

Repair Manual

BMW R45, R 65, R 65 LS



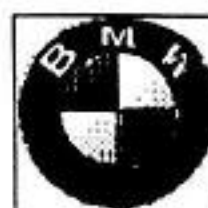
BMW AG

BMW Motorrad GmbH + Co.
Service Department

MW / 187 / 20

BMW Repair Manual R 45, R 65, R
65 LS

BMW Mobile Tradition
Historisches Archiv



Repair manual

BMW R 45
R 65
R 65 LS

BMW AG

BMW Motorrad GmbH + Co.

Order No. 01 51 9 798 671



Table of contents

section	chapter	Page
00	Maintenance and general hints	00–0/1
	Introduction	00–0/3
11	Engine	11–0/1
12	Engine Electrical	12–0/1
13	Fuel supply and adjustments	13–0/1
16	Fuel tank and lines	16–0/1
18	Exhaust system	18–0/1
21	Clutch	21–0/1
23	Transmission	23–0/1
26	Drive shaft	26–0/1
31	Front fork	31–0/1
32	Steering	32–0/1
33	Rear wheel drive	33–0/1
34	Brakes	34–0/1
35	Pedal assembly	35–0/1
36	Wheels and tyres	36–0/1
46	Frame	46–0/1
51	Equipment	51–0/1
52	Dual seat	52–0/1
61	General electrics	61–0/1
62	Instruments	62–0/1
63	Lights	63–0/1

Maintenance and general instructions

Introduction	Page 00-0/ 3
Tightening torques to BMW and DIN standards	00-0/ 5
Bolts and nuts, DIN standards and strength categories	00-0/ 7
Summary of tightening torques for R 45, R 65, R 65 LS	00-0/ 9
Conversion and comparison table for statutory units of measurement	00-0/11
Determining oil and fuel consumption	00-0/13
Engine oil viscosity, temperature chart	00-0/15
Engine oil circuit	00-0/17

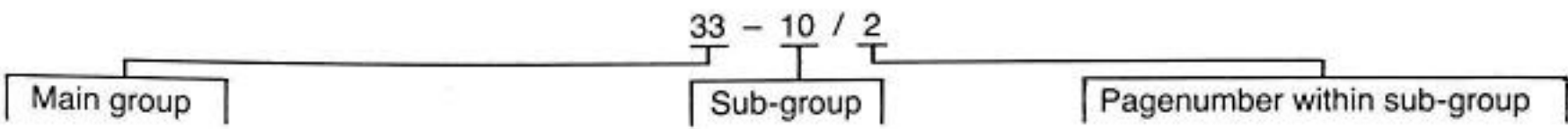
BMW AG

INTRODUCTION

This workshop manual is intended to assist you in performing all the necessary repair and maintenance work on the motorcycle correctly. It should be made available to workshop personnel as a means of adding to the practical and theoretical knowledge they have received at the BMW Service Training School. Regular reference to this manual whenever necessary should make even higher service quality possible.

The numerical layout of the workshop manual is in accordance with the main motorcycle component and assembly group system, from 00 to 99, as used in the Flat Rate Manual.

Example of page numbering system:



Specifications are provided at the start of each main group.

The special tools needed for correct and efficient repair work are summarized in the Service Information "Service Promotion, Group: Equipment-Advisory", No. 0 16 80 (143 R) and its supplements. Use of the special tools for the various operations is illustrated together with the descriptive text in this manual.

Note that the text always describes removal work in full. If installation by following the same work procedure in reverse is not possible, a note is provided.

Supplements to this manual include additions and alternations. A sheet marked "Alteration" is a substitute for an existing sheet and should be filed in its place. A sheet marked "Addition" is new, and should be added to the manual at the correct point.

If technical modifications make it necessary to duplicate repair jobs under the same number, the second repair procedure with the identical number is printed on coloured paper and filed as an addition to the manual.

When necessary, repair instructions will also be published as Service Information. Such instructions are automatically included in the next supplement to the workshop manual. As an additional source of information, you are recommended to refer to the illustrated Parts Service microfilms.

BMW Motorrad GmbH + Co.
Service Department (Technical)

All rights reserved. Not to be reproduced, translated or duplicated wholly or in part without written permission.
Subject to technical modifications; errors and omissions excepted.
Published by BMW Motorrad GmbH + Co.

Printed in Western Germany

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					
	Nuts acc. to BMW N 113 48.0			Nuts acc. to DIN 985		
	Property Class			Property Class		
	8	10	12	8	10	12
M 6	1,1 ^{+0,1}	1,5 ^{+0,2}	1,8 ^{+0,2}	1,0 ^{+0,1}	1,3 ^{+0,2}	1,6 ^{+0,2}
M 8 M 8 x 1	2,5 ^{+0,3}	3,4 ^{+0,4}	4,0 ^{+0,5}	2,5 ^{+0,2}	3,3 ^{+0,3}	3,9 ^{+0,4}
M 10 M 10 x 1,25	4,9 ^{+0,5}	6,8 ^{+0,8}	8,0 ^{+0,9}	4,7 ^{+0,5}	6,4 ^{+0,7}	7,7 ^{+0,8}
M 12 M 12 x 1,5	8,1 ^{+0,9}	11,4 ^{+1,3}	13,5 ^{+1,5}	7,8 ^{+0,8}	10,9 ⁺¹	12,6 ^{+1,5}
M 14 M 14 x 1,5	13,0 ^{+1,5}	18,0 ⁺²	22,0 ⁺²	12,7 ^{+1,5}	17,0 ⁺²	21,0 ⁺²
M 16 M 16 x 1,5	22,5 ⁺²	28,0 ⁺³	33,0 ⁺⁴	19,5 ⁺²	26,0 ⁺³	31,0 ⁺⁴
M 18 M 18 x 1,5	27,0 ⁺³	38,0 ⁺⁴	44,0 ⁺⁵	26,0 ⁺³	36,0 ⁺⁴	42,0 ⁺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 $\mu_{\text{tot.}} = 0.14$.

(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 ($\mu_{\text{tot.}} \approx 0.08$ 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:

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

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 ^{+0,1}	0,6 ^{+0,1}	0,7 ^{+0,1}	0,9 ^{+0,1}	1,2 ^{+0,2}	1,5 ^{+0,2}	425	600	685	855	1210	1440
M 8	1,0 ^{+0,1}	1,6 ^{+0,2}	1,8 ^{+0,2}	2,2 ^{+0,2}	3,0 ^{+0,3}	3,6 ^{+0,4}	740	1190	1330	1570	2170	2630
M 10	2,0 ^{+0,2}	3,2 ^{+0,4}	3,6 ^{+0,4}	4,3 ^{+0,5}	6,0 ^{+0,7}	7,3 ^{+0,8}	1160	1880	2090	2500	3480	4200
M 8x1	1,0 ^{+0,1}	1,0 ^{+0,2}	1,8 ^{+0,2}	2,2 ^{+0,2}	3,0 ^{+0,3}	3,6 ^{+0,4}	740	1190	1330	1610	2200	2670
M 10x1,25	2,0 ^{+0,2}	3,2 ^{+0,4}	3,6 ^{+0,4}	4,3 ^{+0,5}	6,0 ^{+0,7}	7,3 ^{+0,8}	1160	1900	2120	2520	3530	4250
M 12x1,25	3,4 ^{+0,4}	5,4 ^{+0,6}	6,1 ^{+0,7}	7,2 ^{+0,8}	10,3 ⁺¹	12,0 ^{+1,5}	1720	2710	3070	3610	5100	6090
M 12x1,5	3,4 ^{+0,4}	5,4 ^{+0,6}	6,1 ^{+0,7}	7,2 ^{+0,8}	10,3 ⁺¹	12,0 ^{+1,5}	1690	2670	3030	3570	5040	6000
M 14x1,5	5,4 ^{+0,6}	8,6 ⁺¹	9,8 ⁺¹	11,5 ^{+1,5}	16,0 ⁺²	20,0 ⁺²	2330	3720	4180	5030	6970	8510
M 16x1,5	8,3 ⁺¹	13,5 ^{+1,5}	15,5 ^{+1,5}	18,0 ⁺²	25,0 ⁺³	30,0 ⁺⁴	3240	5190	5840	6920	9710	11770
M 18x1,5	11,0 ^{+1,5}	18,0 ⁺²	20,0 ^{+2,5}	24,0 ⁺³	34,0 ⁺⁴	40,0 ⁺⁵	3890	6240	7020	8380	11800	13960
M 20x1,5	16,0 ⁺²	26,0 ⁺³	29,0 ^{+3,5}	34,0 ⁺⁴	49,0 ⁺⁵	59,0 ⁺⁶	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.







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
		84	8.8
Button-headed screws		912 6912	8.8 10.9
Carriage bolts		7986	4.8
Countersunk screws		603	4.6 8.8
		63	4.8 8.8
Oval-head screws		7987	4.8 8.8
		920 921	5.6 ¹⁾
Oval-head countersunk screws		7985	4.8
		91	4.8 8.8
Cheese-head self-tapping screws		7971	1)
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	
		939 940	
Threaded pins		417 551 553	2) 4)
		438	4.8 ⁴⁾
Shoulder studs		427	5.8
Winged screws		316	4.6
Screw plugs		906 908	4.6
		910 7604	5.6 ⁴⁾
Hollow screws		7623 71436	6.8
Cap screws		3871	5.6 ⁴⁾
Slotted plugs		71022	5.6 ⁴⁾

Nuts

Description	shape	DIN No.	Strength rating
Hexagon nuts		439	5)
		985	8 10 ⁴⁾
		934	3)
		936	6G 8G
		70615 70616	8/10 ⁴⁾ 6G/8G ⁴⁾
Castellated nuts		935 937	8/10 6S/8G
Wing nuts		315	GTS

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

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

Summary of tightening torques for R 45–R 65 LS in Nm (lb. ft)

Engine	Nm	lb.ft
Cylinder head nuts (in three stages: 15/25/35 Nm)	35 + 4	26 + 3
Big end bolts	50 ± 2	37 ± 1.4
Clutch housing (flywheel)	100 + 5	74 + 3.7
Nut for valve adjusting screw	20 ± 2	14.7 ± 1.5
Threaded stub pipe for carburettor connection	50	37
Oil drain plug	30 + 5	22 + 3.7
Engine electrical system		
Armature retaining bolt	25 ± 2	18.4 ± 1.5
Spark plugs	20 + 5	14.7 + 3.7
Starter retaining bolts	47.5	35
Exhaust system		
Star nuts for exhaust pipes	200 + 20	147 + 15
Clutch		
Clutch housing cover	20 + 2	14.7 + 1.5
Gearbox		
Attachment to engine	33	24.3
Bearing mount	19	14
Output flange at gearbox output shaft	221.5	163
Gearbox cover to gearbox housing	8	5.9
Nut for kick starter lever (taper screw)	22.5	16.6
Oil filler plug	31	22.9
Oil drain plug	26	19.2
Drive shaft		
Twelve-sided bolt	40	29.5
Front forks		
Fork bridge clamp bolts	40 + 5	29.5 + 3.7
Retaining bolt for damper at slider tube	35 ± 5	25.8 ± 3.7
Screw end plug	80 + 10	59 + 7.5
Oil filler plugs	9	6.6
Oil drain plugs	8	5.9
Steering		
Cap screw	80 + 10	59 + 7.5
Threaded ring	Free from play	

Summary of tightening torques for R 45–R 65 LS in Nm (lb. ft)

(continued)

Rear axle drive with swinging arm	Nm	lb. ft
Nut on input pinion	165	122
Ring nut in axle housing	118	87
Nuts for axle housing cover	17.7	13
Oil level check plug on axle housing	10	7.4
Oil drain plug on axle housing	25.5	18.8
Swinging arm pivot pin	10 + 2	7.4 + 1.5
Locknut for swinging arm pivot pin	100 + 20	74 + 15
Swinging arm oil filler plug	Screwed in but not fully tightened	
Swinging arm oil drain plug	15.7	11.6
Shock absorber rod at spring strut lug	38 ± 2	28 ± 1.5
Retaining bolts (twelve-sided) for axle housing at swinging arm	47	35
Retaining bolts for spring struts	35 + 5	26 + 3.7
Brakes		
Brake pipe to master cylinder	8 + 2	5.9 + 1.5
Brake pipe to brake caliper	8 + 2	5.9 + 1.5
Brake pipe to brake hose	12 + 3	8.8 + 2.2
Wheels and tires		
Wheel bearing friction moment at specified axle nut tightening torque (front wheel)	0.15 ... 0.30	0.11 ... 0.22
Nuts for quick-release axle	48	35
Axle clamping bolts	17	12.5

Conversion and comparison table for statutory units of measurement

Name of unit		Unit symbols old new	Values		
Length		m	m	1 m = 1000 mm 1 km = 1000 m	1 μm = 0,001 mm
Area		m ² qm	m ²	1 m ² = 10 ⁶ mm ²	1 mm ² = 0,01 cm ²
Volume		m ³ cbm	m ³	1 m ³ = 10 ⁶ cm ³	1 dm ³ = 0,001 m ³
		l	l	1 l = 1 dm ³	
Angle	surface	°	°,rad	1 rad = 1 m/m ≈ 57° 1° = π/180 rad	
	spatial	(°) ²	sr	1 sr = 1 m ² /m ²	(1°) ² = (π/180) ² sr
Mass		kg	kg	1 kg = 1000 g	1 g = 1000 mg 1 t = 1 Mg = 1000 kg
Density		kg/m ³	kg/m ³	1 kg/m ³ = 0,001 kg/dm ³	1 kg/dm ³ = 1 kg/l
Imbalance		kgm	kgm	1 kgm = 1000 000 gmm	
Time		sec s	s	1 min = 60 s	1 h = 60 min
Speed of rotation		rps rpm	1/s 1/min	rpm = 1/min	1/min = 1/(60s)
Speed (velocity)		m/s	m/s	1 m/s = 3,6 km/h	
Acceleration		m/s ²	m/s ²		
Force		kp	N	1 N = 1 kgm/s ²	1 kp = 9,81 N
Pressure (gas, liquid)		at		1 at = 1 kp/cm ² = 0,981 bar = 98 066,5 Pa	
		kp/cm ²	N/m ²	1 m WS = 9 806,65 Pa = 9 806,65 N/cm ²	
		mWS	Pa	1 Torr = 1,333 224 mbar	
		Torr	bar	1 mmHg = 133,322 Pa = 133,322 N/m ²	
Mechanical stress			N/m ²	1 N/m ² = 1 Pa	
		kp/mm ²	Pa	1 kp/mm ² = 9,81 N/mm ²	
			N/mm ²		
Energy, work, quantity of heat		kpm hph cal	J kWh	1 J = 1 Nm	1 kWh = 3,6 MJ 1 kpm = 9,81 J
Torque		kpm	Nm	1 kpm = 9,81 Nm	
Power output		hp kpm/s kcal/h	kW Nm/s	1 kW = 1000 W	1 W = 1 Nm/s = 1 J/s
				1 hp = 736 W = 75 kpm/s = 632 kcal/h	
				1 kW = 1,36 hp = 102 kpm/s = 860 kcal/h = 0,239 kcal/s	
Viscosity	dynamic	P	Pas	1 Pas = 1 Ns/m ²	1 P = 0,1 Pas = 1 g/cms
	kinetic	St	m ² /s	1 m ² /s = 1 Pas m ³ /kg	1 St = 1 cm ² /s = 0,0001 m ² /s
Temperature		deg. °C °K	°C K	0 °C ≙ 273,15 K 1deg.= 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 m V = 0,001 V 1 MV = 10 ⁶ V
Electric resistance		Ω	Ω	1 Ω = 1 V/A = 1/S	
Magnetic flux		M	Wb, Vs	1 Wb = 1 Vs	1 M = 10 ⁻⁸ Wb
Magnetic flux density		G	T	1 T = Wb/m ²	1 G = 10 ⁻⁴ T
Magnetic field strength		Oe	A/m	1 A/m = 1 N/Wb	10 e = 10 ³ /4π A/m
Light intensity		HK	cd	1 cd = 1,107 HK	1 HK = 0,903 342 cd
Illumination density		sb	cd/m ²	1 sb = 10 ⁴ cd/m ²	
Illumination intensity		ph	lx	1 ph = 10 ⁴ lx	

Determining oil consumption

Oil consumption can be measured after the motorcycle has covered a distance of approximately 7500 km (5000 miles). This distance is necessary for oil consumption to stabilize.

The engine must not exhibit any oil leaks.

Drain the engine oil at normal operating temperature.

Renew the filter element.

Add fresh oil to the engine.

Run the motorcycle under normal operating conditions until the oil level has dropped to the lower mark on the dipstick. (Difference between MIN and MAX marks = 0.85 l (1.2 Imp. pints/0.89 US quart).

Consumption can also be determined by draining off the oil.

Measurement over a relatively short distance is always inaccurate, since experience has shown that the first half-litre of oil tends to be consumed more quickly.

Oil consumption should not exceed 0.1 l/100 km (app. 350 Imp. miles/pint. app. 590 US miles/quart).

Possible causes of excessive oil consumption:

1. Running-in not yet completed.
2. Leakage past valve guides.
3. Consequences of piston seizure.
4. Piston rings installed incorrectly, broken or worn.
5. Excessive running clearance between valve stems and valve guides.

Determining fuel consumption in accordance with German DIN 70030 standard test method

The carburettor and ignition settings¹⁾ of the motorcycle must be to standard specification.

The tyre size must be as stated in the motorcycle's registration documents.

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

The brakes must be fully released.

The engine should have covered at least 7500 km (5000 miles), and be at normal operating temperature.

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

Road speed over the entire test course should be as uniform as possible, and three-quarters of the top speed of which the motorcycle is capable.

The test speed should not, however, exceed 110 km/h (68 mile/h).

The test course should be as flat as possible and dry; a distance of app. 10 km (6 miles) should be covered in each direction. Uphill and downhill gradients not exceeding 1.5 % (1 in 67) are acceptable.

Air temperature should be between +10 and +30°C (+50 and +86°F), and wind velocity should not exceed 3 m (9.85 ft)/s.

The engine should be supplied with a standard commercially-available grade of fuel (in accordance with the manufacturer's requirements).

Fuel consumption can be determined with a commercial meter or by applying the following formula; an allowance of 10 % should be added for unfavourable circumstances.

$$\frac{\text{Fuel consumed} \times 100}{\text{Distance in km}} = \text{Fuel consumption by standard test method in l/100 km}$$

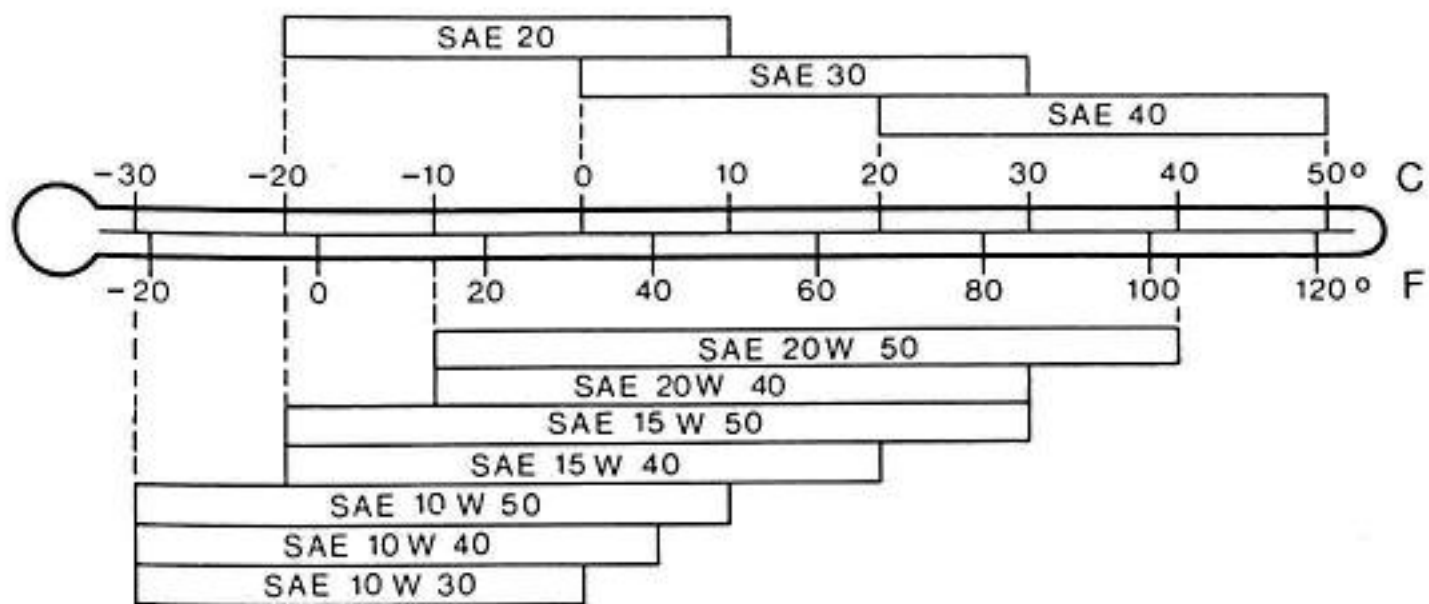
$$\text{(Conversion: } \frac{282.47}{\text{Fuel consumption in l/100 km}} = \text{Fuel consumption in Imperial mile/gal)}$$

$$\frac{235.2}{\text{Fuel consumption in l/100 km}} = \text{Fuel consumption in US mile/gal)}$$

¹⁾ see Specifications

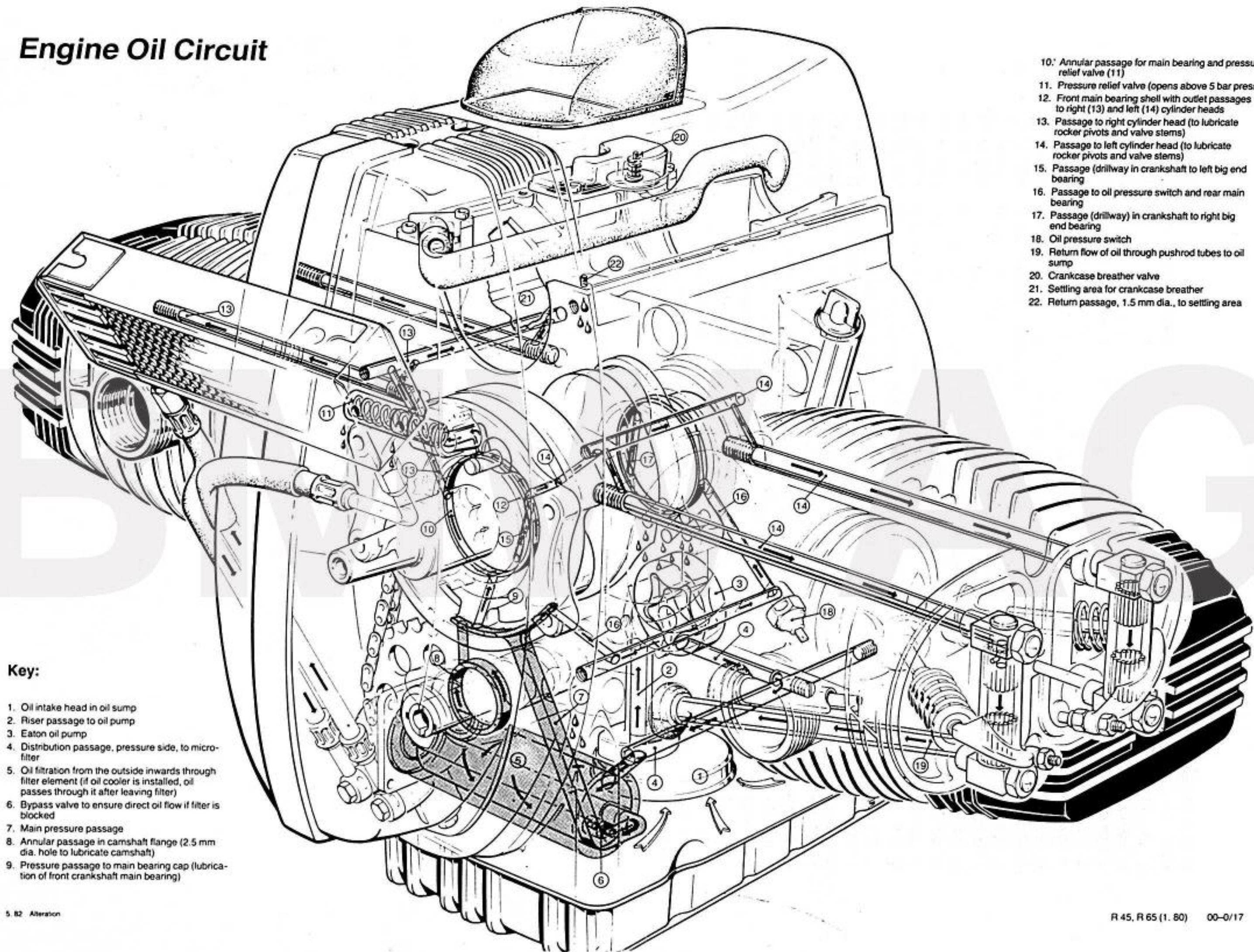
Engine oil viscosity chart

(oil grades for use at various outside temperatures)



Use only HD engine oil of API SE or SF specifications; it should be of reputable make and suitable for use in four-stroke spark-ignition engines.

Engine Oil Circuit



Key:

1. Oil intake head in oil sump
2. Riser passage to oil pump
3. Eaton oil pump
4. Distribution passage, pressure side, to micro-filter
5. Oil filtration from the outside inwards through filter element (if oil cooler is installed, oil passes through it after leaving filter)
6. Bypass valve to ensure direct oil flow if filter is blocked
7. Main pressure passage
8. Annular passage in camshaft flange (2.5 mm dia. hole to lubricate camshaft)
9. Pressure passage to main bearing cap (lubrication of front crankshaft main bearing)

10. Annular passage for main bearing and pressure relief valve (11)
11. Pressure relief valve (opens above 5 bar pressure)
12. Front main bearing shell with outlet passages to right (13) and left (14) cylinder heads
13. Passage to right cylinder head (to lubricate rocker pivots and valve stems)
14. Passage to left cylinder head (to lubricate rocker pivots and valve stems)
15. Passage (drillway in crankshaft to left big end bearing)
16. Passage to oil pressure switch and rear main bearing
17. Passage (drillway) in crankshaft to right big end bearing
18. Oil pressure switch
19. Return flow of oil through pushrod tubes to oil sump
20. Crankcase breather valve
21. Settling area for crankcase breather
22. Return passage, 1.5 mm dia., to settling area

11 Engine

Specifications	. . . . .	Page 11- 0/ 3
Specifications for 1981 models	. . . . .	11- 0/19
11 00 039	Compression test	11-00/ 1
11 00 050	Engine – removing and installing	11-00/ 3
11 11 050	Cylinder – removing and installing	11-11/ 1
11 11 527	Cylinder – reboring and honing	11-11/ 2
11 12 080	Cylinder head – removing and installing	11-12/ 1
11 12 513	Cylinder head – stripping, regrinding valves, assembling	11-12/ 2
11 12 561	Valve guides – renewing	11-12/ 3
11 12 621	One valve ring – renewing	11-12/ 3
11 14 060	Timing chain cover – detaching and attaching	11-14/ 1
11 14 151	Radial seal for crankshaft (clutch end) – renewing	11-14/ 2
11 14 651	Radial seal for crankshaft (alternator end) – renewing	11-14/ 3
11 15 101	Engine breather hose – renewing	11-15/ 1
11 15 101	Engine breather hose (1981 models) – renewing	11-15/ 2
11 15 111	Check valve for engine breather – renewing	11-15/ 1
11 21 001	Crankshaft – renewing	11-21/ 1
11 21 531	Main bearing bushings – renewing	11-21/ 3
11 22 000	Flywheel – removing and installing	11-22/ 1
11 22 000	Clutch housing cover (flywheel) – removing and installing (1981 models)	11-22/ 3
11 24 000	Connecting rod – removing and installing	11-24/ 1
11 25 000	Piston – removing and installing	11-25/ 1
11 31 061	Timing chain sprockets – renewing	11-31/ 1
11 34 504	Valve clearances – adjusting	11-34/ 1
11 41 000	Oil pump – removing and installing	11-41/ 1
	Troubleshooting – engine	11-42/ 3

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Engine type	Four-stroke horizontally opposed twin with overhead valves in hemispherical combustion chambers		
Cylinder bore mm (in)	70 (2.756)	70 (2.756)	82 (3.228)
Piston stroke mm (in)	61.5 (2.421)		
Number of cylinders	2		
Cylinder arrangement	horizontally opposed, transverse		
Stroke/bore ratio	0.87	0.87	0.75
Displacement (fiscal) cm ³ (in ³)	470 (28.68)	470 (28.68)	645 (39.36)
Displacement (effective) cm ³ (in ³)	473.4 (28.89)	473.4 (28.89)	649.6 (39.64)
Compression ratio	8.2:1	9.2:1	9.2:1
Max. effective power output KW (HP) to DIN Standard, at engine speed (min ⁻¹)	20 (27) 6500	26 (35) 7250	33 (45) 7250
Permissible continuous engine speed min ⁻¹	7000	7300	7300
Permissible max. engine speed min ⁻¹	7650	7650	7650
Idling speed min ⁻¹	800 ... 1100		
Permissible max. engine speed during running-in			
up to 1000 km (app. 650 miles) min ⁻¹	4000		
up to 2000 km (app. 1300 miles) min ⁻¹	4500		
Direction of rotation	clockwise, looking down on to generator from front		
Max. torque Nm (mkp, lb. ft) at engine speed min ⁻¹	31.3 (3.2, 23.1) 5000	37.5 (3.8, 27.6) 5500	50 (5.1, 36.9) 5500

Engine**Specifications**

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Mean piston speed m/s (ft/min) at engine speed min ⁻¹	13.3 (2618) 6500	13.3 (2618) 7250	14.8 (2913) 7250
Compression test pressure bar (lb/in ²) good normal poor	above 10.0 (142) 8.5 . . . 10.0 (121 . . . 142) below 8.5 (121)		
Compression test procedure (engine turned over with electric starter)	1. Remove spark plugs 2. Measure with a calibrated compression tester: battery fully charged, engine at normal operating temperature. Run engine at starting speed. Detach constant-depression carburetors before testing		
Fuel	Regular	Super (premium)	
Fuel consumption by DIN 70030 Standard test method at 110 km/h (68 mile/h) liters/100 km (Imp./US gal.)	5.0 (56.5, 47.0)	4.5 (62.8, 52.3)	4.6 (61.4, 51.1)

Engine**Specifications**

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Engine lubrication			
Lubricating system	Pressurized oil circuit		
Oil filter	full-flow		
Pressure differential at which bypass valve opens bar (lb/in ²)	1.5 (21.3)		
Pressure below which oil pressure warning light comes on bar (lb/in ²)	0.2 ... 0.5 (2.84 ... 7.11)		
Relief valve opening pressure bar (lb/in ²)	approx. 5.0 (71.1)		
Oil content without filter change liters (Imp. pints, US quarts)	2.0 (3.5, 2.1)		
with filter change liters (Imp. pints, US quarts)	2.25 (4.0, 2.4)		
Max. oil consumption liters/100 km (miles per Imp. pint/US quart)	0.1 (355,590)		
Oil grade	Brand-name HD oil for 4-stroke spark-ignition engines		
Viscosity at outside temperatures predominantly above +30°C (+86°F)	SAE 40, SAE 20 W 50		
above 0°C (+32°F)	SAE 20 W 40, SAE 20 W 50		
below 0°C (+32°F)	SAE 10 W 30, SAE 10 W 40, SAE 10 W 50		
All the year round down to -20°C (-4°F)	SAE 15 W 50		
Oil pump			
Type	Eaton system (hypotrochoid gearing)		
Pump delivery rate liters (Imp./US gal) at running speed min ⁻¹	1400 (308, 370) 6000		
External rotor dia. mm (in.)	57 ± 0.05 (2.2520 ± 0.002)		
Internal housing dia. mm (in.)	57.2 ^{+0.046} ₀ (2.2520 ^{+0.0018} ₀)		
Clearance between external rotor and pump housing mm (in.)	0.15 ... 0.29 (0.006 ... 0.011)		

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Rotor height mm (in)	14 ^{-0.015} _{-0.045} (0.5512 ^{-0.0006} _{-0.0018})		
Housing depth mm (in)	14 ^{+0.025} _{+0.010} (0.5512 ^{+0.0010} _{+0.0004})		
Clearance between joint face on pump housing and sealing face on rotor mm (in)	0.025 ... 0.070 (0.0010 ... 0.0028)		
Gap between inner and outer rotors mm (in)	0.12 ... 0.20 (0.0047 ... 0.0079)		
Max. wear depth in cover mm (in)	0.05 (0.0020)		
Relaxed length of pressure relief spring mm (in)	68 (2.677)		
Valve clearances: (max. 20° C/68° F) Adjust with engine cold Inlet mm (in) Exhaust mm (in)	0.10 (0.004) 0.15 (0.006) up to 1000 km [600 mile] Inspection) 0.20 (0.008) 0.25 (0.010)		
Valve timing (tolerance ± 2.5°) Inlet opens Inlet closes Exhaust opens Exhaust closes	Timing gear shaft alignment at 2 mm (0.08 in) valve clearance <div> <div> 284° Camshaft 6° bTDC 34° aBDC 46° bBDC 6° bTDC </div> <div> 308° Camshaft 16° bTDC 44° aBDC 56° bBDC 4° aTDC </div> </div>		
Valves: Overall length Inlet mm (in) Exhaust mm (in)	103±0.2 (4.055±0.008) 102.5±0.2 (4.035±0.008)		
Valve head dia. Inlet mm (in)	34 (1.339)		38 (1.496)
Exhaust mm (in)	32 (1.260)		34 (1.339)
Valve stem dia. Inlet mm (in.)	6.96 ... 0.015 (0.2784 ... 0.0006)		

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Min. valve head rim thickness			
Inlet mm (in)	1 $+0.5$ (0.0394 $+0.0197$)		
Exhaust mm (in)	1.2 -0.2 (0.0472 -0.0079)		
Max. valve head runout mm (in)	0.02 (0.0008)		
Valve seat ring			
Extl. dia. mm (in)			
Inlet mm (in)	36.2 (1.425) h 7		39.2 (1.543) h 7
Exhaust mm (in)	36.2 (1.425) e 6		39.2 (1.543) h 7
Bore in cylinder head for valve seat ring			
Inlet mm (in)	36 (1.417) H 7		39 (1.535) H 7
Exhaust mm (in)	36 (1.417) H 7		39 (1.535) H 7
Valve seat angle deg.	90°-20'		
Valve seat width (guide values)			
Inlet mm (in)	app. 1.5 (0.059)		
Exhaust mm (in)	app. 2.0 (0.079)		

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Valve seat ring oversizes mm (in)		0.2 (0.008)	
Valve guides:	Inlet	45 (1.772)	
Overall length mm (in)	Exhaust	45 (1.772)	
Extl. dia mm (in)		14 (0.551) z 6	
Intl. dia. mm (in)		7 (0.276) H 7	
Bore in cylinder head mm (in)		14 (0.551) H 7	
Oversizes, stage 1 mm (in)		14.1 (0.555) z 6	
stage 2 mm (in)		14.2 (0.559) z 6	
Valve stem clearance			
Inlet mm (in)		0.025 ... 0.055 (0.0010 ... 0.0022)	
Exhaust mm (in)		0.04 ... 0.07 (0.0016 ... 0.0028)	
Max. clearance after wear mm (in)		0.1 (0.004) measured at upper end of guide	
Valve gear			
Valve operation		from camshaft, via cup tappets, pushrods and rockers	
Camshaft drive		3/8 x 7/32 in single roller chain with socket insert and hydraulically damped chain tensioner	
Number of chain links		50	

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Valve springs			
Wire thickness mm (in)	4.25 (0.167)		
Extl. coil dia. mm (in)	31.9 (1.256)		
Relaxed spring length mm (in)	Color code brown: app. 46 (1.81); color code blue: app. 43.5 (1.71)		
Spring force in kp (lb. f) at test length mm (in)	29 (63.9) at 37.6 (1.480); 70 (154.3) at 28.5 (1.122)		
Winding direction	clockwise (right-hand)		
Number of active spring turns	4.6 (or 4)		
Total number of spring turns	6		
Length fully compressed mm (in)	25 (0.98)		
Installed direction	with color stripe on windings at cylinder head side		
Rockers:	with needle roller bearings		
Axial play	zero, but free-moving		
Rocker leverage ratio	1 : 1.39		

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Camshaft			
Flange bearing bore in engine block mm (in)		$40^{+0.039}_0$ (1.5748 $^{+0.0016}_0$)	
Flange bearing extl. dia. mm (in)		$40^0_{-0.016}$ (1.5748 $^0_{-0.0006}$)	
Flange bearing bore mm (in)		$25^{+0.013}_0$ (0.9842 $^{+0.0005}_0$)	
Camshaft bearing journal dia., generator end mm (in)		$25^{-0.020}_{-0.033}$ (0.9842 $^{-0.0008}_{0.0013}$)	
Camshaft bearing bore in engine block, flywheel end mm (in)		$24^{+0.021}_0$ (0.9449 $^{+0.0008}_0$)	
Camshaft bearing journal dia., flywheel end mm (in)		$24^{-0.020}_{-0.033}$ (0.9449 $^{-0.0008}_{-0.0013}$)	
Radial clearance at alternator or flywheel end mm (in)		0.02 ... 0.046 (0.0008 ... 0.0018) or 0.02 ... 0.054 (0.008 ... 0.0021)	
Axial play (endplay between camshaft thrust collar and flange bearing mm (in)		0.1 ± 0.02 (0.0039 ± 0.0008)	
Cam base circle mm (in)		28 (1.102)	
Cam lift mm (in)	6.198 (0.244)	6.756 (0.266)	6.756 (0.266)
Tappet extl. dia. mm (in)		$22^{-0.025}_{-0.045}$ (0.8661 $^{-0.0010}_{-0.0018}$)	
Tappet bore in engine block mm (in)		$22^{+0.006}_{-0.015}$ (0.8661 $^{+0.0002}_{-0.0006}$)	
Tappet radial clearance mm (in)		0.01 ... 0.051 (0.0004 ... 0.0020)	
Max. tappet wear clearance mm (in)		0.075 (0.0030)	

Engine

Specifications

Model			R 45 (20 kW)	R 45 (26 kW)	R 65
Crankshaft and bearings			Main bearing journal dia. mm (in)		
Crankshaft			Generator end	Flywheel end	
Crankshaft markings	Standard 0	red/red	59.980 ... 59.990 (2.3614 ... 2.3618)	59.980 ... 59.990 (2.3614 ... 2.3618)	
		red/blue	59.980 ... 59.990 (2.3614 ... 2.3618)	59.971 ... 59.980 (2.3611 ... 2.3614)	
		blue/red	59.971 ... 59.980 (2.3611 ... 2.3614)	59.980 ... 59.990 (2.3614 ... 2.3618)	
		blue/blue	59.971 ... 59.980 (2.3611 ... 2.3614)	59.971 ... 59.980 (2.3611 ... 2.3614)	
Stage 1	0.25 mm (0.0098 in)	red/red	59.730 ... 59.740 (2.3516 ... 2.3520)	59.730 ... 59.740 (2.3516 ... 2.3520)	
		red/blue	59.730 ... 59.740 (2.3516 ... 2.3520)	59.721 ... 59.730 (2.3512 ... 2.3516)	
		blue/red	59.721 ... 59.730 (2.3512 ... 2.3516)	59.730 ... 59.740 (2.3516 ... 2.3520)	
		blue/blue	59.721 ... 59.730 (2.3512 ... 2.3516)	59.721 ... 59.730 (2.3512 ... 2.3516)	
Stage 2	0.50 mm (0.0197 in)	red/red	59.480 ... 59.490 (2.3417 ... 2.3421)	59.480 ... 59.490 (2.3417 ... 2.3421)	
		red/blue	59.480 ... 59.490 (2.3417 ... 2.3421)	59.471 ... 59.480 (2.3414 ... 2.3417)	
		blue/red	59.471 ... 59.480 (2.3414 ... 2.3417)	59.480 ... 59.490 (2.3417 ... 2.3421)	
		blue/blue	59.471 ... 59.480 (2.3414 ... 2.3417)	59.471 ... 59.480 (2.3414 ... 2.3417)	
Stage 3	0.75 mm (0.0295 in)	red/red	59.230 ... 59.240 (2.3319 ... 2.3323)	59.230 ... 59.240 (2.3319 ... 2.3323)	
		red/blue	59.230 ... 59.240 (2.3319 ... 2.3323)	59.221 ... 59.230 (2.3315 ... 2.3319)	
		blue/red	59.221 ... 59.230 (2.3315 ... 2.3319)	59.230 ... 59.240 (2.3319 ... 2.3323)	
		blue/blue	59.221 ... 59.230 (2.3315 ... 2.3319)	59.221 ... 59.230 (2.3315 ... 2.3319)	
Bore for crankshaft main bearing bushing in crankcase mm (in) dia.			$65^{+0.019}_0$ (2.5591 $^{+0.0008}_0$)		
Bore for crankshaft main bearing bushing in bearing cap mm (in) dia.			$65^{+0.019}_0$ (2.5591 $^{+0.0008}_0$)		
Main bearing journal radial clearance mm (in)			0.035 ... 0.065 (0.0014 ... 0.0026)		
Seat dia. for front crankshaft deep-groove ball bearing mm (in)			$35^{+0.025}_{+0.009}$ (1.3780 $^{+0.0010}_{+0.0004}$)		
Bearing seat bore for deep-groove ball bearing in timing chain cover mm (in)			$62^{-0.009}_{-0.39}$ (2.4409 $^{-0.0004}_{-0.0154}$)		

Engine

Specifications

Model			R 45 (20 kW)	R 45 (26 kW)	R 65
Main bearing bushings					
Wall thickness mm (in)					
Standard	0	red blue	2.500 ... 2.510 (0.0984 ... 0.0988) 2.511 ... 2.521 (0.0989 ... 0.0993)		
Stage 1	0.25 mm (0.0098 in)	red blue	2.625 ... 2.635 (0.1033 ... 0.1037) 2.636 ... 2.646 (0.1038 ... 0.1042)		
Stage 2	0.50 mm (0.0197 in)	red blue	2.750 ... 2.760 (0.1083 ... 0.1087) 2.761 ... 2.771 (0.1087 ... 0.1091)		
Stage 3	0.75 mm (0.0295 in)	red blue	2.875 ... 2.885 (0.1132 ... 0.1136) 2.886 ... 2.896 (0.1136 ... 0.1140)		
Engine block mm (in)			Diameter A (crankshaft main bearing bore) 65 (2.5591) H 6 65.000 ... 65.019 (2.5591 ... 2.5598)		Diameter B (bearing cap bore) 130 ^{+0.026} _{-0.007} (5.1181 ^{+0.0010} _{+0.0003}) 129.993 ... 130.026 (5.1178 ... 5.1191)
Crankshaft main bearing diameter with bearing pressed in mm (in)			red 60.007 ... 60.046 (2.3625 ... 2.3640)		blue 59.999 ... 60.038 (2.3622 ... 2.3637)
Bearing caps mm (in)			65.000 ... 65.019 (2.5591 ... 2.5598)		130.003 ... 130.028 (5.1182 ... 5.1192)

Engine

Specifications

Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Seat dia. on crankshaft for chain sprocket mm (in)		$35.003^{+0.020}_{+0.009}$ (1.3781 $^{+0.0008}_{+0.0004}$)		
Chain sprocket mounting bore mm (in)		$35.003^{+0.003}_{-0.013}$ (1.3781 $^{+0.0001}_{-0.0005}$)		
Crankshaft endplay mm (in)		0.08 ... 0.15 (0.0031 ... 0.0059)		
Thrust washer red thickness "S" mm (in) blue thickness "S" mm (in) green thickness "S" mm (in) yellow thickness "S" mm (in)		2.483 ... 2.530 (0.0978 ... 0.0996)		
		2.530 ... 2.578 (0.0996 ... 0.1015)		
		2.578 ... 2.626 (0.1015 ... 0.1034)		
		2.626 ... 2.673 (0.1034 ... 0.1052)		
Max. play after wear mm (in)		0.20 (0.0079)		
Max. permissible runout at outer shaft journal (generator end when supported at main bearings mm (in)		0.02 (0.0008)		
Max. permissible crankshaft imbalance (dynamic) without flywheel cmp		20		
Max. flywheel lateral runout mm (in)		0.1 (0.004)		
Connecting rods and bearings		Crankpin dia. mm (in)		
Standard	0	$48.00^{-0.009}_{-0.025}$ (1.8898 $^{-0.0004}_{-0.0010}$)		
Stage 1	0.25 mm (0.010 in)	$47.75^{-0.009}_{-0.025}$ (1.8799 $^{-0.0004}_{-0.0010}$)		
Stage 2	0.50 mm (0.020 in)	$47.50^{-0.009}_{-0.025}$ (1.8701 $^{-0.0004}_{-0.0010}$)		
Stage 3	0.75 mm (0.030 in)	$47.25^{-0.009}_{-0.025}$ (1.8602 $^{-0.0004}_{-0.0010}$)		
Big end bearing bore mm (in)		$52^{+0.015}_0$ (2.0472 $^{+0.0006}_0$)		
Big end bearing radial clearance mm (in)		0.023 ... 0.069 (0.0009 ... 0.0027)		
Big end bearing width mm (in)		$22^{-0.065}_{-0.117}$ (0.8661 $^{-0.0026}_{-0.0046}$)		
Crankpin bearing width mm (in)		$22^{+0.149}_{+0.065}$ (0.8661 $^{+0.0059}_{+0.0026}$)		
Connecting rod axial play mm (in)		0.130 ... 0.266 (0.0051 ... 0.0105)		
Max. axial play after wear mm (in)		0.32 (0.0126)		

Engine

Specifications

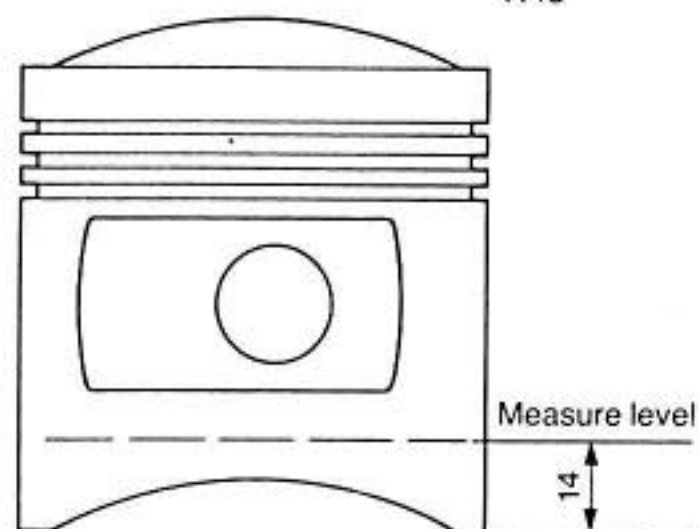
Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Distance between bore centers mm (in)		118 (4.646)		
Small end bearing bore mm (in)		$24^{+0.021}_0$ (0.9449 $^{+0.0008}_0$)		
Small end bushing extl. dia. mm (in)		24.060 ... 24.100 (0.9472 ... 0.9488)		
Bore in small end bushing for piston pin mm (in)		$22^{+0.020}_{0.015}$ (0.8661 $^{+0.0008}_{+0.0006}$)		
Wear limit for piston pin bore in small end bushing mm (in)		22+0.040 (0.8661+0.0016)		
Max. deviation from parallel of small end bores with bearing shells at 150 mm (5.9 in) spacing mm (in)		0.04 (0.0016)		
Max. small end bore twist at 150 mm (5.9 in) spacing mm (in)		1.5 (0.059)		
Permissible difference in weight between the 2 connecting rods g (oz)		± 3 (0.106)		
Cylinders:				
Bore - standard	A mm (in)	69.995+0.01 (2.7557+0.0004)		81.995+0.01 (3.2281+0.0004)
	B mm (in)	70.005+0.01 (2.7561+0.0004)		82.005+0.01 (3.2285+0.0004)
	C mm (in)	70.015+0.01 (2.7565+0.0004)		82.015+0.01 (3.2289+0.0004)
1st oversize, +0.25 mm (0.0098 in)	A mm (in)	70.245+0.01 (2.7655+0.0004)		82.245+0.01 (3.2380+0.0004)
	B mm (in)	70.255+0.02 (2.7659+0.0004)		82.255+0.01 (3.2384+0.0004)
	C mm (in)	70.265+0.01 (2.7663+0.0004)		82.265+0.01 (3.2388+0.0004)
2nd oversize, +0.50 mm (0.0197 in)	A mm (in)	70.495+0.01 (2.7754+0.0004)		82.495+0.01 (3.2478+0.0004)
	B mm (in)	70.505+0.01 (2.7758+0.0004)		82.505+0.01 (3.2482+0.0004)
	C mm (in)	70.515+0.01 (2.7762+0.0004)		82.515+0.01 (3.2486+0.0004)
Surface roughness	μm	3 ... 7		

Engine

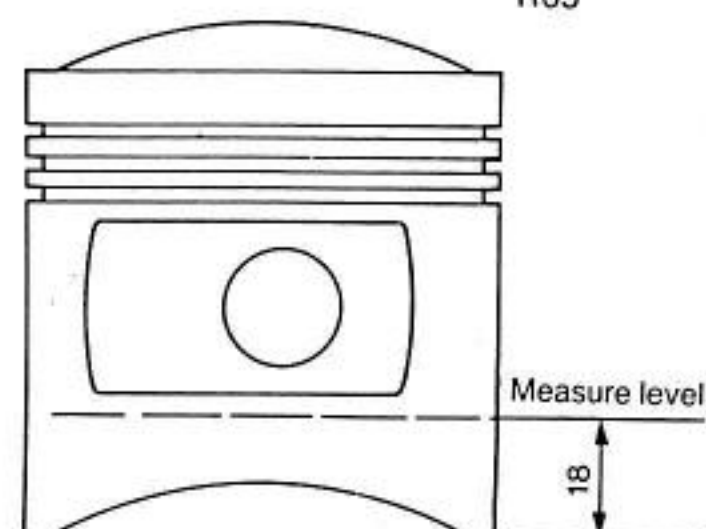
Specifications

Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Permissible cylinder bore out-of-roundness mm (in)		The surface to which the tolerance applies must lie between two coaxial cylinders with a radial spacing of 0.005 mm (0.0002 in)		
Pistons Pattern		convex oval crown		
Complete piston weight group		stamped + or –	Always install two pistons of the same weight group	
Piston dia. (standard) mm (in)	A	69.960±0.005 (2.7543±0.0002)		81.960±0.005 (3.2268±0.0002)
	B	69.970±0.005 (2.7547±0.0002)		81.970±0.005 (3.2272±0.0002)
	C	69.980±0.005 (2.7551±0.0002)		81.980±0.005 (3.2276±0.0002)
1st oversize, +0.25 mm (0.0098 in)	A	70.210±0.005 (2.7642±0.0002)		82.210±0.005 (3.2366±0.0002)
	B	70.220±0.005 (2.7646±0.0002)		82.220±0.005 (3.2370±0.0002)
	C	70.230±0.005 (2.7650±0.0002)		82.230±0.005 (3.2374±0.0002)
2nd oversize, +0.50 mm (0.0197 in)	A	70.460±0.005 (2.7740±0.0002)		82.460±0.005 (3.2465±0.0002)
	B	70.470±0.005 (2.7744±0.0002)		82.470±0.005 (3.2468±0.0002)
	C	70.480±0.005 (2.7748±0.0002)		82.480±0.005 (3.2472±0.0002)
Piston installed clearance	mm (in)	0.030 ... 0.050 (0.0012 ... 0.0020)		
Permissible total wear at piston and cylinder	mm (in)	max. 0.08 (0.0031)		
Piston installed direction		arrow with 'vorn' (front) inscription facing forwards		

R45



R65



Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Piston rings			
1st groove – rectangular ring ¹⁾ Height mm (in)	1.5 ^{-0.010} _{-0.022} (0.0591 ^{-0.0004} _{-0.0009})		1.5 ^{-0.010} _{-0.022} (0.0591 ^{-0.0004} _{-0.0009})
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.030 ... 0.50 (0.012 ... 0.020)
Clearance in groove mm (in)	0.050 ... 0.082 (0.0020 ... 0.0032)		0.050 ... 0.082 (0.0020 ... 0.0032)
2nd groove – micro-angle cutaway ring ¹⁾ Height mm (in)	2.00 ^{+0.010} _{+0.022} (0.0787 ^{+0.0004} _{+0.0009})		2.00 ^{+0.010} _{+0.022} (0.0787 ^{+0.0004} _{+0.0009})
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.30 ... 0.45 (0.012 ... 0.018)
Clearance in groove mm (in)	0.040 ... 0.072 (0.0016 ... 0.0028)		0.040 ... 0.072 (0.0016 ... 0.0028)
3rd groove – equal-chamfer ring ¹⁾ Height mm (in)	3.5 ^{+0.010} _{+0.022} (0.1378 ^{+0.0004} _{+0.0009})		4.00 ^{+0.010} _{+0.022} (0.1575 ^{+0.0004} _{+0.0009})
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.25 ... 0.40 (0.010 ... 0.016)
Clearance in groove mm (in)	0.030 ... 0.062 (0.0012 ... 0.0024)		
Piston ring installed direction	with inscription (TOP) uppermost		

¹⁾ not to DIN standard
– special BMW version

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Piston pin Offset from piston centerline mm (in)	1.0 (0.04)	1.0 (0.04)	1.5 (0.06)
Piston pin diameter mm (in)	$22^{-0.005}$ (0.8661 $^{-0.0002}$)		$22^0_{-0.003}$ (0.8661 $^0_{-0.00012}$)
Piston pin eye bore mm (in)	$22^{+0.007}_{+0.002}$ (0.8661 $^{+0.0003}_{+0.00008}$)		$22^{+0.010}_{+0.003}$ (0.8661 $^{+0.0004}_{+0.00012}$)
Piston pin clearance in piston mm (in)	0.002 ... 0.012 (0.00008 ... 0.00047)		0.005 ... 0.015 (0.00020 ... 0.00059)
Piston pin running clearance in small end bushing mm (in)	0.015 ... 0.025 (0.00059 ... 0.00098)		

¹⁾ always renew piston and piston pin together

Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Performance	The top speed actually reached when the motorcycle is run in will depend to a large extent on air resistance (drag), and thus on the rider's size, seated position and clothing, as well as on road surface condition and the weather.		
Top speed, rider seated km/h (mile/h)	140 (87)	148 (92)	165 (102.5)
Top speed, rider lying flat km/h (mile/h)	145 (90)	160 (99)	175 (108.7)
Acceleration from 0 to 50 km/h (31 mile/h) in s	3.0	2.7	2.3
from 0 to 80 km/h (50 mile/h) in s	5.6	5.0	4.1
from 0 to 100 km/h (62 mile/h) in s	8.5	7.4	5.9
from 0 to 120 km/h (75 mile/h) in s	13.8	11.2	8.6
from 0 to 140 km/h (87 mile/h) in s	20.9	19.0	13.2
from 0 to 160 km/h (100 mile/h) in s	—	—	24.3

Tightening torques Nm (lb. ft)

Cylinder head nuts (in 3 stages, 15 (11)–35(26)–40(29))	40±2 (29±1.5)	Oil pan to crankcase	9 ... 11 (6.6 ... 8.1)
Big end bolts	48 ... 52 (35 ... 38)	Valve adjusting screw nut	18 ... 22 (13.3 ... 16.2)
Flywheel to crankshaft	100 ... 105 (74 ... 77)	Carburetor screw-in stub pipes	12+2 (8.8+1.5)
All other bolts and nuts are to be tightened to the customary values as shown in manufacturers' tables or in the latest BMW 60002.0 standards sheet.			

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Engine type	Four-stroke horizontally opposed twin with overhead valves in hemispherical combustion chambers			
Location of engine number	On the engine block above the oil filler			
Cylinder bore mm (in)	70 (2.756)	70 (2.756)	82 (3.228)	
Piston stroke mm (in)	61.5 (2.421)			
Number of cylinders	2			
Cylinder arrangement	horizontally opposed, transverse			
Stroke/bore ratio	0.87	0.87	0.75	
Displacement (fiscal) cm ³ (in ³)	470 (28.68)	470 (28.68)	645 (39.36)	
Displacement (effective) cm ³ (in ³)	473.4 (28.89)	473.4 (28.89)	649.6 (39.64)	
Compression ratio	8.2:1	9.2:1	9.2:1	
Max. effective power output KW (HP) to DIN Standard, at engine speed (min ⁻¹)	20 (27) 6500	26 (35) 7250	33 (45) 7250	
Permissible continuous engine speed min ⁻¹	7000	7300	7300	
Permissible max. engine speed min ⁻¹	7650	7650	7650	
Idling speed min ⁻¹	800 . . . 1100			
Permissible max. engine speed during running-in				
up to 1000 km (app. 650 miles) min ⁻¹	4000			
up to 2000 km (app. 1300 miles) min ⁻¹	4500			
Direction of rotation	clockwise, looking down on to generator from front			
Max. torque Nm (mkp, lb. ft) at engine speed min ⁻¹	31.3 (3.2, 23.1) 5000	37.5 (3.8, 27.6) 5500	52.3 (5.3, 38.3) 6500	

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Mean piston speed m/s (ft/min) at engine speed min ⁻¹	13.3 (2618) 6500	13.3 (2618) 7250	14.8 (2913) 7250	
Compression test pressure bar (lb/in ²) good normal poor	above 10.0 (142) 8.5 . . . 10.0 (121 . . . 142) below 8.5 (121)			
Compression test procedure (engine turned over with electric starter)	1. Remove spark plugs 2. Measure with a calibrated compression tester: battery fully charged, engine at normal operating temperature. Run engine at starting speed with twistgrip fully open.			
Fuel	Regular	Super (premium)		
Fuel consumption by DIN 70030 Standard test method at 110 km/h (68 mile/h) liters/100 km (Imp./US mile/gal.)	5.0 (56.5, 47.0)	4.5 (62.8, 52.3)	4.6 (61.4, 51.1)	

Engine**Specifications (1981 models)**

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Engine lubrication				
Lubricating system	Pressurized oil circuit			
Oil filter	full-flow			
Pressure differential at which bypass valve opens bar (lb/in ²)	1.5 (21.3)			
Pressure below which oil pressure warning light comes on bar (lb/in ²)	0.2 . . . 0.5 (2.84 . . . 7.11)			
Relief valve opening pressure bar (lb/in ²)	approx. 5.0 (71.1)			
Oil content without filter change liters (Imp. pints, US quarts)	2.0 (3.5, 2.1)			
with filter change liters (Imp. pints, US quarts)	2.25 (4.0, 2.4)			
Max. oil consumption liters/100 km (miles per Imp. pint/US quart)	0.1 (355,590)			
Oil grade	Brand-name HD oil for spark-ignition engines, API Class SE or SF. See viscosity-temperature diagram in Group 00.			
Oil pump				
Type	Eaton system (hypotrochoid gearing)			
Pump delivery rate liters/h (Imp./US gal/h) at running speed min ⁻¹	1400 (308, 370) 6000			
External rotor dia. mm (in.)	57 ± 0.05 (2.2441 ± 0.002)			
Internal housing dia. mm (in.)	57.2 ^{+0.046} ₀ (2.2520 ^{+0.0018} ₀)			
Clearance between external rotor and pump housing mm (in.)	0.15 . . . 0.29 (0.006 . . . 0.011)			

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS		
Rotor height mm (in)	14 ^{-0.015} _{-0.045} (0.5512 ^{-0.0006} _{-0.0018})					
Housing depth mm (in)	14 ^{+0.025} _{+0.010} (0.5512 ^{+0.0010} _{+0.0004})					
Clearance between joint face on pump housing and sealing face on rotor mm (in)	0.025 ... 0.070 (0.0010 ... 0.0028)					
Gap between inner and outer rotors mm (in)	0.12 ... 0.20 (0.0047 ... 0.0079)					
Max. wear depth in cover mm (in)	0.05 (0.0020)					
Relaxed length of pressure relief spring mm (in)	68 (2.677)					
Valve clearances: Adjust with engine cold (max. 20° C/68° F)	up to 1000 km [600 mile] Inspection)					
Inlet mm (in)					0.10 (0.004)	(0.15 [0.006]
Exhaust mm (in)					0.20 (0.008)	(0.25 [0.01]
Valve timing (tolerance ± 2.5°)	Timing gear shaft alignment at 2 mm (0.08 in) valve clearance					
Inlet opens	284° Camshaft	308° Camshaft				
Inlet closes	6° bTDC	16° bTDC				
Exhaust opens	34° aBDC	44° aBDC				
Exhaust closes	46° bBDC	56° bBDC				
	6° bTDC	4° aTDC				
Valves:						
Overall length	Inlet mm (in)	103±0.2 (4.055±0.008)	100±0.2 (3.937±0.008)			
	Exhaust mm (in)	102.5±0.2 (4.035±0.008)	99.3±0.2 (3.909±0.008)			
Valve head dia.	Inlet mm (in)	34 (1.339)		38 (1.496)		
	Exhaust mm (in)	32 (1.260)		34 (1.339)		
Valve stem dia.	Inlet mm (in.)	6.96 - 0.015 (0.274 - 0.0006)				
	Exhaust mm (in)	6.96 - 0.015 (0.274 - 0.0006)				

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Min. valve head rim thickness Inlet mm (in)	1 ^{+0.5} _(0.0394^{+0.0197})			
Exhaust mm (in)	1.2 – 0.2 (0.0472 – 0.0079)			
Max. valve head runout mm (in)	0.02 (0.0008)			
Valve seat ring				
Extl. dia. mm (in)				
Inlet	36.2 (1.425) h 7		39.2 (1.543) h 7	
Exhaust	36.2 (1.425) e 6		39.2 (1.543) h 7	
Bore in cylinder head for valve seat ring				
Inlet mm (in)	36 (1.417) H 7		39 (1.535) H 7	
Exhaust mm (in)	36 (1.417) H 7		39 (1.535) H 7	
Valve seat angle deg.	90° – 20°			
Valve seat width (guide values)				
Inlet mm (in)	app. 1.2 ^{+0.2} _(0.047^{+0.008})			
Exhaust mm (in)	app. 1.4 ^{+0.2} _(0.055^{+0.008})			

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Valve seat ring oversizes mm (in)		0.2 (0.008)		
Valve guides:	Inlet	42 (1.653)		
Overall length mm (in)	Exhaust	42 (1.653)		
Extl. dia mm (in)		14 (0.551) z 6		
Intl. dia. mm (in)		7 (0.276) H 7		
Bore in cylinder head mm (in)		14 (0.551) H 7		
Oversizes, stage 1 mm (in)		14.1 (0.555) z 6		
stage 2 mm (in)		14.2 (0.559) z 6		
Valve stem clearance				
Inlet mm (in)		0.025 ... 0.055 (0.0010 ... 0.0022)		
Exhaust mm (in)		0.04 ... 0.07 (0.0016 ... 0.0028)		
Max. clearance after wear mm (in)		0.1 (0.004) measured at upper end of guide		
Valve gear				
Valve operation		from camshaft, via cup tappets, pushrods and rockers		
Camshaft drive		3/8 x 7/32 in single roller chain with socket insert and hydraulically damped chain tensioner		
Number of chain links		50		

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Valve springs				
Wire thickness mm (in)	4.25 (0.167)			
Extl. coil dia. mm (in)	31.9 (1.256)			
Relaxed spring length mm (in)	Color code brown: app. 46 (1.81); color code blue: app. 43.5 (1.71)			
Spring force in kp (lb. f) at test length mm (in)	29 (63.9) at 37.6 (1.480); 70 (154.3) at 28.5 (1.122)			
Winding direction	clockwise (right-hand)			
Number of active spring turns	4.6 (or 4)			
Total number of spring turns	6			
Length fully compressed mm (in)	25 (0.98)			
Installed direction	with color stripe on windings at cylinder head side			
Rockers:	with needle roller bearings			
Axial play	zero, but free-moving			
Rocker leverage ratio	1 : 1.39			

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Camshaft				
Flange bearing bore in engine block mm (in)		$40^{+0.039}_0$ (1.5748 $^{+0.0016}_0$)		
Flange bearing extl. dia. mm (in)		$40^0_{-0.016}$ (1.5748 $^0_{-0.0006}$)		
Flange bearing bore mm (in)		$25^{+0.013}_0$ (0.9842 $^{+0.0005}_0$)		
Camshaft bearing journal dia., generator end mm (in)		$25^{-0.020}_{-0.033}$ (0.9842 $^{-0.0008}_{0.0013}$)		
Camshaft bearing bore in engine block, flywheel end mm (in)		$24^{+0.021}_0$ (0.9449 $^{+0.0008}_0$)		
Camshaft bearing journal dia., flywheel end mm (in)		$24^{-0.020}_{-0.033}$ (0.9449 $^{-0.0008}_{-0.0013}$)		
Radial play at generator and flywheel ends mm (in)		0.02 ... 0.046 (0.0008 ... 0.0018) or 0.02 ... 0.054 (0.0008 ... 0.0021)		
Axial play (endplay between camshaft thrust collar and flange bearing mm (in)		0.1 ± 0.02 (0.0039 ± 0.0008)		
Cam base circle mm (in)		28 (1.102)		
Cam lift mm (in)	6.198 (0.244)	6.756 (0.266)	6.756 (0.266)	
Tappet extl. dia. mm (in)		$22^{-0.025}_{-0.045}$ (0.8661 $^{-0.0010}_{-0.0018}$)		
Tappet bore in engine block mm (in)		$22^{+0.006}_{-0.015}$ (0.8661 $^{+0.0002}_{-0.0006}$)		
Tappet radial clearance mm (in)		0.01 ... 0.051 (0.0004 ... 0.0020)		
Max. tappet wear clearance mm (in)		0.075 (0.0030)		

Engine

Specifications (1981 models)

Model			R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Crankshaft and bearings			Main bearing journal dia. mm (in)			
Crankshaft			Generator end		Flywheel end	
Crankshaft markings		red/red	59.980 ... 59.990 (2.3614 ... 2.3618)		59.980 ... 59.990 (2.3614 ... 2.3618)	
Standard	0	red/blue	59.980 ... 59.990 (2.3614 ... 2.3618)		59.971 ... 59.980 (2.3611 ... 2.3614)	
		blue/red	59.971 ... 59.980 (2.3611 ... 2.3614)		59.980 ... 59.990 (2.3614 ... 2.3618)	
		blue/blue	59.971 ... 59.980 (2.3611 ... 2.3614)		59.971 ... 59.980 (2.3611 ... 2.3614)	
Stage 1	0.25 mm (0.0098 in)	red/red	59.730 ... 59.740 (2.3516 ... 2.3520)		59.730 ... 59.740 (2.3516 ... 2.3520)	
		red/blue	59.730 ... 59.740 (2.3516 ... 2.3520)		59.721 ... 59.730 (2.3512 ... 2.3516)	
		blue/red	59.721 ... 59.730 (2.3512 ... 2.3516)		59.730 ... 59.740 (2.3516 ... 2.3520)	
		blue/blue	59.721 ... 59.730 (2.3512 ... 2.3516)		59.721 ... 59.730 (2.3512 ... 2.3516)	
Stage 2	0.50 mm (0.0197 in)	red/red	59.480 ... 59.490 (2.3417 ... 2.3421)		59.480 ... 59.490 (2.3417 ... 2.3421)	
		red/blue	59.480 ... 59.490 (2.3417 ... 2.3421)		59.471 ... 59.480 (2.3414 ... 2.3417)	
		blue/red	59.471 ... 59.480 (2.3414 ... 2.3417)		59.480 ... 59.490 (2.3417 ... 2.3421)	
		blue/blue	59.471 ... 59.480 (2.3414 ... 2.3417)		59.471 ... 59.480 (2.3414 ... 2.3417)	
Stage 3	0.75 mm (0.0295 in)	red/red	59.230 ... 59.240 (2.3319 ... 2.3323)		59.230 ... 59.240 (2.3319 ... 2.3323)	
		red/blue	59.230 ... 59.240 (2.3319 ... 2.3323)		59.221 ... 59.230 (2.3315 ... 2.3319)	
		blue/red	59.221 ... 59.230 (2.3315 ... 2.3319)		59.230 ... 59.240 (2.3319 ... 2.3323)	
		blue/blue	59.221 ... 59.230 (2.3315 ... 2.3319)		59.221 ... 59.230 (2.3315 ... 2.3319)	
Bore for crankshaft main bearing shell in engine block mm (in) dia.			$65^{+0.019}_0$ (2.5591 $^{+0.0008}_0$)			
Bore for crankshaft main bearing shell in bearing cap mm (in) dia.			$65^{+0.019}_0$ (2.5591 $^{+0.0008}_0$)			
Main bearing journal radial clearance mm (in)			Red 0.017 ... 0.066 (0.00067 ... 0.00260)		Blue 0.019 ... 0.067 (0.00075 ... 0.00264)	
Seat dia. for front crankshaft deep-groove ball bearing mm (in)			$35^{+0.025}_{+0.009}$ (1.3780 $^{+0.0010}_{+0.0004}$)			
Bearing seat bore for deep-groove ball bearing in timing chain cover mm (in)			$62^{-0.009}_{-0.39}$ (2.4409 $^{-0.0004}_{-0.0154}$)			

Engine

Specifications (1981 models)

Model			R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Main bearing shells						
Wall thickness mm (in)						
Standard	0	red blue	2.500 ... 2.510 (0.0984 ... 0.0988) 2.504 ... 2.514 (0.0986 ... 0.0990)			
Stage 1	0.25 mm (0.0098 in)	red blue	2.625 ... 2.635 (0.1033 ... 0.1037) 2.629 ... 2.639 (0.1035 ... 0.1039)			
Stage 2	0.50 mm (0.0197 in)	red blue	2.750 ... 2.760 (0.1083 ... 0.1087) 2.754 ... 2.764 (0.1084 ... 0.1088)			
Stage 3	0.75 mm (0.0295 in)	red blue	2.875 ... 2.885 (0.1132 ... 0.1136) 2.879 ... 2.889 (0.1133 ... 0.1137)			
Engine block mm (in)			Diameter A (crankshaft main bearing bore) 65 (2.5591) H 6		Diameter B (bearing cap bore) 130 ^{+0.026} _{-0.007} (5.1181 ^{+0.0010} _{+0.0003})	
			65.000 ... 65.019 (2.5591 ... 2.5598)		129.993 ... 130.026 (5.1178 ... 5.1191)	
Crankshaft main bearing diameter with bearing pressed in mm (in)			red 60.007 ... 60.046 (2.3625 ... 2.3640)		blue 59.999 ... 60.038 (2.3622 ... 2.3637)	
Bearing caps mm (in)			65.000 ... 65.019 (2.5591 ... 2.5598)		130.003 ... 130.028 (5.1182 ... 5.1192)	

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Seat dia. on crankshaft for chain sprocket mm (in)	35.003 ^{+0.020} _{+0.009} (1.3781 ^{+0.0008} _{+0.0004})			
Chain sprocket mounting bore mm (in)	35.003 ^{+0.003} _{-0.013} (1.3781 ^{+0.0001} _{-0.0005})			
Crankshaft endplay mm (in)	0.08 ... 0.15 (0.0031 ... 0.0059)			
Thrust washer red thickness "S" mm (in)	2.483 ... 2.530 (0.0978 ... 0.0996)			
blue thickness "S" mm (in)	2.530 ... 2.578 (0.0996 ... 0.1015)			
green thickness "S" mm (in)	2.578 ... 2.626 (0.1015 ... 0.1034)			
yellow thickness "S" mm (in)	2.626 ... 2.673 (0.1034 ... 0.1052)			
Max. play after wear mm (in)	0.20 (0.0079)			
Max. permissible runout at outer shaft journal (generator end) when supported at main bearings mm (in)	0.02 (0.0008)			
Max. permissible crankshaft imbalance (dynamic) without flywheel cmp	20			
Max. flywheel lateral runout mm (in)	0.1 (0.004)			
Connecting rods and bearings	Crankpin dia. mm (in)			
Standard 0	48.00 ^{-0.009} _{-0.025} (1.8898 ^{-0.0004} _{-0.0010})			
Stage 1 0.25 mm (0.010 in)	47.75 ^{-0.009} _{-0.025} (1.8799 ^{-0.0004} _{-0.0010})			
Stage 2 0.50 mm (0.020 in)	47.50 ^{-0.009} _{-0.025} (1.8701 ^{-0.0004} _{-0.0010})			
Stage 3 0.75 mm (0.030 in)	47.25 ^{-0.009} _{-0.025} (1.8602 ^{-0.0004} _{-0.0010})			
Big end bearing bore mm (in)	52 ^{+0.015} ₀ (2.0472 ^{+0.0006} ₀)			
Big end bearing radial clearance mm (in)	0.023 ... 0.069 (0.0009 ... 0.0027)			
Big end bearing width mm (in)	22 ^{-0.065} _{-0.117} (0.8661 ^{-0.0026} _{-0.0046})			
Crankpin bearing width mm (in)	22 ^{+0.149} _{+0.065} (0.8661 ^{+0.0059} _{+0.0026})			
Connecting rod axial play mm (in)	0.130 ... 0.266 (0.0051 ... 0.0105)			
Max. axial play after wear mm (in)	0.32 (0.0126)			

Engine

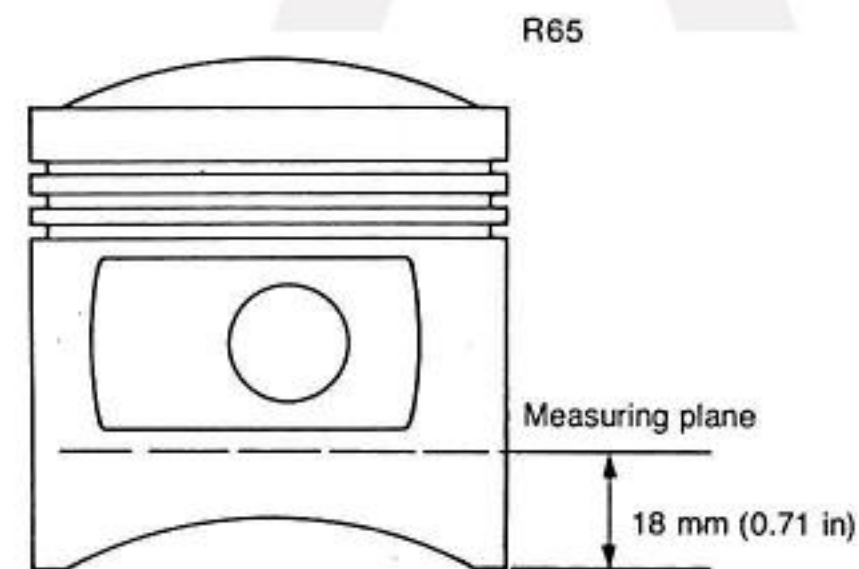
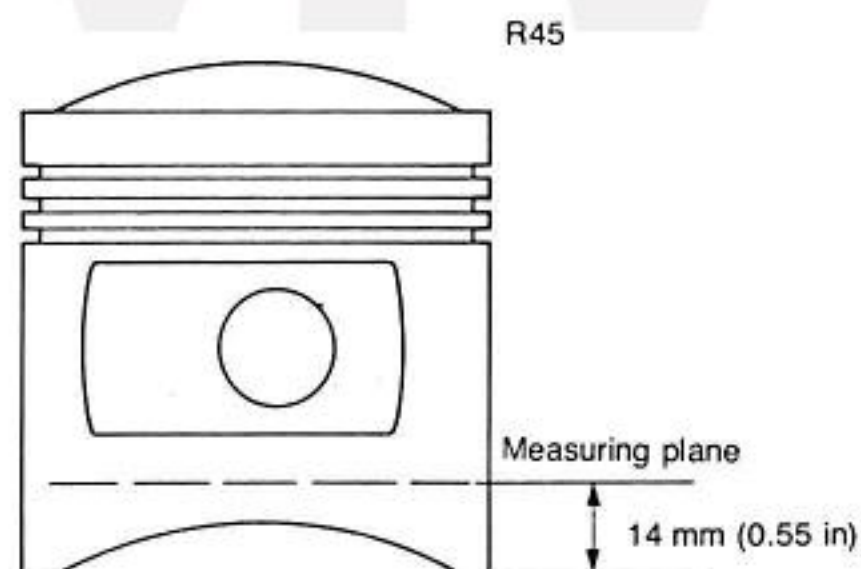
Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Distance between bore centers mm (in)	118 ± 0.1 (4.646 ± 0.0039)			
Small end bearing bore mm (in)	$24^{+0.021}_0$ (0.9449 $^{+0.0008}_0$)			
Small end bushing extl. dia. mm (in)	24.060 ... 24.100 (0.9472 ... 0.9488)			
Bore in small end bushing for piston pin mm (in)	$22^{+0.020}_{0.015}$ (0.8661 $^{+0.0008}_{+0.0006}$)			
Wear limit for piston pin bore in small end bushing mm (in)	22+0.040 (0.8661+0.0016)			
Max. deviation from parallel of small end bores with bearing shells at 150 mm (5.9 in) spacing mm (in)	0.04 (0.0016)			
Max. small end bore twist at 150 mm (5.9 in) spacing mm (in)	1.5 (0.059)			
Permissible difference in weight between the 2 connecting rods g (oz)	± 3 (0.106)			
Cylinders:				
Bore - standard	A mm (in)	69.995+0.01 (2.7557+0.0004)	81.995+0.01 (3.2281+0.0004)	
	B mm (in)	70.005+0.01 (2.7561+0.0004)	82.005+0.01 (3.2285+0.0004)	
	C mm (in)	70.015+0.01 (2.7565+0.0004)	82.015+0.01 (3.2289+0.0004)	
Surface roughness μm	1.5			

Engine

Specifications (1981 models)

Model		R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Permissible cylinder bore out-of-roundness		The surface to which the tolerance applies must lie between two coaxial cylinders with a radial spacing of 0.005 mm (0.0002 in)			
Pistons Pattern		convex oval crown			
Complete piston weight group		stamped + or – Always install two pistons of the same weight group			
Piston dia. (standard) mm (in)	A B C	69.955 ... 69.965 (2.7541 ... 2.7545) 69.965 ... 69.975 (2.7545 ... 2.7549) 69.975 ... 69.985 (2.7549 ... 2.7553)		81.955 ... 81.965 (3.2265 ... 3.2269) 81.965 ... 81.975 (3.2269 ... 3.2273) 81.975 ... 81.985 (3.2273 ... 3.2277)	
Piston installed clearance	mm (in)	0.030 ... 0.050 (0.0012 ... 0.0020)			
Permissible total wear at piston and cylinder	mm (in)	max. 0.08 (0.0031)			
Piston installed direction		arrow with 'vorn' (front) inscription facing forwards			



Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Piston rings				
1st groove – rectangular ring ¹⁾ Height mm (in)	1.5 ^{-0.010} _{-0.022} (0.0591 ^{-0.0004} _{-0.0009})		1.75 ^{-0.010} _{-0.022} (0.0689 ^{-0.0004} _{-0.0009})	
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.30 ... 0.50 (0.012 ... 0.020)	
Clearance in groove mm (in)	0.050 ... 0.082 (0.0020 ... 0.0032)		0.050 ... 0.082 (0.0020 ... 0.0032)	
2nd groove – micro-angle cutaway ring ¹⁾ Height mm (in)	2.00 ^{-0.010} _{-0.022} (0.0787 ^{-0.0004} _{-0.0009})		2.00 ^{-0.010} _{-0.022} (0.0787 ^{-0.0004} _{-0.0009})	
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.30 ... 0.45 (0.012 ... 0.018)	
Clearance in groove mm (in)	0.040 ... 0.072 (0.0016 ... 0.0028)		0.040 ... 0.072 (0.0016 ... 0.0028)	
3rd groove – equal-chamfer ring ¹⁾ Height mm (in)	3.5 ^{-0.010} _{-0.022} (0.1378 ^{-0.0004} _{-0.0009})		4.00 ^{-0.010} _{-0.022} (0.1575 ^{-0.0004} _{-0.0009})	
Ring end gap mm (in)	0.25 ... 0.45 (0.010 ... 0.018)		0.25 ... 0.40 (0.010 ... 0.016)	
Clearance in groove mm (in)	0.030 ... 0.062 (0.0012 ... 0.0024)			
Piston ring installed direction	with inscription (TOP) uppermost			

¹⁾ not to DIN standard
– special BMW version

Engine

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Piston pin Offset from piston centerline mm (in)	1.0 (0.04)		1.5 (0.06)	
Piston pin diameter mm (in)	22−0.005 (0.8661−0.0002)			
Piston pin eye bore mm (in)	22 ^{+0.007} _{+0.002} (0.8661 ^{+0.0003} _{+0.00008})		22 ^{+0.010} _{+0.005} (0.8661 ^{+0.0004} _{+0.0002})	
Piston pin clearance ¹⁾ in piston mm (in)	0.002 ... 0.012 (0.00008 ... 0.00047)		0.005 ... 0.015 (0.00020 ... 0.00059)	
Piston pin running clearance in small end bushing mm (in)	0.015 ... 0.025 (0.00059 ... 0.00098)			

¹⁾ always renew piston and piston pin together

Engine

Specifications (1981 models)

Tightening torques Nm (lb. ft)

Cylinder head nuts (in 3 stages)	15	(11)	Valve adjusting screw nut	20 ± 2	(14.7 ± 1.5)
	25	(18.5)	Carburettor threaded stub pipes	50	(37)
	35 + 4	(26 + 3)	Oil drain plug	30 + 5	(22 + 3.7)
Big end bolts	50 ± 2	(37 ± 1.5)			
Clutch housing (flywheel) to crankshaft	100 + 5	(74 + 3.7)			

All other bolts and nuts are to be tightened to the customary values as shown in manufacturers' tables or on the latest BMW 60002.0 standards sheet.

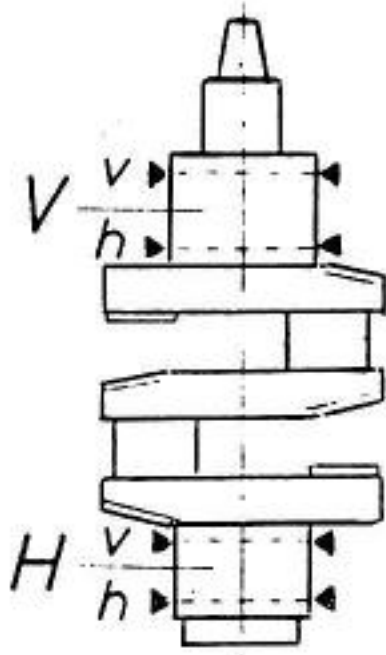
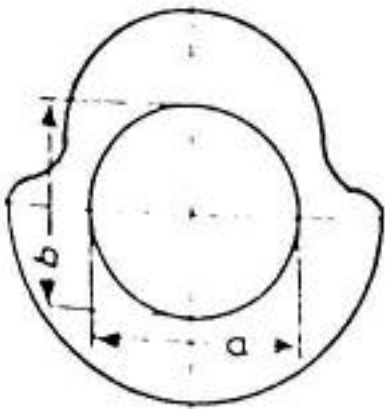
Measurement report sheet for crankshaft main bearing clearances

(See also Service Information, Group: Engine, No. 11 015 80 (146 R))

Model _____ Frame No. _____ Speedometer reading: _____

Order No. _____ Annex to warranty claim No. _____

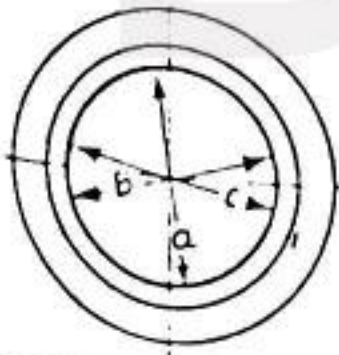
Measurement of
main bearing journals:



Using an external micrometer, measure front main bearing journal V and rear main bearing journal H in directions a and b (3 times each at same point) and at indicated heights v and h. This will yield 24 separate readings which should be entered in the following table. Then calculate the mean values as indicated on the right of the table.

Measuring planes		a			b			Cross-addition	÷ 6 =	Mean value for main bearing journal
59.	V $\frac{v}{h}$								÷ 6 =	△ 59. ... mm
									÷ 6 =	△ 59. ... mm
	H $\frac{v}{h}$								÷ 6 =	△ 59. ... mm
									÷ 6 =	△ 59. ... mm

Measurement of
main bearing shells:



Measure main bearing shells in directions a, b and c. Apply marks with felt-tipped pen to engine block and bearing shell exactly as illustrated. Then proceed as described above. This yields 36 separate readings, which should be entered in the table below and the mean values calculated as shown.

Measuring planes		a			b			c			Cross-addition	÷ 9 =	Mean value for main bearing shell
60.0 ...	V $\frac{v}{h}$											÷ 9 =	△ 60.0 ... mm
												÷ 9 =	△ 60.0 ... mm
	H $\frac{v}{h}$											÷ 9 =	△ 60.0 ... mm
												÷ 9 =	△ 60.0 ... mm

Calculating main
bearing clearances:

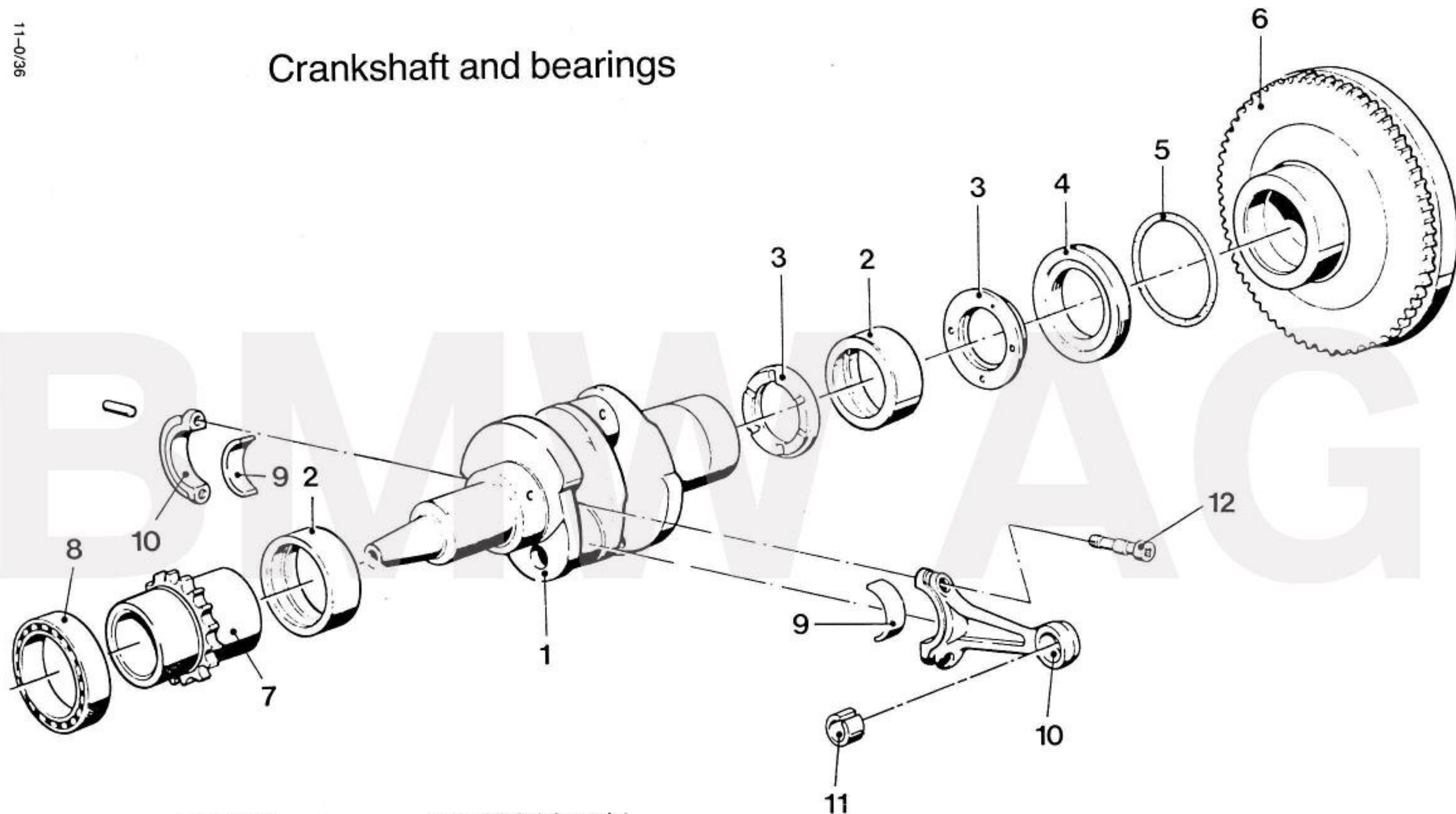
Desired value = 0.020 ... 0.065 mm

Measurement results	Bearing shell diameters			Crankshaft bearing journal diameters			Bearing clearance		
V $\frac{v}{h}$				minus			=		mm
				minus			=		mm
H $\frac{v}{h}$				minus			=		mm
				minus			=		mm

(Date)

(Signature of person performing measurement work)

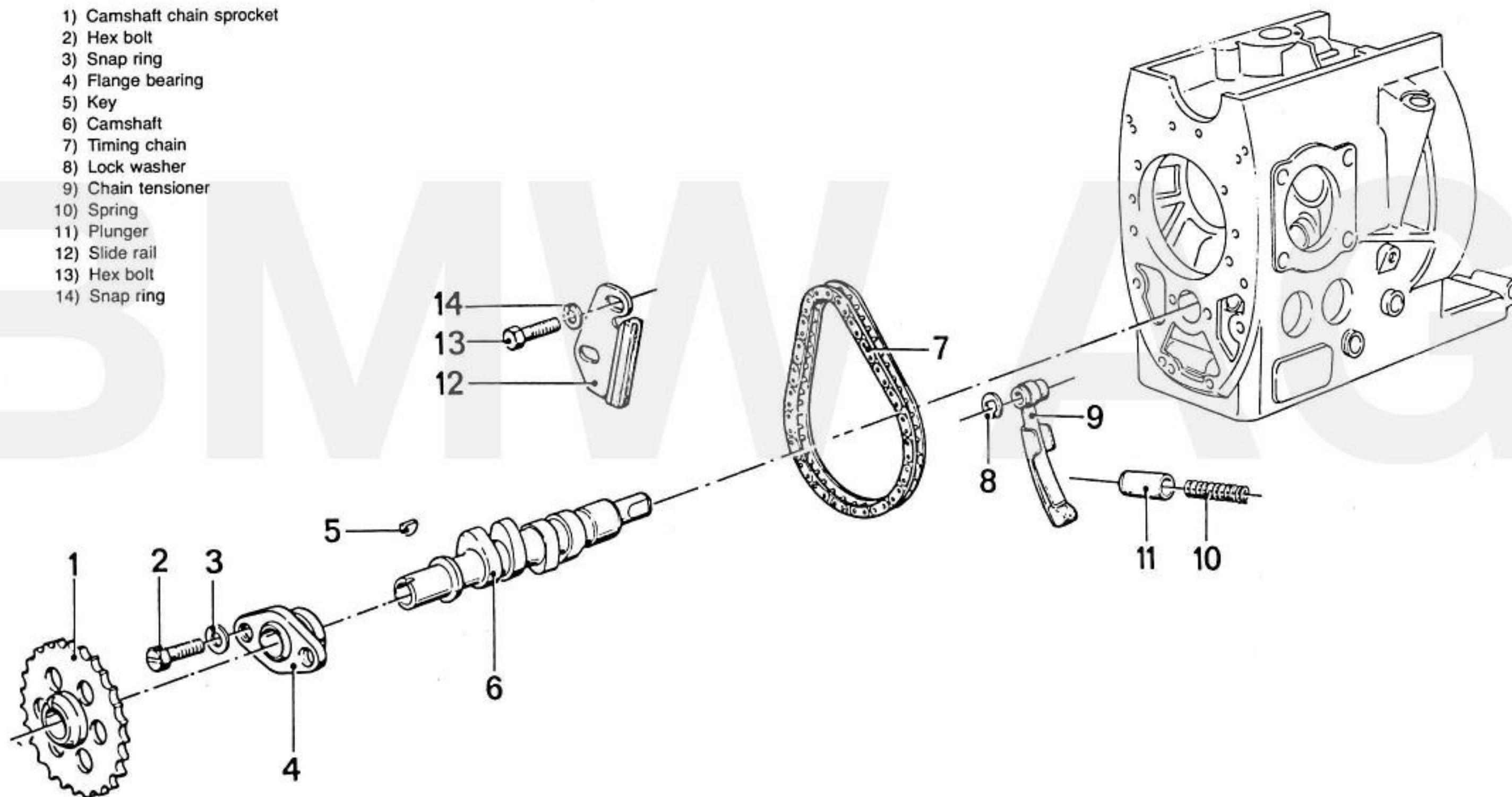
Crankshaft and bearings



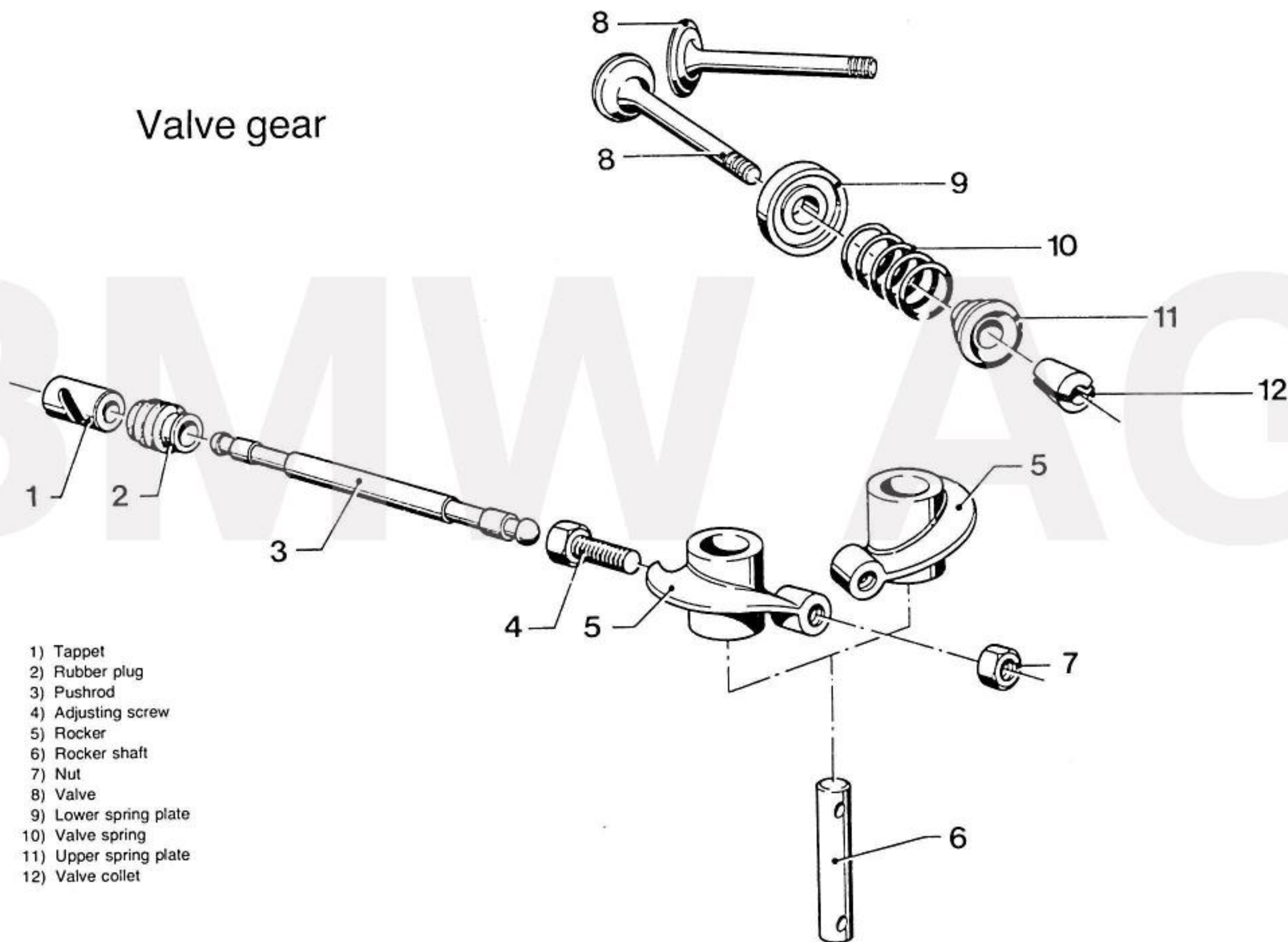
- | | |
|-----------------------|------------------------------|
| 1) Crankshaft | 7) Crankshaft chain sprocket |
| 2) Bearing bushing | 8) Deep-groove ball bearing |
| 3) Thrust washer | 9) Big end bearing shells |
| 4) Shaft sealing ring | 10) Connecting rod |
| 5) Cord ring seal | 11) Small end bushing |
| 6) Flywheel | 12) Big end bolt |

Camshaft and timing chain

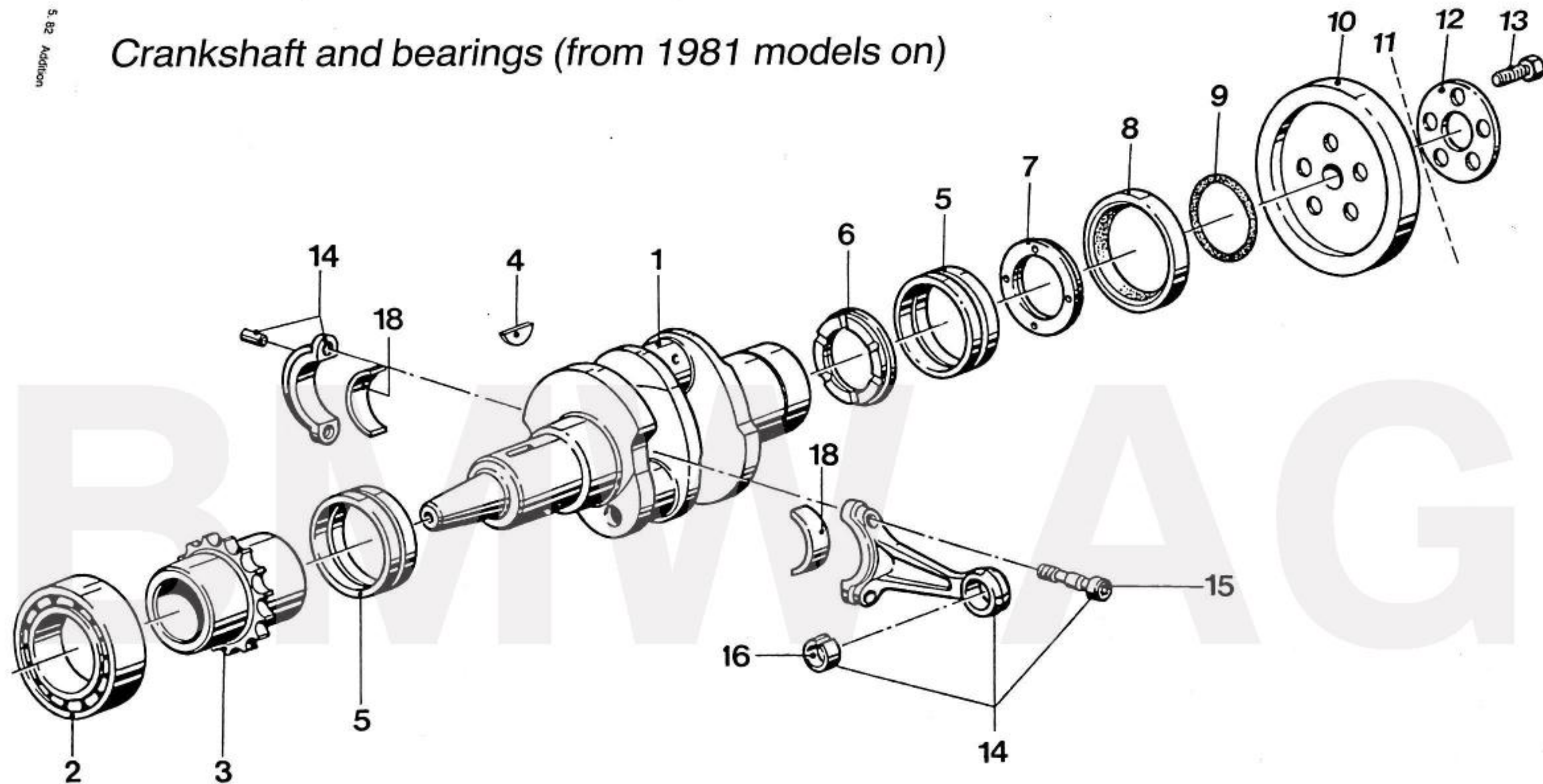
- 1) Camshaft chain sprocket
- 2) Hex bolt
- 3) Snap ring
- 4) Flange bearing
- 5) Key
- 6) Camshaft
- 7) Timing chain
- 8) Lock washer
- 9) Chain tensioner
- 10) Spring
- 11) Plunger
- 12) Slide rail
- 13) Hex bolt
- 14) Snap ring



Valve gear



Crankshaft and bearings (from 1981 models on)

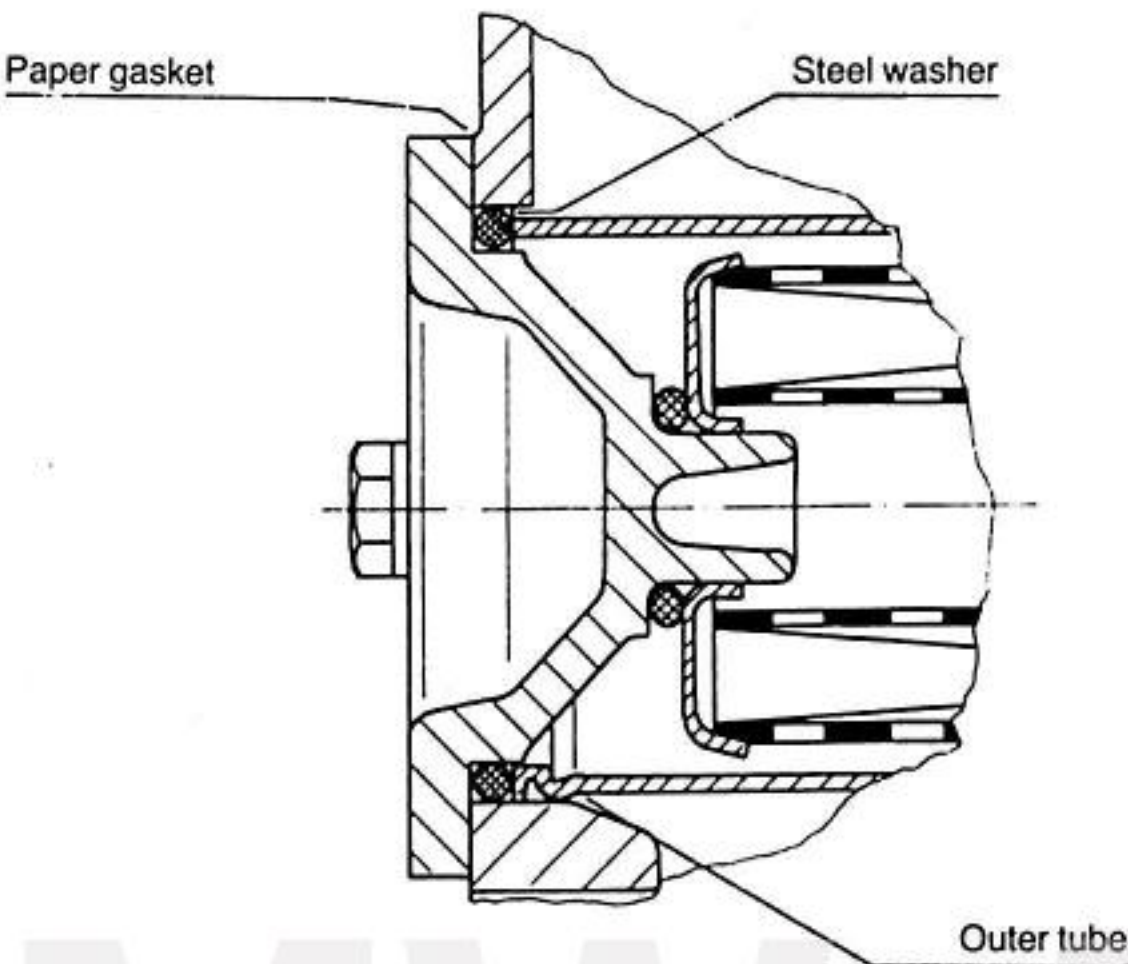


- 1) Crankshaft
- 2) Deep-groove ball bearing
- 3) Chain sprocket
- 4) Key
- 5) Main bearing shell
- 6) Thrust bearing, inner
- 7) Thrust bearing, outer
- 8) Shaft sealing ring
- 9) O-ring

- 10) Thrust ring
- 11) Clutch housing
- 12) Locating disc
- 13) Hex bolt
- 14) Connecting rod
- 15) Big end bolt
- 16) Small-end bushing
- 17) Peg
- 18) Big end bearing shell

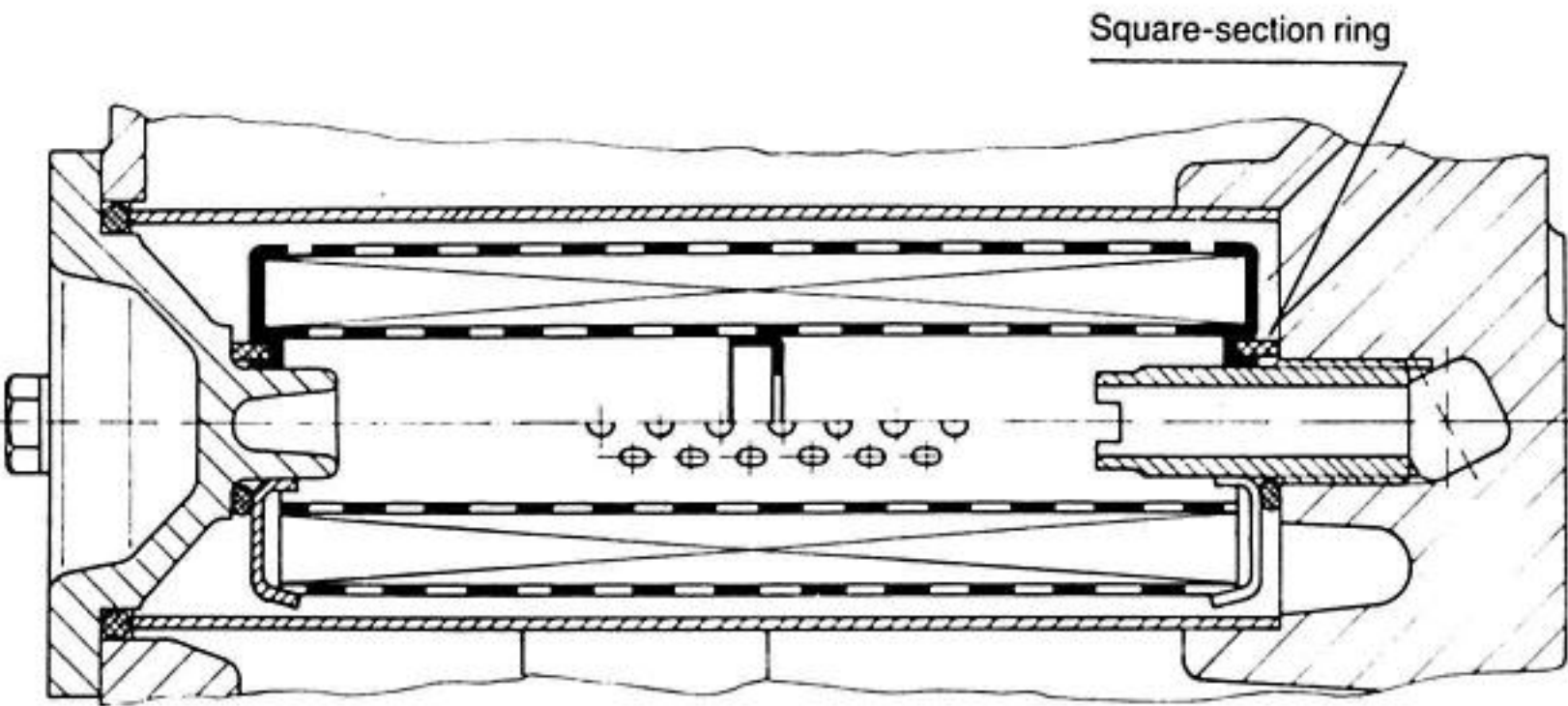
Oil filter – methods of assembly

Old version: with paper gasket and steel washer



New version: without paper gasket and steel washer; with crimped end to outer tube

New oil filter with square-section rings attached with adhesive



Old oil filter without sealing rings

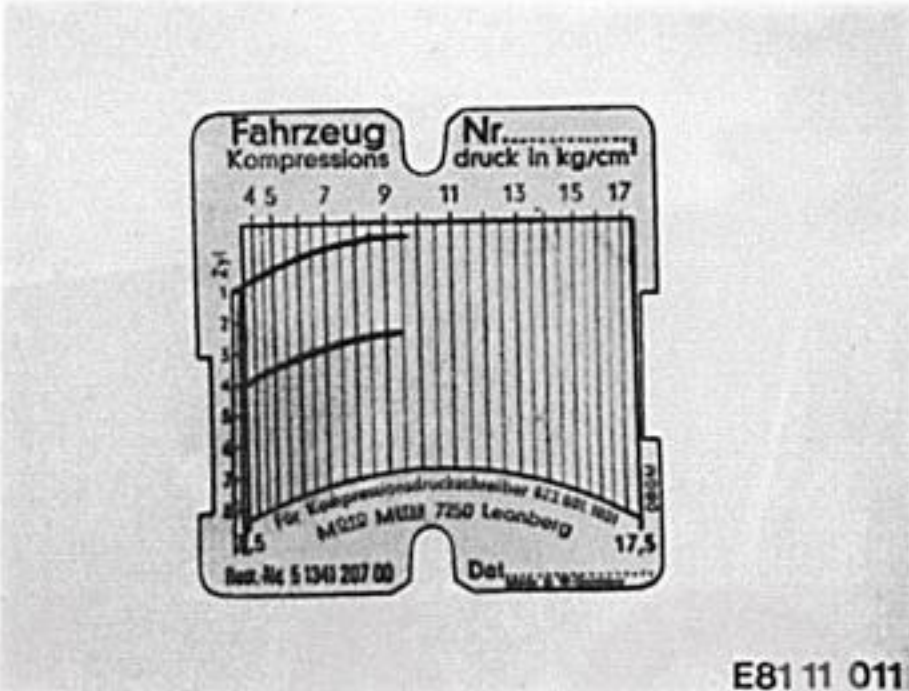
If the new oil filter is installed in place of the old type, remove the sealing rings in the base of the filter housing and on the cover for the oil filter.

11 00 039 Compression test – all cylinders

- 1. Unscrew and remove the spark plugs.
Measure with a calibrated compression tester. The battery must be fully charged, the engine at normal operating temperature and the throttle twistgrip fully open.
Turn the engine over with the starter motor.

Important on models from 1981 on: the ignition circuit must be interrupted (plug connector at ignition unit – see 12 11 004 – or connection to control unit), or else the ignition coil could be damaged beyond repair.

Pen recording card for compression tester.
For compression values, see Specifications.



11 00 050 Engine – removing and installing

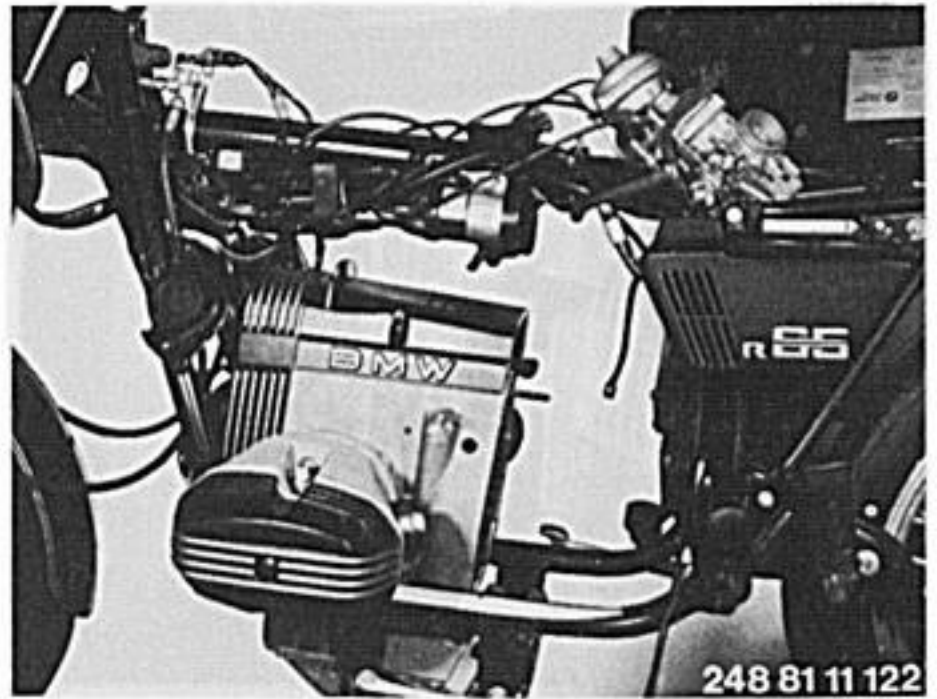
Remove (install) exhaust system – 18 00 020.

Remove (install) gearbox – 23 00 020.

Detach (attach) fuel tank – 16 11 030.

Lower the engine with the jack.

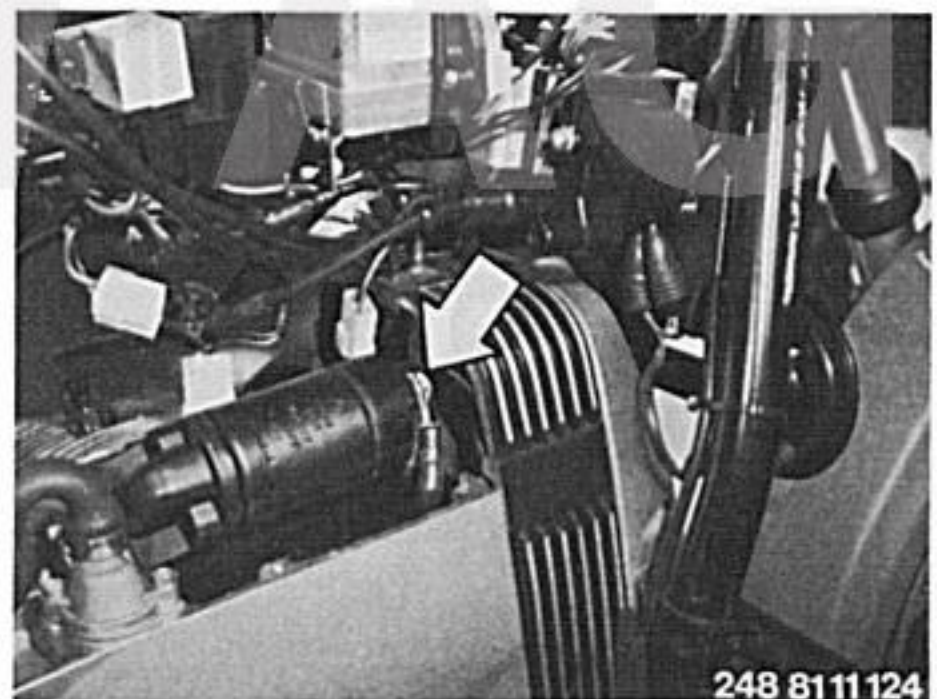
Detach right carburettor from cylinder head and place both carburettors on top of the battery. Detach the spark plug caps and place the leads over the frame.



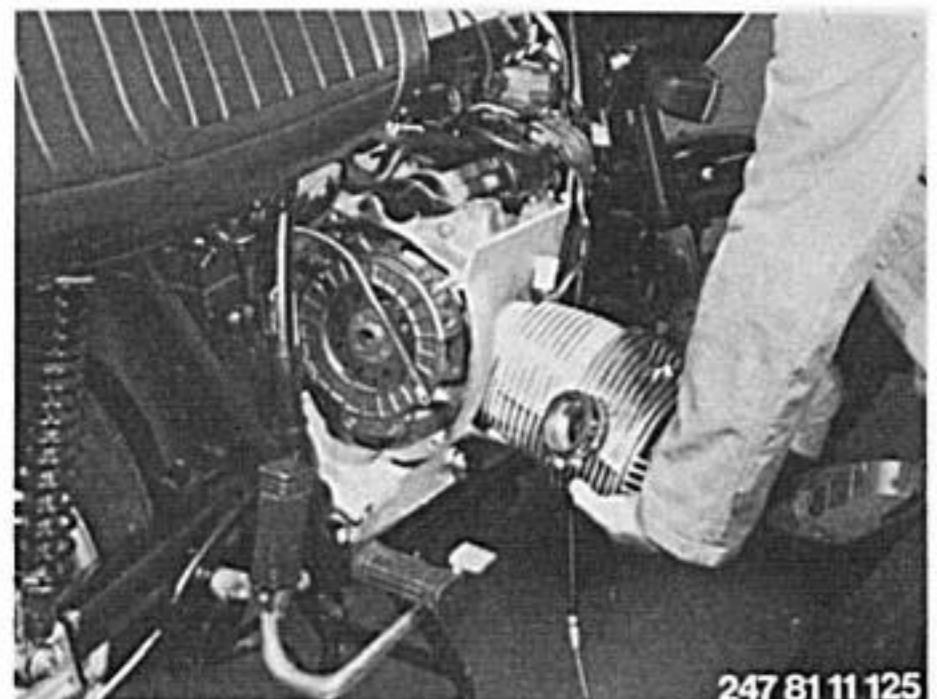
Detach multi-pin plug from control unit. Separate plug connectors (1) and (2) and detach multi-pin plug at regulator (arrow).



Take off the starter motor cover and disconnect the battery + (positive) lead from the starter (arrow).
Remove the right coil.



Move the engine back fully, raise it and tilt to the right (looking forwards) to remove it from the frame.



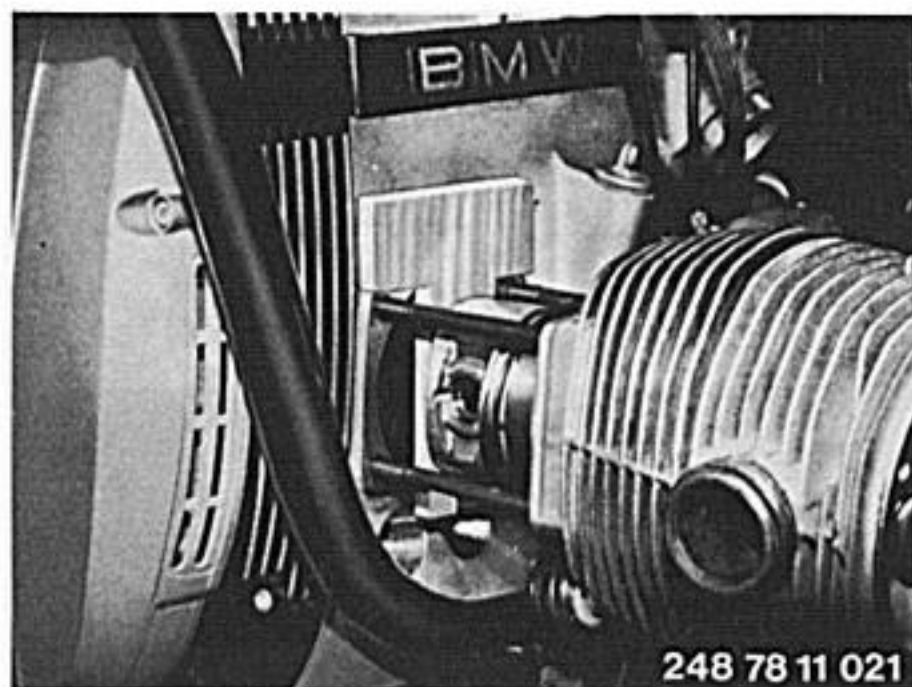
11 11 050 Cylinder — removing and installing

Remove and install cylinder head — 11 12 080.

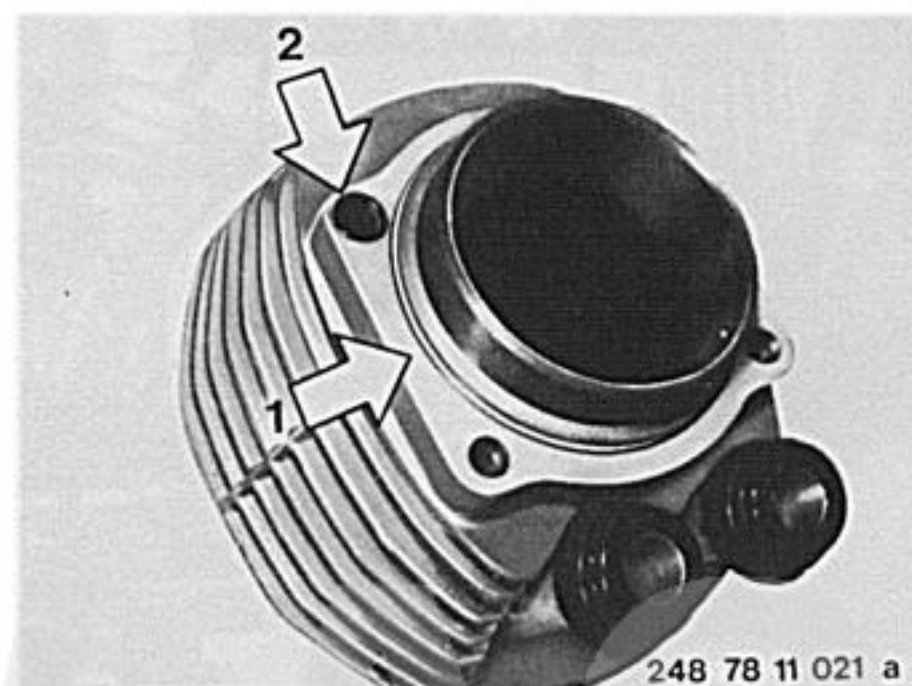
Strike the cylinder sharply several times with a plastic-faced hammer to detach it from the engine block, and pull away.

Note:

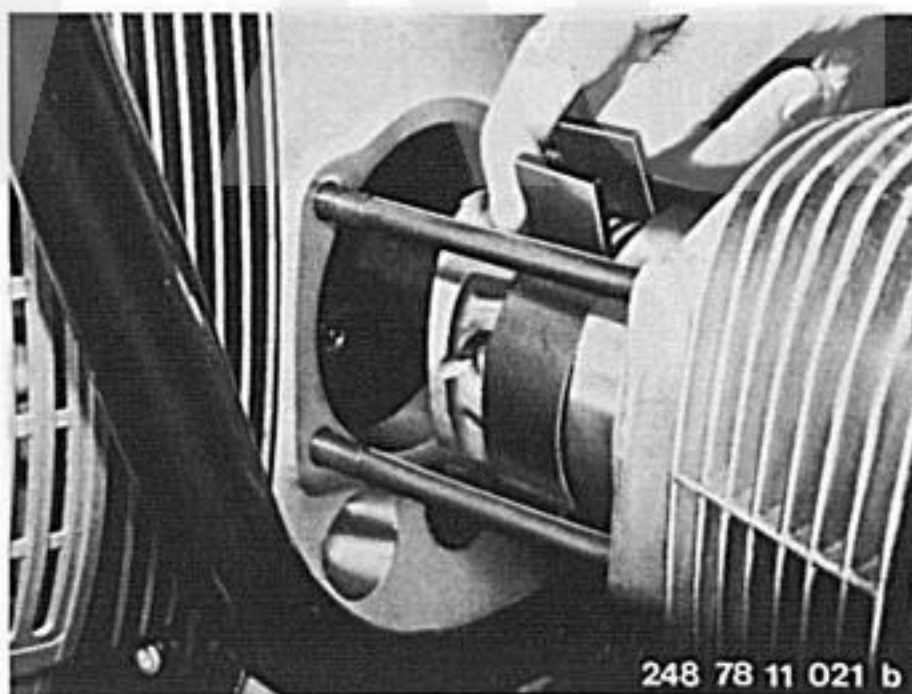
Make sure that the piston does not strike the engine block as the cylinder is pulled off.

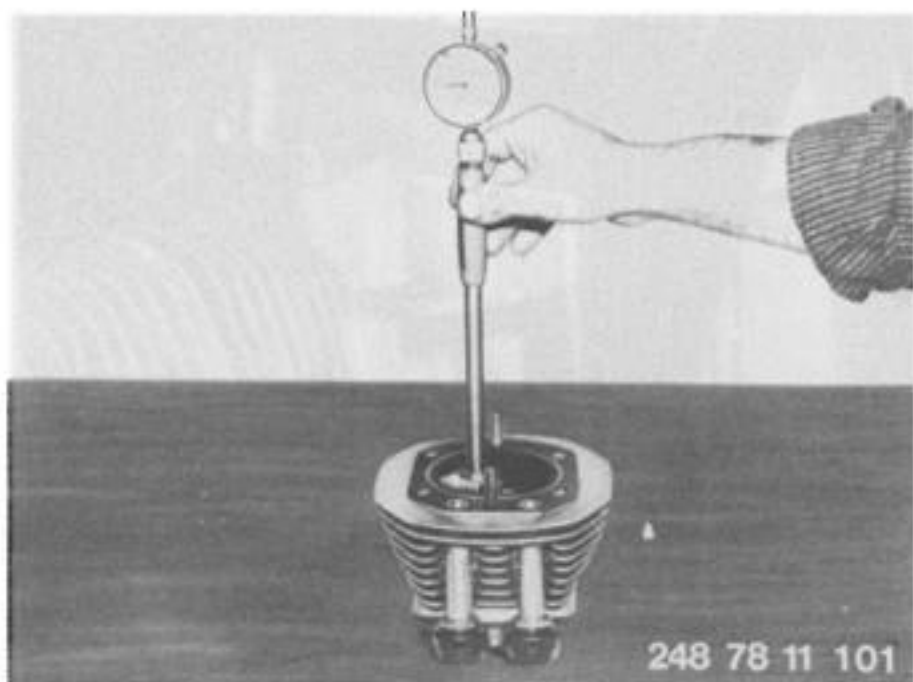


Whenever the cylinder is removed, the O-ring at the cylinder base (1) and the O-rings at the upper studs (2) must be renewed.



To insert the piston into the cylinder when installing, use piston ring clamp BMW 11 2 910 (R 45) or 11 2 905 (R 65).





11 11 527 Cylinder – reboring and honing (not permissible from 1981 models on)

Remove and install cylinder head – 11 12 080.

Remove and install piston – 11 25 000.

All the testing and repair work described as preliminary operations is to be performed only as necessary.

The cylinders can be rebored to two stages. For oversizes, see Specifications.

A third rebores is not possible for reasons of heat dissipation. Measure cylinders after reboring at the cylinder base. Select oversize pistons to suit the size of the rebored cylinders: for piston installed clearances, see Specifications.



BMW AG

11 12 080 Cylinder head – removing and installing

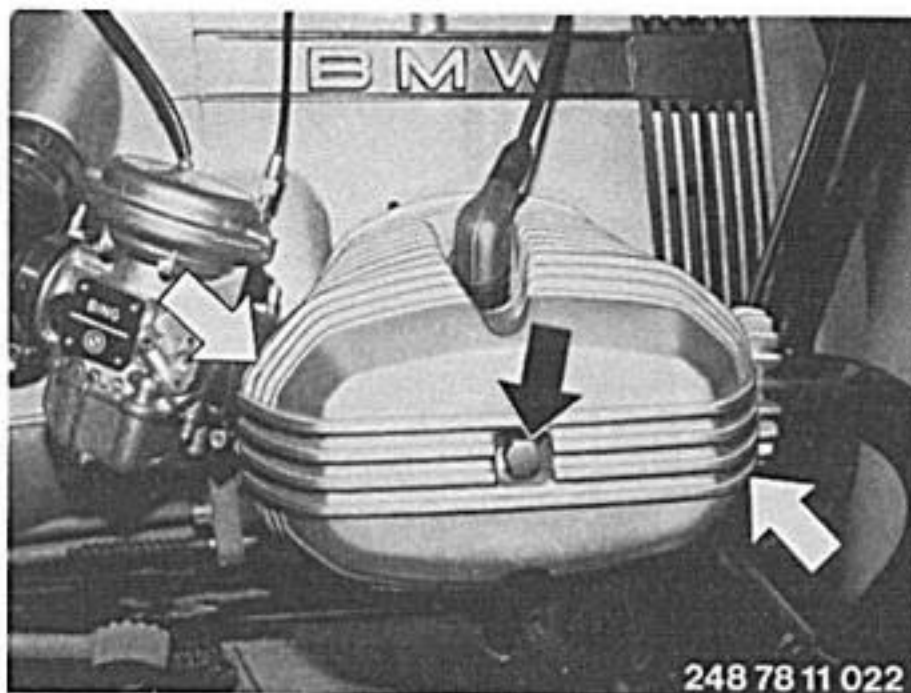
Engine removed (11 00 050) or installed.

If engine remains installed, detach exhaust system.

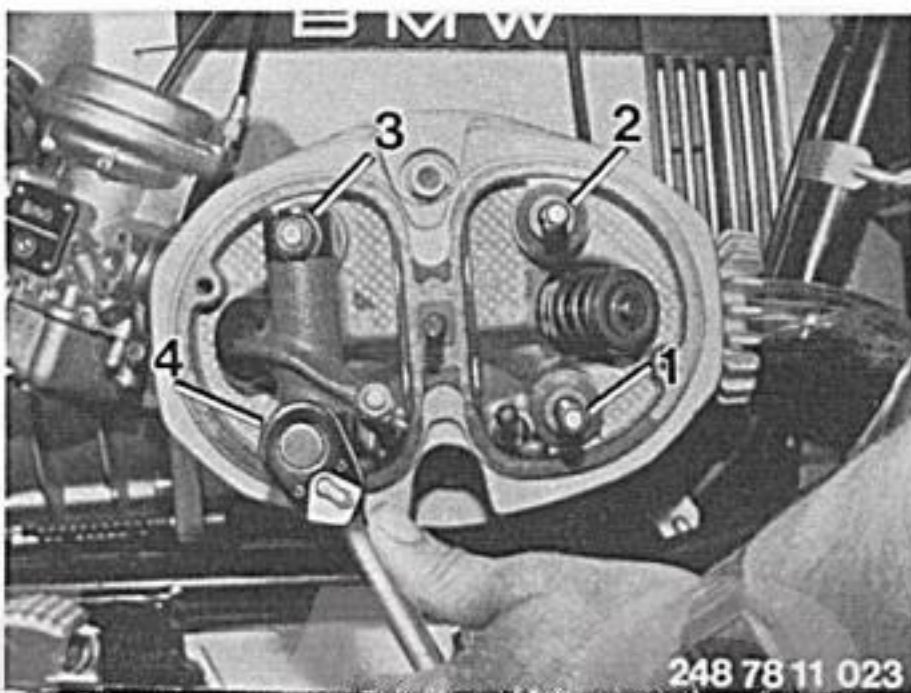
When installing:

Before tightening the cylinder heads down, insert both exhaust pipes with cross-tube into the exhaust ports.

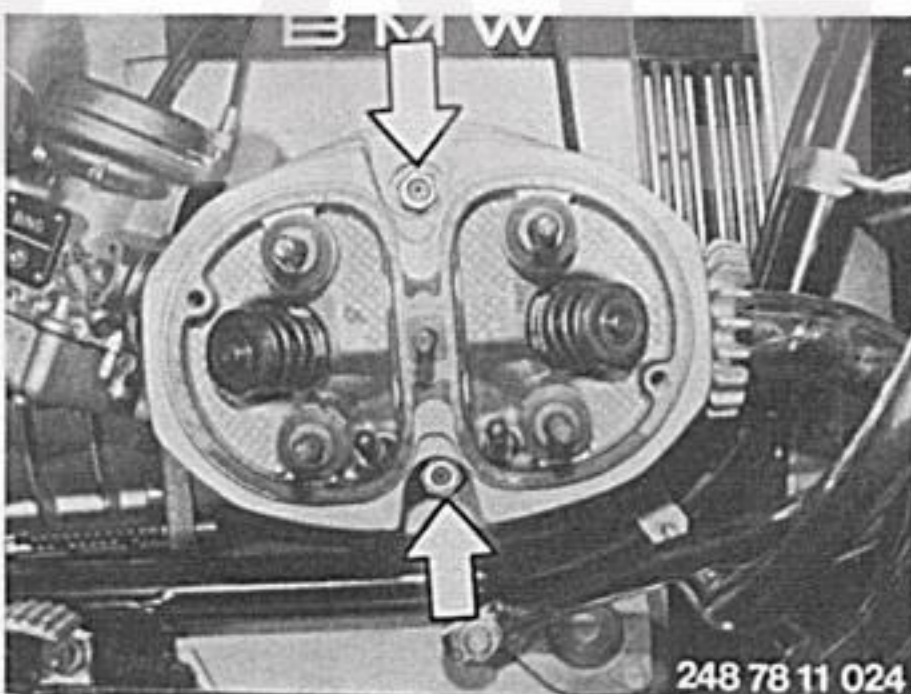
Slacken the cap nut and the two nuts (arrows) and remove the rocker cover and gasket.



Slacken the shouldered nuts, remove both rockers from the tierod bolts and pull out the pushrods.

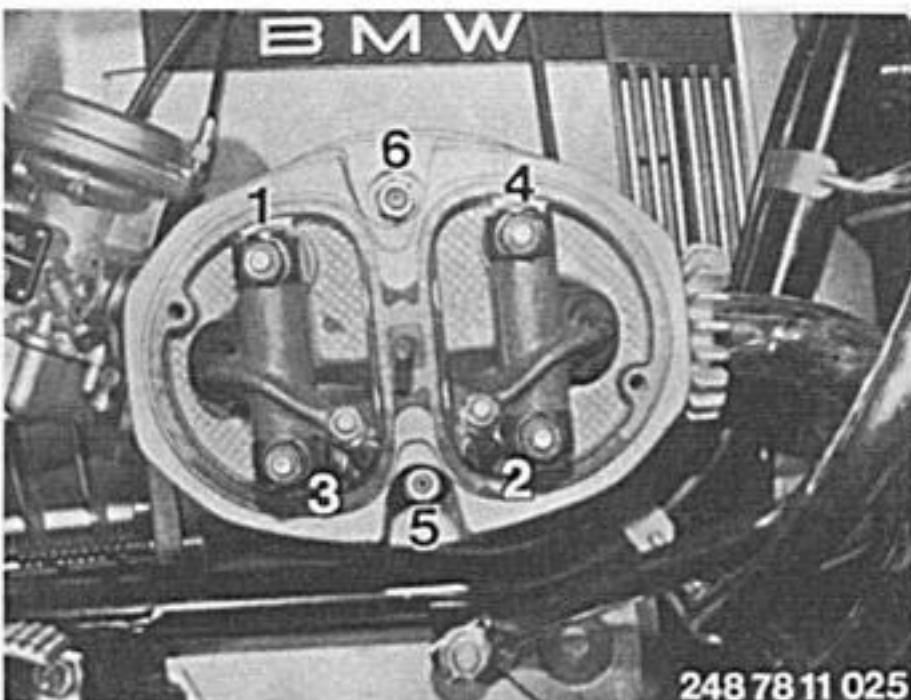


Unscrew the two hex. nuts (arrows). Using a plastic-headed hammer, drive the cylinder head away from the cylinder and pull off at the tierod bolts.



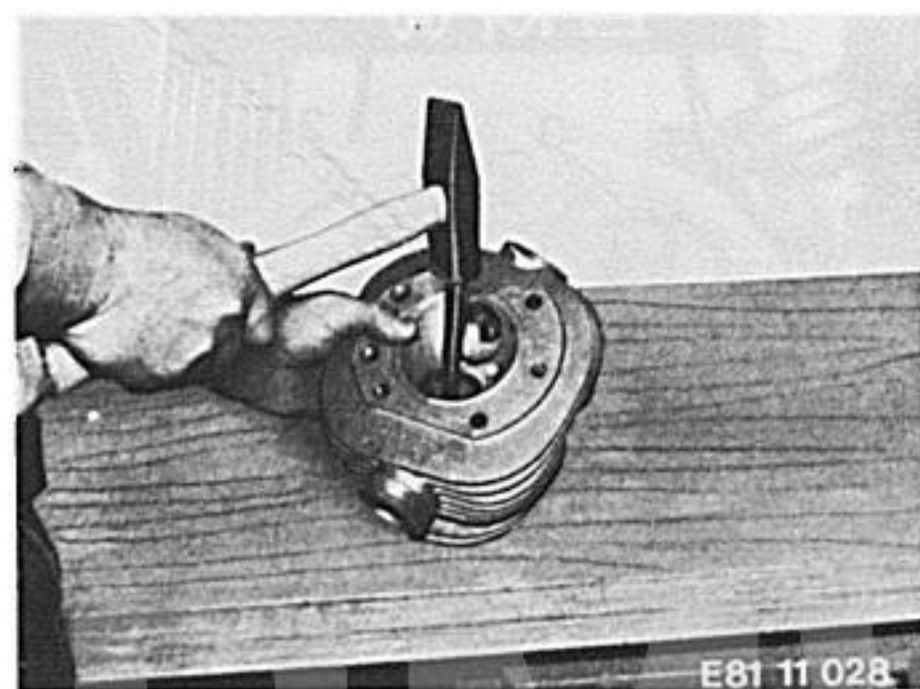
Instructions for installing cylinder head

Tighten the cylinder head nuts with the engine cold in three stages; for tightening order, see sketch. For tightening torques, see Specifications.

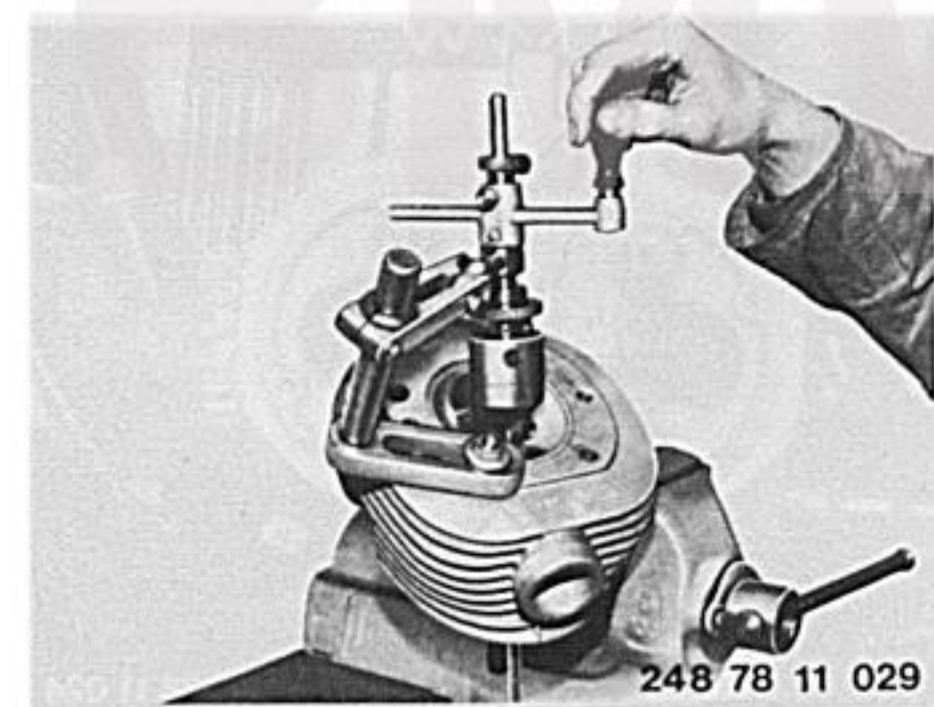




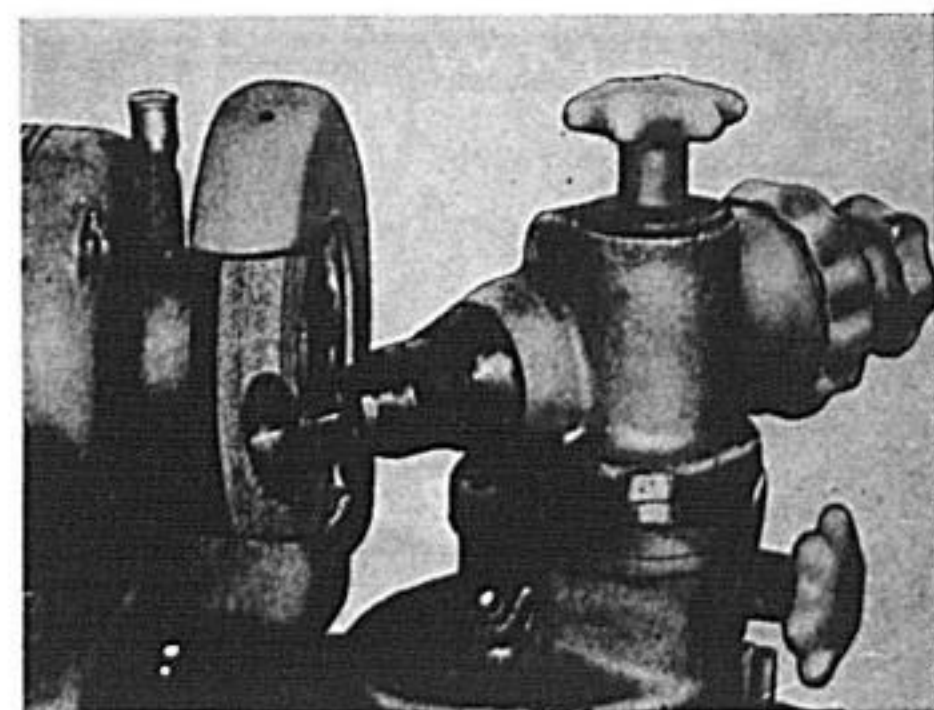
248 78 11 027



E81 11 028



248 78 11 029



11 12 513 Cylinder head – stripping, regrinding valves, assembling

Remove (install) cylinder head 11 12 080.

Attach valve spring clamp BMW No. 11 1 750, tension the valve spring, remove the valve collet and pull out the valve.

Check cylinder head for:

- a) Cracks and condition of joint face
 - b) Firm seating of valve guides (see picture) and valve seats
 - c) Valve guide wear
 - d) Surface condition of pressure face and ball socket
 - e) Radial play at rockers
 - f) Valve spring lengths and spring forces (see Specifications)
 - g) Firm seating of screw-in stub pipes for carburetors.
- If necessary, clean the threads and apply Loctite 270.

Regrinding valve seats

Regrind the valve seat rings in the cylinder head with the Hunger valve seat tool. Seat angle $45^\circ + 20'$. Seat contact face width for inlet valve 1.5 mm (0.06 in), for exhaust valve 2.0 mm (0.08 in) measured at 45° angle. Bevel towards combustion chamber 15° , towards inlet and exhaust ports 75° . The joint face should be close to the maximum valve seat diameter.

Regrind the seat on the valve to $45^\circ 20'$ in the grinding machine. Regrinding must not reduce the valve head edge thickness to below 1 mm (0.04 in). Reground valve heads and valve seat rings machined with Hunger unit do not need to be ground in, but after the valves have been installed a leakage test should be carried out by pouring gasoline (petrol) into the valve chamber.

11 12 561 Valve guides – renewing

Remove and install cylinder head – 11 12 080.

Strip down cylinder head and grind in valves – 11 12 513.

Lower the old valve guide at the top as far as the circlip, then drive the valve guides through into the combustion chamber with BMW 11 1 760 drift, after heating the cylinder head to 240 . . . 260°C (465 . . . 500° F).

Alternatively:

Heat the cylinder head for 2 ½ hours to 240 . . . 260° C (465 . . . 500° F), then knock out the valve guide from the combustion chamber side with BMW drift 11 1 760.

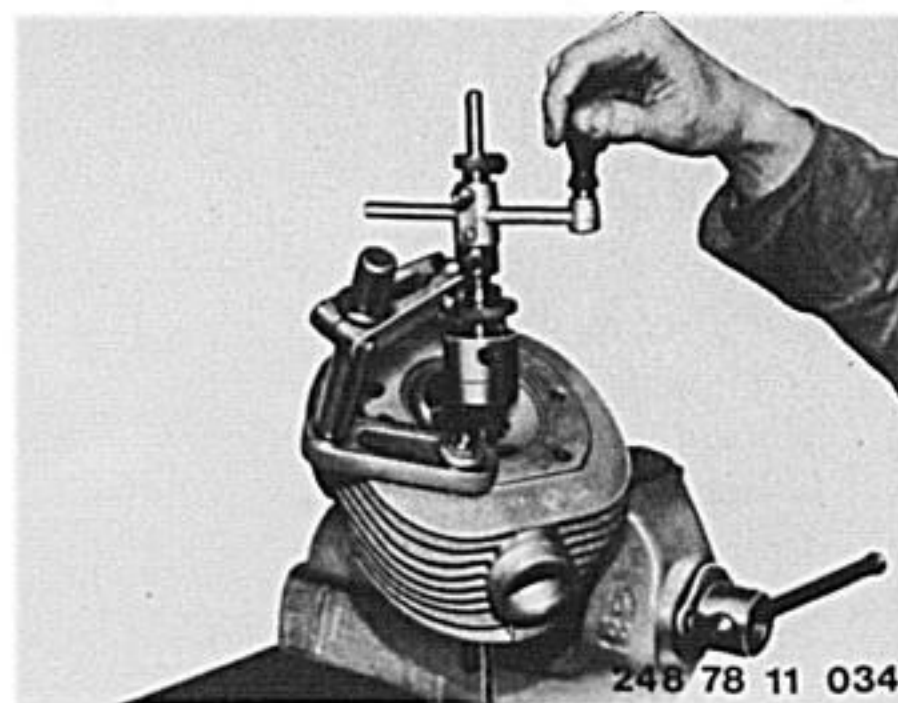
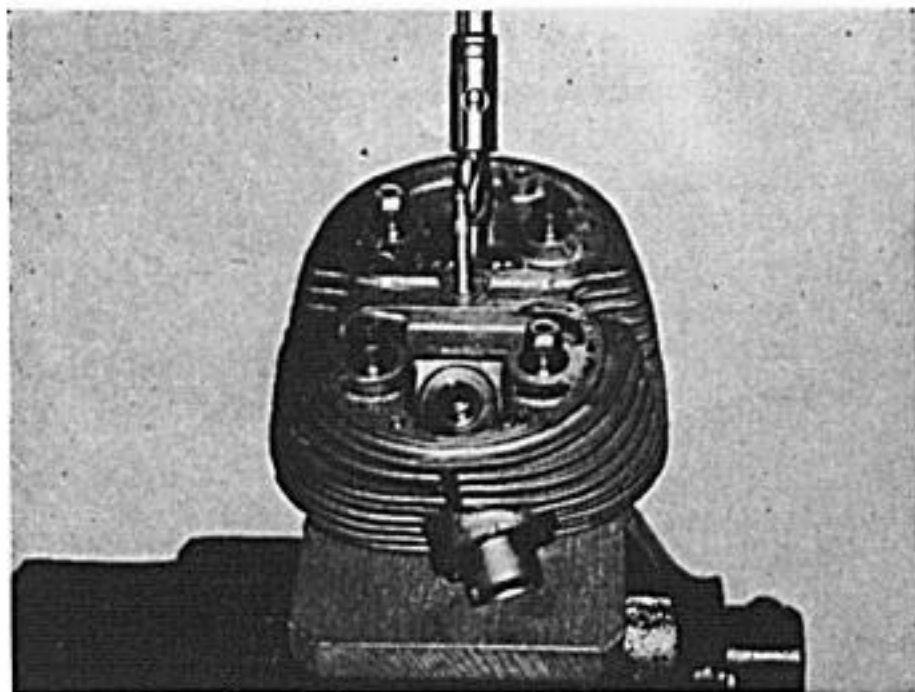
For valve guide and valve guide bore oversizes in cylinder head, see Specifications.

Drive in the new valve guides (see Specifications) with BMW drift 11 1 770; the cylinder head must have been heated to 250° C (482° F).

Place the cylinder head on its side so that the valve guide does not slide in too far.

After the valve guide has cooled down, ream it out with a fixed valve guide reamer, size 7 H7.

Reground the seat on the valve to 45° 20' in the grinding machine. Regrinding must not reduce the valve head edge thickness to below 1 mm (0.04 in). Reground valve heads and valve seat rings machined with Hunger unit do not need to be ground in, but after the valves have been installed a leakage test should be carried out by pouring gasoline (petrol) into the valve chamber.



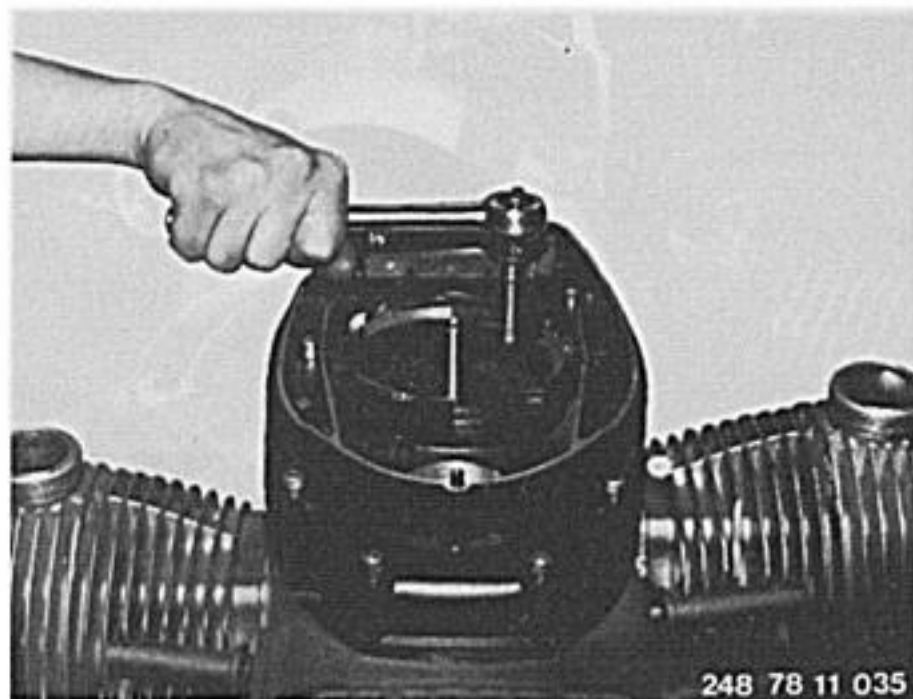
11 14 060 Timing chain cover — detaching and attaching

Engine removed (11 00 050) or installed.

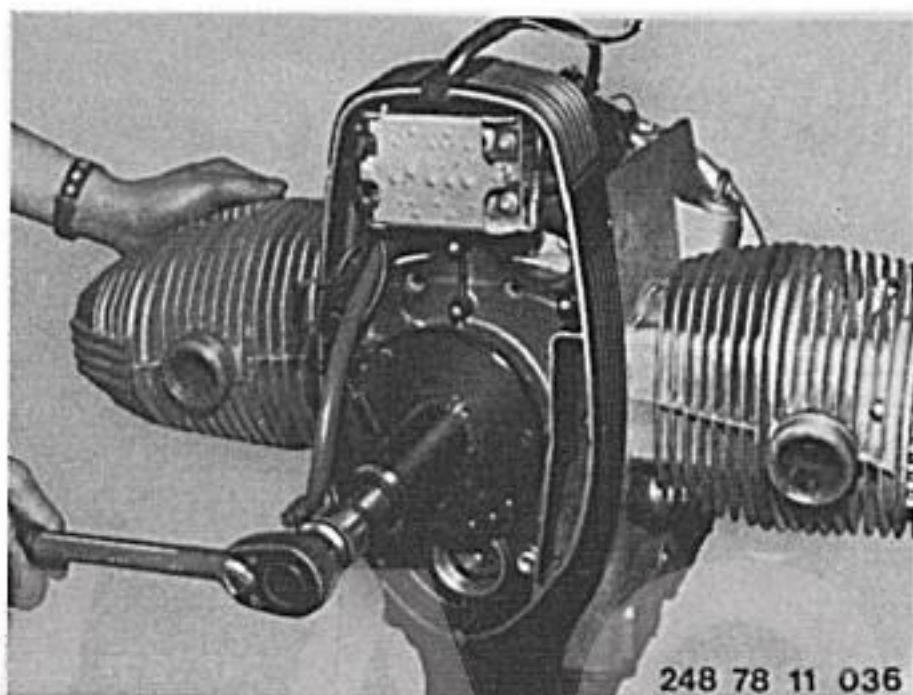
Remove and install alternator — 12 31 020.

Remove and install ignition contact assembly — 12 11 060.

Remove the nine Allen screws and three internal hexagon nuts.



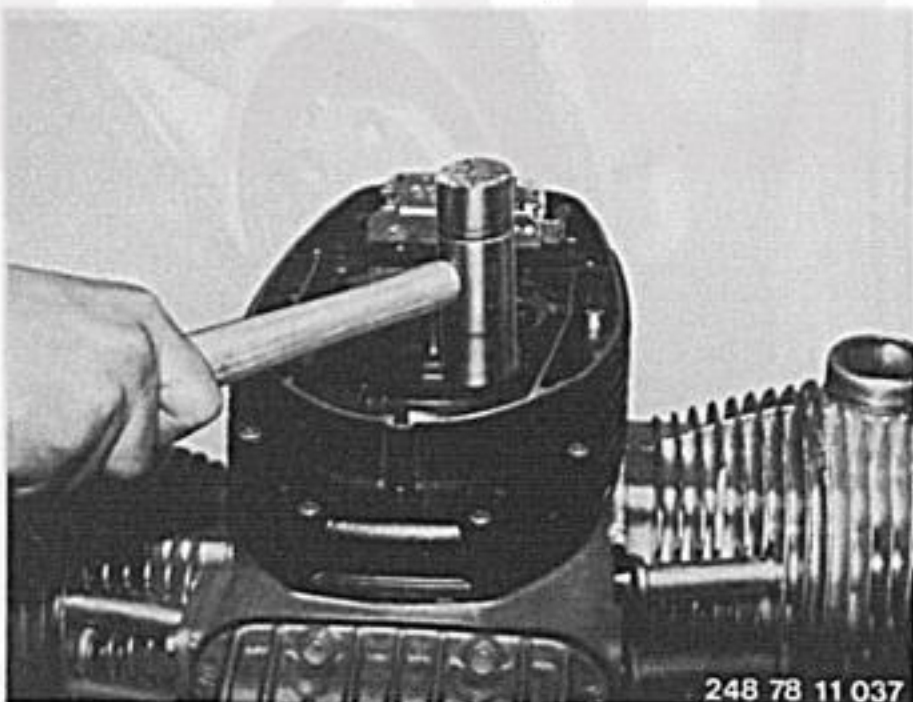
Screw BMW puller 11 1 800 to the tapped mounting holes for the alternator housing, using three M5 Allen screws. Attach the thrust head for the puller and pull off the cover.



Attaching timing chain cover

Heat the cover at the ball bearing seat to approx. 80° C (175° F) and place on the engine block.

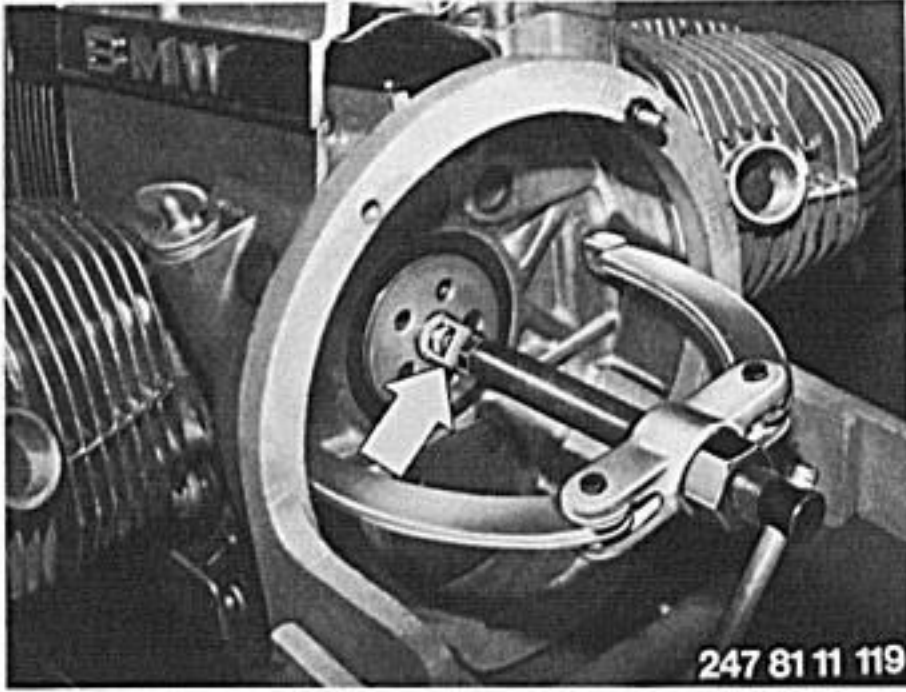
Tighten the Allen screws and nuts, beginning at the center. Remove trapped stresses in the deep-groove ball bearing by striking the bearing seat several times with a plastic-headed hammer.



11 14 651 Radial sealing ring for crankshaft — renewing

Detach and attach timing chain cover — 11 14 060.

Drive in shaft seal for alternator with BMW drift 11 1 850.



11 14 151 Radial seal for crankshaft (clutch end) – renewing

To pull out the seal:

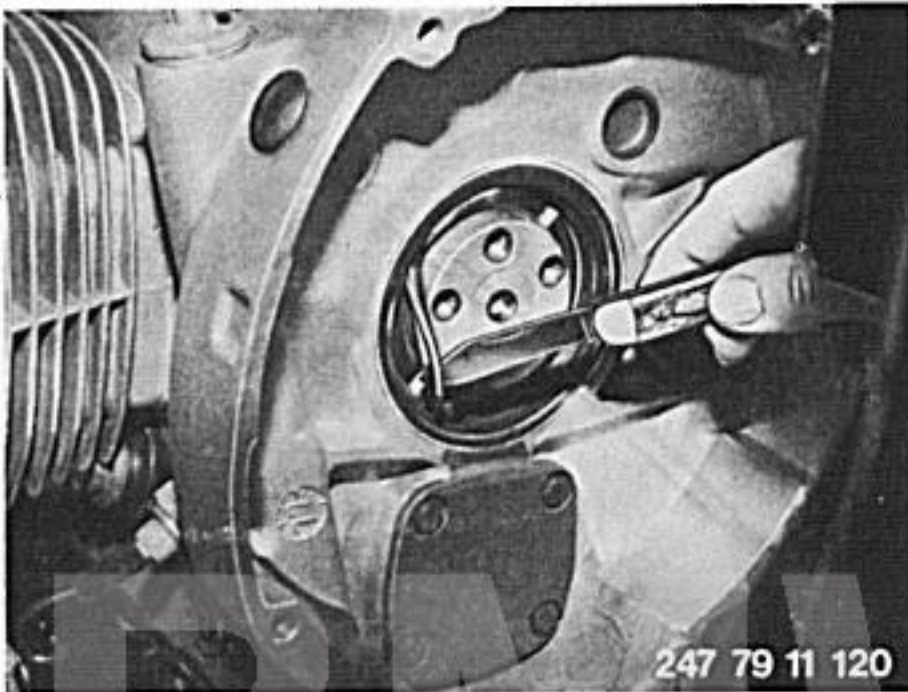
Remove (install) flywheel or clutch housing – 11 22 000.

From 1981 models on, the thrust ring must be pulled off the crankshaft before the radial seal can be extracted.

Offer up puller BMW No. 11 1 870 (arrow) from the side, and pull off the thrust ring using support bridge BMW No. 00 8 550.



Cut into the sealing ring lip for a length of app. 5 cm (2 in) at the bottom left.



Attach the cross-member of puller BMW No. 11 1 890 to the engine block (at the top right and bottom left). Insert the puller spindle and pass the eccentric lug through the cutaway section of the sealing ring until it contacts the thrust washer. The lug should point downwards.

Turn the nut clockwise, holding the flats with a wrench, to pull out the sealing ring.

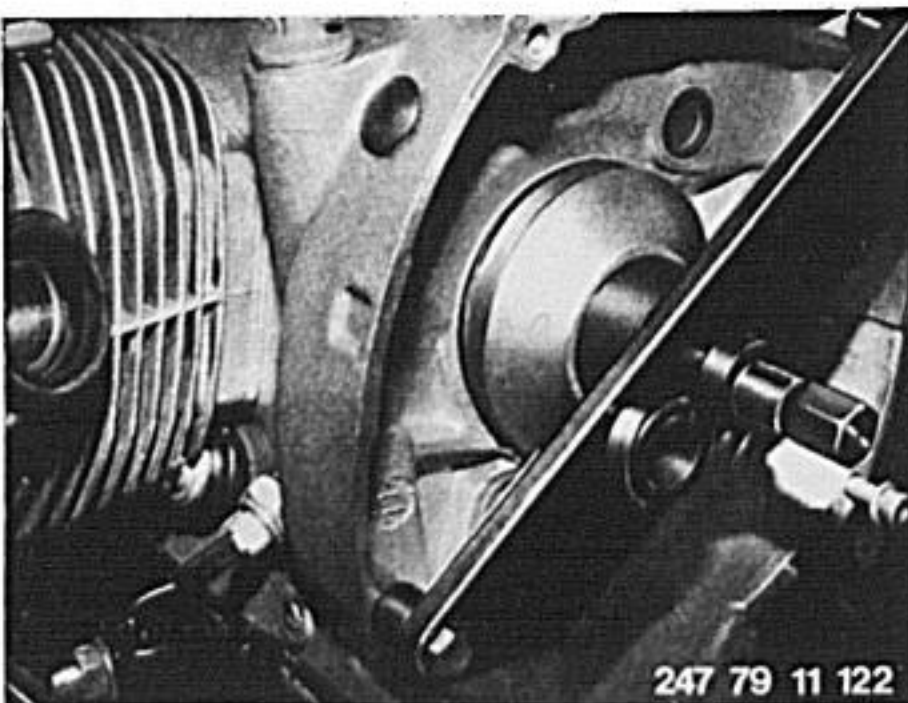
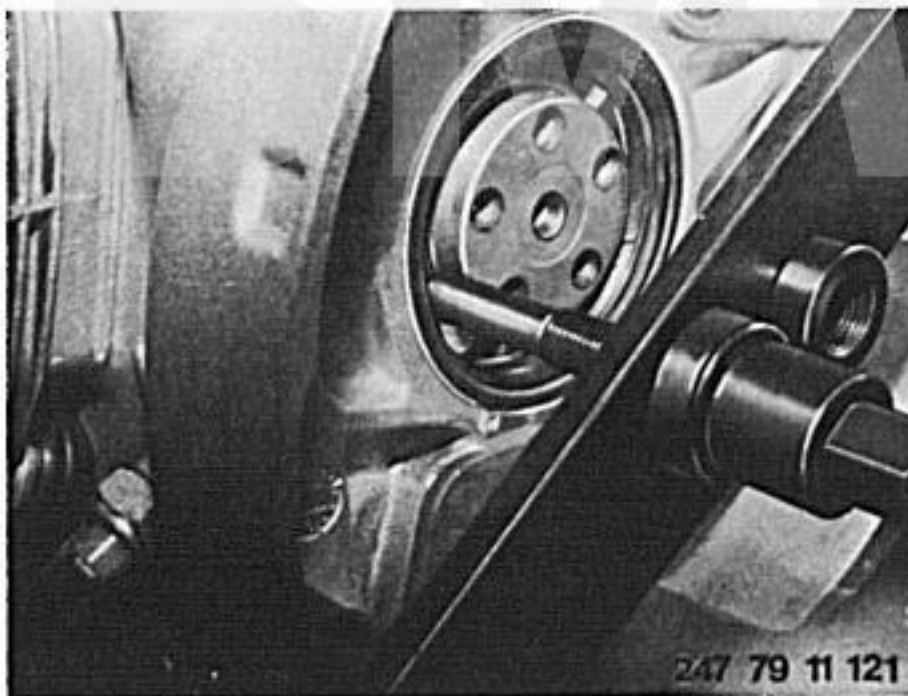


To press in the seal:

Attach the cross-member of installing tool BMW No. 11 1 890 to the engine block (at top on right and bottom on left).

Attach the sealing ring to drift BMW No. 11 1 880, and place the thrust head in position.

Offer up the drift to the engine block, screw the spindle through to the front and press in the sealing ring.



11 14 651 Radial seal for crankshaft (alternator end) – renewing

Detach (attach) the timing chain cover – 11 14 060.

Insert the radial sealing ring for the alternator with drift
BMW No. 11 1 850.

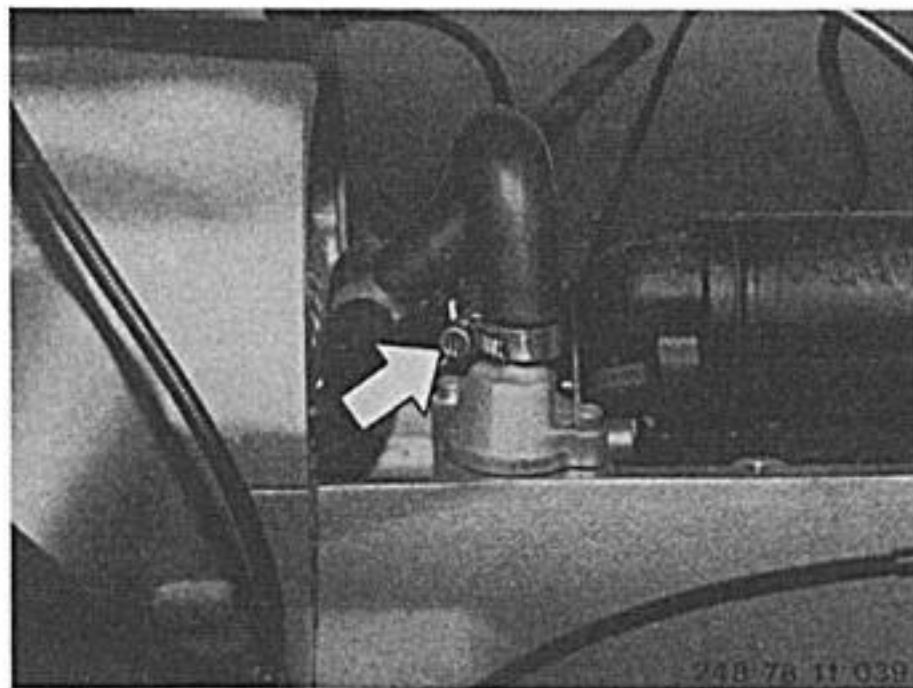


BMW AG

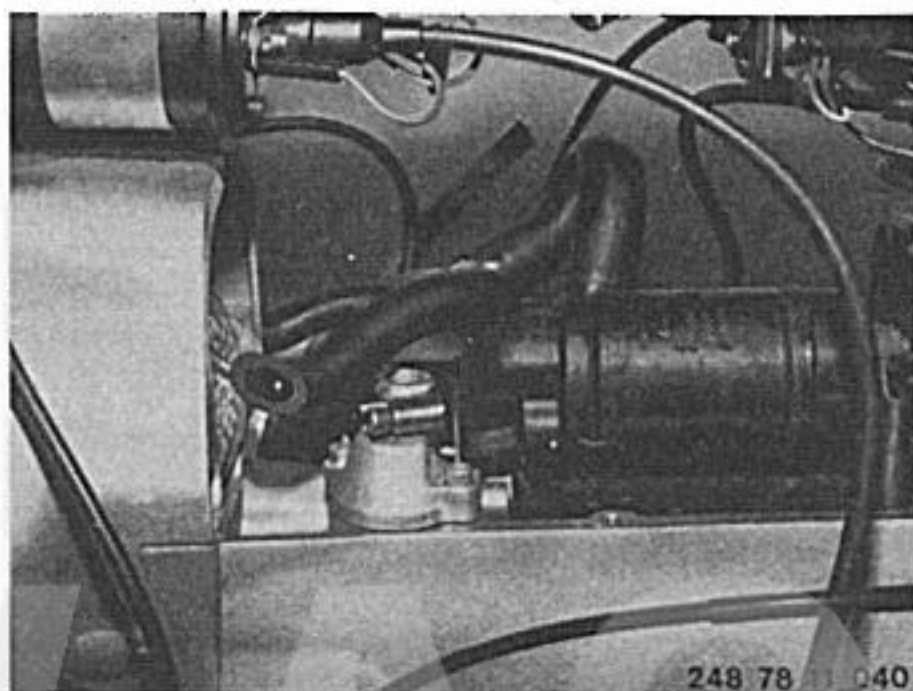
11 15 101 Engine breather hose – renewing

Remove the fuel tank – 16 11 030.

Unscrew the starter cover and remove to the right. Release the retaining clip at the breather head with a screwdriver (arrow).



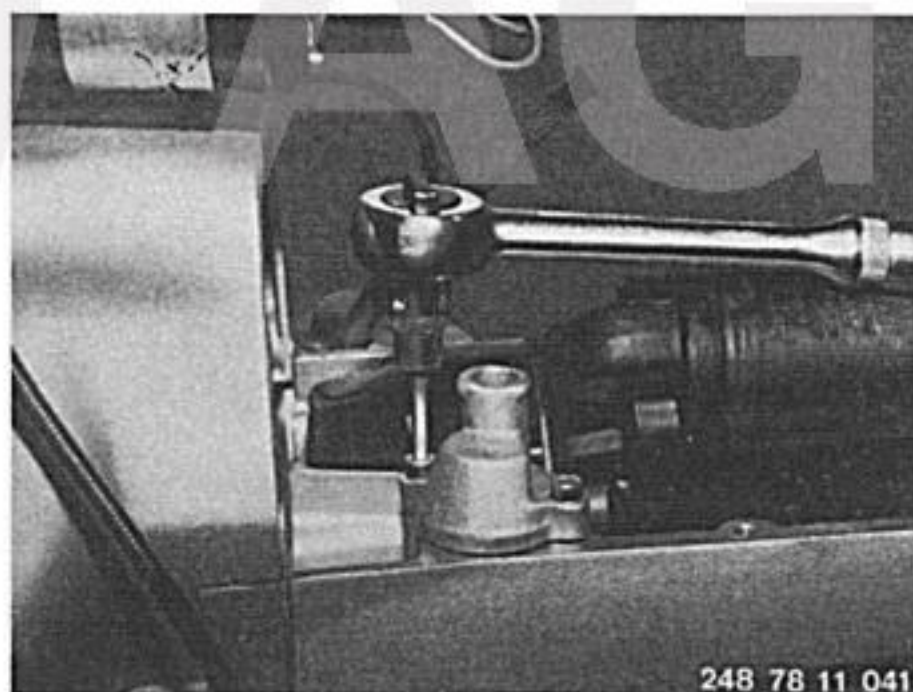
Pull the breather hose out of the air cleaner housing left and right, and detach from the breather head.



11 15 111 Check valve for engine breather – renewing

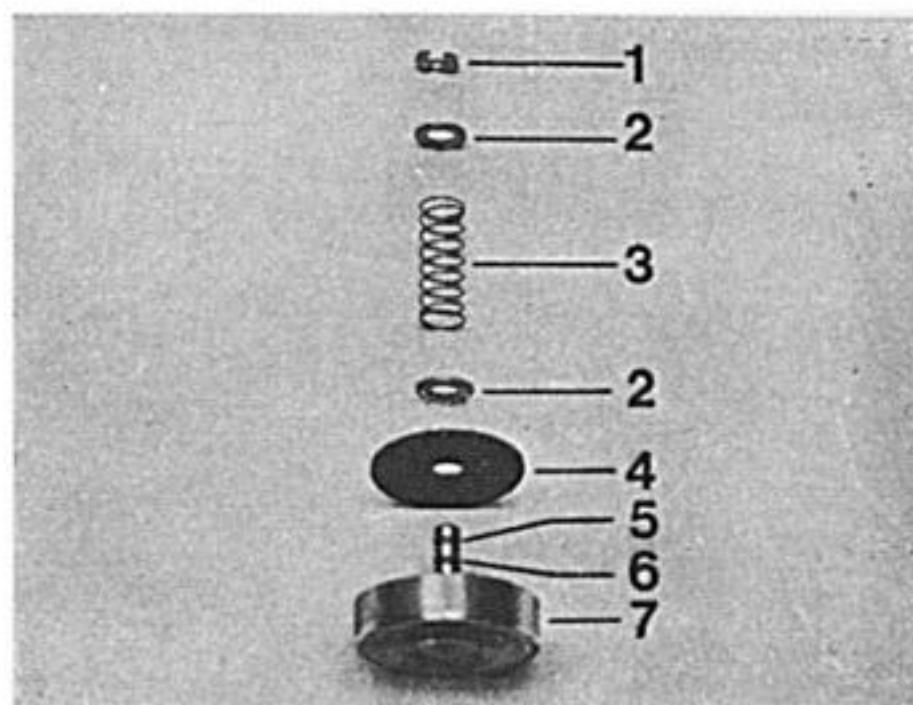
Renew engine breather hose – 11 15 101.

Remove the two Allen screws and take off the breather head.



Check valve (engine breather)

- 1 Keeper
- 2 Washer
- 3 Spring
- 4 Valve plate
- 5 Groove for spring preload (R 45, R 65)
- 6 Groove
- 7 Valve body

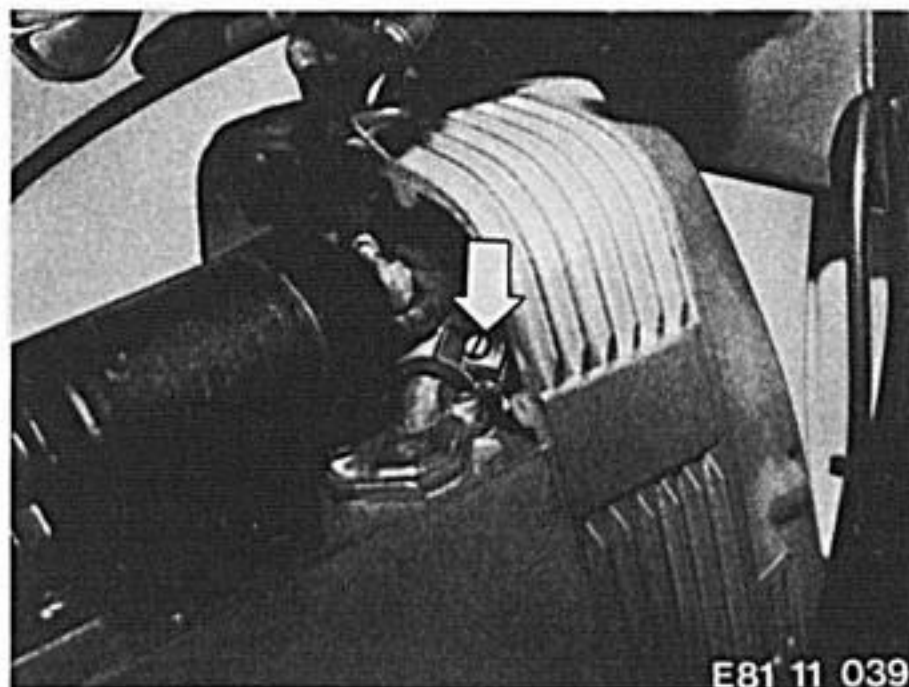


11 15 101 Engine breather hose –renewing (1981 models)

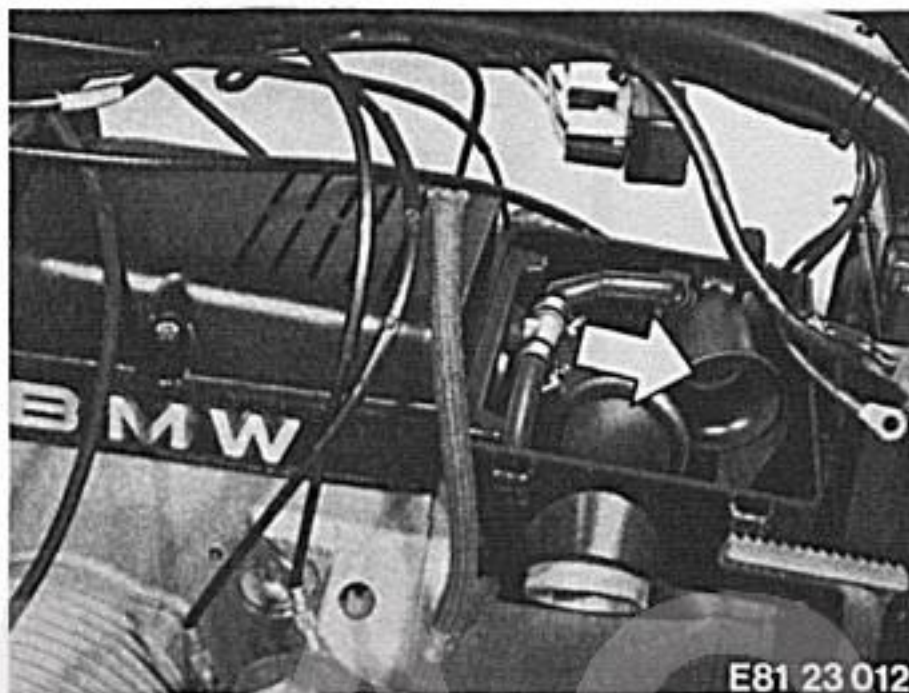
Take off the fuel tank (16 11 030).

Take off the upper section of the air cleaning housing. Pull out the filter element (13 72 000).

Unscrew and remove the Allen screws in the starter motor cover and take off the cover. Using a screwdriver, loosen the clamp strap on the breather dome (arrow) and push back the breather hose.



Pull the T-piece for the crankcase breather out of the air cleaner housing in the direction of the arrow. Press the breather hose back out of the air cleaner housing.



11 21 001 Crankshaft – removing and installing

Remove and install timing case cover – 11 14 060.

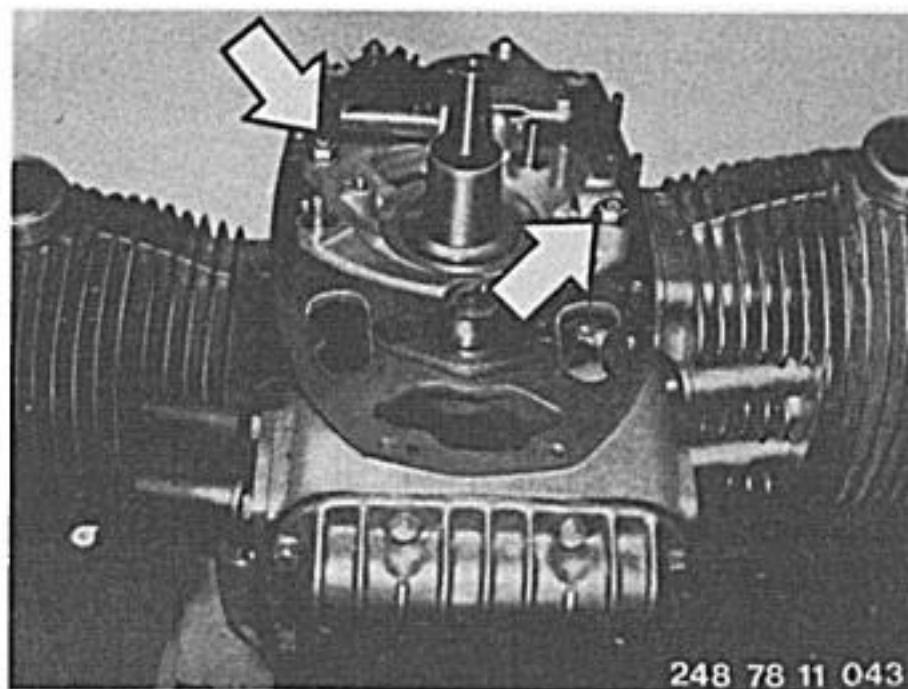
Remove and install chain sprockets – 11 31 061.

Remove and install pistons – 11 25 000.

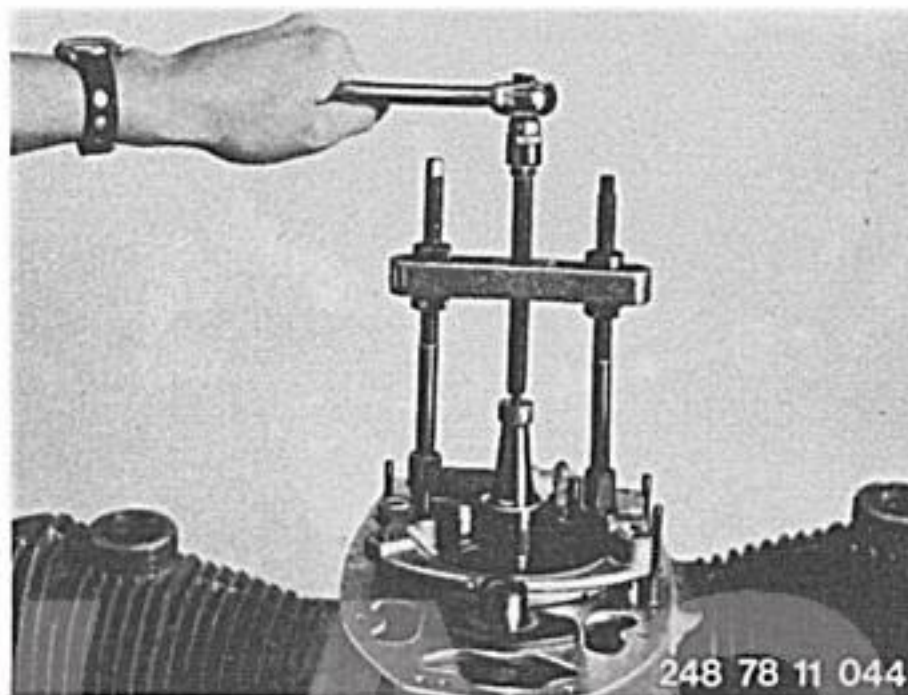
Remove and install connecting rods – 11 24 000.

Remove and install flywheel or clutch housing – 11 22 000.

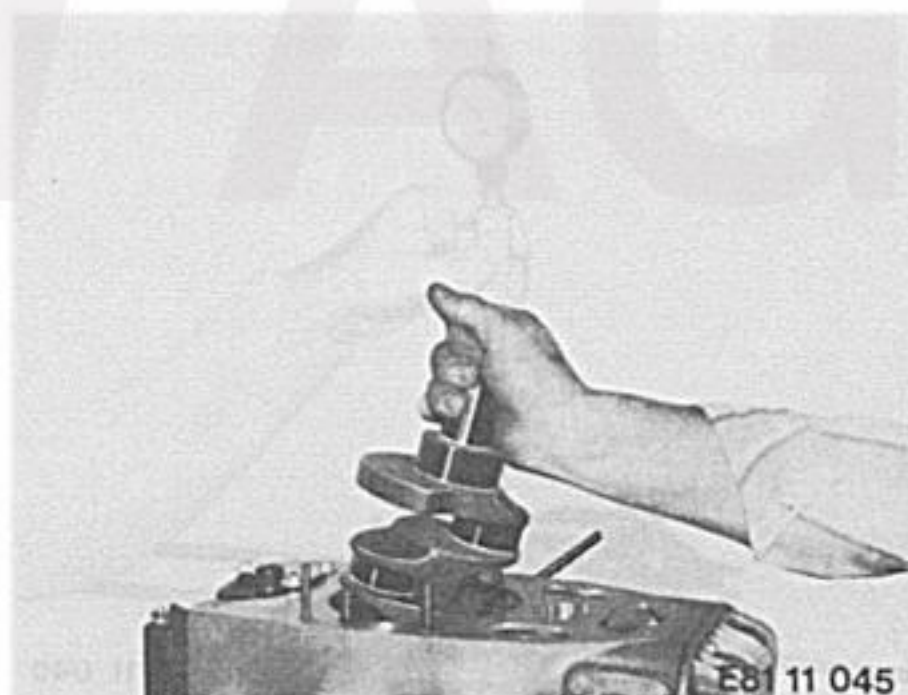
Unscrew retaining nuts at bearing cap.



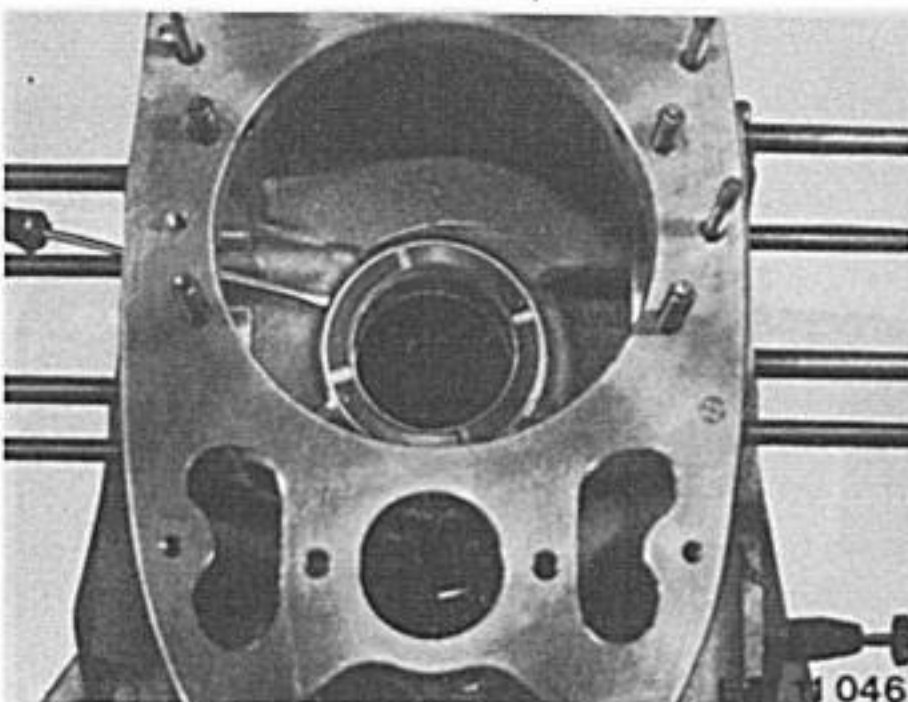
Position the engine vertically. Insert the two bolts of BMW puller 00 7 500 in the tapped holes provided on the main bearing cap. Mount the puller bridge parallel to the main bearing cap, not forgetting the pressure head for the puller. Pull off the main bearing cap.



Pull the crankshaft out of the engine block.



Using a screwdriver, strike the two thrust washers to remove them from the locating pegs.





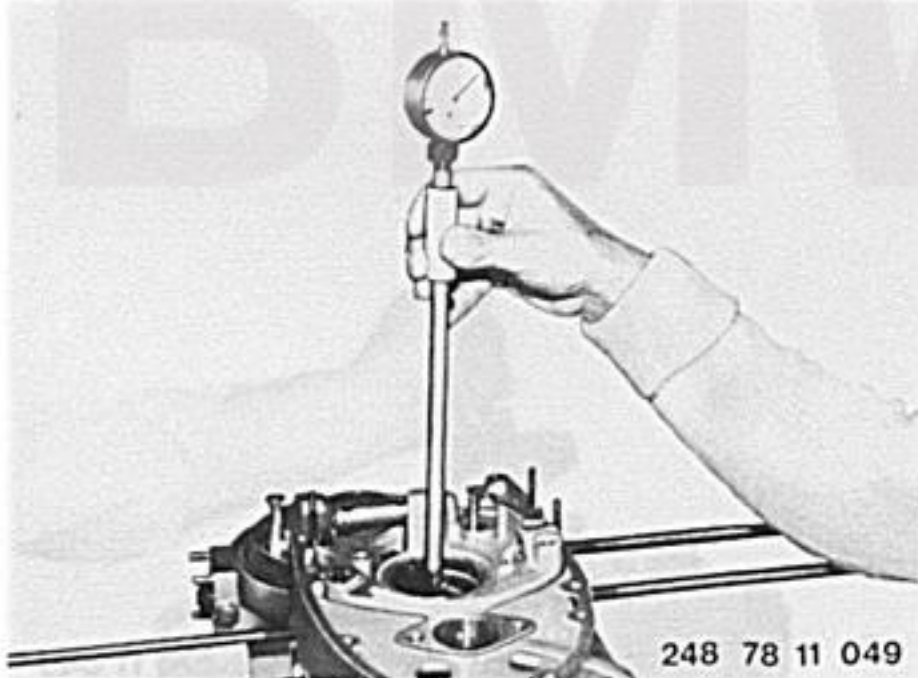
Measure the crankshaft and the bearing bushing.

The main bearing journals must be measured with the micrometer at two points with a 90° included angle, and on two planes.

Front plane



Rear plane



Measure the front main bearing only with the bearing cap installed.

Note:

Before installing the bearing cap, heat the crankcase to 100...120° C (212...248° F).

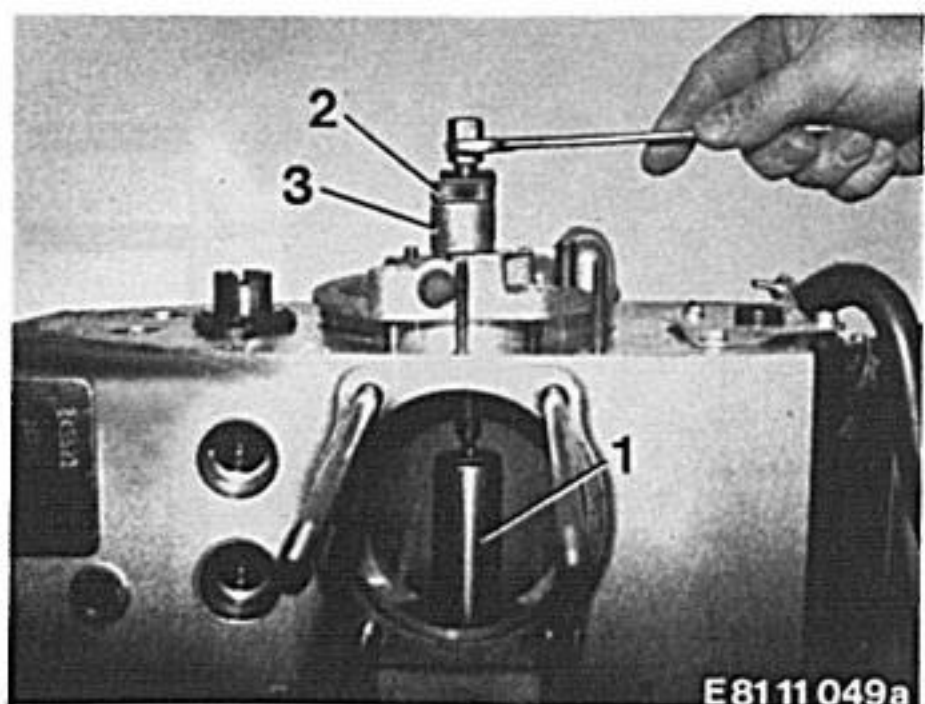
Allow the crankcase to cool down again before measuring.

Warning:

Always use the report sheet provided for main bearing play measurements – see Specifications.



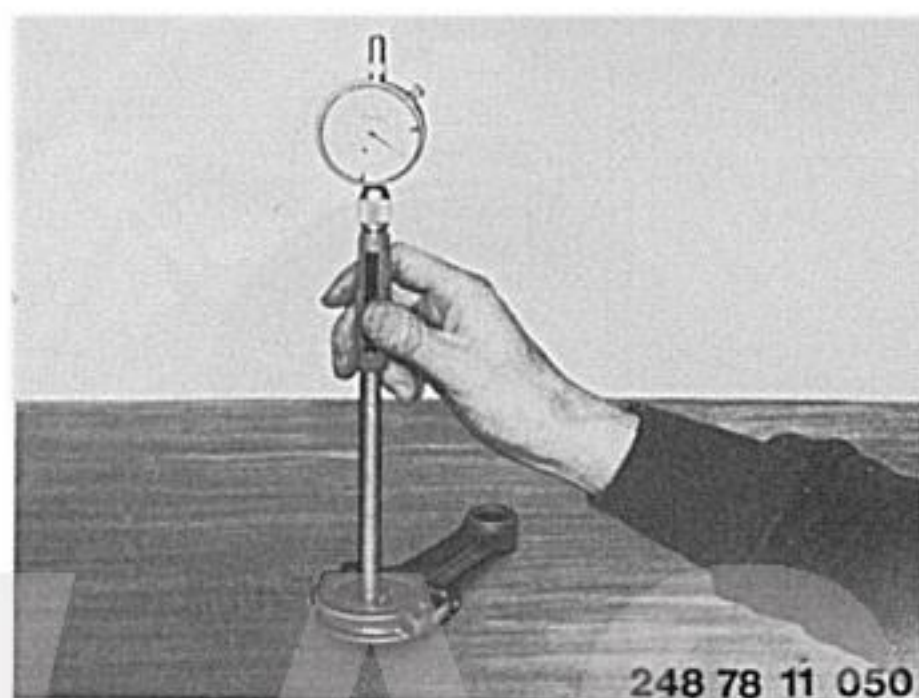
To press off the bearing cap (crankshaft removed), insert the arbor for the main bearings, BMW No. 11 2 720 (1) into the rear bearing. Using screw nipple BMW No. 11 1 710 (2) and the forcing-off bridge with spindle from Kukko extractor 17 K (3), force off the bearing cap.

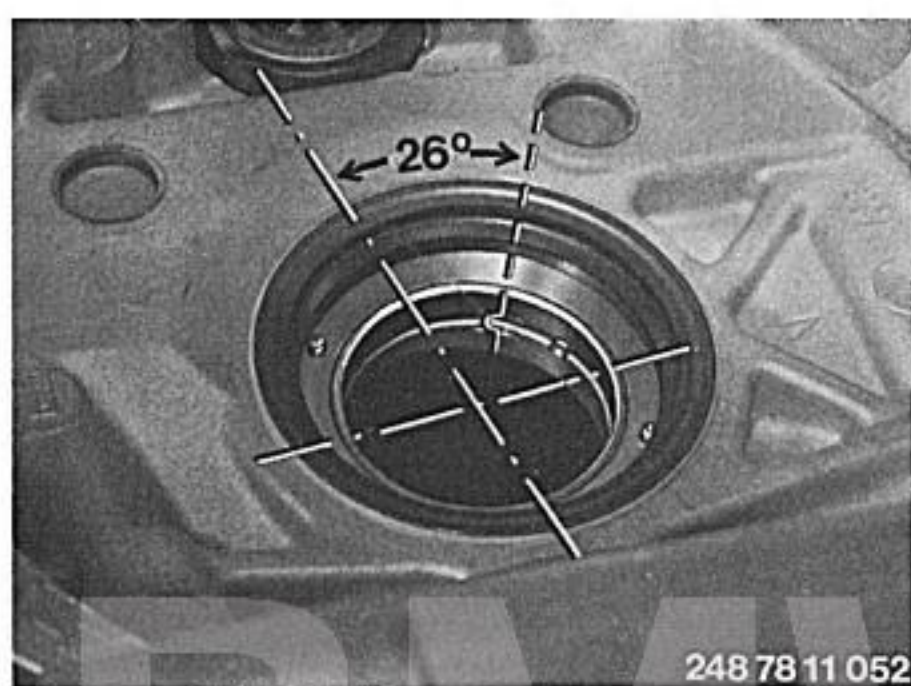
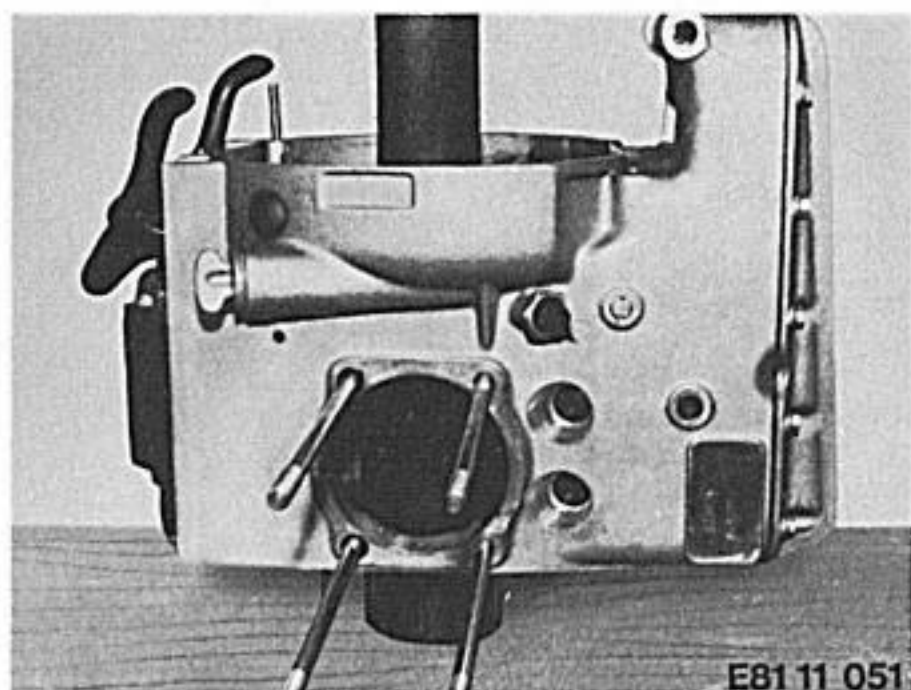


Crankpin
Measure the crankpin.



Measure the big end bearing, in both cases in the same manner as the crankshaft and main bearing bushing.
For bearing play, see Specifications.





11 21 531 Main bearing bushings – renewing

Renew crankshaft – 11 21 001.

Press main bearing bushing out of crankcase:

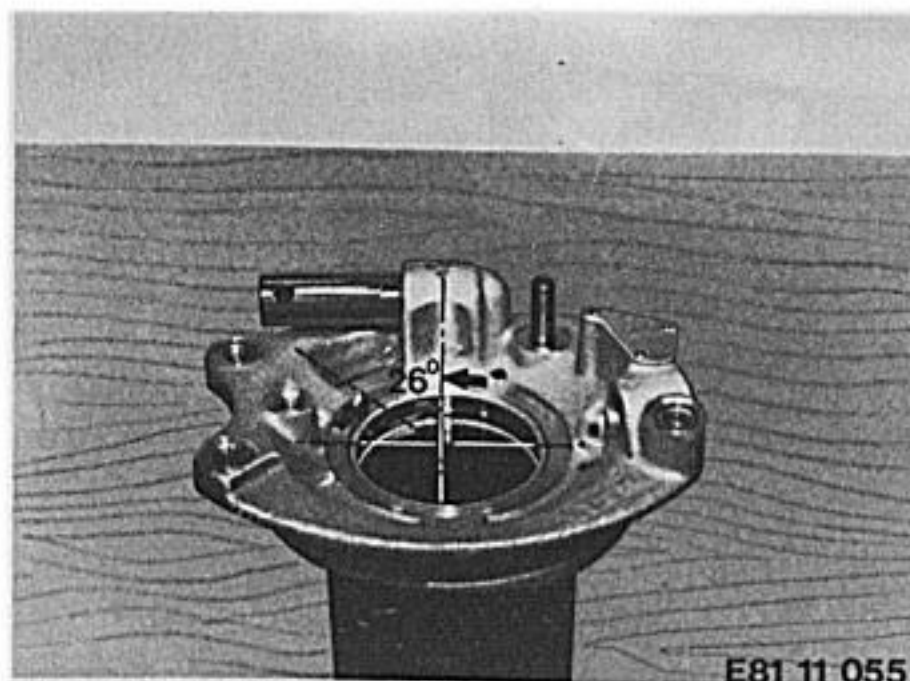
Heat crankcase to 100...120° C (212...248° F), then place over the cylinder of pressing-out tool BMW No. 11 2 710 in such a way that the locating pegs for the inner thrust washer engage in the bores provided in the cylinder. Using pressing-out arbor BMW No. 11 2 700, extract the bearing bushing with a hand press. When pressing in, use aluminium section of 11 2 710 with a section of tube as a reaction block.

Heat the crankcase to 100...120° C (212...248° F). Place the aluminium head of tool BMW No. 11 2 710 on the pressing-out cylinder. Place the crankcase over the tool so that the two locating pegs engage in the pores provided in the aluminium head. Offer up the new bearing bushing so that its gap is at the top right looking at the flywheel end of the engine, and the oil holes in the bearing bushing are at the bottom left and coincide with the bore in the engine block.

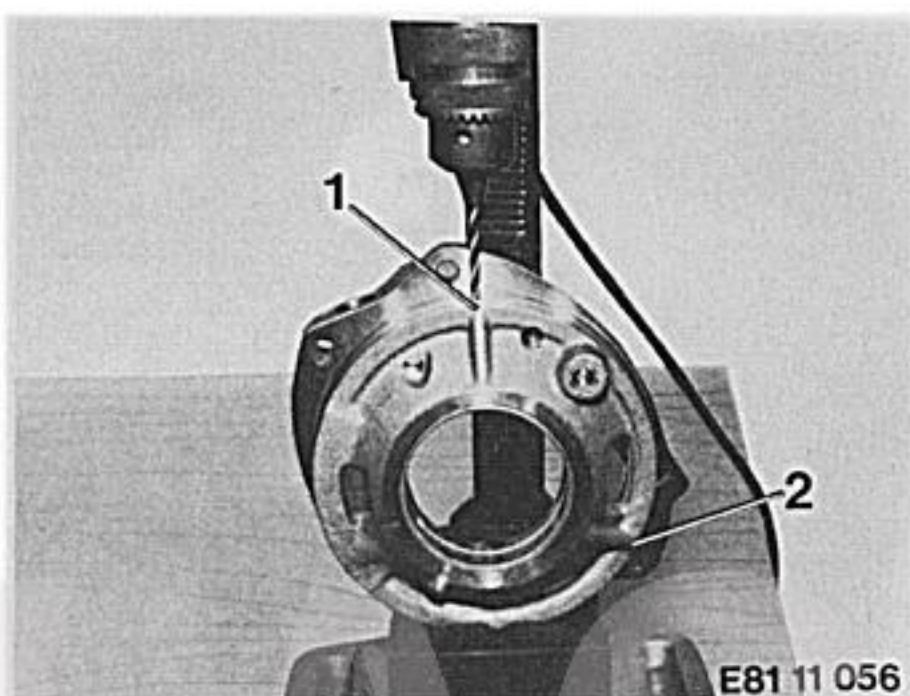
Insert pressing-in arbor with plastic bushing from tool BMW No. 11 2 710 into the bearing bushing. Make sure that the projecting locating pegs in the housing extend into the cutouts at the periphery of the pressing-in arbor after the bearing bushing has been pressed in. The size of the bearing bushing is such that it is slightly recessed in the engine block bearing bore at both sides.

Renewing the main bearing bushing in the main bearing cap: Knock out the bearing bushing locating peg from the inside. Heat the bearing cap to 100...120° C (212...248° F), and place on the cylinder of extracting tool BMW No. 11 2 710. Using pressing-out arbor BMW No. 11 2 700 and the hand press, extract the bearing bushing; alternatively, drive it out with a hammer.

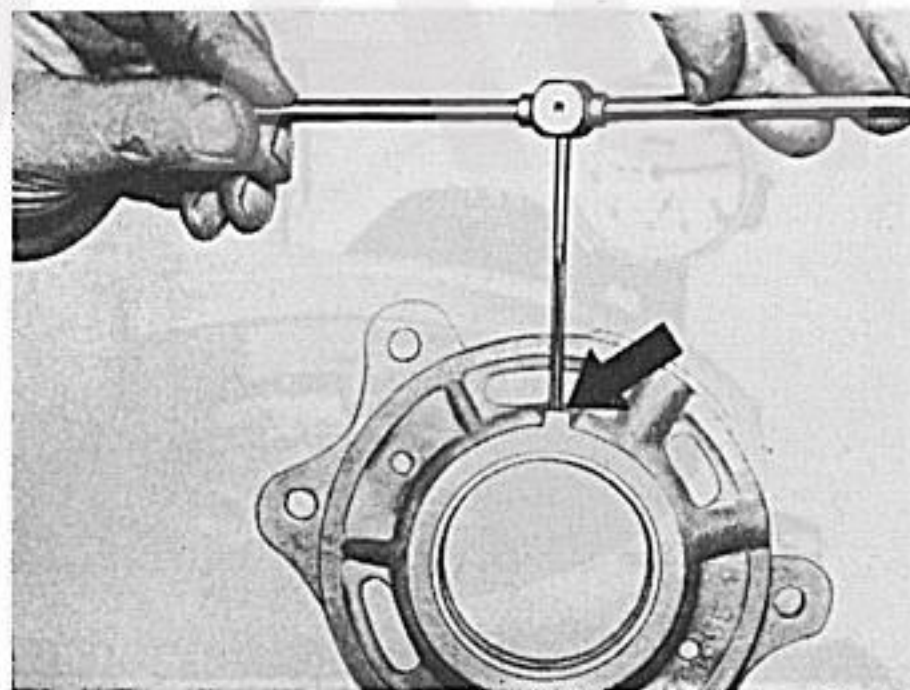
Heat the bearing cap to 100...120° C (212...248° F) and press in the new bearing bushing so that its end gap is at the upper left (looking at the installed bearing cap), with the oil holes vertical. The bearing bushing end gap should be at app. 26° from the vertical (arrow).



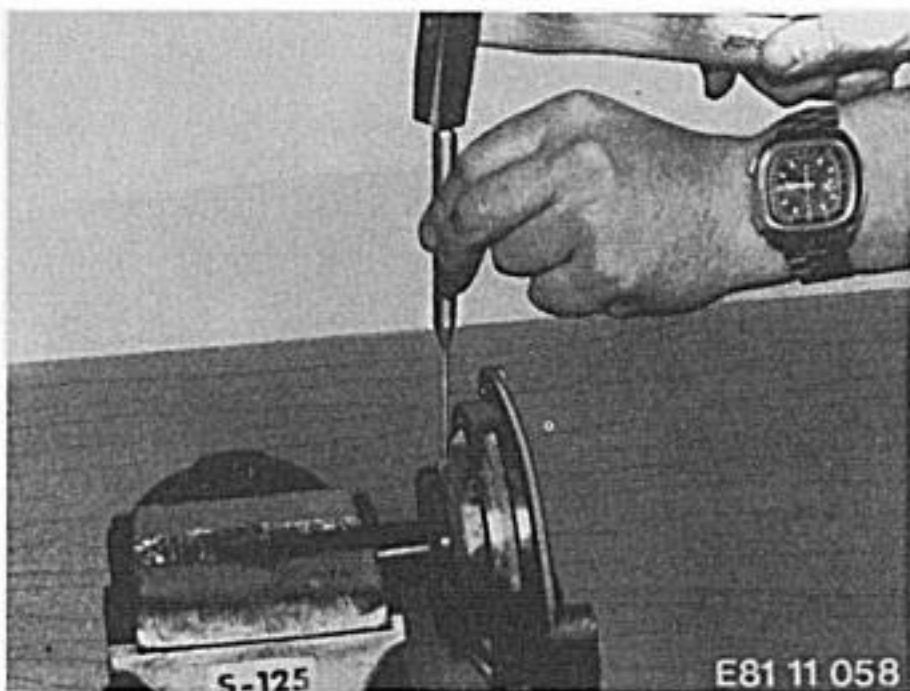
Clamp the bearing cap into a screw vice, using soft jaws. Through the two existing 3.2 mm dia. holes in the bearing cap, drill two additional oil holes (items 1 and 2) in the bearing bushings. Deburr the area round the holes in the bearing bushing most carefully.

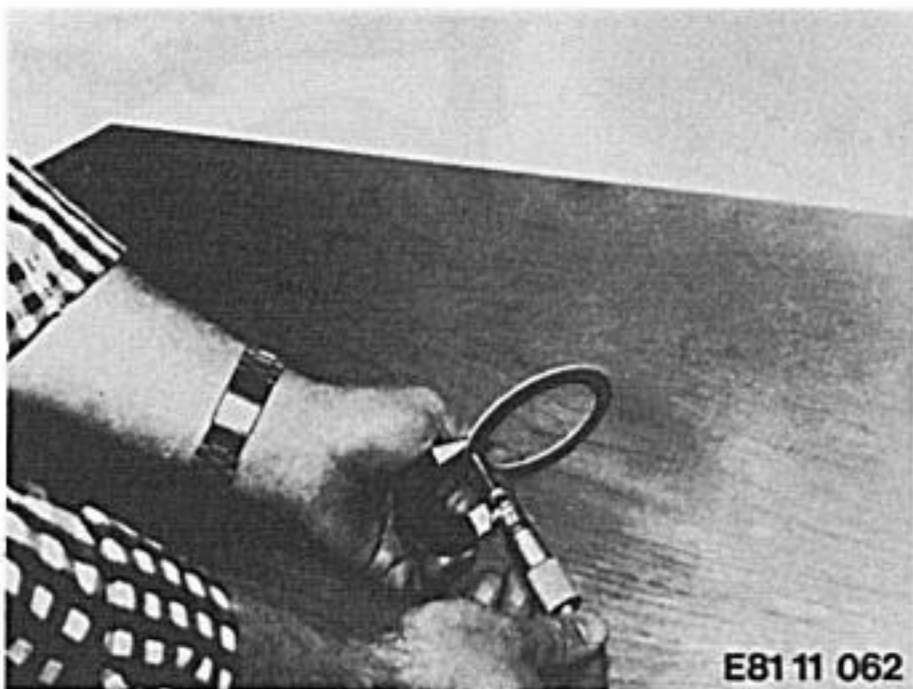
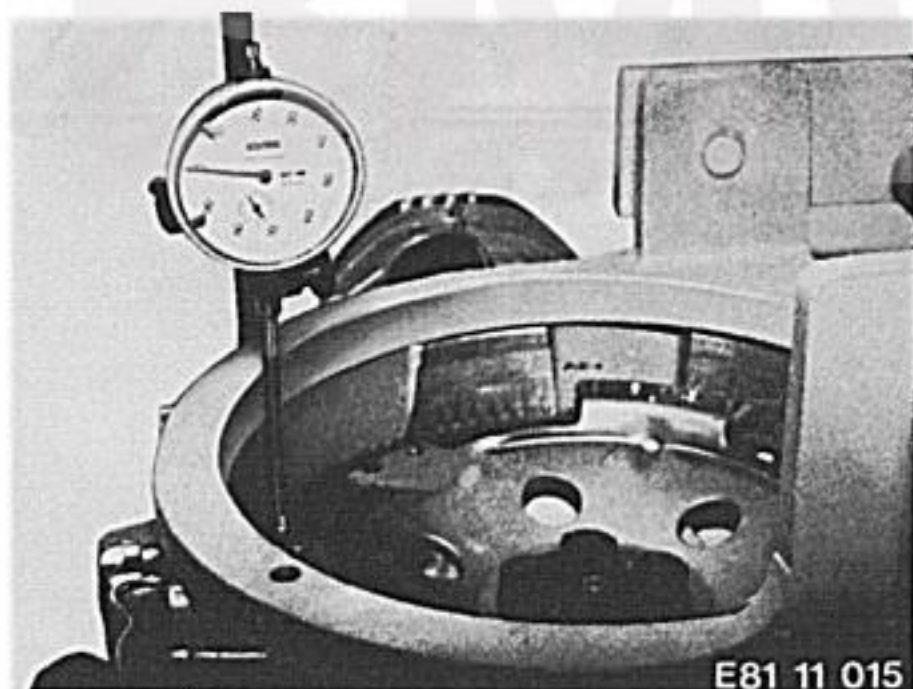
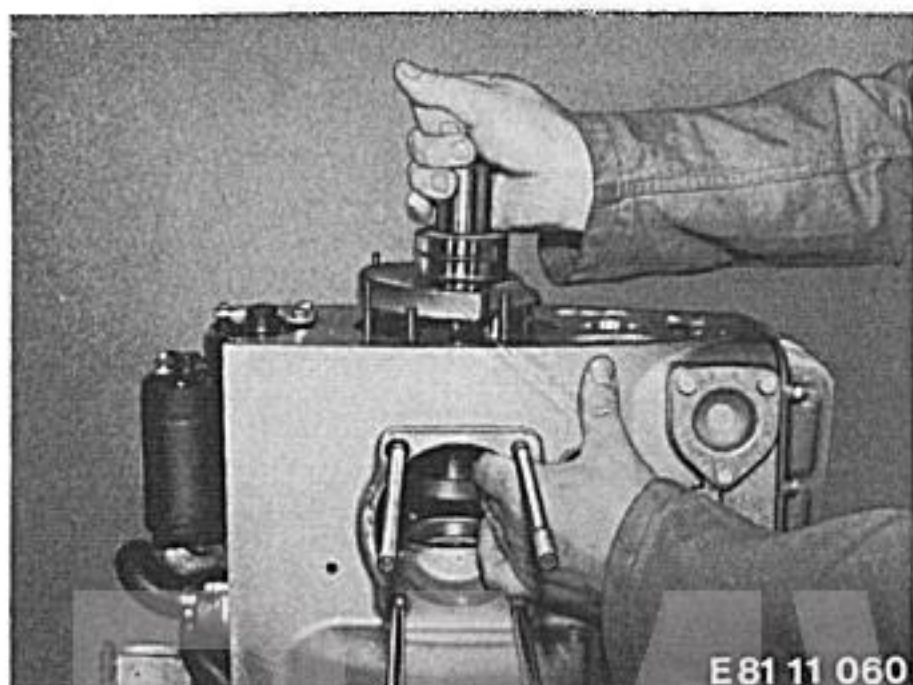
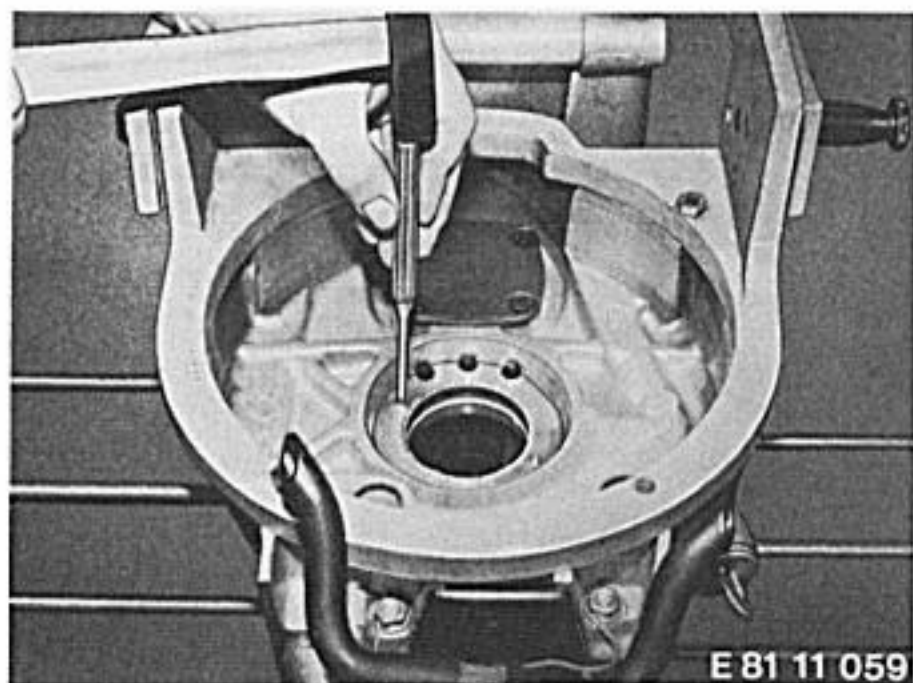


Secure the bearing bushing. Using a 3.9 mm twist drill, make a centre mark through the locating pin hole (4 mm H 8) in the bearing cap, then drill through the bearing bushing to 3.8 mm diameter (basic bore for reaming out). Do not ream right through the bearing bushing with the 4 mm H 8 hand reamer, in order to prevent the locating peg from moving inwards. Carefully deburr the hole edges.



Clamp pressing-in arbor BMW No. 11 2 710 into the vice. Attach the bearing cap to it. Drive the locating peg in until it is still 0.5 to 1.0 mm (0.02–0.04 in) away from the bearing bushing bore. Secure the peg with three punch-marks.





Adjusting crankshaft endplay (axial clearance):

See Specifications for available thrust washer thicknesses. To simplify adjustment of crankshaft endplay, it is advisable to attach a thrust washer marked in red on the locating pegs at the inside and outside. The two locating pegs must project by the same amounts at the clutch and crankshaft ends of the housing. Heat the engine block to align or insert the locating pegs.



Heat the housing to 100...120° C (212...248° F), mount on assembly stand and position vertically. Insert the crankshaft carefully into the block. Place the bearing caps in position and tighten them. Turn the crankcase through 180 degrees. Install the clutch housing (flywheel).

Clutch housing – removing and installing – 11 22 000.



Restore the engine block to a horizontal position. Screw dial gauge holder BMW No. 00 2 500 to the engine's gear-box mounting flange. Determine axial play. Detach the clutch housing again and measure the thrust washer marked in red with a micrometer.



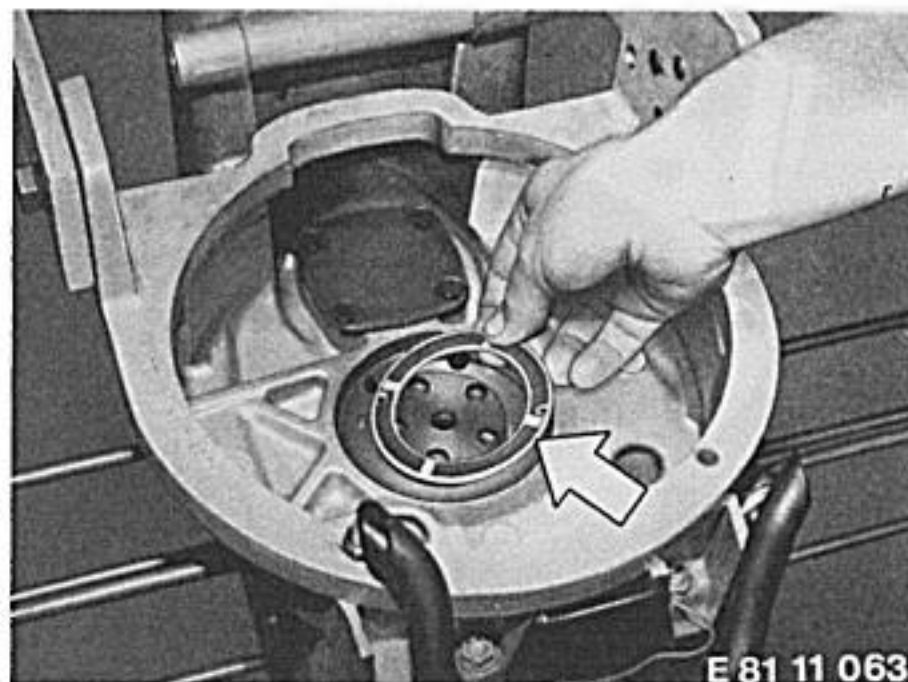
Example:

Endplay (axial clearance as determined):	0.18 mm	(0.0071 in)
Desired endplay:	– 0.12 mm	(0.0047 in)
Difference:	0.06 mm	(0.0024 in)

Thickness of thrust washer removed from engine, as measured:	2.48 mm	(0.0976 in)
Plus difference:	+ 0.06 mm	(0.0024 in)
Thrust washer to be installed:	2.54 mm	(0.1000 in)



Select a thrust washer as close as possible in thickness to the value determined in this way, and not differing by more than $+0.03\text{ mm}$ (0.0012 in) or -0.04 mm (-0.0016 in). Place this thrust washer on the location pins.



Using special tool BMW No. 11 1 890 with drift 11 1 880, press the shaft sealing ring into the crankcase. Press the drift in until it touches the thrust washer.

Note: before installing, place sealing rings in oil for about 2 hours.



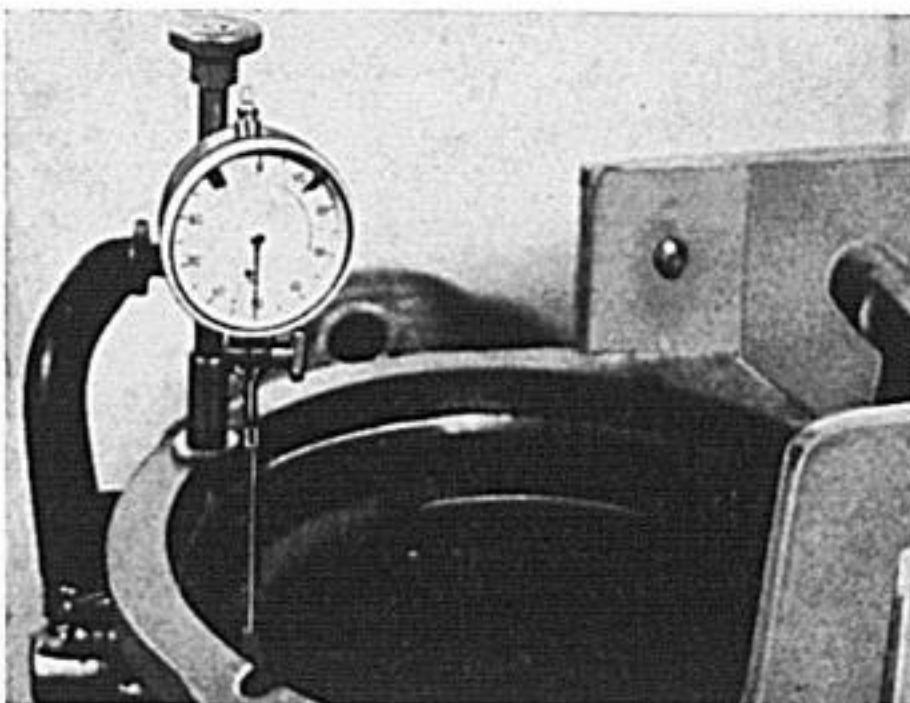
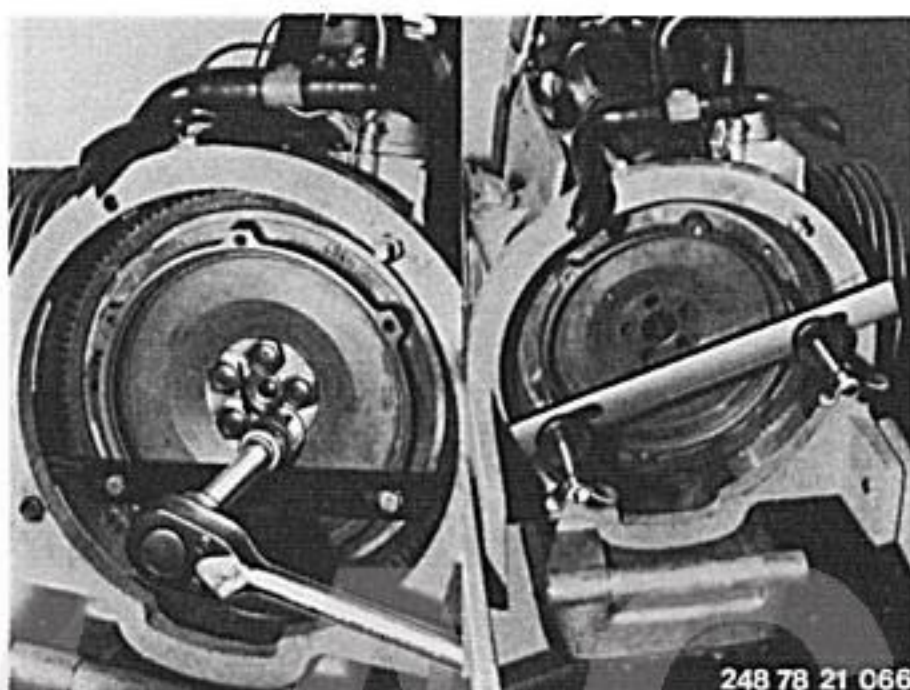
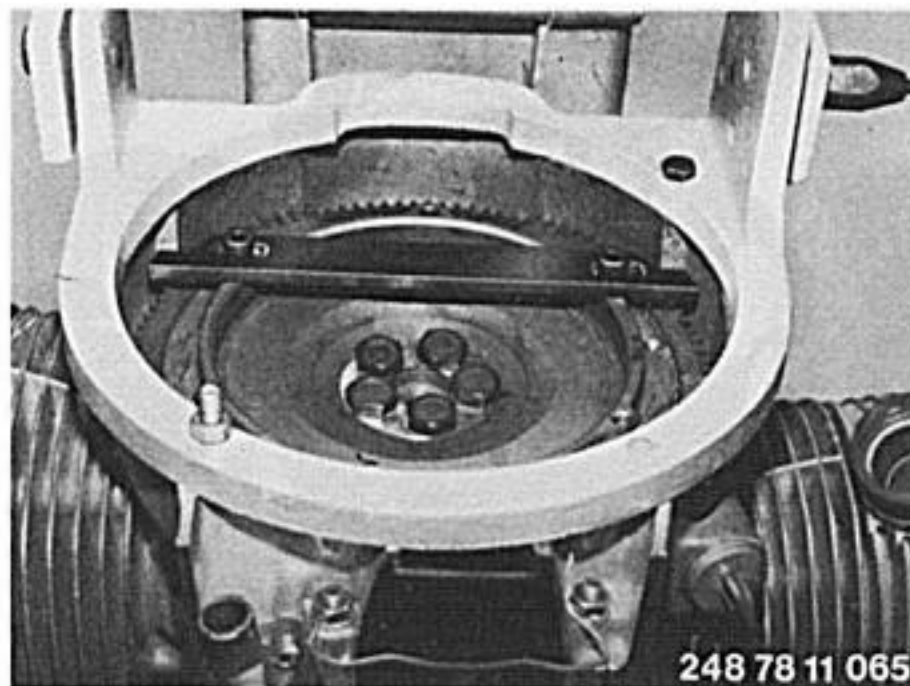
11 22 000 Flywheel – removing and installing

- 1) If engine remains in frame:
remove and install gearbox – 23 00 020
remove and install clutch – 21 21 000.
- 2) If engine is removed:
remove and install engine – 11 00 050
remove and install clutch – 21 21 000.
Attach BMW retaining tool 11 2 800 to flywheel so that the crankshaft cannot turn as the flywheel is loosened.

Remove the 5 retaining bolts and carefully lift away the flywheel after screwing in two clamp bolts. Do not tilt the flywheel. Alternatively, pull the flywheel away from the end of the crankshaft with BMW puller 11 2 810.

When assembling, set the pistons to TDC and mount the flywheel on the end of the crankshaft so that the "OT" (TDC) mark is visible in the sight hole in the housing. Attach counter-holder BMW 11 2 800 to the flywheel. Insert and tighten the 5 retaining bolts to the correct torque (see Specifications). The flywheel is retained by expansion bolts, which must be lubricated with engine oil when inserting. Make sure that the contact faces on the flywheel and the end of the crankshaft are dry and oil-free.

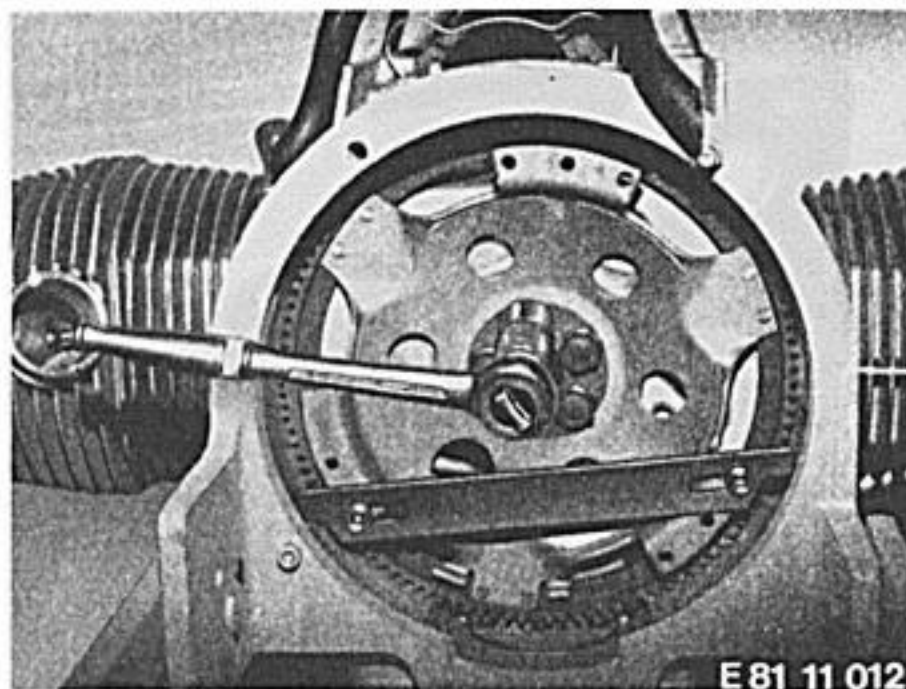
Check lateral runout of the flywheel with a dial gauge attached to BMW dial gauge holder 00 2 500. To eliminate crankshaft endplay when checking flywheel runout, place the engine vertically in the assembly stand. When installed, press down against the centering bearing at the end of the crankshaft.



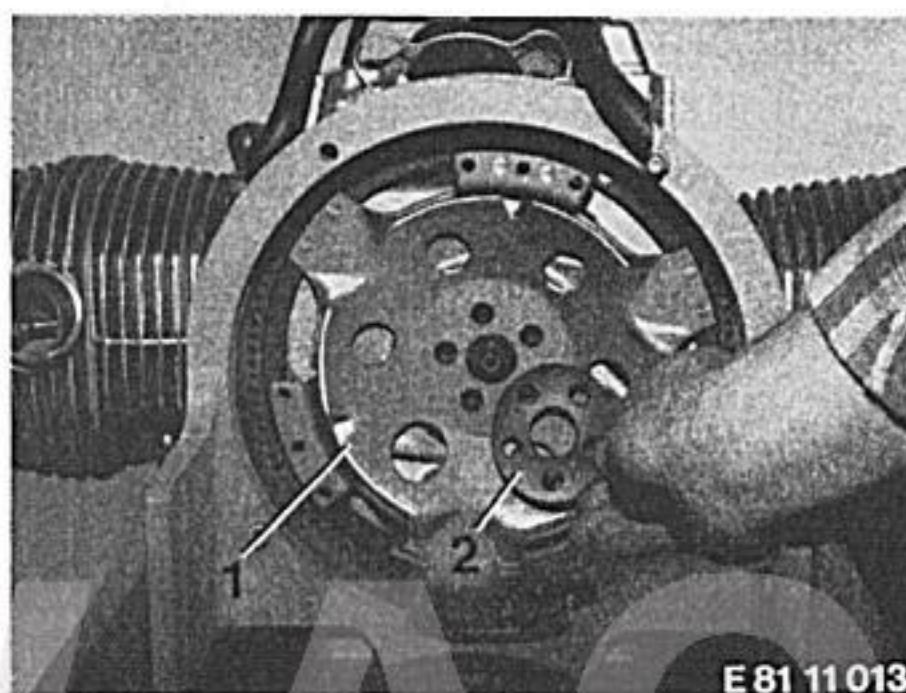
11 22 000 Clutch housing (flywheel) – removing and installing (1981 models)

Remove (install) clutch – 21 21 000.

Attach retaining device BMW No. 11 2 800 to the clutch housing, and unscrew the bolts at the crankshaft. For correct tightening torque, see Specifications.



Take off the clutch housing (1) and steel shims (2).



11 24 000 Connecting rod – removing and installing

Remove and install engine – 11 00 050.

Remove and install the cylinder head – 11 12 080.

Remove and install piston – 11 25 000.

All the testing and repair work described in the preliminary operations should only be performed if needed.

Removal and installation of the connecting rod takes place with the crankshaft in the TDC position. Unscrew the big end bolts with the correct multi-flat wrench. Take off the connecting rods and big end caps with bearing shells.



When installing: both connecting rods should have the locating pins on the alternator side.



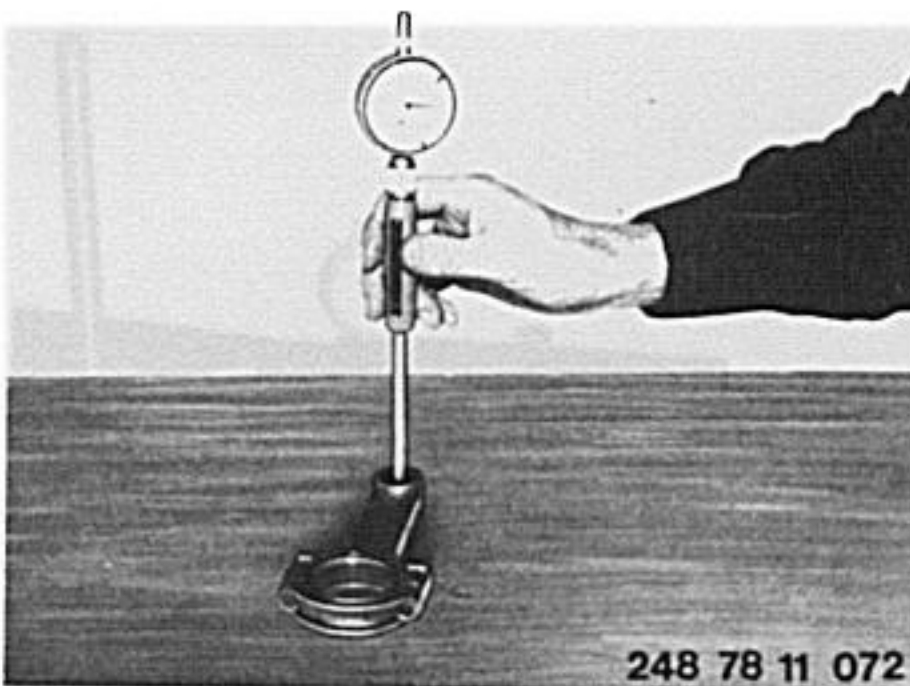
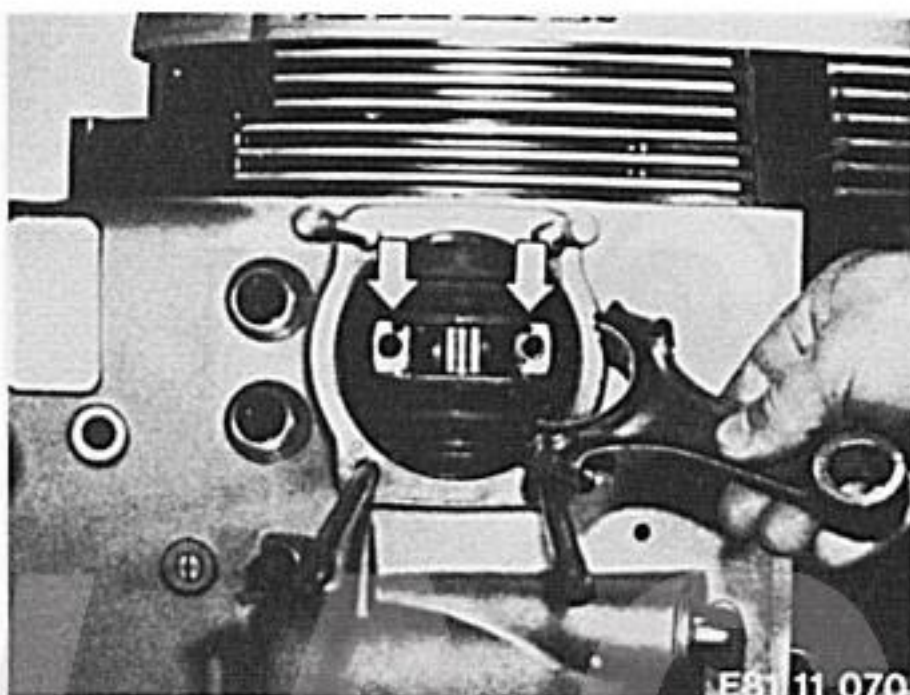
Checking and reconditioning: measure the thickness of the connecting rod at the big end bearing with a micrometer. For measurements, see Specifications.

Both connecting rods used in any engine must bear the same weight markings or color codes.

Check that the small end bushing is firmly seated and within dimensional tolerances.



If the internal diameter of the small end bushing exceeds the permitted wear limit, press out the small end bushing. For dimensions, see Specifications.



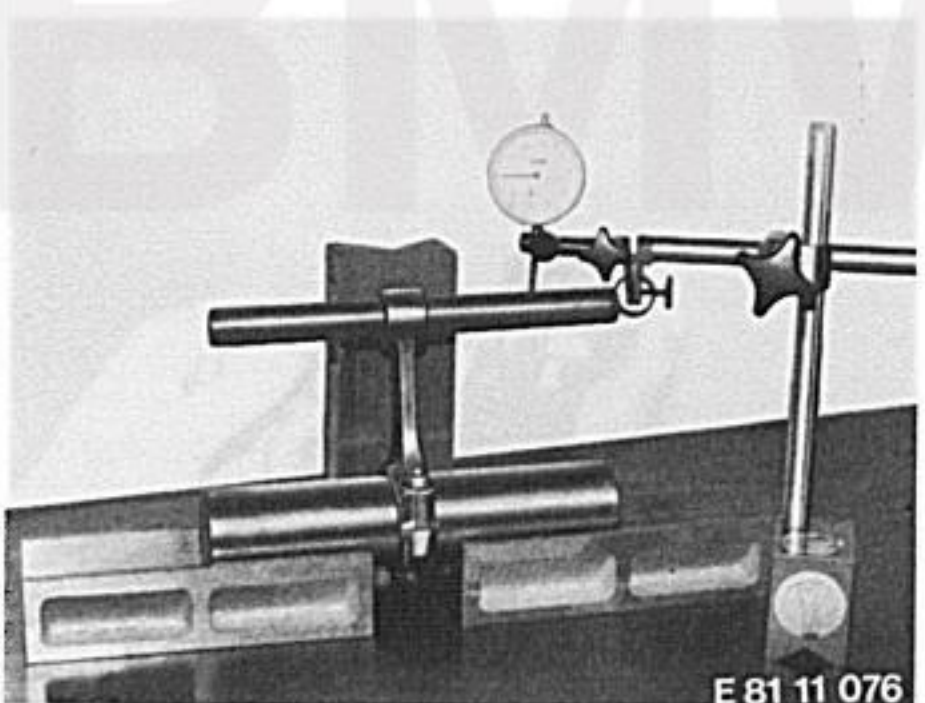


With a new bushing, it should be possible to push the piston pin through by applying light thumb pressure.

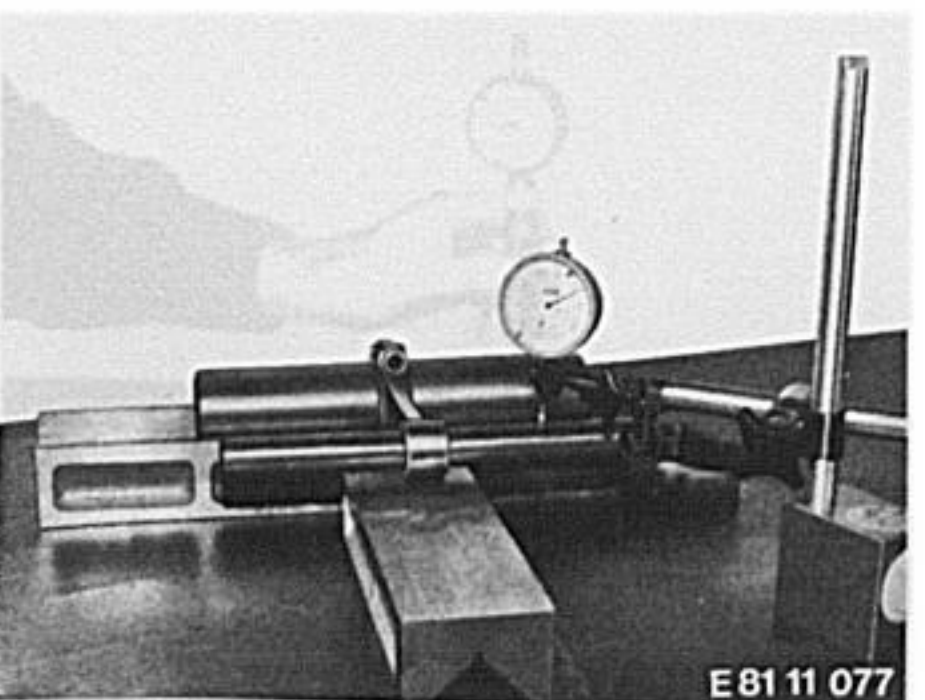


■ Measure connecting rod

Press the bearing shells specified for measurement work into the connecting rod. Attach the rod to a hardened and ground test arbor, and tighten the bolts. The test arbor must have no radial play in the big end bore. Push a hardened and ground measuring arbor approximately 150 mm (5.9 in) long into the small end bushing so that it projects equally at both sides.

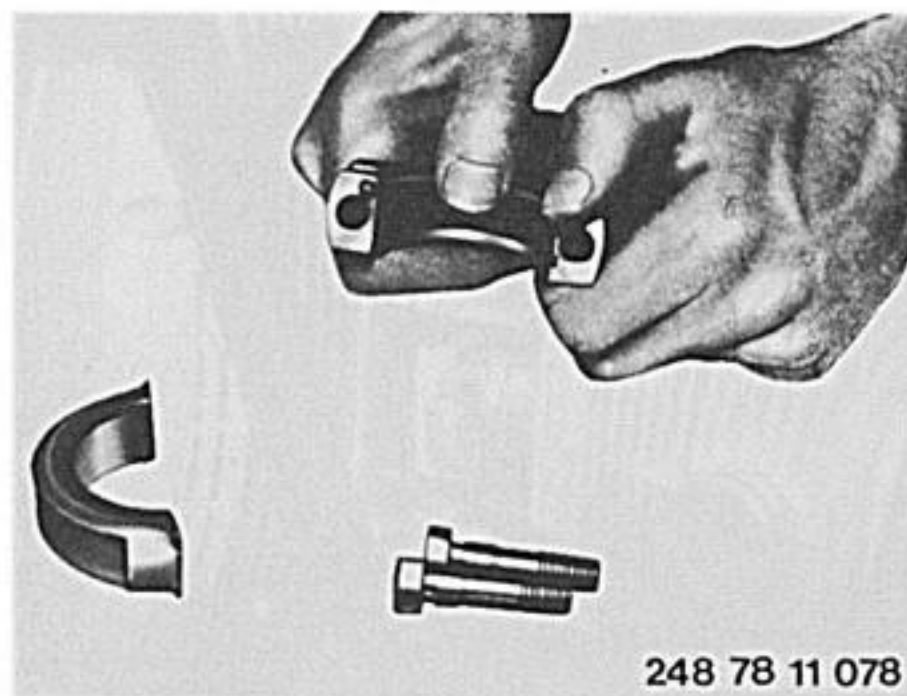


■ Place two V-blocks of identical dimensions on a surface plate. Rest the measuring arbor and connecting rod on the V-blocks. Support the connecting rod vertically. Apply a dial gauge on a stand to the ends of the measuring arbor to check that the piston pin axis is parallel to the crankpin axis. For parallelity tolerances on connecting rod, see Specifications.

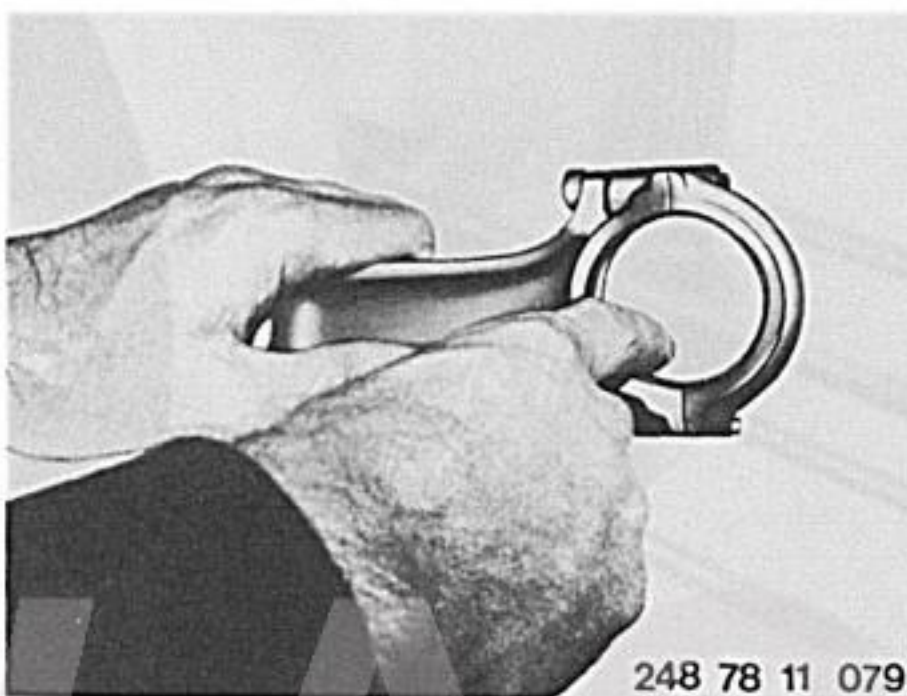


■ Check the connecting rod for twist. Support it as before on the V-blocks and pack under the small end so that the distance from the surface plate to the centres of the big and small end bores is approximately the same. Apply a dial gauge on a stand to the ends of the measuring arbor to determine connecting rod twist, and straighten if necessary. For permissible tolerances, see Specifications.

Press the bearing shells into the clean, circular bore of the connecting rod.



Before installing the connecting rod, apply a light coat of Molykote G paste to the main and big end bearing shells.



11 25 000 Piston – removing and installing

Remove and install cylinder head – 11 12 080.

Pull the cylinder away from the 4 tie bolts. Make sure that when the piston emerges from the cylinder it does not become damaged. Insert the piston protector behind the piston and between the tie bolts to prevent piston damage.



Extract the piston pin circlip by pressing a scribe or a small screwdriver into the lateral groove. Drive out the piston pin with a commercial puller or the BMW 11 2 920 drift.



When installing: attach the piston with the "vorn→" mark on the crown facing forwards. This will ensure that the small-end offset is correct. The piston need not be heated before the piston pin is inserted.

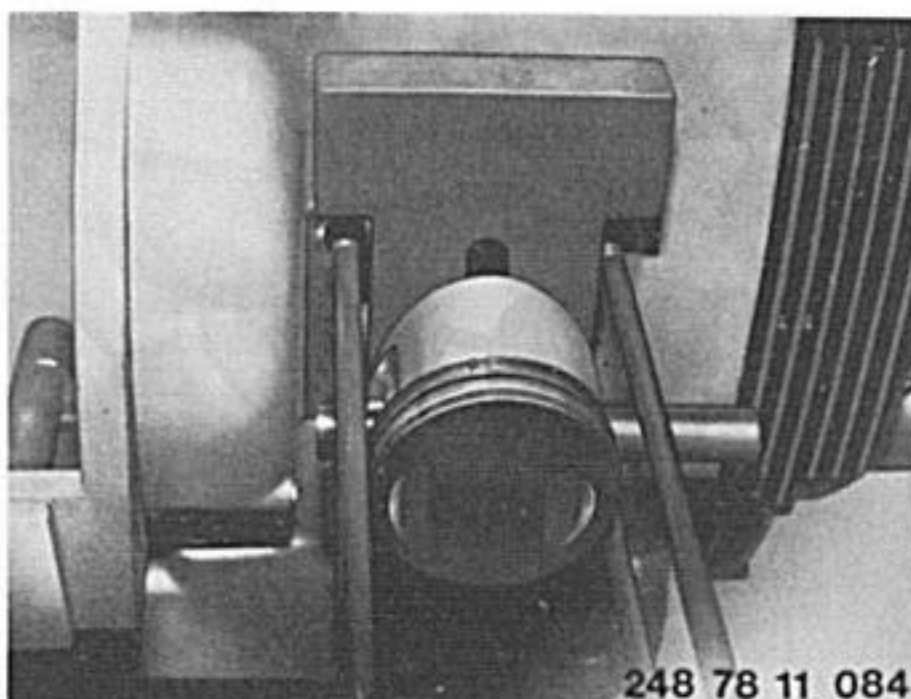
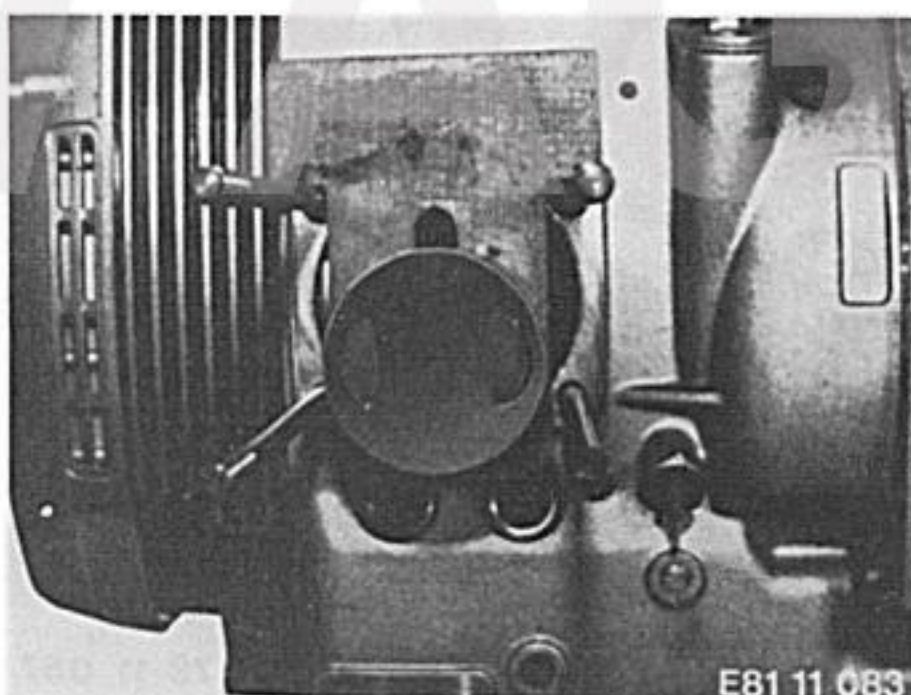
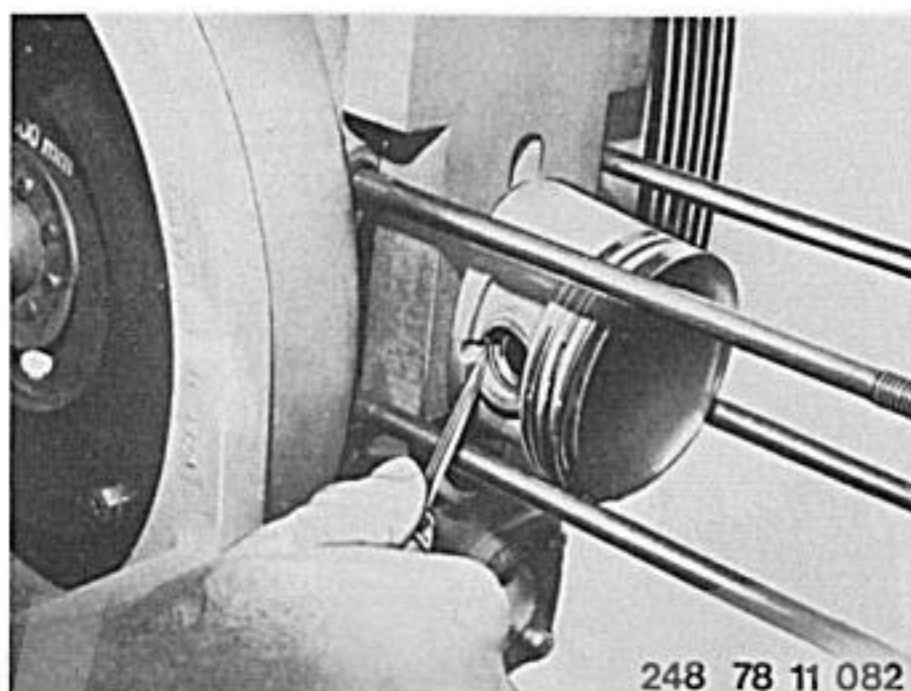
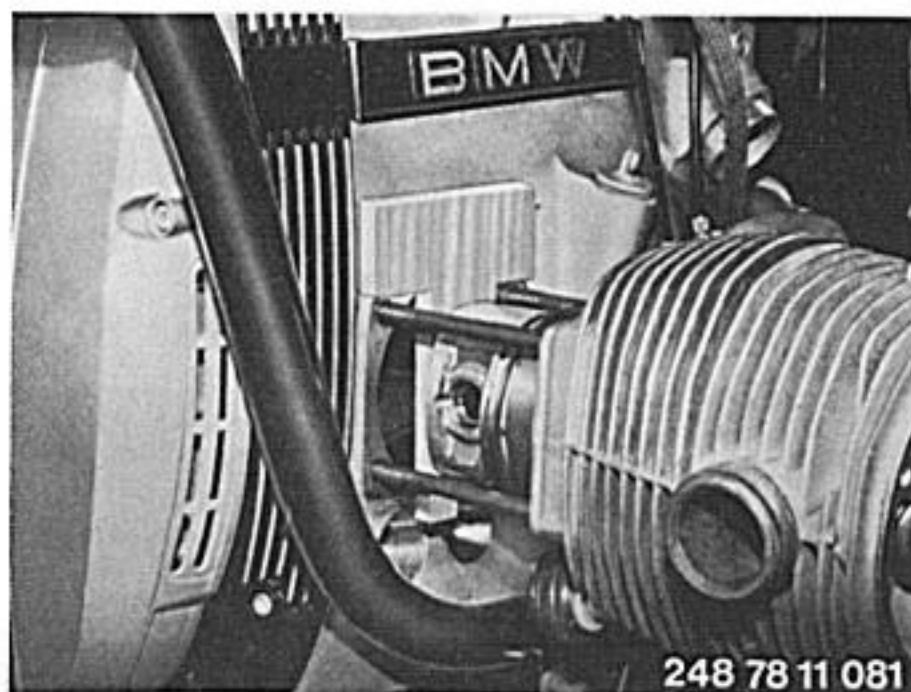
Use two pistons of the same weight group in the engine.

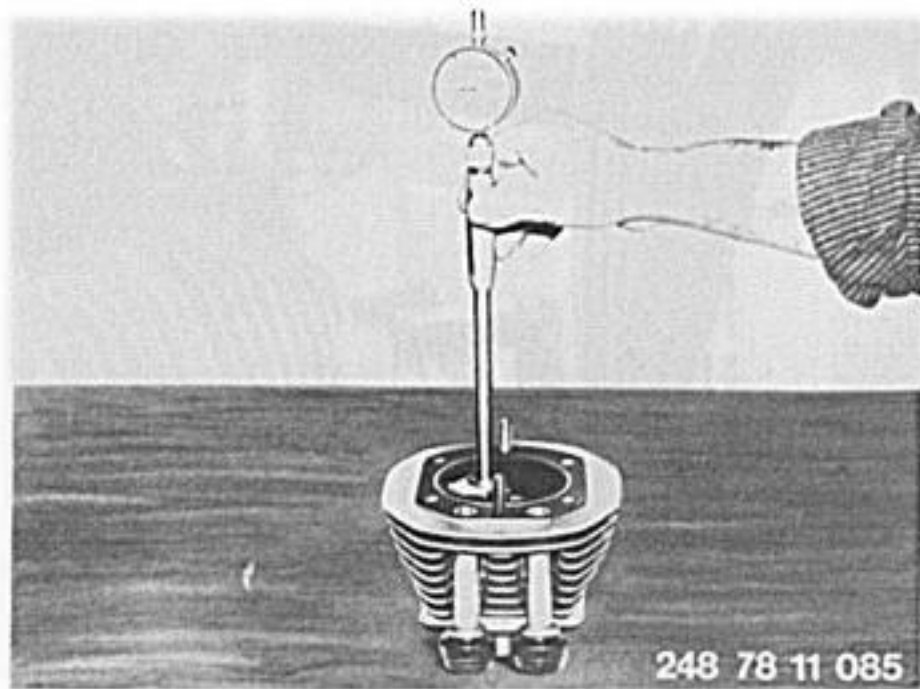


Insert the piston pin circlip in its groove so that one end covers the lateral groove completely. Press the center section of the circlip into the piston pin bore so that the two ends of the ring are as close as possible. Push the ring fully into the groove with BMW drift 11 2 920.

When installing: before placing the cylinder over the piston, clean the base of the cylinder barrel and the cylinder joint face on the engine block with nitro thinners. Make sure that the O-ring seals at the upper studs are not trapped.

Whenever the cylinder barrel is removed, renew the O-ring at the cylinder base and the O-rings at the stud bolts.





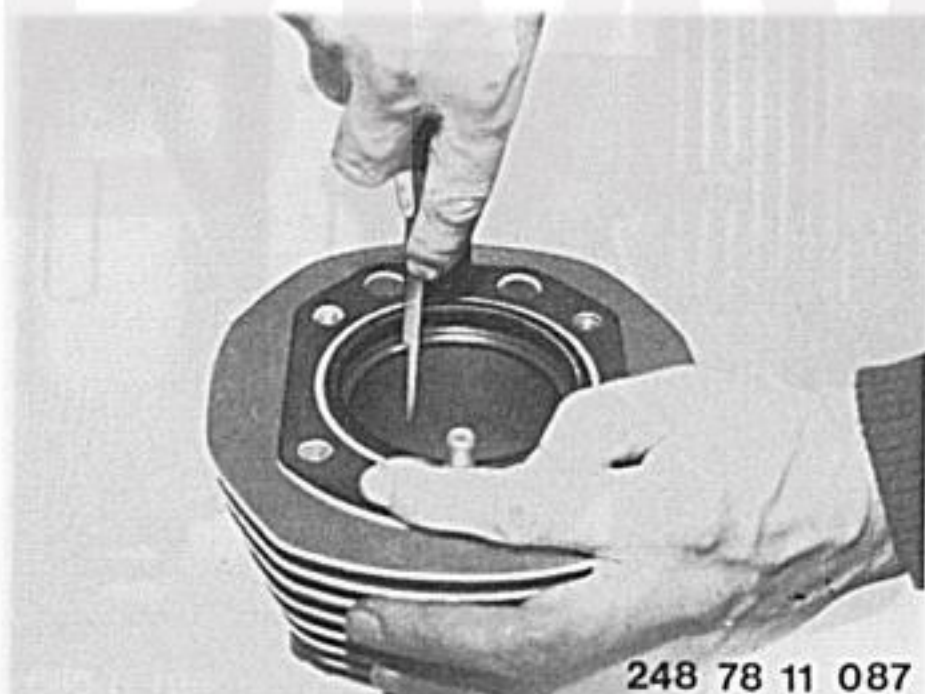
Testing and repair: Measure the cylinder bore in the direction of the piston pin and at 90° to this direction at points 10 mm (0.4 in) from the top, at the center and at the bottom of the bore, using an internal micrometer. The ambient temperature should be 20° C (68° F) for this test.



Measure the piston diameter with a micrometer at the piston skirt. For measuring plane, see Specifications.



Determine piston ring end gaps with a feeler gauge.



Determine clearance of piston rings in grooves with a feeler gauge. For nominal and wear dimensions of cylinder bore, piston diameter and piston ring end gaps and groove clearances, see Specifications.



11 31 061 Chain sprockets — renewing

Engine removed or installed.

If engine is installed, drain the oil.

Remove and install engine — 11 00 500.

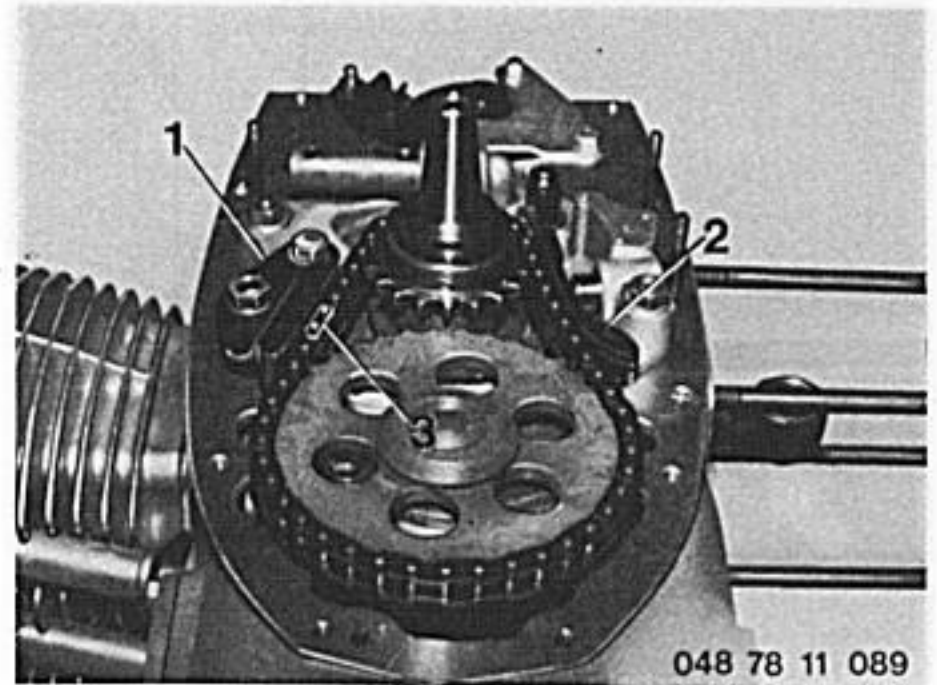
Remove and install ignition contact assembly — 12 11 060.

Detach and attach timing chain cover — 11 14 060.

Remove chain guide rail (1) and chain tensioner arm (2).

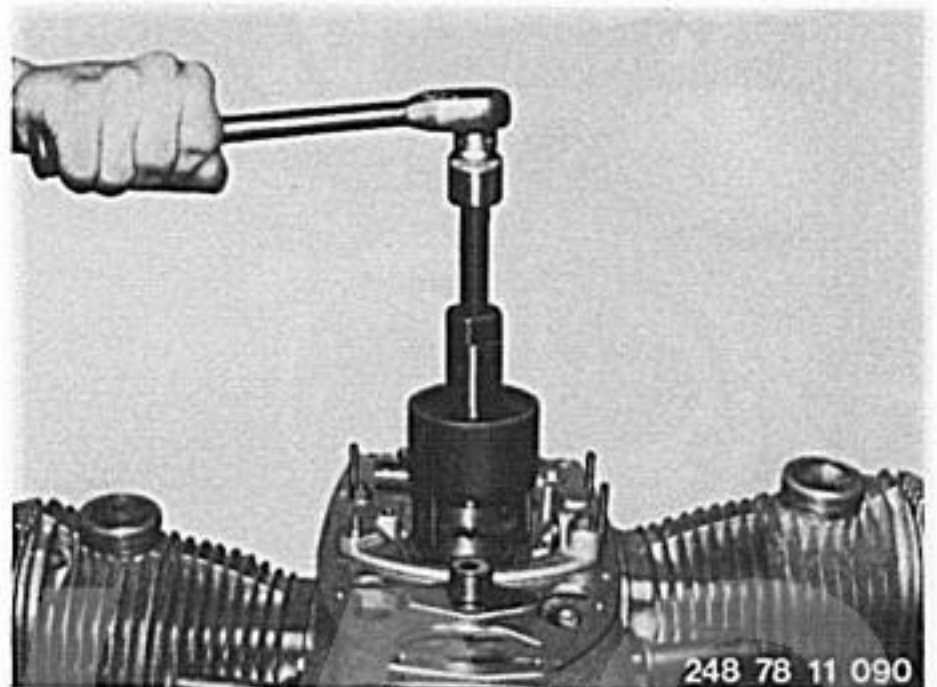
Open the spring link on the chain (3) and remove the chain.

When installing: the spring link must be closed in the direction of the chain movement. The chain guide rail must be parallel to the chain.



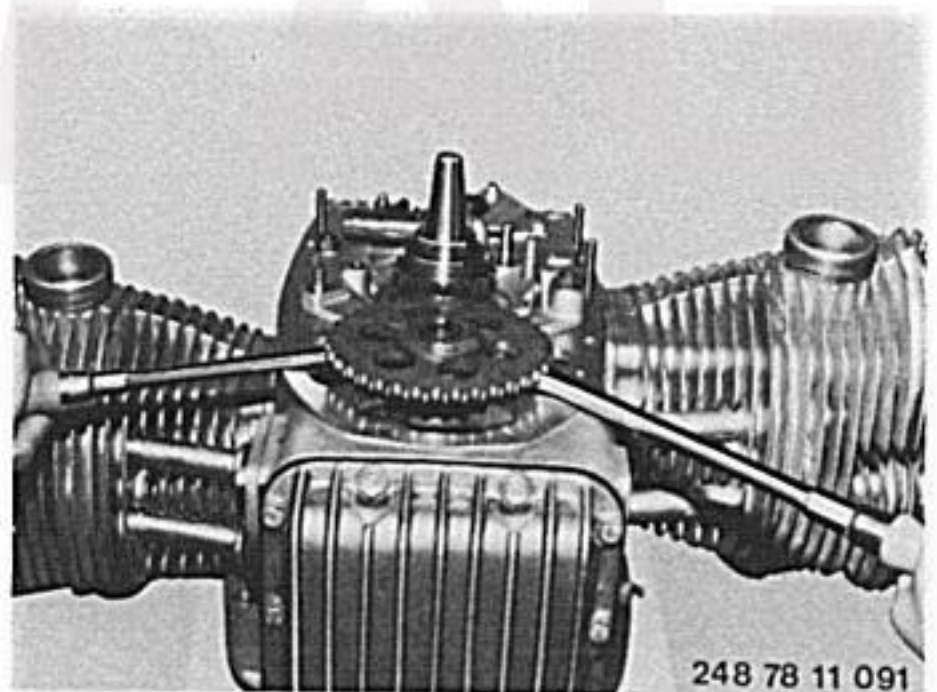
Pull the chain sprocket complete with bearing off the crankshaft. Use BMW puller 11 26 00 and exchange puller cup 11 26 06 for cup with groove.

When installing: heat the chain sprocket to approx. 80° C (175° F).



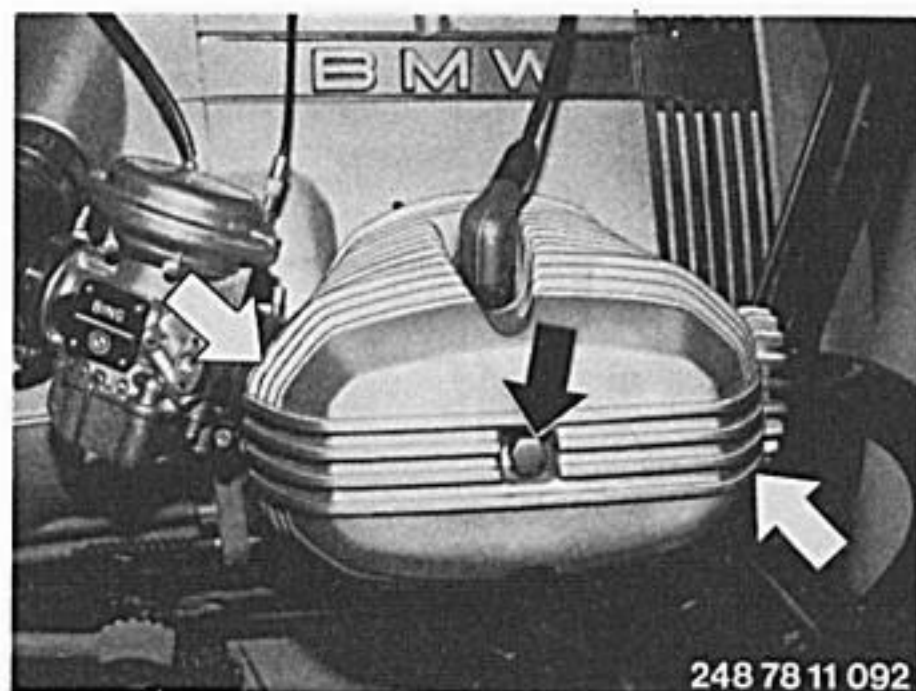
Press off the camshaft chain sprocket with two screwdrivers or remove with a standard commercial two-arm puller.

When installing: the marks on the two chain sprockets must be opposite each other.

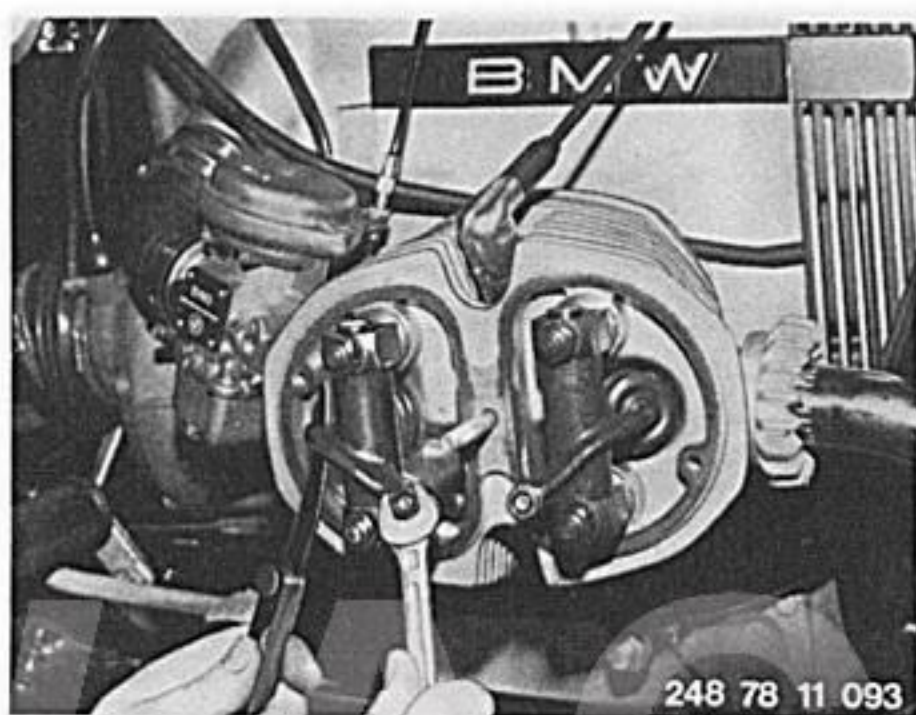


11 34 504 Valve clearances – adjusting

Remove the cap nut and the nuts (arrows). Take off the rocker cover and gasket.



Measure valve clearances with the engine stopped and cold, by inserting a feeler gauge of the correct thickness between the stem of the valve and its rocker. Before doing so, unscrew and remove the spark plugs and turn the engine over – either with the kick starter or by selecting a gear and turning the rear wheel – until the cylinder on which the valve clearances are to be adjusted has its piston at top dead center on the compression stroke. Turn the adjusting screw as necessary after slackening off the locknut; when the valve clearance is correct, retighten the locknut. Check that the valve clearance setting has not altered. For correct valve clearances, see Specifications.



11 41 000 Oil pump – removing and installing

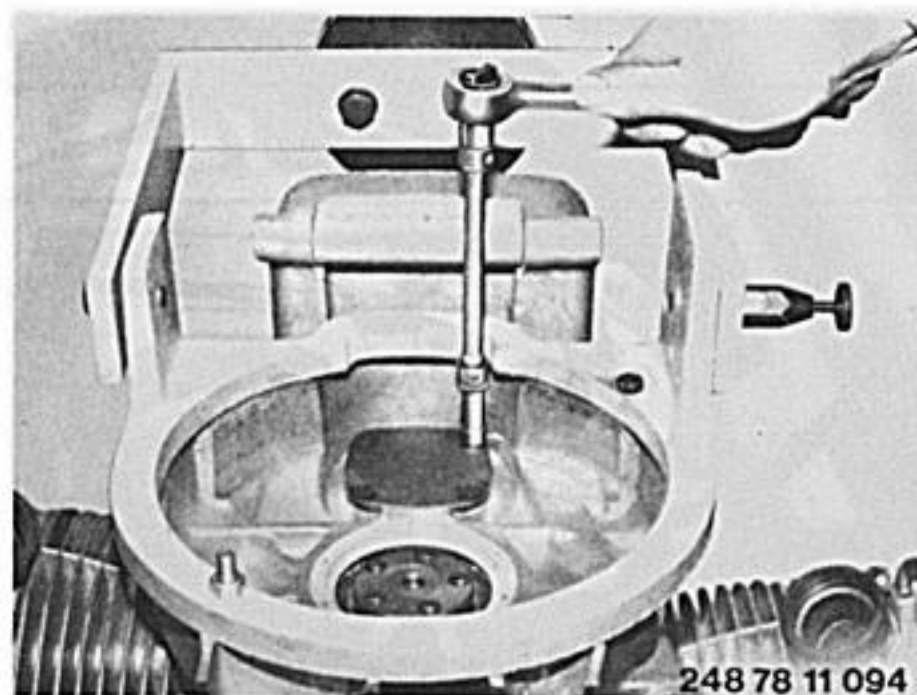
1st method: Remove and install engine 11 00 050.
The illustrations and instructions refer to this method.

2nd method: Remove and install gearbox – 23 00 020.
The engine remains in the frame.

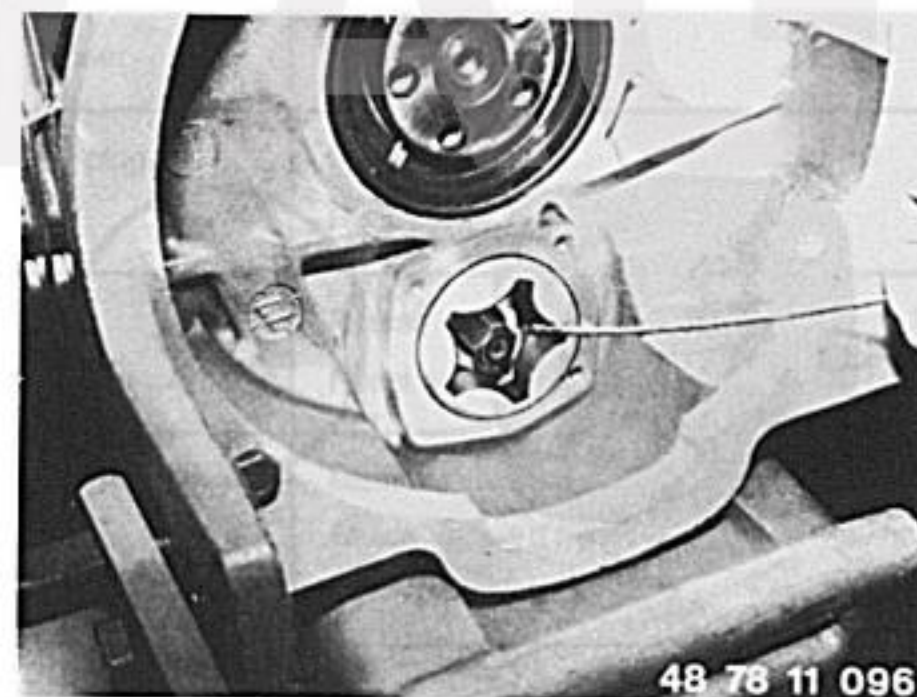
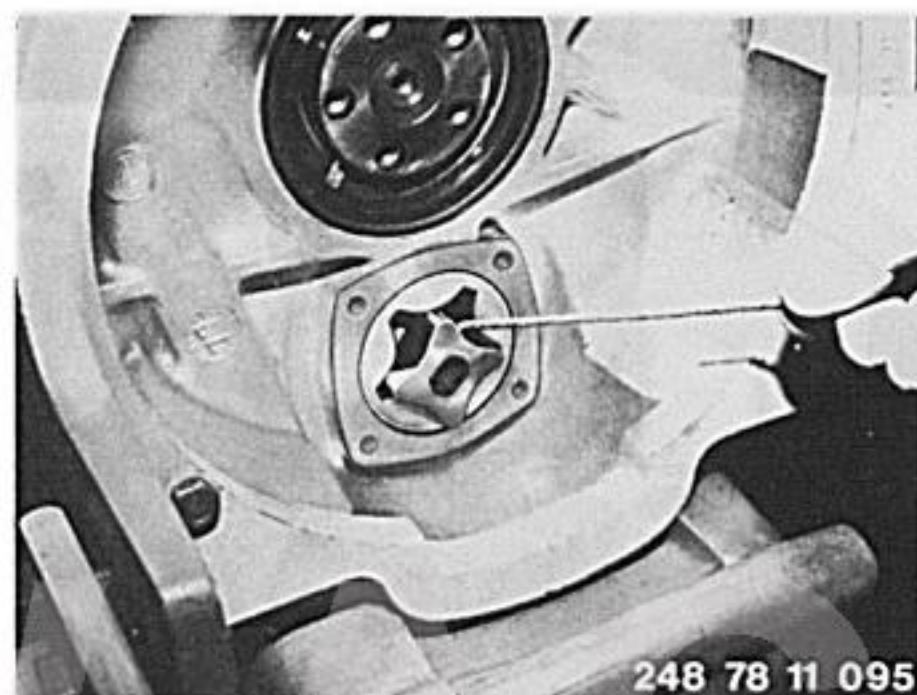
Remove and install clutch – 21 21 000.

Remove and install flywheel – 11 22 000.

Slacken the four hex. bolts and remove the oil pump housing end cover.

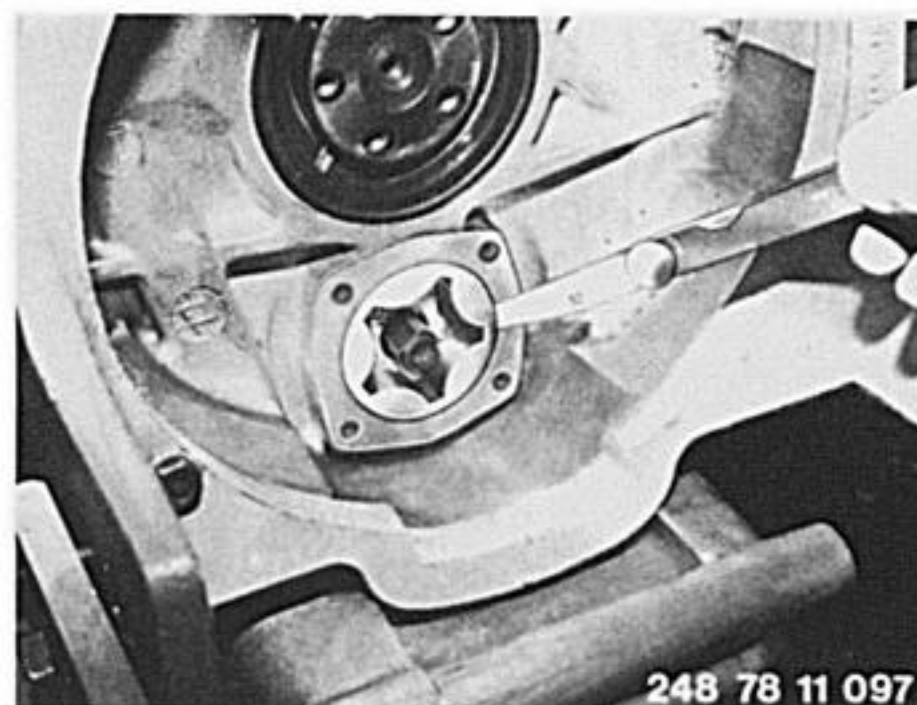


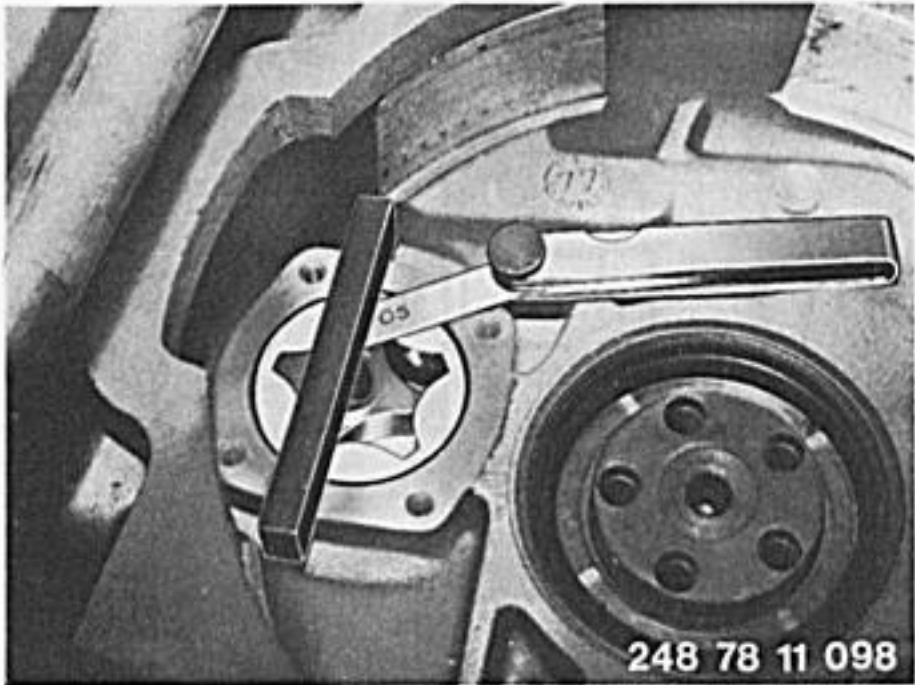
Using a wire hook, remove the inner and outer rotors from the housing.



Testing

Check play between outer rotor and pump housing – see Specifications.



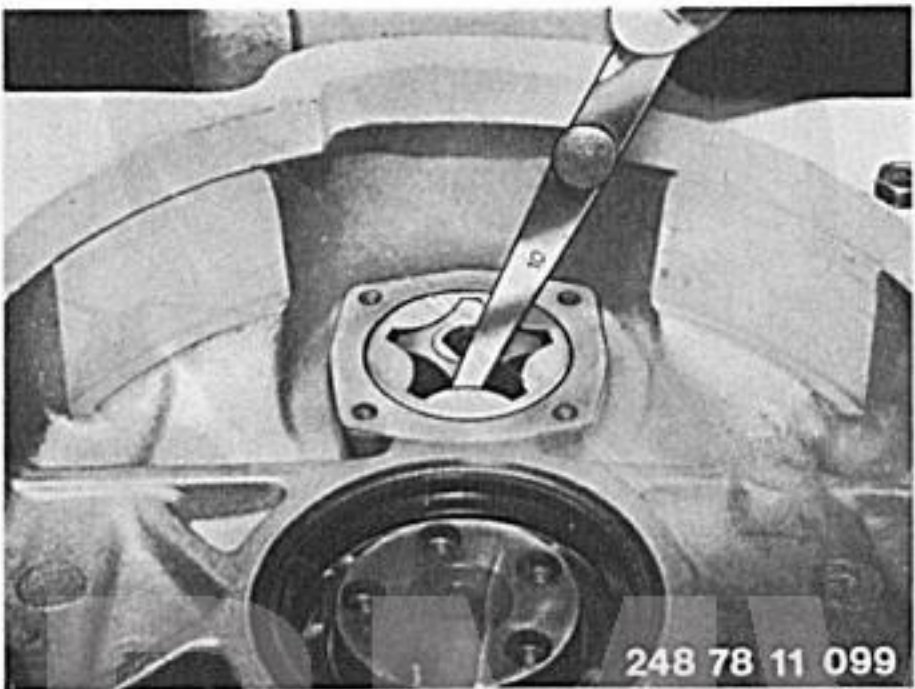


Check play between joint face on pump housing and sealing face on rotor – see Specifications.

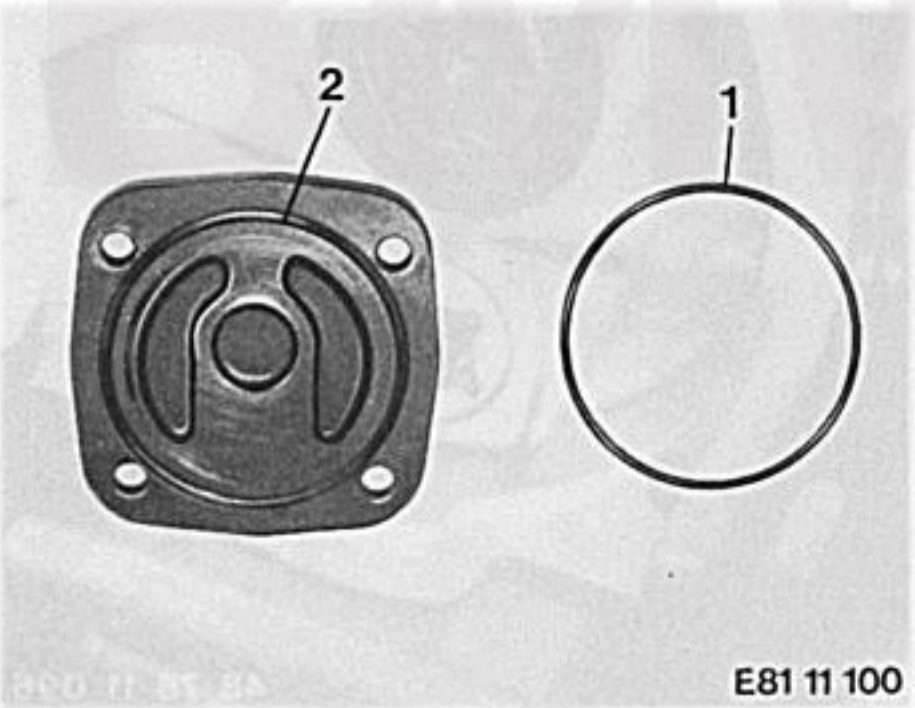


Determine the gap between the inner and outer rotors. For details of clearance, see Specifications.

When assembling, make sure that the O-ring in the end cover is in good condition.



When assembled, the O-ring (1) must be pressed deep enough into the groove to enable the end cover (2) to lie flat on the housing joint face.



Trouble-shooting – engine

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

12 Engine electrical system

Specifications	Page	12- 0/3
Specifications for 1981 models		12- 0/7
12 11 004 Timing the ignition		12-11/1
12 11 004 Timing the ignition on 1981 models		12-11/3
12 11 060 Ignition trigger – removing and installing		12-11/5
12 11 141 Breaker contacts – renewing		12-11/6
		12-11/7
		12-11/9
12 13 100 One ignition coil – removing and installing		12-13/1
12 13 100 Twin ignition coil – removing and installing (1981 models)		12-13/3
12 14 010 Control unit – removing and installing		12-14/1
12 14 025 Heat sink – removing and installing		12-14/1
12 31 009 Alternator, diode board and regulator switch – checking		12-31/1
12 31 019 Alternator with regulator – quick check		12-31/2
12 31 020 Alternator – detaching and attaching		12-31/2
12 31 212 Alternator – reconditioning		12-31/3
12 31 689 Stator winding and rotor – checking		12-31/3
12 32 000 Regulator and alternator – removing and installing		12-31/4
		12-31/5
12 41 009 Starter – checking (installed)		12-41/1
12 41 020 Starter – removing and installing		12-41/1
12 41 513 Starter – stripping and assembling		12-41/3
12 41 541 Carbon brushes – renewing		12-41/4
12 41 602 Starter – reconditioning		12-41/5
12 41 701 Exciter winding – renewing		12-41/6
		12-41/7

Engine — electrical system

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Starter:			
Type	Bosch DF 12 V		
Starting short-circuit current A	320		
Power output kW	0.7		
Torque mkg	0.750		
Starter relay	Bosch		
Armature endplay mm (in)	0.10 ... 0.15 (0.004 ... 0.006)		
Generator (alternator):			
Type	Bosch G 1 14 V 20 A 21/280 W		
Drive	direct from crankshaft		
Max. output W/V	280/14		
Max. current A	20		
Resistance between phase outlets Ohms	0.62		
Charging begins at min ⁻¹	980		
Max. speed min ⁻¹	10 000		
Max. runout at sliprings mm (in)	0.06 (0.0024)		
Min. slipring diameter mm (in)	26.8 (1.055)		
Voltage regulator			
Type (Bosch)	0 190 601 009 AD 1/14 V		
Regulated voltage			
off-load V	13.55 ... 14.25		
on-load V	13.9 ... 13.4		

Engine — electrical system

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Diode board Type (Bosch)	D 120 915 158 14 V 20 A		
Coil Type (Bosch)	E 6 V		
Starting spark length at 300 sparks/min and 3V mm (in)	8 (0.31)		
Operating spark length at 3600 sparks/min mm (in)	13.5 (0.53)		
Spark plugs Thread	M 14 x 1.25 mm		
Bosch	W 175 T 30	W 225 T 30	W 225 T 30
Beru	175/14/3A	225/14/3A	225/14/3A
Champion	N 10 Y	N 6 Y	N 6 Y
Electrode gap mm (in)	0.7 (0.028)		
Contact breaker Type (Bosch)	mechanical ignition contact breaker with centrifugal control in sealed housing; dynamic		
Timing control starts min ⁻¹	1500		
Timing control ends min ⁻¹	3000		
Contact breaker shaft lubrication	Bosch Ft 1 v 8 grease		
Breaker points gap mm (in)	0.45±0.05 (0.018±0.002)		

Engine – electrical system

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Dwell angle deg.	120° at 1000 min ⁻¹		
Condenser	0.2 µF + 20% Bosch No. 1 237 330 295		
Static firing point	6° bTDC		
Adjustment range °CS	26°		

Tightening torques Nm (lb. ft)

Armature retaining bolt	23 ... 27 (17 ... 20)	Spark plugs	23 ... 30 (17 ... 22)
Starter retaining bolts	47.5 (35)		
All other bolts and nuts are to be tightened according to the customary values shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.			

Engine — electrical system

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Starter:				
Type	Bosch DF 12 V			
Starting short-circuit current Amp	320			
Power output kW	0.7			
Torque mkg	0.750			
Starter relay	Bosch			
Armature endplay mm (in)	0.10 ... 0.15 (0.004 ... 0.006)			
Generator (alternator):				
Type	Bosch G 1 14 V 20 A 21/280 W			
Drive	direct from crankshaft			
Max. output W/V	280/14			
Max. current Amp	20			
Resistance between phase outlets Ohms	0.62			
Charging begins at min ⁻¹	980			
Max. speed min ⁻¹	10 000			
Max. runout at sliprings mm (in)	0.06 (0.0024)			
Min. slipring diameter mm (in)	26.8 (1.055)			
Voltage regulator				
Type (Wehrle)	E 1051 B / 14 V			

Engine — electrical system

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Diode board: Type (Bosch)	D 120 915 158 14 V 20 A			
Coil: Type (Bosch)	Twin-spark coil 12 V			
Spark plugs: Thread	M 14 x 1.25 mm			
Bosch	W 7 D	W 5 D		
Beru	14 - 7 D	14 - 5 D		
Champion	N 10 Y	N 6 Y		
Electrode gap mm (in)	0.7 (0.028)			
Contact breaker Type (Bosch)	Breakerless ignition pulse generator (Hall effect transmitter) with integral centrifugal advance system			
Timing control starts min ⁻¹	1500			
Timing control ends min ⁻¹	3000			

Engine – electrical system

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Static firing point (for engine assembly)	6° bTDC			
Adjustment range ° CS	26°			

Tightening torques Nm (lb. ft)

Alternator armature retaining bolts

25 ± 2 (18.4 ± 1.5)

Spark plugs

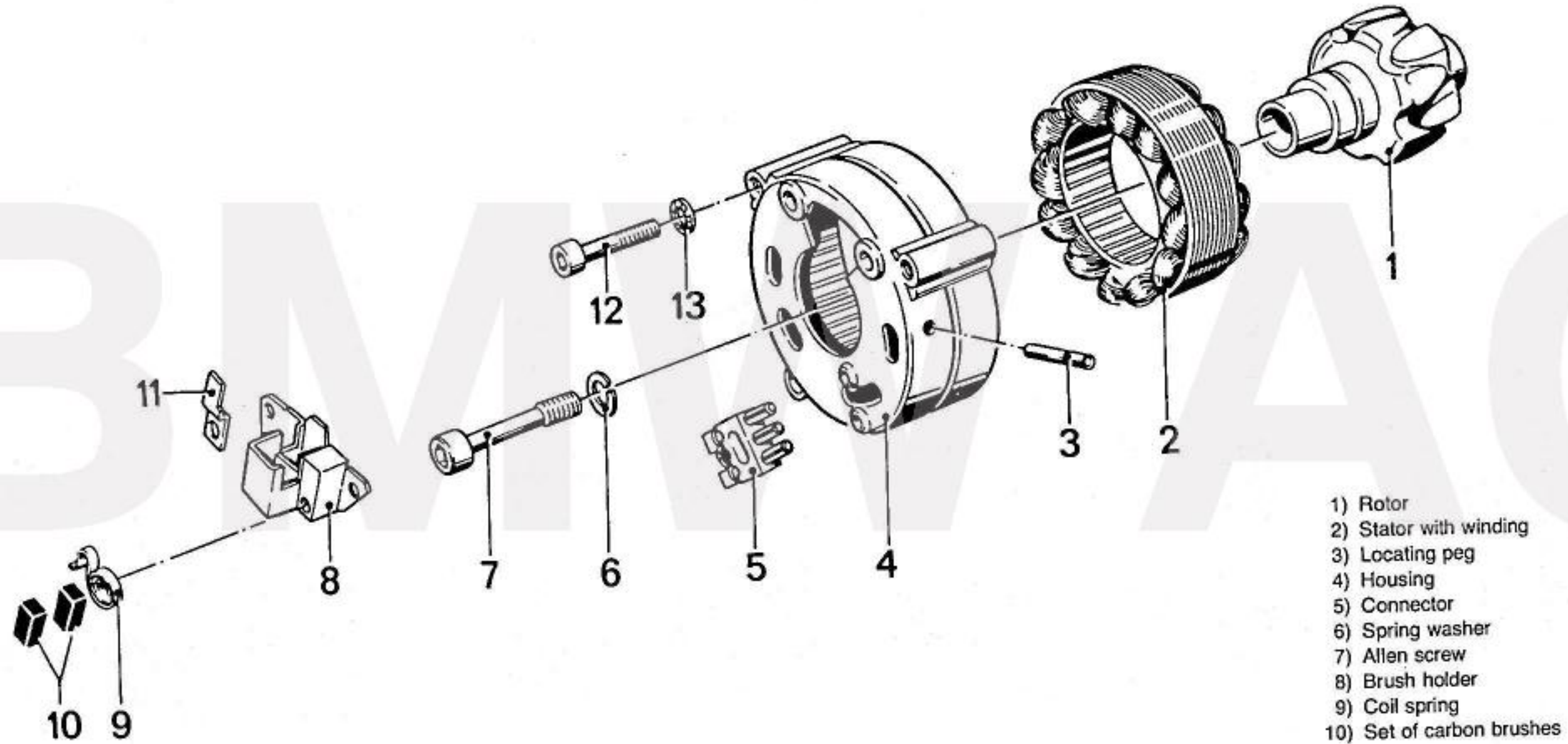
20 + 5 (14.7 + 3.7)

Starter retaining bolts

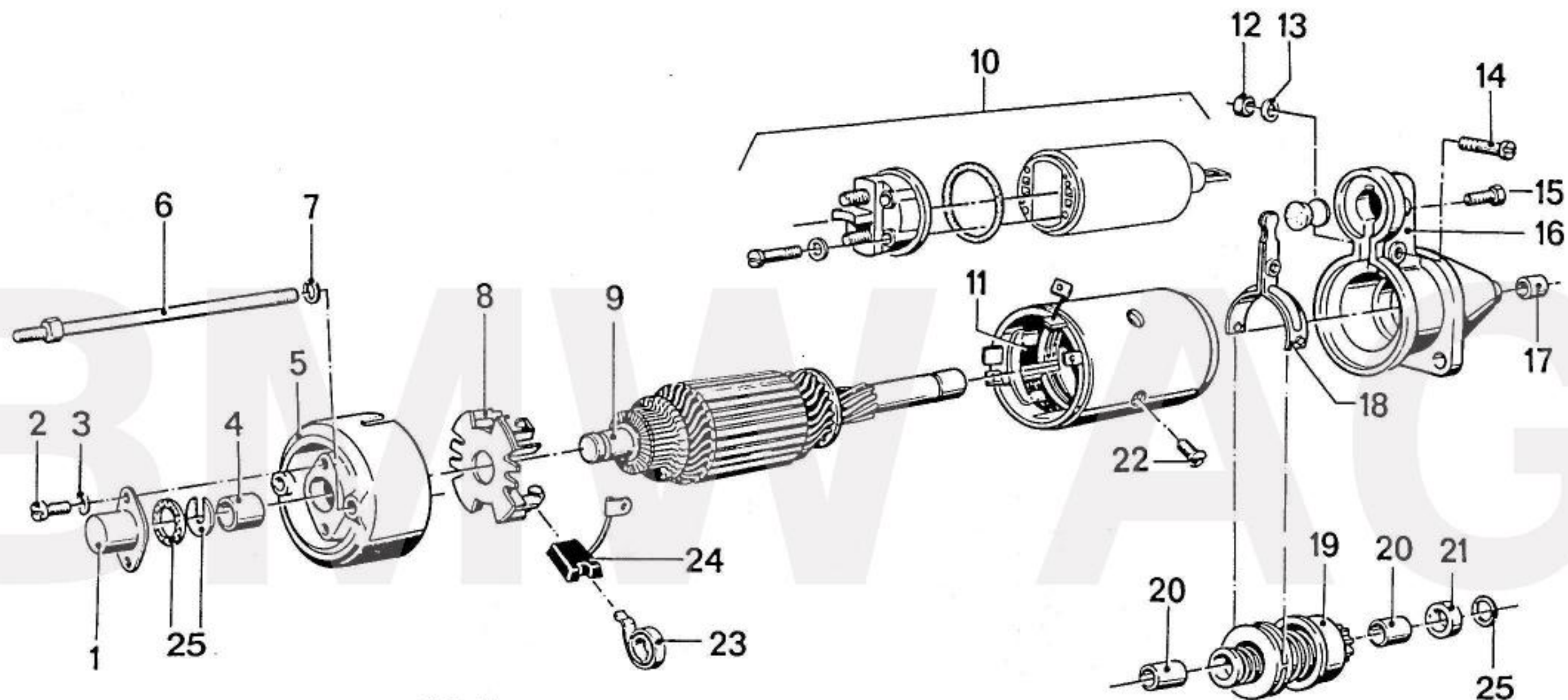
47.5 (35)

All other bolts and nuts are to be tightened according to the customary values shown in the manufacturers' tables or on the latest BMW 60002.0 standards sheet.

Alternator



Starter

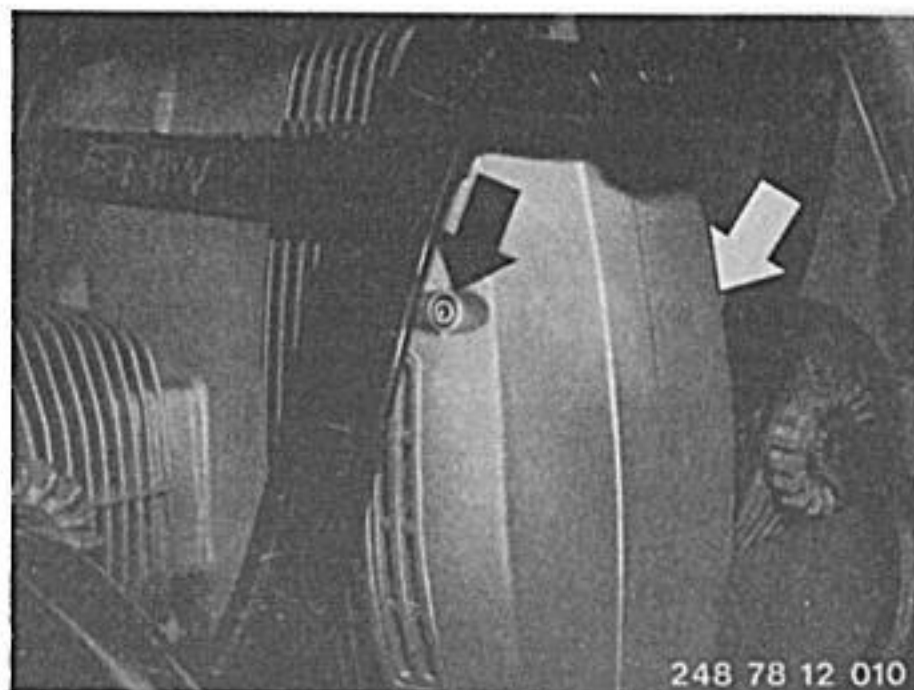


- 1) End cap
- 2) Machine screw
- 3) Spring washer
- 4) Bearing bushing
- 5) Commutator bearing
- 6) Machine screw
- 7) Shim
- 8) Brush holder plate
- 9) Armature
- 10) Solenoid switch
- 11) Exciter winding
- 12) Hex nut
- 13) Spring washer

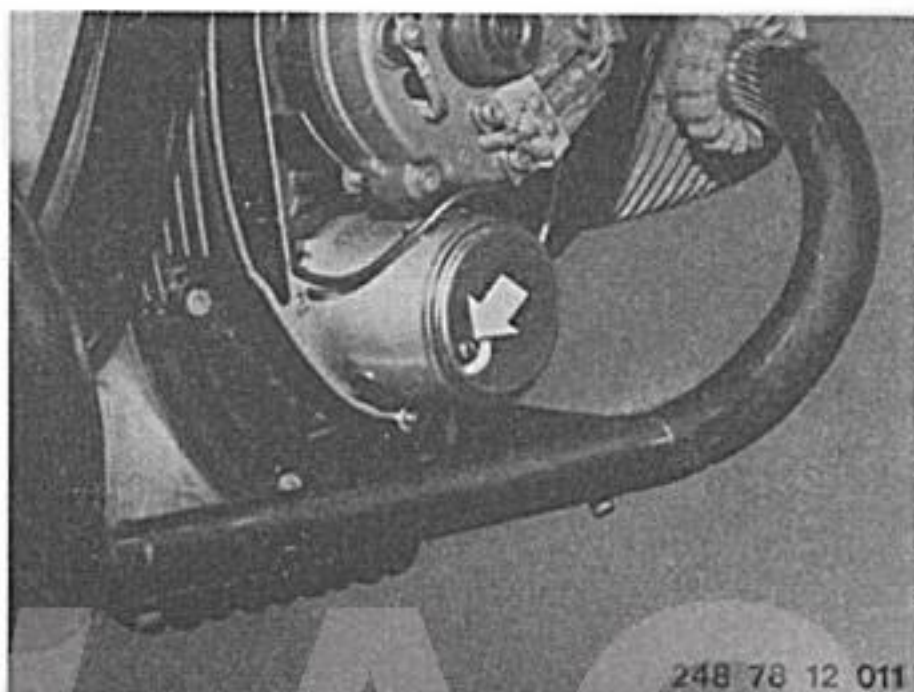
- 14) Machine screw
- 15) Countersunk screw
- 16) Drive-side bearing
- 17) Bearing bushing
- 18) Switch lever
- 19) Starter gear pinion
- 20) Bearing bushing
- 21) Stop ring
- 22) Countersunk screw
- 23) Coil spring
- 24) Carbon brushes
- 25) Washers

12 11 004 Ignition — timing

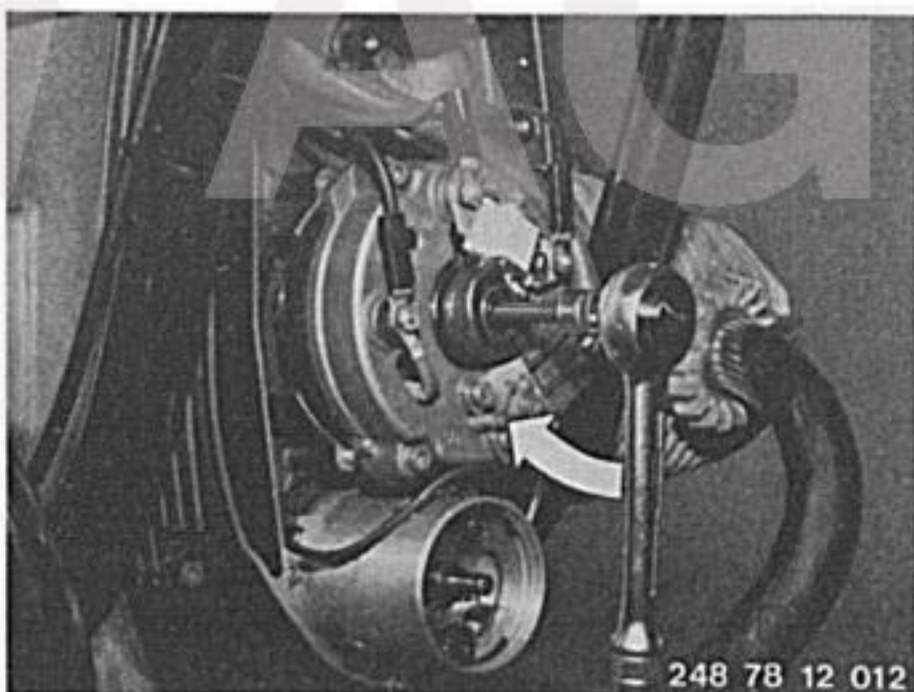
Remove the two Allen screws (arrows) and take off the engine cover.



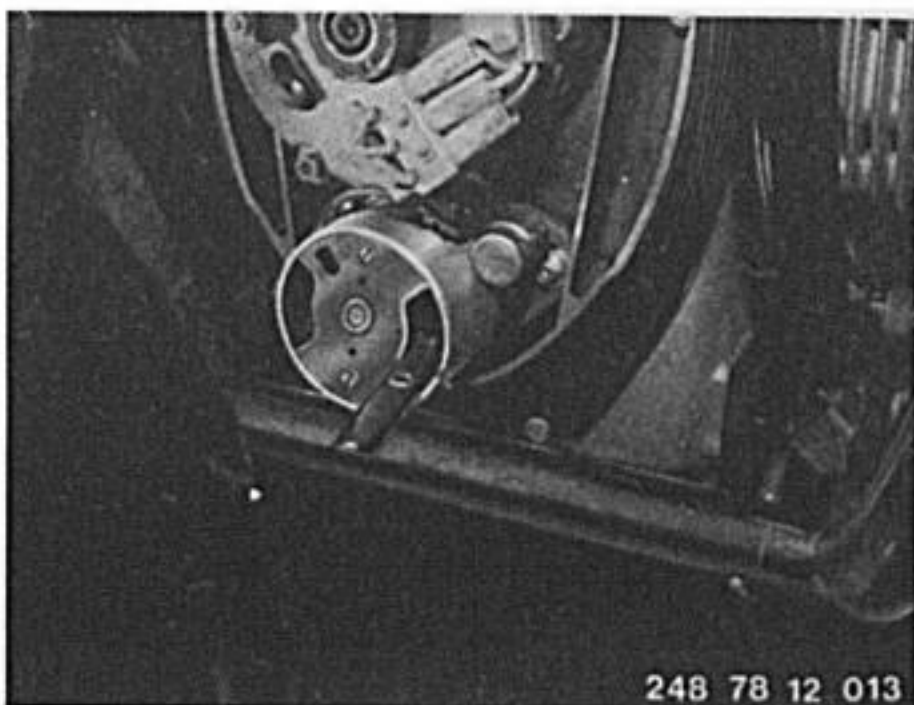
Remove the screw from the ignition contact assembly cover and take off the cover.

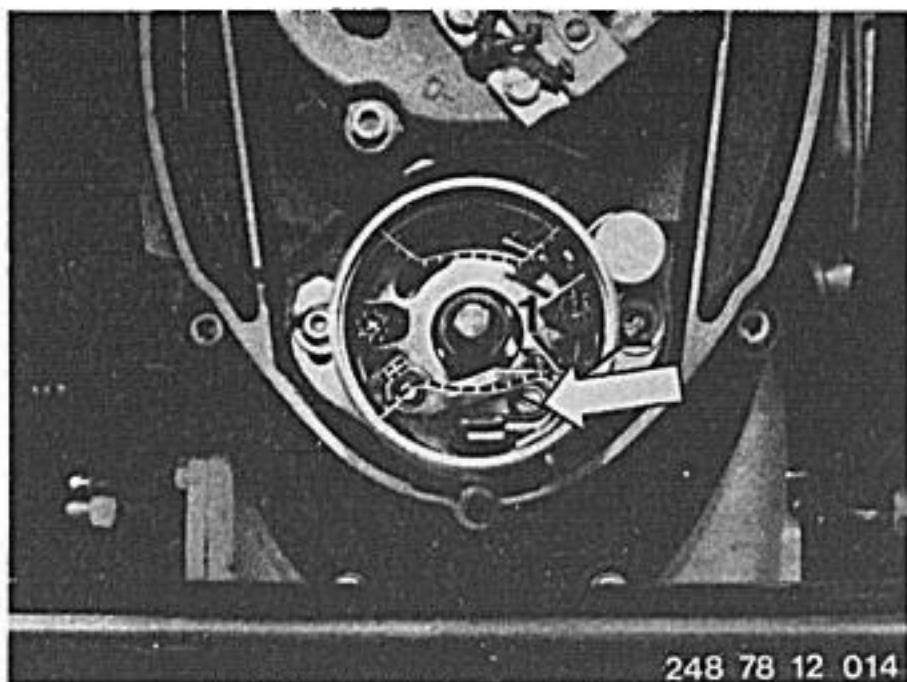


Unscrew and remove the spark plugs and turn the engine over clockwise, looking at the front end of the engine; using the internal hexagon bolt which secures the rotor.



The breaker arm must lift away fully.
Check contact breaker gap with a feeler gauge; it should be 0.40 mm (0.016 in).
If necessary, renew the breaker points — 12 11 141.





Adjusting breaker points gap

Slacken the retaining screw (arrow). Insert a screwdriver in the slot on the opposite contact carrier (1) and turn against anvil (2) to adjust the points gap.

Tighten the locking screw.

Check the breaker points gap or dwell angle (always use a dwell angle tester) once again.

For correct breaker points gap and dwell angle, see Specifications.



Checking ignition timing

Connect the strobe light to the battery and the ignition lead. Start the engine and run up to 3500 min^{-1} . When the flywheel is illuminated, the white spot "Z" (full ignition advance) must be visible in the inspection hole. To check the ignition advance curve, turn the adjusting wheel on the strobe light until the "OT" (TDC) mark appears. The actual amount of ignition advance in degrees is then shown on the calibrated scale of the strobe light. For correct advance angle, see Specifications.

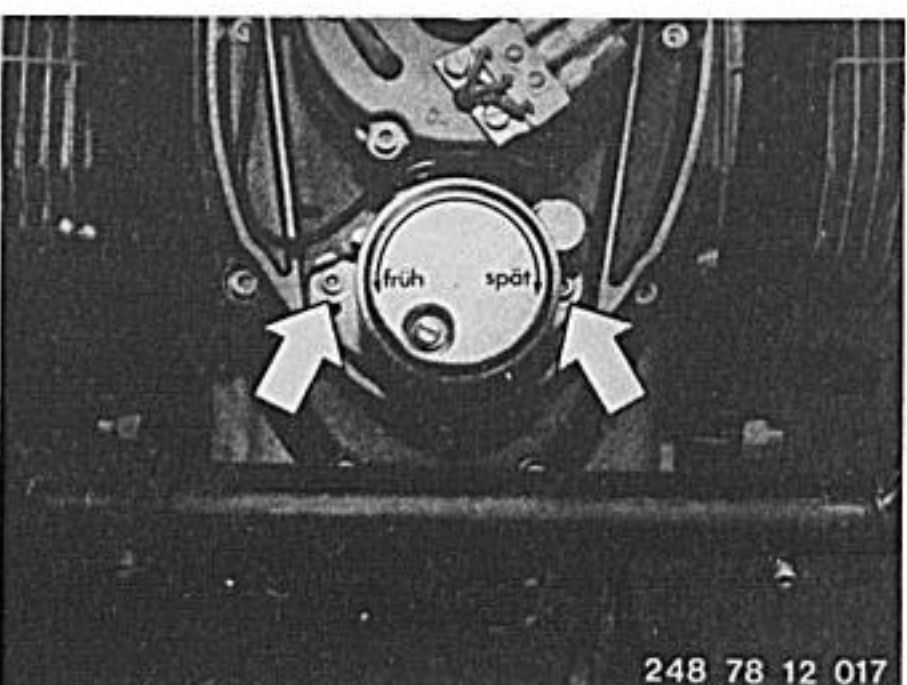
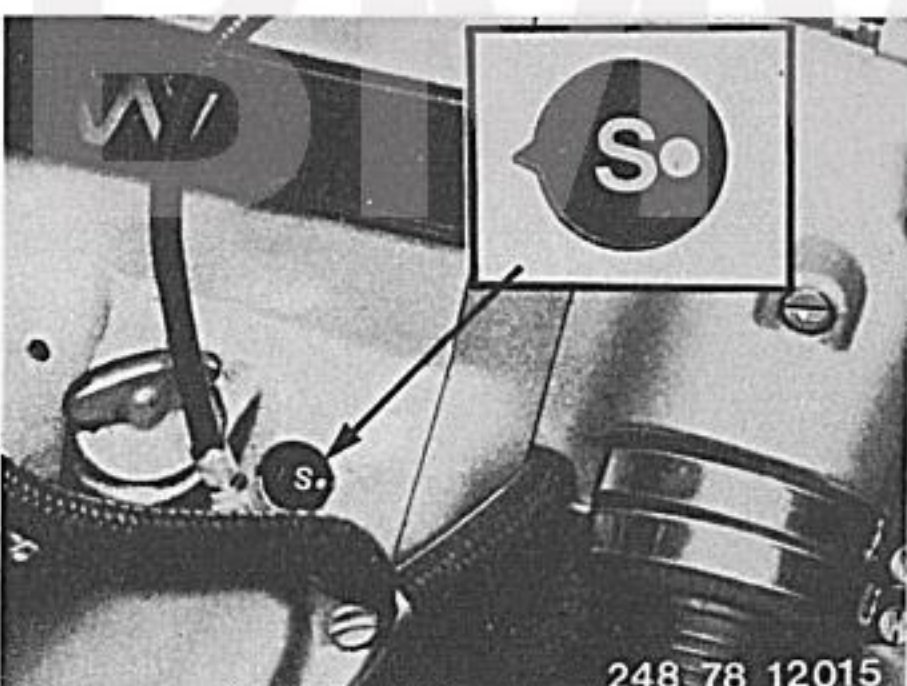
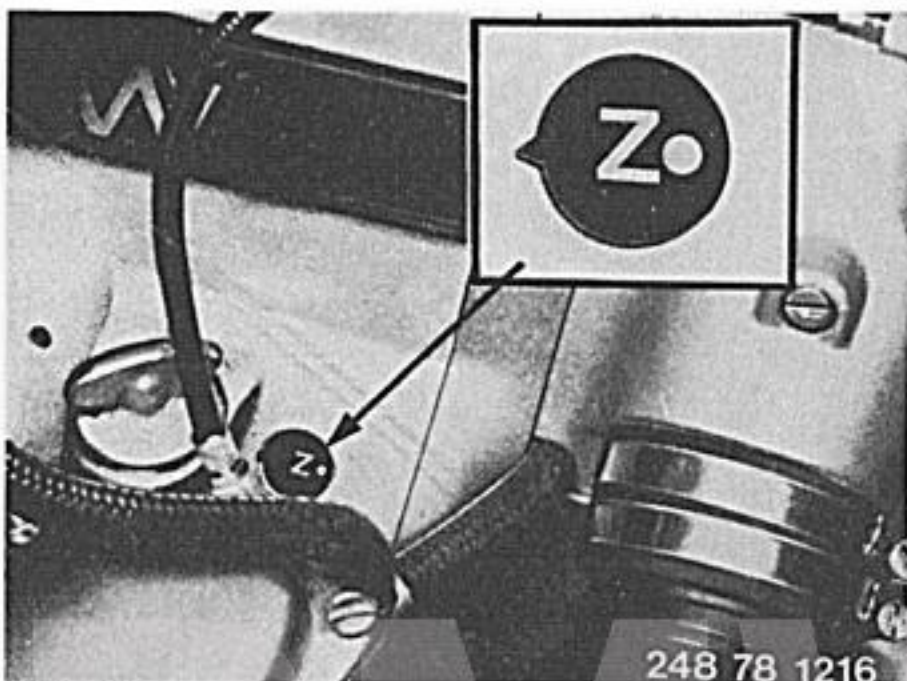


At engine idle speed ($950 \pm 150 \text{ min}^{-1}$) the center white line of flywheel mark "S" must be aligned with the mark on the inspection hole (2). If the line is below center (1), the ignition is retarded. If it is above center (3), the ignition is advanced too far.



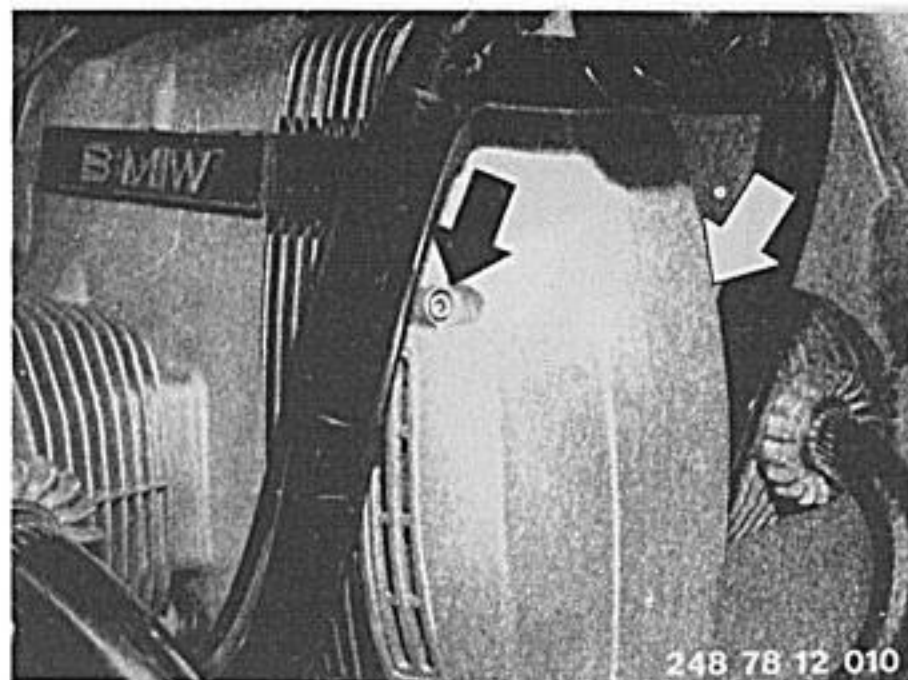
Adjusting ignition timing (with engine running)

Slacken the Allen screws holding the ignition contact assembly (arrows). Turning the complete contact assembly in the same direction as engine rotation retards the ignition; turning it in the opposite direction to engine rotation advances the ignition. Note that the crankshaft and camshaft both rotate in the same direction. Tighten the screws again.



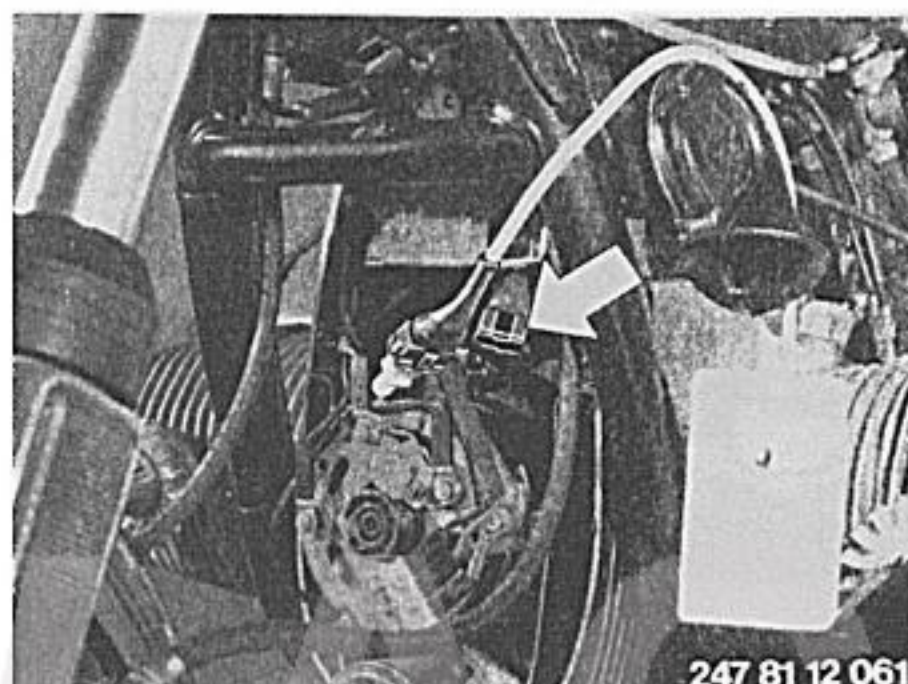
12 11 004 Timing the ignition (static) – 1981 models

Warning: this motorcycle has transistorized coil ignition, a high-performance system on which a fatal shock can result if any live components are touched when the engine is running. Unscrew the two Allen screws (arrows) and take off the engine end cover.

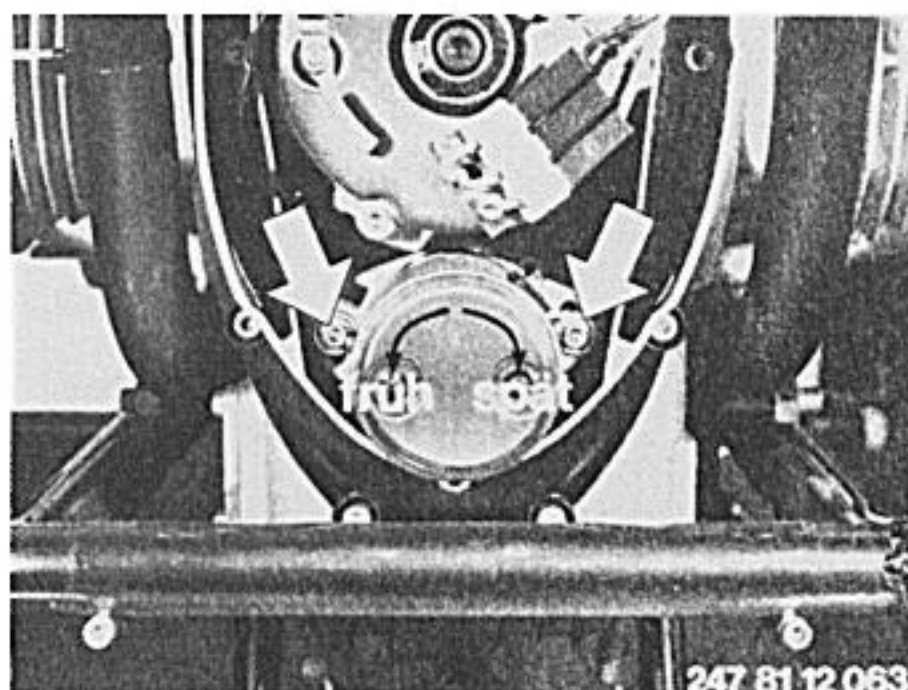


Separate the 3-pin plug (arrow) and connect ignition adjuster BMW No. 12 3 650 to the ignition unit.

Note: remove the wire clip from the plug connector.

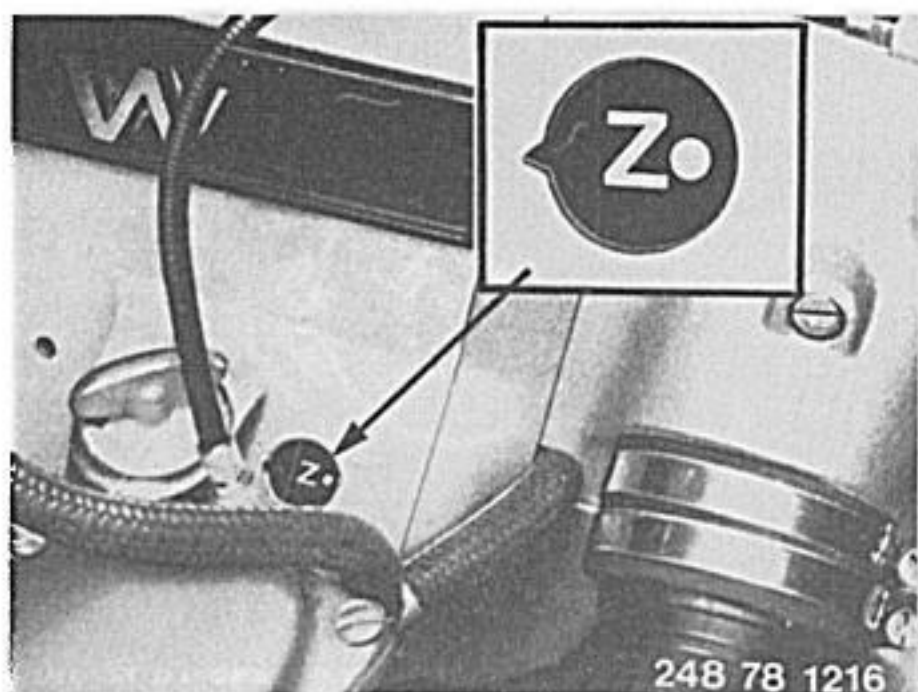


With the spark plugs removed, turn the engine over clockwise (looking from front of motorcycle), using the Allen screw which retains the rotor.



The central white line on the flywheel ('S') must coincide with the mark at the inspection hole on the engine block (second picture, page 12-11/2) when the diode on the ignition tester comes on. If necessary, turn the ignition unit round as illustrated.

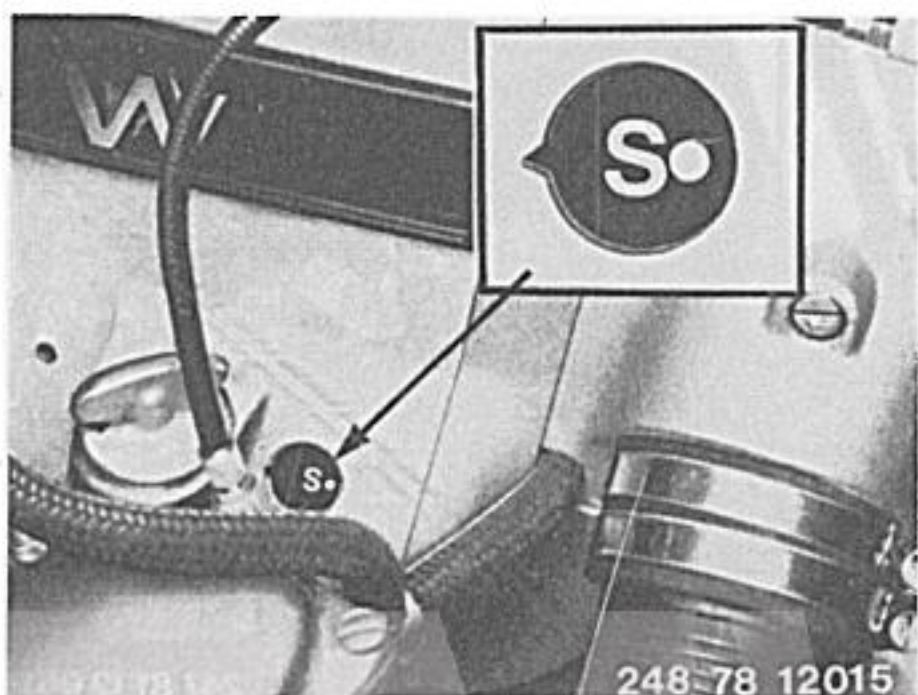
Clockwise = ignition timing retarded
Counterclockwise = ignition timing advanced.



Timing the ignition (dynamic)

Connect strobe light to battery and to ignition lead. Start the engine and run up to a speed of 3500/min. When the light is directed on to the flywheel, the white 'Z' spot should appear in the inspection hole (ignition fully advanced). To check the ignition control characteristic, turn the adjusting wheel on the strobe light until the 'OT' (TDC) mark appears. The calibrated scale on the light will then show the actual amount of ignition timing variation in degrees.

For ignition timing angle, see Specifications.



At engine idle speed (950 ± 150 /min), the central white line 'S' on the flywheel must be aligned with the mark in the inspection hole (2). If the line is below centre, the ignition is retarded; if the line is above centre, the ignition is advanced too far.

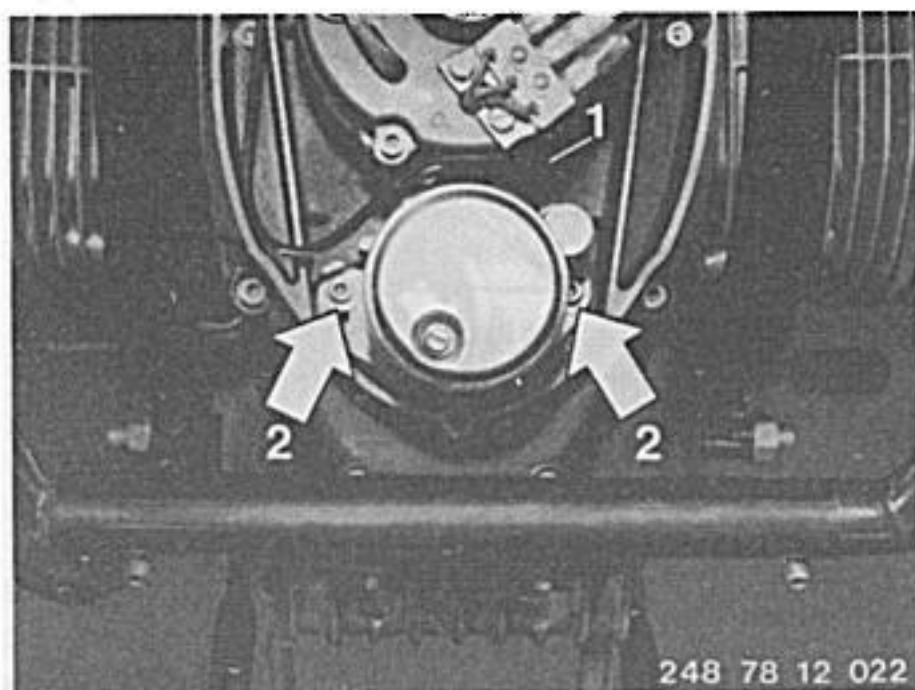


12 11 060 Ignition trigger – removing and installing

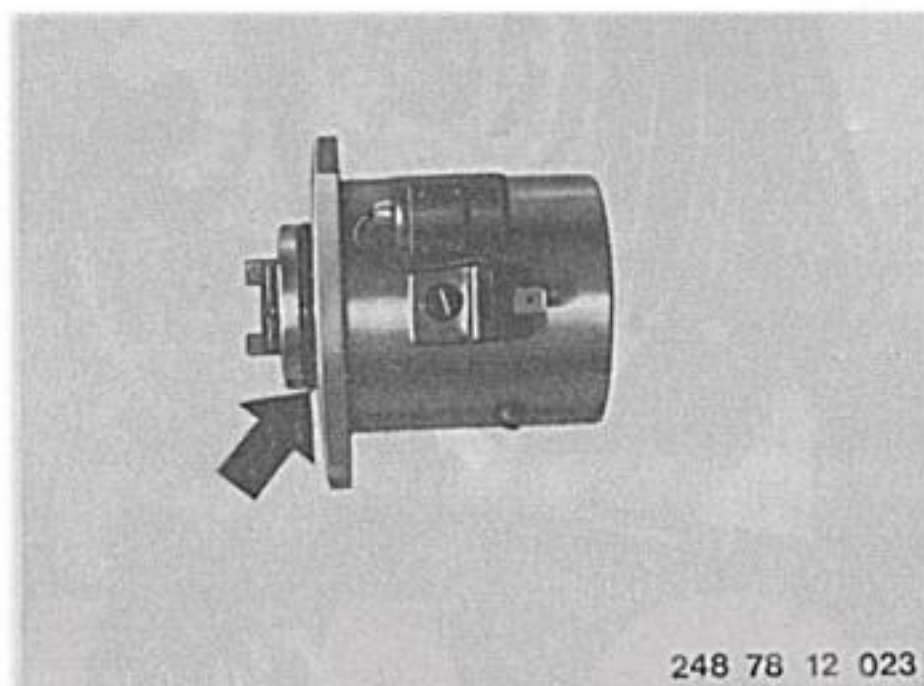
Remove the engine cover.

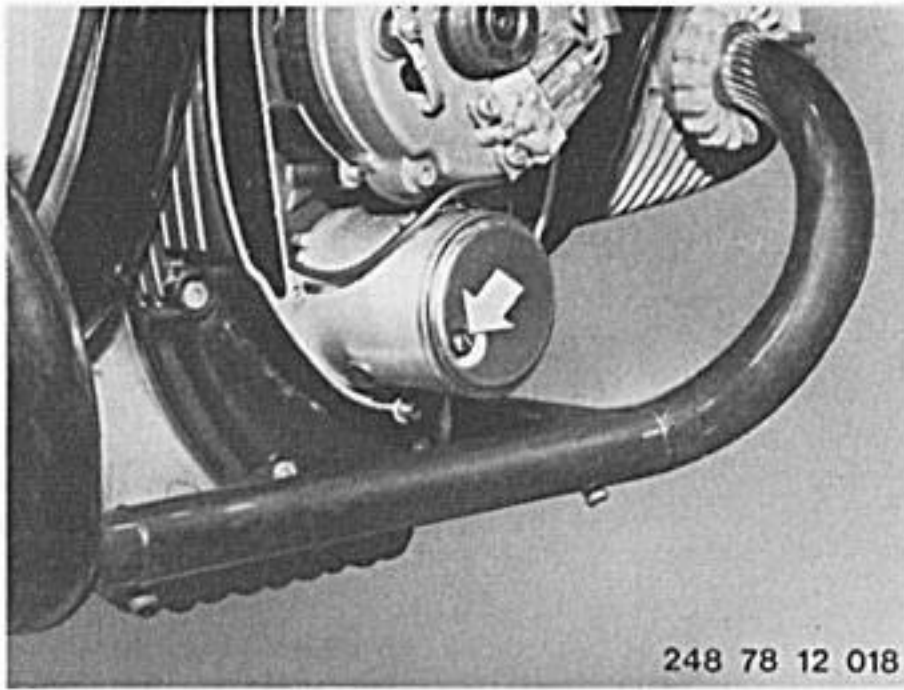
Pull off the flat connector socket (1). Release the Allen screws (2) and remove the ignition trigger from the chain case cover. Item (1) not present on models from 1981 on.

Important: do not attempt to take the ignition trigger assembly apart – always replace as a complete unit.



Renew the sealing ring (arrow) whenever the ignition contact assembly is removed.





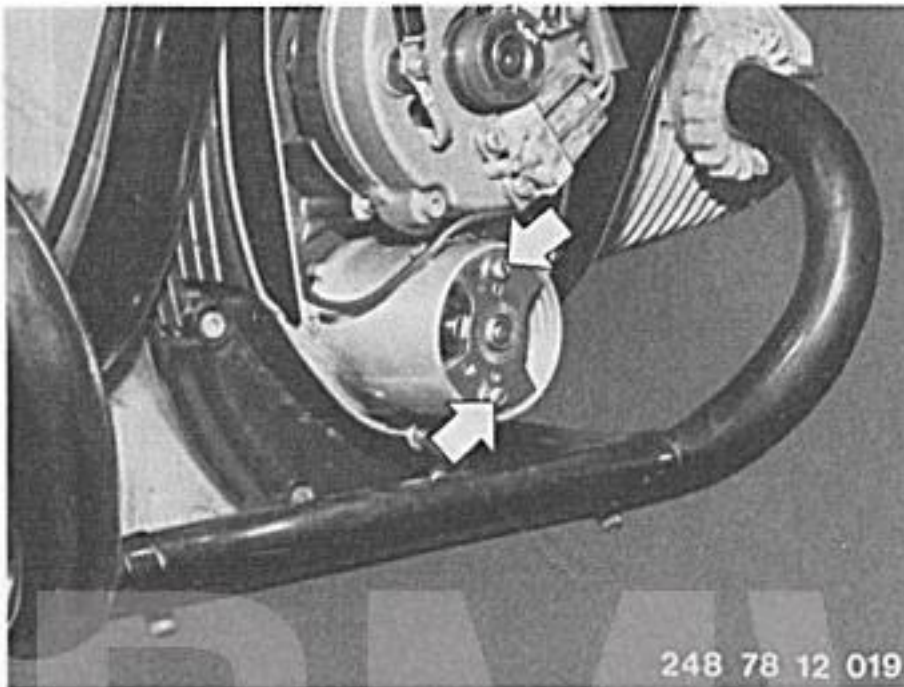
248 78 12 018

12 11 141 Breaker points – renewing

Remove the engine cover after slackening the Allen screws.
Remove the screw on the ignition contact assembly cover (arrow) and take off the cover.



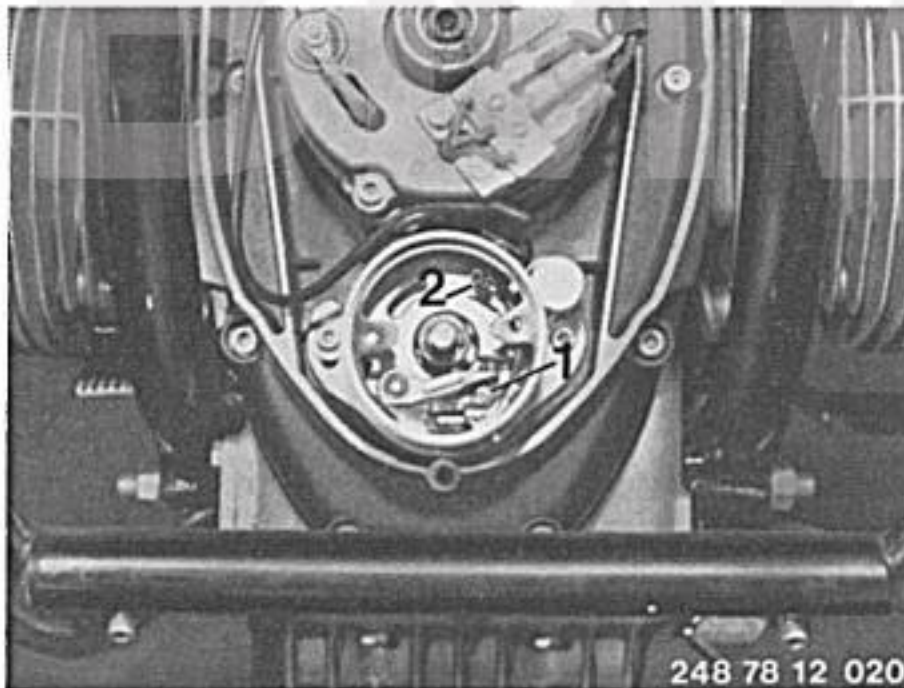
Remove the two screws holding the support bearing (arrows) and take out the bearing.



248 78 12 019



Remove the machine screw (1), pull off the flat pin plug (2) and pull out the complete contact breaker assembly.



248 78 12 020

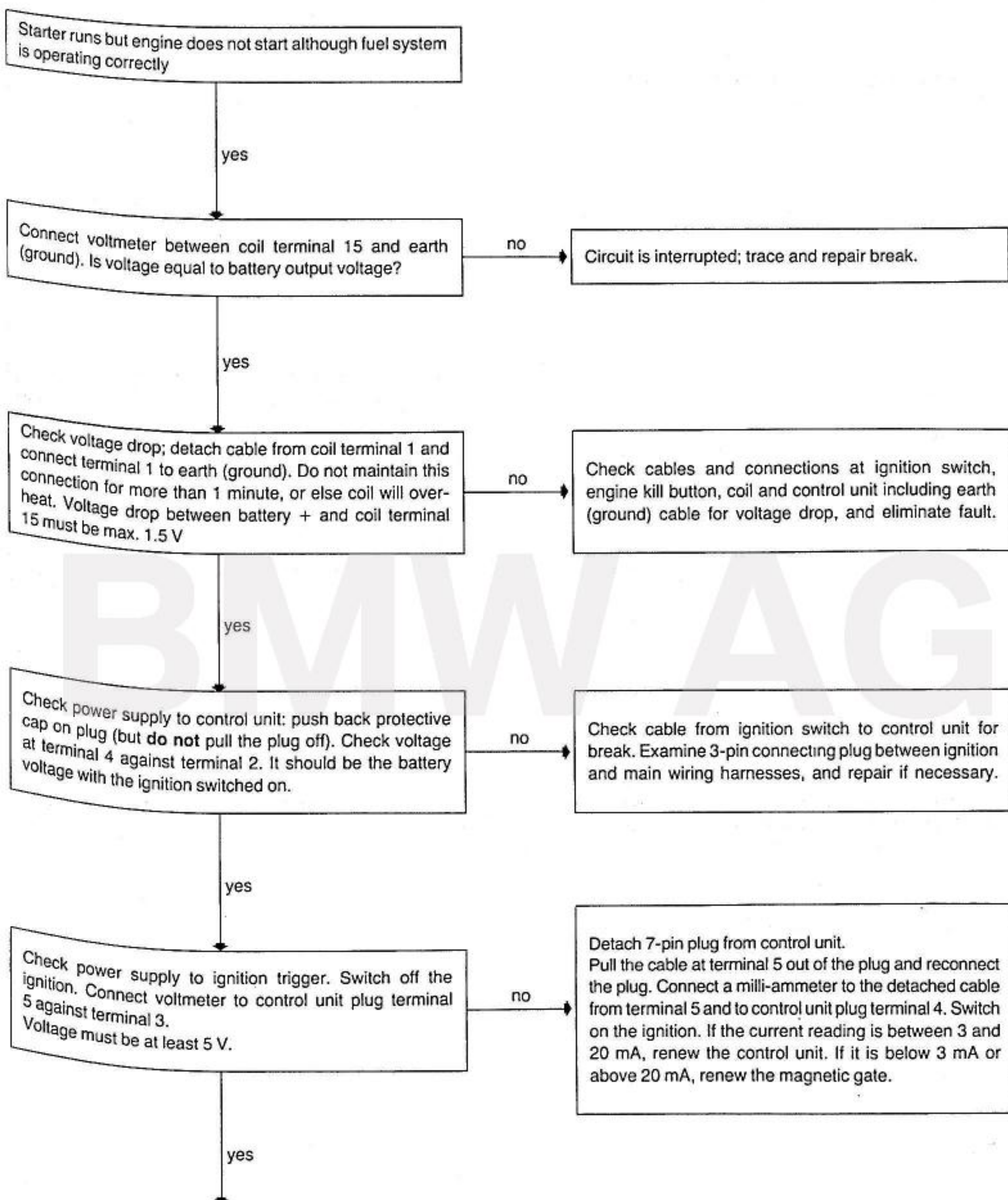


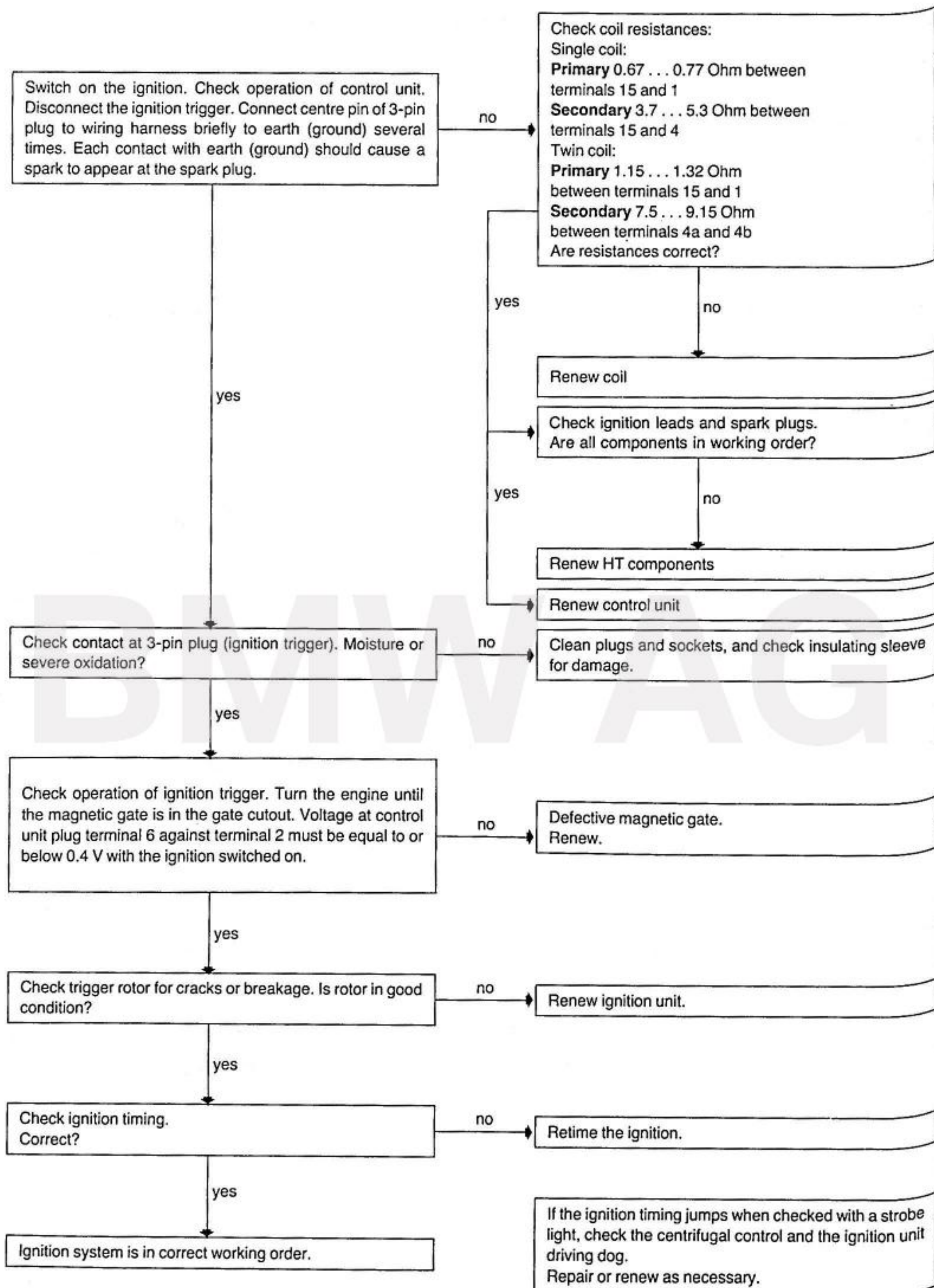
Troubleshooting – ignition system

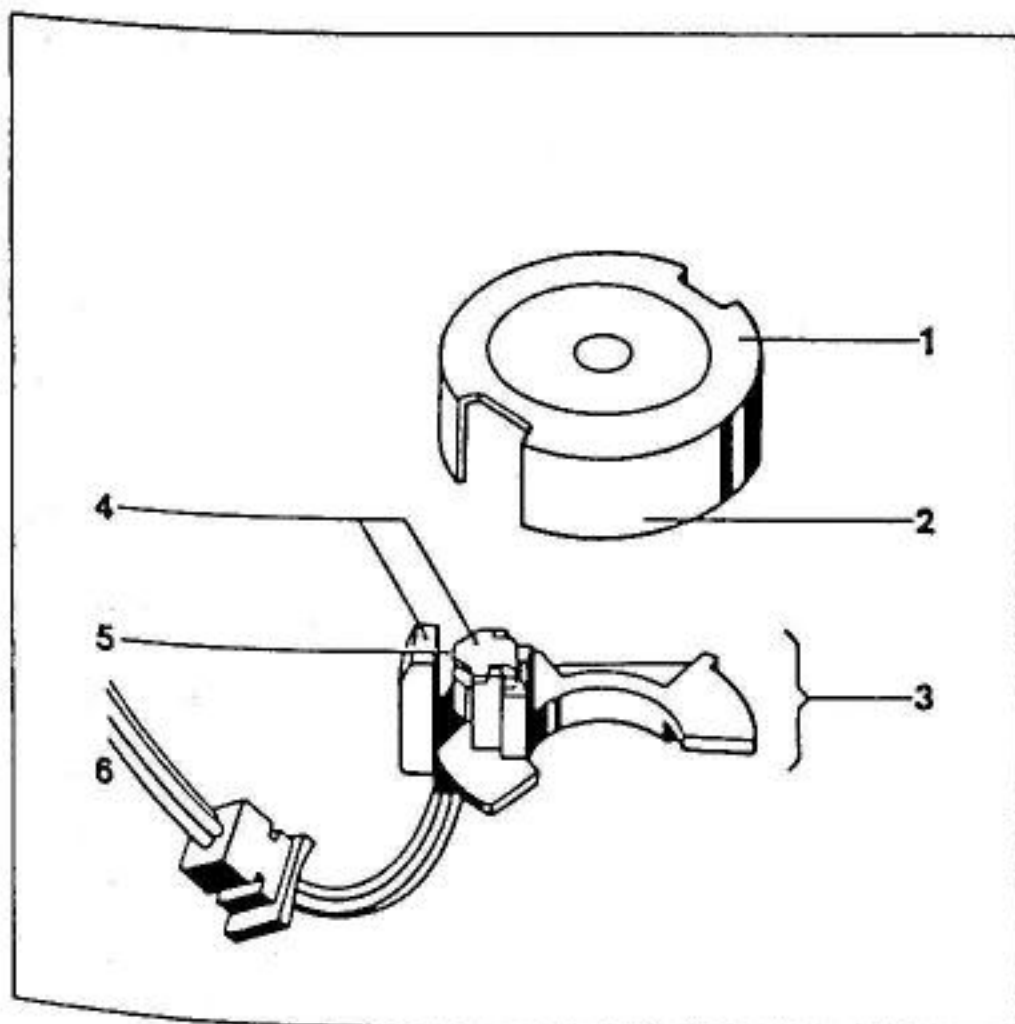
Malfunction	Cause	Remedy
Engine does not start or misfires	Breaker contacts burnt away or dirty	Renew breaker contacts
Drop in engine power	Incorrect dwell angle	Adjust dwell angle
Engine does not accelerate	No centrifugal advance	Check or renew centrifugal control unit
Engine starts, then stalls	Break or short-circuit in capacitor	Renew capacitor
Engine misfires – high fuel consumption	Defective ignition cables Defective spark plug sockets Defective interference suppressors	Renew ignition cables Renew spark plug sockets Renew interference suppressors

BMW AG

Troubleshooting – ignition system (from 1981 models on)







Components of Hall effect transmitter:

- 1 Gate rotor with cutouts
- 2 Gate
- 3 Magnetic gate
- 4 Guide
- 5 Air gap
- 6 Three-core transmitter cable

Warning: after the ignition switch has been turned on, the control unit cuts out after 5 seconds. For measurements at terminal 1, the ignition switch must be turned off and back on again.

BMW AG

12 13 100 One coil — removing and installing

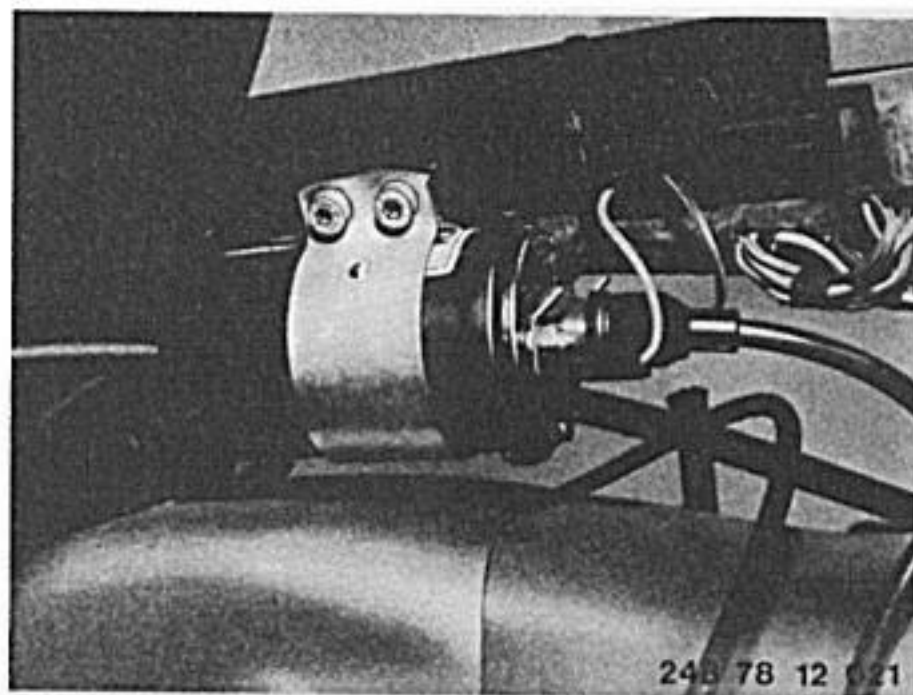
Remove and install fuel tank — 16 11 030.

Disconnect the earth (ground) lead from the battery at the gearbox.

Detach the cables from terminals 1 and 15 and the high-tension cable from the coil.

Loosen the retaining screws with an Allen key.

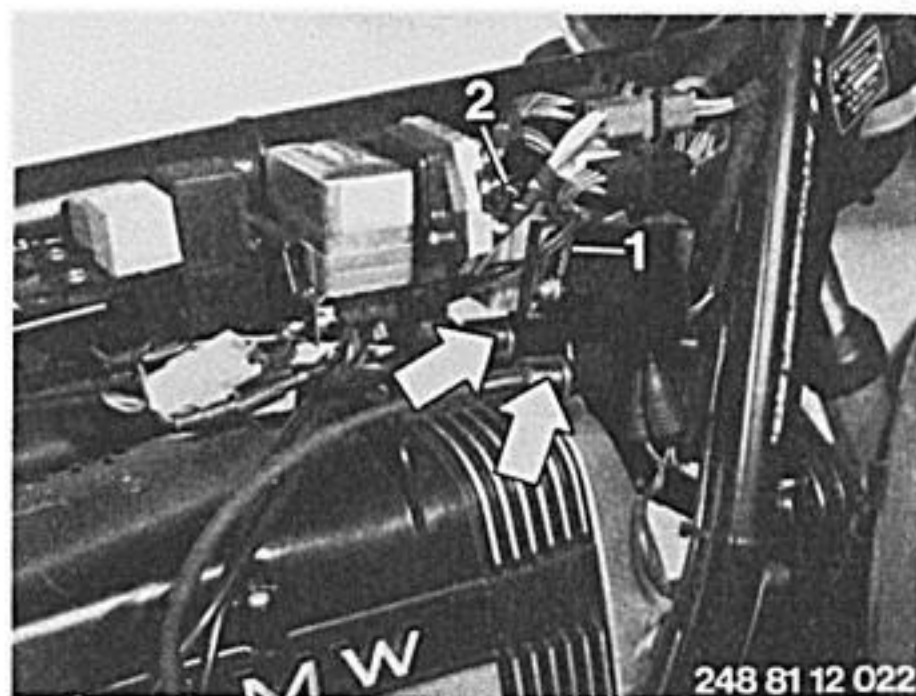
When installing: do not forget the earth (ground) connection to the front coil mounting.



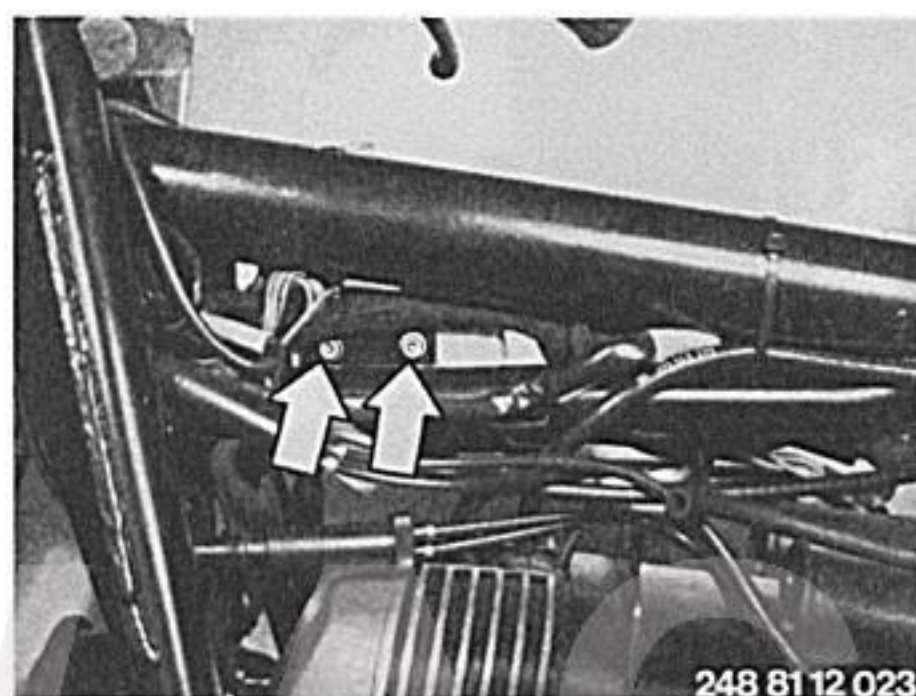
BMW AG

12 13 000 Twin ignition coil – removing and installing (1981 models)

Disconnect the ignition leads (arrows) from the ignition coil and detach the cables at terminals 1 (1) and 15 (2).



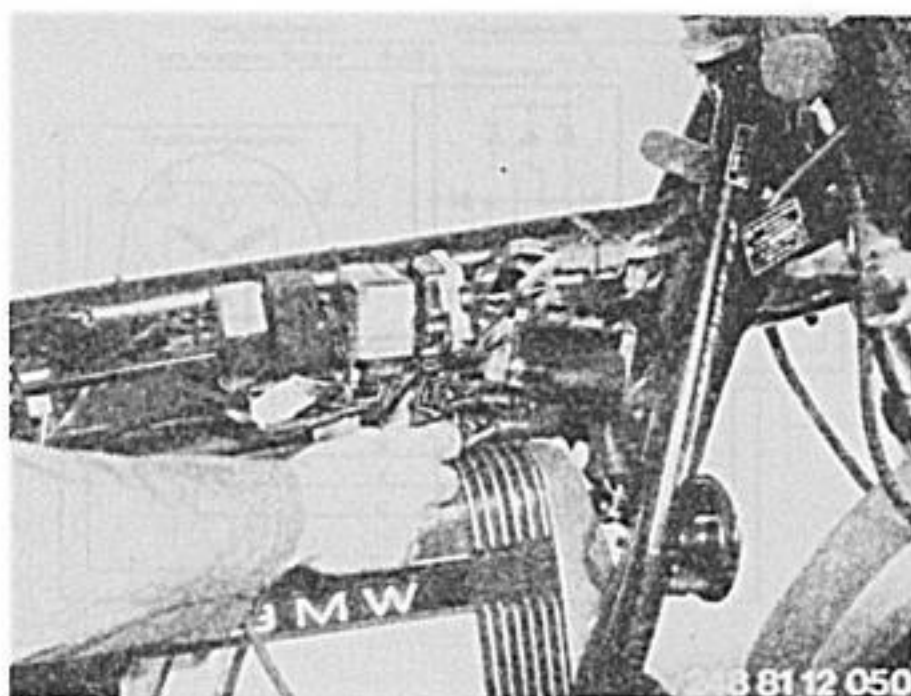
Undo the ignition coil retaining screws (arrows) and take off the ignition coil.



12 14 010 Control unit – removing and installing

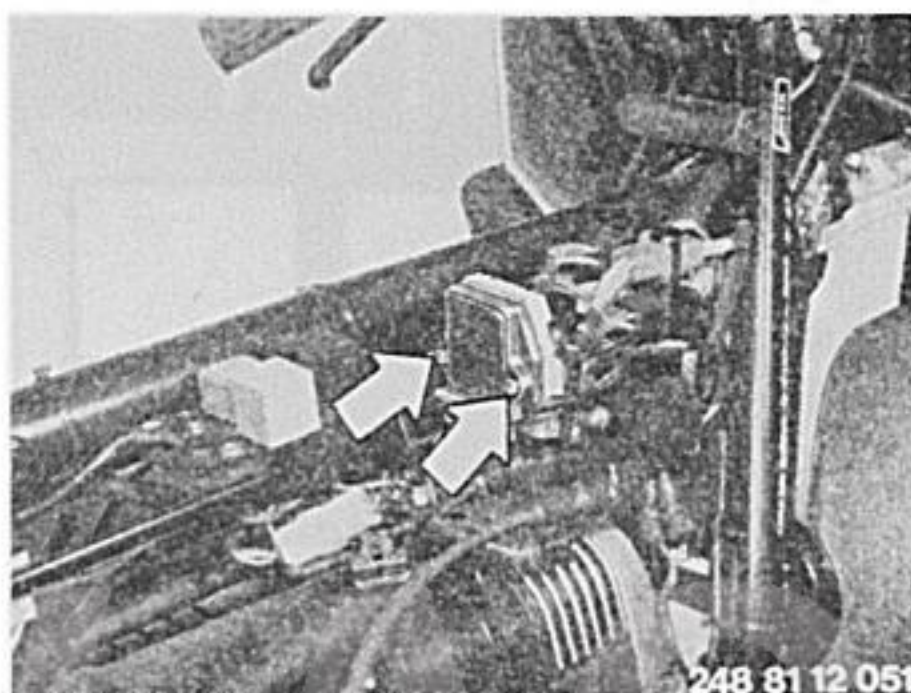
Remove (install) fuel tank – 16 11 030.

Detach multi-pin plug (arrow) from control unit.



Remove (install) regulator for alternator – 12 32 000. Slacken the retaining bolts (arrows) at the control unit and remove the unit.

When installing: to avoid corrosion and the resulting poor heat transfer, apply Curil K 2 to the joint face between the control unit and the heat sink.

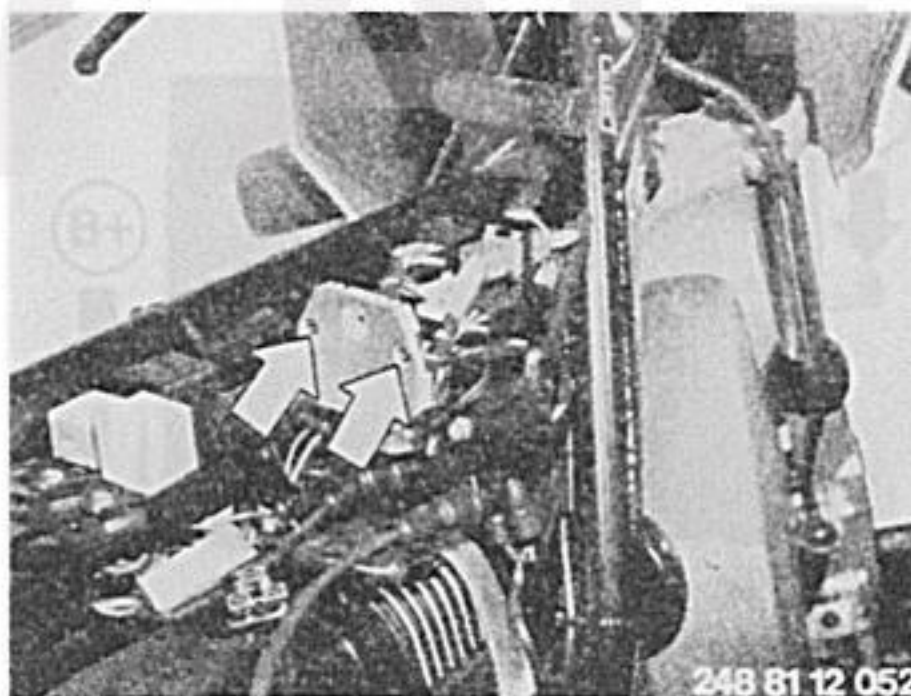


12 14 025 Heat sink – removing and installing

Remove (install) fuel tank – 16 11 030.

Remove (install) control unit – 12 14 010.

Unscrew the bolts (arrows) holding the heat sink and take it off.

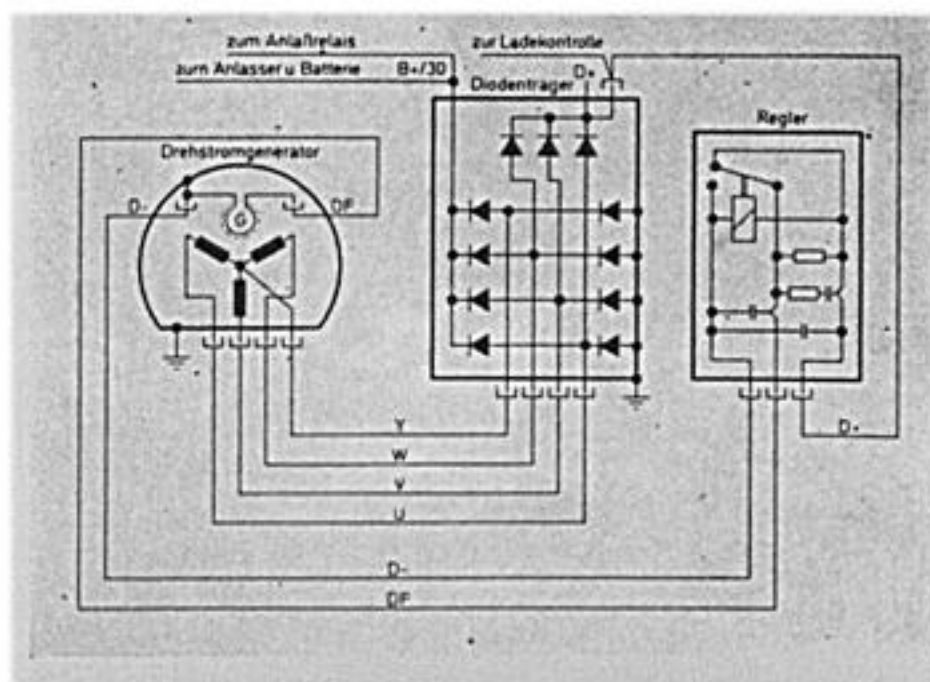


12 31 009 Alternator, diode board and regulator – testing

The illustration shows the layout of the alternator, diode board and regulator.

Warning: Do not disconnect leads between the battery, alternator and regulator unless the engine is at a standstill. If the battery is recharged without removal from the motorcycle, disconnect the positive and negative leads from the battery.

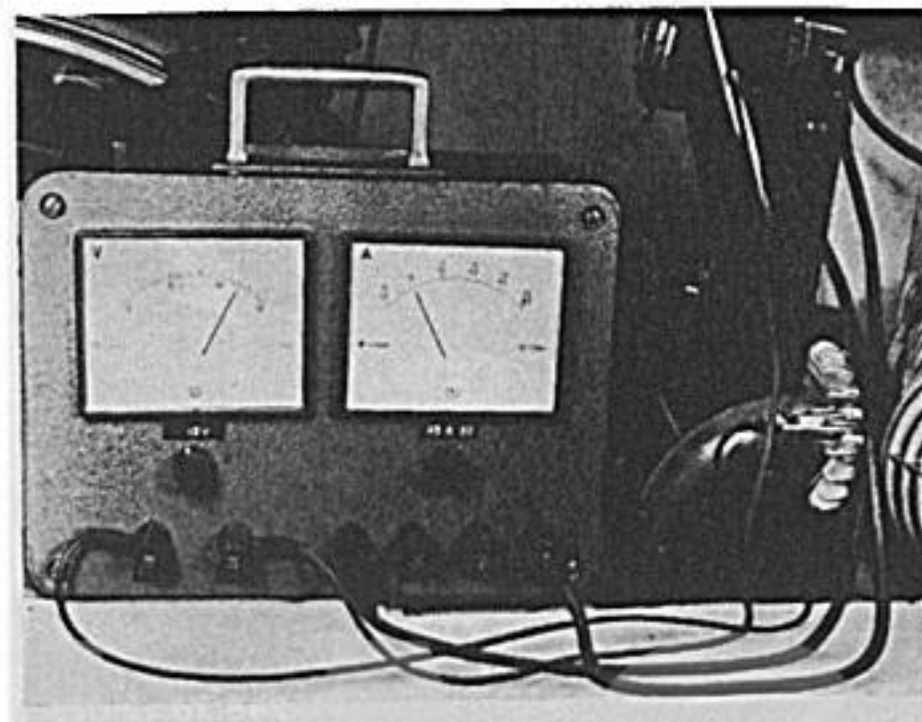
The charge warning lamp is used to pre-excite the alternator.



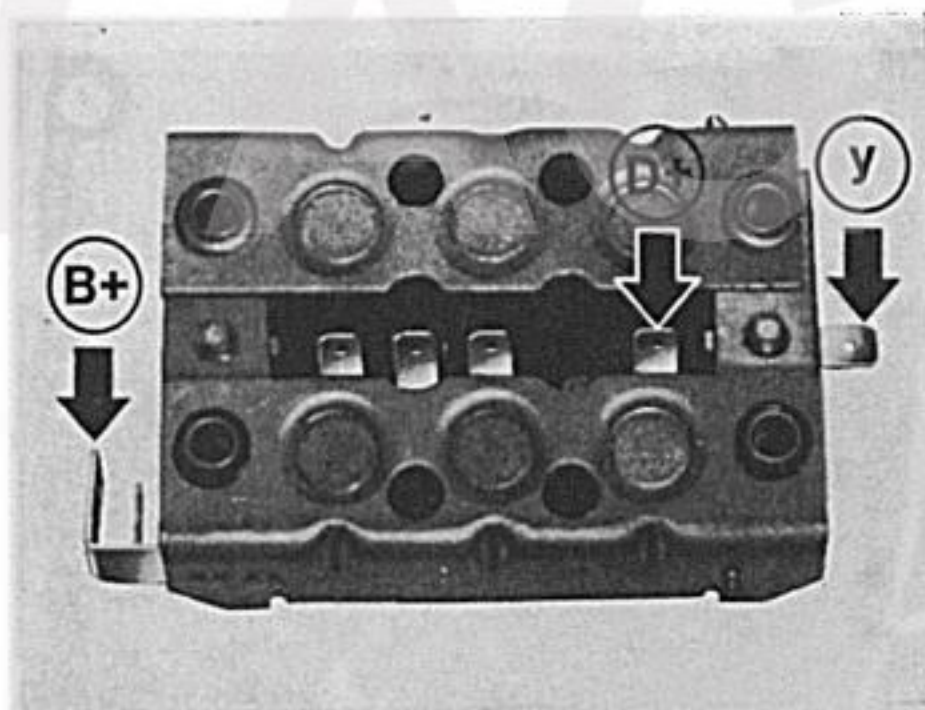
To check the regulator, detach B+ (black lead) from the diode board with the engine at a standstill. Connect a voltmeter to B+ and D-. Start the engine. Shortly before the regulator takes effect, the voltage reading should be 13.5 ... 14.2 V.

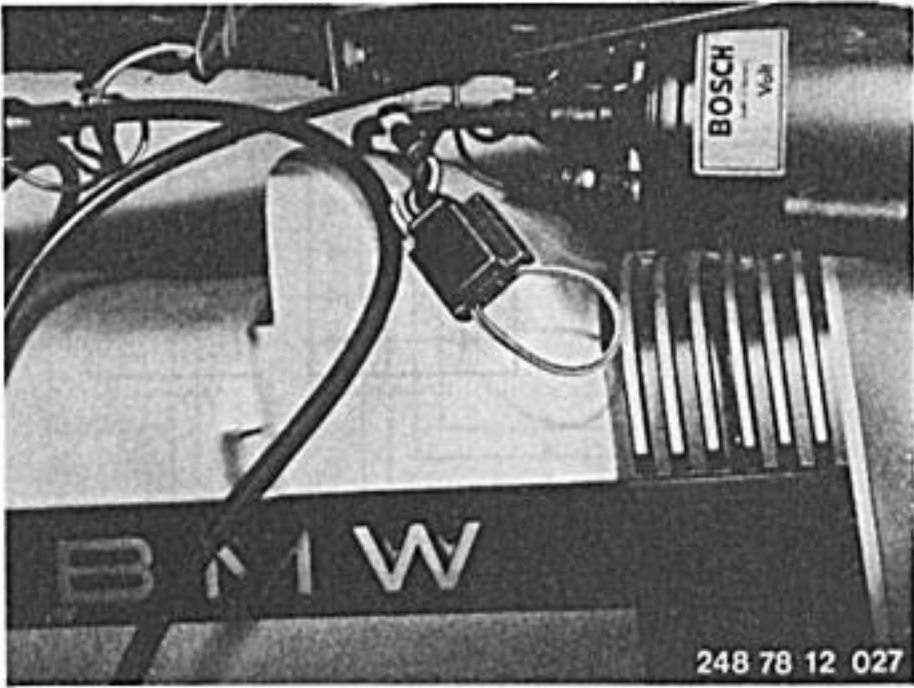
To check the charge current, insert an ammeter reading from 15 to 20 A into lead B+. Switch on current consumers or use a sliding resistor to create a load of 13 A parallel to the battery.

Run the engine at 4000 min⁻¹. Adjust the maximum current at the sliding resistor. Read off the regulator cut-in voltage underload at the voltmeter. For correct values, see Specifications.



A voltmeter with a scale range of approx. 3 V can be used to measure the difference in voltage between D+ and B+ directly. Up to 0.5 V difference in voltage indicates a regulator fault. Between 1.5 and 4V difference in voltage indicates a fault on the diode board.





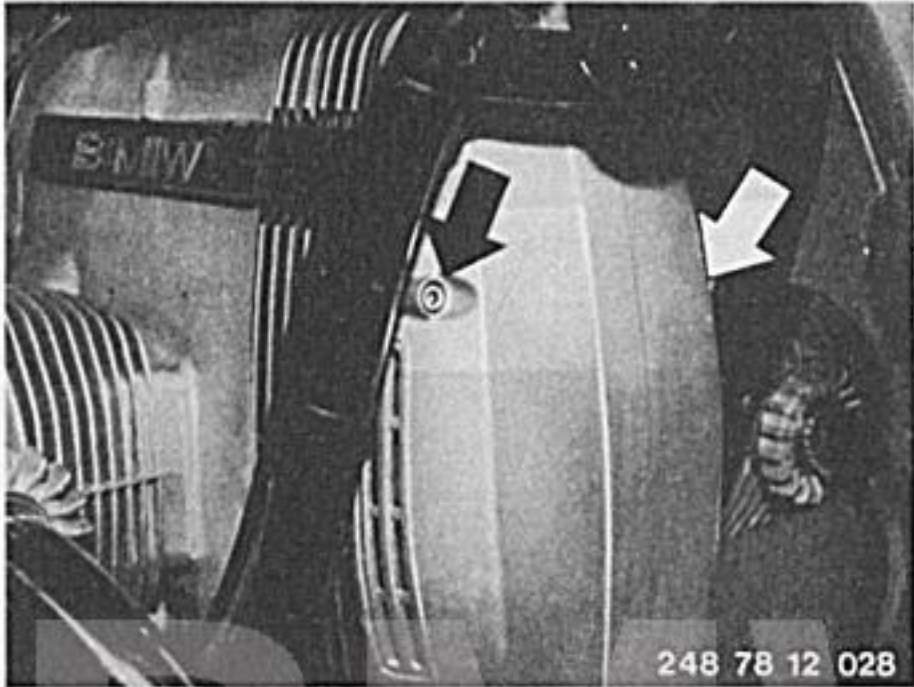
12 31 019 Alternator with regulator – quick check

Fuel tank removed – 16 11 030.

Do not perform this test unless the charge warning lamp remains on continuously when the engine is running.

With the engine stopped, detach the multi-pin plug from the regulator. Using a wire bridge, connect lead D+ (blue) to lead DF (blue-black).

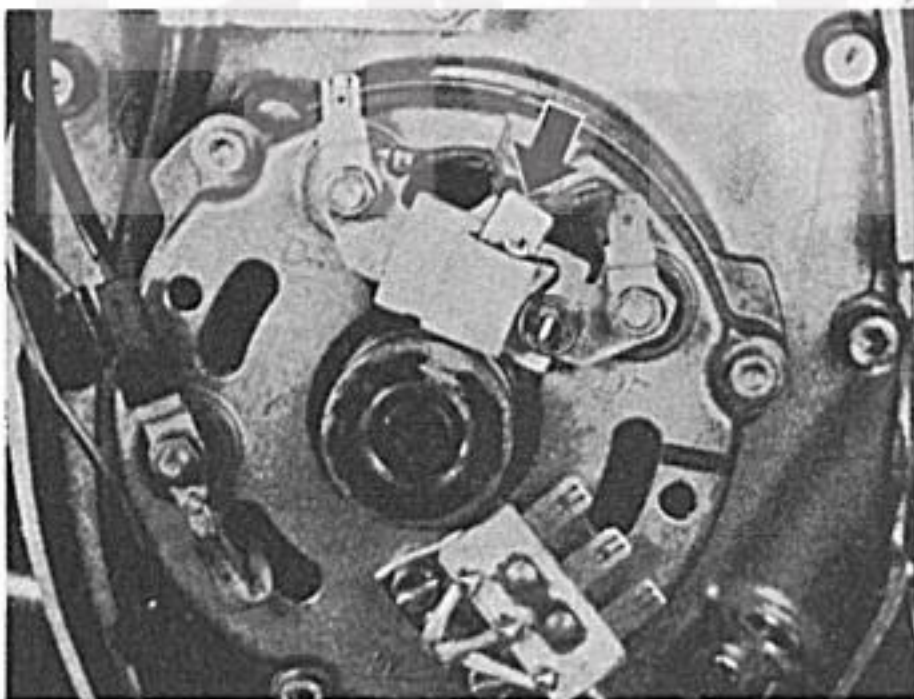
Start the engine and run at approx. 1000 . . . 2000 min⁻¹. If the charge warning lamp goes out immediately, the regulator is faulty. If the charge warning lamp glows faintly or continues to burn brightly, the alternator is faulty.



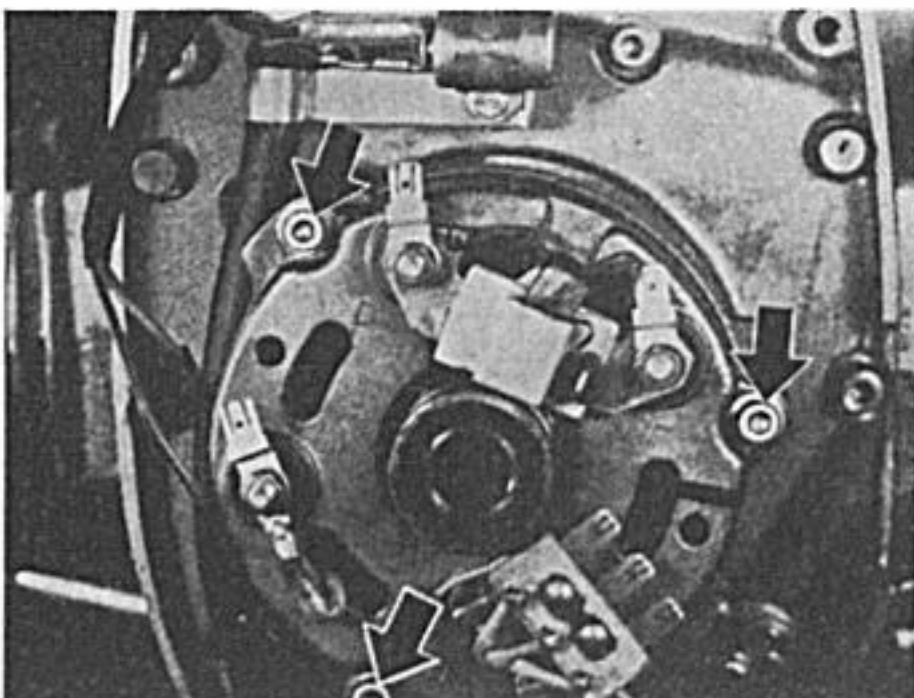
12 31 020 Alternator – detaching and attaching

Engine removed (11 00 050) or installed.

Slacken the three Allen screws and take off the engine cover.

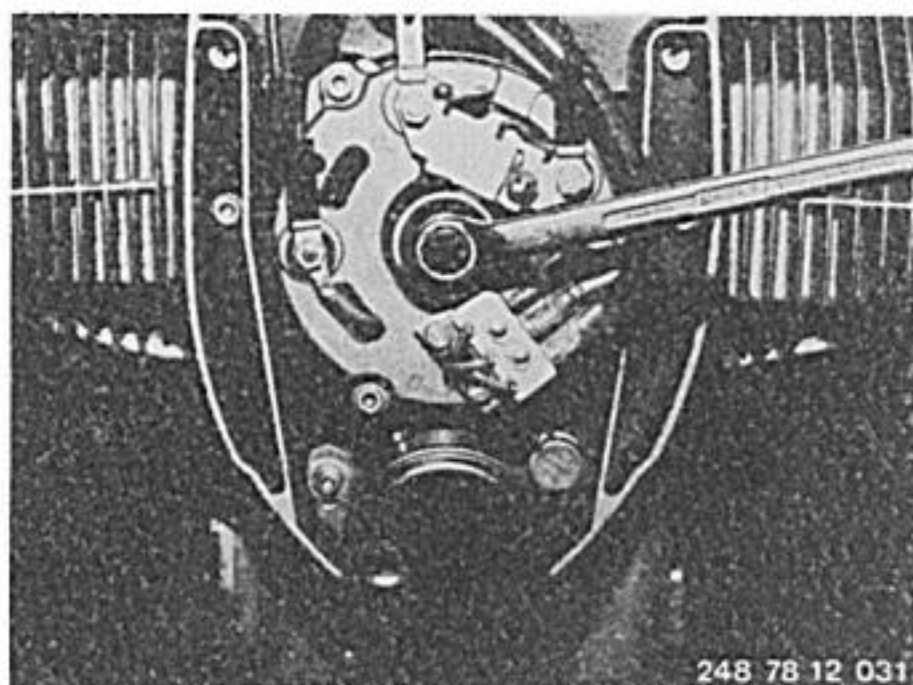


Detach the three-pin flat plug from the pole housing. Raise the carbon brushes slightly and secure in this position with the coil springs.



Remove the three Allen screws from the pole housing and take off the housing.

Loosen the rotor retaining screw and press the rotor off the end of the crankshaft with BMW 12 3 600 extractor bolt.

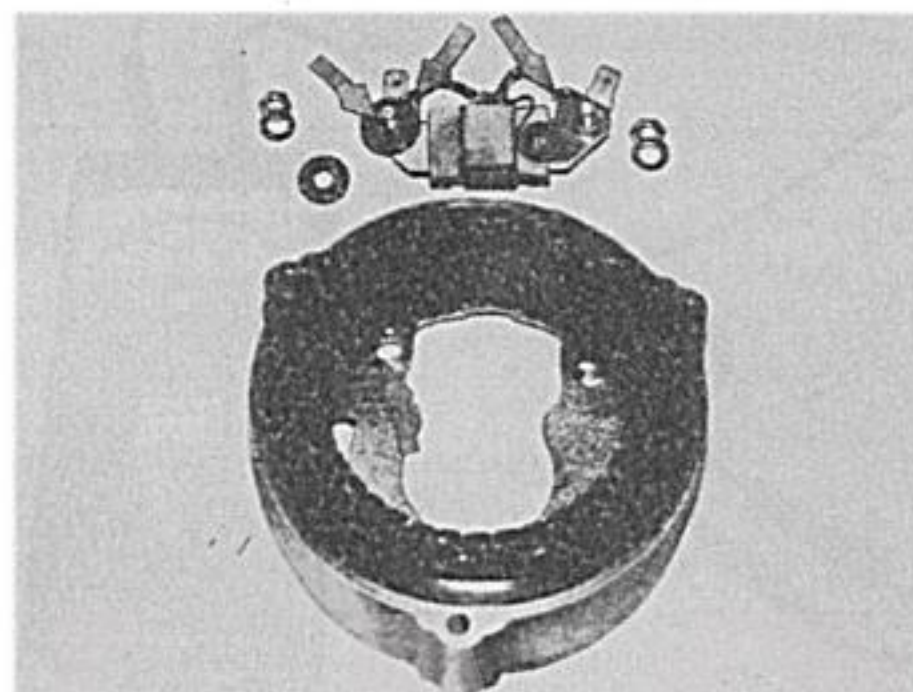


12 31 212 Alternator — reconditioning

Detach and attach the alternator — 12 31 020.

Unscrew the 2 nuts from the inside of the pole housing and pull off the holder with brushes. If new carbon brushes have to be installed, make sure when soldering in (arrow) that no tin runs down into the stranded copper wire.

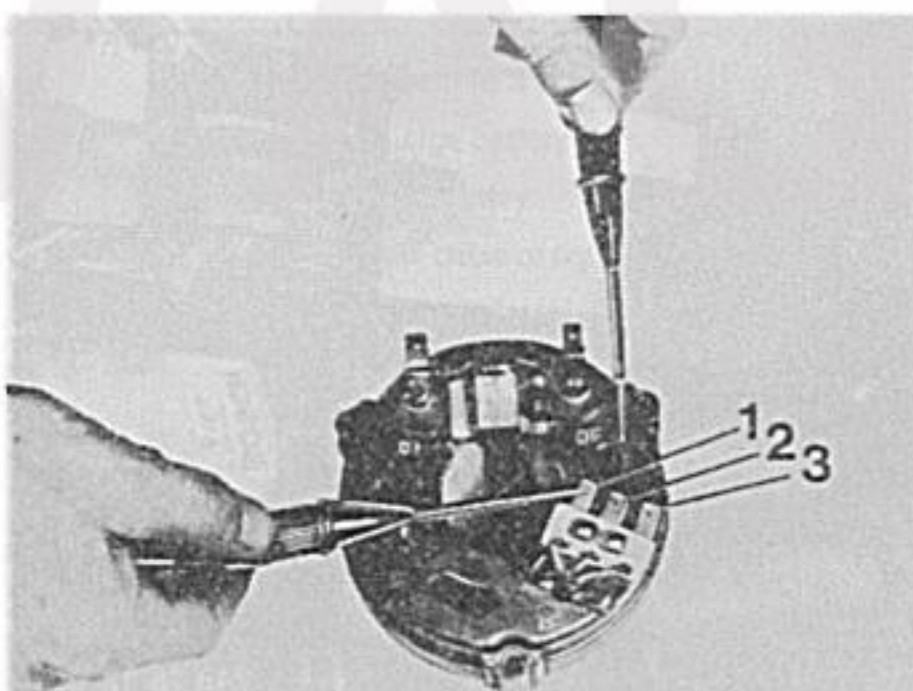
Place the insulating bushings on the brush holder studs. Tighten the brush holder down into the pole housing. Do not forget the insulating washers.



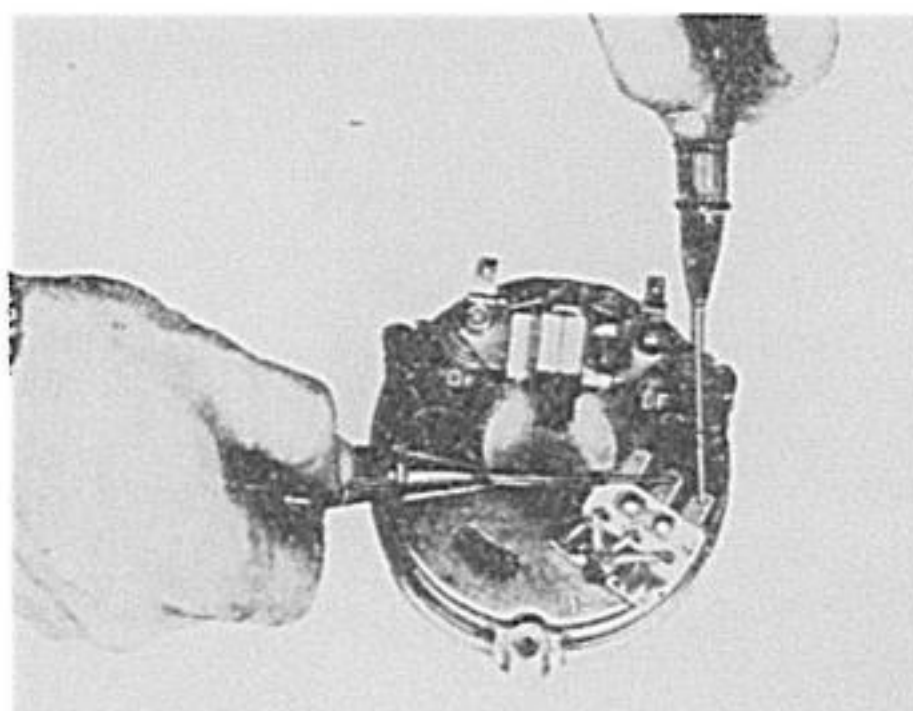
12 31 689 Stator winding and rotor — checking

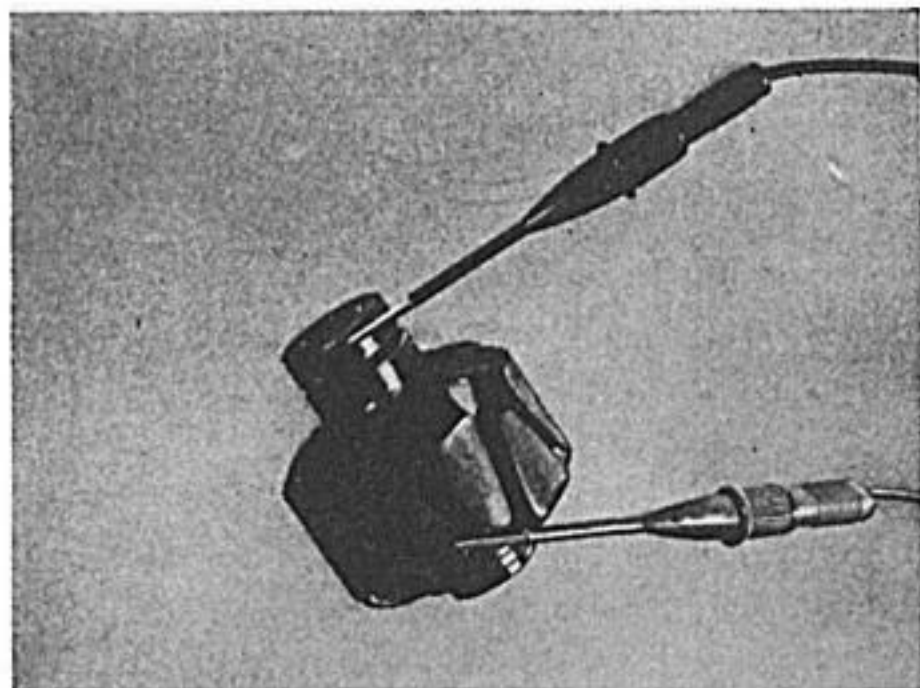
Recondition the alternator — 12 31 212.

Check stator winding with a 40 V AC power supply for short to earth (ground); carry out three measurements in each case.



Check resistance between the phase outlets alternately; for value, see Specifications.

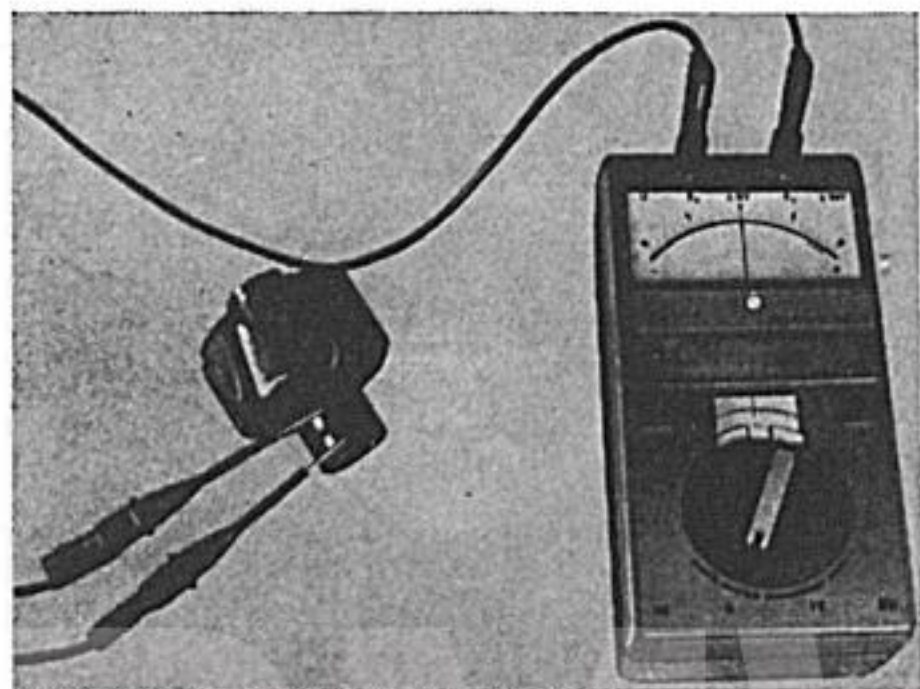




After removing the claw-pole rotor, check with 40 V AC for short to earth (ground).

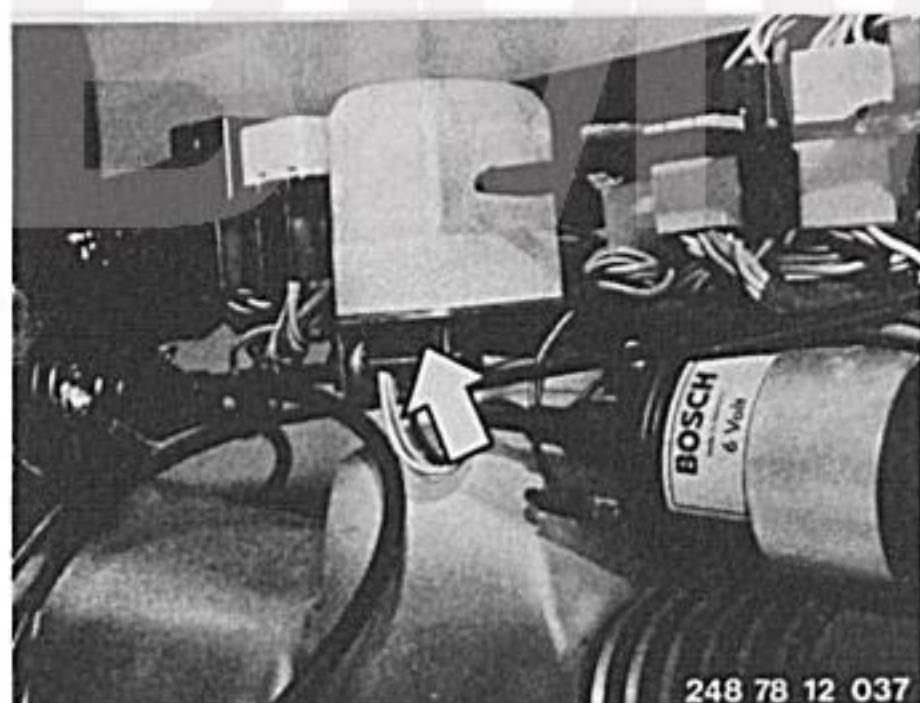


Check the exciter winding (with ohmmeter).



12 32 000 Regulator for alternator — removing and installing

Take off the fuel tank — 16 11 030.
Disconnect the earth (ground) lead from the battery. Pull off the plug (arrow), loosen the two Allen screws and take off the regulator.



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 Defective regulator Defective carbon brushes Defective rectifier diode, or short to earth (ground) Short to earth (ground) in stator Partial short to earth (ground) in rotor	Check cables and connections Renew regulator Renew carbon brushes Renew rectifier diode Renew stator 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 Break or short-circuit in supply leads Defective carbon brushes Defective rotor winding Break in exciter circuit Diode or diode board defective Short to earth (ground) at cable D+/61	Renew regulator Check cables and connections Renew carbon brushes Renew rotor Check cable connections Check diode and diode board, renew if necessary Rectify short or renew cable
Telltale lamp does not come on when engine is started	Defective bulb Break in cable 61	Install a new 3 Watt bulb Rectify break
Telltale lamp does not come on when engine is stopped but ignition switched on	Defective bulb Battery flat Battery defective Cable detached or defective Defective regulator Short circuit at positive diode in alternator Worn carbon brushes Oxide coating on sliprings, break in rotor winding	Install a new 3 Watt bulb Recharge battery Renew battery Renew cable or tighten terminals Renew regulator Disconnect charge cable at once to avoid flat battery; have alternator repaired Renew carbon brushes Have alternator repaired

12 41 009 Starter – checking without removal from motorcycle

Check battery charge – for correct values, see Specifications.

Select 5th gear and engage the footbrake. Operate the starter for 2–3 seconds. The starter voltage should not sink below 8 V, the reading being the same whether voltmeter switch 1 or 2 is used. If this is not the case, the earth (ground) connection on either the engine or the battery is faulty. Read the current value off at the ammeter at the same time (see Specifications).



Important:

If the engine stalls with a gear engaged, it can be restarted without selecting neutral if the clutch lever is pulled up.

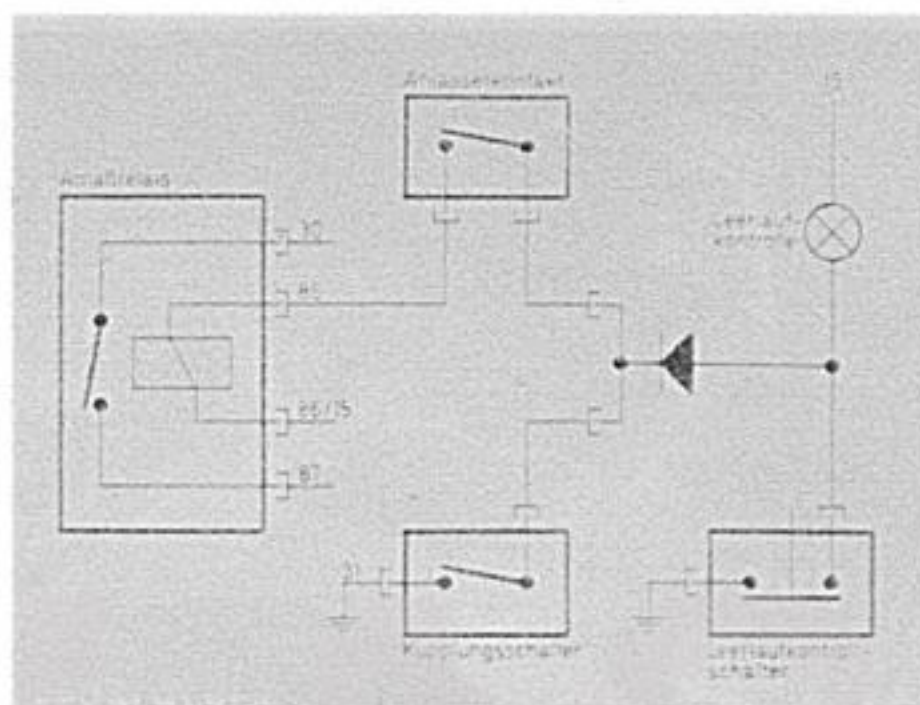
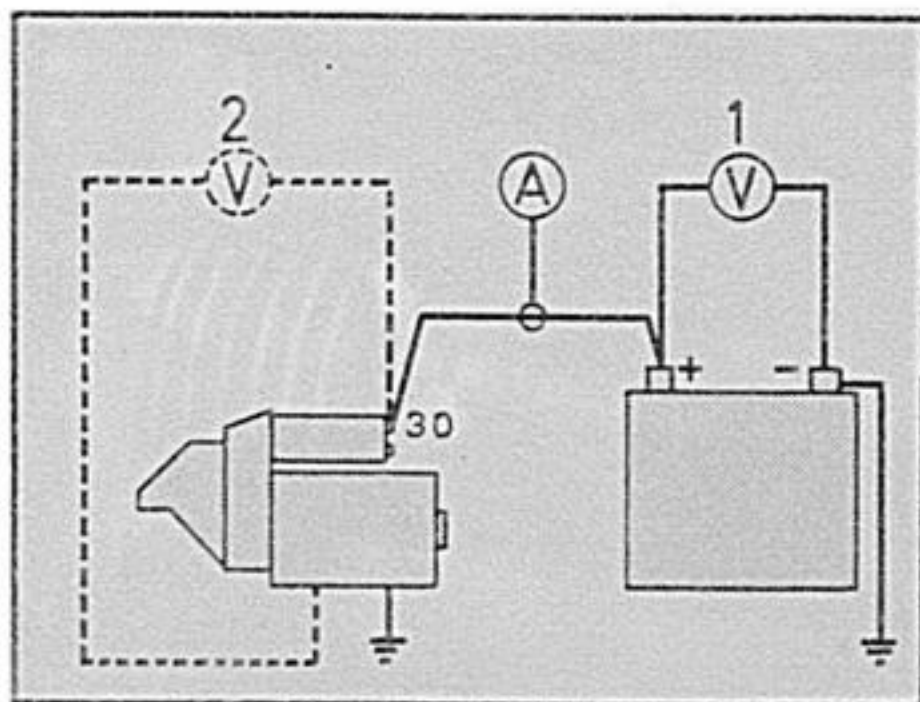
Anlasserkontakt = Starter contact

Anlaßrelais = Starter relay

Leerlaufkontrolle = Neutral indicator

Kupplungsschalter = Clutch switch

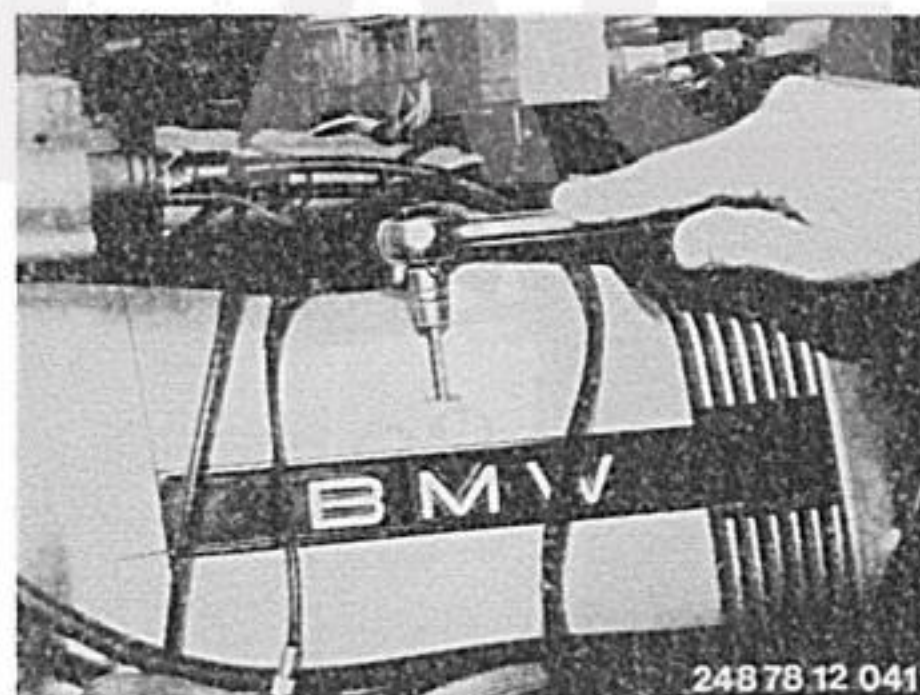
Leerlaufkontrollschalter = Neutral indicating switch



12 41 020 Starter – removing and installing

Disconnect the battery earth (ground) lead.

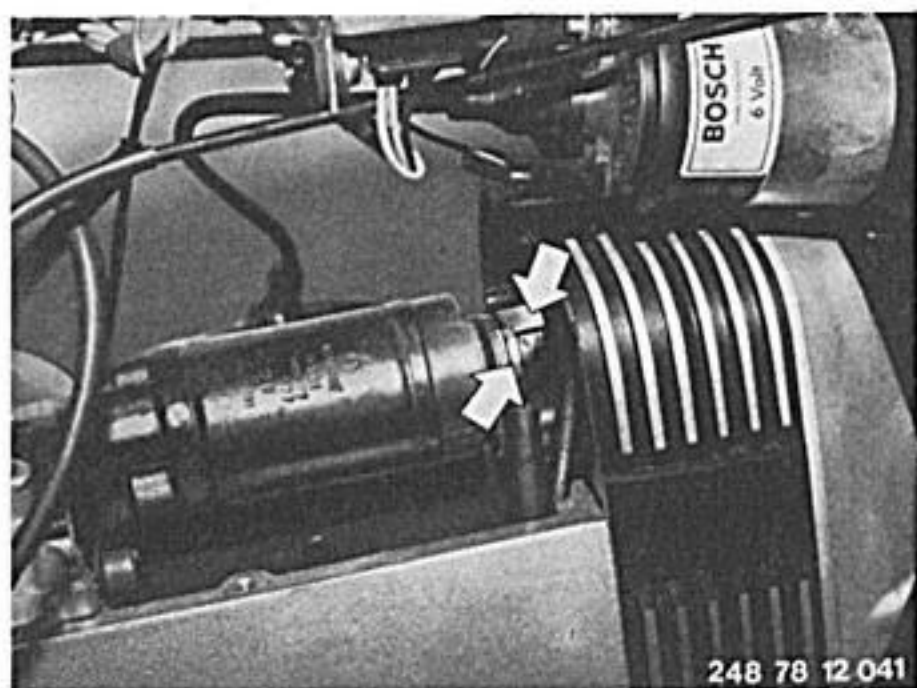
Remove the two Allen screws and lift away the starter cover to the right.



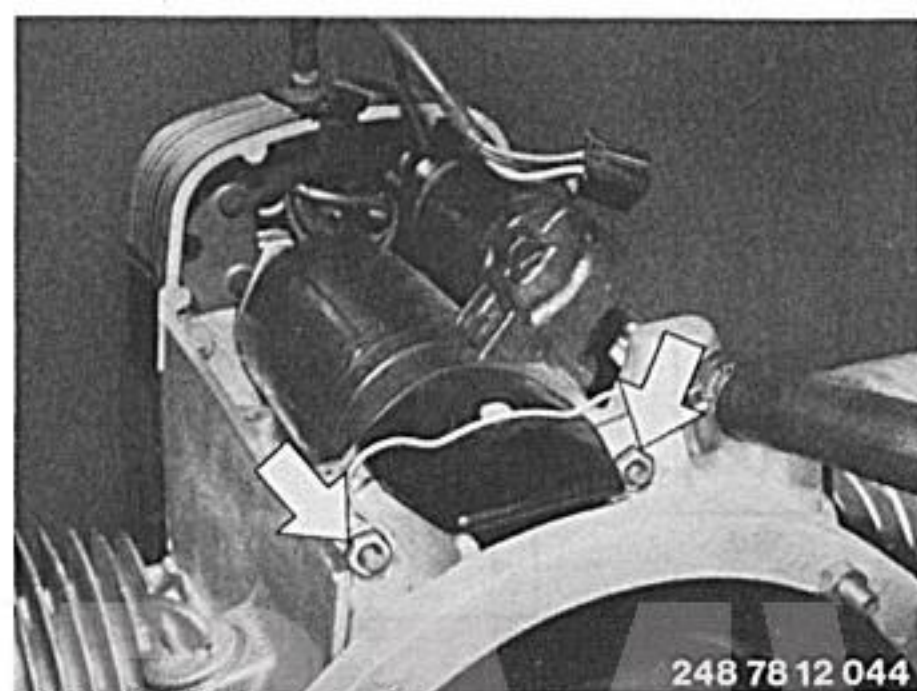
248 78 12 041

Detach the engine breather hose at the breather dome and pull it out of the air cleaner housing. On models from 1981 on, remove the top part of the air cleaner housing and the air cleaner element.

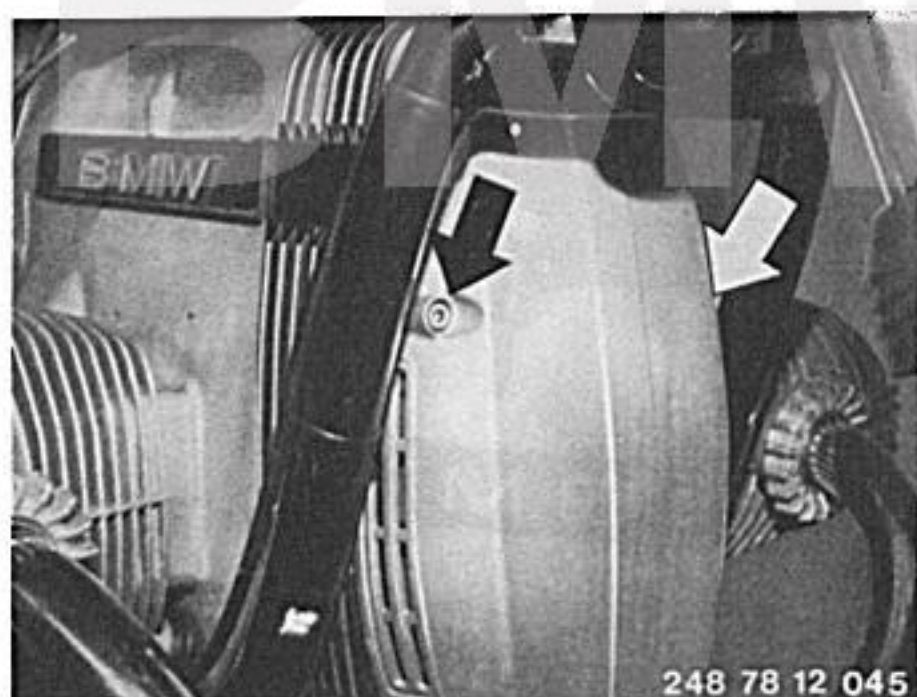




Disconnect the cables (arrows) from the starter.



Slacken the rear starter retaining bolts (arrows).



Remove the two Allen screws and take off the engine cover.

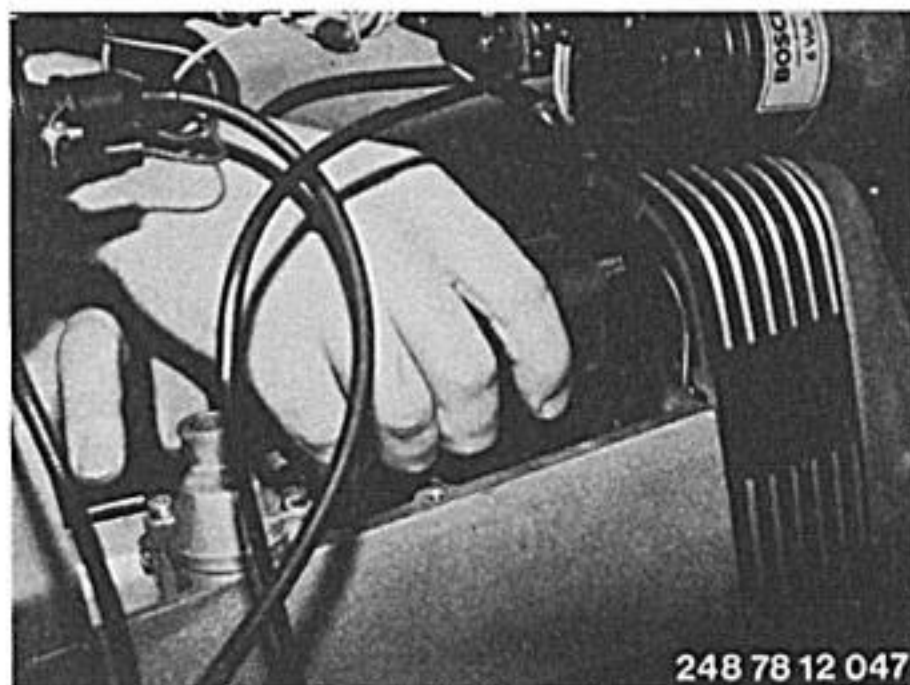


Unscrew the hexagon bolt (arrow) with a socket wrench.



Remove the engine breather hose – 11 15 101.

Remove the starter forwards from its guide.



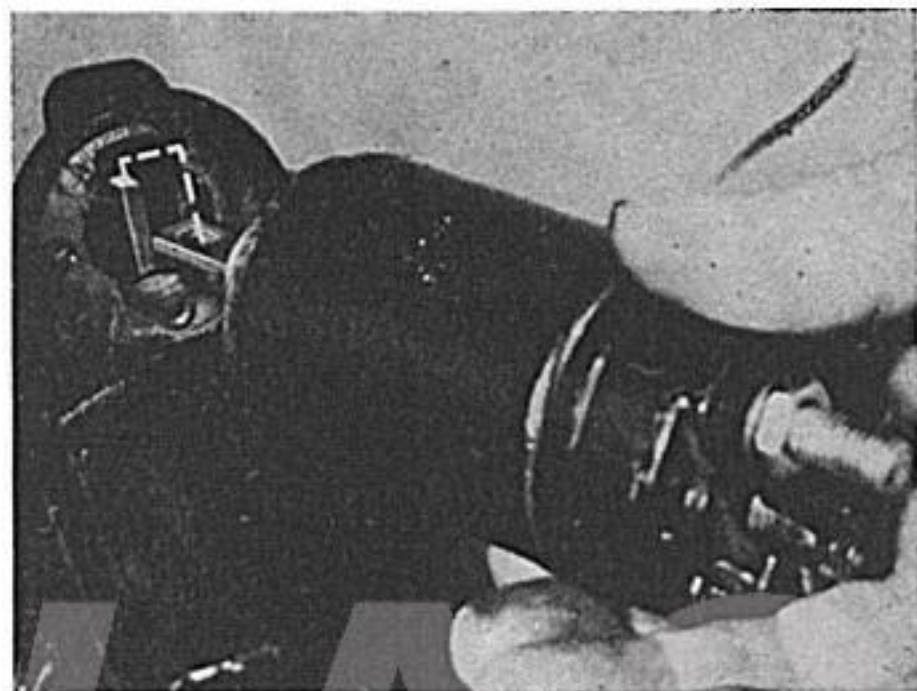
12 41 513 Starter – stripping and assembling

Remove and install the starter – 12 41 020.

Unscrew the cable for the exciter winding.

Detach the solenoid switch.

Disconnect the engagement lever.



Take off the dust cap.

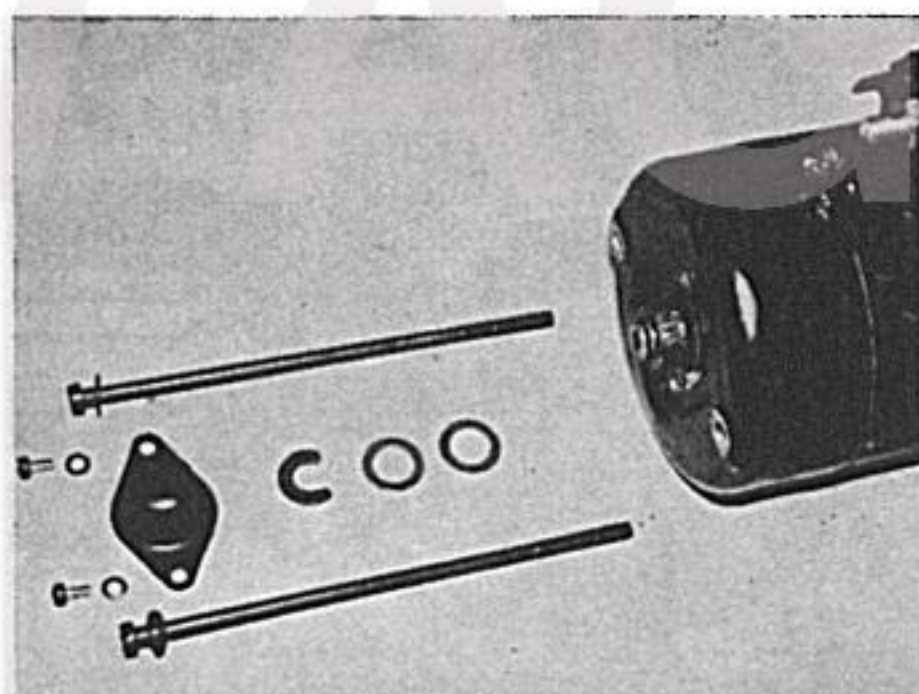
Remove the lock washer, shim and gasket.

Remove the pole housing screws.

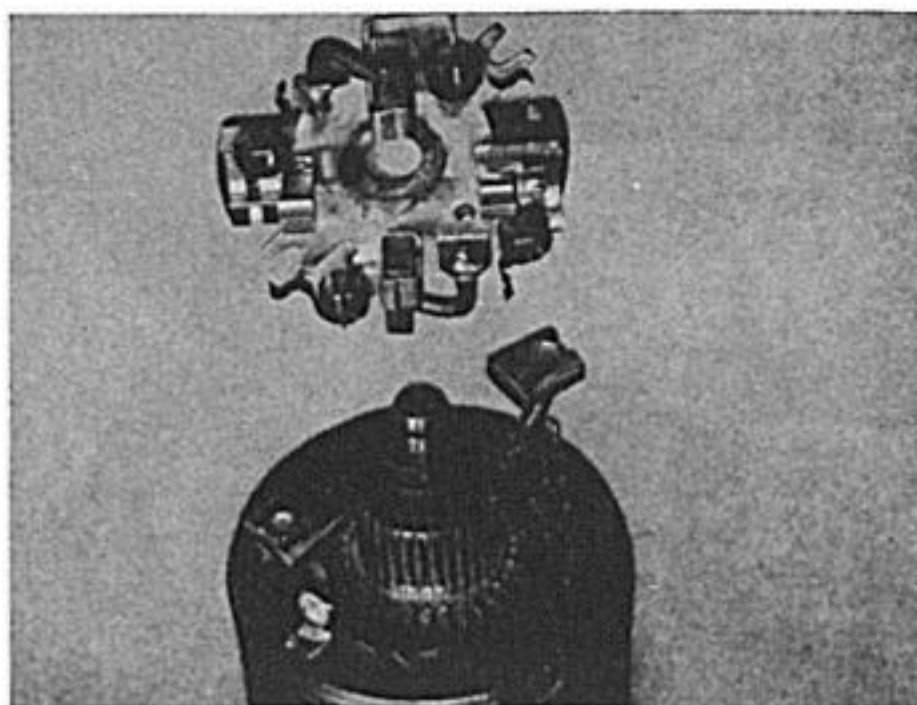
Pull off the cap.

When installing: equalize armature endplay – see Specifications.

Check condition of commutator bearings.



Lift out the positive brushes and take off the brush holder board.

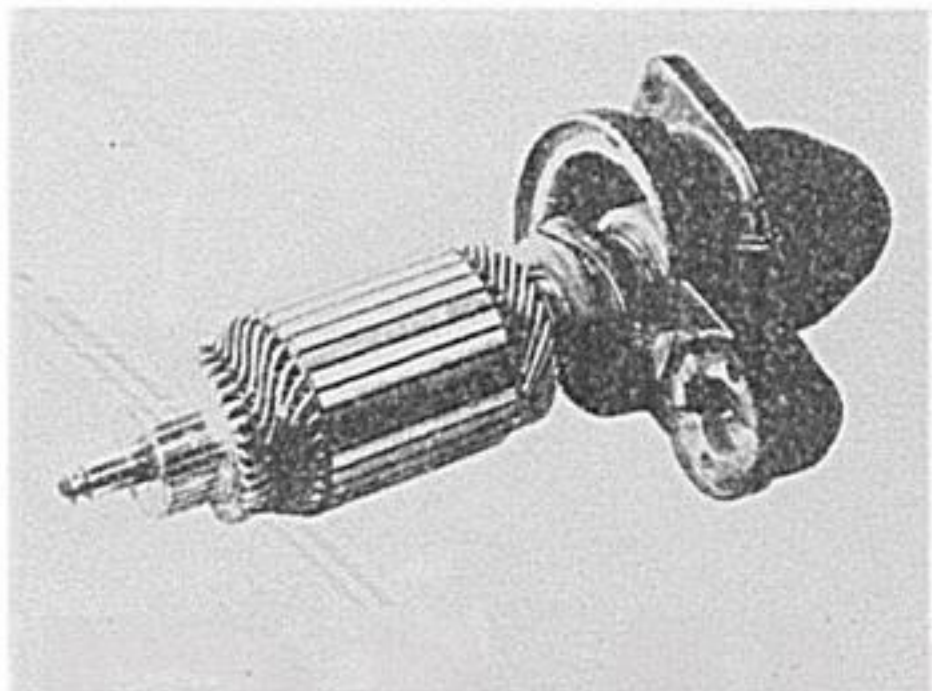




Separate the pole housing from the drive bearing.



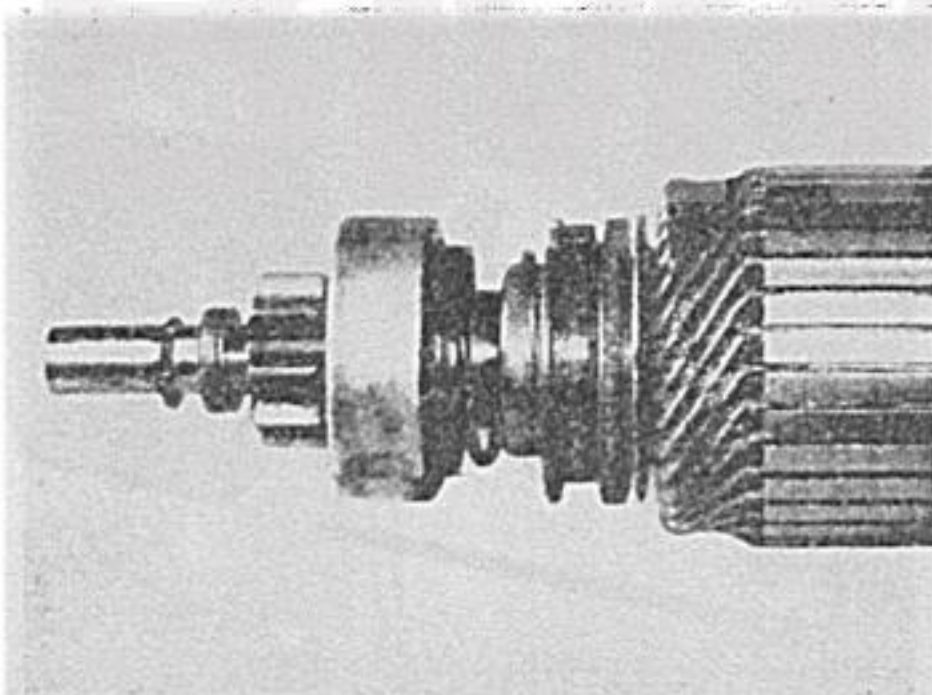
Remove the pivot bolt for the engagement lever.
Pull out the armature with the engagement lever.



Press the thrust ring to the rear.
Extract the circlip.
Pull off the starter gear.

When installing: apply Bosch Ft 2 v 3 silicone grease to the spiral groove and engagement ring.

Pull the thrust ring over the circlip.

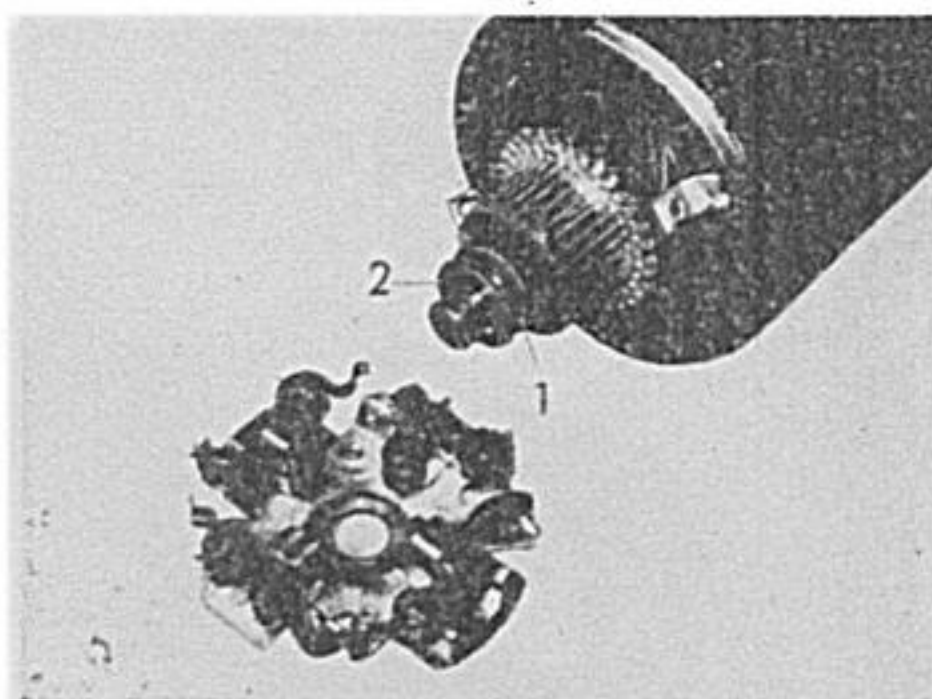


12 41 541 Carbon brushes – renewing

Strip and assemble the starter – 12 41 513.

Unsolder and solder in the carbon brushes at the exciter winding and the brush holder board.

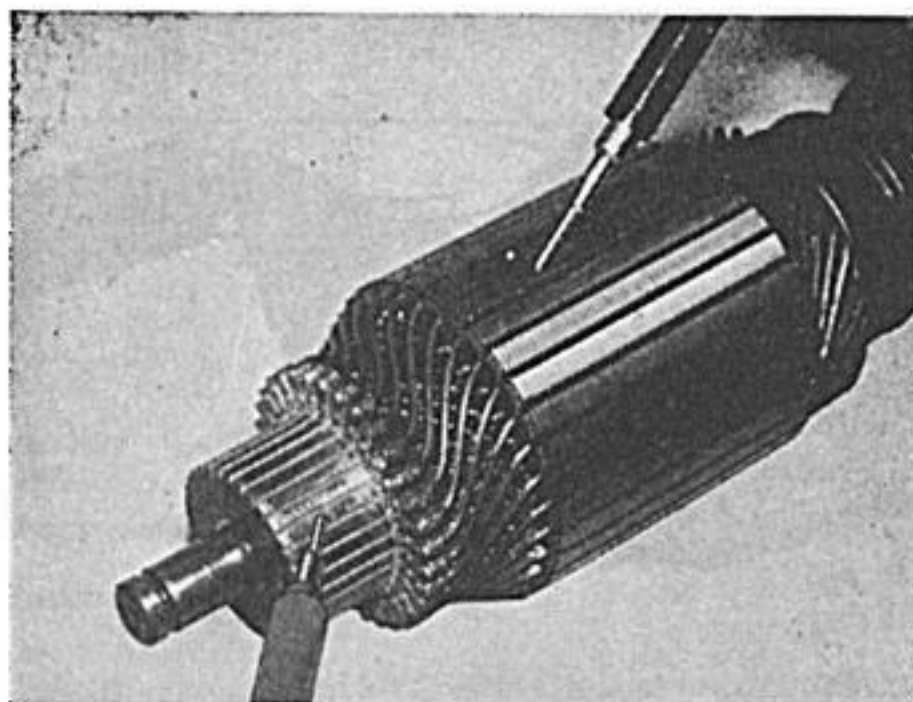
When installing: Washer (1) is at the armature and insulating washer (2) in front of it.



12 41 602 Starter — reconditioning

Strip and assemble the starter — 12 41 513.

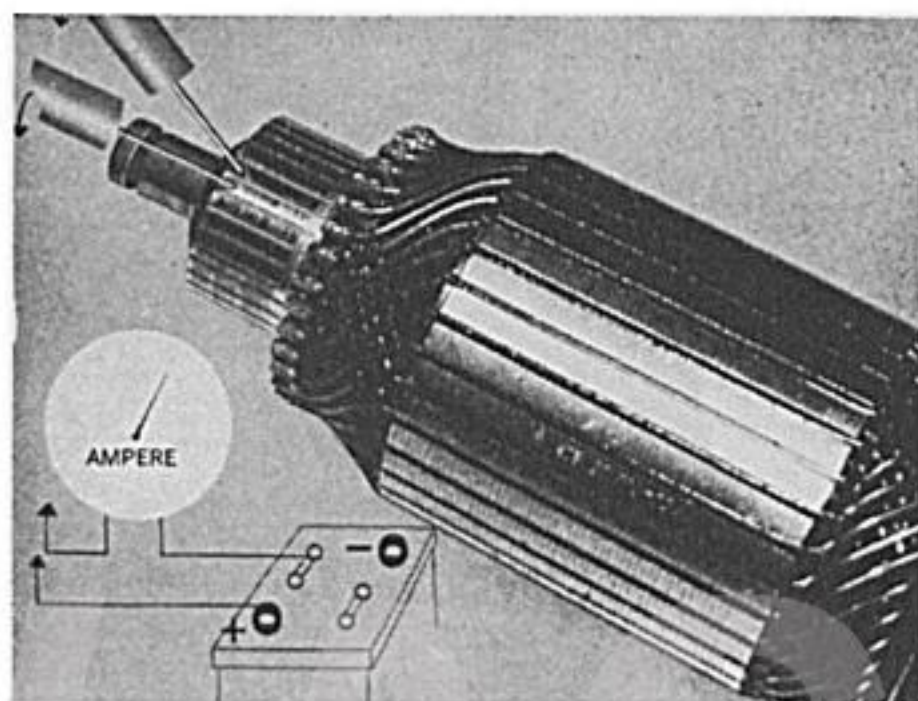
Check armature and field winding with a 220 V test lamp.
Apply the test probes to the commutator and the laminations.
If there is a short to earth (ground), the test lamp will light up and the armature should be renewed.



Insert an ammeter measuring up to 60 A into the current circuit and apply the probes briefly to each lamination in turn. Test voltage 2 ... 4 V.

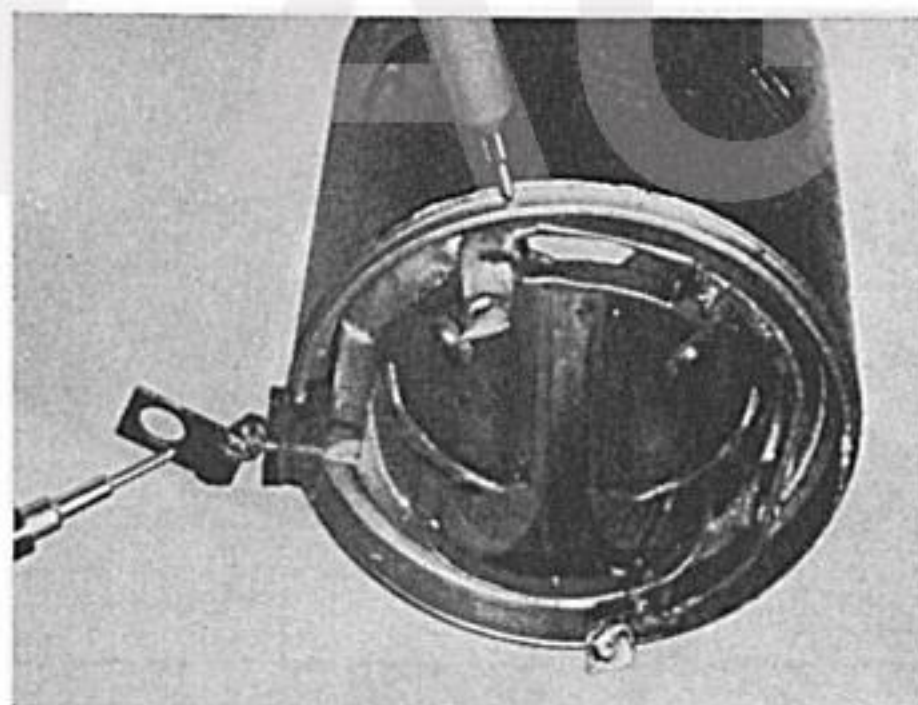
The needle should move by the same amount between each of the laminations.

Severe deviations indicate a break in the circuit and the defective armature should be renewed.



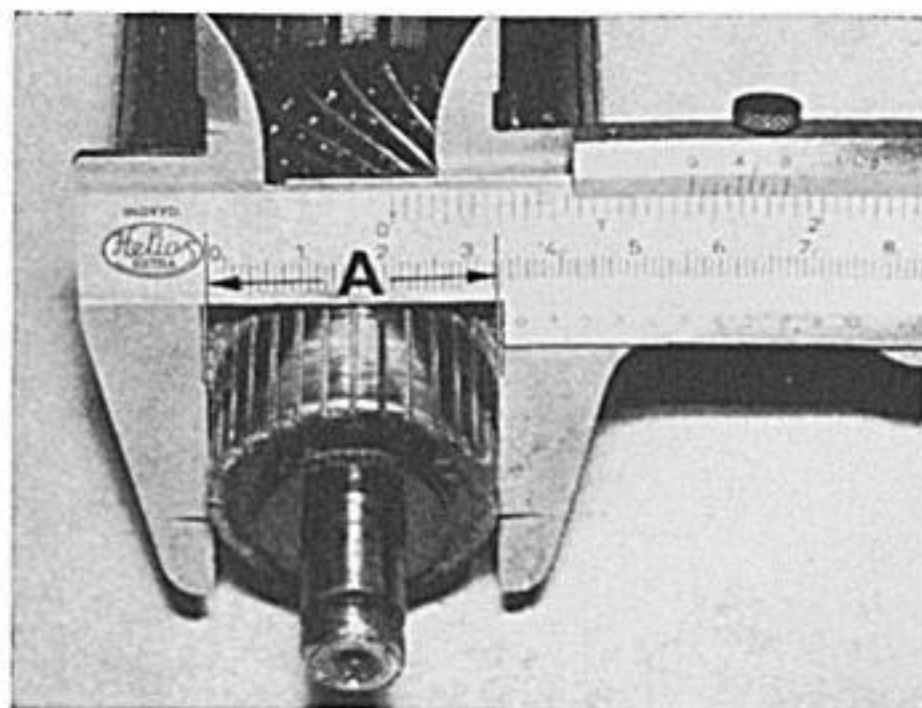
Check the exciter winding for short to earth (ground).

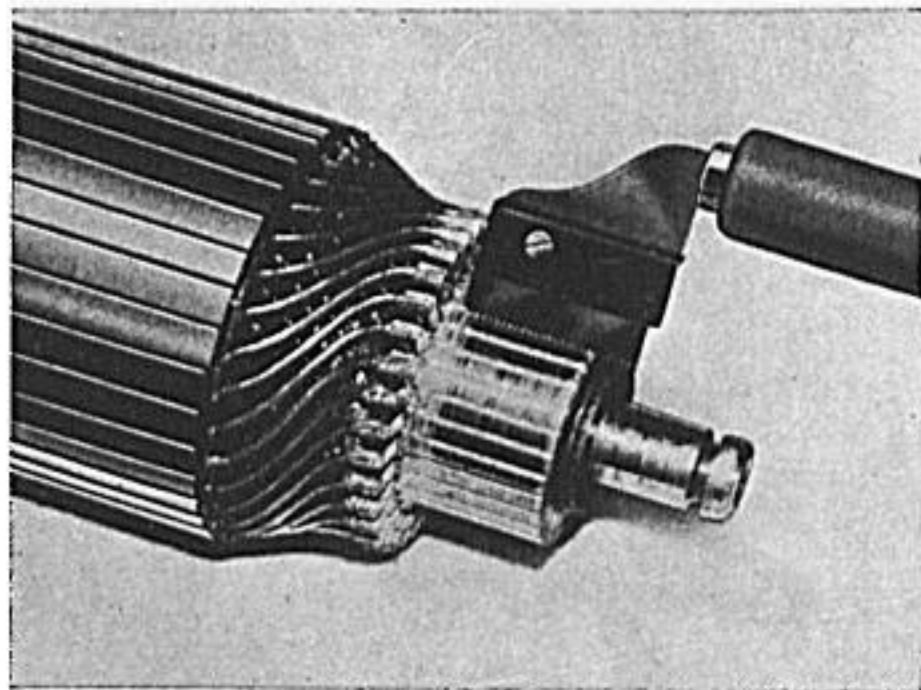
Renew if windings are burned or partially melted.



Skim the commutator to a fine finish.

The diameter (A) of the commutator must not drop below 33 mm (1.3 in).



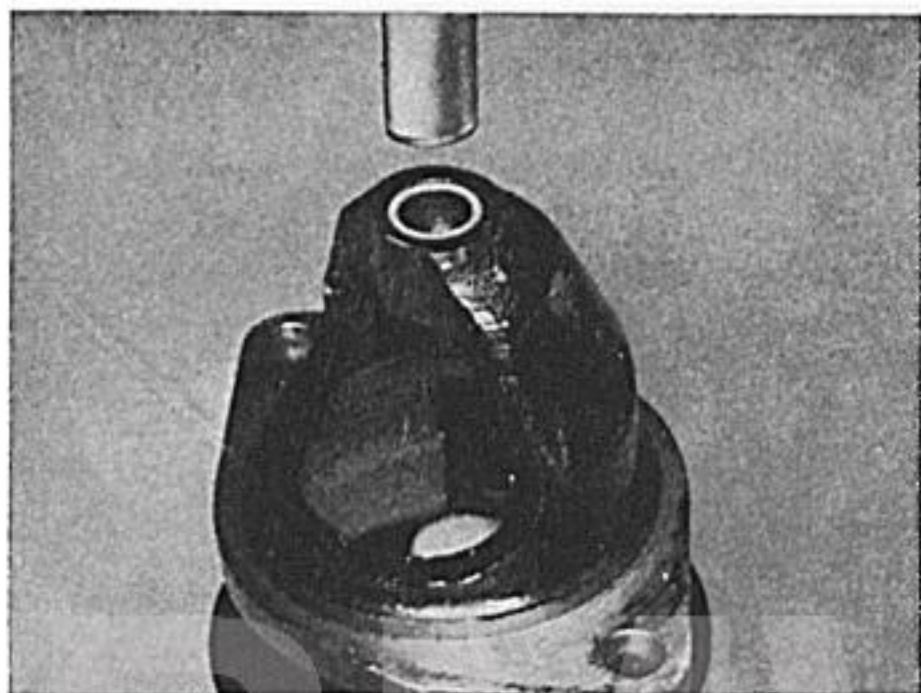


Cut away the commutator laminations. Remove burrs with fine emery cloth. The insulation should be 0.5 mm (0.02 in) lower than the laminations.



Press out the bushing if worn.

When installing: the new bushing should be soaked in engine oil for at least half an hour and pressed in until flush.

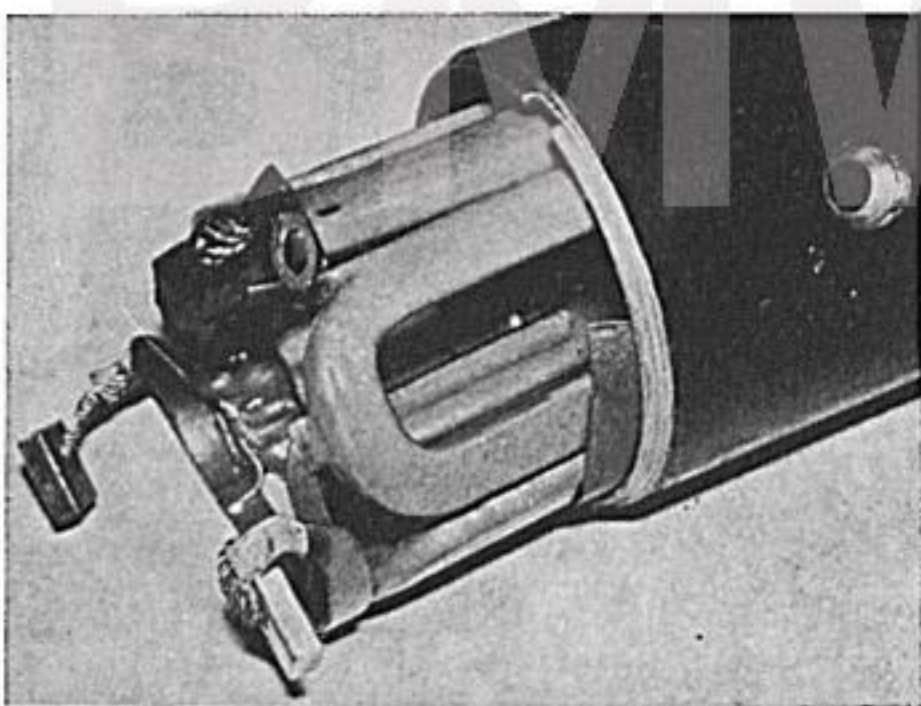


12 41 701 Exciter winding — renewing

Strip and assemble the starter — 12 41 513.

Mark the pole shoes so that the same position is obtained when assembling. Take out the four pole shoe screws. Remove the pole shoes and exciter winding from the pole housing.

When installing: before the pole screws are finally tightened, align the pole shoes to be precisely parallel to the longitudinal axis. Insert paper strip insulation between the exciter winding and the pole housing.



Trouble-shooting – 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. Battery dead. 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. Oxidized battery terminals or earth connection.</p> <p>d) Light burns normally. Bridge terminals 50 and 30 on the starter. The starter turns. Ignition/starter switch defective or input leads interrupted.</p> <p>e) Light burns normally. 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. Solenoid switch contact fouled or scorched.</p>	<p>a) Measure battery voltage. Recharge battery. 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>a) 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 supply and mixture control

Specifications	Page	13- 0/3
Specifications for 1981 models		13- 0/5
Specifications for 1983 models		13- 0/7
13 00 004 Engine idle speed and fuel-air mixture – adjusting		13-00/1
13 10 004 Fuel level – checking and adjusting		13-10/1
13 10 009 Carburettor – cleaning		13-10/1
13 10 100 Left and right carburettors – removing and installing		13-10/2
13 10 370 Cold-start (choke) housing – detaching and attaching		13-10/2
13 23 021 Wire cable for cold-start device (1981 models) – renewing and installing (handlebar end)		13-23/1
13 23 061 Wire cable for cold-start device (1981 models) – removing and installing (carburettor end)		13-23/1
13 23 080 Lever for cold-start device (1981 models) – removing and installing		13-23/2
13 72 000 Air cleaner element – removing and installing		13-72/3
13 72 130 Air cleaner housing – removing and installing (1981 models)		13-72/4

BMW AG

Mixture preparation

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Carburetors Pattern	Two inclined Bing constant-depression carburetors with needle jet, vacuum slide, throttle and central lever float		
Carburetor type BING V 64/II left right	64/26/201 64/26/202	64/28/201 64/28/202	64/32/2030 64/32/2040
Carburetor throat dia. mm (in)	26 (1.02)	28 (1.10)	32 (1.26)
Main jet	118	123	140
Needle jet	2.66		
Jet needle number	46 – 241		
Needle position	2	2	3
Starting jet dia.	60		
Starting air jet dia. mm (in)	2 (0.08)	2.0 (0.08)	
Mixture passage dia. in rotary slide mm (in)	2.0/1.2/0.7 (0.08/0.048/0.028)		
Idle jet	45		
Idle air jet dia. mm (in)	1.0 (0.04)		
Idle mixture regulating screw opening (turns)	1/2		
Bypass passage 1 dia. mm (in) Bypass passage 2 dia. mm (in)	0.8 (0.031)	0.7 (0.028) 0.65 (0.026)	
Float valve dia. mm (in)	2.5 (0.098)		

Mixture preparation

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Float chamber vent dia. mm (in)	4 (0.16)		
Idle outlet passage dia. mm (in)	1.0 (0.04)		
Intake air cleaner	Common "micro-star" dry-type filter for both carburetors		
Fuel system			
Fuel	Regular	Super (Premium)	
Min. octane number	91	98	
(to DIN 51600 standard)	82	88	
Fuel tank	22 liters (4.8 Imp., 5.8 US gal), including 2 l (0.4 Imp., 0.5 US gal) reserve		

Mixture preparation

Specifications (1983 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Carburetors Pattern	Two inclined Bing constant-depression carburetors with needle jet, vacuum slide, throttle and central lever float			
Carburetor type BING V 64/II left right	64/26/303 64/26/304	64/28/303 64/28/304	64/32/307 64/32/308	
Carburetor throat dia. mm (in)	26 (1.02)	28 (1.10)	32 (1.26)	
Main jet	98	105	145	
Needle jet	2.66			2.64
Jet needle number	46 – 241			
Needle position	2			4
Starting jet dia. mm (in)	60 (2.36)			
Starting air jet dia. mm (in)	2.0 (0.08)			
Mixture passage dia. in rotary slide mm (in)	2.0/1.2/0.7 (0.08/0.048/0.028)			
Idle jet	45			
Idle air jet dia. mm (in)	1.0 (0.04)			
Idle mixture regulating screw opening (turns)	1/2			
Bypass passage 1 dia. mm (in)	0.8 (0.031)	0.7 (0.028)		
Bypass passage 2 dia. mm (in)		0.65 (0.026)		
Float valve dia. mm (in)	2.5 (0.098)			

Mixture preparation

Specifications (1983 models)

Model		R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Float chamber vent dia. mm (in)			4 (0.16)		
Idle outlet passage dia. mm (in)			1.0 (0.04)		
Intake air cleaner			Shared plate-type filter		
Fuel system					
Fuel		Regular	Super (Premium)		
Min. octane number	RM	91		98	
(to DIN 51600 standard)	MM	82		88	
Fuel tank		22 liters (4.8 Imp., 5.8 US gal), including 2 l (0.4 Imp., 0.5 US gal) reserve			

Mixture preparation

Specifications (1983 Models)

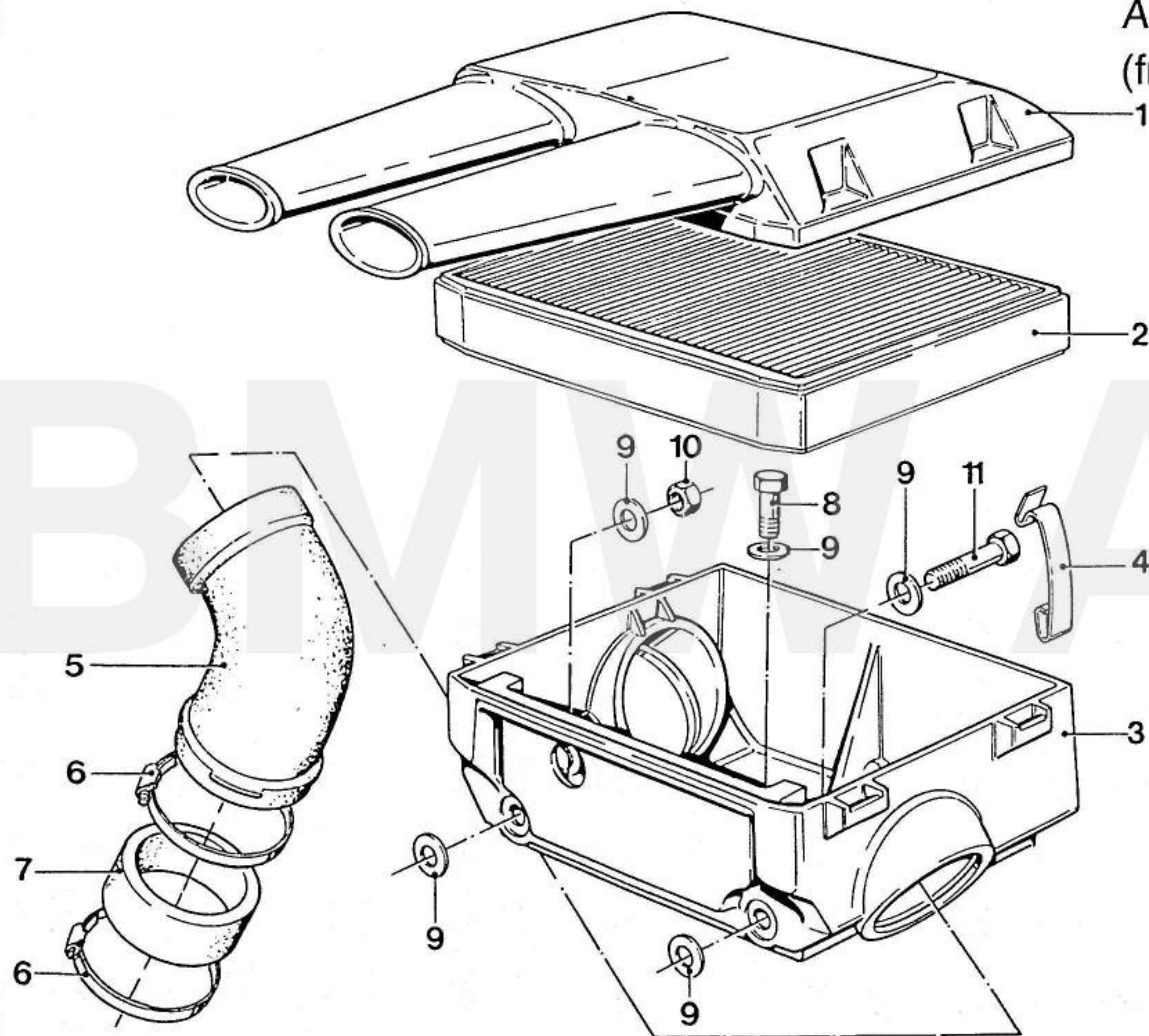
Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Carburetors Pattern	Two inclined Bing constant-depression carburetors with needle jet, vacuum slide, throttle and central lever float			
Carburetor type BING V 64/II left right	64/26/303 64/26/304	64/28/303 64/28/304	64/32/347 64/32/348	(with a modified air intake system)
Carburetor throat dia. mm (in)	26 (1.02)	28 (1.10)	32 (1.26)	
Main jet	98	105	138	
Needle jet	2.66		2.64	
Jet needle number	46-241		46-242	
Needle position	2		3	
Starting jet dia. mm (in)		60 (2.36)		
Starting air jet dia. mm (in)		2.0 (0.08)		
Mixture passage dia. in rotary slide mm (in)		2.0/1.2/0.7 (0.08/0.048/0.028)		
Idle jet		45		
Idle air jet dia. mm (in)		1.0 (0.04)		
Idle mixture regulating screw opening (turns)		1/2		
Bypass passage 1 dia. mm (in)	0.8 (0.031)		0.7 (0.028)	
Bypass passage 2 dia. mm (in)			0.65 (0.026)	
Float valve dia. mm (in)		2.5 (0.098)		

Mixture preparation

Specifications (1983 Models)

Model		R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Float chamber vent dia. mm (in)			4 (0.16)		
Idle outlet passage dia. mm (in)			1.0 (0.04)		
Intake air cleaner			Shared plate-type filter		
Fuel system					
Fuel		Regular	Super (Premium)		
Min. octane number (to DIN 51600 standard)	RM	91		98	
	MM	82		88	
Fuel tank		22 liters (4.8 Imp., 5.8 US gal), including 2 l (0.4 Imp., 0.5 US gal) reserve			

Air cleaner (from 1981 models on)



- 1) Air cleaner housing, upper section
- 2) Air cleaner element
- 3) Air cleaner housing, lower section
- 4) Clip
- 5) Intake pipe
- 6) Hose clip
- 7) Rubber sleeve
- 8) Hex bolt
- 9) Washer
- 10) Hex nut
- 11) Machine screw

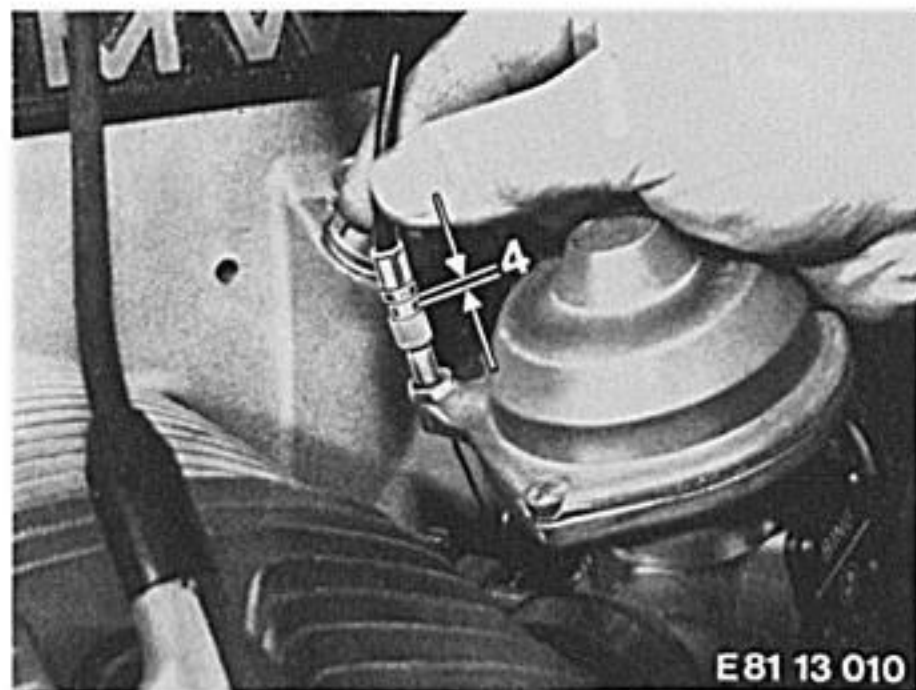
13 00 004 Engine idling – adjusting

Adjust engine idling with the engine at normal operating temperature and the throttle twistgrip closed.

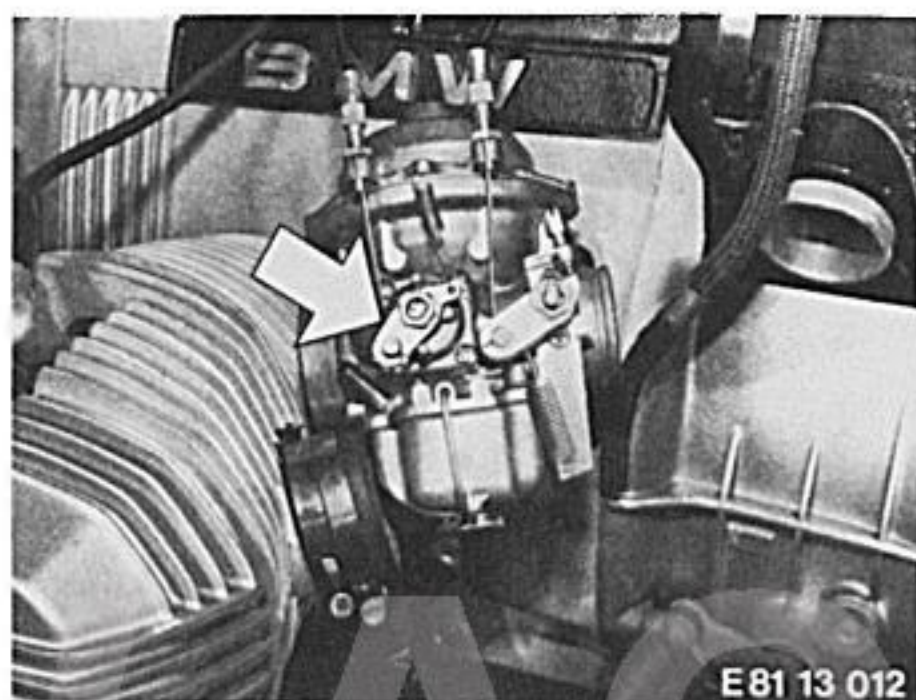
For correct engine idle speed, see Specifications.

Set the throttle cable to a free travel of 4 mm (0.16 in) initially so that the cables do not prevent the throttle butterflies from closing completely.

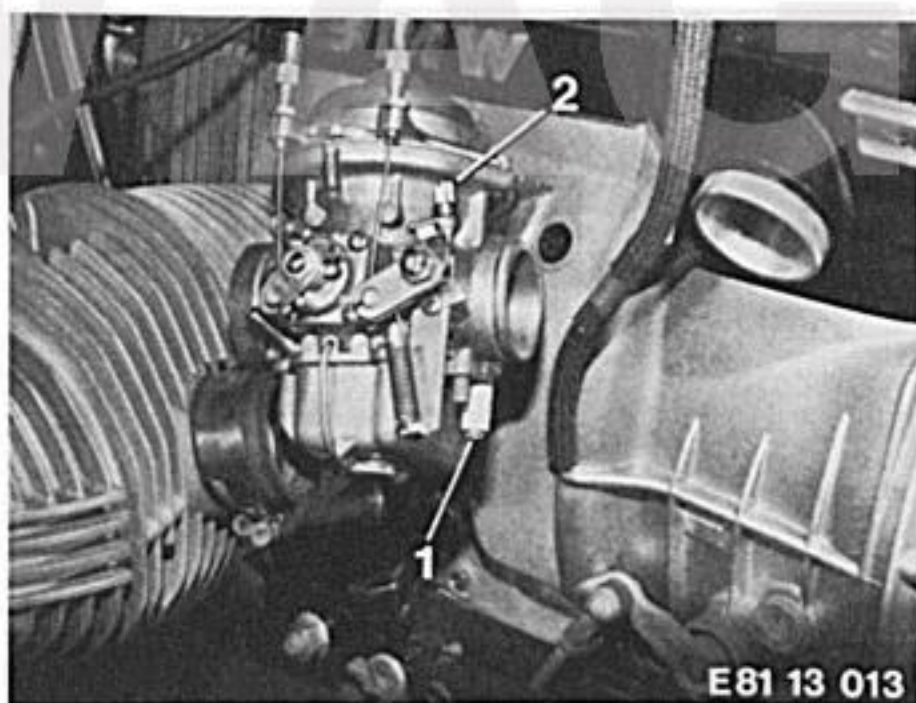
Note: to illustrate this work more clearly, the carburetors have been partly removed and turned to the side.



Move the throttle cables to the initial position and adjust the choke cables so that the starting levers (arrow) are pressed up to their limit of movement when the choke control is off.



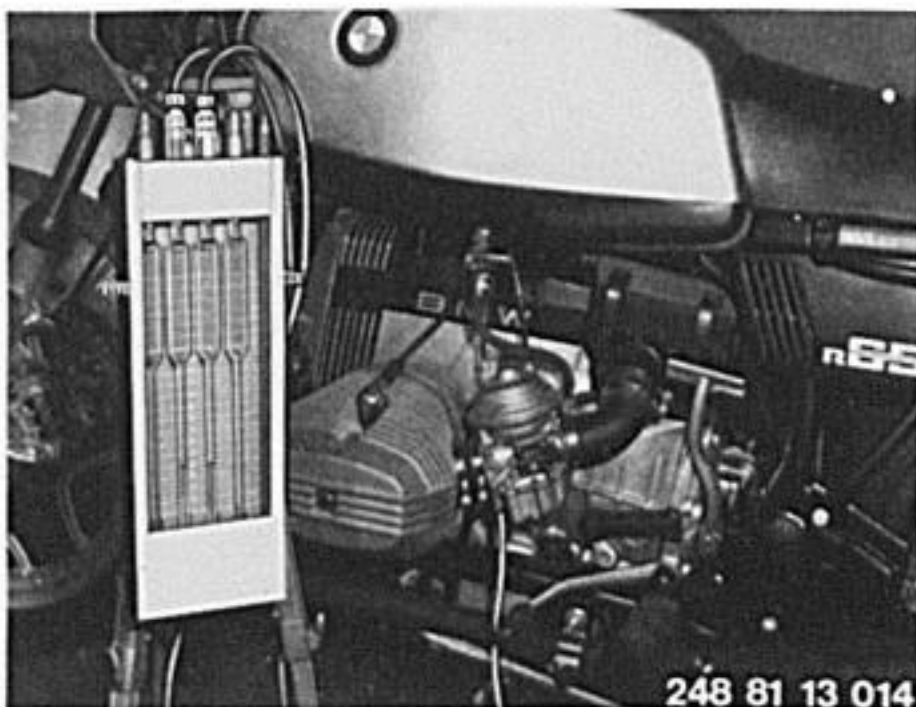
On both carburetors, set the idle mixture control screw 1 and the throttle stop screw 2 to the basic setting. This is done by tightening the idle mixture control screw fully and then unscrewing it again by the correct number of turns (see Specifications). The throttle stop screw is then tightened until it just touches the stop on the throttle butterfly lever, after which it is tightened by a further full turn.

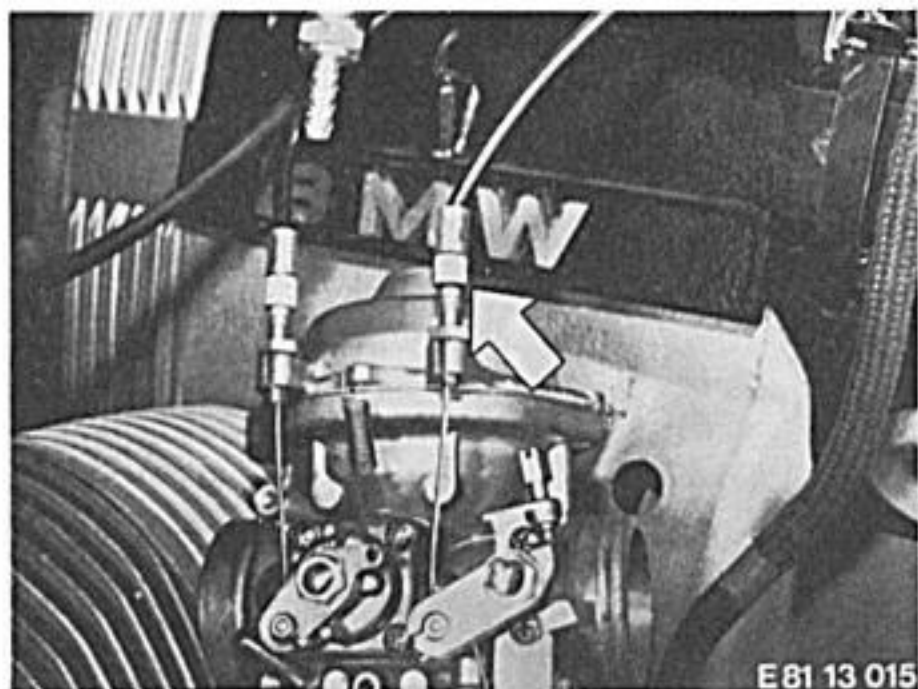


To synchronize the carburetors, use adjusting device BMW No. 13 0 700. Remove the plug at the device connector and push on the rubber hose from the synchronizer.

Turn the throttle stop screw and idle mixture regulating screw in succession until synchronized running is obtained.

If the engine speed is then outside the specified idle speed of 800 . . . 1100 min⁻¹, adjust the engine speed by turning the throttle stop screws on both sides of the engine to the left or right by an equal amount. Final correction is at idle mixture control screw 1.





To adjust the throttle cables, first raise the engine speed slightly at the twistgrip, then pull off first one spark plug cap and then the other, and check engine speed when running on one cylinder only. Adjust the throttle cables accordingly at the adjusting screw and tighten the hexagon locknut (arrow).

Do not run the engine with the motorcycle at a standstill for more than 10 minutes unless some form of outside cooling is provided.



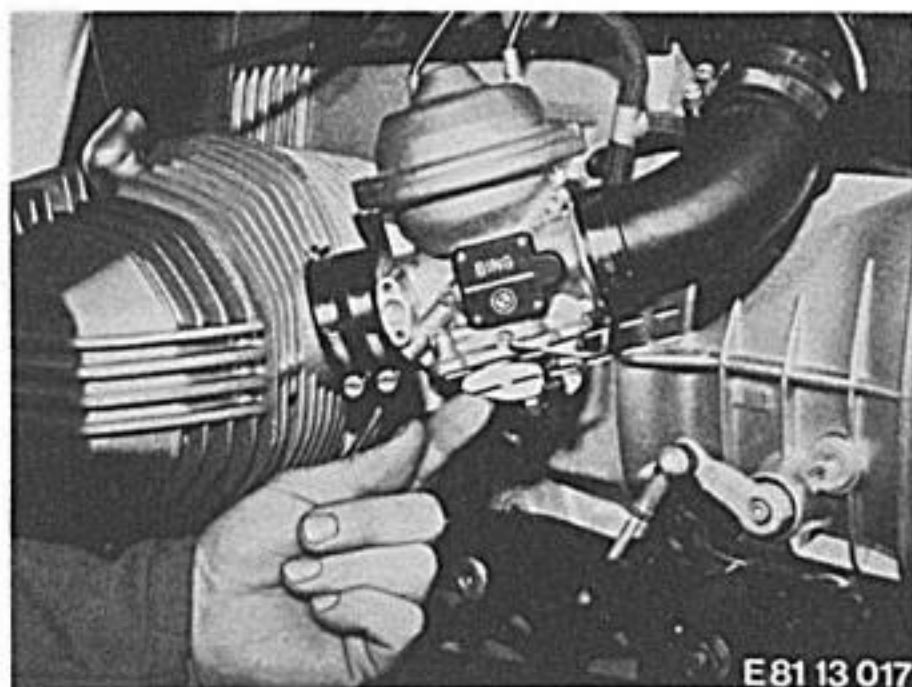
BMW AG

13 10 004 Fuel level – checking and adjusting

Close the fuel tap and remove the float chamber from the carburettor.

Use the finger to push the float upwards and open the fuel tap – there should be no leakage of fuel. Let the float slowly return to its normal position – fuel should start to emerge when the base of the float is parallel with the lower edge of the carburettor housing, as illustrated.

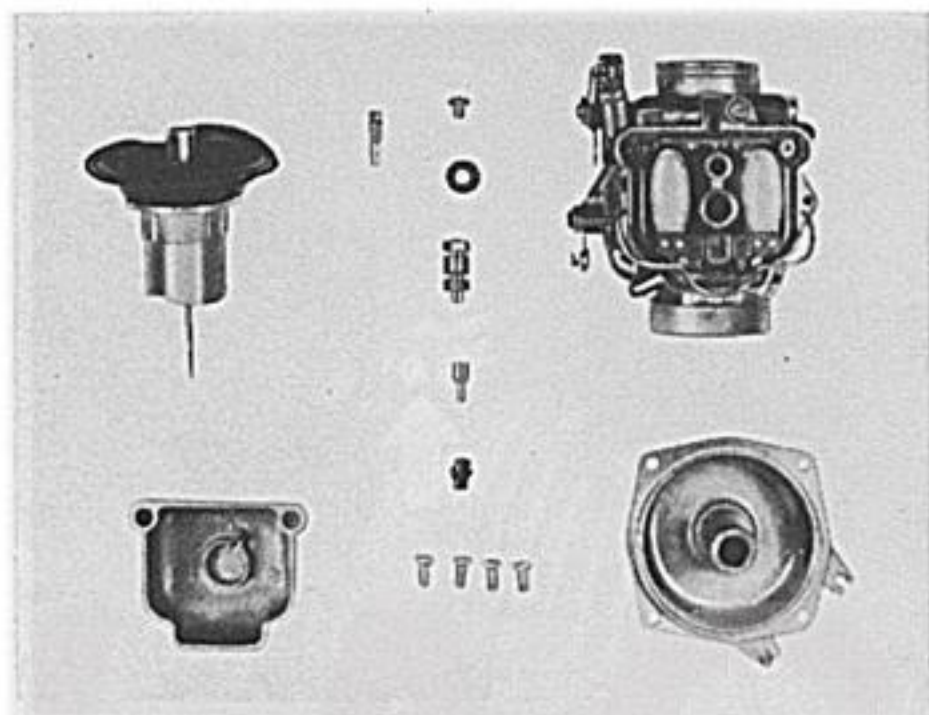
If the fuel emerges too soon or too late, bend the tongue of the float as necessary.

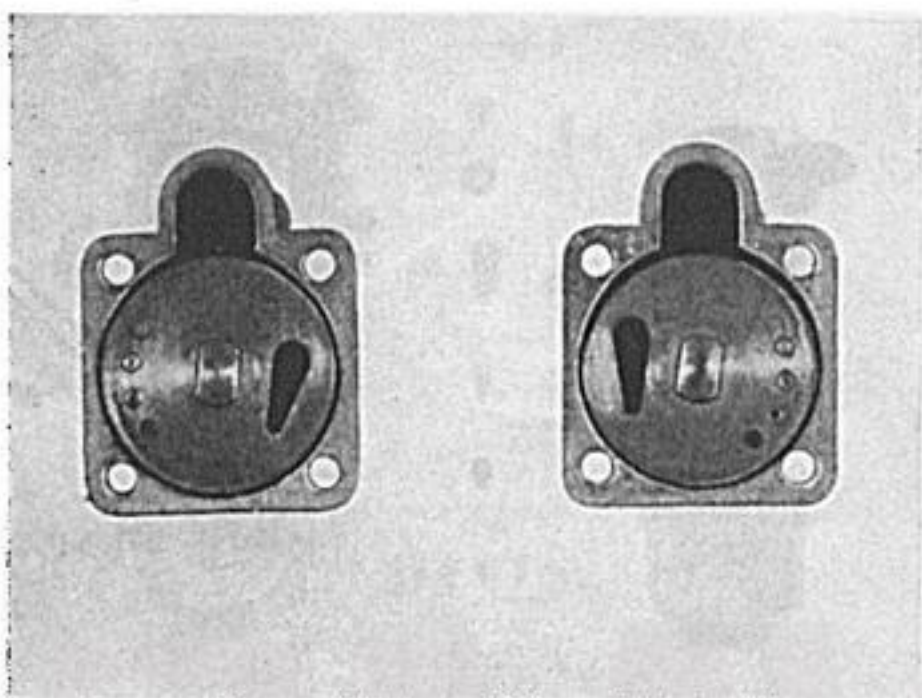
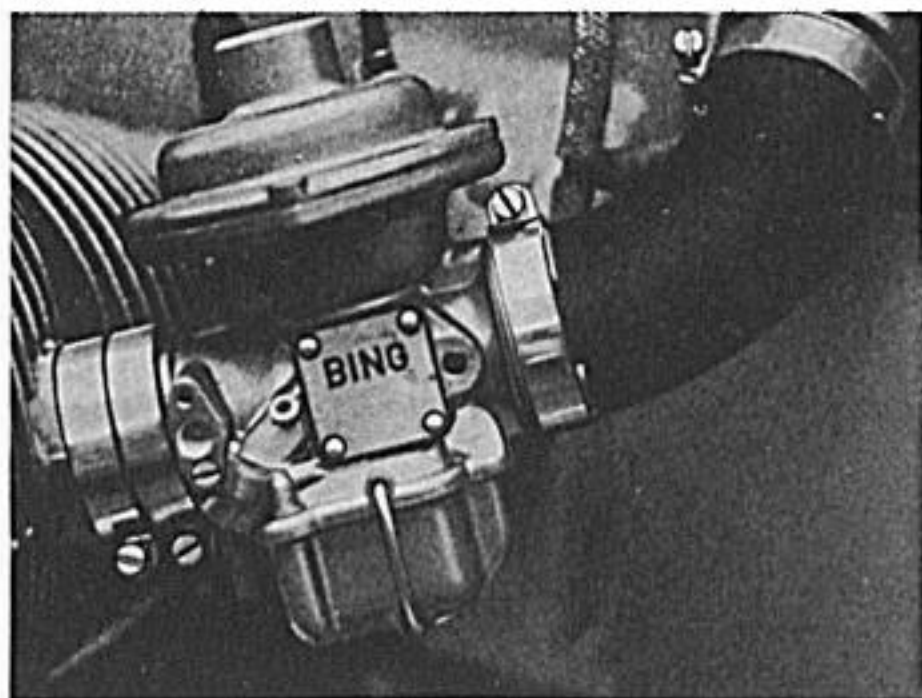


13 10 009 Carburettor – cleaning

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

Remove the cap, plunger with diaphragm, idle jet, main jet block, main jet, needle jet and atomizer. Clean all components in gasoline (petrol) and blow through jets and passages with compressed air.





2

1

13 10 100 Left and right carburettors – removing and installing

Disconnect or detach the choke and throttle cables.
Slacken the clamp straps on the cylinder side and at the air pipes.
Push back the rubber sleeve at the air cleaner housing. Detach the air pipe, then the carburettor.



13 10 370 Cold-start housing – detaching and attaching

Remove and install the left and right carburettors – 13 10 100.

Slacken the 4 countersunk screws and take off the cold start housing with rotary slide and gasket.

Do not accidentally confuse the left and right cold-start housings.

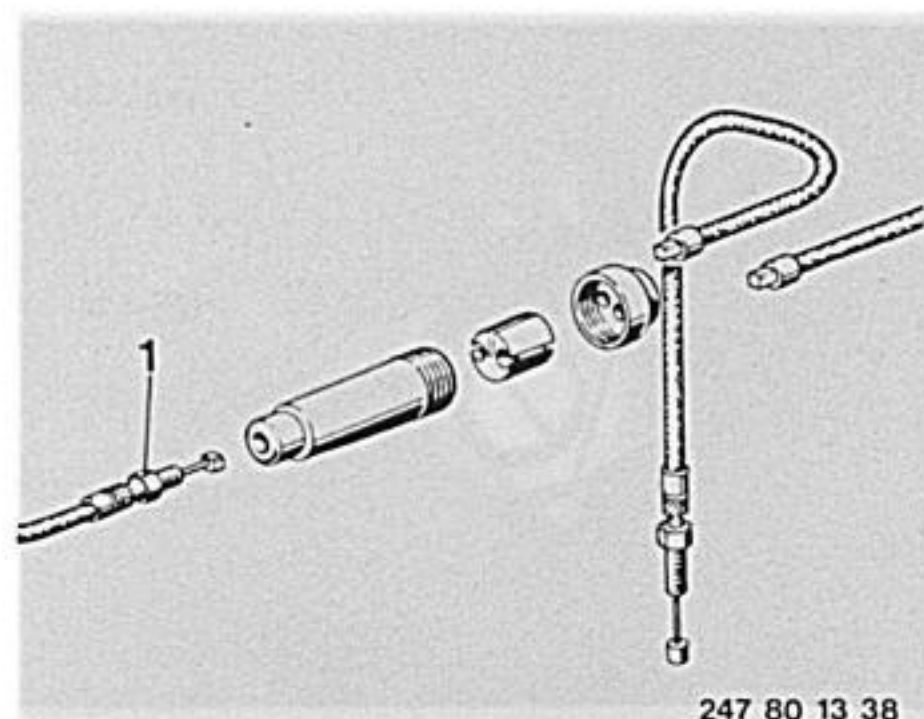
Item 1 = left cold-start housing

Item 2 = right cold-start housing

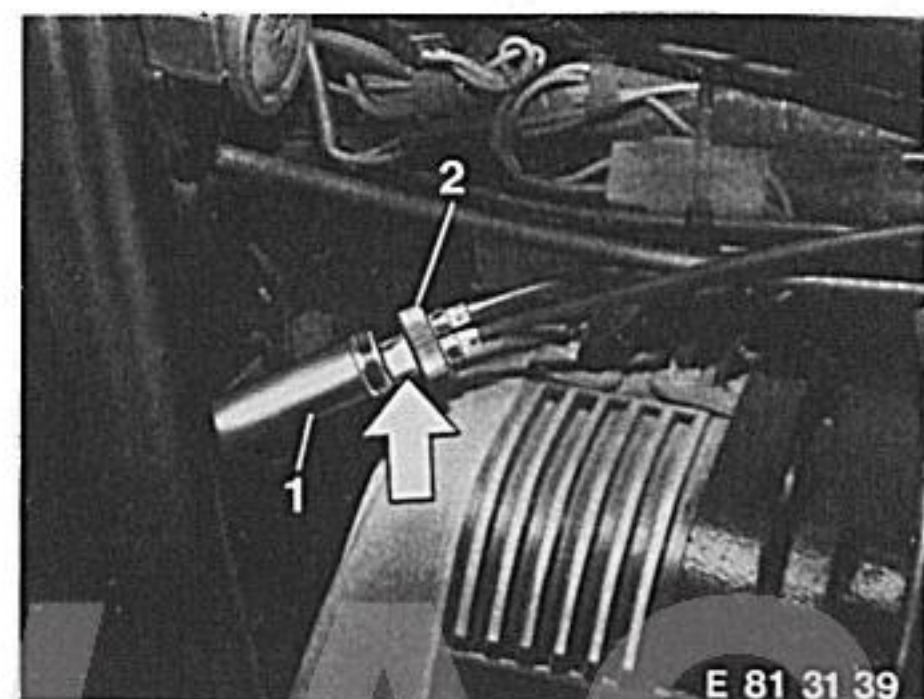


13 23 021 Wire cable for cold-start device (1981 models) – removing and installing (handlebar end)

Remove (Install) lever for cold-start device – 13 23 080. Slacken off the locknut (1) on the adjusting screw at the junction block and tighten the adjusting screw fully.

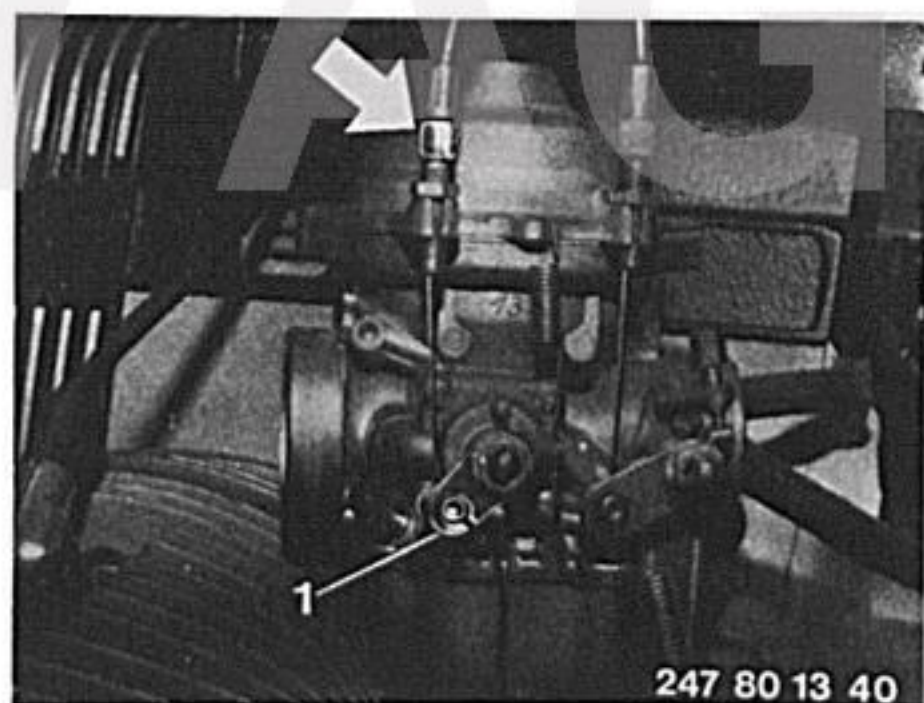


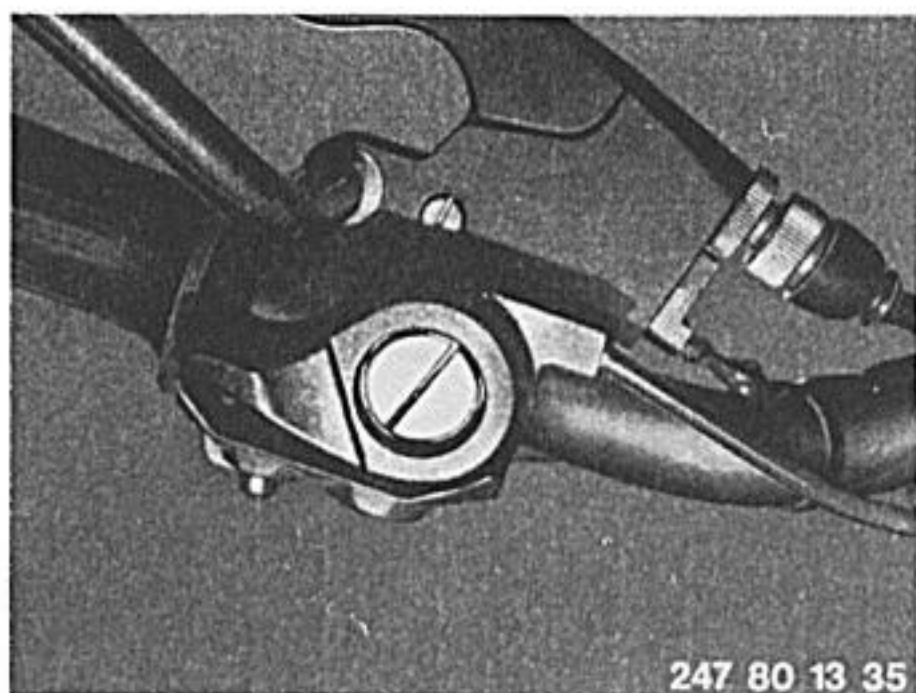
Turn the sleeve of the junction block (1), holding the knurled section (2) firmly.
Disconnect the cable from the junction block (arrow).
When installing: Adjust the wire cable so that the cold-start device opens fully.



13 23 061 Wire cable for cold-start device (1981 models) – removing and installing (carburettor end)

Slacken the locknut on the adjusting screw at the carburettor and remove the screw (arrow) from the carburettor body.
Disconnect the wire cable at the lever (1) for the cold-start device.
Detach the wire cable as described in 13 23 021.
To provide a better illustration of the work, the carburettor in the picture has been removed and turned to the side.





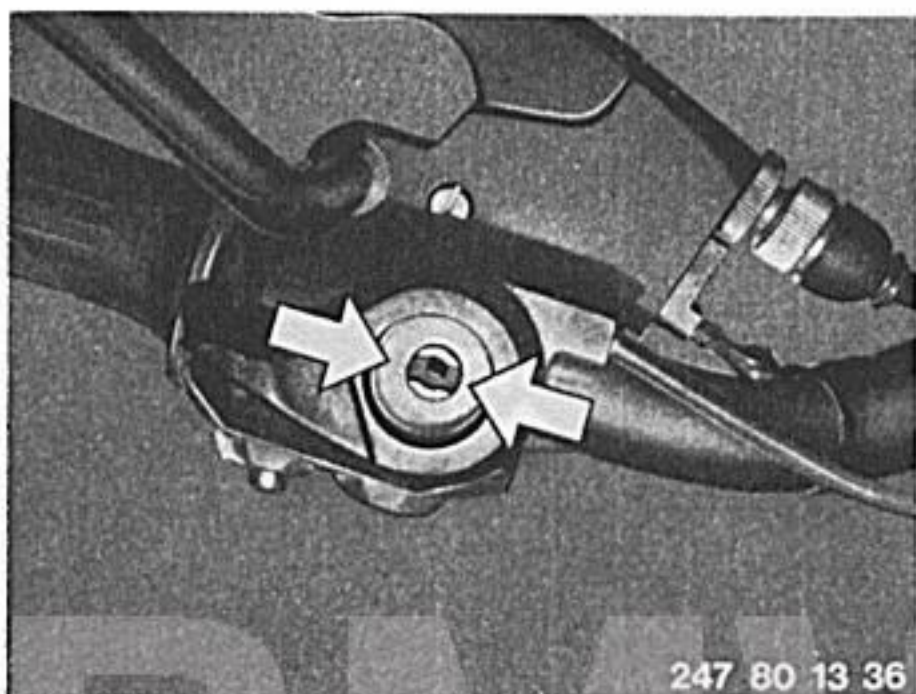
13 23 080 Lever for cold-start device (1981 models – removing and installing

Press out the plastic cover with a small screwdriver. Unscrew and remove the retaining screw.



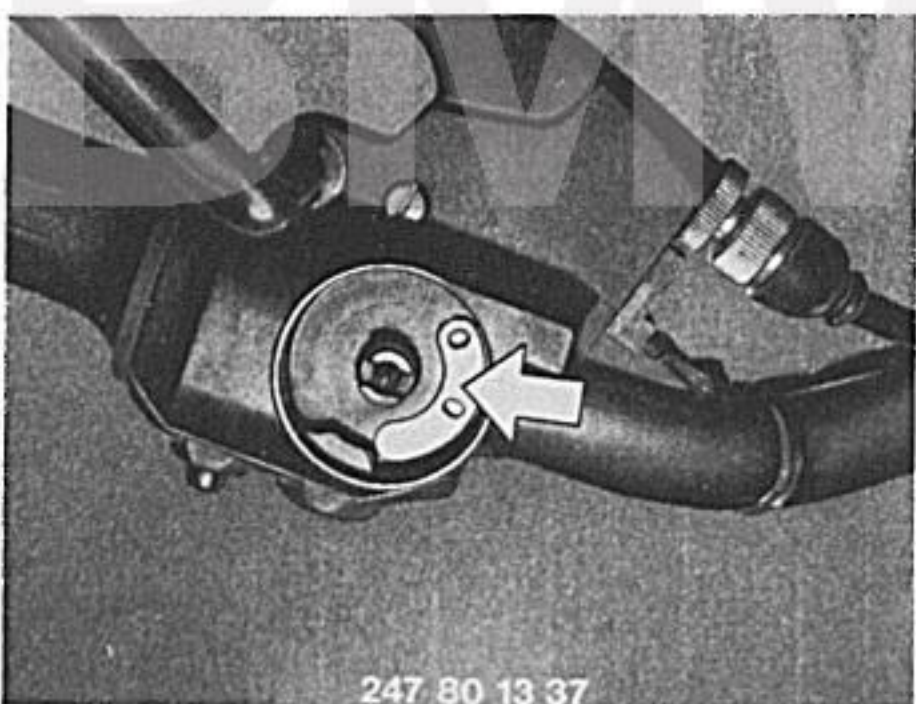
Take off the lever, guiding the cable through the slot in the housing.

When installing: The lugs of the washer must be located in the slots in the housing (arrows).



Disconnect the cable from the lever.

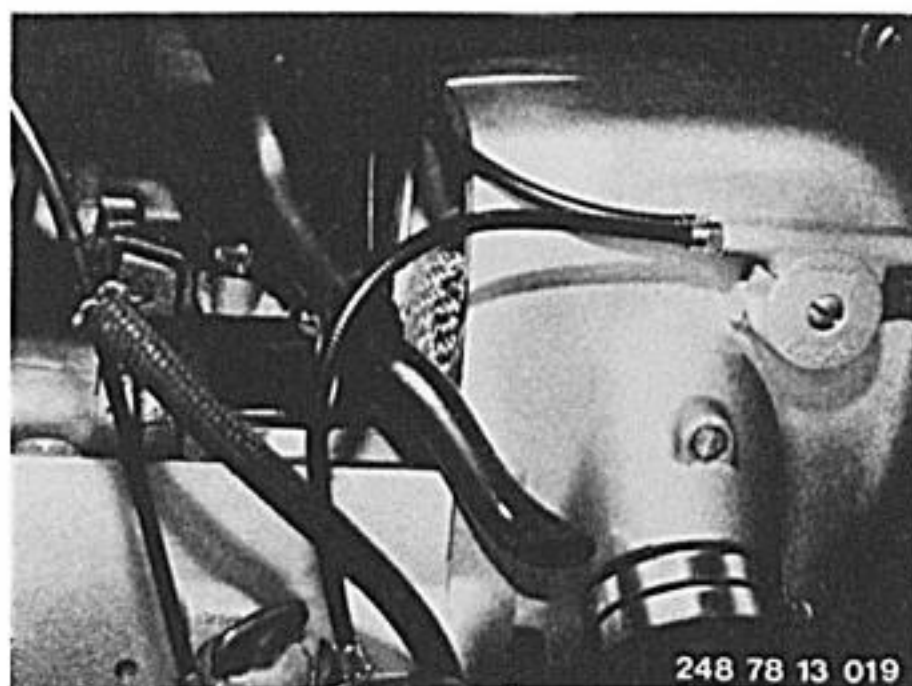
When installing: Make sure that the detent plate is correctly seated (arrow).



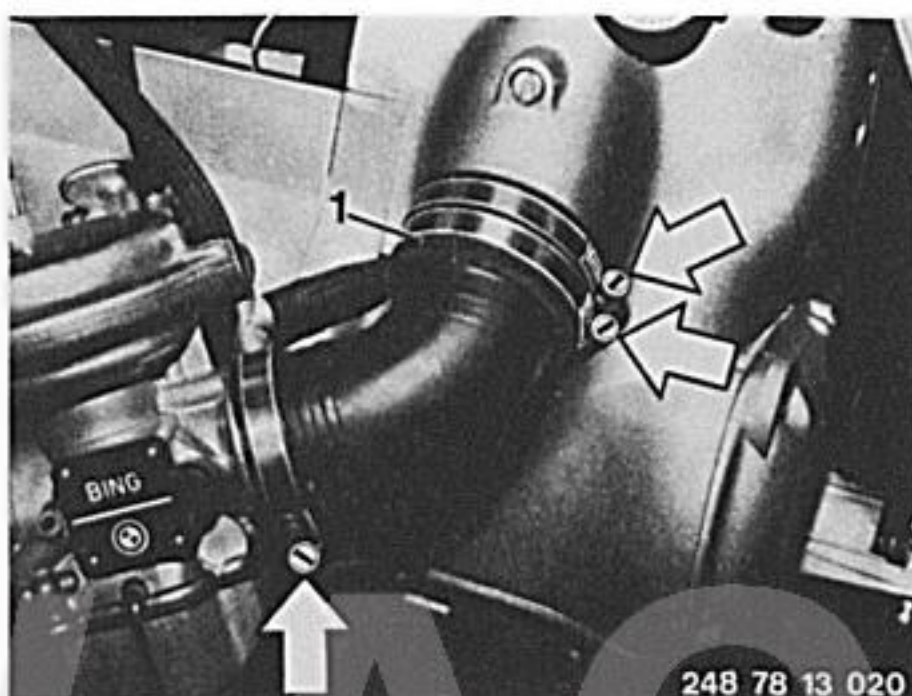
13 72 000 Air cleaner element – removing and installing

Remove and install the fuel tank – 16 11 030.

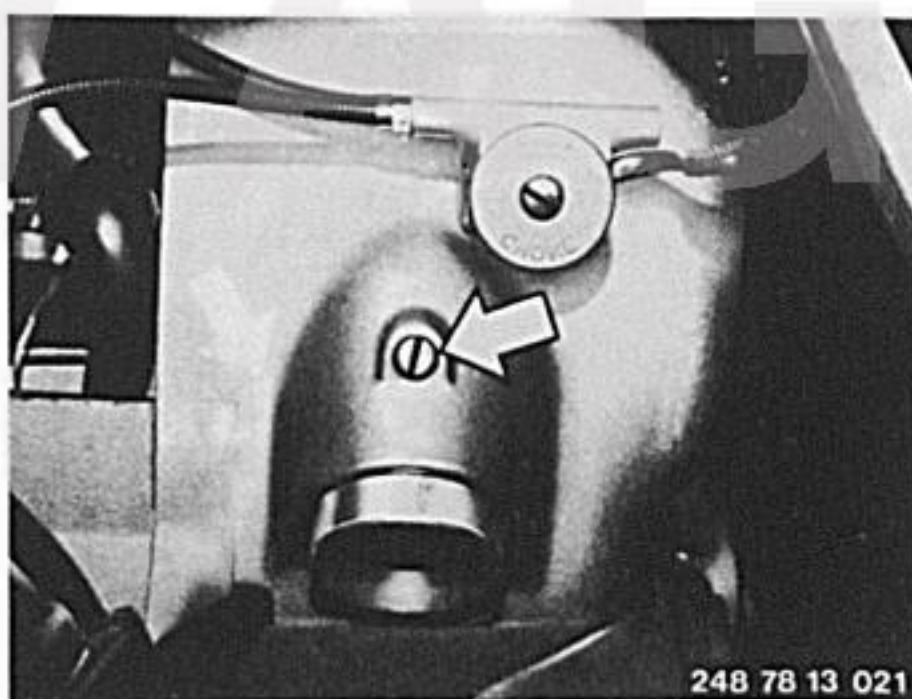
Unscrew the two Allen screws and remove the starter cover to the right. Pull the engine breather hose out of the left half of the air cleaner housing.



Slacken the clamp straps for the left air line (arrows), push back the rubber sleeve (1) and take off the air line.



Take the machine screw (arrow) out of the left air-cleaner housing, and pull off the housing shell.

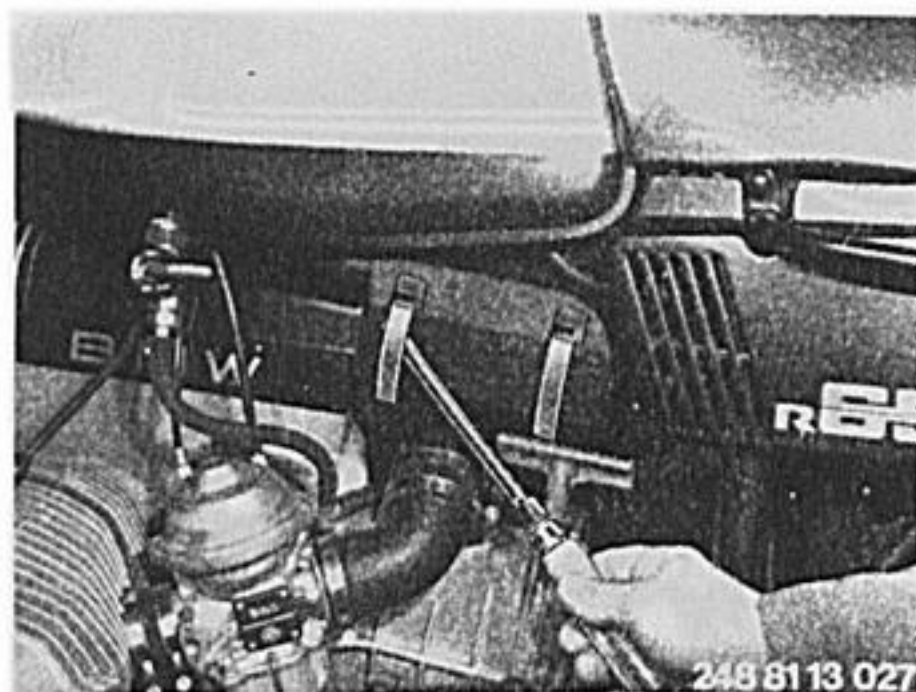


Take out the filter element.



13 72 000 Air cleaner element – removing and installing (1981 models)

Using a screwdriver, lift off the retaining clips.



Pull out the plate-type filter element and slide in the new one. Secure the cover of the air cleaner housing with the clips, making sure that the element is properly located.

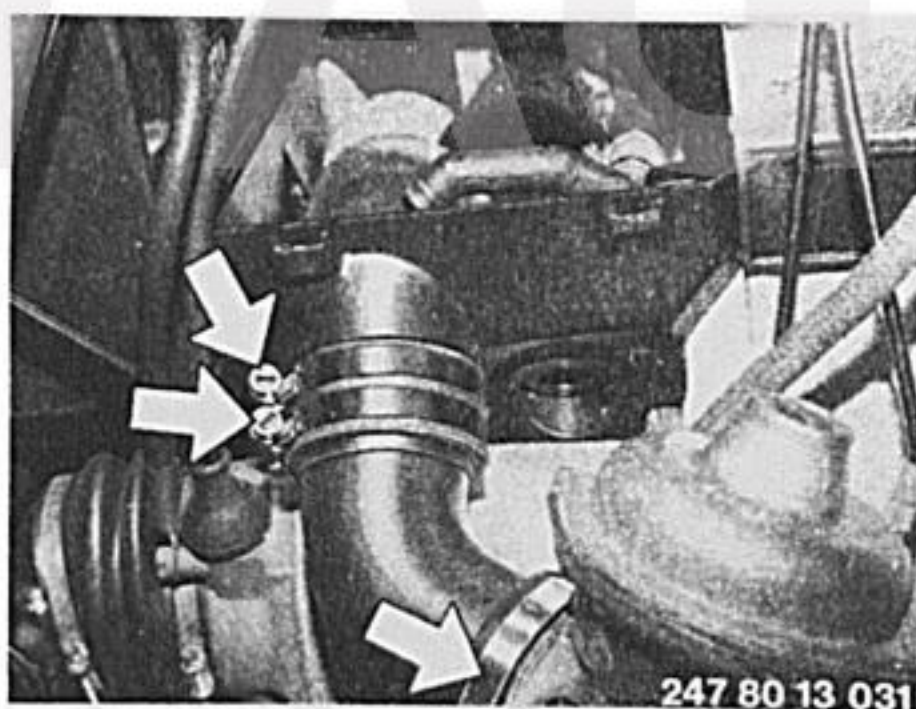
When installing: take care to place the element the right way round – see inscription "hinten" (back) and the arrow mark "TOP-OBEN".



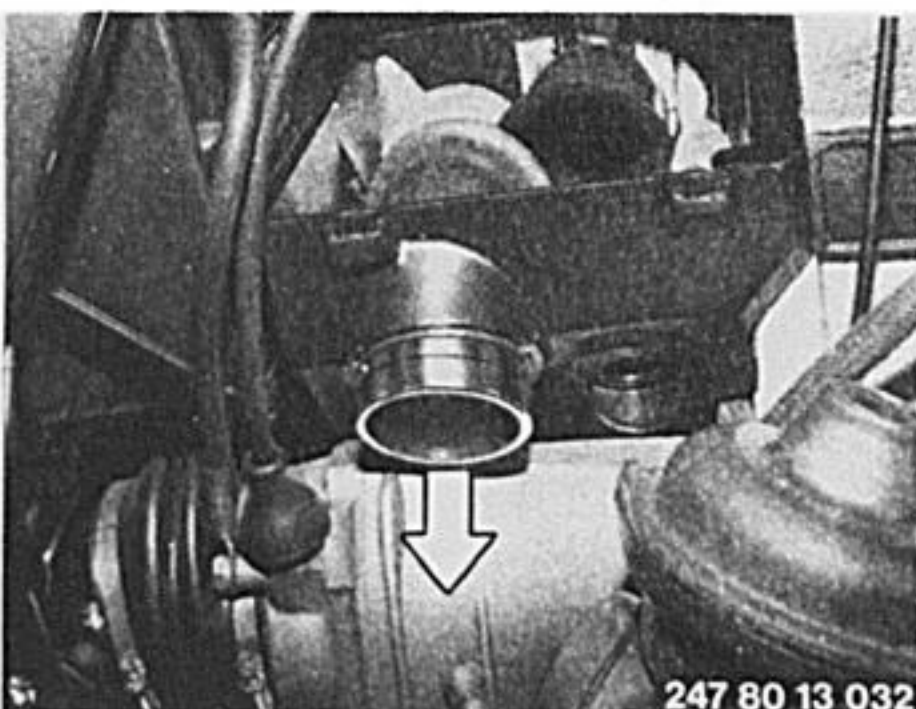
13 72 110 Intake air venturi – removing and installing (1981 models)

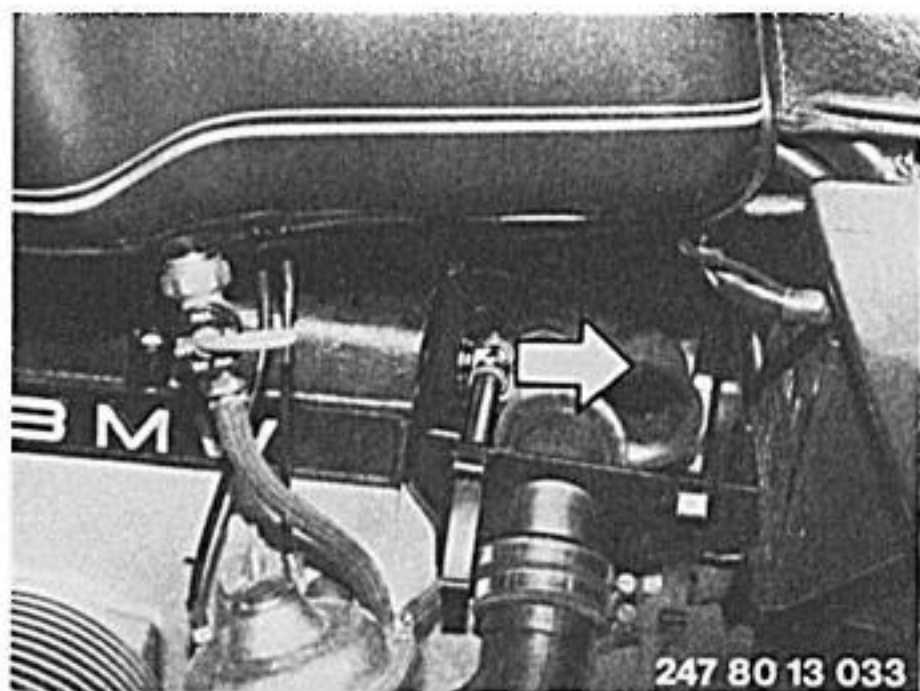
Remove (install) air cleaner – 13 72 000.

Slacken off hose clips at air pipe and detach it after pushing back the rubber sleeve.



Using a screwdriver, press the stub pipe out from the inside, then pull out the intake venturi.





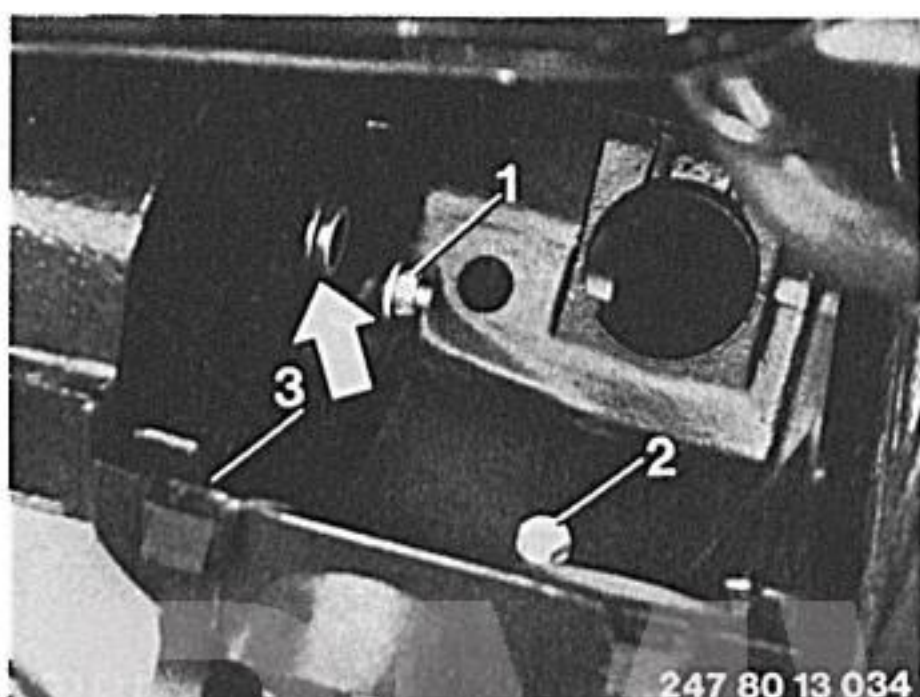
13 72 130 Air cleaner housing – removing and installing (1981 models)

Remove the air cleaner (13 72 000) and pull out the top of the air cleaner housing.

Remove the battery – 61 21 010.

Remove the battery holder – 61 21 100.

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



Unscrew hex nut (1) and bolts (2) and (3) retaining the housing. Press the breather line (arrow) out of the air cleaner housing. Take off the housing.



16 Fuel tank and lines

Specifications	Page 16– 0/3
Specifications for 1981 models	16– 0/3
16 11 030 Fuel tank – removing and installing	16–11/1

BMW AG

Fuel tank and lines

Specifications

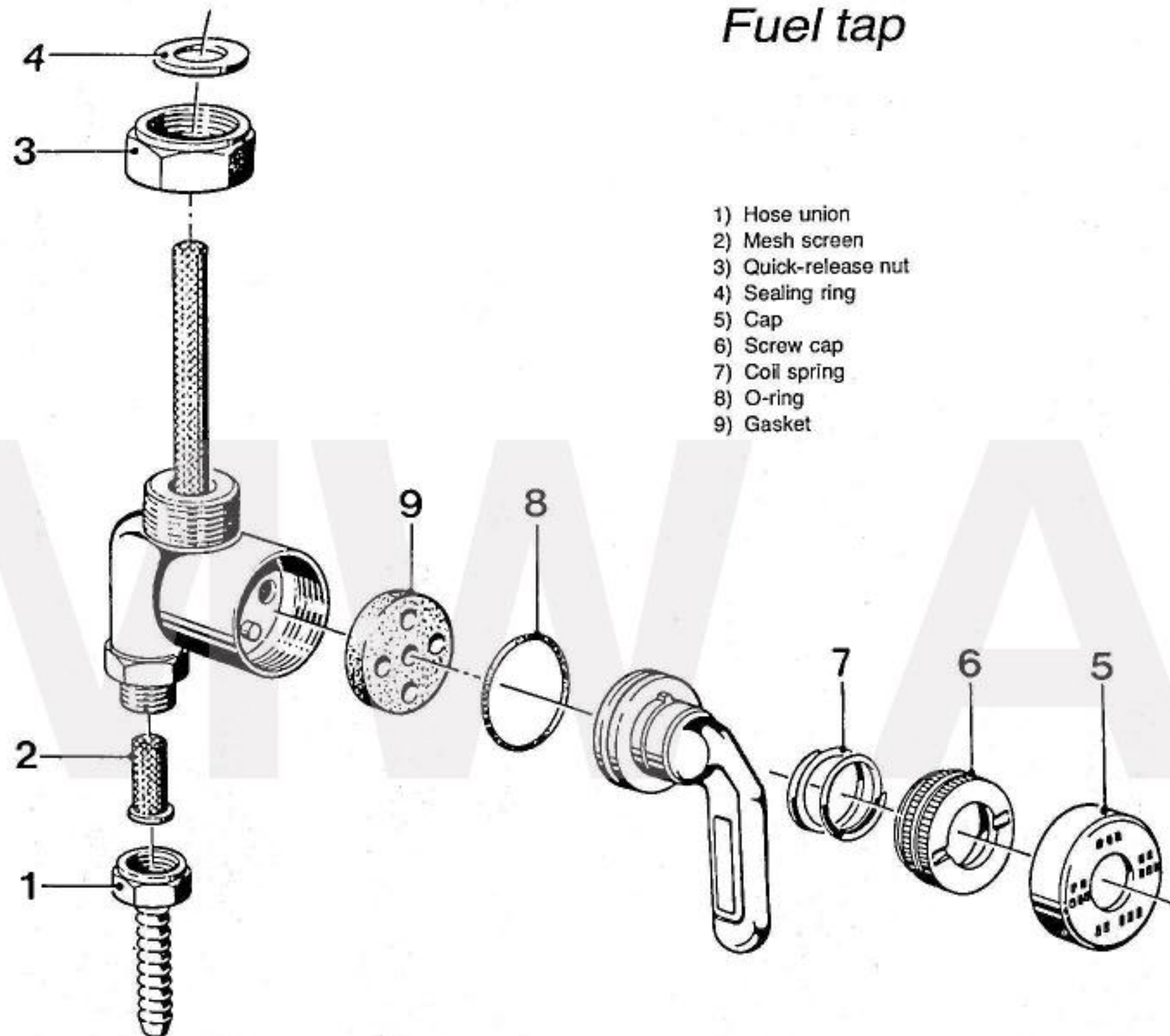
Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Tank capacity incl. reserve		22 (4.8, 5.8)	
of		2 (0.4, 0.5)	

Fuel tank and lines

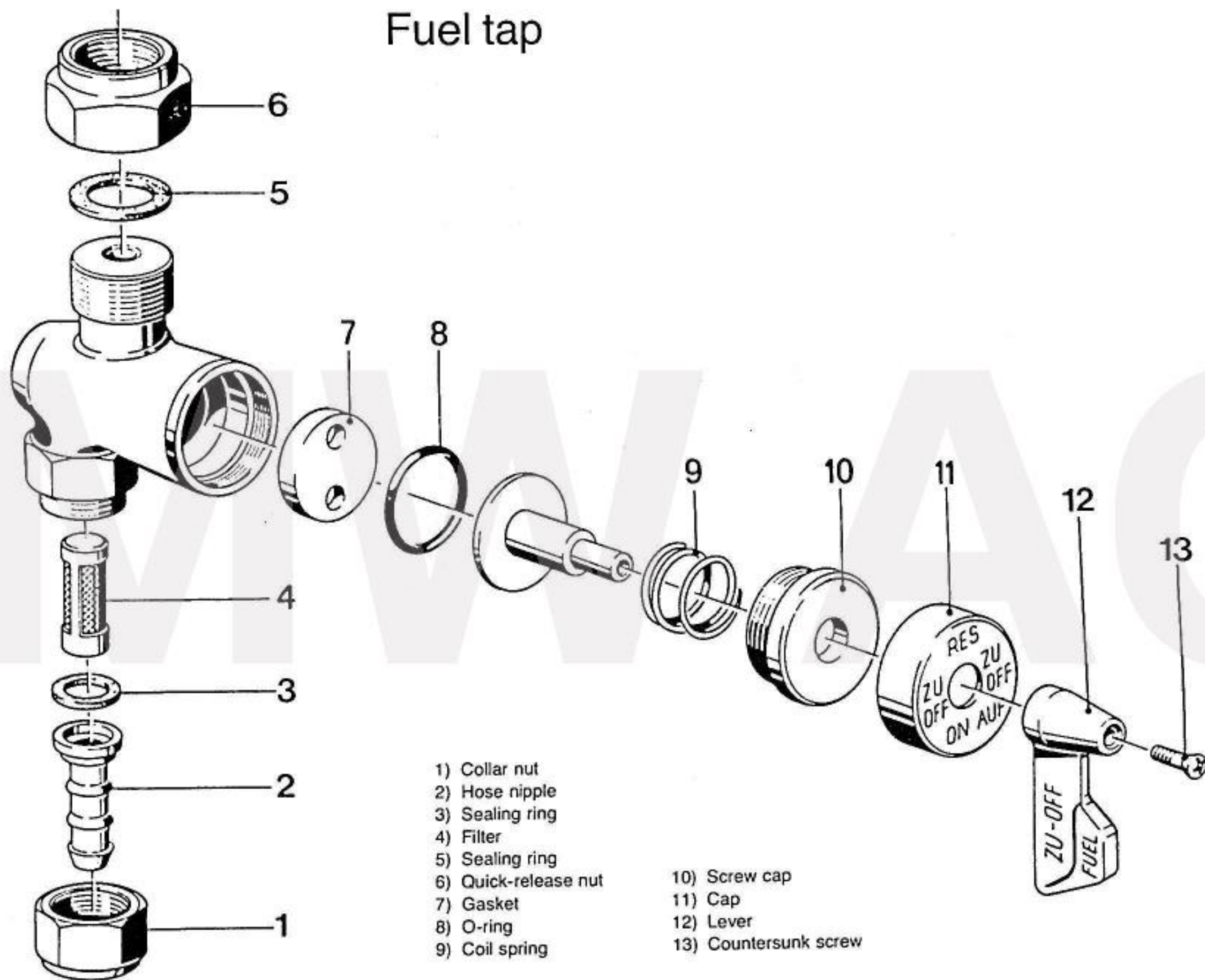
Specifications (1981 models)

Model		R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Tank capacity incl. reserve of	liters (Imp., US gal)		22 (4.8, 5.8)		
	liters (Imp., US gal)		2 (0.4, 0.5)		

Fuel tap



Fuel tap

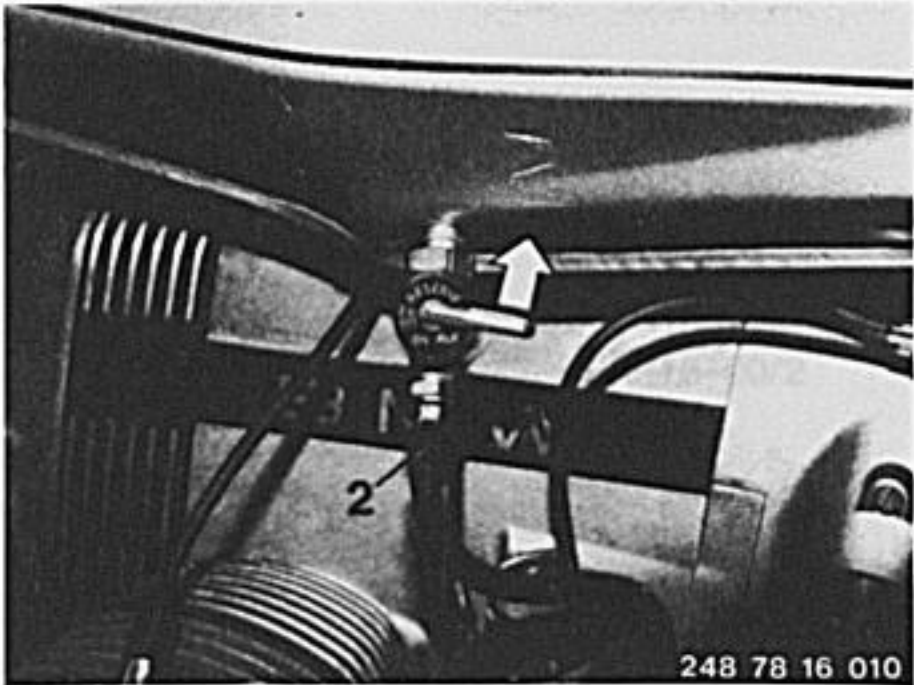


- 1) Collar nut
- 2) Hose nipple
- 3) Sealing ring
- 4) Filter
- 5) Sealing ring
- 6) Quick-release nut
- 7) Gasket
- 8) O-ring
- 9) Coil spring

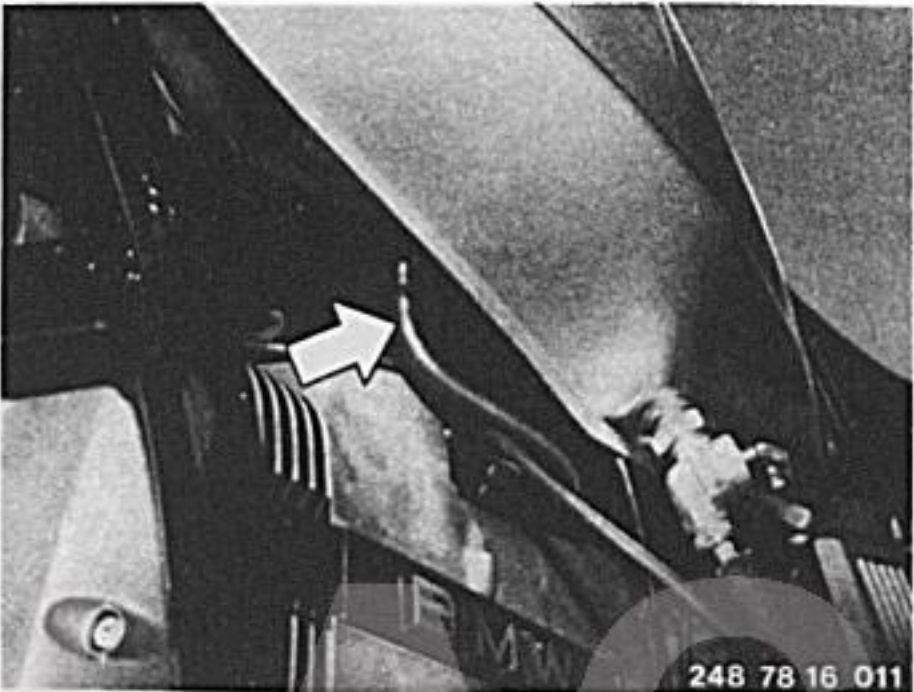
- 10) Screw cap
- 11) Cap
- 12) Lever
- 13) Countersunk screw

16 11 030 Fuel tank — removing and installing

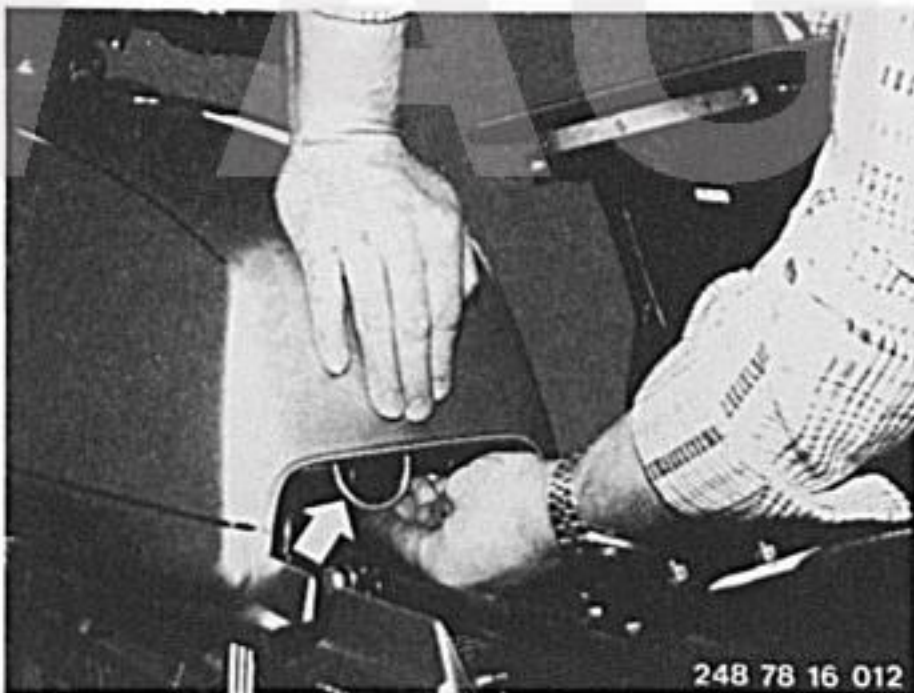
Close the fuel cap (1) and pull off the fuel hose (2).



Pull off the overflow line at the left base of the tank (arrow).



Open the dual seat and take out the tool tray.
With the left hand, press down on the tank and with the right hand fold the retaining clip (arrow) forwards.
Pull the fuel tank back slightly, raise at the front and take off.



18 Exhaust system

Specifications	Page 18– 0/3
Specifications (1981 models)	18– 0/5
18 00 020 Exhaust system – detaching and attaching	18–00/1
18 11 321 Muffler (silencer) – removing and installing	18–00/2

BMW AG

Exhaust system

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Muffler dia. mm (in)	87 (3.43)		
Exhaust pipe dia. mm (in)	32 × 1.5 (1.26 × 0.06)		

Tightening torques Nm (lb. ft)

<p>Spider nut for exhaust pipe 160 ± 20 (118 ± 15)</p> <p>All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.</p>

Exhaust system

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Muffler dia. mm (in)	87 (3.43)			
Exhaust pipe dia. mm (in)	32 × 1.5 (1.26 × 0.06)			

Tightening torques Nm (lb. ft)

Spider nut for exhaust pipe 200 + 20 (147 + 15)

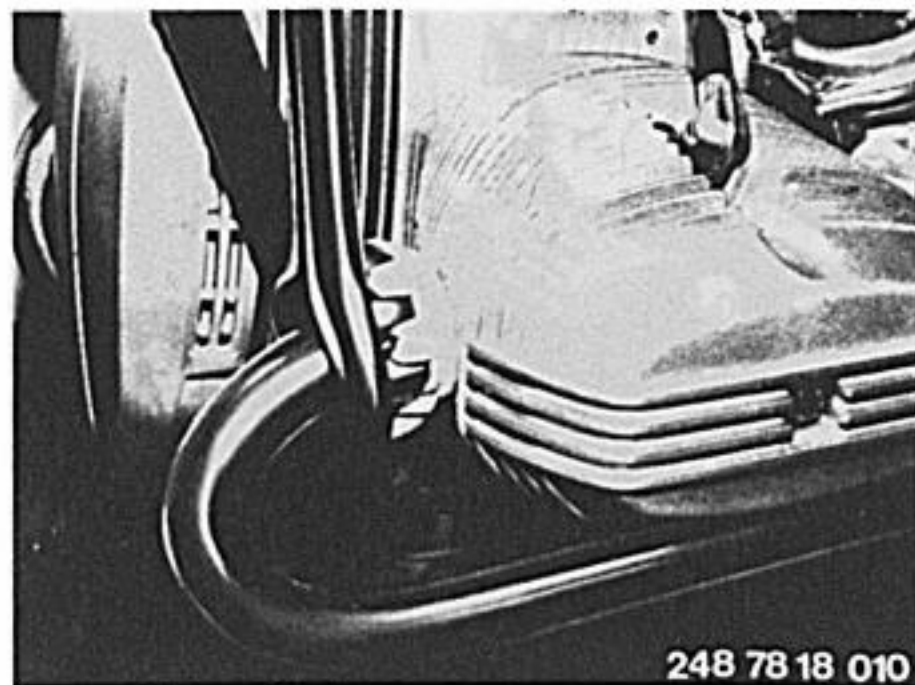
All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.

18 00 020 Exhaust system – removing and installing

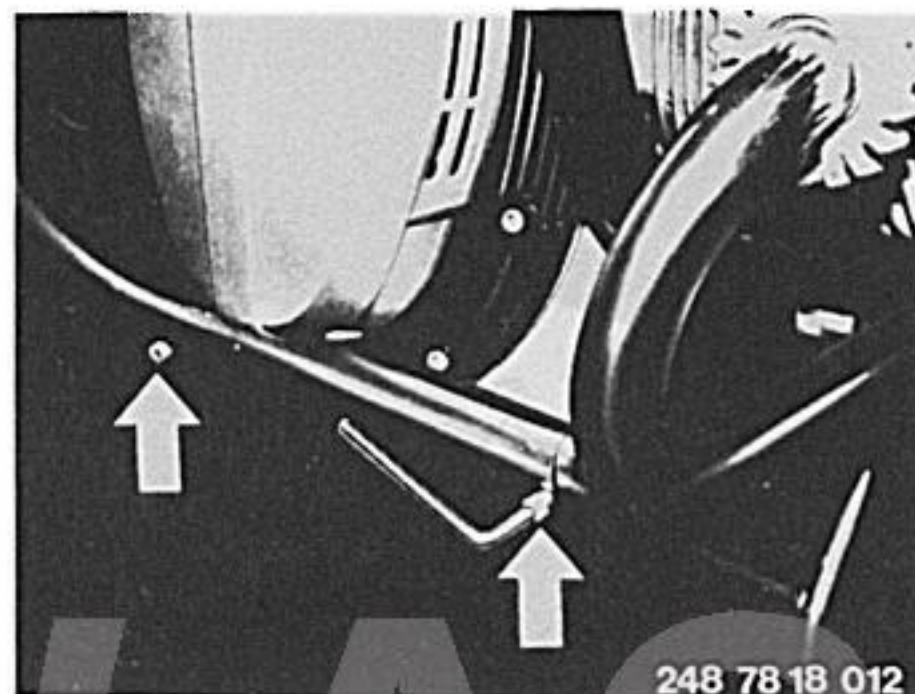
Remove (install) muffler (silencer) – 18 11 321.

Unscrew both exhaust port nuts at the cylinder heads with special wrench BMW No. 18 0 600.

When installing: Apply a coat of corrosion-proofing paste to the clamping points at cylinder head.



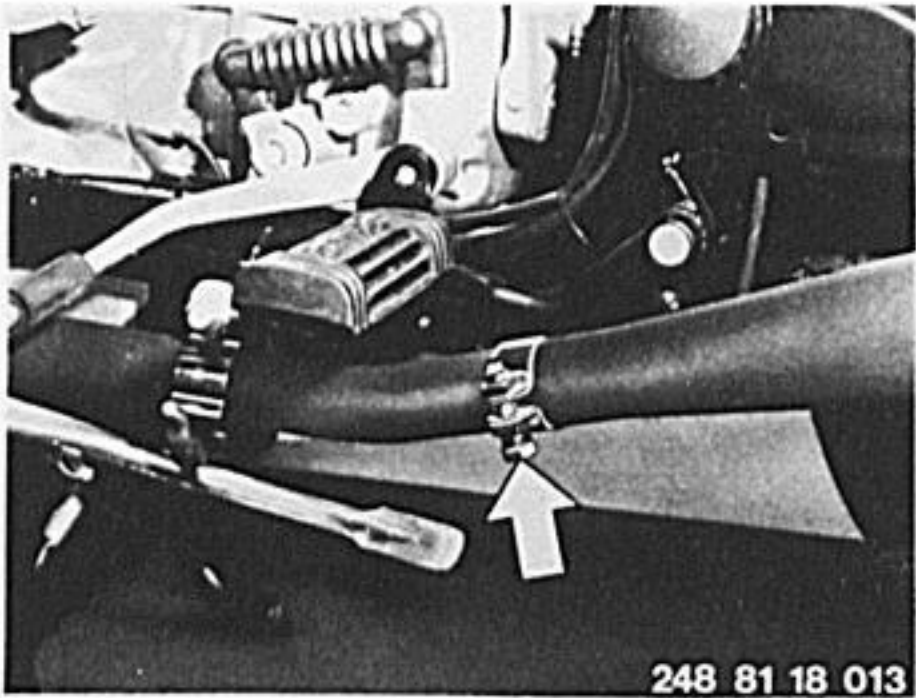
Slacken the Allen screws at the front balancing pipe (arrows).



Unscrew the hex bolt at the rear engine mounting pin and take off the clip (arrow). Loosen the clamp bolts (1) at the rear balancing pipe (from 1981 models on), pull the exhaust pipes out of the cylinder heads and place to one side.

When installing: Apply a coat of corrosion-proofing paste to the clamping points and bolts.



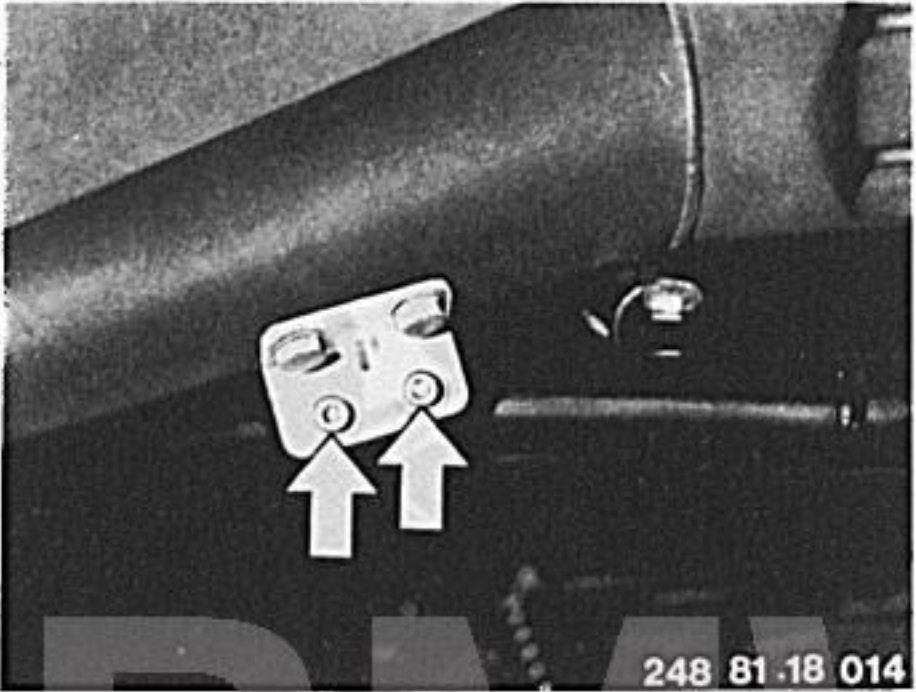


18 11 321 Muffler (silencer) – removing and installing

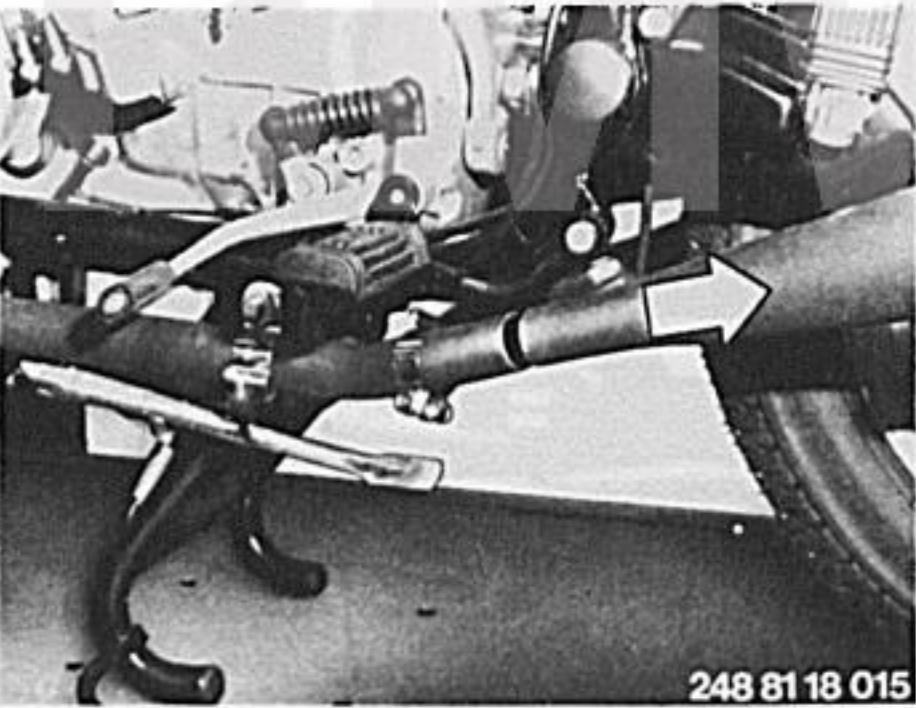
Loosen the hex bolt at the pipe clip and push the clip back.



Unscrew and remove the Allen screws at the frame (arrows).



Remove the muffler (silencer) to the rear.



21 Clutch

Specifications	Page	21- 0/3
Specifications (1981 models)		21- 0/5
21 00 004 Clutch operating clearance – adjusting (1981 models)		21-00/1
21 21 000 Clutch – removing and installing		21-21/1
21 21 000 Clutch – removing and installing (1981 models)		21-21/3
21 51 020 Clutch withdrawal arm – removing and installing		21-51/1
21 51 020 Clutch withdrawal arm – removing and installing (1981 models)		21-51/3

BMW AG

Clutch**Specifications**

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Type	Single dry plate with diaphragm spring		
Diaphragm spring thickness mm (in)	2.6 (0.102)		
Installed spring pressure kp (lb. f)	180 ... 220 (397 ... 485)		
Relaxed height of diaphragm spring mm (in)	15.2±0.5 (0.598±0.020)		
Diaphragm spring dia. (pressure flat) mm (in)	163 (6.42)		
Test procedure for diaphragm spring	Place edge of spring on measuring block and measure difference in spring lug heights: max. 0.3 mm (0.012 in), or place spring lugs on measuring block: max. vertical runout of spring edge 0.8 mm (0.031 in)		
Total thickness of clutch plate with lining mm (in)	6±0.25 (0.236±0.010)		
Extl. dia. of clutch plate mm (in)	160 (6.30)		
Max. lateral runout at periphery of clutch plate mm (in)	0.15 (0.006)		
Max. vertical runout of clutch plate mm (in)	0.3 (0.012)		
Max. vertical runout of diaphragm spring driving disc mm (in)	at intl. dia.	61 ^{+0.05} _{+0.1} (2.402 ^{+0.002} _{+0.004})	
	at extl. dia.	189 ^{+0.1} (7.441 ^{+0.004})	
Clutch play at withdrawal arm (cable) mm (in)	2 (0.008)		

Tightening torques Nm (lb. ft.)

Clutch lever adjusting screw locknut

20 ... 23 (14.7 ... 17.0)

All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

Clutch

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Type	Single dry plate with diaphragm spring			
Diaphragm spring dia. (pressed flat) mm (in)	163 (6.42)			
Total thickness of clutch plate with lining mm (in)	5.5 ± 0.25 (0.216 ± 0.01)			
External dia. of clutch plate mm (in)	165 ± 1 (6.50 ± 0.04)			
Clutch play at withdrawal arm (cable) mm (in)	2 ± 0.5 (0.08 ± 0.02)			

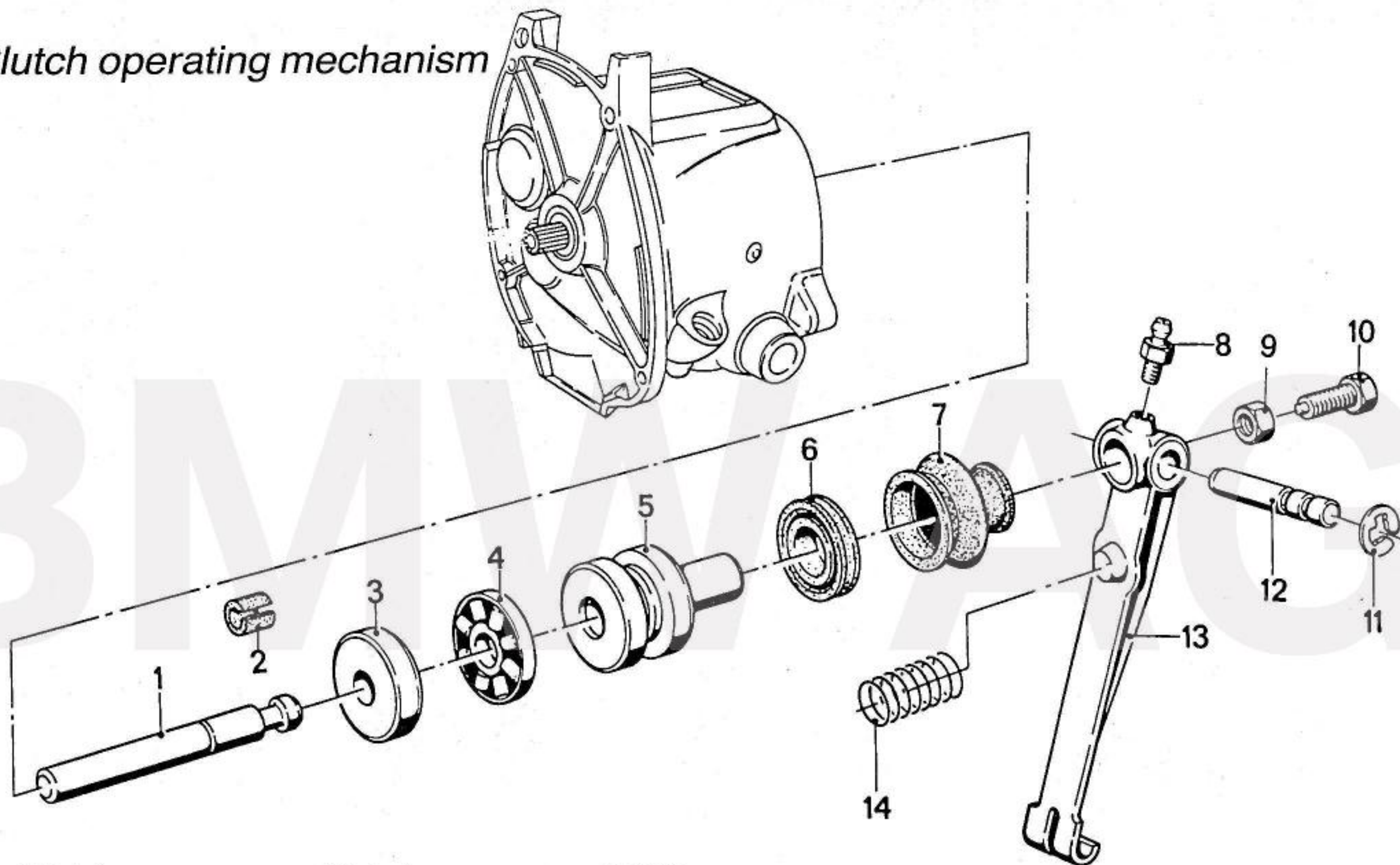
Tightening torques Nm (lb. ft)

Clutch housing cover

20 + 2 (14.7 + 1.5)

All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or on the latest BMW 60002.0 standards sheet.

Clutch operating mechanism

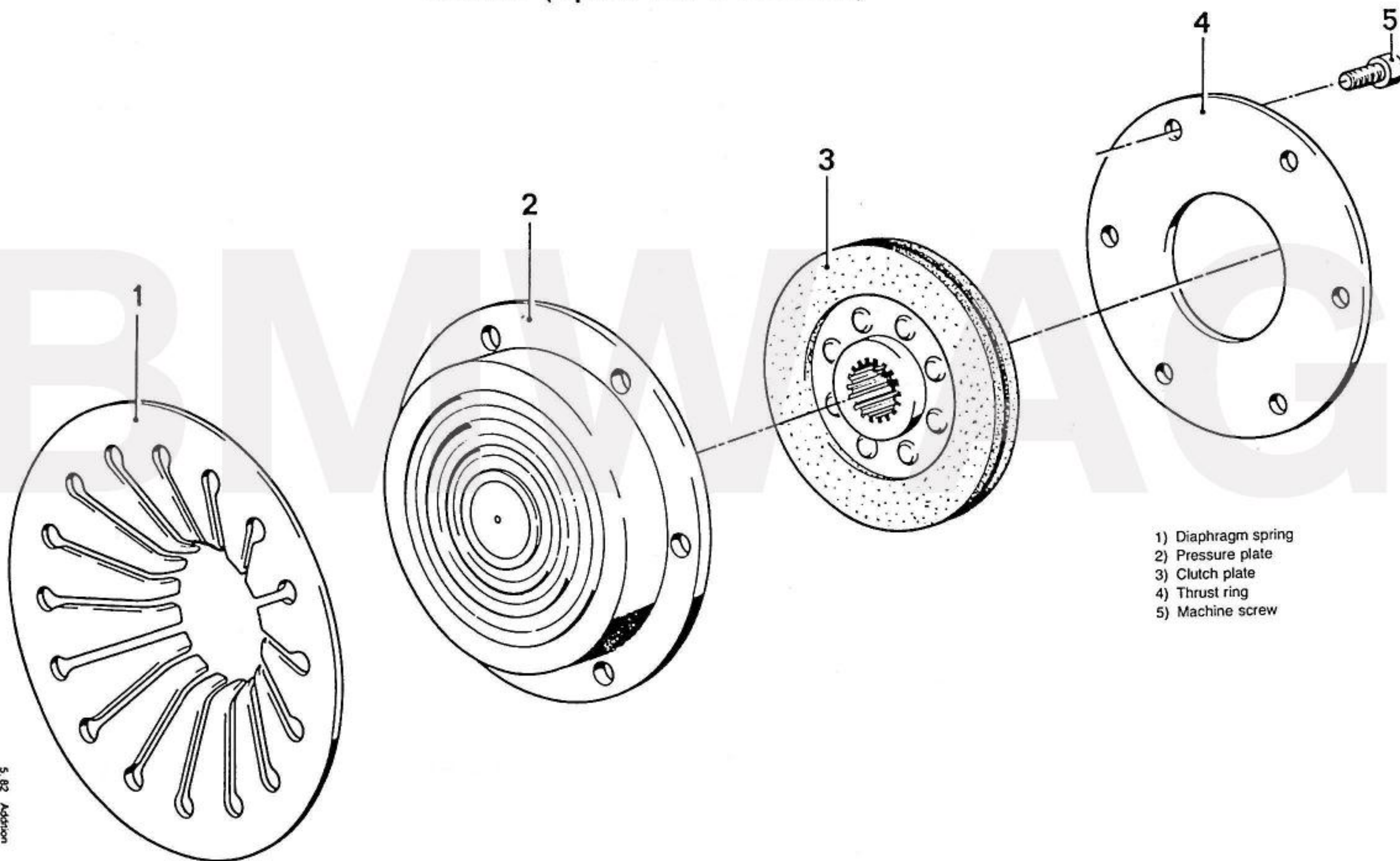


- 1) Pushrod
- 2) Felt ring
- 3) Thrust washer
- 4) Ball cage with balls
- 5) Piston

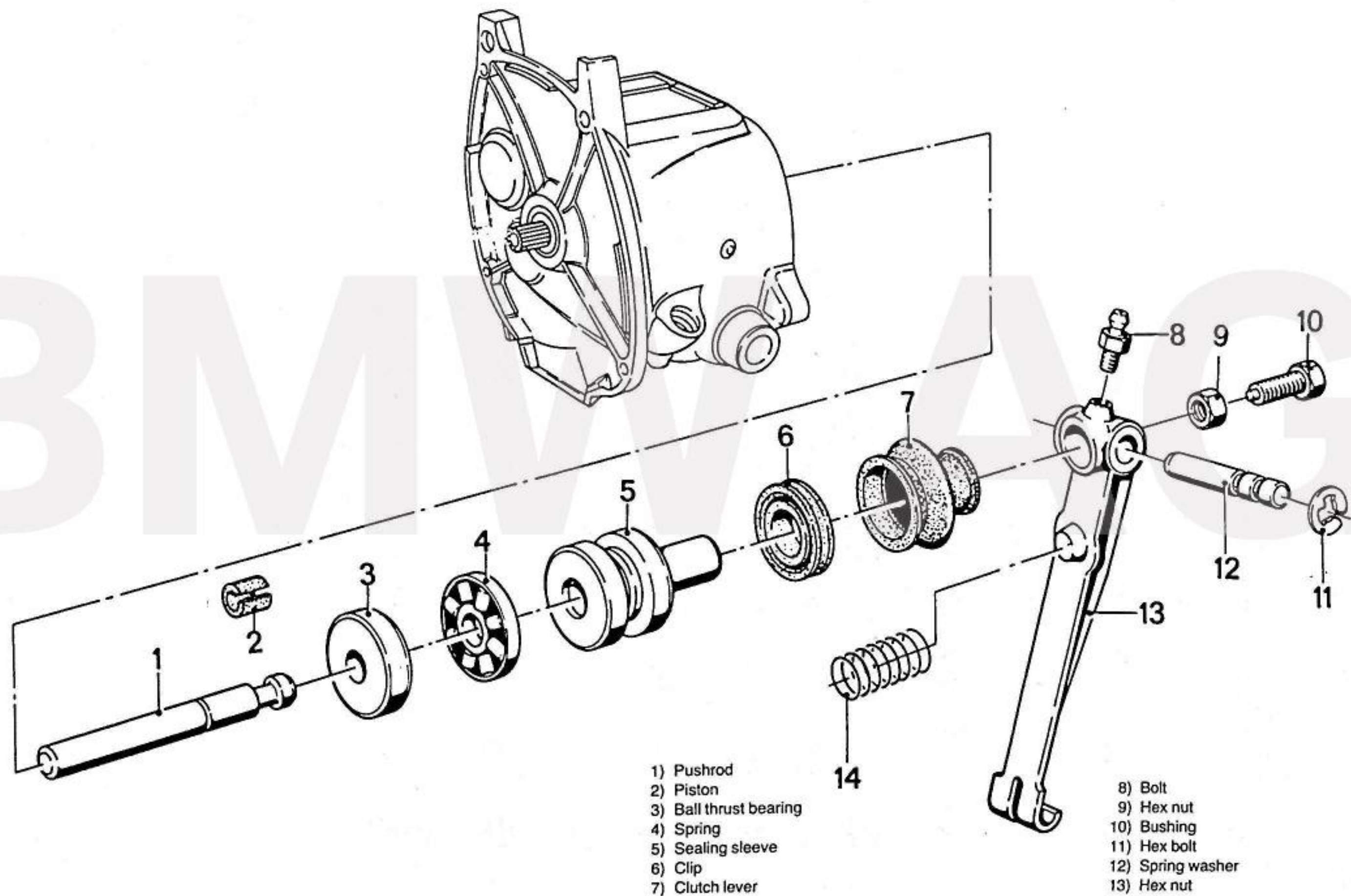
- 6) Sealing ring
- 7) Sealing sleeve
- 8) Grease nipple
- 9) Hex nut
- 10) Hex bolt

- 11) Circlip
- 12) Pivot pin
- 13) Clutch lever
- 14) Coil spring

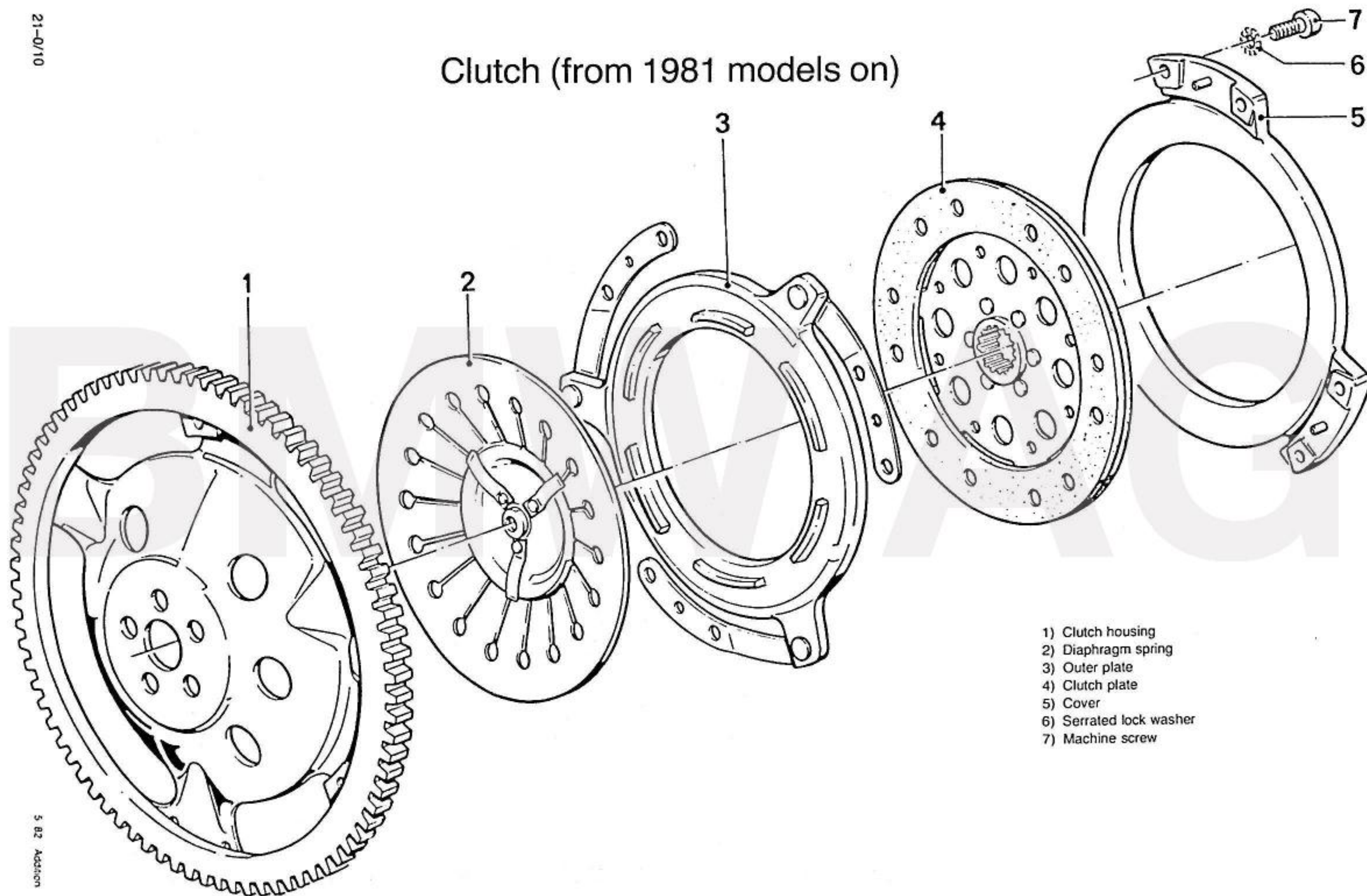
Clutch (up to 1979 models)



Clutch operating mechanism (from 1981 models on)



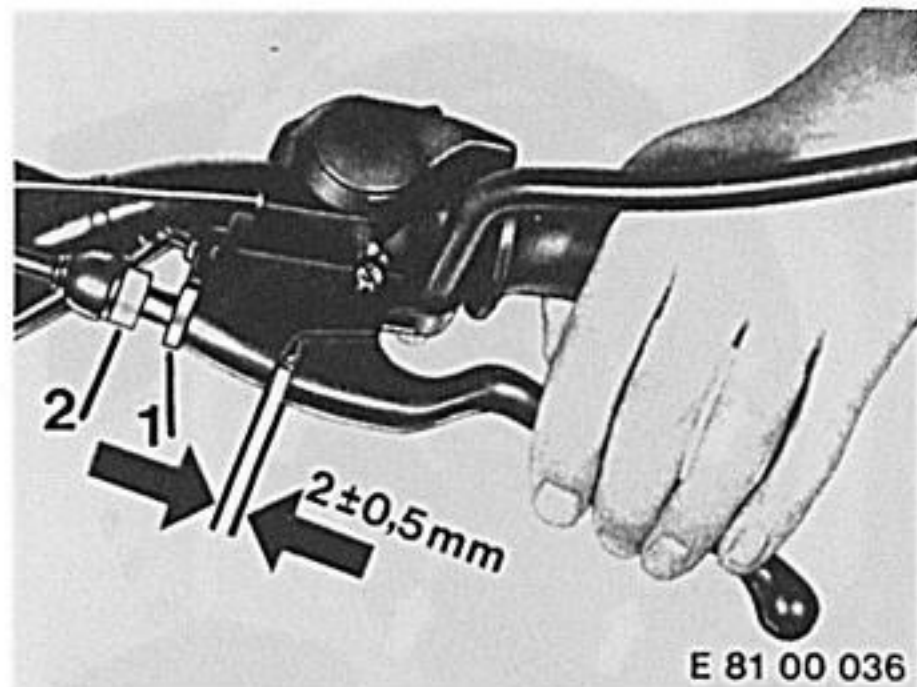
Clutch (from 1981 models on)



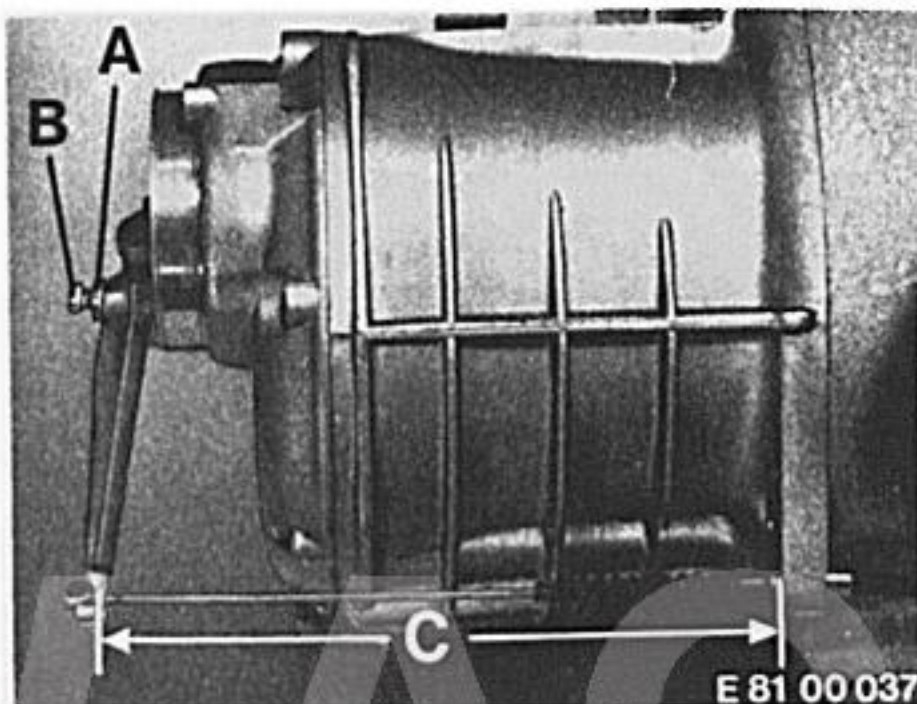
21 00 004 Clutch operating clearance – adjusting (1981 models)

Free travel at the clutch lever on the handlebar must be 2 ± 0.5 mm (0.08 ± 0.02 in); adjust if necessary as follows:

- + Unscrew locknut (1) on wire cable adjusting screw.
- + Turn adjusting screw (2).



- + Dimension 'C' at the clutch lever on the gearbox must be 201 ± 2 mm (7.91 ± 0.08 in). The lever should be at an angle of 4° to the rear.
- + Retighten locknut (1).
- + Unscrew locknut 'A' on the gearbox-end adjusting screw.
- + Turn adjusting screw 'B' until clutch lever free travel at the handlebar is 2 ± 0.5 mm (0.08 ± 0.02 in), then tighten locknut 'A' again.



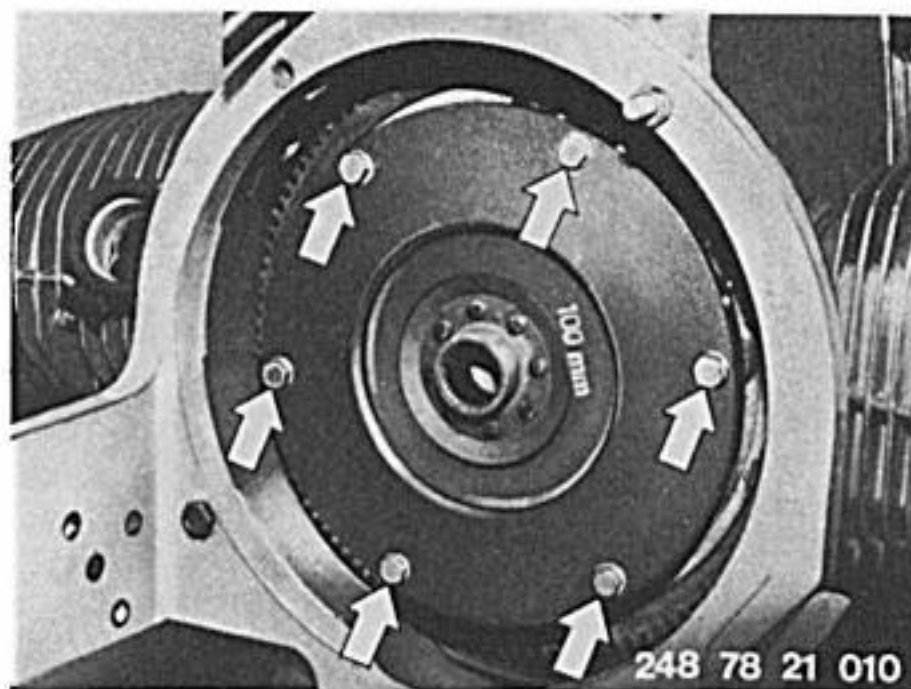
21 21 000 Clutch — removing and installing

1st method: With engine removed — 11 00 050.

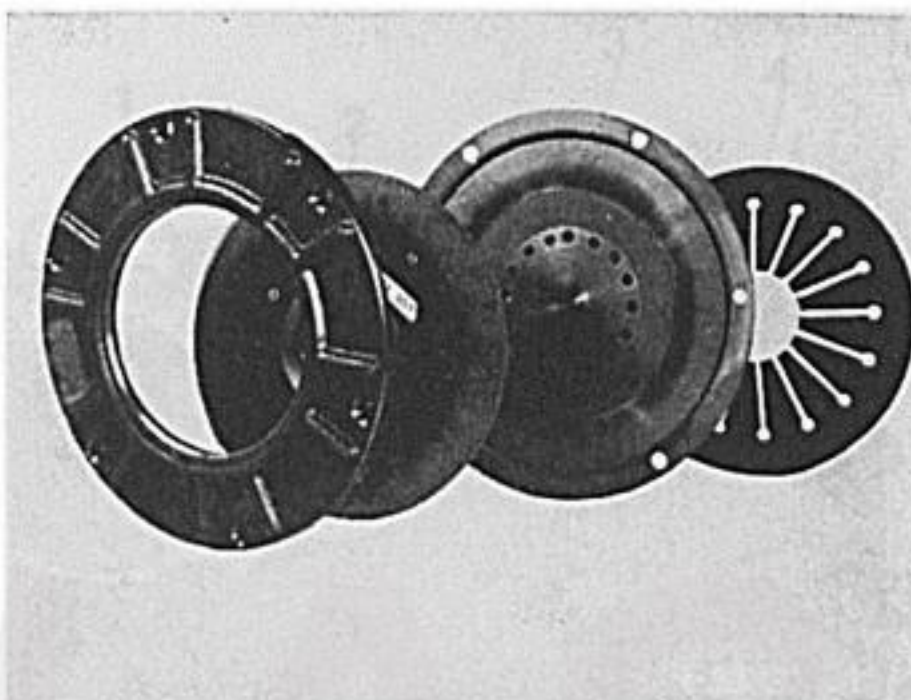
2nd method: With gearbox removed — 23 00 020.

The engine remains in the frame. Illustrations and descriptions refer to this method.

Slacken the 6 Allen screws and remove each second retaining screw. Insert 3 clamp bolts in place of these screws, and tighten the nuts until they contact the thrust ring.

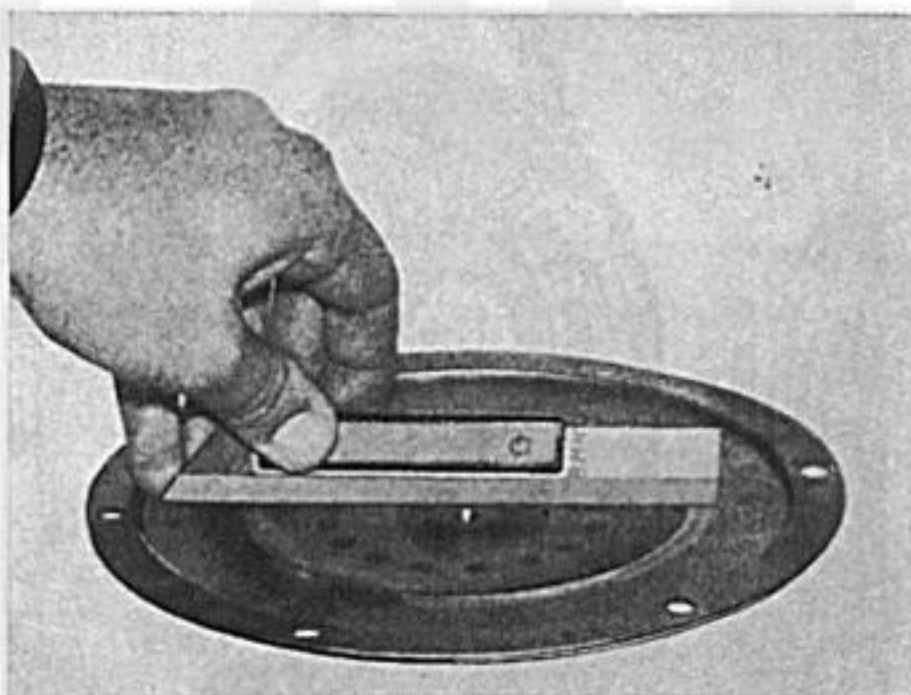


Take off the thrust ring, clutch plate, diaphragm and diaphragm spring.



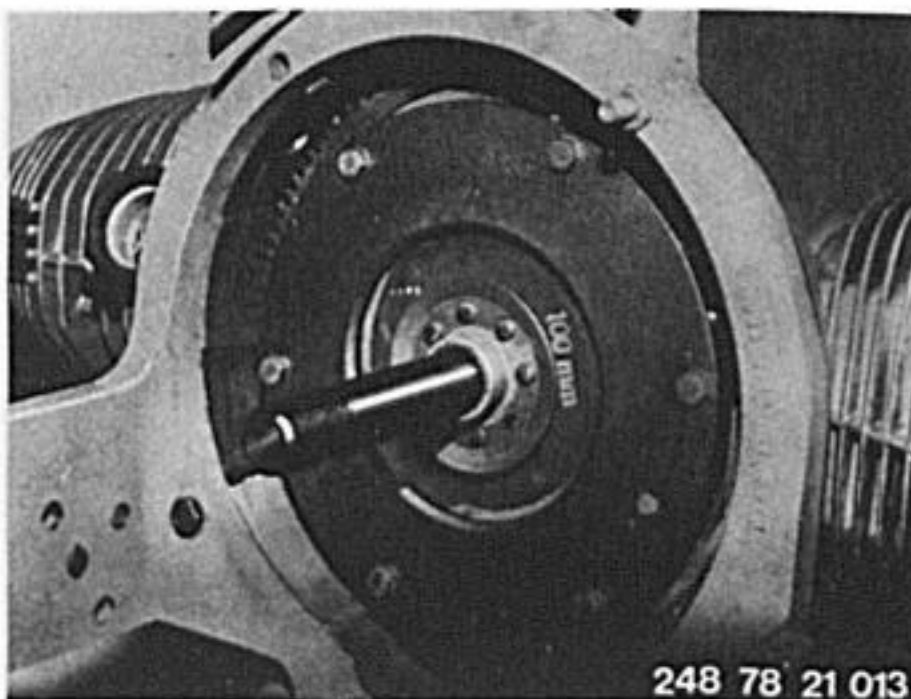
Testing and repair:

Inspect the clutch plate for wear, the diaphragm for distortion and check the force exerted by the diaphragm spring when installed. Check driving plate lateral runout, wear limits and clearances — see Specifications.



When assembling, use BMW centering pin 21 2 650 to maintain the clutch plate in a central position. For tightening torques, see Specifications.

Apply a light coat of "Molykote Longterm 2" grease to the internal splines of the clutch center.

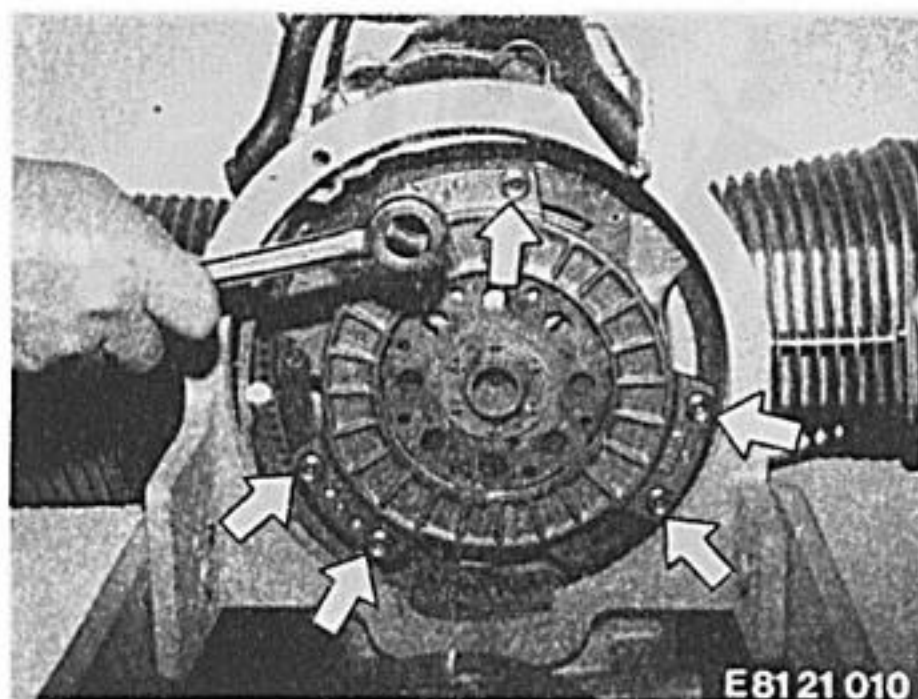


21 21 000 Clutch – removing and installing (1981 models)

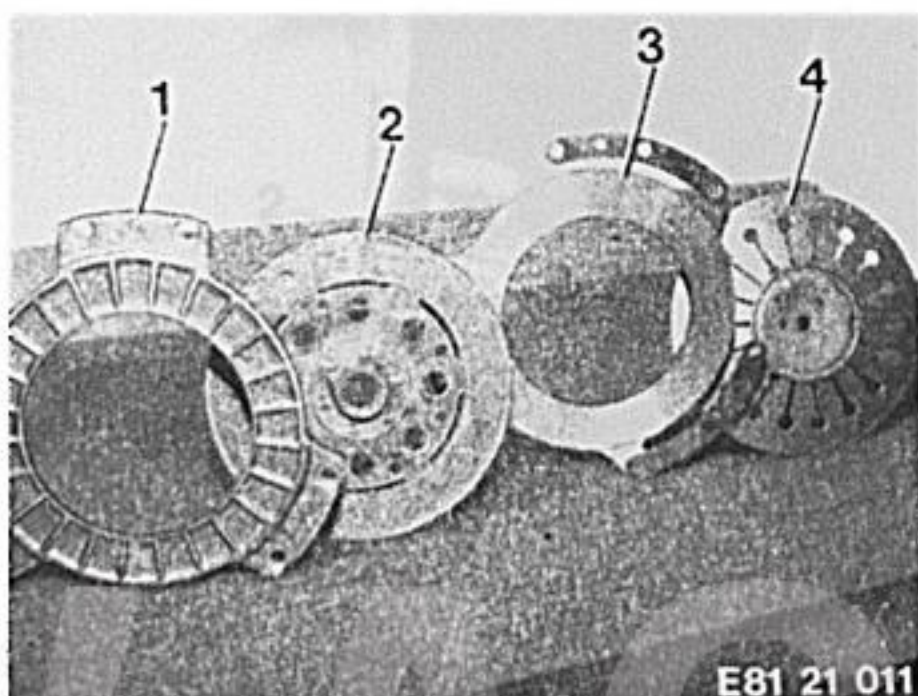
Remove (install) gearbox – 23 00 020.

The engine does not have to be removed.

Unscrew the six retaining bolts at the housing cover.



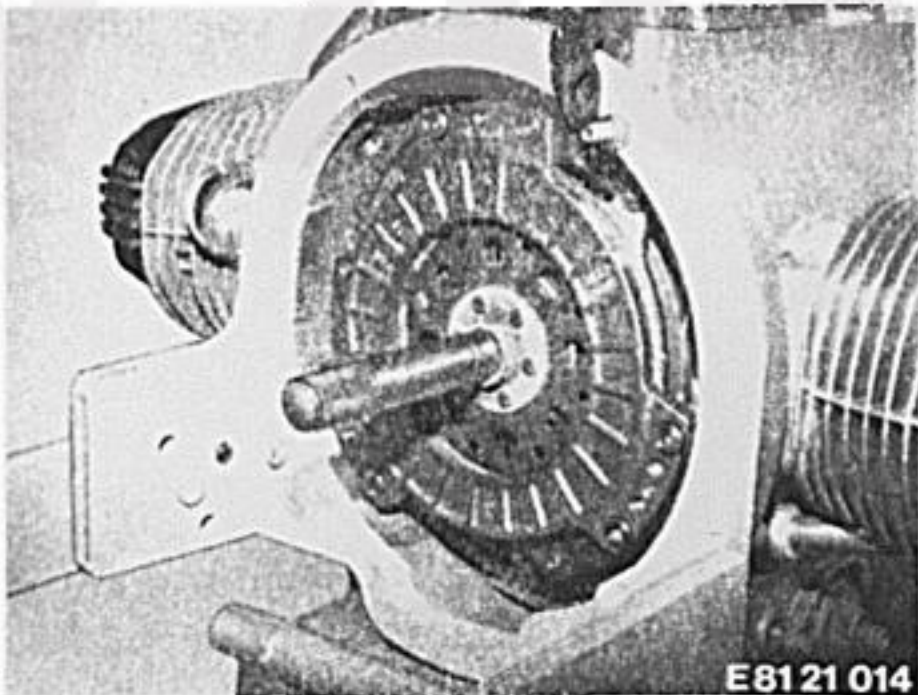
Take off the cover (1), clutch plate (2), outer plate (3) and diaphragm spring (4).



When installing, centre the clutch plate with centering pin BMW No. 21 2 660.

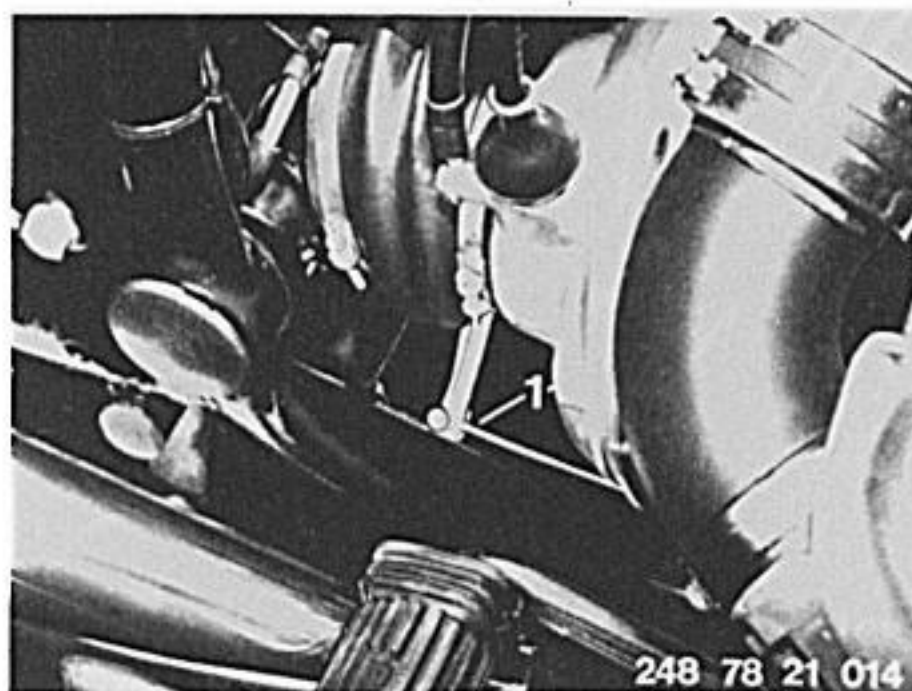
Lubricate the splines with Molykote thin U-n paste.

See Specifications for clutch housing cover tightening torque.

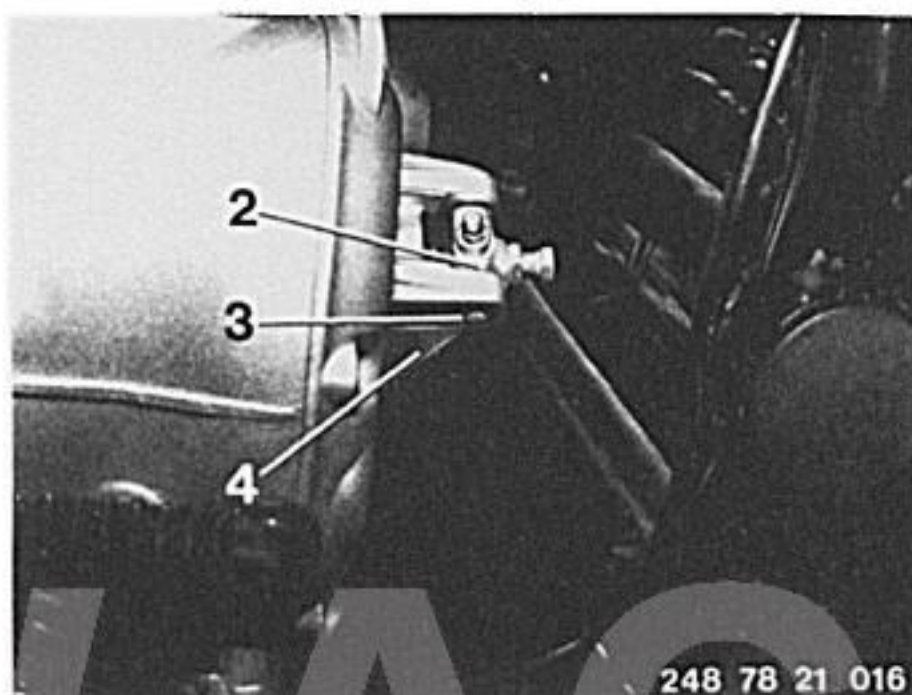


21 51 020 Clutch withdrawal arm – removing and installing

Disconnect the clutch cable (1).



Press out the keeper (2) with screwdriver blades. Remove pin (3) and take off remaining components with coil spring (4).

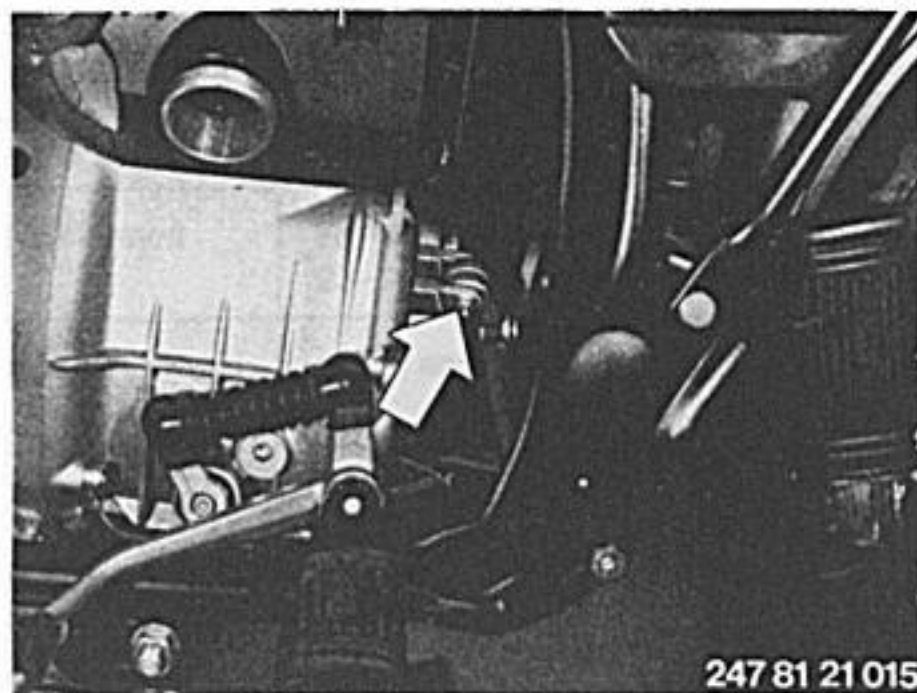


21 51 020 Clutch withdrawal arm – removing and installing (1981 models)

Disconnect the clutch cable from the withdrawal arm.

Slacken the retaining nut (arrow) on the bearing mount, pull out the pin and take off the withdrawal arm.

Adjust operating clearance – 21 00 004.



BMW AG

Troubleshooting – clutch

Fault	Cause	Remedy
Clutch judder	Input shaft incorrectly shimmed	Re-shim input shaft (see Pages 23–21/5 and /6)
Clutch is difficult to operate; clutch judder	Lack of grease on clutch plate/ crankshaft splines	Clean and grease the splines

BMW AG

23 Gearbox

Specifications	Page	23– 0/3
Specifications (1981 models)		23– 0/7
23 00 020 Gearbox – removing and installing		23–00/1
23 00 020 Gearbox – removing and installing (1981 models)		23–00/5
23 11 040 Gearbox cover – detaching and attaching/sealing		23–12/1
23 22 001 Complete gear cluster		23–21/1
23 31 001 Selector forks – renewing		23–31/1
23 31 210 Pivot mount for selector disks – removing and installing		23–31/1
23 31 861 Selector disks – renewing		23–31/2
23 31 881 Shift mechanism – renewing		23–31/2
23 31 401 Electric neutral indicator – renewing		23–31/3
23 51 010 Kick starter – removing and installing		23–31/3
23 51 010 Kick starter – removing and installing		23–31/3
Troubleshooting – gearbox		23–31/5



Gearbox

Specifications

Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Gearbox:		5-speed, in unit with engine block; drive torque damped in all gears		
Gear shift		Hook claw mechanism		
Gear ratios				
1st		4.4		
2nd		2.86		
3rd		2.07		
4th		1.67		
5th		1.50		
Oil grade	above 5° C (41° F)	Brand-name hypoid gear oil, SAE 90		
	below 5° C (41° F)	Brand-name hypoid gear oil, SAE 80		
Oil content	liters (Imp. pints, US quarts)	0.8 (1.4, 0.85)		
Input shaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims		
Countershaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims		
Output shaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims		
Ball bearing seats in housing		press fit (heat housing to app. 100° C [212° F])		
Endplay of free gears on shaft		0.15 ... 0.30 (0.006 ... 0.012)		

Gearbox

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Bushings on output shaft mm (in)	0.005 ... 0.035 (0.0002 ... 0.0014)		
Drive flange radial runout mm (in)	±0.05 (0.002)		
Face runout mm (in)	+0.05 (0.002)		
Transmission from gearbox to rear wheel	Propeller shaft with torsional vibration damper enclosed in right swinging arm tube; universal joint at gearbox and, domed coupling with curved splines at rear wheel end.		
Endplay at gear shift pedal shaft mm (in)	0.1 (0.004)		

Tightening torques Nm (lb. ft)

Attachment to engine	20 ... 23 (14.7 ... 17.0)	Gearbox housing/cover	7 ... 8 (5.2 ... 5.9)
Drive flange at gearbox output shaft	200 ... 220 (147 ... 162)	Kick starter pedal nut	20 ... 23 (14.7 ... 17.0)
		Oil filler plug	28 ... 31 (21 ... 23)
		Oil drain plug	23 ... 26 (17 ... 19)
All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.			

Specifications (1981 models)

Gearbox

Model		R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Gearbox:		5-speed, in unit with engine block; drive torque damped in all gears			
Gear shift		Hook claw mechanism			
Gear ratios					
1st		4.4			
2nd		2.86			
3rd		2.07			
4th		1.67			
5th		1.50			
Oil grade	above 5° C (41° F) below 5° C (41° F)	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80			
		API class GL 5			
Oil content	liters (Imp. pints, US quarts)	0.8 (1.4, 0.85)			
Input shaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims			
Countershaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims			
Output shaft endplay mm (in)		0 ... 0.1 (0 ... 0.004) – adjust with shims			
Ball bearing seats in housing		press fit (heat housing to app. 100° C [212° F])			
Endplay of free gears on shaft mm (in)		0.15 ... 0.30 (0.006 ... 0.012)			

Gearbox

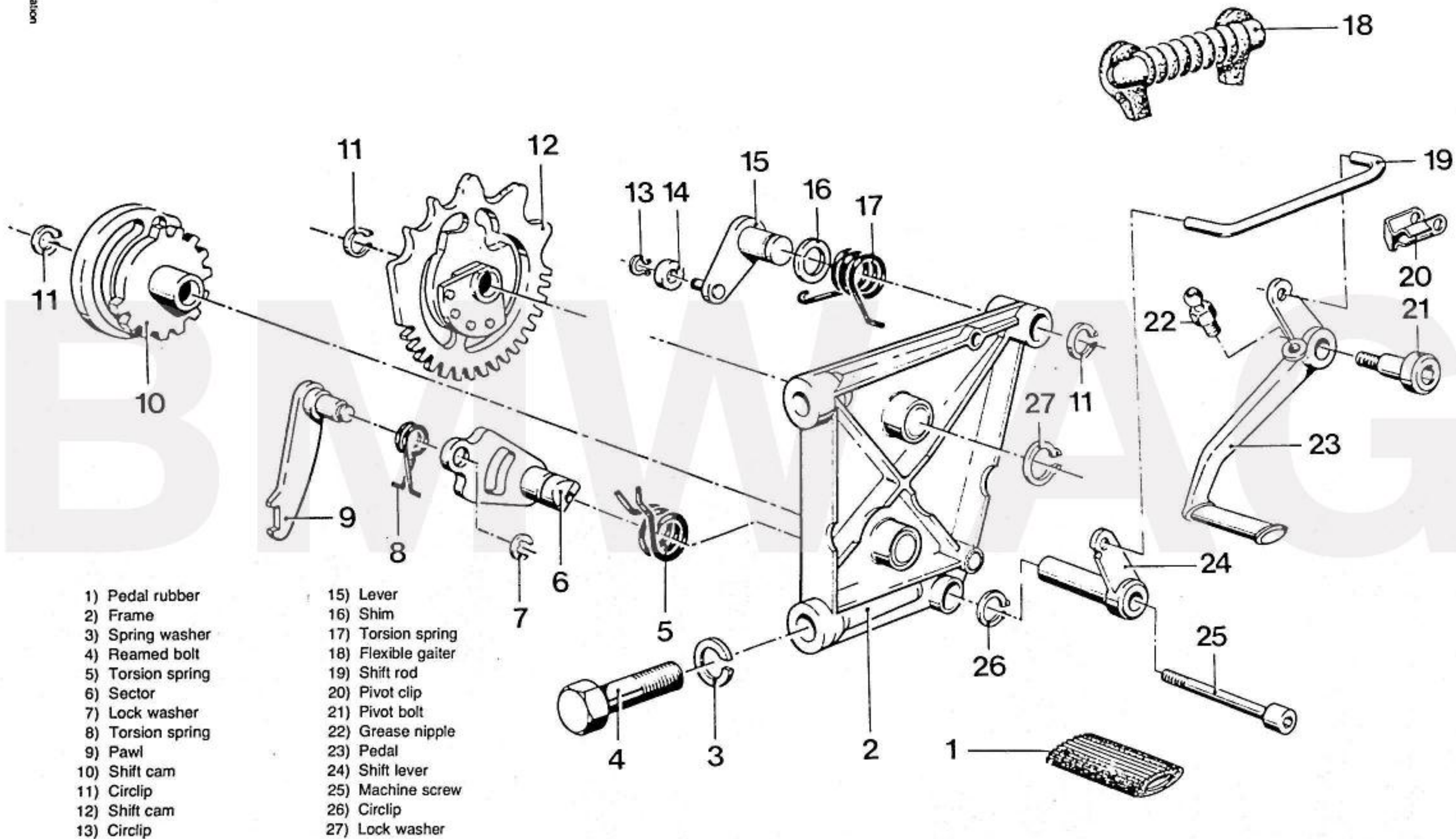
Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Bushings on output shaft mm (in)	0.005 . . . 0.035 (0.0002 . . . 0.0014)			
Drive flange radial runout mm (in)	± 0.05 (0.002)			
Face runout mm (in)	± 0.05 (0.002)			
Transmission from gearbox to rear wheel	Propeller shaft with torsional vibration damper enclosed in right swinging arm tube; universal joint at gearbox, and domed coupling with curved splines at rear-wheel end.			
Endplay at gear shift pedal shaft mm (in)	0.1 (0.004)			

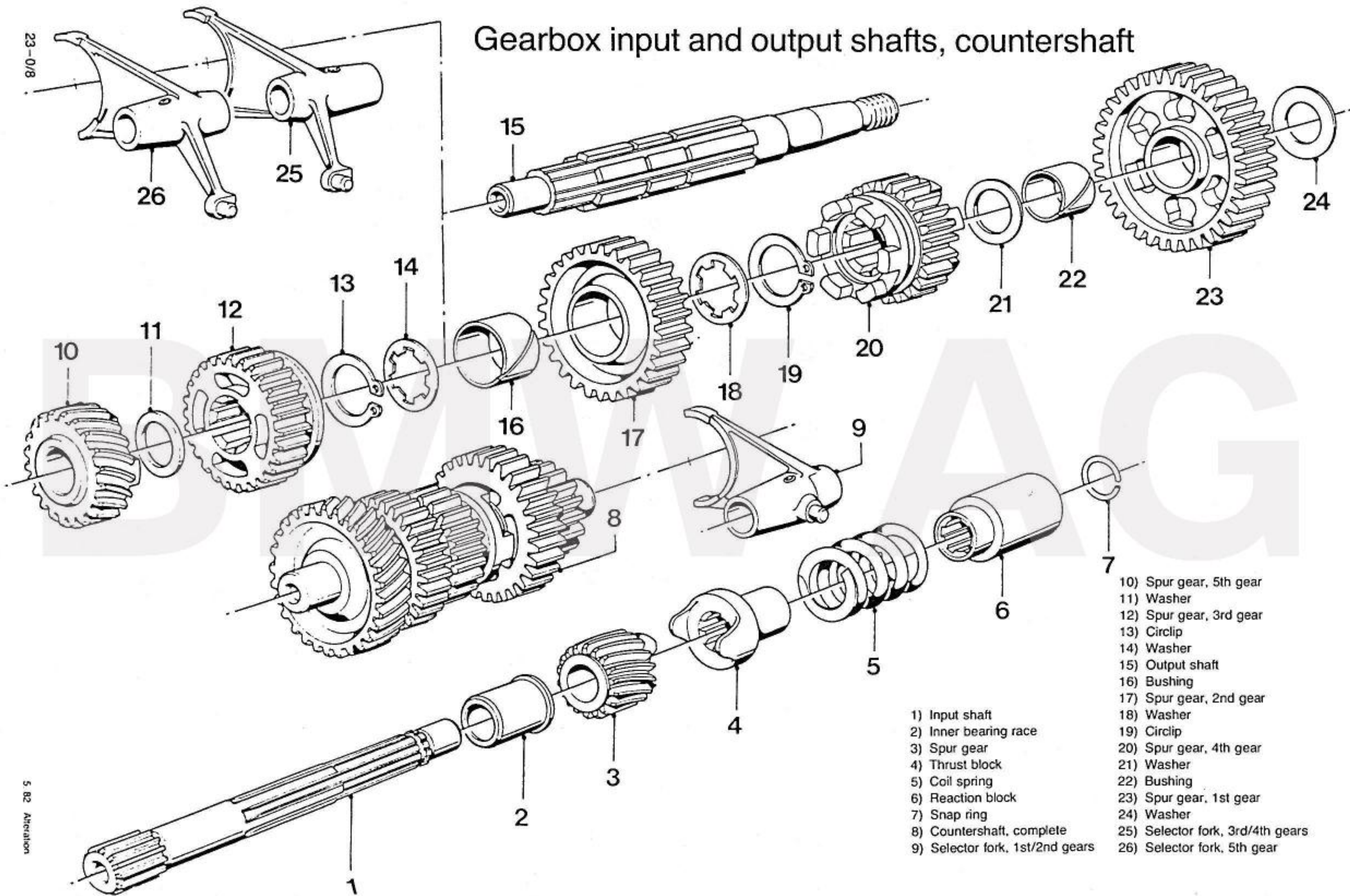
Tightening torques Nm (lb. ft)

Attachment to engine	33 (24)	Gearbox housing/cover	8 (5.9)
Drive flange at gearbox		Kick starter pedal nut	22.5 (16.5)
output shaft	221.5 (163)	Oil filler plug	31 (23)
Bearing mount	19 (14)	Oil drain plug	26 (19)
All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.			

Gear shift mechanism



Gearbox input and output shafts, countershaft



- 1) Input shaft
- 2) Inner bearing race
- 3) Spur gear
- 4) Thrust block
- 5) Coil spring
- 6) Reaction block
- 7) Snap ring
- 8) Countershaft, complete
- 9) Selector fork, 1st/2nd gears

- 10) Spur gear, 5th gear
- 11) Washer
- 12) Spur gear, 3rd gear
- 13) Circlip
- 14) Washer
- 15) Output shaft
- 16) Bushing
- 17) Spur gear, 2nd gear
- 18) Washer
- 19) Circlip
- 20) Spur gear, 4th gear
- 21) Washer
- 22) Bushing
- 23) Spur gear, 1st gear
- 24) Washer
- 25) Selector fork, 3rd/4th gears
- 26) Selector fork, 5th gear

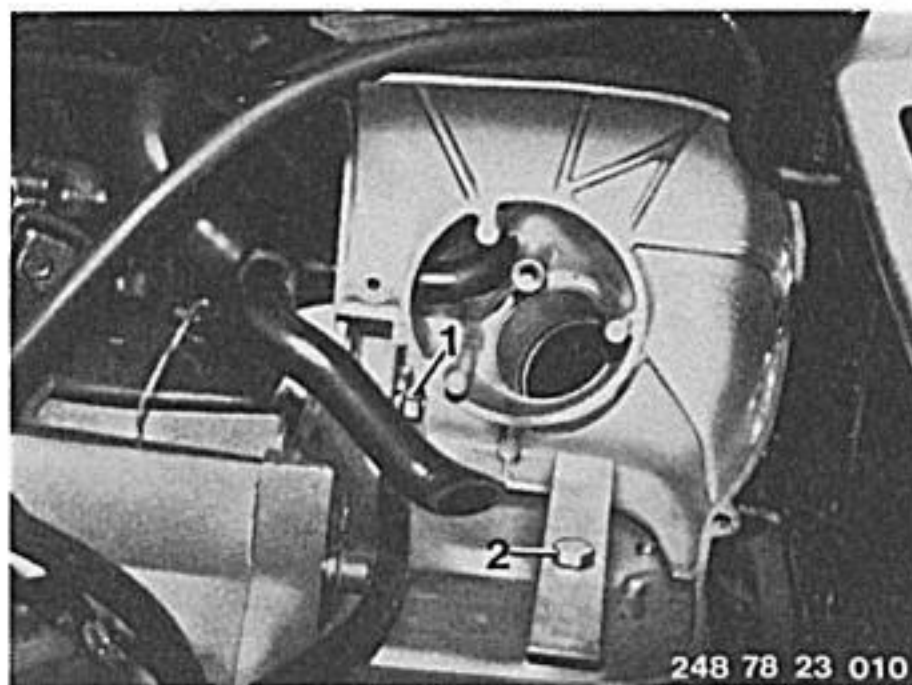
23 00 020 Gearbox — removing and installing

Place the motorcycle on its center stand and prop up additionally behind the center stand.

Remove and install the air cleaner — 13 72 000.

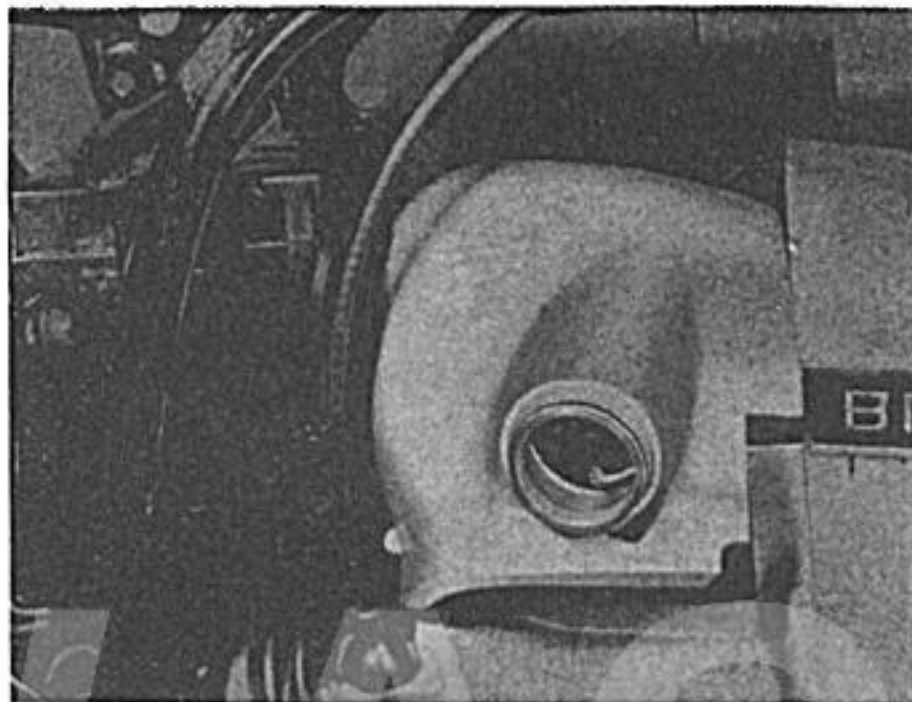
Detach both choke cables at the carburetors and remove the left air-cleaner housing shell with the choke cables.

Remove nut (1) with a straight ring spanner and slacken hex. bolt (2).



Take off the right air-cleaner housing shell, pushing the bleed hose (3) to the rear.

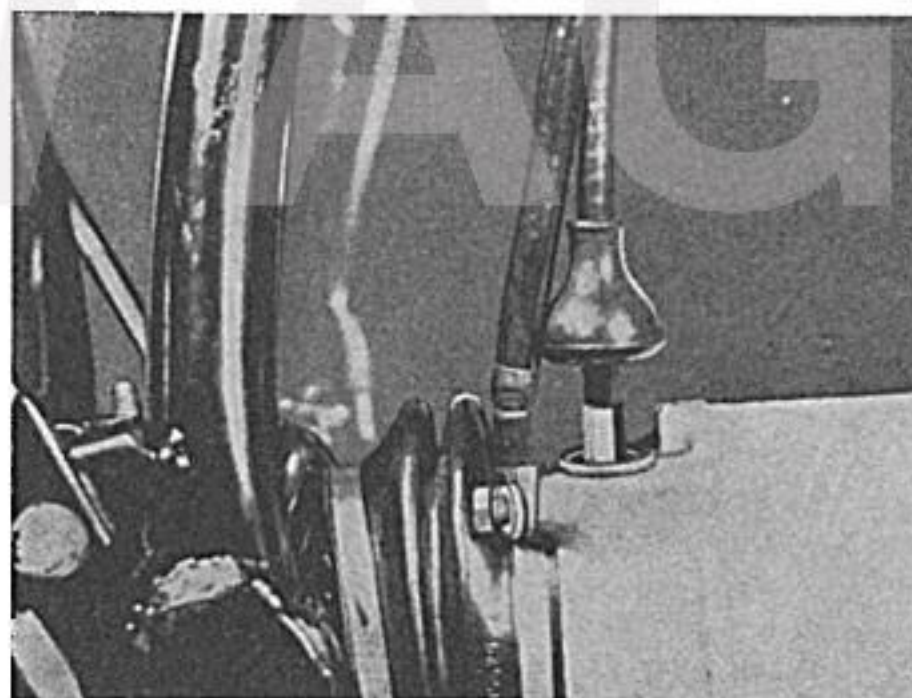
Take off the carburetors.



Push back the rubber cap for the speedometer drive, slacken the retaining screw, detach the battery earth (ground) cable including washer and pull out the speedometer drive shaft.

Remove and install the battery — 61 21 010.

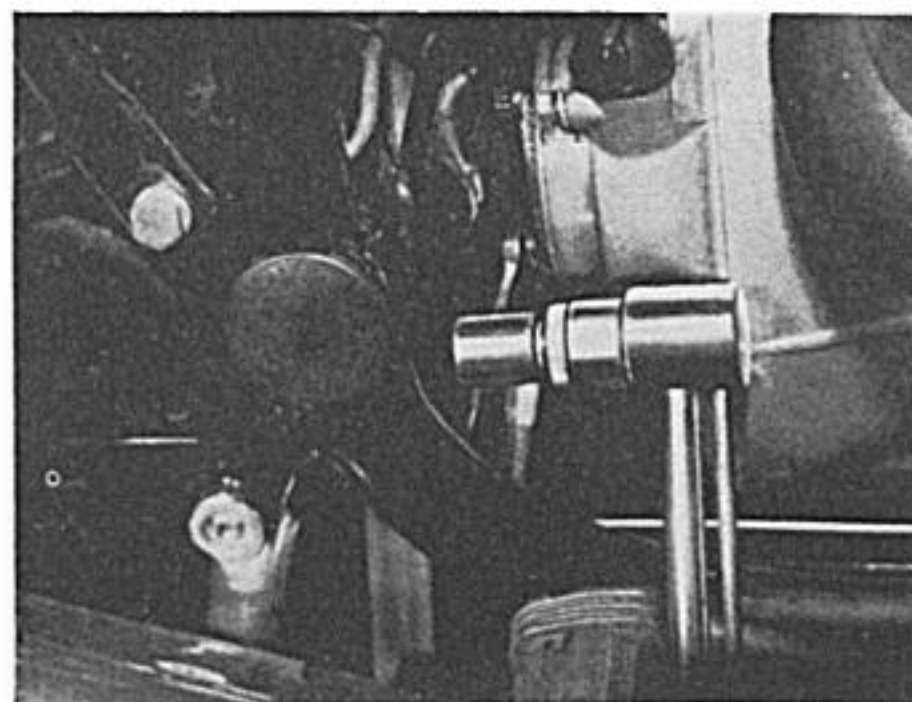
Remove and install the battery carrier — 61 21 100.

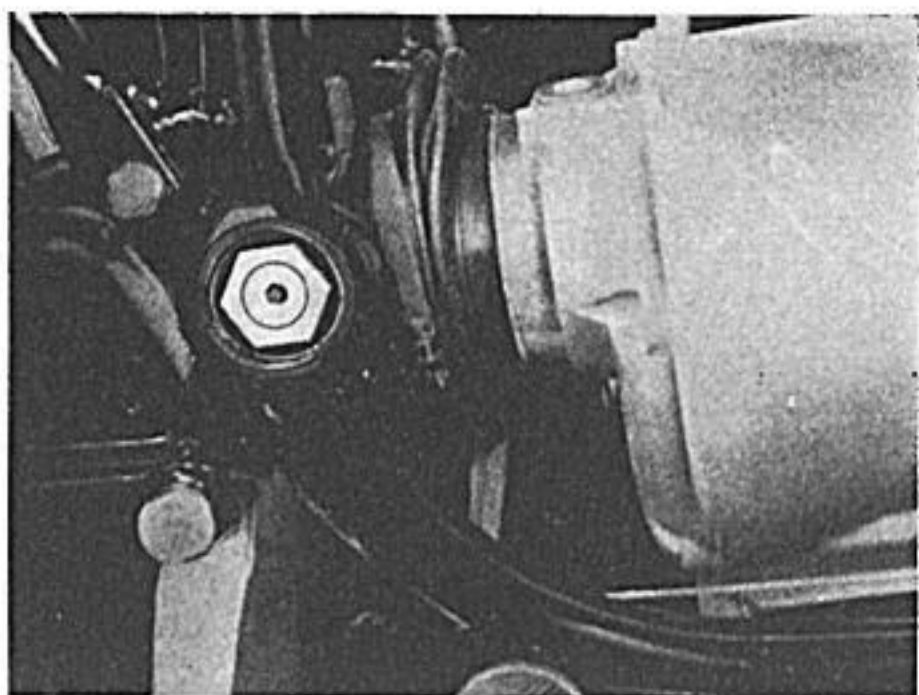


Slacken the strap holding the rubber gaiter at the gearbox and push the rubber gaiter back as far as possible. Provide a vessel to trap escaping oil.

Unscrew the four twelve-sided bolts with a ring spanner and place to one side with their washers. Apply the footbrake to prevent the propeller shaft from turning.

When tightening, use special ring spanner BMW 00 2 560. For tightening torque, see Specifications.

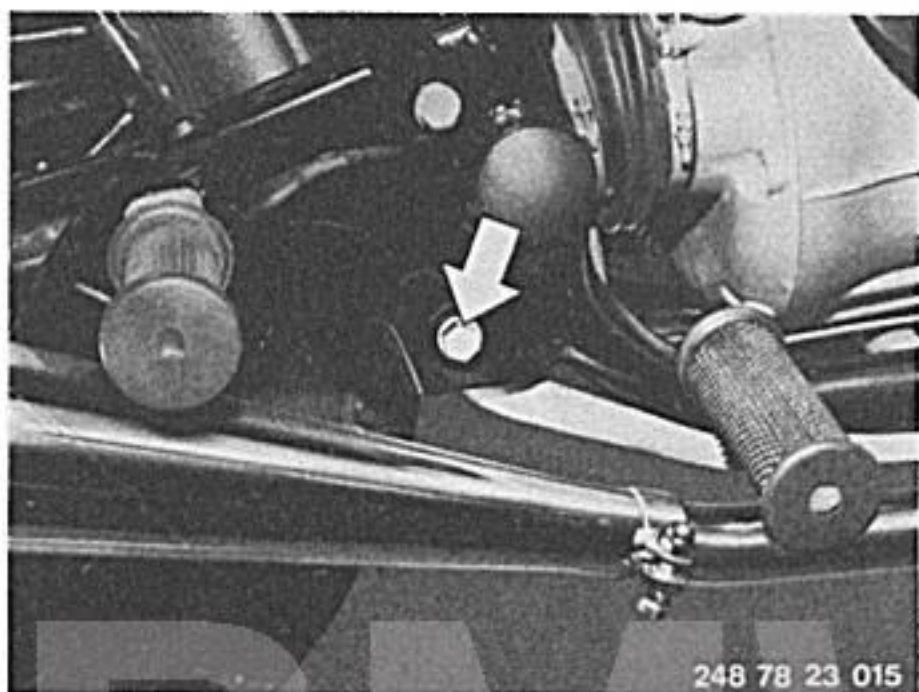




Remove the end cap from the swinging arm bearing. Slacken the bearing journal locknut. Unscrew and remove both bearing journals.

When inserting the swinging arm again make sure that the two pressure sleeves do not project.

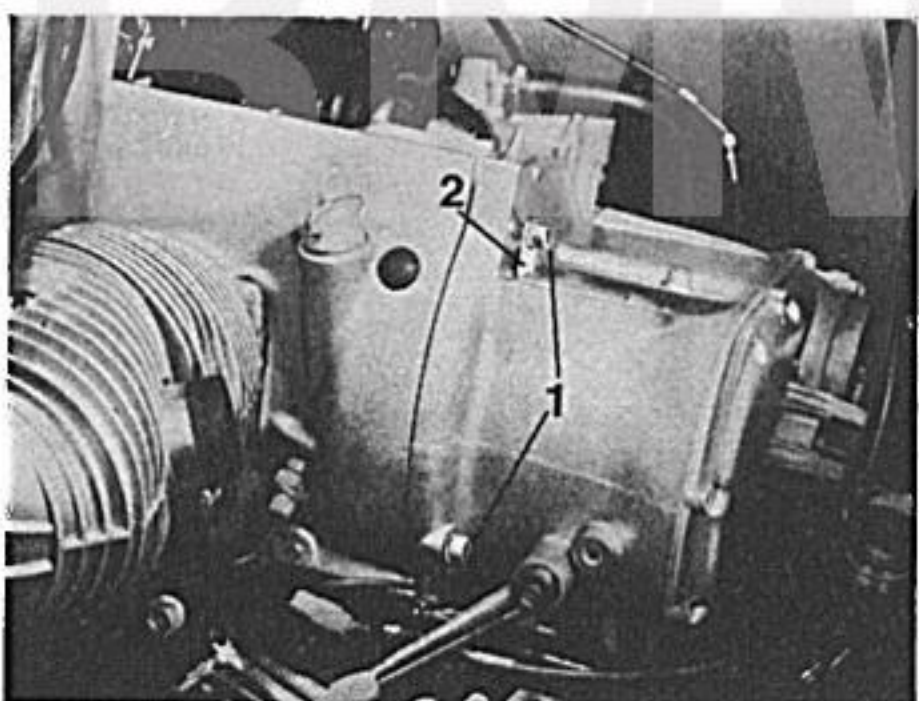
Note correct tightening torque – see Specifications.



Slacken and remove the pivot pin from the brake pedal.

Detach the pullrod at the rear brake.

Pull the brake pedal with pullrod out downwards.

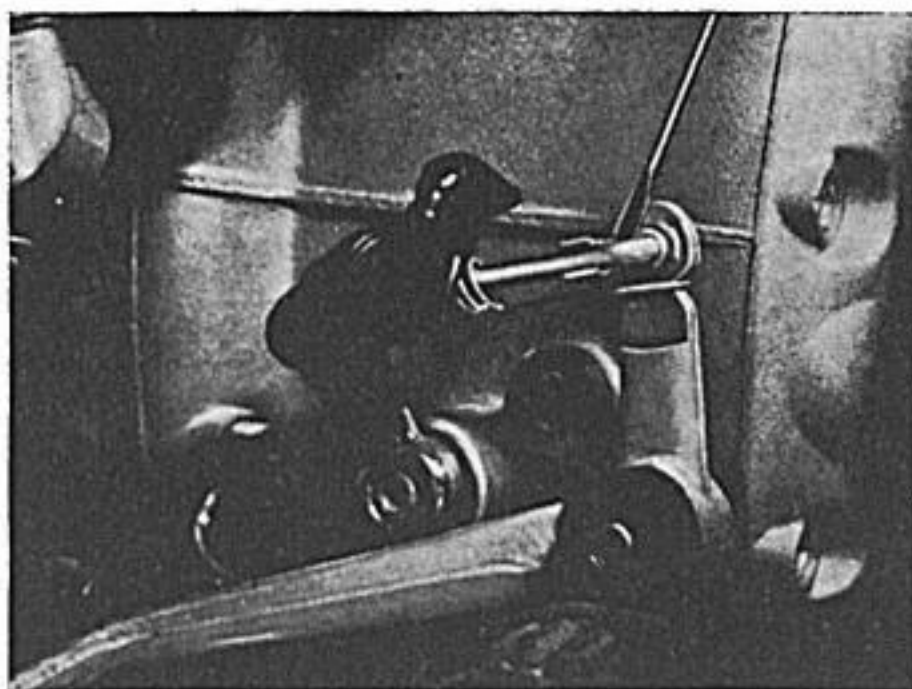


Unscrew and remove the two Allen screws 1 and the hollow internal hexagon screw at the lower right of the gearbox.

When assembling, do not forget plate 2.



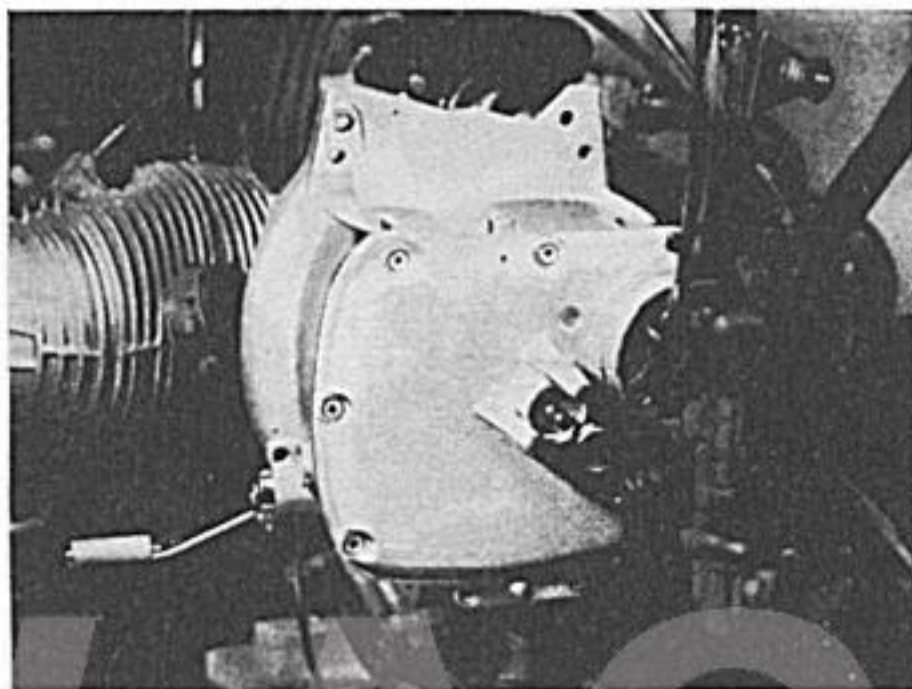
Disconnect the shift mechanism at the pedal. Push back the rubber gaiter. Unhook the spring and press the pullrod out of its keeper with a screwdriver.



With the aid of a block of timber approx. 20 x 20 mm (0.8 x 0.8 in), 400 mm (16 in) long between the tire and the frame, keep the rear section in its rearmost position.

Carefully take out the gearbox, place on the footrest and detach the neutral indicator cable.

Remove the gearbox completely.



BMW AG

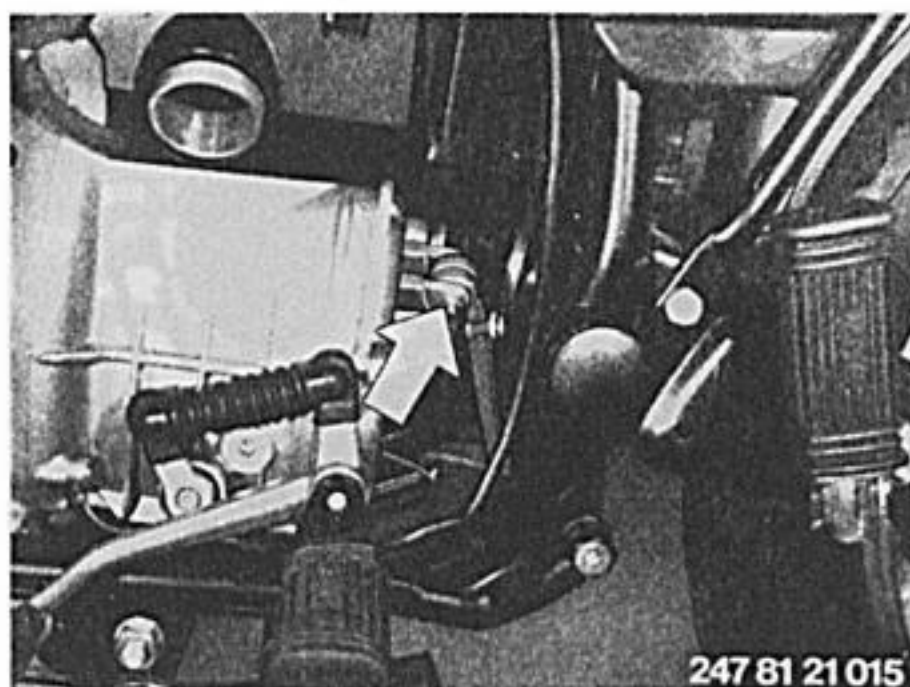
23 00 020 Gearbox – removing and installing (preparatory work for removing engine) (1981 models)

Remove the protective sheet from the lower frame tubes near the pushrod tubes.

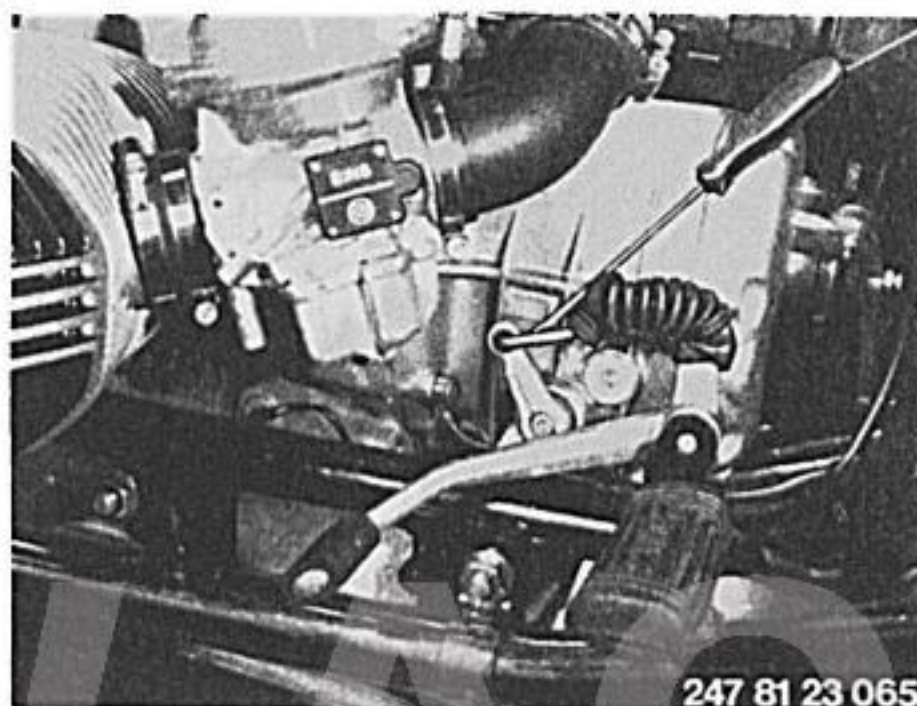
Remove (install) air cleaner element – 13 72 000.

Remove (install) muffler (silencer) – 18 11 321.

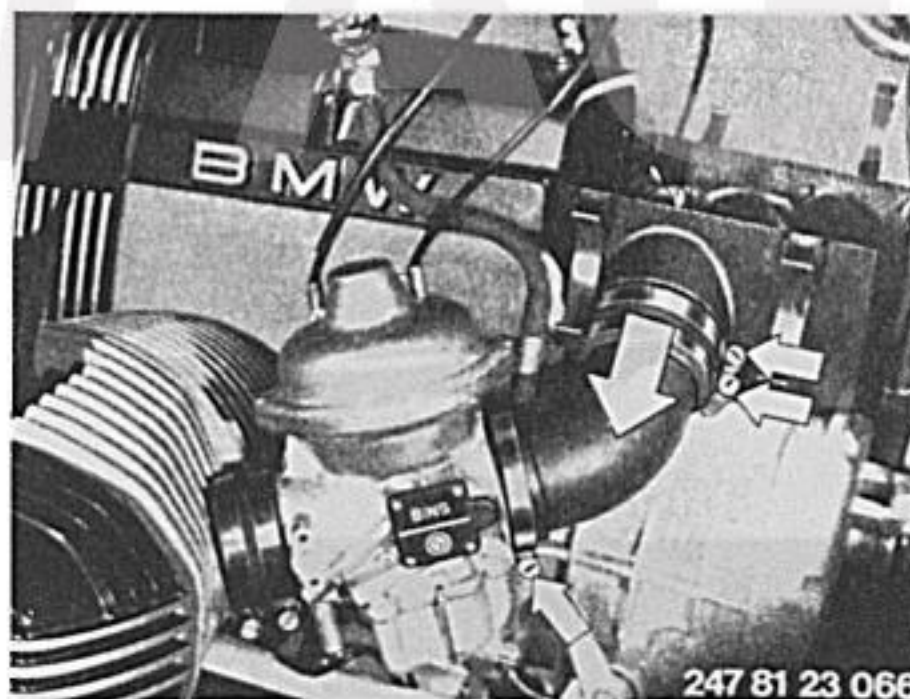
Disconnect clutch operating cable at gearbox end. Unscrew retaining nut (arrow) at bearing mount, pull out pin and take off withdrawal arm.



Pull back the rubber gaiter on the selector linkage and press the pullrod out of its keeper, using a screwdriver.
Detach footrest at frame.

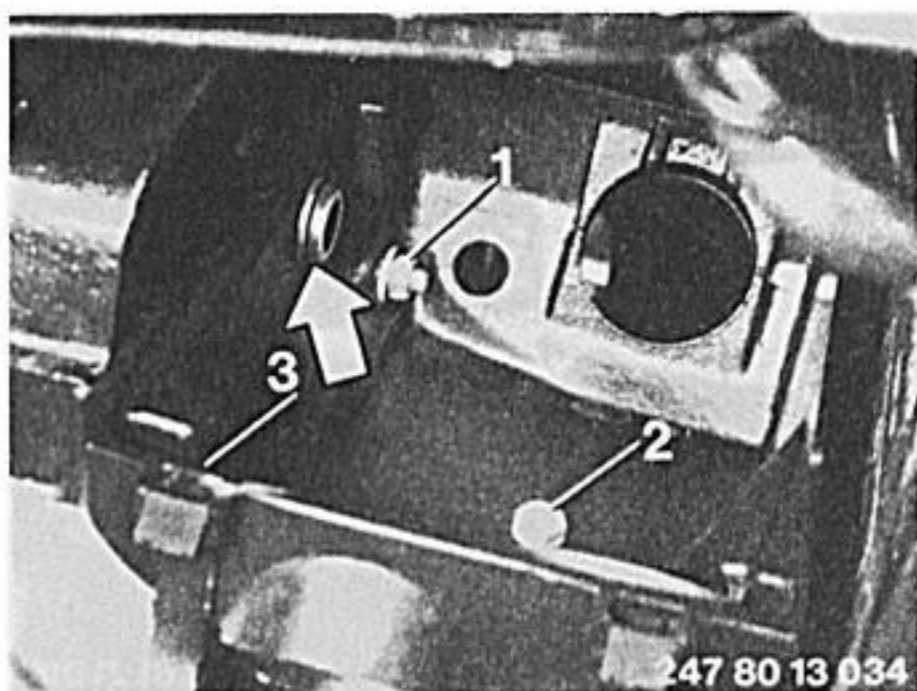


Loosen the hose clips at the left and right air pipes, push back the rubber sleeve and detach the pipes.
Detach the left carburettor from the cylinder head.

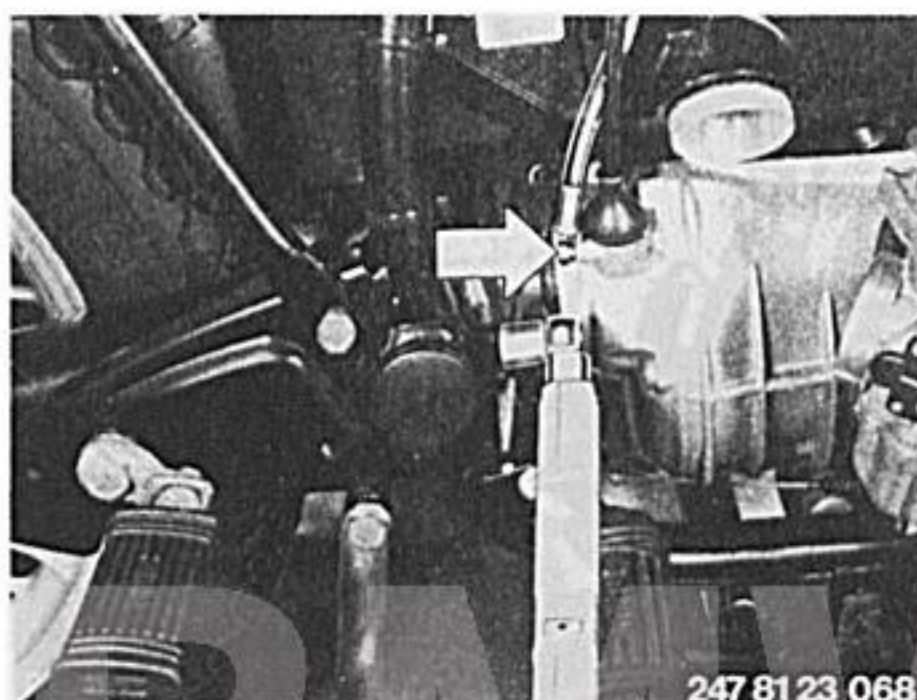


Pull the T-piece for the crankcase breather out of the air cleaner housing in the direction of the arrow.



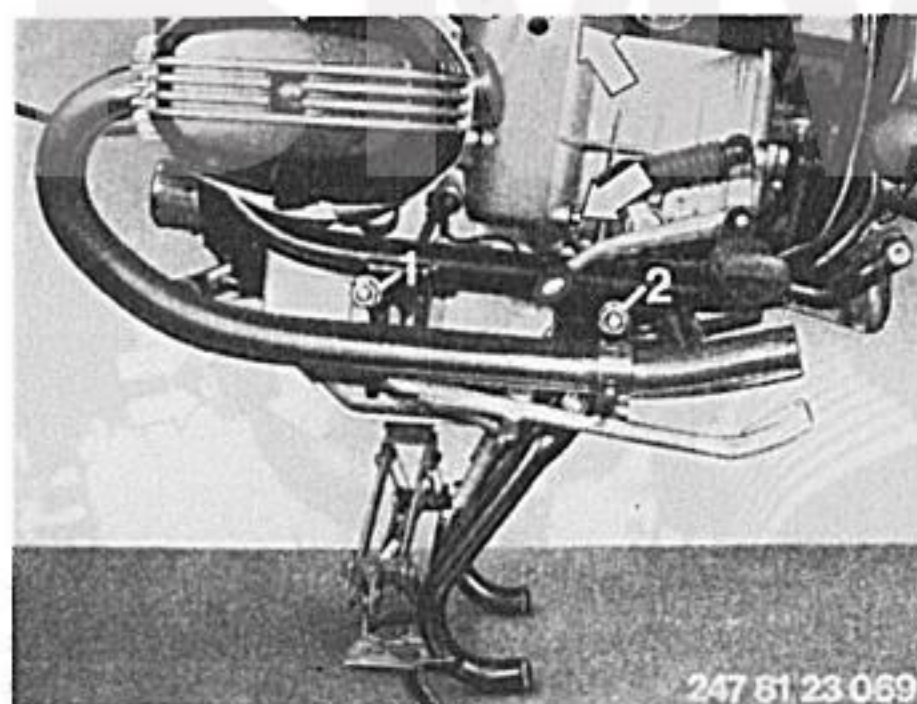


Press the breather pipe (arrow) out of the air cleaner housing. Unscrew hex nut (1) and hex bolts (2, 3) holding the housing.



Detach the rubber sleeve between the swinging fork and the gearbox at the gearbox end. Unscrew the twelve-sided bolts at the universal joint, preventing the rear wheel from turning by applying the brake. When installing, tighten the bolts with the special ring wrench BMW No. 00 2 560 and a torque wrench (for tightening torque, see Specifications).

Unscrew the hex bolt (arrow) and pull out the speedometer drive. This will also release the battery earth (ground) cable.



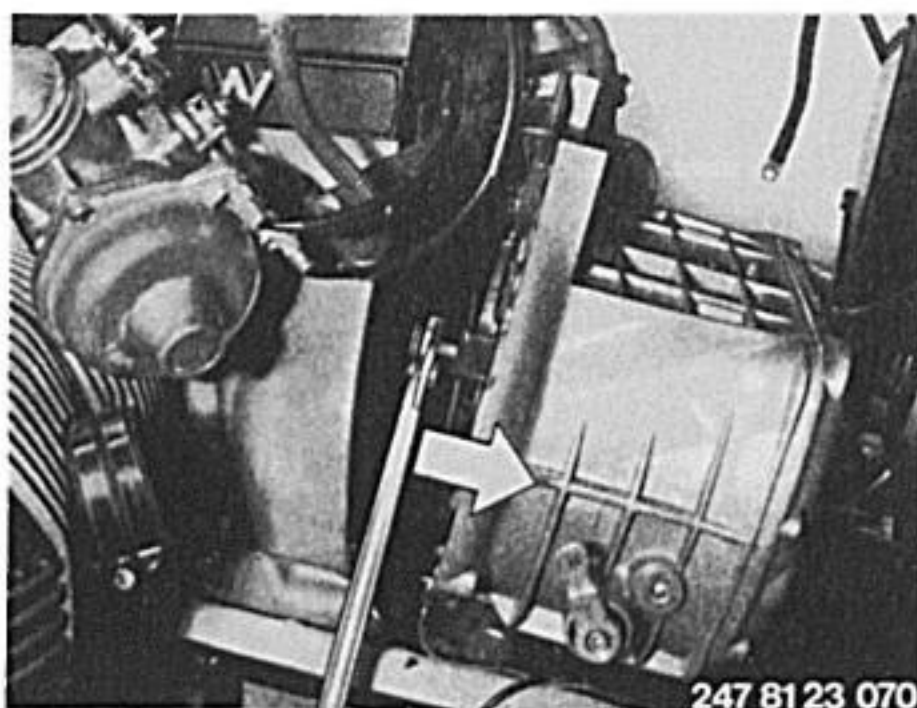
Unscrew the engine mounting pins (1, 2) and the bolts securing the gearbox to the engine (arrow) at left and right.

Support the engine with a scissors-pattern or hydraulic jack so that the mounting pins for the engine can just be pulled out.

Take off the front engine cover and pull the engine forwards as far as the lower frame tubes.

For tightening torques, see Specifications.

Take off the lower section of the air cleaner housing.



Detach the sleeve at the gearbox cover and remove it together with the spring.

Push the gearbox back until the pushrod becomes visible. Using pliers, push the rod back through the gearbox until the gearbox can be lifted out.

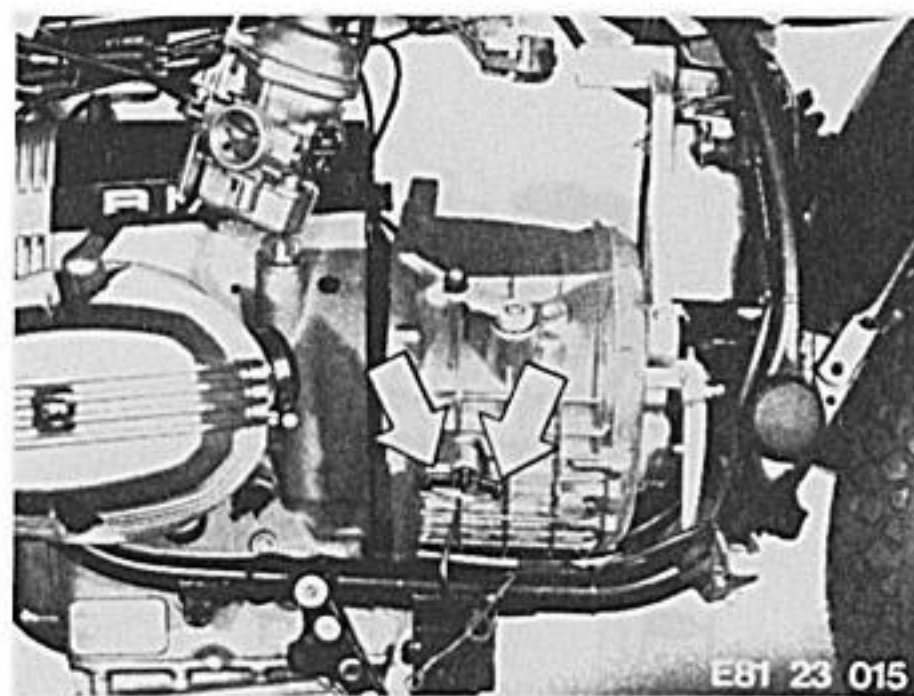
Catch the piston and thrust bearing with a cloth.

Turn the gearbox round on its side and pull the cable connecting shoes off the neutral indicating switch (arrow).

Remove the gearbox to the left and set it down carefully.

Note:

Before installing, lubricate the drive shaft splines with Molykote thin U-n paste.



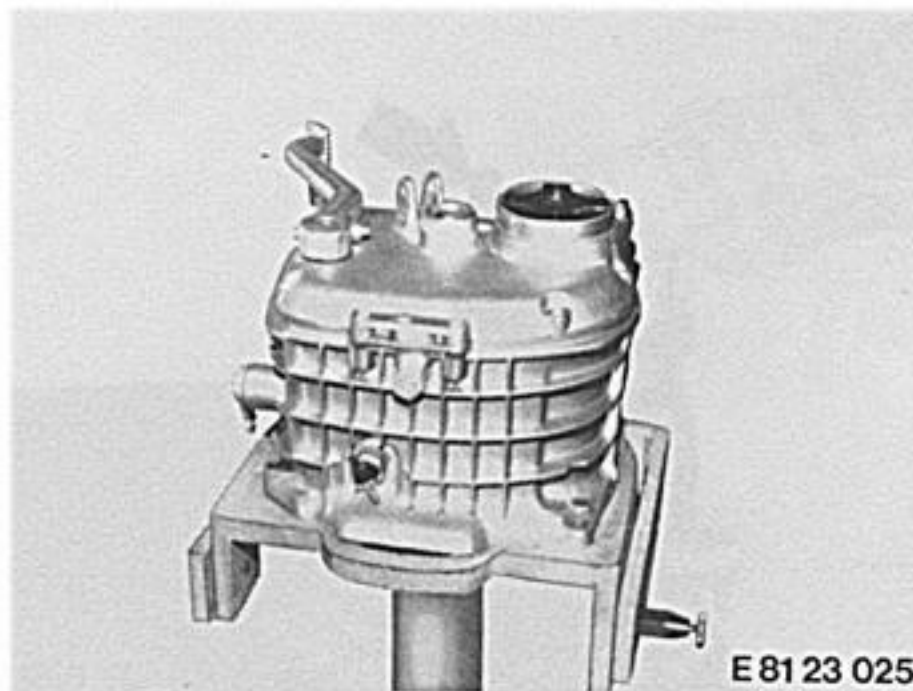
BMW AG

23 11 040 Gearbox cover – detaching and attaching/sealing

Remove (install) gearbox – 23 00 020.

Attach gearbox to assembly stand and secure with two bolts at opposite corners.

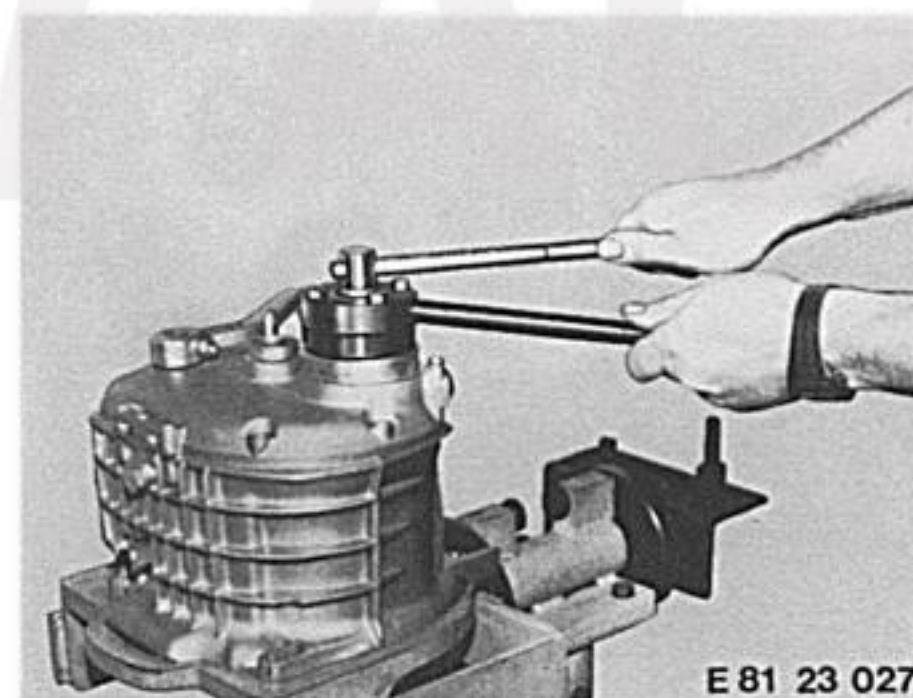
Press the clutch withdrawal arm out of the gearbox.



Pull out the guide sleeve for the speedometer drive worm wheel after removing the retaining screw, and take out the worm wheel.



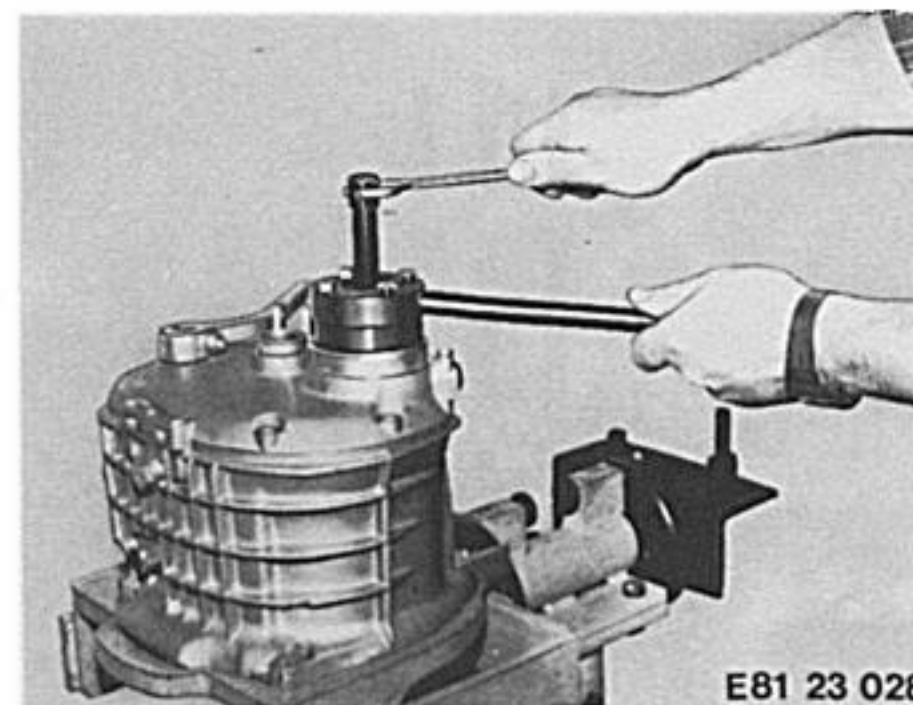
Secure counter-holder BMW No. 23 1 700 without the forcing-off spindle to the output shaft drive flange, using four bolts. Slacken off the retaining nut.

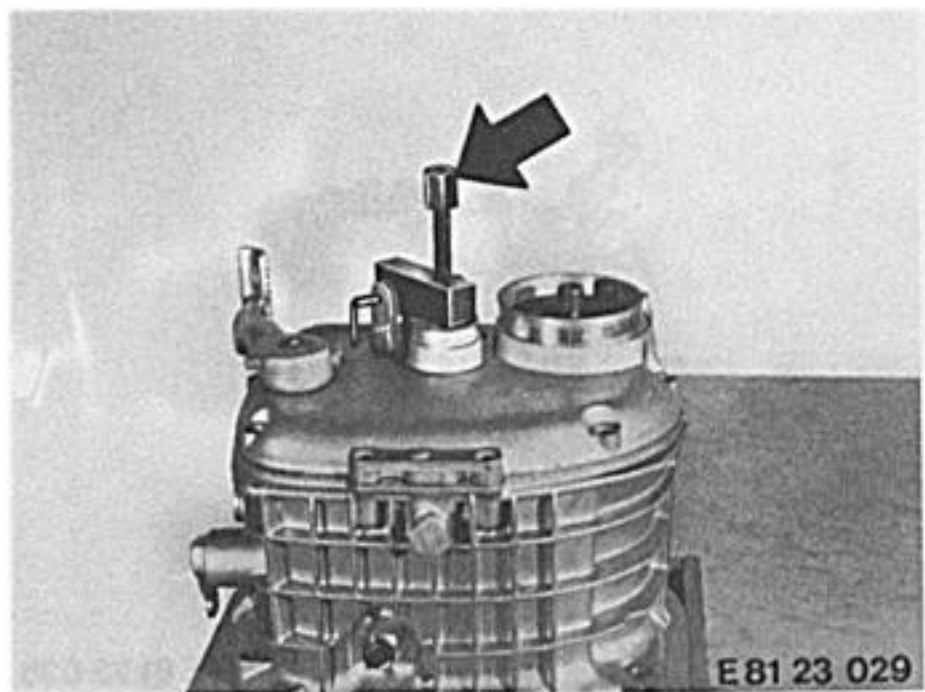


After screwing on counter-holder BMW No. 23 1 700 with its forcing-off spindle, press off the drive flange. If necessary, free the taper seat on the spindle with a light blow.

When installing: When the drive flange is offered up, clean the taper seats with grease-free cleanser and install dry. Oil the retaining nut with a high-viscosity oil.

See Specifications for tightening torque.





Unscrew the bolts holding the gearbox cover, heat the cover to app. 100° C (212° F) and separate it from the housing by a few sharp blows from a plastic-faced hammer. See Specifications for tightening torques.



Remove the shims controlling shaft endplay from the cover. Drive the sealing ring out of the cover with an arbor. Using special tool BMW No. 23 1 750, drive in the new sealing ring.

When installing: The open side of the sealing ring must face the output flange.

23 22 001 Complete gear cluster – removing and installing/stripping down

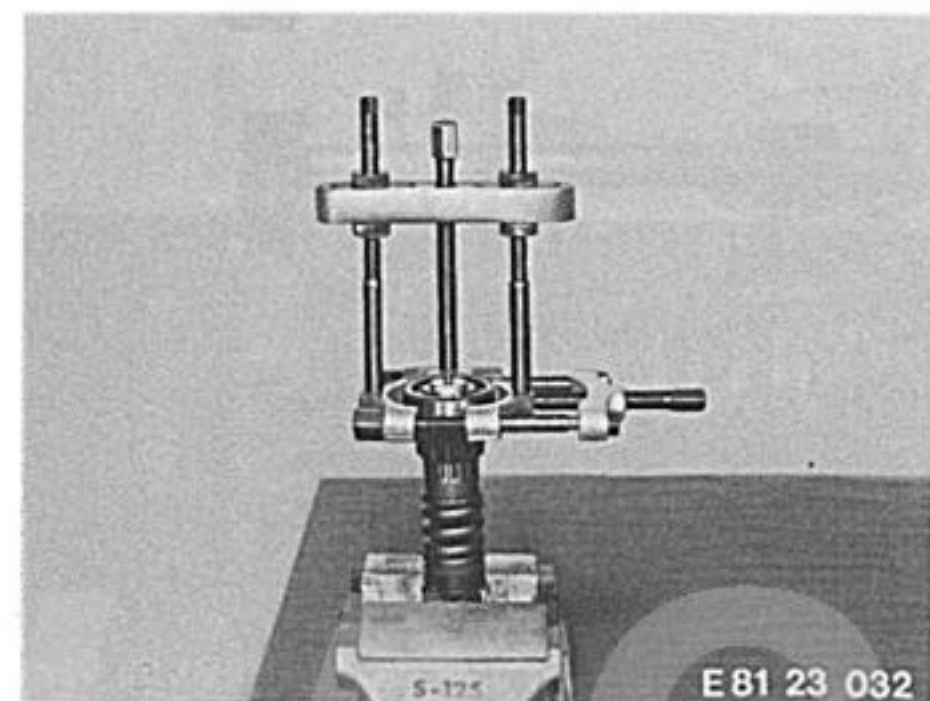
Remove (install) gearbox – 23 00 020.

Detach (attach/seal) gearbox cover – 23 11 040.

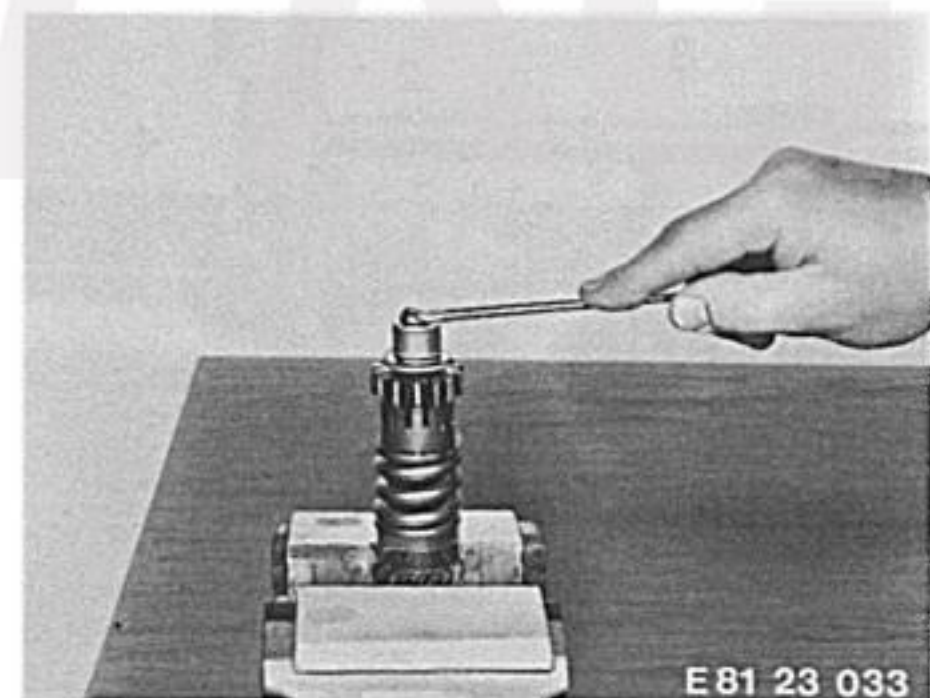
Strike the front end of the input shaft lightly with a plastic-faced hammer to dislodge the shaft, and pull it out of the housing.



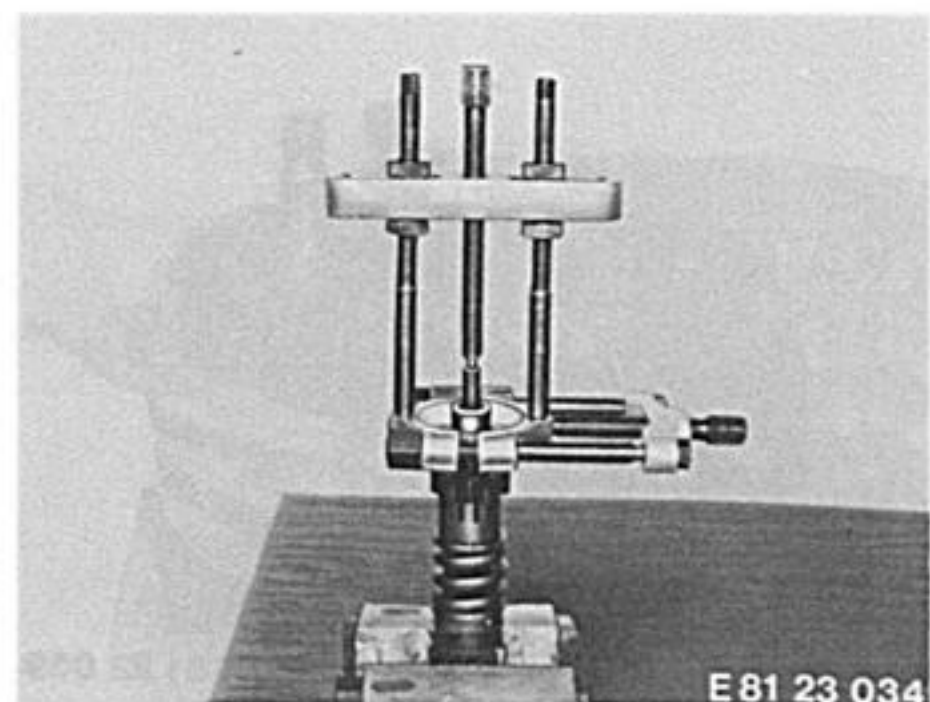
Using universal puller BMW No. 00 7 500, pull off the input shaft ball bearing with cover disc but without bearing bushing (use pressure head for crankshaft).

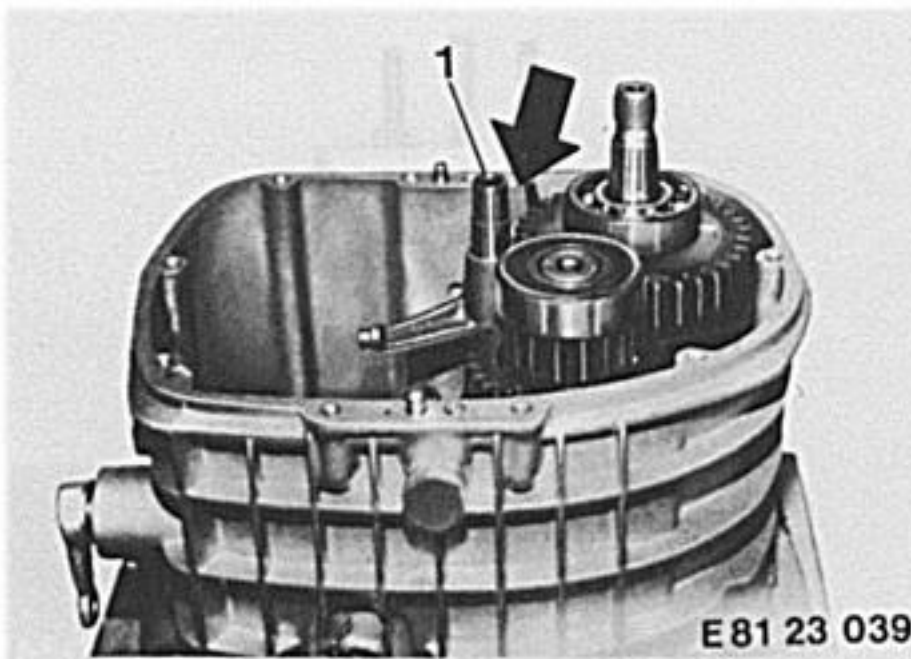
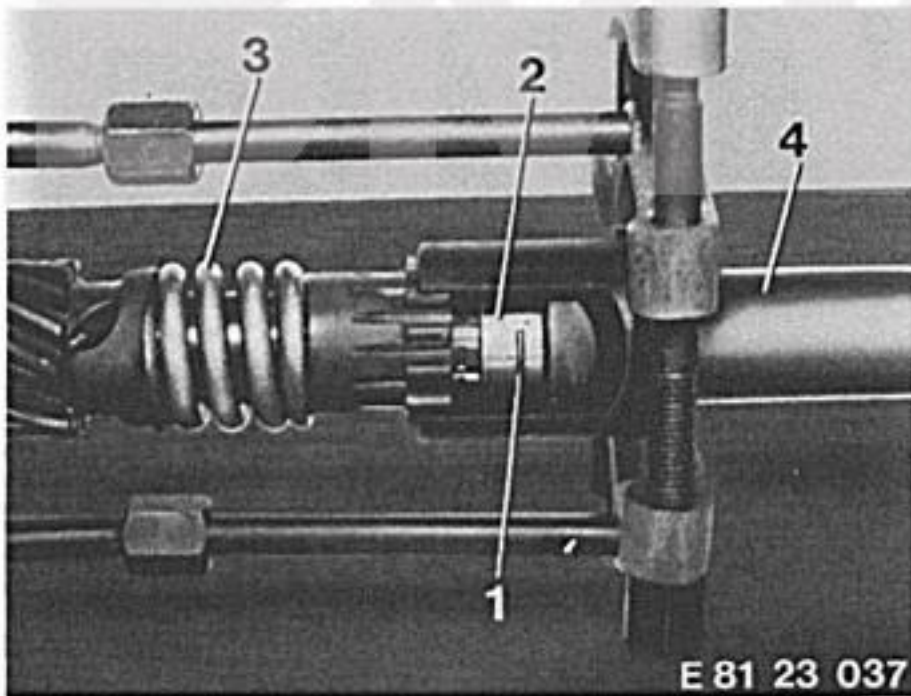
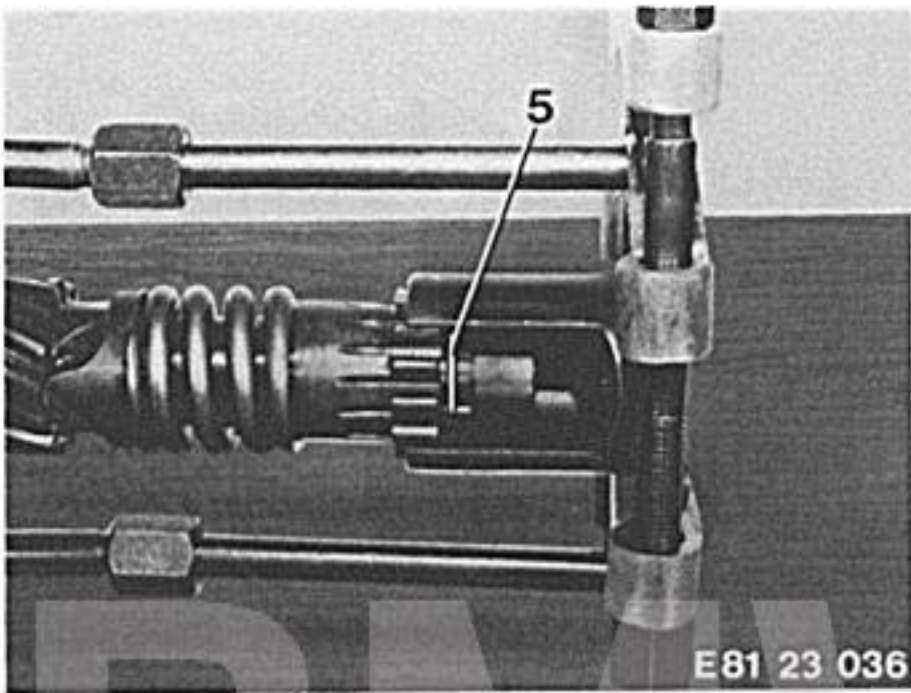
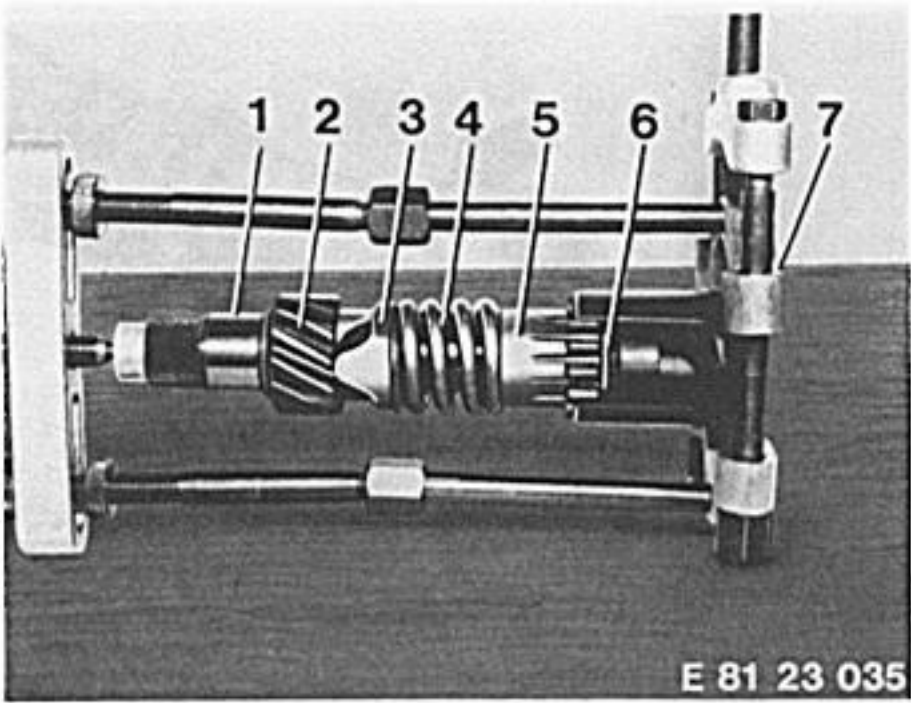


Lever out the small sealing ring with a screwdriver.



Using universal puller BMW No. 00 7 500 and the small pressure head, pull off the bearing bushing.





- 1 Input shaft
- 2 Spur gear
- 3 Thrust piece
- 4 Coil spring
- 5 Reaction piece
- 6 Snap ring
- 7 Universal puller, BMW No. 00 7 500

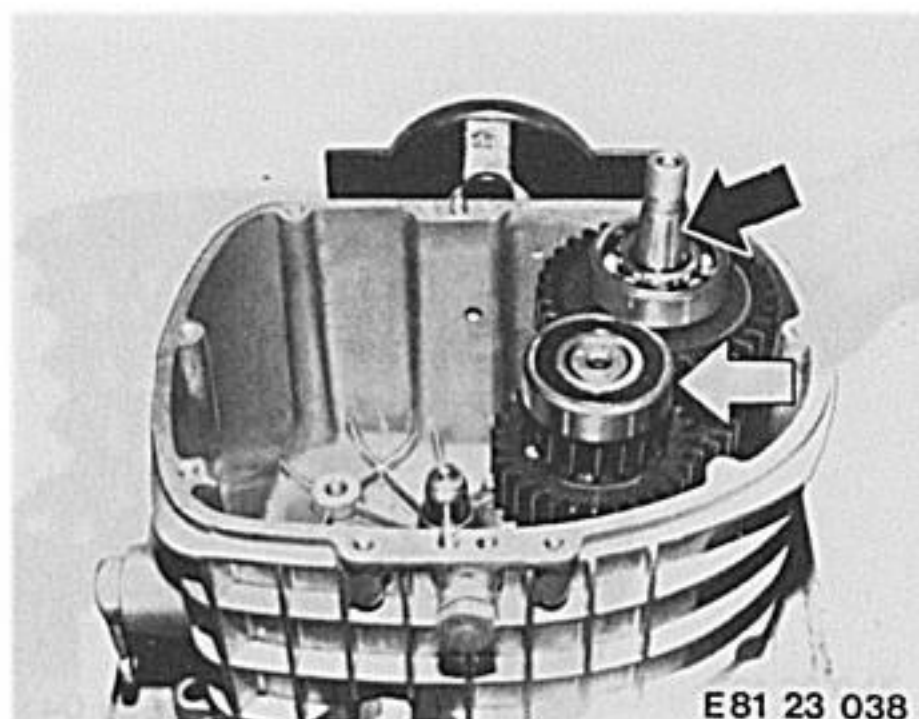
Compress the coil spring with the universal puller in conjunction with assembly bushing 23 2 655. Press out the circlip (5) with a drift or screwdriver, and release the puller.

When assembling the input shaft, compress coil spring (3) with assembly bushing 23 2 655 and universal puller 00 7 500. Place circlip (1) on guide bushing (2) of special tool 23 2 650, and push on as far as the groove with sleeve (4).

Remove (install) bearing mount for selector discs – 23 31 210. Loosen and remove oil baffle plate (arrow). Pull out shaft for selector forks for 1st, 2nd and 5th gears (1). Remove the selector forks. **When installing:** the short guide ends of the selector forks are placed together.

Heat the gearbox housing to 100° C (212° F) at the bearing seats for the output shaft and countershaft, and take out both shafts with the 3rd/4th gear selector fork (arrows).

When installing: the long guide end of the selector fork is towards the bottom of the housing.



E81 23 038

Renew the input shaft radial seal.

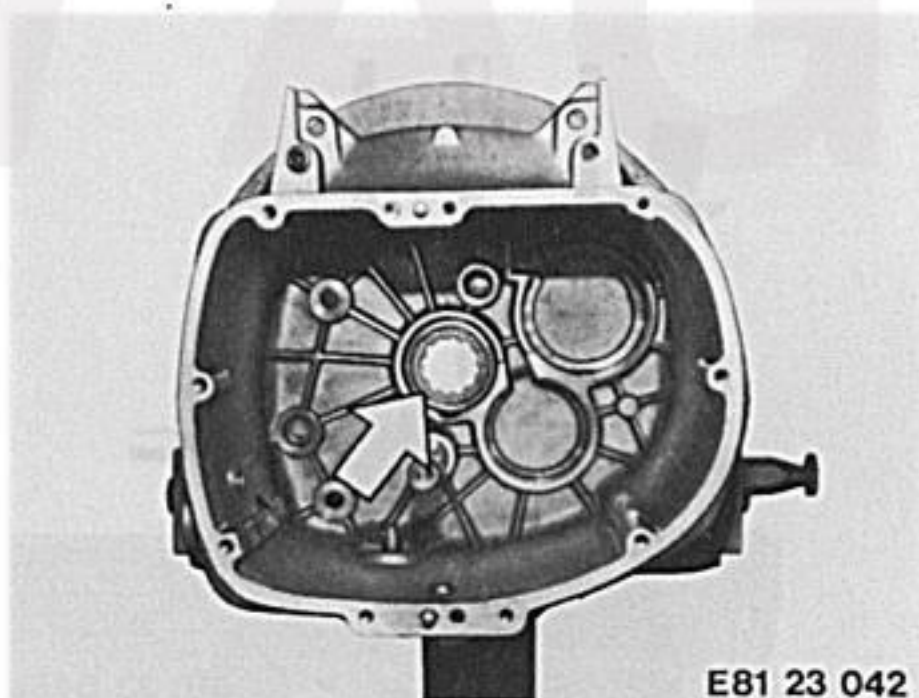
Lever out the existing sealing ring with a screwdriver. Drive the new sealing ring into position with drift BMW No. 21 1 650 and handle BMW 00 5 500.



E81 23 040

Renew the input shaft roller bearing.

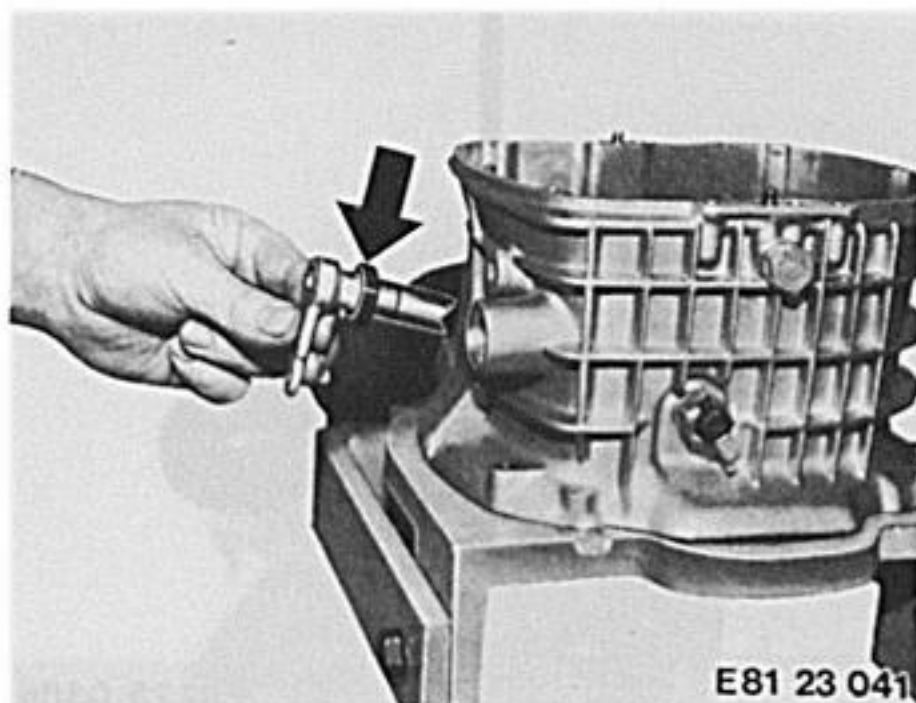
Heat the gearbox housing to app. 100° C (212° F) and pull the bearing (arrow) out with a hook. Insert the new bearing while the housing is still warm.



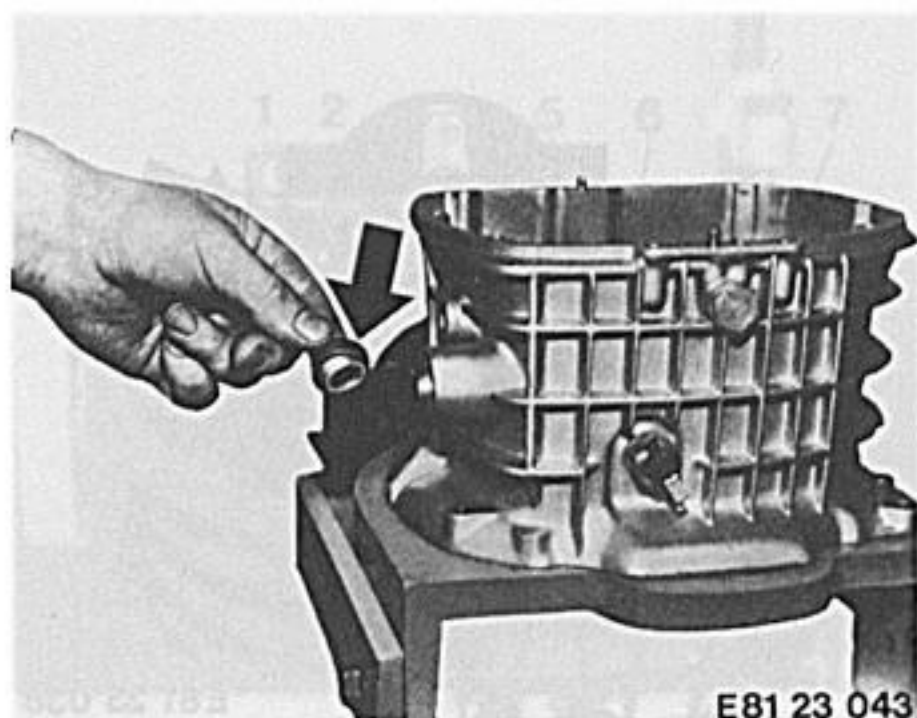
E81 23 042

Renew the radial seal for the shift lever.

Lever the sealing ring out with a screwdriver. Push the new sealing ring (arrow) on to the shift lever and press into the housing by striking lightly.



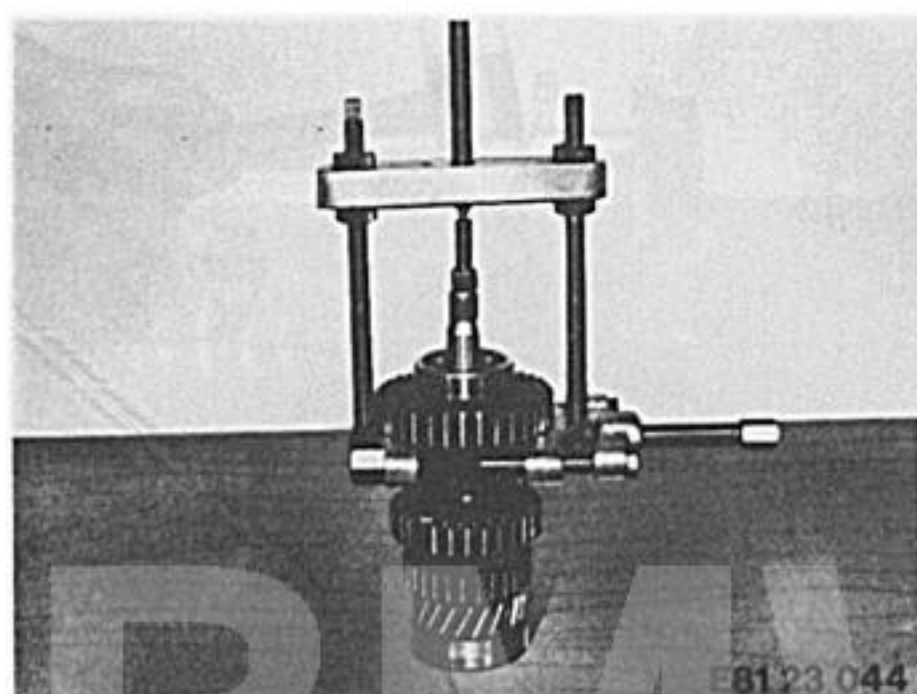
E81 23 041



Renew the pivot bearing for the shift lever.

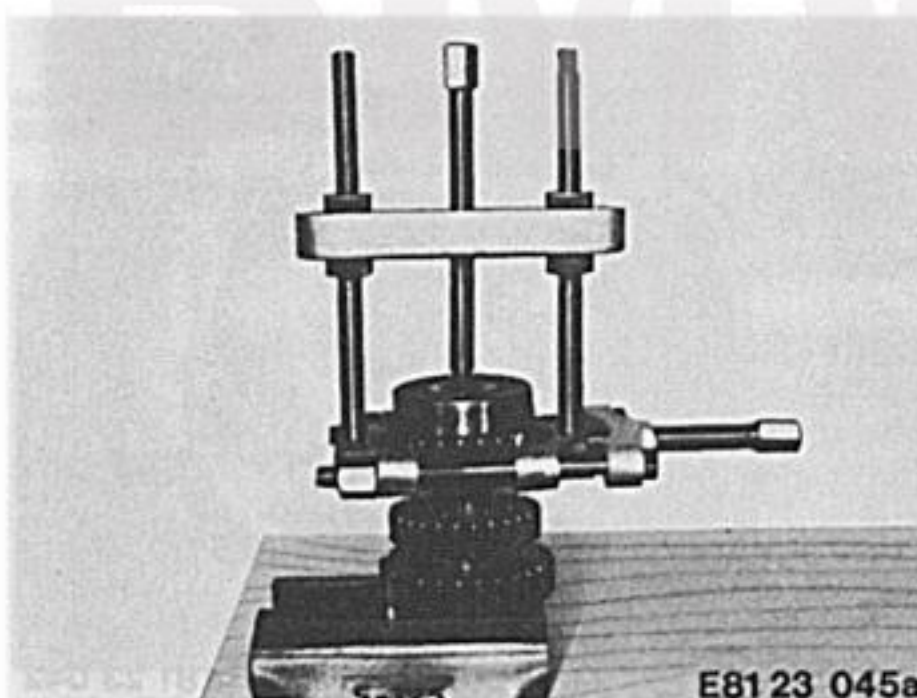
Remove the radial sealing ring.

Pull the bearing (arrow) out with the finger or with a hook. Oil the new bearing lightly and press it in.



Stripping down the output shaft:

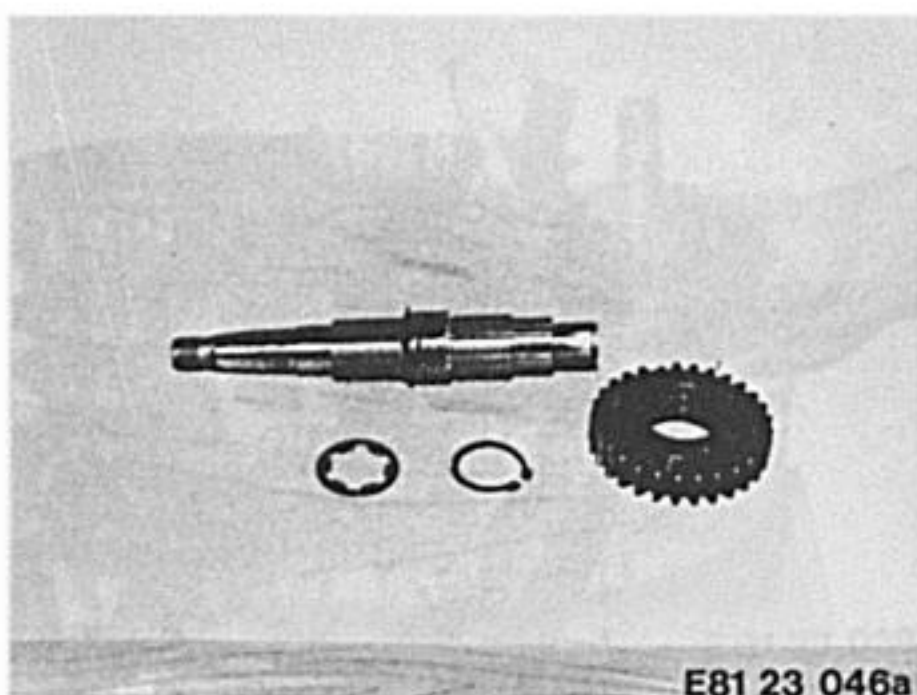
Using universal puller BMW No. 00 7 500, pull off the 1st gear wheel with bearing. Take off the 4th gear wheel.



Clamp the output shaft into the vice with soft jaws.

Remove the circlip from the bearing.

Using universal puller BMW No. 00 7 500, pull off the 5th gear wheel with bearing. Take off the 3rd gear wheel.

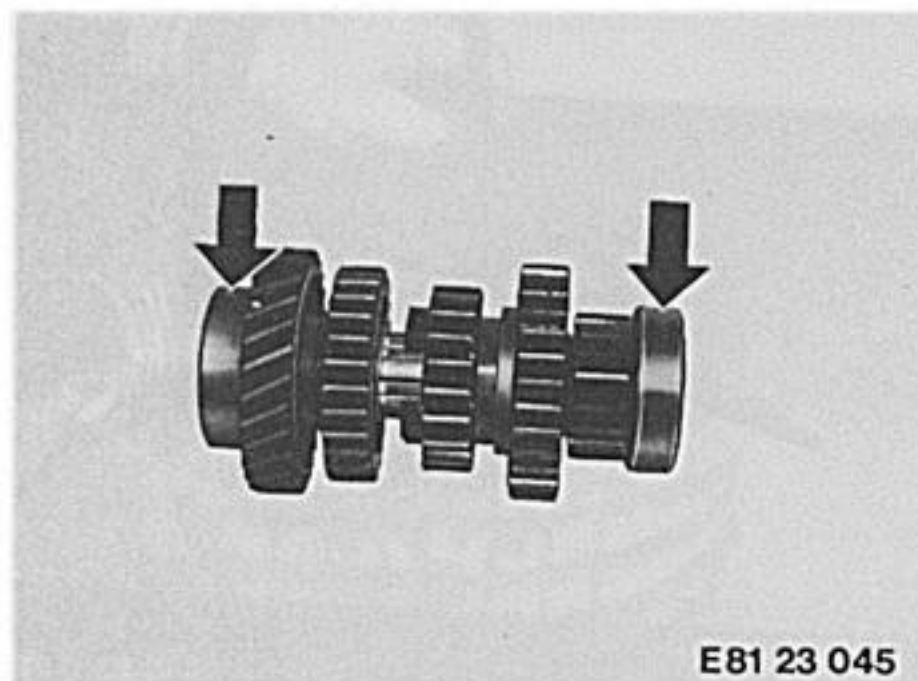


Remove the Seeger circlip from the 2nd gear wheel.

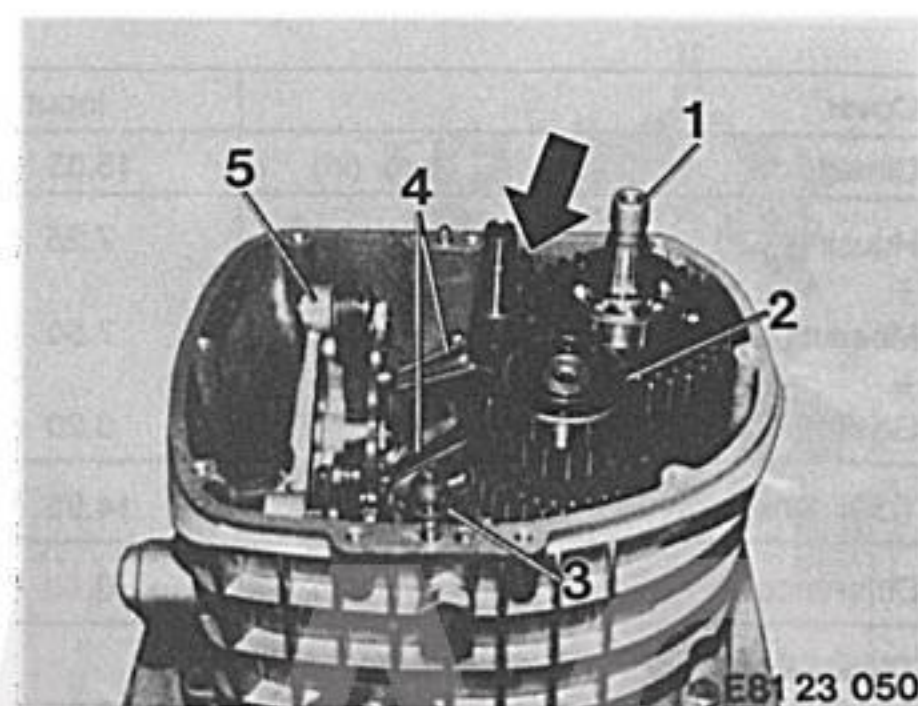
Pull the gear wheel with washer off the shaft.

Note: if the bushing pressed on to the shaft is defective, the output shaft must be renewed.

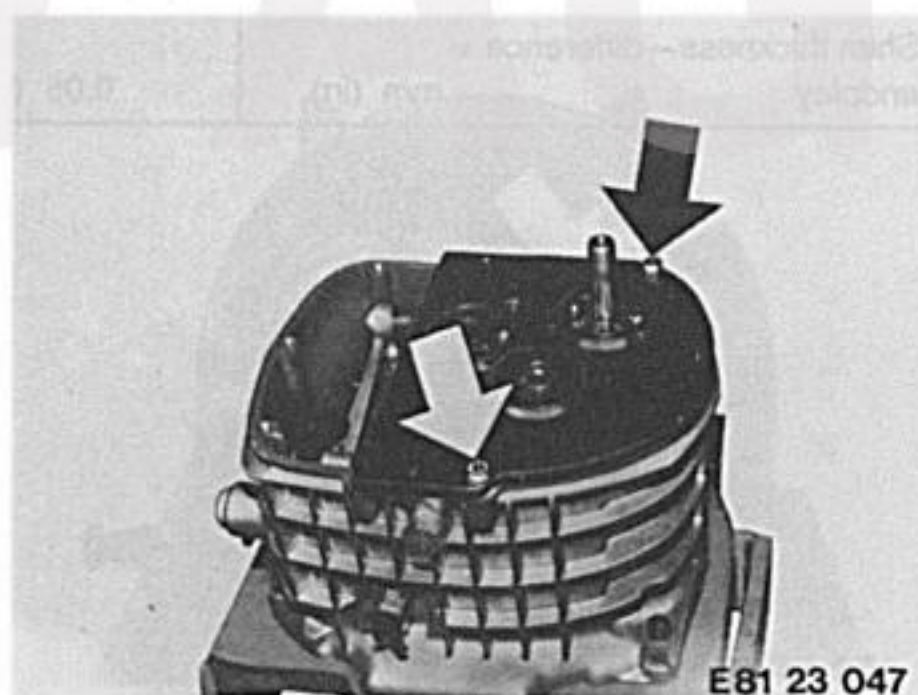
If defective, the countershaft must be renewed as a complete unit. Pull off the bearings (arrows) with Kukko puller BMW No. 00 7 500.



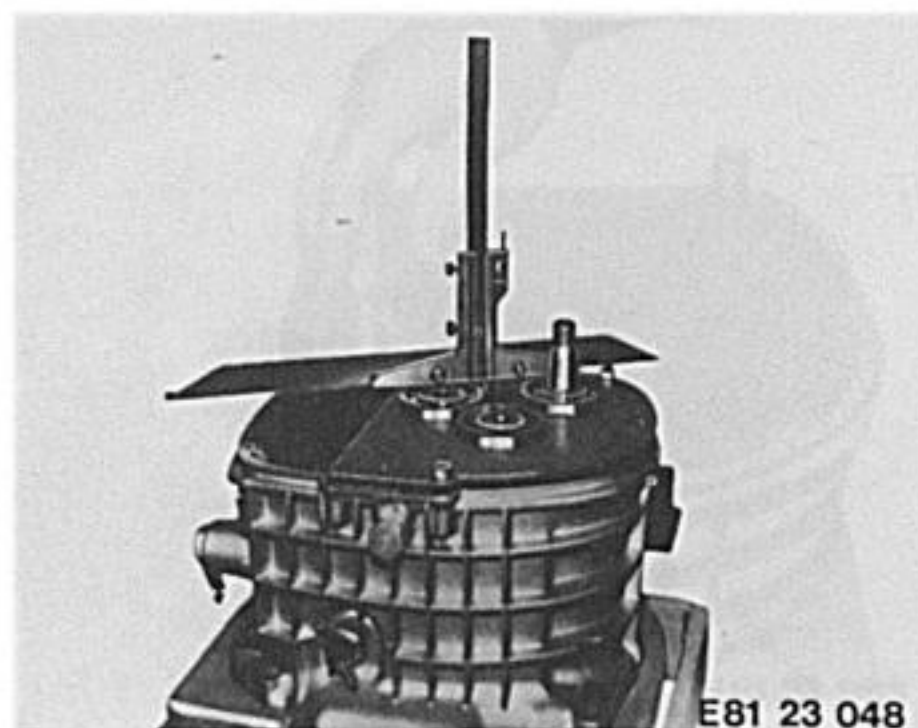
Warm the gearbox casing to app. 80–100° C (176–212° F). Before the output shaft is installed, place the oil trap plate in the ball bearing bore of the housing (arrow). Insert the **output shaft and countershaft** (1,2) together with the 3rd/4th gear selector fork (3) into the housing. Make sure that the shift fork does not jam. Next, insert the 1st/2nd/5th gear selector forks (4) with the small ends together, and secure with the shaft. Install shift block (5) in the neutral position, and insert the input shaft.

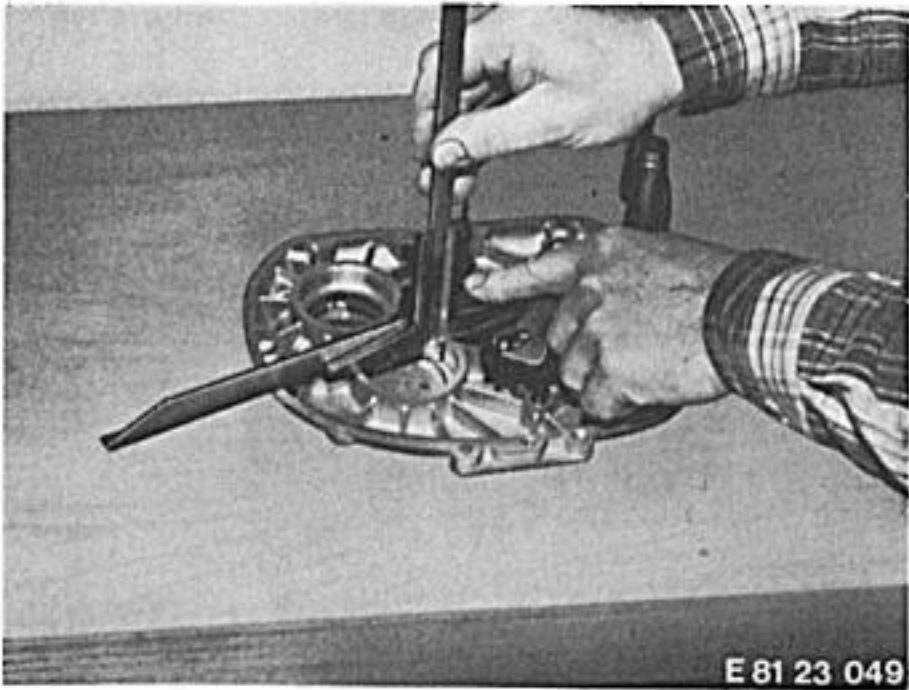


To determine shaft location in the housing, attach measuring plate BMW No. 23 3 650 with two bolts (arrows) to hold it down firmly.



To adjust endplay at the three gearbox shafts, use depth gauge BMW No. 00 2 550 to determine the distance between the ball bearing outer race and the measuring plate. The measured distance plus the thickness of the material and the paper gasket (0.2 mm [0.008 in]) equals the actual distance.





Measure the distance from the joint face on the cover to the base of the ball bearing seat in the cover.

It is advisable to draw up a table of measurements as in the example below.

For permissible endplay, see Specifications.

Cover		Input shaft	Countershaft	Output shaft
Dimension	mm (in)	15.35 (0.604)	15.75 (0.620)	15.35 (0.604)
Housing	mm (in)	7.25 (0.285)	7.30 (0.287)	7.30 (0.287)
+ Measuring plate	mm (in)	7.50 (0.295)	7.50 (0.295)	7.50 (0.295)
+ Gasket	mm (in)	0.20 (0.008)	0.20 (0.008)	0.20 (0.008)
Total dimension	mm (in)	14.95 (0.589)	15.00 (0.591)	15.00 (0.591)
Difference	mm (in)	0.40 (0.016)	0.75 (0.030)	0.35 (0.014)
Thickness of spacing shim including oil trap plate	mm (in)	0.35 (0.014)	0.70 (0.027)	0.30 (0.012)
Shim thickness – difference = endplay	mm (in)	0.05 (0.002)	0.05 (0.002)	0.05 (0.002)

23 31 001 Selector forks – removing and installing

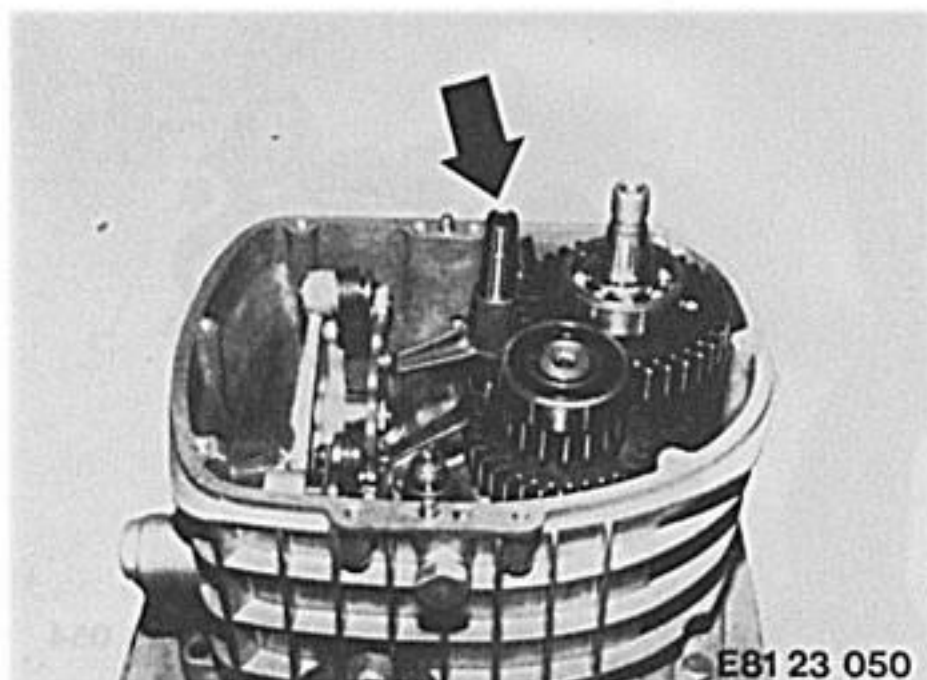
Remove (install) gearbox – 23 00 020.

Detach (attach/seal) gearbox cover – 23 11 040.

Remove (install) bearing mount for selector discs – 23 31 210.

While the housing is still warm, pull the shaft for the 1st/2nd/5th gear selector forks out and place aside together with the selector forks.

To renew the 3rd/4th gear selector forks, the gear cluster must be removed – 23 22 001.

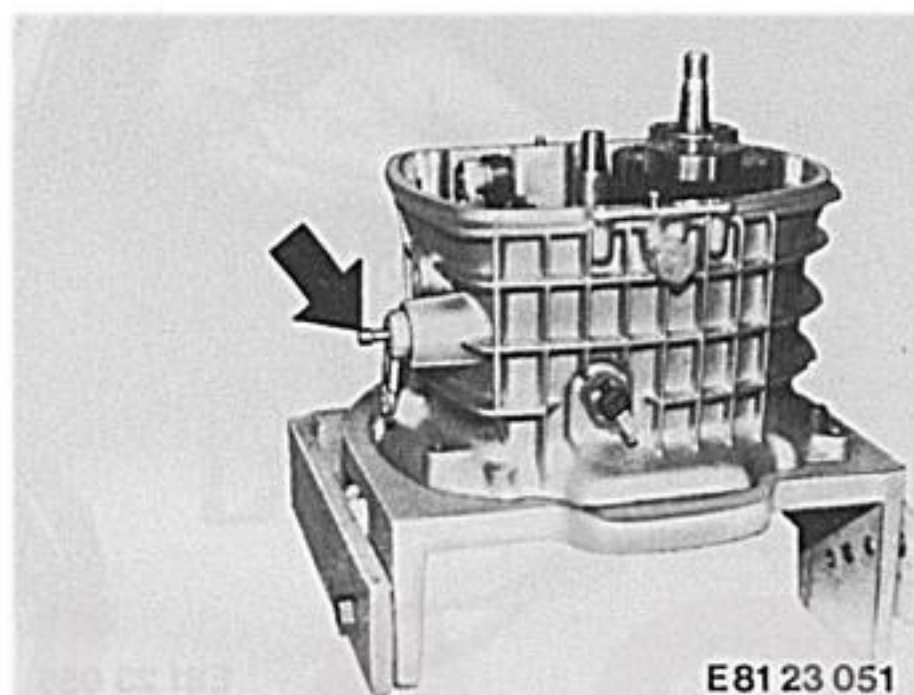


23 31 210 Bearing mount for selector discs – removing and installing

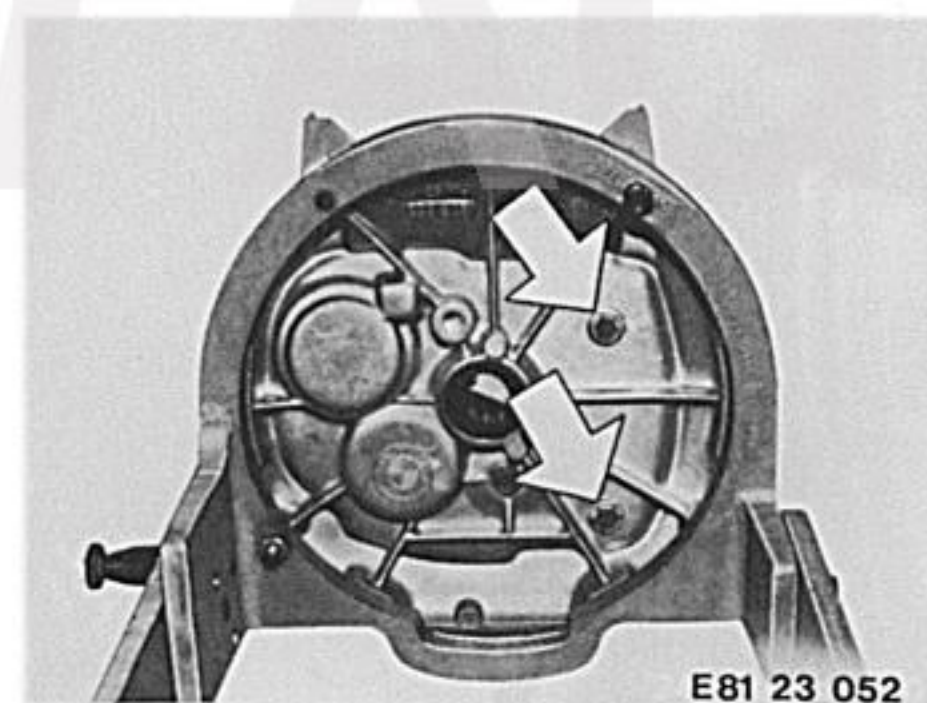
Remove (install) gearbox – 23 00 020.

Detach (attach/seal) the gearbox cover – 2 11 040.

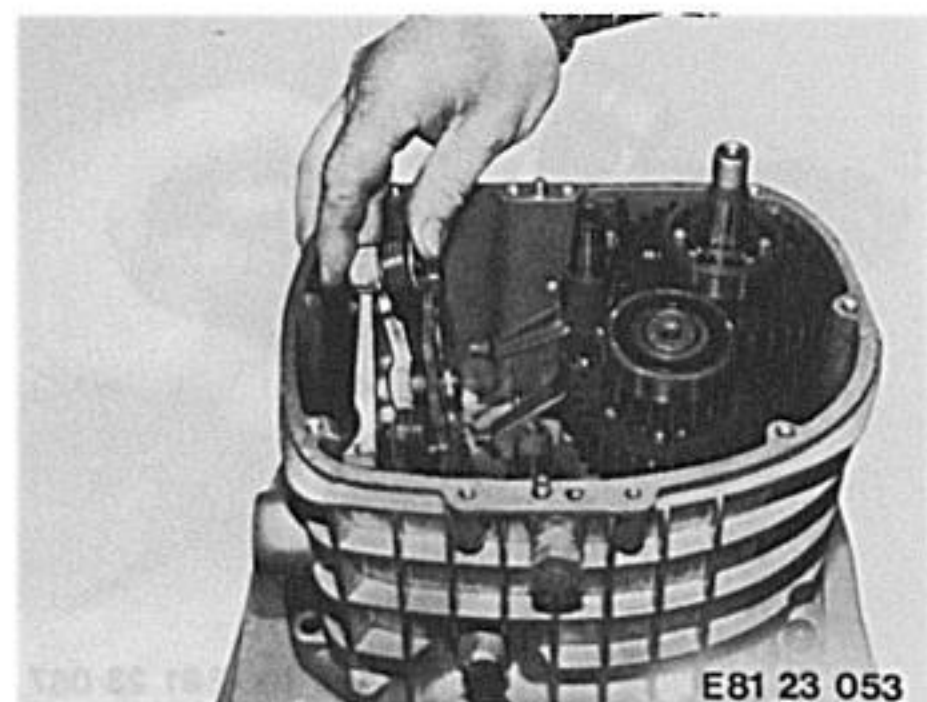
Loosen Allen screw (arrow) and pull out the shift lever.

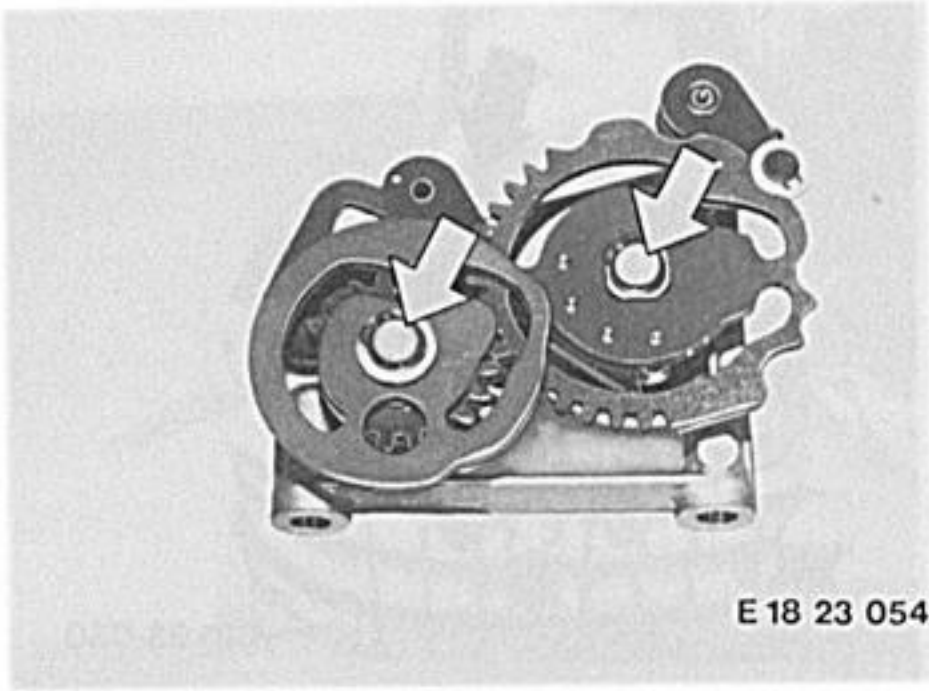


Loosen the two reamed bolts (arrows) holding the bearing mount. For tightening torque, see Specifications.



Tilt the bearing mount to free the selector forks. Take out the bearing mount.





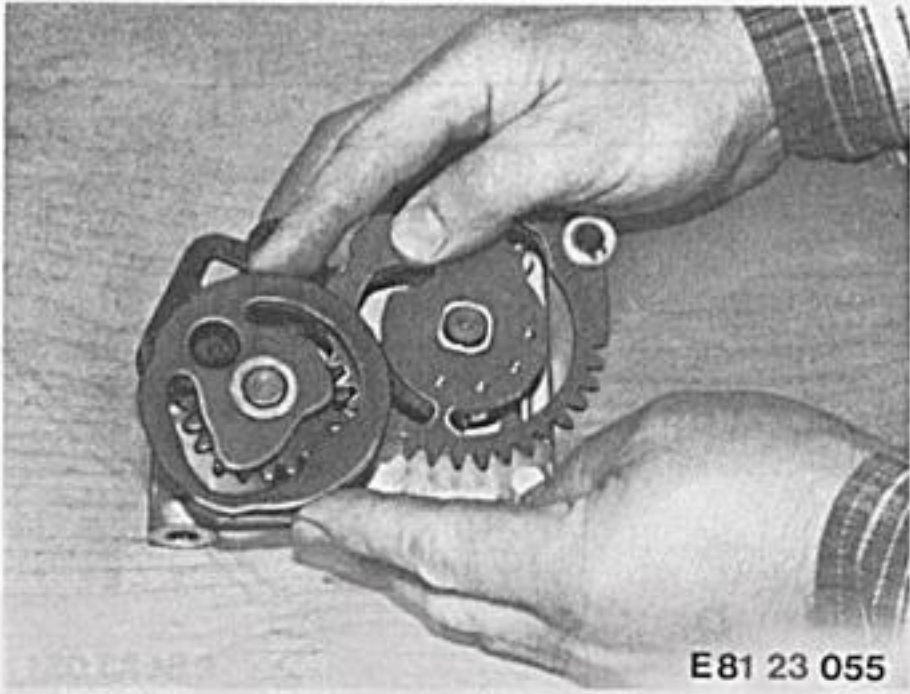
E 18 23 054

23 31 861 Selector discs – removing and installing

Remove (install) bearing mount – 23 31 210.
Take off the 2 Seeger circlips (arrows) holding the selector discs.



Note: when assembling, make sure that the first teeth of the selector discs mesh together.

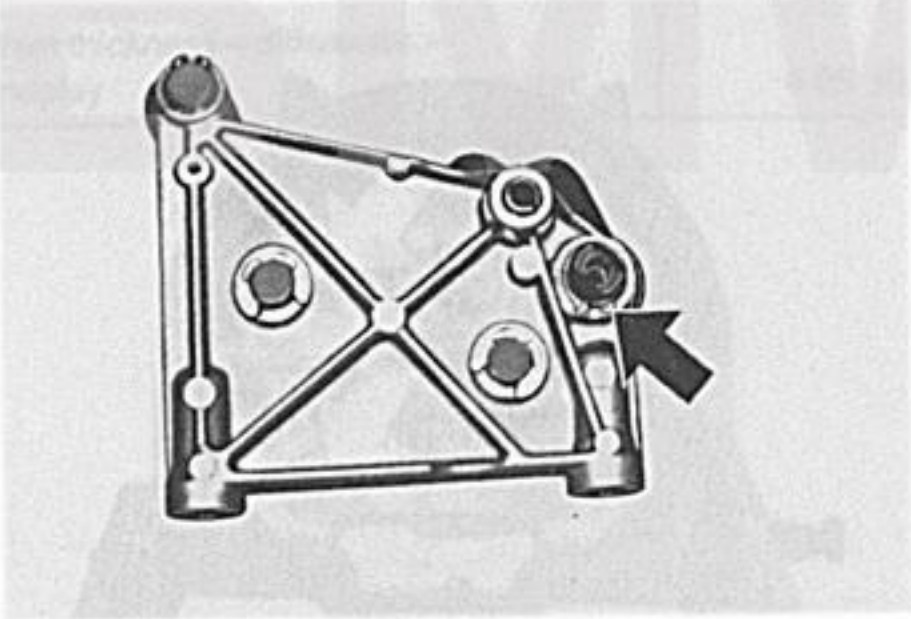


E 81 23 055



23 31 881 Shift mechanism – removing and installing

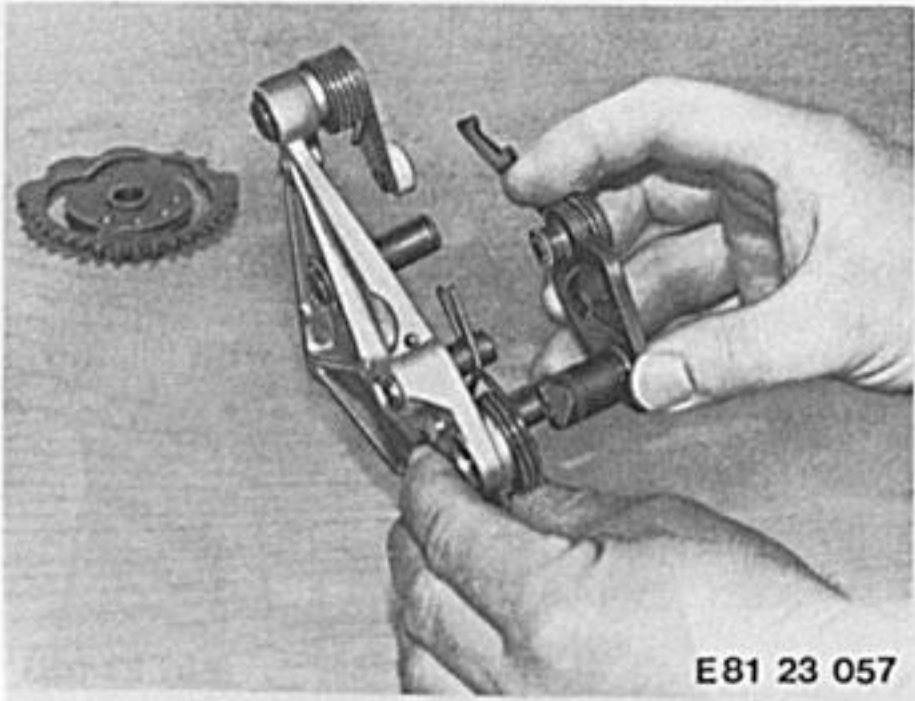
Remove (install) the selector discs – 23 31 861.
Remove Seeger circlip (arrow) holding shift sector.



E 81 23 056



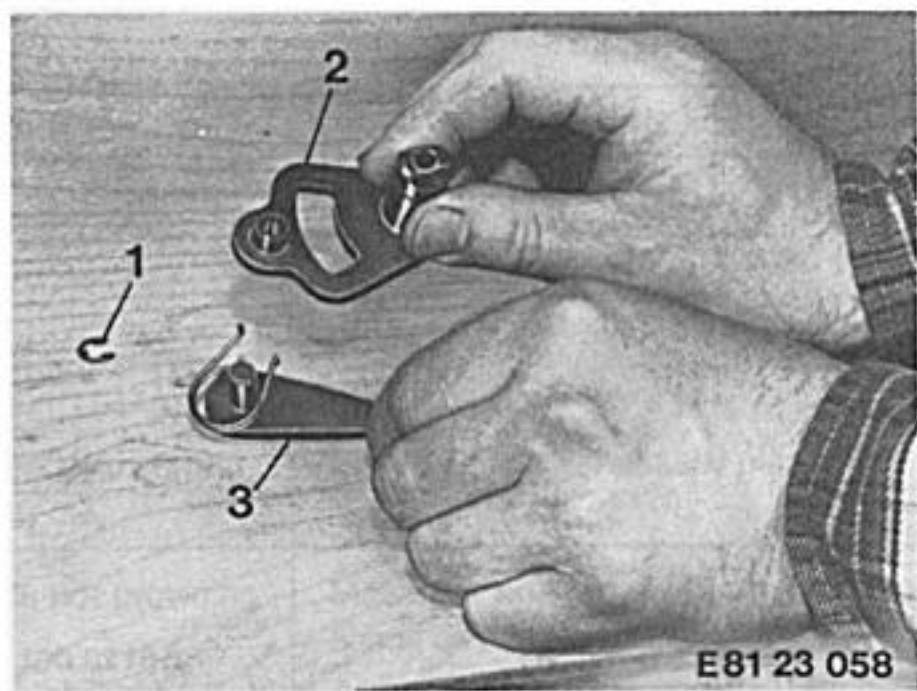
Remove the complete shift sector.
Leave the spring on the bearing mount.



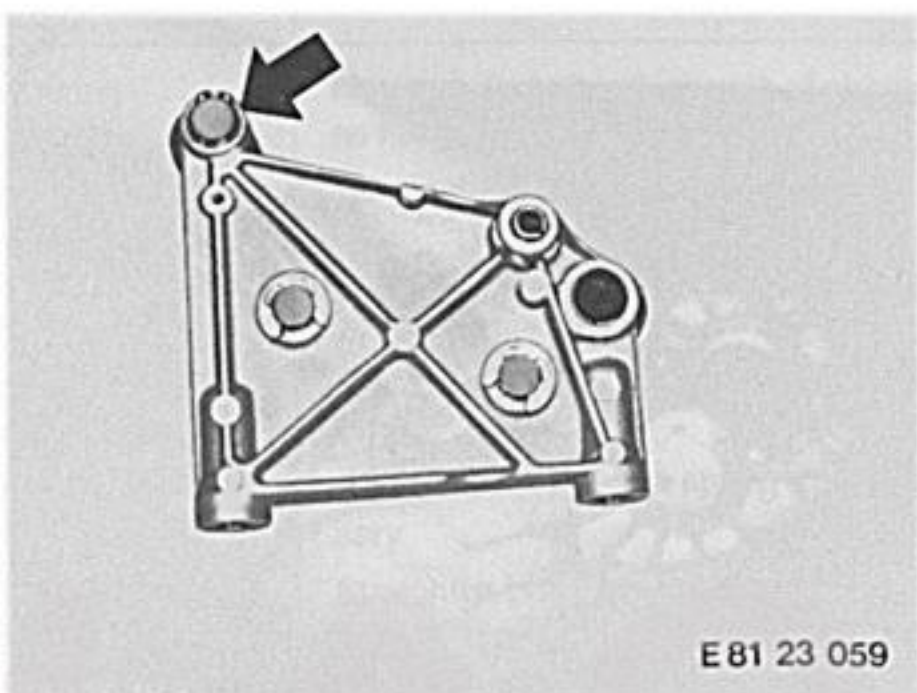
E 81 23 057



Remove circlip (1) holding the pawl, and pull sector (2) away from pawl (3).



Remove the Seeger circlip (arrow) for the gear locking element and pull the gear locking element out of the bearing mount.



23 31 401 Electric neutral indicator – removing and installing

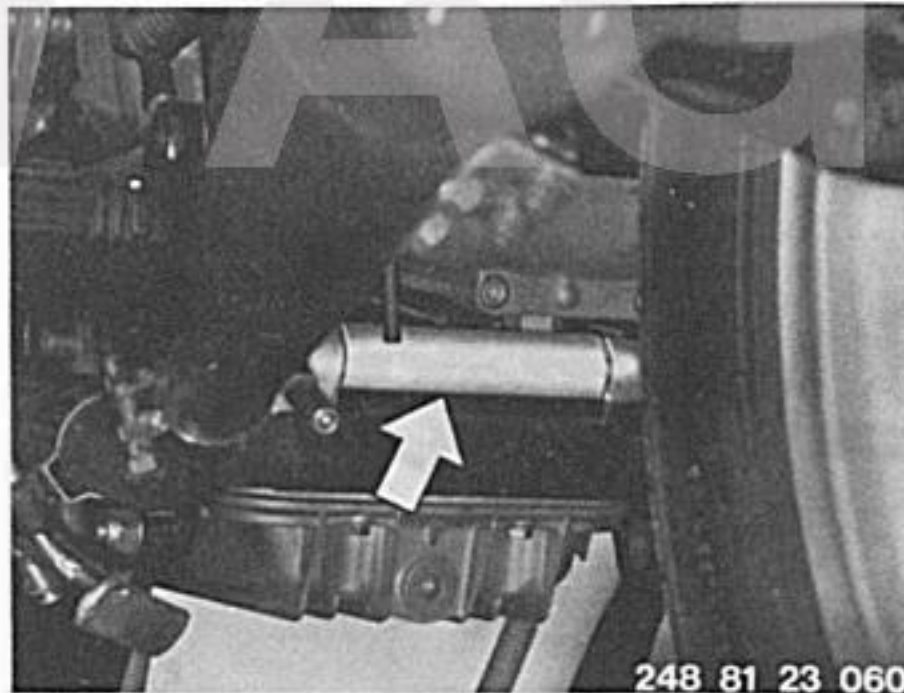
Gearbox installed.

Unscrew the left and right nuts on the rear engine mounting rod and pull out the rod.

Drive the spacing tube (arrow) out of the engine block with a plastic-faced hammer, or lever out with a screwdriver.

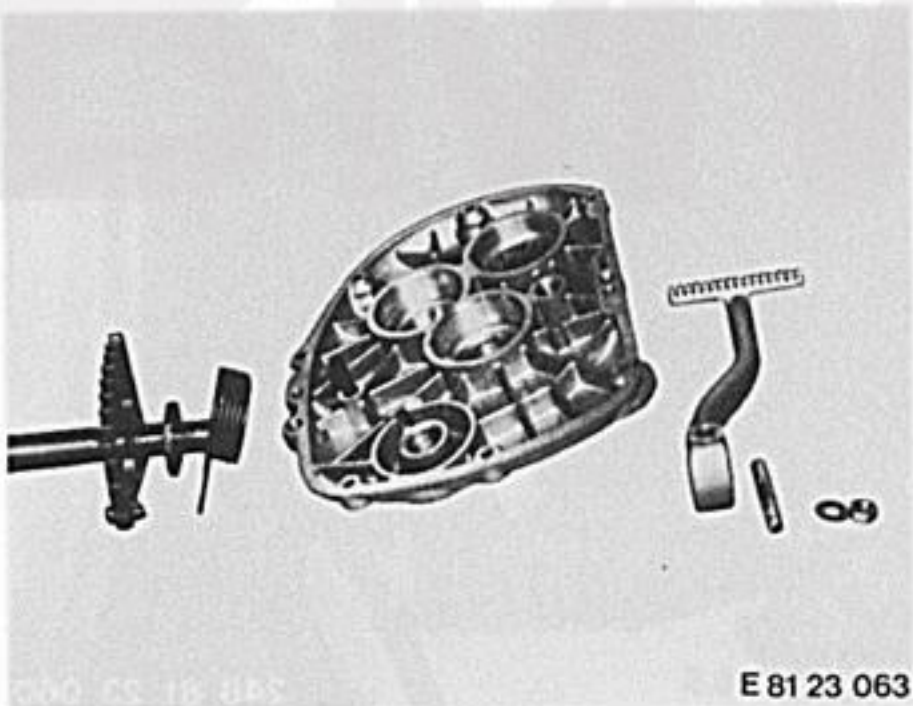
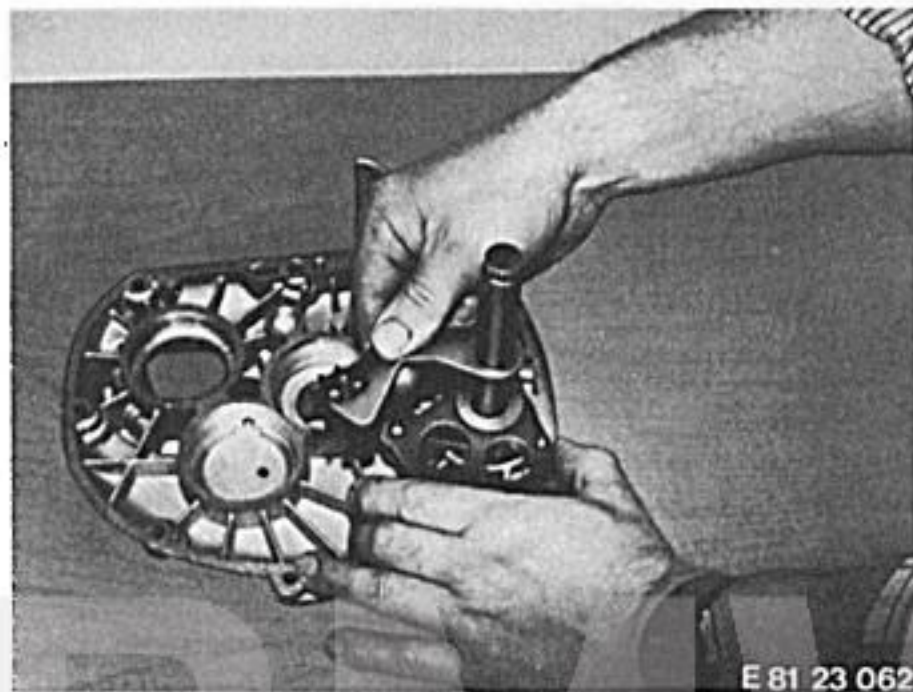
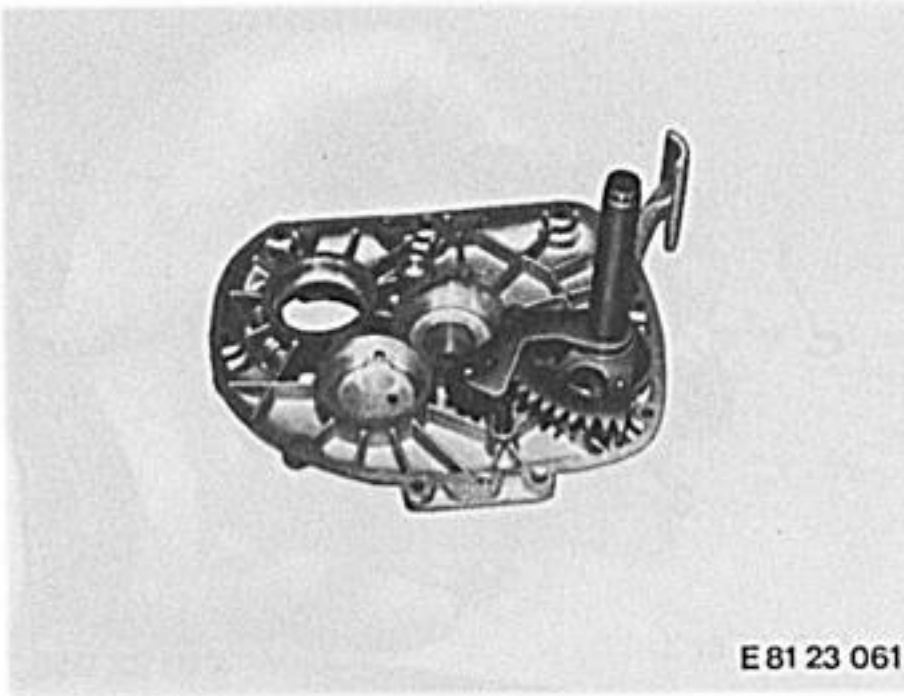
Detach the electric cable.

Unscrew and remove the neutral indicator.



23 51 010 Kick starter – removing and installing

Detach (attach/seal) the gearbox cover – 23 11 040.



Remove the lock ring for the intermediate gear wheel and pull the gear wheel off the kick starter shaft.



Loosen the wedge screw on the kick starter arm and drive it out with powerful hammer-blows.

Pull off the arm.

Pull the kick starter shaft out of the gearbox cover.

For tightening torque, see Specifications.



Troubleshooting – gearbox

Malfunction	Cause	Remedy
Noise from gearbox	Defective bearing Shift forks binding Gearbox shaft not shimmed correctly Noise from gearwheels – incorrect endplay or radial play	Renew bearing Examine forks for rub marks, grind down or renew Measure and determine new shim thicknesses Check endplay and radial play
Gear shift is stiff	Gearbox shaft shims not providing sufficient play Pawl touching large shift disc (for 1st, 2nd and 5th gears)	Measure and alter thickness of shims as necessary Align pawl correctly
Gear shift is stiff when coasting (overrun) Gear shift sticking	Gearbox shafts wandering Burr on shift cam or rough surface in journal guide Shift fork sticking on output shaft, too much play	Measure and alter thickness of shims as necessary Re-machine or renew shift cam Check output shaft and fork, renew if necessary
Gear shift moves too far	Roller on locking device worn Too little spring tension on locking device Pawl is bent	Renew Check tension, renew spring if necessary Straighten pawl
Clutch judder	Input shaft not shimmed correctly	Measure and determine new shim thickness

26 Drive shaft

Specifications	Page 26– 0/3
Specifications (1981 models)	26– 0/5
26 11 000 Drive shaft – removing and installing	26–11/1

BMW AG

Propeller shaft

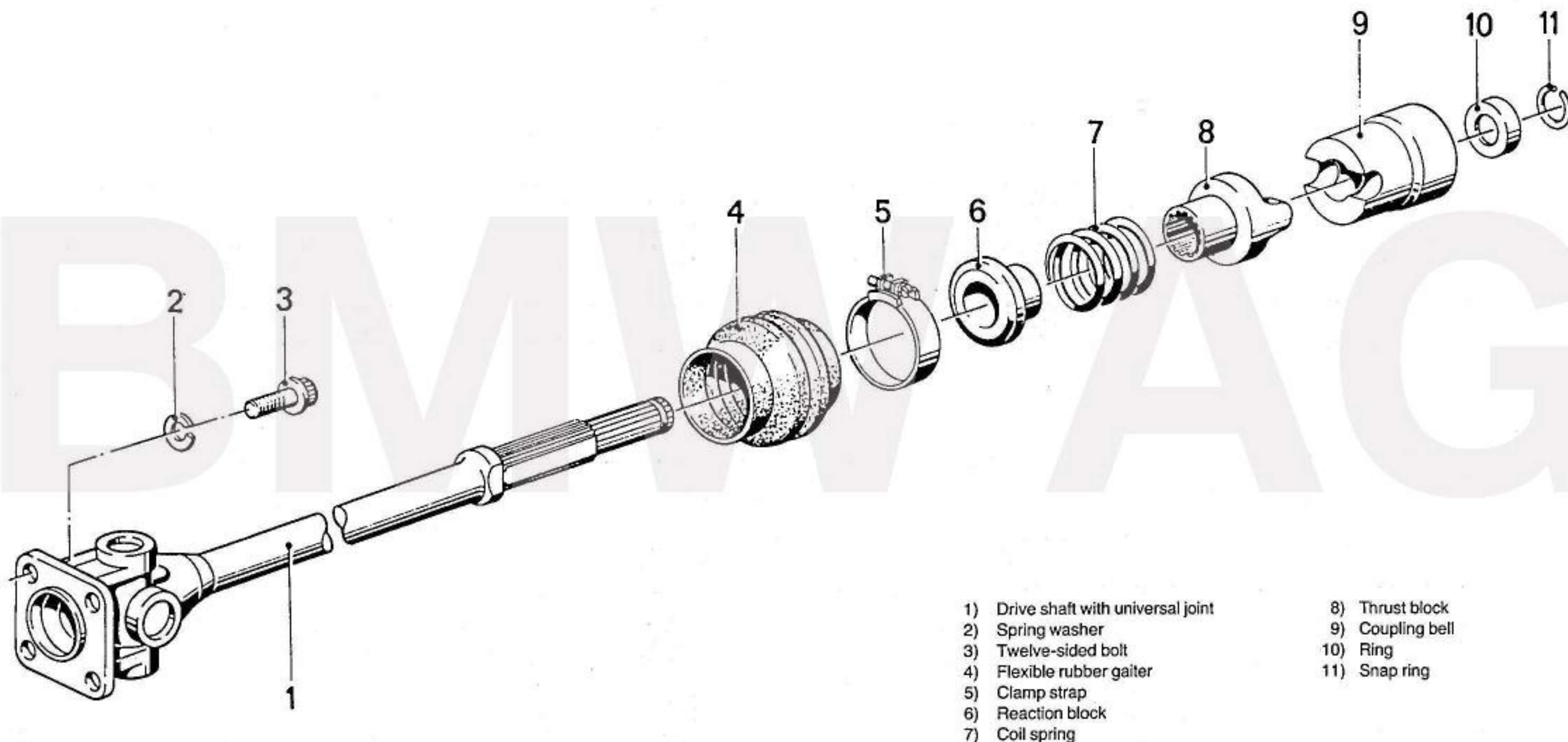
Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Layout	Propeller shaft with torsional vibration damper enclosed in right swinging arm tube; universal joint running on needle roller bearing at gearbox end, domed coupling with curved splines at rear wheel end.		
Oil grade above 5° C (41° F) below 5° C (41° F)	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80		
Oil content liters (Imp. pints, US quarts)	0.15 (0.25, 0.16)		

Tightening torques Nm (lb. ft.)

Twelve-sided bolt	38+4 (28+3)
All other bolts and nuts to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.	

Rear wheel drive shaft with torsional vibration damper



Drive shaft

Specifications (1981 models)

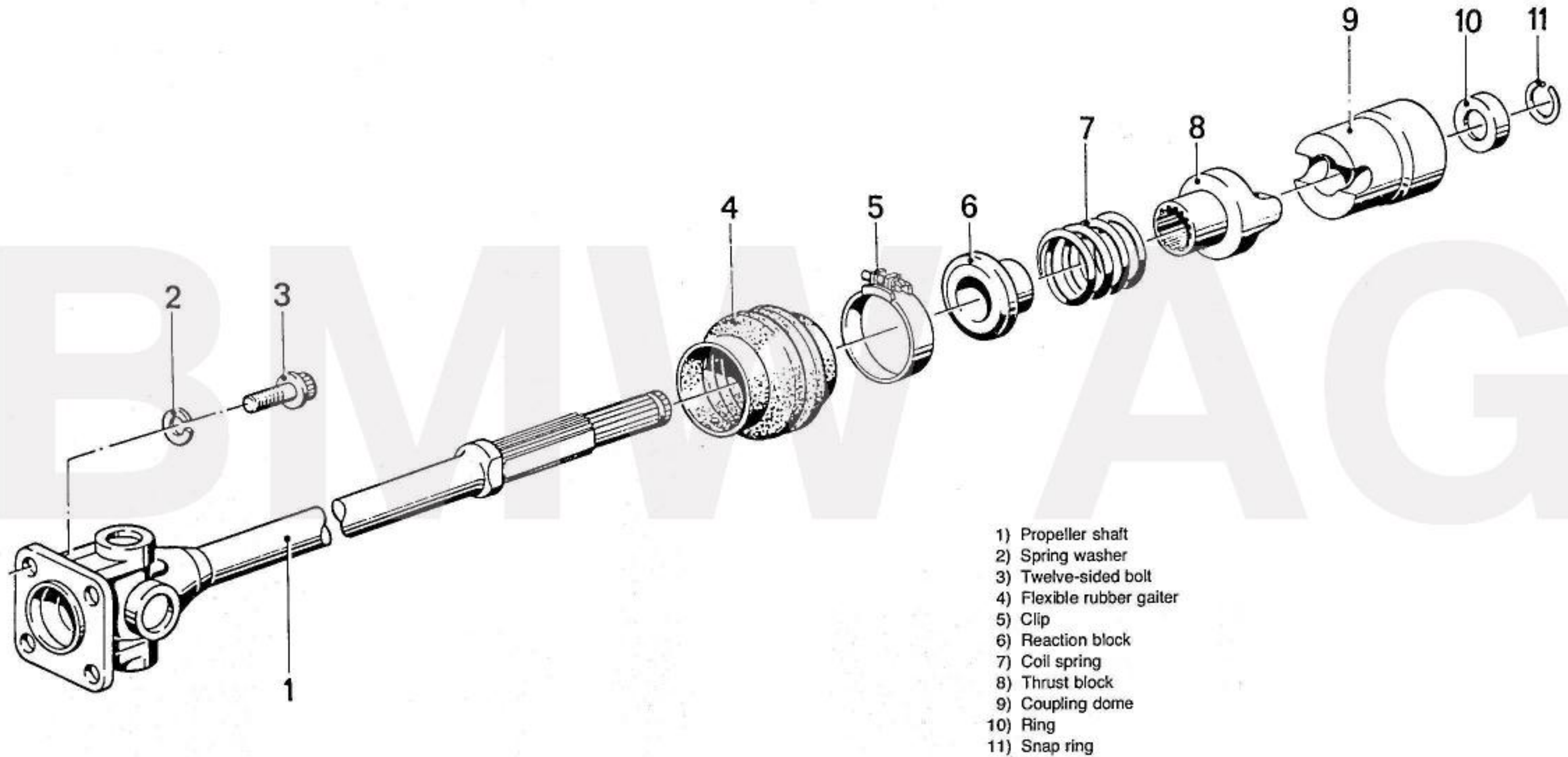
Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Layout	Propeller shaft with torsional vibration damper enclosed in right swinging arm tube; universal joint running on needle roller bearing at gearbox end, domed coupling with curved splines at rear wheel end.			
Oil grade	above 5° C (41° F) below 5° C (41° F)	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80 API class GL 5		
Oil content liters (Imp. pints, US quarts)	0.15 (0.25, 0.16)			

Tightening torques Nm (lb. ft.)

Twelve-sided bolt 40 (29.5)

All other bolts and nuts to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.

Drive shaft with torsional vibration damper



26 11 000 Propeller shaft — removing and installing

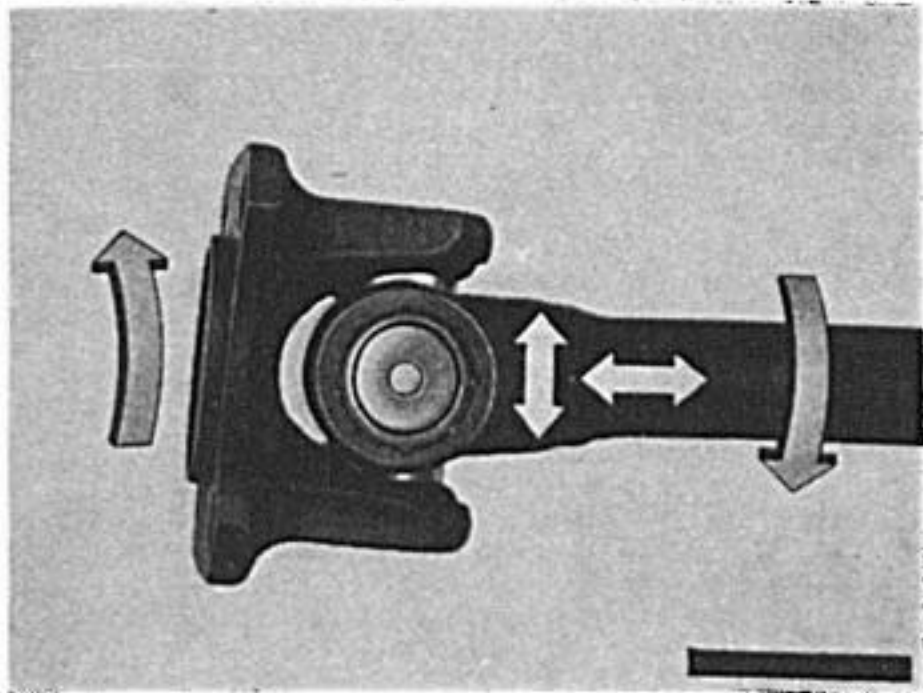
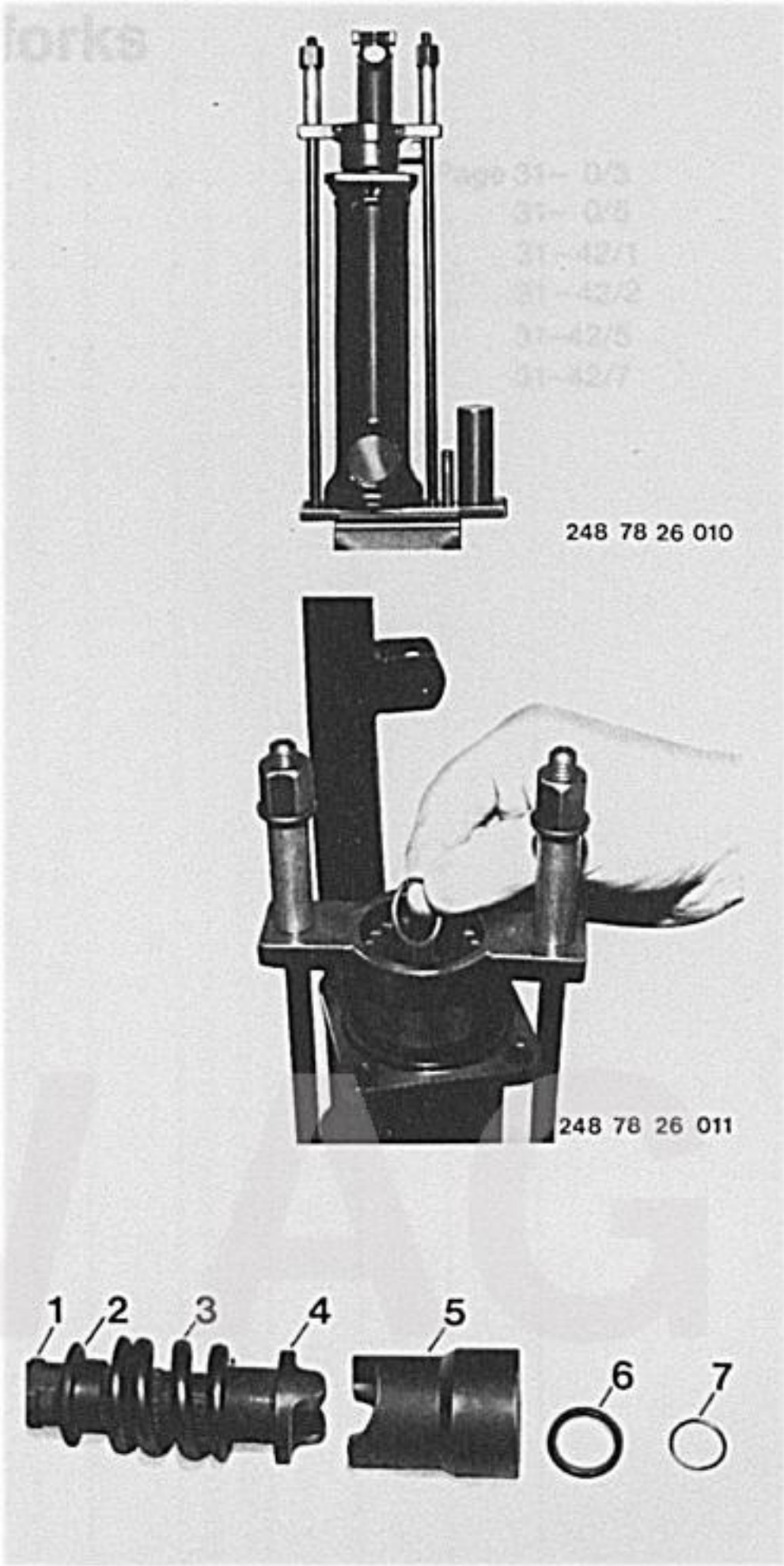
Remove the rear swinging arm — 33 17 350.
Clamp BMW assembly fixture 26 17 00 into the vise and install the swinging arm on the fixture.

Insert a drift into the longitudinal groove and extract the snap ring.
Gradually release the assembly fixture.

Remove the swinging arm from the fixture and pull the propeller shaft and components out of the swinging arm tube.

- 1 Propeller shaft
- 2 Thrust pad
- 3 Spring
- 4 Reaction block
- 5 Coupling housing
- 6 Ring
- 7 Snap ring

Examine the universal joint for wear. Turn the flange and shaft in opposite directions alternately to determine radial play, and push axially to determine endplay.
If necessary, renew the propeller shaft.



31 Front forks

Specifications	Page	31– 0/3
Specifications (1981 models)		31– 0/5
31 42 009 Telescopic fork – measuring		31–42/1
31 42 100 Telescopic fork – removing and installing		31–42/2
31 42 103 Telescopic fork – stripping and assembling		31–42/5
Troubleshooting – front forks		31–42/7

BMW AG

Front axle

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Wheel bearing lubrication	Brand-name multipurpose grease with drip point 180° C (355° F)		
Front wheel caster mm (in)	app. 96 (3.78); not variable		
Steering lock angle	app. 42° to each side		
Front fork angle	42°		
Suspension travel mm (in)	175 (6.89)		
Installed length (measured from top of support tube to machined face on lower fork guide mm (in)	190 (7.48)		
Fixed fork tubes	hard chromium-plated		
Sliding fork tubes	cast light alloy		
Lower fork bridge	forged light alloy		
Oil content per fork leg (initially or when changing oil) liters (Imp. pints, US quarts)	0.190 (0.33, 0.20)		
Oil grade	Shock absorber fluid: Shell 4001, Shell Aero Fluid 4; BP Aero Hydraulic 1; Castrol DB Hydraulic Fluid; Castrol Shock Absorber 1 – 318; Aral P 3441; Aral 1010; BP Olex HLP 2849; Mobil Aero HFA; Mobil DTE 11		
Telescopic fork fixed tube (hard chromium- plated) extl. dia. mm (in)	$36_{-0.075}^{-0.050}$ (1.417 $_{-0.003}^{-0.002}$)		
Fork slider tube intl. dia. mm (in)	$36_0^{+0.025}$ (1.417 $_0^{+0.001}$)		
Clearance between fork slider and fixed fork tubes, max. mm (in)	0.05 ... 0.1 (0.002 ... 0.004)		

Front axle

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Extl. dia. of piston on damper tube mm (in)	27.7 – 0.17 (1.091 – 0.007)		
Intl. dia. of fixed fork tube mm (in)	28±0.15 (1.102±0.006)		
Piston clearance in fixed fork tube mm (in)	0.15 ... 0.62 (0.006 ... 0.024)		
Relaxed length of fork spring mm (in)	490 ⁺¹² (19.29 ^{+0.47})		
Wire diameter of fork spring mm (in)	4.25 (0.167)		

Tightening torques Nm (lb. ft)

End plug	80 + 10 (59 + 7.3)	Retaining screw for damper in slider tube	35±5 (25.8±3.6)
Clamp bolts at lower fork bridge	40 + 5 (29 + 3.6)	Axle clamp bolt	15+2 (11.1+1.5)
		Mudguard stirrup at slider tube	20 ... 25 (14.7 ... 18.4)
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.			

Front axle

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Wheel bearing lubrication	Brand-name anti-friction bearing grease, usable temperature range $-30 \dots +140^{\circ}\text{C}$ ($-22 \dots +284^{\circ}\text{F}$), drip point $150 \dots 230^{\circ}\text{C}$ ($302 \dots 446^{\circ}\text{F}$), high corrosion protection, good water/oxidation resistance; e.g. Shell Retinax A			
Front wheel caster mm (in)	app. 96 (3.78); not variable			
Steering lock angle	app. 42° to each side			app. 35° to each side
Front fork angle	42°			
Suspension travel mm (in)	175 (6.89)			
Test length when installed (measured from top of support tube to machined face on lower fork guide) mm (in)	190 (7.48)			
Fixed fork tubes	hard chromium-plated			
Sliding fork tubes	cast light alloy			
Lower fork bridge	forged light alloy			
Oil content per fork leg (initially or when changing oil) liters (Imp. pints, US quarts)	0.190 (0.33, 0.20)			
Oil grades	Shell 4001; Shell Aero Fluid 4; Castrol DB Hydraulic Fluid; Castrol Shock Absorber Oil 1-318; Castrol Fork Oil Extra Light; Castrol LHM (preferred for below 0°C , [-32°F]); Aral P 3441 shock absorber oil; Aral 1010; Mobil Aero HFA; Mobil DTE 11; Esso Univis J13; BP Aero Hydraulic; BP Olex HLP 2849			
Telescopic fork fixed tube (hard chromium-plated) extl. dia. mm (in)	$36_{-0.075}^{-0.050}$ (1.417 $_{-0.003}^{-0.002}$)			
Fork slider tube intl. dia. mm (in)	$36_0^{+0.025}$ (1.417 $_0^{+0.001}$)			
Clearance between fork slider and fixed fork tubes, max. mm (in)	0.05... 0.1 (0.002... 0.004)			

Front axle

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Extl. dia. of piston on damper tube mm (in)	27.7 – 0.17 (1.091 – 0.007)			
Intl. dia. of fixed fork tube mm (in)	28±0.15 (1.102±0.006)			
Piston clearance in fixed fork tube mm (in)	0.15 ... 0.62 (0.006 ... 0.024)			
Relaxed length of fork spring mm (in)	490 ⁺¹² (19.29 ^{+0.47})			
Wire diameter of fork spring mm (in)	4.25 (0.167)			

Tightening torques Nm (lb. ft)

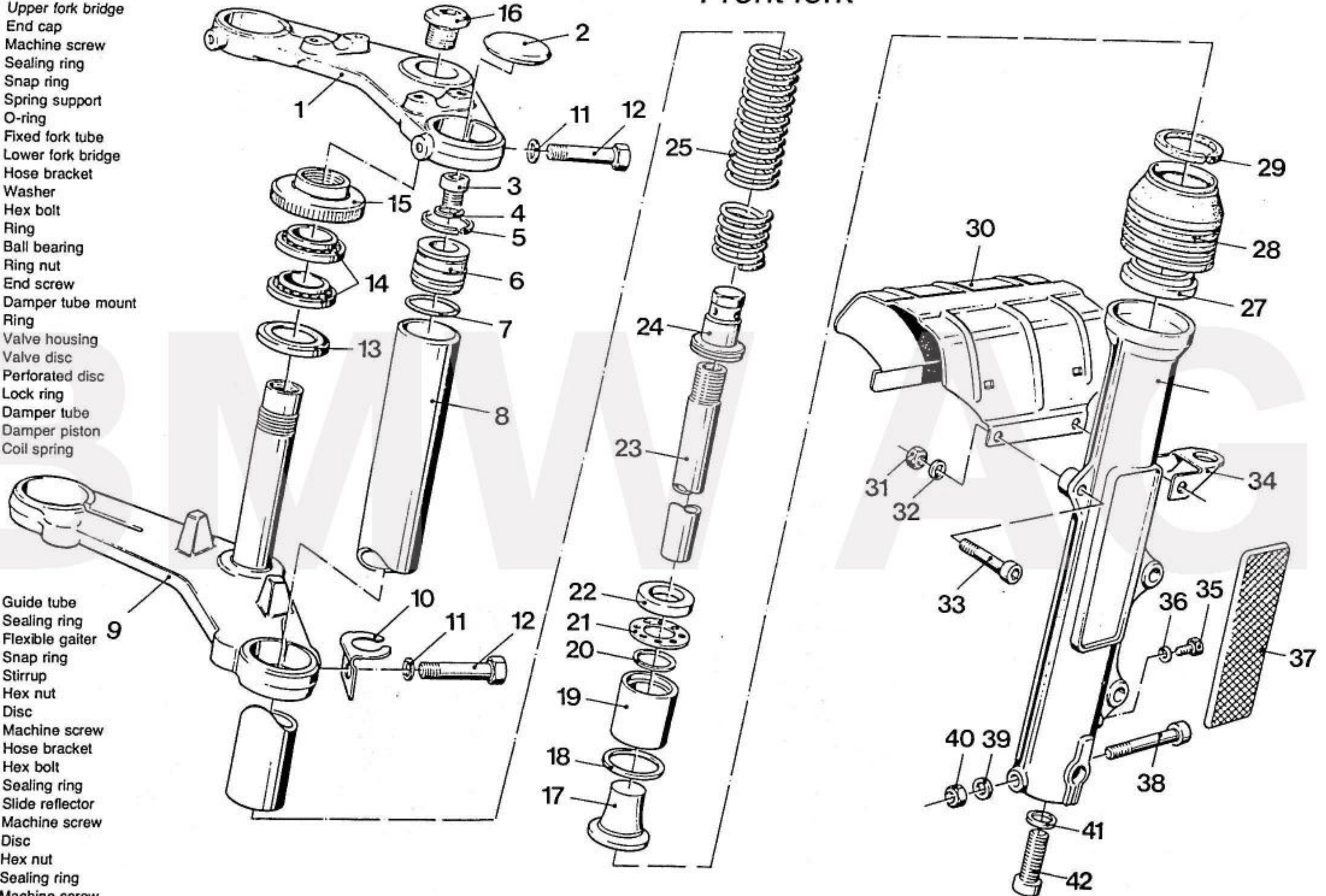
End plug	80 + 0 (59 + 7.3)	Retaining screw for damper in slider tube	35±5 (25.8±3.6)
Clamp bolts at lower fork bridge	40 + 5 (29 + 3.6)	Axle clamp bolt	15+2 (11.1+1.5)
Oil filler plug	9 (6.6)	Mudguard stirrup at slider tube	20 ... 25 (14.7 ... 18.4)
Oil drain plug	8 (5.9)		
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.			

Front fork

5.02 Alteration

- 1) Upper fork bridge
- 2) End cap
- 3) Machine screw
- 4) Sealing ring
- 5) Snap ring
- 6) Spring support
- 7) O-ring
- 8) Fixed fork tube
- 9) Lower fork bridge
- 10) Hose bracket
- 11) Washer
- 12) Hex bolt
- 13) Ring
- 14) Ball bearing
- 15) Ring nut
- 16) End screw
- 17) Damper tube mount
- 18) Ring
- 19) Valve housing
- 20) Valve disc
- 21) Perforated disc
- 22) Lock ring
- 23) Damper tube
- 24) Damper piston
- 25) Coil spring

- 26) Guide tube
- 27) Sealing ring
- 28) Flexible gaiter
- 29) Snap ring
- 30) Stirrup
- 31) Hex nut
- 32) Disc
- 33) Machine screw
- 34) Hose bracket
- 35) Hex bolt
- 36) Sealing ring
- 37) Slide reflector
- 38) Machine screw
- 39) Disc
- 40) Hex nut
- 41) Sealing ring
- 42) Machine screw



31-07

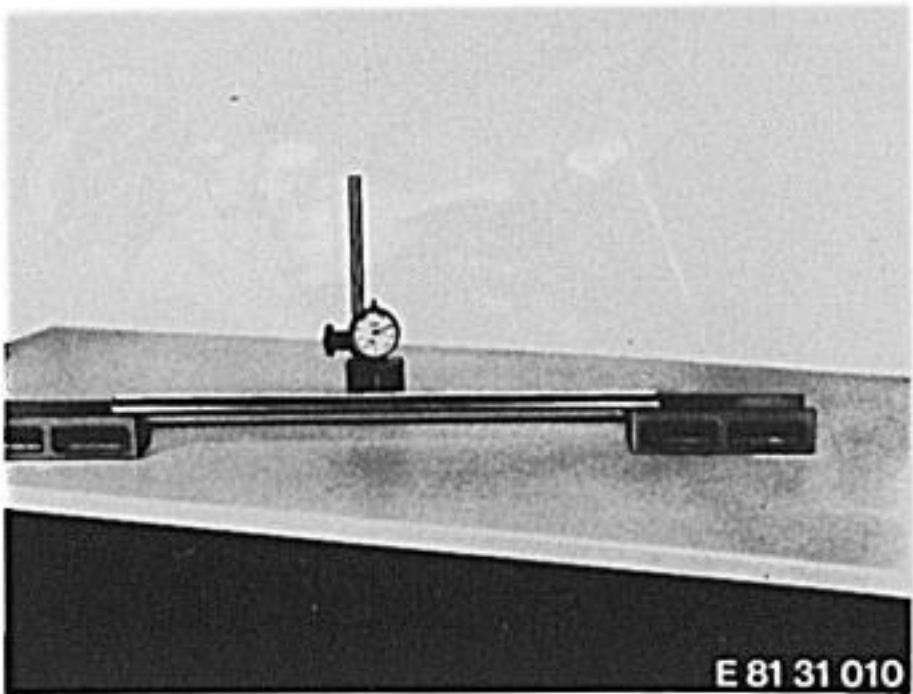
31 42 009 Measuring telescopic forks

Remove (install) telescopic forks – 31 42 100.
Strip down telescopic forks – 31 42 103.
In particular when the forks have been damaged, it is important to examine the lower fork guide and the fixed and slider tubes carefully for possible cracks.
Lay both the ends of the removed fixed tubes in Vee guides or hold in a centre cradle to test for straightness.
See Specifications for relevant measurements.
Warning: Bent slider tubes must not be re-aligned; there is a risk of fatigue fracture.

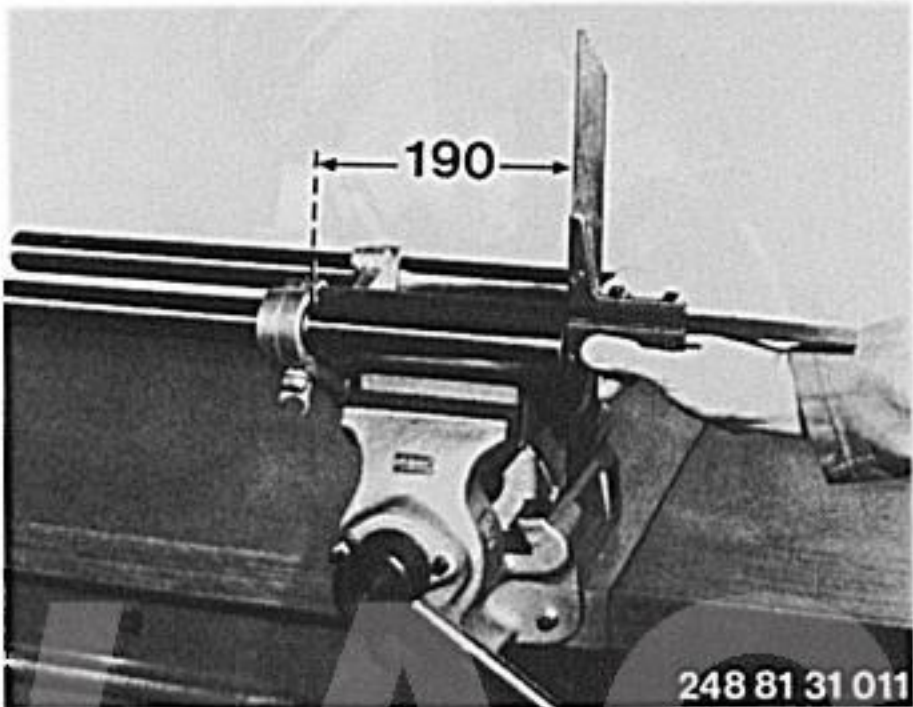
To check the lower fork guide, insert two new slider tubes (test length when installed measured from upper edge of support tube to lower fork guide = 190 mm [7.48 in]).

Lay two BMW No. 31 4 620 measuring rules over the ends of the slider tubes and check for straightness.

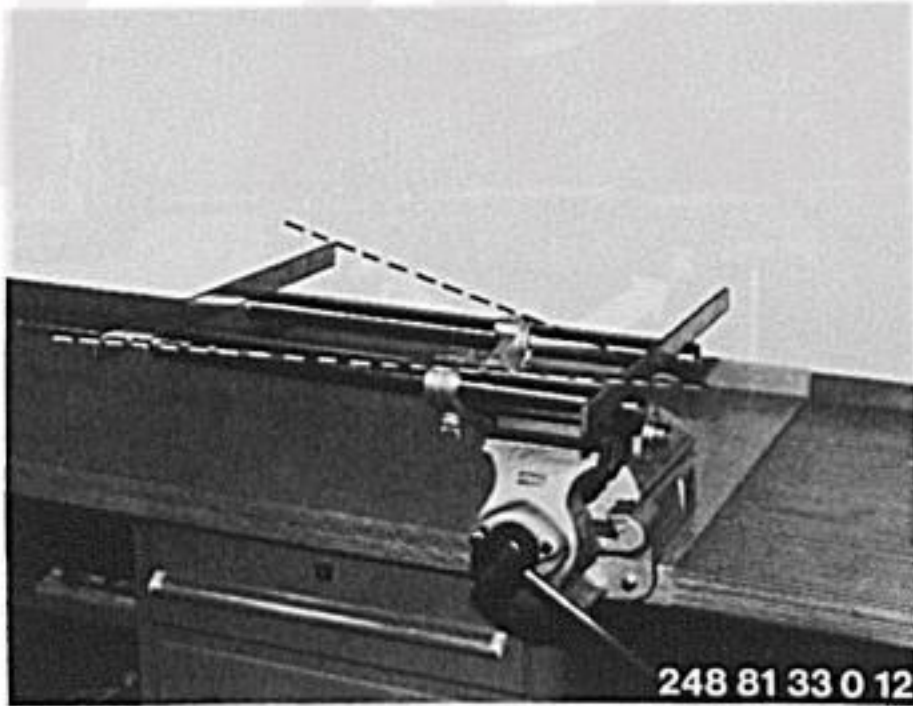
Test the slider tubes for parallelity with a slide gauge. Check that the fork guide tube is flush with the slider tubes. It should be easy to push the fork bridge on to the fixed tubes and fork guide tube.



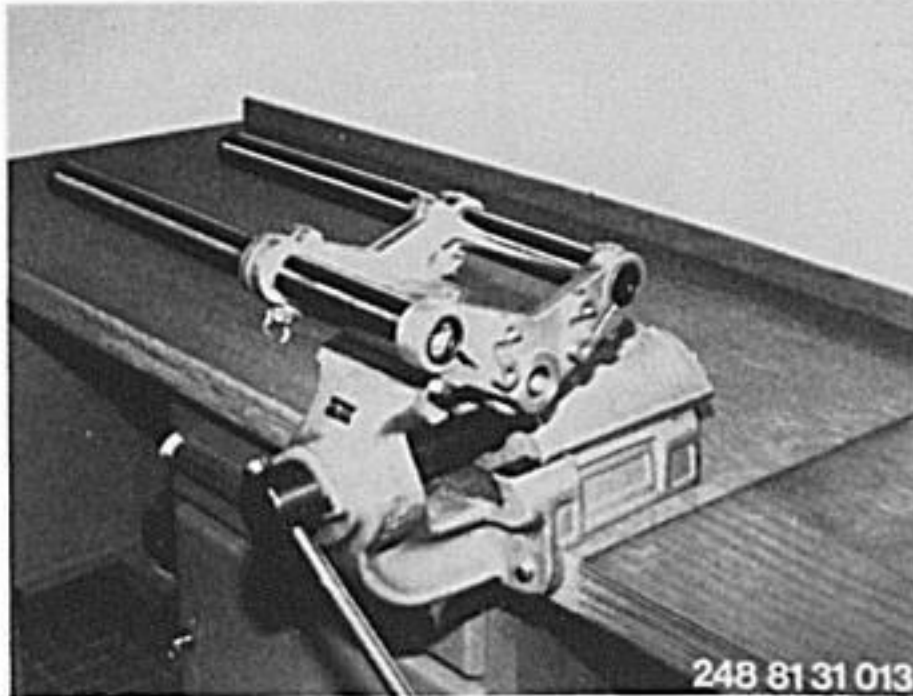
E 81 31 010



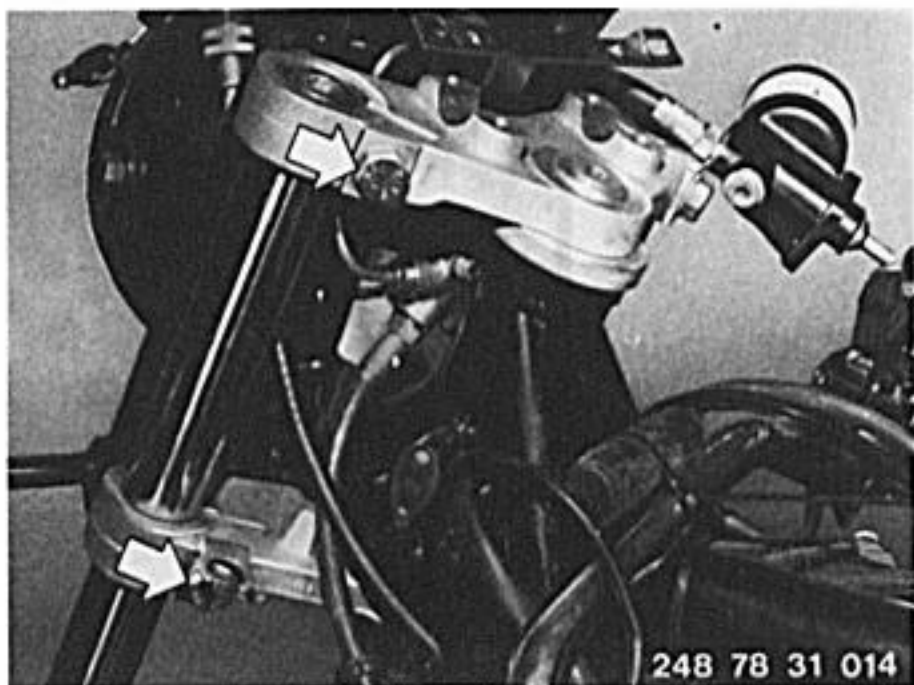
248 81 31 011



248 81 33 0 12



248 81 31 013



31 42 100 Telescopic forks – removing and installing

Remove and install front wheel – 36 30 300.

Remove and install front mudguard – 46 61 000.

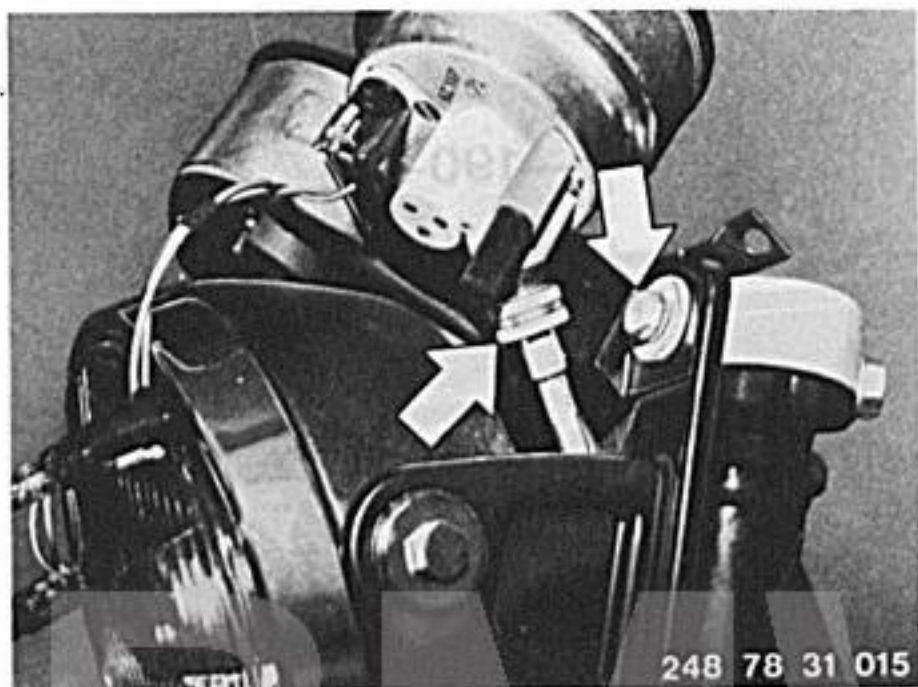
Remove and install handlebar – 32 71 000.

Remove and install brake caliper – 34 11 000.

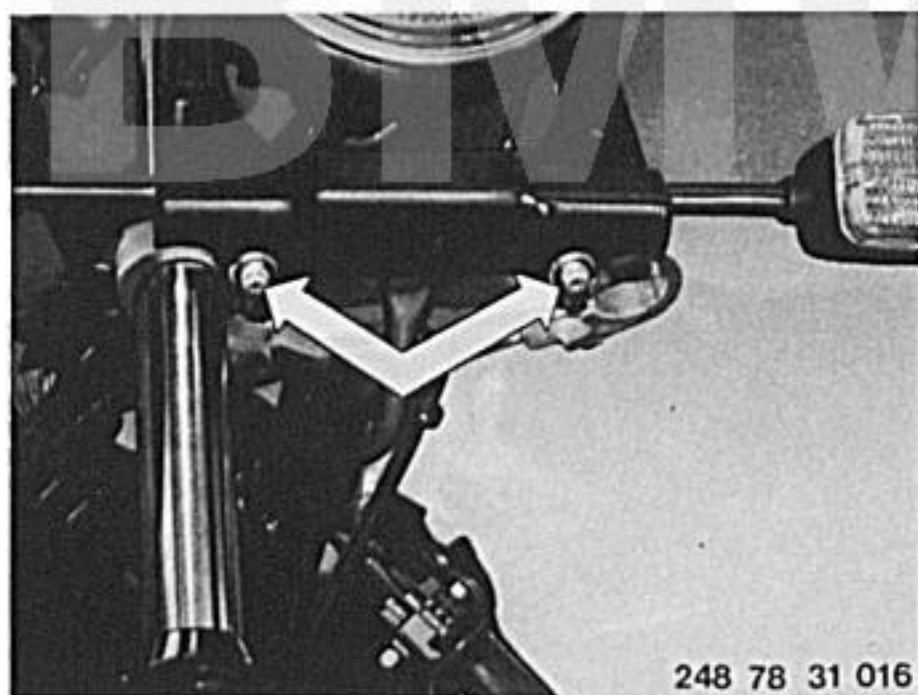
Slacken the clamp bolts (arrows) for the left fixed tube at the upper and lower fork bridges, and pull the fixed and sliding tubes out downwards.



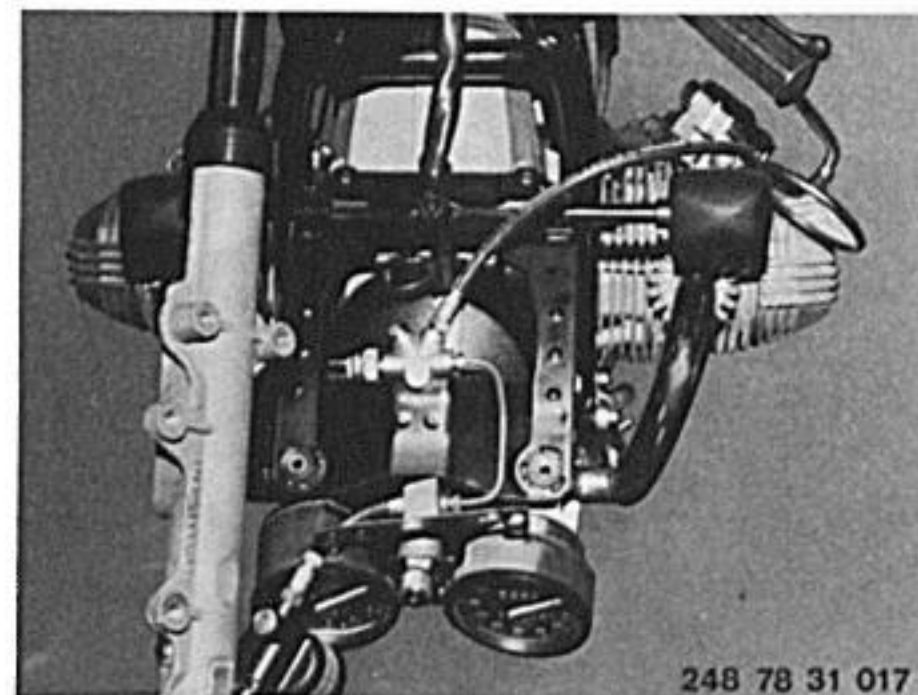
Take out the upper left and right retaining screws (arrows) for the instrument panel and unscrew the speedometer shaft collar nut.



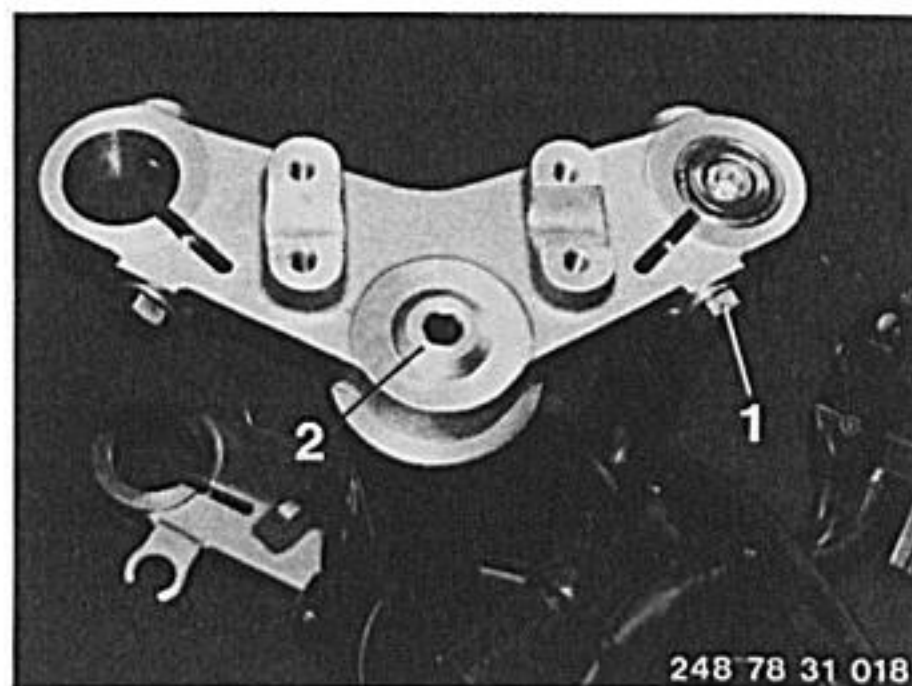
Take out the retaining bolts at the lower fork bridge (arrow).



Pull the instrument panel over the lower fork bridge at one side and allow to hang down.



Unscrew the clamp bolt at the upper right fork bridge (1), remove the end plug (2) and take off the upper fork bridge.



Unscrew the wheel nut by hand and pull the lower fork bridge out of the steering head, striking the fork guide tube lightly at the same time.

The outer races of the upper and lower taper roller bearings remain in the frame.



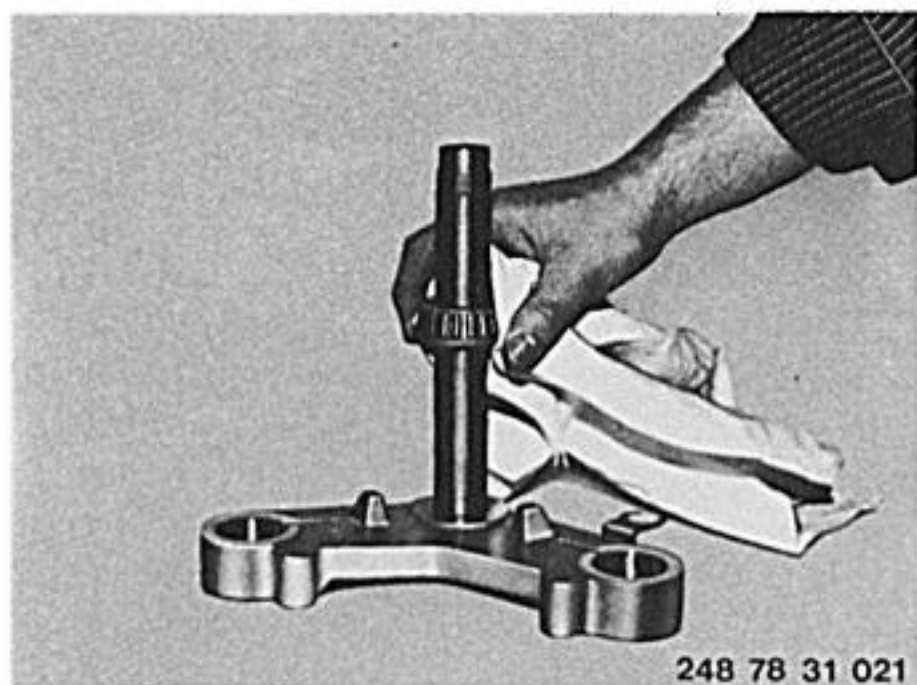
The outer bearing races can be removed with "Kukko" puller BMW 00 5 560 in conjunction with support ring BMW 31 4 800.

When installing: use the old bearing shell to drive in the new shell.



Using the spindle or frame test gauge and BMW spacer 31 4 820, pull the new taper roller bearing outer races in one after the other.





To renew the lower taper roller bearing, heat the lower fork bridge to 80 ... 100° C (176 ... 212° F), drive the guide tube out downwards and insert again immediately without the bearing. Heat the bearing slightly to simplify assembly.

When installing: note the locating marks on the guide tube and fork bridge for the anti-theft lock slot.



To install the fork in the steering head the upper taper roller bearing must first be heated and inserted. After this, the lower fork bridge with guide tube can be carefully pushed into the frame from below. Screw on the collar nut and tighten the bearing by hand until free from play.

Install the right fixed tube in the lower fork bridge (190 mm [7.48 in] above the upper edge of the fork bridge).

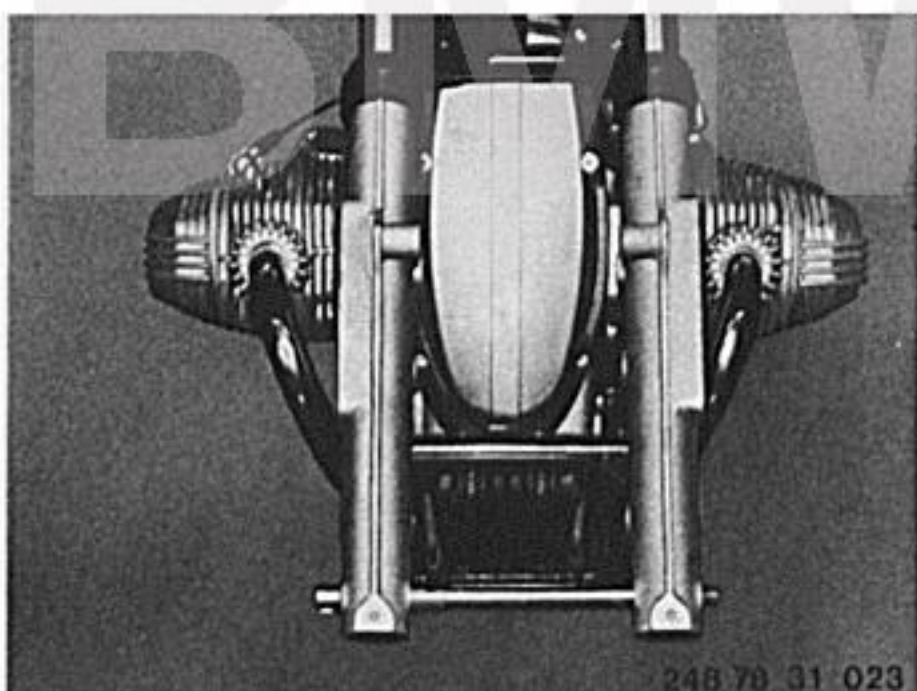
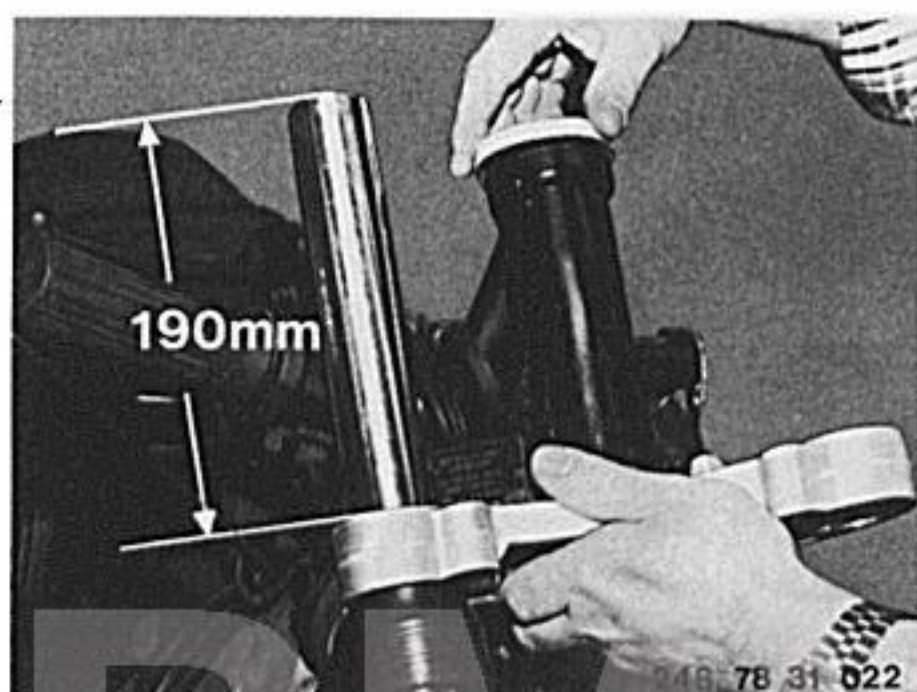
Install the upper fork bridge and tighten the end screw with a torque wrench.

When installing: grease the bearing shells and taper roller bearing thoroughly.



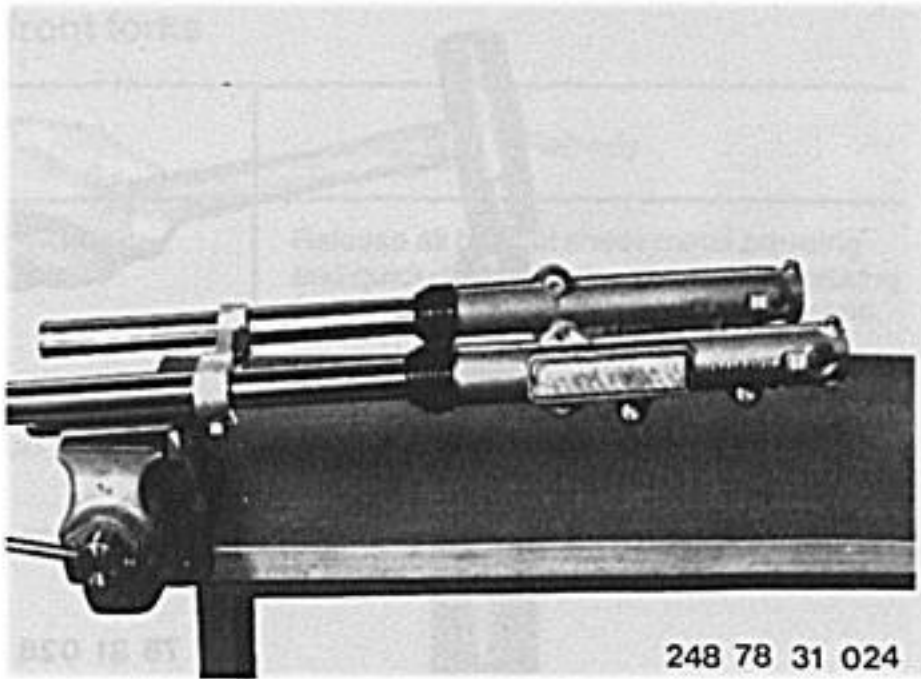
Bolt the instrument carrier to the upper and lower fork bridges. Push the left fixed tube with sliding tube into the fork bridge from below and align initially with the quick-release axle.

After installing the front wheel, loosen the left clamp bolts again and compress the forks several times before retightening the fork clamp bolts.

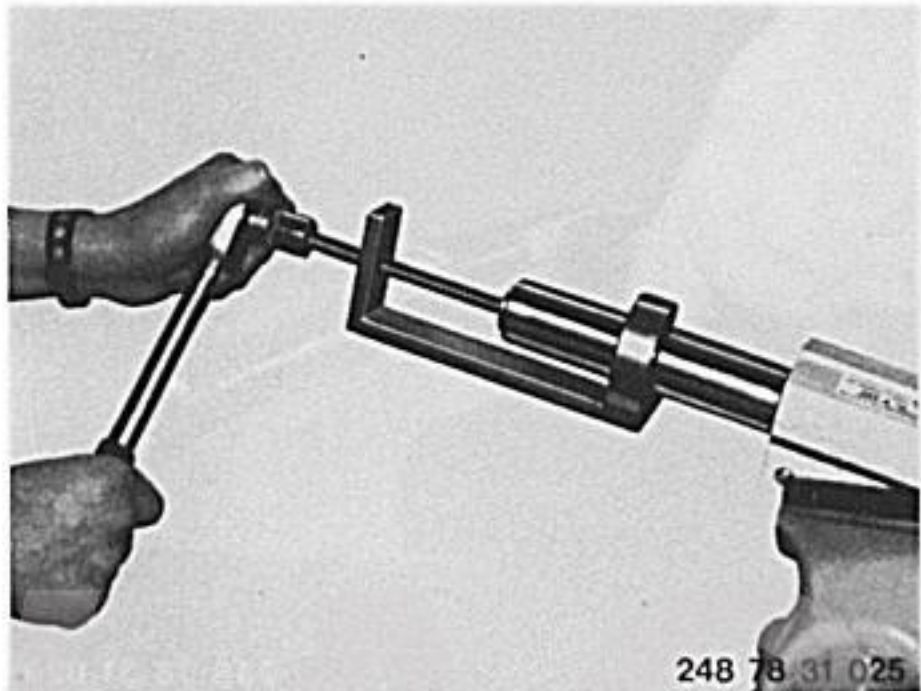


31 42 103 Telescopic forks – stripping and assembling

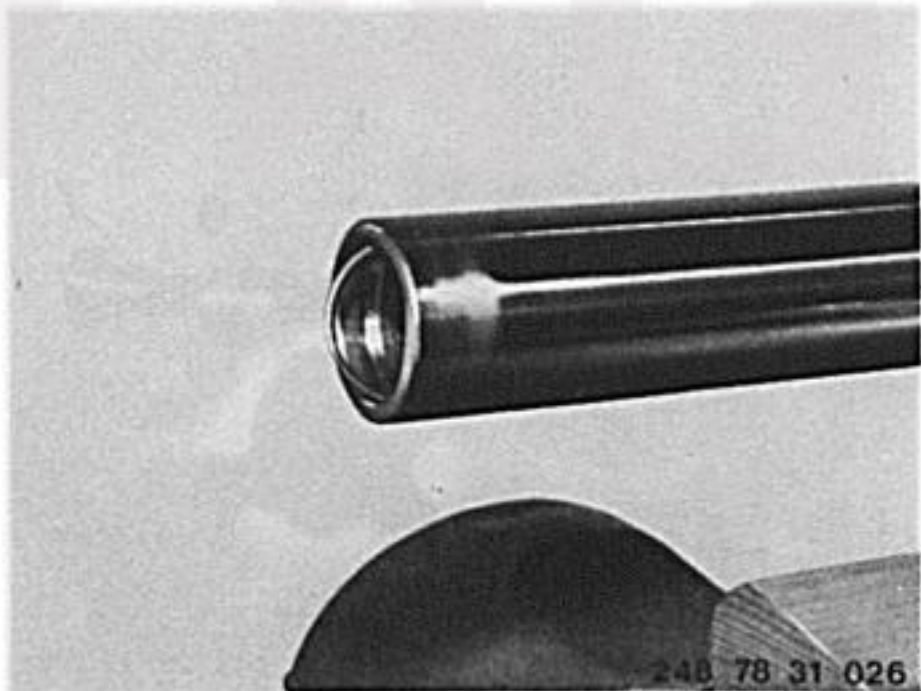
Remove and install telescopic forks – 31 42 100.
Replace the left fixed and sliding tubes in the fork bridge.
Clamp the fork into a vise with wooden block BMW 31 4 600.
Unscrew the oil drain plugs and drain off the oil. See Specifications for filling capacity and oil grades.



Using the BMW 31 4 680 clamping device, press the spring support down against the coil spring until it is approx. 50 mm (2 in) deep in the fixed tube.



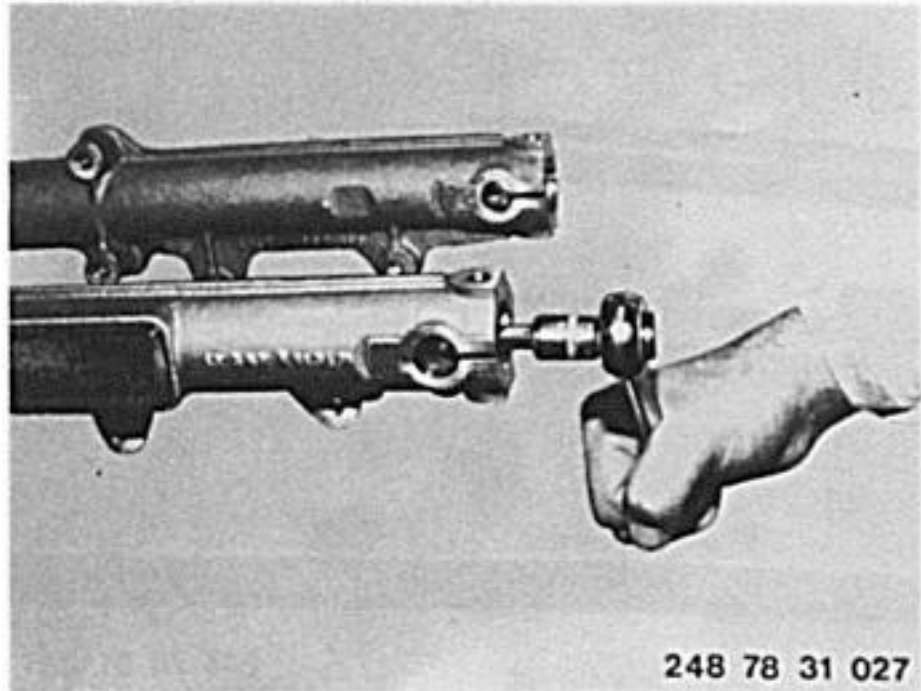
Using a plastic-headed hammer and screwdriver, drive the snap ring out of the seat on the split side, position vertically and pull out by hand.
Release the clamping device and take out the spring support.

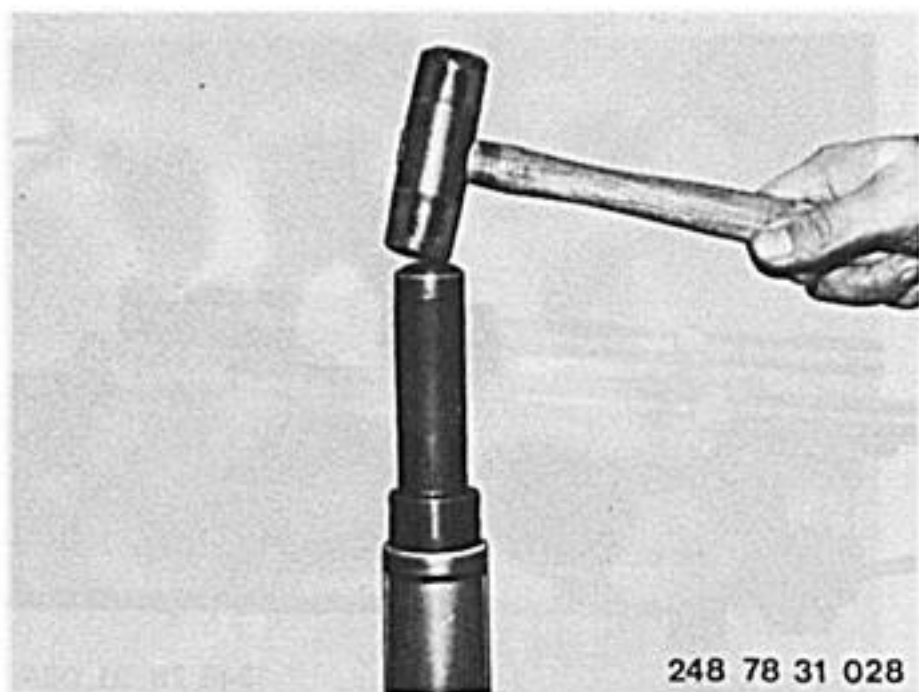


When installing: do not re-use the O-ring at the spring support after removal.

Unscrew the quick-release axle clamp bolts and use an Allen key to unscrew and pull off the threaded base plugs from the slider tubes.

Note: when turning the threaded base plugs, hold the damper inside the fixed tube to prevent it from turning with a double extension and 13 mm socket head.

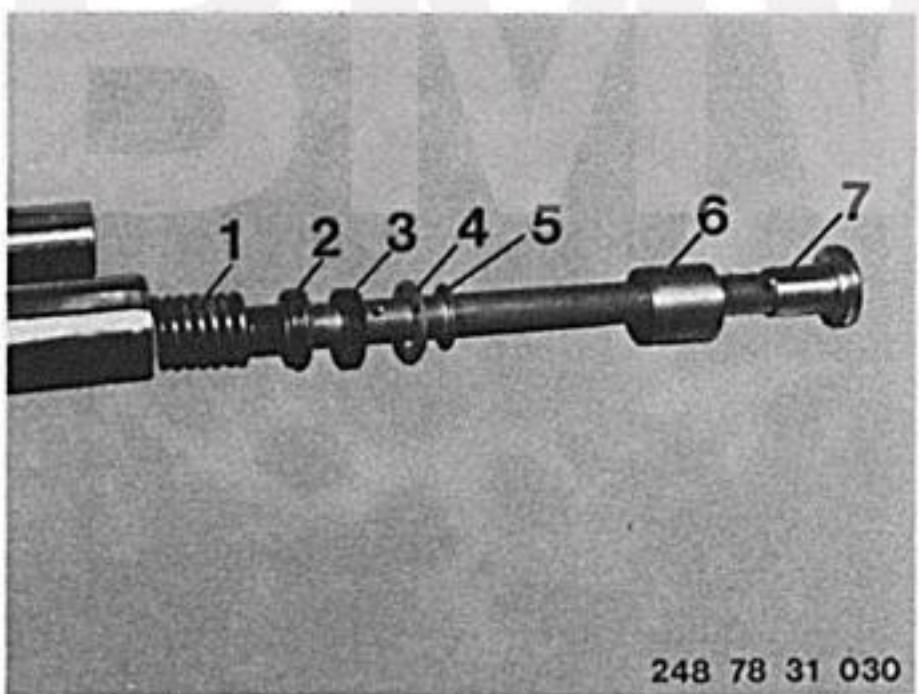




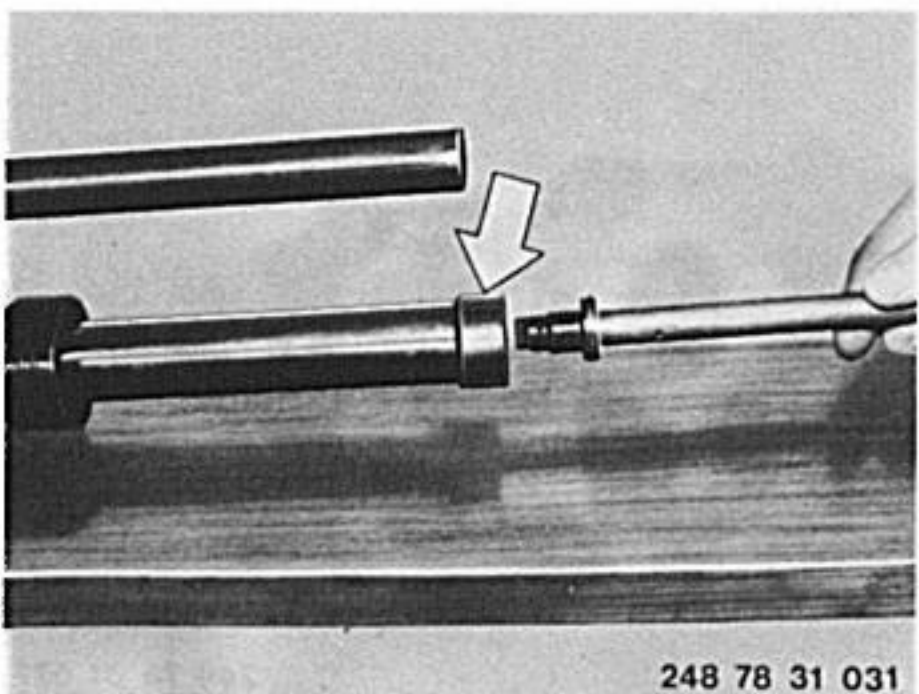
Pull off the fork gaiter and carefully lift out the sealing ring from the slider tube with a screwdriver.
Drive in the new sealing ring with BMW drift 31 4 650.



Remove the circlip from the fixed tube with Seeger circlip pliers and pull the complete damper out of the fixed tube.



- 1 Coil spring
- 2 Damper
- 3 Stop ring
- 4 Perforated disk
- 5 Distributor disk
- 6 Valve housing
- 7 Guide



When installing the damper in the fixed tube, use guide sleeve BMW No. 31 4 720 (arrow) to compress the piston rings.

Push the stop ring through the guide sleeve into the fixed tube using a thin arbor.



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.)

BMW AG

32 Steering

Specifications	Page 32- 0/3
Specifications (1981 models)	32- 0/5
32 00 454 Steering – adjusting	32-00/1
32 71 000 Handlebar – removing and installing	32-71/1
32 73 030 Throttle cable – removing and installing	32-73/1
32 73 030 Throttle cable – removing and installing (1981 models)	32-73/1

BMW AG

Steering

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Steering lock angle	42° to either side		
Handlebar width mm (in)	650 (25.6)		
Handlebar tube dia. mm (in)	22 (0.87)		

Tightening torques Nm (lb. ft) + Friction Values in Ncm

End plug	80 +10	(59 + 7.4)
Steering bearing	35 ± 20 Ncm	
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.		

Steering

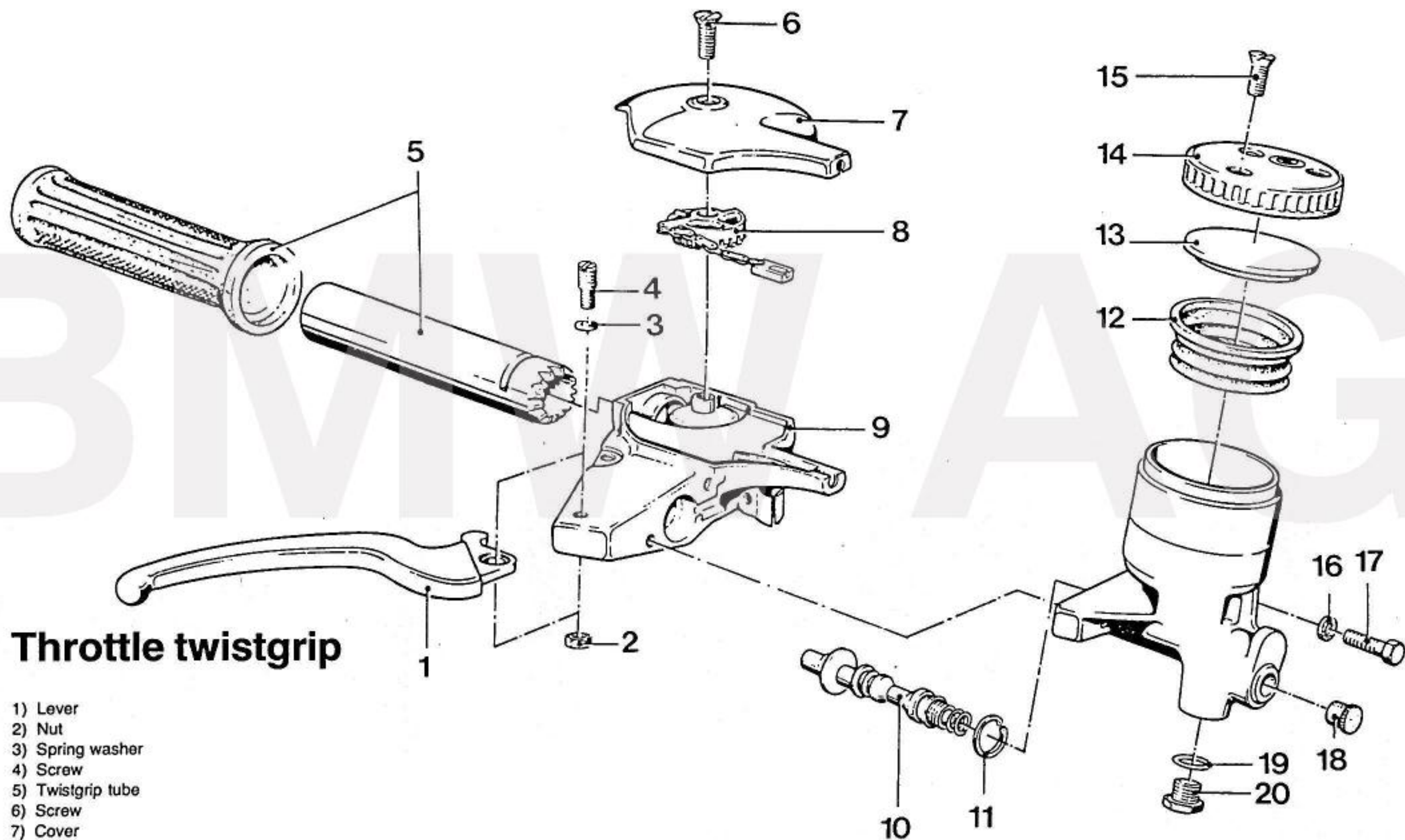
Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Steering lock angle	app. 42° to either side			app. 35° to either side
Handlebar width mm (in)	650 (25.6)			
Handlebar tube dia. mm (in)	22 (0.87)			

Tightening torques Nm (lb. ft)

End plug Round nut	80 + 10 (59 + 7.4) no play
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.	

Throttle twistgrip and master brake cylinder

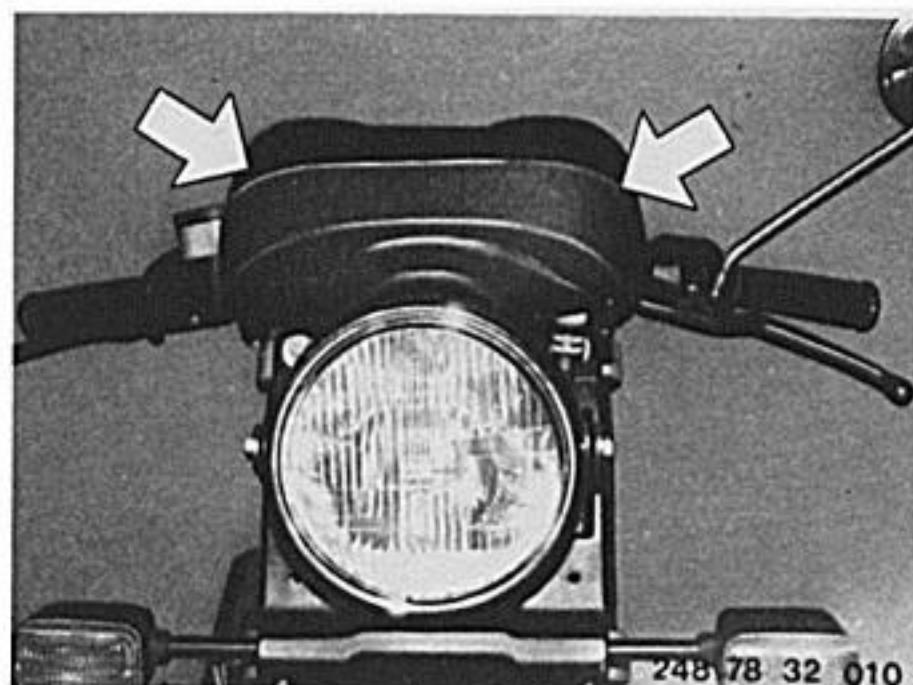


Throttle twistgrip

- 1) Lever
- 2) Nut
- 3) Spring washer
- 4) Screw
- 5) Twistgrip tube
- 6) Screw
- 7) Cover
- 8) Cam
- 9) Housing

32 00 454 Steering – adjusting

Detach the instrument surround (arrows).

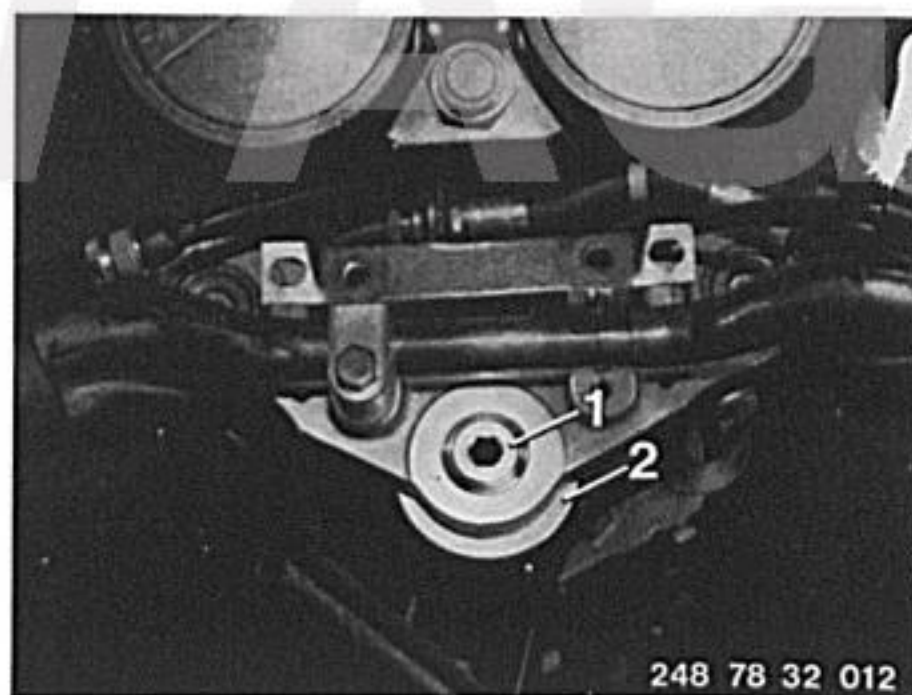


Unscrew the lock ring from the ignition switch (using Seeger circlip pliers), pull out the turn indicator telltale lamp holders and take off the instrument surround.

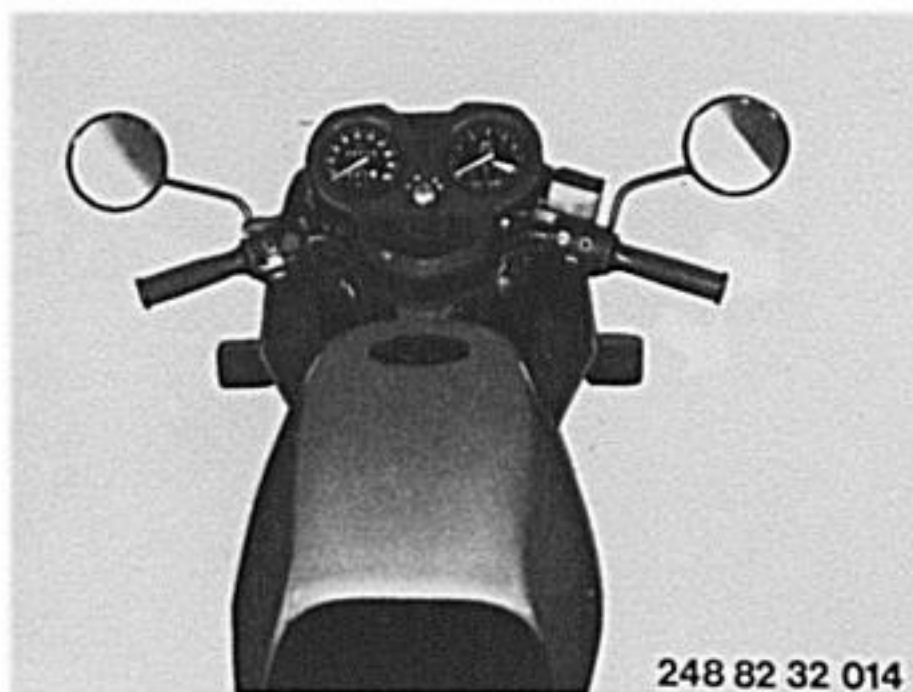


Slacken the end plug, loosen threaded ring (2), strike the bearing sharply to release tension, tighten the threaded ring by hand and tighten the end plug to the correct torque – see Specifications.

Set the steering bearings to zero play.



If the steering head bearings are correctly adjusted, the handlebars should just fall round to the full right lock position when the motorcycle is on its stand.



32 71 000 Handlebar – removing and installing

Remove (install) top section of cockpit fairing (only on R 65 LS) – 46 63 025.

Undo the Phillips screws at left and right of the instrument surround (arrows).

Remove trim.

Pull the direction indicator telltale holders with wires out of the instrument surround.



Using Seeger circlip pliers, unscrew the ignition lock and lift off the instrument surround.



Unscrew the 2 hex. bolts (arrows) holding the handlebar on each side.

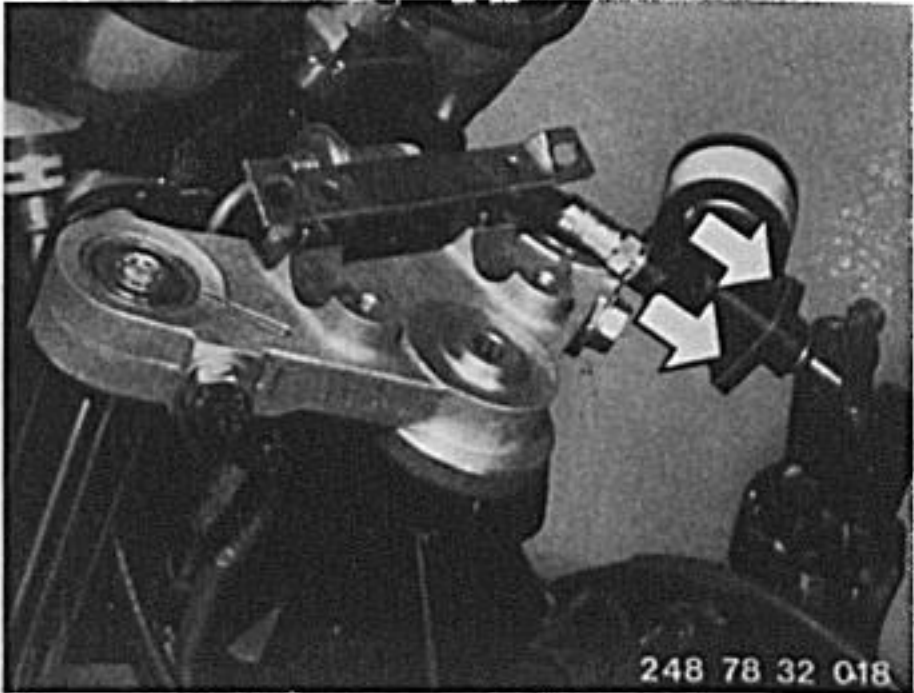
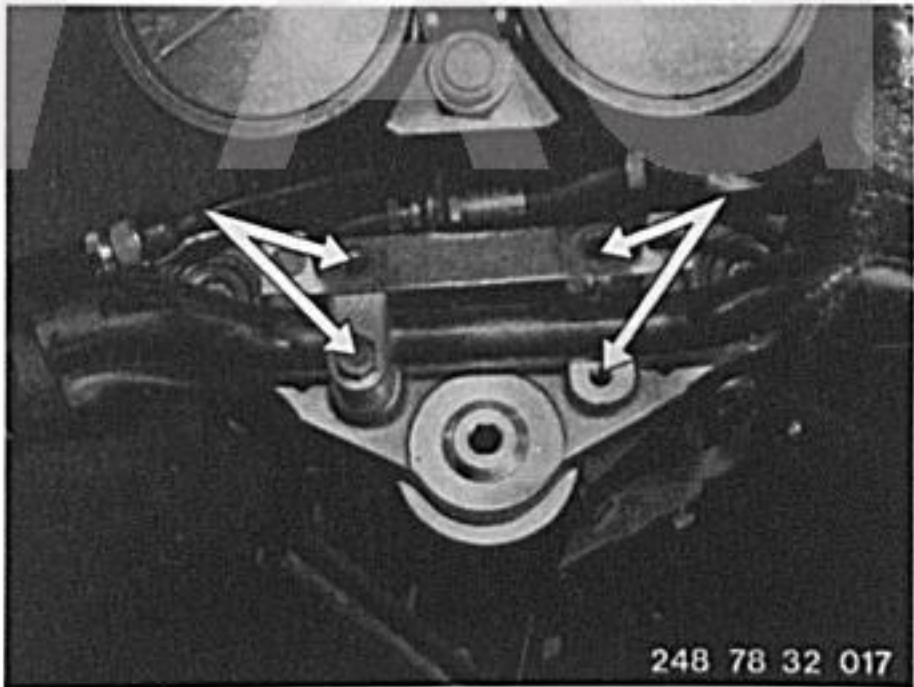
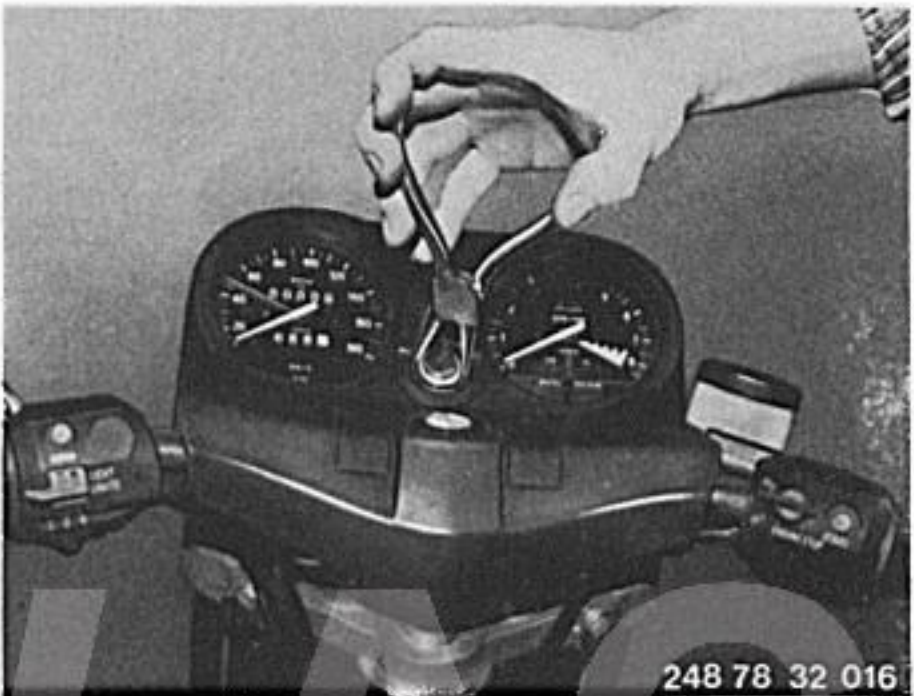
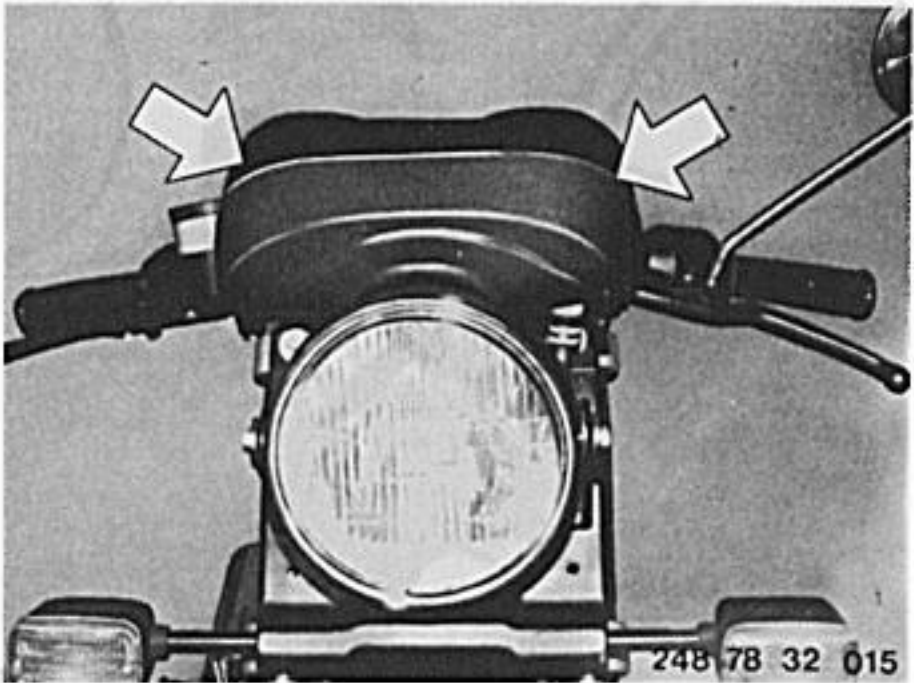


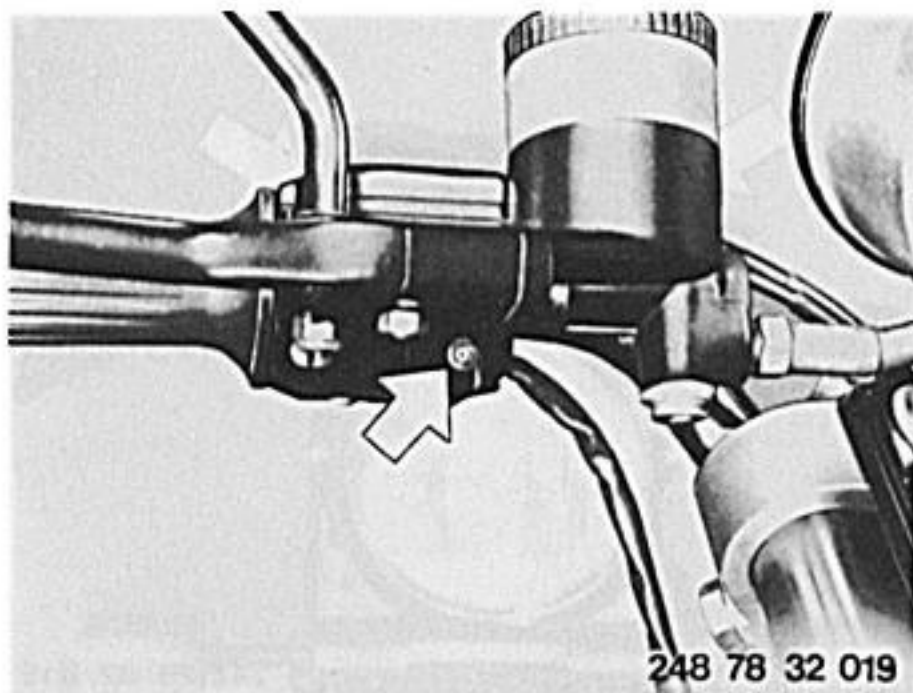
Take out the two Allen screws holding the brake master cylinder (arrows) at the throttle twistgrip.

Remove the throttle cables – 32 73 030.

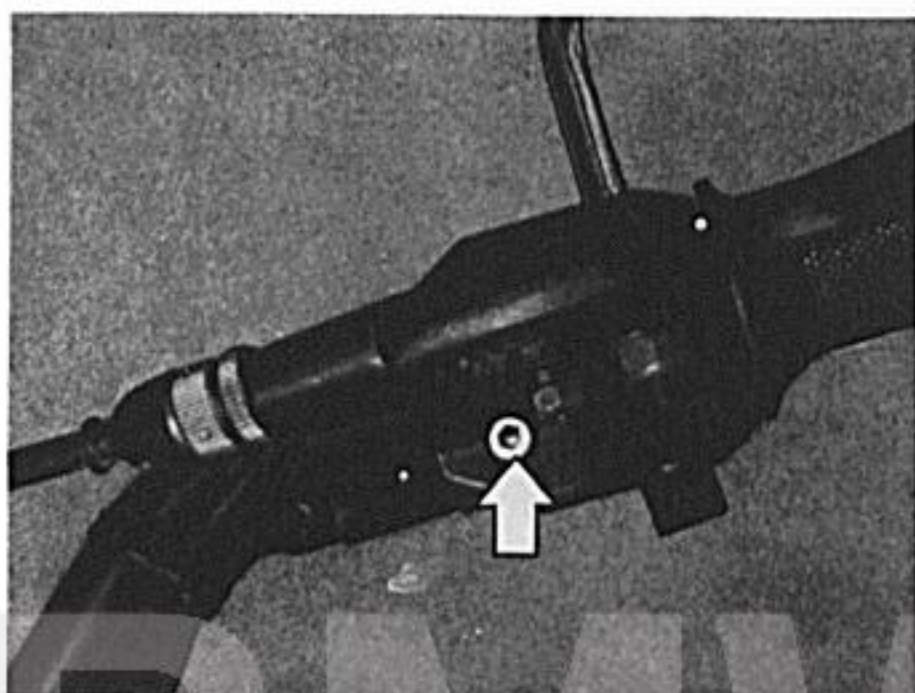
Remove the clutch cable – 32 73 000.

Rest the handlebar on a soft surface on top of the fuel tank.





Take out the Allen screw (arrow) at the right on the twistgrip and brake lever housing and pull off the complete housing.

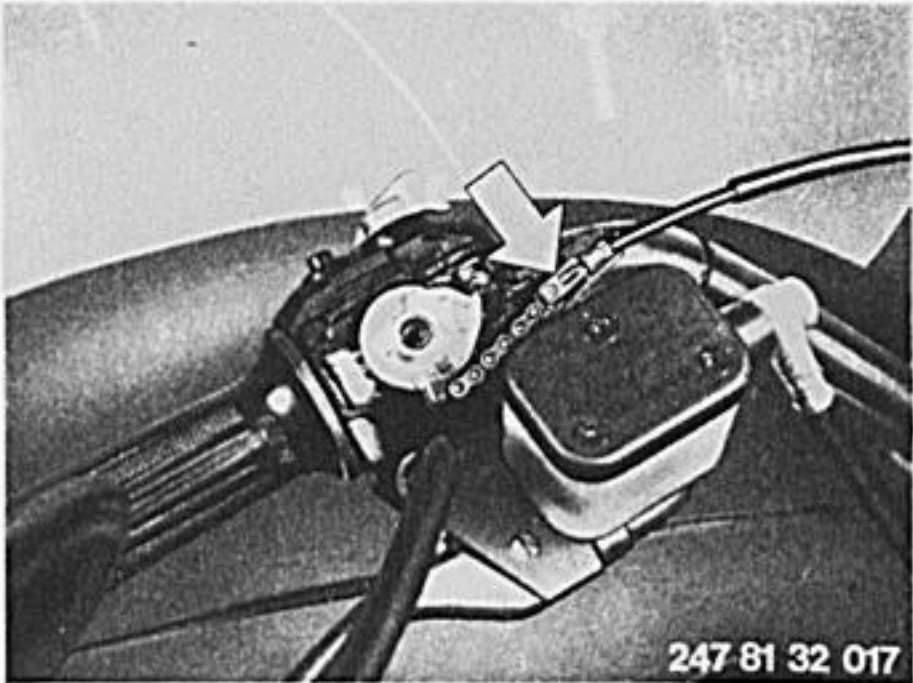


Pull off the left handlebar grip. Blow through the handlebar tube from the right with compressed air to loosen the handgrip. Remove the Allen screw (arrow) from the housing and pull the complete assembly off the handlebar tube.

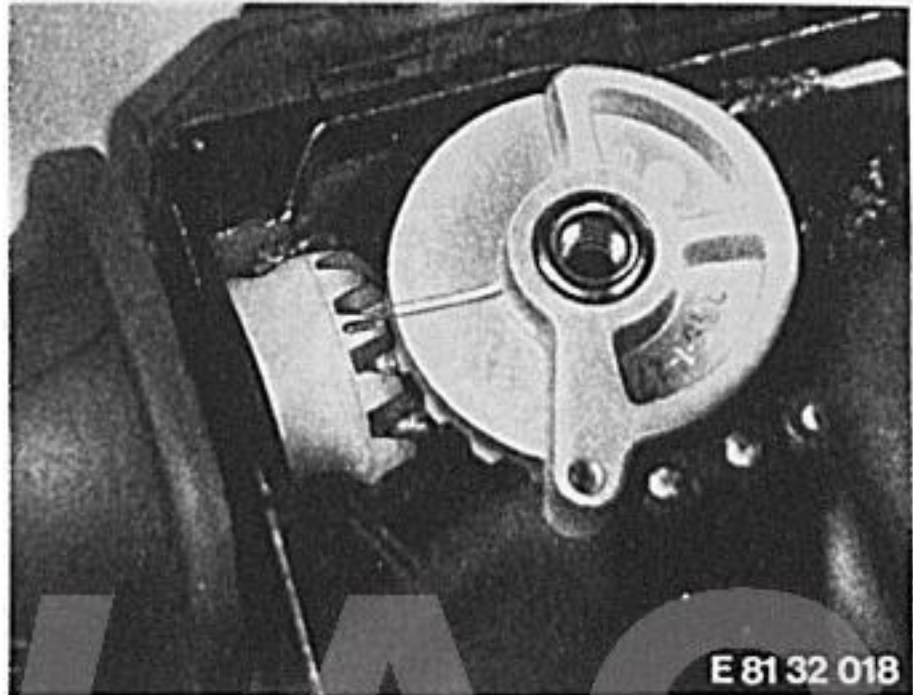


32 73 030 Throttle cable – removing and installing (1981 models)

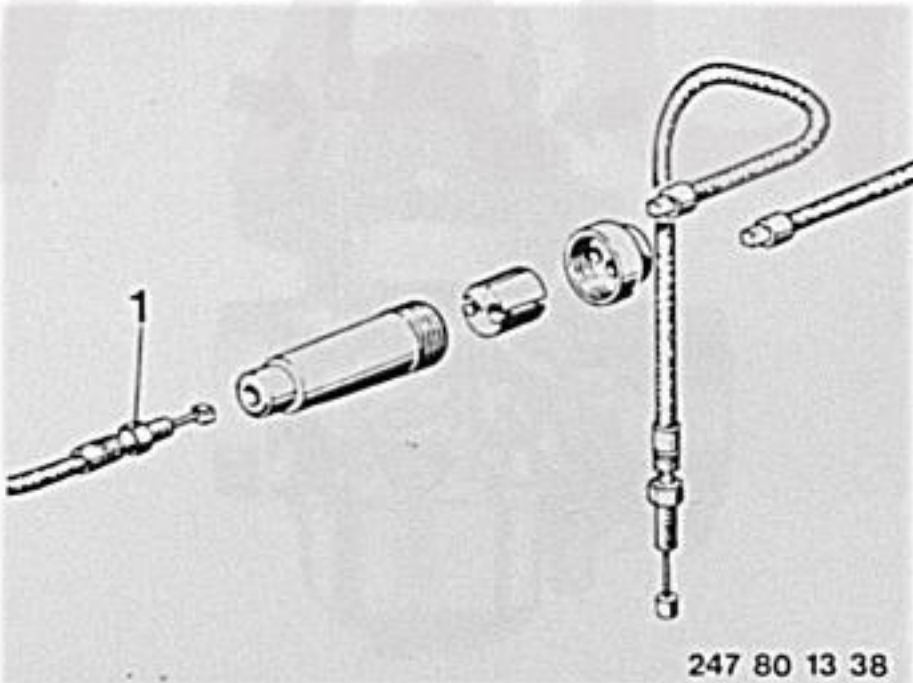
Remove dual seat and fuel tank – 16 11 030.
Push back the moisture-seal cap on the cable, unscrew the throttle cable mechanism cover and disconnect the cable from the chain (arrow).



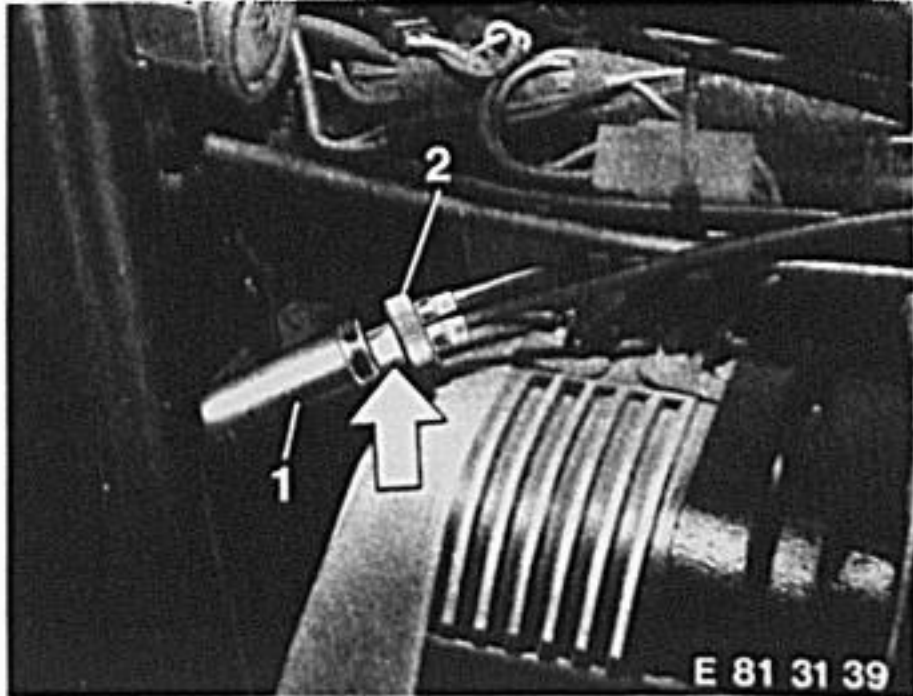
When installing: grease the teeth and the cam in the twistgrip before assembly. Make sure that the mark on the teeth at the twistgrip is aligned with the mark on the cam.

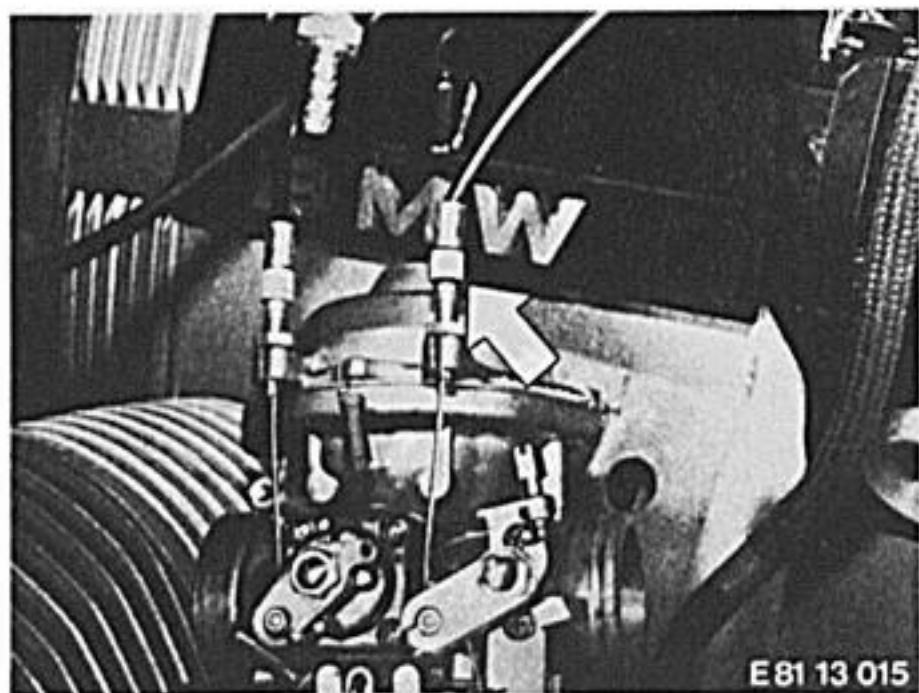


Slacken off the locknut (1) on the adjusting screw at the junction block, and tighten the adjusting screw fully.



Turn the sleeve of the junction block (1), holding the knurled section (2) firmly.
Disconnect the cables from the junction block (arrow).





Slacken the locknut on the adjusting screw at the carburettor and remove the screw (arrow) from the carburettor body. Detach the cable from the throttle control.

Note: Adjust engine idle speed and mixture – 13 00 004.



BMW AG

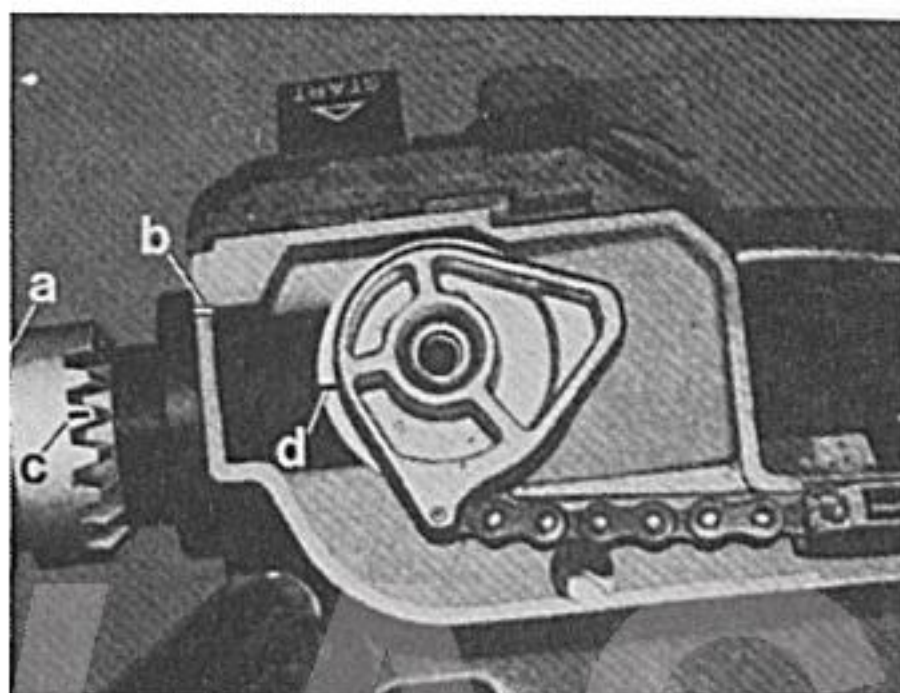
32 73 030 Removing and Installing Accelerator Cable

Push back water cap 1 and unscrew cover 2.

Detach accelerator cable.

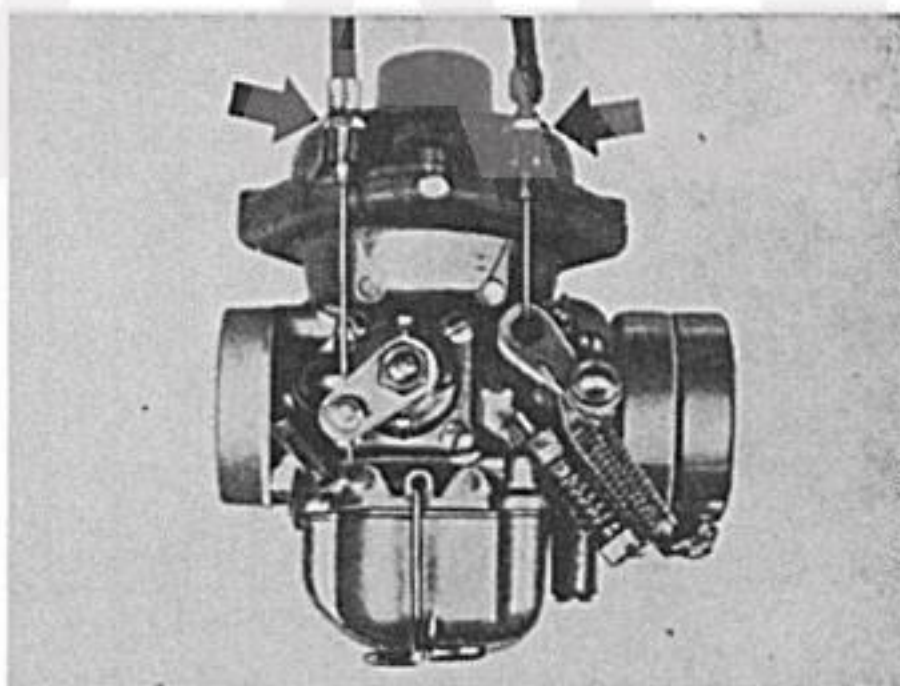
■

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 and suspension

Specifications	Page	33- 0/3
Specifications (1981 models)		33- 0/7
33 10 050 Rear wheel drive – removing and installing		33-10/1
33 10 113 Rear wheel drive – stripping and assembling		33-10/2
33 12 051 Bevel pinion and crownwheel – renewing		33-12/1
33 17 350 Rear swinging arm – removing and installing		33-17/1
33 17 381 Taper roller bearings for rear swinging arm – renewing		33-17/2
33 52 120 Spring strut – removing and installing		33-52/1
33 52 021 Damper – removing and installing		33-17/2
Troubleshooting – rear wheel drive		33-17/5

BMW AG

Rear wheel drive

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Tooth contact pattern	Klingelnberg (Palloid) spiral bevel		
Number of teeth	34 : 8	35 : 9	31 : 9
Ratio	1 : 4.25	1 : 3.89	1 : 3.44
Oil grade (initial filling)	Brand-name running-in grade hypoid gear oil, SAE 90		
After first oil change	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80		
Oil content liters (Imp. pints, US quarts)	0.25 (0.44, 0.26)		
Tooth backlash mm (in)	0.15 . . . 0.20 (0.006 . . . 0.008)		
Crownwheel side play	zero (no gasket)		
Rear suspension	Swinging arm, with 3-position spring struts incorporating double-acting hydraulic dampers		
Suspension travel mm (in)	110 (4.33)		
Damper test			
Test stroke mm (in)	25 (0.98)	75 (2.95)	50 (1.97)
Speed min ⁻¹	100	100	382
Traction phase kp (lb. f)	30±6 (66±13)	62±7 (137±15)	88±10 (194±22)
Compression phase kp (lb. f)	5±3 (11±7)	9±3 (20±7)	28±5 (62±11)

Rear wheel drive

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Springs			
Installed length mm (in)	190.5 (7.50)		
Relaxed length mm (in)	244±4 (9.61±0.16)		
Extl. dia. of spring mm (in)	57.5 (2.26)		
Intl. dia. of spring mm (in)	42.5 (1.67)		
Wire thickness mm (in)	7.5 (0.295)		
Swinging arm			
Oil grade	above 5° C (41° F) below 5° C (41° F)	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80	
Oil content liters (Imp. pints, US quarts)	0.15 (0.26, 0.16)		

Tightening torques Nm (lb. ft)

Nut on drive pinion	150+15 (111+11)	Rear wheel drive oil drain plug	23 ... 26 (17 ... 19)
Threaded ring in housing	100 ... 120 (74 ... 88)	Swinging arm oil filler plug	14 (10.3)
Rear wheel drive oil filler plug	28 ... 31 (21 ... 23)	Swinging arm oil drain plug	14 ... 17 (10.3 ... 12.5)
Swinging arm pivot pin	10 ... 12 (7.3 ... 8.8)	Drive shaft cover nuts	18 ... 21 (13 ... 15)
Damper rod at upper spring strut eye	30 ... 34 (22 ... 25)	Locknut for swinging arm pivot pin	100 ... 110 (74 ... 81)
		Clamp bolt for rear quick-release axle	14-18 (10.3 ... 13.3)

All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

Rear wheel drive

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Tooth contact pattern	Klingelnberg (Palloid) spiral bevel			
Number of teeth	34 : 8	35 : 9	31 : 9	
Ratio	1 : 4.25	1 : 3.89	1 : 3.44	
Oil grade (initial filling)	Brand-name running-in grade hypoid gear oil, SAE 90, API Class GL5			
After first oil change	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80			
Oil content liters (Imp. pints, US quarts)	0.35 (0.62, 0.37) (max. content up to level checking screw)			
Tooth backlash mm (in)	0.08 ... 0.15 (0.003 ... 0.006)			
Crownwheel side play mm (in)	0.1 (0.004)			
Rear suspension	Swinging arm, with 3-position spring struts incorporating double-acting hydraulic dampers			
Suspension travel mm (in)	110 (4.33)			
Damper test				
Test stroke mm (in)	25 (0.98)	75 (2.95)	50 (1.97)	
Speed min ⁻¹	100	100	382	
Traction phase kp (lb. f)	30±6 (66±13)	62±7 (137±15)	88±10 (194±22)	
Compression phase kp (lb. f)	5±3 (11±7)	9±3 (20±7)	28±5 (62±11)	

Rear wheel drive

Specifications (1981 models)

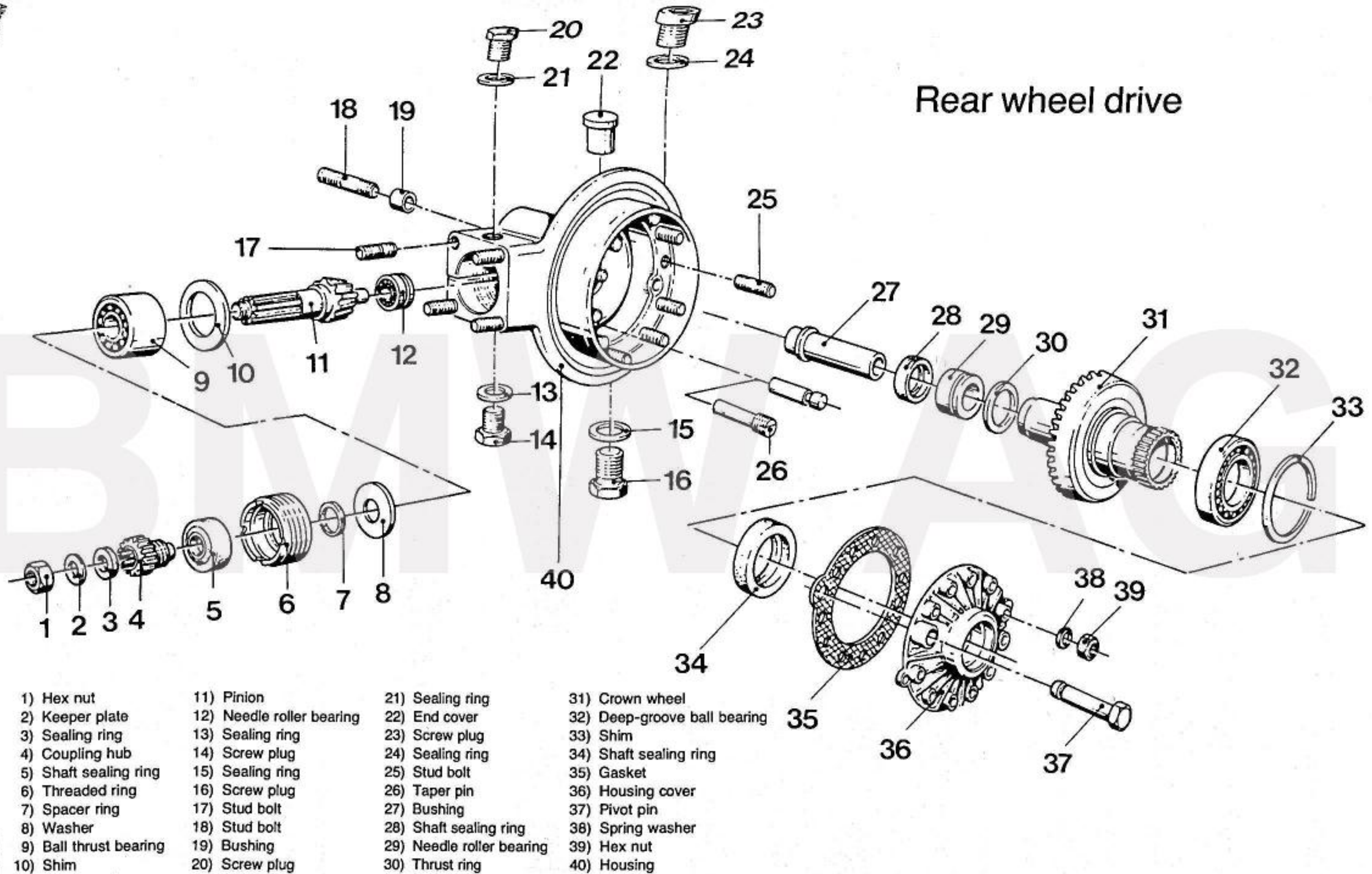
Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Springs				
Installed length mm (in)	190.5 (7.50)			
Relaxed length mm (in)	244±4 (9.61±0.16)			
Extl. dia. of spring mm (in)	57.5 (2.26)			
Intl. dia. of spring mm (in)	42.5 (1.67)			
Wire thickness mm (in)	7.5 (0.295)			
Swinging arm				
Oil grade	above 5° C (41° F) below 5° C (41° F)	Brand-name hypoid gear oil, SAE 90 Brand-name hypoid gear oil, SAE 80 API Class GL 5		
Oil content liters (Imp. pints, US quarts)	0.15 (0.26, 0.16)			

Tightening torques Nm (lb. ft)

Final drive oil drain plug	25.5 (18.8)	Nut on input pinion	165 (122)
Swinging arm oil filler plug	screwed in but not over-tightened	Threaded ring in final drive casing	118 (87)
Swinging arm oil drain plug	15.7 (11.6)	Final drive oil level check screw	10 (7.4)
Nut for final drive cover	17.7 (13.1)	Swinging arm pivot pin	10 + 2 (7.4 + 1.5)
Spring strut lug at piston rod	38 ± 2 (28.0 ± 1.5)	Locknut for swinging arm pin	100 + 20 (74 + 15)
Twelve-sided nut for final drive housing/swinging arm mounting	47 (35)	Spring strut retaining bolts	35 + 5 (26 + 3.7)

All other bolts and nuts are to be tightened as shown in the manufacturers' tables or on the latest BMW 600002.0 standards sheet.

Rear wheel drive

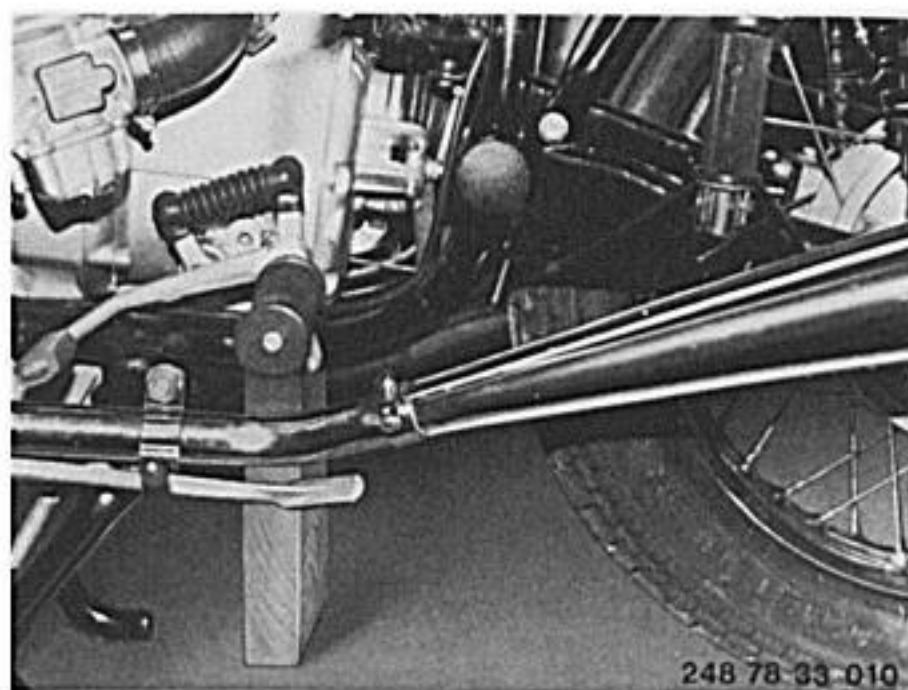


- | | | | |
|------------------------|---------------------------|---------------------------|------------------------------|
| 1) Hex nut | 11) Pinion | 21) Sealing ring | 31) Crown wheel |
| 2) Keeper plate | 12) Needle roller bearing | 22) End cover | 32) Deep-groove ball bearing |
| 3) Sealing ring | 13) Sealing ring | 23) Screw plug | 33) Shim |
| 4) Coupling hub | 14) Screw plug | 24) Sealing ring | 34) Shaft sealing ring |
| 5) Shaft sealing ring | 15) Sealing ring | 25) Stud bolt | 35) Gasket |
| 6) Threaded ring | 16) Screw plug | 26) Taper pin | 36) Housing cover |
| 7) Spacer ring | 17) Stud bolt | 27) Bushing | 37) Pivot pin |
| 8) Washer | 18) Stud bolt | 28) Shaft sealing ring | 38) Spring washer |
| 9) Ball thrust bearing | 19) Bushing | 29) Needle roller bearing | 39) Hex nut |
| 10) Shim | 20) Screw plug | 30) Thrust ring | 40) Housing |

33 10 050 Rear wheel drive — removing and installing

Remove and install the rear wheel — 36 30 320.

Place the motorcycle on its center stand and support below the swinging arm bearing so that the rear wheel can rotate freely.



Unscrew and remove the right spring strut retaining bolt (arrow) and take off complete with washer.

Remove screw (2) and drain the oil from the right swinging arm. Unscrew the filler plug (1) as well to vent the arm and enable the oil to drain more quickly.

When installing: after re-assembling, add oil. See Specifications for oil grade, oil capacity and tightening torques.

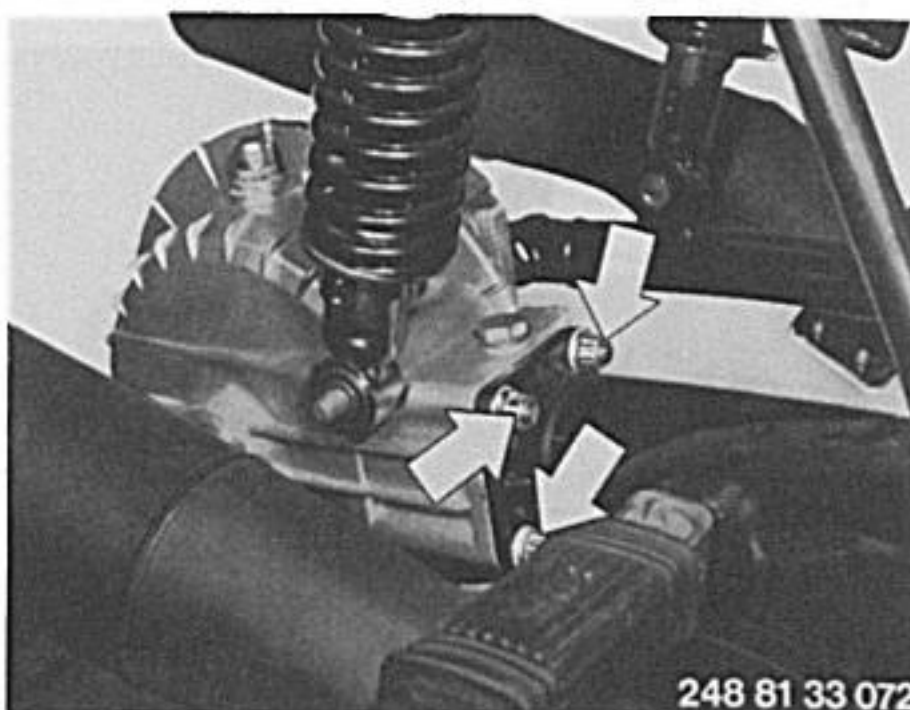


Unscrew the hex or wing nut from the brake rod. Pull the brake rod (1) off the brake lever (2). Remove the hollow pin (3) from the lever, place it on the brake rod and secure with the wing or hex nut.



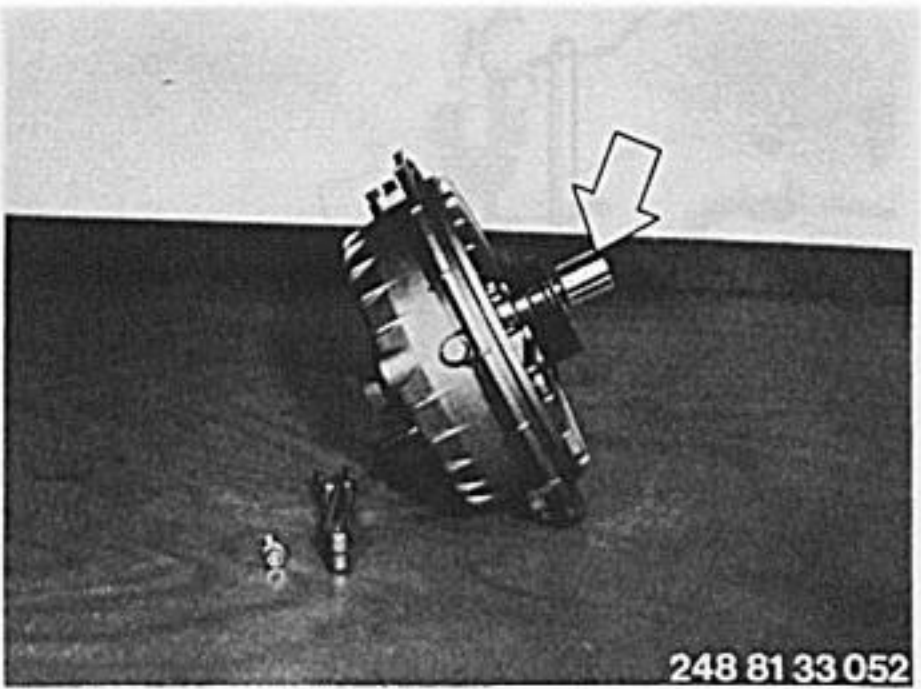
Loosen the upper spring strut retaining bolt and unscrew the 4 nuts (arrows) with spring washers from the bolts securing the right swinging arm. Remove the rear wheel drive.

When assembling, only tighten these four nuts when the axle has been inserted through the rear wheel drive and the axle clamp. See Specifications for tightening torques.

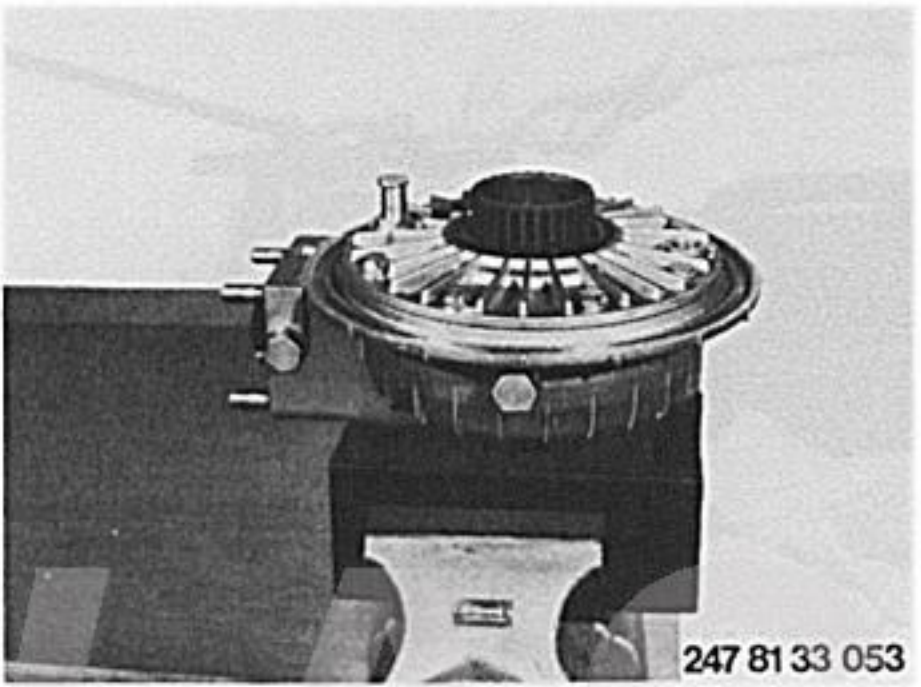


33 10 113 Rear wheel drive – stripping and assembling

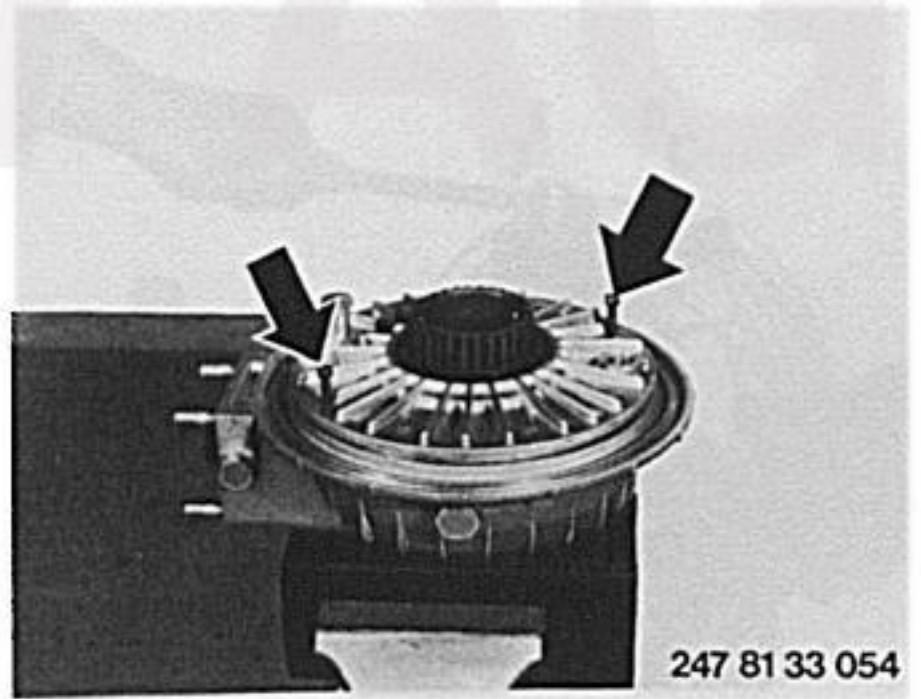
Remove (install) rear wheel drive – 30 10 050.
Drain the oil.
Remove (install) brake shoes – 34 21 150.
Remove clamp screw at brake lever and remove the lever. Pull the brake cam (arrow) out of the rear wheel drive.



Install the rear wheel drive in assembly stand BMW No. 33 1 600 (arrow).

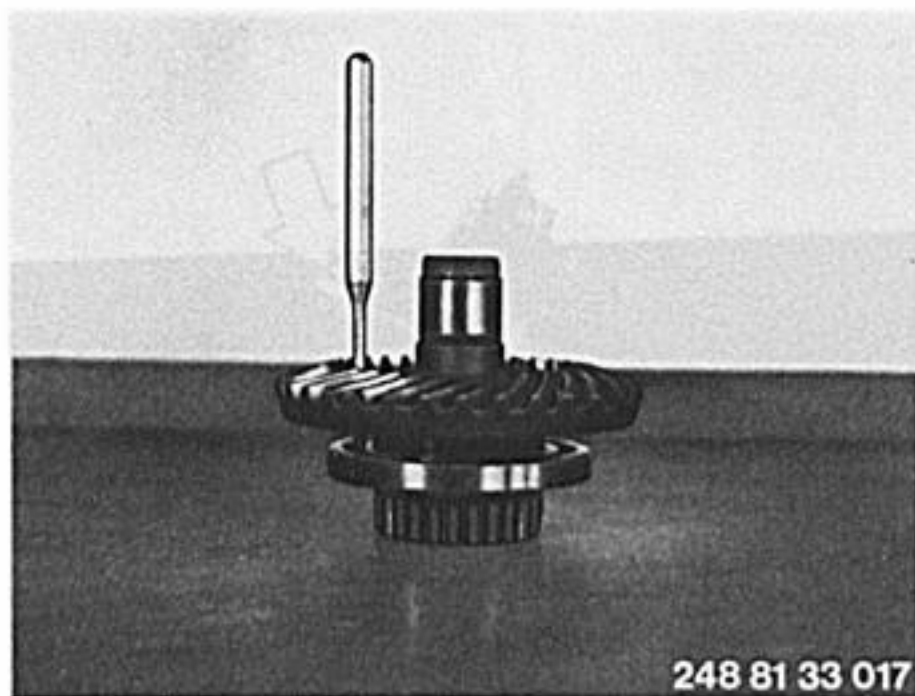


Unscrew the hex bolts from the cover. Heat the cover to app. 80° C (176° F) and force off with two M 5×30 mm bolts (arrows). Take out the oil trap plate.
When installing: Seal the cover with Loctite No. 573 or a paper gasket.
Push assembly sleeve BMW No. 33 1 000 through the shaft sealing ring in the housing cover, then place it on the input gear teeth of the crown wheel and press the cover on to the housing. Heat the cover to app. 80° C (176° F).

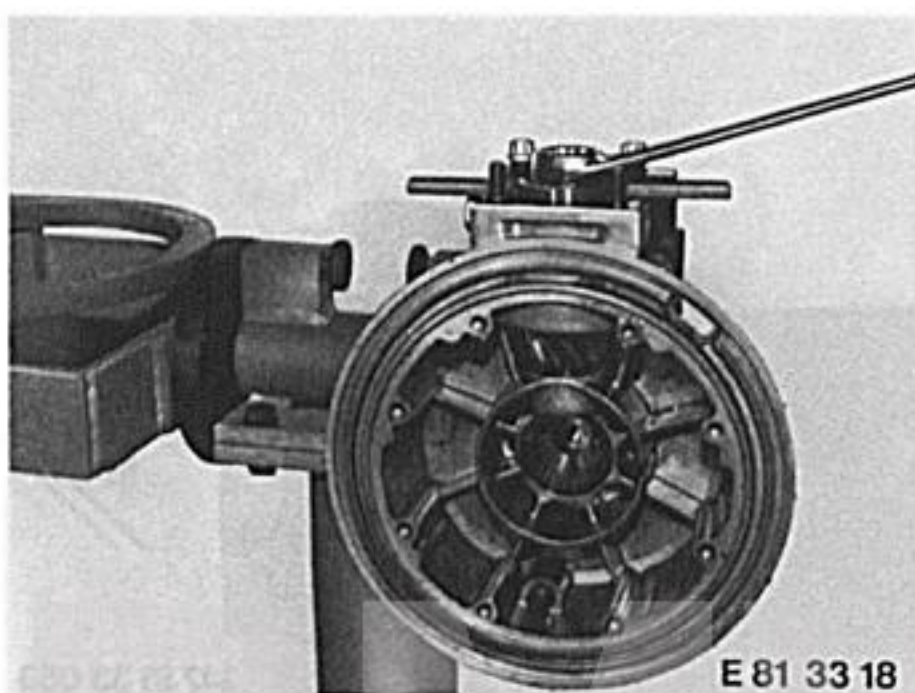


Drive out the shaft sealing ring with a drift from the cover.
Force in the new sealing ring with drift BMW No. 33 1 850 and handle BMW No. 00 5 500.
Note: place the cover on the smooth side of the guide.



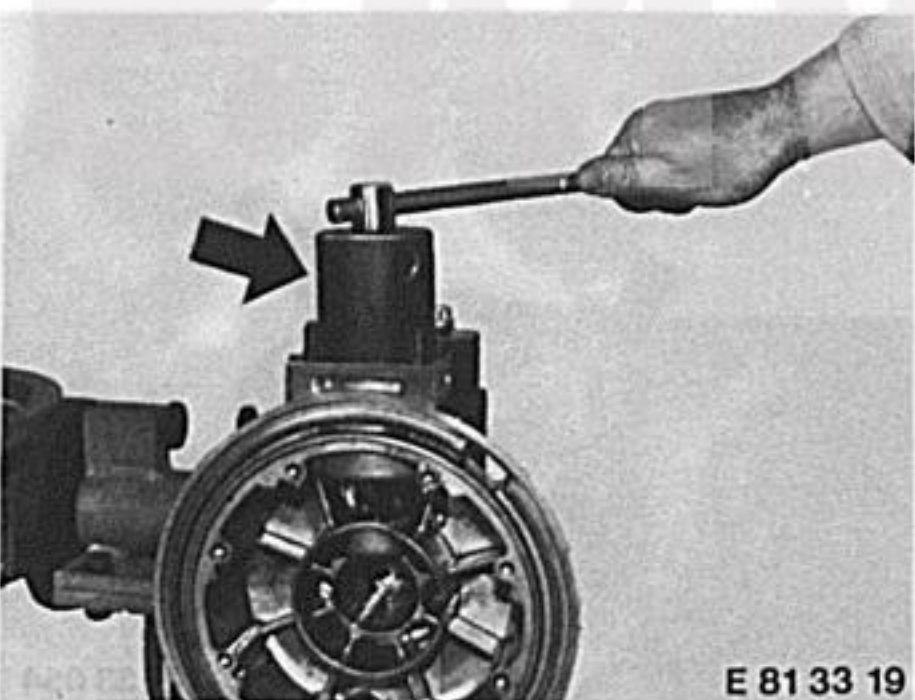


Separate the deep-groove ball bearing from the crown wheel by applying uniform blows of a soft metal drift through the holes provided in the crown wheel.

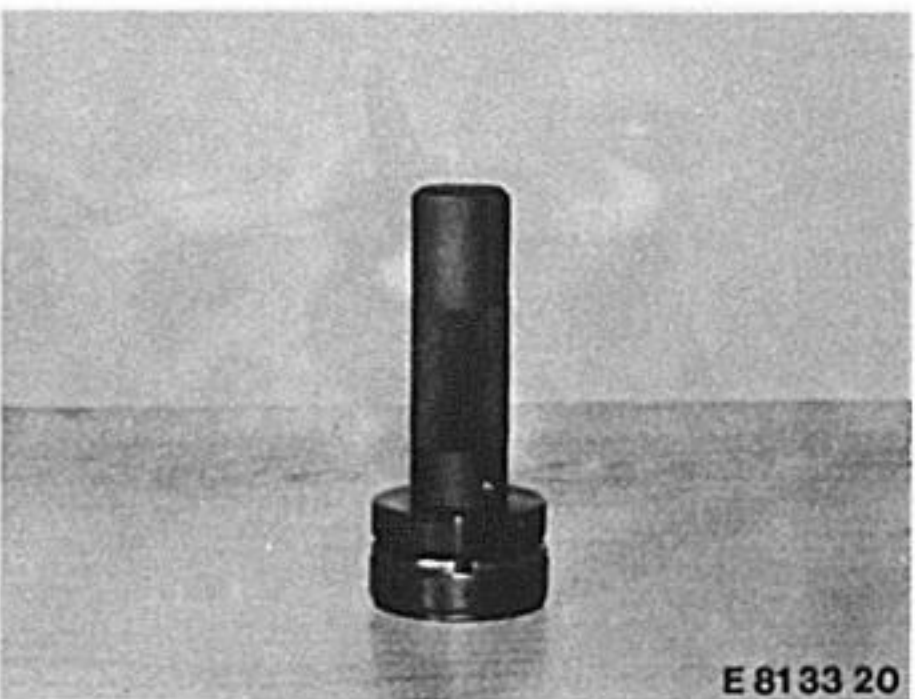


Position the assembly stand vertically. Unscrew the nut from the input pinion and pull off the washer with plastic ring and the pinion.

When installing: the nut is secured with Loctite 274; for tightening torque, see Specifications.



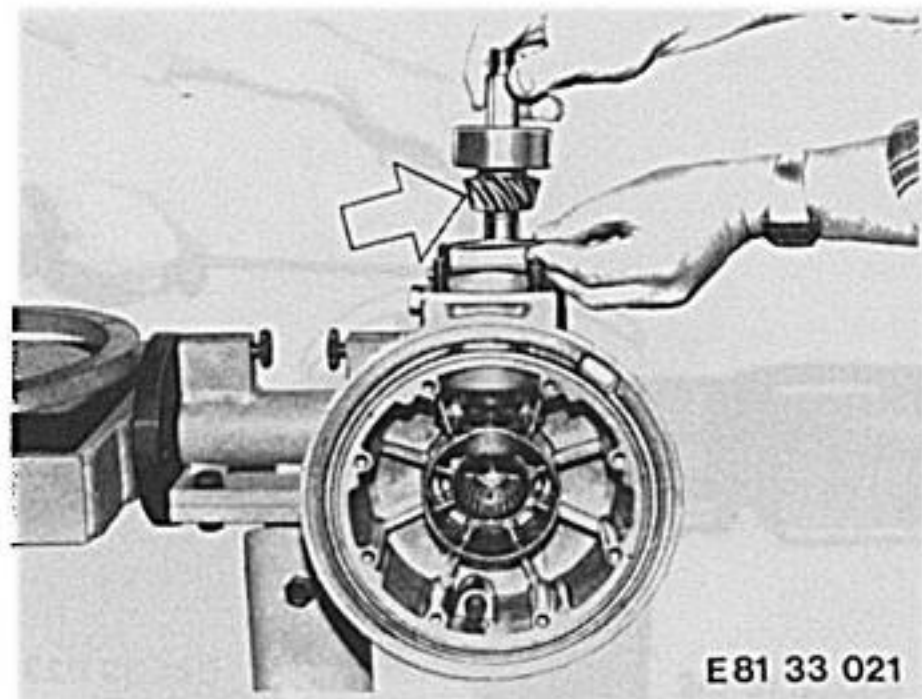
Unscrew and remove the threaded ring complete with shaft sealing ring, using pin wrench BMW No. 33 1 700 (arrow). Also remove the spacer ring and washer. See Specifications for tightening torque.



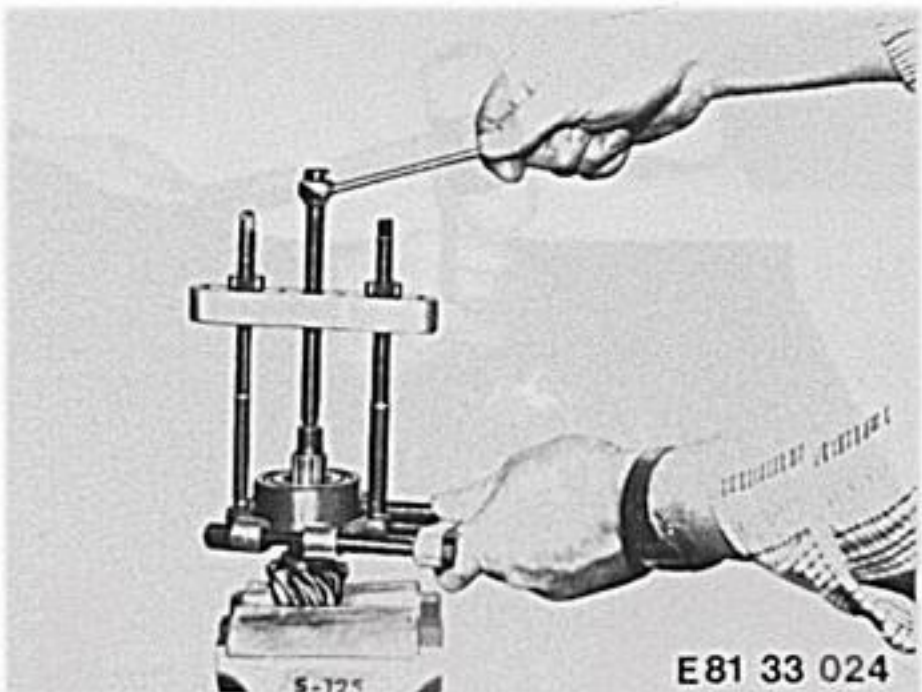
Drive the shaft sealing ring out of the threaded ring with a suitable drift.

Force in the new sealing ring with drift BMW No. 33 1 750 and handle BMW No. 00 5 500.

Heat the housing to app. 120° C (248° F) using a 'Thermochrome' pin. Remove the input bevel pinion (arrow) with ball thrust bearing and shim.

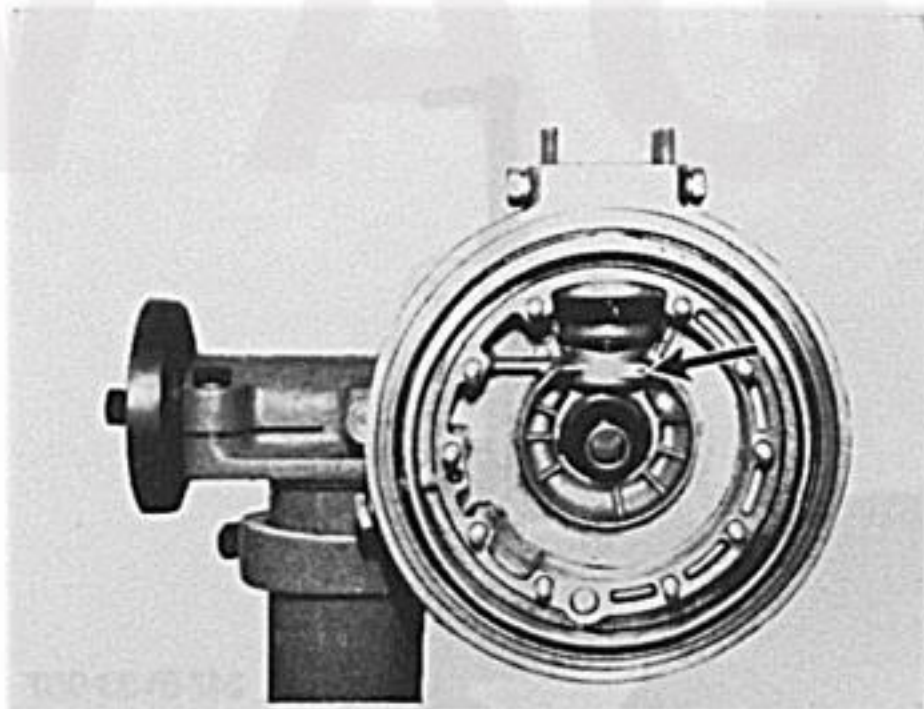


Using Kukko 17 K puller, BMW No. 00 7 500, pull the ball thrust bearing off the input bevel pinion.



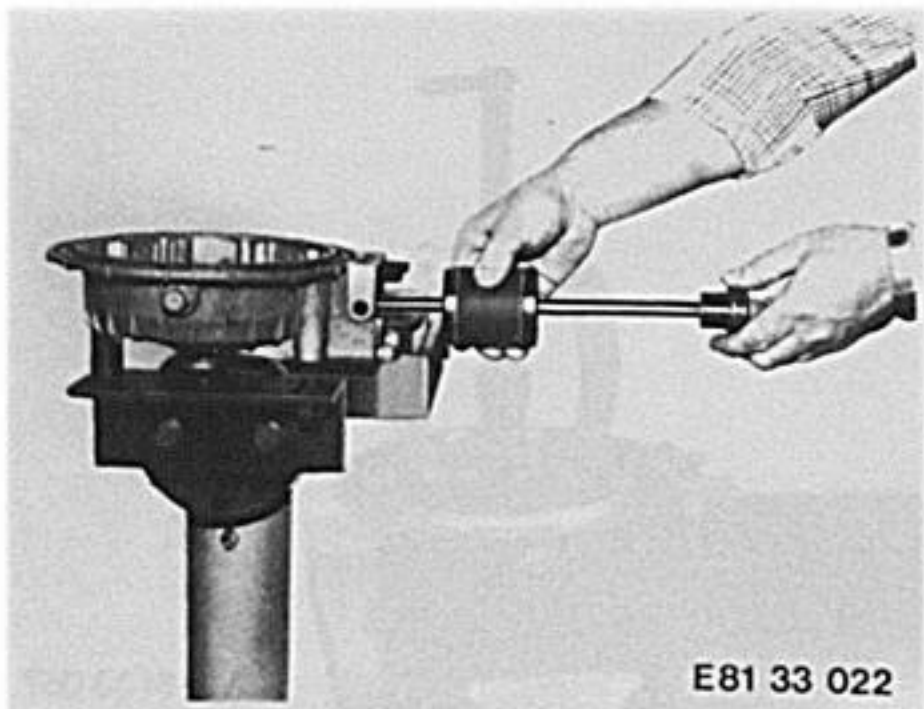
Renew the needle roller bearing for the pinion in the universal joint housing.

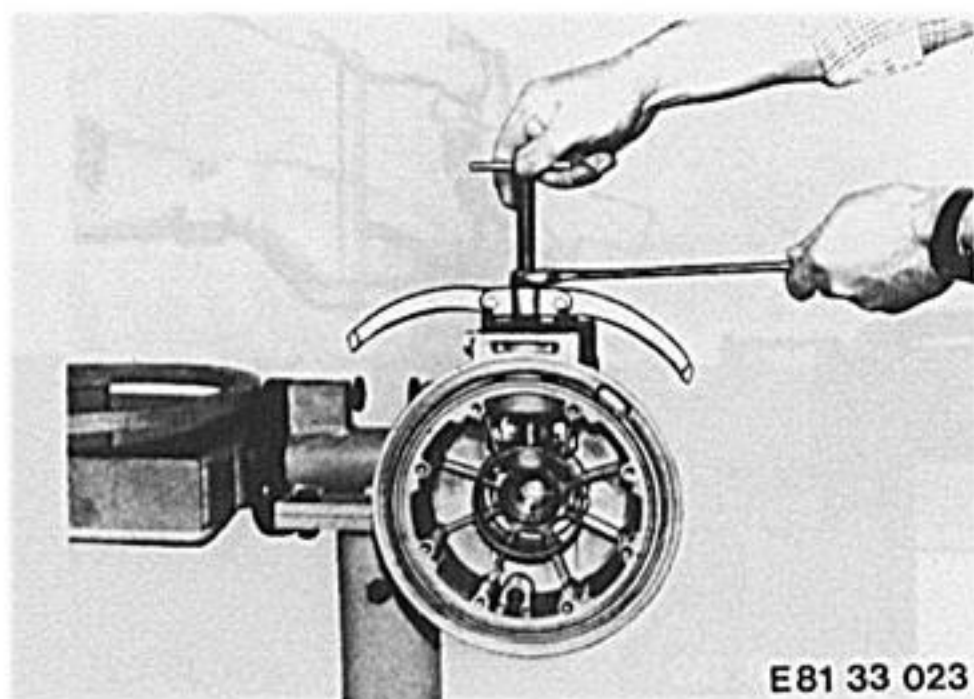
Unscrew and remove the screw (arrow) – on models up to 1979.



Heat the casing to app. 120° C (248° F). Pull out the needle roller bearing (from the input bevel pinion) with internal ball-bearing pul-
 ler No. 400 151/T 2.

When installing: heat the casing to app. 120° C (248° F) and drive in the needle roller bearing for the pinion with a suitable drift.

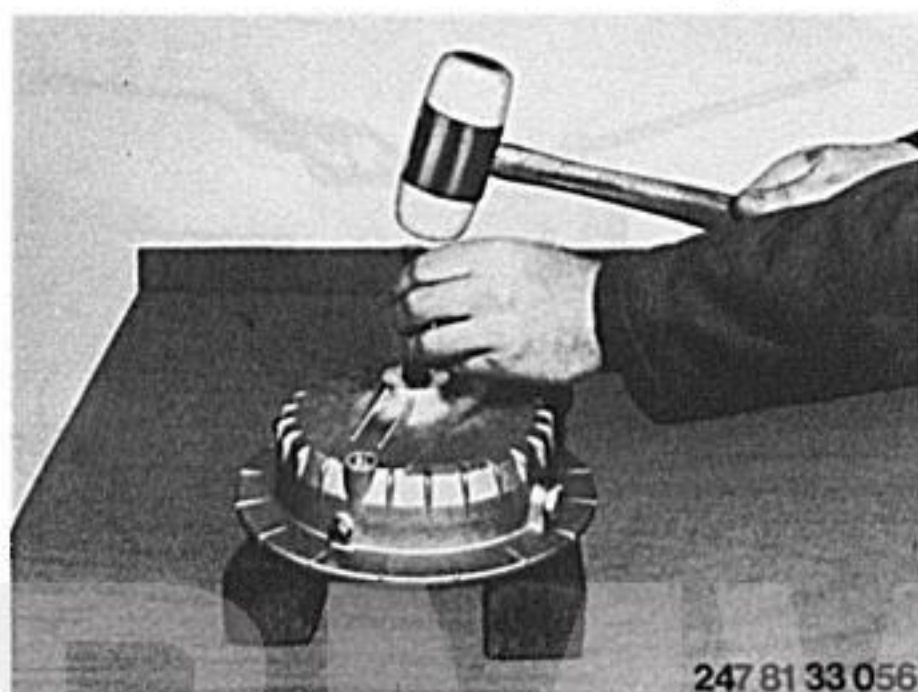




E81 33 023

Alternatively, force the bearing out with Kukko internal puller No. 21/3 and support 22/1.

Do not damage the sealing face.



247 81 33 056

To renew the needle roller bearing for the crown wheel, heat the casing to app. 100° C (212° F).

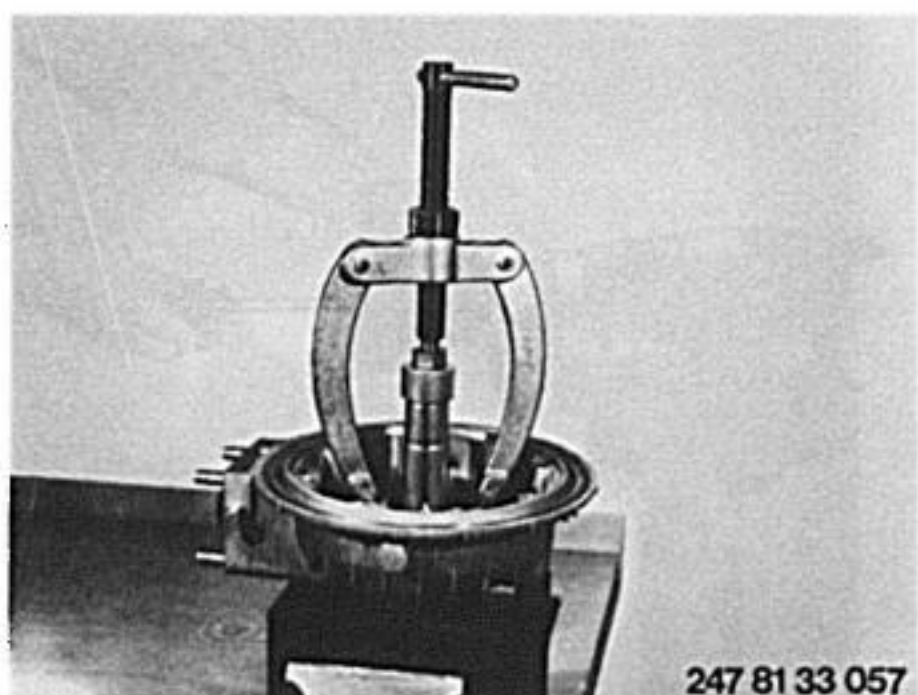
Place it on two wooden blocks with the cover side down and drive out the stub axle bushing with a 17.8 mm (0.7 in) drift.



247 81 33 057

Pull out the needle roller bearing with Kukko puller BMW No. 00 8 560, holding the bearing at the lower edge.

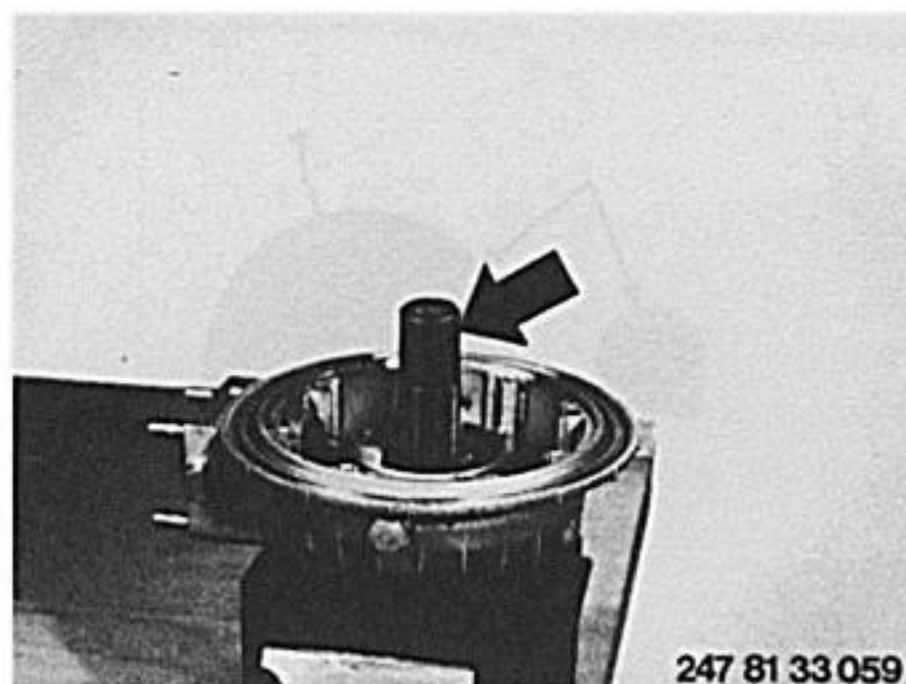
When installing: always heat the casing to app. 100° C (212° F) before inserting the needle roller bearing and the stub axle bushing.



247 81 33 057

Pull out the radial sealing ring with Kukko puller BMW No. 00 8 551 and the support bridge from BMW No. 00 8 560.

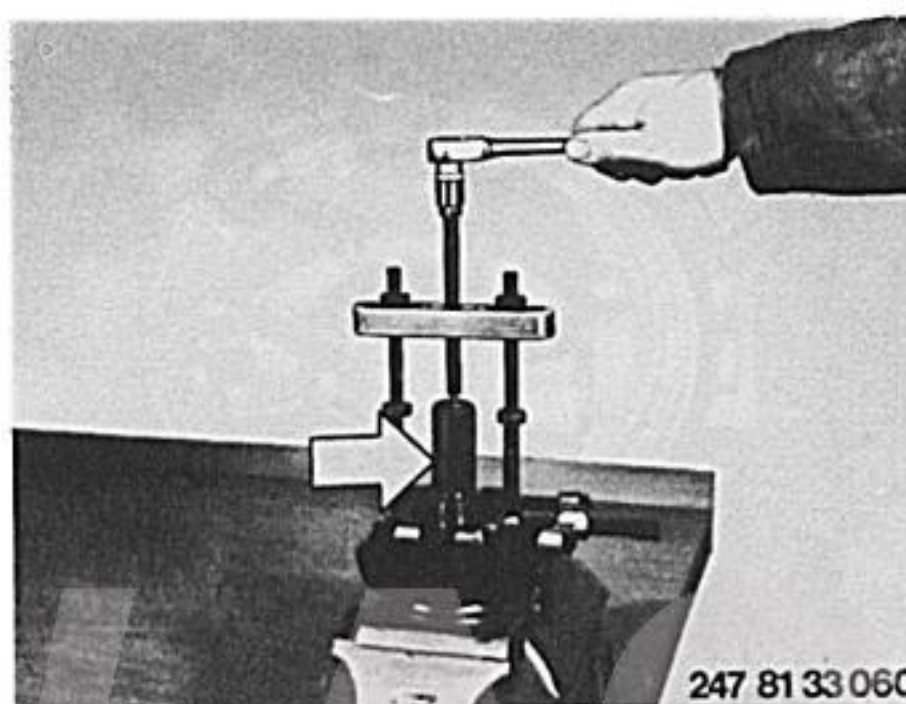
Press in the radial sealing ring with drift BMW No. 33 1 880 in conjunction with handle BMW No. 00 5 500; the open side of the sealing ring faces upwards.



Pull off the inner race of the needle roller bearing with the Kukko universal puller, BMW No. 00 7 500.

Use the 30 mm (1.18 in) spindle support (arrow).

Before assembling, heat the inner race to app. 120° C (248° F).



33 12 051 Drive (bevel) pinion and crown wheel – removing and installing

Strip (assemble) the final drive – 33 10 113.

Drive and crown wheels are matched together. Check to see that their numbers correspond (arrows).

During the assembly test procedure, tolerances are established which will result in smooth running and the correct tooth backlash, provided that numerically paired crown wheels and pinions are always used.



The basic size of the casing measured from the ball thrust bearing shoulder on the pinion to the center of the crown wheel shaft is 75.50 ± 0.05 mm (2.97 ± 0.002 in).

The basic size is not stamped on the casing. If the casing is of a different size, the two digits after the decimal point are marked on the inside in mm as shown (arrow).

The basic size of the pinion is 77.50 mm (3.05 in).

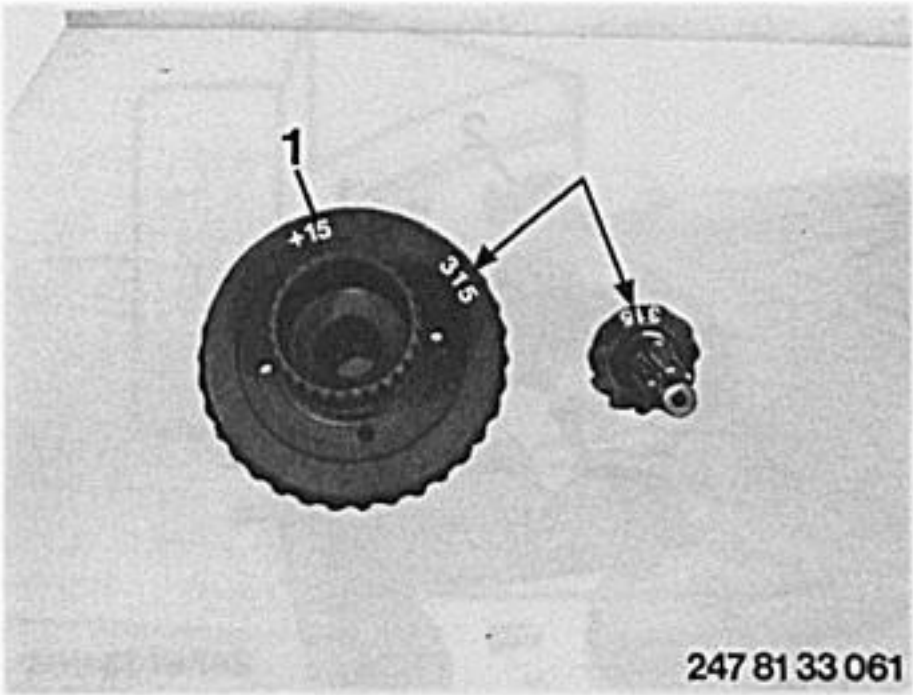
Any difference is marked on the crown wheel in mm (see illustration above) with a + or – sign.



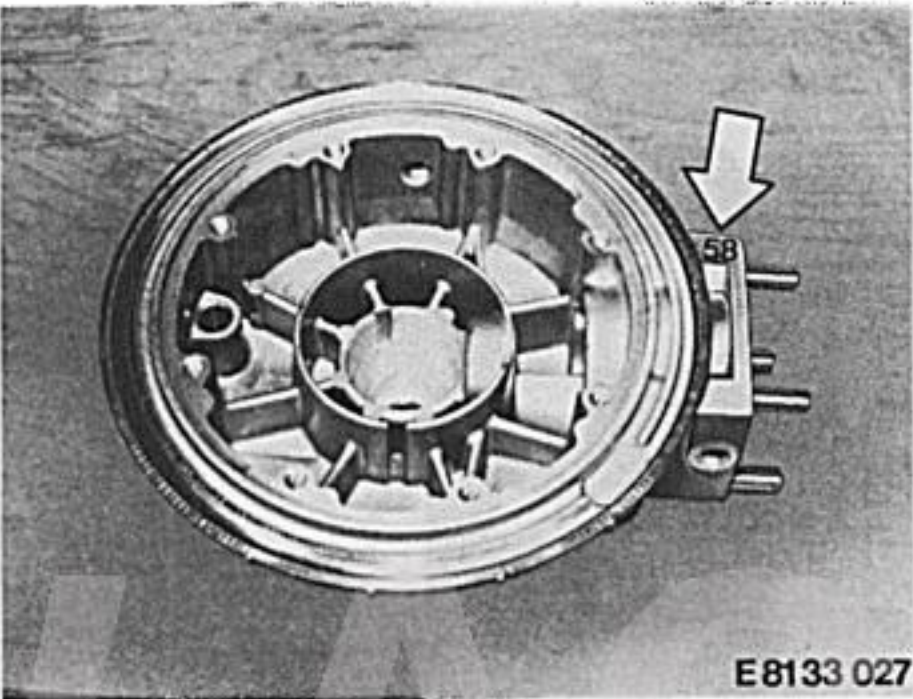
The thickness of the washer (arrow) between the ball thrust bearing shoulder and the seat in the casing is calculated by subtracting the size of the casing from the basic size of the pinion (plus or minus the deviation marked on the crown wheel). If there is no deviation marked on the crown wheel and no measurement on the casing, then the basic sizes apply. In this case the size of the washer will be $77.50\text{ mm} - 75.50\text{ mm} = 2\text{ mm}$ ($3.05 - 2.97\text{ in} = 0.08\text{ in}$). If a deviation of, for example, + 15 is marked on the crown wheel, the size of the washer will be $2.0\text{ mm} + 0.15\text{ mm} = 2.15\text{ mm}$ ($0.080 + 0.006\text{ in} = 0.086\text{ in}$).



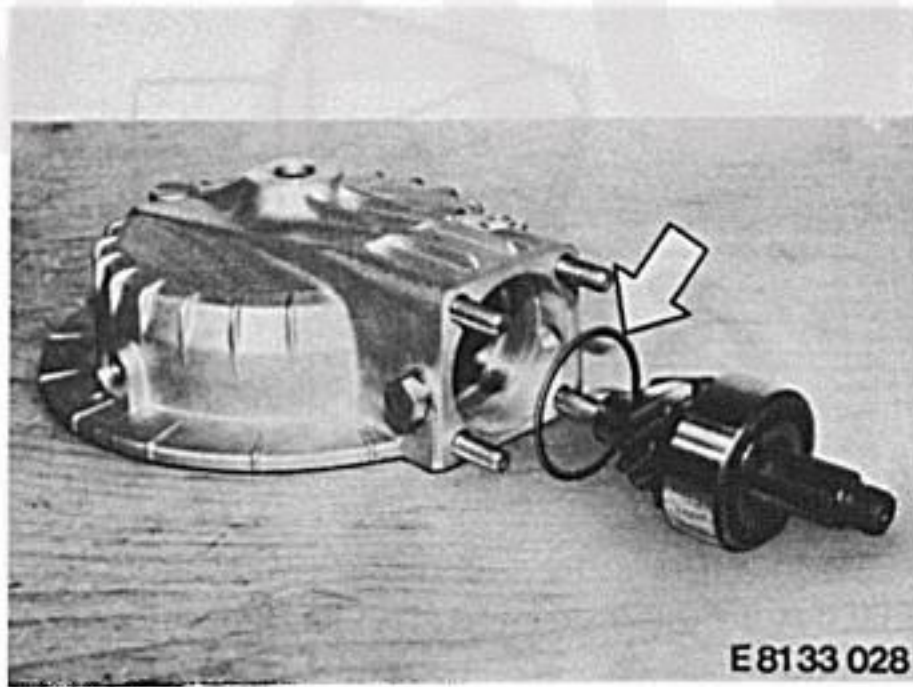
To obtain provisional tooth backlash, insert a bronze ring of sufficient thickness in the casing (arrow).



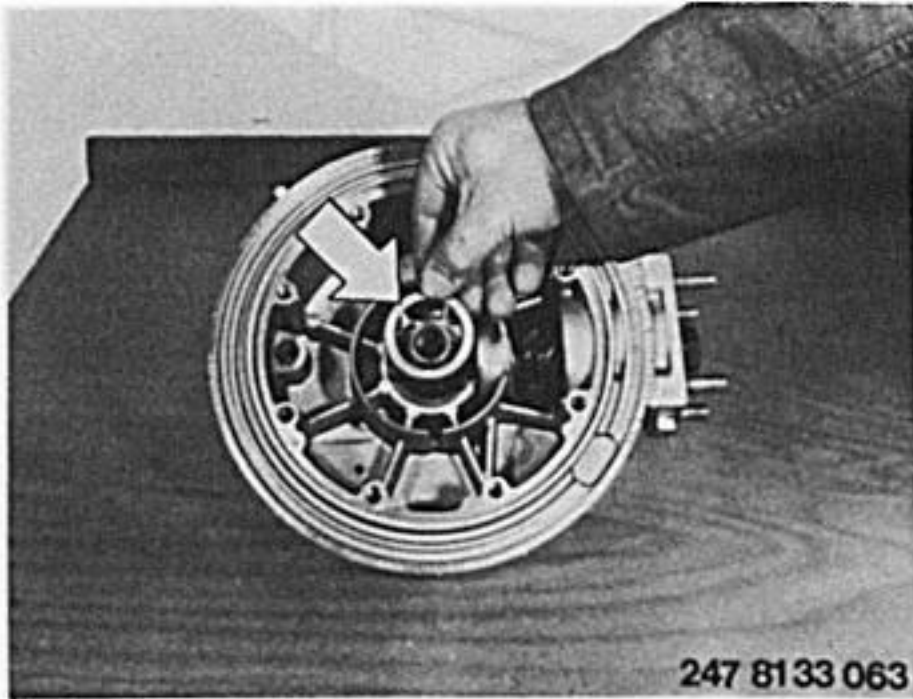
247 8133 061



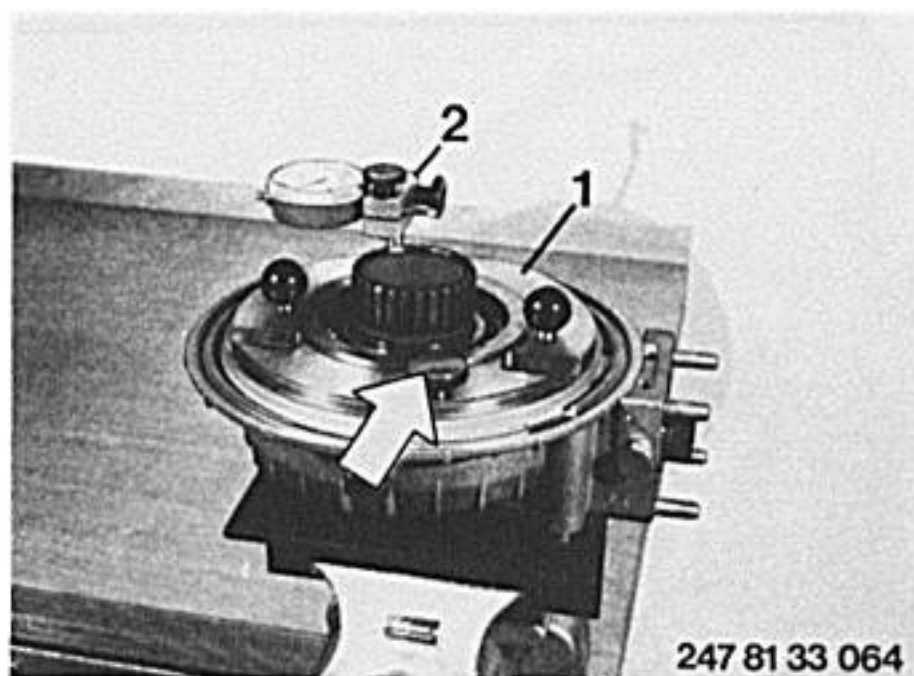
E 8133 027



E 8133 028



247 8133 063

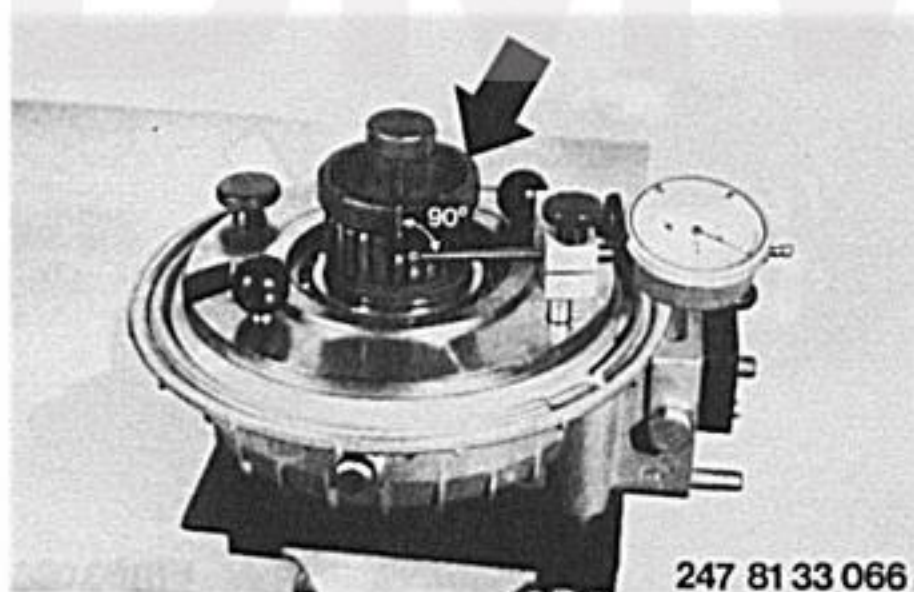


When adjusting tooth backlash use measuring device BMW No. 33 2 610. With the crown wheel installed, place the measuring ring (1) and dial gauge holder (2) on the rear wheel drive casing and turn the knurled thumbscrew (arrow) to hold it in place.



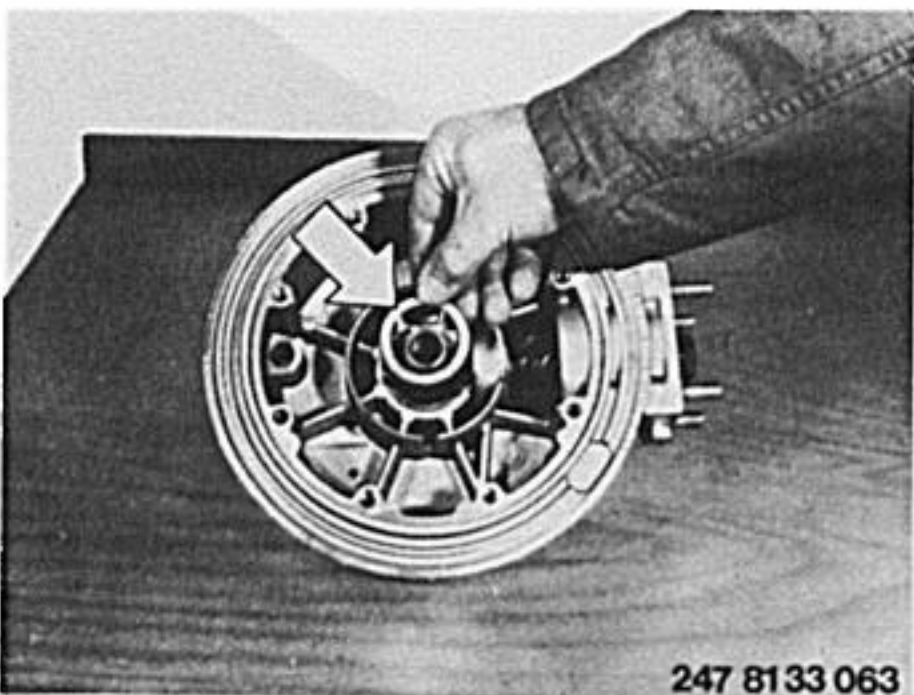
In order to measure tooth backlash with complete accuracy, the pinion drive must be held fast with locking device BMW No. 33 2 620 (arrow).

Note: the measuring ring can only be used on models from 1981 on. All other parts of the measuring device are for use on all models.



Clamp the measuring stop (arrow) to the crown wheel in such a way that the gauge probe, when opposite marking, is at an angle of 90° to the stop. Turn the crown wheel lightly to and fro. Check tooth backlash at three points (at 120° intervals).

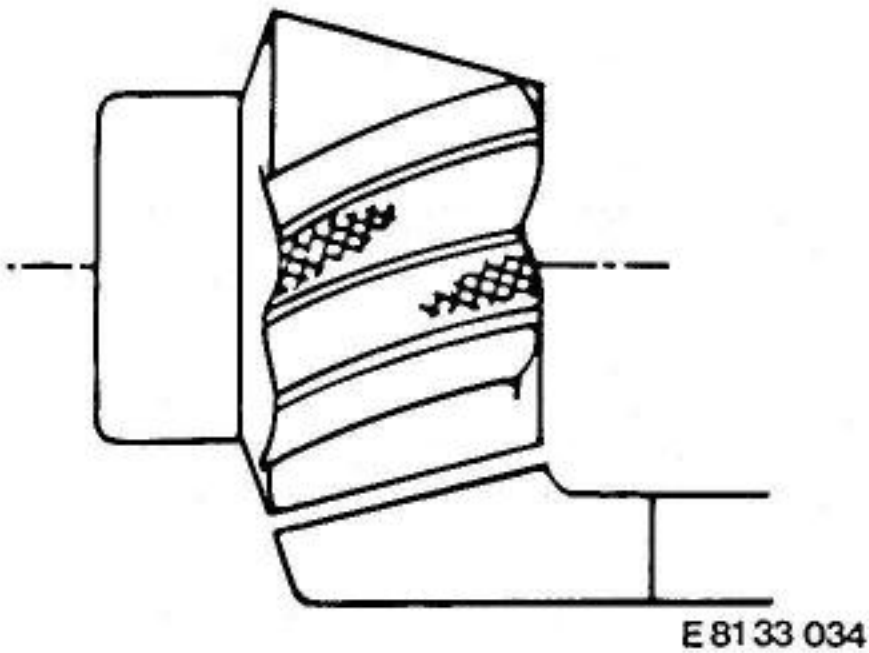
See Specifications for tooth backlash.



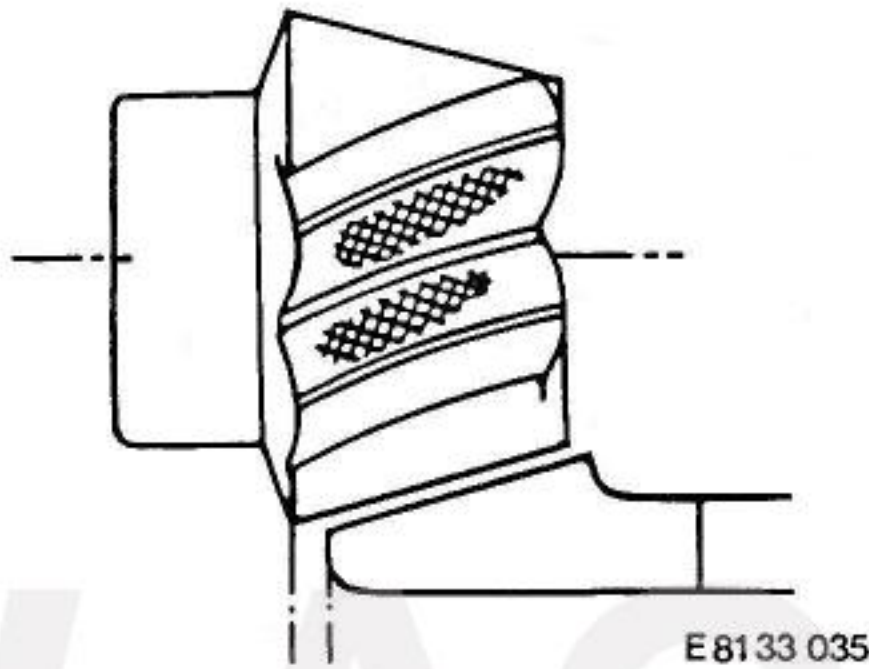
If tooth backlash is too small or too great, then a thicker or thinner bronze ring (arrow) must be inserted accordingly.

To check the tooth contact pattern, colour a few teeth of the drive wheel with engineer's blue or a light oil-bound paint. Install the crown wheel in the casing and turn it vigorously to and fro several times.

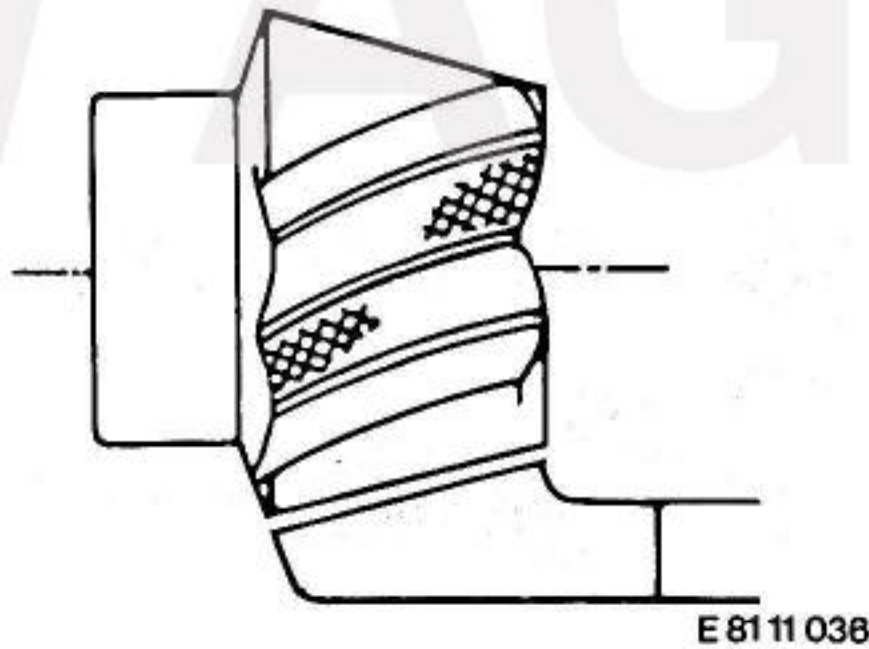
If the contact pattern looks like this (top picture), the drive wheel is too deep in the casing, and a wider spacer must be fitted.



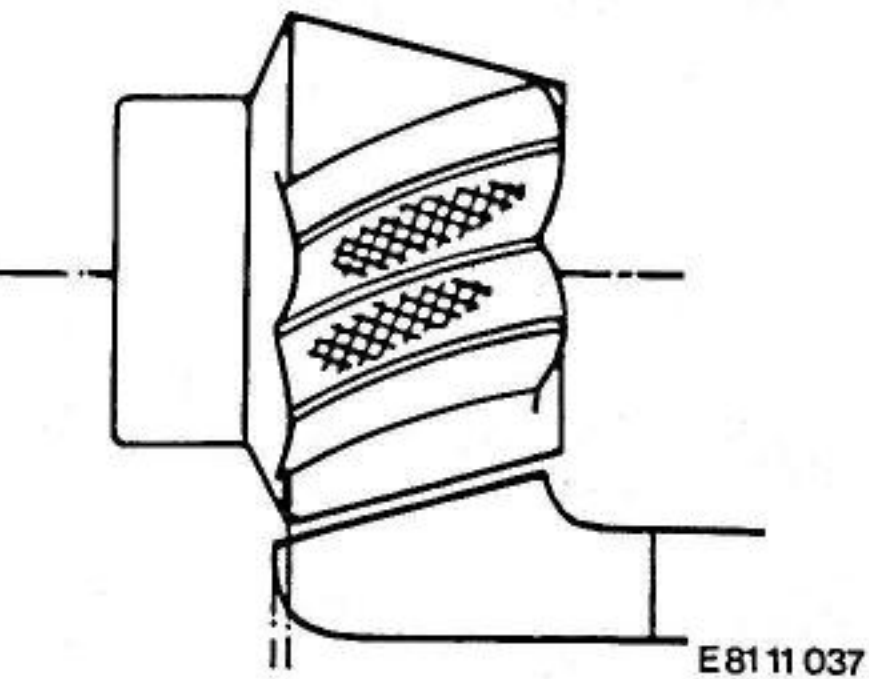
This contact pattern will then result.

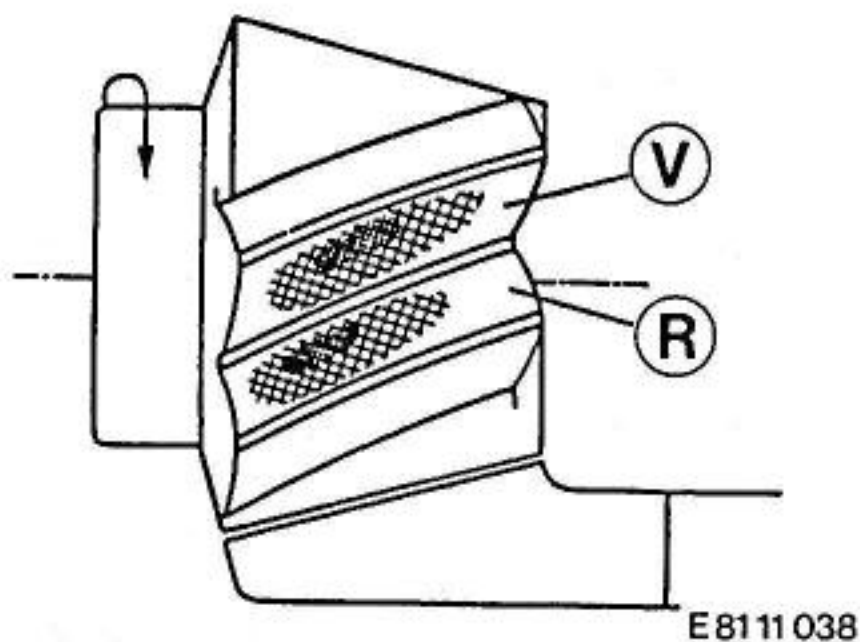


If the contact pattern looks like this, the drive wheel must penetrate deeper in the casing, so that a thinner spacer is necessary.

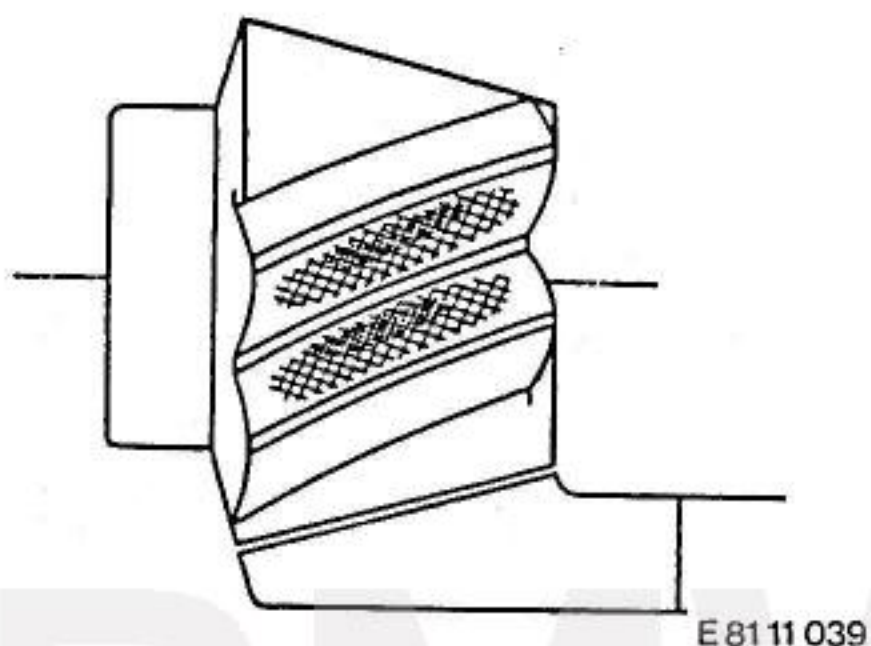


This contact pattern will then be obtained.

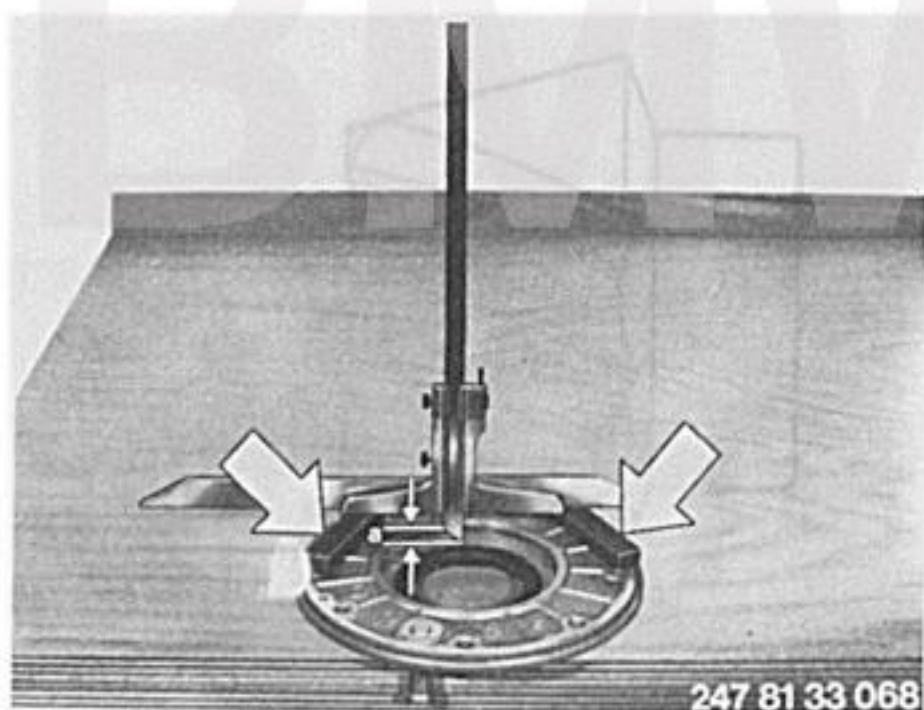




Correct contact pattern in off-load condition:
The contact pattern is in the middle of the forward flank 'V'. On the reverse flank 'R', the contact pattern is nearer the wide end.
The teeth must NEVER touch at the narrow end!



Under load the contact pattern then looks like this.



To adjust lateral play of the crown wheel (on 1981 models), place the ring of the measuring device on the final drive casing. Measure distance 'a' from the joint face of the cover to the ball bearing contact face, using depth gauge BMW No. 00 2 550 and the necessary intermediate spacers (arrows).

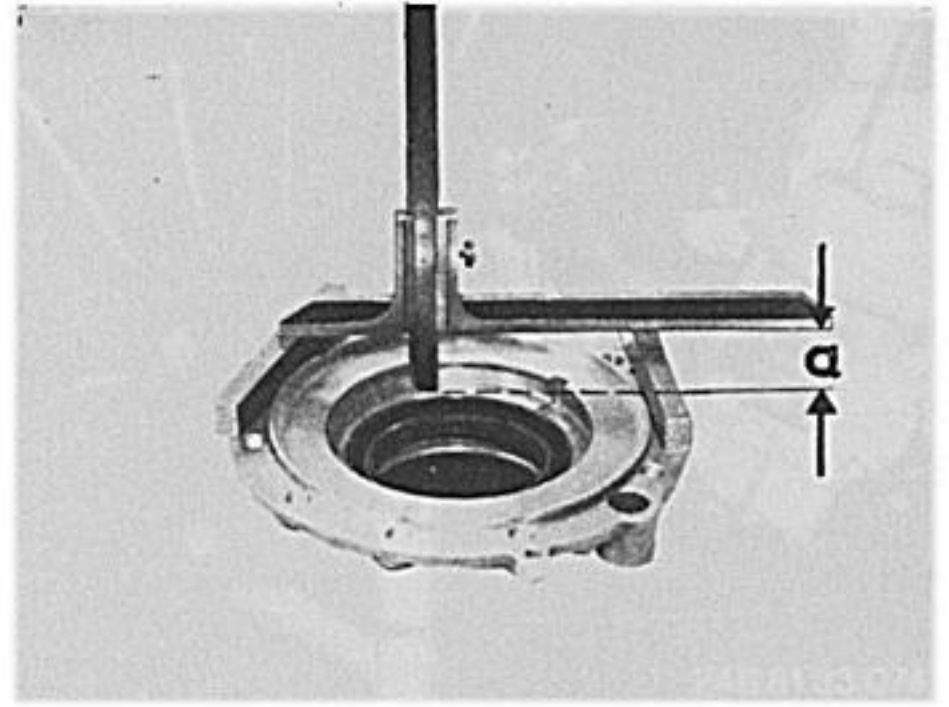
Measured distance	= 20.0 mm (0.787 in)
– spacer thickness	= 9.8 mm (0.386 in)
Dimension 'a'	= 10.2 mm (0.401 in)



Using depth gauge BMW No. 00 2 550, determine distance 'b'.
Measurement 1: from measuring ring through cutout to casing joint face (distance I)
Measurement 2: from measuring ring to outer race of ball bearing (distance II)
Distance I – distance II = dimension 'b'.

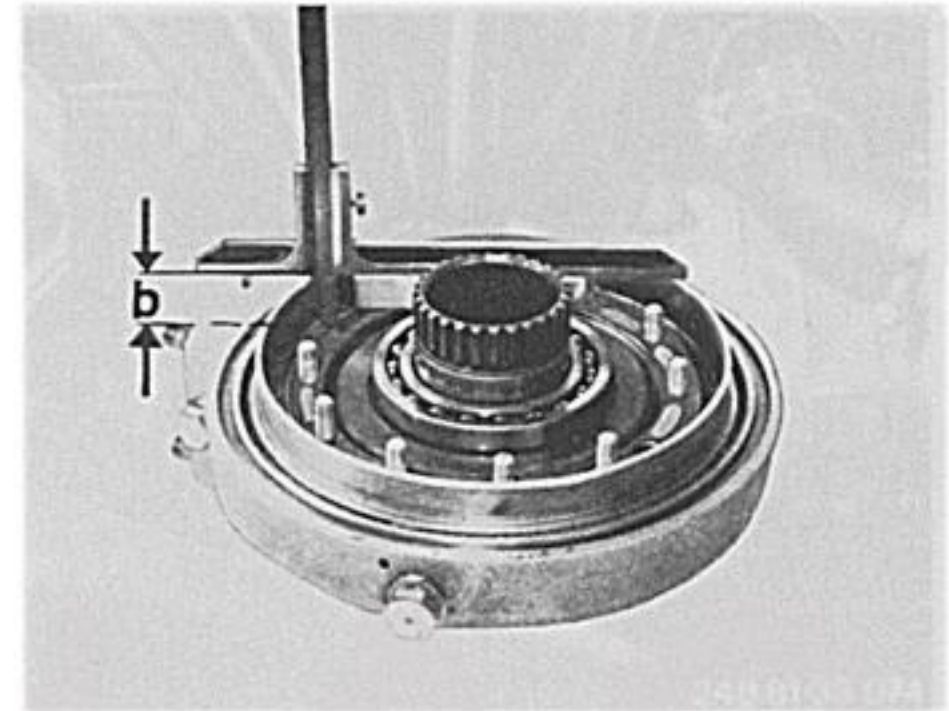
Adjust side-play at crown wheel (1978 models).

With a depth gauge and spacers if necessary, measure distance (a) from the bottom of the deep-groove ball bearing seat to the joint contact faces.



Measure distance (b) from the deep-groove ball bearing on the crownwheel to the joint face on the propeller shaft housing, without a gasket on the joint face. Install suitable shims between the ball bearing and the base of the seat in the cover to reduce play to zero. The correct shim thickness is obtained from the difference between dimensions (a) and (b), -0.1 mm (0.004 in).

After inserting the gasket, the correct clearance is obtained and no pressure exerted on the crownwheel.



33 17 350 Rear swinging arm — removing and installing

Remove and install rear wheel — 36 30 320.

Remove and install rear wheel drive — 33 10 050.

Detach the lower left spring strut mounting.

Detach the rubber sleeve between the gearbox and swinging arm at the gearbox end, and push back as far as possible. Remove the four connecting bolts from the universal joint with a ring spanner and set aside complete with spring washers. When installing, tighten these bolts with the special BMW ring spanner 00 2 560 and a torque wrench (for tightening torque, see Specifications).

Remove the left and right swinging arm pivot bearings. Take off the caps and slacken the locknut (arrow). Unscrew and remove the swinging arm bearing journals.

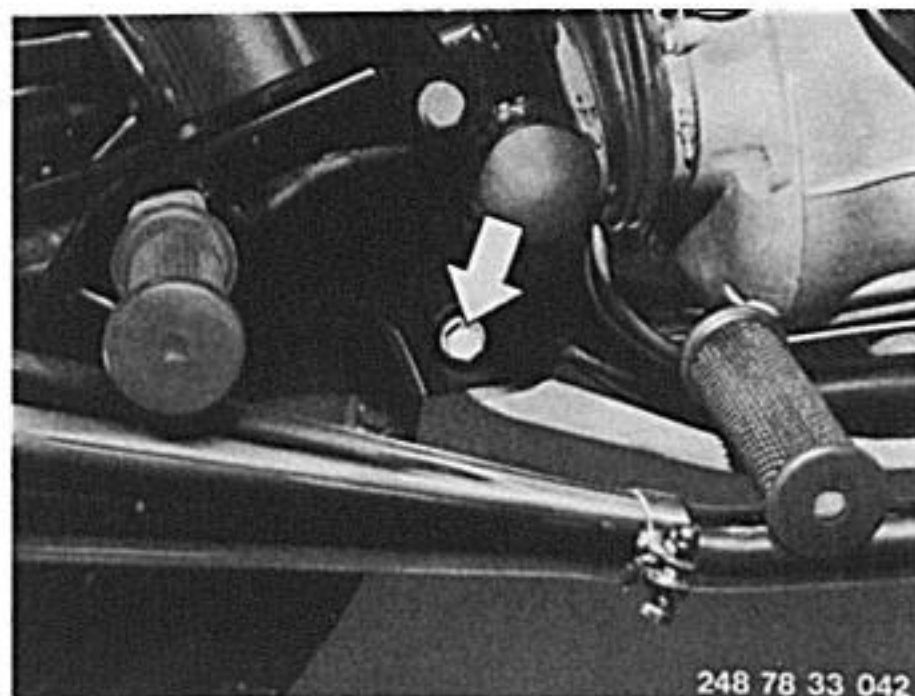
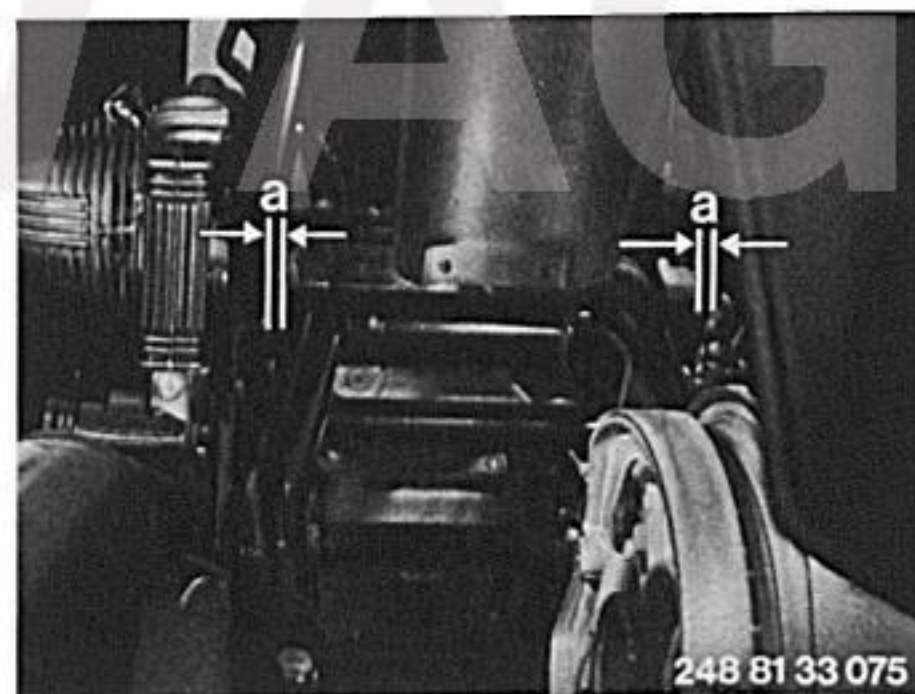
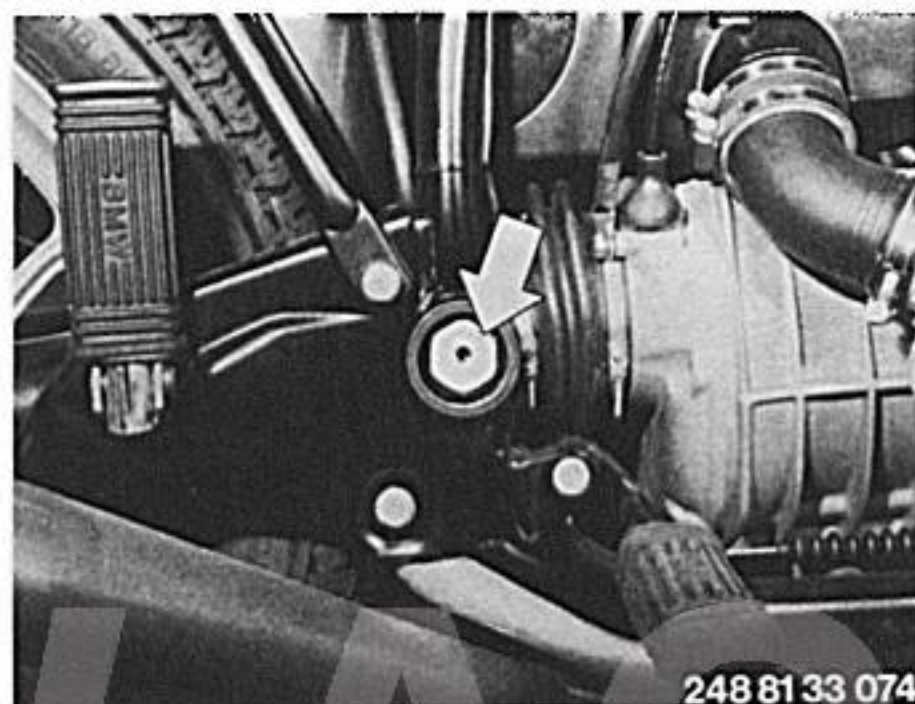
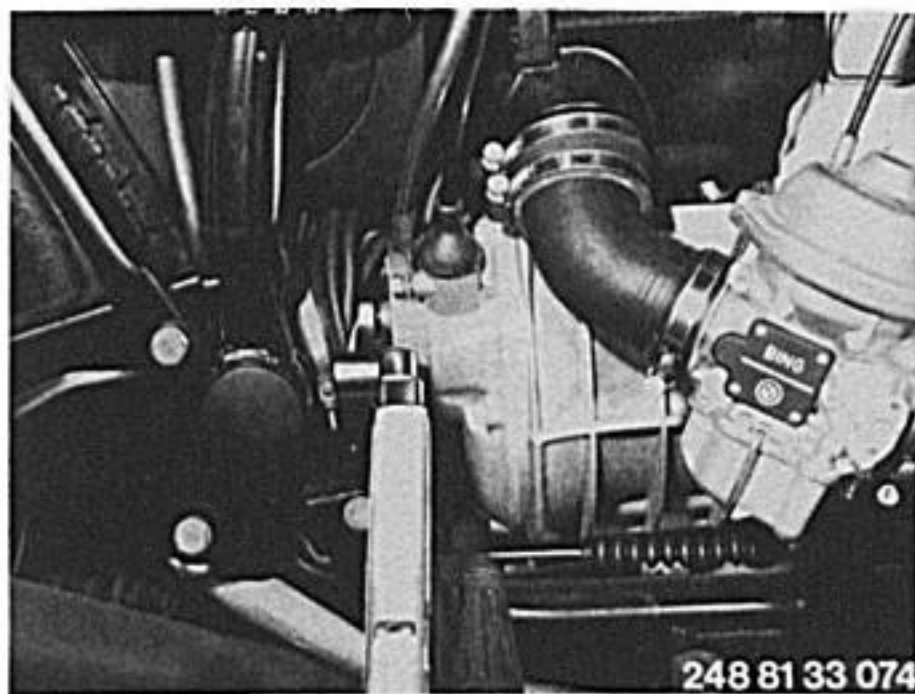
When installing:

Screw the bearing journals in so that the same spacing (a) is obtained at left and right between the swinging fork hub and the frame. The drive shaft must be central in the swinging fork tube so that it does not make contact when the suspension reaches the limits of its travel. If necessary, distances (a) can be slightly different for this reason.

To obtain the necessary bearing preload, tighten both pivot pins to 20 Nm (14.7 lb.ft) torque, then slacken off again and tighten to 12 Nm (8.8 lb.ft). Lock the pivot pins with the hex nuts. For nut tightening torque, see Specifications.

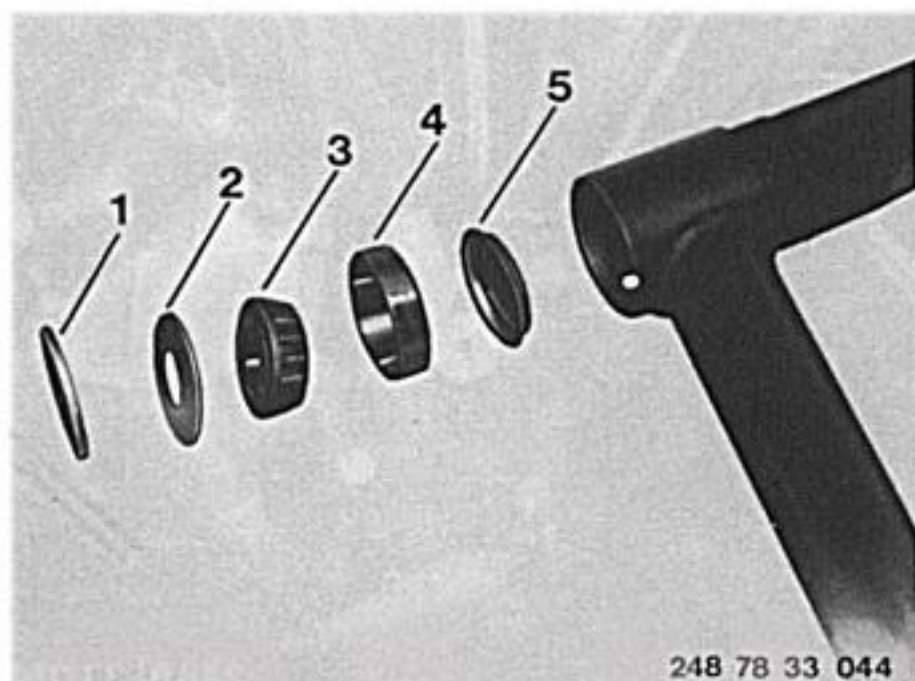
Press in the end caps.

Take off the brake pedal by holding the pivot pin and unscrewing the self-locking nut.





Remove the brake pull-rod retaining bolts.



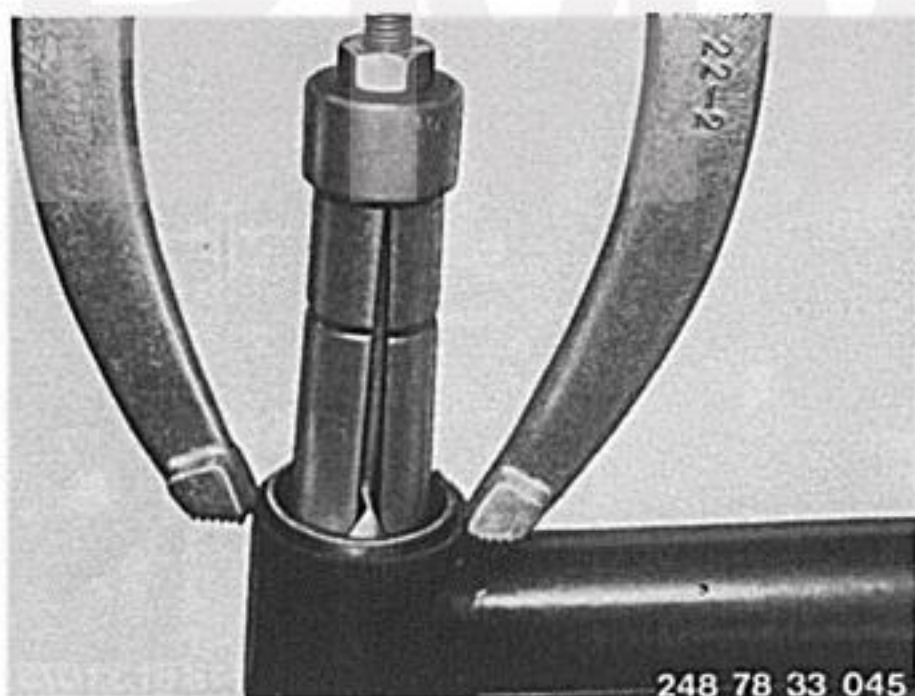
33 17 381 Taper roller bearings for rear swinging arm – renewing

Remove (install) rear swinging arm – 33 17 350.

Remove (install) propeller shaft – 26 11 000.

- 1 Thrust washer
- 2 Protective cap
- 3 Taper roller bearing
- 4 Bearing bushing
- 5 End cap

From 1981 models on, the taper roller bearings are not split.



Remove the thrust washer, protective cap and taper roller bearing together from the swinging arm.

Pull out the outer bearing race with Kukko internal puller BMW No. 00 8 551.

To drive in the bearing bushing, use drift BMW No. 00 5 550.

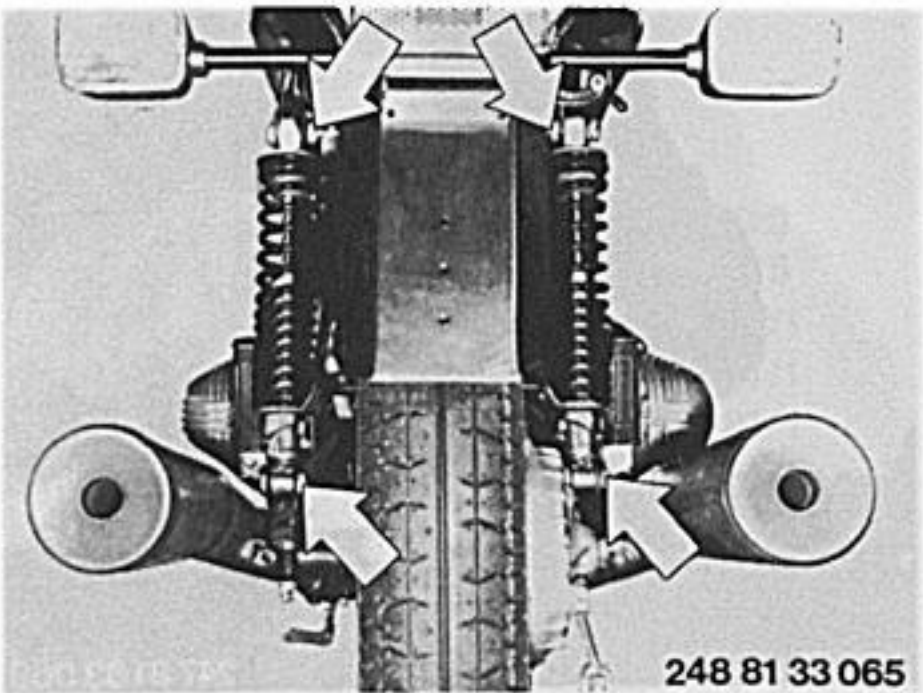
When installing: clean the taper roller bearings before assembling, and grease well.

Notes on 1981 models: pull out the swinging arm bearings with Kukko internal puller No. 21/3 and support 22-1.

Drive in the new bearing with a piece of tube measuring 40×30×50 mm long (1.57×1.18×1.97 in long)

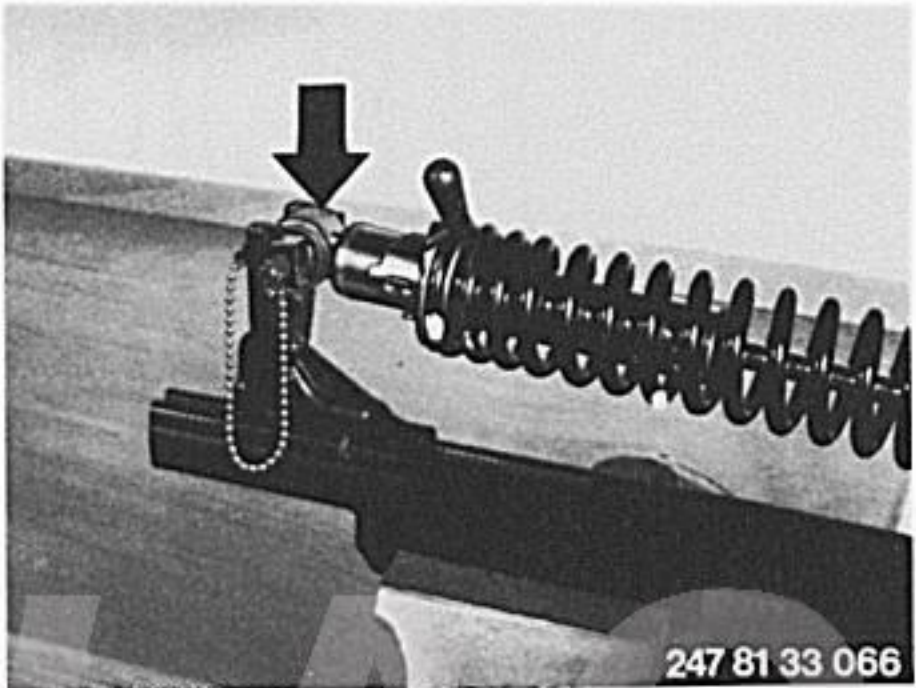
33 52 120 Spring-damper strut – removing and installing

Unscrew the hex nuts (arrows) with washers and take out the upper bolt. On the left damper, press the motorcycle down before removing the lower bolt.
For tightening torque, see Specifications.

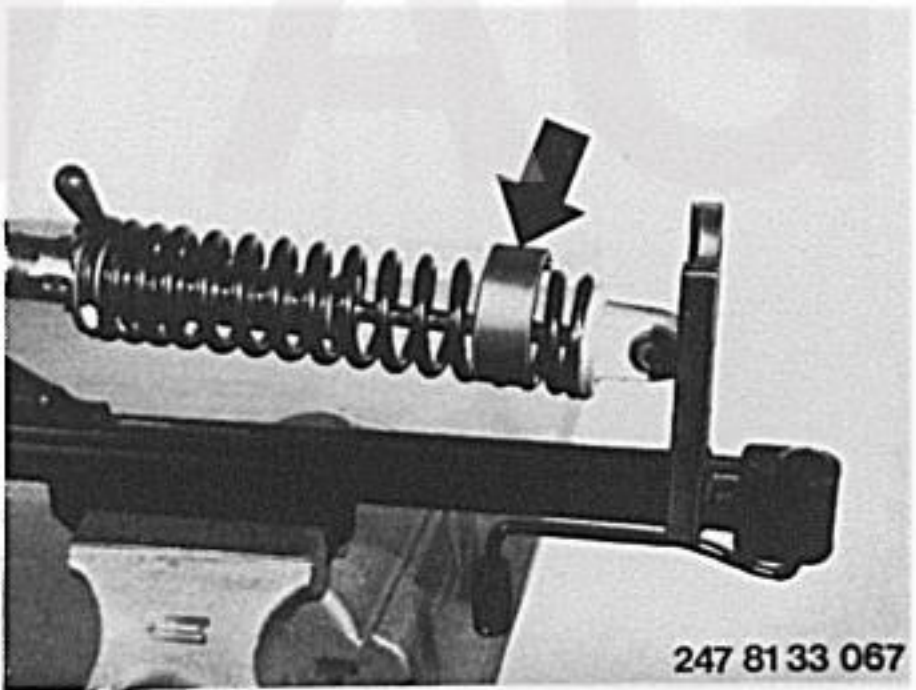


33 52 021 Damper – removing and installing

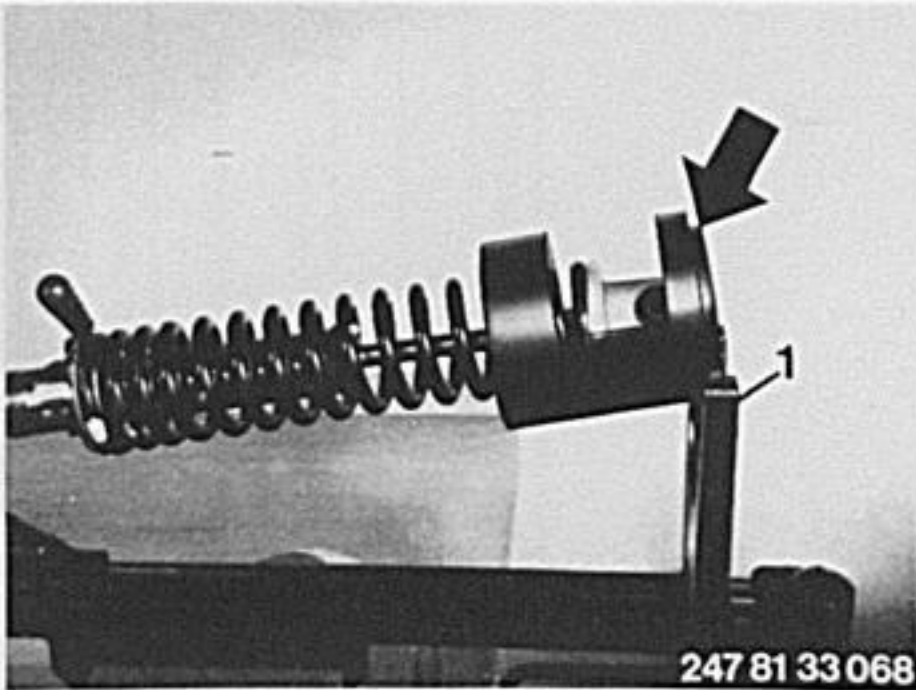
Remove (install) spring-damper strut – 33 52 100.
Secure clamping fixture BMW No. 33 5 600 in the vice. Clamp the lower spring strut mounting lug (arrow) into the fixture.



Insert clamp block BMW No. 33 5 605 (arrow) between the third and fourth turns of the spring.



Push pressure block BMW No. 33 5 610 on to the spring strut until it touches the clamp block. The shoulder (arrow) must be on the same end as the clamp arm (1).





Move the pressure block against the clamp arm and preload the spring strut until the open-ended wrench can be applied to the flats on the piston rod. First push back the rubber buffer. Detach the spring strut lug from the piston rod with a suitable drift (arrow).

Release the tension in the spring strut.

On struts with a spring plate, the damper is removed in the same way as just described.

For tightening torques, see Specifications.



BMW AG

34 Brakes

Specifications	Page	34- 0/3
Specifications (1981 models)		34- 0/5
34 00 046 Front brake – bleeding		34-00/1
34 11 000 Front brake pads – removing and installing		34-11/1
34 21 200 Rear brake linings – removing and installing		34-21/1
34 31 000 Brake master cylinder – removing and installing		34-31/1
Trouble-shooting – brakes		34-31/4

BMW AG

Brakes

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Front wheel	Disc brake		
Brake disc dia. mm (in)	260 (10.24)		
Min. brake disc thickness mm (in)	4.6 (0.18)		
Effective rubbed area per disc cm ² (in ²)	42 (6.51)		
Min. brake pad thickness	1.5 (0.06)		
Max. permissible braking surface runout related to wheel hub mm (in)	0.03 (0.0012)		
Master cylinder piston dia. mm (in)	13 (0.512) or 16 (0.630)		
Wheel brake cylinder piston dia. mm (in)	36 (1.417)		
Brake disc lateral runout mm (in)	0.1 (0.004)		
Rear wheel	Leading and trailing shoe drum, full-width hub		
Brake drum dia. mm (in)	200 (7.87)		
Max. oversize after wear mm (in)	201.5 (7.93)		
Lining thickness mm (in)	30 (1.18)		
Effective rubbed area cm ² (in ²)	107 (16.59)		
Min. brake lining thickness mm (in)	1.5 (0.06)		

Brakes

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Disc brake fluid	DOT 4 : ATE "SL"		
Tightening torques Nm (lb. ft)			
Brake pipe to master cylinder		8+3 (5.9 + 2.2)	
Brake pipe to brake caliper		8+3 (5.9 + 2.2)	

Brakes

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Front wheel	Disc brake			Twin disc brake
Brake disc dia. mm (in)	260 (10.24)			
Min. brake disc thickness mm (in)	4.6 (0.18)			
Effective rubbed area per disc cm ² (in ²)	41.5 (6.43)			
Min. brake pad thickness mm(in)	1.5 (0.06)			
Max. permissible braking surface runout related to wheel hub mm (in)	0.03 (0.0012)			
Master cylinder piston dia. mm (in)	12 (0.472) or 13 (0.512)			15 (0.59) or 16 (0.63)
Wheel brake cylinder piston dia. mm (in)	36 (1.417)			
Brake disc lateral runout mm (in)	0.1 (0.004)			
Rear wheel	Leading and trailing shoe drum, full-width hub			
Brake drum dia. mm (in)	200 (7.87)			220 (8.66)
Max. oversize after wear mm (in)	201.5 (7.93)			221.5 (8.72)
Lining thickness mm (in)	30 (1.18)			
Effective rubbed area cm ² (in ²)	107 (16.59)			89 (13.79)
Min. brake lining thickness mm (in)	1.5 (0.06)			

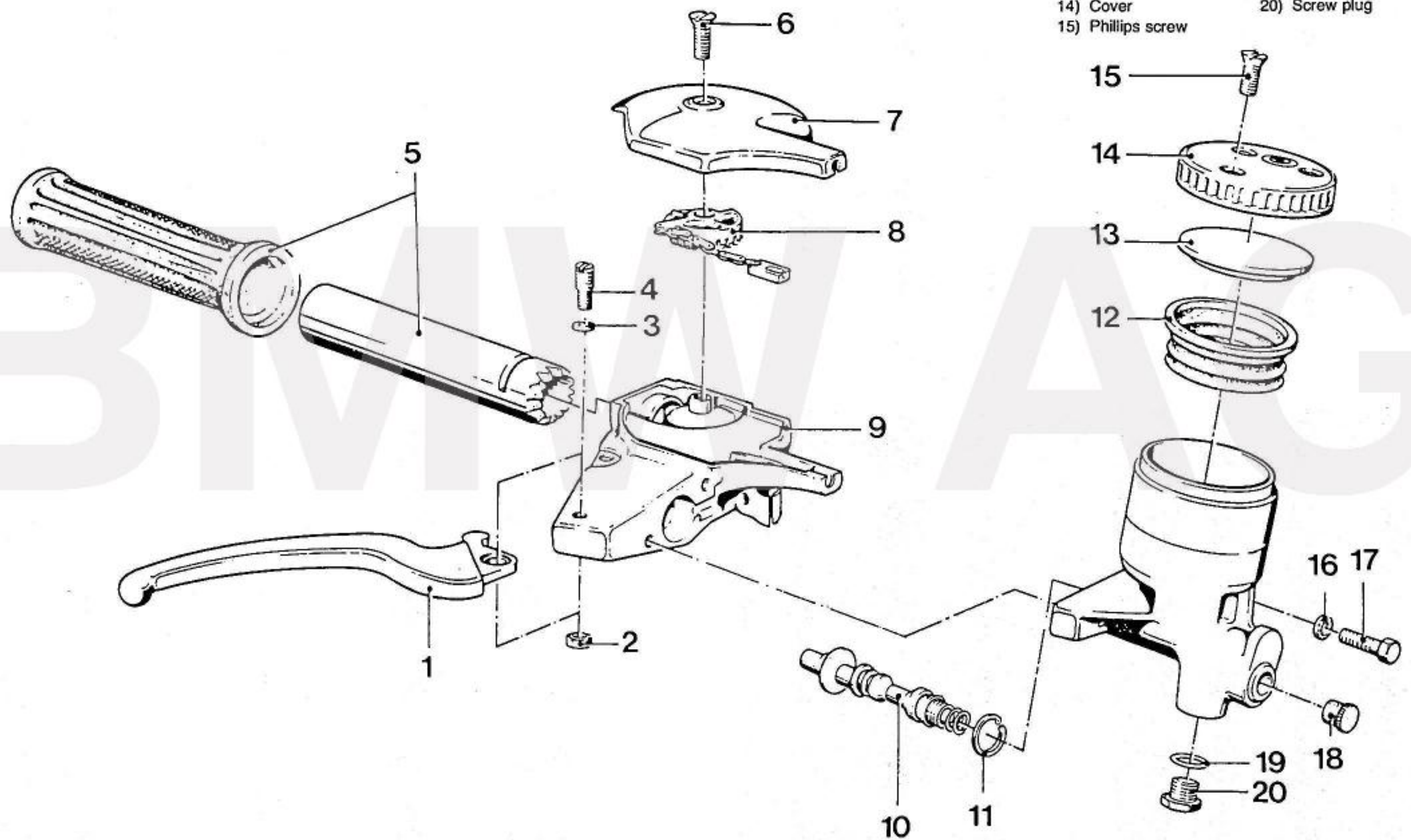
Brakes**Specifications (1981 models)**

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Disc brake fluid	DOT 4 : ATE "SL"			

Tightening torques Nm (lb. ft)

Brake pipe to air hose	12 + 3 (8.8 + 2.2)
Brake pipe to master cylinder	8 + 2 (5.9 + 1.4)
Brake pipe to brake caliper	8 + 2 (5.9 + 1.4)

Throttle twistgrip and master brake cylinder



34 00 046 Front brake – bleeding

Note that brake fluid must be renewed once a year.

Brake fluid is hygroscopic and therefore absorbs moisture from the atmosphere through the vent hole in the reservoir tap.

This gradually reduces the vaporizing point of the brake fluid from 240° C (465° F) to only 160 . . . 180° C (320 . . . 355° F).

Warning: Never allow brake fluid to reach the motorcycle's paintwork. Brake fluid destroys the paint surface.

To refill with brake fluid, take out the screws in the reservoir cap, remove the diaphragm and add fluid up to the "Max." mark. Seal the reservoir again.



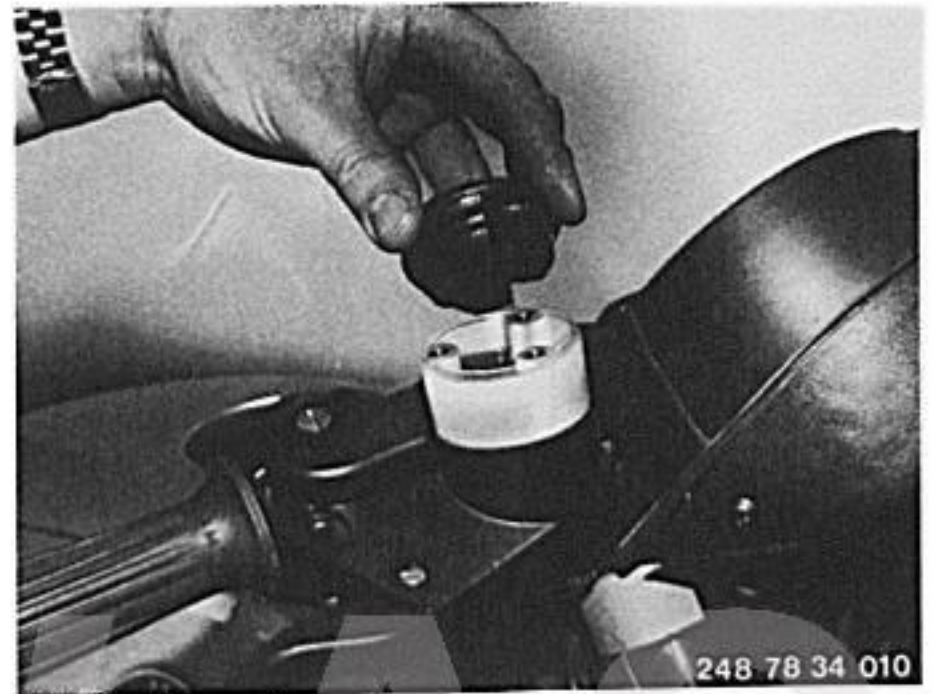
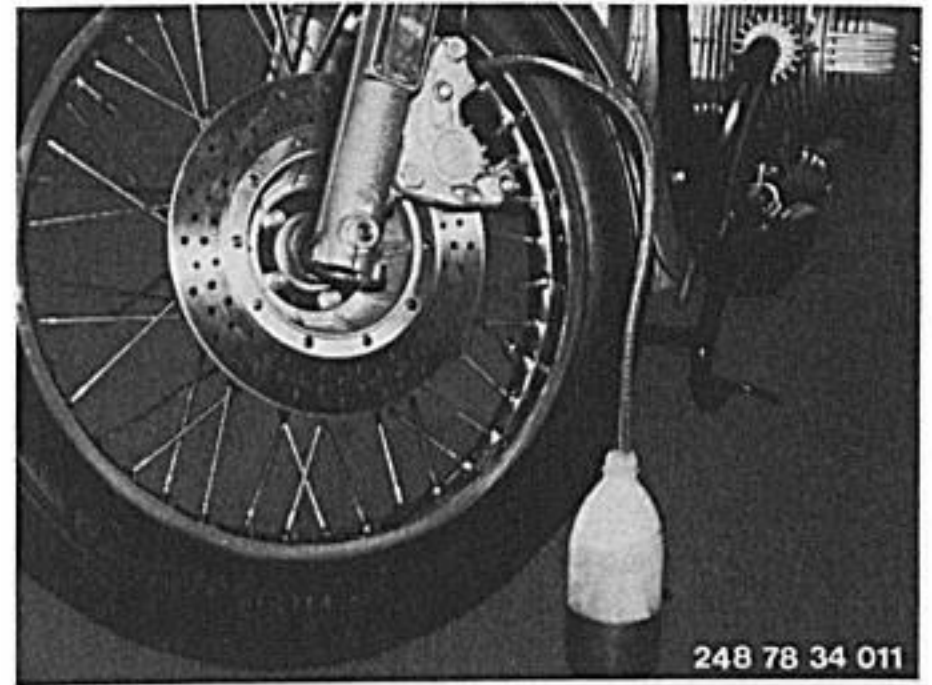
Apply the hand brake lever several times until brake pressure builds up.

Keep the lever applied to maintain pressure, and open the bleed screw, at the same time pulling the lever up firmly. Close the bleed screw before releasing the lever.

Repeat this operation until the brake fluid emerges from the bleed screw free from air bubbles. Then tighten the bleed screw again.

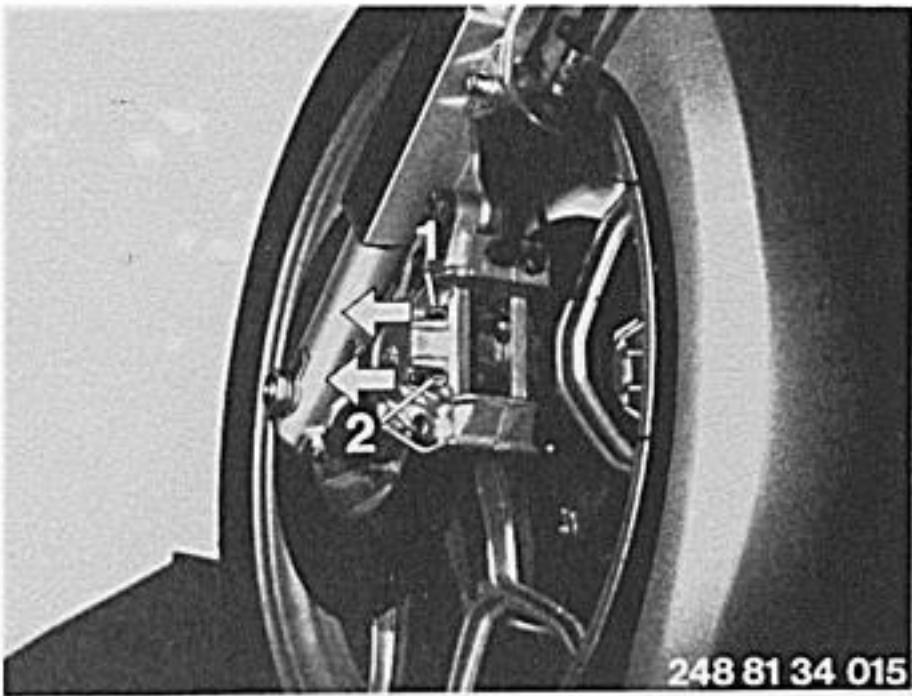
Warning: The brake fluid reservoir must not be pumped dry, or else air will again penetrate the brake circuit.

If the motorcycle has twin disc brakes, bleed at both brake calipers.



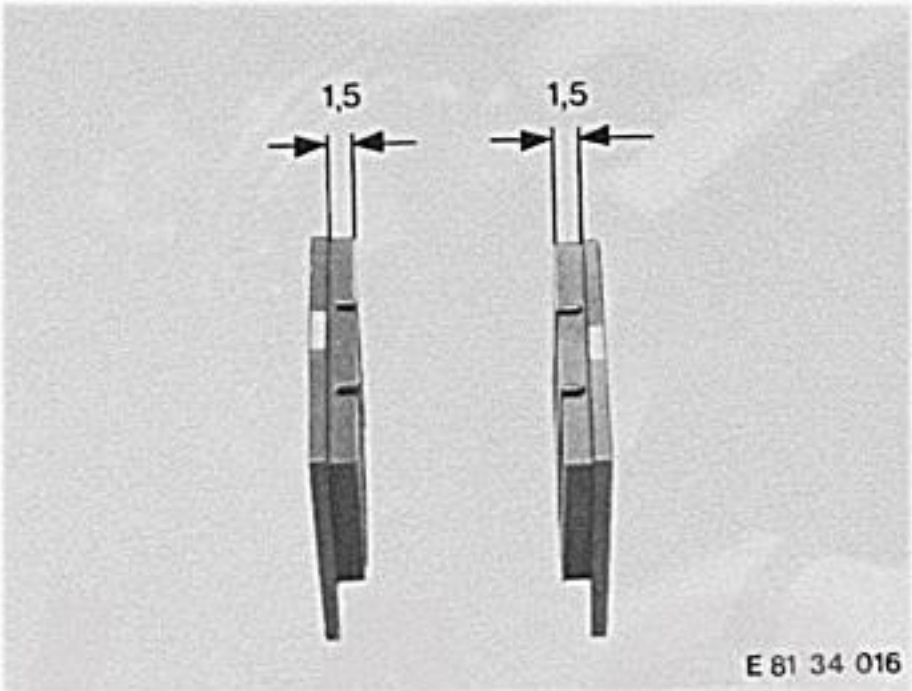
34 11 000 Front brake pads – removing and installing

Lever off the plastic cap from the brake caliper with a screwdriver. Using a drift, force out the brake pad retaining pins (1) and (2) and remove the spreader spring and brake pads.



To avoid scored brake discs, worn pads must be renewed in good time – see illustration for minimum thickness in mm (1.5 mm = 0.06 in).

When installing: push back the brake cylinder pistons before installing the new pads.

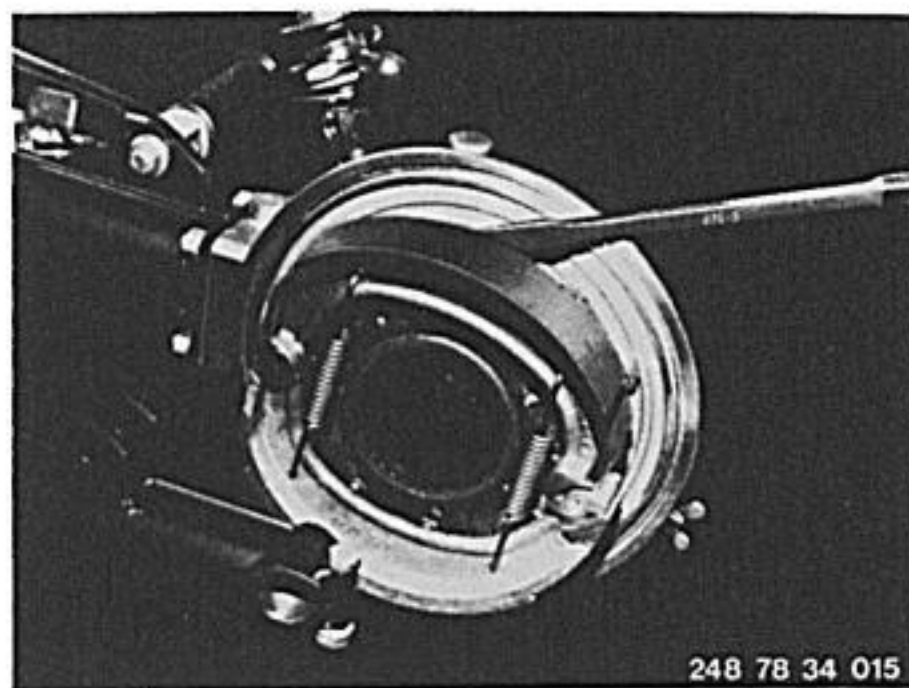


BMW AG

34 21 150 Rear brake shoes – removing and installing

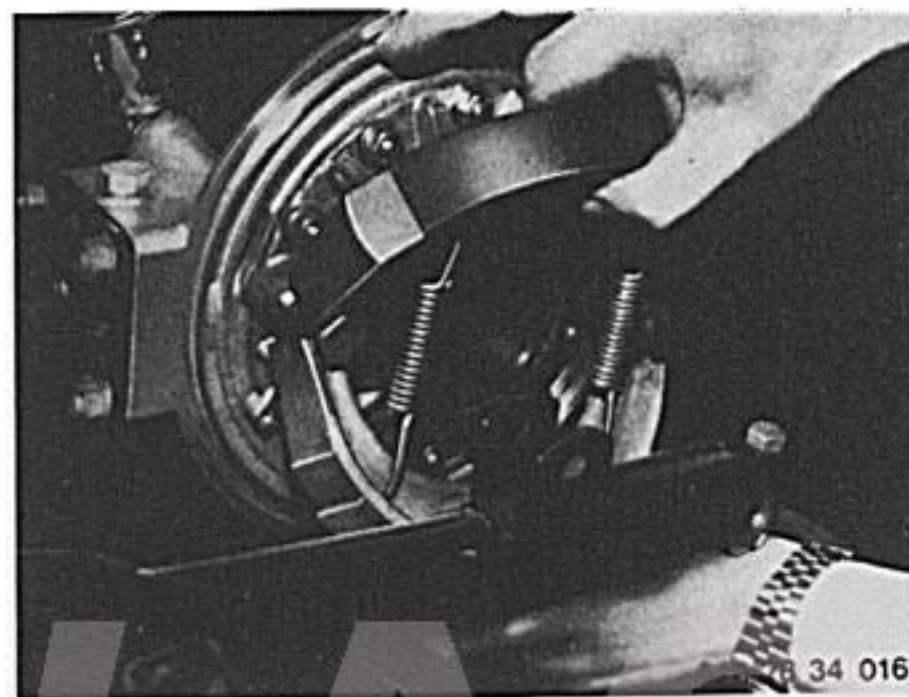
Remove the rear wheel – 36 30 320.

Tilt one brake shoe with a screwdriver away from the rear wheel drive, then disconnect the tension spring.



When installing:

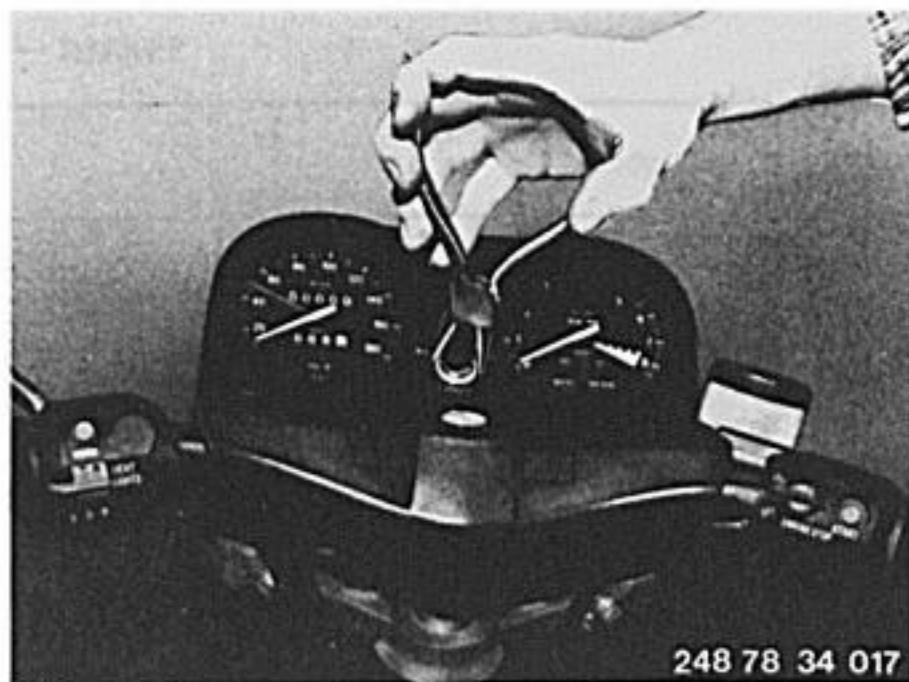
Connect the brake shoes together with the tension springs and press both shoes at the same time on to the brake backplate and brake actuating mechanism.



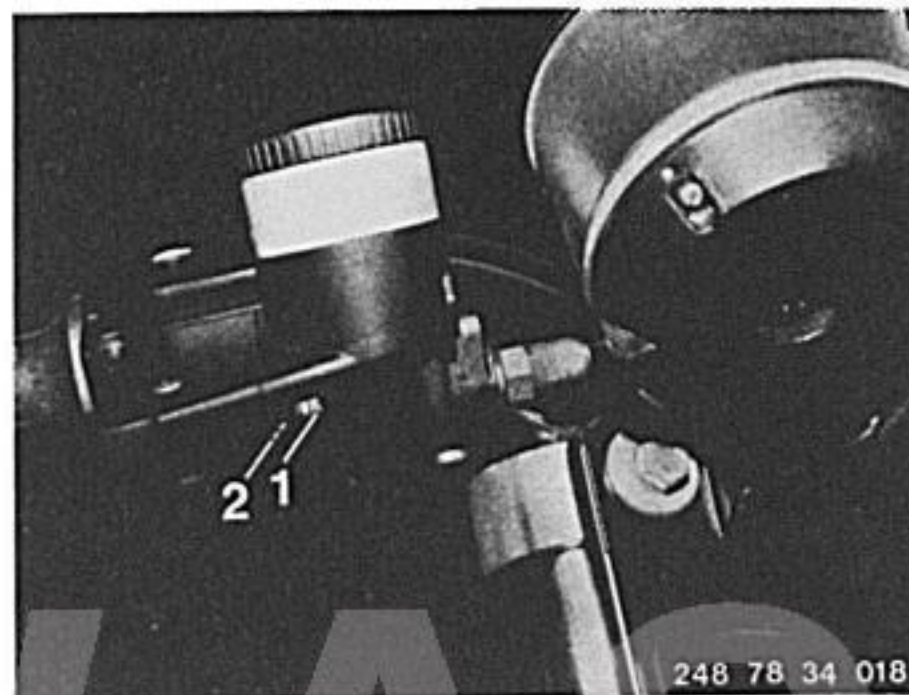
34 31 000 Brake master cylinder — removing and installing

Detach the instrument surround after removing the two Phillips-head screws and unscrewing the threaded ring from the ignition switch with Seeger circlip pliers.

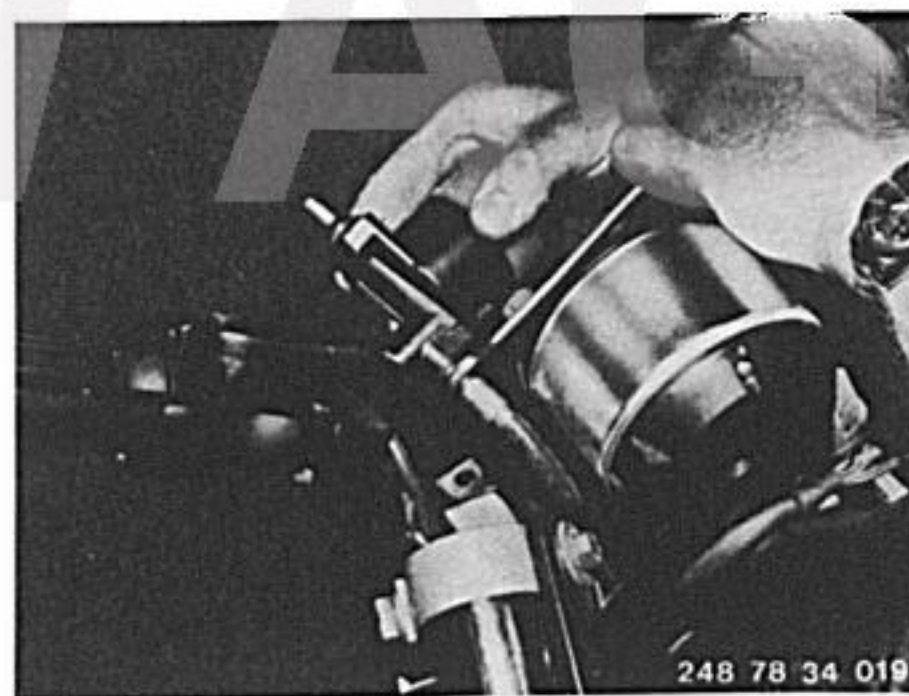
Pull the turn indicator repeater lamp bulb holders out of the instrument surround and lift off the surround.



Loosen the brake hose slightly at the brake fluid reservoir. Take out the two Allen screws (1 and 2) holding the brake cylinder at the handlebar fitting, and pull out the brake cylinder.



Unscrew the brake cylinder from the brake hose, holding the hose with an open-ended wrench to prevent it from turning.



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 Air in brake circuit	Renew Bleed

BMW AG

35 Pedals

35 31 000	Brake pedal – removing and installing	35–21/1
-----------	---------------------------------------	-----------	---------

BMW AG

35 21 000 Foot brake lever — removing and installing

Remove the locking pin from the brake pull rod.

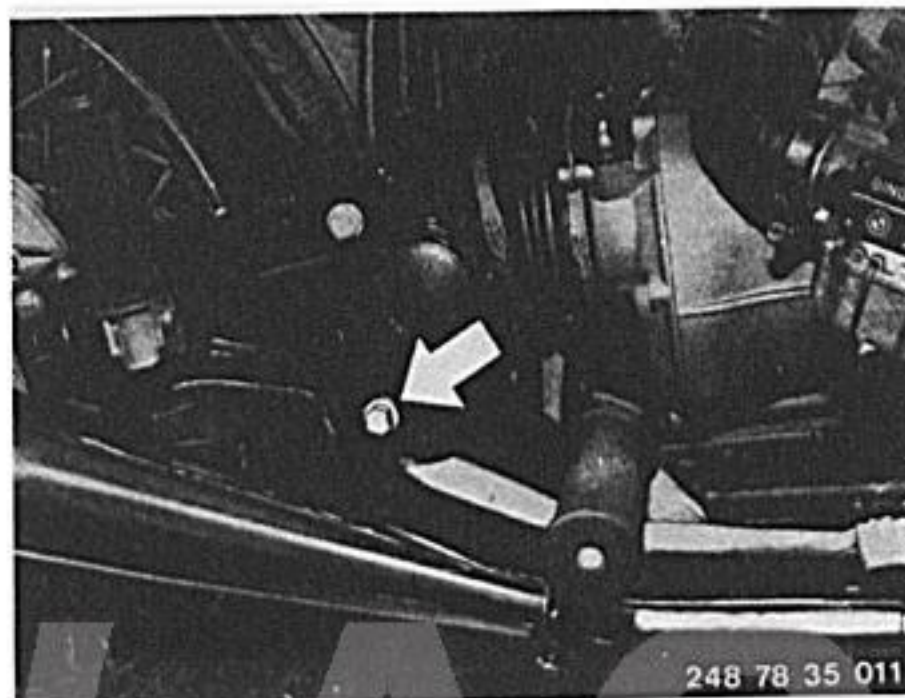


■

Unscrew the self-locking nut, holding the pivot pin (arrow) to prevent it from turning. Take off the foot lever.

Adjusting the foot brake:

Turn the wing nut at the end of the pull rod until the rear wheel brake begins to bite, then slacken the wing nut by 2 . . . 3 turns.



36 Wheels and tyres

Specifications	Page	36- 0/3
Specifications (1981 models)		36- 0/5
36 30 300 Front wheel – removing and installing		36-30/1
36 30 320 Rear wheel – removing and installing		36-30/2
36 30 028 Wheels – static balancing		36-30/3
36 31 371 Wheel bearings of one wheel (front or rear) removing and installing		36-31/1
36 32 081 Lateral and radial runout – measuring		36-32/1

BMW AG

Wheels and tires

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Rim type	Pressure cast light alloy		
Front rim size	1.85 B x 18		
Rear rim size	2.50 B x 18		
Max. radial runout mm (in)	0.9 (0.035) measured at rim shoulder without tire		
Lateral runout, max. mm (in)	0.5 (0.020) measured at rim shoulder without tire		
Front tire size	3.25 – 18	3.25 S 18	3.25 S 18
Rear tire size	4.00 – 18	4.00 S 18	4.00 S 18
Max. tire imbalance, measured at inner rim dia. cmp Equivalent to g (oz)	170 8 ... 9 (0.28 ... 0.32)		
Max. permissible runout at sidewall mm (in)	1.7 (0.067)		
Tire pressures: Front wheel, solo up to/above 160 km/h (100 mile/h) bar (lb/in ²) Two-up, up to/above 160 km/h (100 mile/h) bar (lb/in ²)	1.9/2.1 (27/30) 2.1/2.1 (30/30)		
Rear wheel, solo up to/above 160 km/h (100 mile/h) bar (lb/in ²) Two-up up to/above 160 km/h (100 mile/h) bar (lb/in ²)	2.0/2.2 (28.5/31) 2.2/2.3 (31/33)		
For long journeys at very high speed bar (lb/in ²)	0.2 (3) higher		
Wheel bearing lubrication	Brand-name multipurpose grease (drip point app. 180° C (355° F))		
Quantity of grease per wheel g (oz)	10 (0.35)		

Wheels and tires

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Permissible wheel loads, solo			
Front at 1.9 bar (27 lb/in ²) tire pressure kg (lb)		160 (353)	
Rear at 2.0 bar (28.5 lb/in ²) tire pressure kg (lb)		245 (540)	
Permissible wheel loads, two-up			
Front at 2.0 bar (28.5 lb/in ²) tire pressure kg (lb)		178 (392)	
Rear at 2.25 bar (32 lb/in ²) tire pressure kg (lb)		270 (595)	

Tightening torques Nm (lb. ft) + friction values Ncm

Friction moment in wheel bearings at specified
wheel nut tightening torque

Ncm

150 ... 300

Quick-release axle nuts, front and rear

Nm (lb. ft)

45 ... 50 (33 ... 37)

All other bolts and nuts are to be tightened as shown in the manufacturers'
tables or in the latest BMW 60002.0 standards sheet.

Wheels and tires

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS	
Rim type	Pressure cast light alloy			BMW compound aluminium	
Front rim size	1.85 B x 18			2.15 B x 18	
Rear rim size	2.50 B x 18				
Max. radial runout mm (in)	0.9 (0.035) measured at rim shoulder without tire				
Lateral runout, max. mm (in)	0.5 (0.020) measured at rim shoulder without tire				
Front tire size	3.25 – 18	3.25 S 18	3.25 H 18		
Rear tire size	4.00 – 18	4.00 S 18	4.00 H 18		
Max. tire imbalance, measured at inner rim dia. cmp Equivalent to g (oz)	170 8 ... 9 (0.28 ... 0.32)				
Max. permissible runout at sidewall mm (in)	1.7 (0.067)				
Tire pressures: – in bar (lb/in ²) when cold	One-up		With pillion passenger		
	Front	Rear	Front	Rear	
	Up to 130 km/h (81 mile/h)	1.9 (27)	1.8 (26)	2.1 (30)	2.0 (28)
	130-160 km/h (81-100 mile/h)	1.9 (27)	2.0 (28)	2.1 (30)	2.2 (31)
	Above 160 km/h (100 mile/h)	2.1 (30)	2.2 (31)	2.1 (30)	2.3 (33)
	Important: note minimum legal tread depth.		Recommended minimum tread depths: 2 mm (0.08 in) up to 130 km/h (81 mile/h) 3 mm (0.12 in) above 130 km/h (81 mile/h)		
Wheel bearing lubrication	Band-name anti-friction bearing grease, usable temperature range – 30 ... + 140°C (– 22 ... + 284°F), drip point 150 ... 230°C (302 ... 446°F), high corrosion protection, good moisture and oxidation resistance – e.g. Shell Retinax A				
Quantity of grease per wheel g (oz)	10 (0.35)				

Wheels and tires

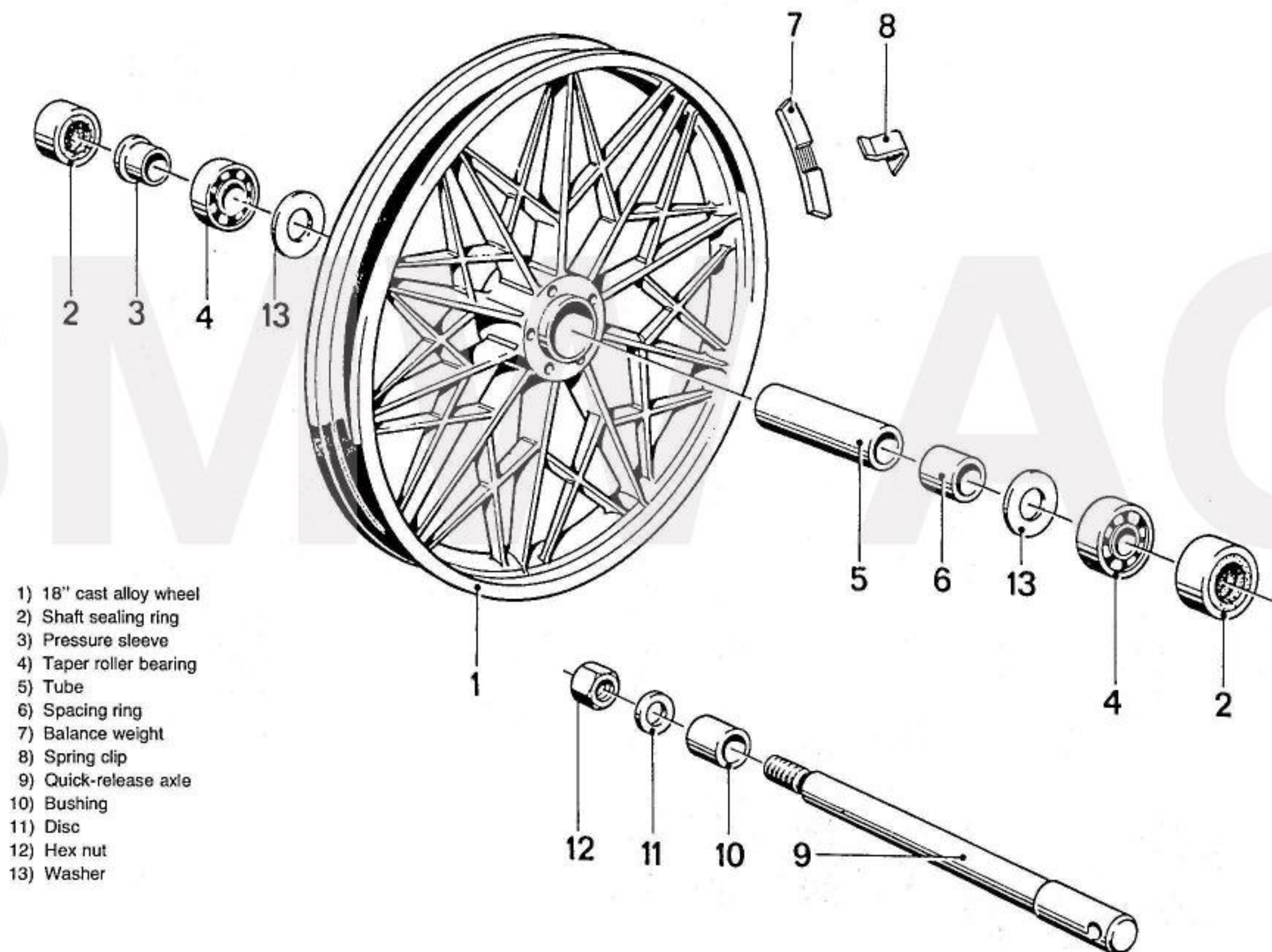
Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Permissible wheel loads				
– front kg (lb)	140 (309)			
– rear kg (lb)	270 (595)			

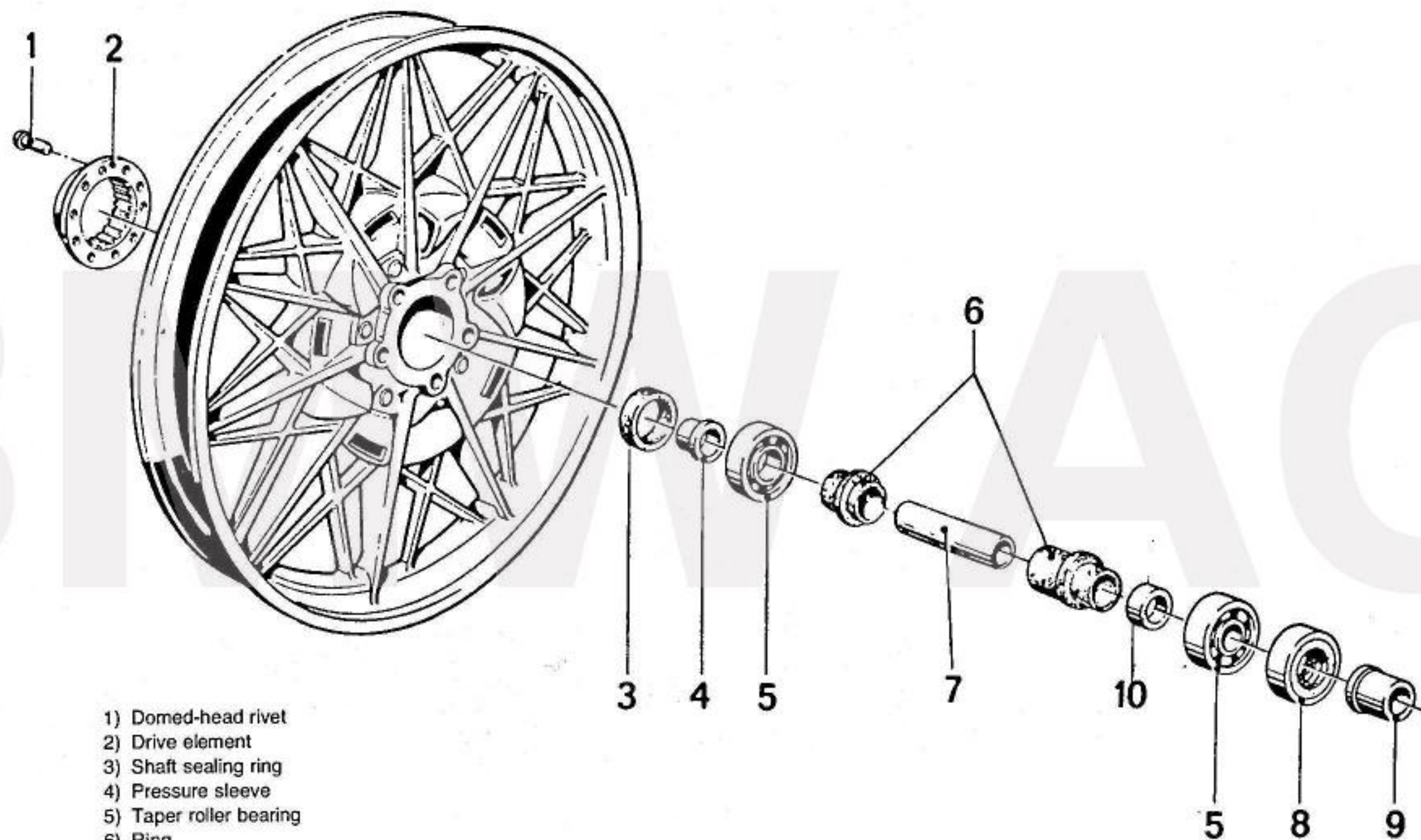
Tightening torques Nm (lb. ft) and friction values in Ncm

Wheel bearing friction at specified axle nut tightening torque	Ncm	15 – 30
Front and rear quick-release axle nuts	Nm (lb. ft)	48 (35)
Axle clamp bolts	Nm (lb. ft)	17 (12.5)
All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables and on the latest BMW 60002.0 standards sheet.		

Front wheel bearings



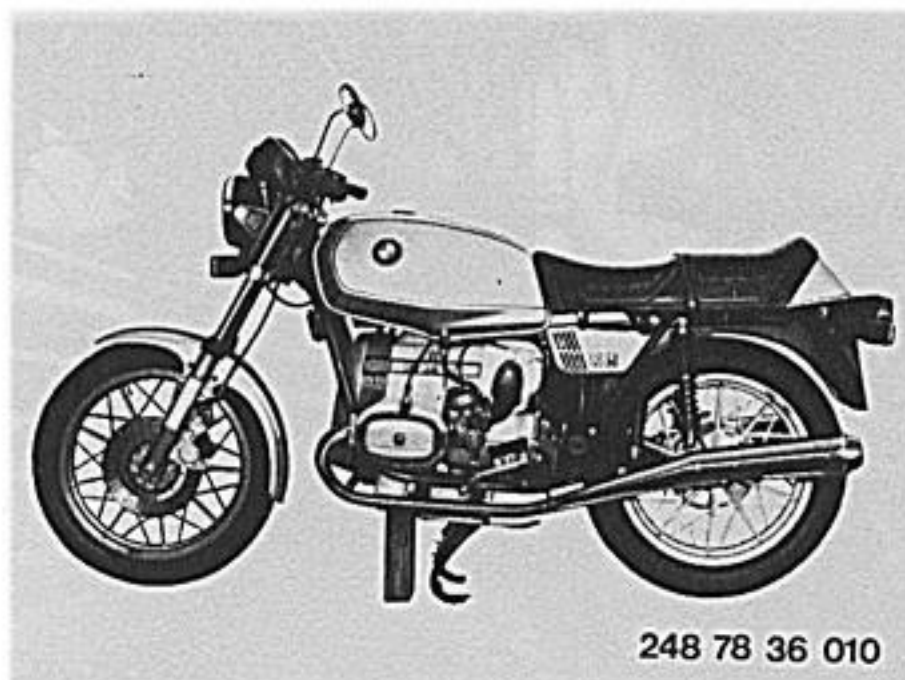
Rear wheel bearings



- 1) Domed-head rivet
- 2) Drive element
- 3) Shaft sealing ring
- 4) Pressure sleeve
- 5) Taper roller bearing
- 6) Ring
- 7) Spacing tube
- 8) Shaft sealing ring
- 9) Pressure sleeve
- 10) Spacing ring

36 30 300 Front wheel – removing and installing

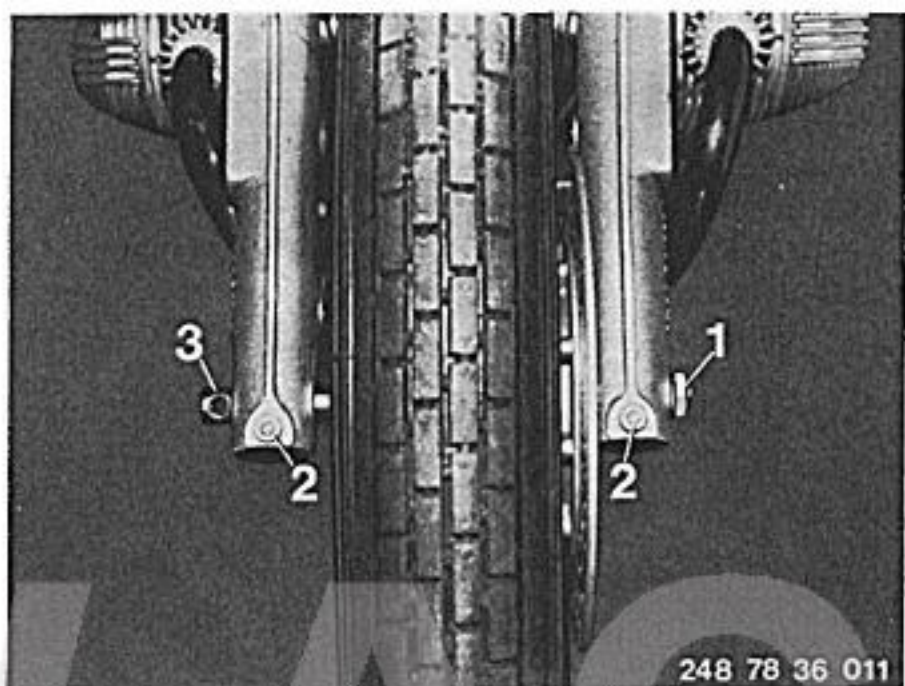
Place the motorcycle on its center stand and support under the oil pan.

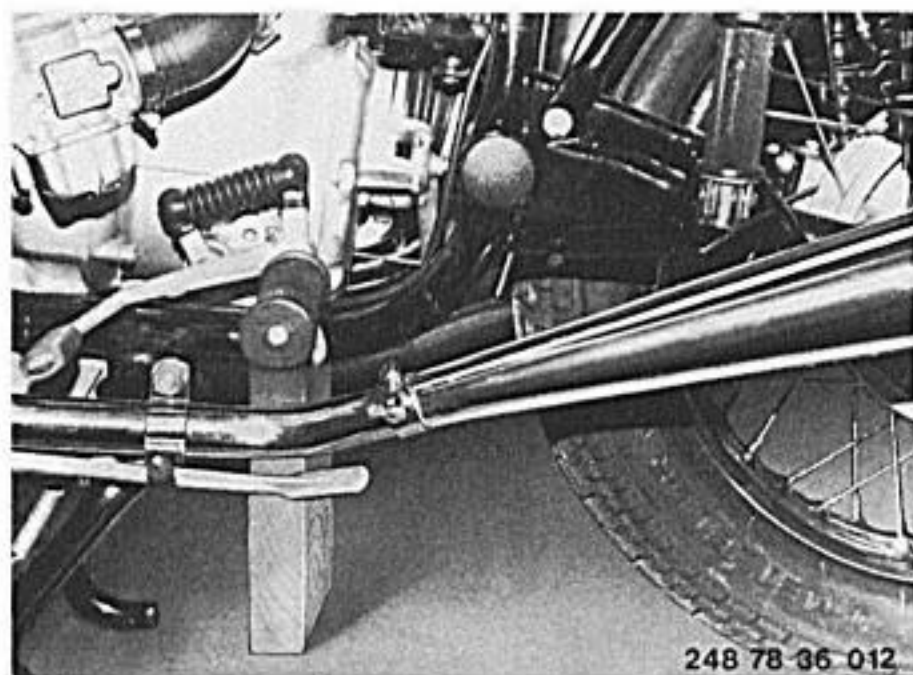


Unscrew the axle nut (1) with washer, slacken the front axle internal hexagon clamp bolts (2) with spring washers and pull out the front axle (3) using a drift.

When installing: grease the front axle lightly, insert and tighten the axle nut first, using a mandrel to prevent the axle from turning if necessary. Next compress the front fork firmly several times, then tighten the clamp bolts. This procedure will prevent stresses from being trapped in the fork slider tubes.

For tightening torques, see Specifications.



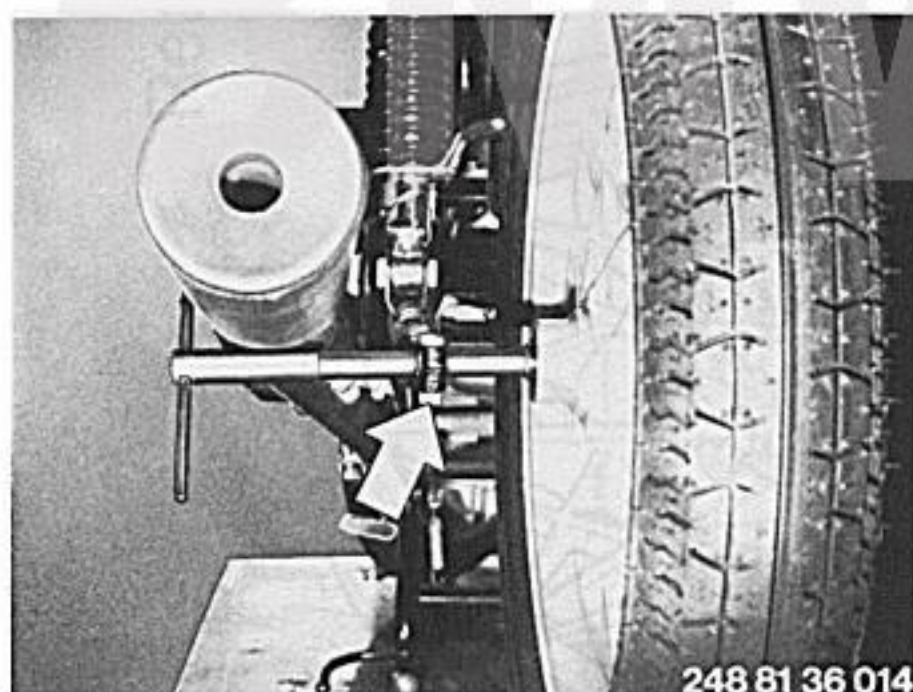


36 30 320 Rear wheel – removing and installing

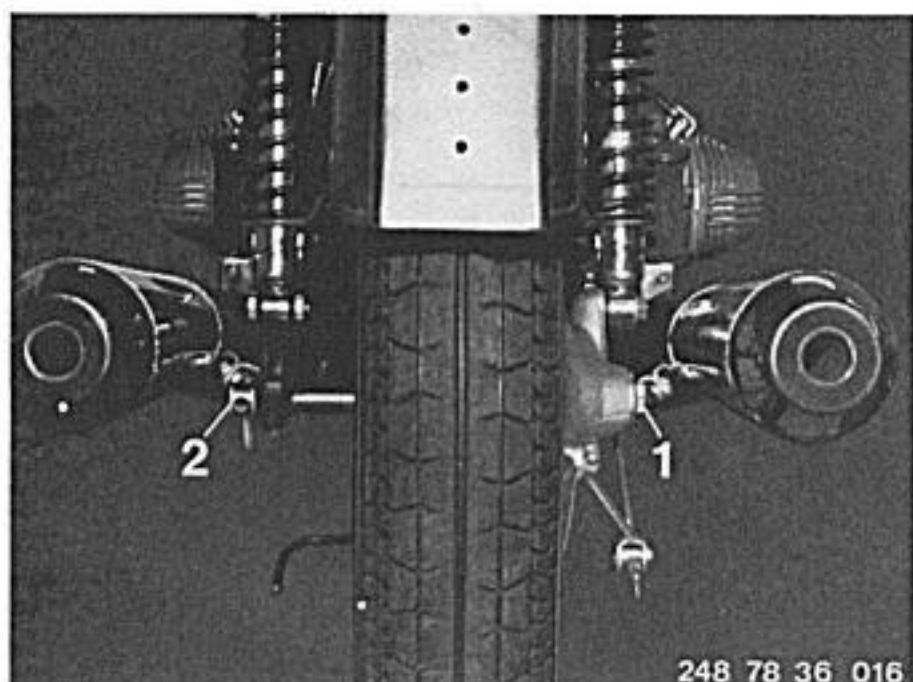
Place the motorcycle on its centre stand and provide additional support under the gearbox.



Unscrew the quick-release axle nut on the drive side and remove it with the washer (arrow).



Unscrew the quick-release axle clamp screw nut (arrow) at the left arm of the swinging fork.



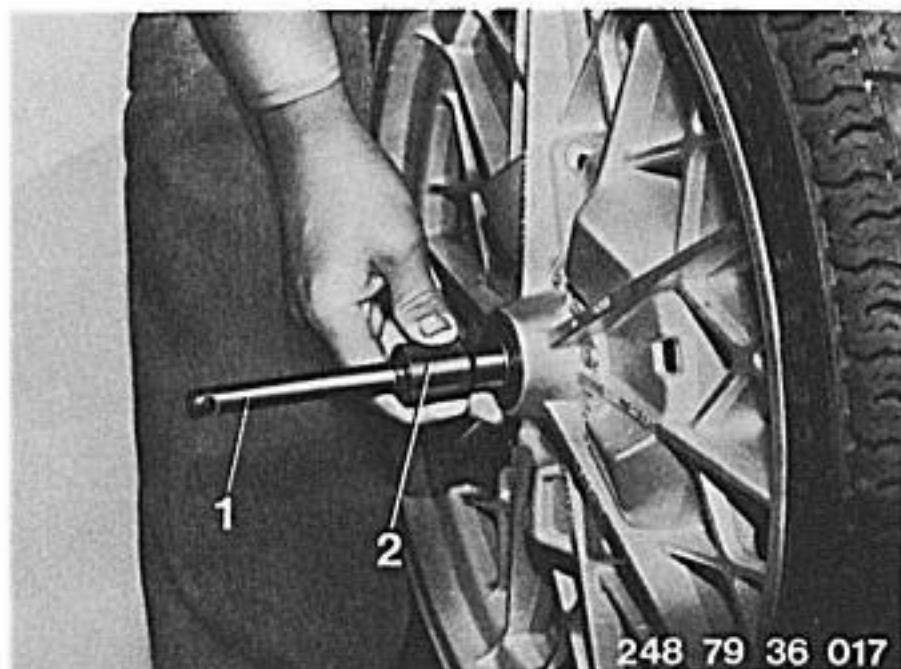
Pull the wheel away from the final drive, and remove it.
Tilt the motorcycle slightly to the right to simplify wheel removal.

When installing: clean the axle and the splines carefully before assembling, and coat lightly with a high-viscosity grease. Turn the quick-release axle as it is pushed in. Tighten the axle nut (1), then compress the motorcycle's suspension fully before tightening clamp screw (2). The cross-hole drilled in the end of the axle must face to the rear (arrow).

See Specifications for tightening torques.

36 30 028 Balancing wheels (static method)

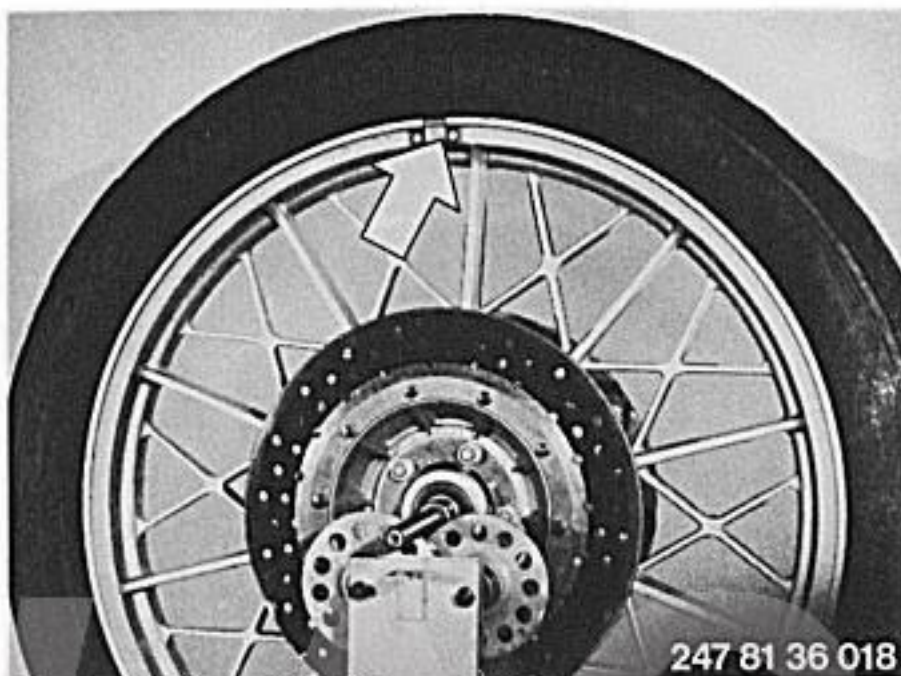
Push the balancing shaft (1) through the wheel bearings and preload them slightly with knurled nut (2).



Mount the wheel on BMW balancing device 36 3 600 and allow it to turn freely until it comes to a standstill. Attach a weight opposite the heaviest point (arrow).

Note:

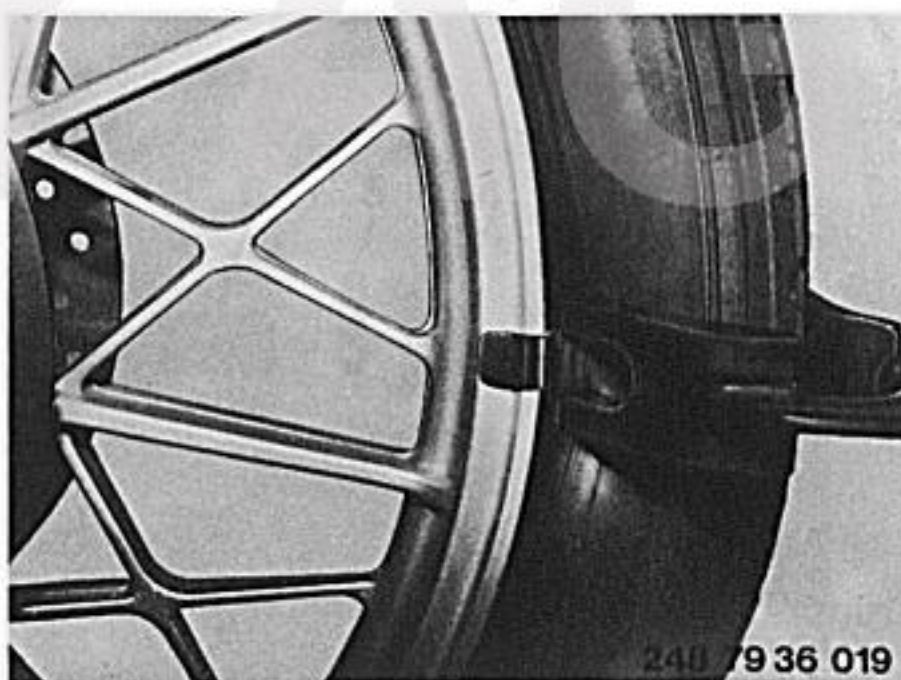
When correctly balanced, the wheel should come to rest at any point (not always in the same position).



For cast alloy wheels, the weights are attached with the aid of assembly pliers BMW No. 36 3 830.

Bring the pliers as close to the rim as possible, press together and push on the weight retaining clip. The amount of weight needed must be divided equally between the left and right sides of the rim.

Warning: maximum balancing weight 60 g (2 oz).



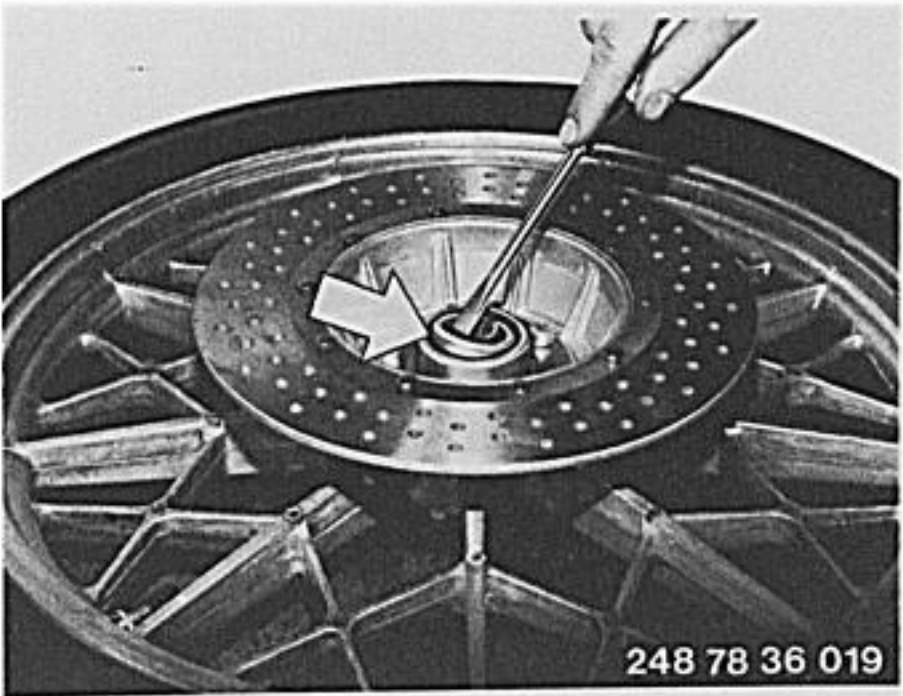
**36 31 371 Wheel bearings for front or rear wheel
— removing and installing**

Remove and install front wheel — 36 30 300.

Remove and install rear wheel — 36 30 320.

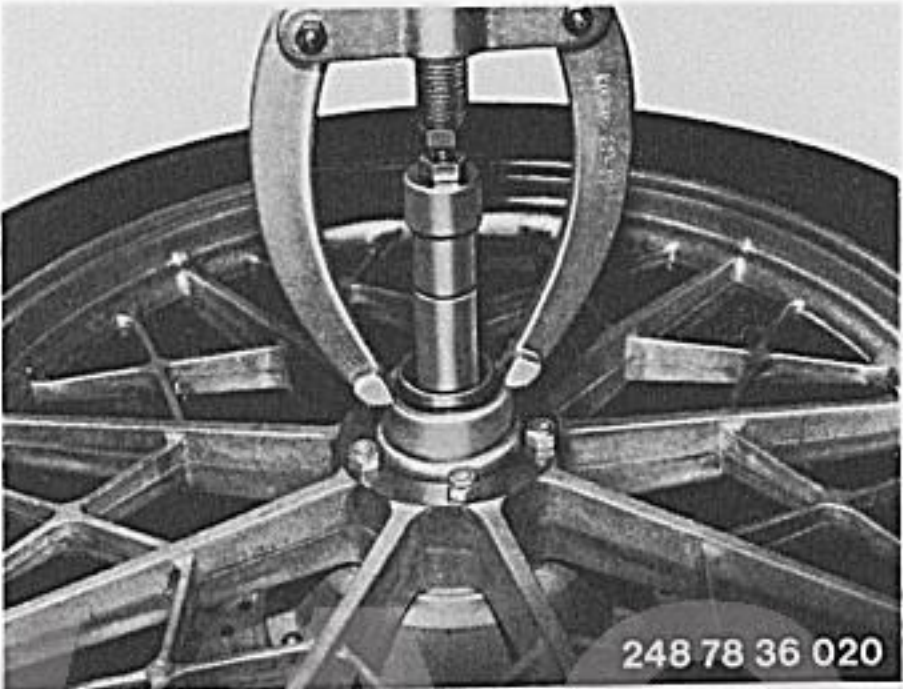
Extract the sealing ring with a screwdriver (arrow).
Take out the thrust block and the taper roller bearing.

When installing: drive the sealing ring in flush.

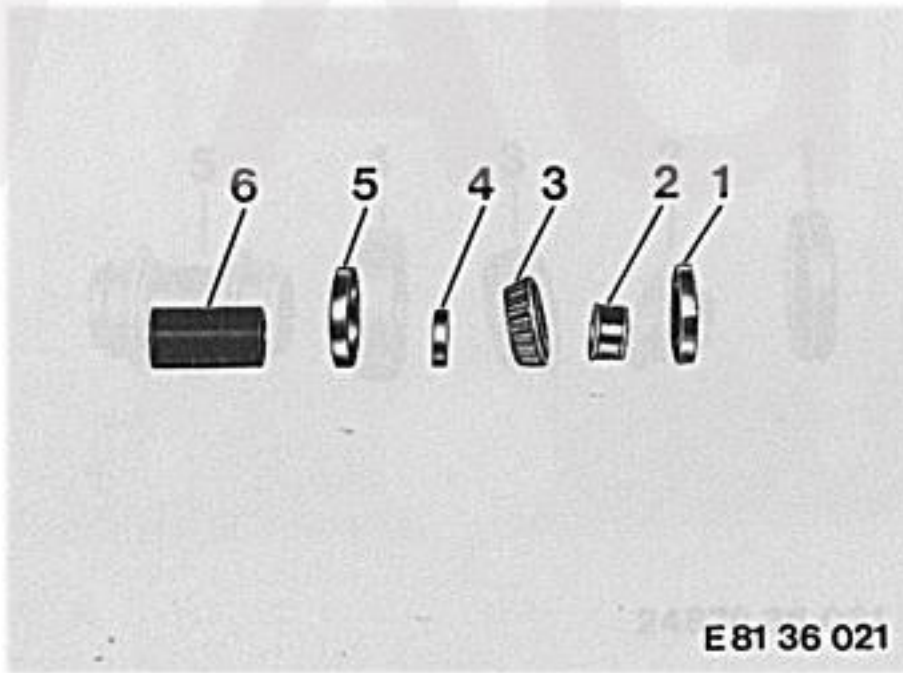


Extract the bearing shell from the hub with a 'Kukko' puller, BMW special tool 00 8 551.

When installing: heat the hub to app. 80°C (175°F) and drive the bearing shell in with BMW drift 00 5 550.



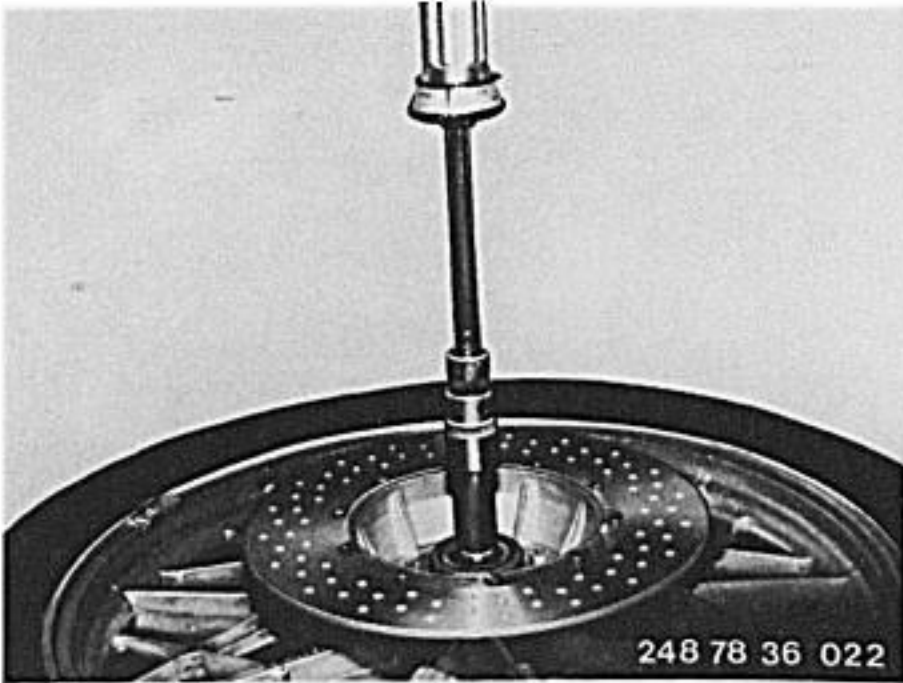
- 1 Sealing ring
- 2 Thrust block
- 3 Taper roller bearing
- 4 Fitted ring
- 5 Bearing shell
- 6 Spacer

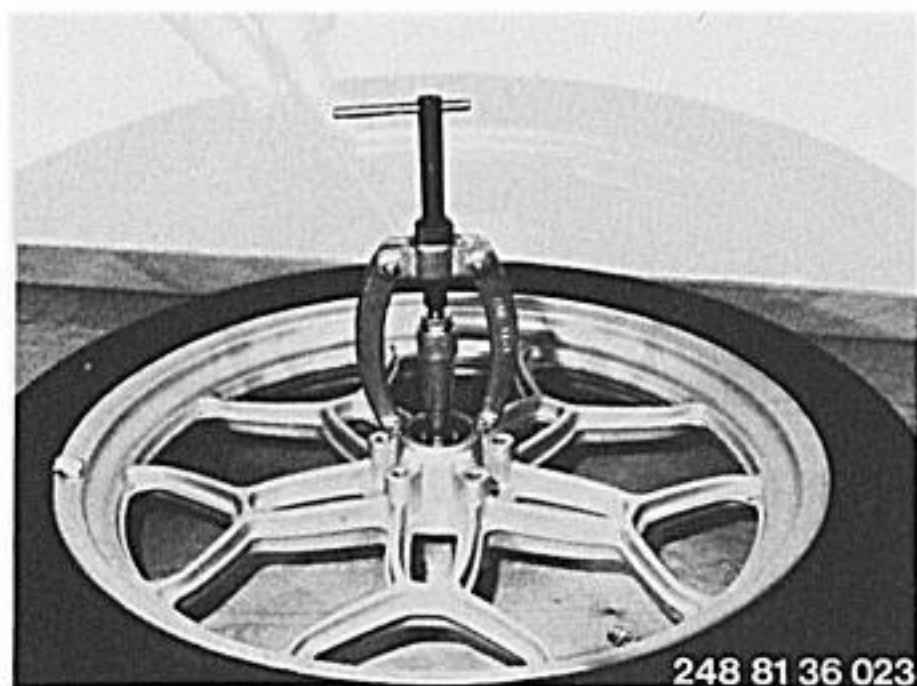


Push the quick-release axle through the wheel hub and preload bearing with 50 mm (2 in) spacing sleeve (arrow) and quick-release axle nut.

Place the friction meter with adapter and socket wrench head on the quick-release axle nut, and check the bearing setting.
For friction value and tightening torque, see Specifications.

Note: the spacing sleeve for the rear wheel is 85 mm (3.35 in) long.





R 65 LS (Deep-groove ball bearings)

Remove brake discs (front wheel only). Place the wheel (hub down) on a hot plate and heat to app. 80° C (176° F) ('Thermo-chrome' pin).

Pull out the ball bearing with Kukko puller No. 21/3 and support bridge 22-1.

Drive in the new bearing with drift BMW No. 00 5 550 while the hub is still warm.



BMW AG

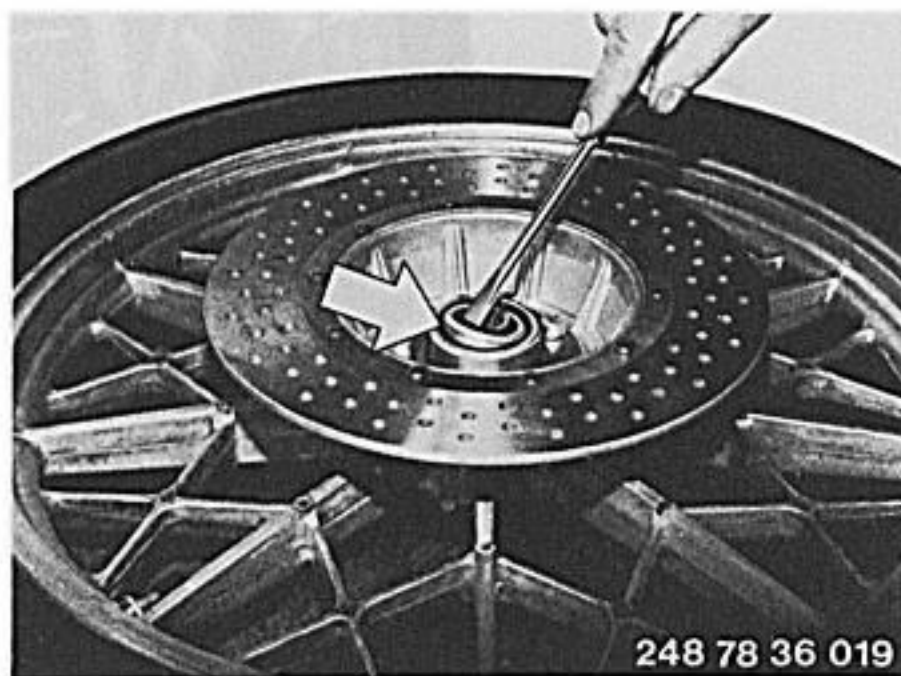
36 31 371 Wheel bearings for front or rear wheel — removing and installing

Remove and install front wheel — 36 30 300.

Remove and install rear wheel — 36 30 320.

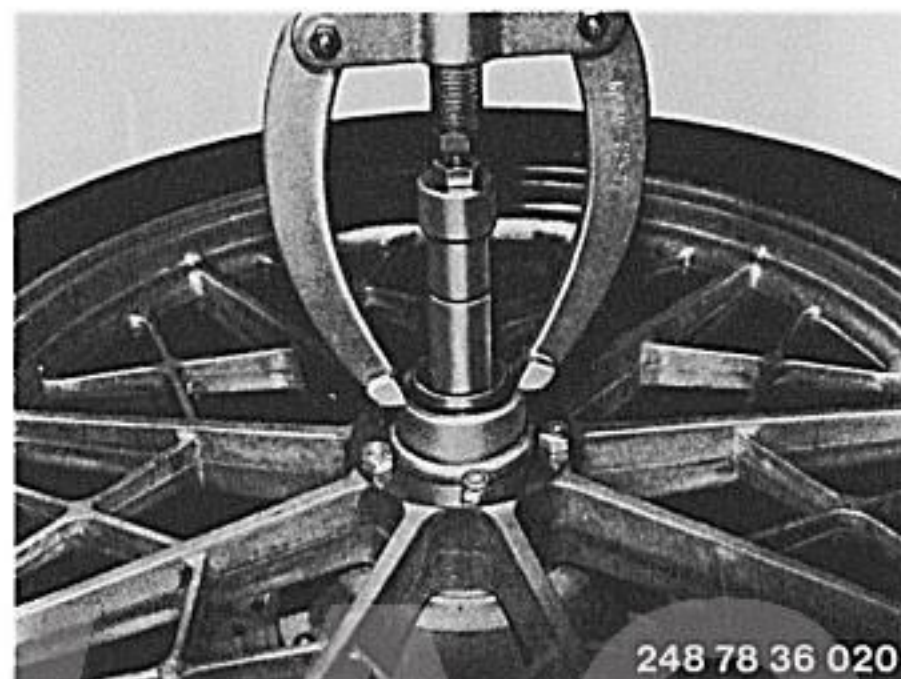
Extract the sealing ring with a screwdriver (arrow).
Take out the thrust block and the taper roller bearing.

When installing: drive the sealing ring in flush.

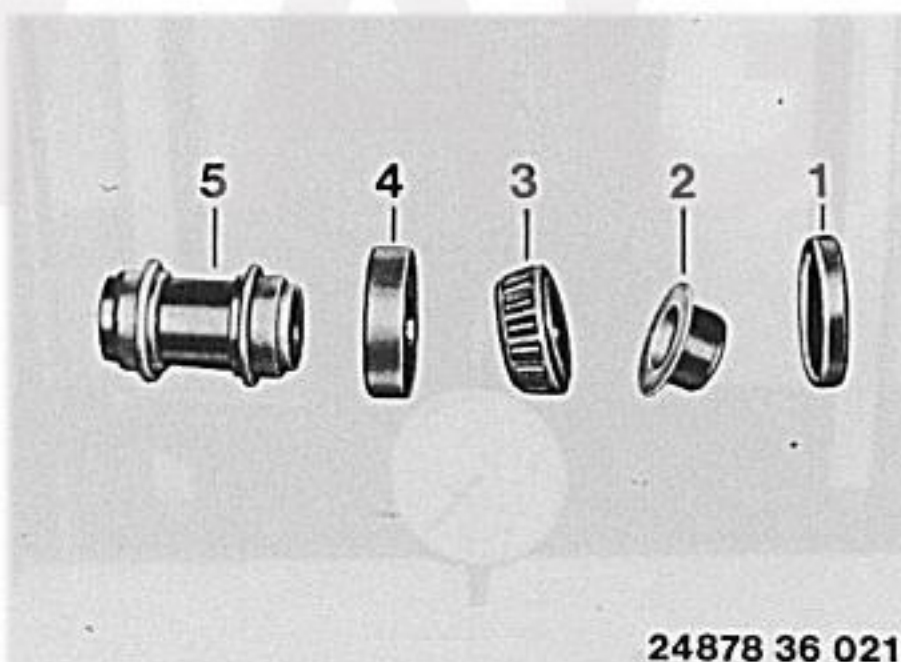


Extract the bearing shell from the hub with a 'Kukko' puller, BMW special tool 00 8 551.

When installing: heat the hub to app. 80°C (175°F) and drive the bearing shell in with BMW drift 00 5 550.



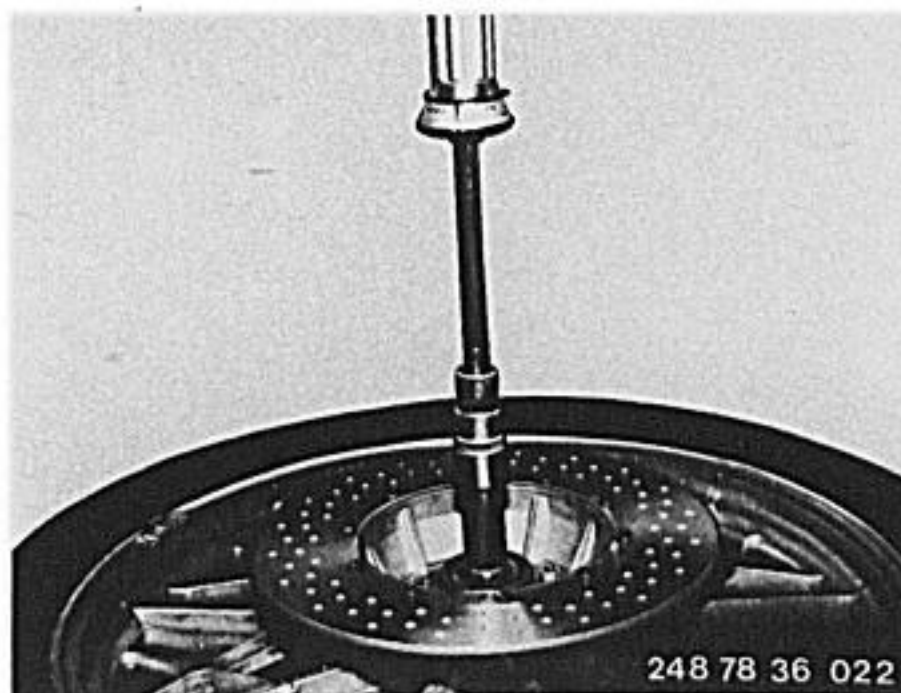
- 1 Sealing ring
- 2 Thrust block
- 3 Taper roller bearing
- 4 Bearing shell
- 5 Spacer



Push the quick-release axle through the wheel hub and preload bearing with 50 mm (2 in) spacing sleeve (arrow) and quick-release axle nut.

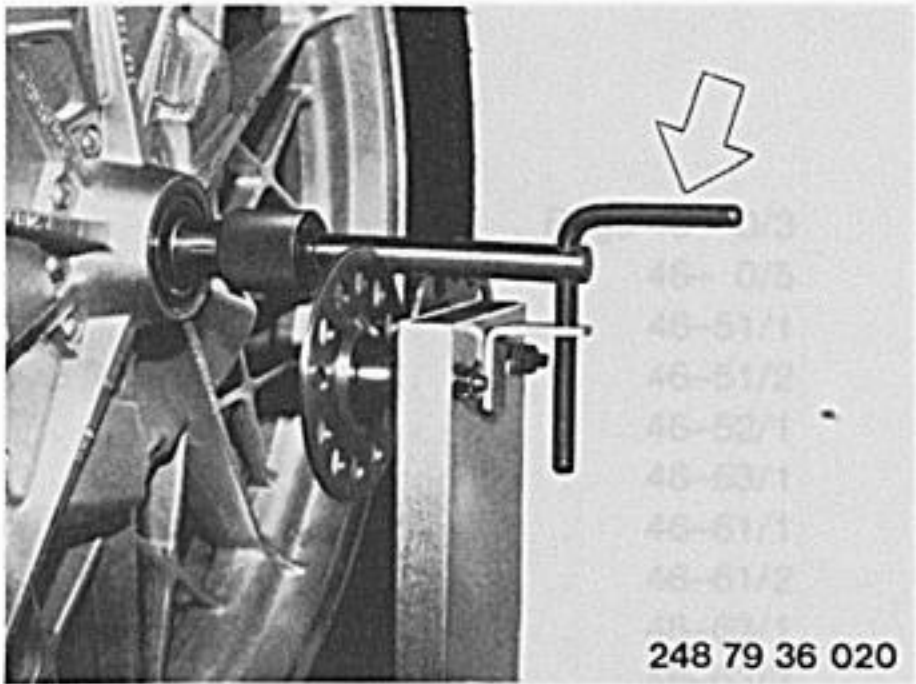
Place the friction meter with adapter and socket wrench head on the quick-release axle nut, and check the bearing setting.
For friction value and tightening torque, see Specifications.

Note: the spacing sleeve for the rear wheel is 85 mm (3.35 in) long.

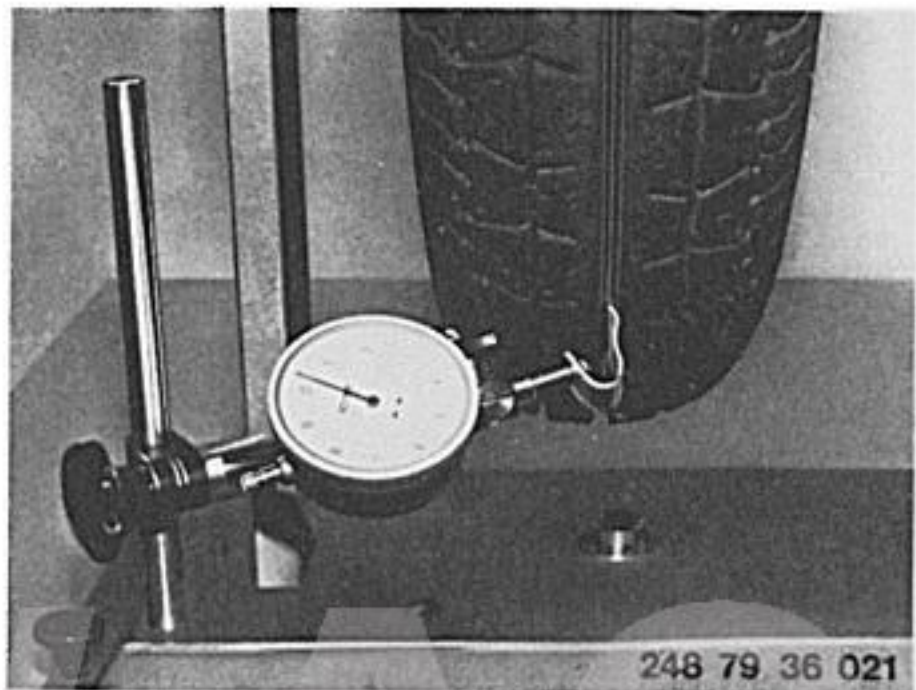


36 32 081 Lateral and radial runout – measuring

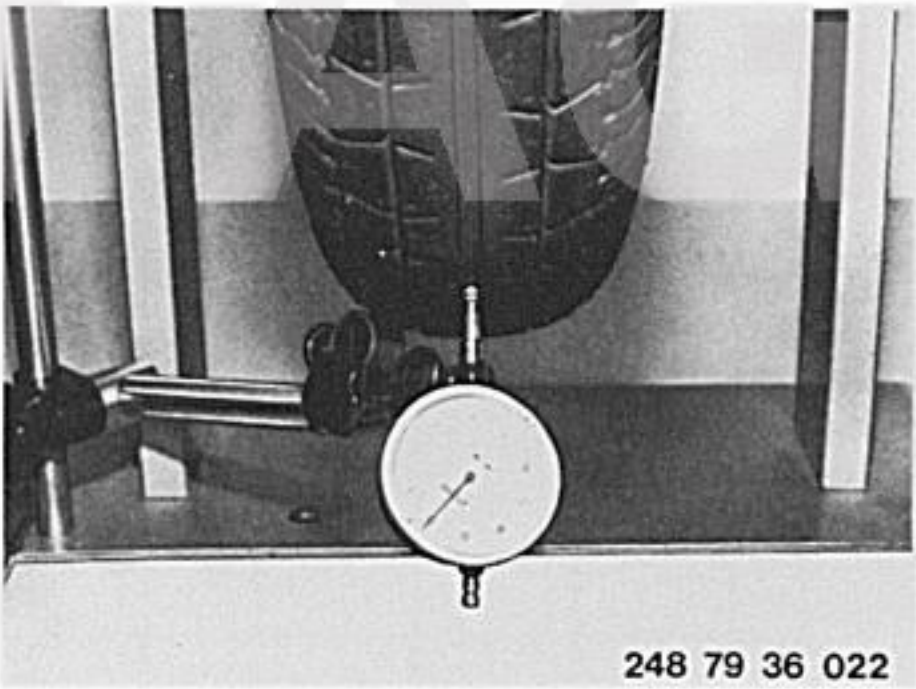
Insert balancing shaft in wheel.
Mount the wheel on balancing stand BMW No. 36 3 600. Prevent the side and measuring shafts from turning with the pin (arrow).



Measure the lateral runout.
Position the measuring gauge feeler on the edge of the tyre's centre groove and set the gauge to zero.
Carefully rotate the wheel.
See Specifications for permissible lateral runout.



Measure the radial runout.
Position the measuring wheel in the base of the tyre's centre groove.
Slowly rotate the wheel.
See Specifications for permissible radial runout.



46 Frame

Specifications	Page 46– 0/3
Specifications (1981 models)	46– 0/5
46 51 040 Wheel track offset – measuring (with gauge)	46–51/1
46 51 501 Front section of frame – checking	46–51/2
46 52 000 Center stand – removing and installing	46–52/1
46 53 000 Prop stand – removing and installing	46–53/1
46 61 000 Front mudguard – removing and installing	46–61/1
46 62 000 Rear mudguard – removing and installing	46–61/2
46 63 020 Cockpit fairing (R 65 LS) – removing and installing	46–63/1
46 63 025 Top section of cockpit fairing (R 65 LS) – removing and installing	46–63/3



Frame

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Frame	Twin loop, oval-section welded steel tube, with bolted-on rear section (not suitable for sidecar use)		
Location of manufacturer's plate	on steering head, right gusset plate		
Location of frame number	on steering head, right gusset plate		
Motorcycle dimensions and weights			
Overall width of engine mm (in)	688 (27.1)		
Max. height excl. mirror (motorcycle unladen) mm (in)	1080 (42.5)		
Height of seat, unladen mm (in)	770 (30.3)		
Overall length mm (in)	2180 (85.8)		
Wheelbase mm (in)	1390 (54.7)		
Max. permissible track offset mm (in)	4 (0.16)		
Ground clearance with 75 kg (165 lb) rider seated mm (in)	105 (4.13)		
Unladen weight incl. lubricants, 24 liters of fuel and tools kg (lb)	205 (452)		
Permissible gross weight = unladen weight plus rider/pillion passenger and luggage kg (lb)	398 (877)		
Permissible wheel loads, solo Front, at 1.9 bar (27 lb/in ²) tire pressure Rear, at 2.0 bar (28.5 lb/in ²) tire pressure	160 (353) 245 (540)		
Permissible wheel loads, two-up Front, at 2.0 bar (28.5 lb/in ²) tire pressure Rear, at 2.25 bar (32 lb/in ²) tire pressure	178 (392) 270 (595)		
Max. number of riders	2 persons		

Tightening torques Nm (lb. ft)

Retaining bolts for rear frame section

25 (18.4)

Center stand retaining bolts

43 ... 48 (32 ... 35)

All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

Frame

Specifications (1981 models)

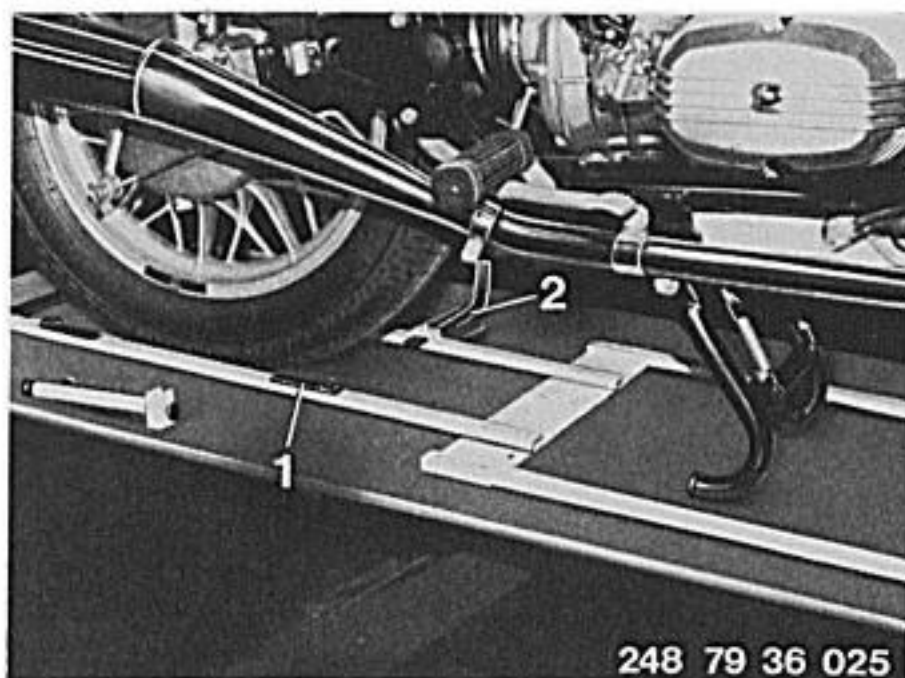
Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Frame	Twin loop, oval-section welded steel tube, with bolted-on rear section (not suitable for sidecar use)			
Location of manufacturer's plate	on steering head, right gusset plate			
Location of frame number	on steering head, right gusset plate			
Motorcycle dimensions and weights				
Overall width of engine mm (in)	688 (27.1)			
Max. height excl. mirror (motorcycle unladen) mm (in)	1080 (42.5)			1090 (42.9)
Height of seat, unladen mm (in)	770 (30.3)			
Overall length mm (in)	2180 (85.8)			
Wheelbase mm (in)	1390 (54.7)			
Max. permissible track offset mm (in)	4 (0.16)			
Ground clearance with 75 kg (165 lb) rider seated mm (in)	105 (4.13)			
Unladen weight incl. lubricants, 22 l (4.8 imp., 5.8 US gal) of fuel and tools kg (lb)	205 (452)			207 (456)
Permissible gross weight = unladen weight plus rider/pillion passenger and luggage kg (lb)	398 (877)			
Max. number of riders	2 persons			

46 51 040 Wheel track offset — measuring (with gauge)

Place motorcycle inside gauge; fixture can be on floor or hoist. Fold back stops (1) and slider (2) or pull in as necessary, push the motorcycle into the gauge and place it on its center stand.

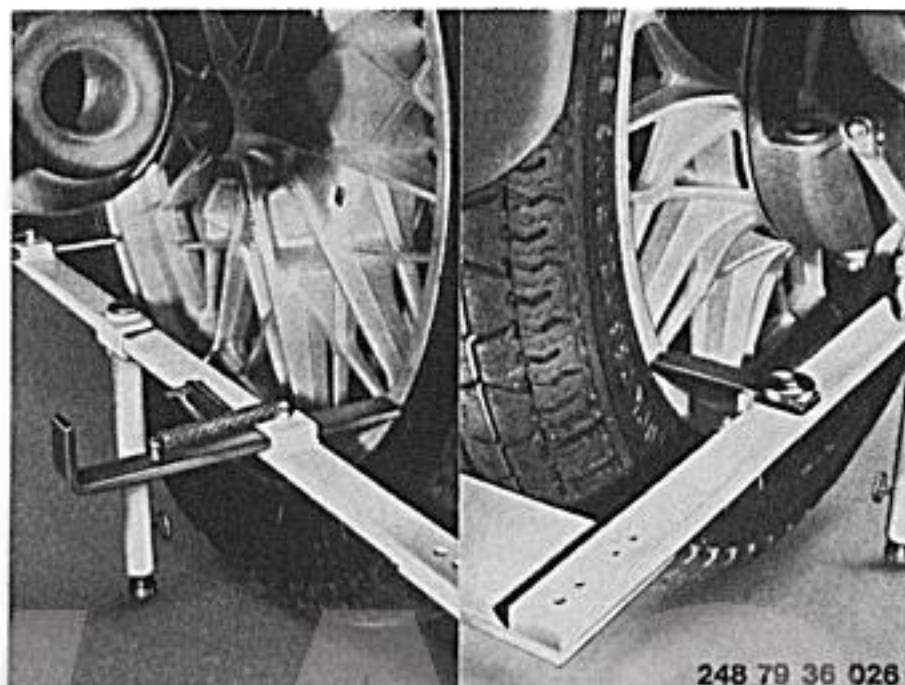
Stop No. for:

36 3 905	Cast alloy wheel with drum brake, 1978 models
36 3 908	Cast alloy wheel with drum brake, 1981 models
36 3 913	R 65 LS, 1982 models



Mount the wheel track offset gauge on its supports (variable-height supports at rear, position about level with quick-release axles). Fold the stops out and release the slider lock (but do not allow the slider to spring out too quickly). Vary the height at the supports until the slider and the stops are only touching the wheel rim.

Press the gauge firmly against the rear wheel from the right side, so that both stops are touching the rim.



To measure wheel track offset, the front wheel must be aligned parallel with one of the measuring rails (arrow). Using a suitable ruler, measure the distance of the front wheel rim from the rail at front and rear, left and right. The difference between the left and right measurements, divided by two, gives the wheel track offset.

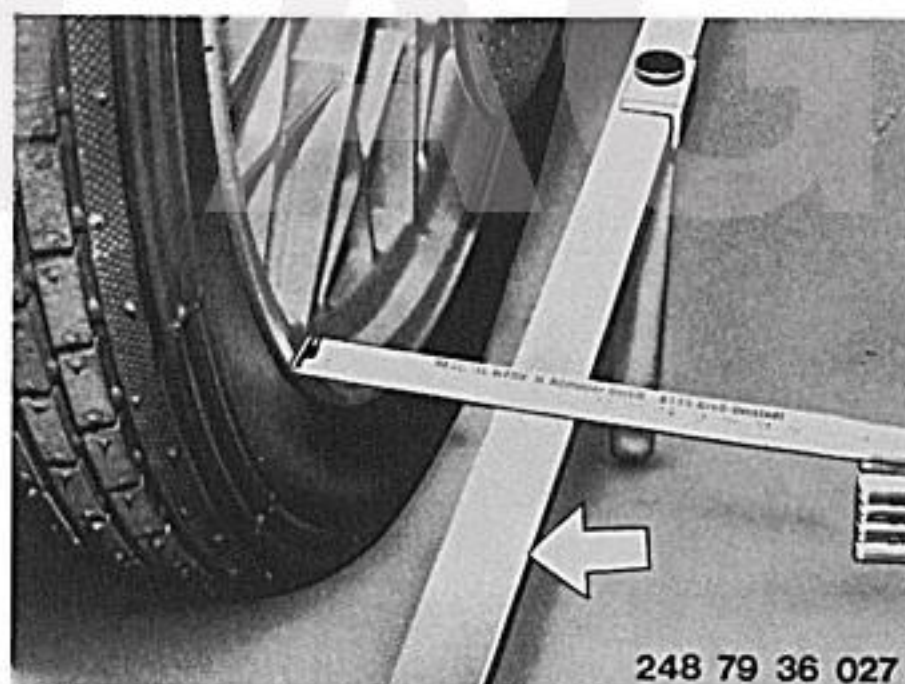
Example:

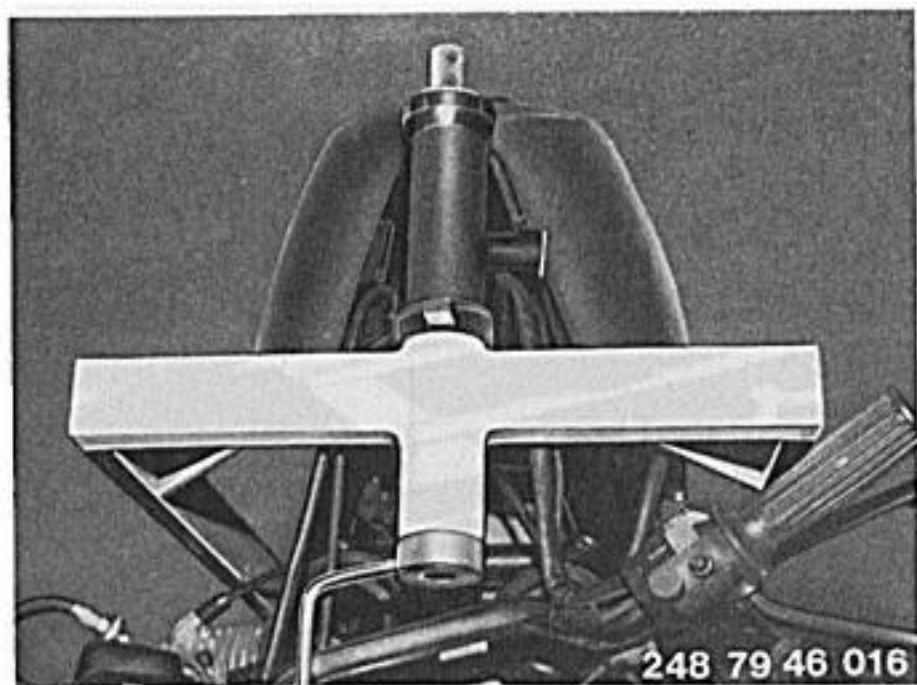
Left, front and rear = 66 mm (2.60 in)

Right, front and rear = 62 mm (2.44 in)

$$\begin{array}{l} 66 \text{ mm} - 62 \text{ mm} \\ (2.60 \text{ in} - 2.44 \text{ in}) \end{array} = \frac{4 \text{ mm (0.16 in) difference}}{2} = 2 \text{ mm (0.08 in) track offset.}$$

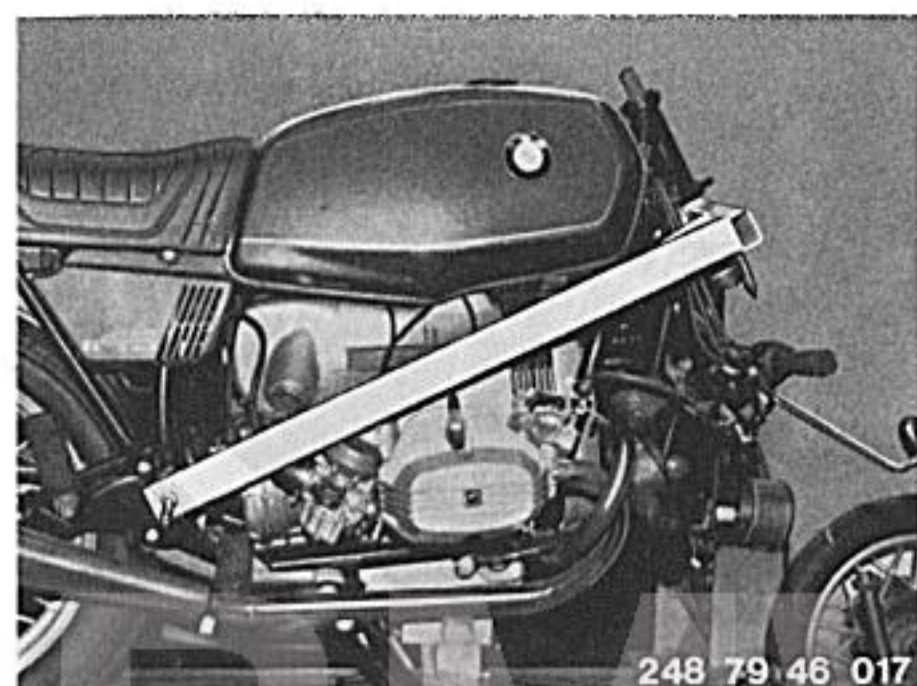
Wheel track offset can be corrected slightly by repositioning the rear swinging fork.





46 51 501 Front section of frame – checking

Remove (install) front forks – 31 42 100.
 The bearing shells remain in position in the steering head.
 Remove and install the left and right carburetors – 13 10 100.
 Unscrew and remove the swinging arm pivot pins.
 Use BMW frame test gauge 46 5 600.
 Attach it to the steering head from underneath, and secure with spindle and nut.



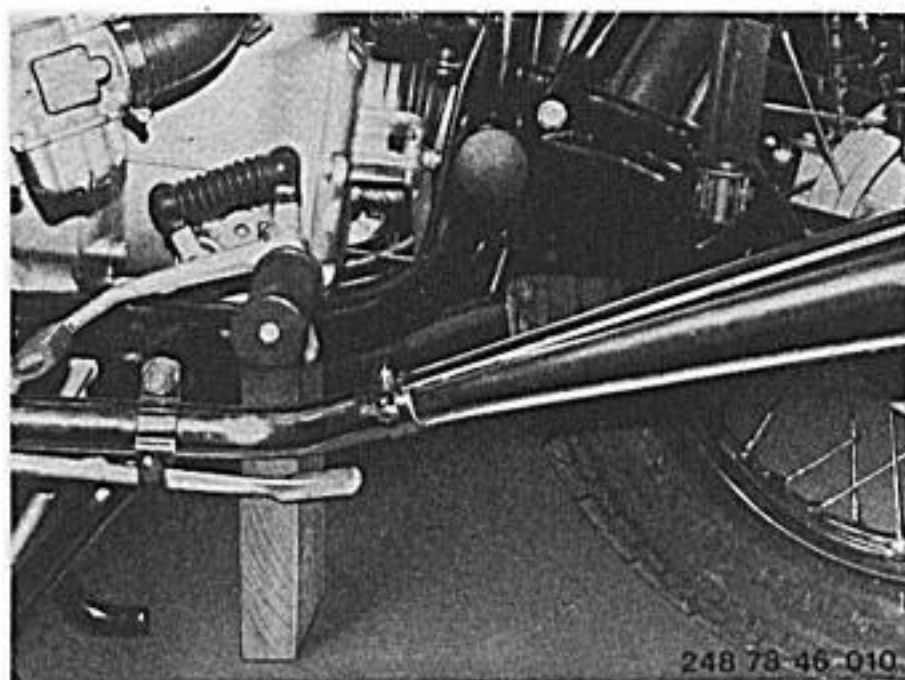
Screw the measuring discs into the left and right swinging arm pivot points on the frame.
 Insert the measuring arbors into the frame test gauge and align the gauge until the distance from the measuring disc is the same at left and right.



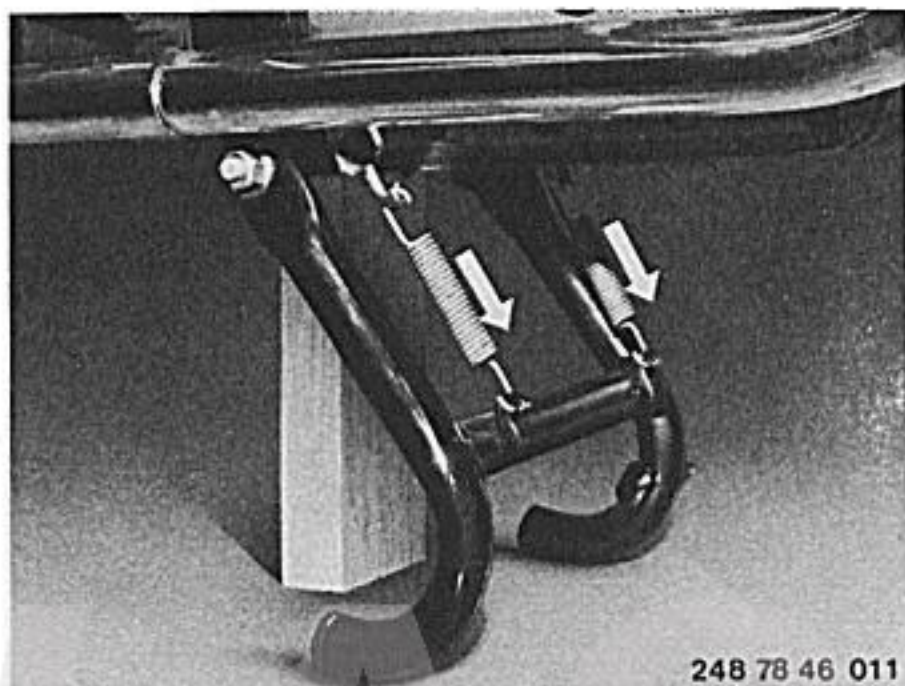
The frame is not distorted if the points of the two measuring arbors are at more or less the same point within the tolerance circle at left and right (maximum difference 1 mm [0.04 in]).

46 52 000 Center stand — removing and installing

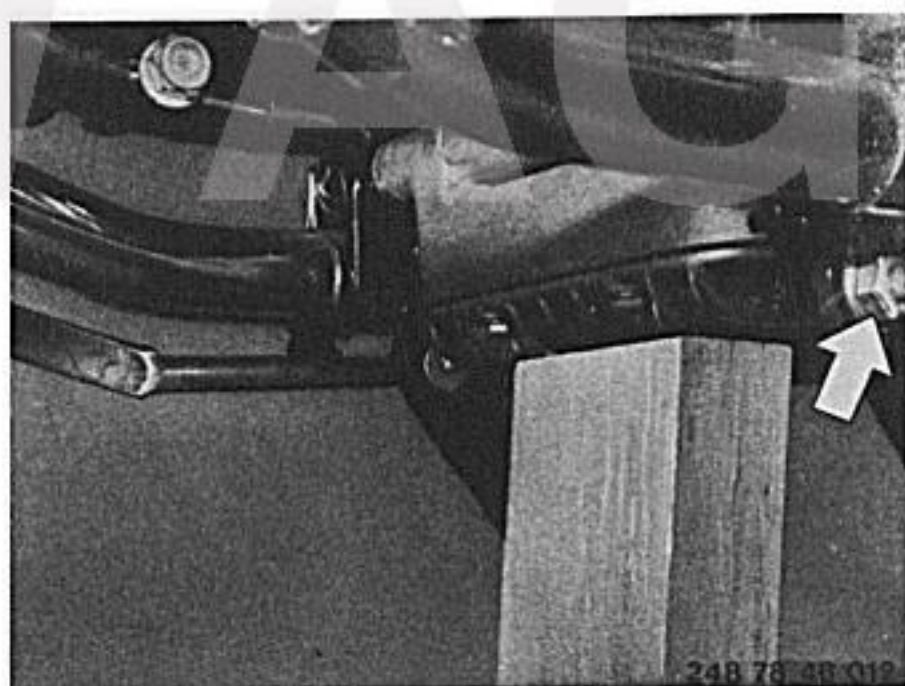
Prop the motorcycle under the oil pan until the center stand is clear of the ground.

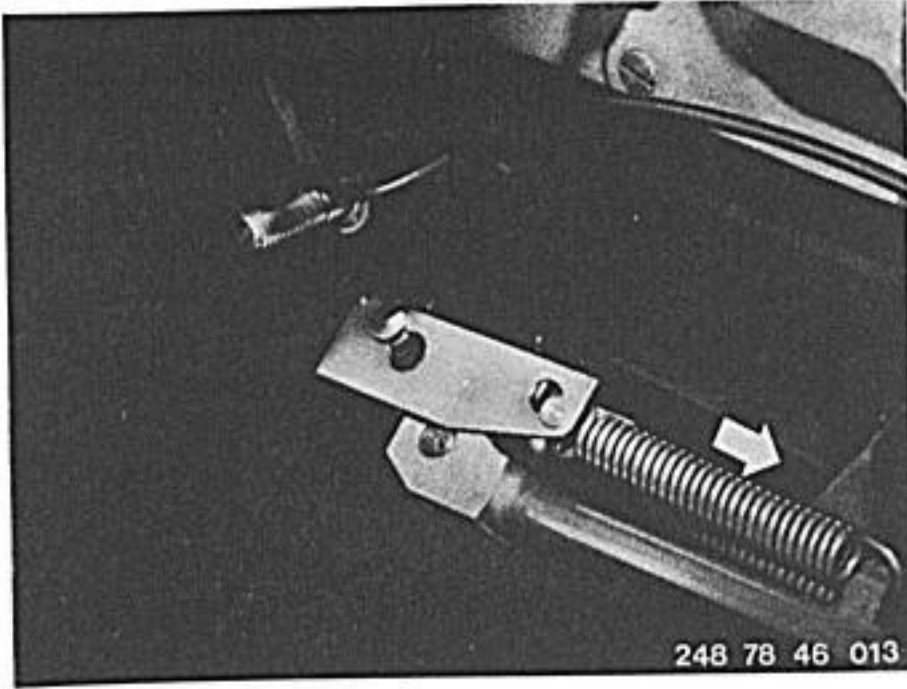


Pull the left and right tension springs down at the center stand (in direction of arrow) and disconnect.



Unscrew the left and right hex. nuts (arrow), holding on the inside with an Allen key.
Remove the center stand forwards.





46 53 000 Prop stand – removing and installing

Disconnect the tension springs for the prop stand in the direction shown by the arrow.



Push the stirrup forwards as shown by the arrow until the pin can be driven out of the bottom.



Press the pin out of the prop stand and take it off.

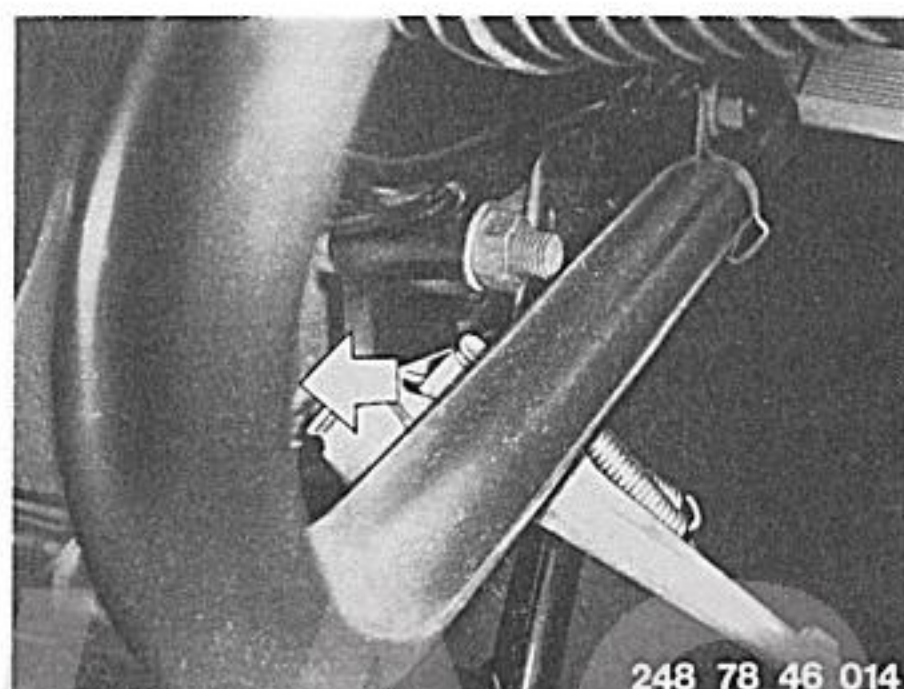


46 53 000 Prop stand – removing and installing

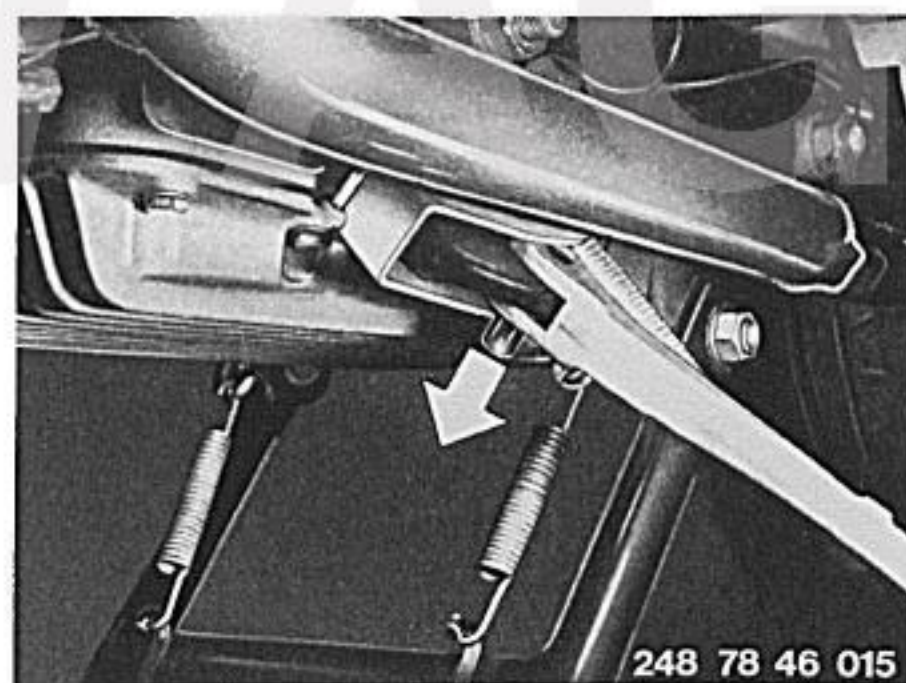
Disconnect the tension springs for the prop stand in the direction shown by the arrow.



Push the stirrup forwards as shown by the arrow until the pin can be driven out of the bottom.



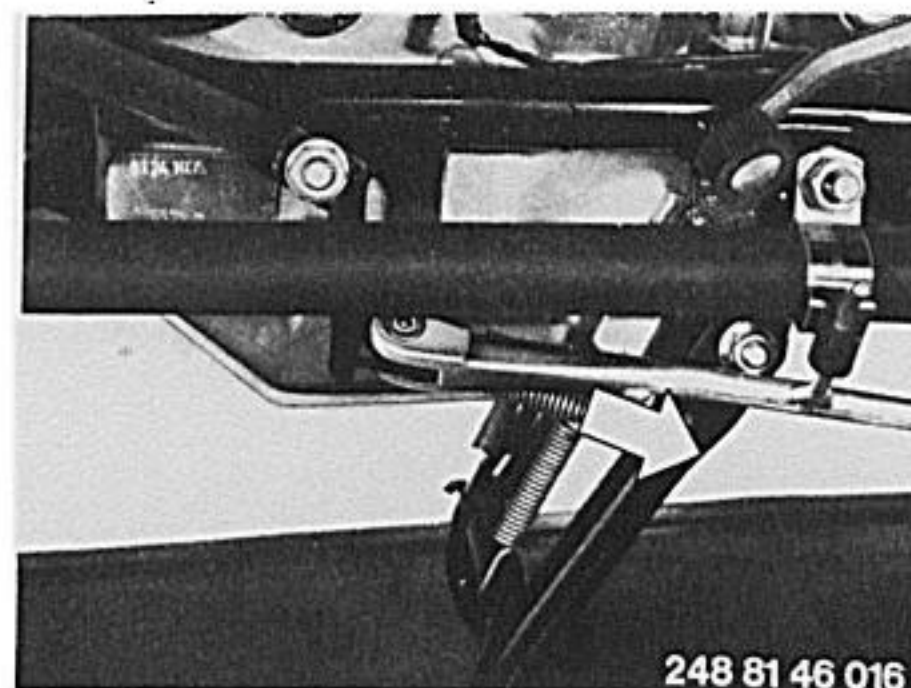
Press the pin out of the prop stand and take it off.

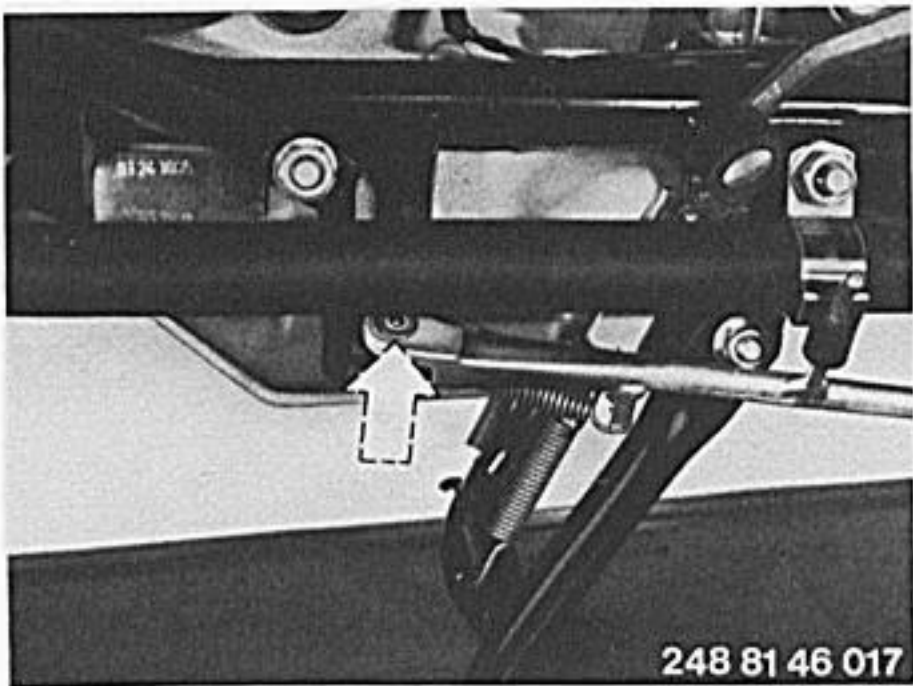


Prop stand – removing and installing (1981 models)

Remove (install) exhaust system – 18 00 020.

Detach the springs in the direction of the arrow.





Remove the Allen screw (arrow) and take off the prop stand.



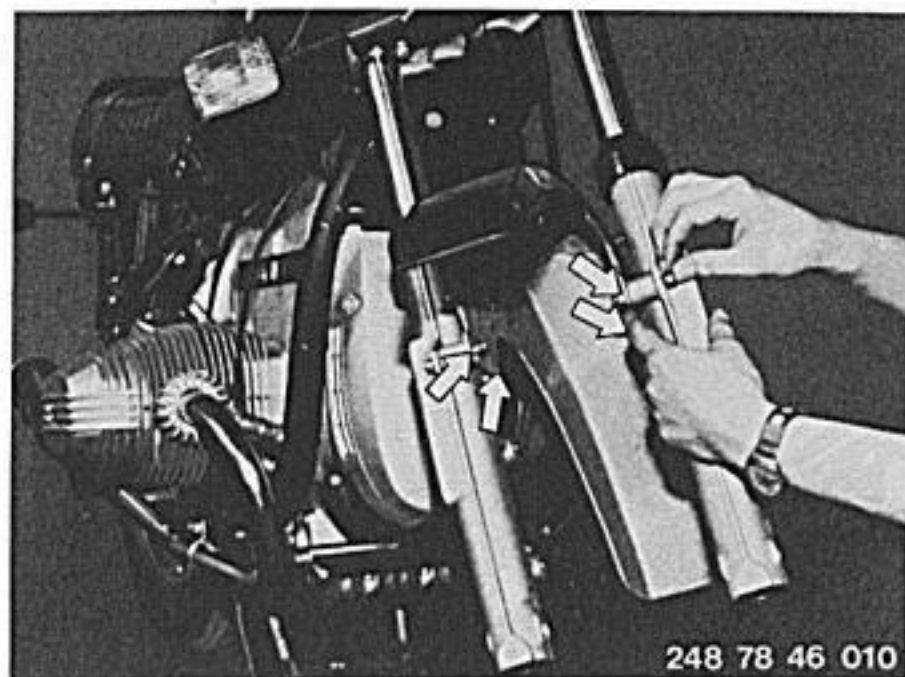
BMW AG

46 61 000 Front mudguard — removing and installing

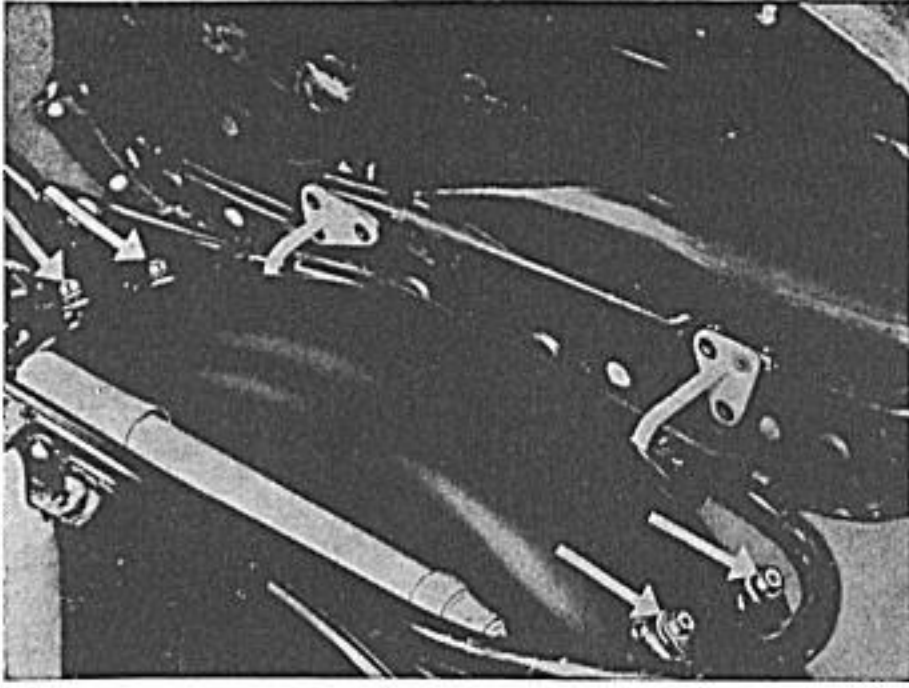
Remove the two Allen screws from the shaped plate at left and right.

To renew a mudguard without shaped plate, remove the four cap nuts from the mudguard.

When installing: do not forget the rubber washers.



BMW AG



46 62 000 Rear mudguard — removing and installing

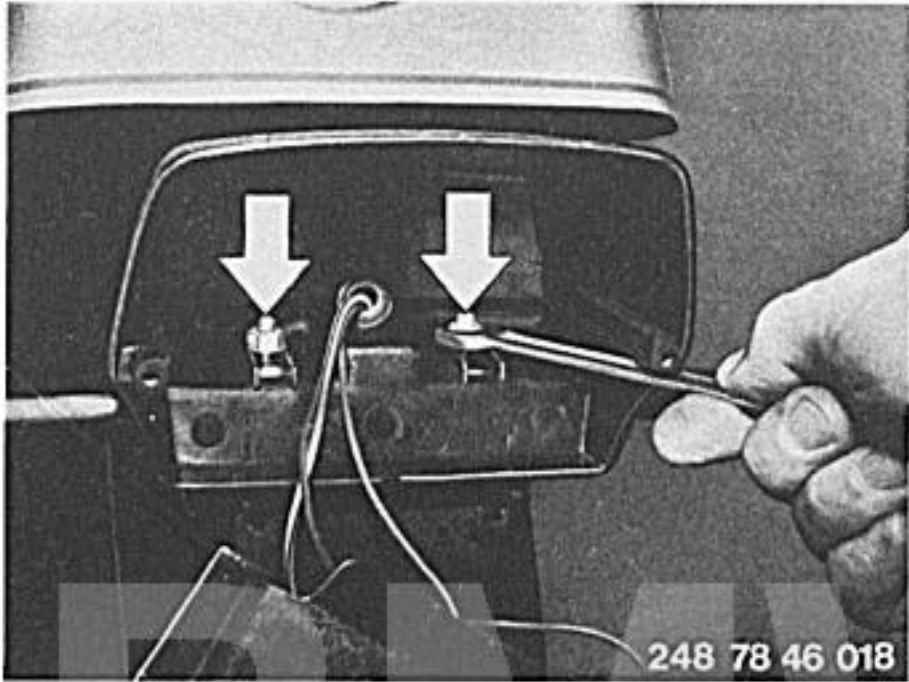
Disconnect the battery earth (ground) lead.

Open the dualseat and remove the four hex. bolts with washers, rubber disks and self-locking nuts (arrow).



Remove both Phillips head screws from the rear light and take off the lens with reflector.

Remove the retaining bolts with washers and nuts (arrow) and the rear light housing with turn indicator holder from the mudguard.

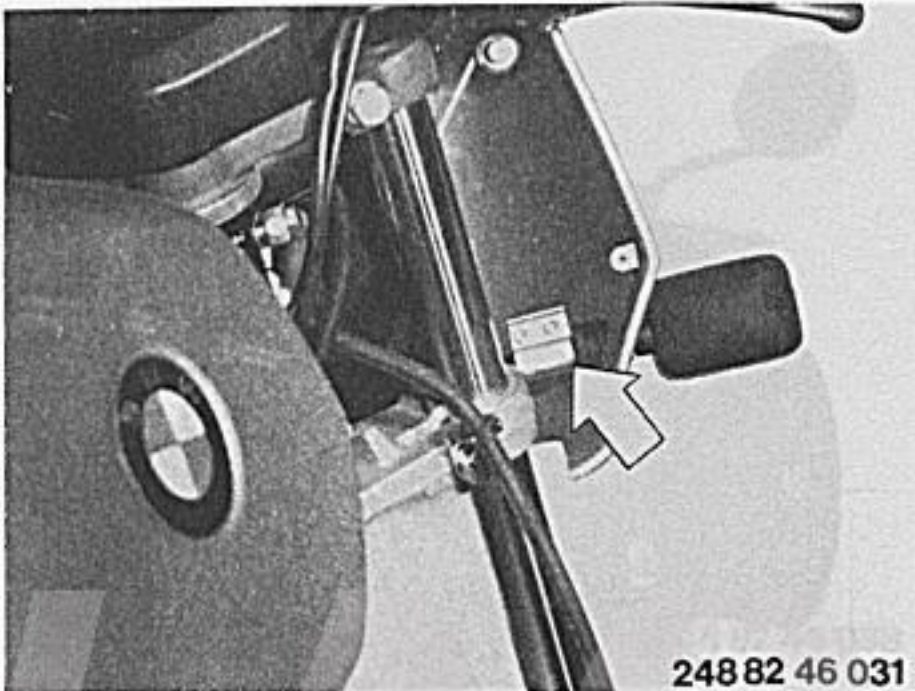


46 63 020 Cockpit fairing (R 65 LS) – removing and installing

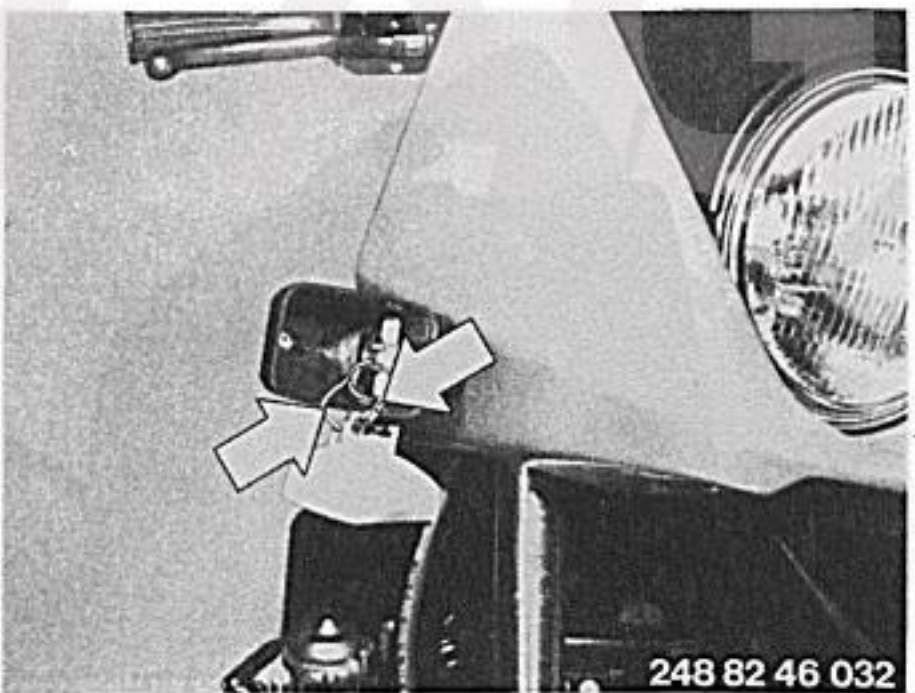
Undo the panel retaining bolts (arrow) at the right and left and remove the panels by lifting them up at an angle.



Loosen the Allen screws at the clamps (arrow) at left and right.

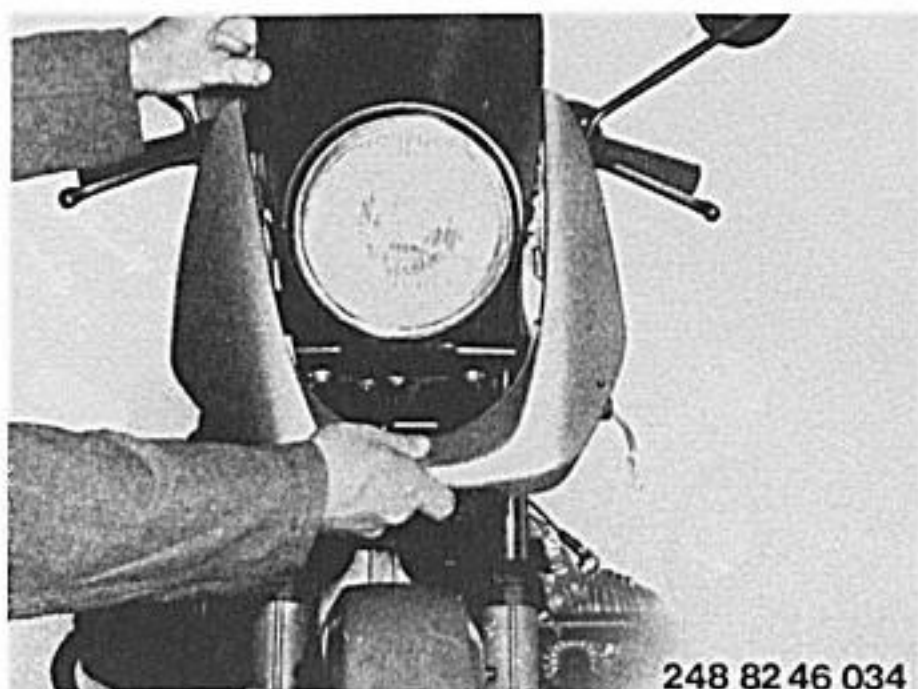


Detach the glass of the front turn indicators and disconnect the cable (arrow) at the reflector housing. Pull the turn indicator housing out of the bottom section of the fairing.



Remove the retaining bolts (arrow) for the bottom section of the cockpit fairing at the right and left.





248 82 46 034

Remove the bottom section of the fairing from the front by pulling off at an angle.

Detach the turn indicator cable from the inside.



Note:

The upper mounting of the bottom section of the fairing is only clamped in the instrument housing (arrow).



248 82 46 035



Undo the threaded ring retaining the ignition lock with Seeger circlip pliers.



248 82 46 037



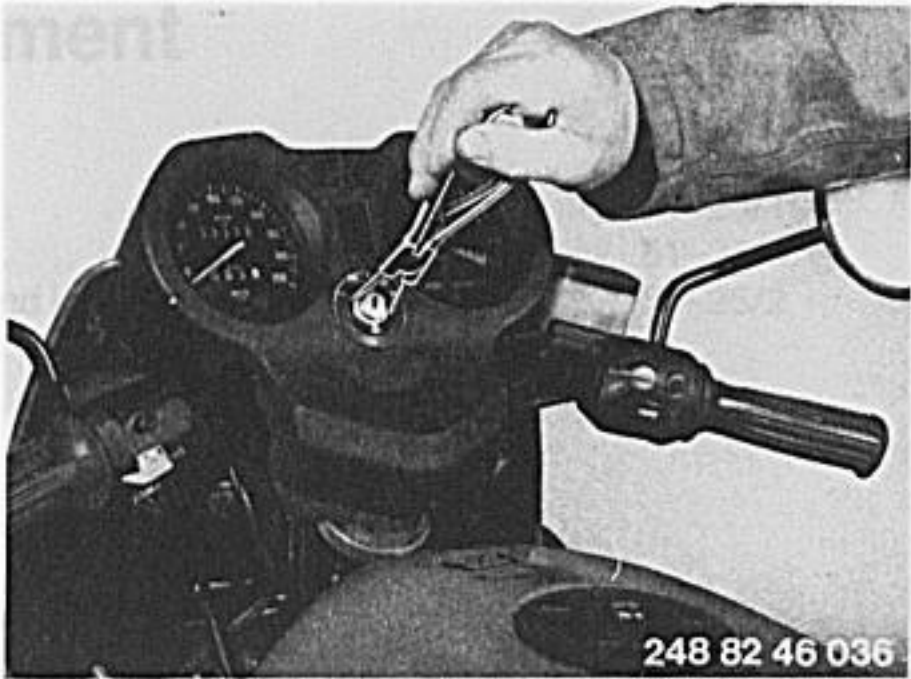
Remove the instrument housing in the direction of the arrow. Pull the turn indicator telltale lamps 1 and 2 out of their holders through the instrument panel openings.



248 82 46 036

**46 63 025 Top section of cockpit fairing
(R 65 LS)
– removing and installing**

Unscrew and remove the threaded ring at the ignition lock using Seeger circlip pliers.



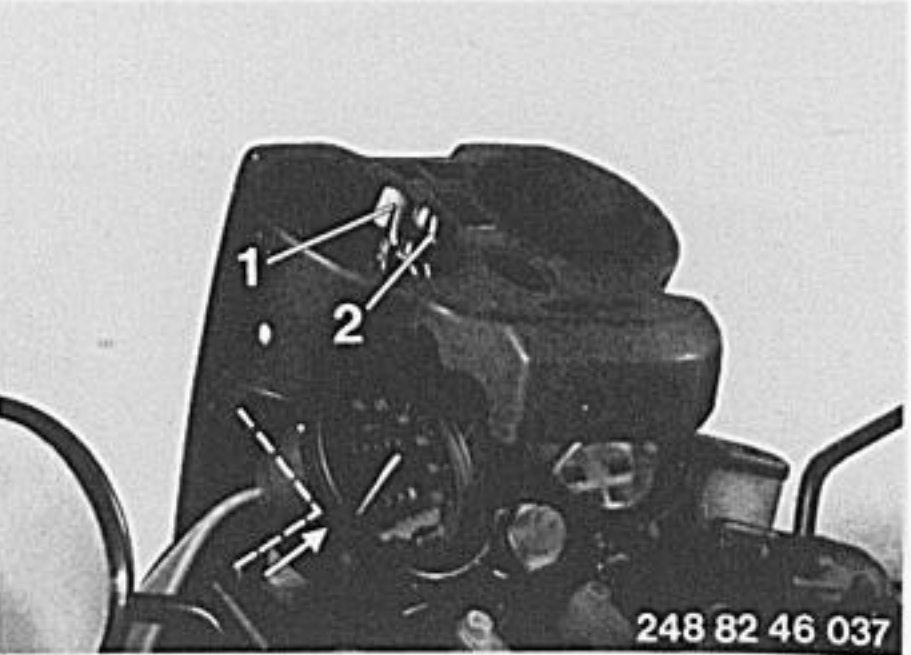
Press the top section of the fairing in with the thumbs at the headlight (arrows) until the retainings lugs (1) and (2) are released.



Press the top section of the fairing out of the upper retaining clamps in the direction of the arrow.



Pull the lamp holders for the turn indicator telltales (1 and 2) out of the top section of the housing.



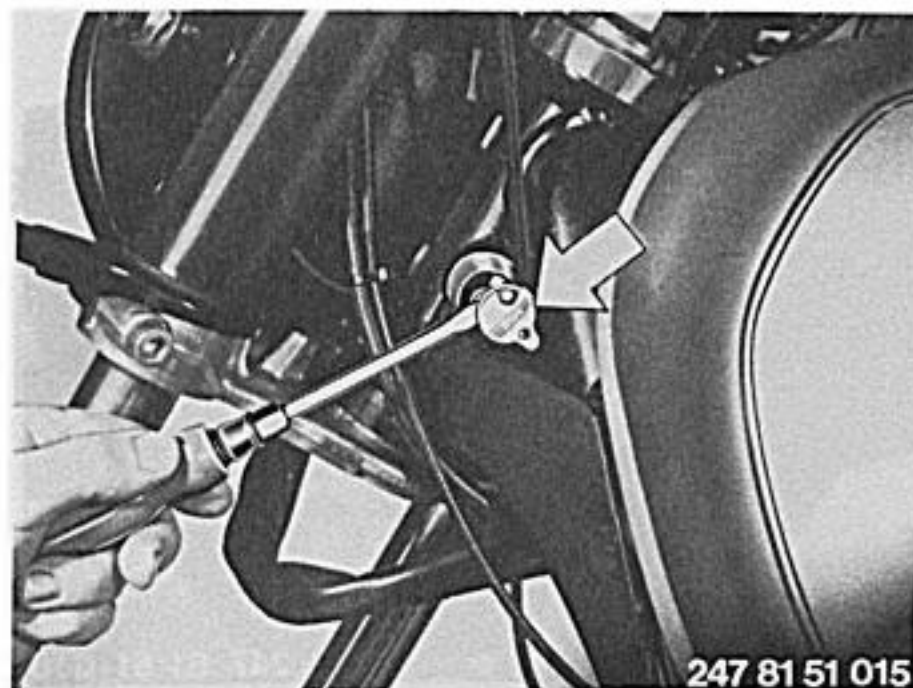
51 Equipment

51 25 030	Steering lock – removing and installing	. . . . .	Page 51–25/1
51 25 050	Dualseat lock – removing and installing	. . . . .	51–25/1
51 25 060	Lock barrel for dualseat lock – removing and installing	. . . . .	51–25/2

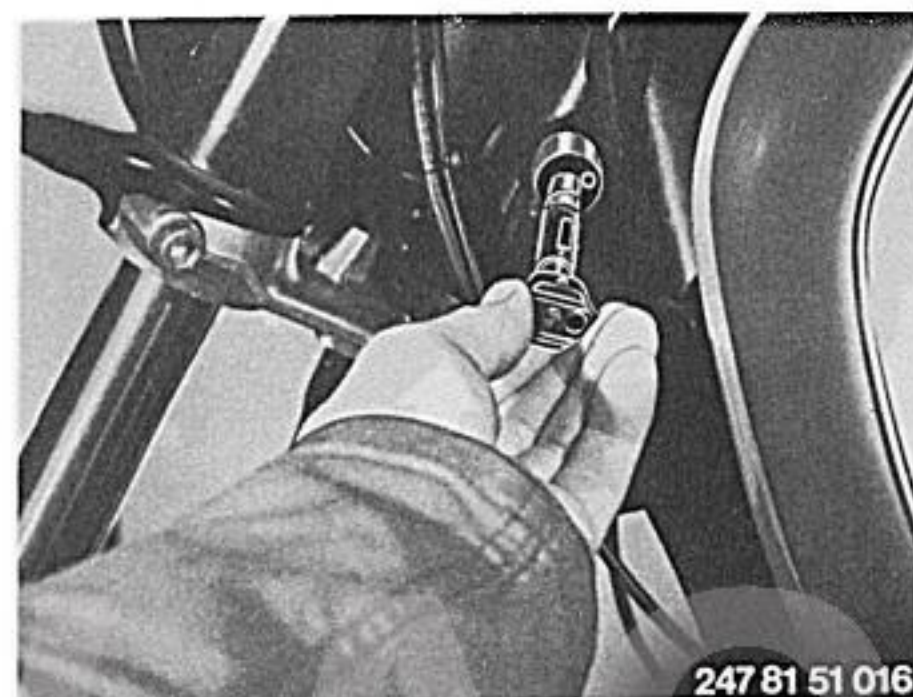


51 25 030 Steering lock – removing and installing

Lever off the cover plate (arrow) with a screwdriver.



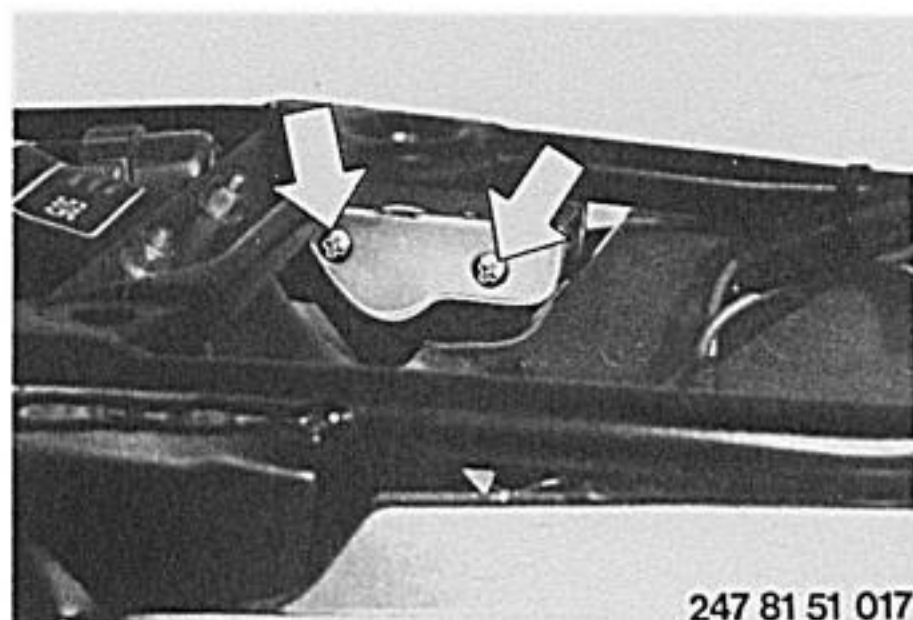
Insert key in lock and turn fully counterclockwise (to left). Pull out the lock barrel.

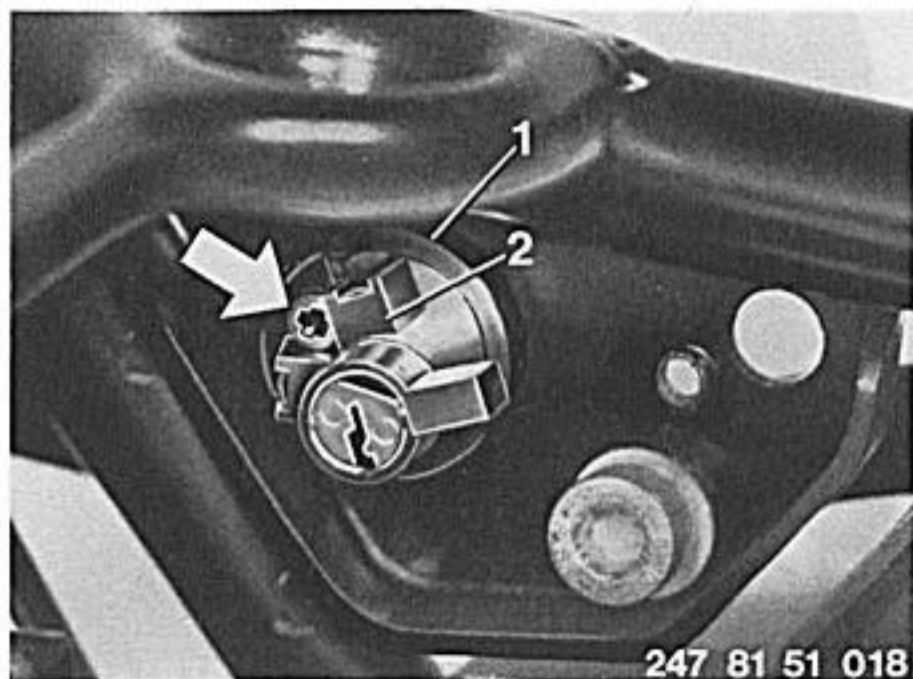


51 25 050 Dualseat lock – removing and installing

Take out both Phillips-head screws (arrows) and detach cover and lock housing.

When installing: insert the back screw loosely first, then the front screw. Make sure that the spring is correctly located.





51 25 060 Lock barrel for dualseat lock – removing and installing

Remove (install) dualseat lock – 51 25 050.

Take out the Phillips-head screw (arrow). Pull the circlip (1) and the lock barrel (2) apart.



When installing: the lock barrel projection must locate in the groove on the lock plate (arrow).



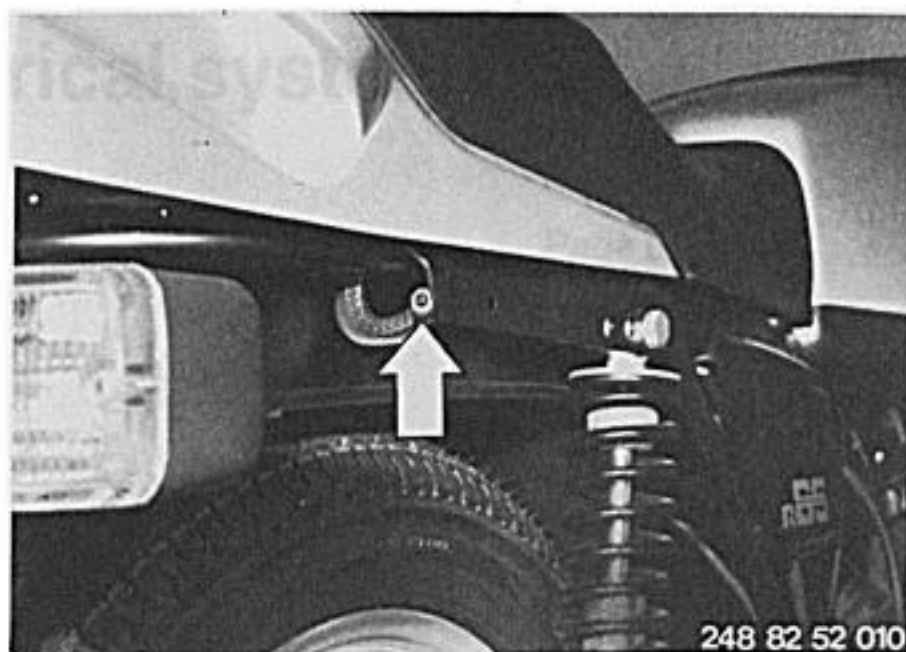
52 Seats

52 53 000	Dualseat – detaching and attaching	52–53/1
-----------	------------------------------------	-----------	---------

BMW AG

52 53 000 Dualseat – removing and installing

Remove keeper (arrow) at front and rear hinge (push aside with a screwdriver). Raise the seat and pull off carefully to the rear.



BMW AG

61 General electrical system

Specifications and circuit diagrams	Page 61– 0/3
Specifications (1981 models)	61– 0/3
61 21 010 Battery – removing and installing	61–21/1
61 21 100 Battery holder – removing and installing	61–21/2
61 31 350 Flasher unit – removing and installing	61–31/1
61 31 367 Buzzer – removing and installing	61–31/1
61 31 365 Buzzer relay – removing and installing	61–31/2
61 31 400 Starter relay – removing and installing	61–31/2
61 33 000 Horn – removing and installing	61–33/1

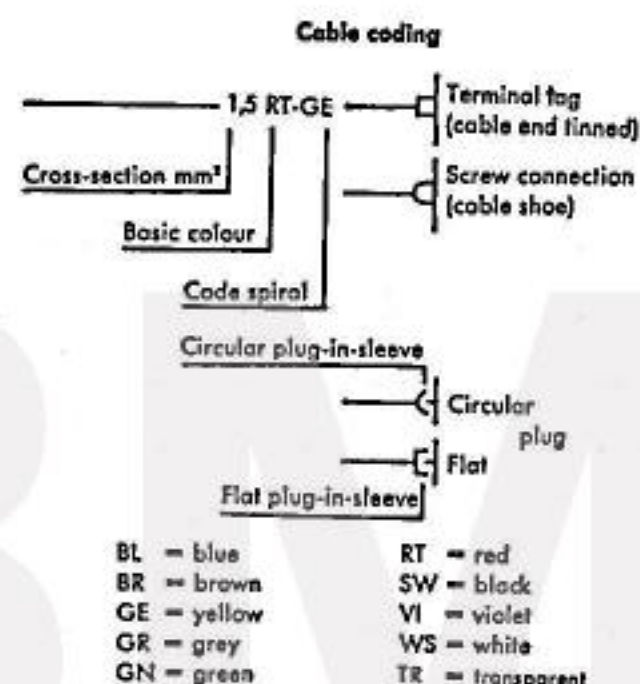
BMW AG

Electrical system – general

Specifications

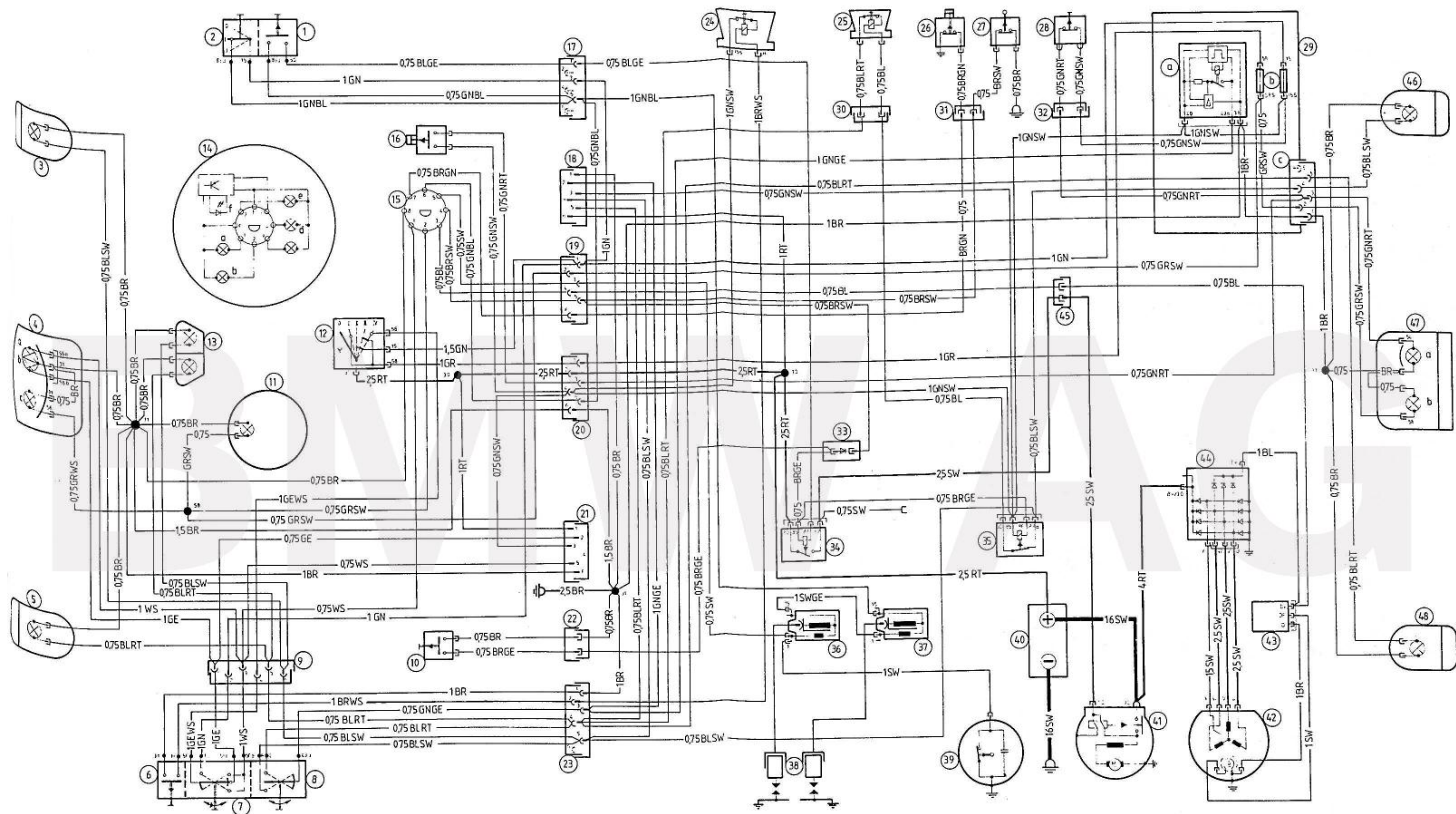
Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Horn	Electromagnetic vibrator horn, 335 Hz		
Battery (VARTA) Voltage V	12		
Capacity Ah	16		
Earthed (grounded) pole	negative		
Flasher unit (Bosch)	0335 200 043 (12 V 2 (4) x 21 W 13 ... 7 W		
Fuses (2)	8 Amp		

Key to electrical circuit diagram — R 45 — R 65



- 1 Kill switch
- 2 Starter switch
- 3 Turn indicator, front right
- 4 Headlight
 - a High beam
 - b Low beam
- 5 Turn indicator, front left
- 6 Horn switch
- 7 Low beam (dip) switch with headlight flasher
- 8 Turn indicator switch
- 9 Six-pin plug
- 10 Clutch-operated switch

- 11 Speedometer dial illumination
- 12 Ignition/light switch
- 13 Turn indicator telltales, left and right
- 14 Revolution counter
 - a High beam telltale (blue)
 - b Dial illumination
 - c Charge warning light (red)
 - d Neutral indicator (green)
 - e Oil pressure warning light (orange)
 - f Light-emitting diode for overspeed warning
- 15 Eight-pin plug for revolution counter
- 16 Handbrake light switch
- 17 Six-pin plug (white)
- 18 Six-pin plug (beige) for hazard warning flashers (special equipment)
- 19 Six-pin plug (grey)
- 20 Six-pin plug (black)
- 21 Six-pin plug (blue) for special equipment
- 22 Two-pin plug
- 23 Six-pin plug (black)
- 24 Horn
- 25 Buzzer for turn-indicator repeater
- 26 Oil pressure switch
- 27 Gearbox switch (neutral)
- 28 Foot brake light switch
- 29 Compartment, right
 - a Flasher unit
 - 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 turn-indicator buzzer
- 36 Coil, front
- 37 Coil, rear
- 38 Spark plugs with caps
- 39 Contact breaker with condenser
- 40 Battery
- 41 Starter
- 42 Alternator
- 43 Regulator
- 44 Diode board
- 45 Two-pin plug
- 46 Turn indicator, rear right
- 47 Rear light
 - a Brake light
 - b Rear and license plate light
- 48 Turn indicator, rear left

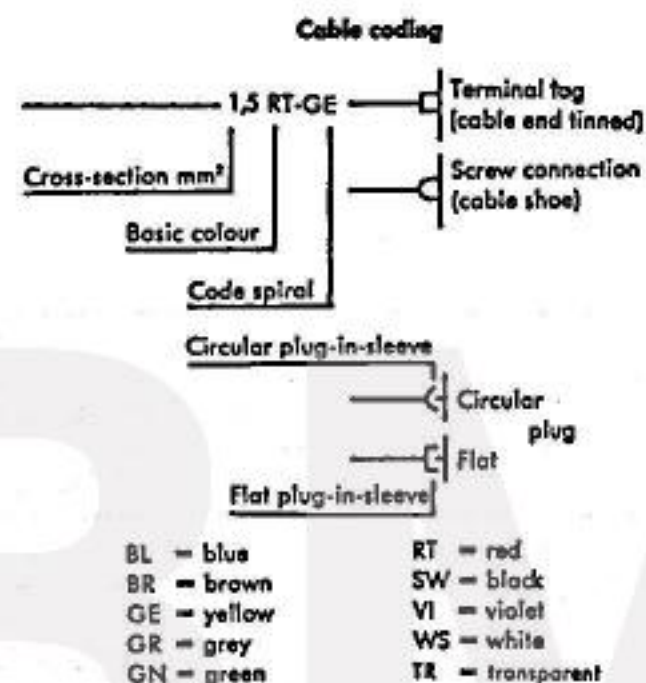


Electrical system – general

Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Horn	Electromagnetic vibrator horn, 335 Hz			
Battery (BMW Mareg) Voltage V		12		
Capacity Ah		16		
Earthed (grounded) pole		negative		
Flasher unit (Wehrle)		12 V 2 (4) x 21 W 13 ... 7 W		
Fuses (2)		8 Amp		

Key to electrical diagram R 45 – R 65 LS (1981 models)

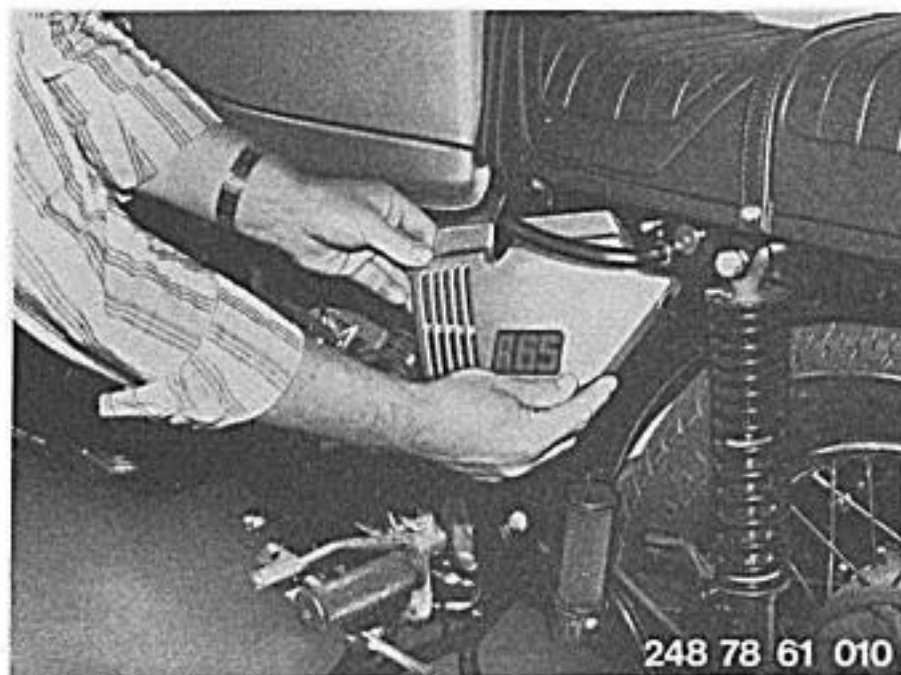


- 1 Front right flashing turn indicator
- 2 Headlight
 - a High beam
 - b Low (dipped) beam
 - c Parking light
- 3 Front left flashing turn indicator
- 4 Left/right turn indicator repeater
- 5 Speedometer dial lighting
- 6 Ignition/light switch
- 7 Hand brake (stop) light switch
- 8 Plug connector to hand brake (stop) light switch
- 9 Revolution counter
 - a High beam telltale (blue)
 - b Dial lighting
 - c Battery charge telltale (red)
 - d Neutral indicator (green)
 - e Oil pressure warning light (red)

- 10 8-pin connector for revolution counter
- 11 Plug connector for optional extras
- 12 Plug connector for left handlebar switch (red)
- 13 Plug connector for left handlebar switch (black)
- 14 Horn push
- 15 Headlight low beam (dip) switch with headlight flasher
- 16 Turn indicator switch
- 17 Horn
- 18 Emergency engine cutout ("kill") switch
- 19 Starter switch
- 20 Clutch switch
- 21 Plug connector for right handlebar switch (white)
- 22 Plug connector for clutch switch
- 23 Fuse box
- 24 Starter relay
- 25 Gearbox switch
- 26 Oil pressure switch
- 27 Plug connector to gearbox and oil pressure switches
- 28 Flasher unit
- 29 Brake pedal (stop) switch
- 30 Plug connector to brake pedal switch
- 31 Plug connector to engine
- 32 Plug connector to rear light
- 33 Twin-spark coil
- 34 Spark plugs with caps
- 35 Plug connector to ignition trigger
- 36 Ignition trigger (Hall effect transmitter)
- 37 Control unit for transistorized coil ignition
- 38 Battery
- 39 Starter
- 40 Diode board
- 41 Voltage regulator
- 42 Alternator
- 43 Right rear flashing turn indicator
- 44 Rear light
 - a Brake (stop) light
 - b Rear and licence plate light
- 45 Left rear flashing turn indicator
- 46 Plug connector for ignition
- 47 Connection for voltmeter

61 21 010 Battery – removing and installing

Remove the right and left battery covers by detaching first the front clip, then the two rear clips. Pull the covers up from the top.



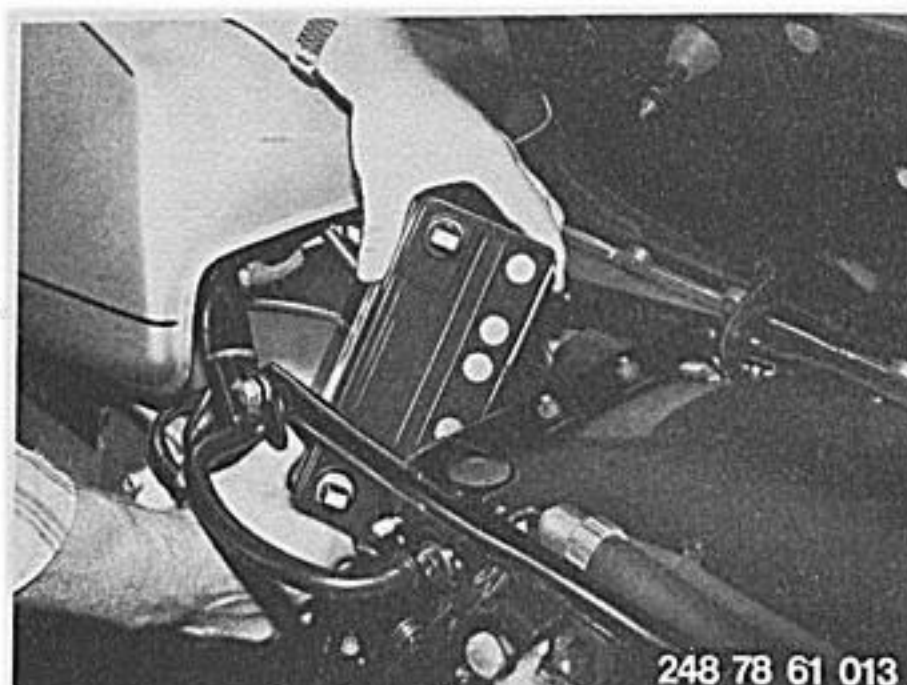
Detach the rubber straps, by pulling down in the direction of the arrow at the left and up at the right. Take off the cover and disconnect the cables at the battery.

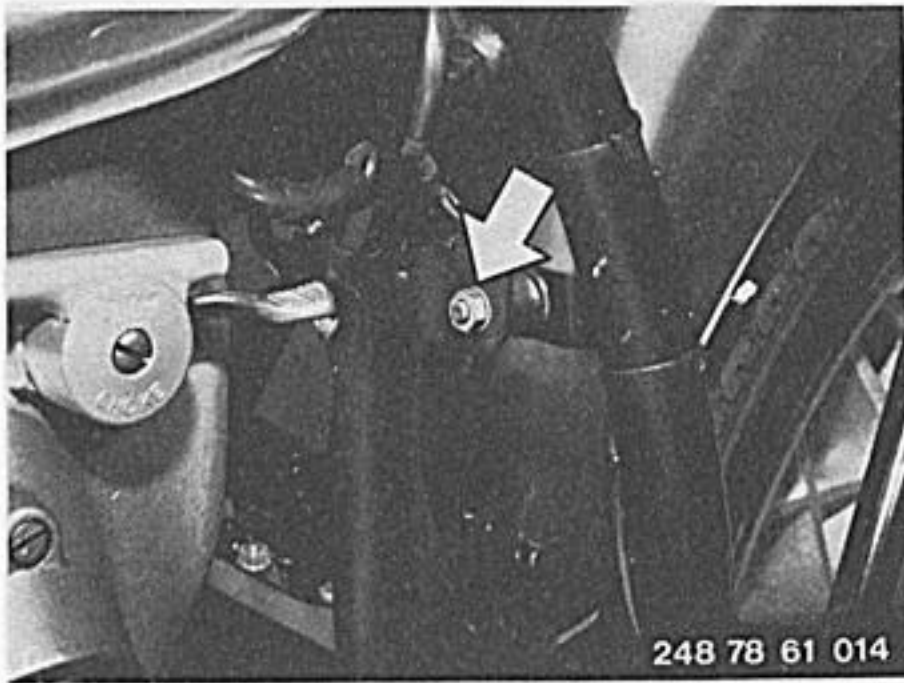


From the left side, tilt the battery to the rear and pull upwards with the right hand. Hold the battery underneath with the left hand, tilt the right side upwards and to the front, and the left side downwards and to the rear, to achieve the position as illustrated.



Tilt the battery fully on to its narrow left side and remove from above.





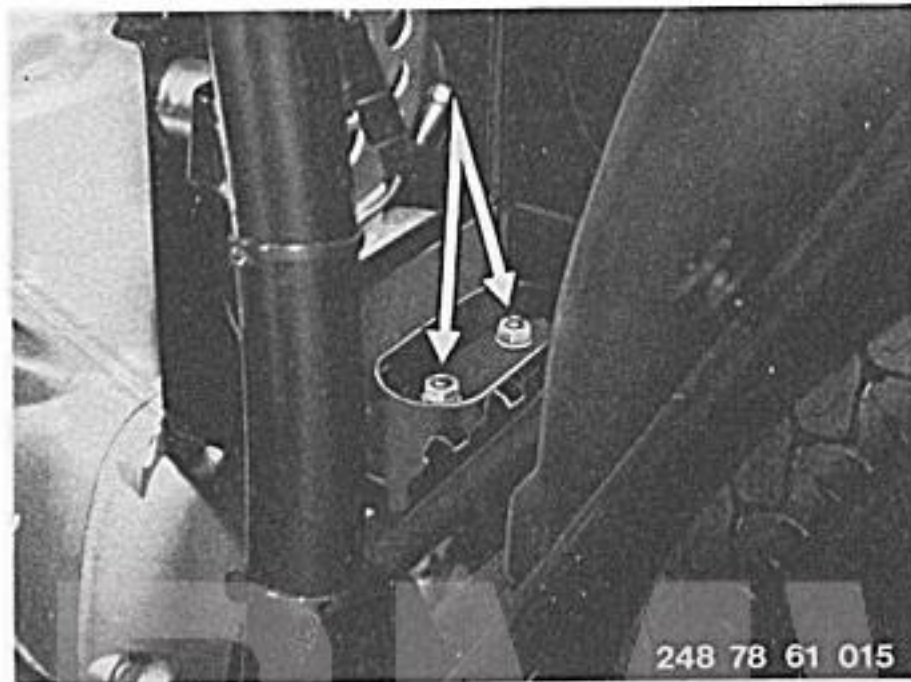
61 21 100 Battery holder – removing and installing

Remove (install) battery – 61 21 010.

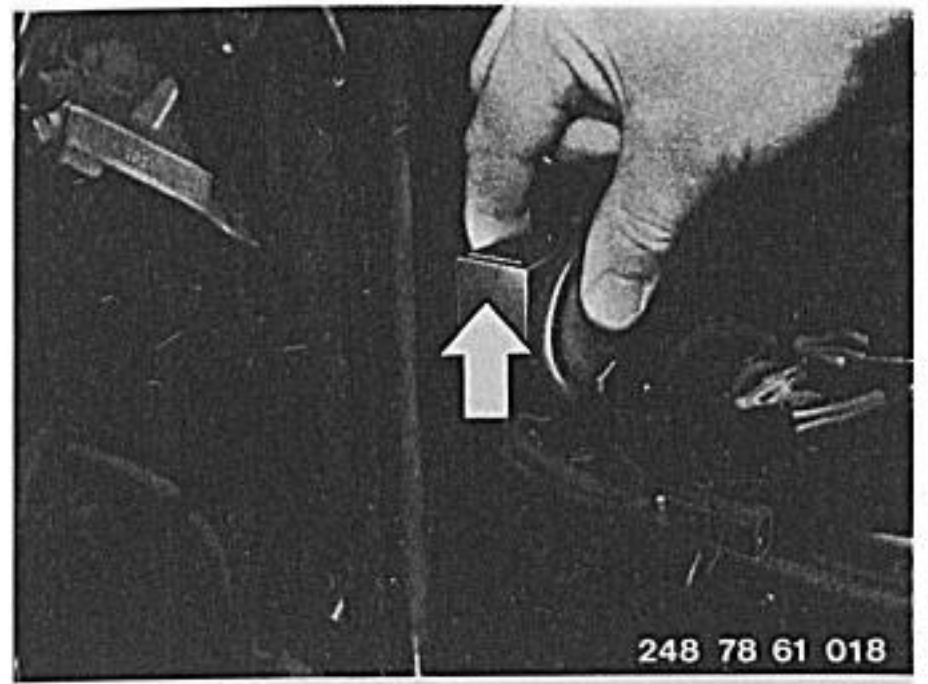
Unscrew the two hex nuts at the top left and right of the battery holder (arrow).



Remove the two hex nuts (arrows) at the base of the holder.



Pull the buzzer upwards and away from the retaining plate.

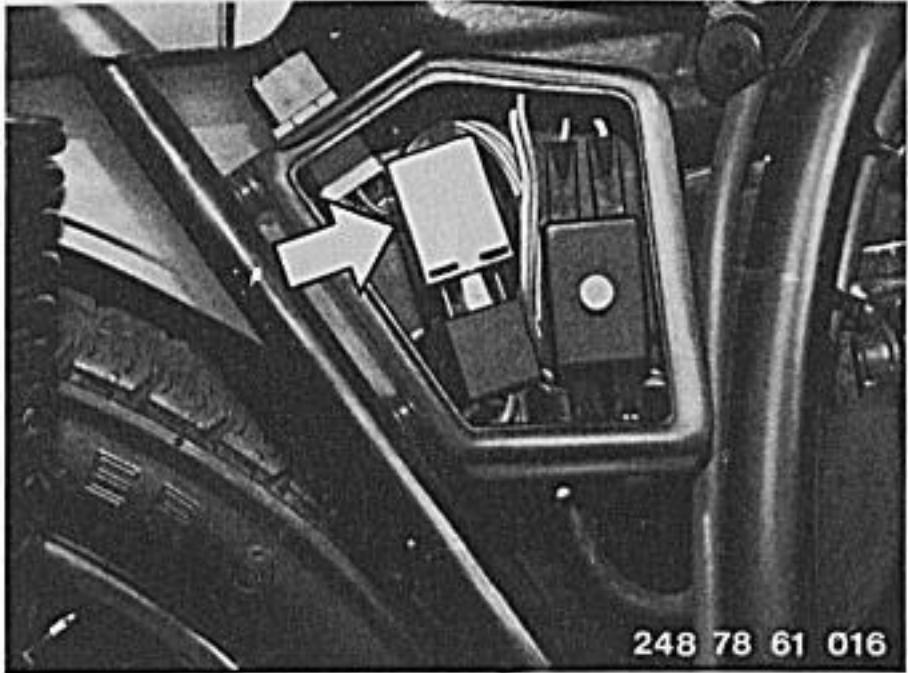


248 78 61 018

BMW AG

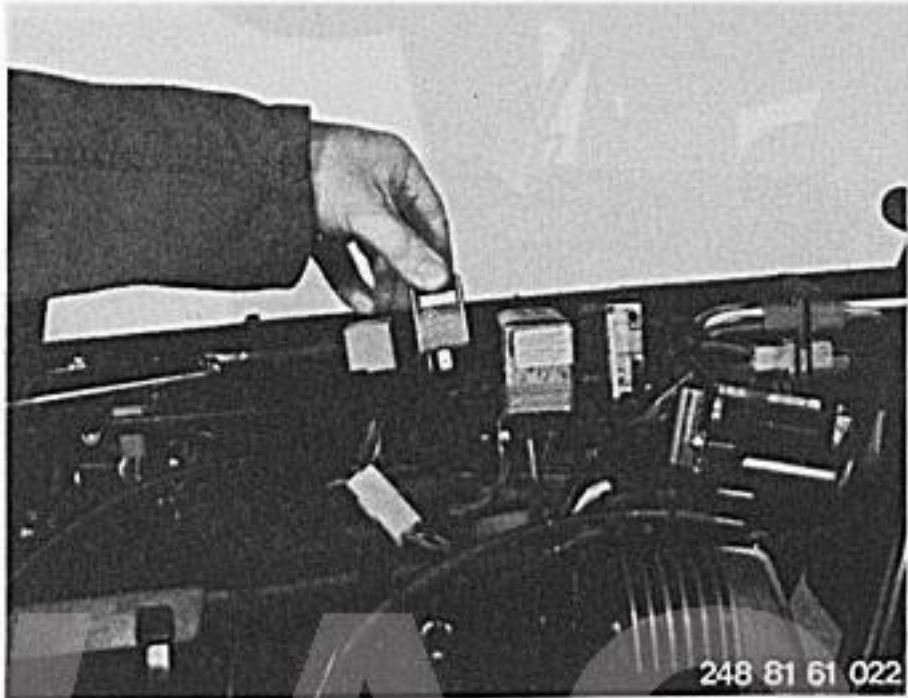
61 31 350 Flasher unit – removing and installing

Detach the earth (ground) cable at the battery. Remove the battery cover at the right. Take hold of the flasher unit (arrow) with two fingers and pull out from above.



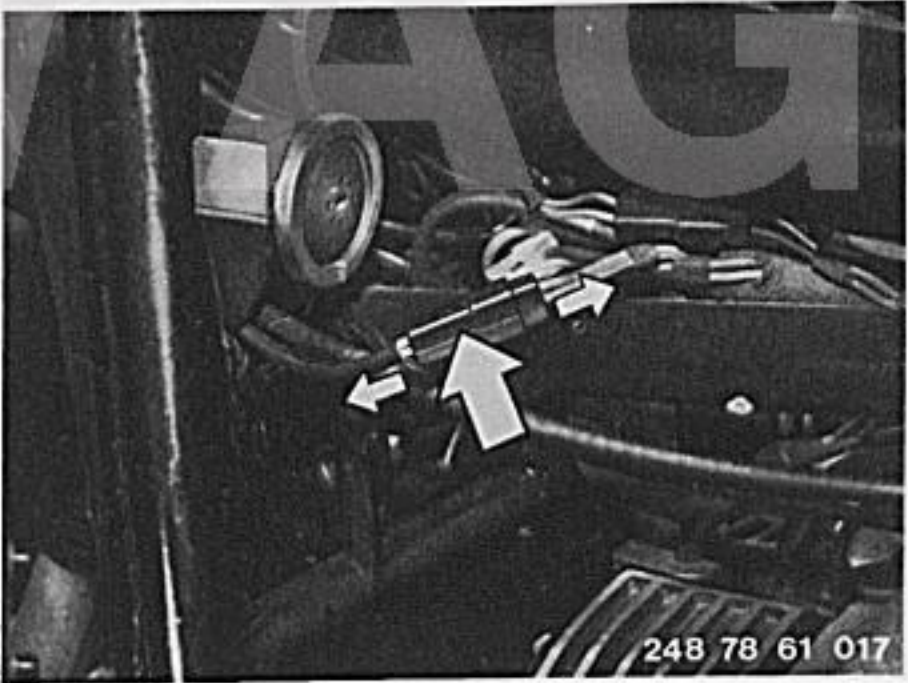
1981 models

Detach the earth (ground) cable at the battery, remove the fuel tank – 16 11 030, and pull out the flasher unit.

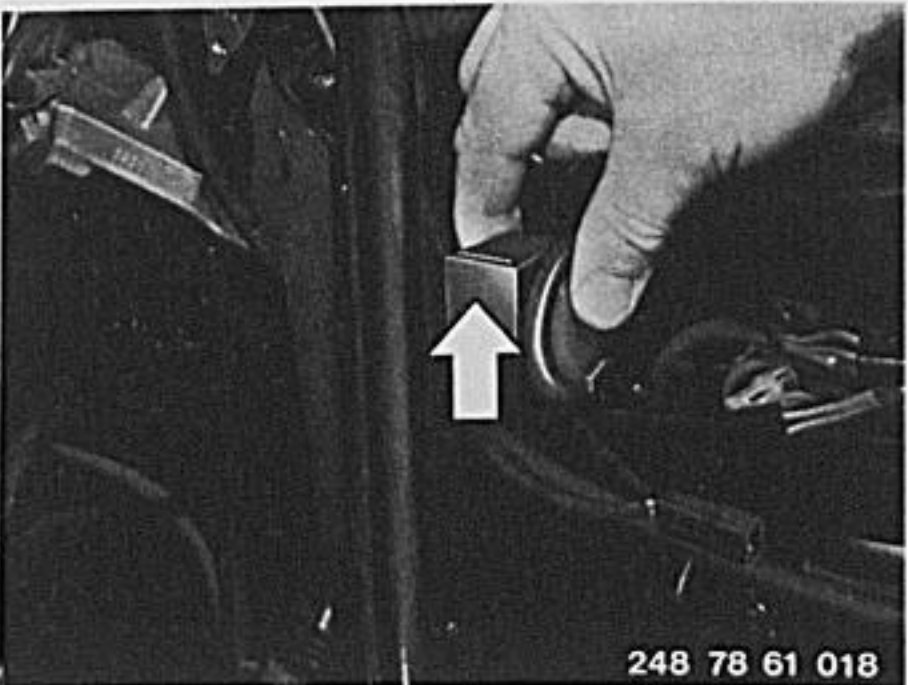


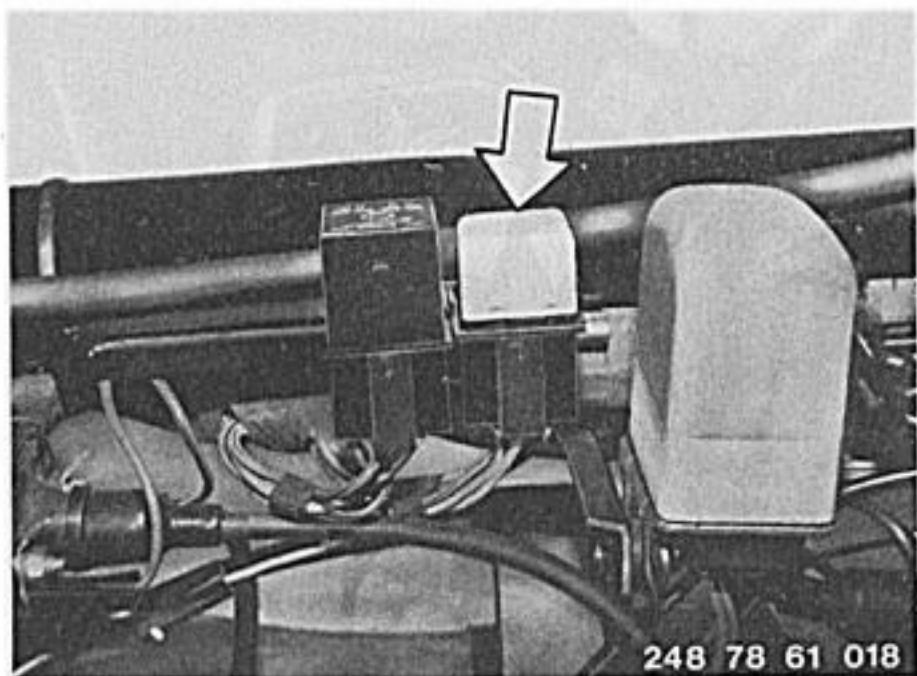
61 31 367 Buzzer – removing and installing

Remove (install) fuel tank – 16 11 030.
Disconnect the 2-pole plug connector (arrow).



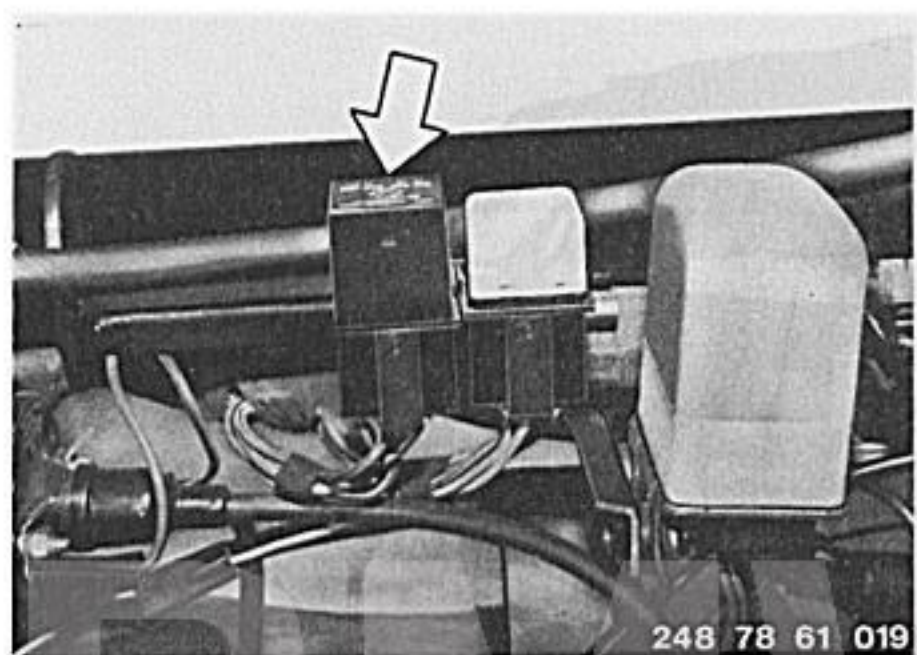
Pull the buzzer up away from the retaining plate.





61 31 365 Buzzer relay – removing and installing

Remove (install) fuel tank – 16 11 030.
Detach relay (arrow) from plug base.



61 31 400 Starter relay – removing and installing

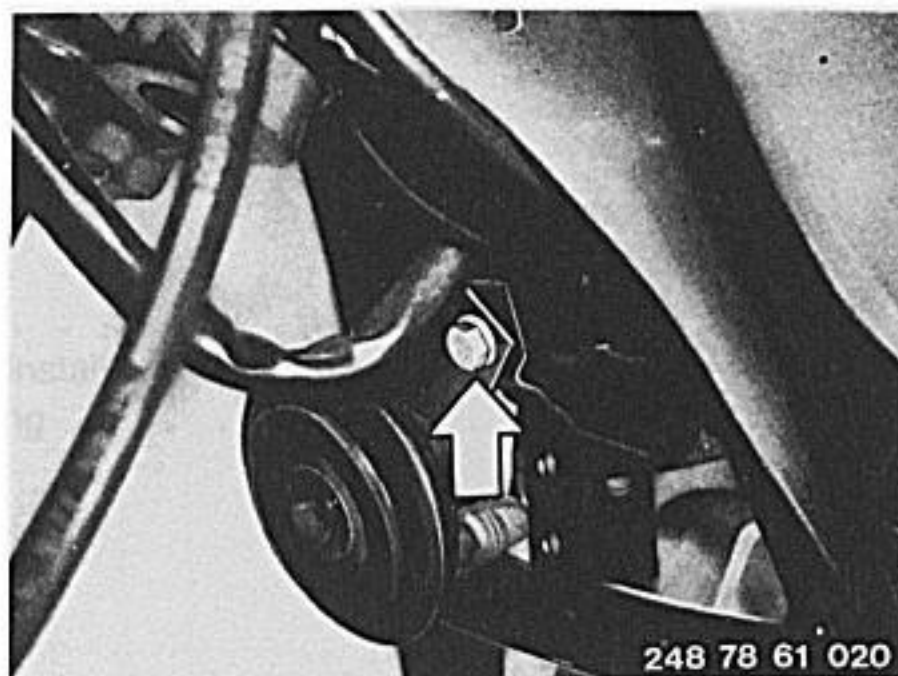
Remove (install) fuel tank – 16 11 030.
Detach starter relay (arrow) from plug base.



The same procedure applies to 1981 models.

61 33 000 Horn — removing and installing

Disconnect the earth (ground) lead from the battery. Unscrew the hex. bolt holding the horn (arrow).



Push back the rainwater cap (arrow) and pull off the flat plug.



BMW AG

62 Instruments

Specifications	Page 62– 0/3
Specifications (1981 models)	62– 0/5
62 12 000 Speedometer – removing and installing	62–12/1
62 12 020 Speedometer drive shaft – removing and installing	62–12/2
62 13 000 Revolution counter – removing and installing	62–13/1



Instruments

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Distance factor, km reading	0.978	0.895	0.93
Distance factor, mile reading	1.575	1.441	1.267
Scale range km/h	10 ... 180		
Scale range mile/h	0 ... 120		
Revolution counter min ⁻¹	0 ... 8500		

Instruments

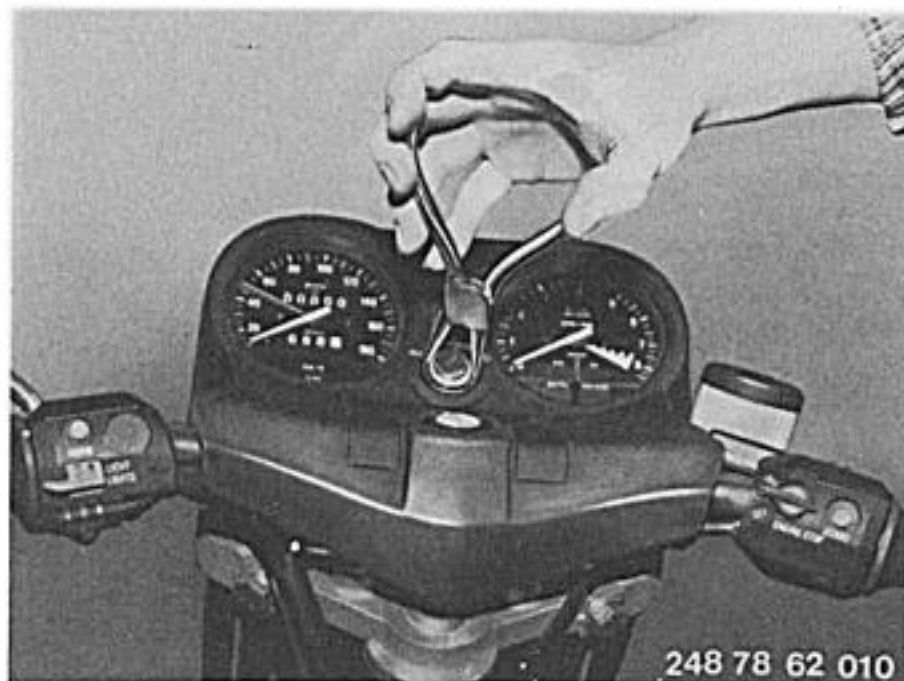
Specifications (1981 models)

Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Distance factor, km reading	0.978	0.895	0.93	0.793
Distance factor, mile reading	1.575	1.441	1.441	1.267
Scale range km/h	10 ... 180			
Scale range mile/h	0 ... 120			
Revolution counter min. ⁻¹	0 ... 8500			

62 12 000 Speedometer – removing and installing

Remove (install) top section of cockpit fairing (only on R 65 LS) – 46 63 025.

Remove the two Phillips head screws from the instrument surround. Unscrew the threaded ring holding the ignition switch with Seeger circlip pliers. Pull the turn indicator telltale lamp holders out of the surround. Take off the instrument surround.

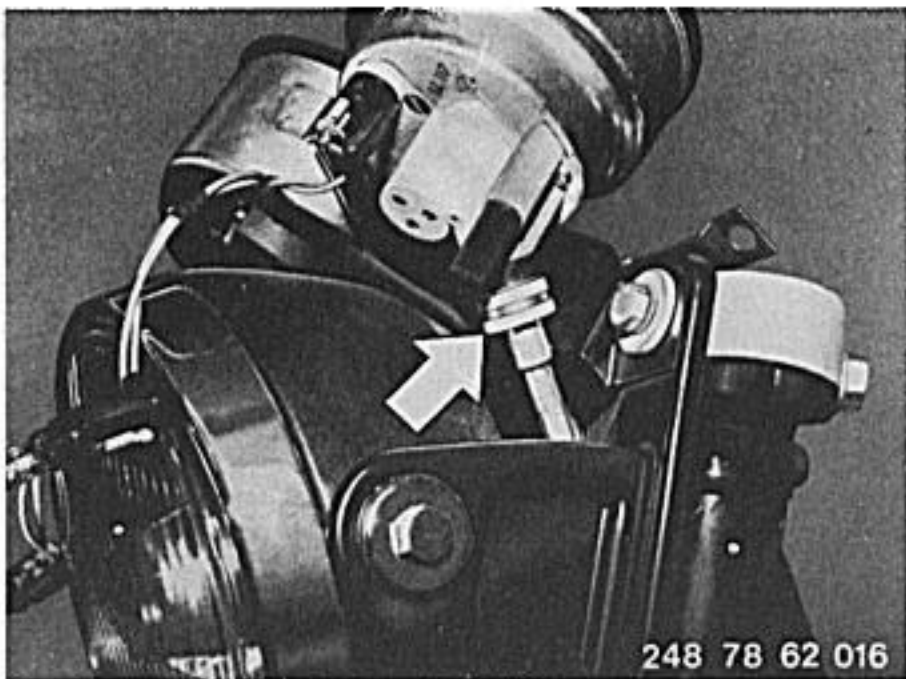


Disconnect the speedometer shaft (1) from the speedometer and pull out the holder (2) for the instrument lighting.



Unscrew the two hex. nuts (arrows) holding the speedometer, and take off the speedometer.





62 12 020 Speedometer drive shaft – removing and installing

Remove (install) top section of cockpit fairing (R 65 LS only) – 46 63 025.

Unscrew the knurled nut (arrow) at the speedometer.



Push back the protective rubber cap for the speedometer drive at the gearbox. Loosen the retaining screw (arrow) until it becomes possible to remove the speedometer drive shaft.

When installing: make sure that the speedometer drive shaft is run correctly along the frame.



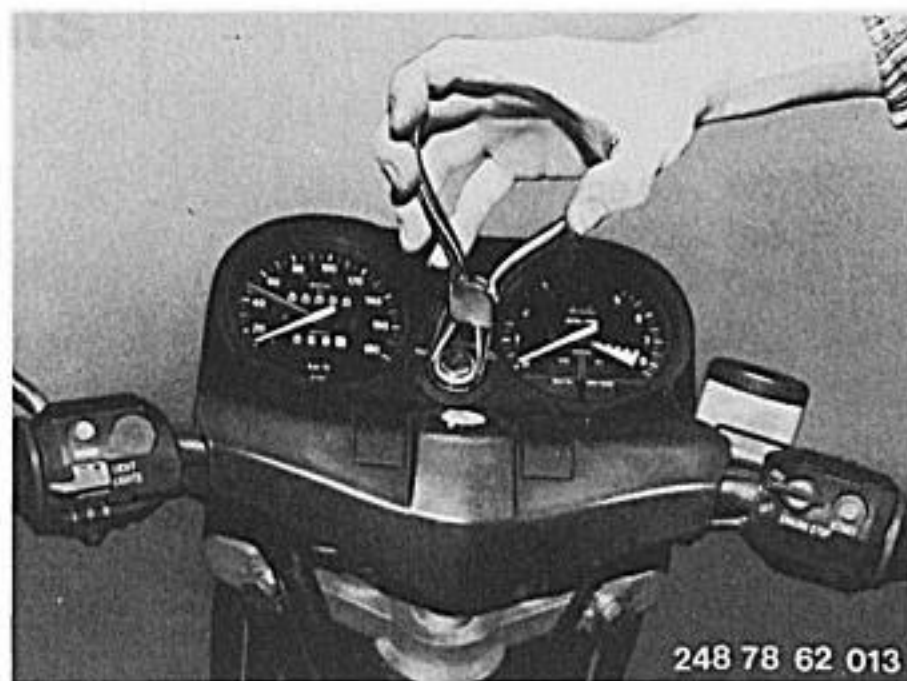
62 13 000 Revolution counter – removing and installing

Remove (install) top section of cockpit fairing (only on R 65 LS) – 46 63 025.

Remove the two Phillips-head screws from the instrument surround. Unscrew the threaded ring holding the ignition switch with Seeger circlip pliers.

Pull out the turn indicator telltale lamp holders.

Take off the instrument surround.



Pull the multi-pin plug away from the revolution counter.

When installing:

Note the semi-circular pin.



Remove the two hex. nuts holding the revolution counter and take off the revolution counter.



63 Lights

Specifications	Page 63– 0/3
Specifications (1981 models)	63– 0/5
63 10 004 Headlight – adjusting	63–10/1
63 21 380 Complete rear light assembly – detaching and attaching	63–10/2
63 23 170 Both flashing turn indicators (front or rear) – removing and installing	63–23/1
63 99 241 Headlight bulb – renewing	63–99/1
63 99 271 One flashing turn indicator bulb (front or rear) – renewing	63–99/2
63 99 381 Rear light bulb – renewing	63–99/2



Lights

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Headlight type	Bosch Type 0 303 551 103		
High and low beams		12 V/60/55 W	H4 halogen bulb
Parking light	T 8/4	12 V/4 W	Parking light bulb
Neutral indicator (green)	W 10/3	12 V/3 W	Indicator light bulb
Charge indicator (red)	W 5/1.2	12 V/1.2 W	Indicator light bulb
Oil pressure warning (red)	W 5/1.2	12 V/1.2 W	Indicator light bulb
High beam telltale (blue)	W 10/3	12 V/3 W	Indicator light bulb
Turn indicator repeater (green)	W 10/3	12 V/3 W	Indicator light bulb
Instrument lighting	W 10/3	12 V/3 W	Indicator light bulb
Rear license plate light	R 19/5	12 V/5 W	Standard bulb
Brake light	P 25/1	12 V/21 W	Standard bulb
Turn indicators (2 each, yellow front and rear)	P 25/1	12 V/21 W	Standard bulb

Lights**Specifications (1981 models)**

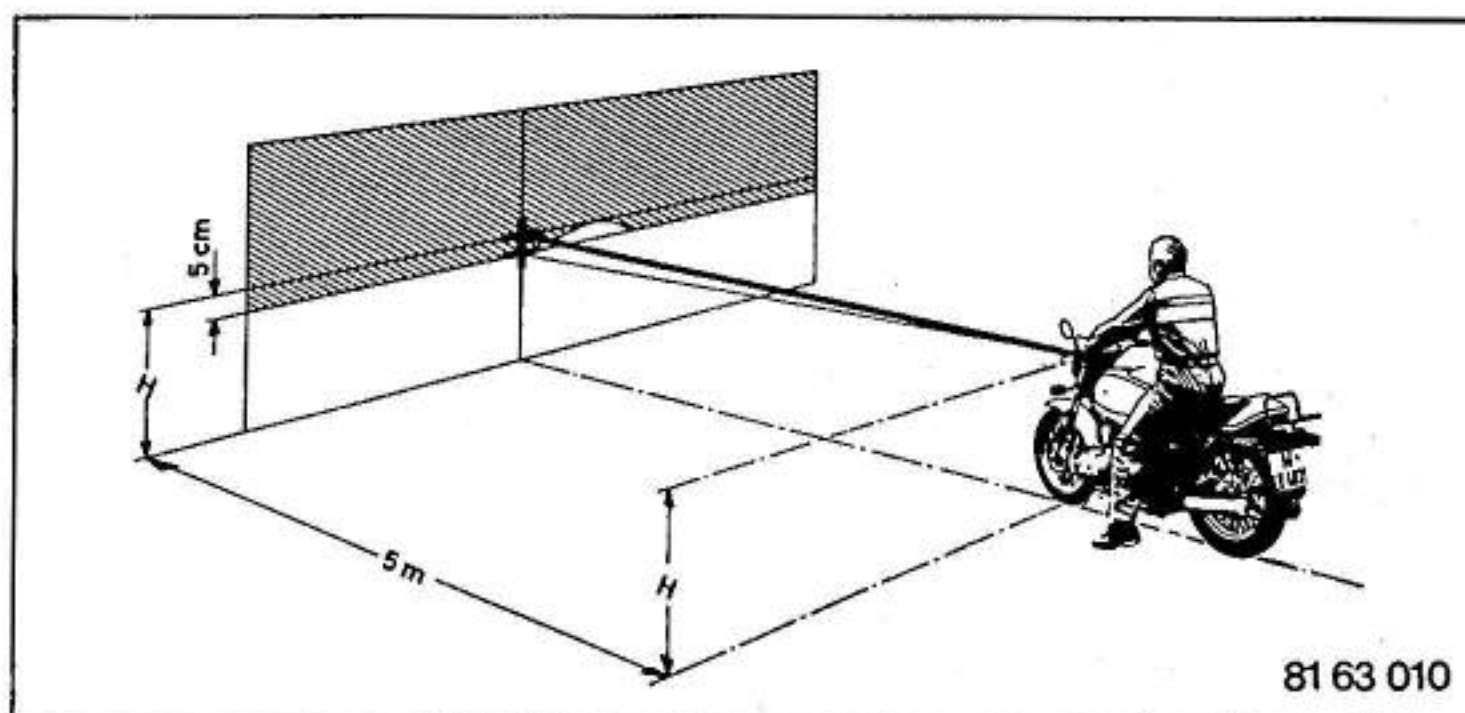
Model	R 45 (20 kW)	R 45 (26 kW)	R 65	R 65 LS
Headlight type	Bosch Type 0 303 551 103			
High and low beams		12 V/60/55 W	H4 halogen bulb	
Parking light	T 8/4	12 V/4 W	Parking light bulb	
Neutral indicator (green)	W 10/3	12 V/3 W	Indicator light bulb	
Charge indicator (red)	W 5/1.2	12 V/1.2 W	Indicator light bulb	
Oil pressure warning (red)	W 5/1.2	12 V/1.2 W	Indicator light bulb	
High beam telltale (blue)	W 10/3	12 V/3 W	Indicator light bulb	
Turn indicator repeater (green)	W 10/3	12 V/3 W	Indicator light bulb	
Instrument lighting	W 10/3	12 V/3 W	Indicator light bulb	
Rear licence plate light	R 19/5	12 V/5 W	Standard bulb	
Brake light	P 25/1	12 V/21 W	Standard bulb	
Turn indicators (2 each, yellow front and rear)	P 25/1	12 V/21 W	Standard bulb	

63 10 004 Headlight — beam setting

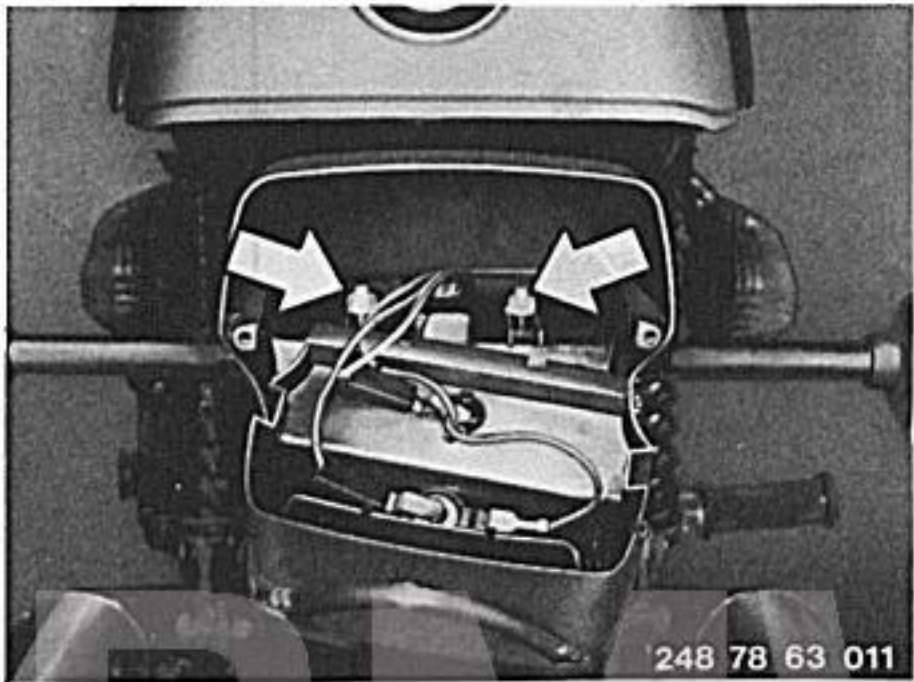
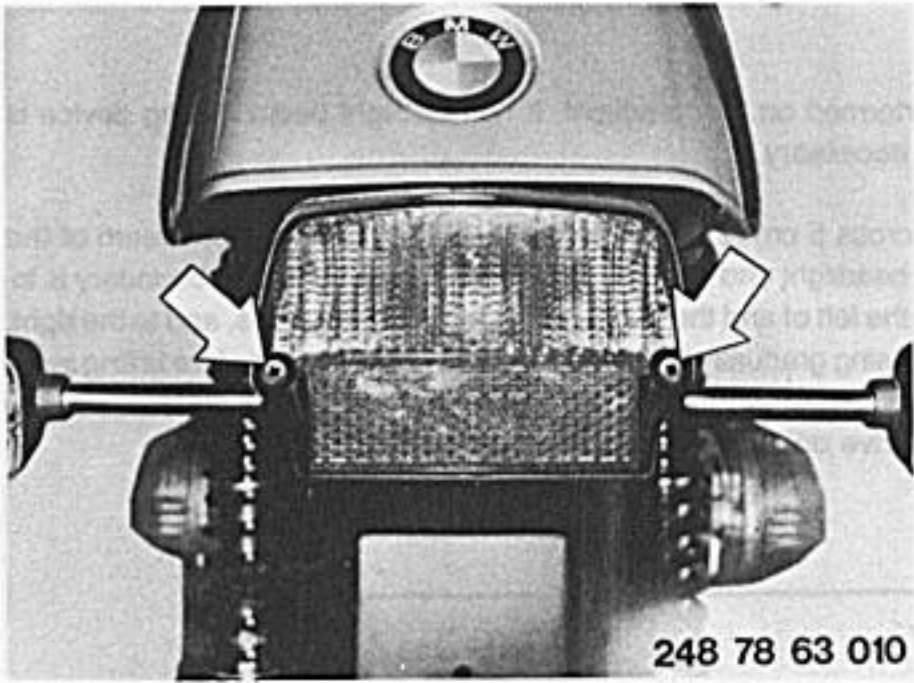
The setting of the headlight beam should be checked whenever work is performed on the headlight. If no headlight beam setting device is available, perform the work as follows: first check tire pressures and correct if necessary.

Position the motorcycle on a flat, level surface 5 m (16 ft. 6 in) away from a light-colored wall. The rider should sit on the machine, which should not be supported on the stand. The rear spring struts should be set to the solo riding position. Measure the distance from the ground to the center of the headlight. Transfer this distance to the wall, mark with a cross and make a second

cross 5 cm (2 in) below the first. Switch on the low beam of the headlight and align the beam so that the light-dark boundary is to the left of and the same height as the lower cross, and to the right, rising gradually to the height of the upper cross before falling away again. (Note: this applies to motorcycles used in countries which drive on the right.)



BMW AG



63 21 380 Complete rear light cluster – detaching and attaching

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.



Detach the leads from the rear of the reflector, making a note of the correct terminals.

Remove the retaining bolts with washers and nuts and take off the housing.

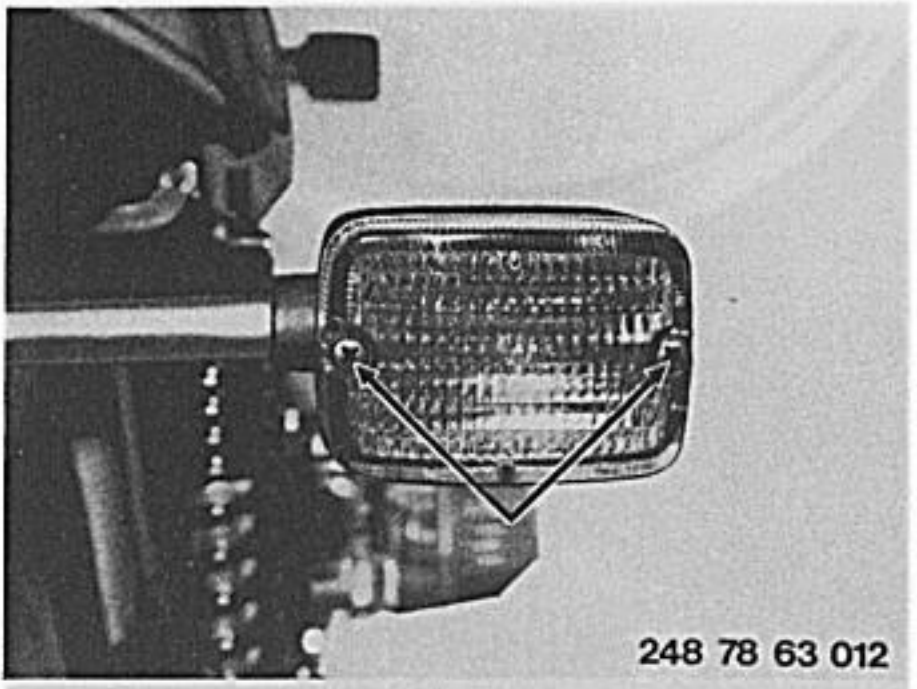
When installing: make sure that the transparent window for the license plate light is at the bottom when the lens is installed.



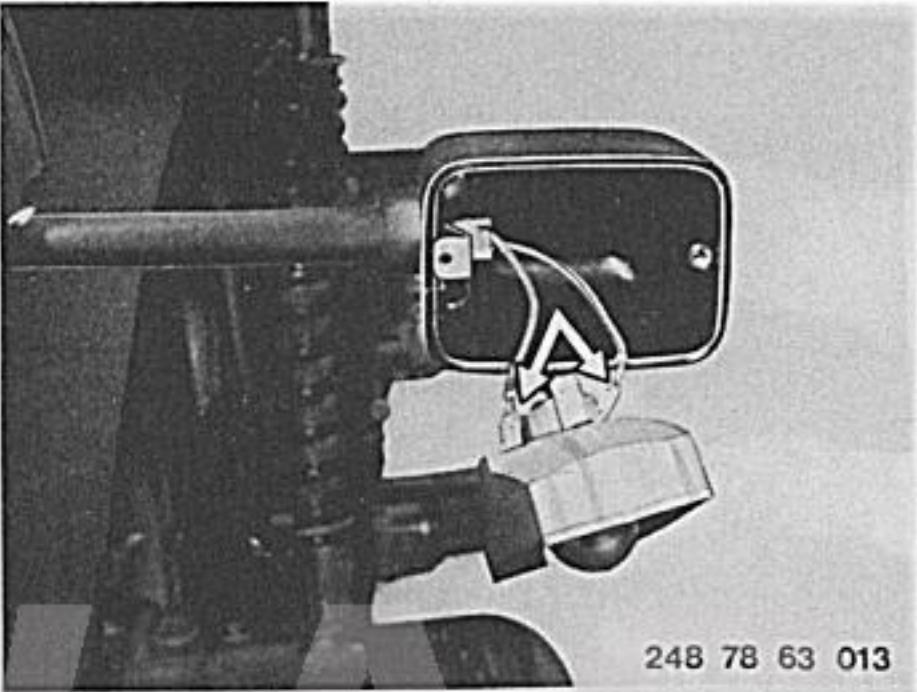
63 23 170 Both flashing turn indicators (front or rear) — removing and installing

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.

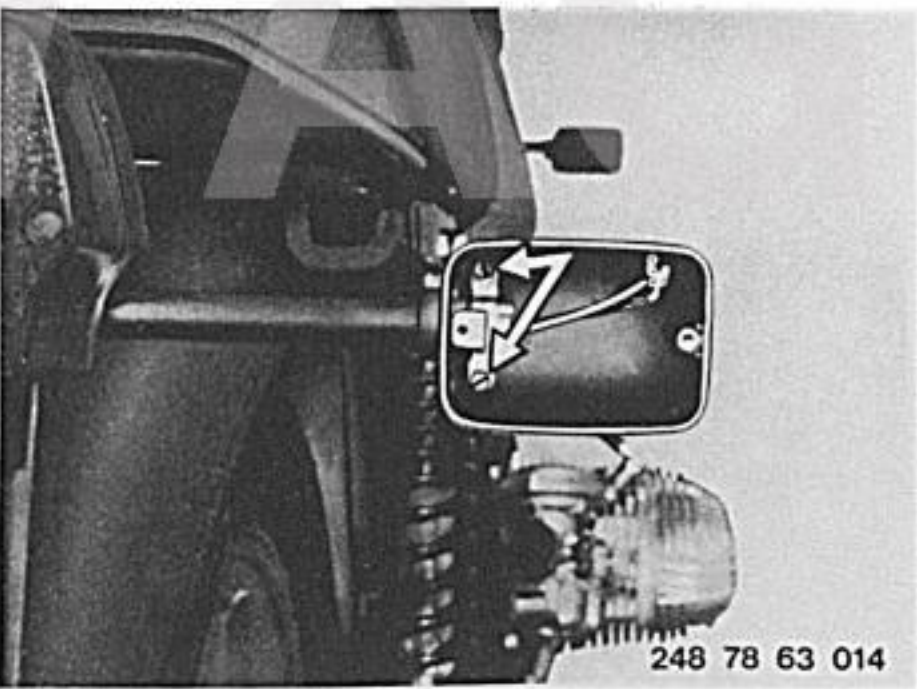
When installing: make sure the 'Top' marking on the lens is uppermost.



Disconnect the leads from the back of the bulb holder.



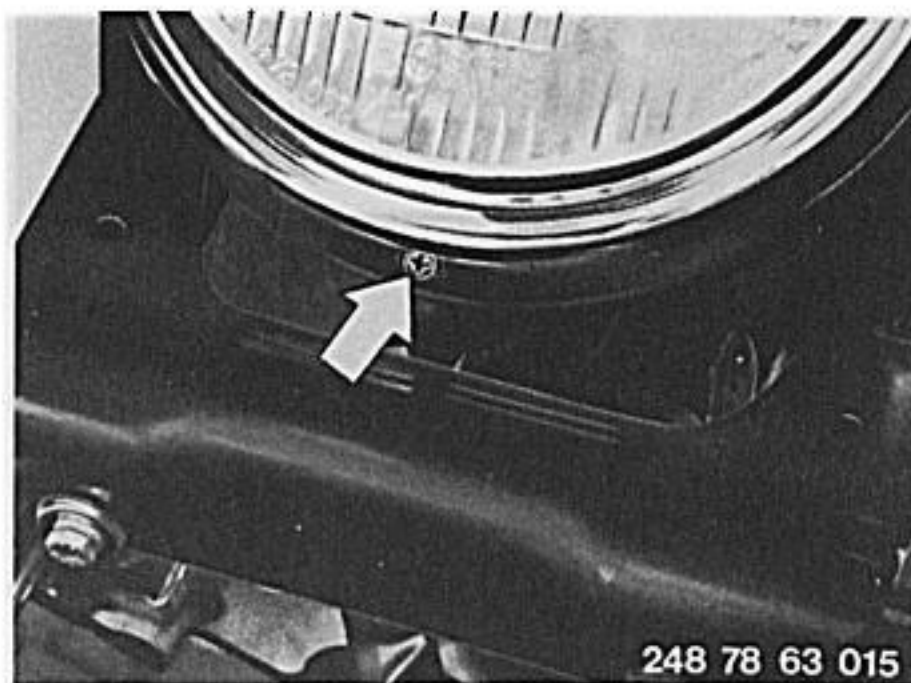
Slacken the two hexagon screws and take off the turn indicator housing.



63 99 241 Headlight bulb – renewing

Remove (install) top section of cockpit fairing (only on R 65 LS) – 46 63 020.

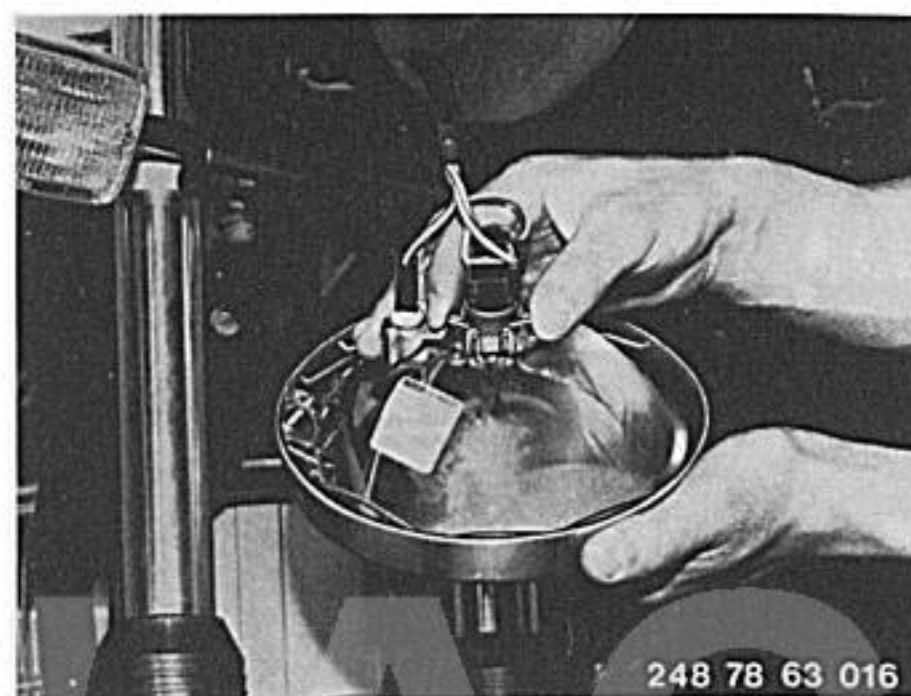
Loosen the Phillips-head screw (arrow) at the bottom of the headlight bezel ring, and pull the ring away from the headlight housing.

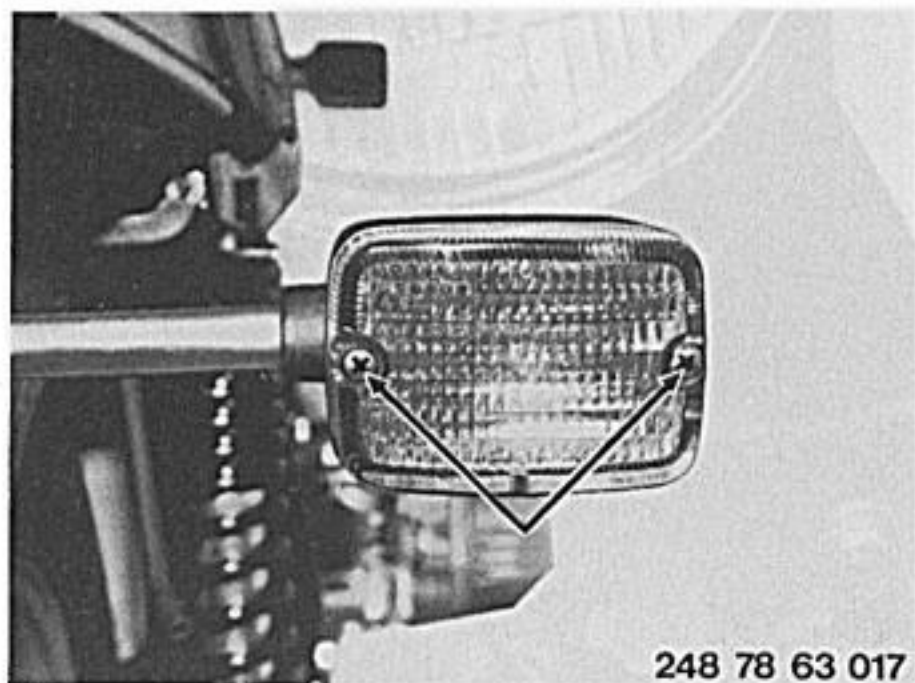


Release the wire clip, remove the halogen bulb from the reflector and pull out of the socket.

When installing: make sure that the locating peg on the halogen bulb engages correctly in the reflector. Do not touch the bulb glass with the fingers.

Pull the parking light bulb holder out of the reflector.





248 78 63 017

63 99 271 One flashing turn indicator bulb (front or rear) — renewing

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.



Press the bulb into its holder and turn to the left to remove.

When installing: make sure that the 'Top' marking on the lens is uppermost.

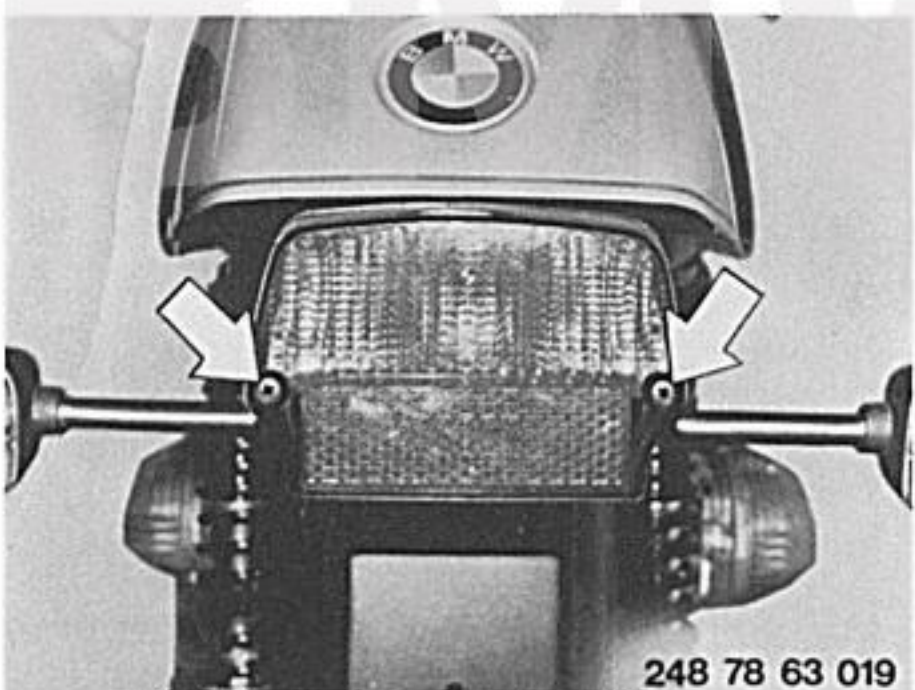


248 78 63 018



63 99 381 Rear light bulb — renewing

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.



248 78 63 019



Press the bulb into its holder and turn to remove.



248 78 63 020



BMW AG