

Data

Number of balls in ball circuit	24
---------------------------------	----

Adjusting Data

	Ncm	(kpcm)
Friction torque of steering worm in bearing cap prior to preloading bearing insert	12–15	(1.2–1.5)
Extra friction of steering worm after preloading bearing insert	5–7	(0.5–0.7)
Friction torque of steering nut in working piston	6–10	(0.6–1.0)
Friction torque of ball circuit for steering worm – steering nut	40–60	(4–6)
Total friction torque	120–160	(12–16)

Tightening Torques

	Nm	(kpm)
Slot nut to bearing cap	120–140	(12–14)
Slot nut in working piston	100–120	(10–12)
Hex. screw for attaching ball guide tube	12–16	(1.2–1.6)
Hex. bolts for attaching bearing cap to steering case	60–65	(6–6.5)
Hex. bolts for attaching housing cover to steering case	30–35	(3–3.5)
Self-locking hex. nut to adjusting screw (SEAL-LOCK flange nut)	60–70	(6–7)
Self-locking hex. nut to adjusting screw (Polystop hex. nut)	30–35	(3–3.5)



46.1 Assembly and Adjustment of Power Steering

Special Tools

Torque wrench 15–65 Ncm (1.5–6.5 kpcm)	001 589 09 21 00
Torque wrench 1.5–5.0 Nm (15–20 kpcm)	000 589 87 21 00
Serrated insert 1/4" square for measuring friction torque	112 589 00 08 00
Hinged pin spanner for bearing insert	000 589 00 05 00
Assembly sleeve for O-ring and teflon ring of steering worm	116 589 00 14 00
Assembly device for steering case	116 589 01 59 00
Installation tool for radial sealing ring	116 589 08 43 00
Measuring device for adjustment of friction torque	116 589 03 21 00
Hex. wrench for screw cover	116 589 00 09 00
Assembly device for bearing cap	116 589 03 59 00
Assembly device for working piston	116 589 04 59 00
Measuring device for friction torque of steering nut	116 589 02 21 00
Slot nut wrench for slot nut on working piston	116 589 00 07 00
Assembly tray for working piston	116 589 02 59 00
Slot nut wrench for slot nut on bearing cap	116 589 01 07 00
Installation tool for radial sealing ring	116 589 07 43 00

Conventional Tools

Pliers for inside lock (J1)	e.g. made by Hazet/Remscheid Order No. 1846 a-1
Pliers for outside lock (A1)	e.g. made by Hazet/Remscheid Order No. 1846 c-1

Steering Worm

- 1 Place lower axial cyl. roller cage (32) on steering worm (3) (Fig. 1).
- 2 Slide assembly sleeve (84) on steering worm (3) and mount O-ring (29) first, then sealing ring (30) (Fig. 1).

Bearing Cap

- 3 Attach bearing cap (7) to device (74), then insert axial disc (61) and then steering worm (3) into bearing cap (Fig. 2 and 3).
- 4 Place upper axial cyl. roller cage (32) on steering worm (Fig. 3).

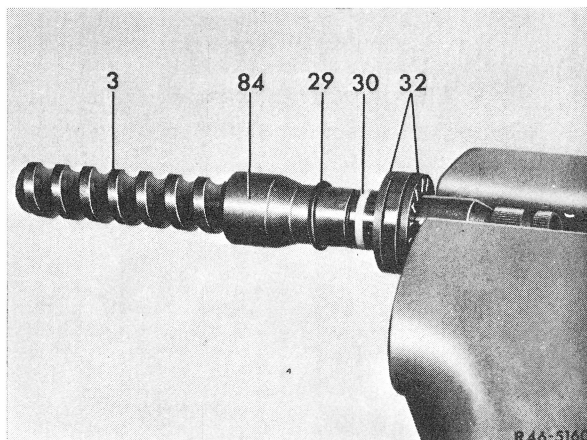


Fig. 1

- | | |
|--------------------------|--|
| 3 Steering worm | 32 Axial cyl. roller cage |
| 29 O-ring | 84 Assembly sleeve for O and teflon ring |
| 30 Sealing ring (teflon) | |

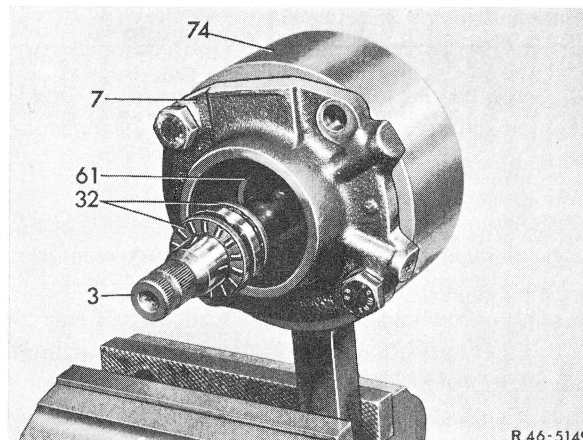


Fig. 3

- | | |
|---------------------------|------------------------------------|
| 3 Steering worm | 61 Axial disc |
| 7 Bearing cap | 74 Assembly device for bearing cap |
| 32 Axial cyl. roller cage | |

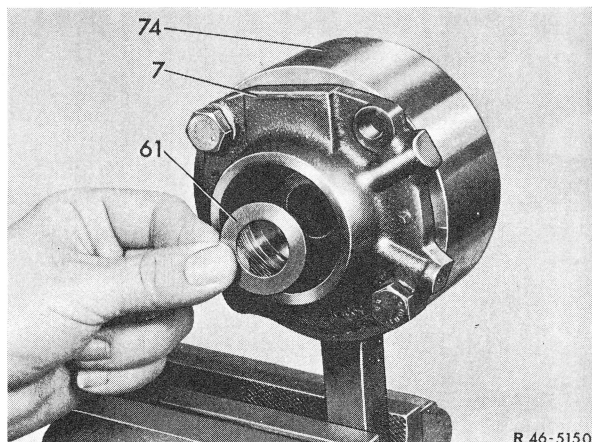


Fig. 2

- | | |
|---------------|------------------------------------|
| 7 Bearing cap | 74 Assembly device for bearing cap |
| 61 Axial disc | |

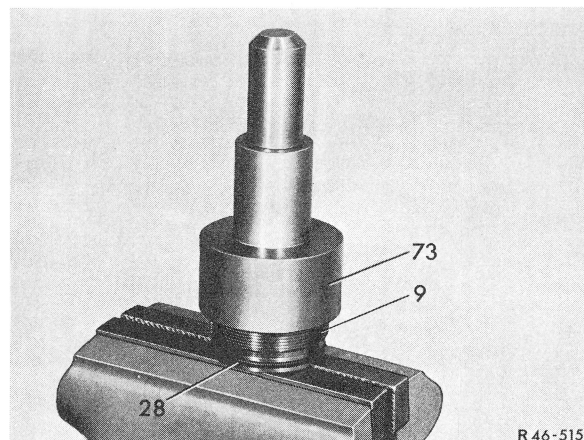


Fig. 4

- | | |
|------------------|--|
| 9 Bearing insert | 73 Installation tool for radial sealing ring |
| 28 O-ring | |

5 Press radial sealing ring (26) into bearing insert (9) with installation tool (73), fill space between both sealing lips with grease and insert locking ring (27) (Fig. 4 and 5).

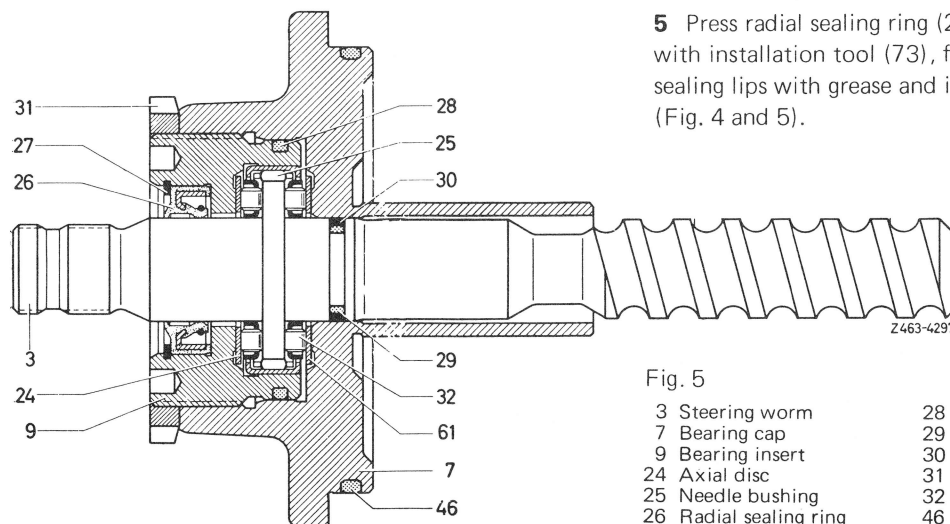


Fig. 5

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

46.1 Assembly and Adjustment of Power Steering

Bearing Cap and Steering Worm

6 Screw bearing insert (9) into bearing cap (7) and tighten lightly. Screw slot nut to bearing insert (Fig. 6).

7 Measure friction torque of steering worm in bearing cap (sealing point only), by positioning measuring device (70) on splining of steering worm. Friction torque should be 12 to 15 Ncm (1.2 to 1.5 kpcm). Then tighten bearing insert (9) with pin spanner until an additional 5–7 Ncm (0.5–0.7 kpcm) friction torque are measured. Then tighten slot nut to 120–140 Nm (12–14 kpm) and check friction torque once again (Fig. 7).

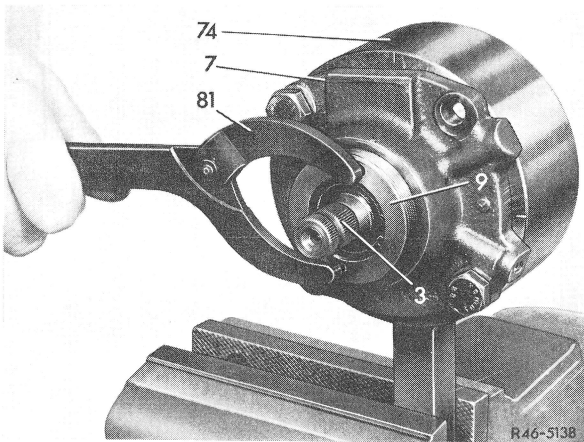


Fig. 6

- | | |
|------------------|--------------------|
| 3 Steering worm | 74 Assembly device |
| 7 Bearing cap | 81 Pin spanner |
| 9 Bearing insert | |

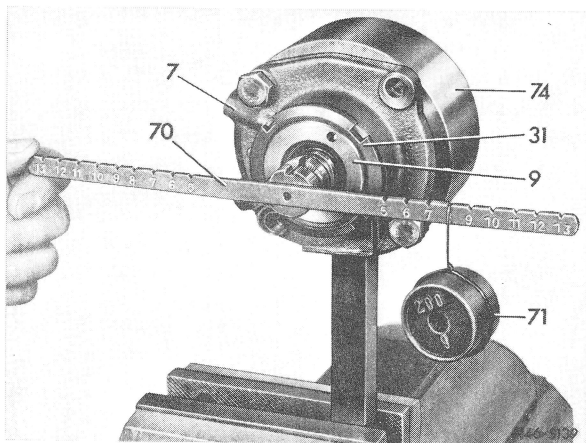


Fig. 7

- | | |
|------------------|---------------------|
| 7 Bearing cap | 70 Measuring device |
| 9 Bearing insert | 71 Weight |
| 31 Slot nut | 74 Assembly device |

8 Friction torque can also be measured with torque wrench (76) in combination with insert (75) (Fig. 8).

9 Remove bearing cap from fixture, position both O-rings (46 and 62) (Fig. 9).

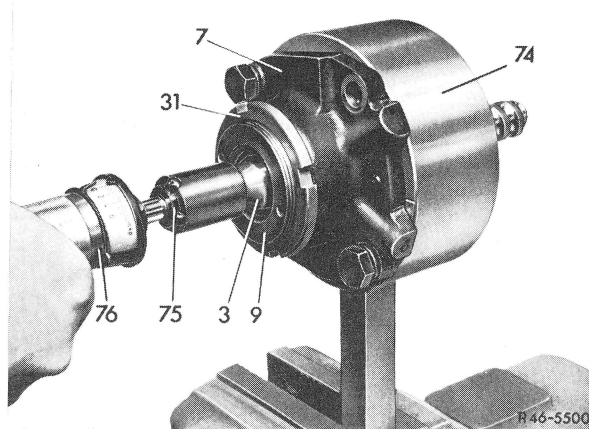


Fig. 8

- | | |
|------------------|--------------------|
| 3 Steering worm | 74 Assembly device |
| 7 Bearing cap | 75 Splined insert |
| 9 Bearing insert | 76 Torque wrench |
| 31 Slot nut | |

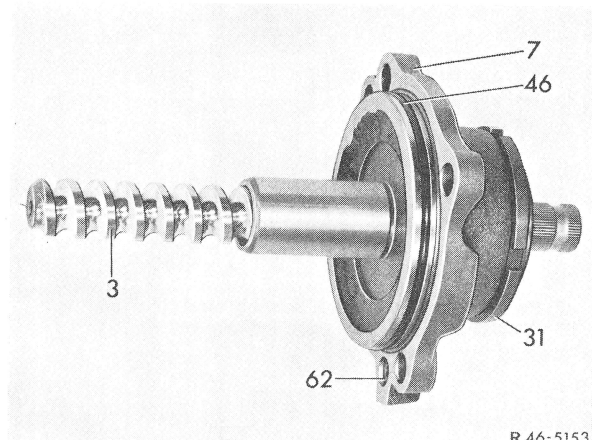


Fig. 9

- | | | |
|-----------------|-------------|-----------|
| 3 Steering worm | 31 Slot nut | 62 O-ring |
| 7 Bearing cap | 46 O-ring | |

Working Piston and Steering Nut

10 Press outer race of axial tapered ball bearing (33) into working piston (5), position ball race and insert steering nut (4) into working piston (Fig. 10 and 11).

11 Insert axial cyl. roller cage (34) into working piston (5) in such a manner that the sheet metal guide on roller cage enters the steering nut (4) (Fig. 11 and 12).

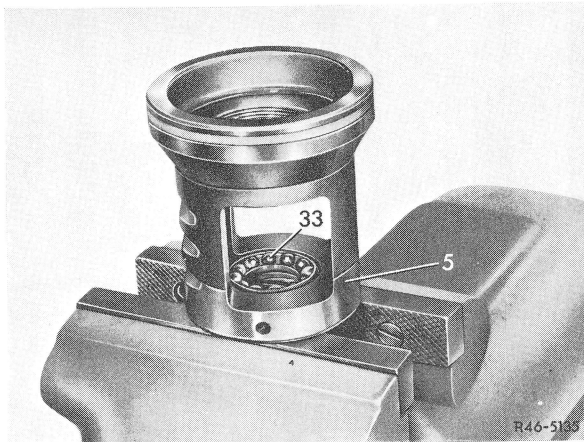


Fig. 10
5 Working piston 33 Axial tapered ball bearing

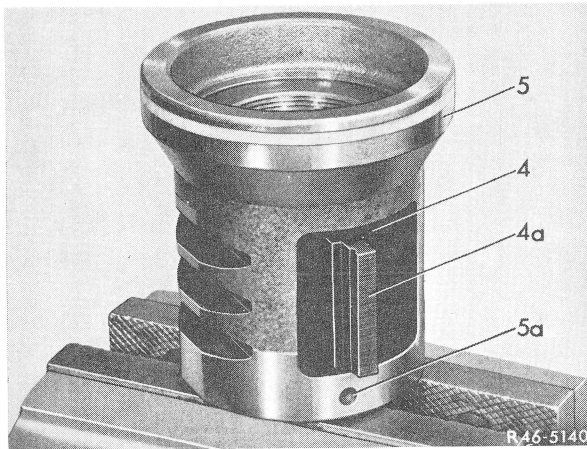


Fig. 11
4 Steering nut 5 Working piston
4a Straightedge on steering nut 5a Center for center position control screw

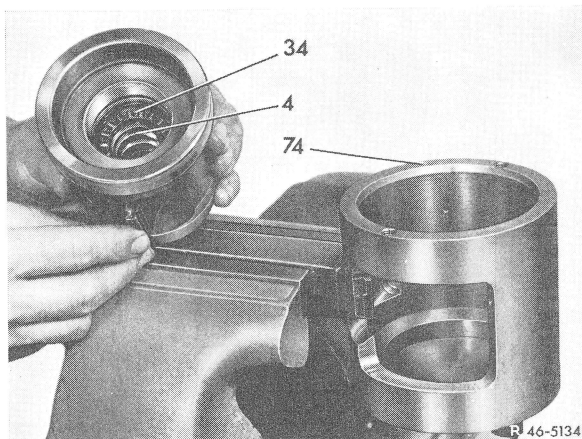


Fig. 12
4 Steering nut
34 Axial cyl. roller cage
74 Assembly device for working piston

12 Insert O-ring (37) and sealing ring (38), as well as axial disc (35) into screw cover (36) (Fig. 14).

Note: The axial disc is installed only on version 1 of power steering. On version 2, the disc is no longer installed, since the screw cover is hardened.

13 Screw slot nut (39) on screw cover (36) into working piston (5) and tighten slightly (Fig. 13 and 14).

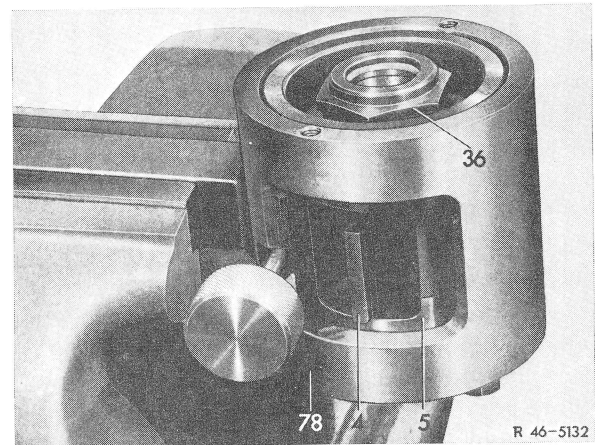


Fig. 13
4 Steering nut 36 Screw cover
5 Working piston 38 Assembly device

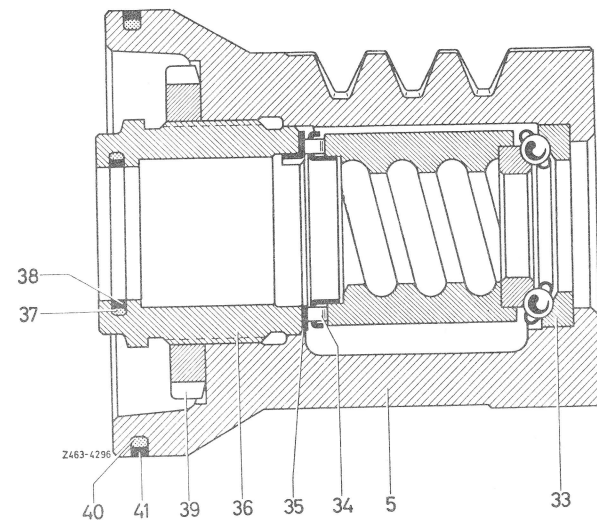


Fig. 14
5 Working piston 37 O-ring
33 Axial tapered ball bearing 38 Sealing ring (teflon)
34 Axial cyl. roller cage 39 Slot nut
35 Axial disc 40 O-ring
36 Screw cover 41 Sealing ring (teflon)

46.1 Assembly and Adjustment of Power Steering

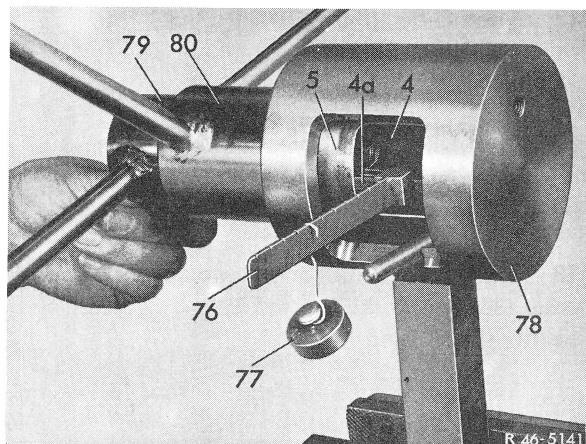


Fig. 15

- | | |
|---------------------------------|---------------------|
| 4 Steering nut | 76 Measuring device |
| 4a Straightedge on steering nut | 77 Weight |
| 5 Working piston | 78 Assembly device |
| | 79 Hex. wrench |
| | 80 Slot nut wrench |

14 Clamp working piston (5) in fixture (78) and adjust friction torque of steering nut in working piston, while placing measuring device (76) on straight-edge (4a) of steering nut. Friction torque is 6 – 10 Ncm (0.6–1.0 kpcm). Then tighten screw cover until weight on measuring device will just turn steering nut. Secure screw cover with slot nut, tightening torque 100–120 Nm (10 to 12 kpm) (Fig. 15).

15 Unclamp working piston from device and place into assembly tray (72) (Fig. 16).

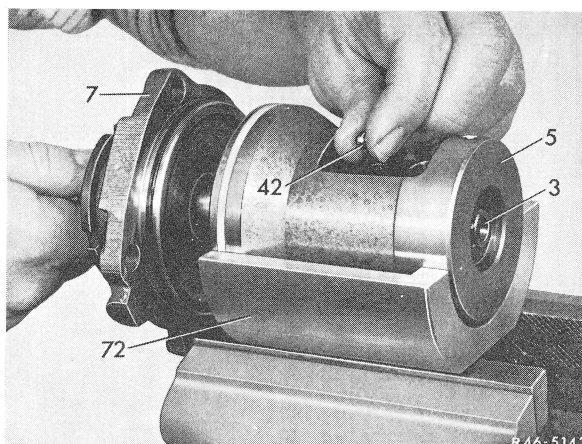


Fig. 16

- | | |
|------------------|-------------------------------------|
| 3 Steering worm | 42 Ball (17 each) |
| 5 Working piston | 72 Assembly tray for working piston |
| 7 Bearing cap | |

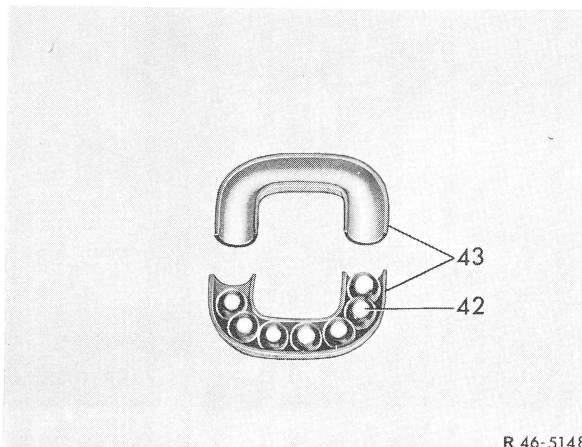


Fig. 17

- | | |
|------------------|--------------------|
| 42 Ball (7 each) | 43 Ball guide half |
|------------------|--------------------|

Steering Worm, Steering Nut

16 Introduce steering worm (3) into steering nut until one ball circuit is completely shown through bore (for balls) in steering nut (Fig. 16).

17 Introduce 17 balls into ball circuit while slowly turning steering wheel to the right (Fig. 16).

18 Fill one ball guide half (43) with grease and insert remaining 7 balls (42) into this guide half. Then attach the other ball guide halves into steering nut (4). Mount fastening clip and screw-in hex. screws with serrated washers and tighten to 12–16 Nm (1.2–1.6 kpm) (Fig. 17 and 18).

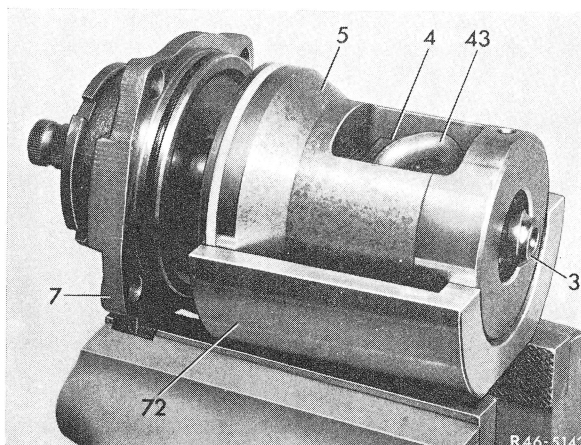


Fig. 18

- | | |
|------------------|--------------------|
| 3 Steering worm | 7 Bearing cap |
| 4 Steering nut | 43 Ball guide half |
| 5 Working piston | 72 Assembly tray |

19 Position measuring fixture (70) on splining of steering worm (3) and measure friction torque of ball circuit (Fig. 19).

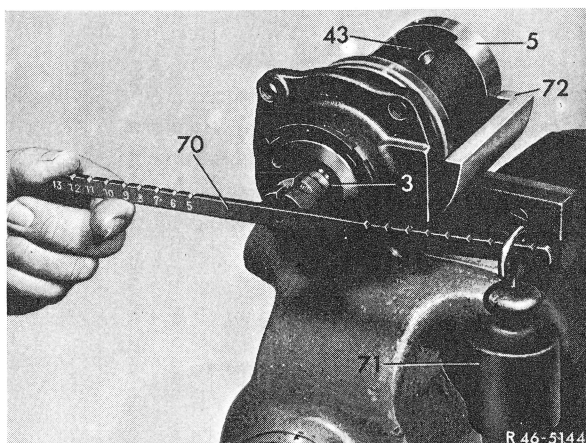


Fig. 19

- | | |
|--------------------|---------------------|
| 3 Steering worm | 70 Measuring device |
| 5 Working piston | 71 Weight |
| 43 Ball guide half | 72 Assembly tray |

The friction torque of steering nut — steering worm should be 40–60 Ncm (4–6 kpcm).

If the friction torque is not within this tolerance, replace complete ball circuit together with steering nut, steering worm and balls.

20 The friction torque can also be measured with torque wrench (76) (Fig. 20).

21 Replace O-ring (23) in steering case (1) (Fig. 21).

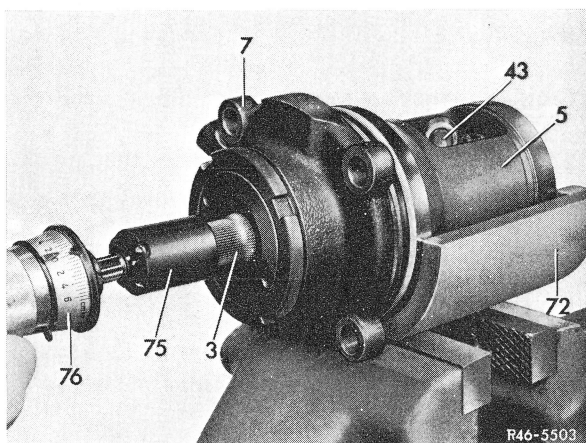


Fig. 20

- | | |
|--------------------|------------------|
| 3 Steering worm | 72 Assembly tray |
| 5 Working piston | 75 Insert |
| 7 Bearing cap | 76 Torque wrench |
| 43 Ball guide half | |

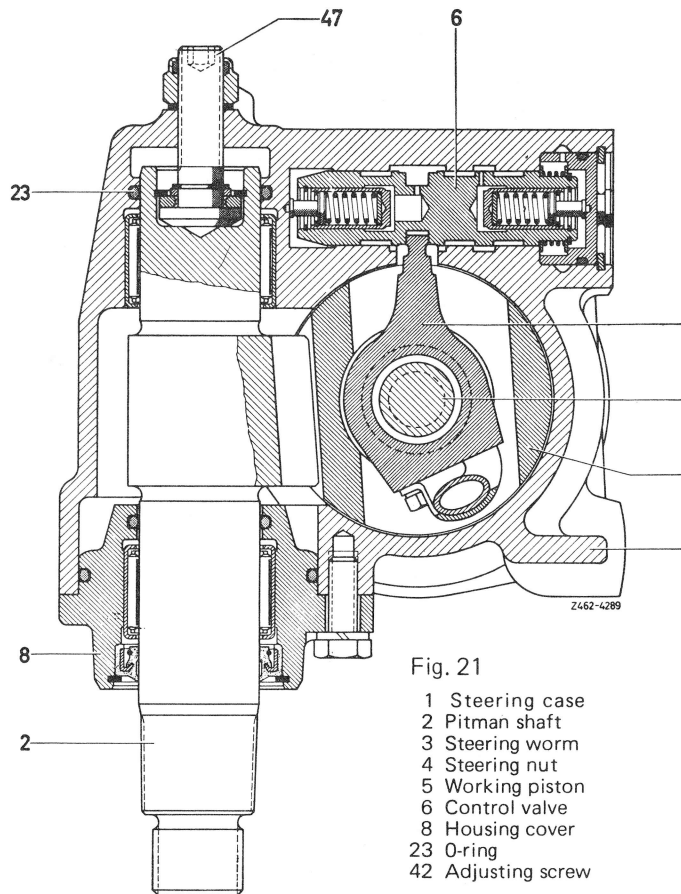


Fig. 21

- | |
|--------------------|
| 1 Steering case |
| 2 Pitman shaft |
| 3 Steering worm |
| 4 Steering nut |
| 5 Working piston |
| 6 Control valve |
| 8 Housing cover |
| 23 O-ring |
| 42 Adjusting screw |

Steering Case, Control Valve

22 On version 1, insert control valve (6) into steering case (1) (Fig. 21 and 22).

23 On version 2, grease spring bolt (65) (Fig. 23), and on version 3, grease spring (67) (Fig. 24) and insert into reaction pistons (12), then insert control valve (6) into steering case (1).

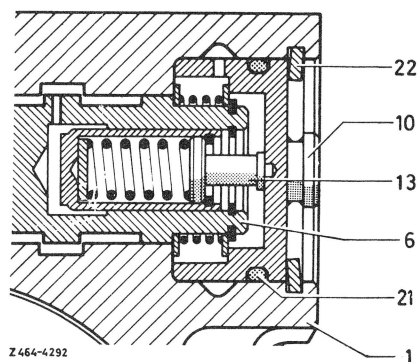


Fig. 22 Control valve version 1

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

46.1 Assembly and Adjustment of Power Steering

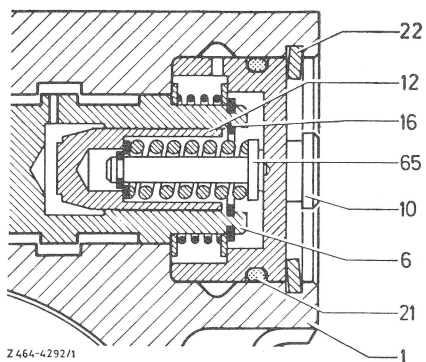


Fig. 23

Control valve version 2

- | | |
|---------------------------------|-----------------|
| 1 Steering case | 21 O-ring |
| 6 Control valve | 22 Locking ring |
| 10 Closing cover | 65 Spring bolt |
| 12 Reaction piston (10 mm dia.) | |

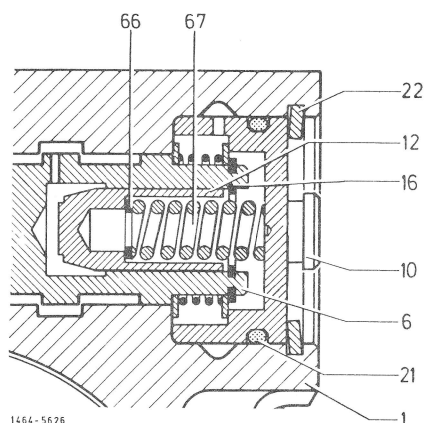


Fig. 24

Control valve version 3

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

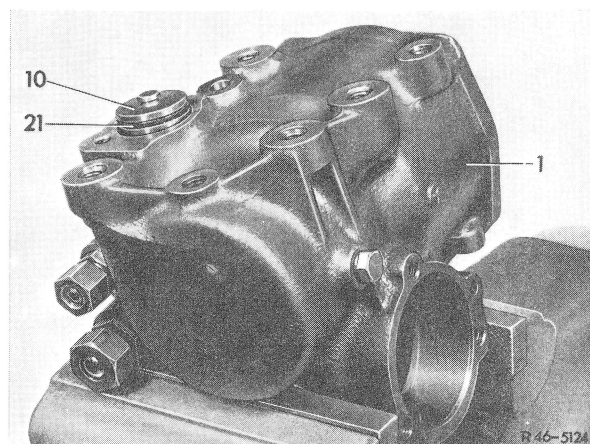


Fig. 25

- | | |
|------------------|-----------|
| 1 Steering case | 21 O-ring |
| 10 Closing cover | |

24 Replace O-ring (21) on closing cover (10), then knock closing cover into steering case by means of a plastic hammer (Fig. 22 to 25).

25 Install locking ring (22) into steering case (1) in such a manner that the lugs of the ring are exerting pressure on closing cover (10). If required, knock-in locking ring slightly by means of a mandrel until correctly fitted in groove of steering case (Fig. 26).

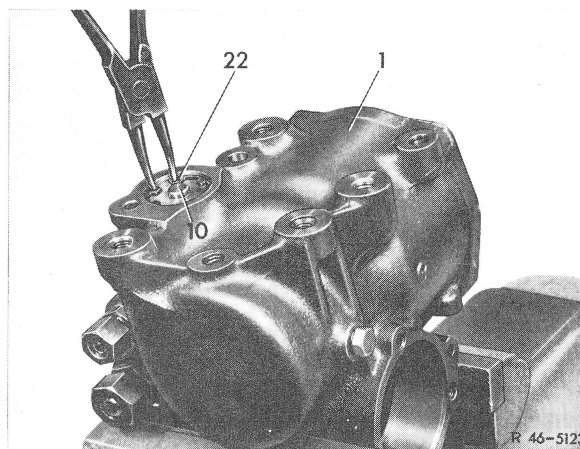


Fig. 26

- | | |
|------------------|-----------------|
| 1 Steering case | 22 Locking ring |
| 10 Closing cover | |

Steering Case, Working Piston

26 Carefully install working piston (5) complete with steering worm (3), steering nut (4) and bearing cap (7) into steering case, while introducing straight-edge of steering nut into groove of control valve (Fig. 27).

Caution! Do not use force.

27 Turn bearing cap in such a manner, that the oil duct on steering case is in alignment with the oil bore on bearing cap. Watch out for correct seat of O-rings. Then screw-in hex. bolts without snap rings and washers and tighten to 60 - 65 Nm (6-6.5 kpm).

28 Turn steering worm with the center tooth gap resting against working piston in center of steering case.

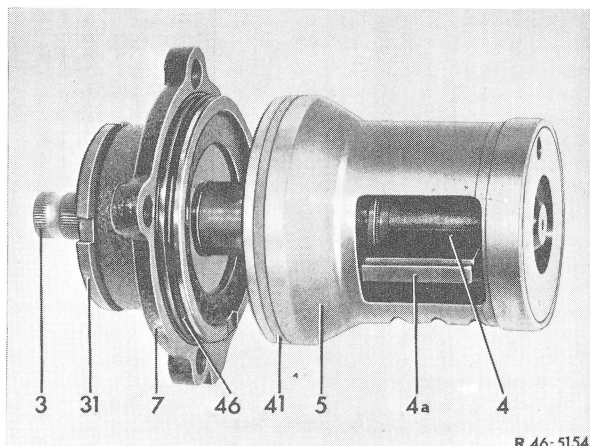


Fig. 27

- | | |
|---------------------------------|--------------------------|
| 3 Steering worm | 7 Bearing cap |
| 4 Steering nut | 31 Slot nut |
| 4a Straightedge on steering nut | 41 Sealing ring (teflon) |
| 5 Working piston | 48 O-ring |

Pitman Shaft, Housing Cover

29 Insert O-rings (54, 55, 63) into housing cover (8) (Fig. 28).

30 Insert adjusting screw (47), including thrust washer (48) and locking ring (49) into pitman shaft (2), making sure of perfect seating of locking ring (Fig. 29 and 31).

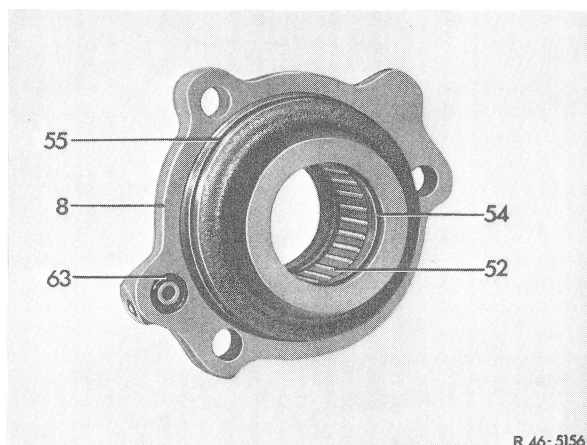


Fig. 28

- | | |
|-------------------|-----------|
| 8 Housing cover | 55 O-ring |
| 52 Needle bushing | 63 O-ring |
| 54 O-ring | |

Note: Install adjusting screw into pitman shaft with as little play as possible. For this purpose, thrust washers 2.85, 2.90, 2.95, 3.00, 3.05 and 3.10 mm thick are available.

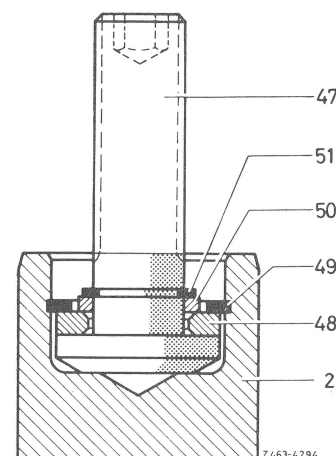


Fig. 29

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

31 Position thrust ring (50) on adjusting screw (47) and insert locking ring (51) (Fig. 29 to 31).

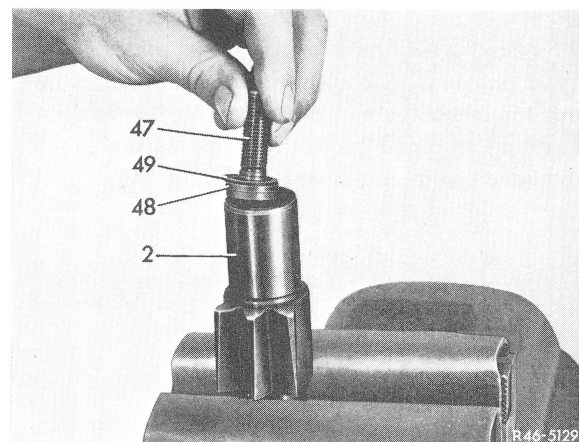


Fig. 30

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

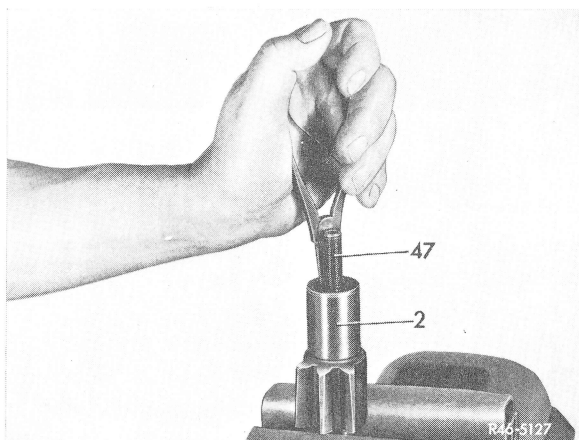


Fig. 31

- | | |
|----------------|--------------------|
| 2 Pitman shaft | 47 Adjusting screw |
|----------------|--------------------|

32 Force radial sealing ring (56) into housing cover (8) and insert locking ring (Fig. 32).

46.1 Assembly and Adjustment of Power Steering

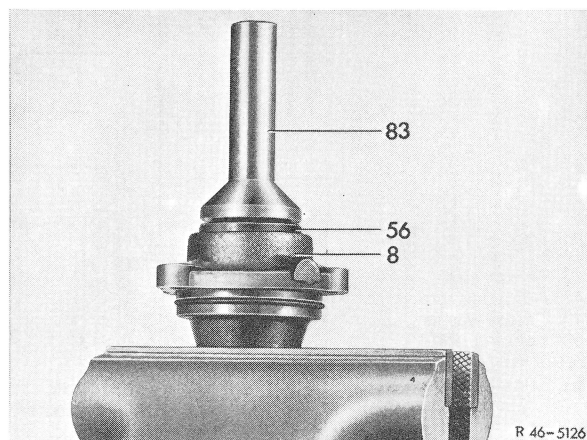


Fig. 32

8 Housing cover
83 Installation tool
56 Radial sealing ring

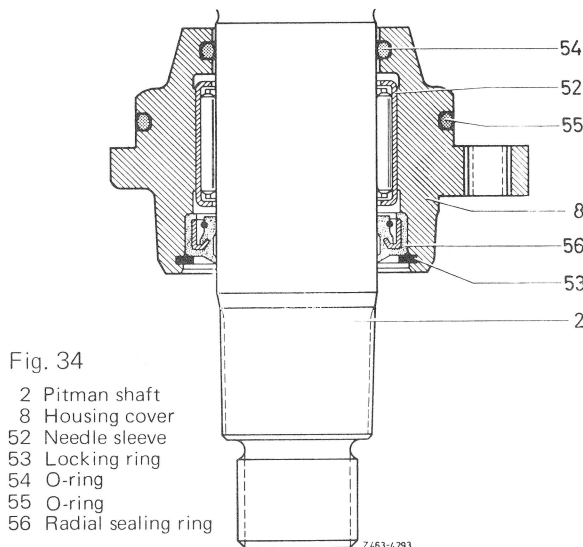


Fig. 34

2 Pitman shaft
8 Housing cover
52 Needle sleeve
53 Locking ring
54 O-ring
55 O-ring
56 Radial sealing ring

33 Place housing cover (8) on pitman shaft (2), then insert pitman shaft into steering housing. Make sure that the center tooth of the pitman shaft enters the center tooth gap of the working piston and that the O-rings are correctly seated (Fig. 33 and 34).

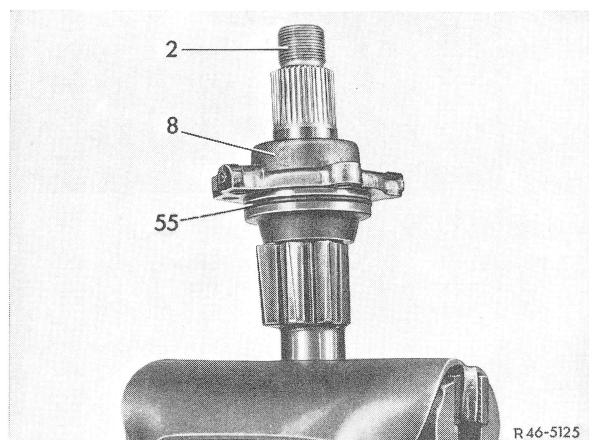


Fig. 33

2 Pitman shaft
8 Housing cover
55 O-ring

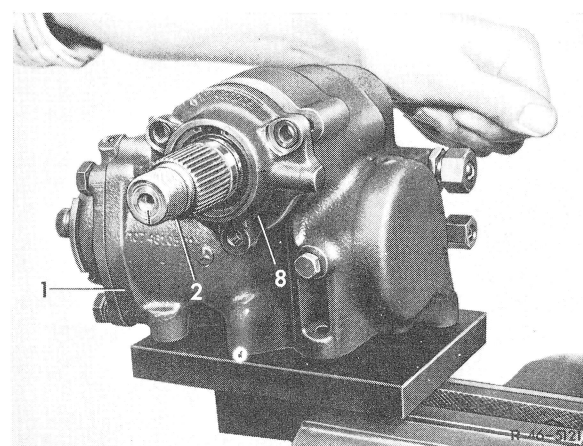


Fig. 35

1 Steering case
2 Pitman shaft
8 Housing cover

34 Screw adjusting screw (47) into steering case until it is hard to move (Fig. 36).

35 Turn housing cover (8) so that both oil ducts are one above the other. Then screw-in hex. bolts with new high-tension snap rings and tighten to 30–35 Nm (3–3.5 kpm) (Fig. 35).

Note: The housing cover is now attached to steering housing by means of 4 hex. screws.

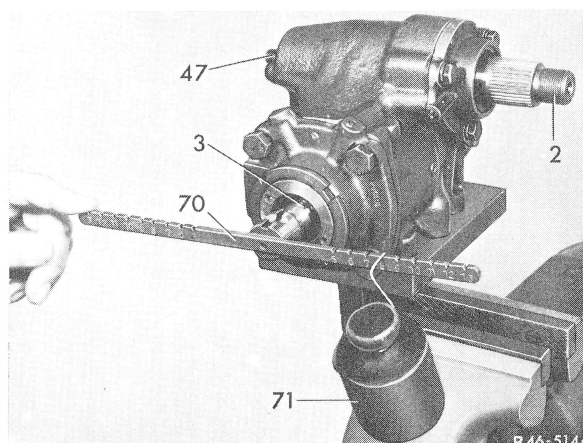


Fig. 36

2 Pitman shaft
3 Steering worm
47 Adjusting screw
70 Measuring device
71 Weight

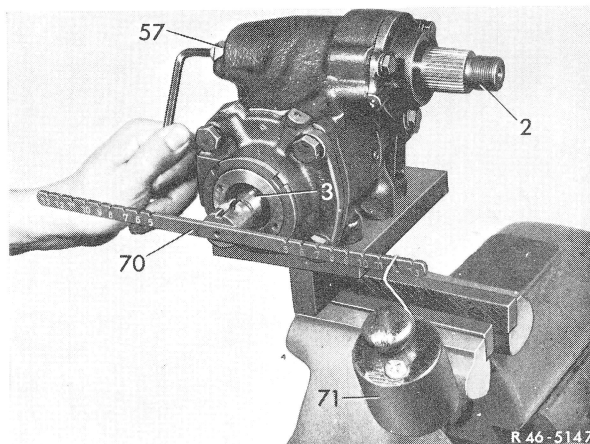


Fig. 37

- | | |
|--------------------------|---------------------|
| 2 Pitman shaft | 70 Measuring device |
| 3 Steering worm | 71 Weight |
| 57 Self-locking hex. nut | |

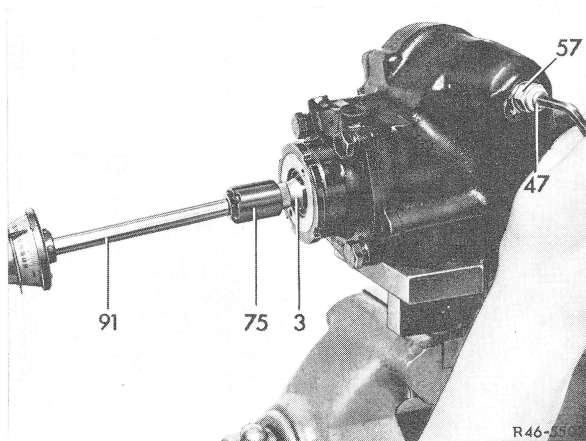


Fig. 38

- | | |
|--------------------------|------------------|
| 3 Steering worm | 75 Insert |
| 47 Adjusting screw | 91 Torque wrench |
| 57 Self-locking hex. nut | |

36 Loosen adjusting screw (47) until the steering worm (3) is easy to turn, then measure friction torque of steering worm and measure friction value (Fig. 36).

37 Adjust pressure mechanism of pitman shaft by turning adjusting screw (47) to the right until the friction torque has increased by 40 – 60 Ncm (4–6 kpcm) (Fig. 37).

38 The friction torque can also be measured with torque wrench (91) (Fig. 38).

39 Screw SEAL-Lock collar nut on adjusting screw (47) and tighten to 60–70 Nm (6–7 kpm), while applying counterhold to adjusting screw (Fig. 38).

Caution! When using Polystop nut, place copper sealing ring on adjusting screw and tighten Polystop nut to 30–35 Nm (3–3.5 kpm) while applying counterhold to adjusting screw.

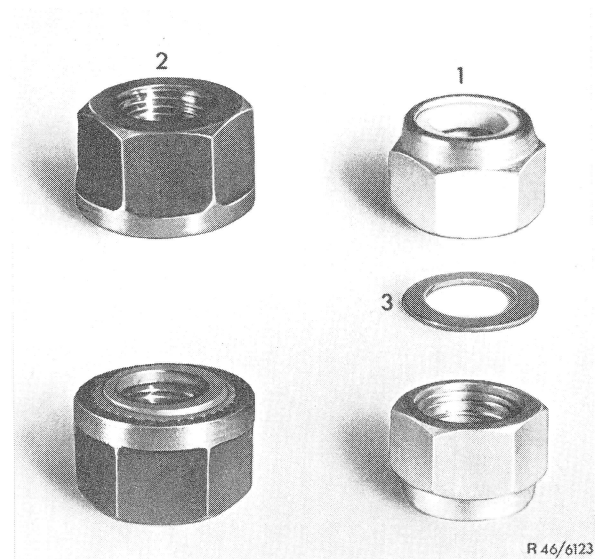


Fig. 39

- | | |
|------------------------|---------------|
| 1 Polystop hex. nut | 3 Copper ring |
| 2 SEAL-Lock collar nut | |

40 Check total friction torque once again (refer to item 36 and 37).