed end up) teflon bushing and star washer, in that order.

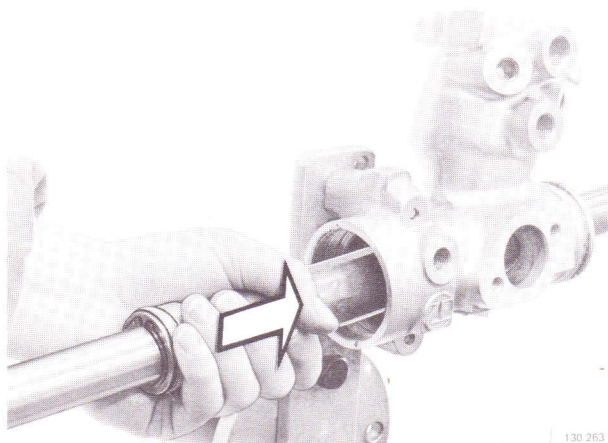
B21



### Attach tube to right side housing

Place right side housing in a vice with soft jaws. Apply ATF oil to both O-rings prior to installation. Install tube with long end IN. Line up scribe marks on tube and housing. Use wrench/spanner **5178** to torque nut to: **120 Nm = 88 ft.lbs.** Apply lubricant to locking collar.

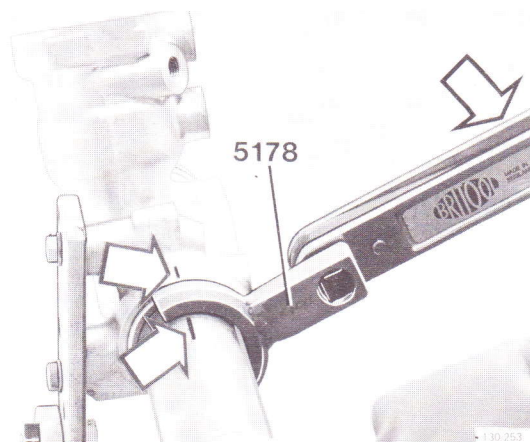
B22



### Install rack and spacer (inner) tube assembly in pinion housing

Fill the gear teeth with lubricant, Volvo P/N 1 161 001-1. Install rack and inner tube assembly.

B23

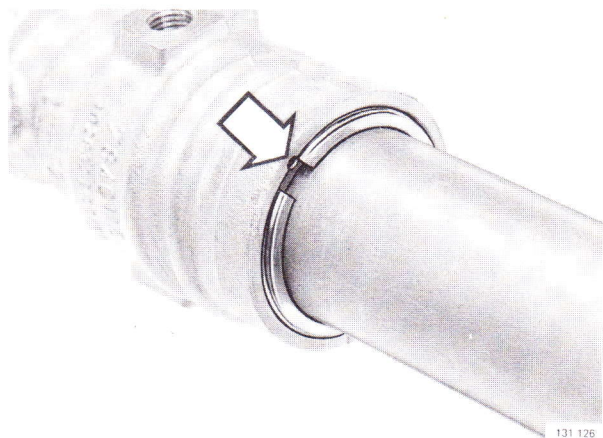


### Attach right side housing and tube assembly to pinion housing

Lubricate center tube with ATF, then attach preassembled right half of the unit to pinion housing being careful not to damage piston and oil seals.

Align scribe marks made during disassembly and torque retaining collar to 120 Nm (88 ft.lbs.) with special tool **5178**.

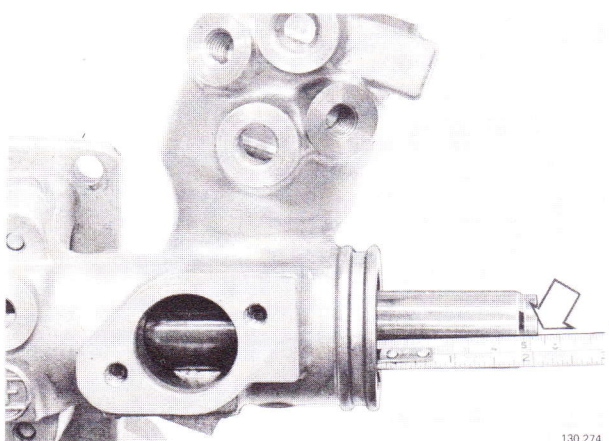
The collar threads should be lightly coated with Volvo lubricant before installation.



B24

### Lock retaining collars after torquing

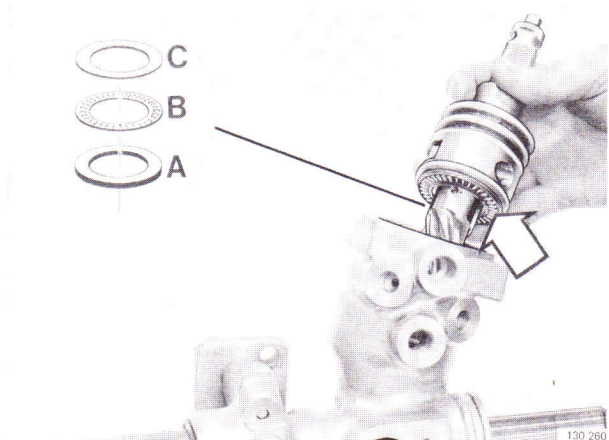
Punch a mark in aluminum housing at one of the recesses on each housing.



B25

### Position steering rack

Adjust steering rack so that it extends 53 mm (2 1/16") from edge of pinion housing.



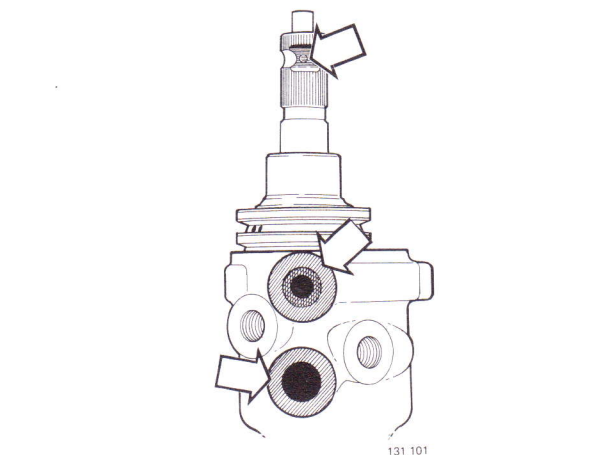
B26

### Install thrust bearing on pinion

Fill pinion teeth with grease – Volvo P/N 1 161 001-1.

Install bearing washer (A) in housing, bevelled edge down.

Attach thrust washer (C) and thrust bearing (B) to valve body with grease.



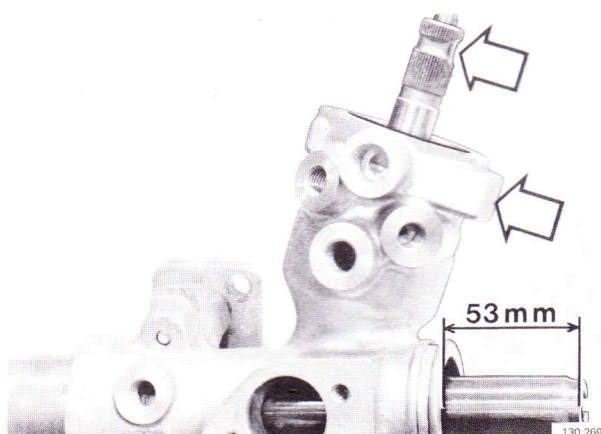
B27

### Install pinion, first step

Hold the pinion so that its flat surface is in line with the upper high pressure outlet (see arrows) and insert into the housing.



B28

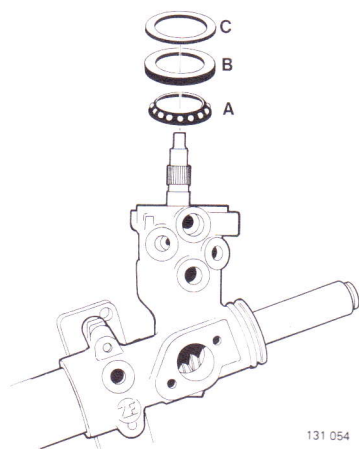


### Install pinion, second step

As the pinion enters the housing, it will turn by itself. When it is fully seated the flat surface should be parallel to the flat surface of the housing (see arrows). Steering rack must not have moved from 53 mm (2 1/16").

**NOTE** This position must be correct. **DO NOT** continue until it is.

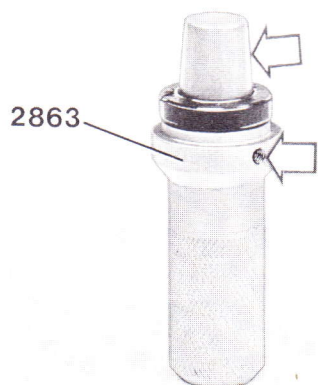
B29



### Install

- Bearing A
- Race B
- Spacer washer C, of previously determined thickness

B30



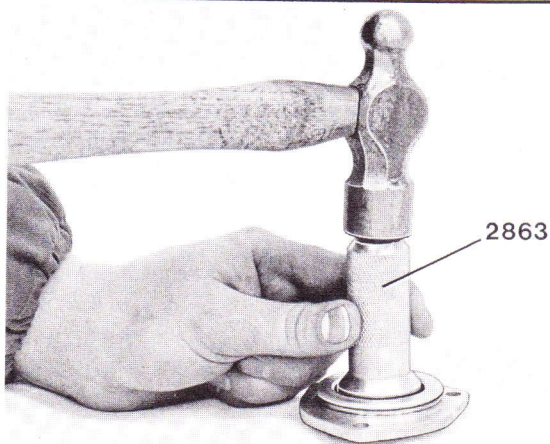
### Install top cover seal on tool

Fill lubricant, Volvo P/N 1 116 001-1, between seal lips.

Install seal on drift **2863**, seal lips toward tool.

Remove screw and cone.

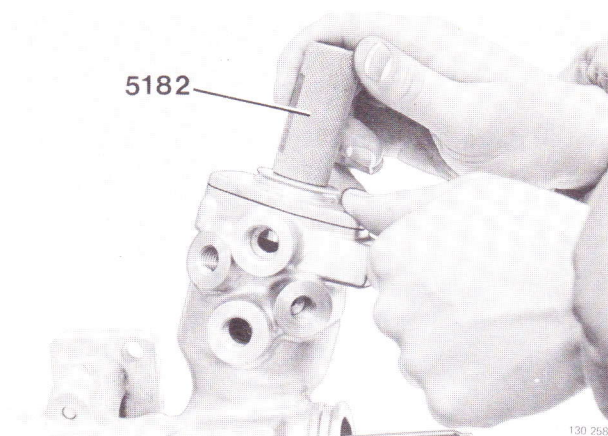
B31



### Install seal

Tap seal into cover.  
Oil O-ring with ATF oil and install.

B32



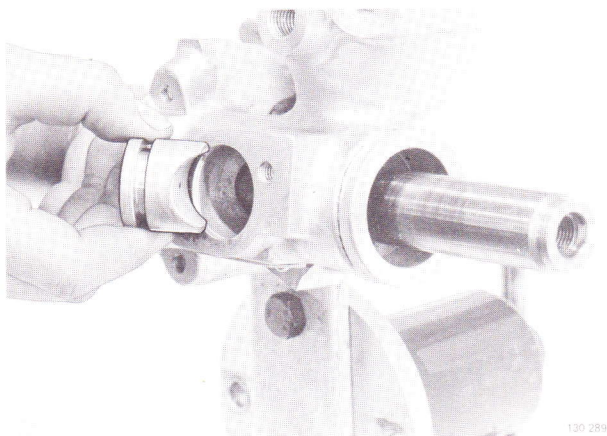
### Install pinion cover and dust seal

Install cover on sleeve **5182**, cone attached. Then remove cone.

Install cover. Torque bolts to: **10 Nm = 7 ft.lbs.**

Install dust seal.

B33

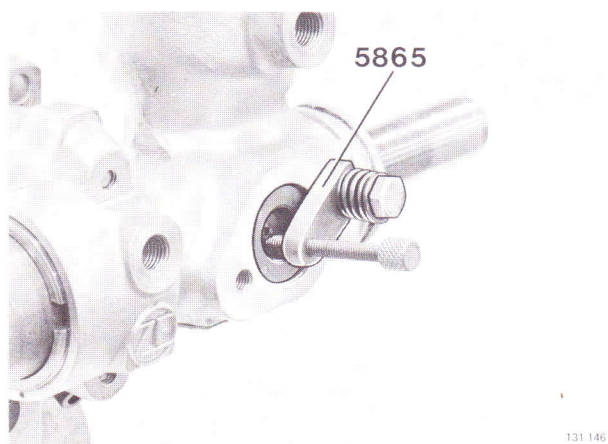


### Install pre-tension piston

Insert pre-tension piston **without** O-ring (be certain that teflon insert is in place on piston).

*Determining pre-tension*

B34



### Install measuring tool

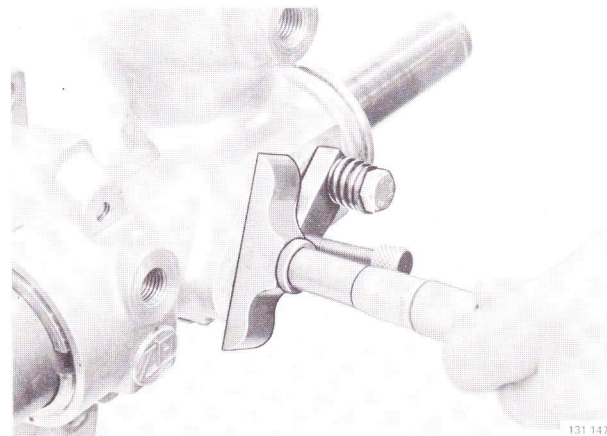
Set-up pre-tension measuring fixture **5865** using one of cover bolt holes with a 45 mm x 8 mm bolt.

Assemble tool with the pre-tension spring between bolt head and tool.

Adjust for slight preload.

Move gear from lock to lock and check that it does not bind or jam.

B35



### Measure distance

Use depth gauge/micrometer to measure distance between housing face and piston top.

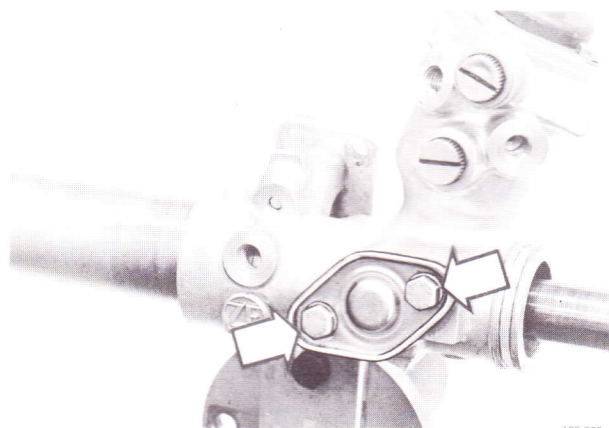
Check the measurement at 3 different points on the steering rack.

Subtract 0.1–0.15 mm (0.004"–0.006") from the smallest reading obtained. Select a washer of that thickness.

Washers are available in thicknesses of 2.10–2.90 mm (0.083"–0.114") in increments of 0.05 mm (0.0019").



B36



### Install cover

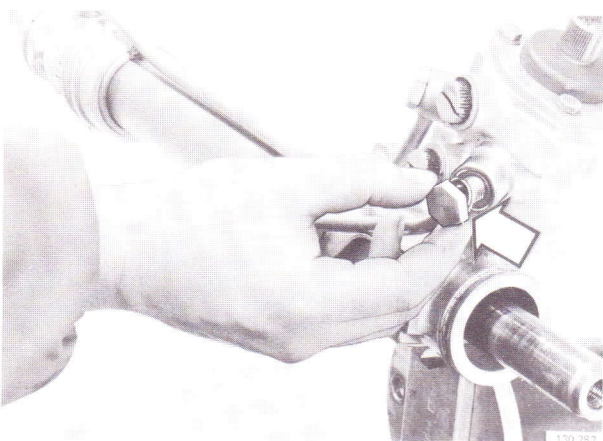
Remove press tool **5865**. Lubricate O-ring and install it on pre-tension piston.

Install pre-determined spacer washer and piston spring. Fill space round spring with lubricant, Volvo P/N 1 116 001-1

Apply sealant Volvo P/N 281 145-3 (USA and Canada: Suitable sealant) on cover sealing surface.

Install cover. Torque bolts to: **22 Nm = 15 ft. lbs.**

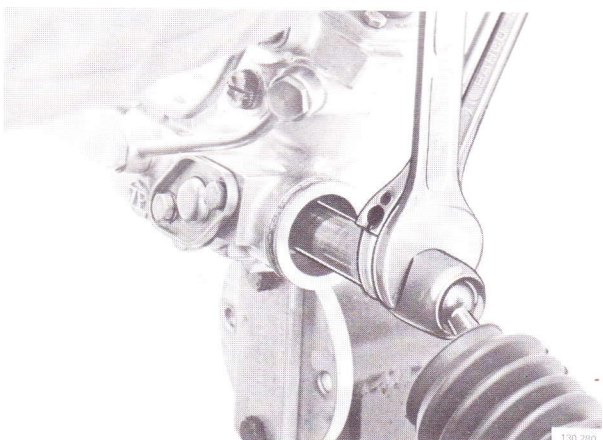
B37



### Install pressure pipes

Make sure O-rings sit correctly in grooves and do not become squeezed. Torque fittings to:  
**22 Nm = 15 ft. lbs.**

B38



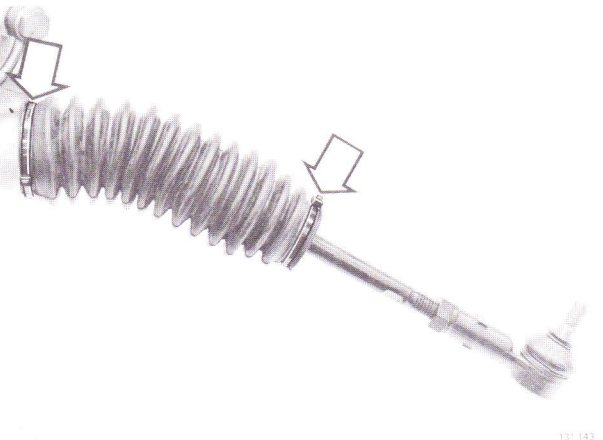
### Install steering rods

Install locks and steering rods.

Use wrench/spanner 27 mm (1 1/16") for lock nut. Use wide adjustable wrench/spanner to hold on flat end of rack, outside teeth.

The wrench/spanner must be used as a counterhold to prevent damage to the pinion gear.

B39



### Finalize steering rod installation

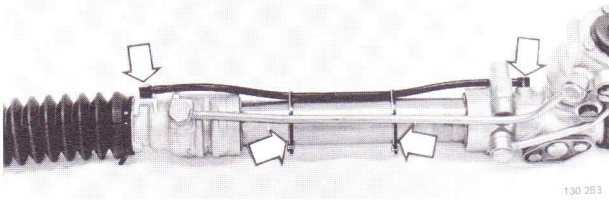
Bend back steering rod locks.

Install rubber bellows. Fill approx. 20 grams (3/4 oz.) of lubricant, Volvo P/N 1 116 001-1, into each rubber bellow.

Attach rubber bellows to housings.

Install inner and outer clamps on both sides.





**Disconnect steering gear from fixture**

Install equalizer tube. Clamp the tube with two plastic clamps.

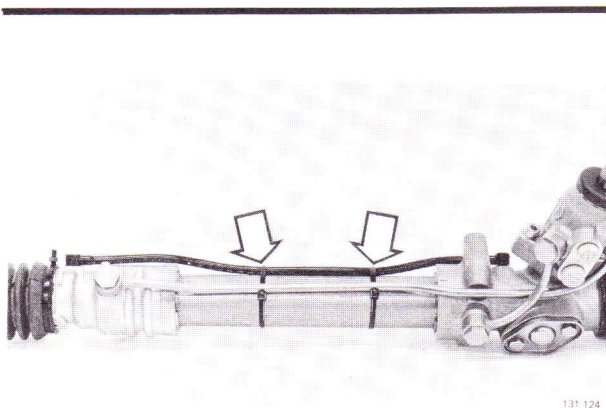
## ZF power steering gear with removable valve housing

### Disassembly

#### Special tools:

1819 **Extractor**, for seals  
2520 **Repair stand** (or 5154)  
4078 **Puller**, for valve unit  
5046 **Fixture**

5154 **Stand** (or 2520)  
5178 **Wrench**, tube nuts  
5179 **Sleeve**



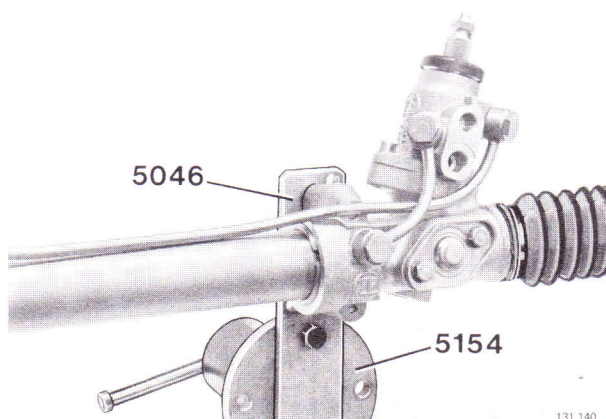
C1

**Clean exterior of steering gear**

C2

**Remove equalizer tube**

Cut plastic clamps holding equalizer tube and remove the tube.

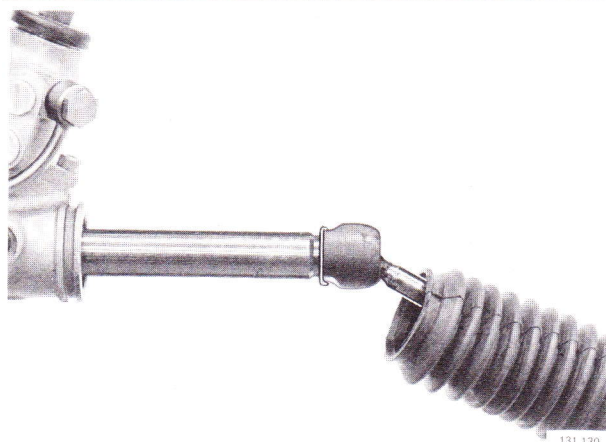


C3

**Attach steering gear to fixture 5046**

C4

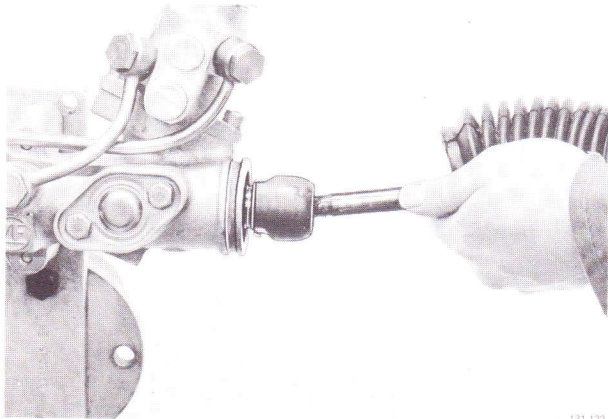
**Install steering gear and fixture assembly on repair stand 2520 or 5154**



C5

**Disconnect rubber bellows at steering gear to gain access to steering rods**

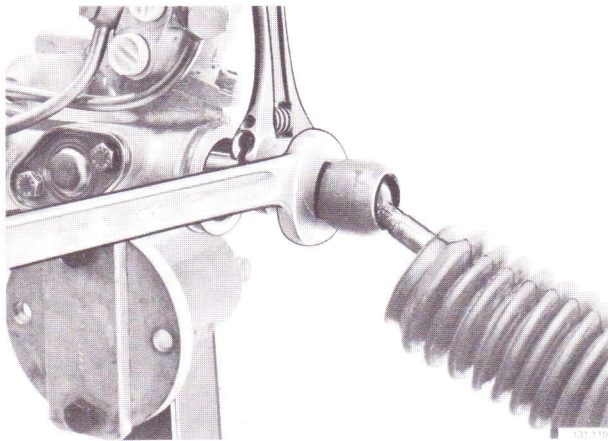
Remove all grease.



131 129

C6

### Check inner and outer ball joints for wear



131 130

C7

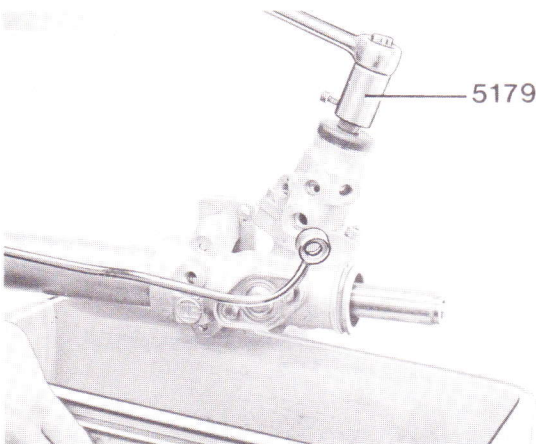
### Remove steering rod

Bend back lock washer for steering rod. Use a hammer and chisel.

Remove rod.

Use a 27 mm (1 1/16") open end wrench on ball joint, and a large adjustable wrench as a counterhold on rack. Position adjustable wrench as close as possible to ball joint.

A counterhold must be used on rack, or damage may occur to rack or pinion teeth.



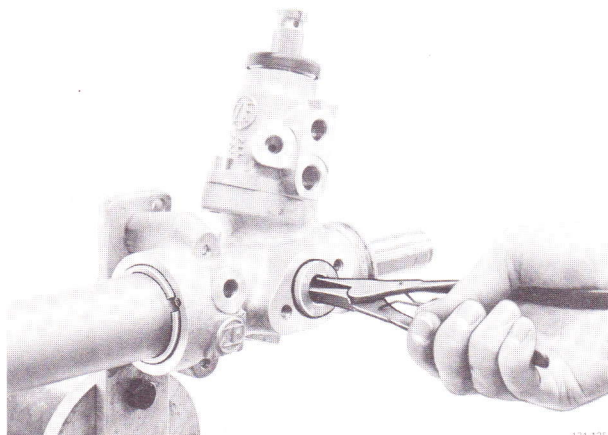
131 128

C8

### Remove pressure pipes with O-rings. Drain lubricant

Place drip tray under pipe fittings. Turn pinion to move rack in and out to pump out oil.

Use socket **5179** to turn pinion gear.



131 125

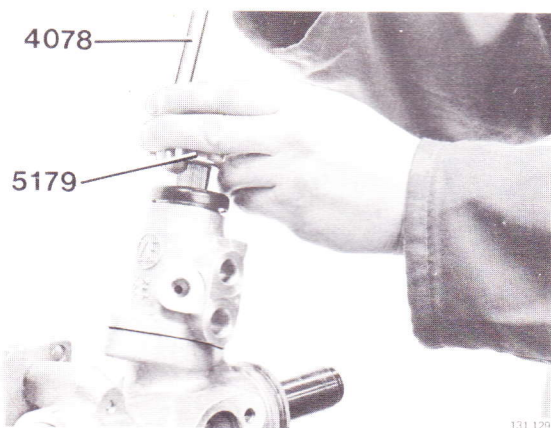
C9

### Remove pre-tensioning piston

- Remove
- Cover
- Washer
- Spring
- Piston



C10



### Remove valve unit

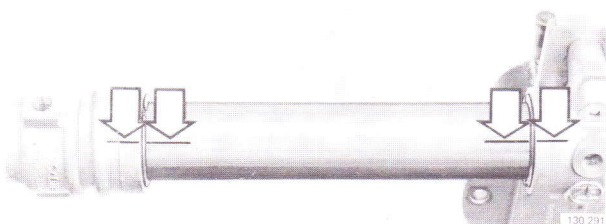
Remove inhex screws. Lift housing containing valve unit.

Remove O-ring under valve unit.

To disconnect valve unit socket **5179** can be installed on shaft end.

Then use puller **4078** and pull straight up.

C11

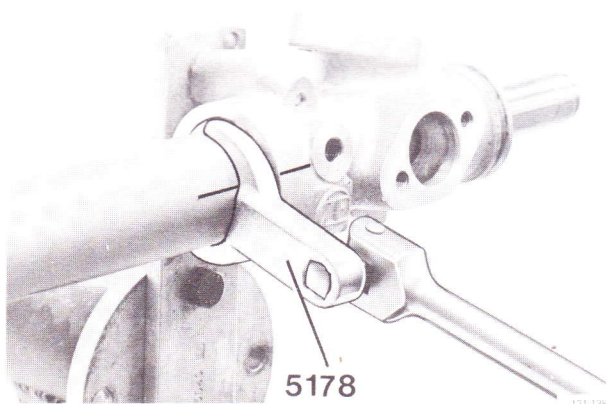


### Dismantle centre tube

Identify position of the two end housings on centre tube by scribe marks as shown.

**CAUTION:** Do not use a punch and hammer.

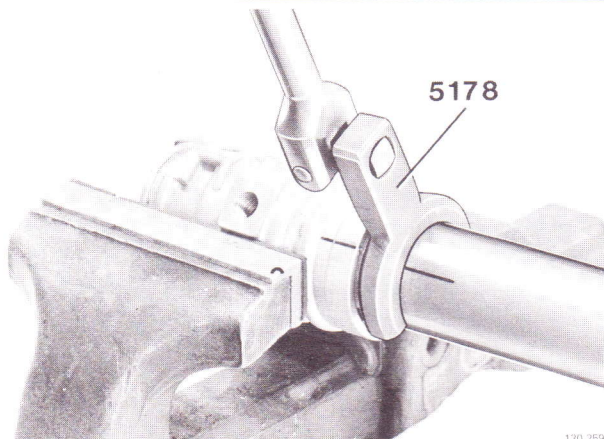
C12



### Remove tube

First loosen locking collar next to the pinion housing, using tool **5178** with suitable handle.

C13



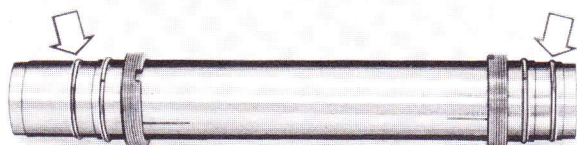
### Remove right side housing

Place right hand housing in a vice (using soft metal jaw protectors as shown).

Using tool **5178**, loosen lock collar.

**CAUTION:** Do not place center tube in the vice.

C14

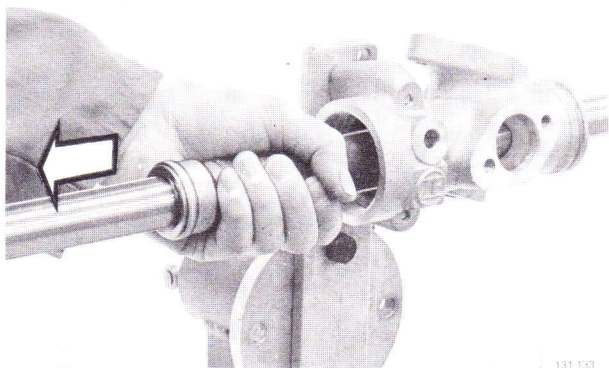


130 279

### Remove O-rings from center tube

**NOTE:** Lock rings need only be removed should locking collar have to be replaced.

C15

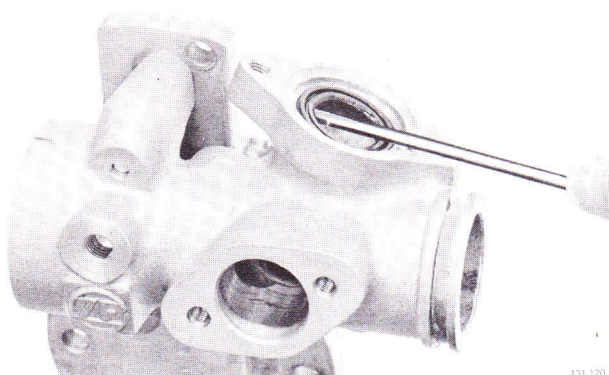


131 133

### Pull out rack and spacer tube

The two components should be pulled out as one unit.

C16

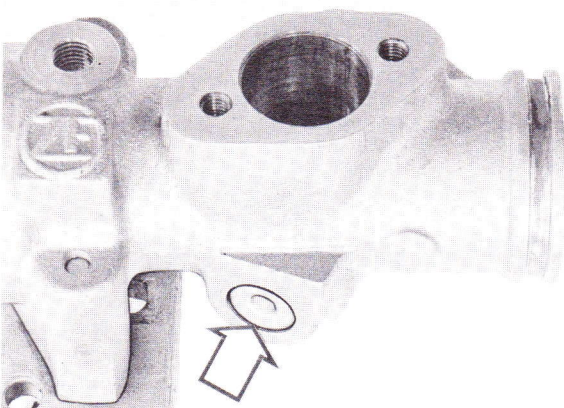


131 120

### Remove seal

Use screwdriver to remove seal.  
Be careful not to damage housing.

C17



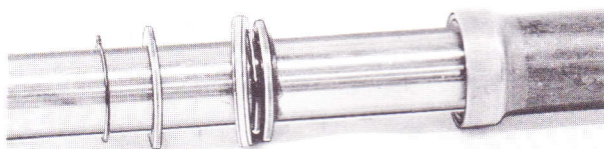
131 112

### Remove needle bearing

Tap out needle bearing using a long punch from inside of housing.

**NOTE:** Bearing should only be removed if it has to be replaced.

C19

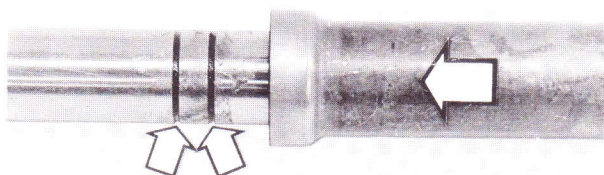


130 271

### Remove spacer (inner) tube from rack

Remove lock rings, thrust washers and piston with teflon ring and O-ring.

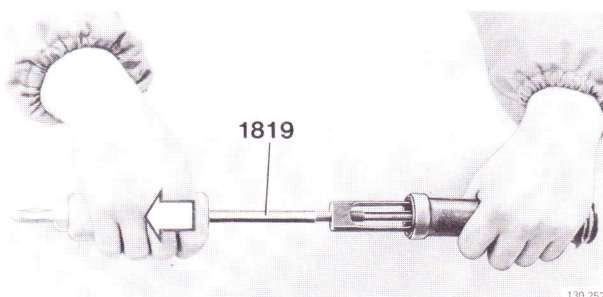
C19



130 273

Fill lock ring grooves with grease, then slide off tube towards the opposing end of rack teeth.

C20

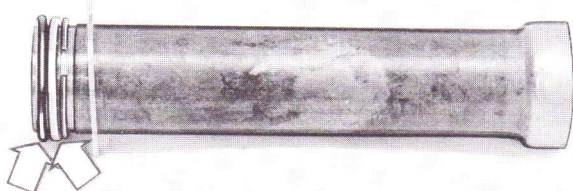


130 252

### Remove seal and bushing

Use tool **1819** for removal of spacer (inner) tube seal and narrow brass bushing.

C21



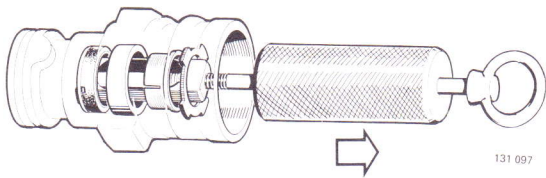
130 278

### Remove O-ring and teflon ring from spacer (inner) tube

**NOTE:** Lock ring and thrust washer shall only be removed should they have to be replaced.



C22

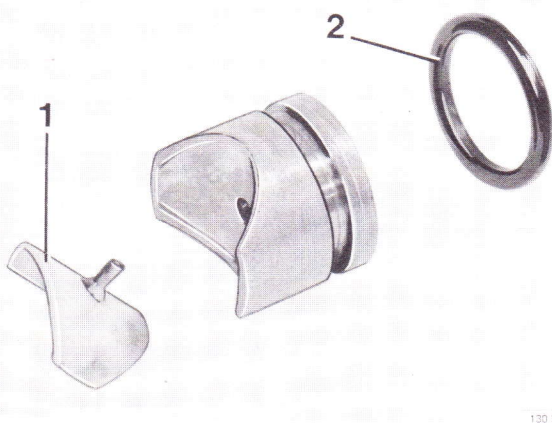


**Remove from the right housing:  
Teflon bushing, seal and star washer**

Use tool **1819** supported underneath washer.

**NOTE:** Washer seal and bushing can also be removed from the other end of housing using a suitable driver.

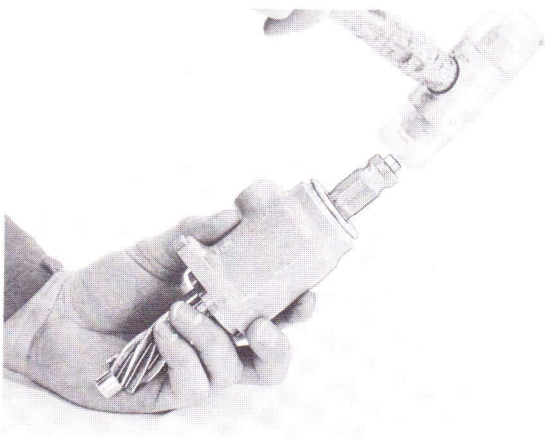
C23



**Remove from pre-tension piston**

- Depressor
- O-ring

C24



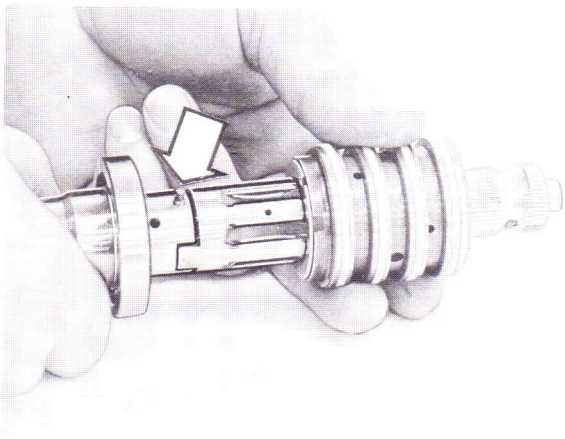
**Remove pinion assembly**

Remove rubber dust cover.

Use plastic mallet to tap pinion assembly out of housing.

Be careful not to drop bearing rollers.

C25



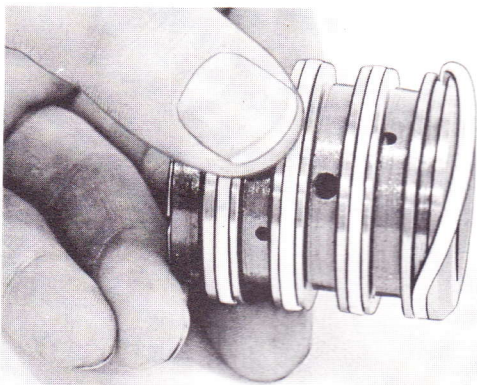
**Remove guide bushings from pinion shaft**

Be careful not to damage surfaces.

**CAUTION:**

**DO NOT** remove dowel pin. See Op. D1 for information.

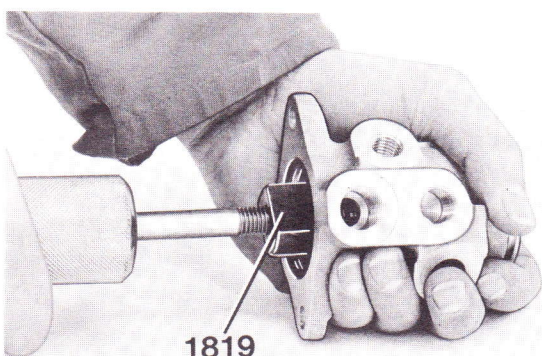
C26



131 122

**Remove sealing rings from guide bushing**

C27



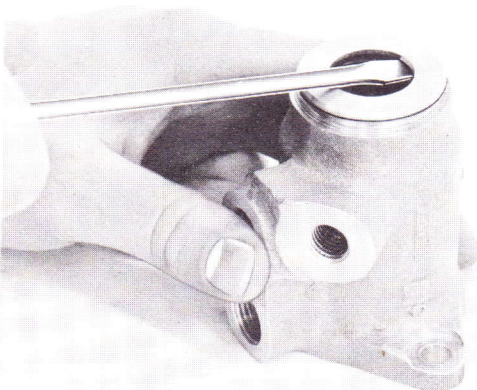
131 118

**Remove roller bearing from valve housing**

Remove 20 rollers.

Use extractor **1918** to remove bearing cage.

C28



131 114

**Remove seal from valve housing**

Use screwdriver to remove seal.

Be careful not to damage housing surfaces.

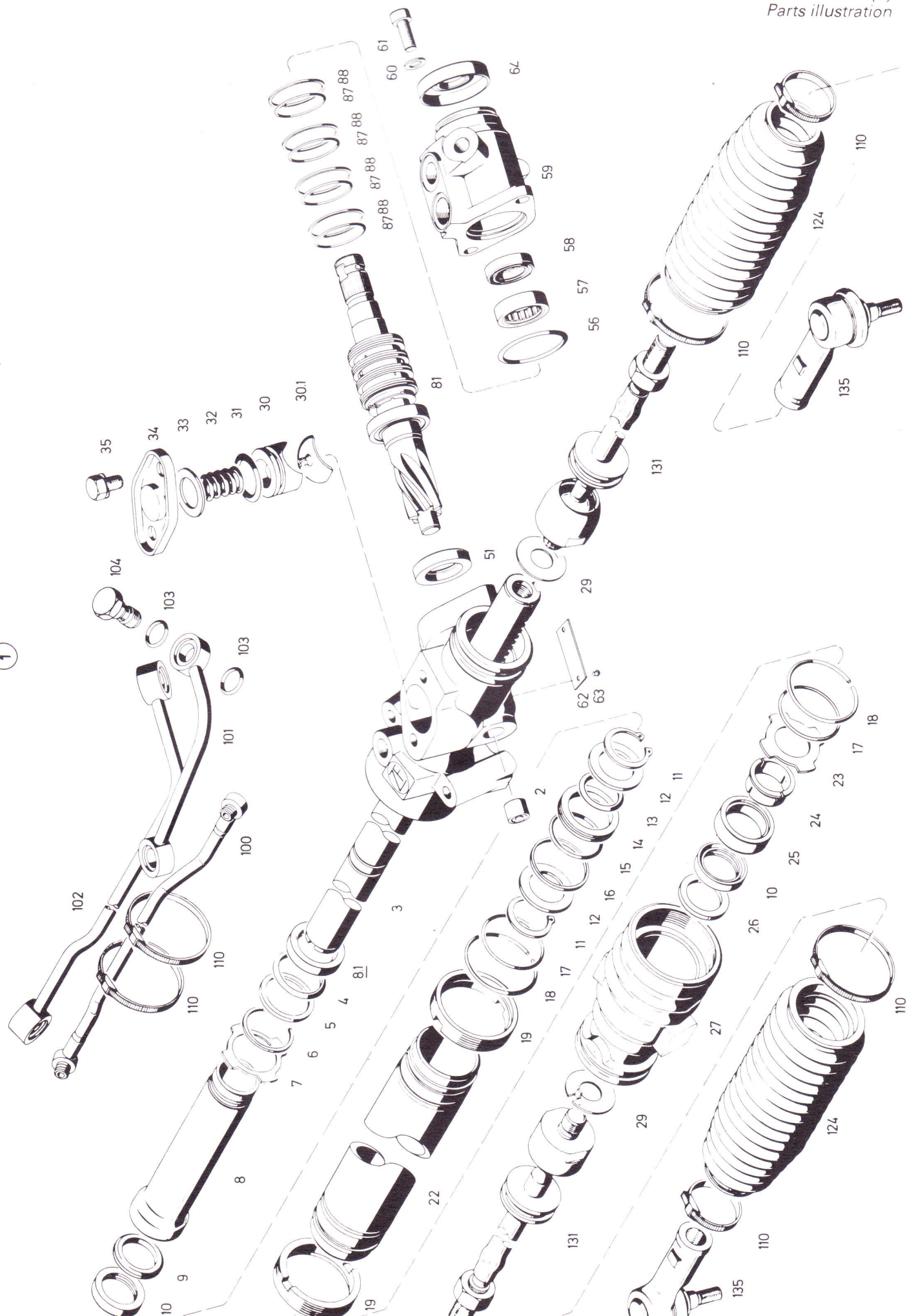


## ZF power steering gear with removable valve housing

### Key to illustration

2	Needle bearing	32	Spring
3	Rack	33	Spacer washer
4	O-ring	34	Cover
5	Spacer ring	35	Screw
6	Lock ring	51	Pinion seal
7	Lock washer	56	O-ring
8	Spacer tube	57	Bearing
8.1	Supporting ring	58	Pinion seal
9	Supporting ring	59	Valve housing
10	Seal	60	Spring washer
11	Lock ring	61	Screw
12	Washer	62	Label
13	O-ring	63	Rivet
14	Piston	64	Dust seal
15	O-ring	81	Valve unit
16	Piston ring	88	Seal
17	O-ring	100	Pipe (air)
18	Lock ring	101	Pipe (short)
19	Nut	102	Pipe (long)
22	Centre tube	103	O-ring
23	Lock washer	110	Pipe fitting
24	Bearing	124	Rubber bellow
25	Bearing	131	Steering rod
26	Thrust washer	135	Ball joint
27	Right end housing		
30	Pre-tensioning piston		
30.1	Depressor		
31	O-ring		

1



## ZF power steering gear with removable valve housing Assembly

### Special tools:

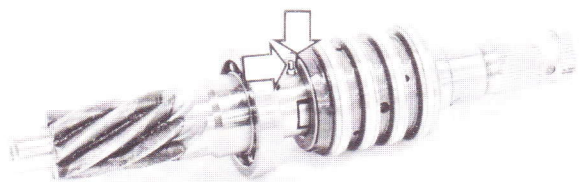
- 1801 **Standard handle**
- 5178 **Wrench**, tube nuts
- 5182 **Adapter**, installing pinion cover
- 5184 **Drift**, bearing and seal
- 5226 **Drift**, installing seal
- 5227 **Drift**, installing roller bearing
- 5865 **Press tool**, pre-tensioning device

### Lubricants:

- Volvo P/N 1 161 001-1
- Volvo P/N 161 006-0 (Or suitable if not available in USA and Canada)
- Automatic Transmission Fluid (ATF)

### Sealant:

- Volvo P/N 281 145-3
- (Or suitable if not available in USA and Canada)



131 112

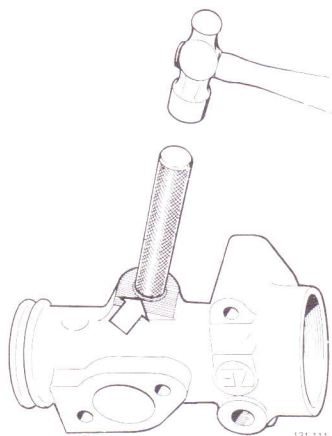
D1

### Clean/inspect/replace

Clean all parts. Inspect for wear and damage. Replace as necessary. **Always** replace seals and O-rings.

**CAUTION:** Never remove lock pin on valve unit. Valve unit setting will be lost and cannot be re-adjusted. So valve unit must be replaced.

If bearing or any other part of valve unit is defective, the valve unit and guide bushing assembly must be replaced.



131 111

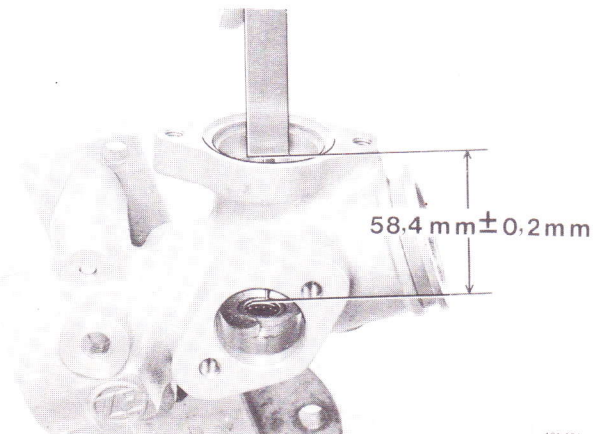
D2

### Install needle bearing in pinion housing (if removed)

Position: See D 3.

Lubricate needle bearing with lubricant, Volvo P/N 1 161 001-1.

Use drift to install bearing.



131 134

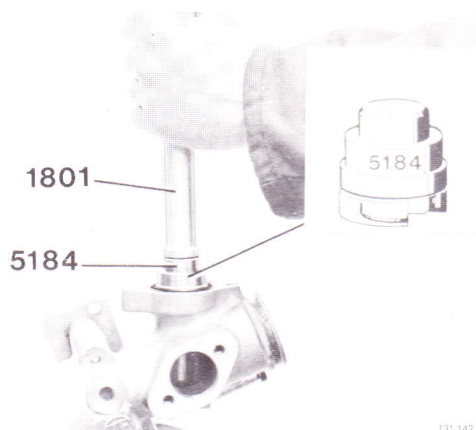
D3

### Correct bearing position:

$58.4 \text{ mm} \pm 0.2 \text{ mm} = 2.2992'' \pm 0.08''$  from seal bottom.



D4



### Install seal and O-ring in pinion housing

Use drift **5184**, applied as shown.

Seal lip should face UP.

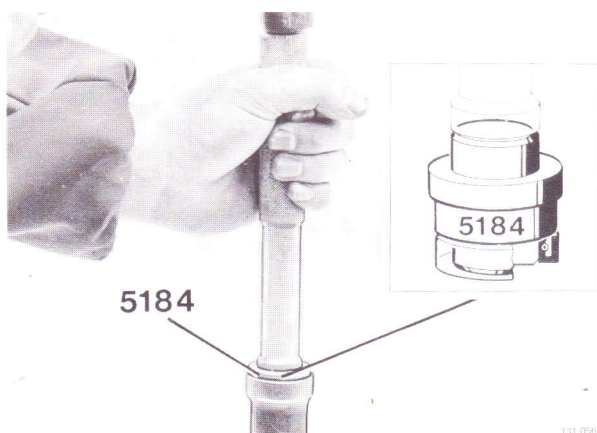
D5



### Install bronze bushing in spacer (inner) tube

Chamfered side DOWN.

D6



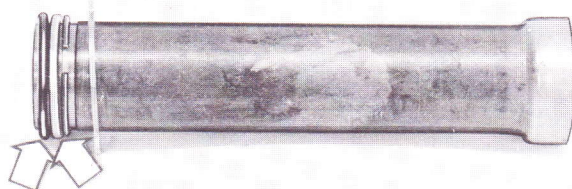
### Install seal in spacer (inner) tube

Fill lubricant, Volvo P/N 1 161 001-1, in space between seal lips.

Install seal in spacer tube, lips UP.

Use drift **5184** and handle **1801** applied as shown.

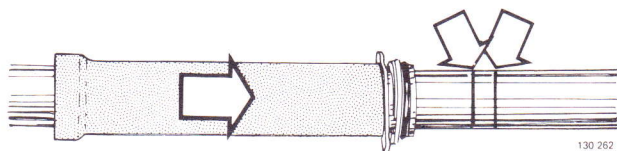
D7



### Install

- Spacer washer (if replaced)
- Lock ring (if replaced)
- Teflon ring
- O-ring

D8

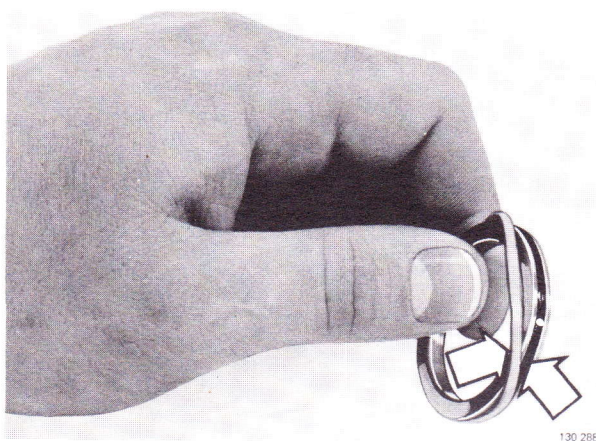


### Install spacer (inner) tube on rack

Fill snap ring grooves and coat surrounding area (indicated by the double arrows) with a thick heavy grease such as wheel bearing grease.

Slide spacer tube into steering rack from the smooth end and pass it quickly over snap ring grooves to prevent seal damage.

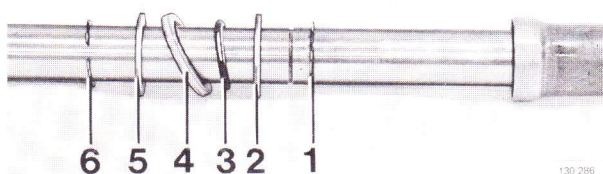
D9



### Install piston ring on piston

First install O-ring, then piston ring.

D10



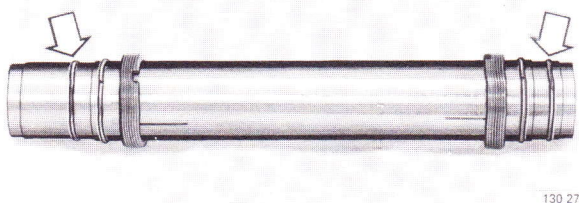
### Install piston with spacer washers and lock rings

Install in order

- Inner lock ring
- Spacer washer
- O-ring
- Piston with rings
- Second spacer washer
- Lock ring

Lock rings with chamfered side toward piston.

D11



### Install tube locking collars and lock rings

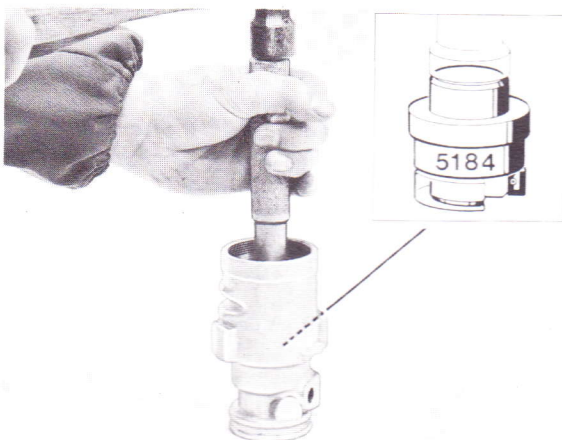
If tube collars have been removed, install on the center tube with recesses for wrench facing center of tube.

Apply lubricant Volvo P/N 1 161 006-0 on collar threads and lock rings.

Install O-rings.



D12



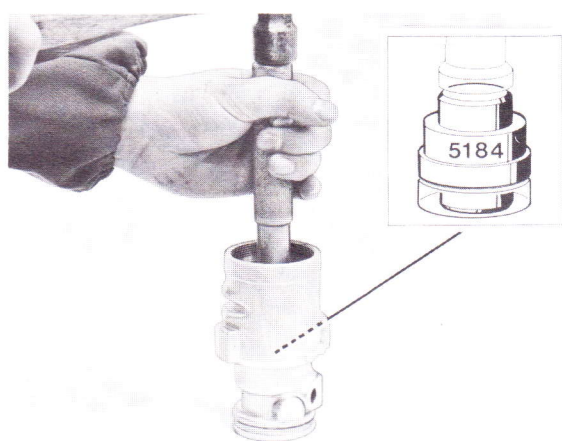
131 058

### Install seals in right side housing

Install bottom washer. Apply lubricant, Volvo P/N 1 161 001-1, on seal lips. Install seal with lips UP.

Use drift **5184** and handle **1801** applied as shown.

D13



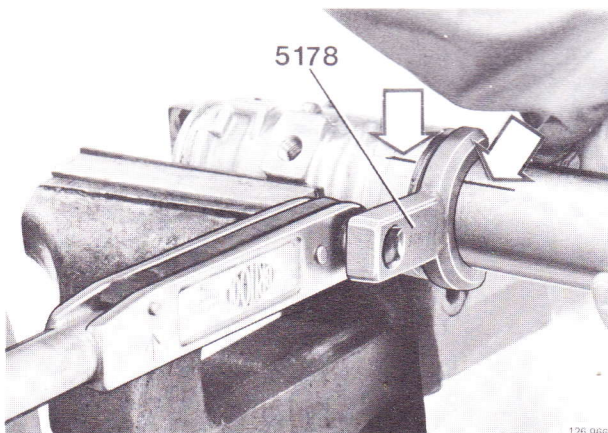
131 057

### Install metal bushing, teflon bushing and star washer

Use drift **5184** and handle **1801** applied as shown.

Install metal bushing (with recessed end up) teflon bushing and star washer, in that order.

D14



125 966

### Attach tube to right side housing

Place right side housing in a vice with soft jaws.

Apply ATF oil to both O-rings prior to installation.

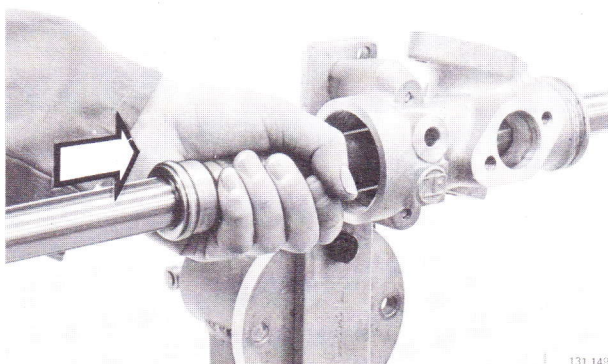
Install tube with long end IN.

Line up scribe marks on tube and housing.

Use wrench/spanner **5178** to torque nut to:  
**120 Nm = 88 ft.lbs.**

Apply lubricant to locking collar.

D15

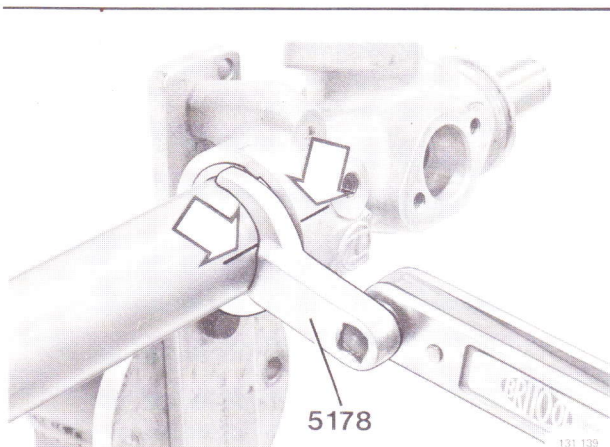


131 149

### Install rack and spacer (inner) tube assembly in pinion housing

Fill gear teeth with lubricant, Volvo P/N 1 161 001-1.  
Install rack and spacer tube assembly.





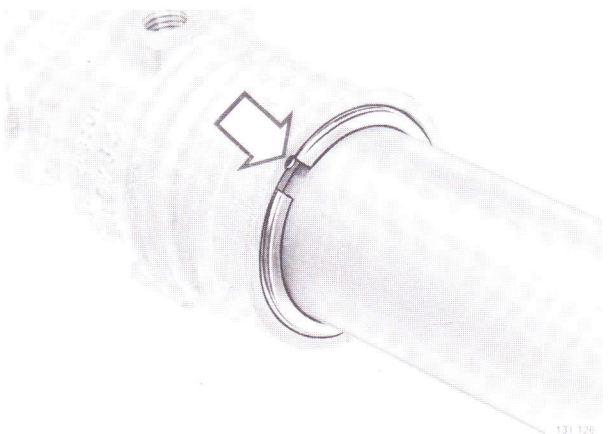
D16

**Attach right side housing and tube assembly to pinion housing**

Lubricate center tube with ATF, then attach preassembled right half of unit to pinion housing being careful not to damage piston and oil seals.

Line up marks made during disassembly and torque retaining collar to 120 Nm (88 ft.lbs.) with special tool 5178.

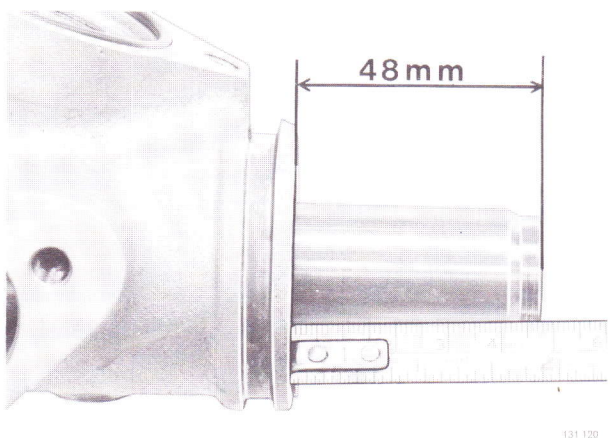
Collar threads should be lightly coated with Volvo lubricant before installation.



D17

**Lock retaining collars**

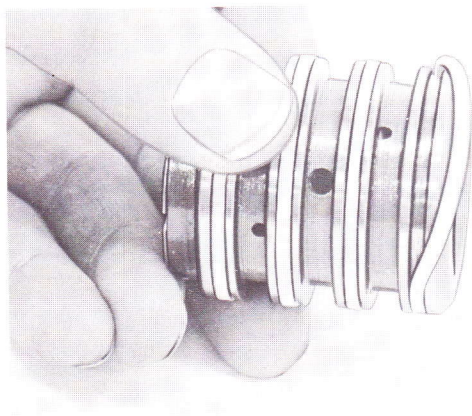
Punch each housing at one of the wrench recesses to lock collar.



D18

**Set rack**

Set rack end at 48 mm = 1 7/8" from edge of pinion housing.

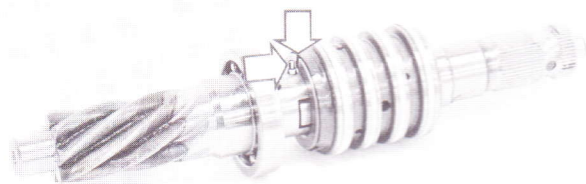


D19

**Install seal rings on guide bushing**

Apply ATF oil to seal rings prior to installation.

D20



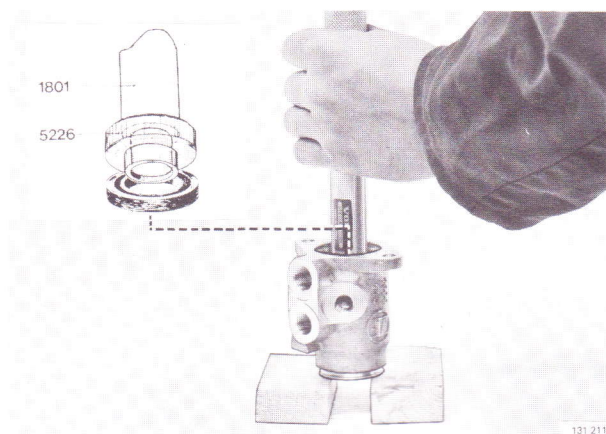
131 113

### Install guide bushing on pinion shaft

Apply ATF oil to surfaces. Install guide bushing. Align bushing with pin on shaft.

Be careful not to damage bushing or shaft.

D21



131 211

### Install seal in valve housing

Apply lubricant, Volvo P/N 1 161 001-1, to space between seal lips.

Install seal with lips toward drift **5226** and tap seal into housing.

Use two wooden blocks under valve housing.

D22

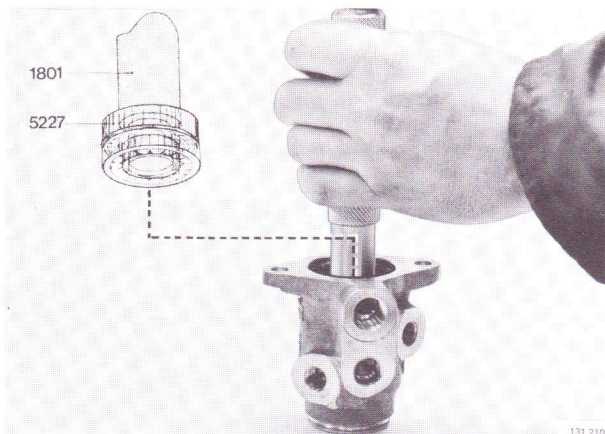


131 217

### Install rollers in roller cage

Apply lubricant, Volvo P/N 1 161 001-1, to roller cage. Install rollers (20).

D23



131 210

### Install roller bearing in pinion housing

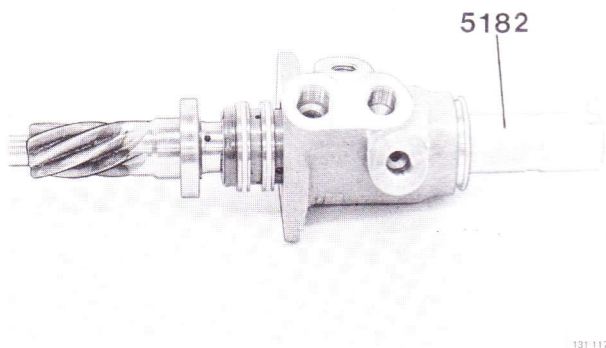
Use handle **1801** and drift **5227**.

Be careful when removing drift.

Rollers may follow drift up.



D24



### Install pinion assembly in valve housing

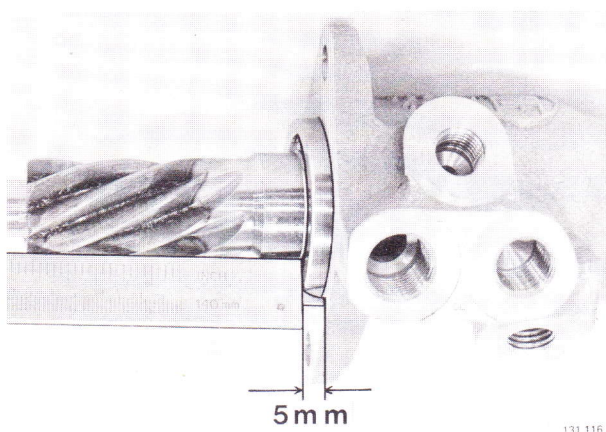
Apply ATF oil to housing and seals.

Install drift **5182** on valve housing.

Insert pinion assembly in valve housing.

Be careful not to damage seals or break rollers loose.

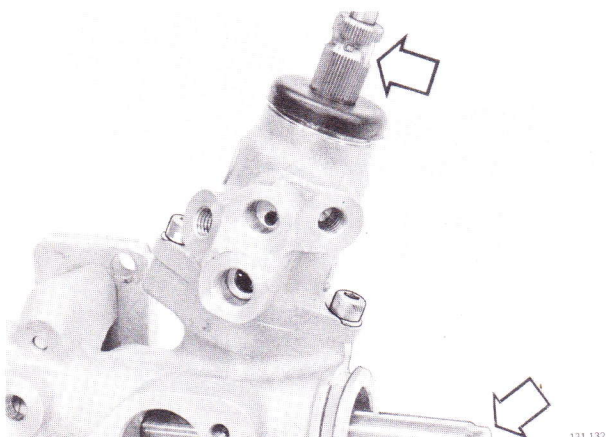
D25



### Check position

Pinion assembly should be 5 mm (0.2") from valve housing face.

D26



### Install valve housing assembly

Carefully install pinion assembly. Make sure O-ring positions correctly and does not become squeezed between valve housing and pinion housing.

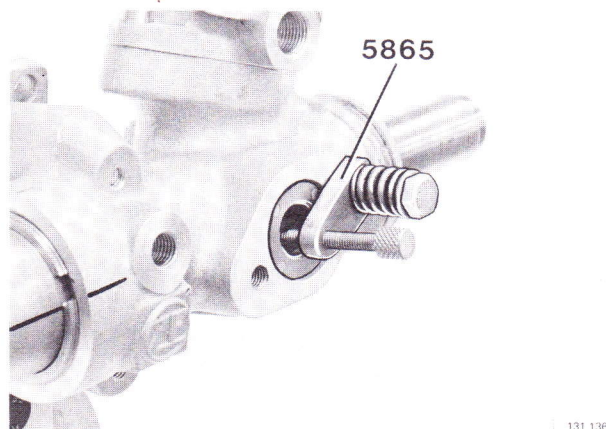
In correct position, flat on pinion should be toward rack end. If necessary, remove and correct.

Rack end should remain at 48 mm (1 7/8") from pinion housing.

Install inhex screws. Torque to:  
**25 Nm = 18 ft. lbs.**

Install dust cover on shaft.

D27



### Install press tool 5865

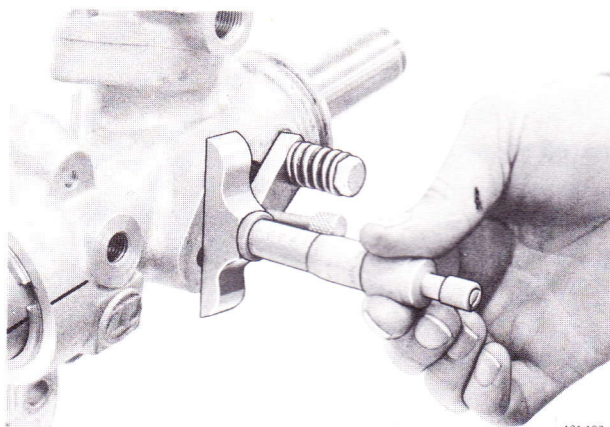
Install pre-tension piston with depressor but without O-ring.

Use 45 mm long M8 bolt to install press tool **5865**. Install piston spring on bolt to press on press tool.

Screw in press tool spindle until it will tension piston but not lock rack.



D28



131 137

### Measure distance

Use depth gauge/micrometer to measure distance between pinion housing and pre-tension piston.

Move rack to three different positions and determine piston's highest point.

D29

### Determine washer thickness

Subtract measured distance by 0.10–0.15 mm.

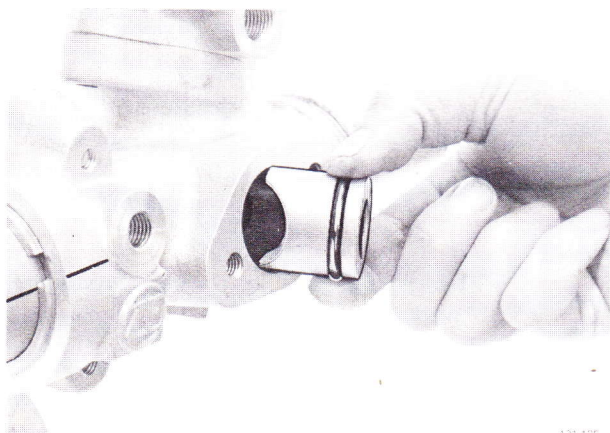
Remaining value determines thickness of spacer washer on top of pretension piston.

Spacer washers are available in increments of 0.05 mm from 2.10 mm to 2.90 mm.

D30

### Remove press tool 5865 and pretension piston

D31



131 135

### Install pre-tensioning device

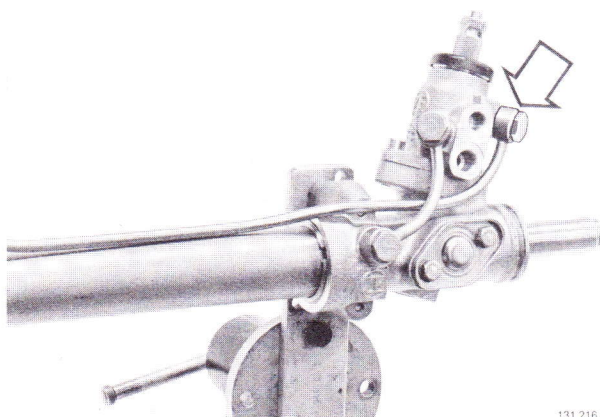
Install O-ring on pre-tension piston. Apply lubricant, Volvo P/N 1 116 001-1, to piston. Install piston in pinion housing.

Install pre-determined spacer washer and piston spring. Fill space round spring with lubricant, Volvo P/N 1 116 001-1.

Apply sealant, Volvo P/N 1 116 006-0 (USA and Canada: Suitable sealant) on cover sealing surfaces. Install cover.

Torque bolts to:  
**22 Nm = 16 ft.lbs.**

D32

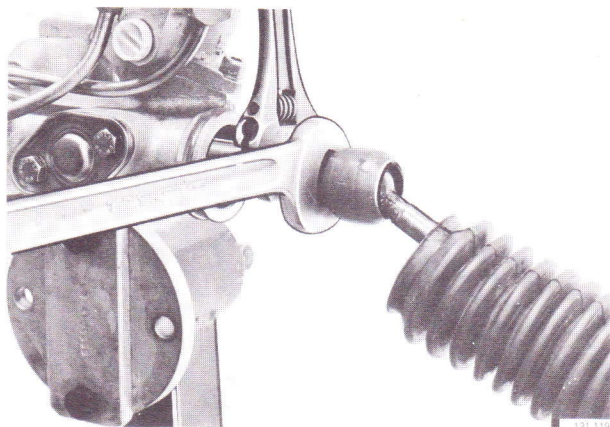


131 216

### Install oil pipes

Longest oil pipe first. Make sure O-rings sit correctly and are not squeezed.

Torque fittings to:  
**20 Nm = 15 ft.lbs.**



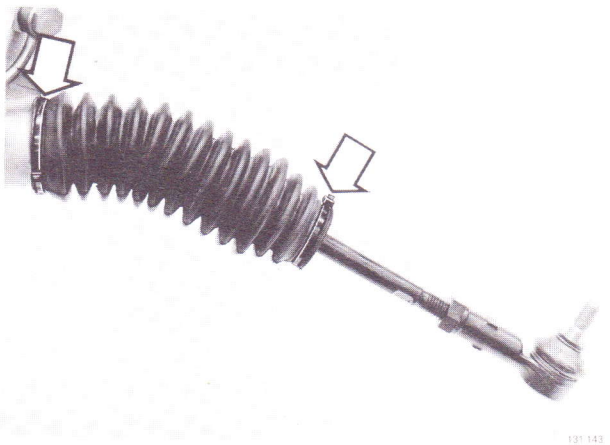
D33

### Install steering rods

Install locks and steering rods. Use wrench/spanner 27 mm (1 1/16") for lock nuts.

Use a wide adjustable wrench/spanner to hold on flat end of rack, outside teeth.

If no wrench/spanner is used as a counterhold the pinion gear may become damaged.



D34

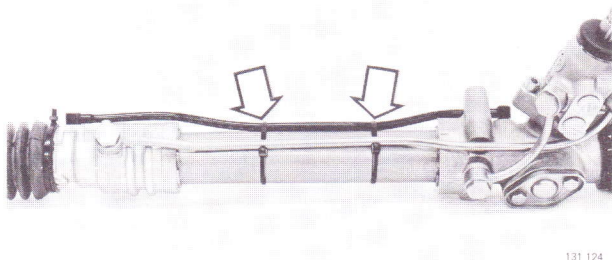
### Finalize steering rod installation

Bend back steering rod locks.

Install rubber bellows. Fill approx. 20 grams (3/4 oz.) of lubricant, Volvo P/N 1 161 001-1, into each rubber bellow.

Attach rubber bellows to housings.

Install inner and outer clamps on both sides.



D35

### Remove steering gear from fixture

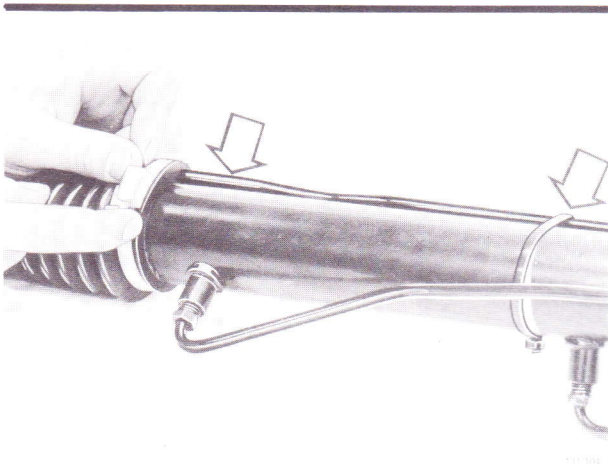
Install equalizer tube. Clamp the tube with two plastic clamps.

## Cam Gear power steering gear with aluminium housing

### Disassembly

#### Special tools:

- 1819 **Standard handle**
- 2520 **Repair stand** (or 5154)
- 5046 **Fixture**
- 5049 **Sleeve**, pinion bearing
- 5154 **Repair stand** (or 2520)
- 5179 **Socket**, steering gear torque

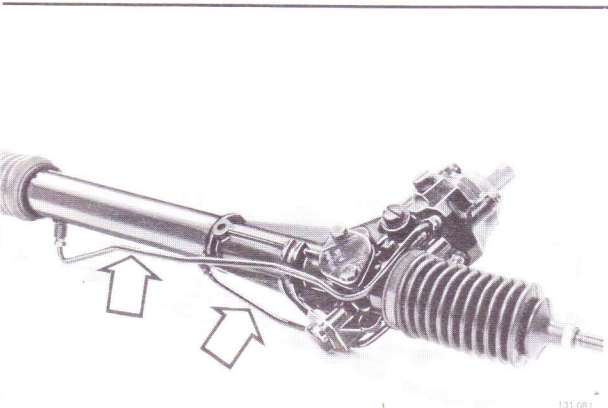


E1

#### Clean exterior of steering gear, remove equalizer tube

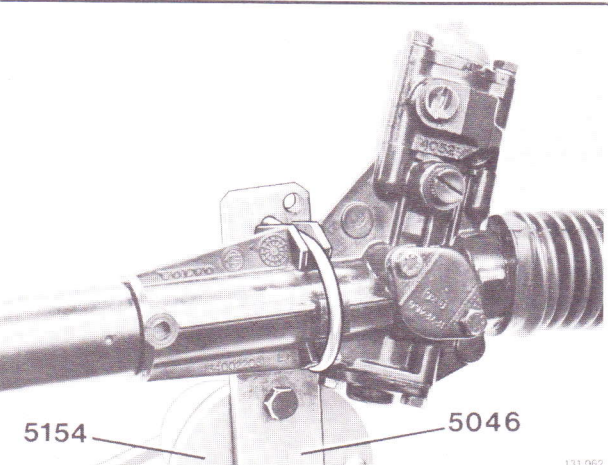
Remove hose clamps holding rubber belows. Clamps are removed by pushing them to the side.

Cut clamps and remove the tube.



E2

#### Remove the two pressure tubes

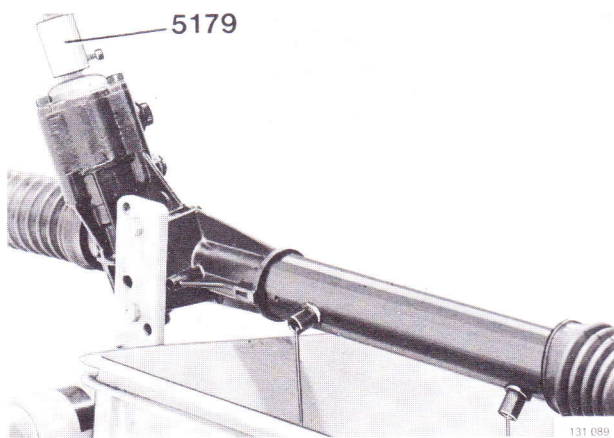


E3

#### Attach steering gear to fixture 5046

Using fixture **5046** and stand **2520** or **5154**, place steering gear as shown using the vehicle's U-bolt as a fastener.





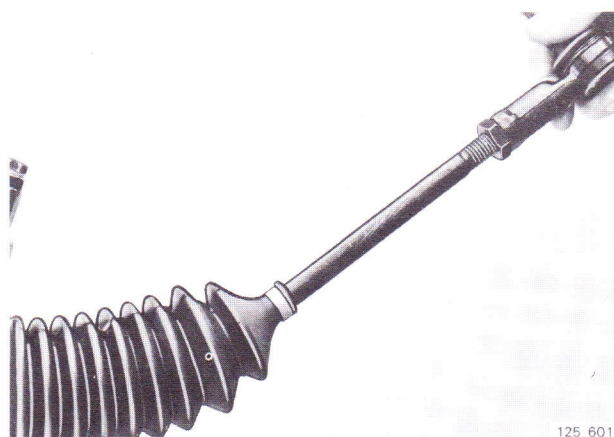
E4

#### Drain lubricant

Empty any remaining oil from rack.

Place an oil pan under pressure pipe outlets.

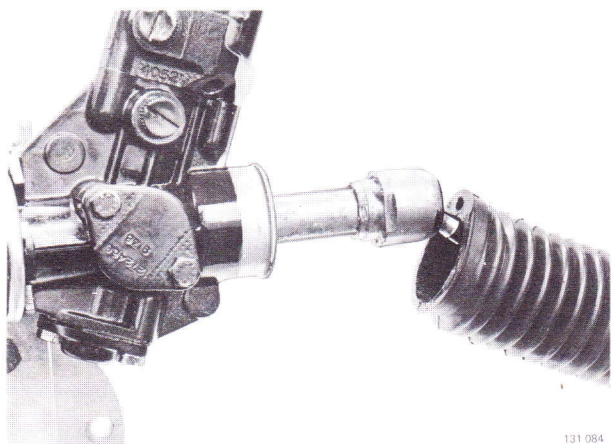
Using tool **5179** and a suitable handle, slowly turn pinion back and forth in full strokes, until all oil is removed. Then place rack in a central position.



E5

#### Check for wear

Check for excessive wear of inner and outer ball joints, left and right side.

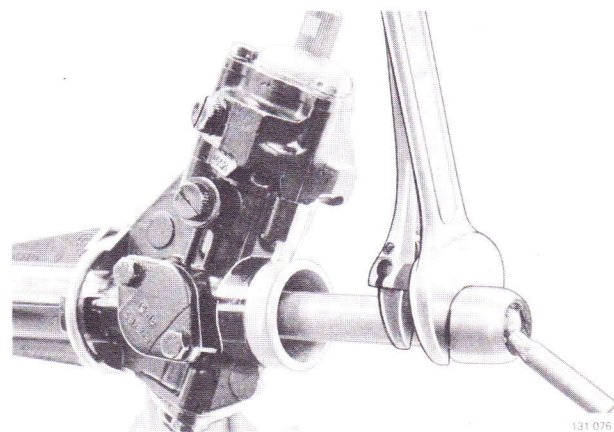


E6

#### Remove all grease

Remove outer clamp and pull back rubber bellows.

Clean grease from rack and ball joint area.



E7

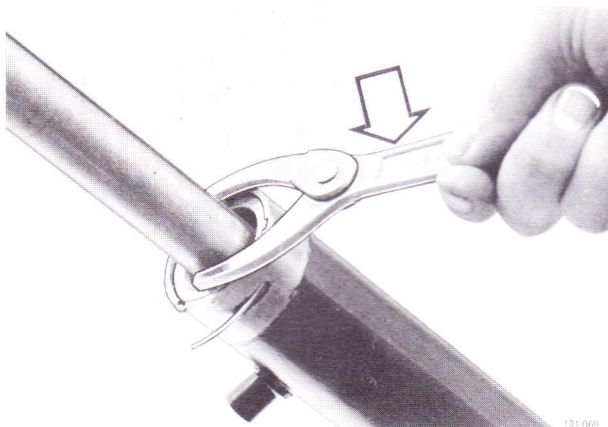
#### Remove steering rods

Use a 32 mm open end wrench on ball joint and counterhold rack rod with a large adjustable wrench.

Place adjustable wrench as close a possible to ball joint.

Remove left side steering rod completely, then loosen right side and allow to remain on rack.

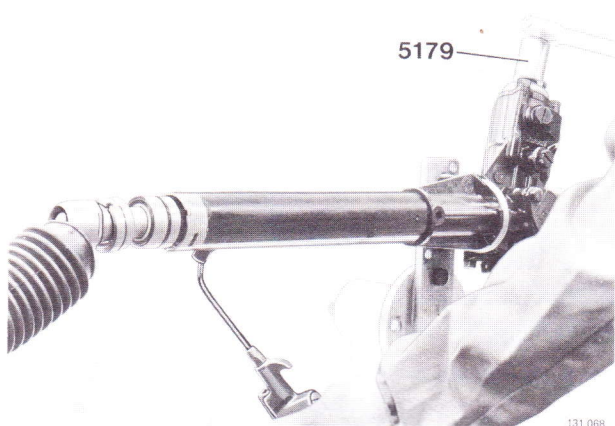
E8



### Remove locking wire for cage on right side

Turn end housing clockwise using a suitable tool (as shown). Steel wire will then protrude through hole in tube.

E9



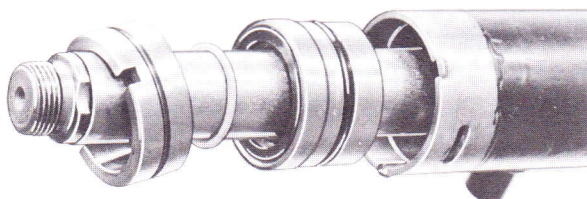
### Remove end housing and bushing

Using tool **5179** and a handle to hold pinion stationary, apply compressed air (as shown).

E10

### Remove right hand side steering rod

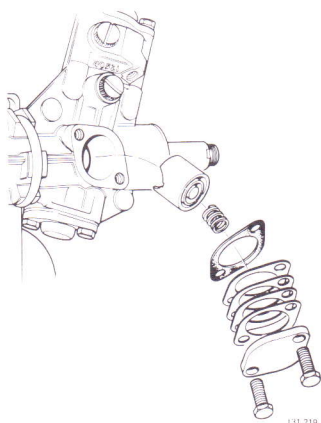
E11



### Remove bearing assembly

Remove end housing plastic ring and bushing.

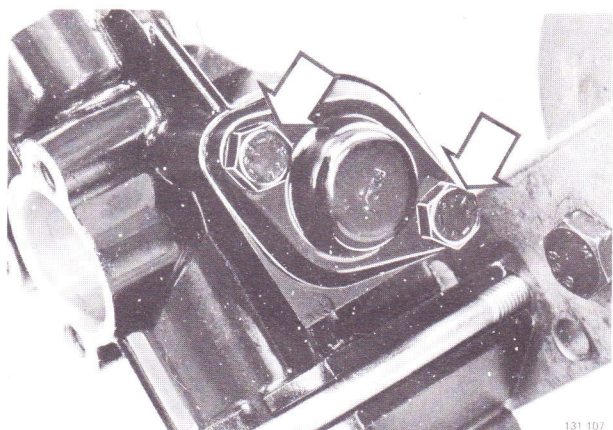
E12



### Remove pre-tension device

- Remove
- Cover
  - Shims
  - Spring
  - Piston



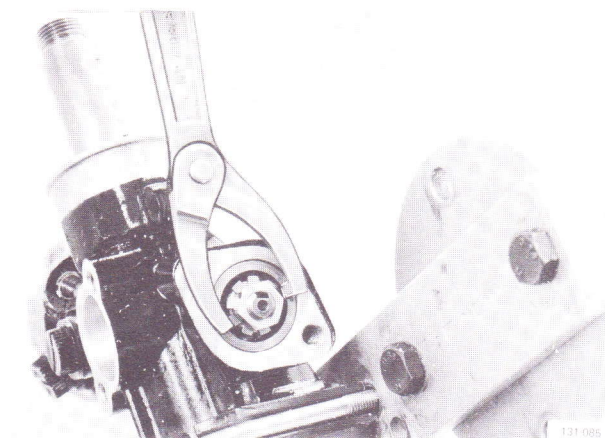


131 107

E13

#### Remove

- Pinion cover
- Lock washer
- Gaskets

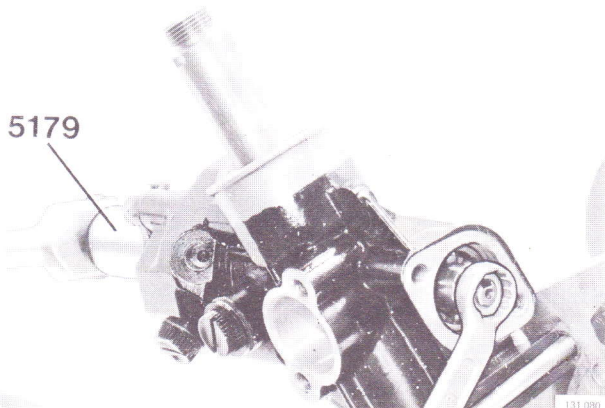


131 085

E14

#### Remove spacer (inner) sleeve

Use a hook spanner.



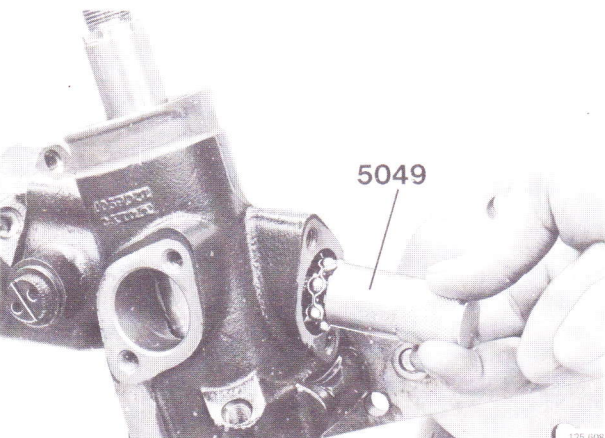
131 080

E15

#### Remove nut

Bend back lock washer.

Use socket **5179** to hold shaft while unscrewing nut.  
Valve should not move.



125 608

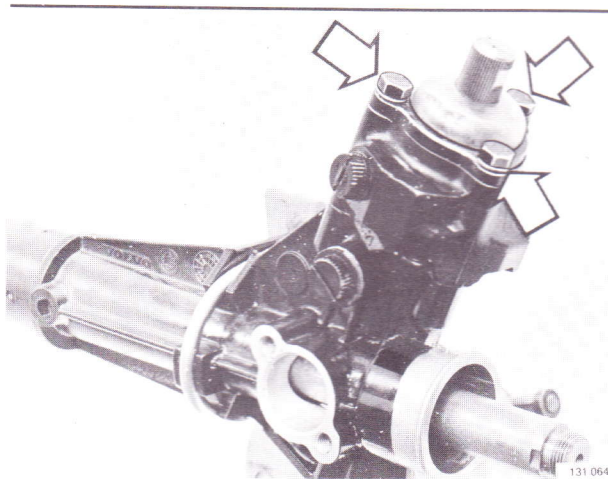
E16

#### Remove

- Inner bearing race
- Ball cage
- Lower race

Use sleeve **5049**.

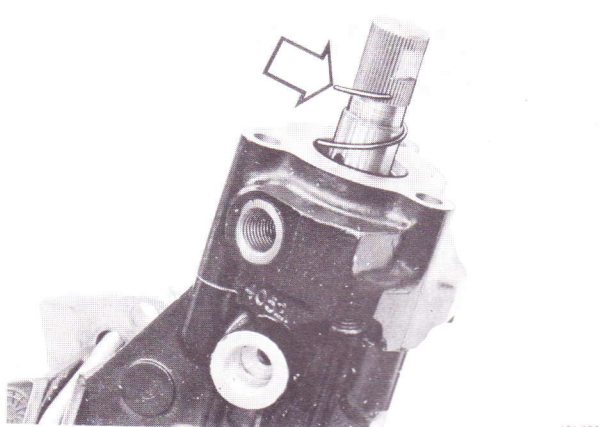




E17

**Remove**

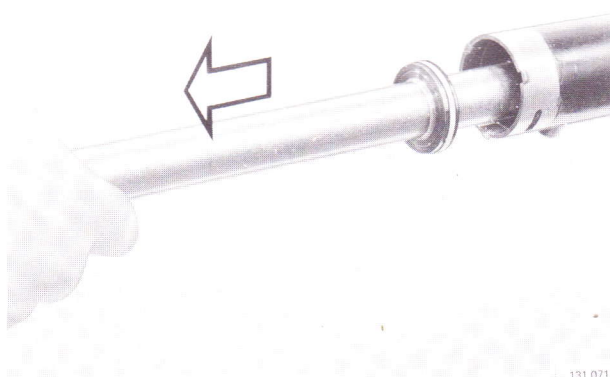
- Dust seal
- Valve housing cover
- O-ring



E18

**Remove**

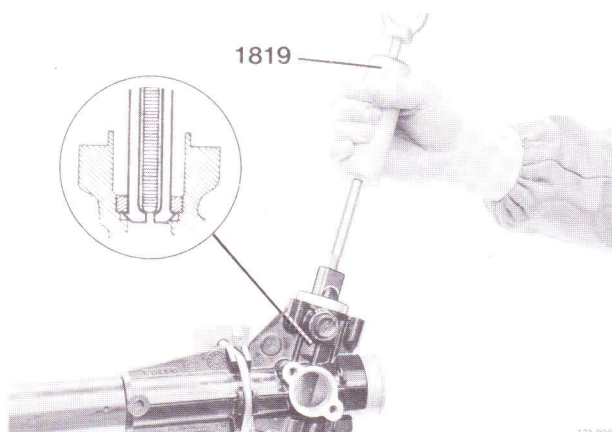
- Spring
- Valve housing and pinion gear. Be careful not to damage valve or valve housing
- O-ring



E19

**Remove rack**

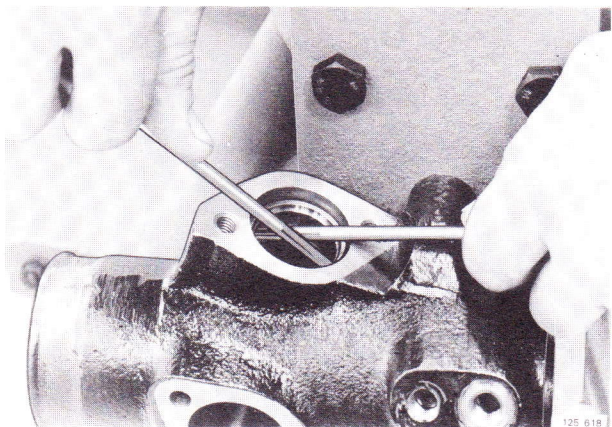
Carefully pull out rack on right side.



E20

**Remove upper bushing and seal for pinion gear**

Use extractor 1819.

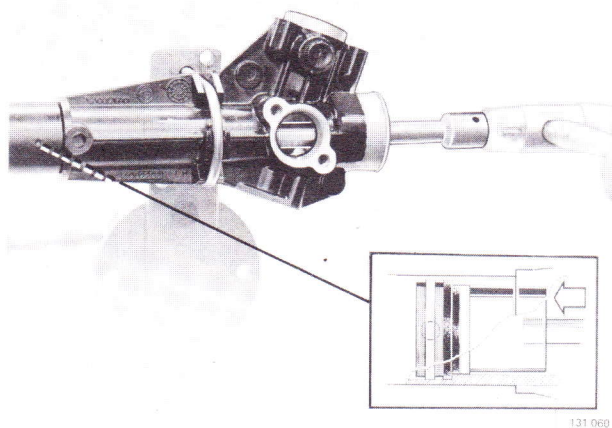


E21

**If necessary, remove inner race for pinion lower bearing**

No need to remove if bearing is OK.

Use two narrow screwdrivers to remove race.



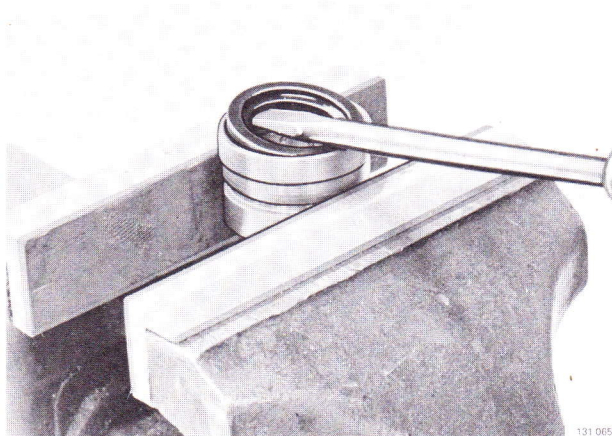
E22

**Tap out seal and spacer ring from tube**

Carefully tap out rack rod seal ring and spacer sleeve from steering gear tube.

Use a 27 mm (1 1/16") socket and two long extensions inserted through housing.

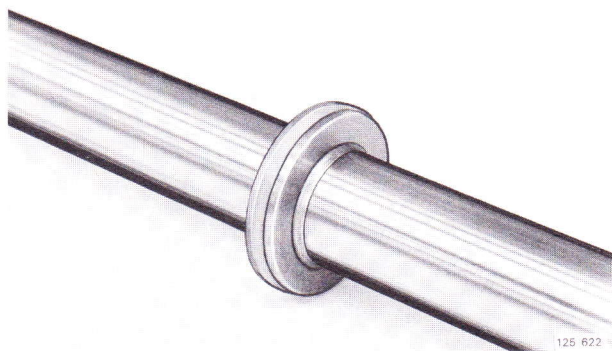
**CAUTION:** It is of vital importance that inner surface of tube is **NOT** damaged by scratches.



E23

**Remove O-ring and seal from bearing**

Place bearing in a vice with soft jaws and pry out seal.



E24

**Rack Rod Piston Seal**

Seal ring should only be removed if it is damaged or if vehicle has been driven in excess of 25,000 miles (40,000 km).

E25



131 066

### **Clean/inspect/replace**

Thoroughly clean all parts. Inspect for wear and damage.

Replace all seals, O-rings, and valve housing cover. See Op. E24 re. piston seal.

If pinion control valves or housing are damaged, the parts should be replaced as one assembly.

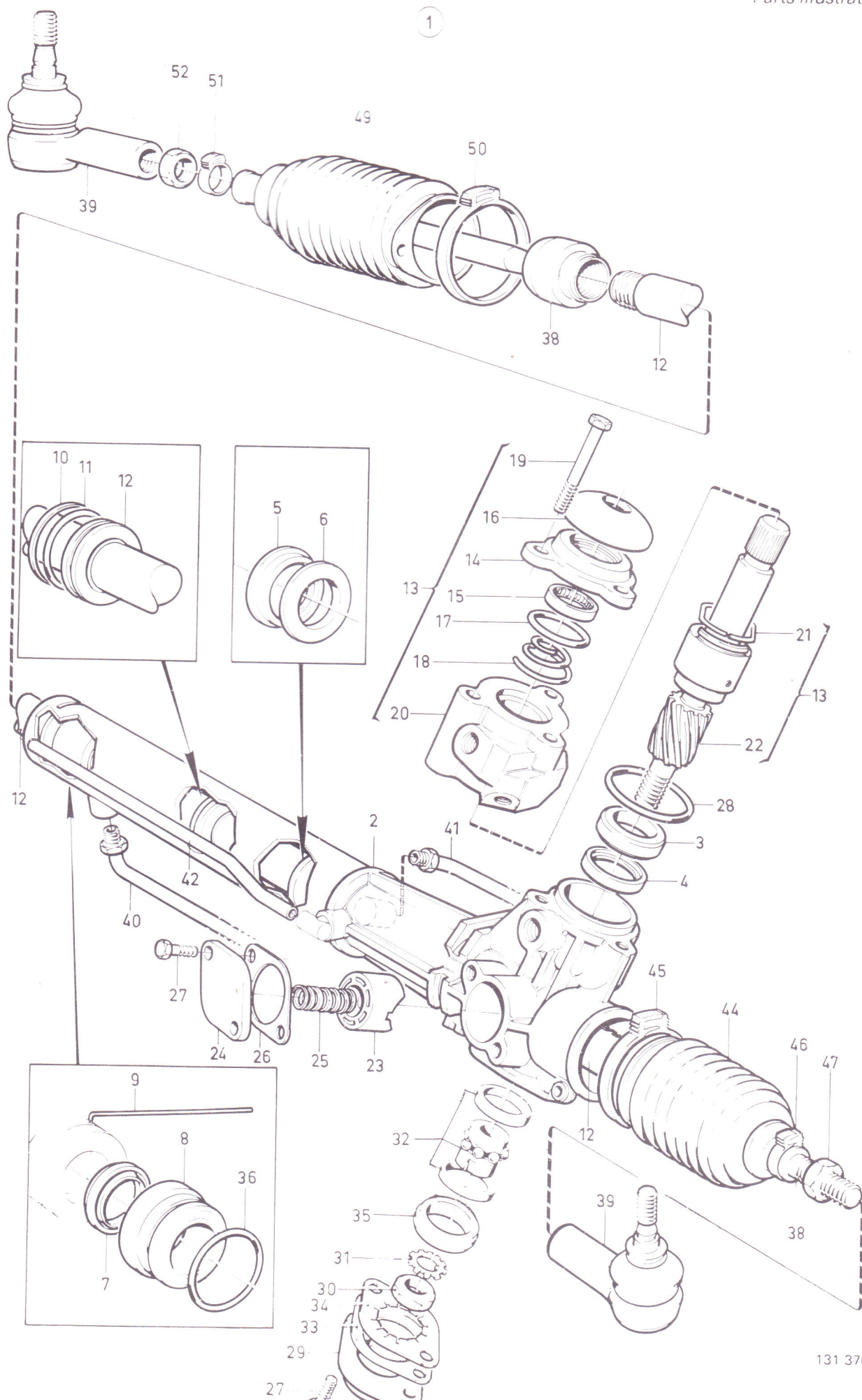
Should right side rack bushing require replacement, complete rack sleeve must be replaced.



## Cam Gear power steering gear with aluminium housing

### Key to illustration

2 Steering gear housing and tube assembly	26 Shim
3 Bearing	27 Screw
4 Seal	28 O-ring
5 Seal	29 Cover
6 Supporting ring	30 Lock nut
7 Seal	31 Lock washer
8 Bearing	32 Ball bearing
9 Locking wire	33 Gasket
10 Piston ring	34 Lock washer
11 O-ring	35 Lock ring
12 Rack	36 O-ring
13 Valve unit with pinion	38 Steering rod
14 Cover	39 Ball joint
15 Bearing	40 Oil pipe
16 Dust seal	41 Oil pipe
17 O-ring	42 Equalizer tube
18 Spring	44 Rubber bellow
19 Screw	45 Clamp
20 Valve housing	46 Clamp
21 Lock ring	47 Nut
22 Pinion	49 Rubber bellow
23 Pre-tensioning piston	50 Clamp
24 Cover	51 Clamp
25 Spring	52 Nut



## Cam Gear power steering gear with aluminum housing

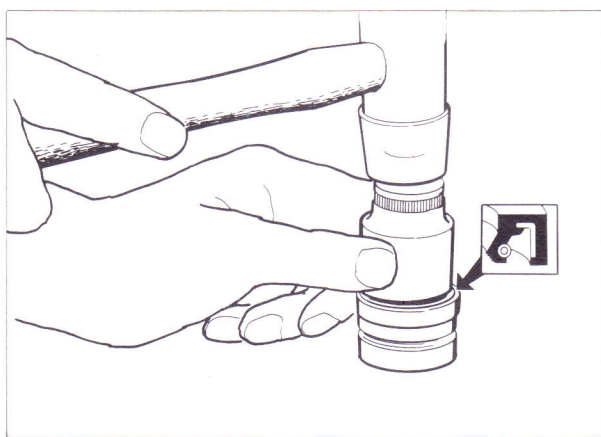
### Assembly

#### Special tools:

- 1801 **Standard handle**
- 5049 **Sleeve**, pinion bearing
- 5179 **Socket**, pinion shaft
- 5182 **Sleeve**, installing cover
- 5184 **Drift**, seal and bearing
- 9177 **Torque gauge**, steering gear

#### Lubricants:

- Volvo P/N 1 161 001-1
- Automatic Transmission Fluid (ATF)



131 063

F1

**Apply ATF oil to all parts prior to assembly**

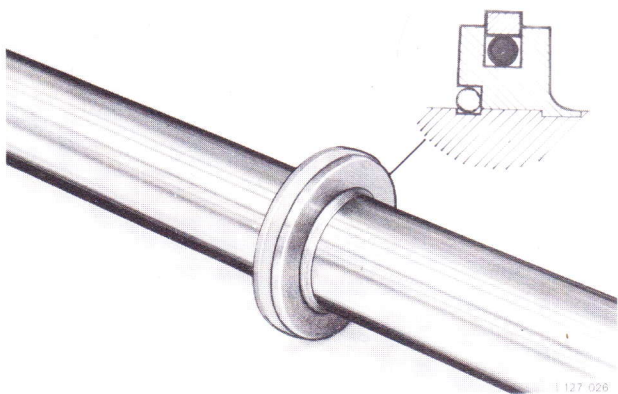
F2

#### Install seal and O-ring

Install seal and O-ring in right side rack sleeve.

Seal lips should face down.

Lubricate seal lips before installation and use a suitable socket as a press tool.



127 026

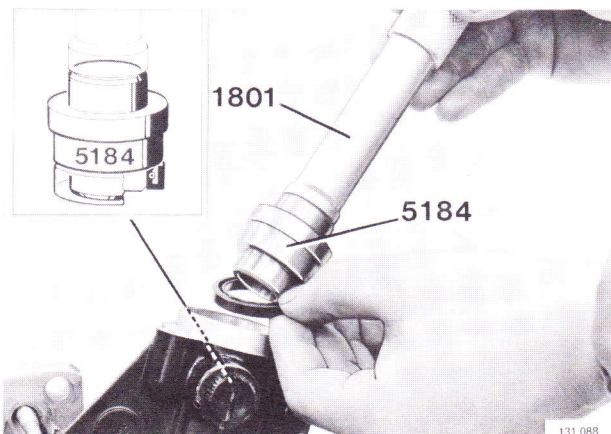
F3

#### Piston seal

Also see op. E2.

First install O-ring and then teflon ring.

Should teflon ring be too difficult to install, it can be heated to 40–50°C (104–122°F).



131 088

F4

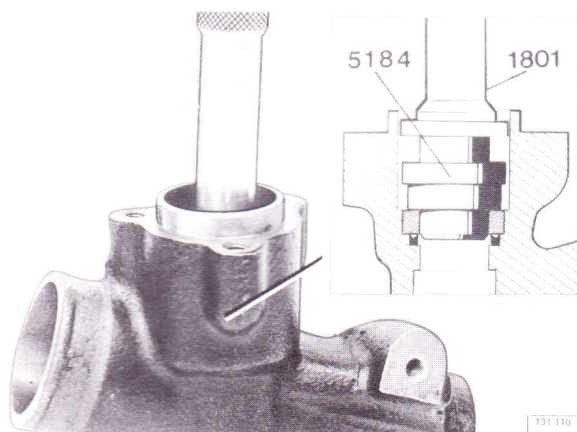
#### Install seal ring in pinion housing

Seal ring lip must face up.

Use tool **1801** and **5184** as shown.



F5

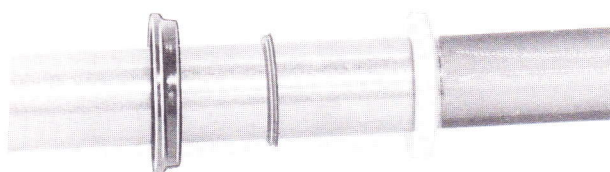


### Install bearing in pinion housing

Prior to assembly, make sure that bearing turns freely on the pinion shaft.

Use tools **1801** and **5184** as shown.

F6

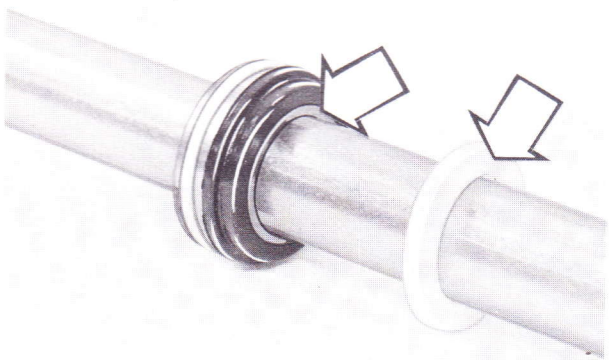


### Install seal and spacer washer on rack rod

First fit spacer washer from the rack toothed side. Then cover rack teeth with tape (for protection) and apply ATF lubricant.

Install seal with lips facing inwards (towards the centre of rack). Next install tapered spacer washer with taper facing seal ring, then second spacer washer.

F7



### Push the two spacer washers together

Make sure to remove tape completely and any glue residues.

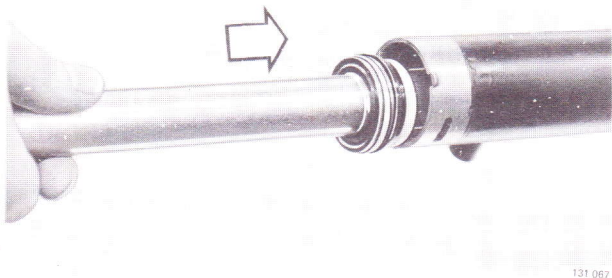
F8



### Lubricate rack teeth

Fill rack teeth with lubricant Volvo P/N 1 161 001-1.

F9



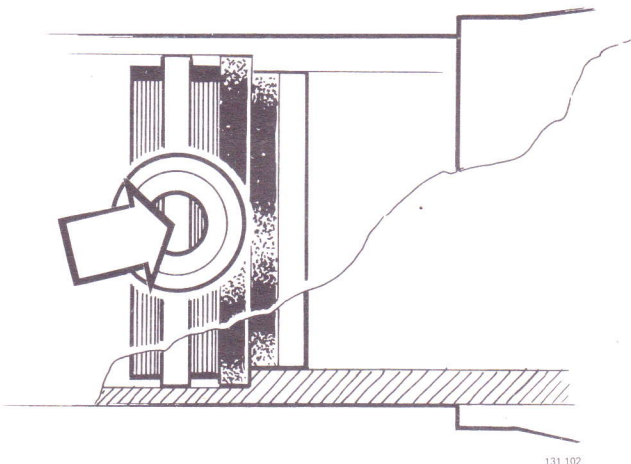
131 067

### Install rack-rod with seals

With teeth facing up, carefully insert rack — avoid scratching the piston tube surface.

As seal ring enters tube, apply pressure on rack. Seal ring and distance washers will lock into position in tube.

F10

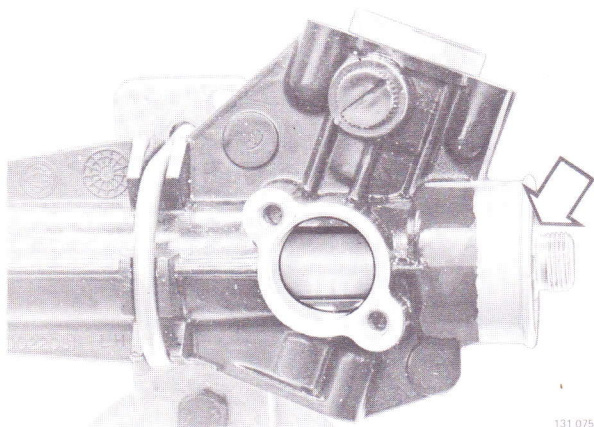


131 102

### Check for correct seating of seal ring

By inspecting through inner high pressure hole, rack piston teflon ring should line up with centre of the hole. This indicates seal ring has reached bottom position.

F11



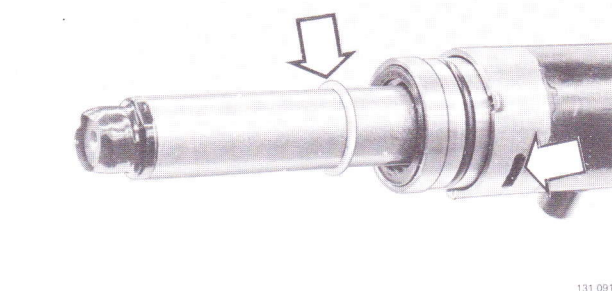
131 075

### Return rack

Pull rack rod back until it is positioned flush with pinion housing left side.

Rack **MUST NOT** be pulled back further, as seals might become damaged.

F12



131 091

### Install right side rack bushing sleeve and plastic spacer ring

Lubricate all components.

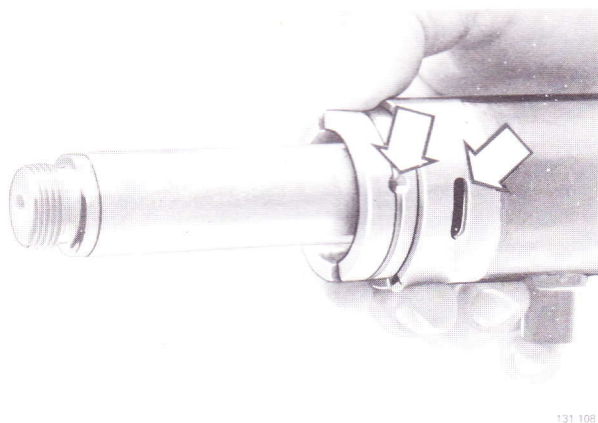
To protect seal, cover threads and edge of the rack with tape. Install rack sleeve with seal facing to the right (towards steering rod end). Take care not to damage sleeve outer O-ring against lock wire groove, as sleeve is pressed into tube.

Install plastic spacer ring on rack with bevelled edge towards seal.

Remove tape.



F13

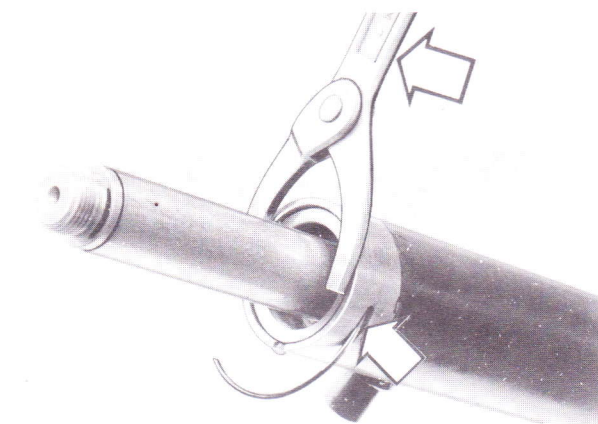


131 108

### Install right end lock sleeve

Place sleeve on rack with recesses for tool facing steering rod end. Turn sleeve so that hole in lock sleeve lines up with elongated hole in tube.

F14



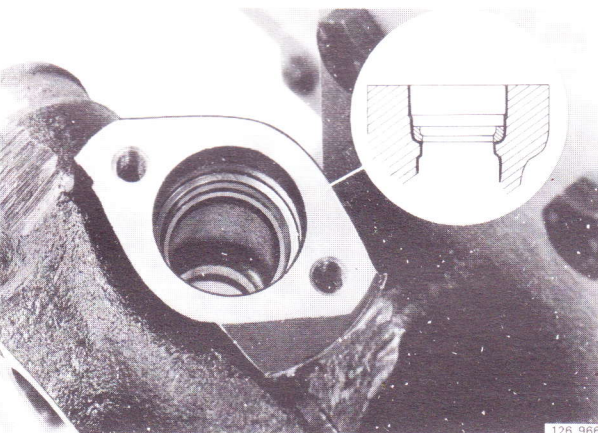
131 090

### Install locking wire

Use a **new** wire.

Install locking wire as shown. Using a suitable tool, slowly turn sleeve anti clockwise until end of locking wire is positioned inside elongated hole in tube.

F15

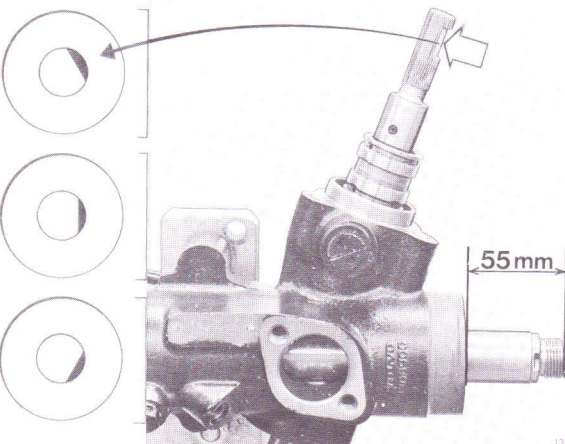


126 966

### Install inner race for pinion lower bearing

(If removed)

F16



131 094

### Install rack rod and pinion

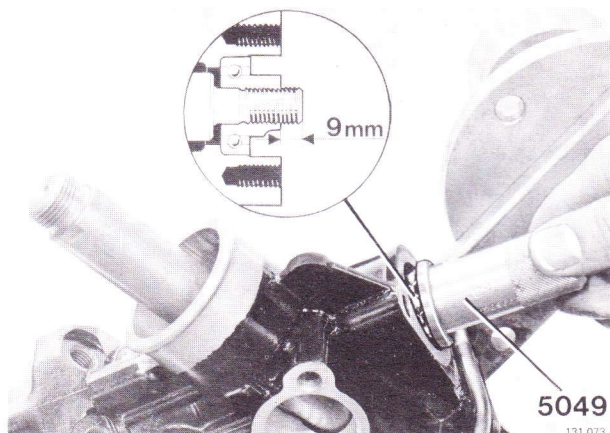
Lubricate components with Volvo lubricant P/N 1 161 001-1. Pinion gear should be packed (filled) with grease.

Install rack rod in housing as shown.

With pinion in place, measurement 55 mm (2 1/8") on rack should be maintained, with flat portion of lockbolt in one of three positions as shown.

Be careful when installing pinion not to damage valve.



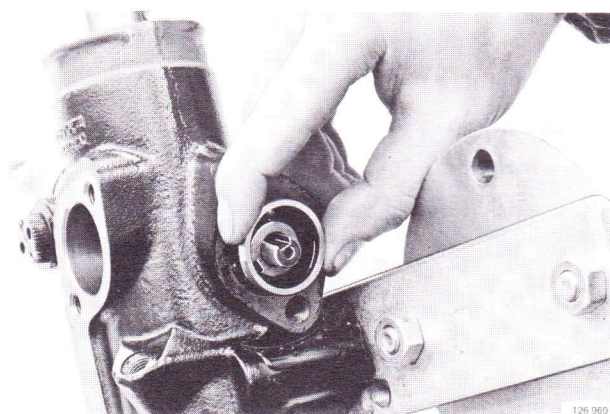


F17

### Install inner bearing cup and cage

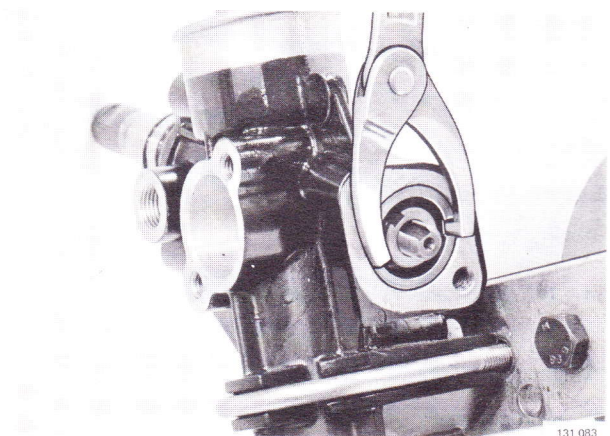
Use tool **5049** to screw on bearing.

Shaft end should protrude approximately 9 mm (23/64"). This will facilitate adjustment later on.



F18

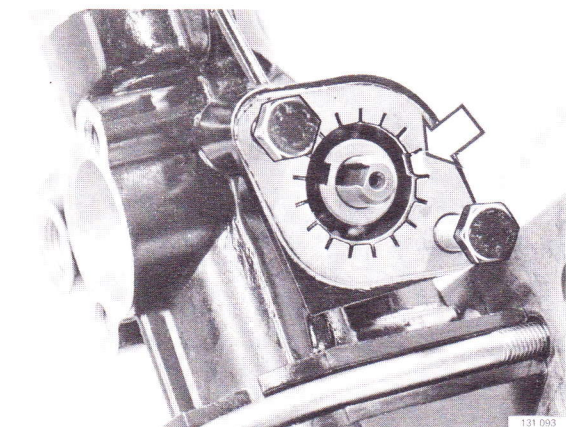
### Install outer race for lower pinion bearing



F19

### Install spacer sleeve

Install sleeve on top of bearing race. Use a suitable tool to screw the sleeve in until it bottoms.



F20

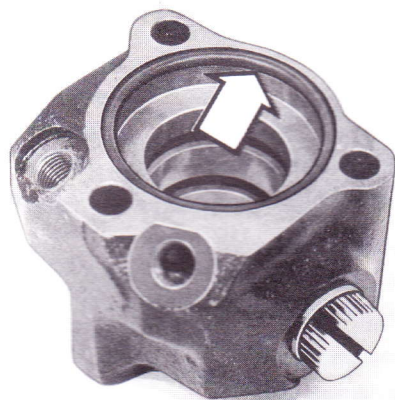
### Determine lock washer position

Place lock washer in position, leaving the two bolts finger tight.

Bend down the lock tab which is lined up with one of recesses on the sleeve.

Remove bolts and washer.

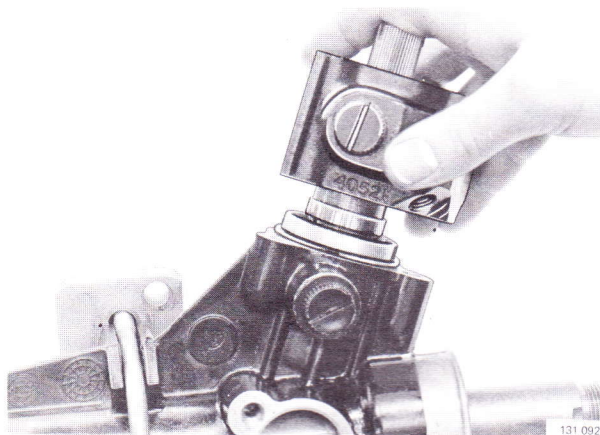
F21



126 973

**Install O-ring in lower part of valve housing**

F22

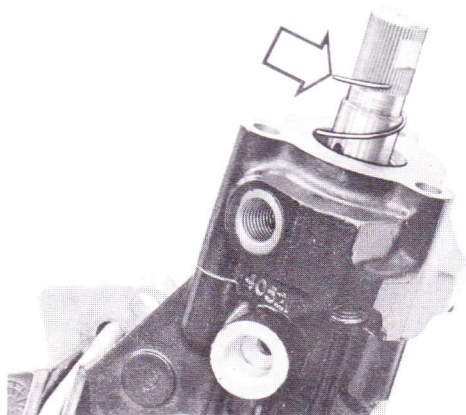


131 092

**Install valve housing**

Be careful not to damage housing or pinion valve assembly.

F23

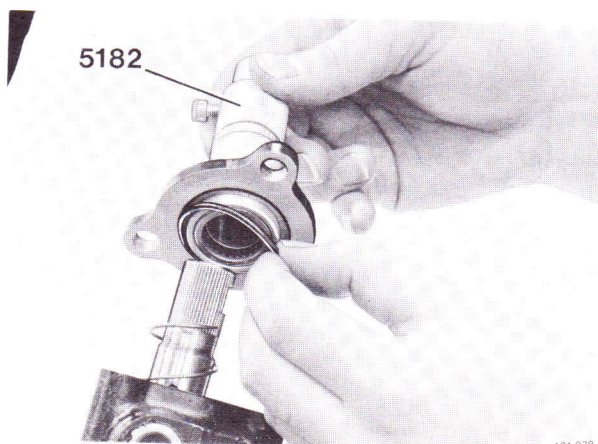


131 086

**Install coil spring**

The large end of spring faces down.

F24



131 078

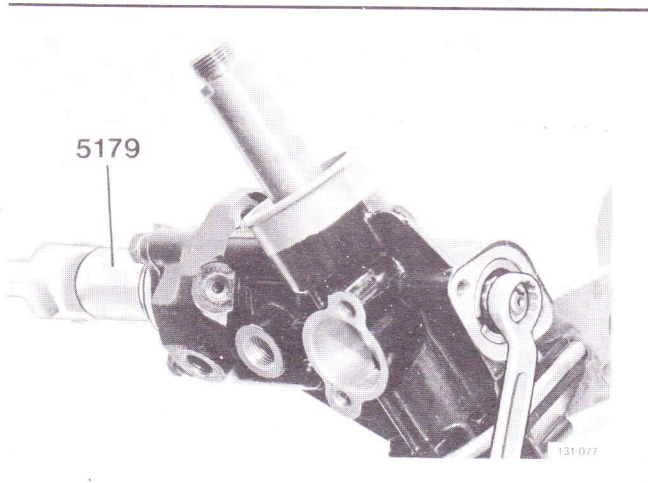
**Install valve housing cover**

Using tool **5182**, place O-ring in position. As cover is installed, make sure that coil spring is not squeezed under cover.

Torque bolt to  
**19 Nm = 14 ft.lbs.**

Install dust seal.

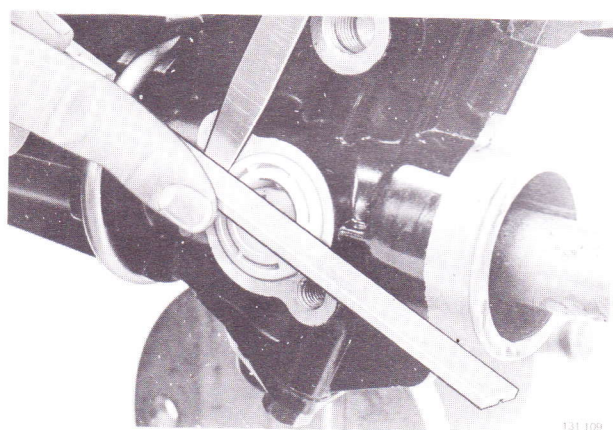




F25

#### Install lock washer and nut

Use socket **5179** as counterhold when tightening nut.  
DO NOT lock with the washer tab.



F26

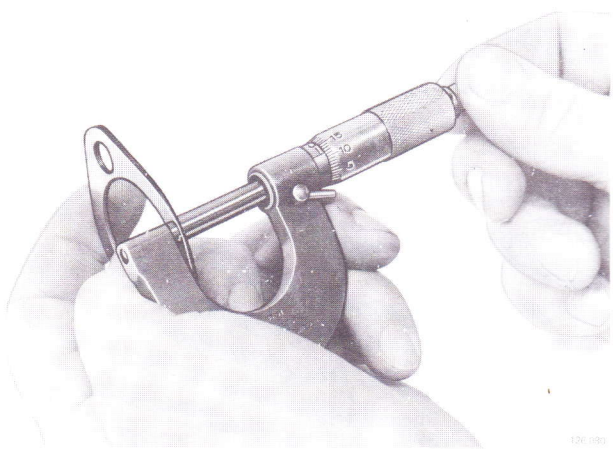
#### Determine shim thickness

Measure pre-tension piston clearance.

Place piston without O-ring in housing. Measure clearance between piston and housing.

Use a ruler and feeler gauge. Press piston against rack, while sliding rack back and forth.

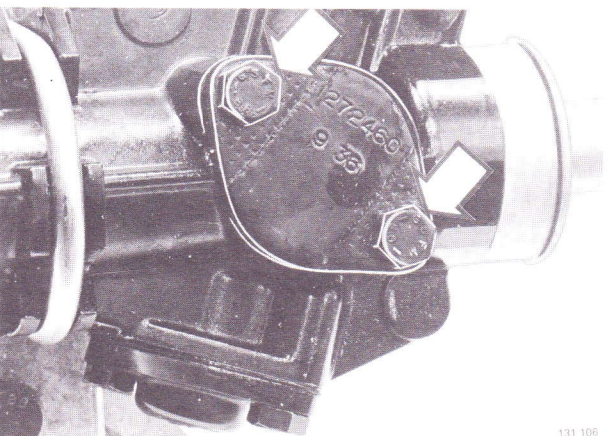
Make a note of maximum clearance obtained.



F27

#### Select shim

Select shim with thickness as noted in op. F26. **Add** 0.05–0.15 mm to obtain correct free play.



F28

#### Install cover

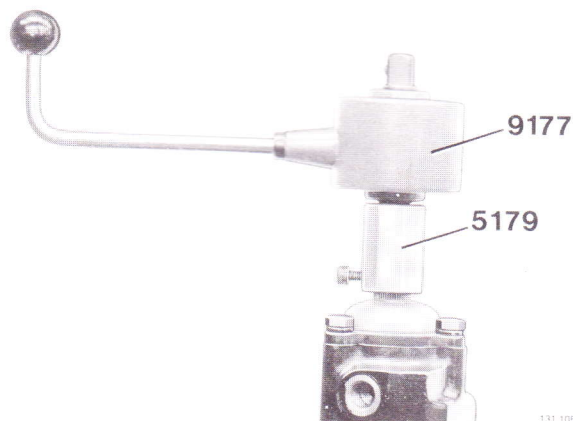
Place spring in position.  
Install shims and gasket.

**NOTE:** Gasket must be installed closest to aluminium housing.

Torque bolts to:  
**17 Nm = 13 ft.lbs.**



F29



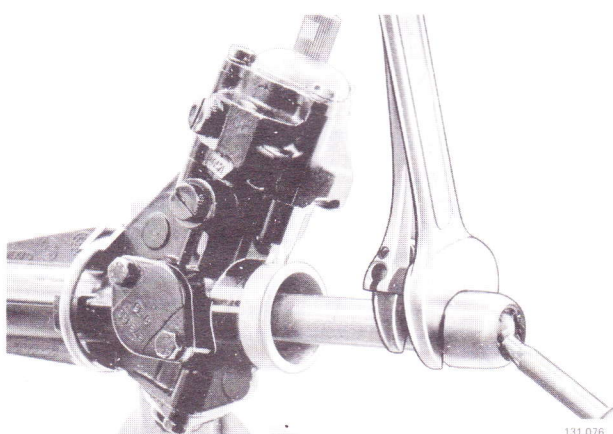
### Check pinion torque

Use socket **5179** to connect torque gauge **9177**, crank rack back and forth between rack end positions.

Correct torque: **0.9–1.7 Nm = 8–15 in.lbs.**

If torque in any position is excessive, stop rack in that position and readjust pretension. If rack binds with pretension piston removed, rack may be warped and should be replaced.

F30



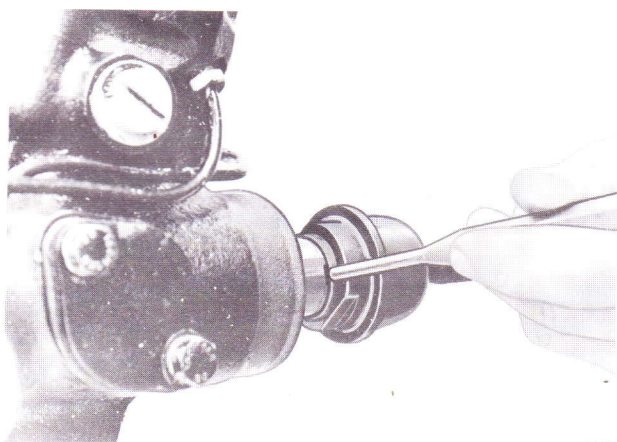
### Install steering rods

Use a 32 mm wrench/spanner on ball joint while supporting rack end with a large adjustable wrench/spanner.

**HINT:** Left and right side steering rods can be exchanged to obtain unused lock portion.

Do not use a steering rod with a broken lock.

F31



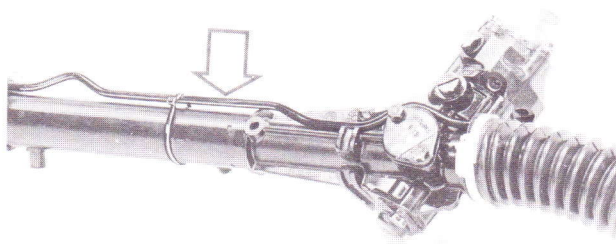
### Lock steering rods

Use narrow punch to lock ball joints in rack recesses.

F32

### Remove steering gear from fixture

F33



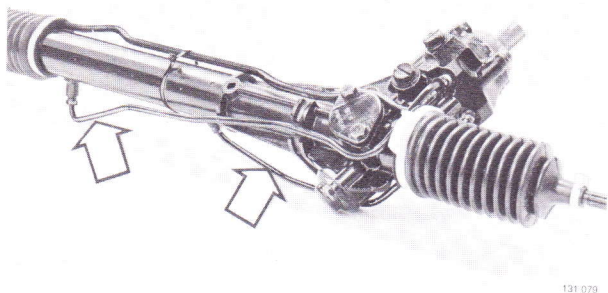
### Attach equalizer tube

Fill approx. 20 grams = 3/4 oz. of grease, Volvo P/N 1 161 001-1, in each rubber bellow.

Install rubber bellows and equalizer tube at the same time.

Install plastic clamps on each rubber bellow. Then secure equalizer tube using a strip clamp.

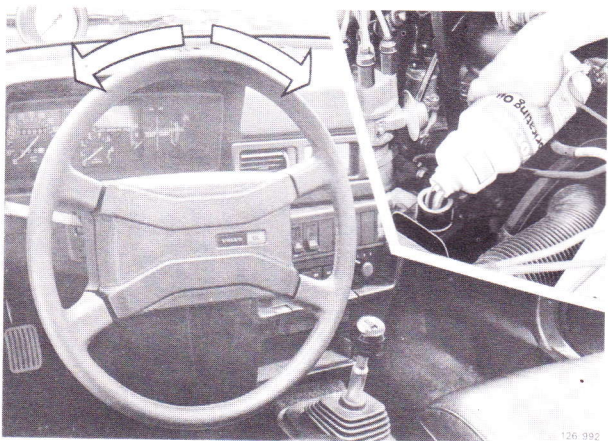
F34



### Install pipes

Install the 2 high pressure pipes

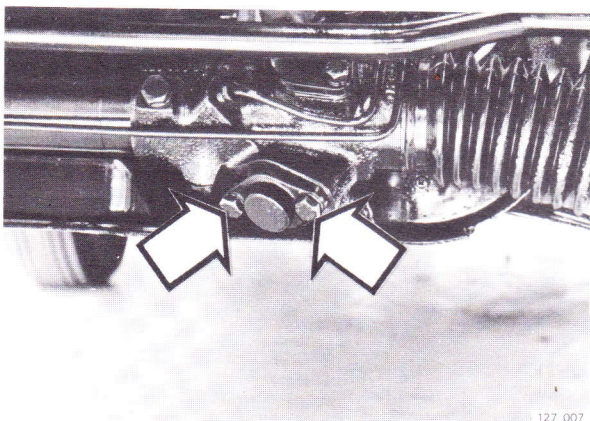
F35



### Adjustment of power balance and filling of fluid

This is made after rack has been installed in vehicle.  
See Manual Steering, section 6(64) TP 30026 (English)  
See Manual Steering, section 6(64) TP 30001 (US)

F36



### After balancing

After completing power balance, install lower steering box cover. Place the gaskets, one on either side of the lock washer.

Tightening torque 19 Nm (= 14 ft.lbs.)



VOLVO SUPPORTS VOLUNTARY  
MECHANIC CERTIFICATION  
BY THE N.I.A.S.E.

(U.S.A. only)

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