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Repair Manual

BMW R 45
R 65

BMW MOTORRAD GMBH Munich

Order No. 01 51 9 798 091

7. 78

FOREWORD

This Repair Manual is designed to assist in ensuring that all necessary maintenance and repair work is carried out in a skilled and competent manner. It is for the use of master mechanics and fitters whose practical and theoretical training at our Service School will be complemented by the detailed information provided in this reference work.

Each main section is preceded by the relevant Technical Data.

The same classification system has been adopted as that used in our Flat Rate Manual.

The page references are broken down as follows, for example 33–10/2:

33 Main Section
–10 Sub-Section
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The special tools necessary for carrying out some aspects of repair work are summarized in Service Promotion (Equipment Advice) Information bulletin No. 6/76 (419 R). In each case their use is illustrated for relevant jobs.

For each operation a description of the removal procedure is always given. If installing is not possible in reverse sequence, appropriate instructions will be provided.

Supplements to this Repair Manual consist of Alterations and Additions. If the sheet is marked 'Alteration', the existing page with the same number should be deleted and the new page inserted. 'Addition' sheets are added to the manual at the correct points.

In addition to the improvements and modifications which are notified regularly by Service Information bulletins we can recommend our clearly and generously illustrated Spare Parts Microfilms as an additional source of information.

BMW MOTORRAD GMBH
Customer Service Department

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12. 77 Alteration

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 ≈ 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 Property Class			Nuts acc. to DIN 985 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 Pv (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 x d according to DIN 934 and exclusively for μ 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 (μ 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 of if there is a deviation in nut height. In such cases values will have to be determined separately.

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

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

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

	Tightening Torque M_A (kpm)						Preload force P_V (kp)					
	Property Class acc. to DIN 267						Property Class acc. to DIN 267					
Threads	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.

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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} up to 2000 km (app. 1300 miles) min^{-1}	 4000 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
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)	5.0 (71.1)		
Oil content without filter change liters (Imp. pints, US quarts) with filter change liters (Imp. pints, US quarts)	2.0 (3.5, 2.1) 2.25 (4.0, 2.4)		
Max. oil consumption liters/100 km (miles per Imp. pint/US quart)	0.1 (355,590)		
Oil grade Viscosity at outside temperatures predominantly above +30°C (+86°F) above 0°C (+32°F) below 0°C (+32°F) All the year round down to −20°C (−4°F)	Brand-name HD oil for 4-stroke spark-ignition engines SAE 40, SAE 20 W 50 SAE 20 W 40, SAE 20 W 50 SAE 10 W 30, SAE 10 W 40, SAE 10 W 50 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.)	$57.1\,^{0}_{-0.025}$ $(2.2480\,^{0}_{-0.0010})$		
Internal housing dia. mm (in.)	$57.2\,^{+0.046}_{0}$ $(2.2520\,^{+0.0018}_{0})$		
Clearance between external rotor and pump housing mm (in.)	0.10 . . . 0.17 (0.0039 . . . 0.0067)		

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
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				
Inlet mm (in)		10 (0.39) (15 [0.59] up to 1000 km [600 mile] Inspection)		
* Exhaust mm (in)		15 (0.59) (20 [0.79] up to 1000 km [600 mile] Inspection)		
Valve timing (tolerance + 2.5°)		Timing gear shaft alignment at 2 mm (0.08 in) valve clearance		
Inlet opens		6° bTDC	16° bTDC	
Inlet closes		34° aBDC	44° aBDC	
Exhaust opens		46° bBDC	56° bBDC	
Exhaust closes		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)	34 (1.339)	38 (1.496)
	Exhaust mm (in)	32 (1.260)	32 (1.260)	34 (1.339)
Valve stem dia.	Inlet mm (in.)	$7^{-0.050}_{-0.065}$ ($0.2756^{-0.0020}_{-0.0026}$)		
	Exhaust mm (in)	$7^{-0.050}_{-0.065}$ ($0.2756^{-0.0020}_{-0.0026}$)		

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: Adjust with engine cold Inlet mm (in) Exhaust mm (in)		10 (0.39) (15 [0.59] 15 (0.59) (20 [0.79] up to 1000 km [600 mile] Inspection)		
Valve timing (tolerance + 2.5°)		Timing gear shaft alignment at 2 mm (0.08 in) valve clearance		
Inlet opens		6° bTDC	16° bTDC	
Inlet closes		34° aBDC	44° aBDC	
Exhaust opens		46° bBDC	56° bBDC	
Exhaust closes		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)	34 (1.339)	38 (1.496)
	Exhaust mm (in)	32 (1.260)	32 (1.260)	34 (1.339)
Valve stem dia.	Inlet mm (in.)	$7^{-0.050}_{-0.065}$ ($0.2756^{-0.0020}_{-0.0026}$)		
	Exhaust mm (in)	$7^{-0.050}_{-0.065}$ ($0.2756^{-0.0020}_{-0.0026}$)		

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 Overall length mm (in) Exhaust	45 (1.772) 45 (1.772)		
Extl. dia mm (in)	14 (0.551) z 6		
Extl 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) Exhaust mm (in)	 0.025 . . . 0.055 (0.0010 . . . 0.0022) 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)	app. 46 (or 43.5) [1.811 (or 1.713)]		
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., fleywheel 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)		
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

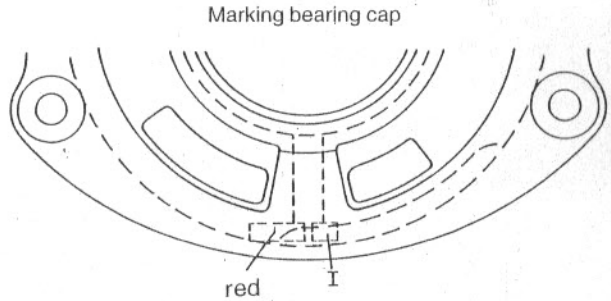
Model			R 45 (20 kW)	R 45 (26 kW)	R 65
Crankshaft and bearings Crankshaft			Main bearing journal dia. mm (in) Generator end		Flywheel end
Crankshaft markings		red/red	59.980 . . . 59.990 (2.3614 . . . 2.3618)		59.980 . . . 59.990 (2.3614 . . . 2.3618)
		red/blue	59.980 . . . 59.990 (2.3614 . . . 2.3618)		59.971 . . . 59.980 (2.3611 . . . 2.3614)
Standard	0	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)
		red/red	59.730 . . . 59.740 (2.3516 . . . 2.3520)		59.730 . . . 59.740 (2.3516 . . . 2.3520)
Stage 1	0.25 mm (0.0098 in)	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)
		red/red	59.480 . . . 59.490 (2.3417 . . . 2.3421)		59.480 . . . 59.490 (2.3417 . . . 2.3421)
Stage 2	0.50 mm (0.0197 in)	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)
		red/red	59.230 . . . 59.240 (2.3319 . . . 2.3323)		59.230 . . . 59.240 (2.3319 . . . 2.3323)
Stage 3	0.75 mm (0.0295 in)	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 3-layer bearing shell in engine block mm (in)			$65^{+0.019}_{0}$ ($2.5591^{+0.0007}_{0}$)		
Bore for 3-layer bearing in bearing cap mm (in)			$65^{+0.019}_{0}$ ($2.5591^{+0.0007}_{0}$)		
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	2.500 . . . 2.510 (0.0984 . . . 0.0988)		
		blue	2.511 . . . 2.521 (0.0989 . . . 0.0993)		
Stage 1	0.25 mm (0.0098 in)	red	2.625 . . . 2.635 (0.1033 . . . 0.1037)		
		blue	2.636 . . . 2.646 (0.1038 . . . 0.1042)		
Stage 2	0.50 mm (0.0197 in)	red	2.750 . . . 2.760 (0.1083 . . . 0.1087)		
		blue	2.761 . . . 2.771 (0.1087 . . . 0.1091)		
Stage 3	0.75 mm (0.0295 in)	red	2.875 . . . 2.885 (0.1132 . . . 0.1136)		
		blue	2.886 . . . 2.896 (0.1136 . . . 0.1140)		

Selection table, bearing cap assembly		to be combined only with		Ø A	Ø B
		Main bearing bushing	Crankshaft		
Bearing cap assembly	red	red	red	65.000 . . . 65.015 (2.5591 . . . 2.5596)	130.003 . . . 130.023 (5.1182 . . . 5.1190)
Bearing cap assembly	blue	blue	blue	65.015 . . . 65.030 (2.5596 . . . 2.5602)	
Bearing cap assembly	red	red	red	65.000 . . . 65.015 (2.5591 . . . 2.5596)	130.023 . . . 130.043 (5.1190 . . . 5.1198)
Bearing cap assembly	blue	blue	blue	65.015 . . . 65.030 (2.5506 . . . 2.5602)	
with pressure relief valve					



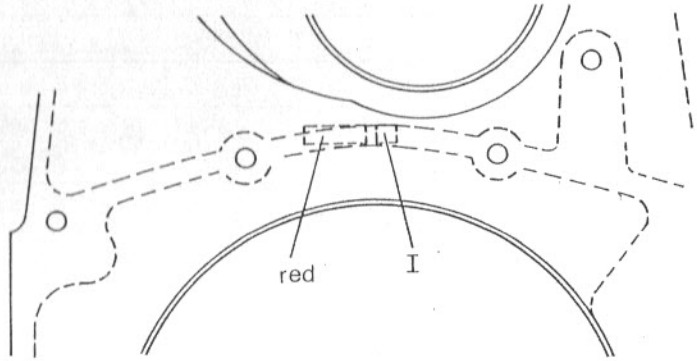
Engine

Specifications

Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Engine block	Ø A (main bearing bores) = 65 (2.5591) H 7 **red** 65.000 . . . 65.015 (2.5591 . . . 2.5596) **blue** 65.015 . . . 65.030 (2.5596 . . . 2.5602)	Ø B (bearing cap bore) = 130 (5.1181) **I** 130.000 . . . 130.020 (5.1181 . . . 5.1189) **II** 130.020 . . . 130.040 (5.1189 . . . 5.1197)	

Selection table, engine block assembly			to be combined only with Main bearing bushing	to be combined only with Crankshaft	Main bearing play at 20° C (68° F) ambient temperature
Engine block assembly	red I		red	red	0.017 . . . 0.062 (0.0007 . . . 0.0024)
Engine block assembly	red II		red	red	0.017 . . . 0.062 (0.0007 . . . 0.0024)
Engine block assembly	blue I		blue	blue	0.020 . . . 0.064 (0.0008 . . . 0.0025)
Engine block assembly	blue II		blue	blue	0.020 . . . 0.064 (0.0008 . . . 0.0025)

Marking engine housing



Engine

Specifications

Model		R 45 (20 kW)			R 45 (26 kW)			R 65	
Main bearings		**Combination I**							
Standard 0		Generator end			Flywheel end				
		Bearing journal dia.	Main bearing bushing	Bearing cap	Bearing journal dia.	Main bearing bushing	Engine block		
Crankshaft marking:	red/red	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red I	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red I		
	red/blue	59.980 . . . 59.990 (2.3614 . . . 2.3618)			59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue I		
	blue/red	59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue I	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red I		
	blue/blue	59.971 . . . 59.980 (2.3611 . . . 2.3614)			59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue I		
Standard 0		**Combination II**							
Crankshaft marking:	red/red	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red II	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red II		
	red/blue	59.980 . . . 59.990 (2.3614 . . . 2.3618)			59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue II		
	blue/red	59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue II	59.980 . . . 59.990 (2.3614 . . . 2.3618)	red	red II		
	blue/blue	59.971 . . . 59.980 (2.3611 . . . 2.3614)			59.971 . . . 59.980 (2.3611 . . . 2.3614)	blue	blue II		

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)	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

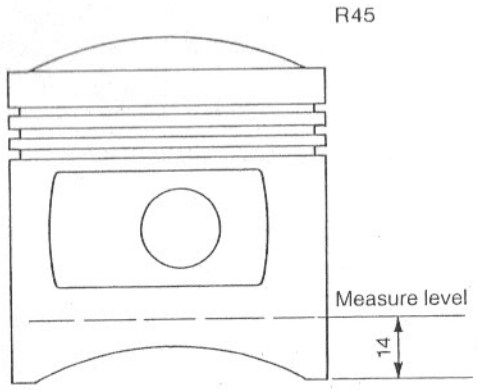
Specifications

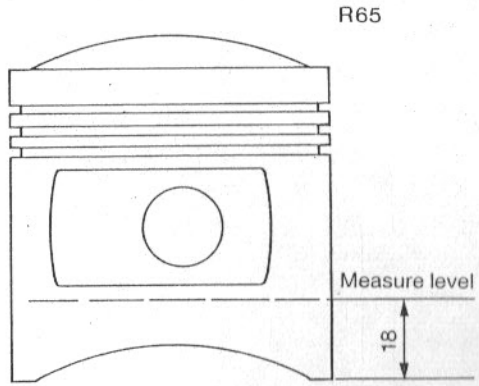
Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Distance between bore centers mm (in)		118 (4.646)		
Small end bearing bore mm (in)		$24^{+0.021}_{0}$ ($0.9449^{+0.0008}_{0}$)		
Small end bushing extl. dia. mm (in)		24.060 . . . 24.100 (0.9472 . . . 0.9488)		
Bore in small end bushing for piston pin mm (in)		$22^{+0.020}_{0.015}$ ($0.8661^{+0.0008}_{+0.0006}$)		
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		

Specifications

Engine

Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Permissible cylinder bore out-of-roundness mm (in)		0.01 (0.0004)		
Pistons Pattern		convex oval crown		
Complete piston weight group		stamped + or −		
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		





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

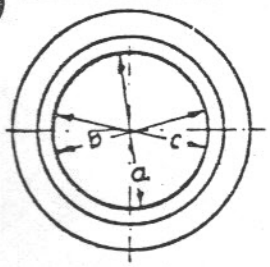
Tightening torques Nm (lb. ft)

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.

Bearing clearances:

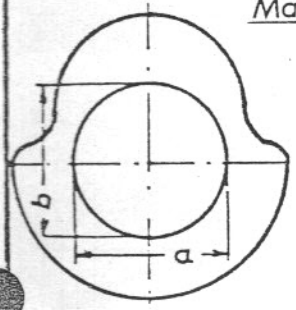
Main bearing



		a			b			c		
F	f									
	r									
R	f									
	r									

Real measure: _____

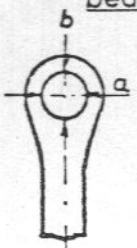
Main bearing Journal



		a			b			Clearance radial			Clearance axial		
F	f												
	r												
R	f												
	r												

Real measure: _____

Connecting rod bearing

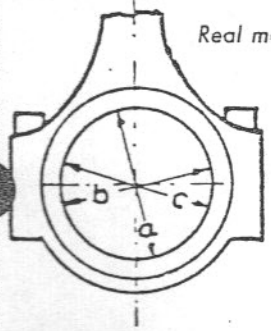


		Piston - pin bushing				Piston pin				Clearance		
Nr 1	a					1	a					
	b						b					
Nr 2	a					2	a					
	b						b					

Real measure: _____

Basic bore dia meter of big end bearing eye

Real measure: _____

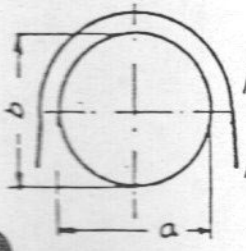


		a			b			c		
Nr 1	f									
	r									
Nr 2	f									
	r									

		Connecting rod with bearing									Connecting rod weight
		a			b			c			
Nr 1	f										
	r										
Nr 2	f										
	r										

Real measure: _____

Crank pin

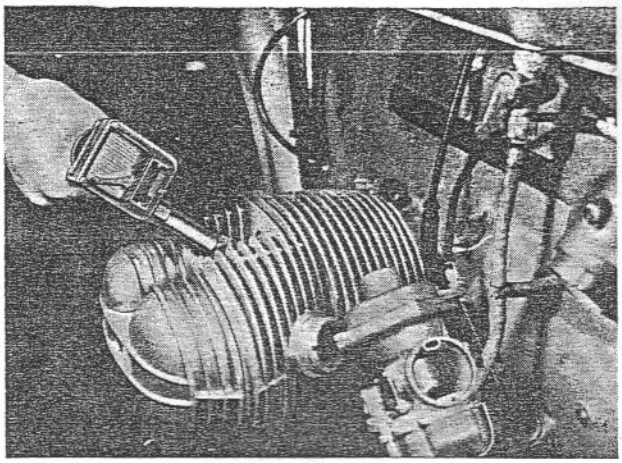


		a			b			Clearance radial			Clearance axial			Clearance Piston pin		
R1	f															
	r															
F2	f															
	r															

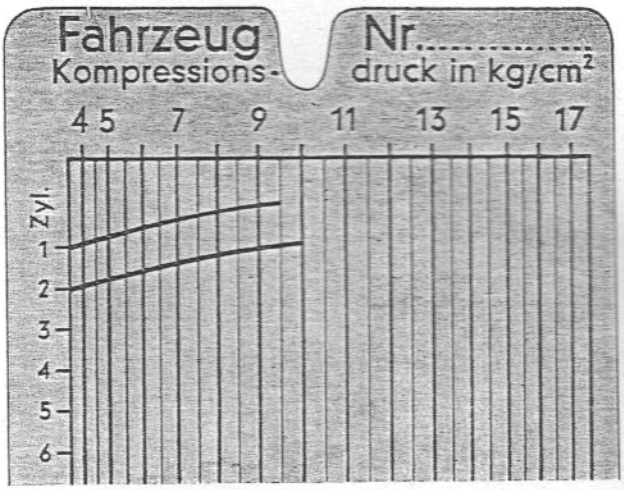
Real measure: _____

11 00 039 Compression test on all cylinders

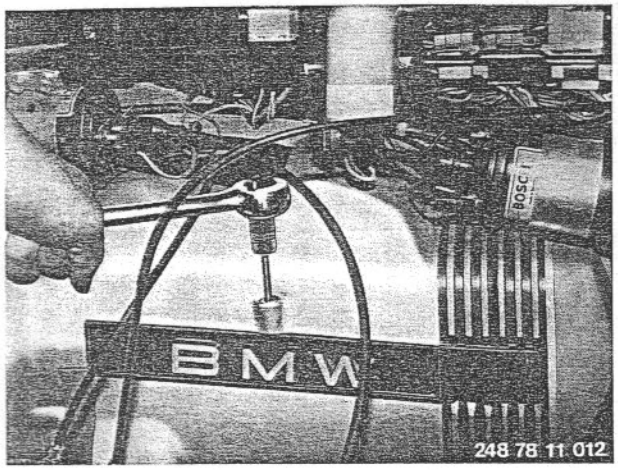
1. Unscrew and remove the spark plugs.
2. Measure with a calibrated compression tester: the battery must be fully charged, the engine at normal operating temperature. Run the engine at starter speed.
   Before testing remove constant depression carburetors.



Specimen graph produced by compression tester.

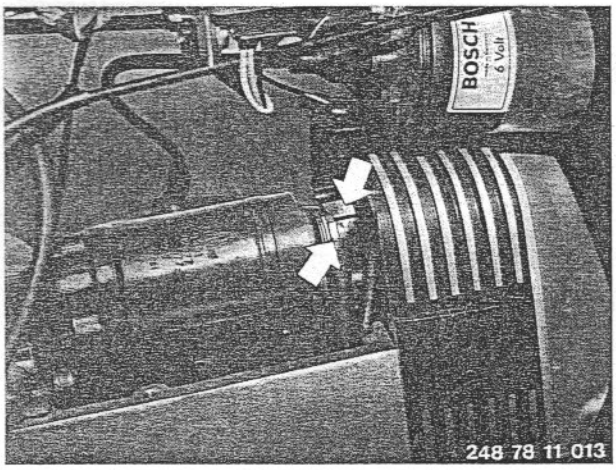


11 00 050 Engine – removing and installing

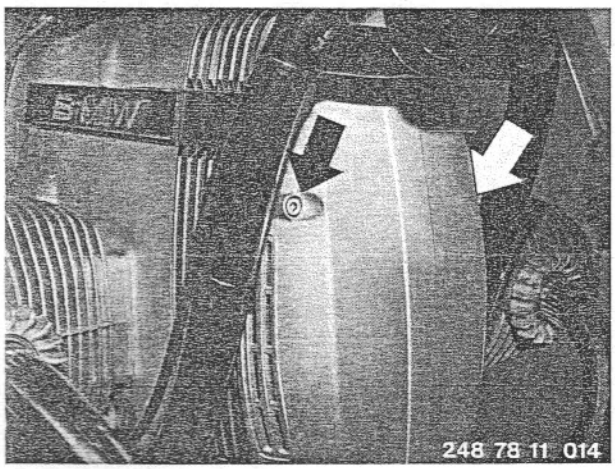


Remove fuel tank – 16 11 030.
Remove front coil – 12 13 100.
Detach plug connectors from engine wiring harness.
Remove exhaust system – 18 00 020.
Remove carburetors – 13 10 100.

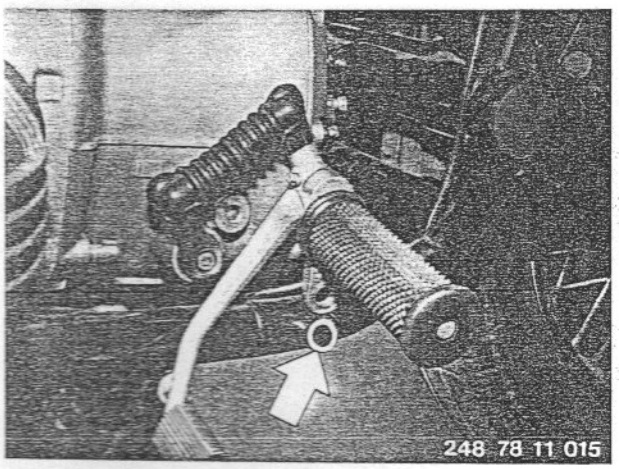
After removing the two Allen screws, take off the starter cover to the right.



Detach the cable (arrow) at the starter.

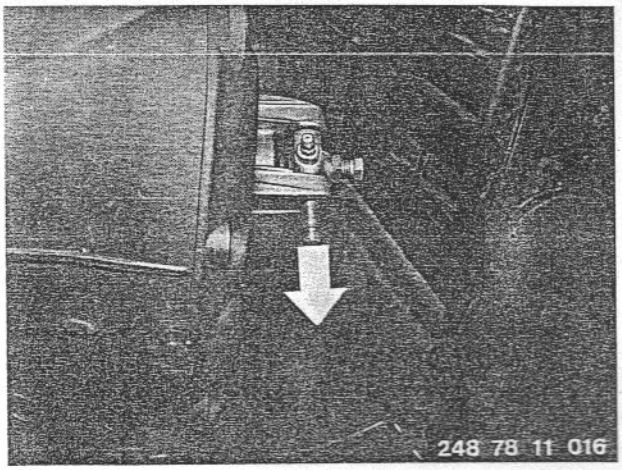


After removing the two Allen screws, take off the engine cover to the right.
When installing, make sure that the condenser cable is not trapped.

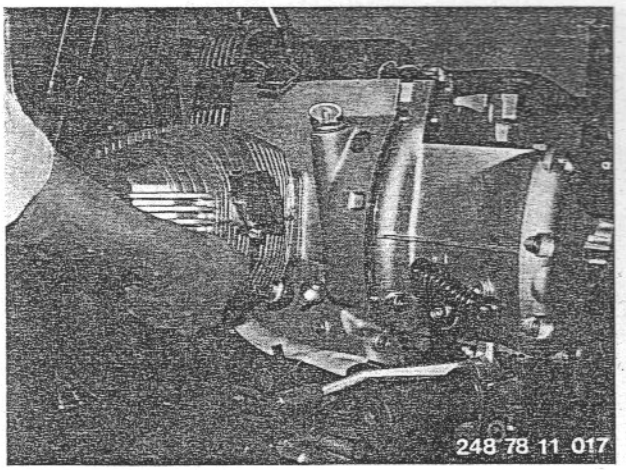


Unscrew the engine support pins.
Leave the shift mechanism attached to the gearbox, but detach the footrest from the frame (arrow).

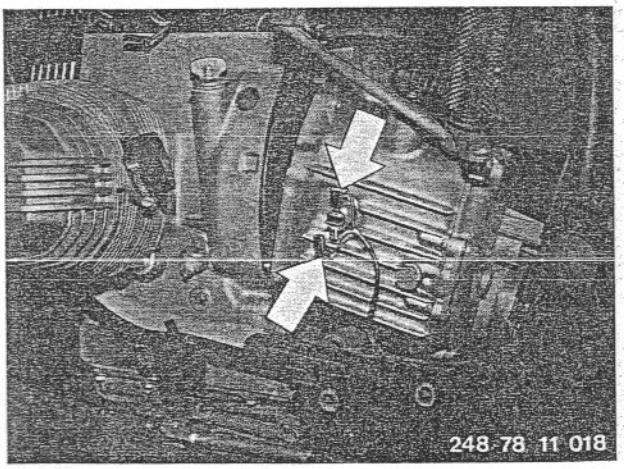
Disconnect the clutch cable at the gearbox end and remove the withdrawal arm.
Press out the lock washer for the pivot pin, using two screwdrivers, and pull the pin out in the direction of the arrow.



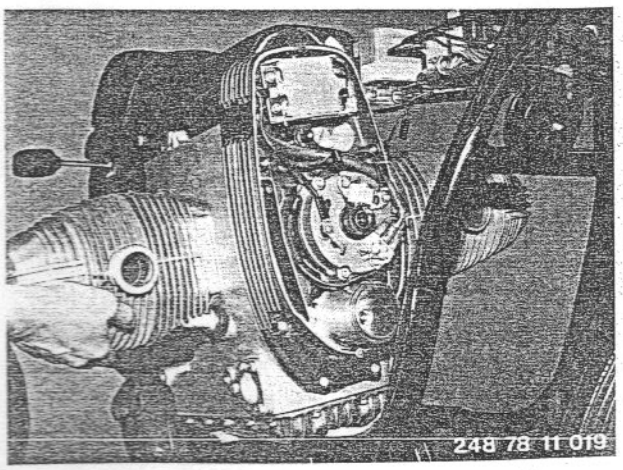
Unscrew the gearbox retaining bolts at the engine and the connecting bolts at the output flange.
Cover the frame tubes in the region of the cylinders on both sides (e.g. with adhesive foam and rags), pull out the engine pins and allow the engine to rest on the frame as far forward as possible.

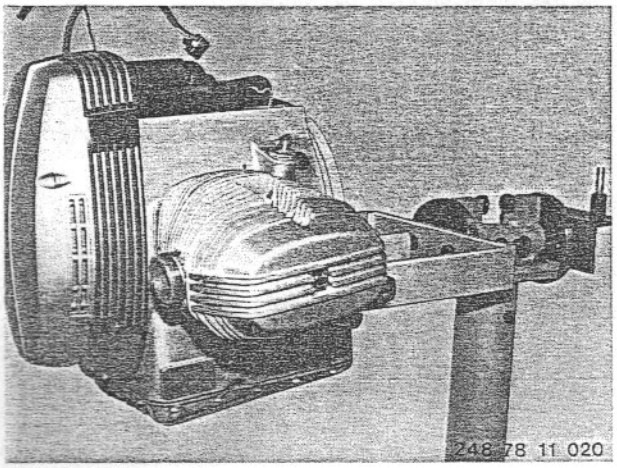


Pull the gearbox away from the engine and detach the cable from the neutral contact switch. Remove the gearbox from the frame.



Move the engine back to the center of the frame, lift it up, tilt the right cylinder and the engine to the right.



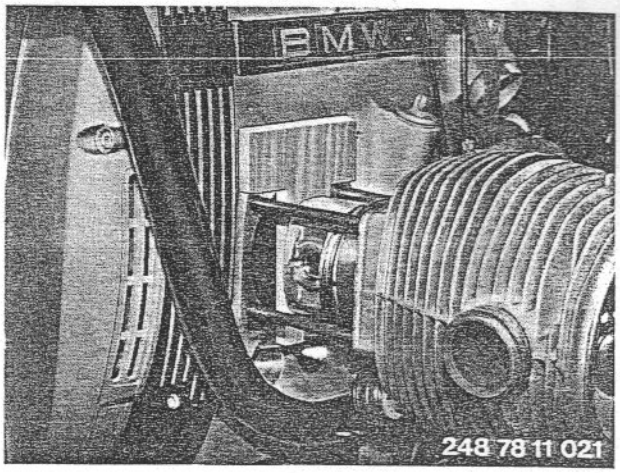


Mount the engine on assembly stand BMW 00 1 500 using fixture BMW 11 0 600.

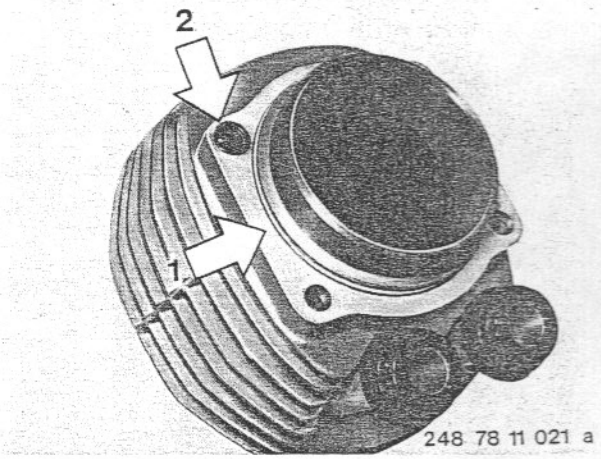
11 11 050 Cylinder – removing and installing

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.

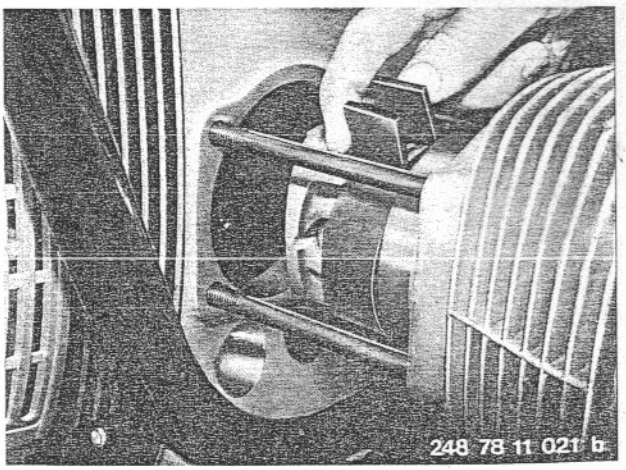
Note:
Make sure that the piston does not strike the engine block as the cylinder is pulled off.

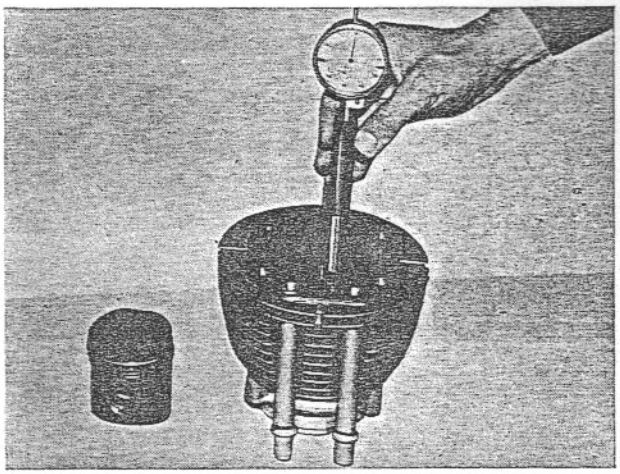


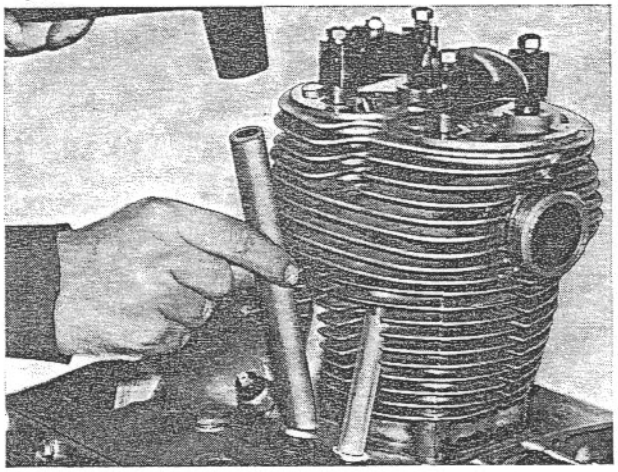
Whenever the cylinder is removed, the O-ring at the cylinder base (1) and the O-rings at the upper studs (2) must be renewed.



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

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 rebore 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.

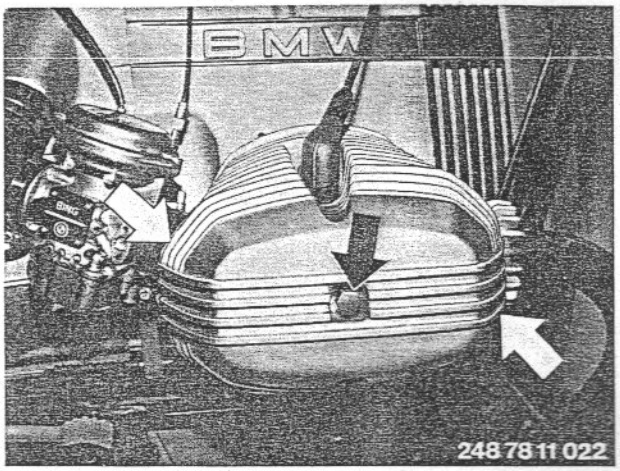
If the pushrod outer tubes are leaking at the rubber sleeve, the contact rings can be driven in to improve rubber sleeve contact with bedding-down tube BMW 11 1 600.

11 12 080 Cylinder head – removing and installing

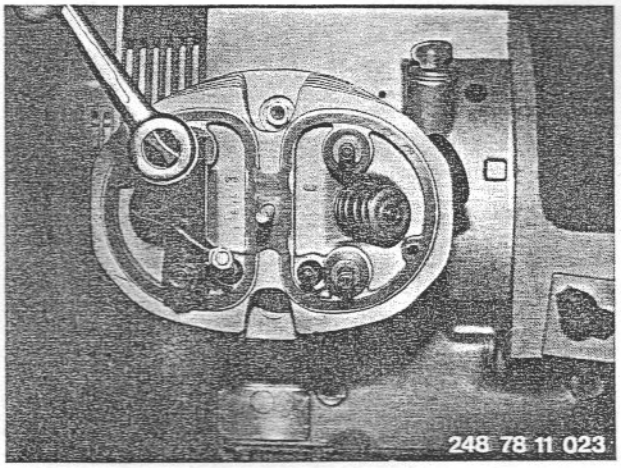
Engine removed (11 00 050) or installed.
If engine remains installed, detach exhaust system.

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

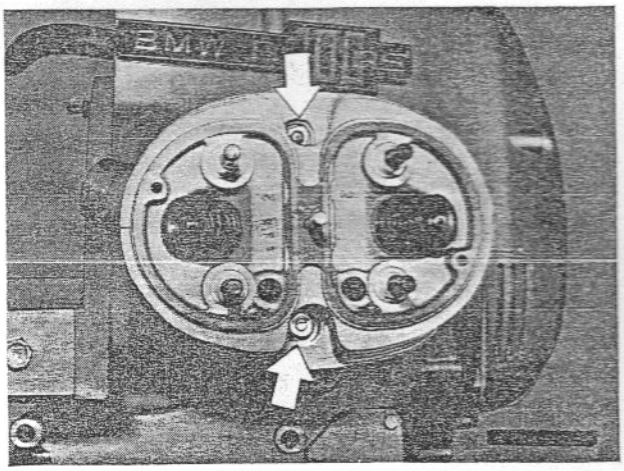
Slacken the cap nut and the two nuts (arrows) and remove the rocker cover and gasket.



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

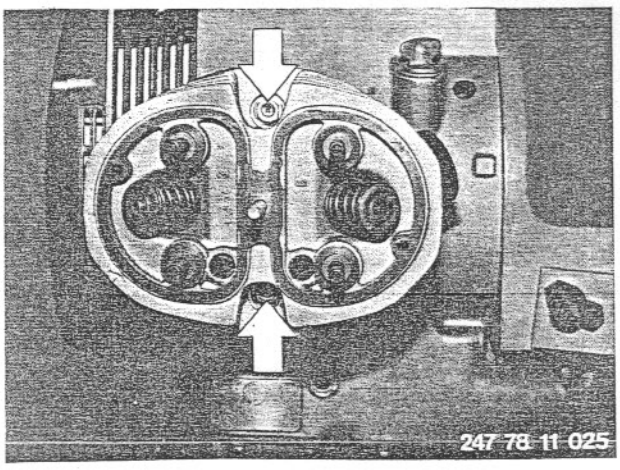


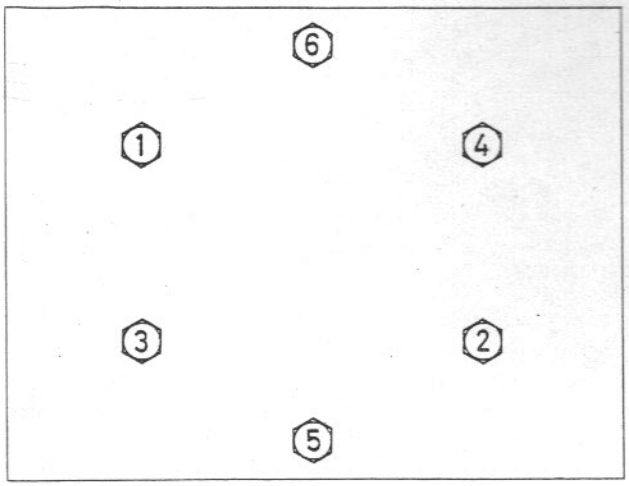
Unscrew the two hex. nuts (arrows). Using a plastic-headed hammer, drive the cylinder head away from the cylinder and pull off at the tierod bolts.



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.



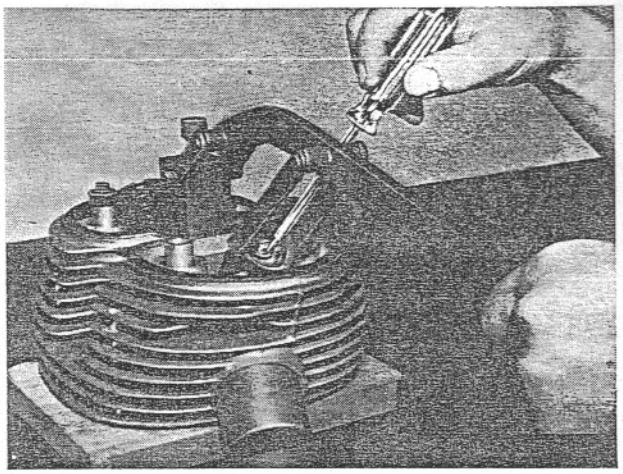


Tightening sequence

11 12 513 Cylinder head – stripping, assembling and grinding in valves

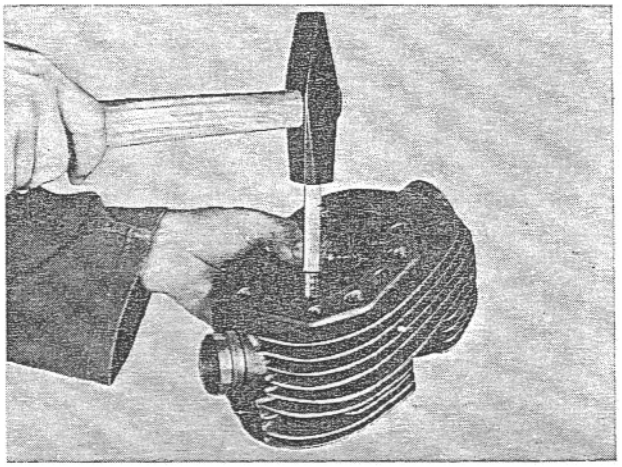
Remove and install cylinder head – 11 12 080.

Secure the cylinder head to assembly fixture BMW 11 1 750, which should be held in a vise. Using the valve lifter for this fixture, press down the valve springs and remove the taper wedges from the spring retaining plates with a magnet or scriber. Take off and retain both spring plates and valve springs. Remove the cylinder head from the assembly fixture and take out the valves.



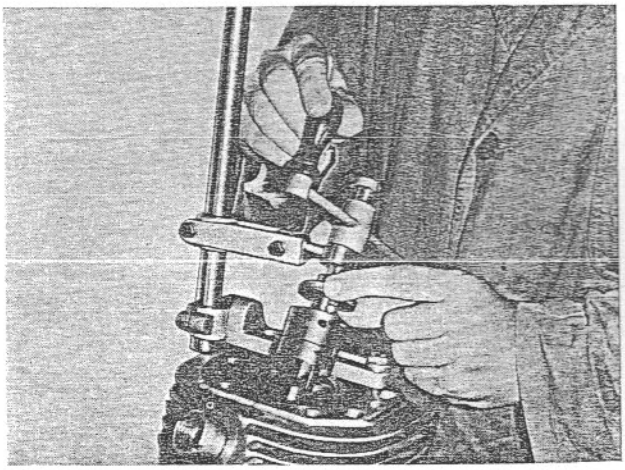
Check cylinder head for:

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 241.

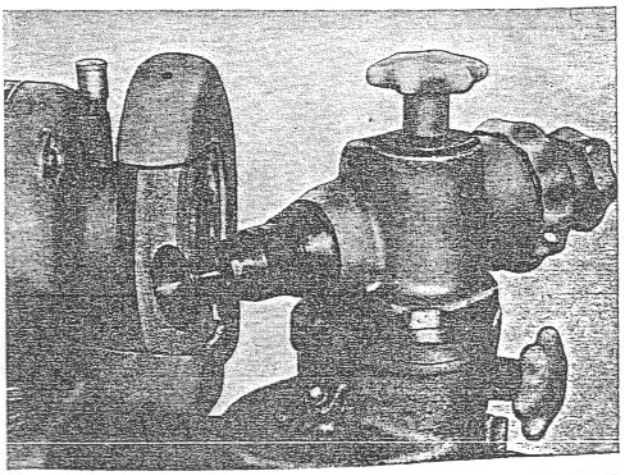


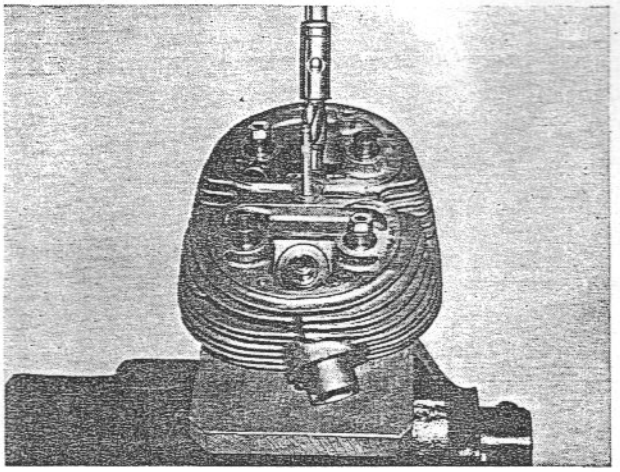
Regrinding valve seats

Regrind the valve seat rings in the cylinder head with the Hunger valve seat tool. Seat angle 45° + 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° 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.



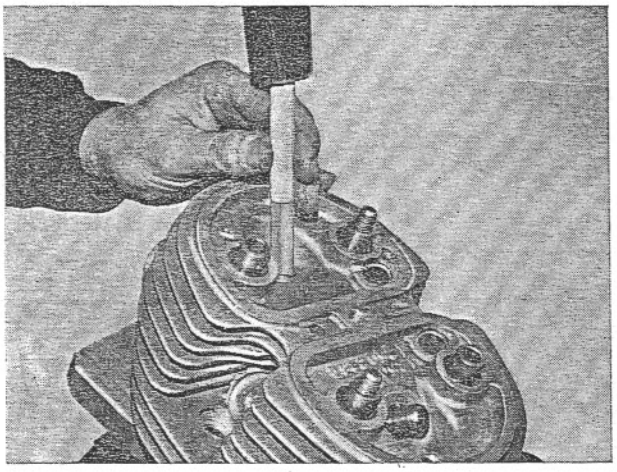


11 12 561 Valve guides – renewing

Remove and install cylinder head – 11 12 080.
Strip cylinder head and grind in valves – 11 12 513.

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

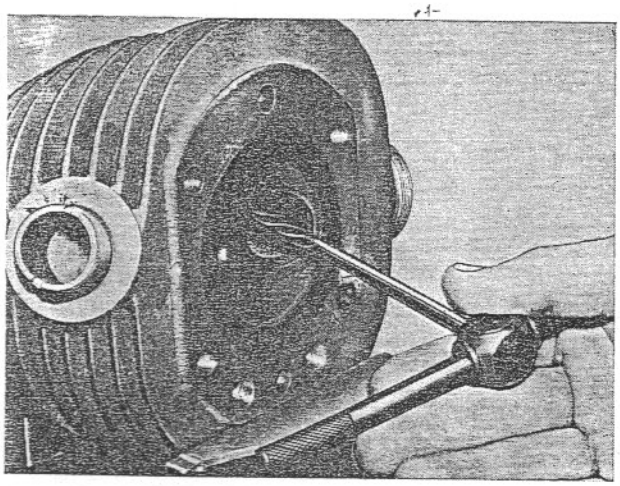
Cut away the old valve guide at the top as far as the circlip.



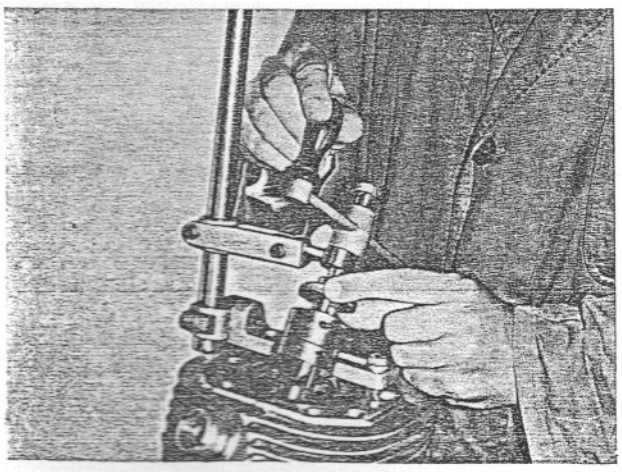
Remove the circlip, heat the cylinder head for 2.5 hours at 240 . . . 260° C (465 - 500° F) and drive out the valve guide into the combustion chamber with BMW 11 1 790 drift.

Before driving out the valve guides, remove the valve support from assembly fixture BMW 11 1 750.

For oversize valve guides and holes in cylinder head, see Specifications.



Attach the circlip to the new valve guide (see Specifications), heat the cylinder head and drive in the guide.
After the valve guide has cooled down, ream it out with a fixed 7H7 valve guide reamer.



11 12 621 One valve seat ring – renewing

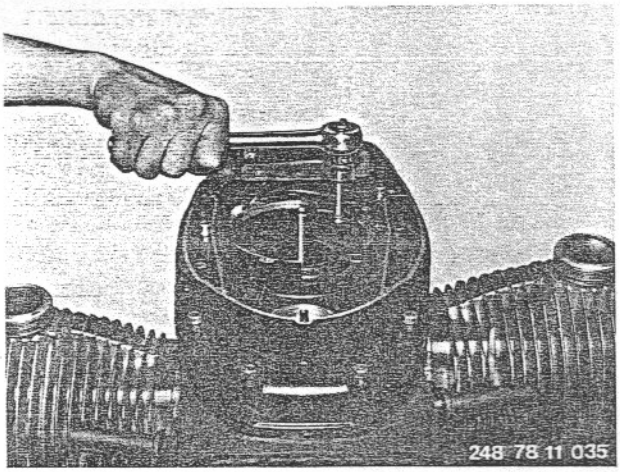
Cylinder head removed – 11 12 080.

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

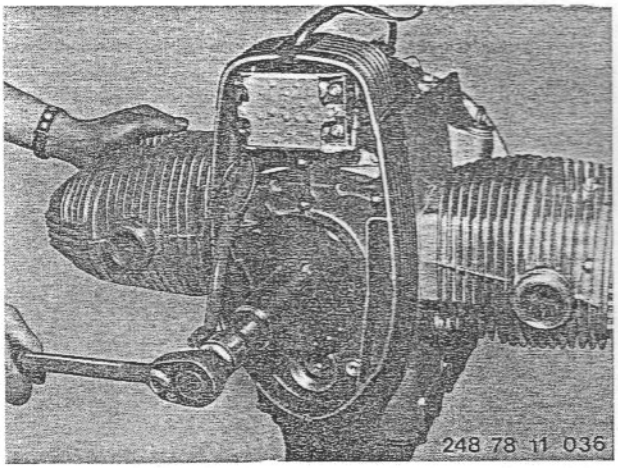
If the valve seat ring has to be renewed after the valve seats have been reground several times, part off the old valve seat ring with the Hunger valve seat tool without damaging the bore in the cylinder head. Heat the cylinder head to 240 . . . 260° C (465 . . . 500° F) and install the new valve seat ring (see Specifications).

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.

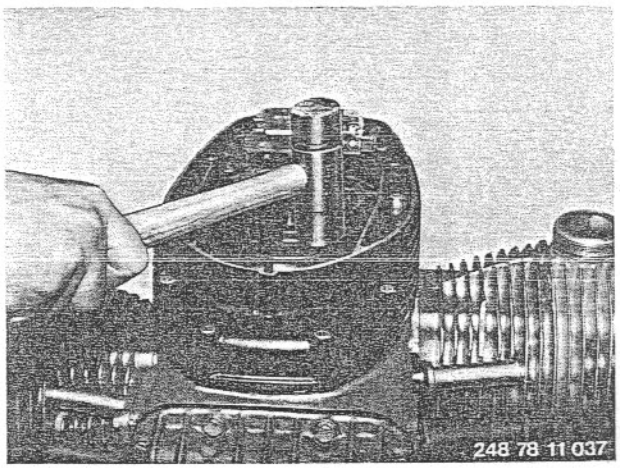


Screw BMW puller 11 1 800 to the tapped mounting holes for the alternator housing, using three M5 Allen screws. Attach the thrust head for the puller and pull off the cover.



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

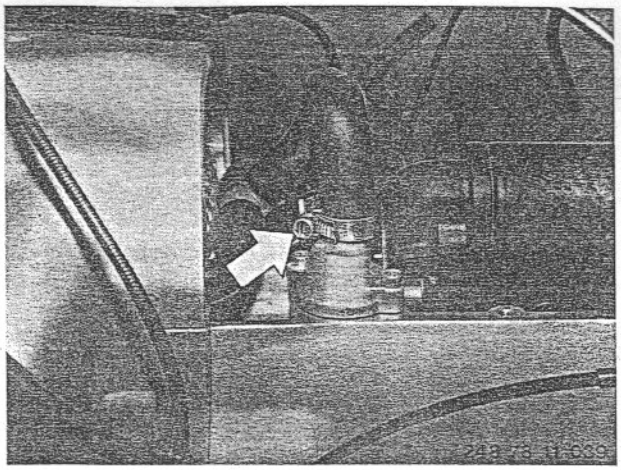
Detach and attach timing chain cover – 11 14 060.

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

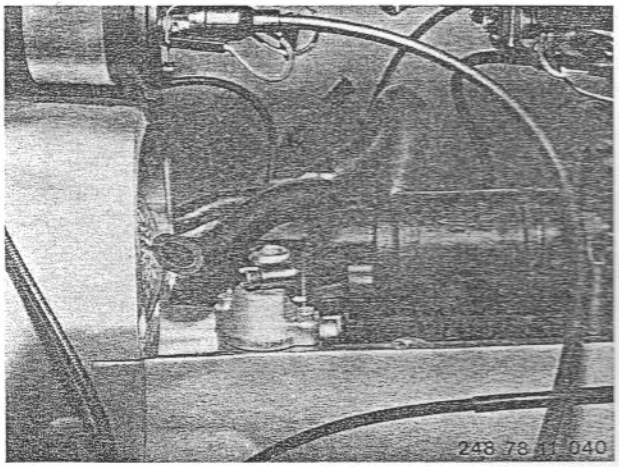


11 15 101 Engine breather hose – renewing

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).



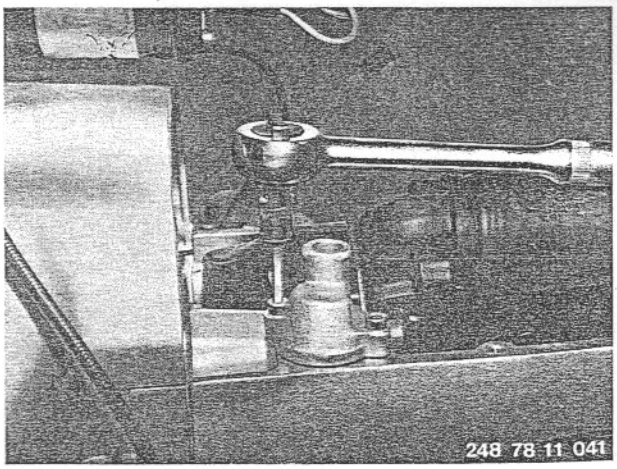
Pull the breather hose out of the air cleaner housing left and right, and detach from the breather head.



11 15 111 Check valve for engine breather – renewing

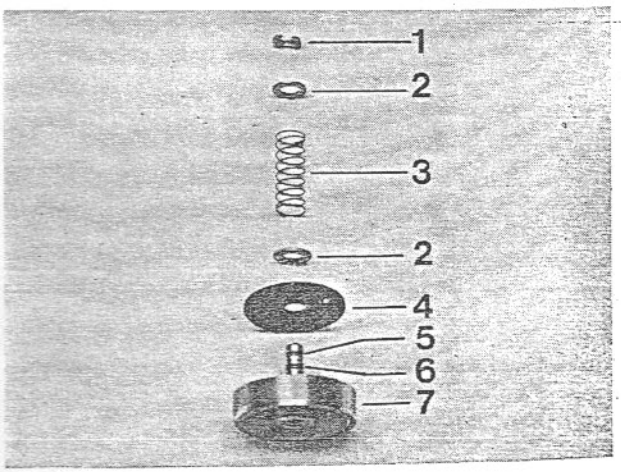
Renew engine breather hose – 11 15 101.

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 21 001 Crankshaft – removing and installing

Remove and install timing case cover – 11 14 060.

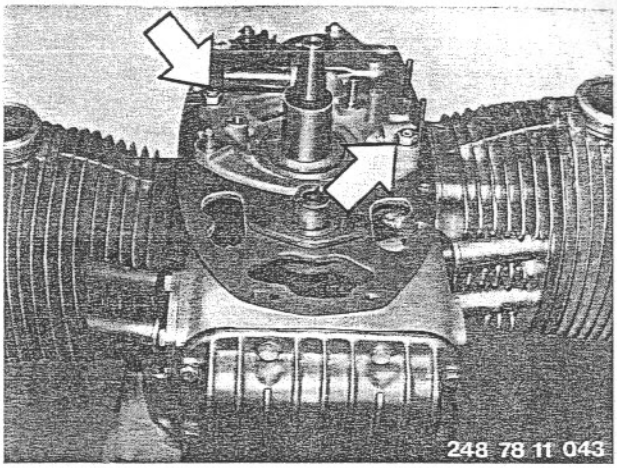
Remove and install chain sprockets – 11 31 061.

Remove and install pistons – 11 25 000.

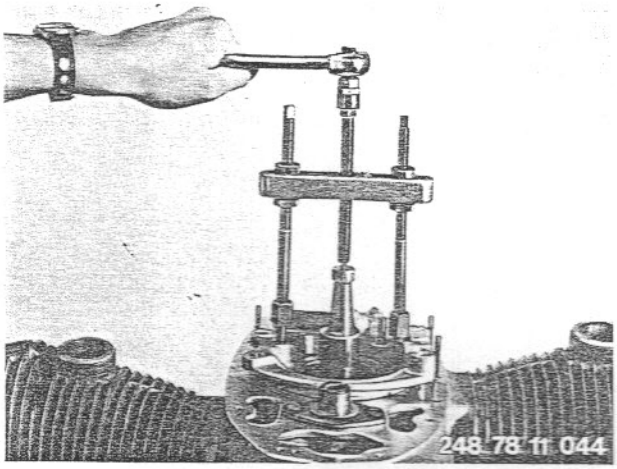
Remove and install connecting rods – 11 24 000.

Remove and install flywheel – 11 22 000.

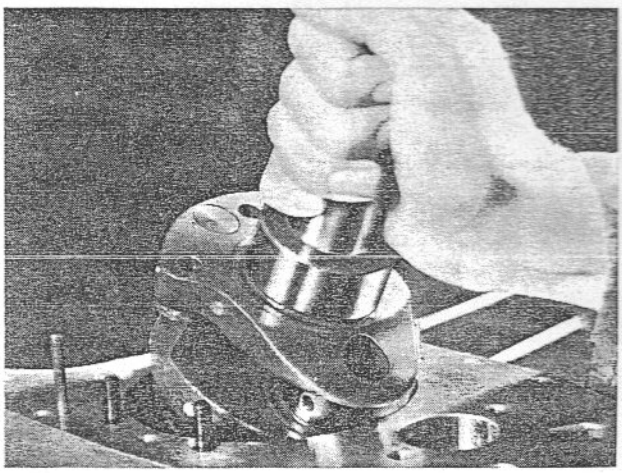
Unscrew retaining nuts at bearing cap.



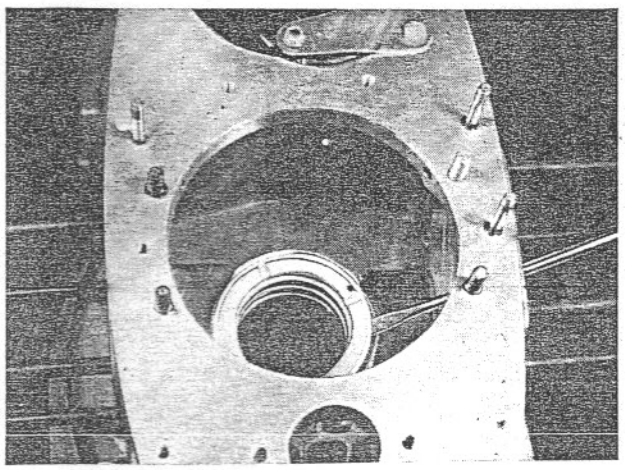
Position the engine vertically. Insert the two bolts of BMW puller 00 7 500 in the tapped holes provided on the main bearing cap. Mount the puller bridge parallel to the main bearing cap, insert the puller thrust head and pull off the main bearing cap.

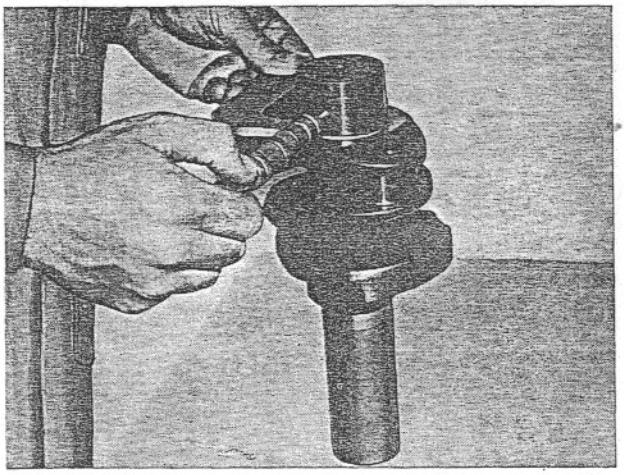


Pull the crankshaft out of the engine block.



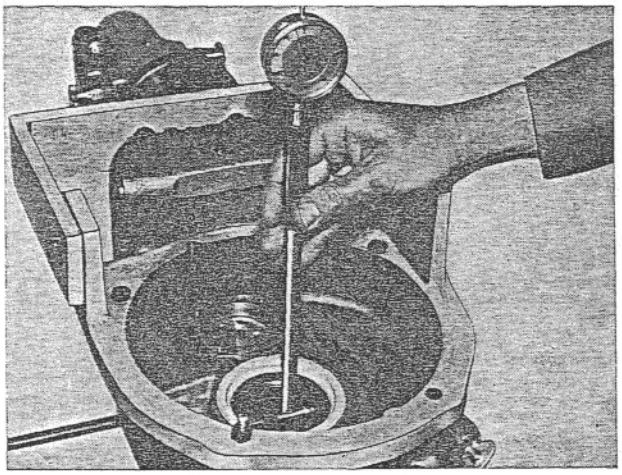
Strike off the two thrust washers at the locating pins with a screwdriver.



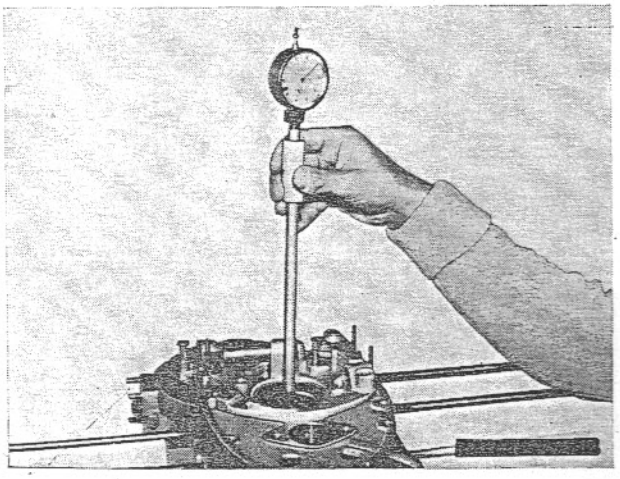


Measuring crankshaft and bearing bushing

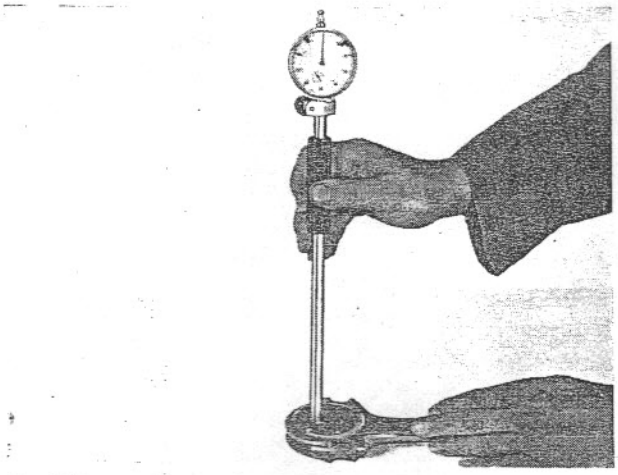
Remove the crankcase from the assembly stand.
Measure the main bearing journals and crankpins with a micrometer, taking readings at right angles.
For measurement sheet, see Specifications.



Bearing bushing in crankcase.



Measure bearing cap in installed position.



Measure big end bore with connecting rod assembled, using an internal micrometer and taking readings at right angles.
For nominal dimensions, wear allowances and measurement sheet, see Specifications.

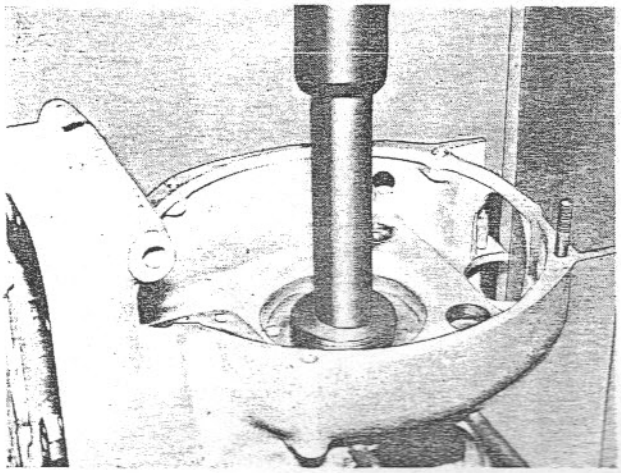
11 21 531 Main bearing bushings – renewing

Renew crankshaft – 11 21 001.

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

Press the main bearing bushing out of the engine block.

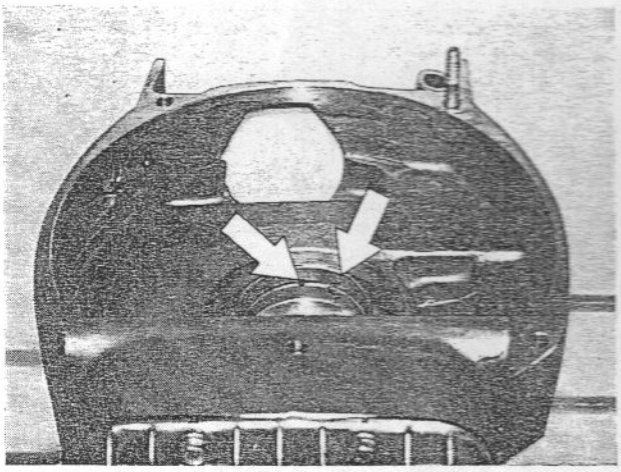
Heat the engine block to 100 . . . 120° C (212 . . . 248° F) and then press over the cylinder of pressing-out tool BMW 11 2 710 so that the locating pins for the inner thrust washer enter the holes provided in the cylinder. Using the pressing-out arbor from special tool BMW 11 2 710, force out the bearing bushing with the hand press.



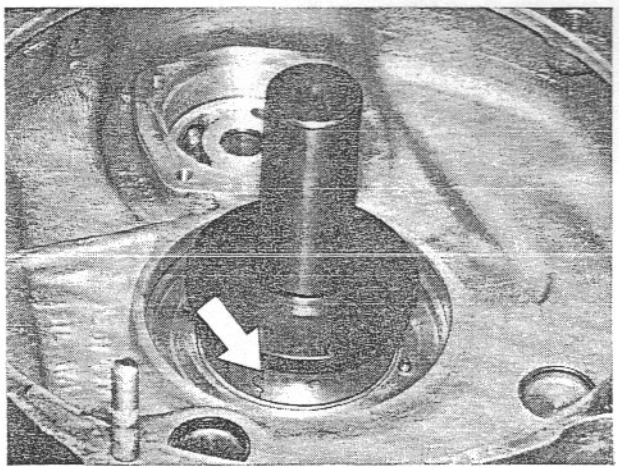
Press in the 1st, 2nd or 3rd oversize bearing bushing as required.

Heat the engine block to 100 . . . 120° C (212 . . . 248° F). Mount the aluminium head of special tool BMW 11 2 710 on the pressing-out cylinder. Place the engine block over the pressing-out tool so that the two locating pins engage in the holes provided in the aluminium head.

Offer up the new bearing bushing so that the butt joint is at the top right, looking at the flywheel end, and the oilways in the bearing bushing are vertical (arrows). The joint line in the bearing bushing should be approx. 26° from the vertical.

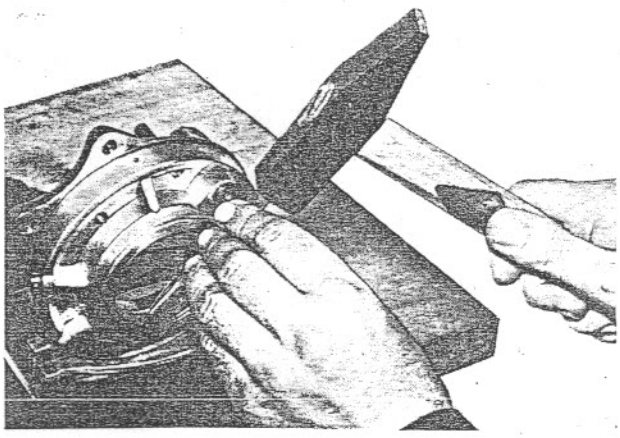


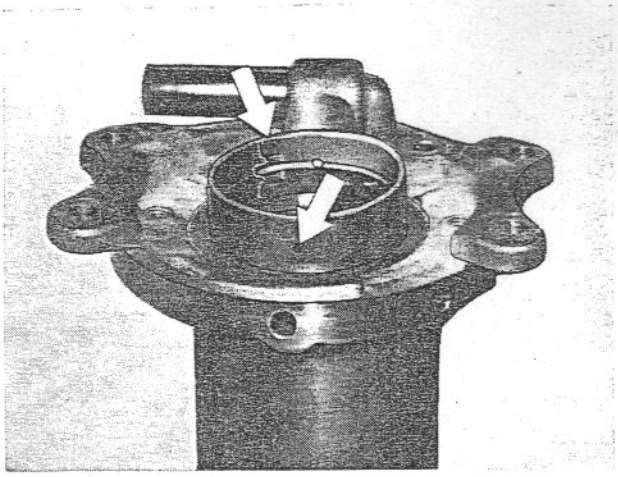
Insert the pressing-in arbor of special tool BMW 11 2 710 in the bearing bushing, complete with its plastic bushing. Make sure that the locating pins projecting from the housing engage in the cutouts at the edge of the pressing-in arbor after the bearing bushing has been pressed in. The dimensions of the bearing bushing are such that it is slightly recessed at both sides in the bore of the housing.



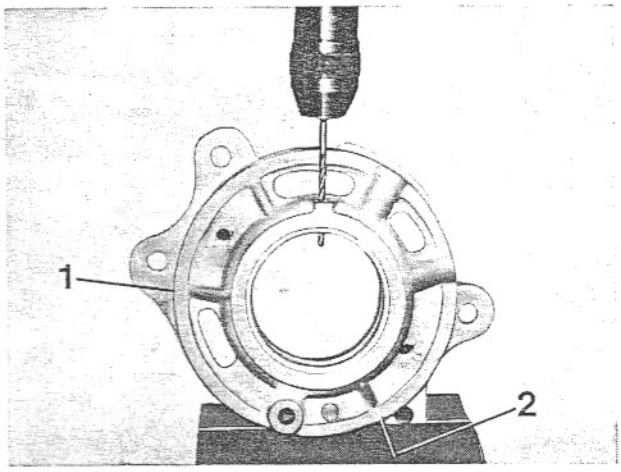
Renew the main bearing bushing in the main bearing cap.

Drive out the bearing bushing locating pin from inside outwards. Heat the bearing cap to 100 . . . 120° C (212 . . . 248° F), and place on the cylinder of pressing-out tool BMW 11 2 710. Using the pressing-out arbor from BMW tool 11 2 710, extract the bearing bushing with the hand press.



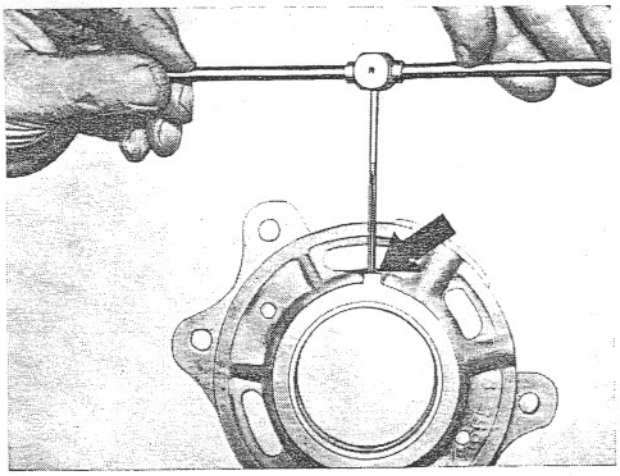


Heat the bearing cap to 100 . . . 120° C (212 . . . 248° F) and press in the new bearing bushing so that the end gap is at the top left, looking at the installed bearing cap, and the oilways are vertical. The joint line in the bearing bushing should be approx. 26° from the vertical (arrows).

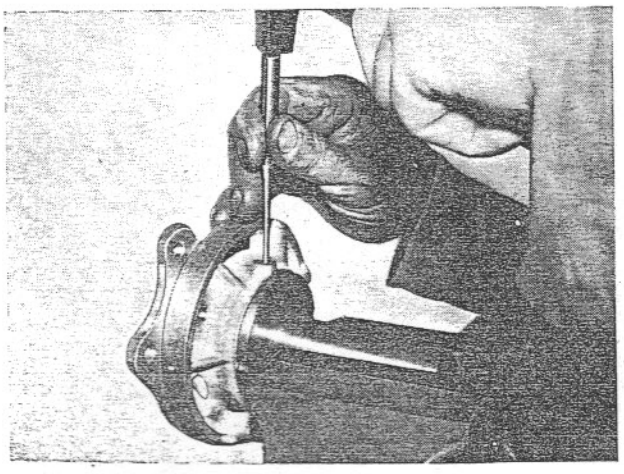


Clamp the bearing cap into the vise, using soft jaws. Drill through the existing 3.2 mm diameter holes in the bearing cap to make two additional oilways, items 1 and 2, in the bearing bushings. Carefully deburr the holes in the bearing bushing.

Secure the bearing bushing. Make a centering mark on the bearing bushing with a 3.9 mm twist drill through the hole (4H8) in the bearing cap for the locating pin. Drill out the bearing bushing to 3.8 mm (basic size of bore for reaming).



Do not allow the hand reamer (4H8) to pass completely through the bearing bushing, so that retaining pin cannot slip inwards. Carefully deburr the end of the hole.

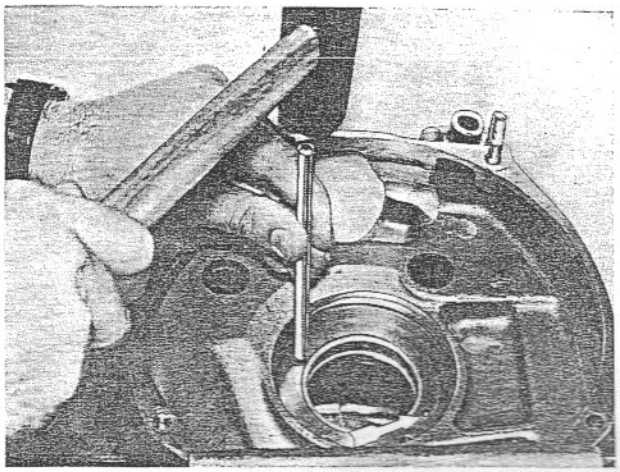


Clamp BMW pressing-in arbor 11 2 710 into the vise and attach the bearing cap. Drive the locating pin in until it is still 0.5 to 1.0 mm (0.02 to 0.04 in) away from the end of the hole in the bearing bushing. Secure the pin with three punch marks.

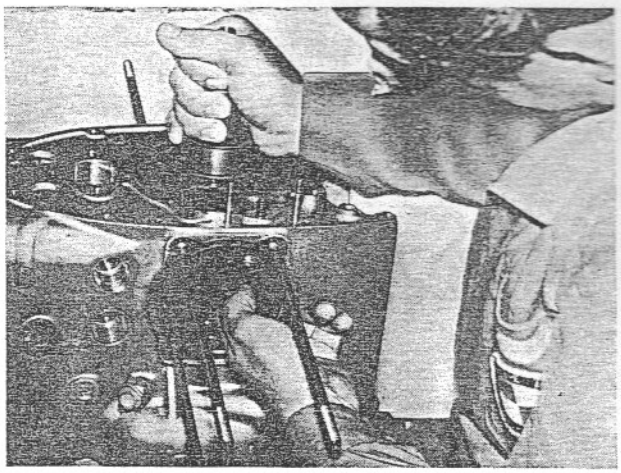
Adjusting crankshaft endplay:

For thrust washer selection table, see Specifications.

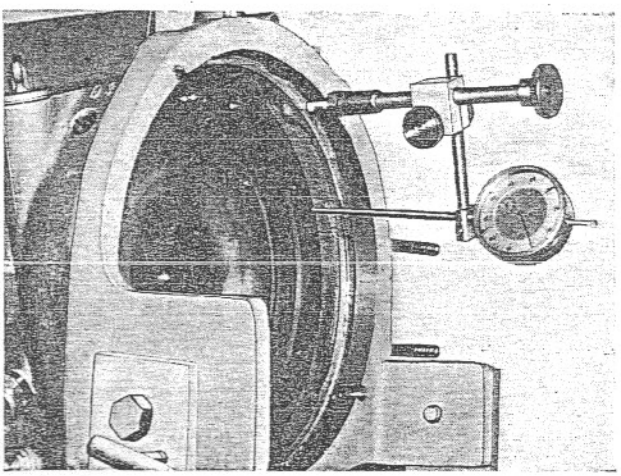
To simplify adjustment of crankshaft endplay, it is good practice to attach a thrust washer marked in red to the locating pins on the inside and outside. Both locating pins must project to an equal amount in the housing at the clutch and crankshaft end. To align or insert the locating pins, heat the engine block.



Heat the housing to 100 . . . 120° C (212 . . . 248° F), mount on the assembly stand and position vertically. Install the bearing cap and tighten down. Turn the crankcase through 190°.
Attach the flywheel (removing and installing flywheel, 11 22 000).

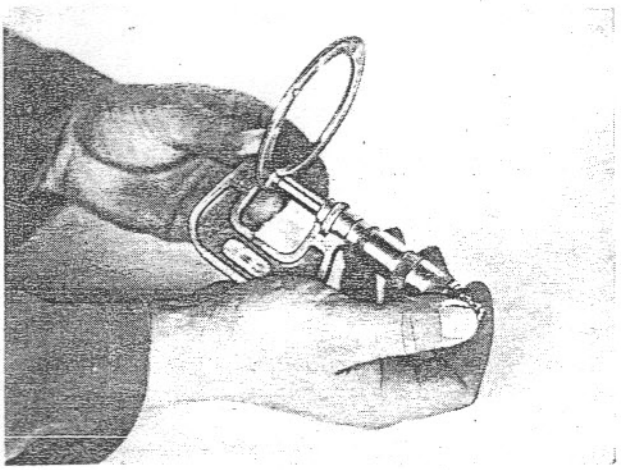


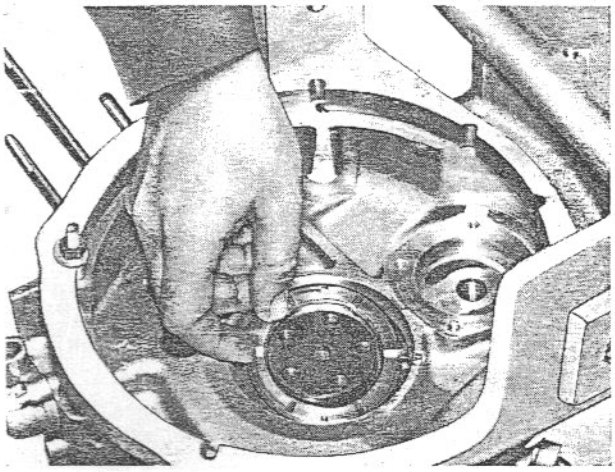
Return the engine block to the horizontal. Screw dial gauge holder BMW 00 2 500 to the gearbox flange of the engine block. Determine endplay. Detach the flywheel again and measure the thrust washer previously installed and marked in red with a micrometer.



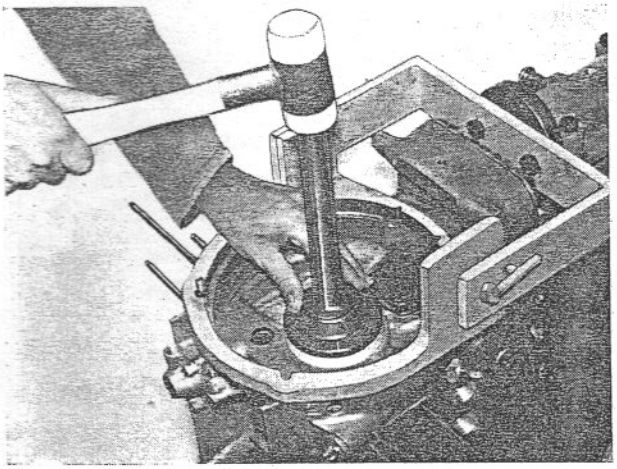
Example:

Endplay as determined	0.18 mm (0.0071 in)
Desired endplay	0.12 mm (0.0047 in)
Difference	0.06 mm (0.0024 in)
Measured thickness of thrust washer as removed	2.48 mm (0.0976 in)
plus difference as above	+0.06 mm (0.0024 in)
Thrust washer needed (blue)	2.54 mm (0.1000 in)





Among the thrust washers coded blue, select one with a thickness as close as possible to the value determined above, and not differing by more + 0.03 mm (0.0012 in) or −0.04 mm (0.0016 in). Attach the thrust washer of the correct thickness to the locating pins.

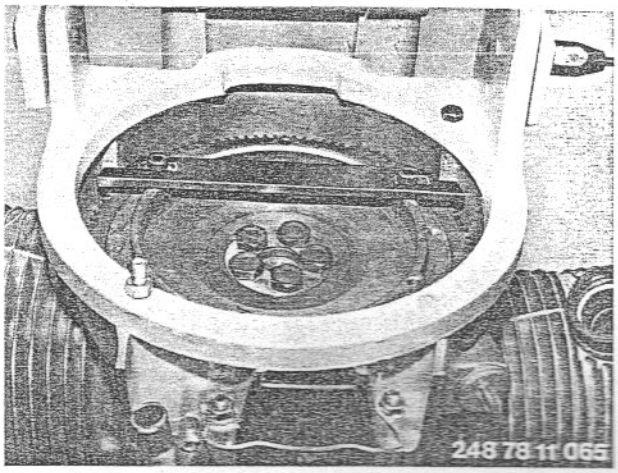


Using BMW drift 11 1 880, drive the radial seal into the crankcase as far as the shoulder. Oil the radial seal lightly.

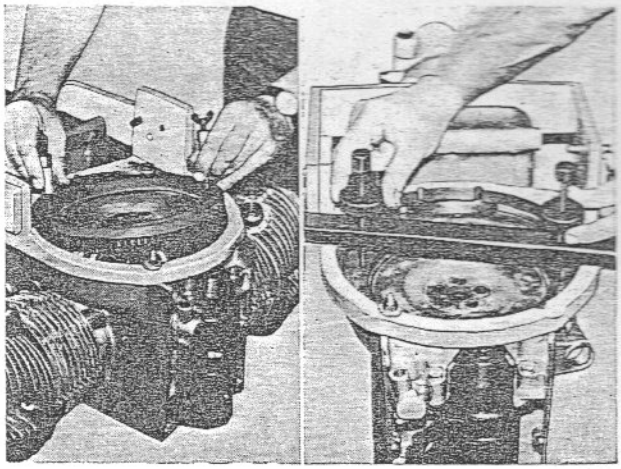
11 22 000 Flywheel – removing and installing

1) If engine remains in frame:
   remove and install gearbox – 23 00 020
   remove and install clutch – 21 21 000

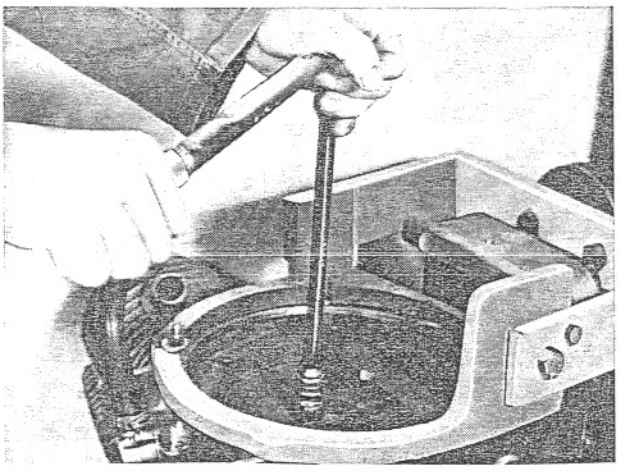
2) If engine is removed:
   remove and install engine – 11 00 050
   remove and install clutch – 21 21 000.
   Attach BMW retaining tool 11 2 800 to flywheel so that the crankshaft cannot turn as the flywheel is loosened.



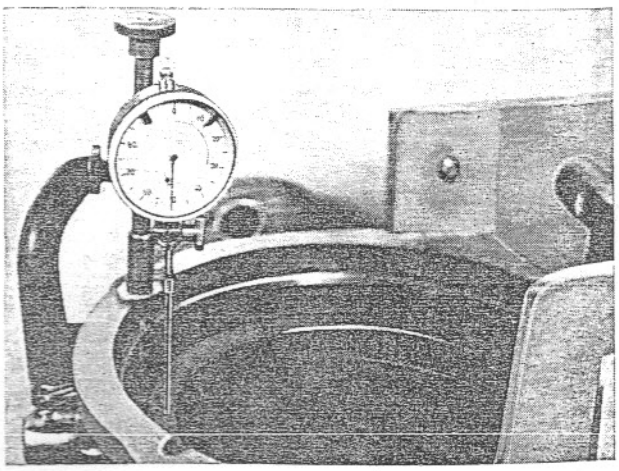
Remove the 5 retaining bolts and carefully lift away the flywheel after screwing in two clamp bolts. Do not tilt the flywheel. Alternatively, pull the flywheel away from the end of the crankshaft with BMW puller 11 2 810.



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 of the crankshaft.

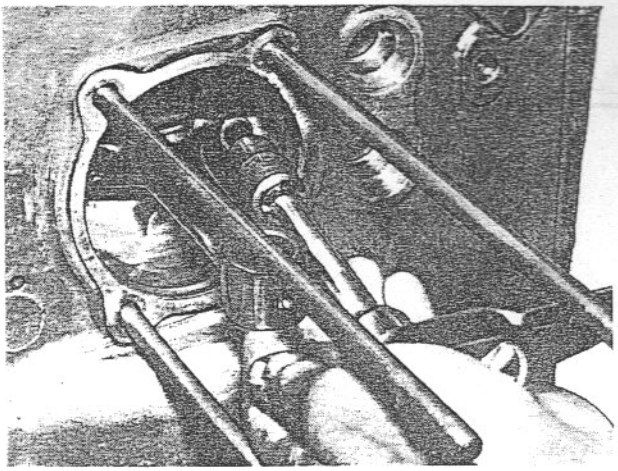


11 24 000 Connecting rod – removing and installing

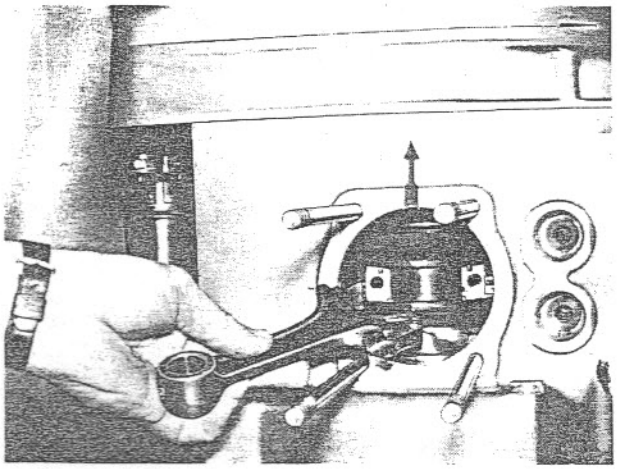
Remove and install engine – 11 00 050.
Remove and install the cylinder head – 11 12 080.
Remove and install piston – 11 25 000.

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

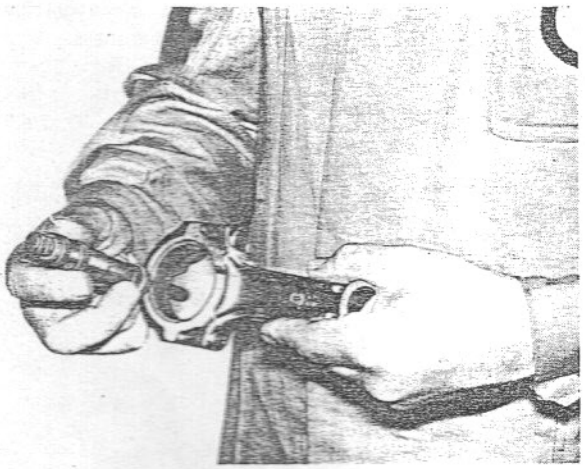
Removal and installation of the connecting rod takes place with the crankshaft in the TDC position. Unscrew the big end bolts with the correct multi-flat wrench. Take off the connecting rod and big end cap with bearing shells.



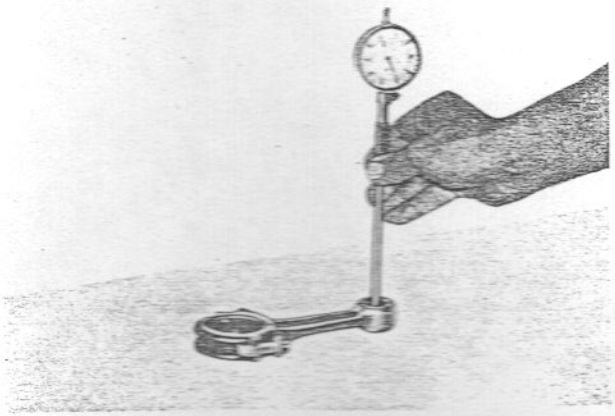
When installing: both connecting rods should have the locating pins on the alternator side.



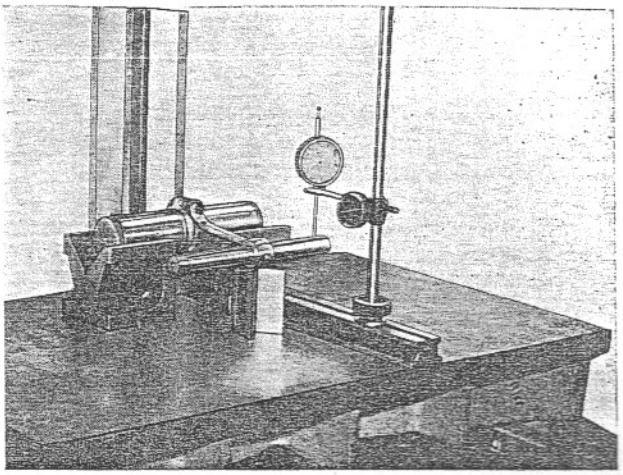
Checking and reconditioning: measure the thickness of the connecting rod at the big end bearing with a micrometer. For measurements, see Specifications.
Both connecting rods used in any engine must bear the same weight markings or color codes.
Check that the small end bushing is firmly seated and within dimensional tolerances.



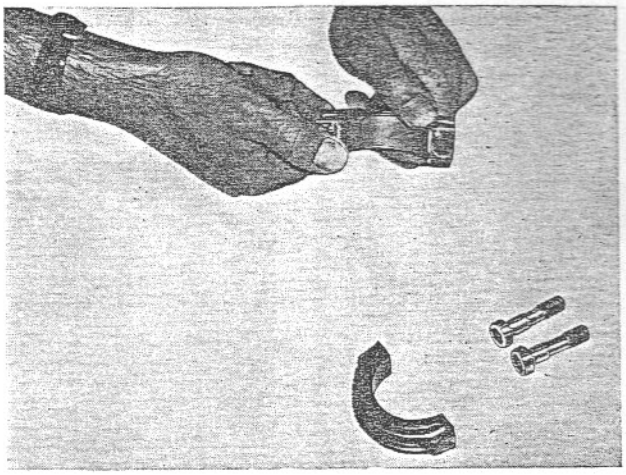
If the internal diameter of the small end bushing exceeds the permitted wear limit, press out the small end bushing. For dimensions, see Specifications.



Check connecting rod twist. Suspend the connecting rod from the Vee-guide again and support at the small end bore so that the distance from the alignment plate to the center of the big end and small end bores is approximately the same. Apply a dial gauge on a suitable stand to the end of the test mandrel and check for connecting rod twist. For permitted tolerances, see Specifications.

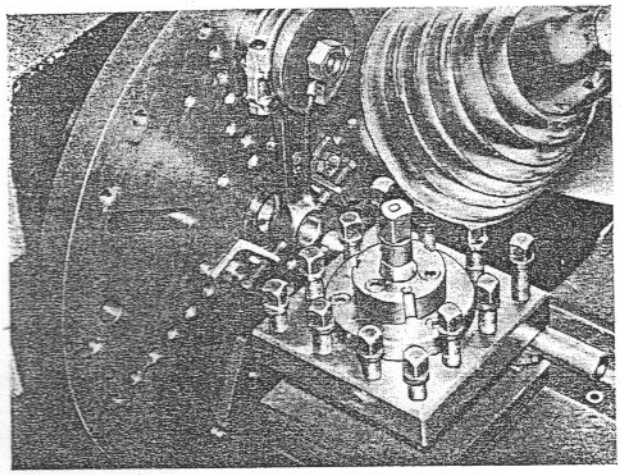


Press the bearing shells into the clean, circular bore of the connecting rod.

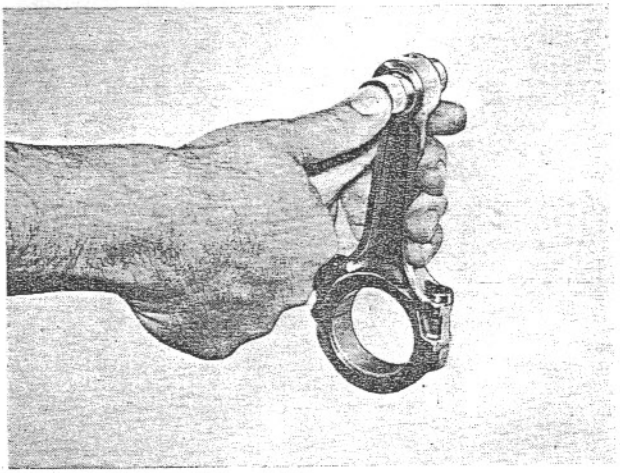


Before installing the connecting rod, apply a light coat of Molykote G paste to the main and big end bearing shells.

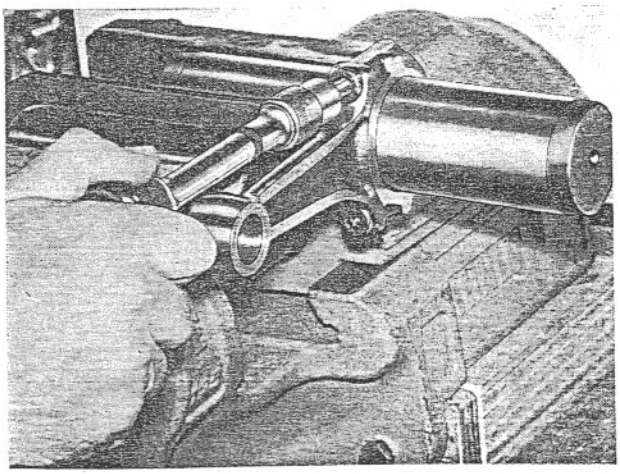




Press in a new, oversize bushing. Mount the connecting rod on the faceplate of a lathe, align and micro-turn to the finished dimension stated in the Specifications.

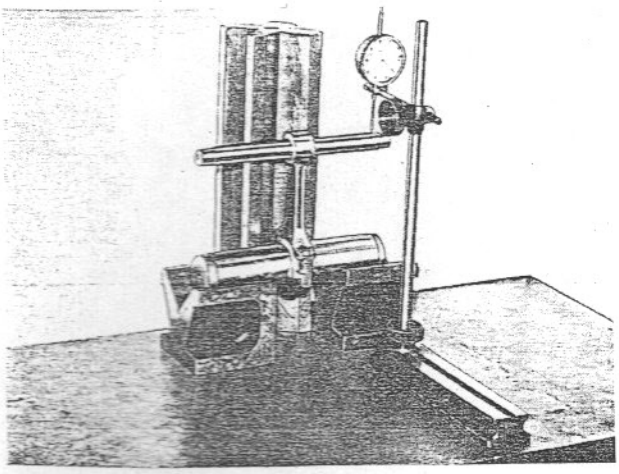


It should be possible to push the piston pin into the new bushing by exerting light thumb pressure.



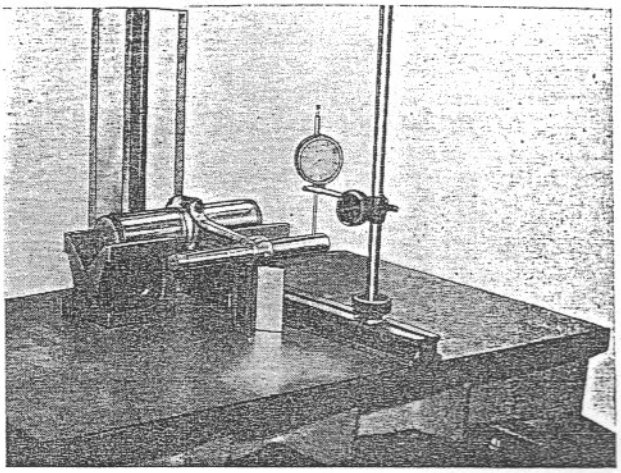
Measuring connecting rod

Press the bearing shells to be used for checking into the connecting rod. Mount the connecting rod on the hardened and ground test mandrel, and tighten the bolts. There should be no radial play between the mandrel and the big end bearing. Push a hardened and ground test mandrel approx. 150 mm (5.9 in) long into the small end bushing so that the mandrel projects by an equal amount on either side.

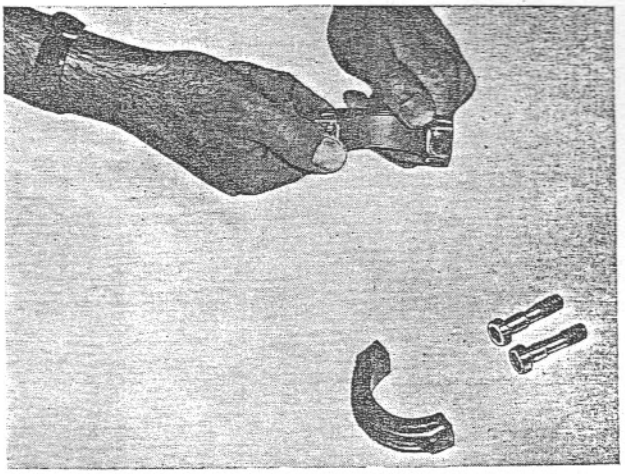


Set up two Vee-guides of equal size on a bedplate. Place the test mandrel with connecting rod on the Vee-guides. Hold the connecting rod vertical. With a dial gauge stand applied to the ends of the test mandrel, check that the piston pin axis is parallel to the big end bearing bore. For connecting rod out-of-parallel limits, see Specifications.

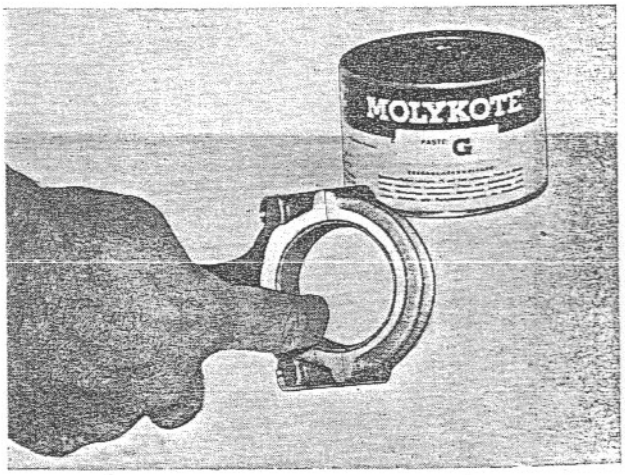
Check connecting rod twist. Suspend the connecting rod from the Vee-guide again and support at the small end bore so that the distance from the alignment plate to the center of the big end and small end bores is approximately the same. Apply a dial gauge on a suitable stand to the end of the test mandrel and check for connecting rod twist. For permitted tolerances, see Specifications.



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



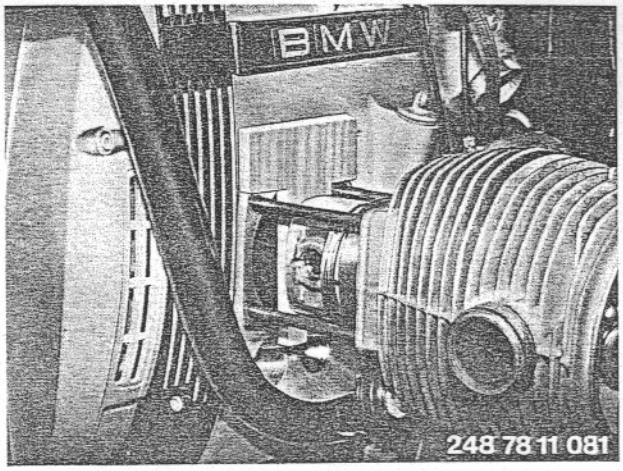
Before installing the connecting rod, apply a light coat of Molykote G paste to the main and big end bearing shells.



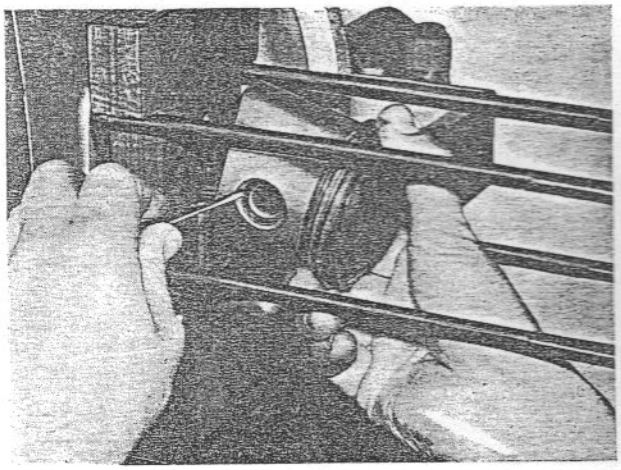
11 25 000 Piston – removing and installing

Remove and install cylinder head – 11 12 080.

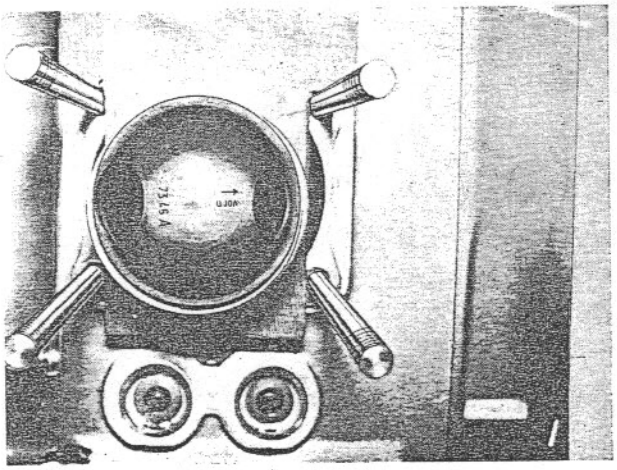
Pull the cylinder away from the 4 tie bolts. Make sure that when the piston emerges from the cylinder it does not become damaged. Insert a piece of wood behind the piston and between the tie bolts to prevent piston damage.



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

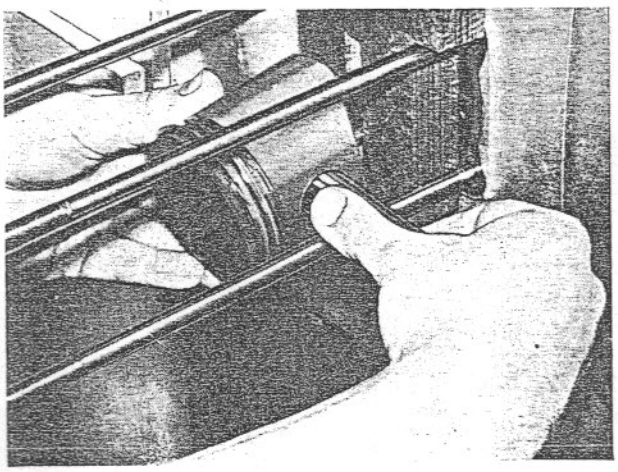


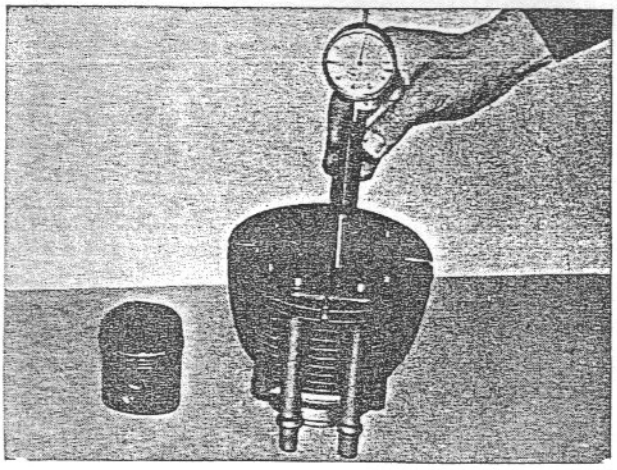
When installing: attach the piston with the "vorn→" mark on the crown facing forwards. This will ensure that the small-end offset is correct. The piston need not be heated before the piston pin is inserted.
Use two pistons of the same weight group in the engine.



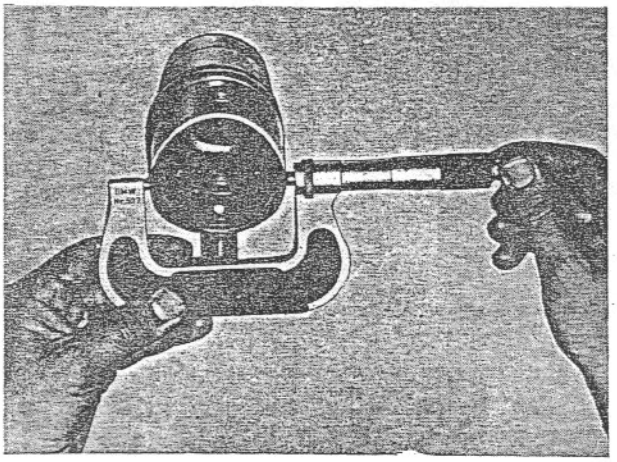
Insert the piston pin circlip in its groove so that one end covers the lateral groove completely. Press the center section of the circlip into the piston pin bore so that the two ends of the ring are as close as possible. Push the ring fully into the groove with BMW drift 11 2 920.

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 cord ring seals at the upper studs are not trapped.

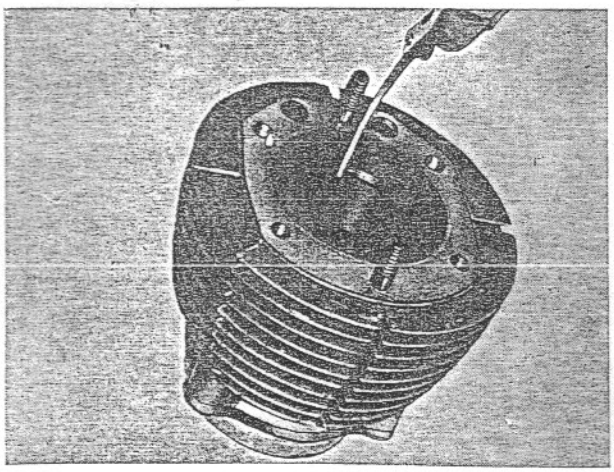




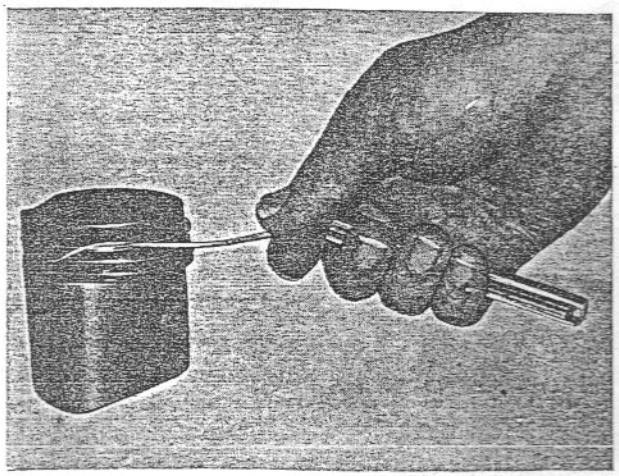
Testing and repair: Measure the cylinder bore in the direction of the piston pin and at 90° to this direction at points 10 mm (0.4 in) from the top, at the center and at the bottom of the bore, using an internal micrometer. The ambient temperature should be 20° C (68° F) for this test.



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.

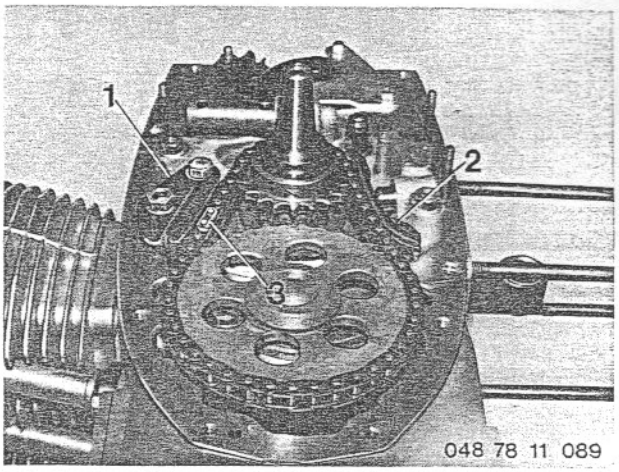


Determine clearance of piston rings in grooves with a feeler gauge. For nominal and wear dimensions of cylinder bore, piston diameter and piston ring end gaps and groove clearances, see Specifications.

11 31 061 Chain sprockets – renewing

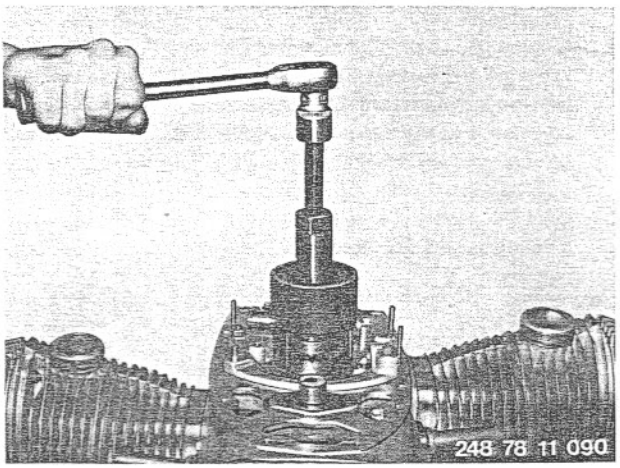
Engine removed or installed.
If engine is installed, drain the oil.
Remove and install engine – 11 00 500.
Remove and install ignition contact assembly – 12 11 060.
Detach and attach timing chain cover – 11 14 060.
Remove chain guide rail (1) and chain tensioner arm (2).
Open the spring link on the chain (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.



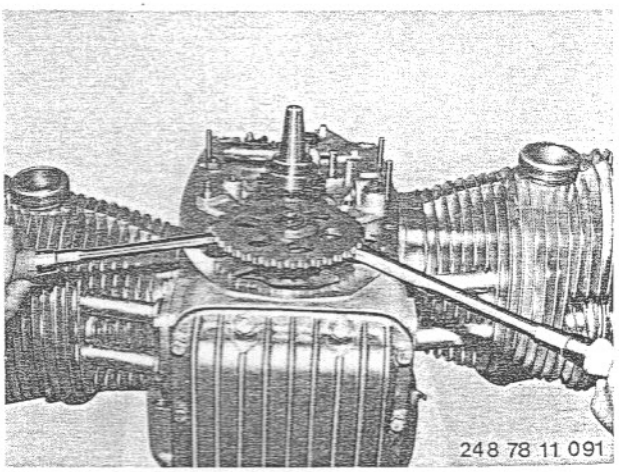
Pull the chain sprocket complete with bearing off the crankshaft. Use BMW puller 11 26 00 and exchange puller cup 11 26 06 for cup with groove.

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



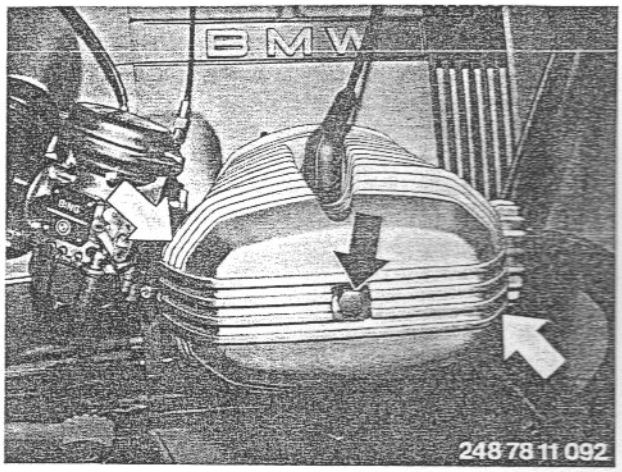
Press off the camshaft chain sprocket with two screwdrivers.

When installing: the marks on the two chain sprockets should be opposite one another.

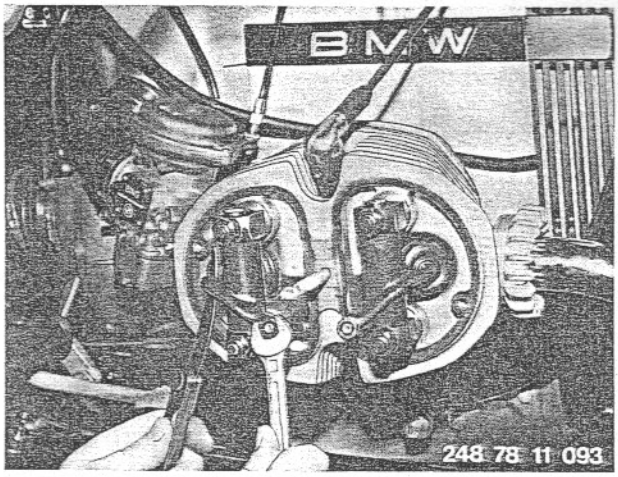


11 34 504 Valve clearances – adjusting

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



Adjust valve clearances with the engine stopped and cold, using a feeler gauge inserted between the valve stem and the rocker. Unscrew and remove the spark plugs and turn the engine over with the kick starter until the cylinder on which the valves are being adjusted is at top dead center on the compression stroke. Both valves are then closed. If necessary, turn the adjusting screw after slackening the locknuts, then tighten the locknut again. Check that the valve clearance has not altered. For correct valve clearances, see Specifications.



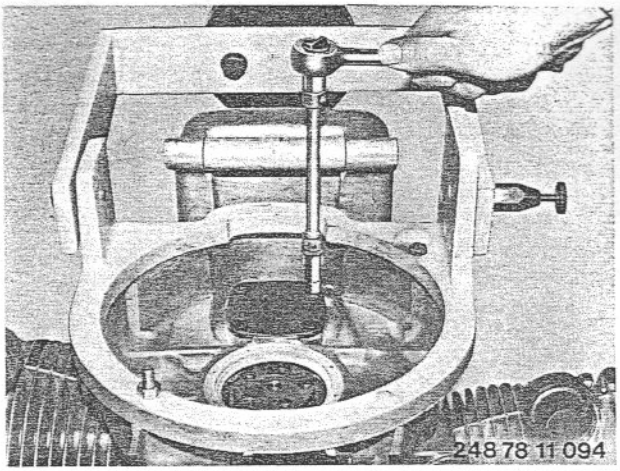
11 41 000 Oil pump – removing and installing

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

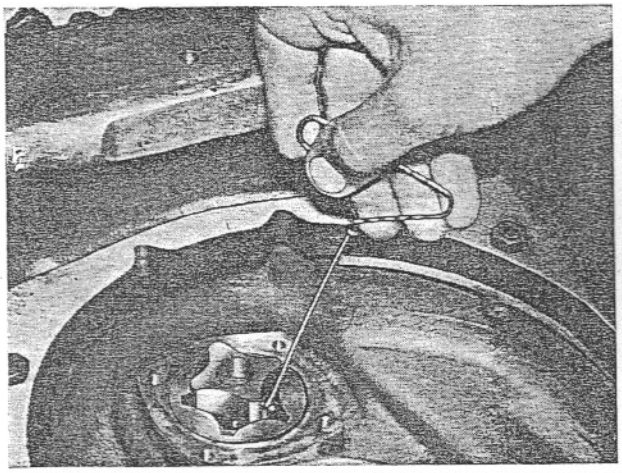
2nd method: Remove and install gearbox – 23 00 020.
The engine remains in the frame.

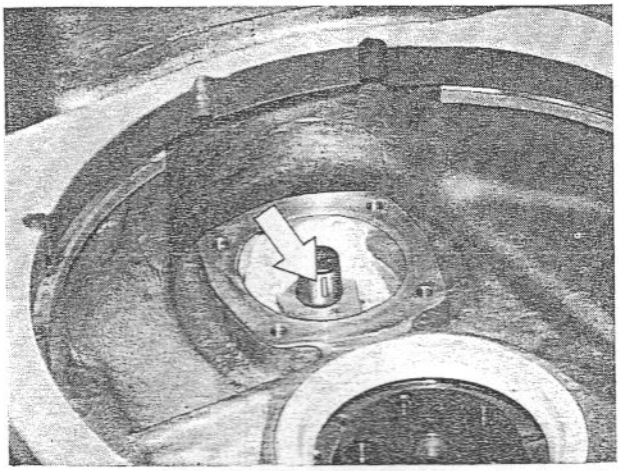
Remove and install clutch – 21 21 000.
Remove and install flywheel – 11 22 000.

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



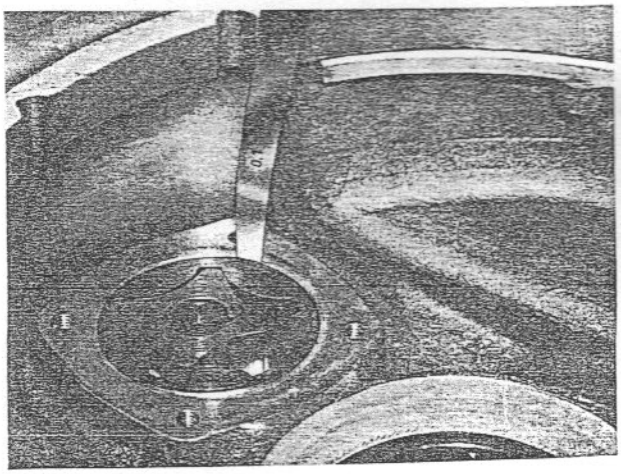
Using a wire hook, remove the inner and outer rotors from the housing.

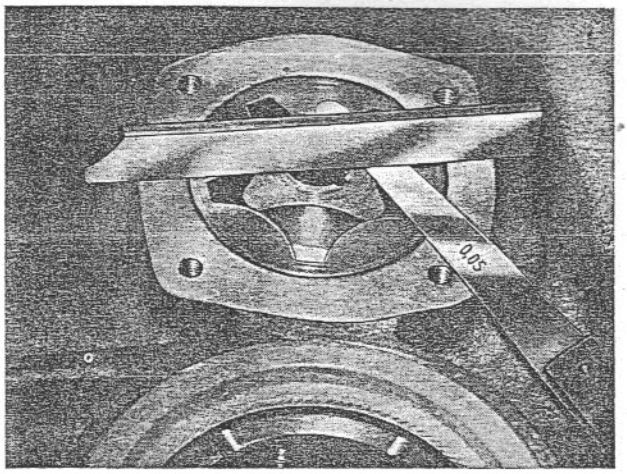




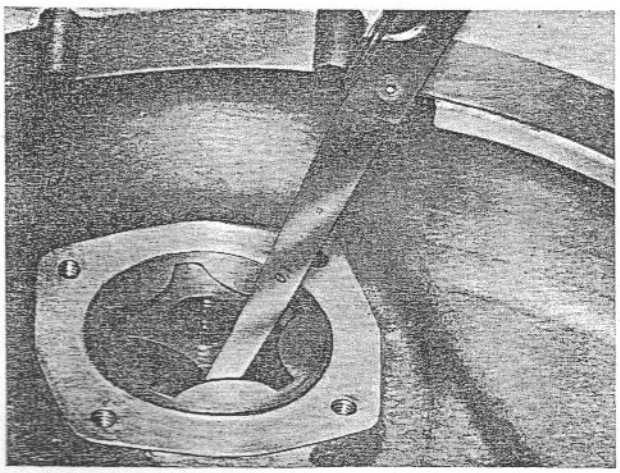
Testing

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



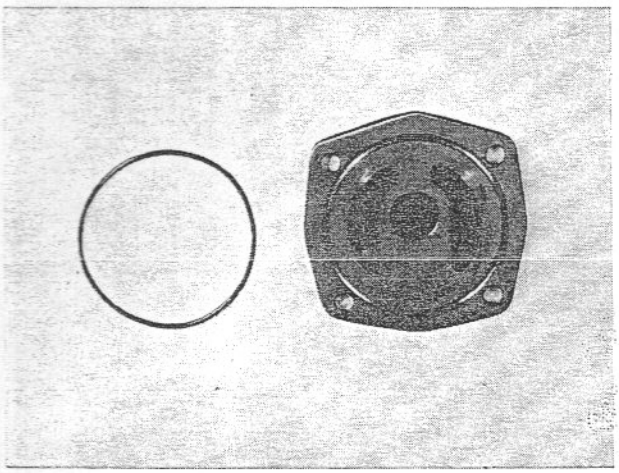


Check play between joint face on pump housing and sealing face on rotor – see Specifications.



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 must be compressed sufficiently for the end cover to rest flat against the housing joint face.

12 Engine electrical system

Specifications		12– 0/3
12 11 004	Timing ignition	12–11/1
12 11 060	Ignition contact assembly – removing and installing	12–11/3
12 11 141	Breaker points – renewing	12–11/4
12 13 100	One coil – removing and installing	12–13/1
12 31 009	Alternator, diode board and regulator – 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 for alternator – removing and installing	12–31/4
	Trouble-shooting – alternator	12–31/5
12 41 009	Starter – checking without removal from motorcycle	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	12–41/5
12 41 602	Starter – reconditioning	12–41/5
12 41 701	Exciter winding – renewing	12–41/6
	Trouble-shooting – starter	12–41/7

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 mkp	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}	10000		
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 on-load V	13.55 . . . 14.25 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)		

Specifications

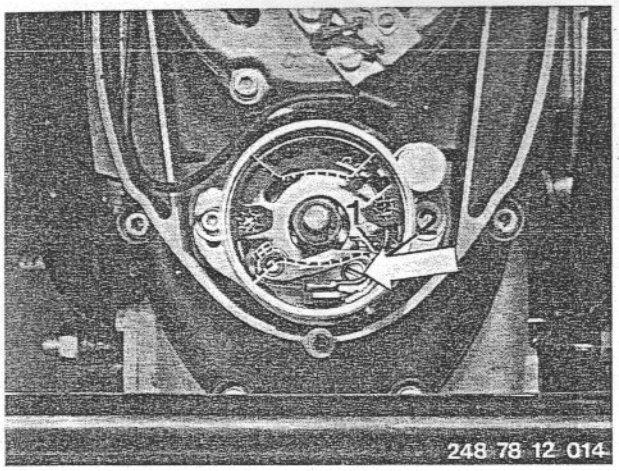
Engine – electrical system

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)

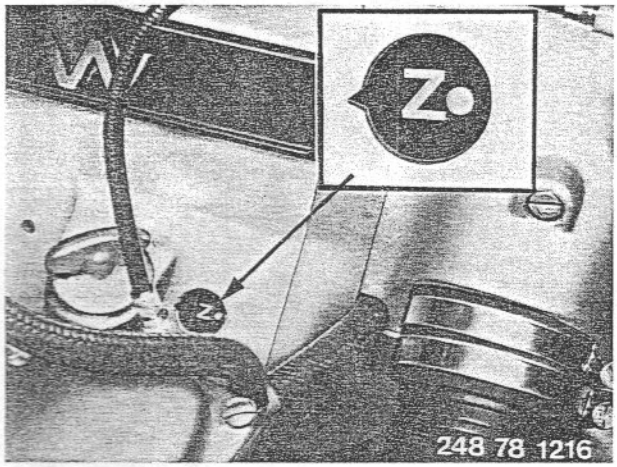
Armature retaining bolt	23 . . . 27 (17 . . . 20)	Spark plugs	23 . . . 30 (17 . . . 22)
Starter retaining bolts	47.5 (35)		

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.



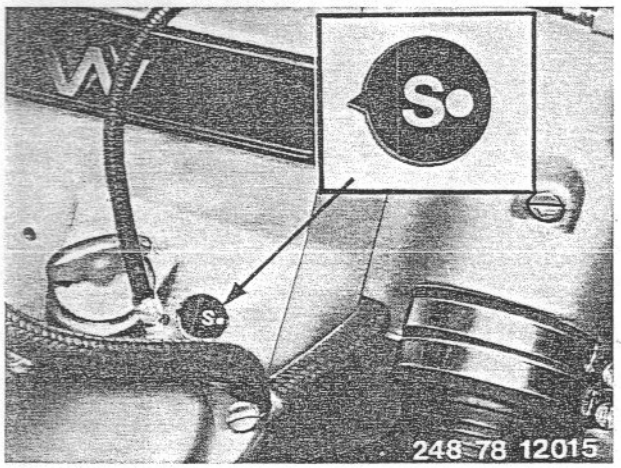
Adjusting breaker points gap

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.

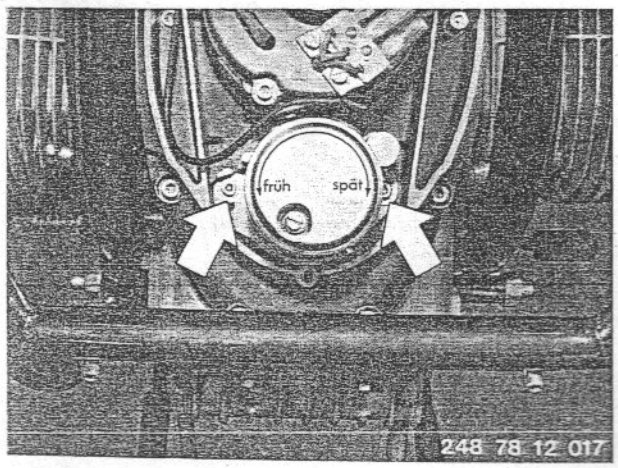


Checking ignition timing

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 ± 150 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.

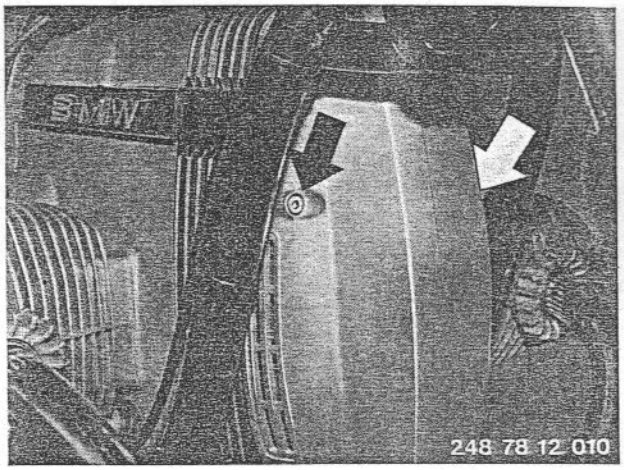


Adjusting ignition timing (with engine running)

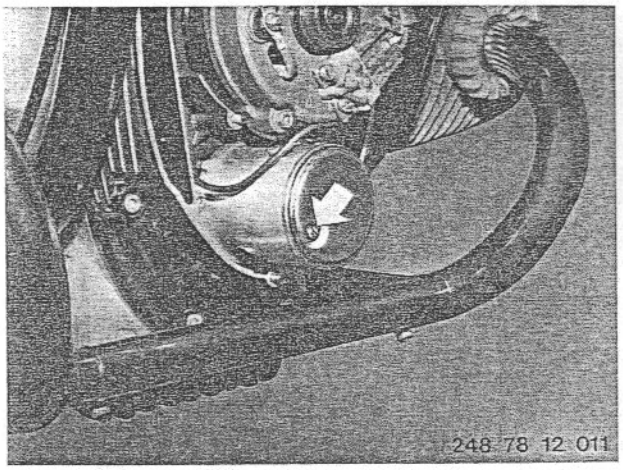
Slacken the Allen screws holding the ignition contact assembly (arrows). Turning the complete contact assembly in the same direction as engine rotation retards the ignition; turning it in the opposite direction to engine rotation advances the ignition. Note that the crankshaft and camshaft both rotate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

12 11 004 Ignition – timing

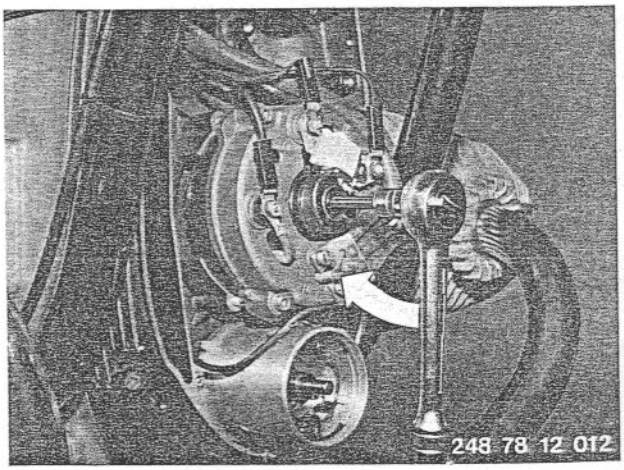
Remove the two Allen screws (arrows) and take off the engine cover.



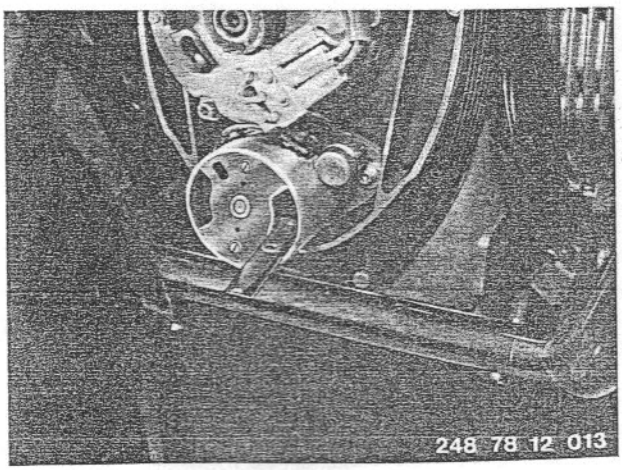
Remove the screw from the ignition contact assembly cover and take off the cover.



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.



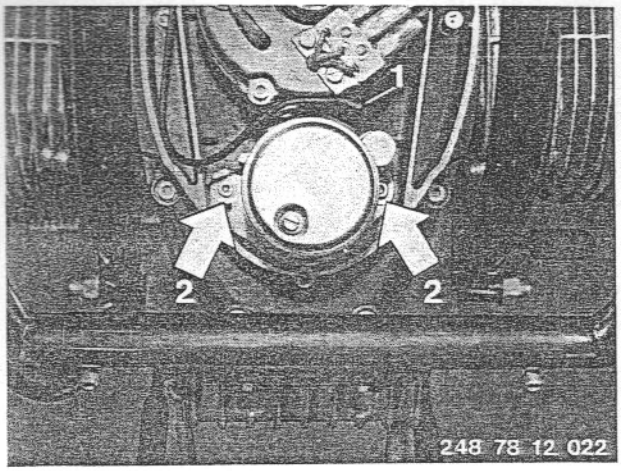
The breaker arm must lift away fully.
Check contact breaker gap with a feeler gauge; it should be 0.40 mm (0.016 in).
If necessary, renew the breaker points – 12 11 141.



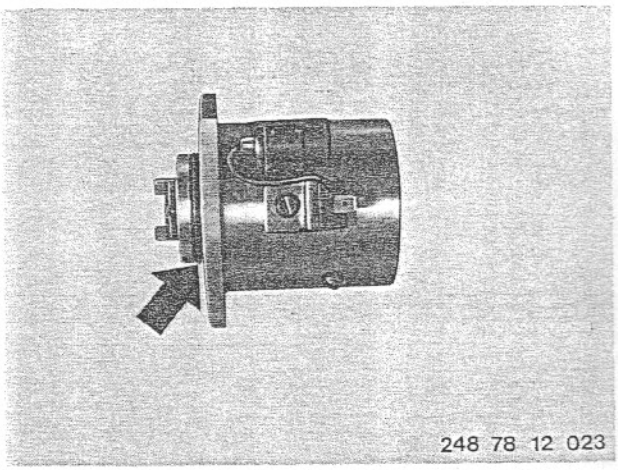
12 11 060 Ignition contact assembly – removing and installing

Take off the engine cover.
Pull off the flat pin plug (1), remove Allen screws (2) and pull the ignition contact assembly out of the timing chain cover.

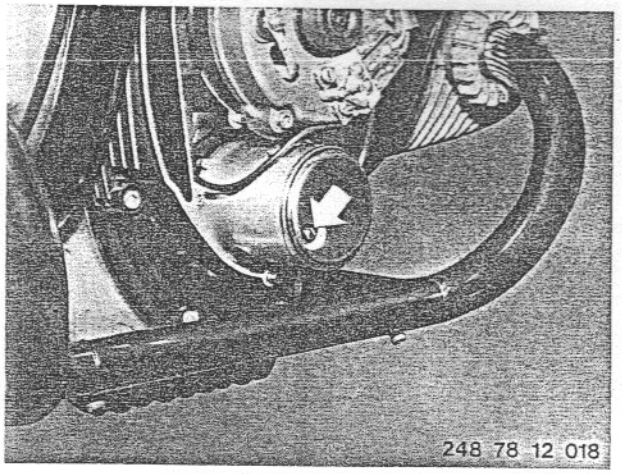
Note: Do not strip down the ignition contact assembly. It must always be replaced as a complete unit.



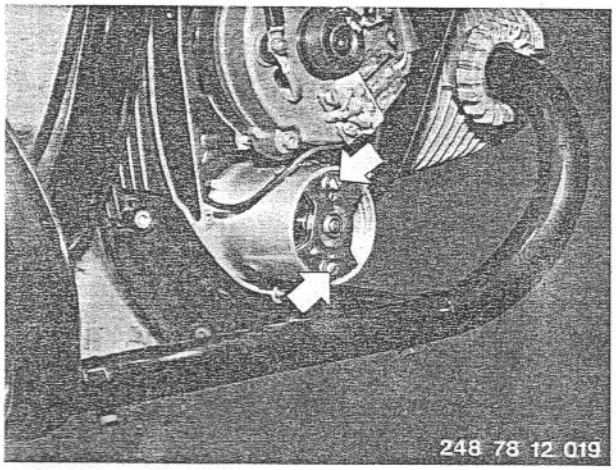
Renew the sealing ring (arrow) whenever the ignition contact assembly is removed.



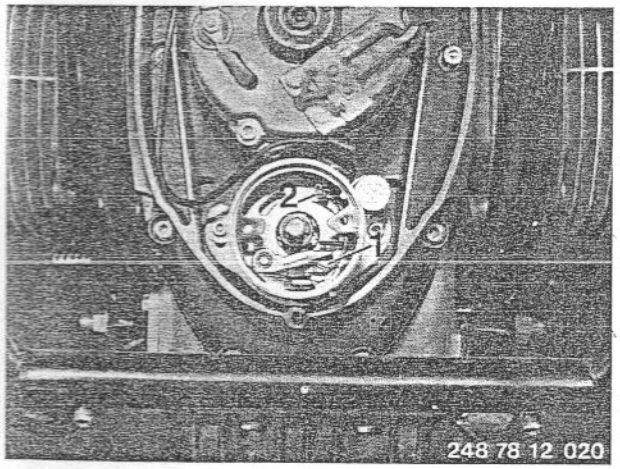
12 11 141 Breaker points – renewing



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.

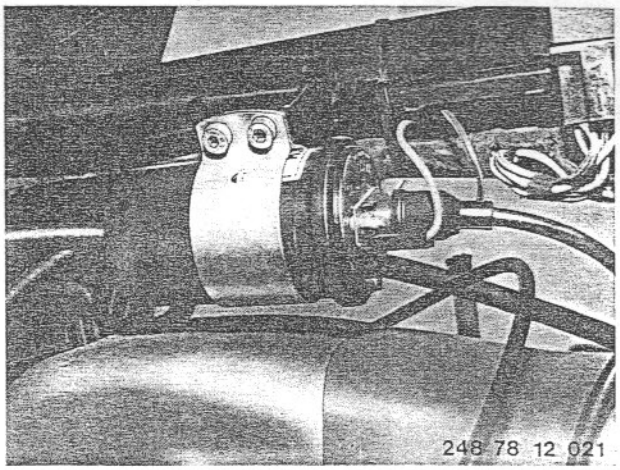


Remove the machine screw (1), pull off the flat pin plug (2) and pull out the complete contact breaker assembly.

12 13 100 One coil – removing and installing

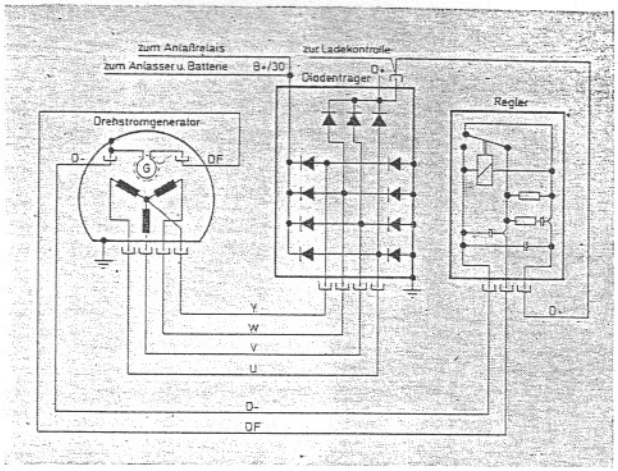
Remove and install fuel tank – 16 11 030.
Disconnect the earth (ground) lead from the battery at the gearbox.
Detach the cables from terminals 1 and 15 and the high-tension cable from the coil.
Loosen the retaining screws with an Allen key.

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



12 31 009 Alternator, diode board and regulator – testing

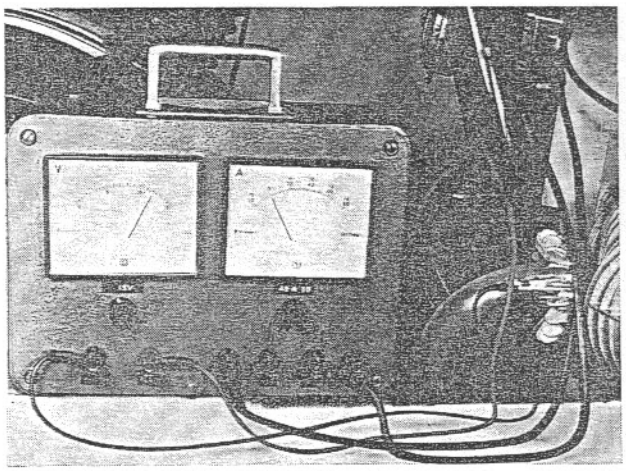
The illustration shows the layout of the alternator, diode board and regulator.



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.

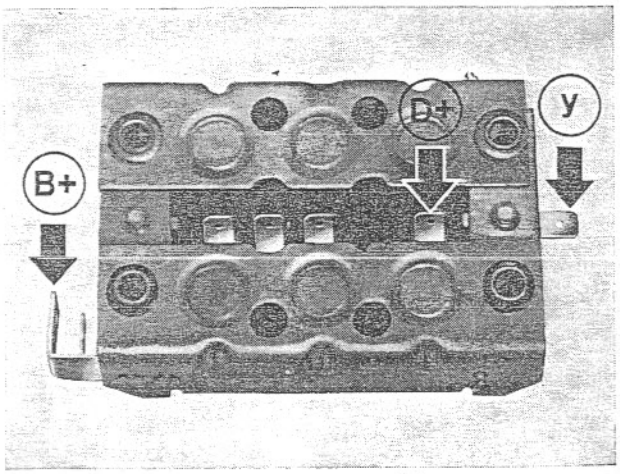
To check the regulator, detach B+ (black lead) from the diode board with the engine at a standstill. Connect a voltmeter to B+ and D−. Start the engine. Shortly before the regulator takes effect, the voltage reading should be 13.5 . . . 14.2 V.



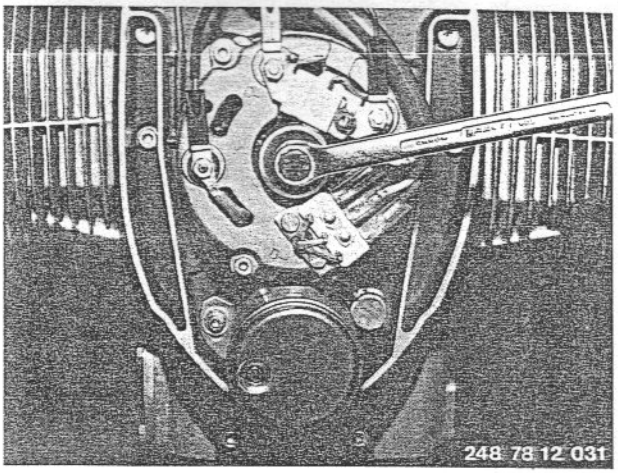
To check the charge current, insert an ammeter reading from 15 to 20 A into lead B+. Switch on current consumers or use a sliding resistor to create a load of 13 A parallel to the battery.

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.



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

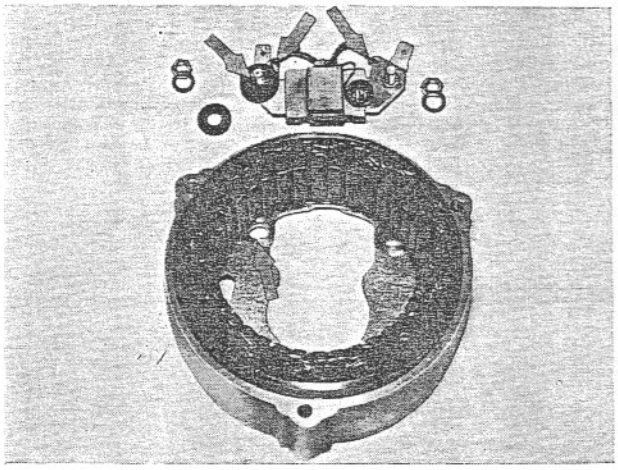


12 31 212 Alternator – reconditioning

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.

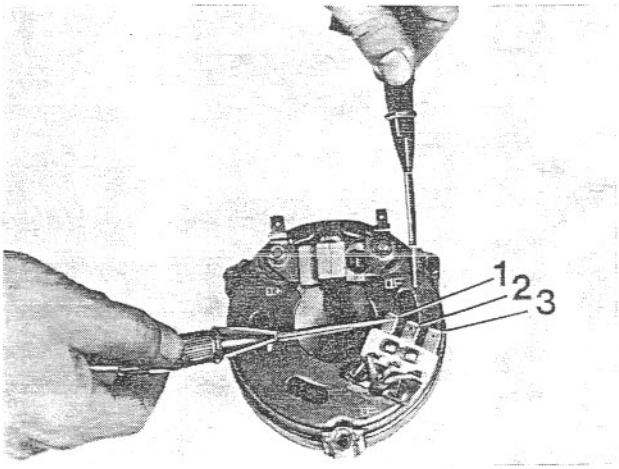
Place the insulating bushings on the brush holder studs.
Tighten the brush holder down into the pole housing.
Do not forget the insulating washers.



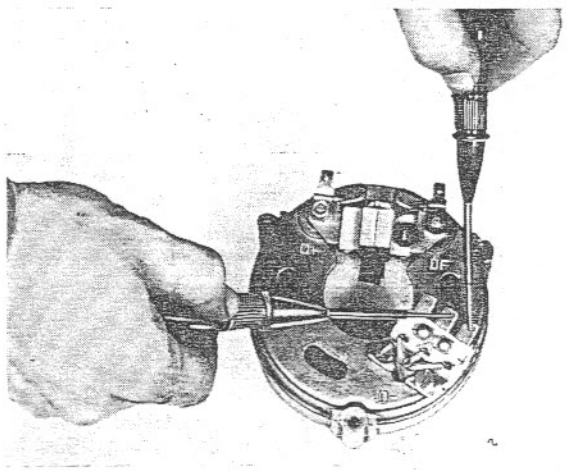
12 31 689 Stator winding and rotor – checking

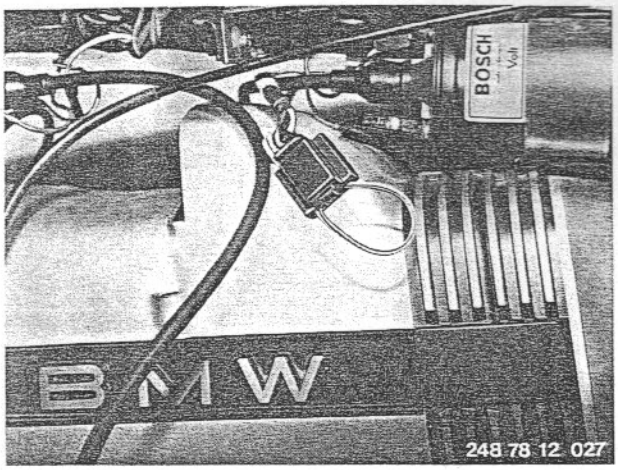
Recondition the alternator – 12 31 212.

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



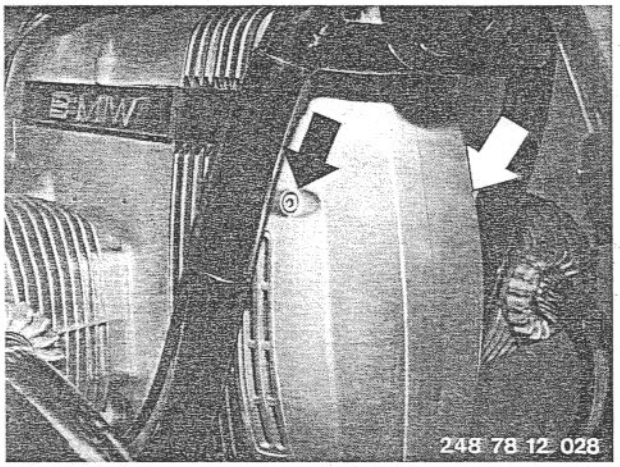
Check resistance between the phase outlets alternately; for value, see Specifications.





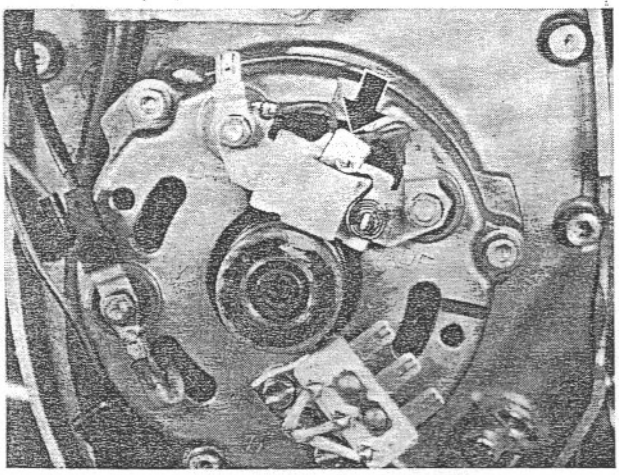
12 31 019 Alternator with regulator – quick check

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.

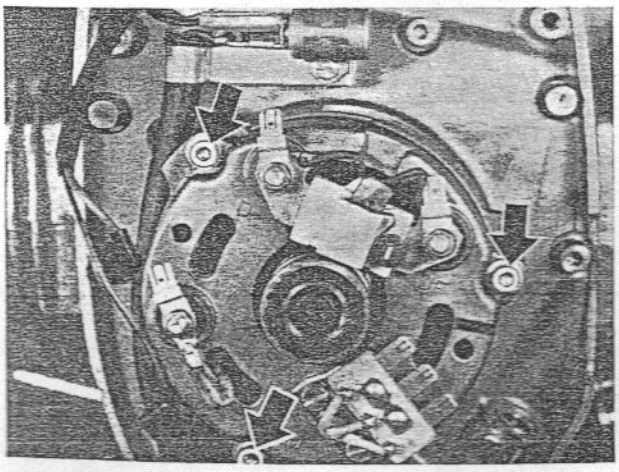


12 31 020 Alternator – detaching and attaching

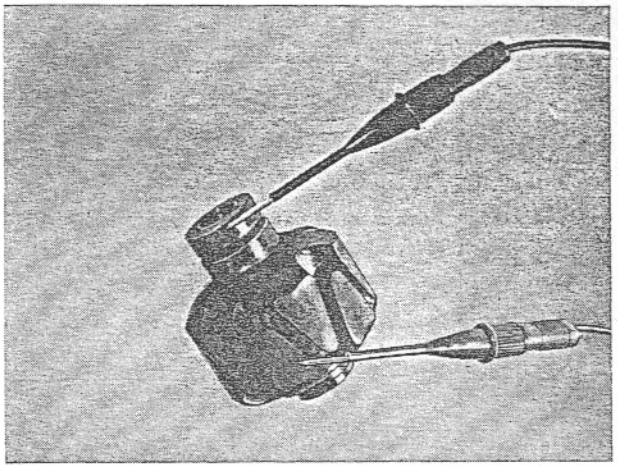
Engine removed (11 00 050) or installed.
Slacken the three Allen screws and take off the engine cover.



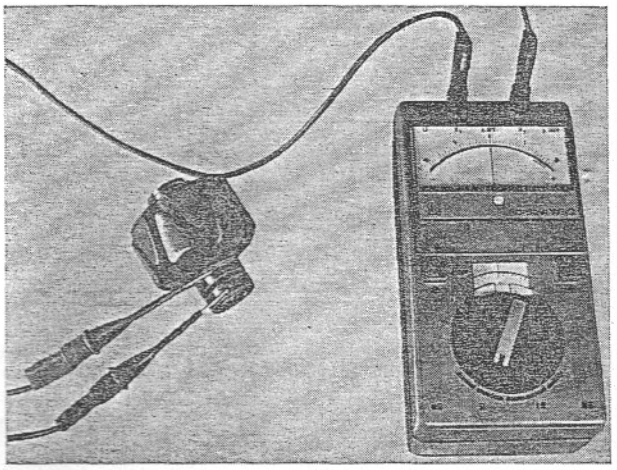
Detach the three-pin flat plug from the pole housing. Raise the carbon brushes slightly and secure in this position with the coil springs.



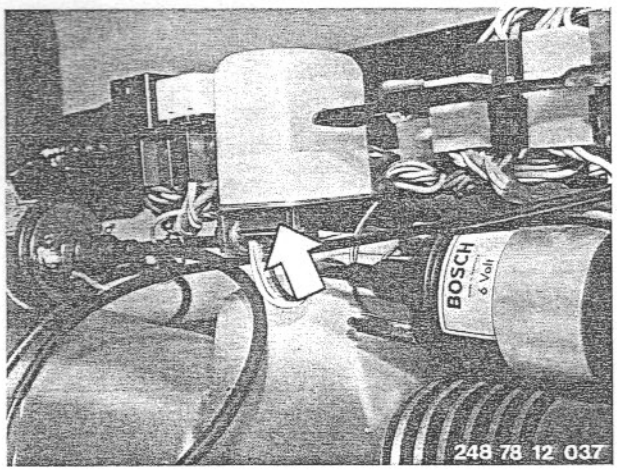
Remove the three Allen screws from the pole housing and take off the housing.



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.

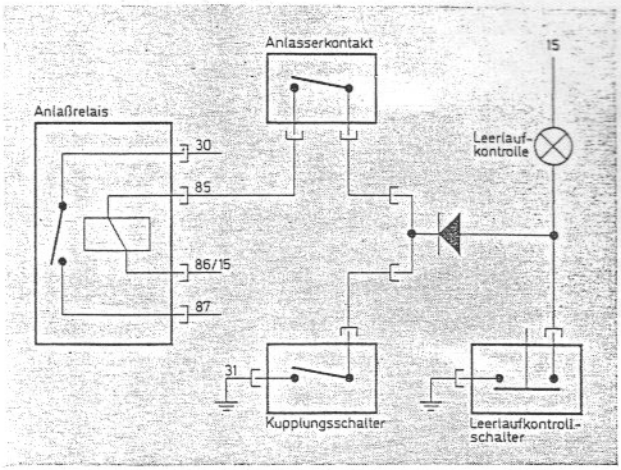
Trouble-shooting - alternator

Fault	Cause	Remedy
Noise from alternator	Carbon brushes whistling	Skim sliprings or renew carbon brushes
Charge warning lamp remains on at half intensity when engine is running	Poor contact at cable connector	Check cable terminals and connector
	Defective regulator	Renew regulator
	Defective carbon brush	Renew carbon brush
	Rectifier diode defective or has short to earth (ground)	Renew rectifier diode
	Stator has short to earth (ground)	Renew stator
	Rotor has partial short to earth (ground)	Renew rotor
Severe gas formation at battery	Poor contact between regulator and alternator	Check cable connections at regulator and alternator
	Defective regulator	Renew regulator
Charge warning lamp remains on at half or full intensity when engine is running	Defective regulator	Renew regulator
	Interruption or short-circuit in connecting leads	Check leads and connections
	Defective carbon brushes	Renew carbon brushes
	Defective rotor winding	Renew rotor
	Break in exciter current circuit	Check cable connections
	Defective diodes or diode board	Check diodes or diode board and renew if necessary

12 41 009 Starter – checking without removal from motorcycle

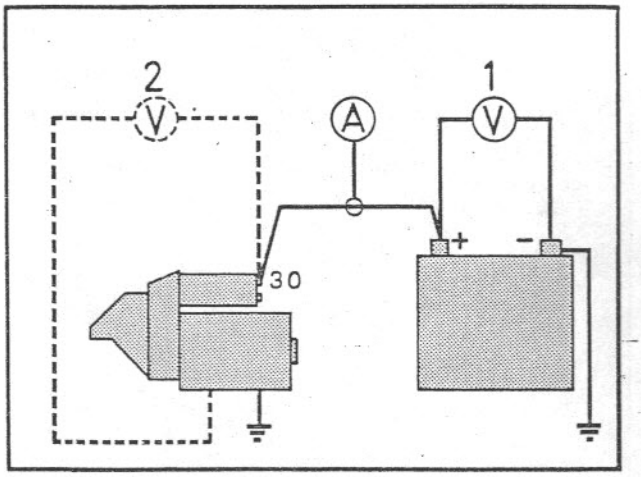
Check battery charge – for correct values, see Specification.

Test by engaging 4th gear and applying the foot brake. Run the starter for 2 - 3 seconds. The starting voltage under load must not drop below 8 V, and must be the same on voltmeter circuits 1 and 2. Failing this, the connection to earth (ground) at the engine or the battery must be poor. At the same time, measure current consumption at the ammeter (see Specifications).



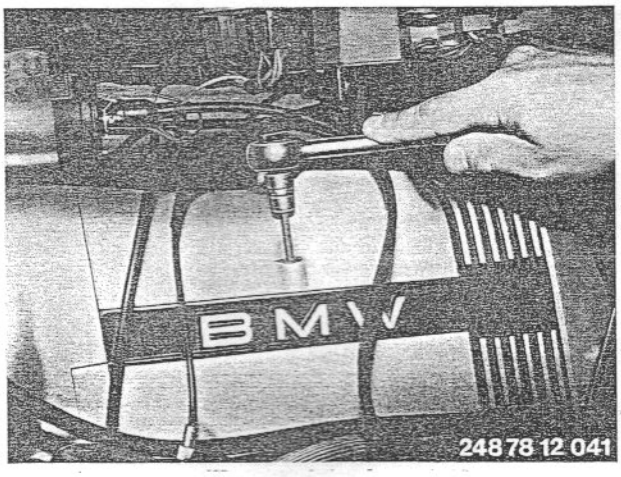
Important:

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



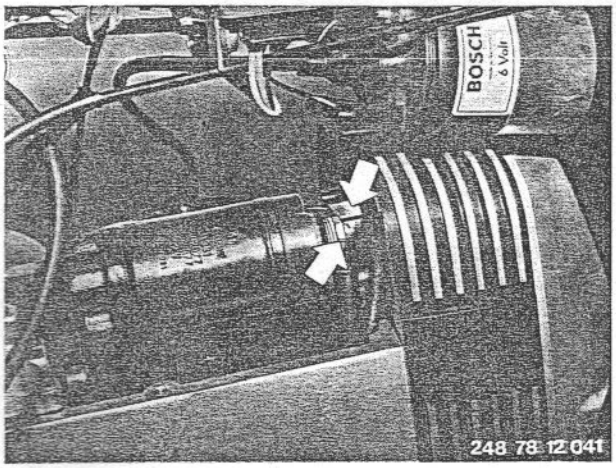
12 41 020 Starter – removing and installing

Disconnect the battery earth (ground) lead.
Remove the two Allen screws and lift away the starter cover to the right.

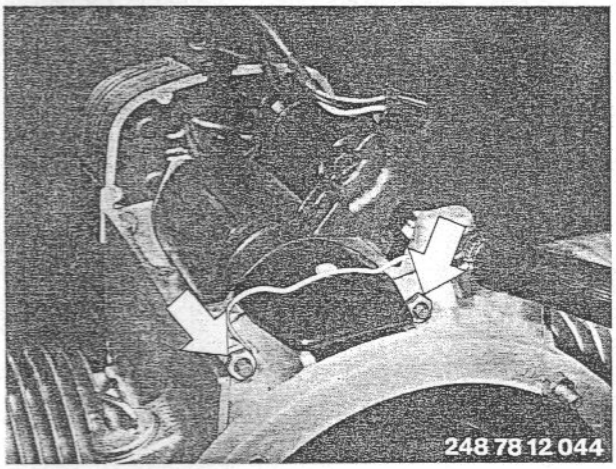


Detach the engine breather hose from the breather head and pull out of the air-cleaner housing.

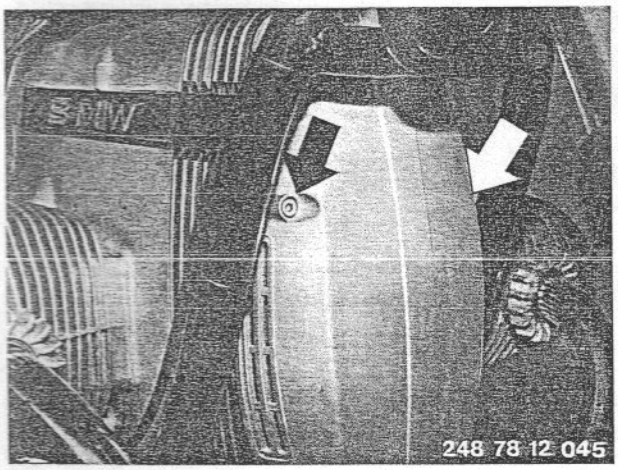




Disconnect the cables (arrows) from the starter.



Slacken the rear starter retaining bolts (arrows).



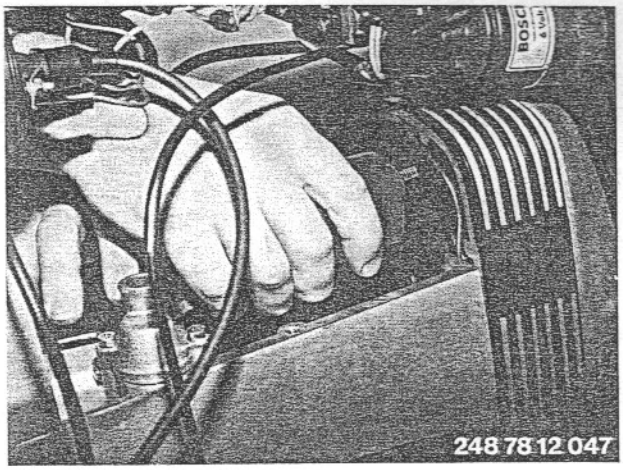
Remove the two Allen screws and take off the engine cover.



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

Remove the engine breather hose – 11 15 101.

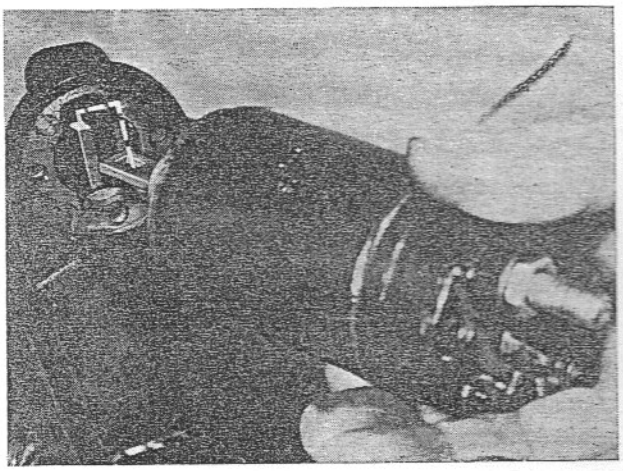
Remove the starter forwards from its guide.



12 41 513 Starter – stripping and assembling

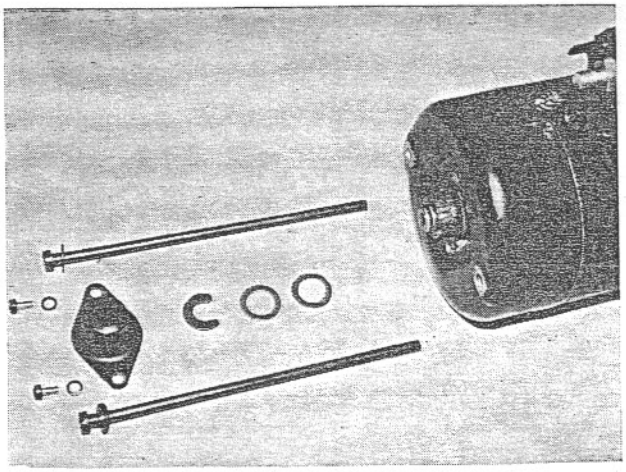
Remove and install the starter – 12 41 020.

Unscrew the cable for the exciter winding.
Detach the solenoid switch.
Disconnect the engagement lever.

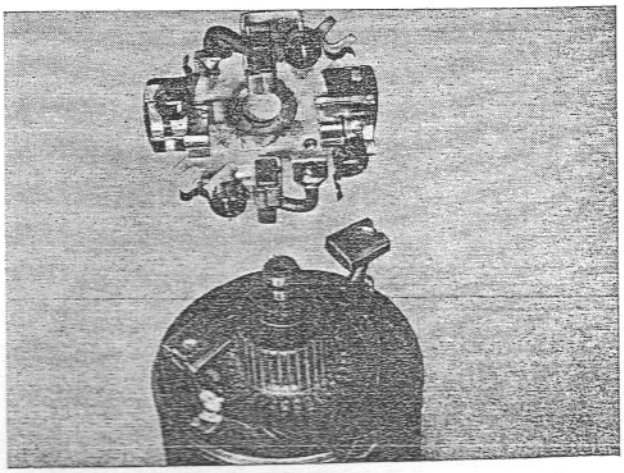


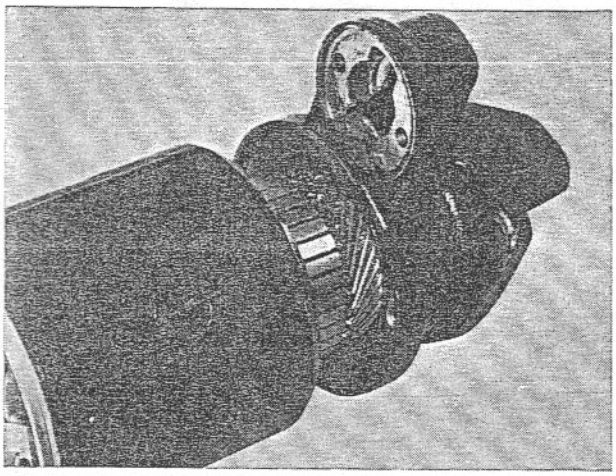
Take off the dust cap.
Remove the lock washer, shim and gasket.
Remove the pole housing screws.
Pull off the cap.

When installing: equalize armature endplay – see Specifications.
Check condition of commutator bearings.

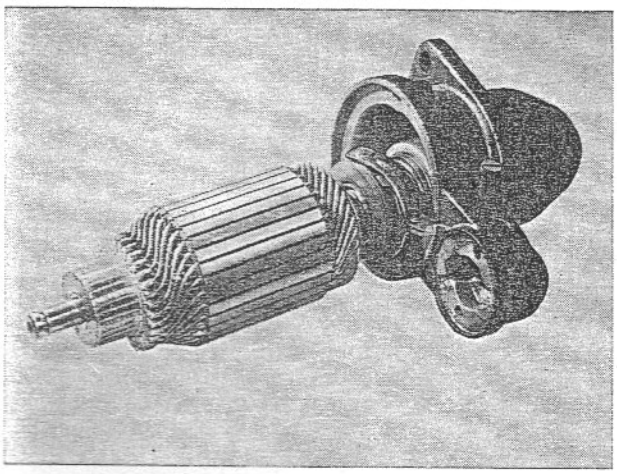


Lift out the positive brushes and take off the brush holder board.

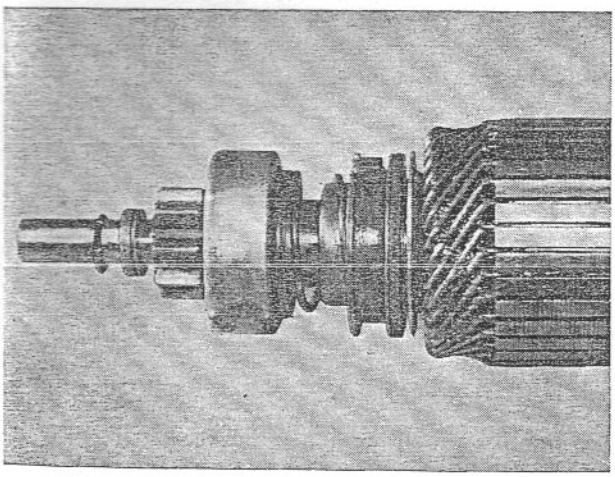




Separate the pole housing from the drive bearing.



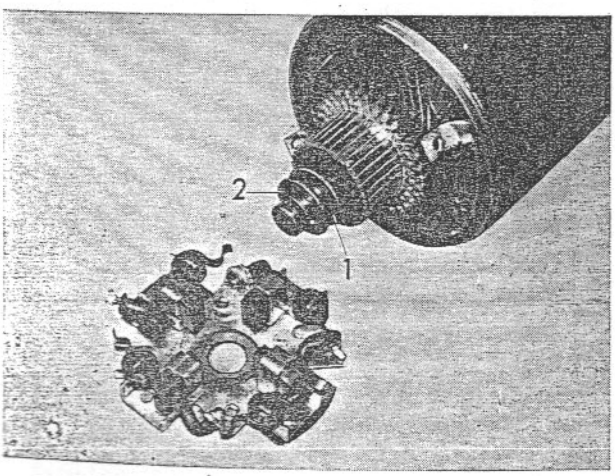
Remove the pivot bolt for the engagement lever.
Pull out the armature with the engagement lever.



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.

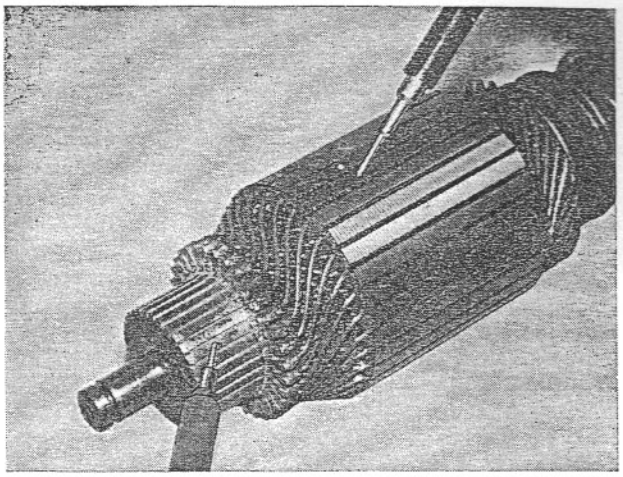
Unsolder and solder in the carbon brushes at the exciter winding and the brush holder board.

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

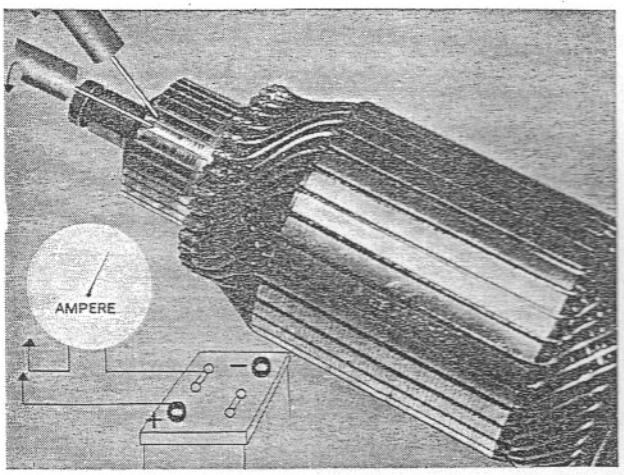
12 41 602 Starter – reconditioning

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.

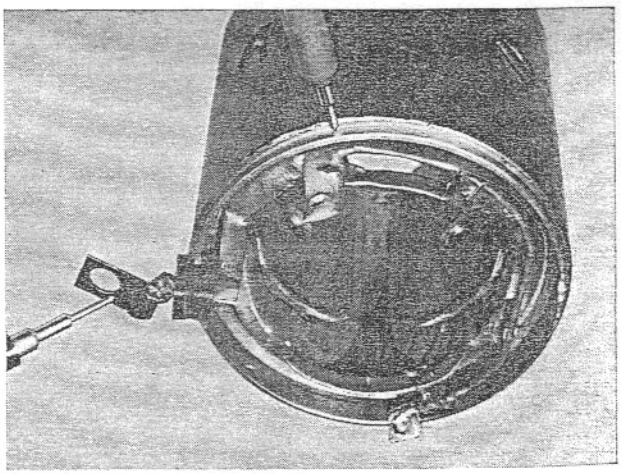


Insert an ammeter measuring up to 60 A into the current circuit and apply the probes briefly to each lamination in turn. Test voltage 2 . . . 4 V.
The needle should move by the same amount between each of the laminations.
Severe deviations indicate a break in the circuit and the defective armature should be renewed.

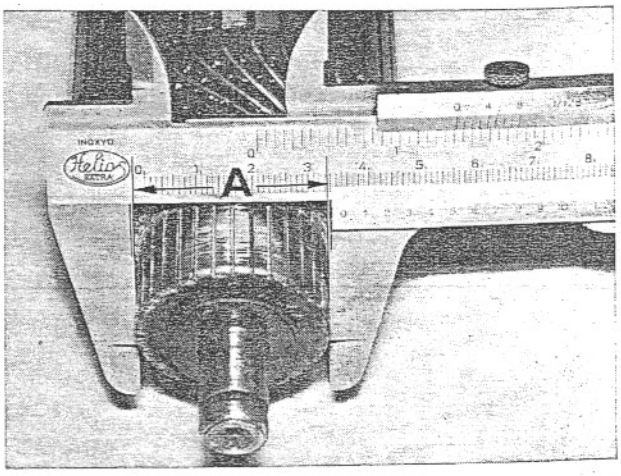


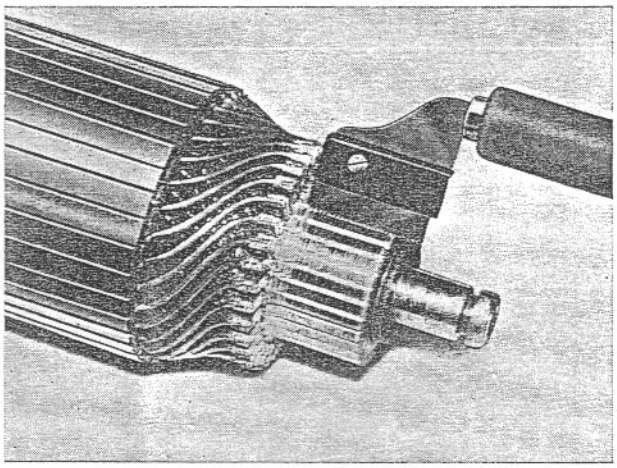
Check the exciter winding for short to earth (ground).

Renew if windings are burned or partially melted.

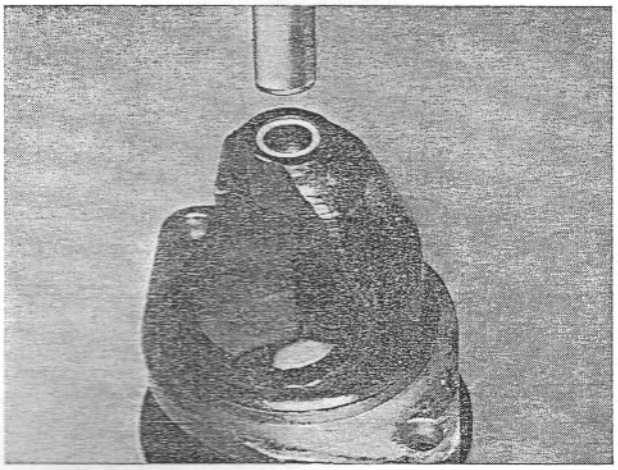


Skim the commutator to a fine finish.
The diameter (A) of the commutator must not drop below 33 mm (1.3 in).



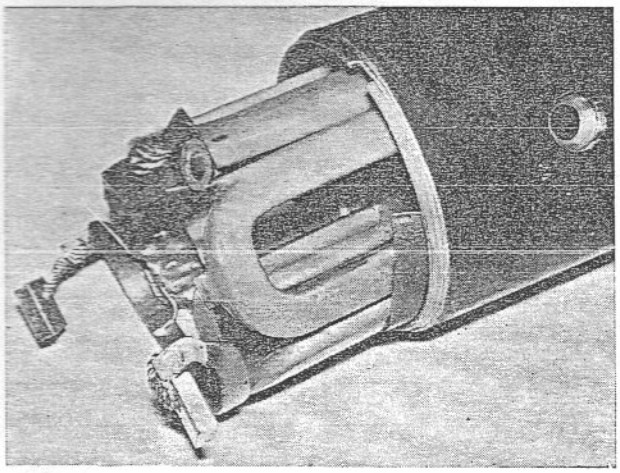


Cut away the commutator laminations. Remove burrs with fine emery cloth. The insulation should be 0.5 mm (0.02 in) lower than the laminations.



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.

13 Mixture preparation

Specifications		Page 13– 0/3
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	Carburetor – cleaning	13–10/1
13 10 100	Left and right carburetors – removing and installing	13–10/2
13 10 370	Cold-start housing – detaching and attaching	13–10/2
13 72 000	Air cleaner element – removing and installing	13–72/1

Trouble-shooting - starter

Fault	Test method/cause	Remedy
Starter does not run when starter pushbutton is operated	Switch on headlight.	
	Headlight does not work. Battery is flat. Battery circuit interrupted.	Measure battery voltage. Recharge battery. Check cable connections.
	Headlight comes on but grows dim when starter is operated. Battery is flat.	Recharge the battery.
	Headlight comes on but goes off completely when starter is run. Battery terminals or earth (ground) connection corroded.	Clean battery terminals or earth (ground) connection.
	Headlight operates at normal intensity. Bridge terminals 30 and 50 at the starter. The starter will then run. The ignition/starter switch is defective or the connecting lead interrupted.	Renew ignition/starter switch or trace or trace and repair break.
	Headlight operates at normal intensity. Solenoid switch is energized but starter does not rotate. Use a suitable lead to connect the positive battery terminal and terminal 30 on the starter. The starter will then rotate. The solenoid switch contacts are dirty or eroded.	Renew solenoid switch.
Starter does not run even if a cable is connected directly from the positive battery terminal to terminal 30.	Carbon brushes too short Carbon brushes sticking Carbon brush contact pressure too low	Renew carbon brushes. Free carbon brushes. Renew coil springs.
Starter runs too slowly and cannot turn engine over.	Commutator dirty	Clean commutator.
	Armature or exciter winding defective.	Recondition starter.
Starter runs at high speed but engine remains stationary or moves jerkily.	Drive pinion defective	Renew drive pinion.
	Gear ring defective	Renew flywheel.
	Drive pinion does not disengage correctly, spiral groove dirty or damaged.	Recondition starter.

13 Mixture preparation

Specifications		Page 13– 0/3
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	Carburetor – cleaning	13–10/1
13 10 100	Left and right carburetors – removing and installing	13–10/2
13 10 370	Cold-start housing – detaching and attaching	13–10/2
13 72 000	Air cleaner element – removing and installing	13–72/1

Specifications

Mixture preparation

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)		

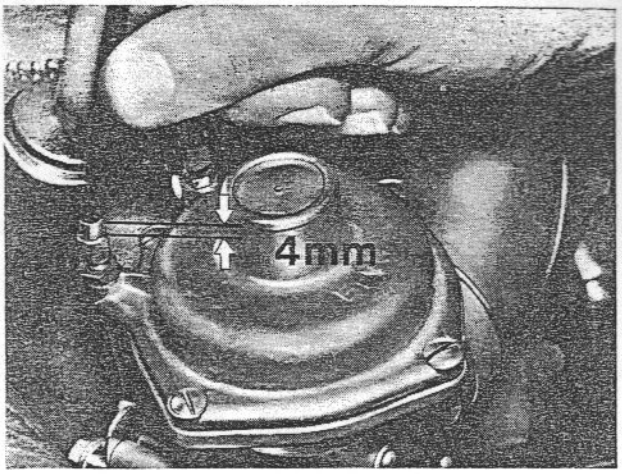
Mixture preparation

Specifications

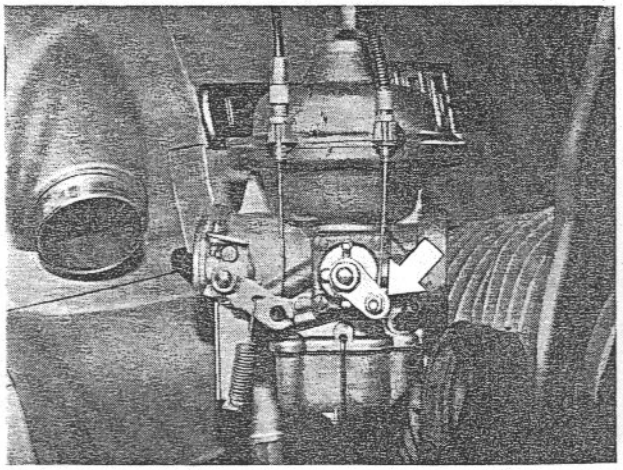
Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Float chamber vent dia. mm (in)		4 (0.16)		
Idle outlet passage dia. mm (in)		1.0 (0.04)		
Intake air cleaner		Common "micro-star" dry-type filter for both carburetors		
Fuel system				
Fuel		Regular	Super (Premium)	
Min. octane number	RM	91	98	
(to DIN 51600 standard)	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		

13 00 004 Engine idling – adjusting

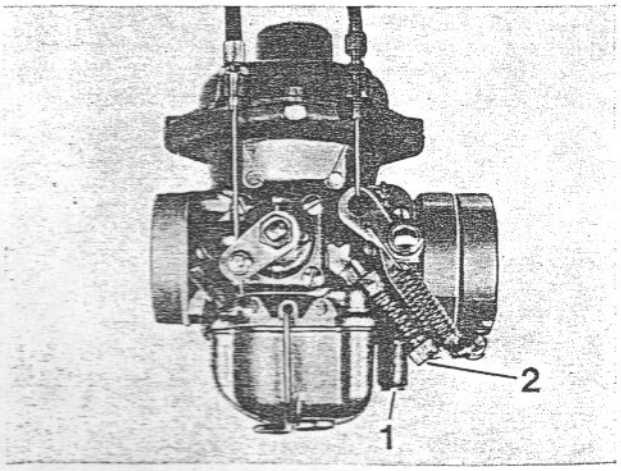
Adjust engine idling with the engine at normal operating temperature and the throttle twistgrip closed.
For correct engine idle speed, see Specifications.
Set the throttle cable to a free travel of 4 mm (0.16 in) initially so that the cables do not prevent the throttle butterflies from closing completely.



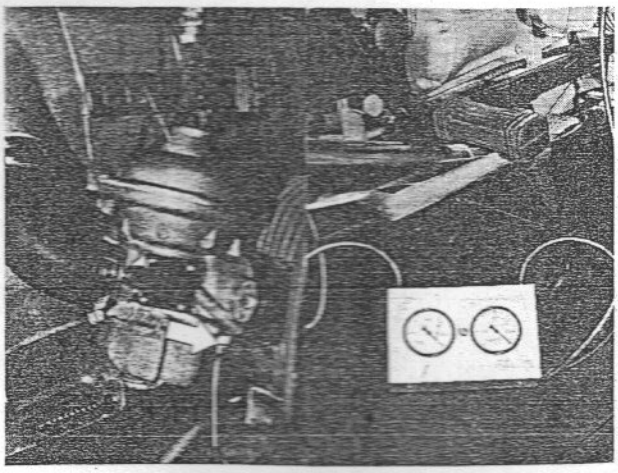
Move the throttle cables to the initial position and adjust the choke cables so that the starting levers (arrow) are pressed up to their limit of movement when the choke control is off.

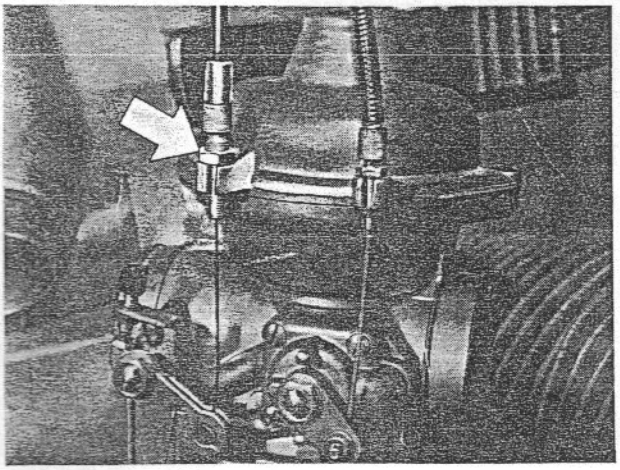


On both carburetors, set the idle mixture control screw 1 and the throttle stop screw 2 to the basic setting. This is done by tightening the idle mixture control screw fully and then unscrewing it again by the correct number of turns (see Specifications). The throttle stop screw is then tightened until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



To synchronize the carburetors, use the BMW "Duo-Test" device 13 0 700.
Take out the screw plug from the test connection (arrow) and push on the Duo-Test rubber hose.
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 twist grip, 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).

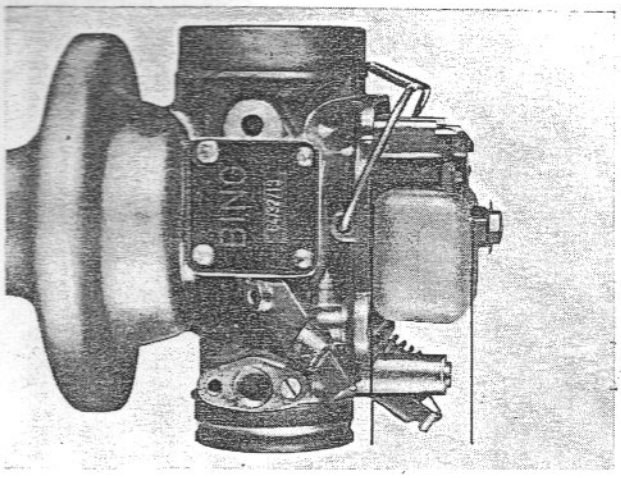
Do not run the engine with the motorcycle at a standstill for more than 10 minutes unless some form of outside cooling is provided.

13 10 004 Fuel level – checking and adjusting

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

With the float chamber cover removed, place the carburetor so that it is horizontal with the float pivot at the top. The tongue of the float hinge should just touch the sprung ball in the float needle.

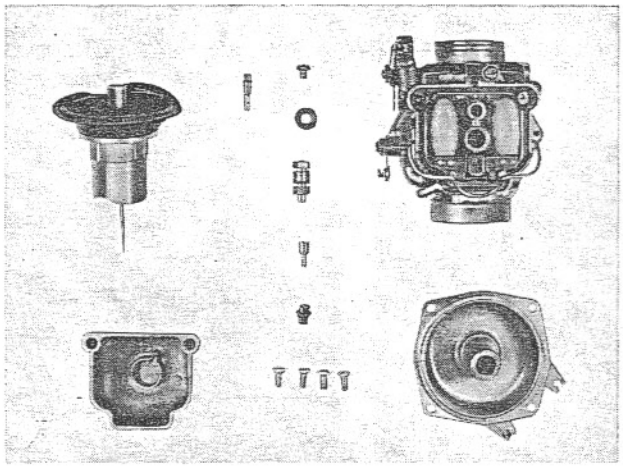
In this position the base of the float must be parallel to the upper edge of the float housing. Re-align the tongue if necessary.

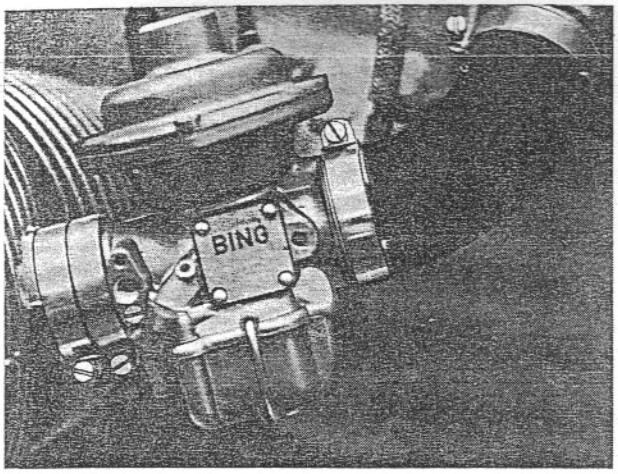


13 10 009 Carburetor – cleaning

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

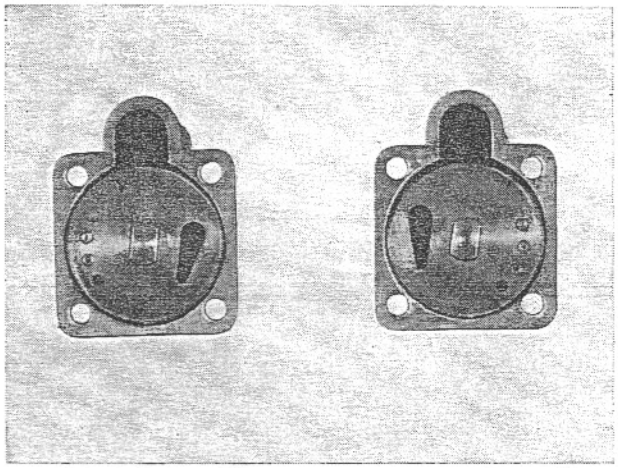
Remove the cap, plunger with diaphragm, idle jet, main jet block, main jet, needle jet and atomizer. Clean all components in gasoline (petrol) and blow through jets and passages with compressed air.





13 10 100 Left and right carburetors – removing and installing

Disconnect or detach the choke and throttle cable.
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 carburetor.



2 1

13 10 370 Cold-start housing – detaching and attaching

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

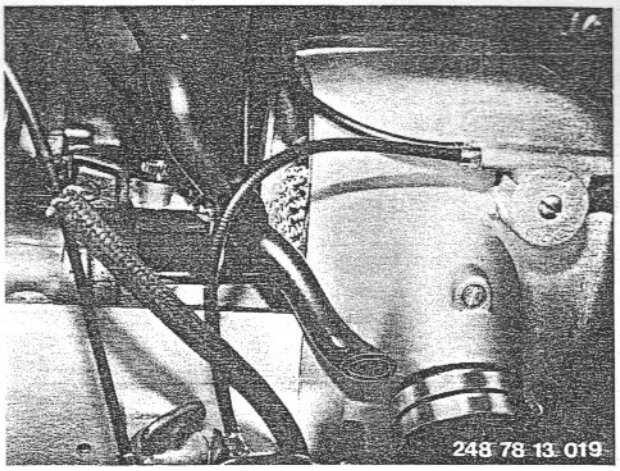
Slacken the 4 countersunk screws and take off the cold start housing with rotary slide and gasket.

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

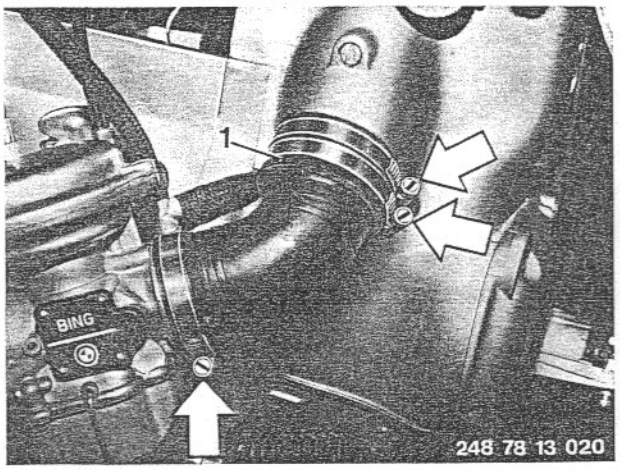
Item 1 = left cold-start housing
Item 2 = right cold-start housing

13 72 000 Air cleaner element – removing and installing

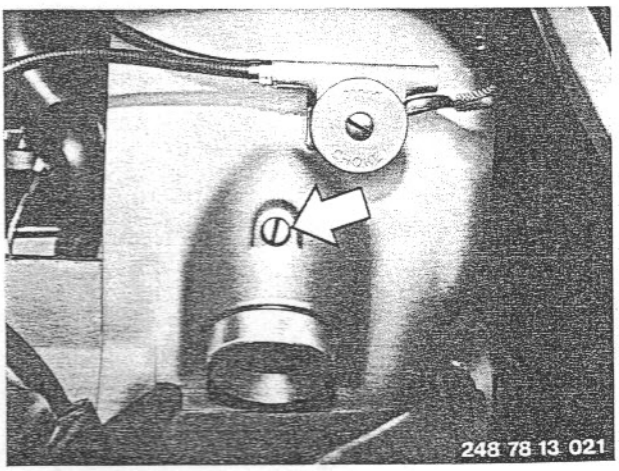
Remove and install the fuel tank – 16 11 030.
Unscrew the two Allen screws and remove the starter cover to the right. Pull the engine breather hose out of the left half of the air cleaner housing.



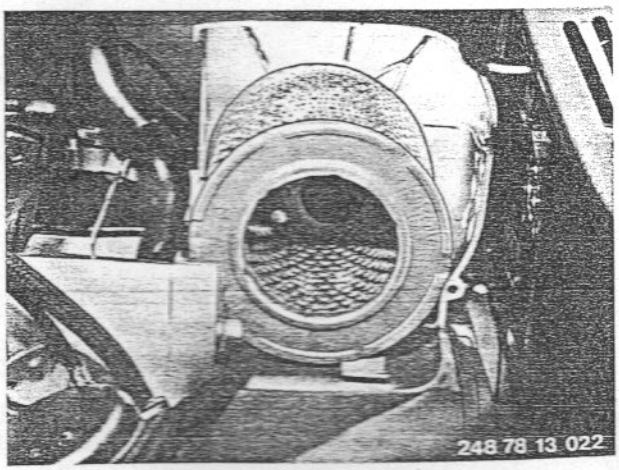
Slacken the clamp straps for the left air line (arrows), push back the rubber sleeve (1) and take off the air line.



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



Take out the filter element.



16 Fuel tank and lines

Specifications . . . . . Page 16– 0/3
16 11 030 Fuel tank – removing and installing 16–11/1

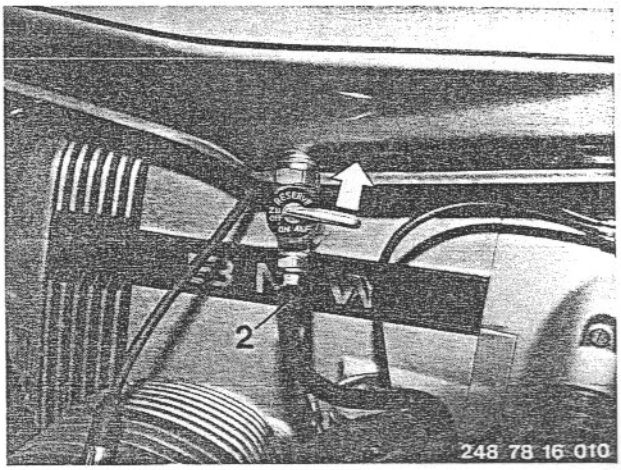
Specifications

Fuel tank and lines

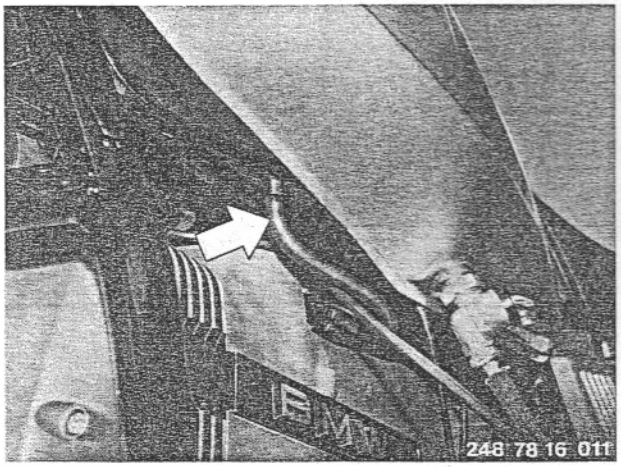
Model		R 45 (20 kW)	R 45 (26 kW)	R 65
Tank capacity	liters (Imp., US gal)	22 (4.8, 5.8)		
incl. reserve of	liters (Imp., US gal)	2 (0.4, 0.5)		

16 11 030 Fuel tank – removing and installing

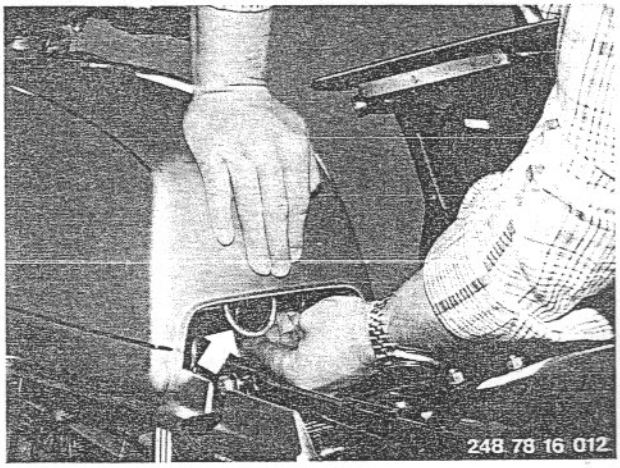
Close the fuel cap (1) and pull off the fuel hose (2).



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
18 00 020 Exhaust system – detaching and attaching 18–00/1
18 11 321 Muffler – renewing 18–00/2

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)		

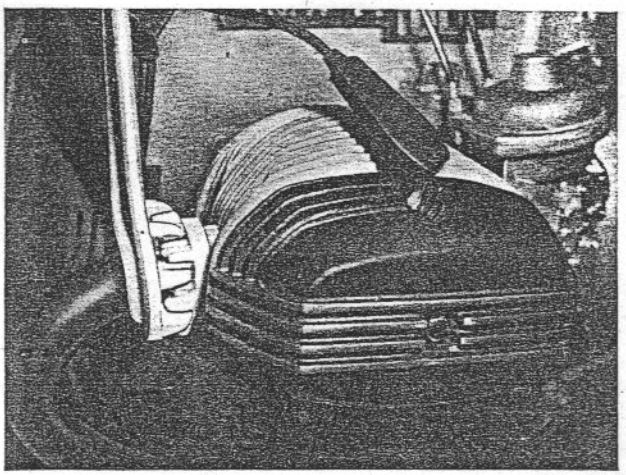
Tightening torques Nm (lb. ft)

Spider nut for exhaust pipe 160 ± 20 (118 ± 15)

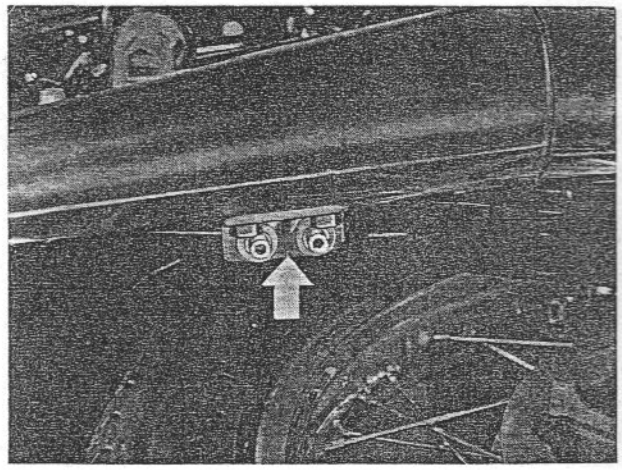
All other bolts and nuts are to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.

18 00 020 Exhaust system – detaching and attaching

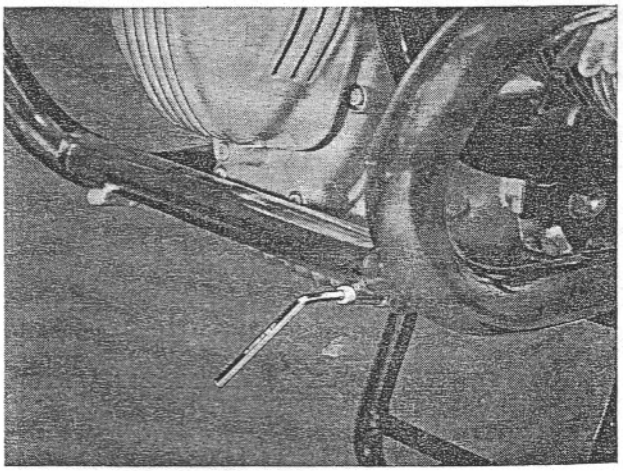
Using exhaust pipe wrench BMW 18 0 600, unscrew both exhaust pipe nuts from the cylinder heads.



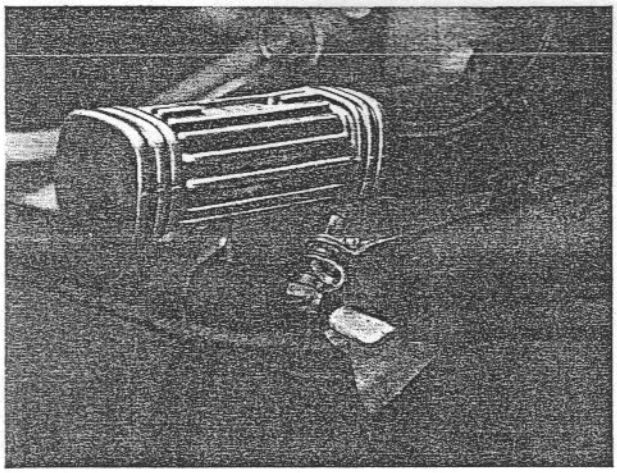
Unscrew the hex. nuts at the footrests and the Allen screws at the frame (arrow).



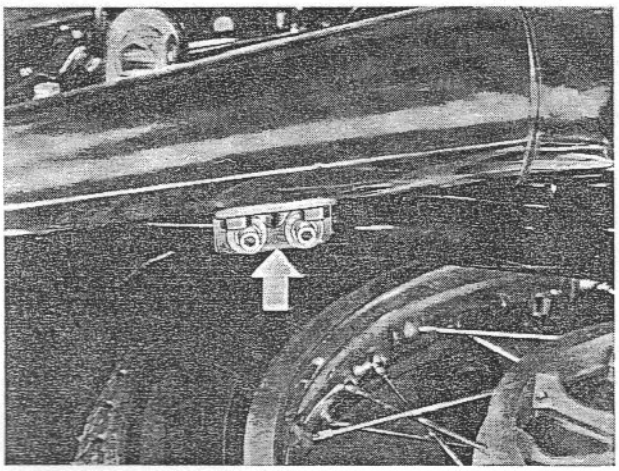
Slacken the Allen screws at the cross-pipe and take off the exhaust pipe.



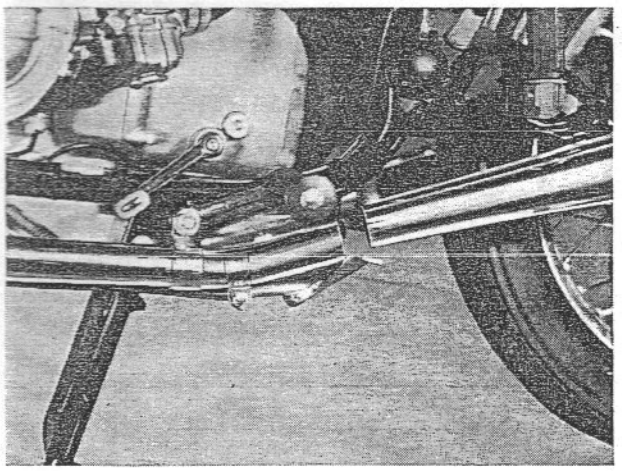
18 11 321 Muffler – renewing



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



Remove the Allen screws at the frame (arrow).



Pull the muffler away to the rear.

21 Clutch

Specifications . . . . . Page 21– 0/3
21 21 000 Clutch – removing and installing 21–21/1
21 51 020 Clutch withdrawal arm – removing and installing 21–51/1

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.	$61^{+0.05}_{+0.1}$ ($2.402^{+0.002}_{+0.004}$)		
Max. vertical runout of diaphragm spring driving disc mm (in) 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.)

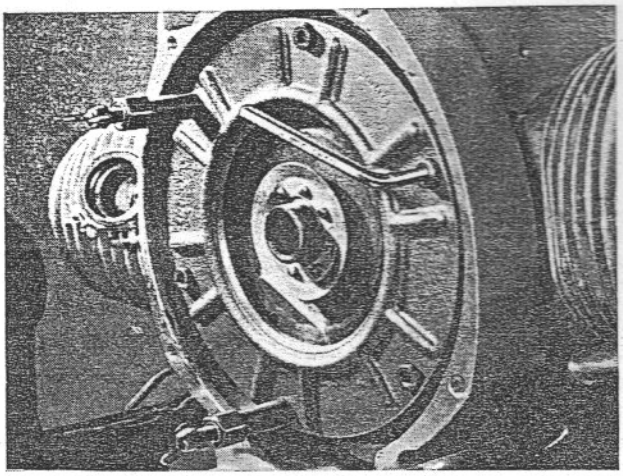
Clutch lever adjusting screw locknut	20 . . . 23 (14.7 . . . 17.0)
Clutch at flywheel	23 (17.0)

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.

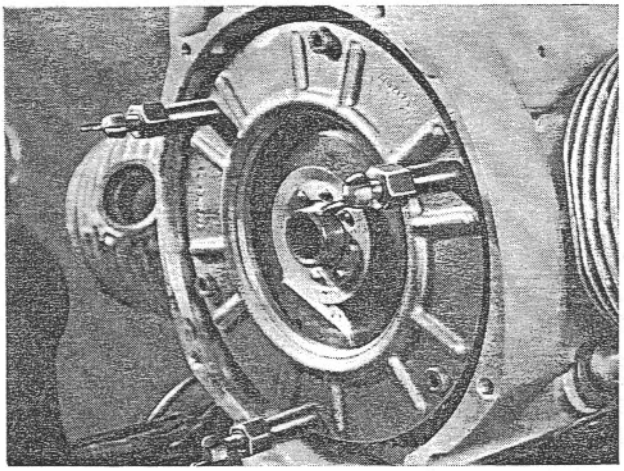
21 21 000 Clutch – removing and installing

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.

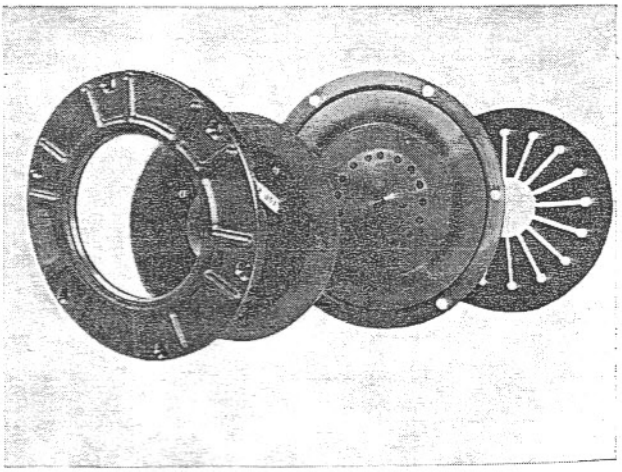
Slacken the 6 Allen screws and remove each second retaining screw. Insert 3 clamp bolts in place of these screws, and tighten the nuts until they contact the thrust ring.



Remove the remaining 3 retaining screws and slacken the nuts on the clamp bolts evenly until the diaphragm spring is completely relaxed.

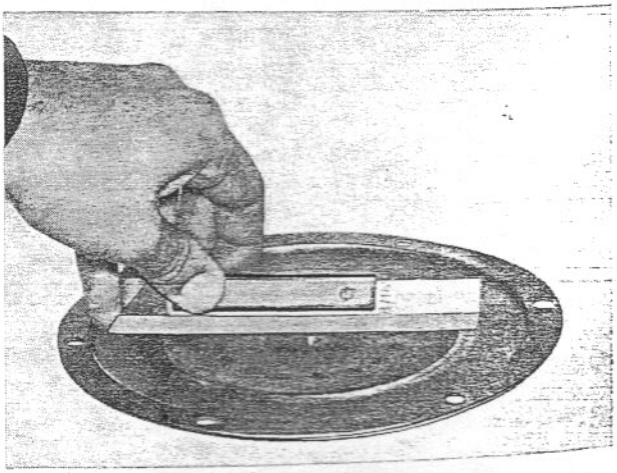


Take off the thrust ring, clutch plate, diaphragm and diaphragm spring.



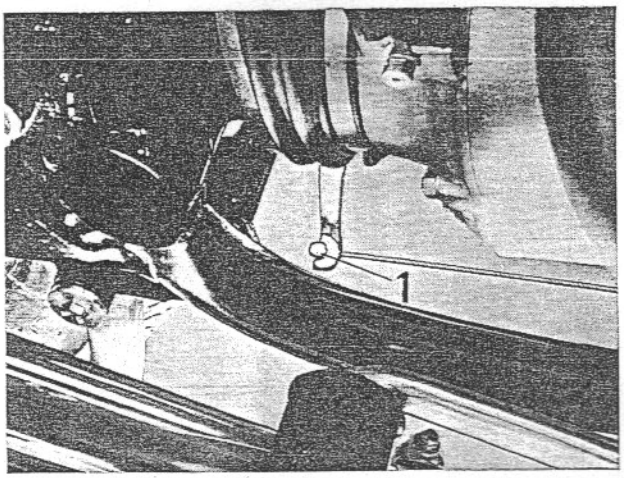
Testing and repair:

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.

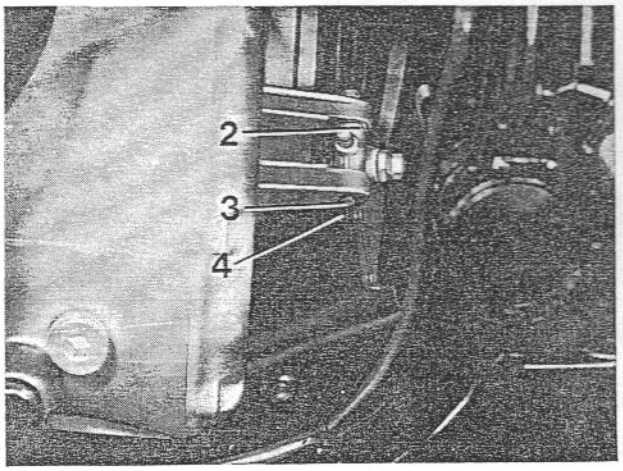


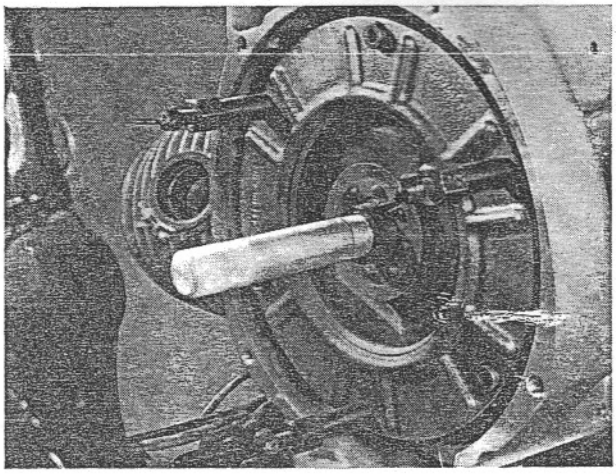
21 51 020 Clutch withdrawal arm – removing and installing

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).





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.

23 Gearbox

Specifications		Page 23– 0/3
23 00 020	Gearbox – removing and installing	23–00/1
23 11 040	Gearbox cover – detaching and attaching/sealing	23–12/1
23 22 001	Complete gear cluster – renewing	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

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		
Oil grade 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)		

Specifications

Gearbox

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.

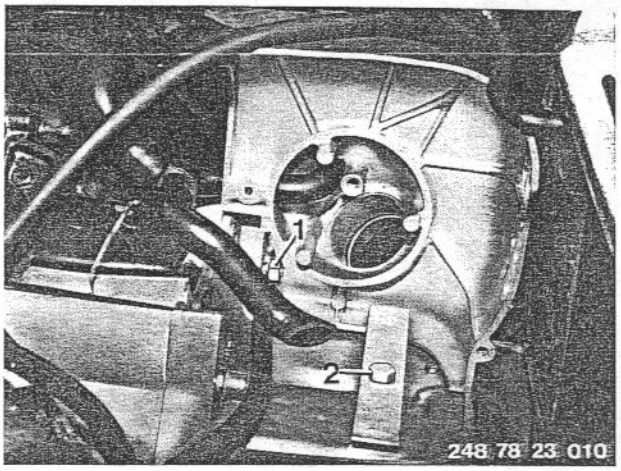
23 00 020 Gearbox – removing and installing

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

Remove and install the air cleaner – 13 72 000.

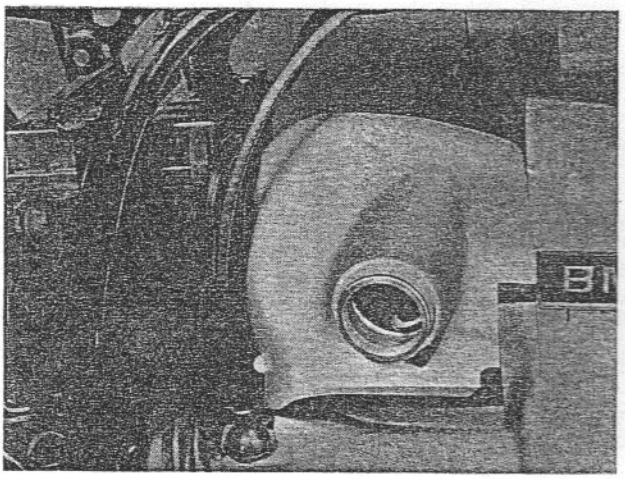
Detach both choke cables at the carburetors and remove the left air-cleaner housing shell with the choke cables.

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



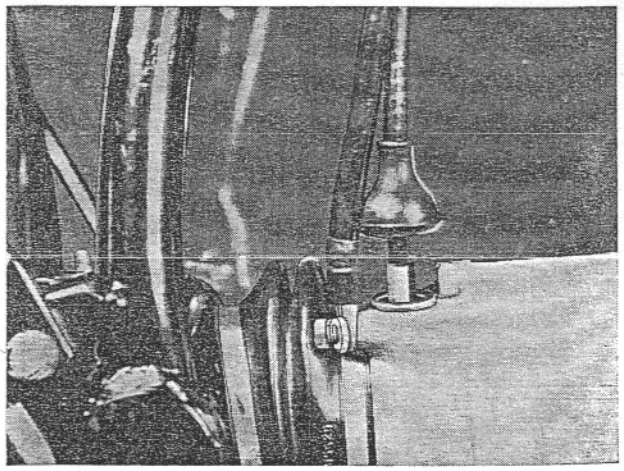
Take off the right air-cleaner housing shell, pushing the bleed hose (3) to the rear.

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.

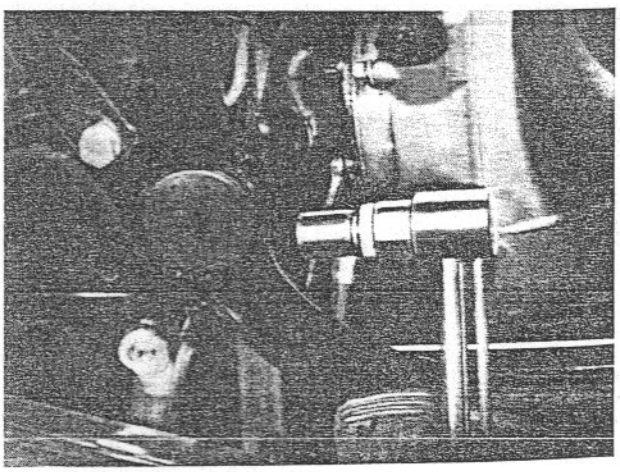
Remove and install the battery – 61 21 010.
Remove and install the battery carrier – 61 21 100.

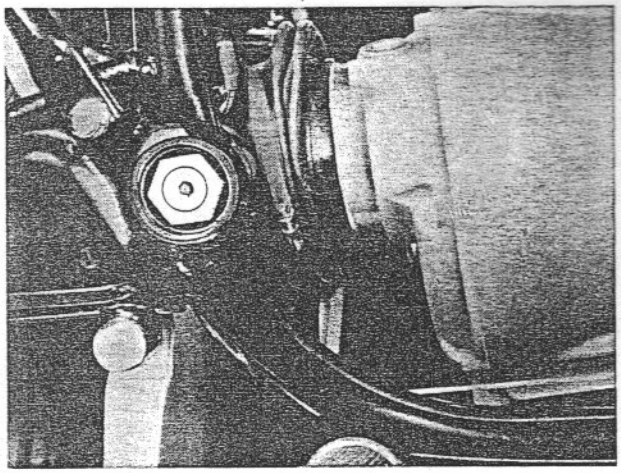


Slacken the strap holding the rubber gaiter at the gearbox and push the rubber gaiter back as far as possible. Provide a vessel to trap escaping oil.

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.

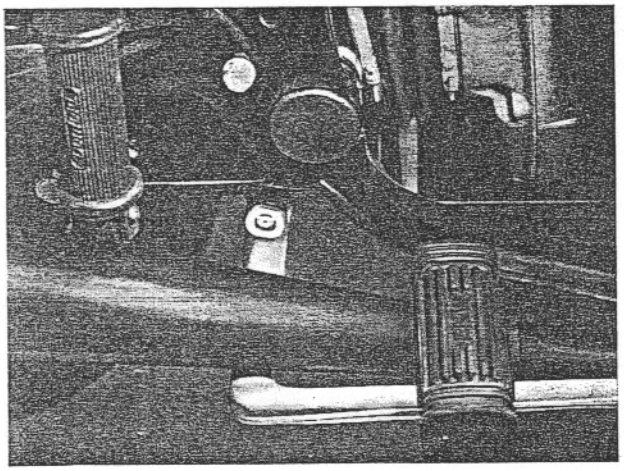




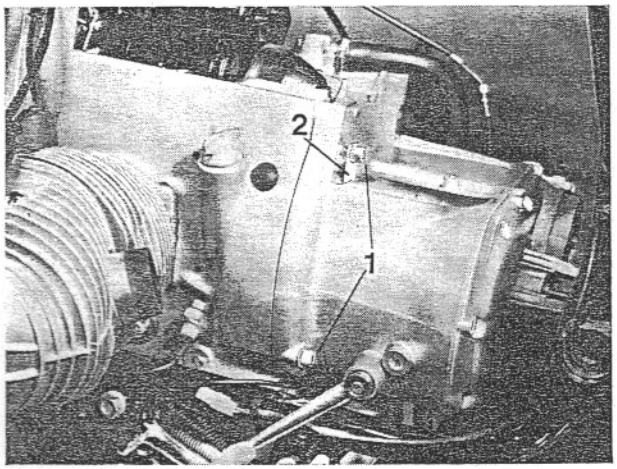
Remove the end cap from the swinging arm bearing. Slacken the bearing journal locknut. Unscrew and remove both bearing journals.

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

Note correct tightening torque – see Specifications.



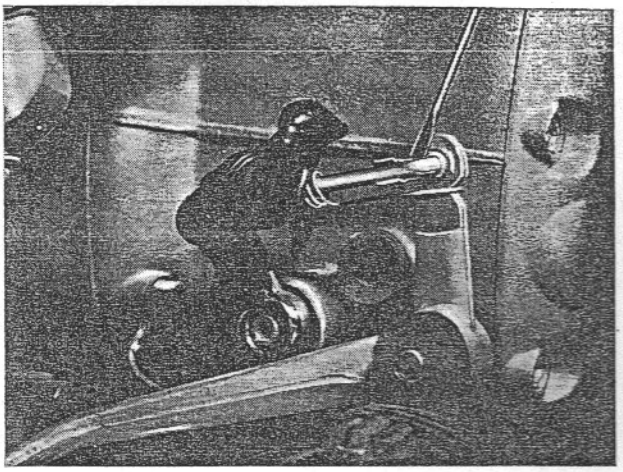
Slacken and remove the pivot pin from the brake pedal.
Detach the pullrod at the rear brake.
Pull the brake pedal with pullrod out downwards.



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.

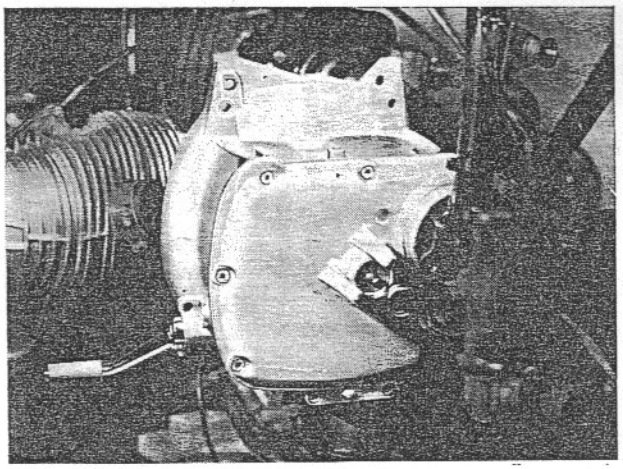
Disconnect the shift mechanism at the pedal. Push back the rubber gaiter. Unhook the spring and press the pullrod out of its keeper with a screwdriver.



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.

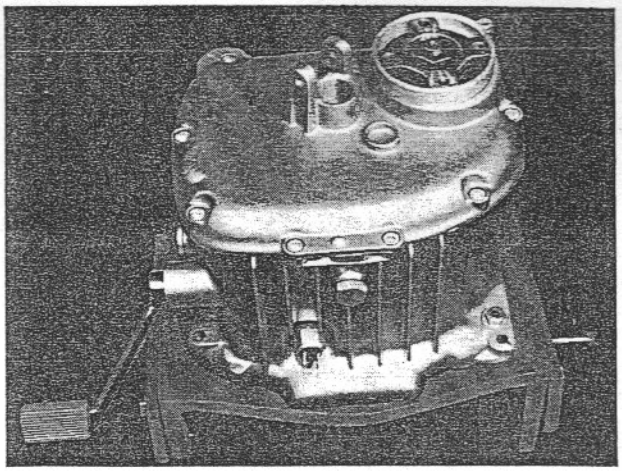
Remove the gearbox completely.



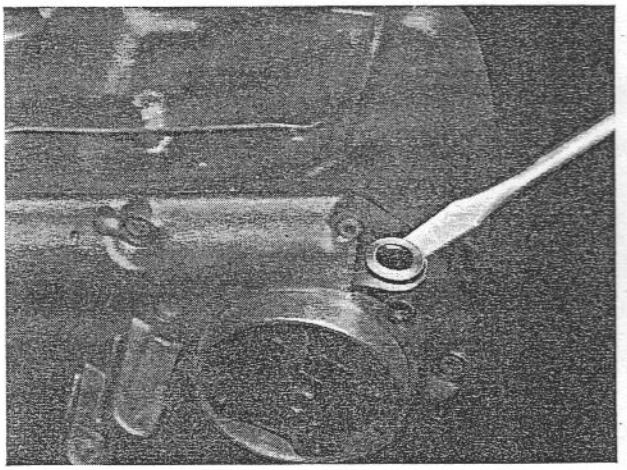
23 11 040 Gearbox cover – detaching and attaching/sealing

Remove and install gearbox – 23 00 020.

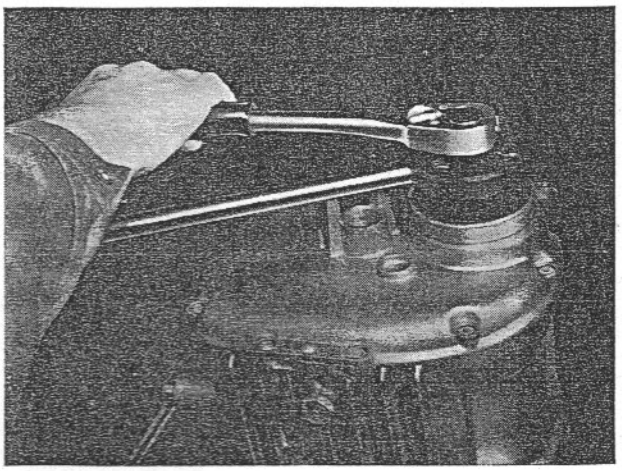
Insert the BMW 11 0 600 mounting for engine and gearbox into the BMW combined assembly stand 00 1 500. Attach the gearbox to the mount with two bolts at opposite sides.



Remove the retaining screw, press out the speedometer worm wheel bushing by means of a screwdriver blade applied to the collar on the bushing, and take out the worm wheel.



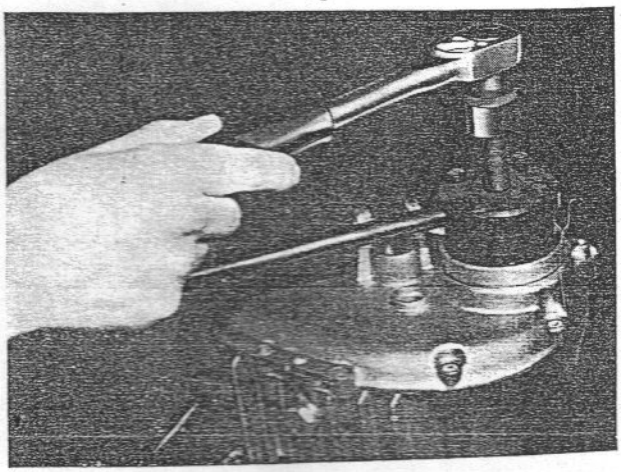
Bolt BMW locking device 23 1 700 to the output shaft flange with four bolts.
Unscrew the retaining nut.

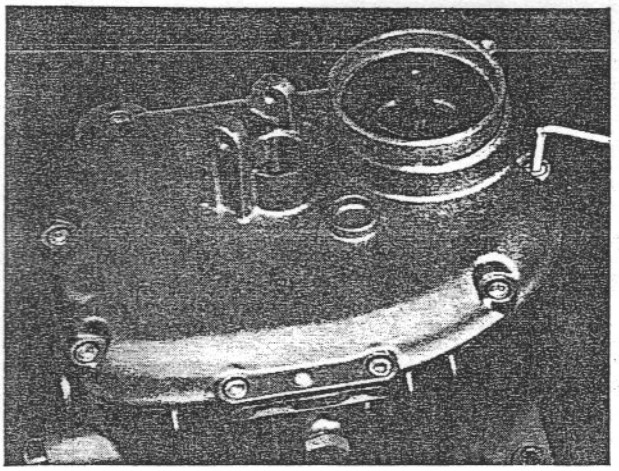


After bolting on the BMW forcing-off tool 23 1 710, press off the drive flange. If necessary, strike the spindle lightly to free the taper seat.

When installing:
clean the taper seats with trichlor solvent and dry before assembling the drive flange.

Apply a high-viscosity oil to the retaining nut.



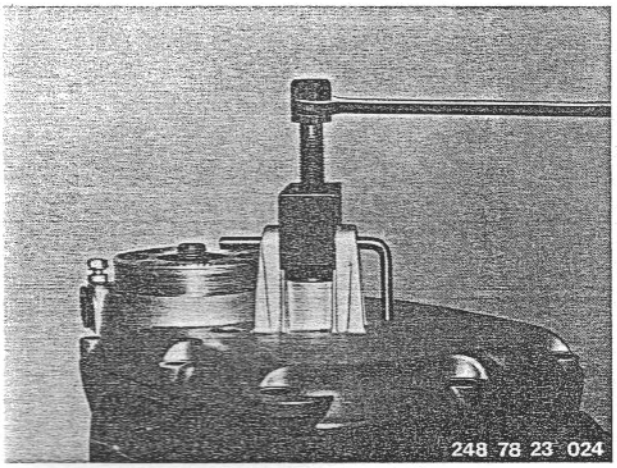


Take off the clutch pressure pad with sealing ring, ball cage, thrust washer and thrust rod with felt ring.

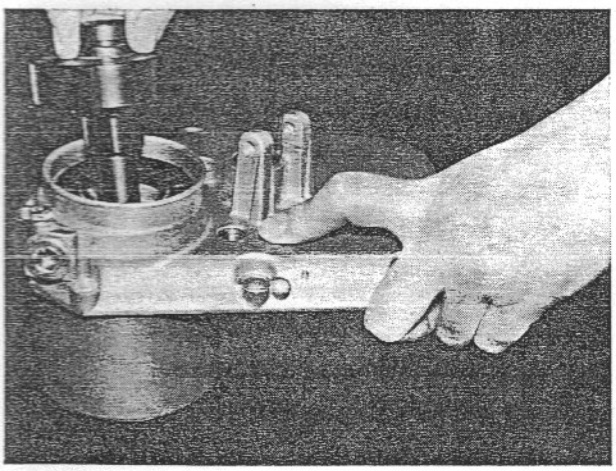
Remove the Allen screws with washers from the gearbox cover.

When assembling, insert the thrust rod with felt ring from the flywheel side to prevent damage to the felt ring. Coat the felt ring with high-temperature bearing grease.

When installing the clutch thrust pad make sure that the two lips on the sealing ring are not folded over.



Heat the gearbox cover to approx. 100° C (212° F) and pull away from the housing with BMW puller 23 3 700.



Remove the shims for shaft endplay adjustment from the cover and discard the output flange radial seal if defective. Drive in the new radial seal with BMW tool 23 1 750. The open side of the radial seal faces the output flange.

23 22 001 Complete gear cluster – renewing

Remove and install gearbox – 23 00 020.

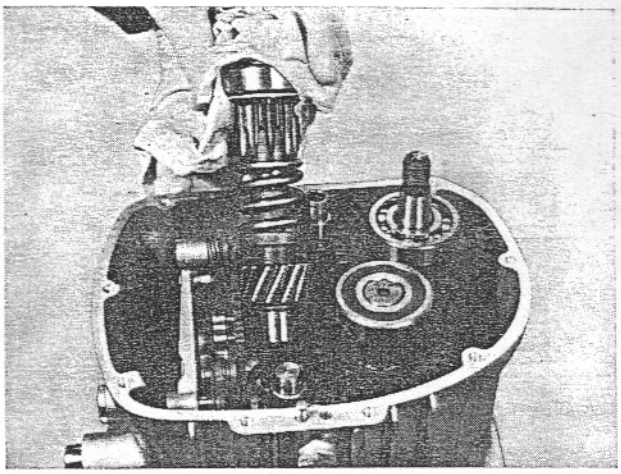
Illustrations and description refer to special version with kick starter.

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

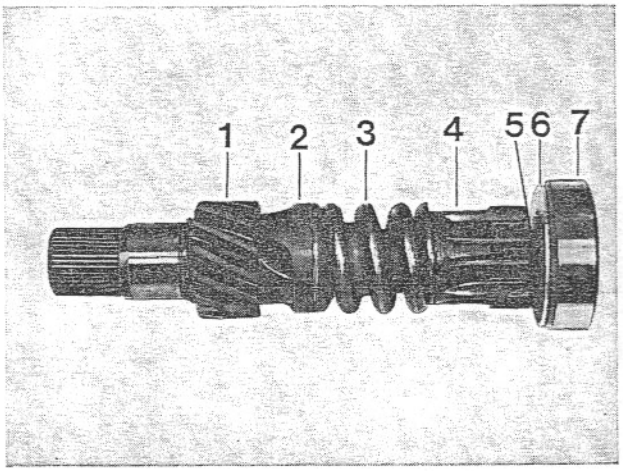
Remove and install the pivot mount – 23 31 210.

Strike the front end of the input shaft lightly with a plastic-headed hammer while the housing is still warm to remove the shaft.

Warning: do not damage the roller bearing.

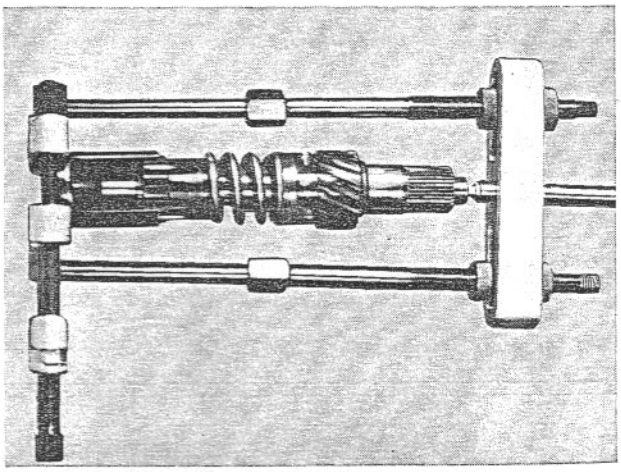


Using all-purpose puller 00 7 500, pull off input shaft bearing 7 and cover disk 6.

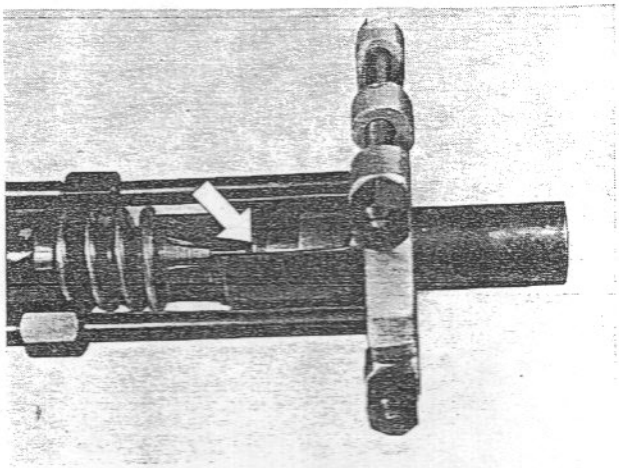


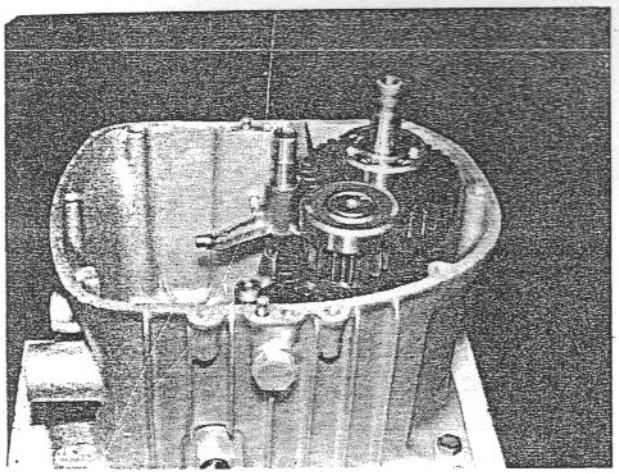
Compress coil spring 3 with all-purpose puller 00 7 500 and extract circlip 5 from its groove. Pull off kick starter drive pinion 4, coil spring 3, thrust pad 2 and input pinion 1.

Note:
Proceed in the same way on input shafts without a kick starter pinion. On input shafts with a front pressure pad, use BMW disk 23 2 760. Insert the disk at the shoulder in the forcing-off sleeve.



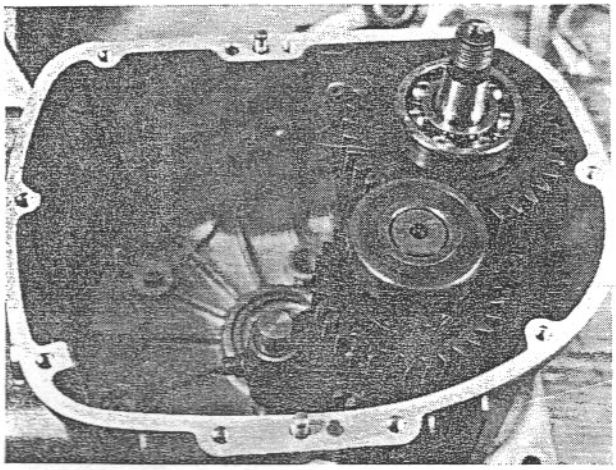
When assembling the input shaft, compress coil spring 3 with the BMW all-purpose puller. Place circlip 5 on the guide bushing and press up as far as the groove with a loose sleeve.





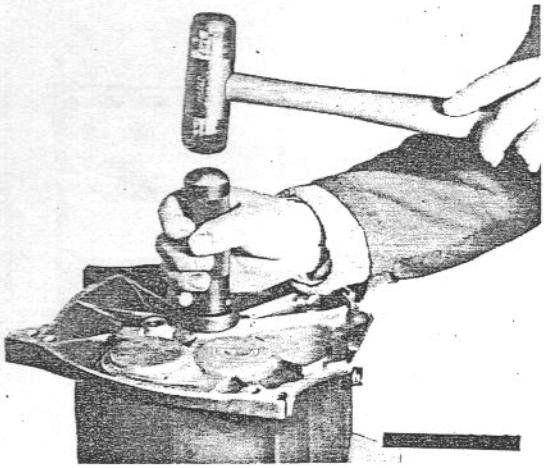
Remove the Phillips-head screw for the oil guide plate and take out the plate. Pull out the shaft for the 1st, 2nd and 5th speed selector forks and remove the forks.

When installing: the short guide ends of the forks are placed together.

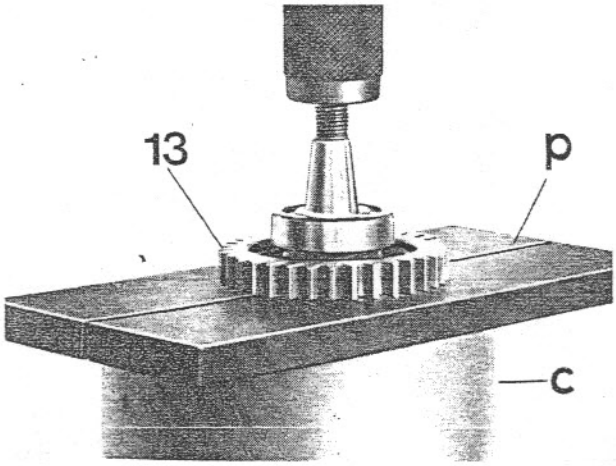


Heat the gearbox to 100° C (212° F) at the bearing seat for the output and intermediate shafts, and remove both shafts complete whit the 3rd and 4th gear selector fork.

When installing: the long guide end of the selector fork points to the bottom of the housing.

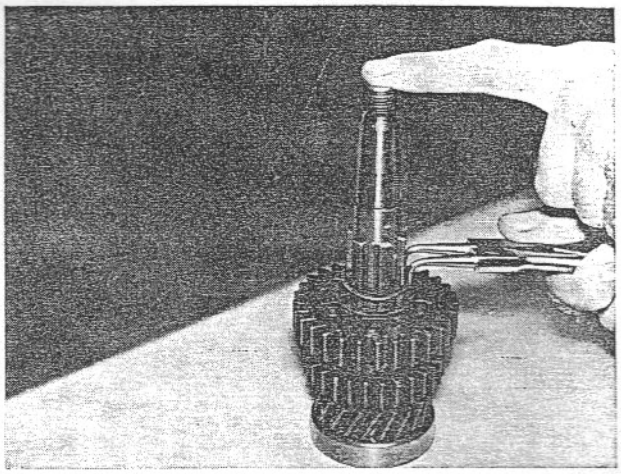


Renew the input shaft radial seal and drive the new seal in with BMW drift 23 1 650 used in conjunction with BMW handle 00 5 500.

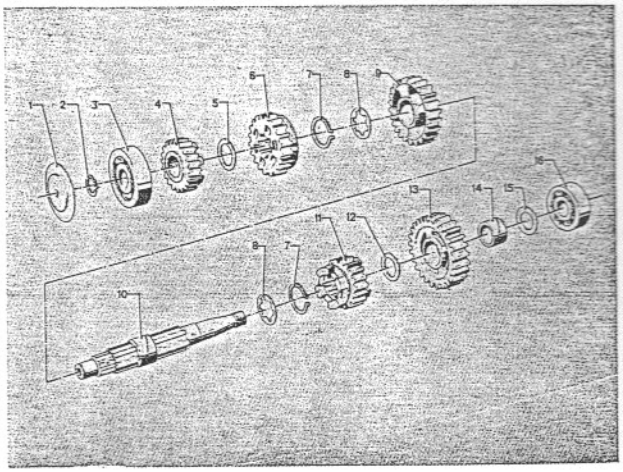


Remove oil trap plate 1 from the base of the bore for the output shaft ball bearing in the housing. Place a split plate p below the 1st gear pinion 13, and mount the split plate on a suitable press cylinder c. Press off the gear pinion together with thrust washer 15 and ball bearing 16.

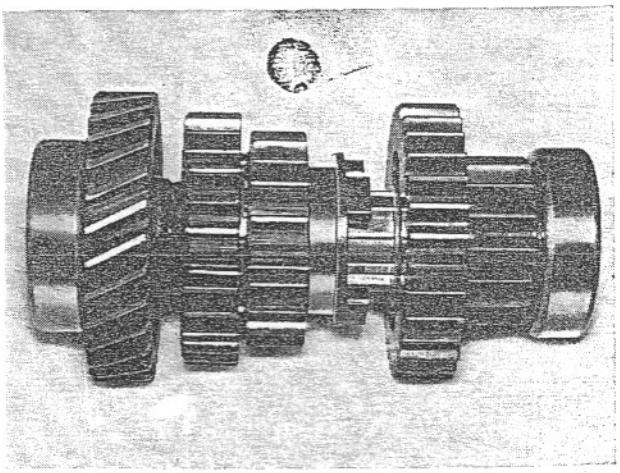
Take off the floating bushing 14 for the 1st gear pinion, the 2nd thrust washer 12 and the 4th gear pinion 11. Take off the circlip 7 for the 2nd and 3rd gear pinion with thrust washer 8, and the 2nd gear pinion 9.



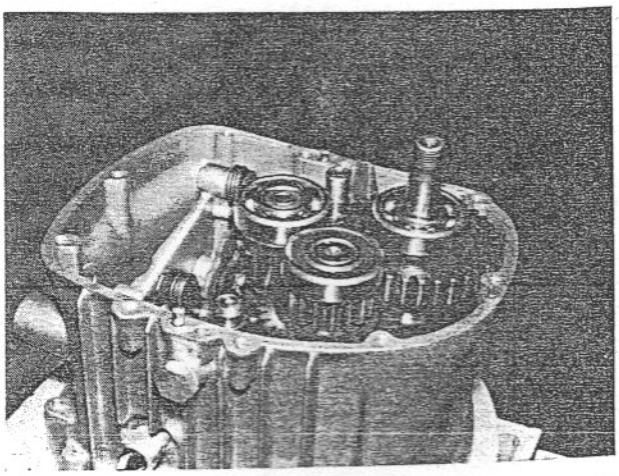
Extract circlip 2 from the front end of the shaft.
Insert a split plate between gear pinion 4 and 6 and mount the plate on a suitable press cylinder. Press off ball bearing 3 with a suitable drift and remove 5th gear pinion 4 with washer 5, 3rd gear pinions 6 and 7 and washer 8. If the shouldered bushing pressed on to the spline track for the 2nd and 3rd gear wheel is defective, the output shaft must be renewed.
Assemble by following the above instructions in reverse.

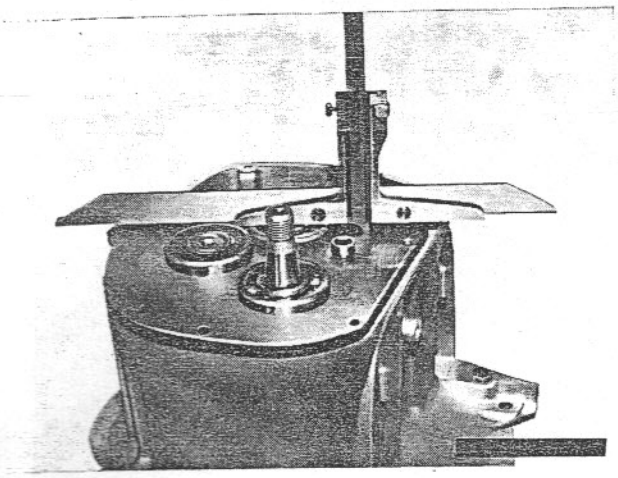


If defective, the intermediate shaft must be renewed complete. Pull off the bearing with "Kukko" puller, BMW 00 7 500.



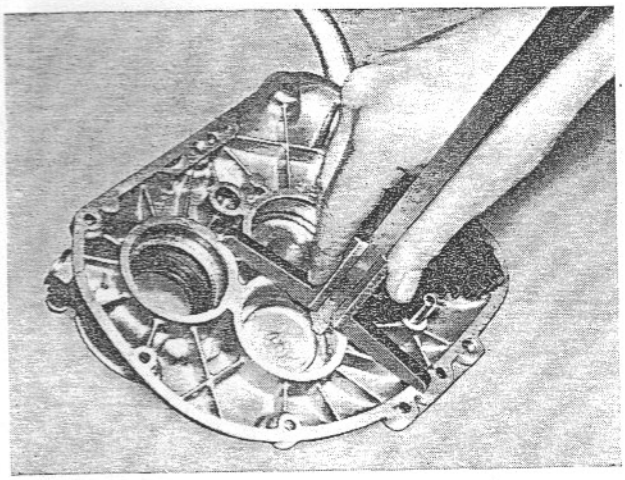
If defective the shaft must be renewed complete.
Before installing the output shaft, place the oil trap plate into the housing bore for the ball bearing.
Install the **output and intermediate shafts** in the housing together with selector fork 3 and 4. Make sure that the selector fork does not stick. Next, insert selector forks 1, 2 and 5 with the short ends together and locate with the shaft.
Assemble the shift mount in the neutral position and install the input shaft.





To measure intermediate shaft endplay, use a depth gauge to measure the distance between the ball bearing and the housing joint face.

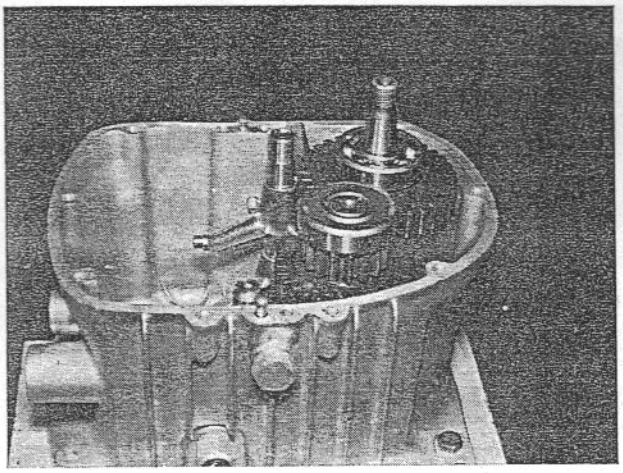
Attach measuring plate BMW 23 3 650 to locate the shafts on the housing.
Add the thickness of the measuring plate to the distance between the ball bearing and the plate.



Next, measure from the housing cover joint face to the base of the ball bearing seat in the cover and reduce play to 0.1 mm (0.004 in) with shims of suitable thickness. Use a small amount of grease to attach the shims at the base of the bearing bore in the gearbox cover.
Shim the three shafts in the same manner: max. endplay 0.1 mm (0.004 in).

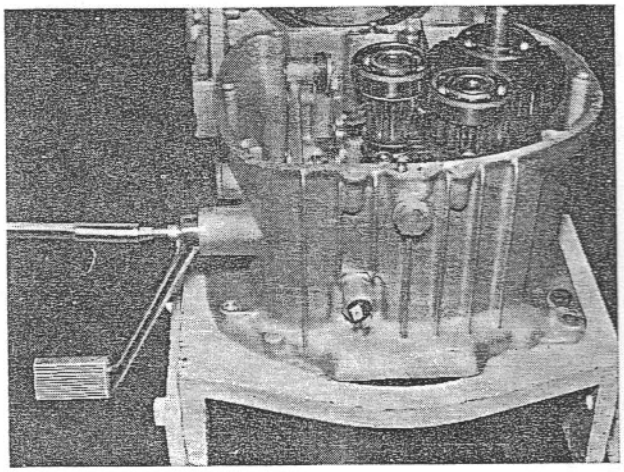
23 31 001 Selector forks – renewing

Remove and install gearbox – 23 00 020.
Detach and attach/seal gearbox cover – 23 11 040.
Remove and install shift mount.
While the housing is warm, pull out the shaft for the 1st, 2nd and 5th gear selector forks and place to one side complete with the selector forks.
Before the 3rd and 4th gear selector forks can be renewed, the gear cluster must be removed.

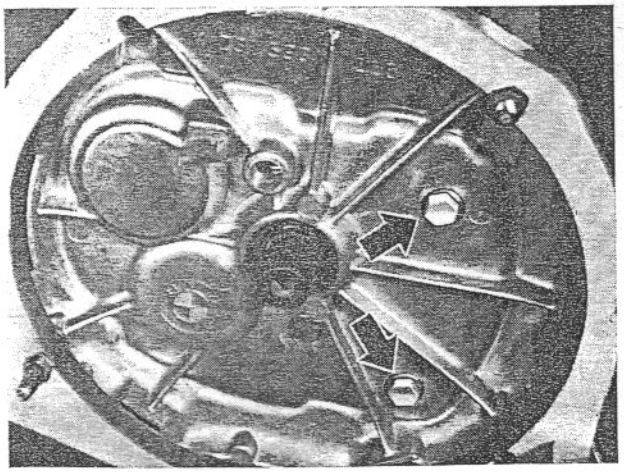


23 31 210 Pivot mount for selector disks – removing and installing

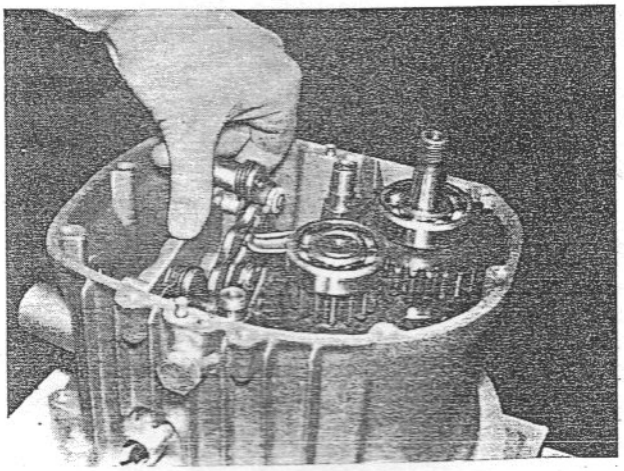
Remove and install gearbox – 23 00 020.
Detach and attach/seal gearbox cover – 23 11 040.
Remove Allen screw and pull out shift lever.

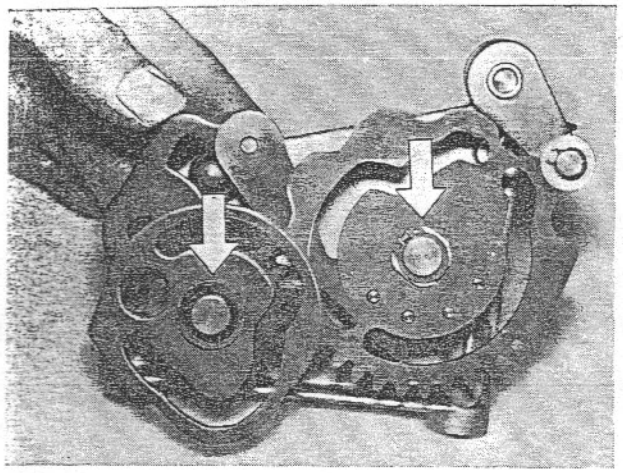


Remove the two reamed bolts (arrows) securing the pivot mount.



Tilt the pivot mount until the selector forks are freed.
Take out the pivot mount.

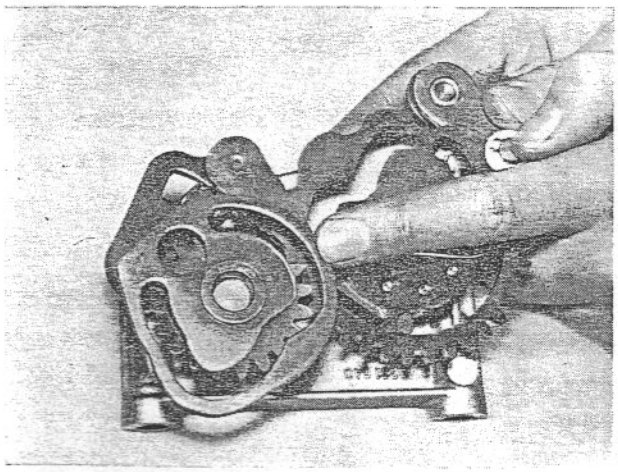




23 31 861 Selector disks – renewing (pivot mount removed)

The repair work described in the preliminary operations is only to be carried out if necessary.

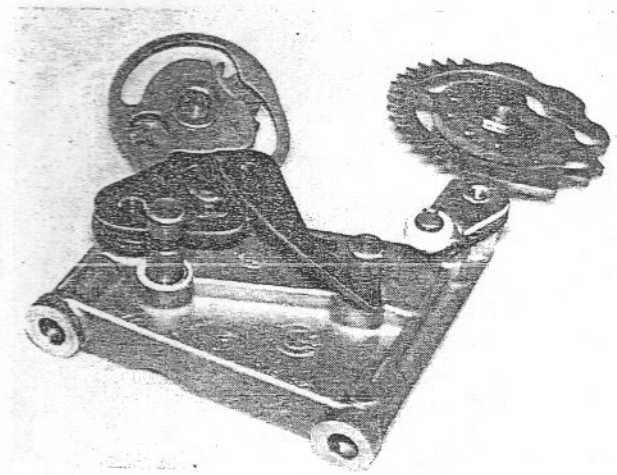
Remove the 2 Seeger circlips (arrows) retaining the cam disks.



■

Renew the selector disks, making sure that the first teeth of the selector disks mesh correctly.

■

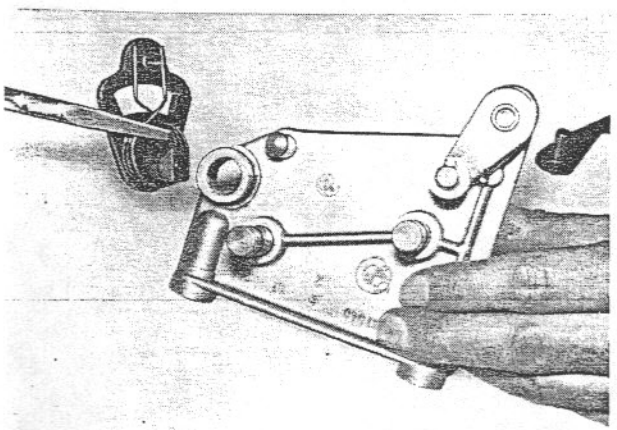


23 31 881 Shift mechanism – renewing (pivot mount removed)

The repair work described in the preliminary operations is only to be carried out if necessary.

Detach the selector disks.

■

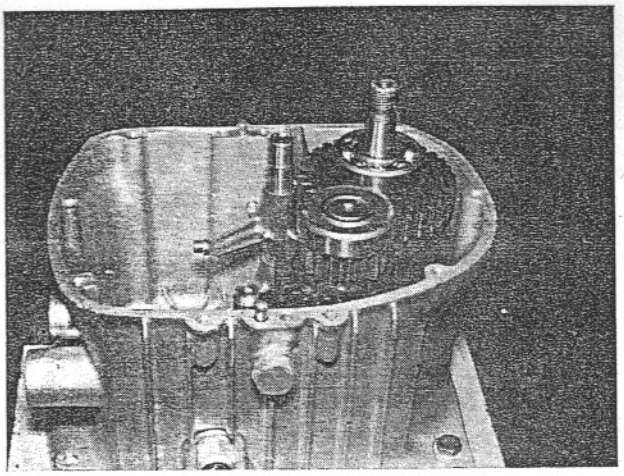


Pull the selector sector out of the guide and take off the spring.

■

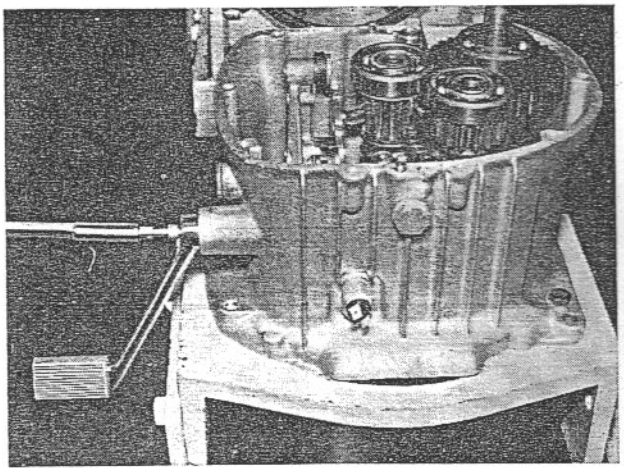
23 31 001 Selector forks – renewing

Remove and install gearbox – 23 00 020.
Detach and attach/seal gearbox cover – 23 11 040.
Remove and install shift mount.
While the housing is warm, pull out the shaft for the 1st, 2nd and 5th gear selector forks and place to one side complete with the selector forks.
Before the 3rd and 4th gear selector forks can be renewed, the gear cluster must be removed.

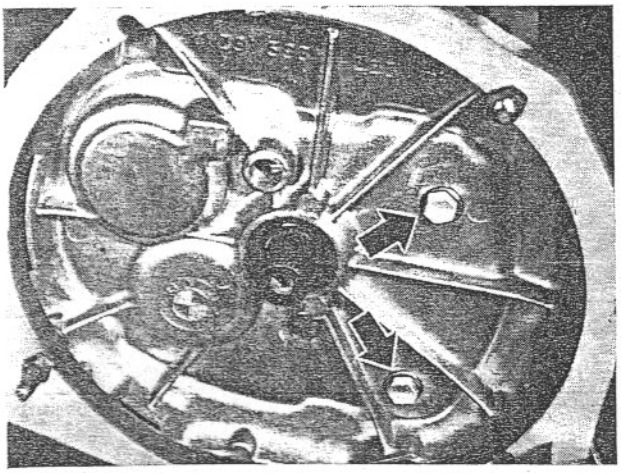


23 31 210 Pivot mount for selector disks – removing and installing

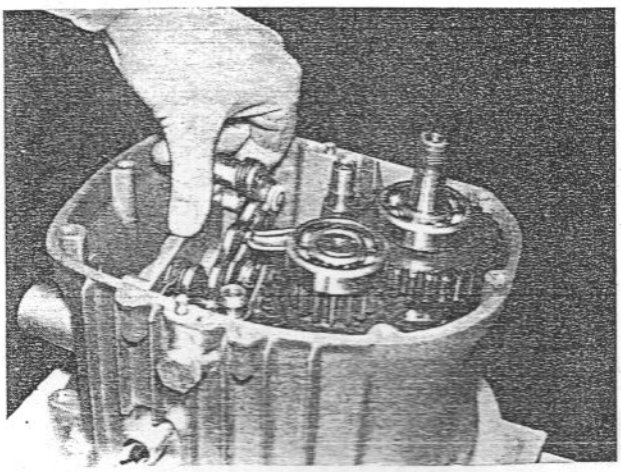
Remove and install gearbox – 23 00 020.
Detach and attach/seal gearbox cover – 23 11 040.
Remove Allen screw and pull out shift lever.



Remove the two reamed bolts (arrows) securing the pivot mount.



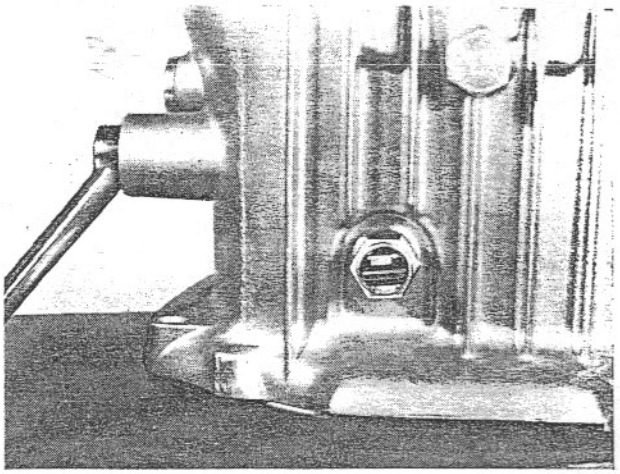
Tilt the pivot mount until the selector forks are freed.
Take out the pivot mount.



23 31 401 Electric neutral indicator – renewing

1. Gearbox removed.

Remove and install gearbox – 23 00 020.
If the gearbox is tilted to one side, the neutral indicator switch can be unscrewed and removed.

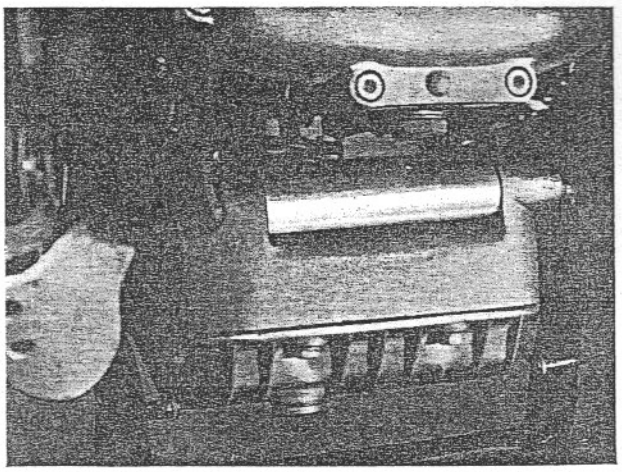


2. Gearbox installed.

Drain the oil.

Unscrew the nuts at the rear engine mounting pins, take off the footrests and exhaust mounting and pull out the engine mounting pins. Drive the spacing tube out of the engine block with a plastic-headed hammer.

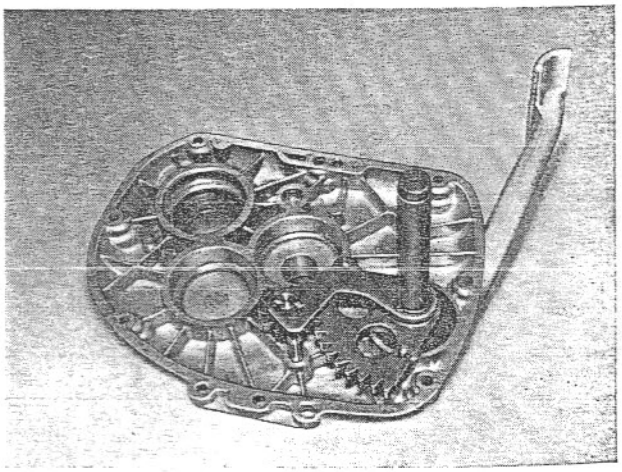
Detach the cables and unscrew the neutral indicating switch.



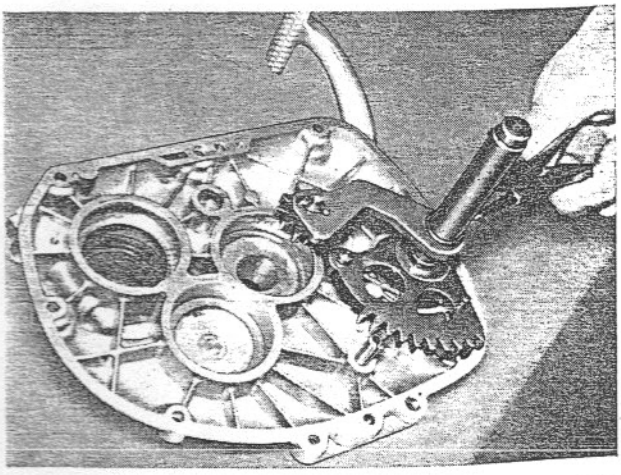
23 51 010 Kick starter – removing and installing (Special equipment option 58.4)

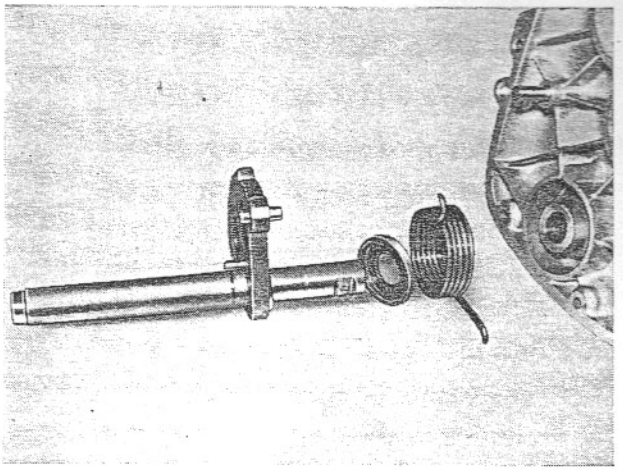
Detach and attach/seal the gearbox cover –. 23 11 040.

The repair work described in the preliminary operations is only to be carried out if necessary.



Lift out the intermediate gear circlip and pull the intermediate gear away from the kick starter.





Unscrew the taper bolt from the kick starter lever and take off the lever. Remove the kick starter with washer and spring from the cover.

26 Propeller shaft

Specifications . . . . . Page 26– 0/3
26 11 000 Propeller shaft – removing and installing 26–11/1

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)		

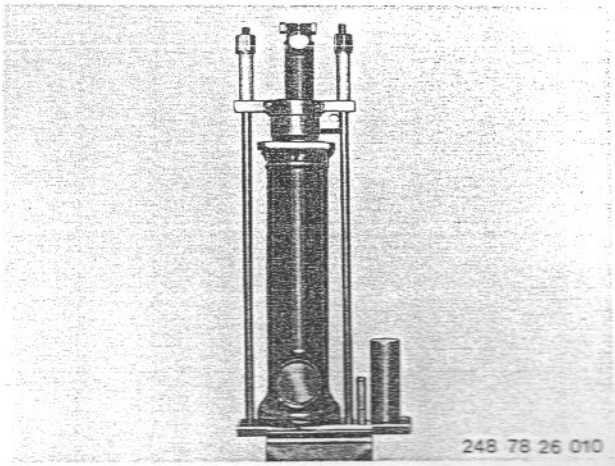
Tightening torques Nm (lb. ft.)

Twelve-sided bolt	38+4 (28+3)

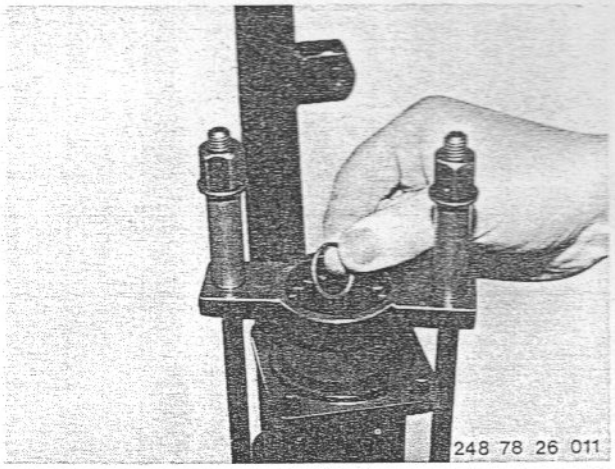
All other bolts and nuts to be tightened to the customary values as shown in the manufacturers' tables or the latest BMW 60002.0 standards sheet.

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.

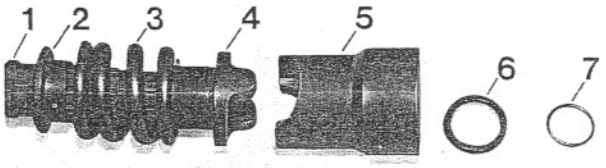


Insert a drift into the longitudinal groove and extract the snap ring.
Gradually release the assembly fixture.



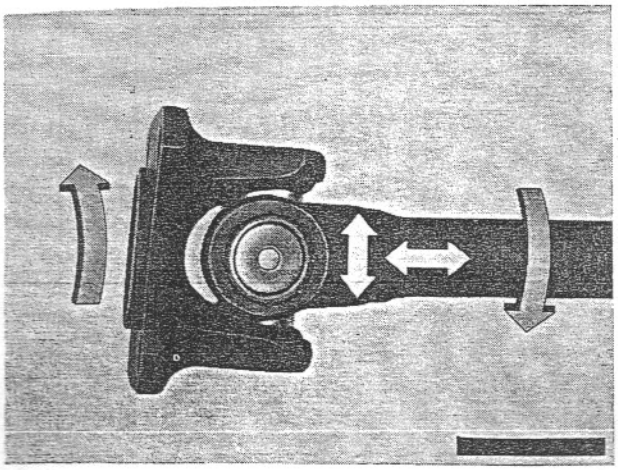
Remove the swinging arm from the fixture and pull the propeller shaft and components out of the swinging arm tube.

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



248 78 26 012

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
31 42 009 Telescopic fork – measuring 31–42/1
31 42 100 Telescopic fork – removing and installing 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

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 (75 kg [165 lb] load) 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)	$36^{-0.050}_{-0.075}$ $(1.417^{-0.002}_{-0.003})$		
Fork slider tube intl. dia. mm (in)	$36^{+0.025}_{0}$ $(1.417^{+0.001}_{0})$		
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	120 . . . 130 (88 . . . 96)	Retaining screw for damper in slider tube	35±5 (25.8±3.6)
Clamp bolts at lower fork bridge	35 . . . 30 (26 . . . 29)	Axle clamp bolt	15+2 (11.1+1.5)
		Mudguard stirrup at slider tube	20 . . . 25 (14.7 . . . 18.4)

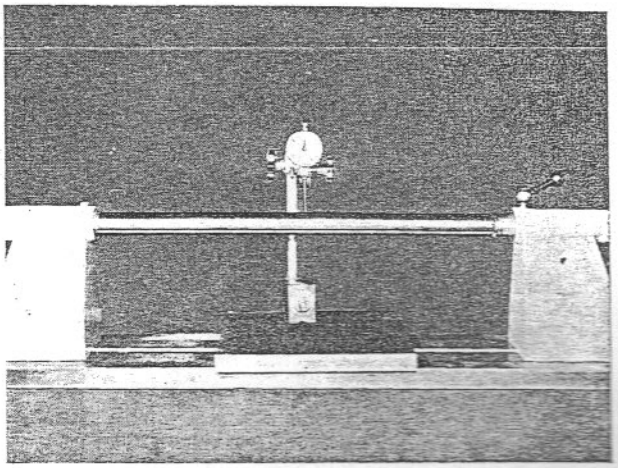
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

31 42 009 Telescopic forks – measuring

Strip and assemble the telescopic forks – 31 42 100.

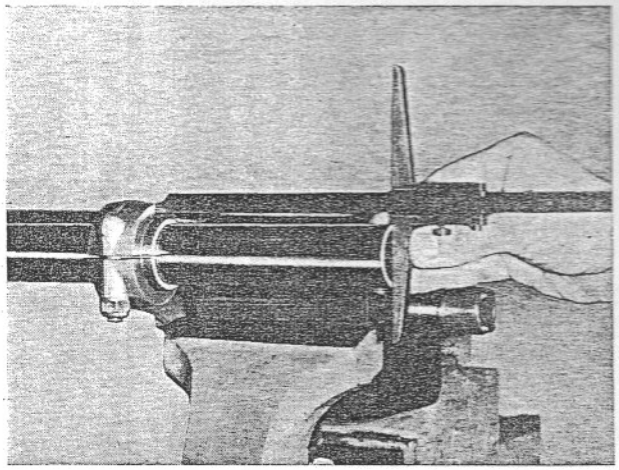
In particular if the forks have been damaged, examine the upper and lower bridges, fixed and sliding tubes for hairline cracks.

Remove the fixed fork tubes and suspend at each end from Vee guides or between centers to check for runout. For maximum permissible runout, see Specifications.

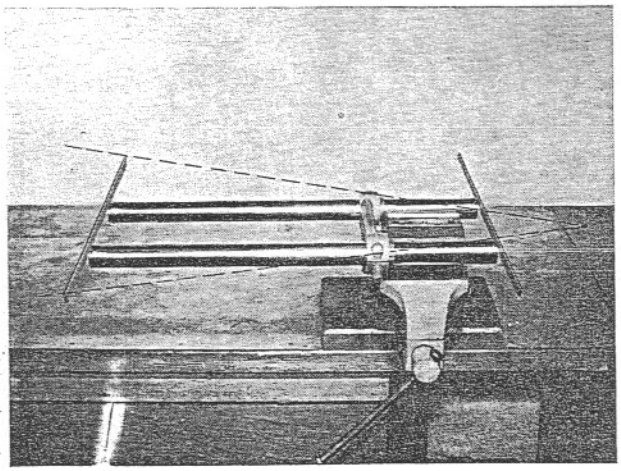


Warning: if bent, the fixed fork tubes must **not be straightened.** There is a risk of fatigue fracture.

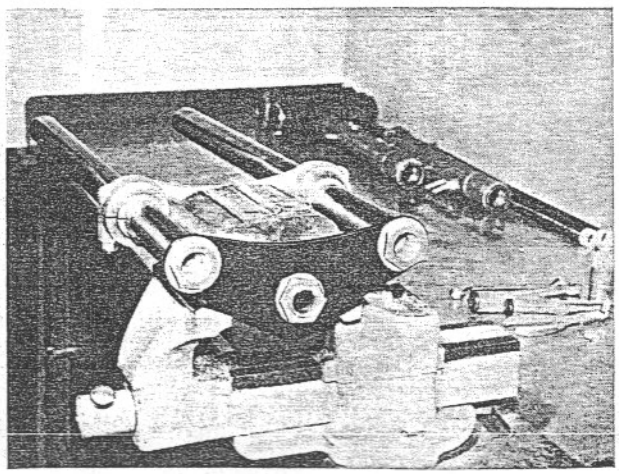
To check the lower fork bridge, clamp two new fixed fork tubes into position (installed length for testing 190 mm (7.48 in) measured from the upper face of the support tubes to the machined face on the lower fork guide).



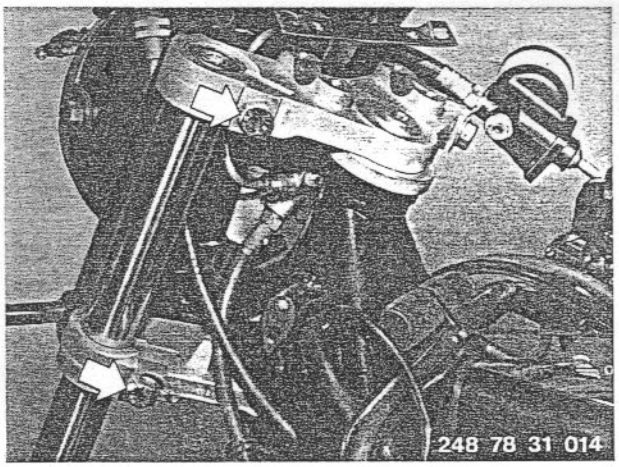
Place two BMW 31 4 620 straight edges across the ends of the fork support tubes and look across these straight edges to determine any distortion.



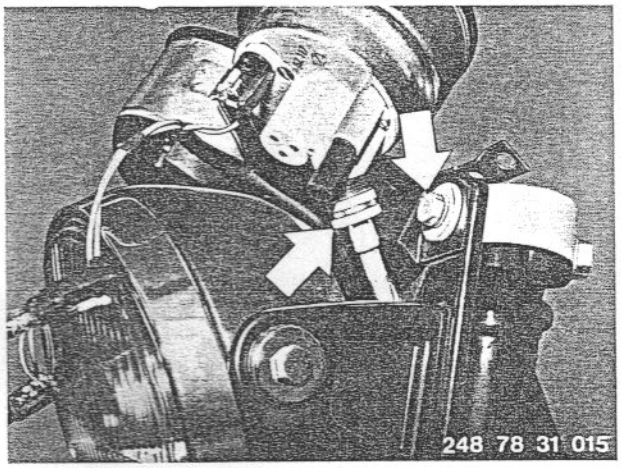
Check with the aid of sliding calipers that the fixed fork tubes are parallel when installed. Check that the fork guide tube is precisely aligned with the fixed tubes. To do this, install the upper fork bridge. It must be possible to install the fork bridge without effort.



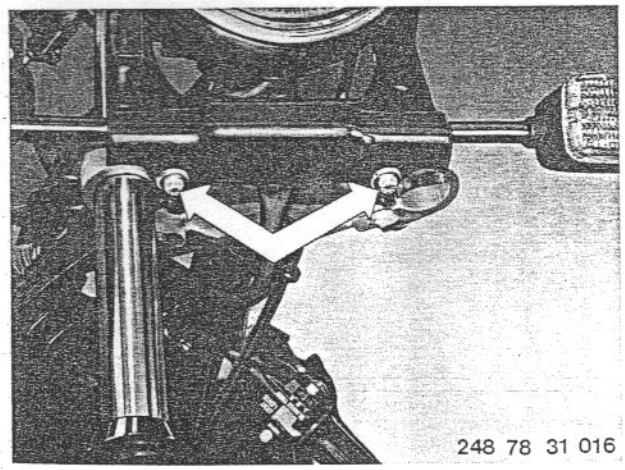
31 42 100 Telescopic forks – removing and installing



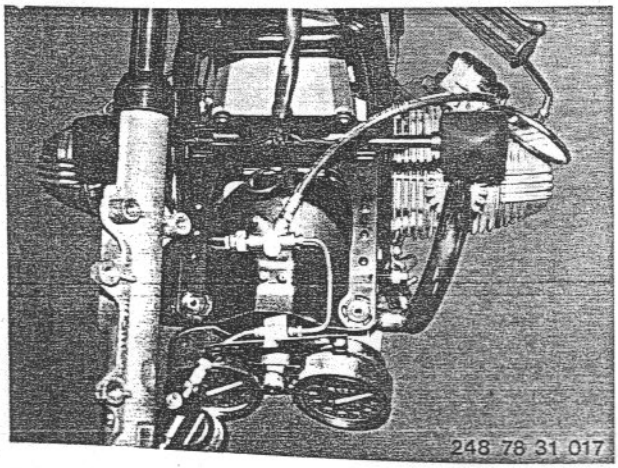
Remove and install front wheel – 36 30 300.
Remove and install front mudguard – 46 61 000.
Remove and install handlebar – 32 71 000.
Remove and install brake caliper – 34 11 000.
Slacken the clamp bolts (arrows) for the left fixed tube at the upper and lower fork bridges, and pull the fixed and sliding tubes out downwards.



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

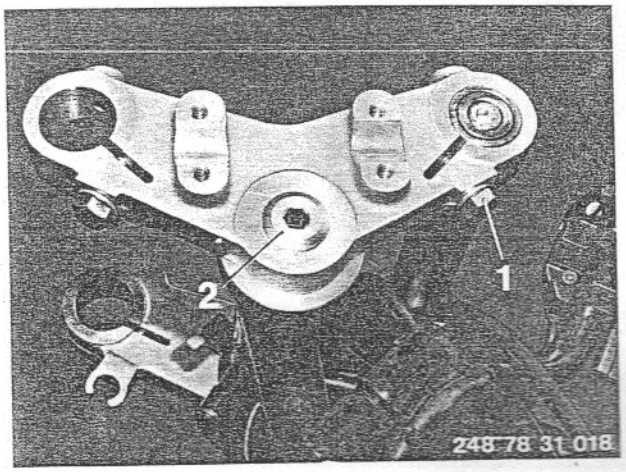


Take out the retaining bolts at the lower fork bridge (arrow).



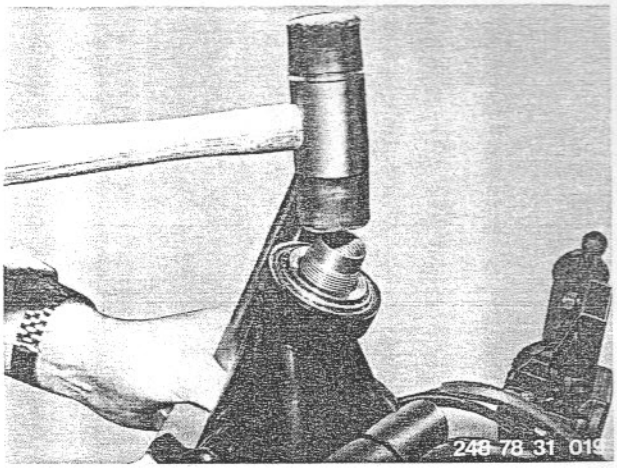
Pull the instrument panel over the lower fork bridge at one side and allow to hang down.

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



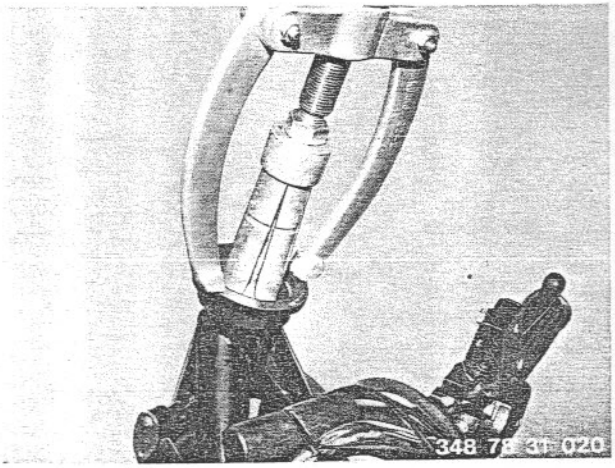
Unscrew the wheel nut by hand and pull the lower fork bridge out of the steering head, striking the fork guide tube lightly at the same time.

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



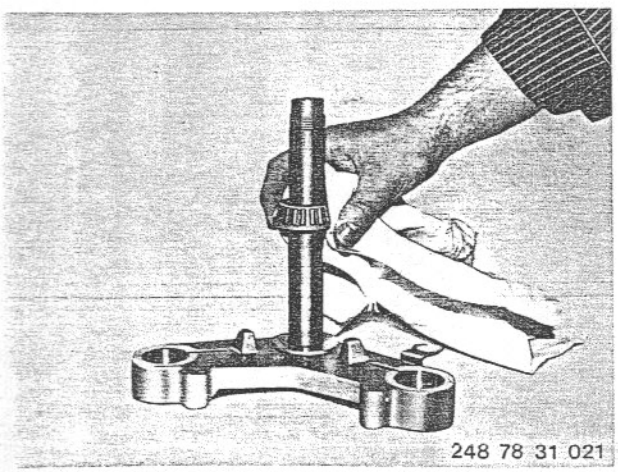
The outer bearing races can be removed with "Kukko" puller BMW 00 5 560 in conjunction with support ring BMW 31 4 800.

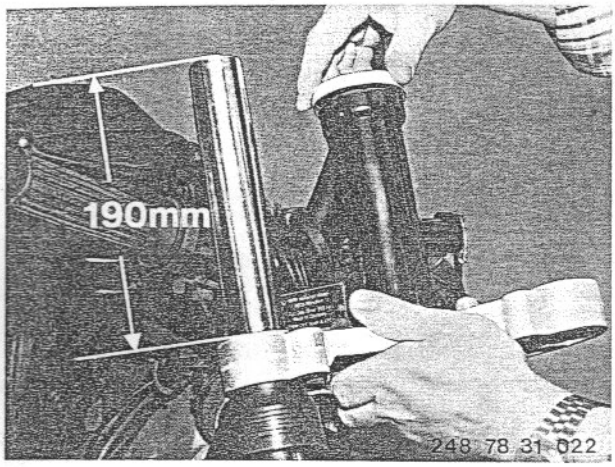
When installing: use the old bearing shell to drive in the new shell.



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.

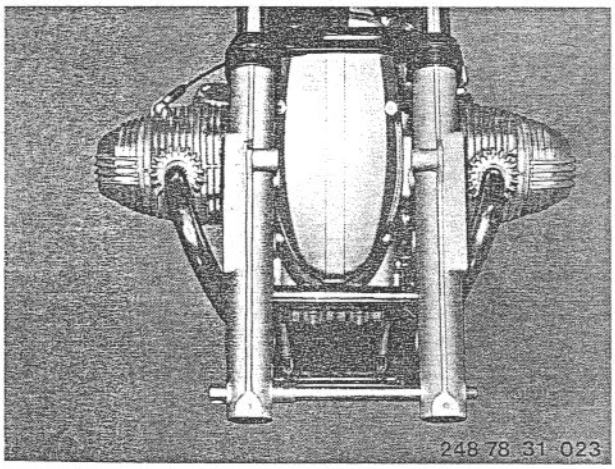
When installing: note the locating marks on the guide tube and fork bridge for the anti-theft lock slot.





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.

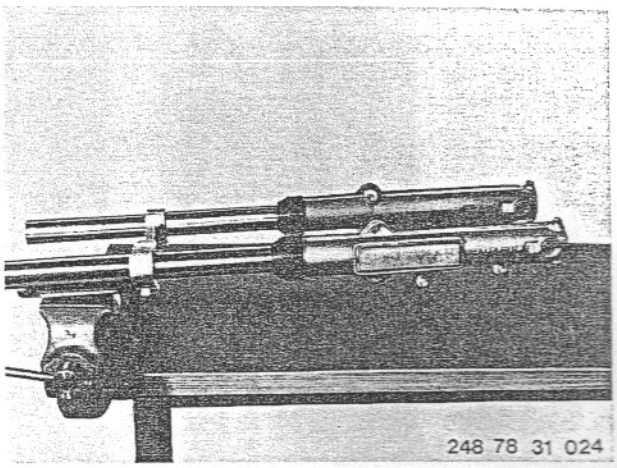
When installing: grease the bearing shells and taper roller bearing thoroughly.



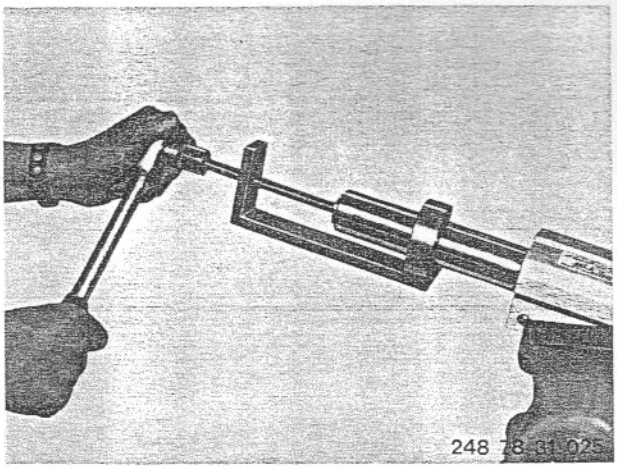
Bolt the instrument carrier to the upper and lower fork bridges.
Push the left fixed tube with sliding tube into the fork bridge from below and align initially with the quick-release axle.
After installing the front wheel, loosen the left clamp bolts again and compress the forks several times before retightening the fork clamp bolts.

31 42 103 Telescopic forks – stripping

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.
The fork tubes should point down slightly.

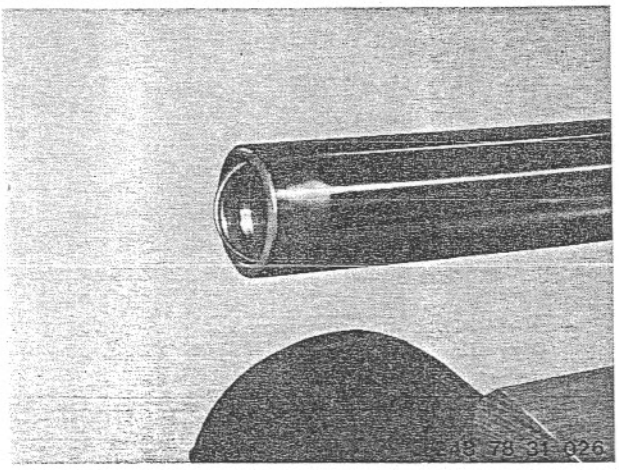


Using the BMW 31 4 680 clamping device, press the spring support down against the coil spring until it is approx. 50 mm (2 in) deep in the fixed tube.



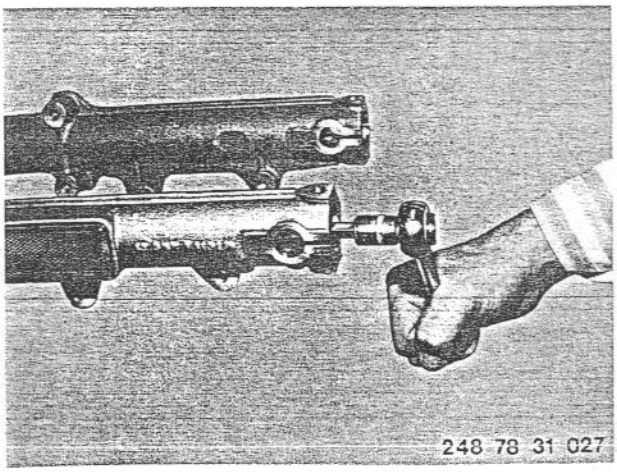
Using a plastic-headed hammer and screwdriver, drive the snap ring out of the seat on the split side, position vertically and pull out by hand.
Release the clamping device and take out the spring support.

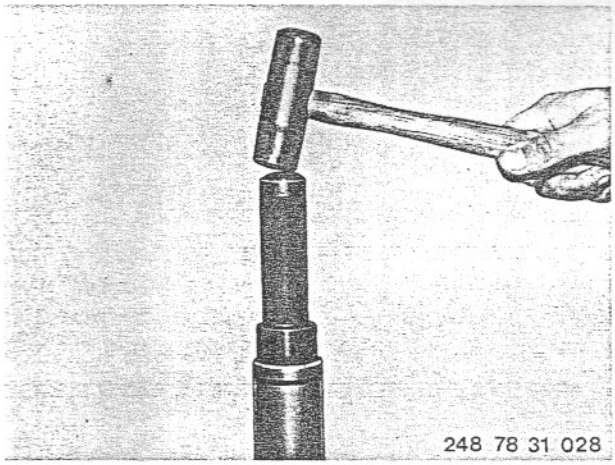
When installing: do not re-use the O-ring at the spring support after removal.



Drain the oil from the fork.
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.

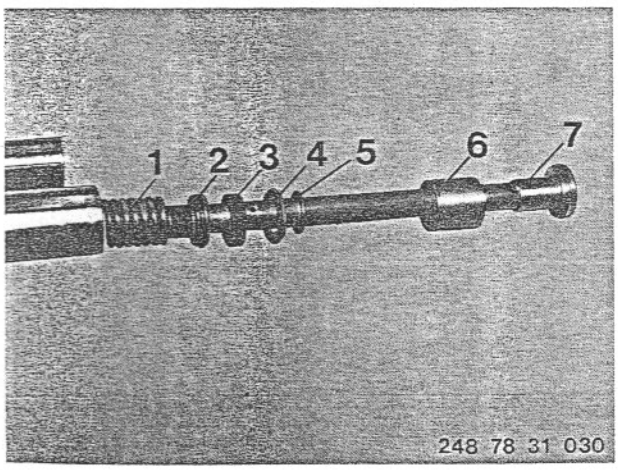




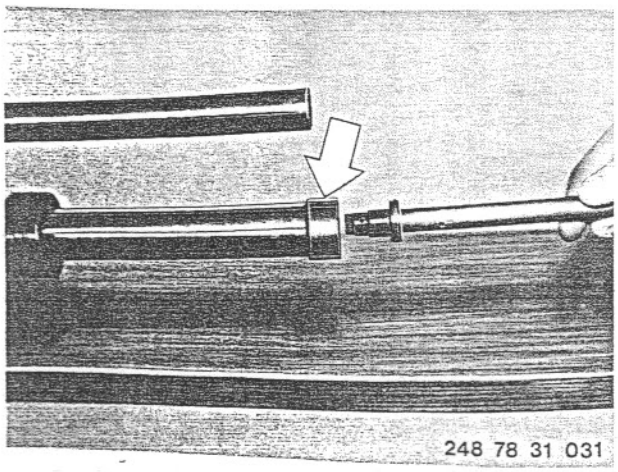
Pull off the fork gaiter and carefully lift out the sealing ring from the slider tube with a screwdriver.
Drive in the new sealing ring with BMW drift 31 4 650.



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



To install the damper in the fixed fork tube, use BMW guide sleeve 31 4 720 (arrow) to compress the piston rings.

32 Steering

Specifications . . . . . Page 32– 0/3
32 00 454 Steering – adjusting 32–00/1
32 71 000 Handlebar – removing and installing 32–71/1
32 73 000 Clutch cable – removing and installing 32–73/1
32 73 030 Throttle cable – removing and installing 32–73/2

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)		

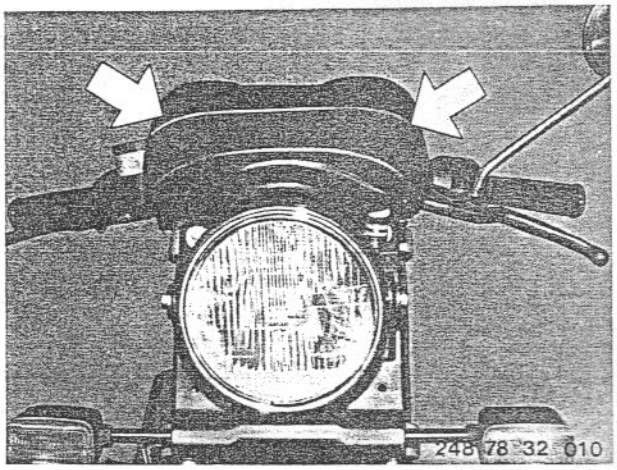
Tightening torques Nm (lb. ft)

End plug	120 . . . 130 (88 . . . 96)

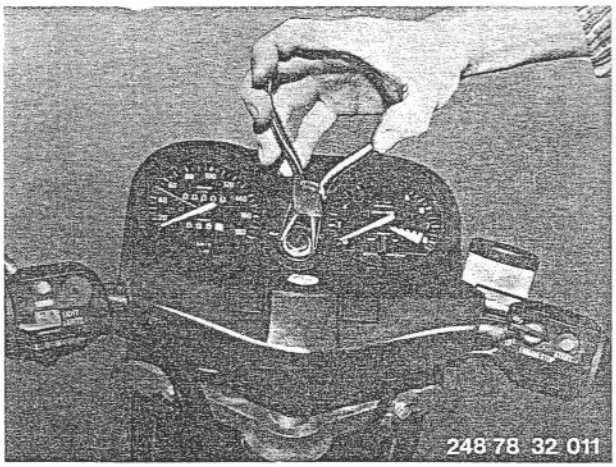
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

32 00 454 Steering – adjusting

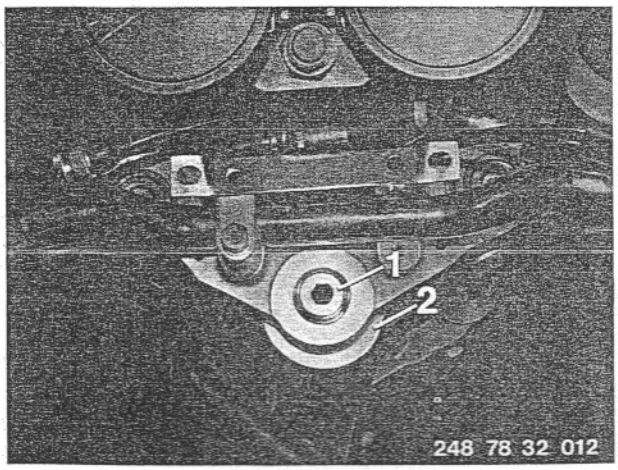
Detach the instrument surround (arrows).



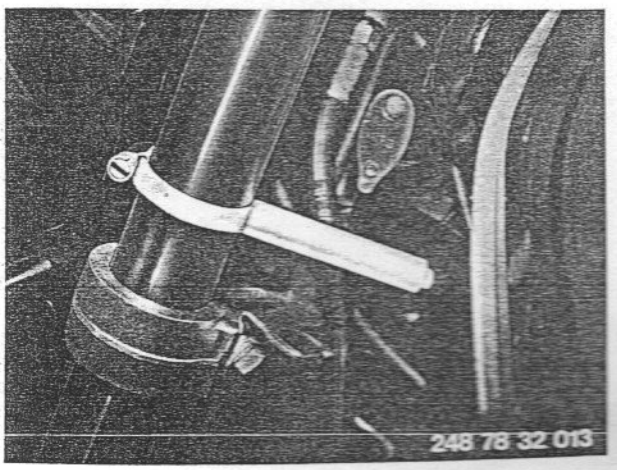
Unscrew the lock ring from the ignition switch (using Seeger circlip pliers), pull out the turn indicator telltale lamp holders and take off the instrument surround.

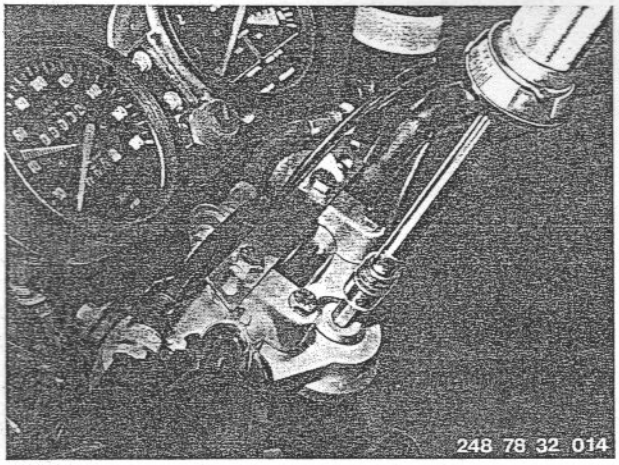


Slacken the end plug, loosen threaded ring (2), strike the bearing sharply to release tension, tighten the threaded ring by hand and tighten the end plug to the correct torque.



Insert a stop between the left gusset plate and the fixed fork tube to hold the front fork at a 20° angle (approx. 65 mm [2.6 in] long.





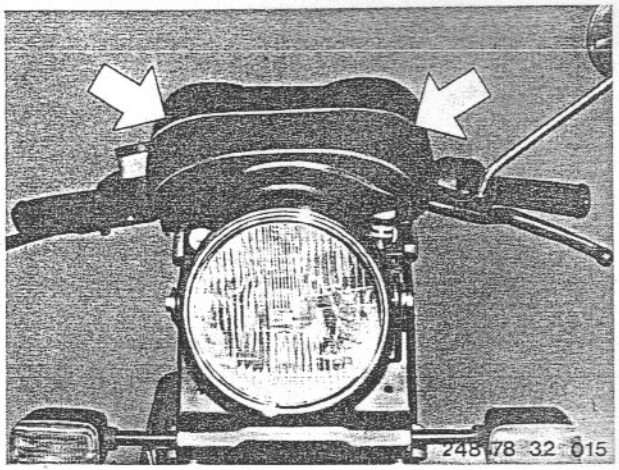
Attach a 10 mm internal hexagon socket head to the friction tester and insert in the end plug.
Turn the front fork back from the 20° angled position to the straight-ahead position by means of the friction tester.

The specified friction values (see Specifications) must not be exceeded.

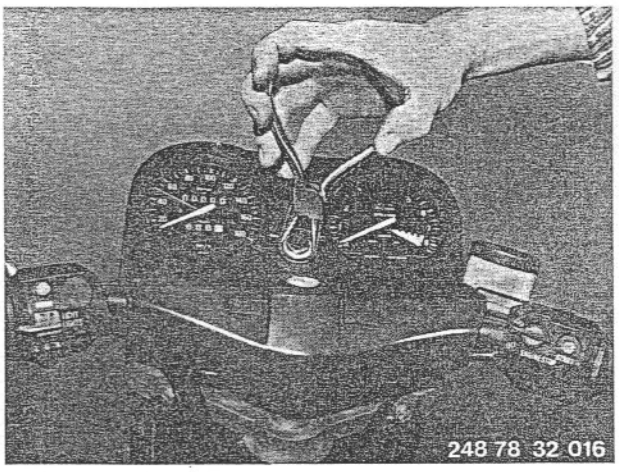
Note:
Make sure that the electrical wiring and wire cables run correctly so that the friction values are not accidentally increased.

32 71 000 Handlebar – removing and installing

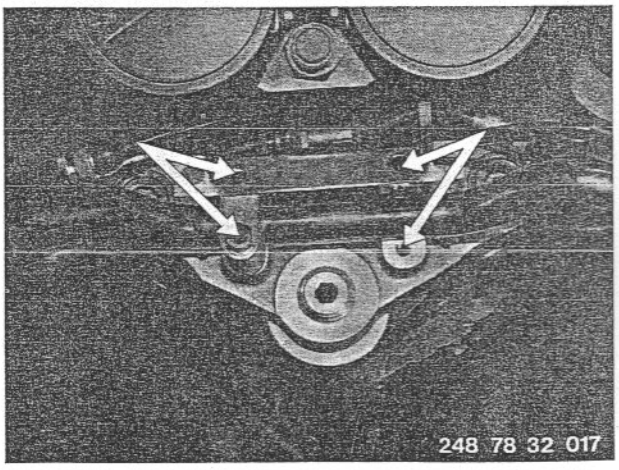
Take out the Phillips-head screws (arrows) at the left and right of the instrument housing.
Take off the cover panel.
Pull the turn indicator repeater light holders (1) with cables out of the instrument housing.



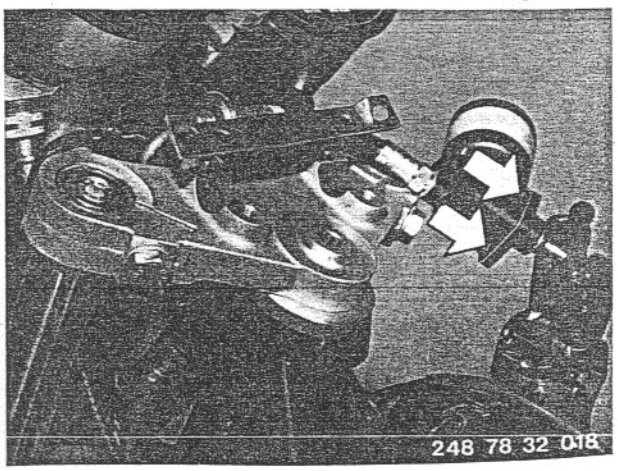
Using Seeger circlip pliers, unscrew the ignition lock and lift off the instrument surround.

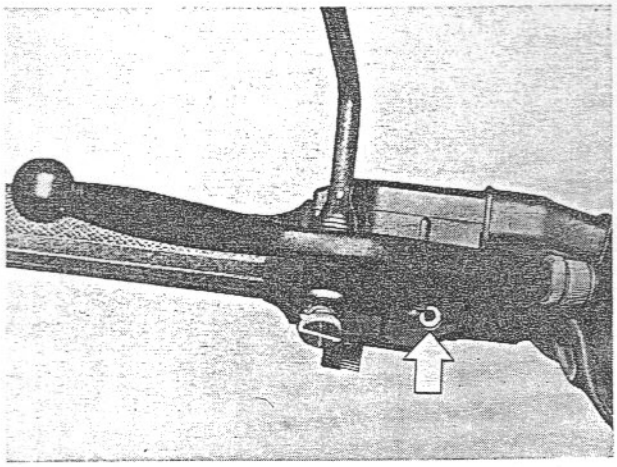


Unscrew the 2 hex. bolts (arrows) holding the handlebar on each side.

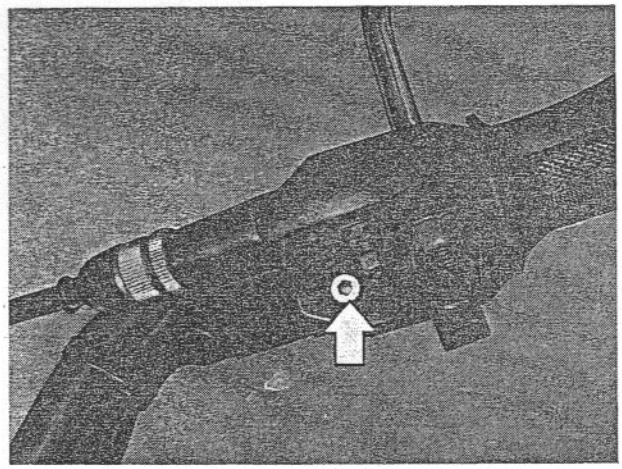


Take out the two Allen screws holding the brake master cylinder (arrows) at the throttle twistgrip.
Remove the throttle cables – 32 73 030.
Remove the clutch cable – 32 73 000.
Rest the handlebar on a soft surface on top of the fuel tank.





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



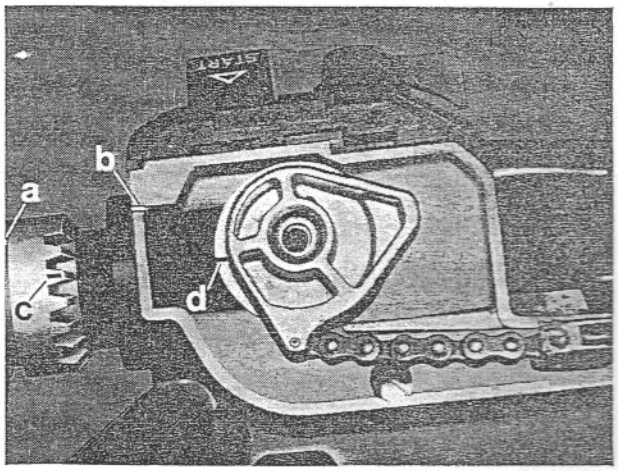
Pull off the left handlebar grip. Blow through the handlebar tube from the right with compressed air to loosen the handgrip. Remove the Allen screw (arrow) from the housing and pull the complete assembly off the handlebar tube.

32 73 030 Throttle cable – removing and installing

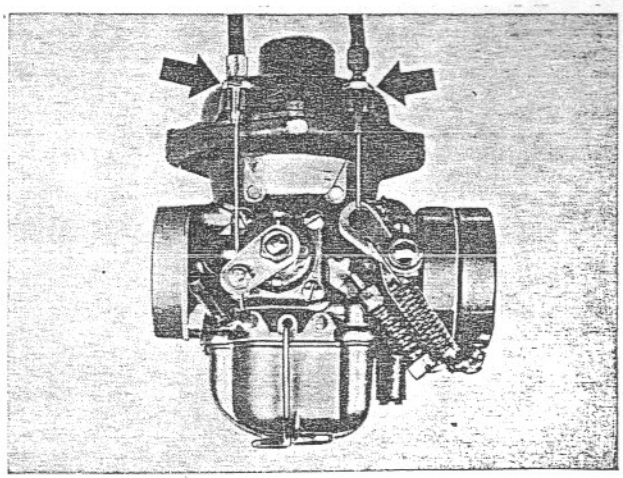
Push back rain water cap 1 and unscrew cover 2.

Disconnect the throttle cable.

When installing: grease the adjuster cam and teeth on the throttle twistgrip before assembly. Make sure that slot end 'a' in the twistgrip is aligned with cutout 'b' on the handlebar grip at the rider's end. Thread the lower cable into the double nipple and insert complete with chain and adjuster cam into the handlebar grip so that marks 'C' and 'd' on the cam and handlebar grip are opposite one another. Insert the upper throttle cable into the double nipple. Attach the cover and at the same time push back the upper throttle cable outer sleeve sufficiently for the end of the outer cable to engage in its seat in the cover cutout. Screw the cover down tightly and push on the rainwater cap.
The full range of throttle cable travel will not be obtained unless these instructions are observed.



Remove and install the fuel tank – 16 11 030.
Unscrew the throttle cable adjusting screw (arrow) and disconnect the cable with nipple at the throttle butterfly lever.



33 Rear wheel drive

Specifications		Page 33– 0/3
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	33–17/2
33 53 580	Coil spring – removing and installing	33–17/2

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 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)	0.25 (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)	Brand-name hypoid gear oil, SAE 90		
Oil grade below 5° C (41° F)	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)

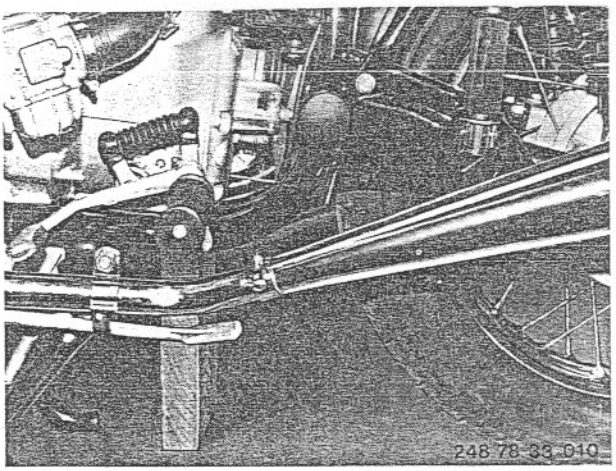
Nut on drive pinion	150+15 (111+11)	Rear wheel drive oil drain plug	23 . . . 26 (17 . . . 19)
Threaded ring in housing	100 . . . 120 (74 . . . 88)	Swinging arm oil filler plug	14 (10.3)
Rear wheel drive oil filler plug	28 . . . 31 (21 . . . 23)	Swinging arm oil drain plug	14 . . . 17 (10.3 . . . 12.5)
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.

33 10 050 Rear wheel drive — removing and installing

Remove and install the rear wheel – 36 30 320.

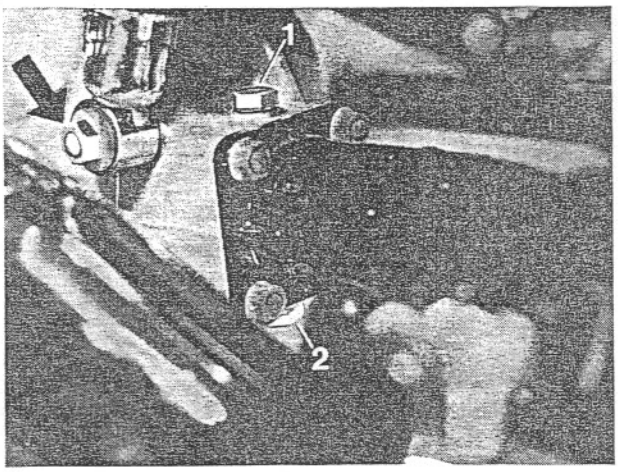
Place the motorcycle on its center stand and support below the swinging arm bearing so that the rear wheel can rotate freely.



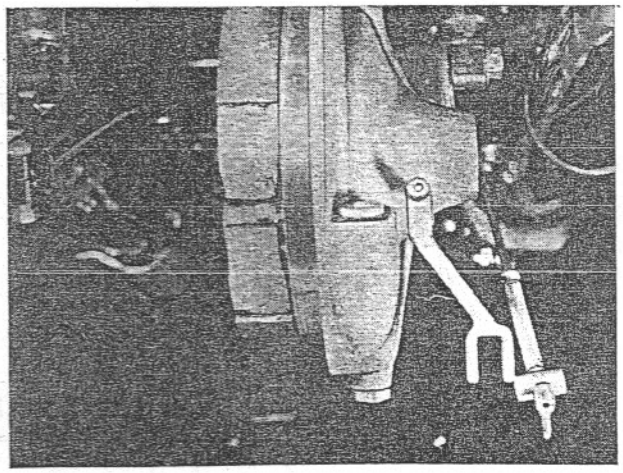
Unscrew and remove the right spring strut retaining bolt (arrow) and take off complete with washer.

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: add 0.25 liter (0.44 Imp. pint, 0.26 US quart) of an oil as laid down in the Specifications after assembly.

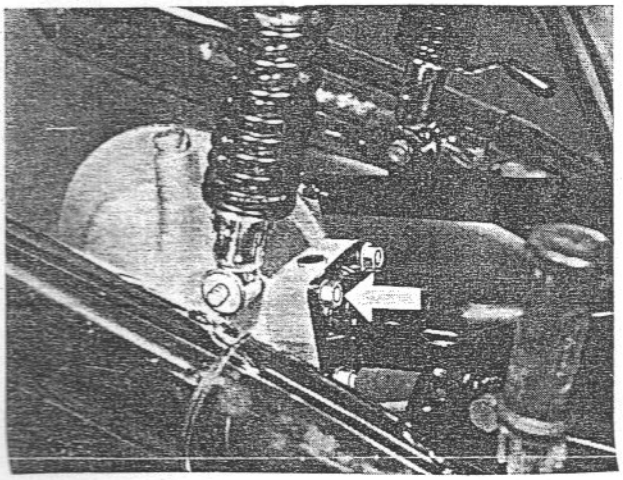


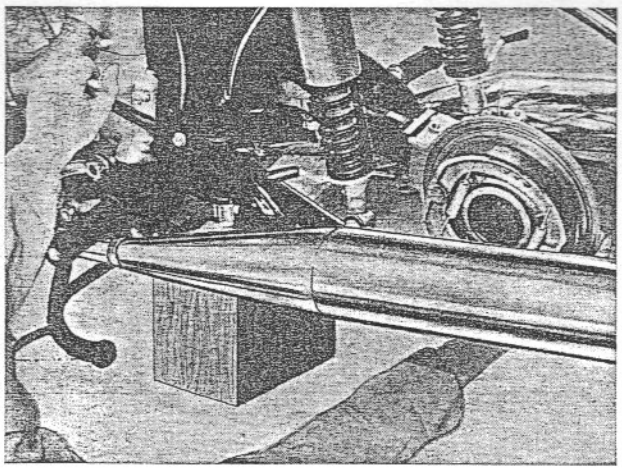
Unscrew the wing nut from the brake rod, pull the brake rod away from the lever pin, take the hollow pin out of the lever, mount it on the brake rod and secure with the wing nut.



Slacken the top spring strut retaining bolt and unscrew the 4 nuts with spring washers from the retaining bolts for the right swinging arm.

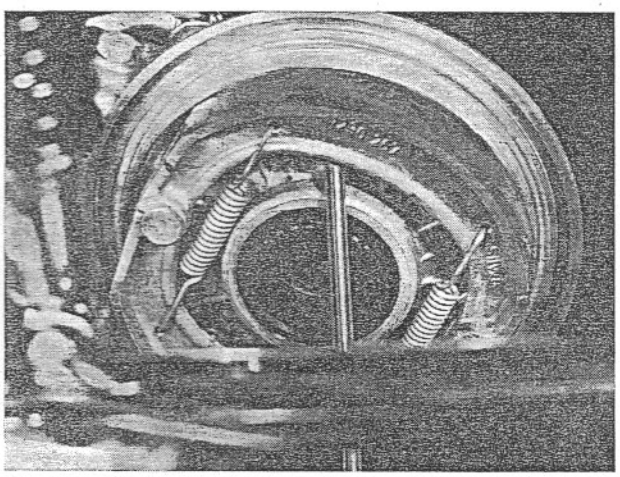
When assembling, do not tighten these four nuts until the axle has been inserted through the rear wheel drive and the axle clamp.





Pull the rear wheel drive away from the swinging arm, and set aside.

When installing: before attaching the rear wheel drive to the swinging arm, turn the propeller shaft so that the splined coupling engages.

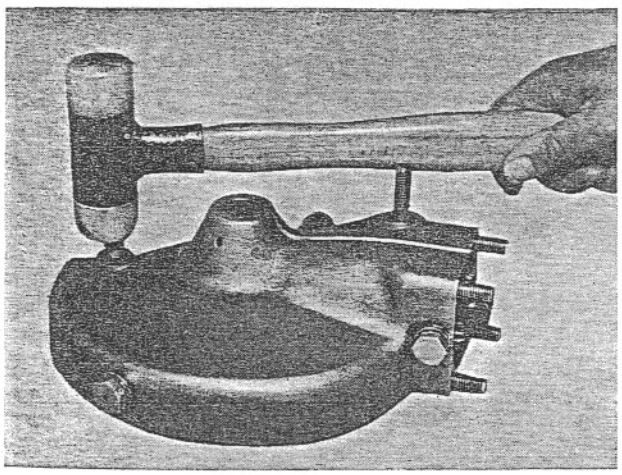


33 10 113 Rear wheel drive – stripping and assembling

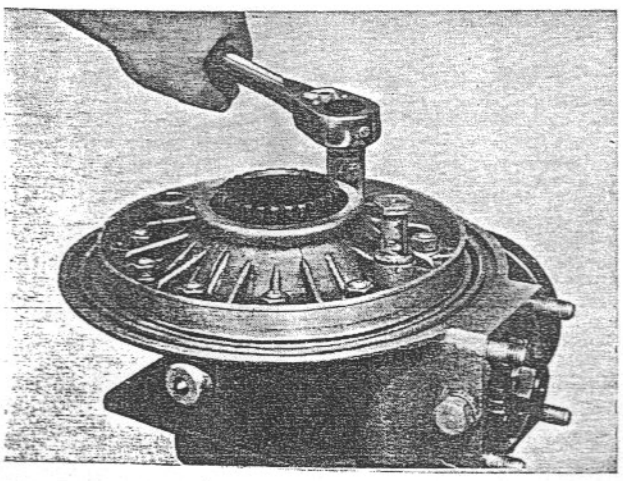
Remove and install the rear wheel drive – 30 10 050.
Drain the oil.

When installing: after assembly, add 0.25 liter (0.44 Imp. pint, 0.26 US quart) of an oil grade as shown in the Specifications.

Mark the relative positions of the rear brake shoes and the housing. Tilt the brake shoe in contact with the bevelled face of the collar disk away from the housing with a screwdriver, then remove both brake shoes.



Unscrew the clamp bolt from the brake lever and remove complete with toothed washer. Take off the brake lever and pull out the brake actuating arm.

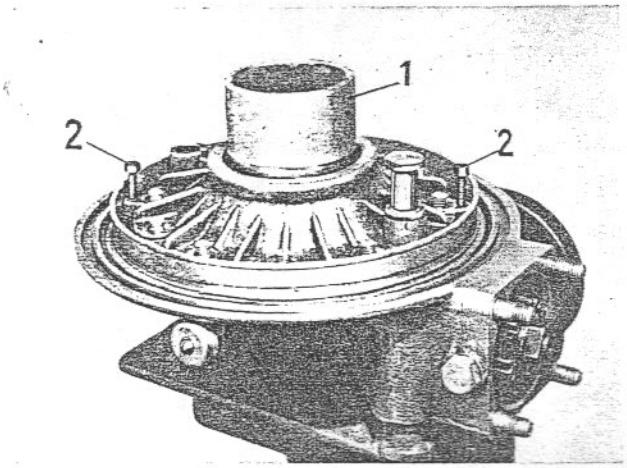


Clamp the housing with BMW tool 33 1 600 to assembly stand BMW 00 1 500.

Remove the 10 nuts from the propeller shaft housing and place to one side complete with spring washers.

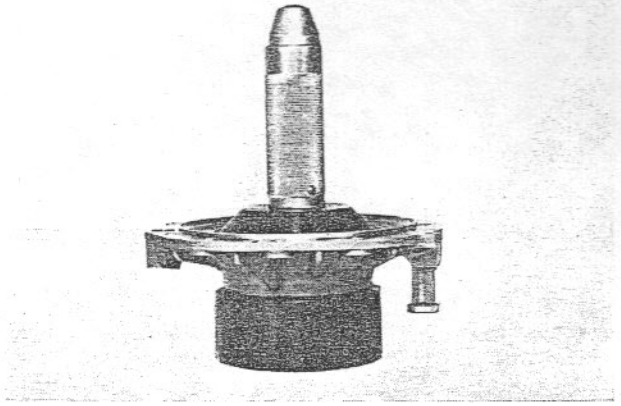
To protect the shaft sealing ring, push assembly sleeve BMW 33 1 800 (1) over the rear wheel coupling splines, insert two standard bolts of the correct size (2) into the tapped holes in the propeller shaft housing cover and force off the cover. Remove the cover, crownwheel with deep-groove ball bearing, needle roller inner race and shim washer.

When installing: heat the propeller shaft housing cover to approx. 80° C (176° F).

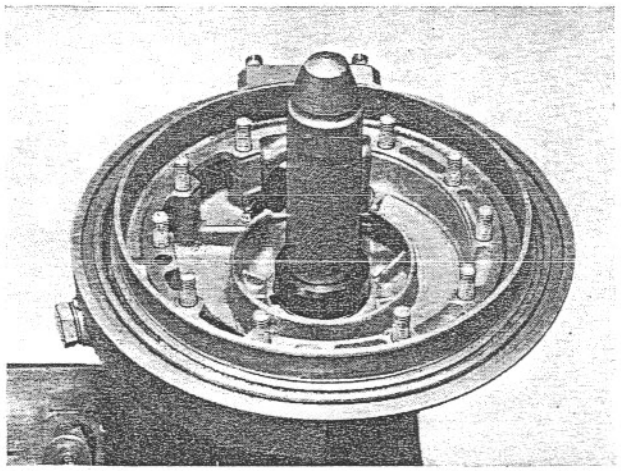


Remove the shaft sealing ring from the propeller shaft housing cover.

When installing: Use special tool BMW 33 1 850 and handle BMW 00 5 500 to insert the new sealing ring.

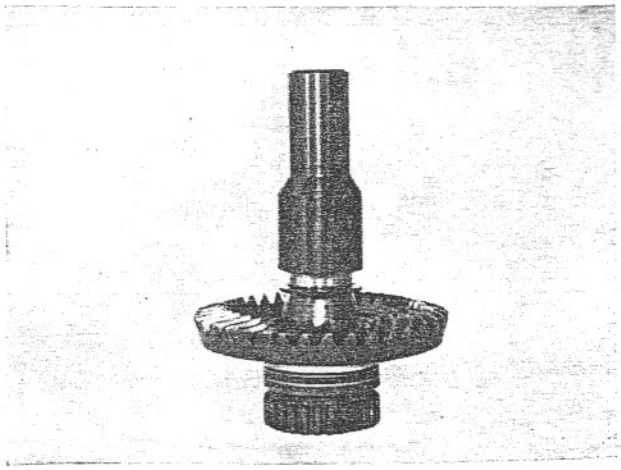


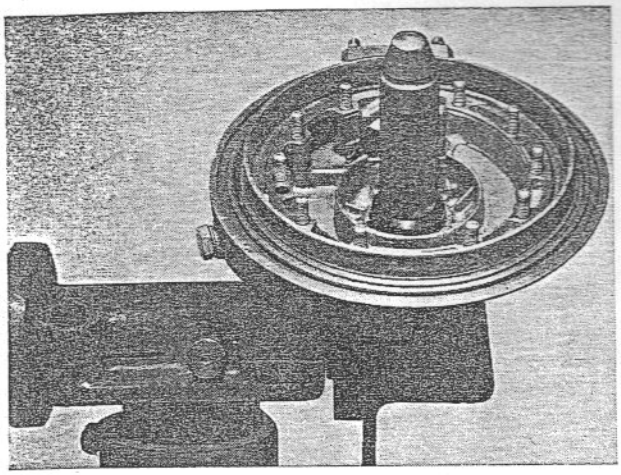
Heat the housing to approx. 100° C (212° F) and pull out the needle roller bearing with two hooks.



Separate the inner race of the needle roller bearing from the crownwheel hub.

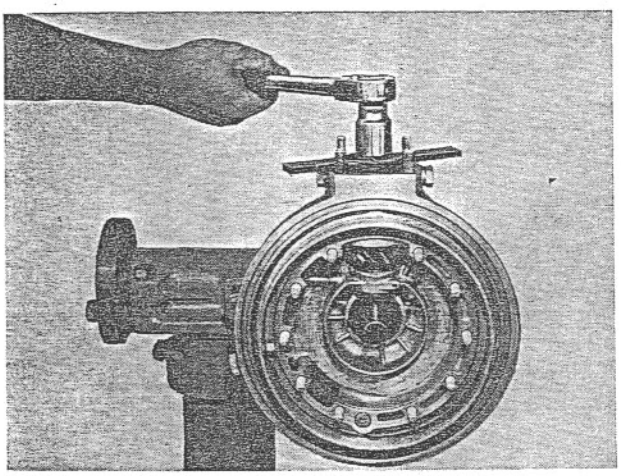
When installing: heat the needle roller bearing inner race to approx. 80° C (176° F).





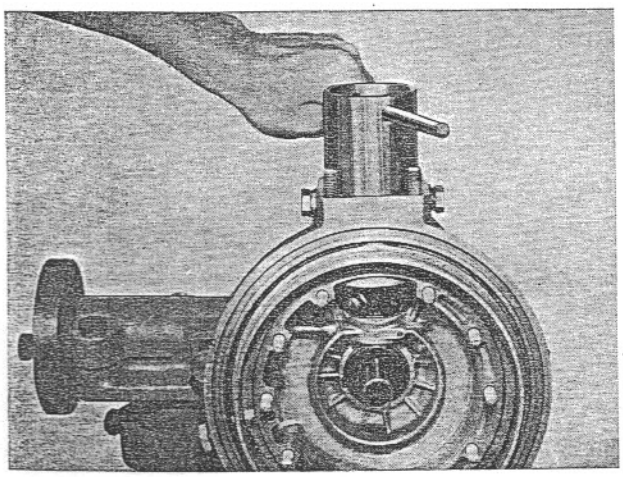
Remove the shaft sealing ring from the propeller shaft housing with a hook.

When installing: insert the new shaft sealing ring with BMW drift 33 1 880 and handle BMW 00 5 500.



Place the propeller shaft pinion holding tool BMW 33 1 650 on the coupling hub and unscrew the nut from the pinion with a socket wrench. Remove the nut, washer, plastic ring and coupling hub.

When installing: secure the nut with "Loctite 74 red". For tightening torque of drive pinion nut, see Specifications.
The thread must be dry and free from grease.



Remove the threaded ring with shaft sealing ring using BMW pin wrench 33 1 700. Take off the spacer ring and washer.

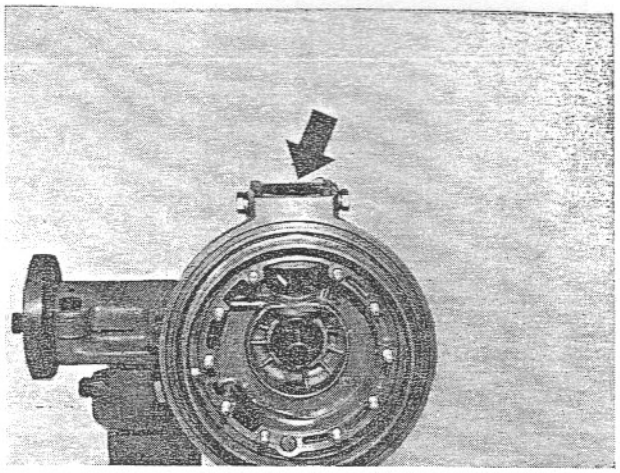
When installing: coat both sides of the spacer ring with sealant to prevent leakage of oil from the swinging arm.



Remove the shaft sealing ring from the threaded ring.

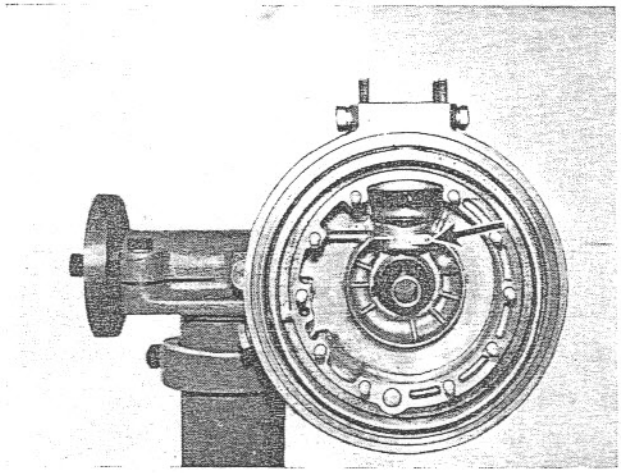
When installing: insert the new shaft sealing ring with BMW drift 33 1 750 and handle 00 5 500.

Heat the housing to approx. 120° C (248° F) with a „Thermochrome" pin. Pull out the pinion (arrow) with ball thrust bearing.



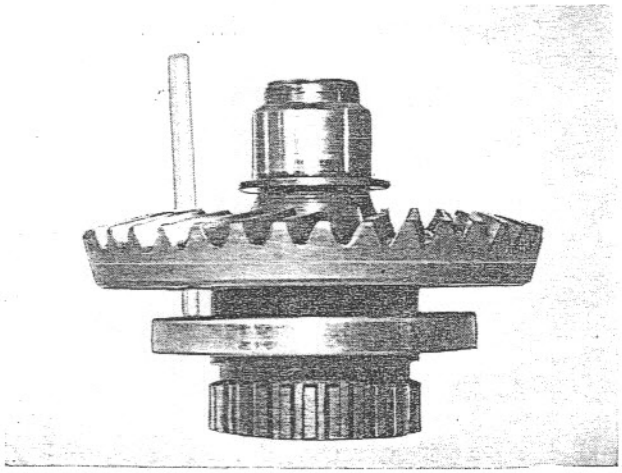
Renew the needle roller bearing in the propeller shaft housing for the pinion.
Take out screw (arrow).
Heat housing to approx. 100° C (212° F) and extract pinion needle roller bearing with "Kukko" 21/3 internal puller.

When installing: heat housing to approx. 100° C (212° F) and drive in needle roller bearing for pinion with a suitable drift.



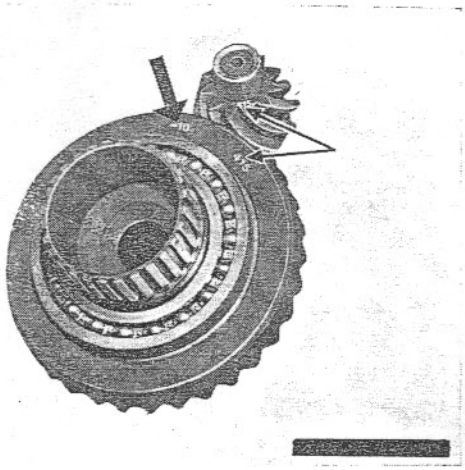
Strike the deep-groove ball bearing on the crownwheel uniformly with a soft metal drift through the holes provided in the crownwheel to drive it out.

When installing: heat the ball bearing to approx. 100° C (212° F).



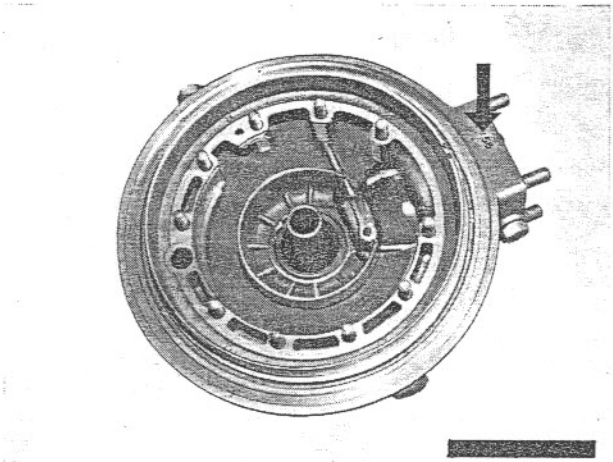
33 12 051 Input bevel pinion with crownwheel – renewing

Strip and assemble the rear wheel drive – 33 10 113.
The pinion and crownwheel form a complete set and must not be renewed separately. Note identification number (arrow).



The identification number confirms that the pinion and crownwheel belong to a set. When these components are run on the test bench, the basic dimensions and tolerances determined there ensure quiet running and correct tooth backlash.

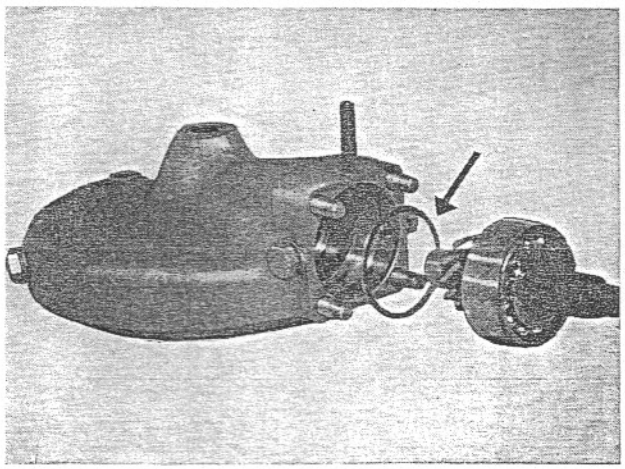
The basic dimension in the housing is 75.50 ± 0.05 mm (2.972 ± 0.002 in), measured from the shoulder of the ball thrust bearing at the pinion to the center line of the crownwheel axis.



The basic dimension is not stamped on the housing. If the housing differs from this dimension, the two decimal places (in mm) are stamped on the inside (arrow).

The basic pinion dimension is 77.50 mm (3.051 in). Any deviation from this dimension is shown with the corresponding sign (plus or minus) on the crownwheel (see arrow in illustration above).

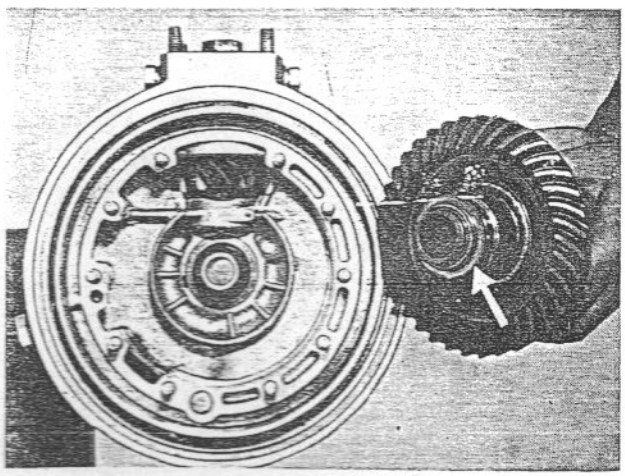
The housing dimension must be deducted from the basic pinion dimension, plus or minus the deviation shown on the crownwheel. The difference indicates the shim washer thickness needed (arrow) between the shoulder of the ball thrust bearing and the bottom of the seat in the housing.

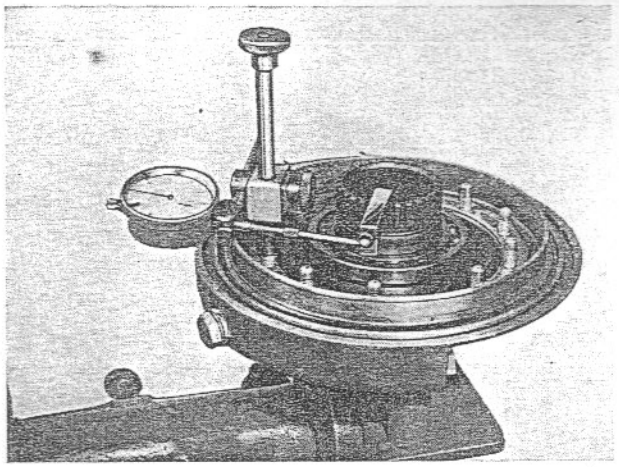


If no deviation is shown on the crownwheel and no dimension on the housing, this indicates that both housing and pinion have been manufactured to the specified basic dimensions.

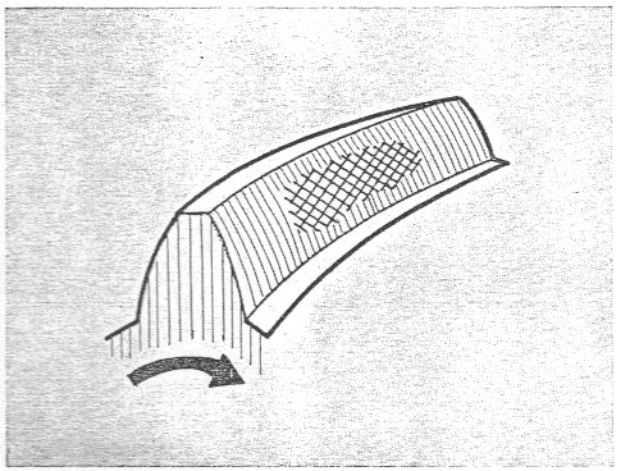
In this case the shim thickness necessary is 77.50 −75.50 mm = 2 mm (0.08 in).

Tooth backlash is adjusted by inserting a bronze thrust ring (arrow) between the shoulder on the needle roller bearing race at the crownwheel and the wide contact face of the outer needle roller bearing race. The actual thickness of the bronze thrust ring, which determines tooth backlash, can then be determined as described below.

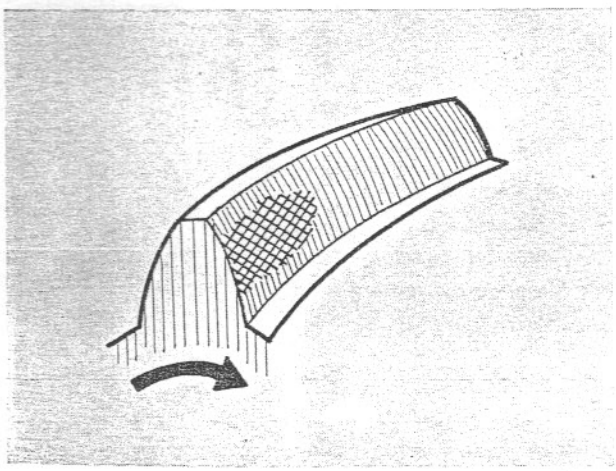




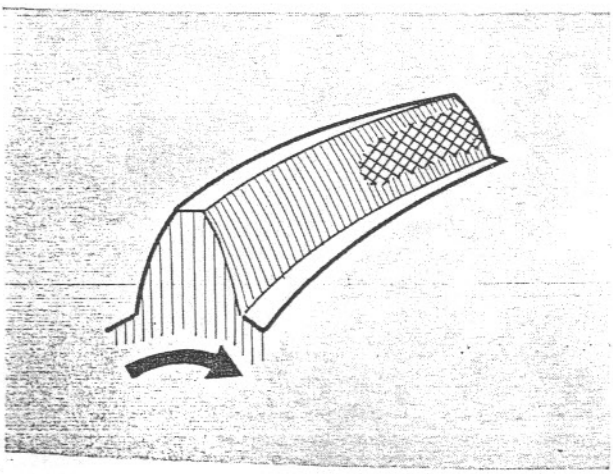
Using a dial gauge and BMW fixture 33 1 630 with clamp 00 2 500, measure tooth contact and tooth backlash (see Specifications) at the outer edge of the crownwheel.



Apply engineer's blue to the front flank of the pinion, and check the tooth contact pattern. The correct contact point on the front flank of the pinion teeth is in the center of the tooth, slightly nearer to the thicker end of the tooth.

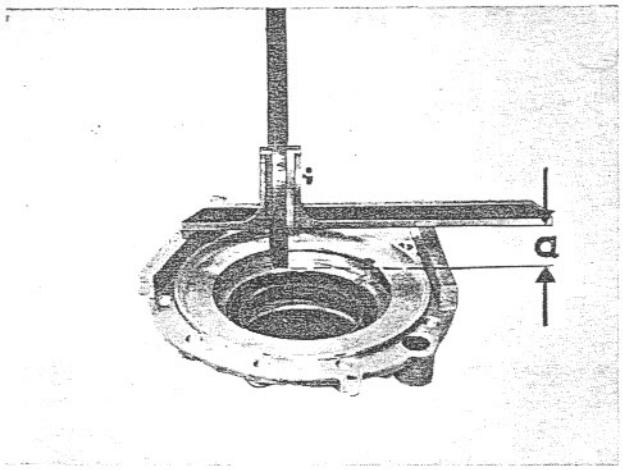


If the contact point is too close to the thick end of the tooth on the front flank of the pinion teeth, increase the distance between the pinion and the crownwheel center line by inserting thicker shims, and correct clearance by using a thinner bronze spacing washer between the inner needle roller race and the outer needle roller race on the crownwheel.

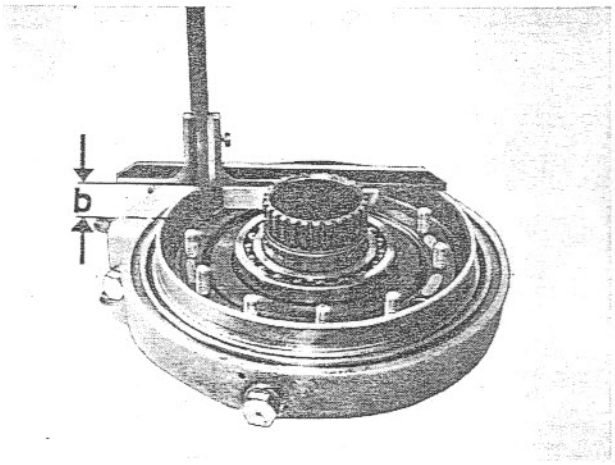


If the contact point is too near the thin end of the teeth, reduce the distance of the pinion from the crownwheel center line by using a thinner shim at the ball bearing outer race, and correct clearance with a thicker bronze spacing washer at the needle roller bearing. Finally, check the tooth contact pattern again. Always heat the housing before removing and installing the pinion to ensure correct bearing contact pressure.

Next, adjust lateral play at crownwheel. This is done by measuring distance (a) from the bottom of the deep-groove ball bearing seat to the cover joint face with a depth gauge and measuring adaptors if necessary.



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.



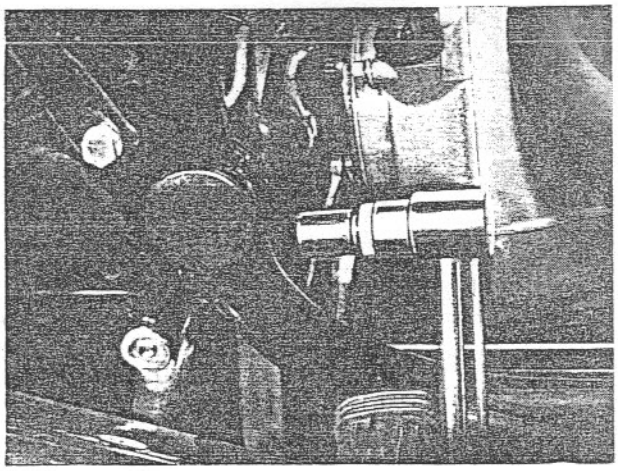
33 17 350 Rear swinging arm – removing and installing

Remove and install rear wheel – 36 30 320.

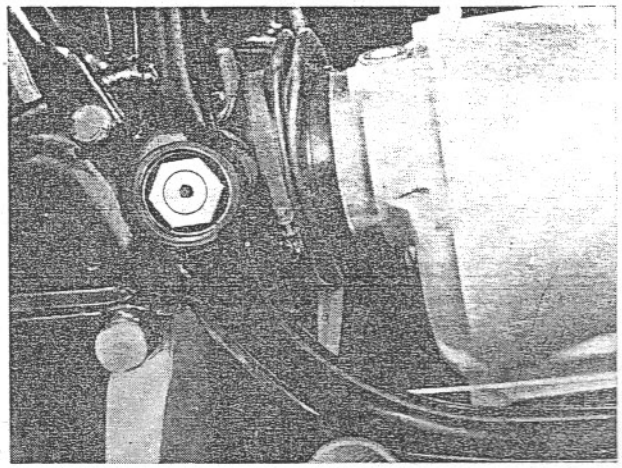
Remove and install rear wheel drive – 33 10 050.

Detach the lower left spring strut mounting.

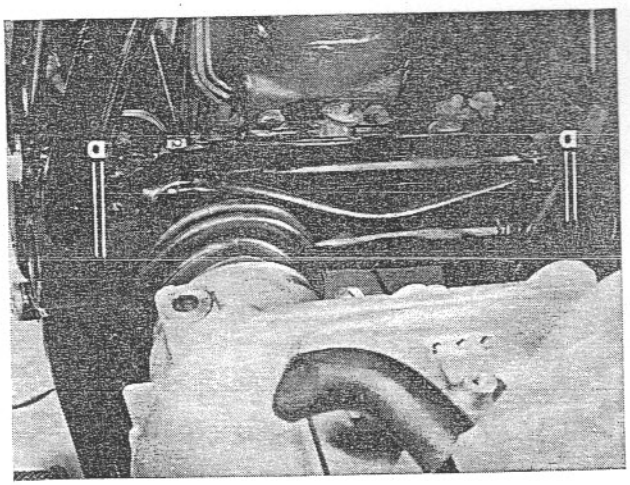
Detach the rubber sleeve between the gearbox and swinging arm at the gearbox end, and push back as far as possible. Remove the four connecting bolts from the universal joint with a ring spanner and set aside complete with spring washers. When installing, tighten these bolts with the special BMW ring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



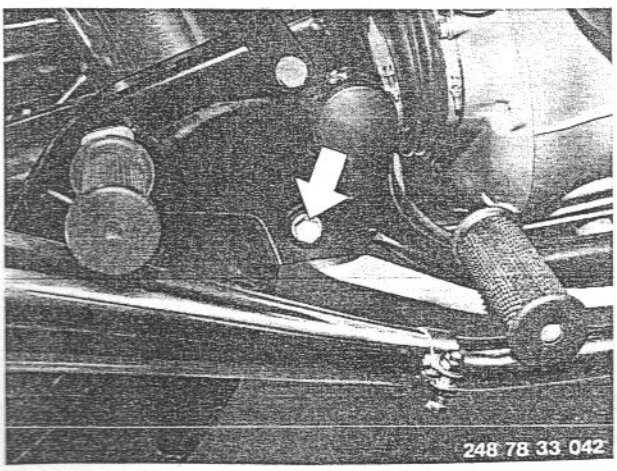
Remove the right and left swinging arm bearings.
Take off the end caps and loosen the locknut. Unscrew the swinging arm pivot journals.

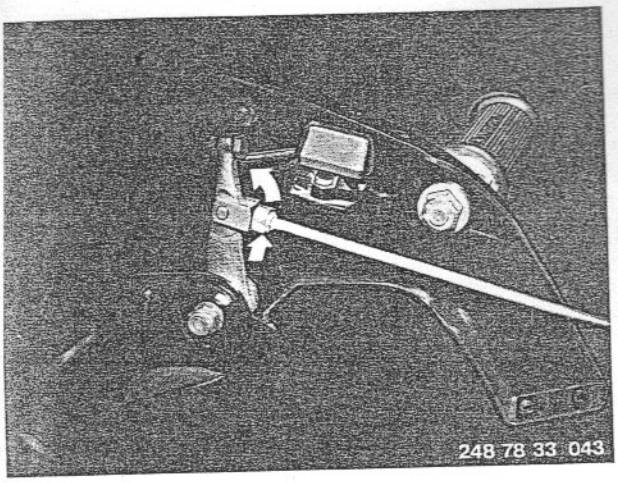


When installing: screw the pivot journals in so that there is the same gap (a) at left and right between the swinging arm pivot hub and the frame. The propeller shaft must be in the center of the swinging arm tube so that it does not strike the tube when the suspension is fully compressed or extended. If necessary, distances (a) may differ slightly. Next, preload the bearing journal on one side by approx. 1/8 additional turn after previously screwing in fully. Lock the bearing journal nuts on both sides and press in the end caps.
There must be no play in the taper roller bearings, but the preload must not be too great either.



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





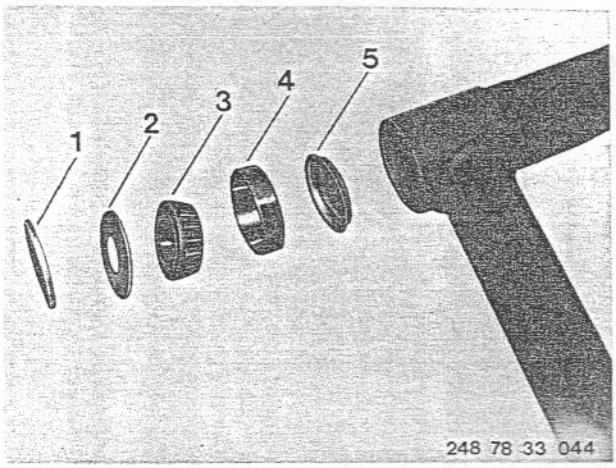
Press safety clamp (arrow) upwards and remove pin.

33 17 381 Rear swinging arm taper roller bearings – renewing

Remove and install the rear swinging arm – 33 17 350.

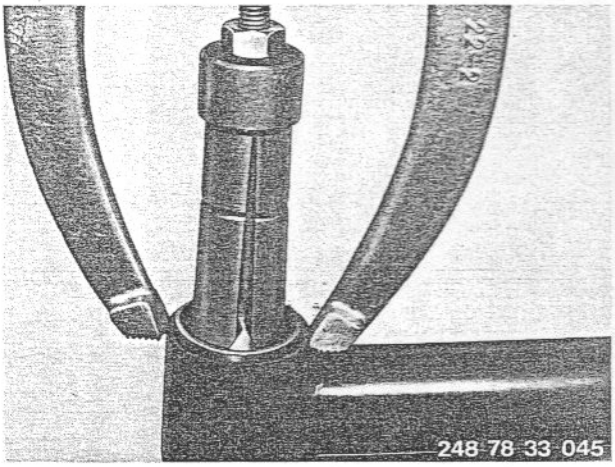
Remove and install the propeller shaft – 26 11 000.

1 Thrust ring
2 Protective cap
3 Taper roller bearing
4 Bearing shell
5 End cap



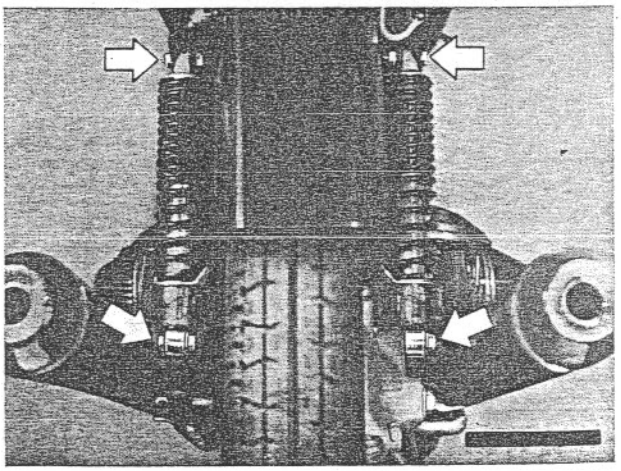
Remove the thrust ring, protective cap and taper roller bearing from the swinging arm together.
Extract the outer bearing race with "Kukko" internal puller, BMW 00 8 551.
Drive in the bearing shell with BMW drift 00 5 550.

When installing:
Clean the taper roller bearings and grease thoroughly.



33 52 120 Spring strut – removing and installing

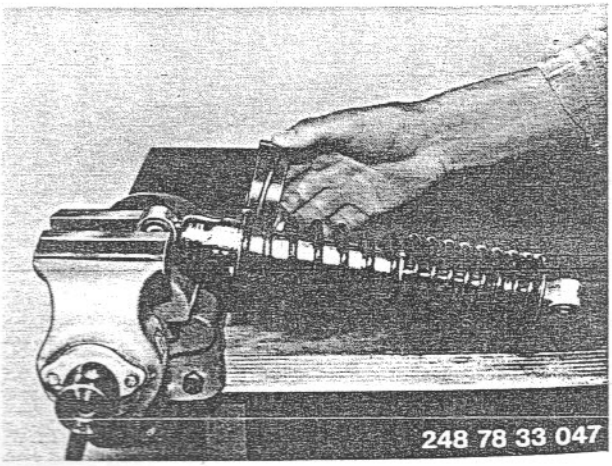
Unscrew the hex. nuts with washers and take out the upper bolt. On the left damper, press the motorcycle down before removing the lower bolt.



33 53 580 Coil spring – removing and installing

Remove and install spring strut – 33 52 120.

Clamp the upper spring strut mounting eye in a vise and set the rate adjuster handle to the solo riding position. Insert BMW clamp 33 5 610 at the upper end of the spring.



Mount the tension plate of the fixture to the clamp, using the spring end plate as a reaction mount. Move the lever on the fixture down until it is heard to lock. Use an open-ended wrench on the two flats of the damper rod to unscrew it from the upper spring strut eye. For tightening torque, see Specifications.

When installing: note correct sequence of components. Do not press the rubber/metal bearings out of the spring strut eyes unless absolutely necessary.

Before assembly, check spring length and spring rating (see Specifications). The damper moves more slowly in tension than in compression, but both movements must be smooth and uniform. When fully compressed, not more than 500 g (1.1 lb.f) must be exerted on the damper or else internal damage will result.

If both tension and compression movements require too little force, or the damper moves jerkily, it must have developed a leak and should be discarded in favor of a new unit.

34 Brakes

Specifications		Page 34– 0/3
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

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) Max. oversize after wear mm (in)	200 (7.87) 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)

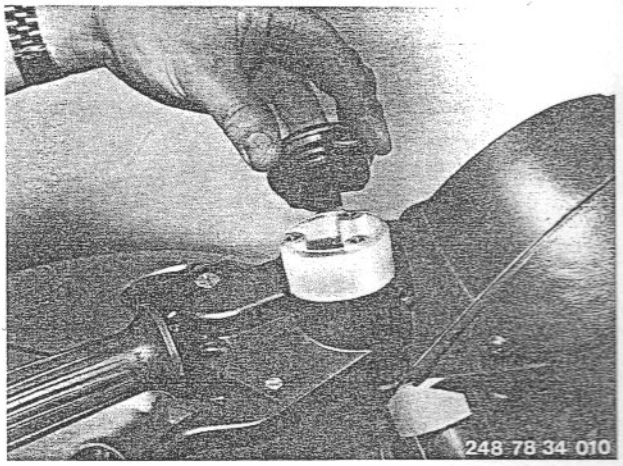
Brake pipe to master cylinder	8+3 (5.9 + 2.2)
Brake pipe to brake caliper	8+3 (5.9 + 2.2)

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.

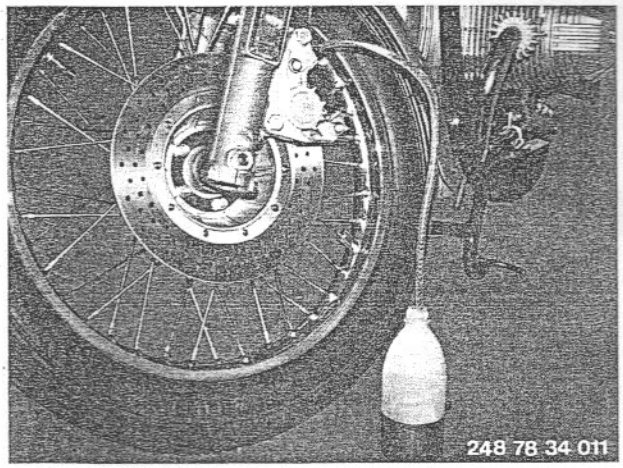


Apply the hand brake lever several times until brake pressure builds up.

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.

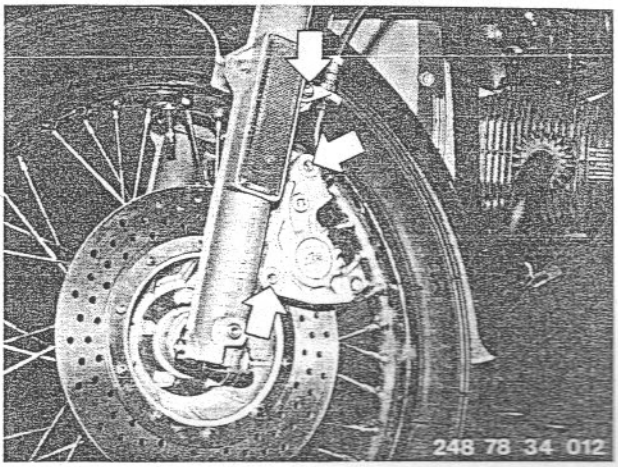
Repeat this operation until the brake fluid emerges from the bleed screw free from air bubbles. Then tighten the bleed screw again.

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

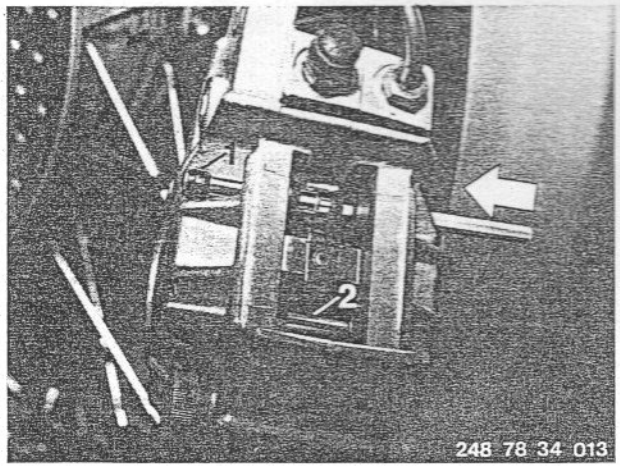


34 11 000 Front brake pads – removing and installing

Remove the two hex. bolts holding the brake caliper and the brake hose holder (arrows).
Lift out the protective cap with a screwdriver.

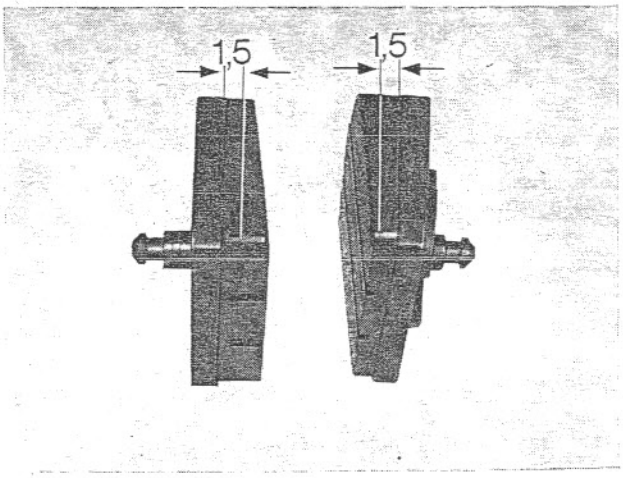


Drive out the locking pins (1) and (2) from the right (arrow) and allow the brake pads to drop out.



To prevent score marks on the brake disk, the brake pads must be renewed in good time. Minimum pad thickness is 1.5 mm (0.06 in).

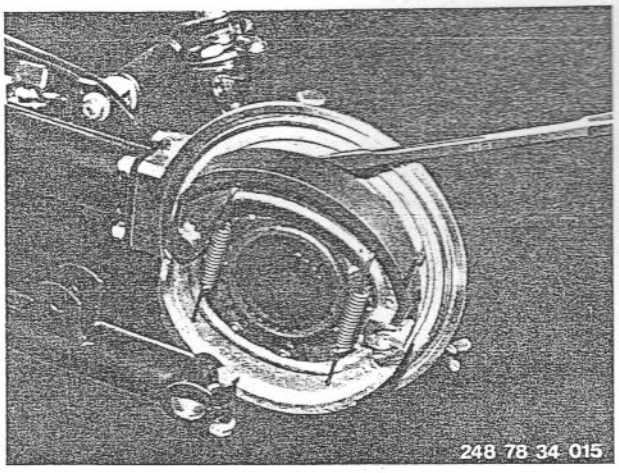
When installing:
Before inserting the new pads, push back the brake cylinder piston with a screw clamp.



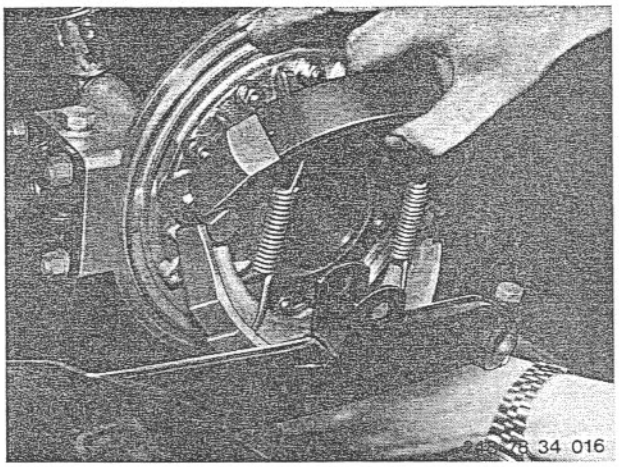
34 21 150 Rear brake shoes – removing and installing

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.

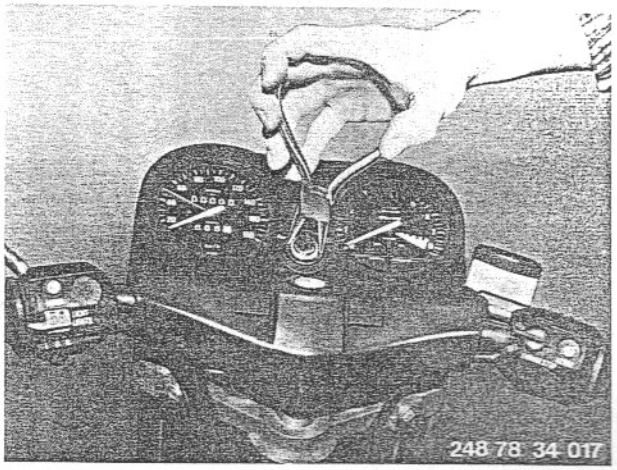


When installing:
Connect the brake shoes together with the tension springs and press both shoes at the same time on to the brake backplate and brake actuating mechanism.

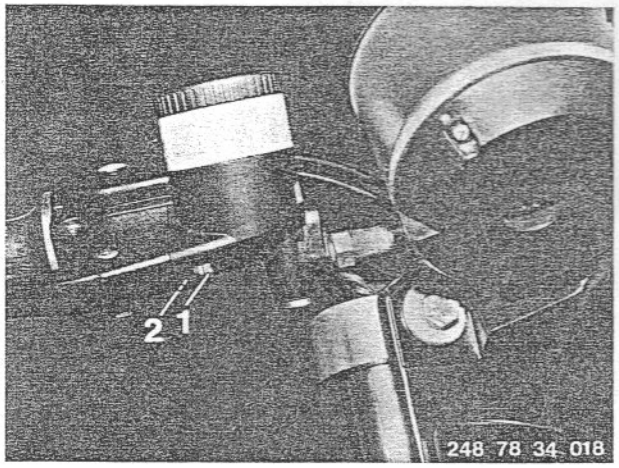


34 31 000 Brake master cylinder – removing and installing

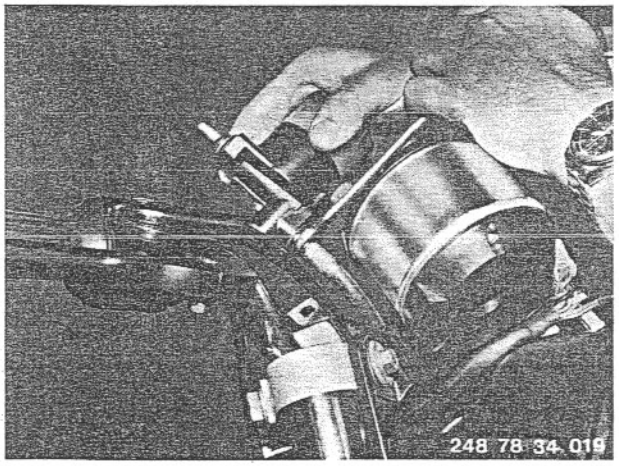
Detach the instrument surround after removing the two Phillips-head screws and unscrewing the threaded ring from the ignition switch with Seeger circlip pliers.
Pull the turn indicator repeater lamp bulb holders out of the instrument surround and lift off the surround.



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.



35 Pedals

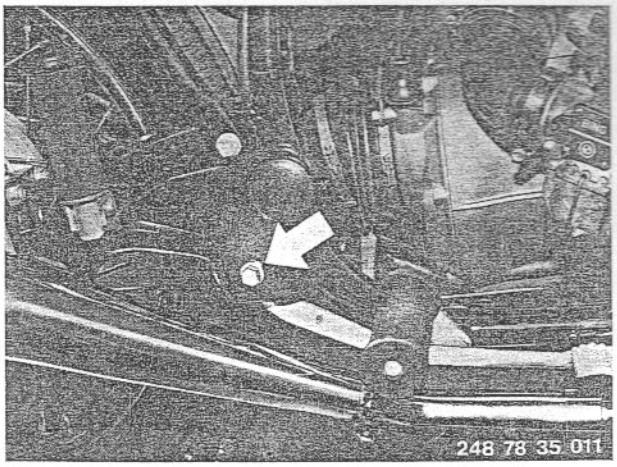
35 31 000 Brake pedal – removing and installing 35–21/1

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 tires

Specifications		Page 36– 0/1
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	36–31/2
36 31 371	Wheel bearings for one road wheel – renewing (front or rear)	36–31/2

Specifications

Wheels and tires

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) Rear at 2.0 bar (28.5 lb/in^2) tire pressure kg (lb)		160 (353) 245 (540)	
Permissible wheel loads, two-up Front at 2.0 bar (28.5 lb/in^2) tire pressure kg (lb) Rear at 2.25 bar (32 lb/in^2) tire pressure kg (lb)		178 (392) 270 (595)	

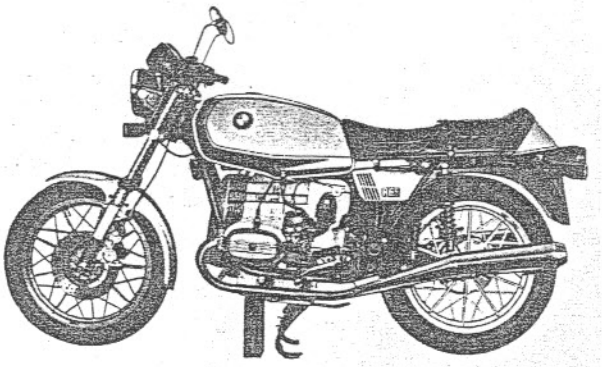
Tightening torques Nm (lb. ft) + friction values Nm

Friction moment in wheel bearings at specified wheel nut tightening torque	Ncm	15 . . . 30
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.

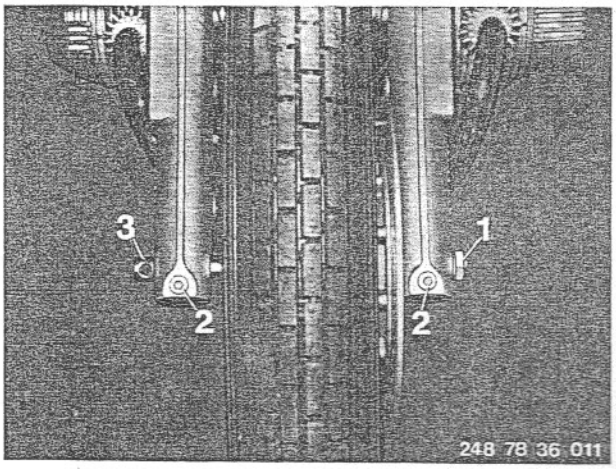
36 30 300 Front wheel – removing and installing

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



248 78 36 010

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.

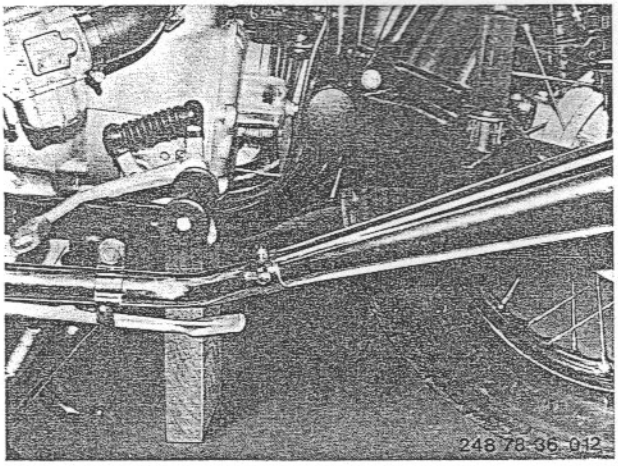


248 78 36 011

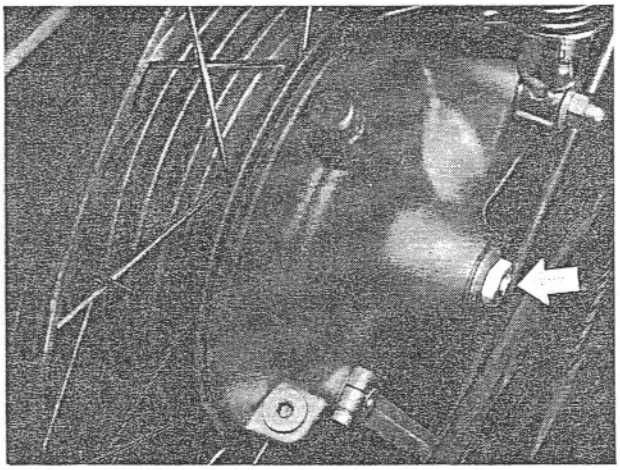
When installing: grease the front axle lightly, insert and tighten the axle nut first, using a mandrel to prevent the axle from turning if necessary. Next compress the front fork firmly several times, then tighten the clamp bolts. This procedure will prevent stresses from being trapped in the fork slider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

Remove the front wheel forwards.

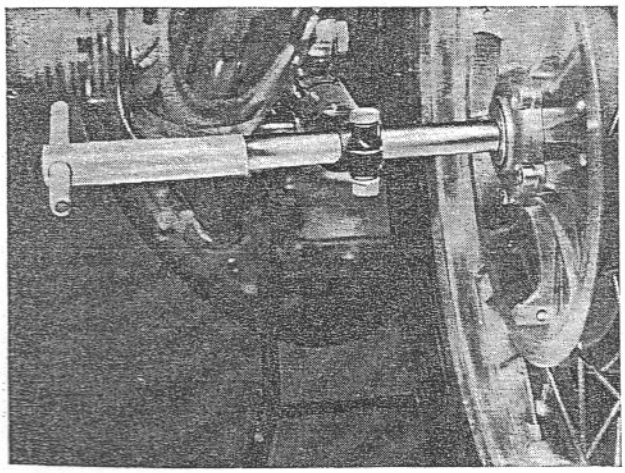
36 30 320 Rear wheel – removing and installing



Place the motorcycle on its center stand and on additional blocks.



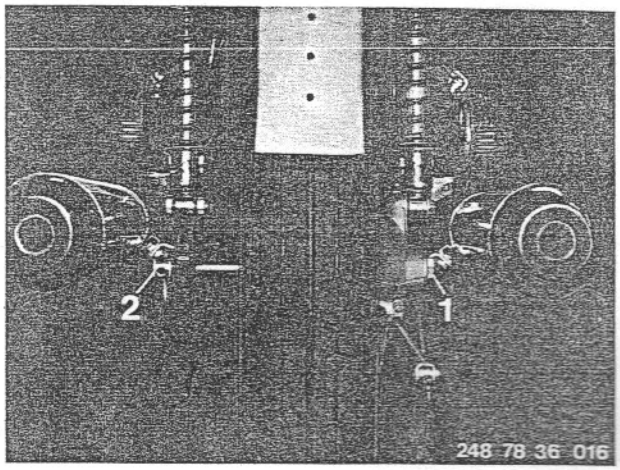
Unscrew the quick-release axle nut on the drive side and take off complete with washer.



Loosen the nut for the quick-release axle clamp bolt on the left swinging arm. Pull out the axle with mandrel.

Pull the wheel away from the drive assembly and take it out, tilting the motorcycle slightly to the right at the same time.

When installing: clean the axle and splines thoroughly and coat lightly with a high-viscosity grease. Turn the axle while inserting. After tightening the axle nut (1), compress the rear suspension before tightening clamp bolt (2).
The lateral hole in the axle end must point to the rear (arrow).



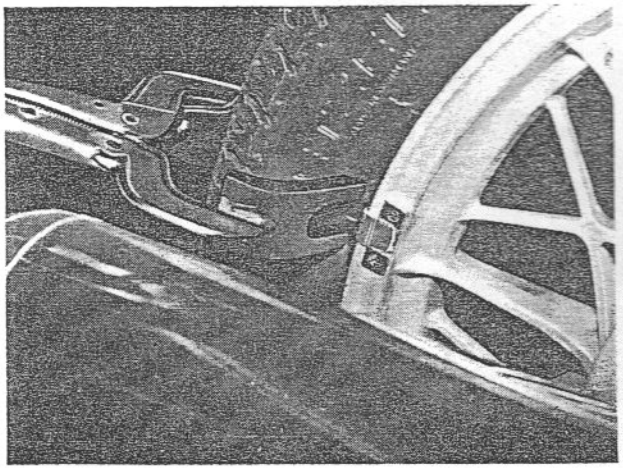
36 30 028 Road wheels – static balancing

Attach the wheel to BMW fixture 36 3 600, tighten and allow the wheel to come to a halt. If correctly balanced, the wheel should not always come to a halt at the same point. For maximum road wheel imbalance, see Specifications.

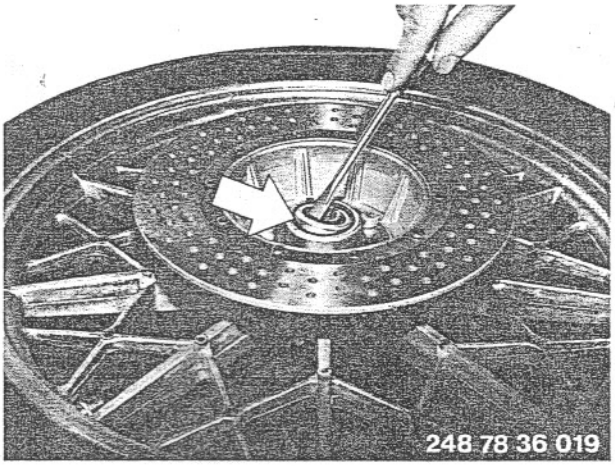
The balance weights for cast-alloy wheels are installed with the aid of special BMW pliers 36 3 880.

Apply the tool as close as possible to the rim, press together and push on the retaining clip for the weight.

Note: The extra weight needed for wheel balancing must be distributed equally between the left and right sides of the rim at the correct point.



36 31 371 One set of wheel bearings (front or rear) — removing and installing

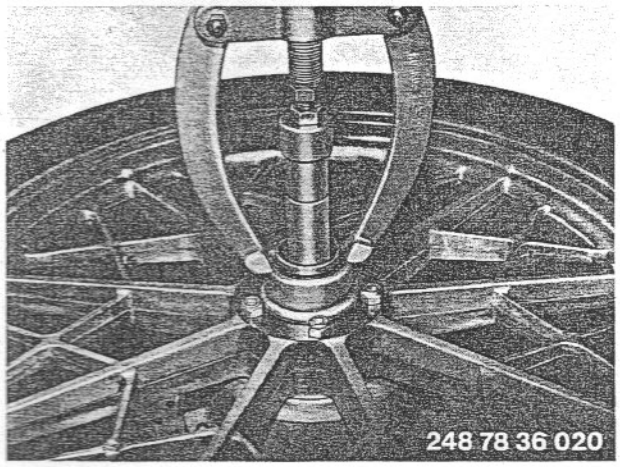


Remove and install front wheel – 36 30 300.

Remove and install rear wheel – 36 30 320.

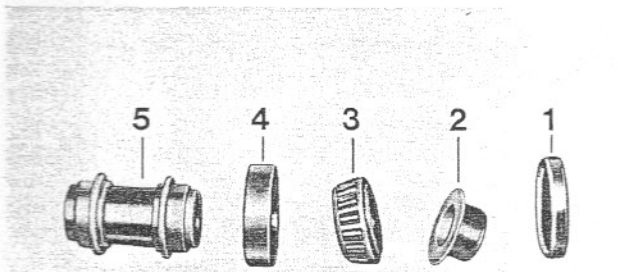
Lift out the sealing ring with a screwdriver (arrow).
Remove the pressure pad and taper roller bearing.

When installing: press the sealing ring fully in until flush.



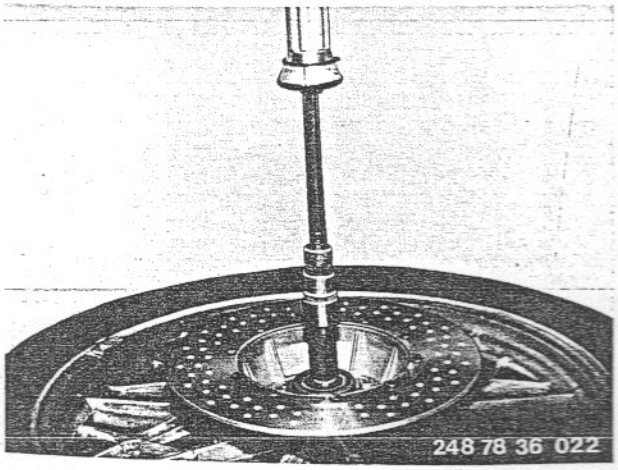
Extract the bearing shell from the hub with "Kukko" puller, BMW 00 8 551.

When installing: heat the hub to approx. 80° C (176° F) and drive in the bearing shell with BMW drift 00 5 550.



24878 36 021

1 Sealing ring
2 Pressure pad
3 Taper roller bearing
4 Bearing shell
5 Spacer



Insert the quick-release axle through the wheel hub and preload with the 50 mm (2 in) spacing sleeve (arrow) and the axle nut bearing.
Attach the friction tester with adapter and socket head insert to the axle nut, and check bearing friction rating. For friction value and tightening torque, see Specifications.

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

46 Frame

Specifications . . . . . Page 46– 0/3
46 52 000 Center stand – removing and installing 46–52/1
46 53 000 Side (prop) stand – removing and installing 46–52/2
46 61 000 Front mudguard – removing and installing 46–61/1
46 62 000 Rear mudguard – removing and installing 46–61/2

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		

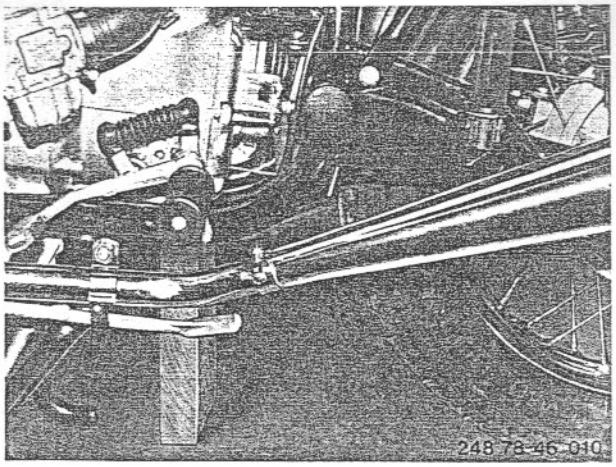
Tightening torques Nm (lb. ft)

Retaining bolts for rear frame section	25 (18.4)	Center stand retaining bolts	43 . . . 48 (32 . . . 35)

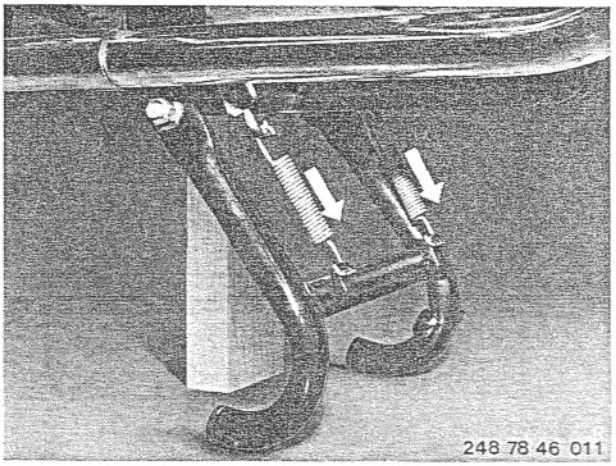
All other bolts and nuts are to be tightened as shown in the manufacturers' tables or in the latest BMW 60002.0 standards sheet.

46 52 000 Center stand – removing and installing

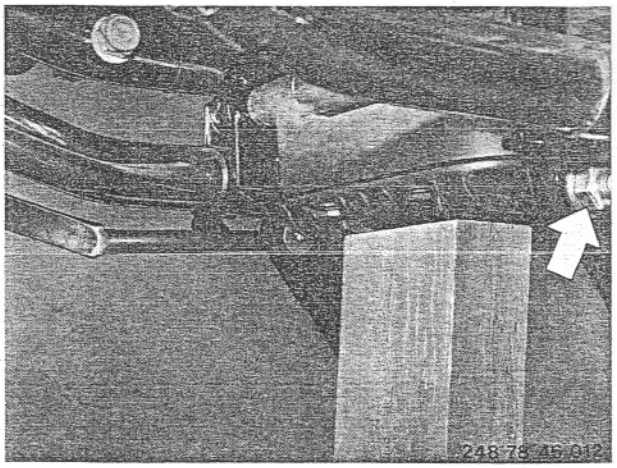
Prop the motorcycle under the oil pan until the center stand is clear of the ground.

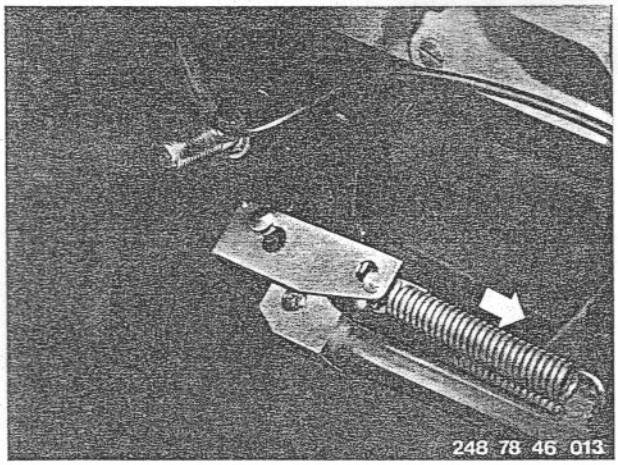


Pull the left and right tension springs down at the center stand (in direction of arrow) and disconnect.



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.

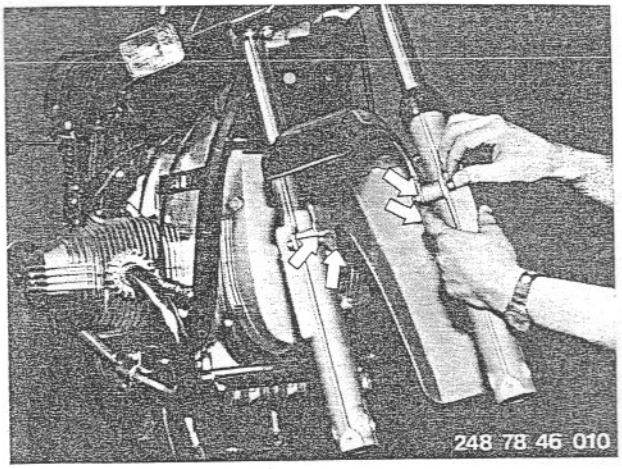
Push the stirrup forwards as shown by the arrow until the pin can be driven out of the bottom.

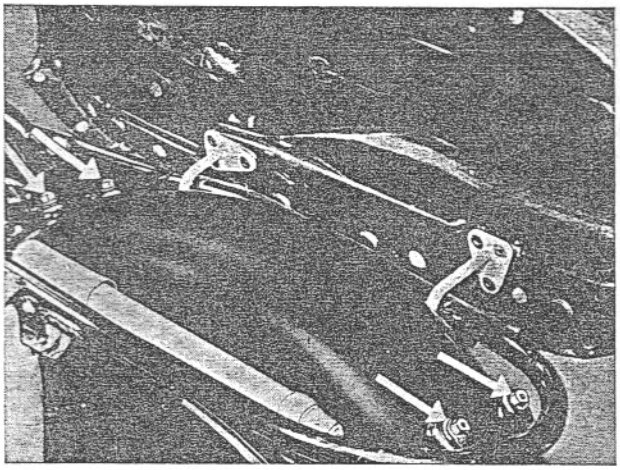
Press the pin out of the prop stand and take it off.

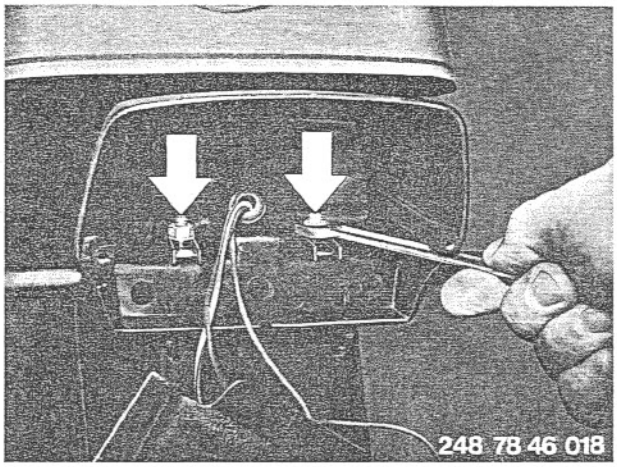
46 61 000 Front mudguard – removing and installing

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.







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).

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

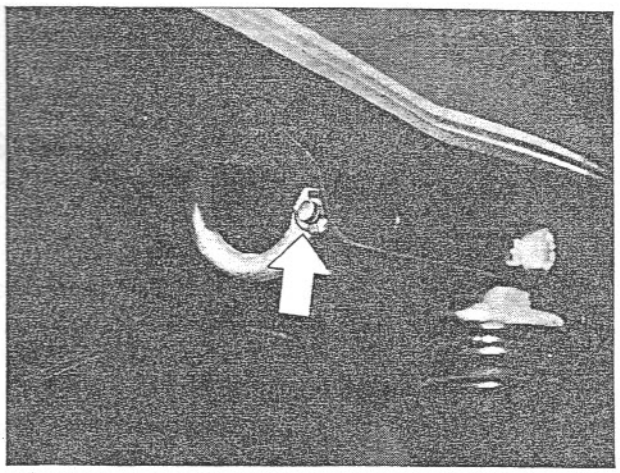
Remove the retaining bolts with washers and nuts (arrow) and the rear light housing with turn indicator holder from the mudguard.

52 Seats

52 53 000 Dualseat – detaching and attaching 52–53/1

52 53 000 Dualseat – detaching and attaching

Remove the keeper from the rear hinge (arrow), open the dual seat, pull to the rear and take off.

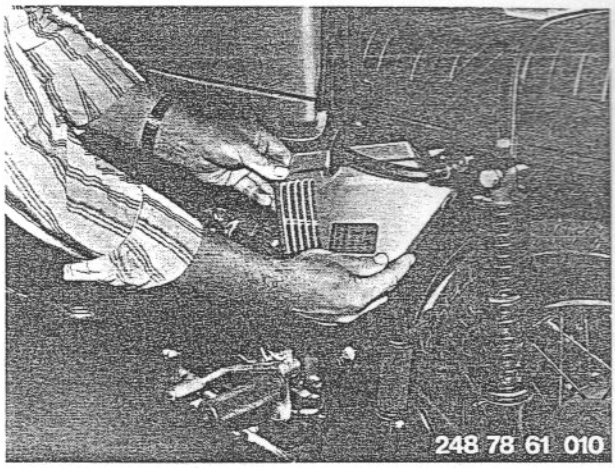


61 General electrical system

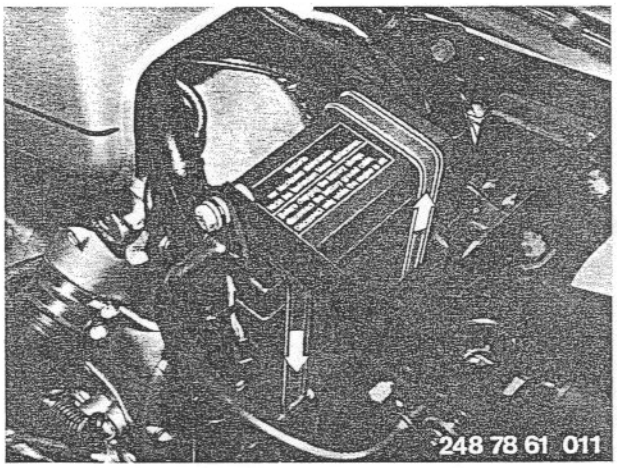
Specifications and circuit diagrams . . . . . Page 61– 0/3
61 21 010 Battery – removing and installing 61–21/1
61 21 100 Battery holder – removing and installing 61–21/2
61 31 350 Flasher unit – removing and installing 61–21/2
61 31 367 Buzzer – removing and installing 61–21/2
61 31 365 Buzzer relay – removing and installing 61–31/1
61 31 400 Starter relay – removing and installing 61–31/1
61 33 000 Horn – removing and installing 61–33/1

61 21 010 Battery – removing and installing

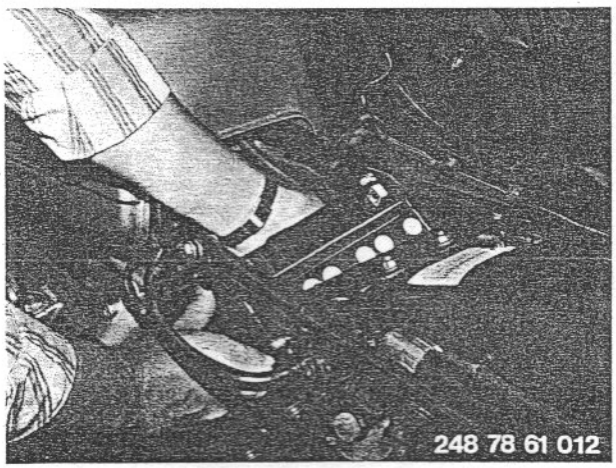
Take off the left and right battery covers, pulling out the front buffer catch first then the two rear catches. Pull the cover upwards at the same time.



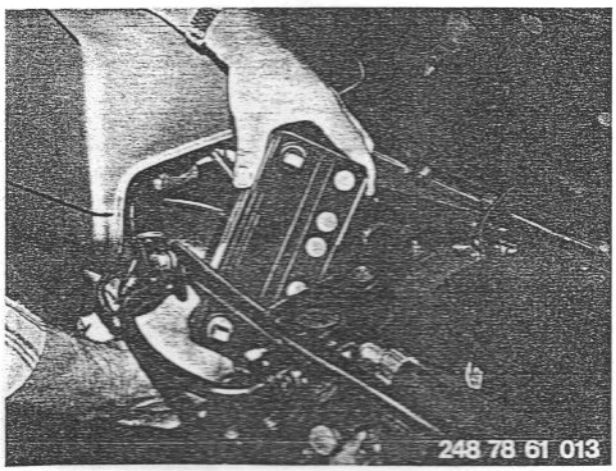
Pull the rubber retainer downwards at the left (arrow) and upwards at the right, and disconnect. Remove the cover and disconnect the leads from the battery.



Using the right hand, pull the battery to the rear and upwards at the left. Place the left hand under the battery. Turn the right side forwards and upwards and the left side to the rear and downwards. This will enable the position shown in the picture to be reached.



Tilt the battery fully over on to the left, narrow side and remove upwards.





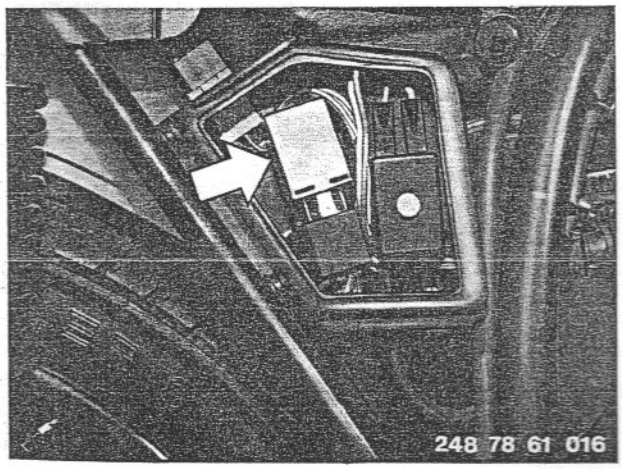
61 21 100 Battery holder – removing and installing

Remove and install the battery – 61 21 010.

Remove the hex. nuts at the left and right top of the battery holder (arrows).

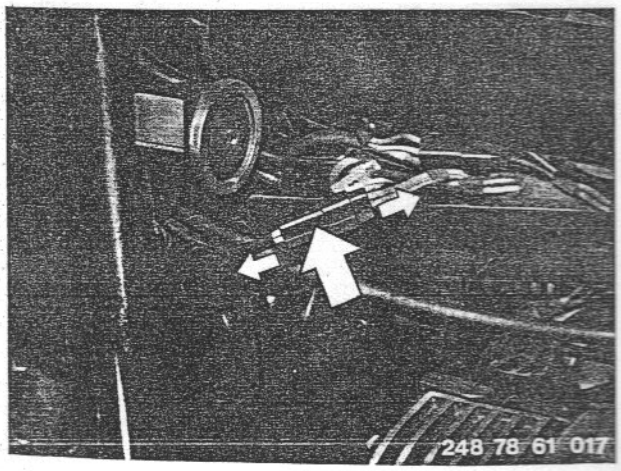


Remove the two hex. nuts holding the base (arrows).



61 31 350 Flasher unit – removing and installing

Disconnect the battery earth (ground) lead and take off the right battery cover. Grasp the flasher unit (arrow) with two fingers and pull out upwards.

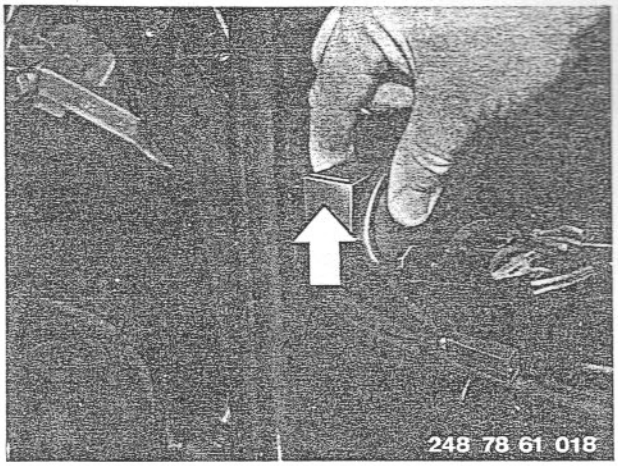


61 31 367 Buzzer – removing and installing

Remove and install the fuel tank – 16 11 030.

Separate the two-pin plug (arrow).

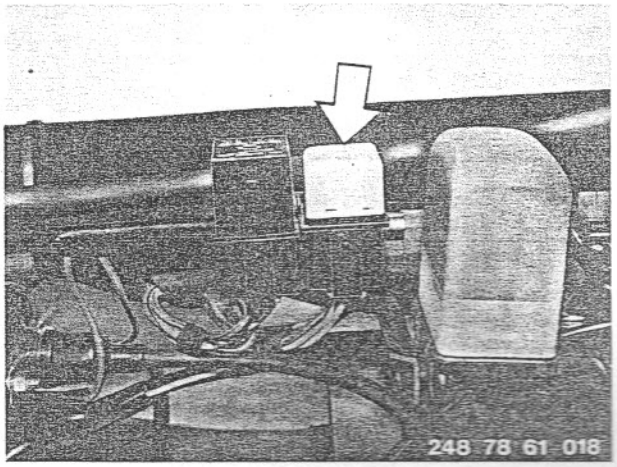
Pull the buzzer upwards and away from the retaining plate.



61 31 365 Buzzer relay — removing and installing

Remove and install the fuel tank – 16 11 030.

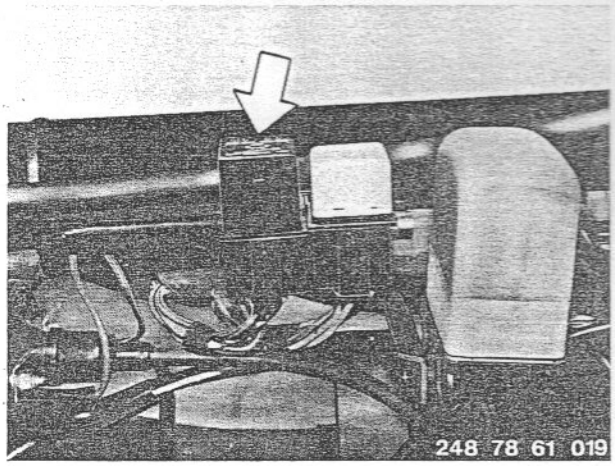
Pull the relay (arrow) away from the bracket.



61 31 400 Starter relay — removing and installing

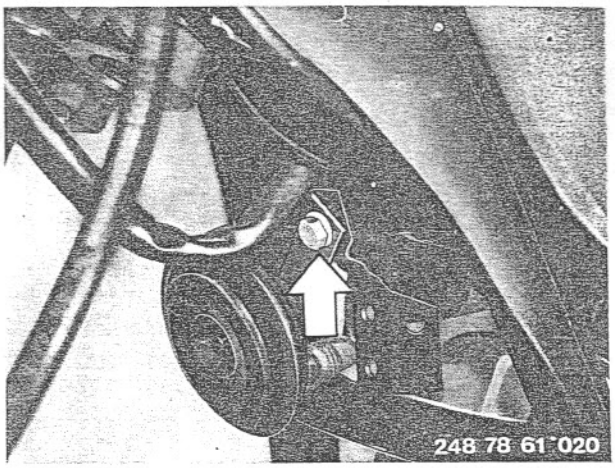
Remove and install the fuel tank – 16 11 030.

Pull the relay (arrow) away from the bracket.

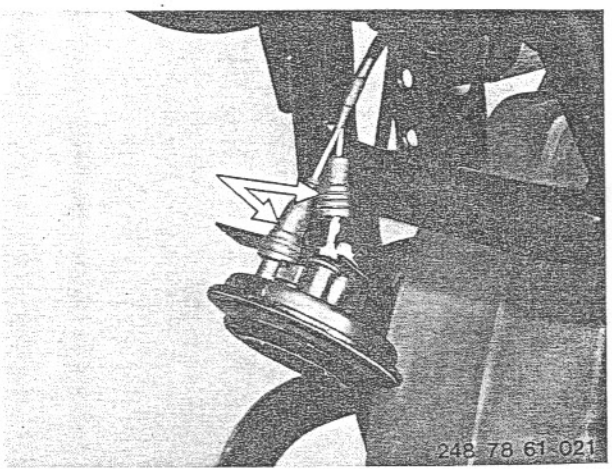


61 33 000 Horn – removing and installing

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.



62 Instruments

Specifications . . . . . Page 62– 0/3
62 12 000 Speedometer – removing and installing 62–12/1
62 12 020 Speedometer shaft – removing and installing 62–12/2
62 13 000 Revolution counter – removing and installing 62–13/1

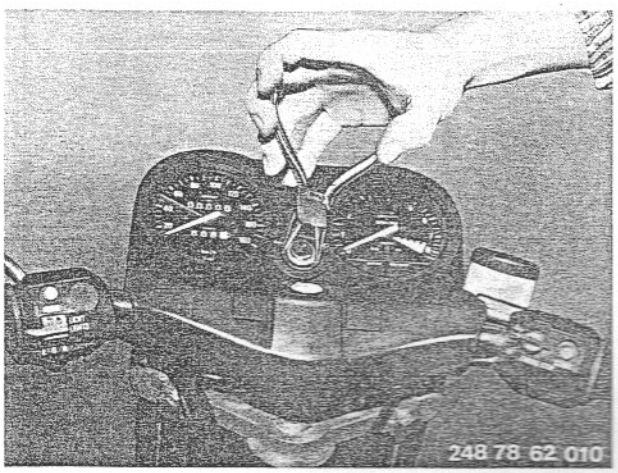
Instruments

Specifications

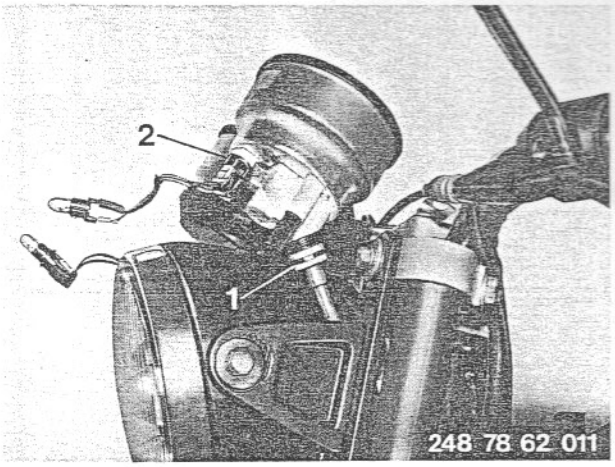
Model	R 45 (20 kW)	R 45 (26 kW)	R 65
Distance factor, km reading	0.978	0.895	0.93
Distance factor, mile reading	1.575	1.441	1.267
Scale range km/h	10 . . . 180		
Scale range mile/h	0 . . . 120		
Revolution counter min^{-1}	0 . . . 8500		

62 12 000 Speedometer — removing and installing

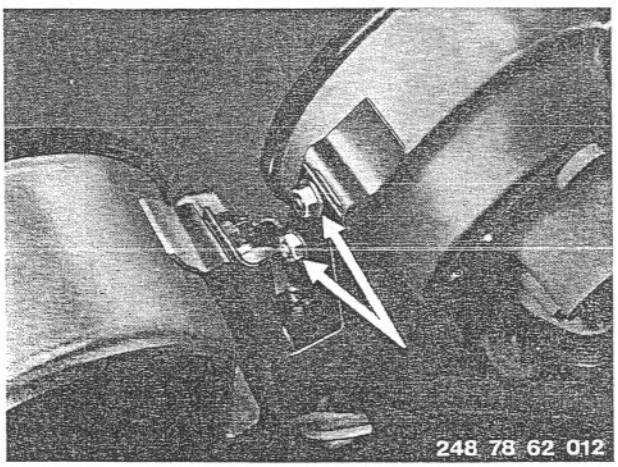
Remove the two Phillips head screws from the instrument surround. Unscrew the threaded ring holding the ignition switch with Seeger circlip pliers. Pull the turn indicator telltale lamp holders out of the surround. Take off the instrument surround.



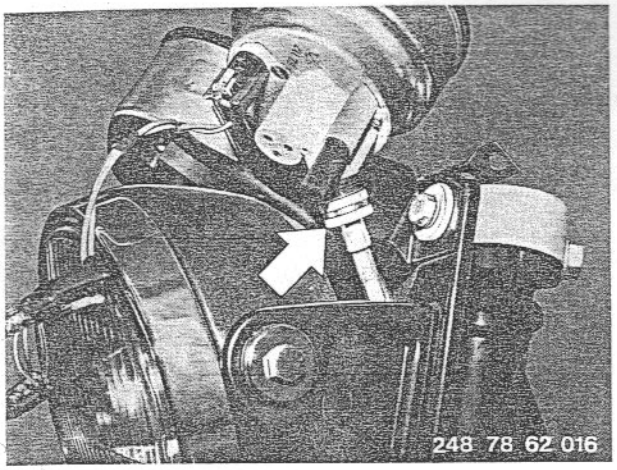
Disconnect the speedometer shaft (1) from the speedometer and pull out the holder (2) for the instrument lighting.



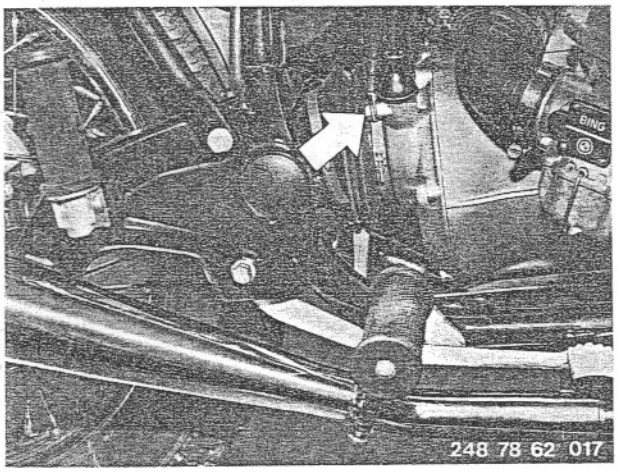
Unscrew the two hex. nuts (arrows) holding the speedometer, and take off the speedometer.



62 12 020 Speedometer shaft – removing and installing



Unscrew the knurled nut.

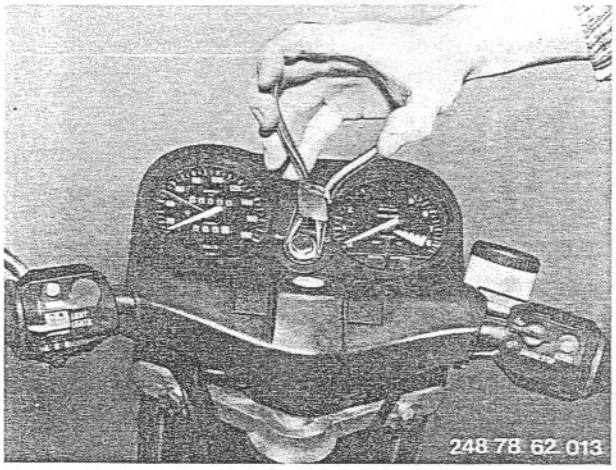


Push back the rubber cap for the speedometer drive at the gearbox. Remove the retaining bolts and take off the battery earth (ground) cable, then pull out speedometer drive shaft and remove complete with washer.

When installing:
Make sure that the drive shaft is run correctly along the frame.

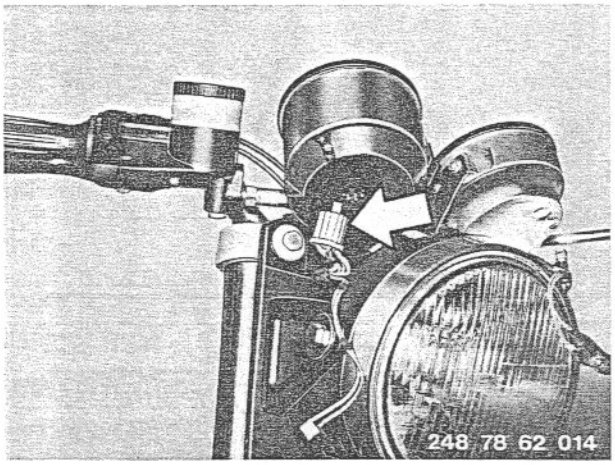
62 13 000 Revolution counter – removing and installing

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.

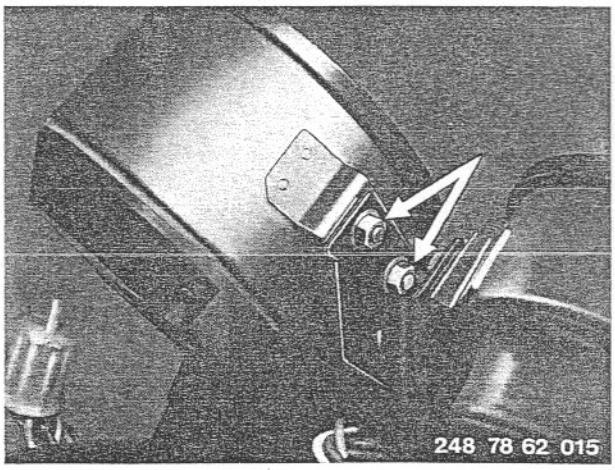


Pull the multi-pin plug away from the revolution counter.

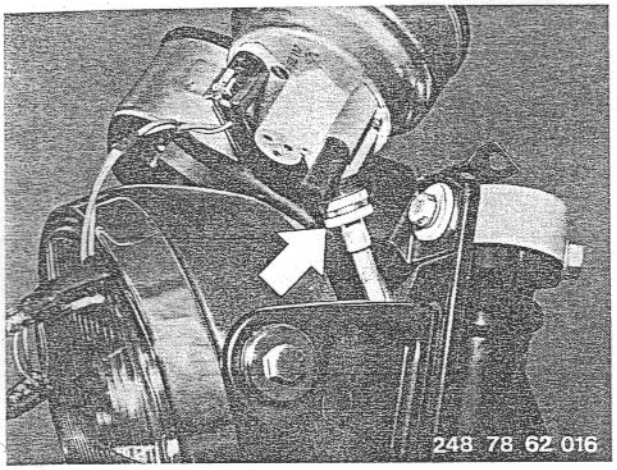
When installing:
Note the semi-circular pin.



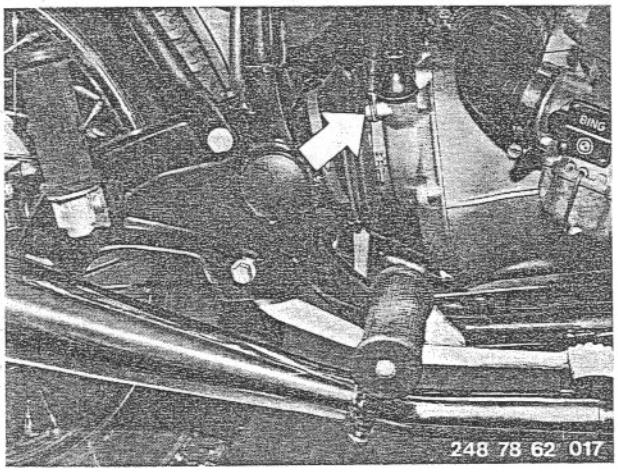
Remove the two hex. nuts holding the revolution counter and take off the revolution counter.



62 12 020 Speedometer shaft – removing and installing



Unscrew the knurled nut.



Push back the rubber cap for the speedometer drive at the gearbox. Remove the retaining bolts and take off the battery earth (ground) cable, then pull out speedometer drive shaft and remove complete with washer.

When installing:
Make sure that the drive shaft is run correctly along the frame.

63 Lights

Specifications		Page 63– 0/3
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

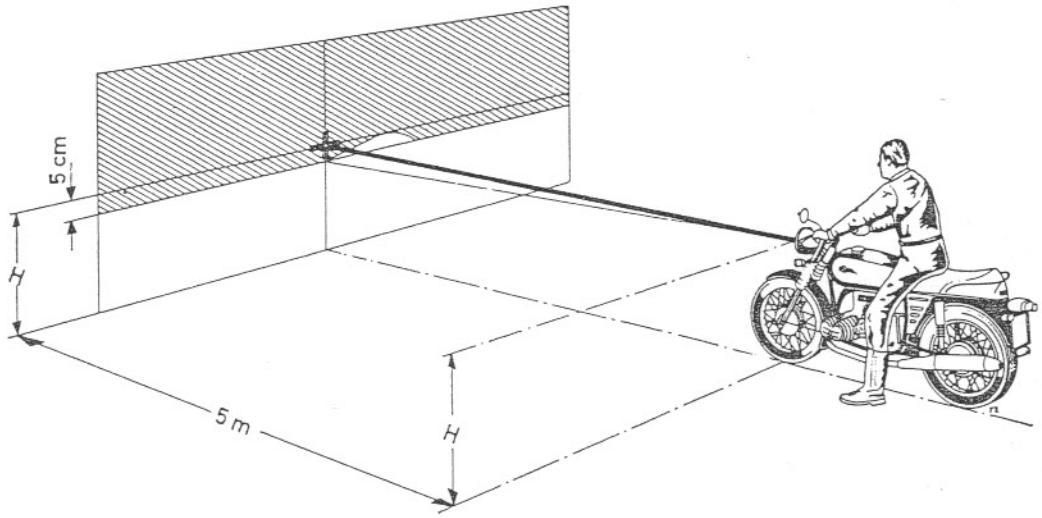
Specifications

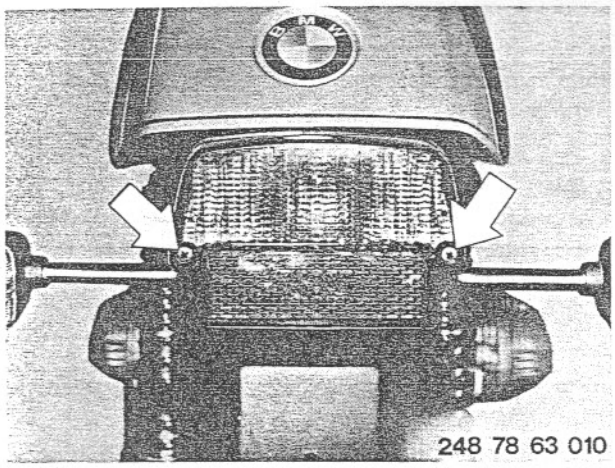
Model	R 45 (20 kW)	R 45 (26 kW)		R 65
Headlight type	Bosch Type 0 303 551 103			
High and low beams		12 V/60/55 W	H4 halogen bulb	
Parking light	T 8/4	12 V/4 W	Parking light bulb	
Neutral indicator (green)	W 10/3	12 V/3 W	Indicator light bulb	
Charge indicator (red)	W 5/1.2	12 V/1.2 W	Indicator light 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	

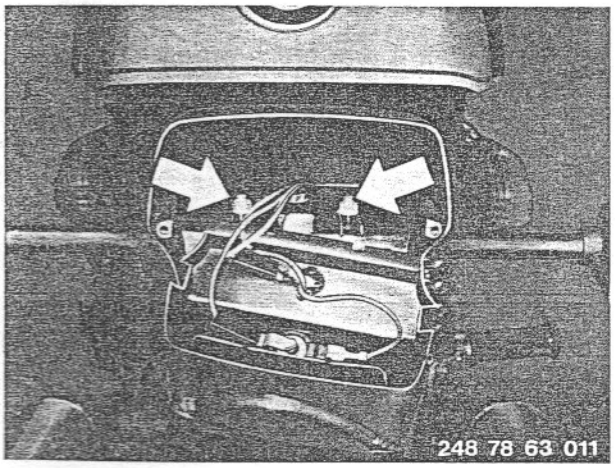
63 10 004 Headlight – beam setting

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 the 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 at the same height as the lower cross, and to the right of the lower cross rises gradually to the height of the upper cross before falling away again.







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.

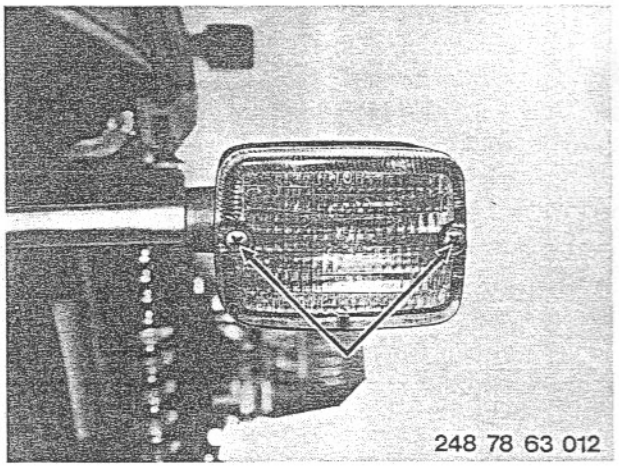
Remove the retaining bolts with washers and nuts and take off the housing.

When installing: make sure that the transparent window for the license plate light is at the bottom when the lens is installed.

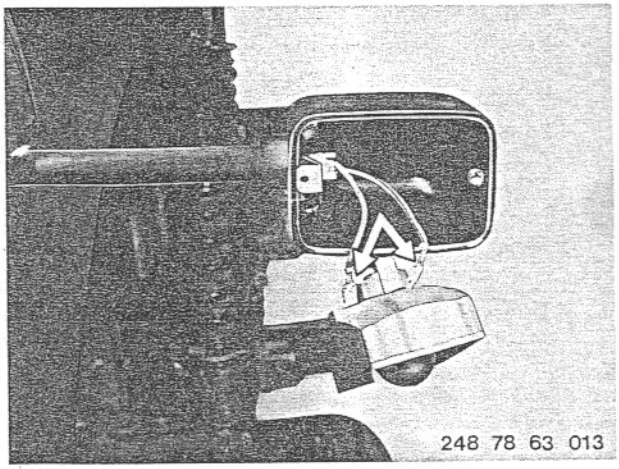
63 23 170 Both flashing turn indicators (front or rear) — removing and installing

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.

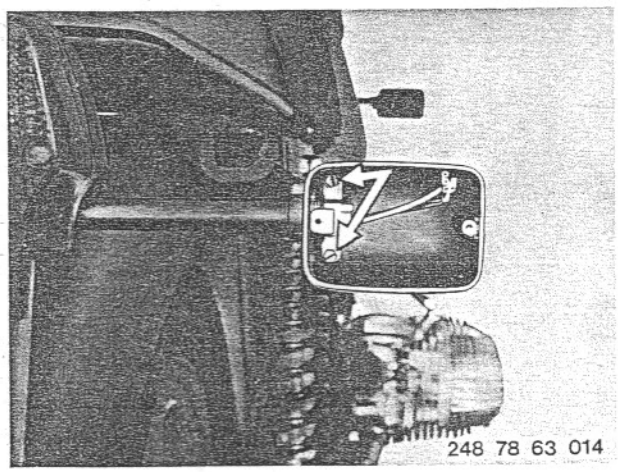
When installing: make sure the 'Top' marking on the lens is uppermost.



Disconnect the leads from the back of the bulb holder.

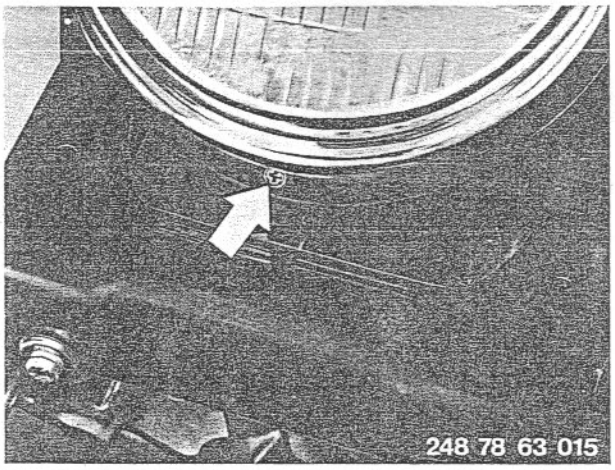


Slacken the two hexagon screws and take off the turn indicator housing.



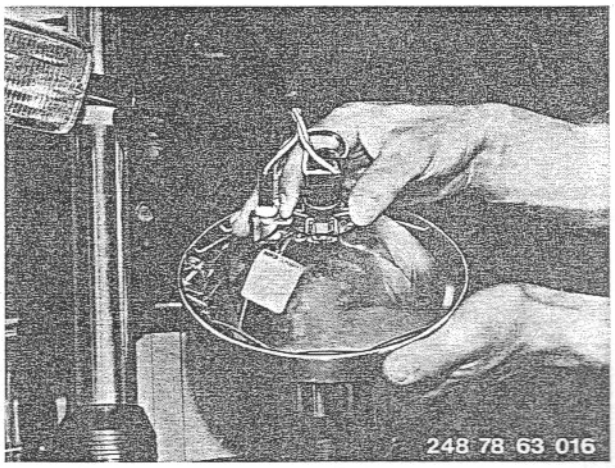
63 99 241 Headlight bulb – renewing

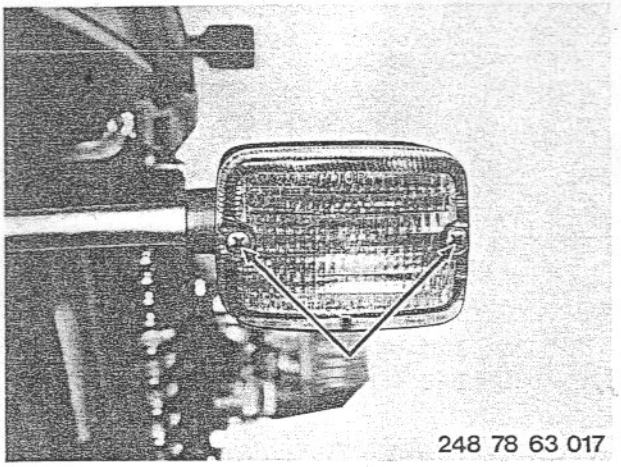
Slacken the Phillips-head screw (arrow) at the bottom of the front ring of the headlight, and pull the ring away from the headlight body.



Release the wire clip, remove the halogen bulb from the reflector and pull out of the socket.

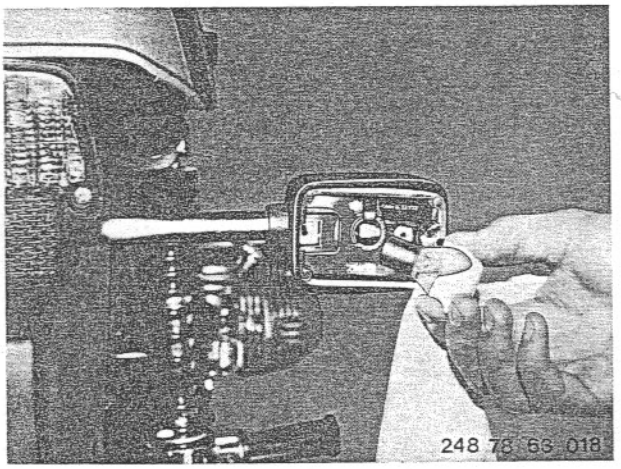
When installing: make sure that the locating peg on the halogen bulb engages correctly in the reflector. Do not touch the bulb glass with the fingers.
Pull the parking light bulb holder out of the reflector.





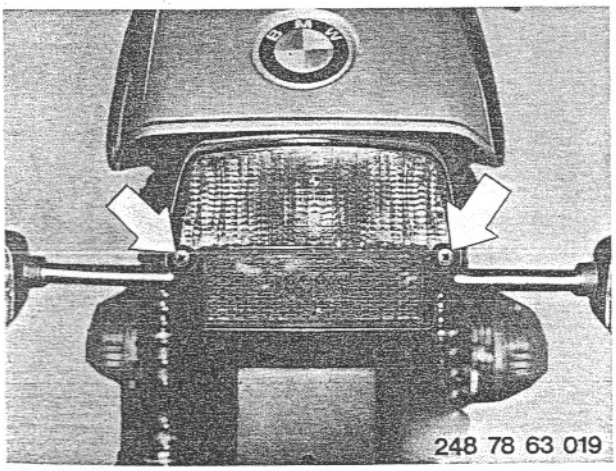
63 99 271 One flashing turn indicator bulb (front or rear) – renewing

Disconnect the battery earth (ground) lead.
Remove the two Phillips-head screws and take off the lens.



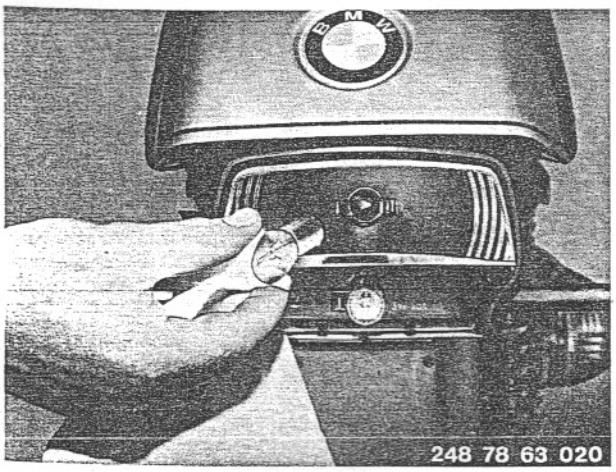
Press the bulb its holder and turn to the left to remove.

When installing: make sure that the 'Top' marking on the lens is uppermost.



63 99 381 Rear light bulb – 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 remove.