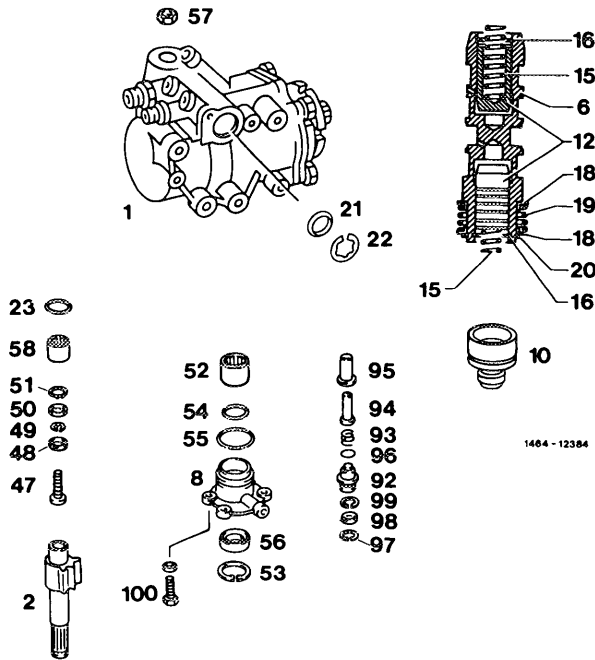
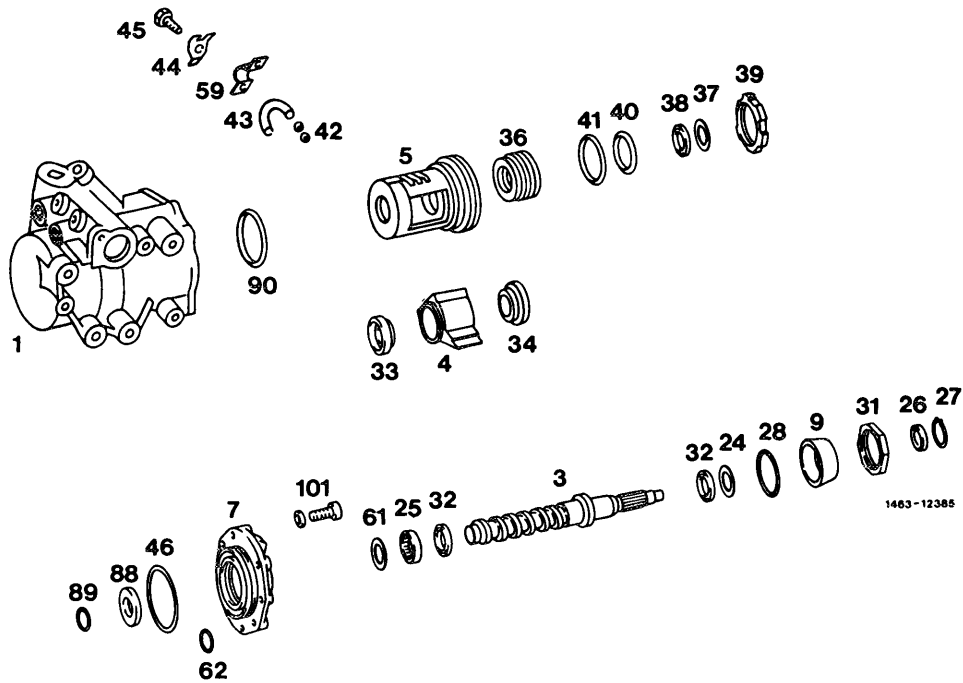


A. Steering gear 765.7 (LS 90)



1 Steering case	Clamp with special tool 123 589 03 59 00
2 Pitman shaft	Check for wear on bearing points and on tooth segment, as well as for distortion. <b>Attention! Pay attention to tothing.</b>
6 Control valve	Pay attention to different versions, <b>do not disassemble!</b>
8 Steering case cover with needle sleeve	Check needle sleeve for damage and quiet running. If needle sleeve is damaged, renew case cover.
10 Closing cap	
12 Reaction bolt	Different diameters, according to steering gear model designation
15 Compression spring	
16 Locking ring	
18 Thrust washer	
19 Compression spring	
20 Locking ring	
21 O-ring (closing cap)	Renew
22 Locking ring	Renew
23 O-ring	Renew
47 Adjusting screw	Mount free of play
48 Thrust washer	
49 Locking ring	Renew
50 Thrust ring	
51 Locking ring	Renew
52 Needle sleeve	Check, renew case cover if required
53 Locking ring	Renew
54 O-ring	Renew
55 O-ring	Renew
56 Radial sealing ring	Renew, special tool 116 589 07 43 00

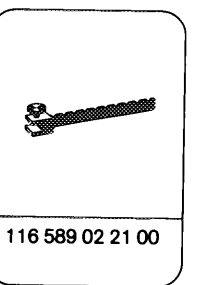
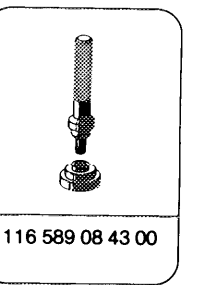
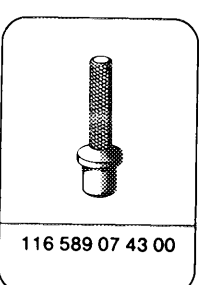
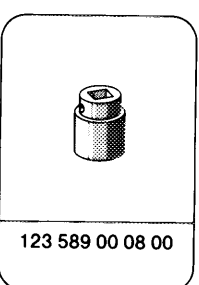
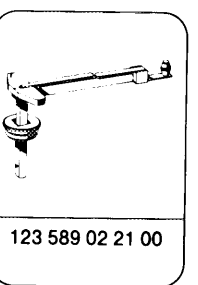
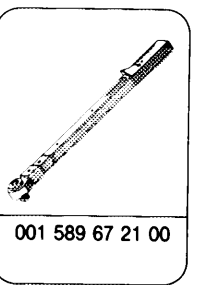
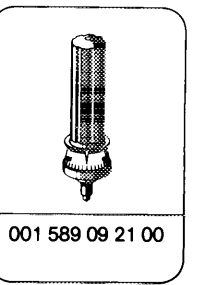
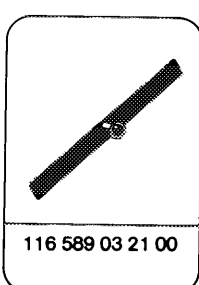
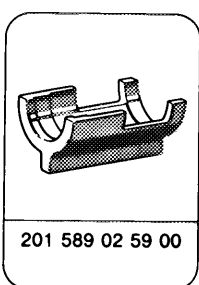
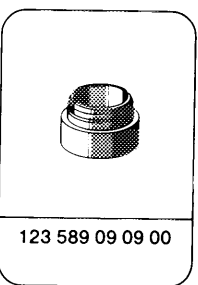
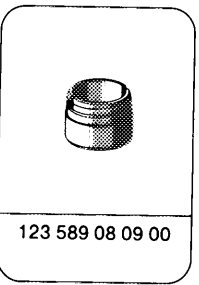
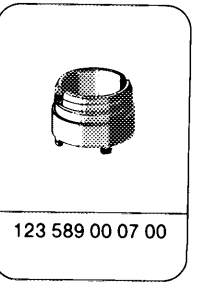
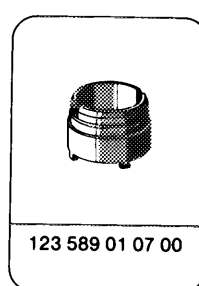
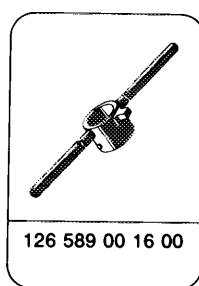
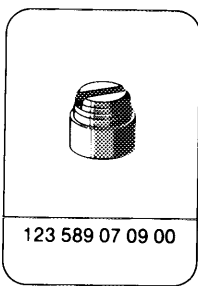
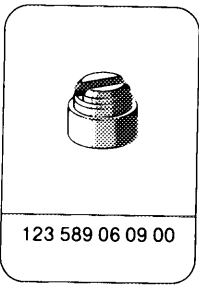
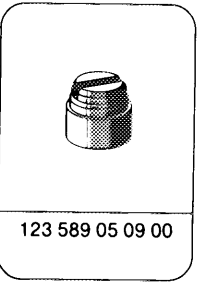
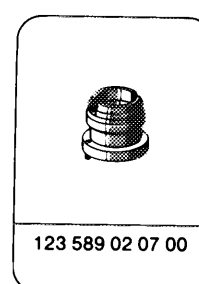
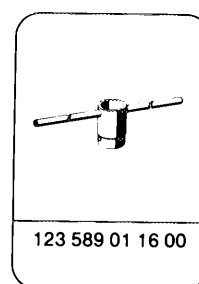
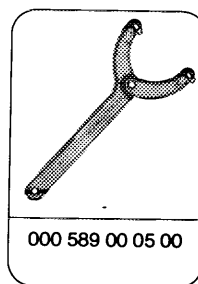
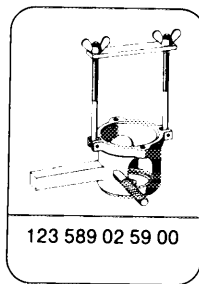
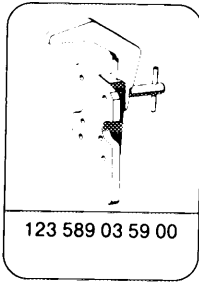
57	Self-locking hex. nut . . . . .	60–65 Nm
58	Needle bearing . . . . .	Control valve 2nd version
92	Cover	Check for damage and quiet running
93	Compression spring	
94	Spring bolt	
95	Bushing	
96	O-ring . . . . .	Renew
97	Locking ring . . . . .	Renew
98	Thrust ring	
99	Locking ring	
100	Hex. head screws . . . . .	Renew, 30–35 Nm



- |     |                                   |   |
|-----|-----------------------------------|---|
| 1   | Steering case                     | Check needle sleeve at top in steering case for damage and quiet running. If required, remove needle sleeve with a conventional puller and renew.   |
| 3   | Steering worm                     | Special tool for mounting 123 589 03 59 00<br>Check ball circuit for score marks. Pay attention to different version, according to steering model designation.                            |
| 4   | Steering nut                      | Special tool for friction torque<br>116 589 03 21 00 or 123 589 02 21 00,<br>116 589 02 21 00 123 589 00 08 00<br>001 589 09 21 00  |
| 5   | Working piston                    | Pay attention to toothing and version (with and without compensation for play)<br>Special tool 201 589 02 59 00<br>123 589 02 59 00   |
| 7   | Bearing cap                       | Pay attention to different version, according to steering model designation.  |
| 9   | Bearing insert with needle sleeve | Check needle sleeve for damage and quiet running. Renew bearing insert completely, if required.<br>Special tool 000 589 00 05 00, 116 589 08 43 00,<br>123 589 01 16 00, 123 589 02 07 00 |
| 24  | Axial washer                      |   |
| 25  | Needle sleeve                     | Renew   |
| 26  | Radial sealing ring               | Renew   |
| 27  | Locking ring                      | Renew   |
| 28  | O-ring                            | Renew   |
| 31  | Slot nut or hex. nut              | 140–160 Nm<br>Special tool 126 589 00 16 00, 123 589 01 07 00<br>or 123 589 09 09 00  |
| 32  | Axial cyl. roller cage            | Check for quiet running and damage  |
| 33  | Axial angular ball bearing        | Check for quiet running and damage  |
| 34  | Axial cyl. roller cage            | Check for quiet running and damage  |
| 36  | Screw cover (hex.)                | Special tool depending on version   |
| 36a | Screw cover (square)              | 123 589 01 16 00, 123 589 05 09 00<br>123 589 07 09 00, 123 589 06 09 00  |

37	O-ring	Renew
38	Sealing ring (teflon)	Renew
39	Slot nut	200–240 Nm
39a	Hex. nut	Special tool 126 589 00 16 00 and 123 589 00 07 00 or 123 589 09 09 00
40	O-ring	Renew
41	Sealing ring (teflon)	Renew
42	Steel balls	24 each
43	Ball guide half	Check for damage
44	Fastening clamp	
45	Hex. head screw	12–16 Nm
46	O-ring	Renew
59	Locking plate	Renew
61	Axial washer	
62	O-ring	Renew
88	Sealing ring (teflon) in bearing cap	Renew
89	O-ring in bearing cap	Renew
90	Stop ring	Different thickness according to steering model designation
101	Hex. head screws	60–65 Nm

**Special tools**



**Conventional tool**

Box wrench, plug-type 19 mm for  
torque wrench 001 589 67 21 00

e.g. made by Wille, D-5600 Wuppertal  
Order No. 732/40 – 19 mm

**Data**

Number of balls in ball circuit

24

**Adjusting values**

Ncm

Friction torque of steering worm in bearing cap  
prior to preloading bearing insert

$\leq 12$

Additional friction torque of steering worm after  
preloading bearing insert

4–7

Friction torque of steering nut in working piston

6–10

Friction torque of ball circuit steering worm – steering nut

30–50

Total friction torque

110–160

**Note**

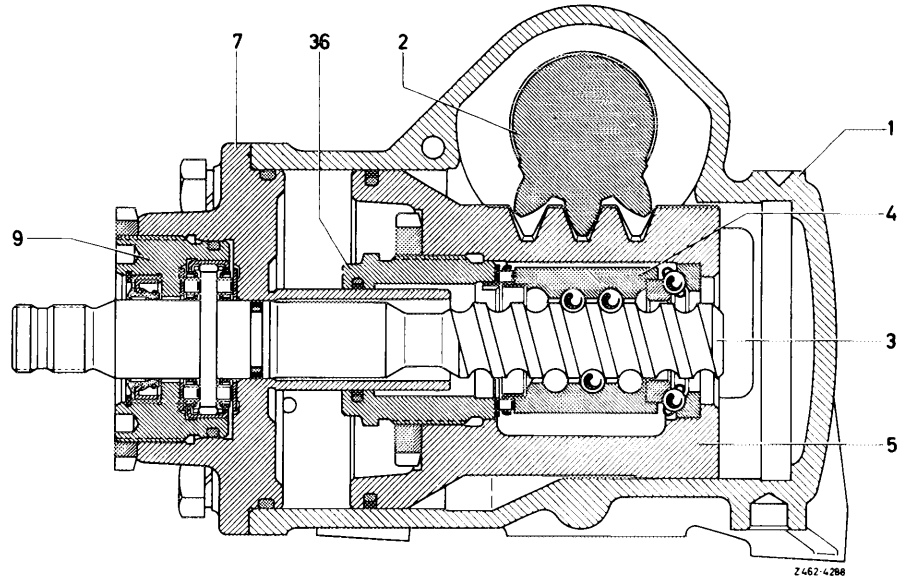
The following description covers assembly and adjustment of the following steering gears:

Steering without and with inside stop

Steering with automatic compensation for play

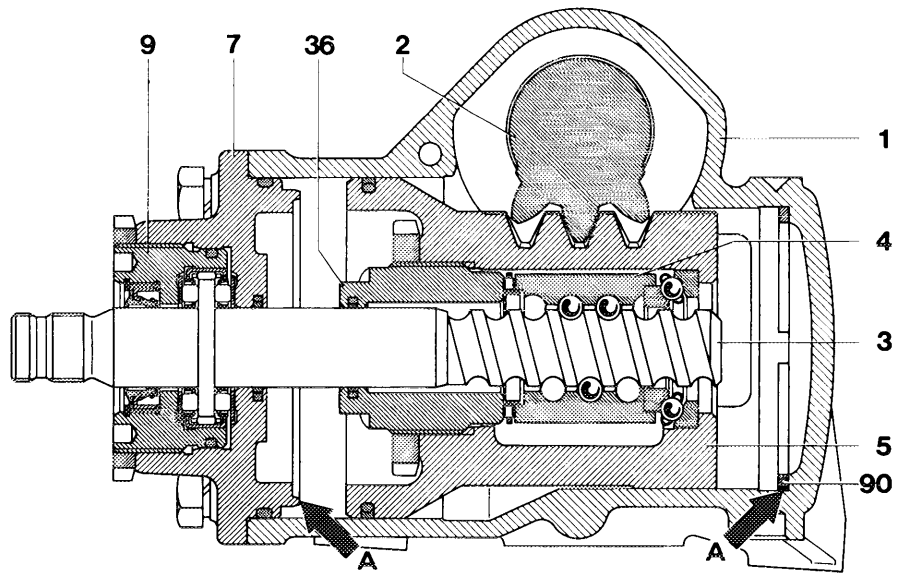
The data valid for the individual models and steering gears with regard to pitch of ball circuit and diameters of reaction piston are shown in list "Differentiating characteristics of steering gears" 46–010.

- 1st version  
 Power steering **without** inside stop  
 (steering 765.700, 765.701, 765.702, 765.703)
- 1 Steering case
  - 2 Pitman shaft
  - 3 Steering worm
  - 4 Steering nut
  - 5 Working piston
  - 7 Bearing cap
  - 9 Bearing insert
  - 36 Screw cap

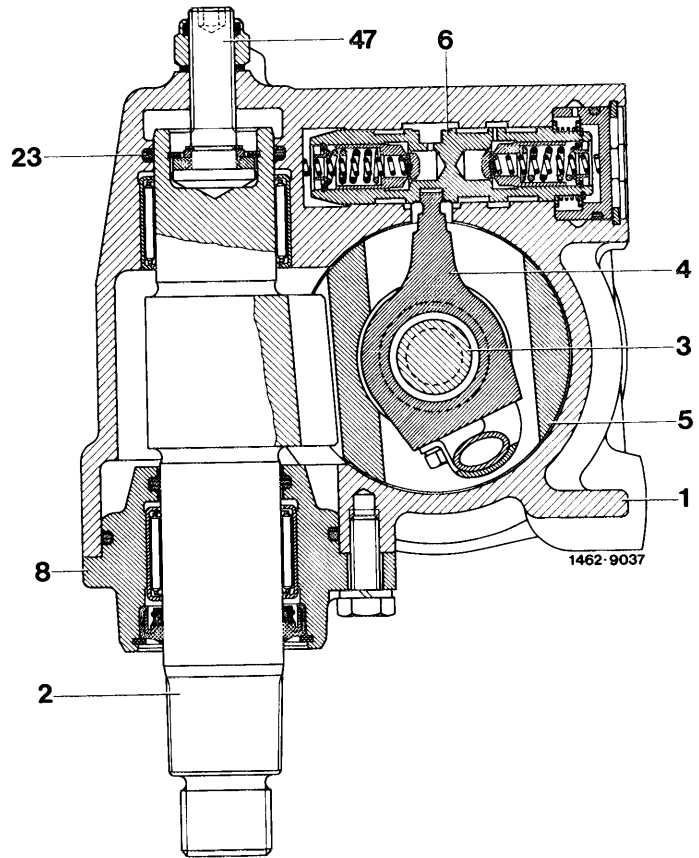


Z462-4288

- 2nd version  
 Power steering **with** inside stop  
 (steering 765.704, 765.706)
- 1 Steering case
  - 2 Pitman shaft
  - 3 Steering worm
  - 4 Steering nut
  - 5 Working piston
  - 7 Bearing cap
  - 9 Bearing insert
  - 36 Screw cap
  - 90 Stop ring
  - A Stop for working piston

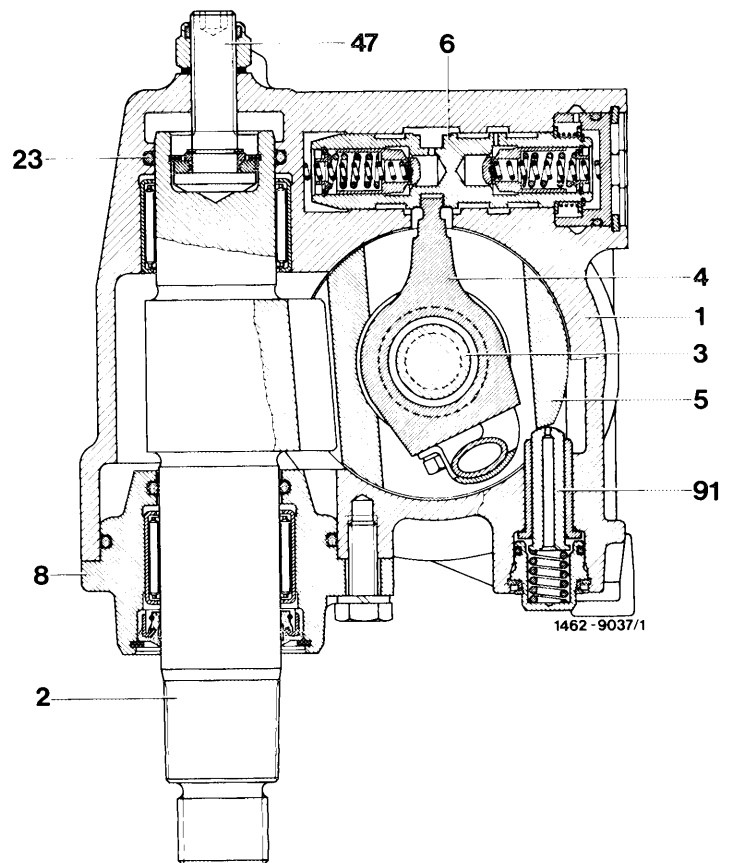


1462-7211/1



Power steering **without** compensation for play  
 (steering 765.700, 765.701, 765.702, 765.703, 765.704)

- 1 Steering case
- 2 Pitman shaft
- 3 Steering worm
- 4 Steering nut
- 5 Working piston
- 6 Control valve
- 8 Case cover
- 23 O-ring
- 47 Adjusting screw



3rd version  
 Power steering **with** automatic compensation for play  
 (steering 765.706)

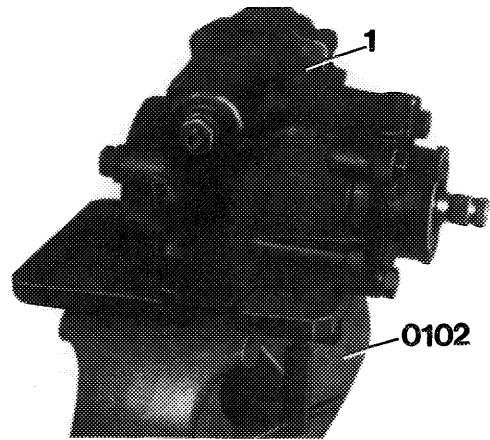
- 1 Steering case
- 2 Pitman shaft
- 3 Steering worm
- 4 Steering nut
- 5 Working piston
- 6 Control valve
- 8 Casing cap
- 23 O-ring
- 47 Adjusting screw
- 91 Automatic compensation for play



## Disassembly

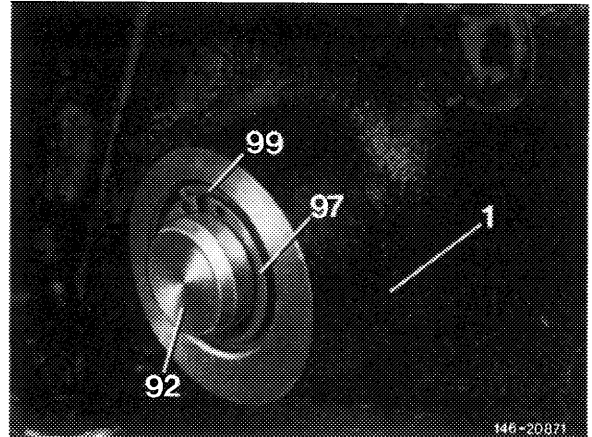
1 Fasten steering (1) to assembly device (0102).

Special tool 123 589 03 59 00



146-15834

2 On steering 3rd version (with automatic compensation for play) turn steering worm until working piston is slightly in lefthand or righthand lock.

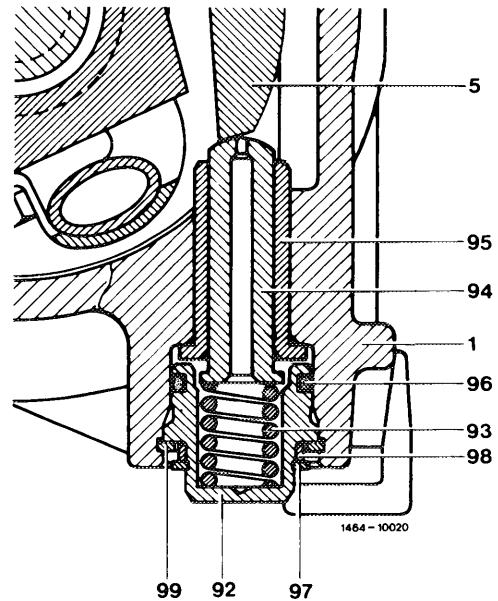


146-20871

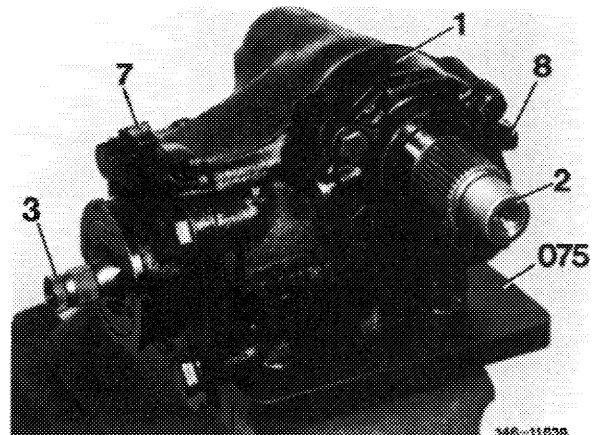
3 Remove locking ring (97) from cover (92), then remove thrust ring (98) from steering case.

Remove locking ring (99) from steering case (1).

Remove compression spring (93), spring bolt (94) and bushing (95).



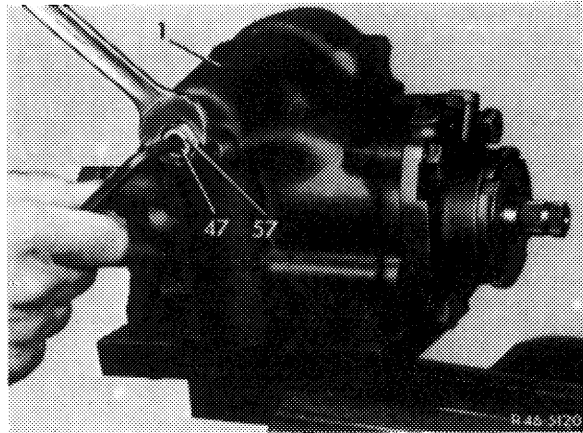
4 Unscrew hex. screws for fastening casing cover (8) to steering case (1).



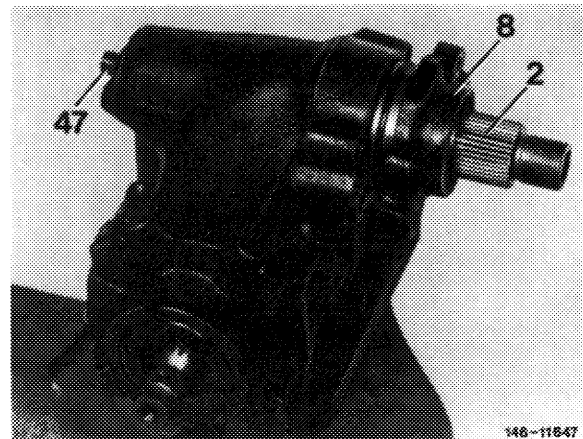
146-11838

5 Unscrew self-locking hex. nut (57) from adjusting screw (47), while applying counterhold to adjusting screw.

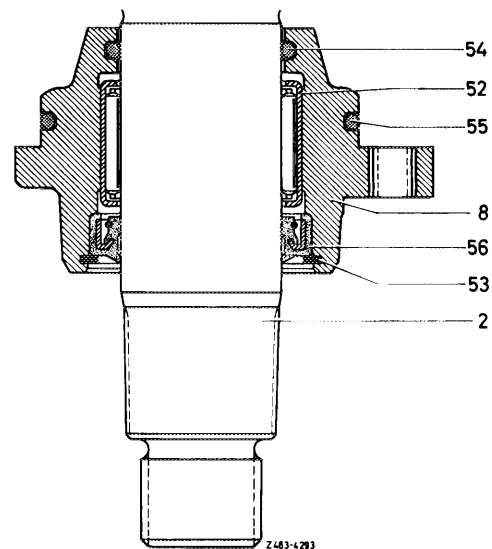
6 In center position of steering, turn adjusting screw to the right, which will force pitman shaft including casing cover out of steering case.



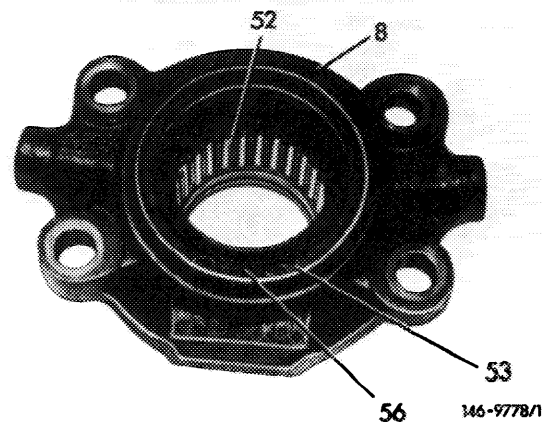
7 Remove casing cover (8) from pitman shaft (2).



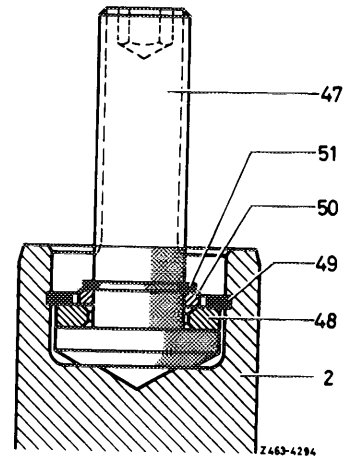
8 Remove O-rings (54 and 55) from casing cover.



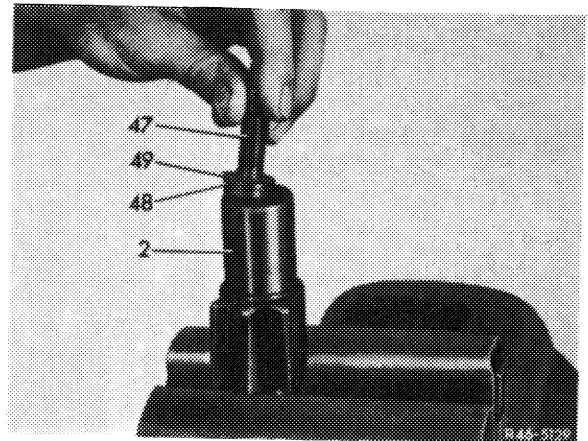
9 Remove locking ring (53) and radial sealing ring (56) from casing cover (8).



10 Take locking ring (51) out of adjusting screw (47), then remove thrust ring (50).



11 Remove locking ring (49) from pitman shaft (2). Remove adjusting screw (47) including thrust washer (48).

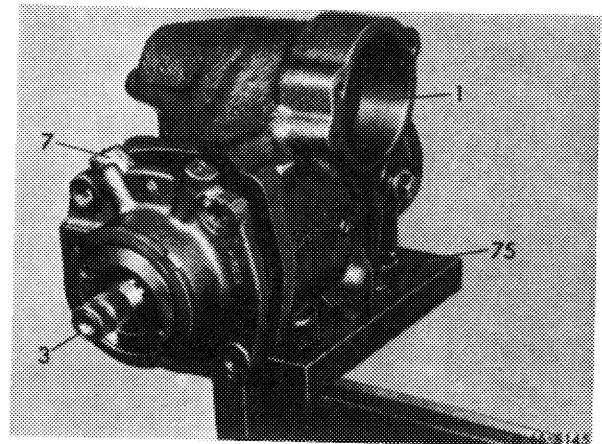


12 Unscrew hex. screws for fastening bearing cap (7) to steering case (1).

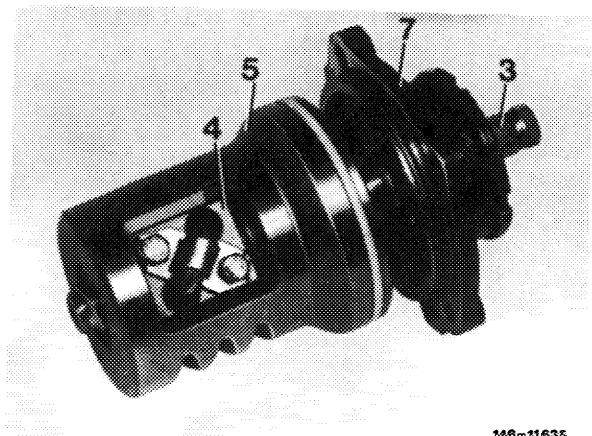
13 Slip steering coupling on steering worm, turn steering worm to the left until bearing cap is pushed slightly out of steering case.

**Attention!**

Do not turn too far, since otherwise the balls may fall out of ball circuit.



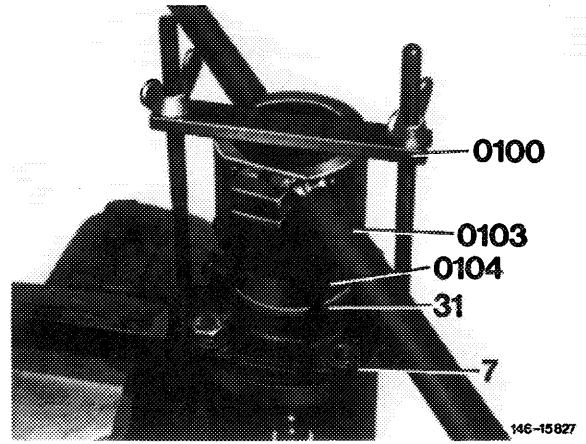
14 Remove bearing cap together with steering worm and working piston out of steering case.



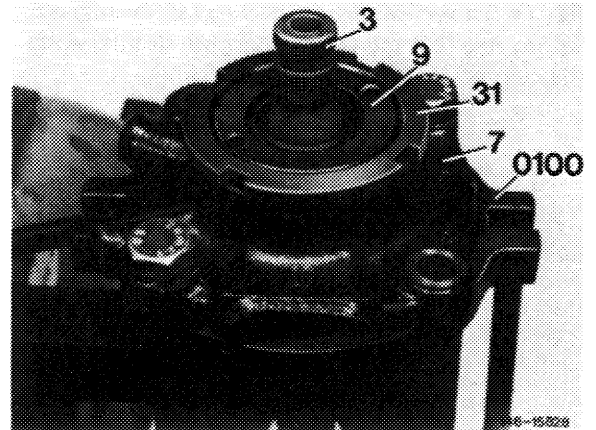


19 Unscrew slot nut or hex. nut with tommy handle (0103) and unscrew pertinent insert (0104) from bearing insert.

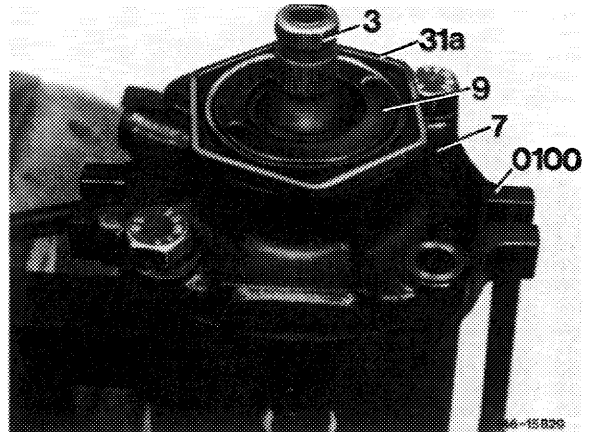
Special tool 126 589 00 16 00 and  
123 589 01 07 00 or  
123 589 09 09 00



Layout bearing insert with slot nut



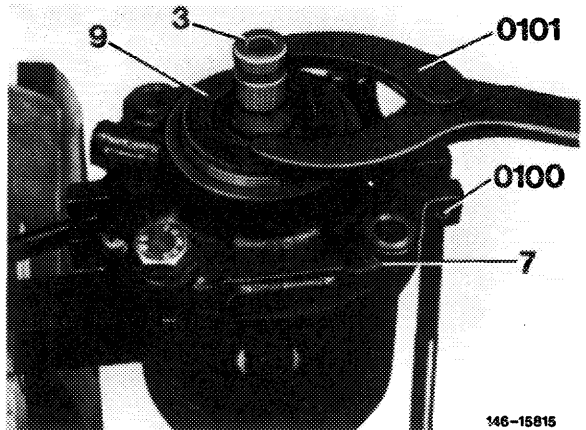
Layout bearing insert with hex. nut



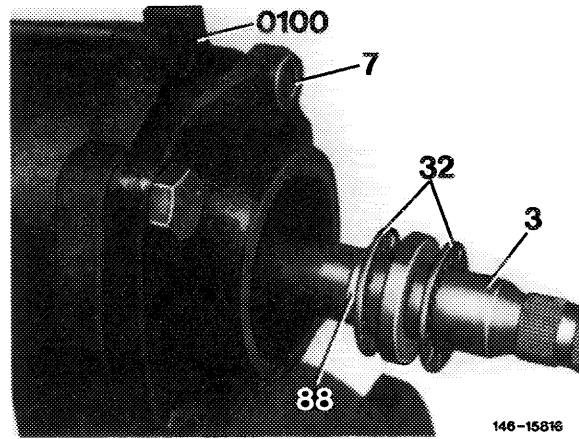
20 Unscrew bearing insert (9) with pin wrench from bearing cap (7).

Special tool 000 589 00 05 00

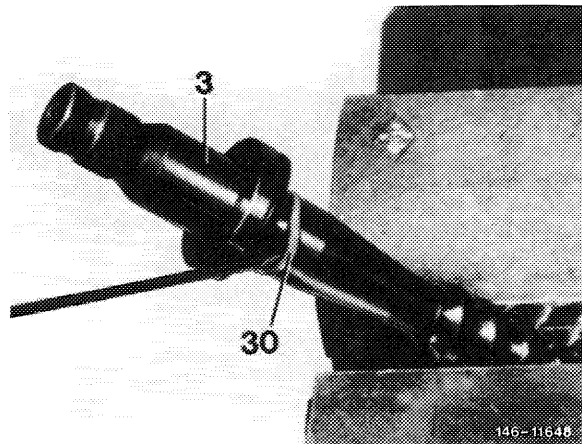
Note: Bearing insert can also be unscrewed by means of the adjustable pin wrench.



21 Remove steering worm (3) from bearing cap (7), remove axial cyl. roller cage (32) from steering worm.

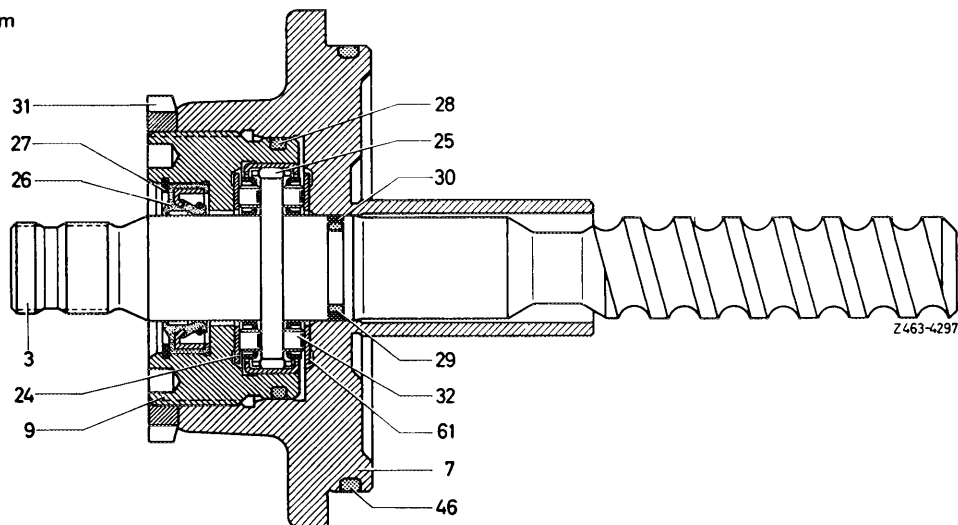


22 On 1st version, remove bearing cap/steering worm sealing ring (30) and O-ring (29) from steering worm (3).



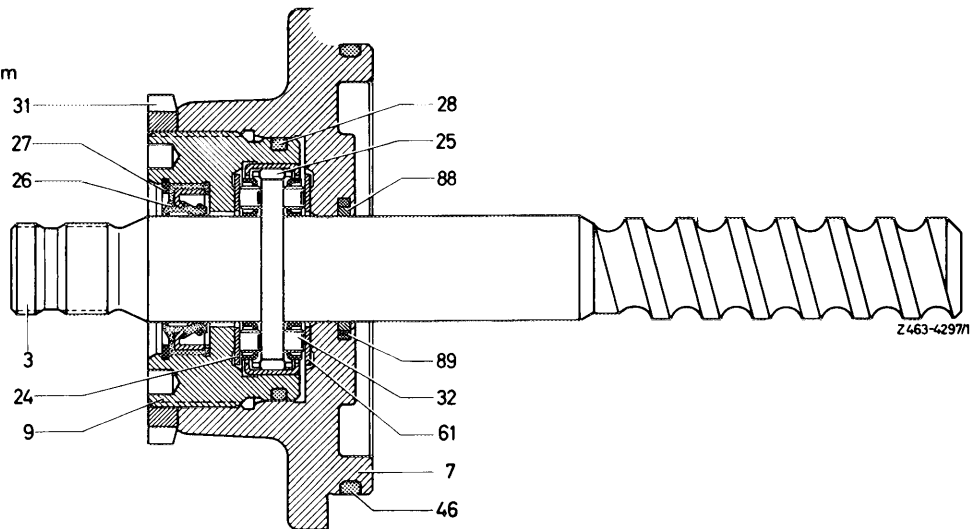
Bearing cap and steering worm  
1st version.  
Bearing cap with neck,  
sealing ring (teflon) and  
O-ring on steering worm

- 3 Steering worm
- 7 Bearing cap
- 9 Bearing insert
- 24 Axial washer
- 25 Needle sleeve
- 26 Radial sealing ring
- 27 Locking ring
- 28 O-ring
- 29 O-ring
- 30 Sealing ring (teflon)
- 31 Slot or hex. nut
- 32 Axial cyl. roller cage
- 46 O-ring
- 61 Axial washer

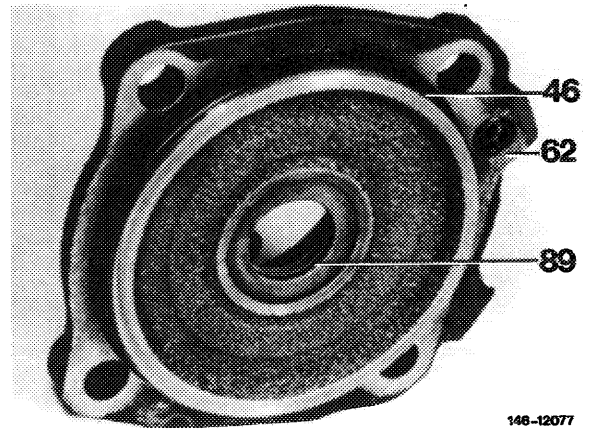


Bearing cap and steering worm  
2nd version.  
Bearing cap without neck,  
sealing ring (teflon) and  
O-ring in bearing cap

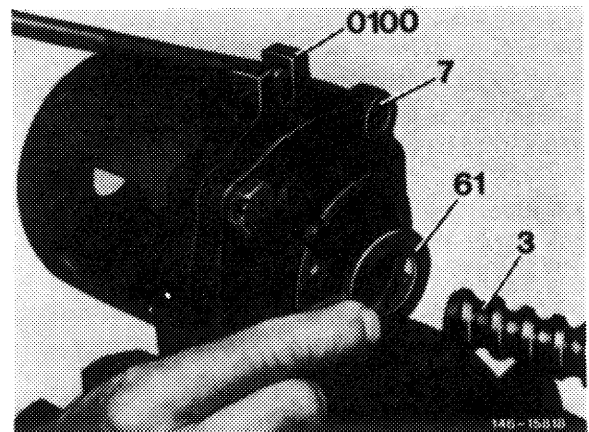
- 3 Steering worm
- 7 Bearing cap
- 9 Bearing insert
- 24 Axial washer
- 25 Needle sleeve
- 26 Radial sealing ring
- 27 Locking ring
- 28 O-ring
- 31 Slot or hex. nut
- 32 Axial cyl. roller cage
- 46 O-ring
- 61 Axial washer
- 88 Sealing ring (teflon)
- 89 O-ring



23 On 2nd version bearing cap/steering worm re-  
move sealing ring (89) and O-ring from bearing cap.

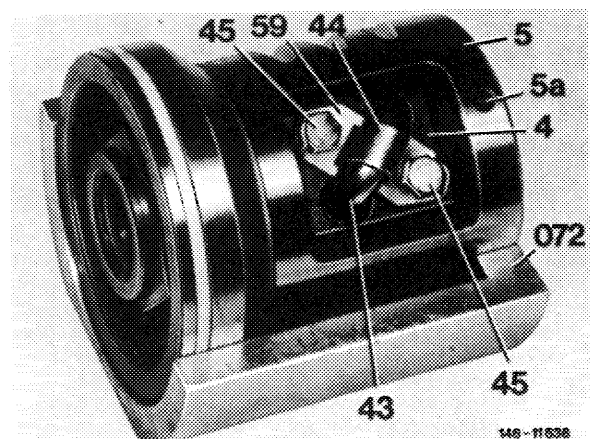


24 Remove axial washer (61) from bearing cap (7).



25 Unbend locking plate (59), unscrew hex. screws  
(45), remove locking plate, fastening clip (44) and  
both ball guide halves (43).

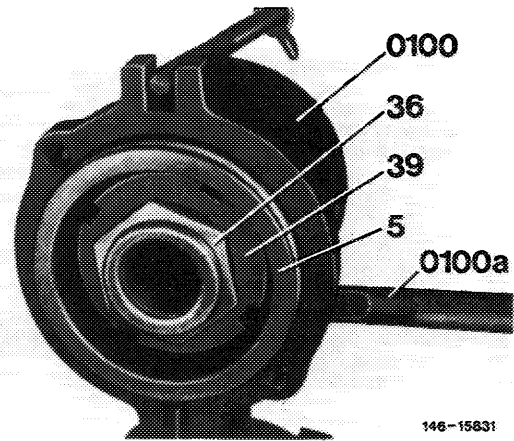
Special tool 201 589 02 59 00



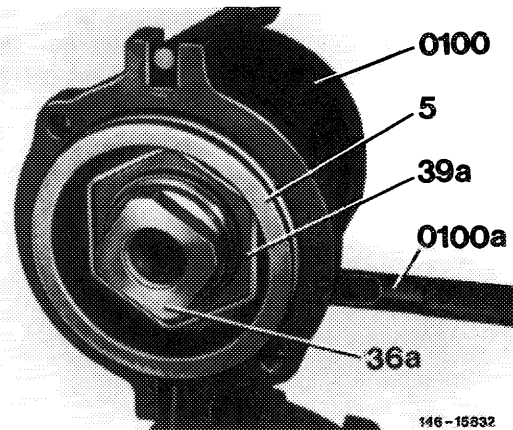


26 Clamp working piston (5) into device (0100) and secure with plug (0100 a).

Special tool 123 589 02 59 00



Layout screw cover (36) with hexagon SW 36 or 46 and slot nut (39)

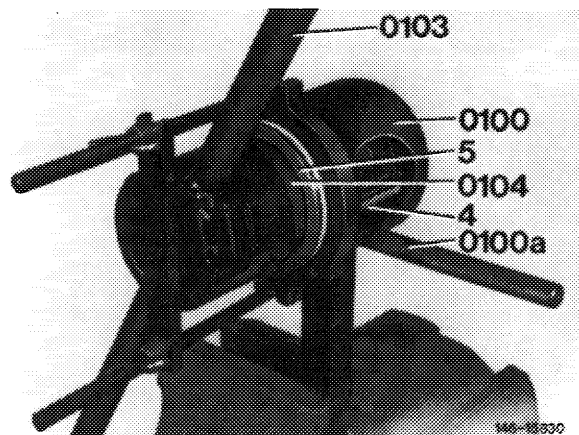


Layout screw cover (36 a) with square head and hex. nut (39 a)

27 Unscrew slot nut or hex. nut with pertinent insert (0104) including tommy handle (0103), then unscrew screw cover with pertinent insert.

Special tool for slot or hex. nut  
126 589 00 16 00, 123 589 00 07 00,  
123 589 09 09 00

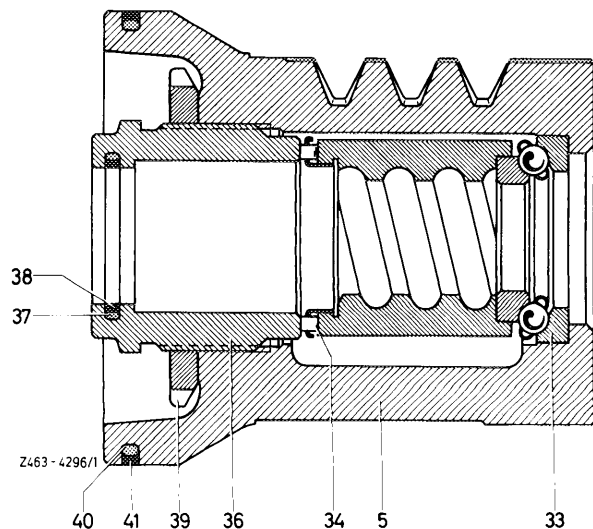
Special tool for screw cover  
123 589 01 16 00, 123 589 05 09 00,  
123 589 06 09 00, 123 589 07 09 00



28 Take sealing ring (teflon) (38) and O-ring (37) from screw cover (36).

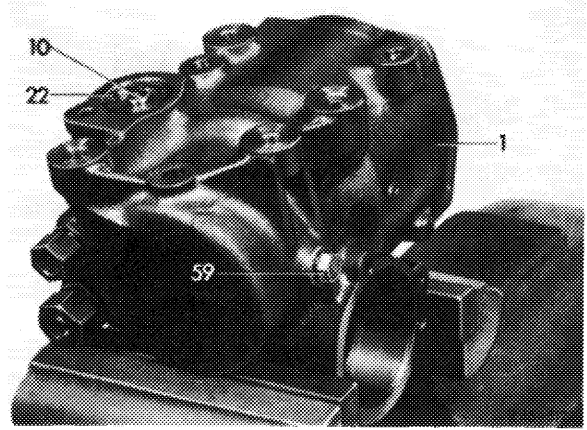
29 Remove axial cyl. roller cage (34) from steering nut (4) and steering nut from working piston (5).

30 Remove axial angular ball bearing (33) from working piston.

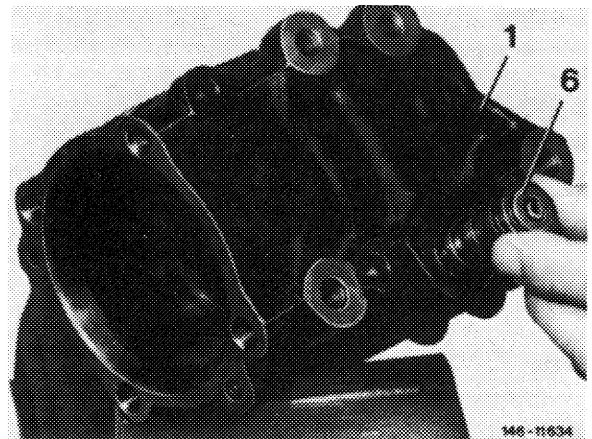




31 Remove locking ring (22) and closing cover (10) from steering case.



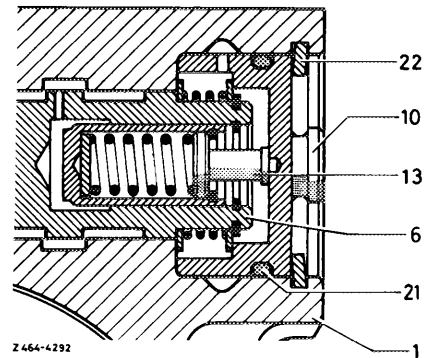
32 Remove control valve (6) from steering case (1), making sure that the springs on control valve 2nd, 3rd and 4th version are not falling out of reaction piston.



33 Remove O-ring (21) from closing cover.

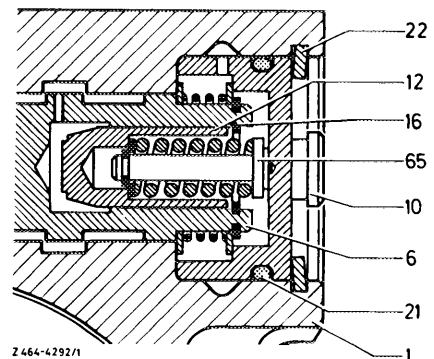
a) Control valve 1st version

- 1 Steering case
- 6 Control valve
- 10 Closing cover
- 13 Supporting bolt
- 21 O-ring
- 22 Locking ring



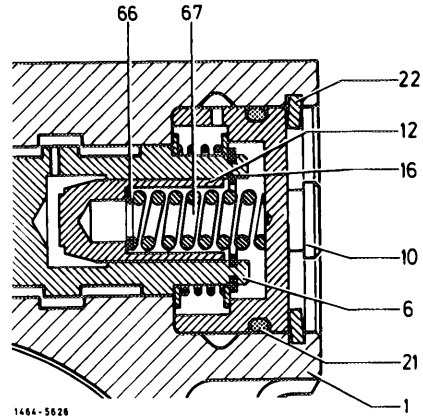
b) Control valve 2nd version

- 1 Steering case
- 6 Control valve
- 10 Closing cover
- 12 Reaction piston
- 21 O-ring
- 22 Locking ring
- 65 Spring bolt



c) Control valve 3rd and 4th version

- 1 Steering case
- 6 Control valve
- 10 Closing cover
- 12 Reaction piston
- 16 Locking ring
- 21 O-ring
- 22 Locking ring
- 66 Compensating washer
- 67 Spring



**Checkup**

Apply strict standards when checking steering components. When in doubt, replace respective part on principle.

**Note**

The ball circuit, that is, the steering worm and the steering nut, are assembled free of play at factory.

To maintain the specified clearance of 0.006 to 0.01 mm between straightedge of steering nut and control valve, both parts are assembled by selection.

The same applies to steering case and the control valve mounted inside case. For this reason, except for gasket and bearing set, only the pitman shaft, the working piston and the case cover are available as spare parts.

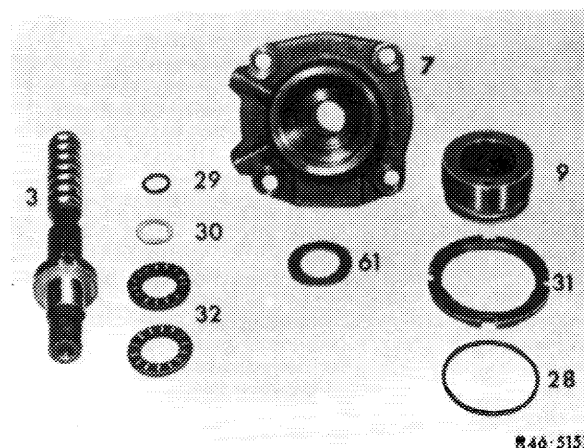
**Steering worm**

34 Check ball circuit on steering worm (3). If impact dents are showing up, replace steering.

**Bearing insert**

35 Check needle sleeve for wear. If needle sleeve is damaged, renew complete bearing insert (9).

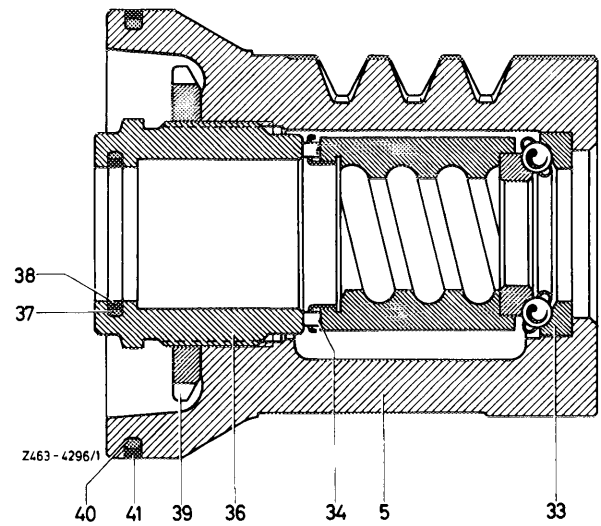
- 3 Steering worm
- 7 Bearing cap
- 9 Bearing insert
- 28 O-ring
- 29 O-ring
- 30 Sealing ring (teflon)
- 31 Slot nut
- 32 Axial cyl. roller cage
- 61 Axial washer



### Working piston and steering nut

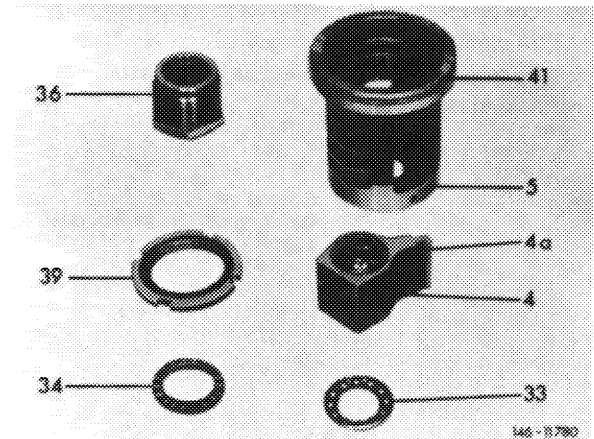
36 Remove sealing ring (41) and O-ring (40) from working piston (5). Press outer race of axial angular ball bearing (33) out of working piston.

37 Remove sealing ring (38) and O-ring (37) from screw cover (36).



38 Check ball circuit in steering nut (4). If impact dents are showing up, replace steering.

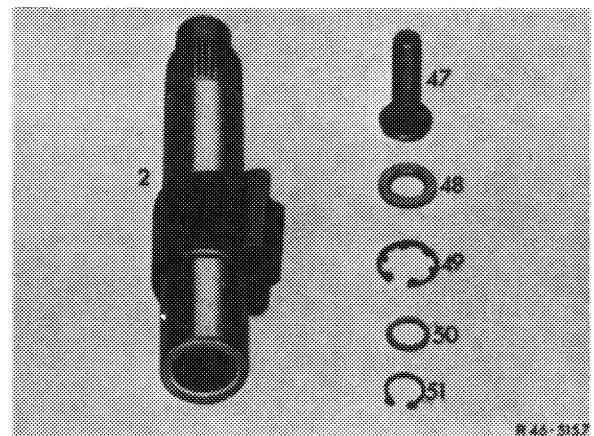
- 4 Steering nut
- 4a Straightedge on steering nut
- 5 Working piston
- 33 Axial angular ball bearing
- 34 Axial cyl. roller cage
- 36 Screw cover
- 39 Slot or hex. nut
- 41 Sealing ring (teflon)



### Pitman shaft

39 Check pitman shaft (2) for wear at bearing points and on tooth segment, as well as for distortion or other damage. Renew pitman shaft, if required.

- 2 Pitman shaft
- 47 Adjusting screw
- 48 Thrust washer
- 49 Locking ring
- 50 Thrust ring
- 51 Locking ring

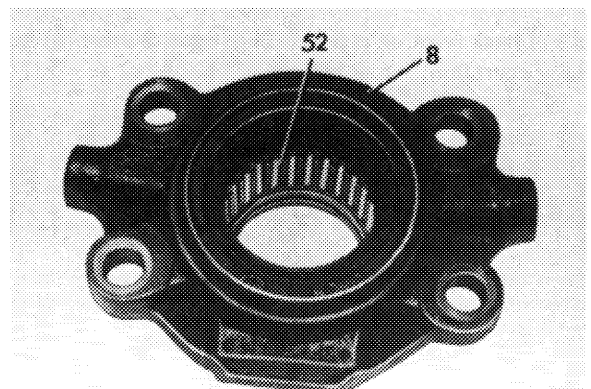


### Case cover

40 Check needle sleeve (52) for wear. If needle sleeve is damaged, renew complete case cover.

### Steering case

41 Check needle sleeve in steering case for wear. If required, pull out needle sleeve with a conventional puller.



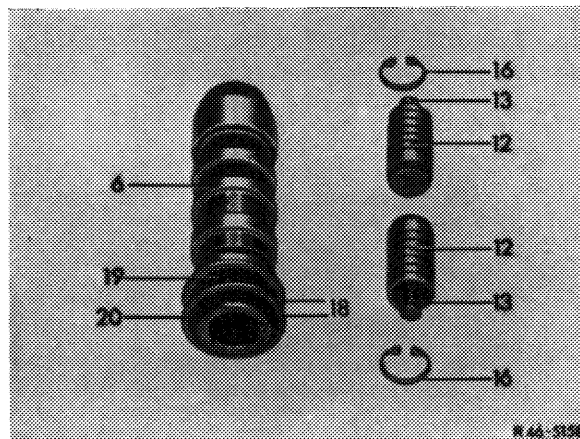
## Control valve

**Note:** On 1st version of control valve the reaction pistons have a diameter of 11 mm and the supporting pistons (13) are secured in reaction pistons by means of locking rings (14). On 2nd version (production starting middle of 1972) the diameter of the reaction pistons is 10 mm. Two spring bolts (65) are inserted in reaction pistons. On control valve 3rd version (production starting end of 1973) the reaction pistons have a diameter of 11 mm. Inside reaction pistons are compensating washer (66) and spring (67). Starting at the beginning of 1976 the control valve 4th version is installed, with a reaction piston diameter of 11.5 mm.

### 1st version

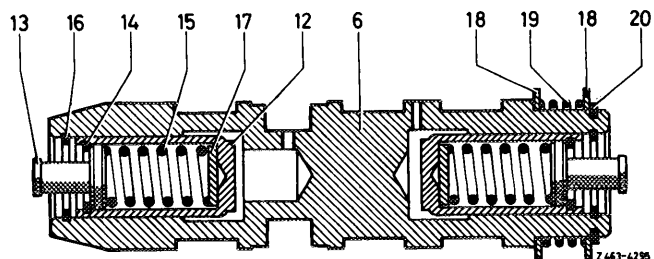
42 Check reaction piston (12) and supporting piston (13) in control valve (6) for easy operation. If required, remove and clean reaction piston after removing locking ring (16).

- 6 Control valve
- 12 Reaction piston (11 mm dia.)
- 13 Supporting bolt
- 16 Locking ring
- 18 Thrust washer
- 19 Compression spring
- 20 Locking ring



**Note:** Do not remove supporting bolts (13) from reaction pistons (12), since the spring load of compression spring (15) is adjusted by means of compensation washers (17).

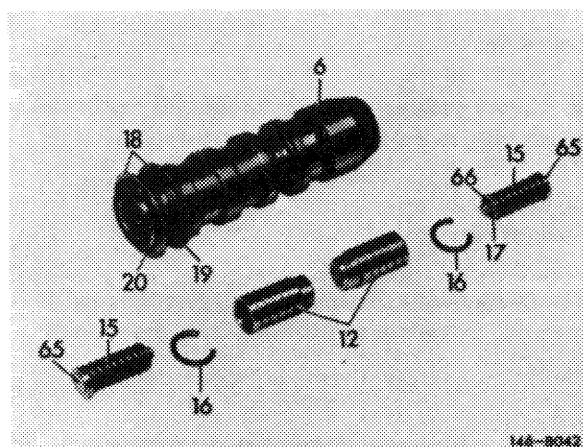
- 6 Control valve
- 12 Reaction piston
- 13 Supporting piston
- 14 Locking ring
- 15 Compression spring
- 16 Locking ring
- 17 Compensating washer
- 18 Thrust washer
- 19 Compression spring
- 20 Locking ring



### 2nd version

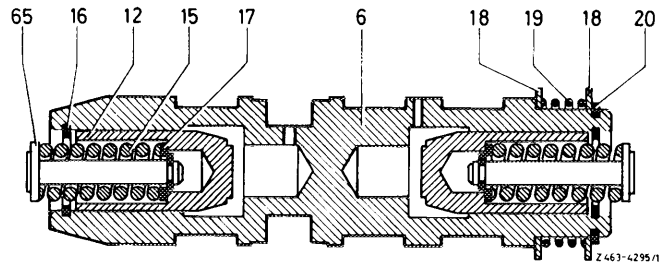
43 Check reaction piston (12) in control valve (6) for easy operation.

- 6 Control valve
- 12 Reaction piston (10 mm dia.)
- 15 Compression spring
- 16 Locking ring
- 17 Compensating washer
- 18 Thrust washer
- 19 Compression spring
- 20 Locking ring
- 65 Spring bolt



**Note:** Do not disassemble spring bolts (65), since the spring preload is adjusted with compensating washers (17).

- 6 Control valve
- 12 Reaction piston (10 mm dia.)
- 15 Compression spring
- 16 Locking ring
- 17 Compensating washer
- 18 Thrust washer
- 19 Compression spring
- 20 Locking ring
- 65 Spring bolt

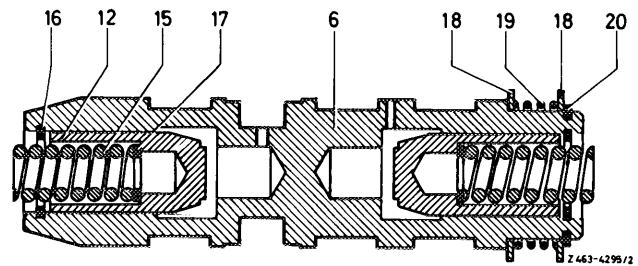


### 3rd and 4th version

44 Check reaction piston (12) in control valve (6) for easy operation.

**Note:** Do not mix up springs (15) and compensating washers (17) of both reaction pistons.

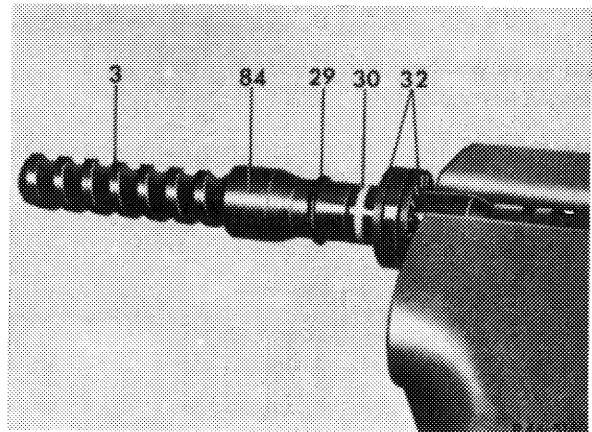
- 6 Control valve
- 12 Reaction piston (11 or 11.5 mm dia.)
- 15 Compression spring
- 16 Locking ring
- 17 Compensating washer
- 18 Thrust washer
- 19 Compression spring
- 20 Locking ring



### Steering worm for steering without inside stop

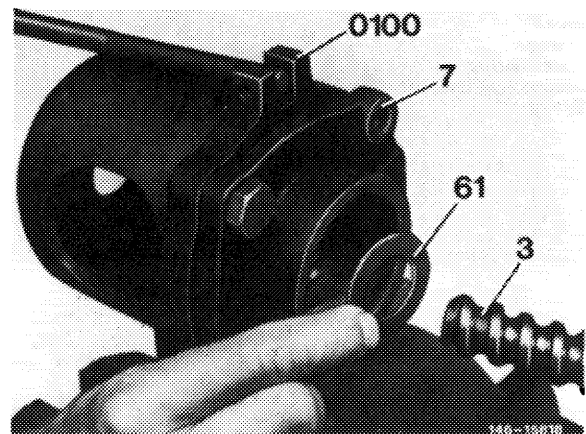
45 Place lower axial cyl. roller cage (32) on steering worm (3).

46 Slip assembly sleeve (84) on steering worm (3) and mount O-ring (29) first, then sealing ring (30).



### Bearing cap for steering without inside stop

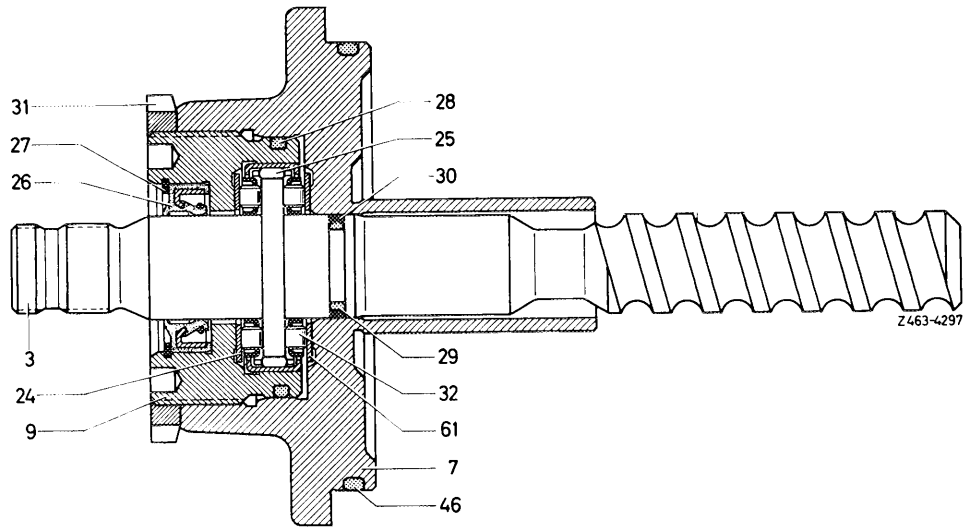
47 Fasten bearing cap (7) in device (0100), insert axial washer (61) into bearing cap, then steering worm (3).



Bearing cap and steering worm for steering without inside stop:

Bearing cap with neck, sealing ring (teflon) and O-ring on steering worm

- 3 Steering worm
- 7 Bearing cap
- 9 Bearing insert
- 24 Axial washer
- 25 Needle sleeve
- 26 Radial sealing ring
- 27 Locking ring
- 28 O-ring
- 29 O-ring
- 30 Sealing ring (teflon)
- 31 Slot or hex. nut
- 32 Axial cyl. roller cage
- 46 O-ring
- 61 Axial washer



Bearing cap and steering worm for steering with inside stop:

Bearing cap without neck, sealing ring (teflon) and O-ring in bearing cap

- 3 Steering worm
- 7 Bearing cap
- 9 Bearing insert
- 24 Axial washer
- 25 Needle sleeve
- 26 Radial sealing ring
- 27 Locking ring
- 28 O-ring
- 31 Slot or hex. nut
- 32 Axial cyl. roller cage
- 46 O-ring
- 61 Axial washer
- 88 Sealing ring (teflon)
- 89 O-ring

