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# Repair Manual

BMW R 45  
R 65

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BMW MOTORRAD GMBH Munich



Order No. 01 51 9 798 092

## SUPPLEMENT FILING REGISTER

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# INTRODUCTION

This repair manual is intended to guarantee that the maintenance and repair work required for BMW cars is done in the correct manner. The manual should be used by shop foremen and mechanics to supplement the practical and theoretical knowledge they have acquired at our service training school.

Specifications are provided at the beginning of each main group.

The group system was taken from our Flat Rate Catalog.

Taking our page numbering system as an example, 33-10/2 means:

33 main group  
-10 subgroup  
/ 2 consecutively numbered page in subgroup

The special tools required for proper repairs are listed in Service Information Bulletin No. 6/76 (419 R) of Service Promotion, Group Equipment. Their application is described in texts accompanying the illustrations.

Each job text always describes the removal procedures. There are appropriate installation notes, if installation cannot be completed in reverse sequence.

Supplements to this manual will include alterations and additions. A sheet marked "alteration" at the bottom replaces an old sheet. Sheets marked "addition" are simply filed at the right place without removing any sheets.

In addition to information on improvements and modifications as announced regularly in our Service Information Bulletins, we recommend that you use the microfilmed parts catalogs as a further source of information.

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Service Division

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# Tightening Torques

for self-locking hexagon nuts

BMW N  
113 49.0

**Applicable** only to nuts according to BMW N 113 48.0 and DIN 985.

Surface condition: Phosphate treated or galvanized bolts/screws, galvanized or unwaxed nuts.

Lubricated condition: either non-lubricated or lubricated with light coat of oil.

For cadmium plated bolts/screws or nuts the tightening torque must be  $\approx 30\%$  less than value given in table when utilization factor of bolt material is the same.

**Not applicable** when surface or lubricated condition of threads is different, property class of bolt/screw is less than 8.8 (e.g. 6.9), in conjunction with expansion bolts/screws.

In such cases values will have to be determined separately.

| Threads     | Tightening Torque $M_A$ (kpm)                 |                      |                      |                                        |                     |                      |
|-------------|-----------------------------------------------|----------------------|----------------------|----------------------------------------|---------------------|----------------------|
|             | Nuts acc. to BMW N 113 48.0<br>Property Class |                      |                      | Nuts acc. to DIN 985<br>Property Class |                     |                      |
|             | 8                                             | 10                   | 12                   | 8                                      | 10                  | 12                   |
| M 6         | 1,1 <sup>+0,1</sup>                           | 1,5 <sup>+0,2</sup>  | 1,8 <sup>+0,2</sup>  | 1,0 <sup>+0,1</sup>                    | 1,3 <sup>+0,2</sup> | 1,6 <sup>+0,2</sup>  |
| M 8         | 2,5 <sup>+0,3</sup>                           | 3,4 <sup>+0,4</sup>  | 4,0 <sup>+0,5</sup>  | 2,5 <sup>+0,2</sup>                    | 3,3 <sup>+0,3</sup> | 3,9 <sup>+0,4</sup>  |
| M 8 x 1     |                                               |                      |                      |                                        |                     |                      |
| M 10        | 4,9 <sup>+0,5</sup>                           | 6,8 <sup>+0,8</sup>  | 8,0 <sup>+0,9</sup>  | 4,7 <sup>+0,5</sup>                    | 6,4 <sup>+0,7</sup> | 7,7 <sup>+0,8</sup>  |
| M 10 x 1,25 |                                               |                      |                      |                                        |                     |                      |
| M 12        | 8,1 <sup>+0,9</sup>                           | 11,4 <sup>+1,3</sup> | 13,5 <sup>+1,5</sup> | 7,8 <sup>+0,8</sup>                    | 10,9 <sup>+1</sup>  | 12,6 <sup>+1,5</sup> |
| M 12 x 1,5  |                                               |                      |                      |                                        |                     |                      |
| M 14        | 13,0 <sup>+1,5</sup>                          | 18,0 <sup>+2</sup>   | 22,0 <sup>+2</sup>   | 12,7 <sup>+1,5</sup>                   | 17,0 <sup>+2</sup>  | 21,0 <sup>+2</sup>   |
| M 14 x 1,5  |                                               |                      |                      |                                        |                     |                      |
| M 16        | 22,5 <sup>+2</sup>                            | 28,0 <sup>+3</sup>   | 33,0 <sup>+4</sup>   | 19,5 <sup>+2</sup>                     | 26,0 <sup>+3</sup>  | 31,0 <sup>+4</sup>   |
| M 16 x 1,5  |                                               |                      |                      |                                        |                     |                      |
| M 18        | 27,0 <sup>+3</sup>                            | 38,0 <sup>+4</sup>   | 44,0 <sup>+5</sup>   | 26,0 <sup>+3</sup>                     | 36,0 <sup>+4</sup>  | 42,0 <sup>+5</sup>   |
| M 18 x 1,5  |                                               |                      |                      |                                        |                     |                      |

Pertinent preload forces  $P_v$  (kp), corresponding with different property classes, are shown in "Tightening Torques and Preload Forces" table of BMW N 600 02.0.

Values given in this table shall apply to bolts/screws or nuts having the above mentioned properties. Tightening torque values including tolerances will only be given on layout or assembly drawings if operations require a value deviating from standards.

Bolts/screws or nuts subjected to high dynamic loads will have their tightening torque value determined by exact calculations and tests.

## Conversion:

1 kpm x 7.233 = tightening torque in ft. lbs.



## Tightening Torques and Preload Forces

**Applicable** only to bolts/screws according to DIN 912, 931, 933, 960, 961, 6912 and nuts having a nut height of  $0.8 \times d$  according to DIN 934 and exclusively for  $\mu_{tot.} = 0.14$ .

(Phosphate treated bolts/screws, nuts without final treatment or galvanized. Lubricated condition: either non-lubricated or lubricated with oil.)

For cadmium plated bolts/screws or nuts ( $\mu_{tot.} \approx 0.08$  to  $0.09$ ) the tightening torque must be  $\approx 30\%$  less than value given in table when utilization factor of bolt material is the same.

**Not applicable** when a different surface or lubricated condition of the threads is used or if there is a deviation in nut height. In such cases values will have to be determined separately.

**Not applicable** to bolts/screws with expansion shanks, self-locking screws or screws used to hold parts made of different materials.

Utilization factor of a bolt/screw with standard metric threads:

$$\sigma_{red} = 0,09 \cdot \sigma_{0,2}$$

| Threads   | Tightening Torque $M_A$ (kpm)  |                      |                      |                      |                     |                      | Preload force $P_V$ (kp)       |      |      |       |       |       |
|-----------|--------------------------------|----------------------|----------------------|----------------------|---------------------|----------------------|--------------------------------|------|------|-------|-------|-------|
|           | Property Class acc. to DIN 267 |                      |                      |                      |                     |                      | Property Class acc. to DIN 267 |      |      |       |       |       |
|           | 5.6                            | 6.8                  | 6.9                  | 8.8                  | 10.9                | 12.9                 | 5.6                            | 6.8  | 6.9  | 8.8   | 10.9  | 12.9  |
| M 6       | 0,4 <sup>+0,1</sup>            | 0,6 <sup>+0,1</sup>  | 0,7 <sup>+0,1</sup>  | 0,9 <sup>+0,1</sup>  | 1,2 <sup>+0,2</sup> | 1,5 <sup>+0,2</sup>  | 425                            | 600  | 685  | 855   | 1210  | 1440  |
| M 8       | 1,0 <sup>+0,1</sup>            | 1,6 <sup>+0,2</sup>  | 1,8 <sup>+0,2</sup>  | 2,2 <sup>+0,2</sup>  | 3,0 <sup>+0,3</sup> | 3,6 <sup>+0,4</sup>  | 740                            | 1190 | 1330 | 1570  | 2170  | 2630  |
| M 10      | 2,0 <sup>+0,2</sup>            | 3,2 <sup>+0,4</sup>  | 3,6 <sup>+0,4</sup>  | 4,3 <sup>+0,5</sup>  | 6,0 <sup>+0,7</sup> | 7,3 <sup>+0,8</sup>  | 1160                           | 1880 | 2090 | 2500  | 3480  | 4200  |
| M 8x1     | 1,0 <sup>+0,1</sup>            | 1,0 <sup>+0,2</sup>  | 1,8 <sup>+0,2</sup>  | 2,2 <sup>+0,2</sup>  | 3,0 <sup>+0,3</sup> | 3,6 <sup>+0,4</sup>  | 740                            | 1190 | 1330 | 1610  | 2200  | 2670  |
| M 10x1,25 | 2,0 <sup>+0,2</sup>            | 3,2 <sup>+0,4</sup>  | 3,6 <sup>+0,4</sup>  | 4,3 <sup>+0,5</sup>  | 6,0 <sup>+0,7</sup> | 7,3 <sup>+0,8</sup>  | 1160                           | 1900 | 2120 | 2520  | 3530  | 4250  |
| M 12x1,25 | 3,4 <sup>+0,4</sup>            | 5,4 <sup>+0,6</sup>  | 6,1 <sup>+0,7</sup>  | 7,2 <sup>+0,8</sup>  | 10,3 <sup>+1</sup>  | 12,0 <sup>+1,5</sup> | 1720                           | 2710 | 3070 | 3610  | 5100  | 6090  |
| M 12x1,5  | 3,4 <sup>+0,4</sup>            | 5,4 <sup>+0,6</sup>  | 6,1 <sup>+0,7</sup>  | 7,2 <sup>+0,8</sup>  | 10,3 <sup>+1</sup>  | 12,0 <sup>+1,5</sup> | 1690                           | 2670 | 3030 | 3570  | 5040  | 6000  |
| M 14x1,5  | 5,4 <sup>+0,6</sup>            | 8,6 <sup>+1</sup>    | 9,8 <sup>+1</sup>    | 11,5 <sup>+1,5</sup> | 16,0 <sup>+2</sup>  | 20,0 <sup>+2</sup>   | 2330                           | 3720 | 4180 | 5030  | 6970  | 8510  |
| M 16x1,5  | 8,3 <sup>+1</sup>              | 13,5 <sup>+1,5</sup> | 15,5 <sup>+1,5</sup> | 18,0 <sup>+2</sup>   | 25,0 <sup>+3</sup>  | 30,0 <sup>+4</sup>   | 3240                           | 5190 | 5840 | 6920  | 9710  | 11770 |
| M 18x1,5  | 11,0 <sup>+1,5</sup>           | 18,0 <sup>+2</sup>   | 20,0 <sup>+2,5</sup> | 24,0 <sup>+3</sup>   | 34,0 <sup>+4</sup>  | 40,0 <sup>+5</sup>   | 3890                           | 6240 | 7020 | 8380  | 11800 | 13960 |
| M 20x1,5  | 16,0 <sup>+2</sup>             | 26,0 <sup>+3</sup>   | 29,0 <sup>+3,5</sup> | 34,0 <sup>+4</sup>   | 49,0 <sup>+5</sup>  | 59,0 <sup>+6</sup>   | 5070                           | 8170 | 9180 | 10680 | 15200 | 18250 |

Values given in this table shall apply to bolts/screws or nuts having the above mentioned properties. Tightening torque values including tolerances will only be given on layout or assembly drawings if

- a) operations require a value deviating from standards,
- b) or property class of bolt/screw and nut is not known.

**Important!** All deviations from this table are pointed out in the "Specifications".

**Conversions:** 1 mkp x 7.233 = tightening torque in ft. lbs.

1 kp x 2.2046 = preload force in lbs.



# 00 Maintenance and General Information

|                                                        |              |
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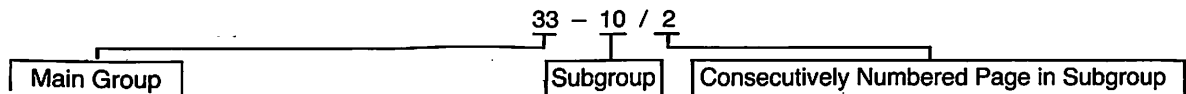


# INTRODUCTION

This repair manual will help to make sure that all of the most important service and repair procedures are performed correctly. When used everyday by shop foremen and mechanics it will supplement the practical and theoretical knowledge acquired in our service training school. This will even further improve the quality of service.

This manual has a chronological layout according to the 00 to 99 group system applied in flat rate catalogs.

Example of page numbering system:



Specifications are provided at the beginning of each main group.

The special tools required for proper repairs are listed in Service Information Bulletins under the service promotion group on equipment, together with supplements. Their application is described in texts and shown in illustrations.

Each job text always describes the removal procedures. There are appropriate installation notes when installation cannot be completed in reverse sequence.

Supplements for this repair manual will consist of alterations and additions. Sheets marked "alteration" replace old sheets. Sheets marked "addition" are new and must be filed according to page number.

*If a job number is used twice, because of engineering changes, the second repair procedures with the same number will be printed on colored paper and must be filed as an addition.*

Repair instructions will also be published in service information bulletins if necessary. They will, of course, be included in the next edition of the repair manual. We also recommend using the spare part microfilm for additional help.

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## Survey of Tightening Torque Values in Nm

|                                             | Nm        |                                                                                 | Nm          |
|---------------------------------------------|-----------|---------------------------------------------------------------------------------|-------------|
| <b>Engine</b>                               |           | Damper in slide tube mounting screw                                             | 30 ÷ 40     |
| Cylinder head nuts (15-35-39 in 3 steps)    | 35 ÷ 39   | Axle mounting screw                                                             | 15 ÷ 17     |
| Connecting rod bolts                        | 48 ÷ 52   | Fender holder to slide tube                                                     | 20 ÷ 25     |
| Flywheel                                    | 100 ÷ 105 |                                                                                 |             |
| Oil pan to crankcase                        | 9 ÷ 11    |                                                                                 |             |
| Nut for valve adjusting screw               | 18 ÷ 22   | <b>Steering</b>                                                                 |             |
| Adapter for carburetor connection           | 12 ÷ 14   | End bolt                                                                        | 80 ÷ 90     |
|                                             |           |                                                                                 |             |
| <b>Engine Electrical System</b>             |           | <b>Rear Axle</b>                                                                |             |
| Armature mounting screw                     | 23 ÷ 27   | Nut on drive pinion                                                             | 150 ÷ 165   |
| Spark plugs                                 | 23 ÷ 30   | Threaded ring on drive pinion                                                   | 100 ÷ 120   |
| Starter mounting screws                     | 47.5      | Nuts on cardan cover                                                            | 18 ÷ 21     |
|                                             |           | Final drive oil filler plug                                                     | 28 ÷ 31     |
| <b>Exhaust System</b>                       |           | Final drive oil drain plug                                                      | 23 ÷ 26     |
| Spider nuts for exhaust                     | 160 ÷ 180 | Shaft bolt for control arm                                                      | 10 ÷ 12     |
|                                             |           | Castle nut for control arm shaft bolt                                           | 100 ÷ 110   |
| <b>Clutch</b>                               |           | Oil filler plug of control arm                                                  | 14          |
| Castle nut for clutch pedal adjusting screw | 20 ÷ 23   | Oil drain plug of control arm                                                   | 14 ÷ 17     |
|                                             |           | Rear stub axle mounting bolt                                                    | 14 ÷ 18     |
|                                             |           | Shock absorber rod to spring strut at top                                       | 30 ÷ 34     |
| <b>Transmission</b>                         |           |                                                                                 |             |
| Transmission to engine                      | 20 ÷ 23   | <b>Brakes</b>                                                                   |             |
| Selector fork or automatic shift            | 23 ÷ 25   | Brake line to master cylinder                                                   | 8 ÷ 11      |
| Output flange to transmission output shaft  | 200 ÷ 220 | Brake line to brake caliper                                                     | 8 ÷ 11      |
| Transmission cover to transmission case     | 8 ÷ 9     |                                                                                 |             |
| Nut for kickstart lever                     | 20 ÷ 23   | <b>Wheels and tires</b>                                                         |             |
| Oil filler screw                            | 28 ÷ 31   | Friction torque of wheel bearings with specified tightening torque of axle nuts | 0.15 ÷ 0.30 |
| Oil drain screw                             | 23 ÷ 26   | Nuts on stub axles, front and rear                                              | 45 ÷ 48     |
|                                             |           |                                                                                 |             |
| <b>Propeller Shaft</b>                      |           | <b>Frame</b>                                                                    |             |
| Twelve-sided head screw                     | 38 ÷ 42   | Frame rear section mounting bolts                                               | 25          |
|                                             |           | Kickstand mounting bolts                                                        | 35          |
| <b>Front Wheel Fork</b>                     |           | 10 Newton meter $\triangleq$ 1 mkgp                                             |             |
| End bolt                                    | 80 ÷ 90   |                                                                                 |             |
| Fork bridge mounting bolts                  | 40 ÷ 45   |                                                                                 |             |



## Determining oil consumption

Wait until about 7 500 km (5 000 miles) have been covered before measuring oil consumption.

This distance is needed for oil consumption to settle down to a steady figure.

There must be no engine oil leaks.

Drain the engine oil while at normal operating temperature.

Drain the oil cooler.

Renew the filter element.

Fill the engine with fresh oil to the correct level.

Ride the machine under normal operating conditions until the oil level drops to the lower mark on the dipstick. Measurement after covering only 500 – 1 000 km (300 – 600 miles) is never accurate, since experience has shown that the first half-liter of oil (about 3/4 pint) is consumed more rapidly than the remainder.

The permissible oil consumption figure is up to 0.1 liter per 100 km (350 miles per Imp. pint, 590 miles per US quart).

Possible causes of excessive engine oil consumption:

1. Running-in is not yet complete
2. Leaks past valve guides
3. Score marks resulting from piston seizure
4. Piston rings incorrectly installed, broken or worn
5. Too much clearance between valve stems and guides.

## Determining fuel consumption by the DIN (German Industrial Standard) 70030 test method

The machine's carburetor and ignition settings<sup>1</sup> must be to standard specification.

The tire sizes must be as stated in the documents.

Tire pressures must be corrected if necessary to the specified values.

The brakes must be fully released.

The engine should have covered at least 7 500 km (5 000 miles) and be at normal operating temperature.

During fuel consumption testing the motorcycle should carry a weight halfway between the gross weight limit and the unladen weight.

Speed over the entire test route should be as uniform as possible, and three-quarters of the machine's top speed.

However, the test speed must not exceed 110 km/h (68 mile/h).

The test route should be as flat and dry as possible and 10 km (6.3 miles) in length. It should be traversed in both directions. Uphill and downhill gradients of up to 1.5% (1 in 67) are permissible.

The air temperature should be between +10° C (50° F) and +30° C (86° F), and the wind velocity not more than 3 m (9.85 ft) / s.

The machine is to run on a brand-name grade of fuel in accordance with the manufacturer's specification.

The fuel consumption should be determined with a commercially available meter or by means of the following formula, adding 10% for unfavorable circumstances.

$$\frac{\text{Fuel consumed} \times 100}{\text{Distance covered in km}} = \text{fuel consumption in l/100 km}$$

$$\text{Note: Fuel consumption in Imperial miles per gallon} = \frac{282.47}{\text{Consumption in l/100 km}}$$

$$\text{Fuel consumption in US miles per gallon} = \frac{235.2}{\text{Consumption in liters/100 km}}$$



## Bolts and Screws

| Description                     | Head shape                                                                          | DIN No. | Strength rating   |
|---------------------------------|-------------------------------------------------------------------------------------|---------|-------------------|
| Hexagon bolts                   |    | 931     | 8.8               |
|                                 |                                                                                     | 933     |                   |
|                                 |                                                                                     | 960     |                   |
|                                 |                                                                                     | 961     |                   |
|                                 |                                                                                     | 70614   | 12.9              |
| Cheese-head screws              |    | 561     | 8.8               |
|                                 |                                                                                     | 84      | 4.8               |
|                                 |    | 912     | 8.8               |
| Button-headed screws            |    | 6912    | 10.9              |
|                                 |                                                                                     | 7986    | 4.8               |
| Carriage bolts                  |    | 603     | 4.6               |
| Countersunk screws              |    | 63      | 8.8               |
|                                 |                                                                                     | 7987    | 4.8               |
|                                 |    | 920     | 8.8               |
| Oval-head screws                |    | 921     | 5.6 <sup>4)</sup> |
|                                 |                                                                                     | 7985    | 4.8               |
| Oval-head countersunk screws    |   | 91      | 4.8               |
|                                 |                                                                                     | 7988    | 8.8               |
| Cheese-head self-tapping screws |  | 7971    | 4.8               |
| Hexagon self-tapping screws     |  | 7976    | 1)                |

| Description                               | Head shape                                                                            | DIN No. | Strength rating   |
|-------------------------------------------|---------------------------------------------------------------------------------------|---------|-------------------|
| Countersunk self-tapping screws           |    | 7982    | 1)                |
| Oval-head self-tapping screws             |    | 7981    | 1)                |
| Oval-head countersunk self-tapping screws |    | 7983    | 1)                |
| Stud bolts                                | -                                                                                     | 833     | 8.8               |
|                                           |                                                                                       | 835     |                   |
|                                           |                                                                                       | 836     |                   |
|                                           |                                                                                       | 838     |                   |
|                                           |                                                                                       | 939     |                   |
| Threaded pins                             |    | 940     | 2) 4)             |
|                                           |                                                                                       | 417     |                   |
|                                           |                                                                                       | 551     |                   |
| Shoulder studs                            |    | 553     | 4.8 <sup>4)</sup> |
|                                           |                                                                                       | 438     | 5.8               |
| Winged screws                             |    | 427     | 4.6               |
| Screw plugs                               |    | 316     | 4.6               |
|                                           |                                                                                       | 906     | 4.6               |
|                                           |                                                                                       | 908     | 5.6 <sup>4)</sup> |
|                                           |                                                                                       | 910     | 5.6 <sup>4)</sup> |
| Hollow screws                             |  | 7604    | 6.8               |
|                                           |                                                                                       | 7623    | 6.8               |
| Cap screws                                |  | 71436   | 5.6 <sup>4)</sup> |
| Slotted plugs                             |  | 3871    | 5.6 <sup>4)</sup> |

## Nuts

| Description      | shape                                                                               | DIN No.            | Strength rating  |
|------------------|-------------------------------------------------------------------------------------|--------------------|------------------|
| Hexagon nuts     |  | 439                | 5)               |
|                  |                                                                                     | 985                | 8                |
|                  |                                                                                     | 934                | 10 <sup>4)</sup> |
|                  |                                                                                     | 936                | 3)               |
|                  |                                                                                     | 70615              | 6G               |
|                  |                                                                                     | 70616              | 8G               |
| Castellated nuts |  | 8/10 <sup>4)</sup> | 8/10             |
|                  |                                                                                     | 6S/8G              |                  |
| Wing nuts        |  | 935                | 6S/8G            |
|                  |                                                                                     | 937                | GTS              |

| Description      | shape                                                                                 | DIN No. | Strength rating    |
|------------------|---------------------------------------------------------------------------------------|---------|--------------------|
| Square nuts      |  | 557     | 5-2                |
|                  |                                                                                       | 562     | 4D-2               |
| Cap nuts         |  | 986     | 8 <sup>4)</sup>    |
|                  |                                                                                       | 1587    | 6-2                |
| Slotted nuts     |  | 70851   | 6G <sup>4)</sup>   |
| Screw caps       |  | 70852   | 5D-2 <sup>4)</sup> |
|                  |                                                                                       | 3870    |                    |
| Knurled nuts     |  | 7606    | 5-2                |
|                  |                                                                                       | 466     |                    |
| Ball collar nuts |  | 467     | 8/10               |
|                  |                                                                                       | 74361   |                    |

1) Case hardened steel, tempered file-hard, depth of case 0.1 ... 0.2 mm (0.004 ... 0.008")

2) up to M 10: 4.8, from M 12: 4.6

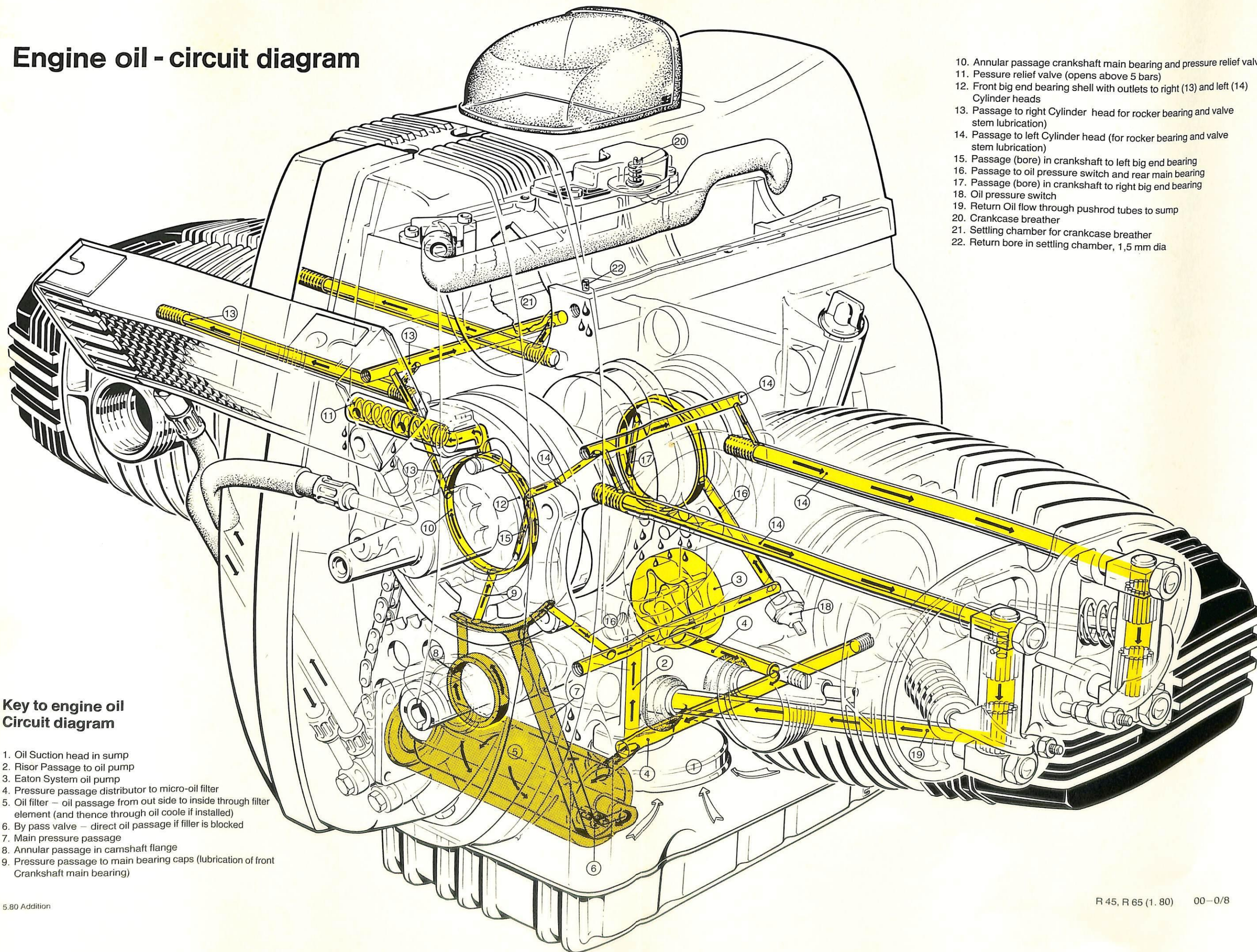
3) up to M 4: 5-2, from M 5: 8 and 10

4) The stipulated strength characteristics deviate from the DIN specification

5) up to M 8: 4D-2, for M 10: 5S-2



# Engine oil - circuit diagram



## Key to engine oil Circuit diagram

1. Oil Suction head in sump
2. Risor Passage to oil pump
3. Eaton System oil pump
4. Pressure passage distributor to micro-oil filter
5. Oil filter - oil passage from out side to inside through filter element (and thence through oil coole if installed)
6. By pass valve - direct oil passage if filter is blocked
7. Main pressure passage
8. Annular passage in camshaft flange
9. Pressure passage to main bearing caps (lubrication of front Crankshaft main bearing)

10. Annular passage crankshaft main bearing and pressure relief valve
11. Pessure relief valve (opens above 5 bars)
12. Front big end bearing shell with outlets to right (13) and left (14) Cylinder heads
13. Passage to right Cylinder head for rocker bearing and valve stem lubrication)
14. Passage to left Cylinder head (for rocker bearing and valve stem lubrication)
15. Passage (bore) in crankshaft to left big end bearing
16. Passage to oil pressure switch and rear main bearing
17. Passage (bore) in crankshaft to right big end bearing
18. Oil pressure switch
19. Return Oil flow through pushrod tubes to sump
20. Crankcase breather
21. Settling chamber for crankcase breather
22. Return bore in settling chamber, 1,5 mm dia



# Tightening Torque Survey for R 65 and R 65 LS

| <b>Engine</b>                                | <b>Nm</b> |
|----------------------------------------------|-----------|
| Cylinder head nuts (in 3 steps: 15/25/35 Nm) | 35 + 4    |
| Connecting rod bolts                         | 50 ± 2    |
| Clutch housing (flyheel)                     | 100 + 5   |
| Nut for valve adjusting screw                | 20 ± 2    |
| Adapter for carburetor connection            | 50        |
| Oil drain plug                               | 30 + 5    |
| <b>Engine Electrical Equipment</b>           |           |
| Alternator rotor mounting screw              | 25 ± 2    |
| Spark plugs                                  | 20 + 5    |
| Starter mounting bolts                       | 47.5      |
| <b>Exhaust system</b>                        |           |
| Spider nuts for exhaust pipes                | 200 + 20  |
| <b>Clutch</b>                                |           |
| Clutch housing cover                         | 20 + 2    |
| <b>Manual Transmission</b>                   |           |
| Connection on engine                         | 33        |
| Connection on console                        | 19        |
| Output flange to transmission output shaft   | 221.5     |
| Transmission cover to transmission case      | 8         |
| Nut (wedge bolt) on kick starter lever       | 22.5      |
| Oil filler plug                              | 31        |
| Oil drain bolt                               | 26        |
| <b>Propeller Shaft</b>                       |           |
| Twelve-sided head bolts                      | 40        |
| <b>Front Wheel Fork</b>                      |           |
| Fork bridge mounting bolts                   | 40 + 5    |
| Absorber mounting bolts in slide tube        | 35 ± 5    |
| Plug                                         | 80 + 10   |
| Oil filler bolts                             | 9         |
| Oil drain bolts                              | 8         |
| <b>Steering</b>                              |           |
| Plug                                         | 80 + 10   |
| Round nut                                    | no play   |



# Tightening Torque Survey for R 65 and R 65 LS

Continued:

## Rear Wheel Drive with Swinging Arm

|                                                                                 | Nm           |
|---------------------------------------------------------------------------------|--------------|
| Nut on drive pinion                                                             | 165          |
| Threaded ring in final drive housing cover                                      | 118          |
| Nuts for final drive housing cover                                              | 17.7         |
| Oil level inspection plug on final drive housing                                | 10           |
| Oil drain plug on final drive housing                                           | 25.5         |
| Shaft bolt of rear wheel swinging arm                                           | 10 + 2       |
| Lock nut for swinging arm shaft bolt                                            | 100 + 20     |
| Oil filler plug on rear wheel swinging arm                                      | finger tight |
| Oil drain plug on rear wheel swinging arm                                       | 15.7         |
| Shock absorber rod to spring strut eye                                          | 38 ± 2       |
| Mounting nuts (twelve sided) for final drive housing to rear wheel swinging arm | 47           |
| Spring strut mounting bolts                                                     | 35 + 5       |

## Brakes

|                                     |        |
|-------------------------------------|--------|
| Brake line to brake master cylinder | 8 + 2  |
| Brake line to brake caliper         | 8 + 2  |
| Brake line to brake hose            | 12 + 3 |

## Wheels and Tires

|                                                                                            |               |
|--------------------------------------------------------------------------------------------|---------------|
| Friction torque of wheel bearings with front wheel axle nuts tightened to specified torque | 0.15 ... 0.30 |
| Stub axle nuts                                                                             | 48            |
| Axle bolts                                                                                 | 17            |



# Standard Units of Measurement

| Measurement                 | Unit symbols          |                               | Relations                                             |                                                        |                               |
|-----------------------------|-----------------------|-------------------------------|-------------------------------------------------------|--------------------------------------------------------|-------------------------------|
|                             | Old                   | New                           |                                                       |                                                        |                               |
| Length                      | m                     | m                             | 1 m = 1000 mm                                         | 1 km = 1000 m                                          | 1 $\mu$ m = 0,001 mm          |
| Area                        | m <sup>2</sup><br>qm  | m <sup>2</sup>                | 1 m <sup>2</sup> = 10 <sup>6</sup> mm <sup>2</sup>    | 1 mm <sup>2</sup> = 0,01 cm <sup>2</sup>               |                               |
| Volume                      | m <sup>3</sup><br>cbm | m <sup>3</sup>                | 1 m <sup>3</sup> = 10 <sup>6</sup> cm <sup>3</sup>    | 1 dm <sup>3</sup> = 0,001 m <sup>3</sup>               |                               |
|                             | l                     | l                             | 1 l = 1 dm <sup>3</sup>                               |                                                        |                               |
| Angle                       | plain                 | ° , rad                       | 1 rad = 1 m/m $\approx$ 57°                           | 1° = $\pi$ /180 rad                                    |                               |
|                             | solid                 | (°) <sup>2</sup><br>sr        | 1 sr = 1 m <sup>2</sup> /m <sup>2</sup>               | (1°) <sup>2</sup> = ( $\pi$ /180) <sup>2</sup> sr      |                               |
| Mass                        | kg                    | kg                            | 1 kg = 1000 g                                         | 1 g = 1000 mg                                          | 1 t = 1 Mg = 1000 kg          |
| Density                     | kg/m <sup>3</sup>     | kg/m <sup>3</sup>             | 1 kg/m <sup>3</sup> = 0,001 kg/dm <sup>3</sup>        |                                                        | 1 kg/dm <sup>3</sup> = 1 kg/l |
| Imbalance                   | kgm                   | kgm                           | 1 kgm = 1000 000 gmm                                  |                                                        |                               |
| Time                        | sec<br>s              | s                             | 1 min = 60 s                                          | 1 h = 60 min                                           |                               |
| Speed                       | U/sec<br>U/min        | 1/s<br>1/min                  | 1 U/min = 1/min                                       | 1/min = 1/(60s)                                        |                               |
| Velocity                    | m/s                   | m/s                           | 1 m/s = 3,6 km/h                                      |                                                        |                               |
| Acceleration                | m/s <sup>2</sup>      | m/s <sup>2</sup>              |                                                       |                                                        |                               |
| Force                       | kp                    | N                             | 1 N = 1 kgm/s <sup>2</sup>                            | 1 kp = 9,81 N                                          |                               |
| Pressure<br>(gas, liquid)   | at                    | N/m <sup>2</sup><br>Pa<br>bar | 1 at = 1 kp/cm <sup>2</sup> = 0,981 bar = 98 066,5 Pa |                                                        |                               |
|                             | kp/cm <sup>2</sup>    |                               | 1 m WS = 9 806,65 Pa = 9 806,65 N/cm <sup>2</sup>     |                                                        |                               |
|                             | mWS                   |                               | 1 Torr = 1,333 224 mbar                               |                                                        |                               |
|                             | Torr<br>mmHg          |                               | 1 mmHg = 133,322 Pa = 133,322 N/m <sup>2</sup>        |                                                        |                               |
| Mechanical load             | kp/mm <sup>2</sup>    | N/m <sup>2</sup>              | 1 N/m <sup>2</sup> = 1 Pa                             |                                                        |                               |
|                             |                       | Pa<br>N/mm <sup>2</sup>       | 1 kp/mm <sup>2</sup> = 9,81 N/mm <sup>2</sup>         |                                                        |                               |
| Energy, Work,<br>Heat value | kpm<br>hph<br>cal     | J<br>kWh                      | 1 J = 1 Nm                                            | 1 kWh = 3,6 MJ                                         | 1 kpm = 9,81 J                |
|                             |                       |                               | 1 cal = 4,1868 J                                      |                                                        |                               |
| Torque                      | kpm                   | Nm                            | 1 kpm = 9,81 Nm                                       |                                                        |                               |
| Power                       | hp<br>kpm/s<br>kcal/h | kW<br>Nm/s                    | 1 kW = 1000 W                                         | 1 W = 1 Nm/s = 1 J/s                                   |                               |
|                             |                       |                               | 1 hp = 736 W = 75 kpm/s = 632 kcal/h                  |                                                        |                               |
| Viscosity                   | dynamic               | Pas                           | 1 Pas = 1 Ns/m <sup>2</sup>                           | 1 P = 0,1 Pas = 1 g/cms                                |                               |
|                             | kinematic             | St                            | 1 m <sup>2</sup> /s = 1 Pas m <sup>3</sup> /kg        | 1 St = 1 cm <sup>2</sup> /s = 0,0001 m <sup>2</sup> /s |                               |
| Temperature                 | deg.<br>°C<br>°K      | °C<br>K                       | 0 °C $\hat{=}$ 273,15 K                               | 1 deg. = 1° K = 1 K = 1° C (temperature difference)    |                               |
|                             |                       |                               |                                                       |                                                        |                               |
| Electric current            | A                     | A                             | 1 mA = 0,001 A                                        | 1 kA = 1000 A                                          |                               |
| Electric voltage            | V                     | V                             | 1 V = 1 W/A                                           | 1 mV = 0,001 V                                         | 1 MV = 10 <sup>6</sup> V      |
| Electric resistance         | $\Omega$              | $\Omega$                      | 1 $\Omega$ = 1 V/A = 1/S                              |                                                        |                               |
| Magnetic flux               | M                     | Wb, Vs                        | 1 Wb = 1 Vs                                           | 1 M = 10 <sup>-8</sup> Wb                              |                               |
| Magnetic flux density       | G                     | T                             | 1 T = Wb/m <sup>2</sup>                               | 1 G = 10 <sup>-4</sup> T                               |                               |
| Magnetic field strength     | Oe                    | A/m                           | 1 A/m = 1 N/Wb                                        | 10 e = 10 <sup>3</sup> /4 $\pi$ A/m                    |                               |
| Luminous intensity          | HK                    | cd                            | 1 cd = 1,107 HK                                       | 1 HK = 0,903 342 cd                                    |                               |
| Luminance                   | sb                    | cd/m <sup>2</sup>             | 1 sb = 10 <sup>4</sup> cd/m <sup>2</sup>              |                                                        |                               |
| Density of light            | ph                    | lx                            | 1 ph = 10 <sup>4</sup> lx                             |                                                        |                               |



### Determining Engine Oil Consumption

Oil consumption measurements can be after motorcycle has been ridden about 7.500 km (5.000 miles).

This distance is required before the oil consumption will be steady.

Engine must not leak oil.

Drain engine oil at operating temperature.

Replace the filter cartridge.

Fill engine with new oil.

Ride motorcycle under normal conditions until oil level has dropped to lower mark on oil dipstick.

Difference between MIN and MAX marks = 0.85 liter.

If necessary determine oil consumption by measuring consumed volume by weight.

Permissible oil consumption: 0.1 ltr./100 km.

### Possible Causes for Excessive Oil Consumption:

1. Breaking-in process not concluded.
2. Valve guides leak.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive play between valve stem and valve guide.

### Determining Fuel Consumption acc. DIN 70030

Engine tuning and ignition timing<sup>1)</sup> of motorcycle must conform with standard version.

Tire size must agree with data in vehicle's registration papers.

Correct tire inflation pressure as specified.

Brakes released completely.

Engine operated at least 7.500 km (5.000 miles) and at operating temperature.

For fuel consumption test motorcycle weight must be half that between maximum total weight and curbweight.

The speed must be kept as constantly as possible and about  $\frac{3}{4}$ ths of the maximum speed over the entire test stretch.

Testing speed, however, should not exceed 110 km/h.

The test stretch chosen should have a level as possible surface, be dry and about 10 km long, which must be driven in both directions.

Uphill and downhill gradients up to 1.5 % are permissible.

The air temperature must be between +10 and +30°C and the wind velocity may be maximum 3 meters per second.

The motorcycle tank must be filled with commercial brand name gasoline as called for in plant specifications.

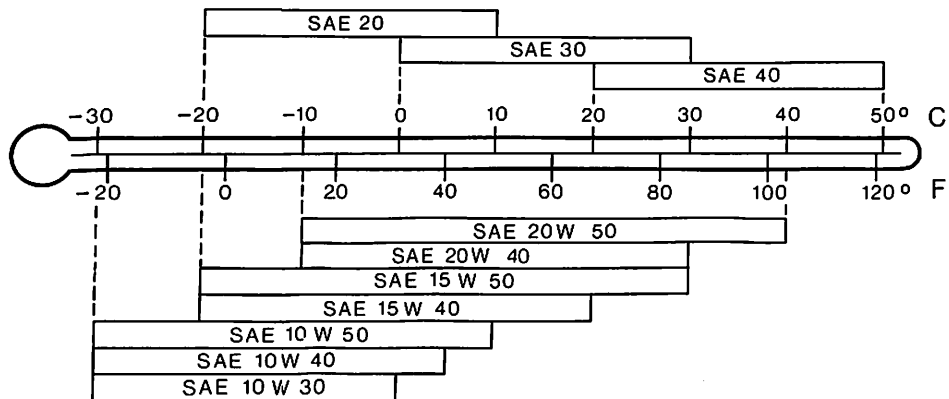
The fuel consumption is measured with a standard tester or by the following formula, whereby 10 % is added to cover any unfavorable conditions.

$$\frac{\text{Consumed fuel} \times 100}{\text{Driven km}} = \text{Normal fuel consumption}$$

<sup>1)</sup> See Specifications

# Engine Oil Viscosity Diagram

## Depending on Outside Temperature

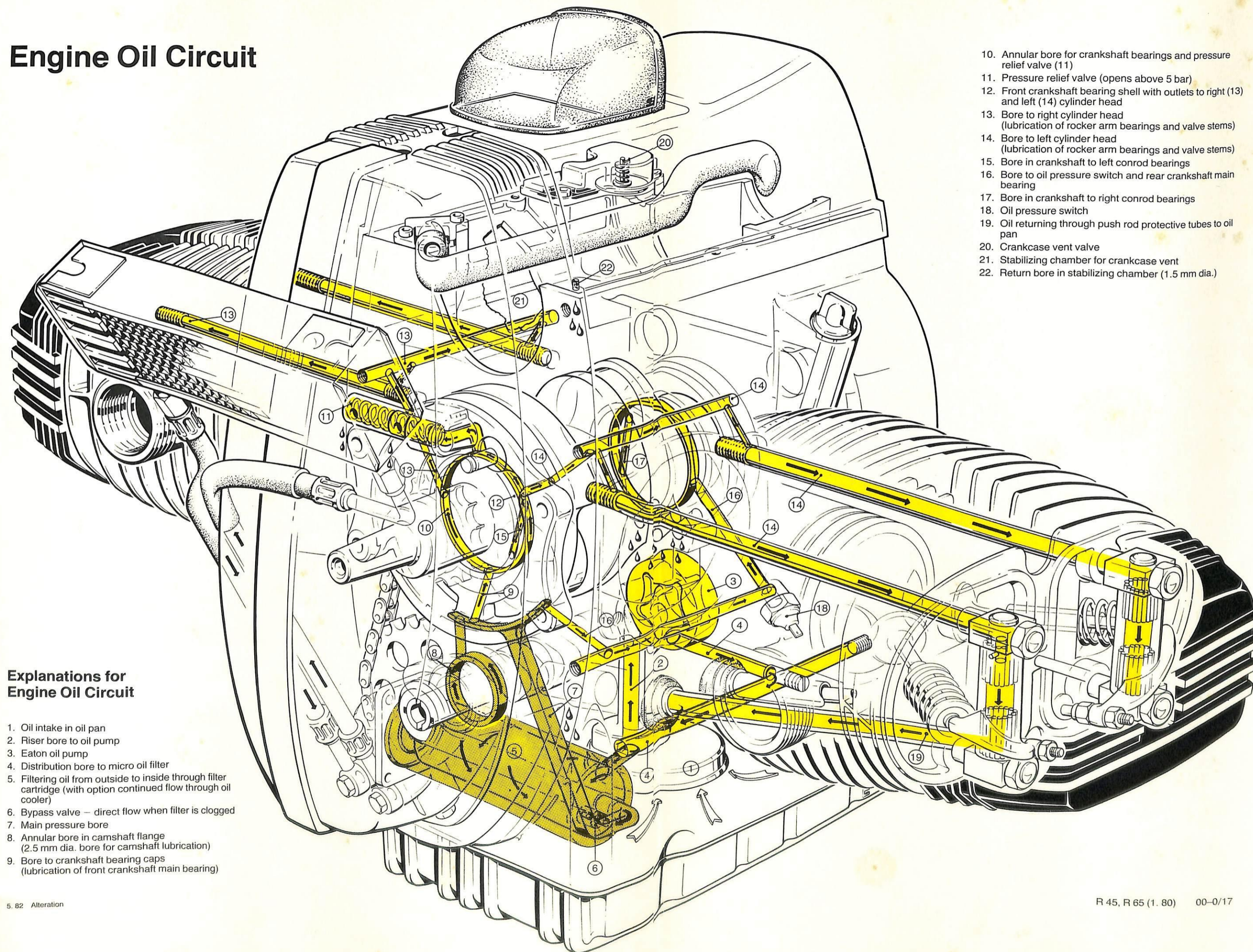


### Application:

Brand name, heavy duty oil of API Classification SE or SF for internal combustion engines.



# Engine Oil Circuit



## Explanations for Engine Oil Circuit

1. Oil intake in oil pan
2. Riser bore to oil pump
3. Eaton oil pump
4. Distribution bore to micro oil filter
5. Filtering oil from outside to inside through filter cartridge (with option continued flow through oil cooler)
6. Bypass valve — direct flow when filter is clogged
7. Main pressure bore
8. Annular bore in camshaft flange (2.5 mm dia. bore for camshaft lubrication)
9. Bore to crankshaft bearing caps (lubrication of front crankshaft main bearing)

10. Annular bore for crankshaft bearings and pressure relief valve (11)
11. Pressure relief valve (opens above 5 bar)
12. Front crankshaft bearing shell with outlets to right (13) and left (14) cylinder head
13. Bore to right cylinder head (lubrication of rocker arm bearings and valve stems)
14. Bore to left cylinder head (lubrication of rocker arm bearings and valve stems)
15. Bore in crankshaft to left conrod bearings
16. Bore to oil pressure switch and rear crankshaft main bearing
17. Bore in crankshaft to right conrod bearings
18. Oil pressure switch
19. Oil returning through push rod protective tubes to oil pan
20. Crankcase vent valve
21. Stabilizing chamber for crankcase vent
22. Return bore in stabilizing chamber (1.5 mm dia.)







# 11 Engine

|                                                                                      |               |
|--------------------------------------------------------------------------------------|---------------|
| Specifications . . . . .                                                             | Page 11- 0/ 3 |
| Specifications - 1981 models . . . . .                                               | 11- 0/19      |
| 11 00 039 Compression - check . . . . .                                              | 11-00/ 1      |
| 11 00 050 Engine - remove and install . . . . .                                      | 11-00/ 3      |
| 11 11 050 Cylinder - remove and install . . . . .                                    | 11-11/ 1      |
| 11 11 527 Cylinder - drill and hone . . . . .                                        | 11-11/ 2      |
| 11 12 080 Cylinder head - remove and install . . . . .                               | 11-12/ 1      |
| 11 12 513 Cylinder head - disassemble and assemble plus grinding in valves . . . . . | 11-12/ 2      |
| 11 12 561 Valve guides - replace . . . . .                                           | 11-12/ 3      |
| 11 12 621 Valve seat insert (one) - replace . . . . .                                | 11-12/ 3      |
| 11 14 060 Timing case cover - remove and install . . . . .                           | 11-14/ 1      |
| 11 14 651 Radial oil seal for crankshaft - replace . . . . .                         | 11-14/ 1      |
| 11 15 101 Engine vent hose - replace . . . . .                                       | 11-15/ 1      |
| 11 15 101 Engine vent hose - replace ('81 mod.) . . . . .                            | 11-15/ 2      |
| 11 15 111 Check valve for engine vent - replace . . . . .                            | 11-15/ 1      |
| 11 21 001 Crankshaft - replace . . . . .                                             | 11-21/ 1      |
| 11 21 531 Main bearing sleeves - replace . . . . .                                   | 11-21/ 3      |
| 11 22 000 Flywheel - remove and install . . . . .                                    | 11-22/ 1      |
| 11 22 000 Clutch housing (flywheel) - remove and install (1981 models) . . . . .     | 11-22/ 3      |
| 11 24 000 Connecting rod - remove and install . . . . .                              | 11-24/ 1      |
| 11 25 000 Piston - remove and install . . . . .                                      | 11-25/ 1      |
| 11 31 061 Sprocket set - replace . . . . .                                           | 11-31/ 1      |
| 11 34 504 Valve clearances - adjust . . . . .                                        | 11-34/ 1      |
| 11 41 000 Oil pump - remove and install . . . . .                                    | 11-41/ 1      |
| Engine - troubleshoot . . . . .                                                      | 11-42/ 3      |

## Specifications

| Engine                                                                                                                | Model                                                 |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
|                                                                                                                       | R 65                                                  |
| Engine design                                                                                                         | Four stroke flat engine with V-shaped overhead valves |
| Location of engine number                                                                                             | On engine block above oil filler neck                 |
| Cylinder bore dia. in mm (in.)                                                                                        | 82 (2.756)                                            |
| Piston stroke in mm (in.)                                                                                             | 61.5 (2.421)                                          |
| Number of cylinders                                                                                                   | 2                                                     |
| Cylinder arrangement                                                                                                  | Opposite                                              |
| Stroke/bore ratio                                                                                                     | 0.75                                                  |
| Fiscal displacement in cm <sup>3</sup> (in. <sup>3</sup> )                                                            | 645 (39.3)                                            |
| Effective displacement in cm <sup>3</sup> (in. <sup>3</sup> )                                                         | 649.6 (39.6)                                          |
| Compression ratio                                                                                                     | 9.2 : 1                                               |
| Max. output in kW (DIN HP) at rpm                                                                                     | 33 (45) 7250                                          |
| Max. permissible constant speed in rpm                                                                                | 7300                                                  |
| Max. permissible top speed in rpm                                                                                     | 7650                                                  |
| Idle speed in rpm                                                                                                     | 800 ... 1100                                          |
| Max. permissible speed while breaking in motorcycle up to 1000 km/600 miles in rpm<br>up to 2000 km/1200 miles in rpm | 4000<br>4500                                          |
| Direction of rotation                                                                                                 | Looking at alternator clockwise                       |
| Max. torque in Nm/mkp/ft lbs at rpm                                                                                   | 50/5.1/37 at 5500                                     |



### Specifications

| Engine                                                                         |                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Model</b>                                                                   | R 65                                                                                                                                                                                                                                    |
| Mean piston speed m/s<br>at rpm                                                | 14.8<br>7250                                                                                                                                                                                                                            |
| Compression in bar (psi)    good<br>normal<br>poor                             | above 10.0 (142)<br>8.5 ... 10.0 (121 ... 142)<br>below 8.5 (121)                                                                                                                                                                       |
| Instructions for checking compression<br>(motorcycle with starter)             | 1. Unscrew spark plugs.<br>2. Check compression with a calibrated compression tester,<br>fully charged battery, engine having operating temperature and running at starter speed.<br>Remove equal pressure carburetor prior to testing! |
| <b>Fuel</b>                                                                    | Premium grade                                                                                                                                                                                                                           |
| Fuel consumption in ltr/100 km (mpg)<br>acc. to DIN 70030 at 110 km/h (70 mph) | 4.6 (51)                                                                                                                                                                                                                                |

# Specifications

| Engine                                                                                                                                                   | Model | R 65                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|
| <b>Engine Lubrication</b><br>Lubricating system                                                                                                          |       | Forced oil circulation                                                                                  |
| Oil filter                                                                                                                                               |       | Full flow                                                                                               |
| Pressure difference to open bypass valve in bar (psi)                                                                                                    |       | 1.5 (21)                                                                                                |
| Oil pressure indicator lamp comes on at pressure below bar (psi)                                                                                         |       | 0.2 ... 0.5 (3 ... 7)                                                                                   |
| Opening pressure of safety valve in bar (psi)                                                                                                            |       | approx. 5.0 (71)                                                                                        |
| Oil volume in ltr. (pints)<br>without filter replacement<br>with filter replacement                                                                      |       | 2.0 (4.23)<br>2.25 (4.75)                                                                               |
| Max. oil consumption in ltr./100 km (mpg)                                                                                                                |       | 0.1 (2350)                                                                                              |
| Oil grade                                                                                                                                                |       | Brand name heavy duty oil for internal combustion engines                                               |
| Viscosity for outside temperatures chiefly<br>above +30° C (86° F)<br>above 0° C (32° F)<br>below 0° C (32° F)<br><b>All year down to -20° F (-4° F)</b> |       | SAE 40, SAE 20 W 50<br>SAE 20 W 40, SAE 20 W 50<br>SAE 10 W 30, SAE 10 W 40, SAE 10 W 50<br>SAE 15 W 50 |
| <b>Oil Pump</b><br>Design                                                                                                                                |       | Eaton System (hypoid-trochoid spline)                                                                   |
| Delivery rate in ltr. (qts)/h at rpm                                                                                                                     |       | 1400 (1480) at 6000                                                                                     |
| Outer rotor dia. in mm (in.)                                                                                                                             |       | 57 ± 0.05 (2.280 ± 0.002)                                                                               |
| Housing inside dia. in mm (in.)                                                                                                                          |       | 57.2 <sup>+0.046</sup> <sub>0</sub> (2.2520 <sup>+0.0018</sup> <sub>0</sub> )                           |
| Outer rotor/pump housing play in mm (in.)                                                                                                                |       | 0.15 ... 0.29 (0.006 ... 0.011)                                                                         |



## Specifications

| Engine                                                                                                                                                  | Model                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                         | R 65                                                                                                                                                                                                  |
| Rotor height in mm (in.)                                                                                                                                | $14 \begin{smallmatrix} -0.015 \\ -0.045 \end{smallmatrix} \begin{smallmatrix} (0.5512 \\ -0.0018) \end{smallmatrix}$                                                                                 |
| Housing depth in mm (in.)                                                                                                                               | $14 \begin{smallmatrix} +0.025 \\ +0.010 \end{smallmatrix} \begin{smallmatrix} (0.5512 \\ +0.0004) \end{smallmatrix}$                                                                                 |
| Play between mating surface (pump housing) and sealing surface (rotor) in mm (in.)                                                                      | 0.025 ... 0.070 (0.0010 ... 0.0027)                                                                                                                                                                   |
| Inner/outer rotor clearance in mm (in.)                                                                                                                 | 0.12 ... 0.20 (0.005 ... 0.008)                                                                                                                                                                       |
| Max. scoring depth in cover in mm (in.)                                                                                                                 | 0.5 (0.002)                                                                                                                                                                                           |
| Relaxed spring length in mm (in.)                                                                                                                       | 68 (2.677)                                                                                                                                                                                            |
| <b>Valve Clearance</b><br>Adjustment on cold engine (max. 20°C/54°F)<br>Intake valve in mm (in.) :<br>Exhaust valve in mm (in.)                         | $0.10 \begin{smallmatrix} (0.004) \\ (0.008) \end{smallmatrix} \begin{smallmatrix} (0.15 \begin{smallmatrix} (0.006) \\ (0.010) \end{smallmatrix}) \end{smallmatrix}$ up to 1000 km (600 mile) insp.) |
| Valve timing (tolerance $\pm 2.5^\circ$ )<br>Intake opens before TDC<br>Intake closes after BDC<br>Exhaust opens before BDC<br>Exhaust closes after TDC | Control shaft device with 2 mm (0.080") valve clearance<br>308° Camshaft    16°<br>44°<br>56°<br>4°                                                                                                   |
| <b>Valves</b><br>Total valve length in mm (in.)<br>Intake<br>Exhaust                                                                                    | $100 \pm 0.2 \begin{smallmatrix} (3.937 \pm 0.008) \\ 99.3 \pm 0.2 \begin{smallmatrix} (3.909 \pm 0.008) \end{smallmatrix} \end{smallmatrix}$                                                         |
| Intake valve head dia. in mm (in.)                                                                                                                      | 38 (1.496)                                                                                                                                                                                            |
| Exhaust valve head dia. in mm (in.)                                                                                                                     | 34 (1.338)                                                                                                                                                                                            |
| Intake valve stem dia. in mm (in.)                                                                                                                      | 6.96 - 0.015 (0.2784 - 0.0006)                                                                                                                                                                        |

## Specifications

| Engine                                                                                                                                                     | Model                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|                                                                                                                                                            | R 65                                                                                                    |
| <b>Engine Lubrication</b>                                                                                                                                  |                                                                                                         |
| Lubricating system                                                                                                                                         | Forced oil circulation                                                                                  |
| Oil filter                                                                                                                                                 | Full flow                                                                                               |
| Pressure difference to open bypass valve in bar (psi)                                                                                                      | 1.5 (21)                                                                                                |
| Oil pressure indicator lamp comes on at pressure below bar (psi)                                                                                           | 0.2 ... 0.5 (3 ... 7)                                                                                   |
| Opening pressure of safety valve in bar (psi)                                                                                                              | approx. 5.0 (71)                                                                                        |
| Oil volume in ltr. (pints)<br>without filter replacement<br>with filter replacement                                                                        | 2.0 (4.23)<br>2.25 (4.75)                                                                               |
| Max. oil consumption in ltr./100 km (mpg)                                                                                                                  | 0.1 (2350)                                                                                              |
| Oil grade                                                                                                                                                  | Brand name heavy duty oil for internal combustion engines                                               |
| Viscosity for outside temperatures chiefly<br>above +30° C (86° F)<br>above 0° C (32° F)<br>below 0° C (32° F)<br><b>All year down to - 20° F (- 4° F)</b> | SAE 40, SAE 20 W 50<br>SAE 20 W 40, SAE 20 W 50<br>SAE 10 W 30, SAE 10 W 40, SAE 10 W 50<br>SAE 15 W 50 |
| <b>Oil Pump</b>                                                                                                                                            |                                                                                                         |
| Design                                                                                                                                                     | Eaton System (hypoid-trochoid spline)                                                                   |
| Delivery rate in ltr. (qts)/h at rpm                                                                                                                       | 1400 (1480) at 6000                                                                                     |
| Outer rotor dia. in mm (in.)                                                                                                                               | 57 ± 0.05 (2.280 ± 0.002)                                                                               |
| Housing inside dia. in mm (in.)                                                                                                                            | 57.2 <sup>+0.046</sup> <sub>0</sub> (2.2520 <sup>+0.0018</sup> <sub>0</sub> )                           |
| Outer rotor/pump housing play in mm (in.)                                                                                                                  | 0.15 ... 0.29 (0.006 ... 0.011)                                                                         |



## Specifications

| Engine                                                                                                                        | Model                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                               | R 65                                                                                                                                                                                                          |
| Rotor height in mm (in.)                                                                                                      | 14 $\begin{smallmatrix} -0.015 \\ -0.045 \end{smallmatrix}$ $\begin{smallmatrix} -0.0006 \\ -0.0018 \end{smallmatrix}$                                                                                        |
| Housing depth in mm (in.)                                                                                                     | 14 $\begin{smallmatrix} +0.025 \\ +0.010 \end{smallmatrix}$ $\begin{smallmatrix} +0.0010 \\ +0.0004 \end{smallmatrix}$                                                                                        |
| Play between mating surface (pump housing) and sealing surface (rotor) in mm (in.)                                            | 0.025 ... 0.070 (0.0010 ... 0.0027)                                                                                                                                                                           |
| Inner/outer rotor clearance in mm (in.)                                                                                       | 0.12 ... 0.20 (0.005 ... 0.008)                                                                                                                                                                               |
| Max. scoring depth in cover in mm (in.)                                                                                       | 0.5 (0.002)                                                                                                                                                                                                   |
| Relaxed spring length in mm (in.)                                                                                             | 68 (2.677)                                                                                                                                                                                                    |
| <b>Valve Clearance</b><br>Adjustment on cold engine (max. 20°C/54°F)<br>Intake valve in mm (in.)<br>Exhaust valve in mm (in.) | 0.05 (0.002) $\begin{pmatrix} 0.15 (0.006) \\ 0.20 (0.008) \end{pmatrix}$ up to 1000 km (600 mile) insp.)<br>Control shaft device with 2 mm (0.080") valve clearance<br>308° Camshaft 16°<br>44°<br>56°<br>4° |
| <b>Valves</b><br>Total valve length in mm (in.)<br>Intake<br>Exhaust                                                          | 100±0.2 (3.937±0.008)<br>99.3±0.2 (3.909±0.008)                                                                                                                                                               |
| Intake valve head dia. in mm (in.)                                                                                            | 38 (1.496)                                                                                                                                                                                                    |
| Exhaust valve head dia. in mm (in.)                                                                                           | 34 (1.338)                                                                                                                                                                                                    |
| Intake valve stem dia. in mm (in.)                                                                                            | 6.96 - 0.015 (0.2784 - 0.0006)                                                                                                                                                                                |

## Specifications

| Engine                                                   | Model                                          |
|----------------------------------------------------------|------------------------------------------------|
|                                                          | R 65                                           |
| Exhaust valve stem dia. in mm (in.)                      | 6.96 - 0.015 (0.2784 - 0.0006)                 |
| Min. valve head edge thickness in mm (in.)               |                                                |
| Intake                                                   | 1.0 <sup>+0.5</sup> (0.040 <sup>+0.020</sup> ) |
| Exhaust                                                  | 1.2 - 0.2 (0.047 - 0.008)                      |
| Max. valve head runout in mm (in.)                       | 0.02 (0.0008)                                  |
| <b>Valve Seat Insert</b>                                 |                                                |
| Intake valve outside dia. in mm (in.)                    | 39.2 h 7 (1.5433)                              |
| Exhaust valve outside dia. in mm (in.)                   | 39.2h7 (1.6433)                                |
| Valve seat insert bore dia. in cylinder head in mm (in.) |                                                |
| Intake                                                   | 39 H 7 (1.5354)                                |
| Exhaust                                                  | 39 H 7 (1.6354)                                |
| Valve seat angle in degrees                              | 90° - 20°                                      |
| <b>Valve Seat Width</b> (reference value)                |                                                |
| Intake in mm (in.)                                       | approx. 1.2 + 0.2 (0.048 + 0.008)              |
| Exhaust in mm (in.)                                      | approx. 1.4 + 0.2 (0.056 + 0.008)              |



# Specifications

| Engine                                  | Model                                   |                                                                                                     | R 65        |
|-----------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------|-------------|
|                                         | Oversize valve seat inserts in mm (in.) |                                                                                                     | 0.2 (0.008) |
| <b>Valve Guide</b>                      |                                         |                                                                                                     |             |
| Total length in mm (in.)                | Intake                                  | 42 (1.680)                                                                                          |             |
|                                         | Exhaust                                 | 42 (1.680)                                                                                          |             |
| Outside dia. in mm (in.)                |                                         | 14 z 6 (0.5512)                                                                                     |             |
| Inside dia. in mm (in.)                 |                                         | 7 H 7 (0.2756)                                                                                      |             |
| Bore dia. in cyl. head in mm (in.)      |                                         | 14 H 7 (0.5512)                                                                                     |             |
| 1st oversize dia. in mm (in.)           |                                         | 14.1 z 6 (0.5551)                                                                                   |             |
| 2nd oversize dia. in mm (in.)           |                                         | 14.2 z 6 (0.5590)                                                                                   |             |
| <b>Valve Stem Clearance</b> in mm (in.) |                                         |                                                                                                     |             |
| Intake                                  |                                         | 0.025 ... 0.055 (0.0010 ... 0.0022)                                                                 |             |
| Exhaust                                 |                                         | 0.04 ... 0.07 (0.0016 ... 0.0027)                                                                   |             |
| Max. wear in mm (in.)                   |                                         | 0.1 (0.004) measured at top end of valve guide                                                      |             |
| <b>Valve Drive</b>                      |                                         |                                                                                                     |             |
| Valve operation                         |                                         | By camshaft via cam followers, push rods and rocker arms                                            |             |
| Camshaft drive                          |                                         | Single roller chain 3/8 x 7/32" with connecting link and chain tensioner with hydr. oil lubrication |             |
| Number of links                         |                                         | 50                                                                                                  |             |

## Specifications

| Engine                                                |                                                    |
|-------------------------------------------------------|----------------------------------------------------|
| Model                                                 | R 65                                               |
| <b>Valve Springs</b>                                  |                                                    |
| Wire gage dia. in mm (in.)                            | 4.25 (0.167)                                       |
| Outside coil dia. in mm (in.)                         | 31.9 (1.256)                                       |
| Relaxed spring length in mm (in.)                     | brown code approx. 46 or 43.5 for blue code        |
| Spring force in kp (lbs) with test length in mm (in.) | 29 (64) at 37.6 (1.480) 70 (154) at 28.5 (1.122)   |
| Wound direction                                       | clockwise                                          |
| Number of active coils                                | 4.6 or 4                                           |
| Total number of coils                                 | 6                                                  |
| Compressed length in mm (in.)                         | 25 (0.984)                                         |
| Installed direction                                   | Coils marked with paint stripes face cylinder head |
| <b>Rocker Arms</b>                                    | With needle bearings                               |
| Axial play of rocker arm                              | Without play, but easy movement                    |
| Rocker arm ratio                                      | 1 : 1.39                                           |



## Specifications

| Engine                                                                 | Model | R 65                                                                     |
|------------------------------------------------------------------------|-------|--------------------------------------------------------------------------|
| <b>Camshaft</b>                                                        |       |                                                                          |
| Flange bearing bore dia. in engine block in mm (in.)                   |       | $40^{+0.039}_{0}$ (1.5748 $^{+0.0015}_{0}$ )                             |
| Flange bearing outside dia. in mm (in.)                                |       | $40^{0}_{-0.016}$ (1.5748 $^{0}_{-0.0006}$ )                             |
| Flange bearing bore dia. in mm (in.)                                   |       | $25^{+0.013}_{0}$ (0.9842 $^{+0.0005}_{0}$ )                             |
| Camshaft bearing journal dia. on alternator end in mm (in.)            |       | $25^{-0.020}_{-0.033}$ (0.9842 $^{-0.0008}_{0.0013}$ )                   |
| Camshaft bearing bore dia. in engine block on flywheel end in mm (in.) |       | $24^{+0.021}_{0}$ (0.9449 $^{+0.0008}_{0}$ )                             |
| Camshaft bearing journal dia. on flywheel end in mm (in.)              |       | $24^{-0.020}_{-0.033}$ (0.9449 $^{-0.0008}_{-0.0013}$ )                  |
| Alternator or flywheel end radial play in mm                           |       | 0.02 ... 0.046 (0.0008 ... 0.0018) or 0.02 ... 0.054 (0.0008 ... 0.0021) |
| Axial play (play between camshaft collar/flange bearing) in mm (in.)   |       | 0.1 $\pm$ 0.02 (0.0040 $\pm$ 0.0008)                                     |
| Cam base circle dia. in mm (in.)                                       |       | 28 (1.102)                                                               |
| Cam lift in mm (in.)                                                   |       | 6.756 (0.266)                                                            |
| Tappet outside dia. in mm (in.)                                        |       | $22^{-0.025}_{-0.045}$ (0.8661 $^{-0.0010}_{-0.0018}$ )                  |
| Tappet bore dia. in engine block in mm (in.)                           |       | $22^{+0.006}_{-0.015}$ (0.8661 $^{+0.0002}_{-0.0006}$ )                  |
| Radial play of tappet in mm (in.)                                      |       | 0.01 ... 0.051 (0.004 ... 0.0020)                                        |
| Max. permissible tappet wear in mm (in.)                               |       | 0.075 (0.0029)                                                           |

## Specifications

| Engine                                                               |                                              | R 65                                                                                                                                                             |                                                                                                                                                                  |
|----------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model                                                                |                                              | Main Bearing Journal Dia. in mm (in.)                                                                                                                            |                                                                                                                                                                  |
| Crankshaft and Bearings                                              |                                              | Alternator End                                                                                                                                                   | Flywheel End                                                                                                                                                     |
| Crankshaft                                                           |                                              |                                                                                                                                                                  |                                                                                                                                                                  |
| Crankshaft color code                                                | red/red<br>red/blue<br>blue/red<br>blue/blue | 59.980 ... 59.990 (2.3614 ... 2.3618)<br>59.980 ... 59.990 (2.3614 ... 2.3618)<br>59.971 ... 59.980 (2.3610 ... 2.3614)<br>59.971 ... 59.980 (2.3610 ... 2.3614) | 59.980 ... 59.990 (2.3614 ... 2.3618)<br>59.971 ... 59.980 (2.3610 ... 2.3614)<br>59.980 ... 59.990 (2.3614 ... 2.3618)<br>59.971 ... 59.980 (2.3610 ... 2.3614) |
| 1st Undersize 0.25 (0.010)                                           | red/red<br>red/blue<br>blue/red<br>blue/blue | 59.730 ... 59.740 (2.3516 ... 2.3520)<br>59.730 ... 59.740 (2.3516 ... 2.3520)<br>59.721 ... 59.730 (2.3512 ... 2.3516)<br>59.721 ... 59.730 (2.3512 ... 2.3516) | 59.730 ... 59.740 (2.3516 ... 2.3520)<br>59.721 ... 59.730 (2.3512 ... 2.3516)<br>59.730 ... 59.740 (2.3516 ... 2.3520)<br>59.721 ... 59.730 (2.3512 ... 2.3516) |
| 2nd Undersize 0.50 (0.020)                                           | red/red<br>red/blue<br>blue/red<br>blue/blue | 59.480 ... 59.490 (2.3417 ... 2.3421)<br>59.480 ... 59.490 (2.3417 ... 2.3421)<br>59.471 ... 59.480 (2.3414 ... 2.3417)<br>59.471 ... 59.480 (2.3414 ... 2.3417) | 59.480 ... 59.490 (2.3417 ... 2.3421)<br>59.471 ... 59.480 (2.3414 ... 2.3417)<br>59.480 ... 59.490 (2.3417 ... 2.3421)<br>59.471 ... 59.480 (2.3414 ... 2.3417) |
| 3rd Undersize 0.75 (0.030)                                           | red/red<br>red/blue<br>blue/red<br>blue/blue | 59.230 ... 59.240 (2.3319 ... 2.3323)<br>59.230 ... 59.240 (2.3319 ... 2.3323)<br>59.221 ... 59.230 (2.3315 ... 2.3319)<br>59.221 ... 59.230 (2.3315 ... 2.3319) | 59.230 ... 59.240 (2.3319 ... 2.3323)<br>59.221 ... 59.230 (2.3315 ... 2.3319)<br>59.230 ... 59.240 (2.3319 ... 2.3323)<br>59.221 ... 59.230 (2.3315 ... 2.3319) |
| Bore for crankshaft main bearing bushing in engine block, dia. in mm |                                              | 65 <sup>+0.019</sup> <sub>0</sub> (2.5590 <sup>+0.0007</sup> <sub>0</sub> )                                                                                      |                                                                                                                                                                  |
| Bore for crankshaft main bearing bushing in bearing cap, dia. in mm  |                                              | 65 <sup>+0.019</sup> <sub>0</sub> (2.5590 <sup>+0.0007</sup> <sub>0</sub> )                                                                                      |                                                                                                                                                                  |
| Main bearing journal radial play in mm (in.)                         |                                              | red 0.017 ÷ 0.066 (0.0006 ... 0.0026)                                                                                                                            | blue 0.019 ± 0.067 (0.0007 ... 0.0026)                                                                                                                           |
| Front crankshaft bearing seat dia. in mm (in.)                       |                                              | 35 <sup>+0.025</sup> <sub>+0.009</sub> (1.3779 <sup>+0.0010</sup> <sub>+0.0003</sub> )                                                                           |                                                                                                                                                                  |
| Bearing seat bore dia. in timing case cover in mm (in.)              |                                              | 62 <sup>-0.009</sup> <sub>-0.39</sub> (2.4409 <sup>-0.0003</sup> <sub>-0.0153</sub> )                                                                            |                                                                                                                                                                  |



## Specifications

| Model                                                    | R 65                                    |                                                                                |
|----------------------------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------|
| <b>Main Bearing Bushing</b>                              |                                         |                                                                                |
| Wall thickness in mm (in.)                               |                                         |                                                                                |
| Standard                                                 | 0                                       | red<br>blue                                                                    |
|                                                          |                                         | 2.500 ... 2.510 (0.09842 ... 0.09882)<br>2.504 ... 2.514 (0.10016 ... 0.10056) |
| 1st Oversize                                             | 0.25 (0.010)                            | red<br>blue                                                                    |
|                                                          |                                         | 2.625 ... 2.635 (0.10334 ... 0.10374)<br>2.629 ... 2.639 (0.10516 ... 0.10556) |
| 2nd Oversize                                             | 0.50 (0.020)                            | red<br>blue                                                                    |
|                                                          |                                         | 2.750 ... 2.760 (0.10827 ... 0.10866)<br>2.754 ... 2.764 (0.11016 ... 0.11056) |
| 3rd Oversize                                             | 0.75 (0.030)                            | red<br>blue                                                                    |
|                                                          |                                         | 2.875 ... 2.885 (0.11319 ... 0.11358)<br>2.879 ... 2.889 (0.11516 ... 0.11556) |
| Engine block                                             |                                         |                                                                                |
|                                                          | dia. A (crankshaft bearing bore) 65 H 6 | dia. B (bearing cap bore) 130 + 0.026<br>- 0.007<br>129.993 ... 130.026        |
|                                                          | 65.000 ... 65.019                       |                                                                                |
| Crankshaft bearing dia. in mm<br>with bearing pressed in |                                         |                                                                                |
|                                                          | red 60.007 ... 60.046                   | blue 59.999 ... 60.038                                                         |
| Bearing cap                                              |                                         |                                                                                |
|                                                          | 65.000 ... 65.019                       | 130.003 ... 130.028                                                            |

# Specifications

## Engine

| Model                                                                                               | R 65                                                                                                                         |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Crankshaft seat dia. for sprocket in mm (in.)                                                       | 35.003 <sup>+0.020</sup> <sub>+0.009</sub> (1.3781 <sup>+0.0008</sup> <sub>+0.0003</sub> )                                   |
| Sprocket take-up bore dia. in mm (in.)                                                              | 35.003 <sup>+0.003</sup> <sub>-0.013</sub> (1.3781 <sup>+0.0001</sup> <sub>-0.0005</sub> )                                   |
| Crankshaft axial play in mm (in.)                                                                   | 0.08 ... 0.15 (0.0031 ... 0.0059)                                                                                            |
| Thrust washer                                                                                       |                                                                                                                              |
| Red thickness "S" in mm (in.)                                                                       | 2.483 ... 2.530 (0.0977 ... 0.0996)                                                                                          |
| Blue thickness "S" in mm (in.)                                                                      | 2.530 ... 2.578 (0.0996 ... 0.1015)                                                                                          |
| Green thickness "S" in mm (in.)                                                                     | 2.578 ... 2.626 (0.1015 ... 0.1034)                                                                                          |
| Yellow thickness "S" in mm (in.)                                                                    | 2.626 ... 2.673 (0.1034 ... 0.1052)                                                                                          |
| Max. permissible wear limit in mm (in.)                                                             | 0.20 (0.008)                                                                                                                 |
| Max. runout on shaft journal (alternator end) outside taken up on main bearing journals in mm (in.) | 0.02 (0.0008)                                                                                                                |
| Max. dynamic unbalance of crankshaft (without flywheel) in cmp                                      |                                                                                                                              |
| Max. lateral runout on flywheel in mm (in.)                                                         | 20<br>0.1 (0.004)                                                                                                            |
| <b>Connecting Rods and Bearings</b>                                                                 |                                                                                                                              |
| Standard 0                                                                                          | Thrust journal dia. in mm (in.)<br>48.00 <sup>-0.009</sup> <sub>-0.025</sub> (1.8898 <sup>-0.0003</sup> <sub>-0.0010</sub> ) |
| Undersize 1 0.25 (0.010)                                                                            | 47.75 <sup>-0.009</sup> <sub>-0.025</sub> (1.8799 <sup>-0.0003</sup> <sub>-0.0010</sub> )                                    |
| Undersize 2 0.50 (0.020)                                                                            | 47.50 <sup>-0.009</sup> <sub>-0.025</sub> (1.8701 <sup>-0.0003</sup> <sub>-0.0010</sub> )                                    |
| Undersize 3 0.75 (0.030)                                                                            | 47.25 <sup>-0.009</sup> <sub>-0.025</sub> (1.8602 <sup>-0.0003</sup> <sub>-0.0010</sub> )                                    |
| Big end dia. in mm (in.)                                                                            | 52.00 <sup>+0.015</sup> <sub>0</sub> (2.0472 <sup>0.0006</sup> <sub>0</sub> )                                                |
| Conrod bearing radial play in mm (in.)                                                              | 0.023 ... 0.069 (0.0009 ... 0.0027)                                                                                          |
| Big end conrod width in mm (in.)                                                                    | 22.00 <sup>-0.065</sup> <sub>-0.117</sub> (0.8661 <sup>-0.0025</sup> <sub>-0.0046</sub> )                                    |
| Thrust journal bearing width in mm (in.)                                                            | 22.00 <sup>+0.149</sup> <sub>+0.065</sub> (0.8661 <sup>+0.0059</sup> <sub>+0.0025</sub> )                                    |
| Conrod axial play in mm (in.)                                                                       | 0.130 ... 0.266 (0.0051 ... 0.0105)                                                                                          |
| Max. axial wear limit in mm (in.)                                                                   | 0.32 (0.012)                                                                                                                 |



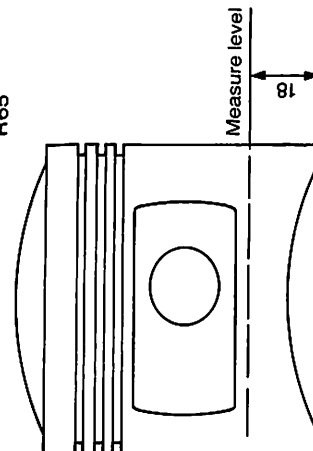
# Specifications

| Engine                                                                                                       | Model    | R 65                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Distance between big and small end bore center lines in mm (in.)                                             |          | 118 (4.645)                                                                                                                               |
| Small end bore dia. in mm (in.)                                                                              |          | $24 \begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$ (0.9449 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$ )                     |
| Conrod bushing outside dia. in mm (in.)                                                                      |          | 24.060 ... 24.100 (0.9472 ... 0.9488)                                                                                                     |
| Piston pin bore dia in conrod bushing in mm (in.)                                                            |          | $22 \begin{smallmatrix} +0.020 \\ +0.015 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} +0.0008 \\ +0.0006 \end{smallmatrix}$ )          |
| Piston pin bore wear limit dia. in conrod bushing in mm (in.)                                                |          | $22 \begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} +0.0016 \\ 0 \end{smallmatrix}$ )                     |
| Max. deviation from parallel for conrod bores with bearing shells at distance of 150 mm (5.905") in mm (in.) |          | 0.04 (0.0016)                                                                                                                             |
| Max. displacement of conrod bores at distance of 150 mm (5.905") in mm (in.)                                 |          | 1.5 (0.060)                                                                                                                               |
| Max. difference in weight of both connecting rods in g                                                       |          | $\pm 3$                                                                                                                                   |
| <b>Cylinders</b>                                                                                             |          |                                                                                                                                           |
| Bore dia.                                                                                                    | Standard | A in mm (in.)<br>B in mm (in.)<br>C in mm (in.)                                                                                           |
|                                                                                                              |          | 81.995 $\div$ 82.005 (3.2281 $\div$ 3.2285)<br>82.005 $\div$ 82.015 (3.2285 $\div$ 3.2289)<br>82.015 $\div$ 82.025 (3.2289 $\div$ 3.2293) |
| 1st Oversize + 0.25 mm (0.010")                                                                              |          | A in mm (in.)<br>B in mm (in.)<br>C in mm (in.)                                                                                           |
|                                                                                                              |          | 82.245 $\div$ 82.255 (3.2380 $\div$ 3.2384)<br>82.255 $\div$ 82.265 (3.2384 $\div$ 3.2388)<br>82.265 $\div$ 82.275 (3.2388 $\div$ 3.2391) |
| 2nd Oversize + 0.50 mm (0.020")                                                                              |          | A in mm (in.)<br>B in mm (in.)<br>C in mm (in.)                                                                                           |
|                                                                                                              |          | 82.495 $\div$ 82.505 (3.2478 $\div$ 3.2482)<br>82.505 $\div$ 82.515 (3.2482 $\div$ 3.2486)<br>82.515 $\div$ 82.525 (3.2486 $\div$ 3.2490) |
| Surface finish in $\mu\text{m}$                                                                              |          | 3-7                                                                                                                                       |

## Specifications

| Engine                                                       | Model       | R 65                                                                                                         |                                                                                                             |
|--------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Max. cyl. bore ovality in mm (in.)                           |             | The toleranced surface must be between two coaxial cylinders, which have a radial distance of 0.005 (0.0002) |                                                                                                             |
| <b>Pistons</b>                                               |             |                                                                                                              |                                                                                                             |
| Piston shape                                                 |             |                                                                                                              | spherical increasing to oval                                                                                |
| Piston assembly weight classes                               |             | + or - stamped                                                                                               | Only install pistons of one weight class!                                                                   |
| Piston dia. in mm (in.)                                      | A<br>B<br>C |                                                                                                              | 81.955 ÷ 81.965 (3.2265 ÷ 3.2269)<br>81.965 ÷ 81.975 (3.2269 ÷ 3.2273)<br>81.975 ÷ 81.985 (3.2273 ÷ 3.2277) |
| 1st Oversize + 0.25 mm (0.010")                              | A<br>B<br>C |                                                                                                              | 82.205 ÷ 82.215 (3.2364 ÷ 3.2368)<br>82.215 : 82.225 (3.2368 ÷ 3.2372)<br>82.225 ÷ 82.235 (3.2372 ÷ 3.2376) |
| 2nd Oversize + 0.50 mm (0.020")                              | A<br>B<br>C |                                                                                                              | 82.455 ÷ 82.465 (3.2462 ÷ 3.2466)<br>82.465 ÷ 82.475 (3.2466 ÷ 3.2470)<br>82.475 ÷ 82.485 (3.2470 ÷ 3.2474) |
| Piston installed clearance in mm (in.)                       |             |                                                                                                              | 0.030 ÷ 0.050 (0.0012 ÷ 0.0020)                                                                             |
| Max. total wear clearance on piston and cylinder in mm (in.) |             |                                                                                                              | max. 0.08 (0.0031)                                                                                          |
| Installed direction of piston                                |             |                                                                                                              | arrow and word "vorn" face forward                                                                          |

R 65





## Specifications

| Engine                                                                  | Model | R 65                                                                                     |
|-------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------|
| <b>Piston Rings</b>                                                     |       |                                                                                          |
| Plain compression ring (1st groove) <sup>1)</sup><br>Height in mm (in.) |       | 1.75 <sup>-0.010</sup> <sub>-0.022</sub> (0.0700 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |
| End clearance in mm (in.)                                               |       | 0.30 ... 0.50 (0.012 ... 0.020)                                                          |
| Side clearance in mm (in.)                                              |       | 0.050 ... 0.082 (0.0020 ... 0.0032)                                                      |
| Taper face ring (2nd groove) <sup>1)</sup><br>Height in mm (in.)        |       | 2.00 <sup>-0.010</sup> <sub>-0.022</sub> (0.0790 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |
| End clearance in mm (in.)                                               |       | 0.30 ... 0.45 (0.012 ... 0.018)                                                          |
| Side clearance in mm (in.)                                              |       | 0.040 ... 0.072 (0.0016 ... 0.0028)                                                      |
| Double bevel ring (3rd groove) <sup>1)</sup><br>Height in mm (in.)      |       | 4.00 <sup>-0.010</sup> <sub>-0.022</sub> (0.1575 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |
| End clearance in mm (in.)                                               |       | 0.25 ... 0.40 (0.010 ... 0.016)                                                          |
| Side clearance                                                          |       | 0.030 ... 0.062 (0.0012 ... 0.0024)                                                      |
| Installed direction of piston rings                                     |       | word "top" facing up                                                                     |

<sup>1)</sup> Not acc. to DIN standards,  
special version for BMW.

# Engine Specifications

| Engine                                              | Model | R 65                                                    |
|-----------------------------------------------------|-------|---------------------------------------------------------|
| <b>Piston Pin</b>                                   |       |                                                         |
| Piston pin offset from center of piston in mm (in.) |       | 1.5 (0.060)                                             |
| Piston pin dia. in mm (in.)                         |       | 22 $-0.005$ (0.86614 $-0.0002$ )                        |
| Bore dia. of piston eye in mm (in.)                 |       | 22 $+0.010$ (0.86614 $+0.00040$ )<br>$+0.005$ $+0.0002$ |
| Piston pin play <sup>1)</sup> in piston in mm (in.) |       | 0.005 ... 0.015 (0.00020 ... 0.00060)                   |
| Piston pin clearance in conrod bushing in mm (in.)  |       | 0.015 ... 0.025 (0.0006 ... 0.0010)                     |

<sup>1)</sup> Only replace pistons and piston pins together.



Specifications

|             |  |                                                                                                                                                                                              |
|-------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine      |  |                                                                                                                                                                                              |
| Model       |  | R 65                                                                                                                                                                                         |
| Performance |  | The actual top speed of a broken in motorcycle depends to a great degree on the air resistance from the size, posture and clothing of the rider, the road conditions and weather conditions. |

Torque Values in Nm (ft lbs)

|                                                                                                                                   |                                                                       |                                                                             |                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------|
| Cylinder head nuts<br>(in 3 steps 15 (11) – 25 (18) – 35 (26))<br>Conrod bolts<br>Flywheel to crankshaft                          | 35 + 4 (26 + 2.9)<br>48 ... 52 (35 ... 38)<br>100 ... 105 (72 ... 76) | Oil pan to crankcase<br>Valve adjusting screw nut<br>Adapter for carburetor | 9 ... 11 (6.5 ... 8)<br>18 ... 22 (13 ... 16)<br>12 + 2 (9 + 1.5) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt suppliers or the new BMW Standard 60002.0. |                                                                       |                                                                             |                                                                   |

## Specifications 1981 Models

| Engine                                                                                                                | R 65                                                  |  | R 65 LS |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--|---------|
| <b>Model</b>                                                                                                          |                                                       |  |         |
| Engine design                                                                                                         | Four stroke flat engine with V-shaped overhead valves |  |         |
| Location of engine number                                                                                             | On engine block above oil filler neck                 |  |         |
| Cylinder bore dia. in mm (in.)                                                                                        | 82 (2.756)                                            |  |         |
| Piston stroke in mm (in.)                                                                                             | 61.5 (2.421)                                          |  |         |
| Number of cylinders                                                                                                   | 2                                                     |  |         |
| Cylinder arrangement                                                                                                  | Opposite                                              |  |         |
| Stroke/bore ratio                                                                                                     | 0.75                                                  |  |         |
| Fiscal displacement in cm <sup>3</sup> (in. <sup>3</sup> )                                                            | 645 (39.3)                                            |  |         |
| Effective displacement in cm <sup>3</sup> (in. <sup>3</sup> )                                                         | 649.6 (39.6)                                          |  |         |
| Compression ratio                                                                                                     | 9.2 : 1                                               |  |         |
| Max. output in kW (DIN HP) at rpm                                                                                     | 37 (50) 7250                                          |  |         |
| Max. permissible constant speed in rpm                                                                                | 7300                                                  |  |         |
| Max. permissible top speed in rpm                                                                                     | 7650                                                  |  |         |
| Idle speed in rpm                                                                                                     | 800 ... 1100                                          |  |         |
| Max. permissible speed while breaking in motorcycle up to 1000 km/600 miles in rpm<br>up to 2000 km/1200 miles in rpm | 4000<br>4500                                          |  |         |
| Direction of rotation                                                                                                 | Looking at alternator clockwise                       |  |         |
| Max. torque in Nm/mkp/ft lbs at rpm                                                                                   | 52.3 at 6500                                          |  |         |



## Specifications 1981 Models

| Engine                                                                         | Specifications 1981 Models                                                                                                                                                                                                              |         |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Model                                                                          | R 65                                                                                                                                                                                                                                    | R 65 LS |
| Mean piston speed m/s<br>at rpm                                                | 14.8<br>7250                                                                                                                                                                                                                            |         |
| Compression in bar (psi)    good<br>normal<br>poor                             | above 10.0 (142)<br>8.5 ... 10.0 (121 ... 142)<br>below 8.5 (121)                                                                                                                                                                       |         |
| Instructions for checking compression<br>(motorcycle with starter)             | 1. Unscrew spark plugs.<br>2. Check compression with a calibrated compression tester,<br>fully charged battery, engine having operating temperature and running at starter speed.<br>Remove equal pressure carburetor prior to testing! |         |
| Fuel                                                                           | Premium grade                                                                                                                                                                                                                           |         |
| Fuel consumption in ltr/100 km (mpg)<br>acc. to DIN 70030 at 110 km/h (70 mph) | 4.6 (51)                                                                                                                                                                                                                                |         |



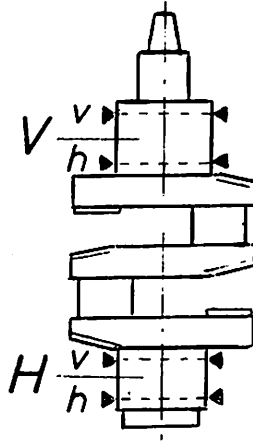
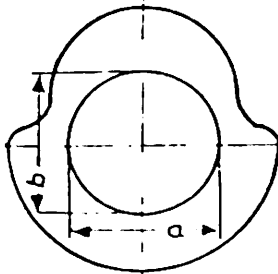
# Testing Report for Crankshaft Main Bearing Play

(also refer to Service Information, Gr. Engine)

Model \_\_\_\_\_ Chassis No. \_\_\_\_\_ Mileage \_\_\_\_\_

Order No. \_\_\_\_\_ Encl. for GA No. \_\_\_\_\_

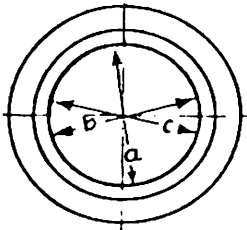
## Measuring Main Bearing Journals:



Measure front main bearing journals V and rear main bearing journals H in directions a and b (each 3 times at same position), transmitting to planes Vv, Vh, Hv, Hh, with an external micrometer. This means 24 different values which must be entered in the table below. Figure out mean values as shown below.

| Measuring Plane |                 | a | b | Cross Addition : 6 = | Mean Value of Main Bearing Journal |
|-----------------|-----------------|---|---|----------------------|------------------------------------|
| 59, ...         | V $\frac{v}{h}$ |   |   | : 6 =                | $\Delta 59, \dots$ mm              |
|                 | V $\frac{v}{h}$ |   |   | : 6 =                | $\Delta 59, \dots$ mm              |
|                 | H $\frac{v}{h}$ |   |   | : 6 =                | $\Delta 59, \dots$ mm              |
|                 | H $\frac{v}{h}$ |   |   | : 6 =                | $\Delta 59, \dots$ mm              |

## Measuring Main bearing Shells:



Measure main bearing shells in directions, a, b and c. Make marks on engine block and bearing caps with a soft-tip pen as shown in the illustration. Otherwise proceed as described above. This means 36 different values which must be entered in the table below. Figure out mean values as shown below.

| Measuring Plane |                 | a | b | c | Cross Addition : 9 = | Mean Value of Main Bearing Shells |
|-----------------|-----------------|---|---|---|----------------------|-----------------------------------|
| 60,0 ...        | V $\frac{v}{h}$ |   |   |   |                      |                                   |
|                 | V $\frac{v}{h}$ |   |   |   |                      |                                   |
|                 | H $\frac{v}{h}$ |   |   |   |                      |                                   |
|                 | H $\frac{v}{h}$ |   |   |   |                      |                                   |

## Calculating Main Bearing Play:

Nominal value = 0.020 ... 0.065 mm

| Measurd Values  | Bearing Shell Dia. | Crankshaft Bearing Journal Dia. | Bearing Play |
|-----------------|--------------------|---------------------------------|--------------|
| V $\frac{v}{h}$ |                    | minus                           | = mm         |
|                 |                    | minus                           | = mm         |
| H $\frac{v}{h}$ |                    | minus                           | = mm         |
|                 |                    | minus                           | = mm         |

Date \_\_\_\_\_

Signature of Tester \_\_\_\_\_

# Crankshaft and Bearings

This technical diagram illustrates the assembly of a crankshaft and its bearings. The central component is the crankshaft (1), which is shown in an exploded view with its various parts. The crankshaft is supported by two main bearings (2) and two smaller bearings (3). The main bearings are shown in an exploded view, with their grooved ball bearings (8) and conrod bearing shells (9) also shown. The smaller bearings (3) are shown with their conrod bearing shells (9) and thrust washers (10). The connecting rod (10) is shown with its pin (11) and pin nut (12). The diagram also shows the crankshaft's gear (6) and its pin (5). The crankshaft is shown with its pin (1) and pin nut (12). The diagram is a black and white line drawing with numbered callouts from 1 to 12.

- 1) Crankshaft
- 2) Bearing bushing
- 3) Thrust washer
- 4) Grooved ball bearing
- 5) Conrod bearing shells
- 6) Connecting rod
- 7) Pin
- 8) Pin nut
- 9) Grooved ball bearing
- 10) Conrod bearing shells
- 11) Thrust washer
- 12) Pin

11-0/20

- 1) Crankshaft
- 2) Bearing bushing
- 3) Thrust washer
- 4) Shaft seal
- 5) Round cord seal
- 6) Flywheel
- 7) Crankshaft sprocket



## Specifications 1981 Models

| Model                                                                               | R 65                                                                                                                              | R 65 LS |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Engine Lubrication</b><br>Lubricating system                                     | Forced oil circulation                                                                                                            |         |
| Oil filter                                                                          | Full flow                                                                                                                         |         |
| Pressure difference to open bypass valve in bar (psi)                               | 1.5 (21)                                                                                                                          |         |
| Oil pressure indicator lamp comes on at pressure below bar (psi)                    | 0.2 . . . 0.5 (3 . . . 7)                                                                                                         |         |
| Opening pressure of safety valve in bar (psi)                                       | approx. 5.0 (71)                                                                                                                  |         |
| Oil volume in ltr. (pints)<br>without filter replacement<br>with filter replacement | 2.0 (4.23)<br>2.25 (4.75)                                                                                                         |         |
| Max. oil consumption in ltr./100 km (mpg)                                           | 0.1 (2350)                                                                                                                        |         |
| Oil grade                                                                           | Brand name HD oil of API classification SE or SF for internal combustion engines.<br>see Group 00, viscosity/temperature diagram. |         |
| <b>Oil Pump</b><br>Design                                                           | Eaton System (hypoid-trochoid spline)                                                                                             |         |
| Delivery rate in ltr. (qts)/h at rpm                                                | 1400 (1480) at 6000                                                                                                               |         |
| Outer rotor dia. in mm (in.)                                                        | 57 ± 0.05 (2.280 ± 0.002)                                                                                                         |         |
| Housing inside dia. in mm (in.)                                                     | 57.2 <sup>+0.046</sup> <sub>0</sub> (2.2520 <sup>+0.0018</sup> <sub>0</sub> )                                                     |         |
| Outer rotor/pump housing play in mm (in.)                                           | 0.15 . . . 0.29 (0.006 . . . 0.011)                                                                                               |         |

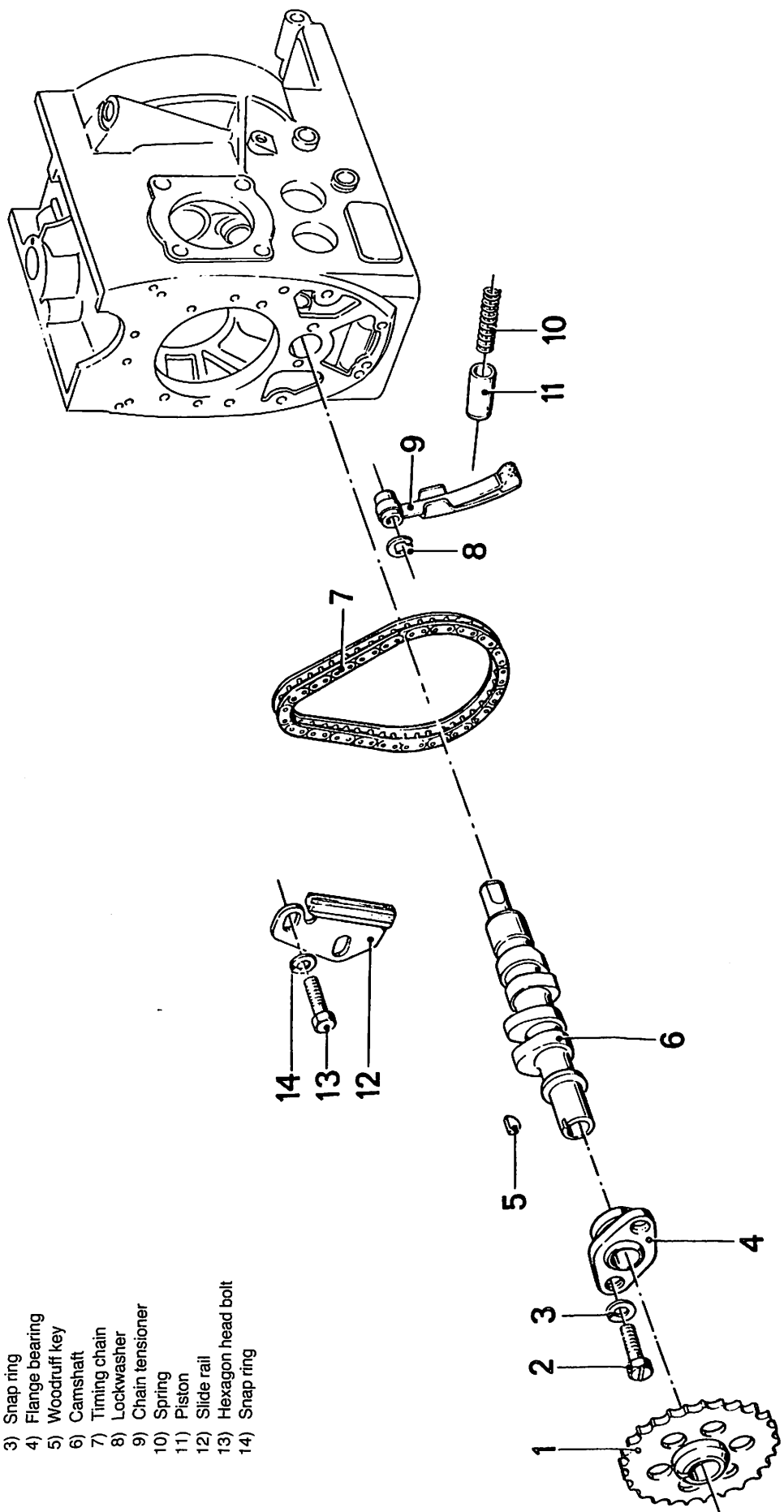


## Specifications 1981 Models

| Engine                                                                                                                                                  | Model                                                                                                                            |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------|
|                                                                                                                                                         | R 65                                                                                                                             | R 65LS |
| Rotor height in mm (in.)                                                                                                                                | 14 $\begin{smallmatrix} -0.015 \\ -0.045 \end{smallmatrix}$ (0.5512 $\begin{smallmatrix} -0.0006 \\ -0.0018 \end{smallmatrix}$ ) |        |
| Housing depth in mm (in.)                                                                                                                               | 14 $\begin{smallmatrix} +0.025 \\ +0.010 \end{smallmatrix}$ (0.5512 $\begin{smallmatrix} +0.0010 \\ +0.0004 \end{smallmatrix}$ ) |        |
| Play between mating surface (pump housing) and sealing surface (rotor) in mm (in.)                                                                      | 0.025 . . . 0.070 (0.0010 . . . 0.0027)                                                                                          |        |
| Inner/outer rotor clearance in mm (in.)                                                                                                                 | 0.12 . . . 0.20 (0.005 . . . 0.008)                                                                                              |        |
| Max. scoring depth in cover in mm (in.)                                                                                                                 | 0.5 (0.002)                                                                                                                      |        |
| Relaxed spring length in mm (in.)                                                                                                                       | 68 (2.677)                                                                                                                       |        |
| <b>Valve Clearance</b><br>Adjustment on cold engine (max. 20°C/54°F)<br>Intake valve in mm (in.)<br>Exhaust valve in mm (in.)                           | 0.10 (0.004) $\begin{pmatrix} 0.15 (0.006) \\ 0.20 (0.008) \end{pmatrix}$ up to 1000 km (600 mile) insp.)                        |        |
| Valve timing (tolerance $\pm 2.5^\circ$ )<br>Intake opens before TDC<br>Intake closes after BDC<br>Exhaust opens before BDC<br>Exhaust closes after TDC | Control shaft device with 2 mm (0.080") valve clearance<br>308° Camshaft 16°<br>44°<br>56°<br>4°                                 |        |
| <b>Valves</b><br>Total valve length in mm (in.)<br>Intake<br>Exhaust                                                                                    | 100 $\pm 0.2$ (3.937 $\pm 0.008$ )<br>99.3 $\pm 0.2$ (3.909 $\pm 0.008$ )                                                        |        |
| Intake valve head dia. in mm (in.)                                                                                                                      | 38 (1.496)                                                                                                                       |        |
| Exhaust valve head dia. in mm (in.)                                                                                                                     | 34 (1.338)                                                                                                                       |        |
| Intake valve stem dia. in mm (in.)                                                                                                                      | 6.96 - 0.015 (0.2784 - 0.0006)                                                                                                   |        |

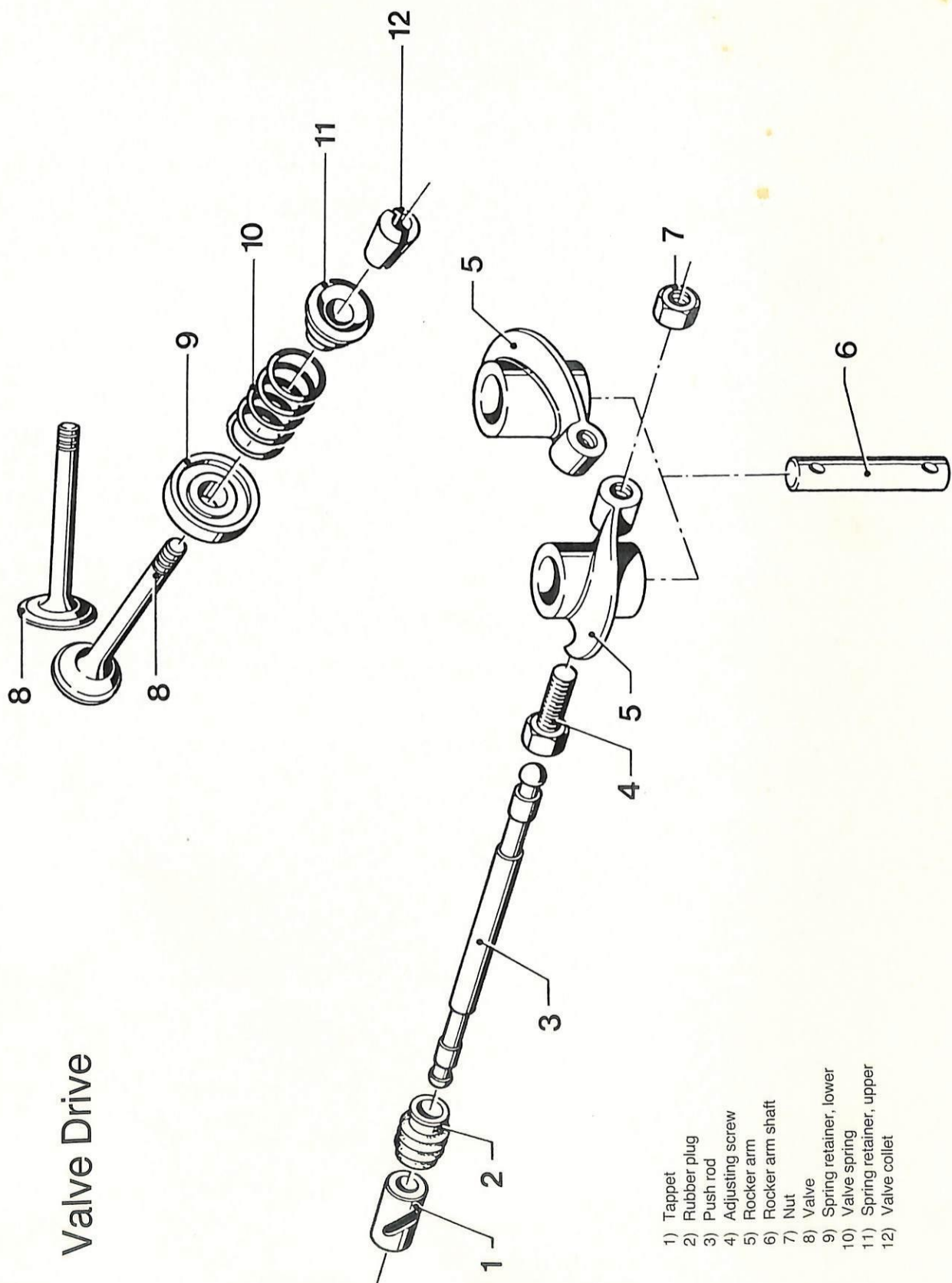
# Camshaft and Timing Chain

- 1) Camshaft sprocket
- 2) Hexagon head bolt
- 3) Snap ring
- 4) Flange bearing
- 5) Woodruff key
- 6) Camshaft
- 7) Timing chain
- 8) Lockwasher
- 9) Chain tensioner
- 10) Spring
- 11) Piston
- 12) Slide rail
- 13) Hexagon head bolt
- 14) Snap ring





# Valve Drive



- 1) Tappet
- 2) Rubber plug
- 3) Push rod
- 4) Adjusting screw
- 5) Rocker arm
- 6) Rocker arm shaft
- 7) Nut
- 8) Valve
- 9) Spring retainer, lower
- 10) Valve spring
- 11) Spring retainer, upper
- 12) Valve collet

## Specifications 1981 Models

| Engine                                                   | R 65 |                                                | R 65 LS |
|----------------------------------------------------------|------|------------------------------------------------|---------|
| <b>Model</b>                                             |      |                                                |         |
| Exhaust valve stem dia. in mm (in.)                      |      | 6.96 - 0.015 (0.2784 - 0.0006)                 |         |
| Min. valve head edge thickness in mm (in.)               |      |                                                |         |
| Intake                                                   |      | 1.0 <sup>+0.5</sup> (0.040 <sup>+0.020</sup> ) |         |
| Exhaust                                                  |      | 1.2 <sup>-0.2</sup> (0.047 <sup>-0.008</sup> ) |         |
| Max. valve head runout in mm (in.)                       |      | 0.02 (0.0008)                                  |         |
| <b>Valve Seat Insert</b>                                 |      |                                                |         |
| Intake valve outside dia. in mm (in.)                    |      | 39.2 h 7 (1.5433)                              |         |
| Exhaust valve outside dia. in mm (in.)                   |      | 39.2h7 (1.6433)                                |         |
| Valve seat insert bore dia. in cylinder head in mm (in.) |      |                                                |         |
| Intake                                                   |      | 39 H 7 (1.5354)                                |         |
| Exhaust                                                  |      | 39 H 7 (1.6354)                                |         |
| Valve seat angle in degrees                              |      | 90° - 20°                                      |         |
| <b>Valve Seat Width</b> (reference value)                |      |                                                |         |
| Intake in mm (in.)                                       |      | approx. 1.2 + 0.2 (0.048 + 0.008)              |         |
| Exhaust in mm (in.)                                      |      | approx. 1.4 + 0.2 (0.056 + 0.008)              |         |



## Specifications 1981 Models

| Engine                                  | R 65                                                                                                |            | R 65 LS |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------|------------|---------|
| <b>Model</b>                            |                                                                                                     |            |         |
| Oversize valve seat inserts in mm (in.) | 0.2 (0.008)                                                                                         |            |         |
| <b>Valve Guide</b>                      |                                                                                                     |            |         |
| Total length in mm (in.)                | Intake                                                                                              | Exhaust    |         |
|                                         | 42 (1.680)                                                                                          | 42 (1.680) |         |
| Outside dia. in mm (in.)                | 14 z 6 (0.5512)                                                                                     |            |         |
| Inside dia. in mm (in.)                 | 7 H 7 (0.2756)                                                                                      |            |         |
| Bore dia. in cyl. head in mm (in.)      | 14 H 7 (0.5512)                                                                                     |            |         |
| 1st oversize dia. in mm (in.)           | 14.1 z 6 (0.5551)                                                                                   |            |         |
| 2nd oversize dia. in mm (in.)           | 14.2 z 6 (0.5590)                                                                                   |            |         |
| <b>Valve Stem Clearance</b> in mm (in.) |                                                                                                     |            |         |
| Intake                                  | 0.025 ... 0.055 (0.0010 ... 0.0022)                                                                 |            |         |
| Exhaust                                 | 0.04 ... 0.07 (0.0016 ... 0.0027)                                                                   |            |         |
| Max. wear in mm (in.)                   | 0.1 (0.004) measured at top end of valve guide                                                      |            |         |
| <b>Valve Drive</b>                      |                                                                                                     |            |         |
| Valve operation                         | By camshaft via cam followers, push rods and rocker arms                                            |            |         |
| Camshaft drive                          | Single roller chain 3/8 x 7/32" with connecting link and chain tensioner with hydr. oil lubrication |            |         |
| Number of links                         | 50                                                                                                  |            |         |



## Specifications 1981 Models

| Engine                                                | Specifications 1981 Models                         |         |
|-------------------------------------------------------|----------------------------------------------------|---------|
| Model                                                 | R 65                                               | R 65 LS |
| <b>Valve Springs</b>                                  |                                                    |         |
| Wire gage dia. in mm (in.)                            | 4.25 (0.167)                                       |         |
| Outside coil dia. in mm (in.)                         | 31.9 (1.256)                                       |         |
| Relaxed spring length in mm (in.)                     | brown code approx. 46 or 43.5 for blue code        |         |
| Spring force in kp (lbs) with test length in mm (in.) | 29 (64) at 37.6 (1.480) 70 (154) at 28.5 (1.122)   |         |
| <b>Wound direction</b>                                | <i>clockwise</i>                                   |         |
| Number of active coils                                | 4.6 or 4                                           |         |
| Total number of coils                                 | 6                                                  |         |
| Compressed length in mm (in.)                         | 25 (0.984)                                         |         |
| Installed direction                                   | Coils marked with paint stripes face cylinder head |         |
| <b>Rocker Arms</b>                                    | With needle bearings                               |         |
| Axial play of rocker arm                              | Without play, but easy movement                    |         |
| Rocker arm ratio                                      | 1 : 1.39                                           |         |



## Specifications 1981 Models

| Engine                                                                 | R 65                                                                                                                             |  | R 65 LS |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--|---------|
| <b>Model</b>                                                           |                                                                                                                                  |  |         |
| <b>Camshaft</b>                                                        |                                                                                                                                  |  |         |
| Flange bearing bore dia. in engine block in mm (in.)                   | 40 $\begin{smallmatrix} +0.039 \\ 0 \end{smallmatrix}$ (1.5748 $\begin{smallmatrix} +0.0015 \\ 0 \end{smallmatrix}$ )            |  |         |
| Flange bearing outside dia. in mm (in.)                                | 40 $\begin{smallmatrix} 0 \\ -0.016 \end{smallmatrix}$ (1.5748 $\begin{smallmatrix} 0 \\ -0.0006 \end{smallmatrix}$ )            |  |         |
| Flange bearing bore dia. in mm (in.)                                   | 25 $\begin{smallmatrix} +0.013 \\ 0 \end{smallmatrix}$ (0.9842 $\begin{smallmatrix} +0.0005 \\ 0 \end{smallmatrix}$ )            |  |         |
| Camshaft bearing journal dia. on alternator end in mm (in.)            | 25 $\begin{smallmatrix} -0.020 \\ -0.033 \end{smallmatrix}$ (0.9842 $\begin{smallmatrix} -0.0008 \\ -0.0013 \end{smallmatrix}$ ) |  |         |
| Camshaft bearing bore dia. in engine block on flywheel end in mm (in.) | 24 $\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$ (0.9449 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$ )            |  |         |
| Camshaft bearing journal dia. on flywheel end in mm (in.)              | 24 $\begin{smallmatrix} -0.020 \\ -0.033 \end{smallmatrix}$ (0.9449 $\begin{smallmatrix} -0.0008 \\ -0.0013 \end{smallmatrix}$ ) |  |         |
| Alternator or flywheel end radial play in mm                           | 0.02 . . . 0.046 (0.0008 . . . 0.0018) or 0.02 . . . 0.054 (0.0008 . . . 0.0021)                                                 |  |         |
| Axial play (play between camshaft collar/flange bearing) in mm (in.)   | 0.1 $\pm$ 0.02 (0.0040 $\pm$ 0.0008)                                                                                             |  |         |
| Cam base circle dia. in mm (in.)                                       | 28 (1.102)                                                                                                                       |  |         |
| Cam lift in mm (in.)                                                   | 6.756 (0.266)                                                                                                                    |  |         |
| Tappet outside dia. in mm (in.)                                        | 22 $\begin{smallmatrix} -0.025 \\ -0.045 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} -0.0010 \\ -0.0018 \end{smallmatrix}$ ) |  |         |
| Tappet bore dia. in engine block in mm (in.)                           | 22 $\begin{smallmatrix} +0.006 \\ -0.015 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} +0.0002 \\ -0.0006 \end{smallmatrix}$ ) |  |         |
| Radial play of tappet in mm (in.)                                      | 0.01 . . . 0.051 (0.004 . . . 0.0020)                                                                                            |  |         |
| Max. permissible tappet wear in mm (in.)                               | 0.075 (0.0029)                                                                                                                   |  |         |



## Specifications 1981 Models

| Engine                                                                  | R 65                                                                                                                             |                                            | R 65 LS                               |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------|
| Model                                                                   | Main Bearing Journal Dia. in mm (in.)                                                                                            |                                            | Flywheel End                          |
| Crankshaft and Bearings<br>Crankshaft                                   | Alternator End                                                                                                                   |                                            |                                       |
| Crankshaft color code                                                   | 59.980 ... 59.990 (2.3614 ... 2.3618)                                                                                            | 59.980 ... 59.990 (2.3614 ... 2.3618)      | 59.980 ... 59.990 (2.3614 ... 2.3618) |
| Standard 0                                                              | 59.980 ... 59.990 (2.3614 ... 2.3618)                                                                                            | 59.971 ... 59.980 (2.3610 ... 2.3614)      | 59.971 ... 59.980 (2.3610 ... 2.3614) |
|                                                                         | 59.971 ... 59.980 (2.3610 ... 2.3614)                                                                                            | 59.980 ... 59.990 (2.3614 ... 2.3618)      | 59.980 ... 59.990 (2.3614 ... 2.3618) |
|                                                                         | 59.971 ... 59.980 (2.3610 ... 2.3614)                                                                                            | 59.971 ... 59.980 (2.3610 ... 2.3614)      | 59.971 ... 59.980 (2.3610 ... 2.3614) |
| 1st Undersize 0.25 (0.010)                                              | 59.730 ... 59.740 (2.3516 ... 2.3520)                                                                                            | 59.730 ... 59.740 (2.3516 ... 2.3520)      | 59.730 ... 59.740 (2.3516 ... 2.3520) |
|                                                                         | 59.730 ... 59.740 (2.3516 ... 2.3520)                                                                                            | 59.721 ... 59.730 (2.3512 ... 2.3516)      | 59.721 ... 59.730 (2.3512 ... 2.3516) |
|                                                                         | 59.721 ... 59.730 (2.3512 ... 2.3516)                                                                                            | 59.730 ... 59.740 (2.3516 ... 2.3520)      | 59.730 ... 59.740 (2.3516 ... 2.3520) |
|                                                                         | 59.721 ... 59.730 (2.3512 ... 2.3516)                                                                                            | 59.721 ... 59.730 (2.3512 ... 2.3516)      | 59.721 ... 59.730 (2.3512 ... 2.3516) |
| 2nd Undersize 0.50 (0.020)                                              | 59.480 ... 59.490 (2.3417 ... 2.3421)                                                                                            | 59.480 ... 59.490 (2.3417 ... 2.3421)      | 59.480 ... 59.490 (2.3417 ... 2.3421) |
|                                                                         | 59.480 ... 59.490 (2.3417 ... 2.3421)                                                                                            | 59.471 ... 59.480 (2.3414 ... 2.3417)      | 59.471 ... 59.480 (2.3414 ... 2.3417) |
|                                                                         | 59.471 ... 59.480 (2.3414 ... 2.3417)                                                                                            | 59.480 ... 59.490 (2.3417 ... 2.3421)      | 59.480 ... 59.490 (2.3417 ... 2.3421) |
|                                                                         | 59.471 ... 59.480 (2.3414 ... 2.3417)                                                                                            | 59.471 ... 59.480 (2.3414 ... 2.3417)      | 59.471 ... 59.480 (2.3414 ... 2.3417) |
| 3rd Undersize 0.75 (0.030)                                              | 59.230 ... 59.240 (2.3319 ... 2.3323)                                                                                            | 59.230 ... 59.240 (2.3319 ... 2.3323)      | 59.230 ... 59.240 (2.3319 ... 2.3323) |
|                                                                         | 59.230 ... 59.240 (2.3319 ... 2.3323)                                                                                            | 59.221 ... 59.230 (2.3315 ... 2.3319)      | 59.221 ... 59.230 (2.3315 ... 2.3319) |
|                                                                         | 59.221 ... 59.230 (2.3315 ... 2.3319)                                                                                            | 59.230 ... 59.240 (2.3319 ... 2.3323)      | 59.230 ... 59.240 (2.3319 ... 2.3323) |
|                                                                         | 59.221 ... 59.230 (2.3315 ... 2.3319)                                                                                            | 59.221 ... 59.230 (2.3315 ... 2.3319)      | 59.221 ... 59.230 (2.3315 ... 2.3319) |
| Bore for crankshaft main bearing<br>bushing in engine block, dia. in mm | $65 \begin{smallmatrix} +0.019 \\ 0 \end{smallmatrix}$ (2.5590 $\begin{smallmatrix} +0.0007 \\ 0 \end{smallmatrix}$ )            |                                            |                                       |
| Bore for crankshaft main bearing<br>bushing in bearing cap, dia. in mm  | $65 \begin{smallmatrix} +0.019 \\ 0 \end{smallmatrix}$ (2.5590 $\begin{smallmatrix} +0.0007 \\ 0 \end{smallmatrix}$ )            |                                            |                                       |
| Main bearing journal radial play in mm (in.)                            | red 0.017 $\div$ 0.066 (0.0006 ... 0.0026                                                                                        | blue 0.019 $\pm$ 0.067 (0.0007 ... 0.0026) |                                       |
| Front crankshaft bearing seat dia.<br>in mm (in.)                       | $35 \begin{smallmatrix} +0.025 \\ +0.009 \end{smallmatrix}$ (1.3779 $\begin{smallmatrix} +0.0010 \\ +0.0003 \end{smallmatrix}$ ) |                                            |                                       |
| Bearing seat bore dia. in timing<br>case cover in mm (in.)              | $62 \begin{smallmatrix} -0.009 \\ -0.39 \end{smallmatrix}$ (2.4409 $\begin{smallmatrix} -0.0003 \\ -0.0153 \end{smallmatrix}$ )  |                                            |                                       |



## Specifications 1981 Models

| Engine                                                    | R 65        |                                                                                | R 65 LS                                                                 |
|-----------------------------------------------------------|-------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Model                                                     |             |                                                                                |                                                                         |
| <b>Main Bearing Bushing</b><br>Wall thickness in mm (in.) |             |                                                                                |                                                                         |
| Standard 0                                                | red<br>blue | 2.500 ... 2.510 (0.09842 ... 0.09882)<br>2.504 ... 2.514 (0.10016 ... 0.10056) |                                                                         |
| 1st Oversize 0.25 (0.010)                                 | red<br>blue | 2.625 ... 2.635 (0.10334 ... 0.10374)<br>2.629 ... 2.639 (0.10516 ... 0.10556) |                                                                         |
| 2nd Oversize 0.50 (0.020)                                 | red<br>blue | 2.750 ... 2.760 (0.10827 ... 0.10866)<br>2.754 ... 2.764 (0.11016 ... 0.11056) |                                                                         |
| 3rd Oversize 0.75 (0.030)                                 | red<br>blue | 2.875 ... 2.885 (0.11319 ... 0.11358)<br>2.879 ... 2.889 (0.11516 ... 0.11556) |                                                                         |
| <b>Engine block</b>                                       |             | dia. A (crankshaft bearing bore) 65 H 6<br>65.000 ... 65.019                   | dia. B (bearing cap bore) 130 + 0.026<br>- 0.007<br>129.993 ... 130.026 |
| Crankshaft bearing dia. in mm<br>with bearing pressed in  |             | red 60.007 ... 60.046                                                          | blue 59.999 ... 60.038                                                  |
| <b>Bearing cap</b>                                        |             | 65.000 ... 65.019                                                              | 130.003 ... 130.028                                                     |



# Specifications 1981 Models

Engine

| Model                                                                                               | R 65                                                                                                                                 | R 65 LS |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------|
| Crankshaft seat dia. for sprocket in mm (in.)                                                       | 35.003 $\begin{smallmatrix} +0.020 \\ +0.009 \end{smallmatrix}$ (1.3781 $\begin{smallmatrix} +0.0008 \\ +0.0003 \end{smallmatrix}$ ) |         |
| Sprocket take-up bore dia. in mm (in.)                                                              | 35.003 $\begin{smallmatrix} +0.003 \\ -0.013 \end{smallmatrix}$ (1.3781 $\begin{smallmatrix} +0.0001 \\ -0.0005 \end{smallmatrix}$ ) |         |
| Crankshaft axial play in mm (in.)                                                                   | 0.08 ... 0.15 (0.0031 ... 0.0059)                                                                                                    |         |
| Thrust washer                                                                                       |                                                                                                                                      |         |
| Red thickness "S" in mm (in.)                                                                       | 2.483 ... 2.530 (0.0977 ... 0.0996)                                                                                                  |         |
| Blue thickness "S" in mm (in.)                                                                      | 2.530 ... 2.578 (0.0996 ... 0.1015)                                                                                                  |         |
| Green thickness "S" in mm (in.)                                                                     | 2.578 ... 2.626 (0.1015 ... 0.1034)                                                                                                  |         |
| Yellow thickness "S" in mm (in.)                                                                    | 2.626 ... 2.673 (0.1034 ... 0.1052)                                                                                                  |         |
| Max. permissible wear limit in mm (in.)                                                             | 0.20 (0.008)                                                                                                                         |         |
| Max. runout on shaft journal (alternator end) outside taken up on main bearing journals in mm (in.) | 0.02 (0.0008)                                                                                                                        |         |
| Max. dynamic unbalance of crankshaft (without flywheel) in cmp                                      | 20                                                                                                                                   |         |
| Max. lateral runout on flywheel in mm (in.)                                                         | 0.1 (0.004)                                                                                                                          |         |
| <b>Connecting Rods and Bearings</b>                                                                 |                                                                                                                                      |         |
| Standard 0                                                                                          | Thrust journal dia. in mm (in.)                                                                                                      |         |
|                                                                                                     | 48.00 $\begin{smallmatrix} -0.009 \\ -0.025 \end{smallmatrix}$ (1.8898 $\begin{smallmatrix} -0.0003 \\ -0.0010 \end{smallmatrix}$ )  |         |
| Undersize 1 0.25 (0.010)                                                                            | 47.75 $\begin{smallmatrix} -0.009 \\ -0.025 \end{smallmatrix}$ (1.8799 $\begin{smallmatrix} -0.0003 \\ -0.0010 \end{smallmatrix}$ )  |         |
| Undersize 2 0.50 (0.020)                                                                            | 47.50 $\begin{smallmatrix} -0.009 \\ -0.025 \end{smallmatrix}$ (1.8701 $\begin{smallmatrix} -0.0003 \\ -0.0010 \end{smallmatrix}$ )  |         |
| Undersize 3 0.75 (0.030)                                                                            | 47.25 $\begin{smallmatrix} -0.009 \\ -0.025 \end{smallmatrix}$ (1.8602 $\begin{smallmatrix} -0.0003 \\ -0.0010 \end{smallmatrix}$ )  |         |
| Big end dia. in mm (in.)                                                                            | 52.00 $\begin{smallmatrix} +0.015 \\ 0 \end{smallmatrix}$ (2.0472 $\begin{smallmatrix} 0.0006 \\ 0 \end{smallmatrix}$ )              |         |
| Conrod bearing radial play in mm (in.)                                                              | 0.023 ... 0.069 (0.0009 ... 0.0027)                                                                                                  |         |
| Big end conrod width in mm (in.)                                                                    | 22.00 $\begin{smallmatrix} -0.065 \\ -0.117 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} -0.0025 \\ -0.0046 \end{smallmatrix}$ )  |         |
| Thrust journal bearing width in mm (in.)                                                            | 22.00 $\begin{smallmatrix} +0.149 \\ +0.065 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} +0.0059 \\ +0.0025 \end{smallmatrix}$ )  |         |
| Conrod axial play in mm (in.)                                                                       | 0.130 ... 0.266 (0.0051 ... 0.0105)                                                                                                  |         |
| Max. axial wear limit in mm (in.)                                                                   | 0.32 (0.012)                                                                                                                         |         |



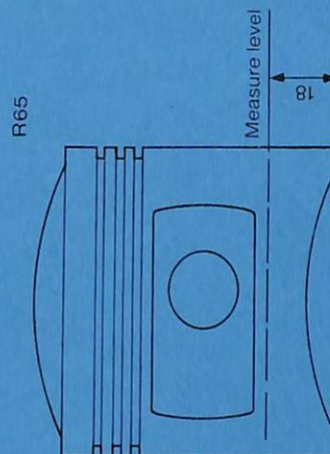
## Specifications 1981 Models

| Model                                                                                                        | R 65                                                                                   | R 65LS                                                                                                      |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Distance between big and small end bore center lines in mm (in.)                                             | 118 (4.645)                                                                            |                                                                                                             |
| Small end bore dia. in mm (in.)                                                                              | 24 <sup>+0.021</sup> <sub>0</sub> (0.9449 <sup>+0.0008</sup> <sub>0</sub> )            |                                                                                                             |
| Conrod bushing outside dia. in mm (in.)                                                                      | 24.060 ... 24.100 (0.9472 ... 0.9488)                                                  |                                                                                                             |
| Piston pin bore dia in conrod bushing in mm (in.)                                                            | 22 <sup>+0.020</sup> <sub>+0.015</sub> (0.8661 <sup>+0.0008</sup> <sub>+0.0006</sub> ) |                                                                                                             |
| Piston pin bore wear limit dia. in conrod bushing in mm (in.)                                                | 22 <sup>+0.040</sup> <sub>0</sub> (0.8661 <sup>+0.0016</sup> <sub>0</sub> )            |                                                                                                             |
| Max. deviation from parallel for conrod bores with bearing shells at distance of 150 mm (5.905") in mm (in.) | 0.04 (0.0016)                                                                          |                                                                                                             |
| Max. displacement of conrod bores at distance of 150 mm (5.905") in mm (in.)                                 | 1.5 (0.060)                                                                            |                                                                                                             |
| Max. difference in weight of both connecting rods in g                                                       | ± 3                                                                                    |                                                                                                             |
| Cylinders                                                                                                    |                                                                                        |                                                                                                             |
| Bore dia.                                                                                                    | Standard                                                                               | A in mm (in.)<br>B in mm (in.)<br>C in mm (in.)                                                             |
|                                                                                                              |                                                                                        | 81.995 ÷ 82.005 (3.2281 ÷ 3.2285)<br>82.005 ÷ 82.015 (3.2285 ÷ 3.2289)<br>82.015 ÷ 82.025 (3.2289 ÷ 3.2293) |
| Surface finish in μm                                                                                         | 1.5                                                                                    |                                                                                                             |



## Specifications 1981 Models

| Engine                                                       | R65                                                                                                          |                                           | R65LS |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------|
| <b>Model</b>                                                 |                                                                                                              |                                           |       |
| Max. cyl. bore ovality in mm (in.)                           | The toleranced surface must be between two coaxial cylinders, which have a radial distance of 0.005 (0.0002) |                                           |       |
| <b>Pistons</b>                                               |                                                                                                              |                                           |       |
| Piston shape                                                 | spherical increasing to oval                                                                                 |                                           |       |
| Piston assembly weight classes                               | + or - stamped                                                                                               | Only install pistons of one weight class! |       |
| Piston dia. in mm (in.)                                      |                                                                                                              |                                           |       |
| Standard                                                     |                                                                                                              |                                           |       |
|                                                              | A                                                                                                            | 81.955 ÷ 81.965 (3.2265 ÷ 3.2269)         |       |
|                                                              | B                                                                                                            | 81.965 ÷ 81.975 (3.2269 ÷ 3.2273)         |       |
|                                                              | C                                                                                                            | 81.975 ÷ 81.985 (3.2273 ÷ 3.2277)         |       |
| Piston installed clearance in mm (in.)                       | 0.030 ... 0.040 (0.0012 ... 0.0016)                                                                          |                                           |       |
| Max. total wear clearance on piston and cylinder in mm (in.) | max. 0.08 (0.0031)                                                                                           |                                           |       |
| Installed direction of piston                                | arrow and word "vorn" face forward                                                                           |                                           |       |





## Specifications 1981 Models

| Engine                                                                  | R 65                                                                                     |  | R 65 LS |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--|---------|
| Model                                                                   |                                                                                          |  |         |
| <b>Piston Rings</b>                                                     |                                                                                          |  |         |
| Plain compression ring (1st groove) <sup>1)</sup><br>Height in mm (in.) | 1.75 <sup>-0.010</sup> <sub>-0.022</sub> (0.0700 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |  |         |
| End clearance in mm (in.)                                               | 0.30 ... 0.50 (0.012 ... 0.020)                                                          |  |         |
| Side clearance in mm (in.)                                              | 0.050 ... 0.082 (0.0020 ... 0.0032)                                                      |  |         |
| Taper face ring (2nd groove) <sup>1)</sup><br>Height in mm (in.)        | 2.00 <sup>-0.010</sup> <sub>-0.022</sub> (0.0790 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |  |         |
| End clearance in mm (in.)                                               | 0.30 ... 0.45 (0.012 ... 0.018)                                                          |  |         |
| Side clearance in mm (in.)                                              | 0.040 ... 0.072 (0.0016 ... 0.0028)                                                      |  |         |
| Double bevel ring (3rd groove) <sup>1)</sup><br>Height in mm (in.)      | 4.00 <sup>-0.010</sup> <sub>-0.022</sub> (0.1575 <sup>-0.0004</sup> <sub>-0.0009</sub> ) |  |         |
| End clearance in mm (in.)                                               | 0.25 ... 0.40 (0.010 ... 0.016)                                                          |  |         |
| Side clearance                                                          | 0.030 ... 0.062 (0.0012 ... 0.0024)                                                      |  |         |
| Installed direction of piston rings                                     | word "top" facing up                                                                     |  |         |

<sup>1)</sup> Not acc. to DIN standards,  
special version for BMW.



## Specifications 1981 Models

| Engine                                                                   | Specifications 1981 Models                                  |         |
|--------------------------------------------------------------------------|-------------------------------------------------------------|---------|
| Model                                                                    | R 65                                                        | R 65 LS |
| <b>Piston Pin</b><br>Piston pin offset from center of piston in mm (in.) | 1.5 (0.060)                                                 |         |
| Piston pin dia. in mm (in.)                                              | 22 $-0.005$ (0.86614 $-0.0002$ )                            |         |
| Bore dia. of piston eye in mm (in.)                                      | 22 $+0.010$ (0.86614 $+0.00040$ )<br>$+0.005$ ( $+0.0002$ ) |         |
| Piston pin play <sup>1)</sup> in piston in mm (in.)                      | 0.005 ... 0.015 (0.00020 ... 0.00060)                       |         |
| Piston pin clearance in conrod bushing in mm (in.)                       | 0.015 ... 0.025 (0.0006 ... 0.0010)                         |         |

<sup>1)</sup> Only replace pistons and piston pins together.



### Specifications 1981 Models

| Engine      |                                                                                                                                                                                              |         |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Model       | R 65                                                                                                                                                                                         | R 65 LS |
| Performance | The actual top speed of a broken in motorcycle depends to a great degree on the air resistance from the size, posture and clothing of the rider, the road conditions and weather conditions. |         |

### Torque Values in Nm (ft lbs)

|                                                                                                                                   |                        |                           |                 |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------|-----------------|
| Cylinder head nuts<br>(in 3 steps 15 (11) - 25 (18) - 35 (26))                                                                    | 35 + 4 (26 + 2.9)      | Oil pan to crankcase      | 30 + 5 (22 + 4) |
| Conrod bolts                                                                                                                      | 50 ± 2 (36 ± 1)        | Valve adjusting screw nut | 20 ± 2 (14 ± 1) |
| Flywheel to crankshaft                                                                                                            | 100 + 5 (72 . . . + 4) | Adapter for carburetor    | 50 (36)         |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt suppliers or the new BMW Standard 60002.0. |                        |                           |                 |

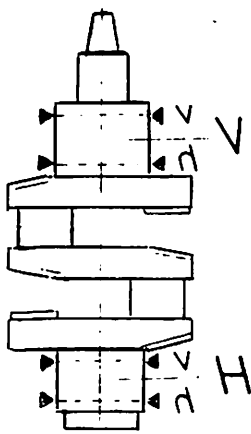
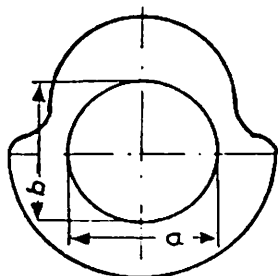
# Testing Report for Crankshaft Main Bearing Play

(also refer to Service Information, Gr. Engine)

Model \_\_\_\_\_ Chassis No. \_\_\_\_\_ Mileage \_\_\_\_\_

Order No. \_\_\_\_\_ Encl. for GA No. \_\_\_\_\_

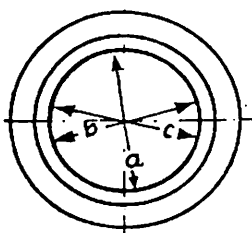
## Measuring Main Bearing Journals:



Measure front main bearing journals V and rear main bearing journals H in directions a and b (each 3 times at same position), transmitting to planes Vv, Vh, Hv, Hh, with an external micrometer. This means 24 different values which must be entered in the table below. Figure out mean values as shown below.

| Measuring Plane |                 | a |  |  | b |  |  | Cross Addition : 6 = | Mean Value of Main Bearing Journal |
|-----------------|-----------------|---|--|--|---|--|--|----------------------|------------------------------------|
| 59, ...         | V $\frac{v}{h}$ |   |  |  |   |  |  | : 6 =                | $\Delta$ 59, ... mm                |
|                 |                 |   |  |  |   |  |  | : 6 =                | $\Delta$ 59, ... mm                |
|                 | H $\frac{v}{h}$ |   |  |  |   |  |  | : 6 =                | $\Delta$ 59, ... mm                |
|                 |                 |   |  |  |   |  |  | : 6 =                | $\Delta$ 59, ... mm                |

## Measuring Main bearing Shells:



Measure main bearing shells in directions, a, b and c. Make marks on engine block and bearing caps with a soft-tip pen as shown in the illustration. Otherwise proceed as described above. This means 36 different values which must be entered in the table below. Figure out mean values as shown below.

| Measuring Plane |                 | a |  |  | b |  |  | c |  |  | Cross Addition : 9 = | Mean Value of Main Bearing Shells |
|-----------------|-----------------|---|--|--|---|--|--|---|--|--|----------------------|-----------------------------------|
| 60,0 ...        | V $\frac{v}{h}$ |   |  |  |   |  |  |   |  |  |                      |                                   |
|                 | H $\frac{v}{h}$ |   |  |  |   |  |  |   |  |  |                      |                                   |

## Calculating Main Bearing Play:

Nominal value = 0.020 ... 0.065 mm

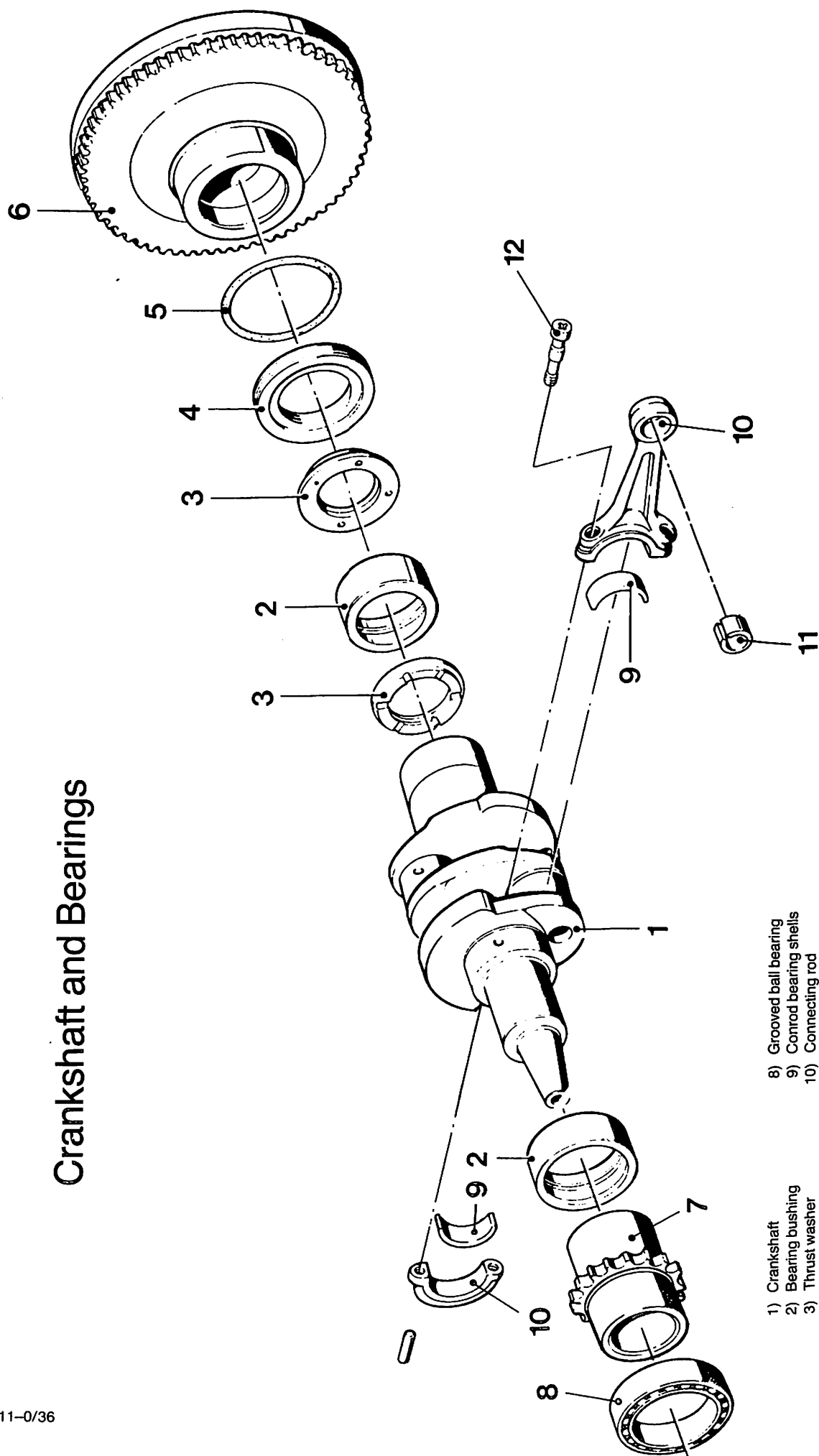
| Measurd Values  | Bearing Shell Dia. |  | Crankshaft Bearing Journal Dia. |   | Bearing Play |    |
|-----------------|--------------------|--|---------------------------------|---|--------------|----|
| V $\frac{v}{h}$ |                    |  | minus                           | = |              | mm |
|                 |                    |  | minus                           | = |              | mm |
| H $\frac{v}{h}$ |                    |  | minus                           | = |              | mm |
|                 |                    |  | minus                           | = |              | mm |

Date \_\_\_\_\_

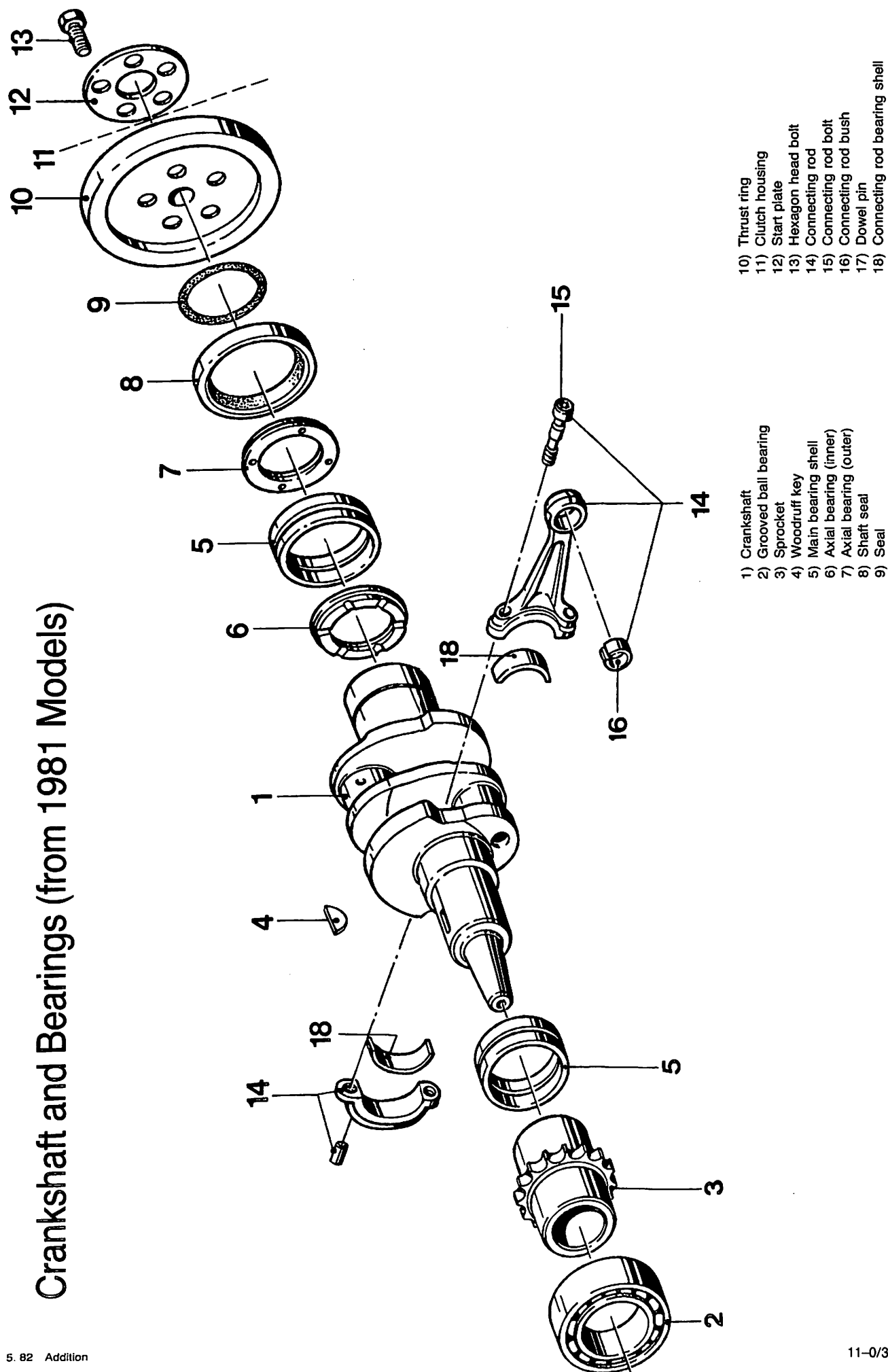
Signature of Tester \_\_\_\_\_



# Crankshaft and Bearings



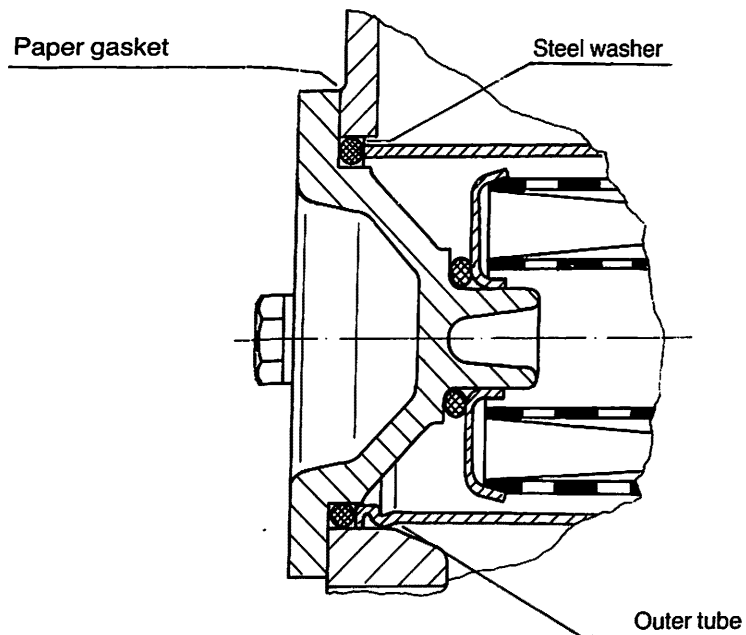
# Crankshaft and Bearings (from 1981 Models)





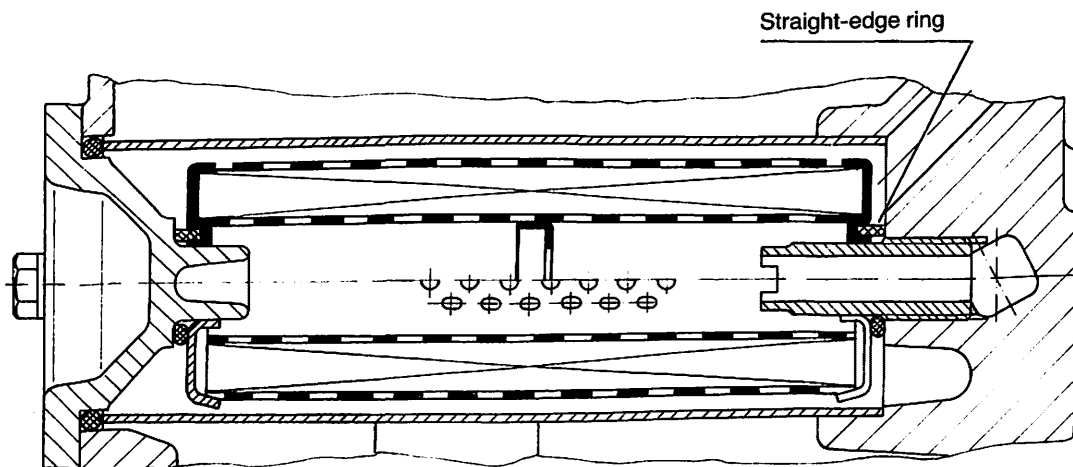
# Oil Filter Installation

**Old Version:** with paper gasket and steel washer



**New Version:** without paper gasket and steel washer, outer tube cringed

**New Oil Filter** with cemented straight-edge rings

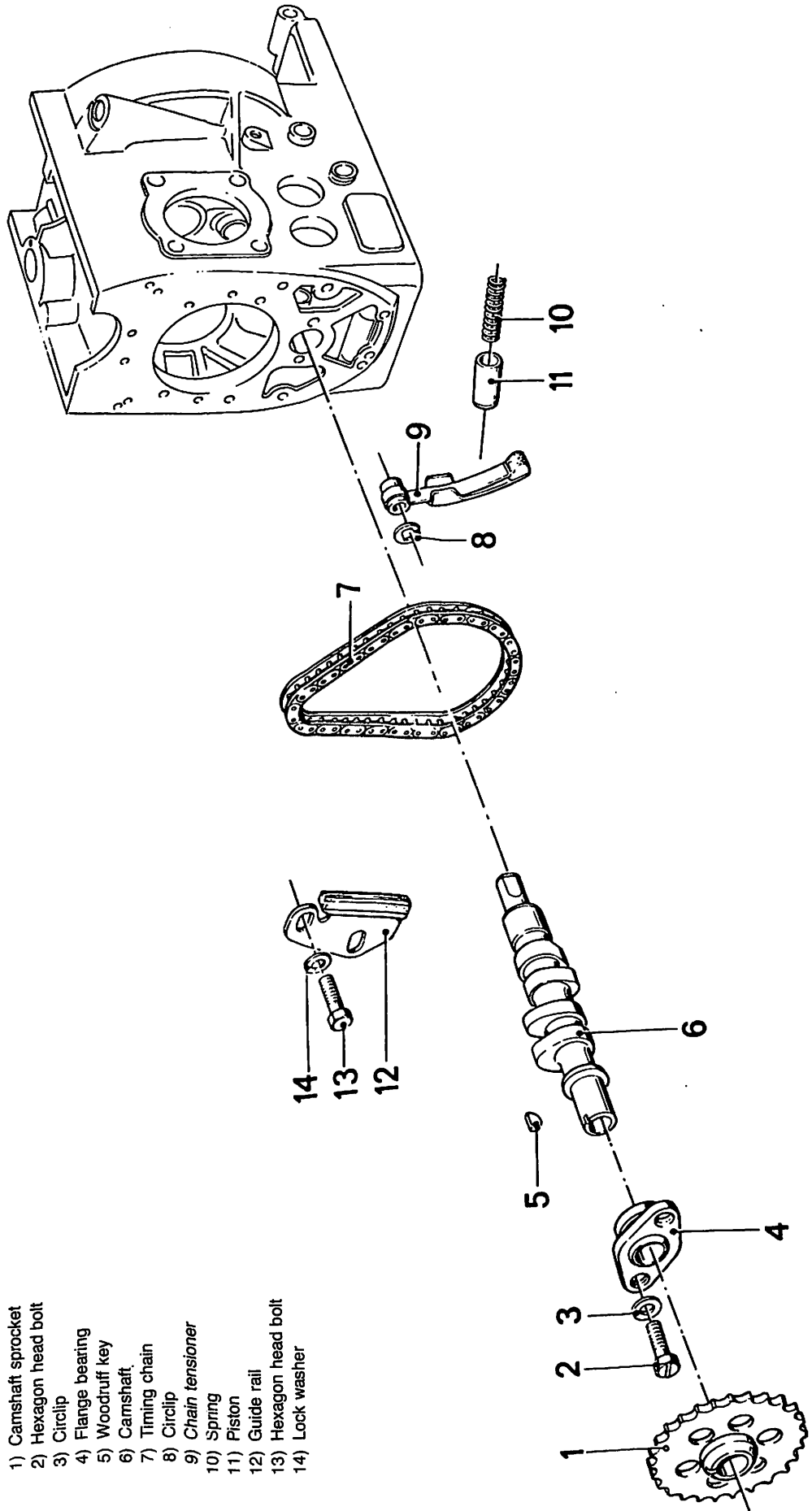


**Old Oil Filter** without seals

If a new oil filter is installed instead of the old version, remove seals on base of filter chamber and on oil filter cover.

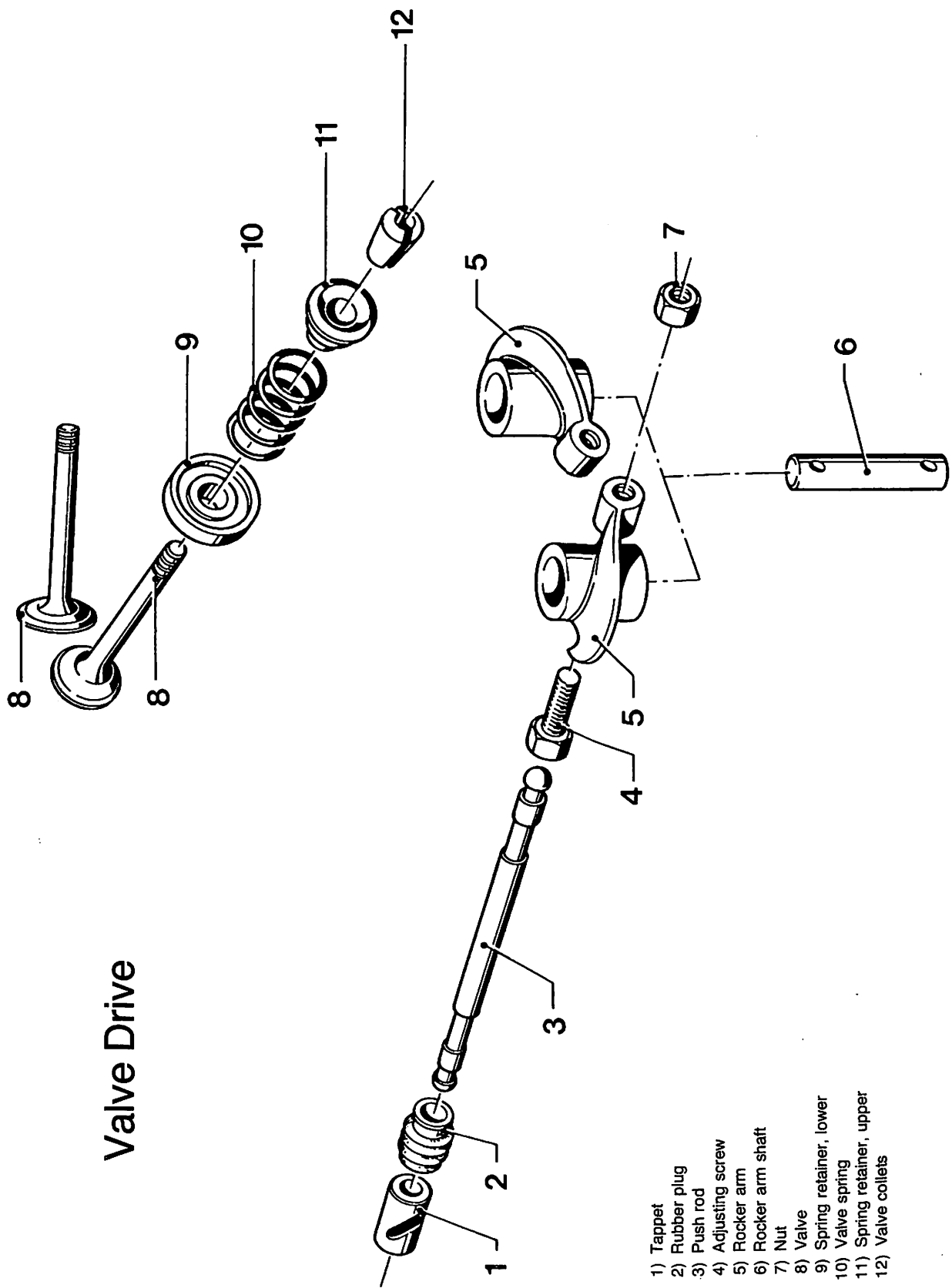
# Camshaft and Timing Chain

- 1) Camshaft sprocket
- 2) Hexagon head bolt
- 3) Circlip
- 4) Flange bearing
- 5) Woodruff key
- 6) Camshaft
- 7) Timing chain
- 8) Circlip
- 9) Chain tensioner
- 10) Spring
- 11) Piston
- 12) Guide rail
- 13) Hexagon head bolt
- 14) Lock washer





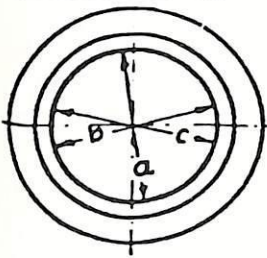
## Valve Drive



- 1) Tappet
- 2) Rubber plug
- 3) Push rod
- 4) Adjusting screw
- 5) Rocker arm
- 6) Rocker arm shaft
- 7) Nut
- 8) Valve
- 9) Spring retainer, lower
- 10) Valve spring
- 11) Spring retainer, upper
- 12) Valve collets

# Bearing clearances:

## Main bearing

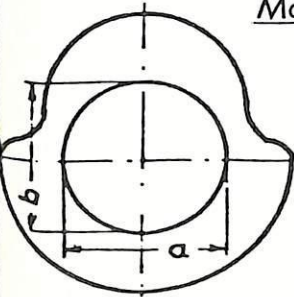


$F \frac{f}{r}$

$R \frac{f}{r}$

Real measure: \_\_\_\_\_

## Main bearing Journal

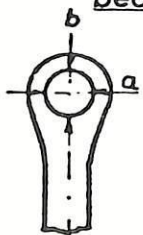


$F \frac{f}{r}$

$R \frac{f}{r}$

Real measure: \_\_\_\_\_

## Connecting rod bearing



### Piston - pin bushing

Nr 1  $\frac{a}{b}$

Nr 2  $\frac{a}{b}$

### Piston pin

1  $\frac{a}{b}$

2  $\frac{a}{b}$

### Clearance

Real measure: \_\_\_\_\_

### Basic bore dia meter of big end bearing eye

Real measure: \_\_\_\_\_

Nr 1  $\frac{f}{r}$

Nr 2  $\frac{f}{r}$

### Connecting rod with bearing

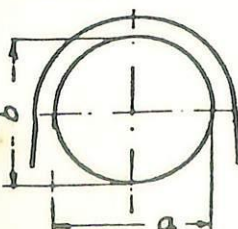
### Connecting rod weight

Nr 1  $\frac{f}{r}$

Nr 2  $\frac{f}{r}$

Real measure: \_\_\_\_\_

## Crank pin



R1  $\frac{f}{r}$

F2  $\frac{f}{r}$

Real measure: \_\_\_\_\_



## 11 00 039 Checking Compression of All Cylinders

### 1. Unscrew spark plugs.

Check compression with a calibrated compression tester and a fully charged battery, engine at operating temperature, throttle twist grip turned to full throttle and at starter speed.

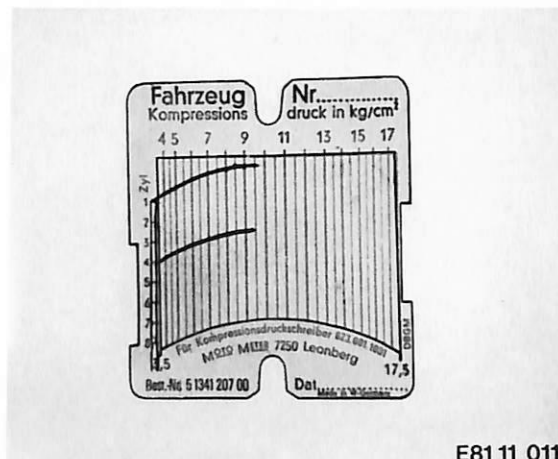
### Important Beginning with 1981 Models:

Make sure ignition is interrupted (plug on ignition box — see 12 11 004 — or connection on control unit), since otherwise ignition coil could be destroyed.



248 82 11 010

Test sheet for compression recorder.  
See Specifications for compression values.



E81 11 011

## 11 00 050 Removing and Installing Engine

Remove and install exhaust assembly 18 00 020.

Remove and install transmission 23 00 020.

Remove and install fuel tank 16 11 030.

Lower engine.

Disconnect right carburetor on cylinder head and place both carburetors aside above the battery.

Pull off spark plug end caps and place above frame.



Pull off multiple-pin plug on control unit.

Disconnect plugs (1) and (2).

Pull off multiple-pin plug on regulator (arrow).



Remove starter cover and disconnect battery positive wire on starter (arrow).



Move back engine, lift and incline to the right looking forward. Finally lift engine out of frame.





## 11 11 050 Removing and Installing Cylinder

Remove and install cylinder head — 11 12 080.

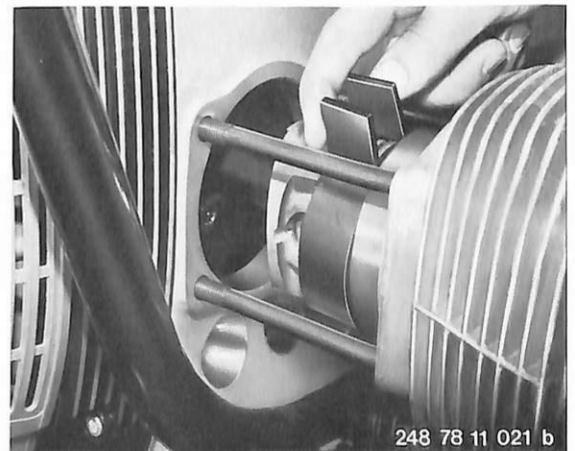
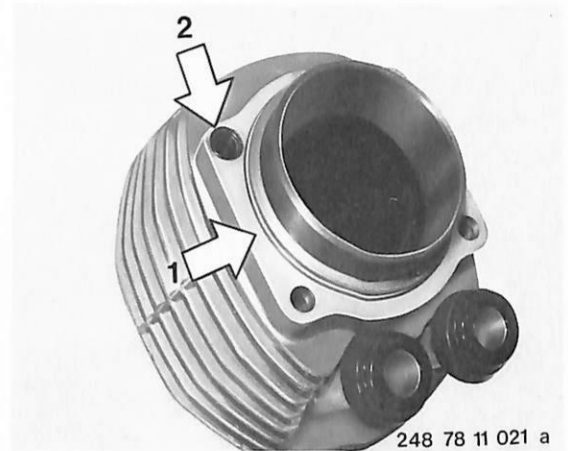
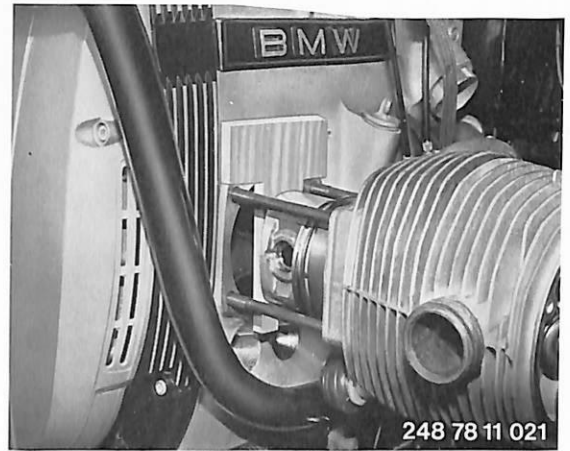
Loosen cylinders with several knocks from a plastic hammer and pull off from housing.

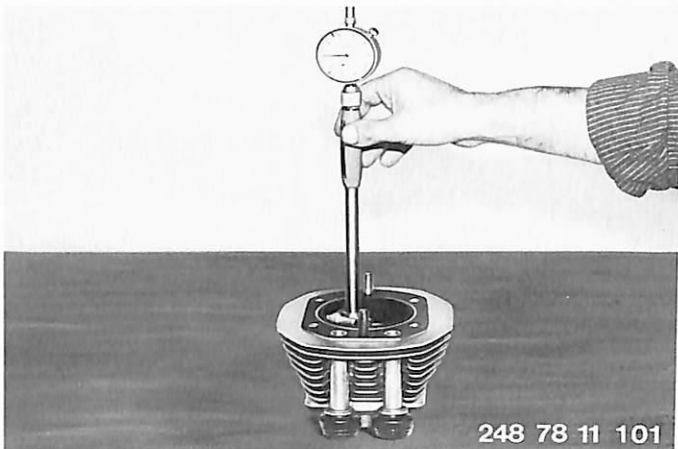
### Note!

Be careful that pistons do not knock against engine block when pulling off cylinders!

Always replace O-ring on cylinder base (1) and O-rings on upper staybolts (2) each time cylinders are removed.

Use piston ring compressor, BMW No. 11 2 910 (R 45) or 11 2 905 (R 65), to guide in pistons.





### 11 11 527 Drilling and Honing Cylinder Bore (no longer possible beginning with 1981 models!)

Remove and install cylinder head – 11 12 080.  
Remove and install pistons – 11 25 000.

Only perform those testing and repairing jobs described in the preparatory procedures when actually required.

Cylinders can be ground in two steps.  
Refer to specifications for oversizes.

Thermic conditions will not permit grinding to a third oversize.  
Measure ground cylinders.

Checkpoint: cylinder base. Select oversize pistons to match ground cylinder size.

Refer to specifications for installed piston clearances.



## 11 12 080 Removing and Installing Cylinder Head

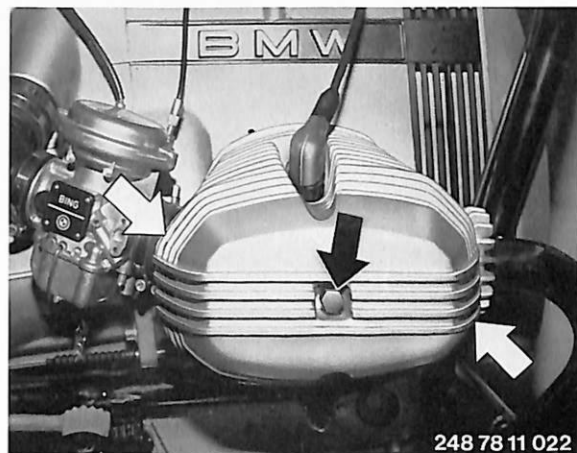
Engine removed — 11 00 050, or installed.  
Take off exhaust system when engine is installed.

### Installation Note!

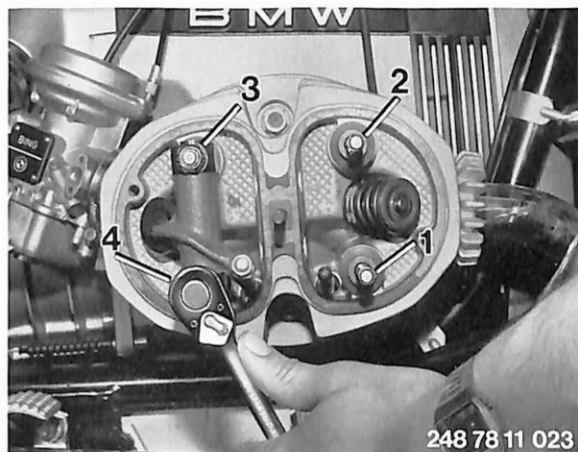
Insert both exhaust manifolds with cross tube into exhaust ports prior to tightening the cylinder heads.

Unscrew cap nut and both nuts (arrows), and take off cylinder head cover and gasket.

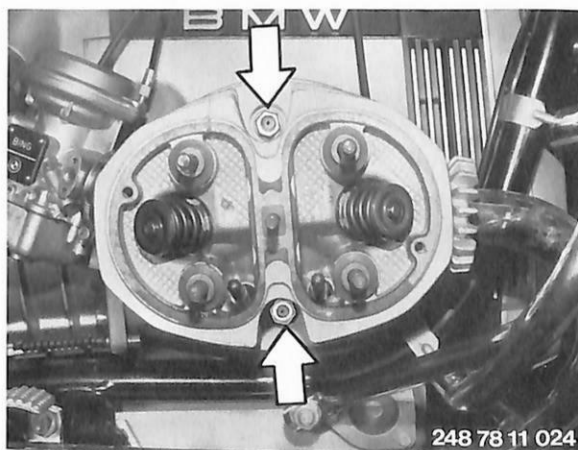
Disconnect intake line at cylinder head (only '80 models).



Remove both rocker arms after unscrewing 4 collar nuts from anchor bolts.  
Remove push rods.

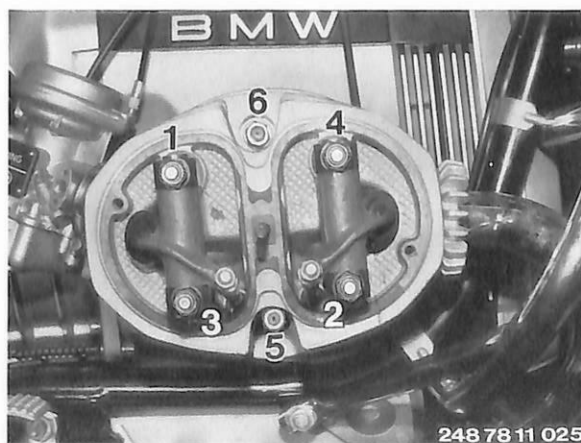


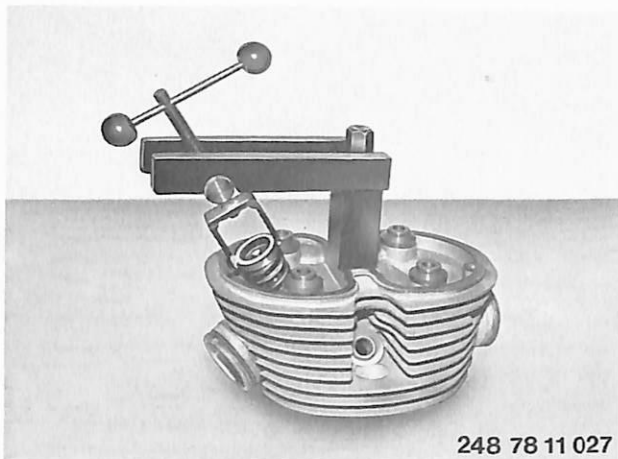
Unscrew two hexagon nuts (arrows).  
Loosen cylinder head from cylinders by applying knocks from a plastic hammer and pull off head from anchor bolts.



### Installation Note for Cylinder Head

Tighten cylinder head mounting nuts of cold engine in three steps referring to sketch for tightening sequence.  
Refer to specifications for torque values.





248 78 11 027

## 11 12 513 Disassembling and Assembling Cylinder Head/Grinding In Valves

Remove and install cylinder head 11 12 080.

Apply valve spring compressor, BMW No. 11 1 750, compress valve springs, remove valve collets and pull out valve.

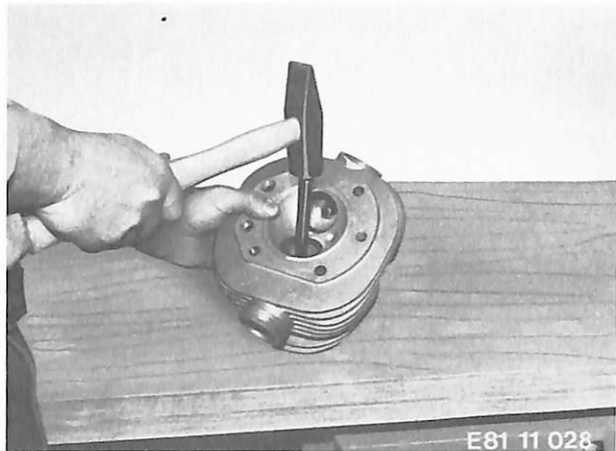
### Check cylinder head for

- cracks and damage on mating surfaces,
- tightness of valve guides (figure) and valve seat inserts,
- wear on valve guides,
- damage on surface of bearing surfaces and ball sockets,
- radial play of rocker arms,
- length of valve springs and force of same (see Specifications), and
- tightness of adapters for carburetor connection. If necessary, install clean threaded inserts with Loctite No. 241.

### Machining Valve Seats

Machine valve seat inserts in cylinder head with a Hunger valve seat machining tool. Seat angle:  $45^\circ + 20'$ , intake valve seat width: 1.5 mm (0.060"); for exhaust valve:  $45^\circ$  angle and 2.0 mm (0.080") width. Chamfer of  $15^\circ$  faces combustion chamber;  $75^\circ$  inclination faces intake or exhaust port. Seal seat should be close to largest valve seat diameter.

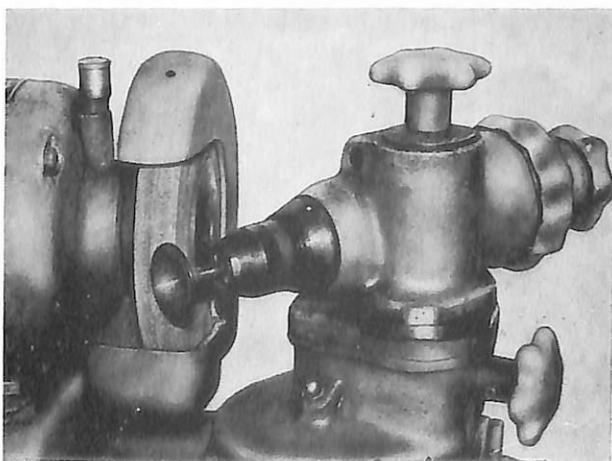
Grind seat on valve to  $45^\circ 20'$  in a grinder. Max. permissible grinding: up to 1 mm (0.040") valve head edge thickness. Ground valve cones and valve seat insert ground with a Hunger tool do not require grinding of the valves, but a leak test (gasoline poured into valve chambers) has to be made after installation of valves.



E81 11 028



248 78 11 029





## 11 12 561 Replacing Valve Guides

Remove and install cylinder head 11 12 080.  
Disassemble cylinder head, grind in valves 11 12 513.

Lower old valve guide at top to circlip and knock valve guides out of warm cylinder head (240 . . . 260° C) toward the combustion chamber with Special Tool BMW No. 11 1 760.

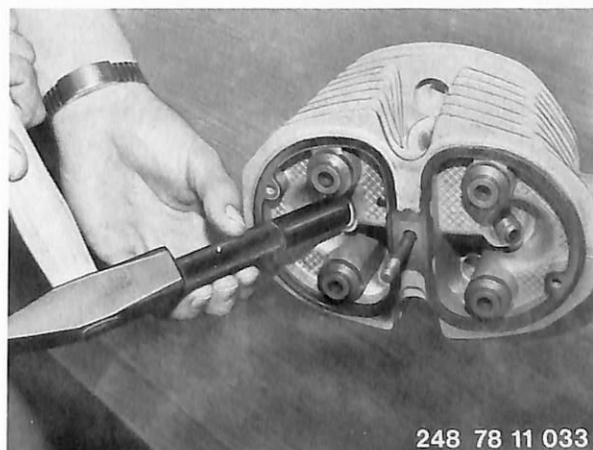
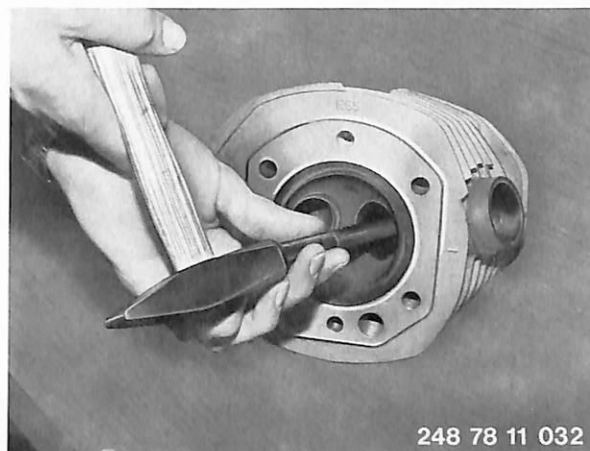
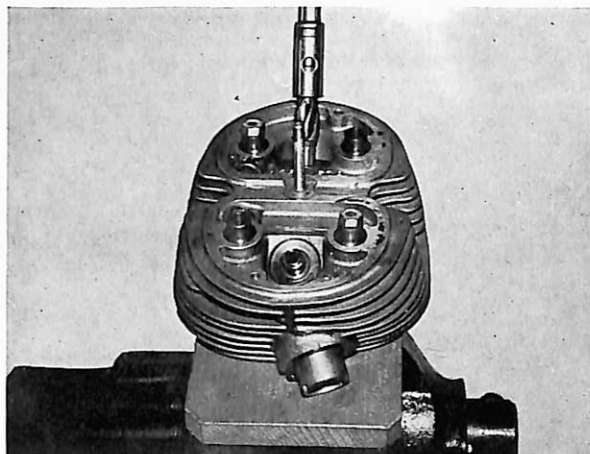
or

Heat cylinder head to 240 . . . 260° C (2 1/2 hours) and knock out valve guide from combustion chamber with Special Tool BMW No. 11 1 760.

Refer to Technical Data for oversize valve guides and standard bores in cylinder head.

Knock new valve guides (see Technical Data) into warm (250° C) cylinder head with Special Tool BMW No. 11 1 770. Cylinder head should be placed on its side to prevent valve guides from sliding in too far.

Ream out cold valve guide with a fixed valve guide reamer 7H7.

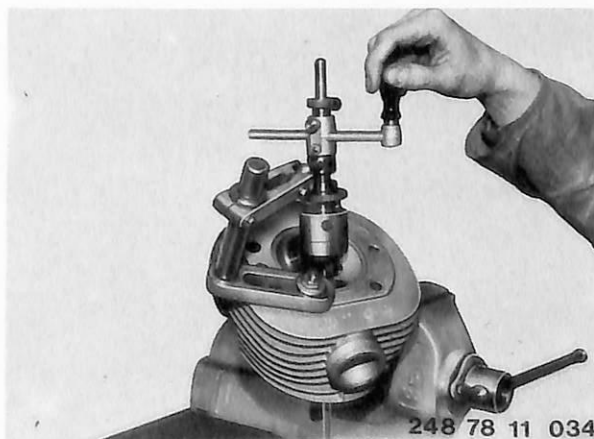


## 11 12 621 Replacing One Valve Seat Insert

Cylinder head removed – 11 12 080.

Disassemble cylinder head, grind valves – 11 12 513.

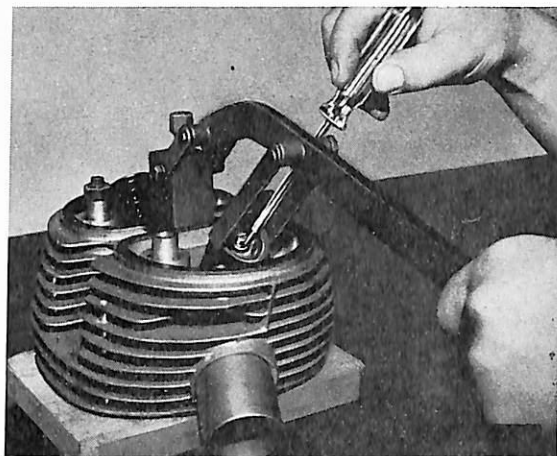
If frequent machining of the valve seats makes it necessary to replace the valve seat inserts, remove (grind) valve seat insert with Hunger tool without damaging the basic bore in cylinder head. Heat cylinder head to 240 . . . 260° C (465 . . . 500° F) and install new valve seat insert (see Specifications).



## 11 12 513 Disassembling and Assembling Cylinder Head and Grinding Valves

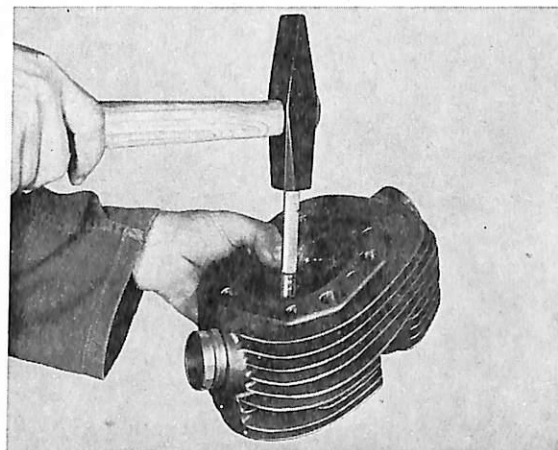
Remove and install cylinder head — 11 12 080.

Mount cylinder head on fixture, BMW No. 11 1 750, which is clamped in a vise. Compress valve springs with valve lifter of this fixture and remove set of cotters from spring retainers with a magnet or scribe. Place both spring retainers and valve springs aside. Remove cylinder head from fixture and pull out valves.



### Check cylinder head for

- a) cracks and damage on mating surfaces,
- b) tightness of valve guides (figure) and valve seat inserts,
- c) wear on valve guides,
- d) damage on surface of bearing surfaces and ball sockets,
- e) radial play of rocker arms,
- f) length of valve springs and force of same (see Specifications), and
- g) tightness of adapters for carburetor connection. If necessary, install clean threaded inserts with Loctite No. 241.

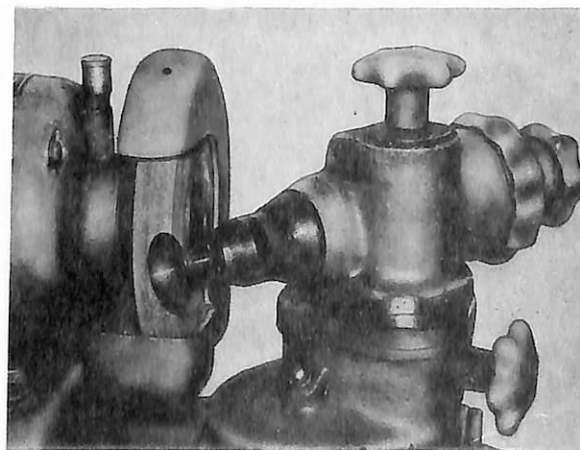


### Machining Valve Seats

Machine valve seat inserts in cylinder head with a Hunger valve seat machining tool. Seat angle:  $45^\circ + 20'$ , intake valve seat width: 1.5 mm (0.060"); for exhaust valve:  $45^\circ$  angle and 2.0 mm (0.080") width. Chamfer of  $15^\circ$  faces combustion chamber;  $75^\circ$  inclination faces intake or exhaust port. Seal seat should be close to largest valve seat diameter.



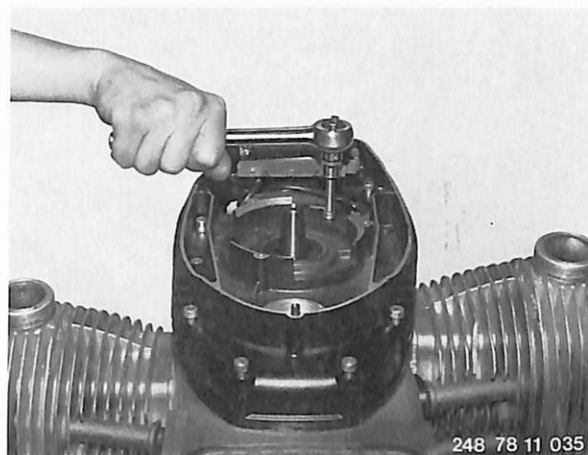
Grind seat on valve to  $45^\circ 20'$  in a grinder. Max. permissible grinding: up to 1 mm (0.040") valve head edge thickness. Ground valve cones and valve seat insert ground with a Hunger tool do not require grinding of the valves, but a leak test (gasoline poured into valve chambers) has to be made after installation of valves.



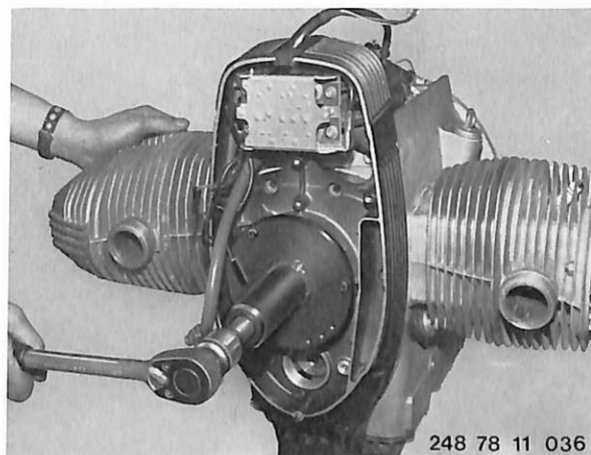


## 11 14 060 Removing and Installing Timing Case Cover

Engine removed (11 00 050) or installed.  
Remove and install alternator — 12 31 020.  
Remove and install spark trigger — 12 11 060.  
Unscrew nine socket head screws and three hexagon nuts.

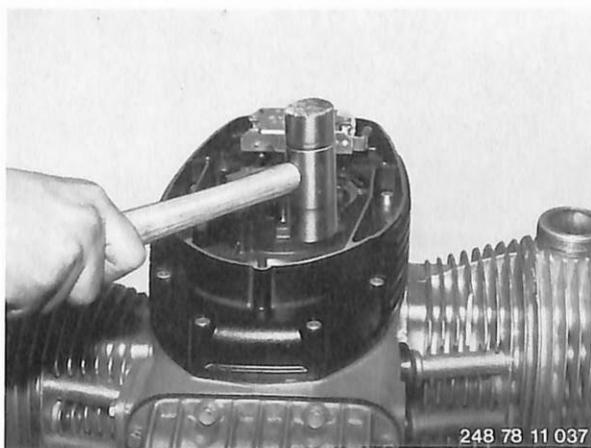


Mount puller, BMW No. 11 1 800, at tapped holes for alternator housing with three (M 5) socket head screws. Install pressure pad for puller and pull off cover.



## Attaching Timing Case Cover

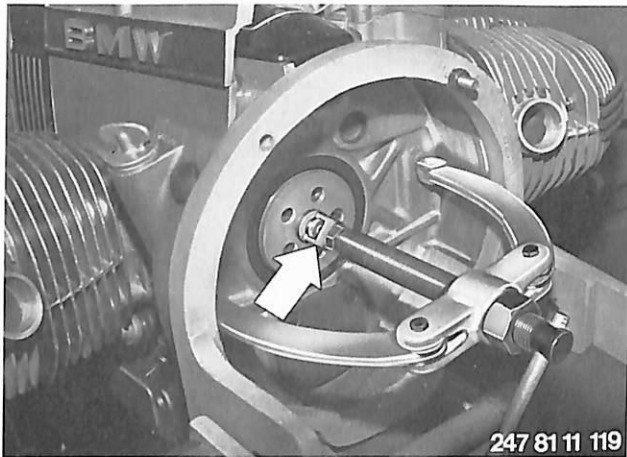
Heat cover at seat of ball bearing to approx. 80° C (175° F) and position on engine.  
Tighten socket head screws and nuts, starting from the center.  
Settle grooved ball bearing by applying several knocks from plastic hammer against bearing seat.



## 11 14 651 Replacing Radial Oil Seal for Crankshaft

Remove and install timing case cover — 11 14 060.

Knock in shaft seal for alternator with a mandrel, BMW No. 11 1 850.



247 81 11 119

## 11 14 151 Replacing Radial Oil Seal for Crankshaft (Transmission End)

### Pulling Out Seal:

Remove and install flywheel or clutch housing 11 22 000.

Bearing race must be pulled off of crankshaft beginning with "1981 models" prior to pulling out shaft seal.

Apply puller, BMW No. 11 1 870 (arrow) from side and pull out bearing race in conjunction with support, BMW No. 00 8 550.



Make approx. 5 cm long cut in lip of seal at bottom left.



Mount beam of puller, BMW No. 11 1 890, on engine block (right top and left bottom).

Apply pulling spindle and insert eccentric tab through cut in seal up to stop on thrust ring.

Tab should face down.

Turn nut clockwise, while holding on wrench surface with a wrench, and pull out seal.

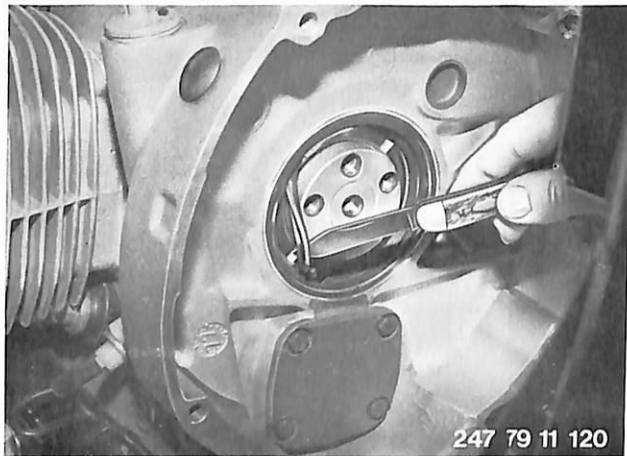


### Pressing In Seal:

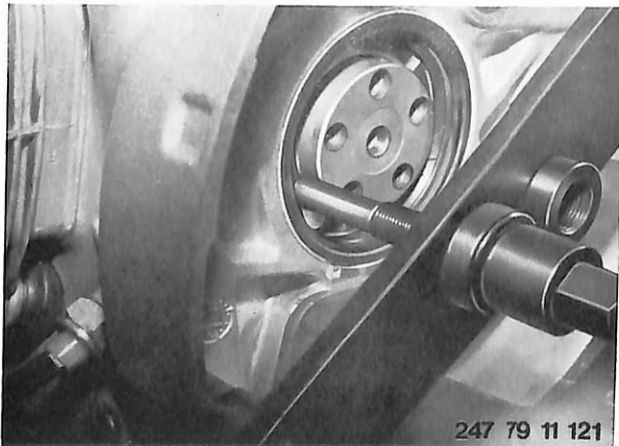
Mount beam of puller, BMW No. 11 1 890, on engine block (right top and left bottom).

Place seal and pressure pad on impact mandrel, BMW No. 11 1 880.

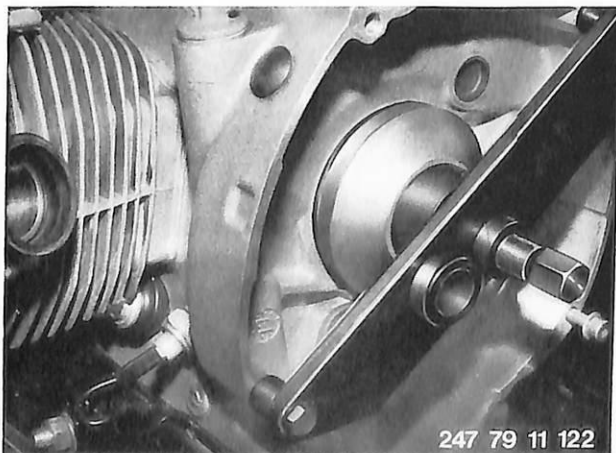
Apply impact mandrel on engine block, screw spindle forward and press in seal.



247 79 11 120



247 79 11 121



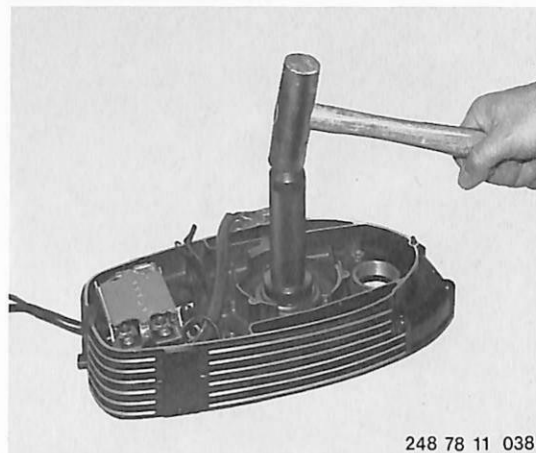
247 79 11 122



## 11 14 651 Replacing Radial Oil Seal for Crankshaft (Alternator End)

Remove and install timing case cover 11 14 060.

Install radial oil seal for front crankshaft journal with impact mandrel, BMW No. 11 1 850.

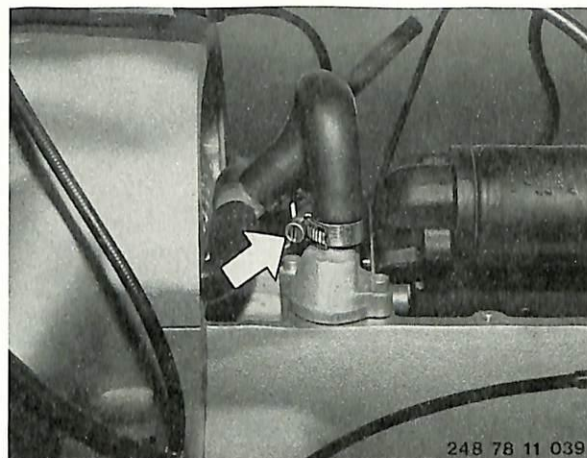


248 78 11 038

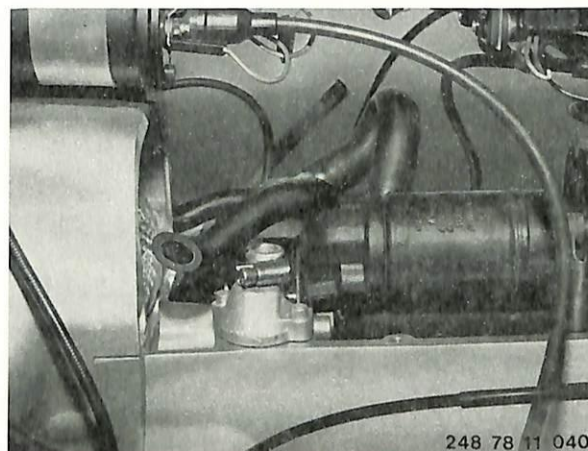
## 11 15 101 Replacing Engine Vent Hose

Remove fuel tank — 16 11 030.

Unscrew starter cover and remove toward right side. Loosen clamp from vent housing with a screwdriver (arrow).



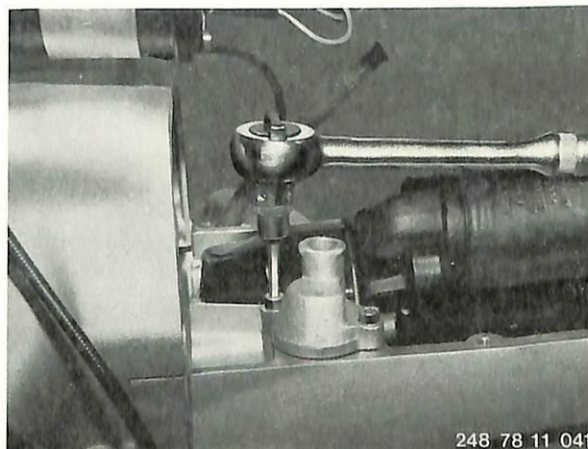
Pull out vent hose from air cleaner housing on left and right, and pull off from vent housing.



## 11 15 111 Replacing Check Valve for Engine Vent

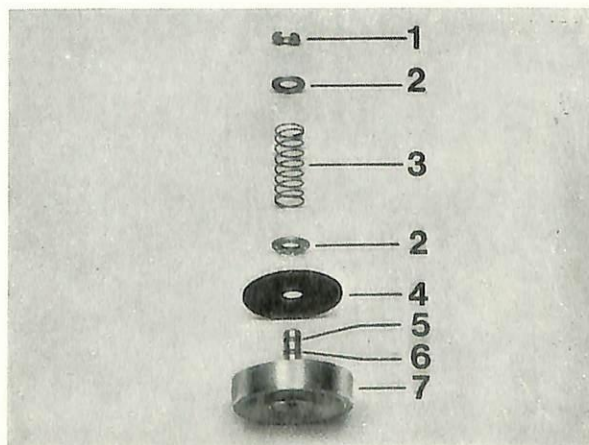
Replace engine vent hose — 11 15 101.

Unscrew two socket head screws and take off vent housing.



### Check Valve (Engine Vent)

- 1 Circlip
- 2 Washer
- 3 Spring
- 4 Valve disc
- 5 Groove for spring pre-load (R 45, R 65)
- 6 Groove
- 7 Valve





### 11 15 101 Replacing Engine Vent Hose (1981 Models)

Remove fuel tank 16 11 030.  
Remove air cleaner housing upper section.  
Pull out filter cartridge 13 72 000.  
Unscrew starter cover socket head screws and remove cover.  
Unscrew clamp on vent dome (arrow) with a screwdriver and push back vent hose.



Pull T-adapter for crankcase vent out of air cleaner housing in direction of arrow.  
Press vent hose out of air cleaner housing.



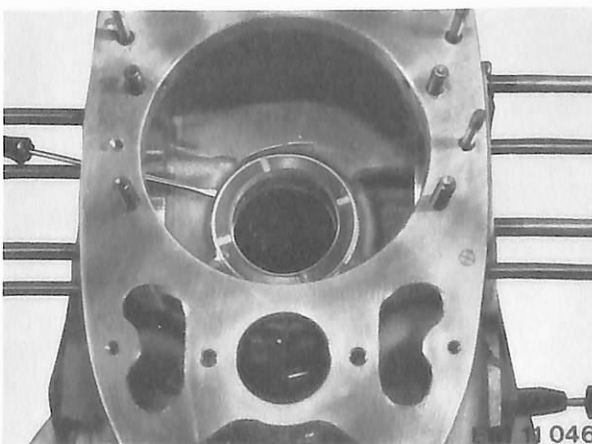
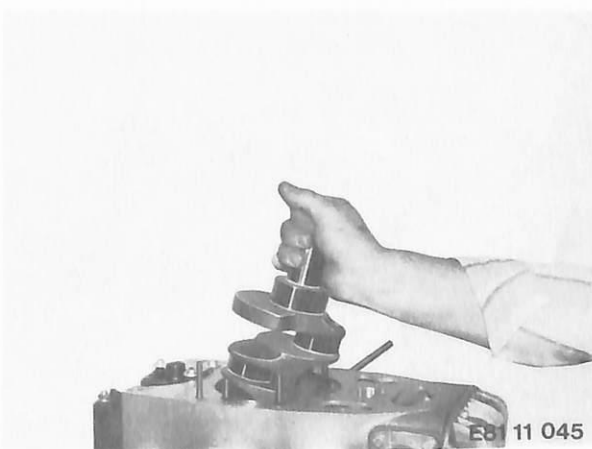
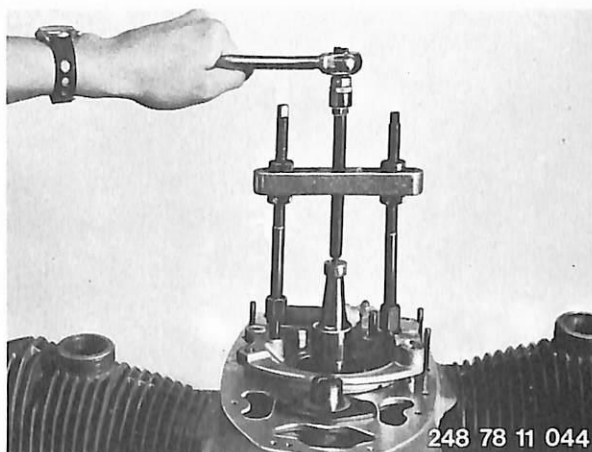
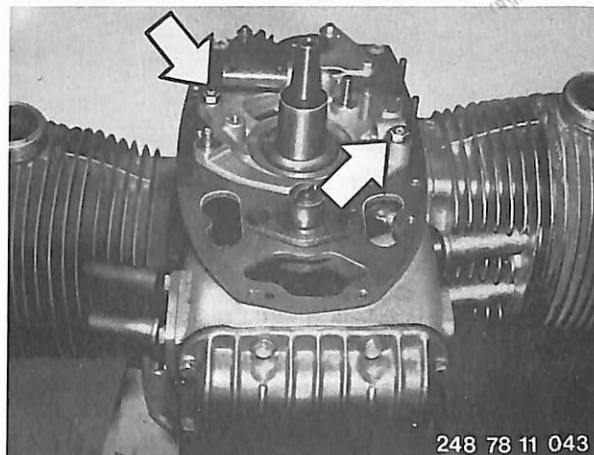
## 11 21 001 Removing and Installing Crankshaft

Remove and install timing case cover 11 14 060.  
Remove and install sprockets 11 13 061.  
Remove and install pistons 11 25 000.  
Remove and install connecting rods 11 24 000.  
Remove and install flywheel or clutch housing 11 22 000.  
Unscrew mounting nuts on bearing cap.

Position engine upright. Screw two screws from puller, BMW No. 00 7 500, in tapped holes of main bearing cap provided for this purpose. Install pulling bar parallel to main bearing cap. Don't forget pressure pad for puller. Pull off main bearing cap.

Pull out crankshaft from engine block.

Lift both thrust washers off a locating pins with a screwdriver.





### Measuring Crankshaft and Bearing Sleeve

Measure crankshaft thrust bearing journal with a micrometer crosswise in two planes.

Front plane.



Rear plane



Measure front crankshaft bearing only with installed bearing cap.

#### Note:

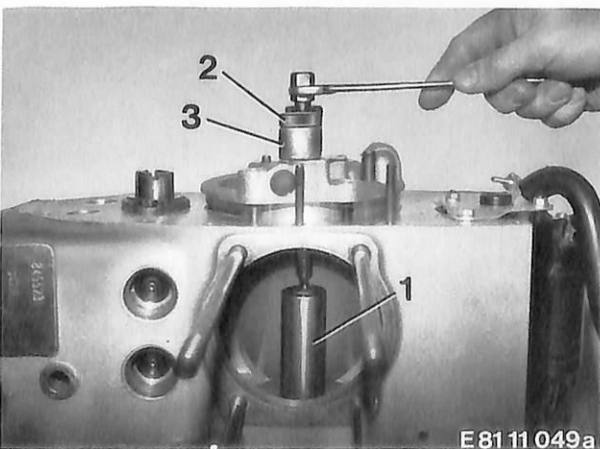
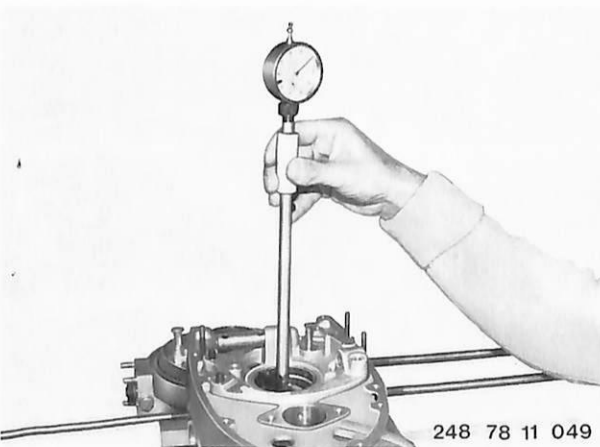
Heat engine block to 100 ... 120 ° C before installing bearing cap. Let engine block cool down before measuring.

#### Important!

Main bearing play must be determined exclusively with help of the "Test Report for Crankshaft Main Bearing Play" – see Specifications!

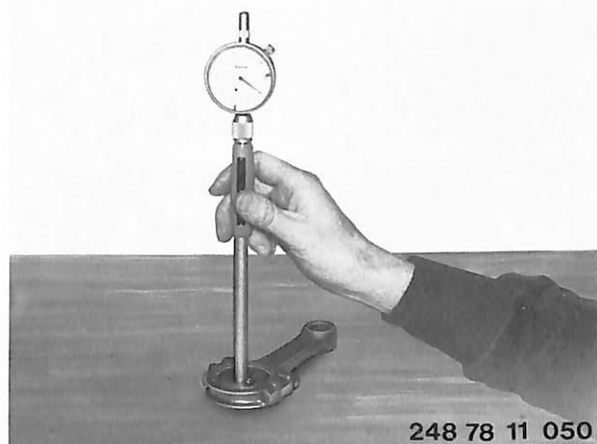


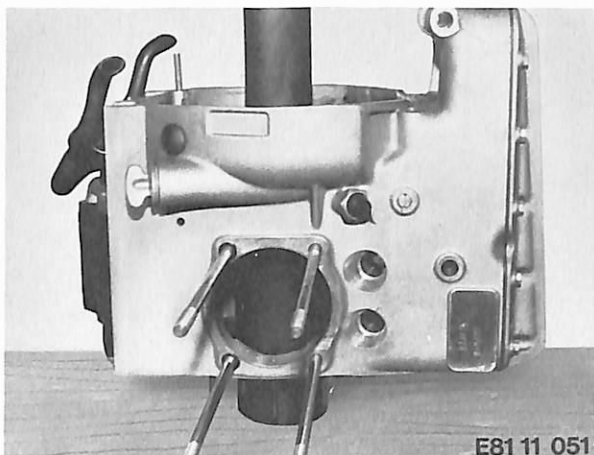
To press off the bearing cap (without crankshaft), place main bearing mandrel, BMW No. 11 2 720, (1) in the rear bearing. Press off bearing cap with nipple, BMW No. 11 1 710, (2) and pressing off bridge with spindle from Kukko 17 K (3).



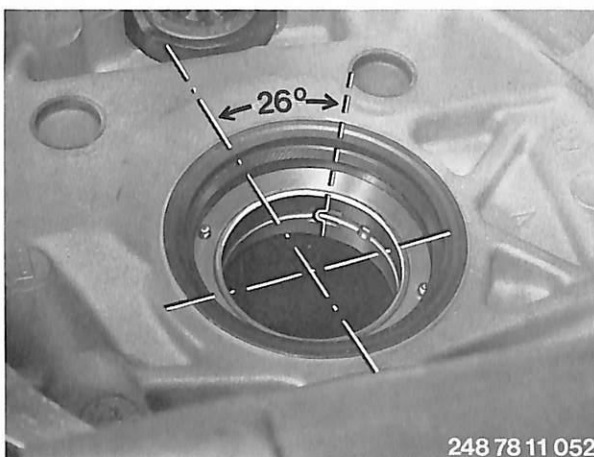


...and connecting rod bearing journals as described for crankshaft and bearing sleeve.  
See Specifications for bearing play values.





E81 11 051



248 78 11 052



248 78 11 053



E81 11 054

## 11 21 531 Replacing Main Bearing Bushings

Replace crankshaft 11 21 001.

Pressing Main Bearing Bushing Out of Crankcase:

Heat crankcase to 100 ... 120° C and then place it over cylinder of special tool, BMW No. 11 2 710, in such a manner that locating pins for inner thrust washer engage in holes of cylinder provided for this purpose. Press out bearing bushing in a manual press with mandrel, BMW No. 11 2 700.

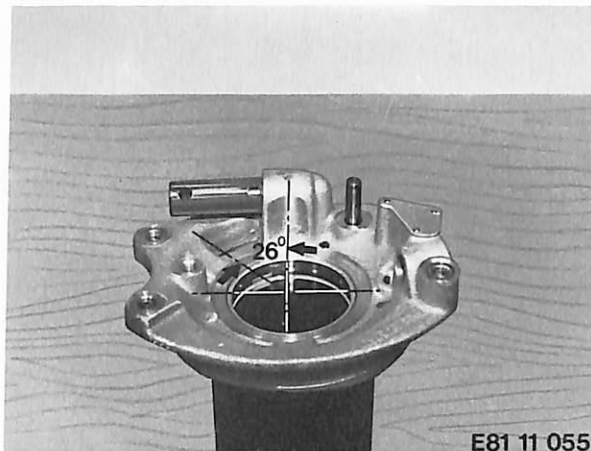
When pressing in, use aluminium part, BMW No. 11 2 710, and a piece of pipe to counterhold.

Heat crankcase to 100 ... 120° C. Place aluminium pad from special tool, BMW No. 11 2 710, on removing cylinder. Install crankcase over fixture in such a manner that both locating pins engage in holes provided in aluminium pad. Install new bearing bushing that bearing bushing gap is located at top right as seen at clutch housing end and oil bores of bearing bushing are positioned flush with bore in housing at bottom left.

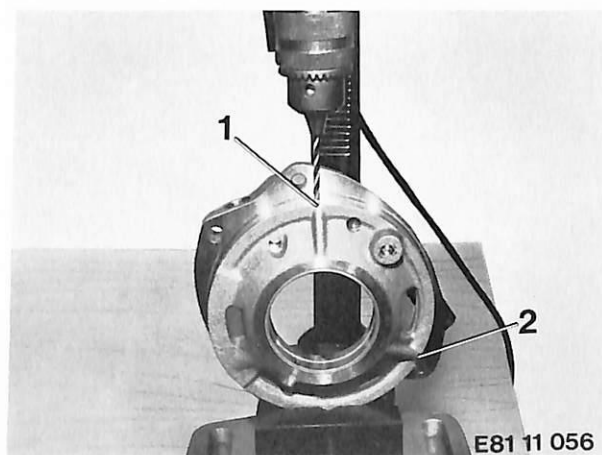
Install mandrel with plastic sleeve from special tool, BMW No. 11 2 710, in bearing bushing. Make sure that locating pins protruding from crankcase extend into openings at periphery of mandrel after pressing in the bearing bushing. The bearing bushing is sized that it will be positioned back in the bearing bore of crankcase on both sides slightly.

Replacing Main Bearing Bushing in Main Bearing Cap:  
Knock out locating pin for bearing bushing from inside to outside. Heat bearing cap to 100 ... 120° C and position on cylinder of special tool, BMW No. 11 2 710. Press out bearing bushing in a manual press with mandrel, BMW No. 11 2 700.

Press new bearing bushing into bearing cap heated to 100 ... 120° C, that bearing bushing gap is located top left as seen on installed bearing cap and oil bores are positioned vertical. Offset bearing bushing gap from vertical by approx. 26° (see arrows).

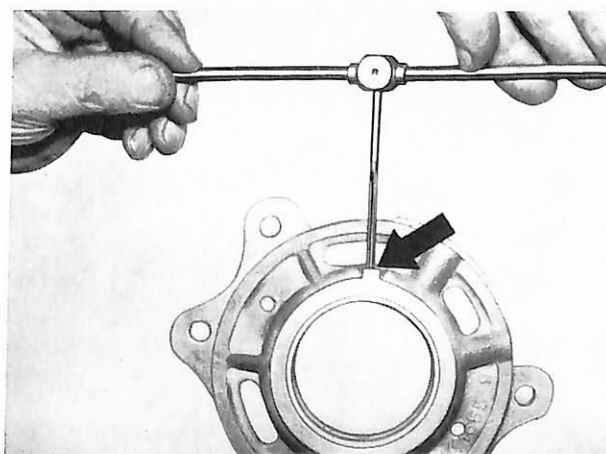


Clamp bearing cap in a vise fitted with soft jaws. Drill two additional oil bores, pos. 1 and 2, in bearing bushing through both 3.2 mm dia. holes already provided in bearing cap. Deburr holes in bearing bushing carefully.

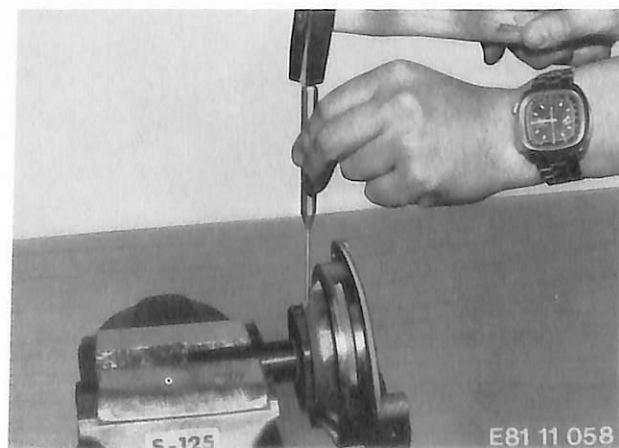


Lock bearing bushing! Drill a center in bearing bushing through the 4 H 8 locating pin hole in bearing cap with a 3.9 mm dia. drill bit. Then drill through bearing bushing with 3.8 mm dia. drill bit (basic ream size bore).

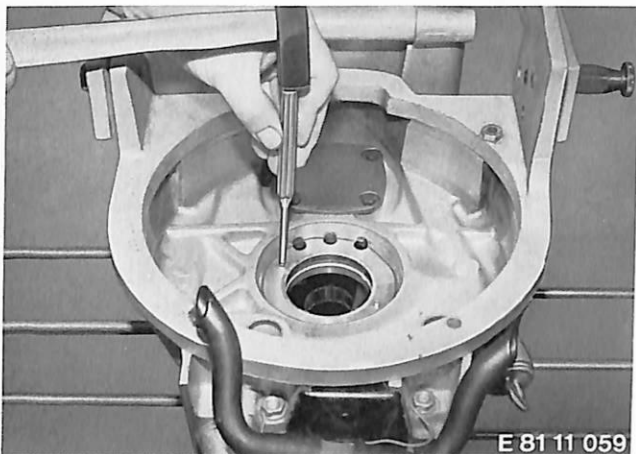
Do not ream through bearing bushing with hand reamer (4 H 8), to prevent lockpin from moving in. Deburr hole carefully.



Clamp bearing cap in a vise fitted with soft jaws. Drill two additional oil bores, pos. 1 and 2, in bearing bushing through both 3.2 mm dia. holes already provided in bearing cap. Deburr holes in bearing bushing carefully.







## Adjusting Axial Play of Crankshaft

See Specifications for table of thrust washers. To be able to adjust axial play of crankshaft easily, it is recommended to place a red-marked thrust washer on inside and outside of locating pins. Both locating pins must have same amount of protrusion from crankcase on clutch and crankshaft ends. Heat crankcase to straighten or install locating pins.



Heat crankcase to 100 ... 120° C, mount on assembly stand and position upright. Guide crankshaft into block carefully. Install bearing caps and tighten bolts. Turn crankcase 180° C. Install clutch housing (flywheel).

Remove and install clutch housing 11 22 000.



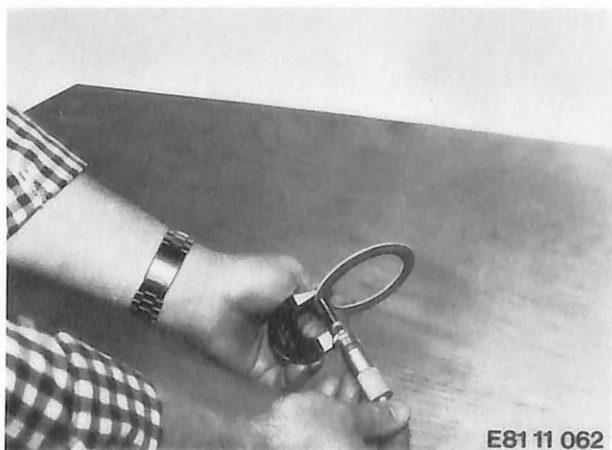
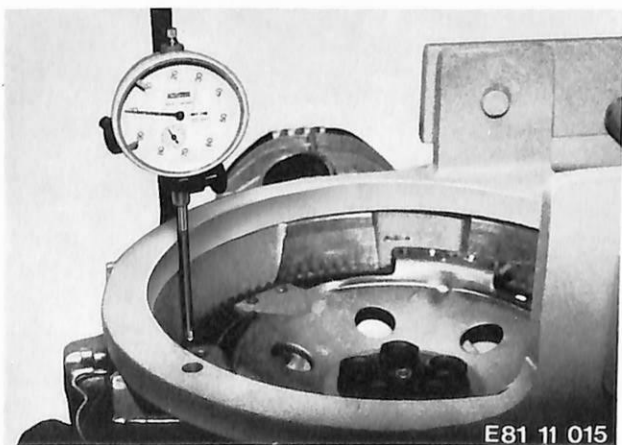
Return crankcase to horizontal position. Mount dial gauge holder, BMW No. 00 2 500, on transmission flange of crankcase. Check axial play.

Remove clutch housing and measure installed, red-marked thrust washer with a micrometer.

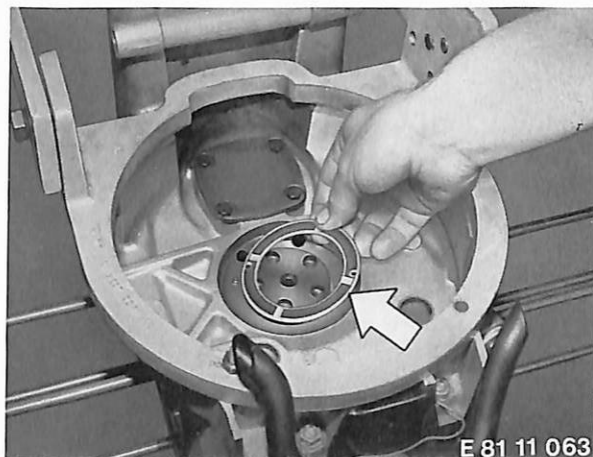


Example:

|                                             |           |
|---------------------------------------------|-----------|
| Measured axial play                         | 0.18 mm   |
| Wanted axial play                           | 0.12 mm   |
| Difference                                  | 0.06 mm   |
| Measured thickness of removed thrust washer | 2.48 mm   |
| Plus difference                             | + 0.06 mm |
| Required thrust washer thickness            | 2.54 mm   |



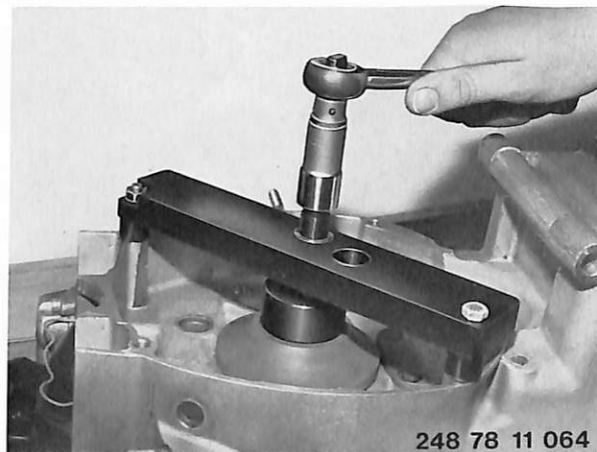
Select a thrust washer, whose thickness is as close as possible to the determined value and does not deviate from it by more than  $+0.03\text{ mm}$  or  $-0.04\text{ mm}$ . Install thrust washer of determined thickness on locating pins.



Press shaft seal into crankcase with special tool, BMW No. 11 1 890, used in conjunction with impact mandrel, BMW No. 11 1 880. Press in impact mandrel far enough, that it rests on the thrust washer.

**Note:**

Place seal in oil about 2 hours before installing.



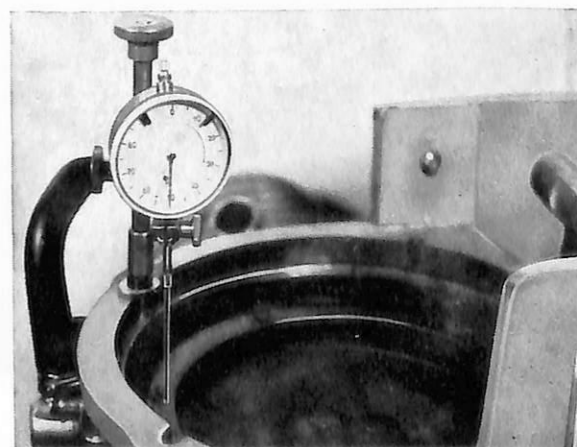
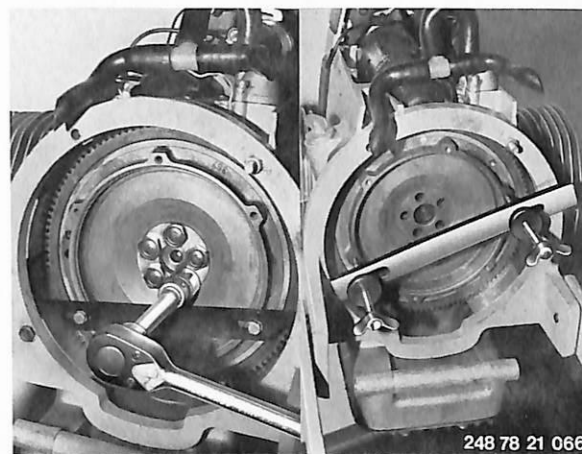
## 11 22 000 Removing and Installing Flywheel

- 1) Engine Remains Installed:  
Remove and install transmission — 23 00 020.  
Remove and install clutch — 21 21 000.
- 2) Engine Removed:  
Remove and install engine — 11 00 050.  
Remove and install clutch — 21 21 000.  
Mount holder, BMW No. 11 2 800, on flywheel that crankshaft will not turn when loosening the flywheel.

Unscrew the 5 mounting bolts and lift out flywheel carefully with help from two screwed in bolts and do not cant, or pull off from crankshaft stub with puller, BMW No. 11 2 810.

When installing, position piston at TDC and install flywheel on crankshaft stub that TDC mark can be seen in sight hole of case. Install counterholder, BMW No. 11 2 800, in flywheel. Tighten the 5 mounting bolts to specified torque, see Specifications. The flywheel is mounted with stretch bolts, which must be installed with engine oil coat. Make sure that bearing surface of flywheel and face of crankshaft are without oil (dry).

Check lateral runout of flywheel with dial gage (dial gage holder, BMW No. 00 2 500). To take up axial play of crankshaft while checking runout of flywheel, position engine upright in assembly stand. Apply pressure to center of crankshaft stub in installed state.



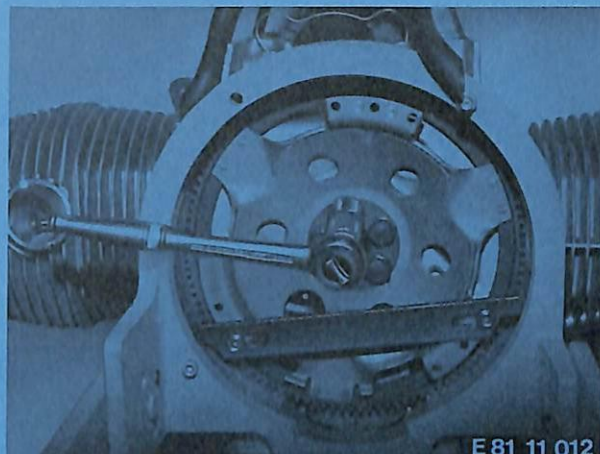


## 11 22 000 Removing and Installing Clutch Housing (Flywheel) 1981 Models

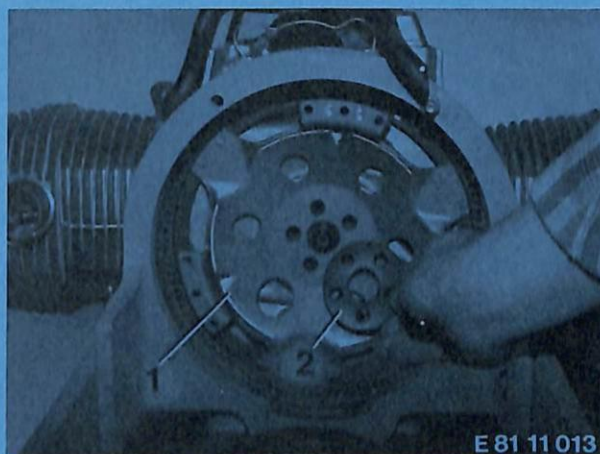
Remove and install clutch 21 21 000.

Mount holder, BMW No. 11 2 800, on clutch housing and unscrew crankshaft bolts.

See Specifications for tightening torque.



Remove clutch housing (1) and steel washer (2).



## 11 24 000 Removing and Installing Connecting Rod

Remove and install engine — 11 00 050.  
Remove and install cylinder head — 11 12 080.  
Remove and install pistons — 11 25 000.

Only perform all testing and adjusting jobs described in the preparatory procedures when actually required.

Position crankshaft at TDC for removal and installation of connecting rod. Unscrew conrod bolts with a multiple socket wrench. Remove connecting rod and cap together with bearing shells.

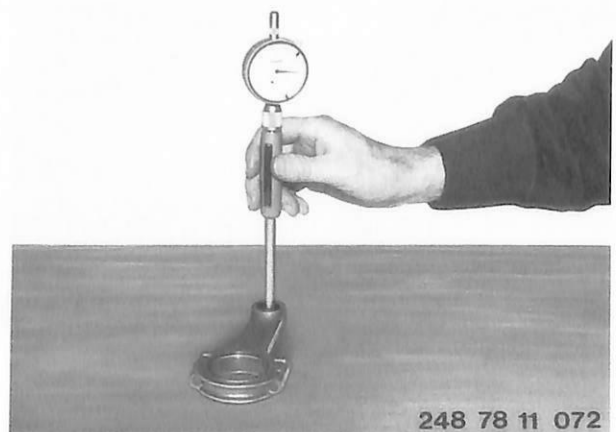
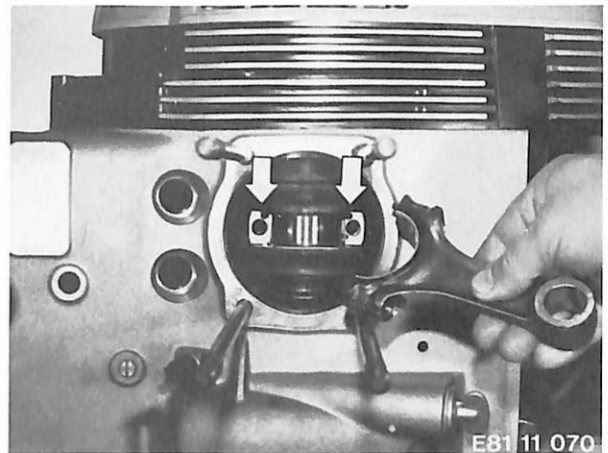
**Installation Note!** Install both connecting rods, that locating pins of connecting rods face alternator side.

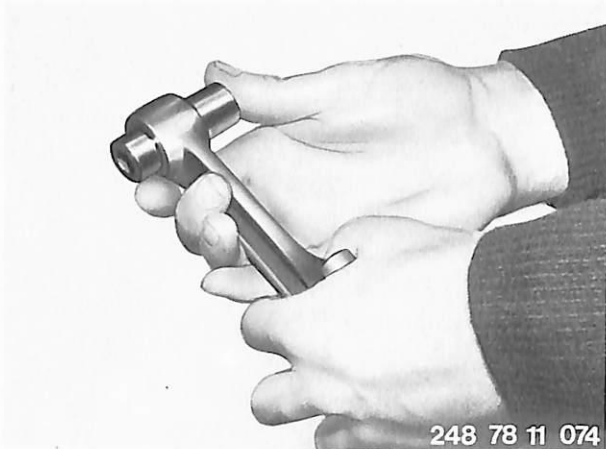
**Inspecting and Repairing:** Measure connecting rod thickness at thrust bearing with a micrometer. Refer to Specifications for dimensions.

Both connecting rods of one engine must have the same weight or color code.

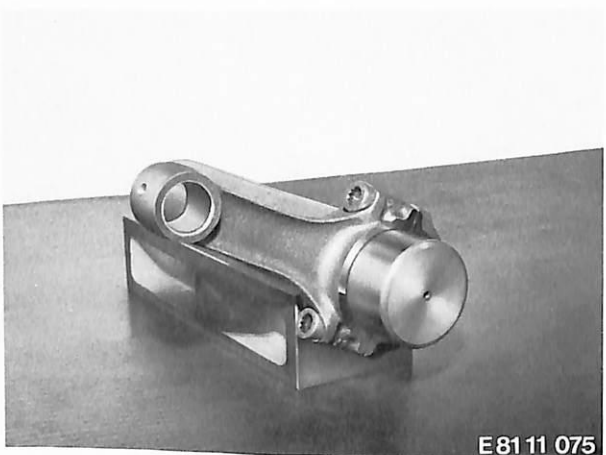
Check tightness and size of piston pin bushing.

If inside diameter of piston pin bushing has been worn beyond wear limits, press out piston pin bushing. Refer to Specifications for dimensions.



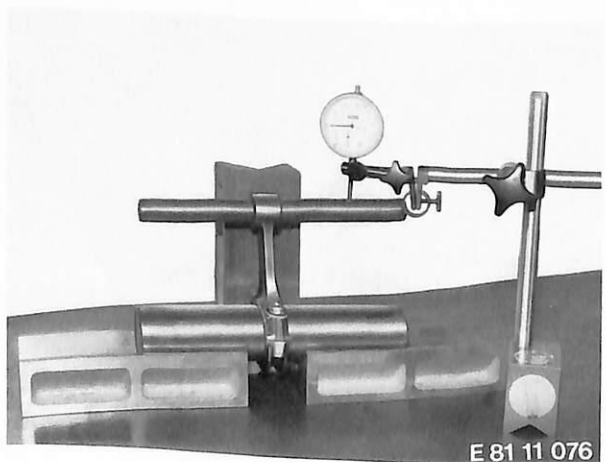


The piston pin should slide easily into a new bushing under thumb pressure.

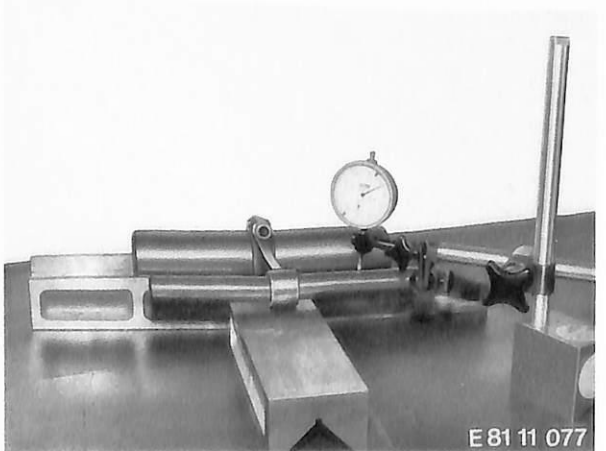


#### Measuring Connecting Rod

Install the bearing shells provided for testing in the connecting rod. Take up connecting rod on a hardened and ground master mandrel and tighten bolts. Master mandrel must not have radial play in the thrust bearing bore. Push a ground and hardened master mandrel, approx. 150 mm long, into piston pin bushing so that mandrel extends from both ends by same amount.



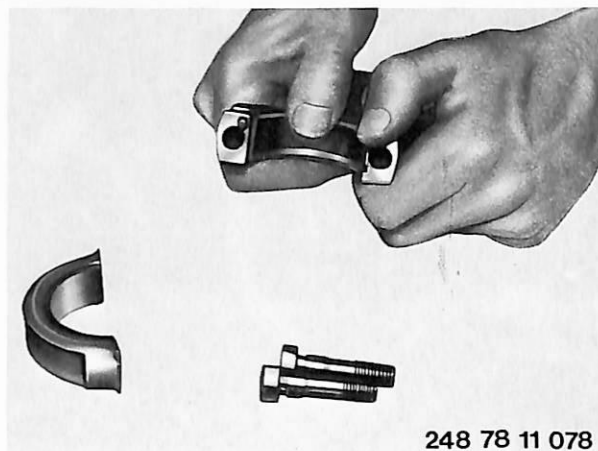
Set up two v-blocks of same size on a calibrated measuring plate. Place master mandrel with connecting rod in v-blocks. Position connecting rod to be vertical with fixture. Use a stand-type dial gauge on ends of master mandrel, to check whether piston pin axis is parallel with thrust journal axis. Refer to Specifications for information on checking parallel of connecting rods.



Check distortion of connecting rod. This requires that connecting rod be again taken up in v-blocks and a support be placed underneath the piston pin eye, that there is approximately equal distance from the measuring plate to the center of the thrust bearing bore and piston pin bore. Check connecting rod for distortion by applying a dial gauge on ends of master mandrel. Refer to Specifications for max. permissible deviation.



Press bearing shells into cleaned connecting rod bearing basic bore.



Give connecting rod bearing shells a light coat of Molykote Paste G before installing.



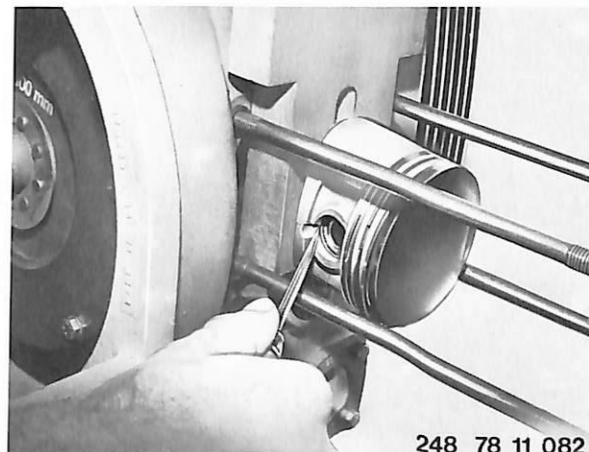
## 11 25 000 Removing and Installing Piston

Remove and install cylinder head – 11 12 080.

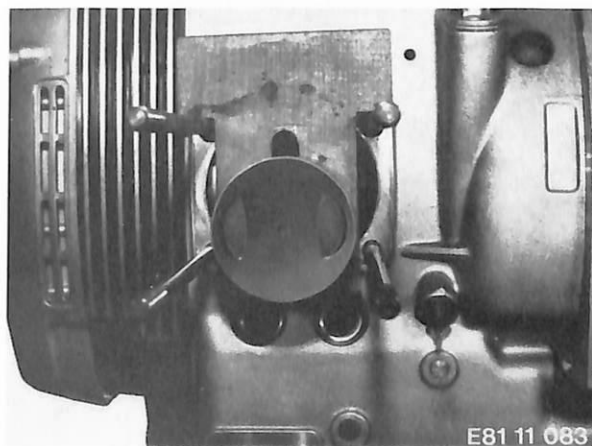
Pull off cylinder from 4 anchor bolts. Be careful not to damage piston when piston leaves cylinder. Install a piece of wood behind the piston, between the anchor bolts, to protect the piston.



Lift out piston pin circlip by pressing a scribe or small screwdriver into lateral groove. Press out piston pin with a standard tool or mandrel, BMW No. 11 2 920.

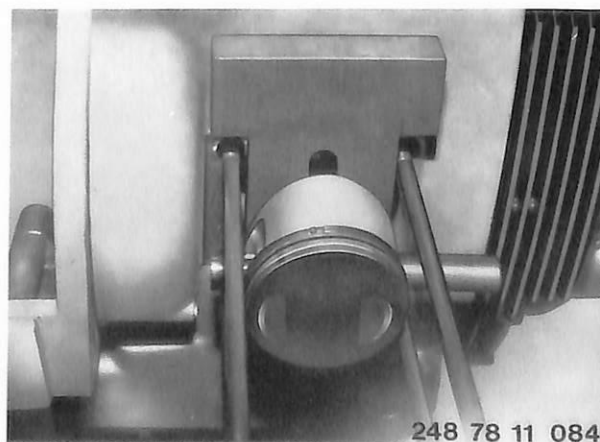


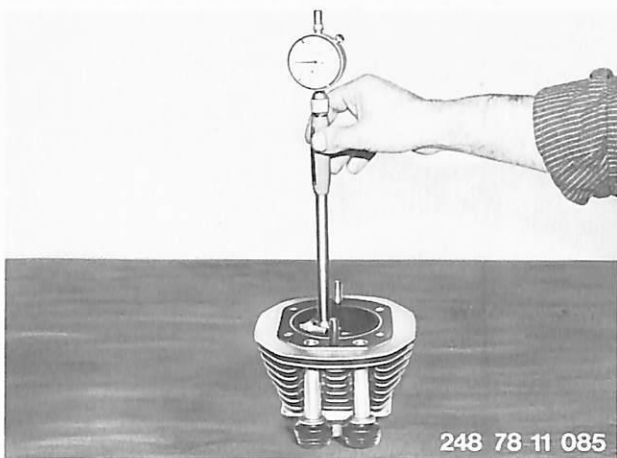
**Installation Note!** Install piston that „vorn“ (= front) on piston crown faces forward. This guarantees correct installation of piston with an offset axis. The piston need not be heated to install the piston pin. Only use pistons of same weight classification in one engine.



Install piston pin circlip in groove that one end covers lateral groove well. Press center part of circlip into piston pin bore that both ends of circlip come close together. Push circlip into groove all the way with mandrel, BMW No. 11 2 920.

**Installation Note!** Prior to installation of cylinder, clean cylinder base and cylinder sealing surfaces on engine block with nitro thinner. Be careful not to pinch round cord seals on upper staybolts.





**Inspecting and Repairing:** Measure cylinder bore with an internal calipers, which is applied in piston pin direction and 90° lateral from this point, 10 mm (0.394") from top, at center and bottom. The ambient temperature should be 20° C (68° F).



Measure piston diameter at piston skirt with a micrometer. Refer to Specifications for measuring data.



Check end and



side clearances of piston rings with a feller gage. Refer to Specifications for standard size and oversize cylinder bore diameters and piston diameters, as well as end and side clearances of piston rings.



## 11 31 061 Replacing Sprockets

Engine installed or removed.

Drain oil when engine remains installed!

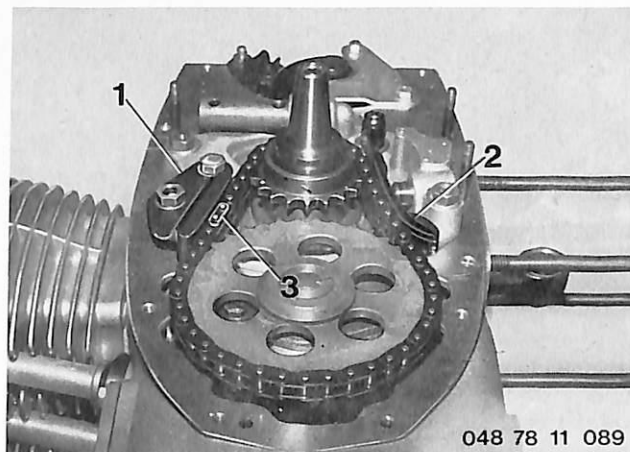
Remove and install engine – 11 00 500.

Remove and install spark trigger – 12 11 060.

Remove and install timing case cover – 11 14 060.

Remove chain guide rail (1) and chain tensioning lever (2). Open chain lock (3) and take off chain.

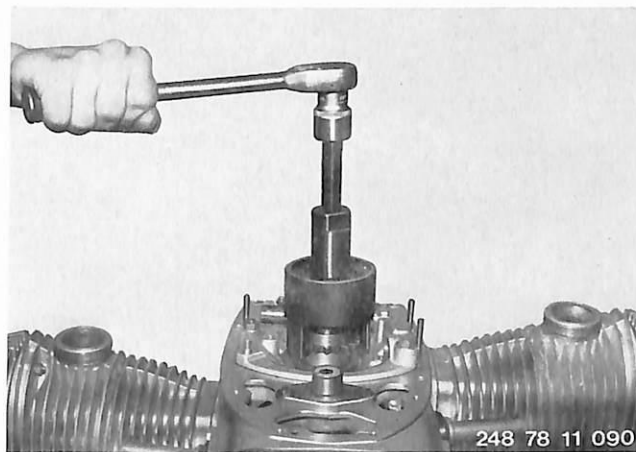
**Installation Note!** Chain lock must be closed in chain's direction of movement. Position chain guide rail parallel to chain.



Pull off sprocket and bearing from crankshaft.

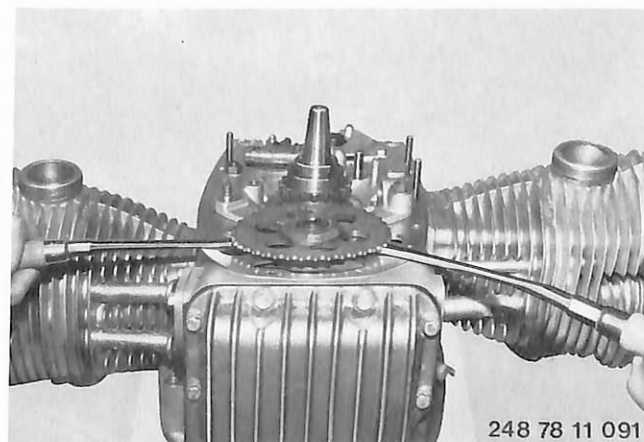
Puller, BMW No. 11 26 00, and pulling shell, BMW No. 11 26 06 (exchange against pulling shell with groove).

**Installation Note!** Heat sprocket to approx. 80° C (175° F).



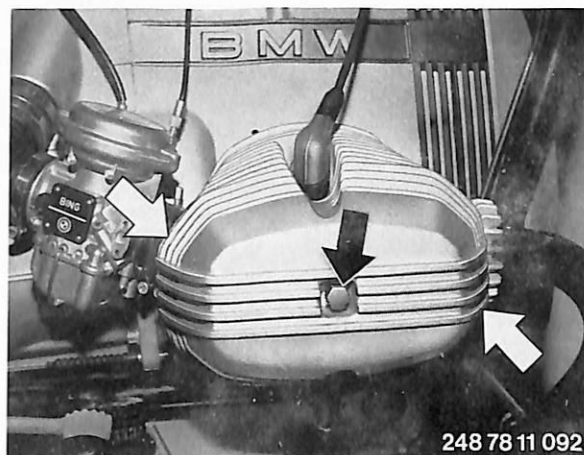
Pry off camshaft sprocket with two screwdrivers, or pull off with a standard two-arm puller.

**Installation:** When installed the marks on both sprockets must be aligned.

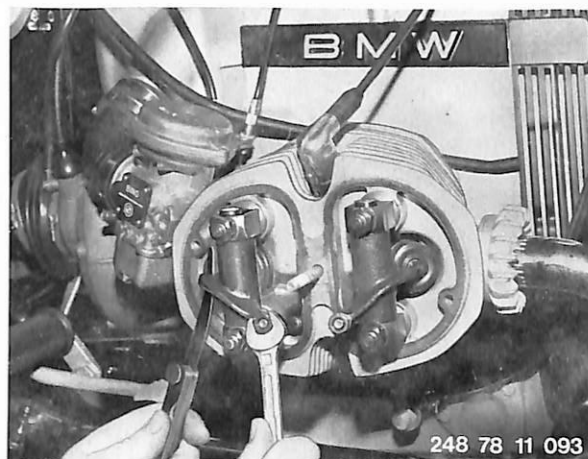


## 11 34 504 Adjusting Valve Clearance

Unscrew cap nut and both nuts (arrows). Remove cylinder head cover and gasket.



Adjust valve play between the valve stem and rocker arm with a feeler gauge blade on a stopped cold engine. This requires unscrewing the spark plugs and turning the engine with the kickstarter or rear wheel after engaging a gear until the cylinder being adjusted is at compression top dead center. Both valves will be closed. If necessary, adjust the adjusting screw after loosening the locknut. Then tighten locknut. Recheck valve play. See Technical Data for valve play.



## 11 41 000 Removing and Installing Oil Pump

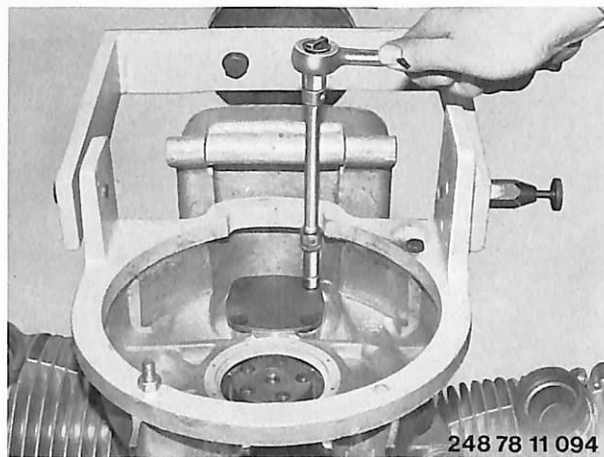
**First Method:** Remove and install engine – 11 00 050.  
Pictures and text have been produced for this method.

**Second Method:** Remove and install transmission – 23 00 020  
(engine remains in frame).

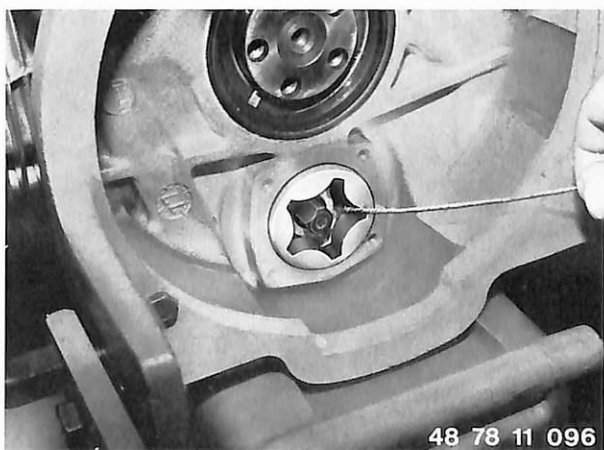
Remove and install clutch – 21 21 000.

Remove and install flywheel – 11 22 000.

Remove end cover from oil pump body after unscrewing the four hexagon head screws.



Take out inner and outer rotors from body with wire hooks.

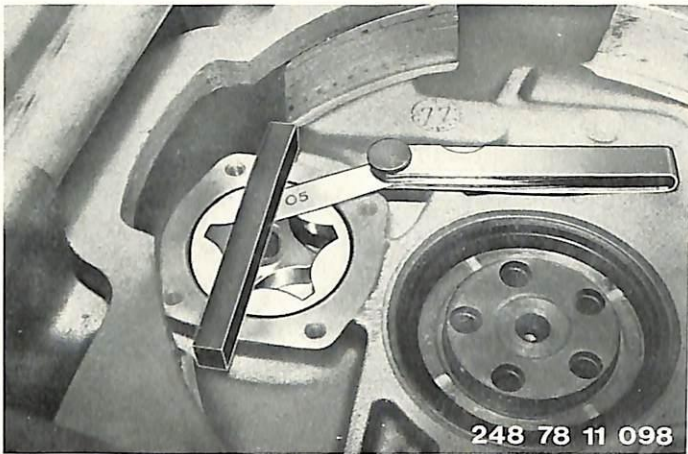


### Inspecting:

Check play between outer rotor and pump body, see Specifications.







Check play between mating surface (pump body) and sealing surface (rotor), see Specifications.

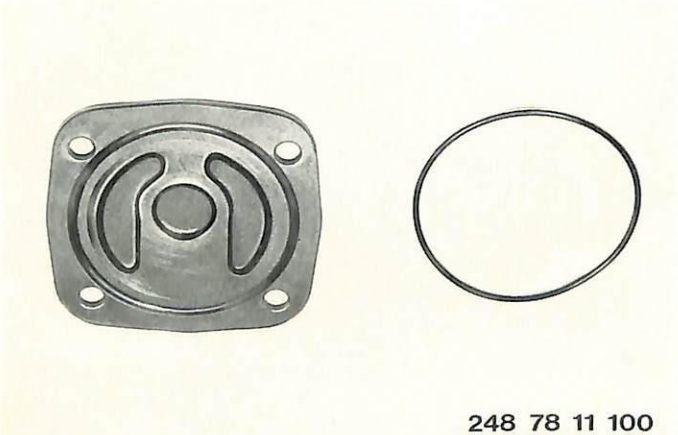


Check gap between inner and outer rotors, see Specifications.

When reassembling, make sure that O-ring in end cover is in perfect condition.



When assembled, O-ring must be compressed so far that the end cover rests flat against mating surface of pump body.



### Trouble-shooting – engine

| Fault                                              | Cause                                                                                                                                                                              | Remedy                                                                                                                              |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Loss of compression                                | Valve leaking or bent<br>Piston ring spring loading too weak,<br>ring gap too large<br>Piston rings broken                                                                         | Regrind or renew<br>Check, renew if necessary<br>Renew                                                                              |
| Low power output                                   | Incorrect ignition timing<br>Float level too low<br>Air cleaner blocked<br>Fuel tap blocked<br>Tank vent defective                                                                 | Check, adjust if necessary<br>Check and adjust if necessary<br>Renew element<br>Clean, check flow rate<br>Drill vent holes (see SI) |
| Engine reluctant to start or will not start at all | Valve clearances too low<br>Choke cannot be closed<br>Ignition timing incorrect<br>Breaker points gap too small<br>Contacts eroded<br>Spark plug gaps incorrect<br>Spark plugs wet | Check and adjust if necessary<br>Check choke setting<br>Check timing<br>Reset points<br>Renew<br>Reset<br>Dry out                   |
| Engine does not accelerate smoothly                | Centrifugal ignition advance too small or not working<br>Broken springs<br>Cam seized to shaft, shaft rusted<br>Spark plug gaps incorrect                                          | Renew centrifugal governor<br>Renew springs<br>Free contact breaker cam<br>Reset                                                    |
| Engine starts, but immediately stalls              | Break or short circuit at condenser                                                                                                                                                | Renew condenser                                                                                                                     |
| Engine misfires – high fuel consumption            | Defective ignition lead or spark plug cap<br>Defective suppressor resistors                                                                                                        | Renew<br>Renew                                                                                                                      |
| Pre-ignition (pinkish)                             | Incorrect ignition timing<br>Incorrect needle position at carburetor                                                                                                               | Retime ignition<br>Reset needle to correct position                                                                                 |
| Oil pressure too low                               | Main bearing play excessive<br>Blocked oil suction head<br>Pressure relief valve stuck open                                                                                        | Measure crankshaft and bearings<br>Check, renew if necessary<br>Remove and repair valve                                             |





# 12 Engine Electrical Equipment

|                                                                     |              |
|---------------------------------------------------------------------|--------------|
| Specifications                                                      | Page 12- 0/3 |
| Specifications – 1981 models                                        | 12- 0/7      |
| 12 11 004 Ignition timing – adjust                                  | 12-11/1      |
| 12 11 004 Ignition timing – adjust (1981 models)                    | 12-11/3      |
| 12 11 060 Ignition trigger – remove and install                     | 12-11/5      |
| 12 11 141 Points–replace                                            | 12-11/6      |
| Ignition – troubleshoot                                             | 12-11/7      |
| Ignition – troubleshoot (1981 models)                               | 12-11/9      |
| 12 13 100 Ignition coil (one) – remove and install                  | 12-13/1      |
| 12 13 100 Ignition coil (double) – remove and install (1981 models) | 12-13/3      |
| 12 14 010 Control unit – remove and install                         | 12-14/1      |
| 12 14 025 Cooler – remove and install                               | 12-14/1      |
| 12 31 009 Alternator, diode carrier and regulator – check           | 12-31/1      |
| 12 31 019 Alternator with regulator – quick test                    | 12-31/2      |
| 12 31 020 Alternator – remove and install                           | 12-31/2      |
| 12 31 689 Stator coil and rotor – check                             | 12-31/3      |
| 12 32 000 Regulator and alternator – remove and install             | 12-31/4      |
| Alternator – troubleshooting                                        | 12-31/5      |
| 12 41 009 Starter in motorcycle – check                             | 12-41/1      |
| 12 41 020 Starter – remove and install                              | 12-41/1      |
| 12 41 513 Starter – disassemble and assemble                        | 12-41/3      |
| 12 41 541 Carbon brushes – replace                                  | 12-41/4      |
| 12 41 602 Starter – overhaul                                        | 12-41/5      |
| 12 41 701 Field coil – replace                                      | 12-41/6      |
| Starter – troubleshoot                                              | 12-41/7      |

## Specifications

| Engine Electrical Parts                  | Model                           |
|------------------------------------------|---------------------------------|
|                                          | R 65                            |
| <b>Starter</b>                           |                                 |
| Type                                     | Bosch DF 12 V                   |
| Starting bypass current in A             | 320                             |
| Output in kW                             | 0.7                             |
| Torque in mkg (ft lbs)                   | 0.750 (5.4)                     |
| Starter relay                            | Bosch                           |
| Armature axial play in mm (in.)          | 0.10 ... 0.15 (0.004 ... 0.006) |
| <b>Alternator</b>                        |                                 |
| Type                                     | Bosch G 1 14 V 20 A 21/280 W    |
| Alternator drive                         | direct off of crankshaft        |
| Max. output in W/V                       | 280/14                          |
| Max. current in A                        | 20                              |
| Resistance between phase outlets in ohms | 0.62                            |
| Charging begins at rpm                   | 980                             |
| Max. speed in rpm                        | 10.000                          |
| Max. runout on slip rings in mm (in.)    | 0.06 (0.0024)                   |
| Min. diameter of slip rings in mm (in.)  | 26.8 (1.055)                    |
| <b>Voltage Regulator</b>                 |                                 |
| Type (Bosch)                             | 0 190 601 009 AD 1/14 V         |
| Regulating voltage in V                  |                                 |
| Without load                             | 13.55 ... 14.25                 |
| With load                                | 13.9 ... 13.4                   |

## Specifications

| Engine Electrical Parts                                              | Model                                                                                 |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Diode Carrier</b><br>Type (Bosch)                                 | R 65<br><br>D 120 915 158 14 V 20 A                                                   |
| <b>Ignition Coil</b><br>Type (Bosch)                                 | E 6 V                                                                                 |
| Starting spark length at 3000 sparks/min.<br>and 3 volts in mm (in.) | 8 (0.315)                                                                             |
| Operating spark length at 3600 sparks/min.<br>in mm (in.)            | 13.5 (0.531)                                                                          |
| <b>Spark Plugs</b><br>Threads                                        | M 14 a 1.25                                                                           |
| Bosch                                                                | W 225 T 30                                                                            |
| Beru                                                                 | 225/14/3A                                                                             |
| Champion                                                             | N 6 Y                                                                                 |
| Electrode gap in mm (in.)                                            | 0.7 (0.028)                                                                           |
| <b>Distributor</b><br>Type (Bosch)                                   | Mech. ignition breaker with centrifugal control in sealed housing, dynamic adjustment |
| Control begins at rpm                                                | 1500                                                                                  |
| Control ends at rpm                                                  | 3000                                                                                  |
| Contact breaker shaft                                                | Bosch Ft 1 v 8 grease                                                                 |
| Contact breaker gap in mm (in.)                                      | 0.45±0.05 (0.018±0.002)                                                               |



### Specifications

| Engine Electrical Parts                       |                                           |
|-----------------------------------------------|-------------------------------------------|
| Model                                         | R 65                                      |
| Dwell angle in degrees                        | 120 at 1000 rpm                           |
| Capacitor                                     | 0.2 $\mu$ F + 20% Bosch No. 1 237 330 295 |
| Static ignition timing for assembly of engine | 6° before TDC                             |
| Control range in degrees on crankshaft        | 26                                        |

### Torque Values in Nm (ft lbs)

|                         |                       |             |                       |
|-------------------------|-----------------------|-------------|-----------------------|
| Armature mounting screw | 23 ... 27 (17 ... 20) | Spark plugs | 23 ... 30 (17 ... 22) |
| Starter mounting screws | 47.5 (34)             |             |                       |

Tighten all other bolts and nuts to common torque values as listed in tables supplied by bolt suppliers or in new BMW Standard 60002.0.

## Specifications 1981 Models

### Engine Electrical Parts

| Model                                     | R 65                                | R 65 LS |
|-------------------------------------------|-------------------------------------|---------|
| <b>Starter</b><br>Type                    | Bosch DF 12 V                       |         |
| Starting bypass current in A              | 320                                 |         |
| Output in kW                              | 0.7                                 |         |
| Torque in mkp (ft lbs)                    | 0.750 (5.4)                         |         |
| Starter relay                             | Bosch                               |         |
| Armature axial play in mm (in.)           | 0.10 . . . 0.15 (0.004 . . . 0.006) |         |
| <b>Alternator</b><br>Type                 | Bosch G 1 14 V 20 A 21/280 W        |         |
| Alternator drive                          | direct off of crankshaft            |         |
| Max. output in W/V                        | 280/14                              |         |
| Max. current in A                         | 20                                  |         |
| Resistance between phase outlets in ohms  | 0.62                                |         |
| Charging begins at rpm                    | 980                                 |         |
| Max. speed in rpm                         | 10,000                              |         |
| Max. runout on slip rings in mm (in.)     | 0.06 (0.0024)                       |         |
| Min. diameter of slip rings in mm (in.)   | 26.8 (1.055)                        |         |
| <b>Voltage Regulator</b><br>Type (Wehrle) | E 1051 B/14 V                       |         |



## Engine Electrical Parts

## Specifications 1981 Models

| Model                                | R 65                                                                                                         | R 65 LS |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------|---------|
| <b>Diode Carrier</b><br>Type (Bosch) | D 120 915 158 14 V 20 A                                                                                      |         |
| <b>Ignition Coil</b><br>Type (Bosch) | Double-spark ignition coil 12 V                                                                              |         |
| <b>Spark Plugs</b><br>Threads        | M 14 a 1.25                                                                                                  |         |
| Bosch                                | W 5 D                                                                                                        |         |
| Beru                                 | 14 -- 5 D                                                                                                    |         |
| Champion                             | N 6 y                                                                                                        |         |
| Electrode gap in mm (in.)            | 0.7 (0.028)                                                                                                  |         |
| <b>Distributor</b><br>Type (Bosch)   | Breakerless ignition pulse transmitter (Hall sensor)<br>with integrated centrifugal advance ignition control |         |
| Control begins at rpm                | 1500                                                                                                         |         |
| Control ends at rpm                  | 3000                                                                                                         |         |



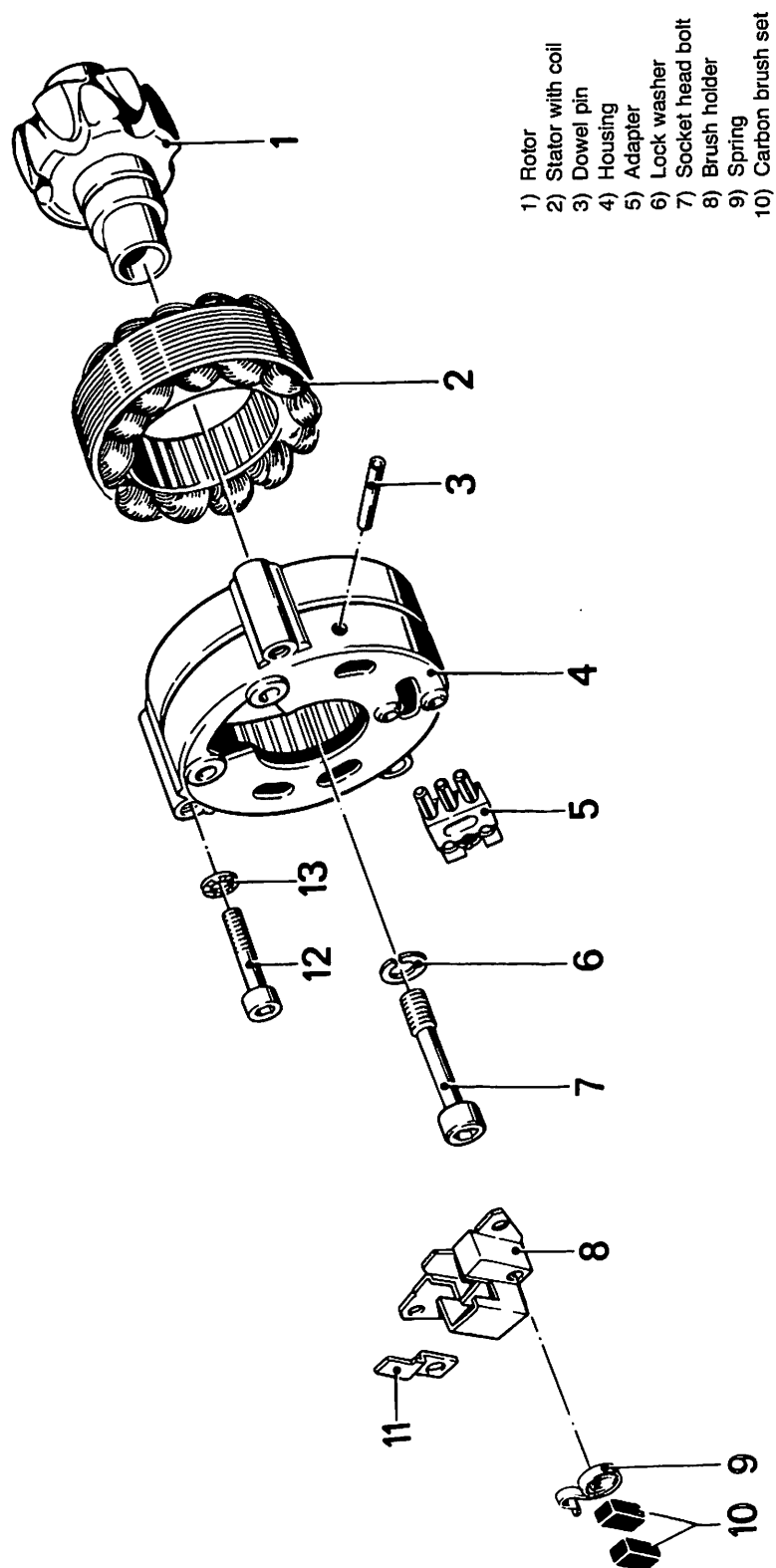
## Specifications 1981 Models

| Engine Electrical Parts                       |  |               |         |
|-----------------------------------------------|--|---------------|---------|
| Model                                         |  | R 65          | R 65 LS |
| Static ignition timing for assembly of engine |  | 6° before TDC |         |
| Control range in degrees on crankshaft        |  | 26            |         |

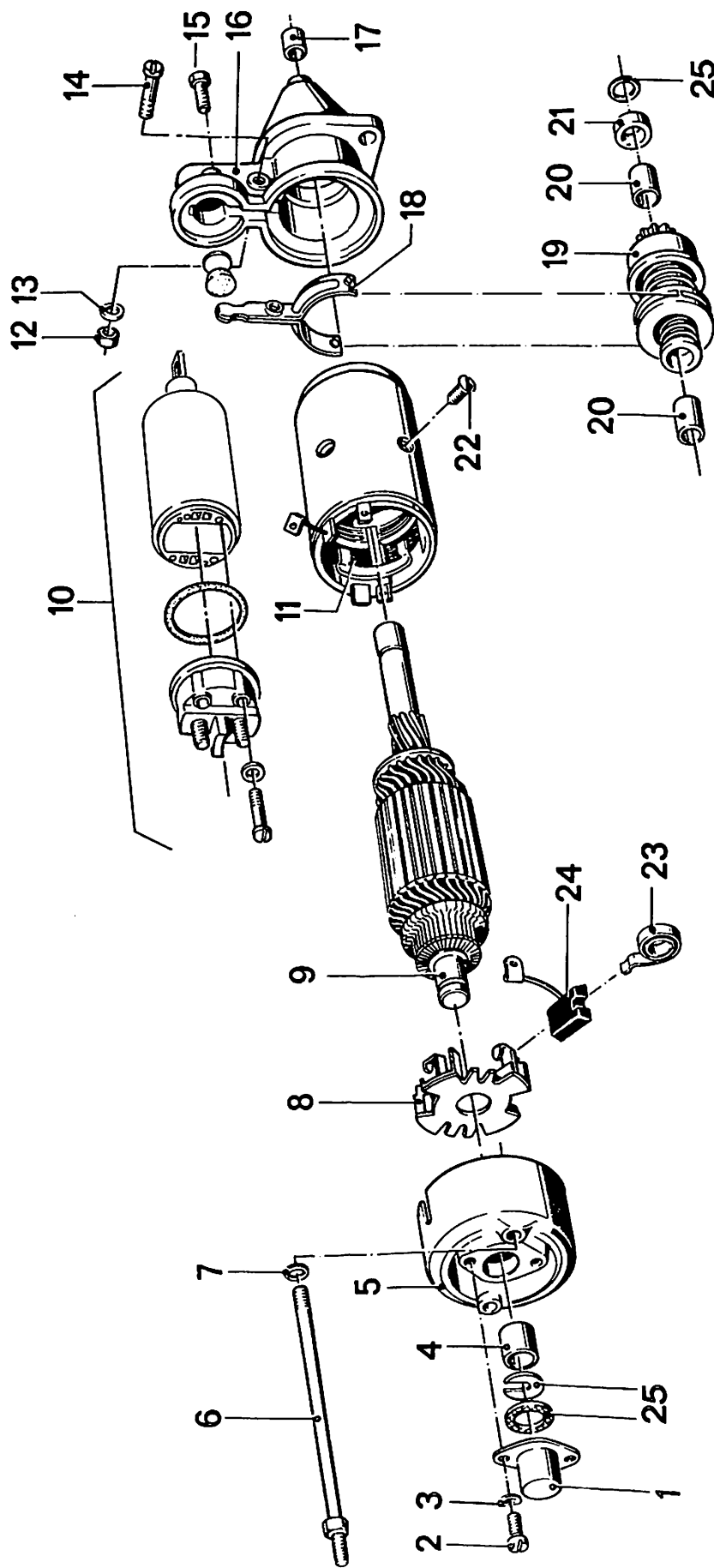
## Torque Values in Nm (ft lbs)

|                                                                                                                                         |                 |             |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|-----------------|
| Armature mounting screw                                                                                                                 | 25 ± 2 (18 ± 1) | Spark plugs | 20 + 5 (14 + 4) |
| Starter mounting screws                                                                                                                 | 47.5 (34)       |             |                 |
| Tighten all other bolts and nuts to common torque values as listed in tables supplied by bolt suppliers or in new BMW Standard 60002.0. |                 |             |                 |

# Alternator



# Starter

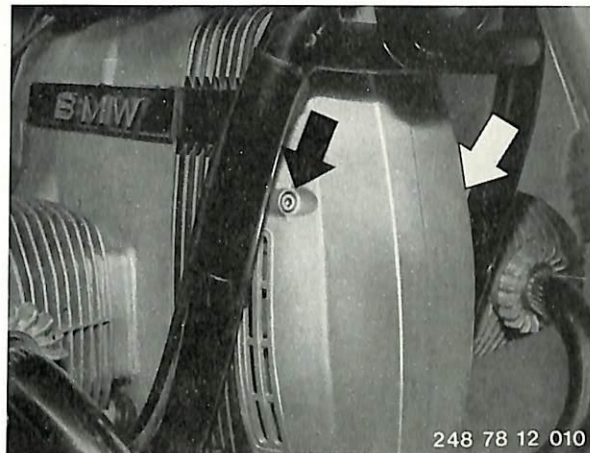


- |                         |                          |
|-------------------------|--------------------------|
| 1) End cap              | 14) Fillister head screw |
| 2) Fillister head screw | 15) Countersunk screw    |
| 3) Lock washer          | 16) Drive bearing        |
| 4) Bearing sleeve       | 17) Bearing sleeve       |
| 5) Commutator bearing   | 18) Operating lever      |
| 6) Fillister head screw | 19) Starter gear         |
| 7) Shim                 | 20) Bearing sleeve       |
| 8) Brush holder plate   | 21) Stop ring            |
| 9) Armature             | 22) Countersunk screw    |
| 10) Solenoid            | 23) Spring               |
| 11) Field coil          | 24) Carbon brush set     |
| 12) Hexagon nut         | 25) Washer               |
| 13) Lock washer         |                          |

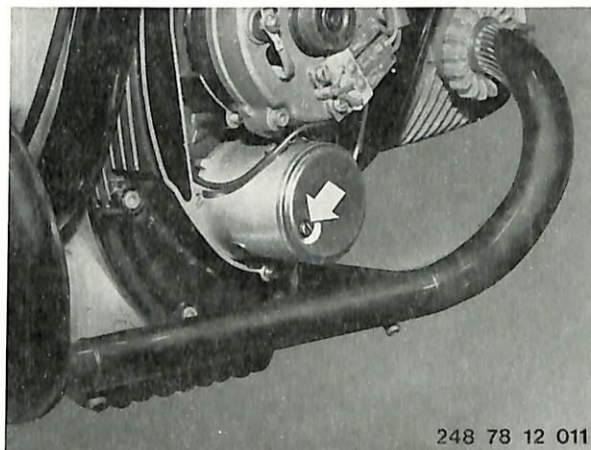


## 12 11 004 Adjusting Ignition Timing

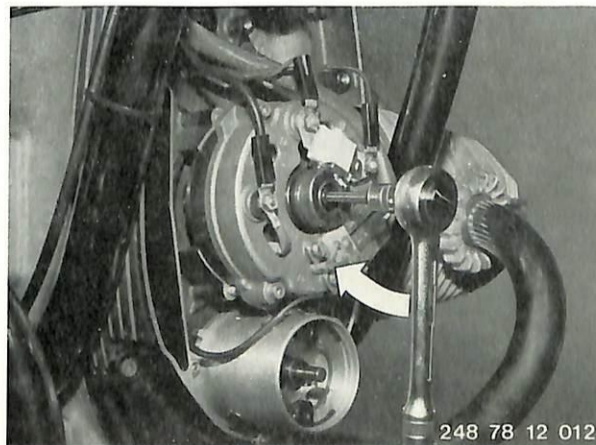
Take off engine cover after unscrewing both socket head screws (arrows).



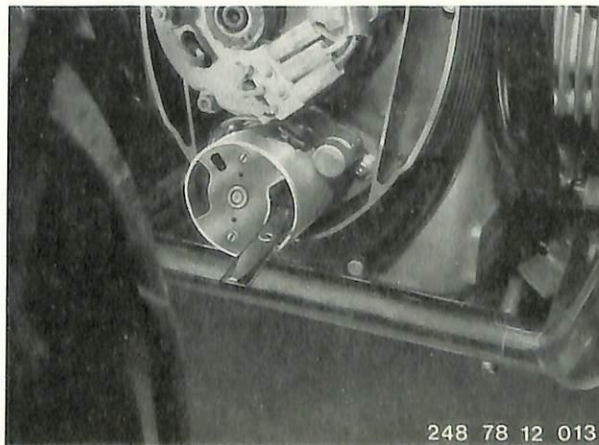
Unscrew slotted head screw on distributor cap and take off cap.

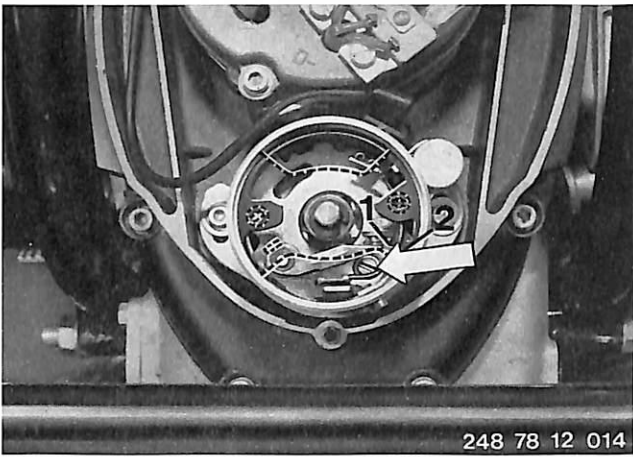


Unscrew spark plugs and turn engine clockwise (opposite forward direction) with socket head screw for rotor.

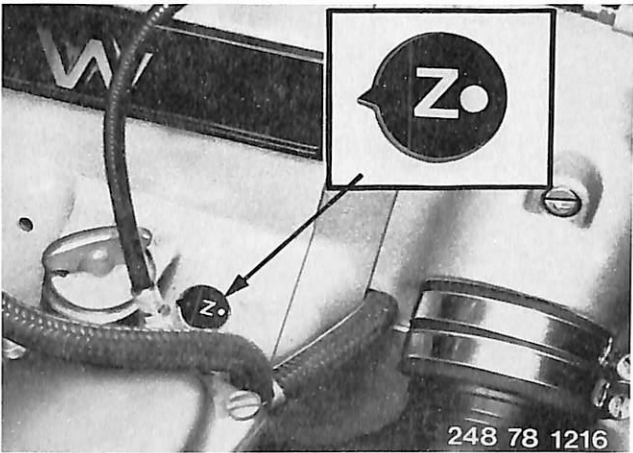


Contact breaker arm (hammer) must lift fully.  
Check 0.40 mm (0.016") point gap with a feeler gage.  
If necessary, replace points — 12 11 141.

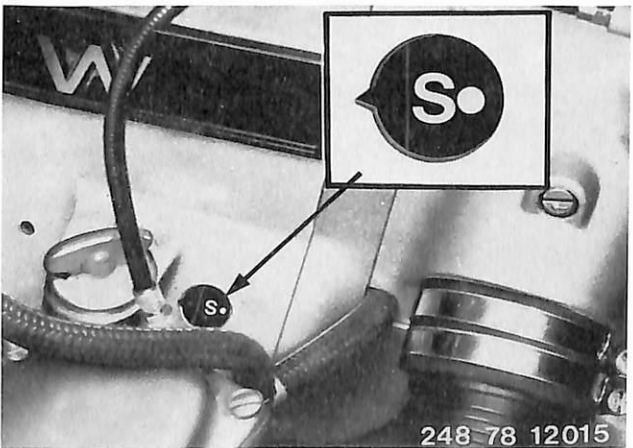




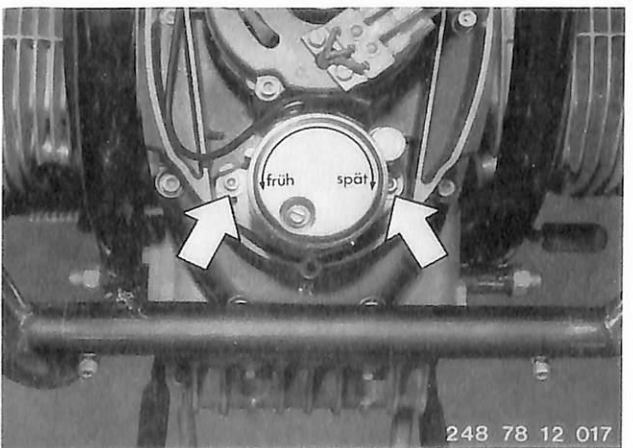
**Adjusting Point Gap:** Loosen screw (arrow). Place tip of screwdriver in slot of point carrier (1) and adjust point gap by turning against anvil (2).  
Tighten screw.  
Recheck point gap or dwell angle (only with dwell angle tester).  
Refer to Specifications for point gap or dwell angle.



**Checking Ignition Timing:** Connect stroboscope lamp to battery and ignition lead. Start engine and increase speed to 3500 rpm. When aiming stroboscope lamp at flywheel, white point „Z” must appear in sight hole (full advance ignition).  
To check the ignition control curve, turn setwheel on stroboscope lamp until „TDC” mark can be seen. The actual ignition angle can now be read from scale on stroboscope lamp.  
Refer to Specifications for ignition angle data.



With engine running at idle speed ( $950 \pm 150$  rpm), center white stripe mark „S” on flywheel must align with sight hole mark (2). If stripe is below center (1), ignition is adjusted too late, and if above center (3), too early.



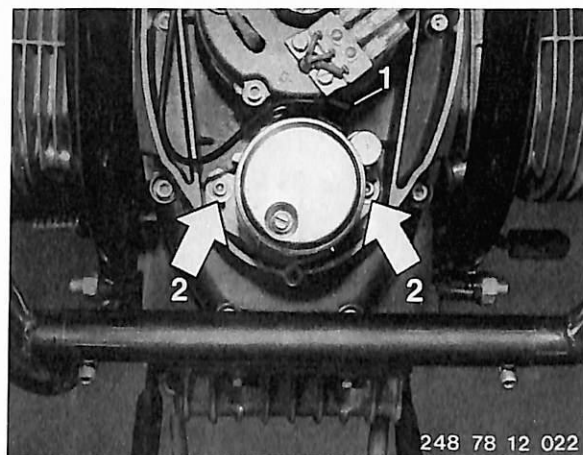
**Adjusting Ignition Timing:** Engine running. Loosen socket head screws of spark trigger (arrows). Turn spark trigger in direction of engine rotation to retard or in opposite direction to advance ignition timing. (Crankshaft and camshaft turn in same direction.)  
Tighten screws again.

## 12 11 060 Removing and Installing Spark Trigger

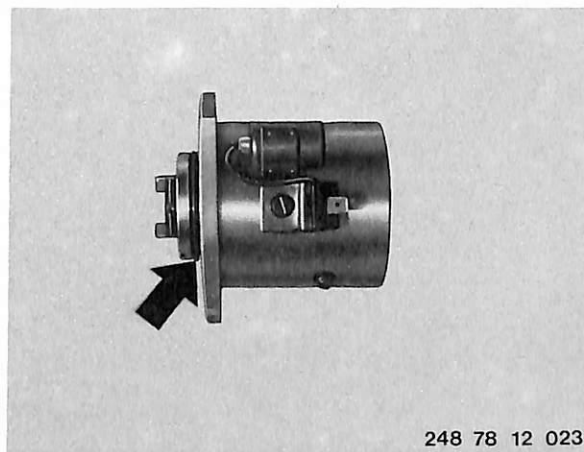
Remove engine cover.

Pull off flat female plug (1). Unscrew socket head screws (2) and pull out spark trigger from timing case cover.

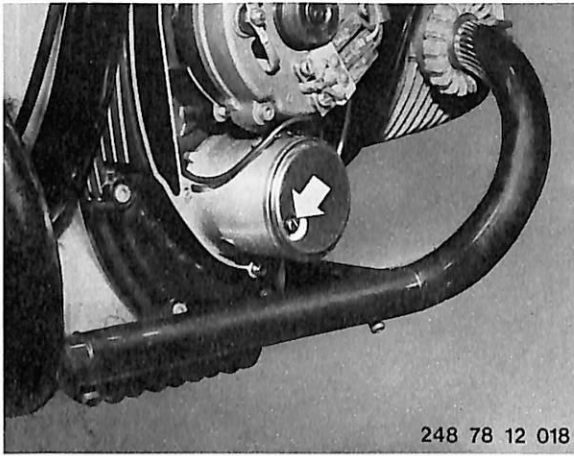
**Note!** Never disassemble spark trigger; always replace entire unit.



Replace seal (arrow) each time spark trigger is removed.



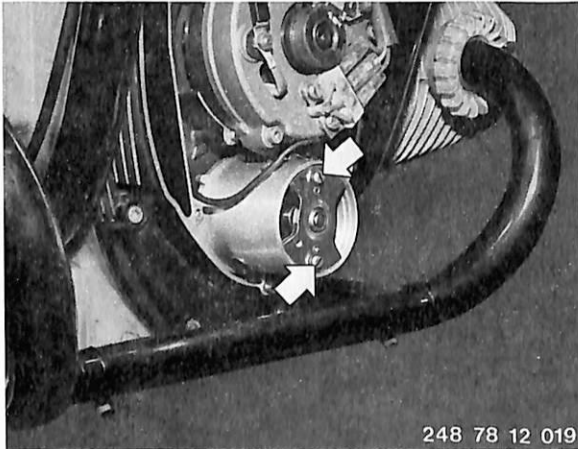




248 78 12 018

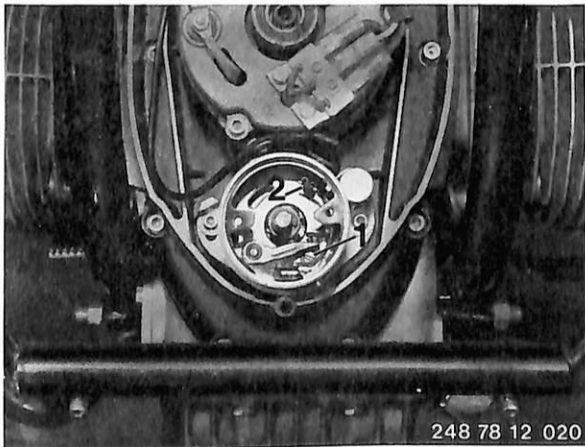
## 12 11 141 Replacing Points

Remove engine cover after loosening the socket head screws. Unscrew slotted head screw on spark trigger cap and remove cap (arrow).



248 78 12 019

Unscrew the two slotted head screws (arrows) for support bracket and remove bracket.



248 78 12 020

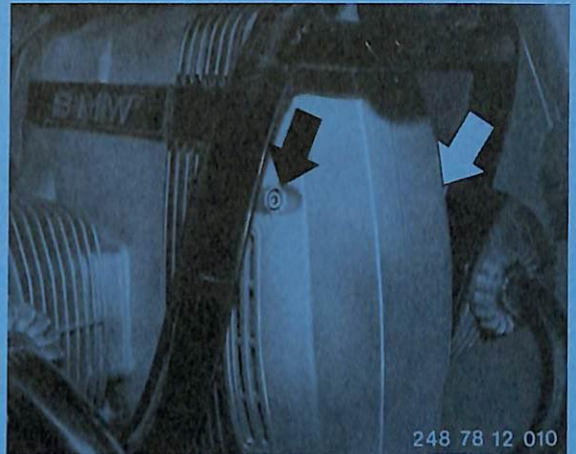
Unscrew fillister head screw (1), pull off flat female plug (2) and pull out entire contact breaker point.

## 12 11 004 Adjusting Ignition Timing (Static) 1981 Models

### Caution!

This motorcycle is equipped with a high voltage transistor coil ignition system (TCI). Touching power carrying parts of system while engine is running is very dangerous!

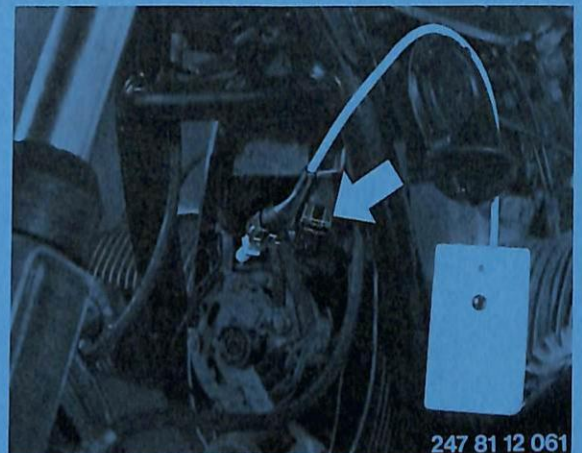
Unscrew both socket head bolts (arrows) and take off engine guard.



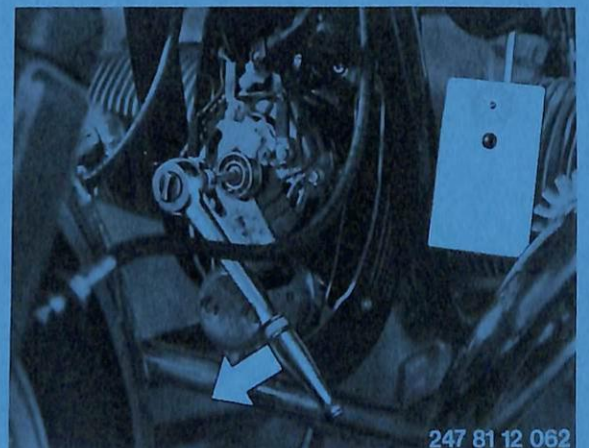
Disconnect 3-pin plug (arrow) and connect ignition tester, BMW No. 12 3 650, on ignition box.

### Note:

Remove wire clamp of plug connection.

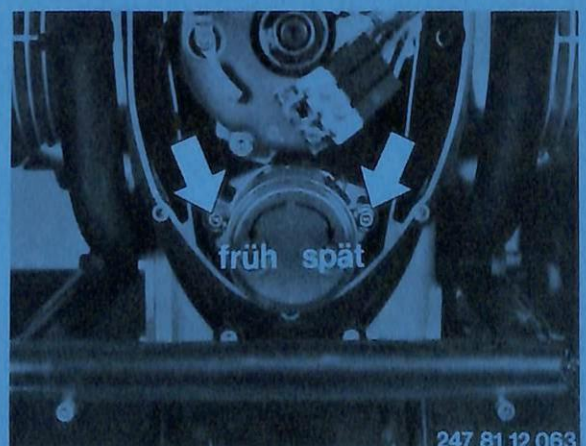


Unscrew spark plugs and crank engine clockwise (opposite forward direction) on socket head bolt for rotor.

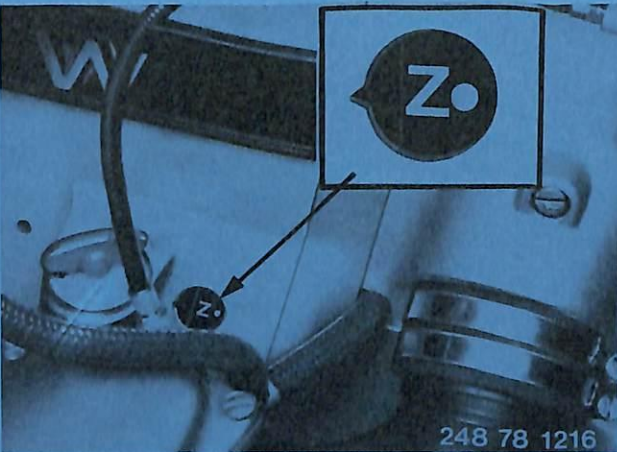
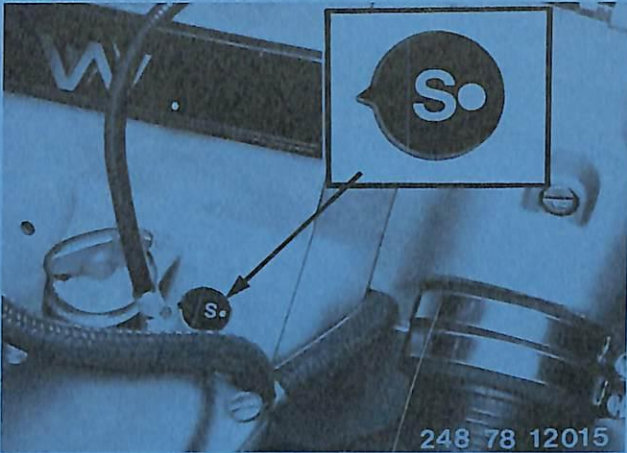


Center white stripe of flywheel mark "S" must be aligned with inspection hole mark on engine block (second figure, page 12-11/2), when diode on ignition tester comes on. Turn ignition box accordingly as shown if necessary.

Turned clockwise = ignition timing retarded.  
Turned anticlockwise = ignition timing advanced.







## Checking Ignition Timing (Dynamic)

Connect stroboscope lamp on battery and ignition wire. Start engine and boost speed to 3500 rpm. When aiming stroboscope lamp at flywheel, white dot "S" should appear in the inspection hole (full advance ignition). To check the ignition control curve, turn setwheel of stroboscope lamp until "TDC" mark appears. The actual ignition angle can now be read from scale on stroboscope lamp.

See Specifications for ignition angle values.

When engine is running at idle speed ( $950 \pm 150$  rpm), the white stripe or white dot of flywheel mark "S" must be aligned with the inspection hole mark (2). If mark is seen below center, ignition timing is too late, and when above center, ignition timing is too early.



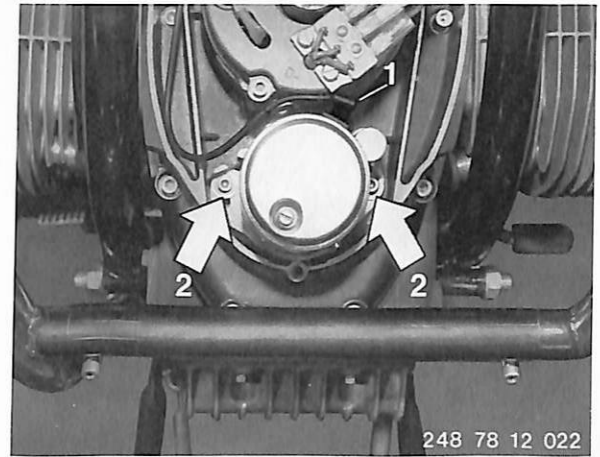
## 12 11 060 Removing and Installing Ignition Trigger

Remove engine guard.

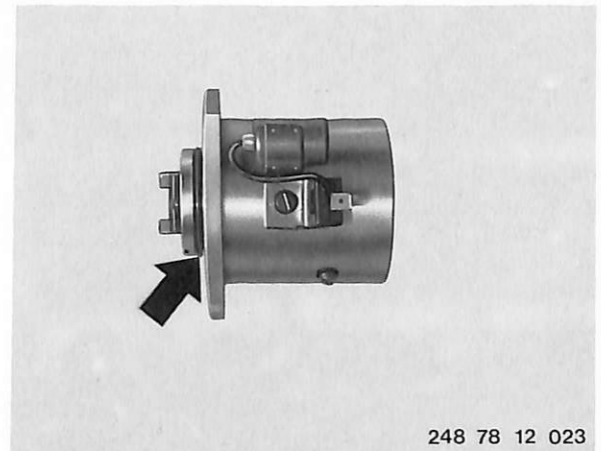
Pull off flat female plug (1), unscrew socket head screws (2) and pull ignition trigger out of timing case cover. (1) not applicable beginning with 1981 models.

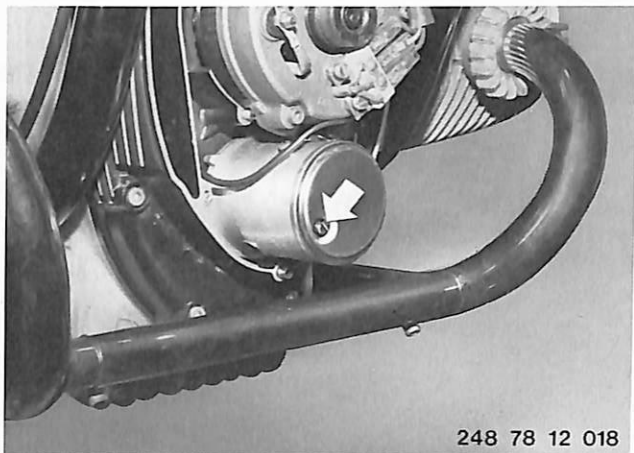
### Note:

Never disassemble ignition trigger – only replace as an assembly!



Replace seal (arrow) each time ignition trigger is removed.

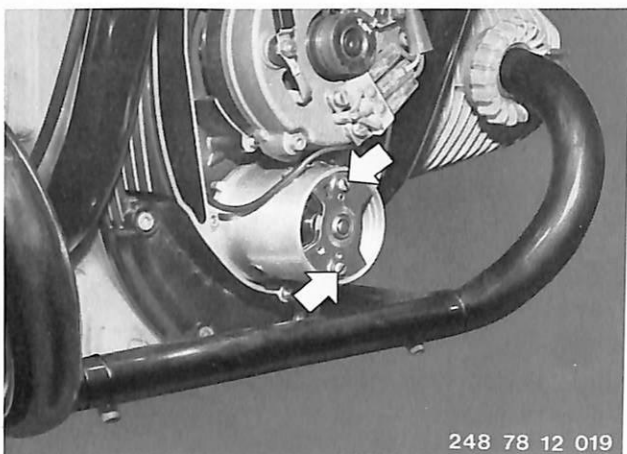




248 78 12 018

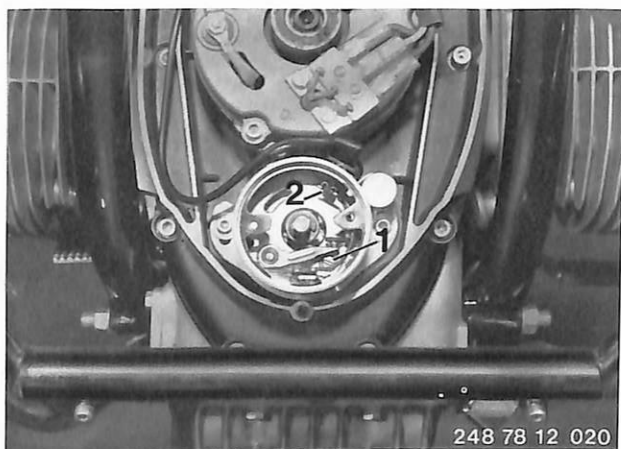
## 12 11 141 Replacing Points

Remove engine cover after loosening the socket head screws. Unscrew slotted head screw on spark trigger cap and remove cap (arrow).



248 78 12 019

Unscrew the two slotted head screws (arrows) for support bracket and remove bracket.



248 78 12 020

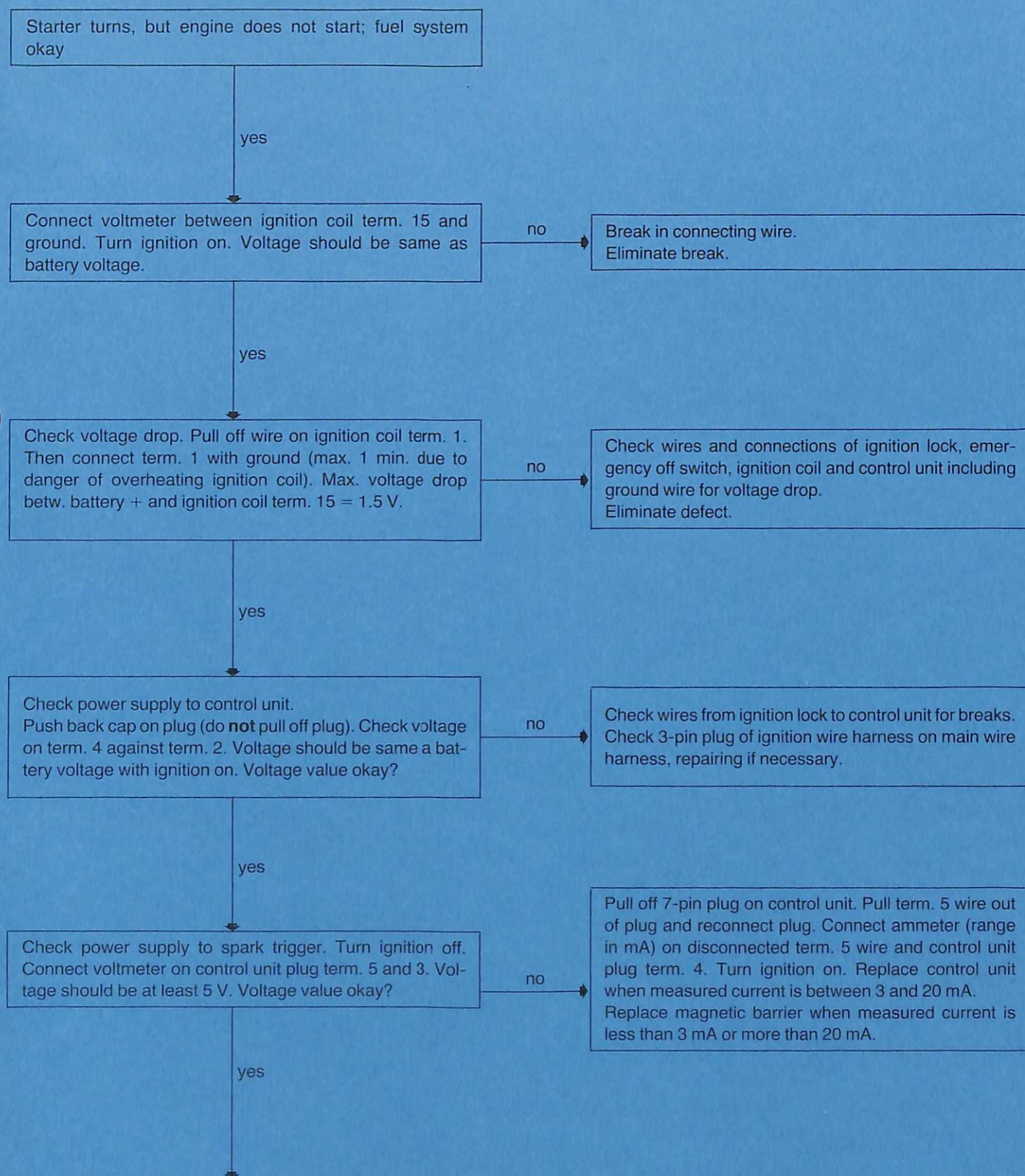
Unscrew fillister head screw (1), pull off flat female plug (2) and pull out entire contact breaker point.

### Troubleshooting Ignition System

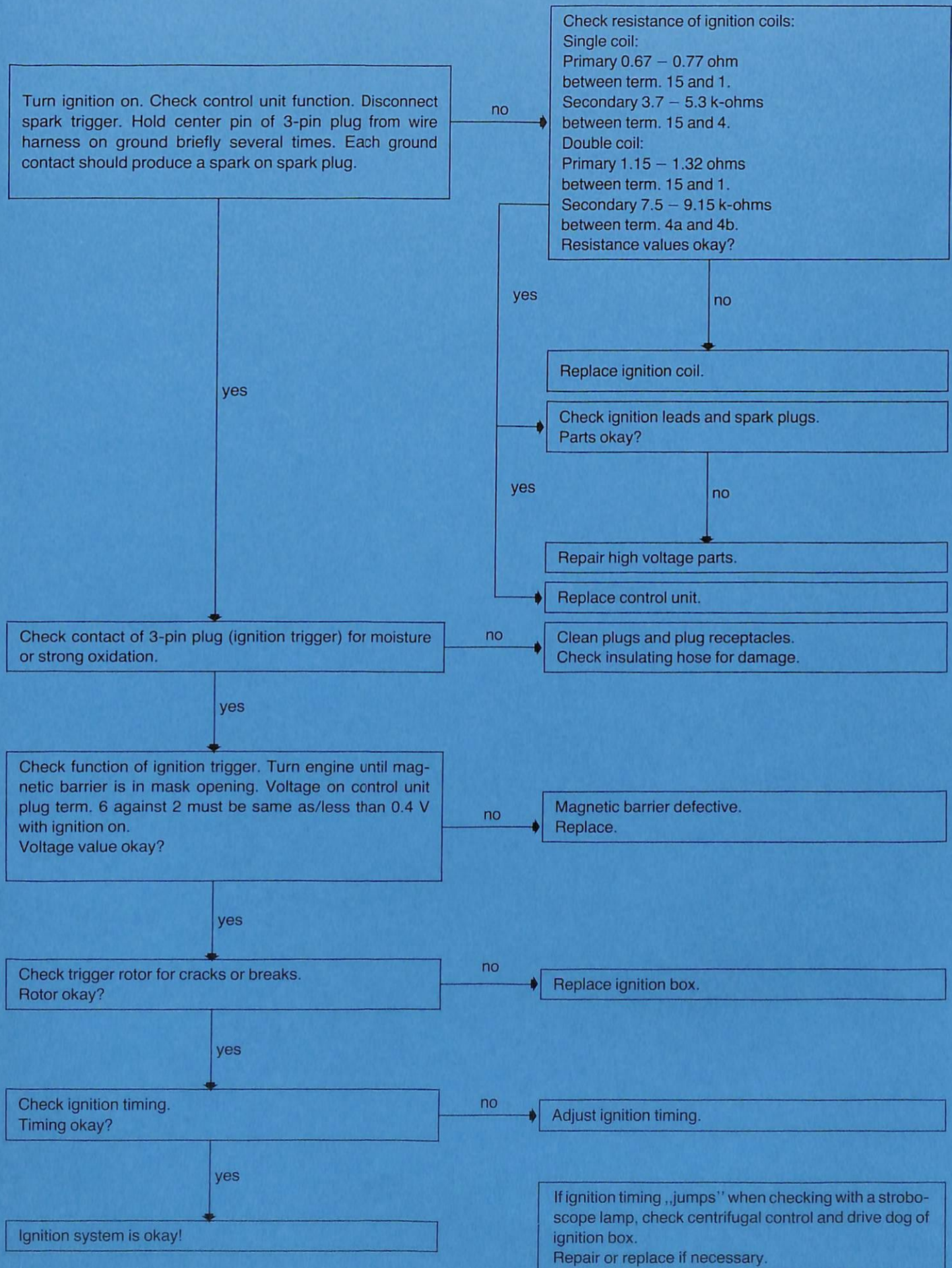
| Condition                               | Cause                                                                          | Correction                                                               |
|-----------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Engine will not start or stops          | Points burnt or dirty                                                          | Replace points                                                           |
| Engine power drops                      | Dwell angle incorrect                                                          | Adjust dwell angle                                                       |
| Engine will not pick up speed           | No centrifugal control                                                         | Check or replace centrifugal governor                                    |
| Engine starts, but stops again          | Break or short in capacitor                                                    | Replace capacitor                                                        |
| Engine misfires – high fuel consumption | Ignition lead defective<br>Spark plug end cap defective<br>Resistors defective | Replace ignition lead<br>Replace spark plug end cap<br>Replace resistors |



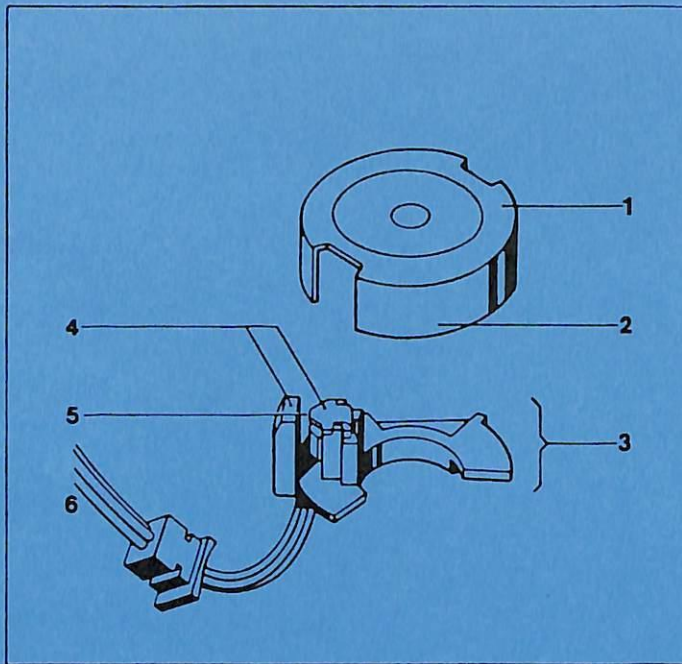
## Troubleshooting Ignition System (1981 Models)











Parts of Hall Sensor:

- 1 Mask rotor with openings
- 2 Mask
- 3 Magnetic barrier
- 4 Guide
- 5 Clearance
- 6 Three-wire sensor lead

**Important!**

Control unit switches off again 5 seconds after switching in on the ignition lock. The ignition lock must be turned off and on again for testing on terminal 1.



## 12 13 100 Removing and Installing One Ignition Coil

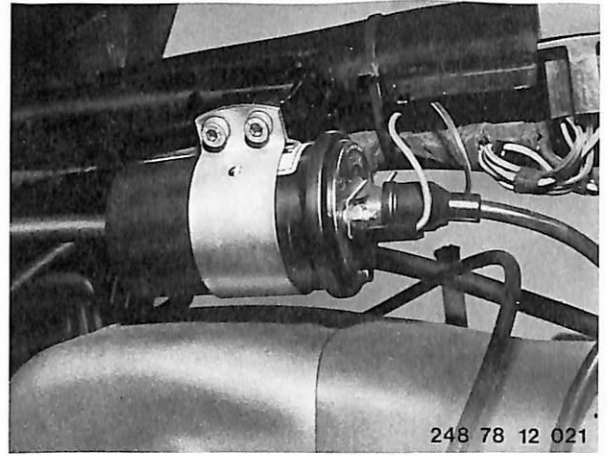
Remove and install fuel tank — 16 11 030.

Disconnect battery's ground wire at transmission.

Pull off wires from terminals „1” and „15”, as well as high tension wire from ignition coil.

Unscrew mounting screws with a socket wrench.

**Installation Note!** Don't forget the ground connection at front ignition coil mounting point.

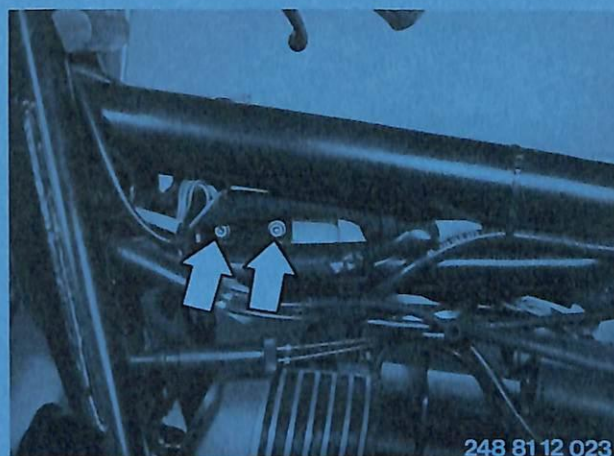


## 12 13 100 Removing and Installing Double Ignition Coil 1981 Models

Pull ignition leads (arrows) out of ignition coil and also pull off wires on terminal 1 (1) and 15 (2).



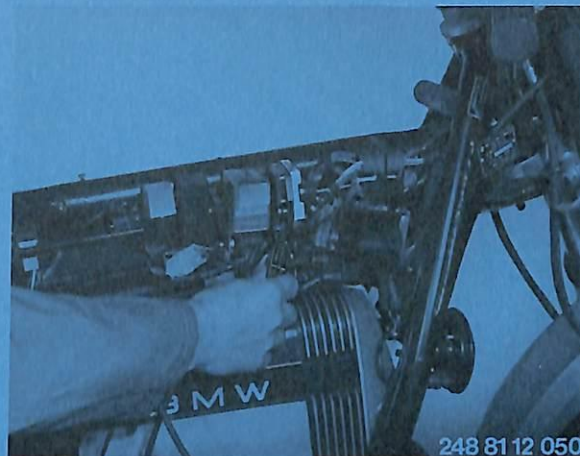
Unscrew mounting screws (arrows) for double ignition coil and take off ignition coil.





## 12 14 010 Removing and Installing Control Unit

Remove and install fuel tank 16 11 030.  
Pull off multiple-pin plug on control unit.



Remove and install regulator for alternator 12 32 000.  
Unscrew mounting bolts (arrows) of control unit and take off control unit.

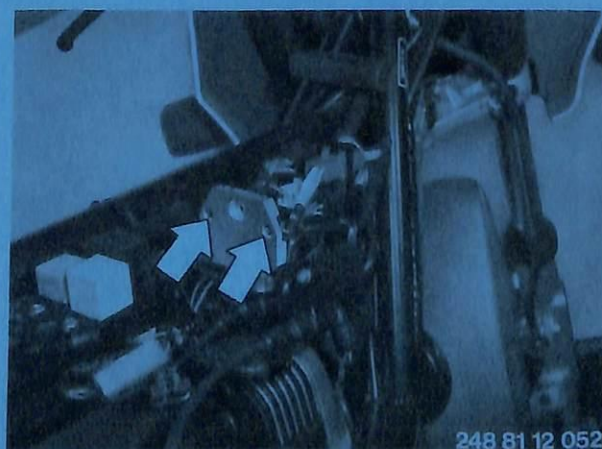
### Installation:

To avoid corrosion and consequently poor thermal transition, coat mating surfaces between control unit and cooler with Curil K2.



## 12 14 025 Removing and Installing Cooler

Remove and install fuel tank 16 11 030.  
Remove and install control unit 12 14 010.  
Unscrew cooler mounting bolts and take off cooler.



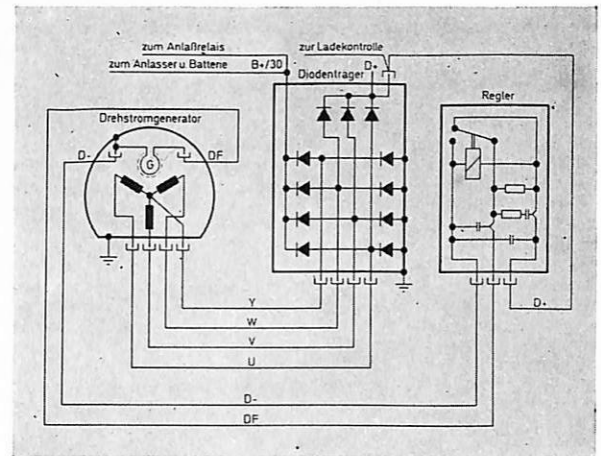


## 12 31 009 Checking Alternator, Diode Carrier and Regulator Cutout

The pictures shows the layout of the alternator, diode carrier and regulator.

**Important!** Only disconnect wires between the battery, alternator and regulator when engine has been stopped. If battery is charged in motorcycle with a battery charger, disconnect plus and minus leads from battery.

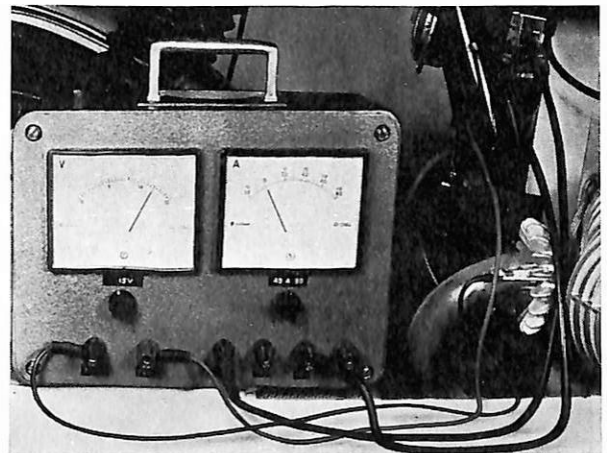
The battery charge indicator lamp is used for initial exciting of alternator.



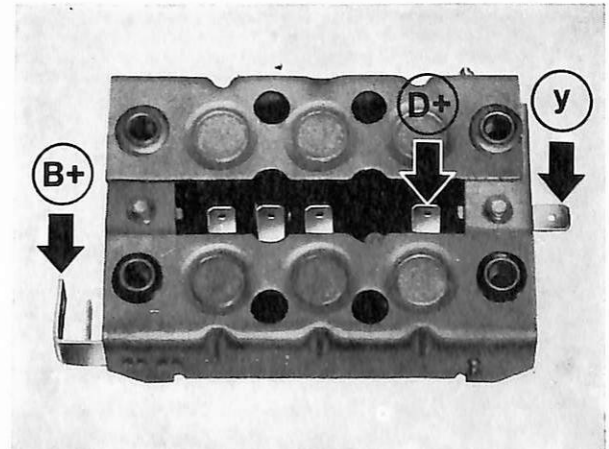
To check regulator, pull off B + (black wire) from diode carrier with engine stopped. Connect voltmeter between B + and D -. Start engine. Voltage should be 13.5 . . . 14.2 volts shortly after the beginning of regulation.

To check the charging current, install an ammeter (range: 15 . . . 20 A) in line B +. Turn on electrical equipment or connect a rheostat, allowing loads up to 13 amperes, parallel to battery.

Run engine at 4000 rpm. Adjust max. amperage on rheostat. Read regulating voltage at load from voltmeter. Refer to Specifications for values.



The voltage difference can be measured direct between D+ and B+ with a voltmeter (range: approx. 3 V). A difference in voltage up to 0.5 V means a defect in the regulator. The defect will be in the diode carrier when difference in voltage is 1.5 . . . 4 V.





### 12 31 019 Fast Testing Alternator with Regulator

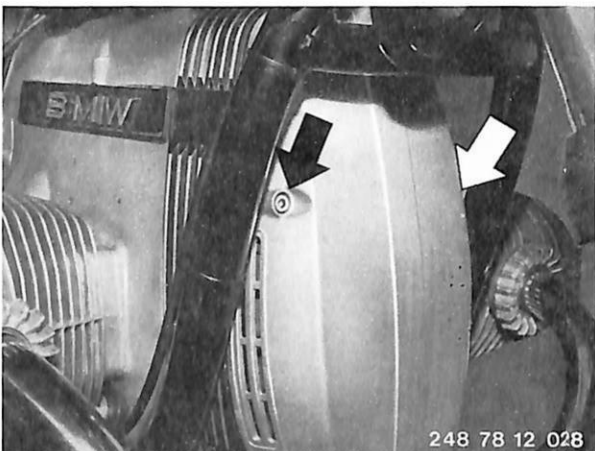
Fuel tank removed – 16 11 030.

Test should only be made when battery charge indicator lamp is on continuously while engine is running.

Pull off multiple plug from regulator with engine stopped. Bridge blue wire D+ and blue/black wire DF.

Start engine and run at approx. 1000 . . . 2000 rpm. Regulator is defective, if battery charge indicator lamp goes out immediately.

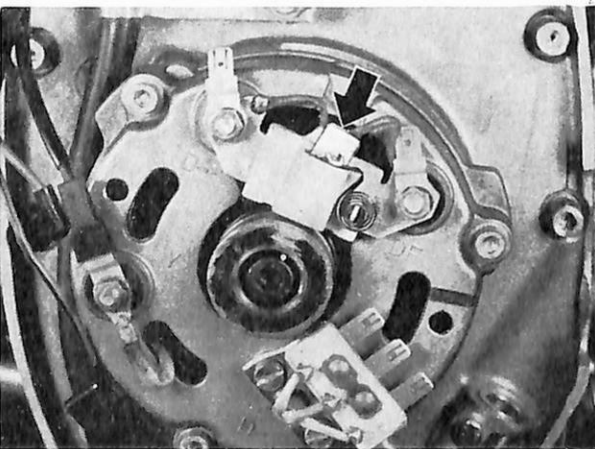
Alternator is defective, if battery charge indicator lamp glimmers or continues to burn bright.



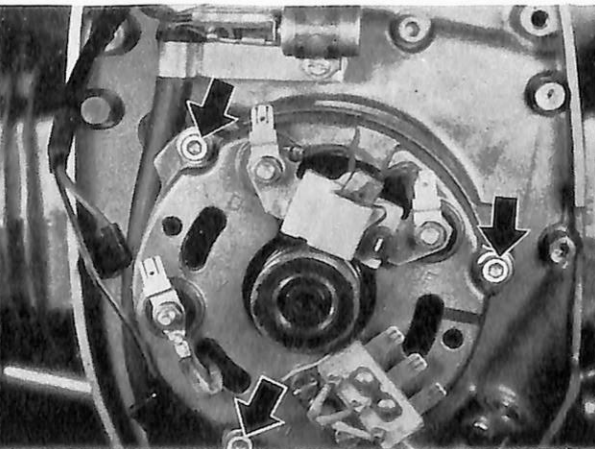
### 12 31 020 Removing and Installing Alternator

Engine removed (11 00 050) or installed.

Take off engine cover after unscrewing the 3 socket head screws.



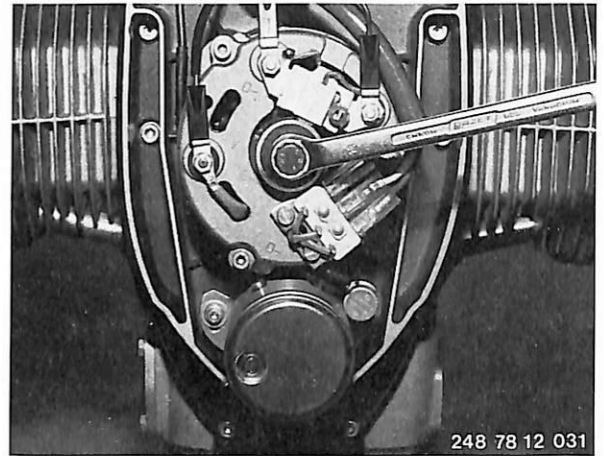
Pull off three-pin flat male plug from pole housing. Pull up carbon brushes a little and hold in this position with springs.



Unscrew the three socket head screws from pole housing and remove pole housing.



Unscrew rotor mounting screw and press off rotor from end of crankshaft with special tool, BMW No. 12 3 600.

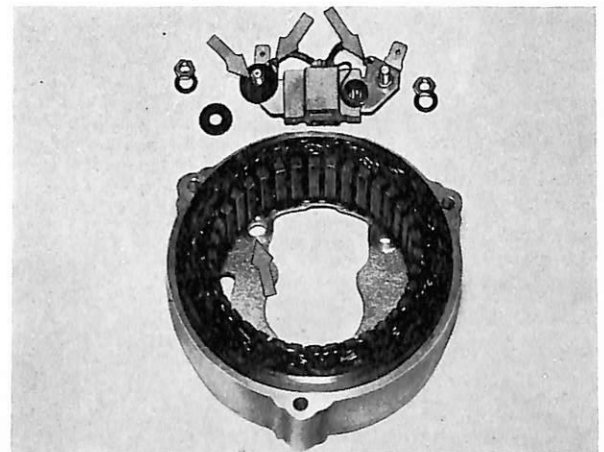


### 12 31 212 Overhauling Alternator

Remove and install alternator – 12 31 020.

Unscrew 2 nuts from inside of pole housing. Pull off brush holder with carbon brushes. If carbon brushes have to be replaced, be careful that solder does not run into copper leads when soldering (arrow).

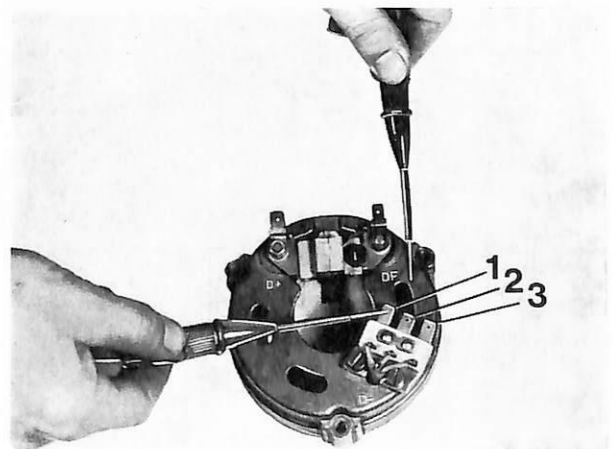
Install insulators on staybolts of brush holder. Install brush holder in pole housing, not forgetting the insulating washers.



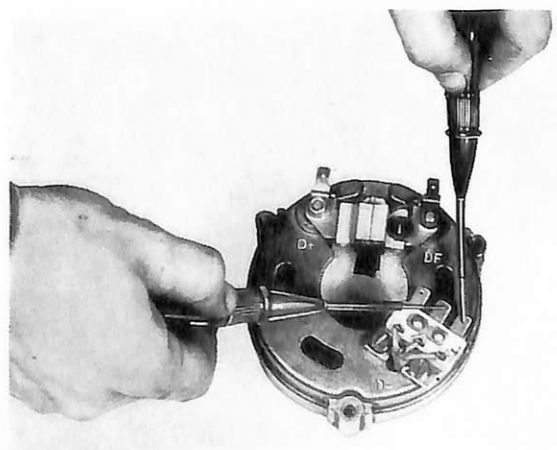
### 12 31 689 Checking Field Coil and Rotor

Overhaul alternator – 12 31 212.

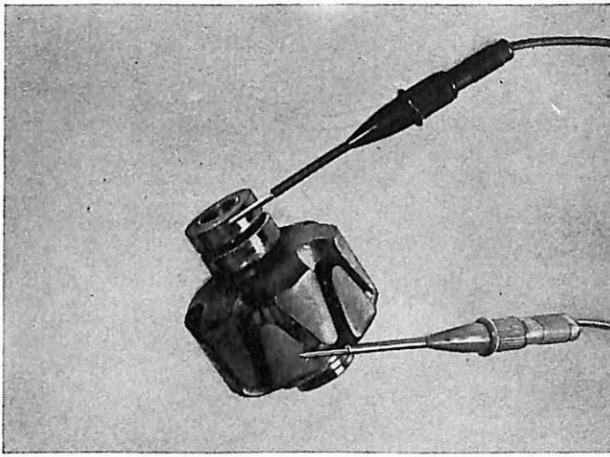
Check ground of field coil with 40 V AC, making 3 measurements.



Check resistance between phase outlets alternately. Refer to Specifications for values.







Check ground of removed claw-type rotor with 40 V AC.



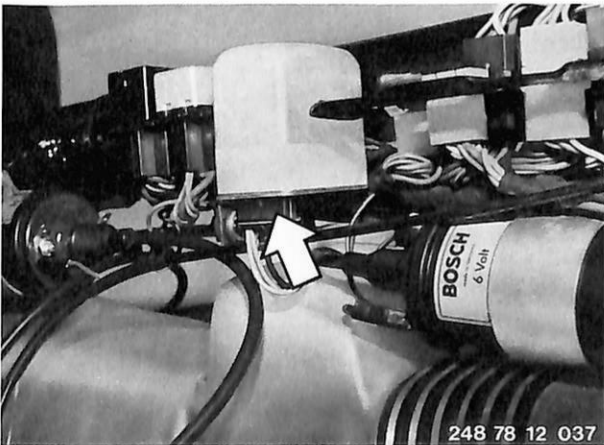
Check exciter coil with ohmmeter.



### 12 32 000 Removing and Installing Regulator Cutout

Remove fuel tank – 16 11 030.

Disconnect ground wire from battery. Pull off plug (arrow) and remove regulator after unscrewing both socket head screws.



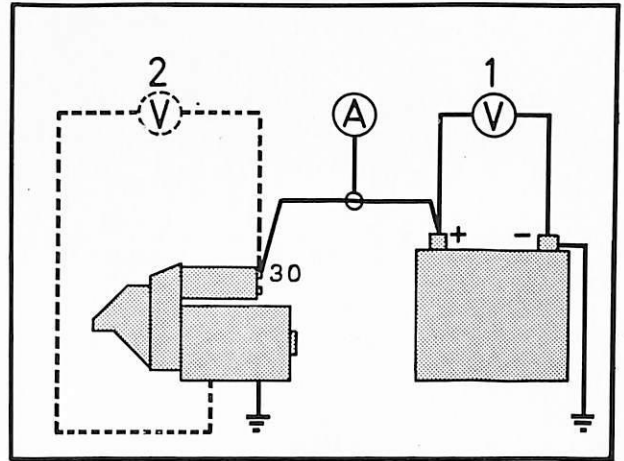
### Trouble-shooting – alternator

| Fault                                                                          | Cause                                                                                                                                                                                                                                       | Remedy                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Noise from alternator                                                          | Carbon brushes squeaking                                                                                                                                                                                                                    | Skim sliprings, renew carbon brushes                                                                                                                                                                                                                             |
| Telltale lamp glows at half intensity when engine is running                   | Poor cable contact<br>Defective regulator<br>Defective carbon brushes<br>Defective rectifier diode, or short to earth (ground)<br>Short to earth (ground) in stator<br>Partial short to earth (ground) in rotor                             | Check cables and connections<br>Renew regulator<br>Renew carbon brushes<br>Renew rectifier diode<br><br>Renew stator<br>Renew rotor                                                                                                                              |
| Battery emitting large amounts of gas                                          | Poor contact between regulator and alternator                                                                                                                                                                                               | Check cable connections between regulator and alternator                                                                                                                                                                                                         |
| Telltale lamp burns at half or full intensity when engine is running           | Defective regulator<br>Break or short-circuit in supply leads<br>Defective carbon brushes<br>Defective rotor winding<br>Break in exciter circuit<br>Diode or diode board defective<br><br>Short to earth (ground) at cable D+/61            | Renew regulator<br>Check cables and connections<br>Renew carbon brushes<br>Renew rotor<br>Check cable connections<br>Check diode and diode board, renew if necessary<br><br>Rectify short or renew cable                                                         |
| Telltale lamp does not come on when engine is started                          | Defective bulb<br>Break in cable 61                                                                                                                                                                                                         | Install a new 3 Watt bulb<br>Rectify break                                                                                                                                                                                                                       |
| Telltale lamp does not come on when engine is stopped but ignition switched on | Defective bulb<br>Battery flat<br>Battery defective<br>Cable detached or defective<br>Defective regulator<br>Short circuit at positive diode in alternator<br><br>Worn carbon brushes<br>Oxide coating on sliprings, break in rotor winding | Install a new 3 Watt bulb<br>Recharge battery<br>Renew battery<br>Renew cable or tighten terminals<br>Renew regulator<br>Disconnect charge cable at once to avoid flat battery; have alternator repaired<br><br>Renew carbon brushes<br>Have alternator repaired |

## 12 41 009 Checking Starter in Motorcycle

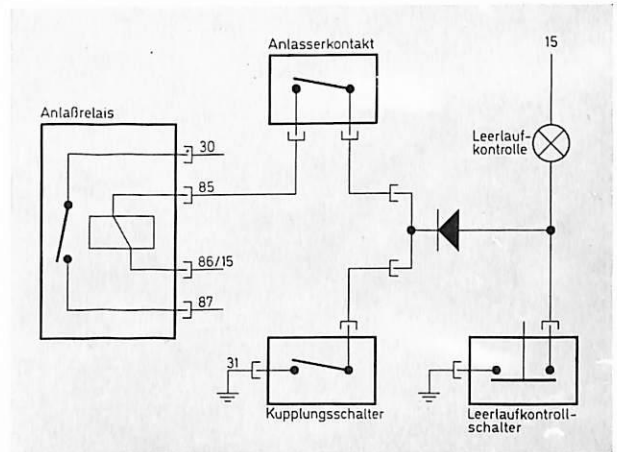
Check battery charge condition, see Specifications for values.

Engage 5th gear and operate brake pedal for testing. Operate starter 2 to 3 seconds. Starting voltage must not drop below 8 volts with load and should be identical in voltmeter positions 1 and 2. If not, ground connection on engine or battery is insufficient. Also read power input on ammeter; see Specifications.



### Important!

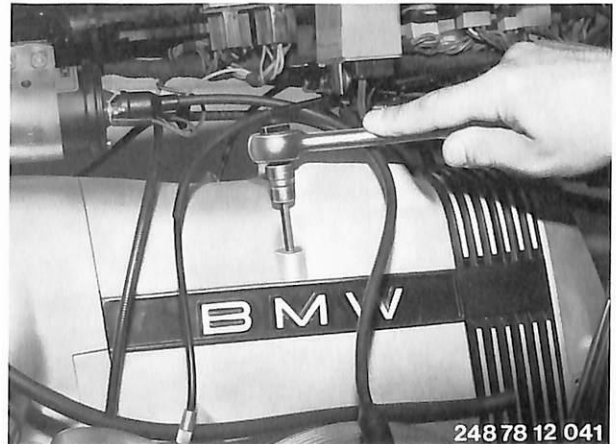
Should engine stall with gear engaged, it is possible to restart engine without disengaging gear by pulling the clutch.



## 12 41 020 Removing and Installing Starter

Disconnect ground from battery.

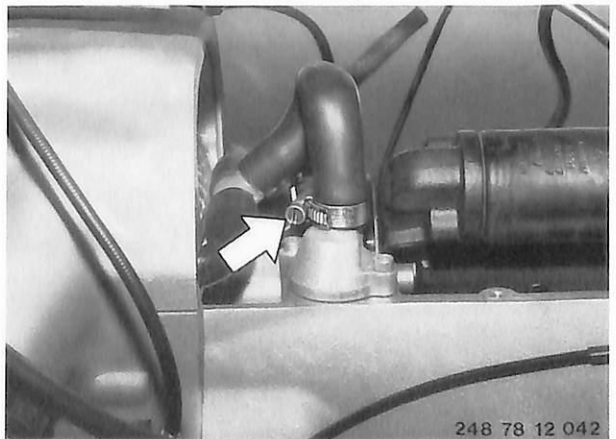
Remove starter cover toward right side after unscrewing both socket head screws.



248 78 12 041

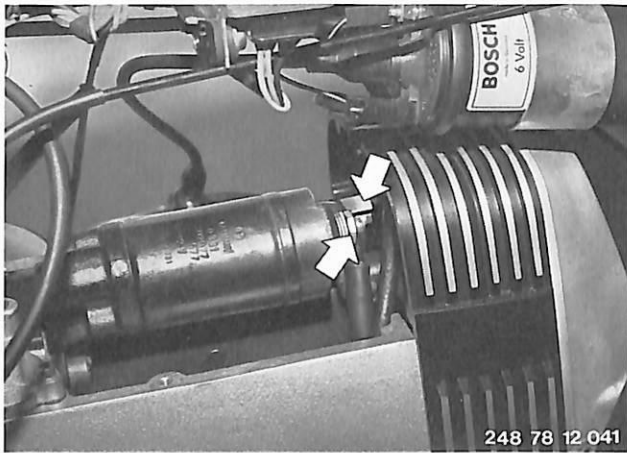
Disconnect engine vent hose on vent dome and pull out of air cleaner housing.

Beginning with 1981 models, remove air cleaner housing upper section and air filter cartridge.

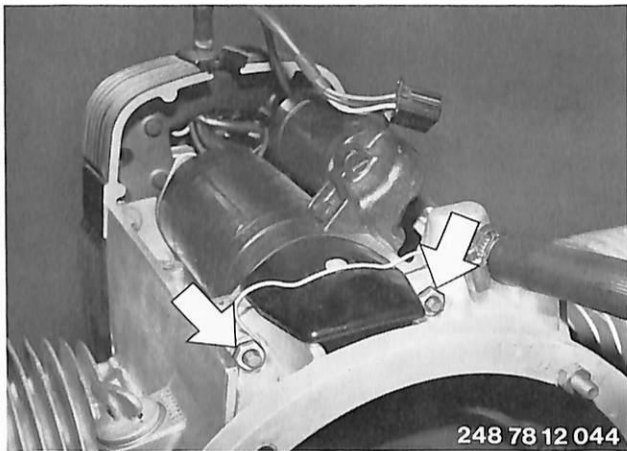


248 78 12 042

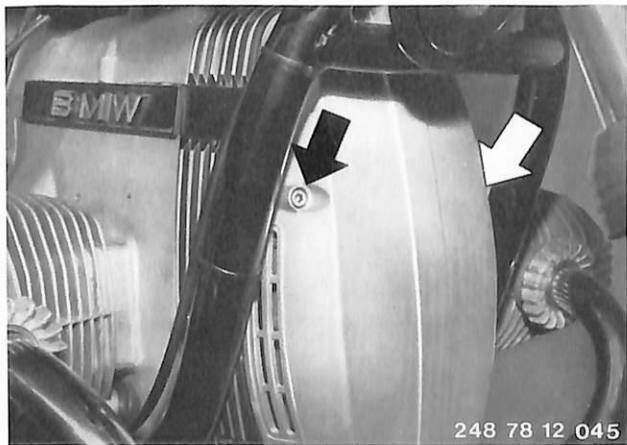




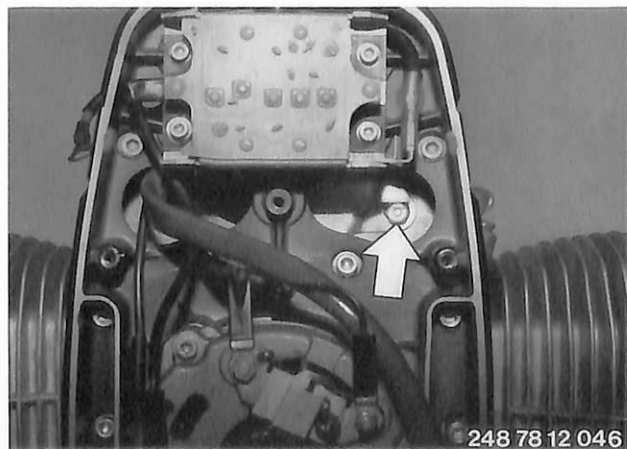
Disconnect wires (arrows) from starter.



Unscrew rear starter mounting screws (arrows).



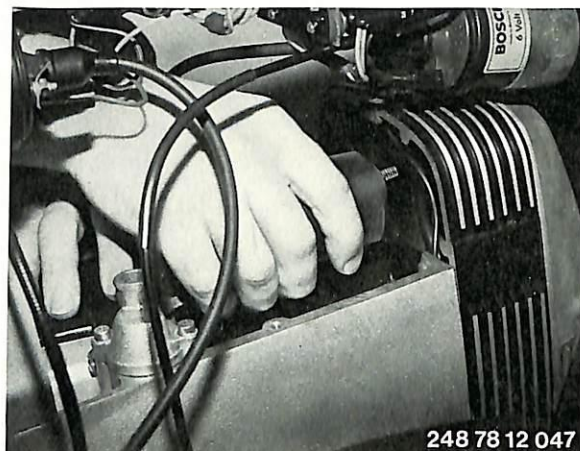
Take off engine cover after unscrewing both socket head screws.



Unscrew hexagon head screw (arrow) with a socket wrench.

Remove engine vent hose — 11 15 101.

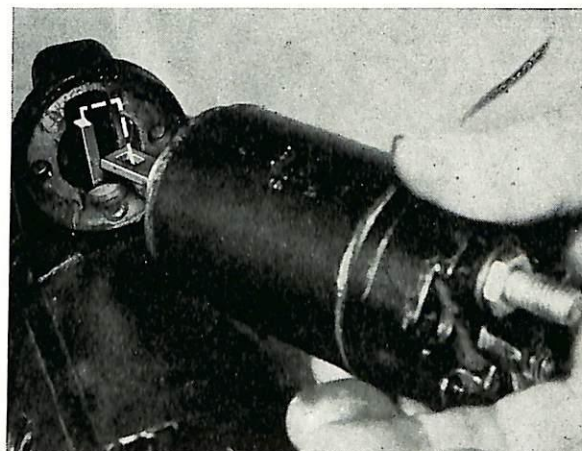
Remove starter from guide forward.



### 12 41 513 Disassembling and Assembling Starter

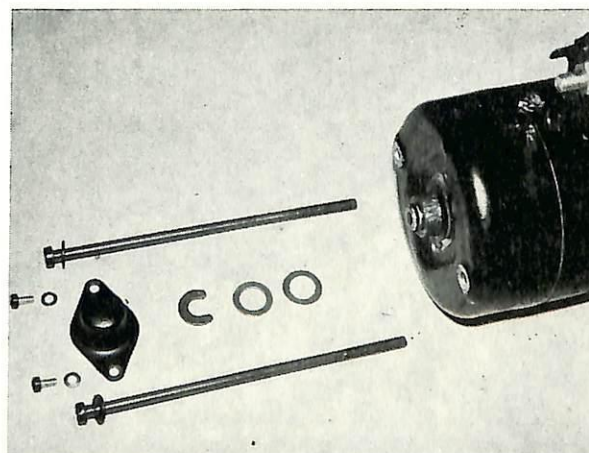
Remove and install starter — 12 41 020.

Unscrew wire for exciter coil.  
Detach solenoid.  
Disengage connecting lever.

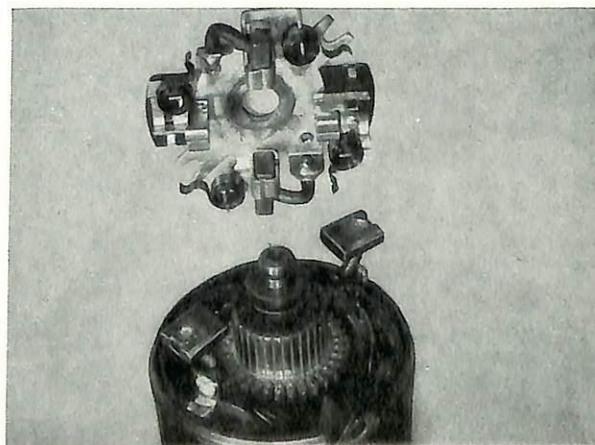


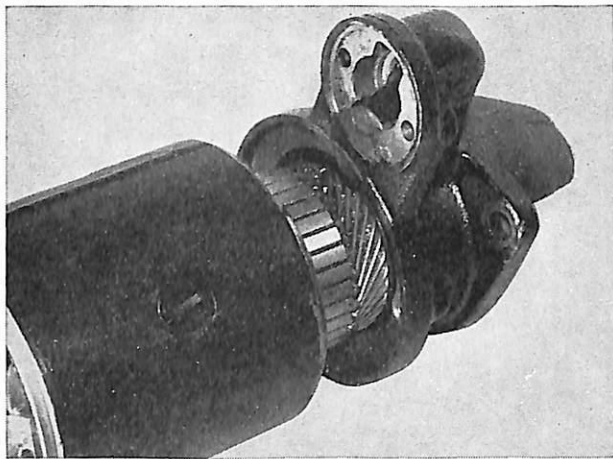
Take off dust cap.  
Remove lockwasher, shim and seal.  
Unscrew pole housing screws.  
Pull off cap.

**Installation Note!** Take up armature axial play, see Specifications.  
Check commutator bearing.

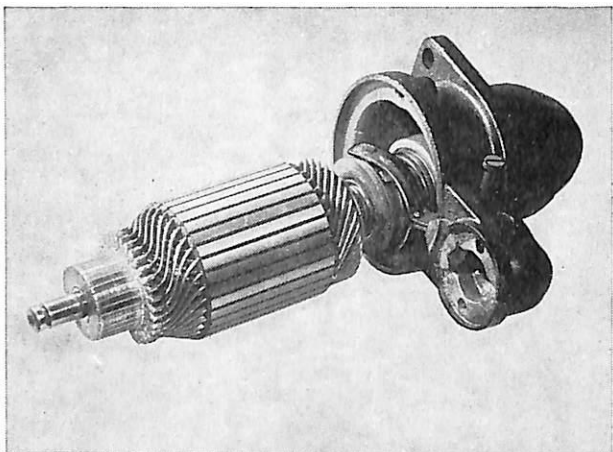


Lift out plus carbon brushes and remove carbon brush holder.

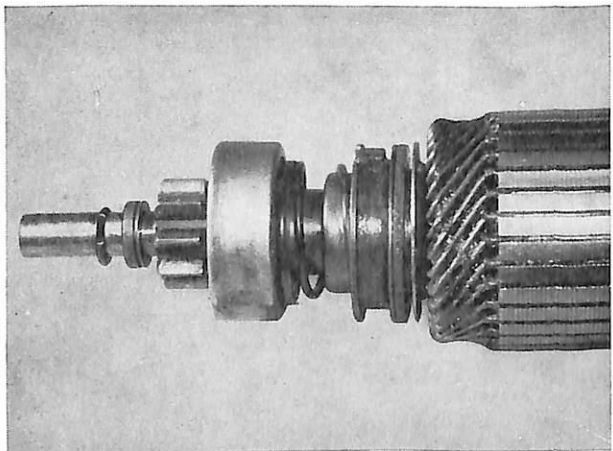




Detach pole housing from drive bearing.



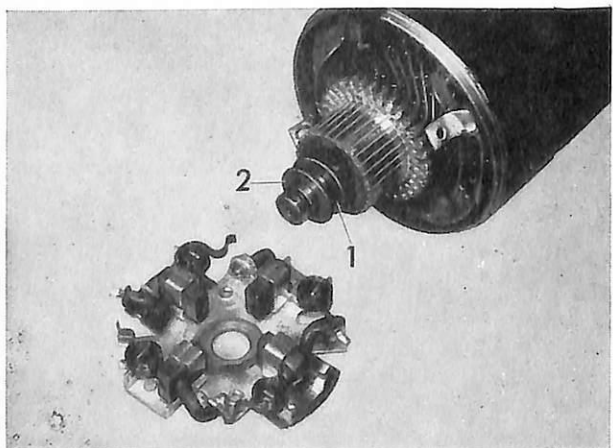
Unscrew bearing bolt for connecting lever.  
Pull out armature with connecting lever.



Press back thrust ring.  
Remove circlip.  
Pull off starter gears.

**Installation Note!** Coat threads and engaging ring with Bosch Ft 2 v 3 silicone grease.

Pull thrust ring over circlip.



## 12 41 541 Replacing Carbon Brushes

Disassemble and assemble starter – 12 41 513.

Unsolder old and solder new carbon brushes at exciter coil and carbon brush holder.

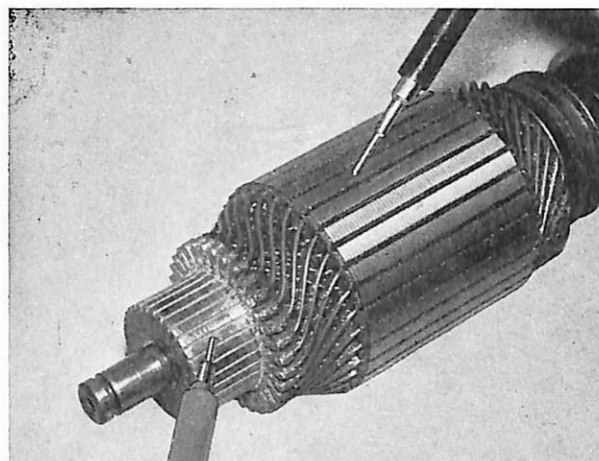
**Installation Note!** Washer (1) on armature, insulator (2) first.



## 12 41 602 Overhauling Starter

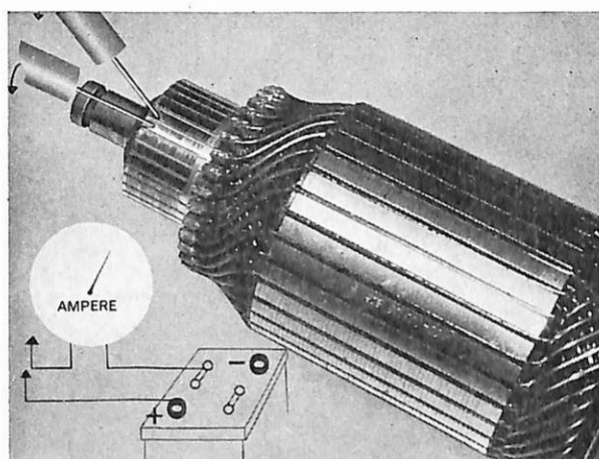
Disassemble and assemble starter — 12 41 513.

Check armature and field coil with a 220 volt test lamp. Touch test prods against commutator and set of plates. Lamp comes on if grounded; replace armature.



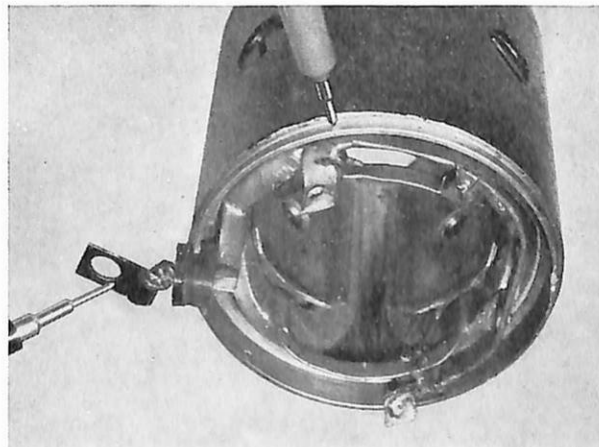
Install ammeter (range: 60 amps) in circuit and touch out commutator from plate to plate briefly. Test voltage: 2 . . . 4 volts. Instrument needle deflection should be equal between separate plates.

Serious deviation indicates a break; replace a defective armature.



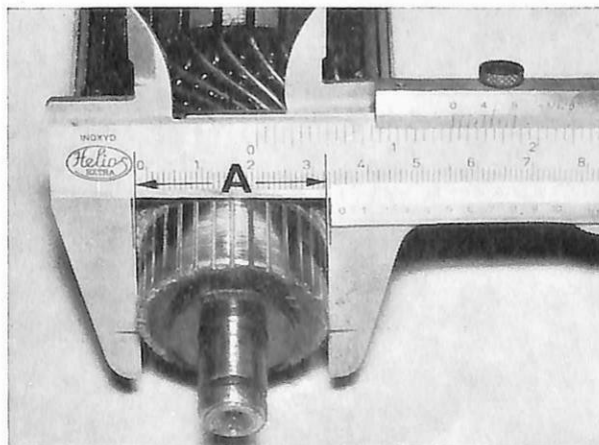
Check exciter coil for ground.

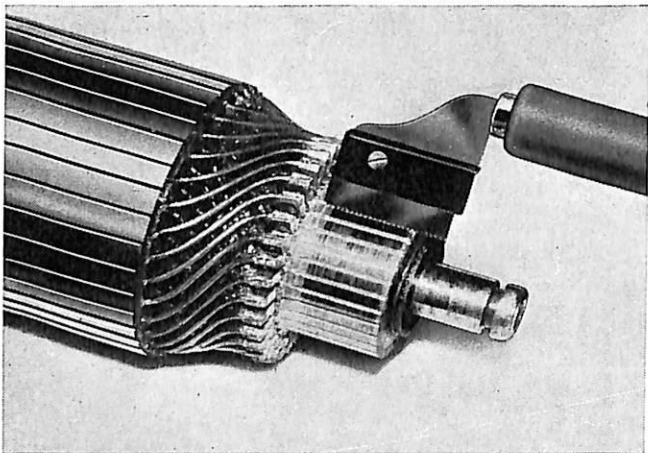
Replace burnt or melted coils.



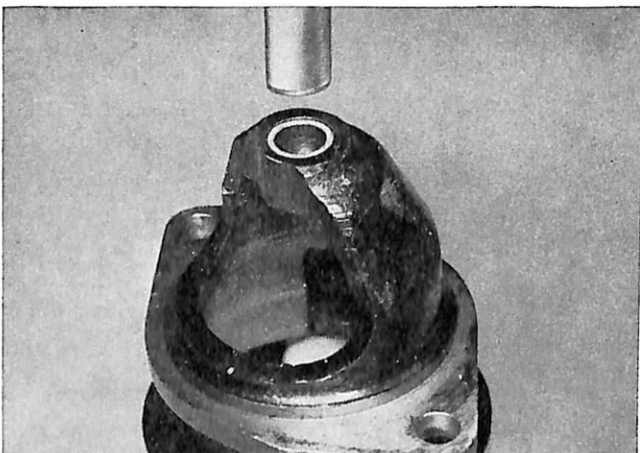
Finish grind commutator.

Commutator diameter (A) must not be less than 33 mm (1.299").



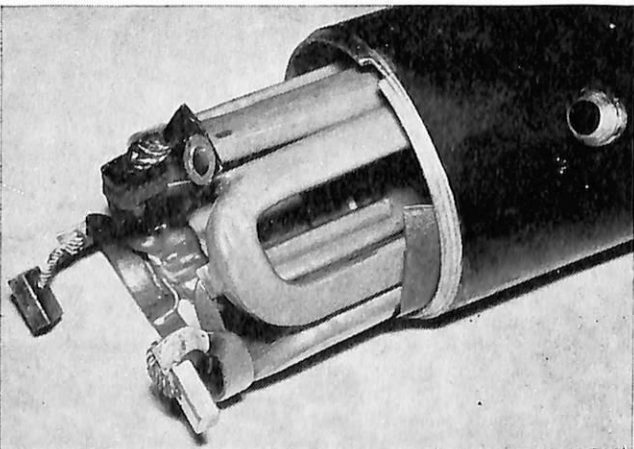


Undercut commutator plates and remove cut burrs with emery cloth. Insulation should be 0.5 mm (0.020") deeper than plates.



Press out bushing, if worn.

**Installation Note!** Prior to installation, soak new bushing in engine oil for at least 1/2 hour. Press in flush.



## 12 41 701 Replacing Exciter Coil

Disassemble and assemble starter – 12 41 513.

Mark position of pole shoes for reinstallation in same position. Unscrew the four pole shoe screws. Remove pole shoe and exciter coil from pole housing.

**Installation Note!** Align pole shoe to be parallel with longitudinal axis before tightening pole screws to final tightness. Place paper insulating strips between exciter coil and pole housing.

### Fault finding on starter

| Fault                                                                                        | Test method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Remedy                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Starter fails to turn when starter button is operated                                        | <p>Switch on light.</p> <p>a) Light does not burn.<br/>Battery dead.<br/>Battery feed interrupted.</p> <p>b) Light burns, becoming gradually dimmer as starter is actuated.</p> <p>c) Light burns but extinguishes immediately starter is actuated.<br/>Oxidized battery terminals or earth connection.</p> <p>d) Light burns normally.<br/>Bridge terminals 50 and 30 on the starter.<br/>The starter turns.<br/>Ignition/starter switch defective or input leads interrupted.</p> <p>e) Light burns normally.<br/>Solenoid switch actuates, starter fails to turn. Bridge with an appropriate lead from the battery positive pole to terminal 30 on the starter. Starter turns.<br/>Solenoid switch contact fouled or scorched.</p> | <p>a) Measure battery voltage.<br/>Recharge battery.<br/>Check battery leads and terminals.</p> <p>b) Recharge battery.</p> <p>c) Clean battery terminals or earth connection.</p> <p>d) Replace ignition/starter switch, remedy interruption.</p> <p>e) Replace solenoid switch.</p> |
| Starter fails to turn when lead is run direct from the battery positive pole to terminal 30. | <p>a) Brushes too short.</p> <p>b) Brushes jamming.</p> <p>c) Inadequate brush pressure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>a) Replace brushes.</p> <p>b) Release jamming.</p> <p>c) Replace thrust springs.</p>                                                                                                                                                                                               |
| Starter turns too slowly, fails to turn engine over.                                         | <p>c) Commutator fouled.</p> <p>b) Faulty armature or energizer coil.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>a) Clean commutator.</p> <p>b) Repair starter.</p>                                                                                                                                                                                                                                 |
| Starter runs at high speed but engine does not turn or moves only in jerks                   | <p>a) Drive pinion defective</p> <p>b) Flywheel gear ring defective</p> <p>c) Drive pinion not engaging; dirty or damaged spiral track</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>a) Renew drive pinion</p> <p>b) Renew flywheel gear ring</p> <p>c) Have starter repaired</p>                                                                                                                                                                                       |
| Drive pinion does not engage and starter runs at high speed                                  | <p>a) Very dirty drive pinion</p> <p>b) Defective coil spring in solenoid switch</p> <p>c) Badly damaged teeth on flywheel gear ring</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>a) Clean drive pinion bearings</p> <p>b) Renew solenoid switch</p> <p>c) Renew gear ring</p>                                                                                                                                                                                       |
| Drive pinion engages but starter does not turn engine over                                   | <p>a) Roller freewheel in drive pinion is slipping</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>a) Renew drive pinion</p>                                                                                                                                                                                                                                                          |





# 13 Fuel System

|                                                                                           |              |
|-------------------------------------------------------------------------------------------|--------------|
| Specifications                                                                            | Page 13- 0/3 |
| Specifications – 1981 models                                                              | 13- 0/5      |
| Specifications – 1983 models                                                              | 13- 0/7      |
| 13 00 004 Engine idle speed and fuel/air mixture – adjust                                 | 13-00/1      |
| 13 10 004 Fuel level – check and adjust                                                   | 13-10/1      |
| 13 10 009 Carburetor – clean                                                              | 13-10/1      |
| 13 10 100 Carburetors, left and right – remove and install                                | 13-10/2      |
| 13 10 370 Choke housing – remove and install                                              | 13-10/2      |
| 13 23 021 Cold start control cable (handlebar end) remove and install<br>(1981 models)    | 13-23/1      |
| 13 23 061 Cold start control cable (carburetor end) – remove and install<br>(1981 models) | 13-23/1      |
| 13 23 080 Cold start control lever – remove and install (1981 models)                     | 13-23/2      |
| 13 72 000 Air filter cartridge – remove and install                                       | 13-72/3      |
| 13 72 130 Air cleaner – remove and install (1981 models)                                  | 13-72/4      |

## Specifications

### Fuel Supply

| Model                                                               | R 65                                                                                                             |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Carburetor Design</b>                                            | Two inclined Bing constant pressure carburetors with needle jet, vacuum valve, throttle and central lever float. |
| Carburetor type BING V 64/II<br>Left carburetor<br>Right carburetor | 64/32/203<br>64/32/204                                                                                           |
| Carburetor opening in mm (in.)                                      | 32 (1.260)                                                                                                       |
| Main jet                                                            | 140                                                                                                              |
| Needle jet                                                          | 2.66                                                                                                             |
| Jet needle no.                                                      | 46-241                                                                                                           |
| Needle position                                                     | 2                                                                                                                |
| Choke jet dia. in mm (in.)                                          | 60 (2.362)                                                                                                       |
| Choke air jet dia. in mm (in.)<br>(choke tank vent)                 | 2.0 (0.080)                                                                                                      |
| Mixture bore dia. in rotary valve in mm (in.)                       | 2.0/1.2/0.7 (0.080/0.047/0.027)                                                                                  |
| Idle jet                                                            | 45                                                                                                               |
| Idle jet dia. in mm (in.)                                           | 1.0 (0.040)                                                                                                      |
| Co level at idle speed Vol. %                                       | 2.0 $\pm$ 0.5                                                                                                    |
| Bypass bore 1 dia. in mm (in.)<br>Bypass bore 2 dia. in mm (in.)    | 0.7 (0.027)<br>0.65 (0.025)                                                                                      |
| Float valve dia. in mm (in.)                                        | 2.5 (0.098)                                                                                                      |



### Specifications

| Fuel Supply                                |                                                       |
|--------------------------------------------|-------------------------------------------------------|
| Model                                      | R 65                                                  |
| Float chamber vent bore dia. in mm (in.)   | 4 (0.157)                                             |
| Idle outlet bore dia. in mm (in.)          | 1.0 (0.040)                                           |
| Air cleaner                                | One "micro star" dry air cleaner for both carburetors |
| Fuel System                                |                                                       |
| Fuel                                       | Premium grade                                         |
| Min. octane (RON) acc. to DIN 51600<br>MON | 98<br>88                                              |
| Fuel tank volume in ltr. (qts.)            | 22 (23) of which 2 (2) in reserve                     |

## For 1980 Models only!

### Fuel Supply Specifications

| Fuel Supply                                         | Model | R 65                                                                                                             |
|-----------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------|
| <b>Carburetor Design</b>                            |       | Two inclined Bing constant pressure carburetors with needle jet, vacuum valve, throttle and central lever float. |
| Carburetor type BING V 64/II                        |       |                                                                                                                  |
| Left carburetor                                     |       | 64/32/303                                                                                                        |
| Right carburetor                                    |       | 64/32/304                                                                                                        |
| Carburetor opening in mm (in.)                      |       | 32 (1.260)                                                                                                       |
| Main jet                                            |       | 145                                                                                                              |
| Needle jet                                          |       | 2.66                                                                                                             |
| Jet needle no.                                      |       | 46-241                                                                                                           |
| Needle position                                     |       | 3                                                                                                                |
| Choke jet dia. in mm (in.)                          |       | 60 (2.362)                                                                                                       |
| Choke air jet dia. in mm (in.)<br>(choke tank vent) |       | 2.0 (0.080)                                                                                                      |
| Mixture bore dia. in rotary valve in mm (in.)       |       | 2.0/1.2/0.7 (0.080/0.047/0.027)                                                                                  |
| Idle jet                                            |       | 45                                                                                                               |
| Idle jet dia. in mm (in.)                           |       | 1.0 (0.040)                                                                                                      |
| Co level at idle speed Vol. %                       |       | 2.0 $\pm$ 0.5                                                                                                    |
| Bypass bore 1 dia. in mm (in.)                      |       | 0.7 (0.027)                                                                                                      |
| Bypass bore 2 dia. in mm (in.)                      |       | 0.65 (0.025)                                                                                                     |
| Float valve dia. in mm (in.)                        |       | 2.5 (0.098)                                                                                                      |

## For 1980 Models only!

| Specifications                           |                                                       |
|------------------------------------------|-------------------------------------------------------|
| Fuel Supply                              |                                                       |
| Model                                    | R 65                                                  |
| Float chamber vent bore dia. in mm (in.) | 4 (0.157)                                             |
| Idle outlet bore dia. in mm (in.)        | 1.0 (0.040)                                           |
| Air cleaner                              | One "micro star" dry air cleaner for both carburetors |
| Fuel System                              |                                                       |
| Fuel                                     | Premium grade                                         |
| Min. octane (RON) acc. to DIN 51600 MON  | 98<br>88                                              |
| Fuel tank volume in ltr. (qts.)          | 22 (23) of which 2 (2) in reserve                     |



## Specifications 1981 Models

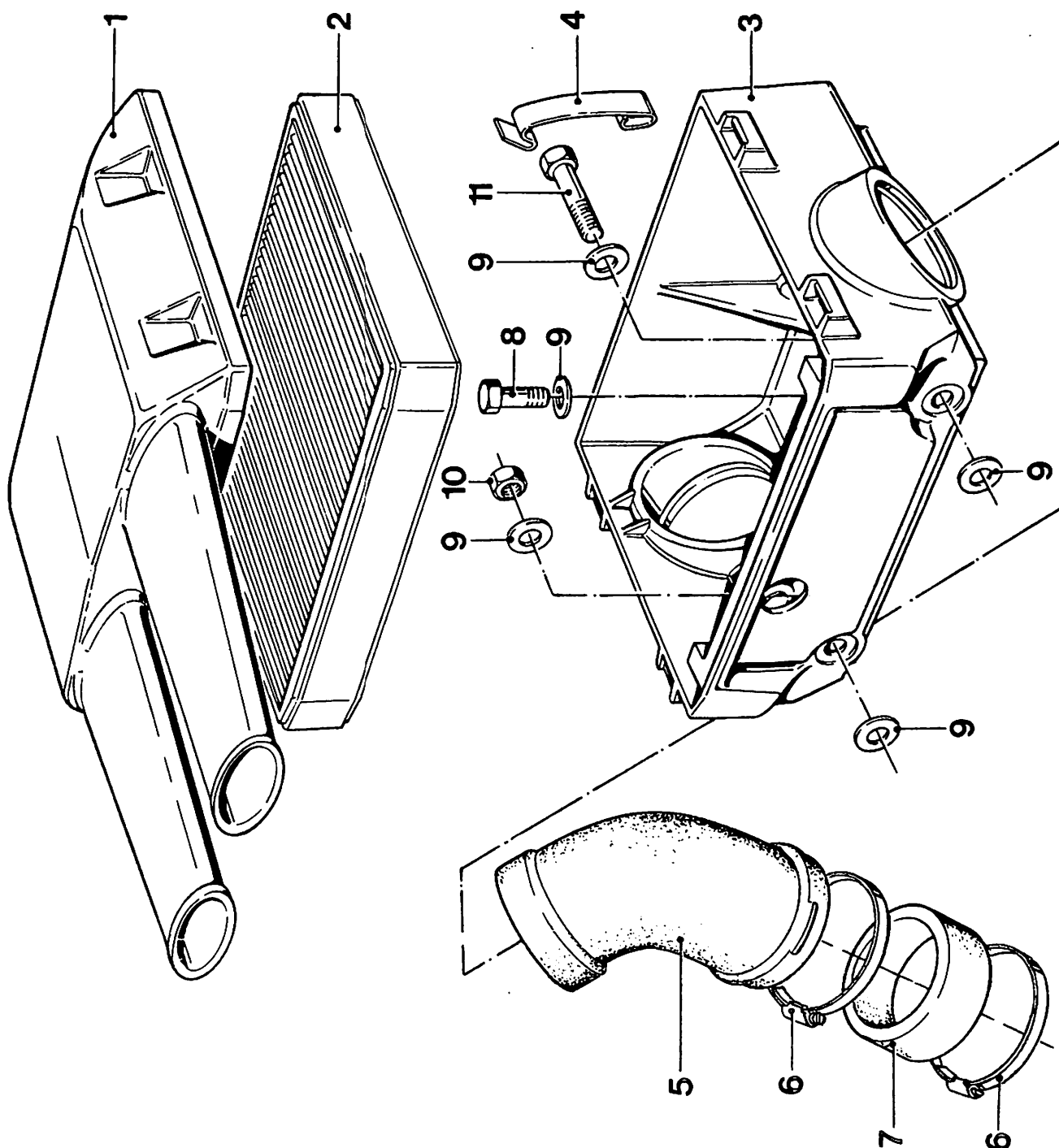
| Fuel Supply                                                         | Model | R 65                                                                                                             | R 65 LS |
|---------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------|---------|
| <b>Carburetor Design</b>                                            |       | Two inclined Bing constant pressure carburetors with needle jet, vacuum valve, throttle and central lever float. |         |
| Carburetor type BING V 64/II<br>Left carburetor<br>Right carburetor |       | 64/32/325<br>64/32/326                                                                                           |         |
| Carburetor opening in mm (in.)                                      |       | 32 (1.260)                                                                                                       |         |
| Main jet                                                            |       | 145                                                                                                              |         |
| Needle jet                                                          |       | 2.66                                                                                                             |         |
| Jet needle no.                                                      |       | 46-241                                                                                                           |         |
| Needle position                                                     |       | 3                                                                                                                |         |
| Choke jet dia. in mm (in.)                                          |       | 60 (2.362)                                                                                                       |         |
| Choke air jet dia. in mm (in.)<br>(choke tank vent)                 |       | 2.0 (0.080)                                                                                                      |         |
| Mixture bore dia. in rotary valve in mm (in.)                       |       | 2.0/1.2/0.7 (0.080/0.047/0.027)                                                                                  |         |
| Idle jet                                                            |       | 40                                                                                                               |         |
| Idle jet dia. in mm (in.)                                           |       | 1.0 (0.040)                                                                                                      |         |
| Co level at idle speed Vol. %                                       |       | 2.0 $\pm$ 0.5                                                                                                    |         |
| Bypass bore 1 dia. in mm (in.)<br>Bypass bore 2 dia. in mm (in.)    |       | 0.7 (0.027)<br>0.65 (0.025)                                                                                      |         |
| Float valve dia. in mm (in.)                                        |       | 2.5 (0.098)                                                                                                      |         |



## Specifications 1981 Models

| Fuel Supply                                |  | R 65 |                                                       | R 65 LS |
|--------------------------------------------|--|------|-------------------------------------------------------|---------|
| Model                                      |  |      |                                                       |         |
| Float chamber vent bore dia. in mm (in.)   |  |      | 4 (0.157)                                             |         |
| Idle outlet bore dia. in mm (in.)          |  |      | 1.0 (0.040)                                           |         |
| Air cleaner                                |  |      | One "micro star" dry air cleaner for both carburetors |         |
| <b>Fuel System</b>                         |  |      |                                                       |         |
| Fuel                                       |  |      | Premium grade                                         |         |
| Min. octane (RON) acc. to DIN 51600<br>MON |  |      | 98<br>88                                              |         |
| Fuel tank volume in ltr. (qts.)            |  |      | 22 (23) of which 2 (2) in reserve                     |         |

# Air cleaner (beginning with 1980 models)



- 1) Air cleaner housing, upper
- 2) Air filter cartridge
- 3) Air cleaner housing, lower
- 4) Clamp
- 5) Intake line
- 6) Hose clamp

- 7) Rubber sleeve
- 8) Hexagon head bolt
- 9) Washer
- 10) Hexagon nut
- 11) Fillister head bolt



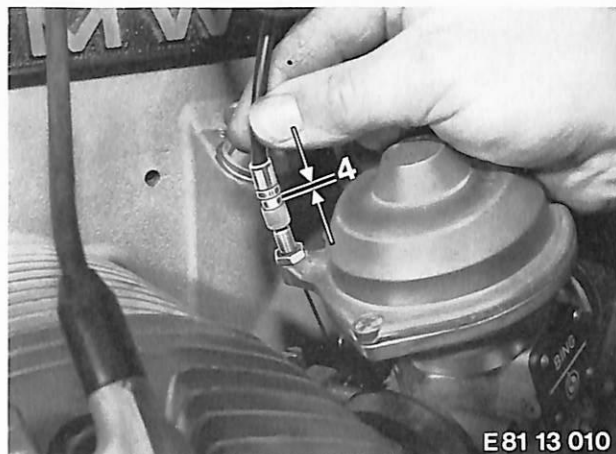
## 13 00 004 Adjusting Engine Idle Speed

Adjust idle speed with engine running and having operating temperature, and with throttle twist grip shut. Refer to Specifications for idle speed.

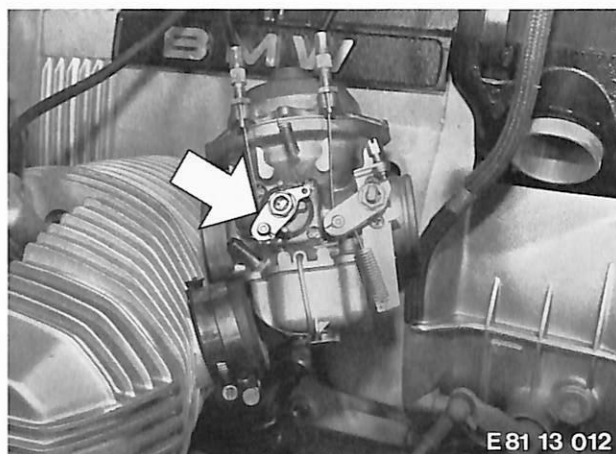
Adjust accelerator cable play to 4 mm (0.157") provisionally, to prevent throttles from catching on cables.

### Note:

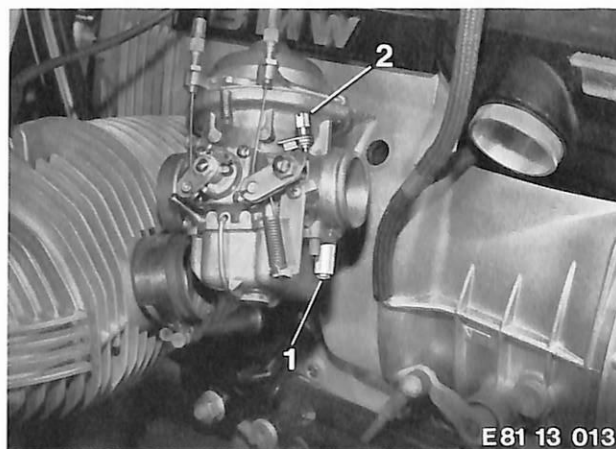
The carburetors have sometimes been detached and turned to the side for more clarity in the pictures.



Adjust accelerator cables to basic position. Adjust choke cables that choke levers (arrow) are pressed to their final position when choke control is switched off.



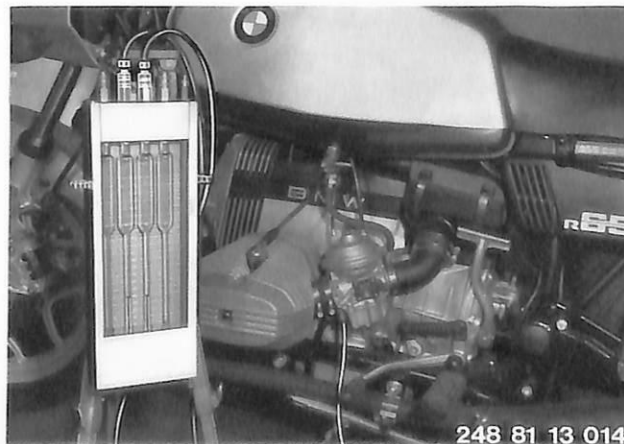
Adjust idle mixture control screw 1 and throttle stop screw 2 of both carburetors to basic position. This means tightening idle mixture control screw fully and then unscrewing it by the specified number of turns, see Specifications. Tighten throttle stop screw until it just touches stop of throttle lever, then tighten screw by one more turn.

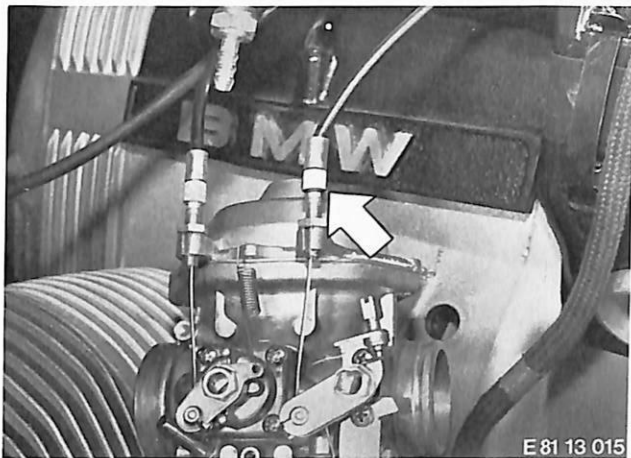


Use tester, BMW No. 13 0 700, to synchronize the carburetors. Unscrew plug (arrow) in tester connection bore and push on rubber hose from synchronizer.

Synchronize carburetors by tightening throttle stop screw and idle mixture control screw alternately.

If engine speed is still not within range of 800 to 1100 rpm, decrease or increase speed by turning both throttle stop screws anticlockwise or clockwise uniformly. Make final adjustment with idle mixture control screw!



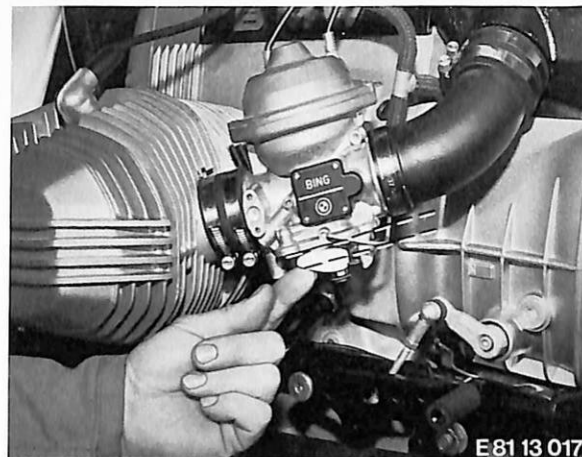


To adjust the accelerator cables, increase engine speed slightly with the throttle twist grip and check speed of each separate cylinder by pulling off the spark plug connectors alternately. Adjust accelerator cables with adjusting screw and counterlock with hexagon nut (arrow).

Never run engine of stationary motorcycle without cooling for more than 10 minutes!

### 13 10 004 Checking and Adjusting Fuel Level

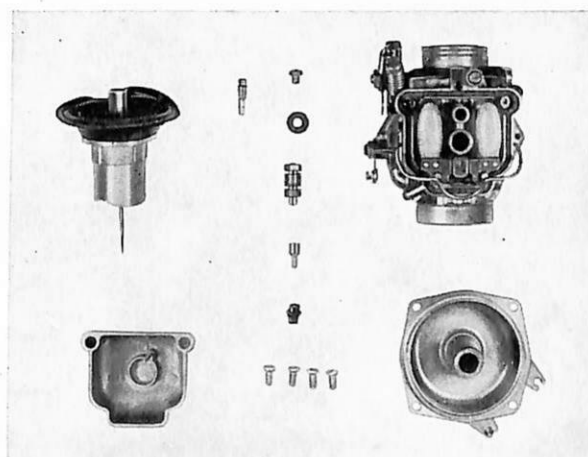
Shut fuel valve and remove float housing on carburetor. Push up float with finger and open fuel valve. No fuel should run out. Lower float slowly. Fuel should start to run out when shaped edge of float is parallel to carburetor housing lower edge as illustrated. Bend tongue on float suspension accordingly when fuel outlet is too early or too late.



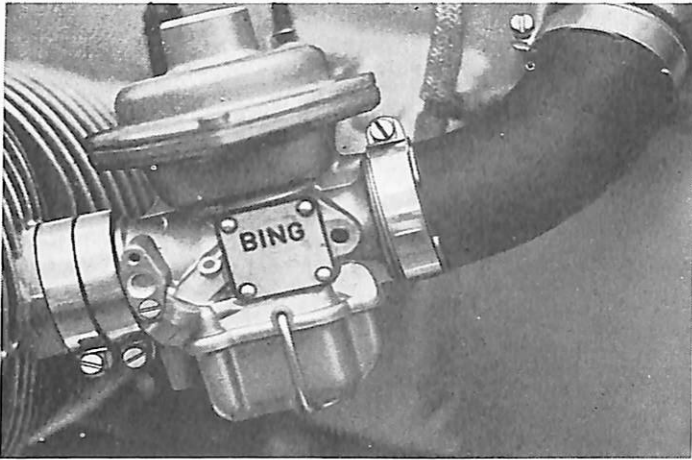
### 13 10 009 Cleaning Carburetors

Remove and install left and right carburetors 13 10 100.

Remove dome cover, piston with diaphragm, main jet carrier, main jet, needle jet and atomizer. Clean all parts in clean gasoline and dry jets and bores with compressed air.







### 13 10 100 Removing and Installing Left and Right Carburetors

Detach or unclamp choke and accelerator cables.  
Loosen straps on cylinder side and on air lines.  
Push back rubber sleeve on air cleaner housing.  
First take off air line and then carburetor.



### 13 10 370 Removing and Installing Choke Housing

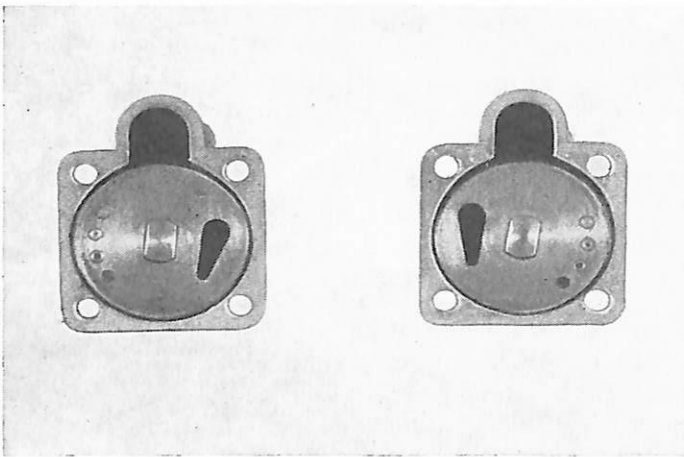
Remove and install left and right carburetors – 13 10 100.

Loosen the 4 oval head countersunk screws and take off choke/carburetor housing with rotary valve and gasket.

Don't mix up left and right choke/carburetor housings!

Pos. 1 = Left choke/carburetor housing

Pos. 2 = Right choke/carburetor housing

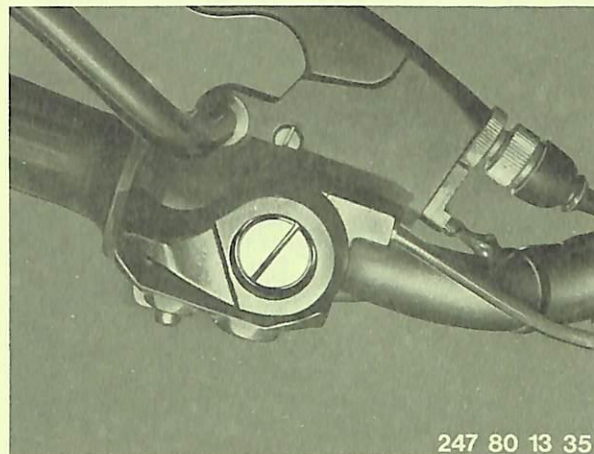


2

1

### 13 23 080 Removing and installing cold start control lever (1980 models)

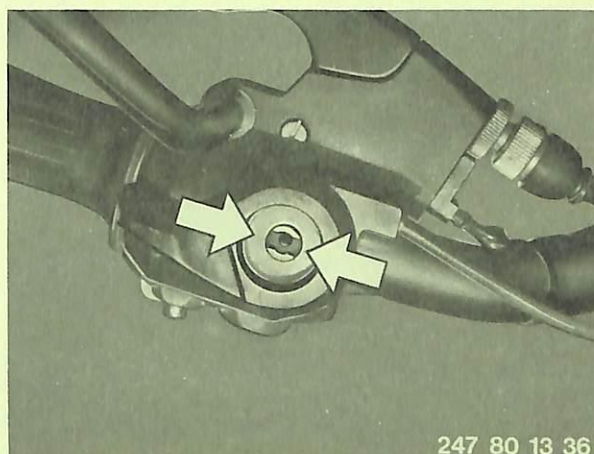
Press out plastic cover with a small screwdriver, unscrew mounting bolt and remove.



Take off lever, guiding cable through slot in housing.

#### **Installation:**

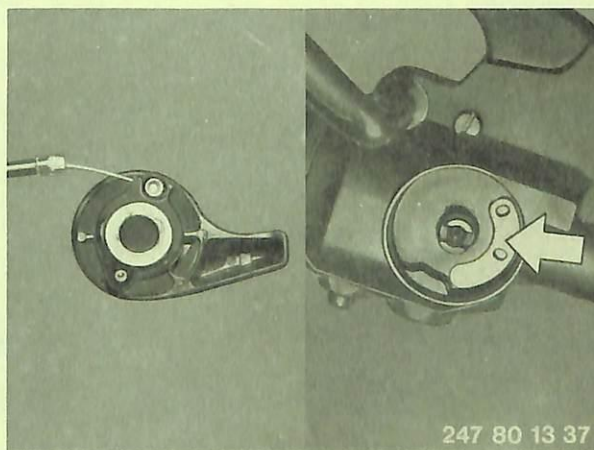
Tabs of washer must fit in slots of housing (arrows).



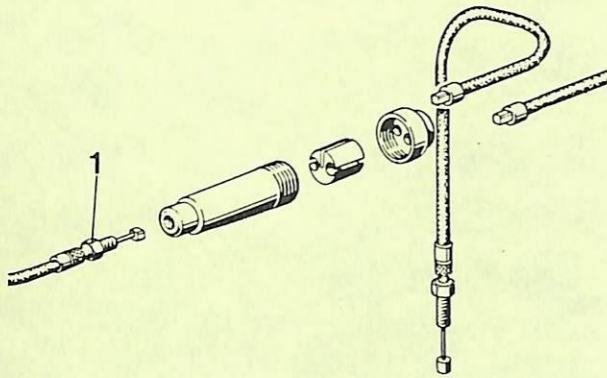
Disconnect cable at lever.

#### **Installation:**

Make sure catch plate fits properly. (arrow)







247 80 13 38

### 13 23 021 Removing and installing cold start control cable (front) – 1980 models

Remove and install cold start control lever 13 23 080. Unscrew locknut of adjusting screw (1) on branch and tighten adjusting screw fully.



Turn sleeve of branch (1), holding the knurled part (2) tight. Disconnect cable at branch (arrow).

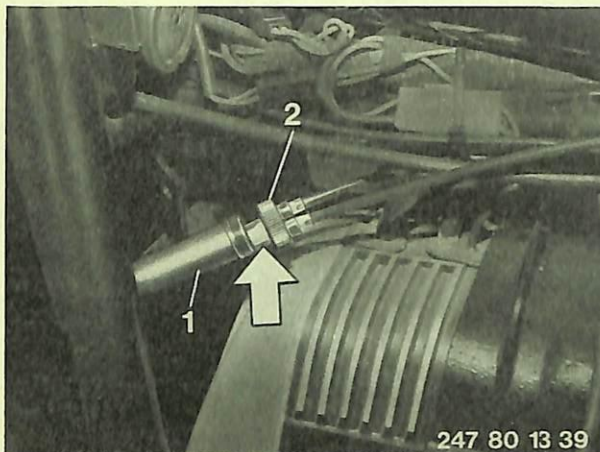


### 13 23 061 Removing and installing cold start control cable (carburetor) – 1980 models

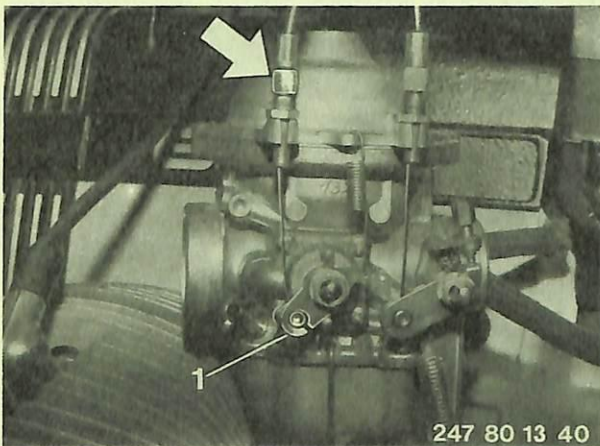
Unscrew locknut of adjusting screw on carburetor and remove screw (arrow) from carburetor housing.

Disconnect cable at lever (1) of cold start control.

Disconnect cable at branch as described in 13 23 021.



247 80 13 39



247 80 13 40



### 13 72 000 Removing and Installing Air Cleaner Filter Cartridge

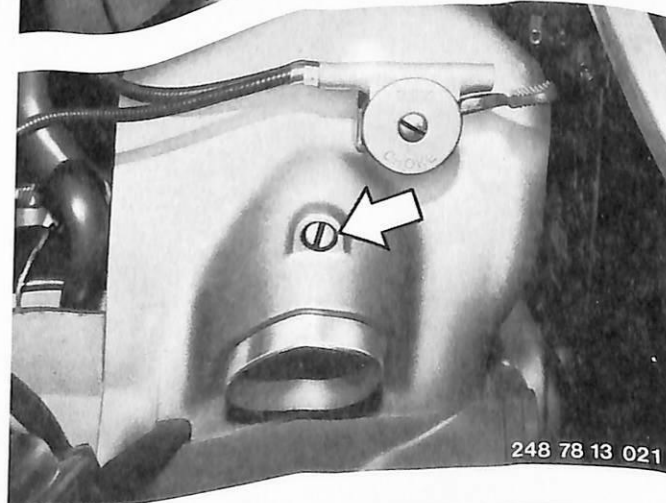
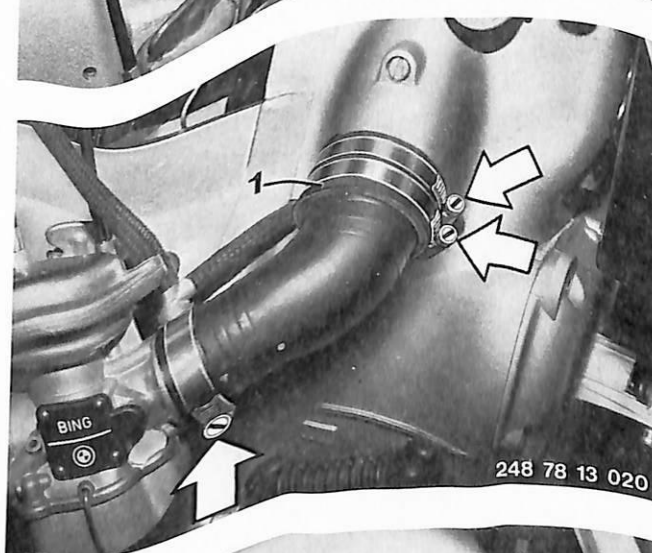
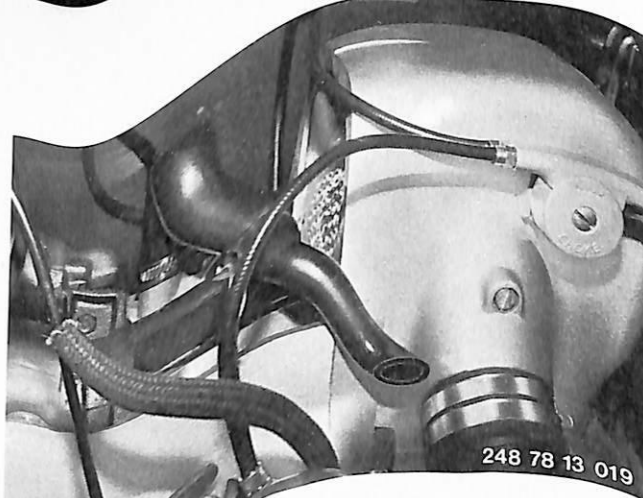
Remove and install fuel tank — 16 11 030.

Take off choke cover toward right after unscrewing both socket head screws and pull out engine vent hose from left half of air cleaner housing.

Loosen clamps from left air line (arrows) and remove air line after pushing back rubber sleeve (1).

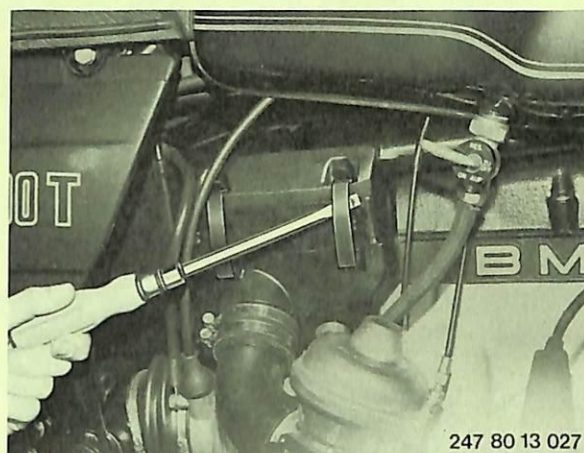
Unscrew fillister head screw (arrow) from left half of air cleaner housing and pull off housing shell.

Remove filter cartridge.

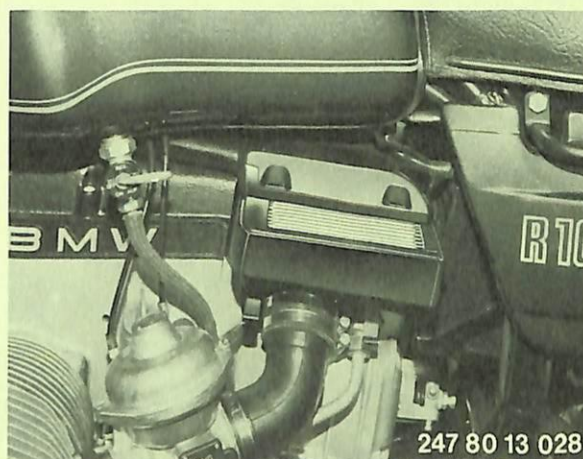


## 13 72 000 Removing and installing air filter cartridge (1980 models)

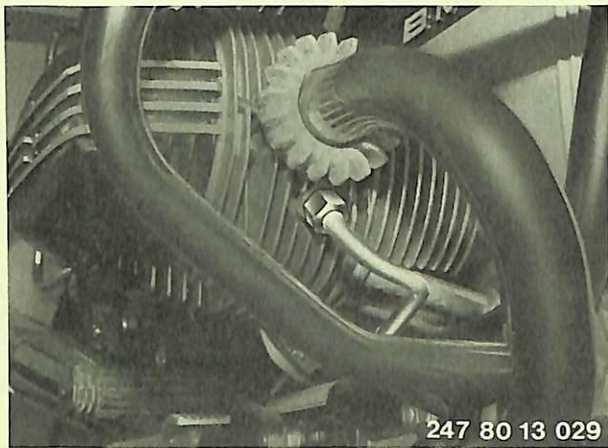
Press off mounting clips with a screwdriver.



Pull out plate filter and push in the new filter. Mount air cleaner housing cover with clips again, making sure that filter fits properly.

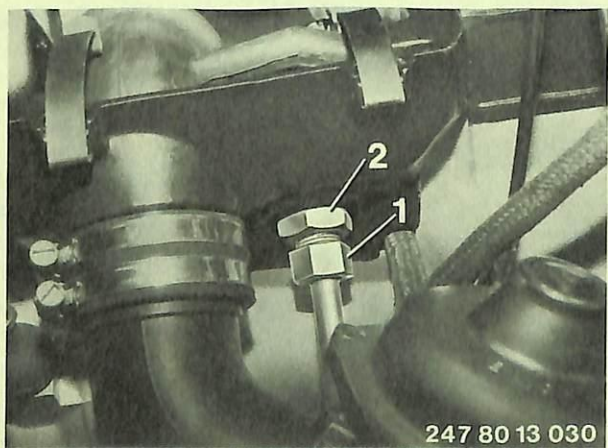






### **13 72 080 Removing and installing intake line (1980 models)**

Unscrew coupling nuts of intake line at cylinder head and air cleaner, and remove intake line.



### **13 72 100 Removing and installing valve (1980 models)**

Remove and install air cleaner 13 72 000.

Pull out air cleaner housing from above.

Unscrew coupling nut of intake line (1) and also mounting nut of valve (2).

Pull valve out of air cleaner housing.



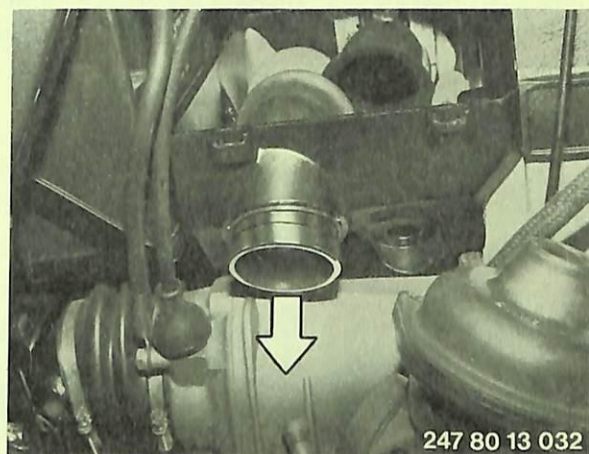
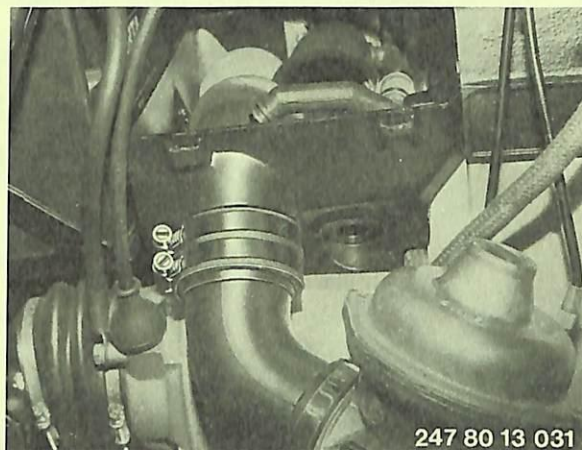


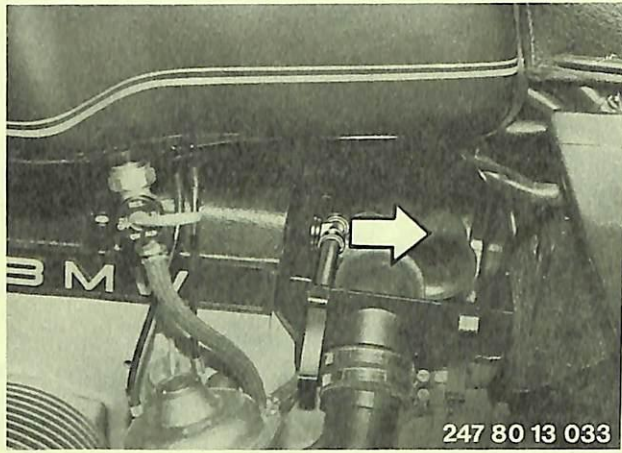
### 13 72 110 Removing and installing intake neck (1980 models)

Remove and install air cleaner 13 72 000.

Loosen hose clamps on intake line, push back rubber sleeve and remove air line.

Press out adapter from inside with a screwdriver and then pull out the intake neck.





247 80 13 033

### 13 72 130 Removing and installing air cleaner (1980 models)

Remove air cleaner 13 72 000 and pull out air cleaner housing from above.

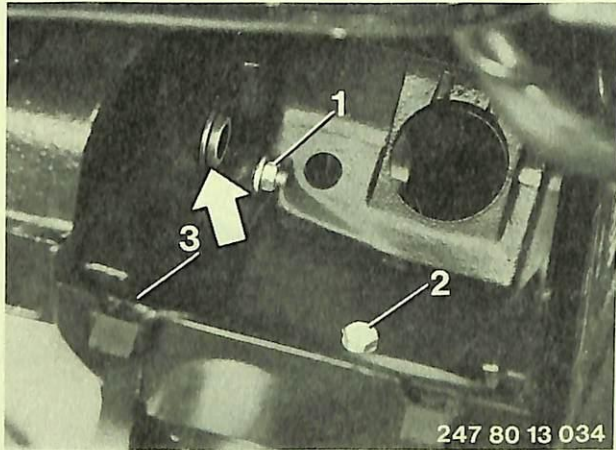
Remove valves 13 72 100.

Remove air lines.

Remove battery 61 21 010.

Remove battery console 61 21 100.

Pull T-adaptor of crankcase breather out of air cleaner housing in direction of arrow.



247 80 13 034

Unscrew nut (1) and bolts (2 and 3) used to mount the housing. Press discharging line (arrow) out of the air cleaner housing. Remove housing.









# 16 Fuel Tank and Lines

|                                                    |              |
|----------------------------------------------------|--------------|
| Specifications . . . . .                           | Page 16- 0/3 |
| Specifications – 1981 models . . . . .             | 16- 0/3      |
| 16 11 030 Fuel tank – remove and install . . . . . | 16-11/1      |

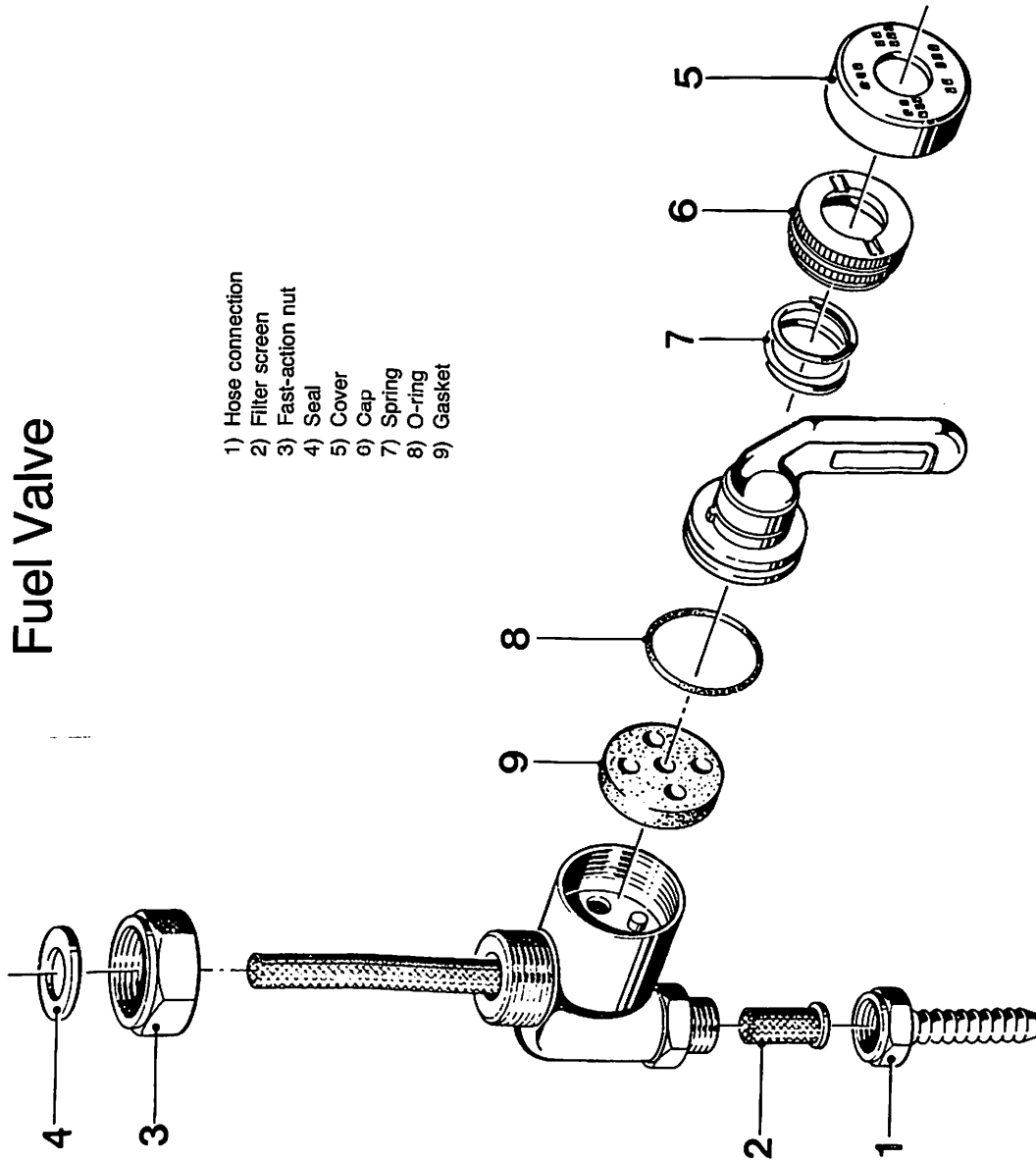
| Fuel Tank and Lines                                                   |  | Specifications   |
|-----------------------------------------------------------------------|--|------------------|
| Model                                                                 |  | R 65             |
| Fuel tank volume in ltr. (qts.)<br>of which in reserve in ltr. (qts.) |  | 22 (23)<br>2 (2) |



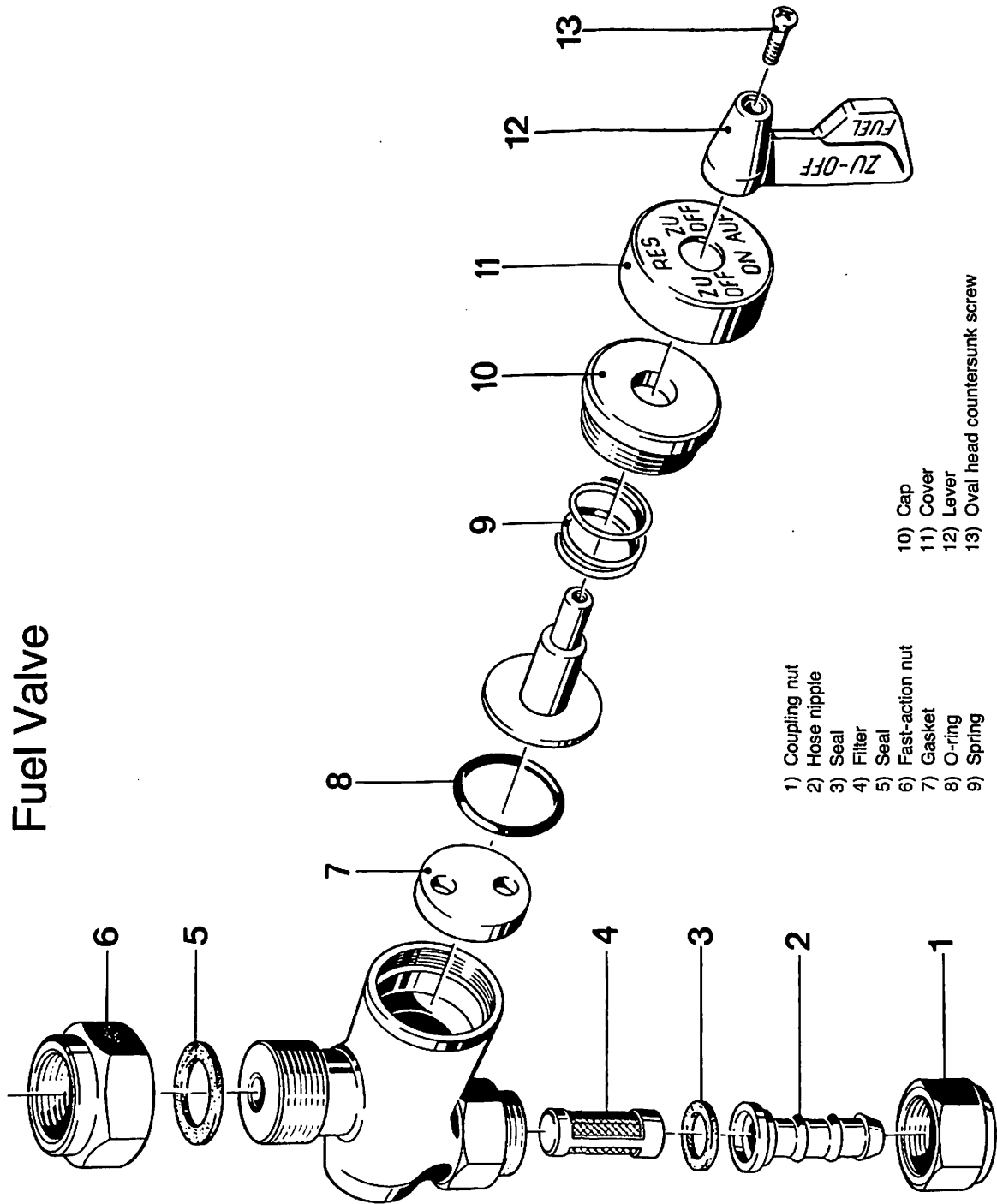
## Specifications 1981 Models

| Fuel Tank and Lines                                                   |  | Specifications 1981 Models |        |
|-----------------------------------------------------------------------|--|----------------------------|--------|
| Model                                                                 |  | R 65                       | R 65LS |
| Fuel tank volume in ltr. (qts.)<br>of which in reserve in ltr. (qts.) |  | 22 (23)<br>2 (2)           |        |

# Fuel Valve



# Fuel Valve



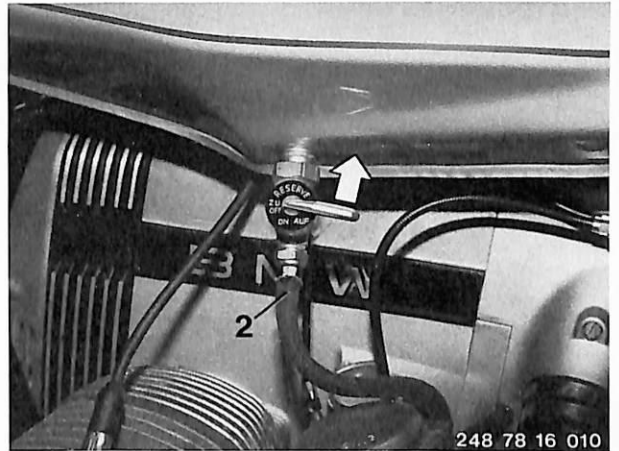
- 1) Coupling nut
- 2) Hose nipple
- 3) Seal
- 4) Filter
- 5) Seal
- 6) Fast-action nut
- 7) Gasket
- 8) O-ring
- 9) Spring

- 10) Cap
- 11) Cover
- 12) Lever
- 13) Oval head countersunk screw



## 16 11 030 Removing and Installing Fuel Tank

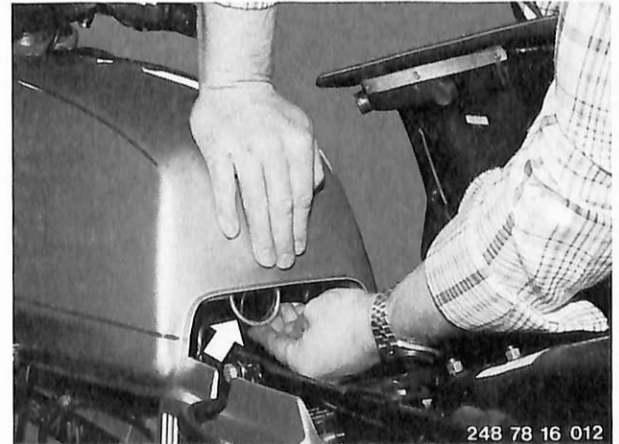
Shut fuel cock (1) and pull off fuel hose (2).



Pull off overflow line from tank at bottom left (arrow).



Fold up rear seat cushion and remove tool tray. Press down tank with left hand and fold bracket (arrow) forward with right hand. Pull back fuel tank slightly, lift front end and remove.





# 18 Exhaust System

|                                                           |              |
|-----------------------------------------------------------|--------------|
| Specifications . . . . .                                  | Page 18- 0/3 |
| Specifications – 1981 models . . . . .                    | 18- 0/5      |
| 18 00 020 Exhaust assembly – remove and install . . . . . | 18-00/1      |
| 18 11 321 Muffler – replace . . . . .                     | 18-00/2      |



| Specifications                |                          |
|-------------------------------|--------------------------|
| Exhaust System                |                          |
| Model                         | R 65                     |
| Muffler dia. in mm (in.)      | 87 (3.425)               |
| Exhaust pipe dia. in mm (in.) | 32 x 1.5 (1.259 x 0.060) |

Torque Values in Nm (ft lbs)

|                                                                                                                                       |                 |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Face nut for exhaust                                                                                                                  | 160±20 (116±14) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                 |

### Specifications 1981 Models

| Exhaust System                | Specifications 1981 Models |         |
|-------------------------------|----------------------------|---------|
| Model                         | R 65                       | R 65 LS |
| Muffler dia. in mm (in.)      | 87 (3.425)                 |         |
| Exhaust pipe dia. in mm (in.) | 32 x 1.5 (1.259 x 0.060)   |         |

### Torque Values in Nm (ft lbs)

Face nut for exhaust

200 + 20 (145 ± 14)

Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0.

## 18 00 020 Removing and Installing Exhaust Assembly

Remove and install muffler 18 11 321.

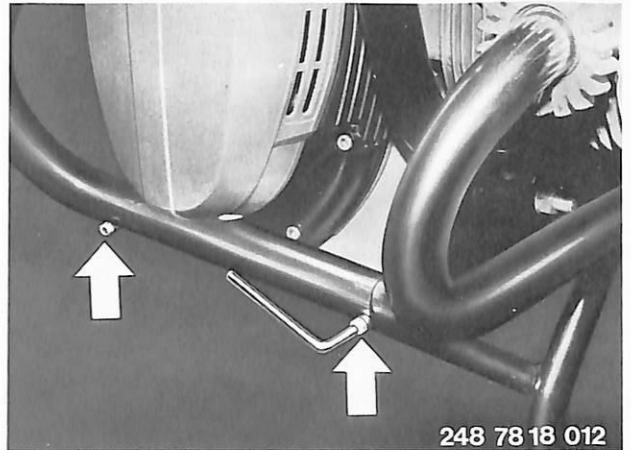
Unscrew both exhaust nuts on cylinder heads with special wrench, BMW No. 18 0 600.

### Installation:

Lubricate adapters on cylinder head with corrosion inhibition paste.



Loosen socket head bolts (arrows) on compensating pipe.



Unscrew hexagon nut on rear engine bolt and remove clamp (arrow). Loosen bolts (1) on rear compensating pipe (from 1981 models). Pull exhaust pipes out of cylinder heads and lay aside.

### Installation:

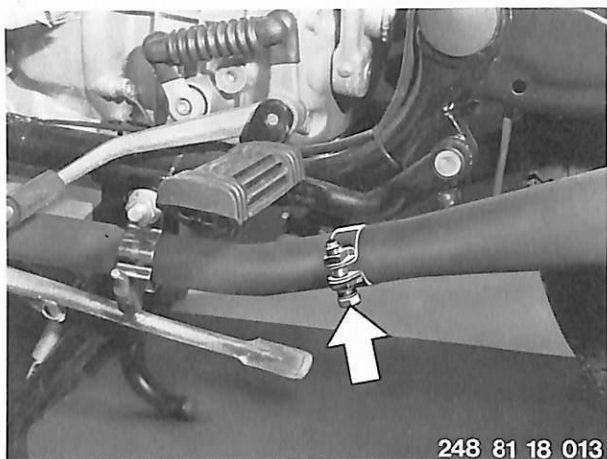
Lubricate clamping surfaces and bolts with corrosion inhibition paste.



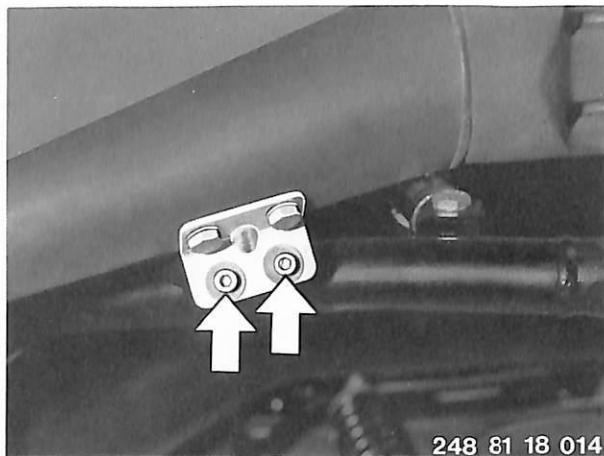


## 18 11 321 Removing and Installing Muffler

Loosen hexagon head screw on clamp and push back clamp.



Unscrew socket head screws from frame (arrow).



Pull off muffler toward rear.





# 21 Clutch

|                                                                   |              |
|-------------------------------------------------------------------|--------------|
| Specifications                                                    | Page 21– 0/3 |
| Specifications – 1981 models                                      | 21– 0/5      |
| 21 00 004 <sup>1/2</sup> Clutch play – adjust (1981 models)       | 21–00/1      |
| 21 21 000 Clutch – remove and install                             | 21–21/1      |
| 21 21 000 Clutch – remove and install (1981 models)               | 21–21/3      |
| 21 51 020 Clutch release lever – remove and install               | 21–51/1      |
| 21 51 020 Clutch release lever – remove and install (1981 models) | 21–51/3      |



## Specifications

| Clutch                                                                 | Model                                                                                                                                                                                                           | R 65 |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Type                                                                   | Single plate, dry clutch with diaphragm spring                                                                                                                                                                  |      |
| Diaphragm material thickness in mm (in.)                               | 2.6 (0.102)                                                                                                                                                                                                     |      |
| Diaphragm pressure in installed state in kp (lbs.)                     | 180 ... 220 (397 ... 485)                                                                                                                                                                                       |      |
| Height of relaxed diaphragm spring in mm (in.)                         | 15.2±0.5 (0.598±0.020)                                                                                                                                                                                          |      |
| Diaphragm spring dia. in mm (in.) (pressed flat)                       | 163 (6.417)                                                                                                                                                                                                     |      |
| Instructions for testing diaphragm spring                              | When placing edge of spring on measuring plate max. difference in height of spring tips is 0.3 mm (0.012") or when placing spring tips on measuring plate max. radial runout of spring edge is 0.8 mm (0.031"). |      |
| Total clutch disc thickness in mm (in.) (plate and liner)              | 6±0.25 (0.236±0.010)                                                                                                                                                                                            |      |
| Clutch disc outside dia. in mm (in.)                                   | 160 (6.299)                                                                                                                                                                                                     |      |
| Max. lateral runout of clutch disc at outside diameter in mm (in.)     | 0.15 (0.006)                                                                                                                                                                                                    |      |
| Max. radial runout of clutch disc in mm (in.)                          | 0.3 (0.012)                                                                                                                                                                                                     |      |
| Max. radial runout of diaphragm/drive plate in mm (in.)<br>Inside dia. | 61 <sup>+</sup> 0.05 <sup>+</sup> 0.002<br>+0.10 (2.401 <sup>+</sup> 0.004)                                                                                                                                     |      |
| Outside dia.                                                           | 189 <sup>+</sup> 0.10 <sup>+</sup> 0.004<br>(7.441 <sup>+</sup> 0.004)                                                                                                                                          |      |

### Torque Values in Nm (ft lbs)

Counternut for clutch lever adjusting screw      20 ... 23 (14 ... 17)

Tighten all other bolts and nuts to common torque values as listed in tables  
from bolt/nut suppliers or the new BMW Standard 60002.0.

## Specifications 1981 Models

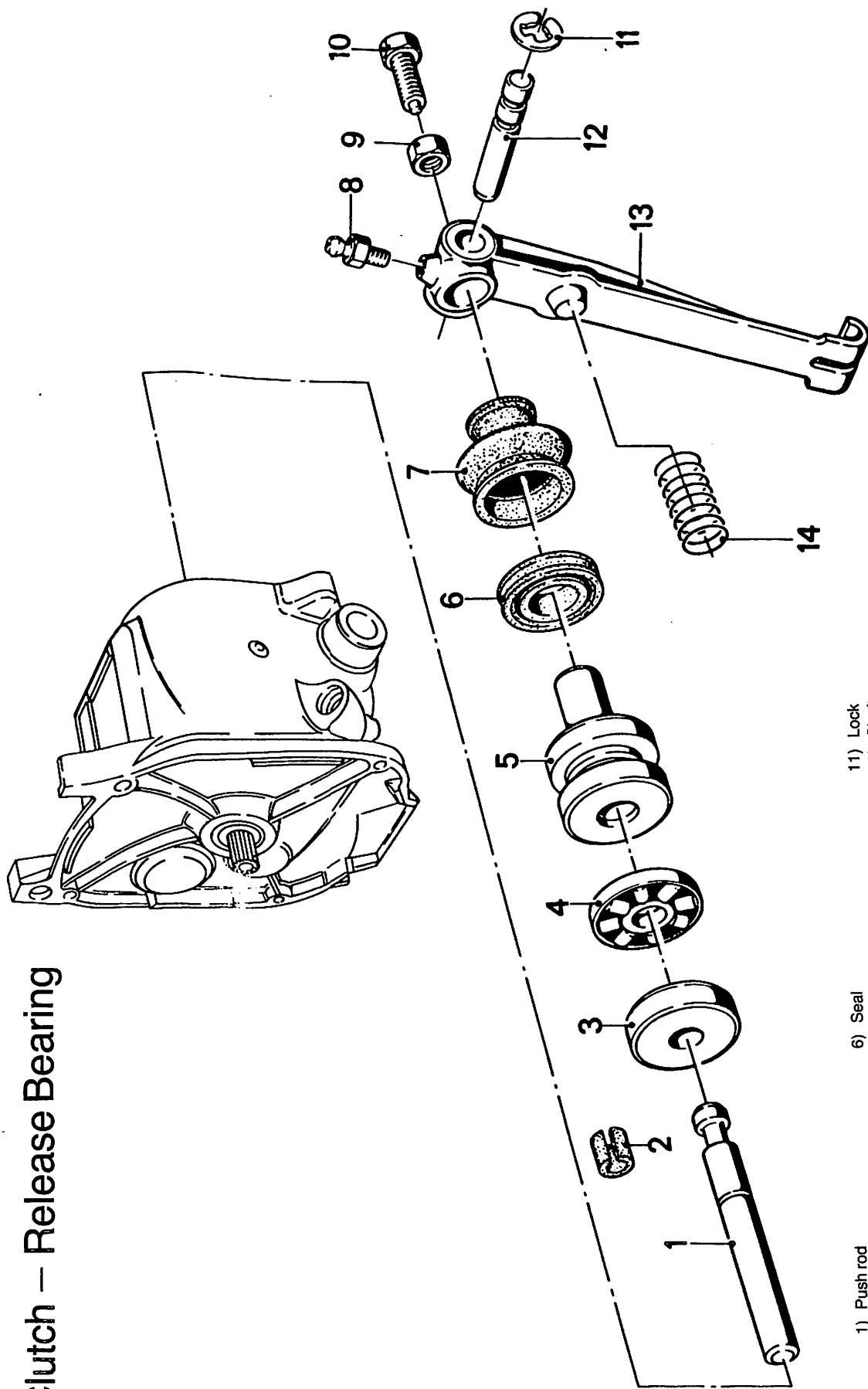
| Clutch                                                       | Model | R 65                                                  | R 65 LS |
|--------------------------------------------------------------|-------|-------------------------------------------------------|---------|
| Type                                                         |       | Single plate, dry clutch with offset diaphragm spring |         |
| Diaphragm spring dia. in mm (in.)<br>(pressed flat)          |       | 163 (6.417)                                           |         |
| Total clutch disc thickness in mm (in.)<br>(plate and liner) |       | 5,5 ± 0.25 (0.216 ± 0.010)                            |         |
| Clutch disc outside dia. in mm (in.)                         |       | 165 ± 1 (6.496 ± 0.040)                               |         |
| Clutch play on handlever<br>(cable) mm (in.)                 |       | 2 ± 0,5 (0.079 ± 0.020)                               |         |

## Torque Values in Nm (ft lbs)

Counternut for clutch lever adjusting screw      20 + 2 (14 + 1)

Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0.

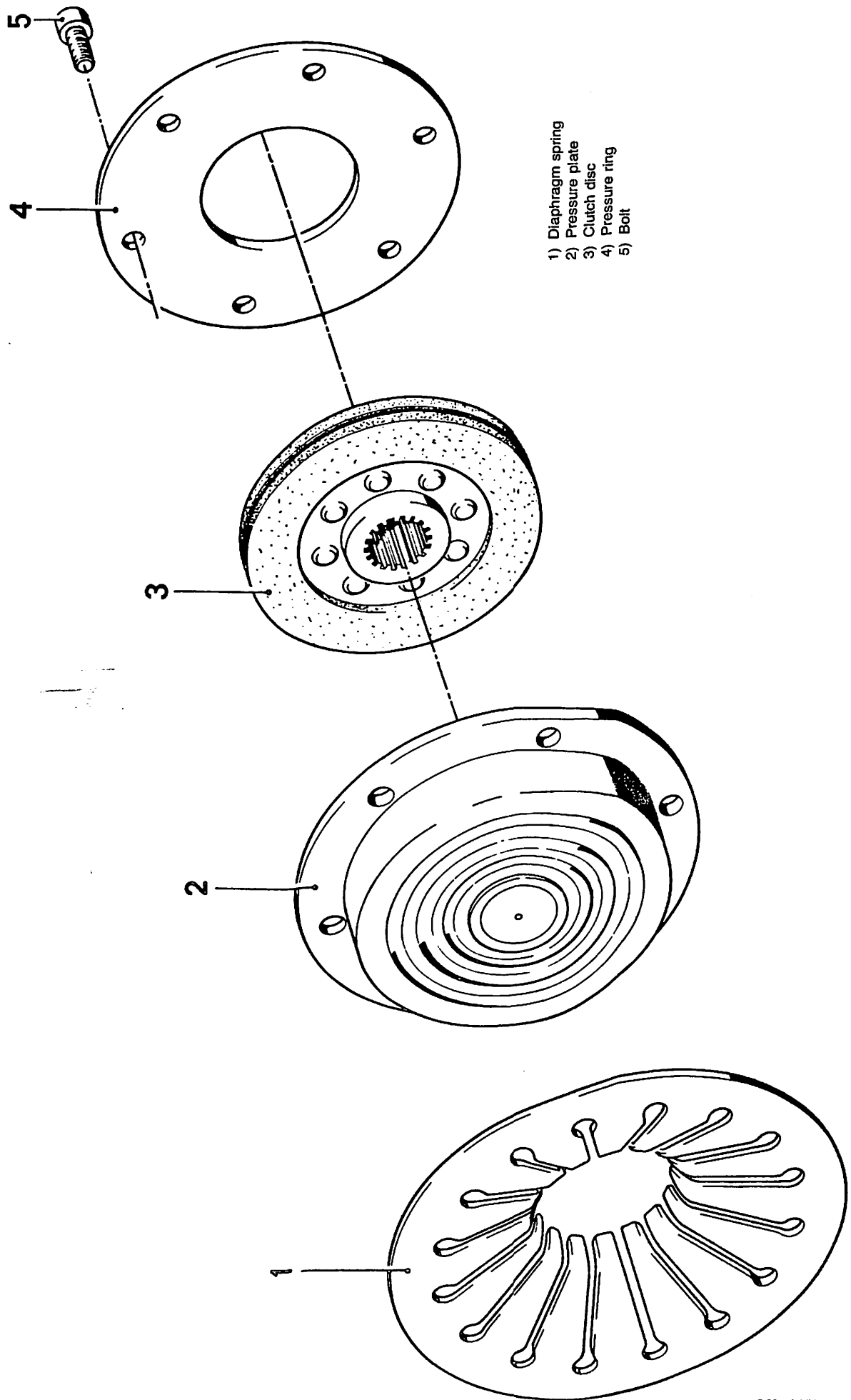
# Clutch – Release Bearing



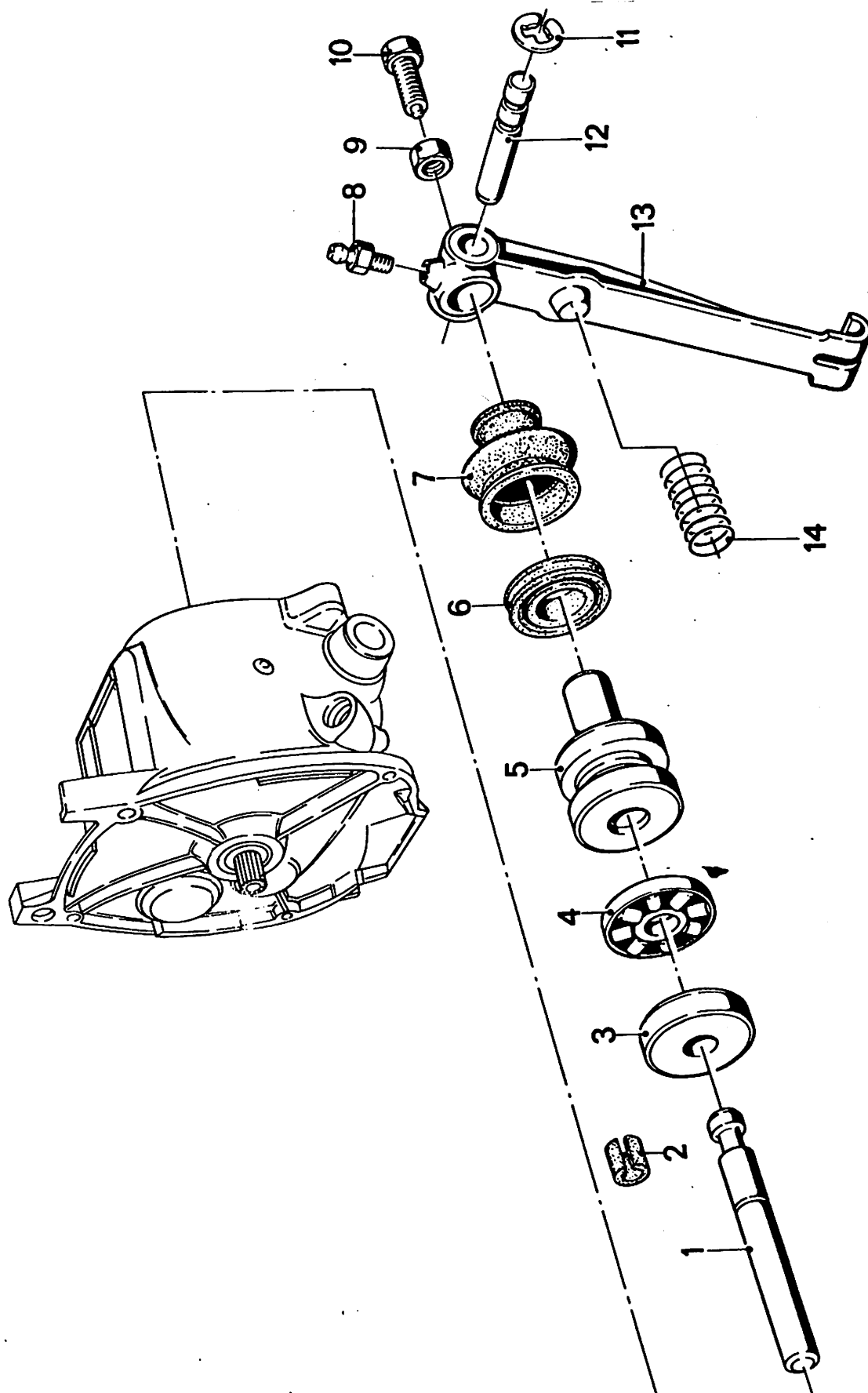
- |                         |                       |                  |
|-------------------------|-----------------------|------------------|
| 1) Push rod             | 6) Seal               | 11) Lock         |
| 2) Felt ring            | 7) Sealing cover      | 12) Shaft        |
| 3) Pressure pad         | 8) Lubricating nipple | 13) Clutch lever |
| 4) Ball cage with balls | 9) Hexagon nut        | 14) Spring       |
| 5) Pressure piston      | 10) Hexagon head bolt |                  |



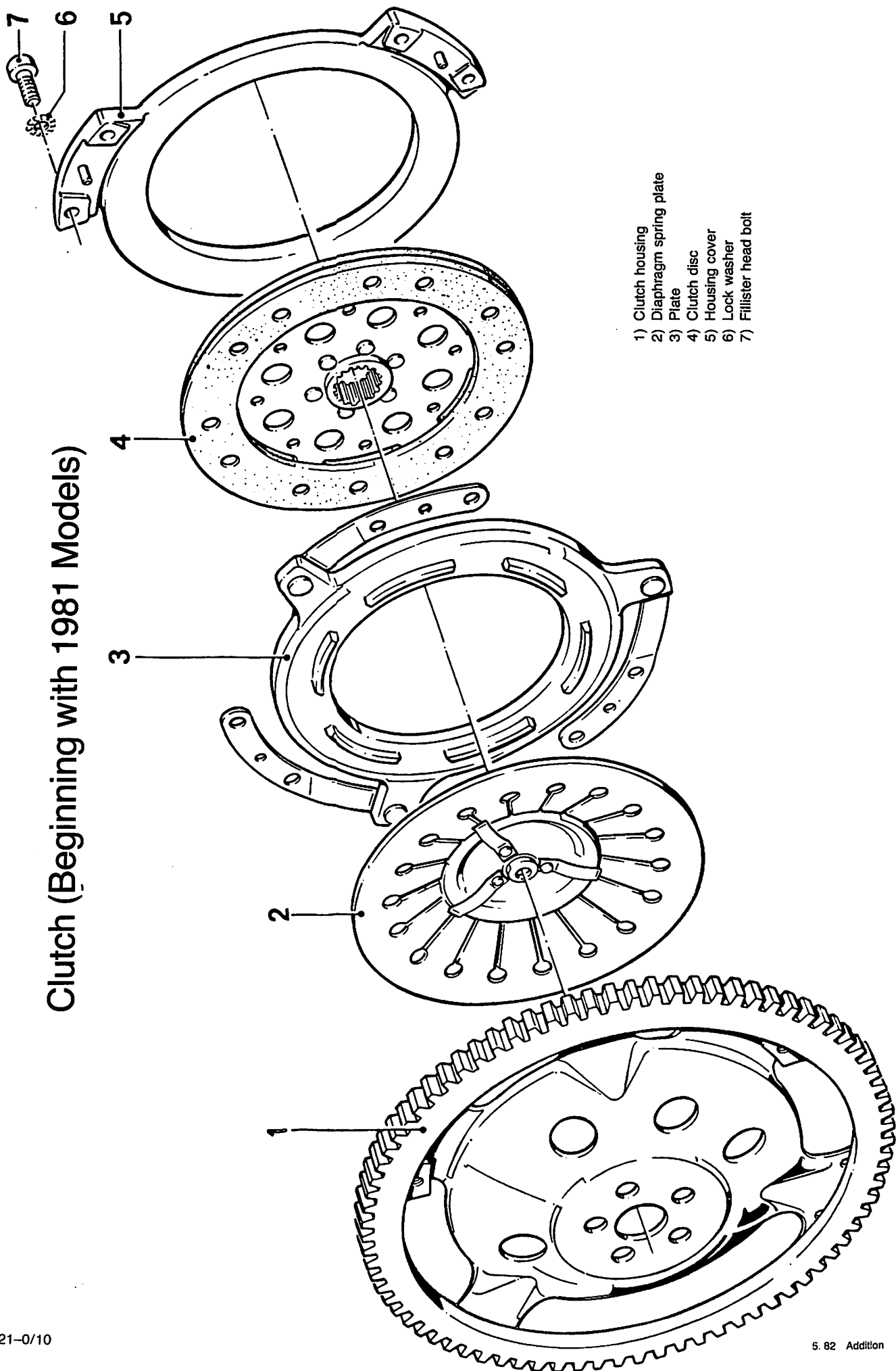
# Clutch (up to 1979 models)



# Clutch Controls (Beginning with 1981 Models)



## Clutch (Beginning with 1981 Models)

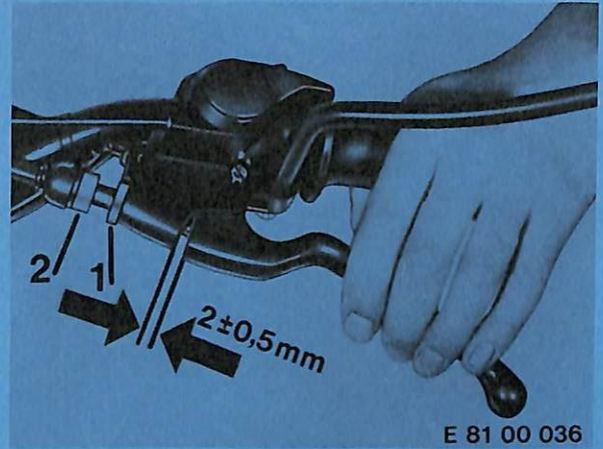




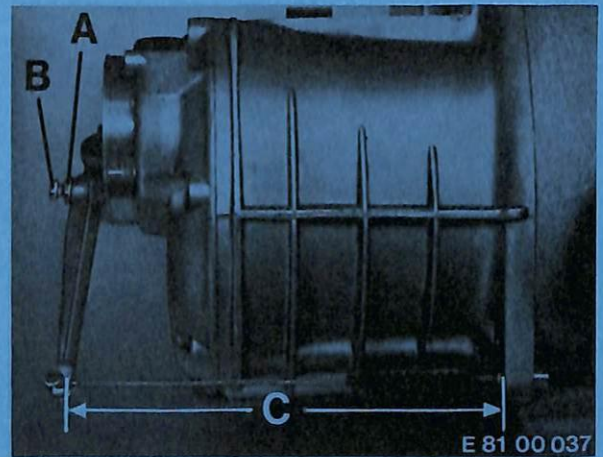
## 21 00 004 Adjusting Clutch Play (1981 Models)

The clutch play on the hand lever should be  $2 \pm 0.5$  mm; adjust as follows if necessary.

- Unscrew lock nut (1) of cable adjusting screw.
- Turn adjusting screw (2) until...



- ... distance "C" =  $201 \pm 2$  mm is reached on transmission end clutch lever (lever is inclined toward rear by about  $4^\circ$ ). Tighten lock nut (1).
- Unscrew lock nut "A" of transmission end adjusting screw.
- Turn adjusting screw "B" until clutch hand lever play is  $2 \pm 0.5$  mm. Then tighten lock nut "A".



## 21 21 000 Removing and Installing Clutch

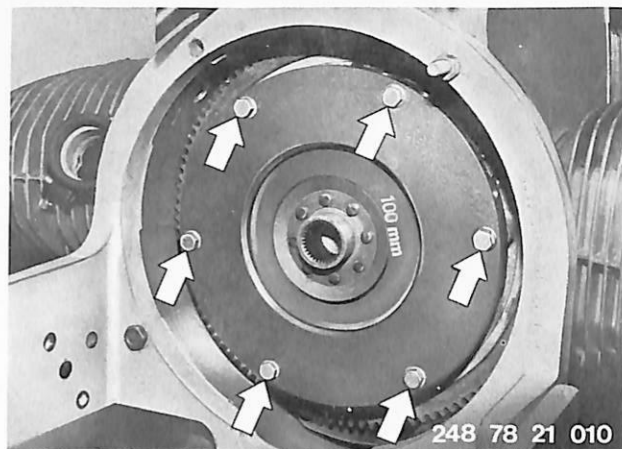
**First Method:** Engine removed – 11 00 050.

**Second Method:** Transmission removed – 23 00 020.

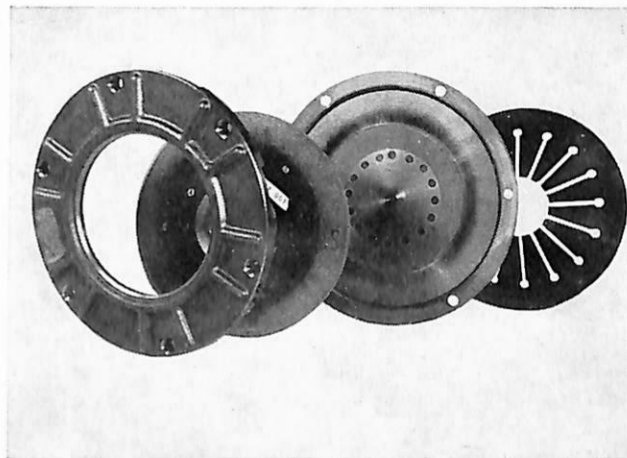
(engine remains in frame)

Pictures and text show procedures after this preparatory work.

Unscrew 6 socket head screws with an angled screwdriver, removing every second screw and installing there 3 clamping bolts, whose nuts must be tightened against the pressure ring.



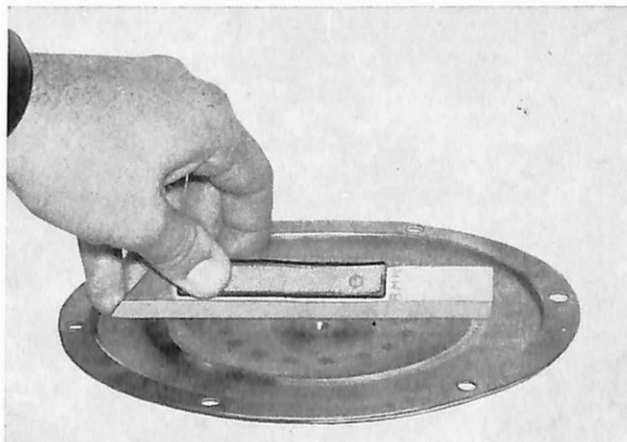
Take off pressure ring, clutch plate, diaphragm spring and plate.



### Inspecting and Repairing:

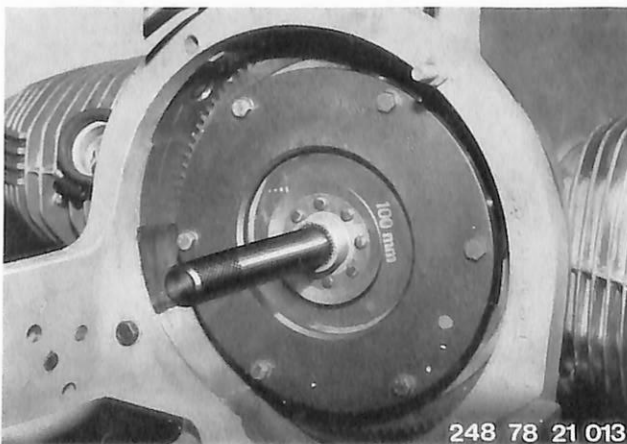
Check clutch plate for wear, diaphragm for distortion and force of diaphragm springs in installed state.

Check lateral runout of drive plate. Refer to Specification for wear limits and clearances.



When assembling, use special tool, BMW No. 21 2 650, to center clutch plate. Refer to Specifications for torque values.

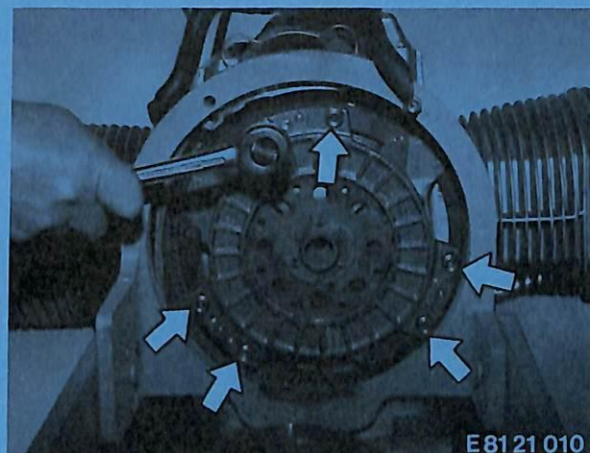
Apply a light coat of Molykote Longterm 2 to spline of clutch hub.





## 21 21 000 Removing and Installing Clutch (1981 Models)

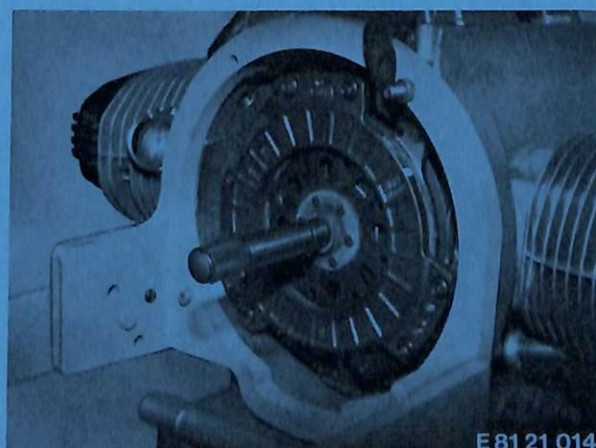
Remove and install transmission 23 00 020.  
Engine does not have to be removed.  
Unscrew six mounting bolts on housing cover.



Take off cover (1), clutch disc (2), plate (3) and diaphragm spring plate (4).



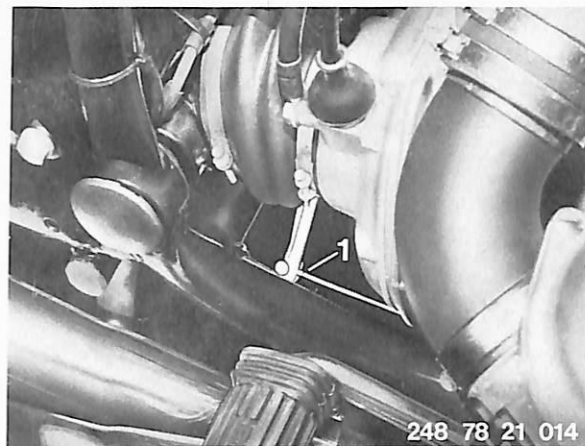
When assembling, center clutch disc with special tool, BMW No. 21 2 660.  
Give clutch teeth a thin coat of Molykote U-n paste. See Specifications for tightening torque of clutch housing cover bolts.



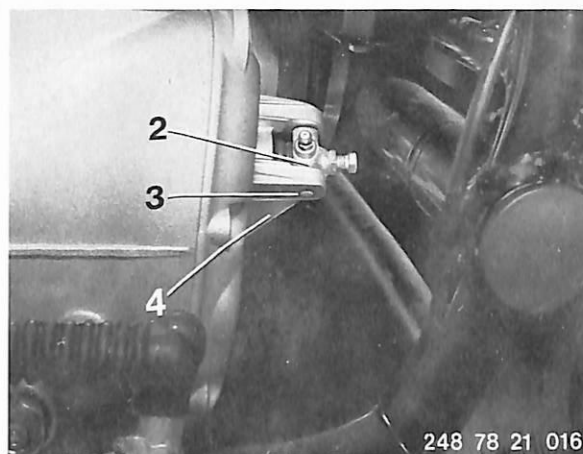


## 21 51 020 Removing and Installing Clutch Release Lever

Disconnect clutch cable (1).



Pry out circlip (2) with screwdrivers and remove pin (3). Lay parts aside with spring (4).

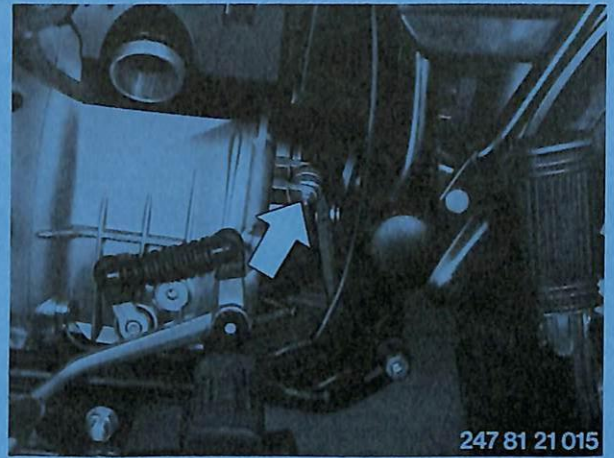


**21 51 020 Removing and Installing Clutch Release Lever  
(1981 Models)**

Disconnect clutch cable on release lever.

Unscrew mounting nut (arrow) on console, pull out bolt and remove release lever.

Adjust clutch play 21 00 004.



### Troubleshooting Clutch

| Condition                               | Cause                                         | Correction                         |
|-----------------------------------------|-----------------------------------------------|------------------------------------|
| Clutch grabs                            | Transmission input shaft spaced incorrectly   | Space new (see page 23–21/5.../6). |
| Clutch operation too slow; clutch grabs | Clutch disc/input shaft spline without grease | Clean and lubricate spline         |





## 23 Transmission

|                                                                     |              |
|---------------------------------------------------------------------|--------------|
| Specifications . . . . .                                            | Page 23- 0/3 |
| Specifications – 1981 models . . . . .                              | 23- 0/7      |
| 23 00 020 Transmission – remove and install . . . . .               | 23-00/1      |
| 23 00 020 Transmission – remove and install (1981 models) . . . . . | 23-00/5      |
| 23 11 040 Case cover – remove and install/seal . . . . .            | 23-12/1      |
| 23 22 001 Gear set – replace . . . . .                              | 23-21/1      |
| 23 31 001 Selector forks – replace . . . . .                        | 23-31/1      |
| 23 31 210 Shift plate console – remove and install . . . . .        | 23-31/1      |
| 23 31 861 Shift plates – replace . . . . .                          | 23-31/2      |
| 23 31 881 Shift controls – replace . . . . .                        | 23-31/2      |
| 23 31 401 Electric idle gauge – replace . . . . .                   | 23-31/3      |
| 23 51 010 Kickstarter – remove and install . . . . .                | 23-31/3      |
| Transmission – troubleshoot . . . . .                               | 23-31/5      |

## Specifications

| Transmission                                                |                                                                                                       |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Model                                                       | R 65                                                                                                  |
| Type                                                        | 5-speed manual transmission with claw-type shift, bolted to engine, drive torque damping in all gears |
| Type of shift                                               | hook shift control                                                                                    |
| Ratios                                                      |                                                                                                       |
| 1st gear                                                    | 4.4                                                                                                   |
| 2nd gear                                                    | 2.86                                                                                                  |
| 3rd gear                                                    | 2.07                                                                                                  |
| 4th gear                                                    | 1.67                                                                                                  |
| 5th gear                                                    | 1.50                                                                                                  |
| Oil grade above 5° C (41° F)<br>below 5° C (41° F)          | brand name hypoid gear lube SAE 90<br>brand name hypoid gear lube SAE 80                              |
| Oil volume in ltr. (pints)                                  | 0.8 (1.7)                                                                                             |
| Input shaft axial play in mm (in.)                          | 0 ... 0.1 (0.004) adjusted with shims                                                                 |
| Auxiliary shaft axial play in mm (in.)                      | 0 ... 0.1 (0.004) adjusted with shims                                                                 |
| Output shaft axial play in mm (in.)                         | 0 ... 0.1 (0.004) adjusted with shims                                                                 |
| Ball bearing fit in case                                    | Press fit (heat case to approx. 100° C/210° F when installing)                                        |
| Axial play of free-running gear wheels on shaft in mm (in.) | 0.15 ... 0.30 (0.006 ... 0.012)                                                                       |



### Specifications

| Transmission                                                 | Model                                                                                                                                                                  |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              | R 65                                                                                                                                                                   |
| Bushings on output shaft in mm (in.)                         | 0.005 ... 0.035 (0.0002 ... 0.0014)                                                                                                                                    |
| Drive flange radial runout in mm (in.)                       | ±0.05 (0.002)                                                                                                                                                          |
| Drive flange axial runout in mm (in.)                        | ±0.05 (0.002)                                                                                                                                                          |
| Power transmission from transmission to rear wheel           | Sealed propeller shaft with torsional absorber in right control arm tube, universal joint on transmission end and hypoid tooth clutch bell housing on wheel drive end. |
| Axial play of foot-operated selector lever shaft in mm (in.) | 0.1 (0.004)                                                                                                                                                            |

### Torque Values in Nm (ft lbs)

|                                                                                                                                       |                                                        |                                                                                            |                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Transmission to engine<br>Output flange (drive flange) to<br>transmission output shaft                                                | 20 ... 23 (14 ... 17)<br><br>200 ... 220 (145 ... 159) | Transmission case/cover<br>Nut for kick starter lever<br>Oil filler plug<br>Oil drain plug | 7 ... 8 ( 5 ... 6 )<br>20 ... 23 (14 ... 17)<br>28 ... 31 (20 ... 22)<br>23 ... 26 (17 ... 19) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                                                        |                                                                                            |                                                                                                |

## Specifications 1981 Models

| Transmission                                                |                                          | Model                                                                                                 |         |
|-------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------|---------|
|                                                             |                                          | R 65                                                                                                  | R 65 LS |
| Type                                                        |                                          | 5-speed manual transmission with claw-type shift, bolted to engine, drive torque damping in all gears |         |
| Type of shift                                               |                                          | hook shift control                                                                                    |         |
| Ratios                                                      |                                          |                                                                                                       |         |
| 1st gear                                                    |                                          | 4.4                                                                                                   |         |
| 2nd gear                                                    |                                          | 2.86                                                                                                  |         |
| 3rd gear                                                    |                                          | 2.07                                                                                                  |         |
| 4th gear                                                    |                                          | 1.67                                                                                                  |         |
| 5th gear                                                    |                                          | 1.50                                                                                                  |         |
| Oil grade                                                   | above 5° C (41° F)<br>below 5° C (41° F) | brand name hypoid gear lube SAE 90<br>brand name hypoid gear lube SAE 80                              |         |
| Oil volume in ltr. (pints)                                  |                                          | 0.8 (1.7)                                                                                             |         |
| Input shaft axial play in mm (in.)                          |                                          | 0 . . . 0.1 (0.004) adjusted with shims                                                               |         |
| Auxiliary shaft axial play in mm (in.)                      |                                          | 0 . . . 0.1 (0.004) adjusted with shims                                                               |         |
| Output shaft axial play in mm (in.)                         |                                          | 0 . . . 0.1 (0.004) adjusted with shims                                                               |         |
| Ball bearing fit in case                                    |                                          | Press fit (heat case to approx. 100° C/210° F when installing)                                        |         |
| Axial play of free-running gear wheels on shaft in mm (in.) |                                          | 0.15 . . . 0.30 (0.006 . . . 0.012)                                                                   |         |



### Specifications 1981 Models

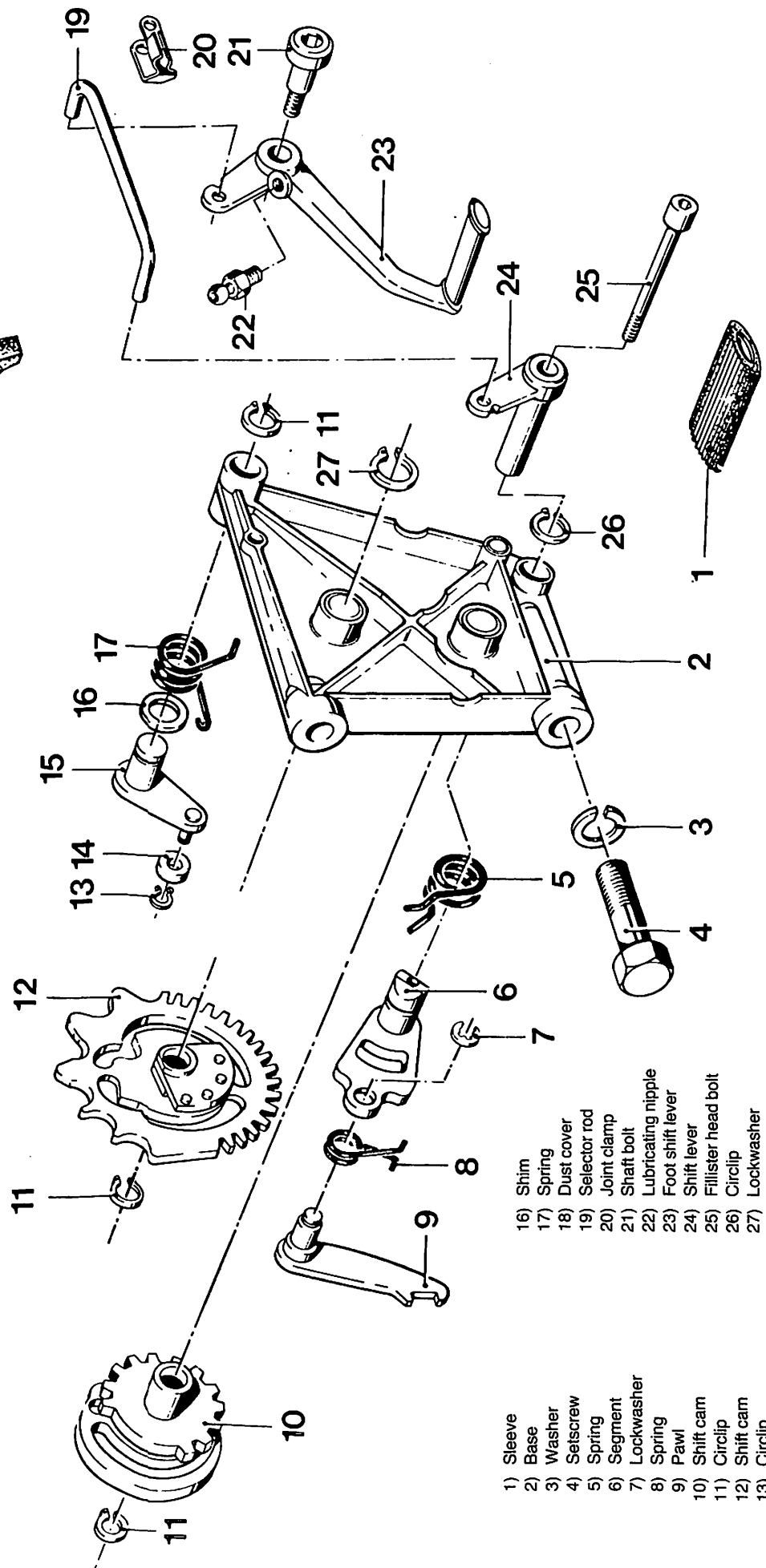
| Transmission                                                 | Specifications 1981 Models                                                                                                                                             |         |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Model                                                        | R 65                                                                                                                                                                   | R 65 LS |
| Bushings on output shaft in mm (in.)                         | 0.005 ... 0.035 (0.0002 ... 0.0014)                                                                                                                                    |         |
| Drive flange radial runout in mm (in.)                       | $\pm 0.05$ (0.002)                                                                                                                                                     |         |
| Drive flange axial runout in mm (in.)                        | $\pm 0.05$ (0.002)                                                                                                                                                     |         |
| Power transmission from transmission to rear wheel           | Sealed propeller shaft with torsional absorber in right control arm tube, universal joint on transmission end and hypoid tooth clutch bell housing on wheel drive end. |         |
| Axial play of foot-operated selector lever shaft in mm (in.) | 0.1 (0.004)                                                                                                                                                            |         |

### Torque Values in Nm (ft lbs)

|                                                                                                                                       |             |           |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------|
| Transmission to engine                                                                                                                | 33 (24)     | 8 (6)     |
| Output flange (drive flange) to transmission output shaft                                                                             | 221,5 (160) | 22,5 (16) |
| Console                                                                                                                               | 19 (14)     | 31 (22)   |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |             | 26 (19)   |



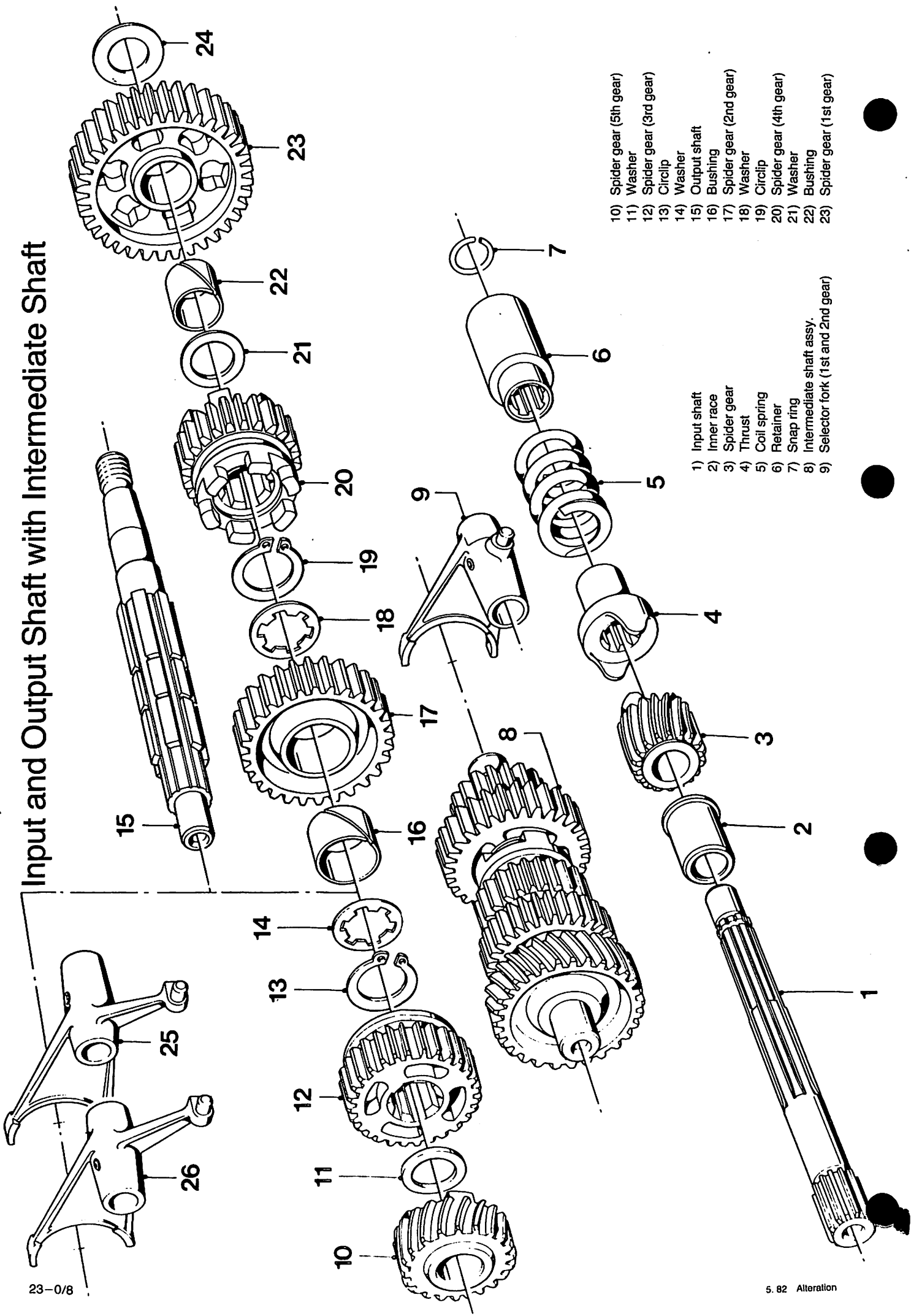
# Shift Mechanism



- 1) Sleeve
- 2) Base
- 3) Washer
- 4) Setscrew
- 5) Spring
- 6) Segment
- 7) Lockwasher
- 8) Spring
- 9) Pawl
- 10) Shift cam
- 11) Circclip
- 12) Shift cam
- 13) Circclip
- 14) Roller
- 15) Lever

- 16) Shim
- 17) Spring
- 18) Dust cover
- 19) Selector rod
- 20) Joint clamp
- 21) Shaft bolt
- 22) Lubricating nipple
- 23) Foot shift lever
- 24) Shift lever
- 25) Fillister head bolt
- 26) Circclip
- 27) Lockwasher

# Input and Output Shaft with Intermediate Shaft



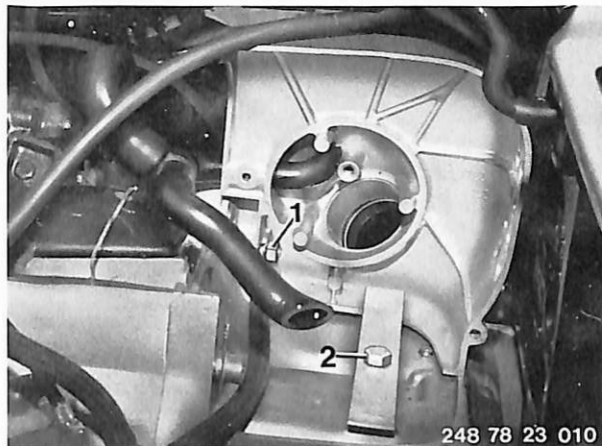
## 23 00 020 Removing and Installing Transmission

Place motorcycle on center stand and use an additional support behind the center stand.

Remove and install air cleaner – 13 72 000.

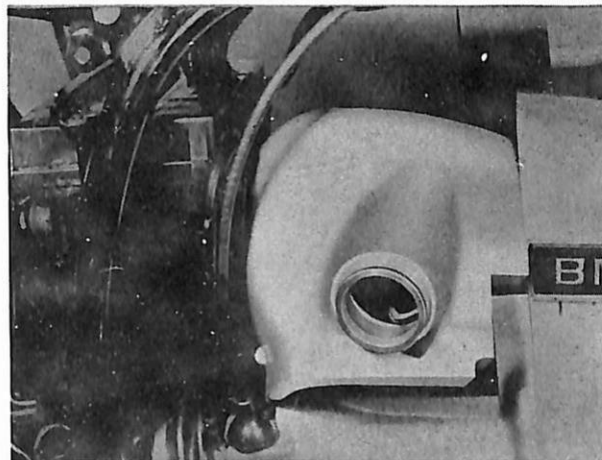
Disconnect both choke cables from carburetors and lay aside left half of air cleaner housing with choke cables.

Unscrew nut (1) with a straight ring wrench, loosen hexagon head screw (2) and



remove right half of air cleaner housing, pushing back vent hose (3).

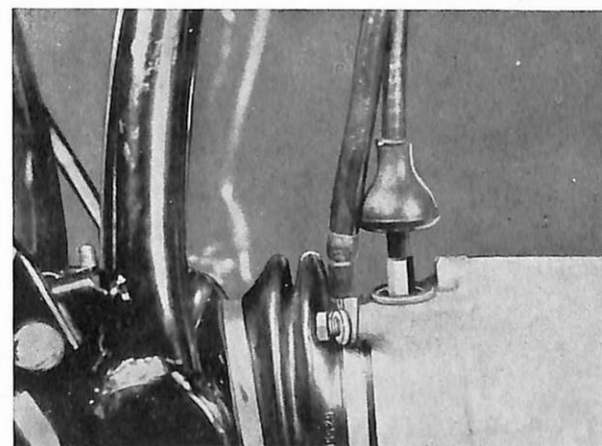
Remove carburetors.



Push back rubber cap for speedometer drive and pull out speedometer drive cable after unscrewing screw and removing battery ground wire with washer.

Remove and install battery – 61 21 010.

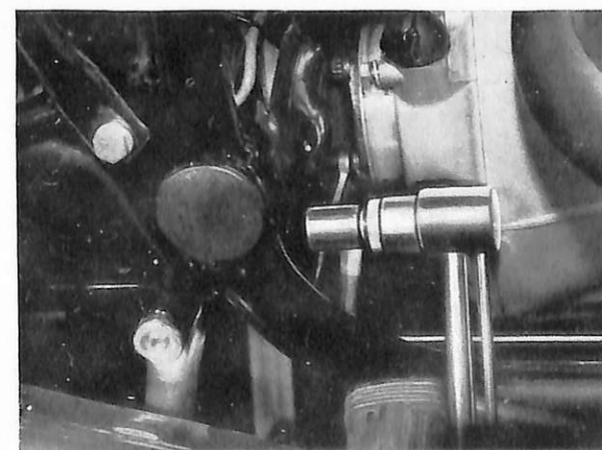
Remove and install battery console – 61 21 100.



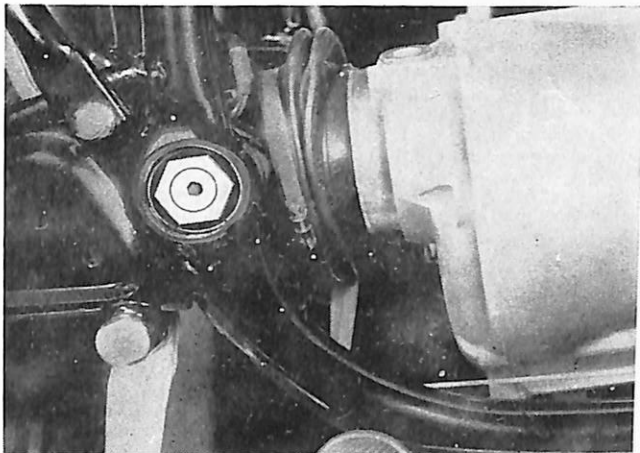
Loosen clamp on rubber bellows on transmission and push back rubber bellows as far as possible. Don't forget oil catch tray.

Unscrew four twelve-sided head screws with a ring wrench and lay aside with washers. Operate brake pedal to hold propeller shaft.

Use special wrench, BMW No. 00 2 560, to tighten screws. Refer to Specifications for torque values.







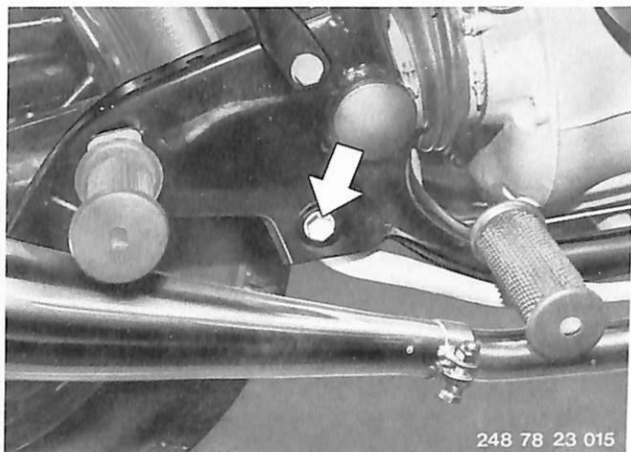
Take off end cap from control arm bearings, loosen counternut on bearing pin and unscrew both bearing pins.

When working in control arm again, make sure that both pressure sleeves do not protrude.

Refer to Specifications for torque values.

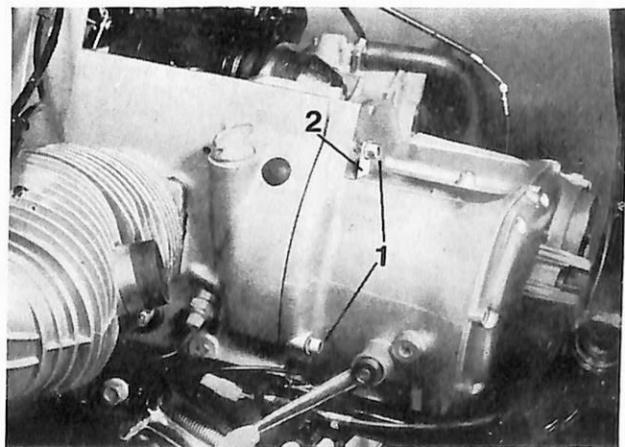


Detach bearing pin from brake pedal and remove.  
Detach push rod at rear wheel brake.  
Pull out brake pedal with push rod downward.

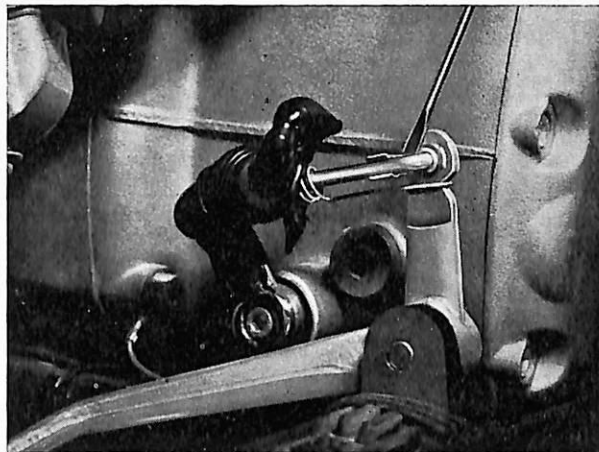


Unscrew two socket head screws 1 and one socket head screw on transmission at bottom right.

Don't forget bar 2 when reassembling.



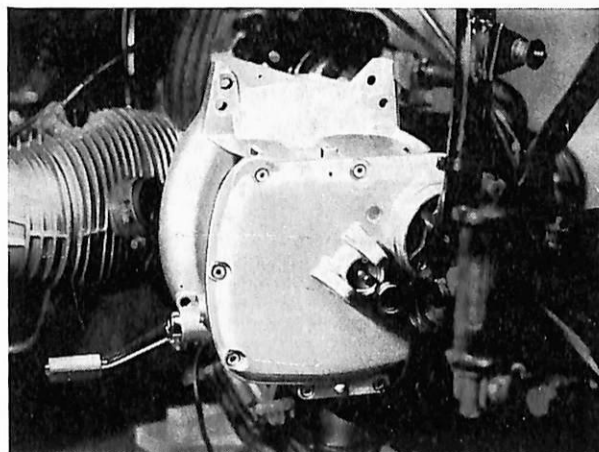
Detach shift mechanism from brake peda. Push back rubber bellows. Unhook spring and pry push rod out of lock with a screwdriver.



Hold control arm tight with help of a piece of wood (20 x 20 mm, 400 mm long / 3/4 x 3/4", 15 3/4" long) inserted between tire and frame rear section at rear most position.

Remove transmission carefully, place on footrest and disconnect wires for idle control.

Remove transmission all the way.





## 23 00 020 Removing and Installing Transmission as Preliminary Work for Removal of Engine (1981 Models)

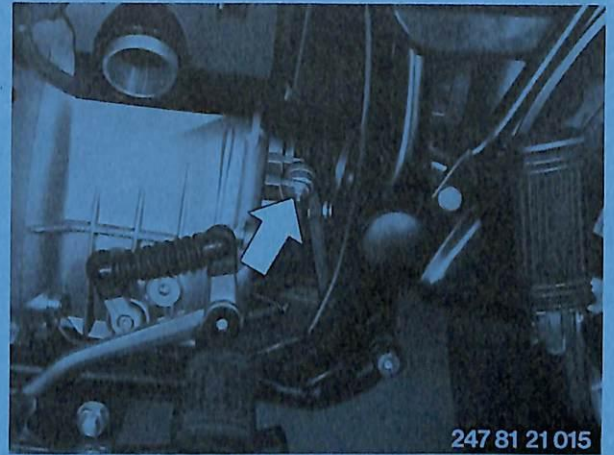
Unglue frame covers (protective sheet) in area of push rod protective tube.

Remove and install air cleaner 13 72 000.

Remove and install muffler 18 11 321.

Disconnect clutch cable on transmission end.

Unscrew mounting nut (arrow) on console, pull off shaft and take off release lever.



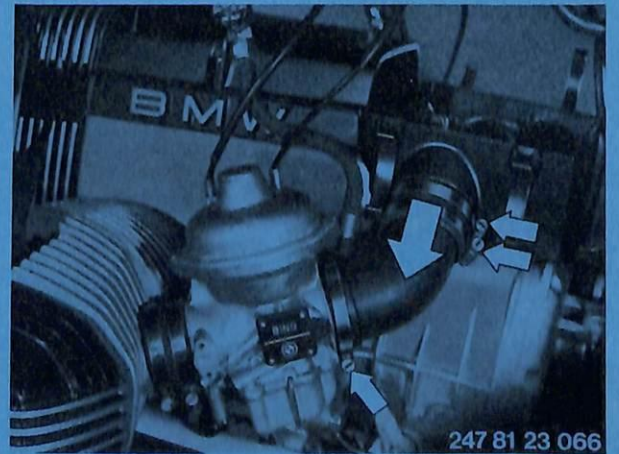
Pull back rubber cover on selector linkage and press pull rod out of lock with a screwdriver.

Disconnect footrest on frame.



Loosen hose clamps on left and right air lines and remove after pushing back rubber sleeve.

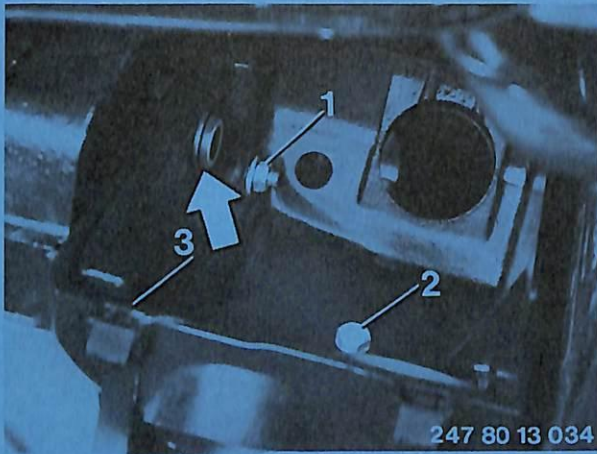
Disconnect left carburetor on cylinder head.



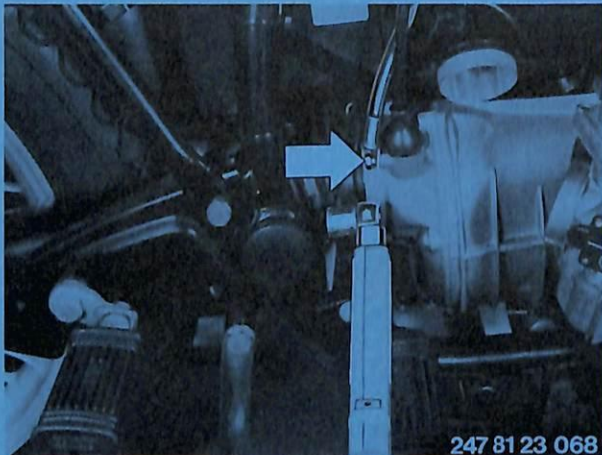
Pull T-adaptor for crankcase vent out of air cleaner housing in direction of arrow.





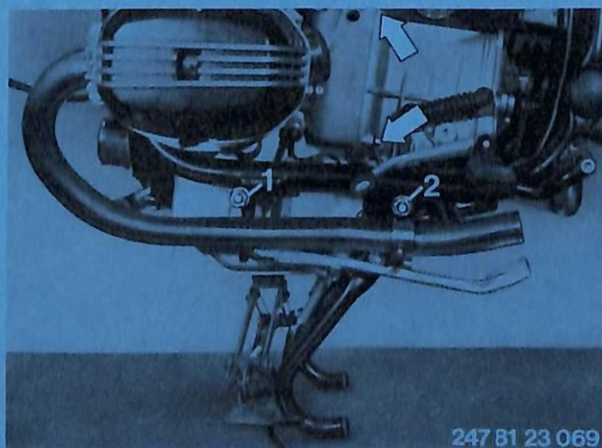


Press vent line (arrow) out of air cleaner housing. Unscrew hexagon nut (1) and hexagon head bolts (2 and 3) on housing.



Disconnect rubber cover between swinging arm and transmission on transmission end. Unscrew twelve-sided head bolts on universal joint, holding rear wheel tight with the rear wheel brake. When installing, tighten bolts with special wrench, BMW No. 00 2 560. See Specifications for tightening torque.

Unscrew hexagon head bolt (arrow) and pull out speedometer drive. This also disconnects the battery ground wire.



Unscrew engine mounting bolts (1 and 2) as well as left and right transmission mounting bolts on engine (arrow). Support engine with a heavy duty car jack or hydraulic lift in such a manner, that engine bolts can still be pulled out. Take off engine guard and pull engine forward on to the frame covers.

See Specifications for tightening torque.

Remove air cleaner housing lower section.



Disconnect cover on transmission cover and remove with spring. Pull back transmission far enough that push rod is visible. Push back push rod in transmission with a pliers until the transmission can be lifted out. Catch pressure piston and thrust bearing with rags.

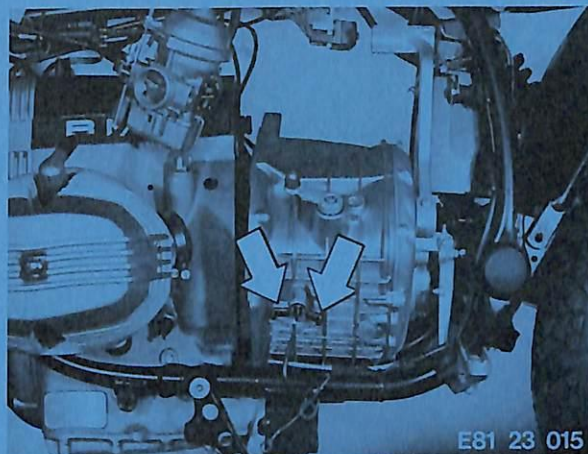


Turn transmission on side and pull off wire connector on idle switch (arrow).

Remove transmission from left side and lay aside.

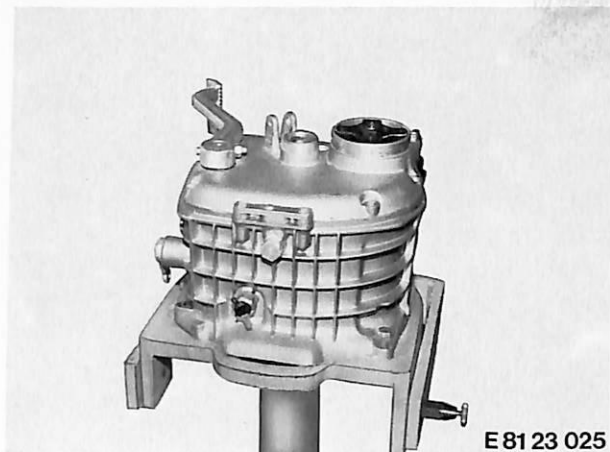
**Note:**

Apply a thin coat of Molykote U-n paste on input shaft spline prior to installation.



## 23 11 040 Removing and Installing/Sealing Transmission Case

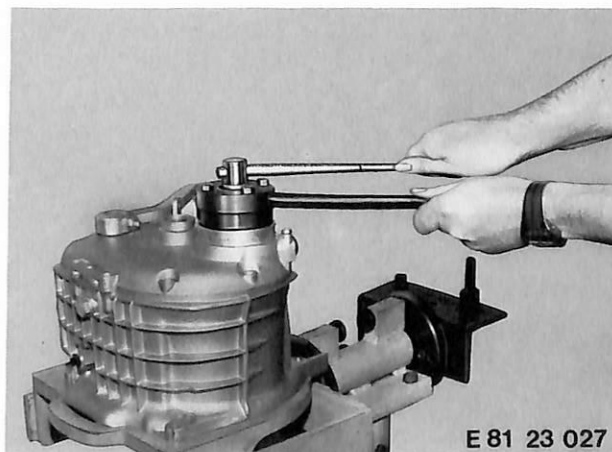
Remove and install transmission 23 00 020.  
Place transmission on assembly stand and secure with two bolts opposite each other.  
Press clutch push rod out of transmission.



Unscrew bolt and pull out guide sleeve for speedometer drive gear. Remove drive gear.



Bolt holder, BMW No. 23 1 700, without pressing-off spindle on drive flange of input shaft with four bolts. Unscrew mounting nut.



Press off drive flange with pressing-off spindle after unscrewing holder, BMW No. 23 1 700. Also disconnect conical seat with a light knock on the spindle.

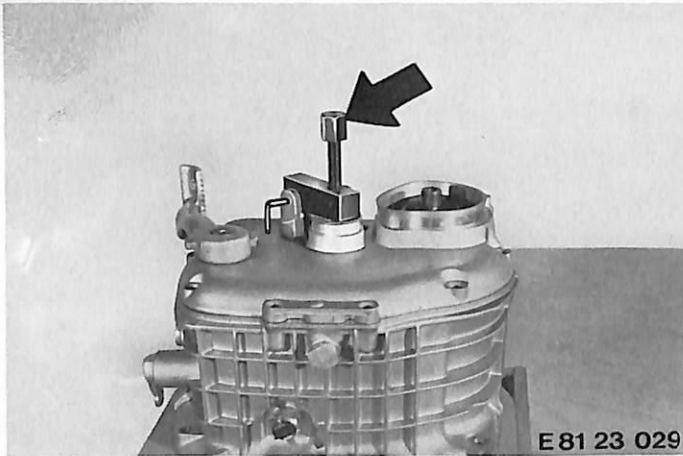
### Installation:

When installing drive flange, clean conical seats with a greaseless cleaning solution and install dry.  
Lubricate mounting nut with a viscous oil.

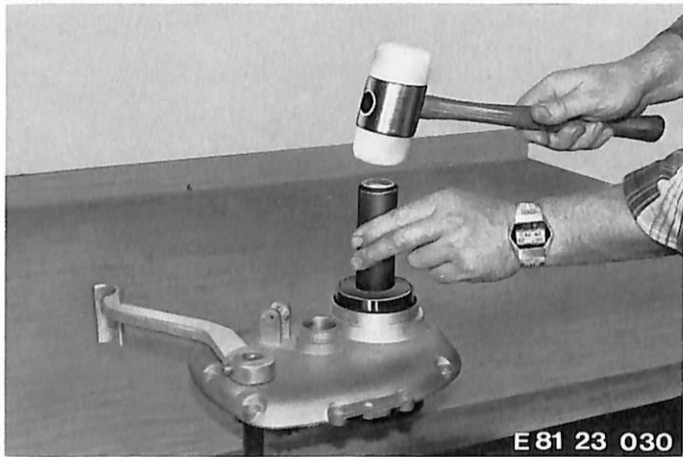
See Specifications for tightening torque.







Unscrew transmission cover mounting bolts. Heat transmission cover to about 100° C and press off with pressing-off tool, BMW No. 23 1 630.  
See Specifications for tightening torque.



Take shims for axial play of shafts out of cover. Knock seal out of cover with a mandrel. Knock in new seal with special tool, BMW No. 23 1 750.

**Installation:**

Open end of seal faces output flange.

## 23 22 001 Removing and Installing/Disassembling Gear Set

Remove and install transmission 23 00 020.

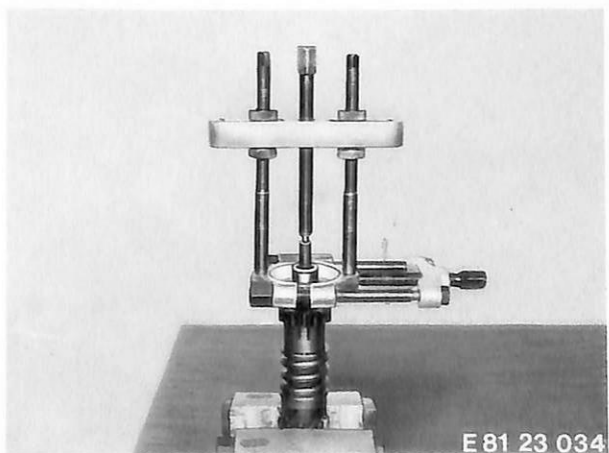
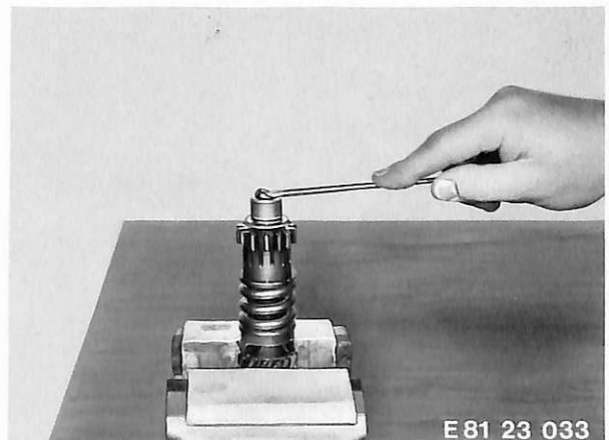
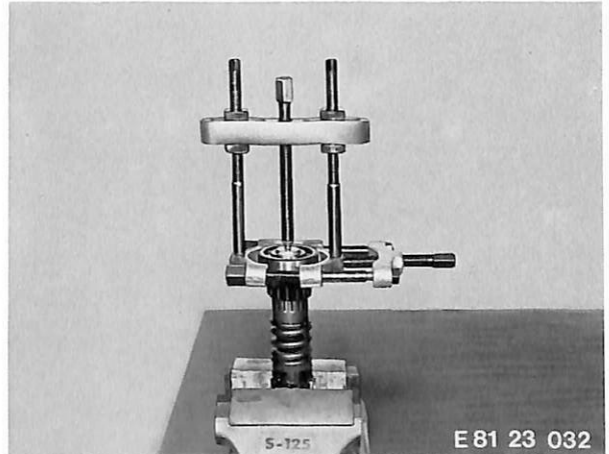
Remove and install/seal transmission case cover 23 11 040.

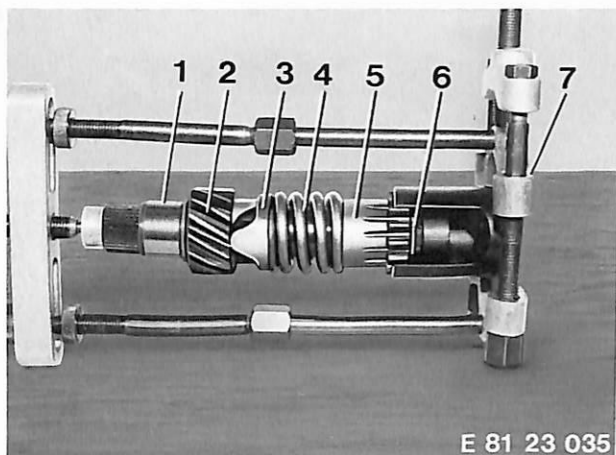
Pull input shaft out of case while applying light knocks on front end of shaft with a plastic hammer.

Pull off input shaft ball bearing with cover, but without bearing sleeve, with a standard puller, BMW No. 00 7 500 (use pressure pad for crankshaft).

Pry out small shaft seal with a small screwdriver.

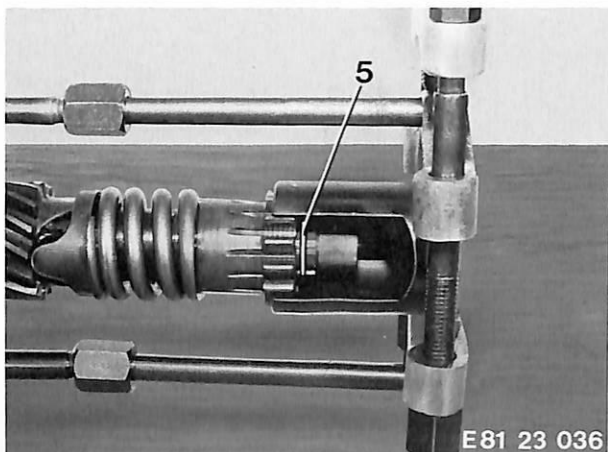
Pull off bearing sleeve with standard puller, BMW No. 00 7 500, and a small pressure pad.





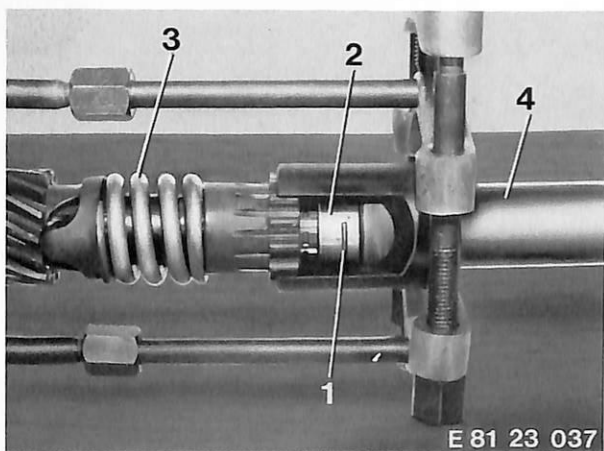
E 81 23 035

1. Input shaft
2. Spur gear
3. Pressure element
4. Coil spring
5. Counterelement
6. Snap ring
7. Standard puller, BMW No. 00 7 500.



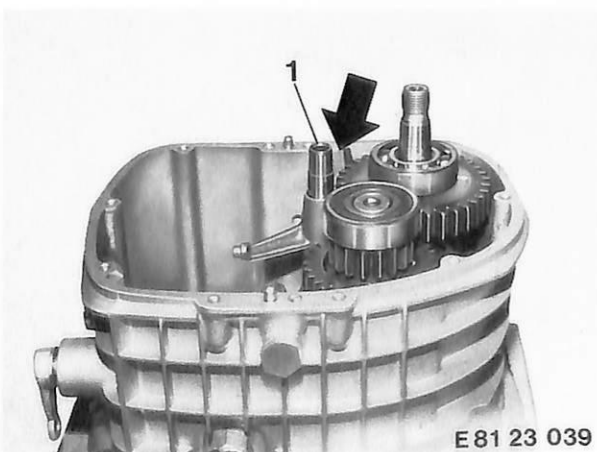
E 81 23 036

Compress coil spring with the standard puller in conjunction with assembly sleeve 23 2 655. Press out circlip (5) with a mandrel or screwdriver and release the puller.



E 81 23 037

When assembling the input shaft, compress spring (3) with assembly sleeve 23 2 655 and standard puller 00 7 500. Place circlip (1) on guide sleeve (2) of tool no. 23 2 650 and push circlip with slip sleeve (4) forward up to groove.



E 81 23 039

Remove and install console for shift plates 23 31 210. Unscrew and remove oil baffle plate (arrow). Pull out shaft for 1st, 2nd and 5th gear selector forks (1). Remove selector forks.

#### Installation:

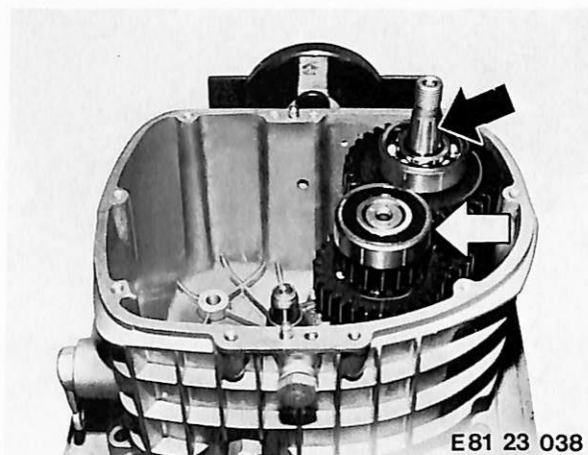
Short guide ends of selector forks face each other.



Heat transmission at bearing seat of output and intermediate shafts to 100° C and remove both shafts with 3rd/4th gear selector fork.

**Installation:**

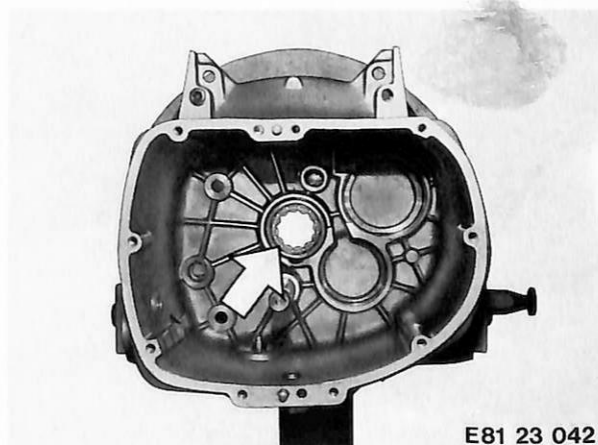
Install selector fork in case with long guide end facing down.



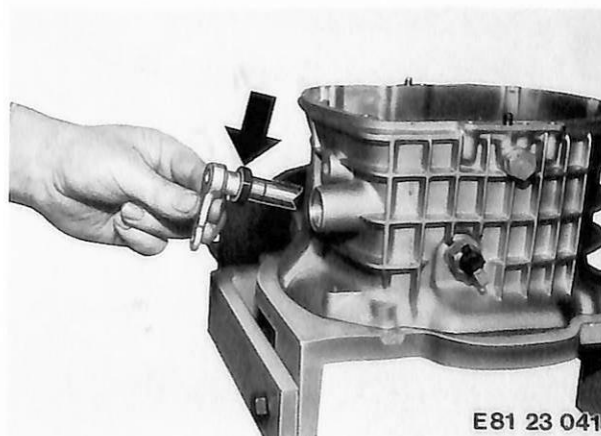
Replace radial oil seal for input shaft.  
Lift out seal with a screwdriver.  
Knock out seal with a screwdriver.  
Knock in new seal with mandrel, BMW No. 23 1 650, used in conjunction with handle, BMW No. 00 5 500.

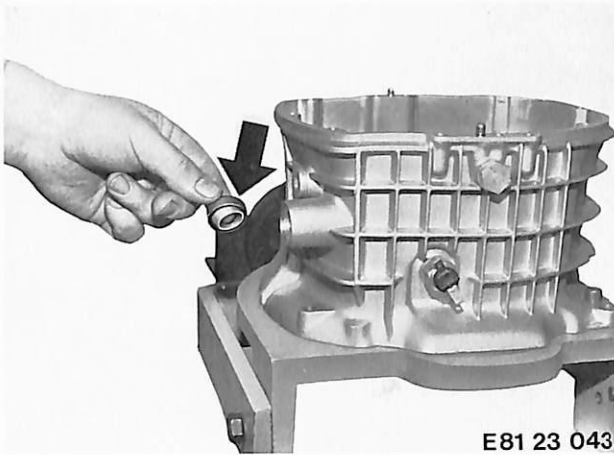


Replace roller bearing of input shaft.  
Heat transmission case to about 100° C and pull out bearing (arrow). Install new bearing in heated case.



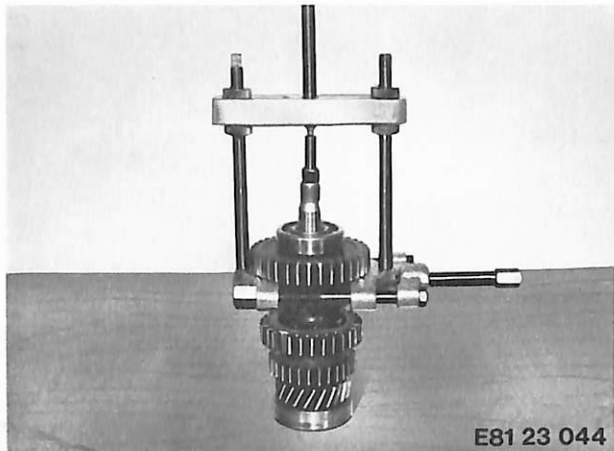
Replace radial oil seal for selector lever.  
Lift out seal with a screwdriver. Push new seal (arrow) on selection lever and press into case by applying light knocks.





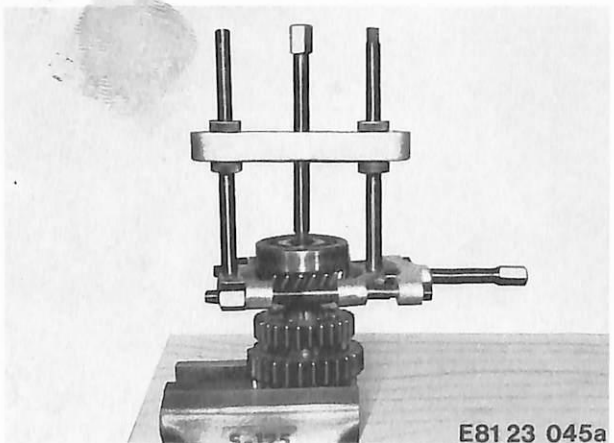
E81 23 043

Replace selector lever radial joint bearing. Remove radial oil seal.  
Pull out bearing (arrow) with a finger or hook.  
Give new bearing a light coat of oil and install.



E81 23 044

Disassemble output shaft.  
Pull off 1st gear and bearing with the universal puller, BMW No. 00 7 500. Remove 4th gear.



E81 23 045a

Clamp output shaft in a vise fitted with soft jaws. Remove circlip in front of bearing. Pull off 5th gear and bearing with the standard puller, BMW No. 00 7 500. Remove 3rd gear.



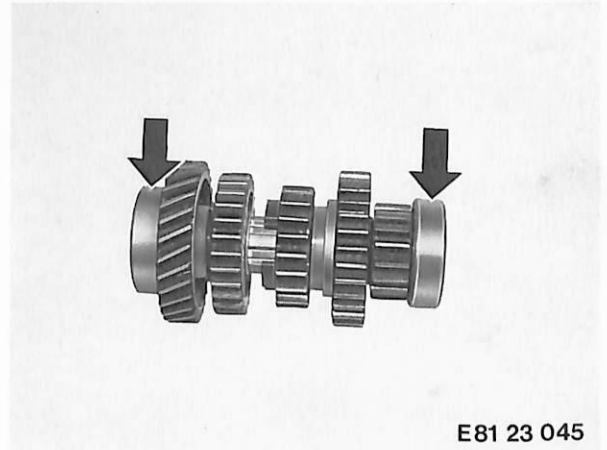
E81 23 046a

Remove circlip in front of 2nd gear. Pull gear with washer off of shaft.

**Note:**

If bushing pressed on shaft is defective, replace the output shaft.

If defective, replace complete intermediate shaft. Pull off bearings (arrows) with Kukko puller, BMW No. 00 7 500.

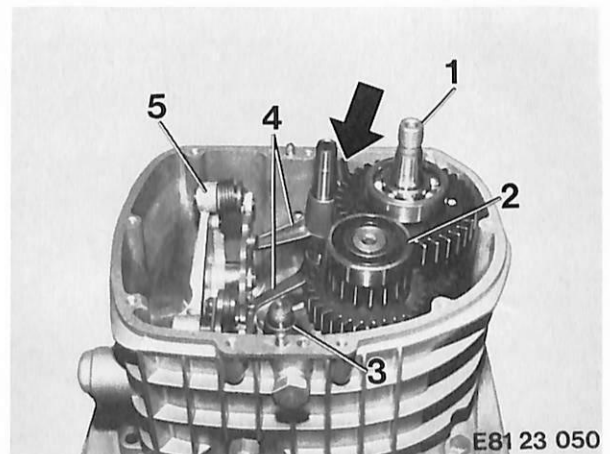


Heat transmission case to about 80 ... 100° C. Place oil baffle plate in ball bearing bore of case (arrow) prior to installing the output shaft.

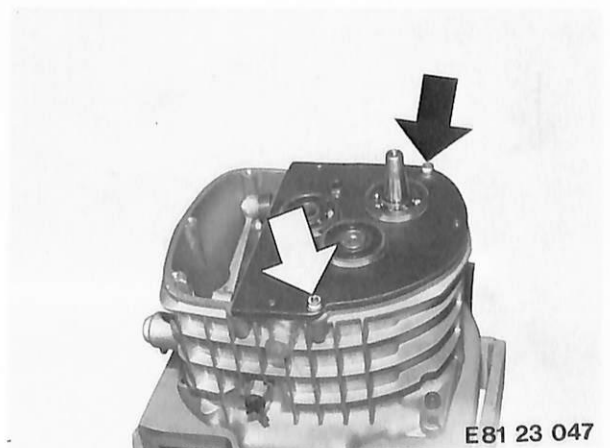
Install output shaft and intermediate shaft (1 and 2) in case together with 3rd and 4th gear selector fork (3).

Make sure that the selector fork does not jam. Then insert 1st, 2nd and 5th gear selector forks (4) with their short ends facing each other and lock on shaft.

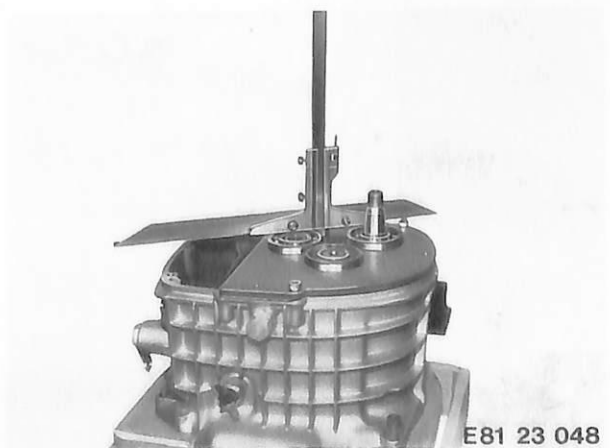
Mount shift base (5) in neutral position and install input shaft.



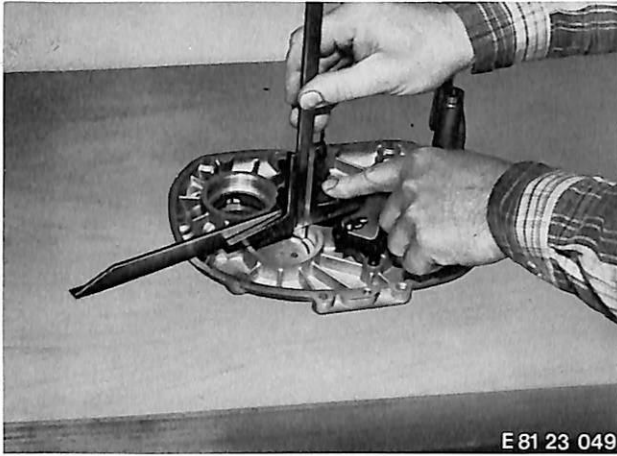
To guide the shafts, place measuring plate, BMW No. 23 3 650, on case and bolt down two screws (arrows) to have plate fit tight.



To adjust axial play of the three transmission shafts, measure distance between ball bearing outer race and measuring plate with a depth gauge, BMW No. 00 2 550. Measured distance + material thickness + paper gasket (0.2 mm) = actual distance.







Measure distance from case cover mating surface to base of ball bearing seat in cover.

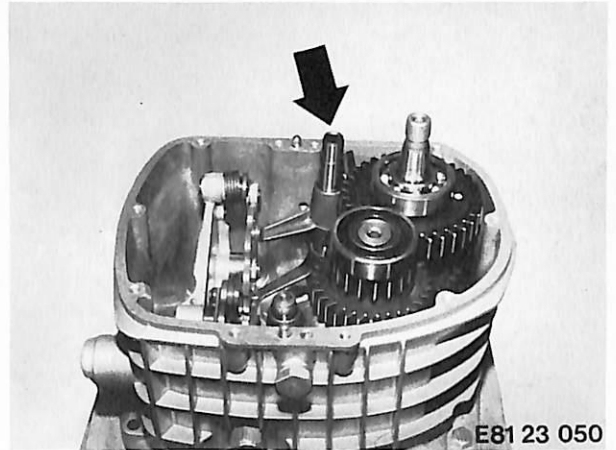
It is recommended to enter the measured distances in a table as shown in the example below.

Refer to Specifications for permissible axial play values.

| Cover                                       |    | Input Shaft | Layshaft | Output Shaft |
|---------------------------------------------|----|-------------|----------|--------------|
| Distance                                    | mm | 15.35       | 15.75    | 15.35        |
| Case                                        | mm | 7.25        | 7.30     | 7.30         |
| +<br>Measuring plate                        | mm | 7.50        | 7.50     | 7.50         |
| +<br>Gasket                                 | mm | 0.20        | 0.20     | 0.20         |
| Distance                                    | mm | 14.95       | 15.00    | 15.00        |
| Difference                                  | mm | 0.40        | 0.75     | 0.35         |
| Shim thickness incl. oil<br>baffle plate    | mm | 0.45        | 0.80     | 0.40         |
| Shim thickness – difference =<br>axial play | mm | 0.05        | 0.05     | 0.05         |

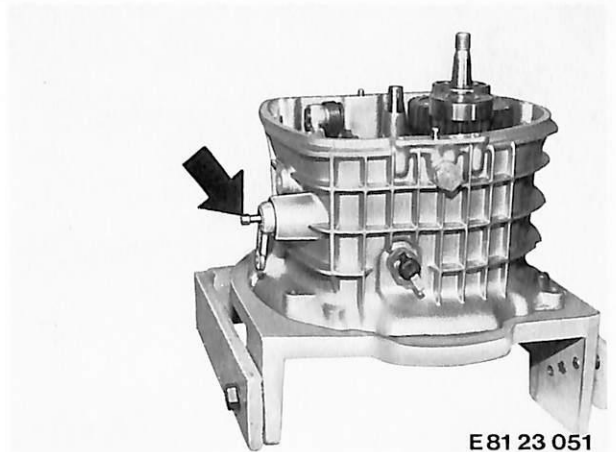
### 23 31 001 Replacing Selector Forks

Remove and install transmission 23 00 020.  
Remove and install/seal case cover 23 11 040.  
Remove and install console for shift plates 23 31 210.  
Pull shaft for 1st/2nd/5th gear selector forks out of case while still warm and lay selector forks aside. Remove gear assembly (23 22 001) to be able to replace 3rd/4th gear selector forks.

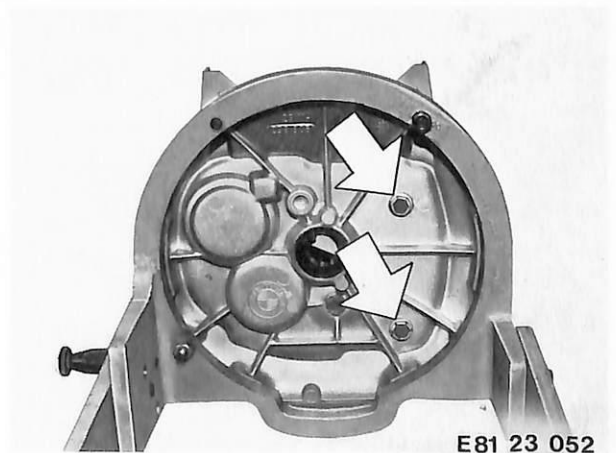


### 23 31 210 Removing and Installing Console for Shift Plates

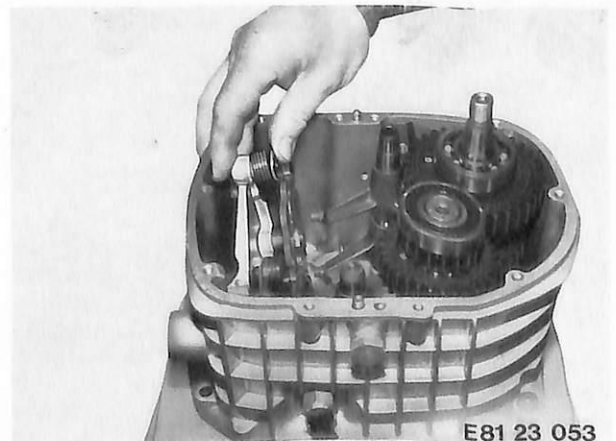
Remove and install transmission 23 00 020.  
Remove and install/seal case cover 23 11 040.  
Unscrew socket head screw (arrow) and pull out shift lever.

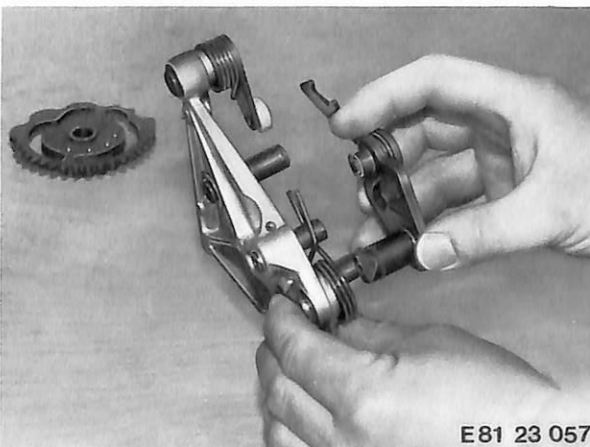
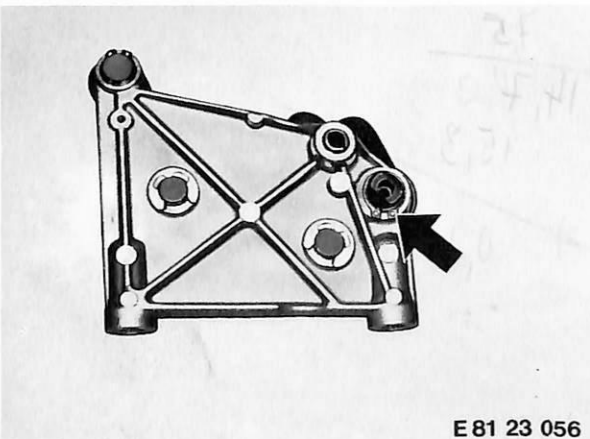
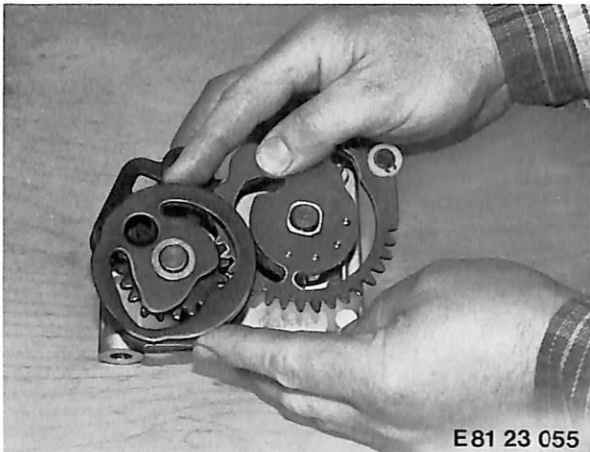


Unscrew two console locating screws (arrows).  
See Specifications for tightening torque.



Tilt console that selector forks are cleared. Remove console.





## 23 31 861 Removing and Installing Shift Plates

Remove and install console 23 31 210.  
Remove two circlips (arrows) holding the shift plates.



### Note:

When assembling, make sure that the first teeth of the shift plates mesh with each other.



## 23 31 881 Removing and Installing Shift Controls

Remove and install shift plates 23 31 861.  
Remove circlip (arrow) for shift element.

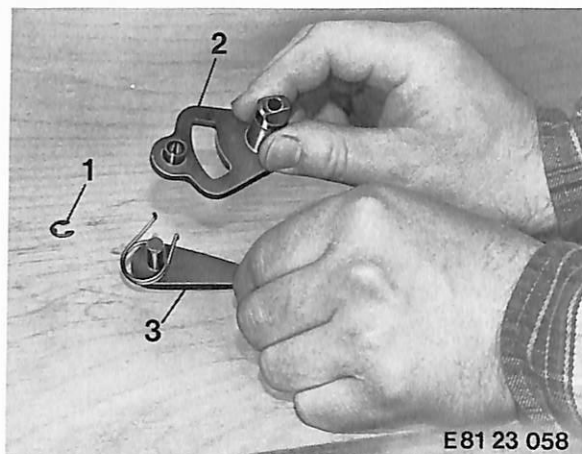


Remove complete shift element. Leave spring on console.

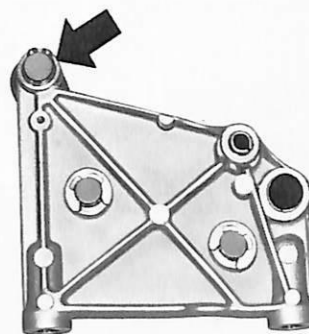




Remove circlip (1) for pawl. Pull element (2) off of pawl (3).



Remove circlip (arrow) for gear arrest and pull arrest out of console.

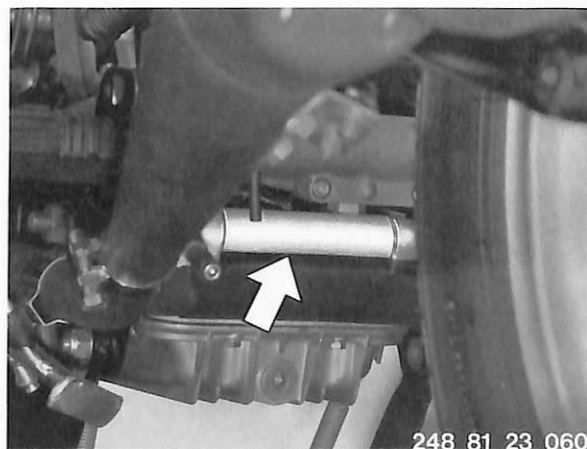


### 23 31 401 Removing and Installing Electric Idle Gauge

Transmission installed.

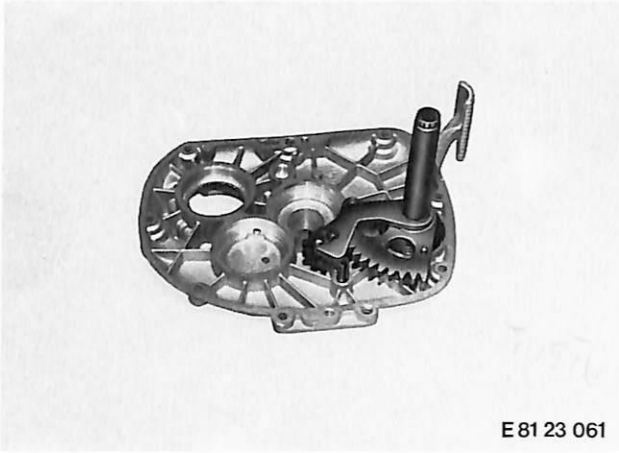
Unscrew left and right nuts on rear engine bolts. Pull out engine bolts.

Knock spacer (arrow) out of engine block with a plastic hammer. Pull off wires and unscrew idle switch.



## 23 51 010 Removing and Installing Kickstarter

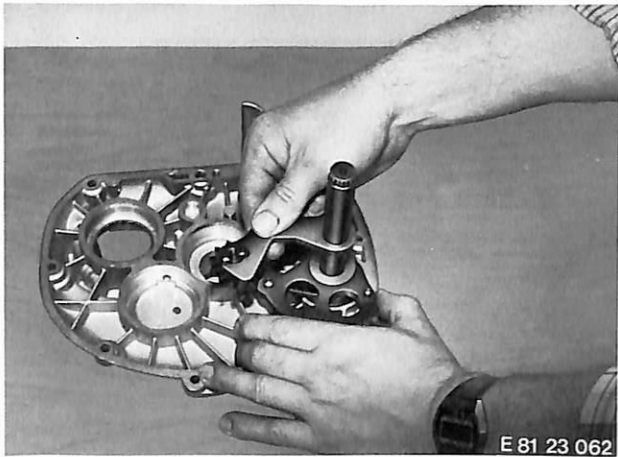
Remove and install/seal transmission case cover 23 11 040.



E 81 23 061



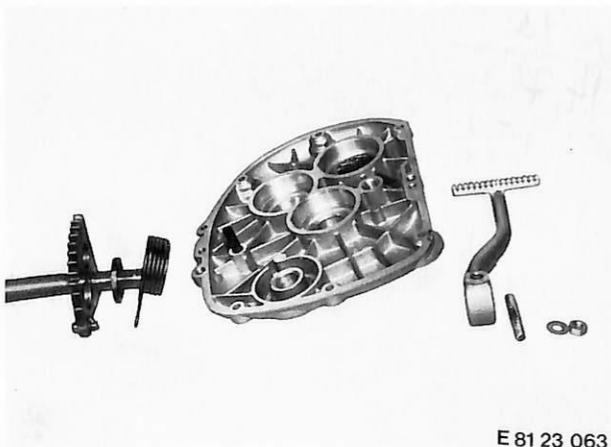
Remove circlip for connecting gear and pull connecting gear off of kickstarter shaft.



E 81 23 062



Unscrew wedge bolt on kickstarter lever and knock out with firm knocks from a hammer. Pull off lever.  
Pull kickstarter shaft out of transmission cover.  
See Specifications for tightening torque.



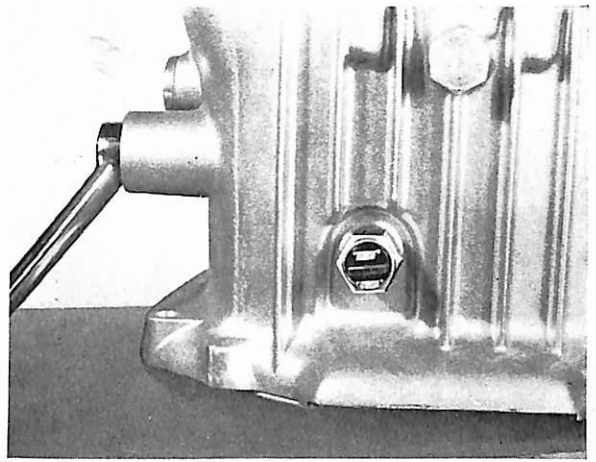
E 81 23 063



## 23 31 401 Replacing Electric Idle Indicator

### 1. Transmission Removed:

Remove and install transmission — 23 00 020.  
Tilt transmission to one side and unscrew idle switch.

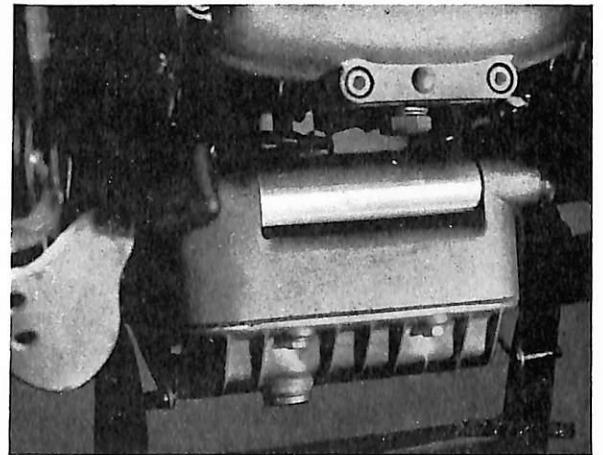


### 2. Transmission Installed:

Drain oil.

Unscrew nuts from rear engine bolts. Remove footrest and exhaust holder. Pull out engine bolts. Knock out spacer from engine block with a plastic hammer.

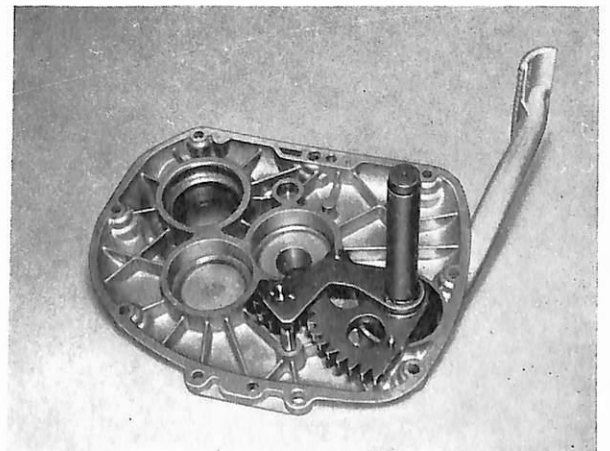
Pull off wires and unscrew idle switch.



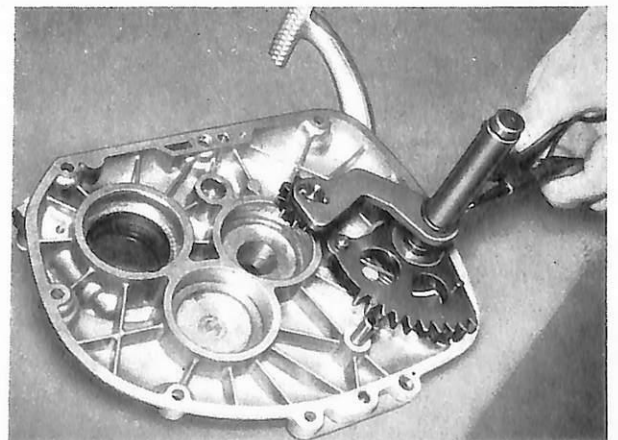
## 23 51 010 Removing and Installing Kick Starter (Optional Extra Equipment 58.4)

Remove and install/seal transmission case cover — 23 11 040.

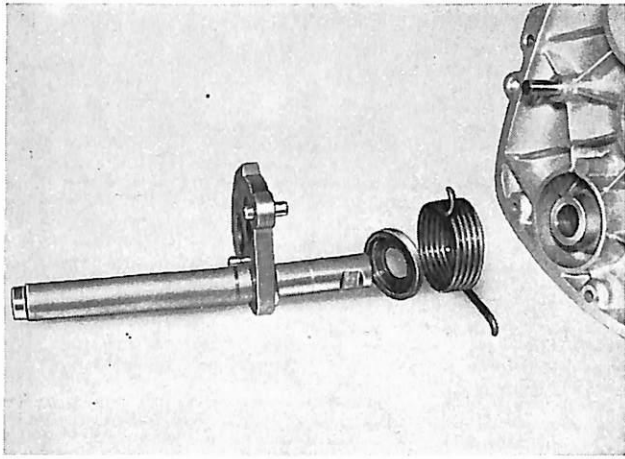
Only perform the repair jobs described in the preparatory work when actually required.



Remove circlip for intermediate gear and pull off intermediate gear from kick starter.







After loosening the screw for kick starter lever and removing same, remove kick starter with washer and spring from cover.

### Troubleshooting Transmission

| Condition                                      | Cause                                                                                                                                         | Correction                                                                                                                 |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Transmission making noise                      | Bearings defective<br>Selector forks grind<br><br>Transmission shaft spacing incorrect<br>Gears making noise – incorrect axial or radial play | Replace<br>Inspect selector forks for signs of grinding, machine or replace<br>Re-space<br><br>Check axial and radial play |
| Difficult shifts                               | Transmission shaft spacing insufficient<br>Pawl on large shift plate (from 1st, 2nd and 5th gears)                                            | Re-space<br><br>Align pawl                                                                                                 |
| Difficult shifts when coasting<br>Shift sticks | Transmission shafts wander<br>Burrs on shift cam, rough finish in journal guide<br>Selector fork seized on selector shaft, excessive play     | Re-space<br>Machine or replace shift cam<br><br>Check or replace selector fork and shaft                                   |
| Overshifting                                   | Roller for arrest worn<br>Spring preload for arrest insufficient<br>Pawl bent                                                                 | Replace<br>Check preload, replace spring if necessary<br>Straighten pawl                                                   |
| Clutch grabs                                   | Input shaft spacing incorrect                                                                                                                 | Re-space                                                                                                                   |





# 26 Propeller Shaft

|                                                          |              |
|----------------------------------------------------------|--------------|
| Specifications . . . . .                                 | Page 26– 0/3 |
| Specifications – 1981 models . . . . .                   | 26– 0/5      |
| 26 11 000 Propeller shaft – remove and install . . . . . | 26–11/1      |

Specifications

| Propeller Shaft                                    |                                                                                                                                                                                            |                                                                          |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Model                                              |                                                                                                                                                                                            | R 65                                                                     |
| Arrangement                                        | Sealed propeller shaft with torsional absorber in right control arm tube, universal joint running on needle bearing at transmission end and hypoid tooth clutch bell housing on drive end. |                                                                          |
| Oil grade above 5° C (41° F)<br>below 5° C (41° F) |                                                                                                                                                                                            | brand name hypoid gear lube SAE 90<br>brand name hypoid gear lube SAE 80 |
| Oil volume in ltr. (pints)                         |                                                                                                                                                                                            | 0.15 (0.3)                                                               |

Torque Values in Nm (ft lbs)

|                                                                                                                                       |                                      |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Twelve-sided head bolt                                                                                                                | 38 <sup>+4</sup> (27 <sup>+3</sup> ) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                                      |

Specifications 1981 Models

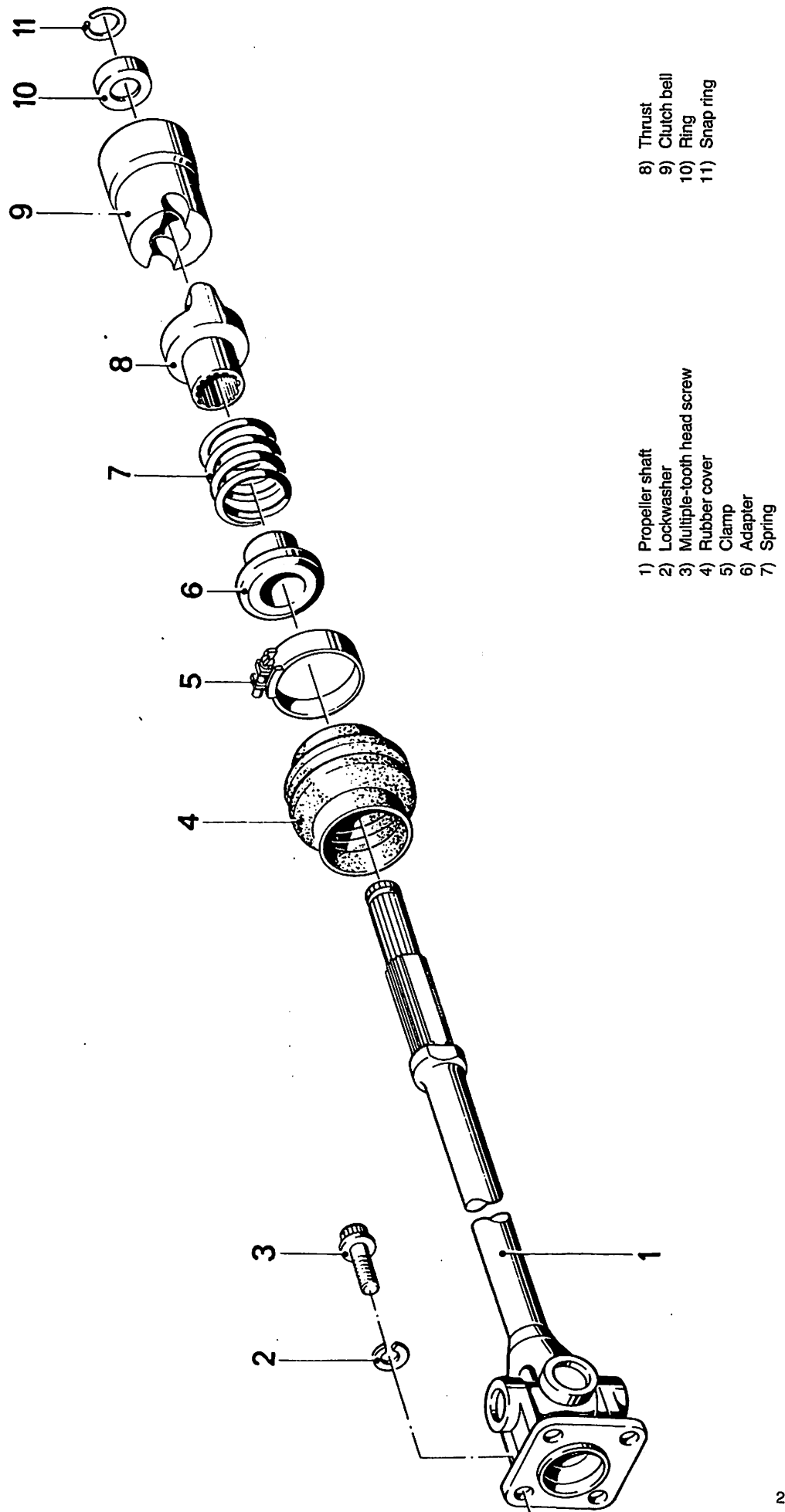
| Propeller Shaft                                    |  |                                                                                                                                                                                            |        |
|----------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Model                                              |  | R 65                                                                                                                                                                                       | R 65LS |
| Arrangement                                        |  | Sealed propeller shaft with torsional absorber in right control arm tube, universal joint running on needle bearing at transmission end and hypoid tooth clutch bell housing on drive end. |        |
| Oil grade above 5° C (41° F)<br>below 5° C (41° F) |  | brand name hypoid gear lube SAE 90 API-Classification GL 5<br>brand name hypoid gear lube SAE 80                                                                                           |        |
| Oil volume in ltr. (pints)                         |  | 0.15 (0.3)                                                                                                                                                                                 |        |

Torque Values in Nm (ft lbs)

|                                                                                                                                       |         |
|---------------------------------------------------------------------------------------------------------------------------------------|---------|
| Twelve-sided head bolt                                                                                                                | 40 (29) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |         |

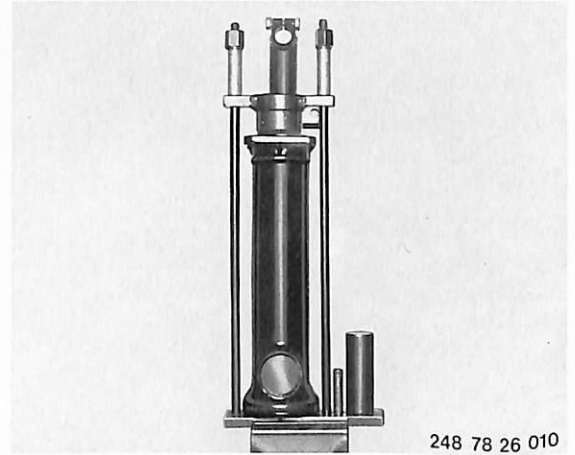


# Propeller Shaft with Torsion Damper

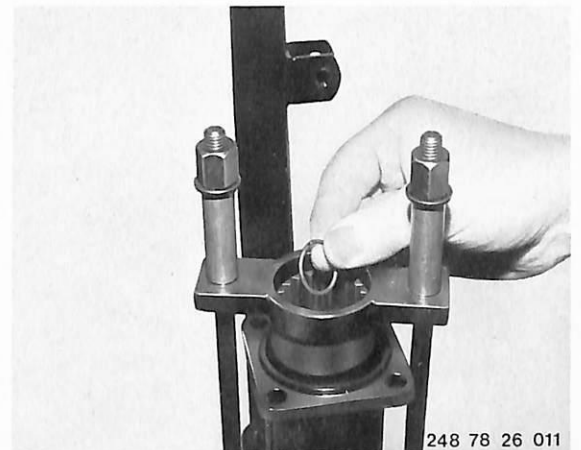


## 26 11 00 Removing and Installing Propeller Shaft

Remove rear wheel control arm — 33 17 350.  
Clamp assembly fixture, BMW No. 26 17 00, in a vise and place control arm in fixture.

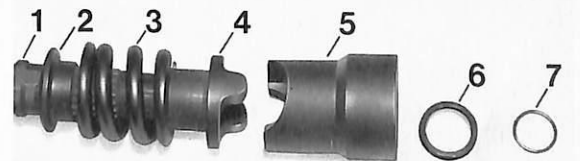


Run a mandrel through long groove and lift out snap ring. Relax assembly fixture slowly.



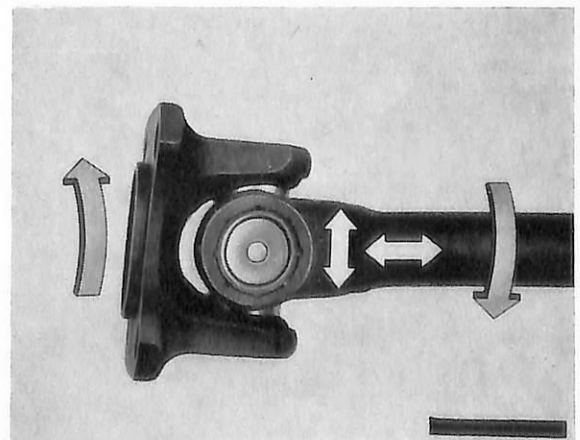
Remove control arm from fixture. Pull out propeller shaft and components from arm beam.

- 1 Propeller shaft
- 2 Pressure pad
- 3 Spring
- 4 Counterpart
- 5 Clutch bell housing
- 6 Ring
- 7 Snap ring



Check universal joint for wear; determine radial play by turning flange and propeller shaft alternately, and axial play by moving axially.

If necessary, replace propeller shaft.







# 31 Front Wheel Fork

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Specifications . . . . .                                      | Page 31– 0/3 |
| Specifications – 1981 models . . . . .                        | 31– 0/5      |
| 31 42 009 Telescope fork – check . . . . .                    | 31–42/1      |
| 31 42 100 Telescope fork – remove and install . . . . .       | 31–42/2      |
| 31 42 103 Telescope fork – disassemble and assemble . . . . . | 31–42/5      |
| Telescope fork – troubleshoot . . . . .                       | 31–42/7      |

## Specifications

### Front Axle

| Model                                                                                                           | R 65                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wheel bearing lubrication                                                                                       | Brand name multi-purpose grease with drip point of 180° C (355° F)                                                                                                       |
| Front wheel caster in mm (in.)                                                                                  | approx. 96 (3.779) – not adjustable –                                                                                                                                    |
| Steering lock                                                                                                   | approx. 42° to each side                                                                                                                                                 |
| Front wheel fork lock angle                                                                                     | 42°                                                                                                                                                                      |
| Spring travel in mm (in.)                                                                                       | 175 (6.890)                                                                                                                                                              |
| Installed length (measured from upper edge of support tube to machined surface on lower fork guide) in mm (in.) | 190 (7.480)                                                                                                                                                              |
| Fork spacer tube                                                                                                | hard chrome-plated                                                                                                                                                       |
| Fork sliding tube                                                                                               | cast aluminum                                                                                                                                                            |
| Lower fork bridge                                                                                               | forged aluminum                                                                                                                                                          |
| Oil volume per fork beam in ltr. (pints)<br>(at oil change)                                                     | 0.190 (0.4)                                                                                                                                                              |
| Oil grade                                                                                                       | Shock absorber oil; Shell Aero Fluid 4, BP Aero Hydraulic 1, Castrol DB Hydraulic Fluid 1–318,<br>Aral P 3441, Aral 1010, BP Olex HLP 2849, Mobil Aero HFA, Mobil DTE 11 |
| Telescope fork spacer tube (hard chrome plated) outside dia. in mm (in.)                                        | $36 \begin{smallmatrix} -0.050 \\ -0.075 \end{smallmatrix} (1.4173 \begin{smallmatrix} -0.0020 \\ -0.0029 \end{smallmatrix})$                                            |
| Fork sliding tube inside dia. in mm (in.)                                                                       | $36 \begin{smallmatrix} +0.025 \\ 0 \end{smallmatrix} (1.4173 \begin{smallmatrix} +0.0010 \\ 0 \end{smallmatrix})$                                                       |
| Running clearance of fork sliding tube to fork spacer tube, max., in mm (in.)                                   | 0.05 ... 0.1 (0.002 ... 0.004)                                                                                                                                           |

## Specifications

### Front Axle

| Model                                                          | R 65                                    |
|----------------------------------------------------------------|-----------------------------------------|
| Piston on absorber tube,<br>outside dia. in mm (in.)           | 27.7 $-0.17$ (1.090 $-0.007$ )          |
| Fork spacer tube inside dia. in mm (in.)                       | 28 $\pm$ 0.15 (1.102 $\pm$ 0.006)       |
| Running clearance of piston in fork<br>spacer tube in mm (in.) | 0.15 $\dots$ 0.62 (0.006 $\dots$ 0.024) |
| Relaxed fork spring length in mm (in.)                         | 490 $^{+12}$ (19.291 $^{+0.472}$ )      |
| Fork spring wire gage dia. in mm (in.)                         | 4.25 (0.167)                            |

### Torque Values in Nm (ft lbs)

|                                                                                                                                          |                    |                                |                               |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------------|
| End plug                                                                                                                                 | 80 + 10 (59 + 7.3) | Absorber in sliding tube screw | 35 $\pm$ 5 (26 $\pm$ 3.6)     |
| Lower fork bridge bolts                                                                                                                  | 40 + 5 (29 + 3.6)  | Guard bracket to sliding tube  | 20 $\dots$ 25 (15 $\dots$ 18) |
|                                                                                                                                          |                    | Axle clamping bolt             | 15 + 2 (11 + 1.4)             |
| Tighten all other bolts and nuts to common torque values as listed in tables<br>from bolt/nut suppliers or the new BMW Standard 60002.0. |                    |                                |                               |



## Specifications – 1981 Models

| Front Axle                                                                                                      |                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model                                                                                                           | R 65 R 65 LS                                                                                                                                                                                                                                                         |
| Wheel bearing lubrication                                                                                       | Brand name bearing grease, application temperature range $-30^{\circ}\text{C} \dots +140^{\circ}\text{C}$ , drip point $150^{\circ} \dots 230^{\circ}\text{C}$ , high corrosion inhibition, good water/oxidation resistance, e. g. Shell Retinax A                   |
| Front wheel caster in mm (in.)                                                                                  | approx. 96 (3.779) – not adjustable                                                                                                                                                                                                                                  |
| Steering lock                                                                                                   | approx. $42^{\circ}$ to each side approx. $35^{\circ}$ to each side                                                                                                                                                                                                  |
| Front wheel fork lock angle                                                                                     | $42^{\circ}$                                                                                                                                                                                                                                                         |
| Spring travel in mm (in.)                                                                                       | 175 (6.890)                                                                                                                                                                                                                                                          |
| Installed length (measured from upper edge of support tube to machined surface on lower fork guide) in mm (in.) | 190 (7.480)                                                                                                                                                                                                                                                          |
| Fork spacer tube                                                                                                | hard chrome plated                                                                                                                                                                                                                                                   |
| Fork sliding tube                                                                                               | cast aluminium                                                                                                                                                                                                                                                       |
| Lower fork bridge                                                                                               | forged aluminium                                                                                                                                                                                                                                                     |
| Oil volume per fork beam in ltr. (pints)<br>(for oil change)                                                    | 0.190 (0.4)                                                                                                                                                                                                                                                          |
| Oil grade                                                                                                       | Shell 4001; Shell Aero fluid 4; Castrol DB Hydraulic Fluid; Castrol Shock Absorber Oil Extra Light; Castrol LHM (preferably below $0^{\circ}\text{C}$ ); Aral P 3441; Aral 1010; Mobil Aero HFA; Mobil DTE 11; Esso UNIVIS J 13; BP Aero Hydraulic; BP-Olex HLP 2849 |
| Telescope fork spacer tube (hard chrome plated) outside dia. in mm (in.)                                        | $36_{-0.075}^{-0.050}$ ( $1.4173_{-0.0029}^{-0.0020}$ )                                                                                                                                                                                                              |
| Fork sliding tube inside dia. in mm (in.)                                                                       | $36_{0}^{+0.025}$ ( $1.4173_{0}^{+0.0010}$ )                                                                                                                                                                                                                         |
| Running clearance of fork sliding tube to fork spacer tube, max. in mm (in.)                                    | $0.05 \dots 0.1$ ( $0.002 \dots 0.004$ )                                                                                                                                                                                                                             |



# Specifications 1981 Models

| Front Axle                                                  |                                          |         |
|-------------------------------------------------------------|------------------------------------------|---------|
| Model                                                       | R 65                                     | R 65 LS |
| Piston on absorber tube, outside dia. in mm (in.)           | 27.7 $-0.17$ (1.090 $-0.007$ )           |         |
| Fork spacer tube inside dia. in mm (in.)                    | 28 $\pm 0.15$ (1.102 $\pm 0.006$ )       |         |
| Running clearance of piston in fork spacer tube in mm (in.) | 0.15 $\dots 0.62$ (0.006 $\dots 0.024$ ) |         |
| Relaxed fork spring length in mm (in.)                      | 490 $+12$ (19.291 $+0.472$ )             |         |
| Fork spring wire gage dia. in mm (in.)                      | 4.25 (0.167)                             |         |

## Torque Values in Nm (ft lbs)

|                                                                                                                                       |                    |                                |                                |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|--------------------------------|
| End plug                                                                                                                              | 80 + 10 (59 + 7.3) | Absorber in sliding tube screw | 35 $\pm 5$ (26 $\pm 3.6$ )     |
| Lower fork bridge bolts                                                                                                               | 40 + 5 (29 + 3.6)  | Guard bracket to sliding tube  | 20 $\dots 25$ (15 $\dots 18$ ) |
| Oil filler plugs                                                                                                                      | 9 (6.5)            | Axle clamping bolt             | 15 + 2 (11 + 1.4)              |
| Oil drain plugs                                                                                                                       | 8 (5.8)            |                                |                                |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                    |                                |                                |

2) Cover  
3) Fillister head screw  
4) Seal  
5) Snap ring  
6) Spring damper  
7) O-ring  
8) Fork spacer tube  
9) Fork bridge, lower  
10) Hose holder  
11) Washer  
12) Hexagon head bolt  
13) Ring  
14) Taper roller bearing  
15) Round nut  
16) Plug  
17) Absorber tube mount  
18) Ring  
19) Valve housing  
20) Valve disc  
21) Perforated ring  
22) Stop ring  
23) Absorber tube  
24) Spring  
25) Guide tube  
26) Seal  
27) Dust cover  
28) Felt pad  
29) Base  
30) Hexagon nut  
31) Washer  
32) Fillister head screw  
33) Hose holder  
34) Hexagon head screw  
35) Seal  
36) Type reflector  
37) Fillister head screw  
38) Washer  
39) Hexagon nut  
40) Seal

- |                          |                          |
|--------------------------|--------------------------|
| 1) Fork bridge, upper    | 27) Seal                 |
| 2) Cover                 | 28) Dust cover <b>9</b>  |
| 3) Fillister head screw  | 29) Felt pad             |
| 4) Seal                  | 30) Base                 |
| 5) Snap ring             | 31) Hexagon nut          |
| 6) Spring damper         | 32) Washer               |
| 7) O-ring                | 33) Fillister head screw |
| 8) Fork spacer tube      | 34) Hose holder          |
| 9) Fork bridge, lower    | 35) Hexagon head screw   |
| 10) Hose holder          | 36) Seal                 |
| 11) Washer               | 37) Type reflector       |
| 12) Hexagon head bolt    | 38) Fillister head screw |
| 13) Ring                 | 39) Washer               |
| 14) Taper roller bearing | 40) Hexagon nut          |
| 15) Round nut            | 41) Seal                 |
| 16) Plug                 | 42) Fillister head screw |
| 17) Absorber tube mount  |                          |
| 18) Ring                 |                          |
| 19) Valve housing        |                          |
| 20) Valve disc           |                          |
| 21) Perforated ring      |                          |
| 22) Stop ring            |                          |
| 23) Absorber tube        |                          |
| 24)                      |                          |
| 25) Spring               |                          |
| 26) Guide tube           |                          |
-



### 31 42 009 Checking Telescope Fork

Remove and install telescope fork 31 42 100.

Disassemble telescope fork 31 42 103.

A thorough inspection of the fork bridge at bottom, stand tubes and sliding tubes for cracks will be necessary in particular when the fork is damaged.

Check removed spacer tubes resting on both ends in vee-blocks or similar for runout.

See Specifications for permissible runout value.

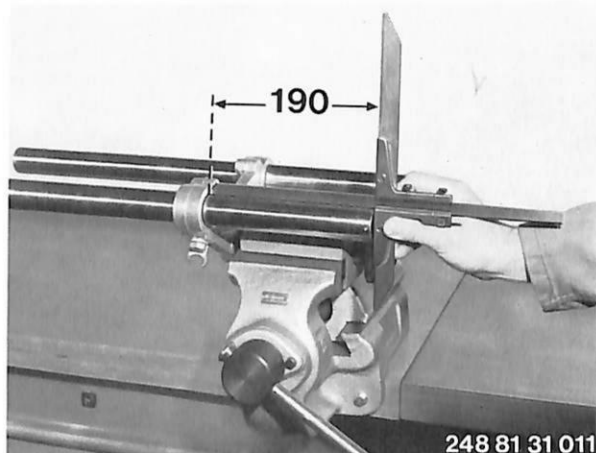
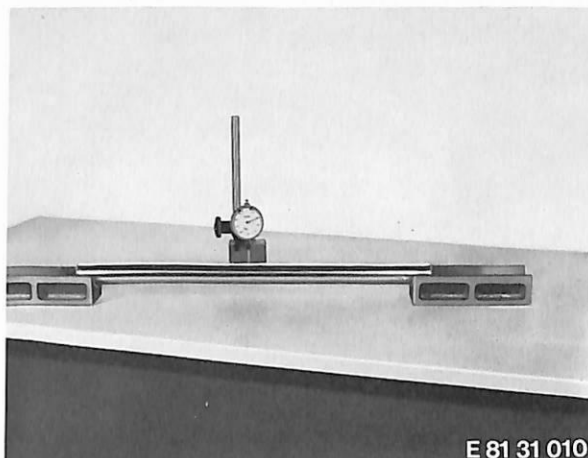
#### **Important!**

Never straighten bent spacer tubes – danger of breaking!

Push in two new spacer tubes to inspect the lower fork bridge (190 mm installed test length for tubes, as measured from spacer tube upper edge to fork bridge).

Place two steel rulers, BMW No. 31 4 620, on ends of fork spacer tubes and check for distortion.

Check spacer tubes for deviation from parallel with a caliper gauge. Check alignment between fork guide tube and spacer tubes. It should be possible to easily push upper fork bridge on spacer tubes and fork guide tube simultaneously.



### 31 42 100 Removing and Installing Telescope Fork

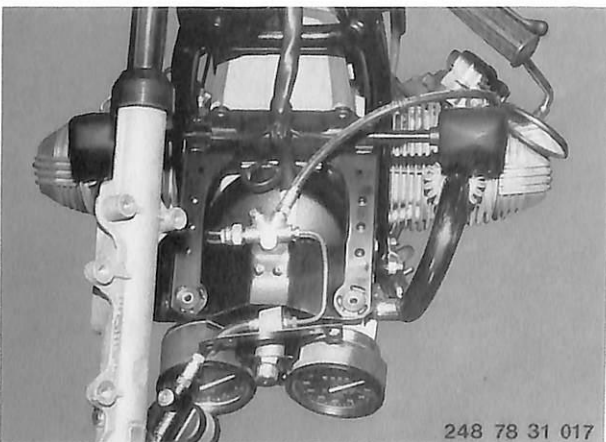
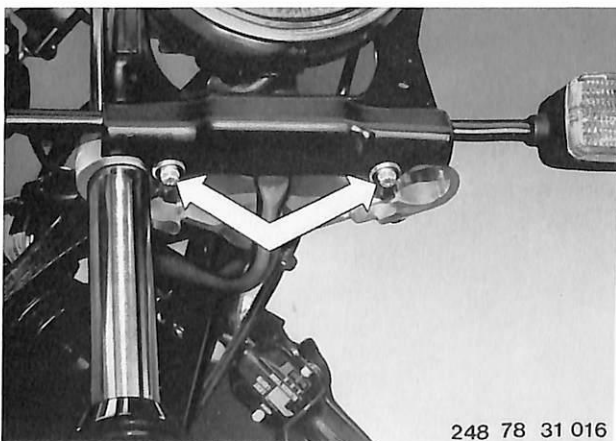
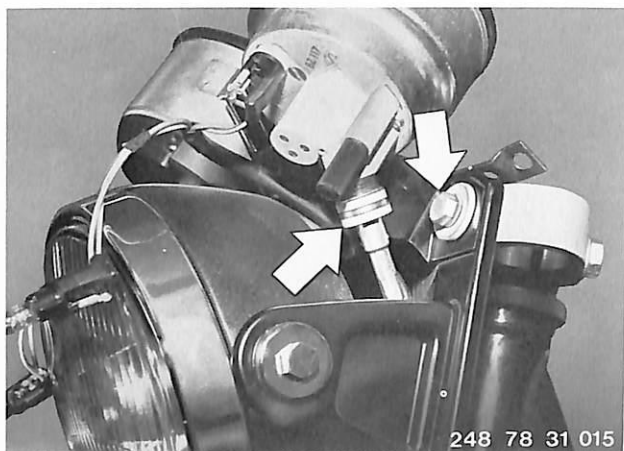
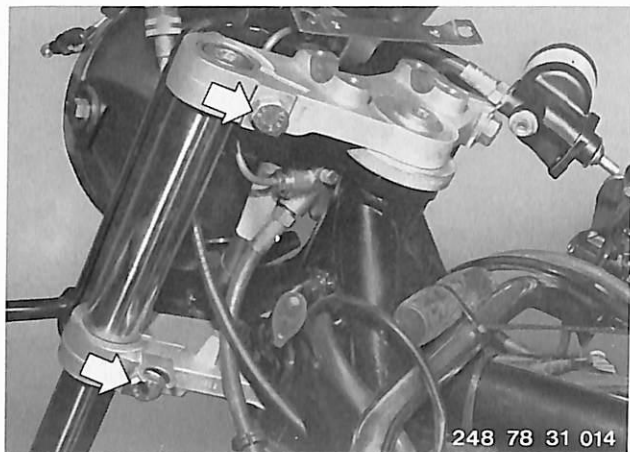
Remove and install front wheel – 36 30 300.

Remove and install front wheel fender – 46 61 000.

Remove and install steering tube – 32 71 000.

Remove and install brake caliper – 34 11 000.

Loosen screws (arrows) for left spacer on upper and lower fork bridge, and pull out spacer with slide downward.



Unscrew instrument carrier mounting screws (arrows) at top left and right, as well as coupling nut for speedometer cable.

Unscrew mounting screws from lower fork bridge (arrow).

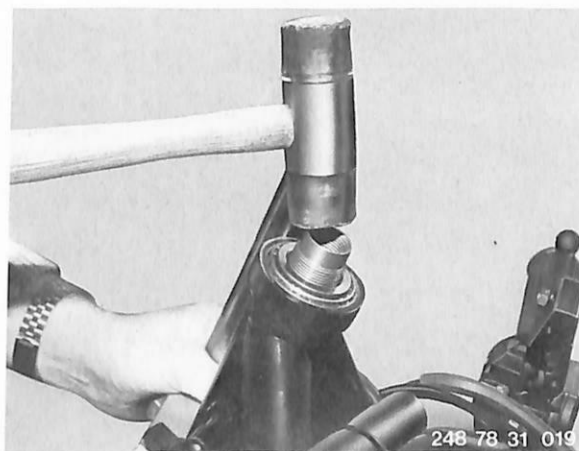
Pull instrument carrier toward side over lower fork bridge and let it hang down.

Unscrew screw from upper fork bridge (1) on right side and plug (2), and remove upper fork bridge.



Unscrew wheel nut by hand and pull out lower fork bridge from control head by applying light knocks against fork guide tube.

The upper and lower taper roller bearing outer races remain in frame.



Outer races are removed for replacement with a Kukko puller, BMW No. 00 5 560, used together with a support, BMW No. 31 4 800.

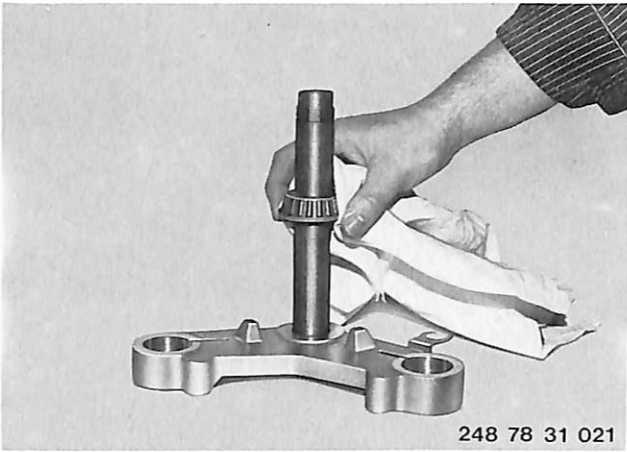
**Installation Note!** Knock in new bearing shell with old shell!



Pull in new outer races one after the other in conjunction with the spindle or frame gauge and spacer, BMW No. 31 4 820.





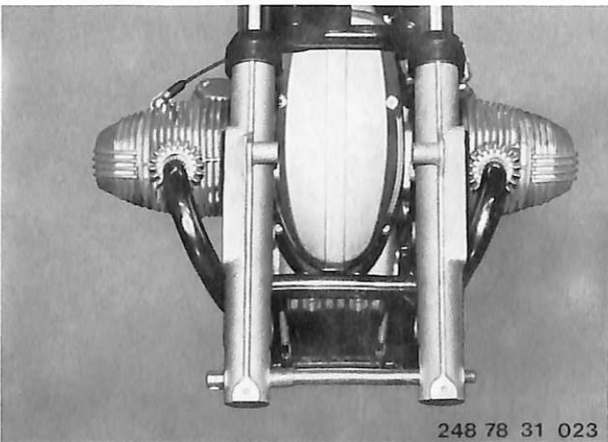


To install forks in control head, first install heated upper taper roller bearing and then push lower fork bridge with control tube into frame from below carefully. Screw on wheel nut and tighten by hand to remove bearing play. Install right spacer in lower fork bridge (190 mm/7 1/2" above upper edge of fork bridge). Mount upper fork bridge and tighten screw to torque.

**Installation Note!** Lubricate bearing shells and taper roller bearings well prior to installation.



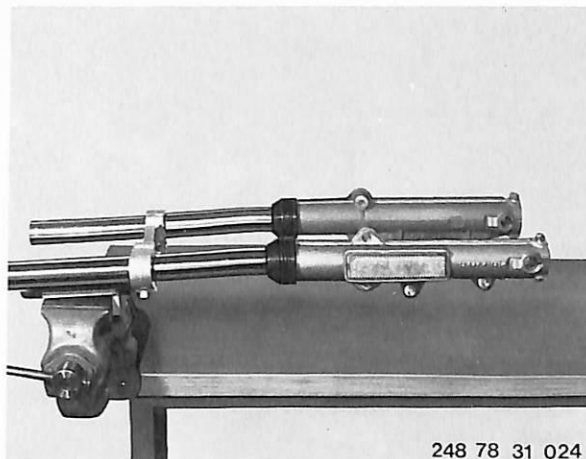
Bolt instrument carrier to upper and lower fork bridge. Push left spacer with slide into fork bridge from below and make initial adjustment with help of stub axle. After installation of front wheel and loosening of left bolts again as well as bottoming the springs several times, retighten the fork bolts.



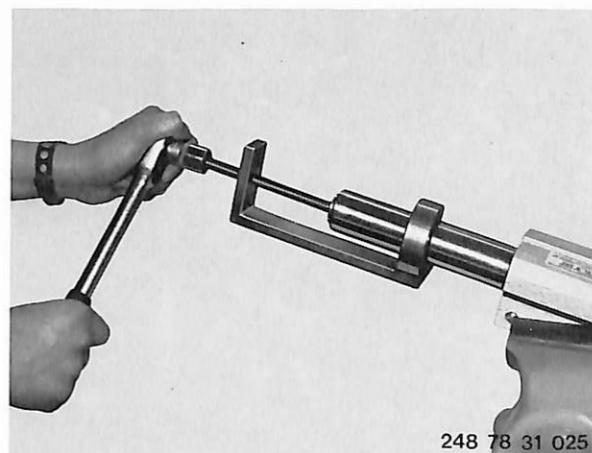
Bolt instrument carrier to upper and lower fork bridge. Push left spacer with slide into fork bridge from below and make initial adjustment with help of stub axle. After installation of front wheel and loosening of left bolts again as well as bottoming the springs several times, retighten the fork bolts.

### 31 42 103 Disassembling Telescope Fork

Remove and install telescope fork – 31 42 100.  
Install left spacer with slide in fork bridge again.  
Clamp fork in a vise, using wood, BMW No. 31 4 600.  
(Have slides face down slightly.)

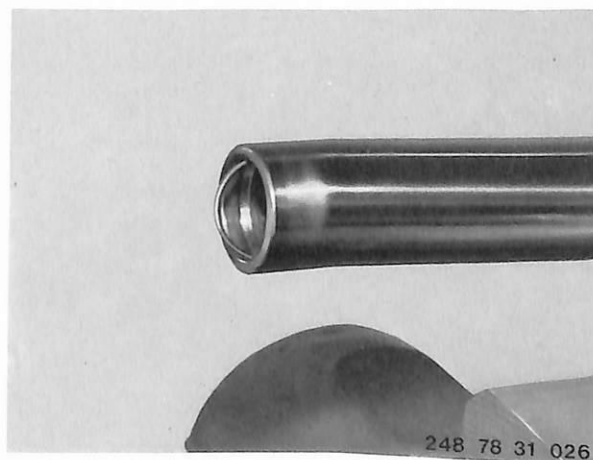


Use fixture, BMW No. . . .  
to press spring retainer against spring into spacer tube to depth  
of approx. 50 mm (2").



Knock out snap ring from seat on split side with belzerite hammer  
and screwdriver. Position upright and pull out by hand.  
Release fixture and remove spring retainer.

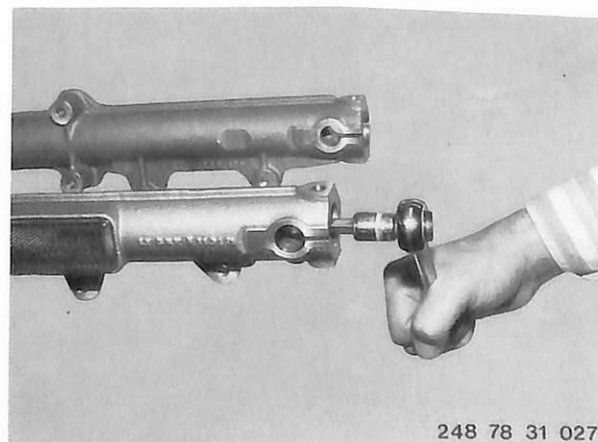
**Installation Note!** Replace O-ring on spring retainer each time  
disassembly takes place.

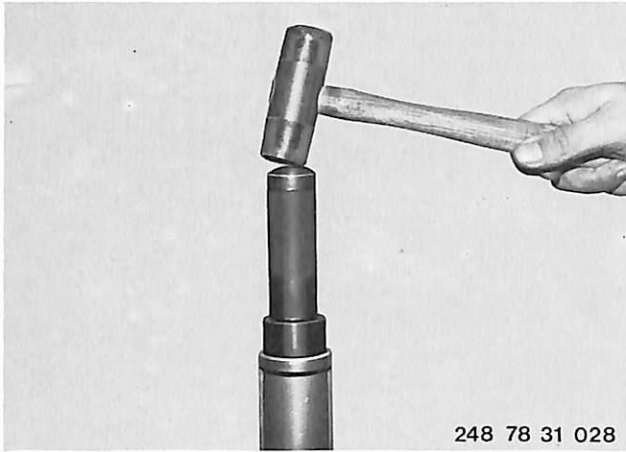


Drain fork oil.

Unscrew bolts for stub axle, loosen bottom screws of slide tubes  
with a socket wrench and pull off slide tubes.

**Note!** When turning bottom screws with a double extension and  
size 13 socket, counterhold absorber on inside in spacer tube.





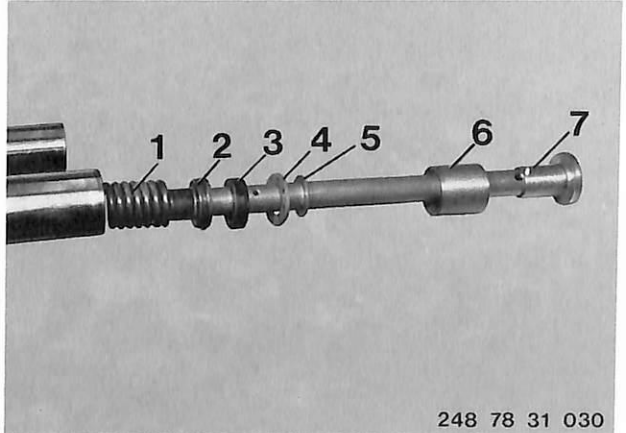
248 78 31 028

Pull off fork cover and lift out seal in slide tube with a screwdriver carefully.  
Knock in new seal with a mandrel, BMW No. 31 4 650.



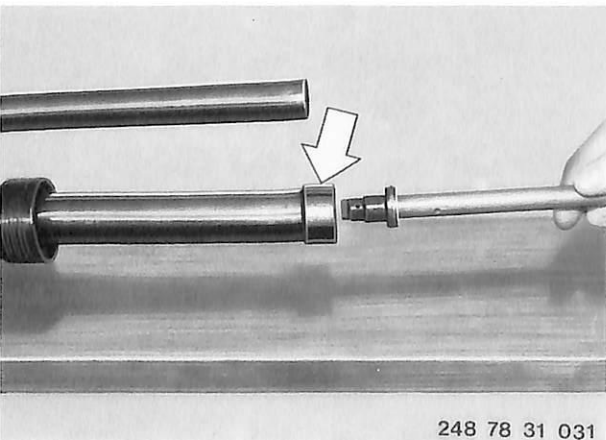
248 78 31 029

Remove circlip in spacer tube with special pliers and pull out entire absorber from spacer tube.



248 78 31 030

- 1 Spring
- 2 Absorber
- 3 Stop ring
- 4 Perforated plate
- 5 Distributor plate
- 6 Valve body
- 7 Guide



248 78 31 031

Use guide sleeve, BMW No. 31 4 720, (arrow) to compress piston rings when installing absorber in the spacer tube.  
Push stop ring through guide sleeve into the spacer tube with a thin mandrel.



### Trouble-shooting – front forks

| Fault                                                                      | Cause                         | Remedy                                                                                                                                                               |
|----------------------------------------------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Forks do not compress easily ('stiction') or seize                         | Forks distorted               | Release all bolts at sheet-metal pressing and quick-release axle, and check pressing for distortion; compress the forks fully and tighten bolts to specified torques |
| Rattling sound when forks are compressed several times in rapid succession | Damping valve touching piston | Insert a rubber washer between these components (see S.I.)                                                                                                           |



## 32 Steering

|                                                                       |              |
|-----------------------------------------------------------------------|--------------|
| Specifications . . . . .                                              | Page 32- 0/3 |
| Specifications – 1981 models . . . . .                                | 32- 0/5      |
| 32 00 454 Steering – adjust . . . . .                                 | 32-00/1      |
| 32 71 000 Steering tube – remove and install . . . . .                | 32-71/1      |
| 32 73 030 Throttle cable – remove and install . . . . .               | 32-73/1      |
| 32 73 030 Throttle cable – remove and install (1981 models) . . . . . | 32-73/2      |



### Steering Specifications

|                                |                  |
|--------------------------------|------------------|
| Model                          | R 65             |
| Steering lock                  | 42° to each side |
| Handlebar width in mm (in.)    | 650 (25.590)     |
| Steering tube dia. in mm (in.) | 22 (0.866)       |

### Torque Values in Nm (ft lbs) + Friction Values in Ncm (in lbs)

|                                                                                                                                       |                    |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| End plug                                                                                                                              | 80 + 10 (59 + 7.3) |
| Steering bearing                                                                                                                      | 350 ± 20 Ncm       |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                    |

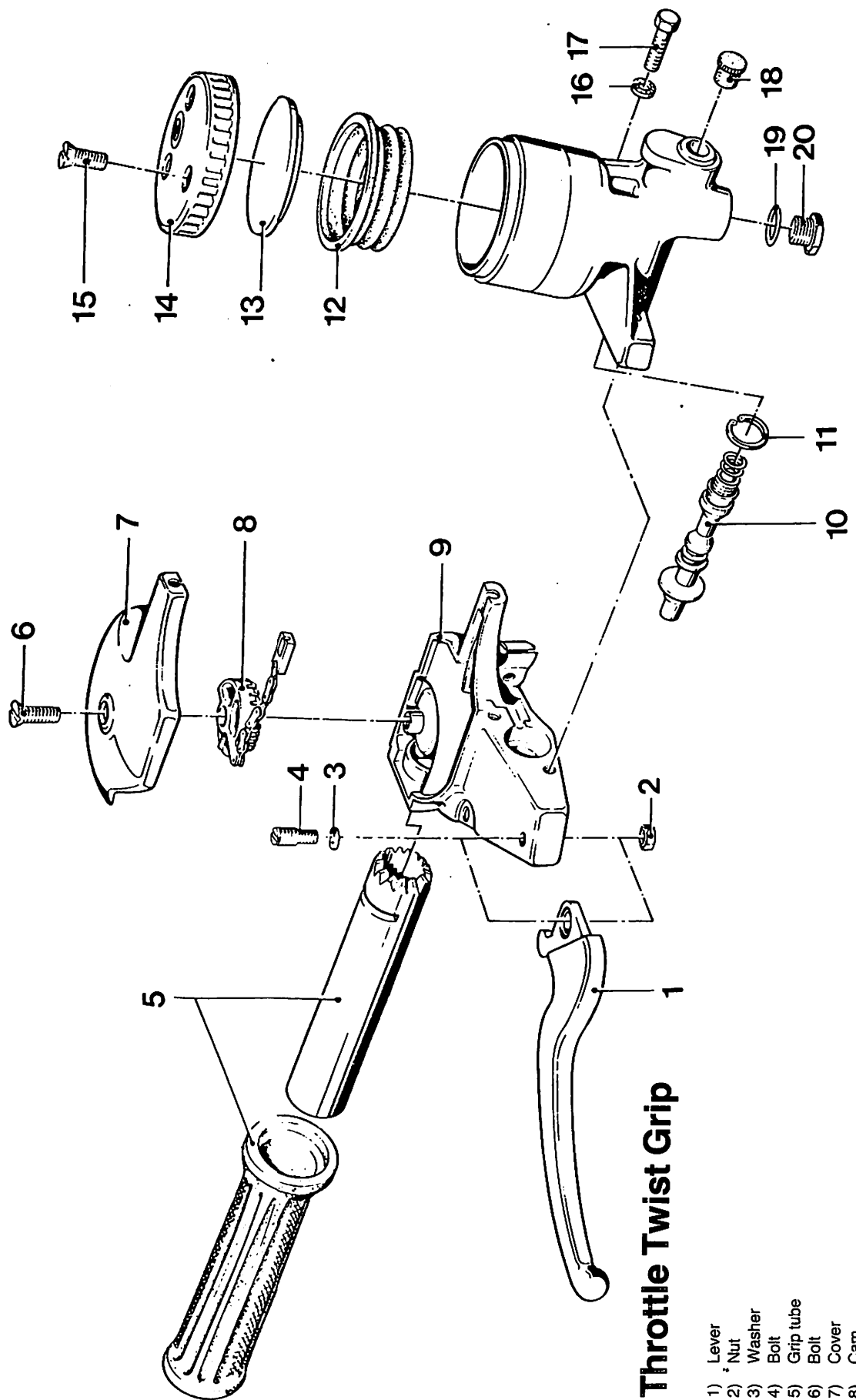
## Specifications 1981 Models

| Steering                       |                          |                          |
|--------------------------------|--------------------------|--------------------------|
| Model                          | R 65                     | R 65 LS                  |
| Steering lock                  | approx. 42° to each side | approx. 35° to each side |
| Handlebar width in mm (in.)    | 650 (25.590)             |                          |
| Steering tube dia. in mm (in.) | 22 (0.866)               |                          |

## Torque Values in Nm (ft lbs) + Friction Values in Ncm (in lbs)

|                                                                                                                                       |                    |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| End plug                                                                                                                              | 80 + 10 (59 + 7.3) |
| Steering bearing                                                                                                                      | without play       |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |                    |

# Throttle Twist Grip and Brake Master Cylinder



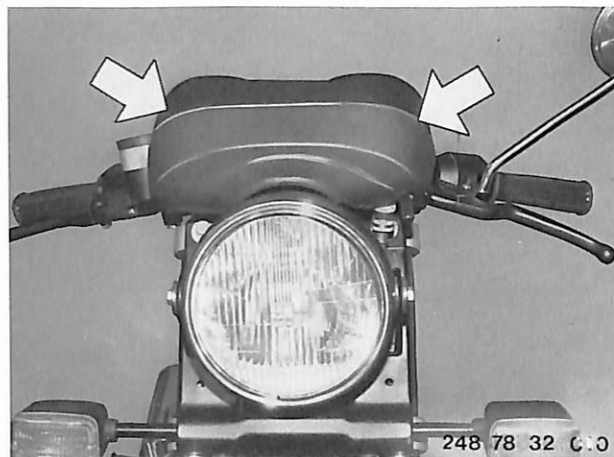
## Throttle Twist Grip

- 1) Lever
- 2) Nut
- 3) Washer
- 4) Bolt
- 5) Grip tube
- 6) Bolt
- 7) Cover
- 8) Cam
- 9) Housing



## 32 00 454 Adjusting Steering

Detach instrument trim (arrows).

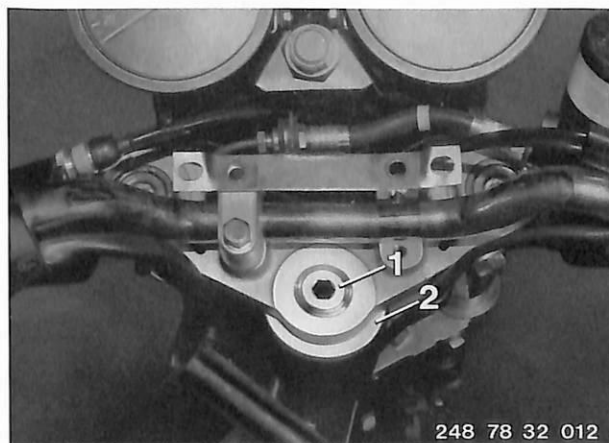


Unscrew round nut from ignition lock (with circlip pliers). Pull out holders of turn signal indicator lamps and remove instrument trim.



Loosen end bolt (1), loosen round nut (2), release bearing with an impact knock, tighten round nut by hand, tighten end bolt to specified tightening torque – see Specifications.

Adjust control head bearing without play.



When control head bearing has been adjusted correctly, the handlebar of a motorcycle on its stand should just fall against the right stop on its own.



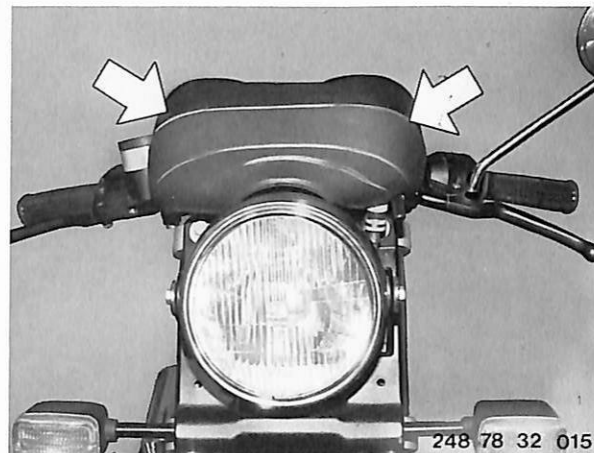
## 32 71 000 Removing and Installing Steering Tube

Remove and install cockpit upper section (only R 65 LS) 46 63 025.

Unscrew one each phillips head screw on left and right sides of instrument housing (arrows).

Take off shield.

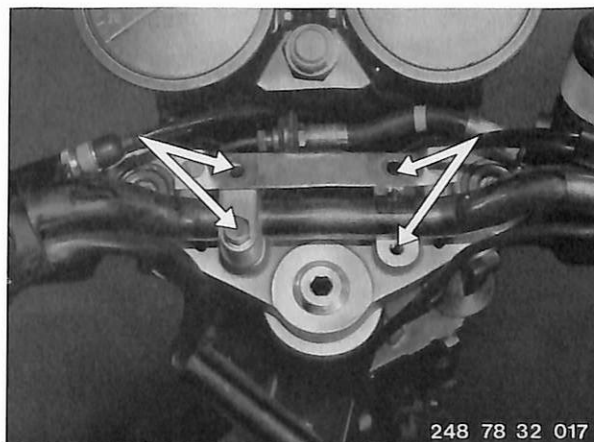
Pull holders of turn signal indicator lamps with wires out of instrument housing.



Unscrew ignition lock screw with circlip pliers and remove instrument trim upward.



Unscrew 2 handlebar mounting screws (arrows).



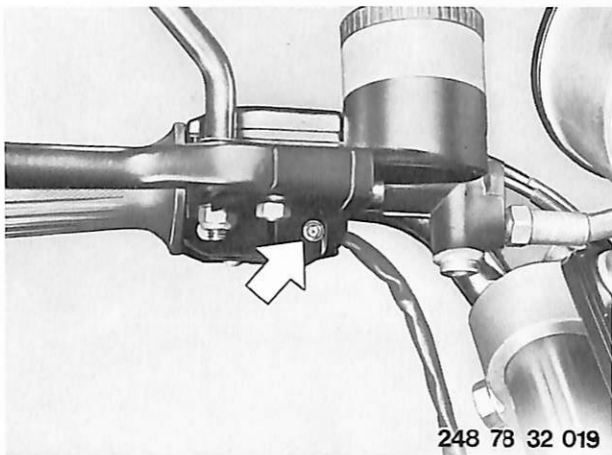
Unscrew 2 socket head screws holding brake master cylinder on throttle grip (arrows).

Remove accelerator cables — 32 73 030.

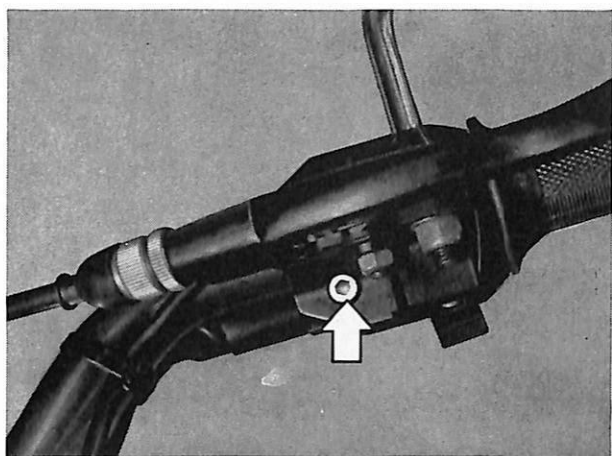
Remove clutch cable — 32 73 000.

Place handlebar tube on fuel tank, using a soft liner.





Unscrew socket head screw (arrow) on right side of housing for throttle twist grip and brake lever, and pull off complete housing.



Pull off left handlebar grip. Apply compressed air to grip through handlebar tube from right side. Unscrew socket head screw (arrow) from housing and pull off instrument from handlebar tube.

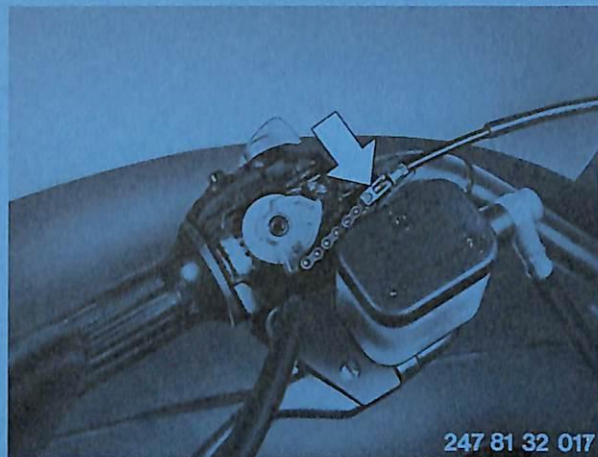




### 32 73 030 Removing and Installing Throttle Cable (1981 Models)

Remove seat and fuel tank 16 11 030.

Push back water protection cap on cable. Unscrew accelerator cable cover and disconnect cable on chain (arrow).

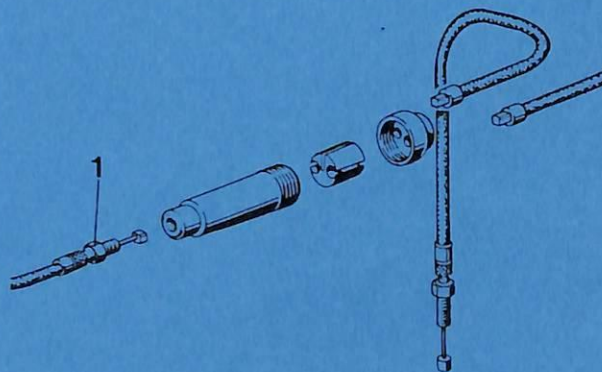


#### Installation:

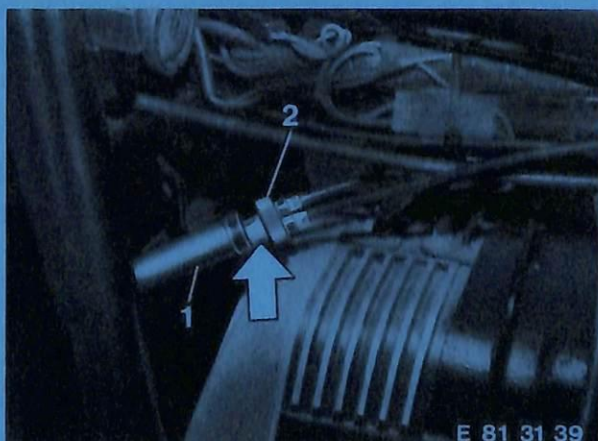
Lubricate adjusting cam and spline on throttle twist grip with grease before assembling. When assembling, make sure mark on tooth of throttle twist grip is aligned with mark on adjusting cam.



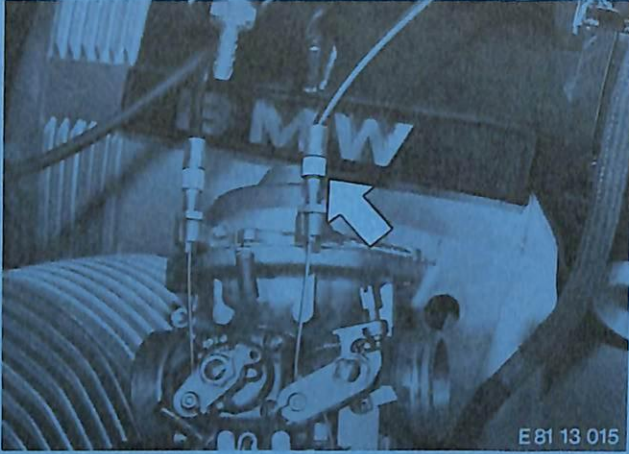
Unscrew lock nut (1) of adjusting screw on distributor and tighten adjusting screw fully.



Turn sleeve of distributor (1) while holding on knurled section (2). Disconnect cables on distributor (arrow).







Unscrew lock nut of adjusting screw on carburetor and remove screw (arrow). Disconnect cable on throttle control.

**Note:**

Adjust engine idle speed and fuel/air mixture 13 00 004.



## 32 73 030 Removing and Installing Accelerator Cable

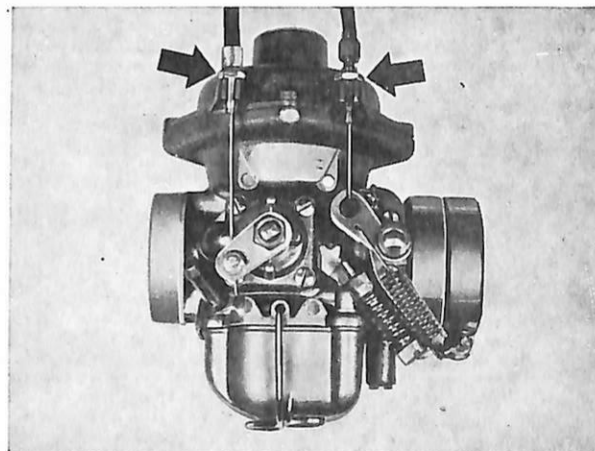
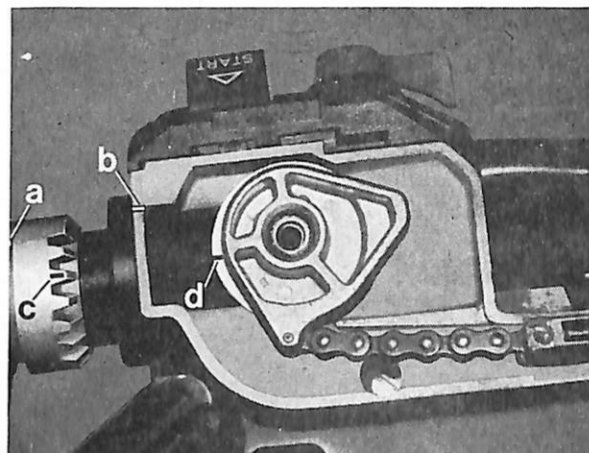
Push back water cap 1 and unscrew cover 2.

Detach accelerator cable.

**Installation Note!** Prior to assembling, lubricate control cam and spline on throttle twist grip with grease. When assembling, make sure that slot end „a” in throttle twist grip aligns with opening „b” in handlebar grip at driver’s side end. Install lower cable in double nipple and insert together with chain and control cam in handlebar grip, that marks „c” and „d” on cam and handlebar grip align. Install upper accelerator cable in double nipple. Position cover and pull back upper accelerator cable sleeve at the same time, that accelerator cable end sleeve can engage in its seat in cover opening. Tighten cover and push on water cap. Only full conformance with these instructions will guarantee correct movement of accelerator cables.

Remove and install fuel tank – 16 11 030.

Unscrew accelerator cable setscrew (arrow) and disconnect cable with nipple from throttle lever.







# 33 Rear Wheel Drive

|                                                                               |              |
|-------------------------------------------------------------------------------|--------------|
| Specifications . . . . .                                                      | Page 33- 0/3 |
| Specifications – 1981 models . . . . .                                        | 33- 0/7      |
| 33 10 050 Rear wheel drive – remove and install . . . . .                     | 33-10/1      |
| 33 10 113 Rear wheel drive – disassemble and assemble . . . . .               | 33-10/2      |
| 33 12 051 Drive pinion with ring gear – replace . . . . .                     | 33-12/1      |
| 33 17 350 Rear wheel swinging arm – remove and install . . . . .              | 33-17/1      |
| 33 17 381 Taper roller bearing of rear wheel swinging arm – replace . . . . . | 33-17/2      |
| 33 52 120 Spring strut – remove and install . . . . .                         | 33-52/1      |
| 33 53 580 Coil spring – remove and install . . . . .                          | 33-17/3      |
| Rear wheel drive – troubleshoot . . . . .                                     | 33-17/5      |

# Specifications

| Rear Wheel Drive                                                |                                                                                   |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Model                                                           | R 65                                                                              |
| Type of teeth                                                   | Klingenberg Palloid spiral                                                        |
| Number of teeth                                                 | 31 : 9                                                                            |
| Ratio                                                           | 1 : 3.44                                                                          |
| Oil grade:<br>Initial filling                                   | Brand name breaking in hypoid gear lube SAE 90                                    |
| After first oil change above 5° C (41° F)<br>below 5° C (41° F) | Brand name hypoid gear lube SAE 90<br>Brand name hypoid gear lube SAE 80          |
| Oil volume in ltr. (pints)                                      | 0.25 (0.53)                                                                       |
| Backlash in mm (in.)                                            | 0.15 ... 0.20 (0.006 ... 0.008)                                                   |
| Lateral play of ring gear                                       | no play (without gasket)                                                          |
| <b>Rear Wheel Suspension</b>                                    | Control arm with 3-way adjustable spring struts and double-action hydr. absorbers |
| Spring travel in mm (in.)                                       | 110 (4.331)                                                                       |
| Shock absorber test                                             |                                                                                   |
| Test travel in mm (in.)                                         | 50 (1.968)                                                                        |
| Test speed in rpm                                               | 100                                                                               |
| Traction stage in kp (lbs)                                      | 88±10 (194±22)                                                                    |
| Pressure stage in kp (lbs)                                      | 28±5 (62±11)                                                                      |



## Specifications

| Rear Wheel Drive                                   |                                                                          |
|----------------------------------------------------|--------------------------------------------------------------------------|
| <b>Model</b>                                       | R 65                                                                     |
| <b>Support Spring</b>                              |                                                                          |
| Installed length in mm (in.)                       | 190.5 (7.500)                                                            |
| Relaxed length in mm (in.)                         | 244±4 (9.606±0.157)                                                      |
| Spring outside dia. in mm (in.)                    | 57.5 (2.264)                                                             |
| Spring inside dia. in mm (in.)                     | 42.5 (1.673)                                                             |
| Wire gage dia. in mm (in.)                         | 7.5 (0.295)                                                              |
| <b>Control Arm</b>                                 |                                                                          |
| Oil grade above 5° C (41° F)<br>below 5° C (41° F) | Brand name hypoid gear lube SAE 90<br>Brand name hypoid gear lube SAE 80 |
| Oil volume in ltr. (pints)                         | 0.15 (0.32)                                                              |

## Torque Values in Nm (ft lbs)

|                                                 |                                          |                                      |                         |
|-------------------------------------------------|------------------------------------------|--------------------------------------|-------------------------|
| Nut on drive pinion                             | 150 <sup>+15</sup> (108 <sup>+11</sup> ) | Final drive oil drain plug           | 23 ... 26 (17 ... 19)   |
| Threaded ring in housing                        | 100 ... 120 (72 ... 87)                  | Control arm oil filler plug          | 14 (10)                 |
| Final drive oil filler plug                     | 28 ... 31 (20 ... 22)                    | Control arm oil drain plug           | 14 ... 17 (10 ... 12)   |
| Bearing pin of control arm                      | 10 ... 12 ( 7 ... 9)                     | Nuts for cardan cover                | 18 ... 21 (13 ... 15)   |
| Shock absorber rod to upper<br>spring strut eye | 30 ... 34 (22 ... 24)                    | Counternut on contr. arm bearing pin | 100 ... 110 (72 ... 79) |
|                                                 |                                          | Bolt for rear stub axle              | 14 ... 18 (10 ... 13)   |

Tighten all other bolts and nuts to common torque values as listed in tables  
from bolt/nut suppliers or the new BMW Standard 60002.0.

## Specifications 1981 Models

### Rear Wheel Drive

| Model                                                           | R 65                                                                                        | R 65 LS |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------|
| Type of teeth                                                   | Klingelnberg Palloid spiral                                                                 |         |
| Number of teeth                                                 | 9 : 32                                                                                      |         |
| Ratio                                                           | 1 : 3.56                                                                                    |         |
| Oil grade:<br>Initial filling                                   | Brand name breaking in hypoid gear lube SAE 90 API-Classification GL 5                      |         |
| After first oil change above 5° C (41° F)<br>below 5° C (41° F) | Brand name hypoid gear lube SAE 90 API-Classification<br>Brand name hypoid gear lube SAE 80 |         |
| Oil volume in ltr. (pints)                                      | 0.35 (0.53)                                                                                 |         |
| Backlash in mm (in.)                                            | 0.08 . . . 0.15 (0.0031 . . . 0.0059)                                                       |         |
| Lateral play of ring gear in mm (in.)                           | 0.1 (0.004)                                                                                 |         |
| <b>Rear Wheel Suspension</b>                                    | Control arm with 3-way adjustable spring struts and double-action hydr. absorbers           |         |
| Spring travel in mm (in.)                                       | 110 (4.331)                                                                                 |         |
| Shock absorber test                                             |                                                                                             |         |
| Test travel in mm (in.)                                         | 50 (1.968)                                                                                  |         |
| Test speed in rpm                                               | 382                                                                                         |         |
| Traction stage in kp (lbs)                                      | 88±10 (194±22)                                                                              |         |
| Pressure stage in kp (lbs)                                      | 28±5 (62±11)                                                                                |         |



## Specifications 1981 Models

### Rear Wheel Drive

| Model                                              | R 65                                                                     | R 65 LS                 |
|----------------------------------------------------|--------------------------------------------------------------------------|-------------------------|
| <b>Support Spring</b>                              |                                                                          |                         |
| Installed length in mm (in.)                       | 190.5 (7.500)                                                            |                         |
| Relaxed length in mm (in.)                         | 244 ± 4 (9.606 ± 0.157)                                                  |                         |
| Spring outside dia. in mm (in.)                    | 57.2 (2.264)                                                             |                         |
| Spring inside dia. in mm (in.)                     | 42.5 (1.673)                                                             |                         |
| Wire gage dia. in mm (in.)                         | 7.5 (0.295)                                                              |                         |
| <b>Control Arm</b>                                 |                                                                          |                         |
| Oil grade above 5° C (41° F)<br>below 5° C (41° F) | Brand name hypoid gear lube SAE 90<br>Brand name hypoid gear lube SAE 80 | API Classification GL 5 |
| Oil volume in ltr. (pints)                         | 0.15 (0.32)                                                              |                         |

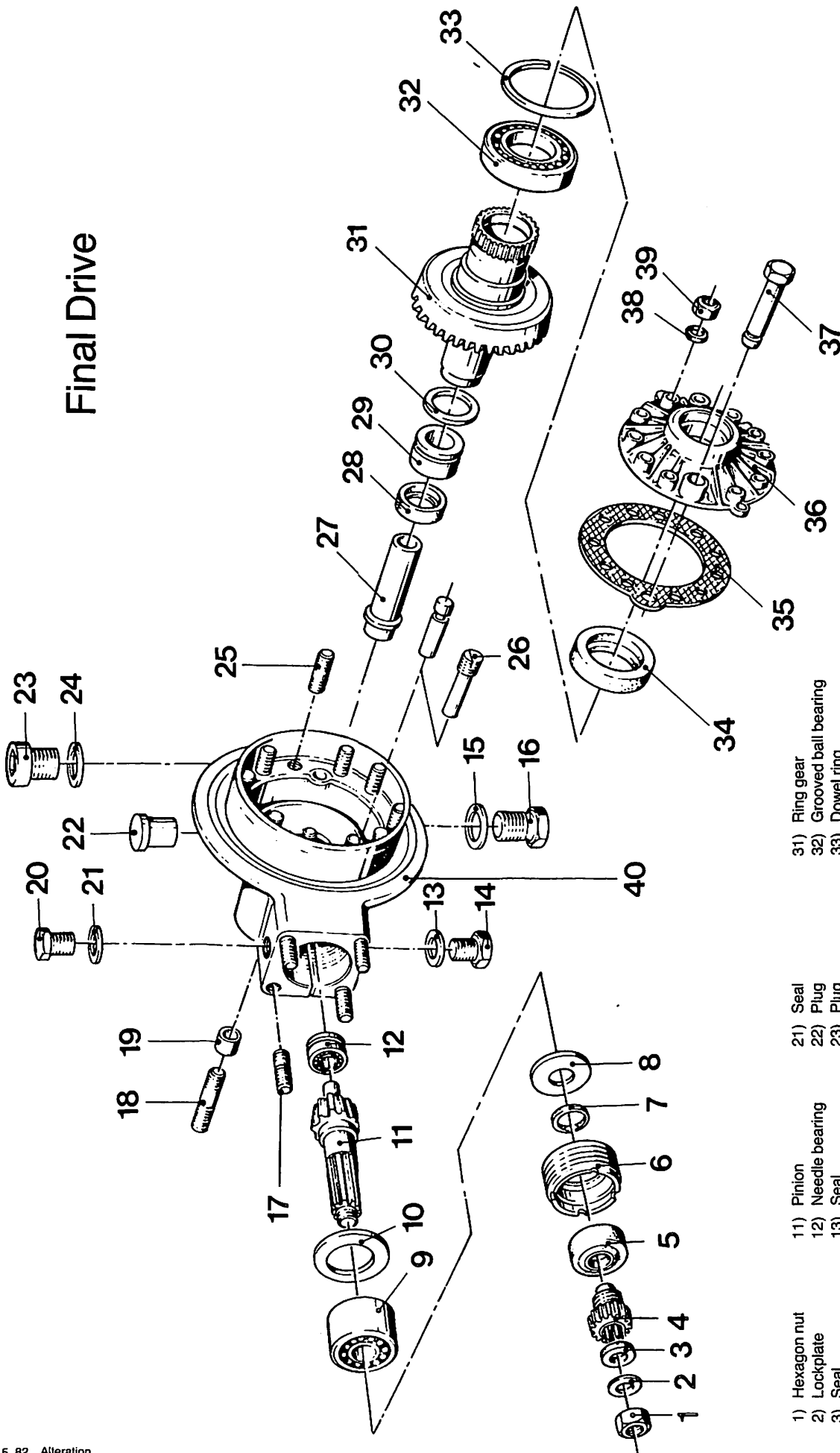
### Torque Values in Nm (ft lbs)

|                                            |                           |                                                                       |                    |
|--------------------------------------------|---------------------------|-----------------------------------------------------------------------|--------------------|
| Oil drain plug in final drive housing      | 25.5 (18)<br>finger tight | Twelve-sided nuts for final drive housing/<br>rear wheel swinging arm | 47 (34)            |
| Oil filler plug in rear wheel swinging arm | 15.7 (11)                 | Nut on drive pinion                                                   | 165 (119)          |
| Oil drain plug in rear wheel swinging arm  | 17.7 (13)                 | Threaded ring in final drive case                                     | 118 (85)           |
| Nuts on final drive case cover             | 38 ± 2 (27 ± 1)           | Oil level inspection bolt in final drive case                         | 10 (7)             |
| Spring strut eye to piston rod             |                           | Shaft bolt of rear wheel swinging arm                                 | 10 + 2 (7 + 1)     |
|                                            |                           | Lock nut for swinging arm shaft bolt                                  | 100 + 20 (72 + 14) |
|                                            |                           | Spring strut mounting bolts                                           | 35 + 5 (25 + 4)    |

All other bolt and nuts are tightened to standard torque values as listed in tables published by suppliers of bolts and nuts or in the new BMW Standard 60002.0.



# Final Drive

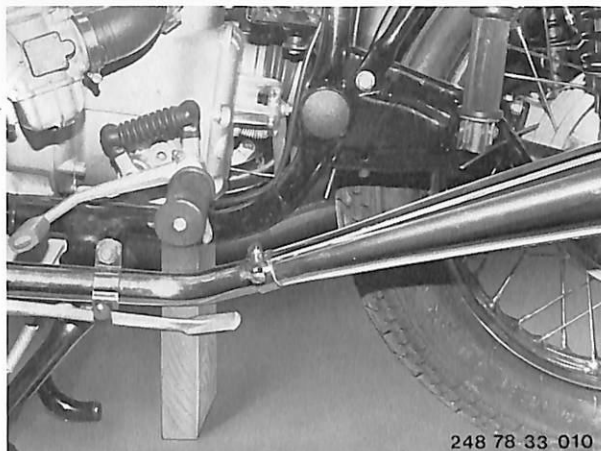


- |                         |                    |                    |                          |
|-------------------------|--------------------|--------------------|--------------------------|
| 1) Hexagon nut          | 11) Pinion         | 21) Seal           | 31) Ring gear            |
| 2) Lockplate            | 12) Needle bearing | 22) Plug           | 32) Grooved ball bearing |
| 3) Seal                 | 13) Seal           | 23) Plug           | 33) Dowel ring           |
| 4) Clutch hub           | 14) Plug           | 24) Seal           | 34) Shaft seal           |
| 5) Shaft seal           | 15) Seal           | 25) Stud           | 35) Gasket               |
| 6) Threaded ring        | 16) Plug           | 26) Notched pin    | 36) Housing cover        |
| 7) Shim                 | 17) Stud           | 27) Bushing        | 37) Bearing pin          |
| 8) Washer               | 18) Stud           | 28) Shaft seal     | 38) Washer               |
| 9) Angular ball bearing | 19) Bushing        | 29) Needle bearing | 39) Hexagon nut          |
| 10) Shim                | 20) Plug           | 30) Thrust ring    | 40) Housing              |

### 33 10 050 Removing and Installing Rear Wheel Drive

Remove and install rear wheel 36 30 320.

Set motorcycle on its kickstand and place a support underneath the swinging arm mount that rear wheel can be turned freely.



Unscrew right spring strut mounting bolt (arrow) and remove with washer.

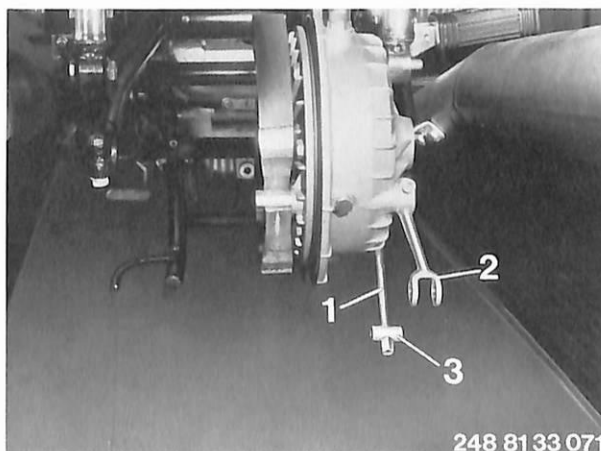
Unscrew plug (2) and drain oil in right rear wheel swinging arm. Also unscrew filler plug (1) to discharge and speed up draining.

#### Installation:

Add oil after assembling. Refer to Specifications for oil volume and grade.

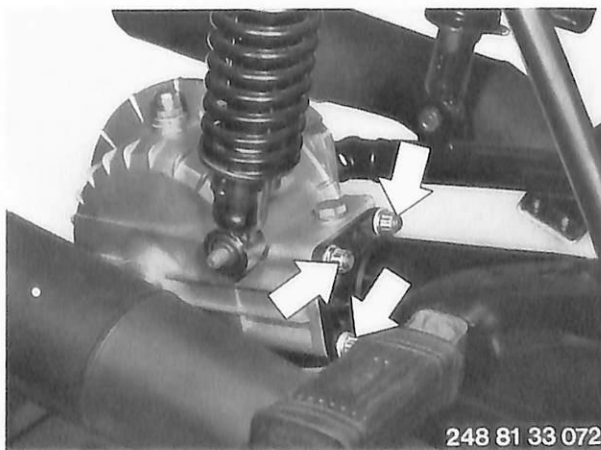


Unscrew hexagon or wing nut on brake linkage. Pull off brake rod (1) on brake lever (2). Take hollow pin (3) out of lever, place on brake rod and hold with wing nut or hexagon nut.



Loosen upper spring strut mounting bolt. Unscrew 4 nuts (arrows) with washers on mounting bolts of right swinging arm. Remove final drive.

When **assembling** only tighten these four nuts after shaft has been inserted through rear wheel drive and stub axle. See Specifications for tightening torque values.



### 33 10 113 Disassembling and Assembling Rear Wheel Drive

Remove and install rear wheel drive 30 10 050.

Drain oil!

Remove and install brake shoes 34 21 150.

Unscrew bolt on brake lever, take off lever and pull brake key (arrow) out of rear wheel drive.



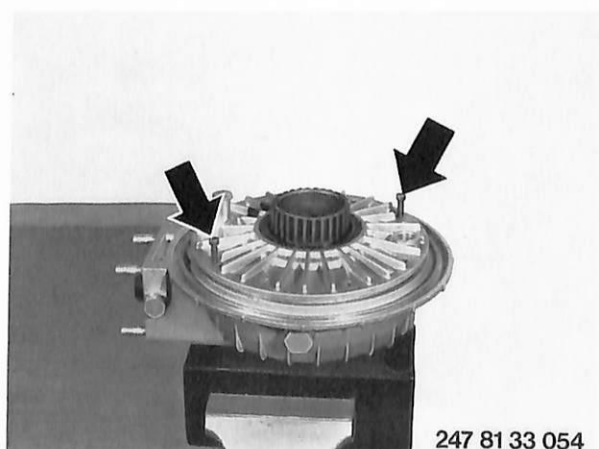
Place rear wheel drive in assembly stand, BMW No. 33 1 600.



Unscrew hexagon head bolts on cover. Heat cover to approx. 80° C and press off with two M 5 × 30 screws (arrows). Remove oil baffle plate.

#### Installation:

Seal cover with Loctite No. 573 or a paper gasket. Insert assembly sleeve, BMW No. 33 1 000, through shaft seal into case cover, then place on drive spline of ring gear and press cover on to case. Heat case cover to about 80° C.



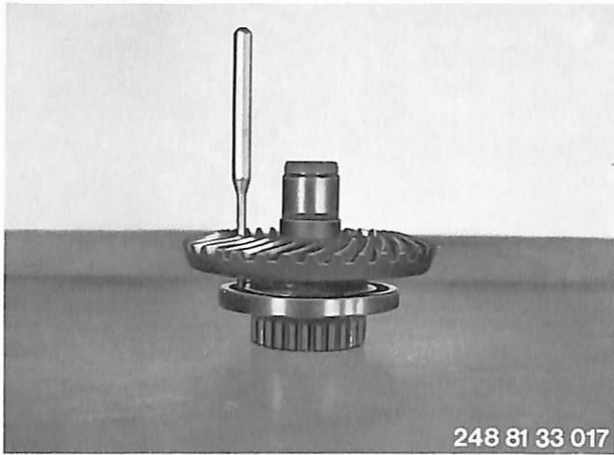
Drive shaft seal out of cover with a mandrel. Drive in new shaft seal with impact mandrel, BMW No. 33 1 850, and handle, BMW No. 00 5 500.

#### Note:

Place cover on smooth side of guide.







Knock off grooved ball bearing of ring gear uniformly with a soft metal mandrel and hammer applied through holes provided for this purpose in the ring gear.



Place assembly stand upright. Unscrew nut on drive pinion and pull off washer with plastic ring and pinion.

**Installation:**

Nut is locked with Loctite No. 274.

See Specifications for tightening torque.



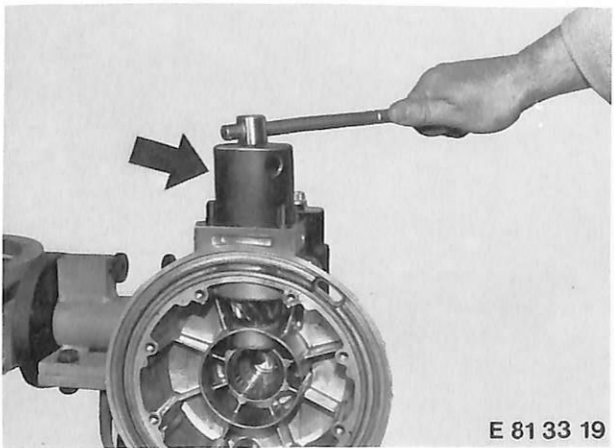
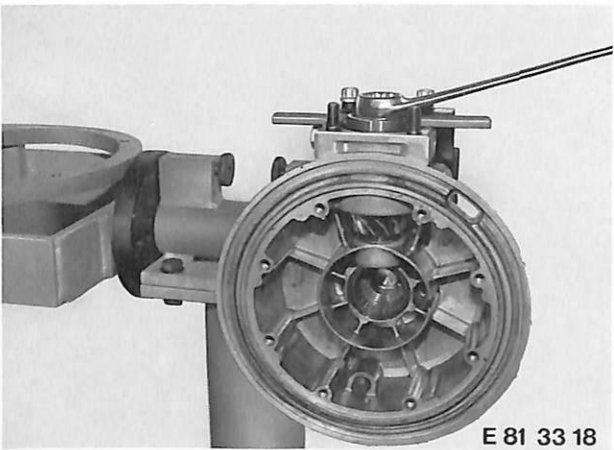
Unscrew threaded ring (arrow) together with shaft seal with special wrench, BMW No. 33 1 700.

Also remove spacer and washer.

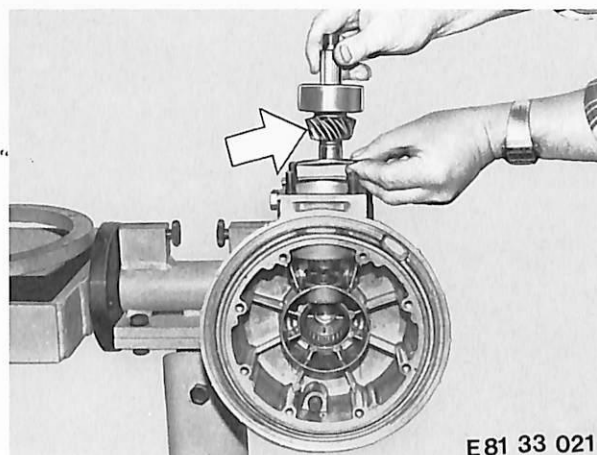
See Specifications for tightening torque.



Knock shaft seal out of threaded ring with a mandrel. Drive in new shaft seal with impact mandrel, BMW No. 33 1 750, and handle, BMW No. 00 5 500.

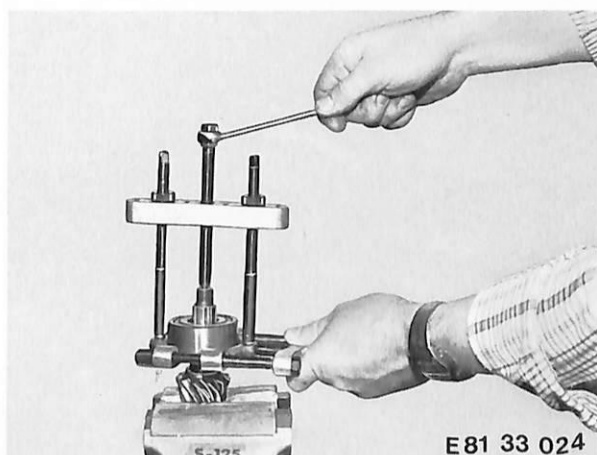


Heat case to about 120° C (check temperature with a thermocolor pencil) and remove drive pinion gear (arrow) with angular ball bearing and shim.



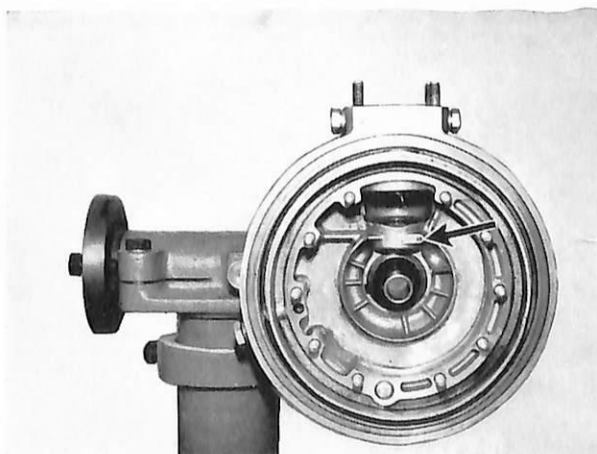
E81 33 021

Pull off angular ball bearing on drive pinion gear with a Kukko 17 K puller, BMW No. 00 7 500.



E81 33 024

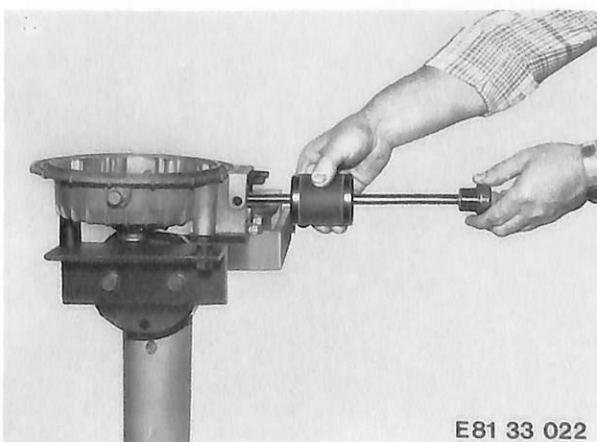
Replace pinion needle bearing in propeller shaft housing. Unscrew and remove bolt (arrow) up to and including 1979 models.



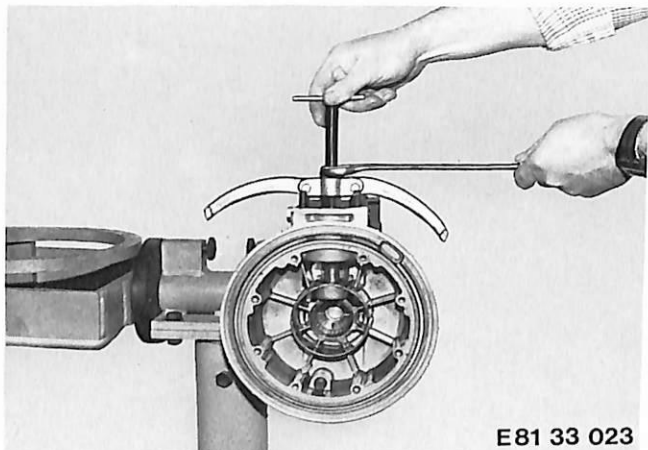
Heat case to about 120°C. Pull out needle bearing (from drive pinion gear) with an internal claw ball bearing puller, No. 400 151/T2.

#### Installation:

Heat case to about 120° C and drive in pinion needle bearing with a suitable mandrel.

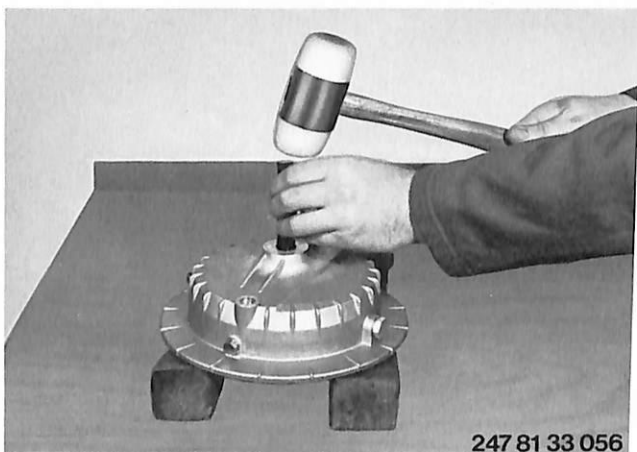


E81 33 022



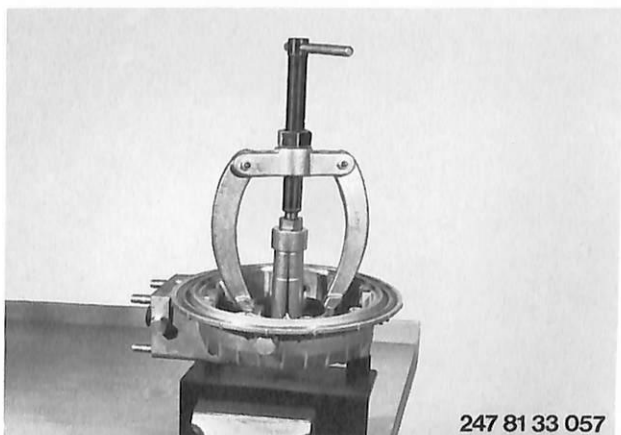
E81 33 023

Or with Kukko internal claw puller No. 21/3 and support 22-1. Be careful not to damage sealing surfaces!



247 81 33 056

Heat case to about 100° C to replace the ring gear needle bearing, place cover end on two pieces of wood and knock out bushing for stub axle with a 17.8 mm dia. mandrel.

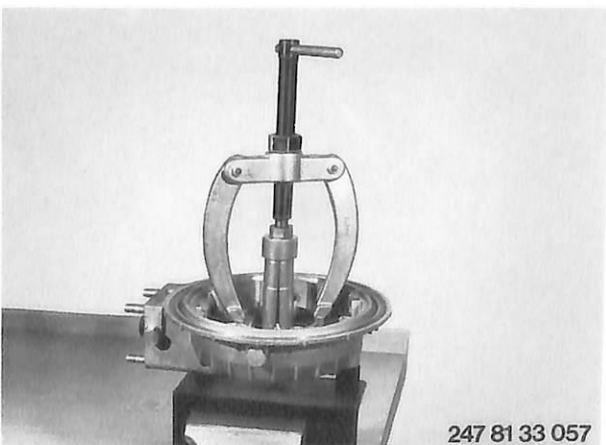


247 81 33 057

Pull out needle bearing with Kukko puller, BMW No. 00 8 560, while clamping bearing on bottom edge.

**Installation:**

Only install needle bearing and bushing for stub axle in a case heated to about 100° C.

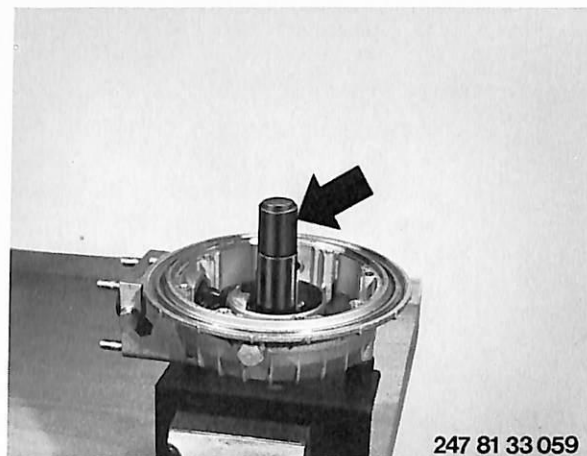


247 81 33 057

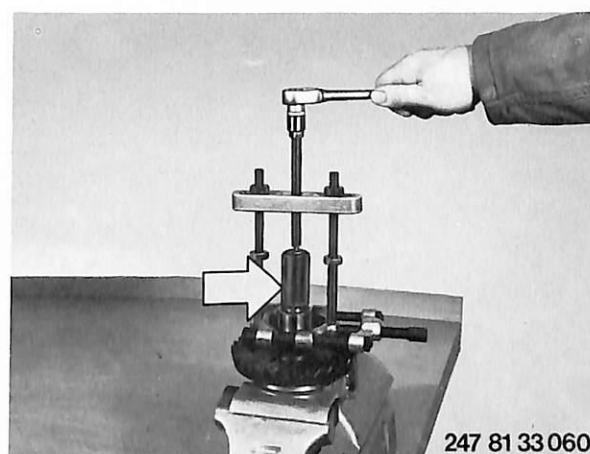
Pull out radial oil seal with Kukko puller, BMW No. 00 8 551, and support bridge from BMW No. 00 8 560.



Drive in radial oil seal, open end of seal facing up, with impact mandrel, BMW No. 33 1 880, used in conjunction with handle, BMW No. 00 5 500.



Pull off needle bearing inner race with a standard Kukko puller, BMW No. 00 7 500. Spindle support 30 mm dia (arrow). Heat inner race to about 120° C for installation.



### 33 12 051 Removing and Installing Drive Pinion and Ring Gear

Disassemble and assemble rear wheel drive 33 10 113. Pinion and ring gear always belong together.

Check pair code (arrow).

The pair code supplies information on the matching of pinion and ring gear. Both parts are given tolerances during test stand inspection, to provide smooth running and correct backlash when installed.

The basic case size is  $75.50 \pm 0.05$  mm, as measured from angular ball bearing shoulder on pinion to center of ring gear axis.

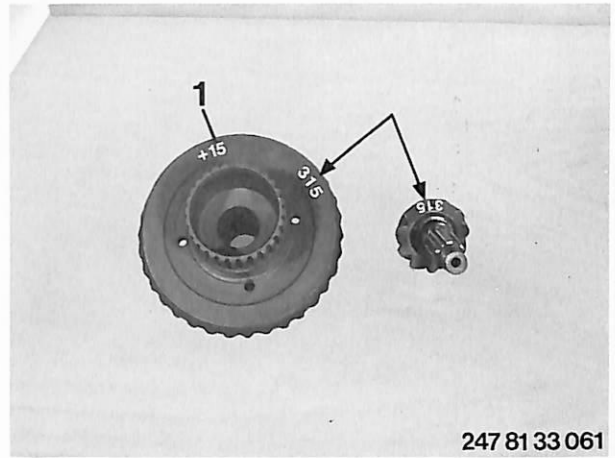
The basic size is not stamped in the case. If the case has a different size, the two digits after the point are stamped on the inside (arrow).

The basic size of the pinion is 77.50 mm. A deviation from this size is provided on the ring gear with pertinent + or - sign (1) (see figure above).

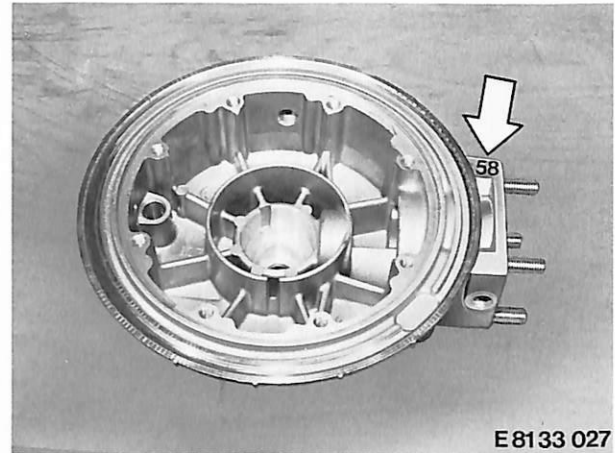
The case size must be subtracted from the basic pinion size (plus or minus the deviation specified on the ring gear). The difference is the thickness of the shim (arrow) required between the angular ball bearing shoulder and seat in the case. If there is no deviation on the ring gear and no size stamping on the case, this means that the case and pinion both have basic size. In this case the thickness of the shim would be:  $77.50 - 75.50 \text{ mm} = 2 \text{ mm}$ .

If deviation is specified on the ring gear, e. g. + 15, the shim thickness would be:  $2.0 + 0.15 \text{ mm} = 2.15 \text{ mm}$ .

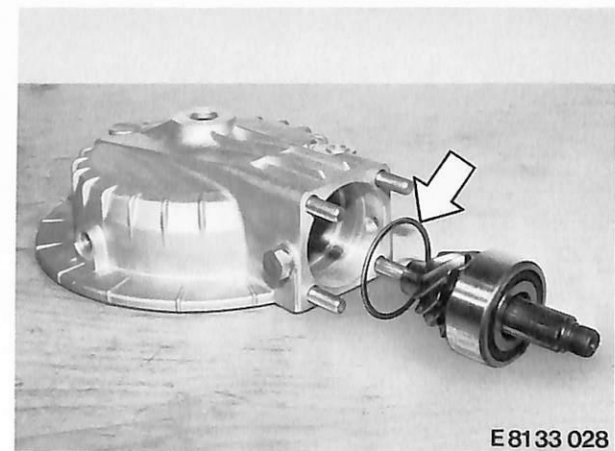
Place an appropriately thick bronze ring (arrow) in the case to reach the backlash provisionally.



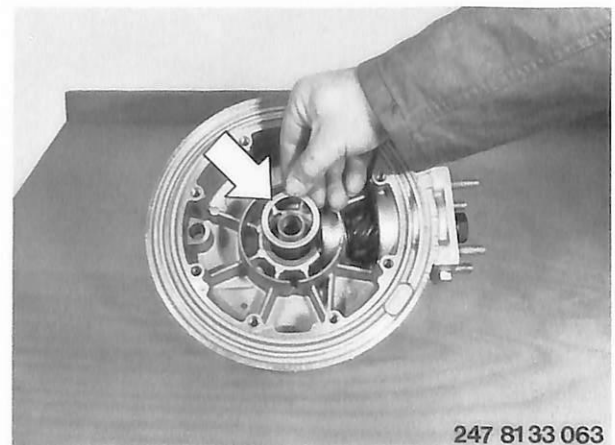
247 81 33 061



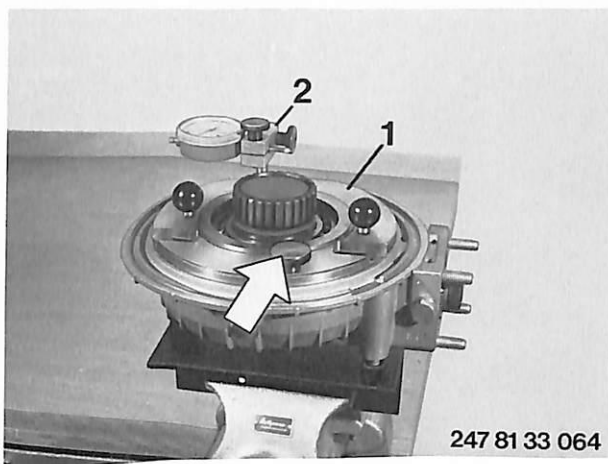
E 81 33 027



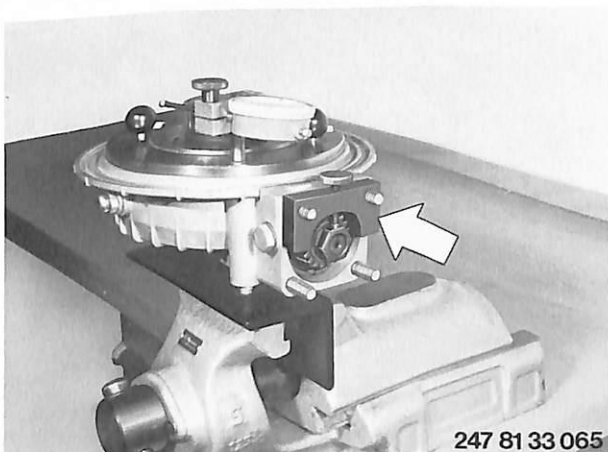
E 81 33 028



247 81 33 063



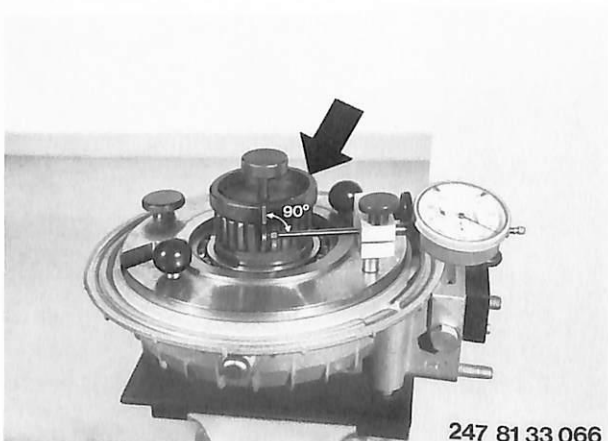
Use master gauge, BMW No. 33 2 610, to adjust the backlash. Place gauge ring (1) with dial gauge holder (2) on final drive case with installed ring gear and mount on case with the knurled head bolt (arrow) to prevent turning.



To be able to measure the backlash correctly, the pinion must be held with the arrest (arrow), BMW No. 33 2 620.

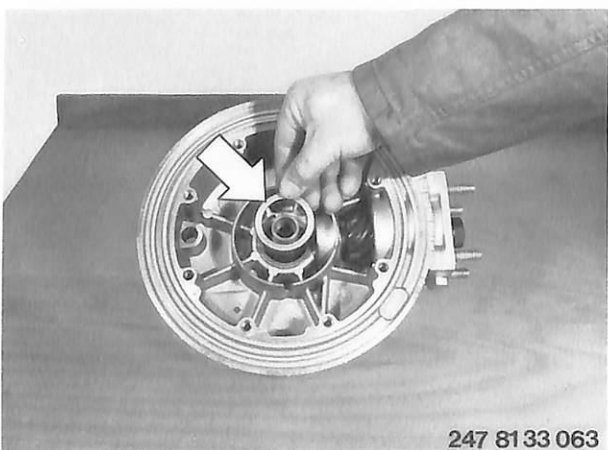
**Note:**

Only use gauge ring (1) beginning with 1981 models. The other parts of the master gauge can be used for all models.



Clamp gauge stop (arrow) in ring gear in such a manner that dial gauge sensor rests on mark of gauge stop at a right angle. Turn ring gear back and forth slightly on gauge stop. Check backlash at three points (offset 120°).

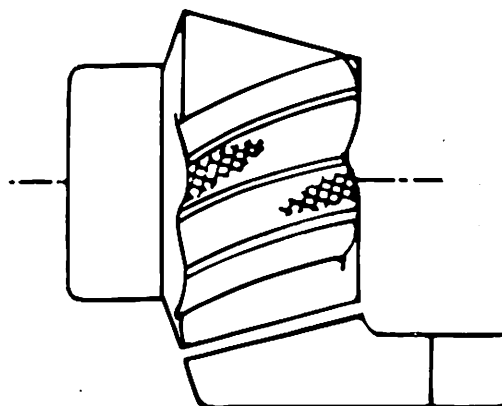
See Specifications for backlash value.



If backlash is too small or too large, a thicker or thinner bronze ring (arrow) must be installed.

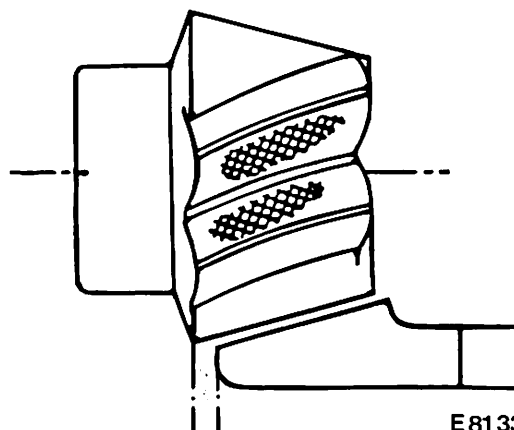


To check the tooth contact pattern, coat one pair of pinion teeth with "paris blue" or a light colored paint. Place ring gear in case and turn back and forth several times under firm pressure. If this tooth contact pattern is produced, the pinion must be taken out of the case further, i. e. a thicker spacer must be installed.



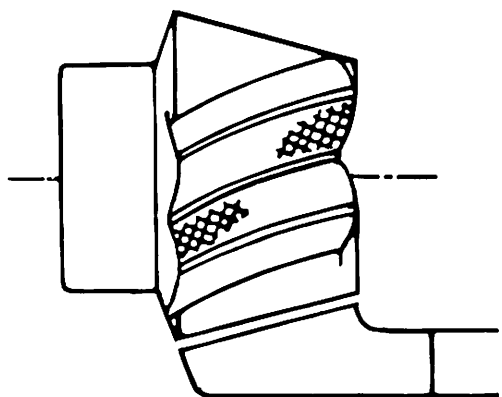
E 81 33 034

This will then be tooth contact pattern.



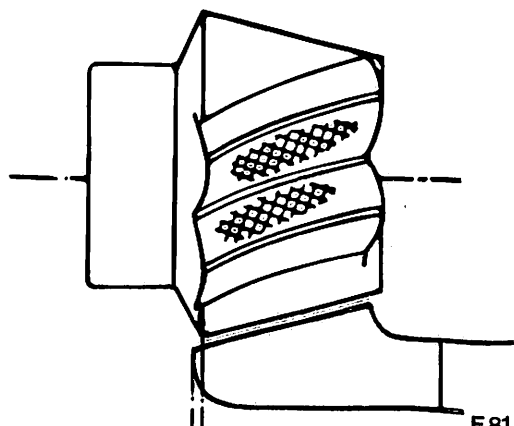
E 81 33 035

If this tooth contact pattern is produced, the pinion must be moved further toward the case center point, i. e. a thinner spacer must be installed.

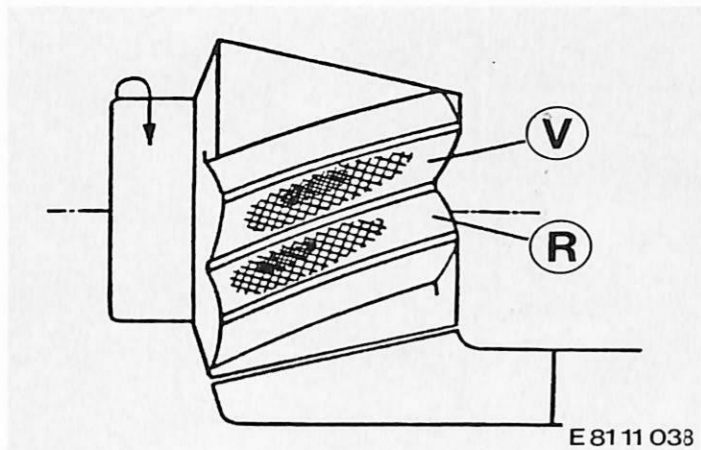


E 81 11 036

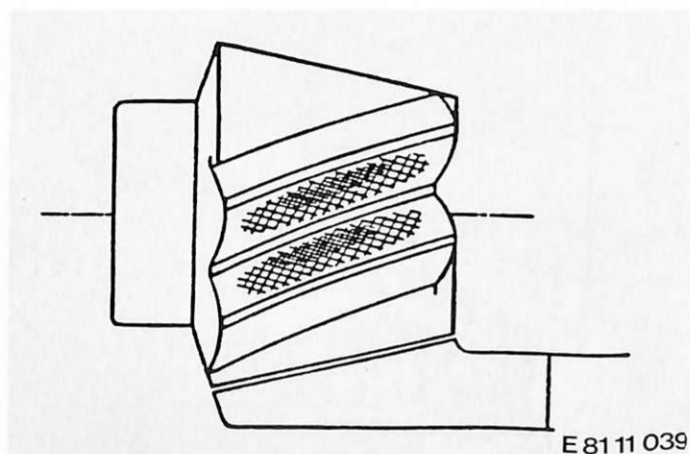
This will then be the tooth contact pattern.



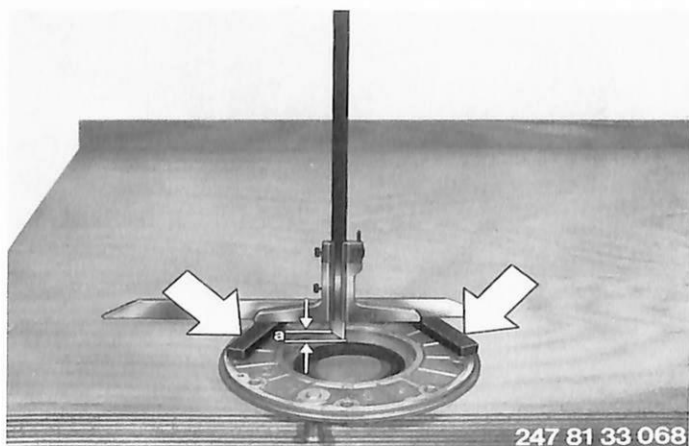
E 81 11 037



Correct tooth contact pattern in unloaded state:  
Tooth contact pattern at center on forward flank "V". Tooth contact pattern closer to outside diameter on reverse flank "R".  
**Never** have tooth contact on small diameter!

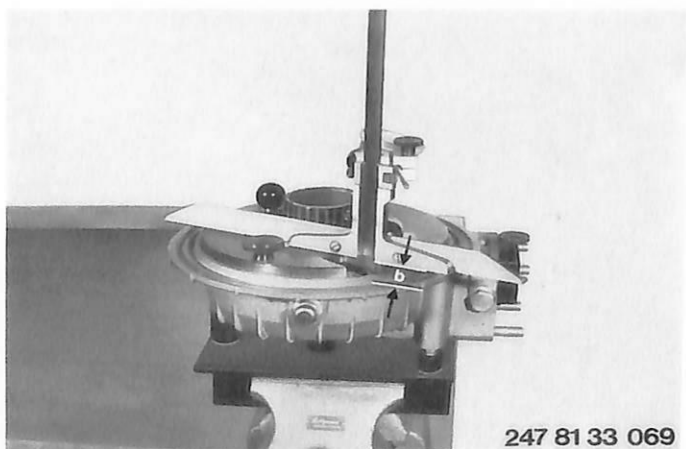


■  
Tooth contact pattern with load looks like this.



■  
Leave gauge ring of master gauge on final drive case to adjust the ring gear lateral play (1981 models). Measure distance "a" from ball bearing seat base to cover mating surface with a depth gauge, BMW No. 00 2 550, and the necessary measuring adapters (arrows).

|                       |         |
|-----------------------|---------|
| Measured distance     | 20.0 mm |
| Thickness of adapters | -9.8 mm |
| Distance "a"          | 10.2 mm |

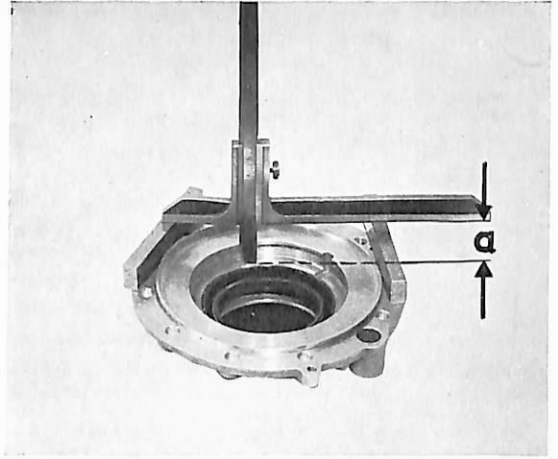


■  
Measure distance "b" with depth gauge, BMW No. 00 2 550.

1. Measure from gauge ring through opening to case mating surface = distance I.
2. Measure from gauge ring to ball bearing outer race = distance II.

Distance I - distance II = distance "b".

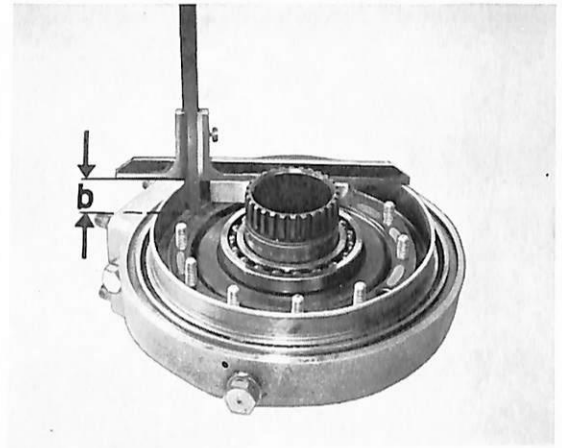
Adjust lateral play of ring gear (1978 models).  
Measure distance (a) from grooved ball bearing seat base to cover mating surfaces with a depth gauge and any necessary measuring adapters.



Measure distance (b) on mating surface of propeller shaft housing without gasket from grooved ball bearing on ring gear to mating surface.

Take up all play by installing appropriately thick shims between the grooved ball bearing and seat in the cover. The necessary shim thickness will be the difference of distance (a) minus distance (b)  $-0.1$  mm.

Installing the gasket will provide the necessary play, so that the ring gear is not under pressure.





### 33 17 350 Removing and Installing Rear Wheel Control Arm

Remove and install rear wheel – 36 30 320.

Remove and install rear wheel drive – 33 10 050.

Detach lower spring strut holder on left side.

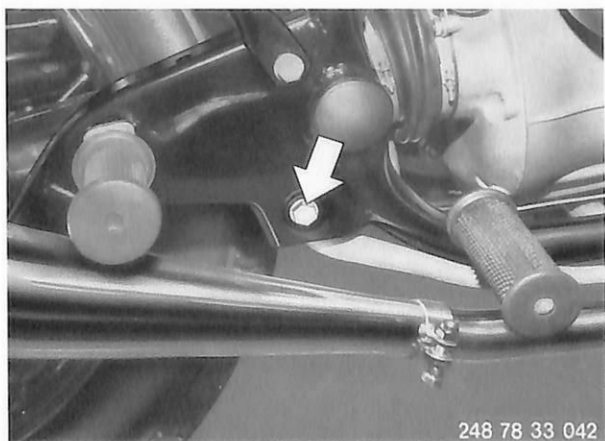
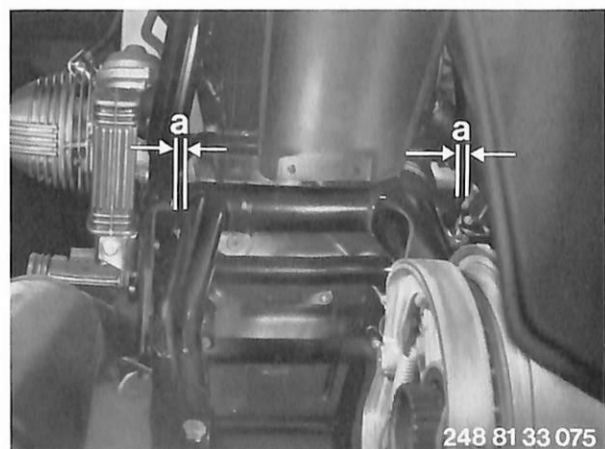
Detach rubber cover between transmission and control arm on transmission end and push back as far as possible. Unscrew 4 connecting screws on universal joint with a ring wrench and lay aside with washers. When assembling, tighten screws with special ring wrench, BMW No. 00 2 560, and a torque wrench (see Specifications for torque values).

Remove left and right control arm mounts. Remove caps and loosen lock nuts. Unscrew control arm bearing journals.

#### Installation:

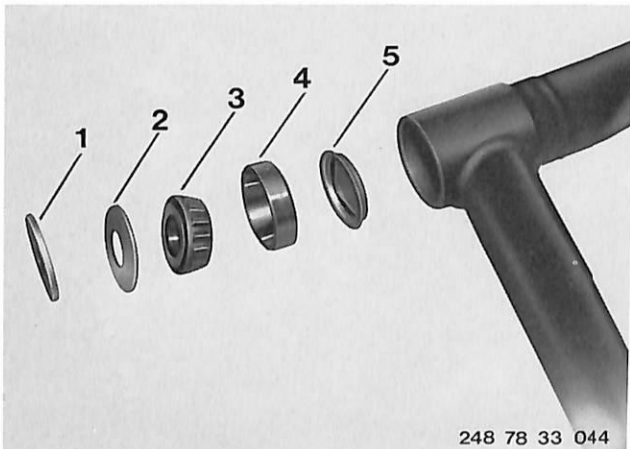
Screw in bearing pin that there is equal distance (a) between control arm hub and frame on left and right sides. The propeller shaft should be at center in the control arm tube so that it can't knock when suspension is bottomed or rebounded fully. If necessary, distances (a) could be adjusted to differ slightly. In order to attain the necessary bearing preload, tighten both bearing pins to 20 Nm, then loosen once again and finally tighten to 12 Nm. Lock bearing pin with a nut. See Technical Data for tightening torque. Push in caps.

Detach brake pedal, counterholding the bearing pin and unscrewing the stop nut for this purpose.





Disconnect lockpin on brake pull rod.



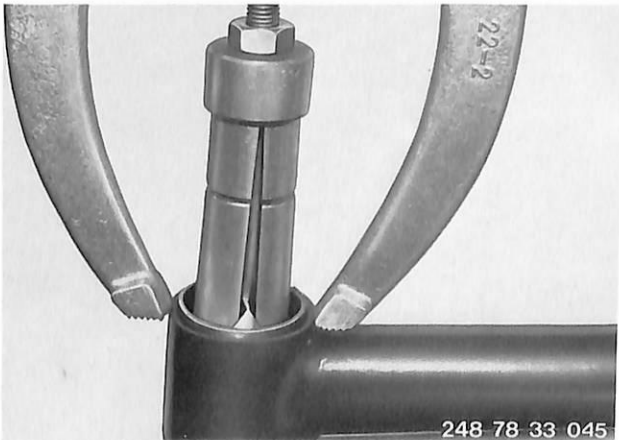
### 33 17 381 Replacing Tapered Roller Bearing of Rear Wheel Control Arm

Remove and install rear wheel control arm 33 17 350.

Remove and install propeller shaft 26 11 000.

- 1 Thrust ring
- 2 Cap
- 3 Tapered roller bearing
- 4 Bearing shell
- 5 End cap

Tapered roller bearings are not split beginning with 1981 models!



Take thrust ring, cap and tapered roller bearing together out of control arm.

Pull out outer bearing race with a Kukko internal claw puller, BMW No. 00 8 551.

Drive in bearing shell impact mandrel, BMW No. 00 5 550.

#### Installation:

Clean and lubricate tapered roller bearing thoroughly when assembling.

#### Note for 1981 models:

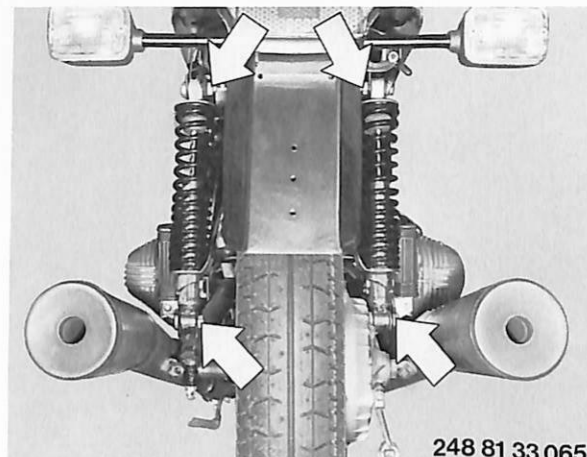
Pull out control arm mount with Kukko internal claw puller no. 21/3 and support 22-1.

Drive in new mount with a 40 × 30 mm pipe which is 50 mm long.

### 33 52 100 Removing and Installing Spring Strut

Unscrew hexagon nuts (arrows) with washers and remove upper bolt. Also push down on motorcycle before removing the bolt of the left shock absorber.

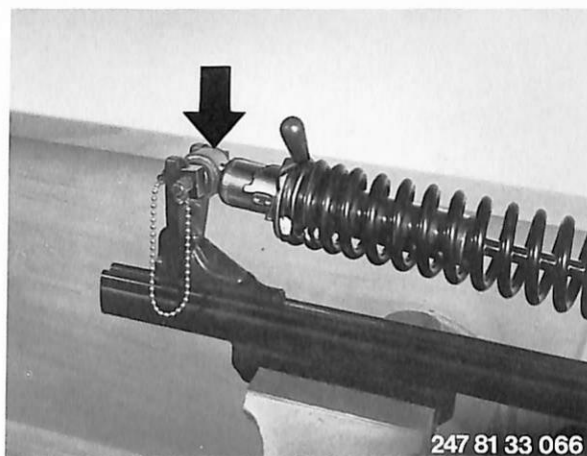
See Specifications for tightening torque.



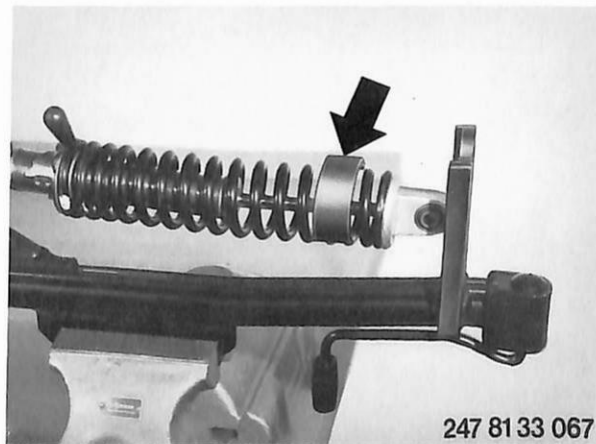
### 33 52 021 Removing and Installing Shock Absorber

Remove and install spring strut 33 52 100.

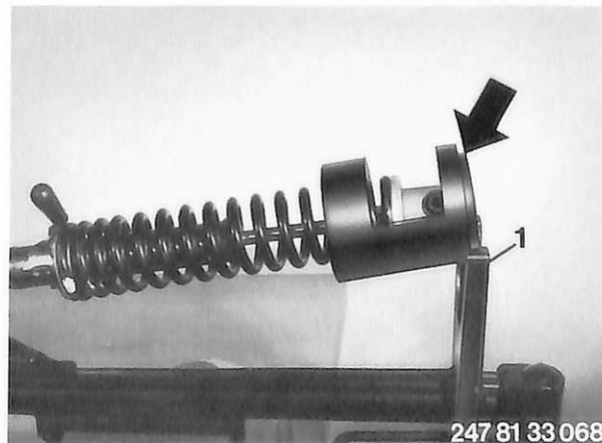
Clamp special tool, BMW 33 5 600, in a vise. Mount lower spring strut eye in the special tool (arrow).



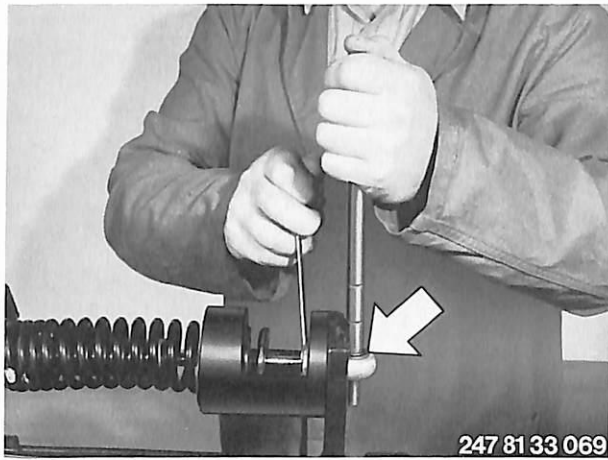
Install clamp, BMW No. 33 5 605, (arrow) between the 3rd and 4th spring coil windings.



Slide thrust pad, BMW No. 33 5 610, on spring strut against clamp. The collar (arrow) must be on side of clamping claw (1).







Move pressure element against clamping claw and preload spring strut enough, that an open-end wrench can be applied on the wrench surface of the shock absorber piston rod. First push back the rubber pad. Disconnect spring strut eye on piston rod (arrow) with a suitable mandrel. Release spring strut. Remove spring struts with absorber spring retainer in the same manner.

See Specifications for tightening torque.



## 34 Brakes

|                                                                |              |
|----------------------------------------------------------------|--------------|
| Specifications . . . . .                                       | Page 34- 0/3 |
| Specifications – 1981 models . . . . .                         | 34- 0/5      |
| 34 00 046 Front wheel brake – bleed . . . . .                  | 34-00/1      |
| 34 11 000 Front brake pads – remove and install . . . . .      | 34-11/1      |
| 34 21 200 Rear brake pads – remove and install . . . . .       | 34-21/1      |
| 34 31 000 Brake master cylinder – remove and install . . . . . | 34-31/1      |
| Brakes – troubleshoot . . . . .                                | 34-31/4      |



## Specifications

### Brakes

| Model                                                                   | R 65                     |
|-------------------------------------------------------------------------|--------------------------|
| <b>Front Wheel</b>                                                      | Disc brake               |
| Brake disc dia. in mm (in.)                                             | 260 (10.236)             |
| Min. brake disc thickness in mm (in.)                                   | 4.6 (0.181)              |
| Effective brake pad area per disc in cm <sup>2</sup> (in <sup>2</sup> ) | 42 (6.5)                 |
| Min. brake pad thickness in mm (in.)                                    | 1.5 (0.060)              |
| Max. runout of brake surface to wheel hub in mm (in.)                   | 0.03 (0.0012)            |
| Master cyl. piston dia. in mm (in.)                                     | 13 (0.512) or 16 (0.630) |
| Wheel brake cyl. piston dia. in mm (in.)                                | 36 (1.417)               |
| Brake disc lateral runout in mm (in.)                                   | 0.1 (0.004)              |
| <b>Rear Wheel</b>                                                       | Simplex solid hub brake  |
| Brake drum dia. in mm (in.)                                             | 200 (7.874)              |
| Max. brake drum wear dia. in mm (in.)                                   | 201.5 (7.933)            |
| Liner width in mm (in.)                                                 | 30 (1.181)               |
| Effective brake liner area in cm <sup>2</sup> (in <sup>2</sup> )        | 107 (16.6)               |
| Min. brake liner thickness in mm (in.)                                  | 1.5 (0.059)              |

Brakes

Specifications

|                            |                              |
|----------------------------|------------------------------|
| Model                      | R 65                         |
| Brake fluid for disc brake | DOT 4 : ATE Brake Fluid "SL" |

Torque Values in Nm (ft lbs)

|                                     |                                    |
|-------------------------------------|------------------------------------|
| Brake line to brake master cylinder | 8 <sup>+3</sup> (6 <sup>+2</sup> ) |
| Brake line to brake caliper         | 8 <sup>+3</sup> (6 <sup>+2</sup> ) |

## Specifications 1981 Models

## Brakes

| Model                                                                   | R 65                      | R 65LS                    |
|-------------------------------------------------------------------------|---------------------------|---------------------------|
| <b>Front Wheel</b>                                                      | Disc brake                | Double disc brake         |
| Brake disc dia. in mm (in.)                                             |                           | 260 (10.236)              |
| Min. brake disc thickness in mm (in.)                                   |                           | 4.6 (0.181)               |
| Effective brake pad area per disc in cm <sup>2</sup> (in <sup>2</sup> ) |                           | 42 (6.5)                  |
| Min. brake pad thickness in mm (in.)                                    |                           | 1.5 (0.060)               |
| Max. runout of brake surface to wheel hub in mm (in.)                   |                           | 0.03 (0.0012)             |
| Master cyl. piston dia. in mm (in.)                                     | 12 or 13 (0.472 or 0.512) | 15 or 16 (0.591 or 0.630) |
| Wheel brake cyl. piston dia. in mm (in.)                                |                           | 36 (1.417)                |
| Brake disc lateral runout in mm (in.)                                   |                           | 0.1 (0.004)               |
| <b>Rear Wheel</b>                                                       | Simplex solid hub brake   |                           |
| Brake drum dia. in mm (in.)                                             | 200 (7.874)               | 220 (8.661)               |
| Max. brake drum wear dia. in mm (in.)                                   | 201.5 (7.933)             | 221.5 (8.720)             |
| Liner width in mm (in.)                                                 |                           | 30 (1.181)                |
| Effective brake liner area in cm <sup>2</sup> (in <sup>2</sup> )        | 107 (16.6)                | 89 (13.8)                 |
| Min. brake liner thickness in mm (in.)                                  |                           | 1.5 (0.059)               |



### Specifications 1981 Models

#### Brakes

| Model                      | R 65                         | R 65 LS |
|----------------------------|------------------------------|---------|
| Brake fluid for disc brake | DOT 4 : ATE Brake Fluid "SL" |         |

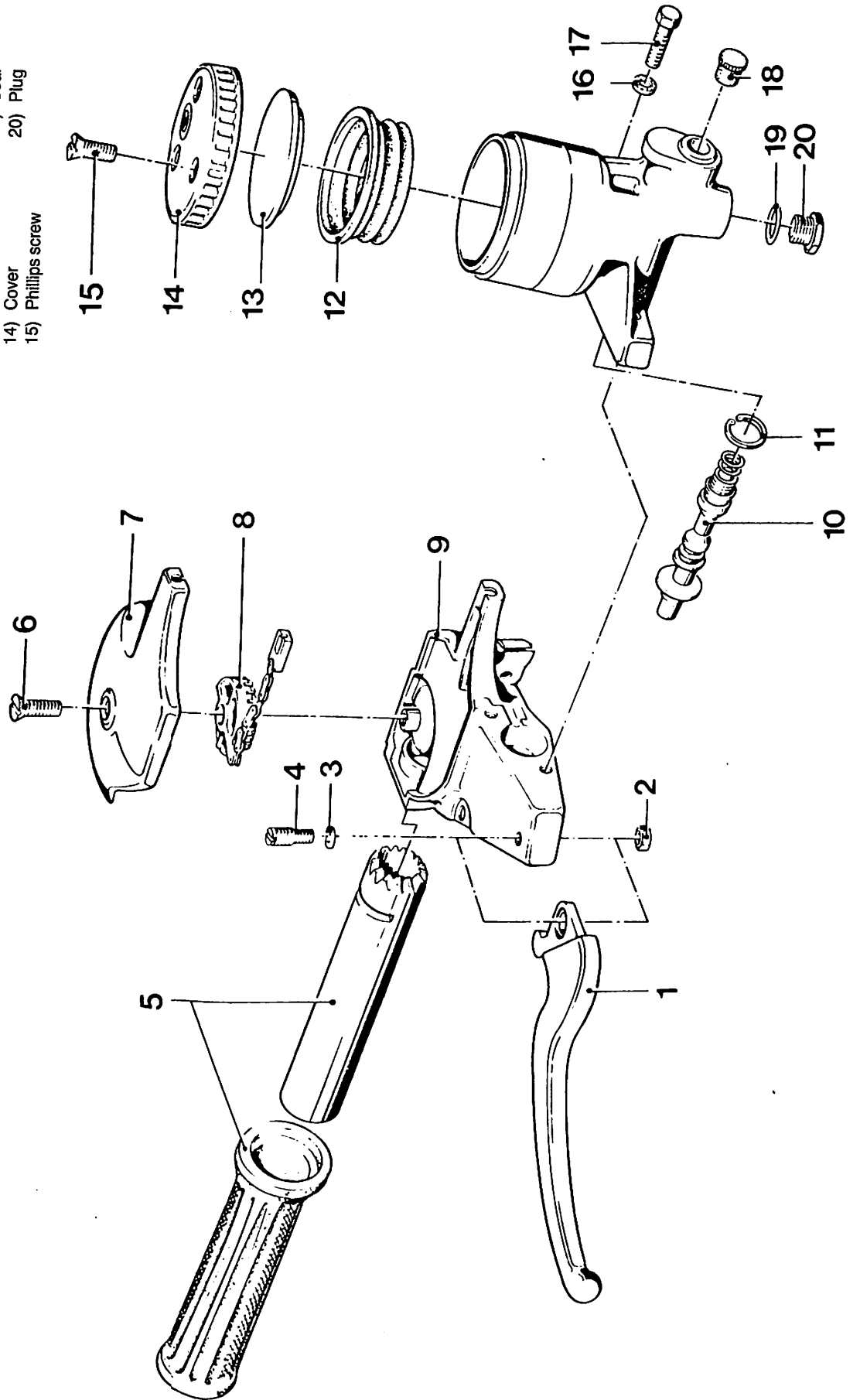
#### Torque Values in Nm (ft lbs)

|                                     |                |
|-------------------------------------|----------------|
| Brake lines to brake hose           | 12 + 3 (9 + 2) |
| Brake line to brake master cylinder | 8 + 2 (6 + 1)  |
| Brake line to brake caliper         | 8 + 2 (6 + 1)  |

# Throttle Twist Grip and Brake Master Cylinder

## Brake Master Cylinder

- 10) Piston
- 11) Circlip
- 12) Dust cover
- 13) Washer
- 14) Cover
- 15) Phillips screw
- 16) Lockwasher
- 17) Fillister head screw
- 18) Plug
- 19) Seal
- 20) Plug



## 34 00 046 Bleeding Front Wheel Brake

Brake fluid must be replaced annually.

Brake fluid is hygroscopic and consequently will take in moisture from the atmosphere through vent hole in brake fluid tank. This could reduce the boiling point of brake fluid from 240° C (465° F) to 160 . . . 180° C (320 . . . 355° F).

**Important!** Be careful not to spill brake fluid on body paint, which would be damaged.

To add brake fluid, loosen screws in tank cap, remove diaphragm and add brake fluid to raise level to „max.” mark. Close tank again.



Apply hand brake lever several times until brake pressure can be felt.

Hold lever under pressure and open bleeder screw while pulling lever firmly at the same time. Don't release lever before tightening the bleeder screw.

Repeat this procedure until brake fluid leaves without air bubbles. Tighten bleeder screw.

**Important!** Never drain brake fluid tank by pumping, since this would cause air to be taken into brake system.

Bleed on each brake caliper for motorcycles with double disc brakes.





### 34 11 000 Removing and Installing Front Brake Pads

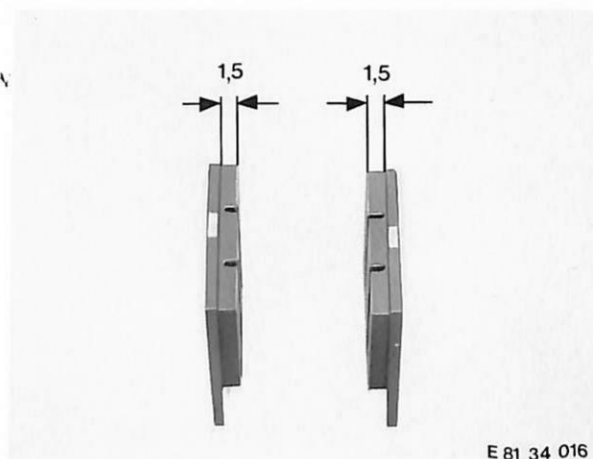
Pry off plastic cap on brake caliper with a screwdriver. Drive out lockpins (1 and 2) from inside to outside with a punch. Remove cross spring and brake pads.



To avoid scoring on brake disc, brake pads must be replaced in good time (minimum pad thickness is given in mm in the picture).

#### Installation:

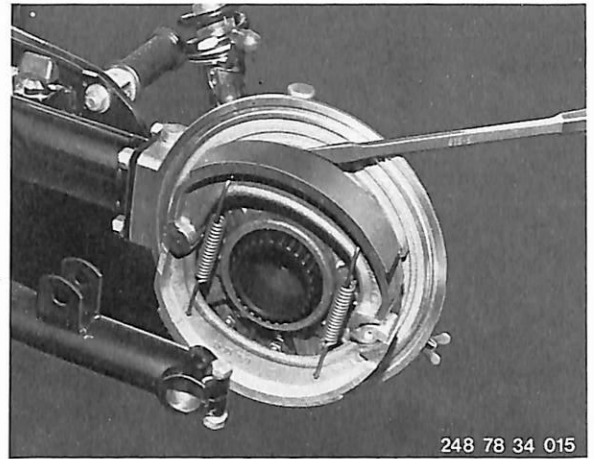
Push back piston of brake cylinder before installing new brake pads.



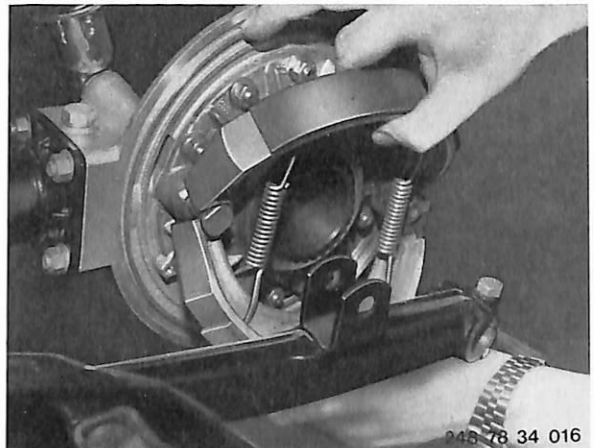
### 34 21 150 Removing and Installing Brake Shoes of Rear Wheel Brake

Remove rear wheel – 36 30 320.

Fold off one brake shoe from rear wheel drive with a screwdriver, and then disconnect spring.

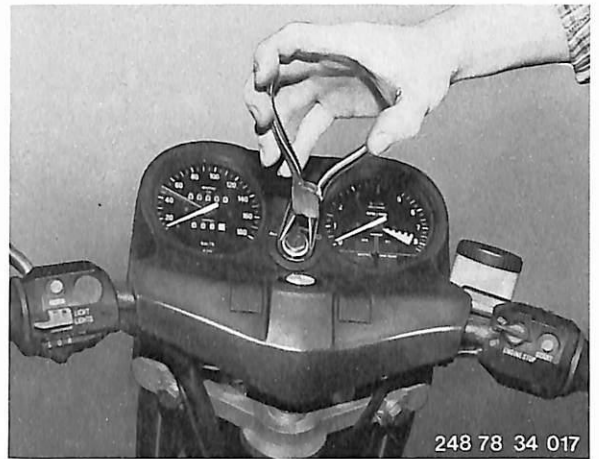


**Installation Note!** Connect brake shoes with springs and press both shoes on to brake anchor and brake key simultaneously.

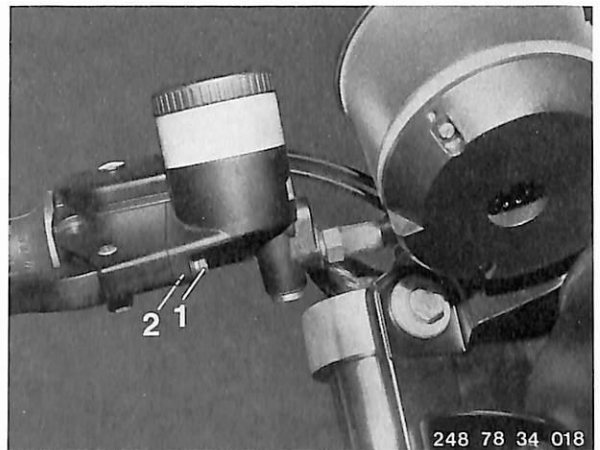


### 34 31 000 Removing and Installing Brake Master Cylinder

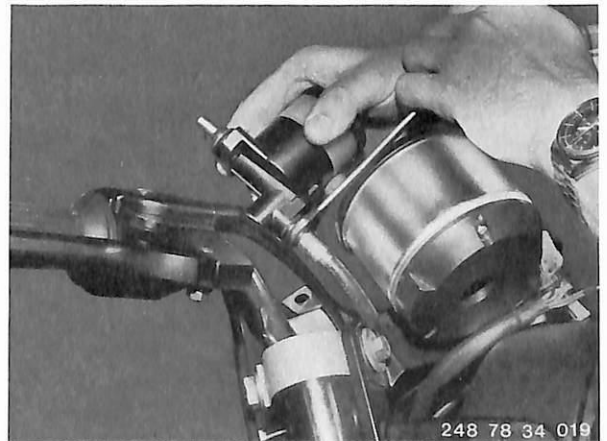
Detach instrument trim, unscrewing two phillips screws and round nut on ignition lock with circlip pliers for this purpose. Pull out holders of turn signal indicator lamps from instrument trim and lift off trim.



Loosen brake hose at brake fluid tank slightly. Unscrew two socket head screws (1 and 2) holding brake cylinder on handlebar instrument and pull out brake cylinder.



Unscrew brake cylinder from brake hose, counterholding hose with an open-end wrench.





### Trouble-shooting – brakes

| Fault                                      | Cause                                                                             | Remedy                                          |
|--------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------|
| Judder at brake lever                      | Excessive lateral runout at brake disc                                            | Renew brake disc                                |
| Poor braking action                        | Brake pads/linings worn<br>Air in brake circuit<br>Eccentric adjustment incorrect | Renew<br>Bleed<br>Check and adjust if necessary |
| Effort required at brake lever is too high | No clearance at handbrake lever or master cylinder                                | Reset                                           |



# 35 Pedals

35 21 000 Brake pedal, removing and installing . . . . .Page 35–21/1



## 35 21 000 Removing and Installing Brake Pedal

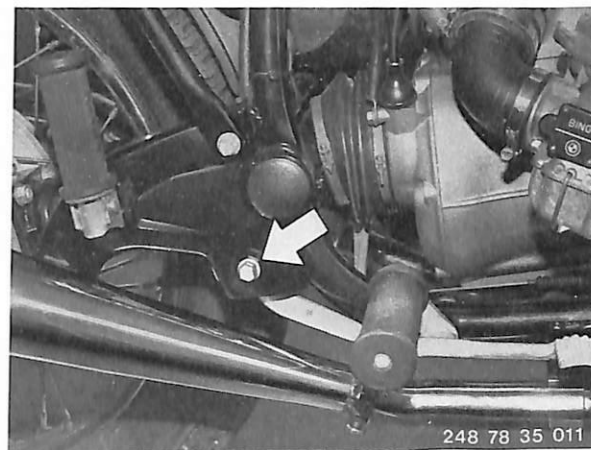
Disconnect lockpin from brake push rod.



Unscrew stop nut, counterholding bearing pin (arrow).  
Remove brake pedal.

### Adjusting Brake:

Adjust winged nut on end of push rod until brakes start to stop rear wheel, then turn back winged nut by 2 to 3 turns.





## 36 Wheels and Tires

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Specifications . . . . .                                      | Page 36— 0/3 |
| Specifications — 1981 models . . . . .                        | 36— 0/5      |
| 36 30 300 Front wheel — remove and install . . . . .          | 36—30/1      |
| 36 30 320 Rear wheel — remove and install . . . . .           | 36—30/2      |
| 36 30 028 Wheels — static balance . . . . .                   | 36—30/3      |
| 36 31 371 Bearings of front or rear wheel — replace . . . . . | 36—31/1      |
| 36 32 081 Lateral and radial runout of tire — check . . . . . | 36—32/1      |

### Specifications

| Wheels and Tires                                                                   | Model                                                                  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|                                                                                    | R 65                                                                   |
| Type of wheel rim                                                                  | pressure cast aluminum                                                 |
| Front rim size                                                                     | 1.85 B x 18                                                            |
| Rear rim size                                                                      | 2.50 B x 18                                                            |
| Max. radial runout in mm (in.)                                                     | 0.9 (0.035) measured on rim flange without tire                        |
| Max. lateral runout in mm (in.)                                                    | 0.5 (0.020) measured on rim flange without tire                        |
| Front tire size                                                                    | 3.25 S 18                                                              |
| Rear tire size                                                                     | 4.00 S 18                                                              |
| Max. tire unbalance measured on inside rim dia. in cmp<br>equalling grams          | 170<br>8 ... 9                                                         |
| Max. runout on side in mm (in.)                                                    | 1.7 (0.067)                                                            |
| Tire pressure in bar (psi)                                                         |                                                                        |
| Front wheel<br>Solo /above 160 km/h (100 mph)<br>Pillion /above 160 km/h (100 mph) | 1.9/2.1 (27/30)<br>2.1/2.1 (30/30)                                     |
| Rear wheel<br>Solo /above 160 km/h (100 mph)<br>Pillion /above 160 km/h (100 mph)  | 2.0/2.2 (28/31)<br>2.2/2.3 (31/33)                                     |
| Extra pressure for driving at top speed over long time in bar (psi)                | 0.2 (3) more                                                           |
| Wheel bearing lubrication                                                          |                                                                        |
| Amount of grease per wheel in grams                                                | 10                                                                     |
|                                                                                    | <b>Brand name multi-purpose grease (drip point at 180° C / 355° F)</b> |



## Wheels and Tires

| Model                                | R 65      |
|--------------------------------------|-----------|
| Max. wheel load solo in kg (lbs.)    |           |
| Front at 1.9 bar (27 psi)            | 160 (353) |
| Rear at 2.0 bar (28 psi)             | 245 (540) |
| Max. wheel load pillion in kg (lbs.) |           |
| Front at 2.00 bar (28 psi)           | 178 (392) |
| Rear at 2.25 bar (32 psi)            | 270 (595) |

## Torque Values in Nm (ft lbs) + Friction Values in Ncm (in lbs)

|                                                                                                              |                         |
|--------------------------------------------------------------------------------------------------------------|-------------------------|
| Frictional torque of wheel bearings with axle nut tightened to specified tightening torque in Ncm (in. lbs.) | 150 ... 300 (13 ... 26) |
| Nuts on stub axles, front and rear, in Nm (ft lbs)                                                           | 45 ... 50 (33 ... 36)   |

Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0.

## Specifications 1981 Models

### Wheels and Tires

| Model                                                                     | R 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | R 65 LS                |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|-------------|--|-------------|--|-------|------|-------|------|-------------------------|----------|----------|----------|----------|-------------------------------|----------|----------|----------|----------|--------------------------|----------|----------|----------|----------|
| Type of wheel rim                                                         | pressure cast aluminium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | BMW Aluminium-Compound |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Front rim size                                                            | 1.85 B x 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2.15 B x 18            |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Rear rim size                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.50 B x 18            |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Max. radial runout in mm (in.)                                            | 0.9 (0.035) measured on rim flange without tire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Max. lateral runout in mm (in.)                                           | 0.5 (0.020) measured on rim flange without tire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Front tire size                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3.25 H 18              |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Rear tire size                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4.00 H 18              |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Max. tire unbalance measured on inside rim dia. in cmp<br>equalling grams |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 170<br>8 . . . 9       |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Max. runout on side in mm (in.)                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.7 (0.067)            |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Tire inflation pressure<br>for cold tires in bar (psi)                    | <table><tr><th rowspan="2"></th><th colspan="2">One Person</th><th colspan="2">Two Persons</th></tr><tr><th>Front</th><th>Rear</th><th>Front</th><th>Rear</th></tr><tr><td>up to 130 km/h (80 mph)</td><td>1.9 (27)</td><td>1.8 (26)</td><td>2.1 (30)</td><td>2.0 (28)</td></tr><tr><td>130 - 160 km/h (80 - 100 mph)</td><td>1.9 (27)</td><td>2.0 (28)</td><td>2.1 (30)</td><td>2.2 (31)</td></tr><tr><td>above 160 km/h (100 mph)</td><td>2.1 (30)</td><td>2.2 (31)</td><td>2.1 (30)</td><td>2.3 (33)</td></tr></table> <p><b>Important!</b> Conform with local legislation on minimum tire tread depth!</p> <p>Recommended (Minimum):<br/>2 mm (0.080") up to 130 km/h (80 mph)<br/>3 mm (0.120") above 130 km/h (80 mph)</p> |                        |          | One Person  |  | Two Persons |  | Front | Rear | Front | Rear | up to 130 km/h (80 mph) | 1.9 (27) | 1.8 (26) | 2.1 (30) | 2.0 (28) | 130 - 160 km/h (80 - 100 mph) | 1.9 (27) | 2.0 (28) | 2.1 (30) | 2.2 (31) | above 160 km/h (100 mph) | 2.1 (30) | 2.2 (31) | 2.1 (30) | 2.3 (33) |
|                                                                           | One Person                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |          | Two Persons |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
|                                                                           | Front                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Rear                   | Front    | Rear        |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| up to 130 km/h (80 mph)                                                   | 1.9 (27)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.8 (26)               | 2.1 (30) | 2.0 (28)    |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| 130 - 160 km/h (80 - 100 mph)                                             | 1.9 (27)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2.0 (28)               | 2.1 (30) | 2.2 (31)    |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| above 160 km/h (100 mph)                                                  | 2.1 (30)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2.2 (31)               | 2.1 (30) | 2.3 (33)    |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Wheel bearing lubrication                                                 | Brand name bearing grease, temperature application range from - 30 (-22) to + 140° C (284° F), drip point 150 . . . 230° C (302 . . . 446° F), high corrosion inhibition, good water/oxidation resistance; e.g. Shell Retinax A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |
| Grease volume per wheel                                                   | 10 grams                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |          |             |  |             |  |       |      |       |      |                         |          |          |          |          |                               |          |          |          |          |                          |          |          |          |          |



## Wheels and Tires

## Specifications 1981 Models

| Model                        | R 65 |  | R 65 LS   |
|------------------------------|------|--|-----------|
| Max. wheel load in kg (lbs.) |      |  |           |
| Front                        |      |  | 140 (309) |
| Rear                         |      |  | 270 (595) |

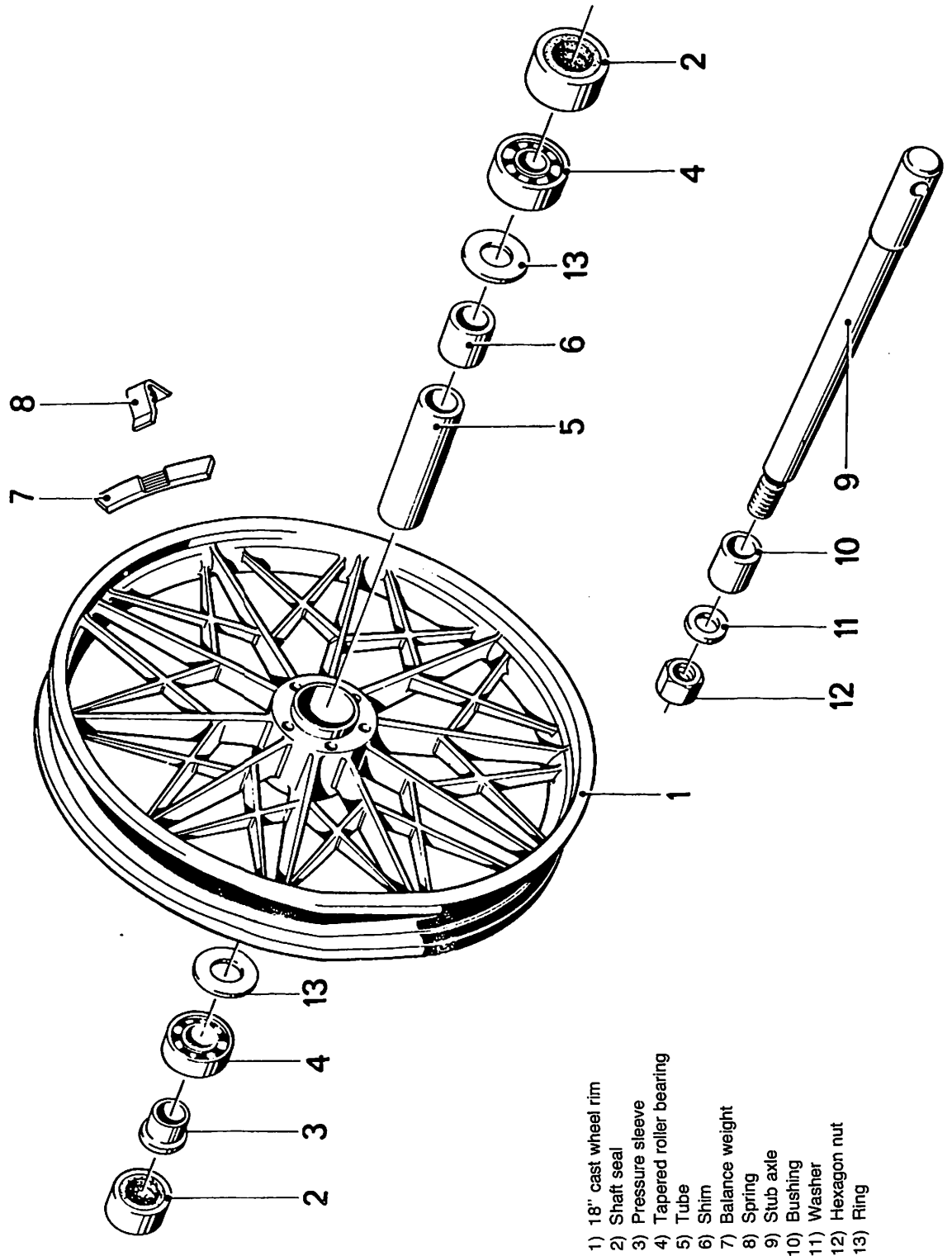
## Torque Values in Nm (ft lbs) + Friction Values in Ncm (in lbs)

Frictional torque of wheel bearings with axle nut tightened to specified tightening torque in Ncm (in. lbs.)  
Nuts on stub axles, front and rear, in Nm (ft lbs)

150 ... 300 (13 ... 26)  
45 ... 50 (33 ... 36)

Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0.

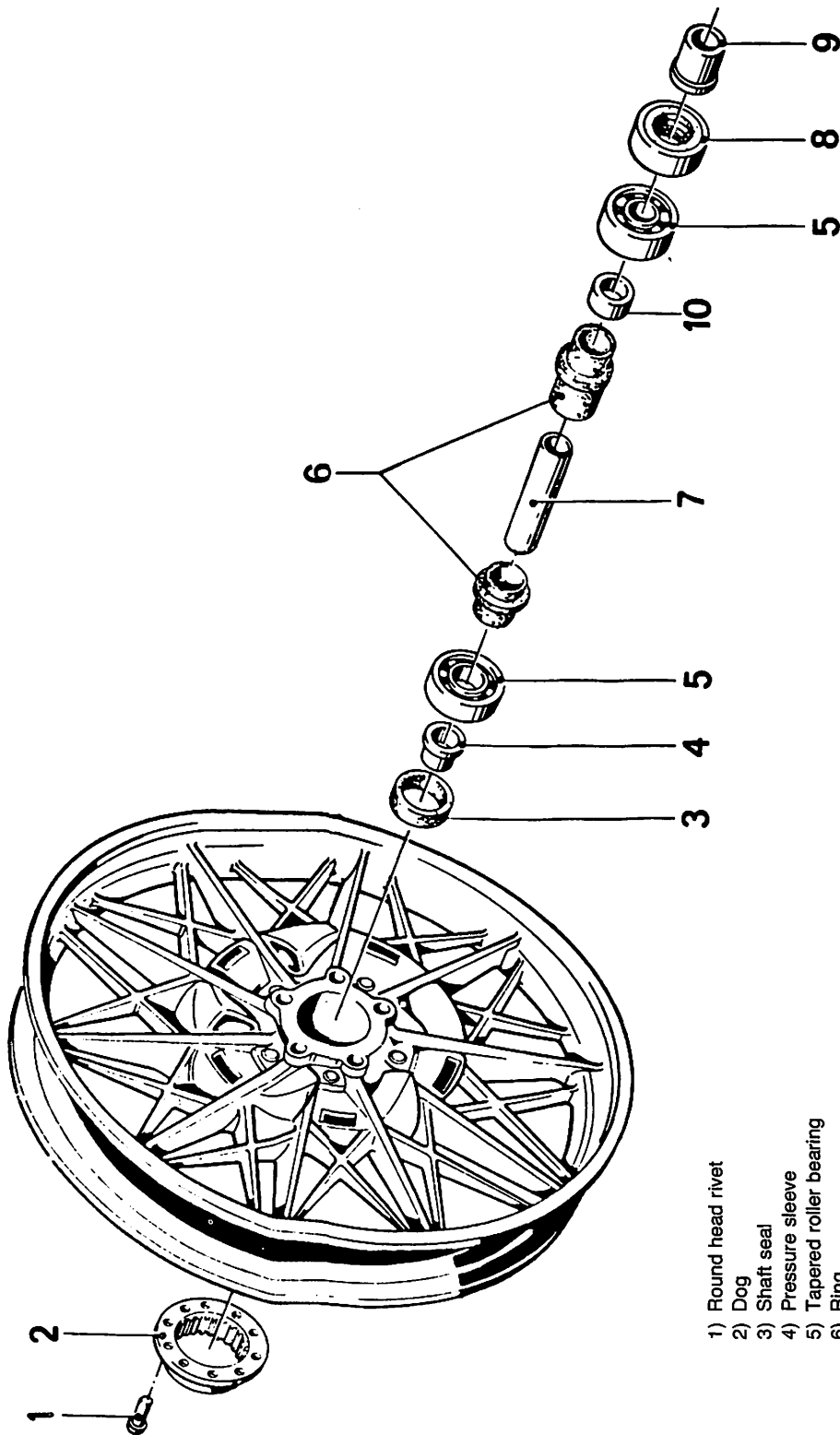
# Front Wheel Bearings



- 1) 18" cast wheel rim
- 2) Shaft seal
- 3) Pressure sleeve
- 4) Tapered roller bearing
- 5) Tube
- 6) Shim
- 7) Balance weight
- 8) Spring
- 9) Stub axle
- 10) Bushing
- 11) Washer
- 12) Hexagon nut
- 13) Ring



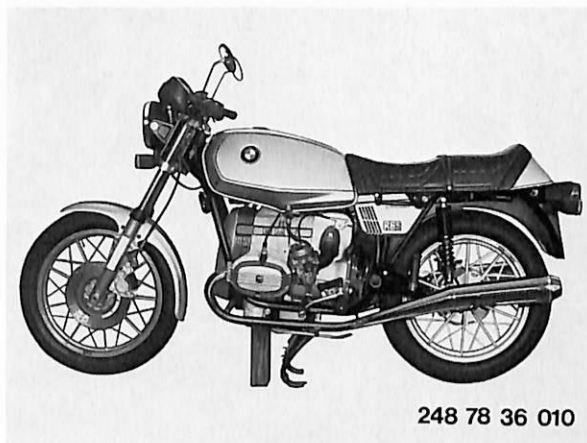
# Rear Wheel Bearings



- 1) Round head rivet
- 2) Dog
- 3) Shaft seal
- 4) Pressure sleeve
- 5) Tapered roller bearing
- 6) Ring
- 7) Spacer
- 8) Shaft seal
- 9) Pressure sleeve
- 10) Shim

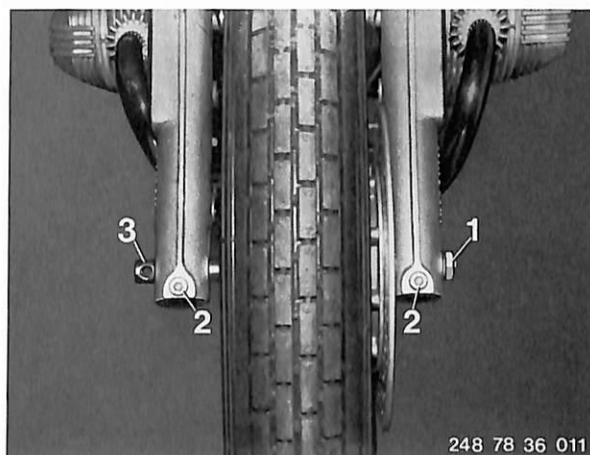
### 36 30 300 Removing and Installing Front Wheel

Place motorcycle on kick stand and put a support underneath the oil pan.



Unscrew axle nut (1) with washer, loosen socket head screws (2) with washers of front axle and pull out front axle (3), applying a mandrel.

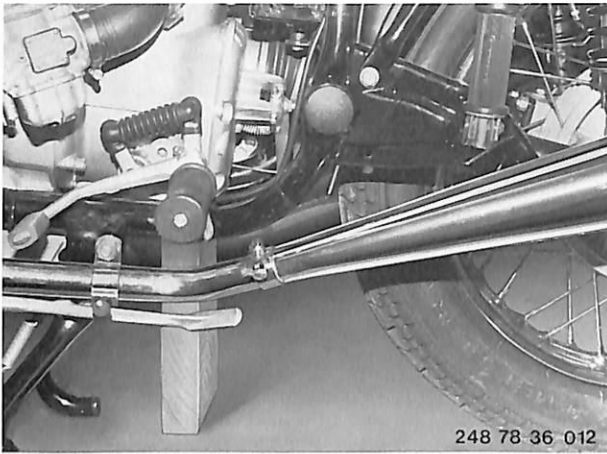
**Installation Note!** When installing the front axle with a light coat of grease, first tighten the axle nut (counterholding with a mandrel, if necessary), then bottom fork suspension firmly several times and finally tighten the mounting screws. This procedure will prevent stress on the fork slide tubes.



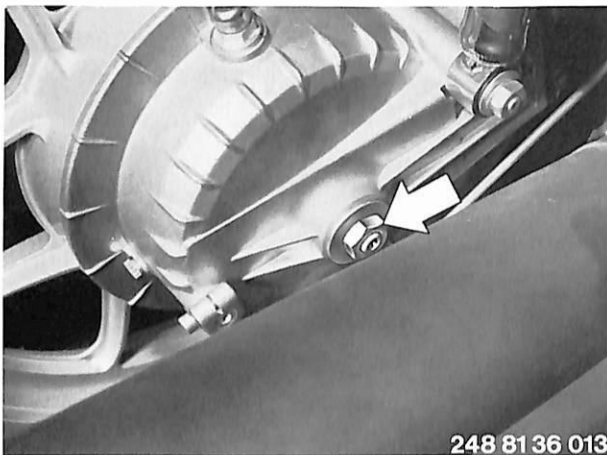
Remove front wheel toward front.

### 36 30 320 Removing and Installing Rear Wheel

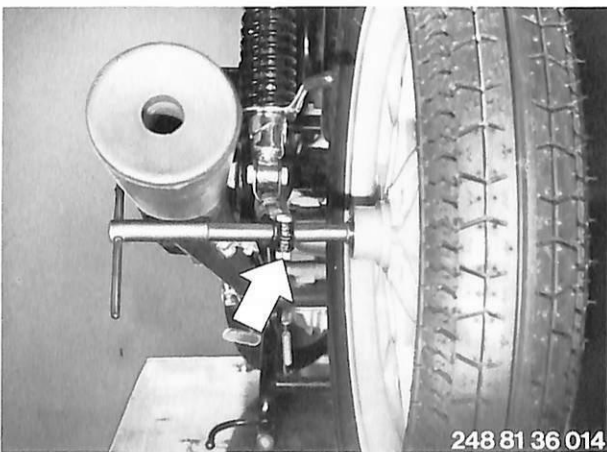
Set up motorcycle on kickstand and also support underneath transmission.



■  
Unscrew stub axle nut on drive end and remove with washer (arrow).

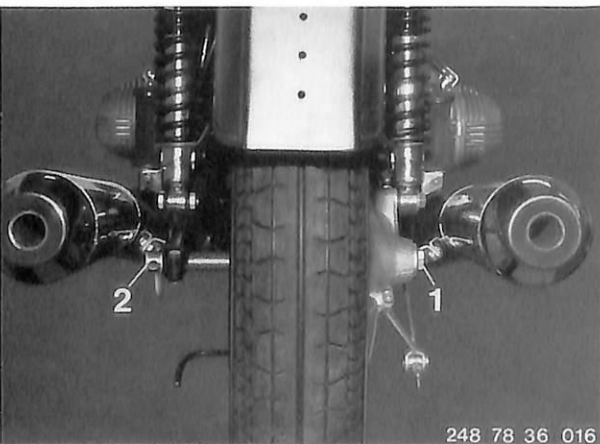


■  
Loosen stub axle bolt nut (arrow) on left control arm.



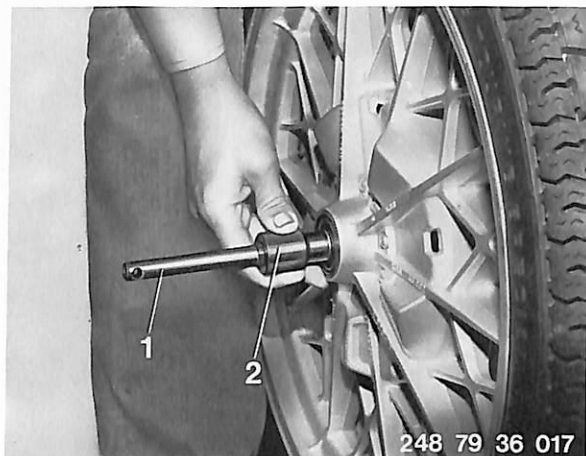
■  
Pull road wheel off of final drive and remove, tilting the motorcycle toward right slightly.

**Installation:** When installing clean shaft and spline thoroughly and lubricate lightly with a viscous grease. Push in stub axle while turning. After tightening stub axle nut (1) bottom motorcycle suspension and then tighten bolt (2). Cross bore in head of axle faces down (arrow).



### 36 30 028 Balancing Wheels Staticly

Insert balancing shaft (1) through wheel bearings and preload bearing slightly with knurled nut (2).



Place wheel on balancing fixture, BMW No. 36 3 600, and let it rotate until it stops on its own. Install weight (arrow) opposite the heaviest point.

**Note:**

A correctly balanced wheel will stop in any position.



Balance weights are installed on cast wheels with the help of assembly pliers, BMW No. 36 3 830.

Apply pliers on rim as close as possible, squeeze together and slide on retaining clip for weight. The necessary weight is installed to equal parts on the left and right sides of the rim opposite each other.

**Important!** Max. balance weight: 60 grams.





### 36 31 371 Removing and Installing Wheel Bearings of One Wheel (Front or Rear)

Remove and install front wheel 36 30 300.

Remove and install rear wheel 36 30 320.

Lift out seal with a screwdriver (arrow).

Remove thrust ring and taper roller bearing.

**Installation:** Knock in seal flush.

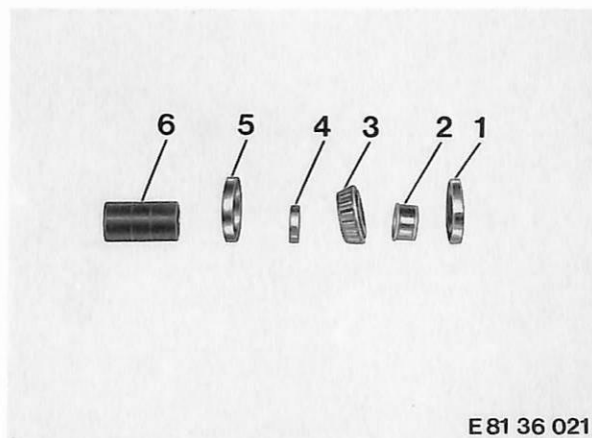


Pull bearing shell out of hub with a Kukko puller, BMW No. 00 8 551.

**Installation:** To install bearing shell, heat hub to about 80° C and knock in shell with Special Tool BMW No. 00 5 550.



- 1 Seal
- 2 Thrust ring
- 3 Tapered roller bearing
- 4 Shim
- 5 Bearing shell
- 6 Spacer



Insert stub axle through wheel hub and preload with 50 mm spacer (arrow) and stub axle nut bearing.

Place friction torque tester with adapter and wrench socket on stub axle nut and check bearing position.

Refer to Technical Data for friction value and tightening torque.

**Note:** Spacer for rear wheel is 85 mm long!





**R 65 LS (Grooved Ball Bearing):**

Remove brake discs (only front wheel). Place wheel rim with hub on hotplate and heat to about 80° C (check temperature with a thermocolor pencil).

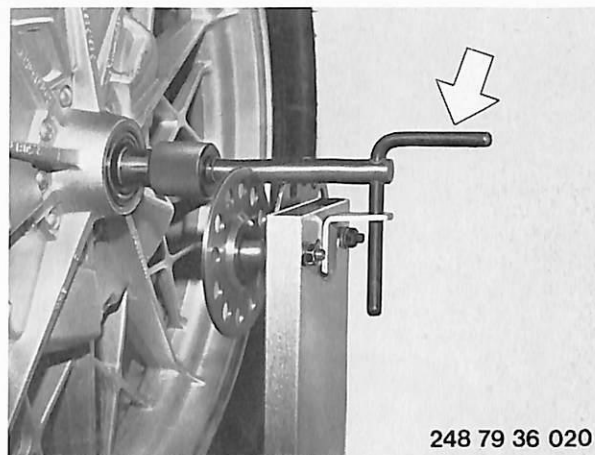
Pull out ball bearing with Kukko puller no. 21/3 and support bridge 22-1.

Drive new bearing into hub while still warm with impact mandrel, BMW No. 00 5 550.



### 36 32 081 Checking Lateral and Radial Runout of Tire

Mount balancing shaft in wheel.  
Place wheel on balancing stand, BMW No. 36 3 600. Stop lateral and measuring shaft with a pin (arrow).

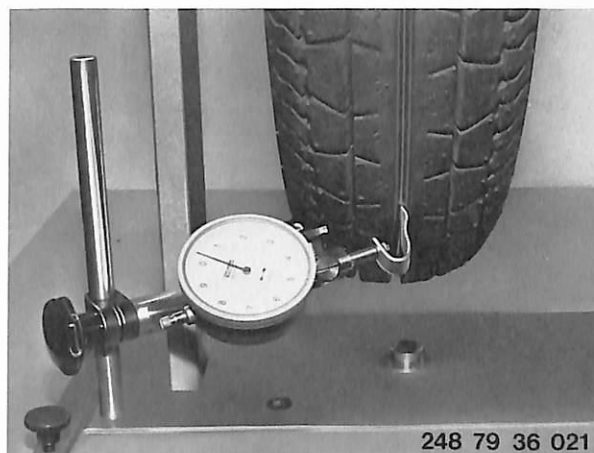


Measure lateral runout.

Apply dial gauge with gauge shoe on flank of center groove in tire against stop and set dial gauge to zero.

Turn wheel carefully.

See Specifications for permissible lateral runout.

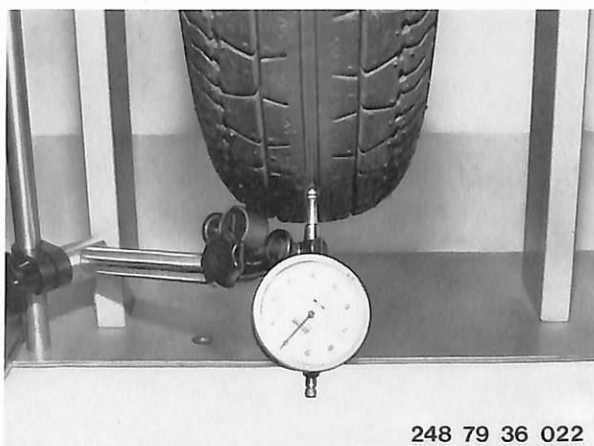


Measure radial runout.

Apply dial gauge with gauge wheel on bottom surface of center groove in tire.

Turn wheel slowly.

See Specifications for permissible radial runout.







# 46 Frame

|                                                                         |              |
|-------------------------------------------------------------------------|--------------|
| Specifications . . . . .                                                | Page 46- 0/3 |
| Specifications – 1981 models . . . . .                                  | 46- 0/5      |
| 46 52 000 Kickstand – remove and install . . . . .                      | 46-52/1      |
| 46 51 040 Toe offset – check (with gauge) . . . . .                     | 46-51/1      |
| 46 51 501 Frame front section – check . . . . .                         | 46-51/2      |
| 46 53 000 Side prop – remove and install . . . . .                      | 46-52/2      |
| 46 61 000 Front wheel fender – remove and install . . . . .             | 46-61/1      |
| 46 62 000 Rear wheel fender – remove and install . . . . .              | 46-61/2      |
| 46 63 020 Cockpit, R 65 LS – remove and install . . . . .               | 46-63/1      |
| 46 63 025 Cockpit upper section, R 65 LS – remove and install . . . . . | 46-63/3      |

## Specifications

| Frame                                                                                          |  | R 65                                                                                                               |
|------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------|
| <b>Model</b>                                                                                   |  |                                                                                                                    |
| <b>Frame</b>                                                                                   |  | Double loop steel pipe frame made of welded oval pipe with bolted rear frame section<br>(not suitable for sidecar) |
| Location of data plate                                                                         |  | on steering head, right end plate                                                                                  |
| Location of chassis number                                                                     |  | on steering head, right end plate                                                                                  |
| <b>Motorcycle Dimensions and Weights</b>                                                       |  |                                                                                                                    |
| Max. width (engine) in mm (in.)                                                                |  | 688 (27.086)                                                                                                       |
| Max. height without mirror in mm (in.)<br>(motorcycle not loaded)                              |  | 1080 (42.520)                                                                                                      |
| Saddle height, unloaded in mm (in.)                                                            |  | 770 (30.315)                                                                                                       |
| Max. length in mm (in.)                                                                        |  | 2180 (85.827)                                                                                                      |
| Wheelbase in mm (in.)                                                                          |  | 1390 (54.724)                                                                                                      |
| Max. track offset in mm (in.)                                                                  |  | 4 (0.157)                                                                                                          |
| Ground clearance with load from<br>rider weighing 75 kg (165 lbs) in mm (in.)                  |  | 105 (4.134)                                                                                                        |
| Curbweight plus lubricants, 24 ltr. (25 qts)<br>of fuel and tools in kg (lbs)                  |  | 205 (452)                                                                                                          |
| Max. total weight = curbweight plus<br>persons and luggage in kg (lbs)                         |  | 398 (540)                                                                                                          |
| Max. wheel load solo in kg (lbs.)<br>Front at 1.9 bar (27 psi)<br>Rear at 2.0 bar (28 psi)     |  | 160 (353)<br>245 (540)                                                                                             |
| Max. wheel load pillion in kg (lbs)<br>Front at 2.00 bar (28 psi)<br>Rear at 2.25 bar (32 psi) |  | 178 (392)<br>270 (595)                                                                                             |
| Max. persons incl. rider                                                                       |  | 2                                                                                                                  |

**Torque Values in Nm (ft lbs)**

|                                                                                                                                       |         |                            |                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------|-----------------------|
| Frame rear section mounting screws                                                                                                    | 25 (18) | Kick stand mounting screws | 43 ... 48 (31 ... 35) |
| Tighten all other bolts and nuts to common torque values as listed in tables from bolt/nut suppliers or the new BMW Standard 60002.0. |         |                            |                       |

## Specifications 1981 Models

| Frame                                                                      | R 65                                                                                                            |  | R 65 LS |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--|---------|
| Model                                                                      | R 65                                                                                                            |  | R 65 LS |
| Frame                                                                      | Double loop steel pipe frame made of welded oval pipe with bolted rear frame section (not suitable for sidecar) |  |         |
| Location of data plate                                                     | on steering head, right end plate                                                                               |  |         |
| Location of chassis number                                                 | on steering head, right end plate                                                                               |  |         |
| <b>Motorcycle Dimensions and Weights</b>                                   |                                                                                                                 |  |         |
| Max. width (engine) in mm (in.)                                            | 688 (27.086)                                                                                                    |  |         |
| Max. height without mirror in mm (in.)<br>(motorcycle not loaded)          | 1080 (42.520)                                                                                                   |  |         |
| Saddle height, unloaded in mm (in.)                                        | 770 (30.315)                                                                                                    |  |         |
| Max. length in mm (in.)                                                    | 2180 (85.827)                                                                                                   |  |         |
| Wheelbase in mm (in.)                                                      | 1390 (54.724)                                                                                                   |  |         |
| Max. track offset in mm (in.)                                              | 4 (0.157)                                                                                                       |  |         |
| Ground clearance with load from rider weighing 75 kg (165 lbs) in mm (in.) | 105 (4.134)                                                                                                     |  |         |
| Curbweight plus lubricants, 24 ltr. (25 qts) of fuel and tools in kg (lbs) | 205 (452)                                                                                                       |  |         |
| Max. total weight = curbweight plus persons and luggage in kg (lbs)        | 398 (540)                                                                                                       |  |         |
| Max. persons incl. rider                                                   | 2                                                                                                               |  |         |

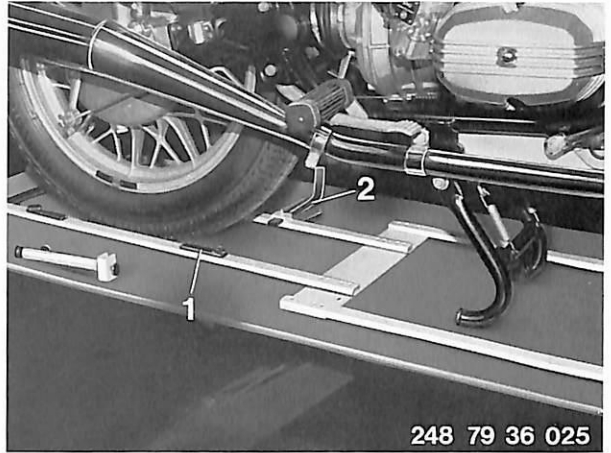


## 46 51 040 Measuring Toe Displacement (with Gauge)

Place motorcycle in gauge, placing fixture on floor or lifting platform for this purpose. Fold away or pull in stops (1) and slide (2), and push motorcycle into gauge and place on center stand.

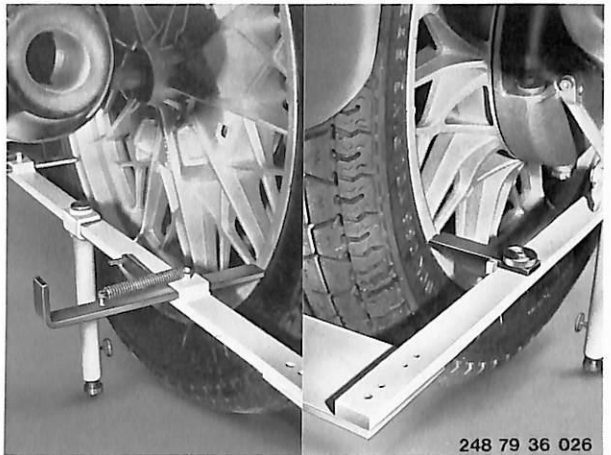
Stop No. For:

- 36 3 905 Cast wheels with drum brakes, 1978 models
- 36 3 908 Cast wheels with drum brakes, 1981 models
- 36 3 913 R 65 LS, 1982 models



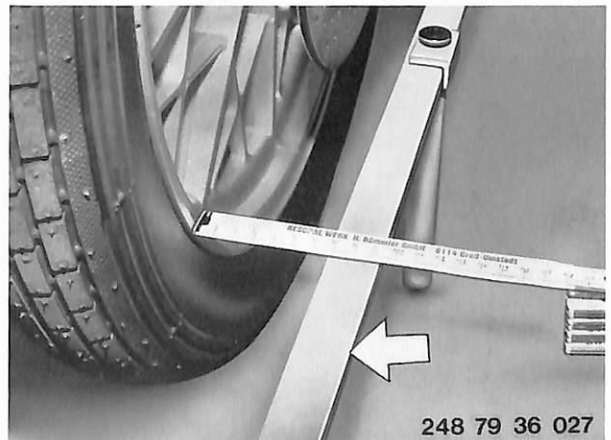
Place toe gauge on supports, position to about height of stub axles, adjustable supports toward rear. Fold out flaps and release slide lock (don't let it snap forward!). Adjust height with the adjustable supports that slide and stops rest on rim only.

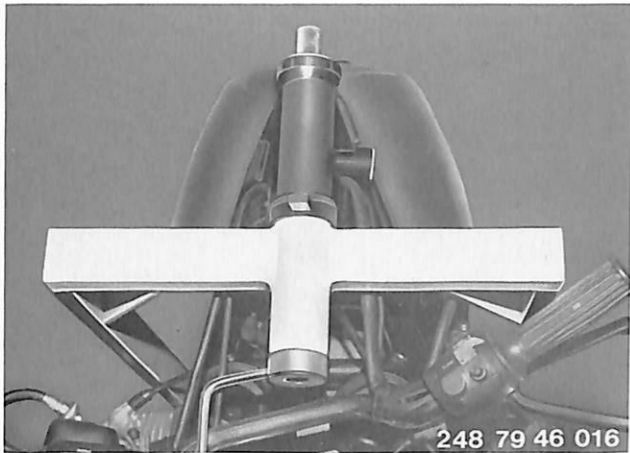
Push gauge against rear wheel firmly from the right side so that both stops rest on the rim.



To be able to measure the toe displacement, the front wheel must be aligned parallel to both measuring rails (arrow). A ruler is used to measure the distance from the front wheel rim to the measuring rail, front and rear, left and right. The difference of both distances is the amount of toe displacement.

The toe displacement can be corrected slightly by moving the control arm.





## 46 51 501 Checking Frame Front Section

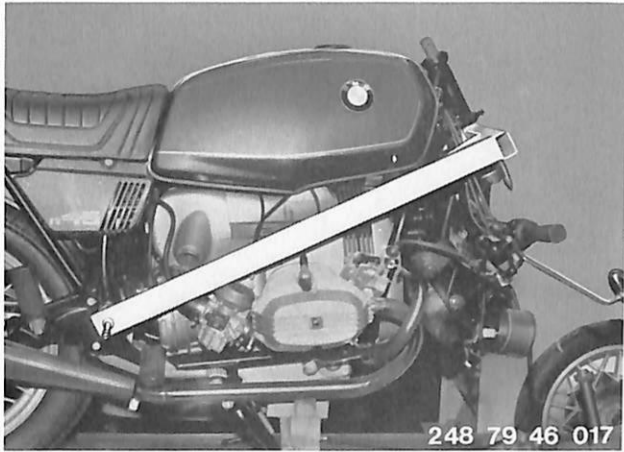
Remove and install front wheel fork 31 42 100.

Bearing shells remain in steering head.

Remove and install left and right carburetors 13 10 100.

Unscrew swinging arm bearing bolts.

Apply frame gauge, BMW No. 46 5 600, on steering head from below and secure with spindle and nut.



Screw measuring discs in left and right control arm takeups of frame.

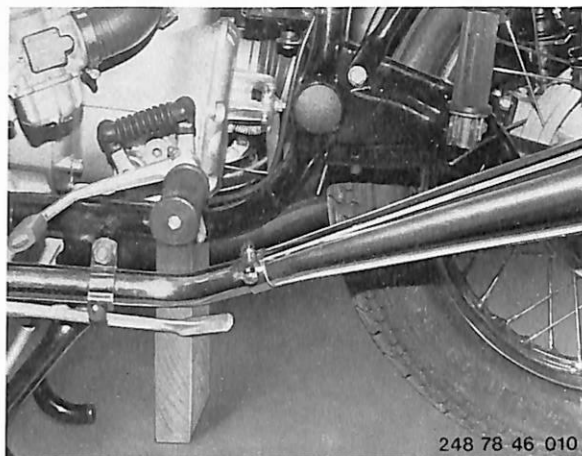
Insert measuring mandrels in frame gauge and align gauge that the distance to the measuring disc is the same on left and right sides.



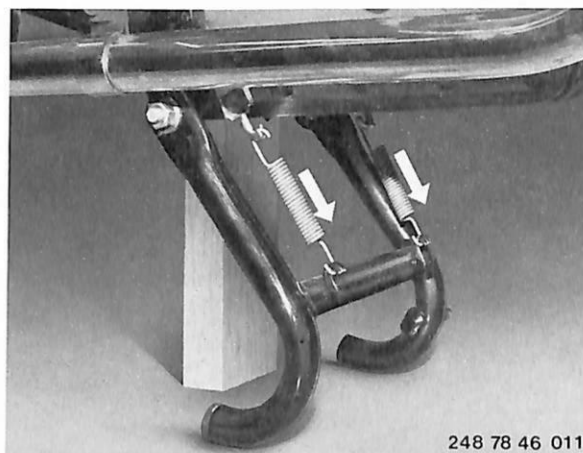
The frame is okay, if the tips of both measuring mandrels are approximately at the same position with the tolerance range on left and right sides.

## 46 52 000 Removing and Installing Kick Stand

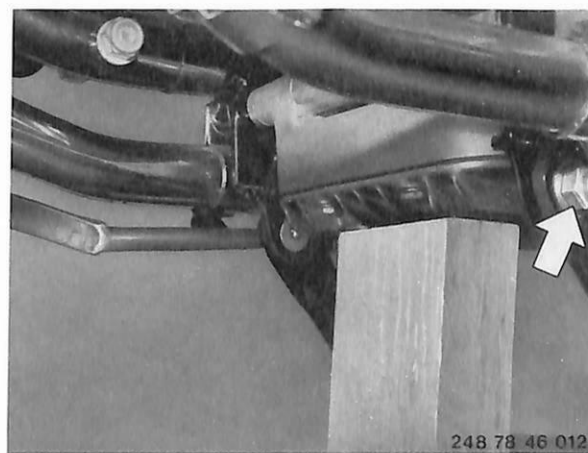
Jack up motorcycle underneath oil pan until the kick stand clears ground.



Pull down spring on left and right sides of kick stand (direction of arrow) and disconnect.



Unscrew left and right hexagon nuts (arrow), counterholding on inside with a socket wrench.  
Remove kick stand toward front.



## 46 53 000 Removing and Installing Side Prop

Disconnect springs for side prop in direction of arrow.



Push bracket forward in direction of arrow, so that pin can be knocked out from below.



Press out pin from side prop and remove.

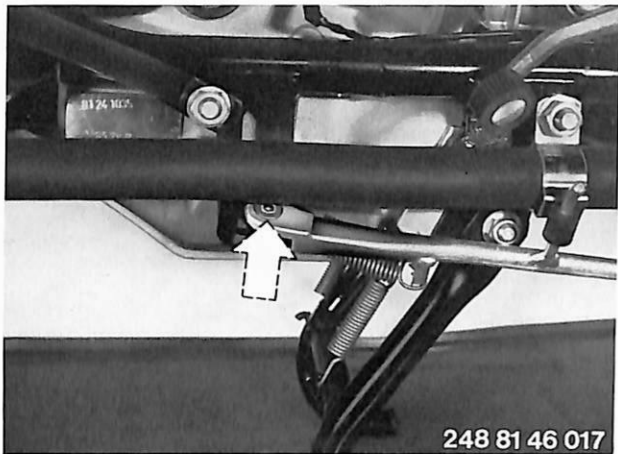


### Removing and Installing Side Prop of 1981 Models

Remove and install exhaust assembly 18 00 020.  
Disconnect springs in direction of arrow.





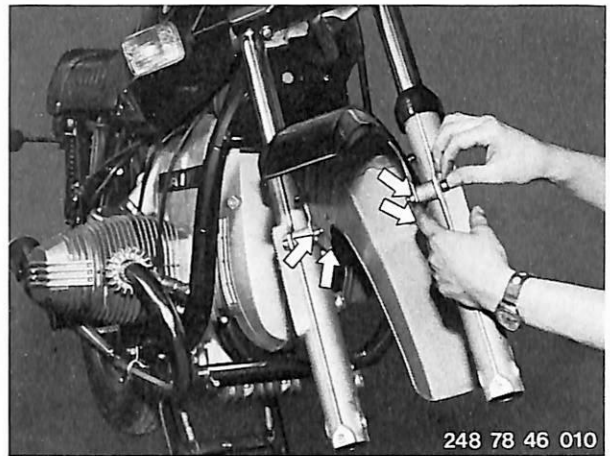


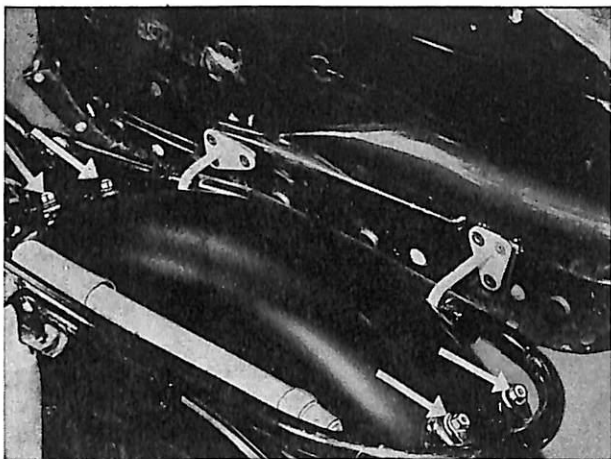
Unscrew socket head screw (arrow) and take off side prop.

## 46 61 000 Removing and Installing Front Wheel Fender

Remove 2 socket head screws from each, left and right, side of section plate.  
Unscrew four cap nuts on fender to replace a fender without a section plate.

**Installation Note!** Don't forget the rubber washers.





## 46 62 000 Removing and Installing Rear Wheel Fender

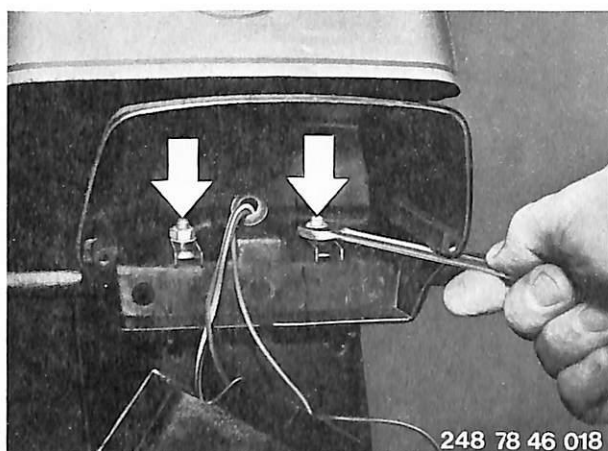
Disconnect ground wire from battery.

Unfold double seat and remove 4 hexagon head screws with washers, rubber washers and stop nuts (arrow).



Remove both phillips screws of tail light and take off lens with reflector.

Unscrew mounting screws with washers and nuts (arrow). Remove tail light housing with turn signal carrier from guard.



### Trouble-shooting – frame and suspension

| Fault                         | Cause                                                                                                                                                                                                                                                                                           | Remedy                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Telescopic forks sticking     | Forks distorted                                                                                                                                                                                                                                                                                 | Unscrew quick-release axle and sheet metal pressing mount<br>Compress forks fully several times<br>Tighten bolts and nuts to correct torques                                                                                                                                                                                                            |
| Unsteady straightline running | Defective steering head bearings<br>Steering head bearings out of adjustment<br>Tire or rim runout<br>Defective wheel bearing<br>Tire of wrong type or make<br>Swinging arm bearing preload incorrect<br>Defective swinging arm bearing<br>One damper defective<br>Track misalignment too great | Renew<br>Reset<br>Check vertical and lateral runout and renew affected items<br>Renew or adjust<br>Renew (use only approved tire)<br>Check setting, correct if necessary<br>Renew and adjust<br>Check dampers (install only dampers with approximately identical traction and compression stages)<br>Check and adjust if necessary (see Specifications) |

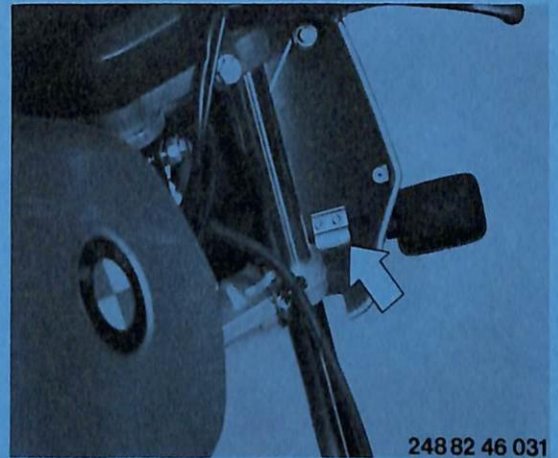


## 46 63 020 Removing and Installing Cockpit for R 65 LS

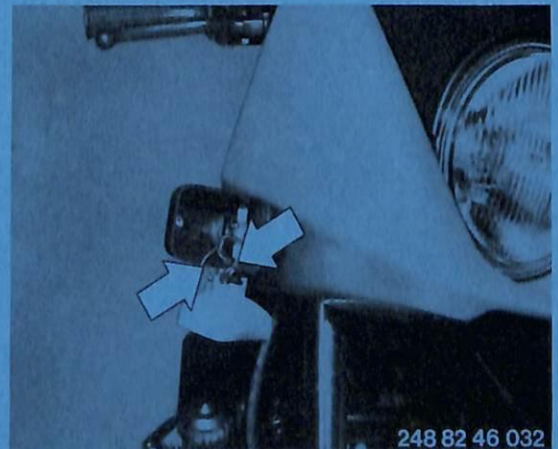
Unscrew mounting screws for left and right trim panels (arrow) and remove trim panels from above at an angle.



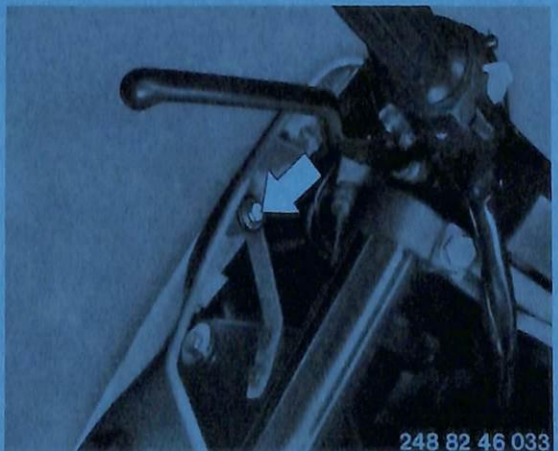
Unscrew socket head screws of clamps (arrow) on left and right sides.



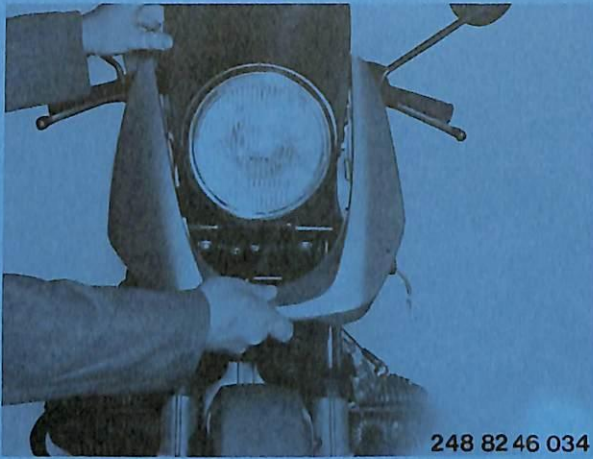
Unscrew lenses of front turn signals and pull off wires (arrow) on reflector housing. Pull turn signal housing out of cockpit lower section.



Unscrew mounting screws for cockpit lower section (arrow) on left and right sides.







Pull off cockpit lower section forward at an angle.  
Pull out turn signal wires toward inside.



**Note:**

Upper mounting point of cockpit lower section is only clamped (arrow) in instrument trim panel.



Unscrew round nut of ignition lock with a special circlip pliers.



Pull off instrument trim panel in direction of arrow.  
Pull turn signal indicator lamps (1 and 2) out of holders through instrument openings.





## 46 63 025 Removing and Installing Cockpit Upper Section for R 65 LS

Unscrew round nut on ignition lock with a special circlip pliers.



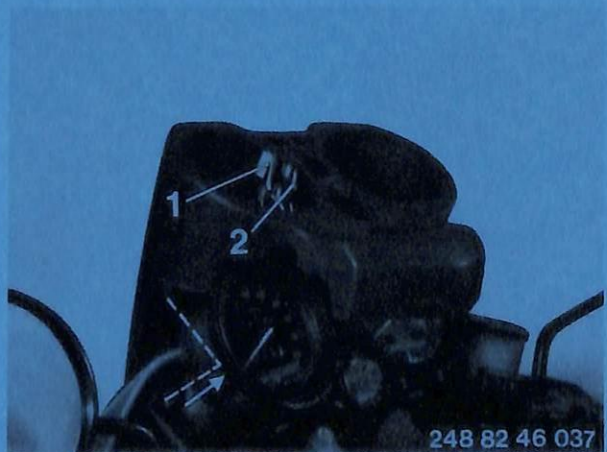
Push trim upper section together on headlight with both thumbs (arrows) until retaining tabs (1 and 2) disengage.



Push trim upper section out of top clamps in direction of arrow.



Pull bulb holders for turn signal indicator lamps (1 and 2) out of trim upper section.







# 51 Equipment

|           |                                                   |              |
|-----------|---------------------------------------------------|--------------|
| 51 25 030 | Steering lock – remove and install . . . . .      | Page 51–25/1 |
| 51 25 050 | Seat lock – remove and install . . . . .          | 51–25/1      |
| 51 25 060 | Seat lock cylinder – remove and install . . . . . | 51–25/2      |

### 51 25 030 Removing and Installing Steering Lock

Pry off cover (arrow) with a screwdriver.



Insert key in lock and turn anticlockwise against stop. Pull out lock cylinder.

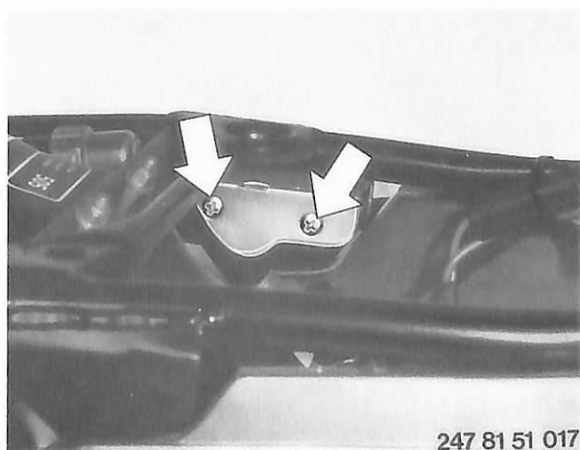


### 51 25 050 Removing and Installing Seat Lock

Unscrew both phillips screws (arrows). Remove cover and lock housing.

#### Installation:

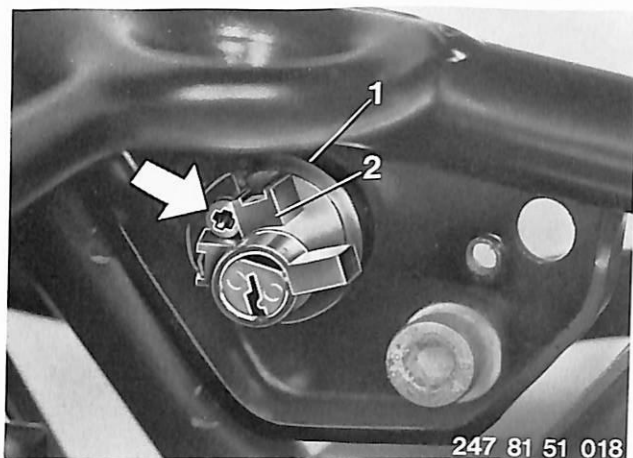
First install rear screw finger tight and then the front screw, making sure spring fits correctly!



## 51 25 060 Removing and Installing Seat Lock Cylinder

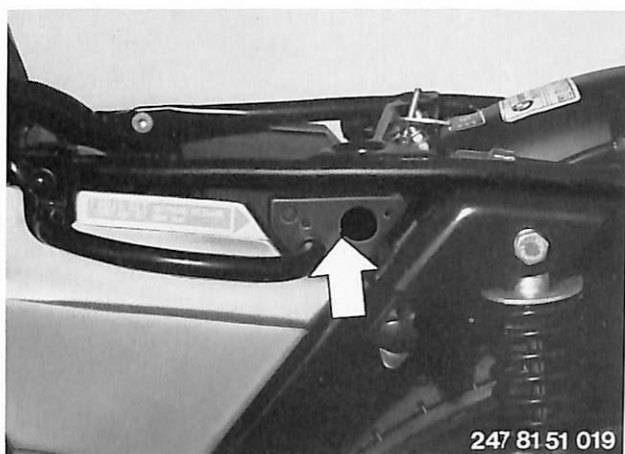
Remove and install seat lock 51 25 050.

Unscrew phillips screw (arrow). Pull circlip (1) and lock cylinder (2) apart.



### Installation:

Tab of lock cylinder must engage in groove of lock plate (arrow).



## 52 53 000 Removing and Installing Seat

Remove retainer (arrow) on front and rear hinges (press away to the side with a screwdriver). Fold up seat, pull back and remove carefully.





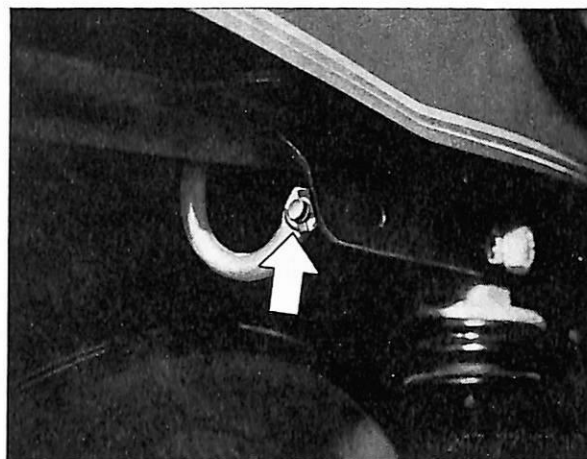


# 52 Seats

52 53 000    Seat, removing and installing    . . . . . Page 52–53/1

## 52 53 000 Removing and Installing Seat

Remove circlip from rear hinge (arrow), fold up seat, pull toward rear and remove.







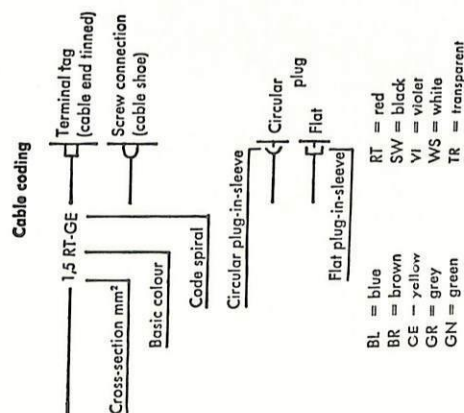
# 61 General Electrical System

|                                                          |              |
|----------------------------------------------------------|--------------|
| Specifications and wiring diagrams . . . . .             | Page 61- 0/3 |
| Specifications – 1981 models . . . . .                   | 61- 0/5      |
| 61 21 010 Battery – remove and install . . . . .         | 61-21/1      |
| 61 21 100 Battery console – remove and install . . . . . | 61-21/2      |
| 61 31 350 Flasher – remove and install . . . . .         | 61-31/1      |
| 61 31 367 Buzzer – remove and install . . . . .          | 61-31/1      |
| 61 31 365 Buzzer relay – remove and install . . . . .    | 61-31/2      |
| 61 31 400 Starter relay – remove and install . . . . .   | 61-31/2      |
| 61 33 000 Horn – remove and install . . . . .            | 61-33/1      |

| General Electric System | Specifications |
|-------------------------|----------------|
|-------------------------|----------------|

|                                         |                                             |
|-----------------------------------------|---------------------------------------------|
| <b>Model</b>                            | R 65                                        |
| <b>Horn</b>                             | Electromagnetic striking horn 335 Hz        |
| <b>Battery (VARTA)<br/>Voltage in V</b> | 12                                          |
| <b>Capacitance in Ah</b>                | 16                                          |
| <b>Pole with ground</b>                 | minus                                       |
| <b>Flasher (Bosch)</b>                  | 0335 200 043 (12 V 2 (4) x 21 W 13 ... 7 W) |
| <b>Fuse (two)</b>                       | 8 amperes                                   |

# Explanations for Wiring Diagram R 45 — R 65



- 1 Emergency off switch
- 2 Starter switch
- 3 Turn signal front right
- 4 Headlight
  - a High beam
  - b Low beam
- 5 Turn signal front left
- 6 Horn switch
- 7 Dimmer and light flasher
- 8 Turn signal switch
- 9 Six pin plug
- 10 Clutch switch

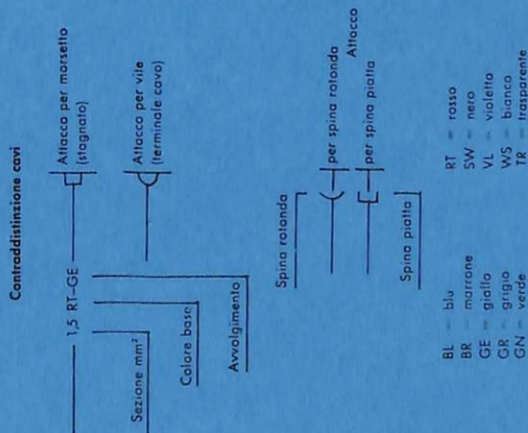
- 11 Speedometer scale light
- 12 Ignition switch
- 13 Indicator lamps left and right
- 14 Tachometer
  - a High beam indicator lamp (blue)
  - b Scale light
  - c Battery charge ind. lamp (red)
  - d Idle indicator lamp (green)
  - e Oil pressure ind. lamp (orange)
  - f Light diode for speed warmer
- 15 Eight pin plug for tachometer
- 16 Hand brake light switch
- 17 Six pin plug (white)
- 18 Six pin plug (beige) for hazard lg.
- 19 Six pin plug (gray)
- 20 Six pin plug (black)
- 21 Six pin plug (blue) for opt. equip.
- 22 Two pin plug
- 23 Six pin plug (black)
- 24 Horn
- 25 Buzzer
- 26 Oil pressure switch
- 27 Transmission idle switch
- 28 Stop light switch
- 29 Box right
  - a Flasher
  - b Fuses
  - c Six pin plug (black)
- 30 Two pin plug
- 31 Two pin plug
- 32 Two pin plug
- 33 Diode
- 34 Starter relay
- 35 Relay for acc. turn signal control
- 36 Ignition coil front
- 37 Ignition coil rear
- 38 Spark plug with connector
- 39 Contact breaker with capacitor
- 40 Battery
- 41 Starter
- 42 Alternator
- 43 Regulator
- 44 Diode plate
- 45 Two pin plug
- 46 Turn signal rear right
- 47 Tail light
  - a Stop light
  - b Tail + license plate light
- 48 Turn signal rear left

## Specifications 1981 Models

| General Electric System             | R 65 |                                       | R 65LS |
|-------------------------------------|------|---------------------------------------|--------|
| Model                               |      |                                       | R 65LS |
| Horn                                |      | Electromagnetic striking horn 335 Hz  |        |
| Battery (BMW-Mareg)<br>Voltage in V |      | 12                                    |        |
| Capacitance in Ah                   |      | 16                                    |        |
| Pole with ground                    |      | minus                                 |        |
| Flasher                             |      | Wehrle (12 V 2 (4) x 21 W 13 ... 7 W) |        |
| Fuse (two)                          |      | 8 amperes                             |        |



## Explanations of Wiring Diagram for R 65-R 65 LS (1981 US Models)



1 Turn signal front right

2 Headlight

a High beam

b Low beam

d Marker light

3 Turn signal front left

4 Turn signal indicator left and right

5 Speedometer scale light

6 Ignition/light switch

7 Hand brake light switch

8 Plug for hand brake light switch

9 Tachometer

a High beam indicator lamp (blue)

b Scale light

c Battery charge indicator lamp (red)

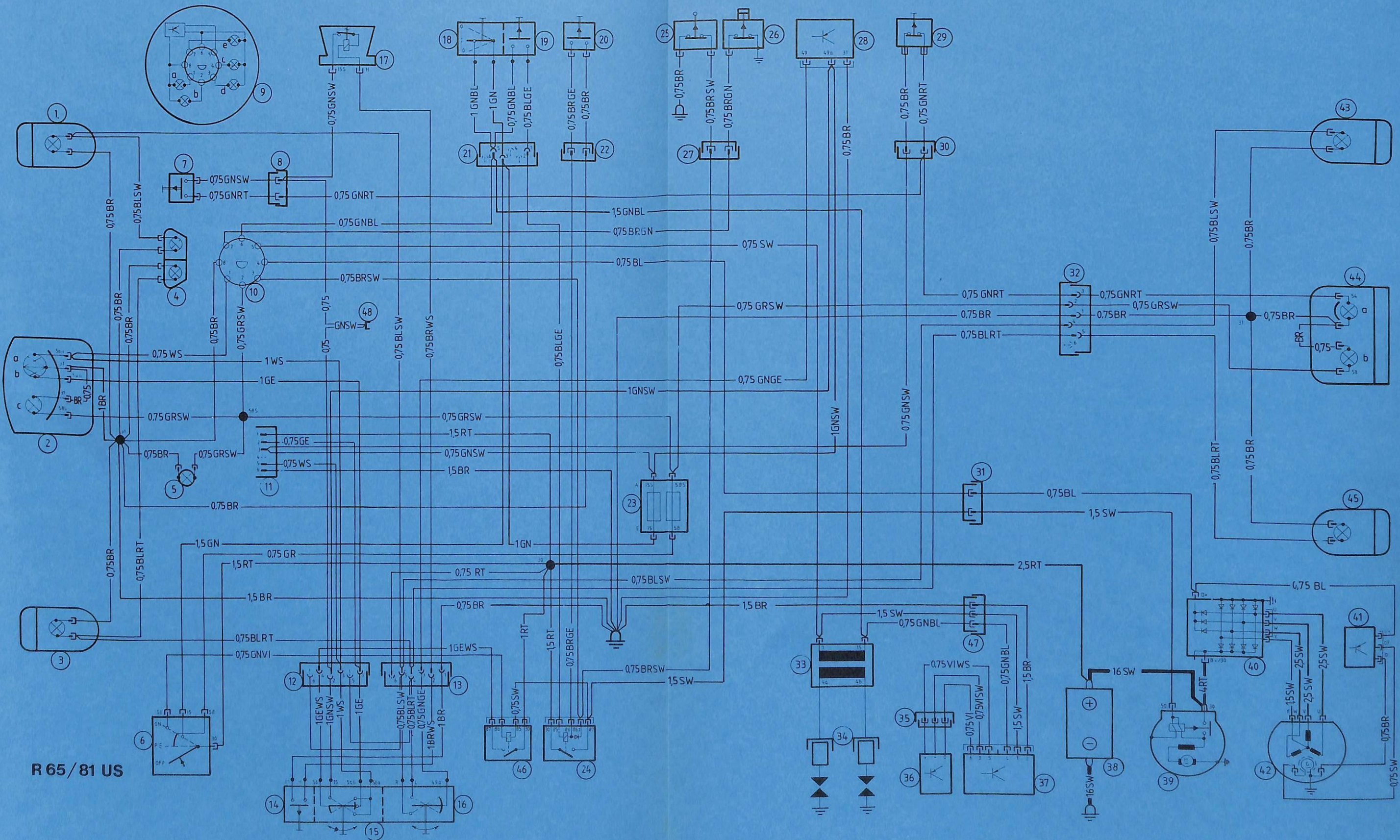
d Idle indicator lamp (green)

e Oil pressure indicator lamp (red)

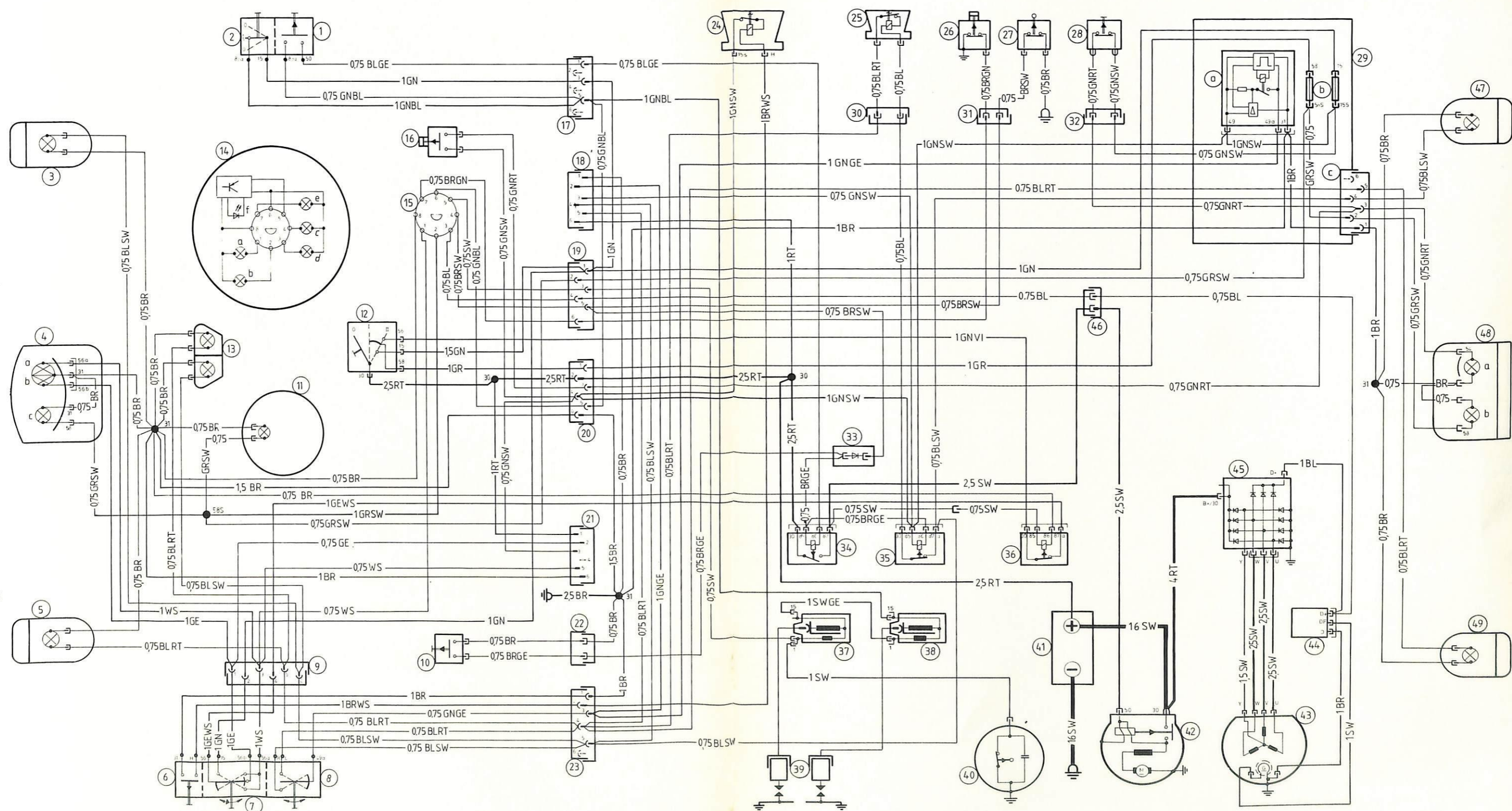
- 10 8-pin plug for tachometer
- 11 Plug for special equipment
- 12 Plug for left handlebar switch (red)
- 13 Plug for left handlebar switch (black)
- 14 Horn switch
- 15 Headlight dimmer/flasher switch
- 16 Turn signal switch
- 17 Horn
- 18 Emergency off switch
- 19 Starter switch
- 20 Clutch switch
- 21 Plug for right handlebar switch (white)
- 22 Plug for clutch switch
- 23 Fuse box
- 24 Starter relay
- 25 Transmission switch
- 26 Oil pressure switch
- 27 Plug for transmission and oil pressure switches
- 28 Flasher
- 29 Foot brake light switch
- 30 Plug for foot brake light switch
- 31 Plug for engine
- 32 Plug for tail lights
- 33 Double spark ignition coil
- 34 Spark plugs with end caps
- 35 Plug for ignition trigger
- 36 Ignition trigger (hall sensor)
- 37 TCI control unit
- 38 Battery
- 39 Starter
- 40 Diode plate
- 41 Regulator
- 42 Alternator
- 43 Turn signal rear right
- 44 Tail lights
  - a Stop light
  - b Tail and license plate light
- 45 Turn signal rear left
- 46 Plug for ignition
- 47 Voltmeter connection



R 65/81 US







## 61 21 010 Removing and Installing Battery

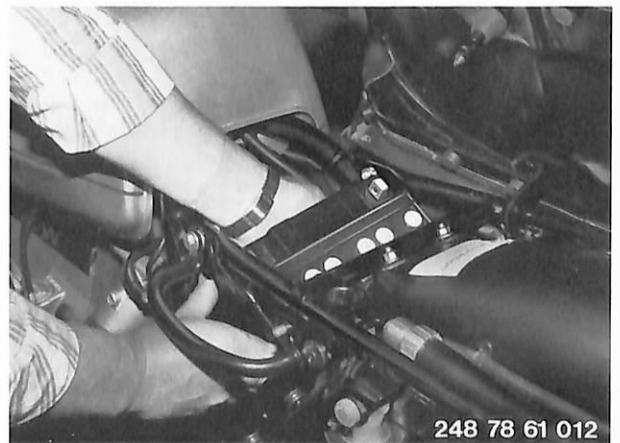
Remove left and right battery cover, first pulling out of front holding pad and then from both rear ones. Pull up cover at same time.



Pull left rubber clamp down in direction of arrow and right up, and disengage. Remove cover and disconnect wires from battery.



Pull out battery from left side with right hand, inclined toward rear and upward. Grab underneath battery with left hand and turn the right side toward front and up; the left side toward rear and down. This means reaching the position illustrated in the figure.



Tilt battery all the way on the left narrow side and pull out upward.





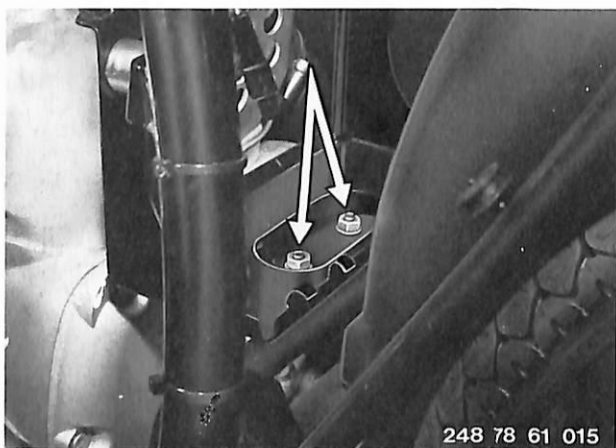
## 61 21 100 Removing and Installing Battery Console

Remove and install battery 61 21 010.

Unscrew one each hexagon nut (arrow) on left and right sides of battery console at top.



Also remove two bottom hexagon nuts (arrows).



### 61 31 350 Removing and Installing Flasher

Disconnect battery ground lead.

Take off right battery cover.

Take hold of flasher (arrow) with two fingers and pull out from above.

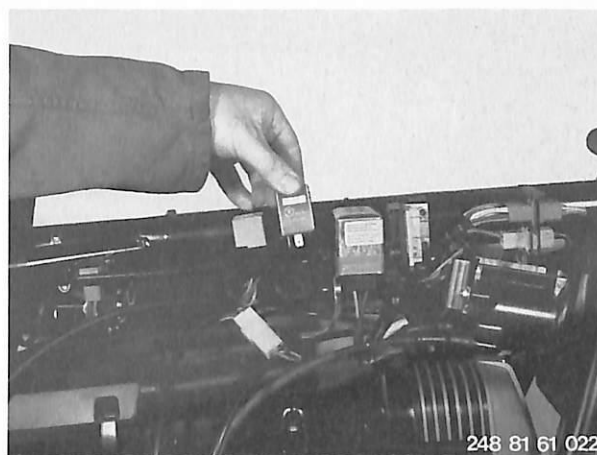


#### 1981 Models

Disconnect battery ground lead.

Remove fuel tank 16 11 030.

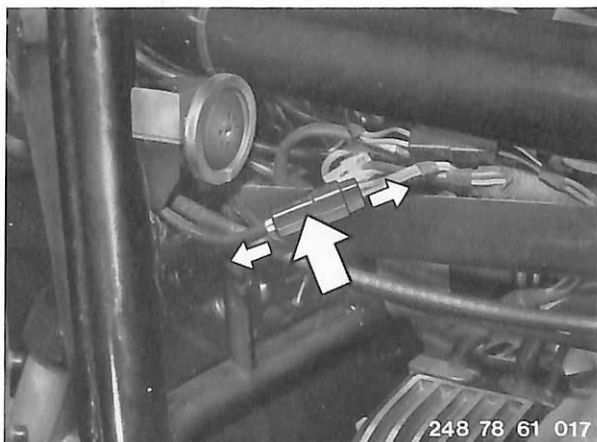
Pull out flasher.



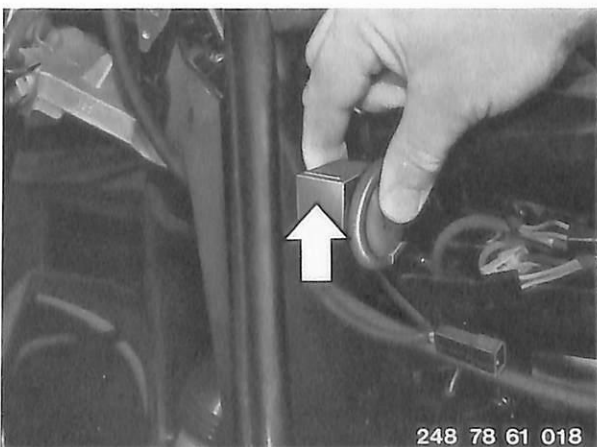
### 61 31 367 Removing and Installing Buzzer

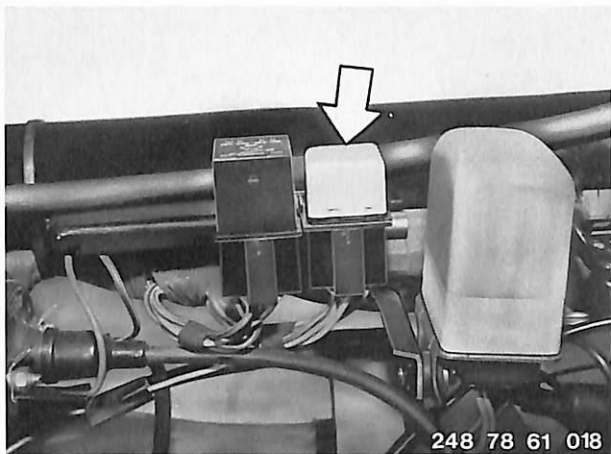
Remove and install fuel tank 16 11 030.

Disconnect two pin plug (arrow).



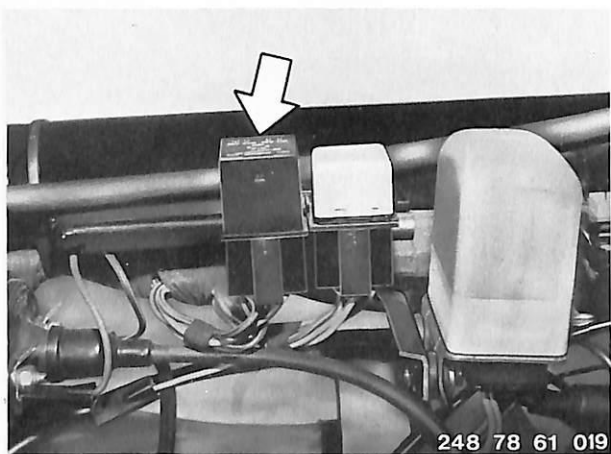
Pull off buzzer on holder from above.





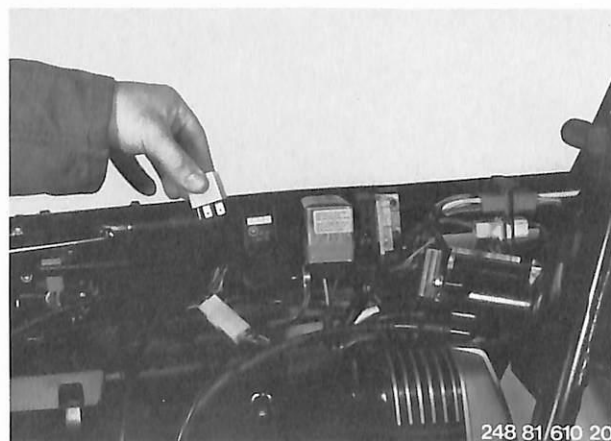
### 61 31 365 Removing and Installing Buzzer Relay

Remove and install fuel tank 16 11 030.  
Pull relay (arrow) out of socket.



### 61 31 400 Removing and Installing Starter Relay

Remove and install fuel tank 16 11 030.  
Pull starter relay (arrow) out of socket.

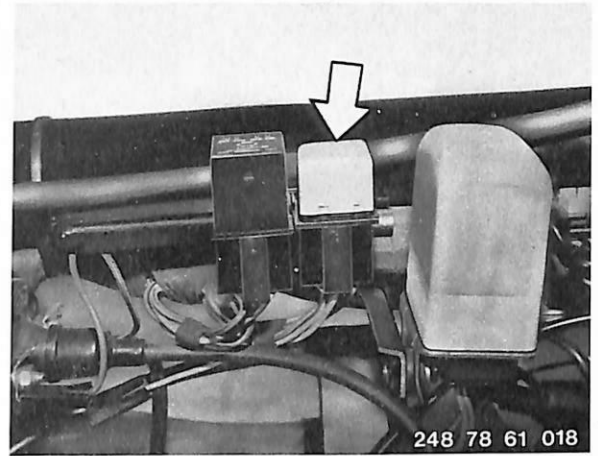


Same is applicable to 1981 models.

### 61 31 365 Removing and Installing Buzzer Relay

Remove and install fuel tank – 16 11 030.

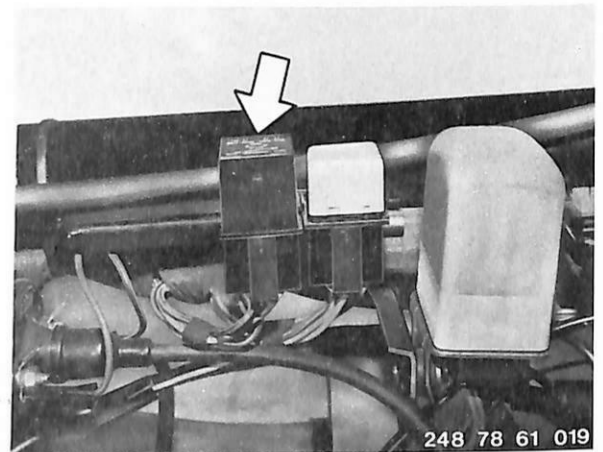
Pull out relay (arrow) from console.



### 61 31 400 Removing and Installing Start Relay

Remove and install fuel tank – 16 11 030.

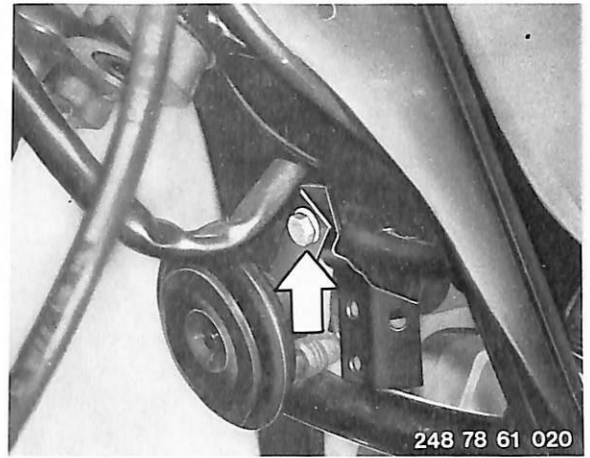
Pull out relay (arrow) from console.



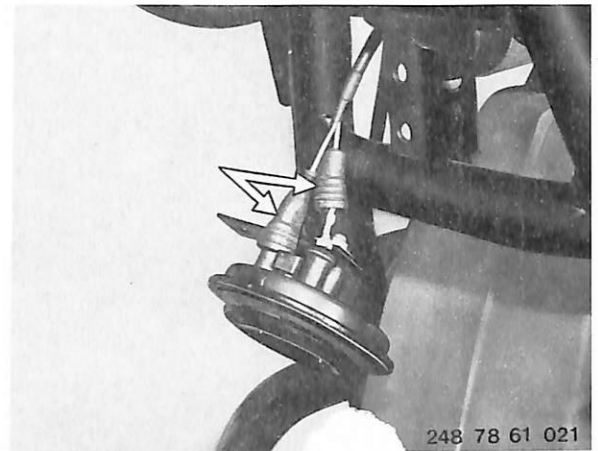


## 61 33 000 Removing and Installing Horn

Disconnect ground wire from battery. Unscrew horn mounting screw (arrow).



Push back water cap (arrow) and pull off flat male plug.





# 62 Instruments

|                                                                  |              |
|------------------------------------------------------------------|--------------|
| Specifications . . . . .                                         | Page 62- 0/3 |
| Specifications – 1981 models . . . . .                           | 62- 0/5      |
| 62 12 000 Speedometer – remove and install . . . . .             | 62-12/1      |
| 62 12 020 Speedometer drive cable – remove and install . . . . . | 62-12/2      |
| 62 13 000 Tachometer – remove and install . . . . .              | 62-13/1      |

**Specifications**

| Instruments              |            |
|--------------------------|------------|
| Model                    | R 65       |
| Constant W for mile gage | 1.267      |
| Gage range in mph        | 0 ... 120  |
| Tachometer rpm           | 0 ... 8500 |



## Specifications 1981 Models

| Instruments                     |  | R 65 |            | R 65 LS |
|---------------------------------|--|------|------------|---------|
| <b>Model</b>                    |  |      |            |         |
| Constant W for km speedometer   |  |      | 0.819      |         |
| Constant W for mile speedometer |  |      | 1.381      |         |
| Gauge range in km/h             |  |      | 10 ... 200 |         |
| Gauge range in mph              |  |      | 0 ... 85   |         |
| Tachometer range in rpm         |  |      | 0 ... 8500 |         |

## 62 12 000 Removing and Installing Speedometer

Remove and install cockpit upper section (only R 65 LS) 46 63 025.

Unscrew two phillips screws of instrument trim panel.  
Unscrew round nut of ignition lock with special pliers.  
Pull turn signal bulb holders out of trim panel. Take off instrument trim panel.



Detach speedometer cable (1) from instrument and pull out holder (2) for instrument light.



Unscrew two instrument mounting nuts (arrows) and remove instrument.





## 62 12 020 Removing and Installing Speedometer Drive Cable

Remove and install cockpit upper section (only R 65 LS) 46 63 025.

Unscrew knurled nut (arrow) on speedometer.



Push back rubber cap for speedometer drive on transmission. Unscrew mounting screw (arrow) far enough that the speedometer drive cable can be pulled out.

### Installation:

Make sure speedometer drive cable is routed correctly along the frame.



## 62 13 000 Removing and Installing Tachometer

Remove and install cockpit upper section (only R 65 LS) 46 63 025.

Unscrew two phillips screws of instrument trim panel.

Unscrew round nut of ignition lock with special pliers.

Pull out holders for turn signal light bulbs.

Take off instrument trim panel.



Pull out multiple plug from instrument.

**Installation Note!** Watch round head pin when installing!



Unscrew two instrument mounting nuts and remove instrument.







# 63 Lights

|                                                                             |              |
|-----------------------------------------------------------------------------|--------------|
| Specifications . . . . .                                                    | Page 63- 0/3 |
| Specifications – 1981 models . . . . .                                      | 63- 0/5      |
| 63 10 004 Headlight – aim . . . . .                                         | 63-10/1      |
| 63 21 380 Tail light assembly – remove and install . . . . .                | 63-10/2      |
| 63 23 170 Turn signals, both (front or rear) – remove and install . . . . . | 63-23/1      |
| 63 99 241 Light bulb for haedlight – replace . . . . .                      | 63-99/1      |
| 63 99 271 Light bulb for turn signal (front or rear) – replace . . . . .    | 63-99/2      |
| 63 99 381 Light bulb for tail light – replace . . . . .                     | 63-99/2      |

## Lights Specifications

| Model                                      | R 65                     |                  |                |
|--------------------------------------------|--------------------------|------------------|----------------|
| Headlight (type)                           | Bosch Type 0 303 551 103 |                  |                |
| High and low beam                          | H-4 halogen lamp         |                  |                |
| Overnight light                            | 12 V / 60/55 W           | H-4 halogen lamp |                |
| Idle indicator lamp (green)                | T 8/4                    | 12 V / 4 W       | Overnight lamp |
| Charge indicator lamp (red)                | W 10/3                   | 12 V / 3 W       | Indicator lamp |
| Oil pressure indicator lamp (red)          | W 5 / 1.2                | 12 V / 1.2 W     | Indicator lamp |
| High beam indicator lamp (blue)            | W 5 / 1.2                | 12 V / 1.2 W     | Indicator lamp |
| Turn signal indicator lamp (green)         | W 10 / 3                 | 12 V / 3 W       | Indicator lamp |
| Instrument light                           | W 10 / 3                 | 12 V / 3 W       | Indicator lamp |
| Tail and license plate light               | W 10 / 3                 | 12 V / 3 W       | Indicator lamp |
| Stop light                                 | R 19 / 5                 | 12 V / 5 W       | Bulb           |
| Turn signal (2 yellow both front and rear) | P 25 / 1                 | 12 V / 21 W      | Bulb           |
|                                            | P 25 / 1                 | 12 V / 21 W      | Bulb           |

### Lights Specifications 1981 Models

| Model                                      | R 65                     | R 65 LS          |
|--------------------------------------------|--------------------------|------------------|
| Headlight (type)                           | Bosch Type 0 303 551 103 |                  |
| High and low beam                          | 12 V / 60/55 W           | H-4 halogen lamp |
| Overnight light                            | T 8/4                    | Overnight lamp   |
| Idle indicator lamp (green)                | W 10/3                   | Indicator lamp   |
| Charge indicator lamp (red)                | W 5 / 1.2                | Indicator lamp   |
| Oil pressure indicator lamp (red)          | W 5 / 1.2                | Indicator lamp   |
| High beam indicator lamp (blue)            | W 10 / 3                 | Indicator lamp   |
| Turn signal indicator lamp (green)         | W 10 / 3                 | Indicator lamp   |
| Instrument light                           | W 10 / 3                 | Indicator lamp   |
| Tail and license plate light               | R 19 / 5                 | Bulb             |
| Stop light                                 | P 25 / 1                 | Bulb             |
| Turn signal (2 yellow both front and rear) | P 25 / 1                 | Bulb             |

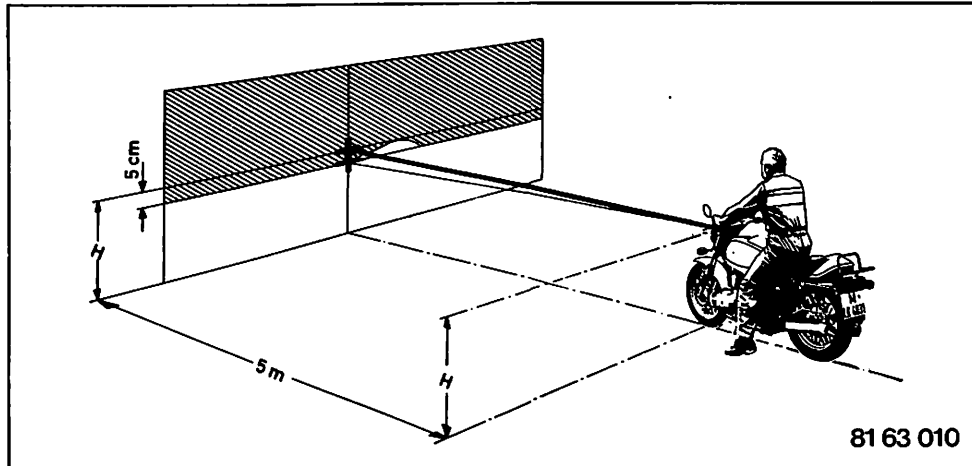


## 63 10 004 Aiming Headlight Beam

Always check aiming of headlight beam after working on headlight. If an aimer is not available, this can be done as described below. Check and, if necessary, correct tire pressures.

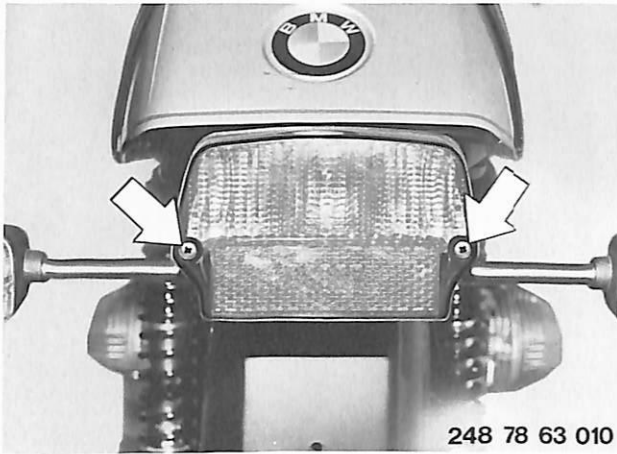
Park motorcycle on its wheels on a level surface 5 meters (16.4 feet) away from a light-colored wall and have rider sit in saddle. The rear spring struts are adjusted for solo riding. Measure distance from floor to center of headlight, transfer this height to wall, make a cross mark and draw a second cross mark 5 cm

(1.968") below first mark. Turn on low beam headlight and align headlight beam, that it's light/dark line runs left from height of lower cross, rising from center of cross to the right up to height of upper cross and then drops again.



## 63 21 380 Removing and Installing Combination Tail Light Assembly

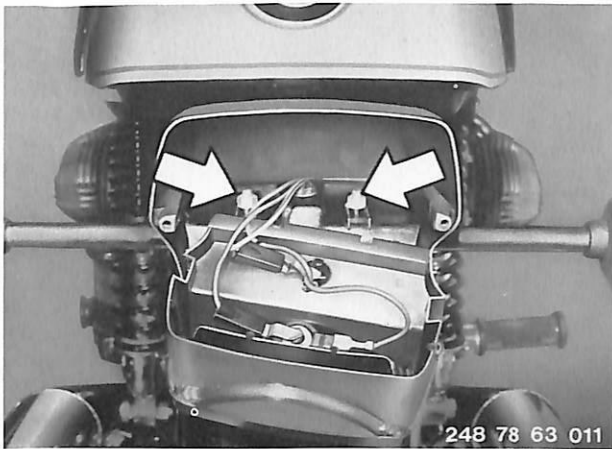
Disconnect ground wire from battery.  
Unscrew both phillips screws and remove lens.



■ Pull off wires from back of reflector, noting connections if necessary.

Unscrew mounting screws with washers and nuts from housing and remove housing.

**Installation Note!** When installing lens, make sure that clear glass for license plate light is at bottom.

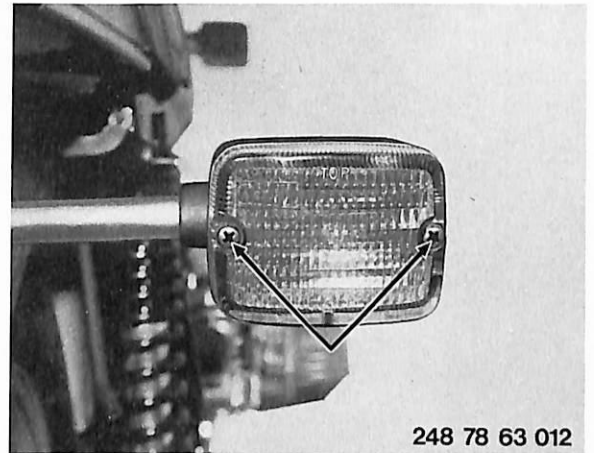


■

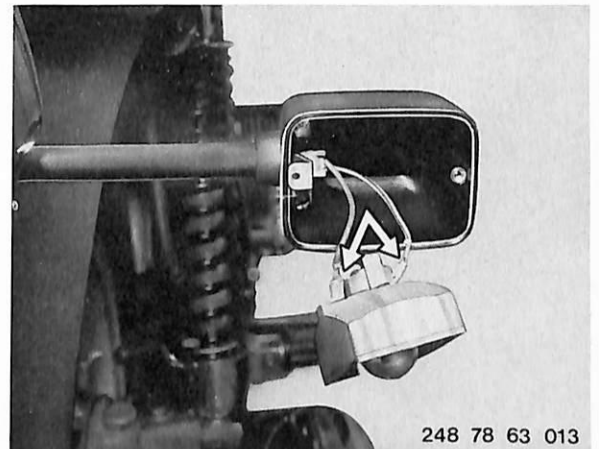
## 63 23 170 Removing and Installing Both Turn Signals(Front or Rear)

Disconnect ground wire from battery.  
Unscrew both phillips screws and remove lens.

**Installation Note!** When installing lens, make sure :hat „top” is up.



Disconnect wires from back of holder.



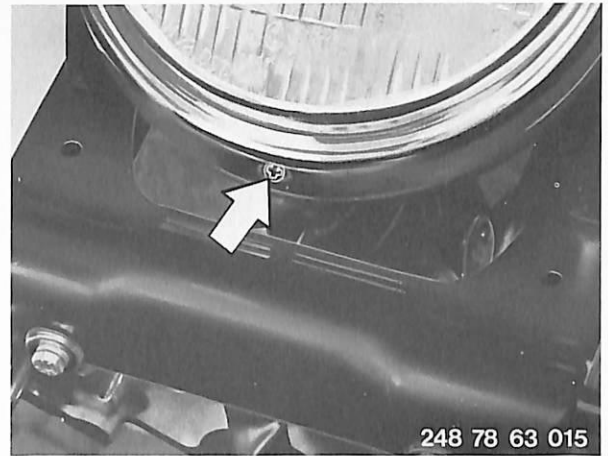
Loosen both screws and take off turn signal housing.



## 63 99 241 Replacing Light Bulb for Headlight

Remove and install cockpit upper section (only R 65 LS) 46 63 020.

Loosen phillips screw (arrow) in headlight face ring at bottom and pull face ring off of headlight housing.

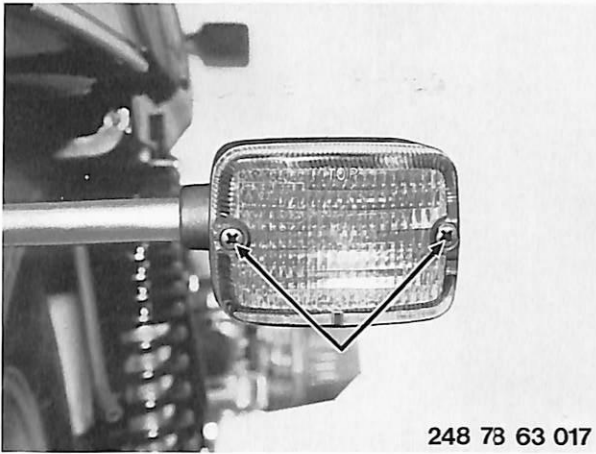


Open wire holder, detach halogene lamp from reflector and pull out from push button plug.

**Installation Note!** When installing halogen lamp, make sure that turning catch engages in reflector.  
Never touch halogene lamp with bare fingers!  
Pull out overnight lamp holder from reflector.







### 63 99 271 Replacing Bulb of One Turn Signal (Front or Rear)

Disconnect ground wire from battery.  
Unscrew both phillips screws and remove lens.



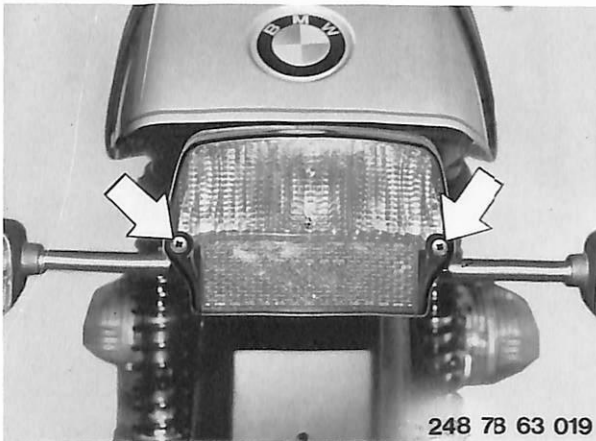
Press bulb into holder and turn anticlockwise to remove.

**Installation Note!** When installing lens, make sure that „top” is up.



### 63 99 381 Replacing Bulb for Tail Light

Disconnect ground wire from battery.  
Unscrew both phillips screws and remove lens.



Press bulb into holder and turn to remove.











