

Repair Manual



F 650 GS

**BMW AG Motorcycle Division
After Sales**

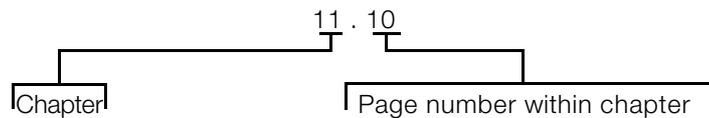
Introduction

This repair manual will help you to perform all the main maintenance and repair work correctly and efficiently. If it is consulted regularly by workshop personnel it will form a useful addition to the theoretical and practical knowledge acquired at the BMW Training Centre. It is a contribution towards achieving even higher Service quality.

A new issue of this repair manual will be published if amendments or additions (supplements) are needed.

All information in both text and illustrations refers to motorcycles in standard condition or with genuine BMW accessories installed, and not to motorcycles which have been modified in any way to depart from the manufacturer's specification.

- The repair manual is structured in the logical sequence of the work to be performed: Removal, Disassembly, Repair, Assembly, Installation.
- The entire contents are divided into individual chapters, corresponding to the Construction Groups.



An arrow symbol followed by the chapter and page numbers is a reference to another chapter, e.g. See Group 46

- Work to be performed during an Inspection is described in Group "00". The various inspection routines are numbered I, II, III and IV. This numbering is repeated in the work descriptions which follow, so that work can take place without interruption.
- Use of the BMW special tools needed for certain tasks is described in the work instructions.

If the need arises, repair instructions are also issued in the form of Service Information. This information is of course incorporated into the next issue of the repair manual. We also recommend, as an additional source of information, the Electronic Parts Catalogue (ETC), which contains clear and easy-to-follow illustrations.

If the work described here is restricted to a particular equipment specification, for instance if a specific optional extra (OE) is fitted, this is stated in square brackets at the start of the item concerned, e.g. **[With heated handlebar grips]**.

Please refer to the following pages as well for a description of other symbols used and how to work with it.

BMW AG Motorcycle Division
After Sales

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After Sales
UX-VS-2
D - 80788 München

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Produced in Germany

Usage

Each chapter starts with the list of contents.

The list of contents is followed by the Technical Data table.

Chapter 00 "Maintenance and general instructions" details the handover checklist and lists all tightening torques and operating fluids.

Key to symbols

In this Workshop Manual for the F 650 GS model, the following symbols are used; their meanings are explained in the table.

Special instructions aimed at improving the work procedures



Note:

Specific information on operating, inspecting and adjusting work for the motorcycle as well as maintenance procedures.



Caution:

Instructions and precautions specifically intended to prevent damage to the motorcycle. Failure to comply with them could invalidate the warranty.



Warning:

This symbol stands for precautions and measures which are essential in order to protect the rider or other persons from possibly severe or fatal injury.

Contents

Headlines for the work described in the chapter..... with the relevant page number

Activities

- Activities
- The bullet symbol means that work steps are described in greater detail under another headline
- Preceding activities
- A line indicates work steps described in greater detail under another headline or in another chapter

If the term "release" or "remove" is used:
the fastener (e.g. screw) must be slackened off and taken out
or

a component (e.g. fuel rail) must be removed to the extent that other components which it conceals (e.g. throttle-valve rail) are accessible

If the term "loosen" or "slacken" is used:
the fastener (e.g. screw) must only be slackened off but not taken out



Tightening torques:

Values are stated if they differ from DIN EN 24 014 or DIN 912 ISO industrial standards.

BMW AG Motorcycle Division

Maintenance schedule

F 650 GS



Customer _____ Licence plate no. _____		BMW Inspection at 1,000 km (600 miles)	BMW Service every 10,000 km (6,000 miles)	BMW Inspection every 20,000 km (12,000 miles)	BMW Annual Service
Order No. _____ Mechanic's signature _____					
Read the fault code memory with the BMW MoDiTeC		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change the engine oil while at regular operating temperature; replace the oil filter element if motorcycle is used only for short journeys or at outside temperatures below 0°C (32°F): every 3 months or at the latest after 3,000 km (1,800 miles)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Replace oil in telescopic forks				<input type="checkbox"/>	
Check the coolant and restore to correct level if necessary *)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Replace the coolant (every 2 years)					<input type="checkbox"/> every 2 years
Check valve clearances, adjust if necessary		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Replace the spark plug				<input type="checkbox"/>	
Drain the outlet hose from the air filter box			<input type="checkbox"/>	<input type="checkbox"/>	
Replace intake air filter If motorcycle is operated in very dirty or dusty conditions, clean or replace the intake air filter every 10,000 km (6,000 miles); check every 3,000 km (1,800 miles)				<input type="checkbox"/>	
Replace fuel filter (every 20,000 km/12,000 miles)				<input type="checkbox"/> 20,000 km	
Check clutch play, adjust if necessary		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Check wheel spoke tension and tighten if necessary more frequently if motorcycle is ridden in severe off-road conditions		<input type="checkbox"/>	<input type="checkbox"/>		
Examine brake pads and discs for wear, replace if necessary *) more frequently if motorcycle is ridden in severe off-road conditions			<input type="checkbox"/>	<input type="checkbox"/>	
Check brake fluid level at front and rear and top up if necessary *)			<input type="checkbox"/>		
Check for operation of brake system and freedom from leaks; repair/replace if necessary *)				<input type="checkbox"/>	
Replace the brake fluid at least once a year					<input type="checkbox"/>
Replace the primary front/rear brake master cylinder cup (every 40,000 km/24,000 miles on a motorcycle with ABS)				<input type="checkbox"/> 40,000 km	
Check wheel bearings and replace if necessary *)				<input type="checkbox"/>	
Check or, if necessary, replace chain, sprocket, chain guide rollers and pinion *) more frequently if motorcycle is ridden in severe off-road conditions			<input type="checkbox"/>	<input type="checkbox"/>	
Check chain tension and adjust if necessary *)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check battery acid level, add distilled water if necessary more frequently if motorcycle is ridden in severe off-road conditions			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clean and grease the battery terminals, if necessary				<input type="checkbox"/>	<input type="checkbox"/>
Check steering head bearings and adjust *) or replace if necessary *)			<input type="checkbox"/>	<input type="checkbox"/>	
Grease the side and main stands			<input type="checkbox"/>	<input type="checkbox"/>	
Grease the brake pedal			<input type="checkbox"/>	<input type="checkbox"/>	
Check bolts and nuts on engine mountings, frame connections, exhaust system mountings, swinging fork pivot, suspension levers, brake pedal, main and side stands and quick-release axles for tightness		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Final inspection with road safety and functional check: - (Clutch, gearshift) - Steering - Front and rear brakes - Side stand contact switch - Condition of tyres and wheels, tyre pressures - Lights and signalling equipment, indicator and warning lights, instruments - Test ride, if necessary		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*) Associated work invoiced separately, see Flat rates brochure, Motorcycle '98

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Pre-delivery Check

F 650 GS



_____	_____	BMW Pre-delivery check
Customer	Licence plate no.	
_____	_____	
Order No.	Mechanic's signature	
Check the shipping crate for damage		<input type="checkbox"/>
Motorcycle: <ul style="list-style-type: none"> - unpack - inspect for damage - install remaining items - clean 		<input type="checkbox"/>
Battery: <ul style="list-style-type: none"> - remove - add acid - charge - grease terminal posts - fit (mark with fitting date) 		<input type="checkbox"/>
Check that the delivery is complete: <ul style="list-style-type: none"> - Toolkit - Documentation - Motorcycle keys - Optional extras 		<input type="checkbox"/>
Read the fault code memory with the BMW MoDiTeC		<input type="checkbox"/>
Check tyre pressures		<input type="checkbox"/>
Fill fuel tank		<input type="checkbox"/>
Final inspection as functional check: <ul style="list-style-type: none"> - Oil inspection - Engine idle speed - Clutch, gearshift - Steering - Hand brakes and foot brakes - Check lights and signalling equipment, warning and indicator lights, instruments, ABS - Test ride, if necessary 		<input type="checkbox"/>

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Service data

F 650 GS



Item	Rated value	Unit of measurement/ specification
Oil capacities		
Engine (with filter)	2.3 (4.05/2.43)	Litres (Imp. pints/US quarts) Specification: see current Service Information
Telescopic fork – for each post	0.60 (1.06/0.63)	Litres (Imp. pints/US quarts) BMW telescopic fork oil
Coolant		
Cooling system (entire)	1.3 (2.29/1.37)	Litres (Imp. pints/US quarts)
Expansion tank	0.1 (0.18/0.11)	Litres (Imp. pints/US quarts)
		Composition: Water: 50% Antifreeze: 50% Antifreeze protection to –25 °C (–13 °F)
Brake fluid		DOT 4
Valve clearances		
Measured cold (max. 35 °C/95 °F)	Inlet: 0.10-0.15 (0.004-0.006) Exhaust: 0.25-0.30 (0.010-0.012)	mm (in) mm (in)
Spark plugs		
Electrode gap	0.6...0.7 (0.02...0.03)	NGK D8 EA mm (in)
Idle speed	1350 +100	rpm
Clutch cable play		
Hand lever cable	1.0 - 2.0 (0.004 - 0.008)	mm (in)
Tyre pressure (on cold tyres)		
solo	front/rear 1.9/2.1 (27/30)	bar (psi)
when fully loaded	2.1/2.3 (30/33)	bar (psi)
Tightening torques:		
Engine oil drain plug	40	Nm
Engine water drain plug	10	Nm
Oil tank drain plug	21	Nm
Oil filter cap	10	Nm
Valve cap	10	Nm
Camshaft bracket	10	Nm
Spark plug	20	Nm
Telescopic fork oil drain plug	6	Nm
Round nut, steering bearing	25	Nm
Steering bearing locking tube	65	Nm
Flanged nut on locking tube	65	Nm
Fork stabilizer clamping screws	21	Nm
Front quick-release axle	80	Nm
Clamping screws for front quick-release axle	21	Nm
Rear quick-release axle	100	Nm
Brake caliper at fork slider tube	41	Nm
Swinging arm bearings	100	Nm
Deflection lever/frame	50	Nm
Deflection lever/spring strut	47	Nm
Deflection lever/tension strut	71	Nm
Swinging fork/tension strut	41	Nm

F 650 GS

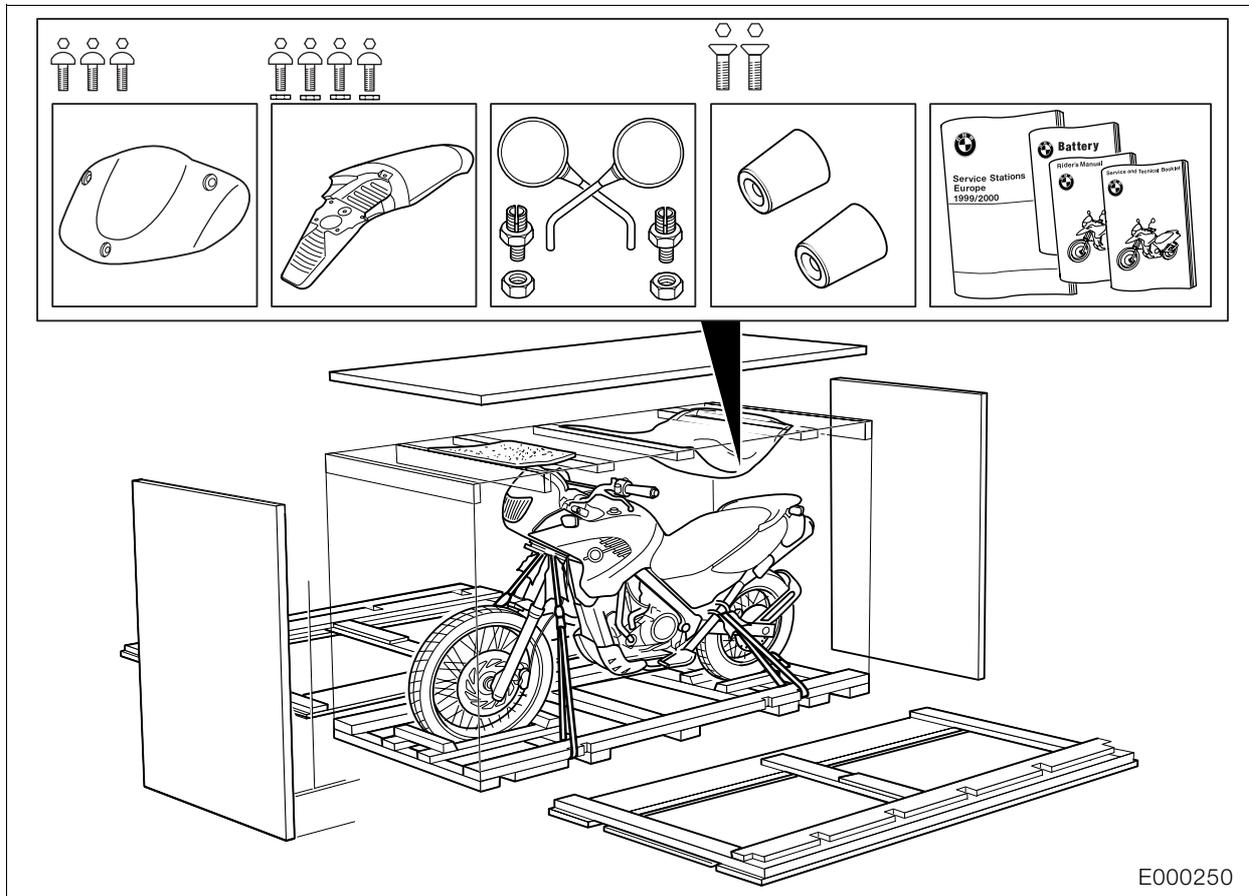
Instructions for pre-delivery check



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E000250

General view of crated motorcycle

Checking the shipping crate for damage

- When the motorcycle arrives, check the crate immediately for damage and if necessary examine the contents for consequential damage.

In case of damage in Germany

- Note the damage on the delivery slip.
- Read the information sheet on damage in transit.
- Notify the supplier without delay (e.g. freight company or DB) and also Bavaria Wirtschaftsagentur GmbH Abteilung ZW - 12 D-80788 München Tel. 089/14327-632 Fax. 089/14327-639

In case of damage in importer markets

- Note the damage on the delivery slip.
 - Comply with specific national market procedures.
- In case of doubt, please submit enquiries to:
 Bavaria Wirtschaftsagentur GmbH
 Abteilung ZW - 12
 D-80788 München
 Tel. +49 (0)89 14327 632
 Fax. (+) 89/14327-639

- Notify the supplier (e.g. freight company) without delay.

Unpacking the motorcycle

- Lever off the cover.
- Take out the separate pack of items.
- Force off cross-struts with a suitable lever.



Caution:

Do not hammer out the cross-strut panels or the motorcycle may be damaged.

- Remove the end panels.
- Remove the side panels.



Caution:

Make sure that the motorcycle cannot topple.

- Remove the straps at front and rear.



Caution:

Remove nails projecting from the base of the crate or lying on the base or on the floor.

- Dispose of the packing materials in an environmentally responsible manner as described in Circular 23/91 - Sales.
- Check the contents of the enclosed package:
 - Front mudguard with fasteners and washers
 - Windshield
 - Mirrors with clamping screws and nuts
 - Handlebar weights with screws
 - Rider's Manual
 - Service and Technical booklet
 - Booklet listing service centres in Europe
 - BMW emergency service sticker
 - Handling instructions for batteries

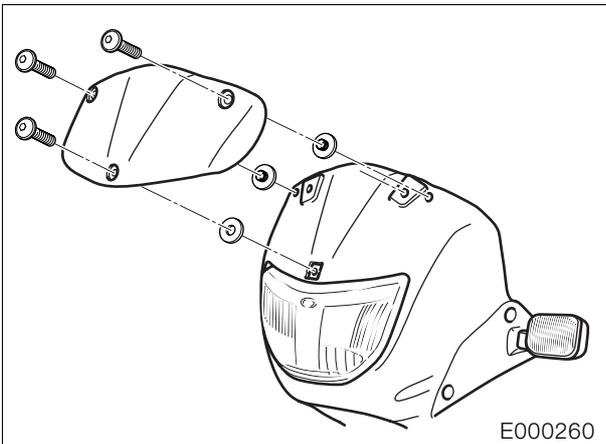
Inspecting motorcycle for damage

- Check for defects.
- Use the "express handling service" to notify BMW AG Sparte Motorrad, UX-VS-1
Fax: 00 49 89 382-33220
- Rectify the fault.
- If parts are needed, order them by using the electronic parts list.
- Costs are to be processed by the warranty claim system (stage 4).
Defect codes:
 - Parts missing 10 01 00 00 00
 - Parts damaged 10 02 00 00 00
 - Incorrect parts delivered 10 03 00 00 00
- If the parts that are needed do not appear in the electronic parts list (e.g. parts for official-user motorcycles), send an order form to:
Fax number 030-3396-2262

Installing remaining items on motorcycle

Installing windscreen

- Wheel the motorcycle clear of the wooden pallet



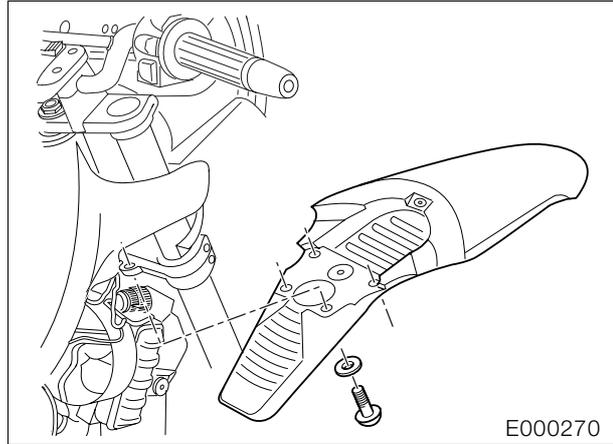
- Tighten the windscreen securing screws.



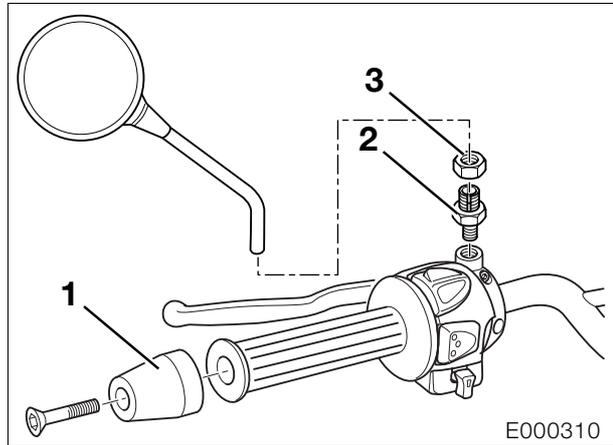
Tightening torques:

Windscreen to cockpit fairing 2 Nm

Installing front mudguard, mirrors and handlebar weights



- Install front mudguard.

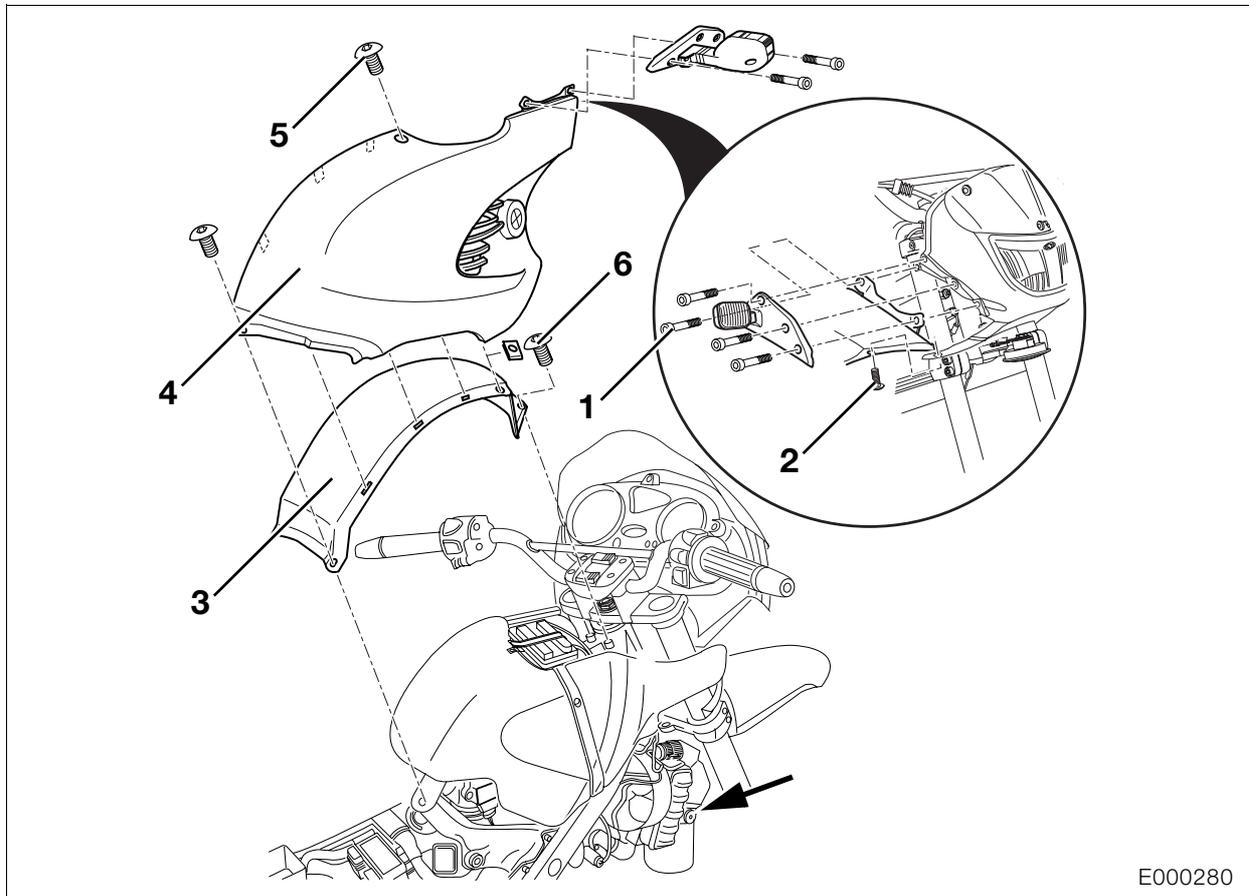


- Install handlebar weights (1).
- Tighten clamp screw (2) on handlebar fitting.
- Install each mirror and secure by tightening nut (3).



Tightening torques:

Front mudguard to fork bridge 3 Nm
 Clamp screw to handlebar fitting 21 Nm
 Union nut of mirror 18 Nm
 Handlebar weight to handlebar 9 Nm



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Filling and charging the battery

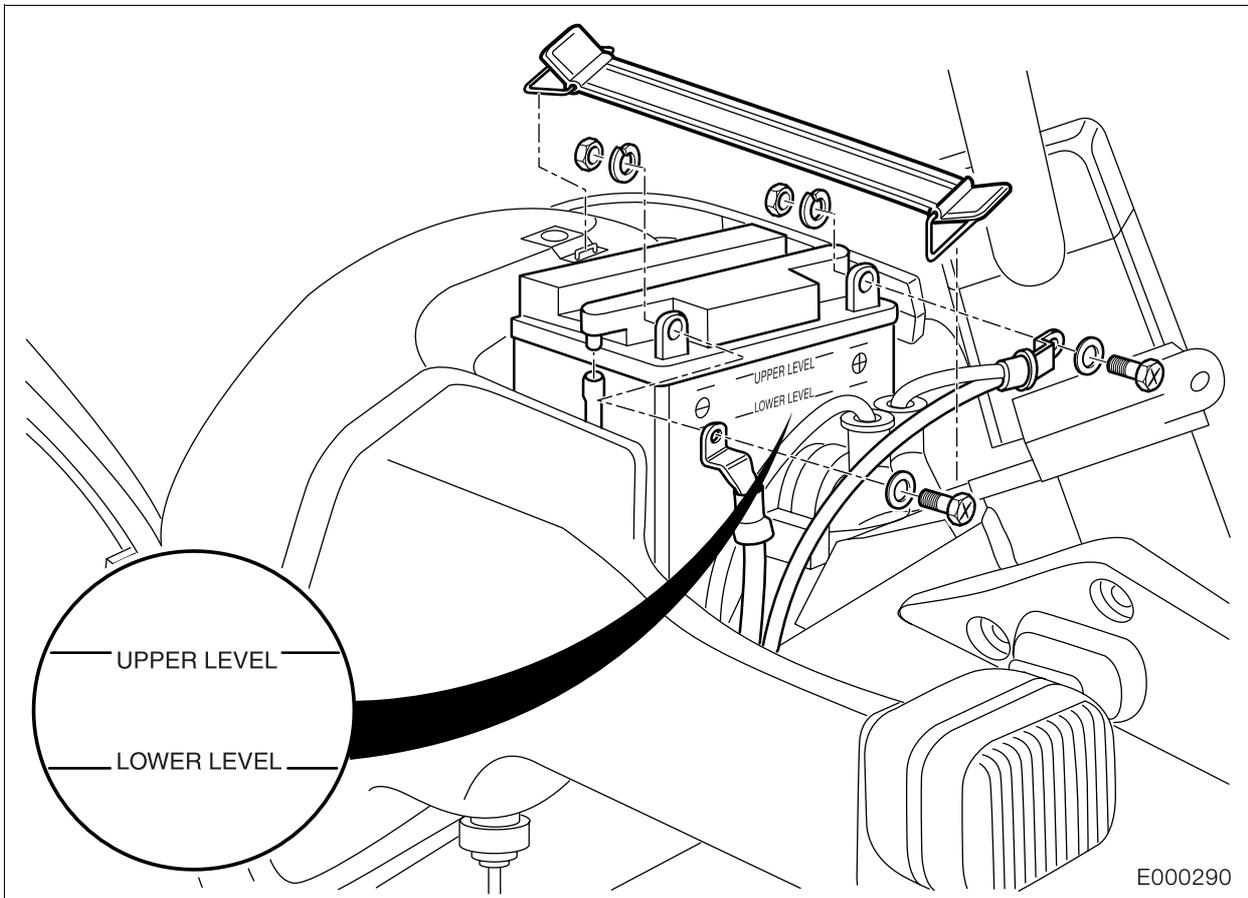
Removing right and centre covers



Note:

Do not remove the windscreen after the side panels have been removed, as otherwise the headlight beam setting will have to be checked.

- Remove the lid of the stowage compartment.
- Remove the seat.
- Remove the fasteners securing turn indicator (1).
- Slacken front securing screw (2).
- Remove securing screws (5) from side cover.
- Pull side cover (4) out of the anchorage (arrow) at the bottom and lift it clear of the centre panel at the top.
- Remove securing screws (6) from centre cover.
- Remove centre cover (3).



Filling and charging the battery



Warning:

Battery acid is highly caustic. Protect your eyes, face, hands, clothing and the paintwork.

- Disengage the rubber strap holding the battery.
- Disconnect the battery breather hose.
- Remove the battery.
- Top up the battery acid to the upper level mark.
- Allow the battery to stand for at least an hour.
- Shake the battery slightly to allow the remaining air bubbles to escape.
- If necessary, top up again to the upper level mark with battery acid.
- Recharge the battery and allow to stand for 24 hours.

Charge current (amps)

..... 10 % of rated battery capacity (Ah)

- Check the acid level and, if necessary, top up with distilled water to the upper level mark.
- Make a note of the charging date on the battery.



Caution:

Connect the positive battery terminal first, then the negative terminal.

- Apply acid-proof grease to the battery terminal posts.
- Install the battery.
- Install right and centre covers.
- Install seat.



Tightening torques:

Right/left covers with centre cover
to mounting frame 2 Nm
Right/left covers to centre cover 2 Nm
Centre cover to main frame at front 2 Nm

Checking that delivery is complete

- All optional extras
- Toolkit:
 - Reversible screwdriver
 - Small star screwdriver
 - 3 open-ended wrenches
a/f 8×10, 14×19, 24
 - Extension for open-ended wrenches
 - Spark plug wrench
 - Wrench for socket-head screws, a/f 8
 - 3 Torx wrenches
Torx T25, T30, T45
 - 3 fuses
7.5A, 15A, 20A
- Documentation
- Motorcycle keys, 3

Reading the fault code memory with the BMW MoDiTeC



- Unclip diagnosis plug (1) behind cover on right.
- Connect the diagnosis unit to the diagnosis plug.
- Read out the fault memory.
- Perform all requisite repair work.
- Clip diagnosis plug into position behind cover on right.

Checking tyre pressures

- Check/correct tyre pressures.

Tyre pressures:

Solo front 1.9 bar (27.0 psi)
 rear 2.1 bar (29.9 psi)

With full load..... front 2.1 bar (29.9 psi)
 rear 2.3 bar (32.7 psi)

Adding fuel to tank

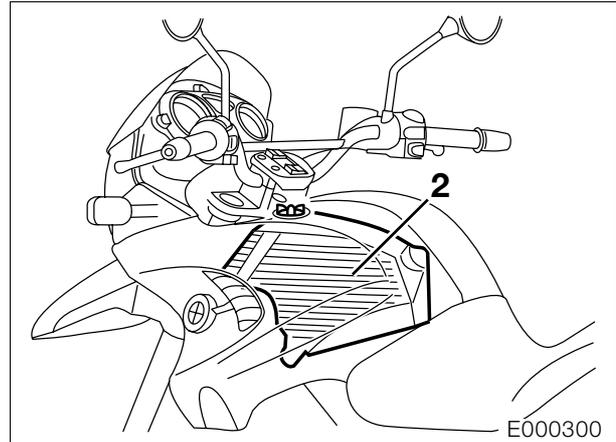
- Fill up with fuel.

Final inspection and function check



Note:

When the motorcycle arrives, the oil level in the tank might be below the sight glass.



- Oil check: if oil is not visible in the sight glass, check whether the oil tank (2) contains oil.
- Clutch
- Check gear shift action.
- Steering
- Front and rear brakes
- **Check lights and signalling equipment:**
- Front and rear parking lights
- Instrument lighting
- Low and high headlight beams, headlight flasher
- Brake light (operate brake at front and rear)
- Turn signals left/right
- Horn
- Telltale and warning lights
- Instruments
- As applicable, check function of optional extras:
- ABS: perform starting test. In the event of a fault in the system, the ABS warning light comes on as soon as the motorcycle is ridden for at least 10 seconds at a speed of 30 km/h (approx. 20 mph) or more.
- If necessary, take the motorcycle for a test ride.
- Confirm pre-delivery check in Service and Technical Booklet.
- See "Inspecting motorcycle for damage" if defects are detected.

Final cleaning

- Clean the motorcycle.



Note:

Do not use a steam or high-pressure water jet. The high steam or water pressure could damage seals, the hydraulic system or electrical components.



Note:

The number-plate carrier is not pre-drilled so that number plates of any shape can be set to the best possible position.

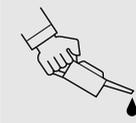
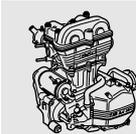
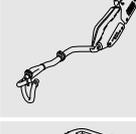
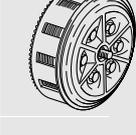
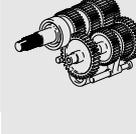
Handing over the motorcycle

This is the ideal opportunity to familiarise the customer with the motorcycle in order to ensure the customer's satisfaction and safety.

- The following points must be demonstrated and explained to the customer:
 - documentation and stowage space
 - toolkit and stowage space
 - suspension preload adjustment to suit total weight
 - checking brake fluid
 - how to adjust the mirrors
 - controls
 - instruments and telltale lights
 - optional equipment and accessories fitted
- The user must be given the following information:
 - running-in recommendations and inspection intervals
 - safety check

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00 Maintenance and general instructions



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Table of operating fluids

Item	Use	Order number	Quantity
Lubricant			
Staburags NBU 30 PTM	High-performance lubricating paste	07 55 9 056 992	75 g tube
Optimoly MP 3	High-performance lubricating paste	07 55 9 062 476	100 g tube
Optimoly TA	High-temperature assembly paste	18 21 9 062 599	100 g tube
Silicone grease 300, heavy	Damping grease	07 58 9 058 193	10 g tube
Retinax EP2	Wheel, steering head and taper roller bearing grease	83 22 9 407 845	100 g tube
Contact spray	Contact spray	81 22 9 400 208	300 ml spray
Chain spray	Drive chain	72 60 2 316 676 72 60 2 316 667	50 ml spray 300 ml spray
Sealants			
3-Bond 1110 B	Surface sealant	07 58 9 056 998	5 g tube
3-Bond 1209	Surface sealant	07 58 9 062 376	30 g tube
omni VISC 1002	Surface sealant (max. 200 °C/392 °F)	07 58 1 465 170	90 g tube
Loctite 574	Surface sealant	81 22 9 407 301	50 ml tube
Curil K 2	Heat-conductive sealant	81 22 9 400 243	250 g can
Hylomar SQ 32 M	Permanently elastic sealant	81 22 9 400 339	100 g tube
Adhesives and retainers			
Loctite 648	Joint adhesive (low clearance)	07 58 9 067 732	5 g bottle
Loctite 638	Joint adhesive (greater clearance)	07 58 9 056 030	10 ml bottle
Loctite 243	Thread retainer, medium-strength	07 58 9 056 031	10 ml bottle
Loctite 270	Thread retainer, strong	81 22 9 400 086	10 ml bottle
Loctite 2701	Thread retainer, strong	33 17 2 331 095	10 ml bottle
Loctite 454	Cyanacrylate adhesive (gel)	07 58 9 062 157	20 g tube
Cleaners			
Brake cleaner	Brake cleaner	83 11 9 407 848	600 ml spray
Metal Polish	Polish for parts	82 14 9 400 890	100 g tube
Testing agents			
Penetrant MR 68	Crack testing agent for aluminium housings	83 19 9 407 855	500 ml spray
Developer MR 70	Crack testing agent for aluminium housings	81 22 9 407 495	500 ml spray
Installation aid			
BMW chilling spray	Chilling components before assembly	83 19 9 407 762	300 ml spray



Tightening torques

Model	F 650 GS
Connection	Nm
11 Engine	
Freewheel housing and freewheel	35 (clean thread + Loctite 648)
Engine block	10
Double drive gear on crankshaft	180 (clean thread + Loctite 243)
Driver	140 (clean thread + Loctite 243)
Pressure plate	10
Magnet hub	180 (clean thread + Loctite 243)
Signal transmitter	8
Ignition cover	10
Cylinder base	10
Spark plug	20
Threaded connection for chain tensioner	40
Oil circuit	
Oil tank to intake air silencer	9
Oil filter cover	10
Oil pressure switch	12 (clean thread + Loctite 243)
Oil tank drain plug	21
Engine oil drain plug	40
Oil supply/oil return lines to engine	35
Oil pump cover	6 (clean thread + Loctite 243)
Oil pressure valve	24
Oil retaining valve	24



Model	F 650 GS
Connection	Nm
Cylinder head	
Collar nuts for cylinder head	60
Collar screws for cylinder head	33
Machine screws (chaincase)	10
Camshaft mount	10
Chain sprockets to camshafts	60 threads oiled
Chain guide to camshaft mount	10 (clean thread + Loctite 243)
Cylinder head cover	10
Machine screw (hole for locating pin)	25
Cylinder head to frame	41
Cylinder head to frame, adjusting sleeve	zero play, max. 5
Cylinder head to frame, locknut	100
12 Engine electrics	
Magnet hub	180 (clean thread + Loctite 243)
Signal transmitter	8
Engine block cover, left/right	10
Starter to clutch cover	10
Necked-down bolts, starter housing	6
Cable cover to engine block	4
Ignition coil and holder	9





Model	F 650 GS
Connection	Nm
13 Fuel preparation and control	
Air intake connection to cylinder head	25
Fuel filter to frame	9
Injector holder to throttle valve	5
Connecting flange, air filter box to battery carrier	5
Intake air silencer to retainer	9
Oil tank to intake air silencer	9
Throttle-valve potentiometer to throttle flap stub	3
Throttle lifter to throttle flap stub	5 (clean thread + Loctite 243)
16 Fuel tank and lines	
Fuel tank to rear frame (M 8 stud)	21
Tank cover to fuel tank	3
Roll-over valve to fuel tank	2
Bracket, activated charcoal filter to fuel tank	3
Fuel pump to fuel tank	36
17 Radiator	
Air duct to frame trussing	3
Expansion tank to radiator	9
Radiator to main frame	9
Water pump drain screw	10
Left engine block cover to engine block	10
Water pump cover	10
Temperature sensor in cylinder head	15
Bleed screw	12

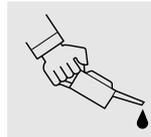
Model	F 650 GS
Connection	Nm
18 Exhaust system	
Oxygen sensor to exhaust	45
Exhaust manifold to cylinder head	20
Silencer to exhaust manifold (Torca clamp)	55
Silencer to rear frame	21
Guard to silencer	9
21 Clutch	
Driver	140 (clean thread + Loctite 243)
Pressure plate	10
Engine block cover, left	10
23 Transmission	
Selector lever to selector shaft	13
27 Drive chain	
Drive pinion cover to engine	2
Chain takeup roller to frame	21
Chain sprocket to chain sprocket carrier	21
Quick-release shaft nut	100
Drive chain tensioning screws	10
Central nut to main shaft	140 (clean thread + Loctite 243)





Model	F 650 GS
Connection	Nm
31 Front forks	
Fork stabiliser to fork leg	21
Clamp screws for fork bridges, top/bottom	21
Plate for bottom fork bridge to fork bridge	9
Oil drain plug	6
Damper retaining screw	20
Knurled nut/bearing preload	25
Locknut at upper fork bridge	65
32 Steering	
Handlebar to fork bridge	21
Handlebar weight to handlebar	9
Clutch fitting to handlebar, M 6	9
Clutch switch to handlebar fitting	5
Pivot pin for brake lever	6
Locknut for pivot pin, clutch lever	8
33 Rear wheel drive	
Suspension strut to frame	50
Suspension strut to angled lever	47
Knob for adjusting suspension-strut damping to holder	21
Holder, suspension-strut damping to frame	9
Swinging fork pivot shaft	100
Tension strut to swinging fork	41
Tension strut to angled lever	71
Angled lever to frame	50

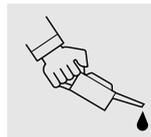
Model	F 650 GS
Connection	Nm
34 Brakes	
Bleed screw in front/rear brake calliper	7
Brake calliper to fork slider tube	41
Brake disc and sensor ring to front wheel	9 (clean thread + Loctite 243)
Brake disc to rear wheel	9 (clean thread + Loctite 243)
Brake fluid reservoir for rear brake to rear frame	1.5
Brake pedal to frame	21
Brake lines/hoses	
Brake hose to brake calliper	18
Brake hose to brake lever fitting	18
Brake hose/brake line interfaces	18
Brake line to master brake cylinder, rear wheel	18
ABS	
ABS sensor front/rear	9
ABS pressure modulator to holder	21
Holder for ABS pressure modulator to frame transverse tube	9
Brake line to ABS pressure modulator	18
Sensor ring to rear wheel	5 (clean thread + Loctite 243)
Brake disc and sensor ring to front wheel	9 (clean thread + Loctite 243)
36 Wheels and tyres	
Clamp nut, front quick-release axle	21
Front quick-release axle to fork leg	80
Rear quick-release axle to swinging arm	100
Chain sprocket to chain sprocket carrier	21



Model	F 650 GS
Connection	Nm
46 Frame	
Body	
Fairing sections/covers	3
Fairing support bracket to frame	21
Grip to rear frame	9
End trimmer to rear frame	9
Tail to rear frame	3
Seat lock to rear frame	9
Number-plate carrier to rear section of rear mudguard	3
Mudguards/wheel guards	
Front mudguard, rear section to front section	3
Front mudguard to fork bridge	3 (clean thread + Loctite 243)
Rear mudguard, front and rear sections to rear frame	9
Rear mudguard, front section to bracket for case carrier	21
Wheel cover, bottom, to bracket	3
Wheel cover bracket to swinging arm	9
Frame	
Footrest plate to main frame	21
Footrest rubber to rear footrest	5
Retaining bracket for intake air silencer to main frame	9
Engine guard to frame trussing	9
Rear frame to main frame, top	21
Rear frame to main frame, bottom	21 (clean thread + Loctite 2701)
Centre stand to main frame	41
Side stand undersection to main frame	21
Engine mounts	
Engine/crankcase to main frame at rear	41
Engine/cylinder head to main frame at top	41
Engine/crankcase to engine mounting at front	41
Engine mounting to main frame	21



Model	F 650 GS
Connection	Nm
51 Equipment	
Ignition/steering lock to fork bridge	21
61 General electrical equipment	
ABS sensor cable to sliding tube	9
ABS sensor to brake calliper mount, rear	9
Clutch switch to handlebar fitting	5
Brake light switch to handlebar fitting	3
Brake light switch, footbrake, to frame	5
Wiring harness with electronic equipment box to frame	7
Lid of electronic equipment box to frame	4
Positive/ground leads, battery	7
Battery holder to battery tray	9
Voltage regulator to bracket	7
Horn to fork bridge	18
Ground terminal for wiring harness to engine block, right	8
62 Instruments	
Instrument cover to instrument cluster	2
63 Lights	
Front turn indicator with cover to cockpit fairing	3
Rear light cluster to number-plate carrier	4





Key to maintenance intervals

Maintenance intervals consist of the first Inspection (after the first 1,000 km/600 miles), the BMW Service, BMW Inspection and BMW Annual Service.

Inspection 1,000 km/600 miles

BMW Running-in Check after the first 1,000 km (600 miles).

BMW Service

After the first 10,000 km/6,000 miles and each additional 20,000 km/12,000 miles (at 18,000 miles ... 30,000 miles ... 42,000 miles).

BMW Inspection

After the first 20,000 km/12,000 miles and each additional 20,000 km/12,000 miles (at 24,000 miles ... 36,000 miles ... 48,000 miles).

BMW Annual Service

Certain tasks maintenance depend on elapsed time as well as the distance the bike has covered. They should therefore be carried out at least once a year (e.g. replacing brake fluid).

If these tasks cannot be carried out during a Service or an Inspection, a BMW Annual Service must be performed.

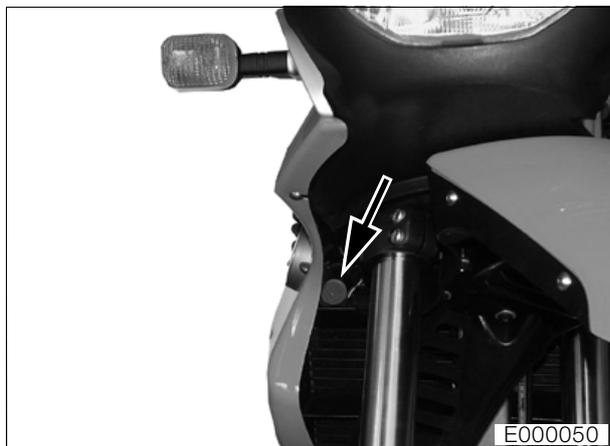
In this Repair Manual, the individual maintenance intervals are shown by the following codes:

- Inspection at 1,000 km (600 miles)..... **I**
- BMW Service at 10,000 km (6,000 miles)..... **II**
- BMW Inspection at 20,000 km (12,000 miles) .. **III**
- BMW Annual Service..... **IV**



00 13 624 Reading the fault code memory with the MoDiTeC

(Inspections I, II, III and IV)



- Unclip diagnosis plug (arrow) behind cover on right.
- Connect the diagnosis unit to the diagnosis plug.
- Read out the fault memory.
- Carry out repairs as specified.

00 11 215 Changing the engine oil and oil filter element

(Inspections I, II, III and IV)



Note:

If an engine failure occurs, the oil tank and feed line must be cleaned with the material used for this purpose in the workshop, and then blown through with compressed air.

00 11 215 Preparatory work

- Remove left cover.
- ➔ See Group 46
- Remove engine guard.
- Remove cover for chain sprocket from engine.

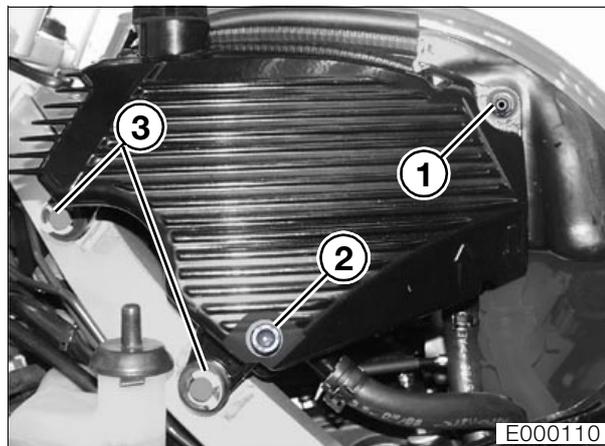
00 11 215 Draining engine oil



Warning:

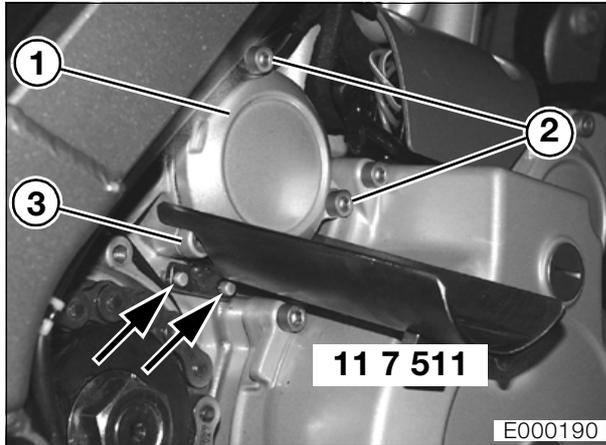
Observe the hazard avoidance instructions for running internal combustion engines in enclosed spaces.

- Warm up the engine to operating temperature.
- Place a suitable container in position to catch the oil.



- Slacken drain plug (2) in oil tank.
- Remove retaining screw (1).
- Remove clamps (3).
- Pull out the oil tank, tilt it to the left and slacken drain plug (2).
- Use the spark-plug wrench (toolkit) to remove the filler cap from the oil tank.
- Fully drain the tank.
- Remove the oil drain plug from the engine and fully drain the oil from the engine.

00 11 215 Replacing oil filter element



- Remove the left-hand screw (3) securing the oil-filter cover (1).
- Remove the cable for the neutral indicating switch from its guide.
- Engage the oil drain guide, **BMW No. 11 7 511**, on the pins (arrows) on the engine block.
- Position a drip tray beneath the engine.
- Remove the screws (2) and remove the oil-filter cover.
- Remove the filter element.
- Fully drain the oil and clean the oil-filter housing.

Caution:

Dispose of the used oil and oil filter in an environmentally compatible manner.

- Fit a new filter element onto the oil-filter cover.
- Coat the O-ring of the new filter element lightly with oil.
- Check the O-ring of the oil-filter cover for damage and replace if necessary.
- Install the oil-filter cover complete with filter element.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

Note:

Do not reinstall the engine guard, cover and chain sprocket cover at this stage, if other maintenance work has to be performed on assemblies normally concealed by these components.

Tightening torques:

Oil filter cover 10 Nm
Cover for chain sprocket 2 Nm

00 11 215 Filling with engine oil

- Install the oil drain plug in the oil tank with a new sealing ring and tighten.
- Install the oil drain plug in the engine with a new sealing ring and tighten.
- Fill the oil tank with 2 l (3.5 Imp. pints/2.1 US quarts) of engine oil and install the filler cap.

Warning:

Observe the hazard avoidance instructions for running internal combustion engines in enclosed spaces.

- Run the engine for thirty seconds.
- Add another 0.3 l (0.53 Imp. pints/0.32 US quarts) of engine oil to the oil tank.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Make sure that when the engine is at operating temperature, the oil level is not above the specified level (arrow).

- Check the oil level with the engine at operating temperature and top up if necessary.

Operating fluids:

Brand-name HD oil, API classification SF, SG or SH; suffix letters CD or CE are permitted; alternatively, brand-name HD oil of CCMC classification G4 or G5; suffix PD2 is permitted.

Engine oil capacity:

For filter
change 2.3 l (4.05 Imp. pints/2.43 US quarts)

Tightening torques:

Oil tank drain plug 21 Nm
Engine oil drain plug 40 Nm
Engine guard to frame 9 Nm



Checking coolant, topping up if necessary

(Inspections I, II and III)



Note:

Check coolant level only when the engine is cold. Do not refill the coolant expansion tank if valve clearance still has to be checked/adjusted.

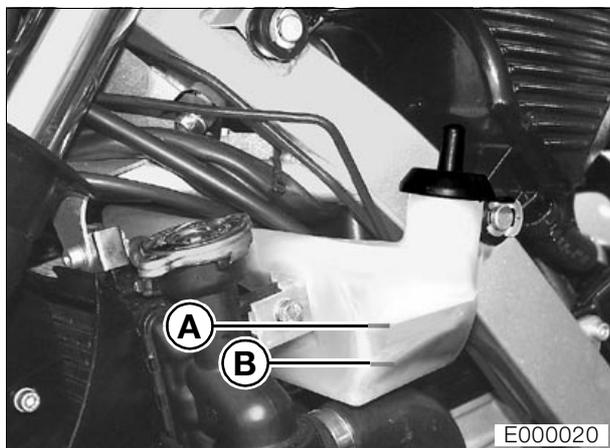


Checking coolant

- Check coolant level through the sight glass in the left cover.
- Top up the coolant if the level is below the MIN mark.

Adding coolant

- Remove left cover.
- ➡See Group 46



Caution:

Anti-freeze protection must be guaranteed to at least -30 °C (-22 °F). Use only nitrite-free long-term antifreeze and corrosion inhibitor. Do not top up expansion tank past the MAX mark (A).

- Check antifreeze concentration in the expansion tank, top up antifreeze if necessary.



Note:

Mix the coolant in a mix ratio of 50 % antifreeze, 50 % water.

- Check coolant level in the expansion tank, top up coolant if necessary.

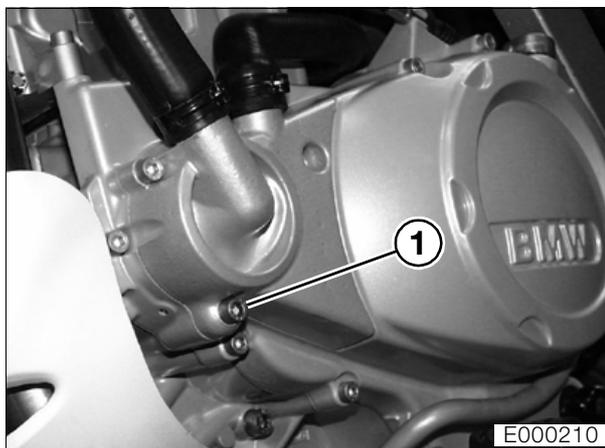
Maximum level..... **A**
Minimum level..... **B**

- Installation is the reverse of the removal procedure.

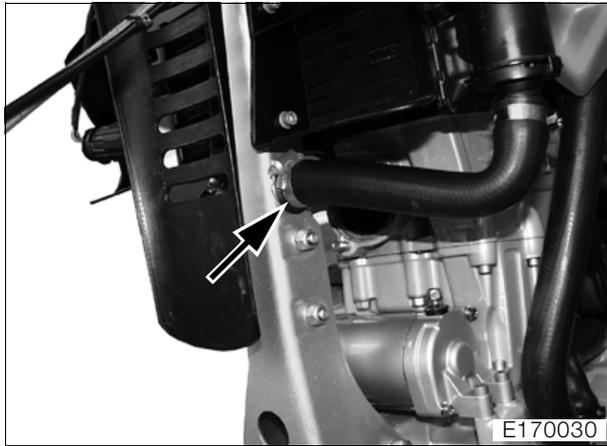
17 00 035 Changing coolant

(Inspection IV, every 2 years)

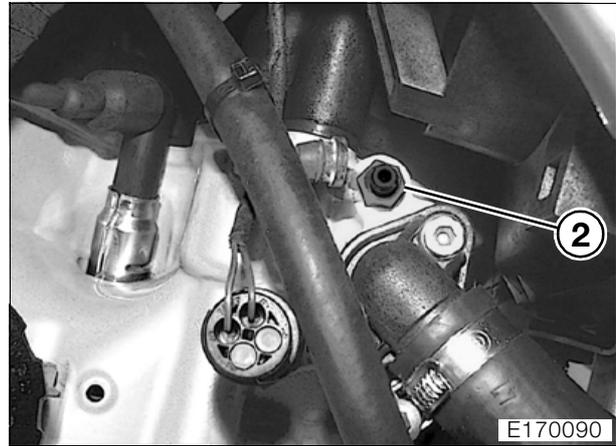
- Remove left cover.
- ➡See Group 46
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.



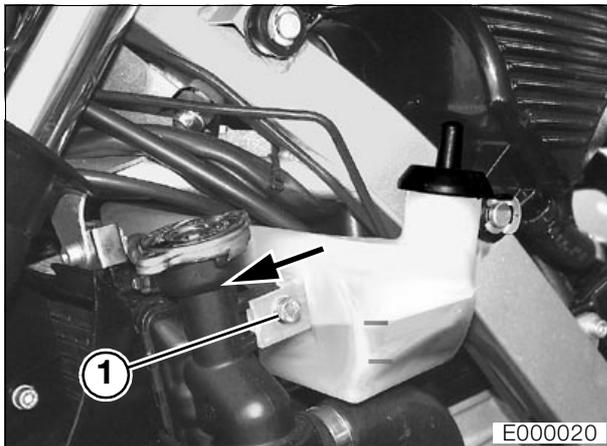
- Remove drain plug (1) from water pump.
- Hold a funnel below the drain and open the radiator cap.
- Drain off all the coolant.



- Disconnect the coolant hose (arrow) at the frame on the left and drain the radiator.



- Slacken bleed screw (2) in cylinder head.
- Connect a hose to the bleed screw.
- Fill the radiator until coolant escapes at the bleed screw; repeatedly squeeze the coolant hoses to expel the air.
- Tighten bleed screw (2).
- Top up coolant until the level reaches the top of the filler neck (arrow).
- Top up expansion tank to the MAX mark.



- Remove fastener (1), lift out the expansion tank and drain off all coolant.

⚠ Caution:

Dispose of old coolant in an environmentally compatible manner.

📄 Note:

Do not install and refill the coolant expansion tank if valve clearance still has to be checked.

- Install the expansion tank.
- Install the drain plug with a new sealing ring and tighten.
- Place motorcycle on its centre stand.

Capacity

Cooling system 1.2 l (2.11 Imp. pints/1.27 US quarts)
 In expansion tank + 0.1 l (1.17 Imp. pints/0.11 US quarts)

Antifreeze

Use only nitrite-free long-term antifreeze and corrosion inhibitor.

Concentration

Antifreeze 50%
 Water 50%

- Run the engine for a short time, then switch it off.
- Check coolant level and top up if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

📄 Note:

Do not reinstall the cover at this stage, if other maintenance work has to be performed.

🔧 Tightening torques:

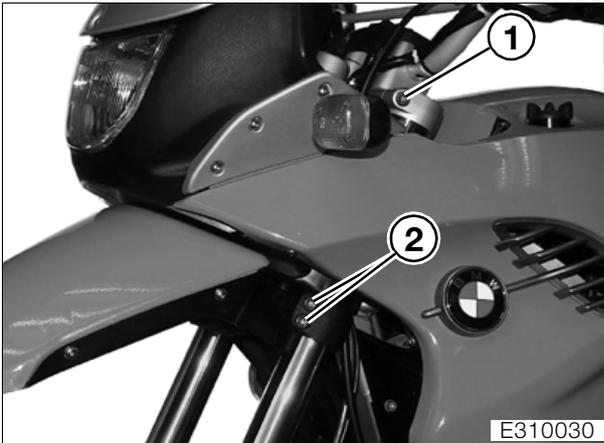
Drain plug 10 Nm
 Expansion tank to radiator 9 Nm
 Bleed screw 12 Nm



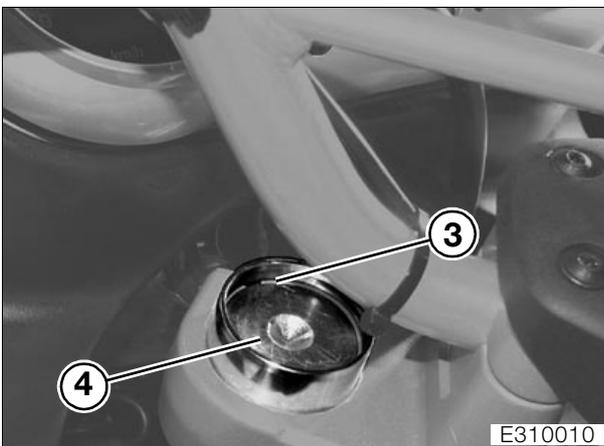
00 11 279 Changing oil in telescopic forks

(Inspection III)

- Place motorcycle on its centre stand.
- Lift front wheel clear of the ground.
- Remove the sealing caps from the fork legs.



- Slacken clamp screws (1, 2) at top/bottom fork bridges.



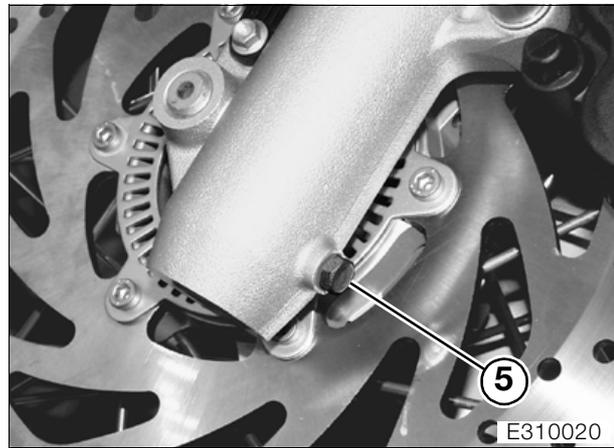
- Pull the fork legs up and tighten the clamp screws.



Warning:

Note that plugs (4) at left and right are spring-loaded. Wear protective goggles when removing and installing.

- Press plug (4) down and remove snap ring (3). Carefully allow the plug to ride up and remove.



- Position a drip tray beneath the telescopic forks.
- Slacken oil drain plugs (5) on left and right.
- Allow all the oil to drain off.



Caution:

Dispose of used oil in an environmentally compatible manner.

- Install the oil drain plugs (5) with new sealing rings and tighten.
- Fill with specified quantity of oil.
- Install plugs in left and right forks, complete with snap rings.
- Slacken clamp screws (1, 2) at top/bottom fork bridges and lower the fork legs.
- Tighten clamp screws at top and bottom fork bridges.
- Install the sealing caps.

Oil content of each fixed fork tube

..... 0.60 l (1.06 Imp. pints/0.62 US quarts)

Operating fluids:

Telescopic fork..... BMW telescopic fork oil



Tightening torques:

Oil drain plug..... 6 Nm
 Clamp screws,
 top/bottom fork bridges 21 Nm

00 11 602 Checking and adjusting valve clearances

(Inspections I, II and III)

00 11 601 Checking valve clearances

Preparatory work

- Remove left, right and centre covers.
- Remove the battery.

Removing the intake air silencer together with the intake air pipe

- Remove the fastener for the intake air silencer from the oil tank.
- Remove the fasteners for the intake air silencer from the retainer.
- Remove the starter relay from the holder.
- Slacken the fasteners for the lid of the electronic equipment box.
- Remove the fasteners for the battery tray.
- Disengage the clamp securing the breather hose and disconnect the hose from the intake air silencer.
- Press the oil tank slightly to the left and carefully disconnect the intake air silencer from the throttle flap stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle flap stub.

Exposing the radiator

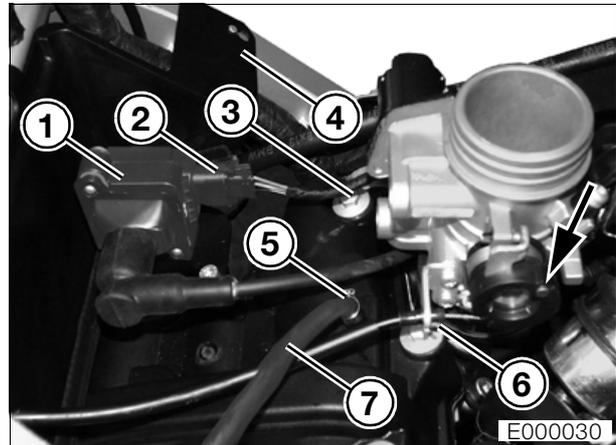


Note:

When temporarily securing the expansion tank, make sure that the cap is above the level of the coolant.

- Disconnect the expansion tank from the radiator, pull it to one side and temporarily secure it to the handlebar with a cable tie or similar.
- Unclip the MoDiTeC plug from its holder.
- Disconnect plug for fan.
- Disengage the clips at top and bottom and remove the fan.
- Protect the interior of the radiator with cardboard or similar.

Exposing cylinder head



- Disconnect ignition coil at plug (2).
- Pull spark plug connector off spark plug.
- Remove screws securing ignition coil (1) to cylinder head cover.
- Disengage throttle cable from adapter (arrow).
- Remove circlip (6) from throttle-cable holder and disengage throttle cable.
- Disengage cover (4) from the anchorages on main frame on each side and remove.
- Remove spark plug.
- Use pliers, **BMW No. 17 5 500**, to release hose clip (5) and disconnect cylinder-head breather hose (7).



Note:

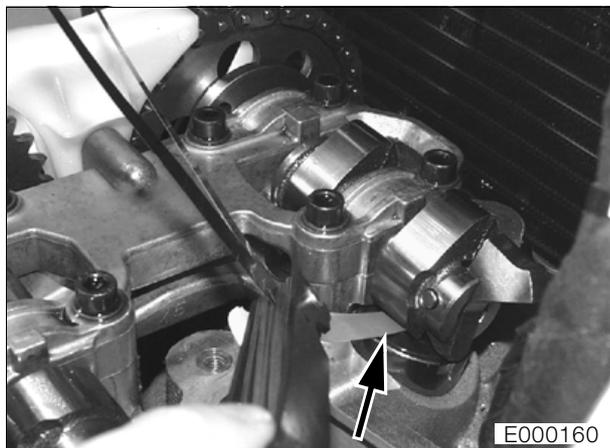
Note the position of the two anchorages for ignition coil (1) on the cylinder-head cover.

- Remove 8 fasteners (3) and remove the cylinder-head cover with gasket.

Turning crankshaft to TDC position

- Remove the central threaded plug in the magnetic housing.
- Use an Allen key to turn the crankshaft clockwise to the TDC position.

Checking valve clearance

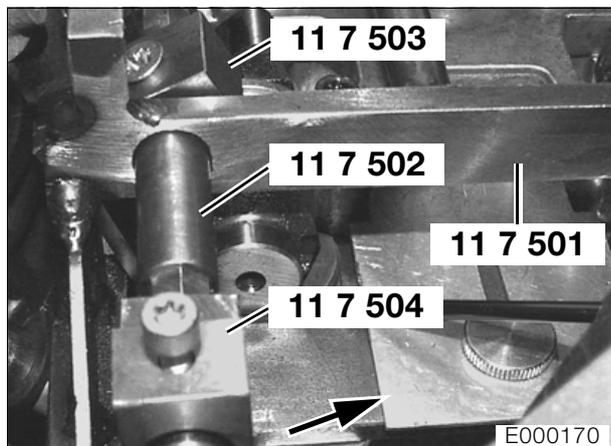


- Use a feeler gauge (arrow) to determine valve clearance.
- Make a note of the valve clearances, or adjust them if necessary.

Valve clearances:

Inlet valve 0.05...0.10 mm (0.002...0.004 in)
 Exhaust valve 0.25...0.30 mm (0.010...0.012 in)

00 11 602 Adjusting valve clearances



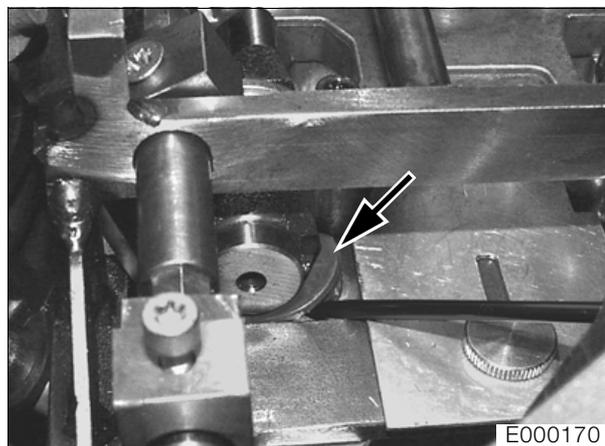
- Secure yoke of valve-clearance adjuster, **BMW No. 11 7 501**, to the cylinder head.
- Seal the aperture in the cylinder head with the cover plate (arrow).
- Turn the camshaft until the points of the cams are up.



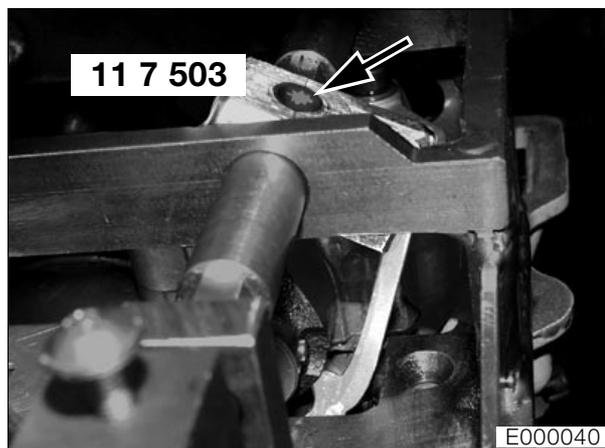
Note:

Thruster toward outer edge of cylinder head.

- Install shaft, **BMW No. 11 7 502**, thruster, **BMW No. 11 7 503**, and clamp block, **BMW No. 11 7 504**.



- Turn the bucket tappet until the shim (arrow) can be levered out at the groove in the bucket tappet.



- Secure thruster, **BMW No. 11 7 503**, on the shaft by tightening the screw (arrow).
- Position thruster, **BMW No. 11 7 503**, on the edge of the bucket tappet.
- Press down the bucket tappet and secure shaft, **BMW No. 11 7 502**, with clamp block, **BMW No. 11 7 504**.



Note:

If the shim is too tight to be removed easily, the hold-down assembly is sitting on the shim instead of on the edge of the bucket tappet. If this happens back off the hold-down assembly and repeat the procedure.

- Release the shim with a screwdriver or similar tool, then use magnetic holder, **BMW No. 11 7 505**, to remove.

- Before installing new shim, check thickness with a micrometer.
- Position the shim in the bucket tappet.
- Carefully release the clamp on the shaft, then remove the shaft and the hold-down assembly.

⚠ Caution:

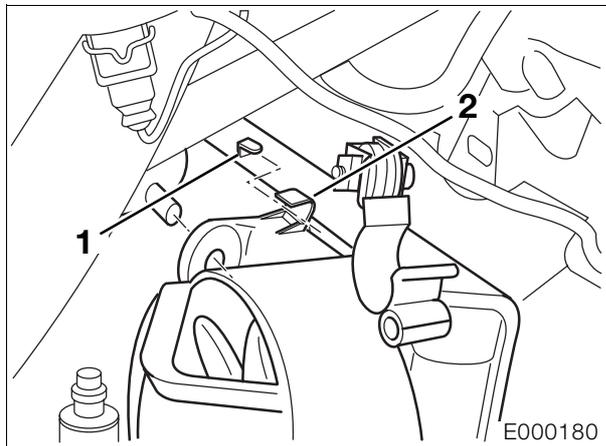
Check that the shim is correctly seated in the bucket tappet.

- Installation is the reverse of the removal procedure: pay particular attention to the following.

Installing cylinder head cover

- Before installing the cylinder head cover, remove all traces of the gasket and clean the sealing face with degreasing agent. Also clean the groove and the seating faces for the gasket.

Installing fan shroud



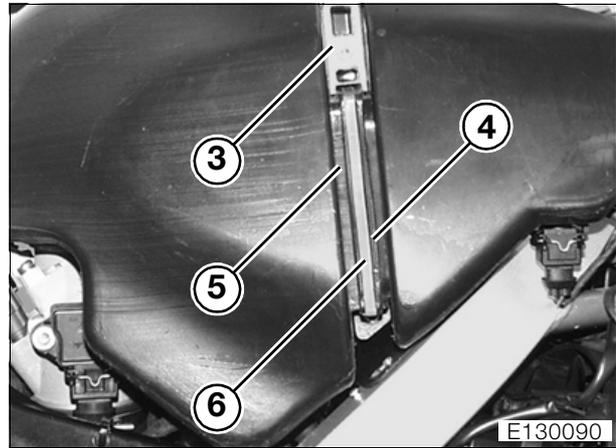
- Engage the tabs at the top and bottom of fan shroud (2) in the hooks on the radiator (1).

Installing intake air silencer

📌 Note:

Do not reinstall the intake air silencer at this stage, if the fuel filter has to be removed. Make sure that the intake pipe is correctly seated on the throttle flap stub.

Installing the intake air duct



- Introduce the fits of intake air silencer (5) with air filter element (6) and intake air duct (4) into the guide on the battery tray (3)/connecting flange.
- If necessary, top up the coolant level in the expansion tank.

Valve clearances:

Inlet valve 0.05...0.10 m (0.002...0.004 in)
 Exhaust valve 0.25...0.30 mm (0.010...0.012 in)

🔧 Tightening torques:

Cylinder head cover to cylinder head 10 Nm
 Ignition coil to cylinder head..... 9 Nm
 Lid of electronic equipment box..... 4 Nm
 Spark plug in cylinder head 20 Nm
 Oil tank to intake air silencer 9 Nm
 Intake air silencer to frame 9 Nm
 Connecting flange, air filter box
 to battery tray..... 5 Nm
 Expansion tank to radiator 9 Nm
 Trim panel/cover 3 Nm

00 12 620 Replacing spark plugs

(Inspection III)

- Pull spark plug connector off spark plug.
- Remove the spark plug with the a/f 18 socket wrench.
- Installation is the reverse of the removal procedure.



Tightening torques:
Spark plug..... 20 Nm

Emptying drain hose from intake air silencer

(Inspections II and III)

- Have a funnel and drip tray ready.



- Remove the plug (arrow) and drain off all the oil.

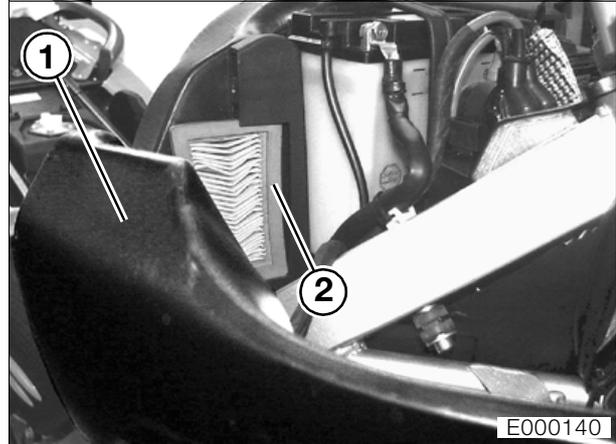
Caution:

Dispose of used oil in an environmentally compatible manner.

00 13 630 Replacing air cleaner element

(Inspection III)

- Remove right cover.
- Remove connecting flange from air filter box.



- Pull intake air duct (1) out of the holder.
- Remove air filter element (2).
- Clean the intake air silencer.
- Assembly is the reverse of the disassembly procedure.

Tightening torques:
Connecting flange..... 5 Nm

00 16 617 Replacing fuel filter

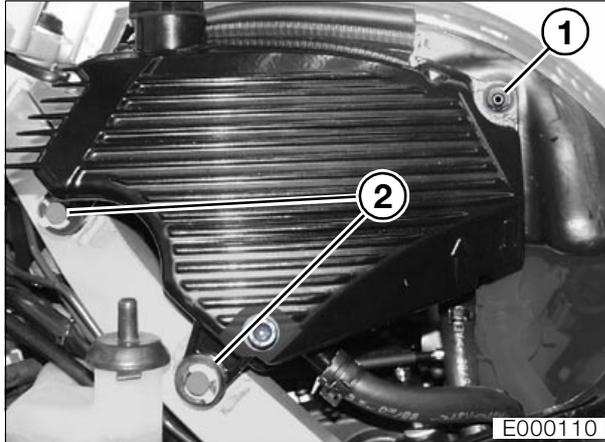
(Inspection III, every 20,000 km/12,000 miles)



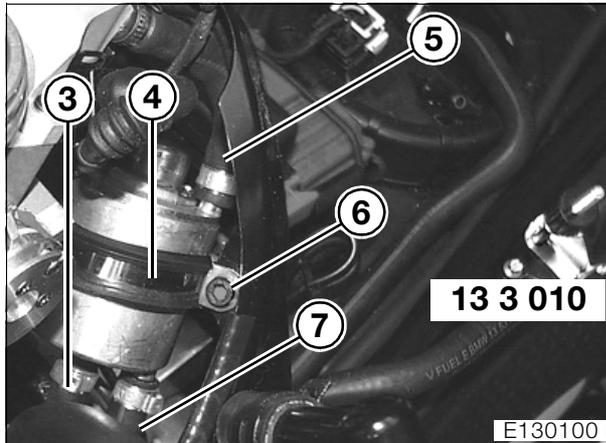
Warning:

Comply with safety precautions when handling or working with fuel; note that the fuel lines are pressurised.

- Remove left cover.



- Remove clips (2) and fastener (1) and pull the oil tank out of the holder.
- Remove the BMS control unit from the holder.



- Remove the fastener securing the fuel filter to frame (6).
- Close off fuel supply line (7) and the line to the fuel injector (5) with hose clips,
BMW No. 13 3 010.

- Slacken the hose clamps.



Warning:

Fuel escapes from the filter when the lines are disconnected.

- Disconnect fuel lines (3, 5, 7) from the filter.
- Remove clamp (4) from the fuel filter.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Note the installed positions of fuel feed line (7) and fuel return line (3).

- Close hose clamps with pliers,
BMW No. 13 1 500.

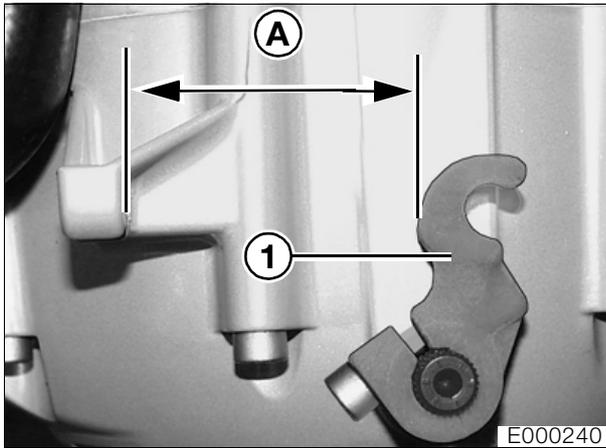


Tightening torques:

Fuel filter to frame	9 Nm
Oil tank to intake air silencer	9 Nm
Air filter box to frame	9 Nm
Connecting flange, air filter box to battery tray	5 Nm

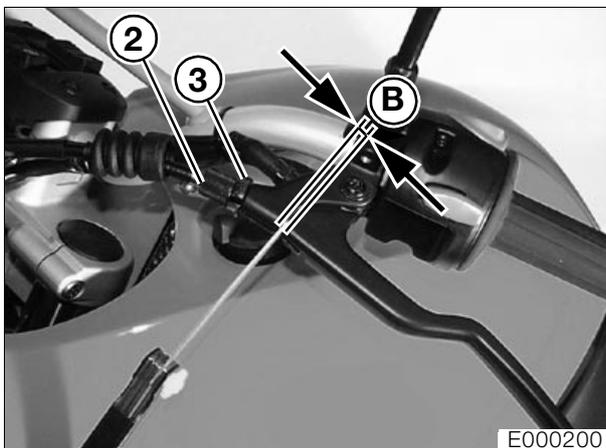
21 00 004 Checking clutch play, adjusting if necessary

(Inspections I, II and III)



- Release lever (1) on the gearbox must be located on the splines such that when it is pressed forward as far as the release point, distance "A" is as specified.

Distance "A" 47...52 mm (1.85...2.05 in)



- Adjust dimension "B" by turning adjusting screw (2) on the clutch handlebar lever.
- Lock adjusting screw (2) with knurled nut (3).

Dimension "B" 1.0...2.0 mm (0.04...0.08 in)

Checking wheel spoke tension, adjusting if necessary

(Inspection II)

- Strike the spokes and listen for differences in the pitch of the sound.
- If spokes are loose, tighten them with spoke nipple wrench, **BMW No. 36 3 800**.

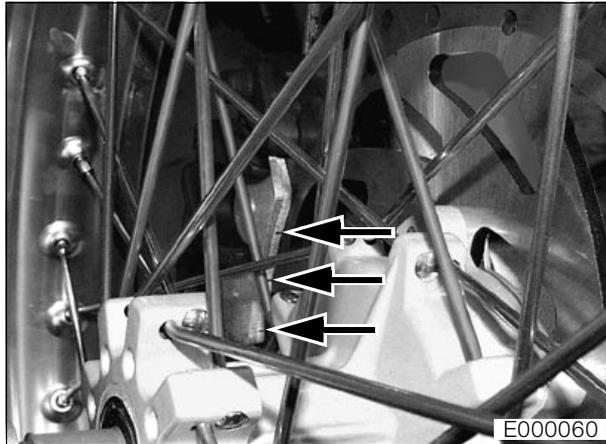
Vertical runout max. 2 mm (0.08 in)
Lateral runout max. 2 mm (0.08 in)

Checking brake pads and discs for wear, replacing if necessary

(Inspections II and III)

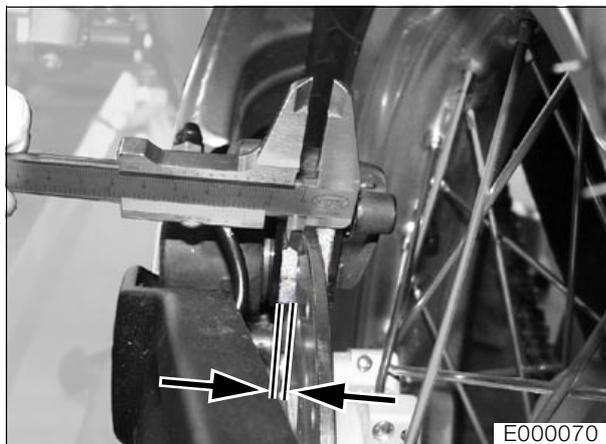
Checking brake pads for wear

Brake pads, front brake



- Visually inspect the brake pads.
 - The brake pad wear marks (arrows) must be clearly visible.

Brake pads, rear brake



- Measuring brake pad thickness (arrows)

Minimum pad thickness 1 mm (0.04 in)

Replacing brake pads



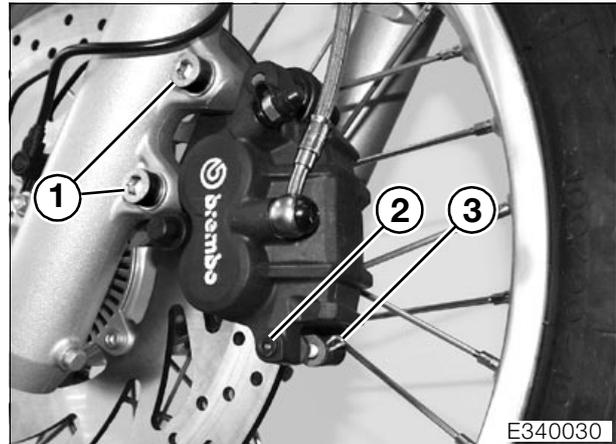
Caution:

Do not operate the brake when dismantled. Do not permit the brake pads to wear past the specified minimum thickness. Always replace the brake pads as a complete set.

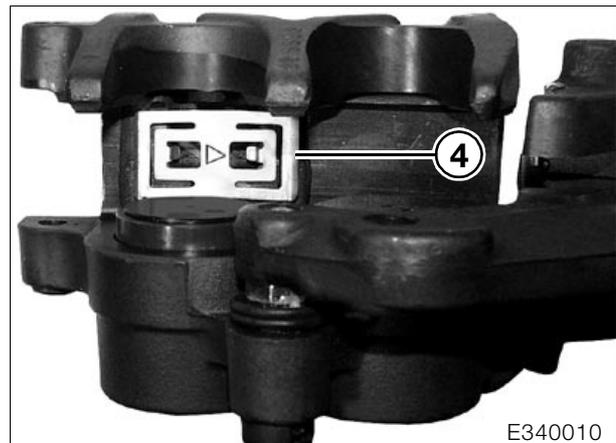


00 34 630 Brake pads, front brake

- Press the brake calliper against the brake disc in order to force the pistons back.



- Remove keeper (3).
- Drive out retaining pin (2).
- Remove the brake pads.
- Remove fasteners (1) and remove brake calliper.



- Make sure that spring (4) is correctly seated and installed right way round: engraved arrow must point in forward direction of travel.
- Install the brake pads.
- Install the keeper and the retaining pin.
- Install brake calliper.
- Operate brake several times until brake pads are correctly seated.

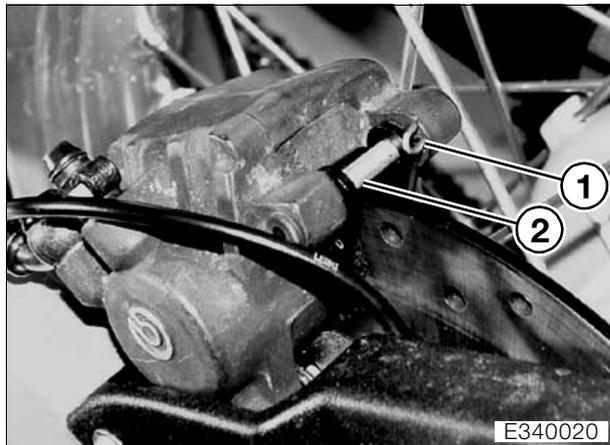


Tightening torques:

Brake calliper to fork slider tube 41 Nm

00 34 633 Brake pads, rear brake

- Press the brake calliper against the brake disc in order to force the pistons back.



- Remove keeper (1).
- Drive out retaining pin (2).
- Remove brake pads.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Operate brake several times until brake pads are correctly seated.

Checking the brake discs

- Carefully check the brake discs for cracks, damage, deformation and scoring.



- Measure the thickness of the brake discs at several points with a calliper gauge.

Brake disc wear limits

Front brake disc 4.5 mm (0.18 in)
 Rear brake disc 4.5 mm (0.18 in)

Checking the brake fluid level and topping up if necessary

(Inspection II)

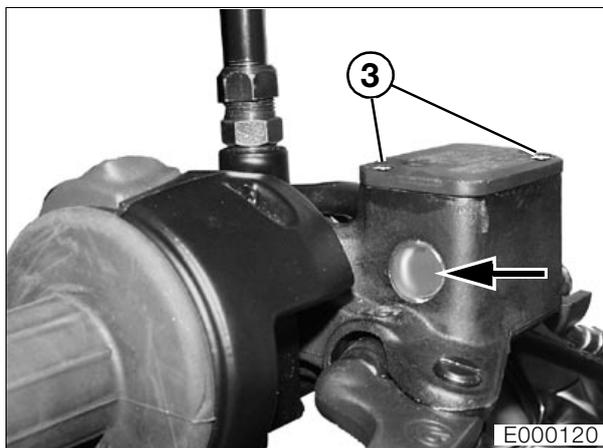


Note:

The volume of the brake fluid (MIN/MAX) is sufficient for lining thicknesses from new to the wear limit. It is not normally necessary to top up the fluid to accommodate lining wear. A level below MIN indicates the possibility of other faults.

Brake fluid level (front brake)

Checking brake fluid level (front brake)



- Turn the handlebars so that the cover of the reservoir is horizontal.
- The brake fluid must be between the top of the sight glass and the centre of the sight glass (arrow).

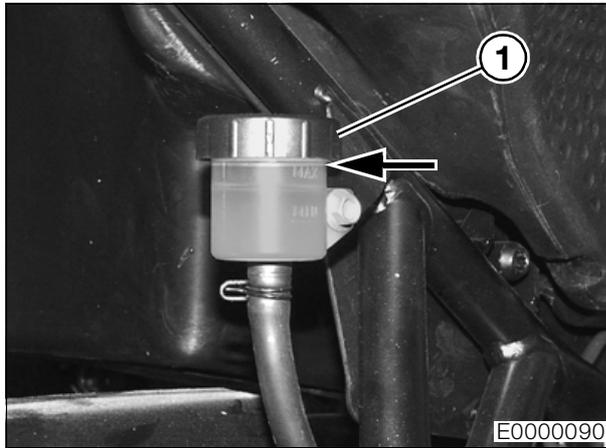
Topping up brake fluid level (front brake)

- Release fasteners (3).
- Remove cover complete with rubber gaiter.
- Add brake fluid up to the top of the sight glass.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Wipe the rim of the reservoir, the rubber gaiter and the cover to remove brake fluid.

Brake fluid gradeDOT 4

Brake fluid level (rear brake)

Checking brake fluid level (rear brake)



Maximum level **“MAX”**
Minimum level **“MIN”**

Topping up brake fluid level (rear brake)

- Take off cover (1) with rubber gaiter.
- Top up the brake fluid level to the **“MAX”** mark (arrow).
- Wipe the rim of the reservoir, the rubber gaiter and the cover to remove brake fluid.

Brake fluid gradeDOT 4

Checking operation of brake system and freedom from leaks, repairing/ replacing if necessary

(Inspection III)

- Check all brake lines for damage and correct routing.
- Wipe down all threaded unions on the brake lines and check them.
- Apply firm pressure to the brake lever and brake pedal and keep this pressure applied for a few moments.
- Release the brakes and check the brake lines for leaks.



Warning:

Defective lines and threaded unions in the brake system must always be replaced without delay.

00 34 606 Changing brake fluid

(Inspection IV)

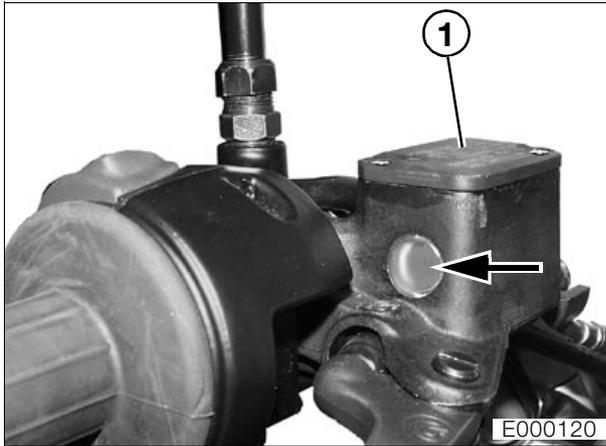


Caution:

Refer to notes on the hazards involved in handling brake fluid.
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.



Changing brake fluid (front brake)



- Turn the handlebars so that the cover of the reservoir is horizontal.
- Remove cover (1) complete with rubber gaiter and top up the level of brake fluid in the reservoir.
- Connect the brake bleeding device to the bleed screw on the brake calliper.
- Open the bleed screw by half a turn.



Caution:

While bleeding the system, do not allow the brake fluid level to drop below the centre of the sight glass (arrow), as otherwise air will be drawn into the brake system. Bleed the system again if this happens.

- Draw off brake fluid until it emerges clear and free from air bubbles.
- Tighten the bleed screw.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Before reassembling, carefully wipe the rim of the reservoir, the rubber gaiter and the cover to remove all traces of brake fluid.

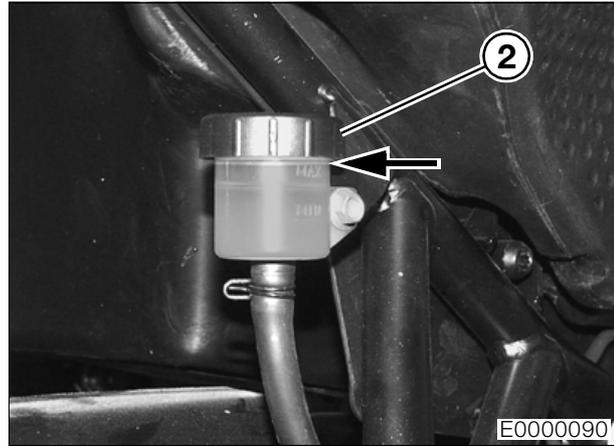
Brake fluid gradeDOT 4



Tightening torques:

Bleed screw 7 Nm

Changing brake fluid (rear brake)



- Remove cover (2) complete with rubber gaiter and top up the level of brake fluid in the reservoir.
- Connect the brake bleeding device to the bleed screw on the brake calliper.
- Open the bleed screw by half a turn.



Caution:

Brake fluid level must not drop below the MIN mark during the bleeding process, otherwise air will be drawn into the brake system. Bleed the system again if this happens.

- Draw off brake fluid until it emerges clear and free from air bubbles.
- Tighten the bleed screw.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Before reassembling, carefully wipe the rim of the reservoir, the rubber gaiter and the cover to remove all traces of brake fluid.

Brake fluid gradeDOT 4



Tightening torques:

Bleed screw 7 Nm

Replacing primary sealing boot, front brake master cylinder

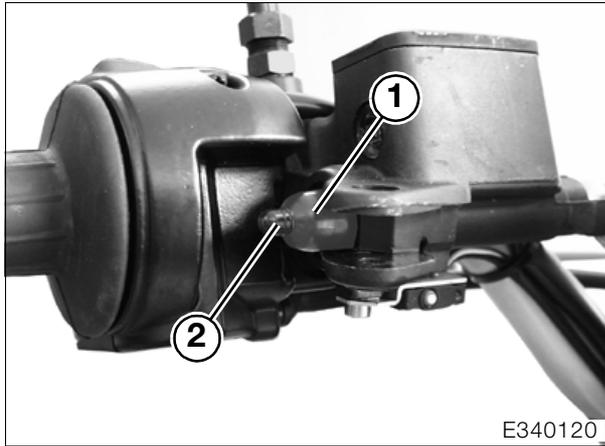
(Inspection III, every 40,000 km/24,000 miles for motorcycles with ABS)

- Place the motorcycle on its main (centre) stand.

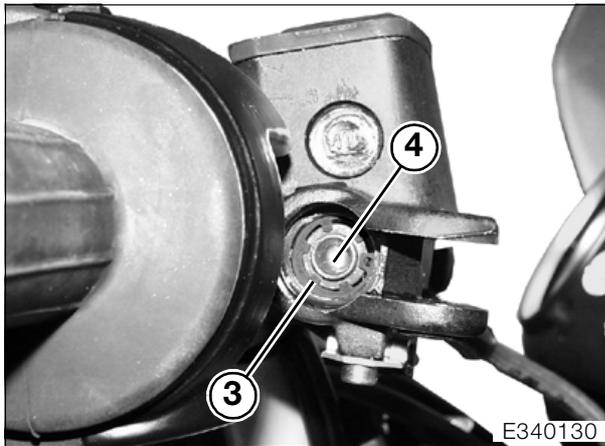
⚠ Caution:

Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

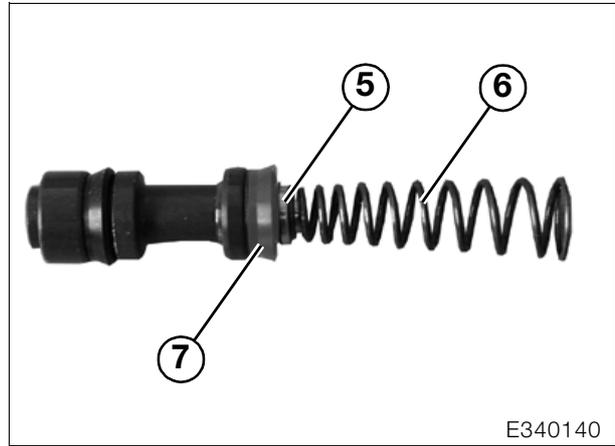
- Drain the front brake system.
- Remove the hand-brake lever.



- Remove thrust pin (2) with boot (1) and spring.
- Carefully force back the brake piston.



- Remove retaining ring (3).
- Use pliers to remove brake piston (4).



- Remove spring (6) with insert (5).

⚠ Caution:

Note the washer between the brake piston and the boot.

- Remove front boot (7).
- Installation is the reverse of the removal procedure: pay particular attention to the following.

⚠ Caution:

Sealing lips of the boots toward the pressure chamber.

- Install new front boot.
- Prior to installation, coat the brake piston and the boots with the assembly fluid supplied.
- Lightly grease the thrust pin with **Shell Retinax A**.
- Fill and bleed the brake system.

🔧 Tightening torques:

Pivot pin of handbrake lever 7 Nm
 Locknut of handbrake lever 7 Nm



Replacing primary sealing boot, rear brake master cylinder

(Inspection III, every 40,000 km/24,000 miles for motorcycles with ABS)

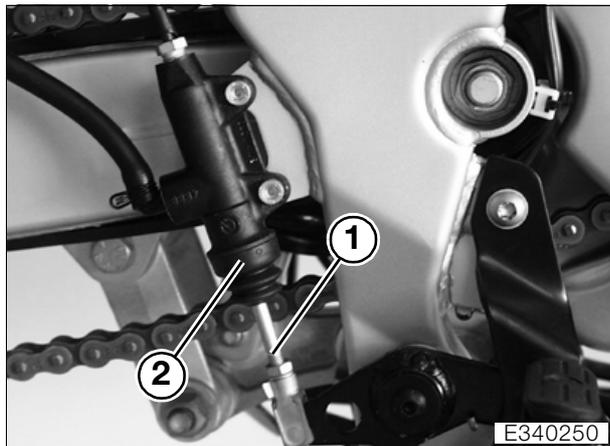
- Place the motorcycle on its main (centre) stand.



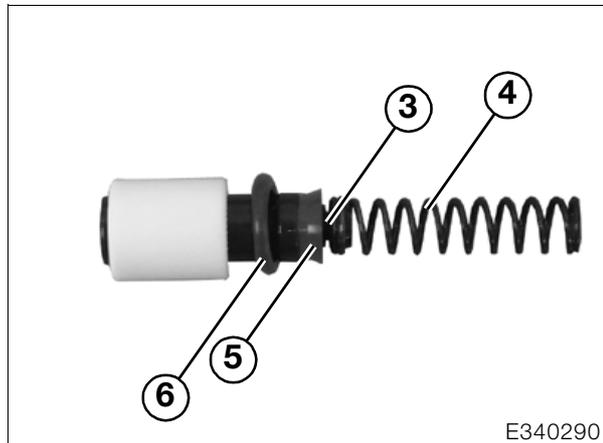
Caution:

Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Drain the rear brake system.



- Disengage piston thrust rod (1).
- Remove the piston thrust rod complete with sealing boot (2).
- Carefully force back the brake piston.
- Remove the circlip.
- Use pliers to remove the brake piston.



- Remove spring (4) with insert (3).



Caution:

Note the washer between the brake piston and the boot.

- Remove front boot (5).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Sealing lip of the boot toward the pressure chamber.



Note:

Replace O-ring (6) prior to installation.

- Install new front boot.
- Prior to installation, coat the brake piston and the boots with the assembly fluid supplied.
- Lightly grease the thrust rod with **Shell Retinax A**.
- Fill and bleed the brake system.

Inspecting front and rear wheel bearings, replacing if necessary

(Inspection III)



Note:

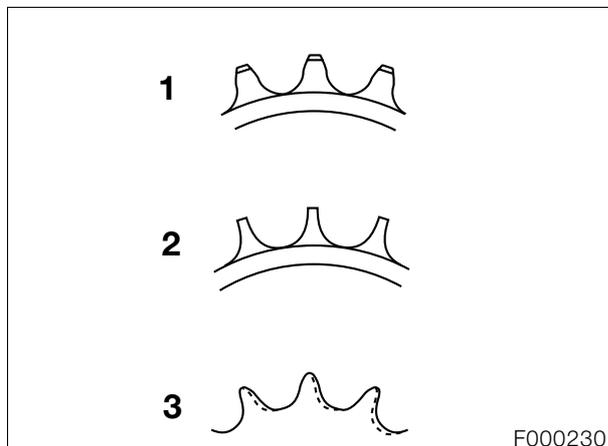
Check play when bearings are cold.

- Lift front/rear wheel of the ground.
- Tilt the front/rear wheel to and fro on the axle.
- No play should be detected.
- Replace the bearings if play is detected.

Checking chain, chainwheel and chain sprocket, replacing if necessary

(Inspections II and III)

- Remove the sprocket cover.
- Check chainwheel and chain sprocket for distortion.



- good (1)
- replace (2)
- replace (3)



Caution:

Always replace the chain, chainwheel and sprocket as a set.

27 71 005 Checking chain tension, adjusting if necessary

(Inspections I, II, III and IV)

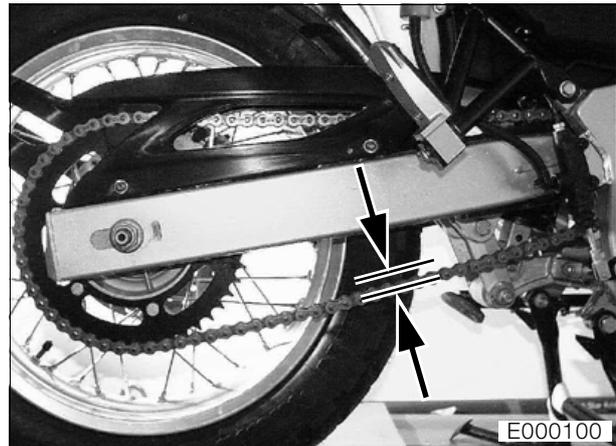
27 71 005 Checking chain tension

- Place the unloaded motorcycle on its main (centre) stand.



Caution:

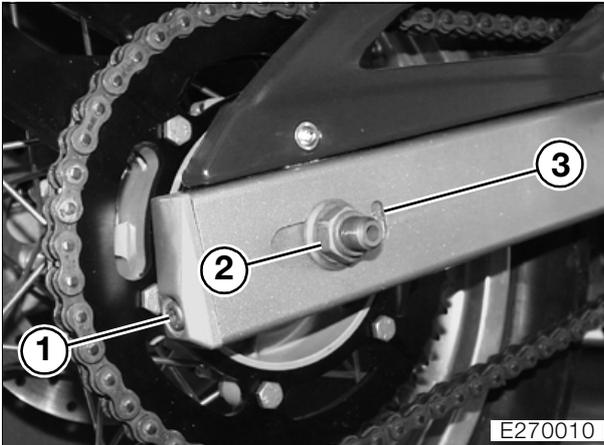
Check and adjust the chain tension only when the motorcycle is unloaded.



- Chains stretch unevenly, so turn the rear wheel to find the point at which chain deflection midway along the run between chainwheel and rear sprocket is least.
- At this point, push the chain up as far as it will go and measure chain deflection.

Chain deflection 35...45 mm (1.38...1.77 in)

27 71 005 Adjusting chain tension



- Loosen quick-release axle nut (2).



Caution:

When tensioning the chain, make sure that wheel alignment is correct. Check that the same number of notch marks are visible in window (3) on each side of the swinging fork.

- Adjust chain slack with chain tensioning screws (1).
- Firmly tighten quick-release axle nut (2).
- Check chain tension.
- Tighten chain tensioning screws (1).

Chain slack 35...45 mm (1.38...1.78 in)



Note:

Allow time for chain spray to take effect after spraying on. Avoid contamination of rider's clothing.



Tightening torques:

Quick-release shaft nut 100 Nm
Chain tensioning screws 10 Nm

61 20 029 Checking battery acid level, adding distilled water if necessary

(Inspections II, III and IV)



Warning:

Battery acid is highly caustic. Protect your eyes, face, hands, clothing and the paintwork.

61 20 029 Checking battery acid level

- Remove left, right and centre covers.
- Check the battery fluid level.
- The battery fluid level must be between maximum **“UPPER LEVEL”** and minimum **“LOWER LEVEL”**.

61 20 029 Adding distilled water

- Open the battery caps.



Caution:

Use only distilled water to top up the acid level in the battery. Never top up with diluted sulphuric acid.

- Top up with distilled water until the fluid level reaches the **“UPPER LEVEL”** mark.
- Replace the battery caps securely.
- Installation is the reverse of the removal procedure.

61 21 520 Cleaning and greasing the battery terminals, if necessary

(Inspections III and IV)



Note:

Disconnecting the battery clears all entries (such as errors, adaptations) from the BMS control unit memory.

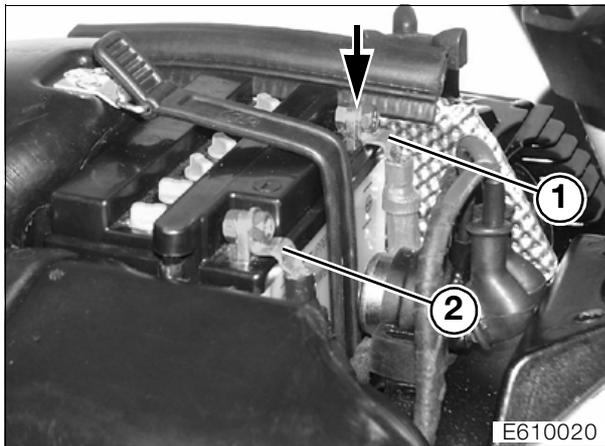
- Remove left, right and centre covers.



Caution:

Disconnect the battery only with the ignition switched off.

Disconnect the negative battery cable first, then the positive cable.



- Disconnect ground cable (2) from the battery.
- Disconnect positive cable (1) from the battery.
- Clean the battery terminals and grease them with **acid-proof battery grease**.

Acid-proof battery terminal grease

.....e.g. Bosch Ft 40 V1

- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Connect the positive battery cable first, then the negative cable.

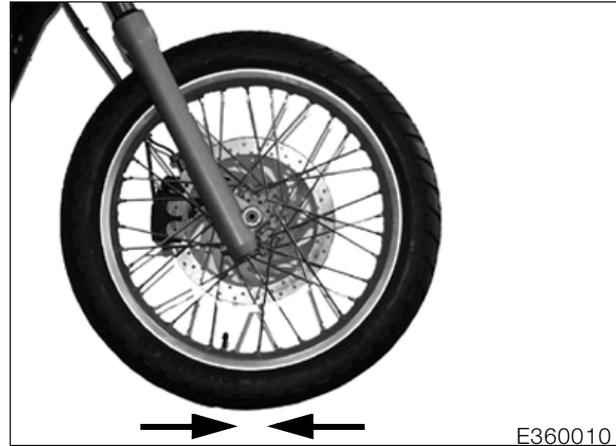
- Route the positive cable vertically (arrow) to the battery post. Make sure that all battery cells are visible through the inspection port in the cover.

32 00 454 Checking and adjusting steering head bearing play, replacing if necessary

(Inspections II and III)

Checking steering head bearing play

- Lift front wheel clear of the ground.



- Move fixed fork tubes forward (arrows).
- Adjust the steering head bearing if play is perceptible.



32 00 454 Checking and adjusting steering head bearing play, replacing if necessary

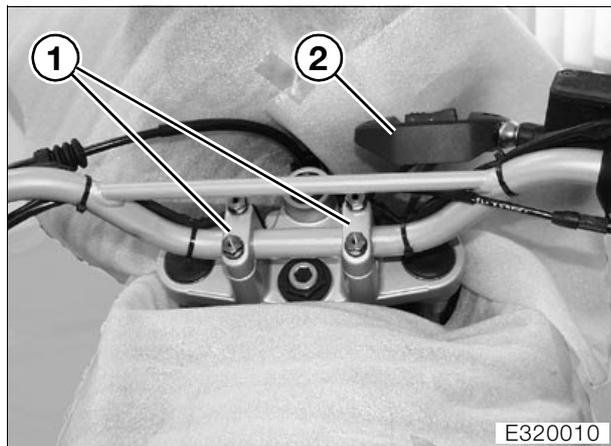
(Inspections II and III)

32 00 454 Adjusting steering head bearing play

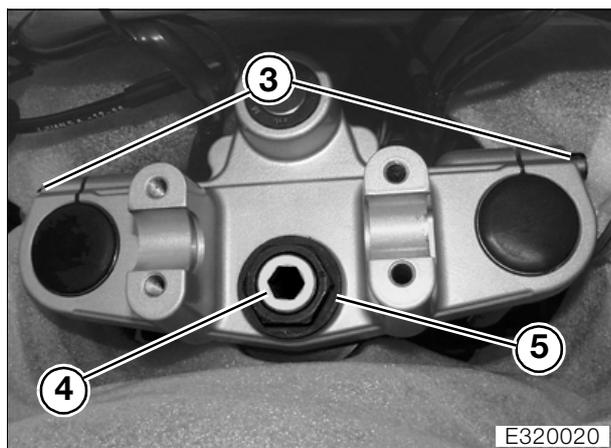


Caution:

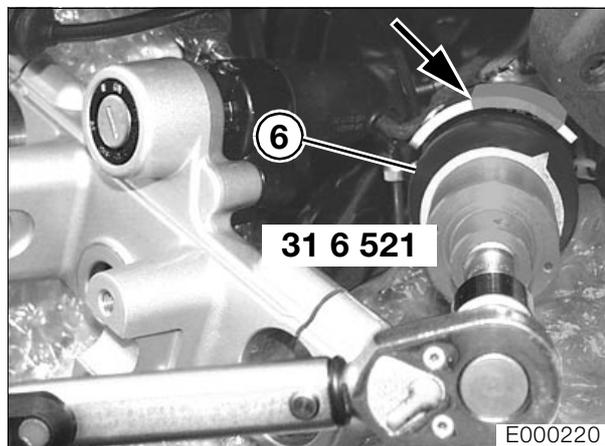
Cover or mask off the instrument cluster and trim to prevent scratches.



- Remove impact pad (2).
- Remove clamp blocks (1).
- Remove the handlebar and place it in front of the instrument cluster.



- Unscrew hex nut (5).
- Release clamping screws (3) at upper fork bridge.
- Remove the upper fork bridge complete with the ignition lock.
- Remove counter-tube (4).



- Slacken round nut (6) with pin-wrench adapter, **BMW No. 31 6 521**, then tighten to 25 Nm.
- Turn forks back and forth twice from lock to lock, and leave the forks at the full left lock position.
- Mark a 40 mm (1.58 in) arc with adhesive tape or similar (arrow) around the circumference of the locking plate at the steering head.
- Align the mark on pin-wrench adapter, **BMW No. 31 6 521**, with the right-hand end of the marked arc.



Note:

40 mm (1.58 in) around the circumference of the locking plate corresponds to an angle of rotation of 60°.

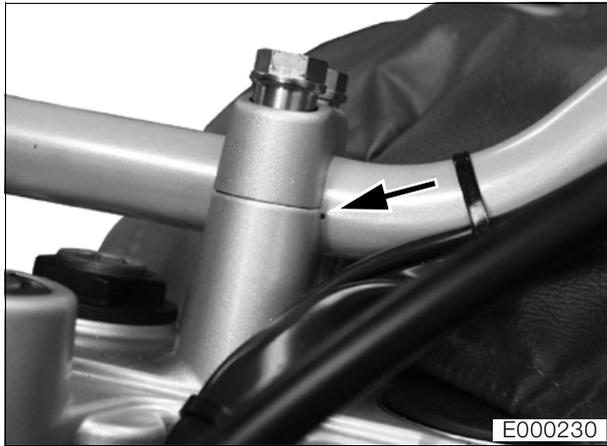
- Turn the round nut clockwise until the pointer on pin-wrench adapter, **BMW No. 31 6 521**, reaches the left-hand end of the marked arc.
- Remove the mark/adhesive tape from the locking plate.



Caution:

Check the mating faces of the fork bridge and knurled nut, rub down with an oilstone if necessary and clean.

- Tighten counter-tube (4).
- Install fork bridge.
- Tighten locknut (5).
- Tighten the clamping screws at fork bridge (3).
- Check play and freedom of movement.



Note:

Use the punch marks (arrow) to align the handlebars as shown.



Warning:

Begin by tightening the front securing screws (as viewed in the forward direction of travel) of the clamp blocks, then tighten the rear securing screws.

- Install handlebars and impact pad.
- Take the load off the front wheel and perform final check.
- With the front wheel off the ground, the weight of the forks must be enough to turn the steering all the way to the left and right full lock positions as soon as the steering is moved away from the straight-ahead position.
- If local points of stiffness are detected when the handlebar is moved to and fro, renew the steering head bearings.



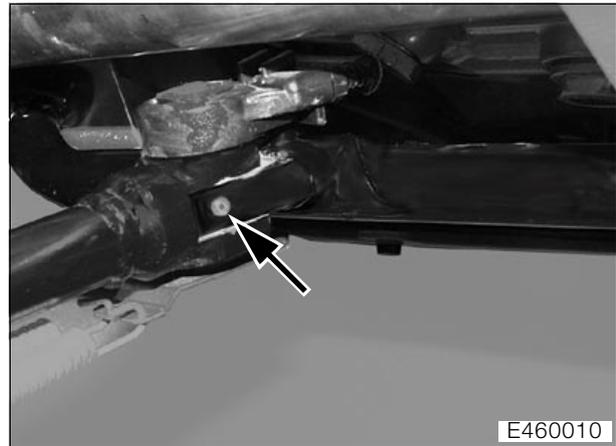
Tightening torques:

Initial torque, round nut	25 Nm
Back off through angle of rotation	60 °
Counter-tube to steering head bearing.....	65 Nm
Hexagon nut to counter-tube	65 Nm
Clamp screws at fork bridge.....	23 Nm
Handlebar to fork bridge	23 Nm

Greasing the side and main stands and the brake pedal lever

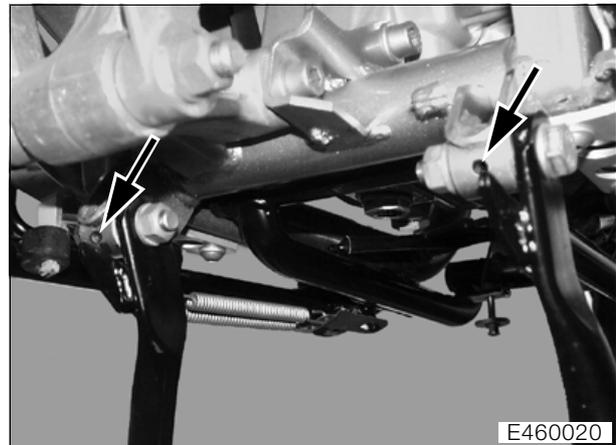
(Inspections II and III)

Side stand



- Grease bearing bush (arrow) with a grease gun until fresh grease emerges at the lubricated faces.
- If very dirty and stiff to move, remove the side stand and grease its pivots.

Main (centre) stand



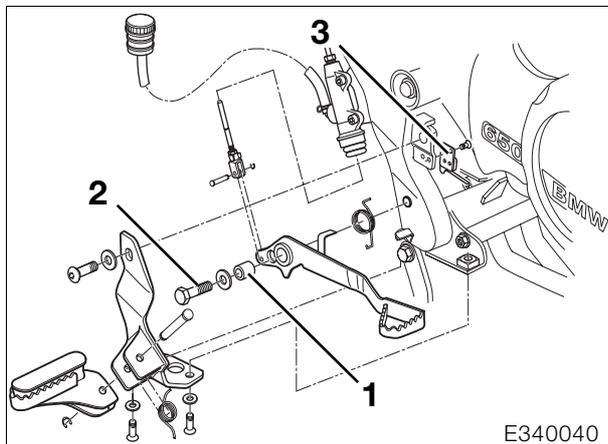
- Grease bearing bushes (arrows) with a grease gun until fresh grease emerges at the lubricated faces.

Lubricant:

for pivot bushing **Staburags NBU 30 PTM**

- If very dirty and stiff to move, remove the main stand and grease its pivots.

Brake pedal



- Remove hexagon fit bolt (2).
- Remove bushing (1).
- Grease the bushing and the fit bolt.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Check operation of brake-light switch (3).



Tightening torques:

Brake pedal to frame 21 Nm

Lubricant:

for pivot bushing..... **Staburags NBU 30 PTM**

Checking security of threaded fasteners

(Inspections I, II, III and IV)

- Check the security of the following threaded fasteners:
 - Engine mounting bolts and nuts
 - Threaded t frame
 - Main and side stands
 - Exhaust mountings
 - Swinging fork pivots
 - Angled lever
 - Brake pedal
 - Quickrelease axles



Tightening torques:

Engine/crankcase	
to main frame at rear	41 Nm
Engine/cylinder head to main frame at top ...	41 Nm
Engine/crankcase to engine mounting	
at front	41 Nm
Engine mounting to main frame	21 Nm
Footrest plate to main frame	21 Nm
Engine guard to frame	9 Nm
Rear frame to main frame	21 Nm
Centre stand to main frame	41 Nm
Side stand undersection to main frame	21 Nm
Exhaust manifold to cylinder head	20 Nm
Silencer to exhaust manifold	
(Torca clamp)	55 Nm
Silencer to rear frame	21 Nm
Spring strut to angled lever	47 Nm
Angled lever to frame	41 Nm
Strut to angled lever	71 Nm
Strut to swinging arm	41 Nm
Swinging-arm axle	100 Nm
Footbrake lever to frame	21 Nm
Clamp of front quick-release axle	23 Nm
Front quick-release axle to fork leg	80 Nm
Rear quick-release axle to swinging arm	100 Nm

Final inspection with road safety and functional check

(Inspections I, II, III and IV)

Road safety check

- Check wheels and tyres.
- Check tyre pressures and correct if necessary.



Tyre tread depth (recommended minimum value)



Warning:

It must comply with legal regulations concerning minimum tyre tread depth.

Front wheel 2 mm (0.08 in)
Rear wheel 3 mm (0.12 in)

Tyre pressures (tyres cold)

Solo

Front wheel 1.9 bar (27.0 psi)
Rear wheel 2.1 bar (30.0 psi)

With full load

Front wheel 2.1 bar (30.0 psi)
Rear wheel 2.3 bar (33.0 psi)

Roadworthiness check

- Clutch, gear shift
- Steering
- Handbrake and foot brake
- Lights and signalling equipment, telltale and warning lights, instruments
- Side-stand switch
- If necessary, test ride



11 Motor

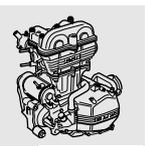
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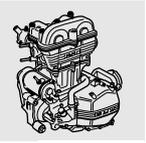
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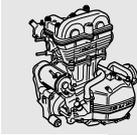


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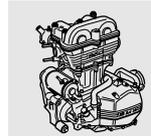


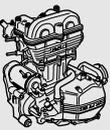
Technical Data		F 650 GS
Engine, general		
Type		Single-cylinder four-stroke, double overhead camshafts driven by roller chain, 4 valves operated by bucket tappets, balancing shaft, liquid-cooled cylinder and cylinder head, integral water pump, 5-speed gearbox and dry sump lubrication.
Cylinder bore	mm (in)	100 (3.94)
Stroke	mm (in)	83.0 (3.27)
Displacement	cc	652
Compression ratio		11.5 : 1
Power output	kW (hp)	37 (50) at 6500 rpm
Max. torque	Nm	60 at 5000 rpm
Idle speed	rpm	1400
Max. continuous engine speed	rpm	7000
Max. engine speed	rpm	7500
Crankshaft (main) bearings		Plain bearing
Engine lubrication		Dry sump, with oil pump
Cylinder		Light alloy, "Nikasil" coated
Piston		Cast aluminium with 3 rings
Oil filter		Full-flow type
Oil pump		2 trochoid pumps, driven from primary output
Oil capacity	l (Imp.pints/ US quarts)	2.3 (4.05/2.43)
Oil pressure (idle speed)	bar (psi)	≥ 0.5 (7.11) (oil temperature 80 °C/176 °F)
Permissible oil consumption	l/100km (miles per Imp. pint/ miles per US quart)	0.1 (350/590)



Technical Data		F 650 GS
Crank gear		
Crankshaft - main bearing play		
On installation	mm (in)	0.030...0.070 (0.0012...0.0028)
Wear limit	mm (in)	0.10 (0.004)
Wear limit, main bearing bore diameter	mm (in)	46.08 (1.814)
Wear limit		
Main bearing journal diameter	mm (in)	47.97 (1.888)
Bearing play	mm (in)	0.10 (0.004)
Runout at crankpin		
Clutch end	mm (in)	0.03 (0.001)
Magnet end	mm (in)	0.05 (0.002)
Connecting rod		
Wear limit, connecting rod		
Radial play		
Big end bore	mm (in)	0.08 (0.003)
Small end bore	mm (in)	0.05 (0.002)
Connecting rod - axial play		
On installation	mm (in)	0.30...0.65 (0.012...0.026)
Wear limit	mm (in)	0.80 (0.031)
Small-end bearing - axial play		
On installation	mm (in)	22.015...22.025 (0.8668...0.8671)
Wear limit	mm (in)	22.04 (0.868)
Compensating shaft		
Bearing journals		
Wear limit		19.96 (0.786)
Cylinder head		
Camshaft journals I/E	mm (in)	21.967...21.980 (0.8649...0.8654)
Wear limit	mm (in)	21.950 (0.8642)
Camshaft bearing play I/E	mm (in)	0.020...0.060 (0.0008...0.0023)
Wear limit	mm (in)	0.090 (0.0035)
Valves		
Valve clearances with engine cold (max. 35 °C/95 °F)		
Inlet valves	mm (in)	0.05...0.10 (0.002...0.004)
Exhaust valves	mm (in)	0.25...0.30 (0.010...0.012)
Valve timing (at 3 mm/0.12 in valve clearance)		
Inlet opens		13° after TDC
Inlet closes		25° after BDC
Exhaust opens		25° before BDC
Exhaust closes		13° before TDC
Valve head dia.		
Inlet	mm (in)	36 (1.41)
Exhaust	mm (in)	31 (1.22)
Stem dia.		
Inlet	mm (in)	4.90...4.94 (0.193...0.194)
Wear limit	mm (in)	4.89 (0.193)
Exhaust	mm (in)	4.90...4.94 (0.193...0.194)
Wear limit	mm (in)	4.89 (0.193)
Valve stem play - installed clearance		
Inlet	mm (in)	0.016...0.058 (0.0006...0.0023)
Wear limit	mm (in)	0.130 (0.0051)
Exhaust	mm (in)	0.031...0.073 (0.0012...0.0029)
Wear limit	mm (in)	0.145 (0.0057)

Technical Data		F 650 GS
Valve seat angle		
Inlet	°	45
Exhaust	°	45
Included valve angle		
Inlet	°	15
Exhaust	°	18
Valve seat width		
Inlet	mm (in)	1.05...1.35 (0.041...0.053)
Wear limit	mm (in)	1.60 (0.063)
Exhaust	mm (in)	1.25...1.55 (0.049...0.061)
Wear limit	mm (in)	2.2 (0.09)
Valve guide		
Inlet Intl. dia.	mm (in)	5.006...5.018 (0.1971...0.1976)
Wear limit	mm (in)	5.080 (0.2000)
Exhaust Intl. dia.	mm (in)	5.006...5.018 (0.1971...0.1976)
Wear limit	mm (in)	5.080 (0.2000)
Bucket tappets (wear limit)		
Extl. dia.	mm (in)	33.400 (1.3150)
Radial clearance in cylinder head	mm (in)	0.200 (0.0079)
Guide dia. in cylinder head	mm (in)	33.600 (1.3229)
Valve spring		
On installation (free length)	mm (in)	min. 40.5 (1.60)
Wear limit	mm (in)	39.0 (1.54)
Camshafts		
Wear limit		
Inlet and exhaust		
Bearing journal diameter	mm (in)	21.95 (0.864)
Cam height I	mm (in)	39.35...39.45 (1.545...1.553)
Cam height E	mm (in)	39.15...39.25 (1.541...1.545)
Wear limit I	mm (in)	39.25 (1.545)
Wear limit E	mm (in)	39.05 (1.537)
Bearing bore dia. in camshaft mount	mm (in)	22.040 (0.8677)
Oil pressure control valve		
Coil spring length, relaxed	mm (in)	min. 14.0 (0.55)
Oil retaining valve		
Coil spring length, relaxed	mm (in)	min. 14.5 (0.57)
Pistons		
Piston diameter		
“A”		
On installation	mm (in)	99.975...99.985 (3.9361...3.9365)
Wear limit	mm (in)	99.940 (3.9347)
Installed clearance	mm (in)	0.015...0.040 (0.0006...0.0016)
Wear limit	mm (in)	0.090 (0.0035)
“B”		
On installation	mm (in)	99.985...99.995 (3.9365...3.9369)
Wear limit	mm (in)	99.950 (3.9351)
Installed clearance	mm (in)	0.015...0.040 (0.0006...0.0016)
Wear limit	mm (in)	0.090 (0.0035)

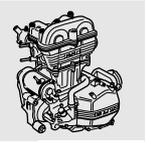




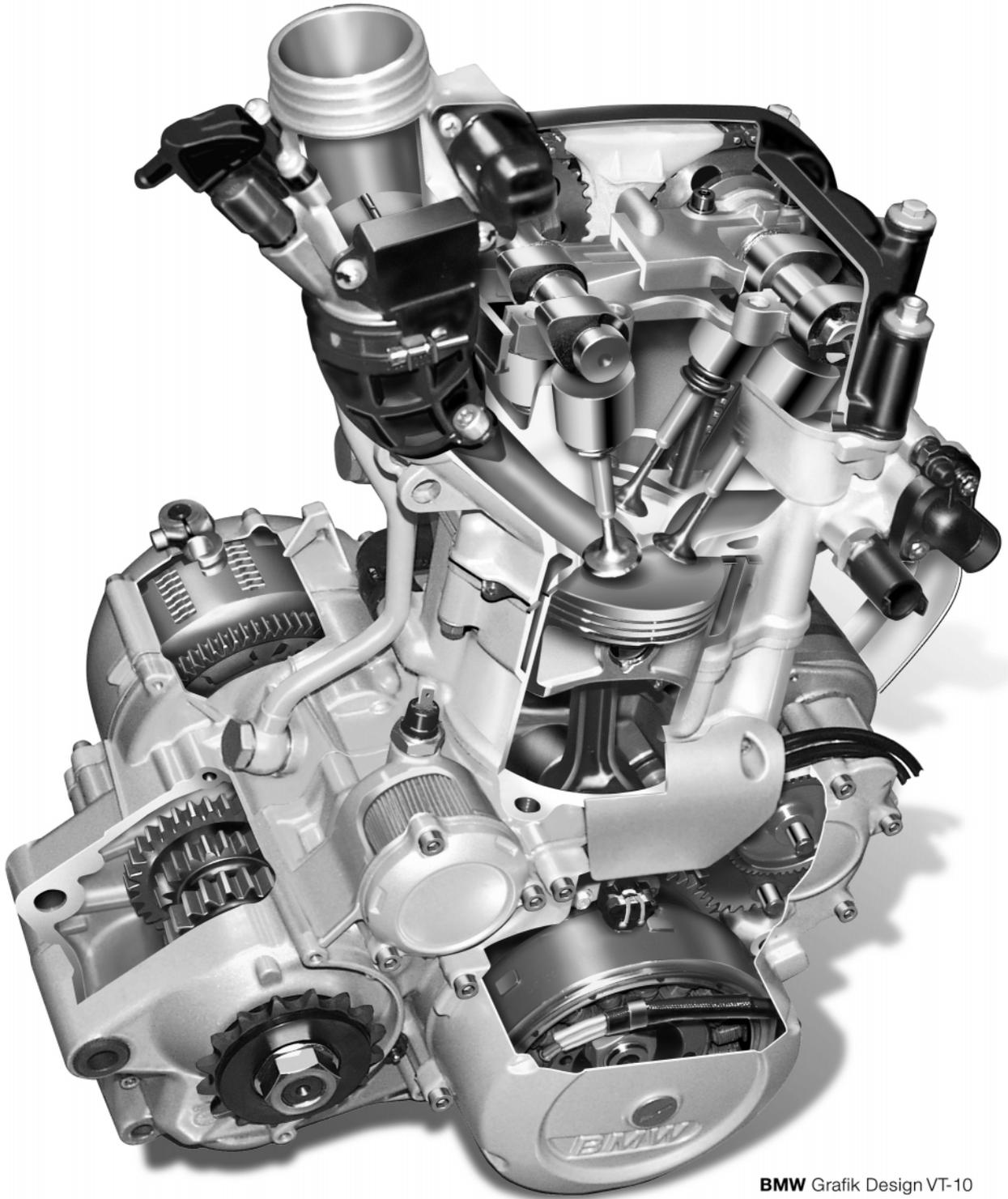
Technical Data		F 650 GS
Piston rings		
1st groove Rectangular-section ring		
Ring thickness	mm (in)	1.2 (0.05)
Ring thickness wear limit	mm (in)	1.15 (0.045)
End gap	mm (in)	0.2...0.4 (0.008...0.016)
End-gap wear limit	mm (in)	1.0 (0.04)
Groove-height wear limit	mm (in)	1.30 (0.051)
Ring float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring float, wear limit	mm (in)	0.15 (0.045)
2nd groove Micro-taper ring		
Ring thickness	mm (in)	1.5 (0.06)
Ring thickness wear limit	mm (in)	1.45 (0.057)
End gap	mm (in)	0.2...0.4 (0.008...0.016)
End-gap wear limit	mm (in)	1.0 (0.04)
Groove-height wear limit	mm (in)	1.6 (0.06)
Ring float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring float, wear limit	mm (in)	0.15 (0.045)
3rd groove Spring-steel oil control ring		
End gap	mm (in)	0.2...0.4 (0.008...0.016)
End-gap wear limit	mm (in)	1.0 (0.04)
Groove-height wear limit	mm (in)	2.6 (0.10)
Ring float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring float, wear limit	mm (in)	0.15 (0.045)
Piston pin		
Piston pin dia.		
Wear limit	mm (in)	21.98 (0.865)
Piston-pin play in small end bore	mm (in)	0.015...0.029 (0.0006...0.0011)
Wear limit	mm (in)	0.050 (0.0020)
in bore in piston	mm (in)	0.012...0.021 (0.0005...0.0008)
Wear limit	mm (in)	0.050 (0.0020)
Cylinder		
Bore		
Cylinder "A"	mm (in)	100.000...100.012 (3.9371...3.9376)
Wear limit	mm (in)	100.03 (3.9382)
Bore		
Cylinder "B"	mm (in)	100.012...100.024 (3.9376...3.9380)
Wear limit	mm (in)	100.04 (3.9387)
Timing chain		
Wear limit		
Distance from sealing face of plug to piston of chain tensioner	mm (in)	9.0 (0.35)
Clutch and gearbox		
Clutch friction plates (8 plates)		
Size per plate on installation	mm (in)	3.45...3.55 (0.136...0.140)
Wear limit for thickness of plate assembly (total)	mm (in)	27.5 (1.082)
Copper springs		
Wear limit at 190 N	mm (in)	27.4 (1.079)
Oil pump		
Oil pumps		primary/secondary

Technical Data		F 650 GS
Housing depth (primary)	mm (in)	14 (0.6)
Housing depth (secondary)	mm (in)	19 (0.7)
Wear limit, installed clearance (radial)	mm (in)	0.25 (0.010)
Wear limit, installed clearance (axial)	mm (in)	0.25 (0.010)



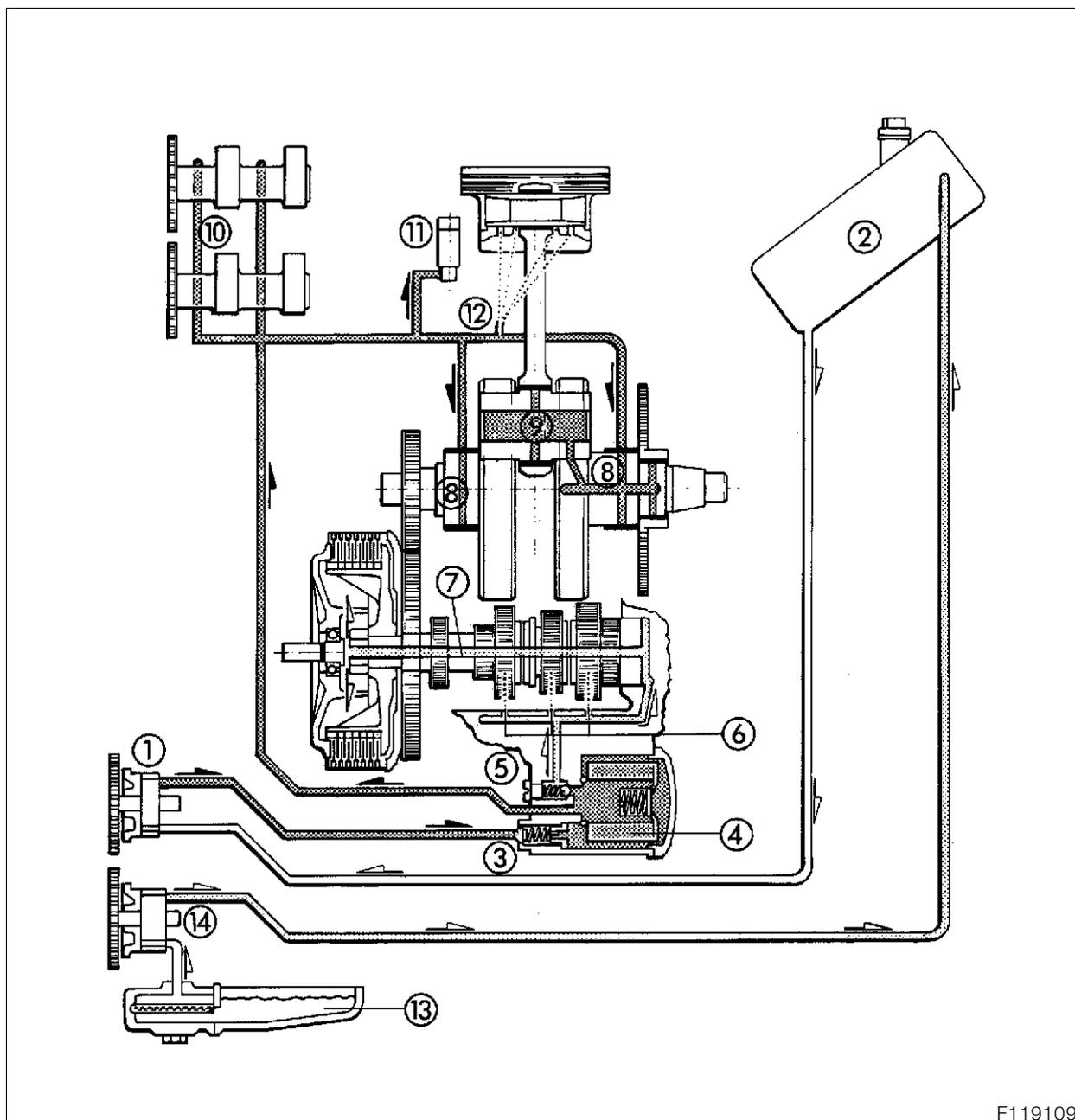


Sectional view of engine



BMW Grafik Design VT-10

E110550

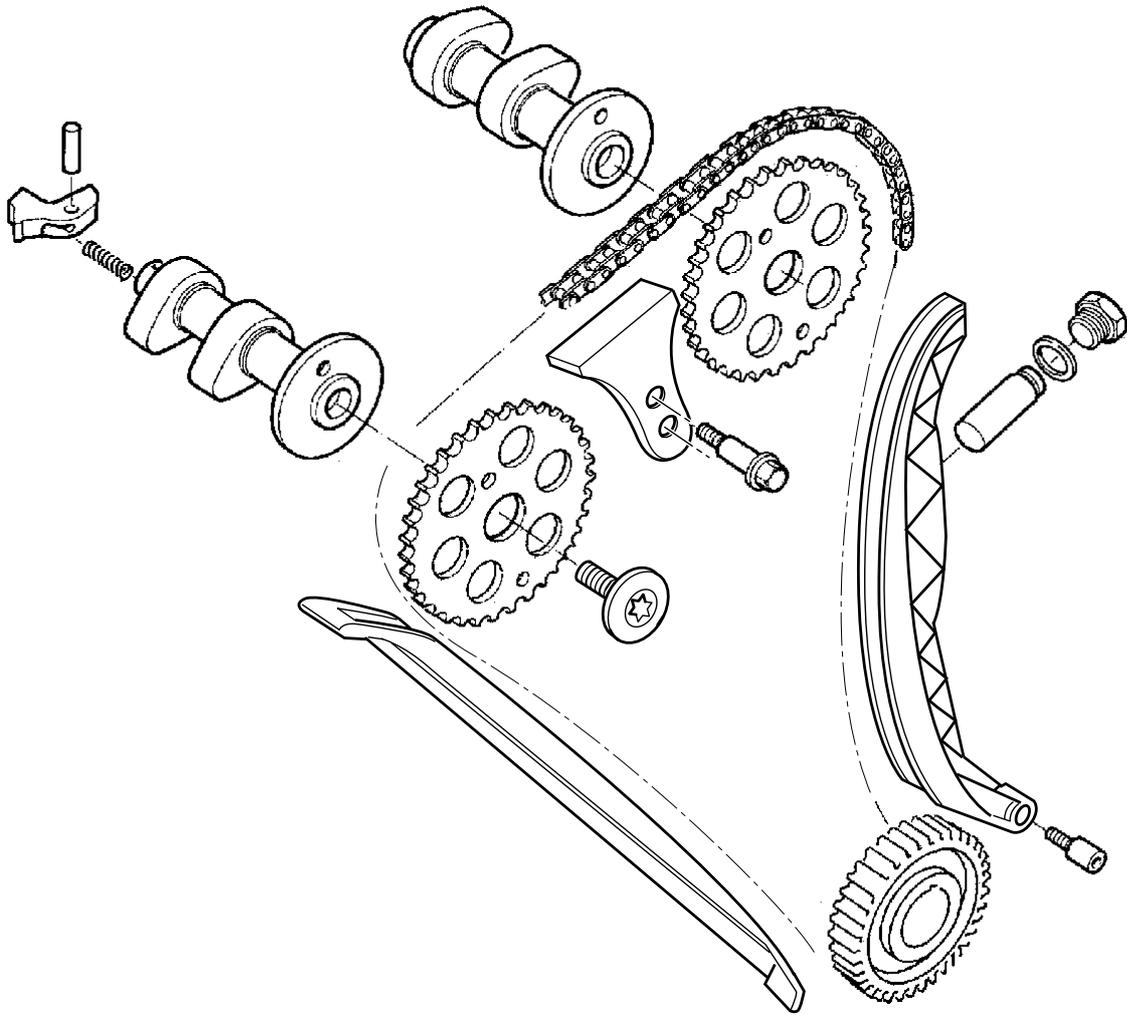
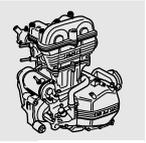


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Engine oil circuit

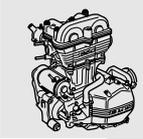
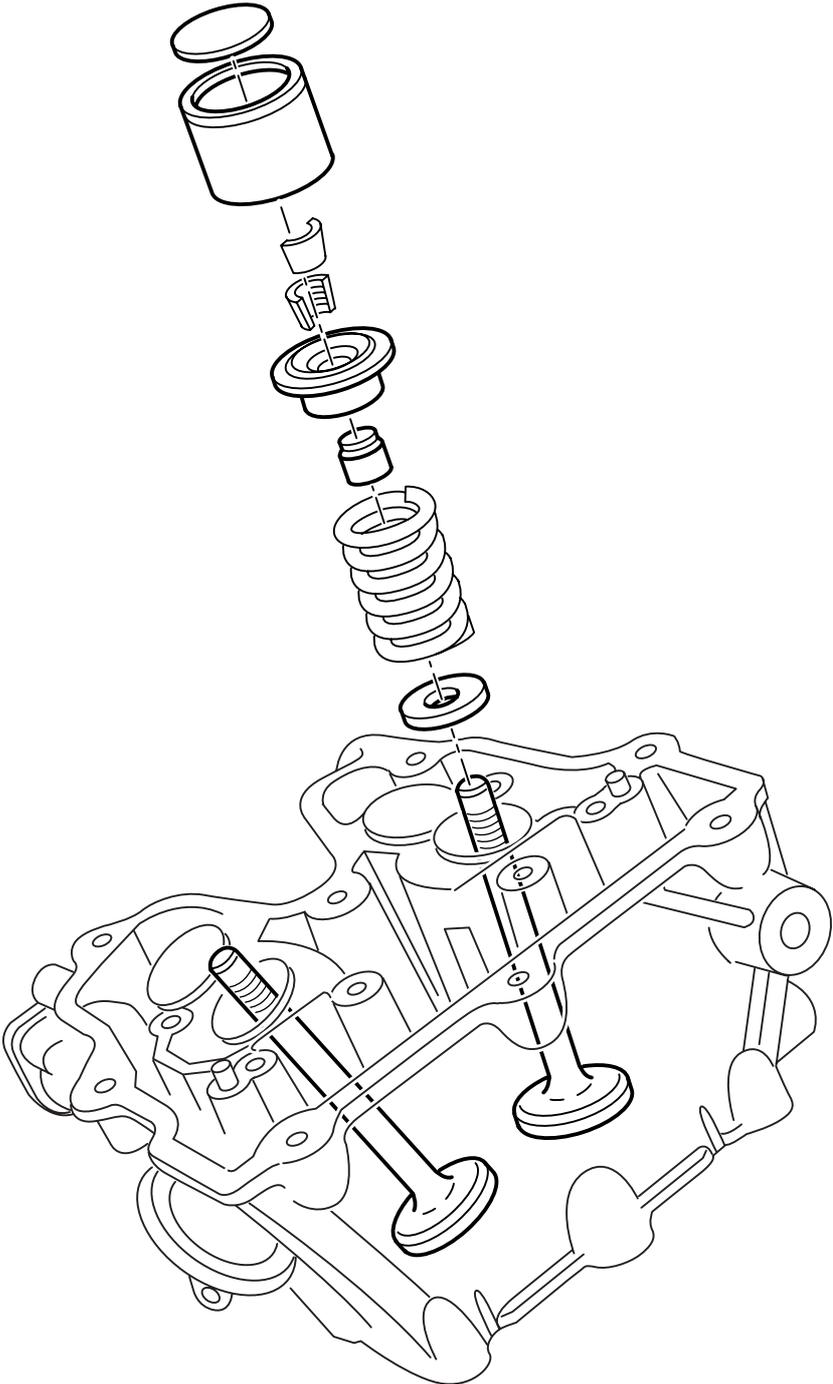
- 1 Delivery pump
- 2 Oil tank
- 3 Check valve
- 4 Oil filter
- 5 Control valve
- 6 Low-pressure line (gearbox)
- 7 Low-pressure line (clutch)
- 8 High-pressure line (crankshaft)
- 9 High-pressure line (big end bearing)
- 10 High-pressure line (camshafts)
- 11 Chain tensioner
- 12 Spray nozzle (for piston)
- 13 Oil sump
- 14 Suction pump

Valve gear

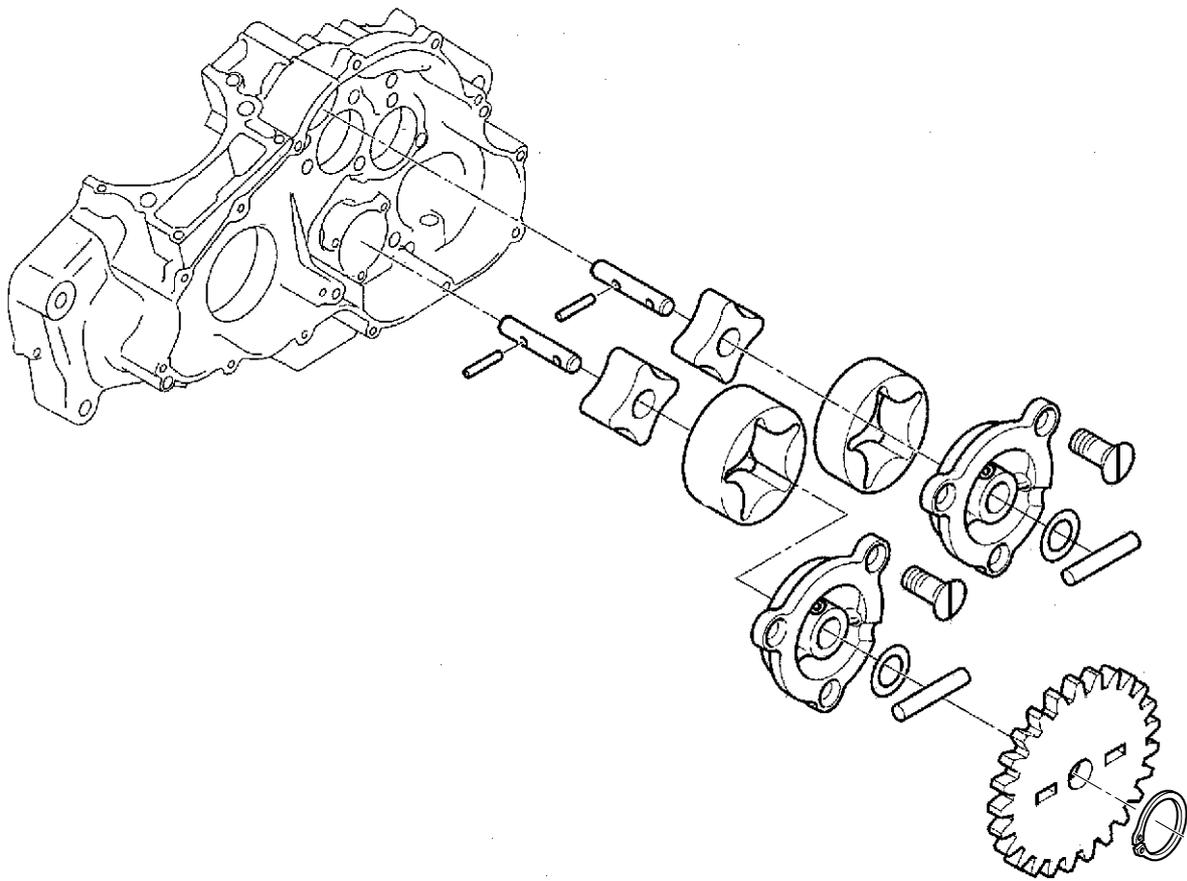
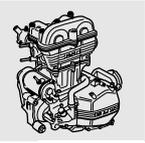


E110440

Valves, components



Oil pumps, components



E110460

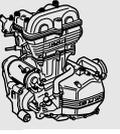
11 12 116 Removing and installing cylinder head, engine installed

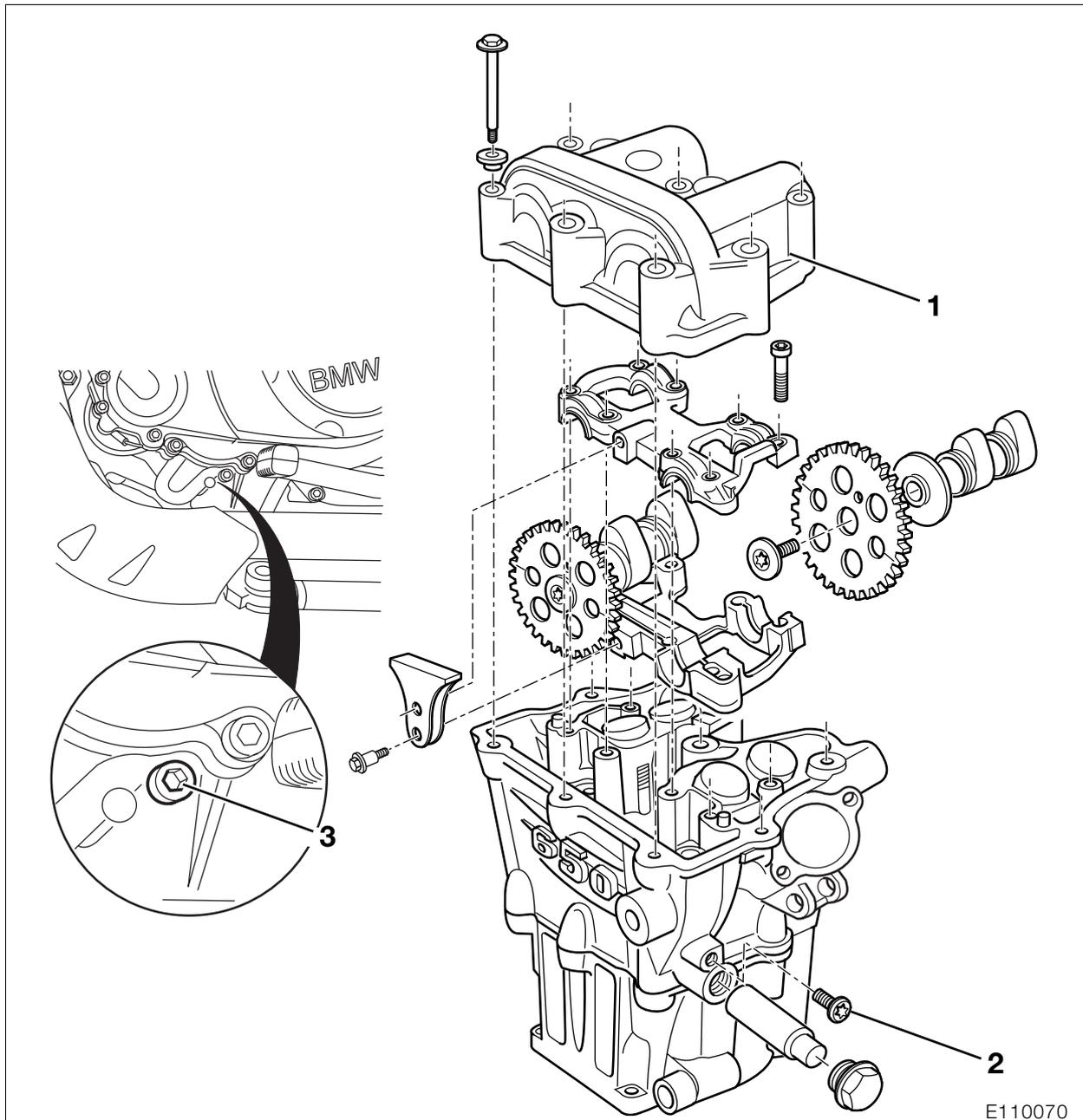


Note:

If an engine failure occurs, the oil tank and oil lines must be cleaned with the material used for this purpose in the workshop, and then blown through with compressed air.

Preparatory work

- 
- Remove left, right and centre covers.
 - ➡See Group 46
 - Remove the battery.
 - ➡See Group 61
 - Drain coolant.
 - ➡See Group 00
 - Drain the engine oil from the oil tank.
 - Remove engine guard.
 - ➡See Group 46
 - Remove the starter motor.
 - ➡See Group 12
 - Remove exhaust manifold and oxygen sensor.
 - ➡See Group 18
 - Expose the radiator.
 - ➡See Group 00
 - Remove the intake air duct.
 - ➡See Group 13
 - Remove intake air silencer.
 - ➡See Group 13
 - Remove the battery box.
 - Remove circlip securing throttle cable to throttle flap stub and disengage the throttle cable from the guide.
 - Disengage throttle cable from adapter.
 - Disconnect plugs at throttle flap stub.
 - Remove the intake pipe from the cylinder head and lay it carefully to one side, complete with the throttle flap stub.
 - Slacken the fastener securing the lid of the electronic equipment box.
 - Disengage the cover from the anchorages on the main frame on each side and remove.
 - Disconnect the starter coil at the plug.
 - Remove the fastener securing the ignition-coil bracket and remove the ignition coil complete with bracket.



E110070

- Remove fastener for oil lines (2) from the cylinder head.
- Use pliers, **BMW No. 17 5 500**, to open the clamp securing the breather hose at the valve cover.
- Remove valve cover (1).
- Remove spark plug.
- Remove centre screw plug on right in engine block.



Note:

TDC position: Marks on the timing-chain sprockets are parallel with the cylinder head, the bores in the timing-chain sprockets are at the top.

- Turn crankshaft to top dead centre position with an Allen key.



Note:

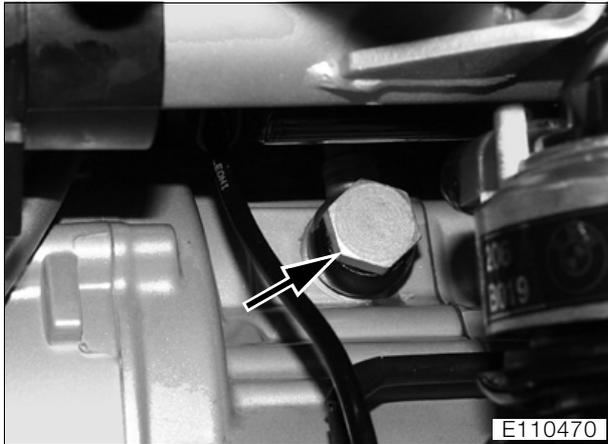
Watch out for escaping oil and catch it in a suitable container.

- Remove screw (3) close to the oil feed stub pipe and install locking screw, **BMW No. 11 6 570**, to prevent the crankshaft from turning.

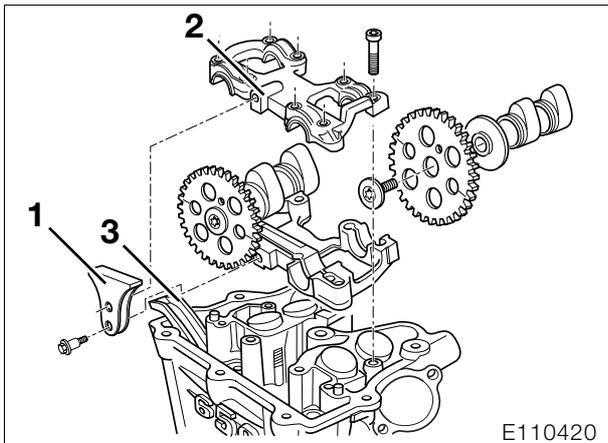
11 31 022 Removing camshafts

- Remove the cable cover from the right-hand side of the cylinder.
- Remove the retainer of the spring-strut adjusting knob from the frame.
- Disconnect plug of oil-pressure switch.
- Raise the rear frame.

➡See Group 46



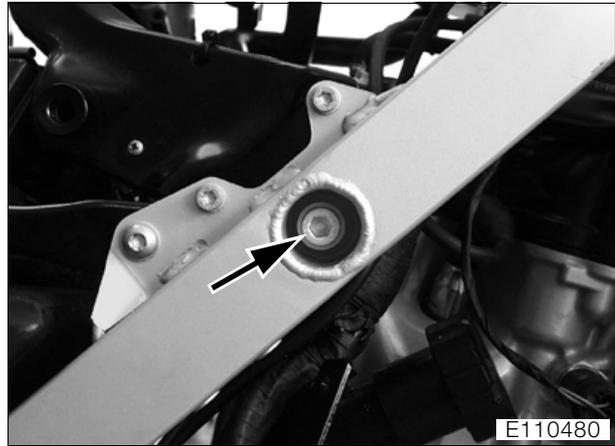
- Disconnect the oil feed line (arrow) from the engine.
- Disconnect the oil feed hose from the oil tank.
- Remove the oil feed line from the ABS modulator frame and push it to the right.
- Remove the chain tensioner.



- Remove chain guide (1).
- Remove upper section of camshaft carrier (2).
- Remove camshafts with chain sprockets.
- Secure timing chain with retaining wire.
- Remove front chain guide rail (3).

11 12 116 Removing cylinder head

- Remove lower section of camshaft carrier.



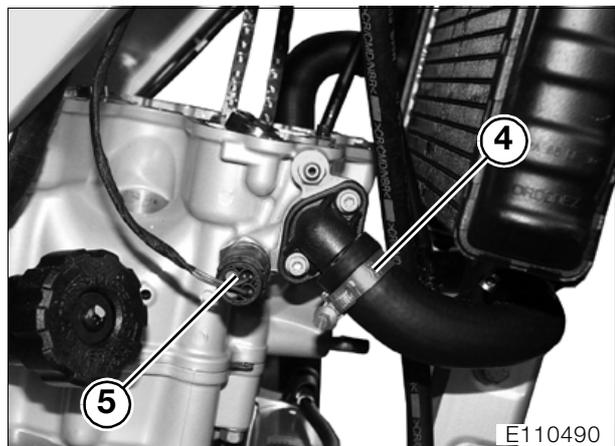
- Remove screws securing cylinder head to frame (arrow).
- Use pin wrench, **BMW No. 11 6 661**, to slacken the locknut.



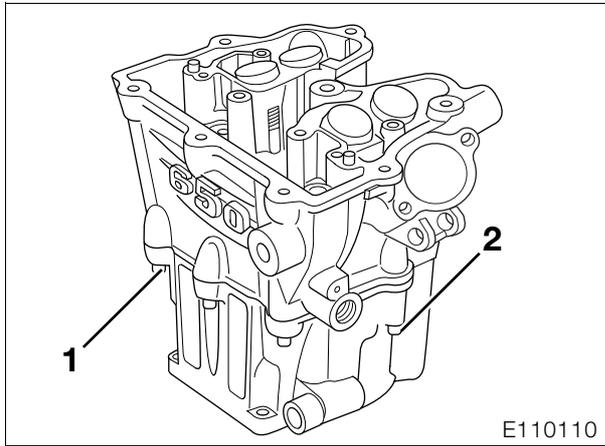
Note:

Note washers.

- Back off the adjuster sleeves.



- Disconnect the coolant hose from cylinder head (4) and drain the last of the coolant from the radiator.
- Disconnect the plug for temperature sensor (5).



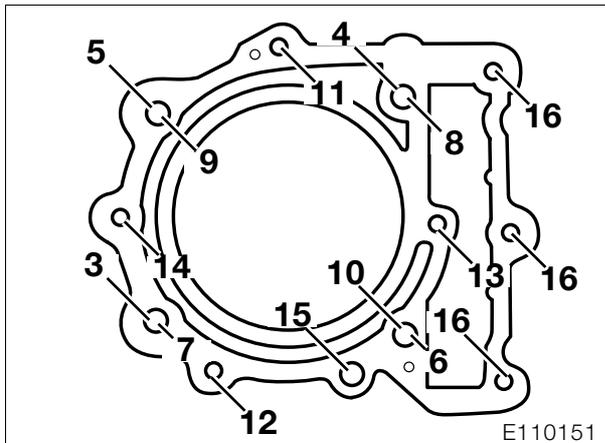
E110110

- Remove machine screws for chaincase (1).
- Disconnect plug of oil-pressure sensor.
- Remove oil pressure switch.
- Remove rear collar screw (2) from cylinder head.
- Remove front collar screws from cylinder head.
- Remove top collar screws from cylinder head.
- Remove collar nuts from cylinder head.
- Raise cylinder head clear of stud bolts, turn the cylinder head and lift it toward the rear to remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Replace cylinder head gasket.



E110151

- Initially tighten the collar nuts of the cylinder head to 20 Nm (3-6) and then tighten to 60 Nm (7-10).
- Tighten the fasteners of the cylinder head to cylinder in the sequence as shown (11-16) to specified torque.

- When looping the timing chain over the camshaft sprockets, make sure that the sprockets are at the TDC position.
- Before installing the cylinder head cover, remove all traces of the gasket and clean the sealing face with degreasing agent. Also clean the groove and the seating faces for the gasket.



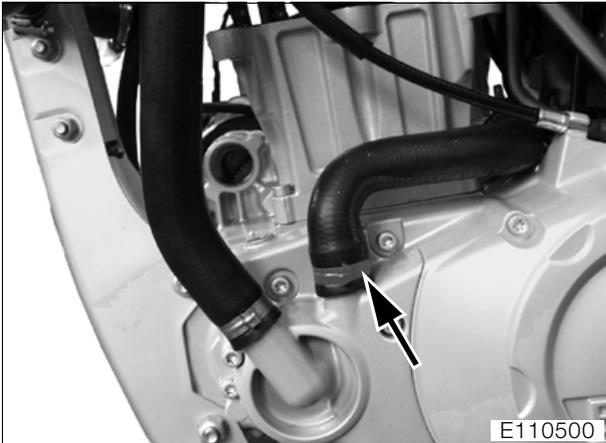
Tightening torques:

Engine guard to frame	9 Nm
Footrest plate to frame	30 Nm
Silencer to exhaust manifold	55 Nm
Exhaust manifold to cylinder head.....	20 Nm
Intake air silencer to frame	9 Nm
Intake pipe to cylinder head	21 Nm
Lid of electronic equipment box to frame	4 Nm
Ignition coil holder.....	9 Nm
Oil lines to cylinder head	8 Nm
Cylinder head cover to cylinder head	10 Nm
Spark plug in cylinder head.....	20 Nm
Rear frame to main frame	21 Nm
Oil line to engine block.....	35 Nm
Timing-chain tensioner to cylinder head.....	40 Nm
Chain guide to bearing cap (clean threads + Loctite 243).....	10 Nm
Camshaft bearing cap to cylinder head	10 Nm
Cylinder head to frame	41 Nm
Cylinder head to frame adjusting sleevezero play max.	5 Nm
Cylinder head to frame locknut.....	100 Nm
Machine screws, chaincase	10 Nm
Collar screws, cylinder head	33 Nm
Collar nuts, cylinder head.....stage 1:	20 Nm
.....stage 2:	60 Nm
Starter to clutch housing	10 Nm
Oil-pressure switch in engine block (clean threads + Loctite 243).....	12 Nm
Cable cover to engine	5 Nm

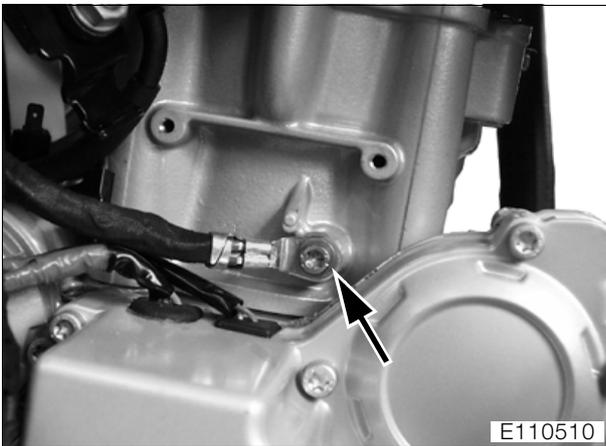


11 11 150 Removing cylinder, engine installed

- Remove cylinder head.



- Use pliers, **BMW No. 17 5 500**, to open the clamp securing the coolant hose to the water pump (arrow) and disconnect the hose.

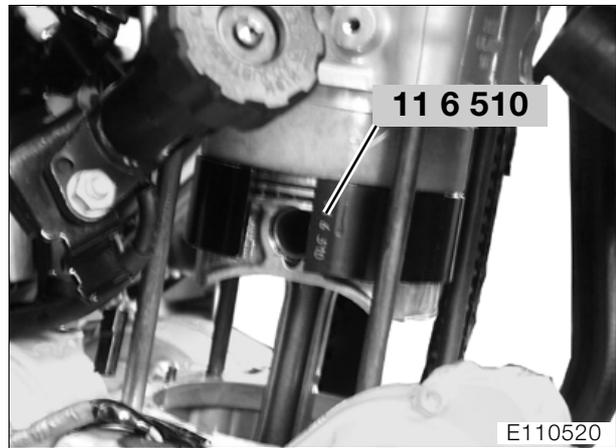


- Disconnect ground cable (arrow) from cylinder.
- Remove cylinder base screws.
- Push the rear chain guide forward and carefully lift the cylinder clear.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

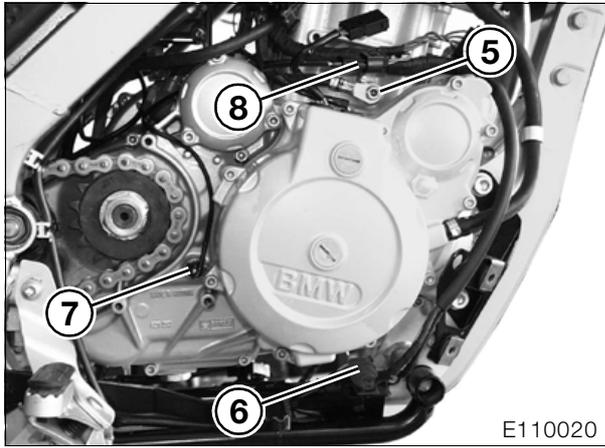
When installing, use a new cylinder base gasket.



- Oil the piston rings and press the sliding piston ring sleeve, **BMW No. 11 6 510**, over the piston rings from above so that the piston projects from the sliding sleeve by about 2 mm (0.08 in).
- Push the timing chain through the chain aperture in the cylinder and secure the chain.
- Slip the cylinder over the piston.
- Remove sliding sleeve.

Tightening torques:

Cylinder to engine block..... 10 Nm
 Ground cable to cylinder..... 8 Nm

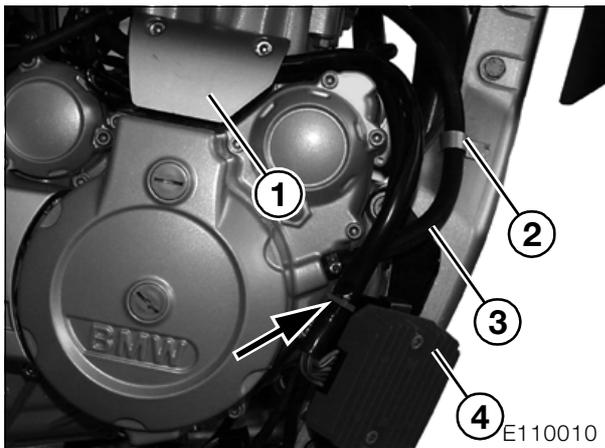


E110020

11 00 050 Removing engine

11 00 050 Preparatory work

- Drain coolant.
- ➔See Group 00
- Place motorcycle on its centre stand.
- Secure front wheel in position.
- Remove seat.
- Remove intake air silencer.
- ➔See Group 13
- Disconnect battery negative terminal.
- Remove engine guard.
- Drain engine oil.
- ➔See Group 00
- Remove rear wheel.
- ➔See Group 36
- Remove exhaust manifold.
- ➔See Group 18
- Disconnect oil feed and return lines from oil tank.



E110010

- Remove cable cover (1) from the engine.
- Cut the cable tie (arrow) at the voltage regulator.
- Disconnect the plug of the voltage regulator.
- Remove voltage regulator (4).
- Straighten tab (2) and release breather line (3).

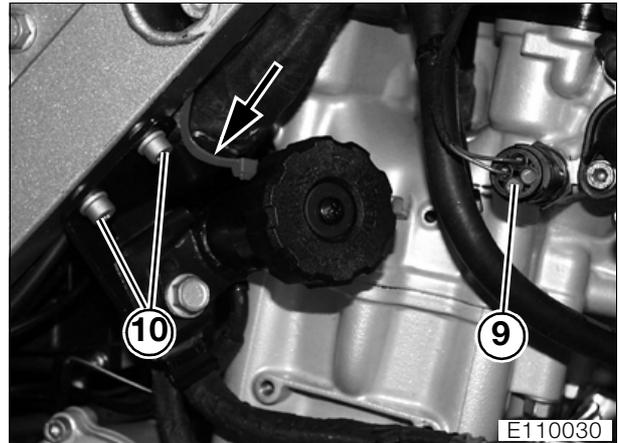


Note:

The chain drive sprocket has to be removed at this point before engine disassembly can proceed.

- Remove the chain sprocket.
- ➔See Group 27
- Remove ground terminal (5) from the engine.

- Disconnect plug of side-stand switch (6).
- Unscrew connector for idle indicator (7).
- Disconnect the plug of ignition trigger (8).
- Disconnect plug of oil pressure sensor in oil filter housing.
- Disconnect positive lead from starter motor.
- Remove frame trussing.
- Remove the chain from the drive sprocket.



E110030

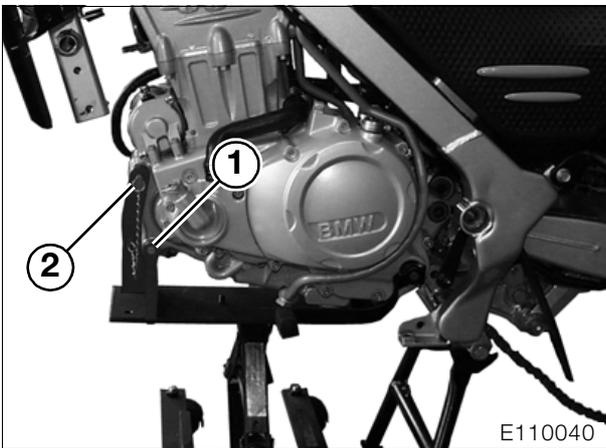
- Cut the cable tie at the adjusting-knob bracket (arrow).
- Remove the fastener securing the adjusting-knob bracket (10).
- Disconnect the plug for the temperature sensor (9).
- Slacken the hose clip at the throttle flap stub and disconnect the throttle flap stub from the intake pipe.
- Disconnect the starter coil at the plug.
- Pull spark plug connector off spark plug.



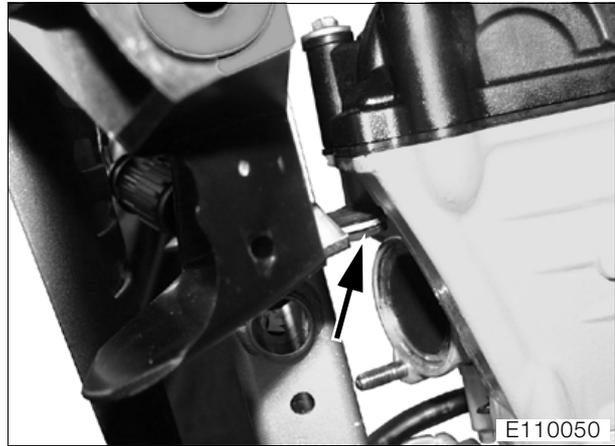
- Remove the ignition-coil bracket complete with ignition coil from the cylinder head cover.
- Disconnect clutch cable from release lever.
- Disconnect breather hose for oil tank from the cylinder head cover.
- Remove radiator.
- ➔ see Group 27
- Remove the right-hand coolant hose.
- Remove fasteners for engine shell and remove engine shell with the bracket for the voltage regulator.
- Remove swinging fork pivot pin.
- Remove bottom rear engine mount fastener.
- Secure the motorcycle by attaching two straps to the front forks.
- Remove the brake pedal.
- Remove the gear shift pedal.

11 00 050 Removing engine

- Secure adapter, **BMW No. 11 0 591**, to the plate for the engine lifter.
- Place engine lifter, **BMW No. 00 1 540**, under engine.

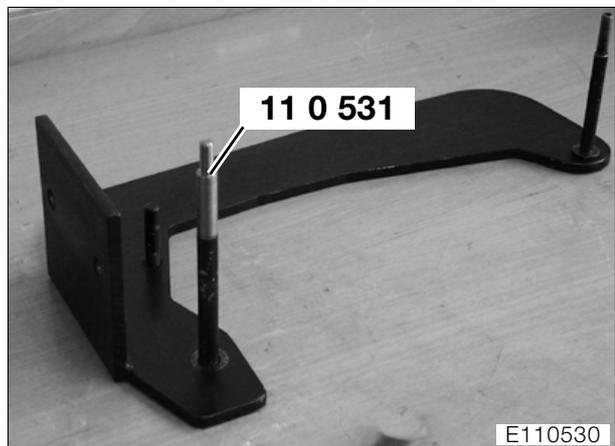


- Secure the engine lifter by installing stud bolt (1) through bottom bore in engine block and securing stud (2) in top bore in engine block.
- Remove screws securing cylinder head to frame on left and right. Use pin wrench, **BMW No. 11 6 661**, to slacken the locknuts and back off the adjusting sleeves.



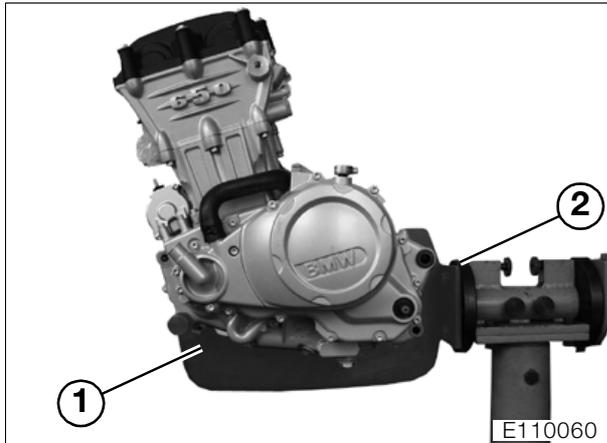
- Lower the engine until the cylinder head is resting on the radiator fastening lug (arrow).
- Continue lowering the engine; the engine tilts toward the rear.
- Continue lowering the engine until the fastening lug is above the cylinder head cover.
- Turn the engine toward the right and push it clear of the motorcycle.

Transferring engine to assembly frame

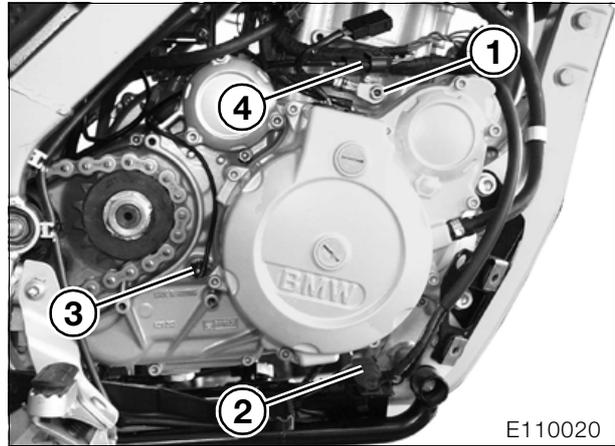


- Secure threaded adapter, **BMW No. 11 0 531**, to engine mount.
- Detach the engine from the engine lifter, leaving the engine on the lifting platform.

- Lay the engine on its left side, as viewed in the forward direction of travel.
- Secure engine adapter, **BMW No. 11 0 640**, to the right side of the engine without a spacer.
- Position the assembly stand beside the lifting platform.
- Manoeuvre the engine so that the engine adapter is level with the flange of the assembly stand.



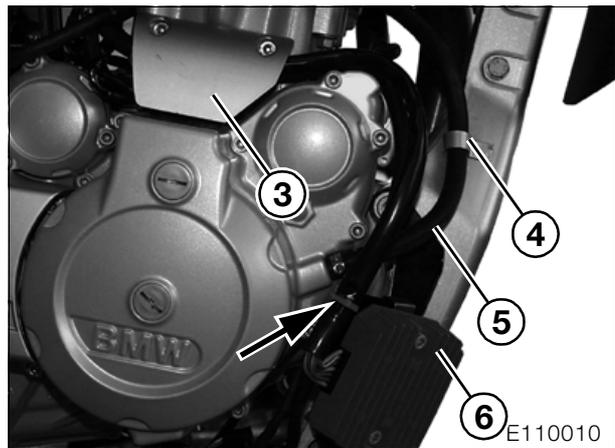
- Secure engine adapter (1) to the flange of the assembly stand (2).
- Turn engine adapter.



11 00 050 Lowering engine

11 00 050 Preparatory work

- Drain coolant.
- ➡ See Group 00
- Place motorcycle on its centre stand.
- Secure front wheel in position.
- Remove seat.
- Remove intake air silencer.
- ➡ See Group 13
- Disconnect battery negative terminal.
- Remove engine guard.
- Drain engine oil.
- ➡ See Group 00
- Remove rear wheel.
- ➡ See Group 36
- Remove exhaust manifold.
- ➡ See Group 18
- Disconnect oil feed and return lines from oil tank.



- Remove cable cover (3) from the engine.
- Cut the cable tie (arrow) at the voltage regulator.
- Disconnect the plug of the voltage regulator.
- Remove voltage regulator (6).
- Straighten tab (4) and release breather line (5).



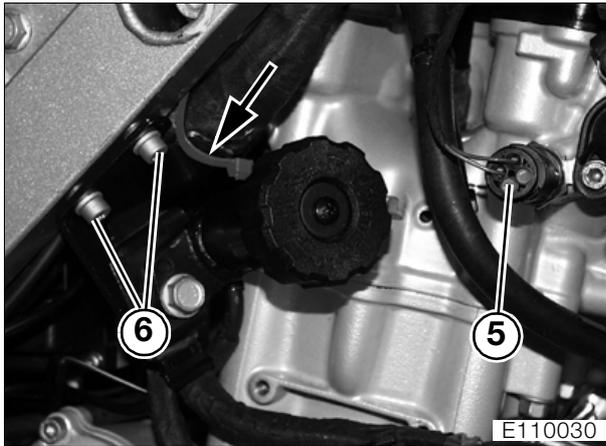
Note:

The chain drive sprocket has to be removed at this point before engine disassembly can proceed.

- Remove the chain sprocket.
- ➡ See Group 27
- Remove ground terminal (1) from the engine.



- Disconnect plug of side-stand switch (2).
- Unscrew connector for idle indicator (3).
- Disconnect the plug of ignition trigger (4).
- Disconnect plug of oil pressure sensor in oil filter housing.
- Disconnect positive lead from starter motor.
- Remove frame trussing.
- Remove the chain from the drive sprocket.

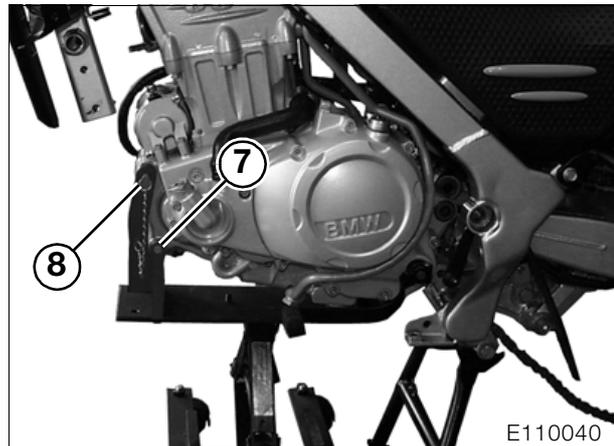


- Cut the cable tie at the adjusting-knob bracket (arrow).
- Remove the fastener securing the adjusting-knob bracket (6).
- Disconnect the plug for the temperature sensor (5).
- Slacken the hose clip at the throttle flap stub and disconnect the throttle flap stub from the intake pipe.
- Disconnect the starter coil at the plug.
- Pull spark plug connector off spark plug.
- Remove the ignition-coil bracket complete with ignition coil from the cylinder head cover.
- Disconnect clutch cable from release lever.
- Disconnect breather hose for oil tank from the cylinder head cover.

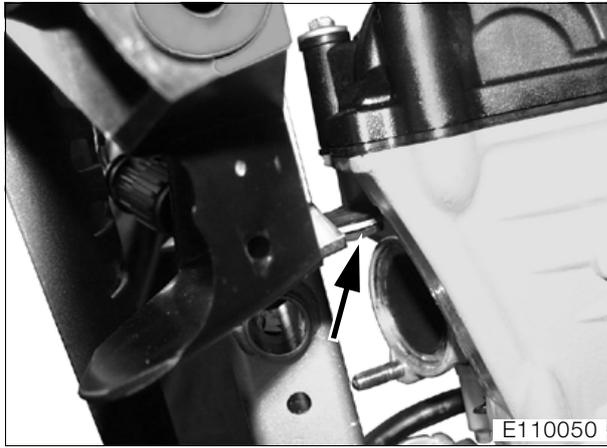
- Remove radiator.
- ➔ see Group 27
- Remove the right-hand coolant hose.
- Remove fasteners for engine shell and remove engine shell with the bracket for the voltage regulator.
- Remove swinging fork pivot pin.
- Remove bottom rear engine mount fastener.
- Secure the motorcycle by attaching two straps to the front forks.
- Remove the brake pedal.
- Remove the gear shift pedal.

11 00 050 Lowering the engine

- Secure adapter, **BMW No. 11 0 591**, to the plate for the engine lifter.
- Place engine lifter, **BMW No. 00 1 540**, under engine.



- Secure the engine lifter by installing stud bolt (7) through bottom bore in engine block and securing stud (8) in top bore in engine block.
- Remove screws securing cylinder head to frame on left and right. Use pin wrench, **BMW No. 11 6 661**, to slacken the locknuts and back off the adjusting sleeves.

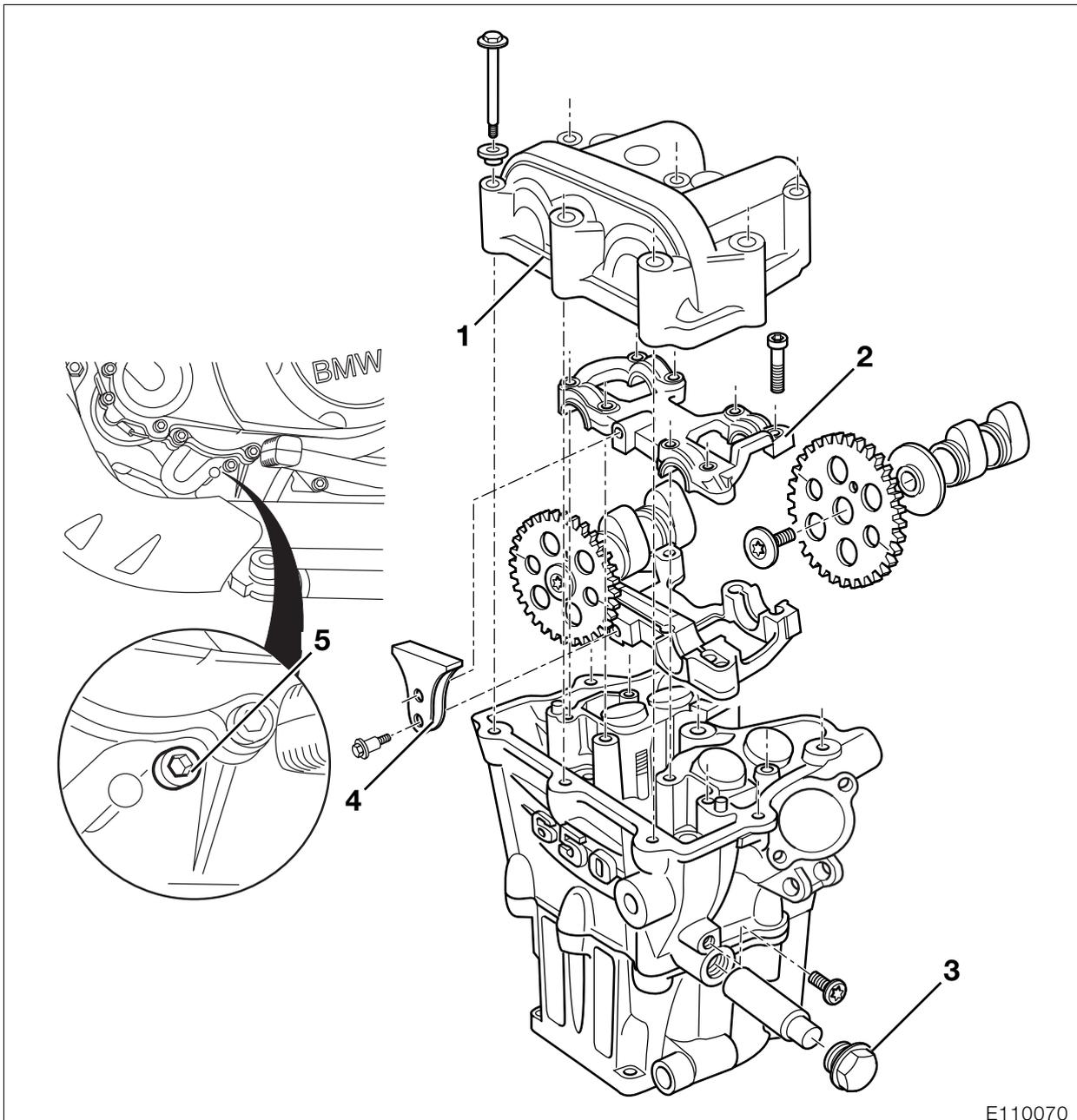


- Lower the engine until the cylinder head is resting on the radiator fastening lug (arrow).
- Continue lowering the engine; the engine tilts toward the rear.
- Continue lowering the engine until the fastening lug is above the cylinder head cover.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Raise the engine and tilt it to the rear.
- Manoeuvre the bottom engine mount into position.
- Raise the engine and manoeuvre the fasteners at the cylinder head into position.
- Install the bottom rear engine mount fastener.
- Install the pivot pin of the swinging arm bearing.
- Back off the adjusting screws for the cylinder head mounts until they are seated against the cylinder head on each side and the cylinder head itself is centered in the frame.

 **Tightening torques:**

Water pump drain screw	10 Nm
Intake air silencer to frame	9 Nm
Engine guard to frame	9 Nm
Engine oil drain plug.....	40 Nm
Rear quick-release axle.....	100 Nm
Drive chain tensioning screws.....	10 Nm
Exhaust manifold to cylinder head.....	20 Nm
Silencer to exhaust manifold	55 Nm
Footrest plate to main frame, left/right.....	30 Nm
Cable cover to engine	5 Nm
Voltage regulator to bracket	7 Nm
Chain drive sprocket to mainshaft (clean threads + Loctite 243).....	140 Nm
Sprocket cover to engine	2 Nm
Ground terminal to engine block	8 Nm
Connecting cable, idle indicator	2 Nm
Frame trussing to engine shell.....	21 Nm
Frame trussing to main frame.....	21 Nm
Spring-strut adjusting knob bracket to frame	9 Nm
Radiator to main frame at top.....	9 Nm
Swinging-arm pivot	100 Nm
Frame to engine at rear	41 Nm
Gearshift pedal to engine	13 Nm
Brake pedal to frame.....	21 Nm
Cylinder head to frame	41 Nm
Cylinder head to frame adjusting sleevezero play max.	5 Nm
Cylinder head to frame locknut.....	100 Nm





E110070

11 00 103 Disassembling engine



Caution:

If there is any mechanical damage, the oil tank and the oil lines must be cleaned.

- Turn crankshaft to top dead centre position with an Allen key.
- Remove screw (5) and lock the crankshaft with locating screw, **BMW No. 11 6 570**.



Note:

Check for secure seating with Allen key.

11 12 516 Removing cylinder head

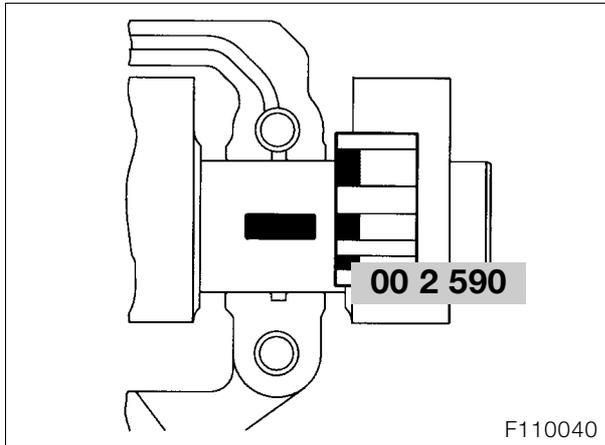
- Remove starter motor
- ➔See Group 12
- Remove oil lines.
- Remove valve cover (1).
- Remove spark plug.
- Remove centre screw plug on right in engine block.

11 31 522 Removing camshafts

- Only unfasten chain sprockets if they need to be replaced.
- Remove chain tensioner (3).
- Remove chain guide (4) from between the chain sprockets.
- Remove fasteners securing camshaft carrier (2).

- Remove camshafts with chain sprockets.
- Take off the lower camshaft carrier.

Checking camshaft for wear



- Measure bearing play with Plastigage type PG-1, **BMW No. 00 2 590**.
- Tighten camshaft carrier to specified torque.

Tightening torque:

Camshaft carrier 10 Nm

- Remove camshaft carrier and determine bearing clearance using comparative scale.

Wear limits:

Cam height, inletmin. 39.25 mm (1.545 in)
 Cam height, exhaustmin 39.05 mm (1.537 in)
 Bearing journal dia.min. 21.950 mm (0.864 in)
 Bearing dia.
 in bearing pedestal.....max. 22.040 mm (0.868 in)
 Bearing playmax. 0.090 mm (0.0035 in)

11 31 671 Removing and installing timing-chain sprockets

- Clamp the camshaft in a vise fitted with protective jaws.
- Remove the fastener securing the sprocket to the camshaft and remove the camshaft sprocket.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Before installing, oil the thread of the chain-sprocket fastener.

Tightening torque:

Sprocket to camshaft
 (thread oiled) 60 Nm

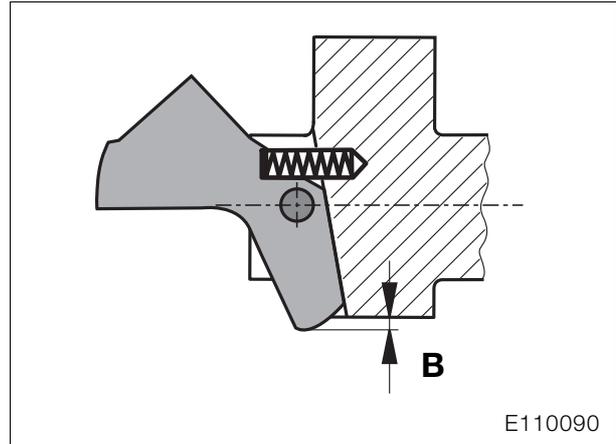
Checking centrifugal decompressor lever



Note:

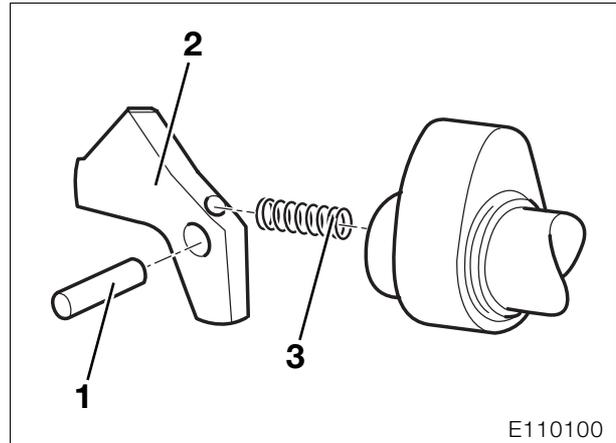
Never stretch the spring, since this alters the predetermined spring force.

- When activated, the lever must not project beyond the cam base circle by less than distance "B".



Distance "B" 0.6 mm (0.02 in)

11 31 530 Disassembling and assembling the centrifugal decompressor

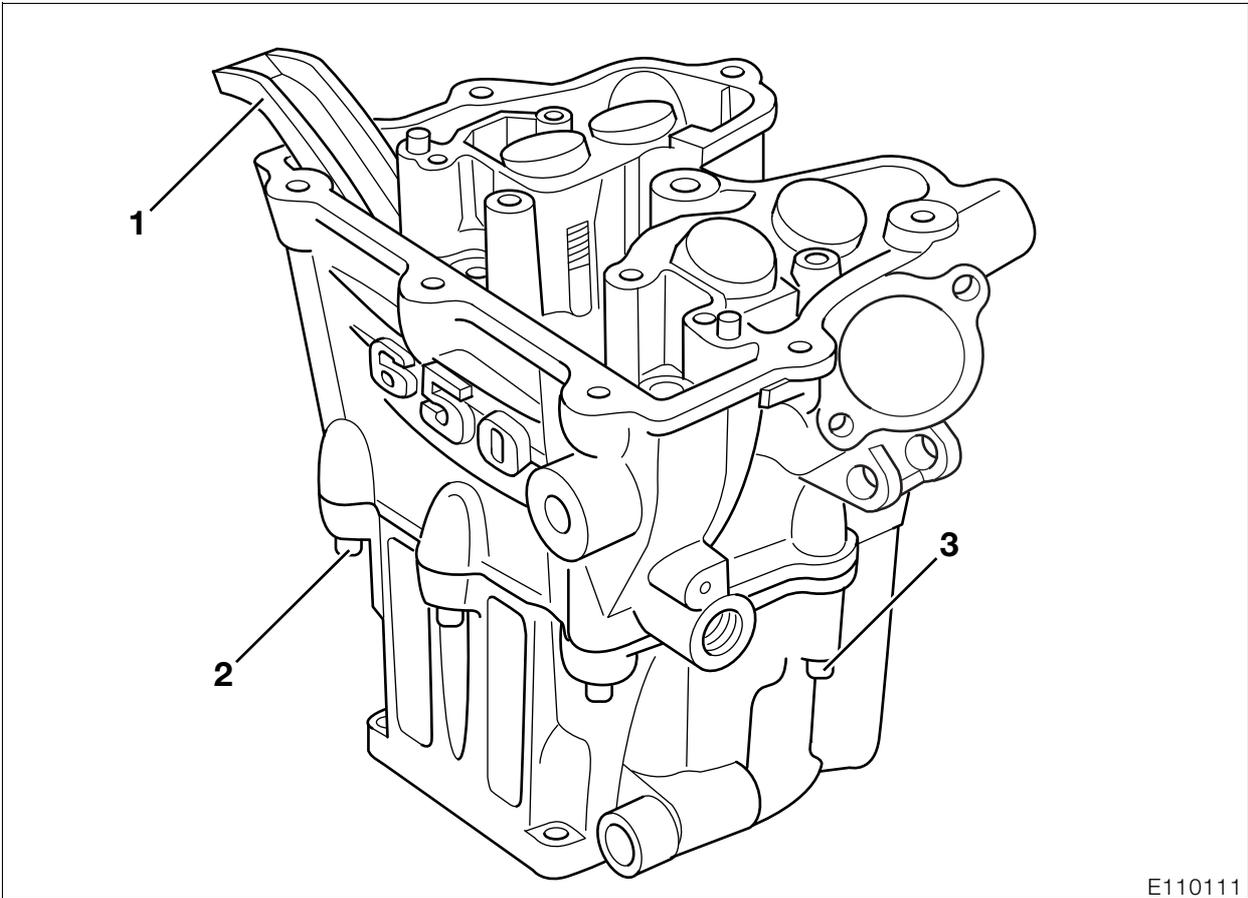


Note:

If the centrifugal decompressor is dismantled, spring (3) must always be renewed.

- Use a suitable punch to press shaft (1) out of centrifugal weight (2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- After assembly, check centrifugal weight for ease of movement.





E110111

11 12 116 Removing cylinder head

- Remove front chain rail (1).
- Release the coolant line hose clips with pliers, **BMW No. 17 5 500**.
- Allow the timing chain to slide into its cavity.
- Remove the starter motor.
- ➡See Group 12
- Remove collar nuts from cylinder head.

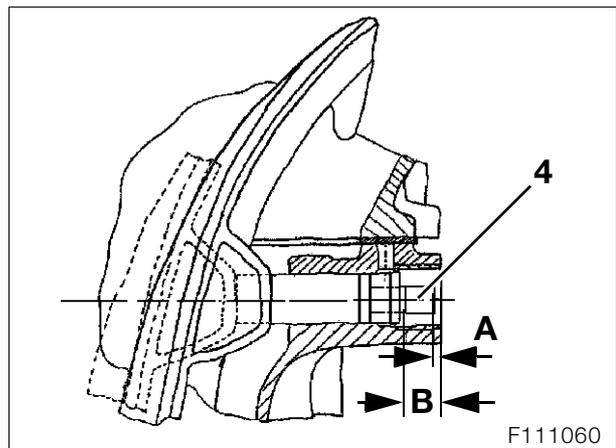


Note:

If the cylinder head does not have to be dismantled, do not separate cylinder head from cylinder. In this case the next six work steps can be omitted.

- Remove machine screws for chaincase (2).
- Remove rear collar screw (3) from cylinder head.
- Remove front collar screws from cylinder head.
- Remove top collar screws from cylinder head.
- Separate the cylinder head from the cylinder.
- Remove cylinder head.

Checking timing chain for wear



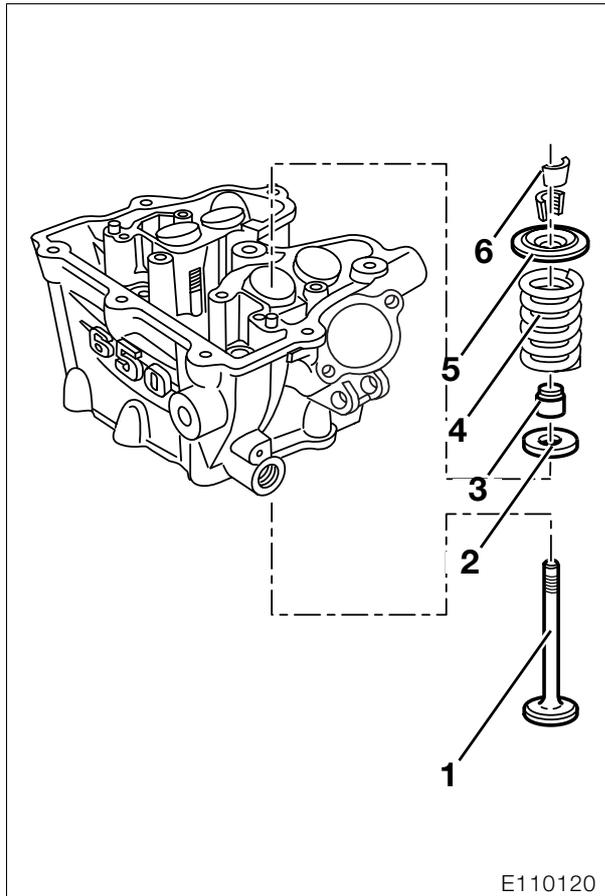
F111060

- Push hydraulic chain tensioner (4) in the direction of the tensioner rail in the guide on the cylinder, until resistance to movement is felt.
- Measure distance (A) from the sealing face to the chain tensioner piston.

- If the wear limit, distance “B”, is exceeded, first inspect the tensioner rail and the two guide rails for score-marks and renew them if necessary.
- If a part has to be renewed, repeat the measurement procedure described above.
If the wear limit has been exceeded, the timing chain must be renewed.

Distance “B”max. 9.0 mm (0.354 in)

11 12 528 Disassembling and assembling cylinder head



- 1 Valve
- 2 Lower valve spring plate
- 3 Valve stem seal
- 4 Valve spring
- 5 Upper valve spring plate
- 6 Valve collets

11 34 020 Removing valves

- Use suction device, **BMW No. 11 3 251**, to pull out the bucket-type tappets.
- Check that bucket tappets and guides are in perfect condition.

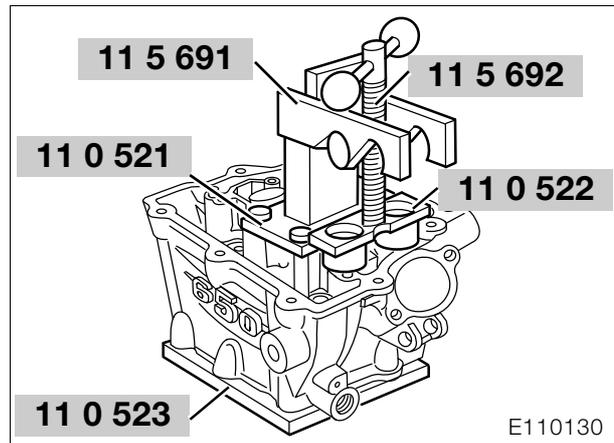
Bore for bucket tappet

In cylinder head.....max. 33.600 mm (1.3229 in)
Radial clearance of bucket tappet.....max. 0.200 mm (0.0079 in)



Caution:

Mark the bucket tappets to ensure that they are re-installed in their original positions (risk of jamming).

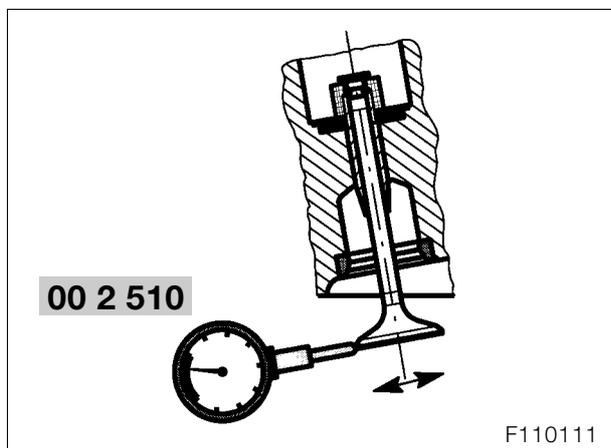


Note:

To simplify removal of the valve collets, tap the valves sharply with a plastic-faced hammer.

- Secure the cylinder head to support plate, **BMW No. 11 0 523**.
- Secure adapter plate, **BMW No. 11 0 521**, support, **BMW No. 11 5 691**, spindle, **BMW No. 11 5 692**, nut, **BMW No. 11 5 693**, and thrust plate, **BMW No. 11 0 522**.
- Press down the valves with the thrust plate.
- Use a screwdriver to press apart and remove the valve collets.
- Pull the valves down to remove.

Checking valve guide for wear

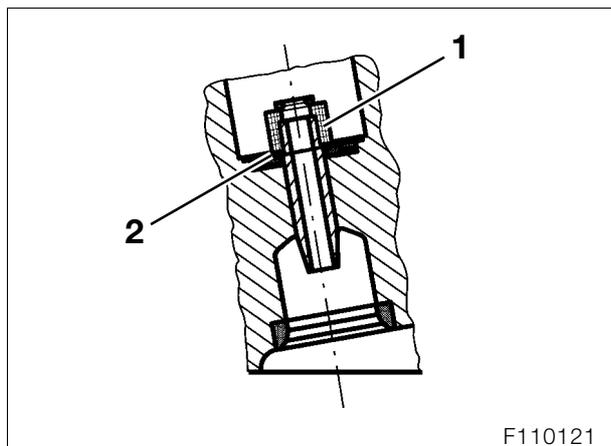


- Insert new valve from combustion chamber side into valve guide until it reaches the valve stem seal.
- Using dial gauge, **BMW No. 00 2 510**, positioned vertically on the valve axis, measure maximum play at right angles to the camshaft axis.

Play:

Max. play..... 0.4 mm (0.016 in)
 Intl. dia. of
 valve guide.....max. 5.080 mm (0.2000 in)

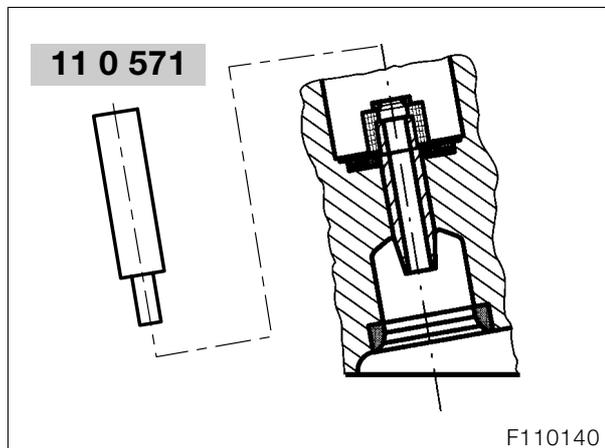
11 12 591 Removing valve guide



⚠ Caution:

Do not damage sliding surfaces on bucket tappets: risk of jamming.

- Pull off valve stem seal (1) with pliers, **BMW No. 11 1 250**.
- Remove valve spring support (2) from cylinder head.



Note:

To facilitate removal, heat the cylinder head to 100 °C (212 °F).

Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

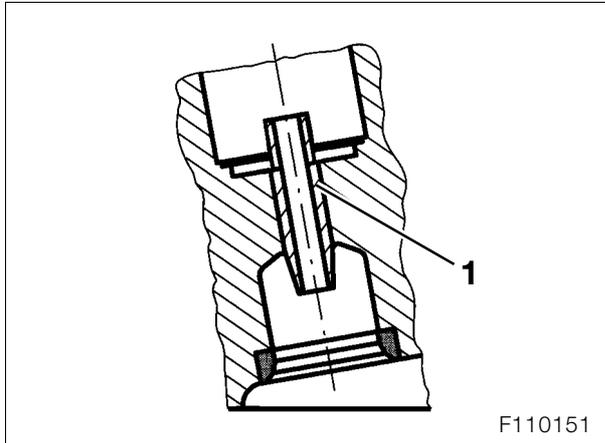
- Use drift, **BMW No. 11 0 571**, to drive out the valve guide toward the combustion chamber.



Caution:

The cylinder head has to be replaced if the bore for the valve guide is worn.

11 12 591 Installing valve guide



- Heat the cylinder head to 100 °C (212 °F).
- Using driving-in tool, **BMW No. 11 0 571**, drive valve guide (1) into the cylinder head until valve guide projection is as specified.

Projection:

Inlet 9.8...10.2 mm (0.39...0.40 in)
 Exhaust 9.8...10.2 mm (0.39...0.40 in)



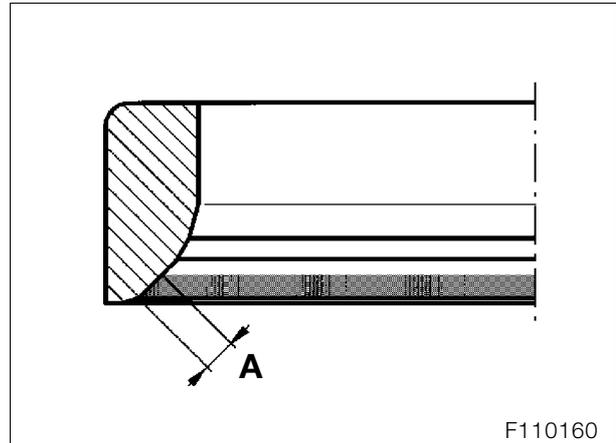
Note:

Only use thread-cutting oil to lubricate the reaming tool.
 Only rotate reaming tool in the cutting direction - never in the opposite direction.
 Withdraw reaming tool at regular intervals for cleaning: always rotate the tool in cutting direction while removing.

- Ream out valve guide with 5H7 reaming tool.

Checking valve seat for wear

- Apply engineer's blue or a similar product to the valve seat rings.
- Install relevant valve and rotate, applying slight pressure.

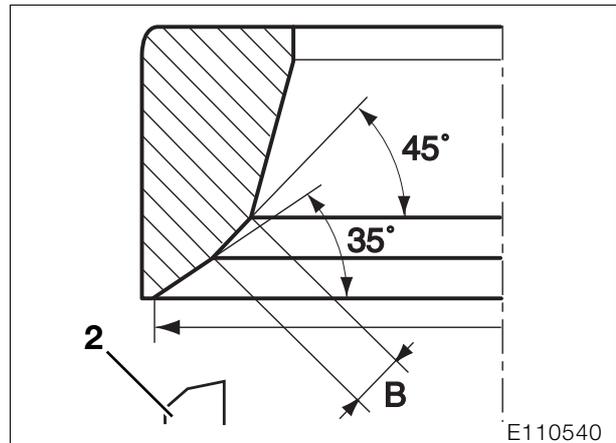


- Check valve seat width "A" and contact pattern for wear.

Wear limits for valve seat width "A":

Inlet valve 1.6 mm (0.063 in)
 Exhaust valve 2.2 mm (0.087 in)

- Once the wear limit of the seat width has been reached, or if the contact pattern is no longer perfect, the seat can be remachined.



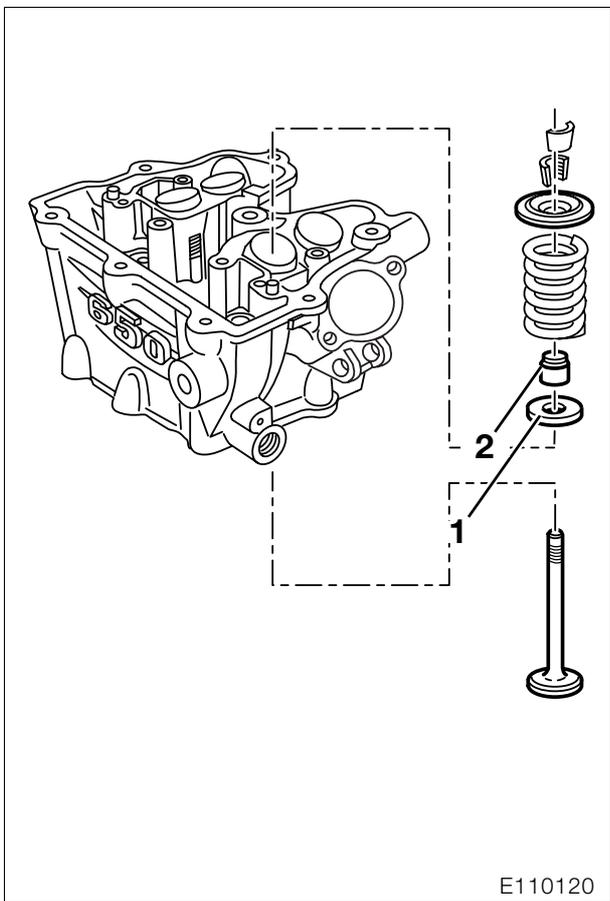
- If necessary, remachine valve seat with valve seat turning tool (2).

Valve seat width "B":

Inlet valve 1.2 mm (0.047 in)
 Exhaust valve 1.4 mm (0.055 in)



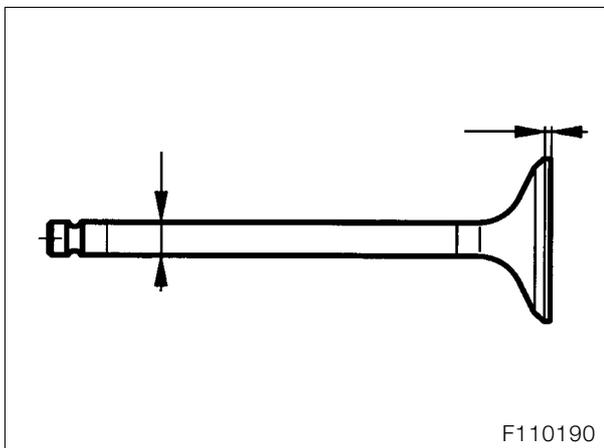
11 34 800 Installing valve stem seal



E110120

- Install bottom valve spring retainer (1).
- Use a drift, **BMW No. 11 6 650**, to insert valve stem seal (2).

Checking valve for wear



F110190

- Check valve stem diameter and valve head seat width.

Wear dimensions for valve:

Stem diameter
 Inlet valve min. 4.89 mm (0.177 in)
 Exhaust valve min. 4.89 mm (0.177 in)

- Check valve for runout.



Note:

Remove oil carbon from valve and deburr grooves for valve collets with an oilstone.
 For wear limits, see Technical Data.

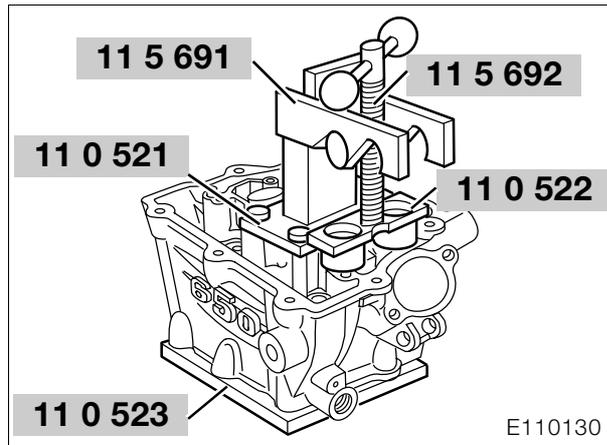
- Check grooves for valve collets.

11 34 020 Installing valves

- Install valve with shrink-fit tube.



Note:
Remove the shrink-fit tube.



- Install valve spring and valve spring retainer.
- Secure the cylinder head to support plate, **BMW No. 11 0 523**.
- Secure adapter plate, **BMW No. 11 0 521**, support, **BMW No. 11 5 691**, spindle, **BMW No. 11 5 692**, nut, **BMW No. 11 5 693**, and thrust plate, **BMW No. 11 0 522**.
- Press down the valves with the thrust plate.



Note:
Install valve collets with a small amount of grease to facilitate assembly.

- Insert the valve collets.
- Check bucket tappets for damage and reinstall on original valves.

11 11 150 Removing cylinder

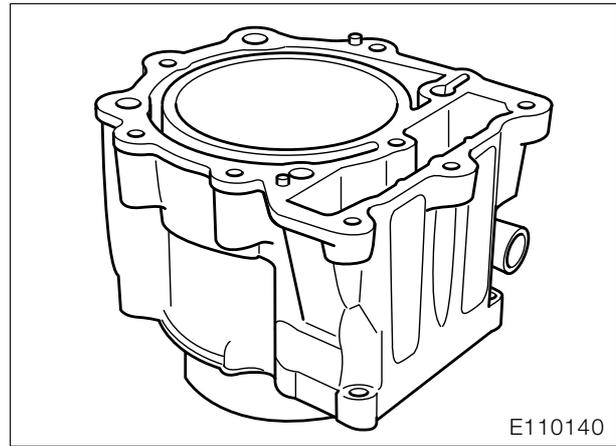
- Separate the cylinder base from the engine block.



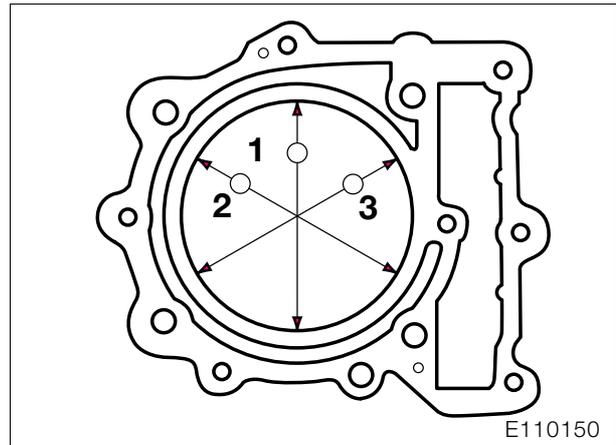
Caution:
When removing cylinder, make sure that the piston does not strike the engine block.

- Remove cylinder.

Checking cylinder



- Check cylinder face and sealing faces for damage and blow out oil ducts for chain tensioner.



- Measure cylinder bore at 55...65 mm (2.17...2.56 in) from the upper edge with an internal micrometer at three points (1, 2, 3).

Wear limits for cylinder bore:

Cylinder A max. 100.03 mm (3.9382 in)
Cylinder B max. 100.04 mm (3.9387 in)



11 25 050 Removing piston

- Remove piston pin circlips.
- Press out piston pin with drift, **BMW No. 11 6 581**.



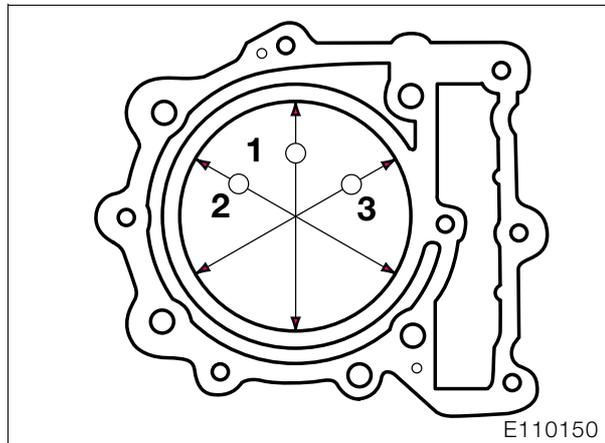
Note:

Mark exhaust-valve side on piston crown.

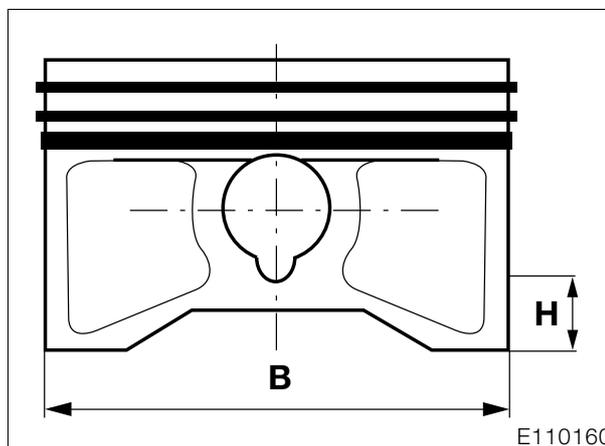
11 25 671 Disassembling piston

- Remove piston rings with piston ring pliers.
- Carefully clean piston.
- Check piston for signs of damage.

Determining clearance of piston in cylinder



- Measure cylinder bore at 55...65 mm (2.17...2.56 in) from the upper edge with an internal micrometer at three points (1, 2, 3).
- Make a note of the largest value as dimension "A".



- Measure piston diameter "B" at distance $H=16\text{ mm}$ (0.63 in) from the lower edge at a right angle to the piston pin axis.



Note:

Determine piston clearance:

Dimension "A" minus dimension "B" = piston clearance

Piston clearance:

When new ... 0.024...0.040 mm (0.0009...0.0016 in)
Wear limit max. 0.100 mm (0.0039 in)

Determining piston ring gaps

- Slip piston ring 60 mm (2.36 in) into cylinder from top and use a feeler gauge to measure ring gap.

Wear dimension:

Ring gap (all piston rings) 1.0 mm (0.04 in)

Determining piston pin clearance

- Measure diameter of piston pin bores in piston stroke direction using an internal micrometer.
- Measure both ends of piston pin with micrometer.

Wear limits:

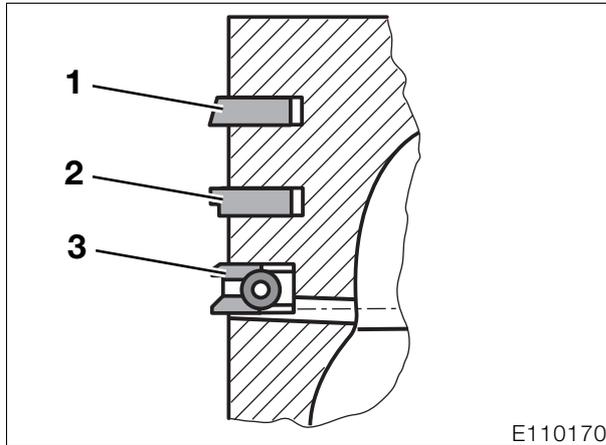
Bore dia. in piston,
vertical max. 22.030 mm (0.8673 in)
Piston pin dia. min. 21.980 mm (0.8654 in)
Radial clearance in
piston max. 0.050 mm (0.0019 in)

11 25 671 Assembling pistons



Note:

The "Top" must face towards the piston crown.
Install the piston rings with their gaps offset by 120 °.



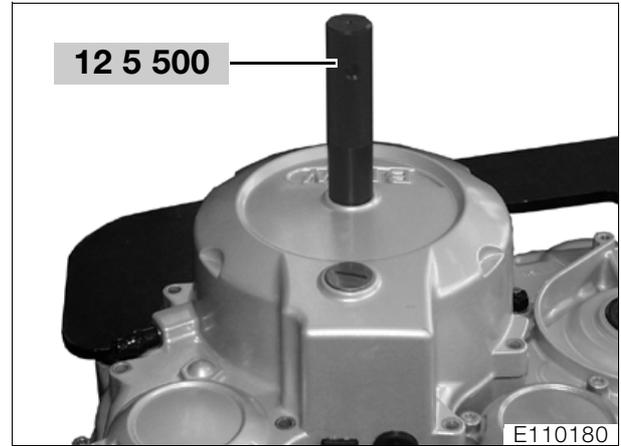
- 1 Groove for rectangular-section ring
- 2 Stepped micro-taper ring
- 3 Groove for spring-steel oil control ring

- Use feeler gauge to measure float of piston rings in groove.

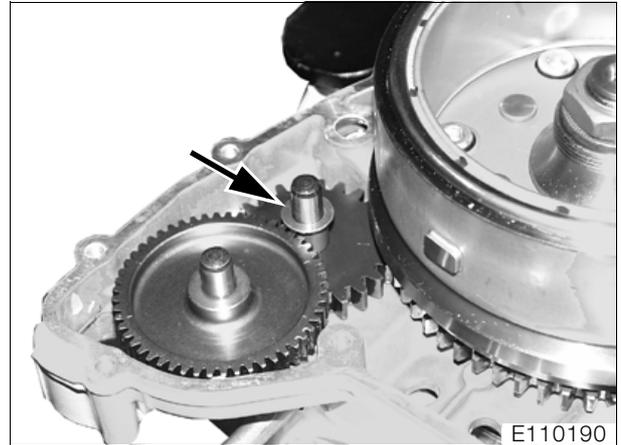
Wear limit,
ring float in groove 0.150 mm (0.006 in)

12 11 070 Removing ignition magnet

- Remove retainer on right engine housing cover.



- Remove the central plug and install handle, **BMW No. 12 5 500**.



- Remove the cover, noting the thrust washer (arrow).



- If necessary, remove ignition trigger (4).





- Unscrew hex nut.
- Heat hub to 80 °C (176 °F).

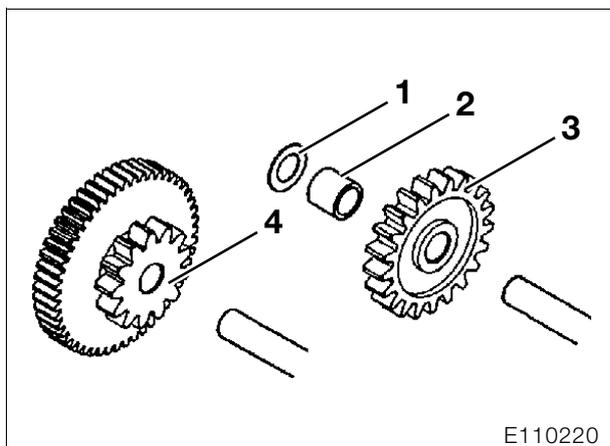


Note:

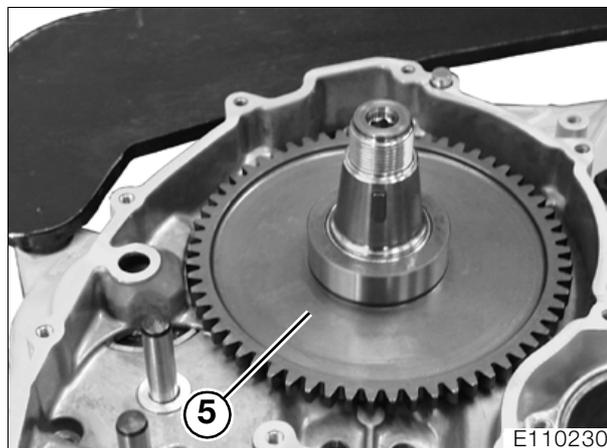
Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

- Using puller, **BMW No. 12 5 510**, pull off magnet rotor.

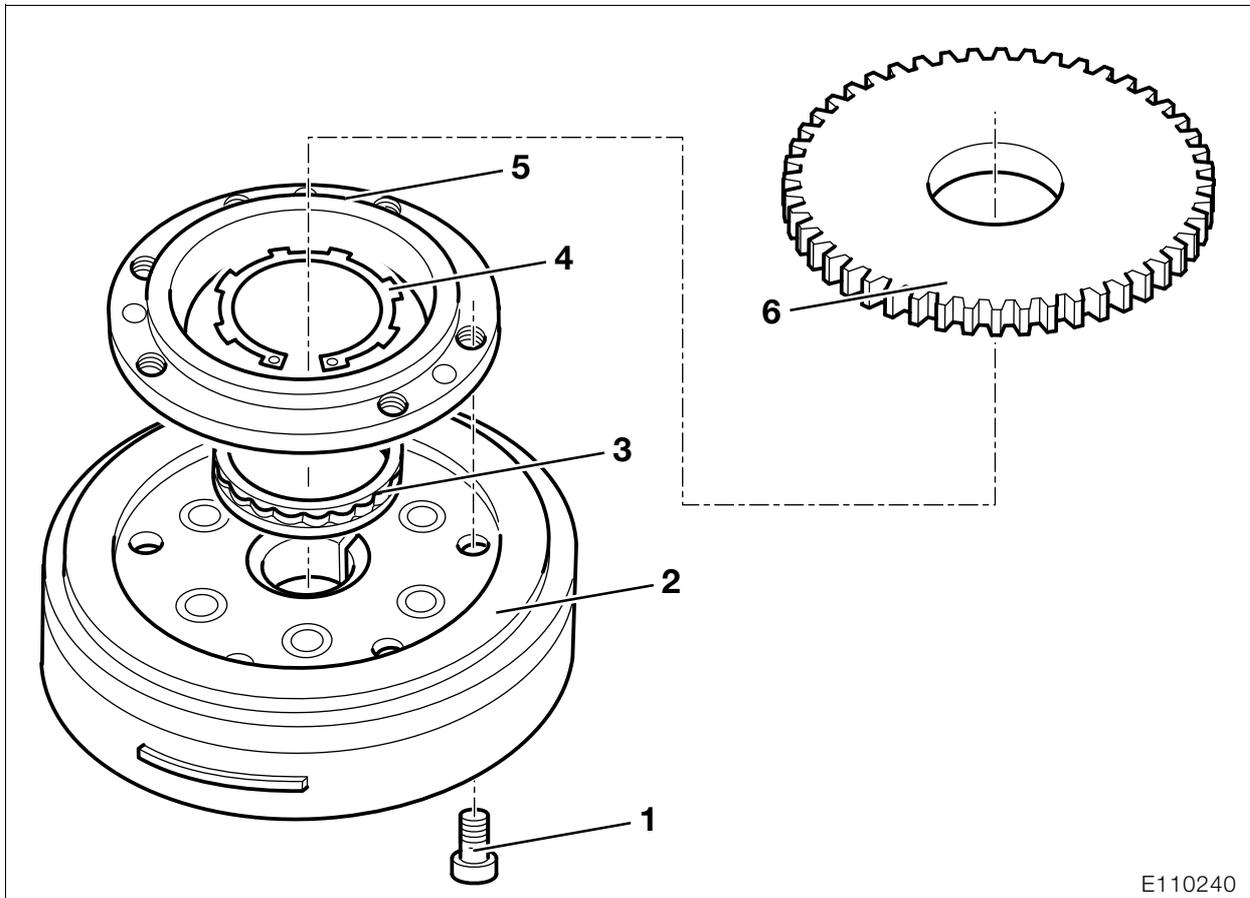
11 26 500 Removing countershaft for starter



- Remove thrust washer (1) and spacer sleeve (2).
- Remove double gear (4).
- Pull off idler gear (3).



- Remove freewheel gear (5).



E110240

12 11 077 Disassembling and assembling freewheel

Disassembling freewheel

- 1 Machine screw
- 2 Magnet rotor
- 3 Freewheel
- 4 Lock ring
- 5 Freewheel housing
- 6 Freewheel gear



Warning:

Securing screws (1) are secured with **Loctite 648** and considerable torque is required to release them.

- Release retaining screws (1).
- Lift off freewheel housing (5).
- Remove circlip (4).
- Remove freewheel gear (3).
- Check freewheel housing and freewheel for wear, isolated chatter marks are permissible.

Assembling freewheel



E110300

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Install freewheel with arrow mark (arrow) down.

- Engage the lugs on the circlip in the recesses in the freewheel gear.
- Clean the threads of the securing screws and freewheel housing, coat threads with **Loctite 648** and install the screws.
- Check locking function and locking direction of freewheel.



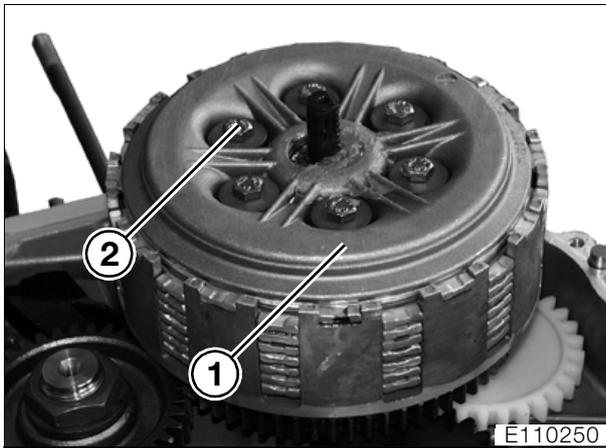
Tightening torques:

Machine screw
(clean threads + Loctite 648) 35 Nm

21 21 000 Removing clutch

- Turn engine round in assembly fixture.
- Remove left retaining for engine housing cover and remove cover.

Removing pressure plate



- Remove hex screws (2) in diagonally opposite sequence.
- Lift off complete pressure plate (1).

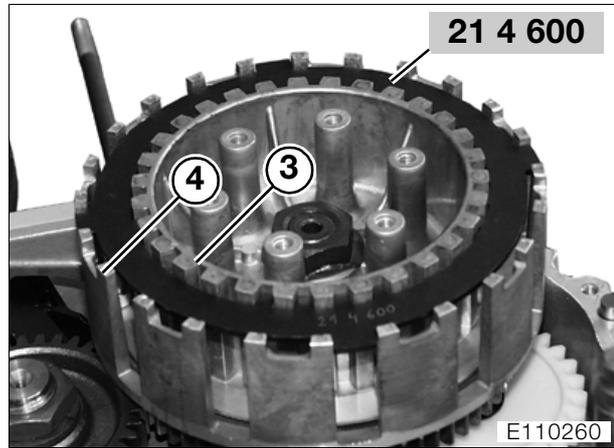
Removing clutch plates



Caution:

The topmost clutch plate is offset. Make sure this plate is installed in the correct position.

- Take plate cluster out of clutch cage.



- Using locating ring, **BMW No. 21 4 600**, prevent clutch cage (4) and driver (3) from moving and unscrew hex nut.
- Pull off driver.
- Pull off clutch cage and ring gear.



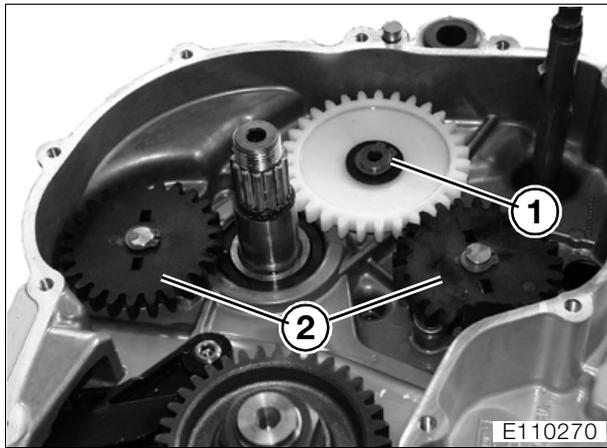
Caution:

Note the backup washer at the bottom.

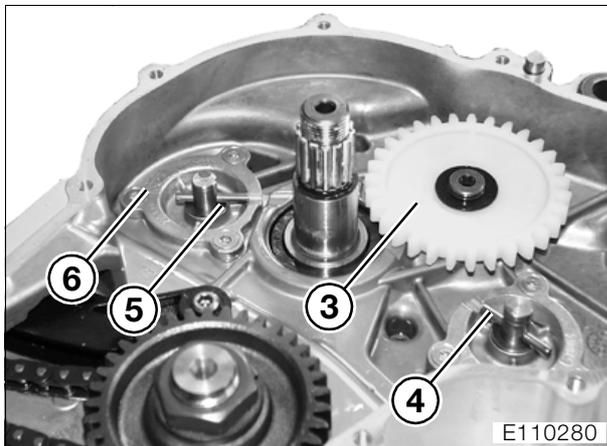
- Pull off needle cages.
- Remove the backup washer.

11 41 000 Removing and installing oil pump

Removing oil pump



- Remove circlip (1) from idler gear.
- Remove the retaining rings of the oil-pump gears (2) and disengage the oil-pump gears.



- Remove idler gear (3).
- Remove needle rollers (4).
- Remove thrust washers (5).
- Remove countersunk screws from cover and lift off cover (6).

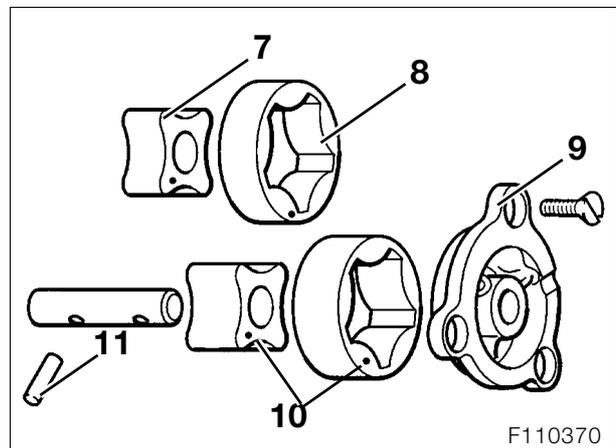
Inspecting oil pump

- Using feeler gauges, measure the clearance between the inner and outer rotors and between the outer rotor and the housing.

Permissible face runouts between:

Inner and outer rotormax. 0.25 mm (0.010 in)
 Radial clearance.....max. 0.25 mm (0.010 in)
 Axial clearance between rotors and covermax. 0.25 mm (0.010 in)

Installing oil pump



- 7 Inner rotor
- 8 Outer rotor
- 9 Cover
- 10 Markings
- 11 Needle roller

- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

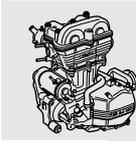
Markings (5) must be visible.

- Oil the inner and outer rotors.
- Clean the threads of the countersunk screws and coat with **Loctite 243**.

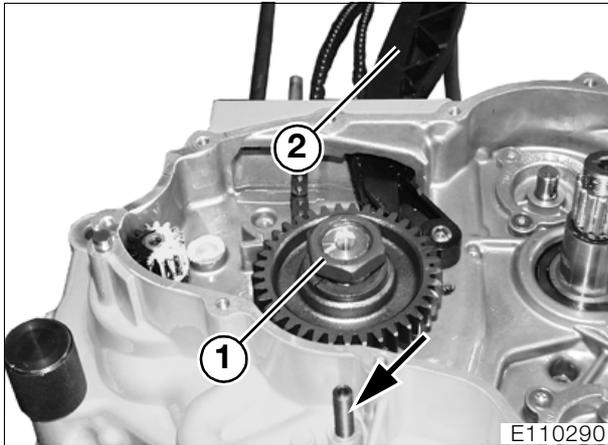


Tightening torque:

Countersunk screws in oil-pump cover (clean threads + Loctite 243) 6 Nm



Removing double drive gear

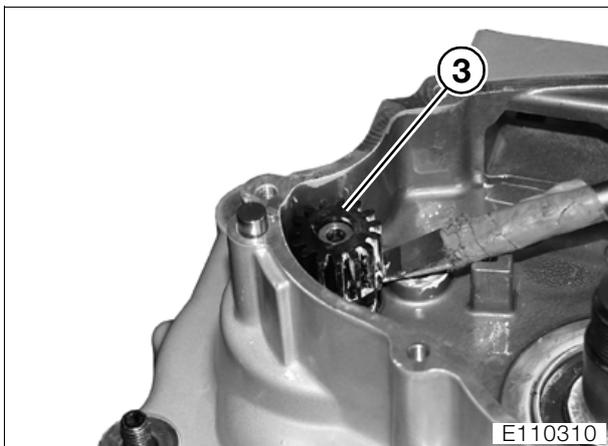


Note:

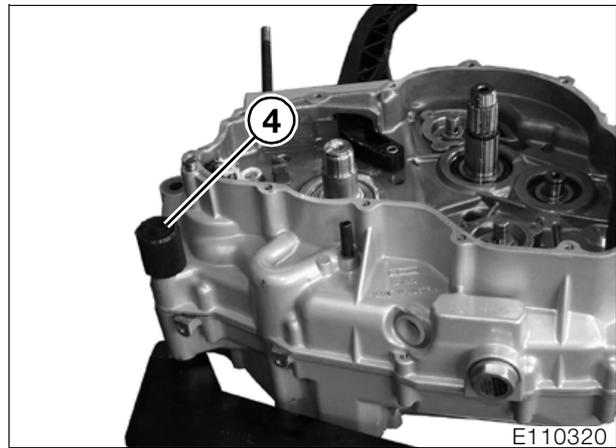
Retaining screw (arrow) must be installed.

- Remove hex nut (1).
- Press chain guide (2) to rear of engine block.
- Pull off double drive gear with timing chain.

11 21 001 Removing crankshaft and balancing shaft



- Lever out water-pump drive gear (3) with a screwdriver.
- Remove needle roller.
- Swivel engine in assembly fixture so that magnet side is uppermost.
- Remove all threaded fasteners for engine housing.
- Remove oil filter and unfasten two fasteners on base plate for engine housing.



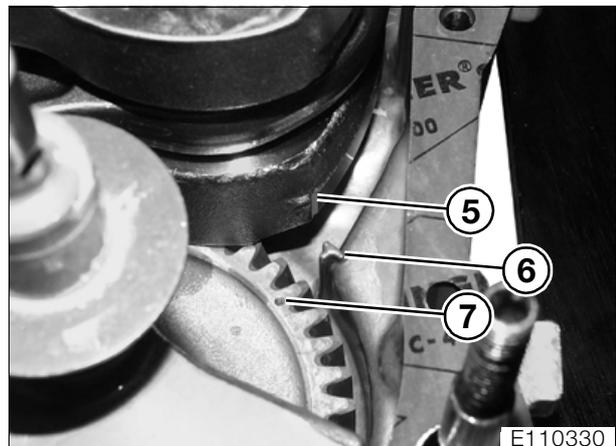
- Swivel assembly fixture so that clutch side is uppermost.
- Remove knurled nuts (4).



Caution:

Do not tilt engine housing: this can cause damage to bearing shell.

- Raise the engine housing at the left and strike the mainshaft, countershaft and balancing shaft alternately with light blows of a plastic-faced hammer, so that these remain in the magnet side.
- Screw knurled nut on to engine support with spacer.



- Align marks (7) on balancing shaft and crankshaft (5) with mark on housing (6).



Note:

Note shims on crankshaft.

- First lift out crankshaft, then balancing shaft.

Checking crankshaft for wear

- Check bearing journal on crankshaft and conrod for signs of damage and wear.

Bearing journal dia.min. 45.97 mm (1.810 in)
 Radial play, main bearing ..max. 0.10 mm (0.004 in)
 Endplay,
 conrod/crankshaft webs....max. 0.80 mm (0.031 in)
 Small end bore dia.max. 22.04 mm (0.868 in)

11 27 020 Removing compensating gear

- Press off compensating gear with pressure pad, **BMW No. 11 0 561**.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Coat the bearing seat for the expander gear on the compensating gear with **Optimoly MP 3**.

- Heat the compensating gear to 100 °C (212 °F).

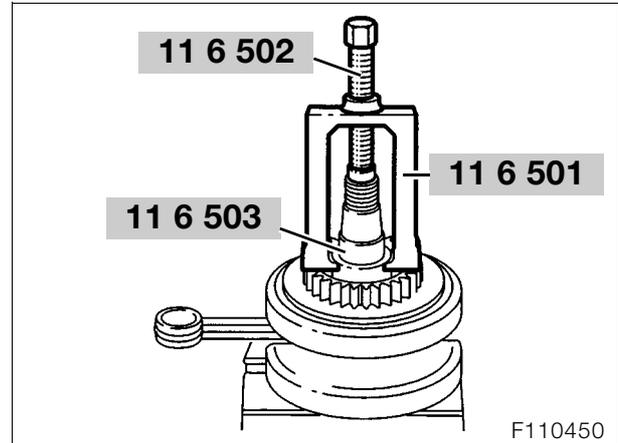


Note:

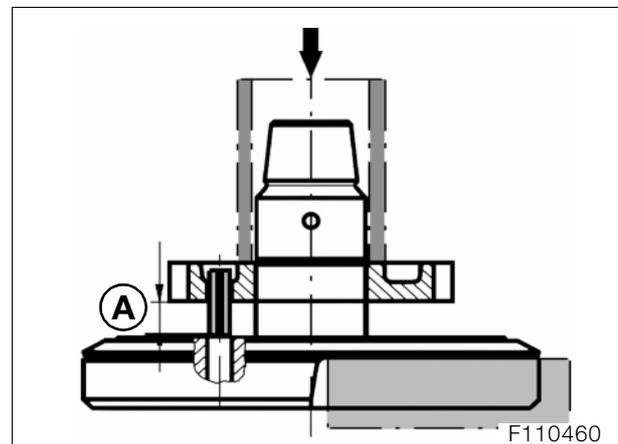
Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

- Use a socket of suitable size or similar adapter to apply pressure to the thrust face of the gear when installing the compensating gear.

Removing and installing crankshaft gear



- Clamp crankshaft into vise with protective jaws.
- Use yoke, **BMW No. 11 6 501**, spindle, **BMW No. 11 6 502**, and pressure pad, **BMW No. 11 6 503**, to pull off the crankshaft gear.



- Installation is the reverse of the removal procedure: pay particular attention to the following.
- When installing, heat the crankshaft gear to 140 °C (284 °F).



Note:

Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.



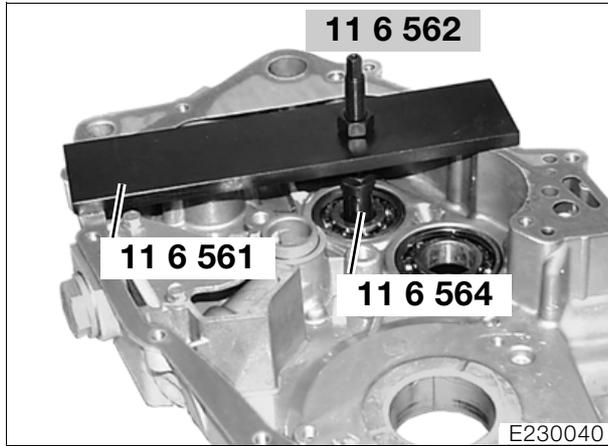
Caution:

Split pin must not protrude from bore in crankshaft gear - this is the support face for the thrust washer.

- Using a suitable adapter, drive the gear onto the crankshaft.

Projection "A" of split pin max. 18 mm (0.709 in)

11 11 205 Removing and installing gear-box mainshaft bearings



Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller. Always renew the mainshaft sealing ring.

- Heat the left of the engine block to 80 – 100 °C (176 – 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 564**, pull off the ball bearing.
- Drive out the mainshaft sealing ring from the inside.
- Heat the right of the engine block to 80 - 100 °C (176 - 212 °F).
- Use a suitable tool such as a socket or similar to press the ball bearing through to the other side from outside.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

The sealed ends of the cage must point outwards.

- To install the ball bearing, heat the engine block to 80 - 100 °C (176 - 212 °F) and spray the ball bearing with **BMW chilling spray**.
- Drive in the shaft sealing ring with sleeve, **BMW No. 23 4 540**, and drift, **BMW No. 23 4 550**.

11 11 210 Removing and installing gear-box compensating shaft bearings



Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller. Always renew the mainshaft sealing ring.

- Heat the left of the engine block to 80 – 100 °C (176 – 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 565**, pull off the ball bearing.
- Heat the right of the engine block to 80 - 100 °C (176 - 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 564**, pull off the ball bearing.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

The sealed ends of the cage must point outwards.

- To install the ball bearing, heat the engine block to 80 - 100 °C (176 - 212 °F) and spray the ball bearing with **BMW chilling spray**.

Wear limit values for bearing seats in housing:

Magneto side:

Countershaft max. Ø 46.99 mm (1.850 in)

Mainshaft max. Ø 62.02 mm (2.442 in)

Clutch side:

Countershaft max. Ø 51.99 mm (2.047 in)

Mainshaft max. Ø 46.99 mm (1.850 in)

11 11 200 Removing and installing grooved ball bearings of gearbox compensating shaft



Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller. Always renew the mainshaft sealing ring.

- Heat the left of the engine block to 80 – 100 °C (176 – 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 563**, pull off the ball bearing.
- Heat the right of the engine block to 80 - 100 °C (176 - 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 563**, pull off the ball bearing.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

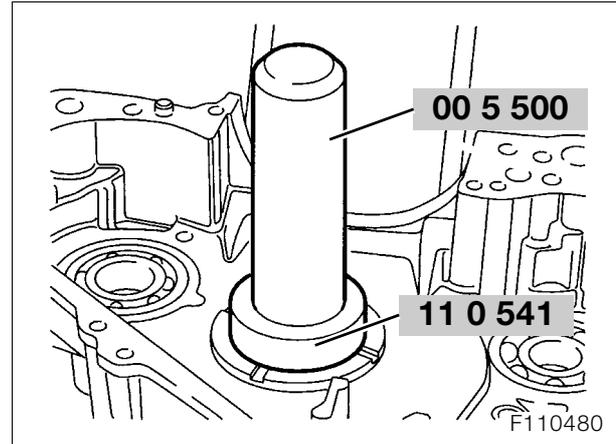
The sealed ends of the cage must point outwards.

- To install the ball bearing, heat the engine block to 80 - 100 °C (176 - 212 °F) and spray the ball bearing with **BMW chilling spray**.

11 21 001 Removing and installing main bearings

- Check main bearings for signs of damage and wear.

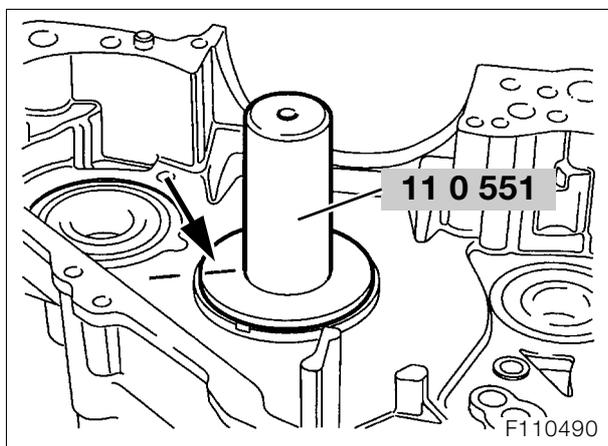
Removal



- Heat the engine housing to 100 °C (212 °F).
- Drive out the bearing bushings with drift, **BMW No. 11 0 541**, and drift, **BMW No. 00 5 500**.



Installation



- Mark the position of the oil hole in the bearing on the housing.
- Heat the engine housing to 100 °C (212 °F).
- Align the mark on the drift (arrow) with the mark on the housing.



Caution:

The bearing bushing must not project beyond the oil pockets.

The end gap of the bearing bushing must always face the balancing shaft.

- Coat bearing bushings with **Optimoly TA** and drive in with drift, **BMW No. 11 0 551**, working from the inside.

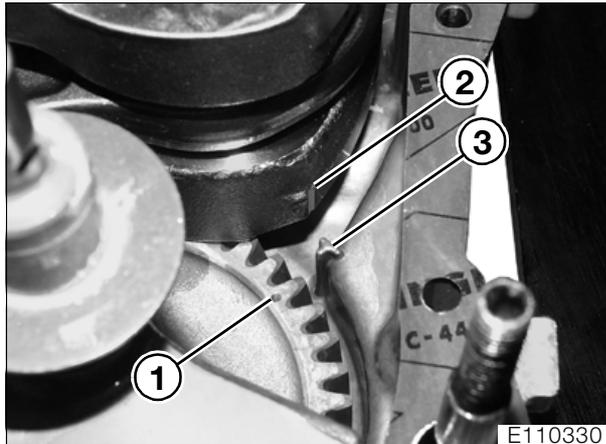
11 00 103 Assembling engine

– Install the gearbox.

➡ See Group 23.

11 21 511 Installing crankshaft and balancing shaft

- Secure right side of engine housing in engine bracket with magnet side facing downwards.



- Install balancing shaft in engine housing; marking (1) must be aligned with marking (3) on housing.
- Coat 1.0 mm (0.04 in) thrust washer with oil and install on crankshaft.
- Rotate crankshaft before installing, so that marking (2) is aligned with marking (3).
- Fit gasket.
- Oil thrust washers and install on crankshaft and balancing shaft.

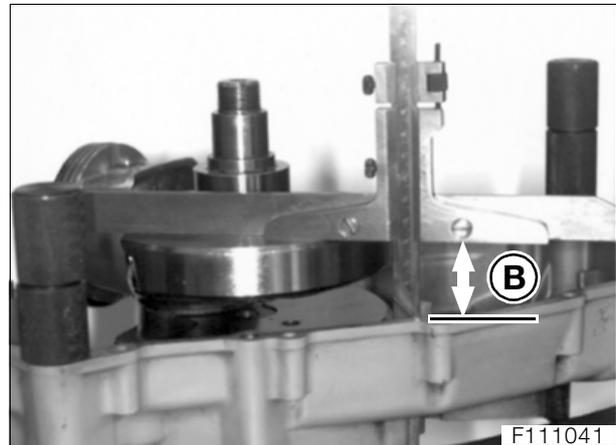


Note:

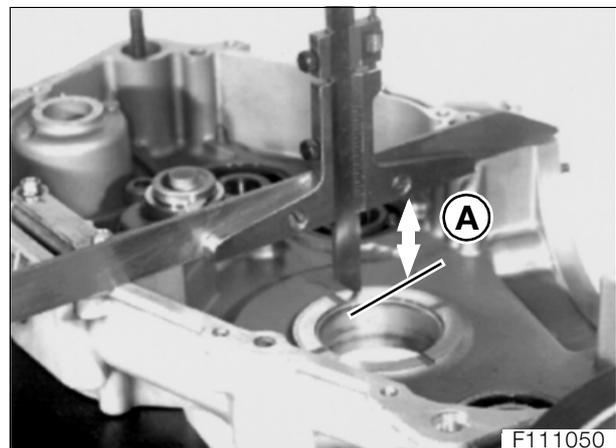
Oil shaft bearing points.
Re-shim the crankshaft and balancing shaft if the housing or either of the shafts was renewed.

- Coat the balancing shaft bearing journals with **Optimoly MP 3**.

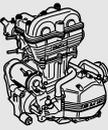
Shimming crankshaft



- Using depth gauge, **BMW No. 00 2 550**, measure distance from crankshaft web to housing joint line = dimension "B".



- Measure distance from left engine housing joint face to spacing washer contact face = dimension "A".
- Dimension "A" minus dimension "B" = crankshaft endplay.





Note:

Allow for the thickness of the compressed gasket (approx. 0.4 mm/0.016 in). On the magnet side, the spacing washer is always 1.0 mm (0.04 in) thick.

- Select a suitable spacing washer to ensure that the correct endplay is obtained.

Crankshaft

endplay 0.1...0.3 mm (0.004...0.012 in)



Note:

Shim the balancing shaft in the same way as the crankshaft. Install spacing washers only on the clutch side.

- Fit left engine housing and screw down.



Note:

Note the two fasteners in the oil filter housing.

- Cut off protruding gasket.



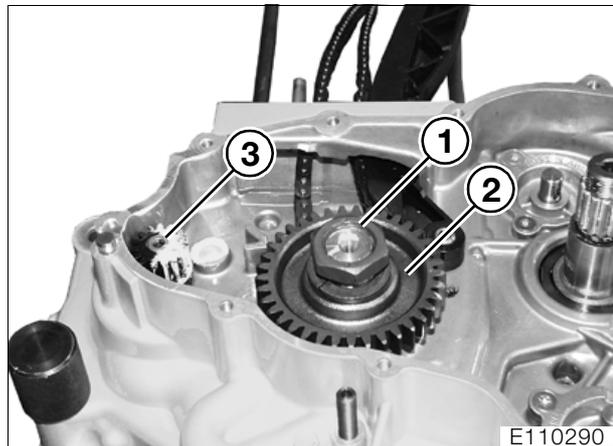
Tightening torque:

Threaded fasteners of engine housing 10 Nm

Installing double drive gear



- Lock the crankshaft in the TDC position with locating screw, **BMW No. 11 6 570**.



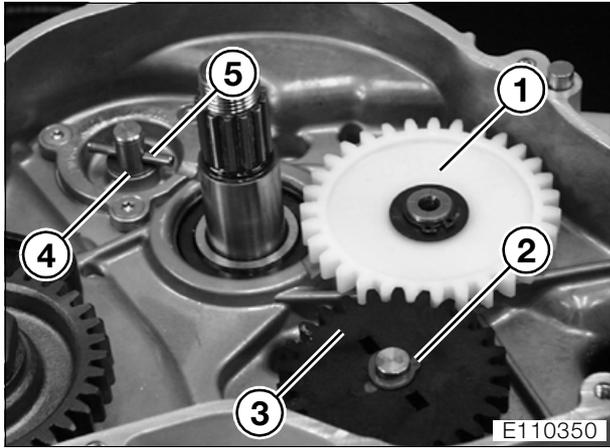
- Insert chain through chain aperture and loop it around crankshaft.
- Slide double drive gear (2) on to crankshaft.
- Engage chain.
- Install snap ring.
- Clean threads of crankshaft and hexagon nut (1), coat threads with **Loctite 243** and install nut.
- Engage needle roller of water-pump drive gear on stub of compensating shaft and push drive gear (3) into position.



Tightening torque:

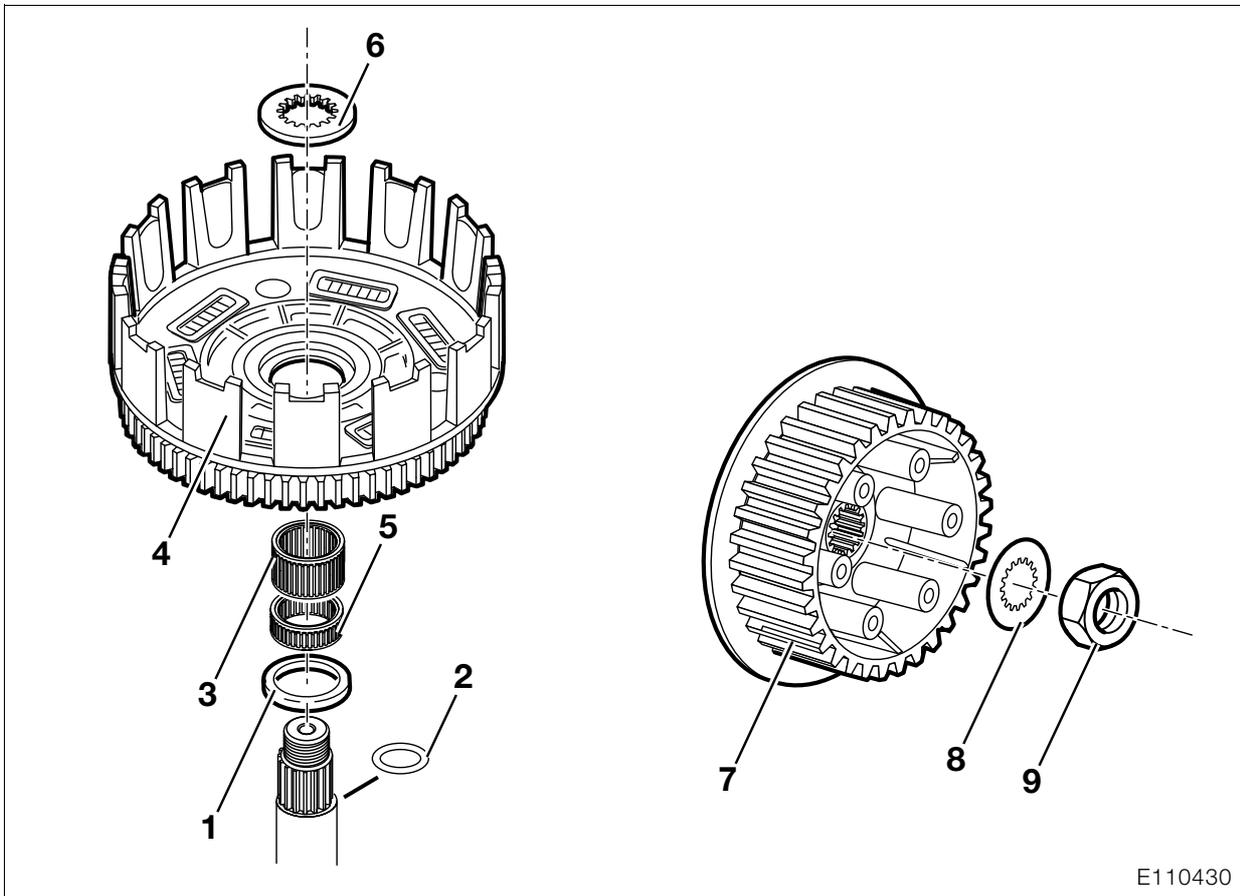
Double drive gear on crankshaft (clean thread + Loctite 243)..... 180 Nm

11 41 000 Installing oil pump gears



- Install idler gear (1) with washer and circlip.
- Install washers (4) of oil pump gears and slide needle rollers (5) into position.
- Install oil pump gears (3) and install the circlips (2).





E110430

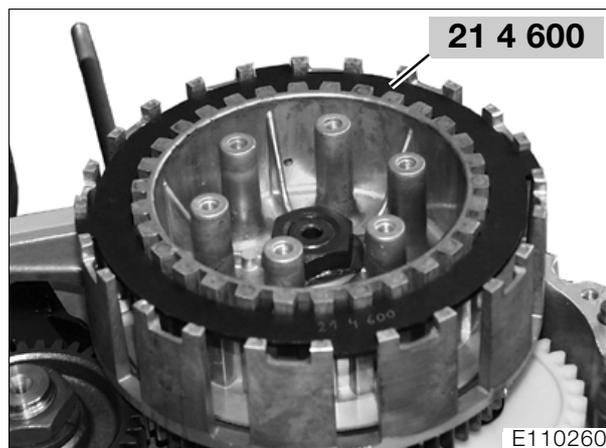
21 21 000 Installing clutch

Installing clutch cage

- Place thrust washer (1) on compensating shaft.
- Coat needle sleeves (3, 5) with oil and install, with the small sleeve (5) down.
- Insert O-ring (2) into groove under splines.
- Install clutch cage (4); gears must all be in mesh.
- Install thrust washer (6) and press it against the O-ring until it is firmly seated and does not spring back.

Installing driver

- Insert driver (7) and coat internal splines with **Optimoly MP 3**.
- Fit locking washer (8); it must engage securely.
- Clean threads of compensating shaft and hexagon nut (9), coat threads with **Loctite 243** and install nut.



E110260

- Insert locating ring, **BMW No. 21 4 600**.
- Tighten hex nut and bend wings of locking washer (8).



Tightening torque:

Driver to compensating shaft
(clean thread + Loctite 243)..... 140 Nm

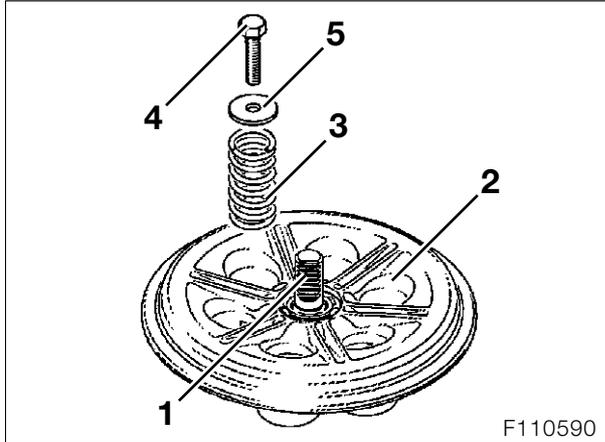
Installing pressure plate

- Insert the plates, starting with a steel plate. Insert steel and lined plates alternately.



Note:

Insert the topmost plate (identified by a black spot) in the offset groove of the clutch cage.



F110590

- Install pressure plate (2).



Note:

All springs (3) must be renewed after each clutch repair.

- Install springs (3).
- Uniformly tighten screws (4) with washers (5) in diagonally opposite sequence.
- Fit gasket.
- Position thrust head (1) correctly in relation to the releaser shaft and hold temporarily in position with grease.
- Align splines on water pump driven gear with driving gear on balancing shaft.
- Fit left engine cover and install securing screws.



Note:

Always replace selector shaft seal in clutch cover.

- Install selector shaft sealing ring in clutch cover with sliding sleeve, **BMW No. 21 4 620**, and drift, **BMW No. 21 4 630**.

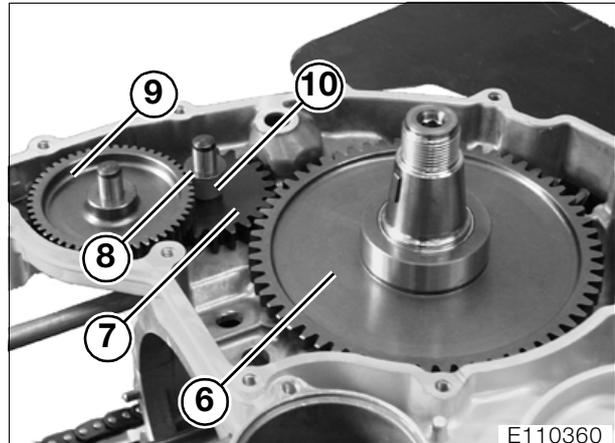


Tightening torque:

Pressure plate to driver 10 Nm
 Engine cover, left 10 Nm

11 26 500 Installing countershaft for starter motor

- Turn engine in assembly fixture so that magnet side is uppermost.



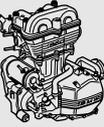
E110360



Note:

Oil the bearing bushing for freewheel gear (6) and the straight pins.

- Slide freewheel gear (6) with the press-fit bearing bushing, onto the crankshaft.
- Push intermediate starter gear (7) on to the straight pin.
- Engage double gear wheel (9) on locating pin.
- Install spacer sleeve (10) and thrust washer (8).



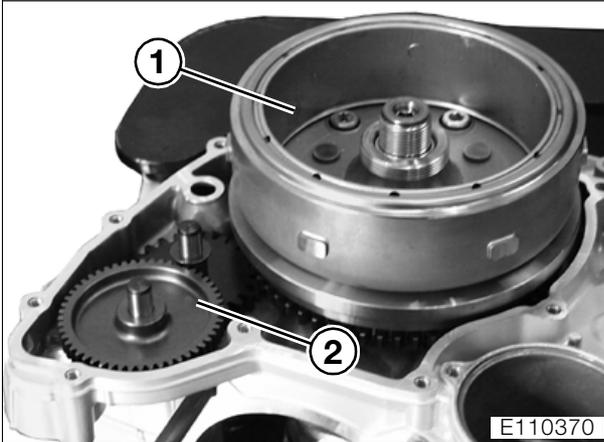
12 11 070 Installing magnetic ignition trigger



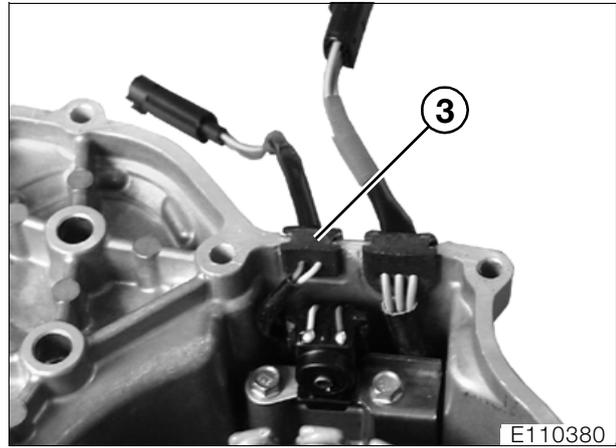
Caution:

Tapers on crankshaft and magnet hub and hex nut must be clean and free of grease.

- Apply a thin coat of **Loctite 648** to the magnet hub taper.
- Oil freewheel in freewheel housing.



- Slide magnet wheel (1) onto crankshaft: woodruff key and keyway must be aligned.
- Rotate starter double gear (2) counter-clockwise to enable the freewheel to slide on to the collar of the freewheel gear.
- Clean the threads on the crankshaft and the threads of the nut.
- Install snap ring and coat threads of hex nut with **Loctite 243** and tighten.



- Coat the rubber grommet (3) of the transmitter and the rubber grommet of the stator cable with **3 Bond 1209** and install in cover of engine block.
- Fit gasket.
- Screw assembly handle, **BMW No. 12 5 500**, into the central hole in the right engine cover.
- Fit right engine housing cover and bolt together.
- Remove assembly handle and screw in cover.

Tightening torque:

Magnetic hub (clean thread + Loctite 243).....	180 Nm
Engine cover, right	10 Nm

11 25 050 Installing piston

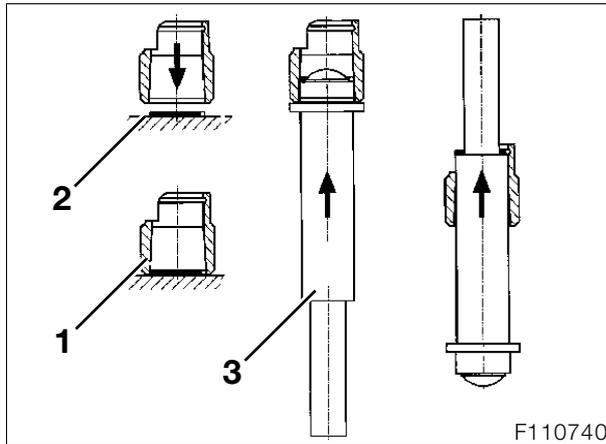
- Coat the small end bore and the piston pin bore in the piston with **Optimoly MP 3**.



Caution:

Note the mark on the exhaust side of the crown applied on disassembly.

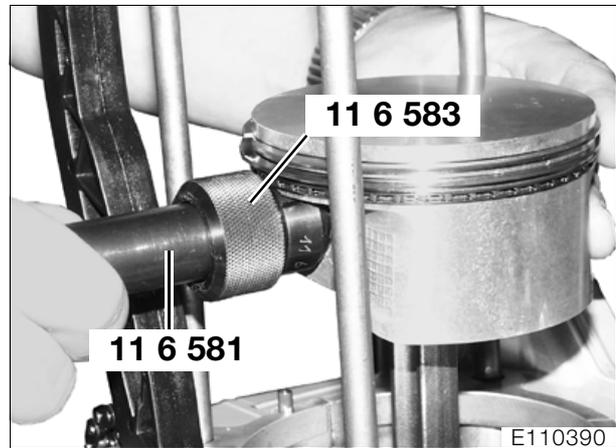
- Install the piston.
- Press the piston pin in with drift, **BMW No. 11 6 581**.



- Install piston pin circlip with mandrel, **BMW No. 11 6 581**, and adapter, **BMW No. 11 6 583**.

Assembly sequence:

- Place piston pin circlip (2) flat on bench.
- Place sleeve (1) over the single-hook circlip (2) so that the ring gap is opposite the flat on the sleeve and the hook is in the groove.
- Press the circlip into the sleeve.
- Using the domed side of assembly drift (3), push the circlip in as far as possible.
- Turn the assembly drift round and push in the circlip until seated in the groove.



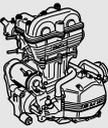
- Position sleeve, **BMW No. 11 6 583**, with installation arbor, **BMW No. 11 6 581**, against piston.



Caution:

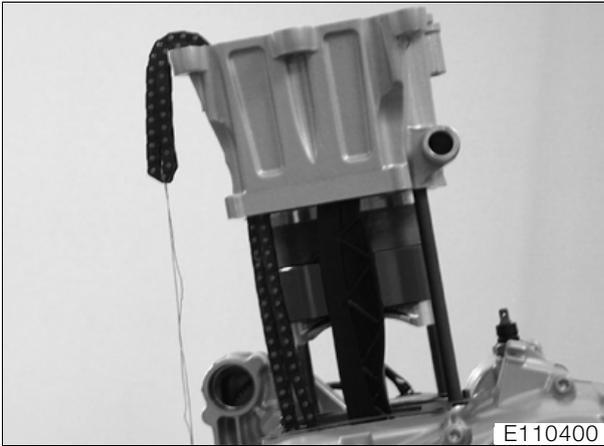
Support side of piston.

- Press piston pin circlip into piston with firm pressure.



11 11 150 Installing cylinder

- Fit cylinder base gasket on engine housing: oil bore must be clear.



- Oil the piston rings and press the sliding piston ring sleeve, **BMW No. 11 6 510**, over the piston rings from above so that the piston projects from the sliding sleeve by about 2 mm (0.08 in).
- Slide timing chain and wire through chain aperture of cylinder, then slide cylinder over piston.
- Remove sliding sleeve.
- Secure cylinder to engine housing hand-tight.

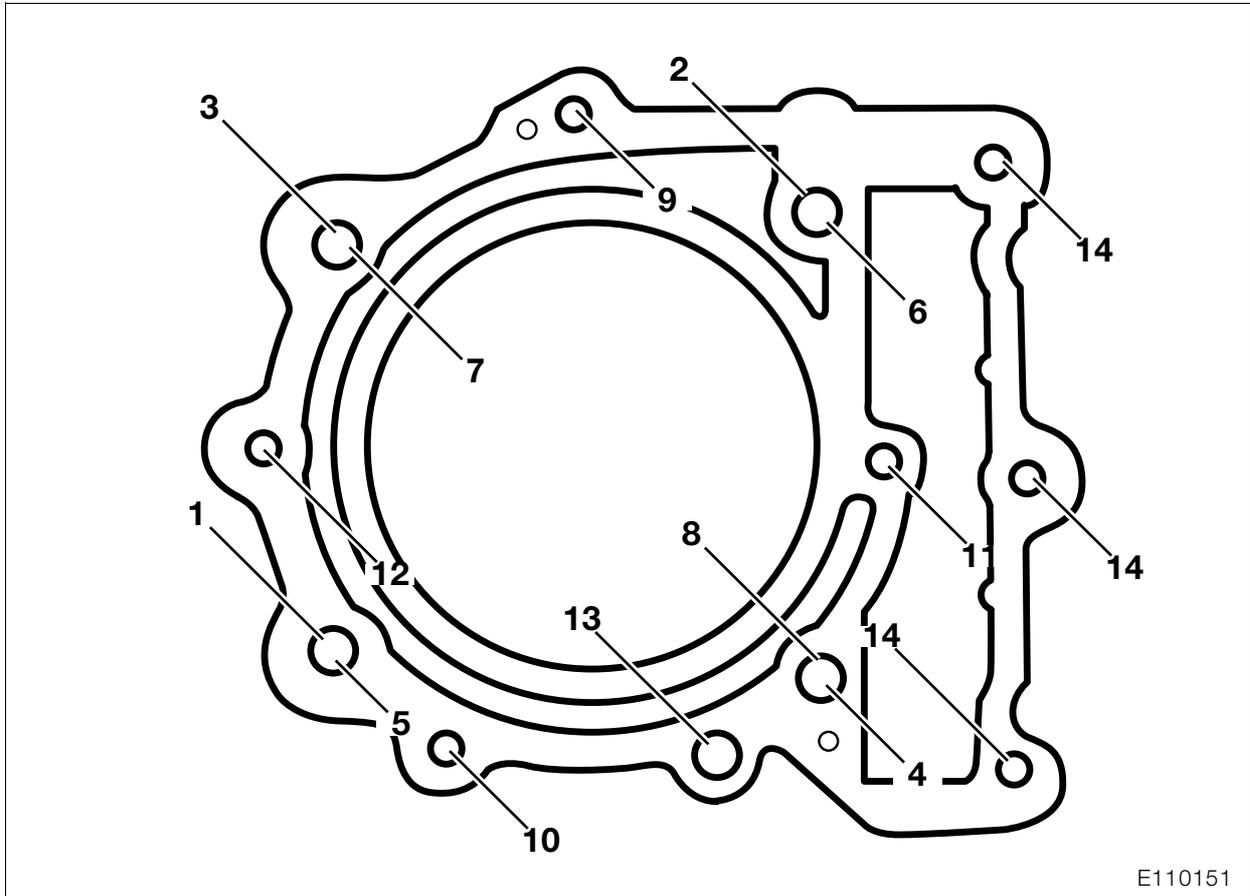
11 12 516 Installing cylinder head



Note:

Install a new cylinder head gasket.

- Install the cylinder head gasket.
- Use a wire hook to pull the timing chain through the cavity in the cylinder head.
- Fit cylinder head with valves installed to cylinder.
- Secure the cylinder head and cylinder loosely together with the collar screws and nuts.



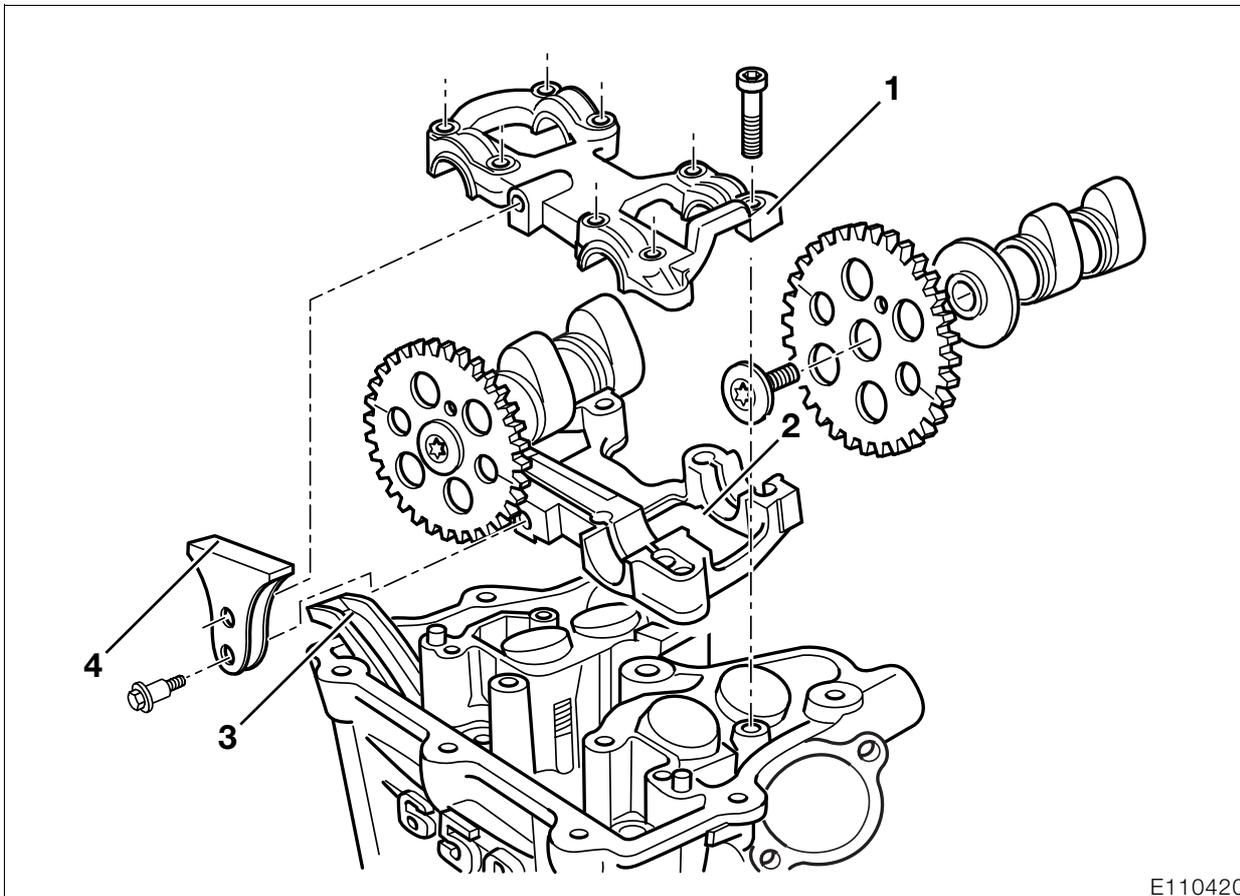
E110151

- Initially tighten the collar nuts of the cylinder head to 20 Nm (1-4) and then tighten to 60 Nm (5-8).
- Tighten the fasteners of the cylinder head to cylinder in the sequence as shown (9-14) to specified torque.
- Tighten machine screws at base of cylinder.



Tightening torques:

Machine screws (chaincase)	10 Nm
Collar screws for cylinder head	33 Nm
Collar nuts to cylinder head.....stage 1:	20 Nm
.....stage 2:	60 Nm



E110420

11 31 529 Installing camshaft and adjusting valves

- Oil outside of bucket tappets and reinstall on original valves.
- Measure thickness of shims with micrometer and note down dimension.
- Place lower part of camshaft carrier (1) on cylinder head.
- Fit camshafts with cam lobes facing upwards, press down by hand and measure valve clearance with feeler gauge.



Note:

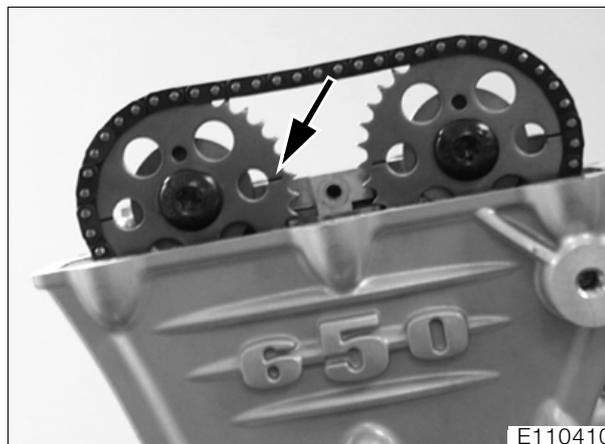
The decompressor in the exhaust camshaft must not press against the bucket tappet, or else the valve clearance will be incorrect.

- Note down dimensions.
- Determine the difference between the nominal and actual values.
- Check thickness of shims with micrometer and replace as appropriate.

Valve clearances:

Inlet valve 0.05...0.10 mm (0.002...0.004 in)
 Exhaust valve 0.25...0.30 mm (0.010...0.012 in)

- Insert chain guide rail (3) in chain cavity.



E110410



Caution:

Marks on the timing-chain sprockets (arrow) must be parallel with the cylinder head, the bores in the timing-chain sprockets must be at the top (TDC position).

- Oil the camshaft journals.
- Install the exhaust camshaft first, then the inlet camshaft.
- Install the upper part of the camshaft carrier (2) and tighten.
- Clean the threads of the chain guide fasteners (4), coat with **Loctite 243** and install the fasteners.

- Check valve clearances.
- Install chain tensioner and tighten threaded fastener with sealing ring.
- Remove all traces of the cylinder head cover gasket and clean the sealing face with degreasing agent. Also clean the groove and the seating faces for the gasket.
- Install valve cover with gasket.
- Connect the oil lines to the engine block.



Note:

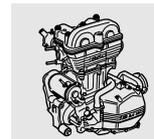
Install the oil return line with the tab at the bottom and the oil feed line with the tab at the top.

- Connect the oil lines to the cylinder head.
- Take out locating pin, **BMW No. 11 6 570**, and insert screw plug with sealing ring.
- Install the spark plug.
- Fit the filter element onto the oil-filter cover.
- Coat the O-ring of the filter element lightly with oil.
- Check the O-ring of the oil-filter cover for damage and replace if necessary.
- Install the oil-filter cover complete with filter element.
- Install starter motor.



Tightening torque:

Camshaft bearing cap	10 Nm
Chain guide to bearing cap (clean threads + Loctite 243)	10 Nm
Timing-chain tensioner to cylinder head	40 Nm
Cylinder head cover to cylinder head	10 Nm
Threaded plug in left side of engine block	25 Nm
Oil line to engine block	35 Nm
Oil line to cylinder head	8 Nm
Spark plug in cylinder head	20 Nm
Starter motor to clutch housing cover	10 Nm
Oil filter cover	10 Nm



11 00 050 Installing engine

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Working from the right, manoeuvre the engine on the lifter into position below the motorcycle.
- Raise the engine and tilt it to the rear.
- Manoeuvre the bottom engine mount into position.
- Raise the engine and manoeuvre the fasteners at the cylinder head into position.
- Install the bottom rear engine mount fastener.
- Install the pivot pin of the swinging arm bearing.
- Back off the adjusting screws for the cylinder head mounts until they are seated against the cylinder head on each side and the cylinder head itself is centered in the frame.

Tightening torque:

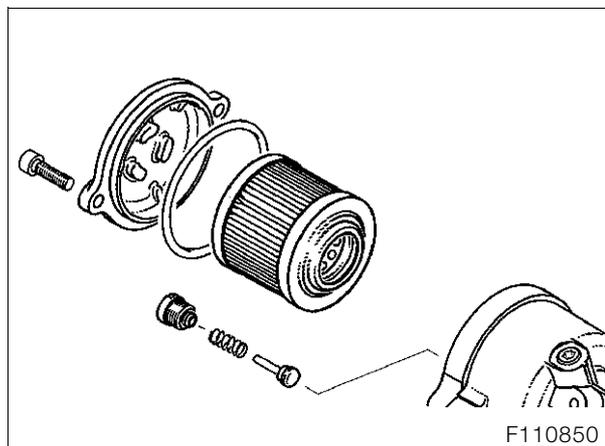
Water pump drain screw	10 Nm
Intake air silencer to frame	9 Nm
Engine guard to frame	9 Nm
Engine oil drain plug	40 Nm
Rear quick-release axle	100 Nm
Drive chain tensioning screws	10 Nm
Exhaust manifold to cylinder head	20 Nm
Silencer to exhaust manifold	55 Nm
Footrest plate to main frame, left/right	30 Nm
Cable cover to engine	5 Nm
Voltage regulator to bracket	7 Nm
Chain drive sprocket to mainshaft (clean threads + Loctite 243)	140 Nm
Sprocket cover to engine	2 Nm
Ground terminal to engine block	8 Nm
Connecting cable, idle indicator	2 Nm
Engine shell to engine	41 Nm
Engine shell to bracing tube	21 Nm
Frame trussing to engine shell	21 Nm
Frame trussing to main frame	21 Nm
Spring-strut adjusting knob bracket to frame	9 Nm
Radiator to main frame at top	9 Nm
Swinging-arm pivot	100 Nm
Frame to engine at rear	41 Nm
Gearshift pedal to engine	13 Nm
Brake pedal to frame	21 Nm
Cylinder head to frame	41 Nm
Cylinder head to frame adjusting sleeve	zero play max. 5 Nm
Cylinder head to frame locknut	100 Nm

Caution:

Never start the engine after it has been dismantled and re-assembled until the engine oil circuit has been bled.

Bleeding engine oil circuit

- Remove oil filter.



- Remove pressure retaining valve (1).
- Remove spark plug.
- Turn engine over with the starter motor until oil emerges at the filter chamber.
- Install pressure retaining valve.
- Install oil filter.
- Turn engine over with starter motor until oil emerges from the oil tank return line.
- Switch on engine, run for a few minutes, then switch off.
- Check oil and coolant levels and top up if necessary.

Tightening torque:

Pressure retaining valve	24 Nm
Oil filter cover	10 Nm

12 Engine electrics

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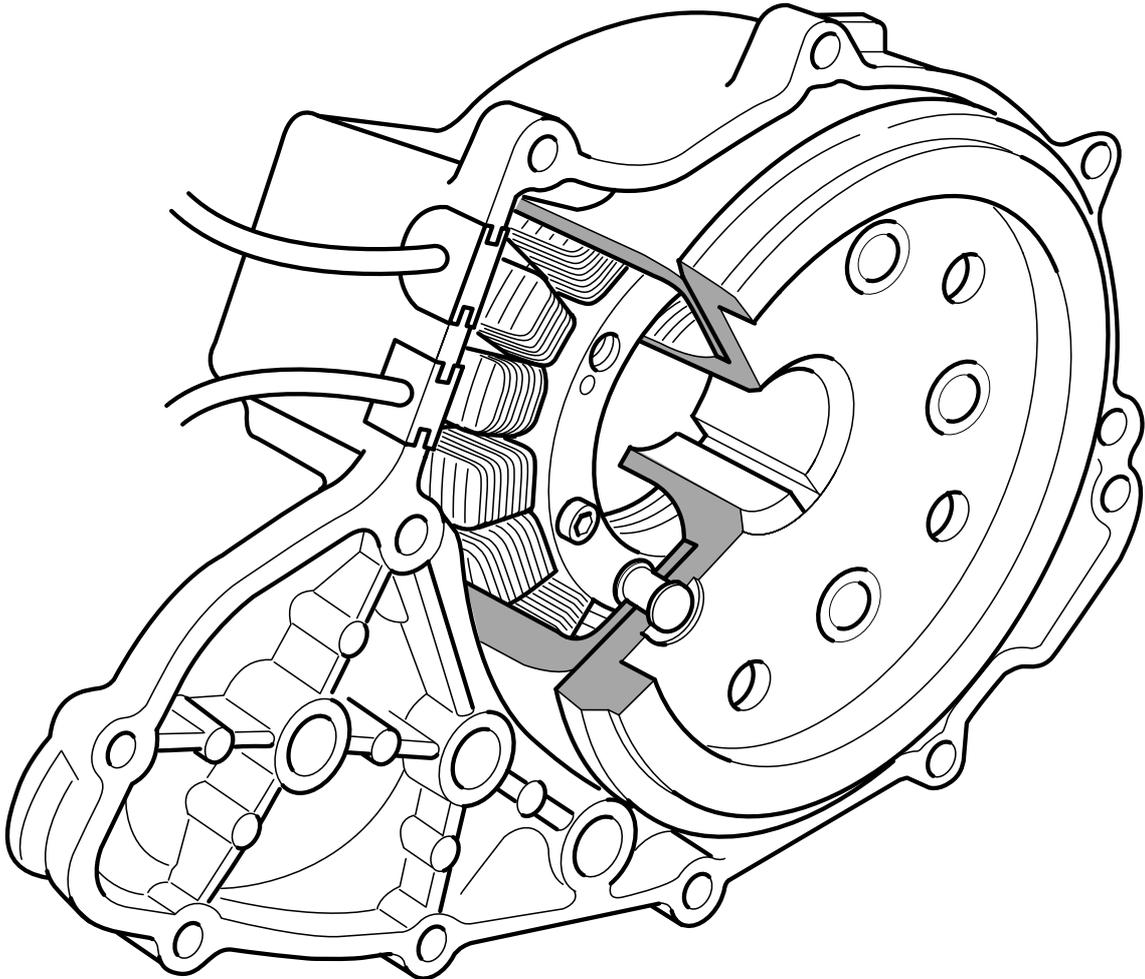


Technical Data		F 650 GS
Ignition system		
Type		Fully transistorised ignition integrated in BMS.
Inductive sensor	Ω	190 ⁻³⁰⁰
Ignition		
Ignition system		BMS (mapped characteristic control)
Speed governing	rpm	7500
Ignition coil		
Primary coil	m Ω	500 \pm 50
Starter motor		
Type		Permanent magnet motor with wedge-block free-wheel, driving crankshaft via countershaft.
Power rating	kW	0.9
Ratio		1:32
Alternator		
Type		Permanent excitation
Drive		Off crankshaft
Maximum output rating	W/V	400/14
Maximum current	A	29
Max. operating speed	rpm	7500
Spark plug		
NGK		D8 EA
Thread	metric	M 12 x 1.25
Electrode gap	mm (in)	0.6-0.7 (0.02-0.03)

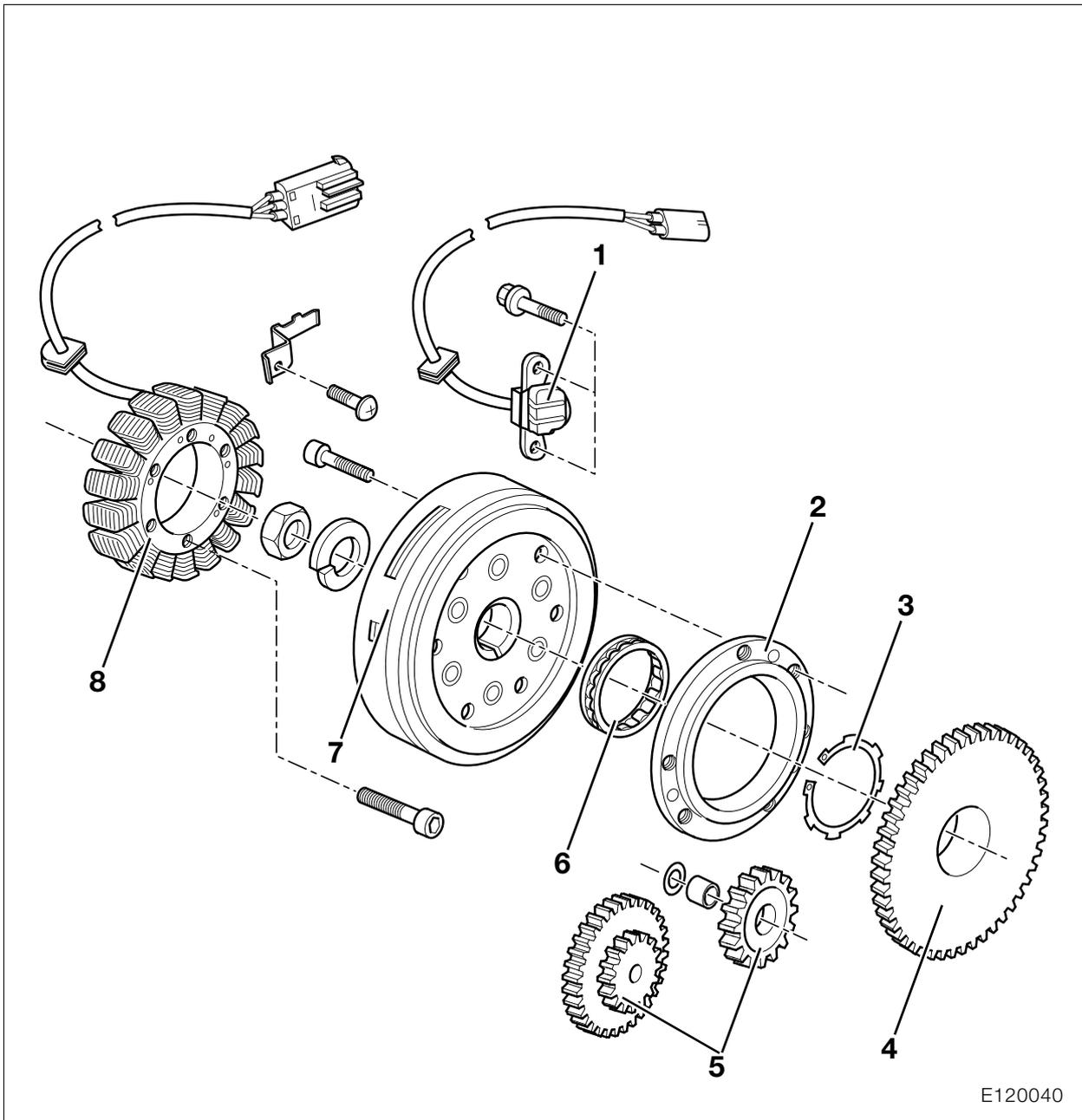




Ignition magneto



Ignition magneto, components



E120040

- 1 Ignition trigger
- 2 Freewheel housing
- 3 Lock ring
- 4 Freewheel gear
- 5 Starter countershaft
- 6 Freewheel
- 7 Magnet rotor
- 8 Stator winding

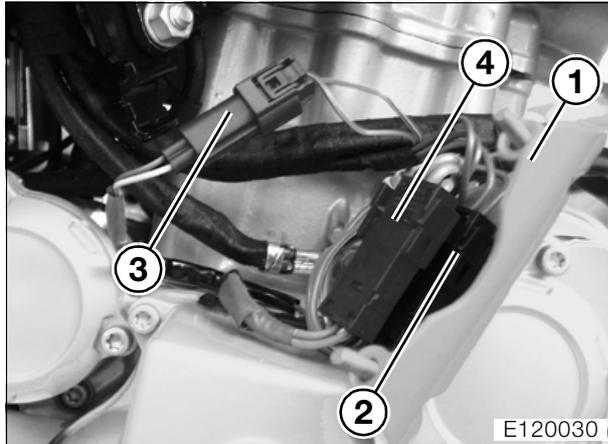
12 11 070 Removing ignition magnet



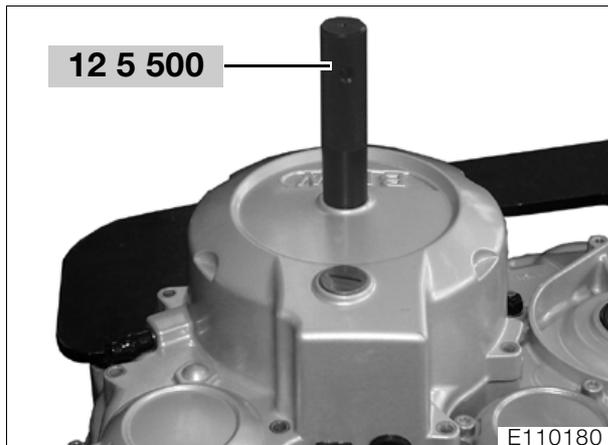
Caution:

Never disconnect plug connection on ignition system while engine is running.

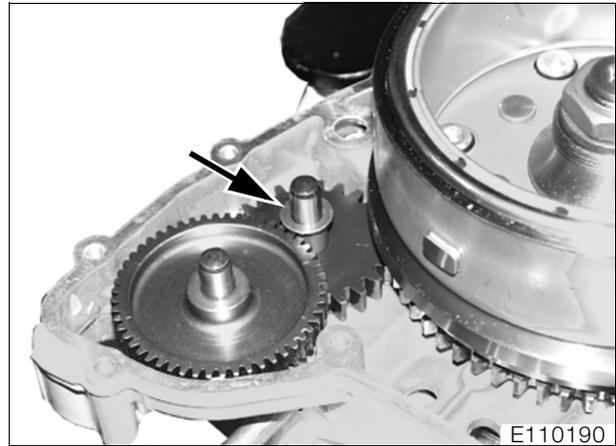
11 14 859 Removing right engine housing cover



- Remove fasteners of cable cover (1).
- Disconnect the plug of the stator (4) from connector (2).
- Disconnect the plug of ignition trigger (3).
- Remove retainer on right engine housing cover.



- Remove central plug and install handle, **BMW No. 12 5 500**.



- Remove the cover, noting the thrust washer (arrow).



- Unscrew hex nut.
- Heat hub to 80 °C (176 °F).



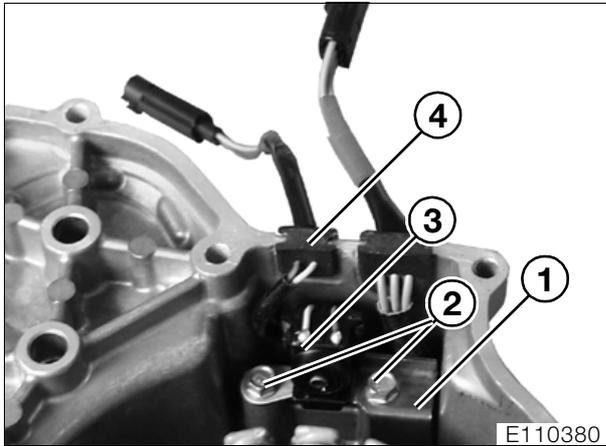
Note:

Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

- Using puller, **BMW No. 12 5 510**, pull off magnet rotor.



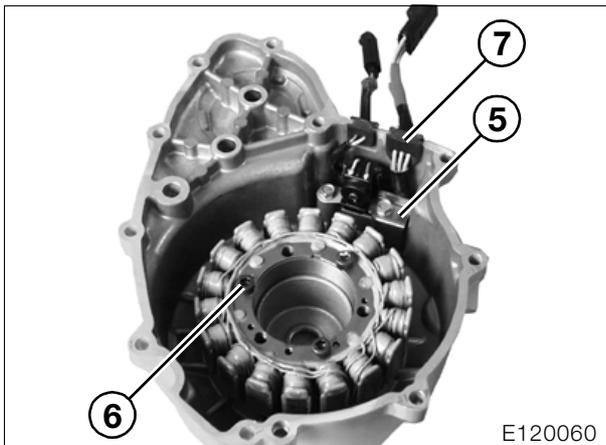
12 11 060 Removing/installing ignition trigger



- Remove fasteners securing ignition trigger (2) in right cover.
- Remove cable holder (1).
- Remove the rubber grommet of ignition trigger (4) from the cover.
- Remove ignition trigger (3).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Coat the rubber grommet of the ignition trigger with **3 Bond 1209** before inserting it into the cover.

 **Tightening torque:**
Ignition trigger in cover..... 8 Nm

Removing/installing stator



- Remove cable holder (5).
- Remove fasteners securing stator (6).
- Remove the rubber grommet of stator (7) from the cover.

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Coat the rubber grommet of the stator with **3 Bond 1209** before inserting it into the cover.
- Clean the threads of the screws and coat with **Loctite 243**.

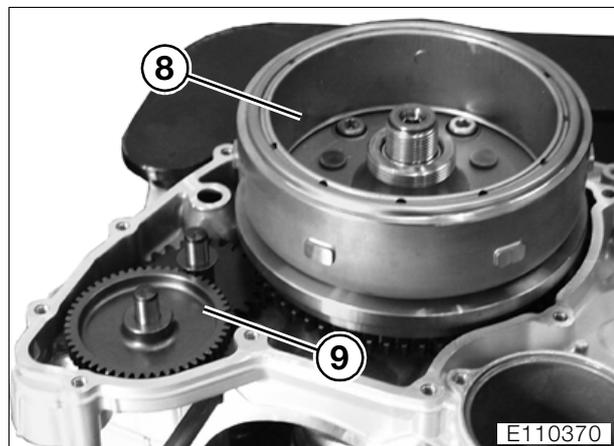
 **Tightening torque:**
Stator to cover
(clean threads + Loctite 243)..... 10 Nm
Cable holder to cover..... 8 Nm

12 11 070 Installing magnetic ignition trigger

12 11 070 Installing magnet wheel

 **Caution:**
Tapers on crankshaft and magnet hub and hex nut must be clean and free of grease.

- Apply a thin coat of **Loctite 648** to the magnet hub taper.
- Oil freewheel in freewheel housing.



- Slide magnet wheel (8) onto crankshaft: woodruff key and keyway must be aligned.
- Rotate starter double gear (9) counter-clockwise to enable the freewheel to slide on to the collar of the freewheel gear.
- Clean the threads on the crankshaft and the threads of the nut.
- Install snap ring and coat threads of hex nut with **Loctite 243** and tighten.

- Fit gasket.
- Screw assembly handle, **BMW No. 12 5 500**, into the central hole in the right engine cover.
- Fit right engine housing cover and bolt together.
- Remove assembly handle and screw in central plug.
- Connect the plugs of the ignition trigger and the stator.
- Clip the stator connector onto the plug.
- Secure the cable cover to the engine.

 **Tightening torque:**

Magnetic hub (clean thread + Loctite 243).....	180 Nm
Engine cover, right	10 Nm
Cable cover to engine	5 Nm

12 41 020 Removing/installing or dismantling starter motor

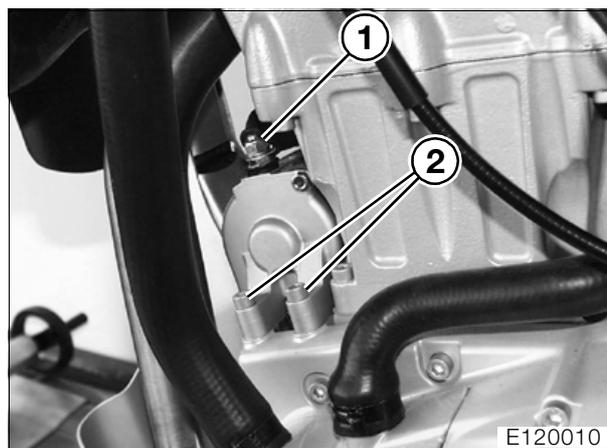
12 41 020 Removing/installing starter motor



Caution:

Disconnect the negative battery cable first, then the positive cable.

- Disconnect the battery.



- Disconnect positive cable (1).
- Remove fastener (2) from engine block and remove starter.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Check O-ring for damage and replace if necessary.



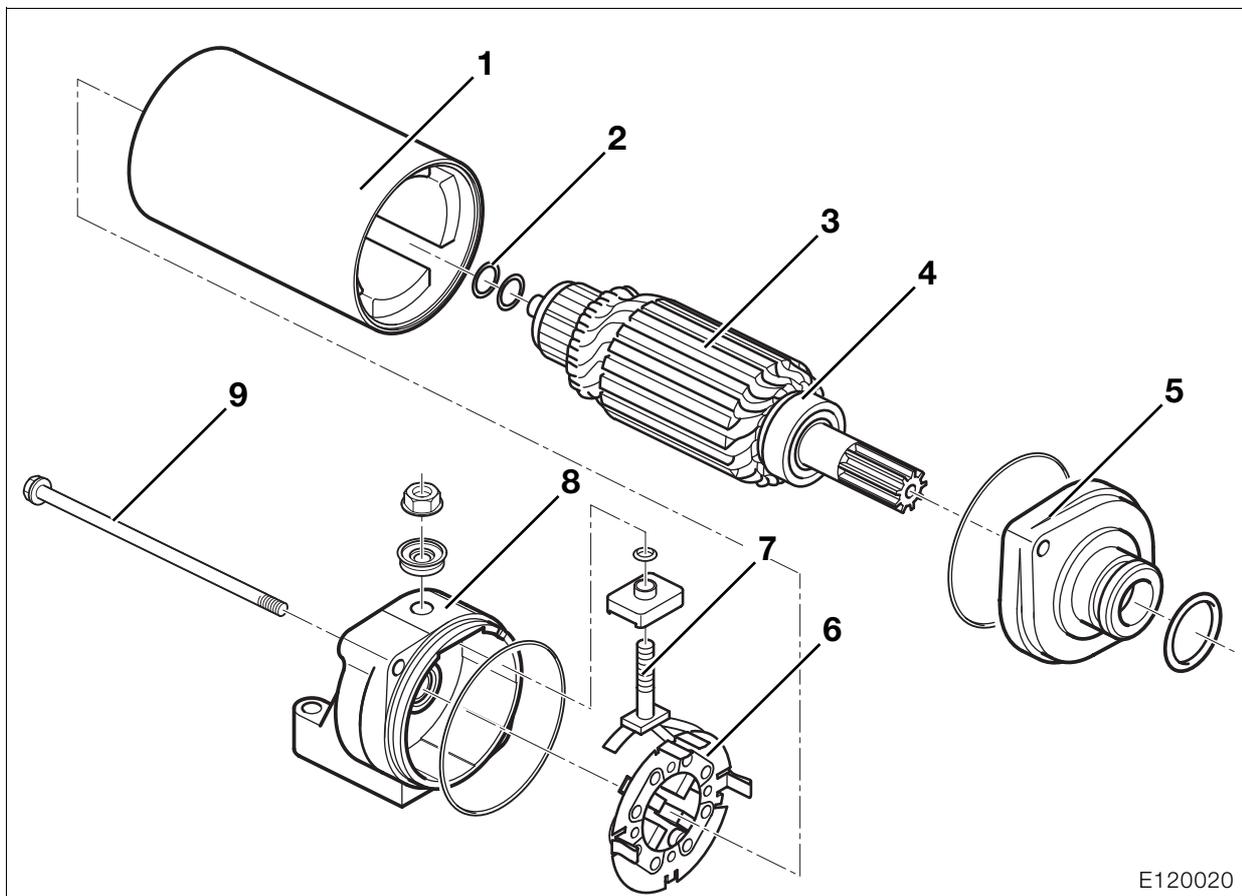
Caution:

Connect the positive battery cable first, then the negative cable.



Tightening torque:

Starter motor to engine block.....	10 Nm
Positive cable to starter motor.....	5 Nm



E120020

12 41 103 Disassembling/assembling starter motor

- Remove necked-down bolts (9).
- Remove armature bearing cover (8) complete with brush-holder plate (6).



Note:

Note thrust washers (2).

- Remove fastener of positive contact (7), lift out brush holder and replace carbon brushes if necessary.
- Remove front cover (5).
- Remove armature (3) from housing (1).
- Using puller, **BMW No. 00 8 400**, pull the ball bearing (4) off the armature shaft.



Note:

The insulation should be 0.5 mm (0.02 in) deeper than the commutator discs: if necessary, remachine with commutator saw.

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Use a suitable tool such as a socket or similar to press the ball bearing onto the armature shaft.
- Using protective jaws, clamp the armature in a vise and slide the brush-holder plate into position, pushing the carbon brushes back for clearance.



E120070



Note:

Make sure that the mark on the housing (arrow) is aligned with positive contact point (10).



Tightening torque:

Necked-down bolts, starter housing	5 Nm
Positive contact to starter motor	4 Nm

12 12 011 Replacing spark plug

See Group 00

12 12 085 Replacing ignition lead

- Remove left, right and centre covers.
- Remove the battery.

Remove the intake air silencer together with the intake air pipe.

- Remove the fastener for the intake air silencer from the oil tank.
- Remove the fasteners for the intake air silencer from the retainer.
- Remove the starter relay from the holder.
- Slacken the fasteners for the lid of the electronic equipment box.
- Remove the fasteners for the battery tray.
- Disengage the clamp securing the breather hose and disconnect the hose from the intake air silencer.
- Press the oil tank slightly to the left and carefully disconnect the intake air silencer from the throttle flap stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle flap stub.
- Disconnect the ignition lead from the ignition coil and the spark plug and remove.



Tightening torque:

Lid of electronic equipment box	4 Nm
Oil tank to intake air silencer	9 Nm
Intake air silencer to frame	9 Nm
Trim panel/cover	3 Nm

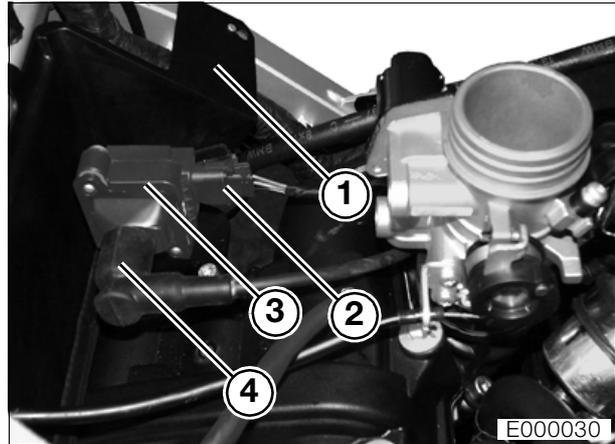
12 13 000 Removing/installing coil

- Remove left, right and centre covers.
- Remove the battery.

Remove the intake air silencer together with the intake air pipe.

- Remove the fastener for the intake air silencer from the oil tank.
- Remove the fasteners for the intake air silencer from the retainer.
- Remove the starter relay from the holder.
- Slacken the fasteners for the lid of the electronic equipment box.
- Remove the fasteners for the battery tray.

- Disengage the clamp securing the breather hose and disconnect the hose from the intake air silencer.
- Press the oil tank slightly to the left and carefully disconnect the intake air silencer from the throttle flap stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle flap stub.

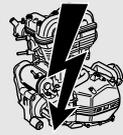


- Disengage cover (1) from the anchorages on main frame on each side and remove.
- Disconnect starter coil (2) at plug.
- Pull spark plug connector (4) off spark plug.
- Remove screws securing ignition coil (3) to cylinder head cover.



Tightening torques:

Ignition coil to cylinder head	9 Nm
Lid of electronic equipment box	4 Nm
Oil tank to intake air silencer	9 Nm
Intake air silencer to frame	9 Nm
Trim panel/cover	3 Nm



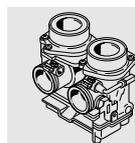


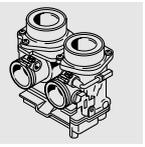
13 Fuel preparation and control

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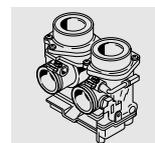
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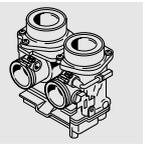
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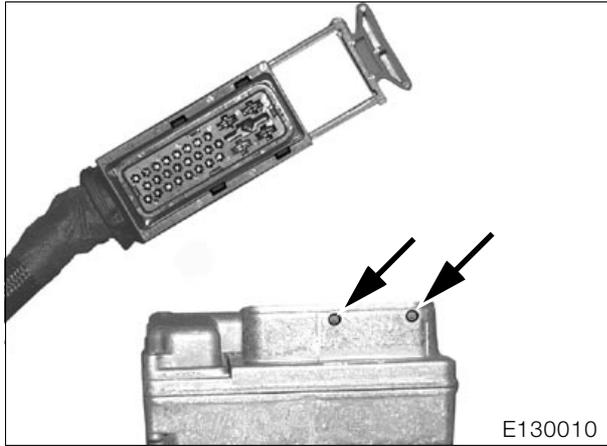
Technical Data		F 650 GS
Fuel grade		Super (premium), unleaded. 95 octane (RON)
Mixture preparation		Manifold injection
Fuel pressure	bar (psi)	3.5±0.2 (49.8±2.8)
Throttle stub pipe intl. dia.	mm (in)	46 (1.8)
Air filter		Paper filter
Intake stub pipe	mm (in)	43 (1.7)





13 61 010 Removing and installing BMS control unit

- Remove seat.
- Unhook the retaining strap and remove the control unit.
- Pull the red locking grip forward and at the same time pull the connector up and off the control unit.

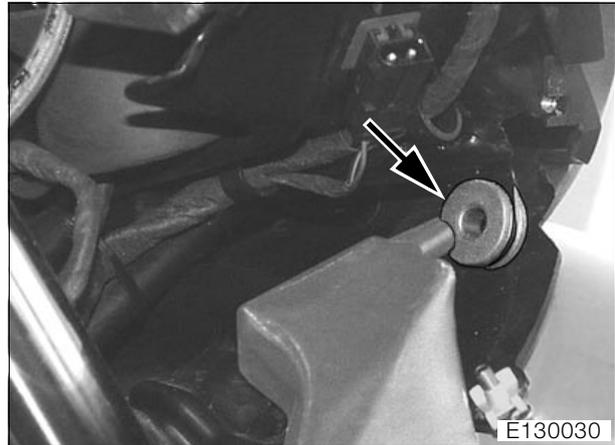


- When reinstalling, push the connector with grooves onto the pins (arrows) on the control unit and close the locking mechanism.

13 72 120 Removing and installing intake air pipe

- Remove right cover.
- Disconnect the plug for the air temperature sensor.
- Remove the connecting flange from the intake air silencer.
- Remove the intake air pipe.
- If necessary, remove the air temperature sensor.

- Installation is the reverse of the removal procedure: pay particular attention to the following.

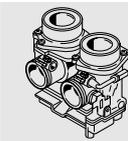


- Slide the pin on the intake air pipe into the rubber grommet (arrow) on the trim-panel mount.



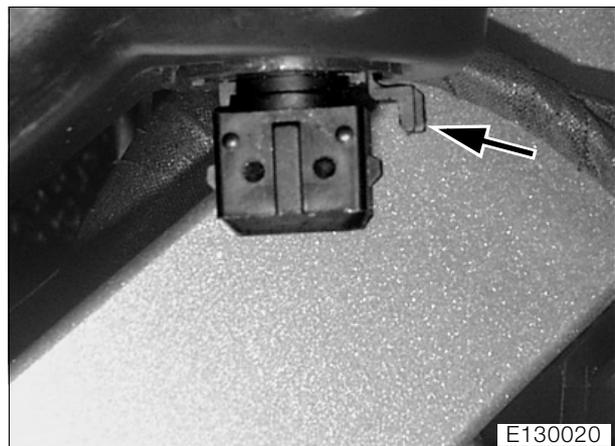
Tightening torques:

Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm



13 62 010 Removing/installing air temperature sensor

- Remove right cover.
- Disconnect the plug for the temperature sensor.



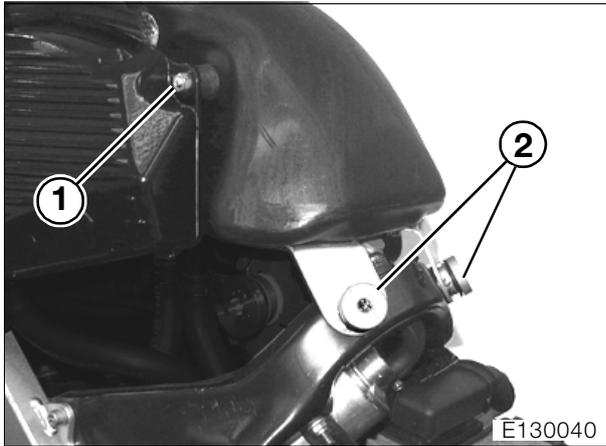
- Press in the lug (arrow) and remove the temperature sensor from the intake air pipe.

00 13 630 Replacing air filter element

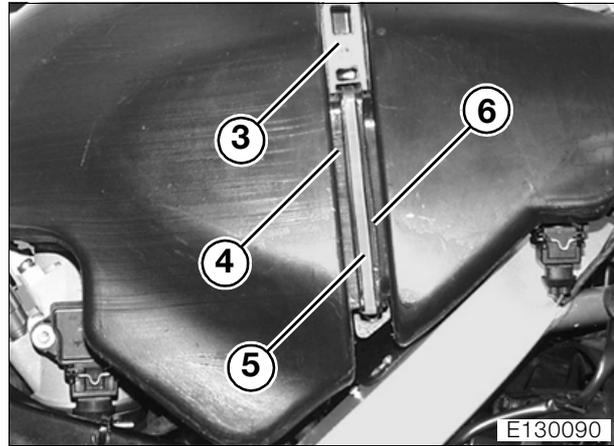
See Group 00

13 72 130 Removing and installing intake air silencer

- Remove left, right and centre covers.
- Remove the intake air pipe.
- Disengage the rubber strap holding the battery.



- Remove the fasteners securing the intake air silencer to oil tank (1) and retainer (2).
- Press the oil tank slightly to the left until stud (1) is exposed and carefully disconnect the intake air silencer from the throttle flap stub.
- Disconnect breather and drain hoses.
- Remove air filter element, if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Make sure that the intake pipe is correctly seated on the throttle flap stub.



- Introduce the fits of intake air silencer (4) with air filter element (5) and intake air duct (6) into the grooves in the battery tray (3)/connecting flange.

⚠ Tightening torques:

Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank.....	9 Nm
Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm

13 71 006 Removing and installing intake air pipe

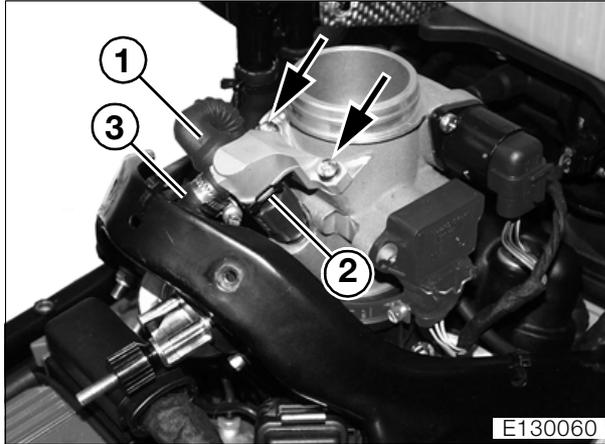
- Remove intake air silencer.



- Carefully open bead (arrow) and slide the intake pipe into the intake air silencer.
- Remove the intake pipe through the aperture for the air filter element.
- Installation is the reverse of the removal procedure.

13 64 165 Removing and installing injection nozzle

- Remove left, right and centre covers.
- Remove the intake air pipe.
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle flap stub and secure the silencer to the frame with a cable tie.



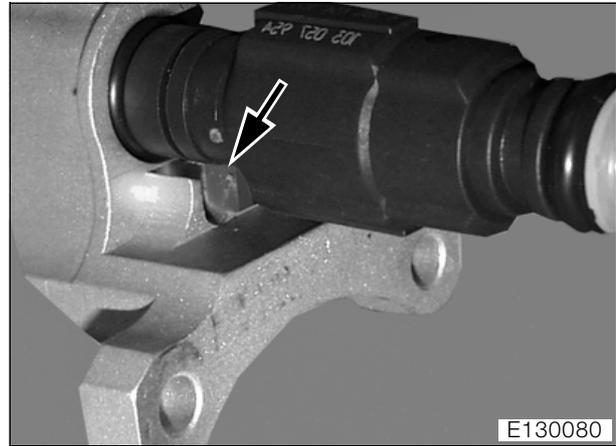
- Disconnect the plug of fuel injector (1).
- Use a hose clamp, **BMW No. 13 3 010**, to close off fuel line (3).
- Slacken the hose clip securing the fuel line and disconnect the line from the throttle flap stub.
- Remove spring clip (2).
- Remove the fasteners for the fuel-injector holder (arrows).
- Remove the fuel-injector holder complete with fuel injector.
- Disconnect the fuel injector from the fuel-injector holder.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

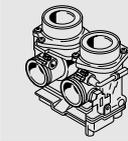
Fit new O-rings when reinstalling a used fuel injector.

- Grease O-rings lightly.

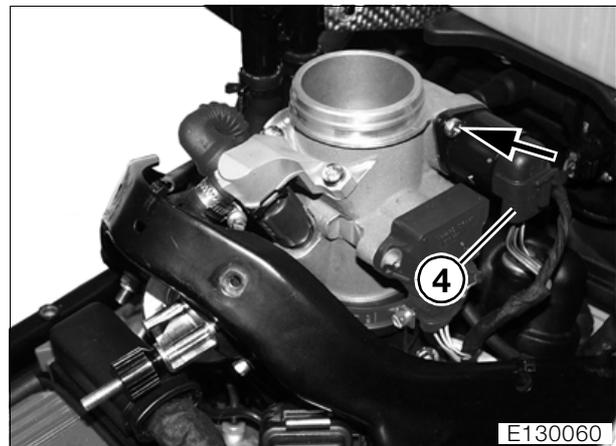


- Install the fuel injector in the fuel-injector holder with the lug on the injector (arrow) in the groove in the holder.

13 54 020 Removing and installing throttle valve actuator



- Remove left, right and centre covers.
- Remove the intake air pipe.
- Remove intake air silencer.



- Disconnect plug of throttle-valve actuator (4).
- Remove the fasteners securing the throttle-valve actuator (arrow).
- Remove the throttle valve actuator.
- Check the O-ring for damage.
- Clean the threads.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Coat threads of fasteners with Loctite 243.

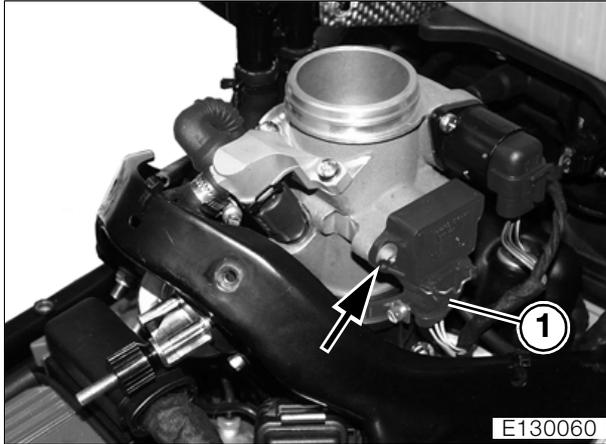


Tightening torque:

Throttle-valve actuator to throttle flap stub (clean threads + Loctite 243)..... 5 Nm

13 63 005 Replacing throttle-valve potentiometer

- Remove left, right and centre covers.
- Remove the intake air pipe.
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle flap stub and secure the silencer to the frame with a cable tie.



E130060

- Disconnect plug of throttle-valve potentiometer (1).
- Remove the fasteners (arrow).
- Remove the throttle-valve potentiometer.
- Installation is the reverse of the removal procedure.



Note:

It is not necessary to adjust the throttle-valve potentiometer after installation (self-teaching system).

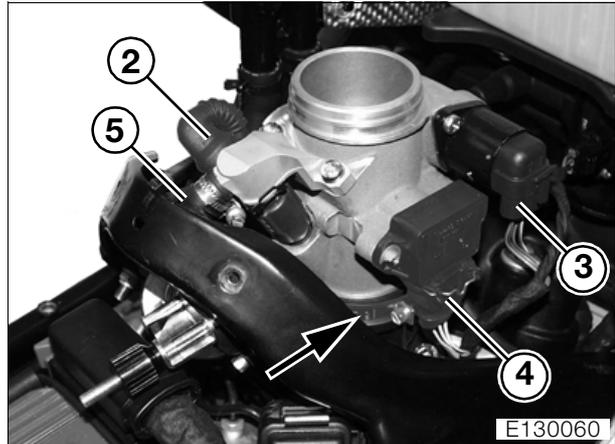


Tightening torque:

Throttle-valve potentiometer to throttle flap stub 3 Nm

13 54 017 Removing and installing throttle-valve stub pipe

- Remove left, right and centre covers.
- Remove the intake air pipe.
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle flap stub and secure the silencer to the frame with a cable tie.
- Remove circlip securing throttle cable to throttle flap stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.



E130060

- Disconnect the plugs for fuel injector (2), throttle-valve potentiometer (4) and throttle-valve actuator (3).
- Use a hose clamp, **BMW No. 13 3 010**, to close off fuel line (5).
- Slacken the hose clip securing the fuel line and disconnect the line from the throttle flap stub.
- Slacken hose clip (arrow) on the intake pipe.
- Pull the throttle flap stub off the intake pipe.
- If necessary, remove fuel-injector holder and fuel injector.

- Installation is the reverse of the removal procedure.



Tightening torques:

Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank	9 Nm
Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm

13 71 000 Removing and installing intake pipe

- Removing throttle stub pipe
- Release the two fasteners securing the intake pipe to the cylinder head and remove the intake pipe.
- Remember to clean the sealing faces before re-installing.



Tightening torques:

Air intake pipe to cylinder head	21 Nm
Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank	9 Nm
Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm

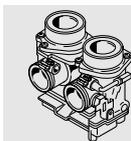
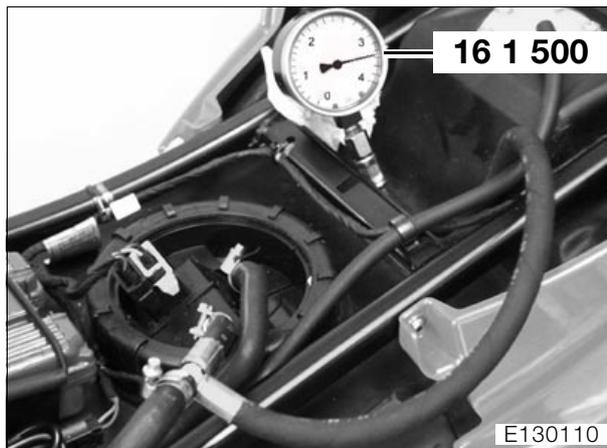
13 60 505 Checking fuel pressure



Warning:

Comply with safety precautions when handling or working with fuel; note that the fuel lines are pressurised.

- Remove seat.



- Connect a test pressure gauge, **BMW No. 16 1 500**, between fuel feed line and tank outlet.
- Start engine and allow to idle.

Fuel pressure:

Specification 3.5±0.2 bar (49.8±2.8 psi)



Note:

If fuel pressure is lower or higher than specification, check the fuel pump, fuel filter, pressure regulator and lines.

Removing and installing fuel hoses

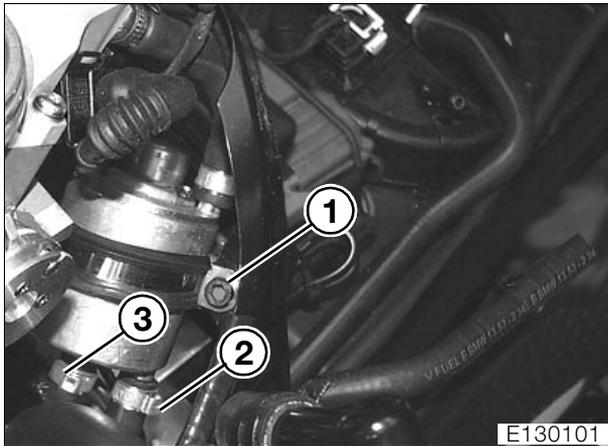


Warning:

Comply with safety precautions when handling or working with fuel; note that the fuel lines are pressurised.

Removing and installing feed and return lines

- Remove seat.
- Remove left cover.
- Remove the BMS control unit from the holder.
- Disengage the oil tank.



- Remove the fastener securing the fuel filter (1) to the frame bow.
- Slacken hose clamps.



Warning:

Fuel escapes when the hoses are disconnected.

- Disconnect fuel feed line (2) and fuel return line (3).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



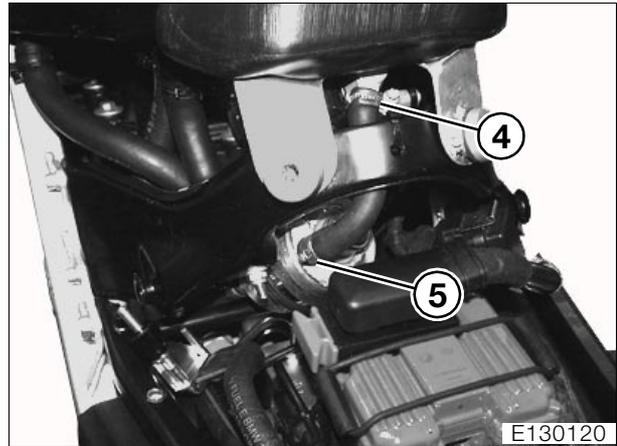
Caution:

Note the installed positions of fuel feed line (2) and fuel return line (3).

- Secure hose clips (2, 3) with pliers, **BMW No. 13 1 500**.

13 31 135 Removing and installing line to fuel injector

- Remove seat.
- Remove left, right and centre covers.
- Use a hose clamp, **BMW No. 13 3 010**, to close off the fuel feed line.



- Open hose clips (4, 5).
- Disconnect the fuel line.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Secure hose clip (5) with pliers, **BMW No. 13 1 500**.

32 72 305 Removing and installing throttle cable

See Group 32

16 Fuel tank and lines

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Removing and installing warning-contact switch for fuel level	9
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Removing and installing activated charcoal filter	10
[USA version]	10





Technical Data		F 650 GS
Fuel tank		
Type		Plastic tank with cover
Tank capacity	l (Imp.gal/ US gal)	17.3 (3.8/4.6) (including 4 l (0.88/1.06) reserve)
Type of fuel		Super (premium), unleaded. 95 octane (RON)
Fuel pump		
Type		Peripheral-gear pump
Operating voltage	V	7 - 15
Fuel pressure	bar (psi)	3.5 (49.8)
Delivery rate	l/h (Imp.gal/h; US gal/h)	150 (33; 39.6) at 13.5V, 3.5 bar (49.8 psi)





16 11 030 Removing and installing fuel tank

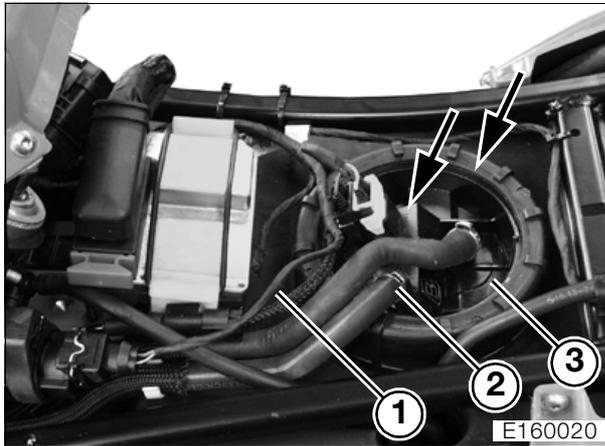


Caution:

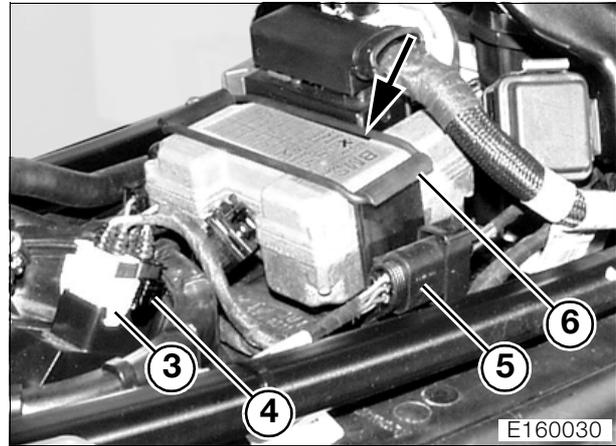
Note risks when handling fuel.
Disconnect ground lead from battery and insulate.

16 11 030 Removing fuel tank

- Remove the seat and the toolkit.
- Secure front wheel in position.
- Removing chain takeup roller.
- ➔See Group 27
- Remove left and right rear trim panels.
- Remove left and right silencers.
- ➔See Group 18
- Remove brake fluid reservoir from rear frame.
- Close off the brake line to the brake master cylinder beneath the fuel tank.



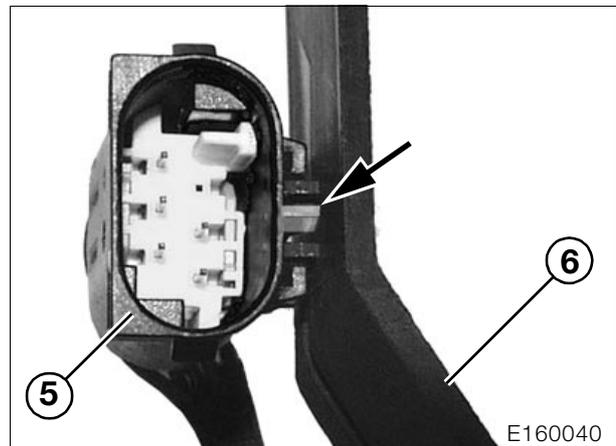
- Close off fuel supply line (1) and the fuel return line (2) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Disconnect breather hose (3) from the roll-over valve.



Note:

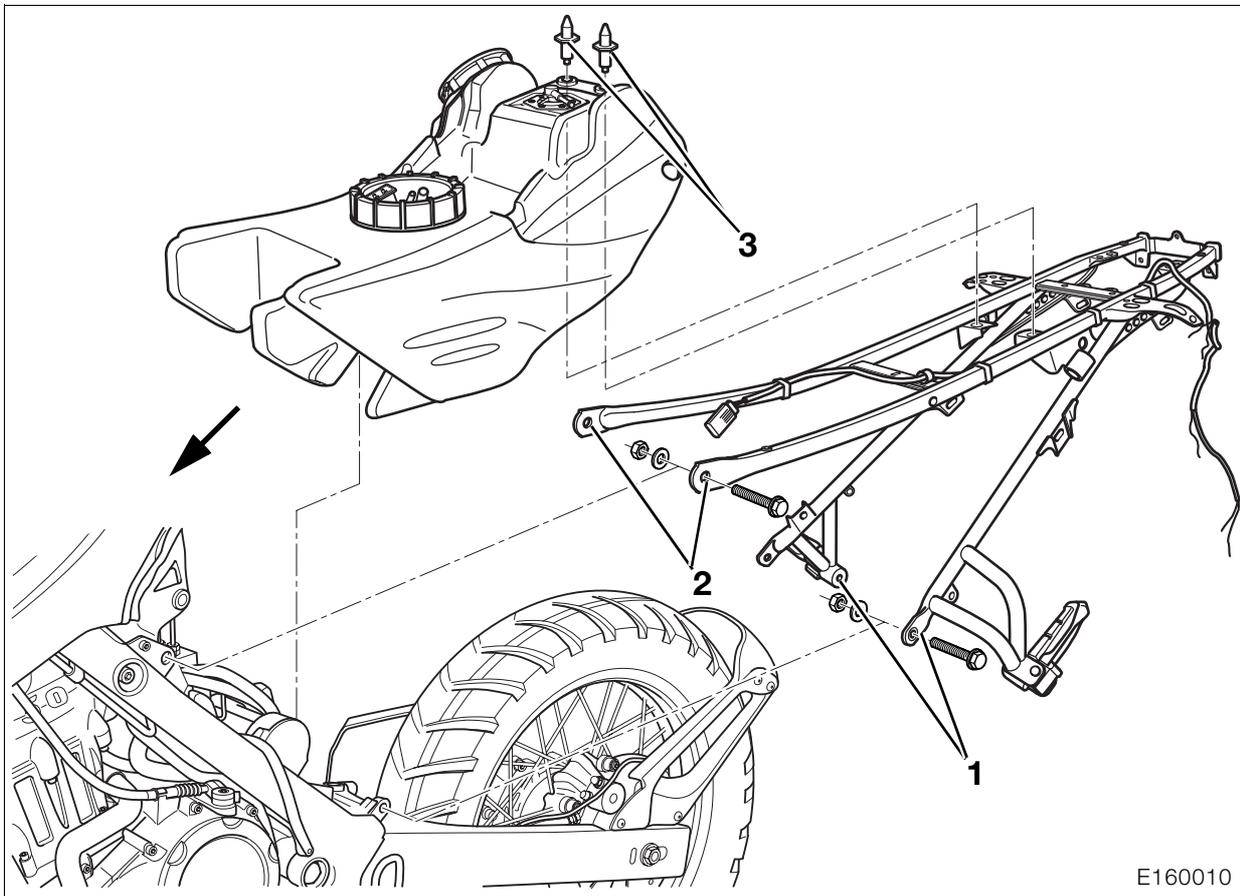
Do not unplug the BMS control unit.

- Disengage the rubber strap (arrow) and remove the BMS control unit.
- Disconnect the plugs for fuel-level sensor (3) and fuel pump (4).
- Disconnect the plug for rear light/turn indicator (5).
- Remove holder (6) for BMS control unit from the fuel tank.



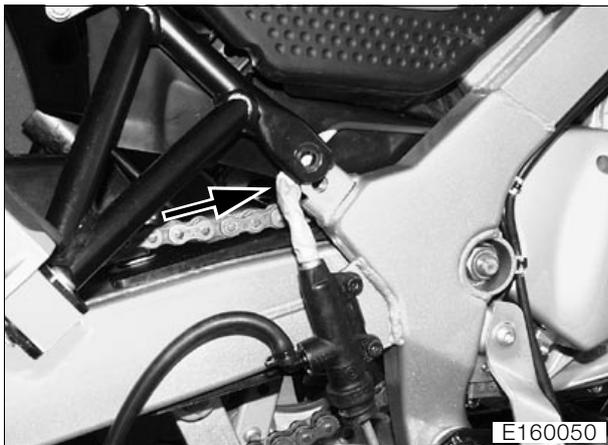
- Press the tab (arrow) down and remove the plug for rear light/turn indicator (5) from holder (6) for the BMS control unit.





- Remove lower fasteners (1) securing rear frame to main frame.

- Remove upper fasteners (2) securing the rear frame to the main frame and carefully remove the rear frame complete with the tank.
- Remove the fastener securing the rear section of the rear mudguard to the rear frame.
- Remove the fasteners securing the fuel tank to rear frame (3).
- Remove fuel tank.



Caution:

Note the brake line (arrow) at the brake master cylinder. Do not allow the weight of the rear frame to rest on the brake line.

16 11 030 Installing fuel tank

- Installation is the reverse of the removal procedure: pay particular attention to the following.

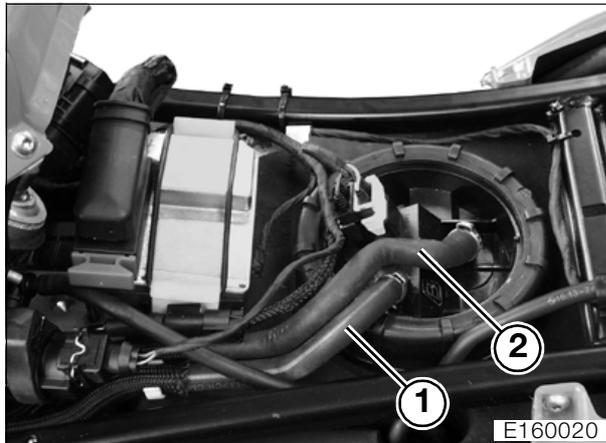


Caution:

Note the brake line at the brake master cylinder. Do not allow the weight of the rear frame to rest on the brake line.



- When installing the fuel tank and the rear frame, make sure that all lines and hoses are routed at the top of the tank.



- Make sure that fuel feed hose (1) and fuel return hose (2) are correctly routed.



Warning:

Do not use screw-type hose clamps on the fuel hoses, because they could damage the hoses and result in a fire hazard.

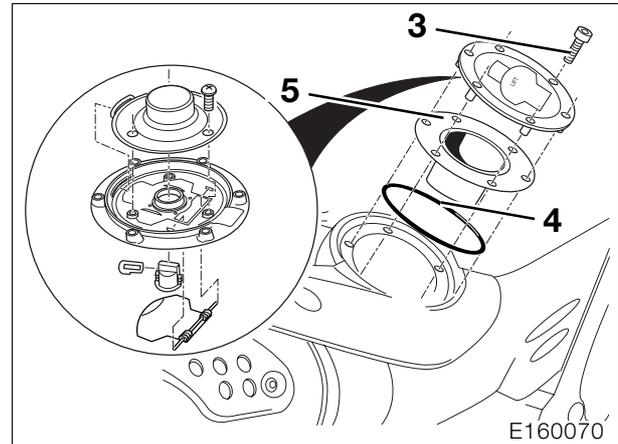
- Close hose clamps with pliers, **BMW No. 13 1 500.**



Tightening torques:

Fuel tank to rear frame	21 Nm
Rear frame to main frame	21 Nm
Silencer to rear frame	21 Nm
Clip for silencer	55 Nm
Exhaust manifold to cylinder head	20 Nm
Tail to rear frame	3 Nm
Brake fluid reservoir for rear brake to rear frame	5 Nm

16 11 211 Removing and installing fuel filler cap



- Remove fasteners (3) holding the fuel filler cap.
- Remove fuel filler cap (3) together with fuel filler neck (5) and sealing ring (4).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Check sealing ring (4) for damage, replace if necessary.



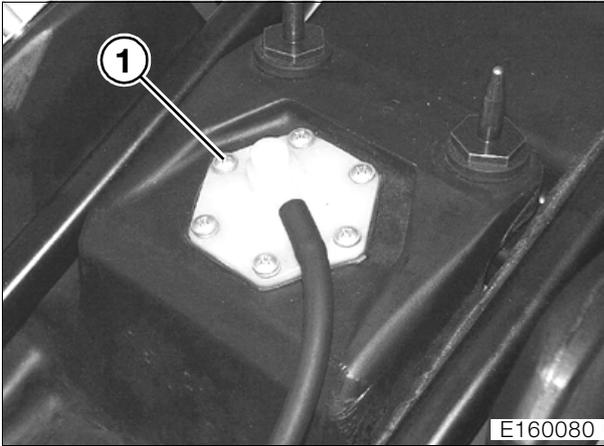
Tightening torques:

Fuel filler cap to fuel tank	3 Nm
------------------------------------	------



Removing and installing roll-over valve

- Remove seat.



- Disconnect breather hose.
- Release fasteners (1).
- Remove roll-over valve with gasket.
- Remember to clean the sealing faces before re-installing.



Tightening torques:
Roll-over valve to fuel tank 3 Nm

16 12 008 Replacing fuel filter

See Group 00

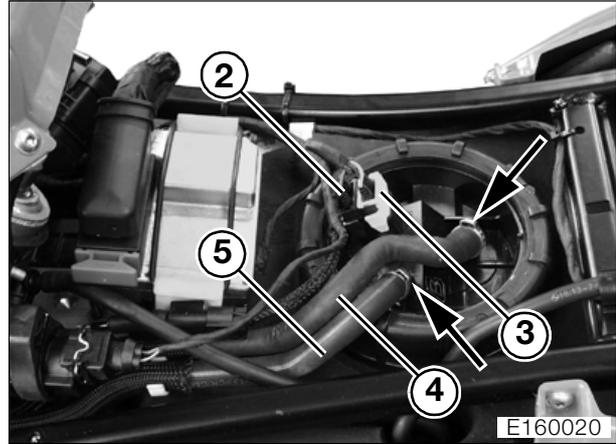
16 14 011 Removing and installing fuel pump



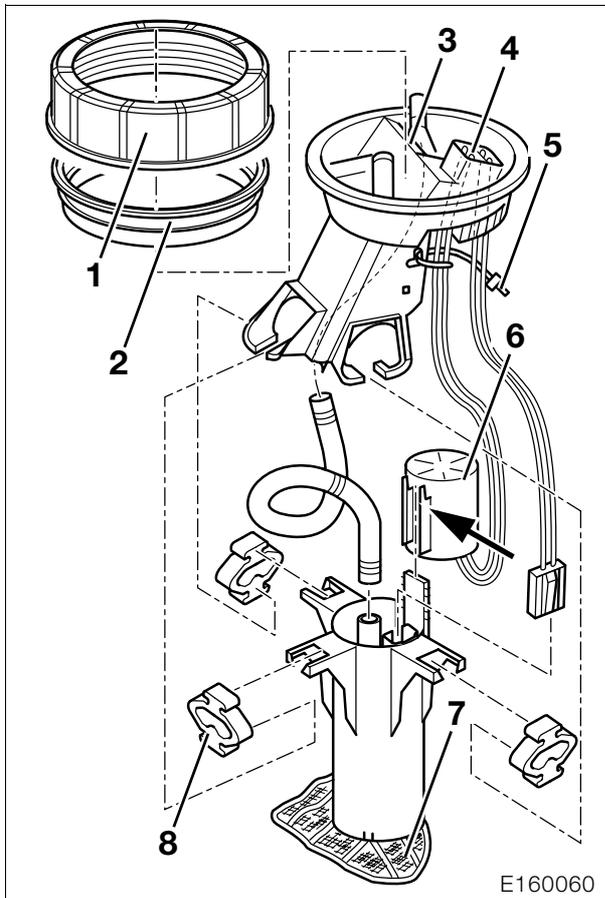
Caution:

Note risks when handling fuel.
Disconnect ground lead from battery and insulate.

- Remove seat.



- Disconnect the plugs for fuel-level sensor (3) and fuel pump (2).
- Close off fuel supply line (5) and the fuel return line (4) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.



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- Release ring (1) using wrench, **BMW No. 16 1 021**
- Remove fuel-pump unit (3) with gasket (2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Make sure the fuel-pump unit is installed in the correct position and that the fuel feed hose and the fuel return hose are correctly routed.
- Close hose clamps with pliers, **BMW No. 13 1 500**.

 **Tightening torques:**

Union nut to fuel tank 36 Nm

16 14 009 Removing and installing fuel pump

- Remove fuel pump unit.
- Remove the warning-contact switch.
- Remove the fuel strainer.
- Installation is the reverse of the removal procedure.

16 14 500 Removing and installing fuel strainer

- Remove fuel pump unit.
- Using a screwdriver, pry fuel strainer (7) off the pump.
- Installation is the reverse of the removal procedure.

16 14 050 Removing and installing warning-contact switch for fuel level

- Remove fuel pump unit.
- Cut through cable clip (5).
- Clamp fuel-pump unit in vise with protective jaws.
- Use a screwdriver to bend back the tabs on contact switch (6) and push the switch off the pump bracket.
- Use a punch of suitable diameter to drive pins (4) out of the housing.
- Installation is the reverse of the removal procedure.



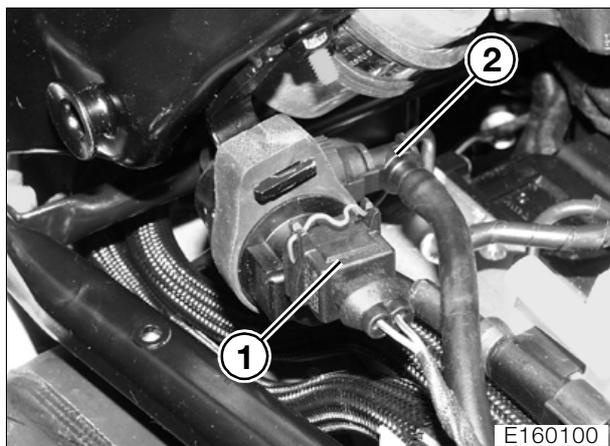
Note:

The reserve fuel capacity of the fuel tank can be adjusted by varying the height of the contact switch in the tank.

Removing and installing fuel-evaporation control valve

[USA version]

- Place motorcycle on its centre stand.
- Remove seat.
- Remove the BMS control unit from the holder.



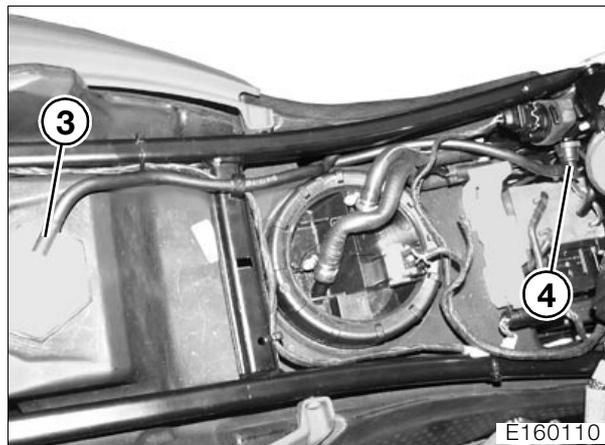
- Disconnect plug (1) from fuel-evaporation control valve.
- Disconnect the activated charcoal filter from fuel-evaporation control valve (2).
- Disconnect the breather hose from the throttle flap stub to the fuel-evaporation control valve.
- Remove the fuel-evaporation control valve.
- Installation is the reverse of the removal procedure.



16 13 001 Removing and installing activated charcoal filter

[USA version]

- Place motorcycle on its centre stand.
- Remove seat.



- Disconnect the fuel hose from roll-over valve (3).
- Disconnect the activated charcoal filter from fuel-evaporation control valve (4).
- Raise the rear frame.
- ➔ See Group 46
- Remove the securing screw from the underside of the holder for the activated charcoal filter.
- Pull the holder complete with the activated charcoal filter down to remove.
- Open the holder and remove the activated charcoal filter.
- Installation is the reverse of the removal procedure.



! Tightening torques:

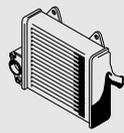
Rear frame to main frame	21 Nm
Brake fluid reservoir to rear frame	5 Nm
Clamp for silencer	55 Nm
Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Engine guard to frame.....	9 Nm

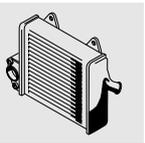
17 Radiator

Contents

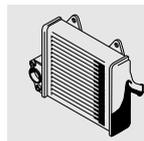
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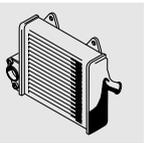
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Installing coolant pump	8
Adding coolant	8
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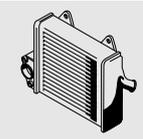


Technical Data		F 650 GS
Cooling system		
Cooling system capacity		
Total capacity	l (Imp.pints/ US quarts)	1.3 (2.29/1.37)
Coolant circuit	l (Imp.pints/ US quarts)	1.20 (2.113/1.268)
Coolant expansion tank	l (Imp.pints/ US quarts)	0.10 (0.176/0.106)
Coolant		Use only nitrite-free long-term antifreeze and corrosion inhibitor.
Fan cut-in temperature	°C (°F)	102 (225)
Cut-in temperature for coolant warning light	°C (°F)	118 (245)
Pressure relief valve in end cover opens at	bar (psi)	1.5 ^{+0.2} (21.34 ^{+2.85})
Coolant mixing ratio		Water: 50%, antifreeze: 50% Protection down to -25 °C (-13 °F)
Thermostat opening temperature	°C (°F)	85 (185)
Cooling system test pressure	bar (psi)	1.5 (21.34)

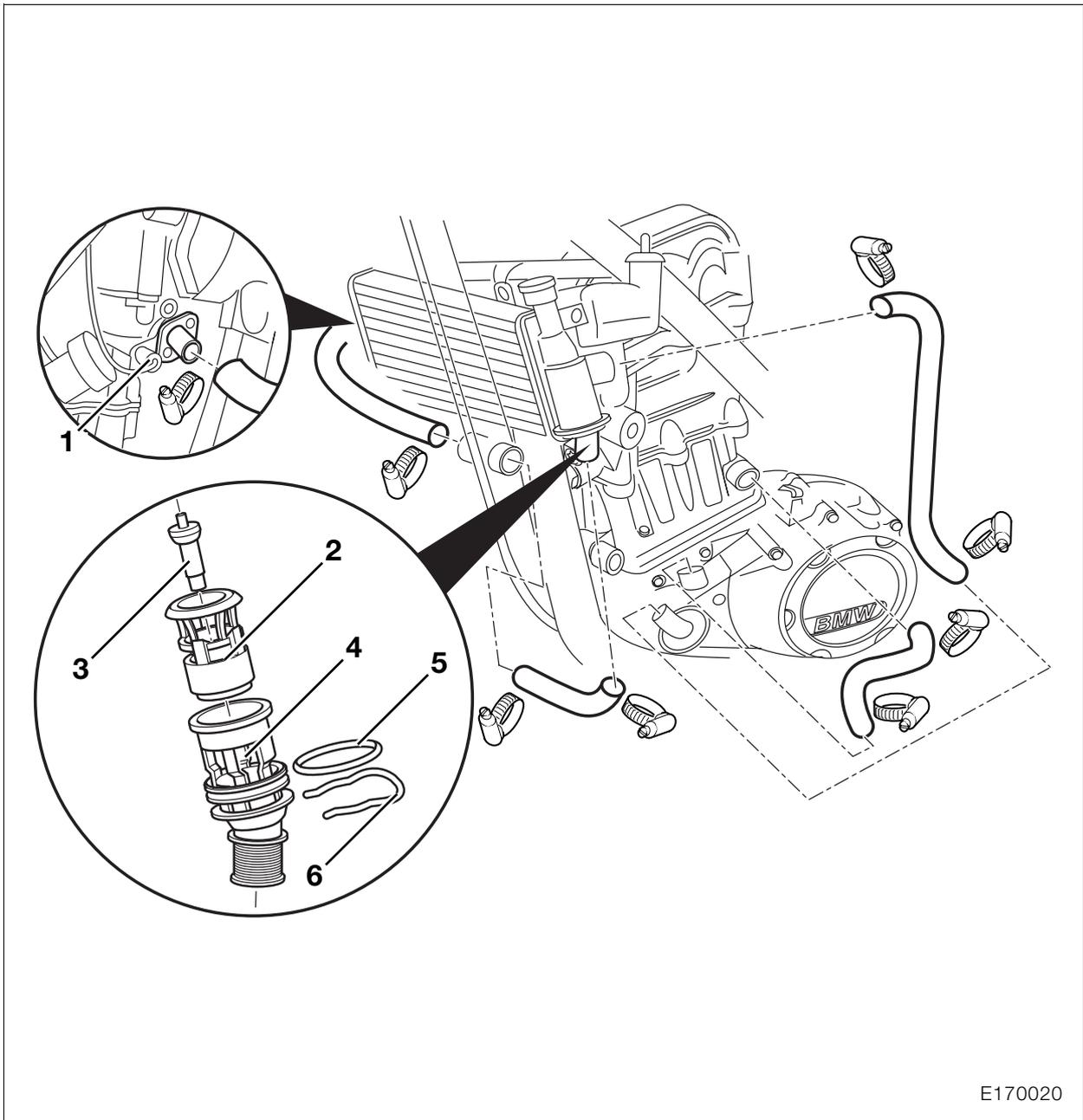




Coolant circuit

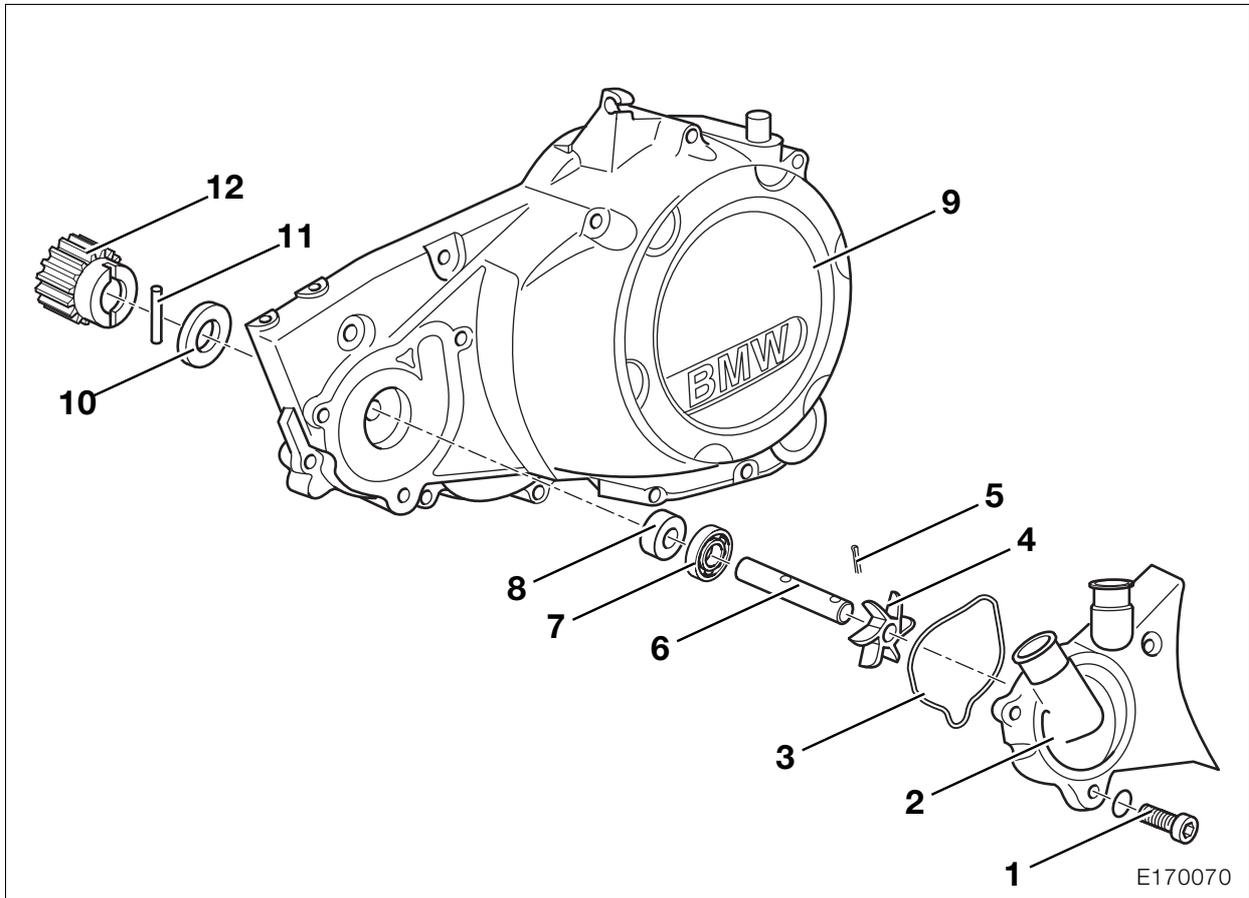


Thermostat, components



E170020

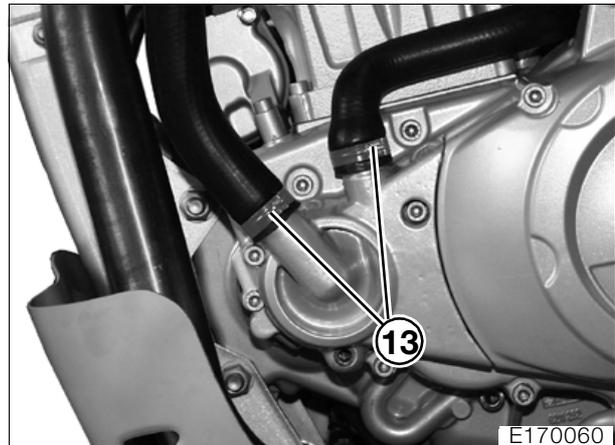
- 1 Coolant-temperature sensor
- 2 Thermostat housing
- 3 Thermostat
- 4 Cover
- 5 O-ring
- 6 Spring clip



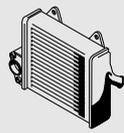
11 51 025 Removing and installing coolant pump

11 51 025 Removing coolant pump

- Remove seat.
- Remove left cover.
- ➔See Group 46
- Drain engine oil.
- ➔See Group 00
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.
- Remove drain plug (1) from water pump.
- Hold a funnel below the drain and open the radiator cap.
- Drain off all the coolant.
- Place motorcycle on its centre stand.
- Remove the gear shift pedal.
- Remove the starter motor.
- ➔See Group 12
- Disconnect clutch cable at releaser shaft.
- Disconnect the oil return line from the engine and the oil tank.
- Disconnect the oil line from the cylinder head.



- Using hose clip pliers, **BMW No. 17 5 500**, remove hose clips (13).
- Remove water pump cover (2) with seal (3).
- Drive out pin (5) and remove impeller (4).
- Remove left engine cover (9).
- Press out sealing rings (7, 8).
- Remove shaft (6) by pulling inwards.
- Remove washer (10), pin (11) and gear (12).



11 51 025 Installing coolant pump



Note:

Check shaft for score-marks at sealing ring tracks. Always replace shaft and sealing rings as a set.

- Install gearwheel, shaft, pin and washer in engine cover.



Note:

Check sealing ring for water pump cover and renew if necessary.

- Lower the engine.
- ➔See Group 11
- Remove oil return line.
- Attach the left engine housing cover.
- Connect the oil return line to the engine.
- Install the engine.
- ➔See Group 11
- Pack the space between the sealing rings with **Shell Retinax EP2**.
- Drive inner sealing ring onto its seat with drift, **BMW No. 11 6 540**.
- Drive in outer sealing ring flush with the friction face, using the appropriate adapter.
- Install impeller wheel with locking collet.
- Renew sealing ring on drain plug.
- Tighten the hose clips with hose clip pliers, **BMW No. 17 5 500**.
- Connect the clutch cable to the releaser shaft.
- Attach the gear shift lever.
- Install the seat.
- Add coolant.
- ➔ See below

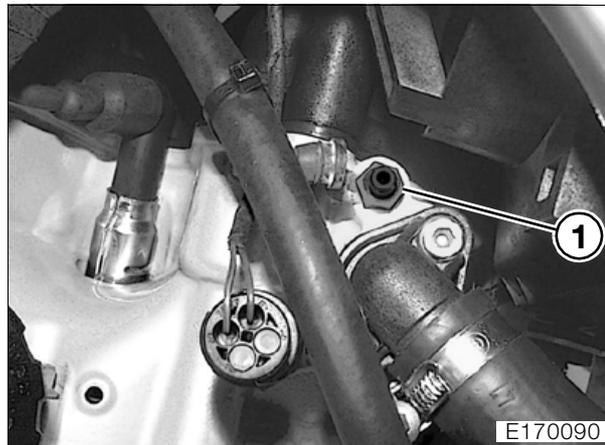


Tightening torques:

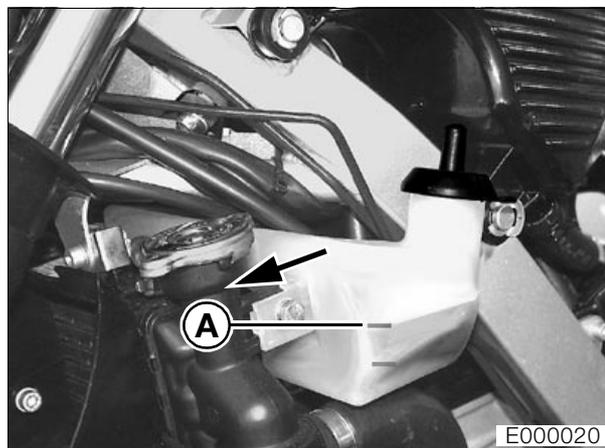
Engine block cover, left	10 Nm
Water pump cover	10 Nm
Water pump drain screw	10 Nm
Oil line to cylinder head	8 Nm
Oil line to engine block	35 Nm

17 00 035 Adding coolant

- Place motorcycle on its centre stand.



- Slacken bleed screw (1) in cylinder head.
- Connect a hose to the bleed screw.
- Fill the radiator until coolant escapes at the bleed screw; repeatedly squeeze the coolant hoses to expel the air.
- Tighten bleed screw (1).



- Top up coolant until the level reaches the top of the filler neck (arrow).
- Top up the coolant in the expansion tank until the level reaches the MAX mark (A).

Filling capacity

Cooling system	1.2 l (2.11 Imp. pints/1.27 US quarts)
In expansion tank	+ 0.1 l (1.18 Imp. pints/0.11 US quarts)

Antifreeze

Use only nitrite-free long-term antifreeze and corrosion inhibitor.

Concentration

Antifreeze50%
Water50%

- Run the engine for a short time, then switch it off.
- Check coolant level and top up if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Do not reinstall the cover at this stage, if other maintenance work has to be performed.



Tightening torques:

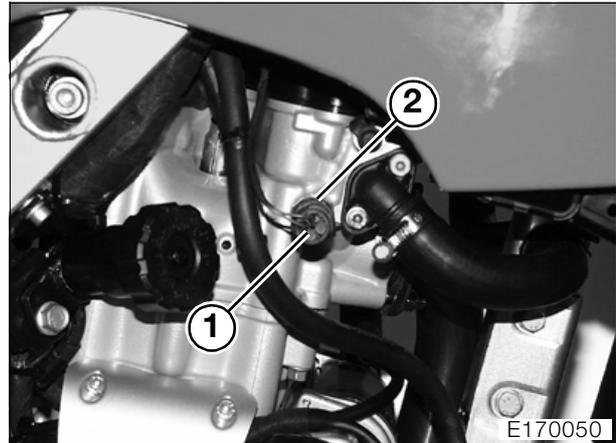
Drain plug..... 10 Nm
Expansion tank to radiator..... 9 Nm
Bleed screw 12 Nm

Removing and installing coolant-temperature sensor

– Drain coolant.

➔ See Group 00

- Place motorcycle on its centre stand.

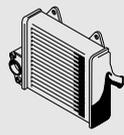


- Remove plug from coolant temperature sensor (1).
- Remove coolant-temperature sensor (2).
- Installation is the reverse of the removal procedure.



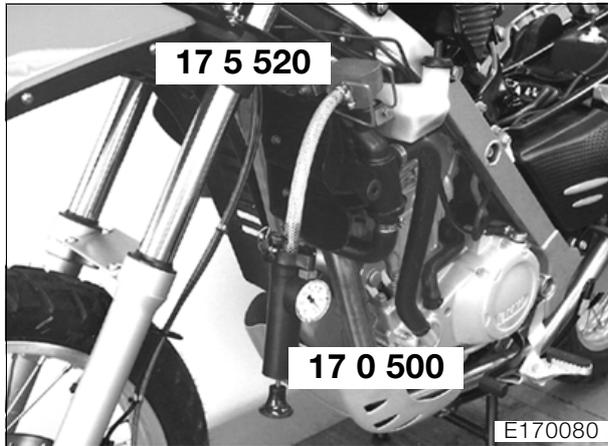
Tightening torque:

Temperature sensor..... 15 Nm



17 00 010 Checking cooling system for leaks

- Remove left cover.
- ➡See Group 46
- Open the filler cap on the radiator.

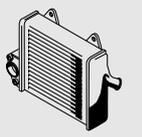


- Connect pump, **BMW No. 17 0 500**, with adapter and neck, **BMW No. 17 5 520**, to filler neck.
- Pressure-test the system; the pressure must remain unchanged for at least 5 minutes.

Setting:

Test pressure 1.5 bar (21.34 psi)

- Installation is the reverse of the removal procedure.



Removing and installing coolant hoses

- Place motorcycle on its centre stand.
- Remove left cover.
- Drain coolant.
- ➡See Group 00
- Remove the right-hand coolant hose.
- Remove the left-hand coolant hose between radiator and frame.

17 12 036 Replacing coolant hose (radiator/water pump)

- Use pliers, **BMW No. 17 5 500**, to open the clamp securing the coolant hose to the water pump.
- Disconnect the coolant hose from the radiator.

17 12 068 Replacing coolant hose (filler bowl/expansion tank)

- Disconnect the expansion tank from the radiator and pull it to one side.
- Disconnect the coolant hose from the radiator and the expansion tank.



Tightening torque:

Coolant hoses to radiator/engine/frame 2 Nm

17 00 035 Replacing coolant

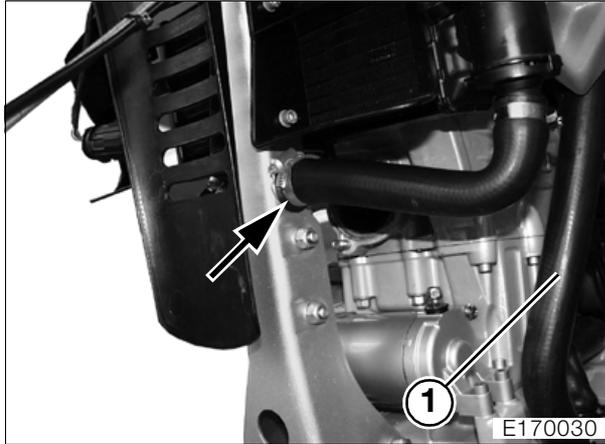
See Group 00

17 40 000 Removing and installing fan

- Remove right cover.
- Unclip the MoDiTeC plug from its holder.
- Disconnect plug for fan.
- Disengage the clips at top and bottom and remove the fan.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Slide the rubber grommet of the fan onto the pin of the expansion tank and then engage the tabs of the fan on the radiator.

17 11 007 Removing and installing radiator

- Place motorcycle on its centre stand.
- Remove left, right and centre covers.
- Drain coolant.
- ➡ See Group 00
- Disconnect the expansion tank from the radiator, pull it to one side and let it dangle from the hose.
- Remove the fan.



- Disconnect the coolant hose (arrow) at the frame on the left and drain the radiator.
- Use pliers, **BMW No. 17 5 500**, to open the clamp securing the coolant hose to the water pump housing (1).
- Remove the radiator fasteners.



Note:

Take care not to damage the radiator on the cylinder head cover.

- Raise the radiator and release the pin at the bottom from the lug.
- Pull the radiator complete with expansion tank to the left and remove.
- Installation is the reverse of the removal procedure.



Tightening torque:

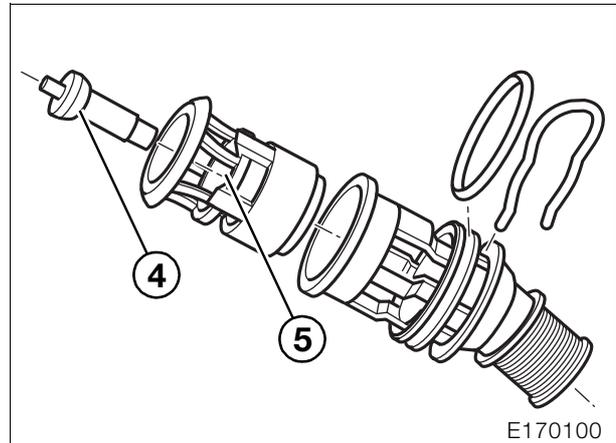
Radiator to main frame 9 Nm
Coolant hoses to radiator/engine/frame 2 Nm

17 11 045 Removing and installing thermostat

- Remove left cover.
- Drain coolant.
- ➡ See Group 00
- Do not close the radiator cap.



- Remove spring clip (2).
- Use a screwdriver to pry cover (3) out of the groove (arrow).



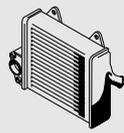
- Remove thermostat insert (5) with thermostat (4) from the housing.

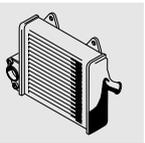


Note:

Check O-ring for cracks and replace if necessary.

- Installation is the reverse of the removal procedure.





18 Exhaust system

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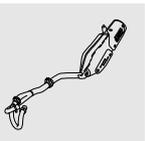
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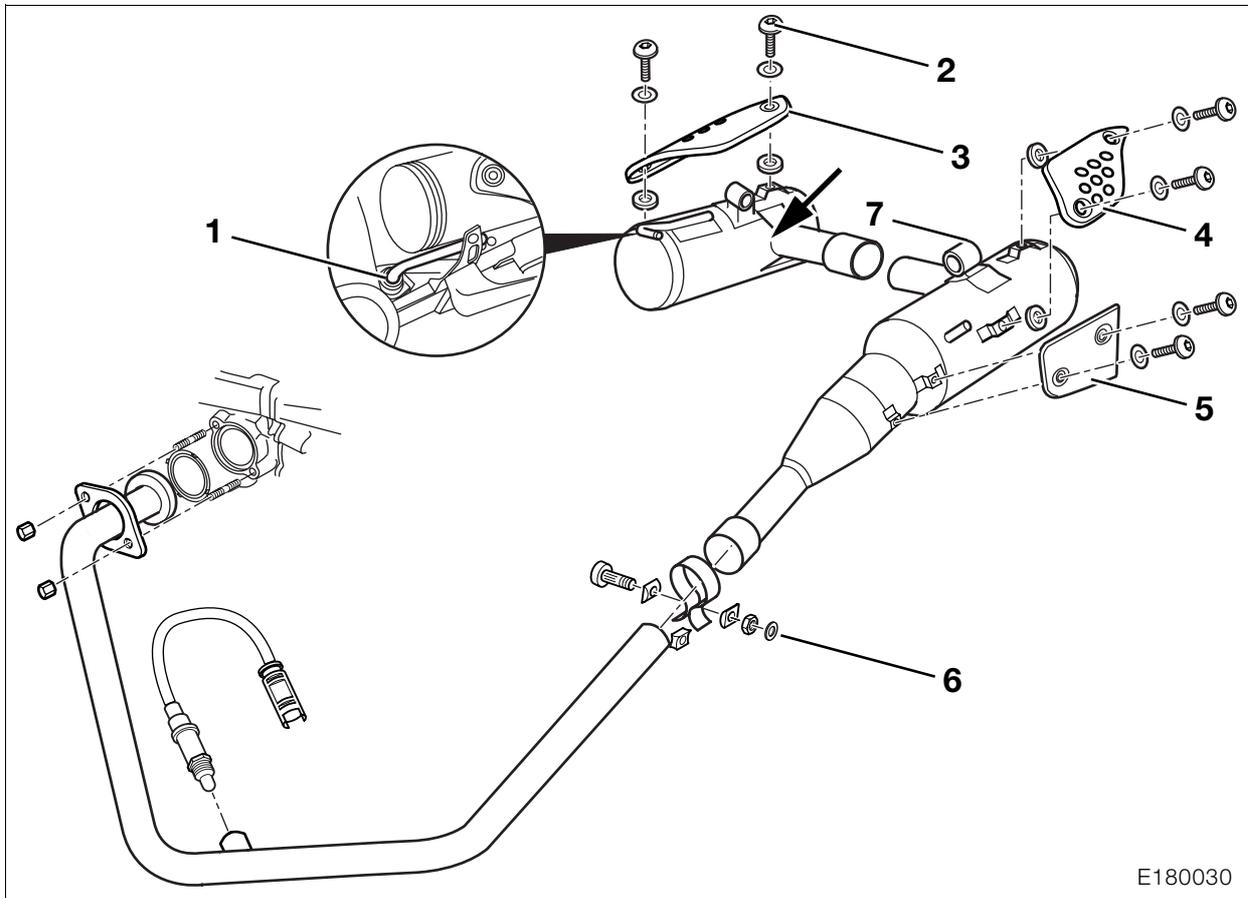




Technical Data	F 650 GS
Exhaust system	
Emission control	3-way catalytic converter
Silencer (muffler)	Reflection/absorption-type silencer







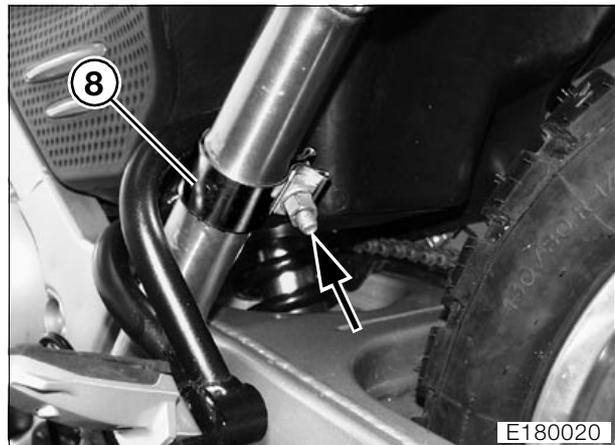
E180030

18 00 020 Removing and installing exhaust system

- Installation is the reverse of the removal procedure, pay particular attention to the following.

18 11 301 Removing and installing right-hand silencer

- Remove number plate.
- Remove the fastener (arrow) securing the silencer to the rear frame.
- Separate the right-hand silencer with balance pipe from the left-hand silencer and at the same time lift it clear of bracket (1).
- If necessary, remove fasteners (2) and remove silencer guard (3).
- Installation is the reverse of the removal procedure.



E180020

18 11 301 Removing and installing left-hand silencer

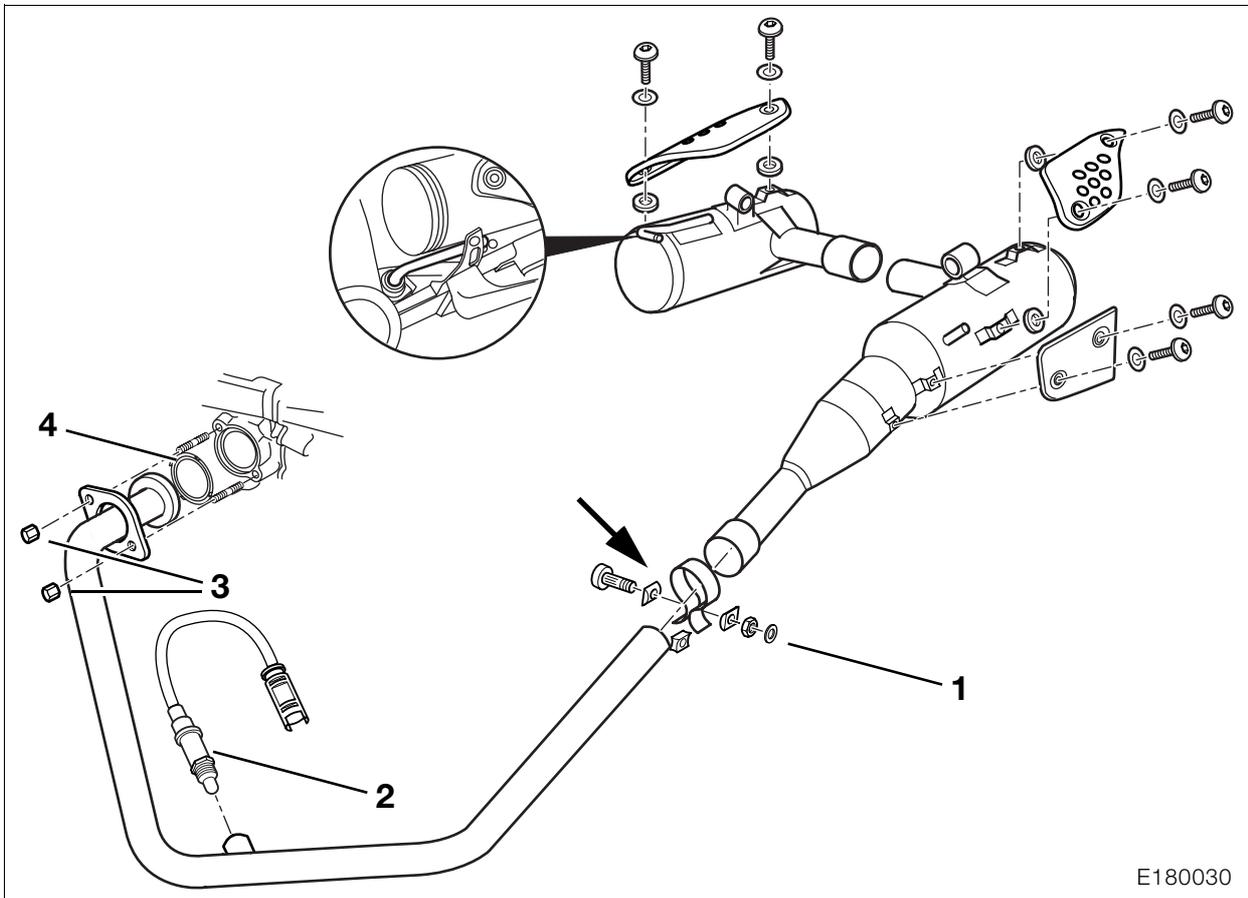
- Remove right-hand silencer.
- Remove the fastener securing the silencer to the rear frame.
- Loosen clamp (6) for silencer.
- Separate the left-hand silencer with connecting pipe from the exhaust manifold and at the same time lift it clear of bracket (7).
- If applicable, remove silencer guard (4) and guard (5) for catalytic converter.

- Make sure that the installed position (arrow) of the clamp for silencer (8) is correct.

Tightening torques:

Guard to silencer	9 Nm
Clamp for silencer	55 Nm
Silencer to rear frame.....	21 Nm





18 11 151 Removing and installing exhaust manifold and oxygen sensor

Removing exhaust manifold and oxygen sensor

- Remove engine guard
- Loosen clamp (1) for silencer.

- Remove the left footrest plate.
- Extend side stand.
- Remove fasteners (3) securing manifold to cylinder head.
- Remove the exhaust manifold and remove seal (4).
- Remove oxygen sensor (2).

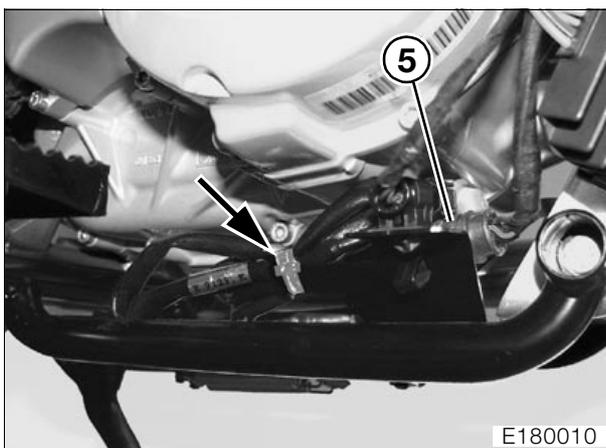
Installing exhaust manifold and oxygen sensor



Note:

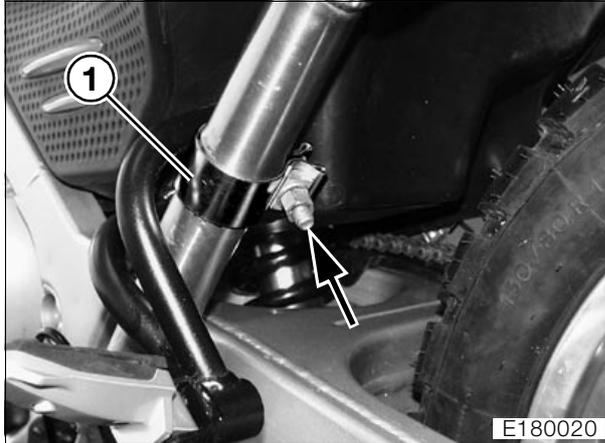
It is not necessary to grease the threads if you are installing a new oxygen sensor.

- Lightly coat the threads of the oxygen sensor with **Optimoly TA**.
- Tighten the oxygen sensor at the hexagon with socket wrench insert, **BMW No. 11 7 020**.
- Position a new gasket (4) on the manifold.
- Introduce the exhaust manifold into the left-hand silencer and into the cylinder head.

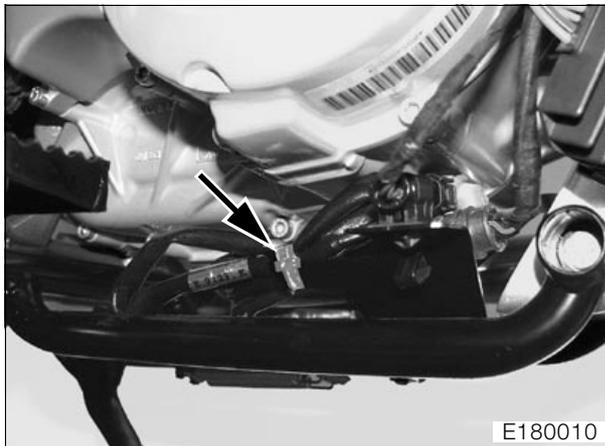


- Release cable tie (arrow) on right-hand frame trussing.
- Disconnect plug (5) for the oxygen sensor.

- Uniformly tighten the fasteners securing the manifold to the cylinder head.



- Tighten clamp (1) for the silencer, making sure that the clamp is correctly positioned (arrow).
- Connect the plug for the oxygen sensor.



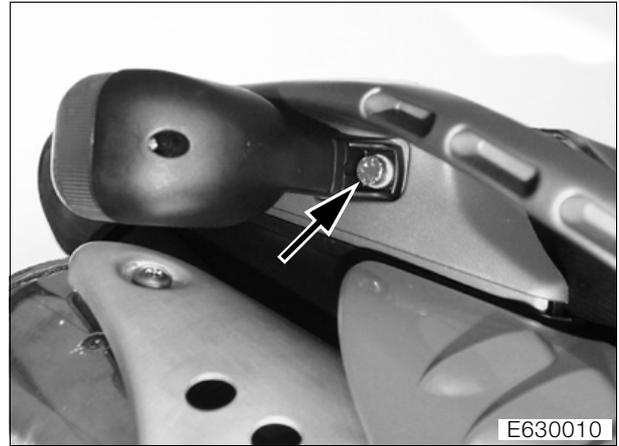
- Using a cable tie (arrow), secure the oxygen sensor cable and the cable for the side-stand switch to the frame trussing.
- Install the engine guard.

 **Tightening torques:**

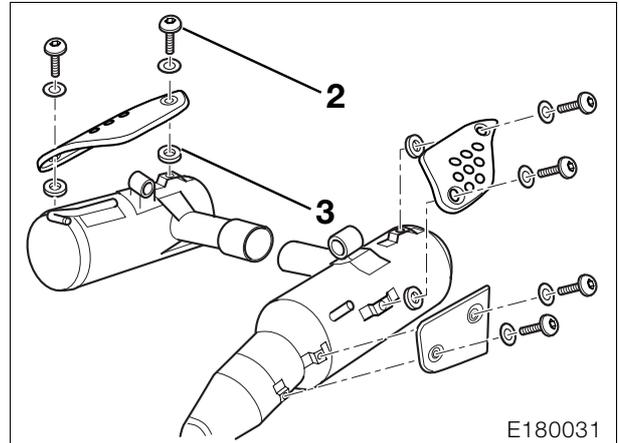
Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Clamp for silencer	55 Nm
Engine guard to frame.....	9 Nm

18 12 212 Replacing guard for silencer

- Remove the lid of the glove compartment.



- Remove the fastener (arrow) securing the turn indicator at the handle and push the turn indicator aside.

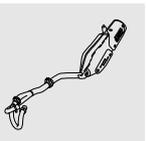


- Remove the fasteners securing the guard to silencer (2) and remove guard complete with damper washers (3).
- Installation is the reverse of the removal procedure.

 **Tightening torques:**

Guard to silencer	9 Nm
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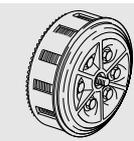


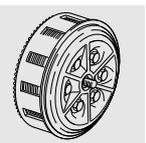
21 Clutch

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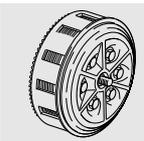
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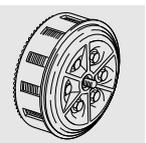
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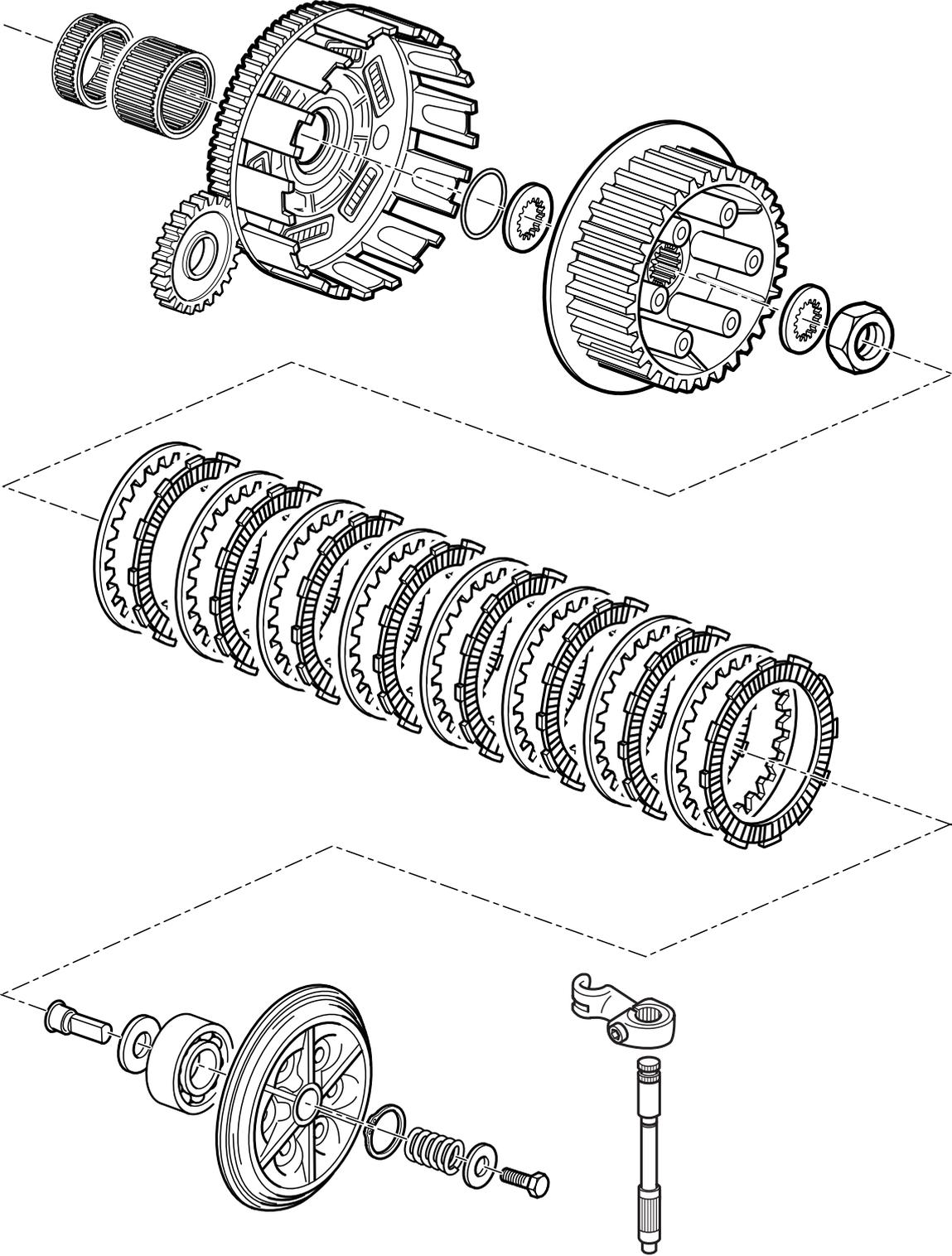


Technical Data		F 650 GS
Clutch		
Type		Pull-action multi-plate clutch in oilbath
Clutch plate diameter	mm (in)	144 (5.7)
Manual effort required	N	85 (at 40 mm/1.6 in from pivot point)
Operation		mechanical
Wear limits:		
Distortion of lined plates	mm (in)	0.25 (0.010)
Distortion of steel plates	mm (in)	0.15 (0.006)
Total height of lined plates	mm (in)	27.5 (1.08)
Total height of plate assembly	mm (in)	39.1 (1.54)





Clutch, components

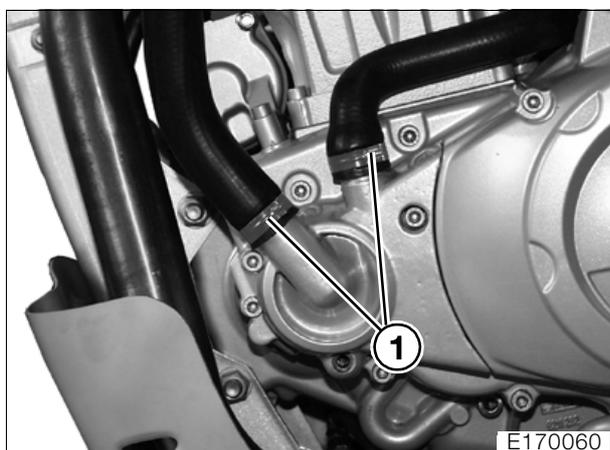


E210010

21 21 000 Removing and installing clutch

21 21 000 Removing clutch

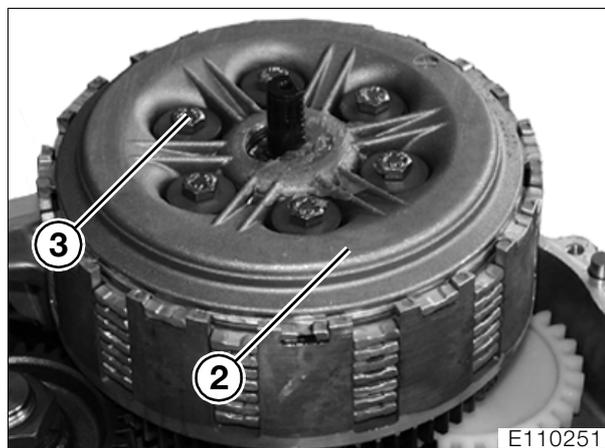
- Remove seat.
- Remove left cover.
- ➔See Group 46
- Drain engine oil.
- ➔See Group 00
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.
- Remove drain plug (1) from water pump.
- Hold a funnel below the drain and open the radiator cap.
- Drain off all the coolant.
- Place motorcycle on its centre stand.
- Remove the gear shift pedal.
- Remove the starter motor.
- ➔See Group 12
- Disconnect clutch cable at release shaft.
- Disconnect the oil return line from the engine and the oil tank.
- Disconnect the oil line from the cylinder head.



- Using hose clip pliers, **BMW No. 17 5 500**, remove hose clips (1).
- Remove left engine housing cover.

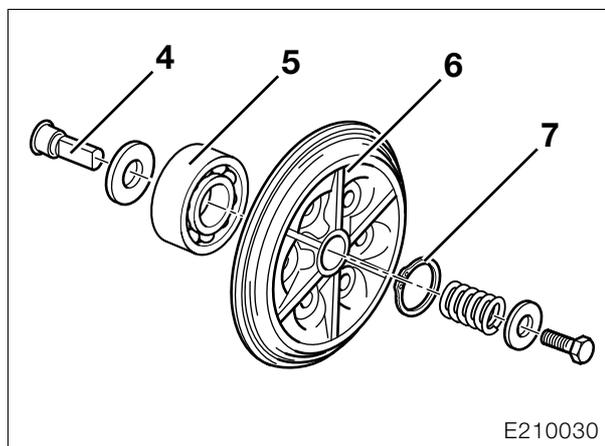


Removing pressure plate



- Remove hex screws (3) in diagonally opposite sequence.
- Lift off complete pressure plate (2).
- Check length of compression springs.

Disassembling and reassembling pressure plate



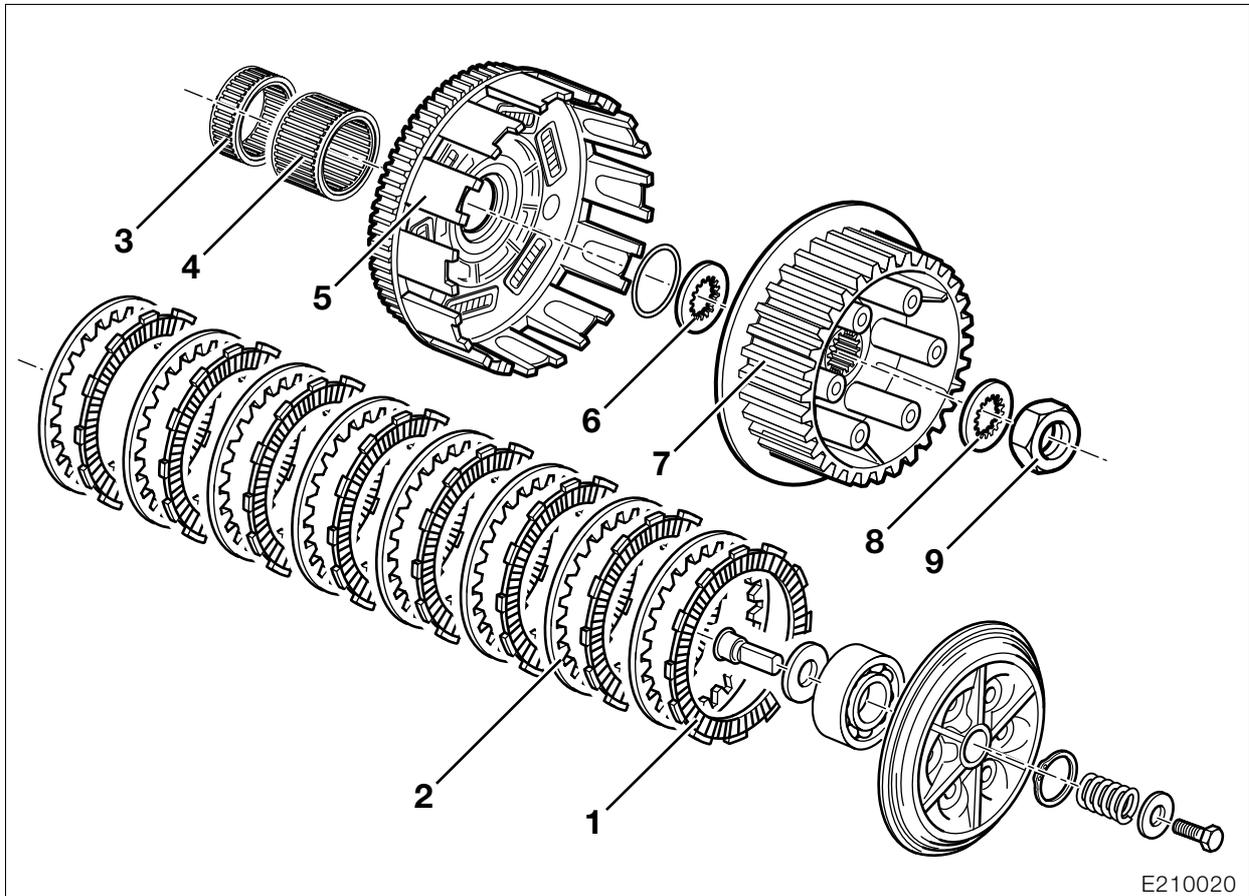
- Remove circlip (7) with circlip pliers.
- Check splines on release head (4).
- Heat pressure plate (6) to 80 °C (176 °F) and drive in grooved ball bearing (5), using a suitable drift (such as a socket, for example).



Note:

Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

- Grooved ball bearing (5) must turn easily.
- Installation is the reverse of the removal procedure.



E210020

Removing clutch plates, driver and clutch cage



Note:

When dismantling the clutch plate cluster, mark the order in which the plates are installed.

- Take the plate cluster, lined plates (1) and inner plates (2) out of the clutch cage.



- Using locating ring, **BMW No. 21 4 600**, secure clutch cage (5) and driver (7) in position.

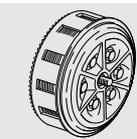
- Remove lock washer (8).

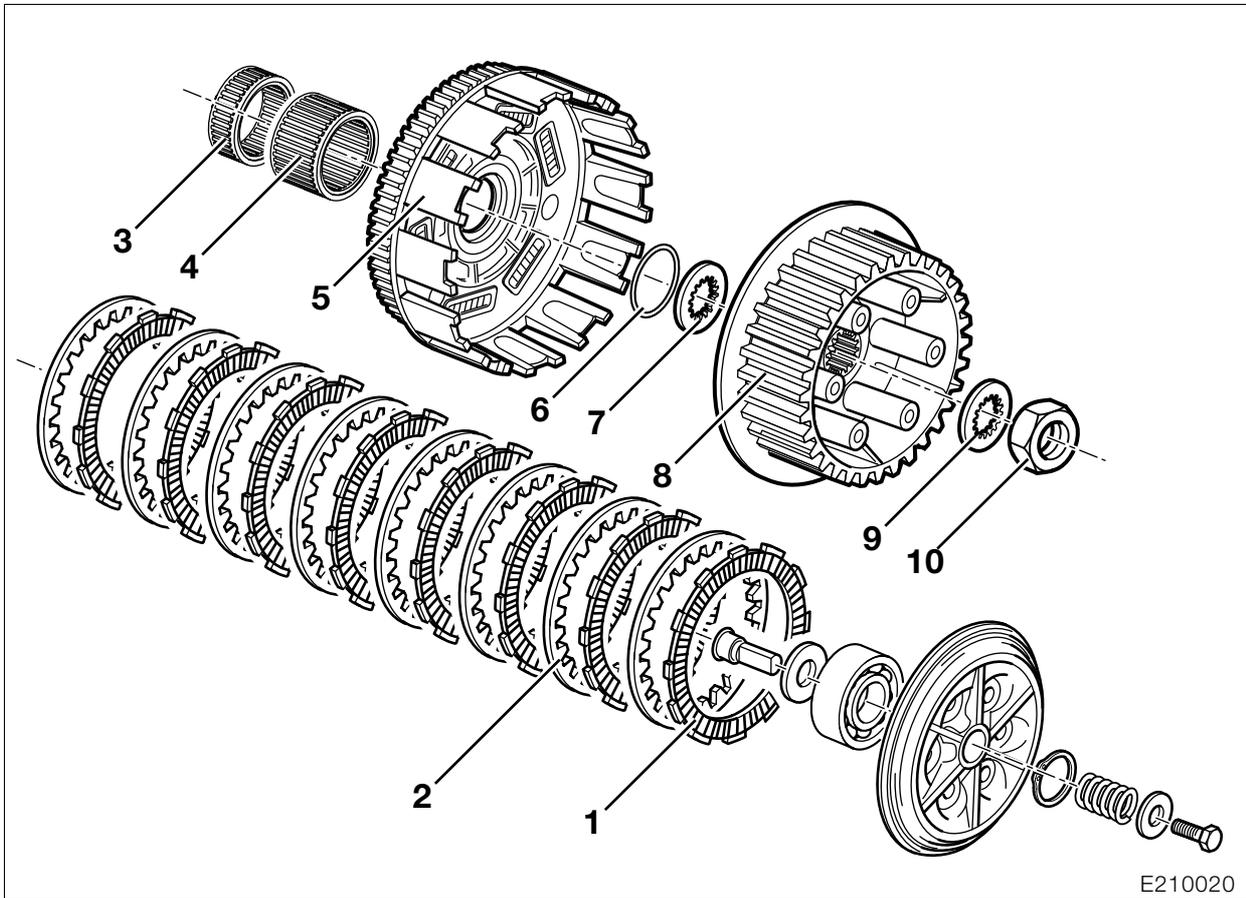


Note:

Hex nut (9) is secured with **Loctite 243** and should be heated if necessary before unscrewing.

- Unscrew hex nut (9).
- Remove driver (7).
- Remove clutch cage (5) incl. serrated washer (6).
- Remove needle cages (3, 4).





E210020

Installing clutch cage

- Coat needle sleeves (3, 4) with oil and install, with the small sleeve (3) down.
- Insert O-ring (6) into groove under splines.
- Install clutch cage (5); gears must all be in mesh.
- Attach thrust washer (7) and press it against the O-ring until it is firmly seated and does not spring back.

Installing driver

- Insert driver (8) and coat internal splines with **Optimoly MP 3**.
- Fit serrated washer (9); it must engage securely.
- Clean threads of compensating shaft and hexagon nut (10), coat threads with **Loctite 243** and install nut.
- Insert locating ring, **BMW No. 21 4 600**.
- Tighten hex nut and tilt up retaining plate (8).

Tightening torques:

Driver to compensating shaft
(clean thread + Loctite 243)..... 140 Nm

Installing pressure plate

- Insert the plates, starting with a steel plate. Install steel plates (2) and lined plates (1) alternately; with marked lined plate always at the top.



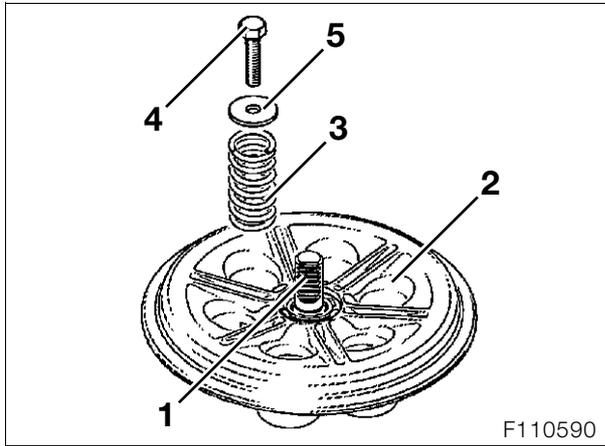
Note:

Insert the topmost plate in the offset groove of the clutch cage.

Check clutch plates for wear

- Measure the height of the 8 lined plates when pressed together.
- Height of complete compressed plate cluster.

Height of lined plate cluster	min. 27.5 mm (1.08 in)
Height of complete plate cluster	min. 39.1 mm (1.54 in)
Lined plate distortion.....	0.25 mm (0.010 in)
Steel plate distortion	0.15 mm (0.006 in)



F110590

- Install pressure plate (2).



Note:

All springs (3) must be renewed after each clutch repair.

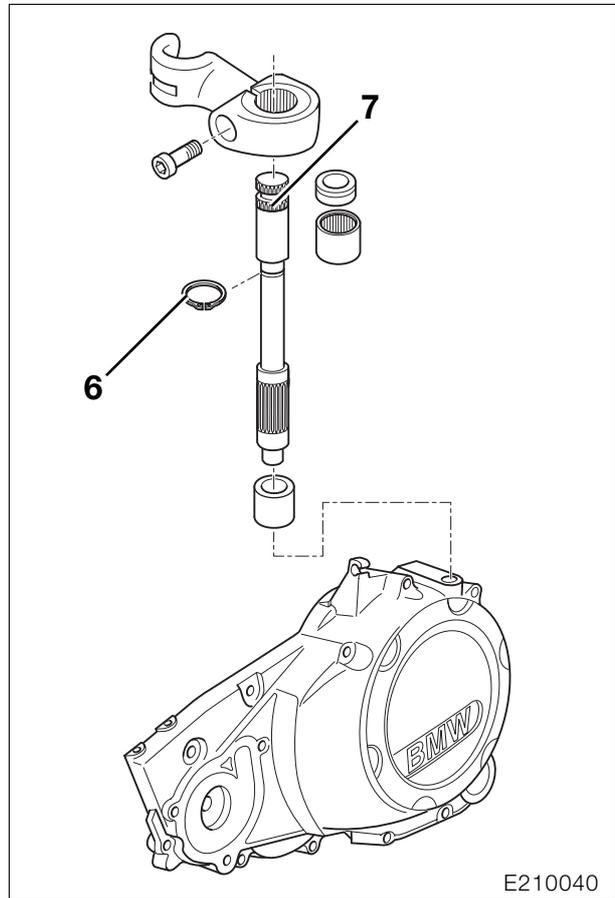
- Install springs (3).
- Uniformly tighten screws (4) with washers (5) in diagonally opposite sequence.
- Position thrust head (1) correctly in relation to the release shaft and hold temporarily in position with grease.



Tightening torques:

Pressure plate to driver 10 Nm

Removing and installing releaser shaft



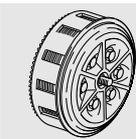
E210040

- Remove keeper (6) for release shaft (7).
- Withdraw release shaft from cover.



E210050

- Using puller, **BMW No. 21 4 610**, pull out both needle roller bearings and the sealing ring together.



- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Drive the lower and upper needle roller bearings in together with drift, **BMW No. 21 4 640**.
- Insert release shaft.
- Cover the splines on the release shaft with slide-on sleeve, **BMW No. 21 4 620**.
- Using drift, **BMW No. 21 4 630**, drive in sealing ring.

21 21 000 Installing clutch

- Lower the engine.
- ⇒See Group 11
- Remove oil return line.
- Align splines on water pump driven gear with driving gear on compensating shaft.
- Fit gasket.



Note:

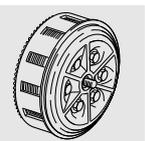
Always replace selector shaft seal in clutch cover.

- Install selector shaft sealing ring in clutch cover with sliding sleeve, **BMW No. 21 4 620**, and drift, **BMW No. 21 4 630**.
- Fit left engine cover and install securing screws.
- Connect the oil return line to the engine.
- Install the engine.
- ⇒See Group 11



Tightening torques:

Engine block cover, left	10 Nm
Drain plug for water pump	10 Nm
Oil line to cylinder head	8 Nm
Oil line to engine block	35 Nm

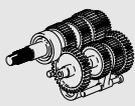


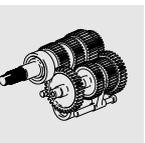
23 Gearbox

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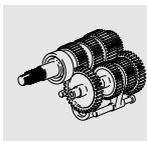
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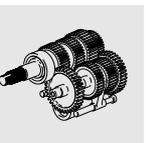
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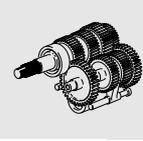
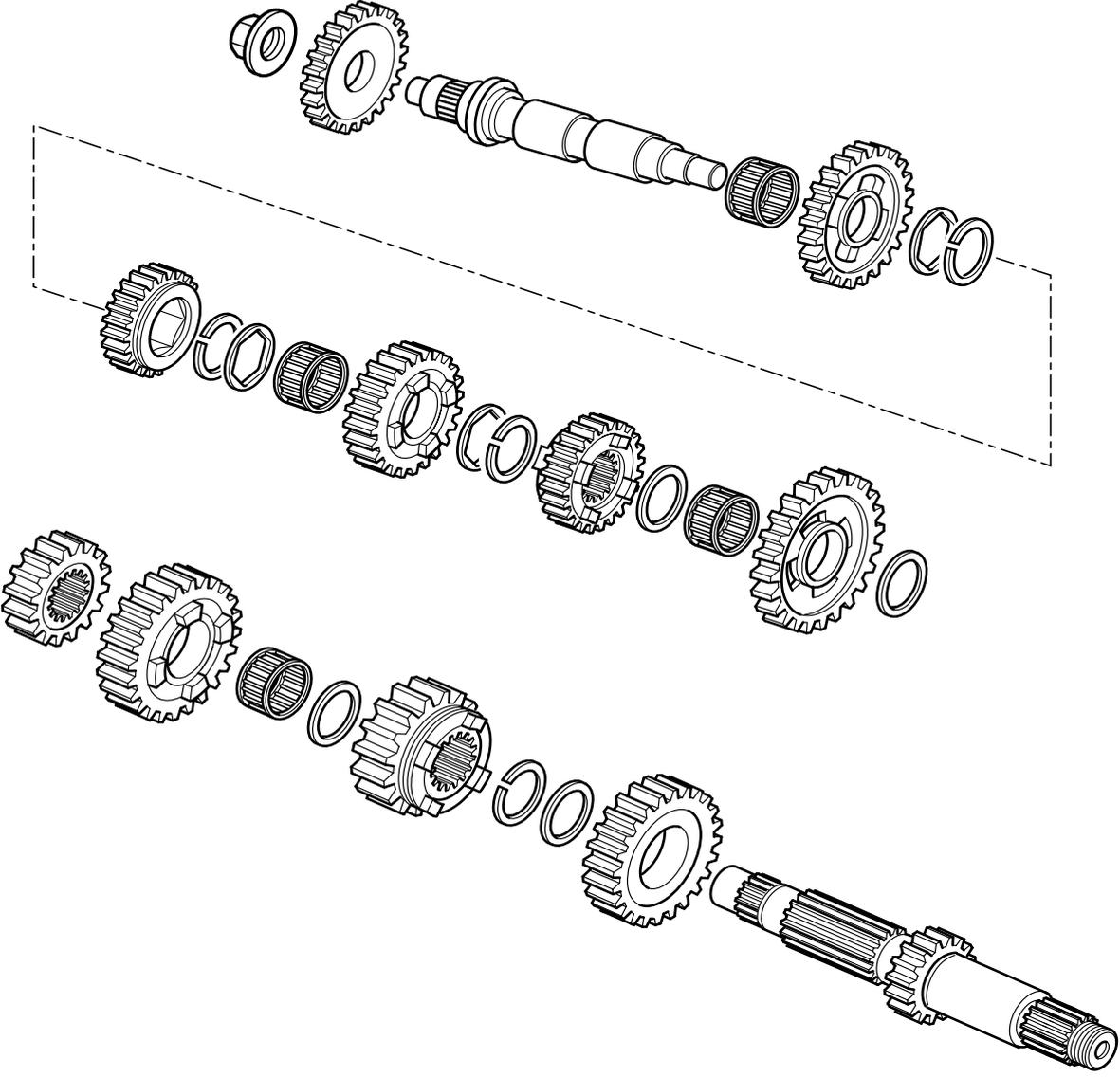


Technical Data		F 650
Transmission		
Type		Integral 5-speed gearbox with claw shift
Gear steps		Primary: 37/72=1:1.946
Gearbox ratios:	1st gear	12/33 = 1:2.750
	2nd gear	16/28 = 1:1.750
	3rd gear	16/21 = 1:1.313
	4th gear	22/23 = 1:1.045
	5th gear	24/21 = 1:0.875
Engine ratio:	1st gear	1:5.352
	2nd gear	1:3.406
	3rd gear	1:2.555
	4th gear	1:2.034
	5th gear	1:1.703
Wear limit values for selector fork:		
Selector fork guide journal diameter	mm (in)	min. 5.85 (0.230)
Thickness at contact faces	mm (in)	min. 3.45 (0.136)
Wear limit values for mainshaft:		
Shaft diameter, magneto side	mm (in)	min. 24.98 (0.983)
Shaft diameter, clutch side	mm (in)	min. 16.98 (0.669)
Wear limit values for countershaft:		
Shaft diameter, magneto side	mm (in)	min. 16.98 (0.669)
Shaft diameter, clutch side	mm (in)	min. 24.97 (0.983)



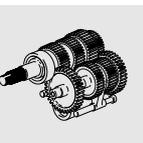
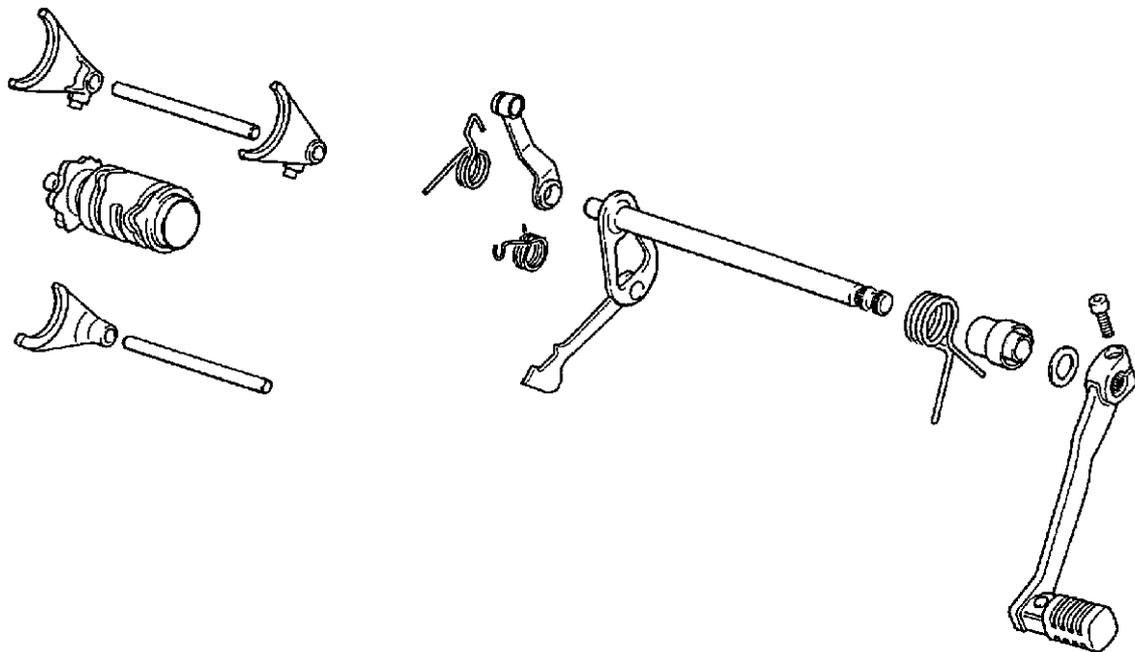


Gearbox shafts, components

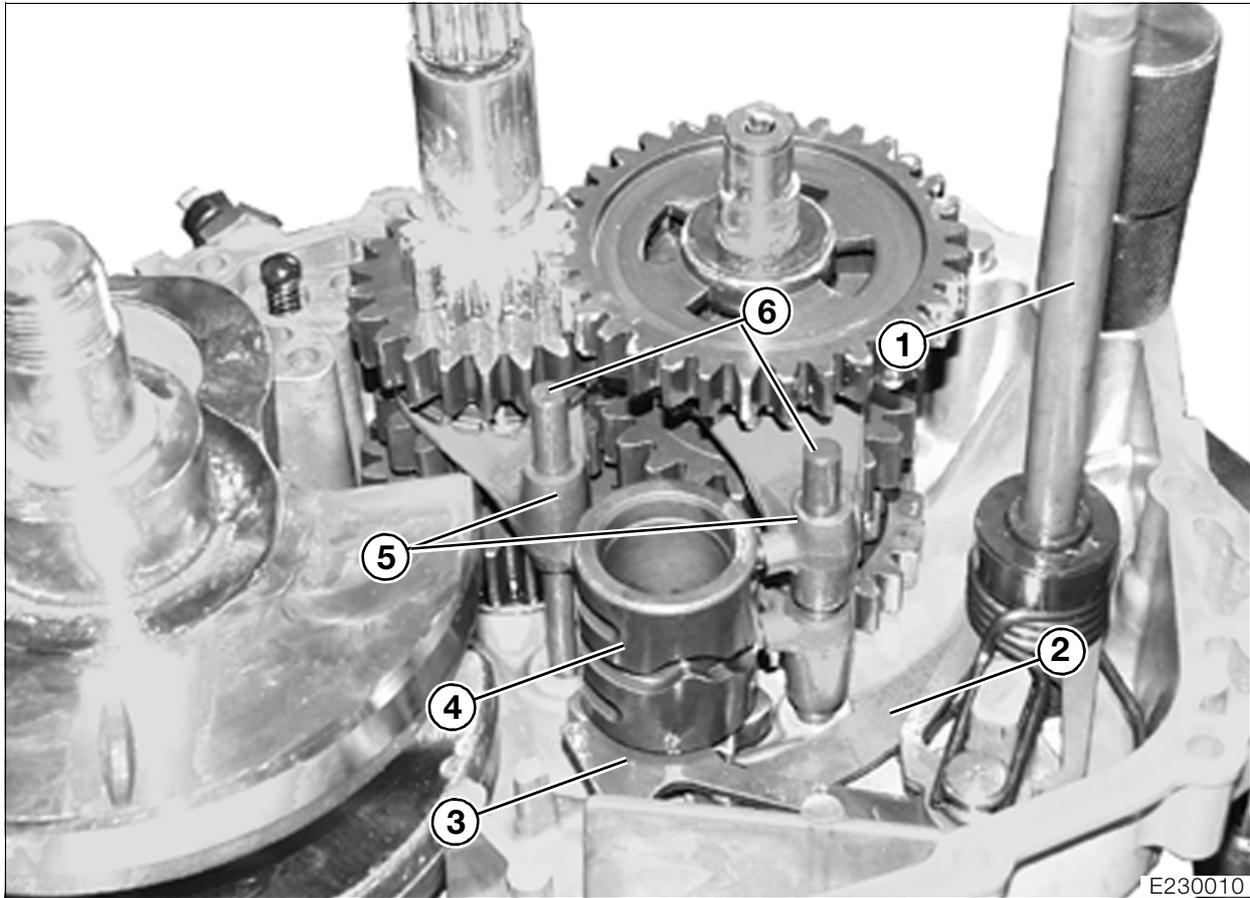


E230050

Gear shift pedal, components



F239030



23 00 100 Removing/installing gearbox



Caution:

If there is any mechanical damage, the oil tank must be cleaned.

- Remove the engine.
- ➡See Group 11
- Disassemble the engine.
- ➡See Group 11

23 00 640 Removing selector shaft with pawl and index lever

- Pry the sealing ring of the selector shaft out of the cover.
- Press shift pawl (3) slightly outward and withdraw selector shaft with shift pawl (1, 3).
- Remove index lever (2) and spring.

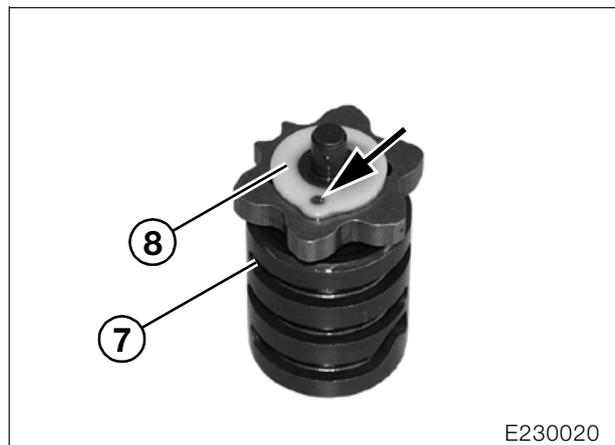
23 00 158 Removing selector forks

- Pull out guide pins (6) of selector forks.

- Swing the selector forks (5) out and remove them.
- Inspect contact surfaces of selector forks and guide pins for signs of wear.

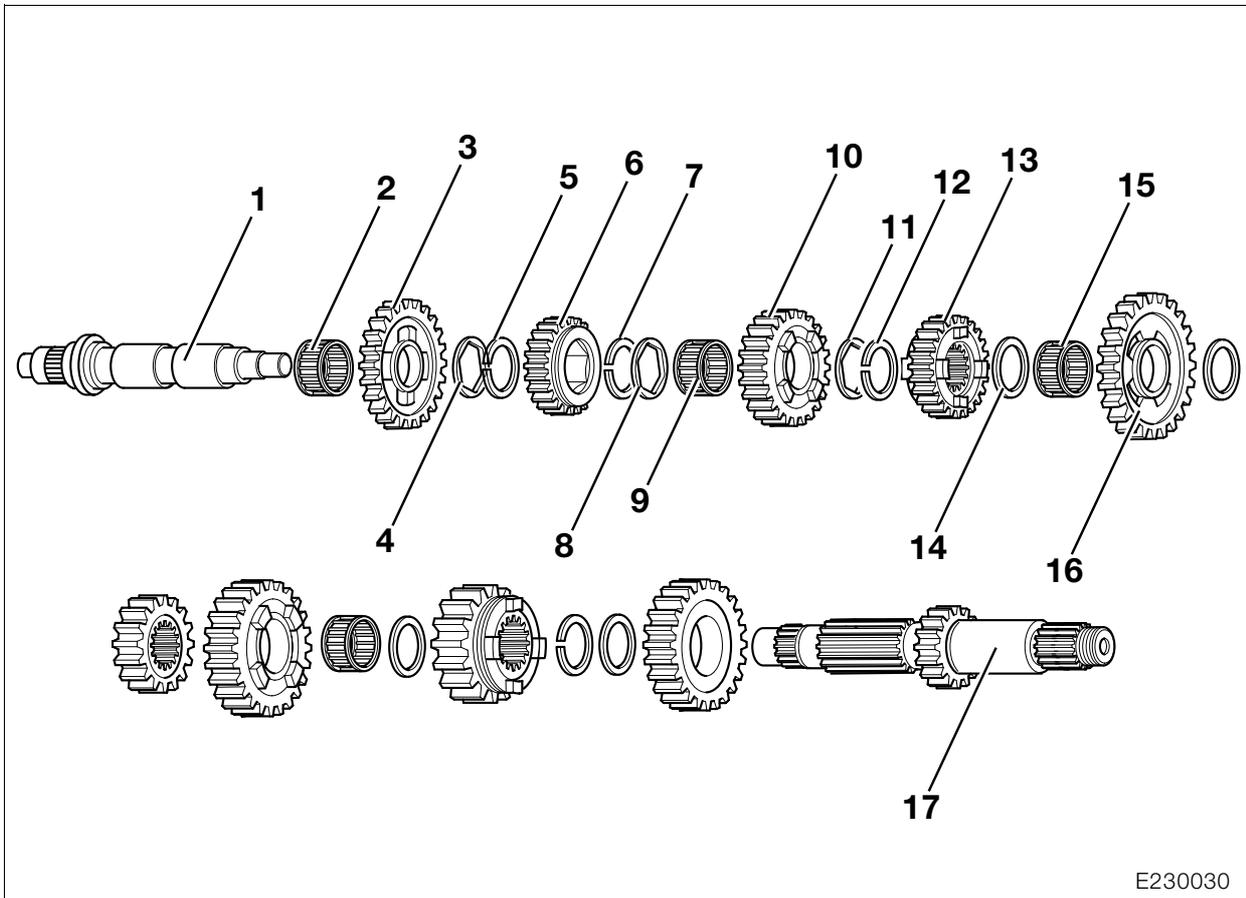
23 00 651 Removing selector drum

- Withdraw selector drum (4).



- Inspect selector drum guide tracks (7) and insulating washer (8) with neutral indicating contact (arrow) for signs of wear.





E230030

23 00 600 Removing, disassembling and reassembling gearbox shafts

Removing gearbox shafts

- Pull sliding gears (13, 16) with bearing (15) and washer (14) off the mainshaft.
- Strike mainshaft (1) and countershaft (17) lightly with a plastic-faced hammer and remove them.

23 00 636 Disassembling and reassembling mainshaft

- Clamp the mainshaft in a vise fitted with protective jaws.



Caution:

Do not alter the stop on the special pliers, **BMW No. 23 4 500**, in order to avoid opening up the circlip too much.

- Using special pliers, **BMW No. 23 4 500**, push back retaining ring (7) slightly so that retaining ring (12), which is retained by angled ring (11), can be removed.

- Pull off gearwheel (10) with needle roller bearing (9) and washer (8).
- Remove retaining ring (7).
- Remove gearwheel (6).
- Remove circlip (5) with washer (4).
- Pull off gearwheel (3).
- Pull off needle bearing (2).



Note:

Check all bearings, bearing journals, tooth edges, keyways and annular grooves for wear.

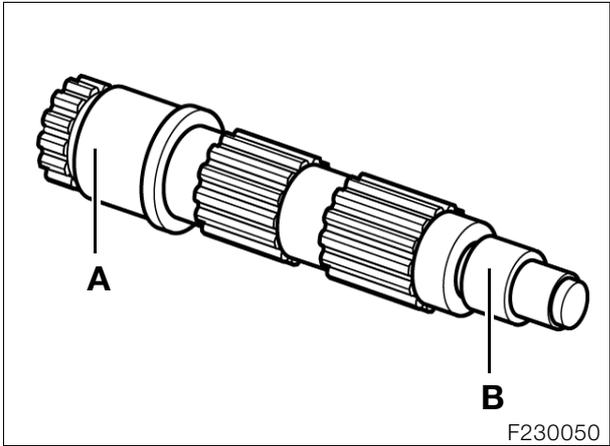
Always replace gearwheels complete with their matching gearwheels as pairs.

Edges of ring grooves must not be blunt.

Always renew circlips and install them only with special pliers, **BMW No. 23 4 500**.

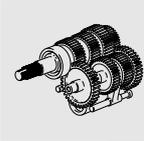
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Position retaining ring (7) approx. 3 mm (0.12 in) below the groove. After installing retaining ring (12), push retaining ring (7) up with gearwheel (6) until the retaining ring is seated in its groove.

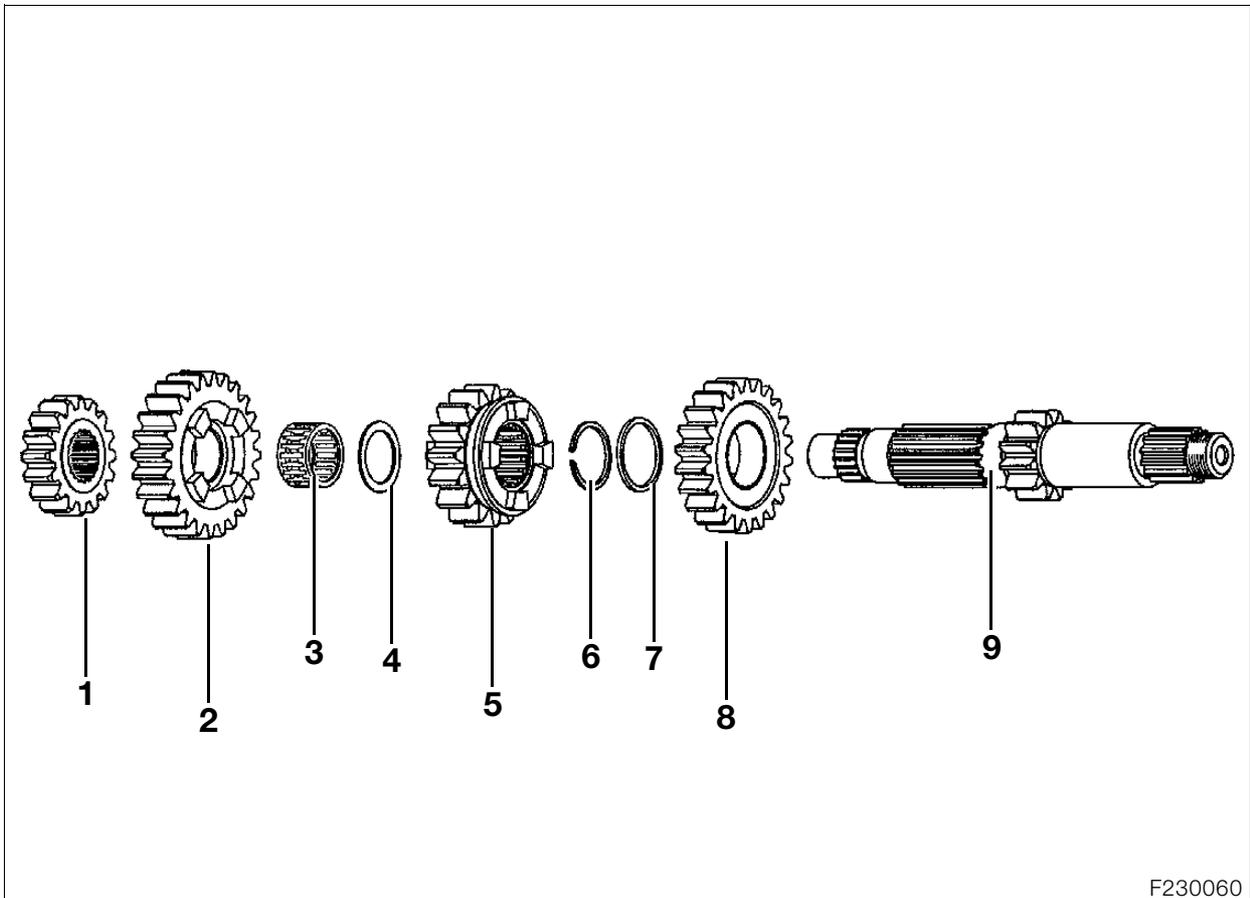
Checking mainshaft for wear



Wear limits:

"A" Shaft diameter, magneto	
side	24.98 mm (0.983 in)
"B" Shaft diameter, clutch	
side	16.98 mm (0.669 in)
Runout	0.02 mm (0.0008 in)





F230060

23 00 622 Disassembling and reassembling compensating shaft

- Clamp the compensating shaft in a vise fitted with protective jaws.
- Pull off gearwheels (1, 2).
- Pull off needle roller bearing (3) and washer (4).
- Pull off gearwheel (5).
- Remove circlip (6) with special pliers, **BMW No. 23 4 500**.
- Pull off washer (7) and gearwheel (8).



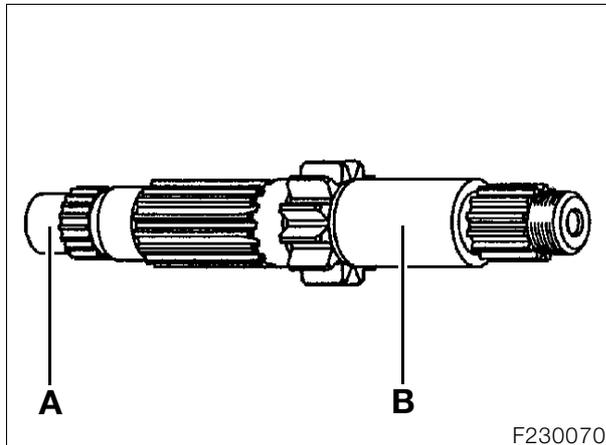
Note:

Inspect all bearings, bearing journals, tooth flanks, keyways and ring grooves for signs of wear. Renew gears only together with the corresponding meshing gears.

Edges of ring grooves must not be blunt. Always renew circlips and install them only with special pliers, **BMW No. 23 4 500**.

- Assembly is the reverse of the disassembly procedure.

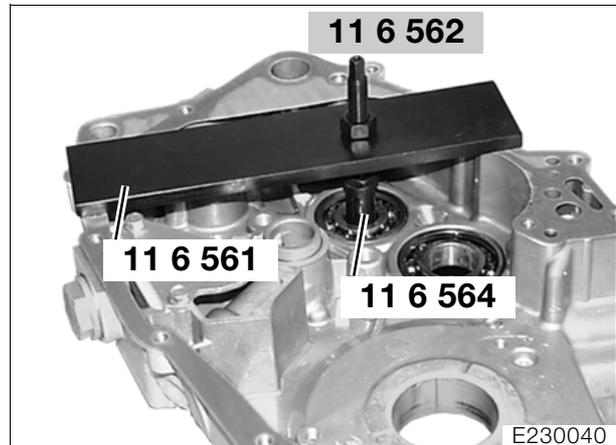
Checking countershaft for wear



Wear limits:

"A" Shaft diameter,	
magneto side	min. 16.98 mm (0.669 in)
"B" Shaft diameter, clutch	
side	min. 24.97 mm (0.983 in)
Inside diameter of bearing seat	
4th gear sliding	
gearwheel	max. 25.53 mm (1.005 in)
Runout	0.02 mm (0.0008 in)

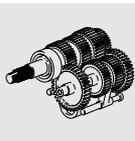
11 11 205 Replacing gearbox mainshaft bearings



Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller. Always renew the mainshaft sealing ring.

- Heat the left of the engine block to 80 – 100 °C (176 – 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 564**, pull off the ball bearing.
- Drive out the mainshaft sealing ring from the inside.
- Heat the right of the engine block to 80 - 100 °C (176 - 212 °F).
- Working from outside and using a suitable socket, press the bearing through to the other side.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- To install the bearings, heat the engine block to 80 - 100 °C (176 - 212 °F).



11 11 210 Replacing gearbox compensating shaft bearings



Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller.

- Heat the left of the engine block to 80 – 100 °C (176 – 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 565**, pull off the ball bearing.
- Heat the right of the engine block to 80 - 100 °C (176 - 212 °F).
- Using bearing puller plate, **BMW No. 11 6 561**, spindle, **BMW No. 11 6 562**, and spreader sleeve, **BMW No. 11 6 564**, pull off the ball bearing.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- To install the bearings, heat the engine block to 80 - 100 °C (176 - 212 °F).

Wear limit values for bearing seats in housing:

Magneto side:

Countershaft max. Ø 46.99 mm (1.850 in)

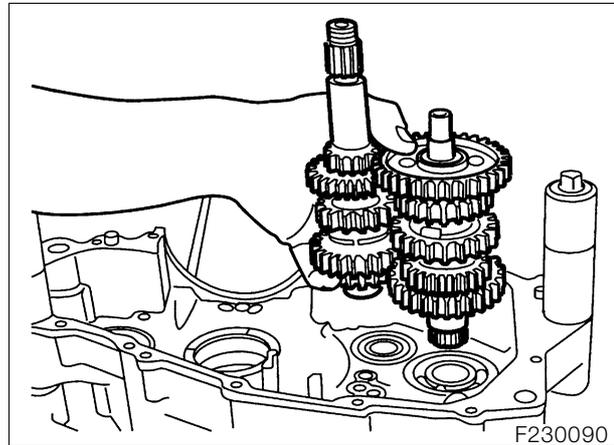
Mainshaft max. Ø 62.02 mm (2.442 in)

Clutch side:

Countershaft max. Ø 51.99 mm (2.047 in)

Mainshaft max. Ø 46.99 mm (1.850 in)

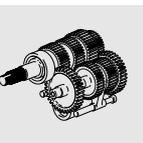
23 00 600 Installing gearbox shafts



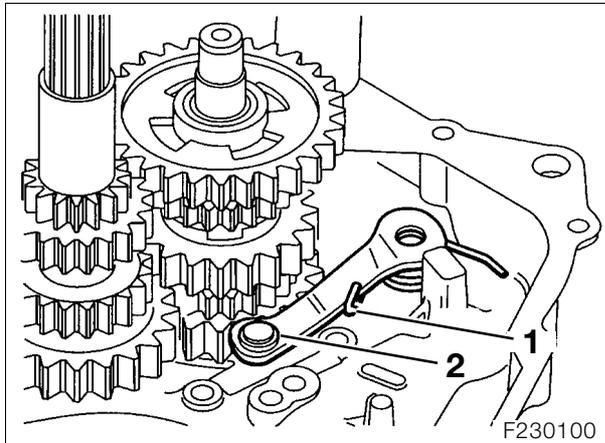
Note:

The gearbox shafts are easier to install if the crankshaft is removed beforehand.

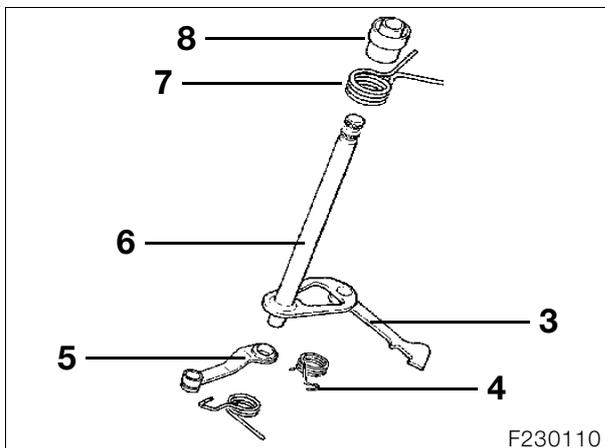
- Install the countershaft and mainshaft together, coating the main bearing points with **Optimoly MP 3**.
- Drive the shafts in against their seats with light blows of a plastic-faced hammer.



23 00 640 Installing selector shaft

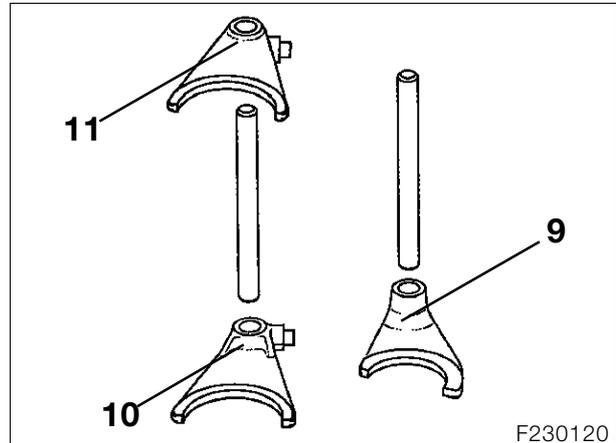


- Install index lever (2) with index spring (1) in housing.



- Engage pawl spring (4) on shift pawl (3).
- Insert selector shaft (6) in housing and secure index lever (5) in position.
- Push hairpin spring (7) with sleeve (8) on to selector shaft (7).
- Engage the hairpin spring to the bearing journal.

23 00 658 Installing selector forks



- Insert selector fork (9) in shift gear of counter-shaft.
- Insert selector rod and swivel together with the selector fork in the direction of the crankshaft.
- Insert selector forks (10, 11) in the corresponding shift gears of the mainshaft.
- Insert selector rod and swivel it outwards together with the selector forks.
- Drive the selector shafts onto their seats with light blows of a plastic-faced hammer.

23 00 651 Installing selector drum

- Install the selector drum in the neutral position. The contact pin in the plastic plate is above the neutral indicator switch in the housing.
- Press back index lever and selector pawl and install selector drum.
- Move index lever and selector pawl into mesh.
- Turn selector forks so that they engage the selector drum.



Note:

Select all gears in succession, at the same time checking that the selector pawl is withdrawn freely from the selector drum in all gears.

- Check gearbox functions.
- Assemble the engine.

➡See Group 11

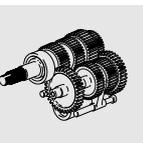


Note:

The clicking sound as the selector pawl engages must be clearly audible.



- Select all gears once again and move the shift lever slowly to the “0” position.
 - Cover the splines on the selector shaft with slide-on sleeve, **BMW No. 21 4 620**.
 - Using drift, **BMW No. 21 4 630**, drive in sealing ring.
 - Drive in the mainshaft sealing ring with drift, **BMW No. 23 4 550**, and sliding sleeve, **BMW No. 23 4 540**.
 - Install the engine.
- ➡See Group 11



27 Drive chain

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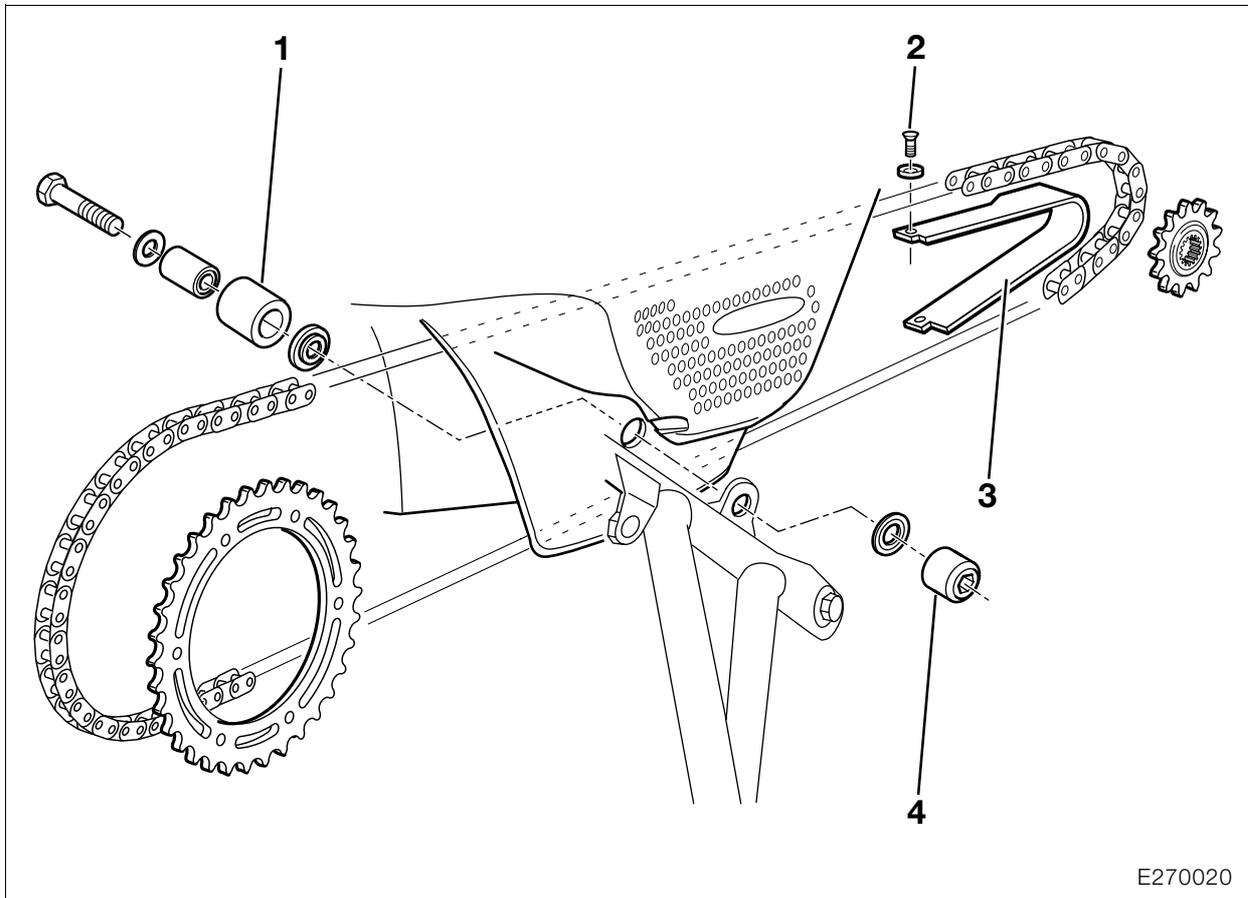




Technical Data		F 650 GS
Chain drive		
Number of teeth on chain sprocket		16
Number of teeth on chainwheel		47
Secondary ratio		1:2.937
Secondary drive		O-ring chain 5/8" x 1/4"
Chain links		112
Chain length	mm (in)	1000 (39.4)
Roller diameter	mm (in)	10.16 (0.400)







E270020

27 71 000 Removing and installing chain, chainwheel and chain sprocket

Caution:

Always replace the chain, chainwheel and chain sprocket as a set.

27 72 001 Removing and installing chain

- Remove the sprocket cover.
- Remove rear swinging arm.
- ➔See Group 33
- Lift chain off chain sprocket and remove by pulling towards the rear.
- Inspect chain takeup roller (1) and slide rail (3) for wear and replace if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Adjust chain tension before tightening the nut on the quick-release axle.

Tightening torques:

Swinging arm pivot shaft	100 Nm
Strut to swinging arm	41 Nm
Rear quick-release axle.....	100 Nm
Chain tensioning screws	10 Nm
Wheel cover bracket to swinging arm.....	9 Nm

27 72 009 Removing and installing chain guide rail

- Release fasteners (2) at top and bottom and remove guide rail (3).
- Installation is in the reverse of the removal procedure.

Removing and installing chain takeup roller



Note:

The chain takeup roller can be removed and installed without removing the chain and the rear wheel.

- Remove nut (4) with a/f 6 Allen key.
- Remove chain takeup roller (1) together with the fastener.
- Installation is the reverse of the removal procedure.

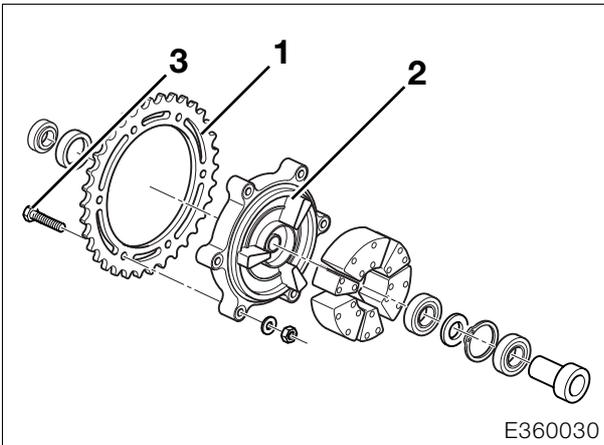
Tightening torques:

Chain takeup roller to frame	21 Nm
------------------------------------	-------



27 71 000 Removing chainwheel

- Remove rear wheel.
- ➡See Group 36

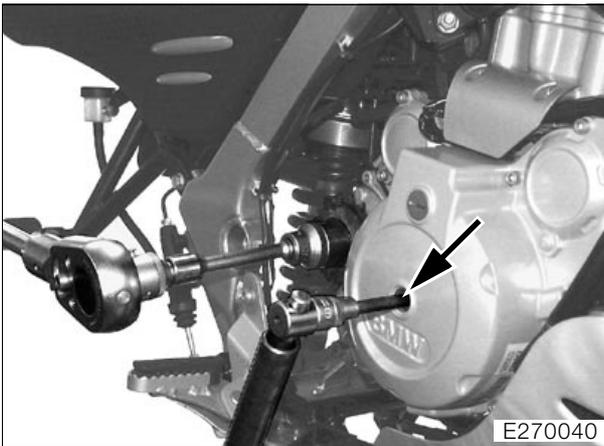


- Remove chainwheel carrier (2) together with chainwheel (1) from rear wheel hub.
- Remove screws (3) and remove the chainwheel.

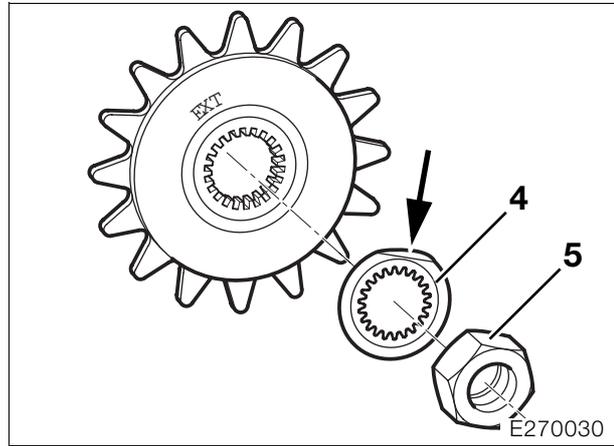
 **Tightening torques:**
Chainwheel to carrier 21 Nm

27 71 000 Removing chain sprocket

- Remove the chain.
- Select first gear.
- Straighten the tabs of the locking washer on the central nut.



- Remove the plug on the right side of the crankcase.
- Hold crankshaft with Allen key (arrow).



 **Warning:**

Central nut (5) is secured with **Loctite 243** and considerable torque is required to release it.

- Unscrew central nut (5).
- Remove the locking washer (4).
- Use puller, **BMW No. 00 8 400**, to pull the chainwheel off the mainshaft.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Lightly coat the mainshaft with **Optimoly MP 3** before installing the chainwheel.
- The sprocket must be installed with the "EXT" marking on the outside.
- Install a new locking washer (4).
- Clean threads of central nut and mainshaft, coat threads with **Loctite 243** and install nut.
- Bend up tab (arrow) of locking washer.

 **Tightening torques:**
Central nut on mainshaft
(clean thread + Loctite 243)..... 140 Nm

27 72 009 Removing and installing chain guide rail with swinging arm installed

- Remove the sprocket cover.
- Remove the rear quick-release axle.
- Remove the chain from the chainwheel and chain sprocket.
- Remove the fasteners securing the chain guide rail to the swinging arm.
- Pull out the guide rail between the sprocket and the main frame.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Do not damage the guide rail when installing; mask with tape if necessary.

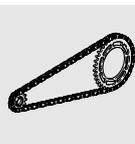


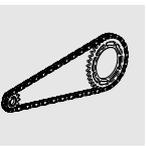
Tightening torques:

Rear quick-release axle	100 Nm
Chain tensioning screws	10 Nm

27 71 005 Adjusting chain tension

See Group 00





32 Steering

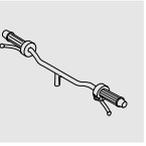
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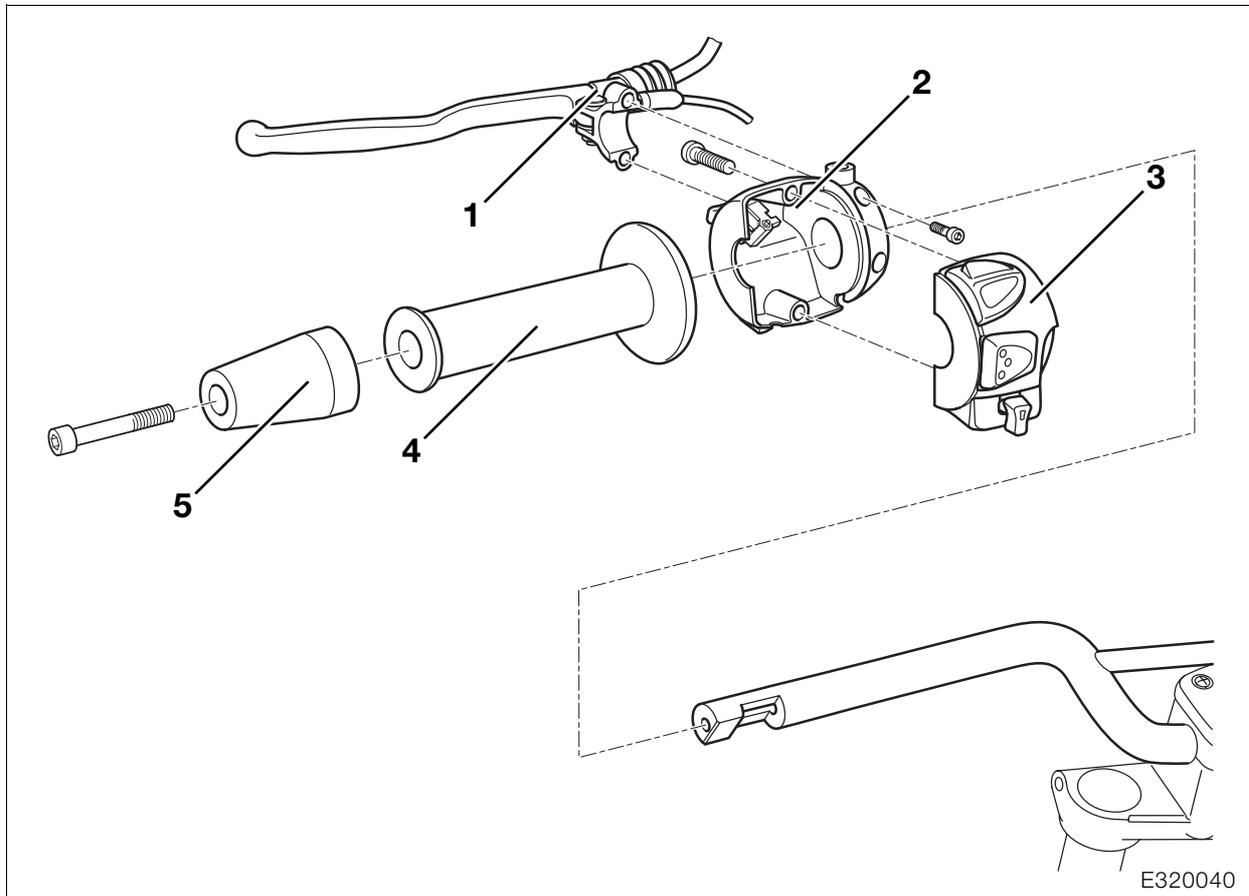
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Technical Data		F 650 GS
Steering		
Type		One-part tubular handlebar with cross-tie
Steering lock angle	°	40
Steering tube diameter	mm (in)	22 (0.87)
Width across handlebars (handlebar only, without grips)	mm (in)	770 (30.3)







E320040

Removing and installing left and right handlebar fittings

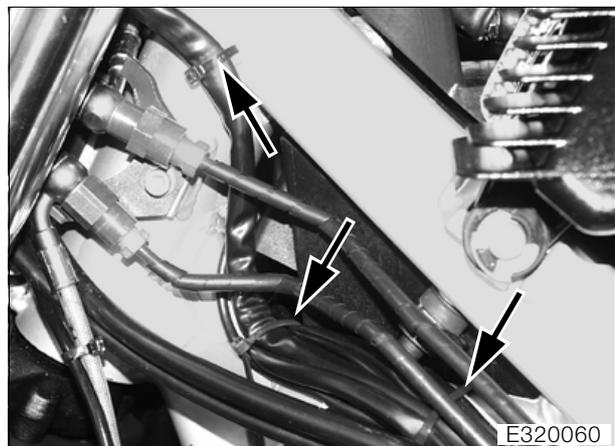


Note:

To avoid damage, use a protective apron for the tank, **BMW No. 16 1 600**.

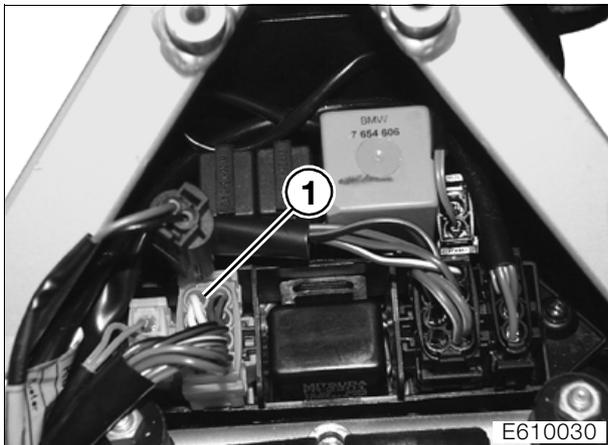
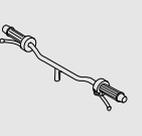
Removing and installing left handlebar fitting

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers.
- Cut the cable tie at the handlebar.
- Remove cover (3) from housing (2).
- Remove clutch fitting (1).
- Remove handlebar weight (5).
- Remove rubber grip (4).

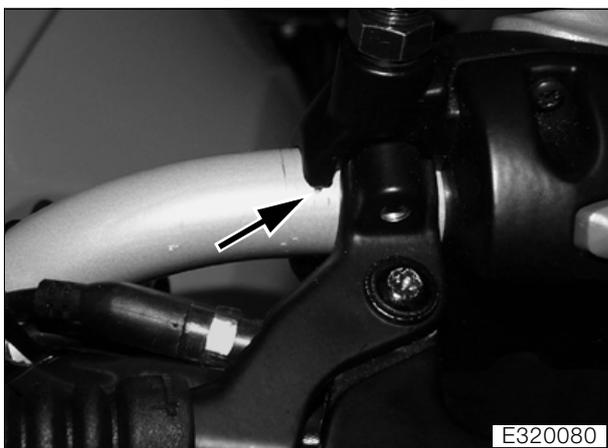


E320060

- Cut through cable ties (arrows).
- Disconnect the expansion tank and pull it to one side.
- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Disengage cover from the anchorage on main frame on left.



- Disconnect plug of left-hand multi-function switch (1).
- Push the cover over the cylinder head slightly to one side and remove the connector.
- Cut through the cable ties securing the cables at the multi-function switch and the clutch switch.
- Slide the housing off the handlebar.
- Remove the mirrors, if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Install the rubber grip with **Loctite 638 and surface activator**.



Note:

The position of the handlebar fittings is indicated by a punch mark (arrow) on the handlebar.

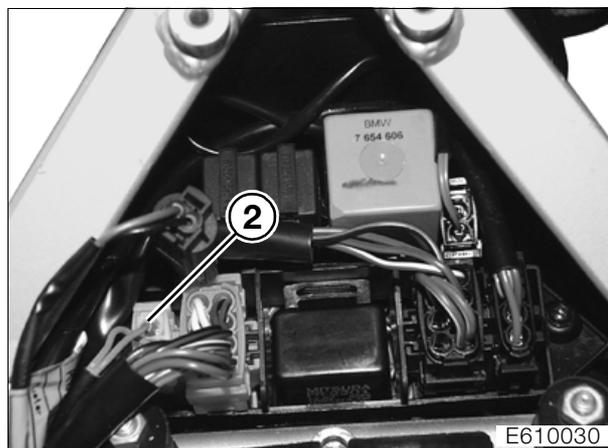


Tightening torques:

- Clutch-lever fitting to handlebar 9 Nm
- Handlebar weight to handlebar..... 9 Nm
- Oil tank to intake air silencer 9 Nm
- Lid of electronic equipment box 4 Nm
- Expansion tank to radiator..... 9 Nm

61 31 295 Removing and installing clutch switch

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers.
- Release clutch switch on handlebar fitting.
- Cut through the cable ties securing the cables at the handlebar and the multi-function switch.
- Cut through the cable tie at the frame head.
- Disconnect the expansion tank and pull it to one side.
- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Disengage cover from the anchorage on main frame on left.

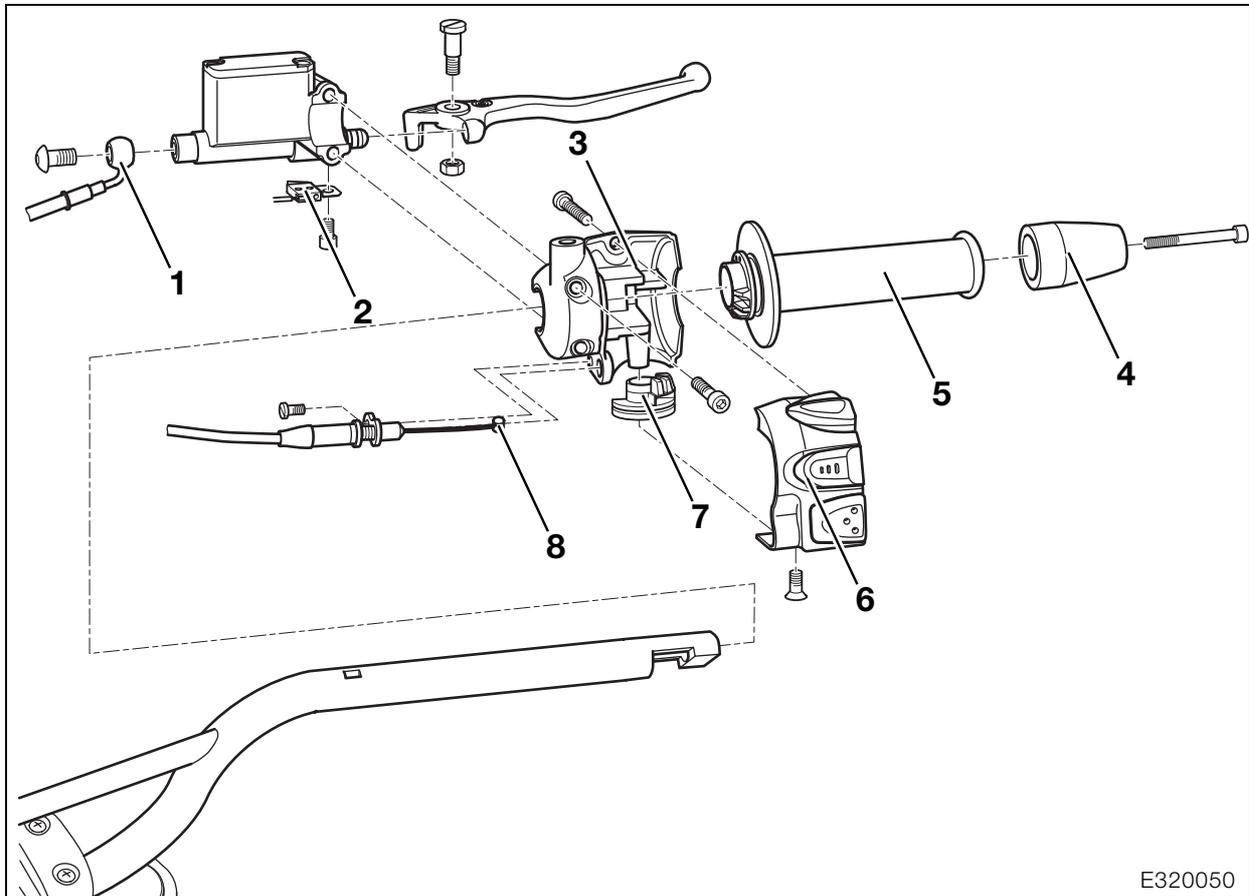


- Separate plug connector at clutch switch (2).
- Push the cover over the cylinder head slightly to one side and remove the connector.
- Installation is the reverse of the removal procedure.



Tightening torques:

- Oil tank to intake air silencer 9 Nm
- Lid of electronic equipment box 4 Nm
- Expansion tank to radiator 9 Nm
- Clutch switch to handlebar fitting 5 Nm



E320050

Removing and installing right handlebar fitting

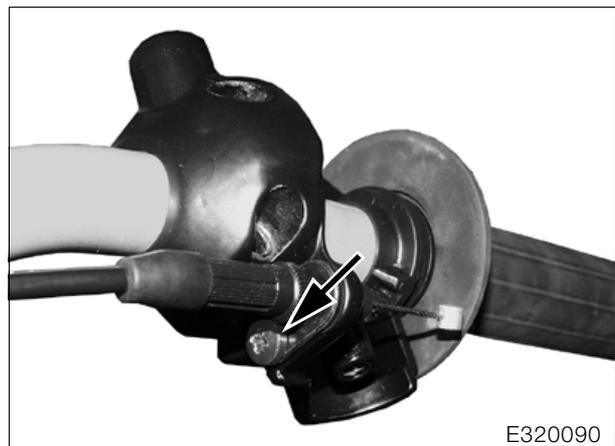
- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers.
- Cut the cable tie at the handlebar.



Caution:

Refer to notes on the hazards involved in handling brake fluid.

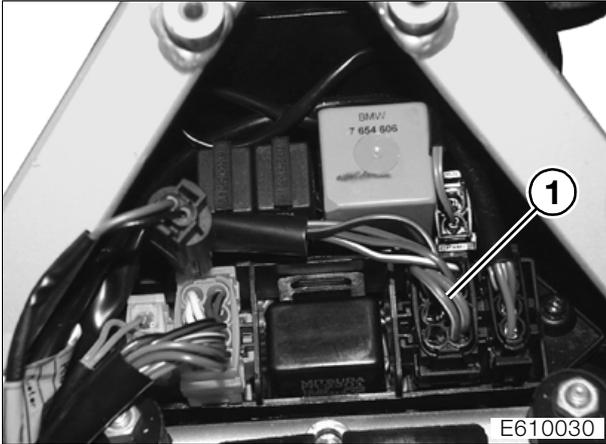
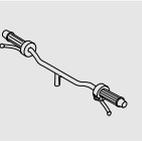
- Disconnect and seal brake hose (1).
- Remove brake microswitch (2).
- Release cover (6) and leave it dangling on the cable.
- Remove throttle-cable roller (7) and disengage throttle-cable nipple (8).
- Remove brake fitting.



E320090

- Remove fastener for throttle cable (arrow) and pull out the throttle cable.
- Remove handlebar weight (4).
- Remove housing (3) together with twist-grip tube (5).

- Disconnect the expansion tank and pull it to one side.
- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Disengage cover from the anchorage on main frame on left.



- Disconnect plug of right-hand multi-function switch (1).
- Push the cover over the cylinder head slightly to one side and remove the connector.
- Cut through the cable ties securing the cables at the multi-function switch and the clutch switch.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Top up brake fluid and bleed brake system.



Note:

Before assembling, grease the handlebar end and nipple mount (arrow) lightly with **Shell Retinax EP2**.

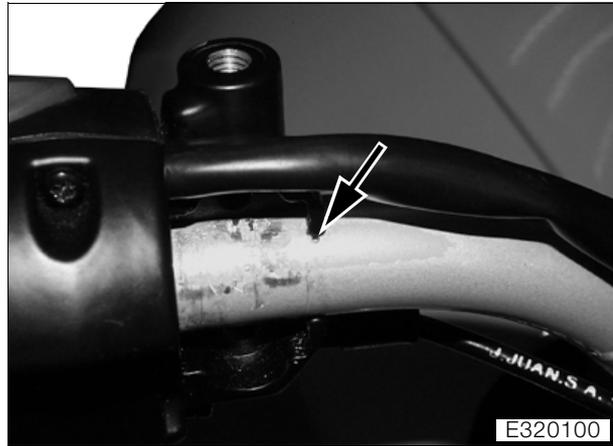
- Position the twist-grip tube in the groove before mounting it on the handlebar.



Note:

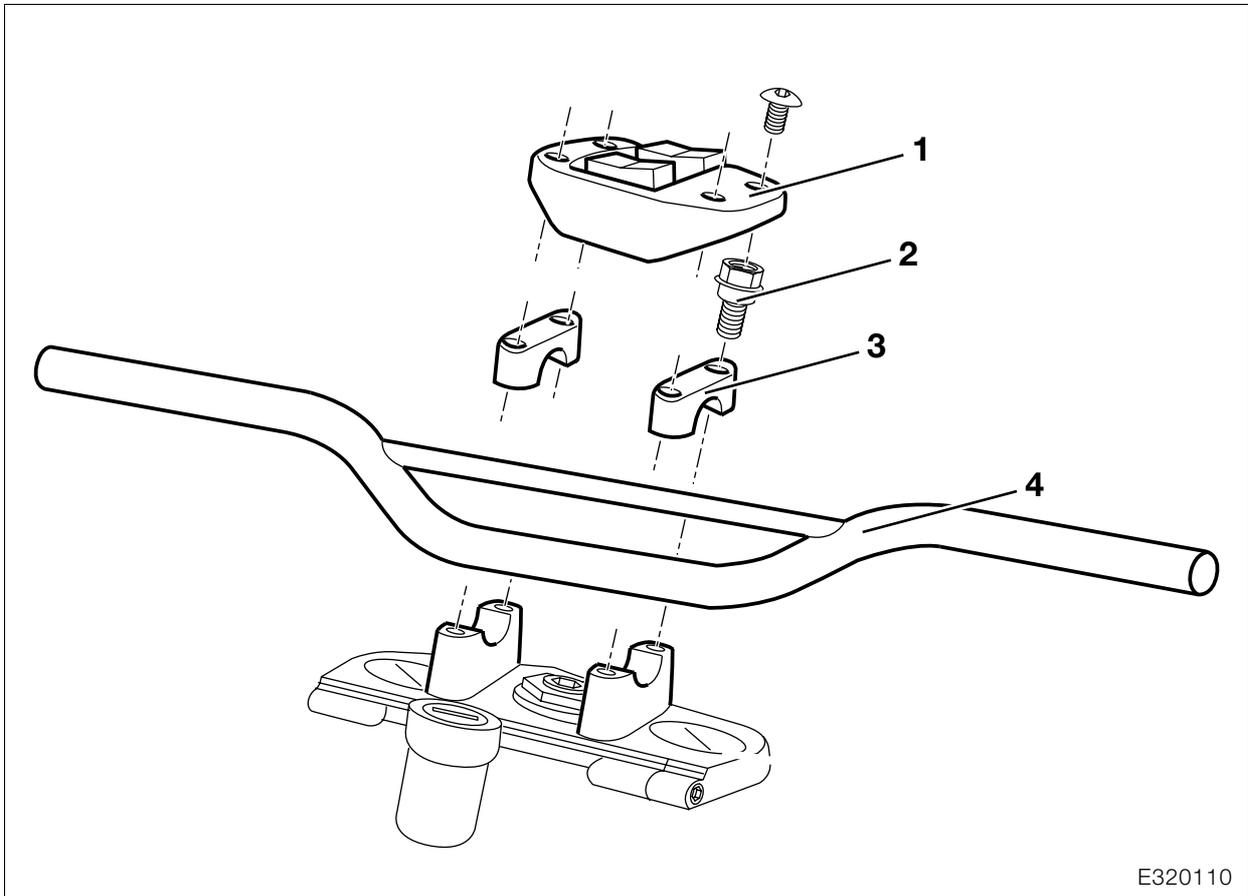
The position of the handlebar fittings is indicated by a punch mark (arrow) on the handlebar.

Throttle cable play approx. 1 mm (0.04 in)



Tightening torques:

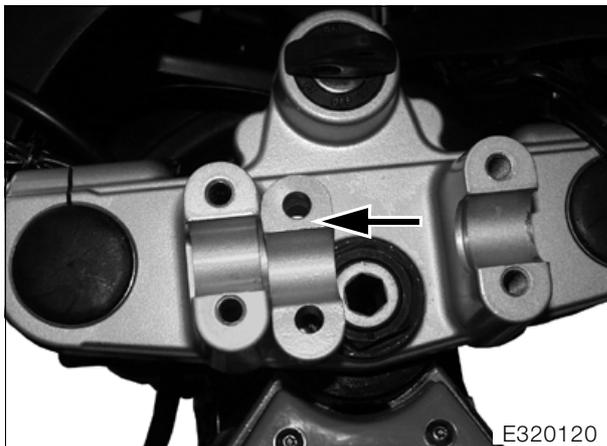
Handlebar fitting to handlebar	9 Nm
Handlebar weight to handlebar	9 Nm
Brake hose to brake master cylinder	18 Nm
Oil tank to intake air silencer	9 Nm
Lid of electronic equipment box	4 Nm
Expansion tank to radiator	9 Nm



E320110

32 71 008 Removing and installing handlebar

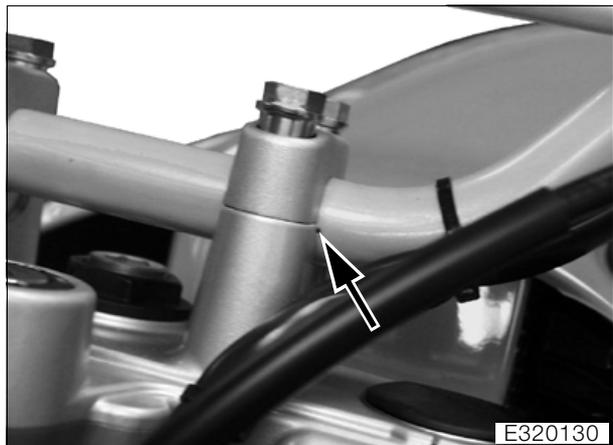
- Remove left handlebar fitting.
- Remove right handlebar fitting.
- Remove impact pad (1).
- Loosen clamping screws (2).
- Remove handlebar (4) together with clamping blocks (3).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



E320120

Caution:

Note the position of the clamping blocks. Wide hole spacing (arrow) to the front.



E320130

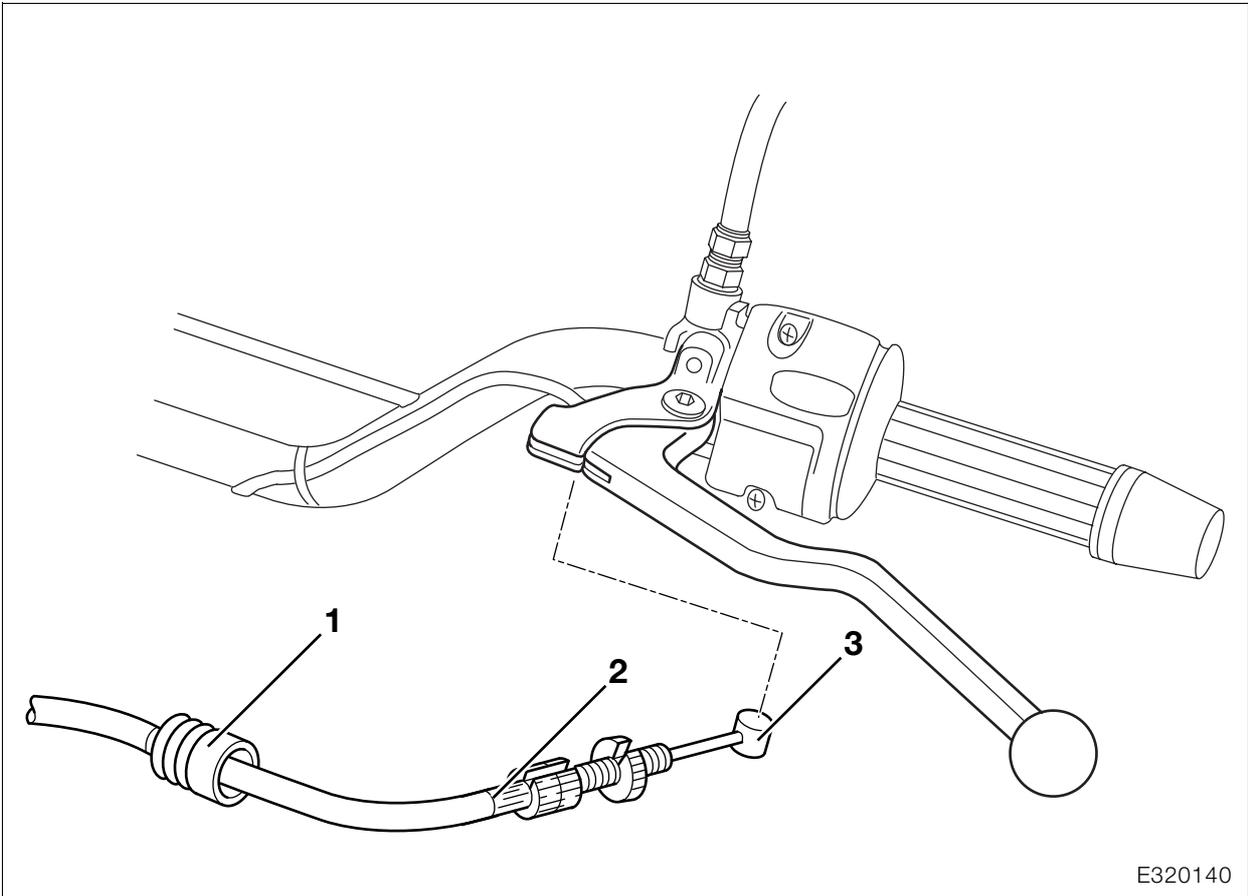
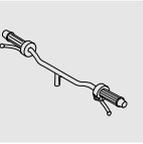
Note:

The position of the handlebar is indicated by a punch mark (arrow) on the handlebar.

- Begin by tightening the front securing screws (as viewed in the forward direction of travel), then tighten the rear securing screws.

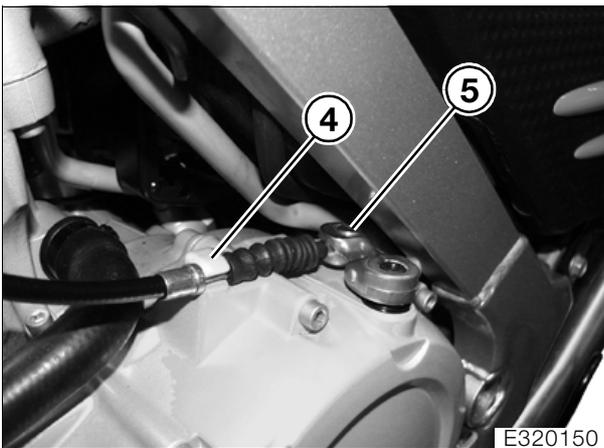
Tightening torques:

Handlebar to fork bridge 21 Nm

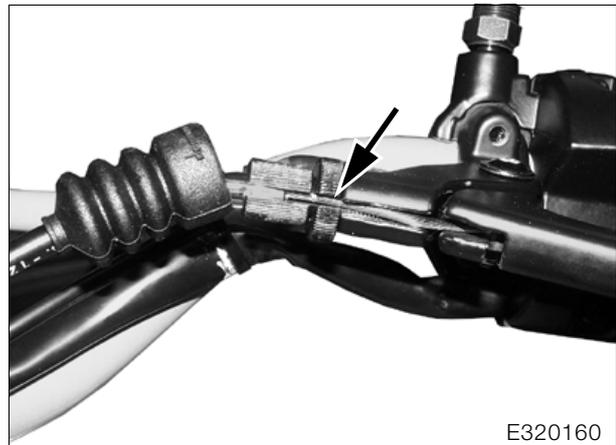


E320140

32 72 330 Removing and installing clutch cable



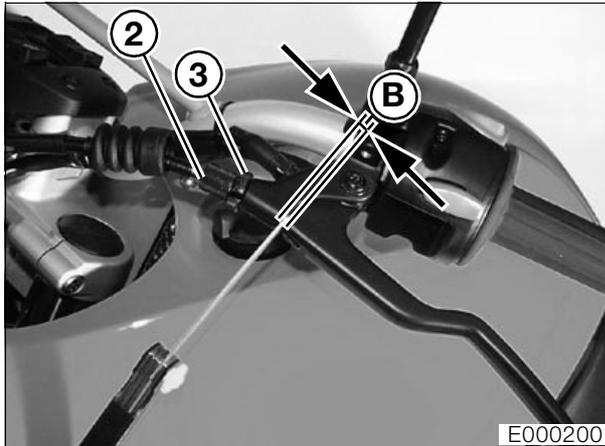
- Disengage clutch cable (5) from release lever.
- Pull cable out of holder (4).
- Remove rubber grommet (1) from clutch lever.



- Make sure that slots in adjusting screw, locknut and lever fitting (arrow) are in line.
- Pull back cable shroud (2).
- Pull the cable forward through the slot and disengage nipple (3).
- Pull the cable out to the rear.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

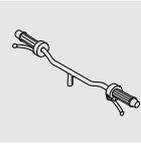
 **Caution:**

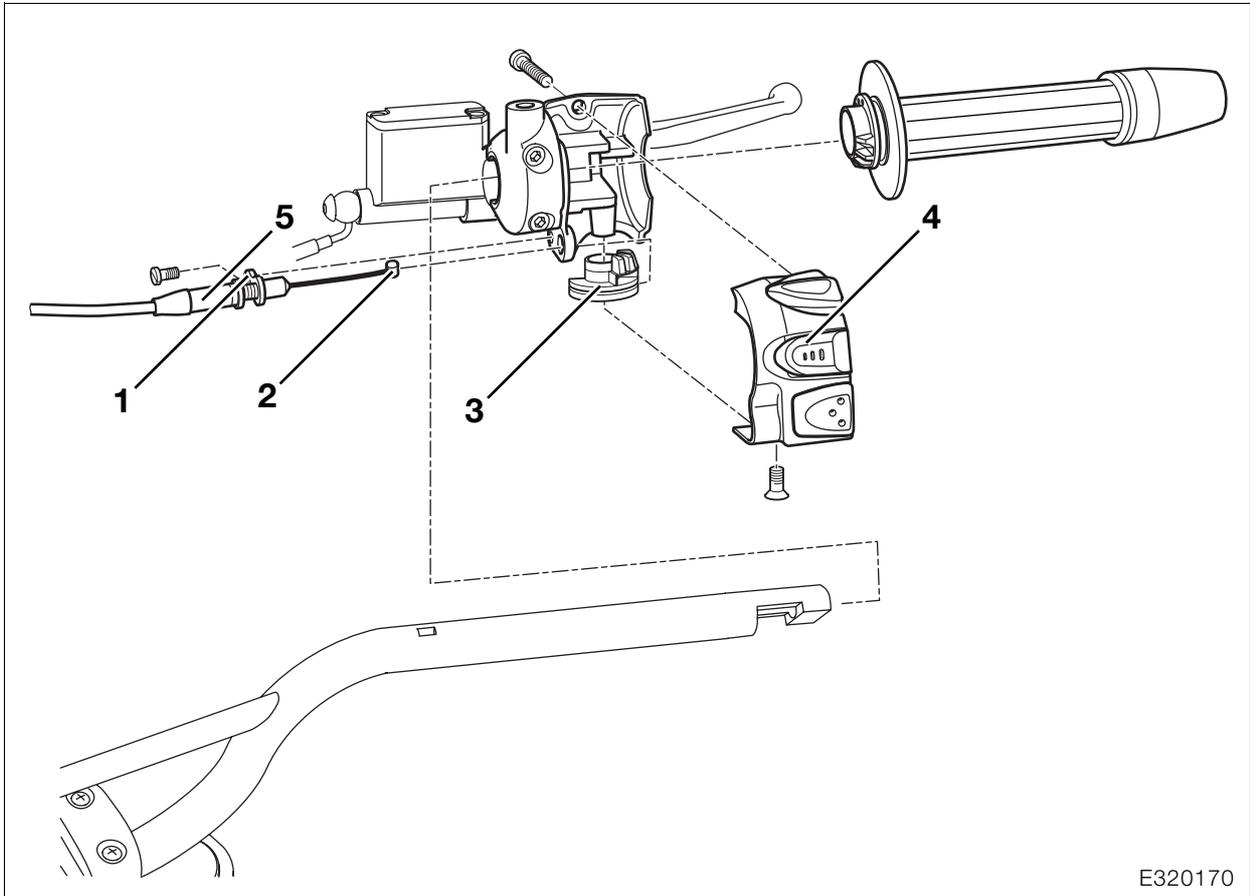
Make sure that the clutch cable is not kinked when installed.



- After installing the cable, adjust clutch clearance by setting distance "B" by turning adjusting screw (2) on the clutch handlebar fitting.
- Lock adjusting screw (2) with knurled nut (3).

Distance "B" 1.0...2.0 mm (0.04...0.08 in)



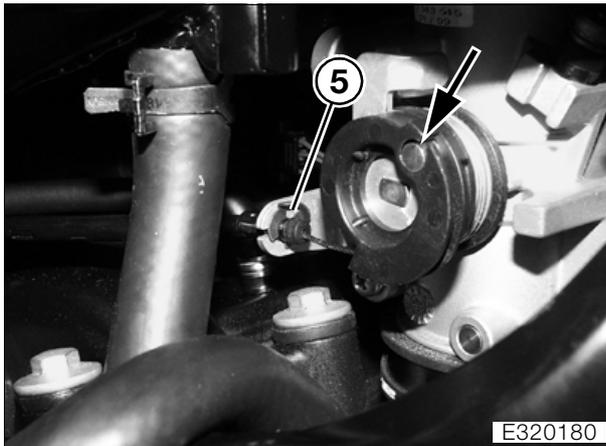


E320170

32 72 305 Removing and installing throttle cable

- Remove seat.
- Remove left cover.

- Remove cover (4).
- Remove fastener for throttle cable (1) from instrument cluster housing.
- Disengage throttle-cable adapter (3) and disengage nipple (4).
- Remove the throttle cable.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



E320180

 **Note:**

Make sure that the cable is not kinked when installed.

- Adjust throttle-cable play with adjusting screw (5).

Throttle cable play.....approx. 1 mm (0.04 in)

 **Tightening torques:**

Cover of multi-function switch..... 1 Nm

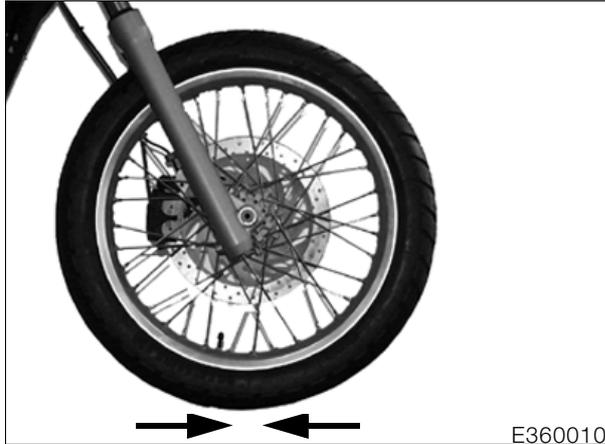
- Disengage throttle cable from adapter (arrow).
- Remove circlip (5) from throttle-cable holder and disengage throttle cable.
- Pull the cable out toward the handlebar.

32 00 454 Checking and adjusting steering head bearing play, renewing if necessary

(Inspections II and III)

32 00 454 Checking steering head bearing play

- Lift front wheel clear of the ground.



- Move fixed fork tubes forward (arrows).
- Adjust the steering head bearing if play is perceptible.

32 00 454 Checking and adjusting steering head bearing play, renewing if necessary

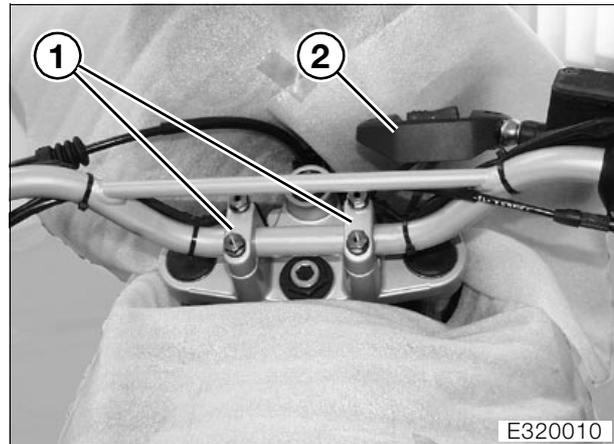
(Inspections II and III)

32 00 454 Adjusting steering head bearing play

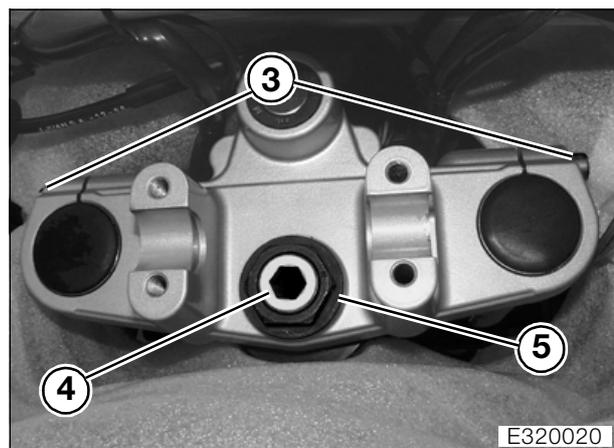


Caution:

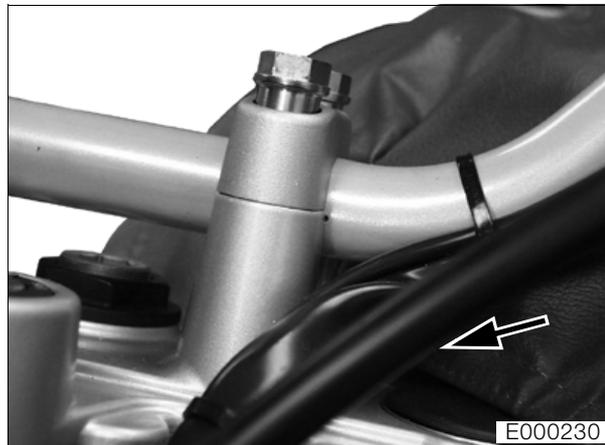
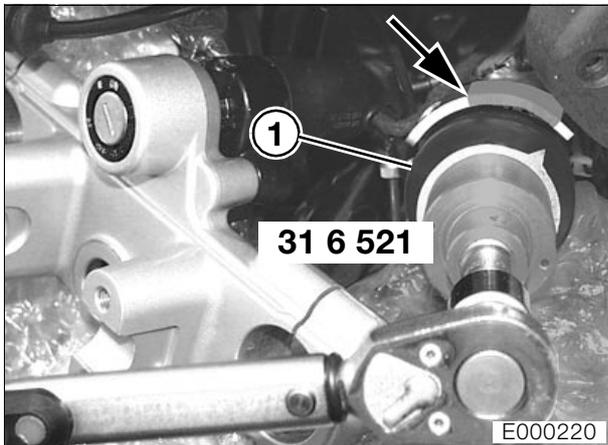
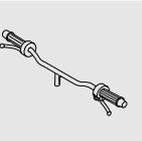
Cover or mask off the instrument cluster and trim to prevent scratches.



- Remove impact pad (2).
- Remove clamp blocks (1).
- Remove the handlebar and place it in front of the instrument cluster.



- Unscrew hex nut (5).
- Release clamping screws (3) at upper fork bridge.
- Remove the upper fork bridge complete with the ignition lock.
- Remove counter-tube (4).



- Slacken round nut (1) with pin-wrench adapter, **BMW No. 31 6 521**, then tighten to 25 Nm.
- Turn forks back and forth twice from lock to lock, and leave the forks at the full left lock position.
- Mark a 40 mm (1.58 in) arc with adhesive tape or similar (arrow) around the circumference of the locking plate at the steering head.
- Align the mark on pin-wrench adapter, **BMW No. 31 6 521**, with the right-hand end of the marked arc.



Note:

40 mm (1.58 in) around the circumference of the locking plate corresponds to an angle of rotation of 60 °.

- Turn the round nut clockwise until the pointer on pin-wrench adapter, **BMW No. 31 6 521**, reaches the left-hand end of the marked arc.
- Remove the mark/adhesive tape from the locking plate.



Caution:

Check the mating faces of the fork bridge and knurled nut, rub down with an oilstone if necessary and clean.

- Tighten the counter-tube.
- Install fork bridge.
- Firmly tighten locknut.
- Tighten the clamping screws of the fork bridge.
- Check play and freedom of movement.



Note:

Use the punch marks (arrow) to align the handlebars as shown.



Warning:

Begin by tightening the front securing screws (as viewed in the forward direction of travel) of the clamp blocks, then tighten the rear securing screws.

- Install handlebars and impact pad.
- Lift front wheel clear of the ground and perform final check.
- With the front wheel off the ground, the weight of the forks must be enough to turn the steering all the way to the left and right full lock positions as soon as the handlebar is moved away from the straight-ahead position.
- If local points of stiffness are detected when the handlebar is moved to and fro, renew the steering head bearings.

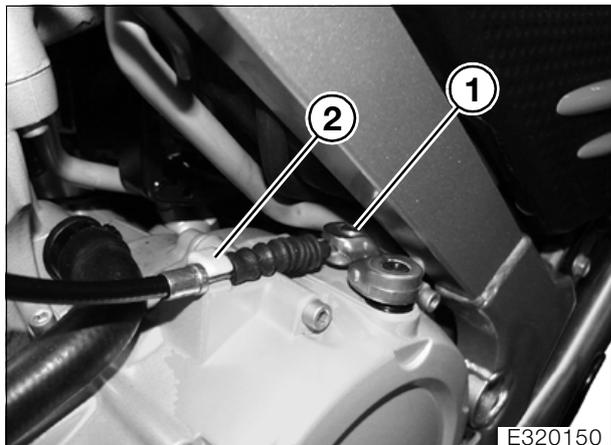


Tightening torques:

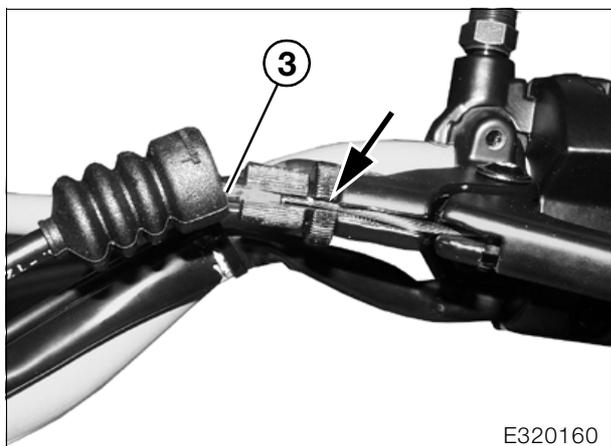
Initial torque, round nut	25 Nm
Back off through angle of rotation	60 °
Counter-tube to steering head bearing	65 Nm
Hexagon nut to counter-tube	65 Nm
Clamp screws at fork bridge	21 Nm
Handlebar to fork bridge	21 Nm

Removing and installing left and right handlebar levers

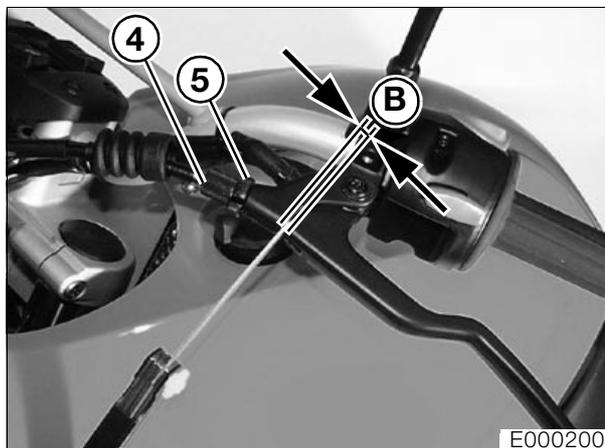
32 72 070 Removing and installing left handlebar lever



- Disengage clutch cable (1) from release lever.
- Pull cable out of holder (2).
- Remove the rubber grommet from the clutch lever.



- Make sure that slots in adjusting screw, locknut and lever fitting (arrow) are in line.
- Pull back cable shroud (3).
- Pull the cable forward through the slot and disengage the nipple.
- Slacken the locknut at the handlebar lever
- Slacken the pivot pin of the clutch lever.
- Installation is the reverse of the removal procedure.



- After installing the cable, adjust clutch clearance by setting distance "B" by turning adjusting screw (4) on the clutch handlebar fitting.
- Lock adjusting screw (4) with knurled nut (5).

Dimension "B" 1.0...2.0 mm (0.04...0.08 in)

Tightening torques:

Locknut 5 Nm
Pivot pin of clutch lever 3 Nm

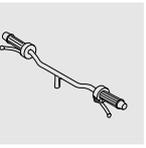
32 72 119 Removing and installing right handlebar lever

- Slacken the locknut at the handlebar lever.
- Slacken the pivot pin of the handbrake lever.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

Tightening torques:

Locknut of handbrake lever 7 Nm
Pivot pin of handbrake lever 7 Nm

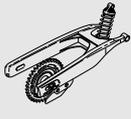




33 Rear wheel drive

Contents

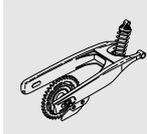
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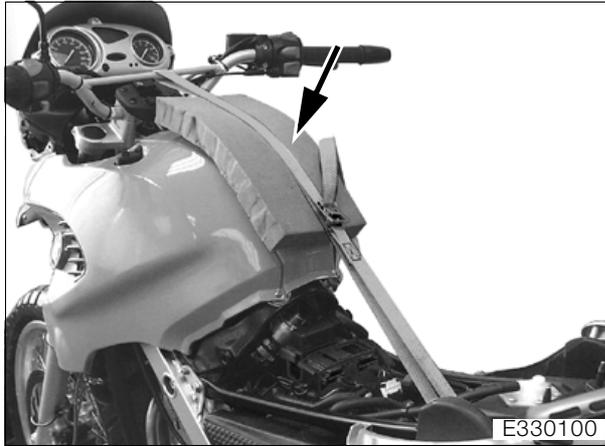
Technical Data		F 650 GS
Rear suspension		
Suspension strut		Central suspension strut pivoted to lever system. Spring base and rebound damping continuously adjustable.
Suspension travel	mm (in)	165 (6.50) at wheel 47.5 (1.87) at suspension strut
Swinging arm		
Type		Twin box swinging arm.
Swinging arm length	mm (in)	564 (22.2)





33 53 000 Removing and installing suspension strut

- Remove exhaust manifold.
- ➔See Group 18
- Secure front wheel in position.



Caution:

Protect trim panel parts with a material such as foam rubber (arrow) to prevent damage.

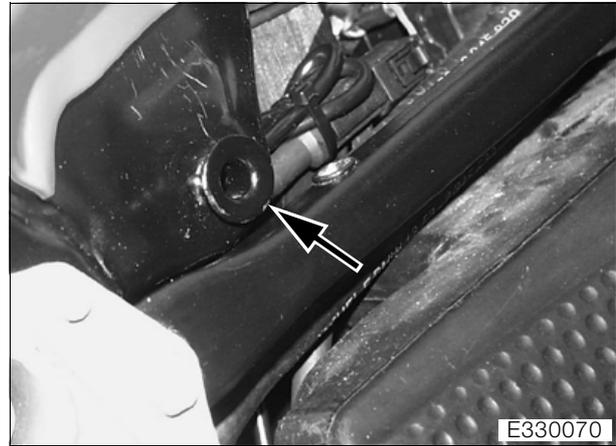
- Use a strap to secure the rear frame to the transverse arm.



Note:

Do not unplug the control unit.

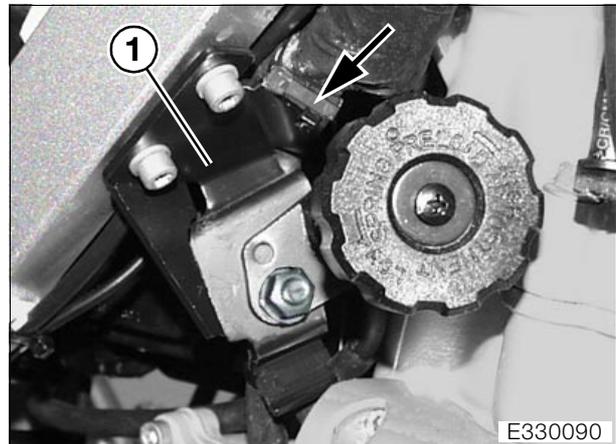
- Remove the BMS control unit from the holder.
- Remove the fuse box.
- Remove brake fluid reservoir from rear frame.
- Remove lower fasteners securing rear frame to main frame.
- Slightly pretension the strap.
- Slacken upper fasteners securing rear frame to main frame.



Caution:

Do not raise the rear frame all the way, as it is seated against the lock of the seat (arrow).

- Raise the rear frame far enough to expose the eye of the spring strut and secure the rear frame in this position with the strap.



- Release the cable strap (arrow).
- Remove the spring-strut adjusting knob with retainer (1).
- Separate the retainer from the adjusting knob.
- Pull the adjusting knob through to the rear.
- Lift the load off the rear wheel and remove the fastener securing the spring strut to the angled lever.



33 17 350 Removing and installing rear swinging fork

- Removing ABS sensor
- Remove rear wheel.

➡ See Group 36



E330080

- Remove the fastener securing the spring strut to frame (1).
- Pull the spring strut with adjusting knob to the rear and remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

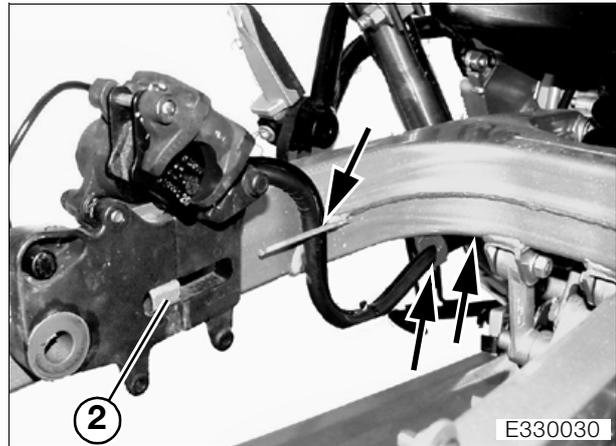
When lowering the rear frame, make sure that the brake line is routed between the front section of the mudguard and the rear frame.

- Preinstall the spring strut complete with all fasteners, but do not fully tighten the fasteners until they are all installed.
- Take care not to damage the brake line and the main frame when lowering the rear frame into position.
- Clean the threads of the bottom screws which secure the rear frame, coat the threads with **Loctite 2701** and install.



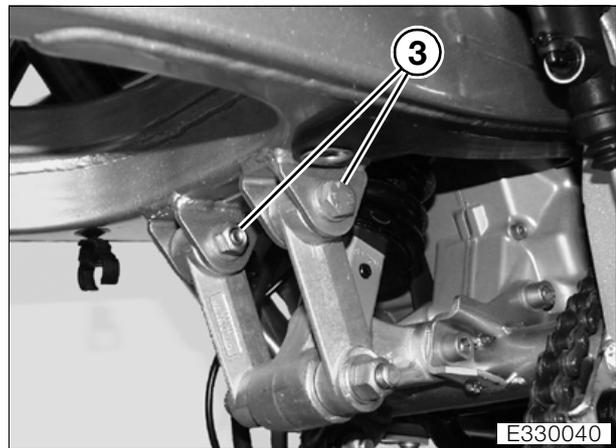
Tightening torques:

Suspension strut to frame	50 Nm
Suspension strut to angled lever	47 Nm
Adjusting knob to retainer	21 Nm
Retainer to frame	9 Nm
Rear frame to main frame, top	21 Nm
Rear frame to main frame, bottom (clean thread + Loctite 2701)	21 Nm
Brake fluid reservoir to rear frame	1.5 Nm
Clamp for silencer	55 Nm
Oxygen sensor to exhaust	45 Nm
Exhaust manifold to cylinder head	20 Nm
Engine guard to frame	9 Nm



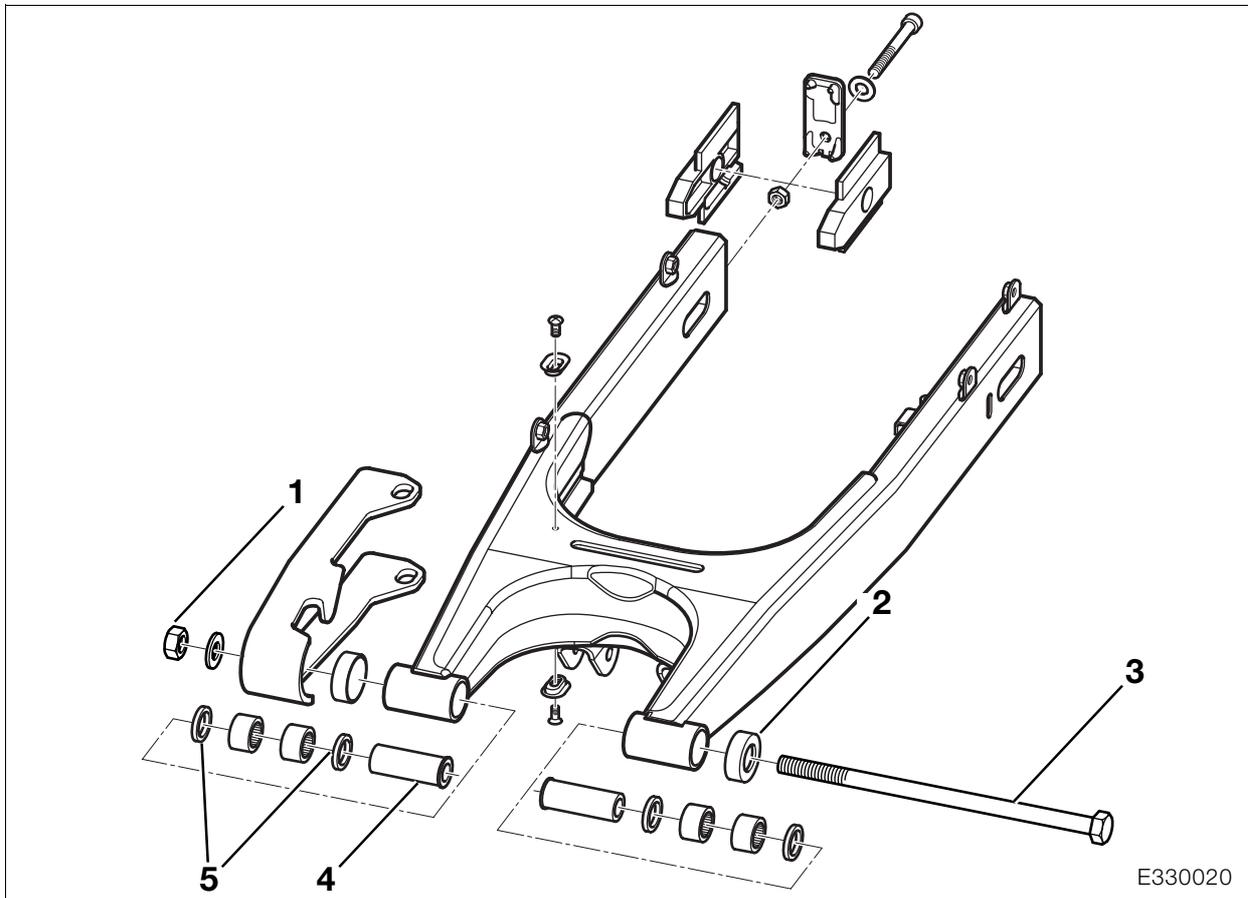
E330030

- Remove the brake calliper from guide (2) and remove brake hose from clips (arrows).



E330040

- Remove the fasteners (3) securing the struts to swinging arm.



- Remove nut (1) at swinging-arm pivot shaft (3).
- Remove swinging-arm pivot shaft (3).
- Pull the swinging arm to the rear to remove; remove thrust washers (2).
- Remove chain guide rail, if necessary.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Grease needle bearings with **Shell Retinax EP2**.

- Adjust chain tension.
- ➡See Group 00



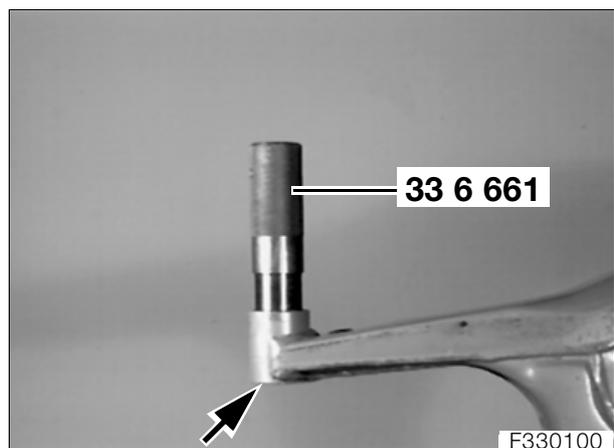
Tightening torques:

Swinging-arm pivot shaft.....	100 Nm
Tension strut to swinging fork	41 Nm
Rear quick-release axle.....	100 Nm
Wheel cover bracket to swinging arm.....	9 Nm
ABS sensor to holder	9 Nm

33 17 373 Removing and installing needle roller races in rear swinging fork

Removing needle roller races

- Remove bearing bushes (4) and sealing rings (5) from swinging arm.

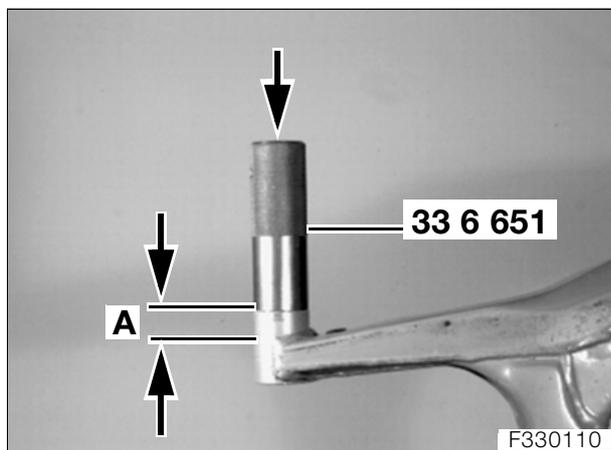


Caution:

Protect mating faces (arrow) of the swinging arm from scratches by covering with masking tape or similar.

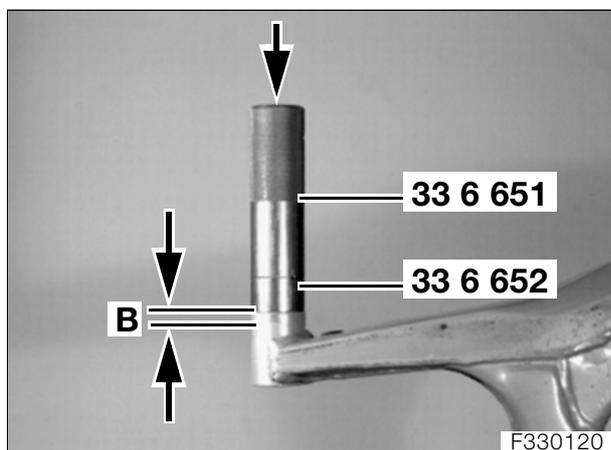
- Drive needle roller races out of rear swinging arm with drift, **BMW No. 33 6 661**.

Installing needle roller races



- Heat bearing seats to 100 °C (212 °F).
- Press in the inner needle roller races with drift, **BMW No. 33 6 651**.

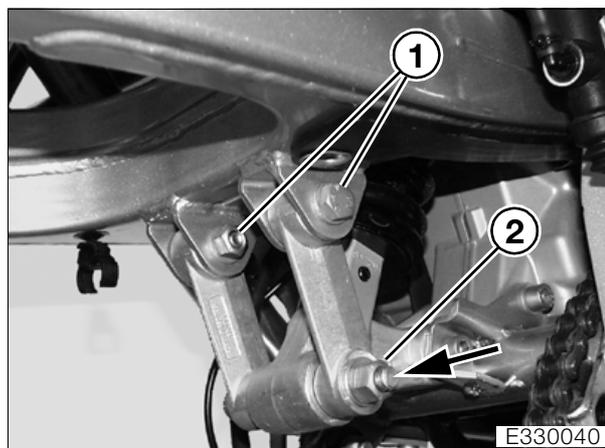
Press-in depth "A" 36.5 mm (1.44 in)



- Press in the outer needle roller races with drift, **BMW No. 33 6 651**, and spacing sleeve, **BMW No. 33 6 652**.
- Fit bearing bushes and sealing rings into swinging arm.

Press-in depth "B" 3 mm (0.12 in)

33 53 220 Removing and installing struts



- Remove nut (2).
- Slightly raise the rear wheel and pull double end stud (arrow) to the left to remove.
- Remove the fasteners securing the struts to swinging arm (1).
- Remove the tension struts.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Grease needle bearings with **Shell Retinax EP2**.



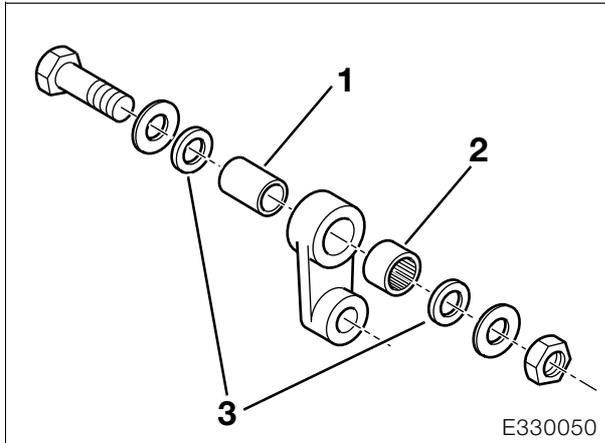
Tightening torques:

Tension strut to swinging arm 41 Nm
 Strut to angled lever 71 Nm

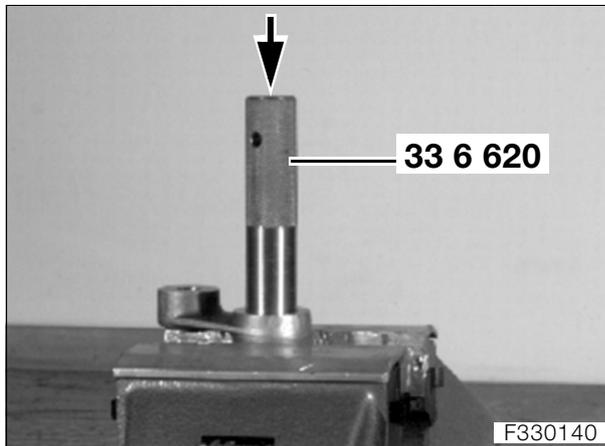
33 53 620 Removing and installing needle roller bearing in tension strut

Removing needle roller bearing

- Remove left and right tension struts.



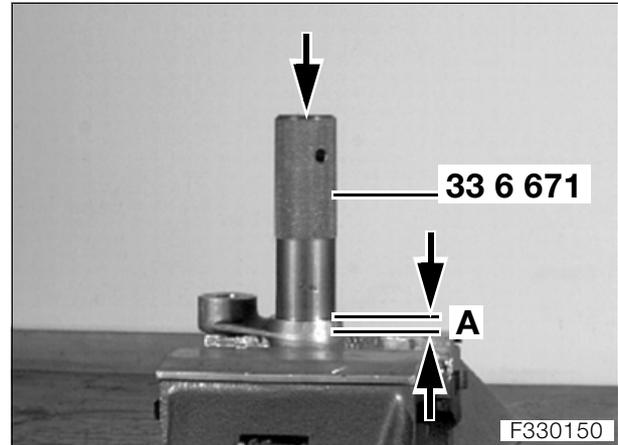
- Remove bearing bushing (1).
- Lever out sealing rings (3) with screwdriver.



- Drive out needle roller bearing (2) with drift, **BMW No. 33 6 620**.

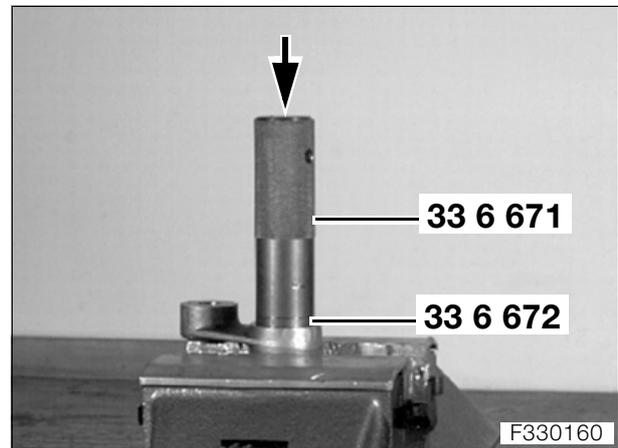
Installing needle roller bearing

- Heat bearing seats to 100 °C (212 °F).



- Press in needle roller bearing (2) with drift, **BMW No. 33 6 671**.

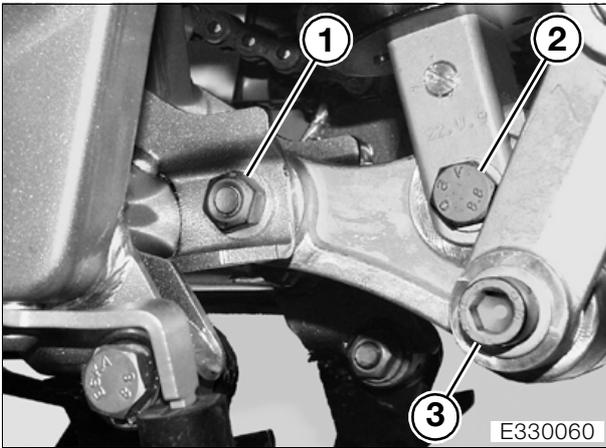
Press-in depth "A" 4.5 mm (0.18 in)



- Press in sealing rings (3) with drift, **BMW No. 33 6 671**, and spacing ring, **BMW No. 33 6 672**.
- Fit bearing bushing (1).



33 53 200 Removing and installing angled lever



- Slacken the nut of the fastener securing the strut to the angled lever (3).
- Slightly raise the rear wheel and withdraw fastener (3).
- Remove the fastener securing the angled lever to spring strut (2).
- Remove the fastener securing the angled lever to frame (1) and remove the angled lever.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Grease needle bearings with **Shell Retinax EP2**.



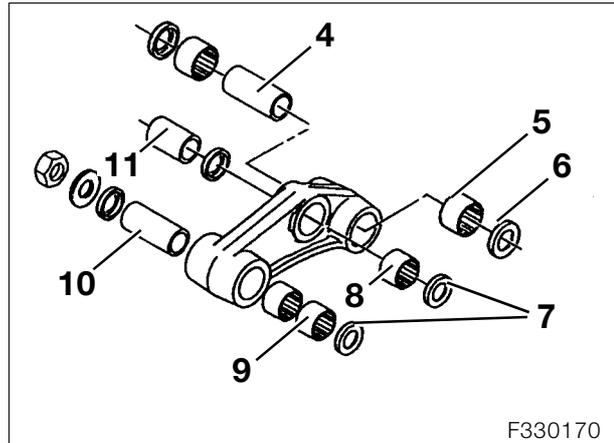
Tightening torques:

Angled lever to frame	50 Nm
Angled lever to spring strut	47 Nm
Angled lever to strut	71 Nm

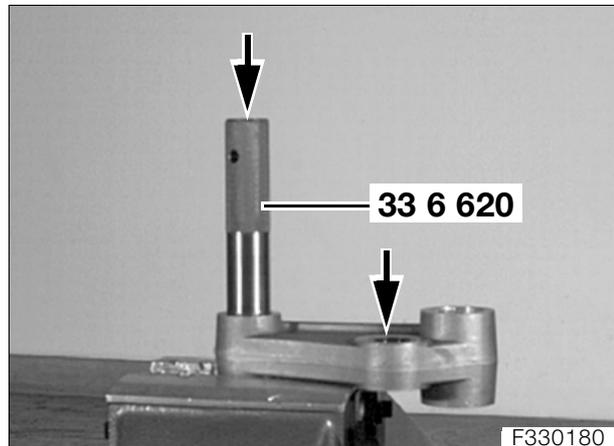
33 53 610 Removing and installing needle roller bearings and needle roller races in angled lever

Removing needle roller bearings and needle roller races

- Remove angled lever.



- Remove bearing bushings (4, 11, 10).
- Lever out sealing rings (6, 7) with screwdriver.



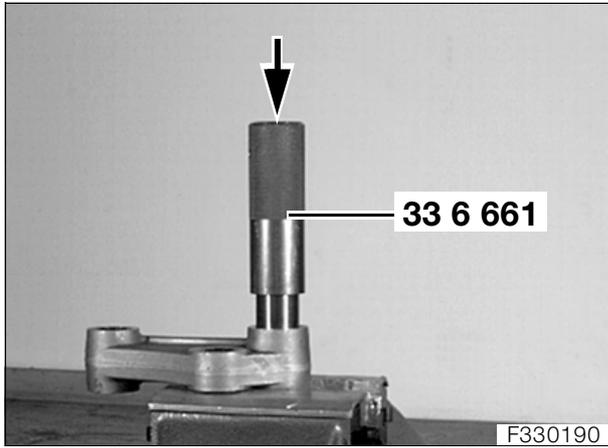
Note:

To facilitate removal, heat the angled lever to 100 °C (212 °F).

Use temperature measuring device,

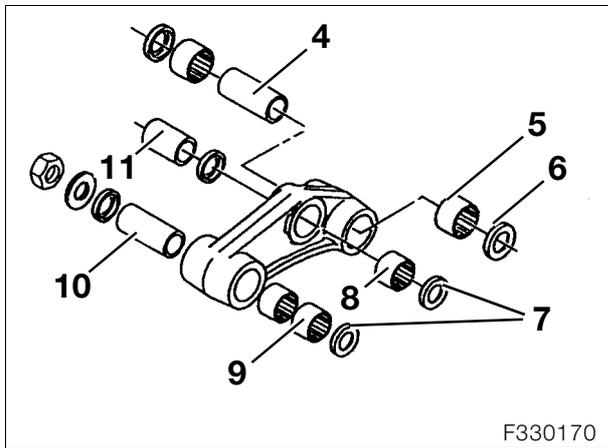
BMW No. 00 1 900, to check heat rise.

- Drive out needle roller bearings (8, 9) with drift, **BMW No. 33 6 620**.

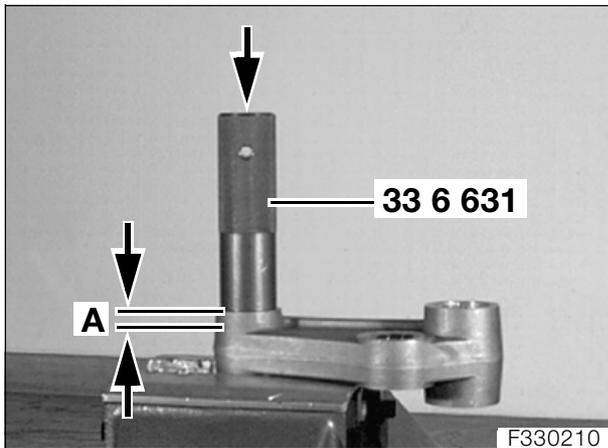


- Drive out needle roller races (5) with drift, **BMW No. 33 6 661**.

Installing needle roller bearings and needle roller races

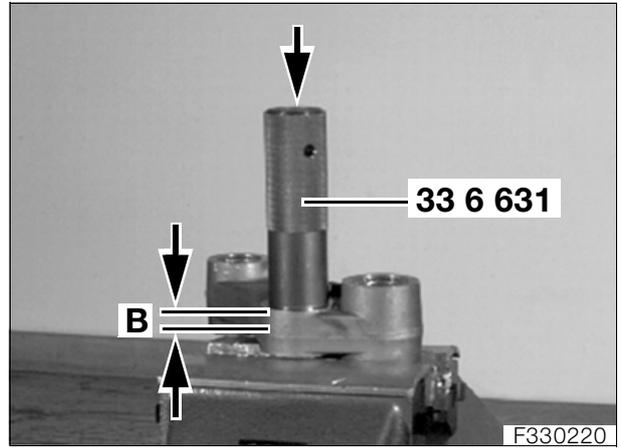


- Heat bearing seats to 100 °C (212 °F).



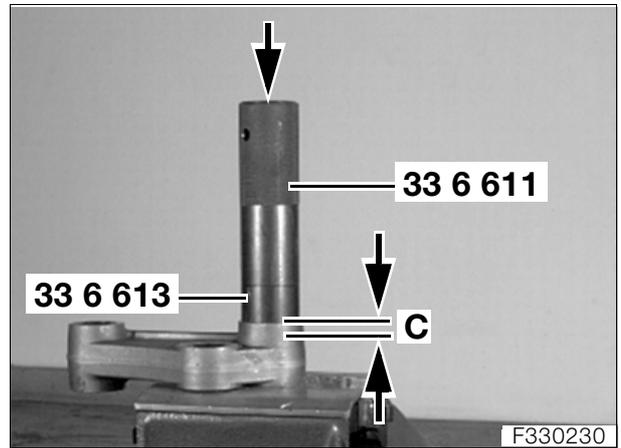
- Drive in needle roller bearing (9) with drift, **BMW No. 33 6 631**, working from both sides.

Press-in depth "A" 4 mm (0.16 in)



- Press in needle roller bearing (8) with drift, **BMW No. 33 6 631**.

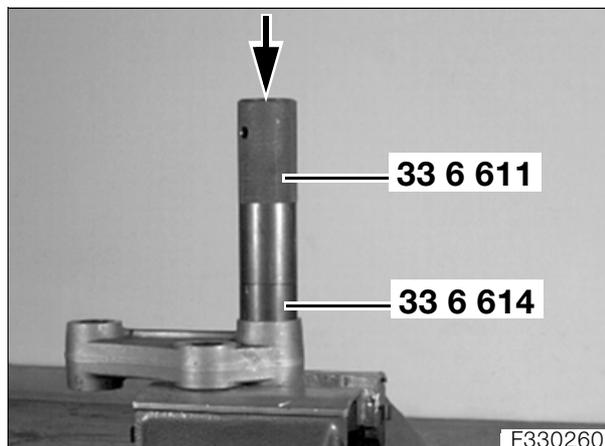
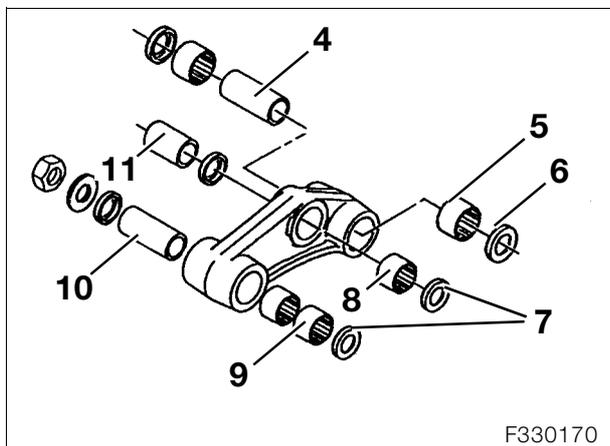
Press-in depth "B" 4 mm (0.16 in)



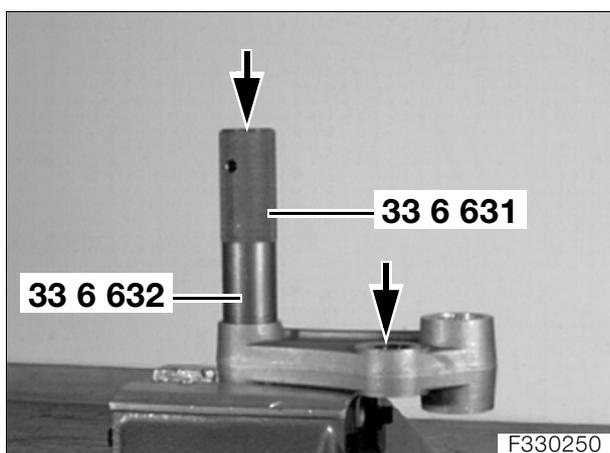
- Drive in needle roller races (5) with drift, **BMW No. 33 6 611**, and spacing sleeve, **BMW No. 33 6 613**, working from both sides.

Press-in depth "C" 4.5 mm (0.18 in)





- Press in sealing rings (6) with drift, **BMW No. 33 6 611**, and spacing ring, **BMW No. 33 6 614**.
- Install bearing bushings (4, 11, 10).



- Press in sealing rings (7) with drift, **BMW No. 33 6 631**, and spacing ring, **BMW No. 33 6 632**.

34 Brakes

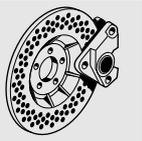
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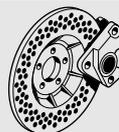
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Technical Data		F 650 GS
Brakes		
Brake fluid		DOT 4
Brake actuation		Hydraulic
Front wheel		
Front brake		2-piston floating calliper with rigidly mounted disc
Brake disc dia.	mm (in)	300 (11.81)
Brake-disc thickness	mm (in)	5 (0.20)
Minimum thickness	mm (in)	4.5 (0.18)
Permissible lateral runout	mm (in)	0.25 (0.010)
Brake pads		Sintered
Brake pad surface area	cm ² (sq in)	46 (7.1)
Minimum lining thickness	mm (in)	1 (0.04)
Piston dia. in brake calliper	mm (in)	30/32 (1.18/1.26)
Piston diameter in handlebar lever cylinder	mm (in)	13 (0.51)
Rear wheel		
Rear brake		1-piston floating calliper with rigidly mounted disc
Brake disc dia.	mm (in)	240 (9.45)
Brake-disc thickness	mm (in)	5 (0.20)
Minimum thickness	mm (in)	4.5 (0.18)
Permissible lateral runout	mm (in)	0.25 (0.010)
Brake pad surface area	cm ² (sq in)	29 (4.5)
Minimum lining thickness	mm (in)	1 (0.04)
Piston dia. in brake calliper	mm (in)	34 (1.34)
Piston dia. in foot brake cylinder	mm (in)	11 (0.43)
Brake pads		Organic





34 11 021 Removing and installing front brake calliper

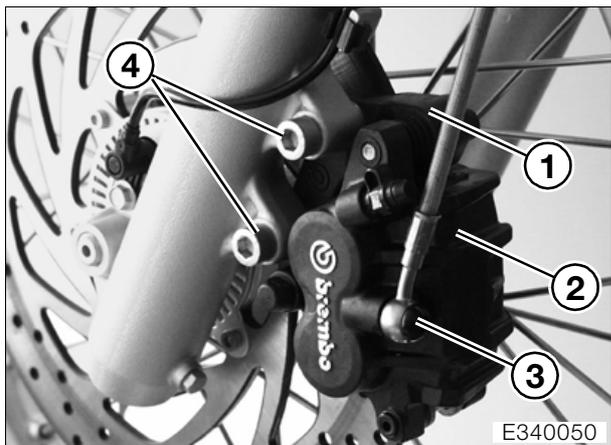
34 11 008 Removing and installing front brake pads



Caution:

Refer to notes on the hazards involved in handling brake fluid.

- Press the brake calliper against the brake disc in order to force the pistons back.



- Release brake line (3) at brake calliper and seal the line.
- Loosen retaining screws (4) for brake support bracket.
- Carefully pull brake carrier (1) with brake calliper (2) off the brake disc.



Caution:

Do not damage brake pads.

- Installation is the reverse of the removal procedure.



Note:

Remove sealing rings for brake line.



Caution:

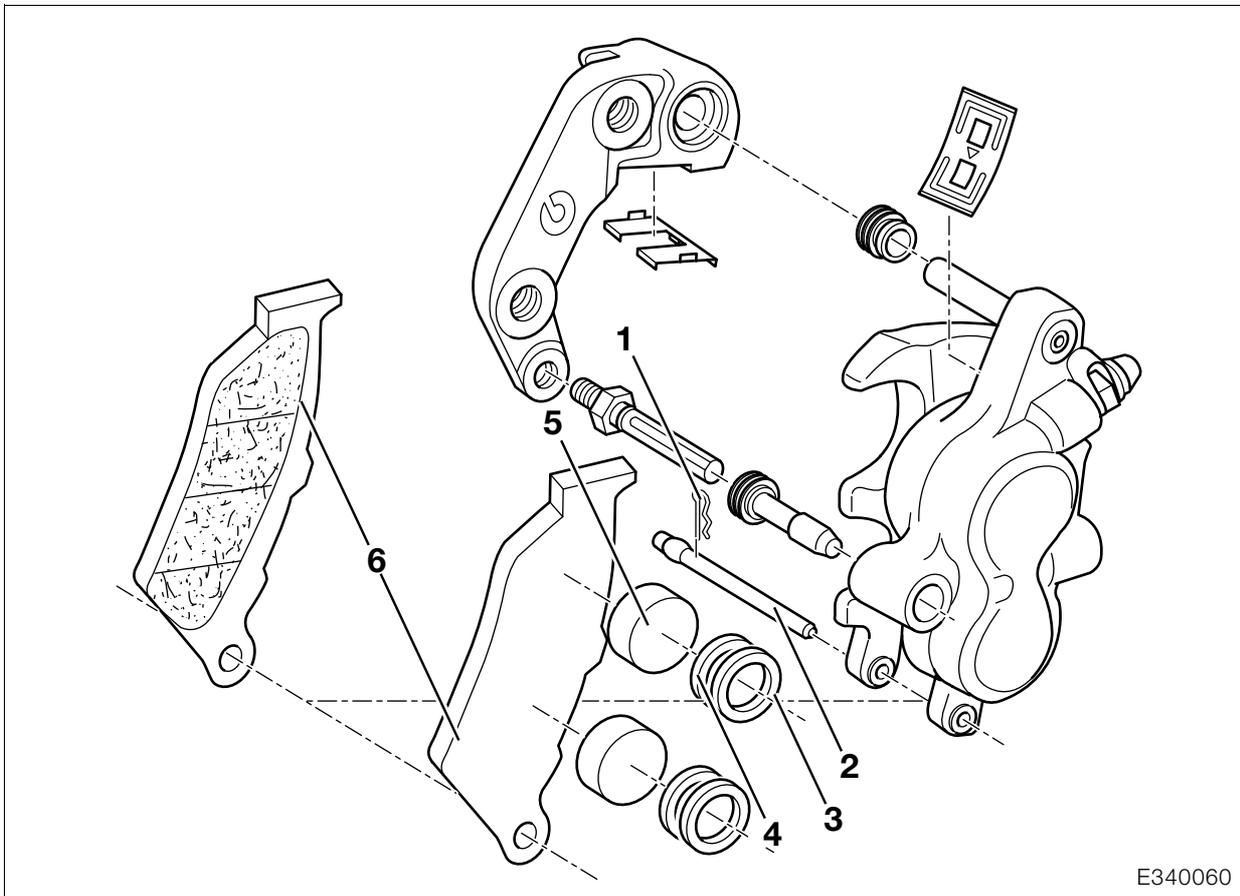
Top up brake fluid and bleed brake system.
Operate brake several times until brake pads are correctly seated.



Tightening torque:

Brake calliper to fork slider tube..... 41 Nm
Brake line to brake calliper 18 Nm





34 11 521 Removing and installing front brake pistons

- Remove front brake calliper.
- Remove the split-pin keeper (1) from retaining pin (2).
- Drive the retaining pin out towards the wheel side.
- Pull the brake pads (6) down to remove.
- Hold a cloth over the brake calliper.

Caution:

Do not insert your fingers between the pistons; risk of injury.

- **Carefully** press out brake pistons (5), using a compressed air gun at the brake line connection.

- Remove the two sealing rings (3, 4) from the left and right brake piston bores.
- Examine the brake calliper pistons for damage.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Coat new sealing rings (3, 4) with brake fluid and install.
- Coat the brake pistons (5) with the assembly fluid supplied and install.

Caution:

Keep the brake pistons parallel with their bores when installing.

- Using piston compressor, **BMW No. 34 1 500**, if necessary press the pistons fully back.
- Install the brake pads.

34 11 809 Removing and installing front brake disc

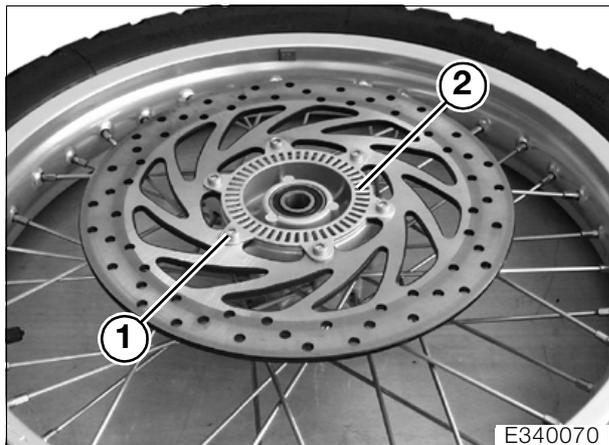


Caution:

Do not operate the brake with the wheel removed.

– Remove front wheel.

➔See Group 36



Note:

Retaining screws (1) are secured with **Loctite 243** and should be heated if necessary before removal.

- Remove retaining screws (1) with brake disc.
- **[ABS]** Remove sensor ring (2).
- Remove brake disc.



Caution:

The inscription on the brake disc must face towards the outside.

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 243** and install the screws.
- Check the ABS sensor gap and adjust if necessary.

➔See Group 34



Tightening torque:

Brake disc to front-wheel hub
(clean thread + Loctite 243)..... 9 Nm

Checking brake disc for wear

See Group 00

Checking front brake disc for lateral runout

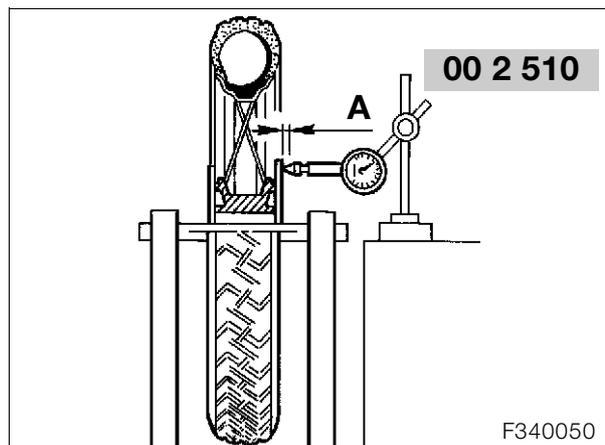


Caution:

Do not operate the brake with the wheel removed.

– Remove front wheel.

➔See Group 36



- Mount front wheel on balancing stand, **BMW No. 36 3 617**, with balancing shaft, **BMW No. 36 3 600**.
- Using dial gauge, **BMW No. 00 2 510**, measure lateral runout.

Lateral runout "A" max. 0.25 mm (0.010 in)

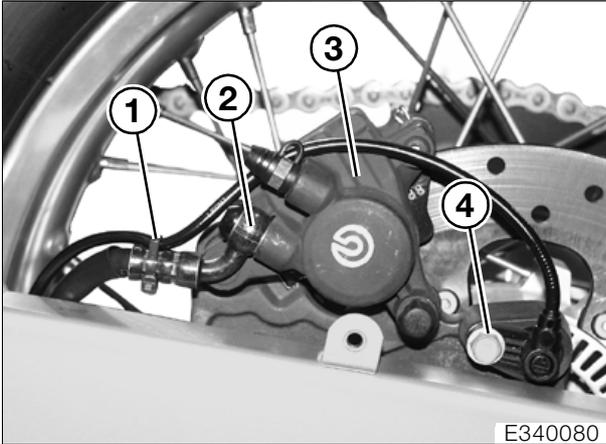
34 21 222 Removing and installing rear brake calliper



Caution:

Refer to notes on the hazards involved in handling brake fluid.

- Remove wheel cover together with chain cover.
- Press the brake calliper against the brake disc in order to force the pistons back



E340080

- Cut through cable tie (1).
- **[ABS]** Remove fastener securing ABS sensor (4) and remove ABS sensor.
- Disconnect brake line (2) at brake calliper and seal the line.



Caution:

Do not operate the brake with the wheel removed.

- Remove rear wheel.
- ➔See Group 36



Caution:

Do not damage brake pads.

- Remove brake calliper (3) from the rear swinging fork.

- Installation is the reverse of the removal procedure.



Note:

Remove sealing rings for brake line.



Caution:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are correctly seated.

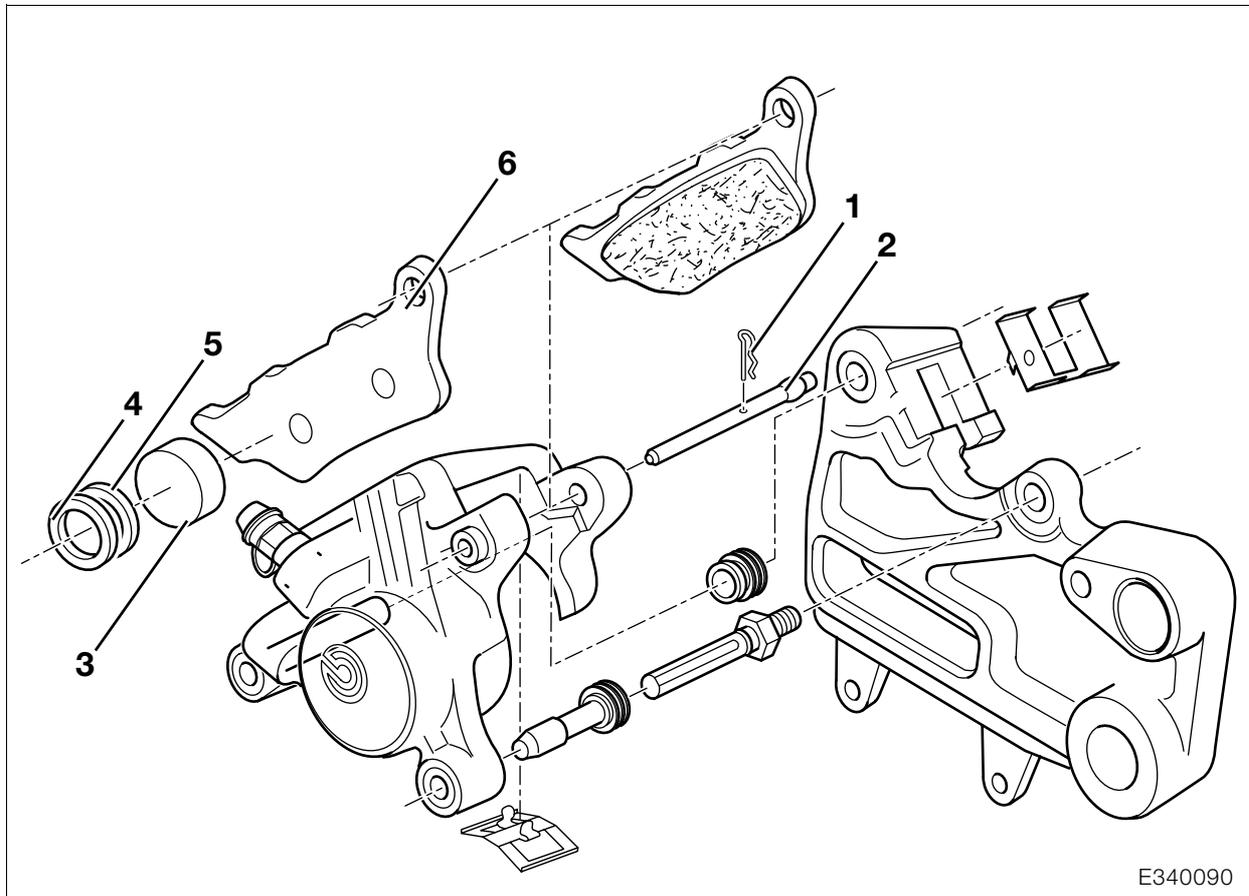


Tightening torque:

Brake line to brake calliper	18 Nm
ABS sensor to bracket	9 Nm
Quick-release axle	100 Nm
Wheel cover bracket to swinging arm.....	9 Nm

34 21 200 Removing and installing rear brake pads

See Group 00



E340090

Removing and installing rear brake piston

- Remove rear brake calliper.
- Remove the split-pin keeper (1) from retaining pin (2).
- Drive the retaining pin out towards the wheel side.
- Remove brake pads (6).
- Hold a cloth over the brake calliper.

Caution:

Do not insert your fingers between the pistons; risk of injury.

- **Carefully** press out brake piston (3), using a compressed air gun at the brake line connection.

- Remove the two sealing rings (4, 5) from the brake piston bore.
- Examine the brake calliper piston for damage.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Coat new sealing rings (4, 5) with brake fluid and install.
- Coat the brake piston (3) with the assembly fluid supplied and install.

Caution:

Keep the brake piston parallel with its bore when installing.

- Using piston compressor, **BMW No. 34 1 500**, if necessary press the piston fully back.
- Install the brake pads.

34 21 301 Removing and installing rear brake disc

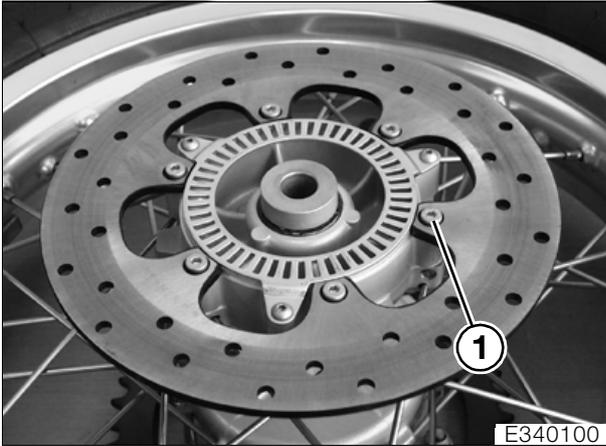


Caution:

Do not operate the brake with the wheel removed.

– Remove rear wheel.

➔See Group 36



Note:

Retaining screws (1) are secured with **Loctite 243** and should be heated if necessary before removal.

- Remove retaining screws (1) with brake disc.
- Remove brake disc.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

The inscription on the brake disc must face towards the outside.

- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 243** and install the screws.



Tightening torque:

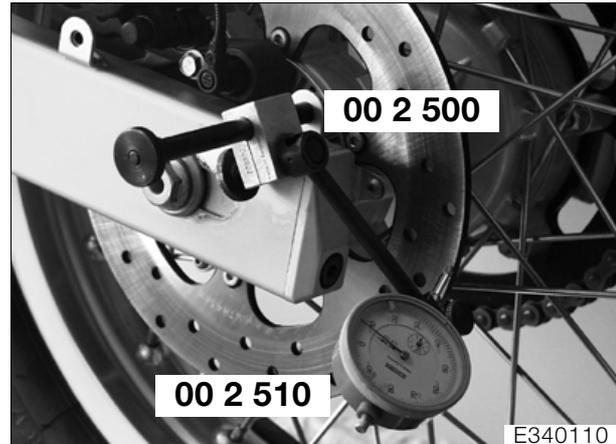
Brake disc to rear-wheel hub
(clean thread + Loctite 243)..... 9 Nm

Checking brake disc for wear

See Group 00

Checking rear brake disc for lateral runout

- Place motorcycle on its centre stand.
- Remove wheel cover together with chain cover.



- Attach dial gauge holder, **BMW No. 00 2 500**, to the rear swinging arm.
- Using dial gauge, **BMW No. 00 2 510**, measure lateral runout.

Lateral runout.....max. 0.25 mm (0.010 in)

Replacing primary sealing boot front brake master cylinder

See Group 00

Removing and installing front brake master cylinder

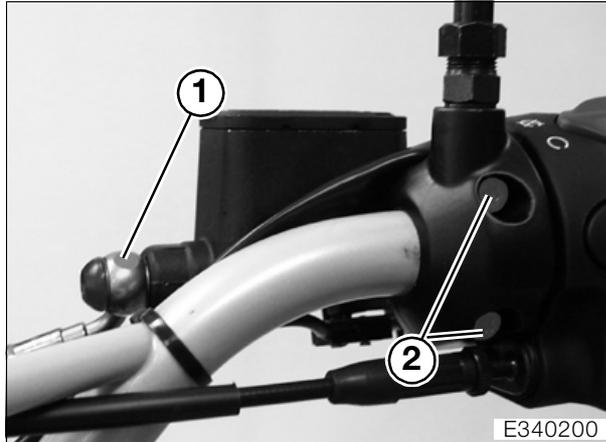
- Place the motorcycle on its main (centre) stand.



Caution:

Refer to notes on the hazards involved in handling brake fluid.

- Drain the brake system.
- Remove brake microswitch.



- Disconnect brake hose (1) from the brake master cylinder.
- Remove screws securing brake master cylinder (2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Replace the sealing rings for the brake hose.



Caution:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are correctly seated.



Tightening torque:

Brake hose to brake master cylinder 18 Nm
 Brake master cylinder to handlebar 9 Nm

32 72 119 Removing and installing handbrake lever

See Group 32

Replacing primary sealing boot, rear brake master cylinder

See Group 00

34 31 001 Removing and installing rear brake master cylinder

- Place the motorcycle on its main (centre) stand.

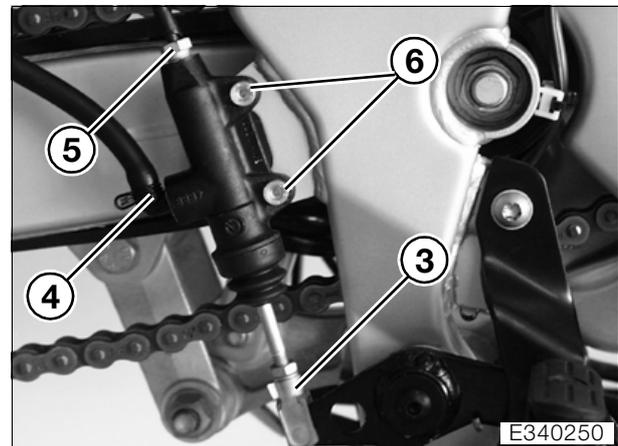


Caution:

Refer to notes on the hazards involved in handling brake fluid.

Do not operate the brake when dismantled.

- Drain the brake system.



- Disengage piston thrust rod (3).
- Disconnect brake line (5).
- Disconnect hose from reservoir (4).
- Remove fasteners (6) securing brake master cylinder.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Secure brake line to brake master cylinder.



! Caution:

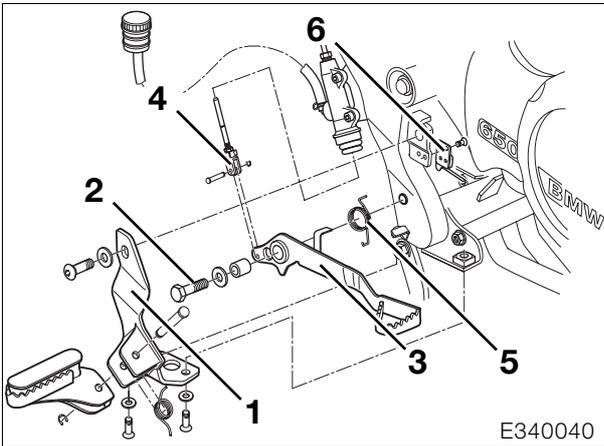
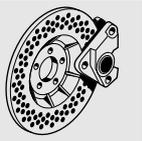
Top up brake fluid and bleed brake system.
Operate brake several times until brake pads rest on disc.

Play at piston thrust rod 0.5...1.5 mm (0.02...0.06 in)

! Tightening torque:

Brake line at master cylinder 18 Nm
Brake master cylinder to frame 9 Nm

35 21 000 Removing and installing footbrake lever



- Remove footrest plate (1).
- Disengage piston thrust rod (4).
- Remove hexagon fit bolt (2).
- Remove brake pedal (3), leaving torsion spring (5) on the frame.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

! Note:

Grease the bearing bushing with **Staburags NBU 30 PTM**.
Check play at piston thrust rod and adjust if necessary.
See removal and installation of brake master cylinder.

! Caution:

Check operation of brake-light switch (6).

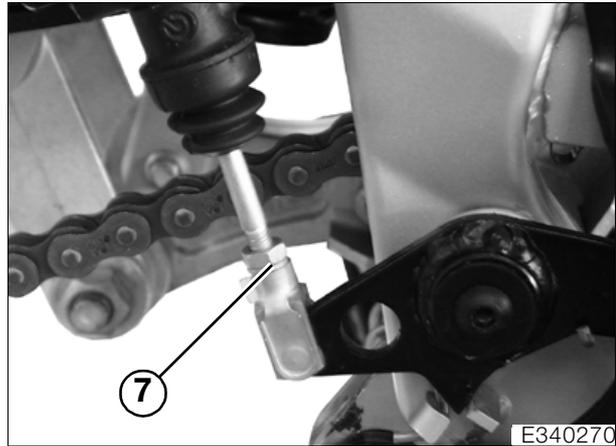
Play at piston thrust rod 0.5...1.5 mm (0.02...0.06 in)

! Tightening torque:

Brake pedal to frame 21 Nm

Checking play at piston thrust rod, adjusting if necessary

Checking play at piston thrust rod



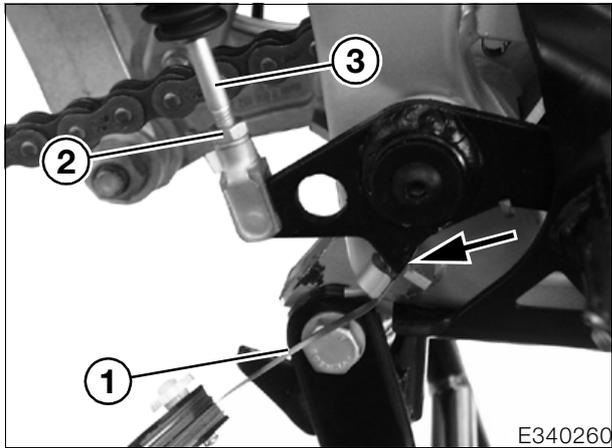
- With no load applied to the brake pedal, i.e. lug of lever against stop on frame (arrow), play must be perceptible at piston thrust rod (7).

! Note:

Adjust the piston thrust rod if no play is perceptible.

- Adjusting play at piston thrust rod
➔ See below.

Adjusting play at piston thrust rod

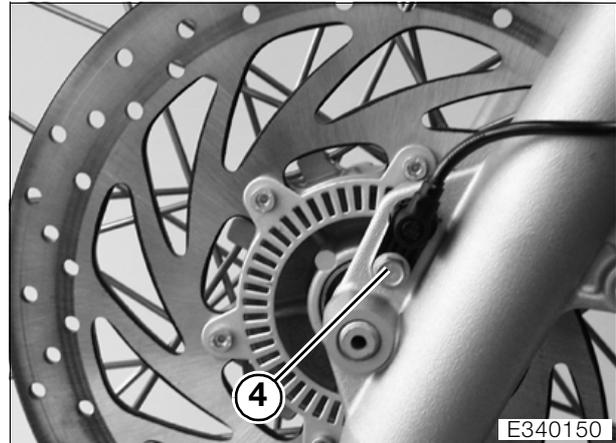


- Insert feeler gauge (1) 0.2 mm (0.008 in) thick between the lug of the brake pedal and the stop on the frame (arrow).
- Slacken nut (2) on the thrust rod at the brake master cylinder.
- Turn piston rod (3) clockwise to obtain play.
- Carefully back off piston rod to take up play and tighten locknut.
- Tighten the locknut on the piston rod and remove the feeler gauge.

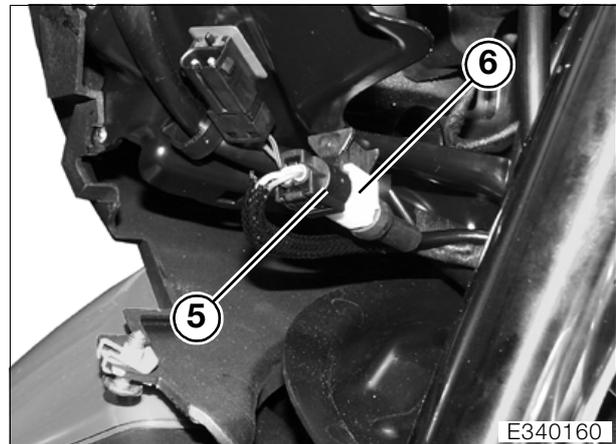
 **Tightening torques:**
 Locknut..... 9 Nm

34 52 044 Removing and installing front ABS sensor

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover.



- Remove the fastener securing ABS sensor (4) to the front fork.



- Disconnect ABS plug (5).
- Press ABS plug (6) to the rear and out of its holder.
- Cut the cable ties on the brake hose and the instrument carrier.
- Remove the sensor cable from the holder on the front fork.
- Remove the sensor and the cable.
- Installation is the reverse of the removal procedure.
- Check the ABS sensor gap and adjust if necessary.

➡ See Group 34

 **Tightening torques:**
 Front ABS sensor..... 9 Nm



34 51 610 Removing front ABS sensor ring

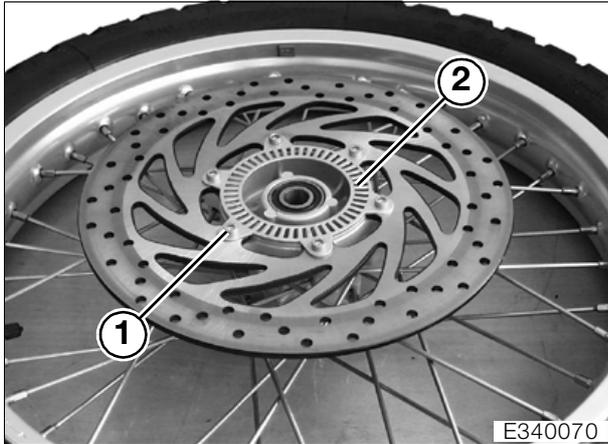


Caution:

Do not operate the brake with the wheel removed.

- Remove front wheel.

➡See Group 36



Note:

Retaining screws (1) are secured with **Loctite 243** and should be heated if necessary before removal.

- Remove retaining screws (1) from brake disc.
- Remove sensor ring (2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 243** and install the screws.
- Check the ABS sensor gap and adjust if necessary.

➡See Group 34

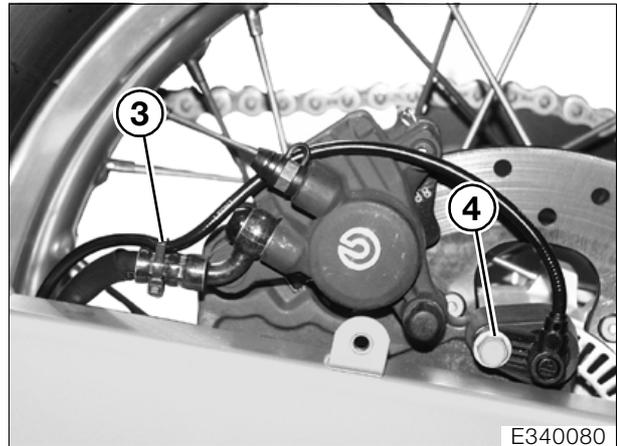


Tightening torque:

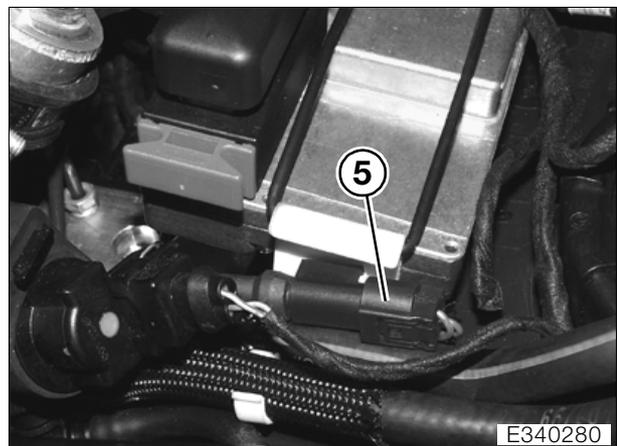
Brake disc to front-wheel hub
(clean thread + Loctite 243)..... 9 Nm

34 52 111 Removing and installing rear ABS sensor

- Place motorcycle on its centre stand.
- Remove seat.
- Remove wheel cover together with chain cover.



- Cut through cable tie (3).
- Remove fastener securing ABS sensor (4) and remove ABS sensor.



- Disconnect ABS sensor plug (5) and unclip the plug from the control-unit holder.
- Raise the rear frame.
- ➡See Group 46
- Remove the ABS sensor cable from the clip on the holder of the ABS control unit.
- Cut the cable tie at the interface between brake line and brake hose.
- Open 2 clips on the swinging arm and remove the ABS sensor cable.

- Cut the cable ties on the brake hose.
 - Installation is the reverse of the removal procedure.
 - Check the speed/ABS sensor gap and adjust if necessary.
- ➡See Group 34



Tightening torque:

ABS sensor to holder 9 Nm
 Wheel cover bracket to swinging arm..... 9 Nm

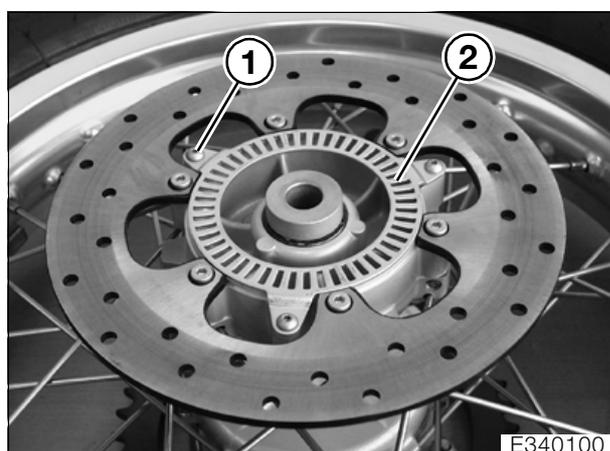
34 51 619 Removing and installing rear ABS sensor ring



Caution:

Do not operate the brake with the wheel removed.

- Remove rear wheel.
- ➡See Group 36



Note:

Retaining screws (1) are secured with Loctite 243 and should be heated if necessary before removal.

- Remove securing screws (1) from sensor ring.
- Remove sensor ring (2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 243** and install the screws.
- Check the speed/ABS sensor gap and adjust if necessary.

➡See Group 34



Tightening torque:

Sensor ring to rear-wheel hub
 (clean thread + Loctite 243)..... 5 Nm

34 51 050 Removing and installing ABS control unit



Caution:

All work on the ABS control unit must be carried out by an authorised BMW workshop.

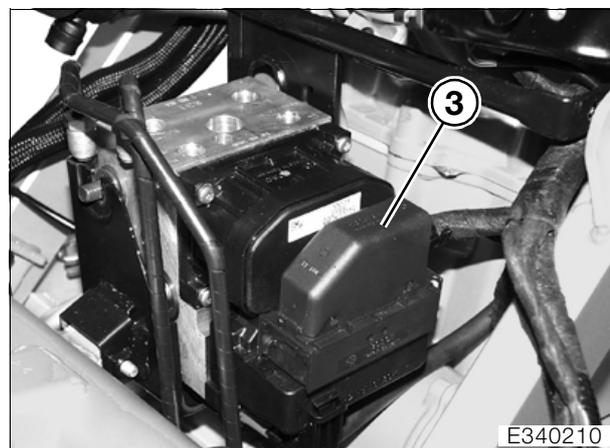
- Remove the rear frame.
- ➡See Group 46
- Remove front brake lines.
- ➡ See below



Caution:

If brake fluid escapes, it may damage paint. Line connections must be protected against dirt penetration; seal or cover ends of lines and ports.

- Disconnect rear brake line from control unit.
- Remove screws securing the control unit to the holder.



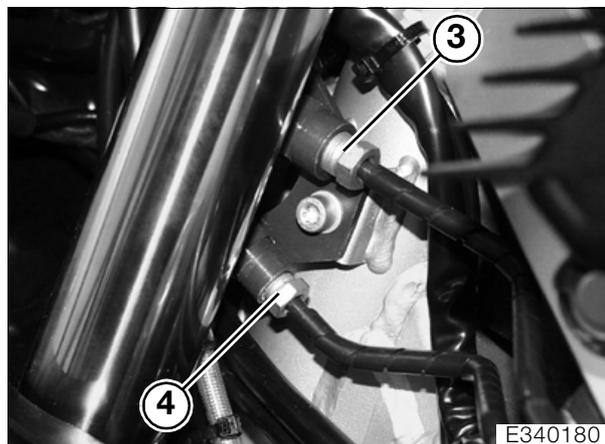
- Disconnect plug for control unit (3).
- Carefully push the rear brake lines to one side.
- Lift the control unit, pull it to the rear and remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

⚠ Caution:

Top up brake fluid and bleed brake system.
Operate brake several times until brake pads rest on disc.

🔧 Tightening torque:

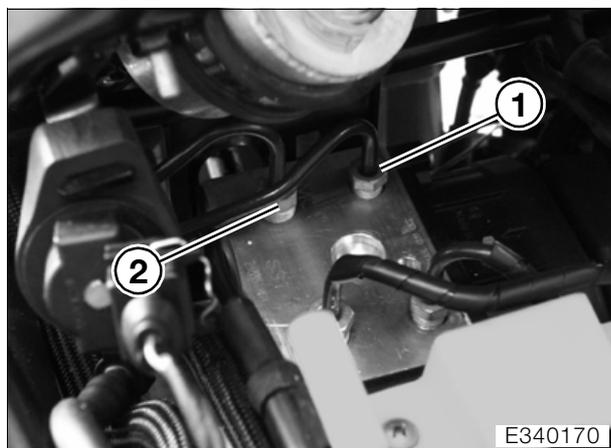
Brake line to ABS control unit	18 Nm
Brake line at interface to brake hose	18 Nm
Expansion tank to radiator.....	9 Nm
ABS control unit to holder	21 Nm



Removing and installing front brake lines/hoses (with ABS)

Removing and installing brake lines

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover.
- Drain the brake system.
- Disconnect the expansion tank and pull it to one side.



- Disconnect brake line to brake calliper (1) and brake line to brake master cylinder (2) at control unit.

- Disconnect brake line to brake calliper (4) and brake line to brake master cylinder (3) at interface.
- Release the brake line from the clips on the frame.
- Remove the brake lines.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Begin by installing the brake line from the brake master cylinder to the ABS control unit and then tighten the securing screw on the control unit.
- Tighten the screws securing the brake lines to the control unit and the interface to the brake hoses.

⚠ Caution:

Top up brake fluid and bleed brake system.
Operate brake several times until brake pads are correctly seated.

🔧 Tightening torque:

Brake line to ABS control unit	18 Nm
Brake line at interface to brake hose	18 Nm
Expansion tank to radiator	9 Nm

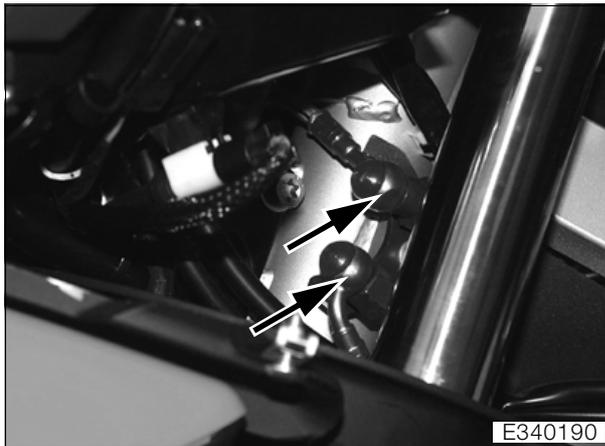
34 32 401 Removing and installing front brake hoses

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover.

 **Caution:**

Refer to notes on the hazards involved in handling brake fluid.

- Drain the brake system.
- Disconnect brake hose from brake calliper.



- **[ABS]** Disconnect the brake hoses at the interface to the brake lines (arrows).
- Cut the cable ties on the brake hose and the sensor cable.
- Disconnect the brake hose from the brake master cylinder.
- Release the brake hose from the clip on the throttle cable.
- Remove the brake hose.
- **[ABS]** Remove both brake hoses.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

 **Note:**

Replace the sealing rings for the brake hoses.

 **Caution:**

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are correctly seated.

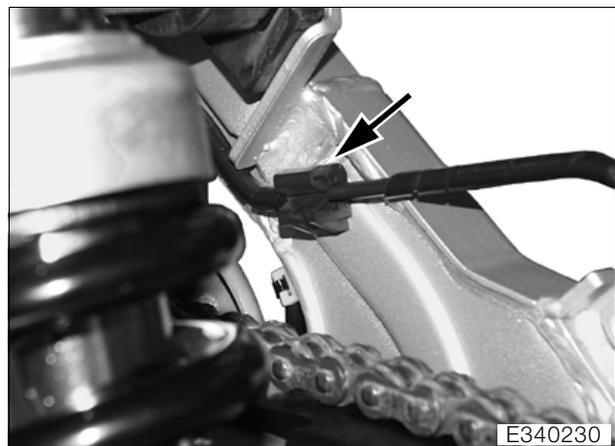
 **Tightening torque:**

Brake hose to brake master cylinder	18 Nm
Brake hose to brake calliper.....	18 Nm
Brake hose at interface to brake line	18 Nm

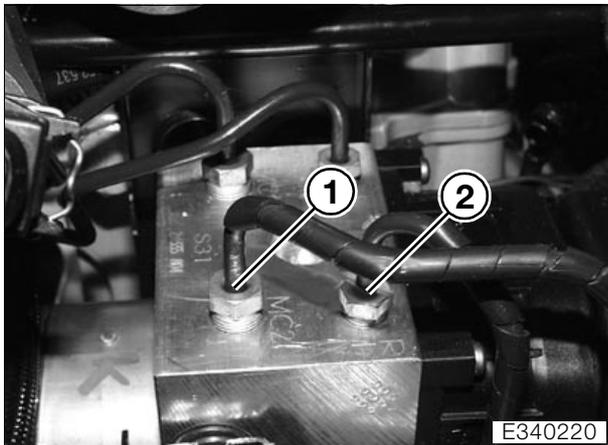
Removing and installing rear brake lines/hoses (with ABS)

Removing and installing brake lines

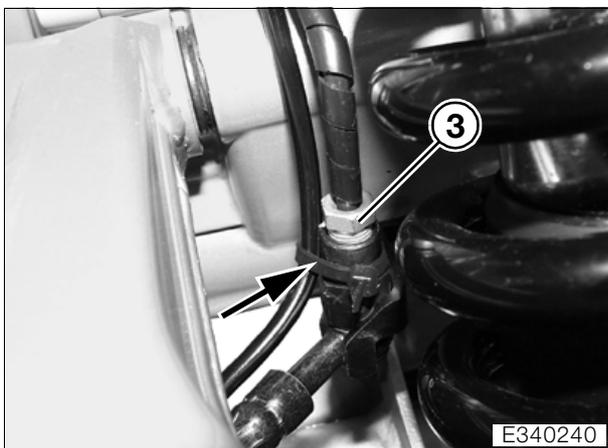
- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Drain the rear brake system.
- Disconnect brake line from brake master cylinder.
- Raise the rear frame.
- ➡See Group 46



- Release the brake line from the holder (arrow) on the frame.



- Disconnect brake line to brake master cylinder (1) before disconnecting brake line to brake calliper (2) at control unit.
- Lift the brake line, turn it and pull it to the rear to remove.
- Disconnect the brake line at the interface to the hose at the control unit.



- Cut through cable tie (arrow).
- Disconnect brake line (3) at interface to brake hose.
- Pull the brake line to the rear to remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Retighten brake line at interface to brake hose.
- Tighten the screws securing the brake line to the control unit.
- Secure brake line to brake master cylinder.

⚠ Caution:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are correctly seated.

🔧 Tightening torque:

Brake line to ABS control unit 18 Nm
 Brake line at interface to brake hose 18 Nm
 Brake line to brake master cylinder 18 Nm

34 52 080 Removing and installing brake hose

- Place the motorcycle on its main (centre) stand.
- Drain the brake system.
- Cut the 2 cable ties on the brake hose and the ABS sensor cable.
- Disconnect brake hose from brake calliper.
- Disconnect brake hose at interface to brake line.
- Open 2 clips on the swinging arm and remove the brake hose.
- Release the brake hose from the clips on the swinging arm.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

📄 Note:

Replace the sealing rings for the brake hoses.

⚠ Caution:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are correctly seated.

🔧 Tightening torque:

Brake hose at interface to brake line 18 Nm
 Brake hose to brake calliper 18 Nm

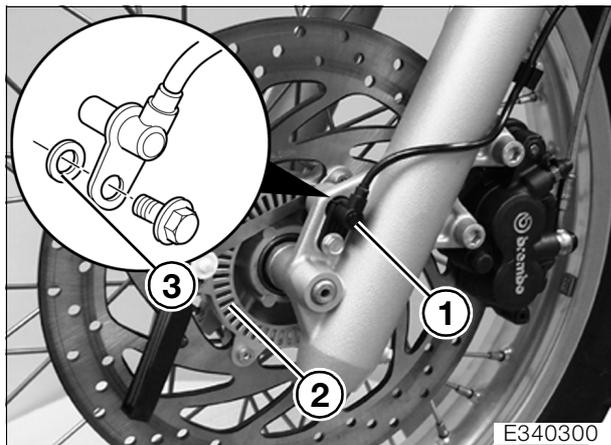
34 52 544 Checking/adjusting front ABS sensor gap



Caution:

Always check the ABS sensor gap after replacement of ABS sensor, sensor ring, wheel bearing, front wheel, front forks, spacer, quick-release axle or brake disc.

- Lift front wheel clear of the ground.



- Using a feeler gauge, measure the gap between ABS sensor (1) and sensor ring (2) at three points 120° apart.

Adjusting ABS sensor gap

- If gap is greater than 1 mm (0.04 in) at one or more points.
 - Remove ABS sensor (1).
 - Remove washer (3).
- If gap is less than 0.1 mm (0.004 in) at one or more points.
 - Slacken ABS sensor (1).
 - Install washer (3).



Caution:

After adjusting, spin the wheel and make sure that the ABS sensor does not touch the sensor ring.

ABS sensor gap 0.10...1.0 mm (0.004...0.04 in)



Tightening torque:

Front ABS sensor 9 Nm

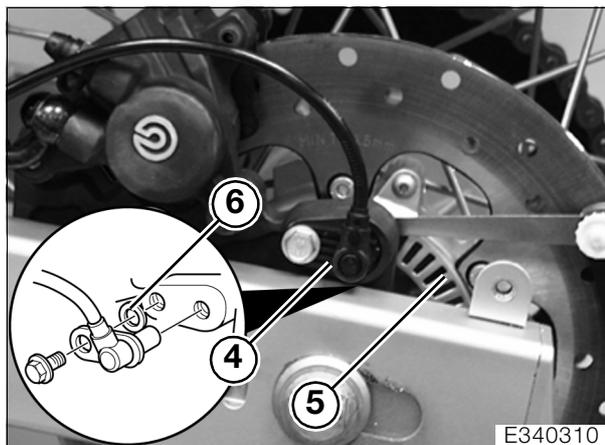
34 52 544 Checking/adjusting rear speed/ABS sensor gap



Caution:

Always check the speed/ABS sensor gap after replacement of ABS sensor, sensor ring, brake-calliper bracket, spacer sleeve, rear wheel or wheel bearing.

- Lift rear wheel clear of the ground.
- Remove wheel cover and chain cover.



- Using a feeler gauge, measure the gap between ABS sensor (4) and sensor ring (5) at three points 120° apart.

Adjusting ABS sensor gap

- If gap is greater than 1 mm (0.04 in) at one or more points.
 - Remove ABS sensor (4).
 - Remove washer (6).
- If gap is less than 0.1 mm (0.004 in) at one or more points.
 - Slacken ABS sensor (4).
 - Install washer (6).



Caution:

After adjusting, spin the wheel and make sure that the ABS sensor does not touch the sensor ring.

ABS sensor gap 0.10...1.0 mm (0.004...0.04 in)



Tightening torque:

Rear ABS sensor..... 9 Nm



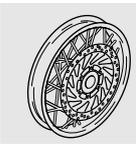


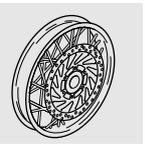
36 Wheels and tyres

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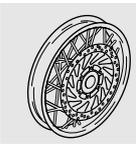
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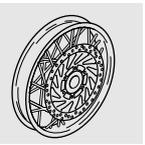
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Technical Data			F 650 GS
Wheels and tyres			
Rim size	Front Rear		2.50"x19" 3.00"x17"
Vertical runout		mm (in)	2.0 (0.08)
Lateral runout		mm (in)	2.0 (0.08)
Maximum permissible imbalance		g (oz.)	5 (0.18)
Tyre size	Front Rear		100/90-19 130/80-17
Tyre pressures (tyres cold)			
Solo	Front	bar (psi)	1.9 (27.0)
Solo	Rear	bar (psi)	2.1 (30.0)
Full load	Front	bar (psi)	2.1 (30.0)
Full load	Rear	bar (psi)	2.3 (33.0)





36 30 300 Removing/installing front wheel

36 30 300 Removing front wheel

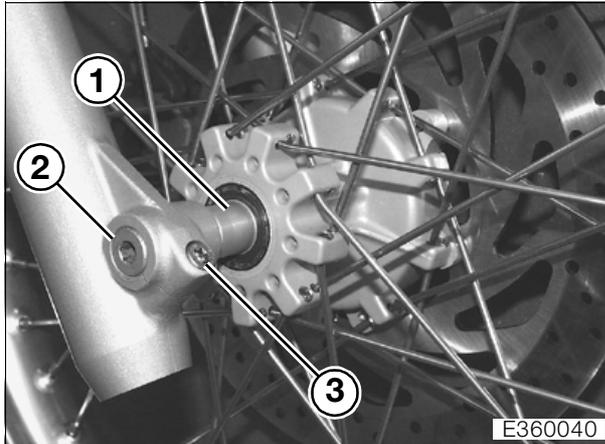
- Place motorcycle on its centre stand.
- Take load off front wheel/lift clear of ground.



Caution:

When removing, avoid damage to ABS sensor, sensor ring, brake disc and brake pads.

- Press the brake calliper against the brake disc in order to force the pistons back.



- Slacken clamp screw (3) for the quick-release axle.
- Loosen quick-release axle (2).



- Raise the front wheel and remove quick-release axle (2) and lift out spacer (4).



Caution:

Do not operate the handbrake lever when the wheel is removed.

Protect the wheel bearings against dirt and moisture.

- Take the front wheel out forwards.

36 30 300 Installing the front wheel



Caution:

When installing, avoid damage to ABS sensor, sensor ring, brake disc and brake pads.

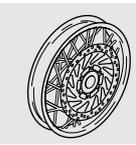
- Clean the quick-release axle and the contact face of the shaft sealing ring and grease them with **Optimoly TA**.
- Install spacer sleeve (1).
- Insert the front wheel between the telescopic fork legs.
- Install quick-release axle (2) with spacer (4).
- Firmly tighten quick-release axle.
- Lower the front wheel to the ground and, with the handbrake applied, compress the front suspension firmly several times.
- Tighten clamp screw (3) for the quick-release axle.
- Check the ABS sensor gap and adjust if necessary.

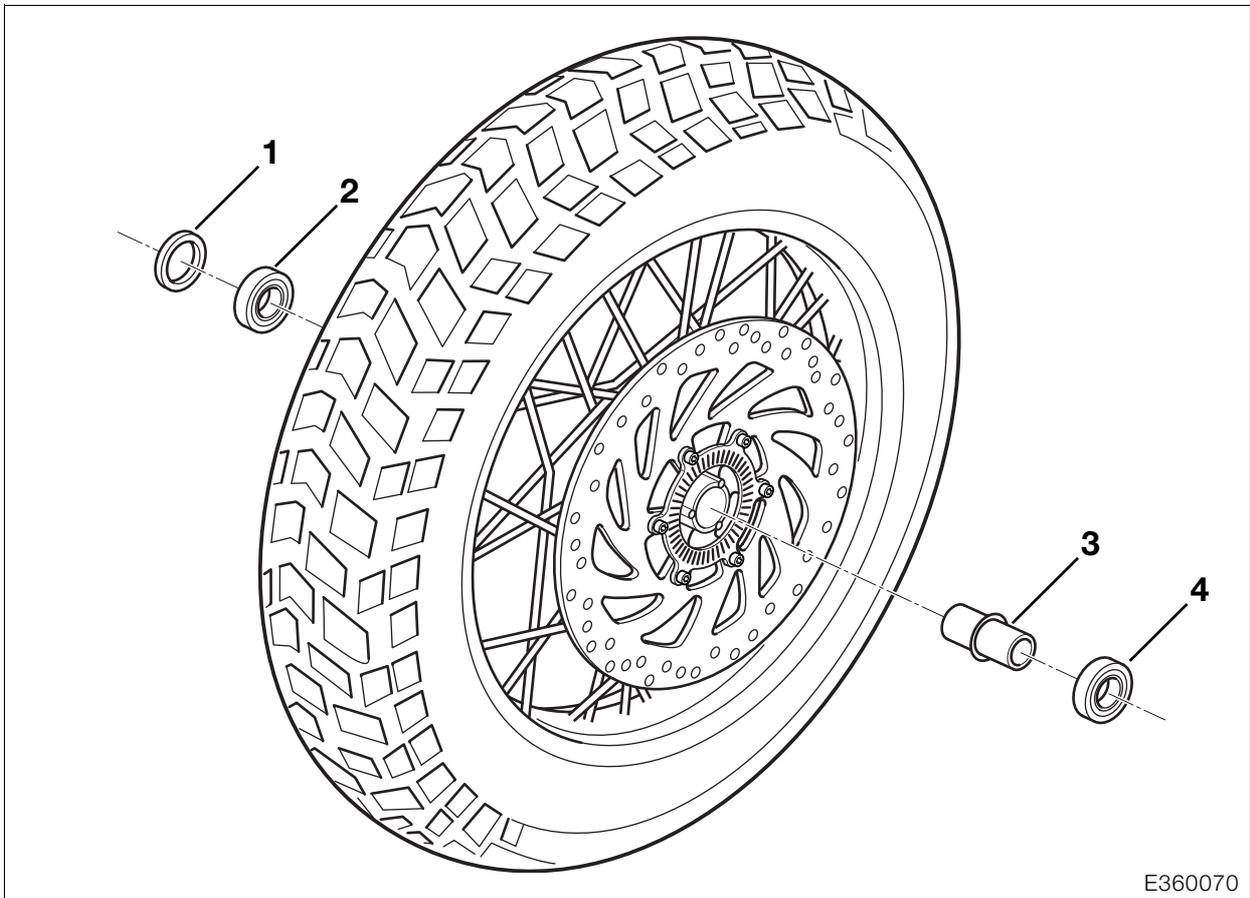
➔See Group 34



Tightening torques:

Quick-release axle 80 Nm
 Clamp screw 23 Nm

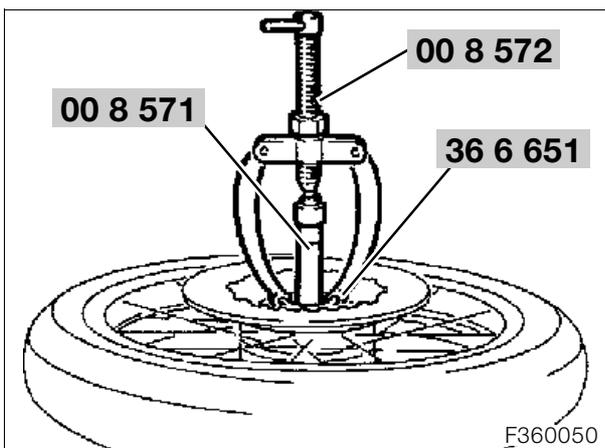




E360070

36 31 851 Removing/installing front wheel bearing

- Remove front wheel.



F360050



Note:

To facilitate removal or installation, heat the bearing seat to 100 °C (212 °F).
To avoid damaging the wheel hub, use support ring, **BMW No. 36 6 651**.

Removing left-hand wheel bearing

- Remove wheel bearing (4) with counter-support, **BMW No. 00 8 572**, internal puller, **BMW No. 00 8 571**, and support ring, **BMW No. 36 6 651**.
- Remove spacer sleeve (3).

Removing right-hand wheel bearing

- Lever out shaft sealing ring (1) with screwdriver.
- Remove bearing (2) with counter-support, **BMW No. 00 8 572**, internal puller, **BMW No. 00 8 571**, and support ring, **BMW No. 36 6 651**.

36 31 851 Installing wheel bearings

- Clean the bearing seats.
- Drive in the left-hand wheel bearing with drift, **BMW No. 36 6 600**.
- Install the spacer bushing.
- Drive in the right-hand wheel bearing with drift, **BMW No. 36 6 600**, until seated, making sure that the load is supported only on the left-hand wheel bearing.

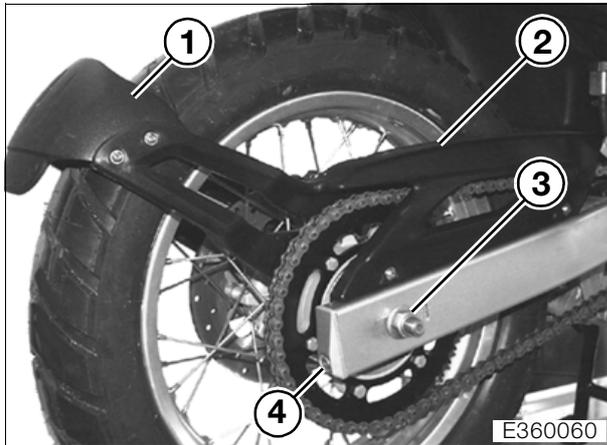


Note:

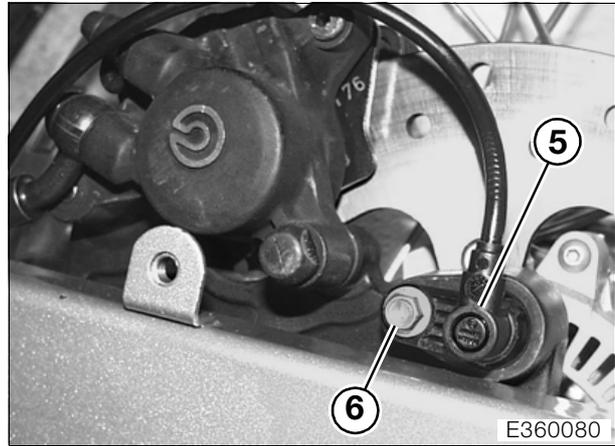
The left-hand bearing must be seated on the stop in the wheel hub. The spacer sleeve between the two bearings should have no more than minimal axial clearance, if any.

- Drive in the new shaft sealing ring with a drift, **BMW No. 36 6 600**.
 - Check the ABS sensor gap and adjust if necessary.
- ➔See Group 34

36 30 320 Removing/installing rear wheel



- Place motorcycle on its centre stand.
- Remove wheel cover (1) together with chain guard (2).



- Remove fastener (6) and remove ABS sensor (5) from its holder.
- Press the brake calliper against the brake disc in order to force the pistons back.
- Loosen chain tensioning screws (4) on left and right sides.
- Unscrew quick-release axle nut (3).
- Remove chain from chainwheel.
- Remove quick-release axle.



Caution:

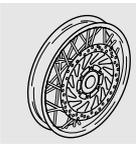
Do not operate the brake pedal when the wheel is removed.

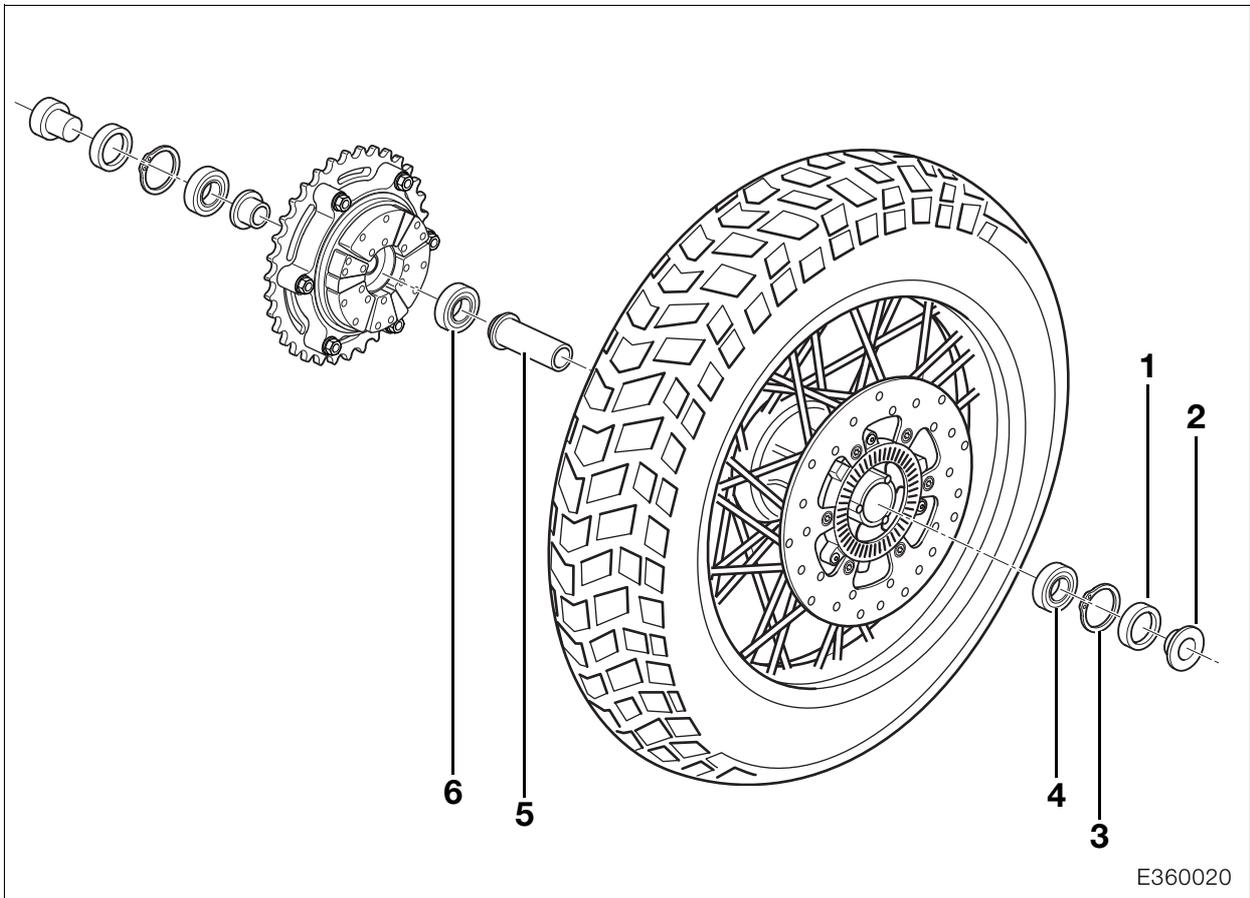
- Pull the wheel to the rear to remove.
 - Installation is the reverse of the removal procedure: pay particular attention to the following.
 - Clean the quick-release axle and the contact face of the shaft sealing ring and grease them with **Optimoly TA**.
 - Adjust chain tension.
- ➔See Group 00
- Check the speed/ABS sensor gap and adjust if necessary.
- ➔See Group 34



Tightening torques:

Quick-release axle 100 Nm
 Wheel cover bracket to swinging arm..... 9 Nm
 ABS sensor to holder 9 Nm





E360020

36 31 861 Removing/installing rear wheel bearings

- Remove rear wheel.
- Remove chainwheel carrier with chainwheel from rear wheel hub.
- Lay the wheel on two wooden blocks so that the brake disc is clear of the bench.



Note:

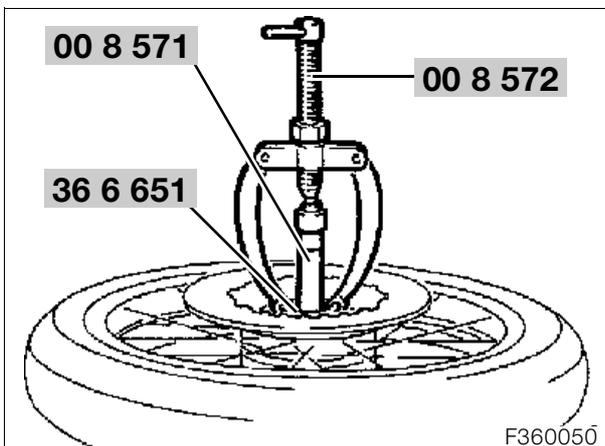
To facilitate removal or installation, heat the wheel hub to 100 °C (212 °F). Use temperature measuring device, **BMW No. 00 1 900**, to check heat rise.

Removing left-hand wheel bearing

- Remove spacer (2).
- Lever out shaft sealing ring (1) with screwdriver.
- Remove circlip (3) with suitable pliers.
- Remove wheel bearing (4) with counter-support, **BMW No. 00 8 572**, internal puller, **BMW No. 00 8 571**, and support ring, **BMW No. 36 6 651**.

Removing right-hand wheel bearing

- Remove wheel bearing (5) with counter-support, **BMW No. 00 8 572**, and internal puller, **BMW No. 00 8 571**.
- Remove spacer sleeve (6).



F360050

36 31 861 Installing wheel bearings

- Clean the bearing seats.
- Drive in the wheel bearing with drift, **BMW No. 36 6 600**, until seated, and install the locking ring.
- Slide the spacer sleeve into the wheel hub from the right.
- Drive in the right-hand wheel bearing with drift, **BMW No. 36 6 600**, making sure that the load is supported only on the left-hand wheel bearing.



Note:

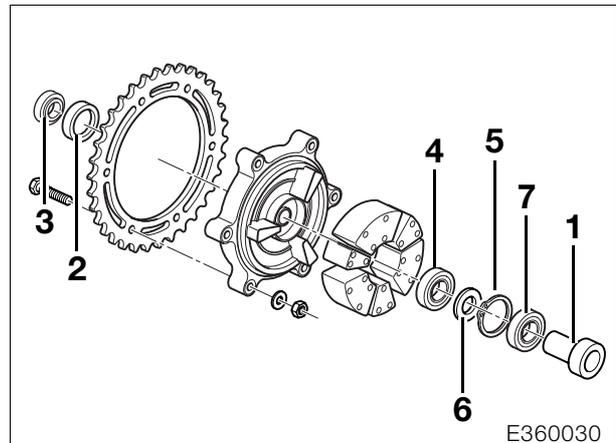
The left-hand bearing must be seated on the stop in the wheel hub. The spacer sleeve between the two bearings should have no more than minimal axial clearance, if any.

- Drive in shaft sealing ring with drift, **BMW No. 36 6 600**, and grease the friction face with **Optimoly TA**.
- Check the speed/ABS sensor gap and adjust if necessary.

➔See Group 34

Removing/installing bearing in chain-wheel carrier

- Remove rear wheel.
- Remove drive damper.



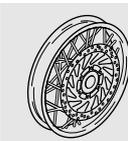
- Remove spacer sleeve (1).
- Remove spacer sleeve (3).
- Lever out shaft sealing ring (2) with screwdriver.
- Heat the hub to approx. 100 °C (212 °F).

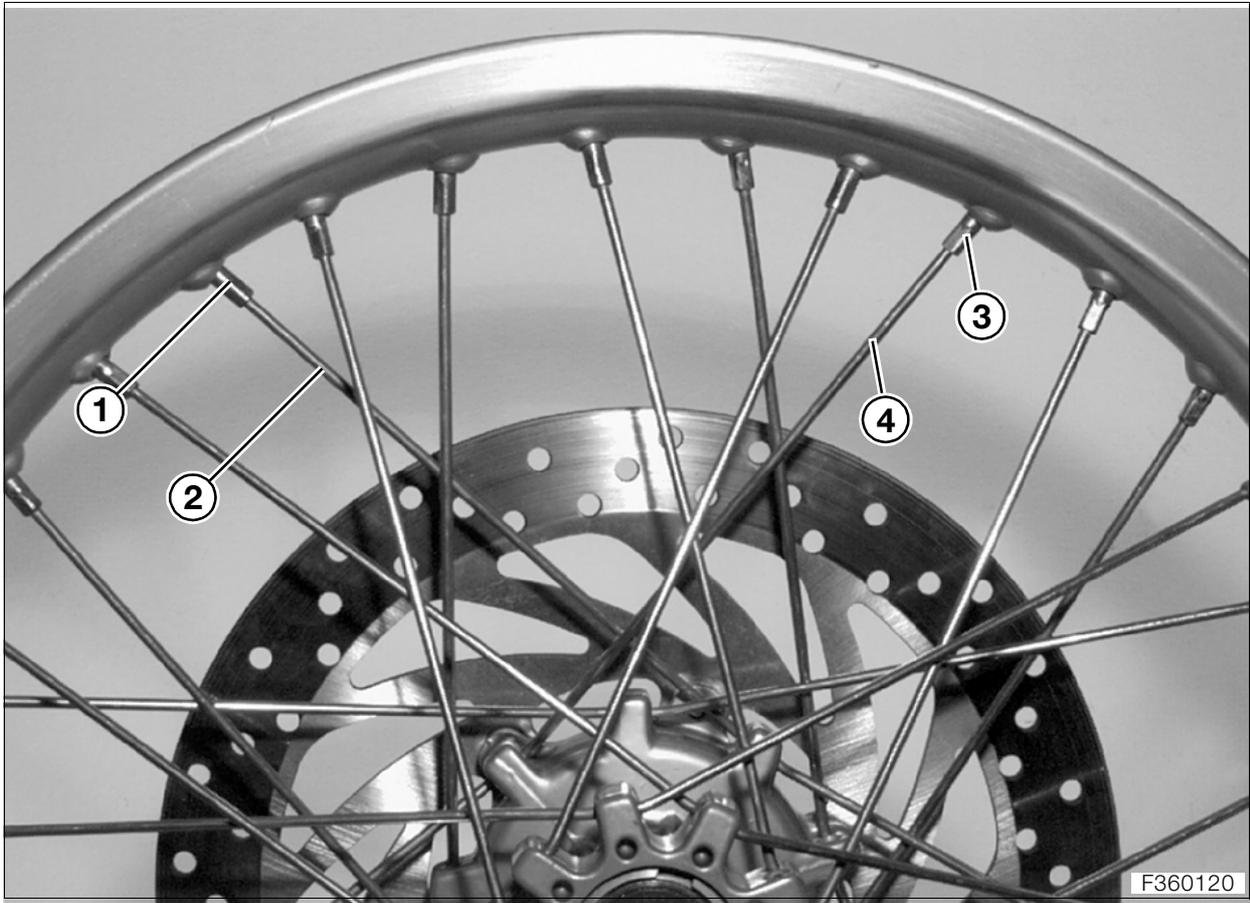


Caution:

To avoid damage to the chainwheel carrier, use a suitable support for the internal puller.

- Remove bearing (7) with counter-support, **BMW No. 00 8 572**, and internal puller, **BMW No. 00 8 574**.
- Take out circlip (5) with circlip pliers.
- Remove backup washer (6).
- Remove bearing (4) with counter-support, **BMW No. 00 8 572**, and internal puller, **BMW No. 00 8 574**.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Drive bearing (4) in with drift, **BMW No. 36 5 512**.
- Drive bearing (7) in with drift, **BMW No. 36 5 512**.
- Install a new shaft sealing ring (2).
- Grease the contact face of spacer sleeve (1) with **Staburags NBU 30 PTM**.





Removing/installing wheel spokes

Removing/installing front wheel spokes

- Remove/install front wheel.
- ➔ See above
- Remove tyre.



Note:

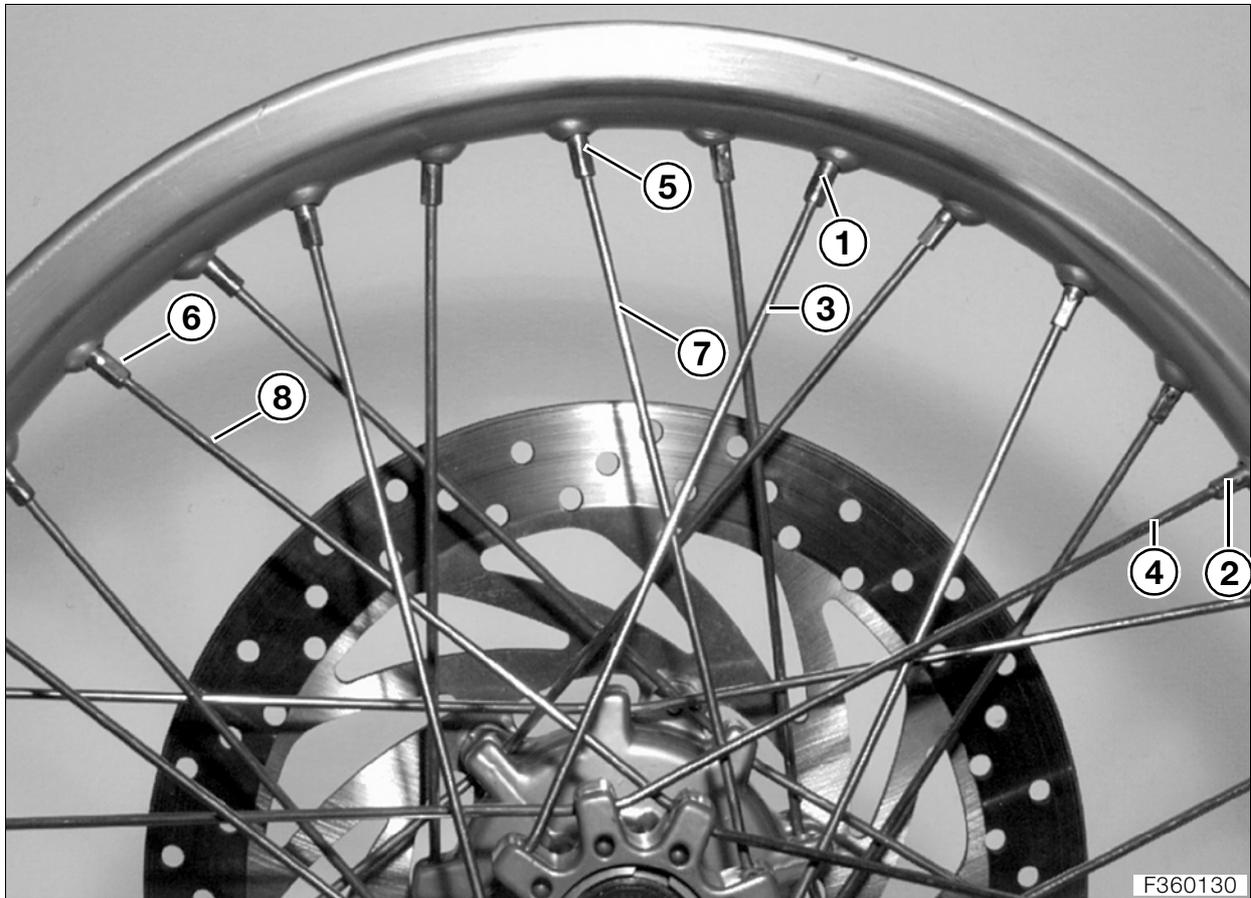
Use nipple tensioner, **BMW No. 36 3 800**.

Outer left spokes

- Release spoke nipple (1).
- Pull spoke (2) out of wheel hub.

Inner left spokes

- Release spoke nipple (3).
- Pull spoke (4) out of wheel hub.



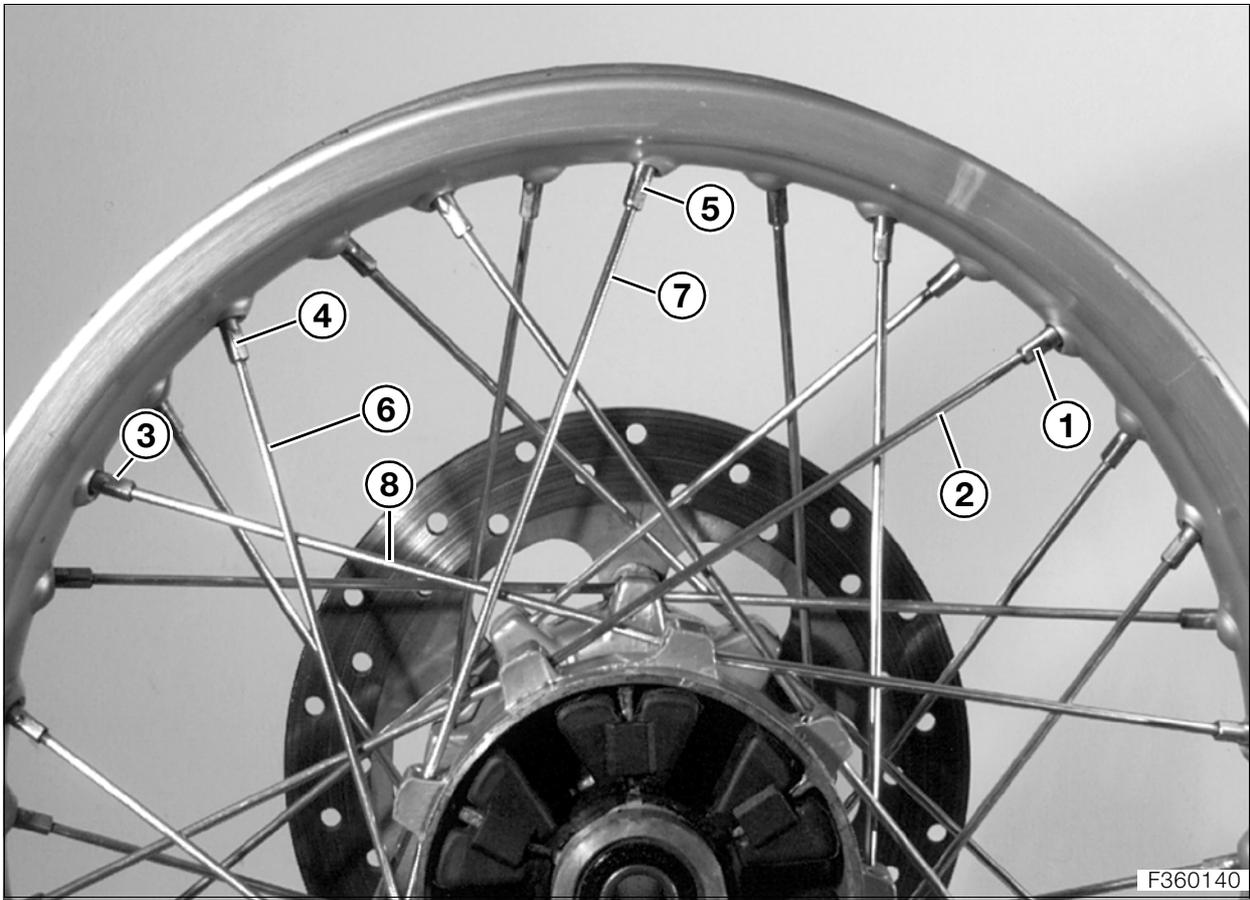
Outer right spokes

- Release spoke nipple (1).
- Release spoke nipple (2).
- Turn spoke (3) outwards.
- Pull spoke (4) out of wheel hub.

- Installation is the reverse of the removal procedure: pay particular attention to the following.
 - After installing, centre the wheel rim.
- ➡ See below

Inner right spokes

- Release spoke nipple (5).
- Release spoke nipple (6).
- Turn spoke (7) inwards.
- Pull spoke (8) out of wheel hub.



F360140

Removing/installing rear wheel spokes

- Remove/install rear wheel.
- ➔ See above
- Remove tyre.



Note:

Use nipple tensioner, **BMW No. 36 3 800.**

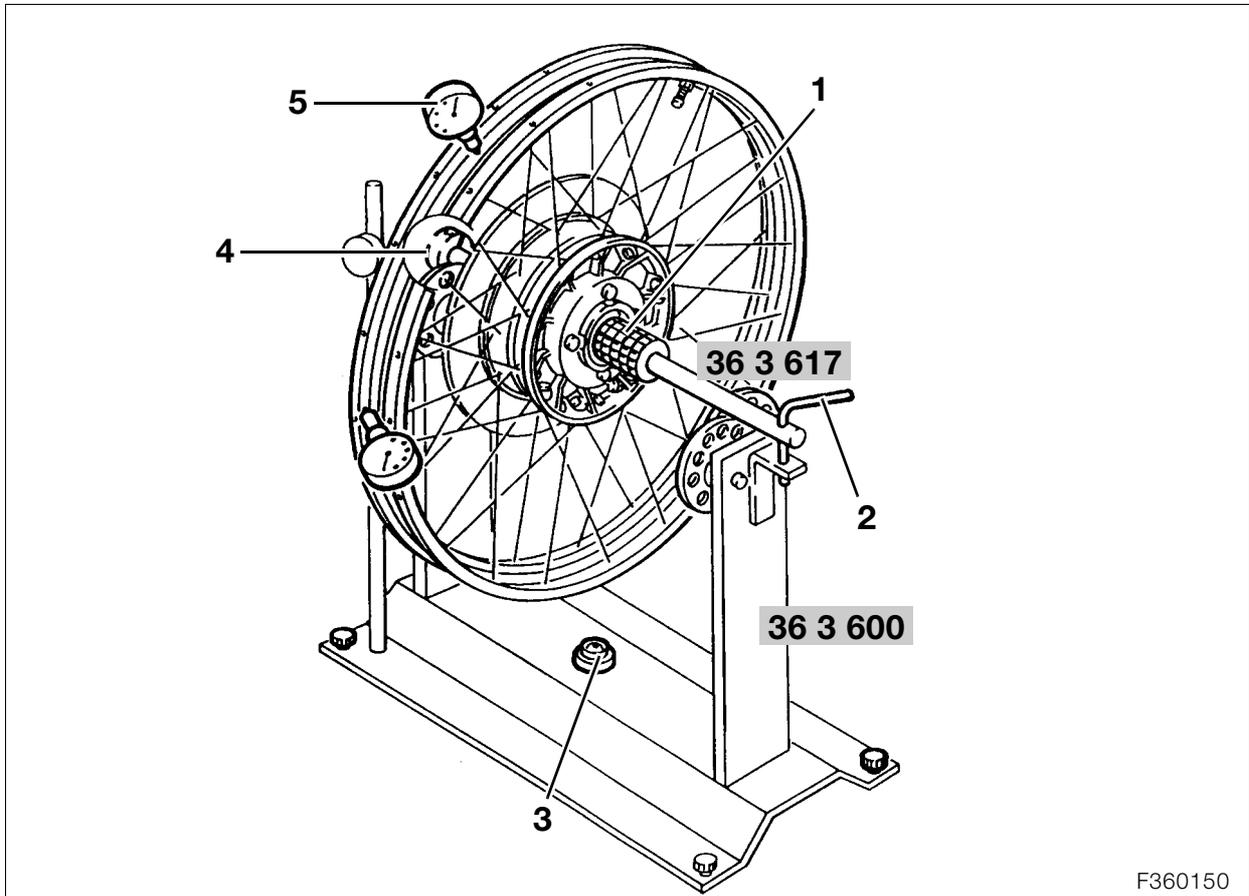
Inner left and right spokes

- Release spoke nipple (3).
- Release spoke nipple (4).
- Release spoke nipple (5).
- Turn spokes (6) and (7) outwards.
- Pull spoke (8) out of wheel hub.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- After installing, centre the wheel rim.

➔ See below

Outer left and right spokes

- Release spoke nipple (1).
- Pull spoke (2) out of wheel hub.



F360150

36 32 528 Checking and centering front and rear wheel rims

- Remove the wheels.

36 32 528 Checking rims

- **[Rear wheel]** Remove chainwheel carrier complete with chainwheel from the rear-wheel hub.
- **[Rear wheel]** Remove the spacer on the left.
- Remove tyre.
- Level the balancing unit, **BMW No. 36 3 600**, by means of bubble gauge (3) in the baseplate.
- Pass the balancing shaft, **BMW No. 36 3 617**, through the wheel bearings.
- Lightly pretension bearing with knurled nut (1).
- Fit wheel on balancing device.
- Use pin (2) to lock the balancing shaft against the balancing stand to prevent the shaft from turning.
- Push locating disc (4), **BMW No. 36 3 615**, on to the balancing shaft on the opposite end, until there is no play at the balancing shaft. Secure the locating disc in position.



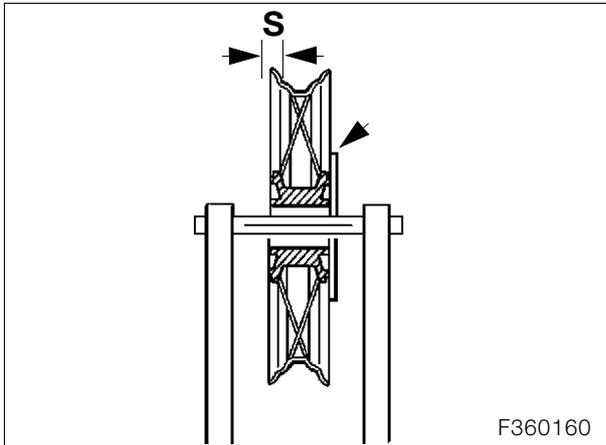
Note:

Apply the dial gauge, **BMW No. 00 2 510**, only to the machined inner surface of the wheel rim.

- Measure lateral and vertical runout with dial gauge (5), **BMW No. 00 2 510**.

Vertical runout..... max. 2 mm (0.08 in)
Lateral runout..... max. 2 mm (0.08 in)

Centering lateral runout



F360160



Caution:

Never attempt to eliminate all the lateral runout by adjusting only one or two spokes.



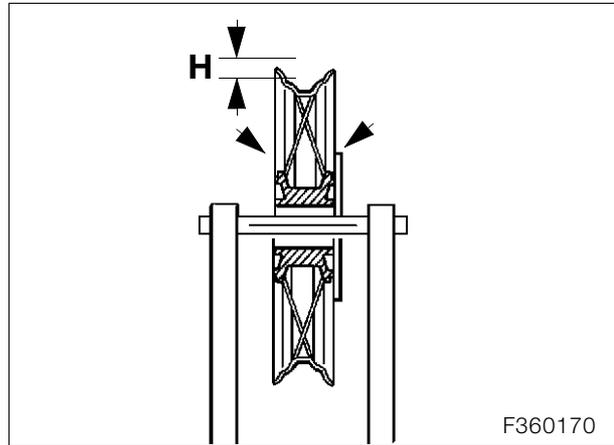
Note:

Vertical runout must be checked every time lateral runout is corrected.

- Correct lateral runout "S" by tightening the spokes on the opposite side (arrow).

Lateral runout..... max. 2 mm (0.08 in)

Centering vertical runout



F360170

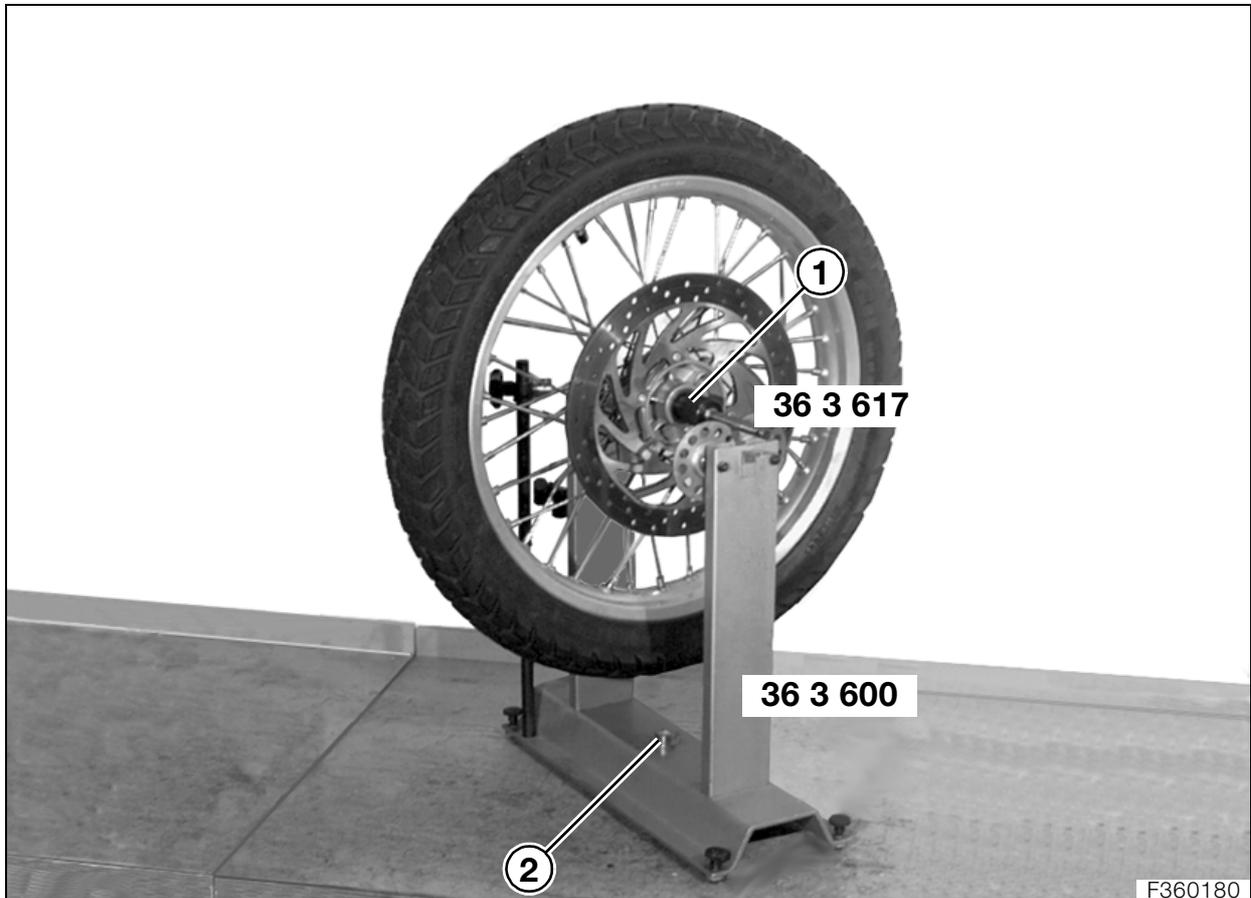


Caution:

Spokes which protrude from the spoke nipples must be shortened.

- Correct vertical runout "H" by tightening the spokes at left and right (arrow).

Vertical runout..... max. 2 mm (0.08 in)



F360180

36 30 528 Static balancing of front/rear wheel

- Remove the wheels.
- **[Rear wheel]** Remove chainwheel carrier complete with chainwheel from the rear-wheel hub.
- Level the balancing unit, **BMW No. 36 3 600**, by means of bubble gauge (2) in the baseplate.
- Pass the balancing shaft, **BMW No. 36 3 617**, through the wheel bearings.
- Lightly pretension bearing with knurled nut (1).
- Fit wheel on balancing device.
- Allow wheel to settle.
- Clean the attachment points for the adhesive weights.



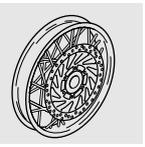
Caution:

Maximum balance weight 50 grams (1.8 oz.).
Maximum number of weights 10; 5 per side.

- Affix adhesive weights uniformly spaced on both sides of the rim opposite the wheel's heaviest point.
- Repeat the balancing procedure as a check.

Maximum permissible imbalance

..... 5 g (0.18 oz.)

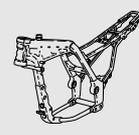


46 Frame

Contents

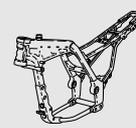
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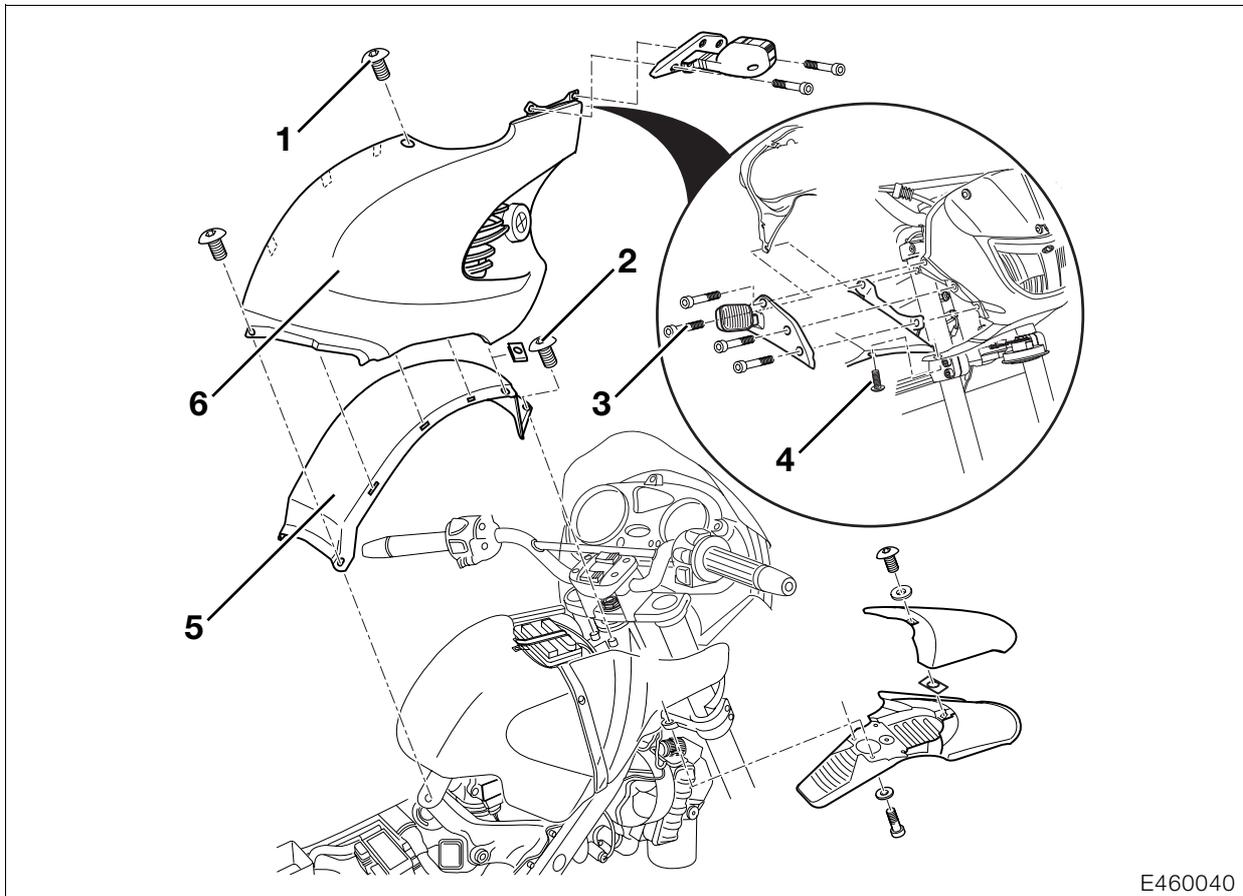




Technical data		F 650
Frame		
Frame		Bridge frame with frame trussing
Type plate location		Top section of main frame, at right
Location of VIN		On right of steering head
Max. height (windscreen)	mm (in)	1265 (49.803)
Maximum width (across mirrors)	mm (in)	890 (35.04)
Maximum length	mm (in)	2101 (82.72)
Height of seat (without load)	mm (in)	780 (30.70)
Wheelbase (without load)	mm (in)	1479 (58.23)
Unladen weight (ready for road, fuel tank full)	kg (lbs)	193 (425.57)
Gross weight limit	kg (lbs)	380 (837.75)
Steering head angle in normal-load position	°	60.8
Axle load distribution in unladen-weight position, front/rear	%	46/54
Castor (in normal-load position)	mm (in)	113 (4.45)







E460040

Removing and installing covers

- Remove the seat.

Removing and installing left/right cover

- Remove fasteners securing turn indicator (3) and disconnect plug of turn indicator.
- Slacken front securing screw (4).
- Remove securing screws (1) from side cover.
- Remove side cover (6).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

When installing turn indicators, make sure that turn-indicator cable is not trapped.



Tightening torques:

Right/left covers with centre cover
to mounting frame 2 Nm
Right/left covers to centre cover 2 Nm

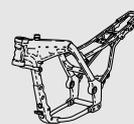
Removing and installing centre cover

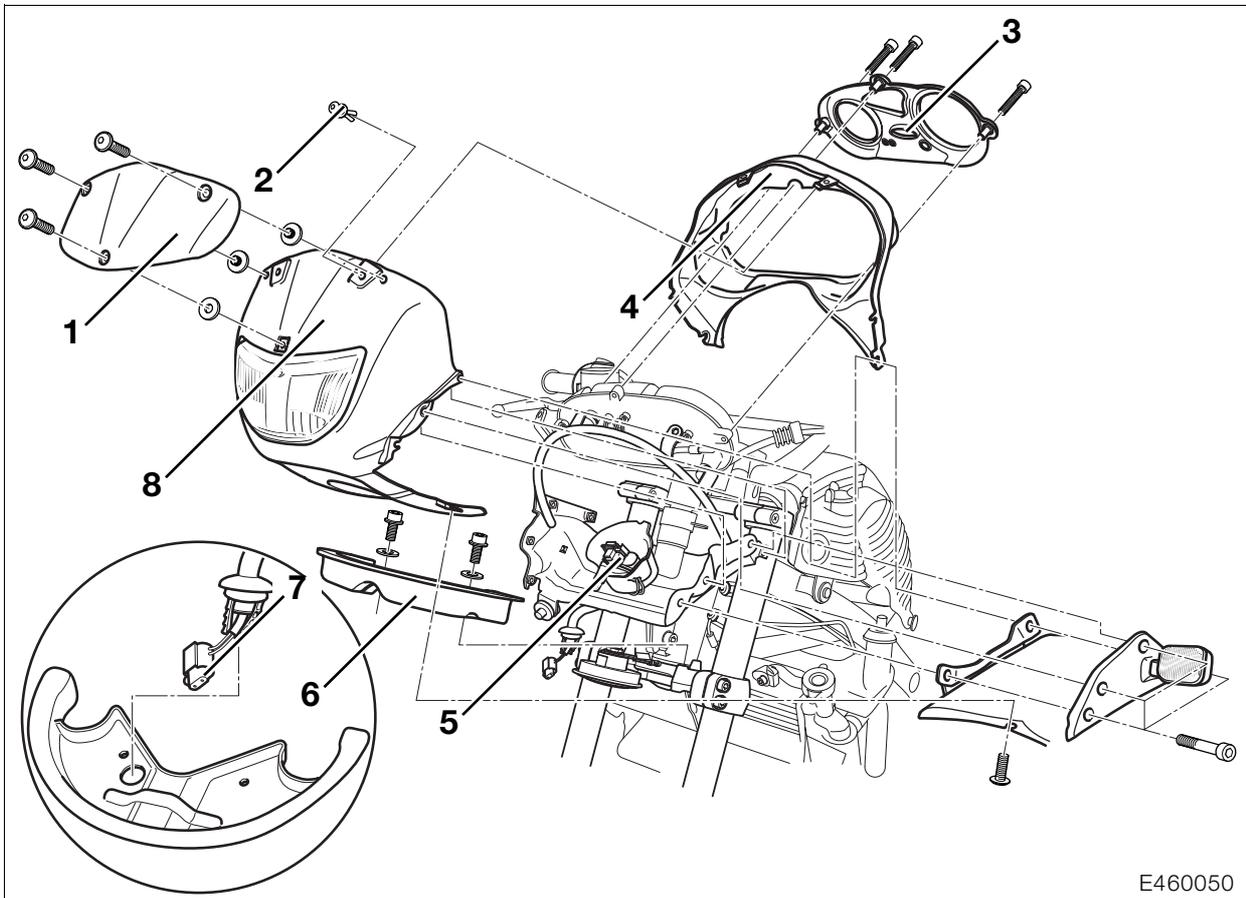
- Remove left and right covers.
- Remove securing screws (2) from centre cover.
- Remove centre cover (5).
- Installation is the reverse of the removal procedure.



Tightening torques:

Centre cover to main frame at front 2 Nm





E460050

Removing and installing cockpit fairing

- Remove left and right covers.
- ➔ See above



Note:

Note washers and rubber ring.

- Remove windscreen (1).
- Remove the fasteners securing the cockpit fairing (2).
- Disconnect multi-pin plug (5).
- Pull the rubber boot to the rear.
- Pull the socket of the sidelight out of the headlight housing.
- Remove the fairing lower section complete with headlight (8).
- Remove instrument cover (3).
- Remove fairing upper section (4).
- Remove front mudguard.
- ➔ See below
- Disconnect plug for horn (7).
- Remove cover (6).

- Installation is the reverse of the removal procedure: pay particular attention to the following.



Warning:

After installing the windscreen, check and if necessary adjust the headlight setting.

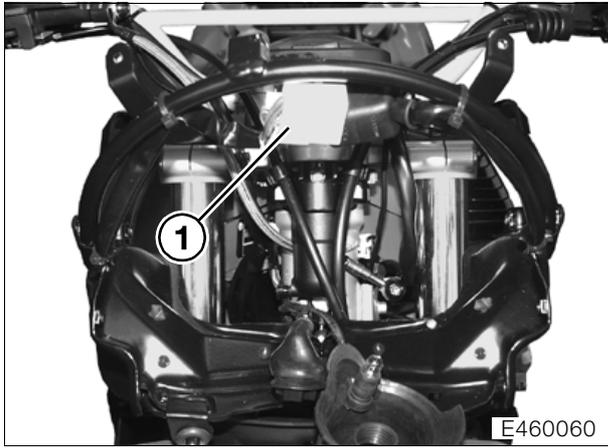


Tightening torques:

Windscreen fasteners..... 2 Nm

46 63 198 Removing and installing fairing bracket

- Remove instrument panel.
- ➔ See Group 62
- Unclip plug for turn indicators.
- **[ABS]** Disconnect front ABS sensor plug and unclip the plug.

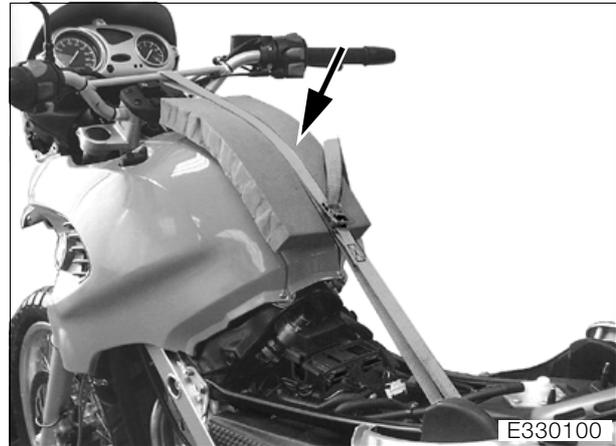


- Disconnect plug of instrument panel (1).
- Cut through cable clip.
- Push cable holder through toward inside.
- Turn the handlebars to the left.
- Remove the fasteners securing the fairing bracket.
- Remove the fairing bracket.
- Installation is the reverse of the removal procedure.

 **Tightening torques:**
 Fairing bracket to main frame 21 Nm

Raising rear frame

- Remove exhaust manifold.
- ➡ See Group 18
- Secure front wheel in position.



Caution:

Protect trim panels with a material such as foam rubber (arrow) to prevent damage.

- Use a strap to secure the rear frame to the transverse arm.

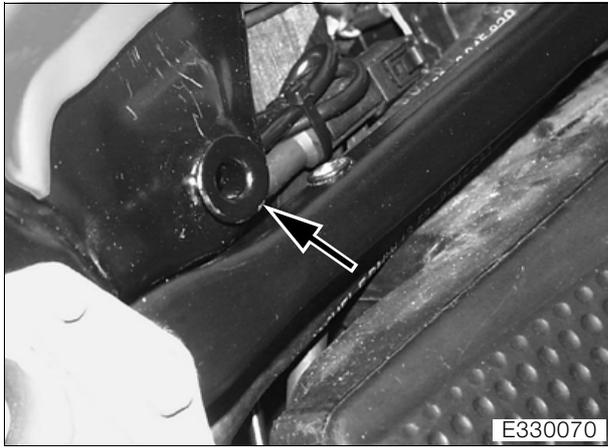


Note:

Do not unplug the control unit.

- Remove the BMS control unit from the holder.
- Remove the fuse box.
- Remove brake fluid reservoir from rear frame.
- Remove lower fasteners securing rear frame to main frame.
- Slightly pretension the strap.
- Slacken upper fasteners securing rear frame to main frame.





⚠ Caution:

Do not raise the rear frame all the way, as it would contact the lock of the seat (arrow).

- Raise the rear frame far enough to expose the eye of the spring strut and secure the rear frame in this position with the strap.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

📄 Note:

When lowering the rear frame, make sure that the brake line is routed between the front section of the mudguard and the rear frame.

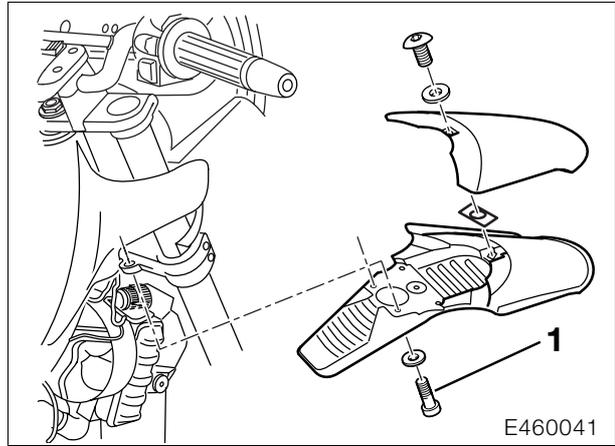
- Clean the threads of the frame and the securing screws for the rear frame, coat threads with **Loctite 2701** and install the screws.

🔧 Tightening torques:

Rear frame to main frame, top	21 Nm
Rear frame to main frame, bottom (clean threads + Loctite 2701)	21 Nm
Brake fluid reservoir to rear frame	5 Nm
Clamp for silencer	55 Nm
Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Engine guard to frame.....	9 Nm

46 61 000 Removing and installing front mudguard

- Place the motorcycle on its centre stand.



- Remove fasteners securing front mudguard (1).
- Remove front mudguard.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the fork bridge and the securing screw of the front mudguard, coat threads with **Loctite 243**.

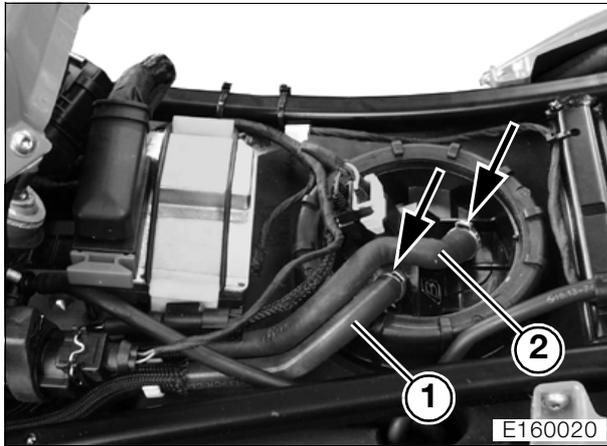
🔧 Tightening torques:

Front mudguard to fork bridge
(clean threads + Loctite 243)..... 3 Nm

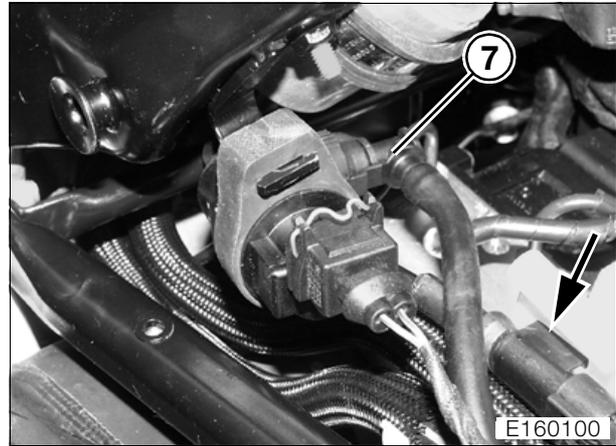
46 51 050 Removing and installing rear frame

- Place the motorcycle on its main (centre) stand.
- Secure front wheel in position.
- Remove the seat.
- Remove exhaust manifold.
- ➡ See Group 18

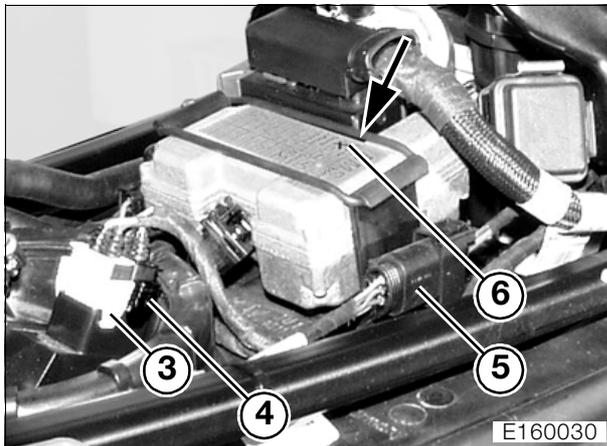
- Remove the fuse box.
- Remove brake fluid reservoir from rear frame.



- Close off fuel supply line (1) and the fuel return line (2) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Release fuel hoses from clips on control-unit holder.



- Unclip ABS sensor plug (arrow) from the control-unit holder.
- **[US]** Disconnect hose from fuel evaporation control valve (7).
- Remove lower fasteners securing rear frame to main frame.
- Remove upper fasteners securing the rear frame to the main frame and carefully remove the rear frame complete with the tank.
- Installation is the reverse of the removal procedure: pay particular attention to the following
- When installing the rear frame, make sure that all lines and hoses are routed at the top of the tank.



Note:
Do not unplug the BMS control unit.

- Disengage the rubber strap (arrow) and remove the BMS control unit (6).
- Disconnect the plugs for fuel-level sensor (3) and fuel pump (4).
- Disconnect the plug for rear light/turn indicator (5).

Note:
When lowering the rear frame, make sure that the brake line is routed between the front section of the mudguard and the rear frame.

- Clean the threads of the frame and the securing screws for the rear frame, coat threads with **Loctite 2701** and install the screws.
- Make sure that fuel feed hose (1) and fuel return hose (2) are correctly routed.

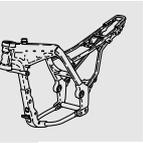
Warning:
Do not use screw-type hose clamps on the fuel hoses, because they could damage the hoses and result in a fire hazard.

- Close hose clamps with pliers, **BMW No. 13 1 500**.

Tightening torques:

Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Clamp for silencer.....	55 Nm
Engine guard to frame.....	9 Nm
Brake fluid reservoir for rear brake to rear frame	5 Nm
Rear frame to main frame, top.....	21 Nm
Rear frame to main frame, bottom (clean threads + Loctite 2701).....	21 Nm





51 Equipment

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Removing and installing lock barrel	6
Removing and installing lock for rear stowage compartment	6
Removing and installing lock barrel for fuel tank filler cap	6
Replacing mirrors	7





Technical Data	F 650 GS





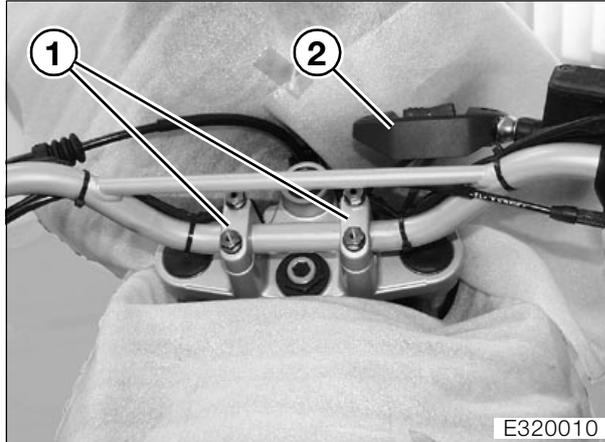
51 25 040 Removing and installing ignition switch/steering lock

- Place motorcycle on its centre stand.

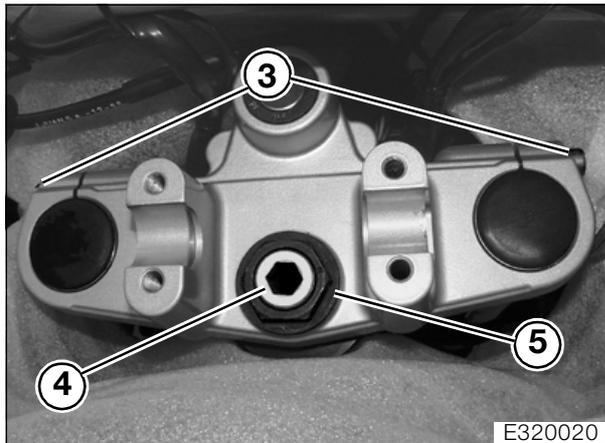


Caution:

Cover or mask off the instrument cluster and trim to prevent scratches.

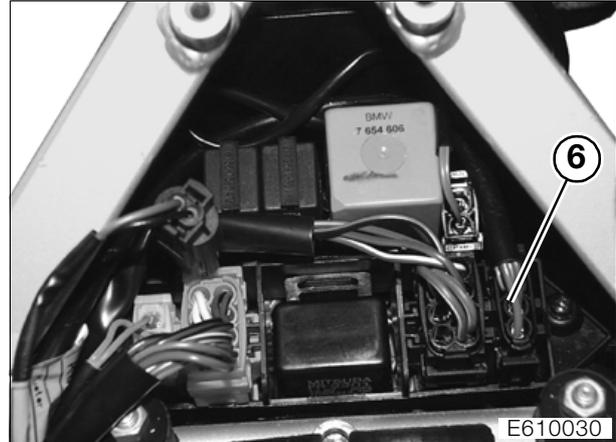


- Remove impact pad (2).
- Remove clamp blocks (1).
- Remove the handlebar and place it in front of the instrument cluster.

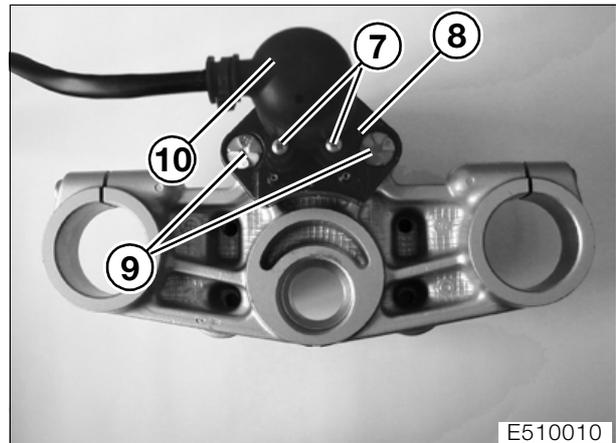


- Unscrew hex nut (5).
- Release clamping screws (3) at upper fork bridge.
- Unclip the clutch cable and the brake hose from their holders.
- Cut through the 2 cable ties at the left of the frame head.

- Cut through the 2 cable ties at the left of the frame head.
- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Disengage cover from the anchorage on main frame on left.



- Disconnect plug for ignition lock (6).
- Remove the cable complete with the plug.
- Remove the upper fork bridge complete with the ignition lock.



- Remove securing screws (7) and remove ignition switch (10).
- Using a 5 mm (0.20 in) bit, drill at least 6 mm (0.24 in) into the non-removable screws (9).
- Using an 8 mm (0.31 in) bit, drill at least 5 mm (0.20 in) into the non-removable screws.
- Break off the heads of the non-removable screws.
- Remove the ignition lock (8) from the fork bridge.



- Remove the shanks of the non-removable screws.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Tighten the non-removable screws with socket wrench insert, **BMW No. 51 0 530**.



Warning:

Begin by tightening the front securing screws (as viewed in the forward direction of travel) of the clamp blocks, then tighten the rear securing screws.

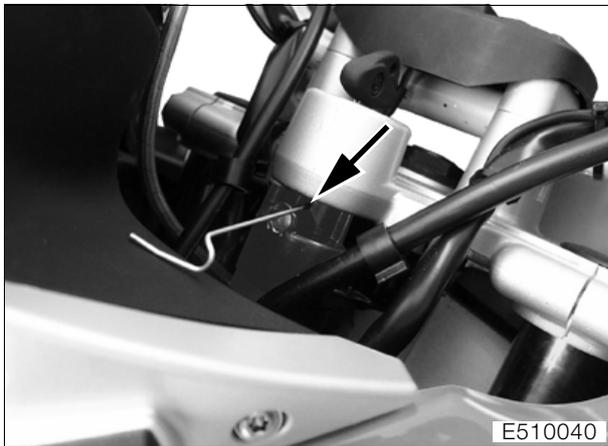


Tightening torques:

Ignition/steering lock to fork bridge 21 Nm
 Hexagon nut to counter-tube 65 Nm
 Clamp screws for fork bridge 23 Nm
 Handlebar to fork bridge 23 Nm

Removing and installing lock barrel

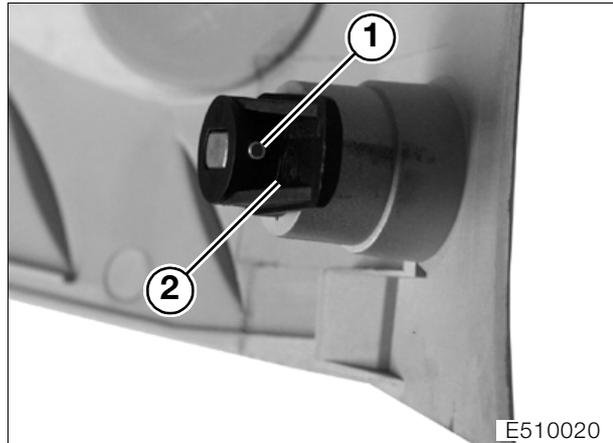
- Place motorcycle on its centre stand.
- Turn the handlebars to the left.
- Turn the ignition key to the ON position.



- Press in the safety catch by inserting a suitable tool through the opening (arrow), e.g. a piece of wire.
- Pull the lock barrel out with the ignition key.

Removing and installing lock for rear stowage compartment

- Place motorcycle on its centre stand.
- Remove the lid of the rear stowage compartment.
- Clamp the lid in a vise with protective jaws.



- Use a punch of suitable diameter to drive out pin (1).
- Remove latch (2).
- Press out the lock.
- Installation is the reverse of the removal procedure.

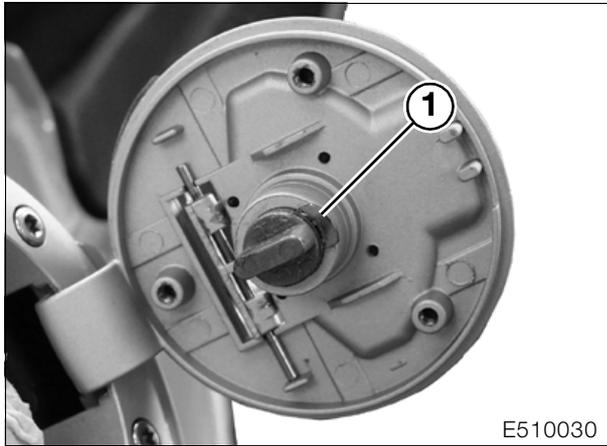
51 25 030 Removing and installing lock barrel for fuel tank filler cap



Note:

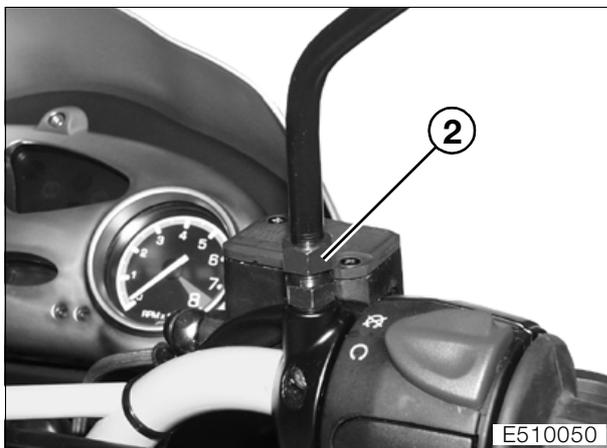
Make sure that screws do not fall into fuel tank: cover fuel tank filler neck with cloth.

- Open the fuel filler cap.
- Remove the bottom part of the filler cap.



- Insert key in lock barrel and press down on retainer (1).
- Pull out lock barrel with key.
- Grease the new lock barrel with **Optimoly MP 3**.
- Insert the lock barrel with the key.
- Installation is the reverse of the removal procedure.

51 16 042 Replacing mirrors



- Slacken nut (2).
- Remove the mirror.
- Installation is the reverse of the removal procedure.

 **Tightening torques:**
 Mirror to handlebar fitting 18 Nm





61 General electrical equipment

Contents	Page
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View from right	6
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Relay positions in electronic equipment box	7
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Removing and installing battery carrier	9
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Motorcycle fuses	9
Fuses	9
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Removing and installing coolant-temperature sensor	10
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Removing and installing side stand switch	10
Removing and installing rear-brake switch for brake light	10
Removing and installing front-brake switch for brake light	11
Removing and installing horn	12
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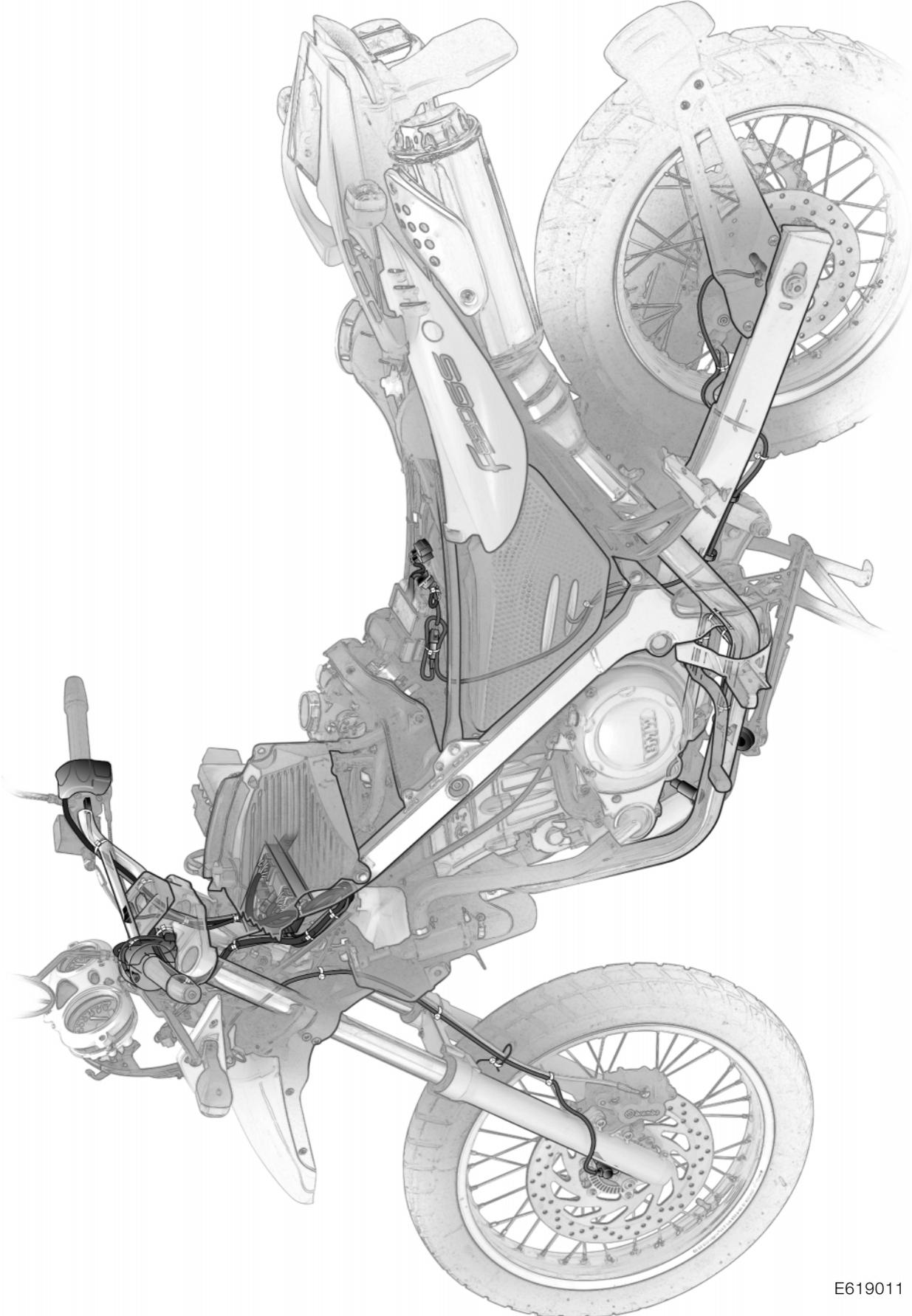
Technical Data	F 650	
General electrical equipment		
Circuit voltage	V	12
Battery	A/h	12





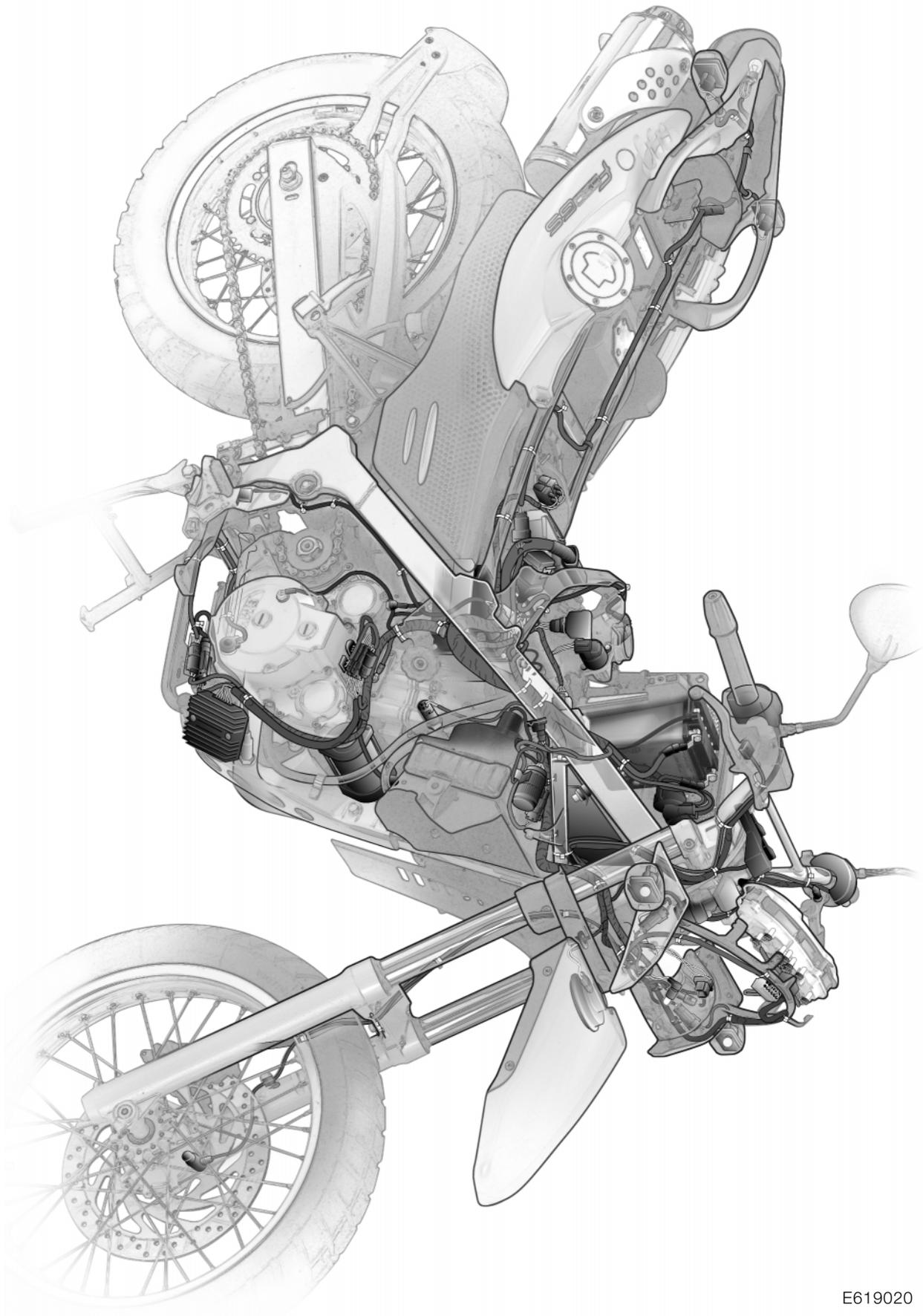
Wiring harness

View from left



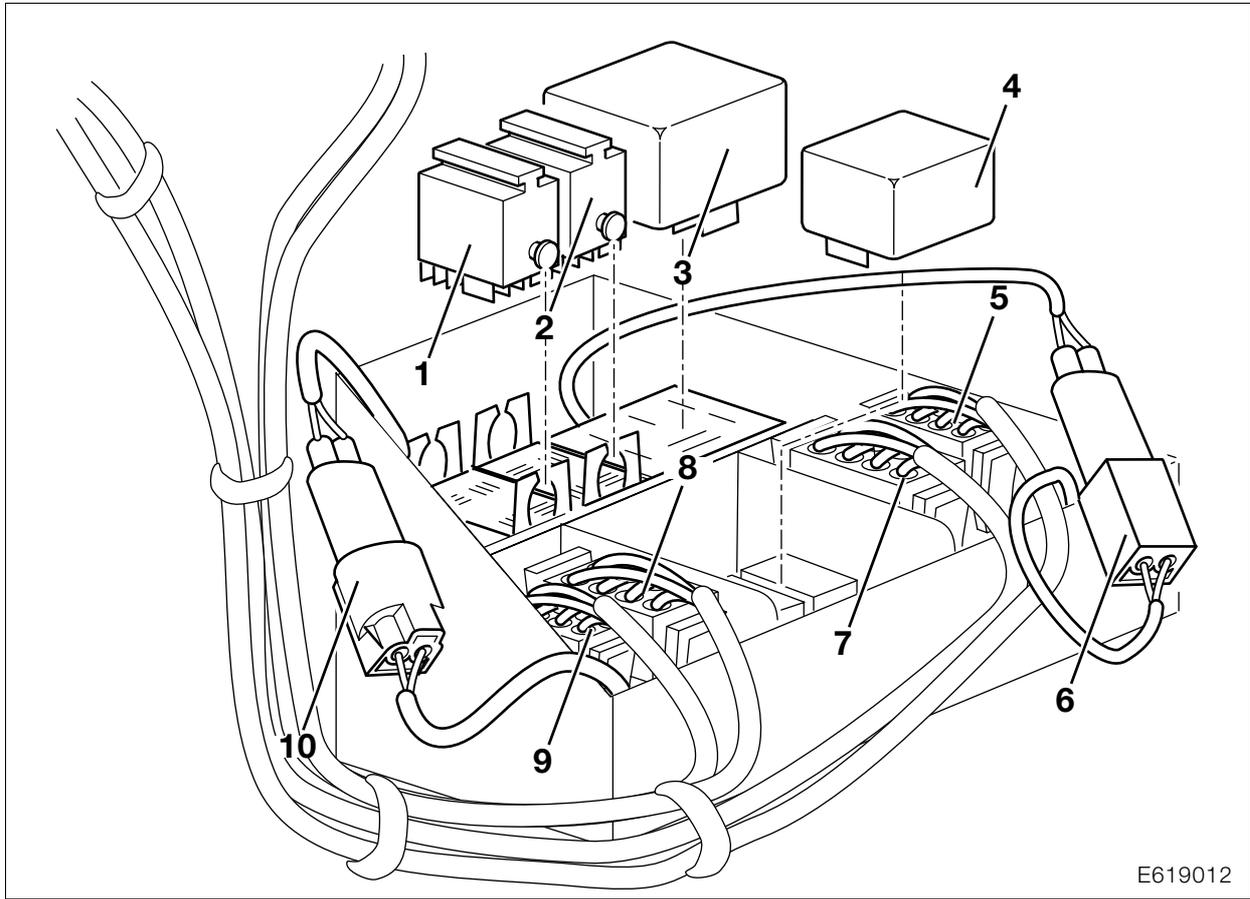
E619011

View from right



E619020

Component positions in electronic equipment box



E619012

Relay positions in electronic equipment box

- 1 Relief relay
- 2 BMS relay
- 3 Diode relay
- 4 Flasher unit

Connectors, electronic equipment box

- 5 Ignition light switch
- 6 Brake light switch
- 7 Multi-function switch, right
- 8 Multi-function switch, left
- 9 Clutch switch
- 10 ABS switch



61 21 010 Removing and installing battery



Warning:

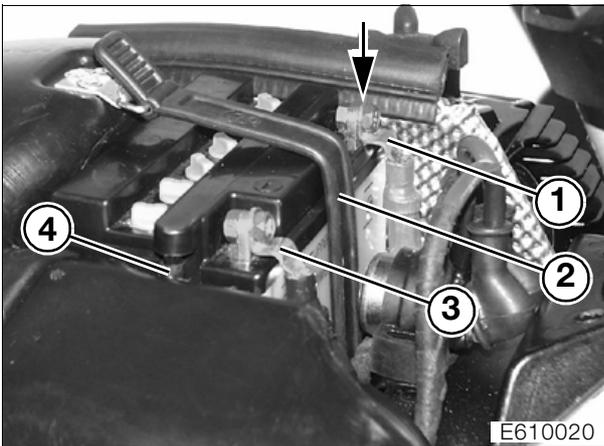
Battery acid is highly caustic. Protect your eyes, face, hands, clothing and the paintwork.

- Remove left, right and centre covers.
➡See Group 46



Caution:

Disconnect the battery only with the ignition switched off. Disconnect the negative battery terminal first, then the positive one.



- Disconnect the earth lead (3) from the battery and insulate it.
- Remove positive lead (1) from battery.
- Disengage rubber strap (2) holding the battery.
- Remove battery drain tube (4).
- Remove the battery.
- Grease the battery posts with **acid-proof battery terminal grease**.

Acid-proof battery terminal grease

.....e.g. Bosch Ft 40 V1



Note:

Disconnecting the battery clears all entries (such as errors, adaptations) from the BMS control unit memory.

The loss of the adaptations may sometimes lead to engine performance being temporarily impaired when the engine is restarted.

The BMS restores the lost adaptations itself over the following operating hours.

- Switch on the ignition.
- Open the throttle once or twice fully with the engine off. Motronic registers the throttle valve position.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Caution:

Connect the positive battery terminal first, then the negative terminal.

- Route the positive lead vertically (arrow) to the battery post. Make sure that all battery cells are visible through the inspection port in the cover.



61 21 100 Removing and installing battery carrier

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers.
- Remove the battery.
- ➡ See above
- Remove the intake air pipe.
- ➡ See Group 13
- Remove intake air silencer.
- ➡ See Group 13
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Remove the fasteners for the battery tray.
- Installation is the reverse of the removal procedure.

Tightening torques:

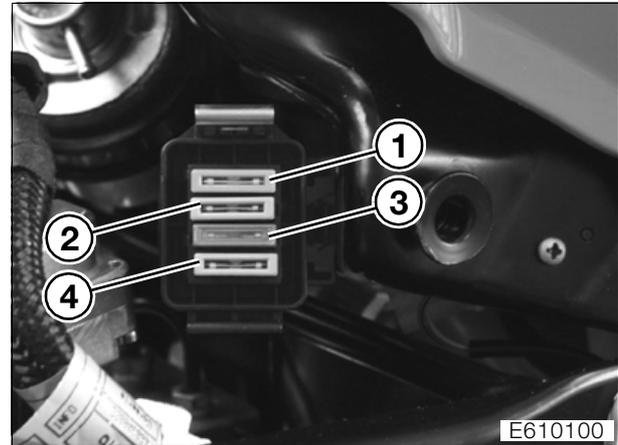
Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank	9 Nm
Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm
Lid of electronic equipment box	4 Nm

Replacing fuses

Motorcycle fuses

- Remove seat.
- Open the cover of the fuse box.
- Replace the defective fuse.

Fuses



1 BMS Compact	20 A
2 Headlight, brake light, turn indicators, horn	15 A
3 Fan	7.5 A
4 Heated handlebar grips	7.5 A

61 13 011 Removing and installing electronic equipment box

- Remove battery carrier.
- ➡ See above
- Disconnect the expansion tank from the radiator, pull it to one side and allow it to dangle from the hose.
- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove circlip securing throttle cable to throttle flap stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.
- Pull the throttle cable forward to remove.
- Disengage the cover from the anchorages on the main frame on each side and remove.
- Remove screws securing ignition coil to cylinder head cover.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Remove the relay panel from the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Remove the fastener securing the electronic equipment box to the frame.
- Pull the electronic equipment box toward the rear and off the pin on the frame.
- Turn the electronic equipment box and remove it toward the rear.
- Installation is the reverse of the removal procedure.



 **Tightening torques:**

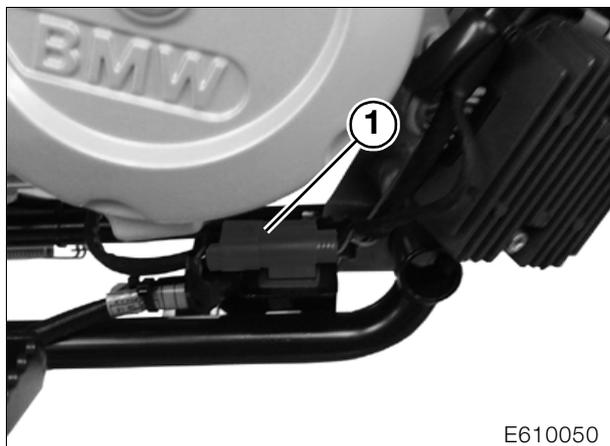
Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank	9 Nm
Connecting flange	5 Nm
Fasteners, cover/ trim panel for turn indicator	3 Nm
Lid of electronic equipment box	4 Nm
Electronic equipment box to frame.....	5 Nm
Expansion tank to radiator.....	9 Nm
Ignition coil to cylinder head.....	9 Nm

61 31 906 Removing and installing coolant-temperature sensor

See Group 17

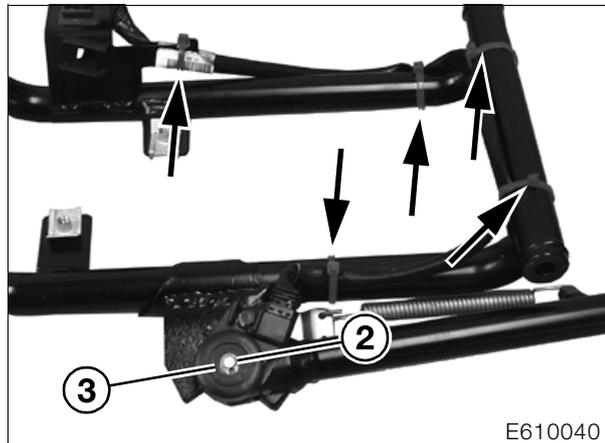
61 31 302 Removing and installing side stand switch

- Place motorcycle on its centre stand.
- Remove the engine guard.



E610050

- Disconnect side-stand switch plug (1) and unclip the plug.
- Disconnect plug of oxygen sensor.
- Remove lower section.



E610040

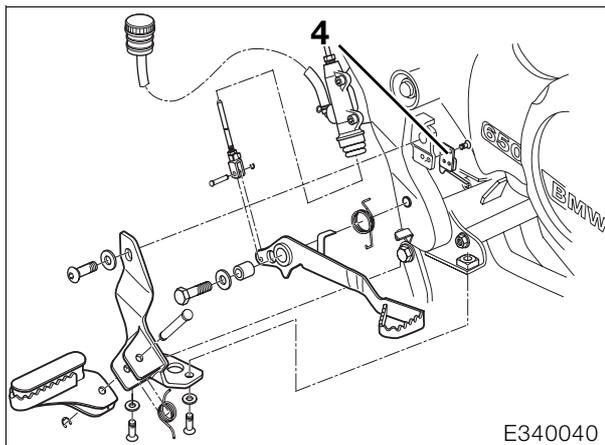
- Cut the cable ties at the lower section (arrows).
- Remove retaining ring (2).
- Lift switch (3).
- Disconnect plug of switch (3).
- Installation is the reverse of the removal procedure.

 **Tightening torques:**

Lower section to engine shell.....	21 Nm
Lower section to main frame	21 Nm
Engine guard to frame.....	9 Nm

61 31 310 Removing and installing rear-brake switch for brake light

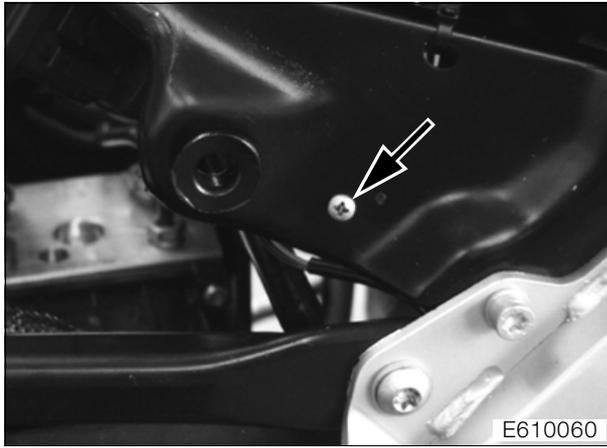
- Remove seat.
- Remove right cover.



E340040

- Remove brake-light switch (4).
- Cut through the cable tie at the frame.
- Remove the fuse box.





- Remove the fastener securing the plug of the brake-light switch (arrow) at the frame
- Disconnect plug of brake light switch.
- Installation is the reverse of the removal procedure.

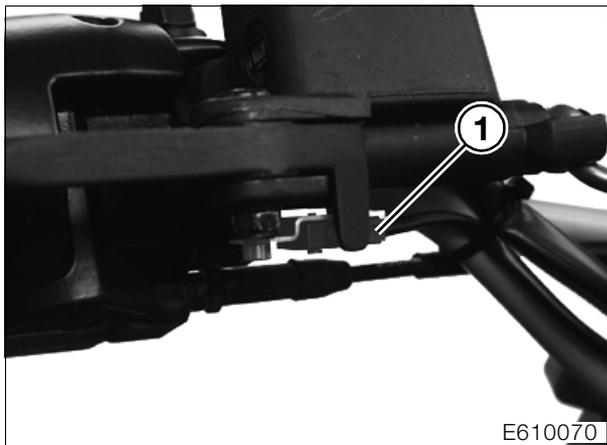


Tightening torques:

Brake light switch, footbrake, to frame 5 Nm

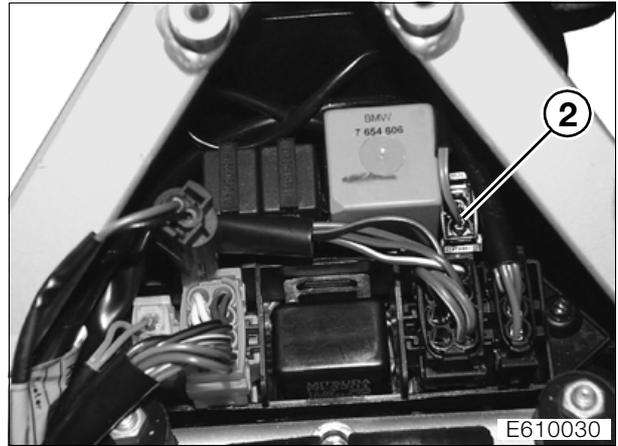
61 31 300 Removing and installing front-brake switch for brake light

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers.



- Remove brake-light switch (1).
- Cut through cable clip.
- Disconnect the expansion tank and pull it to one side.

- Remove the fasteners securing the oil tank and allow the oil tank to dangle to one side on the hoses.
- Remove the starter relay from the holder.
- Remove the lid of the electronic equipment box.
- Cut through the cable tie holding the wiring harness at the electronic equipment box.
- Disengage cover from the anchorage on main frame on left.



- Disconnect plug of brake light switch (2).
- Push the cover over the cylinder head slightly to one side and remove the connector.



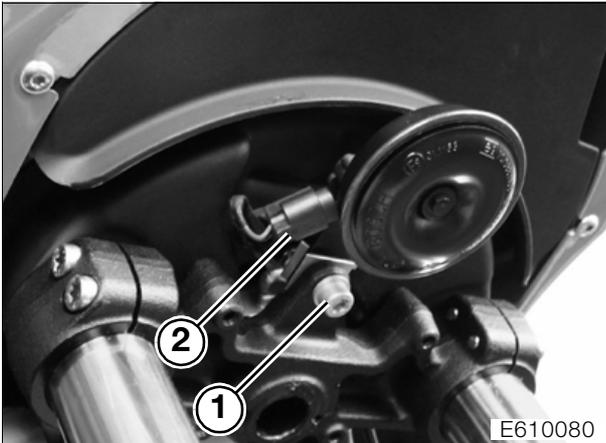
Tightening torques:

Oil tank to intake air silencer 9 Nm
 Lid of electronic equipment box 4 Nm
 Expansion tank to radiator 9 Nm
 Brake-light switch to handlebar fitting 3 Nm



61 33 000 Removing and installing horn

- Remove front mudguard.
- ➡See Group 46

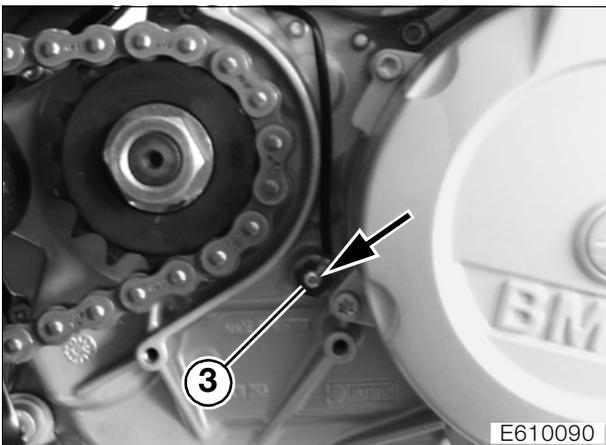


- Disconnect plug for horn (2).
- Remove fastener securing horn (1).
- Installation is the reverse of the removal procedure.

-  **Tightening torques:**
- Horn to bottom fork bridge 18 Nm
 - Lid of electronic equipment box 4 Nm
 - Front mudguard to fork bridge 3 Nm

61 31 227 Removing and installing idle-indicator switch

- Remove cover for chain drive sprocket.



- Remove fastener securing cable to idle-indicator switch.
- Remove idle switch (3).

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the idle-indicator switch and coat with **Loctite 243**.

-  **Tightening torques:**
- Idle-indicator switch (clean thread + Loctite 243) 3 Nm

Removing and installing front and rear ABS sensors

See Group 34



62 Instruments

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Telltale/warning lights	5
Removing and installing instrument panel	6
Replacing telltale/warning lights	6
Disassembling and assembling instrument cluster	6
Removing and installing wiring harness	7

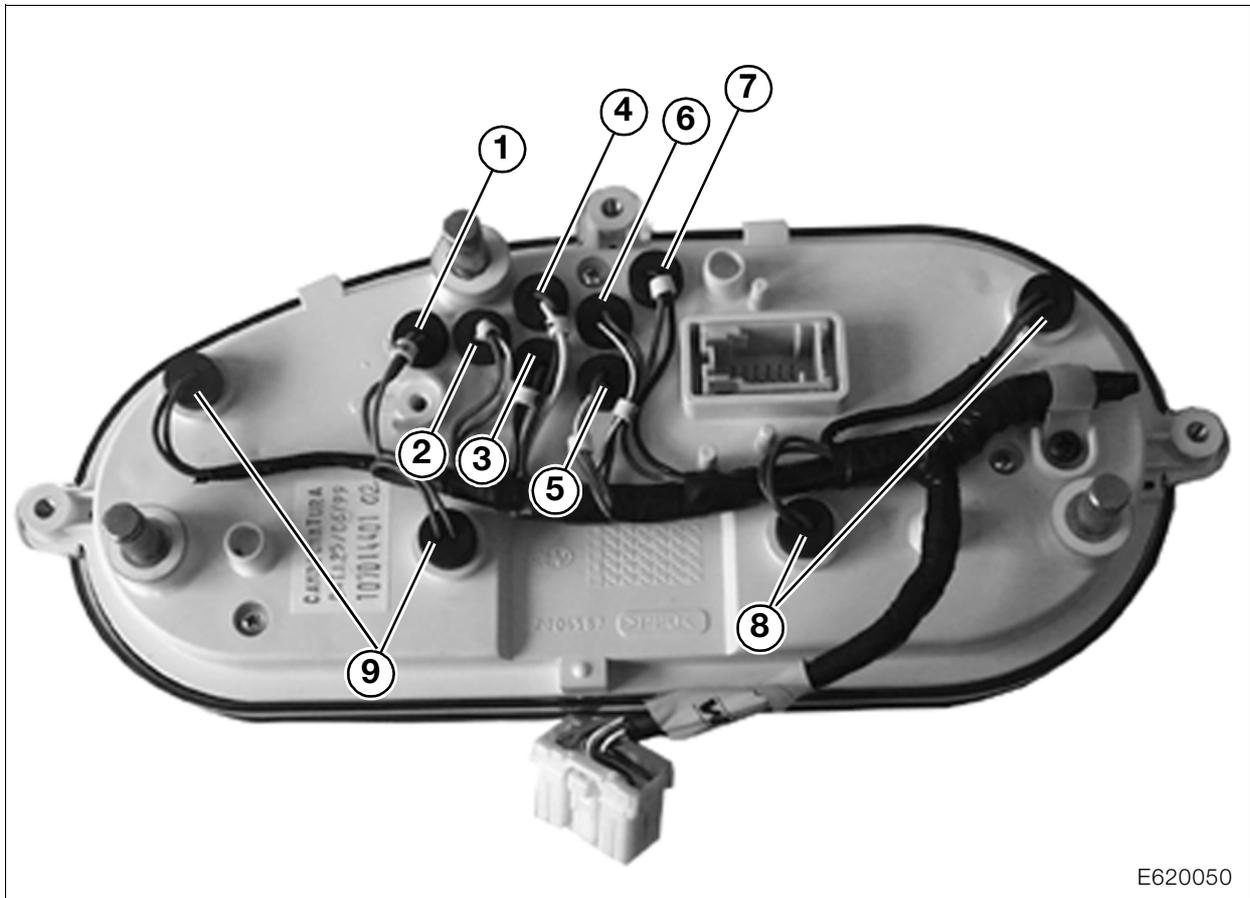




Technical Data	F 650 GS
Instruments	
Speedometer and revolution counter lighting	W5/1.2 - 12V 1.2W
Telltale and warning lights <ul style="list-style-type: none"> Flashing turn indicator Idle Oil pressure Water temperature High (main) beam headlight ABS Fuel gauge 	W5/1.2 - 12V 1.2W W5/1.2 - 12V 1.2W







E620050

Telltale/warning lights

- 1 Water temperature
- 2 Oil pressure
- 3 Idle
- 4 High (main) beam headlight
- 5 Fuel gauge
- 6 ABS
- 7 Flashing turn indicator
- 8 Speedometer lighting
- 9 Revolution counter lighting



62 11 200 Removing and installing instrument panel

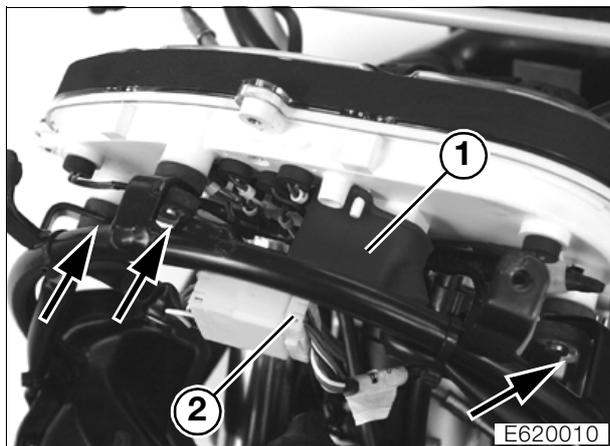
- Place motorcycle on its centre stand.
- Remove left and right covers.



Note:

Note washers and rubber ring.

- Remove the windshield.
- Remove the instrument cover.
- Remove the fairing upper section.
- Disconnect the multi-pin plug from the headlight.
- Pull off the rubber boot and pull the socket of the sidelight to the rear.
- Remove the fairing lower section complete with the headlight.



- Disconnect the plug for the warning lights (2).
- Pull off the rubber boot (1) and disconnect the plug.
- Remove the fuses (arrows) and remove the instrument cluster.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



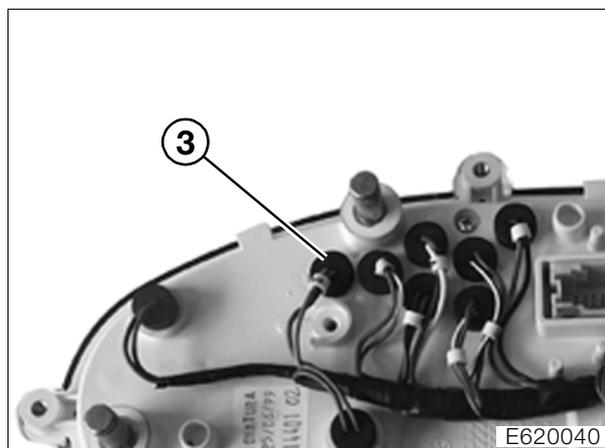
Warning:

After installing the windscreen, check and if necessary adjust the headlight setting.



Replacing telltale/warning lights

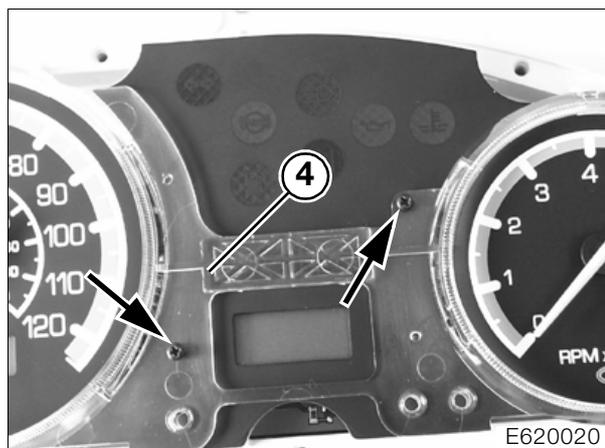
- Remove instrument panel.



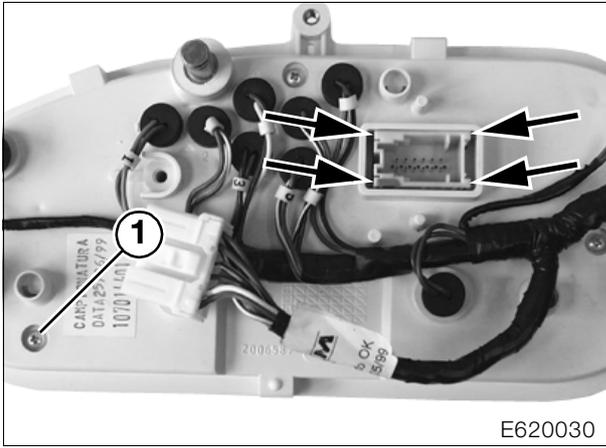
- Remove rubber grommet (3).
- Pull the indicator light out of the socket.
- Installation is the reverse of the removal procedure.

62 11 630 Disassembling and assembling instrument cluster

- Remove instrument panel.
- Remove 3 securing screws from the transparent instrument cover and remove the cover.
- Remove the bezel.



- Remove the securing screws (arrows) and remove the cover (4).

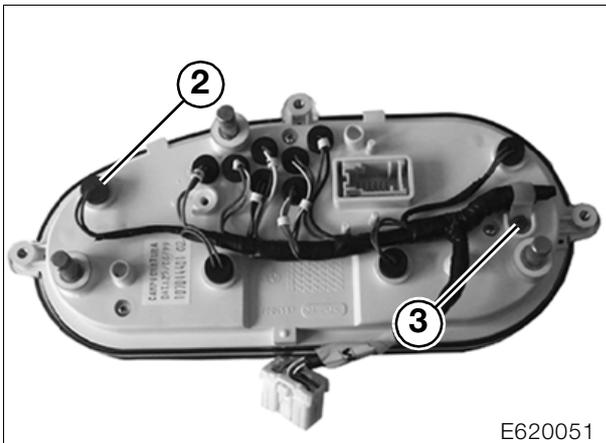


E620030

- Remove the 3 securing screws (1) from the rear of the housing.
- Press back the 4 snap locks (arrows) on the plug housing and press out the instrument panel.
- Installation is the reverse of the removal procedure.

Removing and installing wiring harness

- Remove instrument panel.
- ➡ See above



E620051

- Pull out the warning lights (2) with the rubber grommet.
- Disconnect the wiring harness (3).
- Installation is the reverse of the removal procedure.



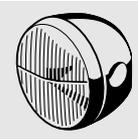


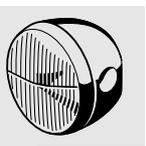
63 Lights

Contents

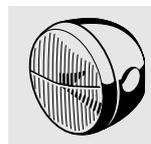
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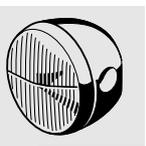
Technical Data	3
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Bulb, parking light	6
Flashing turn indicator	7
Rear lights	7
Checking and adjusting headlight beam angle	7
Vertical adjustment	7
Lateral adjustment	7





Technical Data	F 650
Lights	
Headlight	Halogen headlight and manual beam throw adjustment
Bulbs	
High beam/low beam	H4 halogen, 12V 60/55W, asymmetric
Parking light	12V 5W Type T8/4
Brake light/rear light	12V 21/5W Type P25-2
Flashing turn indicator	12V 10W Type P25-1







63 12 090 Removing and installing headlight

- Place motorcycle on its centre stand.
- Remove left and right covers.



Note:

Note washers and rubber ring.

- Remove the windshield.
- Remove the fasteners securing the cockpit fairing.
- Disconnect the multi-pin plug.
- Pull the rubber boot to the rear.
- Pull the socket of the sidelight out of the headlight housing.
- Remove the headlight complete with the trim panel.
- Press the adjustment screws (arrows) to release the headlight from the trim panel.
- If necessary, remove rubber ring (1).
- Installation is the reverse of the removal procedure: pay particular attention to the following.

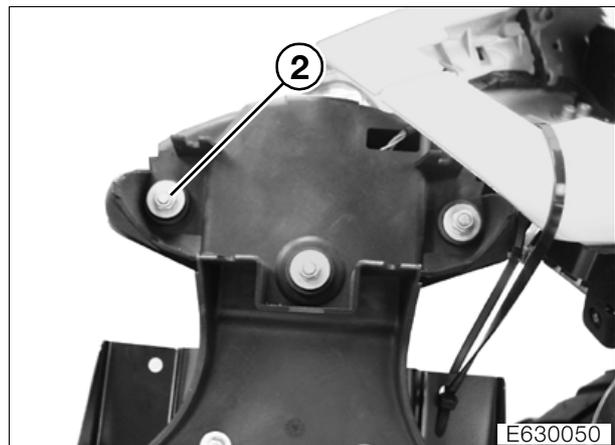


Warning:

After installing the windscreen, check and if necessary adjust the headlight setting.

63 21 380 Removing and installing rear light

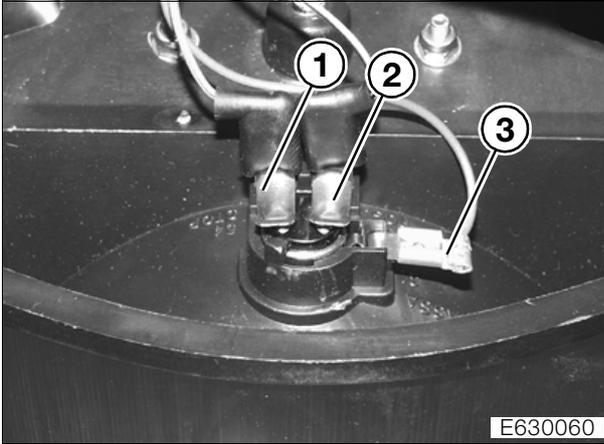
- Remove the lid of the stowage compartment.
- Remove the number plate holder complete with the rear light from the frame.
- Secure the number plate holder to the rear frame with a cable tie or similar.



- Remove the screws securing rear light (2).



- Disconnect the plug of the rear light.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



E630060

Colours of the wires in the housing for tail light/brake light

- 1 green-red
- 2 blue-black
- 3 brown

Tightening torques:

Rear light cluster to number-plate carrier 4 Nm
 Number-plate carrier to rear mudguard 3 Nm

Replacing bulb



Caution:

Always switch off the ignition before changing bulbs.

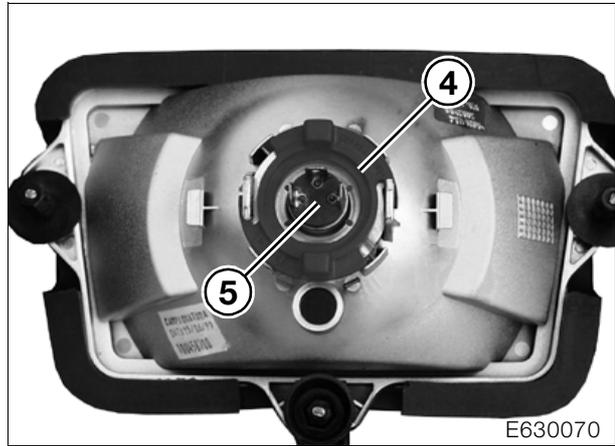


Note:

Do not touch inside of reflector and glass of bulbs with bare hands.

63 12 241 Bulb for low-beam headlight/high-beam headlight

- Place motorcycle on its centre stand.
- Disconnect the multi-pin plug.
- Pull the rubber boot to the rear.

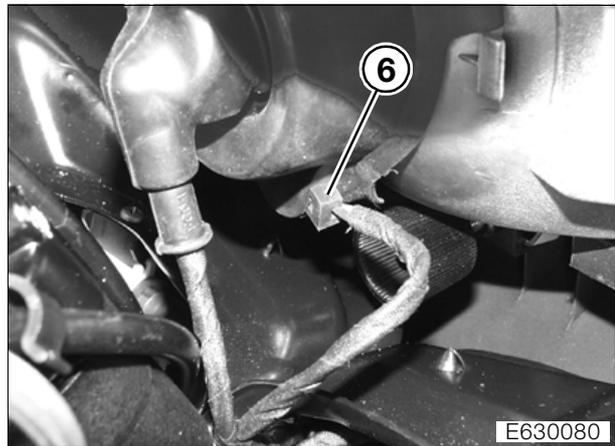


E630070

- Turn retainer (4) counterclockwise to release and remove.
- Remove bulb (5).
- Installation is the reverse of the removal procedure.

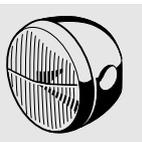
63 99 161 Bulb, parking light

- Place motorcycle on its centre stand.



E630080

- Pull the socket (6) to the rear and out of the headlight housing.
- Press the bulb in and turn it counterclockwise to release.
- Installation is the reverse of the removal procedure.



63 99 271 Flashing turn indicator

- Remove turn-indicator cover.
- Press the bulb to the rear and turn it counter-clockwise to release.
- Installation is the reverse of the removal procedure.

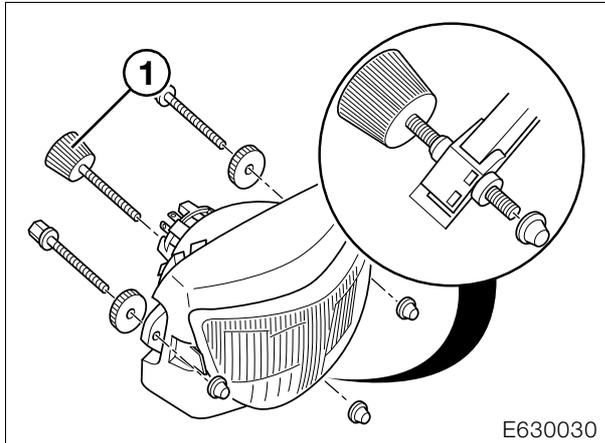
63 99 381 Rear lights

- Remove rear-light lens.
- Press the bulb to the rear and turn it counter-clockwise to release.
- Installation is the reverse of the removal procedure.

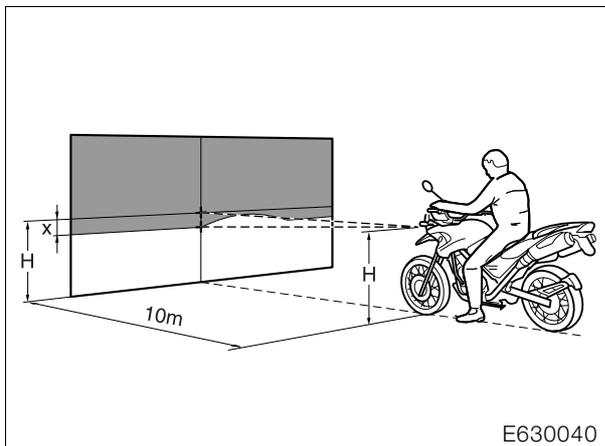
63 10 004 Checking and adjusting headlight beam angle

Vertical adjustment

- Set the spring tension to the basic setting.
- Rider's weight on motorcycle (75 kg/165 lbs).



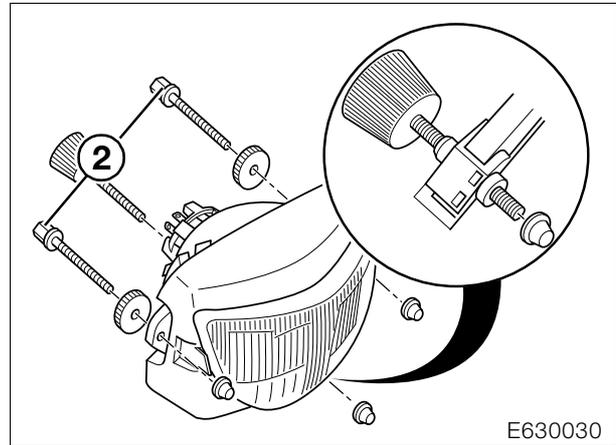
- Manually adjust the headlight range by turning adjusting screw (1).



Setting for headlight beam angle adjuster

X 10 cm (4 in) at a distance of 10 m (32.8 ft)

Lateral adjustment



- If necessary, adjust lateral throw by turning screws (2) with the aid of an appropriate adapter.

