

Repair Manual



F 650 GS/GS Dakar

**BMW Motorrad
After Sales**

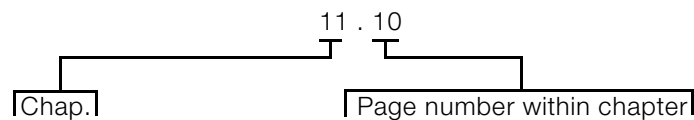
Introduction

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.



If a reference is needed to a different page or chapter, an arrow symbol is shown followed by the chapter and page numbers, e.g. (↔ 12.5)

- 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 (ETK), 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. **[Dakar]**.

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

BMW Motorrad
After Sales

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Structure

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" lists all tightening torques and the operating fluids.

Key to symbols

In this Repair Manual for the F 650 GS/GS Dakar, the following symbols are used; their meanings are explained in the tables.

Special instructions aimed at improving the work procedures



Note:

Special information on operating and inspecting the motorcycle as well as maintenance and adjustment procedures.



Important:

Instructions and precautions specifically intended to prevent damage to the motorcycle. Disregarding them may render the warranty invalid.



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 indicates work steps that are described in greater detail under another headline
- Preceding activities
- A line indicates work steps that are described in greater detail under another headline or in another chapter

The term "remove" means that:

the fastener (e.g. screw) must be slackened off and taken out

or

a component (e.g. injection rail) has to be removed to the extent that components behind it (e.g. throttle valve) are rendered accessible

The term "loosen" means that:

the fastener (e.g. screw) must be backed off, but not removed



Tightening torques:

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

BMW Motorcycle Maintenance schedule F 650 GS/F 650 GS Dakar



Customer _____ Licence plate no. _____		BMW Inspection at 1,000 km (600 miles)	BMW Service 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"/>
Renew oil in telescopic forks [Dakar version only]				<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"/>	<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"/>	<input type="checkbox"/>	
Check for operation of brake system and freedom from leaks; repair/replace if necessary *) Replace the brake fluid at least once a year				<input type="checkbox"/>	<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 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"/>
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, pivot lever [Dakar version only], main and side stands 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 2000					

BMW Motorcycle Pre-delivery Check F 650 GS/F 650 GS Dakar



		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 - 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"/>

BMW Motorcycle

Service data

F 650 GS/F 650 GS Dakar



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 [Dakar version only]	0.55 (0.97/0.58)	Litres (Imp. pints/US quarts) BMW telescopic fork oil
Coolant Cooling system (entire) Expansion tank	1.3 (2.29/1.37) 0.1 (0.18/0.11)	Litres (Imp. pints/US quarts) 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 when fully loaded	front/rear 1.9/2.1 (27/30) 2.1/2.3 (30/33)	bar (psi) bar (psi)
Tightening torques: Engine oil drain plug Engine water drain plug Oil tank drain plug Oil filter cap Valve cap Camshaft bracket Spark plug Telescopic fork oil drain plug Round nut, steering bearing Steering bearing locking tube Flanged nut on locking tube Fork stabilizer clamping screws Brake caliper at fork slider tube Deflection lever/frame Deflection lever/spring strut Deflection lever/tension strut	40 10 21 10 10 10 20 6 25 65 65 21 41 50 47 71	Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm Nm

Contents

Group / Chapter

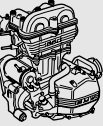
00 Tightening torques Operating fluids

00 Pre-delivery check

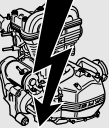
00 Maintenance



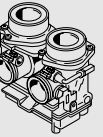
11 Motor



12 Engine electrics



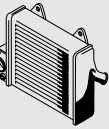
13 Fuel preparation and control



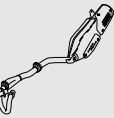
16 Fuel tank and lines



17 Radiator



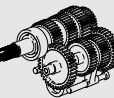
18 Exhaust system



21 Clutch



23 Gearbox



27 Drive chain



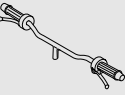
31 Front forks



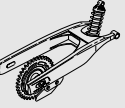
>> Continuation

Group / Chapter

32 Steering



33 Rear wheel drive



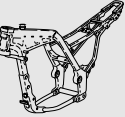
34 Brakes



36 Wheels and tyres



46 Frame



51 Equipment



61 General electrical equipment



62 Instruments



63 Lights



<< Back

00 Tightening torques

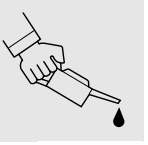
Operating fluids

Contents

Page

Tightening torques	3
11 Engine	3
12 Engine electrics	4
13 Fuel preparation and control	4
16 Fuel tank and lines	5
17 Radiator	5
18 Exhaust system	5
21 Clutch	6
23 Transmission	6
27 Drive chain	6
31 Front forks	6
32 Steering	7
33 Rear wheel drive	7
34 Brakes	7
46 Frame	8
51 Equipment	10
61 General electrical equipment	10
62 Instruments	10
63 Lights	10
Table of operating fluids	11





Tightening torques

Model	F 650 GS / GS Dakar	
Connection		
11 Engine		
Freewheel housing and freewheel	Nm	35 (clean thread + Loctite 648)
Engine block	Nm	10
Double drive gear on crankshaft	Nm	180 (clean thread + Loctite 243)
Driver	Nm	140 (clean thread + Loctite 243)
Pressure plate	Nm	10
Magnet hub	Nm	180 (clean thread + Loctite 243)
Signal transmitter	Nm	8
Ignition cover	Nm	10
Cylinder base	Nm	10
Spark plug	Nm	20
Fastener for chain tensioner	Nm	40
Oil circuit		
Oil tank to intake air silencer	Nm	9
Oil filter cover	Nm	10
Oil pressure switch	Nm	12 (clean thread + Loctite 243)
Oil tank drain plug	Nm	21
Engine oil drain plug	Nm	40
Oil supply/oil return lines to engine	Nm	42 (with copper seals)
Oil pump cover	Nm	6 (clean thread + Loctite 243)
Oil pressure valve	Nm	24
Oil check valve	Nm	24
Cylinder head		
Collar nuts for cylinder head	Nm	60
Collar screws for cylinder head	Nm	33
Machine screws (chaincase)	Nm	10
Camshaft mount	Nm	10
Chain sprockets to camshafts	Nm	60 threads oiled
Chain guide to camshaft mount	Nm	10 (clean thread + Loctite 243)





Model	F 650 GS / GS Dakar	
Connection		
11 Engine		
Cylinder head cover	Nm	10
Machine screw (hole for locating pin)	Nm	25
Cylinder head to frame	Nm	41
Cylinder head to frame, adjusting sleeve	Nm	zero play, max. 5
Cylinder head to frame, locknut	Nm	100
Model	F 650 GS / GS Dakar	
Connection		
12 Engine electrics		
Magnet hub	Nm	180 (clean thread + Loctite 243)
Signal transmitter	Nm	8
Engine block cover, left/right	Nm	10
Starter to clutch cover	Nm	10
Necked-down bolts, starter housing	Nm	6
Cable cover to engine block	Nm	4
Ignition coil and holder	Nm	9
Model	F 650 GS / GS Dakar	
Connection		
13 Fuel preparation and control		
Air intake pipe to cylinder head	Nm	25
Fuel filter to frame	Nm	9
Injector holder to throttle valve	Nm	5
Connecting flange, air filter box to battery carrier	Nm	5
Intake air silencer to retainer	Nm	9
Oil tank to intake air silencer	Nm	9
Throttle-valve potentiometer to throttle valve stub	Nm	3
Throttle lifter to throttle valve stub	Nm	5 (clean thread + Loctite 243)

Model	F 650 GS / GS Dakar	
Connection		
16 Fuel tank and lines		
Fuel tank to rear frame (M 8 stud)	Nm	21
Fuel filler cap to fuel tank	Nm	3
Roll-over valve to fuel tank	Nm	2
Bracket, activated charcoal filter to fuel tank	Nm	3
Fuel pump to fuel tank	Nm	36
Model	F 650 GS / GS Dakar	
Connection		
17 Radiator		
Air duct to frame trussing	Nm	3
Expansion tank to radiator	Nm	9
Radiator to main frame	Nm	9
Water pump drain screw	Nm	10
Left engine block cover to engine block	Nm	10
Water pump cover	Nm	10
Temperature sensor in cylinder head	Nm	15
Bleed screw	Nm	12
Model	F 650 GS / GS Dakar	
Connection		
18 Exhaust system		
Oxygen sensor to exhaust	Nm	45
Exhaust manifold to cylinder head	Nm	20
Silencer to exhaust manifold (Torca clamp)	Nm	55
Silencer to rear frame	Nm	9
Heat shield to silencer	Nm	9





Model		F 650 GS / GS Dakar	
Connection			
21 Clutch			
Driver	Nm	140 (clean thread + Loctite 243)	
Pressure plate	Nm	10	
Engine block cover, left	Nm	10	
Model		F 650 GS / GS Dakar	
Connection			
23 Transmission			
Selector lever to selector shaft	Nm	15	
Model		F 650 GS / GS Dakar	
Connection			
27 Drive chain			
Drive pinion cover to engine	Nm	2	
Chain takeup roller to frame	Nm	21	
Chain sprocket to chain sprocket mount	Nm	21	
Quick-release shaft nut	Nm	100	
Drive chain tensioning screws	Nm	10	
Central nut to main shaft	Nm	140 (clean thread + Loctite 243)	
Model		F 650 GS	F 650 GS Dakar
Connection			
31 Front forks			
Fork stabiliser to fork leg	Nm	21	
Clamp screws for fork bridges, top/bottom	Nm	21	
Plate for bottom fork bridge to fork bridge	Nm	9	
Oil drain plug	Nm	6	
Damper retaining screw	Nm	20	
Round nut			
Preload	Nm	25	
Back off through angle of rotation	°	60	
Counter-tube to steering head bearing	Nm	65	
Hexagon nut to counter-tube	Nm	65	
Screw plug in fork	Nm	-	25

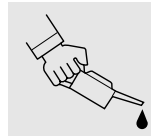
Model		F 650 GS / GS Dakar
Connection		
32 Steering		
Handlebars to fork bridge	Nm	21 (apply Optimoly TA to thread)
Handlebar weight to handlebars	Nm	9
Clutch fitting to handlebars, M 6	Nm	9
Clutch switch to handlebar fitting	Nm	5
Pivot pin for brake lever	Nm	6
Locknut for pivot pin, clutch lever	Nm	8
Model		F 650 GS / GS Dakar
Connection		
33 Rear wheel drive		
Suspension strut to frame	Nm	58
Wrench angle	°	45
Suspension strut to angled lever	Nm	47
Knob for adjusting suspension-strut damping to holder	Nm	21
Holder, suspension-strut damping to frame	Nm	9
Swinging-fork pivot shaft	Nm	100
Reaction link to swinging fork	Nm	41
Reaction link to angled lever	Nm	71
Angled lever to frame	Nm	58
Wrench angle	°	45
Model		F 650 GS / GS Dakar
Connection		
34 Brakes		
Bleed screw in front/rear brake caliper	Nm	7
Brake caliper to fork slider tube	Nm	41
Brake disc and sensor ring to front wheel	Nm	9 (clean thread + Loctite 243)
Brake disc to rear wheel	Nm	9 (clean thread + Loctite 243)
Brake fluid reservoir for rear brake to rear frame	Nm	1.5
Brake pedal to frame	Nm	21





Model	F 650 GS / GS Dakar	
Connection		
34 Brakes		
Brake lines/hoses		
Brake hose to brake caliper	Nm	18
Brake hose to brake lever fitting	Nm	18
Brake hose/brake line interfaces	Nm	18
Brake line to master brake cylinder, rear wheel	Nm	18
ABS		
ABS sensor front/rear	Nm	9
ABS pressure modulator to holder	Nm	21
Holder for ABS pressure modulator to frame transverse tube	Nm	9
Brake line to ABS pressure modulator	Nm	18
Sensor ring to rear wheel	Nm	5 (clean thread + Loctite 243)
Brake disc and sensor ring to front wheel	Nm	9 (clean thread + Loctite 243)
Model	F 650 GS / GS Dakar	
Connection		
36 Wheels and tyres		
Clamp nut, front quick-release axle	Nm	21
Front quick-release axle to fork leg	Nm	45
Rear quick-release axle to swinging fork	Nm	100
Chain sprocket to chain sprocket mount	Nm	21
Model	F 650 GS / GS Dakar	
Connection		
46 Frame		
Body		
Fairing sections/covers	Nm	3
Fairing support bracket to frame	Nm	21
Grip to rear frame	Nm	9
End trimmer to rear frame	Nm	9
Tail to rear frame	Nm	4
Tail section (mounting for case holder) to rear frame	Nm	4 (clean thread + Loctite 243)

Model		F 650 GS / GS Dakar
Connection		
46 Frame		
Seat lock to rear frame	Nm	9
Number-plate carrier to rear section of rear mudguard	Nm	3 (clean thread + Loctite 243)
Mudguards/wheel guards		
Front mudguard, rear section to front section	Nm	3
Front mudguard to fork bridge	Nm	3 (clean thread + Loctite 243)
Rear mudguard, front and rear sections to rear frame	Nm	9
Rear mudguard, front section to bracket for case carrier	Nm	21
Wheel cover, bottom, to bracket	Nm	3 (clean thread + Loctite 243)
Wheel cover bracket to swinging fork	Nm	9
Frame		
Footrest plate to main frame	Nm	21
Footrest rubber to rear footrest	Nm	5
Retaining bracket for intake air silencer to main frame	Nm	9
Engine guard to frame truss	Nm	9
Rear frame to main frame, top	Nm	21
Rear frame to main frame, bottom	Nm	21 (clean thread + Loctite 2701)
Centre stand to main frame	Nm	41
Side stand to bottom truss	Nm	40
Side stand bottom truss to main frame	Nm	21
Engine mounts		
Engine/crankcase to main frame at rear	Nm	41
Cylinder head to frame	Nm	41
Cylinder head to frame, adjusting sleeve	Nm	zero play, max. 5
Cylinder head to frame, locknut	Nm	100
Engine/cylinder head to main frame at top	Nm	41
Engine shell to engine	Nm	41
Engine shell to bracing tube	Nm	21

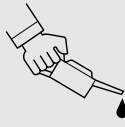


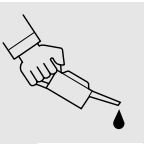


Model	F 650 GS / GS Dakar	
Connection		
51 Equipment		
Ignition/steering lock to fork bridge	Nm	21
Model	F 650 GS / GS Dakar	
Connection		
61 General electrical equipment		
ABS sensor cable to sliding tube	Nm	9
ABS sensor to brake caliper mount, rear	Nm	9
Clutch switch to clutch handlebar fitting	Nm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

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 (narrow gap)	07 58 9 067 732	5 g bottle
Loctite 638	Joint adhesive (wide gap)	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 chrome-plated 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





00 Pre-delivery check

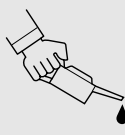
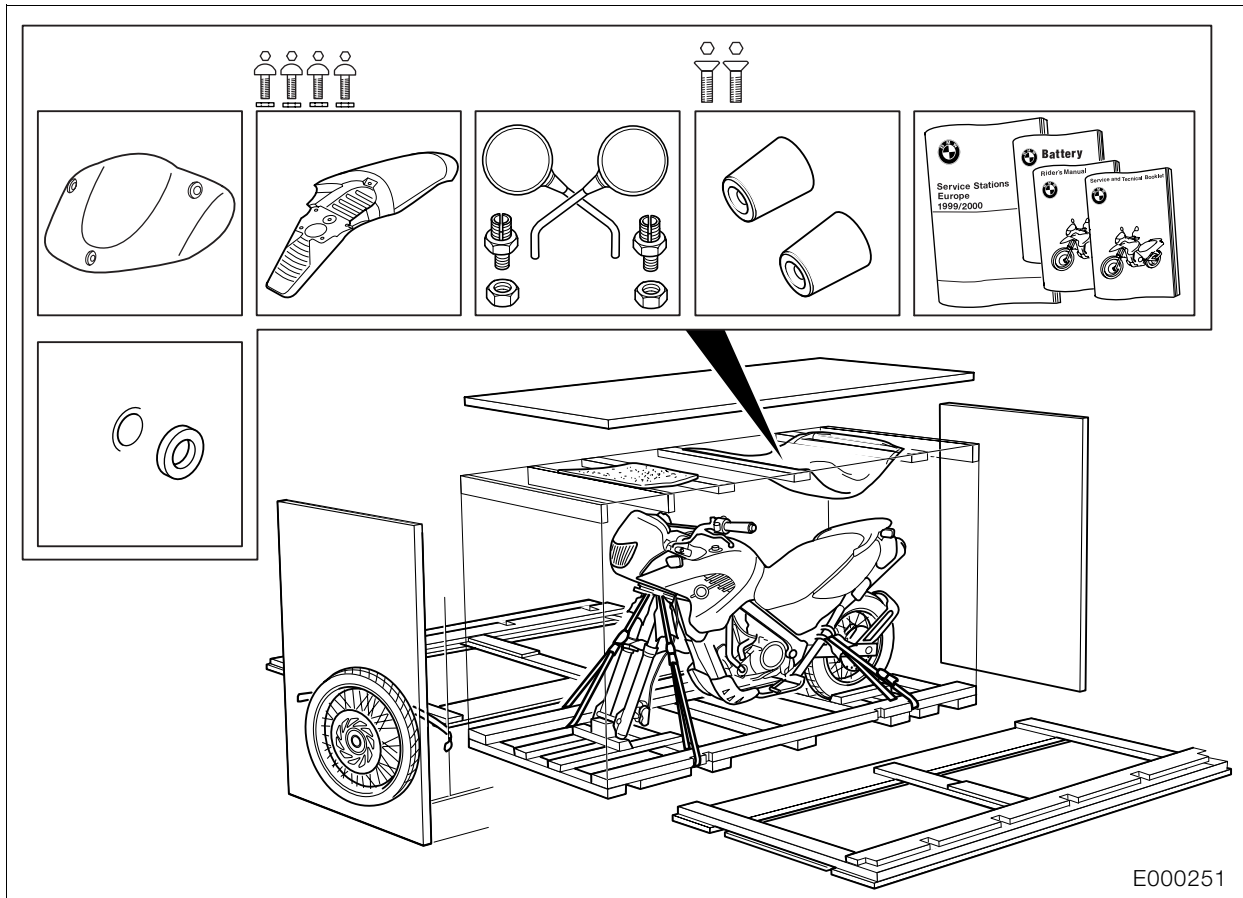
Contents

Page



General view of crated motorcycle	15
Checking the shipping crate for damage	15
In case of damage in Germany	15
In case of damage in importer markets	15
Unpacking the motorcycle	15
Inspecting motorcycle for damage	16
Installing remaining items on motorcycle	16
Installing the front wheel	16
Installing windscreen	17
Installing front mudguard, mirrors and handlebar weights	18
Filling and charging the battery	19
Removing right and centre covers	19
Filling and charging the battery	20
Checking that delivery is complete	21
Reading the fault code memory with the BMW MoDiTeC	21
Checking tyre pressures	21
Adding fuel to tank	21
Final inspection and function check	21
Final cleaning	22
Handing over the motorcycle	22





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.

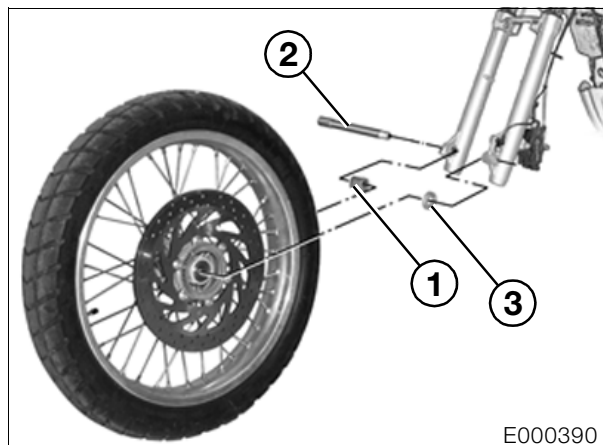
- Remove the straps at front and rear.



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
 - Spacer sleeve, spacer
 - four washers for front mudguard
 - Rider's Manual
 - Service and Technical booklet
 - Booklet listing service centres in Europe
 - BMW emergency service sticker
 - Handling instructions for batteries

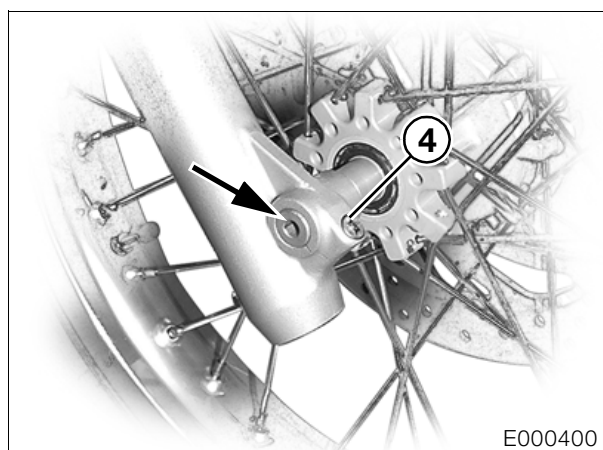


E000390

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

- Install spacer sleeve (1).
- Insert the front wheel between the telescopic fork legs.
- Install quick-release axle (2) with spacer (3).



E000400

Installing remaining items on motorcycle

Installing the front wheel



Caution:

Take care not to damage the ABS sensor, sensor ring, brake disc and brake pads when installing.

- Raise front of motorcycle (e.g. with crane).
- Clean the quick-release axle and the contact face of the shaft sealing ring and grease them with **Optimoly TA**.

- Tighten the quick-release axle (arrow).
- Lower the front wheel to the ground, compress the front suspension firmly several times.
- Tighten clamping screw (4) securing the quick-release axle.

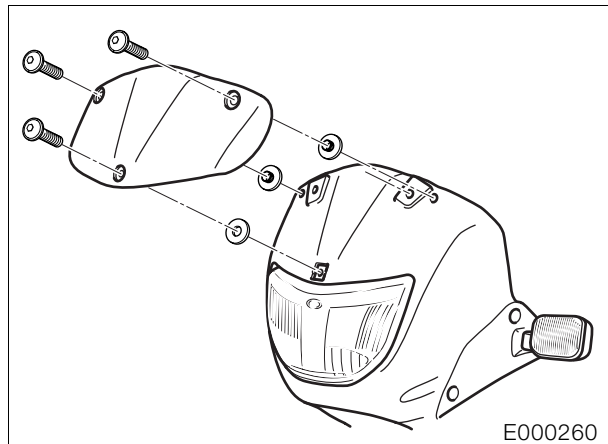


Tightening torques:

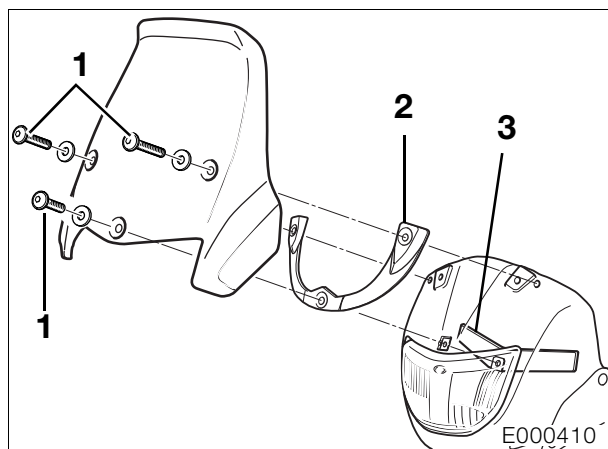
Quick-release axle 45 Nm
Clamping screw 21 Nm

Installing windscreen

- Wheel the motorcycle clear of the wooden pallet.



- **[GS]** Tighten the windscreen securing screws.



- **[Dakar]** Align retainer (3) in bottom fairing panel.
- **[Dakar]** Place windscreen (1) in position with spacer (2).
- **[Dakar]** Tighten fasteners of windscreen (1).



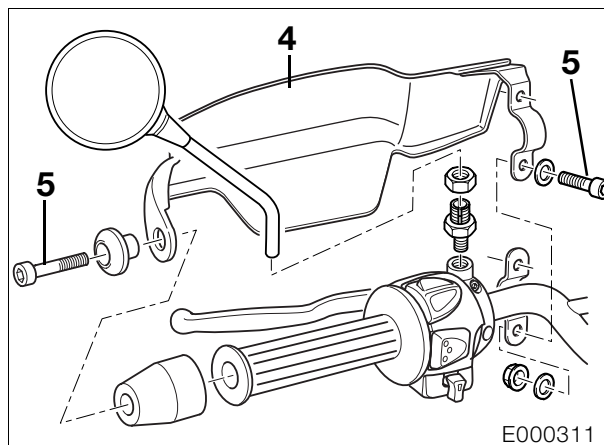
Important:

[Dakar] Make sure that hand protectors do not contact windscreen or handlebar fittings when handlebars are turned to full lock.



Note:

If necessary, the handlebars can be turned slightly (max. 1.5°) toward the rider.



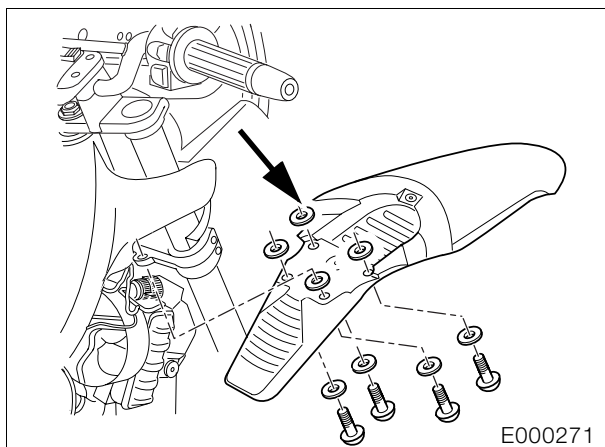
- **[Dakar]** After turning the handlebars to full left/right lock, align the hand protectors (4) with the windscreen and the handlebar fittings.
- **[Dakar]** Tighten fasteners (5).



Tightening torques:

Windscreen to cockpit fairing	2 Nm
Hand protector to handlebars	9 Nm

Installing front mudguard, mirrors and handlebar weights

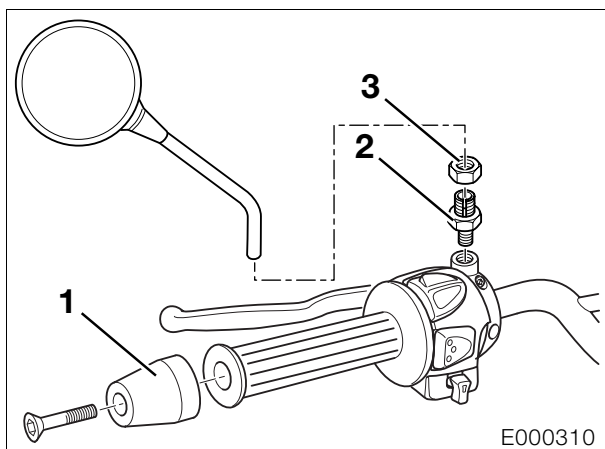


- Install front mudguard.



Caution:

Insert four washers (arrow) between front mudguard and lower fork bridge.

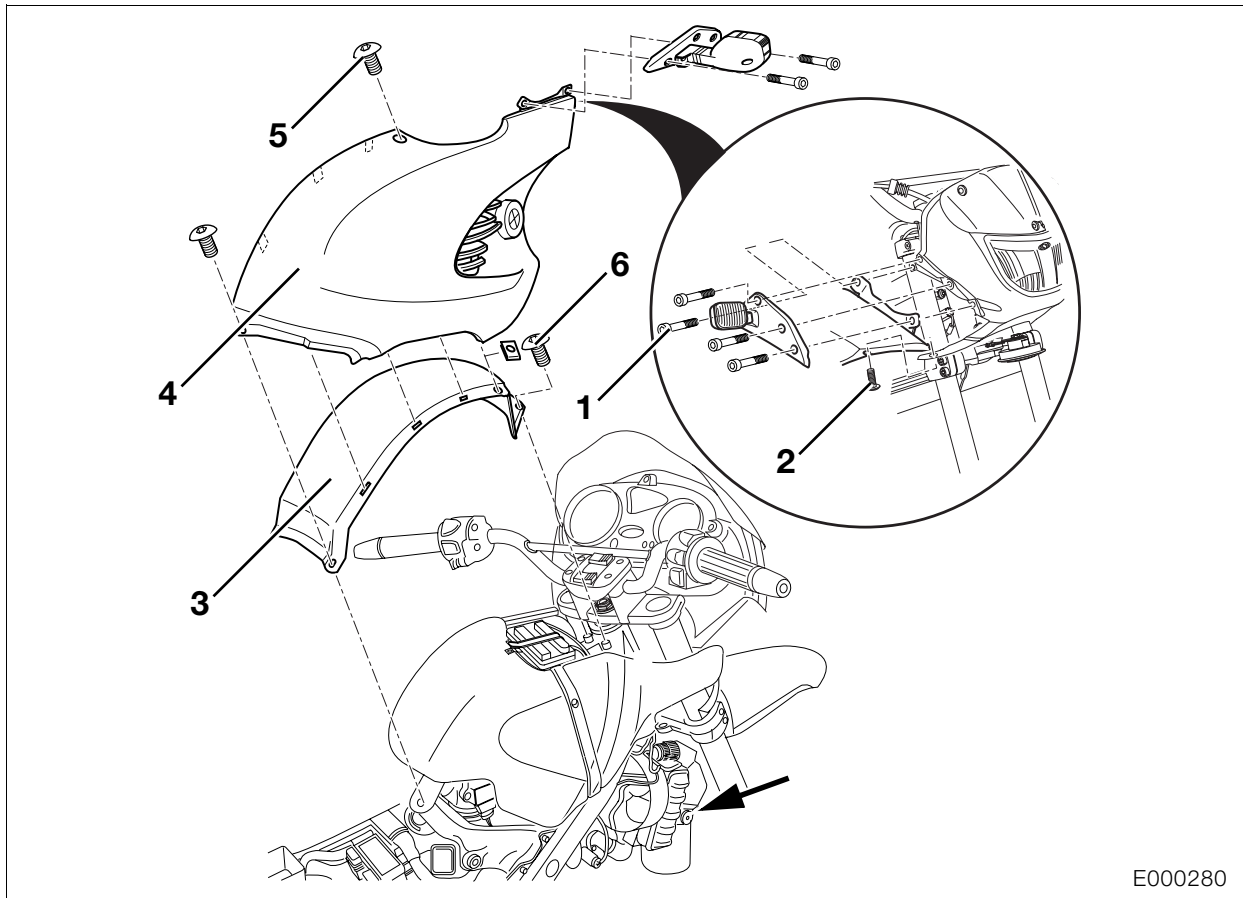


- Install handlebar weights (1).
- Tighten clamp screw (2) on handlebar fitting.
- Install each mirror and secure by tightening union nut (3).



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



E000280

Filling and charging the battery

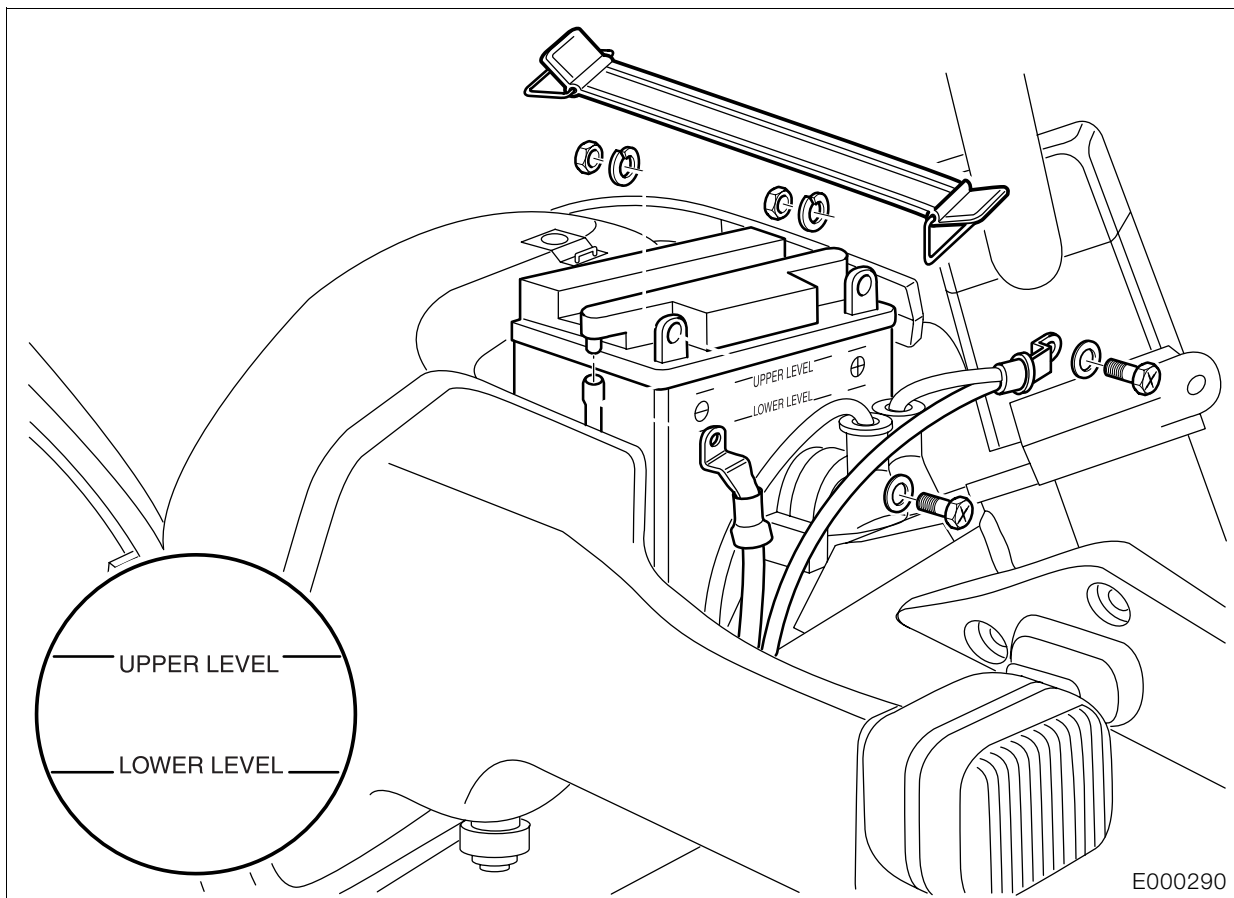
Removing right and centre covers



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.



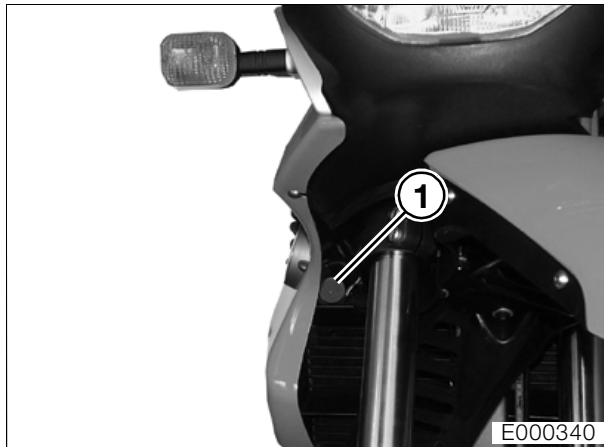
Tightening torques:

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, T40, 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

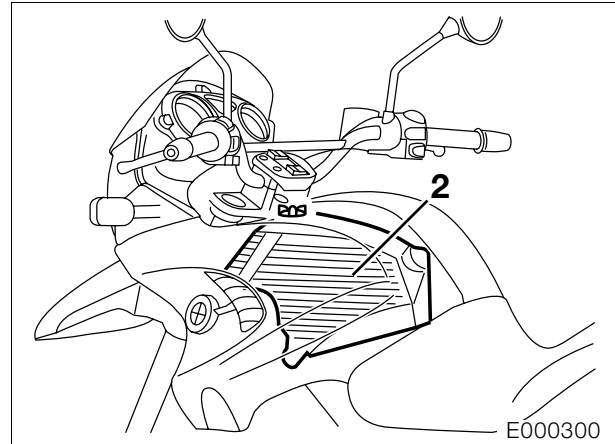
- Fill up with fuel.

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

00 Maintenance



Contents

Page

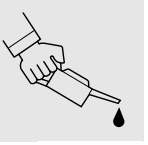
Key to maintenance intervals	27
Reading the fault code memory with the MoDiTeC	28
(Inspections I, II, III and IV)	28
Changing the engine oil and oil filter element	28
(Inspections I, II, III and IV)	28
Preparatory work	28
Draining engine oil	28
Replacing oil filter element	29
Filling with engine oil	29
Checking coolant, topping up if necessary	30
(Inspections I, II and III)	30
Checking coolant	30
Adding coolant	30
Changing coolant	30
(Inspection IV, every 2 years)	30
[Dakar] Changing oil in telescopic forks	32
(Inspection III)	32
Checking and adjusting valve clearances	33
(Inspections I, II and III)	33
Checking valve clearances	33
Preparatory work	33
Removing the intake air silencer together with the intake air pipe.	33
Exposing the radiator	33
Exposing cylinder head	33
Turning crankshaft to TDC position	34
Checking valve clearance	34
Adjusting valve clearances	34
Installing cylinder head cover	35



Replacing spark plugs	36
(Inspection III)	36
Emptying drain hose from intake air silencer	36
(Inspections II and III)	36
Replacing air cleaner element	36
(Inspection III)	36
Replacing fuel filter	37
(Inspection III, every 20,000 km/12,000 miles)	37
Checking clutch play, adjusting if necessary	38
(Inspections I, II and III)	38
Checking wheel spoke tension, adjusting if necessary	38
(Inspections II and III)	38
Checking brake pads and discs for wear, replacing if necessary	39
(Inspections II and III)	39
Checking brake pads for wear	39
Brake pads, front brake	39
Brake pads, rear brake	39
Replacing brake pads	39
Brake pads, front brake	39
Brake pads, rear brake	40
Checking the brake discs	40
Checking the brake fluid level and topping up if necessary	41
(Inspections II and III)	41
Brake fluid level (front brake)	41
Checking brake fluid level (front brake)	41
Topping up brake fluid level (front brake)	41
Brake fluid level (rear brake)	41
Checking brake fluid level (rear brake)	41
Topping up brake fluid level (rear brake)	41
Checking operation of brake system and checking for leaks; repairing/replacing as necessary	41
(Inspection III)	41
Changing brake fluid and bleeding brake system	42
(Inspection IV)	42
Changing brake fluid (front brake)	42

Changing brake fluid (rear brake)	43
Replacing primary sealing boot front brake master cylinder	44
(Inspection III, every 40,000 km/24,000 miles for motorcycles with ABS)	44
Replacing primary sealing boot, rear brake master cylinder	45
(Inspection III, every 40,000 km/24,000 miles for motorcycles with ABS)	45
Checking chain, chainwheel and chain sprocket, replacing if necessary ..	46
(Inspections II and III)	46
Checking chain tension, adjusting if necessary	46
(Inspections I, II, III and IV)	46
Checking chain tension	46
Adjusting chain tension	47
Checking battery acid level, adding distilled water if necessary	47
(Inspections II, III and IV)	47
Checking battery acid level	47
Adding distilled water	47
Cleaning and greasing the battery terminals, if necessary	48
(Inspection IV)	48
Checking and adjusting steering head bearing play, renewing if necessary	48
(Inspections II and III)	48
Checking steering head bearing play	48
Adjusting steering head bearing play	49
Greasing the side and main stands and the brake pedal lever	50
(Inspections II and III)	50
Side stand	50
Main (centre) stand	50
Brake pedal	51
Checking security of threaded fasteners	51
(Inspections I, II, III and IV)	51
Final inspection with road safety and functional check	52
(Inspections I, II, III and IV)	52
Road safety check	52
Tyre tread depth (recommended minimum value)	52
Tyre pressures (tyres cold)	52
Roadworthiness check	52





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 40,000 km ... 60,000 km ... 80,000 km) (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 40,000 km ... 60,000 km ... 80,000 km) (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 motorcycle has covered. They should therefore be carried out at least once a year (e.g. changing brake fluid).

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

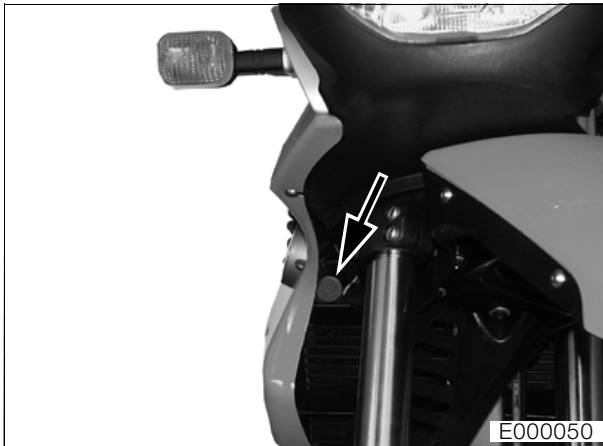
In this Repair Manual, the individual maintenance intervals are shown by the following codes:

- 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 (→ 46.5).
- Remove engine guard (→ 46.8).
- Remove cover for chain sprocket from engine.

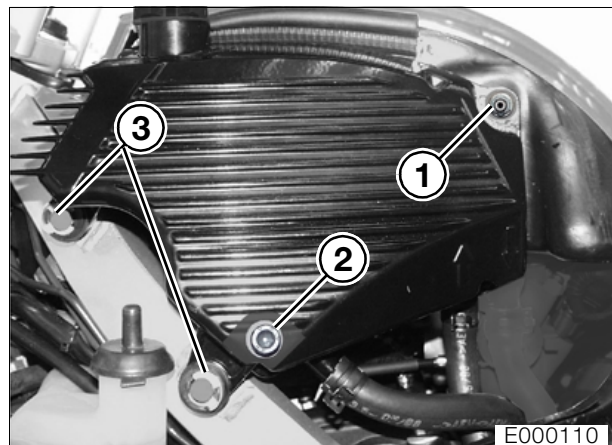
00 11 215 Draining engine oil



Warning:

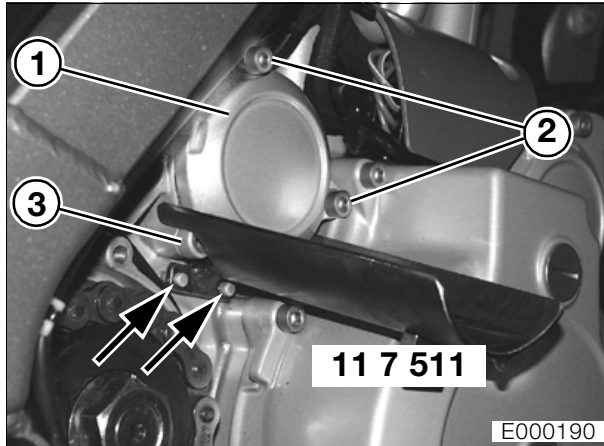
Observe the hazard avoidance instructions for running internal combustion engines in enclosed spaces.

- 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 remove 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-indicator 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.



Important:

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 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 torque:

Oil filter cover 10 Nm
Cover for chain sprocket 2 Nm

00 11 215 Filling with engine oil

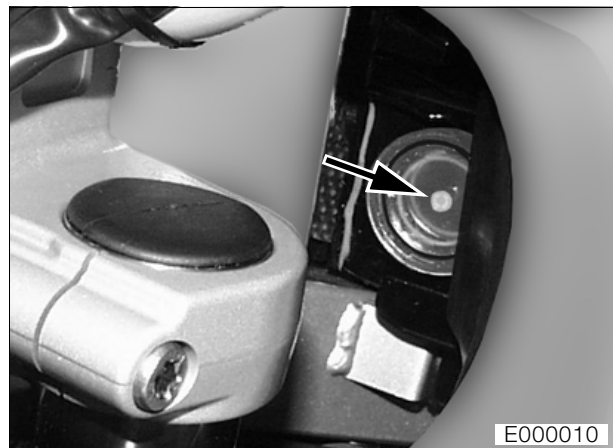
- Install the oil drain plug in the oil tank with a new sealing ring and tighten.
- Install the oil drain plug in the engine with a new sealing ring and tighten.
- Fill the oil tank with 2 l (3.52 Imp. pints/ 2.11 US quarts) of engine oil and install the filler cap.



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.



Important:

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.

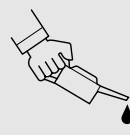
Engine oil capacity:

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.

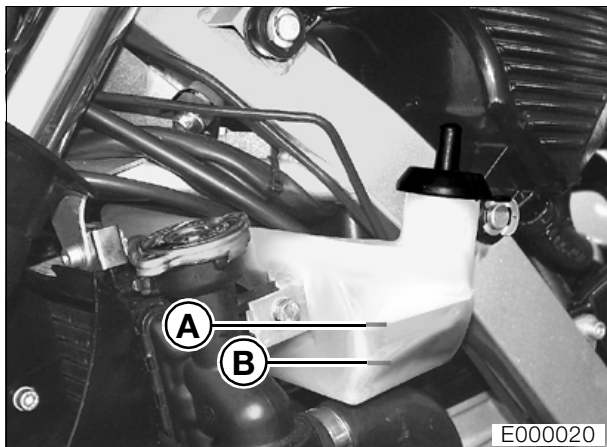


Checking coolant

- 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 (→ 46.5).



Important:

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 to a ratio of 50 % antifreeze, 50 % water.

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

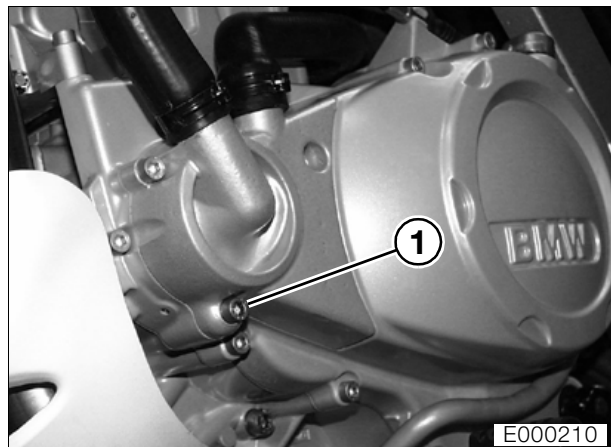
Maximum level..... **A**
Minimum level..... **B**

- Installation is the reverse of the removal procedure.

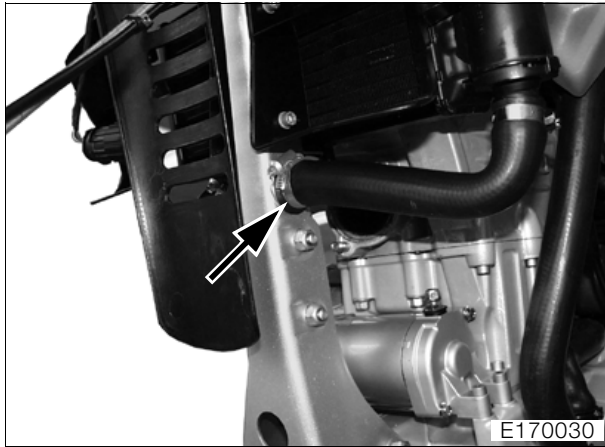
17 00 035 Changing coolant

(Inspection IV, every 2 years)

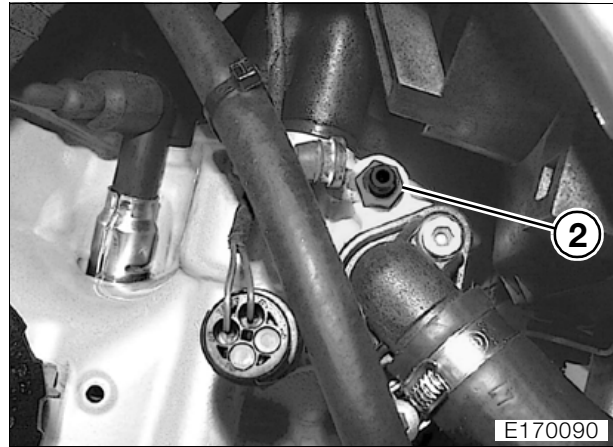
- Remove left cover (→ 46.5).
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.



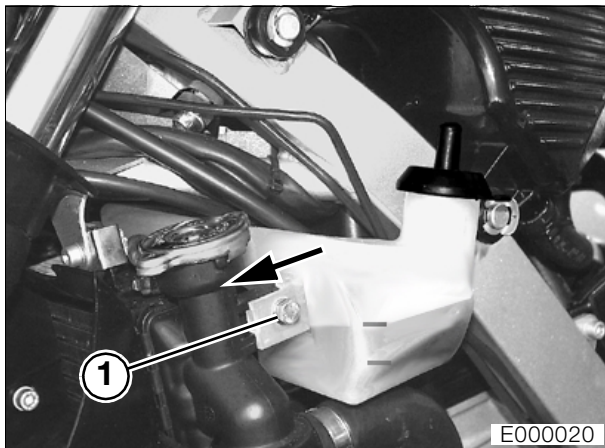
- Remove drain plug (1) from water pump.
- Hold a funnel below the drain and open the radiator cap.
- Drain off all the coolant.



- 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.

⚠ Important:

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.

Filling capacity

Cooling system	..... 1.2 l (2.11 Imp. pints/1.27 US quarts)
In expansion tank	..... + 0.1 l (0.18 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.

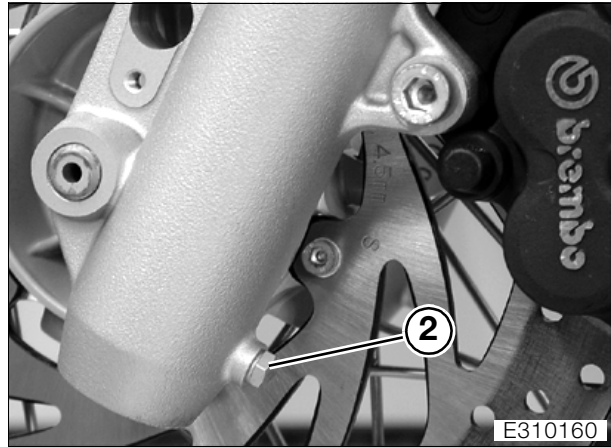
🔧 Tightening torques:

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

00 11 279 [Dakar] Changing oil in telescopic forks

(Inspection III)

- Install stand, **BMW No. 00 1 610**, and place the motorcycle on the stand.
- Relieve load on front wheel.



Warning:

Note that screw plugs (1) at left and right are spring-loaded.

- Release screw plugs (1).

- Position a drip tray beneath the telescopic forks.
- Slacken oil drain plugs (2) on left and right.
- Allow all the oil to drain off.



Important:

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.
- Lightly oil thread of screw plug.



Note:

Check O-ring of screw plug for damage and renew if necessary.



Warning:

Note that screw plugs (1) at left and right are spring-loaded.

- Install and tighten screw plugs on left and right.

Capacity per fork leg

..... 0.55 l (0.97 Imp. pints/0.58 US quarts)

Operating fluids:

Telescopic fork.....BMW telescopic-fork oil



Tightening torque:

Oil drain plug..... 6 Nm
Screw plug in fork 25 Nm

00 11 602 Checking and adjusting valve clearances

(Inspections I, II and III)

0011601 Checking valve clearances

Preparatory work

- Remove left, right and centre covers (→ 46.5).
- Remove battery (→ 61.10).

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 valve stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle valve stub.

Exposing the radiator

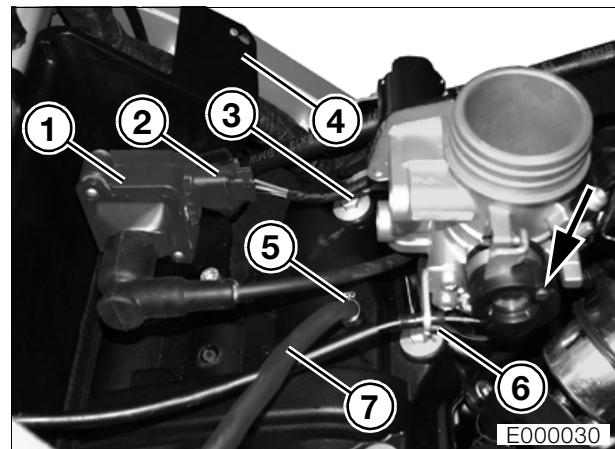


Note:

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 and pull it to one side. Use cable ties to secure it to the handlebars.
- 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 starter coil (2) at plug.
- 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).
- Open the clips securing the oil tank.
- Remove the oil tank and tilt it to the right.



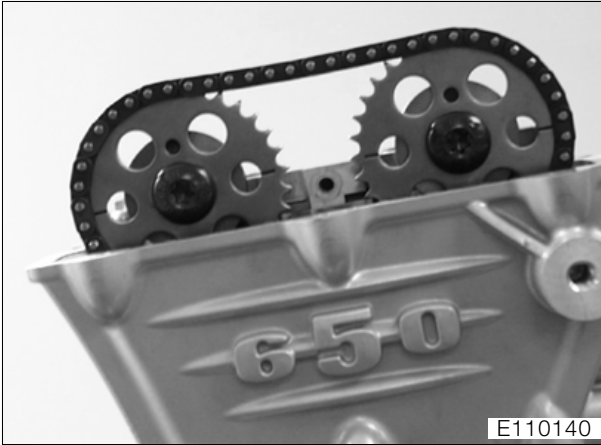
Note:

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.

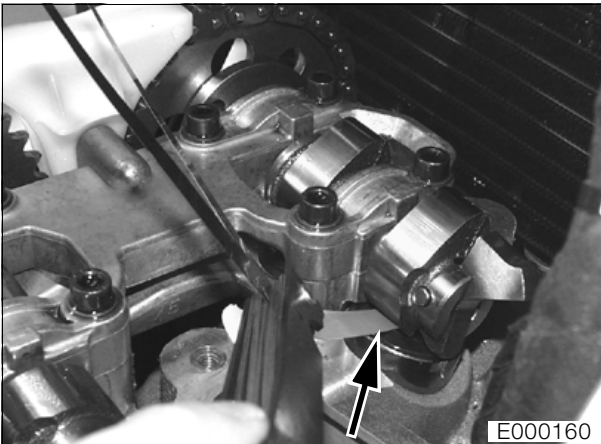


Note:

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.

- Use an Allen key to turn the crankshaft clockwise to the TDC position.

Checking valve clearance

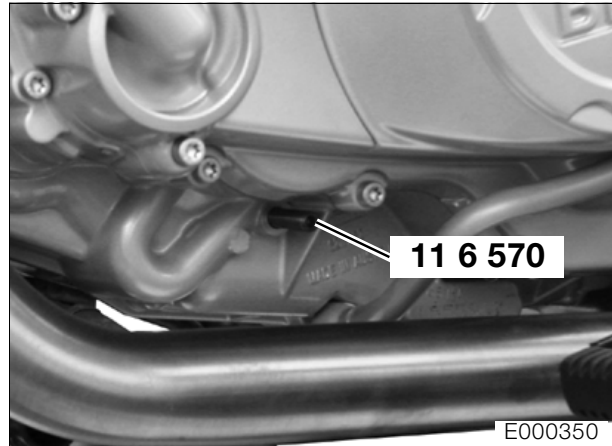


- Use a feeler gauge (arrow) to determine valve clearance.
- Make a note of the valve clearances, or adjust them if necessary.

Valve clearances:

Inlet valve 0.10...0.15 mm (0.004...0.006 in)
Exhaust valve 0.25...0.30 mm (0.01...0.012 in)

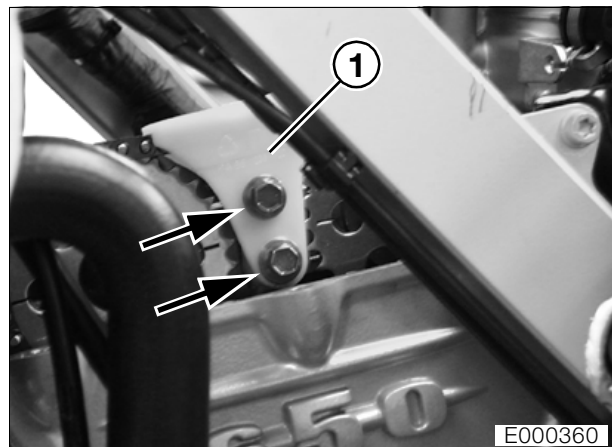
00 11 602 Adjusting valve clearances



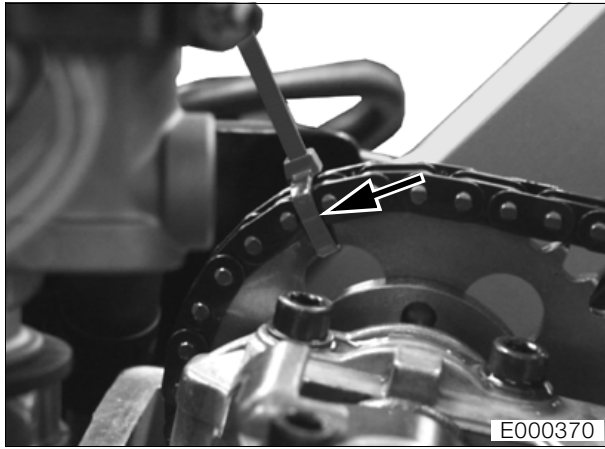
Note:

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

- Remove the screw at the oil feed stub pipe and insert locating screw, **BMW No. 11 6 570**, to lock the crankshaft at TDC.



- Remove the fasteners securing the chain guide (arrows) and remove chain guide (1).



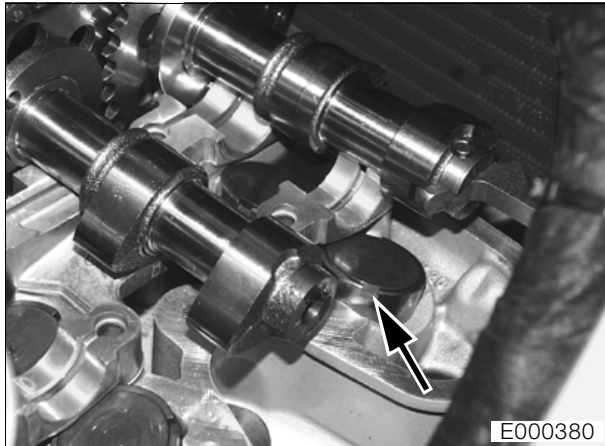
- Use cable ties (arrow) to secure the timing chain to both sprockets.
- Remove the upper section of the camshaft carrier.



Important:

Oil the camshaft bearings to facilitate removal and installation of the camshafts.

- Carefully remove the inlet camshaft and lay it aside.
- Carefully remove the exhaust camshaft and lay it aside.



- Turn the bucket tappet until the shim (arrow) can be levered out at the groove in the bucket tappet.
- Before installing new shims, check thickness with a micrometer.
- Position the shim in the bucket tappet.



Important:

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.
- When installing the inlet camshaft, press the chain rail back against the chain tensioner if necessary.



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.

- Before installing the chain guide, remove the locating screw and install the screw plug, fitted with a new sealing ring.
- Turn the engine over once and bring it to TDC.
- Check the TDC positions of the camshaft sprockets.
- Check valve clearances.
- Clean the threads of the securing screws for the chain guide, coat threads with **Loctite 243** and install the screws.



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.



Note:

Do not reinstall the unit consisting of intake air silencer, intake duct and battery carrier at this stage, if the fuel filter has to be removed.

Make sure that the intake pipe is correctly seated on the throttle valve stub.

- If necessary, top up the coolant in the expansion tank.

Valve clearances:

Inlet valve 0.10...0.15 mm (0.004...0.006 in)
 Exhaust valve 0.25...0.30 mm (0.01...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
 Expansion tank to radiator 9 Nm
 Trim panel/cover 3 Nm
 Camshaft bearing cap to cylinder head 10 Nm
 Chain guide to bearing cap
 (clean threads + Loctite 243) 10 Nm
 Threaded plug in left side of engine block 25 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 torque:**
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.

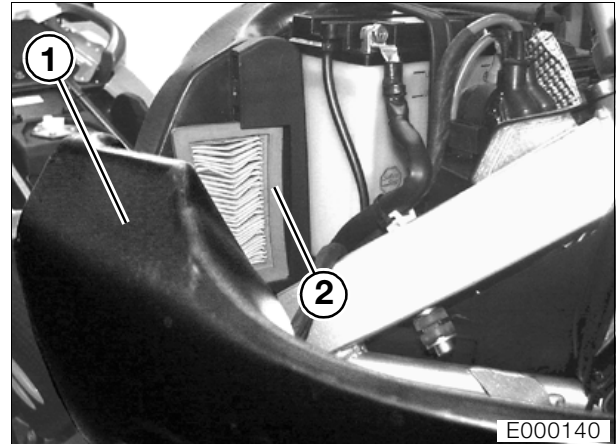
Important:

Dispose of used oil in an environmentally compatible manner.

00 13 630 Replacing air cleaner element

(Inspection III)

- Remove right cover (→ 46.5).
- 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 torque:**
Connecting flange..... 5 Nm

0016617 Replacing fuel filter

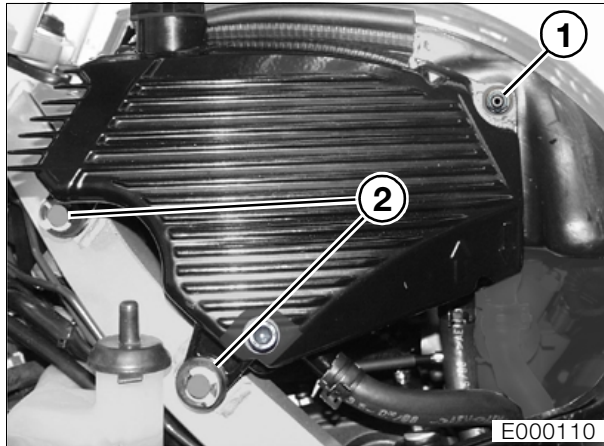
(Inspection III, every 20,000 km/12,000 miles)



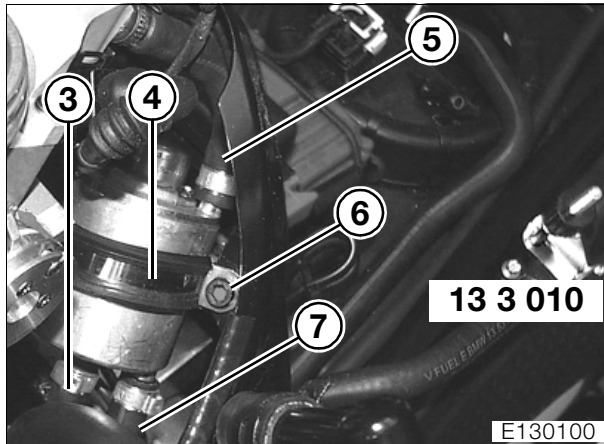
Warning:

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

- Remove left cover (→ 46.5).



- 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.

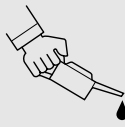
- Slacken the hose clamps.



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.



Important:

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

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

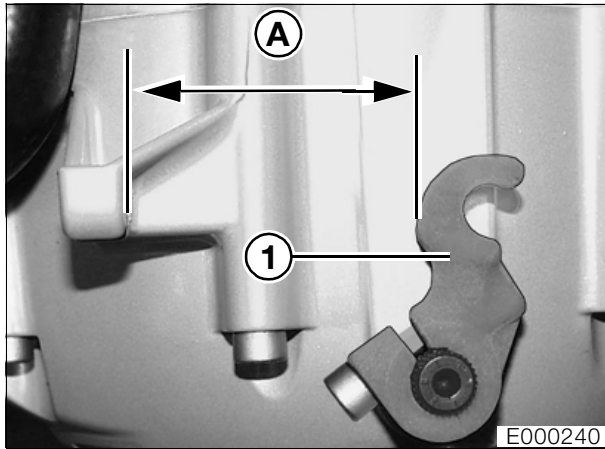


Tightening torques:

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

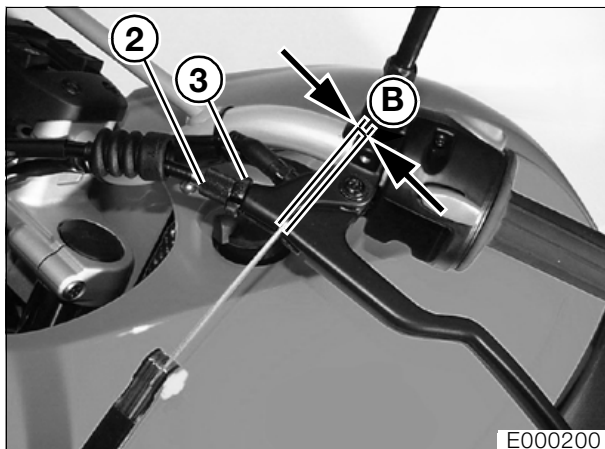
21 00 004 Checking clutch play, adjusting if necessary

(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...2.047 in)



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

Distance "B" 1.0...2.0 mm (0.039...0.078 in)

Checking wheel spoke tension, adjusting if necessary

(Inspections II and III)

- Tap 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**.

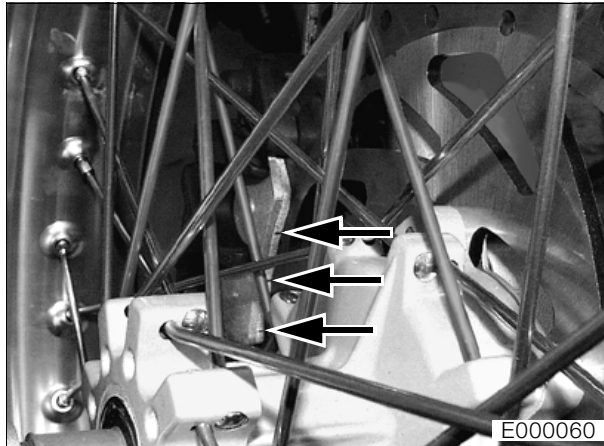
Vertical runout..... max. 2 mm (0.08 in)
Lateral runout..... max. 2 mm (0.08 in)

Checking brake pads and discs for wear, replacing if necessary

(Inspections II and III)

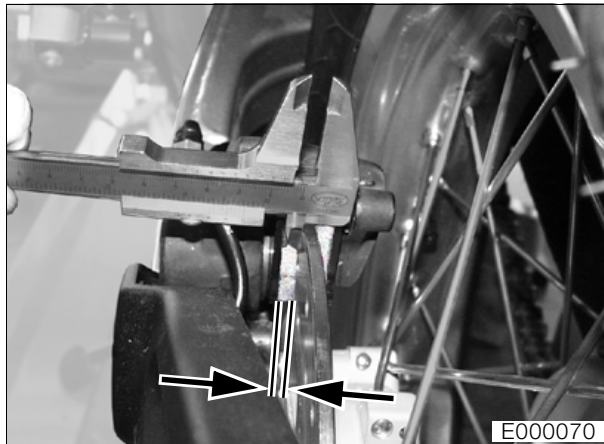
Checking brake pads for wear

Brake pads, front brake



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

Brake pads, rear brake



- Measure brake pad thickness (arrows)

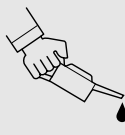
Minimum pad thickness 1 mm (0.039 in)

Replacing brake pads



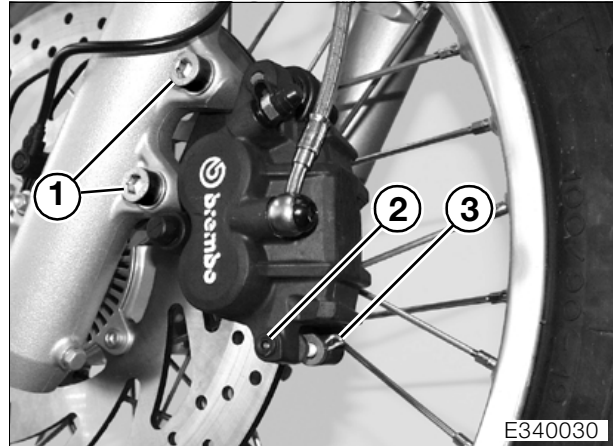
Important:

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.

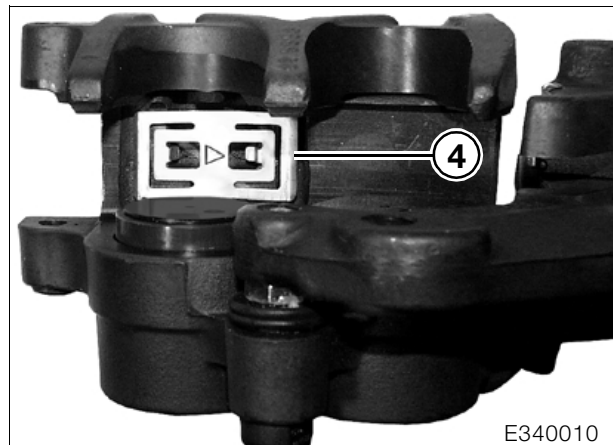


00 34 630 Brake pads, front brake

- Press the brake caliper against the brake disc in order to force the piston back.



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



- 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 caliper.
- Operate brake several times until brake pads are bedded.

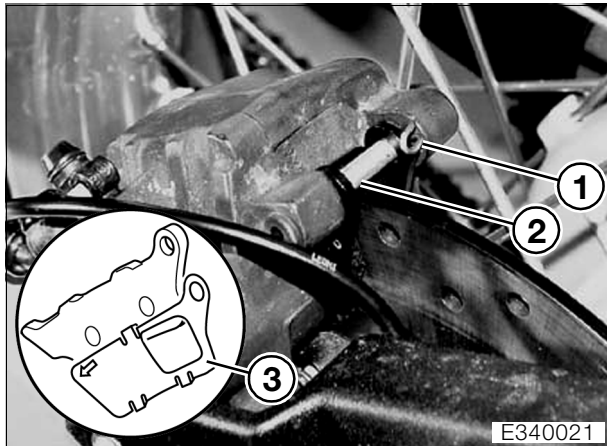


Tightening torque:

Brake caliper to fork slider tube..... 41 Nm

00 34 633 Brake pads, rear brake

- Press the brake caliper against the brake disc in order to force the piston 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.



Note:

When replacing brake pads, remove separator (3) from the original brake pad and clip it to the new brake pad on the piston side.

- Operate brake several times until brake pads are bedded.

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 caliper 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

(Inspections II and III)



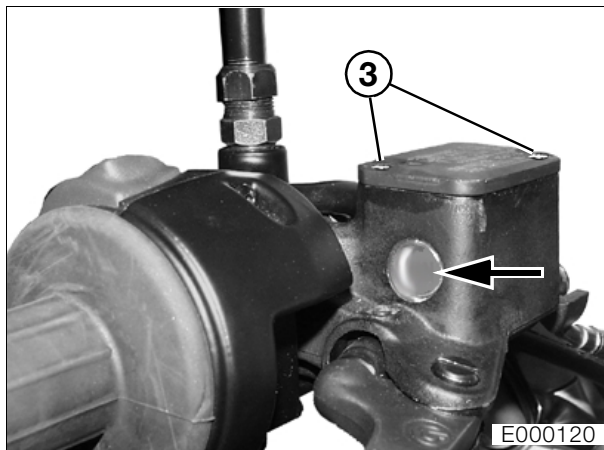
Note:

The volume of the brake fluid (MIN/MAX) is sufficient for brake-pad thicknesses from new to the wear limit. It is not normally necessary to top up the fluid to accommodate brake-pad 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).

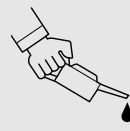
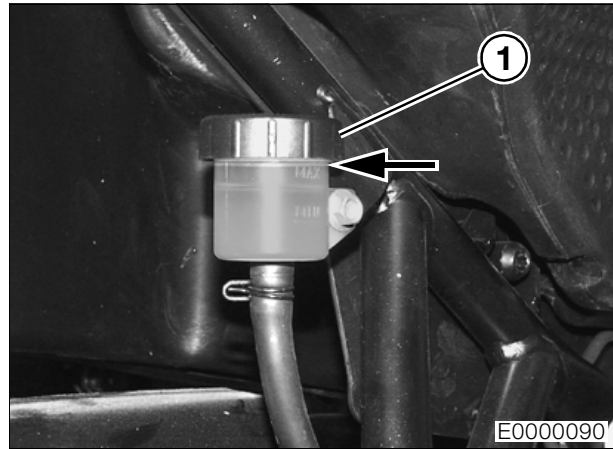
Topping up brake fluid level (front brake)

- 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 checking for leaks; repairing/replacing as 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 and bleeding brake system

(Inspection IV)

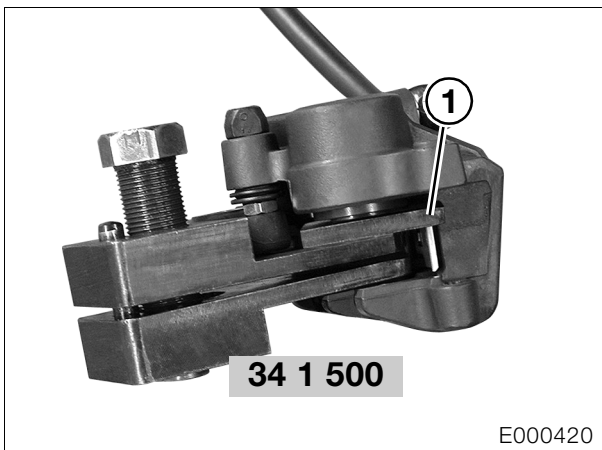


⚠ Important:

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.

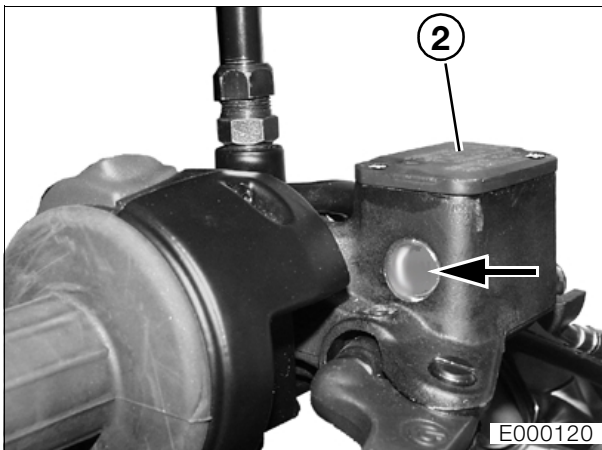
Changing brake fluid (front brake)

- Remove brake pads (→ 00.39).



E000420

- Using resetting tool, **BMW No. 34 1 500**, and strips of metal sheet (1) (approx. 9 mm/0.35 in thick), force back the brake pads.



E000120

- Turn the handlebars so that the cover of the reservoir is horizontal.
- 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 caliper.
- Open the bleed screw by half a turn.

⚠ Important:

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.

📄 Note:

[ABS] Place rubber diaphragm and reservoir cap in position.
Carefully tighten the securing screws.

⚠ Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

If the **BMW MoDiTeC** is not used there is a danger of residual air remaining in the control circuits of the ABS system.

- **[ABS]** Bleed the brakes using the **BMW MoDiTeC**.

Brake fluid gradeDOT 4

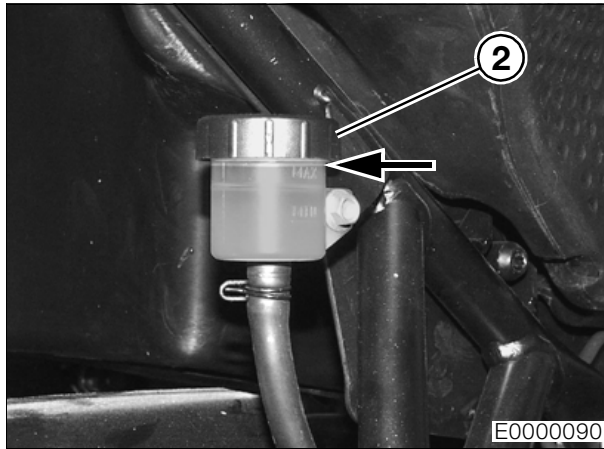


⚠ Tightening torques:

Bleed screw 7 Nm

Changing brake fluid (rear brake)

- Press the brake caliper against the brake disc in order to force the piston back.



- 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 caliper.
- Open the bleed screw by half a turn.



Important:

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.



Note:

[ABS] Place rubber diaphragm and reservoir cap in position.
Carefully tighten the securing screws.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.

- **[ABS]** Bleed the brakes using the **BMW**MoDiTeC.

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)

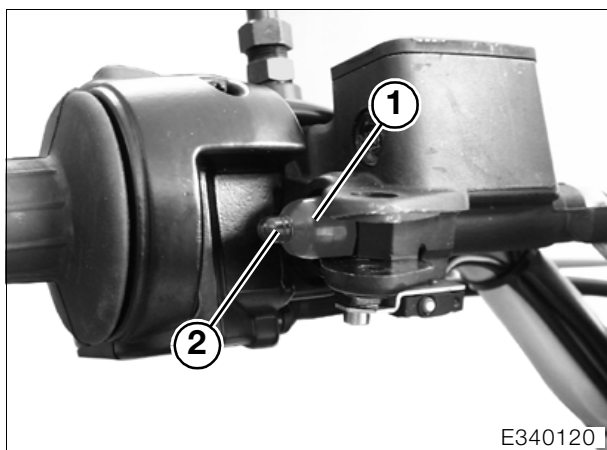
- Place the motorcycle on its main (centre) stand.



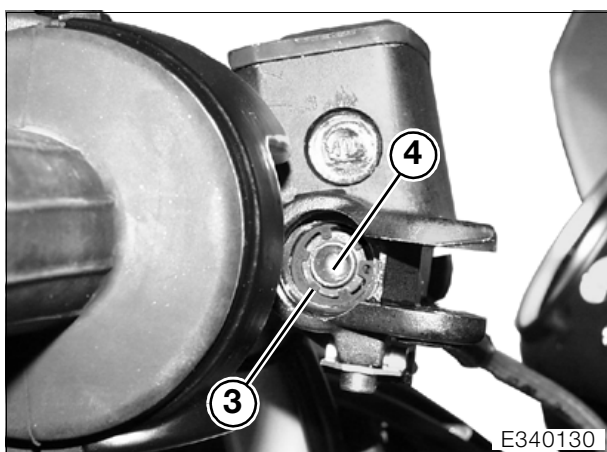
Important:

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

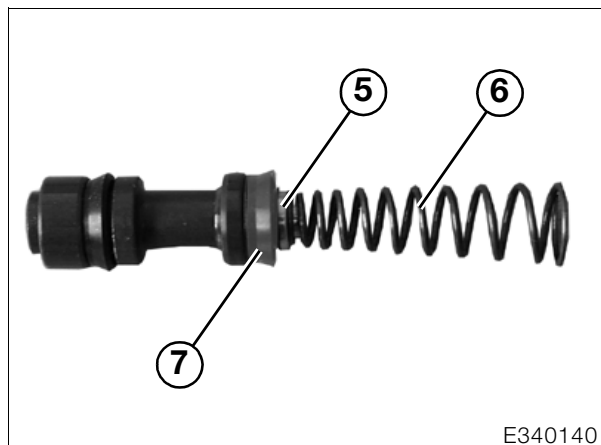
- Drain the front brake system.
- Remove the hand-brake lever.



- 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).



Important:

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.



Important:

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**.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

If the **BMW MoDiTeC** is not used there is a danger of residual air remaining in the control circuits of the ABS system.

- 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)

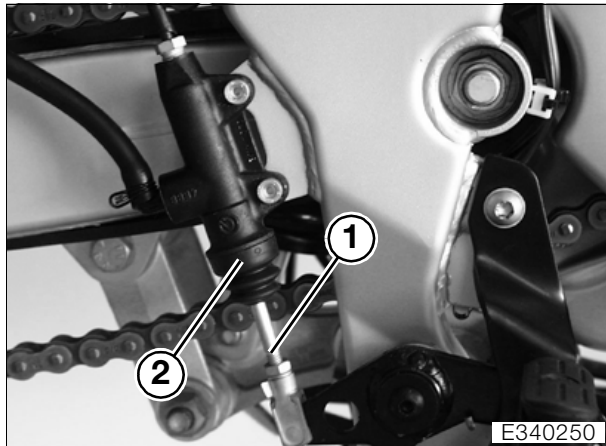
- Place the motorcycle on its main (centre) stand.



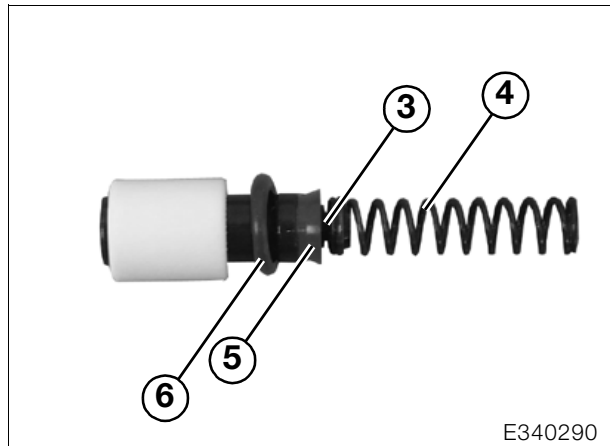
Important:

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.



E340290

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



Important:

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.



Important:

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**.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

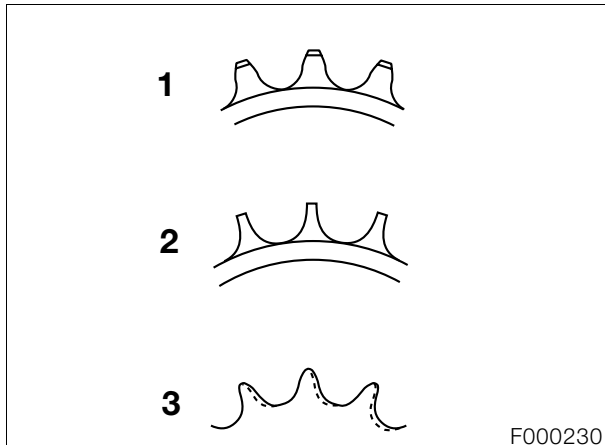
If the **BMW MoDiTeC** is not used there is a danger of residual air remaining in the control circuits of the ABS system.

- Fill and bleed the brake system.

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)

Important:

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

27 71 005 Checking chain tension, adjusting if necessary

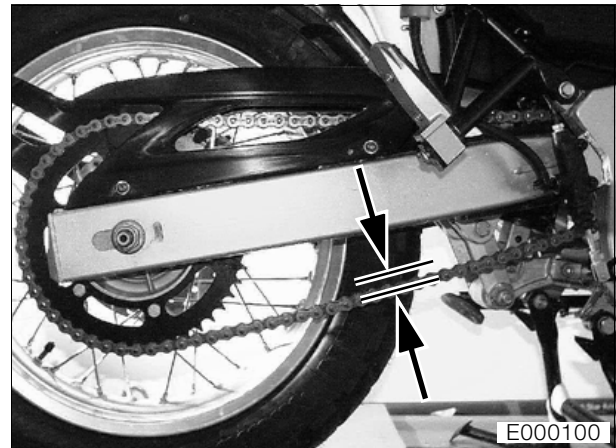
(Inspections I, II, III and IV)

27 71 005 Checking chain tension

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

Important:

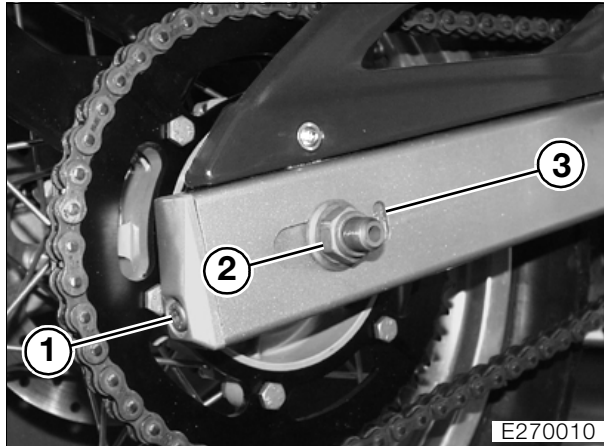
Check and adjust the chain tension only when the motorcycle is unloaded.



- 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 (1.378...1.771 in)

27 71 005 Adjusting chain tension



- Loosen quick-release axle nut (2).

Important:

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 deflection 35...45 mm (1.378...1.771 in)

Note:

Allow time for chain spray penetrate after spraying on. This keeps grease off rider's clothing.

Tightening torques:

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

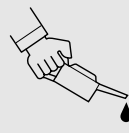
61 20 029 Checking battery acid level, adding distilled water if necessary

(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 (→ 46.5).
- Check the battery fluid level.
- The acid level must be between the **“UPPER LEVEL”** and the **“LOWER LEVEL”** marks.

61 20 029 Adding distilled water

- Open the battery caps.



Important:

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

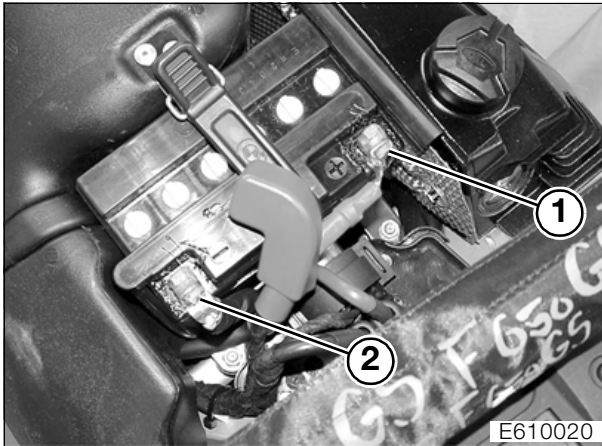
(Inspection IV)

- Remove left, right and centre covers (→ 46.5).



Important:

Disconnect the battery only with the ignition switched off.
Disconnect the negative battery terminal first, then the positive terminal.



- Disconnect ground cable (2) from the battery.
- Disconnect positive lead (1) from 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.

Important:

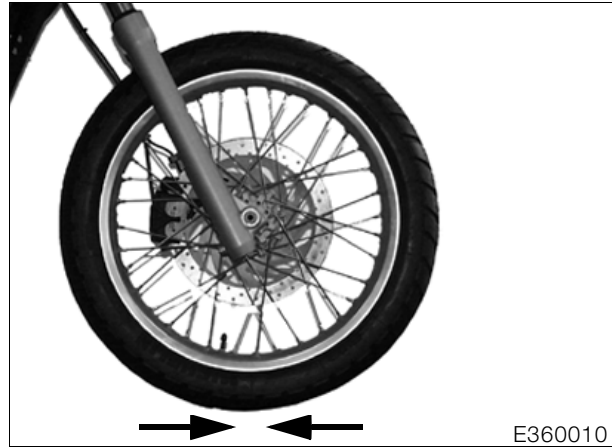
Connect the positive battery terminal first, then the negative terminal.

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

(Inspections II and III)

Checking steering head bearing play

- Relieve load on front wheel.



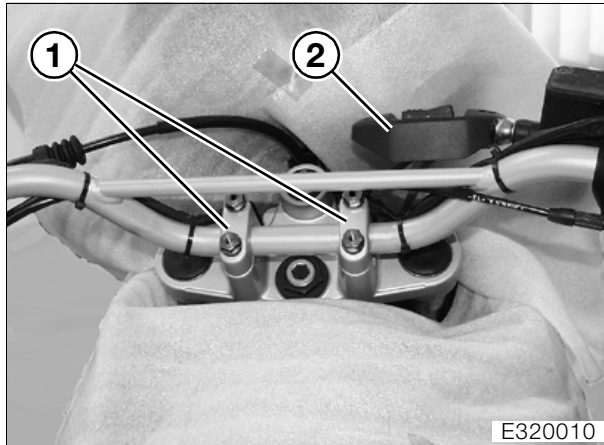
- Move fixed fork tubes forward (arrows).
- Adjust the steering head bearing if play is perceptible.
- Swing the fork legs all the way through their full range of travel and check for catches.
- Replace the steering head bearings if there are in the movement (→ 31.18).

32 00 454 Adjusting steering head bearing play

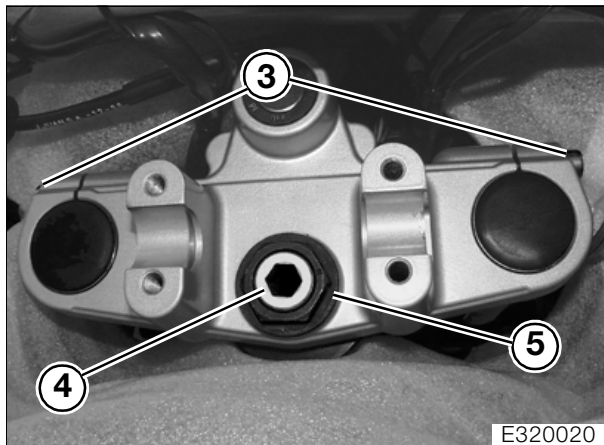


Important:

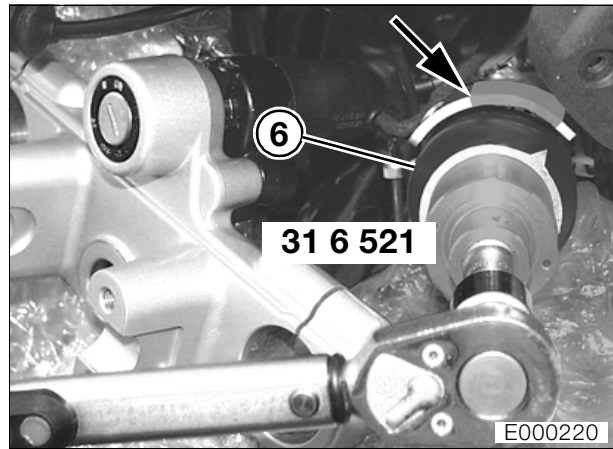
Cover or mask off the instrument cluster and trim to prevent scratches.



- Remove impact pad (2).
- Remove clamp blocks (1).
- Remove the handlebars and place them 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 (1.575 in) arc around the circumference of the locking plate at the steering head, with adhesive tape or similar (arrow).
- Align the mark on pin-wrench adapter, **BMW No. 31 6 521**, with the right-hand end of the marked arc.



Note:

40 mm (1.575 in) around the circumference of the locking plate corresponds to an angle of rotation of 60°.

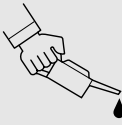
- Turn the round nut clockwise until the pointer on pin-wrench adapter, **BMW No. 31 6 521**, reaches the left-hand end of the marked arc.
- Remove the mark/adhesive tape from the locking plate.

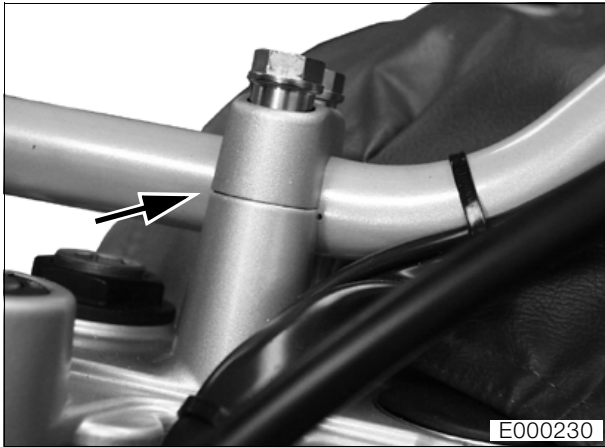


Important:

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 catches are perceptible in the movement of the handlebars, replace the steering head bearings.



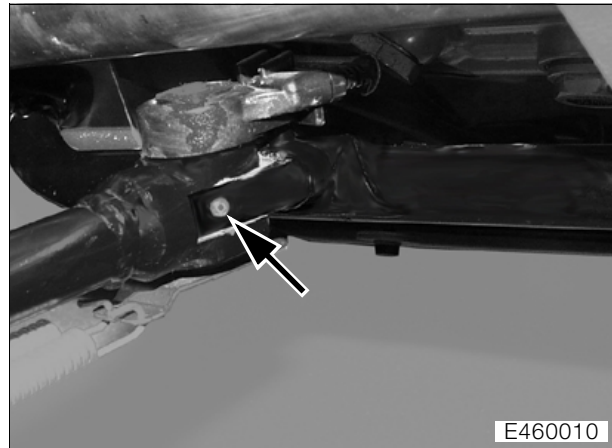
Tightening torques:

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
Handlebars to fork bridge.....	23 Nm

Greasing the side and main stands and the brake pedal lever

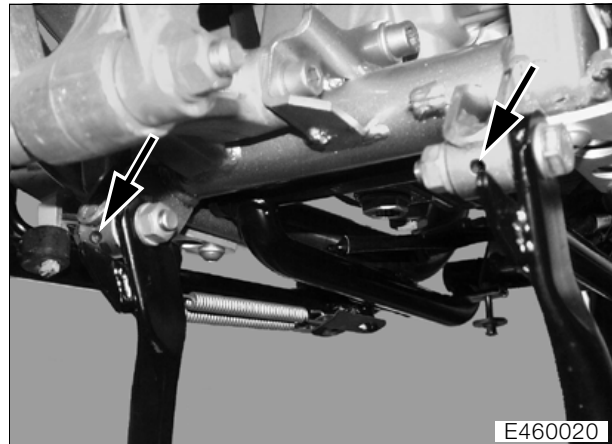
(Inspections II and III)

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



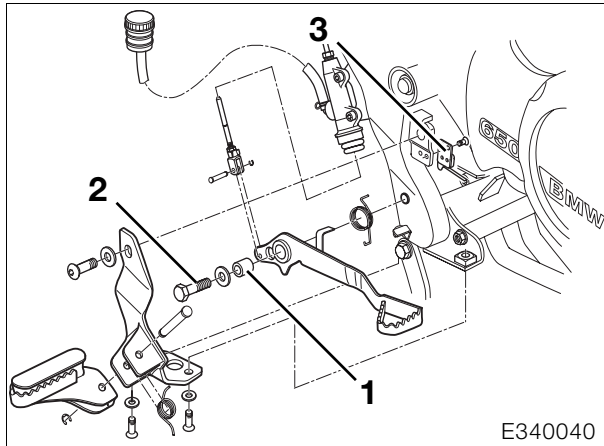
- Grease bearing bushes (arrows) with a grease gun until fresh grease emerges at the lubricated faces.

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.



Important:

Check operation of brake-light switch (3).



Tightening torque:

Brake pedal to frame 21 Nm

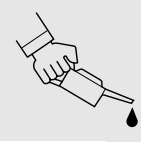
Lubricant:

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 fasteners of frame
 - Main and side stands
 - Exhaust mountings
 - **[Dakar]** Angled lever



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 bottom truss to main frame	21 Nm
Exhaust manifold to cylinder head.....	20 Nm
Silencer to exhaust manifold	
(Torca clamp)	55 Nm
Spring strut to angled lever	47 Nm
Angled lever to frame	58 Nm + 45°
Strut to angled lever	71 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:

Thread depth 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)

One-up

Front wheel 1.9 bar (27.56 psi)
Rear wheel 2.1 bar (30.46 psi)

With full load

Front wheel 2.1 bar (30.46 psi)
Rear wheel 2.3 bar (33.36 psi)

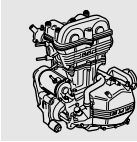
Roadworthiness check

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

11 Motor

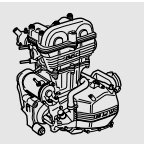
Contents

Page

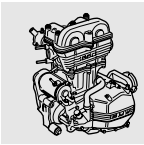


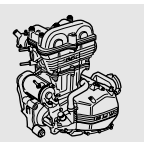
Technical Data	5
Cutaway view of engine	11
Engine oil circuit	12
Valve gear	13
Valves, components	14
Oil pumps, components	15
Removing and installing cylinder head, engine installed	16
Preparatory work	16
Removing camshafts	18
Removing cylinder head	18
Removing cylinder, engine installed	20
Removing engine	21
Preparatory work	21
Removing engine	22
Transferring engine to assembly frame	22
Disassembling engine	24
Removing cylinder head	24
Removing camshafts	24
Checking camshaft for wear	25
Removing and installing timing-chain sprockets	25
Checking centrifugal decompressor lever	25
Disassembling and assembling the centrifugal decompressor	25
Removing cylinder head	26
Checking timing chain for wear	26

Disassembling and assembling cylinder head	27
Removing valves	27
Bore for bucket tappet	27
Checking valve guide for wear	28
Removing valve guide	28
Installing valve guide	29
Checking valve seat for wear	29
Installing valve stem seal	30
Checking valve for wear	30
Installing valves	31
Removing cylinder	31
Checking cylinder	31
Removing piston	32
Disassembling piston	32
Determining clearance of piston in cylinder	32
Determining piston ring gaps	33
Determining piston pin clearance	33
Assembling pistons	33
Removing ignition magnet	33
Removing countershaft for starter	34
Disassembling and assembling freewheel	35
Disassembling freewheel	35
Assembling freewheel	35
Removing clutch	36
Removing pressure plate	36
Removing clutch plates	36
Removing and installing oil pump	37
Removing oil pump	37
Inspecting oil pump	37
Installing oil pump	37
Removing double drive gear	38
Removing crankshaft and balancing shaft	38
Checking crankshaft for wear	39
Removing compensating gear	39
Removing and installing crankshaft gear	39
Removing and installing gearbox mainshaft bearings	40
Removing and installing gearbox countershaft bearings	40

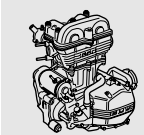


Removing and installing grooved ball bearings of balancing shaft	41
Removing and installing main bearings	41
Removal	41
Installation	42
Assembling engine	43
Installing crankshaft and balancing shaft	43
Shimming crankshaft	43
Installing double drive gear	44
Installing oil pump gears	45
Installing clutch	46
Installing clutch cage	46
Installing driver	46
Installing pressure plate	47
Installing countershaft for starter motor	47
Installing magnetic ignition trigger	48
Installing piston	49
Installing cylinder	50
Installing cylinder head	50
Installing camshaft and adjusting valves	52
Installing engine	54
Bleeding engine oil circuit	55



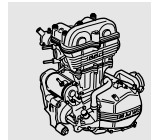


Technical Data		F 650 GS / GS Dakar
Engine, general		
Type		Single-cylinder four-stroke, double overhead camshafts driven by roller chain, 4 valves operated by bucket tappets, balancing shaft, liquid-cooled cylinder and cylinder head, integral water pump, 5-speed gearbox and dry sump lubrication.
Cylinder 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 6,500 rpm
Max. torque	Nm	60 at 5,000 rpm
Neutral speed	rpm	1,400
Max. continuous engine speed	rpm	7,000
Max. engine speed	rpm	7,500
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 by primary drive
Oil capacity	l (Imp. pints/US quarts)	2.3 (4.05/2.43)
Oil pressure (neutral speed)	bar (psi)	≥ 0.5 (7.11) (oil temperature 80 °C/176 °F)
Permissible oil consumption	l/1,000 km	1 (350 miles per Imp. pint/590 miles per US quart)
Crank gear		
Main bearing play		
Installed dimension	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 diameter	mm (in)	47.97 (1.888)
Bearing play	mm (in)	0.10 (0.004)
Runout at crankpin		
Clutch side	mm (in)	0.03 (0.001)
Magneto side	mm (in)	0.05 (0.002)

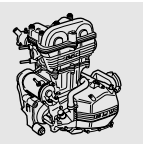


Technical Data		F 650 GS / GS Dakar
Connecting rod		
Wear limit, connecting rod		
Radial clearance		
Big-end bore	mm (in)	0.08 (0.003)
Small-end bore	mm (in)	0.05 (0.002)
Big end bearing endplay		
Installed dimension	mm (in)	0.30...0.65 (0.012...0.026)
Wear limit	mm (in)	0.80 (0.031)
Small-end bore		
Installed dimension	mm (in)	22.015...22.025 (0.8668...0.8671)
Wear limit	mm (in)	22.04 (0.868)
Balancing shaft		
Bearing journals		
Wear limit	mm (in)	19.96 (0.786)
Cylinder head		
Camshaft journals, inlet/exhaust	mm (in)	21.967...21.980 (0.8649...0.8654)
Wear limit	mm (in)	21.950 (0.8642)
Camshaft bearing play, inlet/exhaust	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 valve	mm (in)	0.10...0.15 (0.004...0.0059)
Exhaust valve	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)

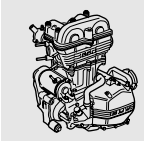
Technical Data		F 650 GS / GS Dakar
Valve seat angle		
Inlet	°	45
Exhaust	°	45
Included valve angle		
Inlet	°	15
Exhaust	°	18
Valve seat width		
Inlet	mm (in)	1.05...1.35 (0.041...0.053)
Wear limit	mm (in)	1.60 (0.063)
Exhaust	mm (in)	1.25...1.55 (0.049...0.061)
Wear limit	mm (in)	2.2 (0.09)
Valve guide		
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 play 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 journals	mm (in)	21.95 (0.864)
Cam height, inlet	mm (in)	39.35...39.45 (1.545...1.553)
Cam height, exhaust	mm (in)	39.15...39.25 (1.541...1.545)
Wear limit, inlet	mm (in)	39.25 (1.545)
Wear limit, exhaust	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)

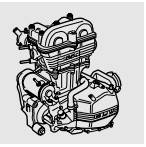


Technical Data		F 650 GS / GS Dakar
Piston		
Piston dia. "A"		
Installed dimension	mm (in)	99.975...99.985 (3.9361...3.9365)
Wear limit	mm (in)	99.940 (3.9347)
Installed clearance	mm (in)	0.015...0.040 (0.0006...0.0016)
Wear limit	mm (in)	0.090 (0.0035)
Piston dia. "B"		
Installed dimension	mm (in)	99.985...99.995 (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)
Piston rings		
1st groove rectangular-section ring		
Ring thickness	mm (in)	1.2 (0.05)
Ring height wear limit	mm (in)	1.15 (0.045)
Ring gap	mm (in)	0.2...0.4 (0.008...0.016)
Gap wear limit	mm (in)	1.0 (0.04)
Groove height wear limit	mm (in)	1.30 (0.051)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.045)
2nd groove micro-taper ring		
Ring thickness	mm (in)	1.5 (0.06)
Ring height wear limit	mm (in)	1.45 (0.057)
Ring gap	mm (in)	0.2...0.4 (0.008...0.016)
Gap wear limit	mm (in)	1.0 (0.04)
Groove height wear limit	mm (in)	1.6 (0.06)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.045)
3rd groove spring-steel oil control ring		
Ring gap	mm (in)	0.2...0.4 (0.008...0.016)
Gap wear limit	mm (in)	1.0 (0.04)
Groove height wear limit	mm (in)	2.6 (0.10)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.045)

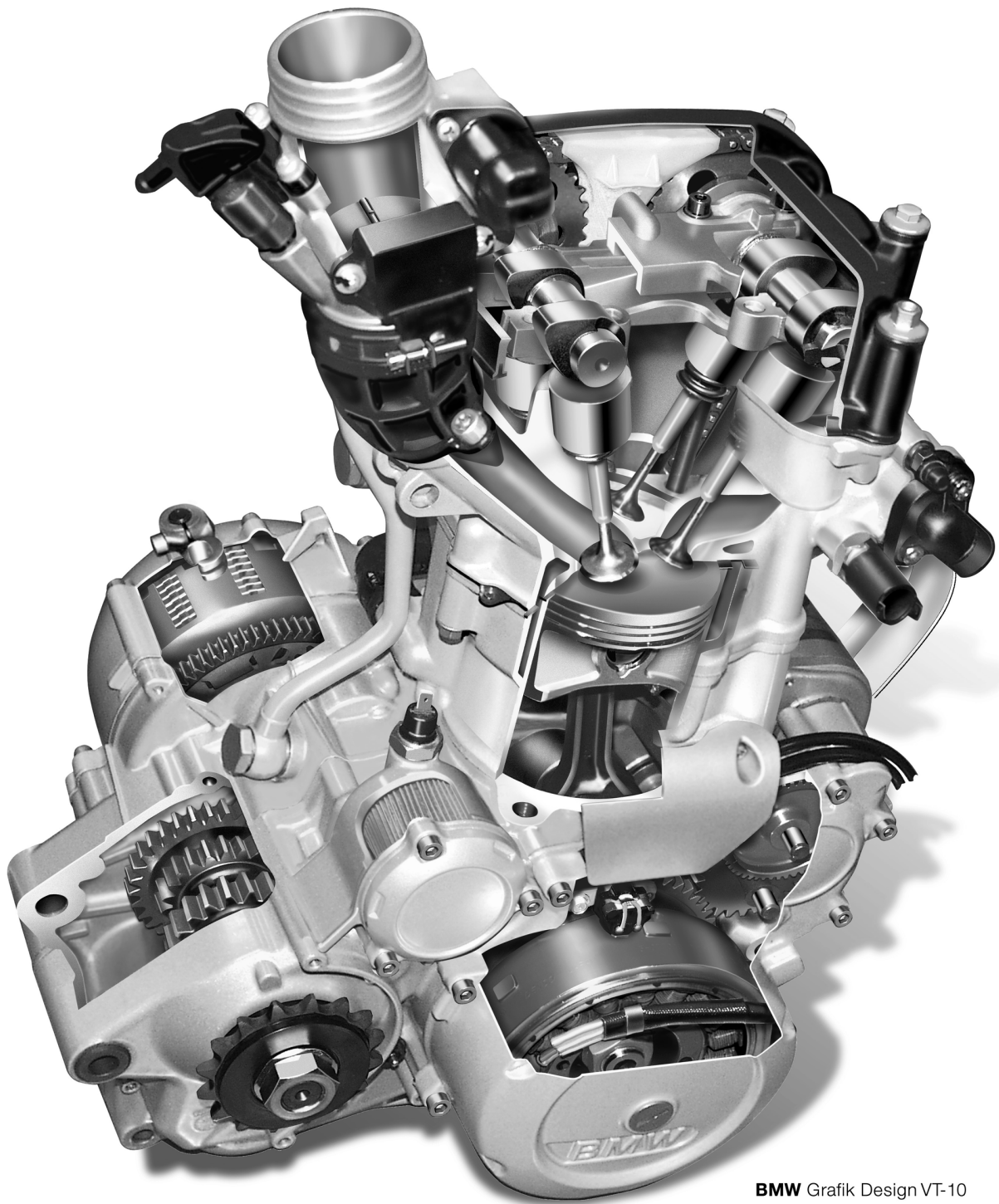
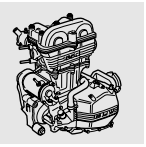


Technical Data		F 650 GS / GS Dakar
Piston pin		
Piston pin dia.		
Wear limit	mm (in)	21.98 (0.865)
Piston-pin play		
in piston-pin bore	mm (in)	0.015...0.029 (0.0006...0.0011)
Wear limit	mm (in)	0.050 (0.0020)
in bore (piston)	mm (in)	0.012...0.021 (0.0005...0.0008)
Wear limit	mm (in)	0.050 (0.0020)
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)		
Installed dimension of each plate	mm (in)	3.45...3.55 (0.136...0.140)
Wear limit, height of cluster (total)	mm (in)	27.5 (1.082)
Clutch springs		
Wear limit at 190 N	mm (in)	27.4 (1.079)
Oil pump		
Oil pumps		primary/secondary
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)



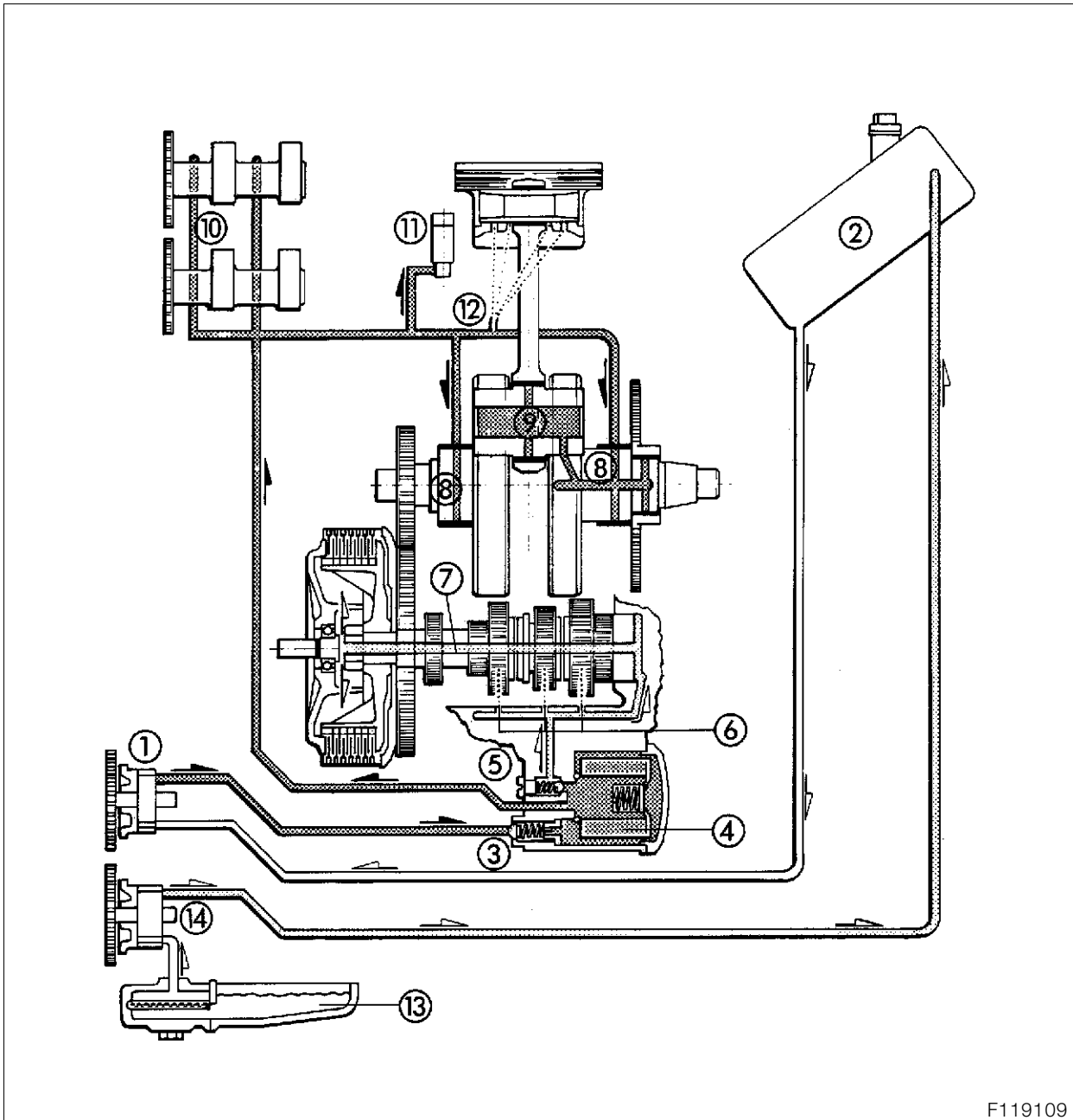
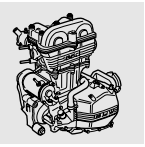


Cutaway view of engine



BMW Grafik Design VT-10

E110550

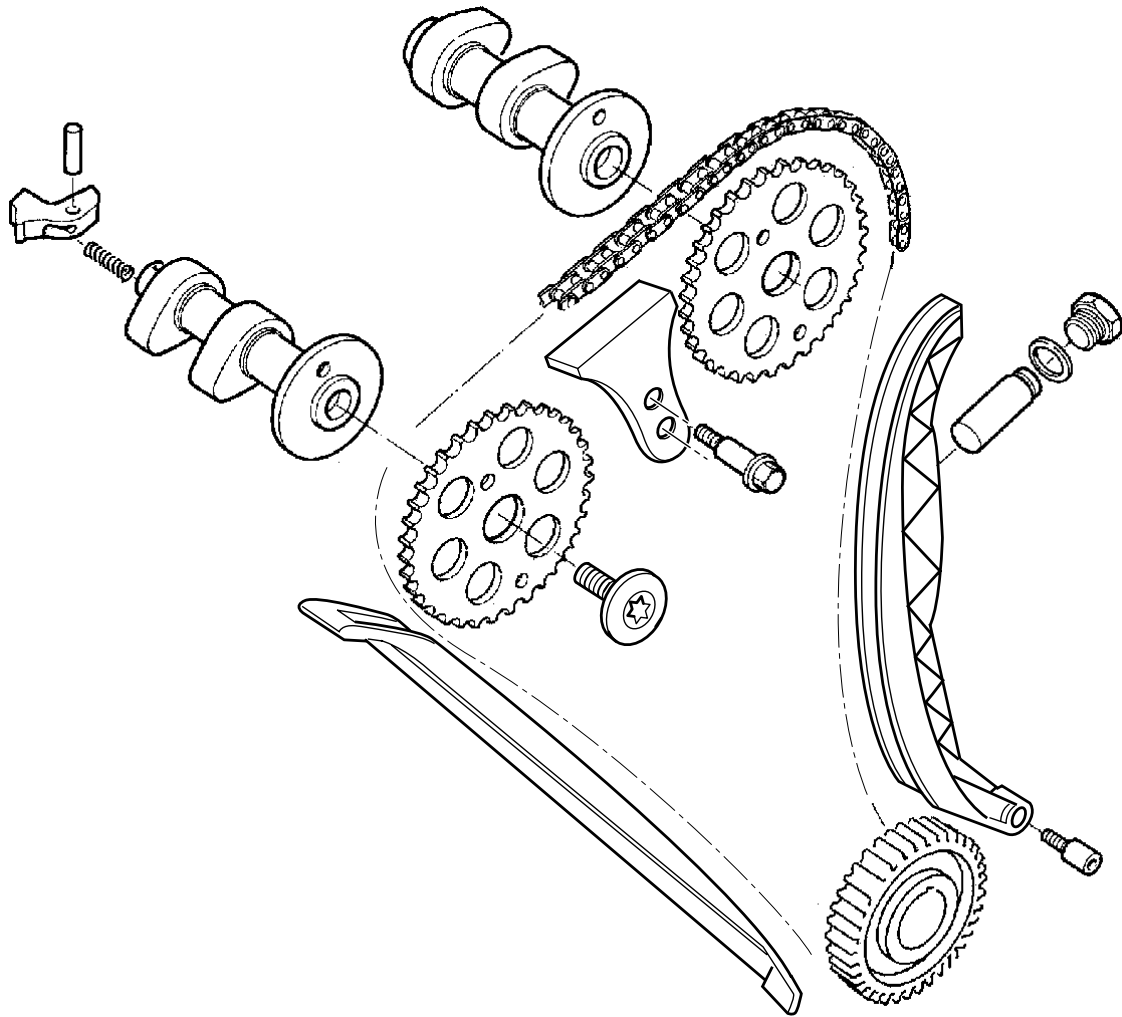
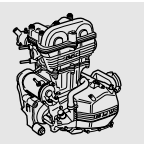


F119109

Engine oil circuit

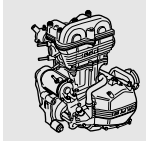
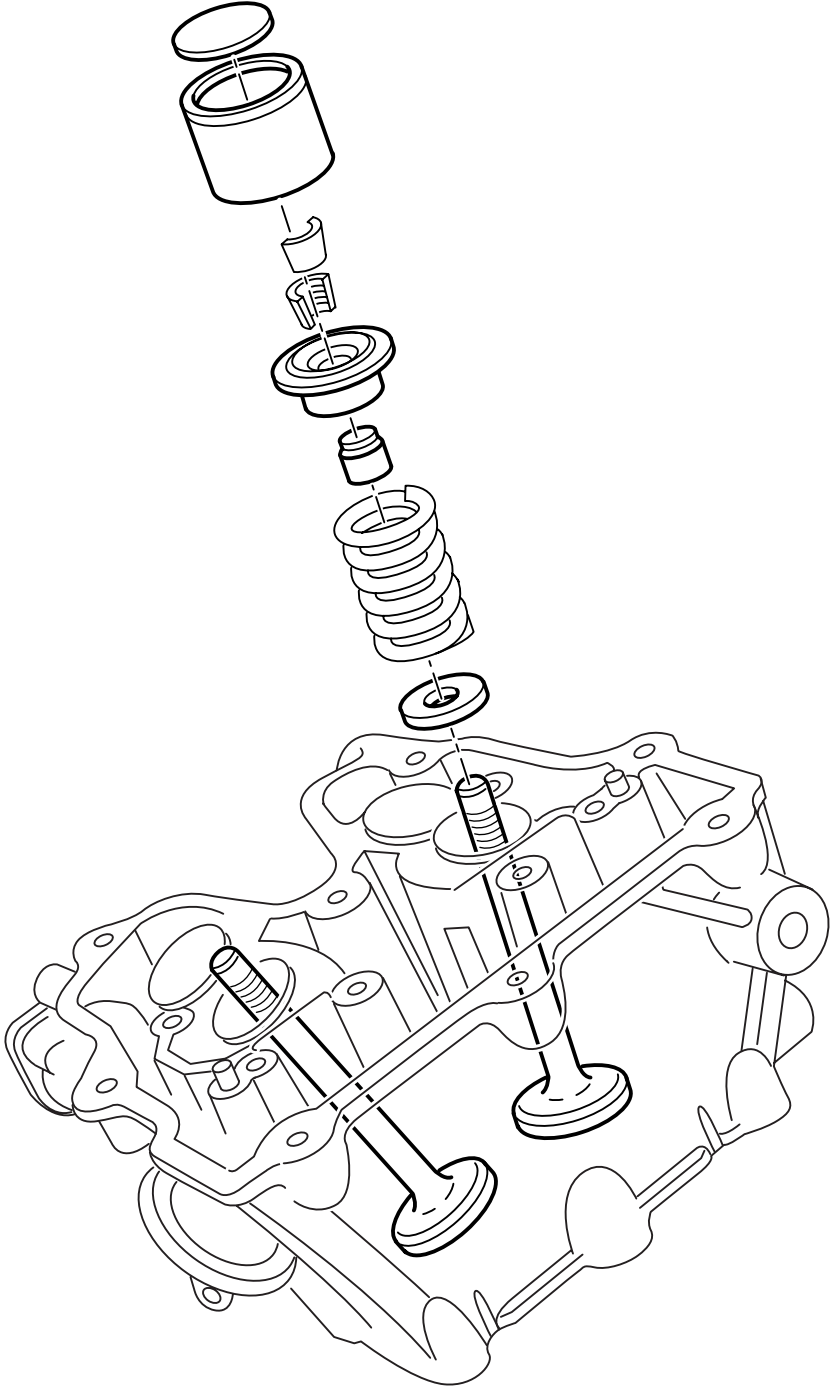
1. Delivery pump
2. Oil tank
3. Check valve
4. Oil filter
5. Control valve
6. Low-pressure line (gearbox)
7. Low-pressure line (clutch)
8. High-pressure line (crankshaft)
9. High-pressure line (big end bearing)
10. High-pressure line (camshafts)
11. Chain tensioner
12. Spray nozzle (for piston)
13. Oil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

Valve gear



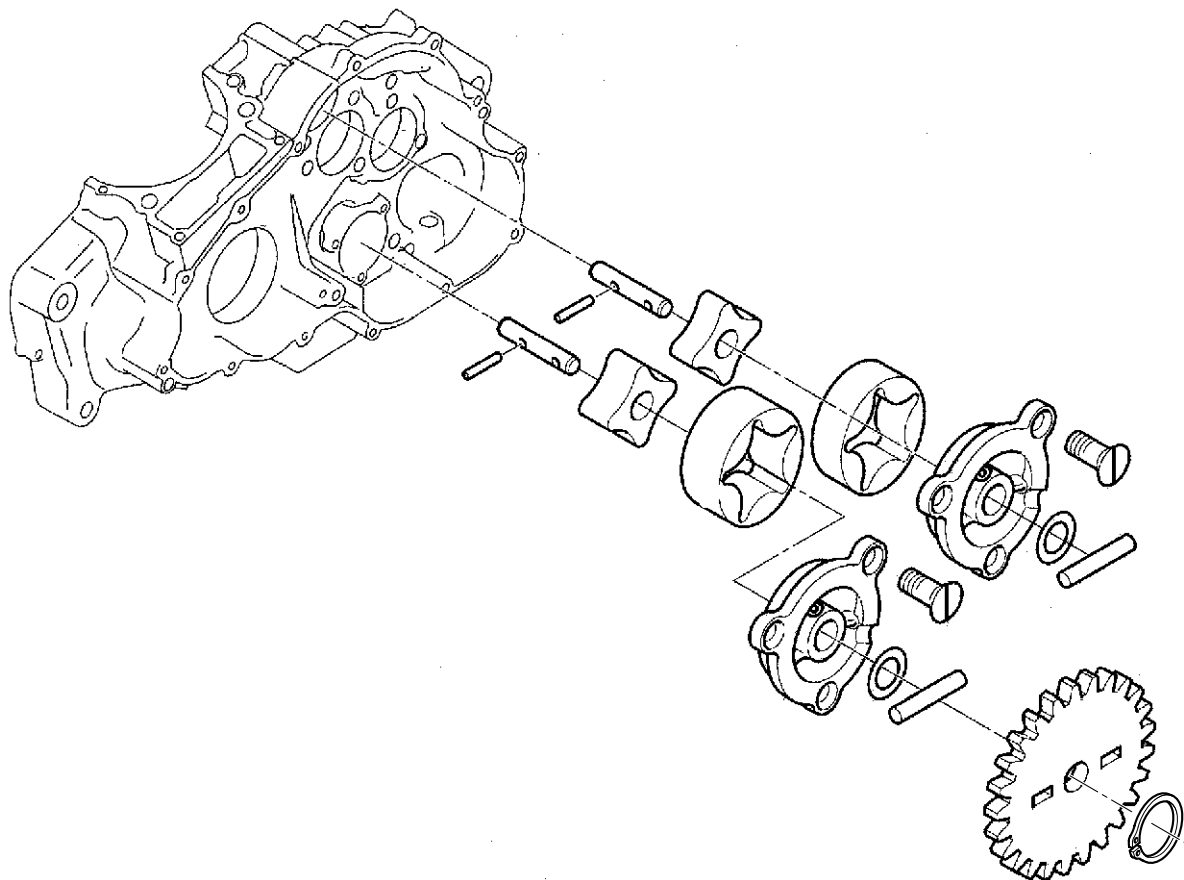
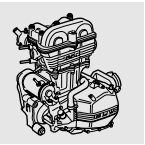
E110440

Valves, components



E110450

Oil pumps, components



E110460

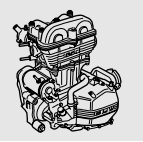
11 12 116 Removing and installing cylinder head, engine installed



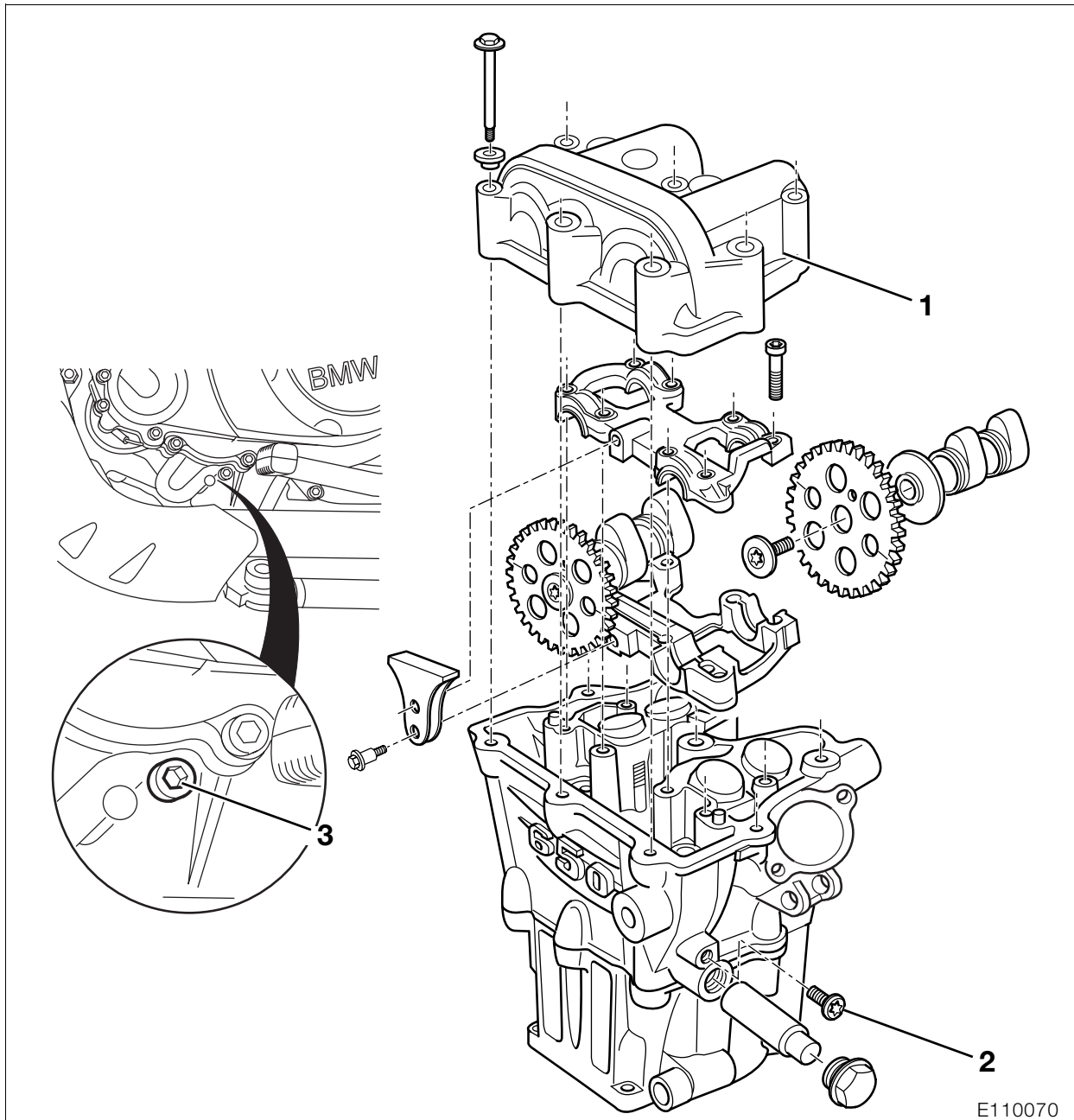
Note:

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 (→ 46.5).
- Remove battery (→ 61.10).
- Drain coolant (→ 00.30).
- Drain the engine oil from the oil tank.
- Remove engine guard (→ 46.8).
- Remove starter (→ 12.9).
- Remove exhaust manifold and oxygen sensor (→ 18.6).
- Expose radiator and remove fan (→ 17.10).
- Remove intake air pipe (→ 13.5).
- Remove intake air silencer (→ 13.6).
- Remove the battery box.
- Remove circlip securing throttle cable to throttle valve stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.
- Disconnect plugs at throttle valve stub.
- Remove the intake pipe from the cylinder head and lay it carefully to one side, complete with the throttle valve 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 cylinder head cover.
- Remove cylinder head cover (1).
- Remove spark plug.
- Remove centre screw plug in engine block cover, right.



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.



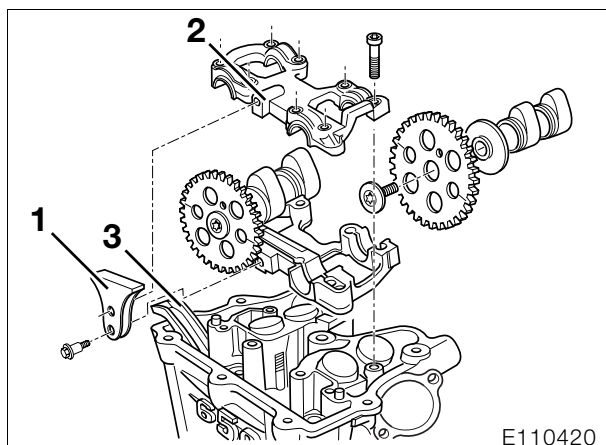
Note:

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

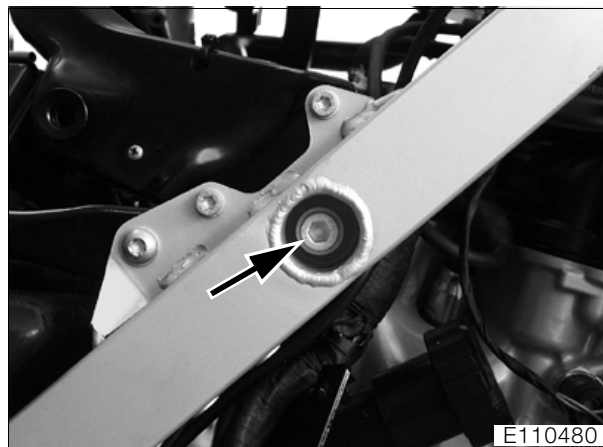
- Remove the cable cover from the right-hand side of the cylinder.
- Remove the retainer of the spring-strut adjusting knob from the frame.



- Remove chain guide (1).
- Remove upper section of camshaft carrier (2).
- Press chain tensioning rail back against chain tensioner.
- 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.



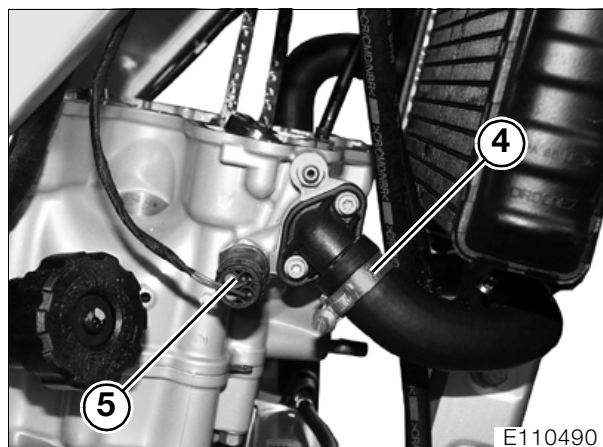
- Remove screws securing cylinder head to frame (arrow).
- Use pin wrench, **BMW No. 11 6 661**, to slacken the locknut.



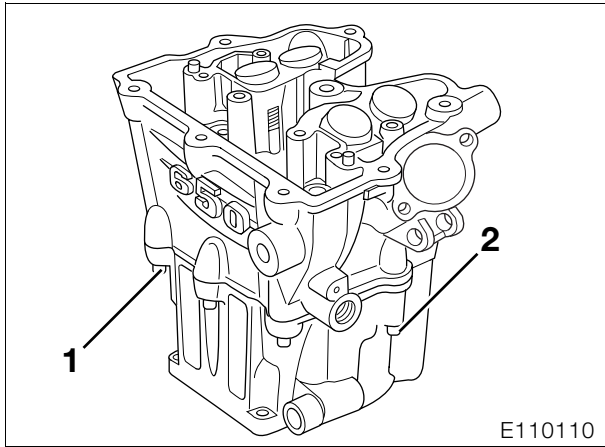
Note:

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).



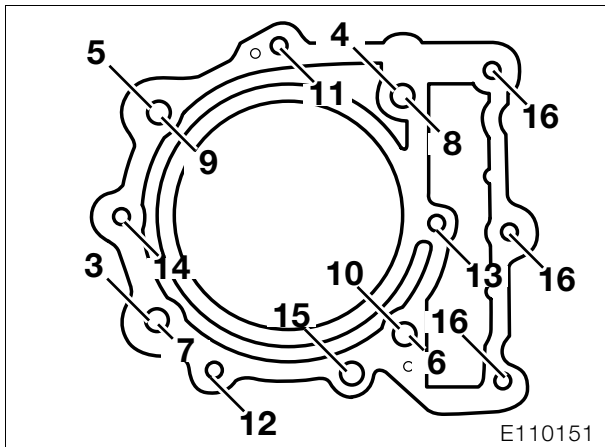
E110110

- 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

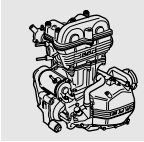
- Initially tighten the collar nuts of the cylinder head to 20 Nm (3-6) and then tighten to 60 Nm (7-10).
- Tighten the fasteners of the cylinder head to cylinder in the sequence as shown (11-16) to specified torque.

- 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.



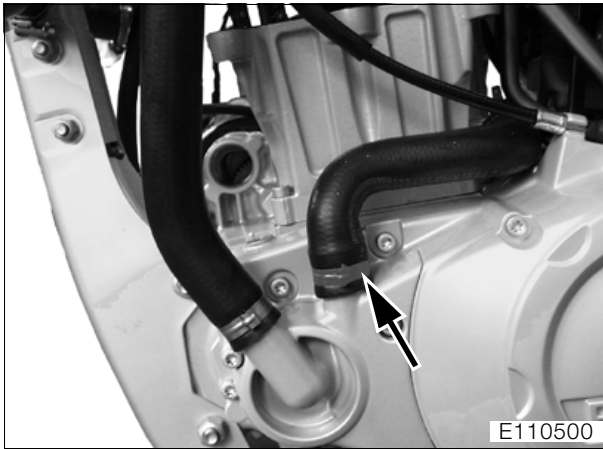
Tightening torques:

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, adjuster sleeve	zero 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



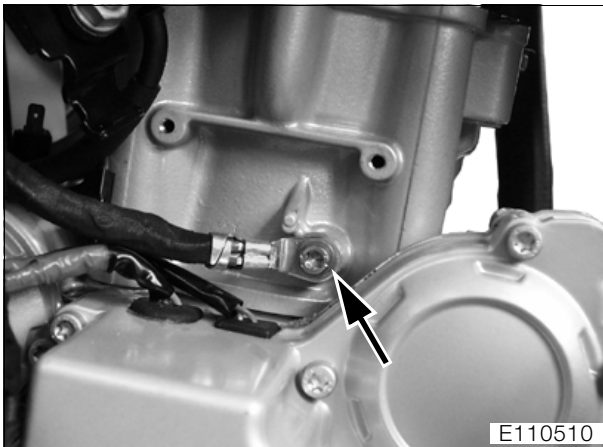
11 11 150 Removing cylinder, engine installed

- Remove cylinder head (→ 11.18).



E110500

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



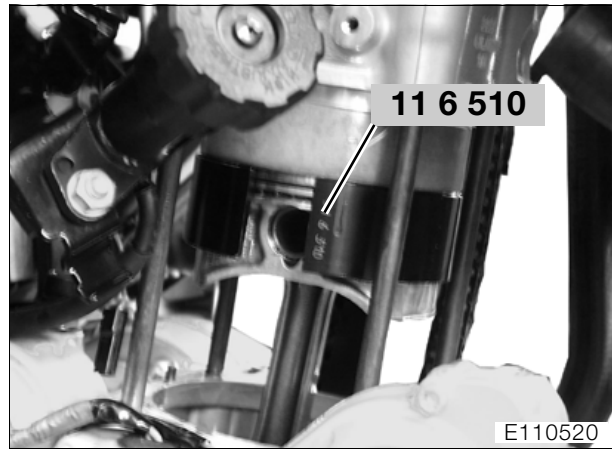
E110510

- 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.



E110520

- 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.



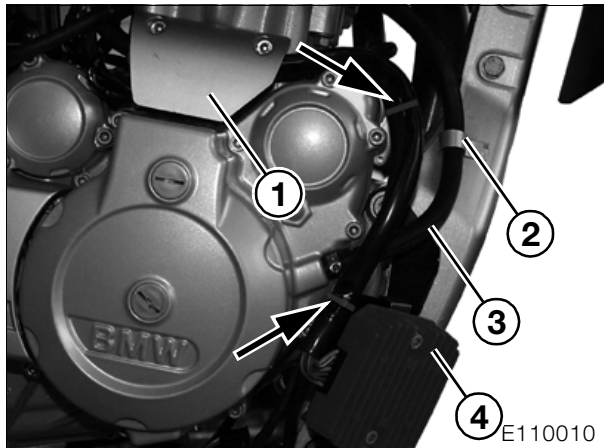
Tightening torques:

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

11 00 050 Removing engine

11 00 050 Preparatory work

- Drain coolant (⇒ 00.30).
- Place motorcycle on its centre stand.
- Secure front wheel in position.
- Remove seat.
- Remove intake air silencer (⇒ 13.6).
- Disconnect battery negative terminal.
- Remove engine guard (⇒ 46.8).
- Drain engine oil (⇒ 00.28).
- Remove exhaust manifold (⇒ 18.6).
- Disconnect oil feed and return lines from oil tank.



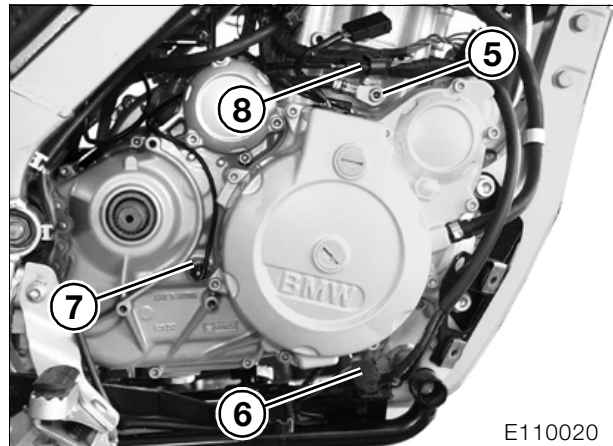
- Remove cable cover (1) from the engine.
- Cut the 2 cable ties (arrow) at the voltage regulator.
- Disconnect the plug of the voltage regulator.
- **[GS]** Remove voltage regulator (4).
- Straighten tab (2) and release breather line (3).
- Remove cover for chain sprocket.



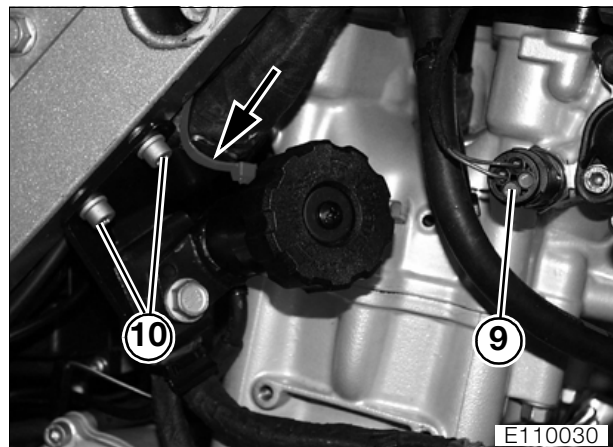
Note:

Do not remove the chain when removing the chain sprocket. The sprocket complete with chain is pulled off the main shaft and secured to the frame with the aid of a cable tie. It is not necessary to remove the rear wheel and chain.

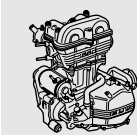
- Remove chain sprocket (⇒ 27.6).



- Remove ground terminal (5) from the engine.
- Disconnect plug of side-stand switch (6).
- Unscrew connector for neutral 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 truss.



- 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 valve stub and disconnect the throttle valve stub from the intake pipe.
- Disconnect the starter coil at the plug.
- Pull spark plug connector off spark plug.



- Remove radiator (→ 17.11).
- 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 the right-hand coolant hose.
- Remove fasteners for engine shell and remove engine shell with the bracket for the voltage regulator.



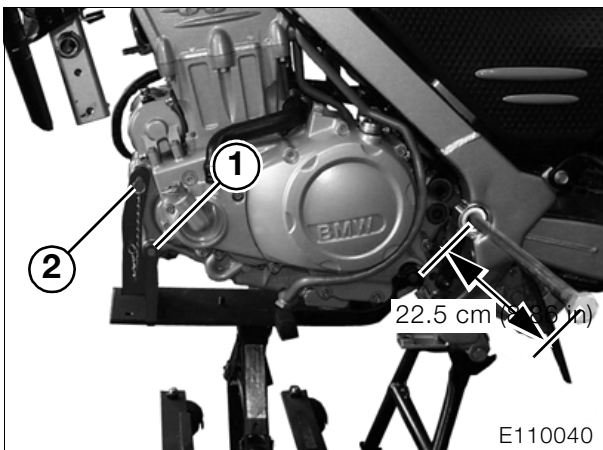
Note:

When locating pin, **BMW No. 11 0 661**, is inserted and the floating bearing stud is pulled out 22.5 cm (8.86 in), the rear swinging fork remains in place in the frame, but the engine is free.

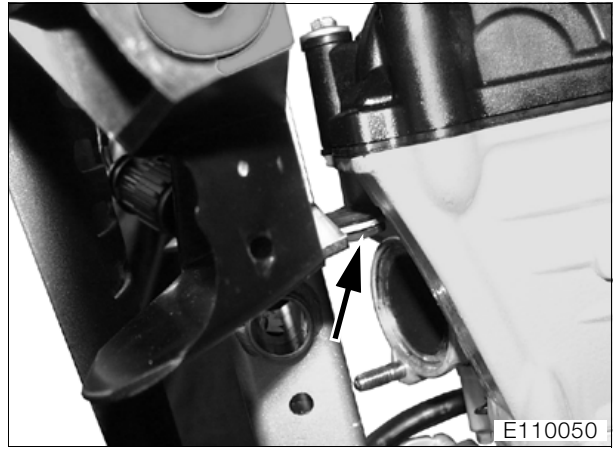
- Slacken nut of swinging-arm bearing.
- Insert locating pin, **BMW No. 11 0 661**, to force swinging-arm stud out of frame and pull the stud 22.5 cm (8.86 in) out of the frame.
- Remove bottom rear engine mount fastener.
- Secure the motorcycle by attaching two straps to the front forks.
- Remove the 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.

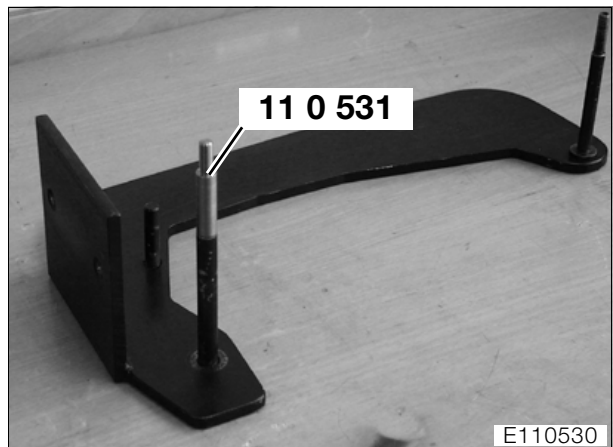


- Secure the engine lifter by installing stud bolt (1) through bottom bore in engine block and securing stud (2) in top bore in engine block.
- Remove screws securing cylinder head to frame on left and right. Use pin wrench, **BMW No. 11 6 661**, to slacken the locknuts and back off the adjusting sleeves.



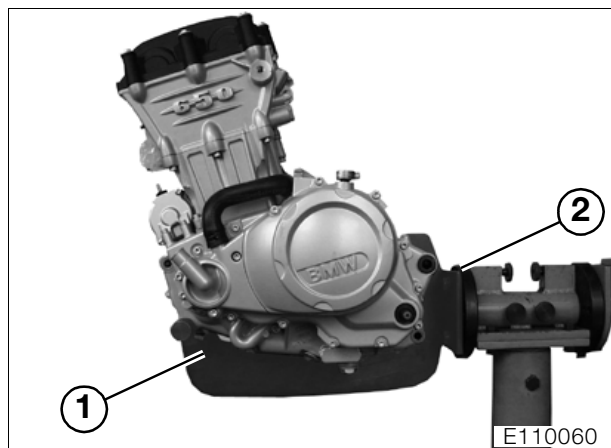
- Lower the engine until the cylinder head is resting on the radiator fastening lug (arrow).
- Continue lowering the engine; the engine tilts toward the rear.
- Continue lowering the engine until the fastening lug is above the cylinder head cover.
- Turn the engine toward the right and push it clear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

Transferring engine to assembly frame

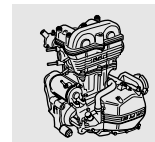


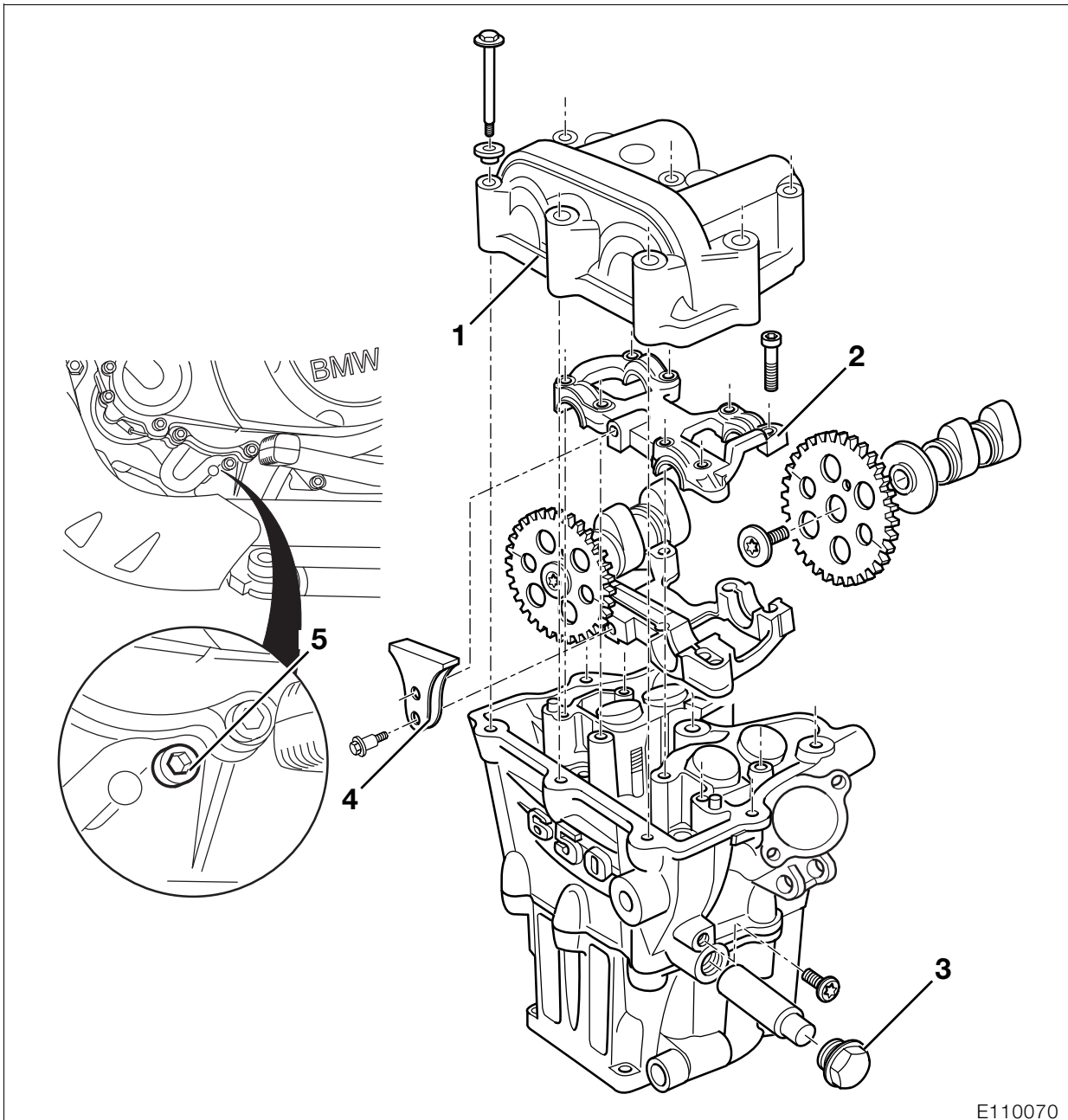
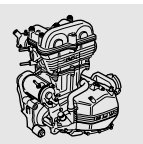
- Secure threaded adapter, **BMW No 11 0 531**, to engine mount.
- Detach the engine from the engine lifter, leaving the engine on the lifting platform.

- 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 00 103 Disassembling engine



Important:

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 screws (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

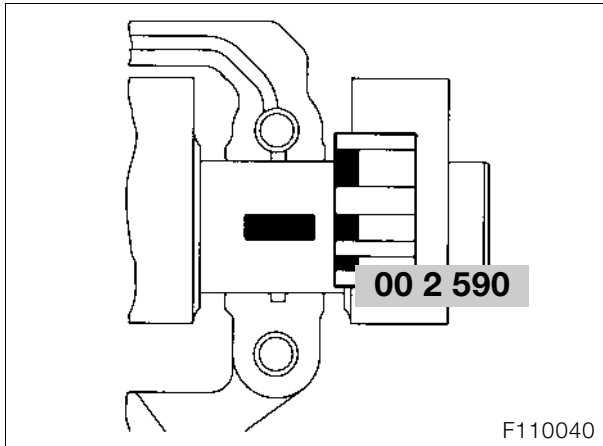
- Remove starter (→ 12.9)
- Remove oil lines.
- Remove cylinder head cover (1).
- Remove spark plug.
- Remove centre screw plug in engine block cover, right.

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 mount.

Checking camshaft for wear



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

Tightening torque:

Camshaft mount..... 10 Nm

- Remove camshaft mount 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

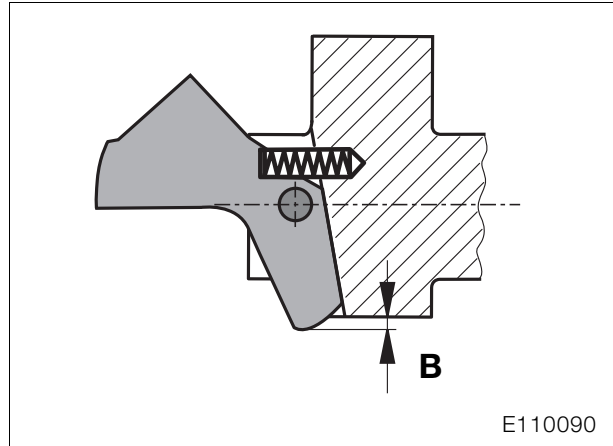
Checking centrifugal decompressor lever



Note:

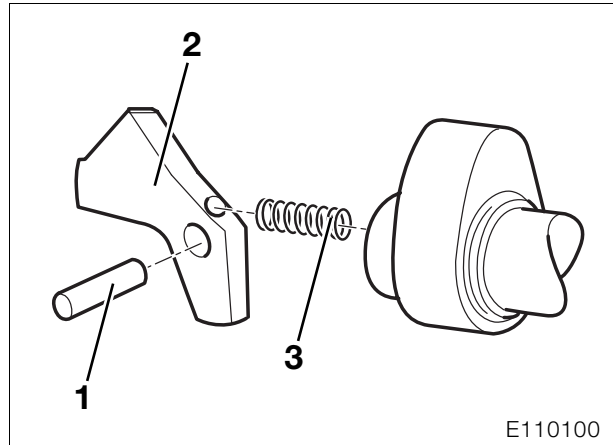
Never stretch the spring, since this alters the preset spring force.

- 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)

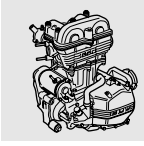
11 31 530 Disassembling and assembling the centrifugal decompressor

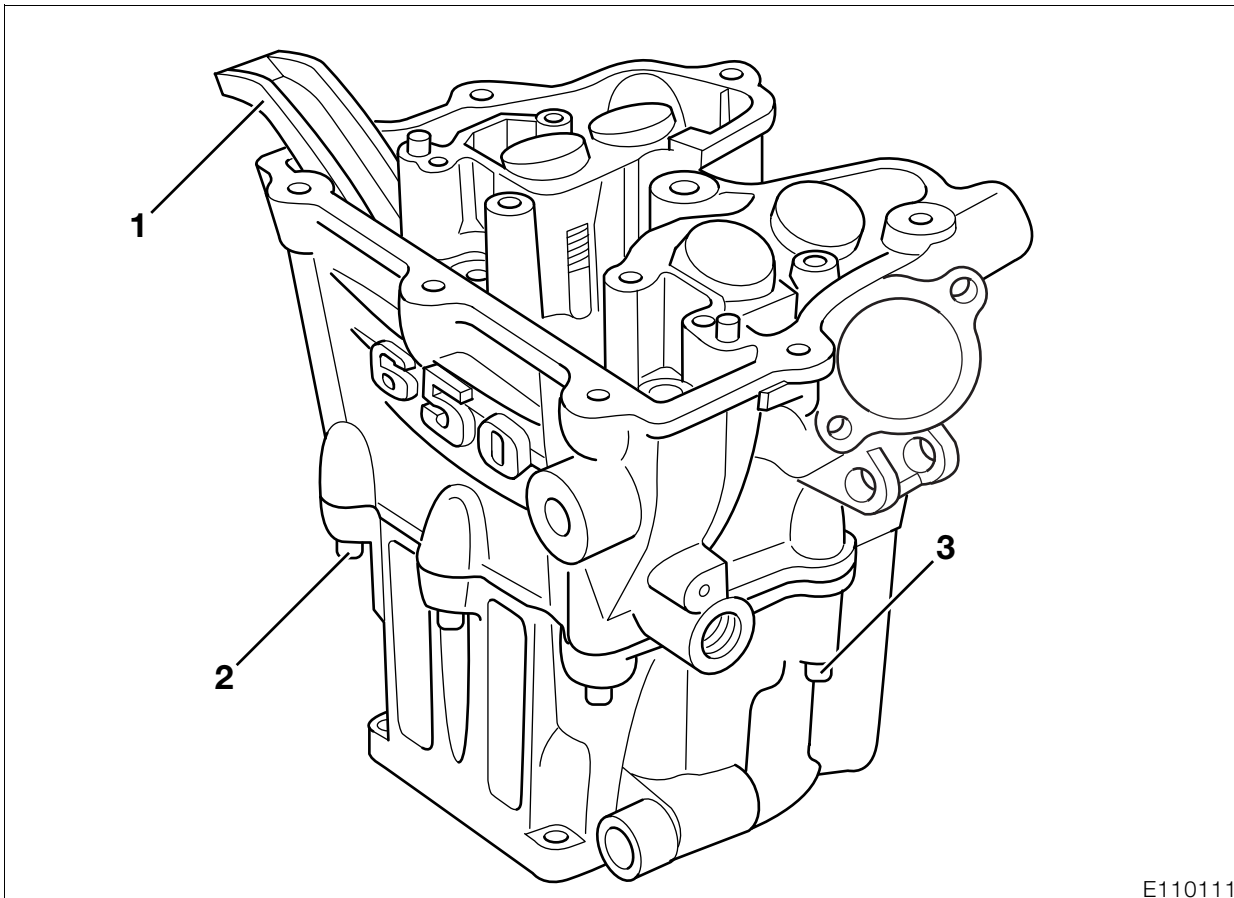
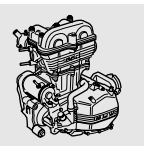


Note:

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**.
- Secure timing chain with cable tie.
- Remove starter (→ 12.9).
- Remove collar nuts from cylinder head.

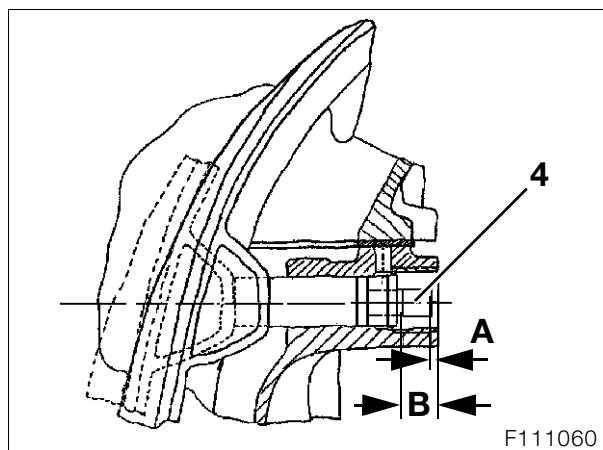


Note:

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



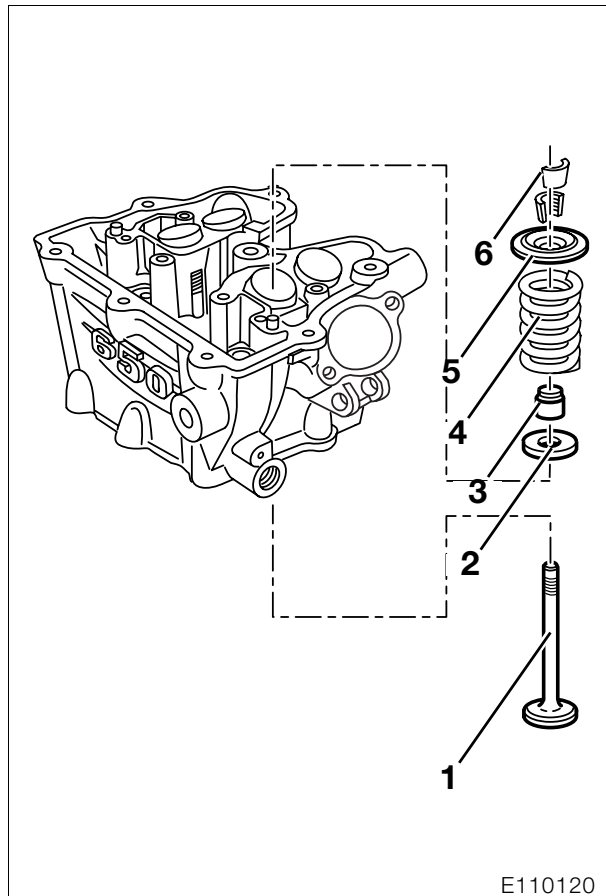
F111060

- 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 retainer
3. Valve stem seal
4. Valve spring
5. Upper valve retainer
6. Valve collets

11 34 020 Removing valves

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

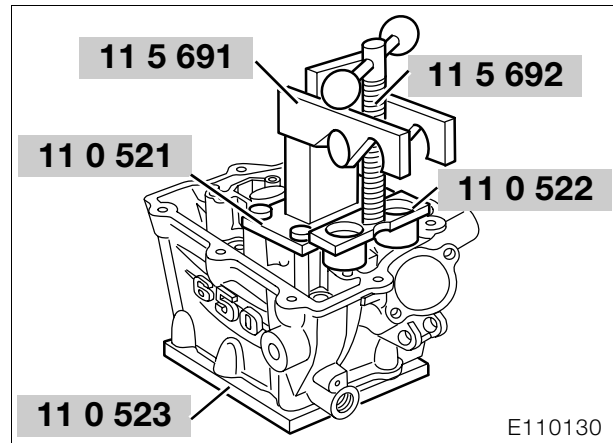
Bore for bucket tappet

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



Important:

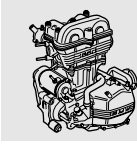
Assign and mark bucket tappets (risk of jamming).



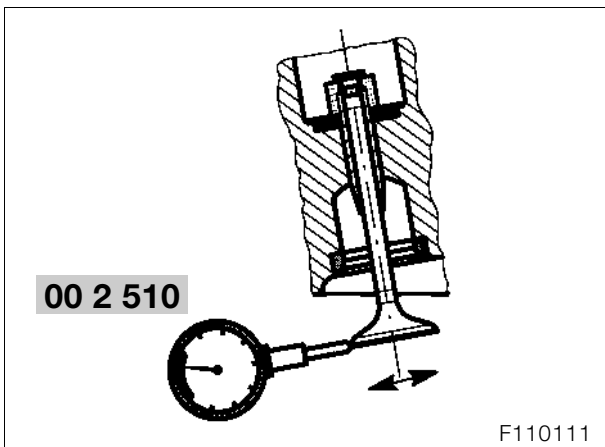
Note:

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

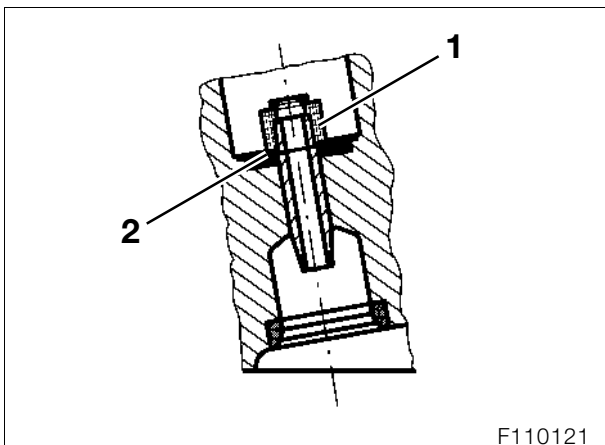


- Insert new valve from combustion chamber side into valve guide until it reaches the valve stem seal.
- Using dial gauge, **BMW No. 00 2 510**, positioned vertically on the valve axis, measure maximum tilt clearance across the camshaft axis.

Tilt clearance:

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

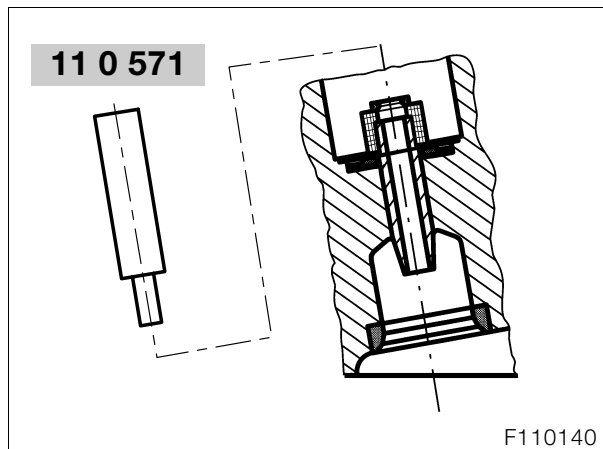
11 12 591 Removing valve guide



⚠ Important:

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 simplify driving out, heat the cylinder head to 100 °C (212 °F).

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

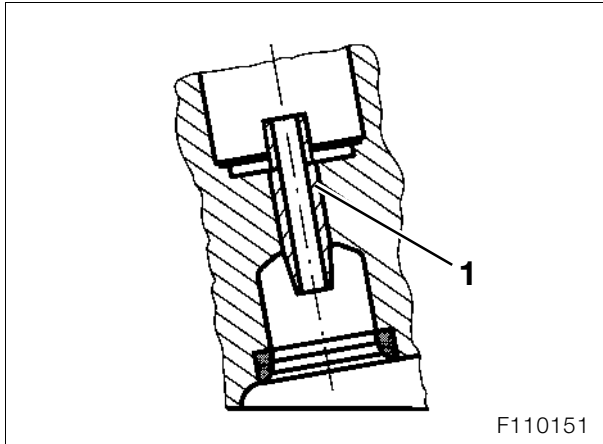
- Use drift, **BMW No. 11 0 571**, to drive out the valve guide toward the combustion chamber.



Important:

If the valve guide bore in the cylinder head is worn, the cylinder head must be replaced.

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)



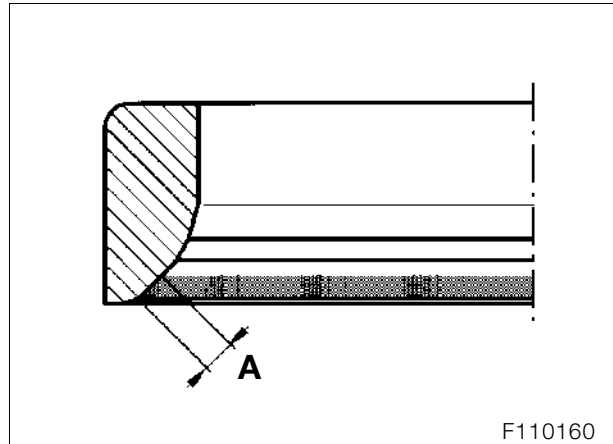
Note:

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 in cutting direction when doing so!

- 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 correct valve and rotate, applying slight pressure.

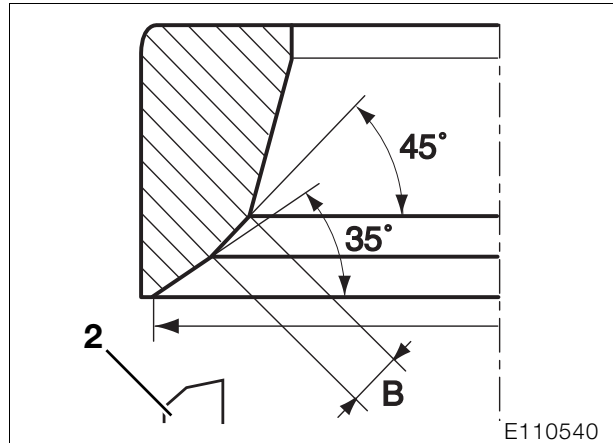


- Check valve seat width "A" and contact pattern for wear.

Wear limits for valve seat width "A":

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

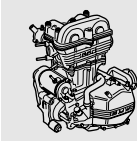
- If the wear limit of the seat width has been reached, or the contact pattern is no longer perfect, the seat can be remachined.



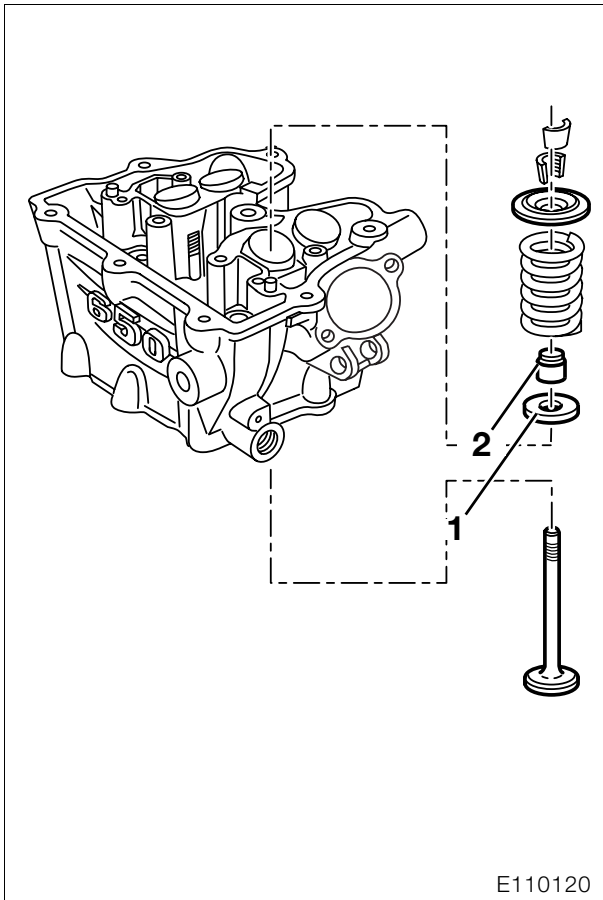
- If necessary, remachine valve seat with valve seat turning tool (2).

Valve seat width "B":

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

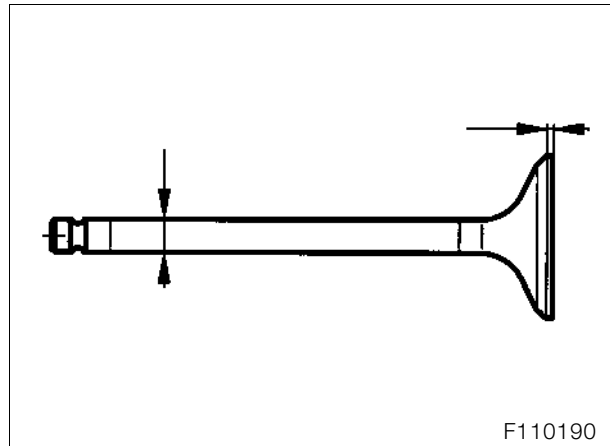


11 34 800 Installing valve stem seal



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

Checking valve for wear



- Check valve stem diameter and valve head seat width.

Wear dimensions for valve:

Stem diameter

Inlet valve min. 4.89 mm (0.192 in)

Exhaust valve min. 4.89 mm (0.192 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.

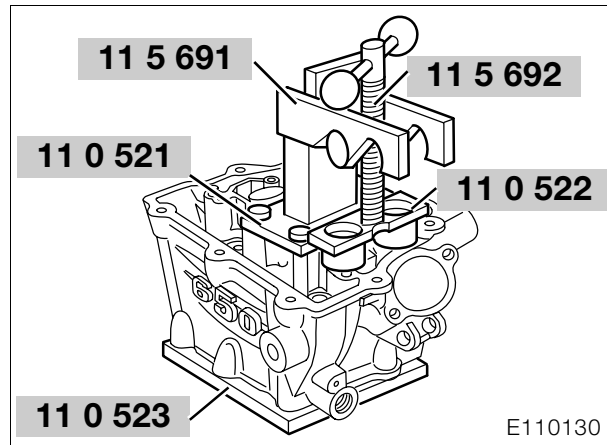
- Check grooves for valve collets.

11 34 020 Installing valves

- Install valve with shrink-fit tube.



Note:
Remove the shrink-fit tube.



- Install valve spring and valve spring plate.
- 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:
Coat valve collets with a small amount of grease to facilitate assembly.

- Insert the valve collets.
- Check bucket tappets for damage and fit to correct valves.

11 11 150 Removing cylinder

- Separate the cylinder base from the engine block.

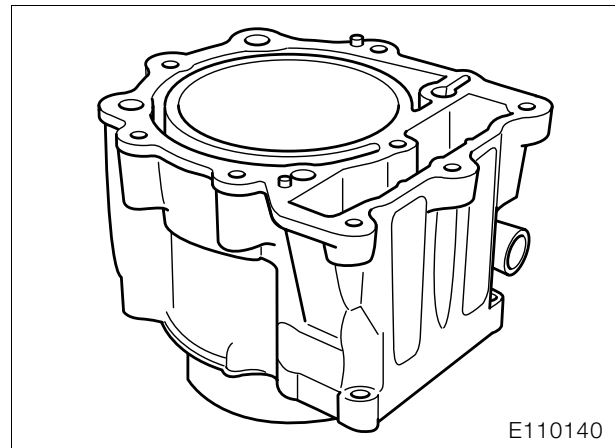


Important:

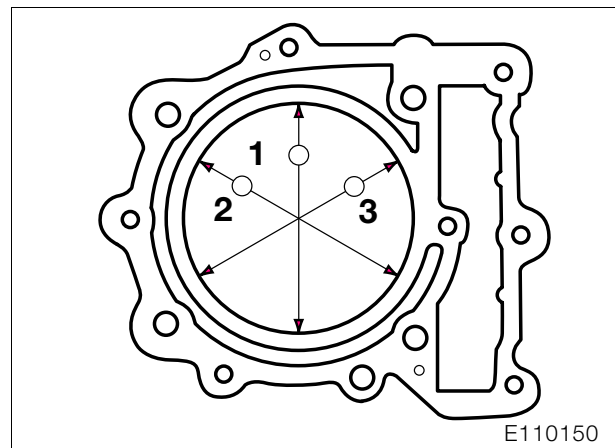
When removing cylinder, make sure that the piston does not strike the engine block.

- Remove cylinder.

Checking cylinder



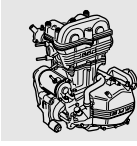
- Check cylinder face and sealing faces for damage and blow out oil ducts for chain tensioner.



- Measure cylinder bore at distance of 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.



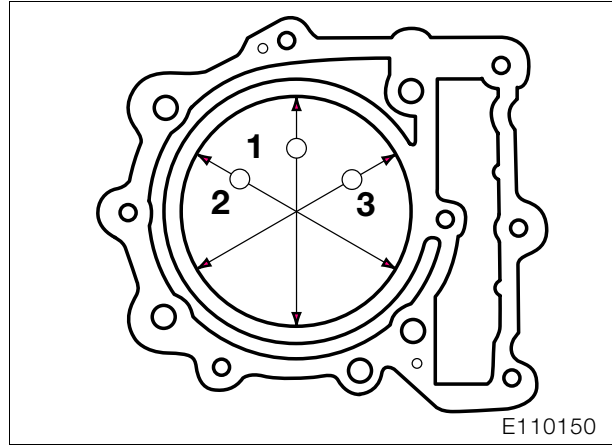
Note:

Mark exhaust-valve side on piston crown.

11 25 671 Disassembling piston

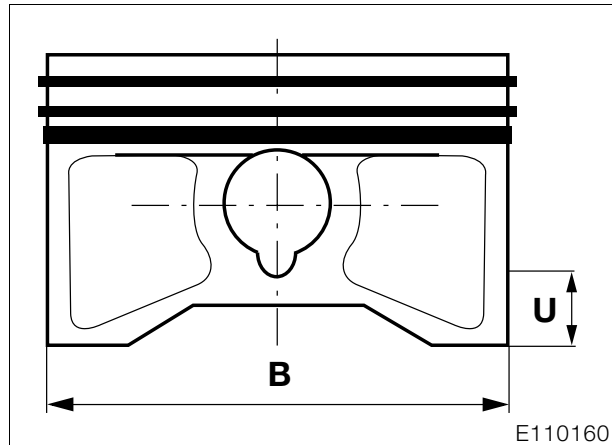
- Remove piston rings with piston ring pliers.
- Carefully clean piston.
- Check piston for signs of damage.

Determining clearance of piston in cylinder



E110150

- Measure cylinder bore at distance of 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".



E110160

- Measure piston diameter "B" at distance $H=16$ 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

- Install piston ring in cylinder and measure 60 mm (2.36 in) from top edge of cylinder with feeler gauge to determine 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:

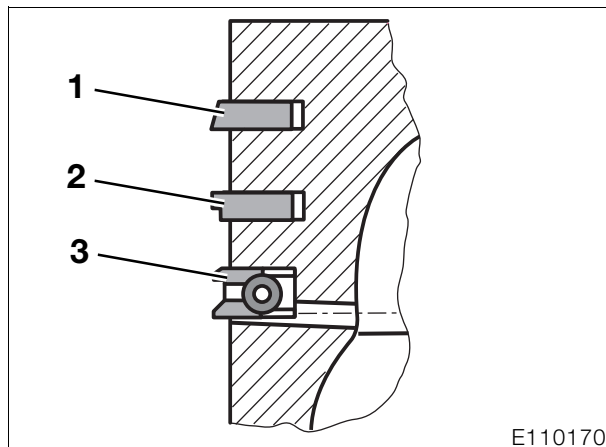
Bore dia. in piston,
verticalmax. 22.030 mm (0.8673 in)
Piston pin dia.min. 21.980 mm (0.8654 in)
Radial clearance
in pistonmax. 0.050 mm (0.0019 in)

11 25 671 Assembling pistons



Note:

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



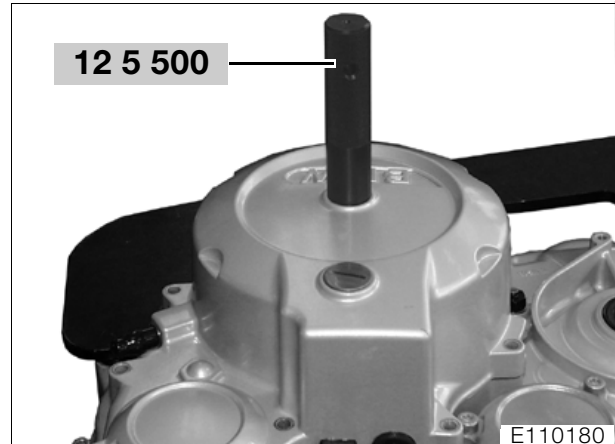
1. Groove for rectangular-section ring
2. Stepped micro-taper ring
3. Groove for spring-steel oil control ring

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

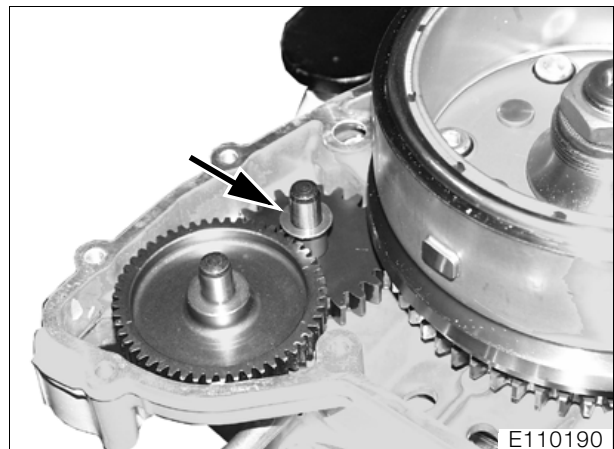
Wear limit, ring float in groove . 0.150 mm (0.006 in)

12 11 070 Removing ignition magnet

- Remove fastener of right engine block cover.



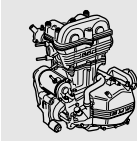
- Release the central locking screw, insert and tighten handle, **BMW No. 12 5 500**.

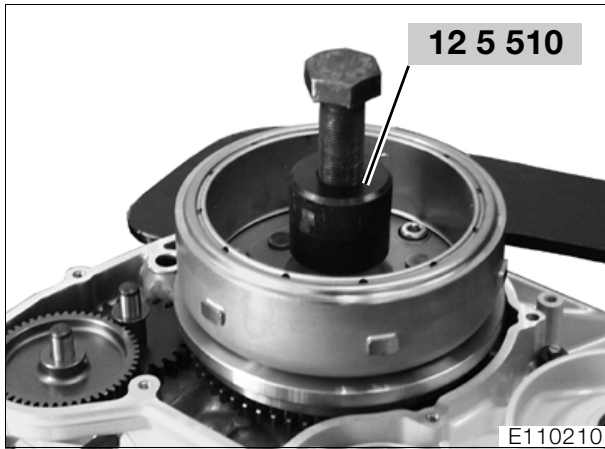
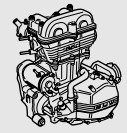


- Remove the cover, noting the thrust washer (arrow).



- If necessary, remove ignition trigger (4).





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

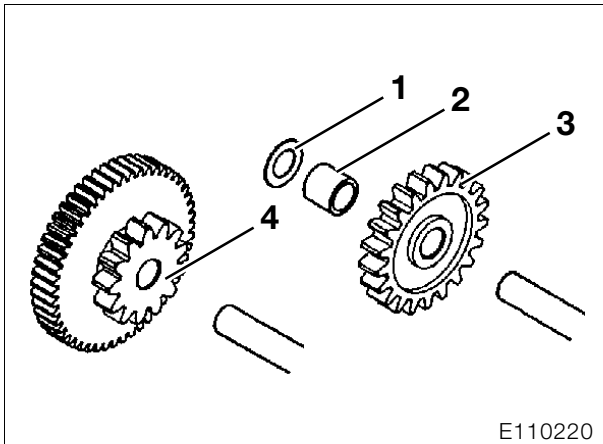


Note:

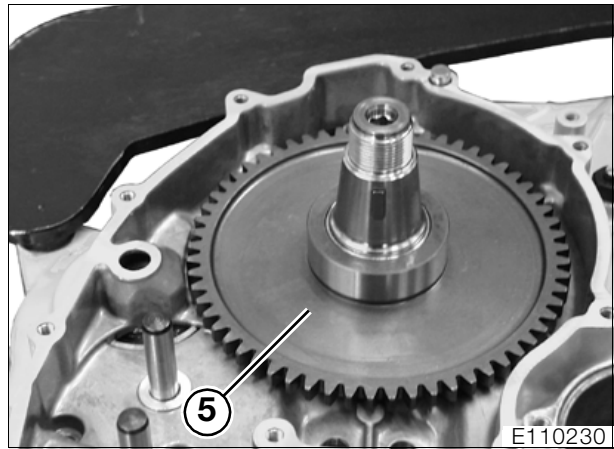
Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

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

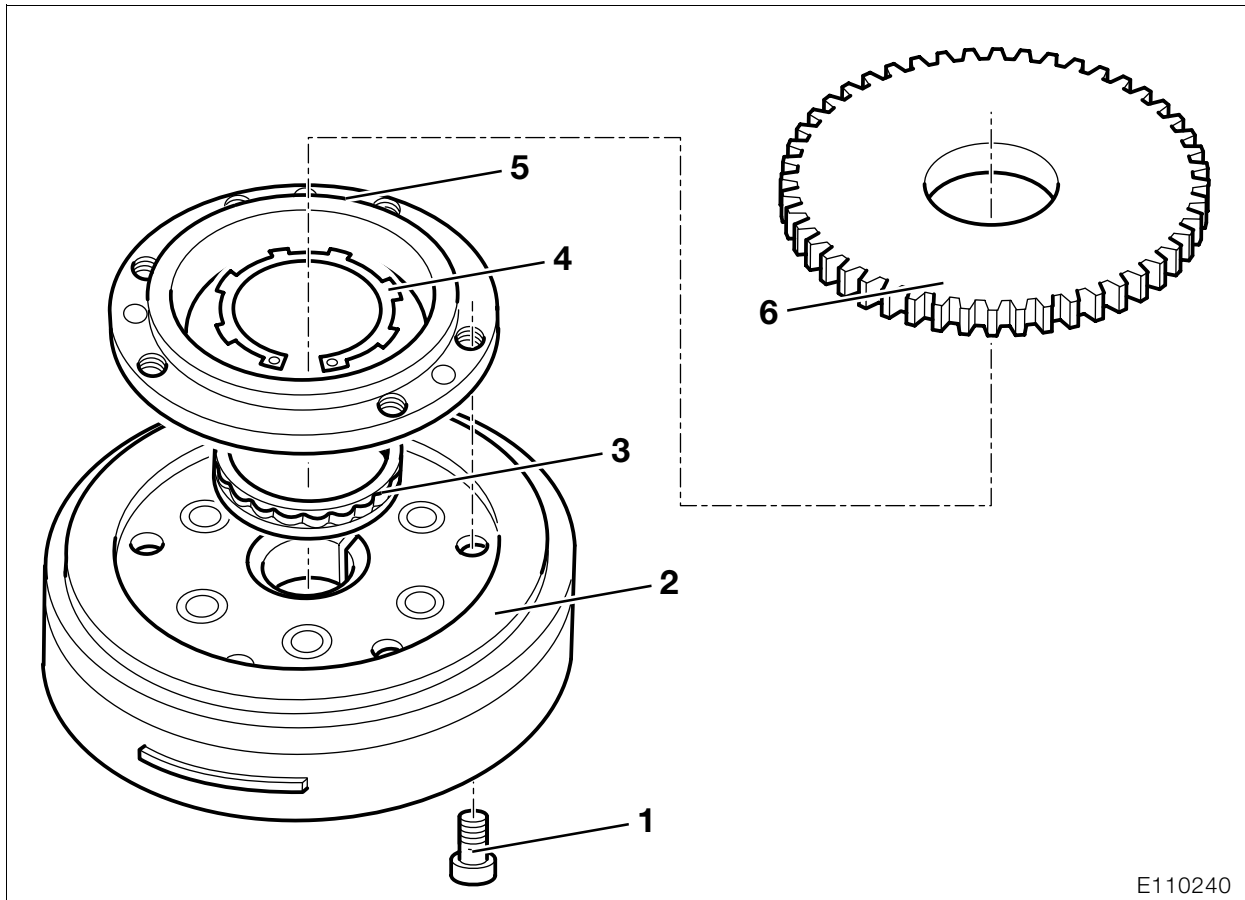
11 26 500 Removing countershaft for starter



- Remove thrust washer (1) and spacer sleeve (2).
- Remove double gear (4).
- Pull off angled 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 securing screws (1).
- Lift off freewheel housing (5).
- Remove lock ring (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 tabs of the lock ring 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.



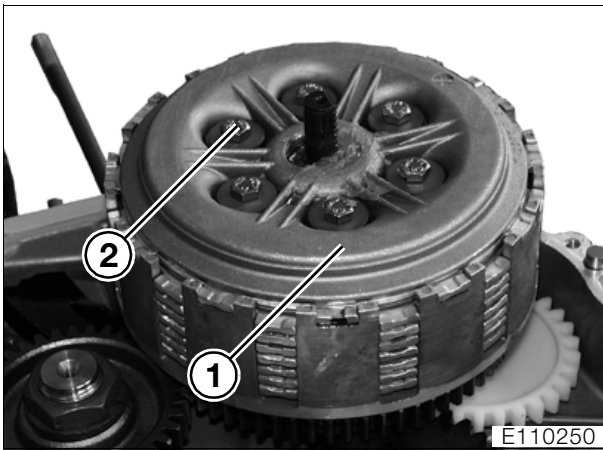
Tightening torques:

Machine screw
(clean threads + Loctite 648) 35 Nm

21 21 000 Removing clutch

- Turn engine round in assembly fixture.
- Remove fastener for left engine block scower and remove cover.

Removing pressure plate



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

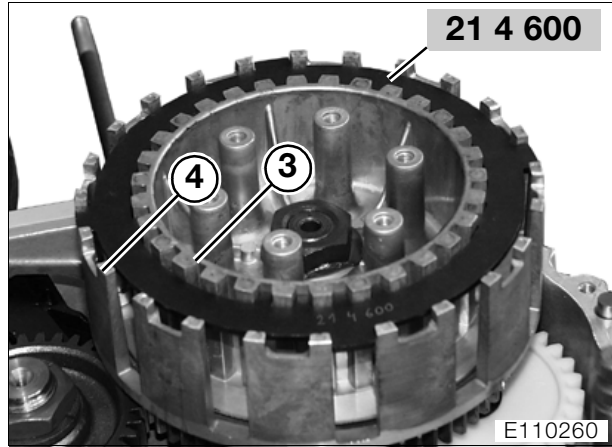
Removing clutch plates



Important:

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 toothed washer.



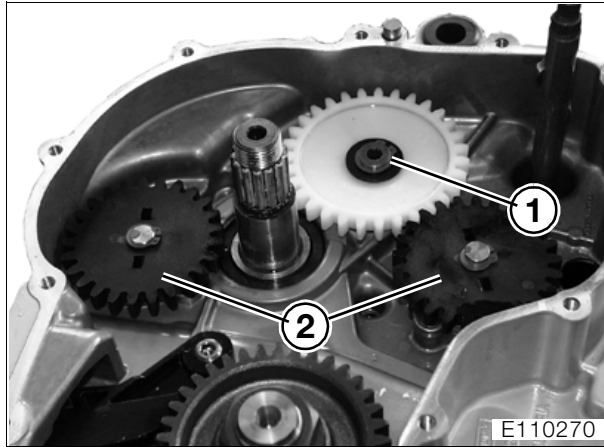
Important:

Note the backup washer at the bottom.

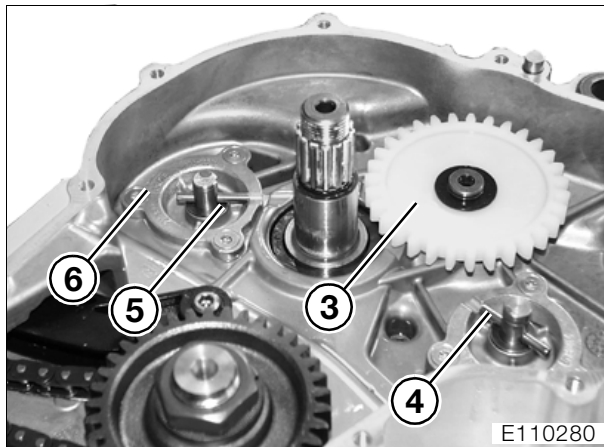
- Pull off needle cages.
- Remove the backup washer.

11 41 000 Removing and installing oil pump

Removing oil pump



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



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

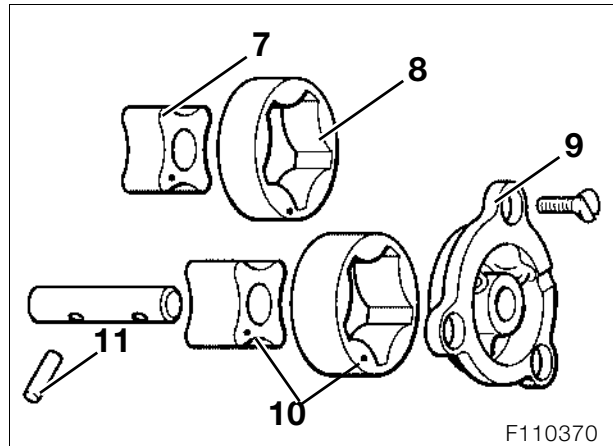
Inspecting oil pump

- 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:

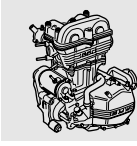
Markings (5) must be visible.

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

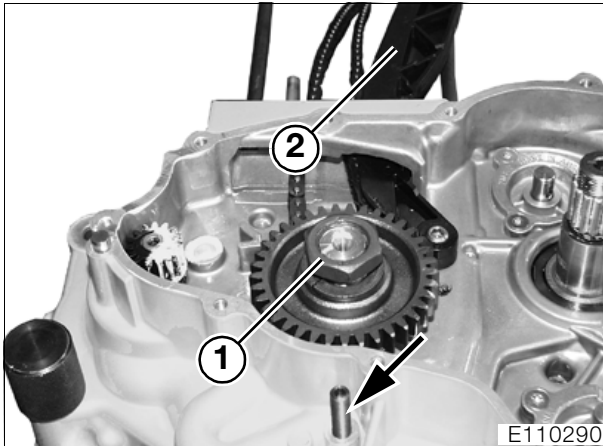


Tightening torque:

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



Removing double drive gear

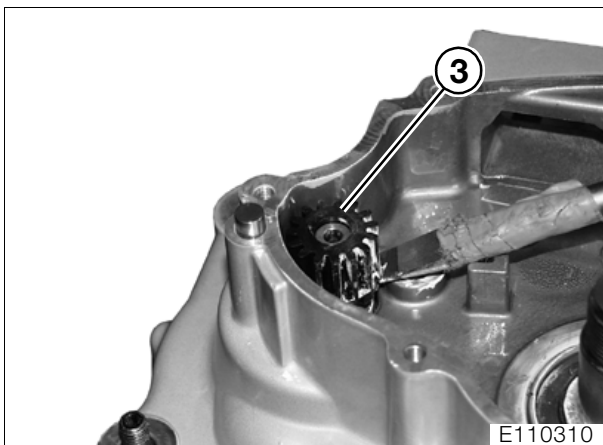


Note:

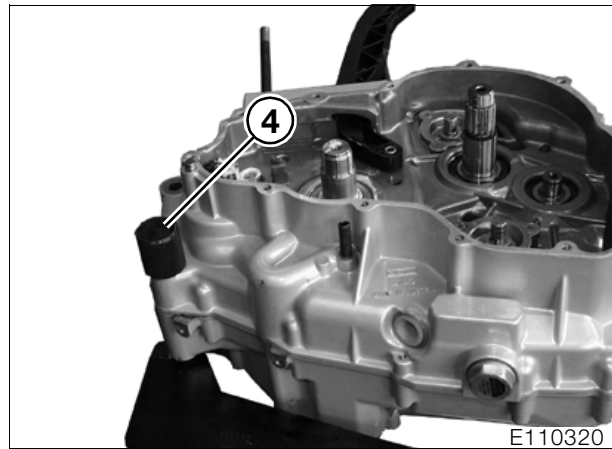
Retaining screw (arrow) must be installed.

- 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 fasteners on engine block.
- Remove oil filter and unfasten two fasteners for engine block in base.



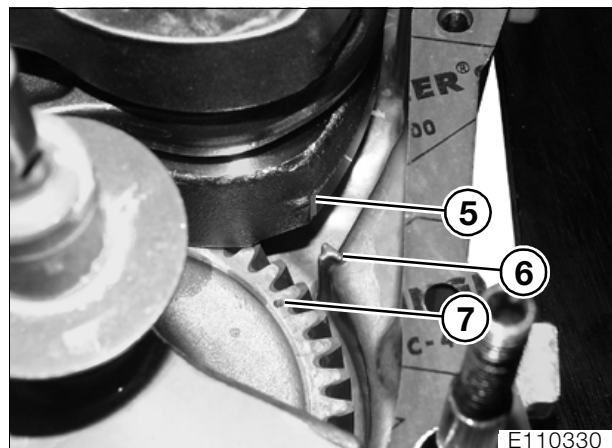
- Swivel assembly fixture so that clutch side is uppermost.
- Remove knurled nuts (4).



Important:

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

- Lift off left half of engine block, tapping 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
 websmax. 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).

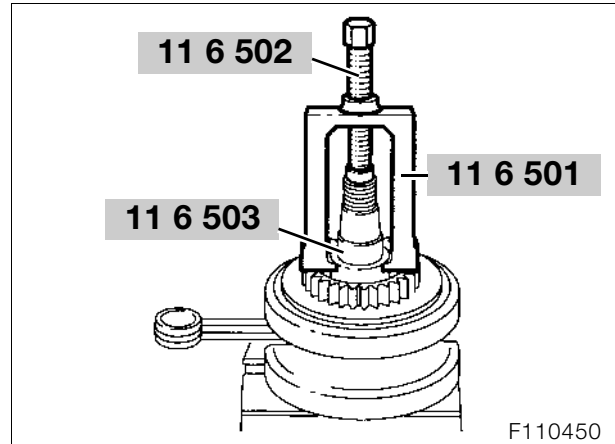


Note:

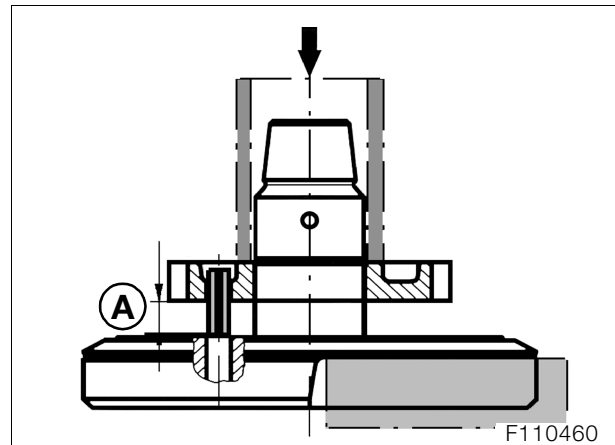
Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

- 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.

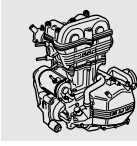


Important:

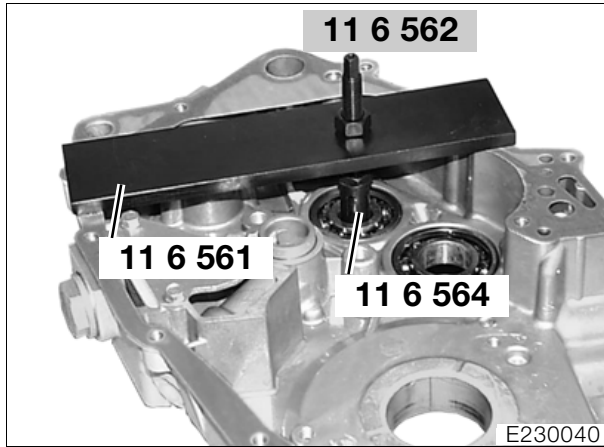
Pin must not protrude from bore in crankshaft gear - this is the support face for the thrust washer.

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

Projection "A" of pinmax. 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).
- 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.



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 °C) 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 countershaft 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. dia. 46.99 mm (1.850 in)

Mainshaft max. dia. 62.02 mm (2.442 in)

Clutch side:

Countershaft max. dia. 51.99 mm (2.047 in)

Mainshaft max. dia. 46.99 mm (1.850 in)

11 11 200 Removing and installing grooved ball bearings of balancing 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:

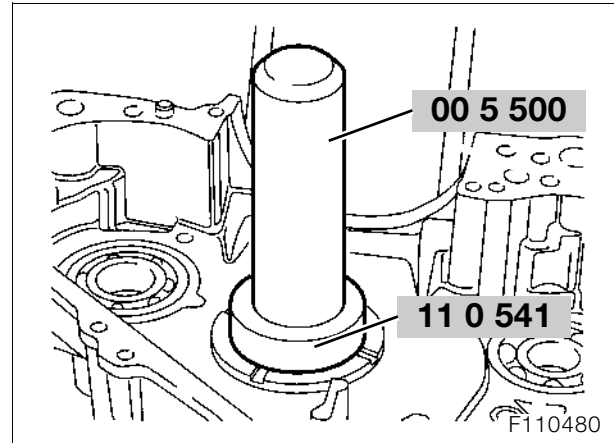
The sealed ends of the cage must point outwards.

- 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**.

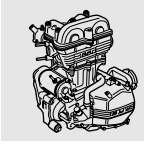
11 21 001 Removing and installing main bearings

- Check main bearings for signs of damage and wear.

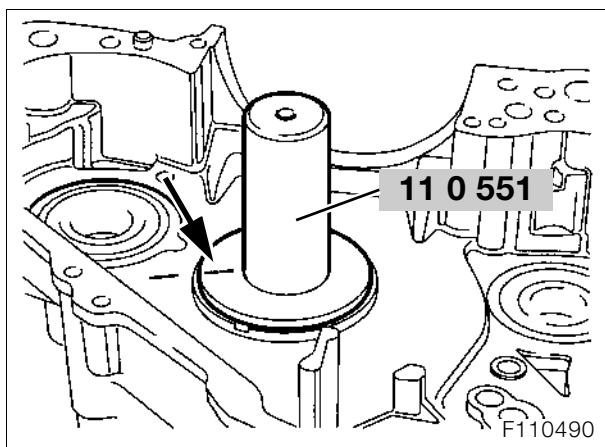
Removal



- 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.



Important:

The bearing bushing must not project beyond the oil pockets.

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

Before driving in, fit both bearing halves with O-ring on mandrel.

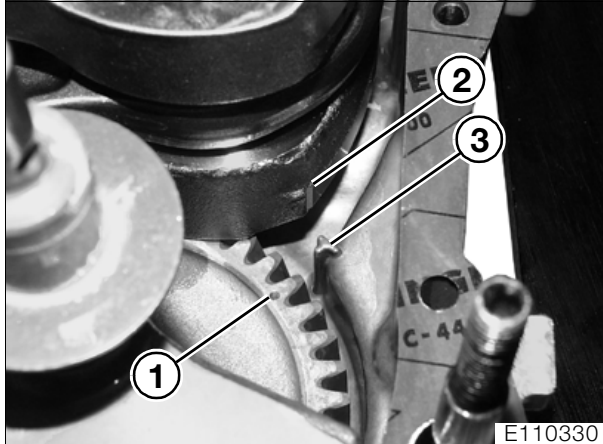
- Coat bearing bushings with **Optimoly TA** and drive in with drift, **BMW No. 11 0 551**, working from the inside.

11 00 103 Assembling engine

- Install the gearbox (→ 23.7).

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

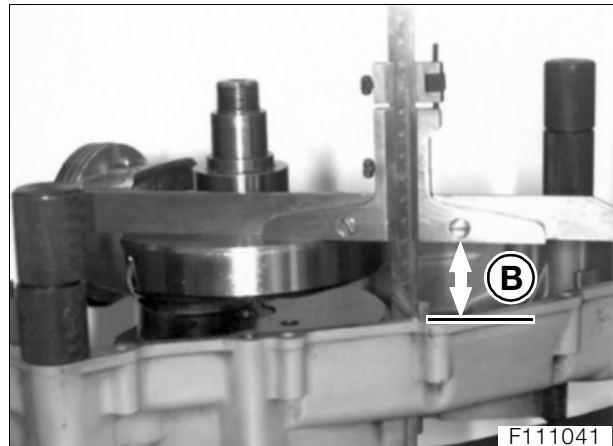


Note:

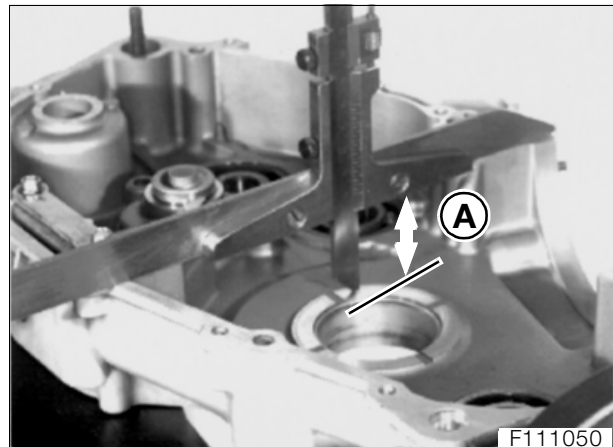
Oil shaft bearing points.
Re-shim the crankshaft and balancing shaft if the housing or either of the shafts was renewed.

- 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 mating face = dimension "B".



- Measure distance from left engine housing mating face to shim 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 end, the shim is always 1.0 mm (0.04 in) thick.

- Select a suitable shim 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 shims only on the clutch side.

- Fit left engine housing and install fasteners.



Note:

Note the two fasteners in the oil filter housing.

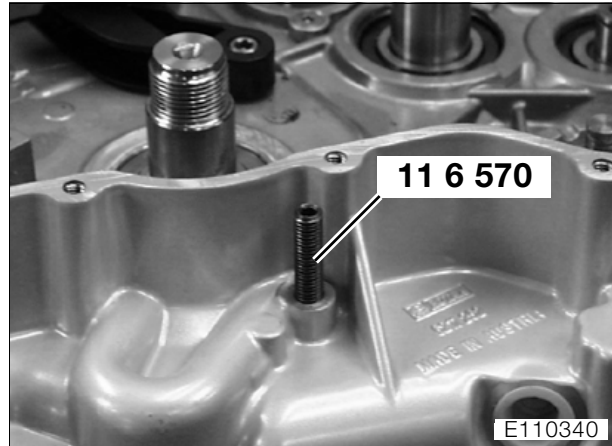
- Cut off protruding gasket.



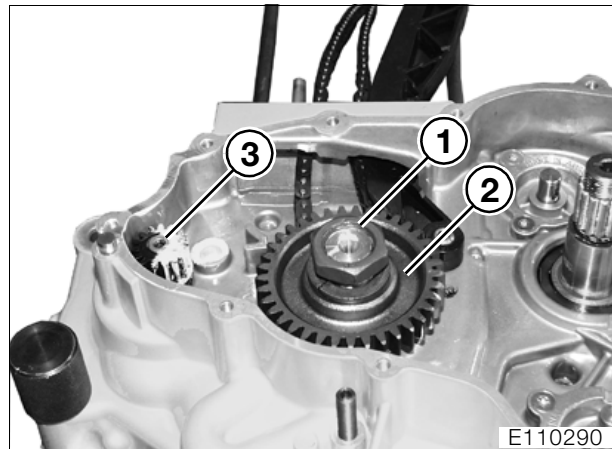
Tightening torque:

Fasteners for engine housing 10 Nm

Installing double drive gear



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



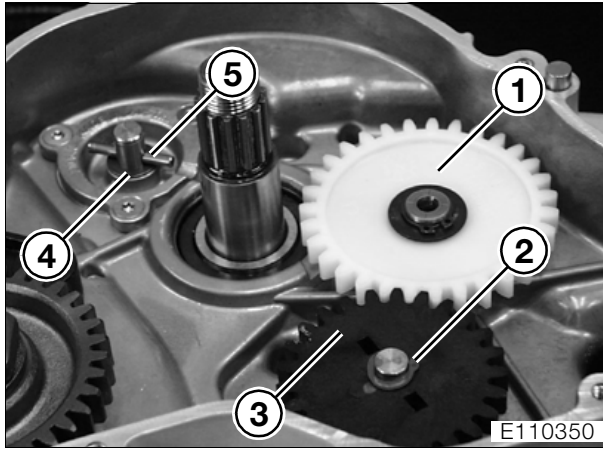
- Insert chain through chain aperture and place around crankshaft.
- Slide double drive gear (2) on to crankshaft.
- Engage chain.
- Install snap ring.
- Clean threads of crankshaft and hexagon nut (1), coat threads with **Loctite 243** and install nut.
- Engage needle roller of water-pump drive gear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



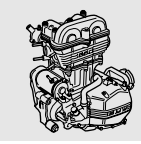
Tightening torque:

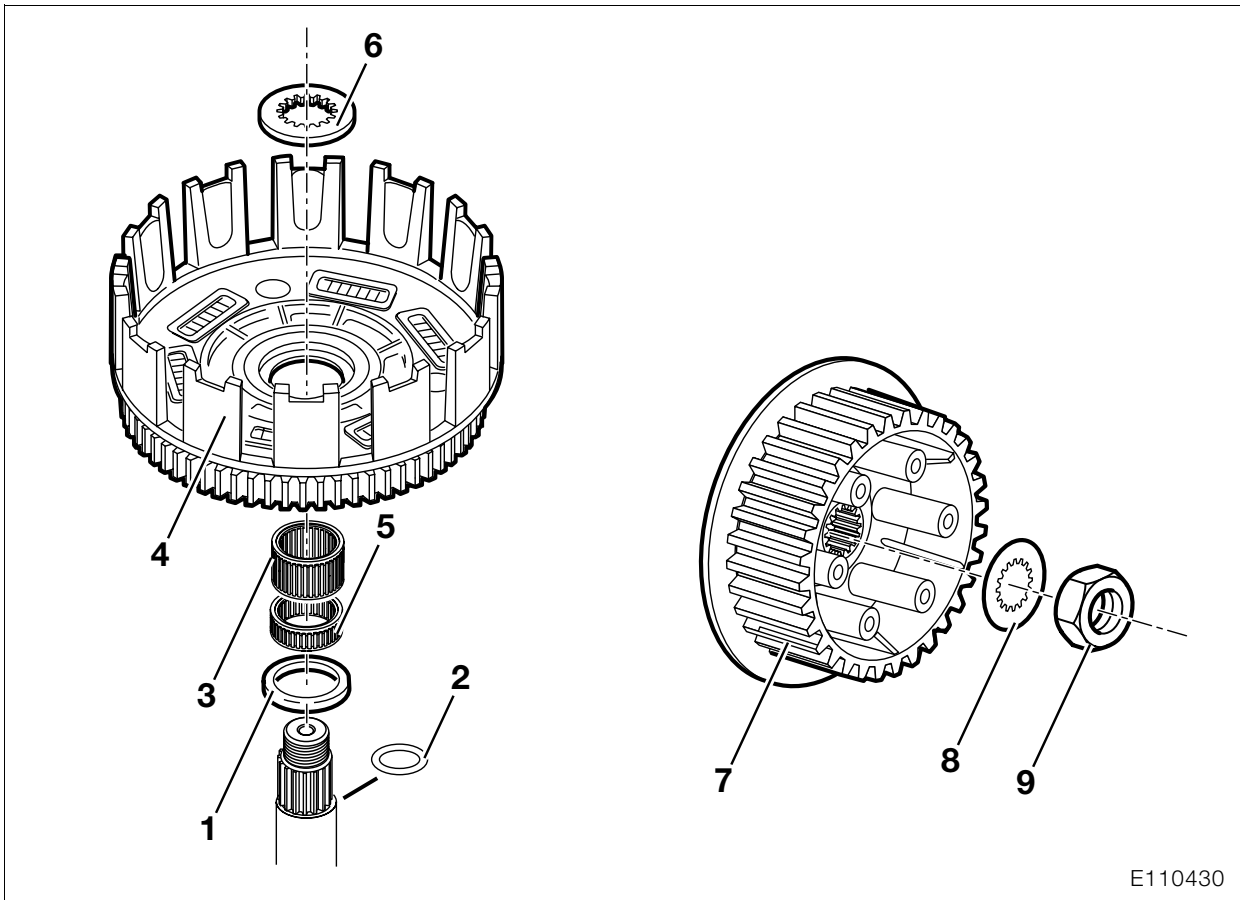
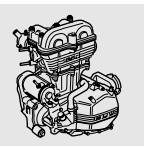
Double drive gear on crankshaft
(clean thread + Loctite 243)..... 180 Nm

11 41 000 Installing oil pump gears



- Install angled 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

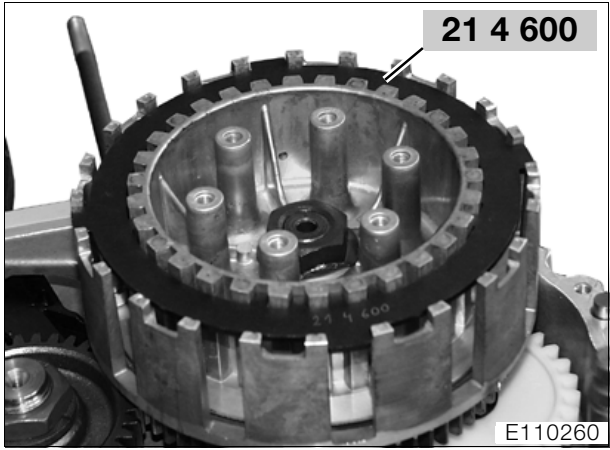
21 21 000 Installing clutch

Installing clutch cage

- Place thrust washer (1) on countershaft.
- 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 retaining washer (8); it must engage securely.
- Clean threads of countershaft and hexagon nut (9), coat threads with **Loctite 243** and install nut.



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

Tightening torque:
 Driver to countershaft
 (clean thread + Loctite 243)..... 140 Nm

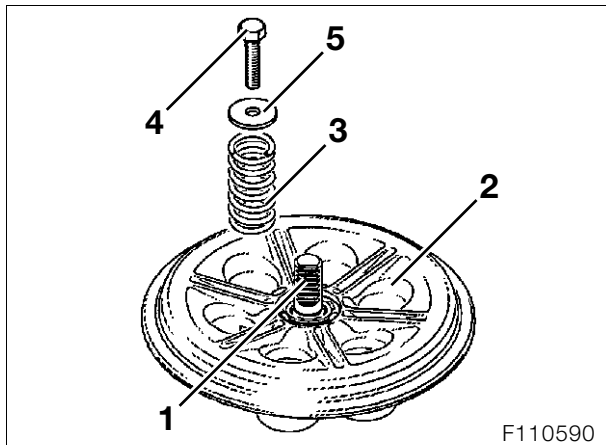
Installing pressure plate

- 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**.

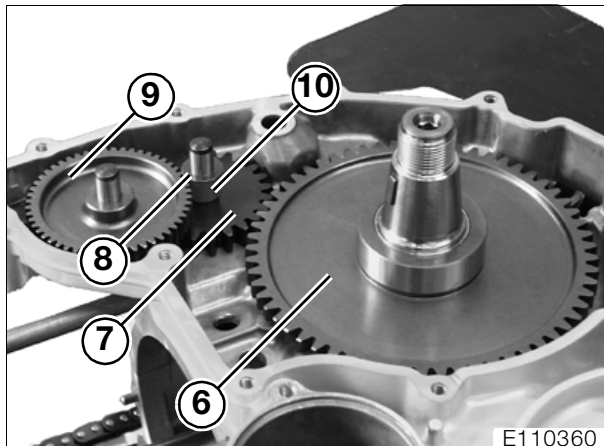


Tightening torque:

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.



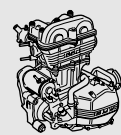
E110360



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 (9) on locating pin.
- Install spacer sleeve (10) and thrust washer (8).



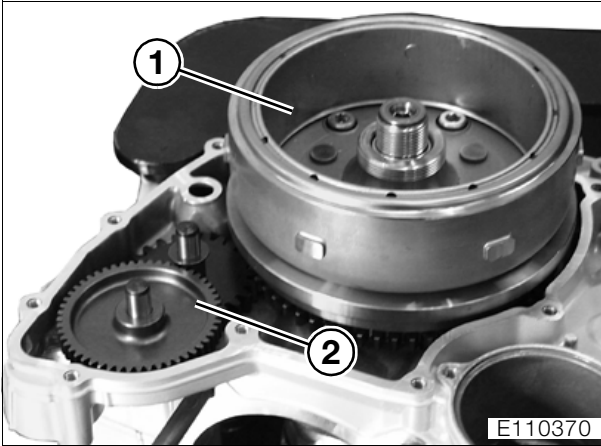
12 11 070 Installing magnetic ignition trigger



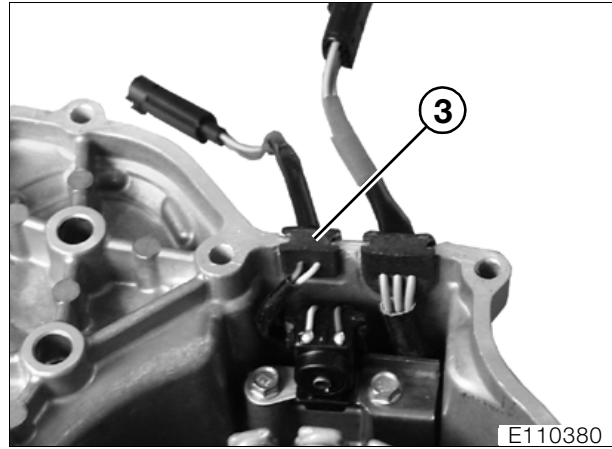
Important:

Tapers on crankshaft, 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 secure hex nut with **Loctite 243** and tighten.



- Coat the rubber grommet (3) of the transmitter and the rubber grommet of the stator cable with **Three 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 install securing screws.
- 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

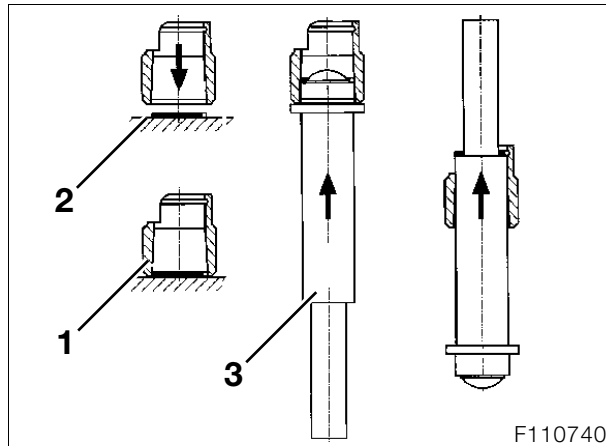
- Coat the small end bore in the crankshaft and the piston pin bore in the piston with **Optimoly MP 3**.



Important:

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**.

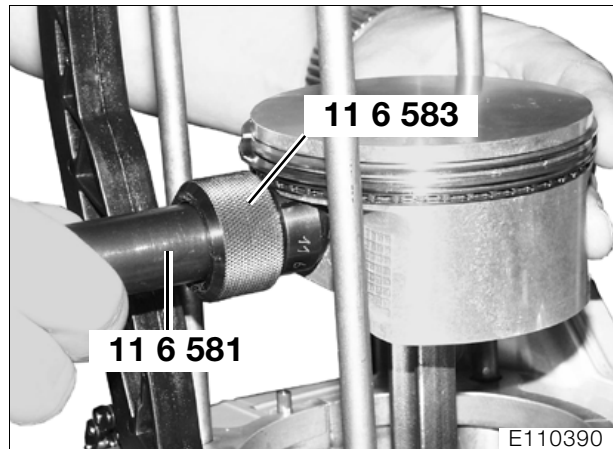


Note:

Lightly oil inside of slider.

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 area 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 as far forward as possible.
- Turn the assembly drift round and push the circlip in as far as the groove.



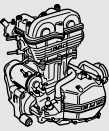
- Position sleeve, **BMW No. 11 6 583**, with installation arbor, **BMW No. 11 6 581**, against piston.



Important:

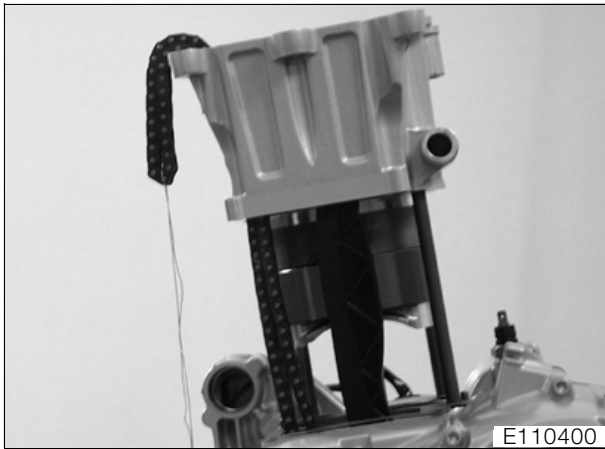
Support side of piston.

- Press piston pin circlip into piston with firm pressure.



11 11 150 Installing cylinder

- Fit cylinder base seal 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 tie wire through chain aperture of cylinder, then slide cylinder over piston.
- Remove sliding sleeve.
- Secure cylinder to engine housing hand-tight.

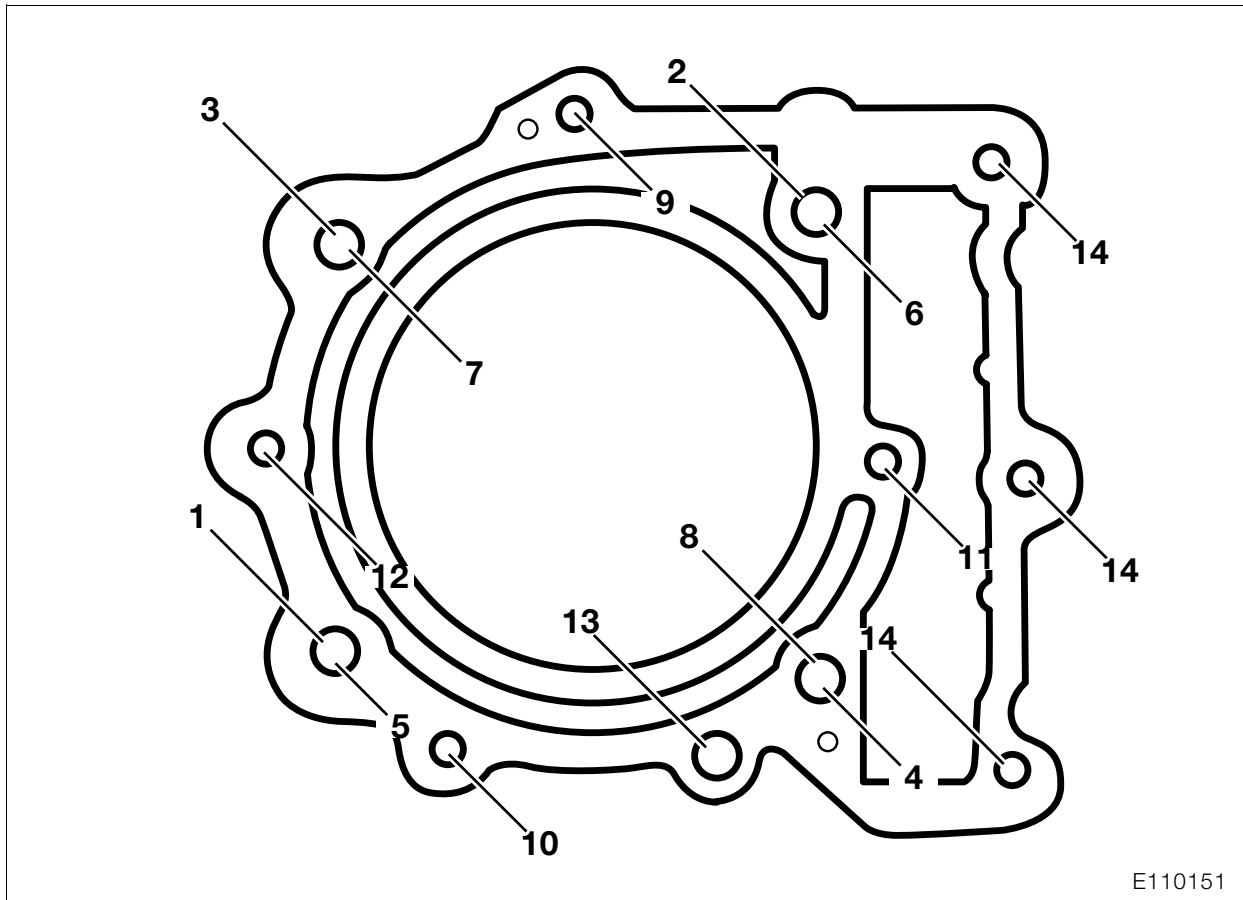
11 12 516 Installing cylinder head



Note:

Replace cylinder head gasket.

- Install the cylinder head gasket.
- Fit timing chain with wire hook on cylinder head through chain aperture.
- Fit cylinder head with valves installed to cylinder.
- Secure the cylinder head and cylinder loosely together with the shouldered screws and nuts.



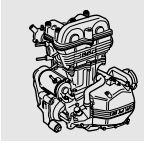
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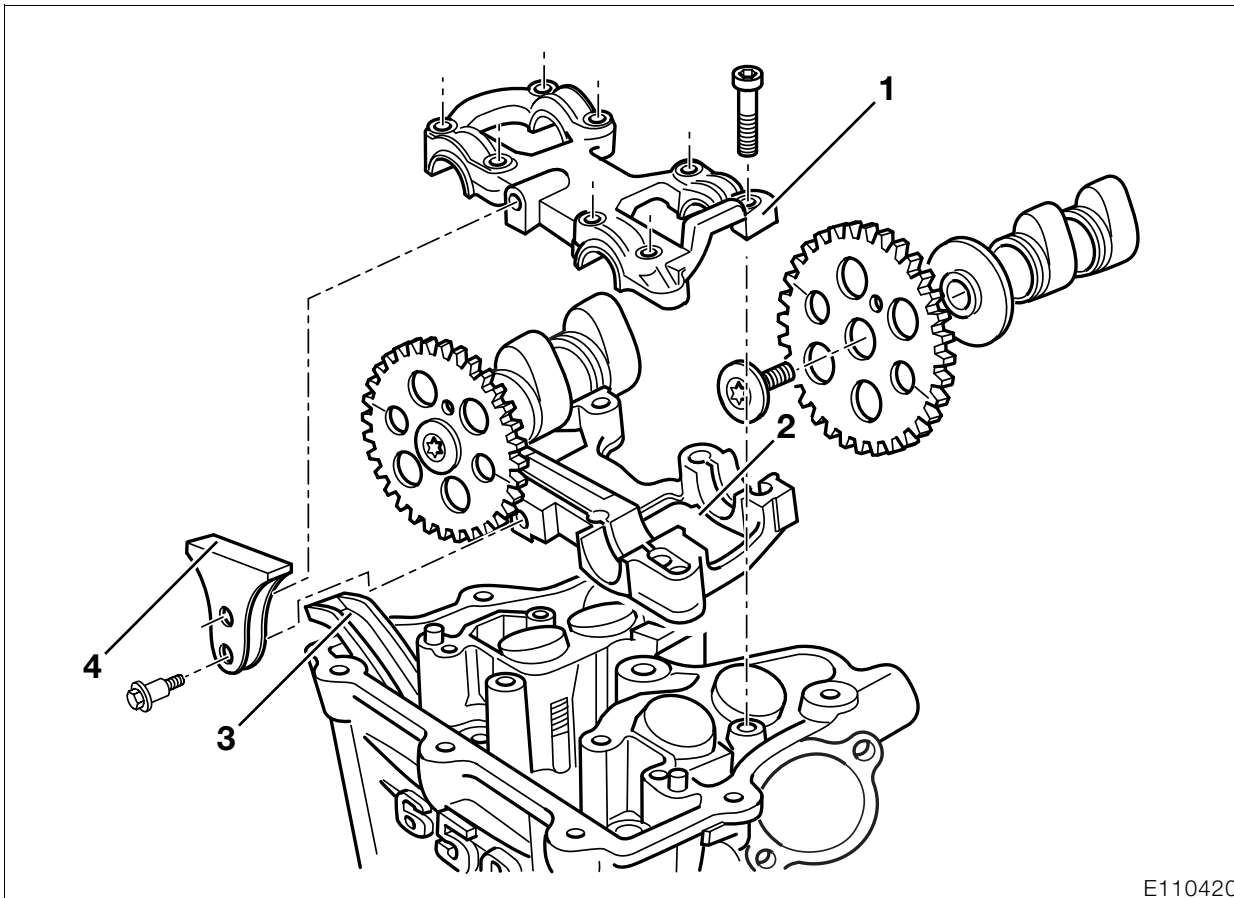
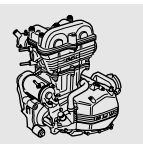
- Initially tighten the collar nuts of the cylinder head to 20 Nm (1-4) and then tighten to 60 Nm (5-8).
- Tighten the fasteners of the cylinder head to cylinder in the sequence as shown (9-14) to specified torque.
- Tighten machine screws at base of cylinder.



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 install at the correct valves.
- Measure thickness of shim plates with micrometer and note down thickness.
- Place lower part of camshaft mount (1) on cylinder head.
- Fit camshafts with cam lobes facing upwards, press down by hand and measure valve clearance with feeler gauge.



Note:

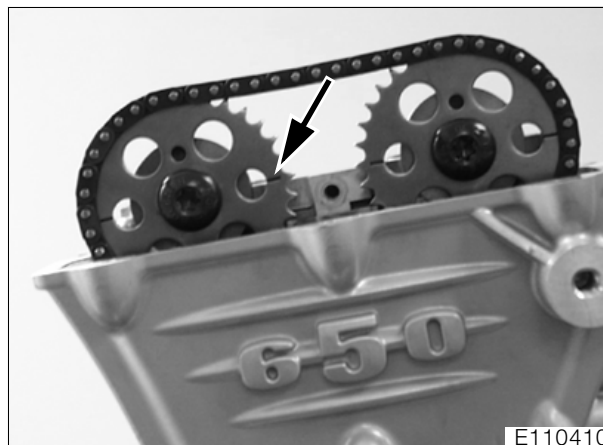
The decompressor in the exhaust camshaft must not press against the bucket tappet, or else the valve clearance will be incorrect.

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

Valve clearances:

Inlet valve 0.10...0.15 mm (0.004...0.006 in)
 Exhaust valve 0.25...0.30 mm (0.010...0.012 in)

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



E110410



Important:

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 half of camshaft mount (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 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 cylinder head cover with gasket.
- Connect oil lines to engine block, using new copper sealing rings.



Note:

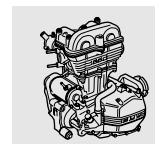
Install the oil return line with the tab at the bottom and the oil feed line with the tab at the top.

- Connect the oil lines to the cylinder head.
- Remove 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.



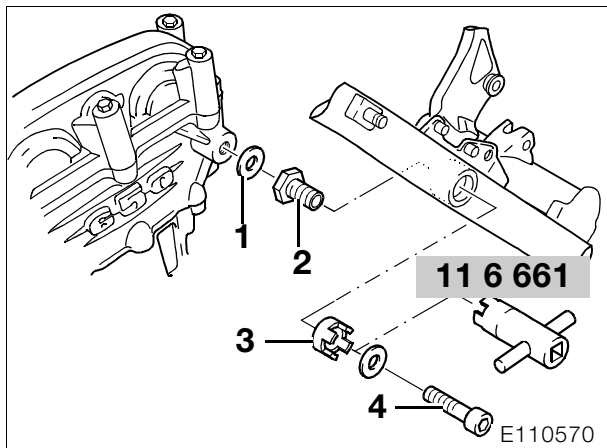
Tightening torques:

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	
(using copper sealing ring)	42 Nm
Oil line to cylinder head	8 Nm
Spark plug in cylinder head	20 Nm
Starter motor to bell 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-fork bearing.



- Back off the adjuster sleeves (2) on left and right until they are seated with washers (1) against the cylinder head on each side and the cylinder head itself is centered in the frame.
- Tighten locknut (3) using special wrench, **BMW No. 11 6 661**.
- Tighten fastener (4).



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, neutral indicator.....	2 Nm
Engine shell to engine	41 Nm
Engine shell to bracing tube	21 Nm
Frame truss to engine shell	21 Nm
Frame truss to main frame.....	21 Nm
Spring-strut adjusting knob bracket to frame	9 Nm
Radiator to main frame at top.....	9 Nm
Swinging-fork pivot	100 Nm
Frame to engine at rear	41 Nm
Gearshift pedal to engine	15 Nm
Brake pedal to frame.....	21 Nm
Cylinder head to frame	41 Nm
Cylinder head to frame, adjuster sleeve	zero play, max. 5 Nm
Cylinder head to frame, locknut.....	100 Nm

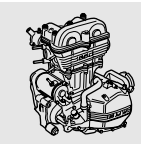
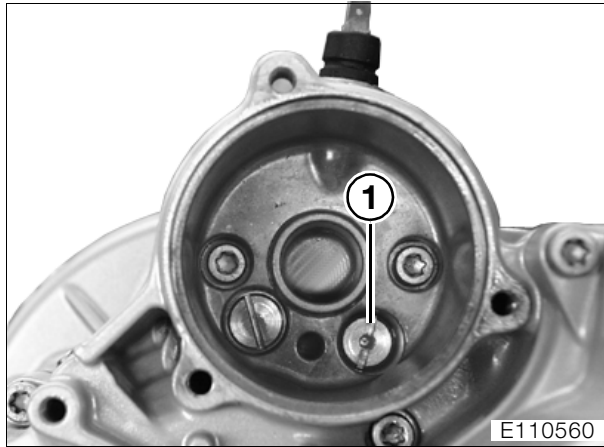


Important:

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 check valve (1).
- Remove spark plug.
- Turn engine over with the starter motor until oil emerges at the filter chamber.
- Install check 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:

Check valve.....	24 Nm
Oil filter cover	10 Nm

12 Engine electrics

Contents

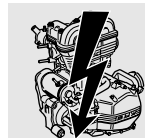
Page

Technical Data	3
Ignition magneto	5
Ignition magneto, components	6
Removing ignition magneto	7
Removing right engine housing cover	7
Removing and installing ignition trigger	8
Removing and installing stator	8
Installing magnetic ignition trigger	8
Installing magnet rotor	8
Removing and installing or dismantling starter motor	9
Removing and installing starter motor	9
Disassembling/assembling starter motor	10
Replacing spark plug (→ 00.36)	11
Replacing ignition lead	11
Remove the intake air silencer together with the intake air pipe.	11
Removing and installing coil	11
Remove the intake air silencer together with the intake air pipe.	11



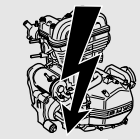
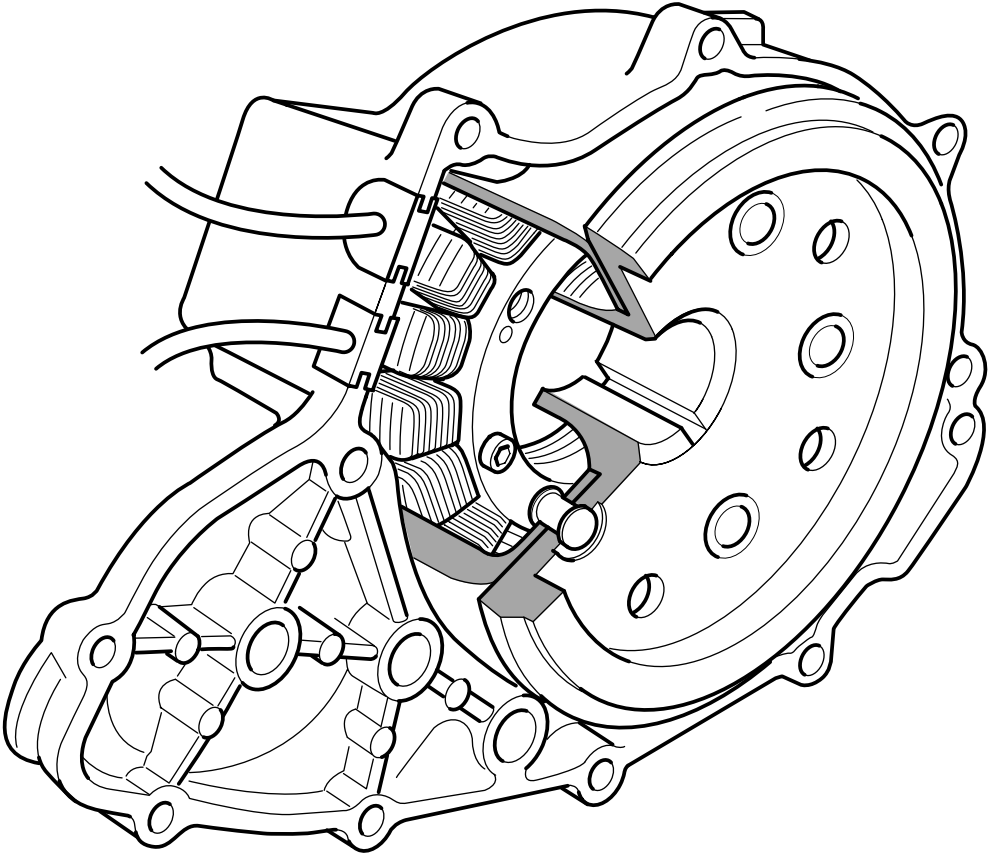


Technical Data		F 650 GS / GS Dakar
Ignition system		
Type		Fully transistorised ignition integrated in BMS.
Inductive sensor	Ω	190 ⁻³⁰⁰
Ignition		
Ignition system		BMS (mapped characteristic control)
Speed limitation	rpm	7,500
Ignition coil		
Primary coil	m Ω	500 \pm 50
Starter motor		
Type		Permanent-magnet 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. engine speed	rpm	7,500
Spark plug		
NGK		D8 EA
Thread	metric	M 12 x 1.25
Electrode gap	mm (in)	0.6-0.7 (0.02-0.03)

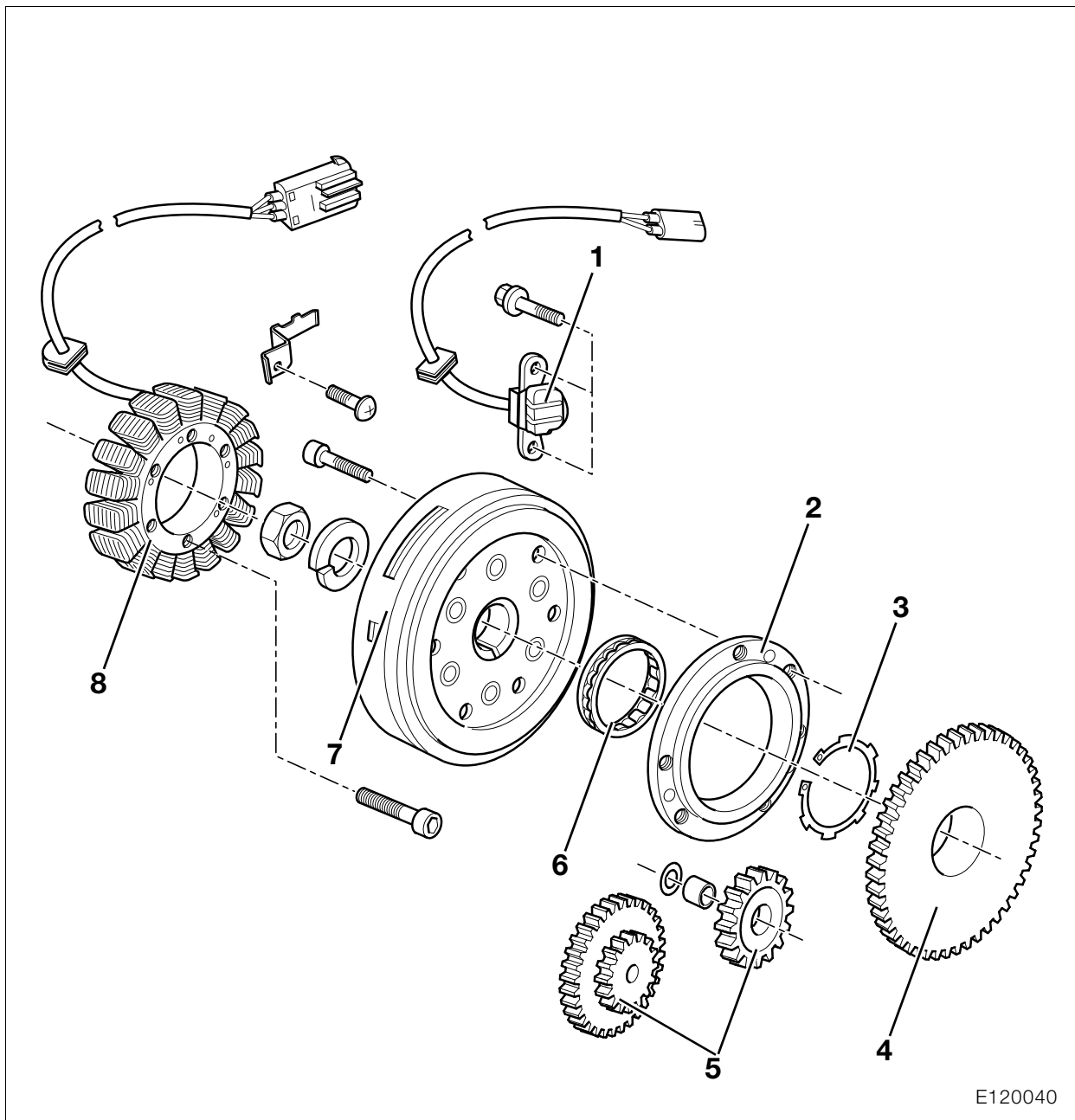




Ignition magneto



Ignition magneto, components



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

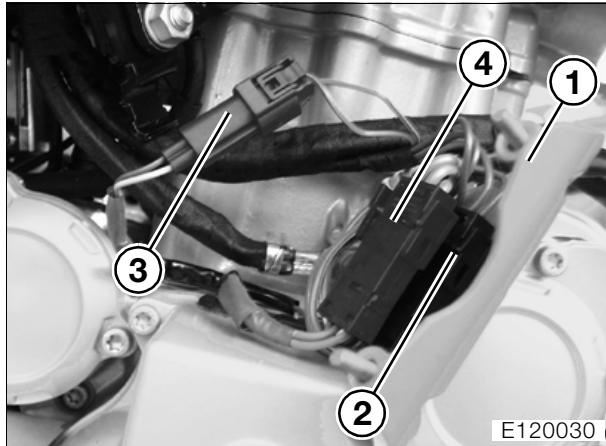
12 11 070 Removing ignition magneto



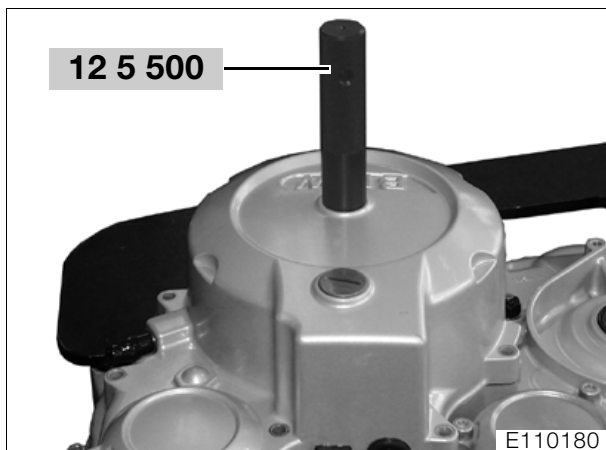
Important:

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

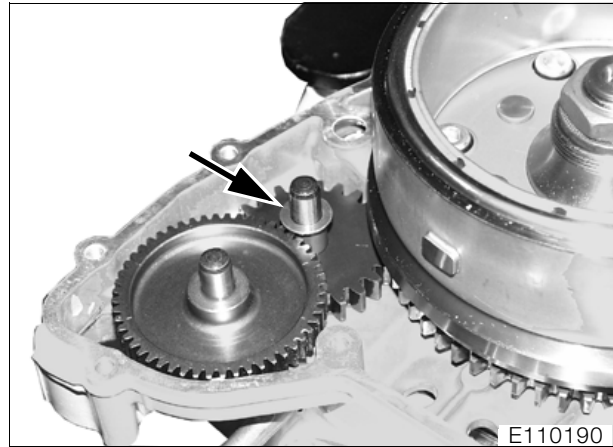
11 14 859 Removing right engine housing cover



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



- Remove the central locking screw, insert and tighten handle, **BMW No. 12 5 500**.



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



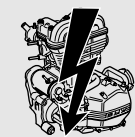
- Unscrew hex nut.
- Heat hub to 80 °C (176 °F).



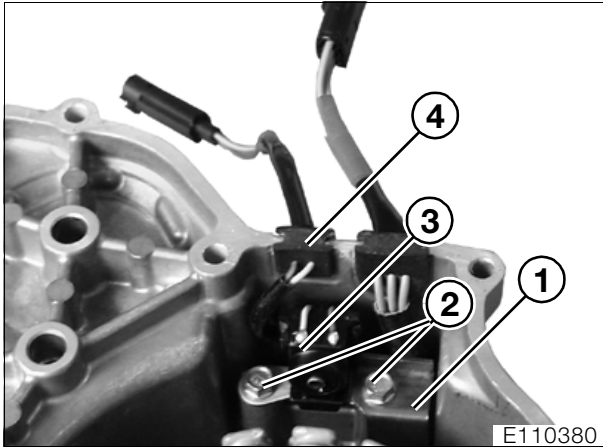
Note:

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


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



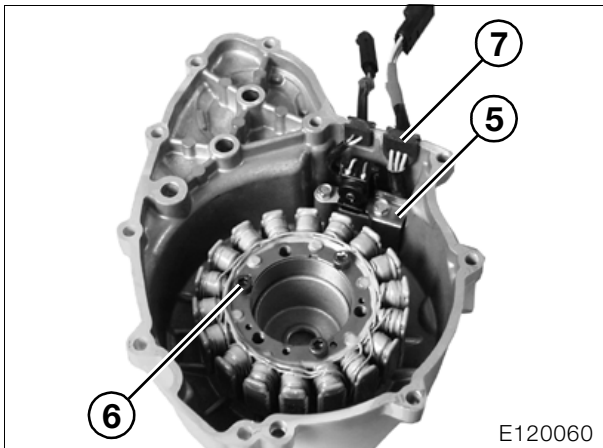
12 11 060 Removing and installing ignition trigger



- Remove fasteners securing ignition trigger (2) on right in 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 **Three Bond 1209** before inserting it into the cover.

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

Removing and 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 **Three Bond 1209** before inserting it into the cover.
- Clean the threads of the screws and coat with **Loctite 243**.

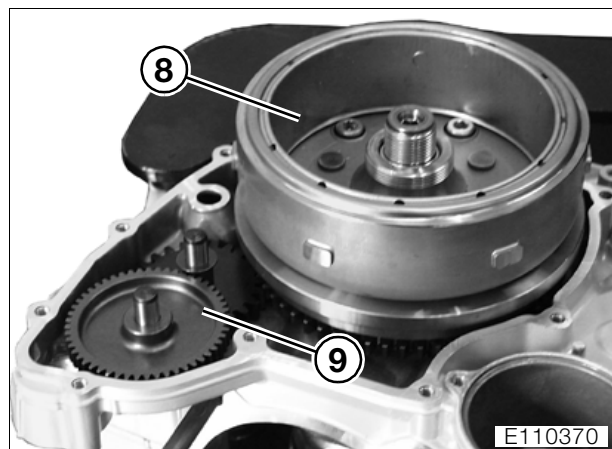
 **Tightening torque:**
Stator to cover
(clean threads + Loctite 243)..... 10 Nm
Cable holder to cover..... 8 Nm

12 11 070 Installing magnetic ignition trigger

12 11 070 Installing magnet rotor

 **Important:**
Tapers on crankshaft, 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 rotor (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 secure 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 install securing screws.
- Remove assembly handle and screw in cover.
- 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 and installing or dismantling starter motor

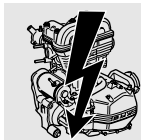
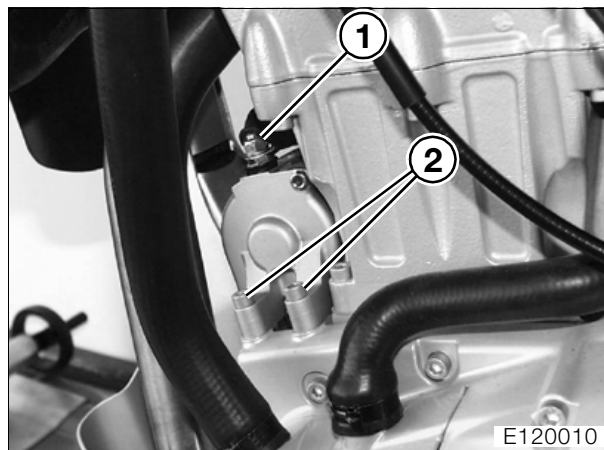
12 41 020 Removing and installing starter motor



Important:

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

- Disconnect the battery.



- Disconnect positive lead (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.



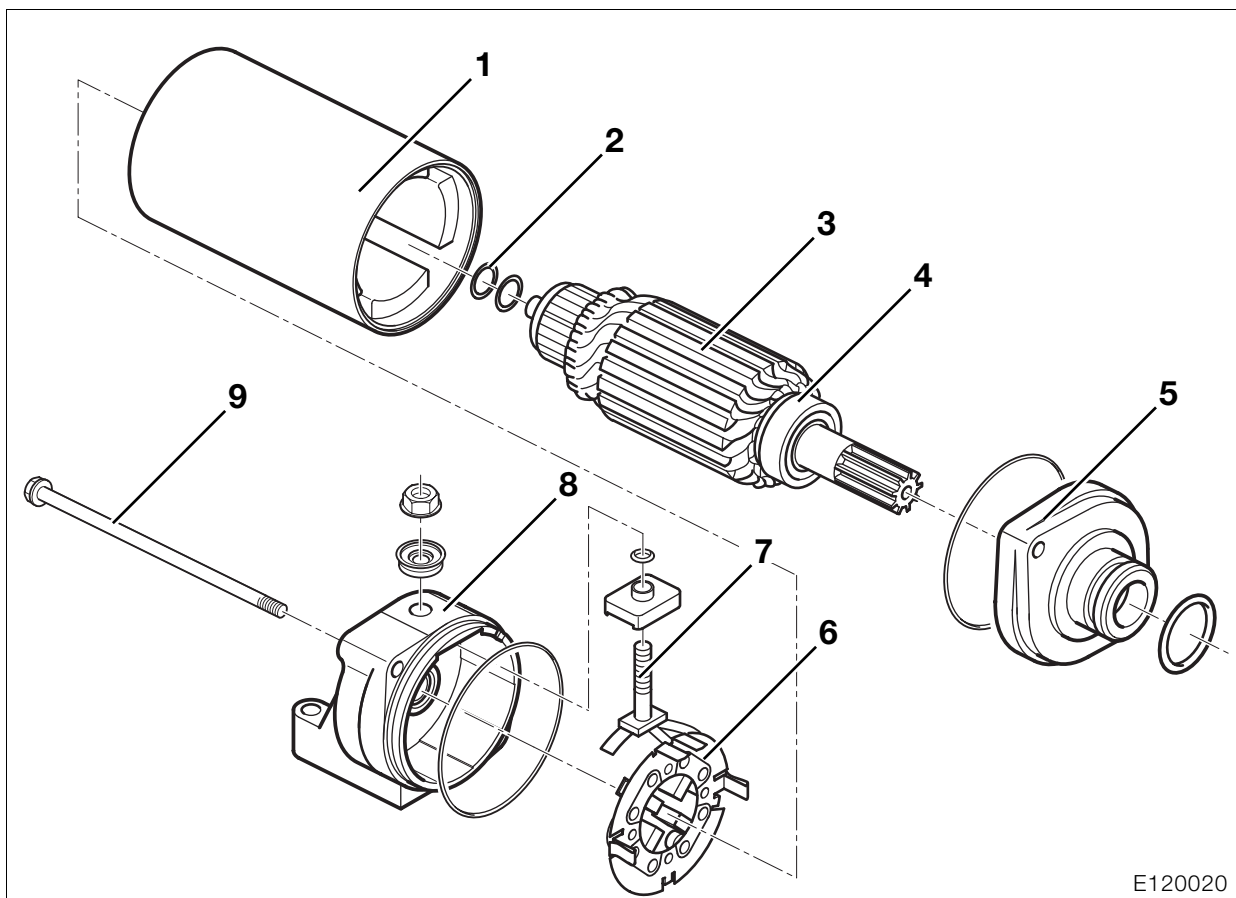
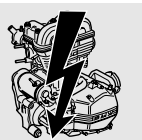
Important:

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



Tightening torque:

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



E120020

12 41 103 Disassembling/assembling starter motor

- Remove necked-down bolt (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 (0.0197 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 bolt, starter motor	5 Nm
Positive contact to starter motor	4 Nm

12 12 011 Replacing spark plug (⇒ 00.36)

12 12 085 Replacing ignition lead

- Remove left, right and centre covers (⇒ 46.5).
- Remove battery (⇒ 61.10).

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 valve stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle valve stub.
- Disconnect the ignition lead from the ignition coil and the spark plug and remove.



Tightening torques:

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

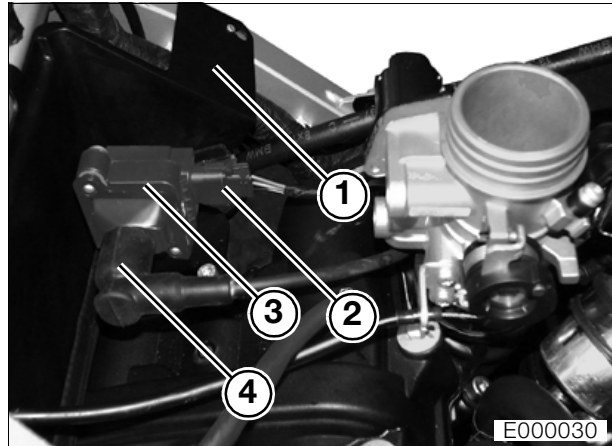
12 13 000 Removing and installing coil

- Remove left, right and centre covers (⇒ 46.5).
- Remove battery (⇒ 61.10).

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 valve stub.
- Pull the intake air silencer with intake air pipe and battery carrier to the rear to remove.
- Cover/seal the throttle valve stub.

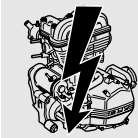


- Disengage cover (1) from the anchorages on main frame on each side and remove.
- Disconnect starter coil (2) at plug.
- Pull spark plug connector (4) off spark plug.
- Remove screws securing ignition coil (3) to cylinder head cover.



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

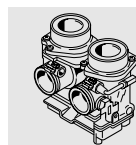


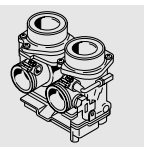
13 Fuel preparation and control

Contents

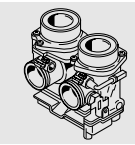
Page

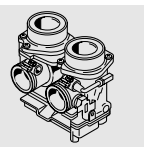
Technical Data	3
Removing and installing BMS control unit	5
Removing and installing intake air pipe	5
Removing and installing air temperature sensor	5
Replacing air filter element (→ 00.36)	6
Removing and installing intake air silencer	6
Removing and installing intake air pipe	6
Removing and installing injection nozzle	7
Removing and installing throttle-valve actuator	7
Replacing throttle-valve potentiometer	8
Removing and installing throttle-valve stub pipe	8
Removing and installing intake pipe	9
Checking fuel pressure	9
Removing and installing fuel hoses	10
Removing and installing feed and return lines	10
Removing and installing line to fuel injector	10
Removing and installing throttle cable (→ 32.12)	10





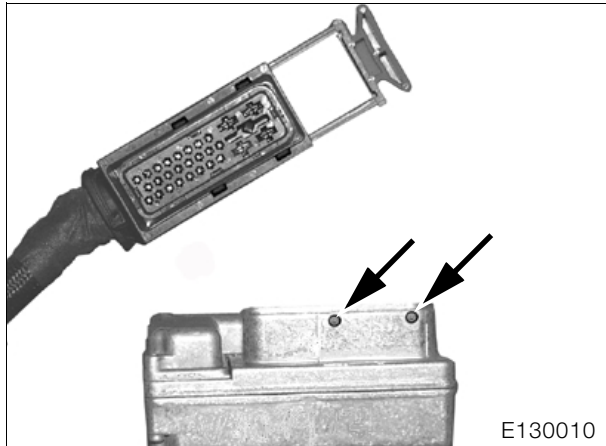
Technical Data		F 650 GS / GS Dakar
Fuel grade		Super (premium), unleaded. 95 octane (RON)
Mixture preparation		Manifold injection
Fuel pressure	bar (psi)	3.5±0.2 (50.76±2.8)
Throttle stub pipe intl. dia.	mm (in)	46 (1.81)
Air filter		Paper filter
Intake stub pipe	mm (in)	43 (1.70)





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.

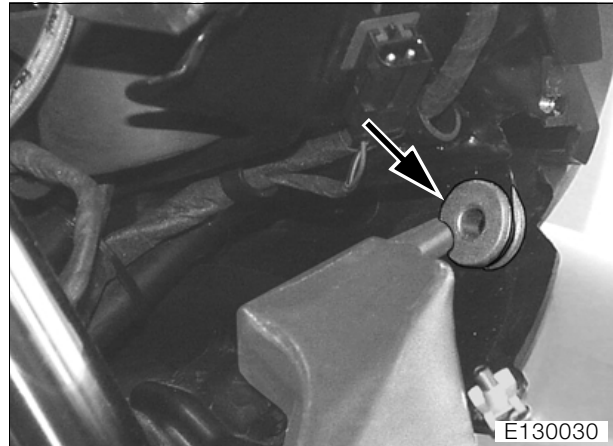


- When reinstalling, push the connector with grooves onto the pins (arrows) on the control unit and close the locking mechanism.

13 72 120 Removing and installing intake air pipe

- Remove right cover (→ 46.5).
- 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.

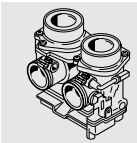
- Installation is the reverse of the removal procedure: pay particular attention to the following.



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

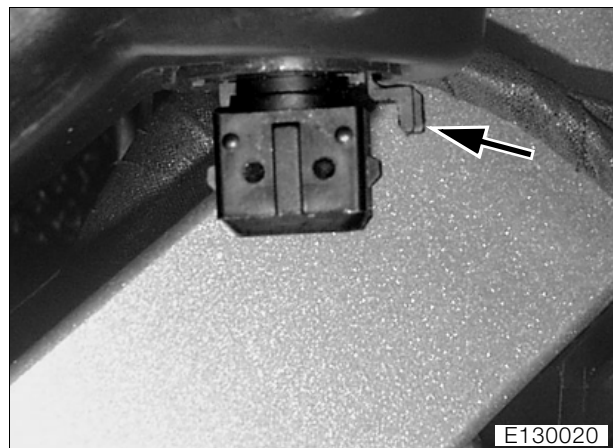
Tightening torques:

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



13 62 010 Removing and installing air temperature sensor

- Remove right cover (→ 46.5).
- Disconnect the plug for the temperature sensor.

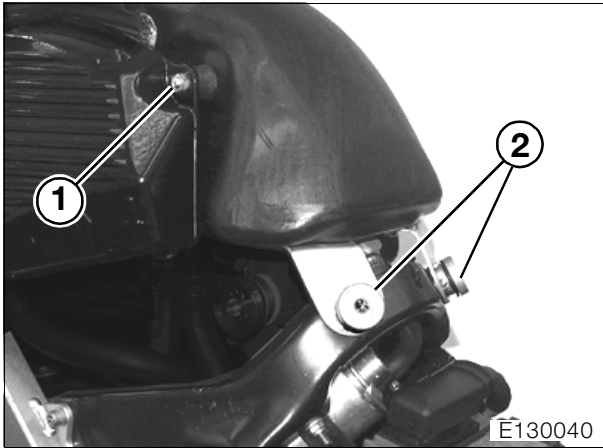


- Press in the lug (arrow) and remove the temperature sensor from the intake air pipe.

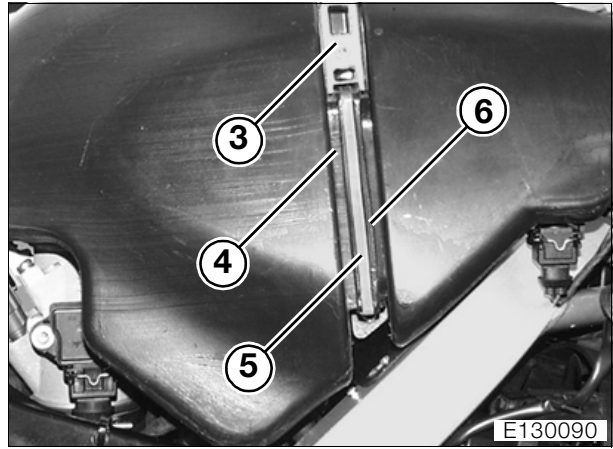
00 13 630 Replacing air filter element
 (→ 00.36)

13 72 130 Removing and installing intake air silencer

- Remove left, right and centre covers (→ 46.5).
- Remove intake air pipe (→ 13.5).
- 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 valve 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 valve 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

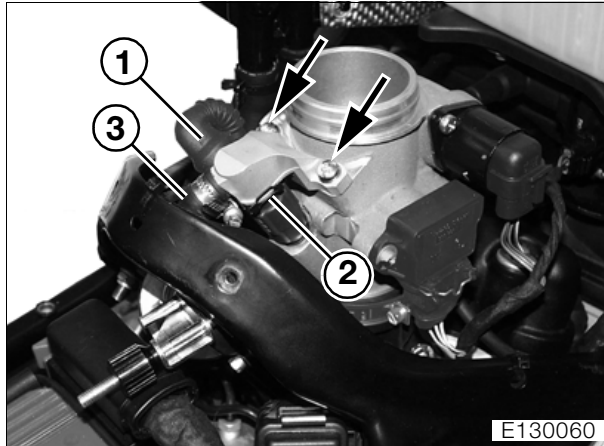
- Remove intake air silencer (→ 13.6).



- 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 (⇒ 46.5).
- Remove intake air pipe (⇒ 13.5).
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle valve stub and secure the silencer to the frame with a cable tie.



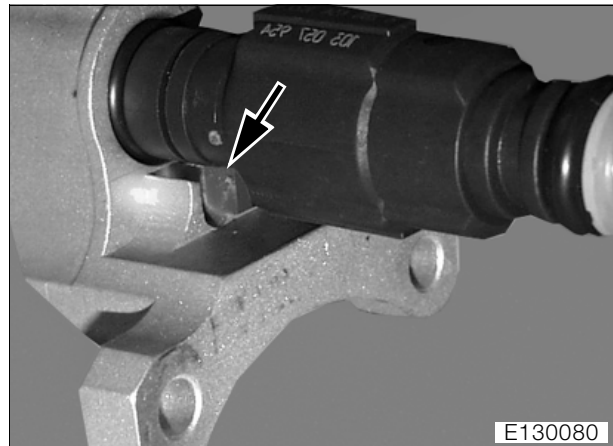
- Disconnect the plug of fuel injector (1).
- Use a hose clamp, **BMW No. 13 3 010**, to close off fuel line (3).
- Slacken the hose clip securing the fuel line and disconnect the line from the throttle valve stub.
- Remove spring clip (2).
- Remove the fasteners for the fuel-injector holder (arrows).
- 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.

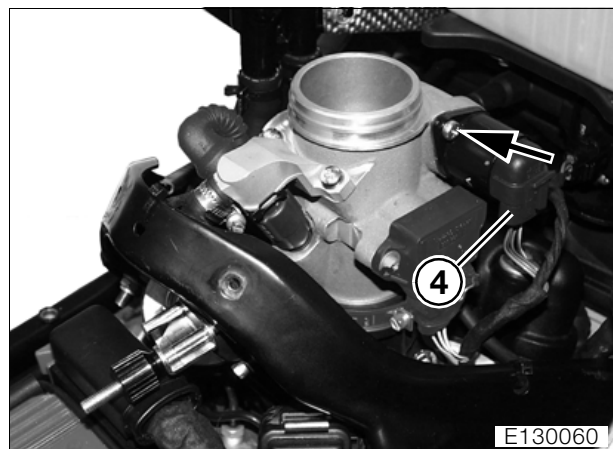
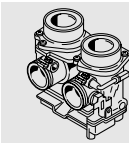
- Grease O-rings lightly.



- 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 (⇒ 46.5).
- Remove intake air pipe (⇒ 13.5).
- Remove intake air silencer (⇒ 13.6).



- 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.

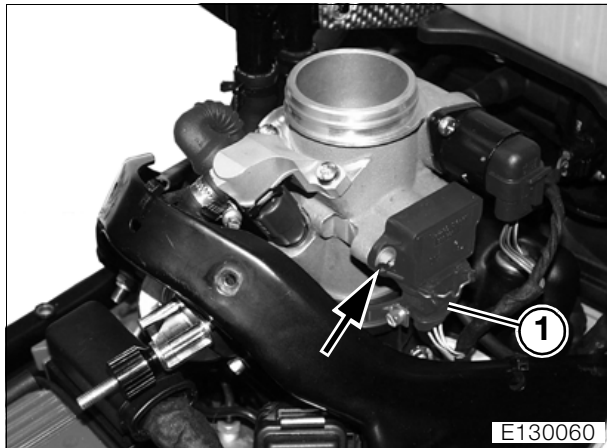


Tightening torque:

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

13 63 005 Replacing throttle-valve potentiometer

- Remove left, right and centre covers (⇒ 46.5).
- Remove intake air pipe (⇒ 13.5).
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle valve stub and secure the silencer to the frame with a cable tie.



- Disconnect plug of throttle-valve potentiometer (1).
- Remove the fasteners (arrows).
- 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).

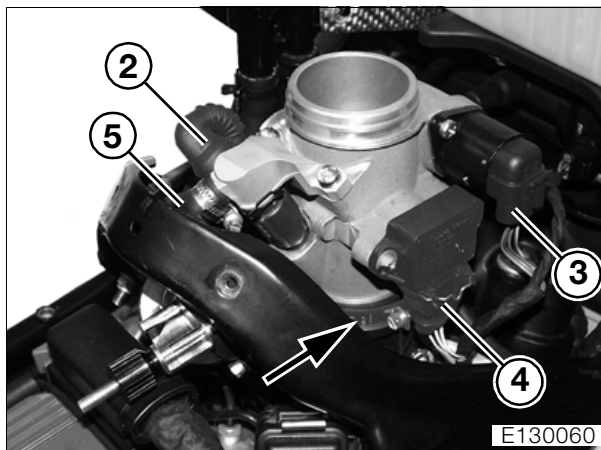


Tightening torque:

Throttle-valve potentiometer to throttle valve stub 3 Nm

13 54 017 Removing and installing throttle-valve stub pipe

- Remove left, right and centre covers (⇒ 46.5).
- Remove intake air pipe (⇒ 13.5).
- Remove the fasteners securing the intake air silencer to the oil tank and retainer.
- Carefully disconnect the intake air silencer from the throttle valve stub and secure the silencer to the frame with a cable tie.
- Remove circlip securing throttle cable to throttle valve stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.



- 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 valve stub.
- Slacken hose clip (arrow) on the intake pipe.
- Pull the throttle valve 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

- Remove throttle stub pipe (→ 13.8).
- Release the two fasteners securing the intake pipe to the cylinder head and remove the intake pipe.
- Remember to clean the sealing faces before reinstalling.



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

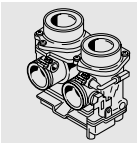
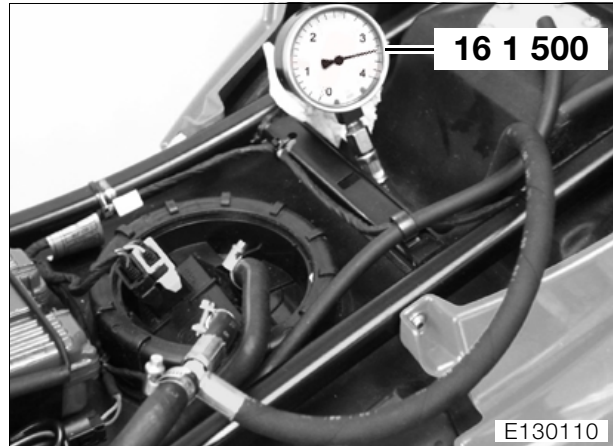
13 60 505 Checking fuel pressure



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 run in neutral.

Fuel pressure:

Specification 3.5±0.2 bar (50.76±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

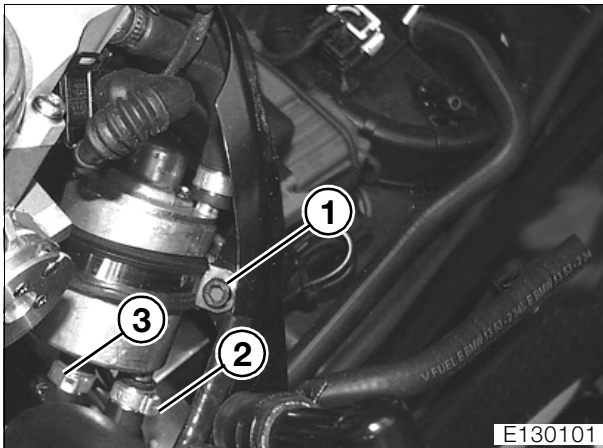


Warning:

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 (→ 46.5).
- 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.



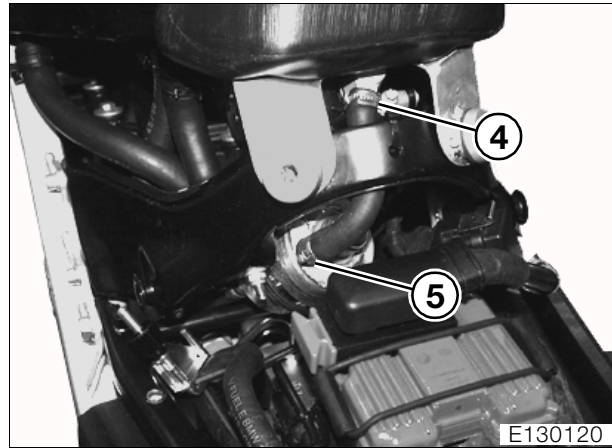
Important:

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 (→ 46.5).
- 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 (→ 32.12)

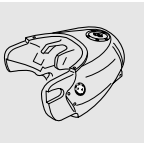
16 Fuel tank and lines

Contents

Page

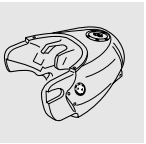
Technical Data	3
Removing and installing fuel tank	5
Removing fuel tank	5
Installing fuel tank	7
Removing and installing fuel filler cap	7
Removing and installing roll-over valve	8
Replacing fuel filter (→ 00.37)	8
Removing and installing fuel pump	8
Removing and installing fuel pump	9
Removing and installing fuel strainer	9
Removing and installing fuel-evaporation control valve	10
[USA version]	10
Removing and installing activated charcoal filter	10
[USA version]	10





Technical Data		F 650 GS /GS Dakar
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 (50.76)
Delivery rate	l/h (Imp. gal/h; US gal/h)	150 (33.015/39.6) at 13.5V, 3.5 bar (50.76 psi)





16 11 030 Removing and installing fuel tank

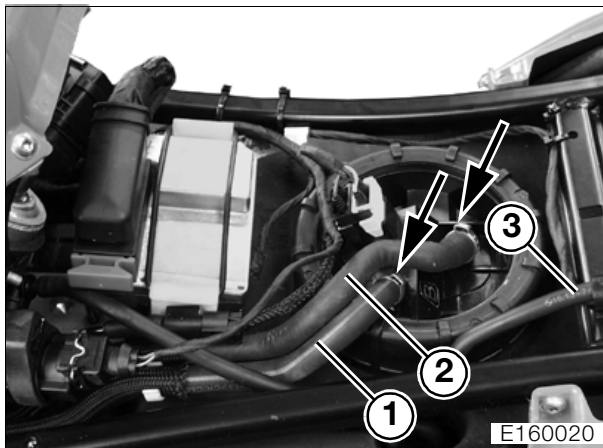


Important:

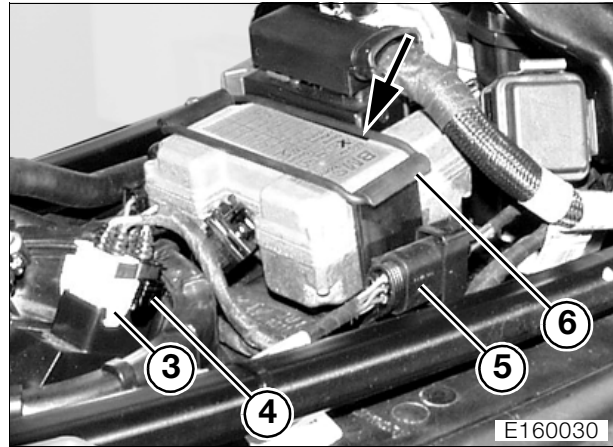
Note risks when handling fuel.
Disconnect ground lead from battery and insulate.

16 11 030 Removing fuel tank

- Remove the seat and the toolkit.
- Secure front wheel in position.
- Remove chain take up roller (→ 27.5).
- Remove right and left rear trim panels (→ 46.9).
- Remove right and left silencers (→ 18.5).
- Remove brake fluid reservoir from rear frame.
- Close off the brake line to the brake master cylinder beneath the fuel tank.



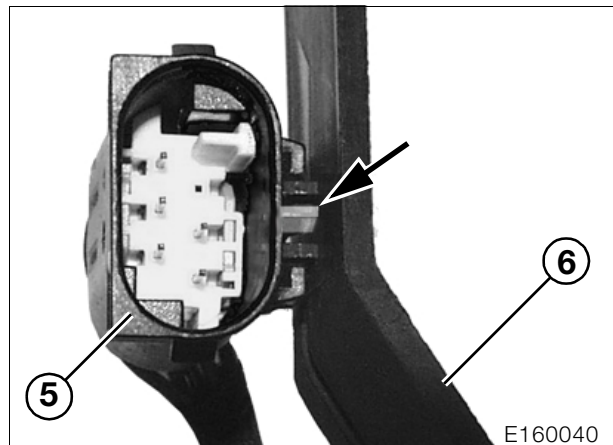
- Close off fuel supply line (1) and the fuel return line (2) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Disconnect breather hose (3) from the roll-over valve.



Note:

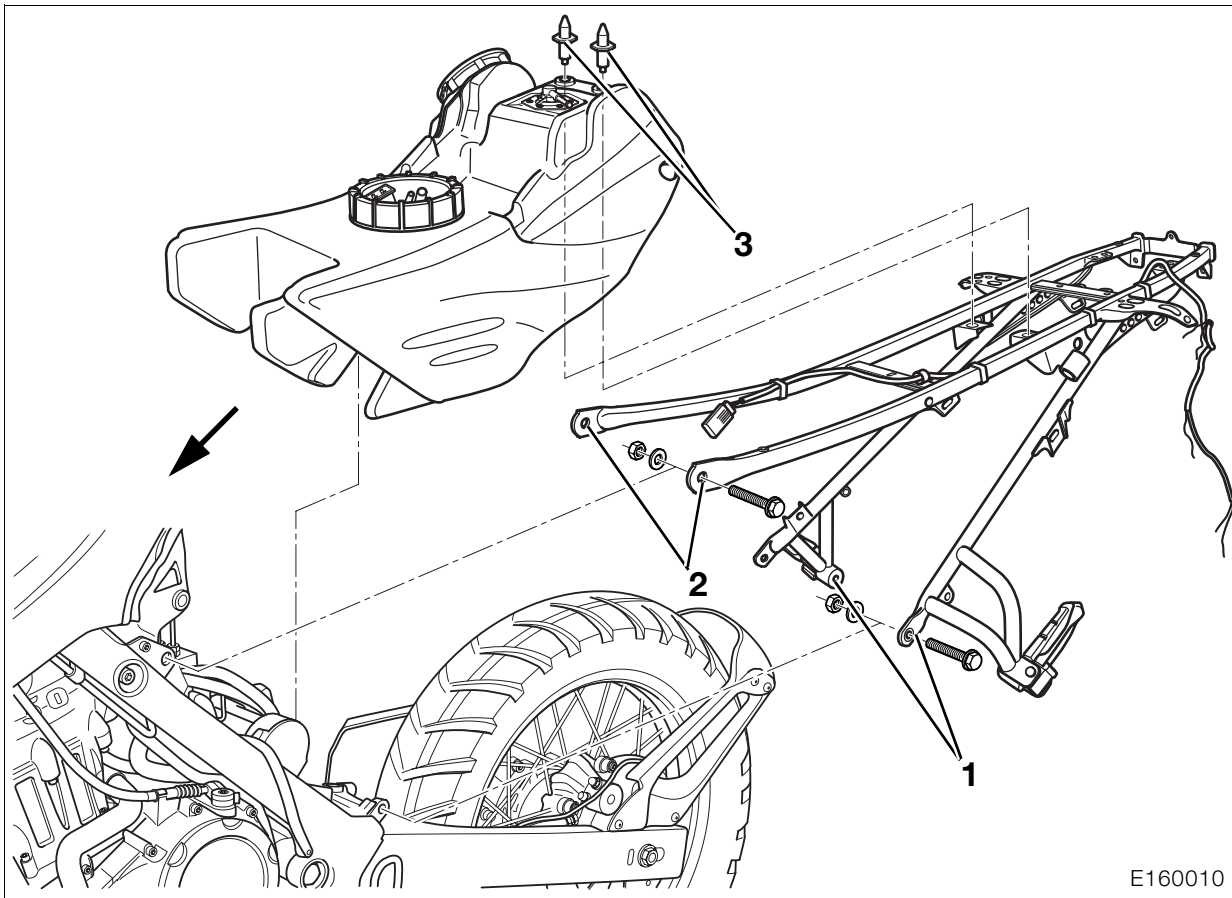
Do not unplug the BMS control unit.

- 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.



⚠ Important:

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

16 11 030 Installing fuel tank

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

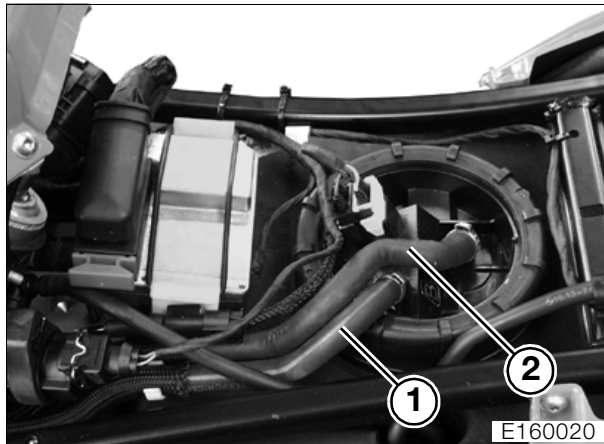


Important:

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

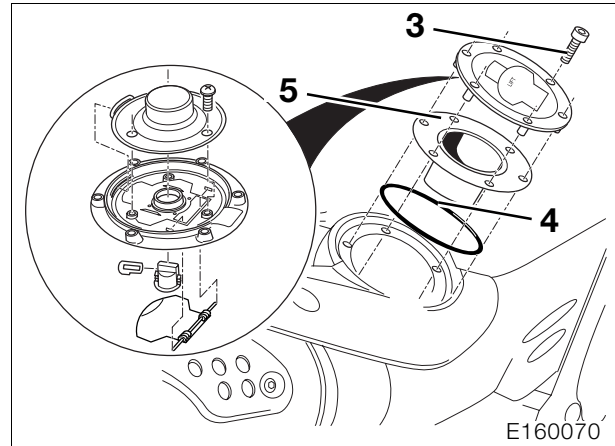
- Close hose clamps with pliers, **BMW No. 13 1 500.**



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 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.



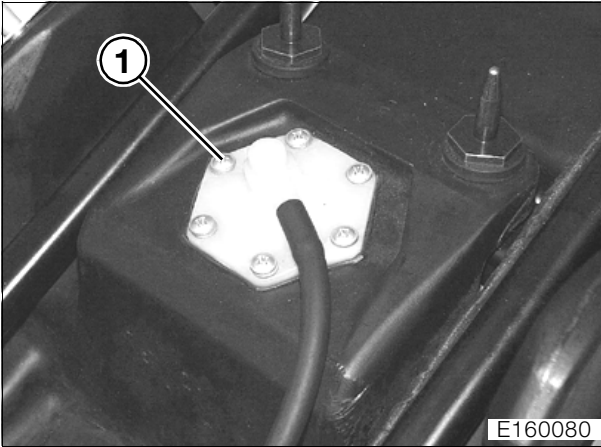
Tightening torques:

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 (→ 00.37)

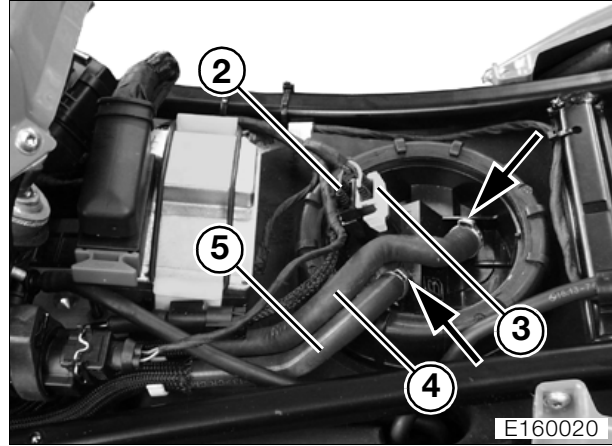
16 14 011 Removing and installing fuel pump



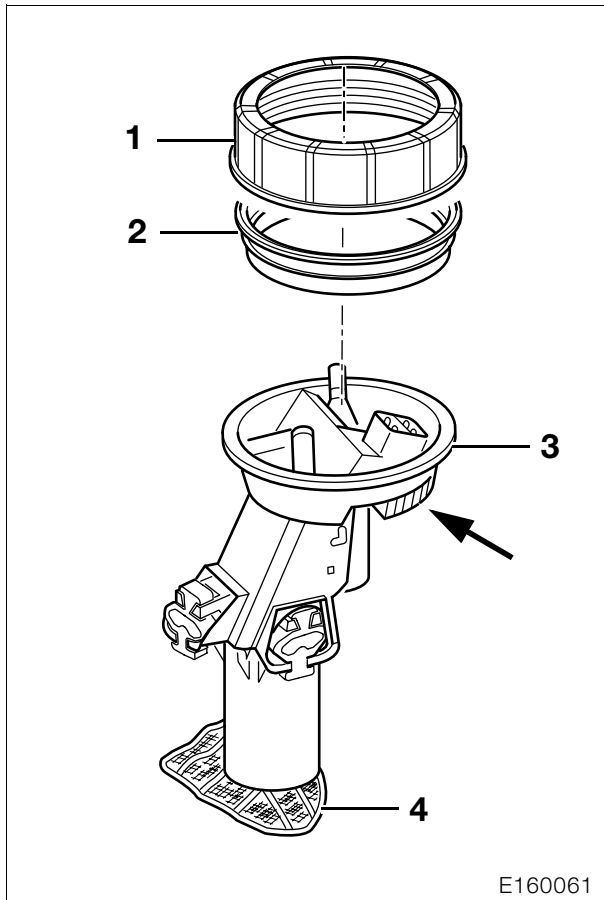
Important:

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.



16 14 009 Removing and installing fuel pump

- Remove fuel-pump unit (→ 16.8).
- 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 (4) off the pump.
- Installation is the reverse of the removal procedure.



Note:

Remove the warning contact switch for the fuel level only along with the pump unit. The reserve fuel capacity of the fuel tank can be adjusted by varying the height of the contact switch in the tank.



- 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**.



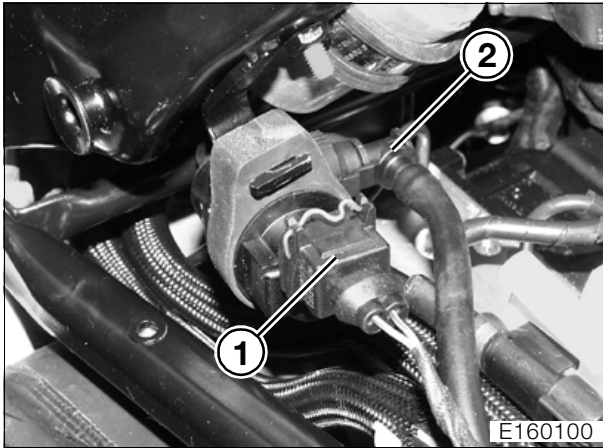
Tightening torques:

Union nut to fuel tank 36 Nm

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.



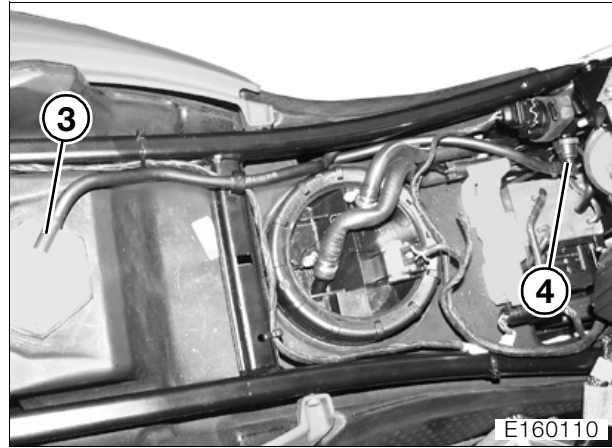
- Disconnect plug (1) from fuel-evaporation control valve.
- Disconnect the activated charcoal filter from fuel-evaporation control valve (2).
- Disconnect the breather hose from the throttle valve stub to the fuel-evaporation control valve.
- Remove the fuel-evaporation control valve.
- Installation 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 rear frame (→ 46.13).
- 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.

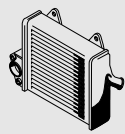


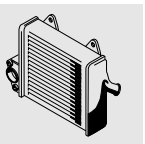
Tightening torques:

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

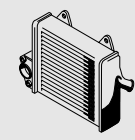
17 Radiator

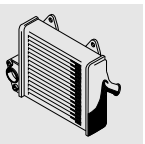
Contents	Page
Technical Data	3
Coolant circuit	5
Thermostat, components	6
Removing and installing coolant pump	7
Removing coolant pump	7
Installing coolant pump	8
Adding coolant	8
Removing and installing coolant-temperature sensor	9
Checking cooling system for leaks	10
Removing and installing coolant hoses	10
Replacing coolant hose (radiator/water pump)	10
Replacing coolant hose (filler bowl/expansion tank)	10
Changing coolant (→ 00.30)	10
Removing and installing fan	10
Removing and installing radiator	11
Removing and installing thermostat	11



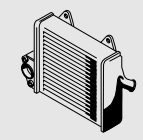
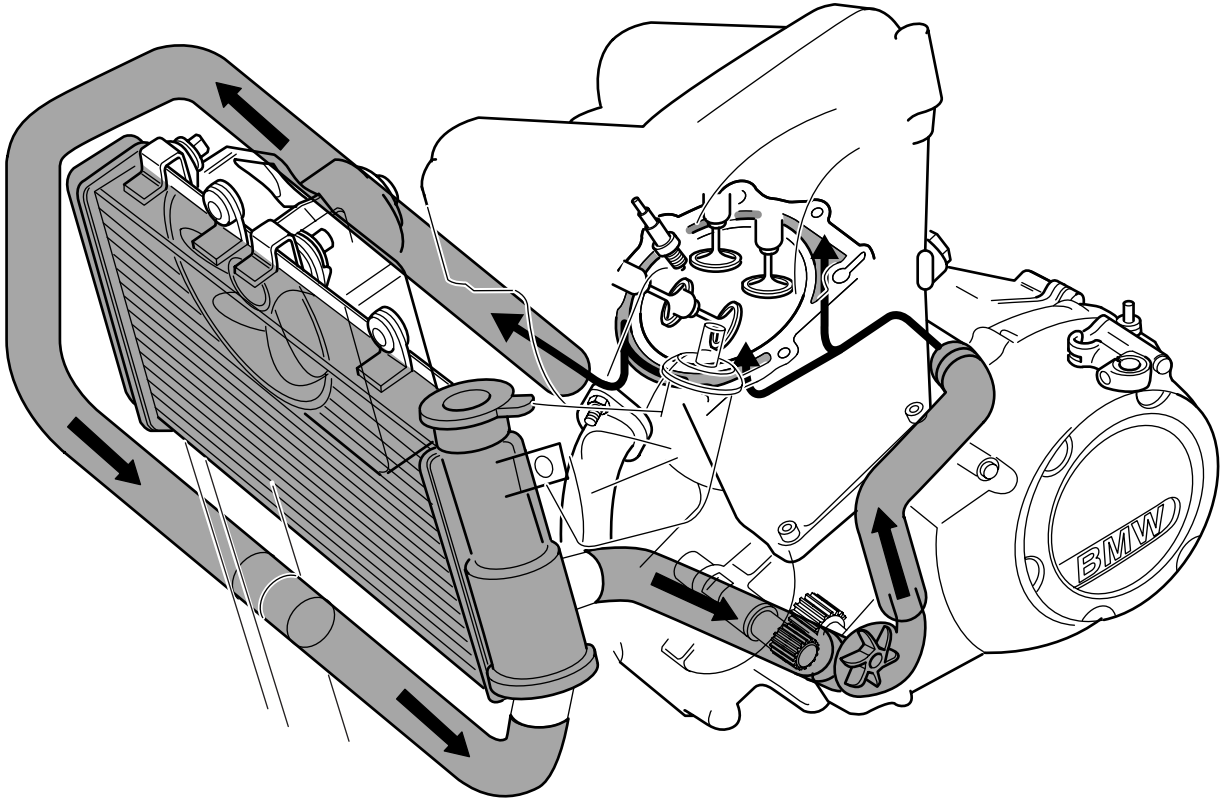


Technical Data		F 650 GS / GS Dakar
Cooling system		
Cooling system capacity		
Total capacity	l (Imp. pints/ US quarts)	1.3 (2.29/1.37)
Coolant circuit	l (Imp. pints/ US quarts)	1.20 (2.11/1.27)
Coolant expansion tank	l (Imp. pints/ US quarts)	0.10 (0.18/0.11)
Coolant		Use only nitrite-free long-term 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)

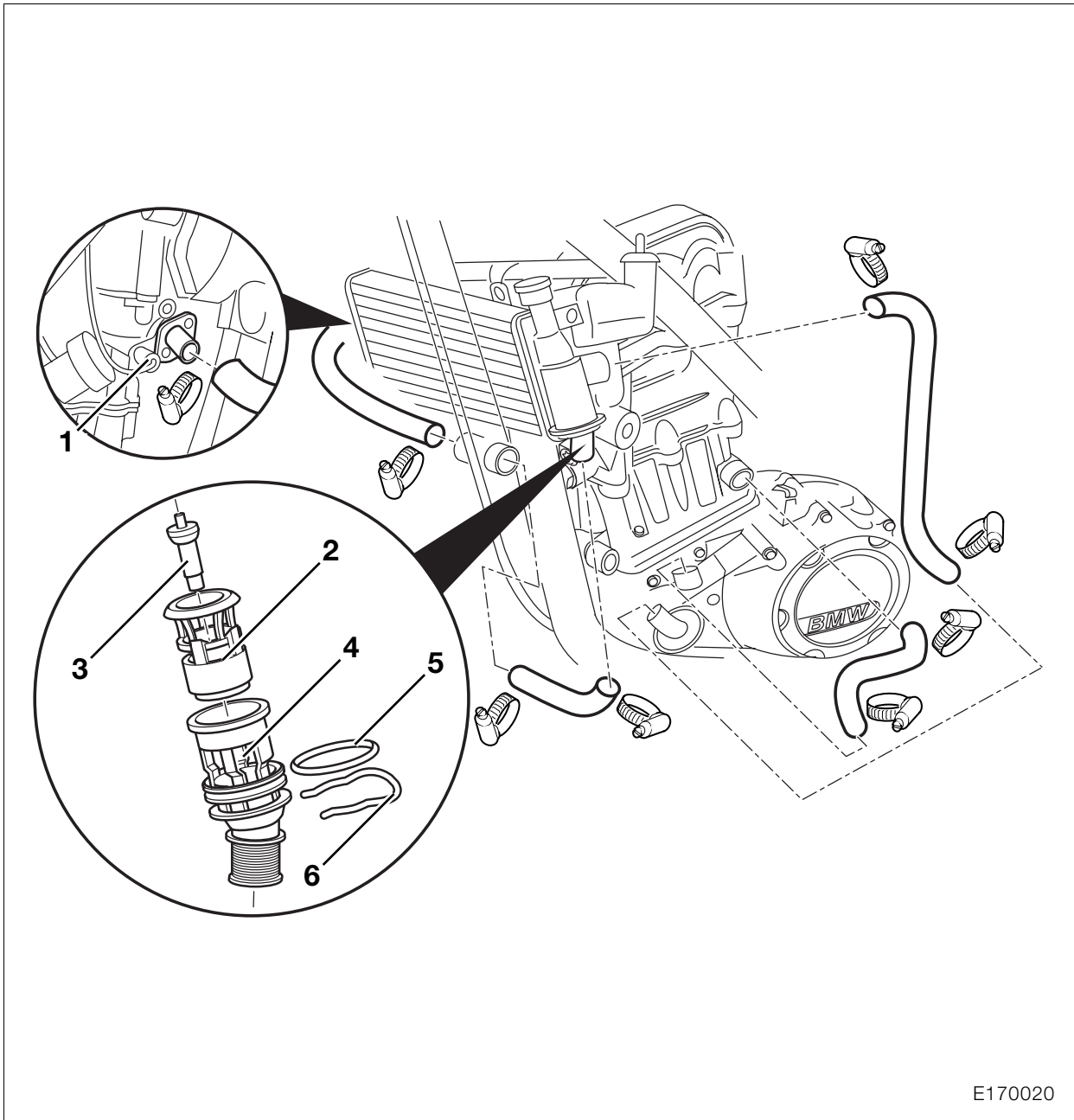




Coolant circuit

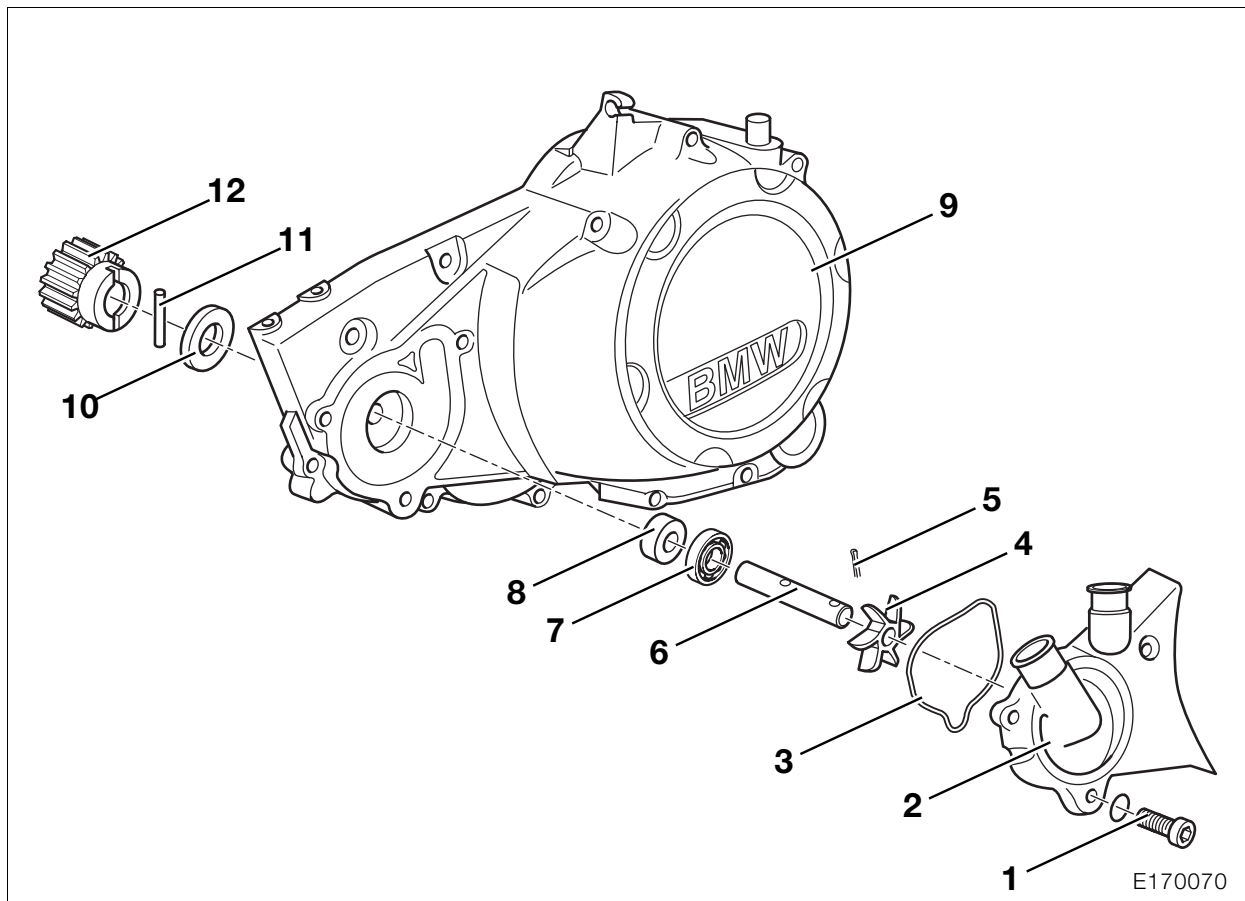


Thermostat, components



E170020

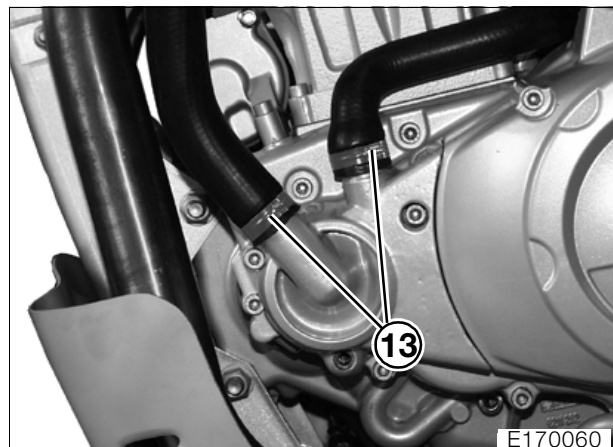
1. Coolant-temperature sensor
2. Thermostat housing
3. Thermostat
4. Cover
5. O-ring
6. Spring clip



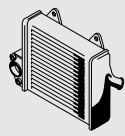
11 51 025 Removing and installing coolant pump

11 51 025 Removing coolant pump

- Remove seat.
- Remove left cover (→ 46.5).
- Drain engine oil (→ 00.28).
- 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 exhaust manifold (→ 18.6).
- Remove left footrest (→ 46.19).
- Remove the gear shift pedal.
- Remove starter (→ 12.9).
- Disengage clutch cable from release lever.
- Remove release lever.
- 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).
- Remove shaft (6) by pulling inwards.
- Press out sealing rings (7, 8).
- Remove disc (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.

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



Note:

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



Note:

Install oil return line complete with engine block cover.

- Fit left engine cover and install securing screws.



Note:

Align link of oil return line with tapped bore in cylinder head and carefully install screw.

- Connect the oil return line to the engine.
- Connect the oil return line to the oil tank.
- 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**.
- Install clutch lever, engage clutch cable and adjust.
- Install the gear shift lever.
- Install left footrest.
- Install starter motor.
- Install exhaust manifold.
- Top up engine oil to correct level.
- Install the seat.
- Top up coolant to correct level.

➔ See below

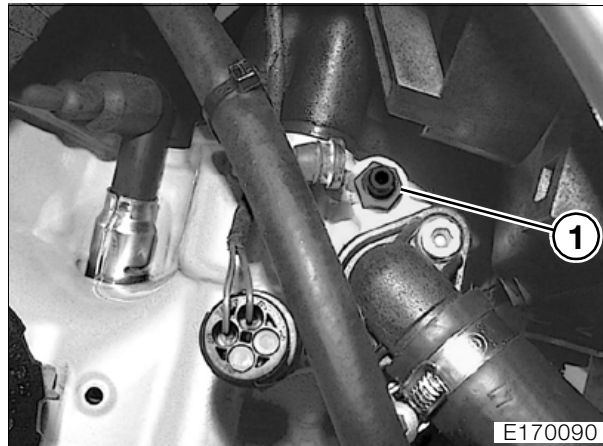


Tightening torques:

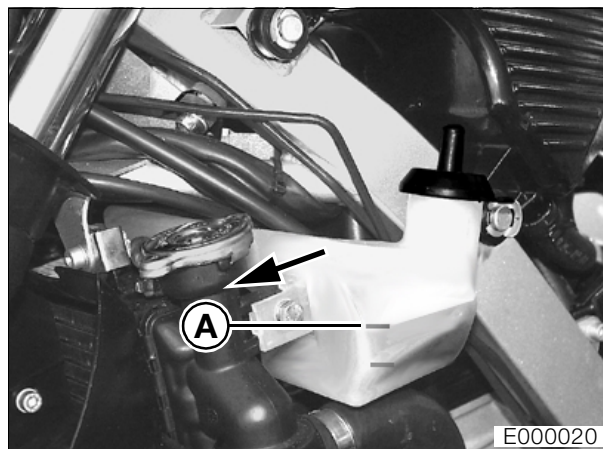
Engine block cover, left	10 Nm
Water pump cover.....	10 Nm
Water pump drain screw	10 Nm
Oil line to cylinder head.....	8 Nm
Oil line to engine block.....	35 Nm

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.

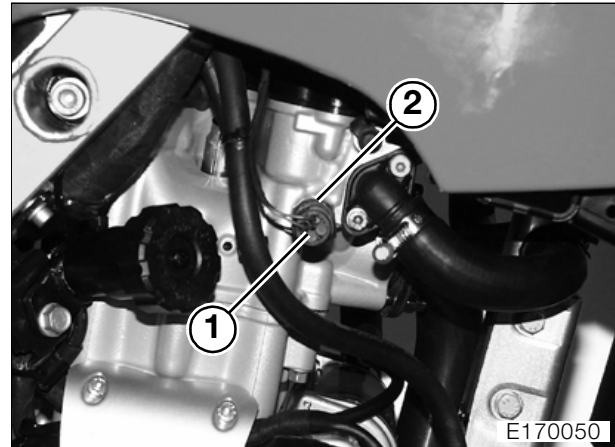


Tightening torques:

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

Removing and installing coolant-temperature sensor

- Drain coolant (→ 00.30).
- Place motorcycle on its centre stand.

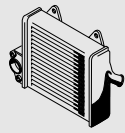


- Remove plug from coolant temperature sensor (1).
- Remove coolant-temperature sensor (2).
- Installation is the reverse of the removal procedure.



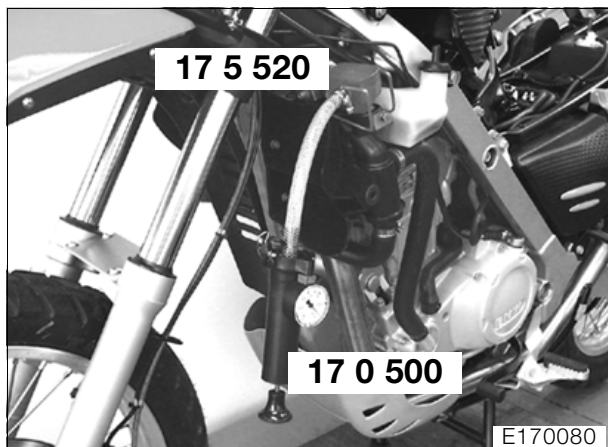
Tightening torque:

Temperature sensor 15 Nm



17 00 010 Checking cooling system for leaks

- Remove left cover (→ 46.5).
- Open the filler cap on the radiator.

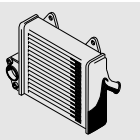


- Connect pump, **BMW No. 17 0 500**, with adapter and neck, **BMW No. 17 5 520**, to filler neck.
- Pressure-test the system; the pressure must remain unchanged for at least 5 minutes.

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 (→ 46.5).
- Drain coolant (→ 00.30).
- 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

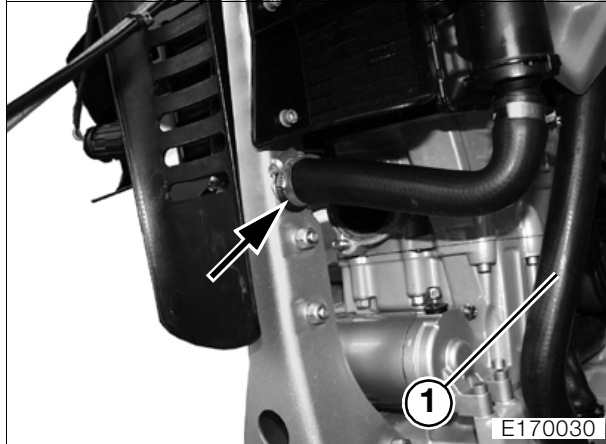
17 00 035 Changing coolant (→ 00.30)

17 40 000 Removing and installing fan

- Remove right cover (→ 46.5).
- 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 (⇒ 46.5).
- Drain coolant (⇒ 00.30).
- Disconnect the expansion tank from the radiator, pull it to one side and let it dangle from the hose.
- Remove fan (⇒ 17.10).



- 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.

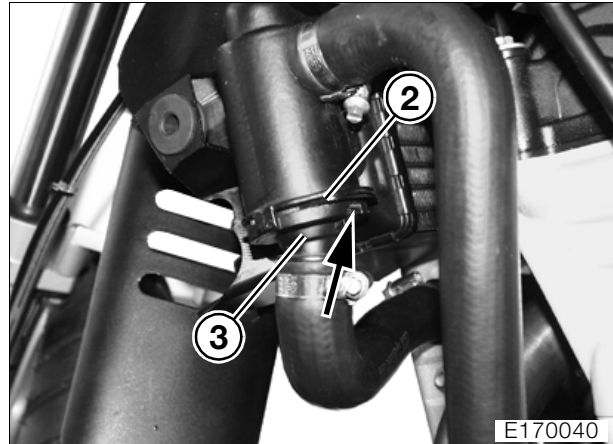
- Raise the radiator and release the pin at the bottom from the lug.
- Pull the radiator complete with expansion tank to the left and remove.
- Installation is the reverse of the removal procedure.

 **Tightening torque:**

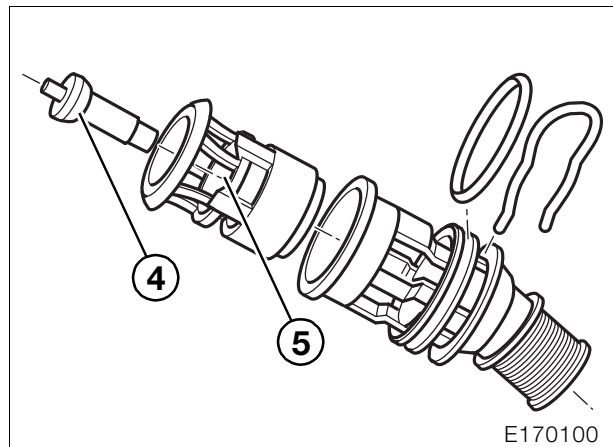
Radiator to main frame 9 Nm
Coolant hoses to radiator/engine/frame 2 Nm

17 11 045 Removing and installing thermostat

- Remove left cover (⇒ 46.5).
- Drain coolant (⇒ 00.30).
- Do not close the radiator cap.



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

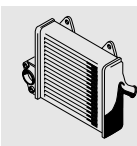


- Remove thermostat insert (5) with thermostat (4) from the housing.

 **Note:**

Check O-ring for cracks and replace if necessary.

- Installation is the reverse of the removal procedure.

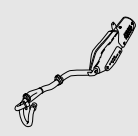


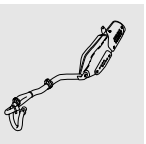
18 Exhaust system

Contents

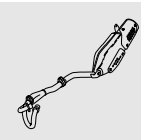
Page

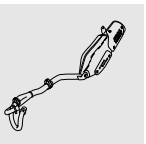
Technical Data	3
Removing and installing exhaust system	5
Removing and installing right-hand silencer	5
Removing and installing left-hand silencer	5
Removing and installing exhaust manifold and oxygen sensor	6
Removing exhaust manifold and oxygen sensor	6
Installing exhaust manifold and oxygen sensor	6
Replacing guard for silencer	7

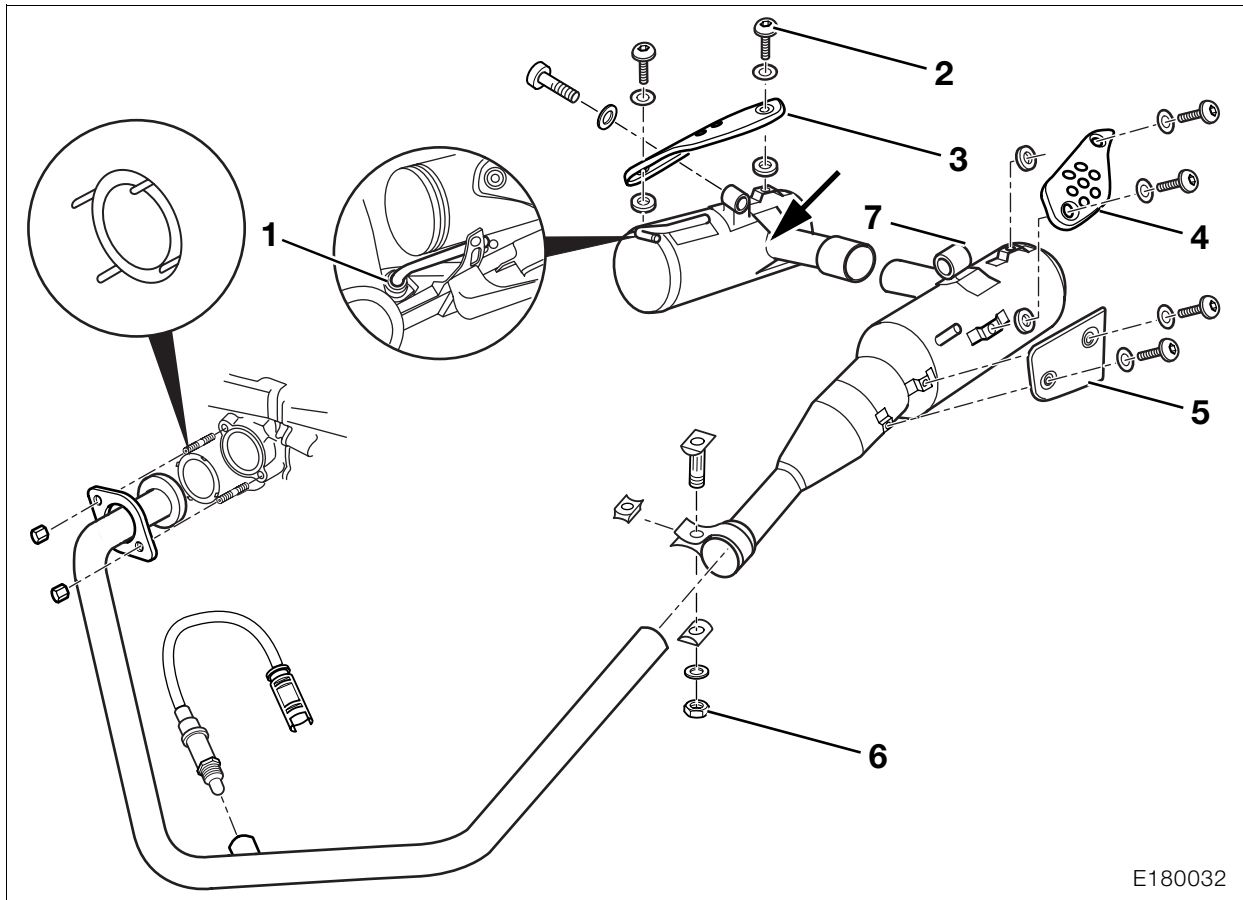




Technical Data	F 650 GS / GS Dakar
Exhaust system	
Emission control	3-way catalytic converter
Silencer (muffler)	Reflection/absorption-type silencer







E180032

18 00 020 Removing and installing exhaust system

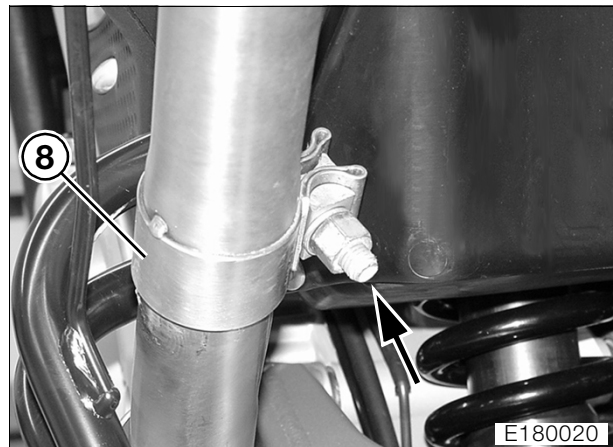
- Installation is the reverse of the removal procedure: pay particular attention to the following.

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.

18 11 301 Removing and installing left-hand silencer

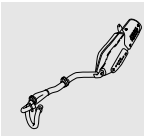
- Remove right-hand silencer.
- Remove the fastener securing the silencer to the rear frame.
- Loosen clamp (6) for silencer.
- Separate the left-hand silencer with connecting pipe from the exhaust manifold and at the same time lift it clear of bracket (7).
- If applicable, remove silencer guard (4)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

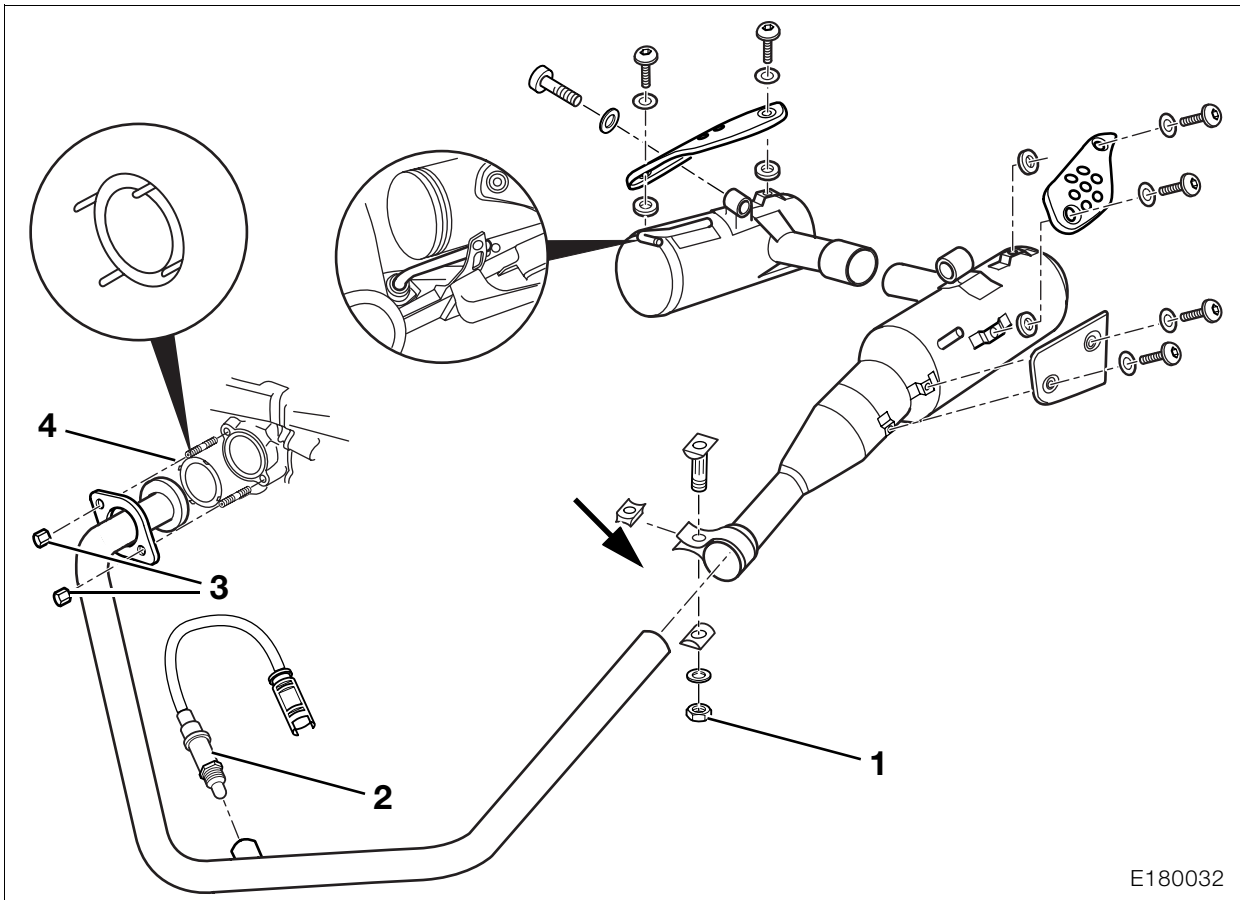


- Make sure that the installed position (arrow) of the clamp for silencer (8) is correct.

Tightening torques:

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





E180032

18 11 151 Removing and installing exhaust manifold and oxygen sensor

Removing exhaust manifold and oxygen sensor

- Remove engine guard (→ 46.8)
- 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).

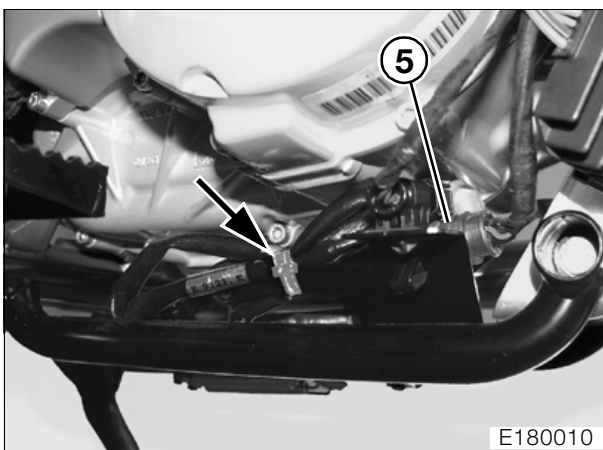
Installing exhaust manifold and oxygen sensor



Note:

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

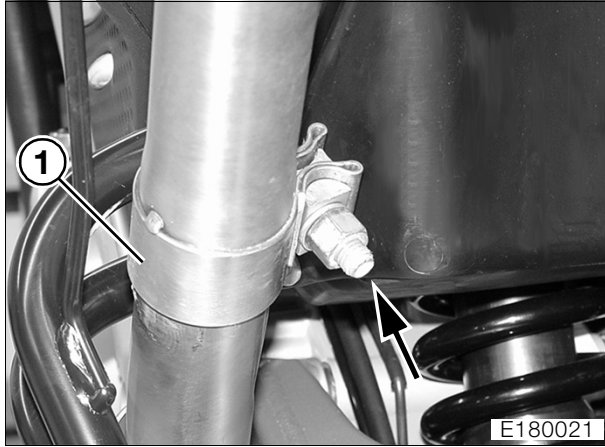
- Lightly coat the threads of the oxygen sensor with **Optimoly TA**.
- Tighten the oxygen sensor at the hexagon with socket wrench insert, **BMW No. 11 7 020**.
- Position a new gasket (4) on the manifold.
- Introduce the exhaust manifold into the left-hand silencer and into the cylinder head.



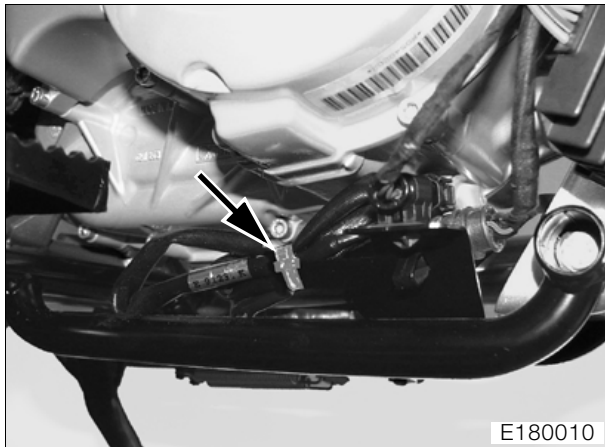
E180010

- 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.



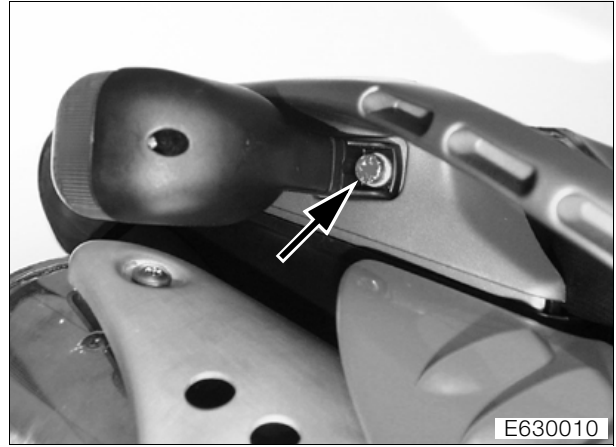
- Using a cable tie (arrow), secure the oxygen sensor cable and the cable for the side-stand switch to the frame truss.
- Install engine guard (→ 46.8).

Tightening torques:

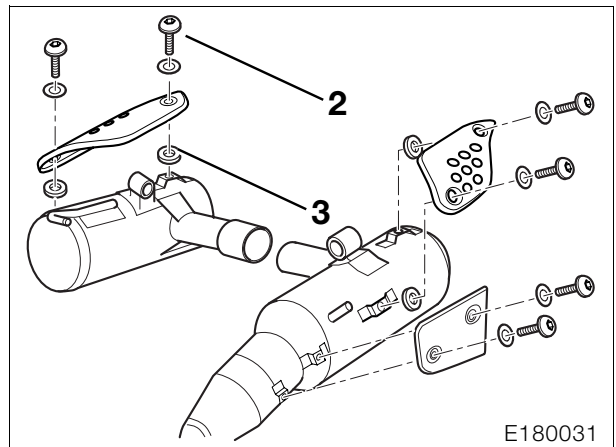
Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Clamp for silencer	55 Nm
Engine guard to frame.....	9 Nm

18 12 212 Replacing guard for silencer

- Remove the lid of the glove compartment.



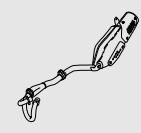
- Remove the fastener (arrow) securing the turn indicator at the handle and push the turn indicator aside.



- 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.

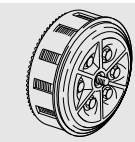
Tightening torques:

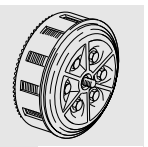
Guard to silencer	9 Nm
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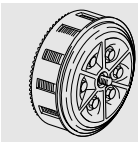
21 Clutch

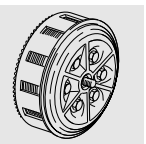
Contents	Page
Technical Data	3
Clutch, components	5
Removing and installing clutch	6
Removing clutch	6
Removing pressure plate	6
Disassembling and reassembling pressure plate	6
Removing clutch plates, driver and clutch cage	7
Installing clutch cage	8
Installing driver	8
Installing pressure plate	8
Removing and installing releaser shaft	9
Installing clutch	10



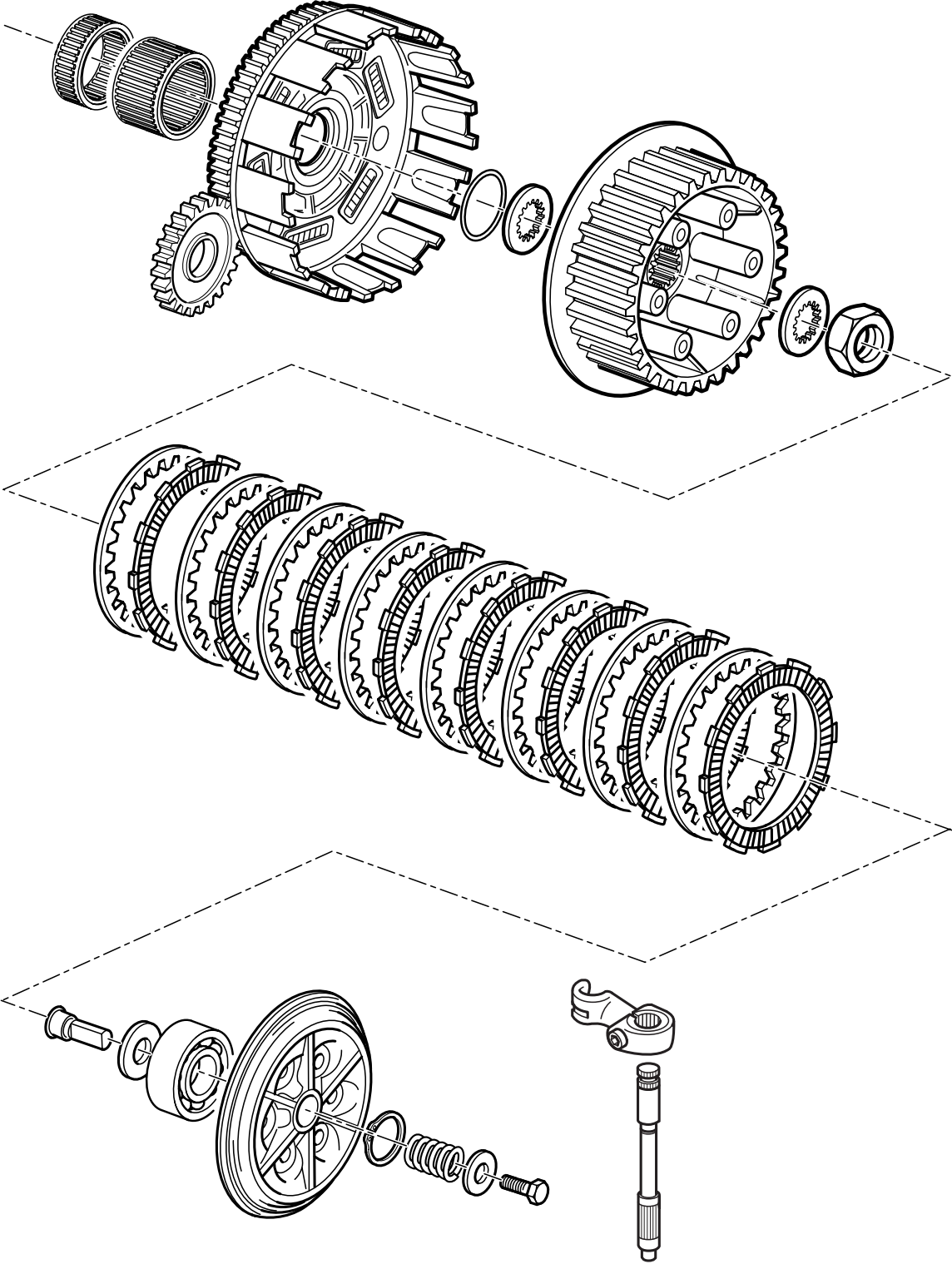


Technical Data		F 650 GS / GS Dakar
Clutch		
Type		Pull-action multi-plate clutch in oilbath
Clutch plate diameter	mm (in)	144 (5.7)
Manual effort required	N	85 (at 40 mm (1.6 in) from pivot point)
Operation		mechanical
Wear limits:		
Lined plate distortion	mm (in)	0.25 (0.010)
Steel plate distortion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





Clutch, components

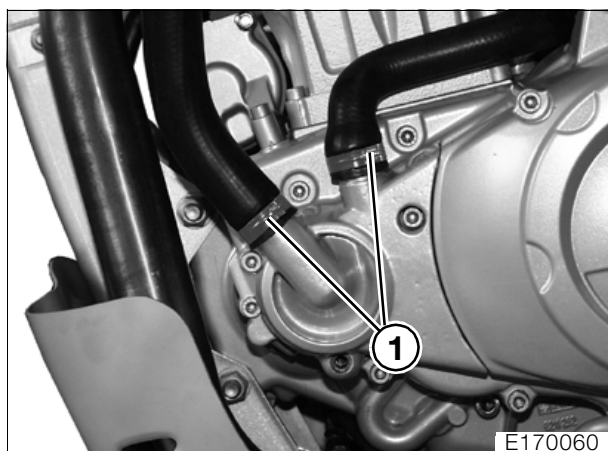


E210010

21 21 000 Removing and installing clutch

21 21 000 Removing clutch

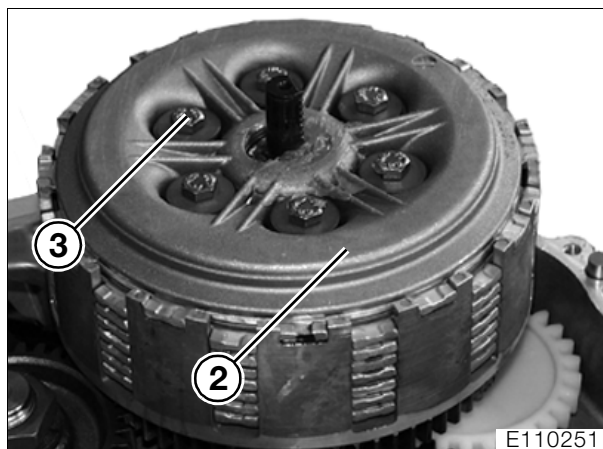
- Remove seat.
- Remove left cover (→ 46.5).
- Drain engine oil (→ 00.28).
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.
- Remove drain plug (1) from water pump.
- Hold a funnel below the drain and open the radiator cap.
- Drain off all the coolant.
- Place motorcycle on its centre stand.
- Remove exhaust manifold (→ 18.6).
- Remove left footrest (→ 46.19).
- Remove the gear shift pedal.
- Remove starter (→ 12.9).
- Disconnect clutch cable from release shaft.
- Disconnect the oil return line from the engine and the oil tank.
- Disconnect the oil line from the cylinder head.



E170060

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

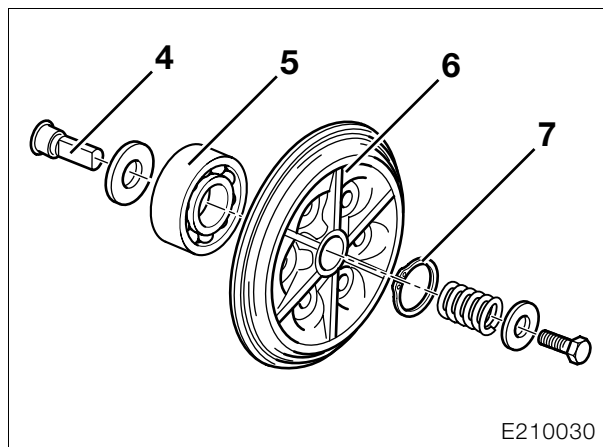
Removing pressure plate



E110251

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

Disassembling and reassembling pressure plate



E210030

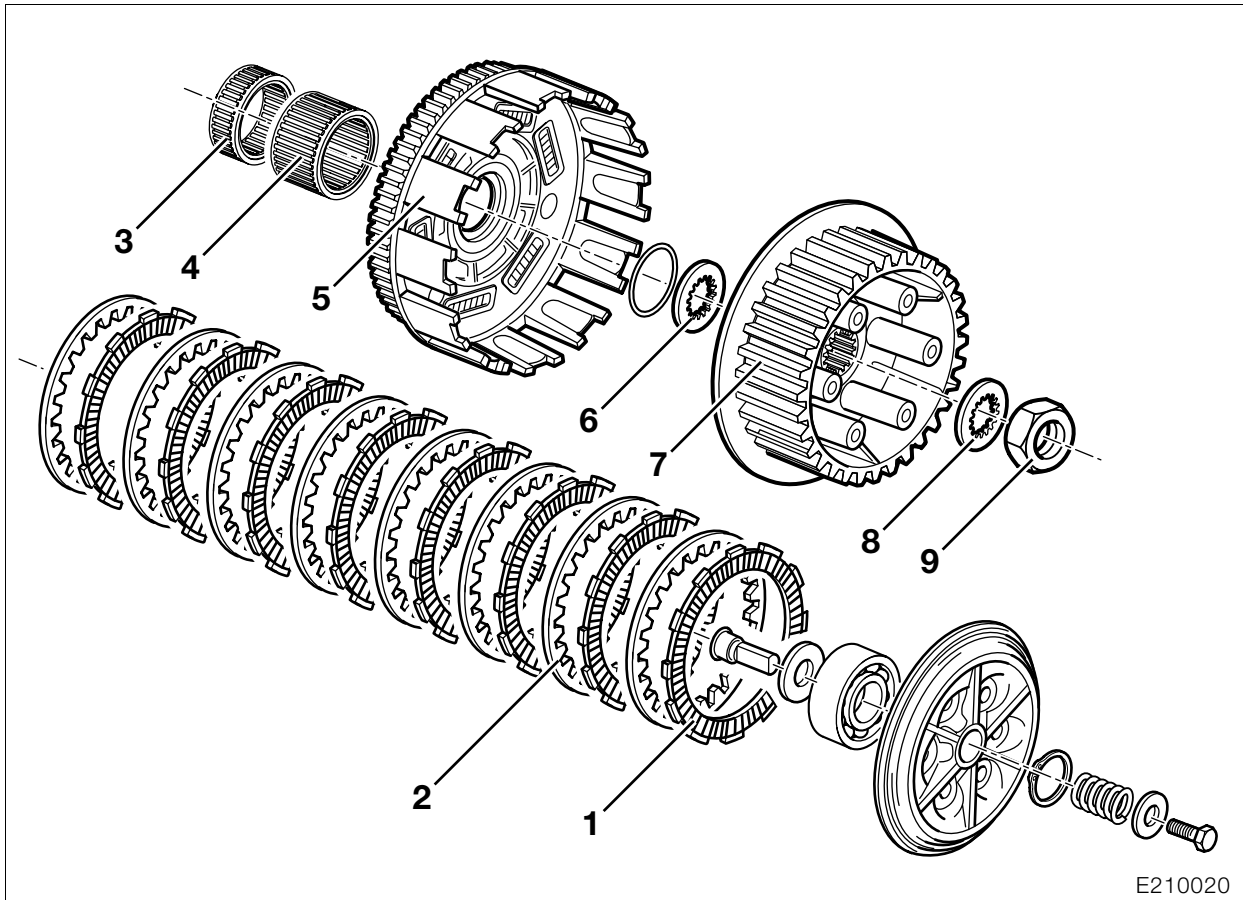
- Remove circlip (7) with circlip pliers.
- Check splines on release head (4).
- Heat pressure plate (6) to 80 °C (176 °F) and drive out grooved ball bearing (5), using a suitable drift (such as a socket, for example).



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.

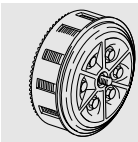
- Remove lock washer (8).

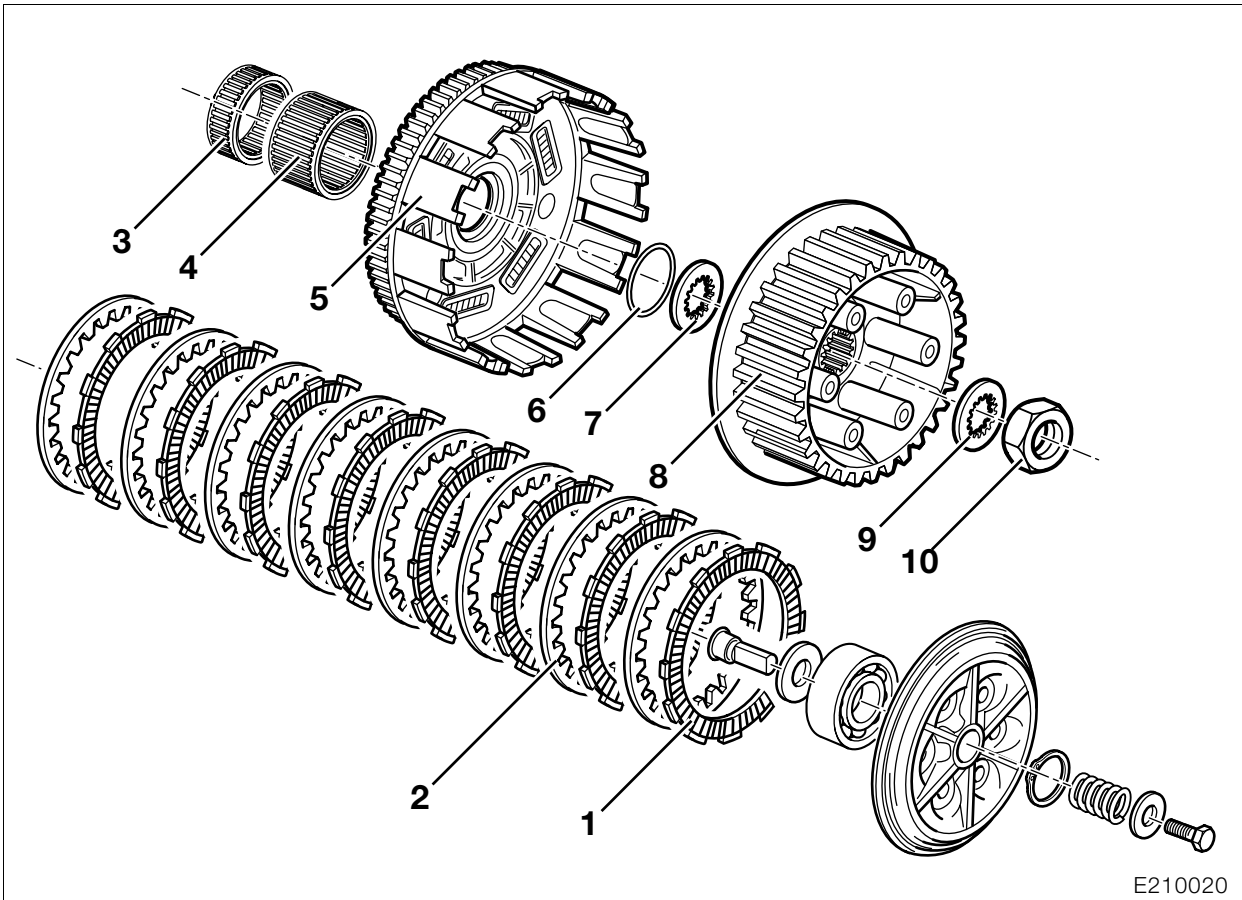


Note:

Hex nut (9) is retained 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.
- Install thrust washer (7) and press it against the O-ring until it is firmly seated and does not spring back.

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.

Installing driver

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

Check clutch discs for wear

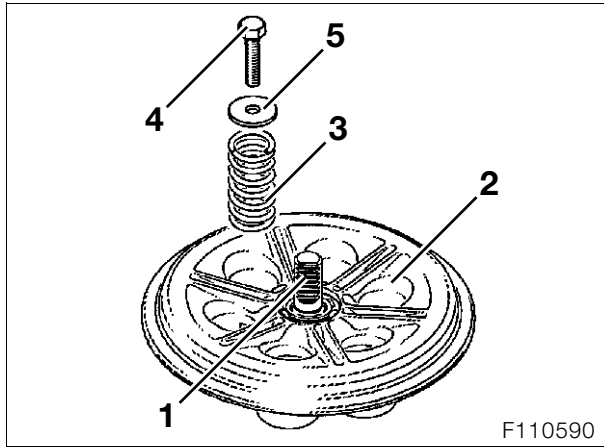
- Measure the height of the 8 lined plates when pressed together.
- Height of complete compressed plate cluster.

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)



Tightening torques:

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



F110590

- Install pressure plate (2).



Note:

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

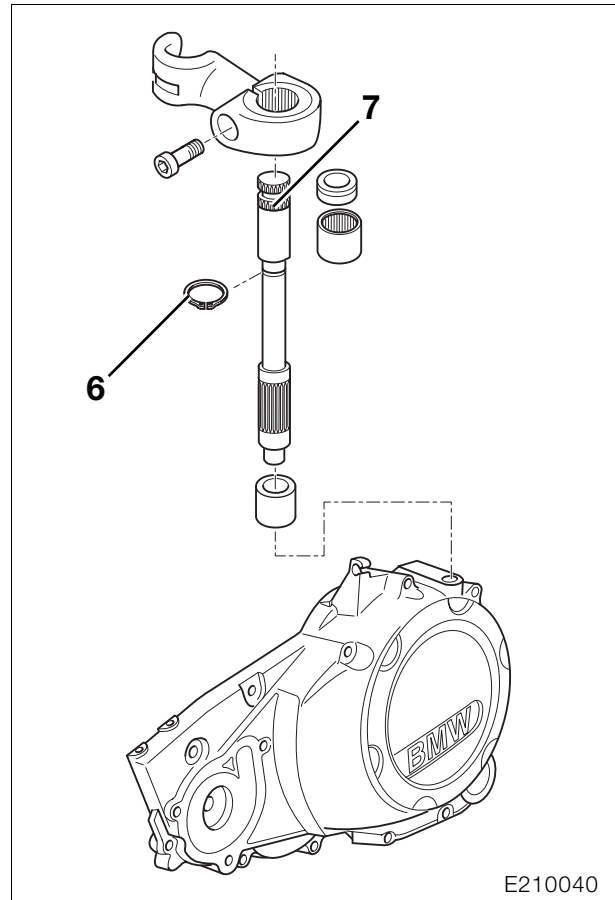
- Install springs (3).
- Uniformly tighten screws (4) with washers (5) in diagonally opposite sequence.
- Position thrust head (1) correctly in relation to the releaser shaft and hold temporarily in position with grease.



Tightening torques:

Pressure plate to driver 10 Nm

Removing and installing releaser shaft



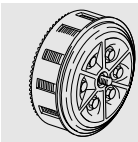
E210040

- Remove keeper (6) for releaser shaft (7).
- Withdraw releaser 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 releaser shaft.
- Cover the splines on the releaser 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

- Align splines on water pump driven gear with driving gear on balancing 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**.



Note:

Install oil return line complete with engine block cover.

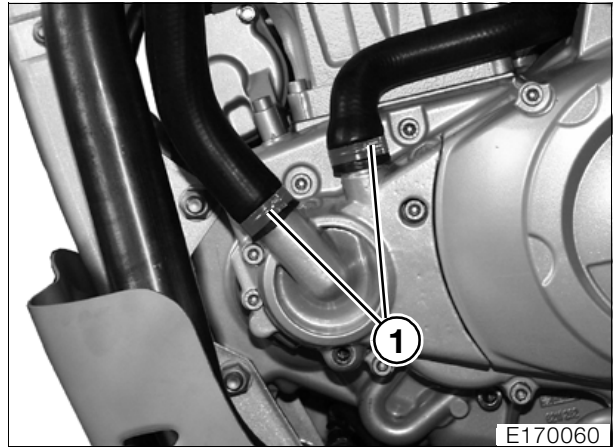
- Fit left engine cover and install securing screws.



Note:

Align link of oil return line with tapped bore in cylinder head and carefully install screw.

- Connect the oil return line to the engine.
- Connect the oil return line to the oil tank.
- Install clutch lever, engage clutch cable and adjust.

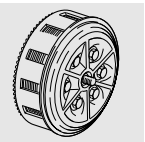


- Using hose clip pliers, **BMW No. 17 5 500**, install hose clips (1).
- Install the gear shift lever.
- Install left footrest.
- Install starter motor.
- Install exhaust manifold.
- Fill the engine-coolant and engine-oil systems to correct levels.



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

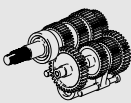


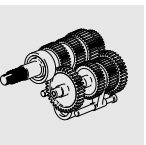
23 Gearbox

Contents

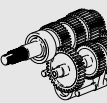
Page

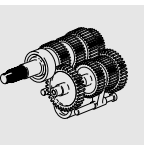
Technical Data	3
Gearbox shafts, components	5
Gear shift pedal, components	6
Removing and installing gearbox	7
Removing selector shaft with pawl and index lever	7
Removing selector forks	7
Removing selector drum	7
Removing, disassembling and reassembling gearbox shafts	8
Removing gearbox shafts	8
Disassembling and reassembling mainshaft	8
Checking mainshaft for wear	9
Disassembling and reassembling countershaft	10
Checking countershaft for wear	11
Replacing gearbox mainshaft bearings	11
Replacing gearbox countershaft bearings	12
Installing gearbox shafts	12
Installing selector shaft	13
Installing selector forks	13
Installing selector drum	13



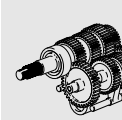
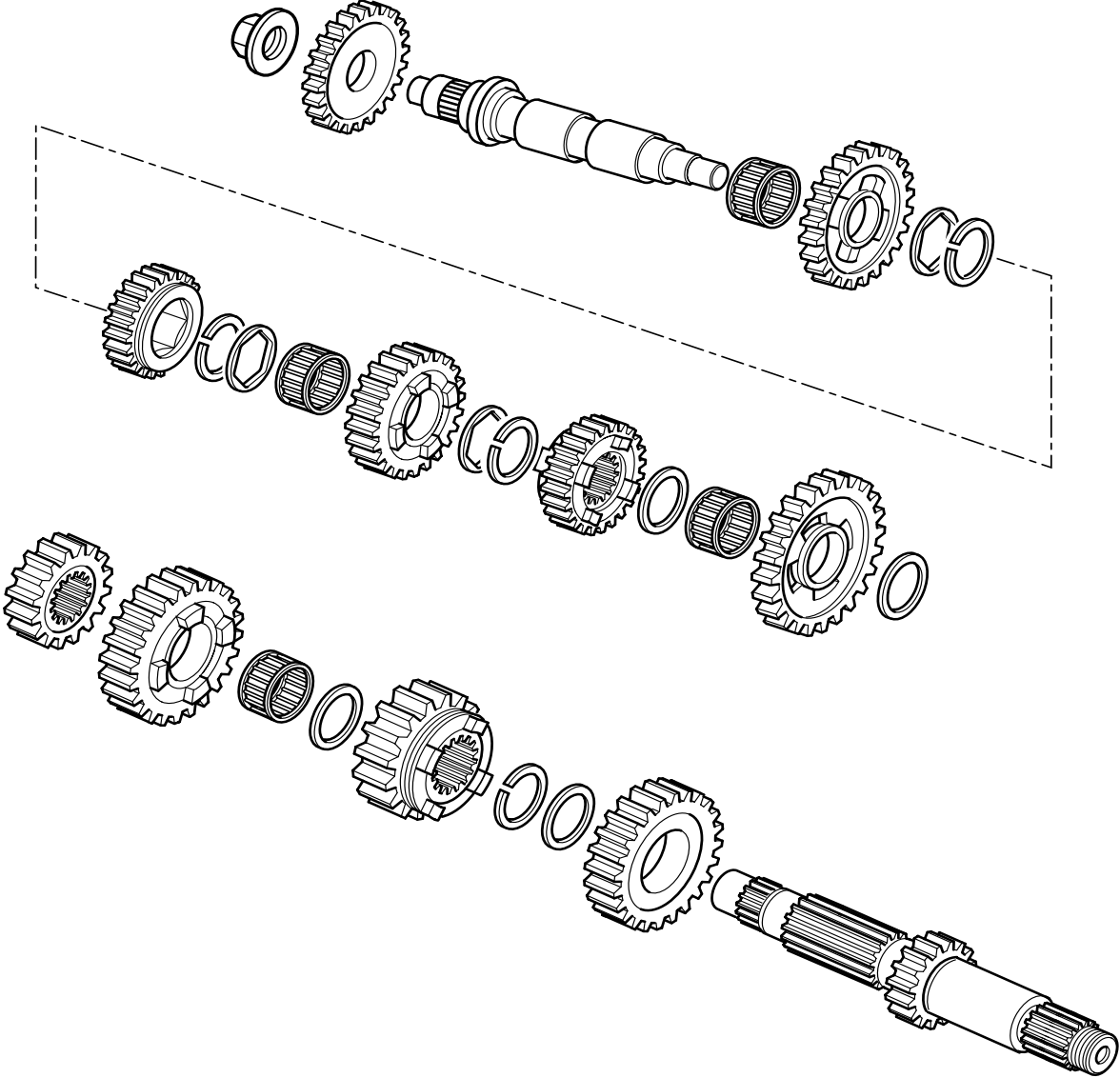


Technical Data		F 650 GS / GS Dakar
Transmission		
Type		Integral 5-speed gearbox with claw shift
Gear steps		Primary: 37/72=1:1.946
Gearbox ratios:	1st gear	12/33 = 1:2.750
	2nd gear	16/28 = 1:1.750
	3rd gear	16/21 = 1:1.313
	4th gear	22/23 = 1:1.045
	5th gear	24/21 = 1: 0.875
Engine ratio:	1st gear	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)

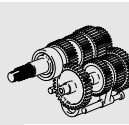
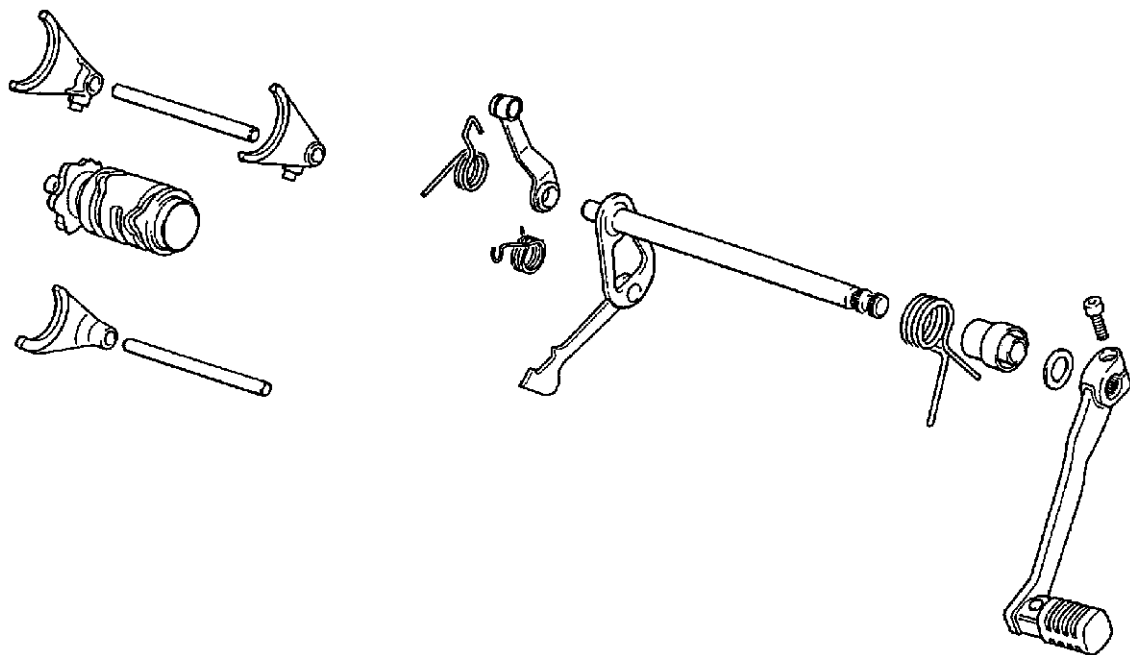




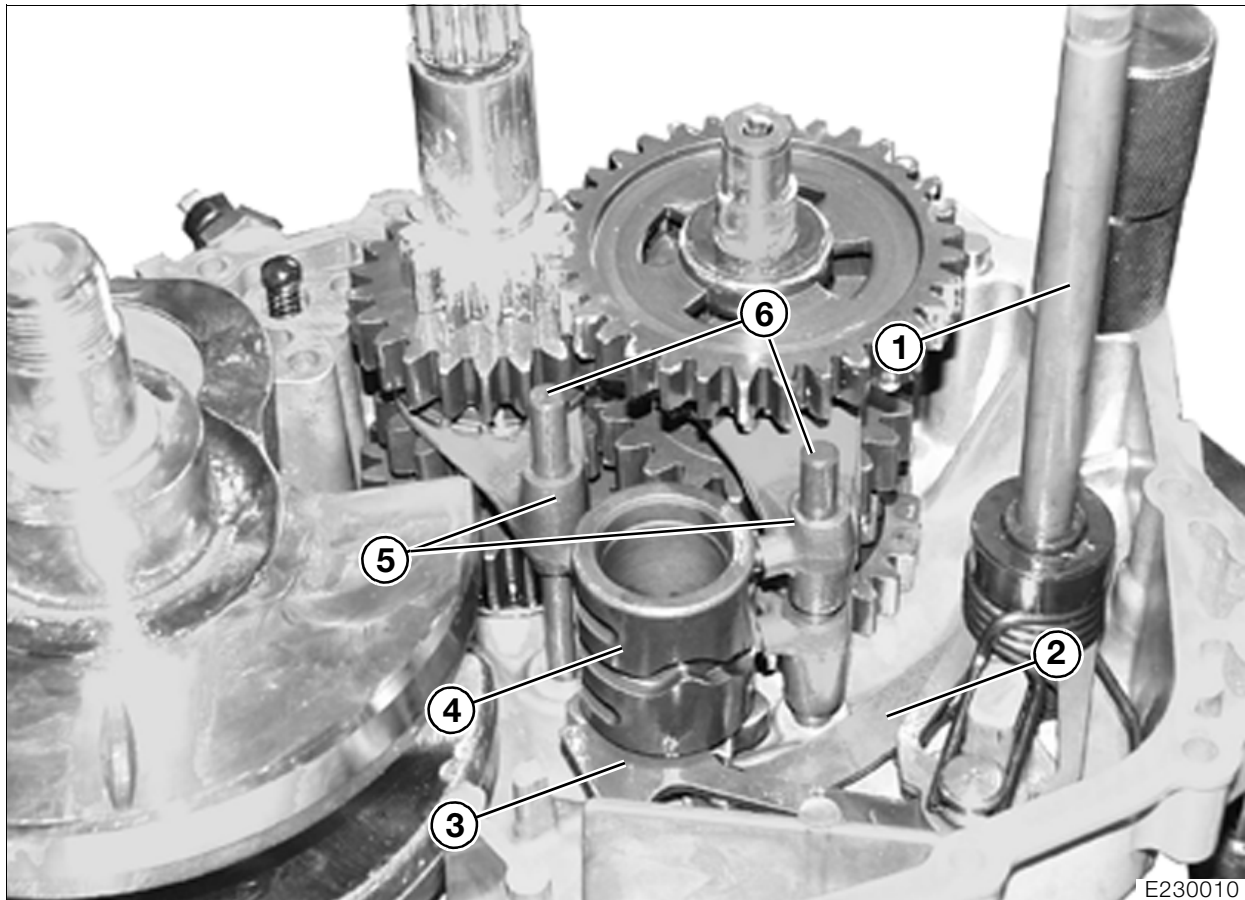
Gearbox shafts, components



Gear shift pedal, components



F239030



E230010

23 00 100 Removing and installing gearbox

Important:

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

- Remove engine (⇒ 11.21).
- Disassemble engine (⇒ 11.24).

23 00 640 Removing selector shaft with pawl and index lever

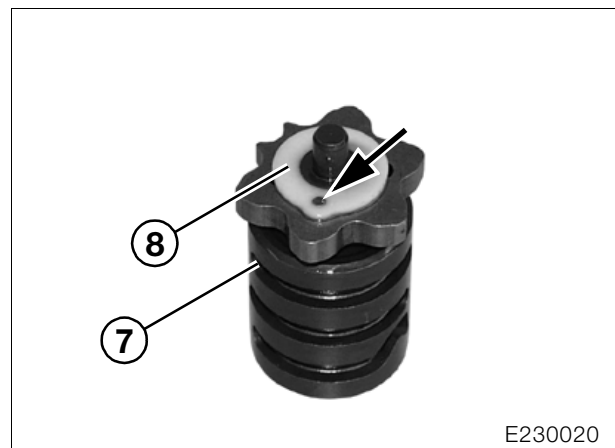
- Pry the sealing ring of the selector shaft out of the cover.
- Press shift pawl (3) slightly outward and withdraw selector shaft with shift pawl (1, 3).
- Remove index lever (2) and spring.

23 00 158 Removing selector forks

- Remove guide pins (6) from selector forks.
- Swing the selector forks (5) out and remove them.
- Inspect contact surfaces of selector forks and guide pins for signs of wear.

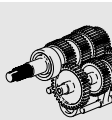
23 00 651 Removing selector drum

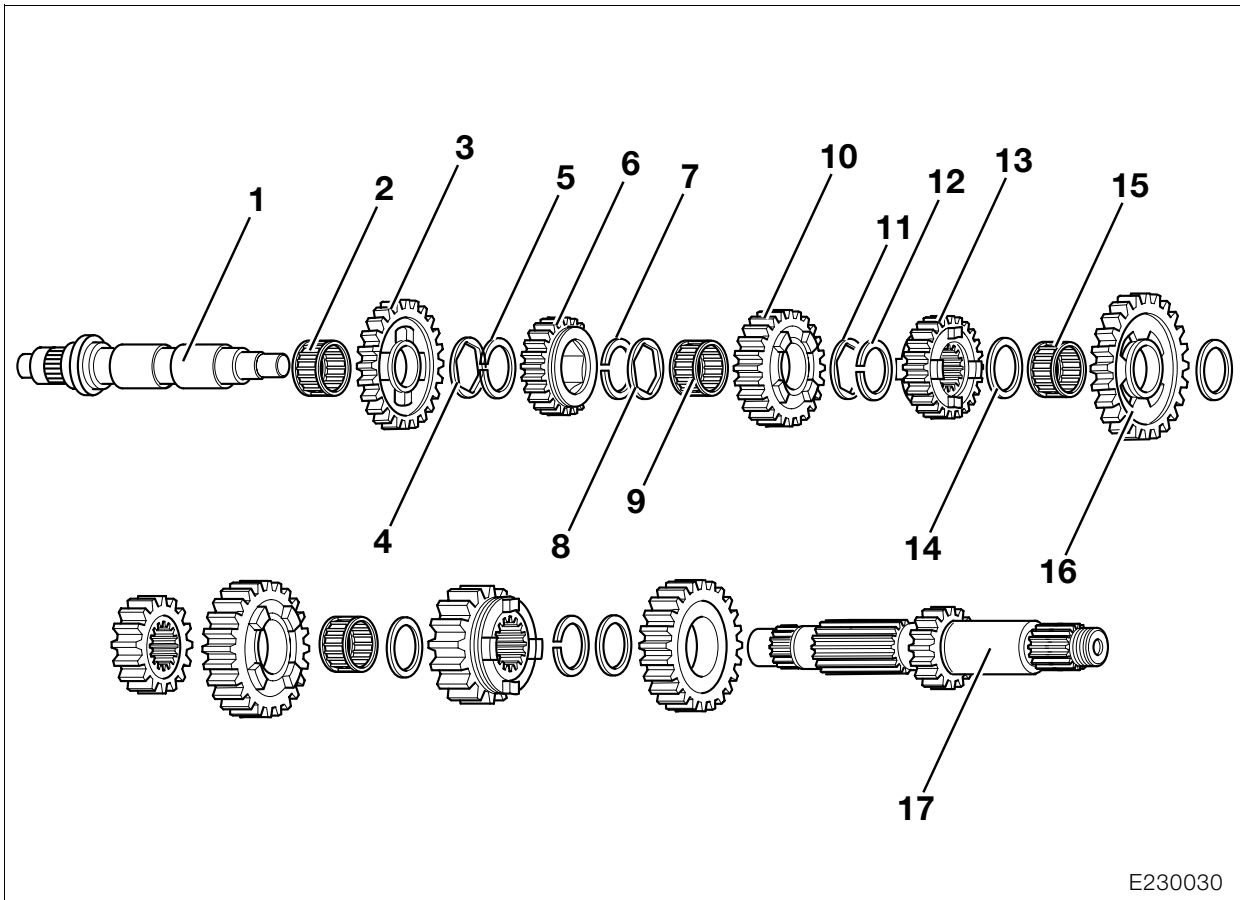
- Withdraw selector drum (4).



E230020

- Inspect selector shaft guide tracks (7) and insulating washer (8) with neutral-indicator 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.
- Tap 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.



Important:

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 circlip (7) slightly so that circlip (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:

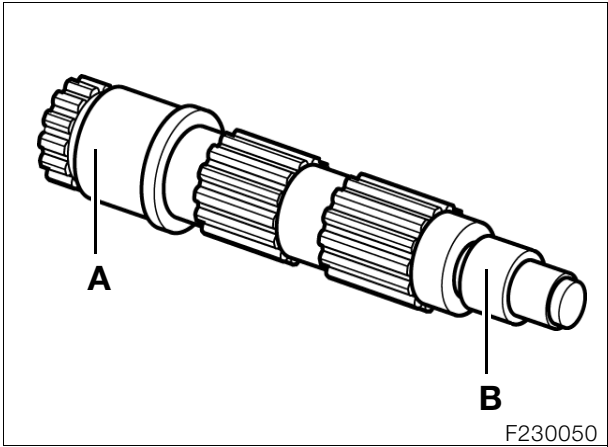
Check all bearings, bearing journals, tooth edges, keyways and annular grooves for wear, always replace gearwheels complete with their matching gearwheels as pairs.

Edges of ring grooves must not be rounded.

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

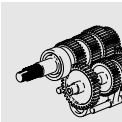
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Position retaining ring (7) approx. 3 mm (0.12 in) below the groove. After installing retaining ring (12), push retaining ring (7) up with gearwheel (6) until the retaining ring is seated in its groove.

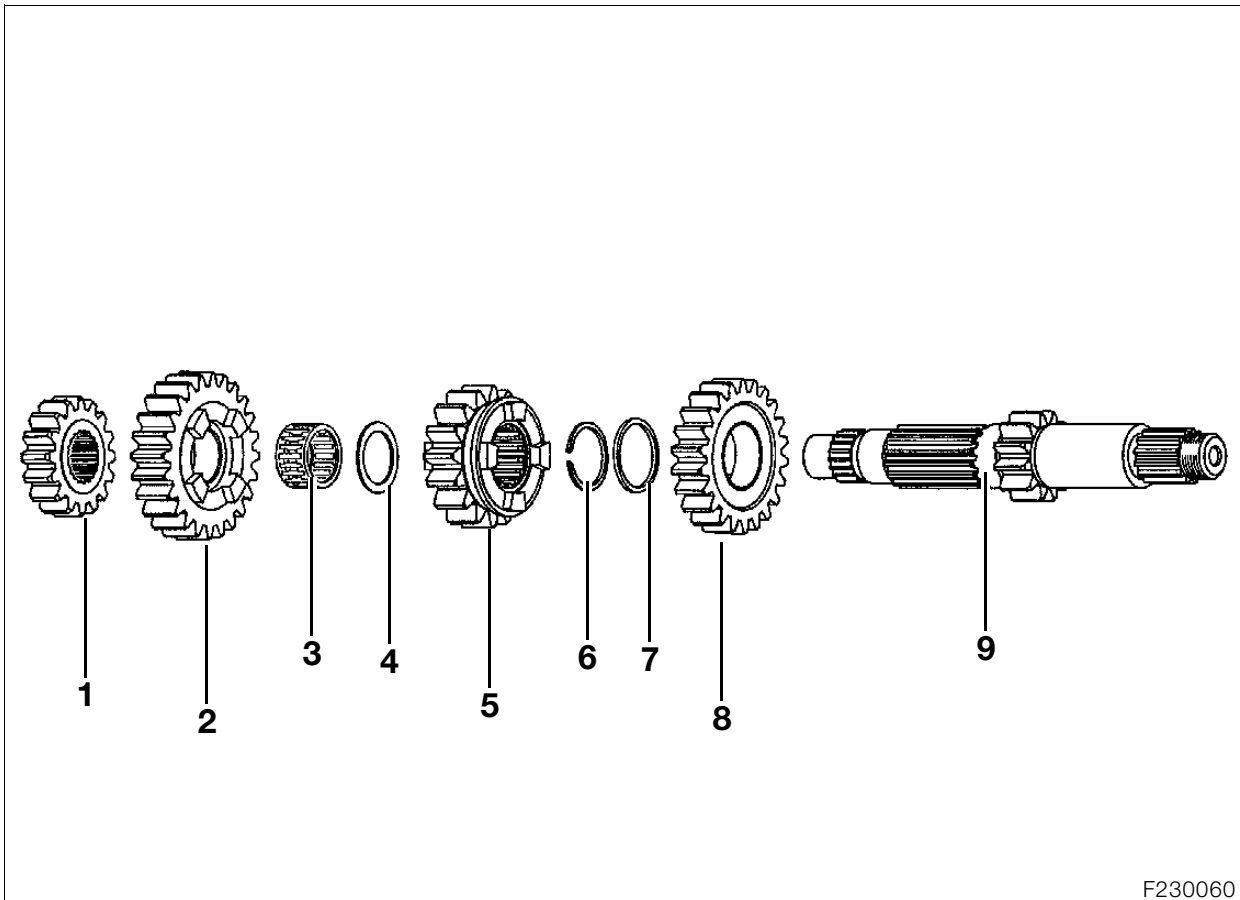
Checking mainshaft for wear



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 countershaft

- Clamp the countershaft 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).

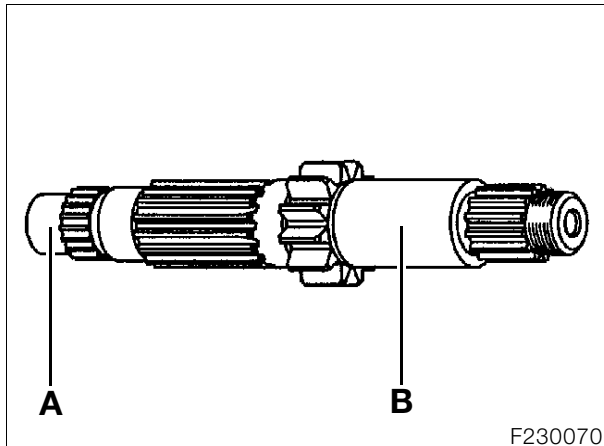


Note:

Inspect all bearings, bearing points, 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 rounded. Always renew circlips and install them only with special pliers, **BMW No. 23 4 500**.

- Assembly is the reverse of the disassembly procedure.

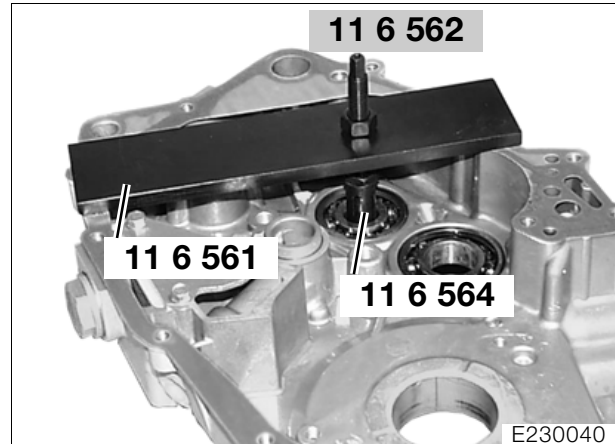
Checking countershaft for wear



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)

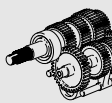
11 11 205 Replacing gearbox mainshaft bearings



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 counter-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. dia. 46.99 mm (1.850 in)

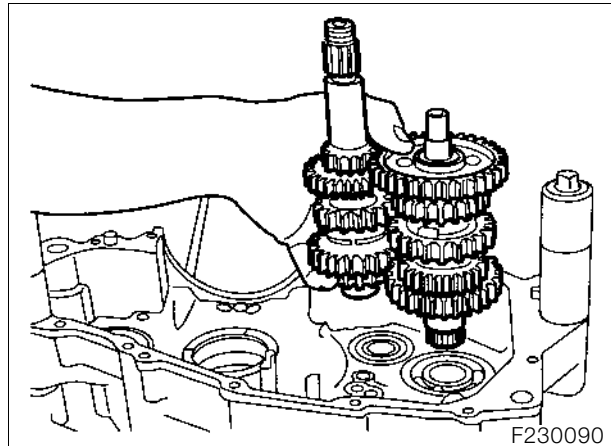
Mainshaft max. dia. 62.02 mm (2.442 in)

Clutch side:

Countershaft max. dia. 51.99 mm (2.047 in)

Mainshaft max. dia. 46.99 mm (1.850 in)

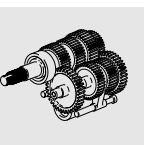
23 00 600 Installing gearbox shafts



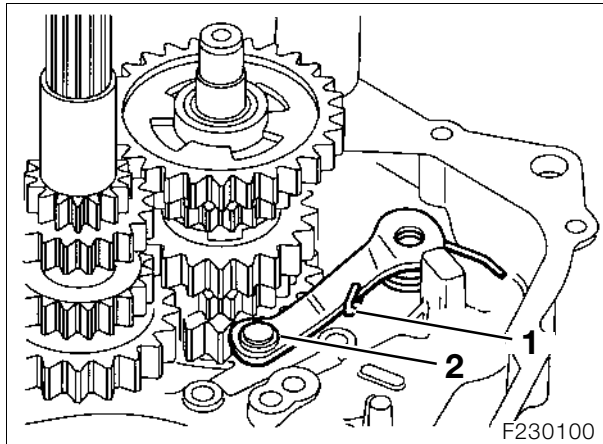
Note:

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

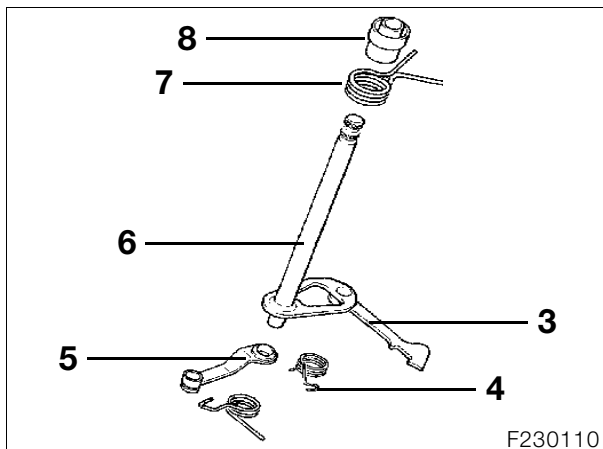
- Install the countershaft and mainshaft together, coating the main bearing points with **Optimoly MP 3**.
- Drive the shafts in against their seats with light blows of a plastic-faced hammer.



23 00 640 Installing selector shaft

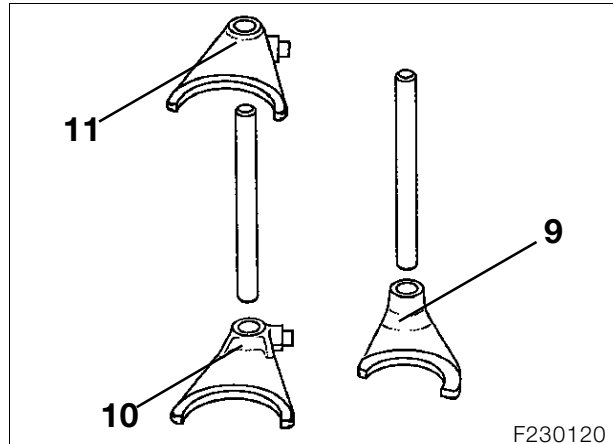


- Install index lever (2) with index spring (1) in housing.



- Attach pawl spring (4) to 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 on the pivot.

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:

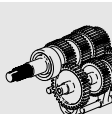
Select all gears in succession, at the same time checking that the selector pawl is withdrawn freely from the shift drum in all gears.

- Check gearbox functions.
 - Assemble engine (→ 11.43).

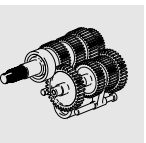


Note:

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



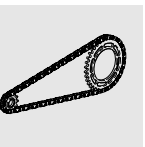
- Select all gears once again and move the shift lever slowly to the “0” position.
- Cover the splines on the selector shaft with slide-on sleeve, **BMW No. 21 4 620**.
- Using drift, **BMW No. 21 4 630**, drive in sealing ring.
- Drive in the mainshaft sealing ring with drift, **BMW No. 23 4 550**, and sliding sleeve, **BMW No. 23 4 540**.
- Install engine (→ 11.54).



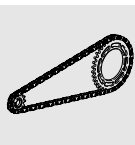
27 Drive chain

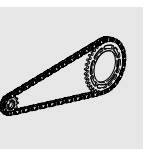
Contents	Page
Technical Data	3
Removing and installing chain, chainwheel and chain sprocket	5
Removing and installing chain	5
Removing and installing chain guide rail	5
Removing and installing chain takeup roller	5
Removing chainwheel	6
Removing chain sprocket	6
Removing and installing chain guide rail with swinging fork installed	7
Adjust chain tension (→ 00.47)	7

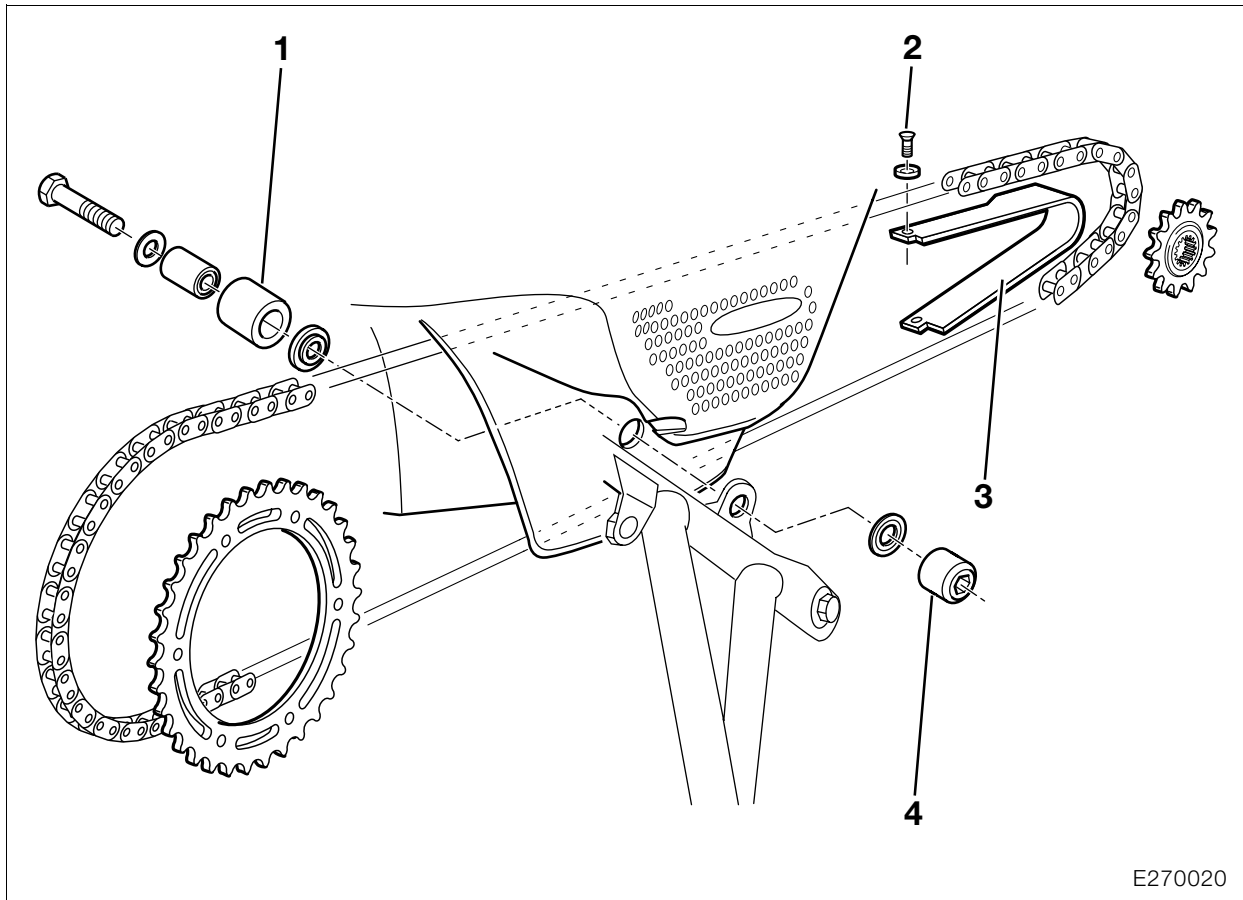




Technical Data		F 650 GS / GS Dakar
Chain drive		
Number of teeth on chain sprocket		16
Number of teeth on chainwheel		47
Secondary ratio		1:2.937
Secondary drive		O-ring chain 5/8" x 1/4"
Chain links		112
Chain length	mm (in)	1,000 (39.4)
Roller diameter	mm (in)	10.16 (0.40)







E270020

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

Important:

Always renew the chain, chainwheel and chain sprocket together.

27 72 001 Removing and installing chain

- Remove the sprocket cover.
- Remove rear wheel swinging fork (→ 33.6).
- 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-fork pivot shaft	100 Nm
Strut to swinging fork	41 Nm
Rear quick-release axle	100 Nm
Chain tensioning screws	10 Nm
Wheel cover bracket to swinging fork	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.

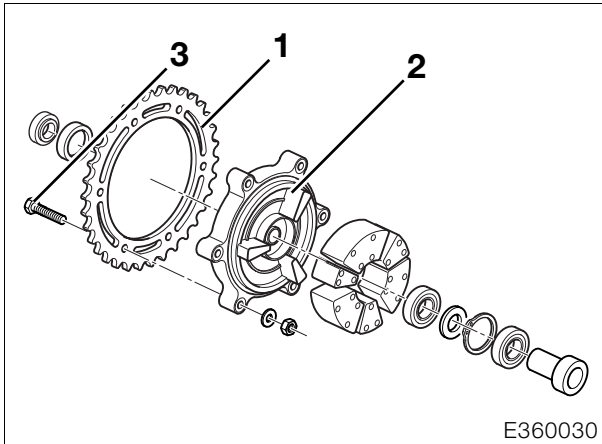
Tightening torques:

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



27 71 000 Removing chainwheel

- Remove rear wheel (→ 36.7).



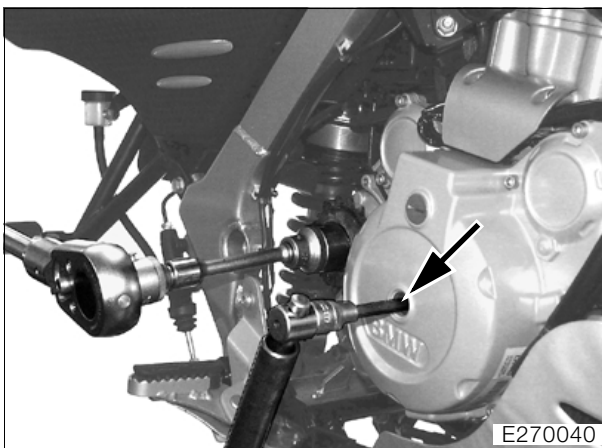
- Remove chainwheel carrier (2) together with chainwheel (1) from rear wheel hub.
- Remove screws (3) and remove the chainwheel.

Tightening torques:

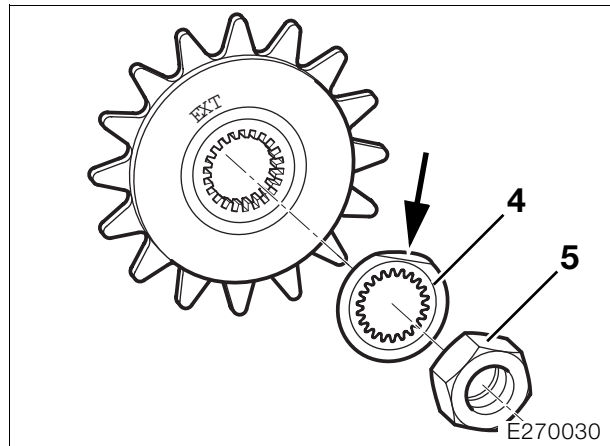
Chainwheel to carrier 21 Nm

27 71 000 Removing chain sprocket

- Remove chain (→ 27.5).
- Select first gear.
- Straighten the tabs of the locking washer on the central nut.



- Open 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 sprocket 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 sprocket.
- 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 fork 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 fork.
- 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 Adjust chain tension (→ 00.47)

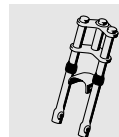


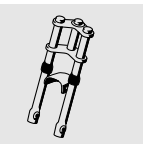
31 Front forks

Contents

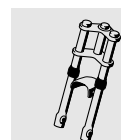
Page

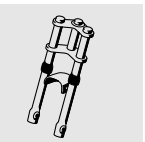
Technical Data	3
Telescopic fork, components	5
[Dakar] Changing oil in telescopic forks	6
Removing and installing telescopic fork	7
Removing telescopic fork	7
Installing telescopic fork	8
Disassembling telescopic fork	10
Removing fixed tube	10
Disassembling fixed tube	11
Measuring telescopic fork	12
Checking lower fork bridge	12
Checking parallel alignment of fixed tubes	13
Checking fixed tube runout	13
Assembling telescopic fork	14
Assembling fixed tube	14
Assembling telescopic fork	17
Removing and installing steering head bearing	18
Upper steering head bearing	18
Lower steering head bearing	19



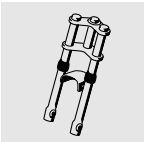
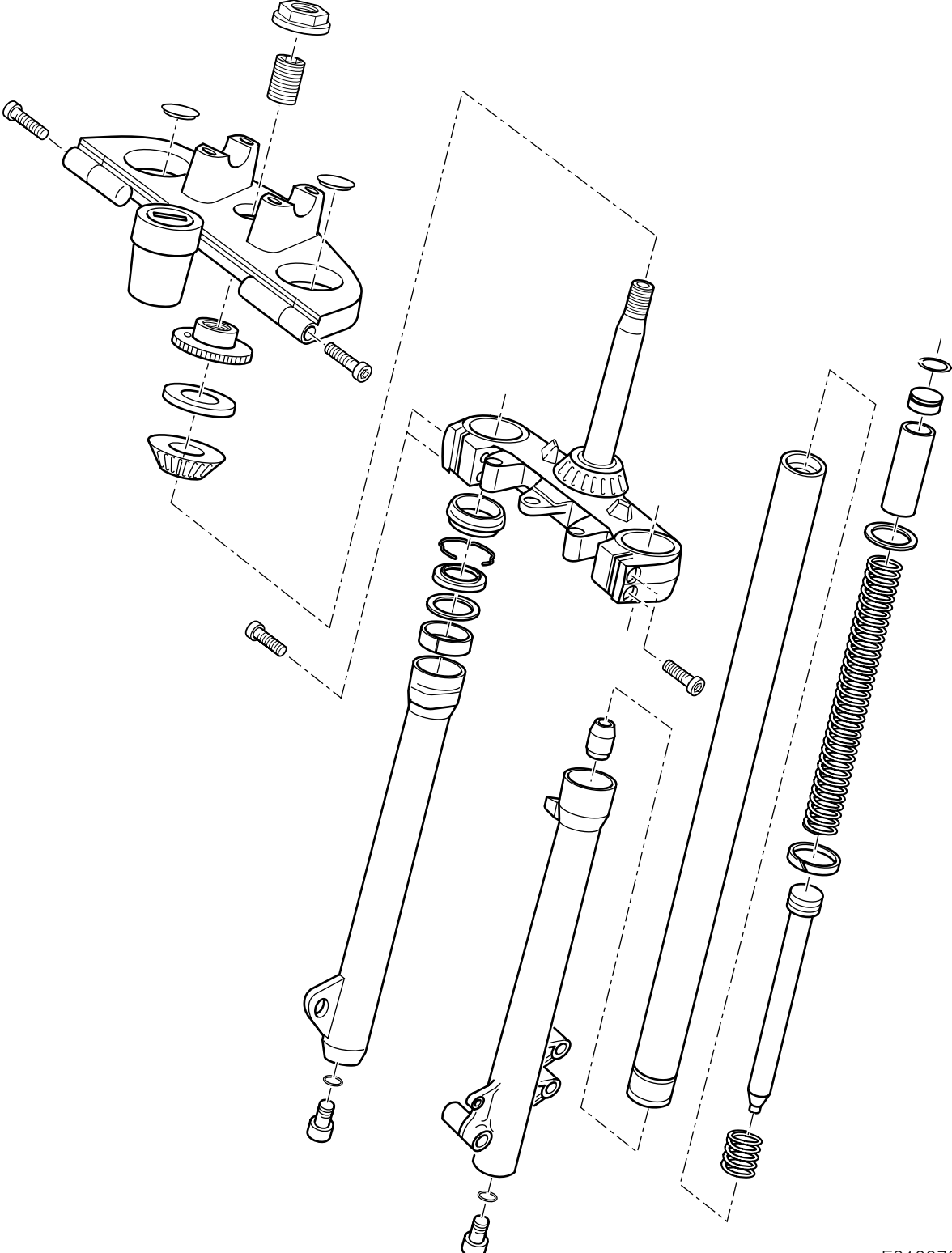


Technical Data		F 650 GS	F 650 GS Dakar
Front forks			
Front wheel caster	mm (in)	113 (4.449)	123 (4.842)
Steering lock angle	°	40	40
Front suspension travel (normal-load position, 85 kg (187 lbs) load)	mm (in)	170 (6.69)	210 (8.268)
Length of suspension spring in fork	mm (in)	515.1 (20.279)	467.9 (18.421)
Wire diameter of suspension spring	mm (in)	4.8 (0.189)	5.0 (0.197)
Grease in sleeve		Retinax EP2	
Telescopic-fork fixed tube			
Installed (test) length of fixed tubes	mm (in)	approx. 215 (8.46)	approx. 218 (8.58)
Fixed tube surface		Hard chrome plated	
Extl. dia. of fixed fork tubes	mm (in)	41 (1.614)	
Fixed fork tube runout limit	mm (in)	0.1 (0.0039)	
Telescopic-fork oil			
Telescopic-fork oil - approved grades		BMW telescopic-fork oil	
[regular suspension] Capacity per fork leg (initial fill)	l (Imp. pints/ US quarts)	0.61 (1.07/0.64)	0.56 (0.98/0.59)
[regular suspension] Capacity per fork leg (oil change)	l (Imp. pints/ US quarts)	0.60 (1.06/0.63)	0.55 (0.97/0.58)
[lowered suspension] Capacity per fork leg (initial fill)	l (Imp. pints/ US quarts)	0.62 (1.09/0.65)	–
[lowered suspension] Capacity per fork leg (oil change)	l (Imp. pints/ US quarts)	0.61 (1.07/0.64)	–





Telescopic fork, components



E310070

00 11 279 [Dakar] Changing oil in telescopic forks

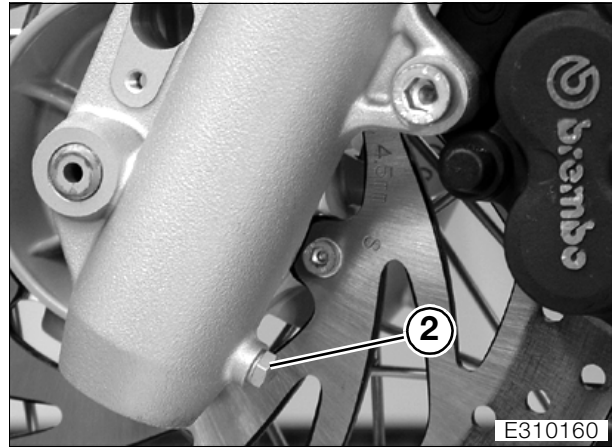
- Install stand, **BMW No. 00 1 610**, and place the motorcycle on the stand.
- Relieve load on front wheel.



Warning:

Note that screw plugs (1) at left and right are spring-loaded.

- Release screw plugs (1).



- Position a drip tray beneath the telescopic forks.
- Slacken oil drain plugs (2) on left and right.
- Allow all the oil to drain off.



Important:

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.
- Lightly oil thread of screw plug.



Note:

Check O-ring of screw plug for damage and renew if necessary.



Warning:

Note that screw plugs (1) at left and right are spring-loaded.

- Install and tighten screw plugs on left and right.

Capacity per fork leg

..... 0.55 l (0.968 Imp. pints/0.581 US quarts)

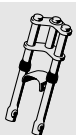
Operating fluids:

Telescopic fork.....BMW telescopic-fork oil



Tightening torque:

Oil drain plug..... 6 Nm
Screw plug in fork 25 Nm



31 42 100 Removing and installing telescopic fork

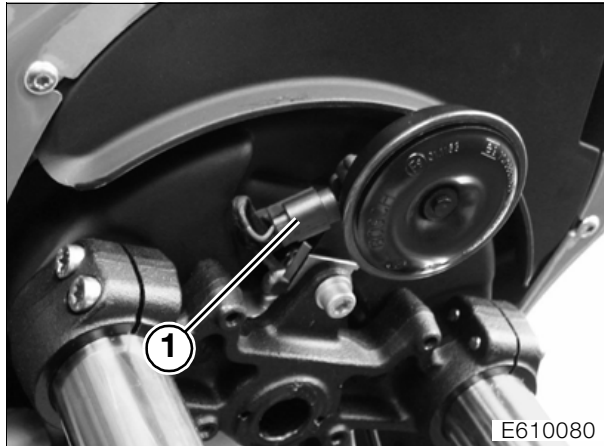
3142 Removing telescopic fork



Important:

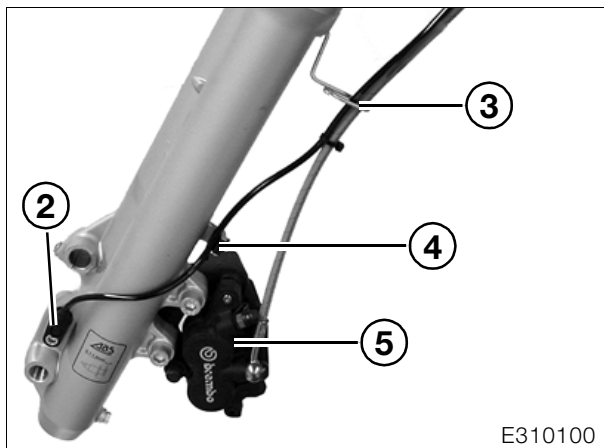
Cover or mask off the instrument cluster and trim to prevent scratches.

- Remove front mudguard (→ 46.8).



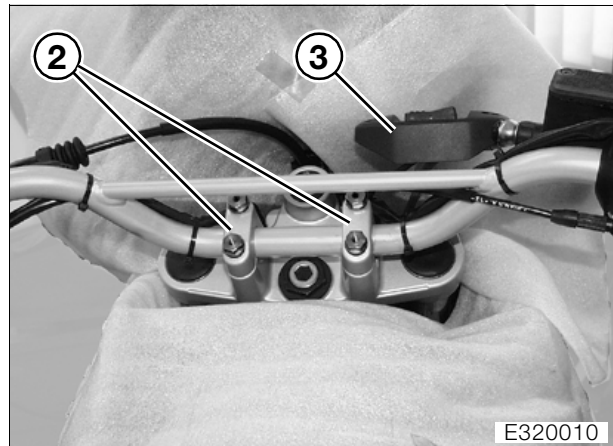
E610080

- Disconnect plug for horn (1).
- Push plug with rubber grommet up and out of the fork bridge cover.
- Remove front wheel (→ 36.5).



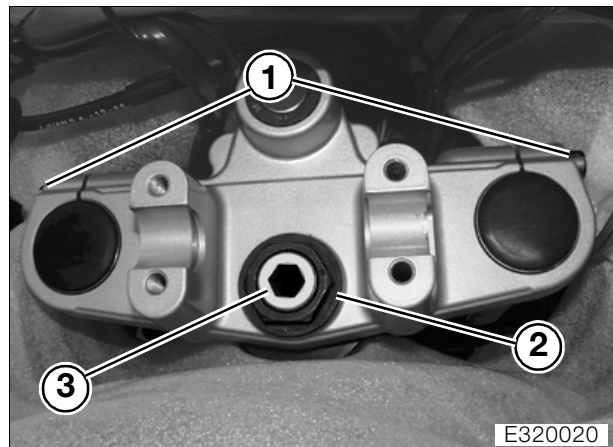
E310100

- **[GS]** Remove front ABS sensor (2).
- **[GS]** Release ABS sensor cable from clip (4).
- Remove brake hose with ABS sensor cable from clip (3) on sliding tube.
- Remove fasteners securing front brake caliper (5) and use cable ties to secure the caliper to the engine guard, so that there is no strain on the brake line.



E320010

- Remove impact pad (3).
- Remove clamp blocks (2).
- Release the clutch and throttle cables from their clips.
- Remove the handlebars and place them in front of the instrument cluster.



E320020

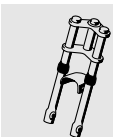
- Unscrew hex nut (2).
- Release clamping screws (1) at upper fork bridge.
- Remove the upper fork bridge complete with the ignition lock.
- Remove counter-tube (3).



Important:

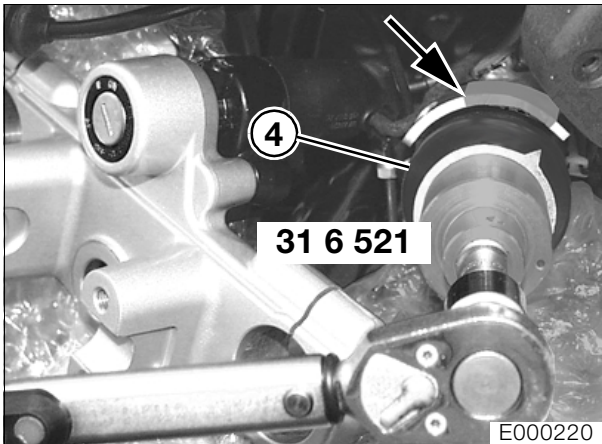
When removing the upper taper roller bearing, secure the front forks so that they cannot slip out.

- Remove round nut with upper taper roller bearing, using socket, **BMW No. 31 6 521**.
- Remove front forks.
- Remove horn.
- Remove fork bridge cover.



3142 Installing telescopic fork

- Fit lower fork bridge into steering head.
- Install round nut.
- Pass plug for horn with rubber grommet through upper fork bridge cover and connect plug.



- Tighten round nut (4) with socket, **BMW No. 31 6 521**, to 25 Nm.
- Turn lower fork bridge back and forth twice from lock to lock, and leave it at the full left lock position.
- Mark a 40 mm (1.575 in) arc around the circumference of the locking plate at the steering head, with adhesive tape or similar (arrow).
- Align the mark on pin-wrench adapter, **BMW No. 31 6 521**, with the right-hand end of the marked arc.

Note:

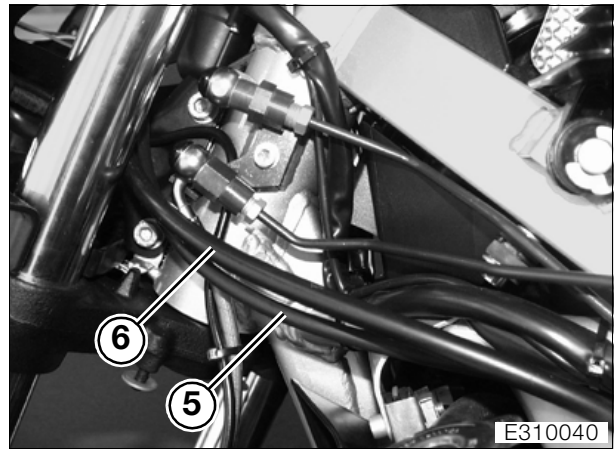
40 mm (1.575 in) around the circumference of the locking plate corresponds to an angle of rotation of 60°.

- 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.

Important:

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

- Place upper fork bridge in position.



Note:

Make sure that throttle cable (5) and clutch cable (6) are correctly routed.

- Slide forks into fork bridges from below.
- Provisionally clamp the forks in position.
- Install counter-tube and tighten.
- Firmly tighten locknut.



Note:

Check that the installed position of the forks is correct, e.g. with a precision straight-edge.

Warning:

Note that screw plugs at left and right are spring-loaded.

- Lower forks until top of tube (without cap, **[Dakar]** without screw plug) is flush with the top of the upper fork bridge (left and right).
- Tighten clamp screws at upper and lower fork bridges.



- **[GS]** Fit caps to fork legs.
- **[Dakar]** Lightly oil threads of screw plugs.



Note:

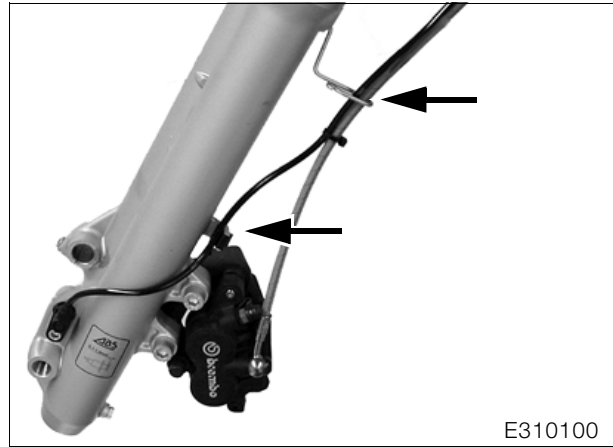
Check O-rings of screw plugs for damage and renew if necessary.



Warning:

Screw plugs are spring-loaded.

- **[Dakar]** Install and tighten screw plugs on left and right.
 - Install handlebars.
 - Checking steering head bearing play (→ 00.48).
 - Install front mudguard (→ 46.8).
 - Install front wheel (→ 36.5).



- Install brake caliper and ABS sensor.



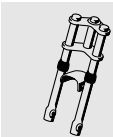
Note:

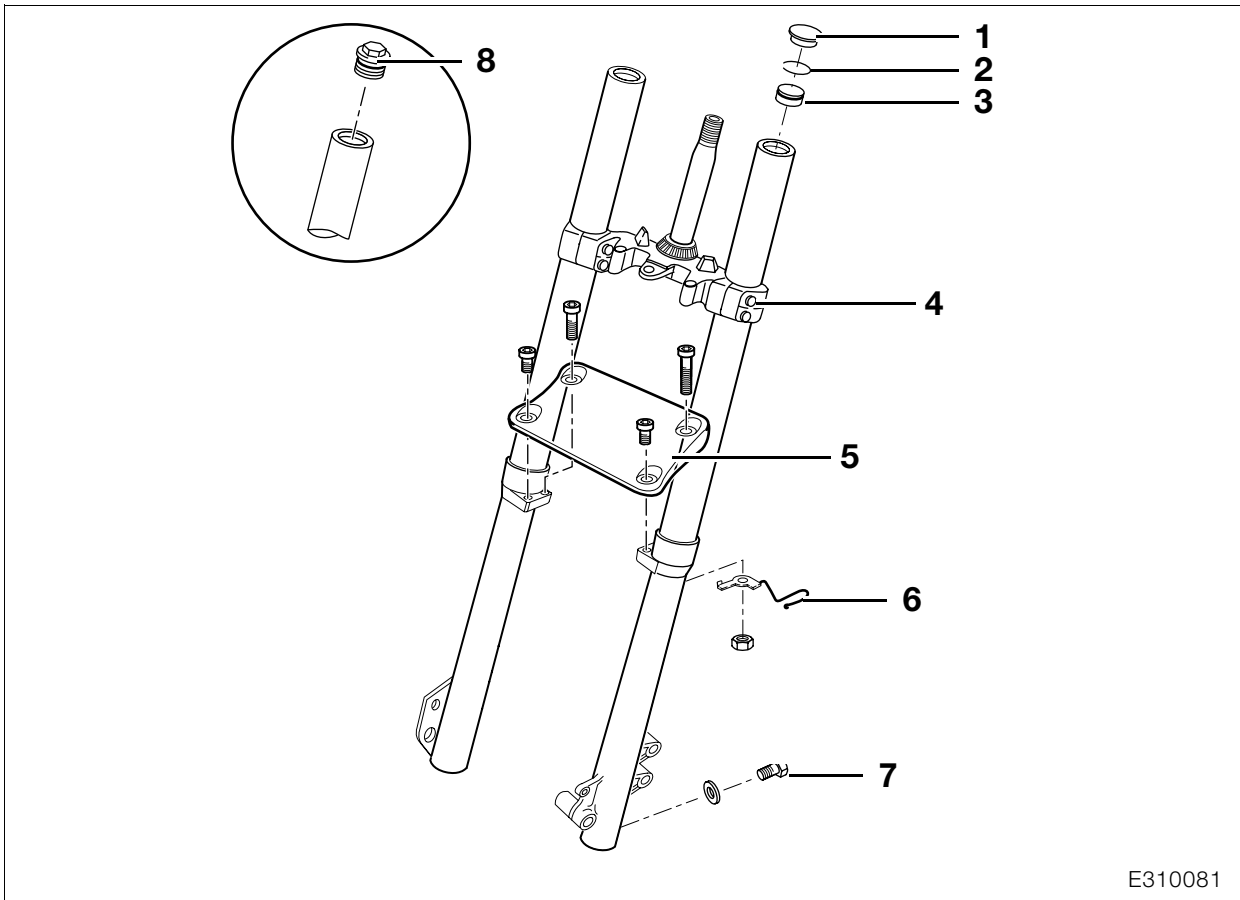
Make sure that ABS sensor cable and brake hose are correctly routed.



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
Handlebars to fork bridge.....	21 Nm
(clean thread + Optimoly TA)	
Clamp screw, front quick-release axle	21 Nm
Front quick-release axle to fork leg	45 Nm
Brake caliper to slider tube	41 Nm
ABS sensor to bracket	9 Nm
Screw plug in fork	25 Nm





E310081

31 42 503 Disassembling telescopic fork

Removing fixed tube

- Remove clamp (6).
 - Remove fork stabiliser (5).
 - Slacken clamping screws (4) at lower fork bridge.
 - Remove fixed tube together with slider tube from fork bridge.
 - Clamp slider tube in vice with protective jaws.
 - Position a drip tray beneath the fixed tube.
 - Remove oil drain plug (7).
 - Allow all the oil to drain off.
- **[GS]** Remove sealing caps (1).



Warning:

Note that plugs (3) at left and right are spring-loaded. Wear protective goggles when removing and installing.

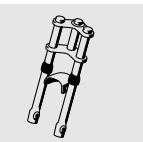
- **[GS]** Press plug (3) down and remove snap ring (2). Carefully allow the plug to ride up and remove.

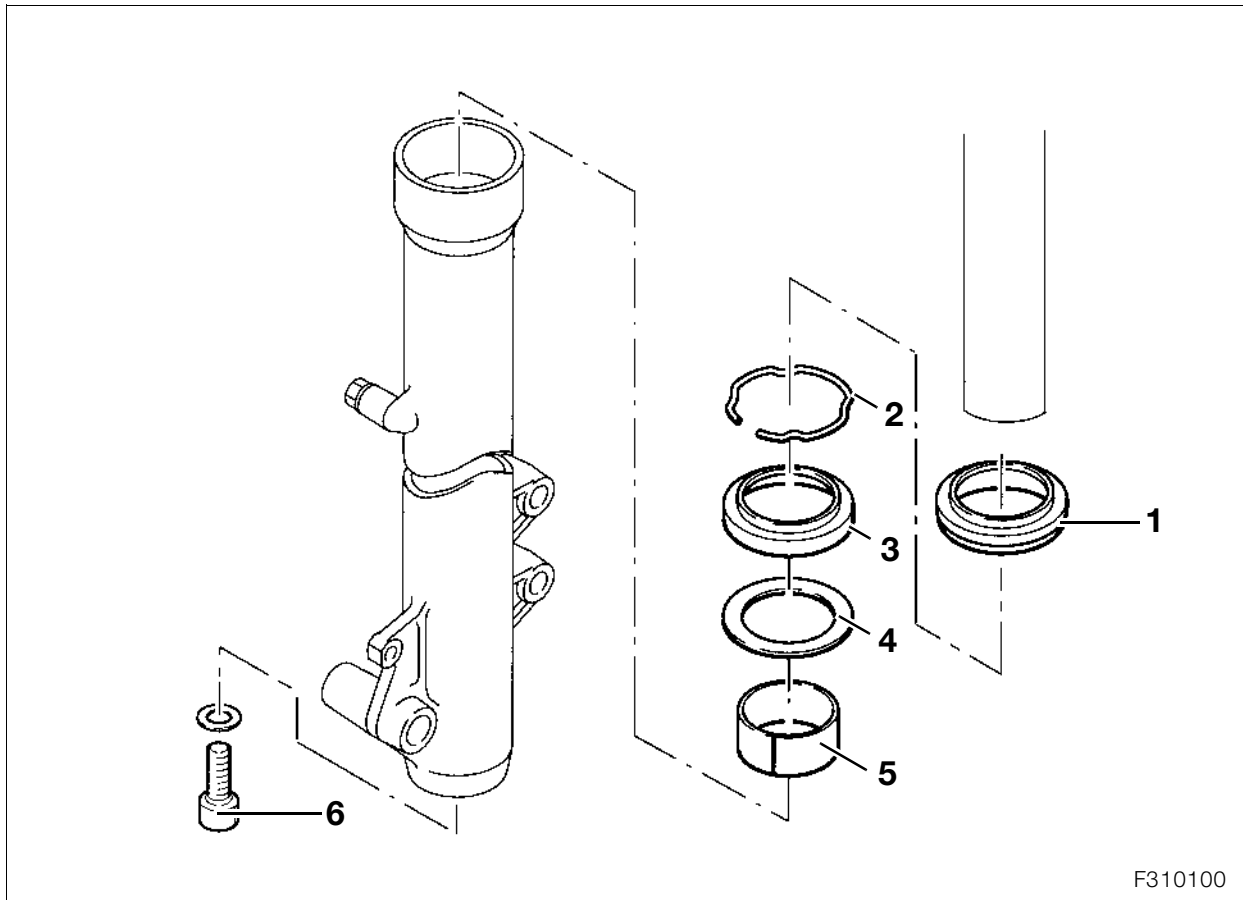


Warning:

Note that screw plugs (1) at left and right are spring-loaded.

- **[Dakar]** Remove screw plugs (8).





F310100

Disassembling fixed tube

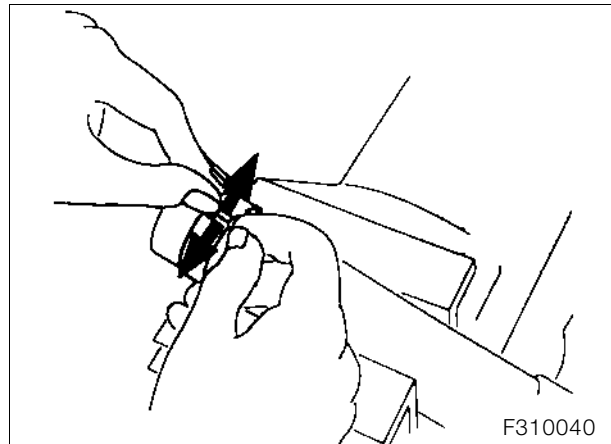
- Clamp slider tube in vice with protective jaws.
- Remove spacer and spring with washer from fixed tube.
- Remove dust cap (1).
- Lever out circlip (2) with screwdriver.



Note:

Catch escaping oil in a suitable container.

- Release securing screw (6) of damper in slider tube.
- Remove coil spring and individual parts of the damper from fixed tube.
- Push fixed tube slightly into slider tube and pull sharply to remove fixed tube, sealing ring (3), intermediate ring (4) and slide bush (5) from the slider tube.



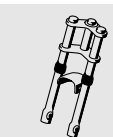
F310040



Note:

Replace damaged slide bushes.

- Press the slide bush apart with two fingers (arrows) and pull off the fixed tube.



31 42 500 Measuring telescopic fork



Important:

After being involved in an accident, the telescopic fork must be examined for cracks and damage.

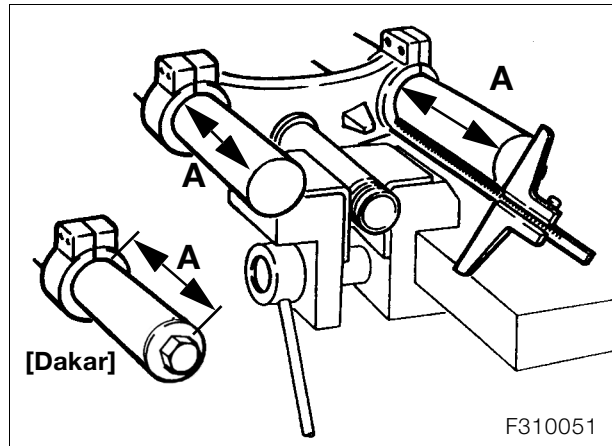


Note:

When clamping the fork bridge into the vice, use soft jaws.

- Clamp the fork bridge at the steering tube.

Checking lower fork bridge



- Install two new fixed tubes with test length **A** in the lower fork bridge.

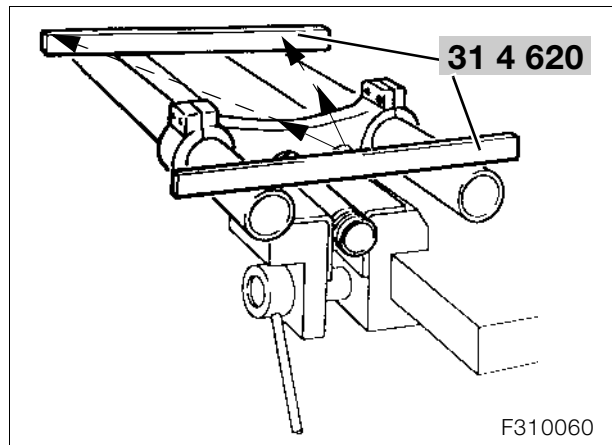


Note:

Use fixed tubes with caps installed.

Installed (test) length **A**

[GS]	215 mm (8.46 in)
[Dakar]	218 mm (8.58 in)



- Place two straight-edges, **BMW No. 31 4 620**, across the upper and lower ends of the fixed tubes.



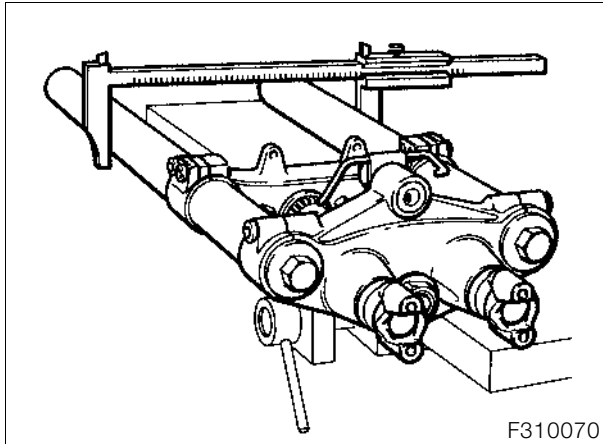
Important:

Replace distorted fork bridges.

- Check visually to determine any distortion.



Checking parallel alignment of fixed tubes

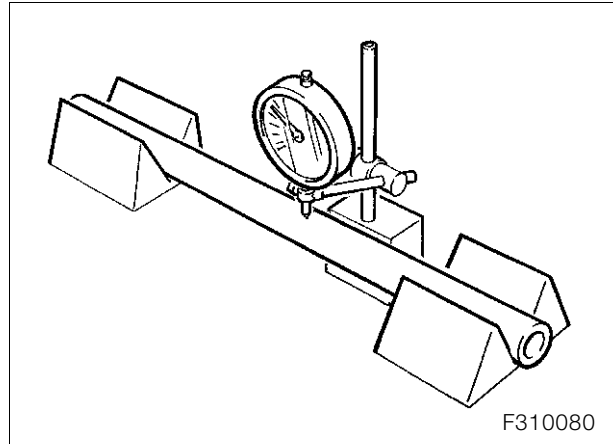


Note:

The fork bridge must slide smoothly over the fixed tubes.

- Install upper fork bridge.
- Check that fixed tubes are parallel with sliding calipers.
- Check flush alignment of steering tube with respect to fixed tube.

Checking fixed tube runout



- Place both ends of fixed tube in V-blocks.

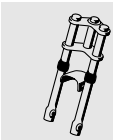


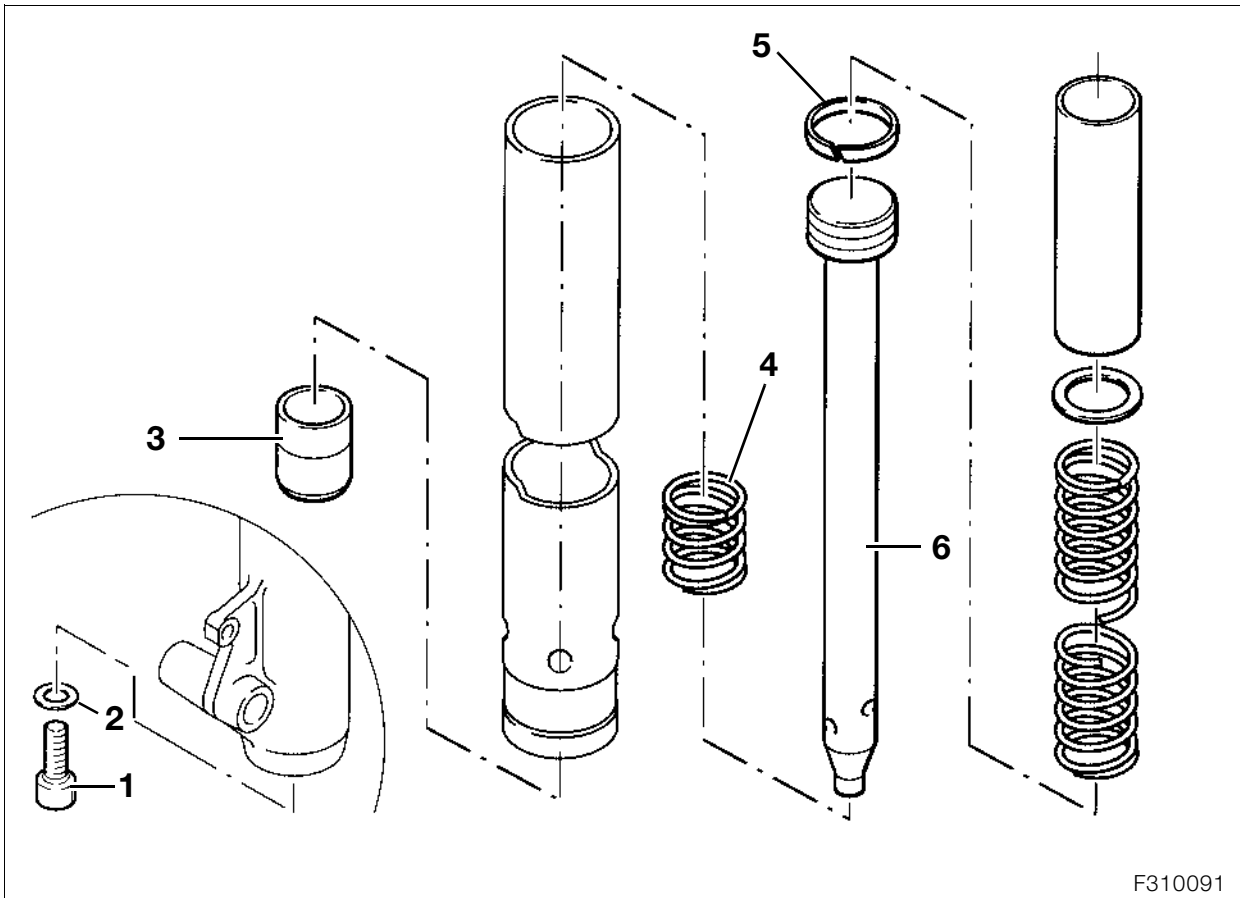
Warning:

Do not attempt to straighten bent fixed tubes.

- Rotate fixed tube slowly and check with dial gauge.

Fixed fork tube runout limit 0.1 mm (0.004 in)





F310091

31 42 503 Assembling telescopic fork

Assembling fixed tube

- Fit damper tube (6) with piston ring (5) and spring (4) into fixed tube.
- Fit guide piece (3) onto damper tube (6).

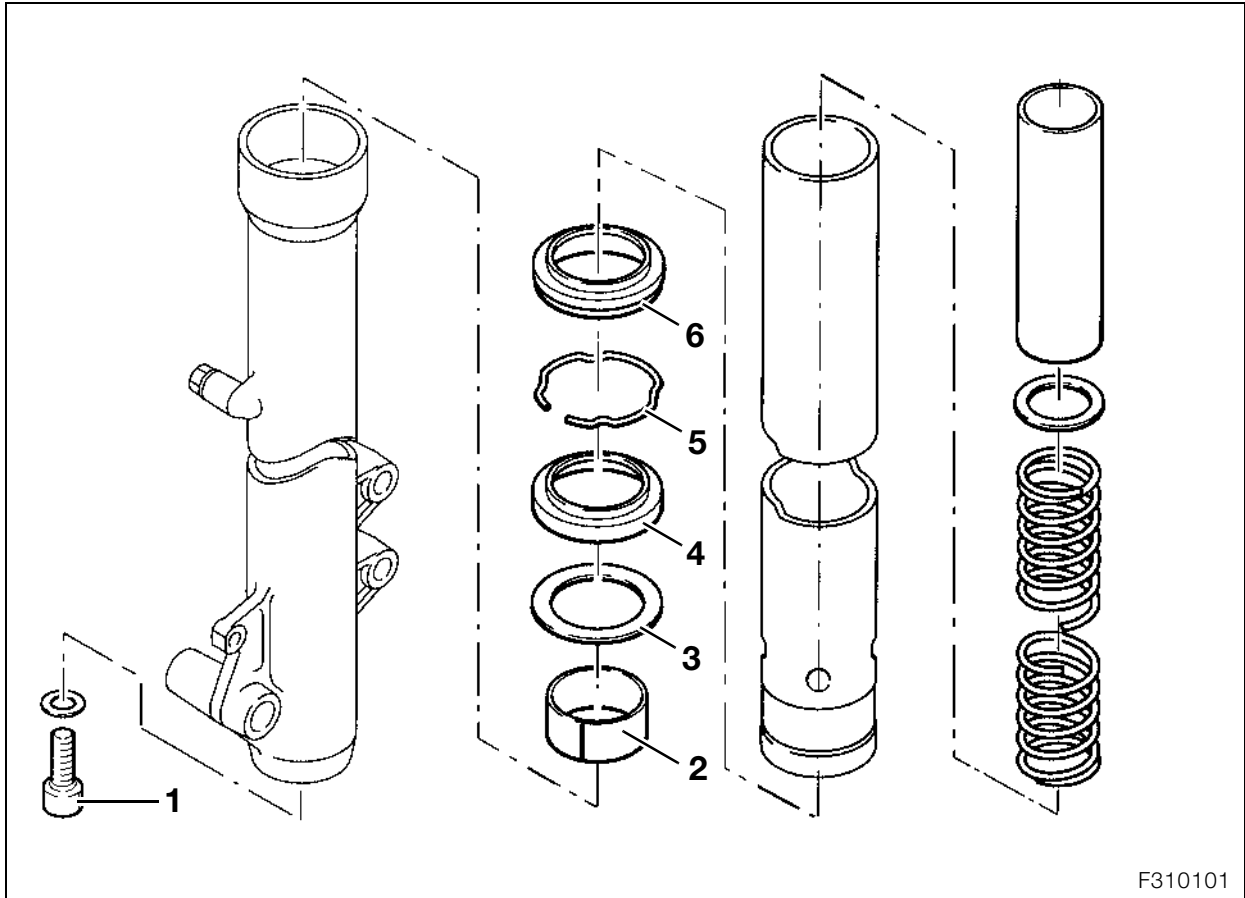


Note:

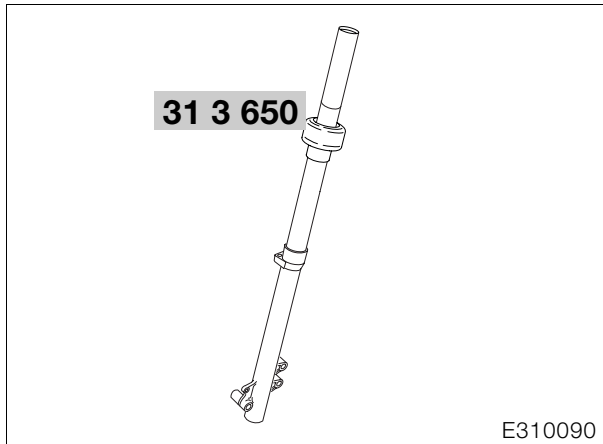
Lightly oil slide bushes with fork oil before assembly.

- Push the fixed tube with the slide bush into the slider tube.
- Loosely insert retaining screw (1) for damper with new sealing ring (2).





F310101



E310090

 **Note:**

Lightly oil slide bushes with fork oil before assembly.

- Slide upper slide bush (2) over fixed tube and press lightly into the slider tube.
- Carefully drive in the slide bush with drift, **BMW No. 31 3 650**.

- Install intermediate ring (3).



Note:

Before assembly, lightly coat outside of radial shaft seal with tyre fitting lubricant.
Installed position: wording uppermost.

- Drive in radial shaft seal (4) in the same way.
- Install retaining ring (5) in groove over the seal.

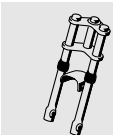


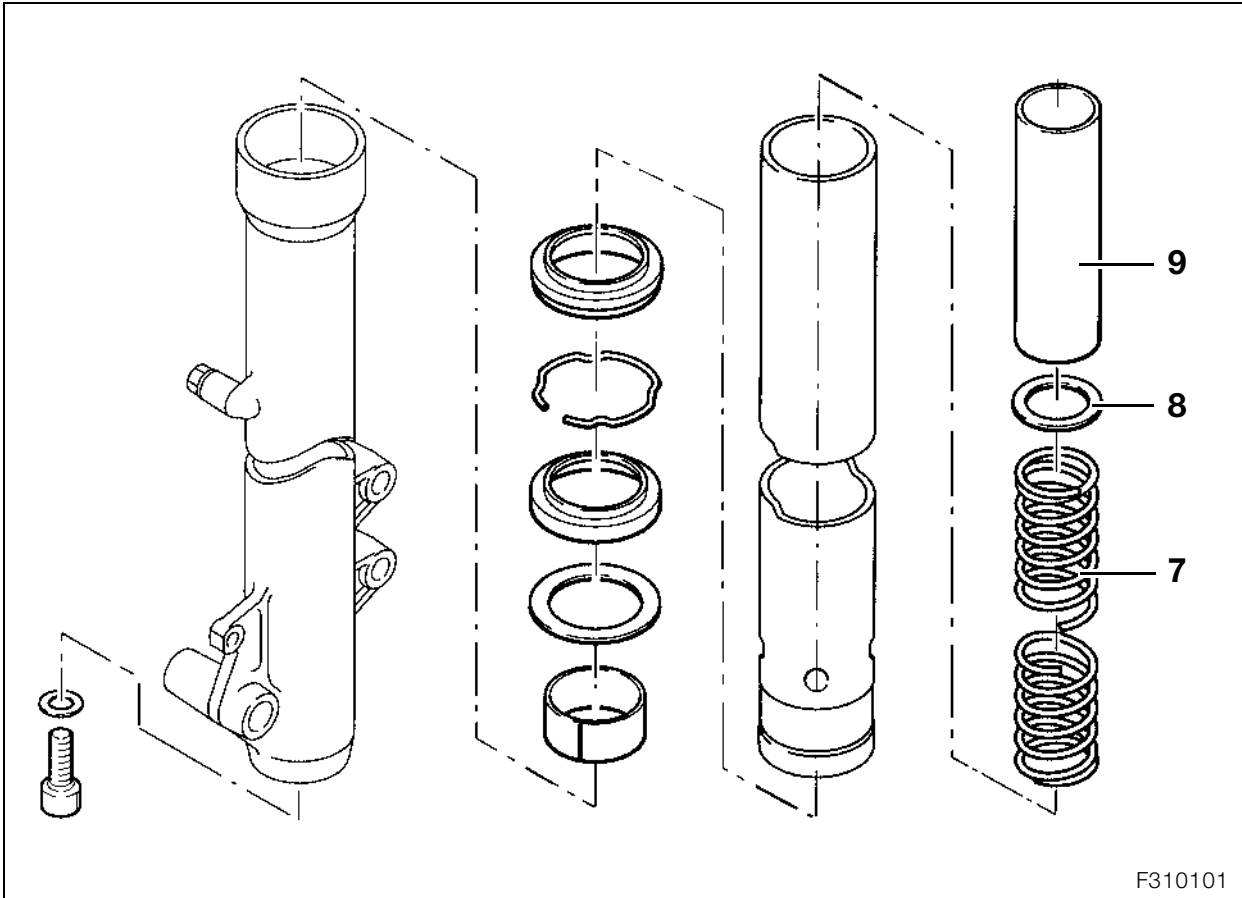
Note:

Fill the lubricant pocket in dust sleeve (6) with **Shell Retinax EP2**.

Installed position: the lubricant pocket in the dust sleeve faces inward toward the slider tube.

- Drive dust sleeve (6) into the slider tube with the convex side of drift, **BMW No. 31 3 650**.
- Tighten shock absorber retaining screw (1) in the slider tube.
- Fill with specified quantity of oil.





F310101

⚠ Important:

The taper-wound end of coil spring (7) should be at the bottom of the fixed tube. If the coil spring is inserted the wrong way round, it will damage the sliding surface in the fixed tube when the fork is compressed.

- Insert coil spring (7) into the fixed tube with the taper-wound end of the spring at the bottom.
- Install support ring (8) and spacer sleeve (9).

🚫 Warning:

Screw plugs/screws are spring-loaded.

- **[GS]** Press plugs down and insert retaining rings to secure.
- **[Dakar]** Lightly oil threads of screw plugs.

📄 Note:

Check O-ring of screw plug for damage and renew if necessary.

- **[Dakar]** Install and tighten screw plugs on left and right.

Capacity per fork leg

Oil change

[regular suspension]

..... 0.60 l (1.06 Imp. pints/0.63 US quarts)

[lowered suspension]

..... 0.61 l (1.07 Imp. pints/0.64 US quarts)

[Dakar] 0.55 l (0.97 Imp. pints/0.58 US quarts)

Initial filling

[regular suspension]

..... 0.61 l (1.07 Imp. pints/0.64 US quarts)

[lowered suspension]

..... 0.62 l (1.09 Imp. pints/0.65 US quarts)

[Dakar] 0.56 l (0.98 Imp. pints/0.59 US quarts)

Oil gradesBMW telescopic-fork oil



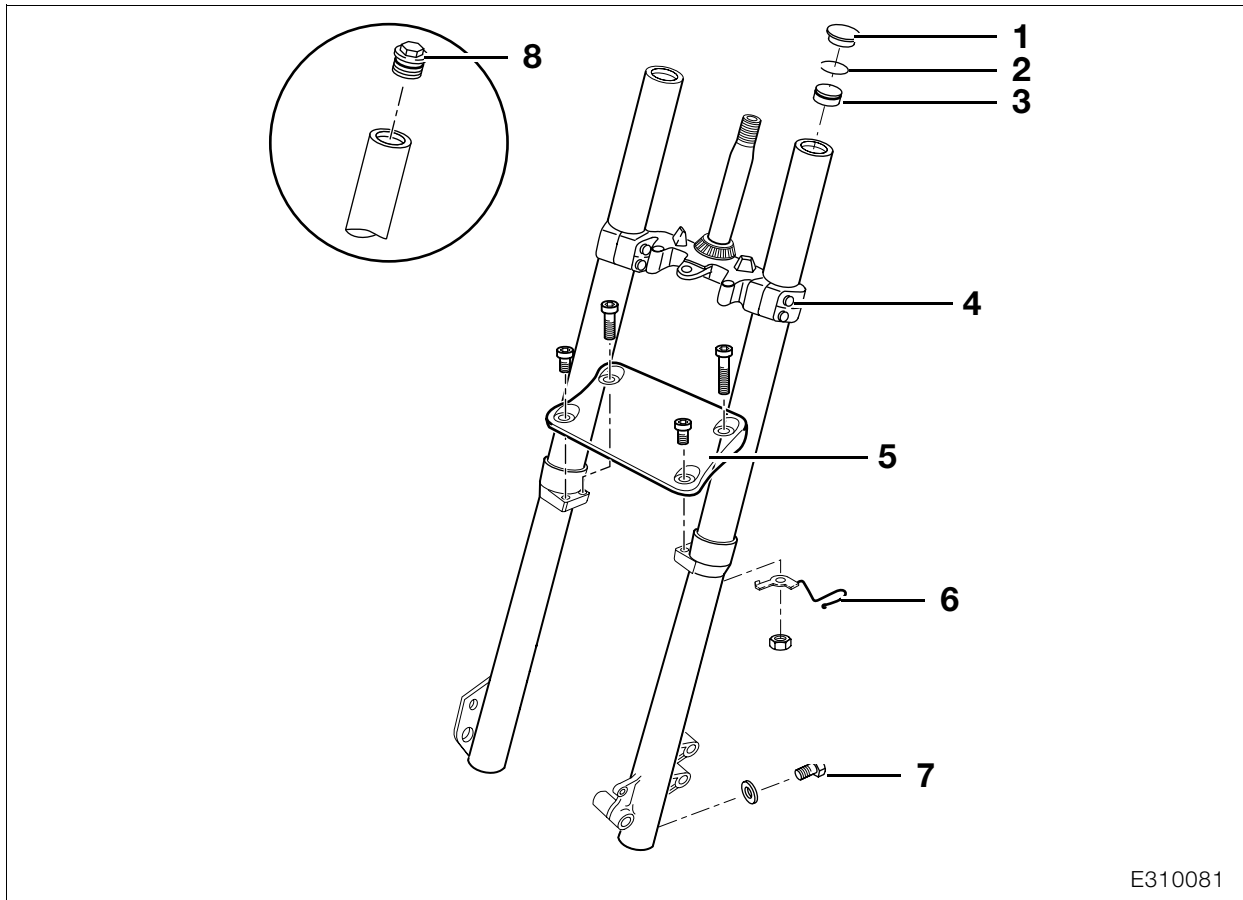
Tightening torques:

Oil drain plug 6 Nm

Damper retaining screw 20 Nm

[Dakar] Screw plugs 25 Nm





E310081

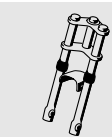
Assembling telescopic fork

- Install fork stabiliser (5), noting positions of the screws (length). Hand-tighten the screws.
- Screw in the quick-release axle all the way, but do not tighten.
- Place lower fork bridge in position. Hand-tighten clamping screws (4).
- Install forks, adjust steering head bearing play and install upper fork bridge (hand-tighten the screws).
- Slacken and retighten screws of fork stabiliser.
- Remove forks.
- Install clamp (6).
- Install fork bridge cover.
- Install horn.
- Remove quick-release axle.



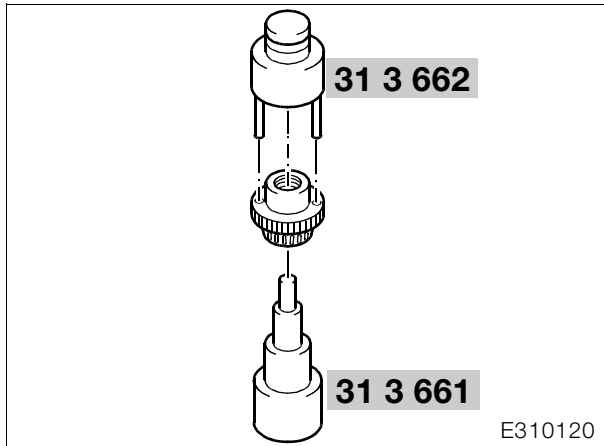
Tightening torques:

Fork stabiliser to fork leg 21 Nm

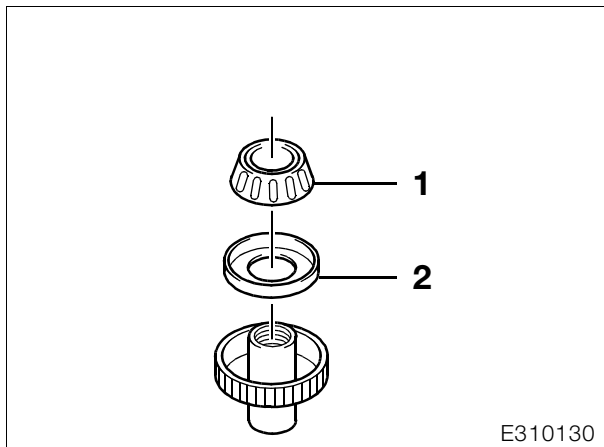


31 42 721 Removing and installing steering head bearing

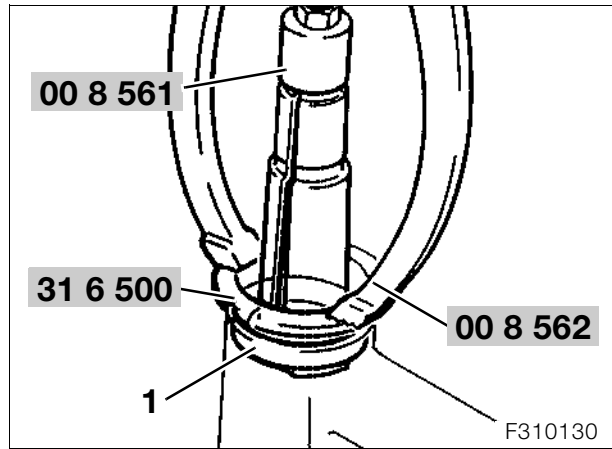
Upper steering head bearing



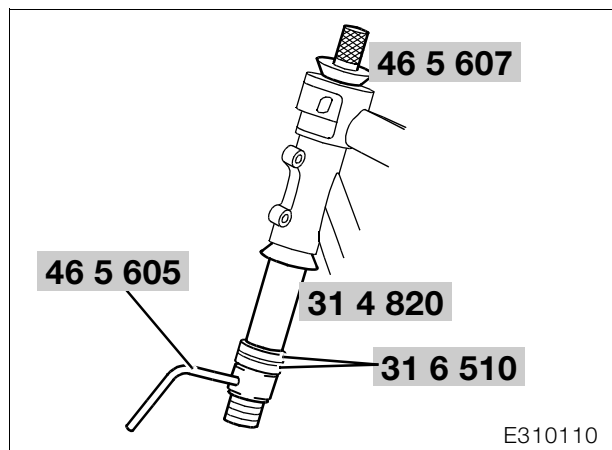
- Without applying heat, press upper taper roller bearing out of round nut, using support, **BMW No. 31 3 661**, and mandrel, **BMW No. 31 3 662**.



- Without applying heat, press in new bearing (1) and new dust cap (2), using a suitable mandrel.



- Pull out bearing outer race (1) with adapter, **BMW No. 00 8 562**, and internal puller, **BMW No. 00 8 561**, and protective ring, **BMW No. 31 6 500**.



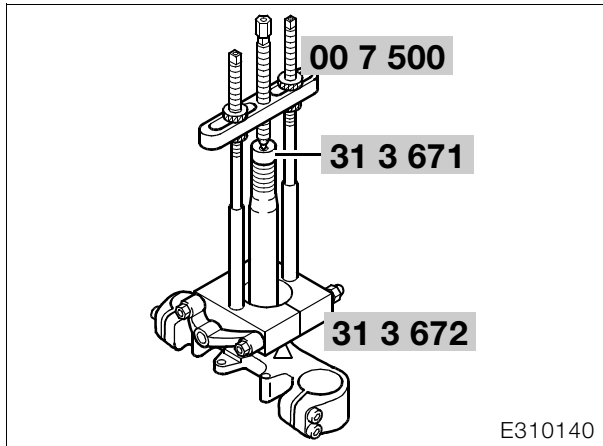
⚠ Important:

Always replace bearing and outer bearing race together.

- Install new bearing outer race using steering head mandrel, **BMW No. 46 5 607**, puller, **BMW No. 31 4 820**, two spacers, **BMW No. 31 6 510**, and lever, **BMW No. 46 5 605**, and make sure the bearing race is correctly seated.

Lower steering head bearing

- The procedures for removing and installing the lower outer bearing race are the same as those for the upper race.



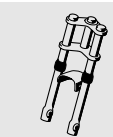
- Use universal puller, **BMW No. 00 7 500**, jaws, **BMW No. 31 3 672**, and thrust piece, **BMW No. 31 3 671**, to pull the bearing off the steering tube.
- Place new dust cap in position.
- Heat the new bearing and place it in position, if necessary driving it fully home with a suitable drift.



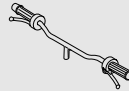
Important:

Before adjusting steering bearing play, allow the fork bridge to cool down.

- Adjust steering bearing play (→ 32.13).



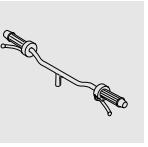
32 Steering



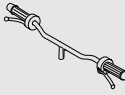
Contents

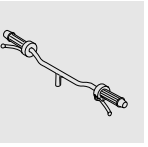
Page

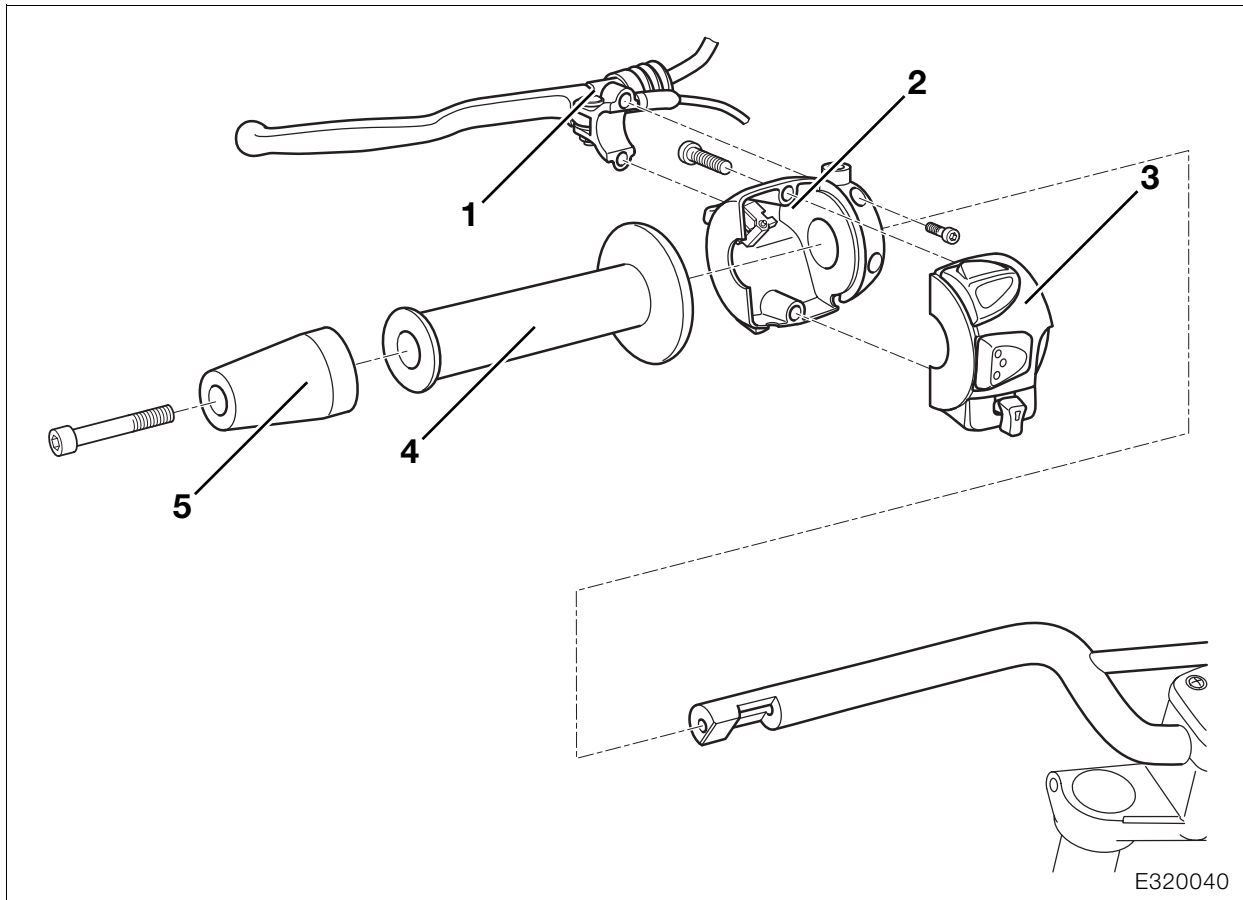
Technical Data	3
Removing and installing left and right handlebar fittings	5
Removing and installing left handlebar fitting	5
Removing and installing clutch switch	6
Removing and installing right handlebar fitting	7
Removing and installing handlebars	9
Removing and installing clutch cable	10
Removing and installing throttle cable	12
Checking and adjusting steering head bearing play, renewing if necessary	13
(Inspections II and III)	13
Checking steering head bearing play	13
Adjusting steering head bearing play	13
Removing and installing left and right handlebar levers	15
Removing and installing left and right handlebar levers	15
Removing and installing right handlebar lever	15



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







Removing and installing left and right handlebar fittings

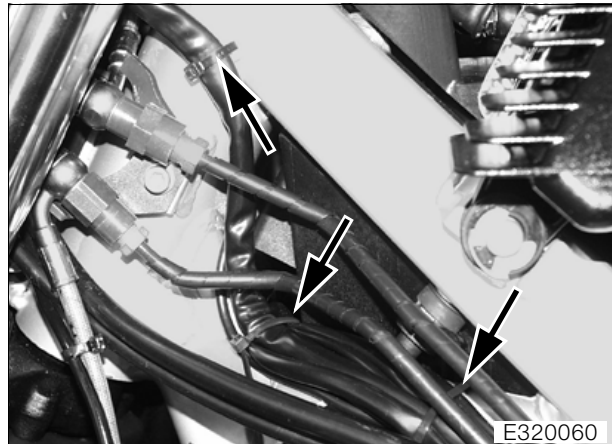


Note:

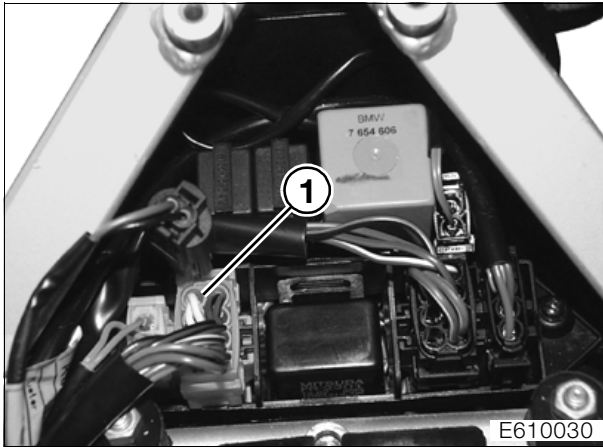
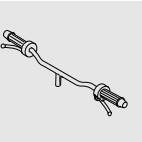
To avoid damage, use a protective apron for the tank, **BMW No. 16 1 600**.

Removing and installing left handlebar fitting

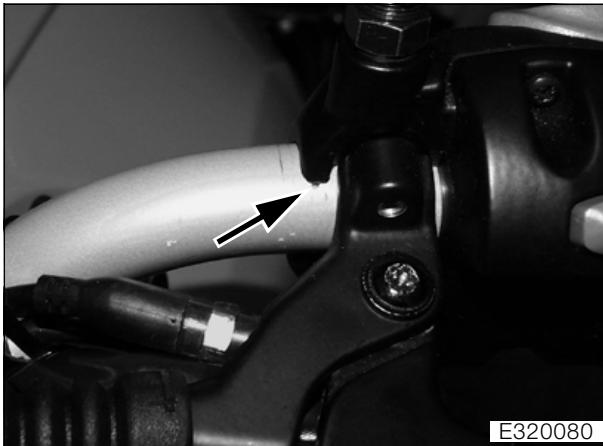
- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers (→ 46.5).
- **[Dakar]** Remove hand protectors (→ 46.8).
- Cut the cable tie at the handlebar.
- Remove cover (3) from housing (2).
- Remove clutch fitting (1).
- Remove handlebar weight (5).
- Remove rubber grip (4).



- 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.

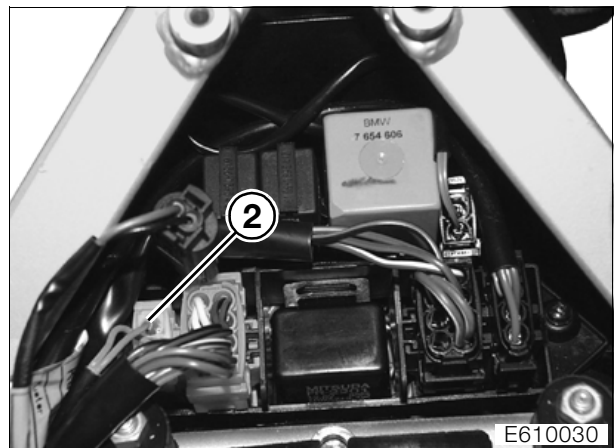


Tightening torques:

- 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 (→ 46.5).
- 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.

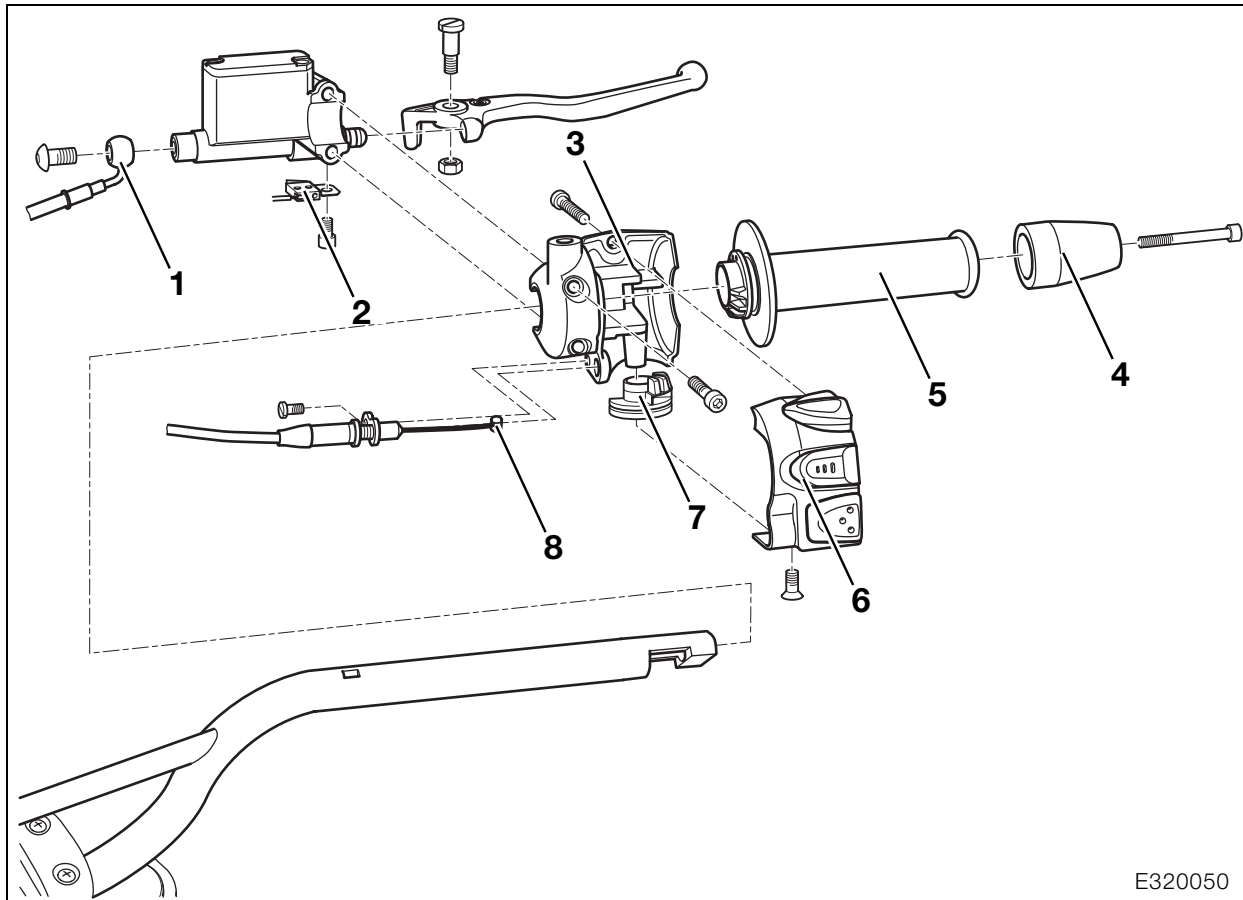


- Disconnect plug at clutch switch (2).
- Push the cover over the cylinder head slightly to one side and remove the connector.
- Installation is the reverse of the removal procedure.



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

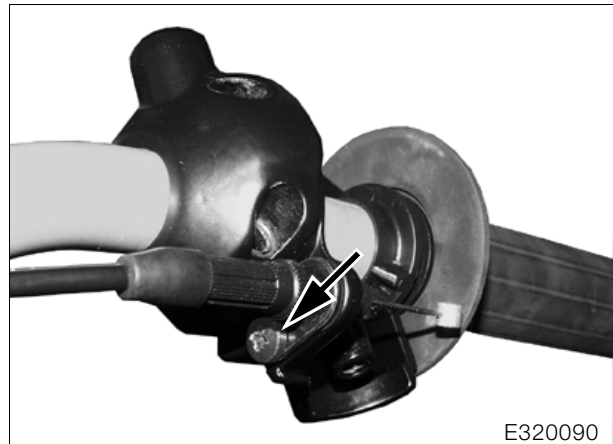
- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers (→ 46.5).
- **[Dakar]** Remove hand protectors (→ 46.8).
- Cut the cable tie at the handlebar.



Important:

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

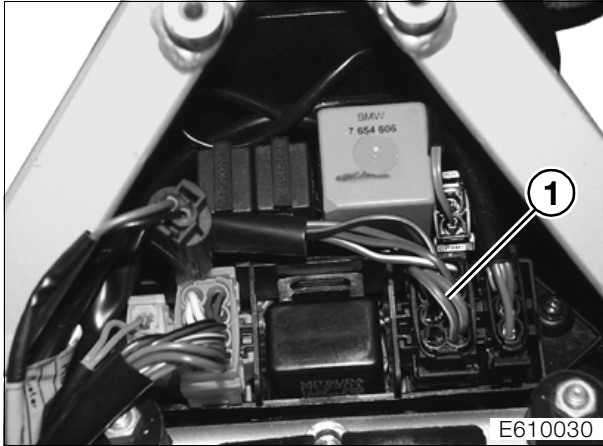
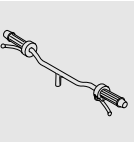
- Disconnect and seal brake hose (1).
- Remove brake microswitch (2).
- Release cover (6) and leave it dangling on the cable.
- Remove throttle-cable roller (7) and disengage throttle-cable nipple (8).
- Remove brake fitting.



E320090

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

⚠ Important:

Top up brake fluid and bleed brake system.

📄 Note:

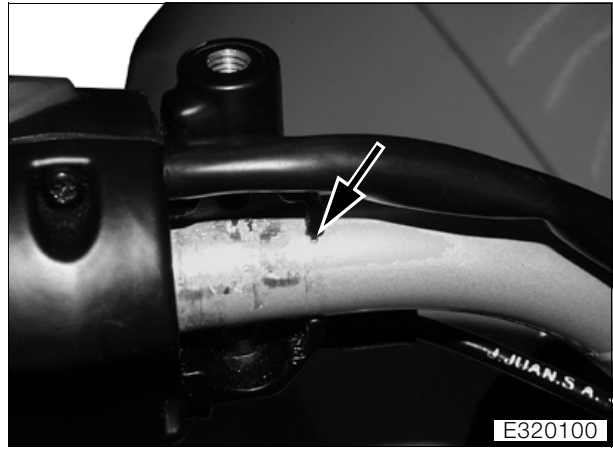
Before assembling, grease the handlebar end and nipple mount (arrow) lightly with **Shell Retinax EP2**.

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

📄 Note:

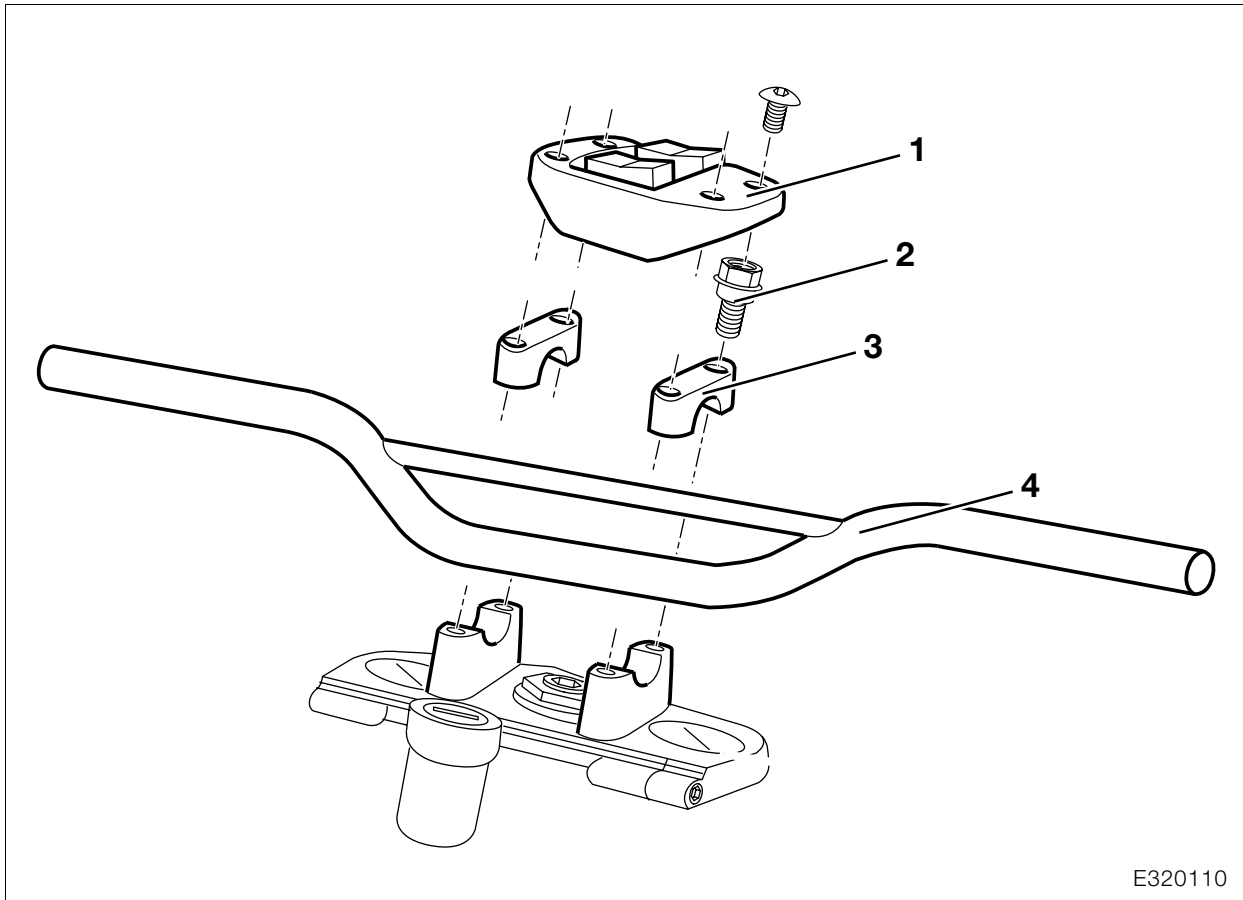
The position of the handlebar fittings is indicated by a punch mark (arrow) on the handlebar.

Throttle cable play..... approx. 1 mm (0.040 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

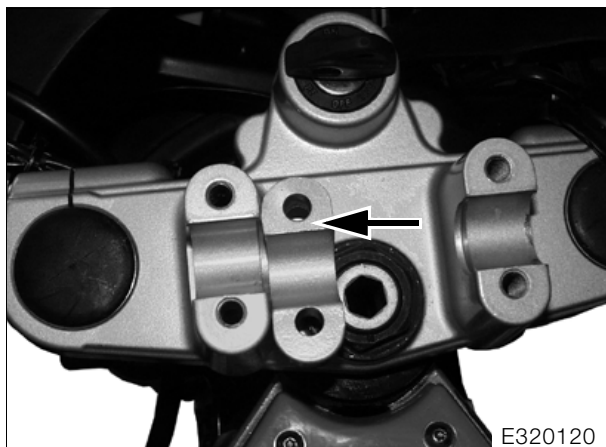
32 71 008 Removing and installing handlebars

- Remove left handlebar fitting (→ 32.5).
- Remove right handlebar fitting (→ 32.7).
- Remove impact pad (1).
- Loosen clamping screws (2).
- Remove handlebars (4) together with clamping blocks (3).
- Installation is the reverse of the removal procedure: pay particular attention to the following.

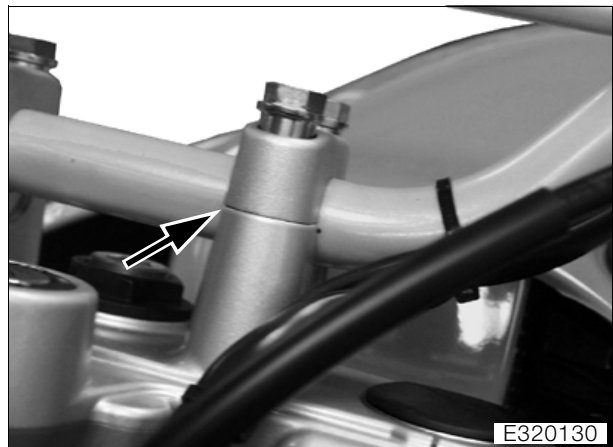


Important:

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



E320120



E320130



Note:

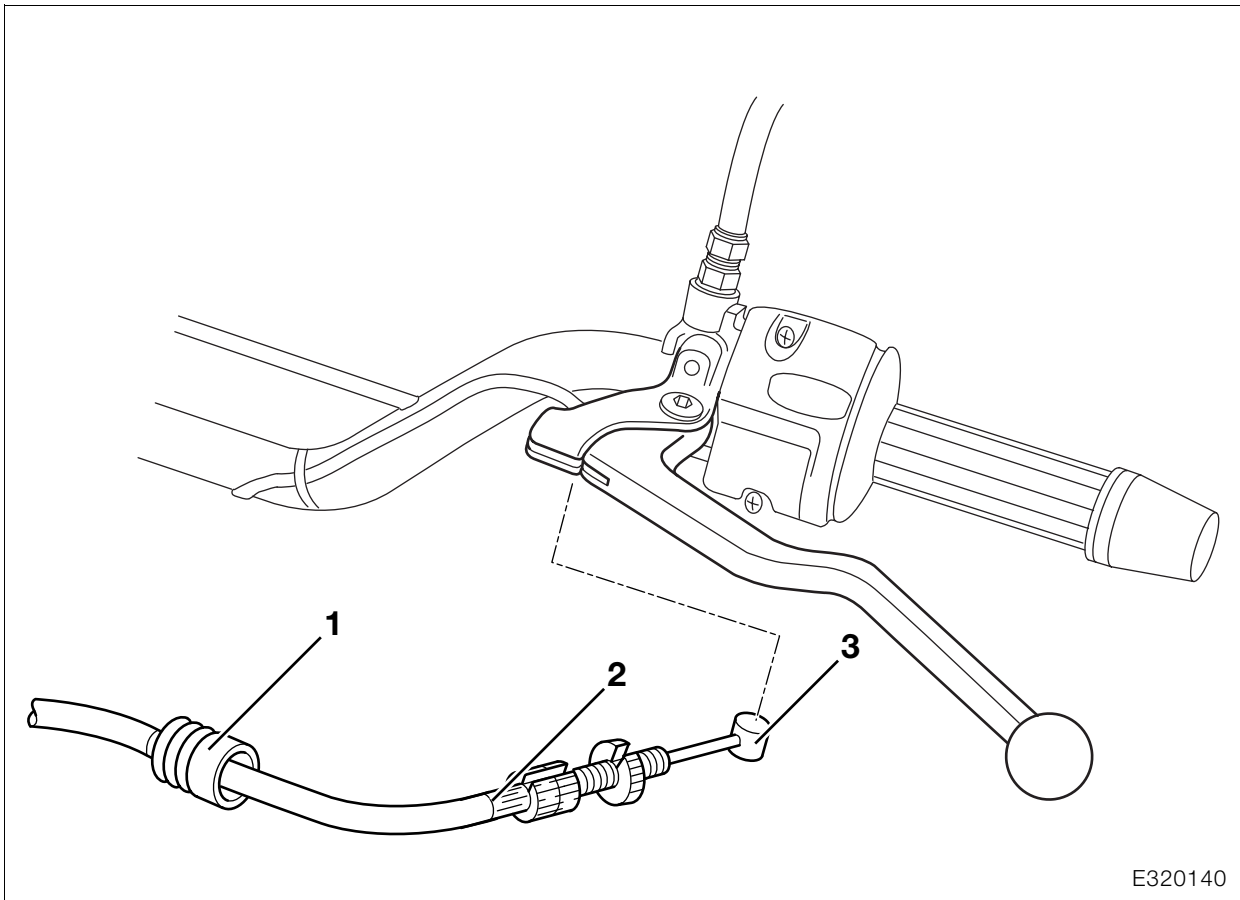
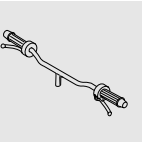
The position of the handlebar is indicated by a punch mark (arrow) on the handlebar.

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



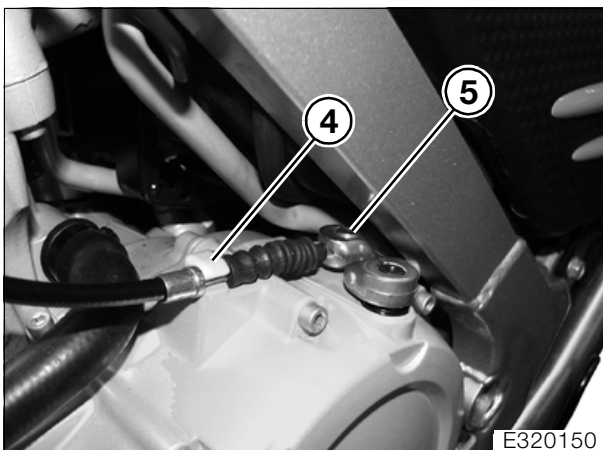
Tightening torques:

Handlebars to fork bridge
(apply Optimoly TA to thread) 21 Nm



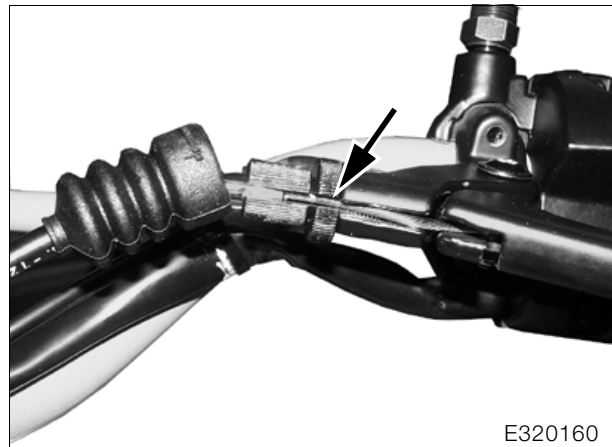
E320140

32 72 330 Removing and installing clutch cable



E320150

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

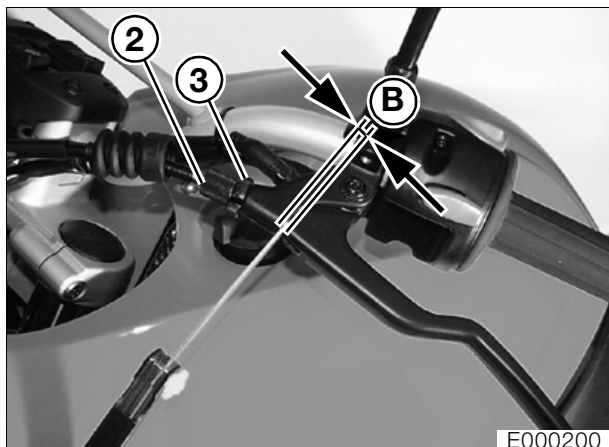


E320160

- 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.

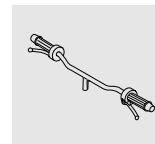
 **Important:**

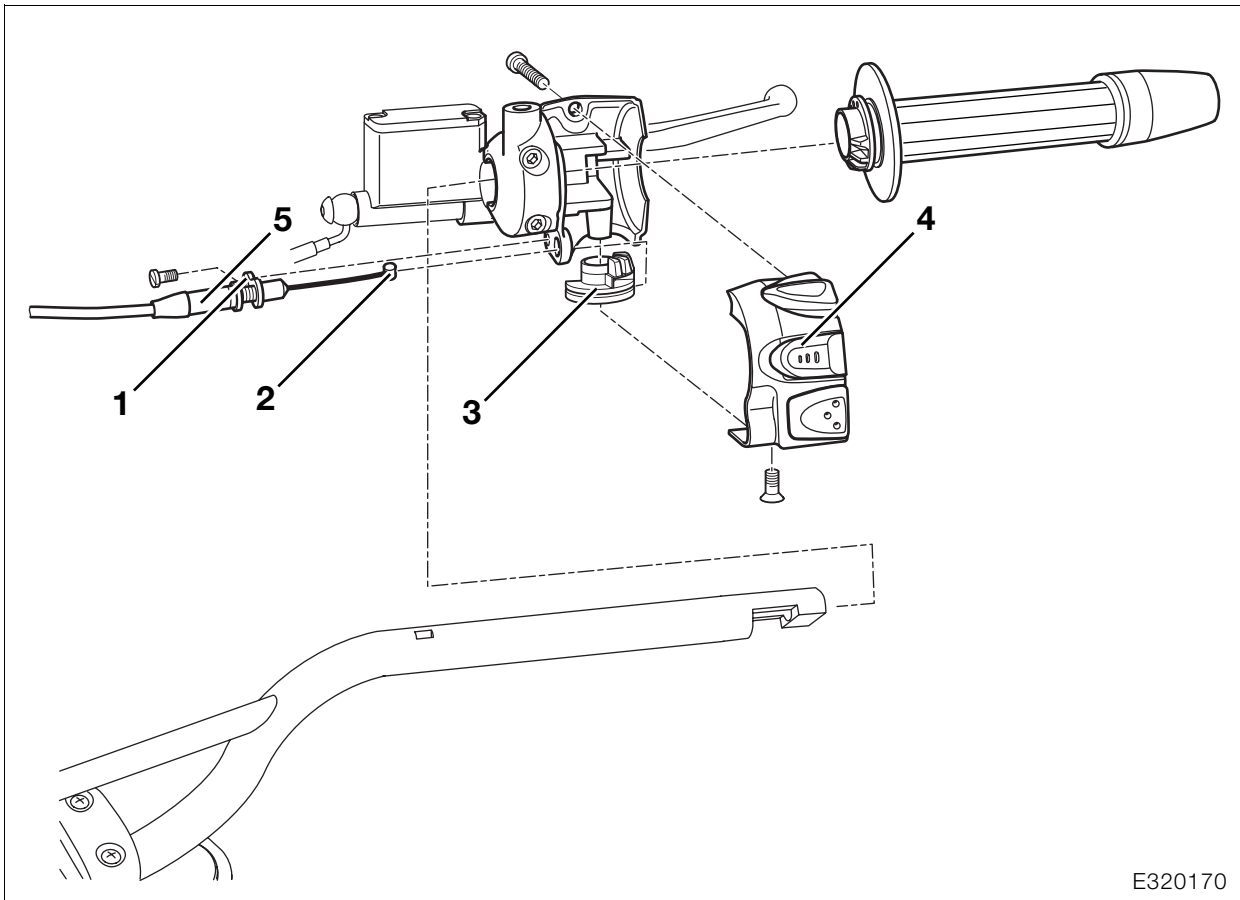
Make sure that the clutch cable is not kinked when installed.



- 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 (0.040...0.08 in)

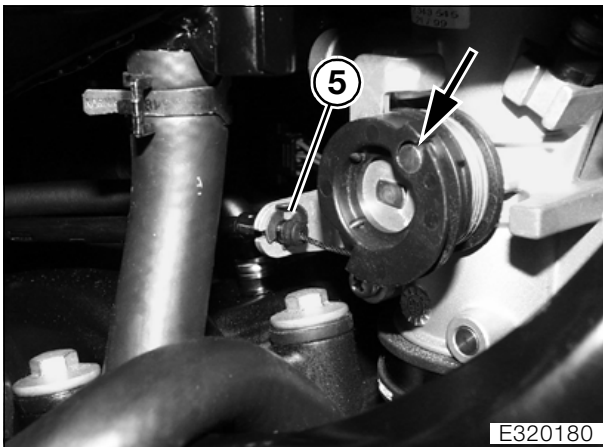




E320170

32 72 305 Removing and installing throttle cable

- Remove seat.
- Remove left cover (→ 46.5).



E320180

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

- 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.



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 (0.040 in)



Tightening torques:

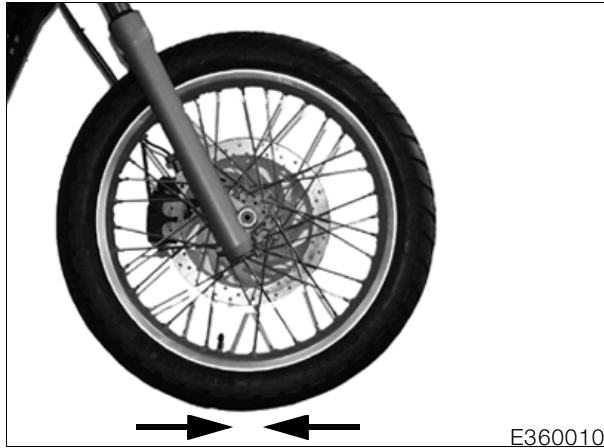
Cover of multi-function switch 1 Nm

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

- Relieve load on front wheel.



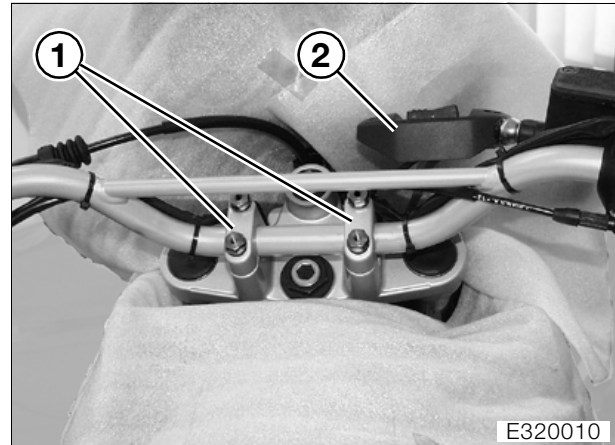
E360010

- Move fixed fork tubes forward (arrows).
- Adjust the steering head bearing if play is perceptible.
- Swing the fork legs all the way through their full range of travel and check for catches.

32 00 454 Adjusting steering head bearing play

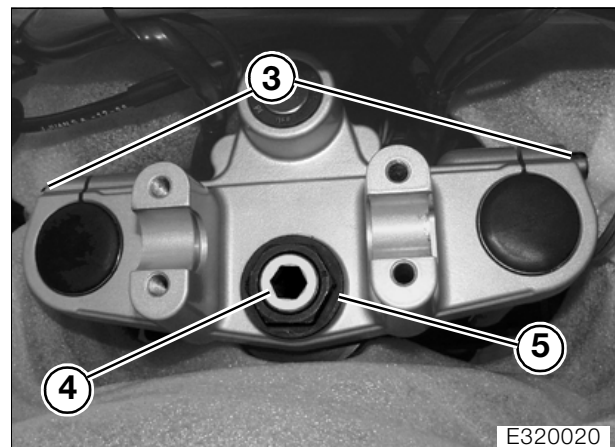
⚠ Important:

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



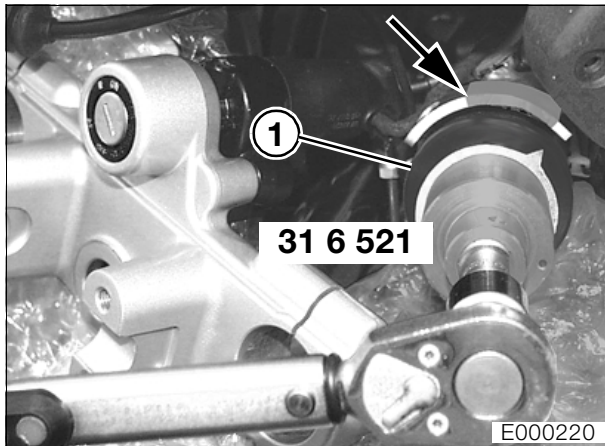
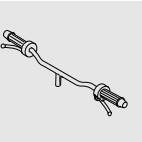
E320010

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



E320020

- 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 (1.57 in) arc around the circumference of the locking plate at the steering head, with adhesive tape or similar (arrow).
- Align the mark on pin-wrench adapter, **BMW No. 31 6 521**, with the right-hand end of the marked arc.



Note:

40 mm (1.57 in) around the circumference of the locking plate corresponds to an angle of rotation of 60 °.

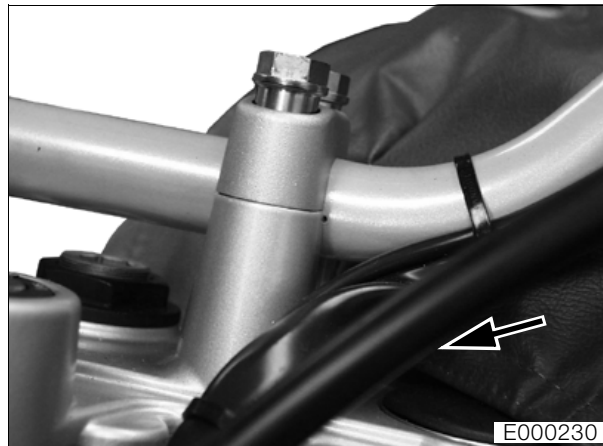
- Turn the round nut clockwise until the pointer on pin-wrench adapter, **BMW No. 31 6 521**, reaches the left-hand end of the marked arc.
- Remove the mark/adhesive tape from the locking plate.



Important:

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.
- 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 catches are perceptible when the handlebars are moved to and fro, renew the steering head bearings.

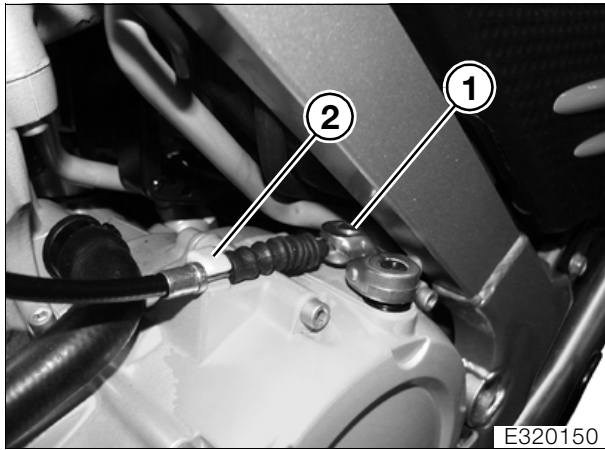


Tightening torques:

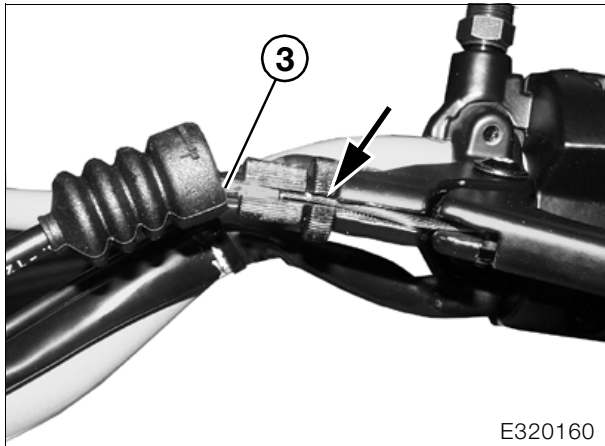
Initial torque, round nut	25 Nm
Back off through angle of rotation	60 °
Counter-tube to steering head bearing	65 Nm
Hexagon nut to counter-tube	65 Nm
Clamp screws at fork bridge	21 Nm
Handlebars to fork bridge.....	21 Nm

Removing and installing left and right handlebar levers

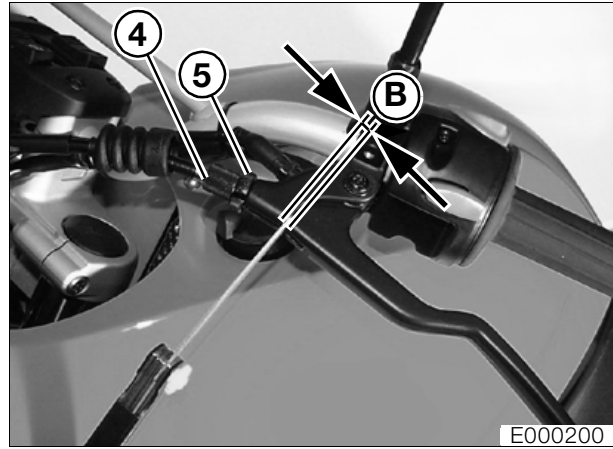
32 72 070 Removing and installing left and right handlebar levers



- 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.
- Remove pivot pin of 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).

Distance "B" 1.0...2.0 mm (0.040...0.08 in)

Tightening torques:

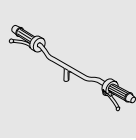
Locknut 5 Nm
Pivot pin of clutch lever 3 Nm

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:

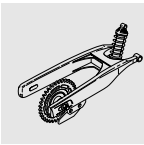
Locknut of handbrake lever 7 Nm
Pivot pin of handbrake lever 7 Nm



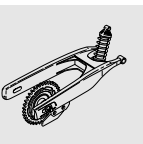
33 Rear wheel drive

Contents

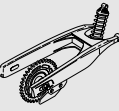
Page

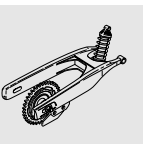


Technical Data	3
Removing and installing suspension strut	5
Removing and installing rear swinging fork	6
Removing and installing needle roller races in rear swinging fork	7
Removing needle roller races	7
Installing needle roller races	8
Removing and installing reaction links	8
Removing and installing needle roller bearing in reaction link	9
Removing needle roller bearing	9
Installing needle roller bearing	9
Removing and installing angled lever	10
Removing and installing needle roller bearings and needle roller races in angled lever	10
Removing needle roller bearings and needle roller races	10
Installing needle roller bearings and needle roller races	11



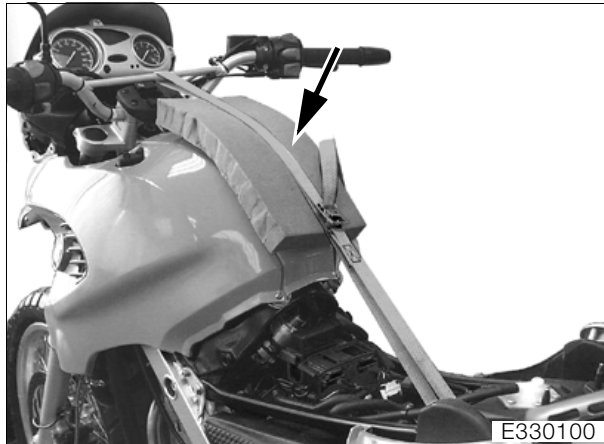
Technical Data		F 650 GS	F 650 GS Dakar
Rear suspension			
Suspension strut		Central suspension strut pivoted to lever system. Spring base and rebound damping continuously adjustable.	
Suspension travel			
at wheel	mm (in)	165 (6.50)	210 (8.268)
at suspension strut	mm (in)	47.5 (1.87)	59.5 (2.34)
Swinging fork			
Type		Box-section fork	
Swinging fork length	mm (in)	564 (22.2)	





33 53 000 Removing and installing suspension strut

- Remove exhaust manifold (→ 18.6).
- Secure front wheel in position.



⚠ Important:

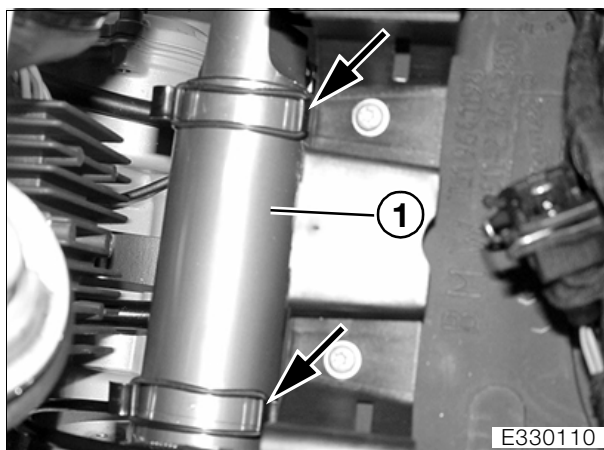
Protect trim panels with a material such as foam rubber (arrow) to prevent damage.

- Use a strap to secure the rear frame to the tie bar of the handlebars.

📄 Note:

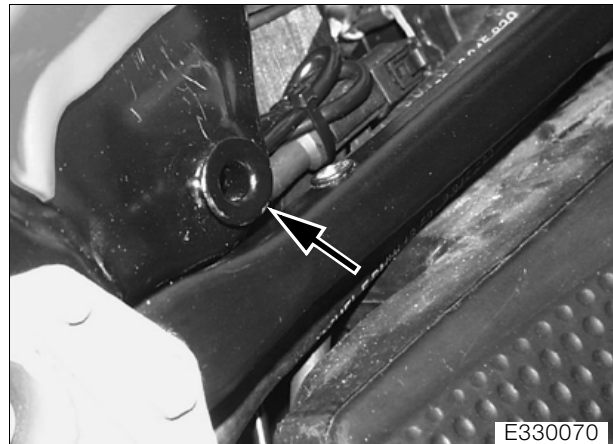
Do not unplug the control unit.

- Remove the BMS control unit from the holder.
- Remove the fuse box.



- **[Dakar]** Remove rubber element from holder (arrow).
- **[Dakar]** Remove reservoir (1) from holder and lower it to the right.

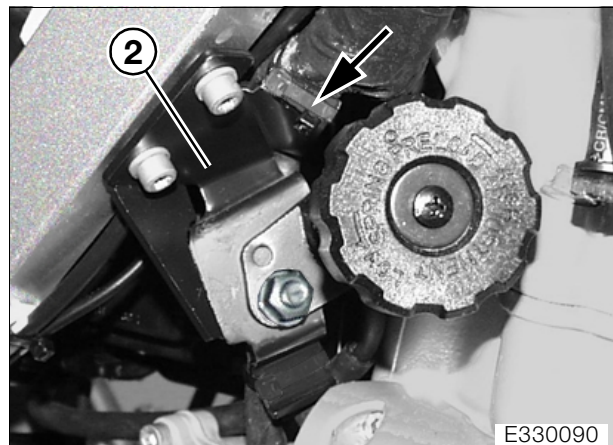
- Remove brake fluid reservoir from rear frame.
- Remove lower fasteners securing rear frame to main frame.
- Slightly pretension the strap.
- Slacken upper fasteners securing rear frame to main frame.



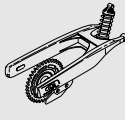
⚠ Important:

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 (2).
- 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

- Remove ABS sensor (→ 34.15).
- Remove rear wheel (→ 36.7).



E330080

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



Warning:

Use a new screw and nut to secure the spring strut to the frame (1).



Note:

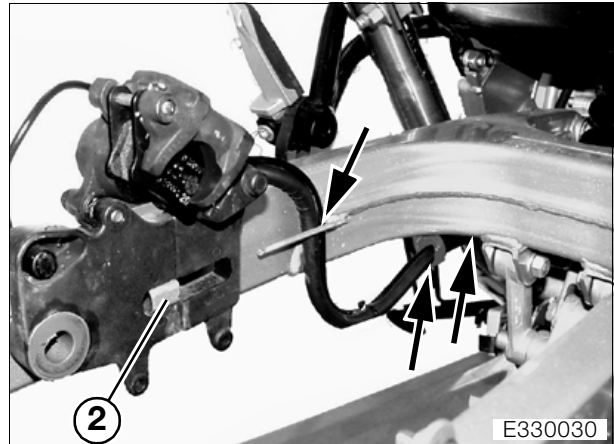
When lowering the rear frame, make sure that the brake line is routed between the front section of the rear mudguard and the rear frame.

- 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 rear frame securing screws, coat threads with **Loctite 2701** and install.



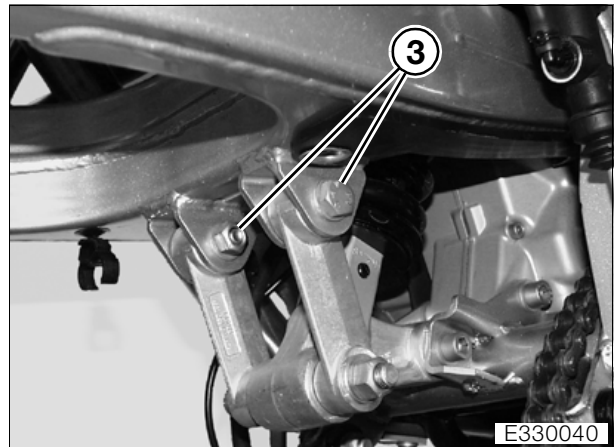
Tightening torques:

Suspension strut to frame	58 + 45° 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



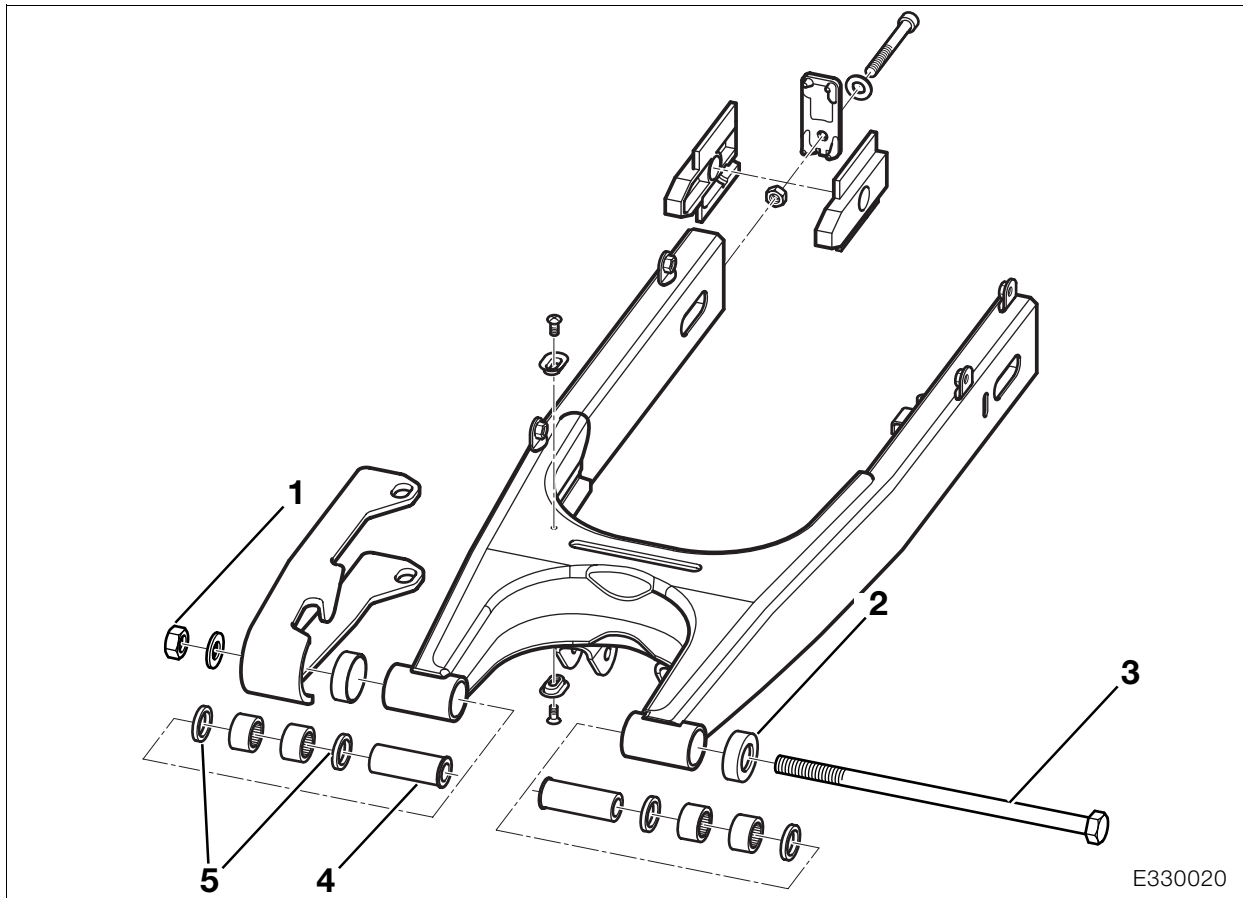
E330030

- Remove the brake caliper from guide (2) and remove brake hose from clips (arrows).



E330040

- Remove the fasteners securing the struts to swinging fork (3).



- Remove nut (1) at swinging-fork pivot shaft (3).
- Remove swinging-fork pivot shaft (3).
- Pull the swinging fork 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.

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 fork.



Note:

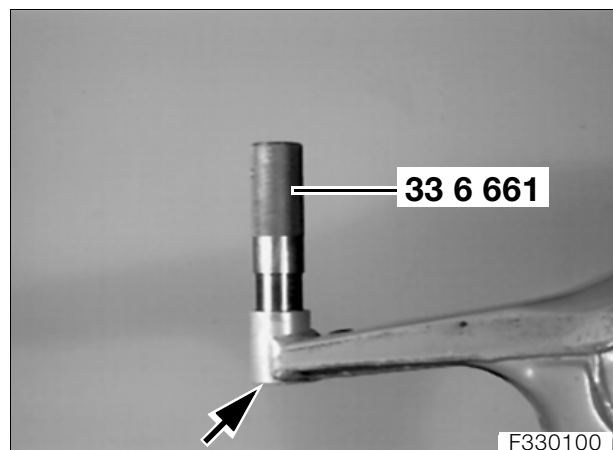
Grease needle bearings with **Shell Retinax EP2**.

- Adjust chain tension (→ 00.46).



Tightening torques:

Swinging-fork pivot shaft.....	100 Nm
Reaction link to swinging fork.....	41 Nm
Rear quick-release axle.....	100 Nm
Wheel cover bracket to swinging fork.....	9 Nm
ABS sensor to holder.....	9 Nm

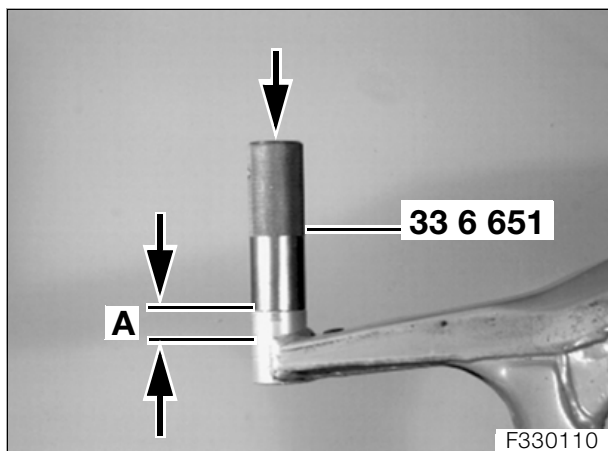


Important:

Protect mating faces (arrow) of the swinging fork from scratches by covering with masking tape or similar.

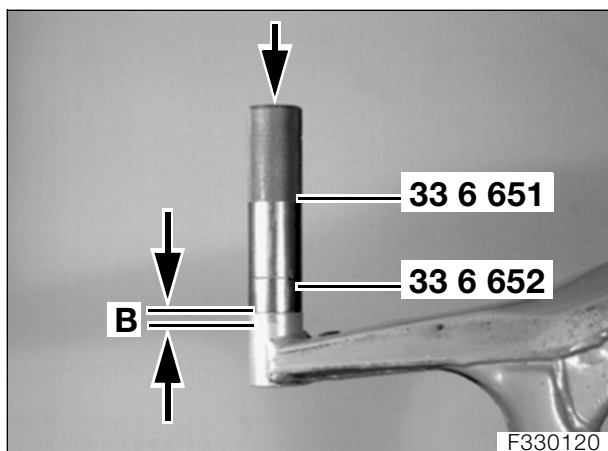
- Drive needle roller races out of rear swinging fork with drift, **BMW No. 33 6 661**.

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**.

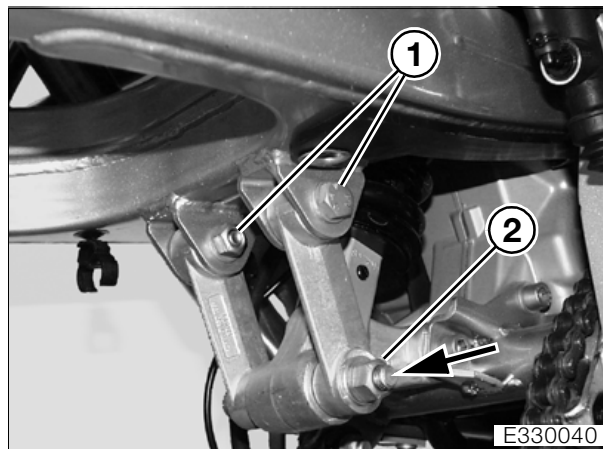
Press-in depth "A" 36.5 mm (1.44 in)



- 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 fork.

Press-in depth "B" 3 mm (0.12 in)

33 53 220 Removing and installing re-action links



- Remove nut (2).
- Slightly raise the rear wheel and pull double end stud (arrow) to the left to remove.
- Remove the fasteners securing the links to swinging fork (1).
- Remove the reaction links.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

Grease needle bearings with **Shell Retinax EP2**.



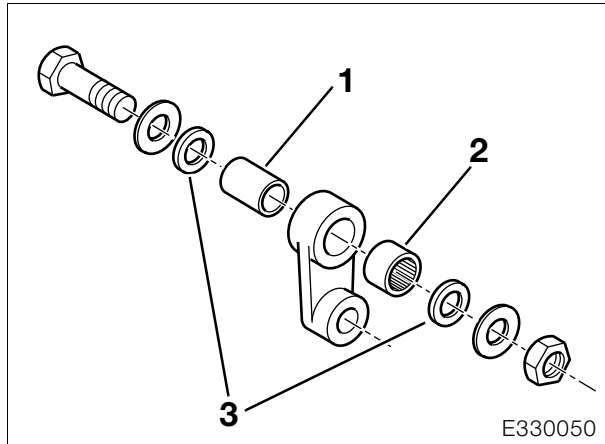
Tightening torques:

Reaction link to swinging fork 41 Nm
 Link to angled lever 71 Nm

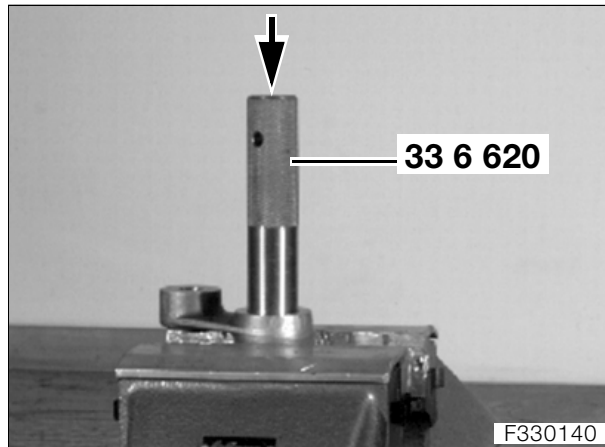
33 53 620 Removing and installing needle roller bearing in reaction link

Removing needle roller bearing

- Remove left and right reaction links.



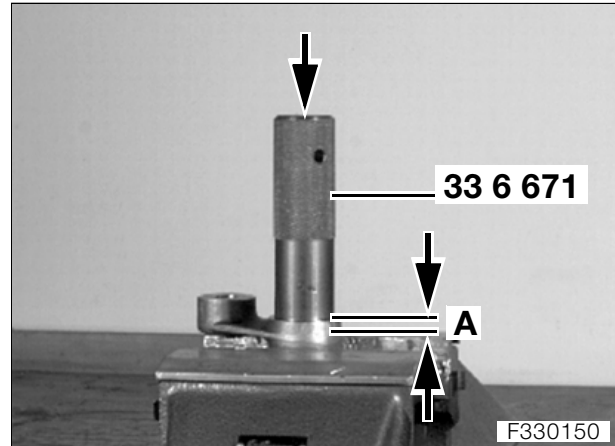
- Remove bearing bush (1).
- Lever out sealing rings (3) with screwdriver.



- Drive out needle roller bearing (2) with drift, **BMW No. 33 6 620**.

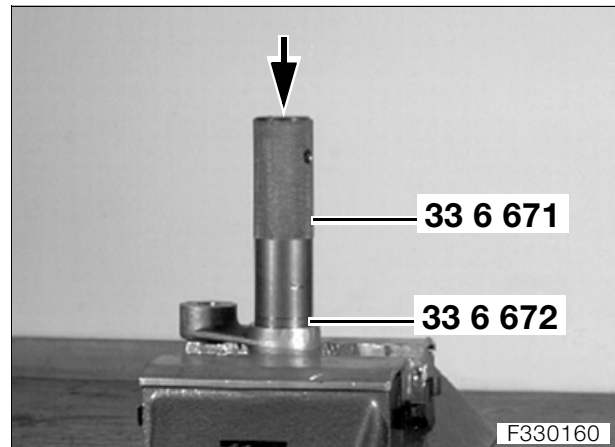
Installing needle roller bearing

- Heat bearing seats to 100 °C (212 °F).

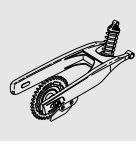


- Press in needle roller bearing (2) with drift, **BMW No. 33 6 671**.

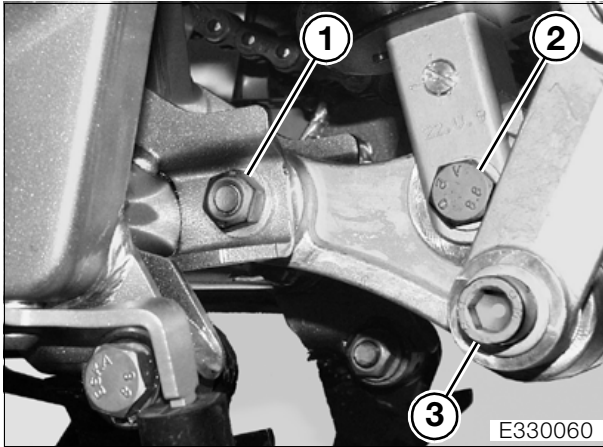
Press-in depth "A" 4.5 mm (0.18 in)



- 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 link to the angled lever (3).
- Slightly raise the rear wheel and remove 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.



Warning:

Use a new screw and nut to secure the angled lever to the frame (1).



Note:

Grease needle bearings with **Shell Retinax EP2**.



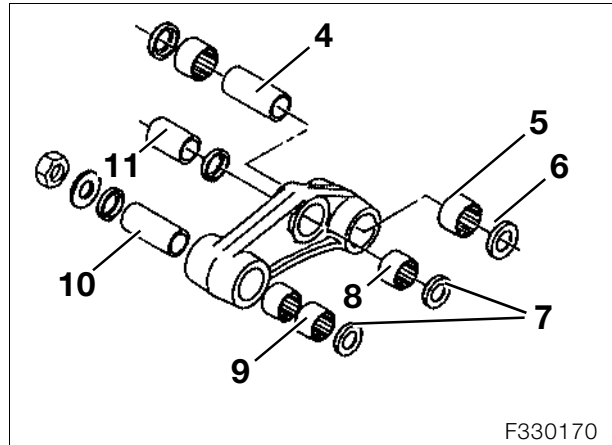
Tightening torques:

Angled lever to frame 58 Nm + 45°
 Angled lever to spring strut 47 Nm
 Angled lever to reaction link 71 Nm

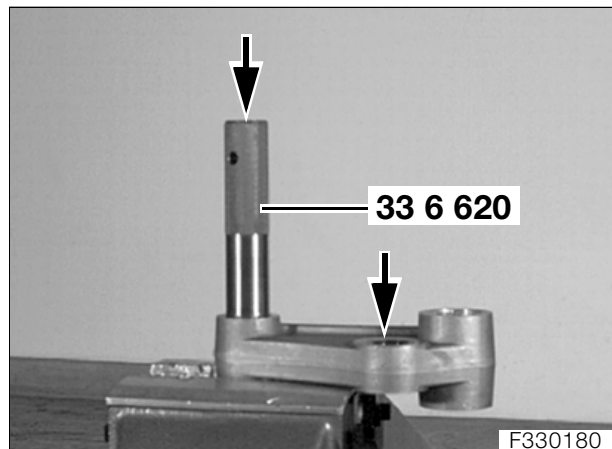
33 53 610 Removing and installing needle roller bearings and needle roller races in angled lever

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.



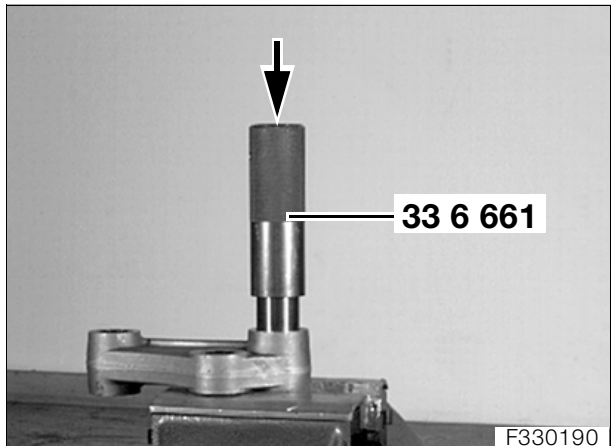
Note:

To simplify driving out, heat the angled lever to 100 °C (212 °F).

Use temperature measuring device,

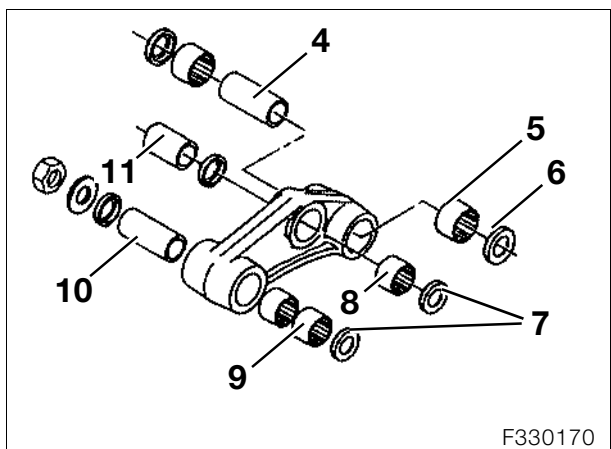
BMW No. 00 1 900, to check heat rise.

- Drive out needle roller bearings (8, 9) with drift, **BMW No. 33 6 620**.

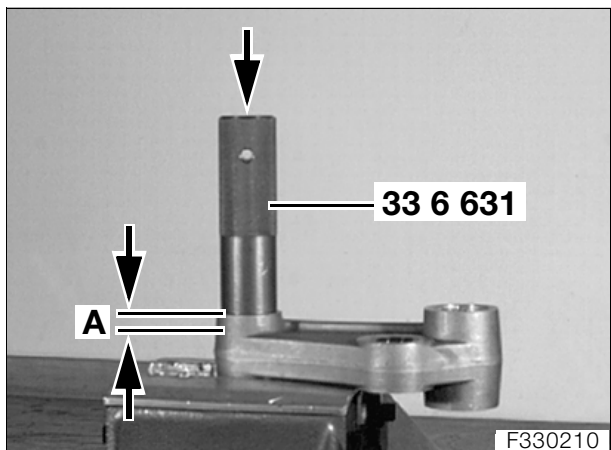


- Drive out needle roller races (5) with drift, **BMW No. 33 6 661**.

33 53 Installing needle roller bearings and needle roller races

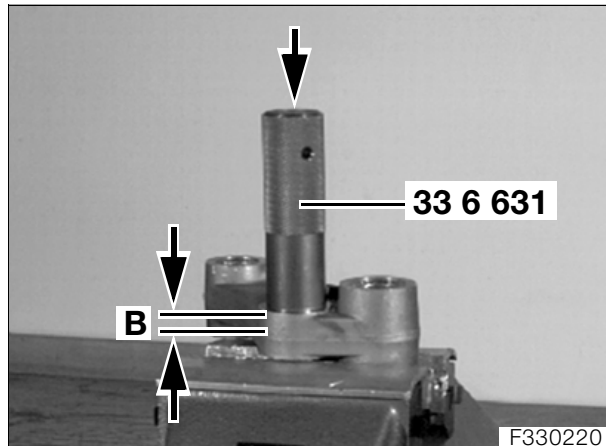


- Heat bearing seats to 100 °C (212 °F).



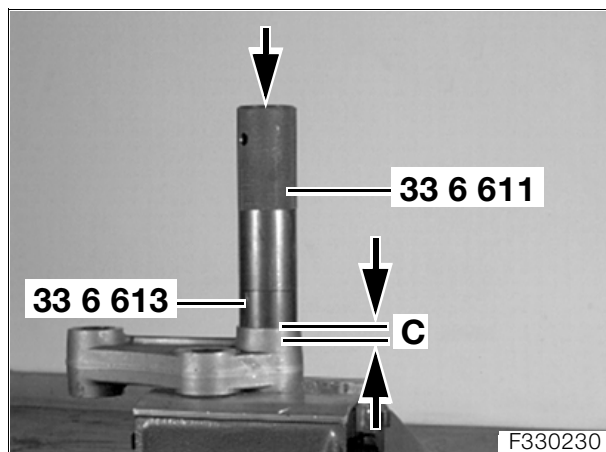
- Drive in needle roller bearing (9) with drift, **BMW No. 33 6 631**, working from both sides.

Press-in depth "A" 4 mm (0.16 in)



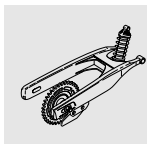
- Press in needle roller bearing (8) with drift, **BMW No. 33 6 631**.

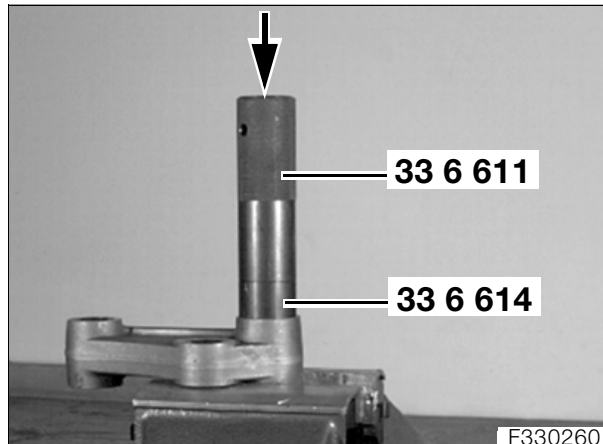
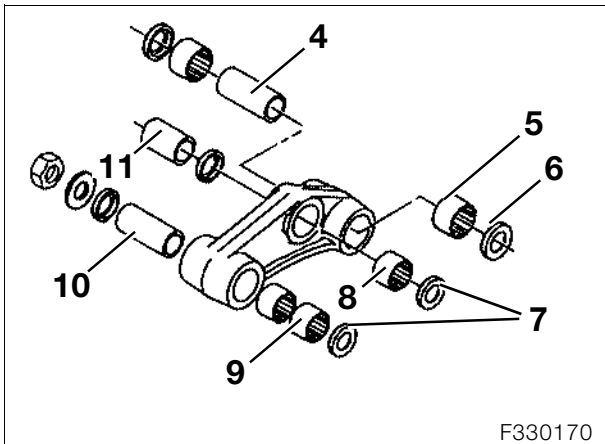
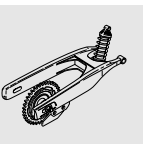
Press-in depth "B" 4 mm (0.16 in)



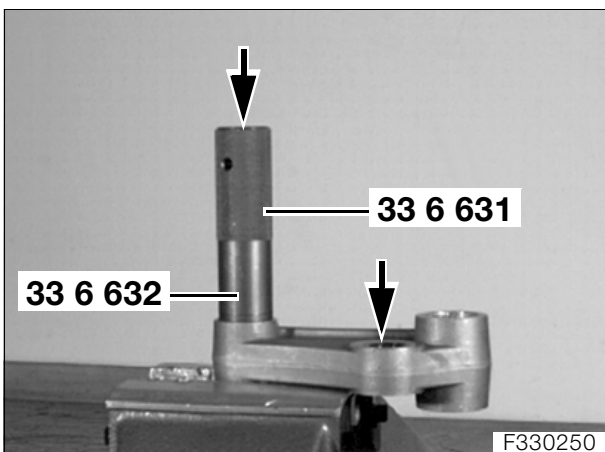
- Drive in needle roller races (5) with drift, **BMW No. 33 6 611**, and spacing sleeve, **BMW No. 33 6 613**, working from both sides.

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).



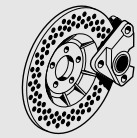
- Press in sealing rings (7) with drift, **BMW No. 33 6 631**, and spacing ring, **BMW No. 33 6 632**.


34 Brakes

Contents

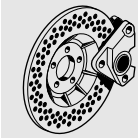
Page

Technical Data	3
Removing and installing front brake caliper	5
Removing and installing front brake pads (⇒ 00.39)	5
Removing and installing front brake pistons	6
Removing and installing front brake disc	7
Checking brake disc for wear (⇒ 00.40)	7
Checking front brake disc for lateral runout	7
Removing and installing rear brake caliper	8
Removing and installing rear brake pads (⇒ 00.40)	8
Removing and installing rear brake pistons	9
Removing and installing rear brake disc	10
Checking brake disc for wear (⇒ 00.40)	10
Checking rear brake disc for lateral runout	10
Replacing primary sealing boot, front brake master cylinder (⇒ 00.44)	10
Removing and installing front brake master cylinder	11
Removing and installing handbrake lever (⇒ 32.15)	11
Replacing primary sealing boot, rear brake master cylinder (⇒ 00.45)	11
Removing and installing rear brake master cylinder	12
Removing and installing footbrake lever	13
Checking play at piston thrust rod, adjusting if necessary	13
Checking play at piston thrust rod	13
Adjusting play at piston thrust rod	14
Removing and installing front ABS sensor	14
Removing and installing front ABS sensor ring	15



Removing and installing rear ABS sensor	15
Removing and installing rear ABS sensor ring	16
Removing and installing ABS control unit	16
Removing and installing front brake lines/hoses (with ABS)	17
Removing and installing brake lines	17
Removing and installing front brake hoses	18
 Removing and installing rear brake lines/hoses (with ABS)	19
Removing and installing brake lines	19
Removing and installing brake hose	20
Checking/adjusting front ABS sensor gap	20
Adjusting ABS sensor gap	20
Checking and adjusting gap of speed/rear ABS sensor	21
Adjusting ABS sensor gap	21

Technical Data		F 650 GS / GS Dakar
Brakes		
Brake fluid		DOT 4
Brake actuation		hydraulic
Front wheel		
Front brake		2-piston floating caliper 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 (7.13)
Minimum lining thickness	mm (in)	1 (0.04)
Piston dia. in brake caliper	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 caliper 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 (4.46)
Minimum lining thickness	mm (in)	1 (0.04)
Piston dia. in brake caliper	mm (in)	34 (1.34)
Piston dia. in footbrake cylinder	mm (in)	11 (0.43)
Brake pads		Organic



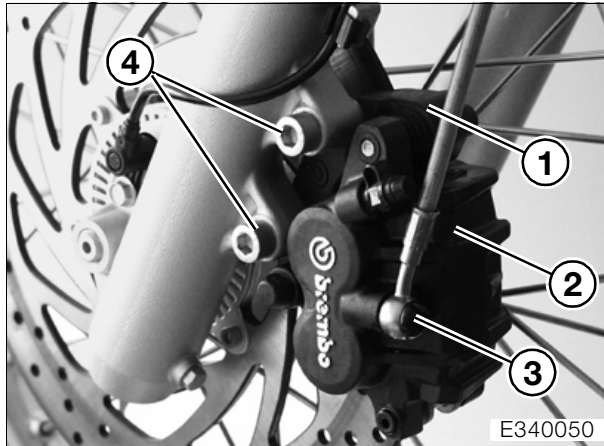


34 11 021 Removing and installing front brake caliper

Important:

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

- Press the brake caliper against the brake disc in order to force the piston back.



- Disconnect brake line (3) from brake caliper and seal the line.
- Loosen retaining screws (4) for brake support bracket.
- Carefully pull brake carrier (1) with brake caliper (2) off the brake disc.

Important:

Do not damage brake pads.

- Installation is the reverse of the removal procedure.



Note:

Replace sealing rings for brake line.



Important:

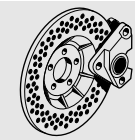
Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

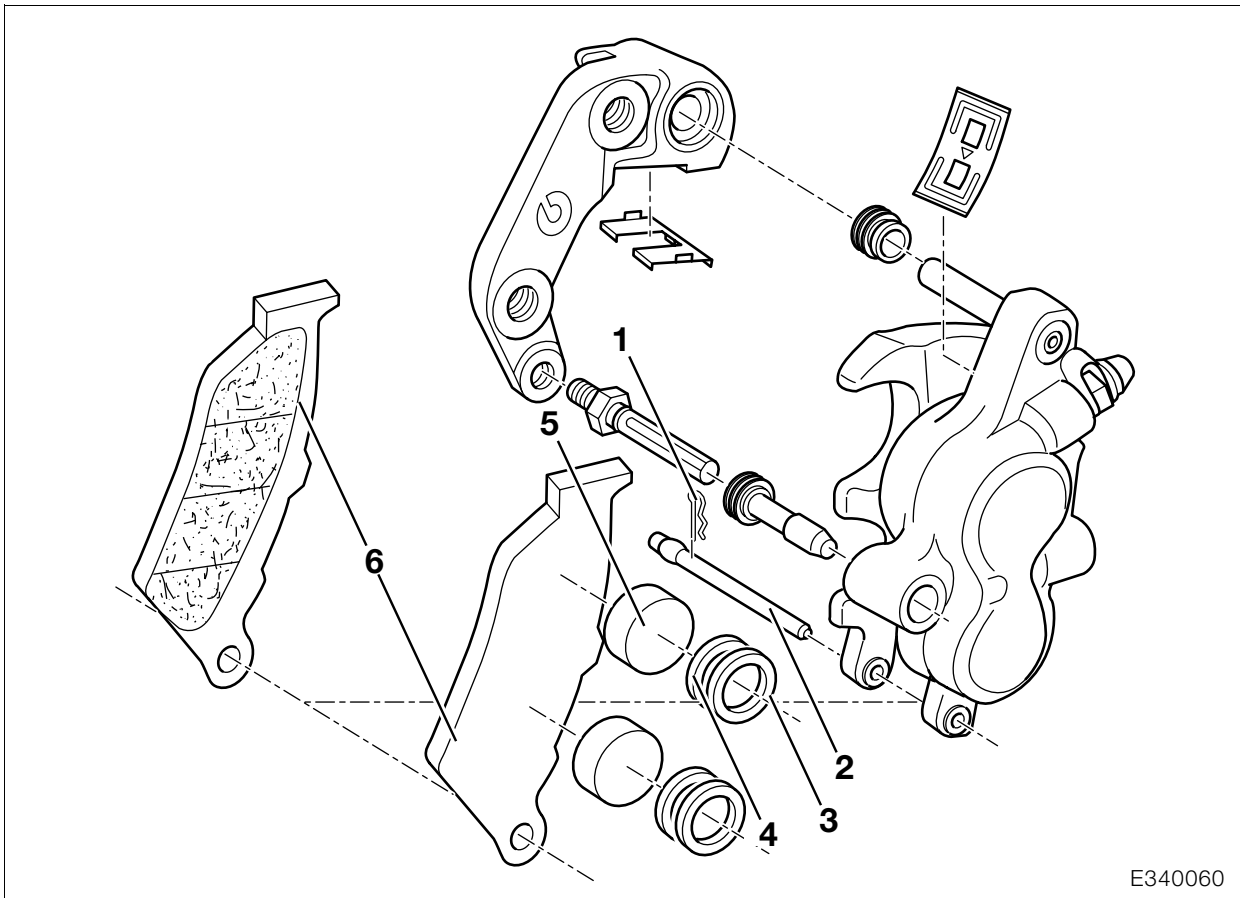
If the **BMW MoDiTeC** is not used there is a danger of residual air remaining in the control circuits of the ABS system.



Tightening torque:

Brake caliper to fork slider tube..... 41 Nm
Brake line to brake caliper..... 18 Nm

34 11 008 Removing and installing front brake pads (→ 00.39)



E340060

34 11 521 Removing and installing front brake pistons

- Remove front brake caliper.
- 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 caliper.

Important:

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 cylinder bores.
- Examine the brake caliper 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.

Important:

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.

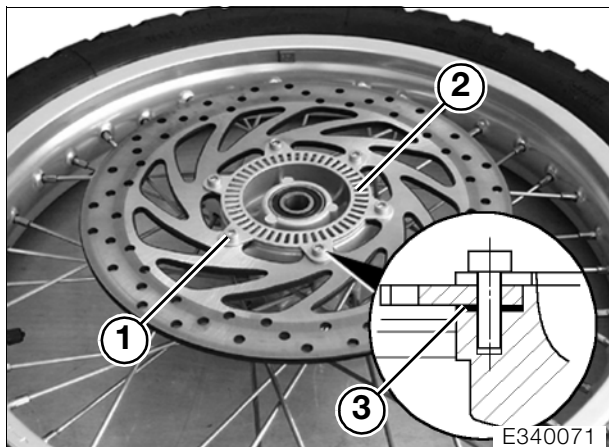
34 11 809 Removing and installing front brake disc



Important:

Do not operate the brake with the wheel removed.

- Remove front wheel (→ 36.5).



Note:

Retaining screws (1) are secured with **Loctite 243** and should be heated if necessary before removal.

- Remove retaining screws (1) from brake disc.
- **[ABS]** Remove sensor ring (2).
- Remove brake disc.
- Remove separators (3).



Important:

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.
- Install new separators (3).
- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 243** and install the screws.
- Check gap of ABS sensor 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
(→ 00.40)

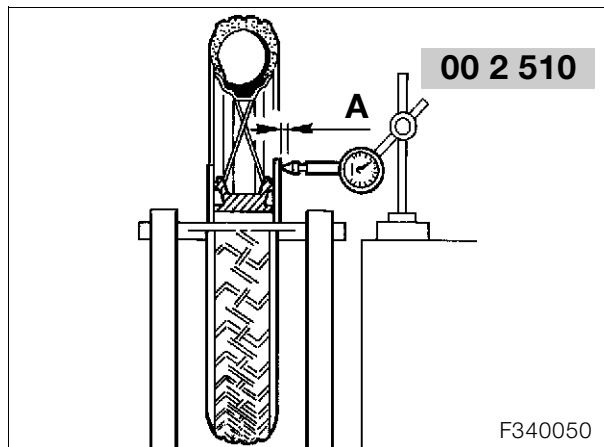
Checking front brake disc for lateral runout



Important:

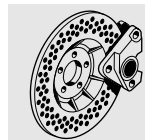
Do not operate the brake with the wheel removed.

- Remove front wheel (→ 36.5).



- 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)

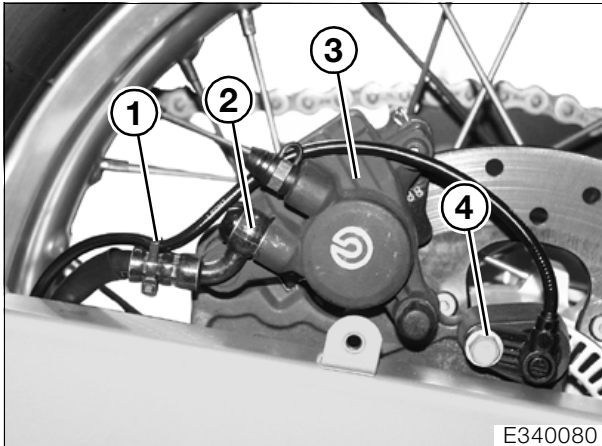


34 21 222 Removing and installing rear brake caliper

Important:

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

- Remove wheel cover together with chain cover.
- Press the brake caliper against the brake disc in order to force the piston back



- Cut through cable tie (1).
- **[ABS]** Remove fastener securing ABS sensor (4) and remove ABS sensor.
- Disconnect brake line (2) from brake caliper and seal the line.

Important:

Do not operate the brake with the wheel removed.

- Remove rear wheel (⇒ 36.7).

Important:

Do not damage brake pads.

- Remove brake caliper (3) from the rear swinging fork.

- Installation is the reverse of the removal procedure.



Note:

Replace sealing rings for brake line.



Important:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

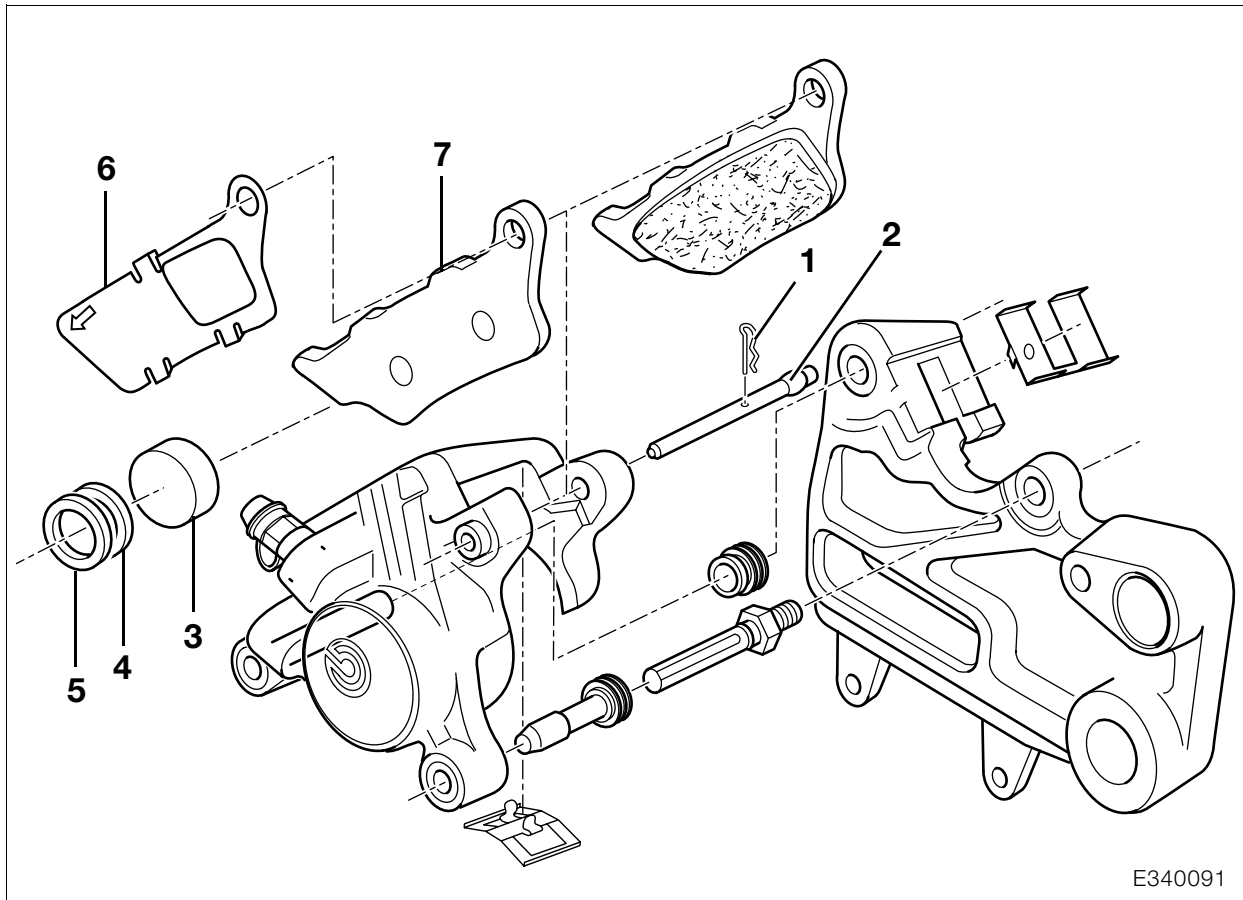
If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.



Tightening torque:

Brake line to brake caliper.....	18 Nm
ABS sensor to bracket	9 Nm
Quick-release axle	100 Nm
Wheel cover bracket to swinging fork.....	9 Nm

34 21 200 Removing and installing rear brake pads (⇒ 00.40)



E340091

Removing and installing rear brake pistons

- Remove rear brake caliper.
- Remove the split-pin keeper (1) from retaining pin (2).
- Drive the retaining pin out towards the wheel side.
- Remove brake pads (7).
- Hold a cloth over the brake caliper.

Important:

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 cylinder bores.
- Examine the brake caliper pistons 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.

Important:

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.

Note:

Make sure that the separator (6) is clipped onto the brake pad on the piston side.

- Install the brake pads.

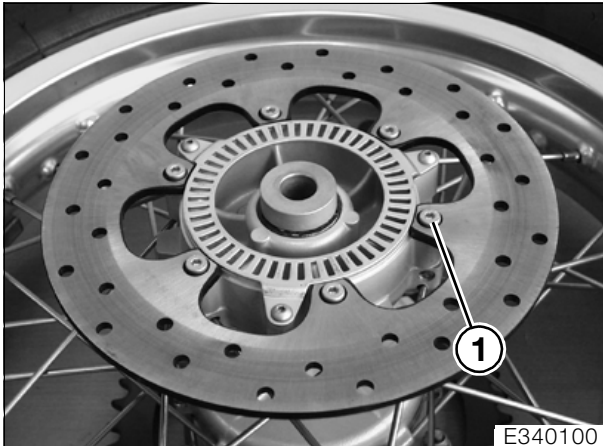
34 21 301 Removing and installing rear brake disc



Important:

Do not operate the brake with the wheel removed.

- Remove rear wheel (→ 36.7).



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



Important:

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.



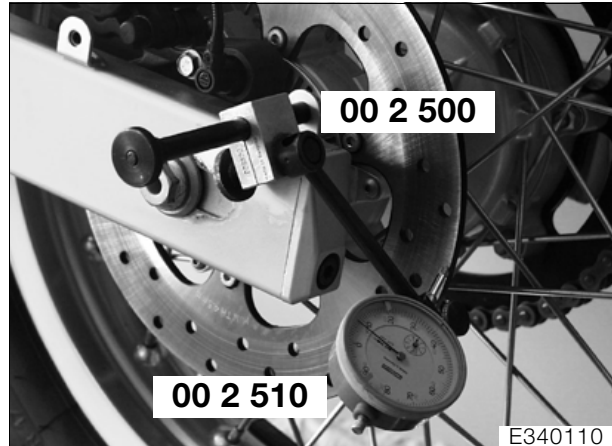
Tightening torque:

Brake disc to rear-wheel hub
(clean thread + Loctite 243)..... 9 Nm

Checking brake disc for wear (→ 00.40)

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 fork.
- 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

(→ 00.44)

Removing and installing front brake master cylinder

32 72 119 Removing and installing handbrake lever (→ 32.15)

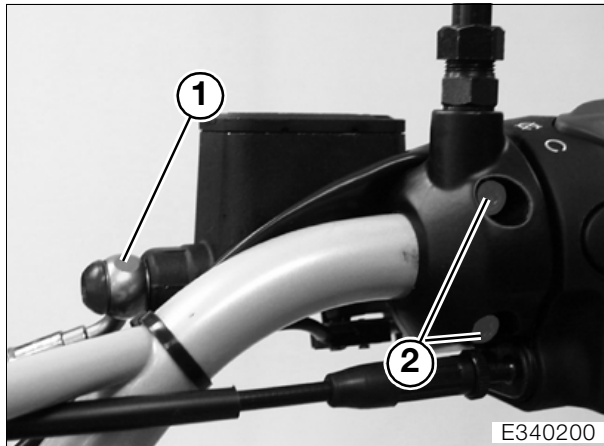
- Place the motorcycle on its main (centre) stand.



Important:

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.



Important:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.



Important:

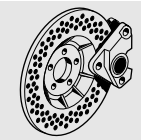
If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.



Tightening torque:

Brake hose to brake master cylinder 18 Nm
Brake master cylinder to handlebars 9 Nm



34 31 001 Removing and installing rear brake master cylinder

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

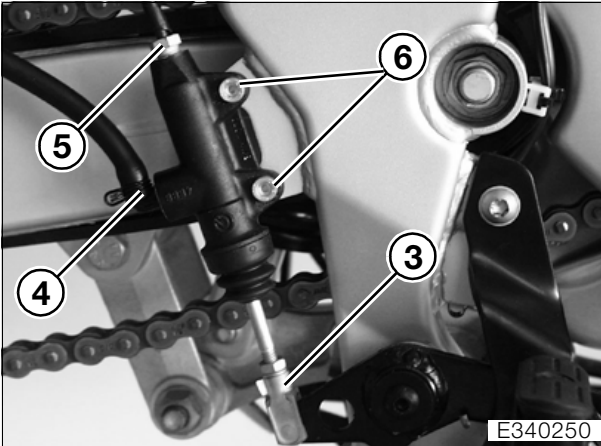


Important:

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.
- Tighten brake line to brake master cylinder.



Important:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.



Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.

Play at piston thrust rod

..... 0.5...1.5 mm (0.02...0.06 in)

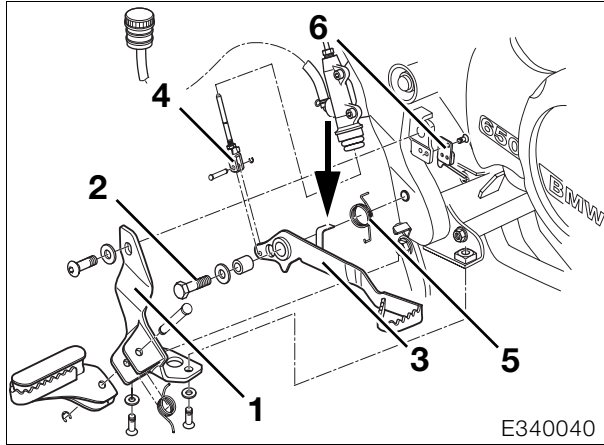


Tightening torque:

Brake line to 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:**

Check protective hose (arrow) for damage. Replace the hose if it is damaged.

 **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.

 **Important:**

Check operation of brake-light switch (6).

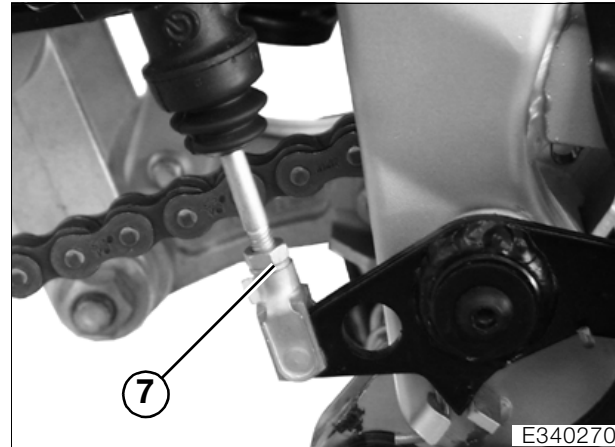
Play at piston thrust rod
..... 0.5...1.5 mm (0.02...0.06 in)

 **Tightening torque:**

Brake pedal to frame 21 Nm

Checking play at piston thrust rod, adjusting if necessary

Checking play at piston thrust rod

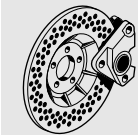


- With no load applied to the brake pedal, i.e. lug of lever against stop on frame (arrow), play must be perceptible at piston thrust rod (7).

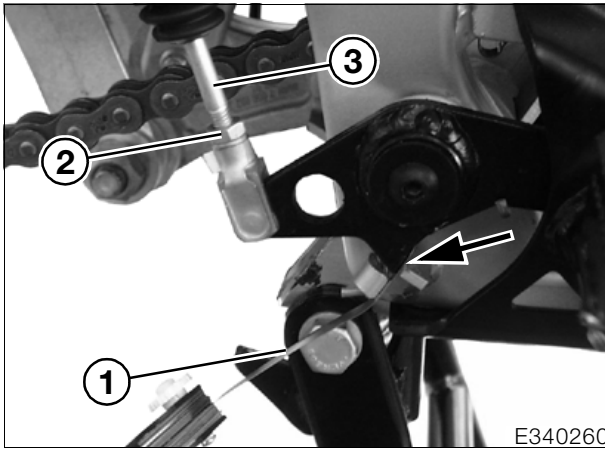
 **Note:**

Adjust the piston thrust rod if no play is perceptible.

– Adjusting play at piston thrust rod (→ 34.14)



Adjusting play at piston thrust rod

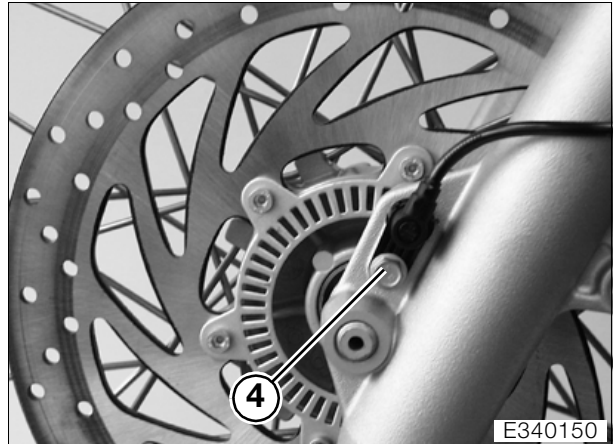


- Insert feeler gauge (1) 0.2 mm (0.008 in) thick between the lug of the brake pedal and the stop on the frame (arrow).
- Slacken nut (2) on the thrust rod at the brake master cylinder.
- Turn piston rod (3) clockwise to obtain play.
- Carefully back off piston rod to take up play and tighten locknut.
- Tighten the locknut on the piston rod and remove the feeler gauge.

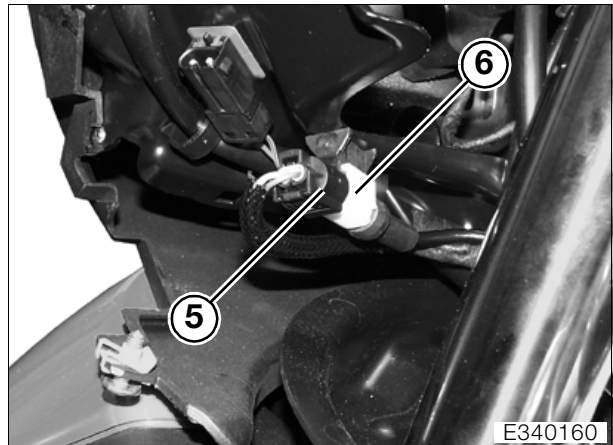
 **Tightening torques:**
 Locknut..... 9 Nm

34 52 044 Removing and installing front ABS sensor

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover (→ 46.5).



- 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 gap of ABS sensor and adjust if necessary (→ 34.20)

 **Tightening torques:**
 Front ABS sensor..... 9 Nm

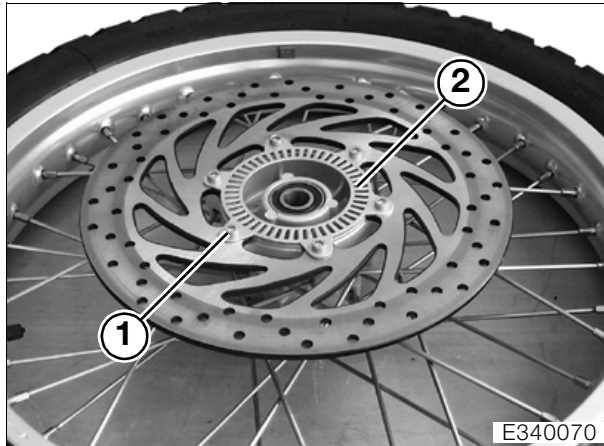
34 51 610 Removing and installing front ABS sensor ring



Important:

Do not operate the brake with the wheel removed.

- Remove front wheel (→ 36.5).



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 gap of ABS sensor and adjust if necessary (→ 34.20).

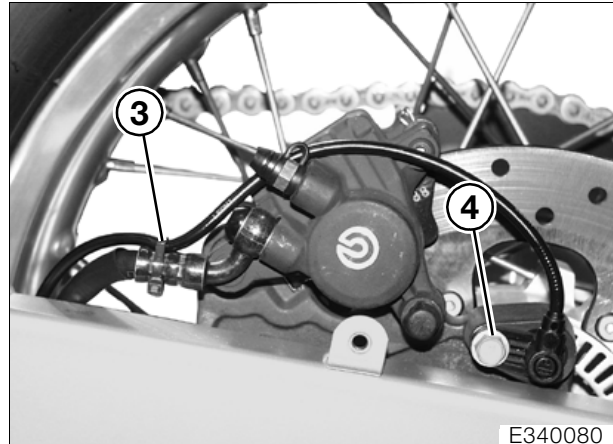


Tightening torque:

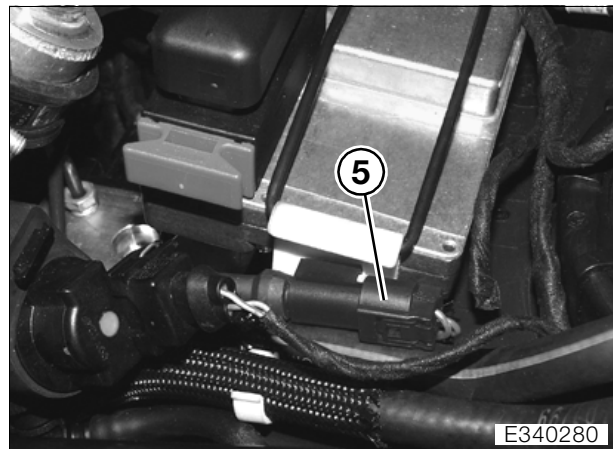
Brake disc to front-wheel hub
(clean thread + Loctite 243)..... 9 Nm

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 rear frame (→ 46.13).
- 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 fork and remove the ABS sensor cable.

- Cut the cable ties on the brake hose.
- Installation is the reverse of the removal procedure.
- Check gap of speed/ABS sensor and adjust if necessary (→ 34.21).



Tightening torques:

ABS sensor to holder 9 Nm
 Wheel cover bracket to swinging fork..... 9 Nm

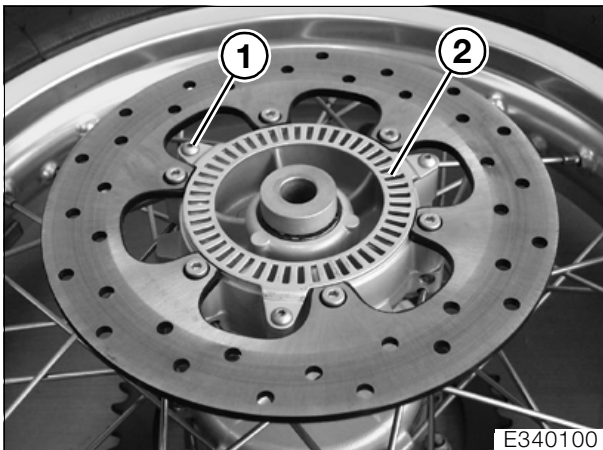
34 51 619 Removing and installing rear ABS sensor ring



Important:

Do not operate the brake with the wheel removed.

- Remove rear wheel (→ 36.7).



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 gap of speed/ABS sensor and adjust if necessary (→ 34.21).



Tightening torque:

Sensor ring to rear-wheel hub
 (clean thread + Loctite 243)..... 5 Nm

34 51 050 Removing and installing ABS control unit



Important:

All work on the ABS control unit must be carried out by an authorised BMW workshop.

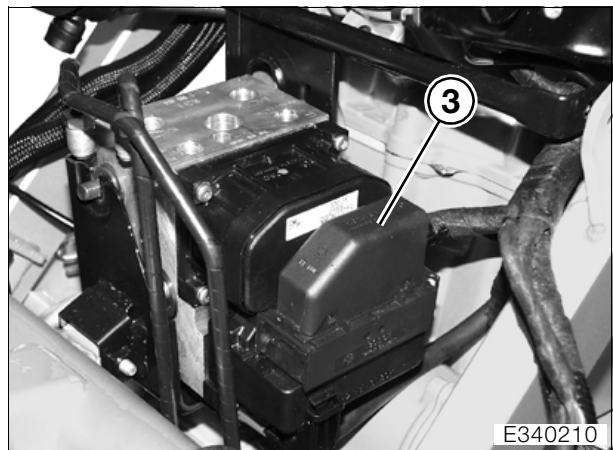
- Remove rear frame (→ 46.14).
- Remove front brake lines (→ 34.17).



Important:

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.

 **Important:**

Top up brake fluid and bleed brake system.
Operate brake several times until brake pads are bedded.

 **Important:**

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.
If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.



Tightening torques:

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)

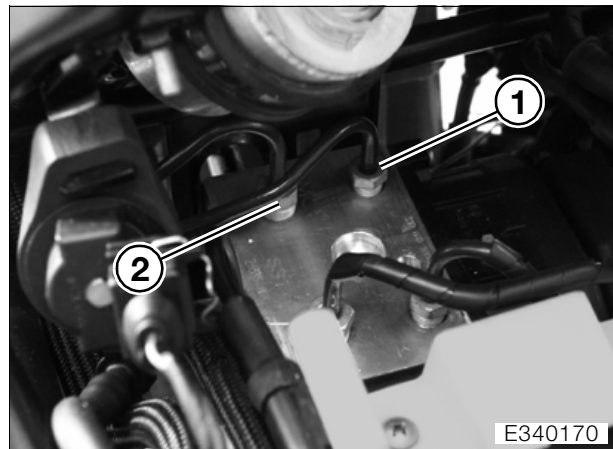
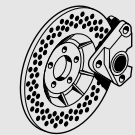
 **Important:**

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

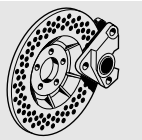
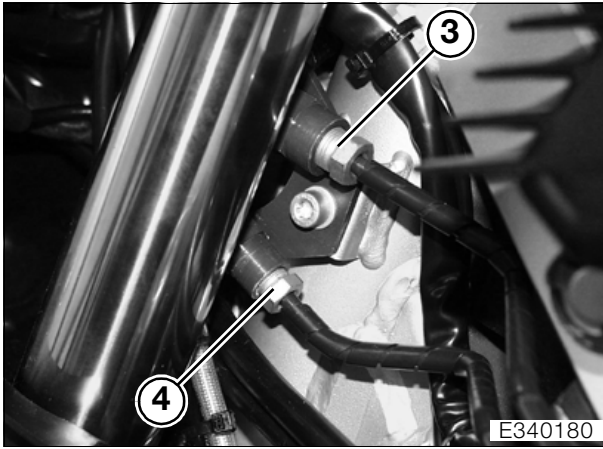
If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.

Removing and installing brake lines

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover (→ 46.5).
- Drain the brake system.
- Disconnect the expansion tank and pull it to one side.



- Disconnect brake line to brake caliper (1) and brake line to brake master cylinder (2) at control unit.



- Disconnect brake line to brake caliper (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.

! Important:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.

! Tightening torques:

Brake line to ABS control unit	18 Nm
Brake line at interface to brake hose	18 Nm
Expansion tank to radiator.....	9 Nm

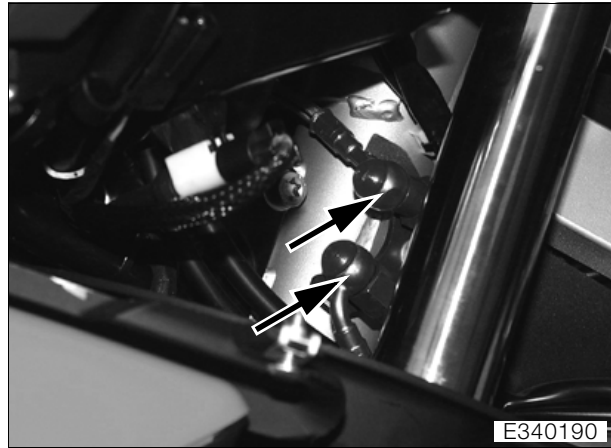
34 32 401 Removing and installing front brake hoses

- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Remove left cover (→ 46.5).

! Important:

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

- Drain the brake system.
- Disconnect brake hose from brake caliper.



- **[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.

! Important:

Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.

! Tightening torques:

Brake hose to brake master cylinder.....	18 Nm
Brake hose to brake caliper	18 Nm
Brake hose at interface to brake line	18 Nm

Removing and installing rear brake lines/hoses (with ABS)



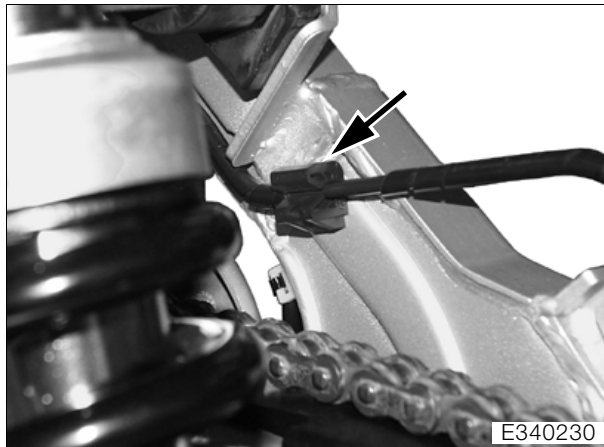
Important:

If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW**MoDiTeC, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

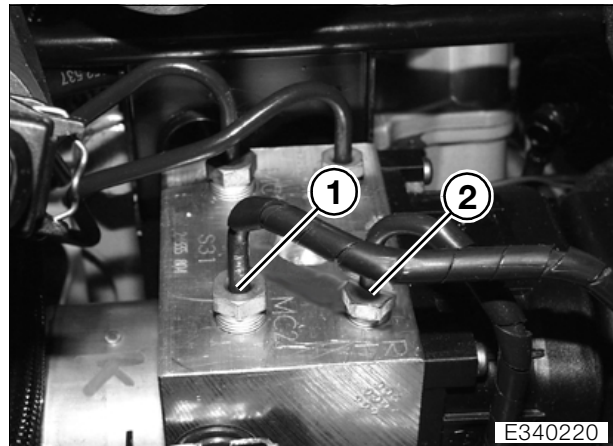
If the **BMW**MoDiTeC is not used there is a danger of residual air remaining in the control circuits of the ABS system.

Removing and installing brake lines

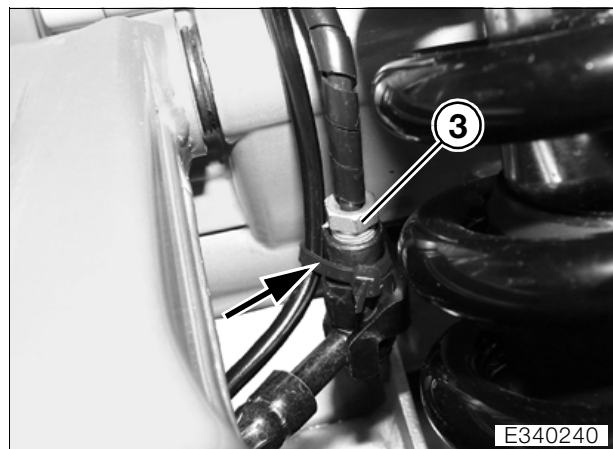
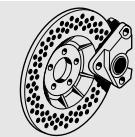
- Place the motorcycle on its main (centre) stand.
- Remove seat.
- Drain the rear brake system.
- Disconnect brake line from brake master cylinder.
- Raise rear frame (→ 46.13).



- 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 caliper (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.
- Tighten brake line to brake master cylinder.

! Important:

Top up brake fluid and bleed brake system.
Operate brake several times until brake pads are bedded.

! Tightening torques:

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 caliper.
- Disconnect brake hose at interface to brake line.
- Open 2 clips on the swinging fork and remove the brake hose.
- Release the brake hose from the clips on the swinging fork.
- Installation is the reverse of the removal procedure: pay particular attention to the following.

📄 Note:

Replace the sealing rings for the brake hoses.

! Important:

Top up brake fluid and bleed brake system.
Operate brake several times until brake pads are bedded.

! Tightening torques:

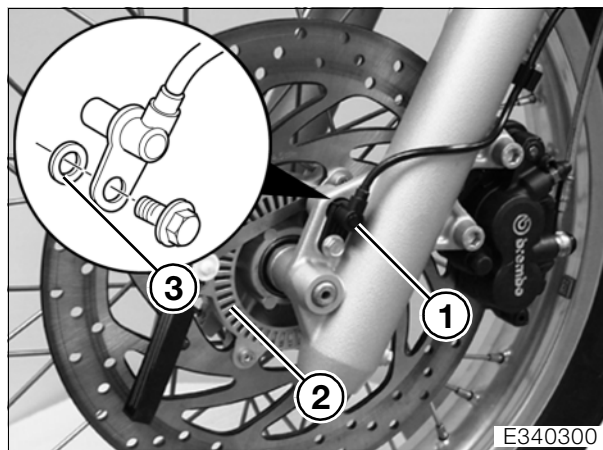
Brake hose at interface to brake line 18 Nm
Brake hose to brake caliper 18 Nm

34 52 544 Checking/adjusting front ABS sensor gap

! Important:

Check the ABS sensor gap if the ABS sensor, sensor ring, wheel bearing, front wheel, telescopic fork, spacer, quick-release axle, or brake disc has been replaced.

- Take load off front wheel and lift it clear of ground.



- Check gap between ABS sensor (1) and sensor ring (2) by inserting feeler gauge at three points offset 120° around the ring.

Adjusting ABS sensor gap

- Gap is larger than 1 mm (0.04 in) at at least one point.
 - Remove ABS sensor (1).
 - Remove washer (3).
- Gap is less than 0.1 mm (0.004 in) at at least one point.
 - Remove ABS sensor (1).
 - Install washer (3).

! Important:

After adjusting, check clearance of ABS sensor round the entire circumference of sensor ring.

ABS sensor gap 0.10...1.0 mm (0.004...0.04 in)

! Tightening torque:

Front ABS sensor 9 Nm

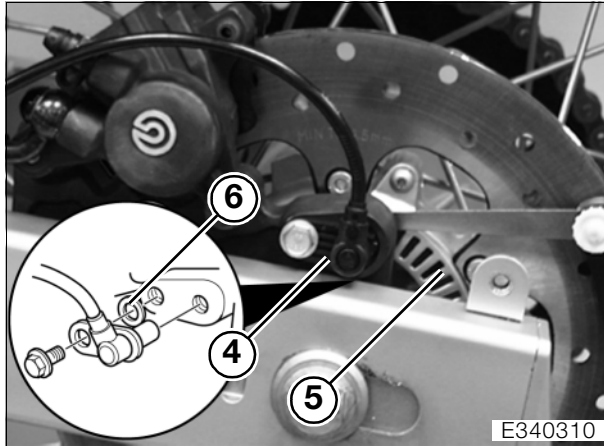
34 52 544 Checking and adjusting gap of speed/rear ABS sensor



Important:

Check the speed/ABS sensor gap if the ABS sensor, sensor ring, brake-caliper holder, spacer sleeve, rear wheel, or wheel bearing has been replaced.

- Take the weight off the rear wheel.
- Remove wheel cover together with chain cover.



- Check gap between ABS sensor (4) and sensor ring (5) by inserting feeler gauge at three points offset 120° around the ring.

Adjusting ABS sensor gap

- Gap is larger than 1 mm (0.04 in) at at least one point.
 - Remove ABS sensor (4).
 - Remove washer (6).
- Gap is less than 0.1 mm (0.004 in) at at least one point.
 - Remove ABS sensor (4).
 - Install washer (6).



Important:

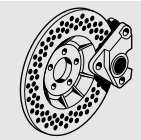
After adjusting, check clearance of ABS sensor round the entire circumference of sensor ring.

ABS sensor gap 0.10...1.0 mm (0.004...0.04 in)



Tightening torque:

ABS sensor, rear 9 Nm

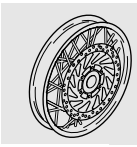


36 Wheels and tyres

Contents

Page

Technical Data	3
Removing and installing front wheel	5
Removing front wheel	5
Installing the front wheel	5
Removing and installing front wheel bearing	6
Removing left-hand wheel bearing	6
Removing right-hand wheel bearing	6
Installing wheel bearings	7
Removing and installing rear wheel	7
Removing and installing rear wheel bearings	8
Removing left-hand wheel bearing	8
Removing right-hand wheel bearing	8
Installing wheel bearings	9
Removing and installing bearing in chainwheel carrier	9
Removing and installing spokes	10
Removing and installing front wheel spokes	10
Outer left spokes	10
Inner left spokes	10
Outer right spokes	11
Inner right spokes	11
Removing and installing rear wheel spokes	12
Outer left and right spokes	12
Inner left and right spokes	12
Checking and centering front and rear wheel rims	13
Checking rims	13
Centering lateral runout	14
Centering vertical runout	14
Static balancing of front/rear wheel	15





Technical Data		F 650 GS	F 650 GS Dakar
Wheels and tyres			
Rim size			
Front		2.50"x19"	1.60"x21"
Rear		3.00"x17"	
Vertical runout	mm (in)	2.0 (0.079)	
Lateral runout	mm (in)	2.0 (0.079)	
Maximum permissible imbalance	g (oz.)	5 (0.20)	
Tyre size			
Front		100/90-19	90/90-21s
Rear		130/80-17	
Tyre pressures (tyres cold)			
One-up, front	bar (psi)	1.9 (27.56)	
One-up, rear	bar (psi)	2.1 (30.46)	
Full load, front	bar (psi)	2.1 (30.46)	
Full load, rear	bar (psi)	2.3 (33.36)	





36 30 300 Removing and installing front wheel

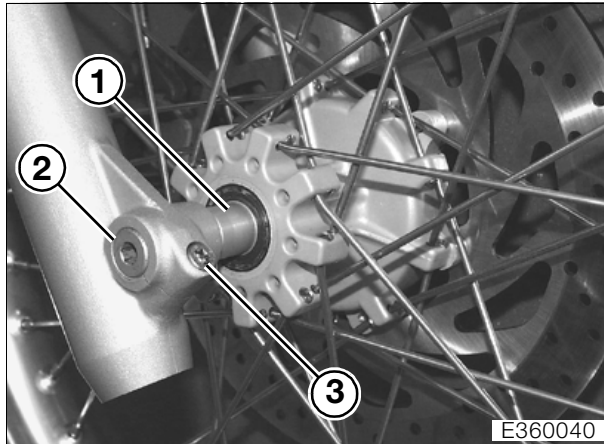
36 30 300 Removing front wheel

- Place motorcycle on its centre stand.
- Take load off front wheel/lift clear of ground.

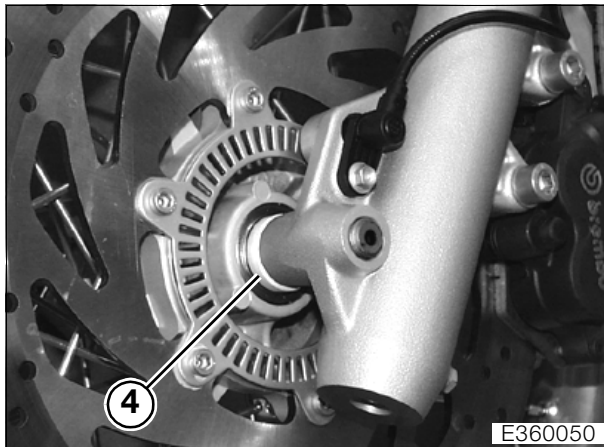
Important:

When removing, avoid damage to ABS sensor, sensor ring, brake disc and brake pads.

- Press the brake caliper against the brake disc in order to force the piston 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).

Important:

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

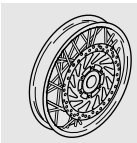
Important:

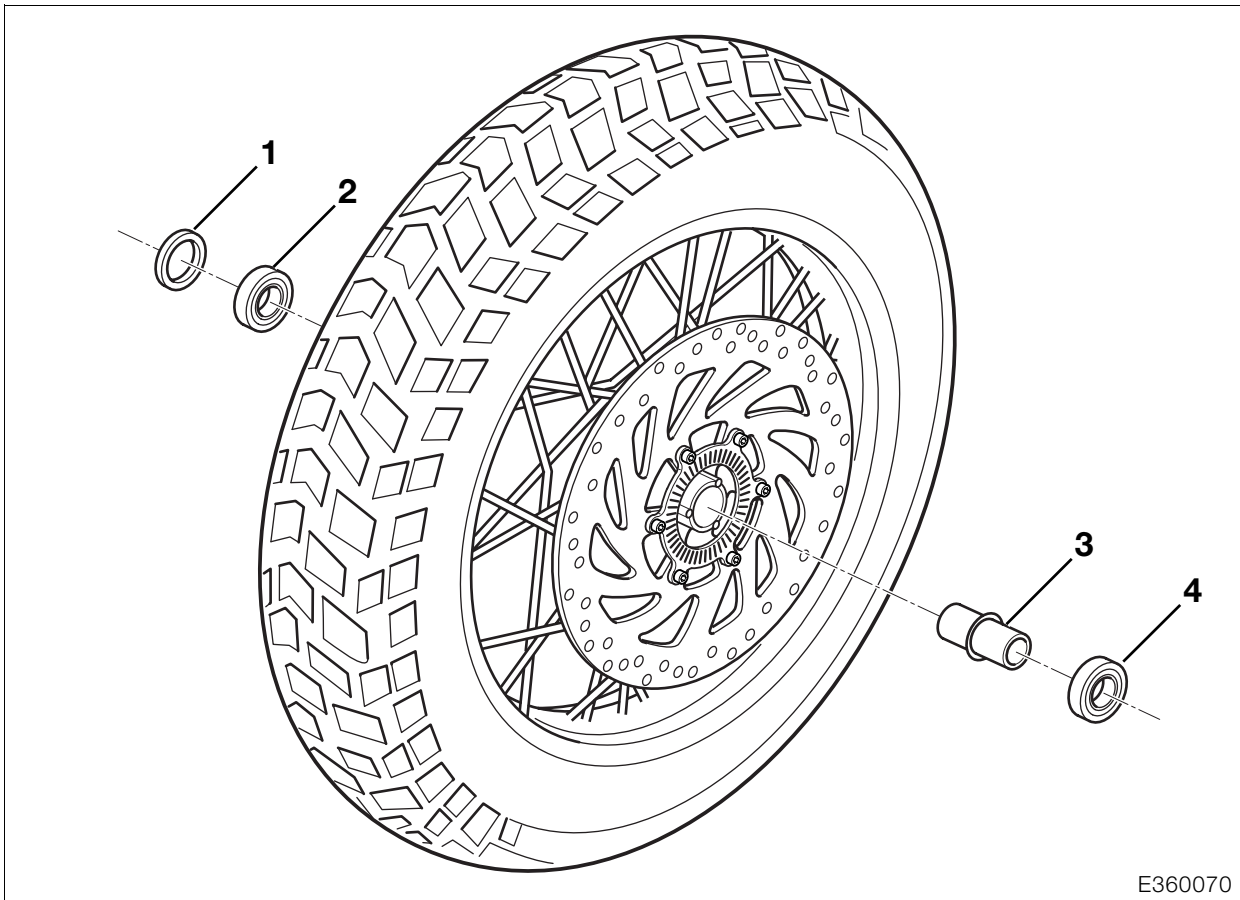
When installing, avoid damage to ABS sensor, sensor ring, brake disc and brake pads.

- 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 gap of ABS sensor and adjust if necessary (→ 34.20).

Tightening torques:

Quick-release axle 45 Nm
Clamping screw 21 Nm

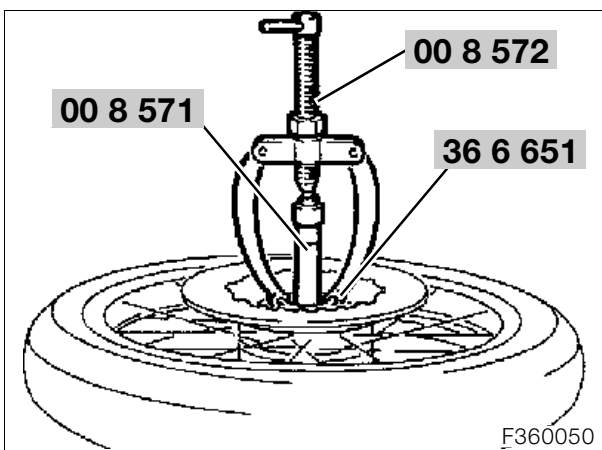




E360070

36 31 851 Removing and installing front wheel bearing

- Remove front wheel.



F360050



Note:

To simplify 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.

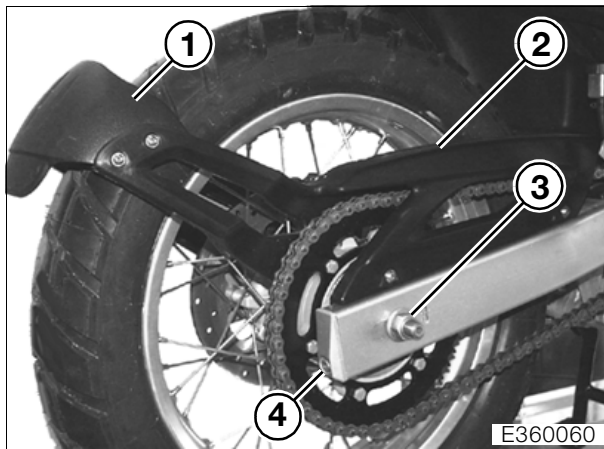


Note:

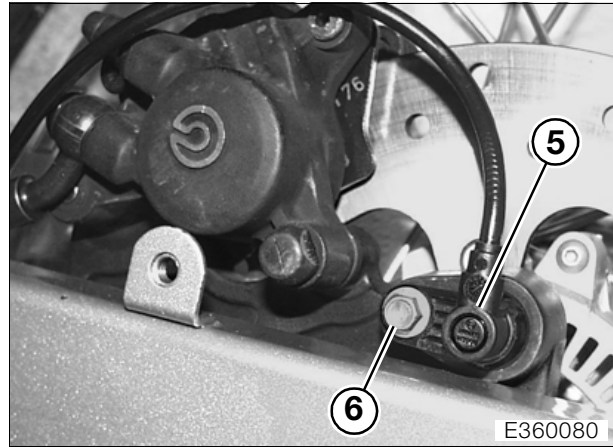
The left-hand bearing must be seated on the stop in the wheel hub. The spacer sleeve between the two bearings should have no more than minimal axial clearance, if any.

- Drive in the new shaft sealing ring with a drift, **BMW No. 36 6 600**.
- Check gap of ABS sensor and adjust if necessary (⇒ 34.20).

36 30 320 Removing and 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 caliper against the brake disc in order to force the piston 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.



Important:

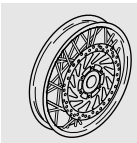
Do not operate the brake pedal when the wheel is removed.

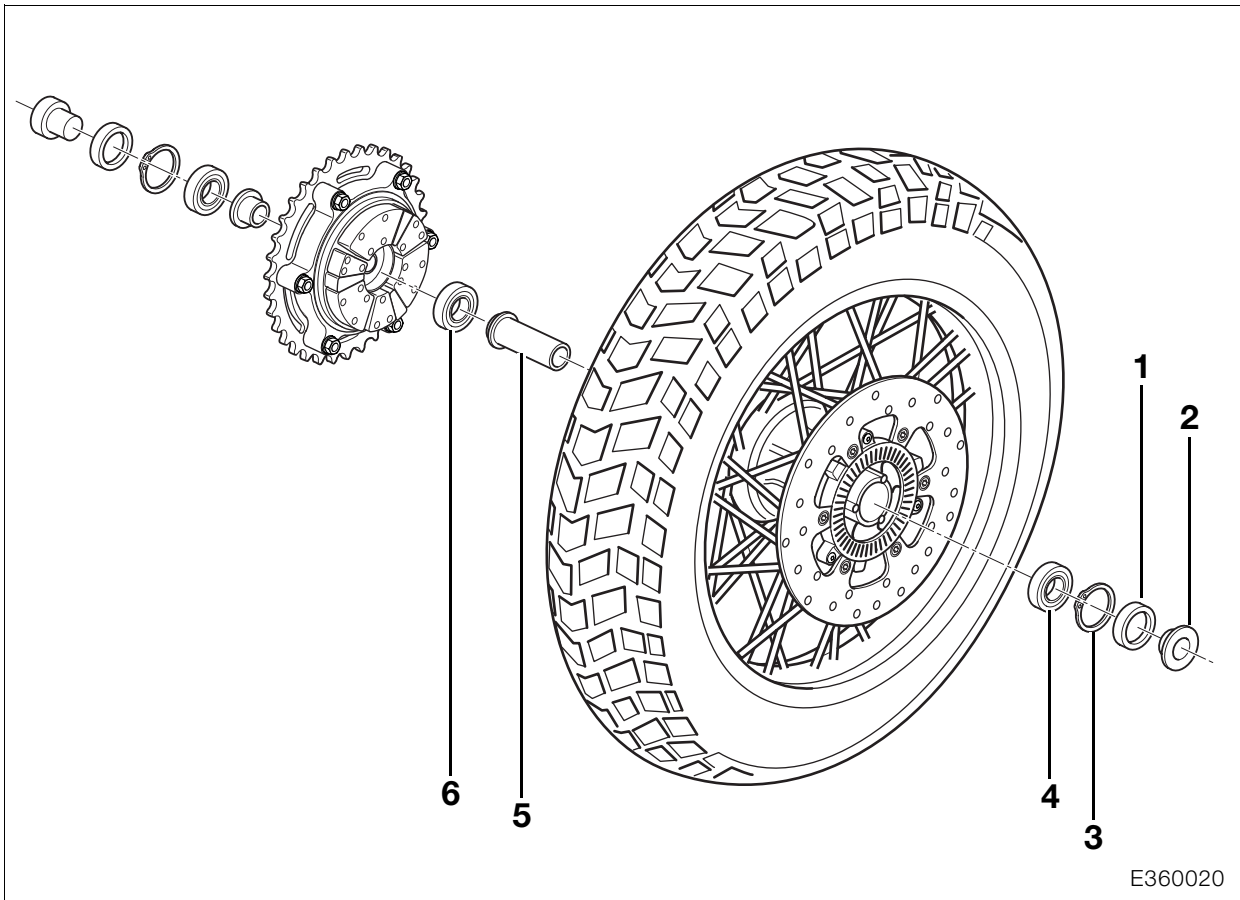
- Pull the wheel to the rear to remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the quick-release axle and the contact face of the shaft sealing ring and grease them with **Optimoly TA**.
- Adjust chain tension (⇒ 00.47).
- Check gap of speed/ABS sensor and adjust if necessary (⇒ 34.21).



Tightening torques:

Quick-release axle 100 Nm
 Wheel cover bracket to swinging fork..... 9 Nm
 ABS sensor to holder 9 Nm





36 31 861 Removing and installing rear wheel bearings

- Remove rear wheel.
- Remove chainwheel carrier with chainwheel from rear wheel hub.
- Place the wheel on two wooden blocks so that the brake disc is free.



Note:

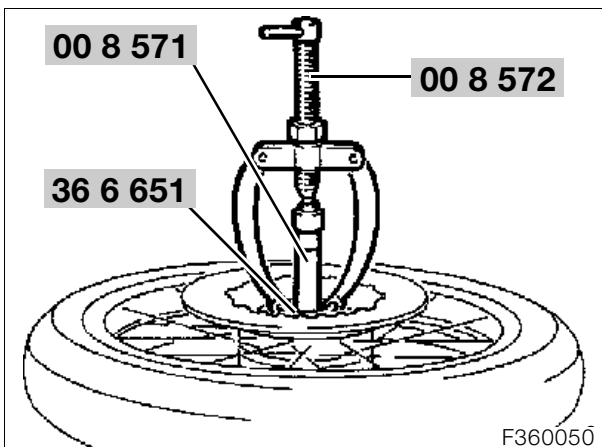
To simplify removal or installation, heat the wheel hub to 100 °C (212 °F). Use temperature measuring device, **BMW No. 00 1 900**, to check heat rise.

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).



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.



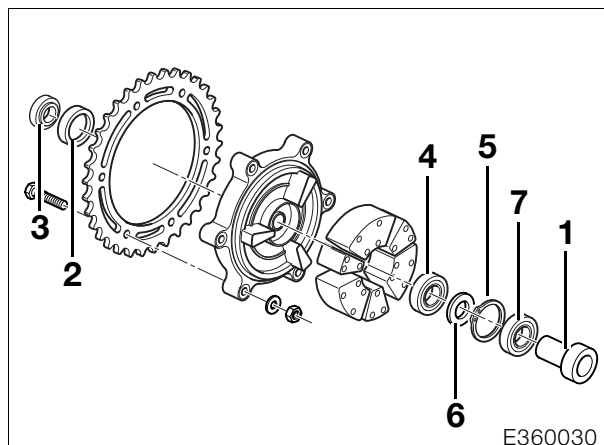
Note:

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 gap of speed/ABS sensor and adjust if necessary (→ 34.21).

Removing and installing bearing in chainwheel 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).

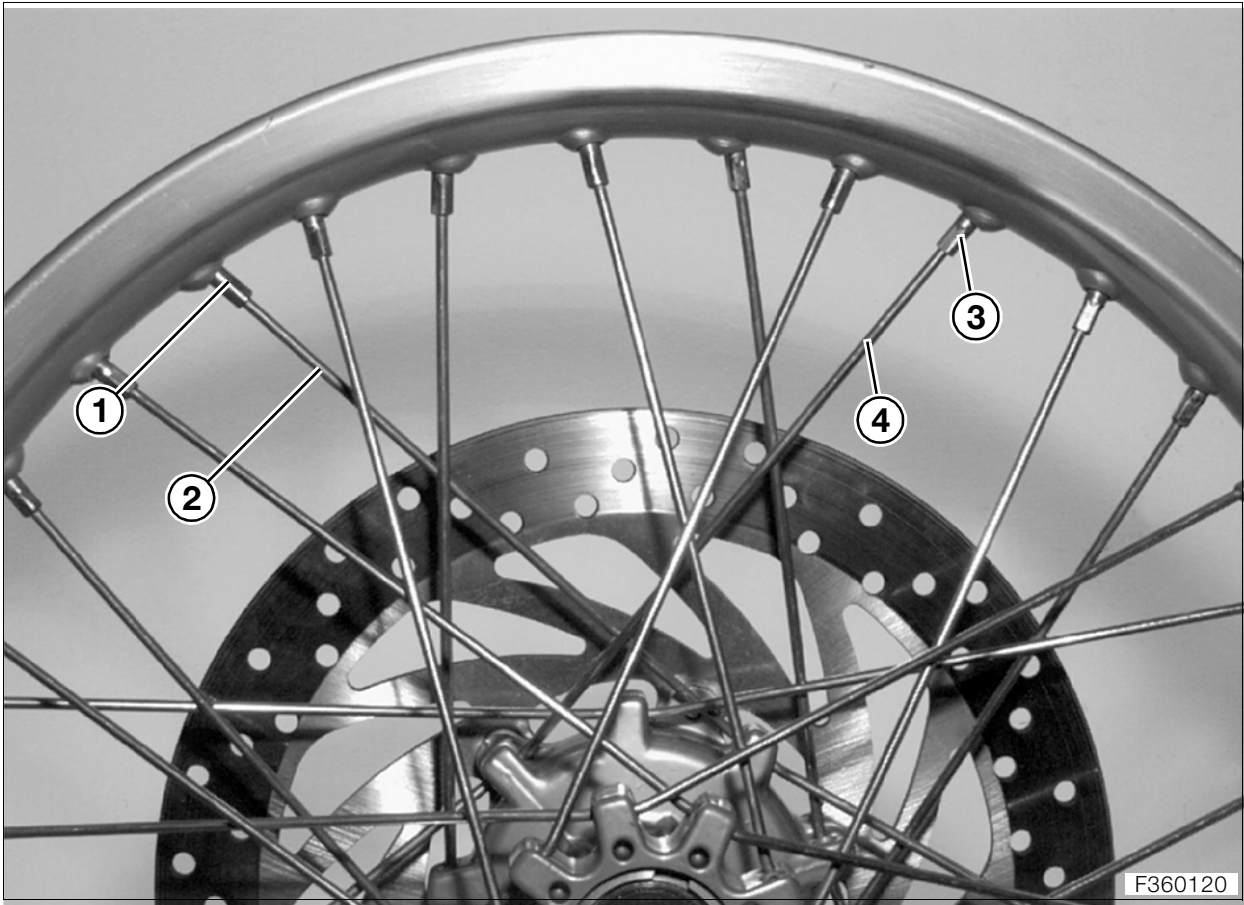


Important:

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 and installing spokes

Removing and installing front wheel spokes

- Remove and install front wheel (→ 36.5).
- Remove tyre.



Note:

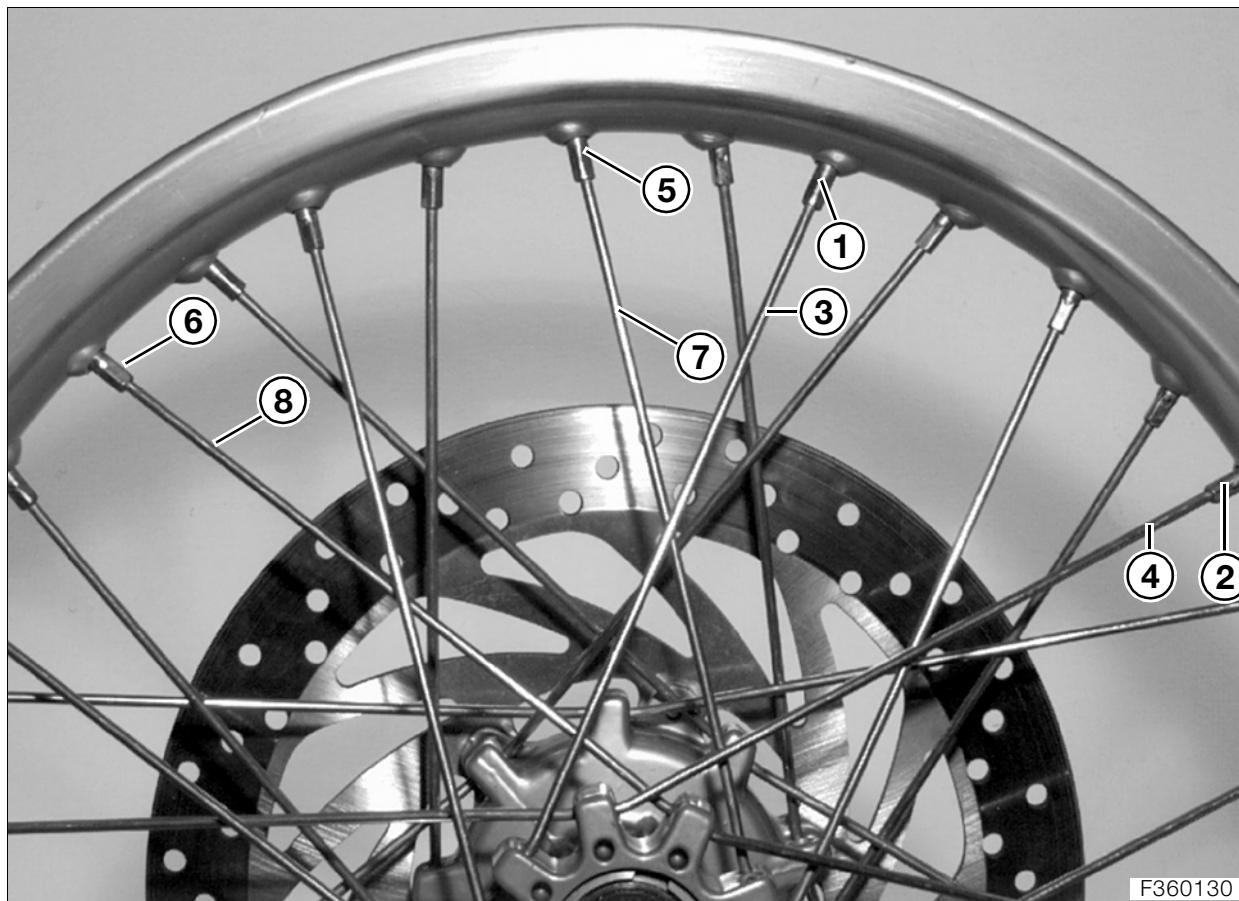
Use nipple tensioner, **BMW No. 36 3 800**.

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

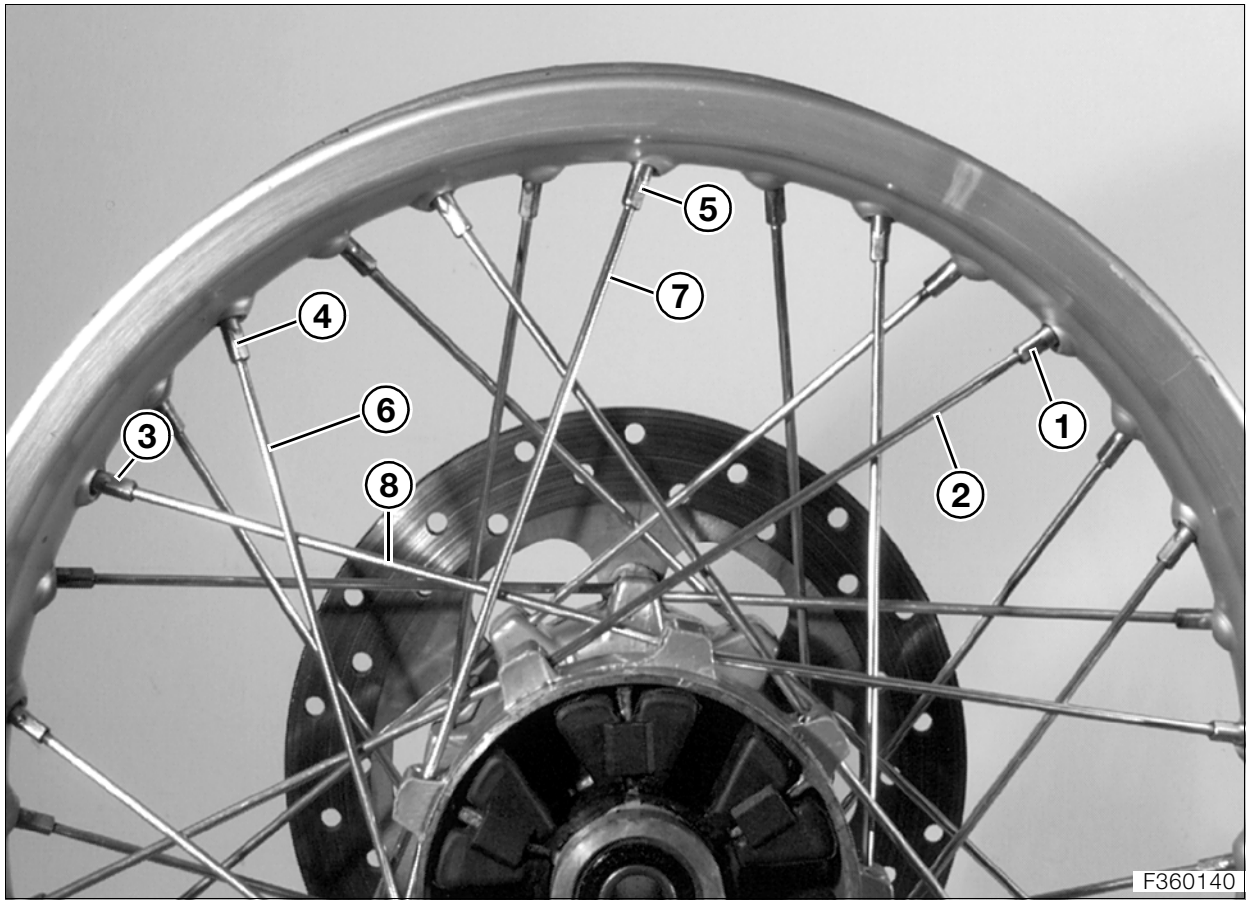
- Release spoke nipple (1).
- Release spoke nipple (2).
- Turn spoke (3) outwards.
- Pull spoke (4) out of wheel hub.

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

– After installing, centre the wheel rim (→ 36.13).

Inner right spokes

- Release spoke nipple (5).
- Release spoke nipple (6).
- Turn spoke (7) inwards.
- Pull spoke (8) out of wheel hub.



Removing and installing rear wheel spokes

- Remove and install rear wheel (→ 36.7).
- Remove tyre.



Note:

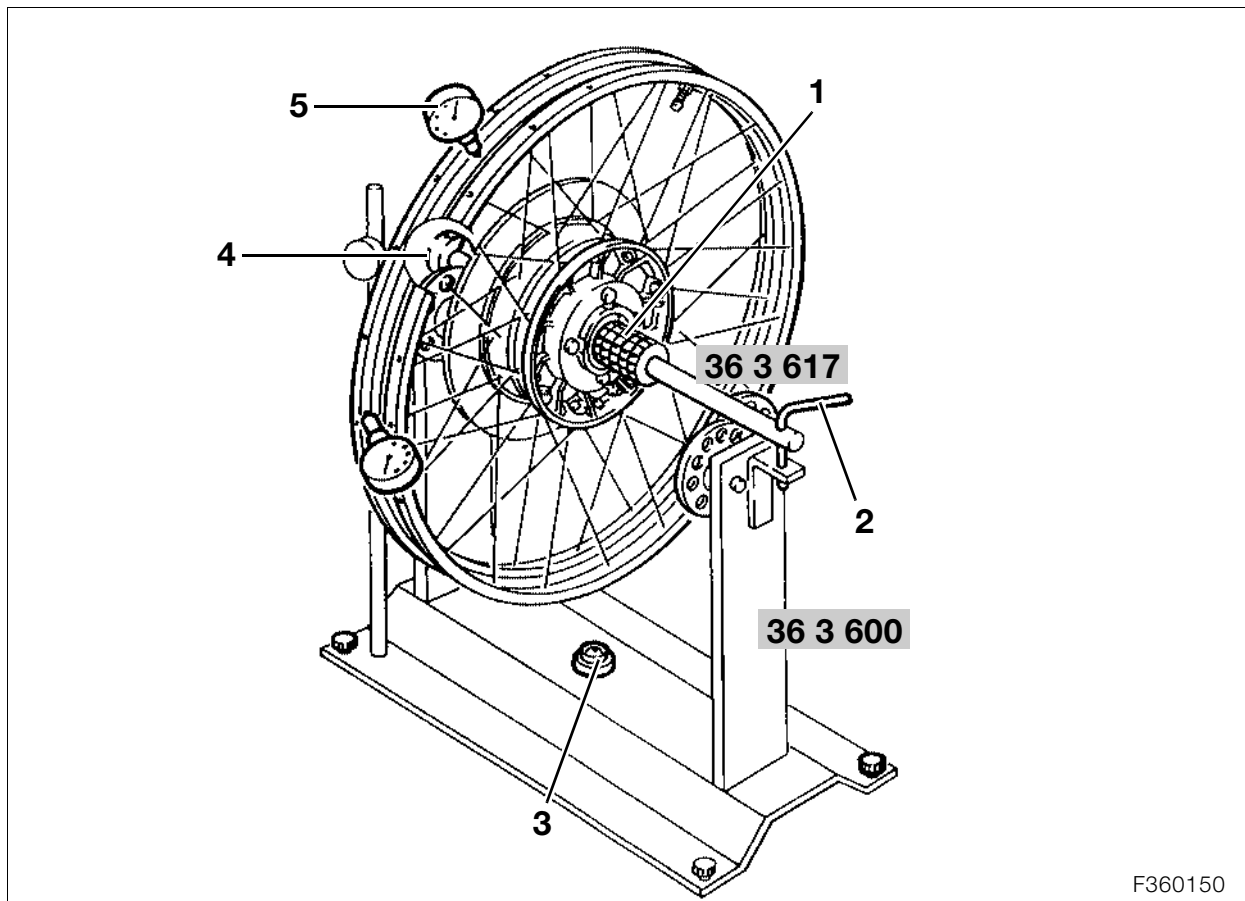
Use nipple tensioner, **BMW No. 36 3 800**.

Inner left and right spokes

- Release spoke nipple (3).
- Remove 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 (→ 36.13).

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**, at 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.



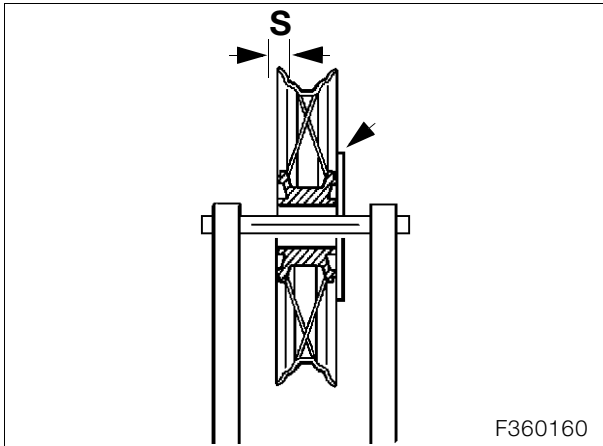
Note:

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



⚠ Important:

Never attempt to eliminate all the lateral runout at only one or two spokes.

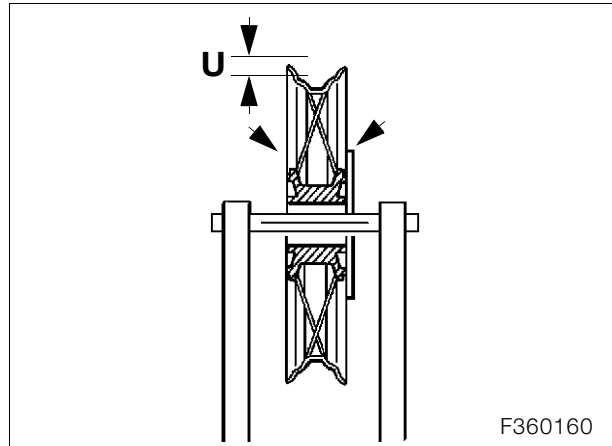
📌 Note:

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

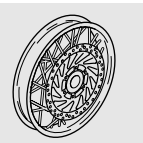


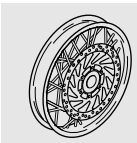
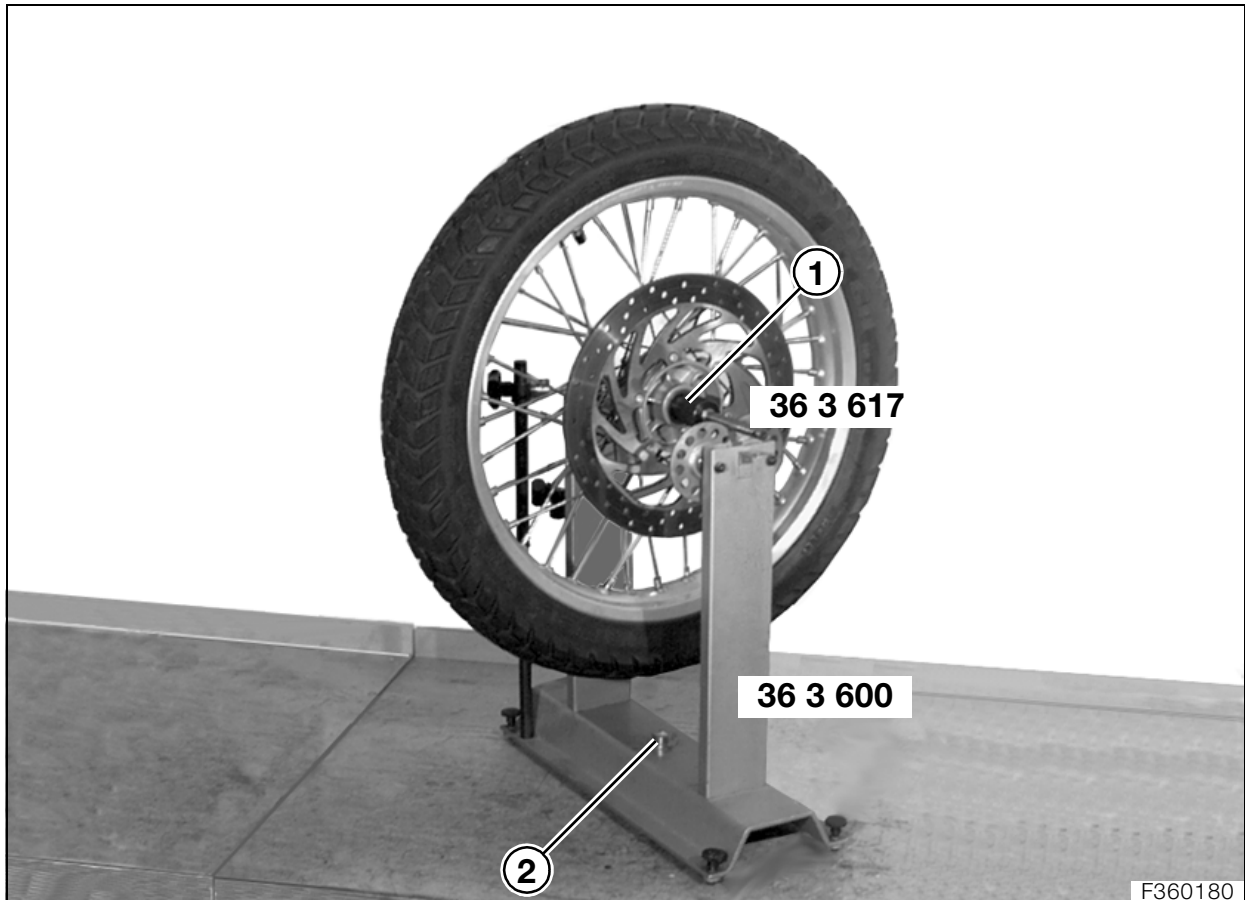
⚠ Important:

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)





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**, at 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.



Important:

Maximum balance weight 50 grammes (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

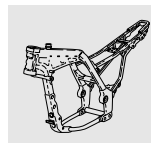
..... 5 g (0.18 oz.)

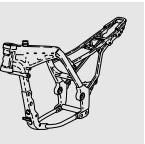
46 Frame

Contents

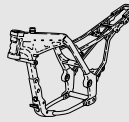
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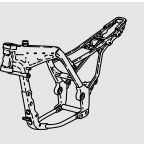
Technical Data	3
Removing and installing fairing	5
Removing and installing covers	5
Removing and installing left and right covers	5
Removing and installing centre cover	5
Removing and installing cockpit fairing	6
Removing and installing fairing bracket	7
[Dakar] Removing and installing hand protectors	8
Removing and installing engine guard	8
Removing and installing front mudguard	8
Removing and installing left/right rear trim panel	9
Removing and installing left/right grip	9
Removing and installing number-plate panel	10
Removing and installing base of stowage compartment and partition	11
Removing and installing seat latch	11
Removing and installing rear mudguard	12
Raising, removing and installing rear frame	13
Raising rear frame	13
Removing and installing rear frame	14
Removing frame	16
Removing and installing right footrest	19
Removing and installing left footrest	19
Removing and installing bottom truss	20
Removing and installing side stand	20
Removing and installing main (centre) stand	21

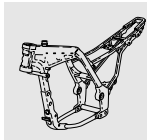
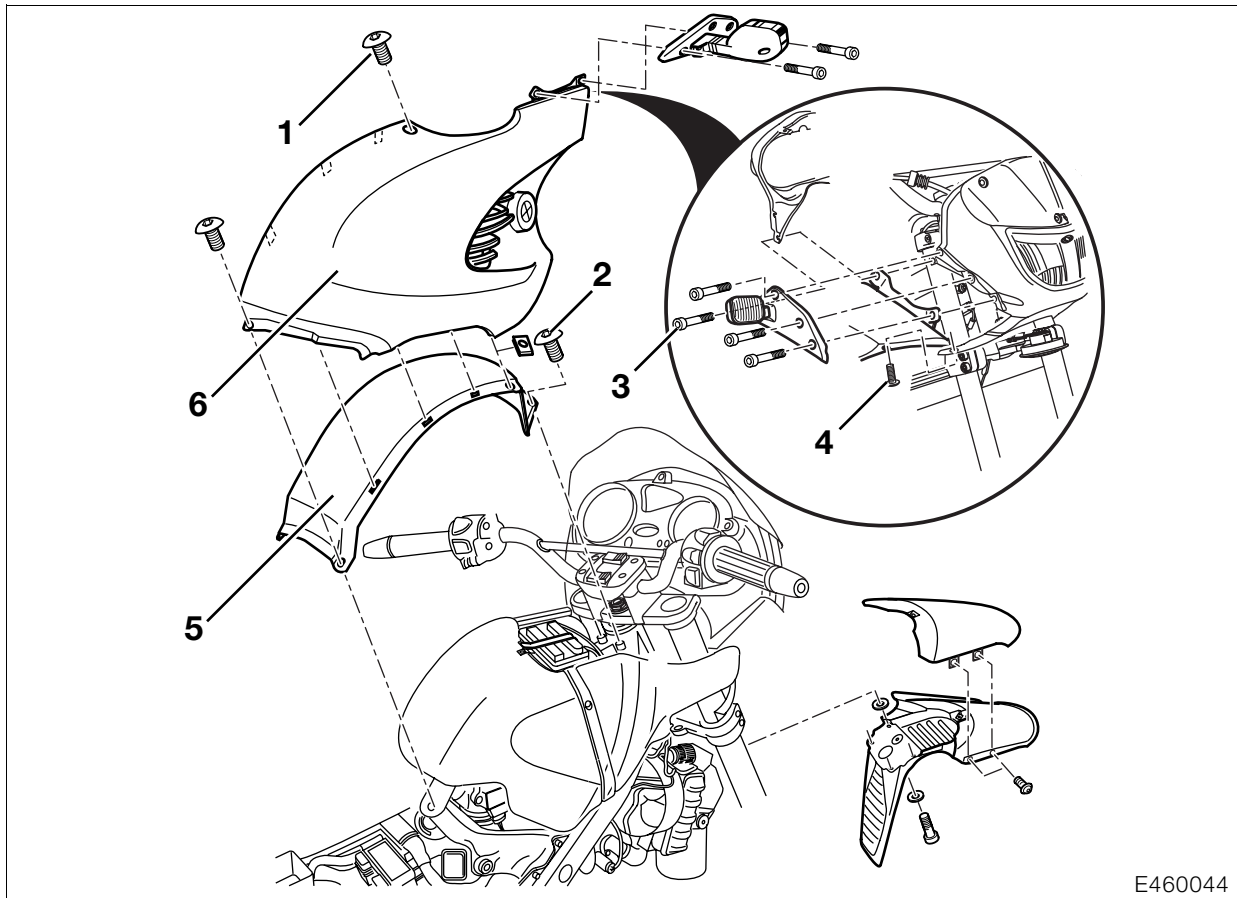




Technical Data		F 650 GS	F 650 GS Dakar
Frame			
Frame		Bridge-type frame with bottom truss	
Type plate location		Main frame upper rail, right	
Frame No. location		On right of steering head	
Max. height (windscreen)	mm (in)	1,265 (49.80)	1,412 (55.59)
Maximum width (across mirrors)	mm (in)	890 (35.039)	
Maximum length	mm (in)	2,101 (82.71)	
Height of seat (without load)	mm (in)	780 (30.70)	870 (34.25)
Wheelbase (without load)	mm (in)	1,479 (58.228)	1,489 (58.62)
Unladen weight (ready for road, fuel tank full)	kg/lbs	193 (425.49)	192 (423.28)
Permitted gross weight	kg/lbs	380 (837.75)	
Steering head angle in normal-load position	°	60.8	
Axle load distribution in empty-weight position, front/rear	%	46/54	
Castor (in normal-load position)	mm (in)	113 (4.449)	123 (4.842)







46 63 Removing and installing fairing

46 63 Removing and installing covers

- Remove seat.

Removing and installing left and right covers

- Remove trim of cockpit fairing (3) and disconnect plug for turn indicator.
- Slacken front securing screw (4).
- Remove screws (1) securing the side cover.
- Remove side cover (6).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Important:

Make sure that the turn-indicator cable is not trapped when you install the turn indicators.



Tightening torques:

Right/left cover with centre cover to frame 2 Nm
 Right/left cover to centre cover 2 Nm
 Right/left cover to cockpit fairing at bottom.... 2 Nm
 Trim for cockpit fairing to fairing bracket 2 Nm

Removing and installing centre cover

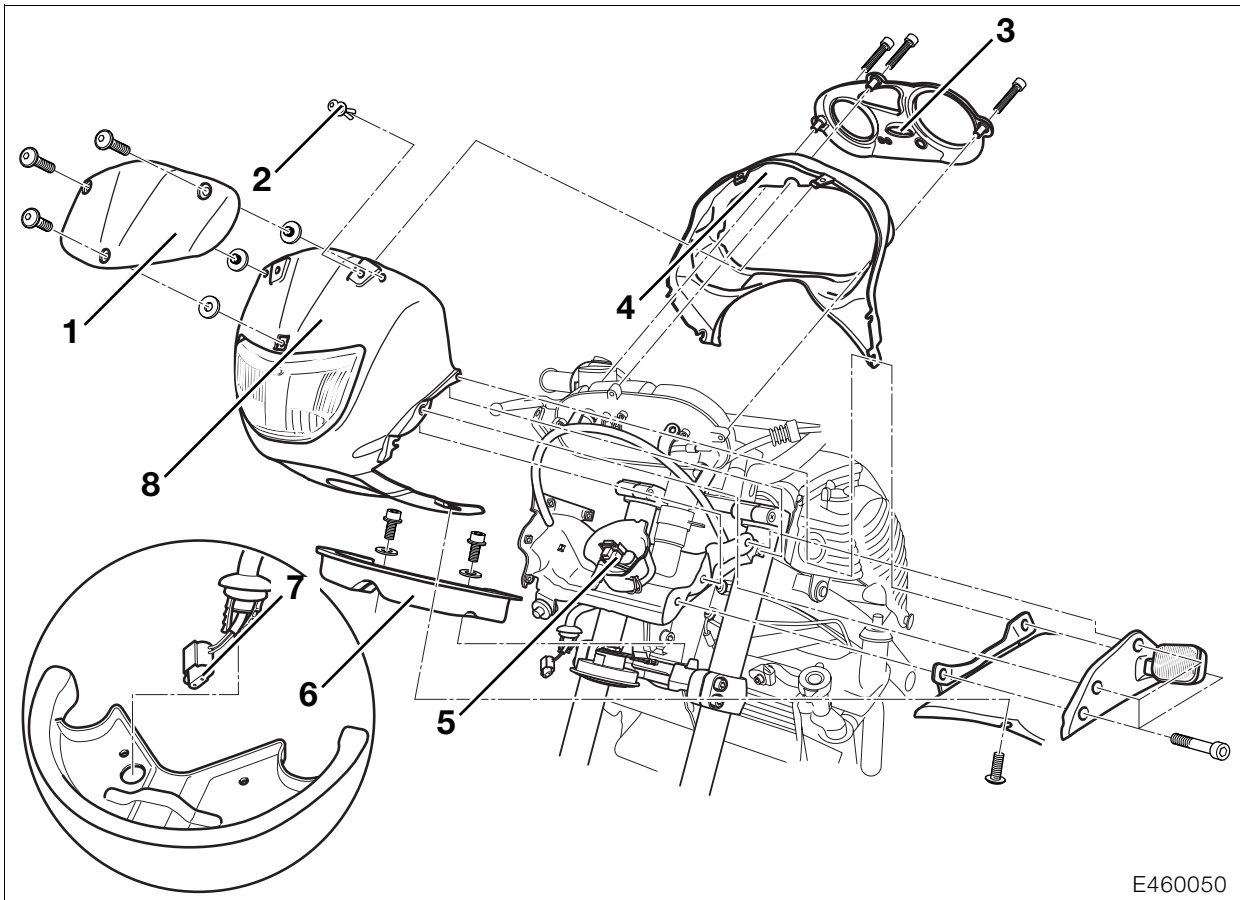
- Remove left and right covers.
- Remove screws (2) securing the centre cover.
- Lift off the centre cover (5).
- Installation is the reverse of the removal procedure.



Tightening torques:

Centre cover to main frame at front 2 Nm

E460044



46 63 Removing and installing cockpit fairing

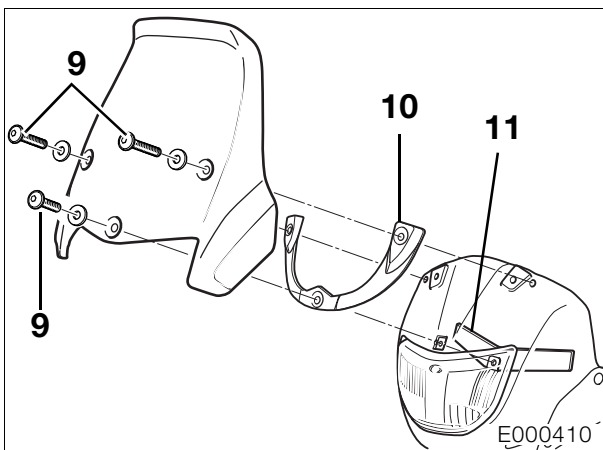
- Remove left and right covers (⇒ 46.5).



Note:

Note washers and rubber ring.

- **[GS]** Remove windscreen (1).



- **[Dakar]** Remove fasteners for windscreen (9).
- **[Dakar]** Remove windscreen (9) with spacer (10).

- 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 the headlight (8).
- Remove the instrument cover (3).
- Remove front fairing top section (4).
- Remove front mudguard (⇒ 46.8).
- Disconnect plug for horn (7).
- Remove cover (6).

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- **[Dakar]** Align retainer (11) in fairing bottom section (8).



Warning:

After installing the windscreen, check and if necessary adjust the headlight setting.

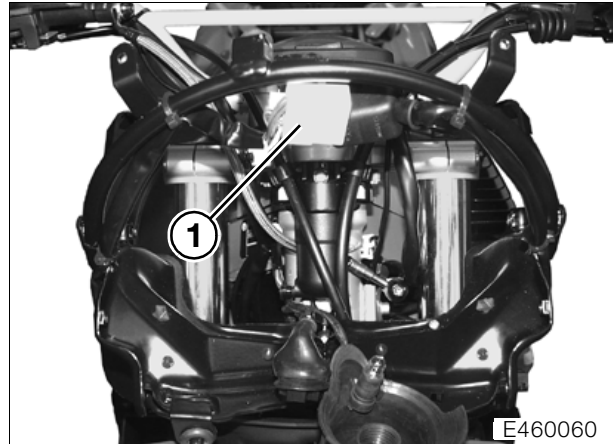


Tightening torques:

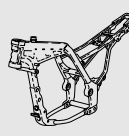
Fasteners for windscreen 2 Nm
 Cover to lower fork bridge 3 Nm
 Instrument cover to instrument cluster 2 Nm

46 63 198 Removing and installing fairing bracket

- Remove instrument cluster (→ 62.6).
- Unclip connector for turn indicator.
- **[ABS]** Disconnect front ABS sensor plug and unclip the plug.



- Disconnect plug of instrument cluster (1).
- Cut through cable clip.
- Press cable holder inwards to release it.
- 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.

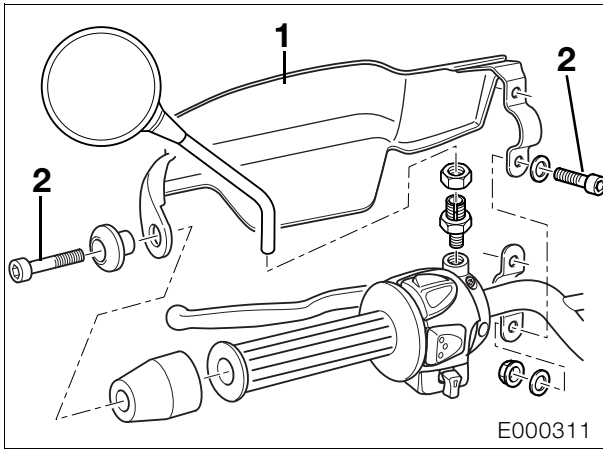


Tightening torques:

Fairing bracket to main frame 21 Nm

46 63 [Dakar] Removing and installing hand protectors

- Place motorcycle on its centre stand.

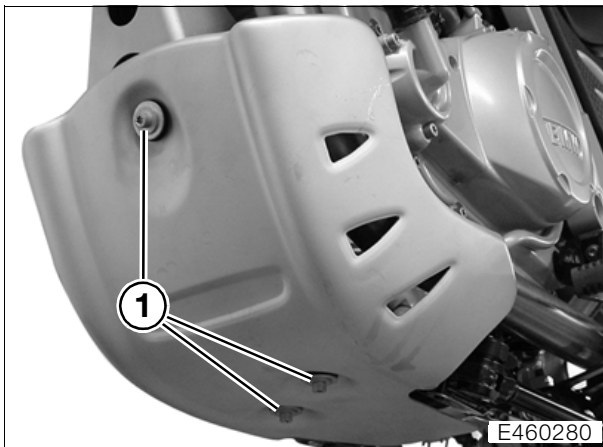


- Release fasteners (2).
- Remove hand protector (1).
- Installation is the reverse of the removal procedure.

! Tightening torques:
Hand protector to handlebars 9 Nm

Removing and installing engine guard

- Place motorcycle on its centre stand.



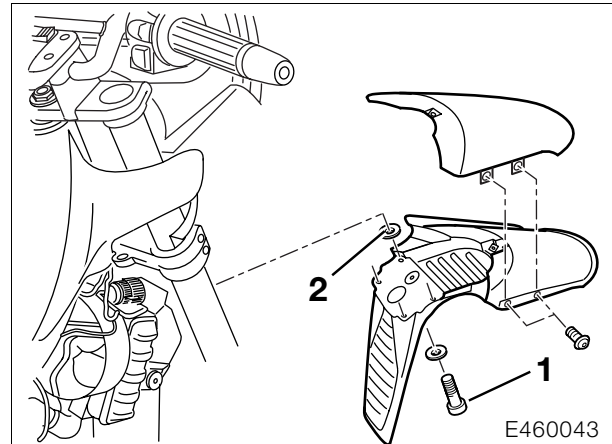
- Remove 3 screws (1).
- Remove engine guard.
- Installation is the reverse of the removal procedure.

! Tightening torques:
Engine guard to frame truss 9 Nm

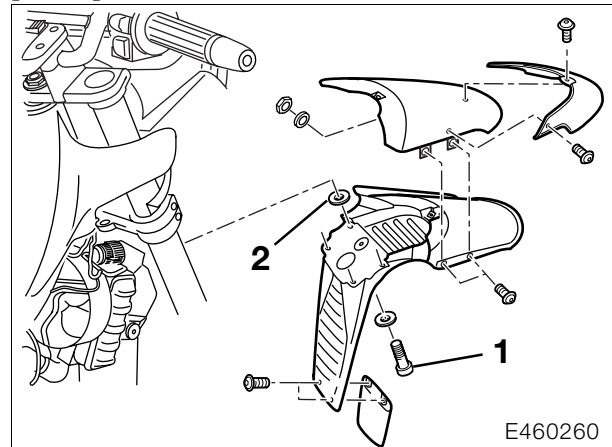
46 61 000 Removing and installing front mudguard

- Place motorcycle on its centre stand.

[GS]



[Dakar]

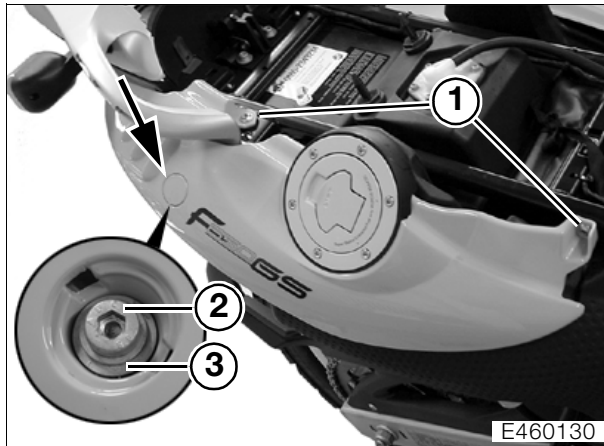


- Remove fasteners securing front mudguard (1).
- Remove front mudguard.
- Remove 4 washers (2) from mudguard.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the tapped bore in the fork bridge and the threads of the securing screw, coat threads with **Loctite 243** and install the screw.

! Tightening torques:
Front mudguard to fork bridge
(clean thread + Loctite 243)..... 3 Nm

46 63 Removing and installing left/right rear trim panel

- Remove seat.



- Unclip cover (arrow).
- Remove 2 screws (1).
- Remove screw (2).
- Remove the bezel.



Important:

Note second washer (3) when installing.

- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the tapped bore in the rear frame and the threads of the cover securing screw (2), coat threads with **Loctite 243** and install the screw.



Tightening torques:

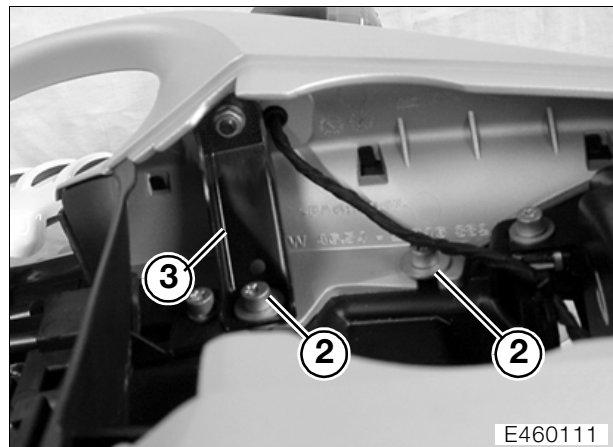
Trim panel to rear frame 4 Nm
 Trim panel to rear frame (mount for case holder)
 (clean thread + Loctite 243)..... 4 Nm

46 63 Removing and installing left/right grip

- Open the stowage compartment.
- Remove left/right silencer (→ 18.5).
- Remove turn-indicator cover.
- Disconnect cable and pull through.
- Remove turn indicator.



- Remove screws (1).

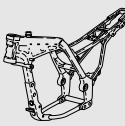


- Remove screws (2).
- Remove bracket (3) and grip.
- Installation is the reverse of the removal procedure.



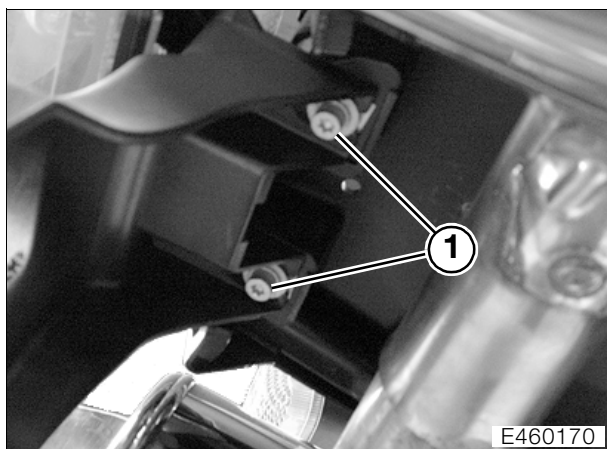
Tightening torques:

Grip to rear frame 9 Nm
 Turn indicator to tail section 3 Nm

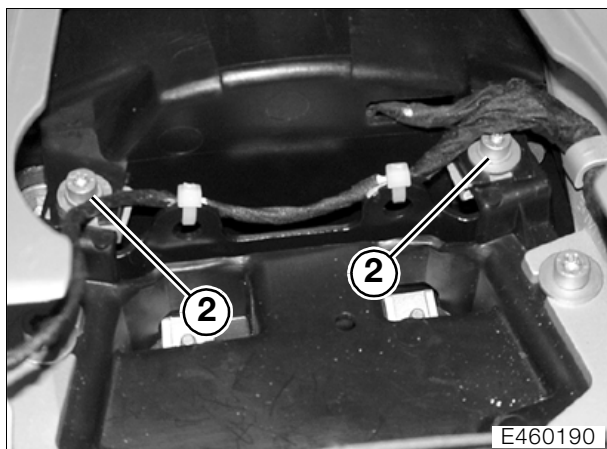


46 63 Removing and installing number-plate panel

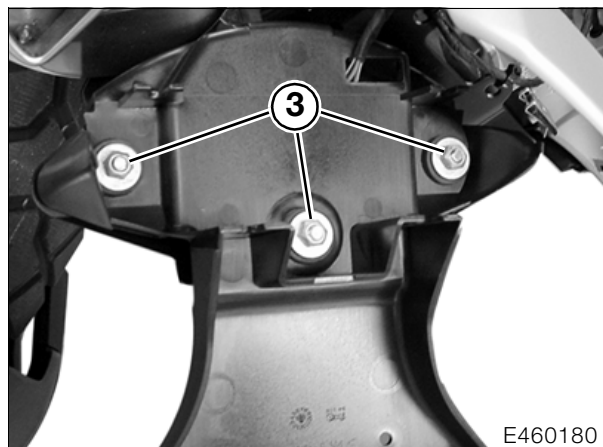
- Open the stowage compartment.



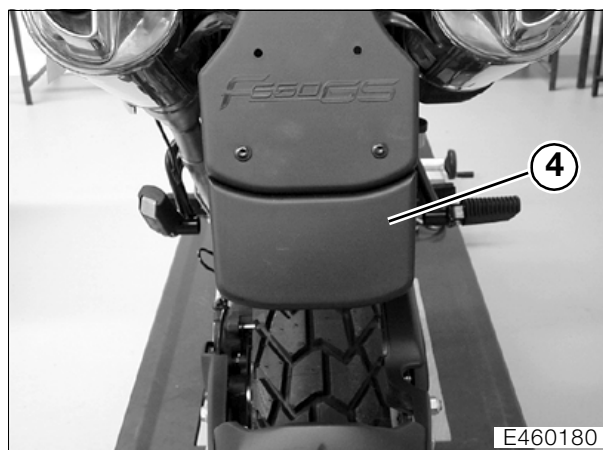
- Remove 2 fasteners (1) at bottom.



- Remove 2 fasteners (2) at top.
- Lift off the number-plate panel with tail light and turn it over.



- Remove nuts (3).
- Disconnect plugs.
- Remove tail light.



- **[Dakar]** Remove spray guard (4).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the securing screws for number-plate panel (1 and 2), coat threads with **Loctite 243** and install the screws.

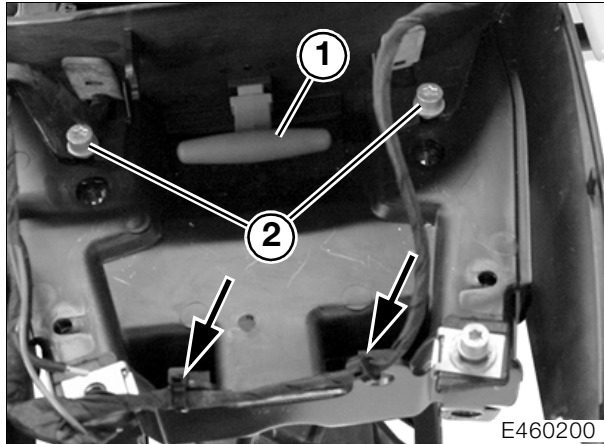


Tightening torques:


Number-plate panel to rear mudguard (clean thread + Loctite 243).....	3 Nm
Tail light to number-plate panel	4 Nm
Spray guard to number-plate panel.....	3 Nm

46 63 Removing and installing base of stowage compartment and partition

- Remove seat.
- Remove number plate panel (→ 46.10).
- Remove left and right grips (→ 46.9).

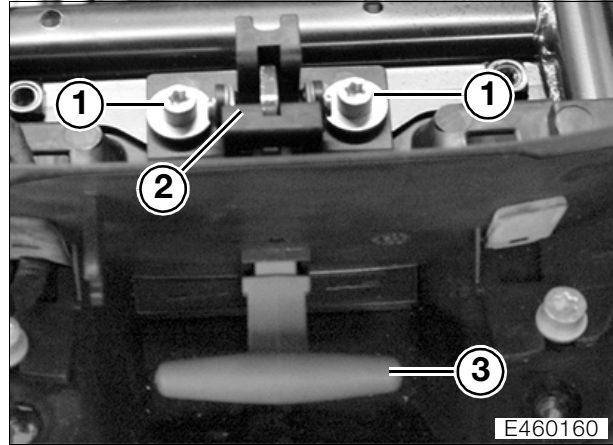


- Release fasteners (2).
- Cut through cable ties (arrows).
- Remove the stowage compartment.
- Unclip grip (1).
- Remove partition and pull the cable through.
- Installation is the reverse of the removal procedure.

 **Tightening torques:**
 Stowage compartment to rear frame 3 Nm

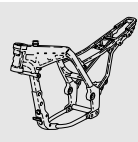
46 63 Removing and installing seat latch

- Remove seat.



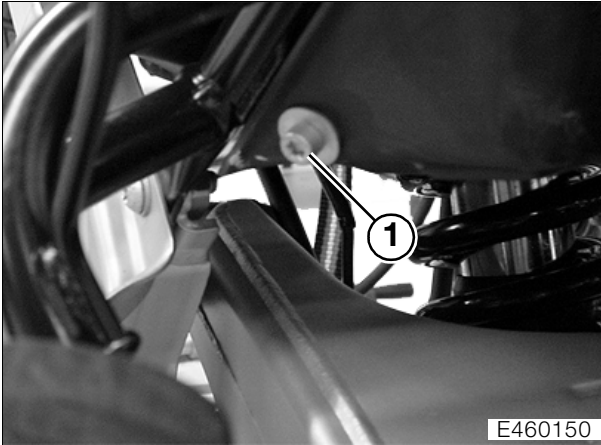
- Unclip grip (3).
- Remove screws (1).
- Remove latch (2).
- Installation is the reverse of the removal procedure.

 **Tightening torques:**
 Seat lock to rear frame 9 Nm

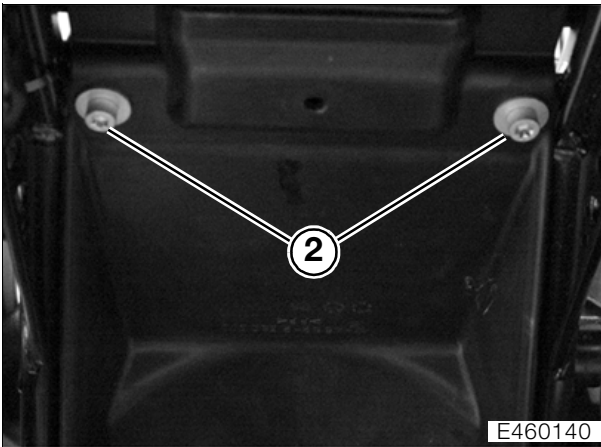


46 62 200 Removing and installing rear mudguard

- Remove exhaust manifold (→ 18.6).
- Remove chain takeup roller (→ 27.5).



- Release fasteners (1).



- Release fasteners (2).
- Remove mudguard.
- Installation is the reverse of the removal procedure.



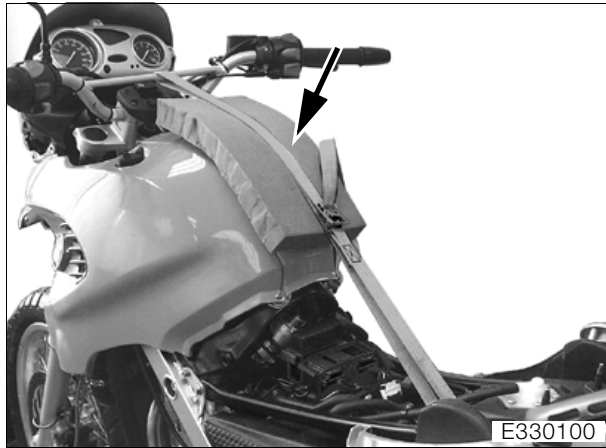
Tightening torques:

Mudguard to rear frame..... 3 Nm

Raising, removing and installing rear frame

Raising rear frame

- Remove exhaust manifold (→ 18.6).
- Secure front wheel in position.



! Important:

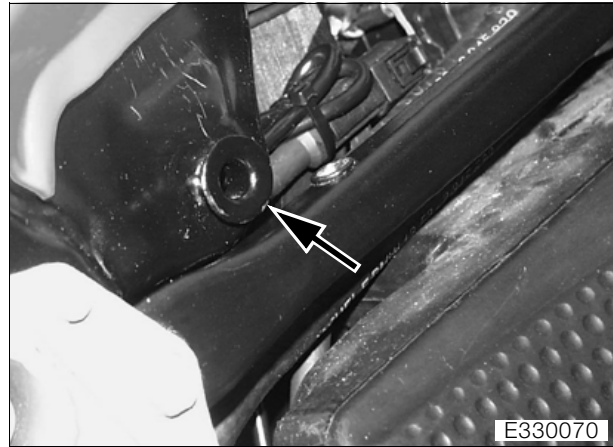
Protect trim panels with a material such as foam rubber (arrow) to prevent damage.

- Use a strap to secure the rear frame to the tie bar of the handlebars.

📄 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.



! Important:

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

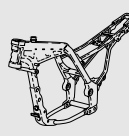
📄 Note:

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

- Clean the tapped bore in the frame and the threads of the bottom rear frame securing screw, coat threads with **Loctite 2701** and install the screw.

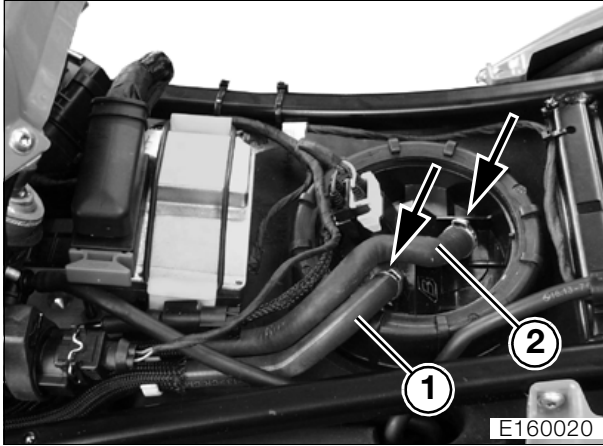
🔧 Tightening torques:

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	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

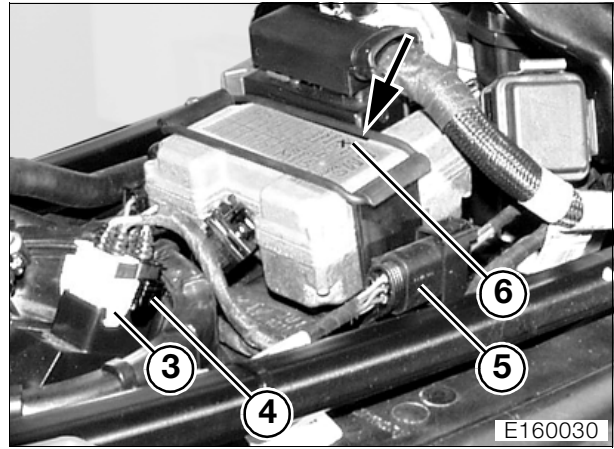
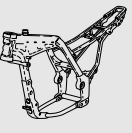


46 51 050 Removing and installing rear frame

- Place the motorcycle on its main (centre) stand.
 - Secure front wheel in position.
 - Remove seat.
 - Remove exhaust manifold (→ 18.6).
- Remove the fuse box.
 - Remove brake fluid reservoir from rear frame.



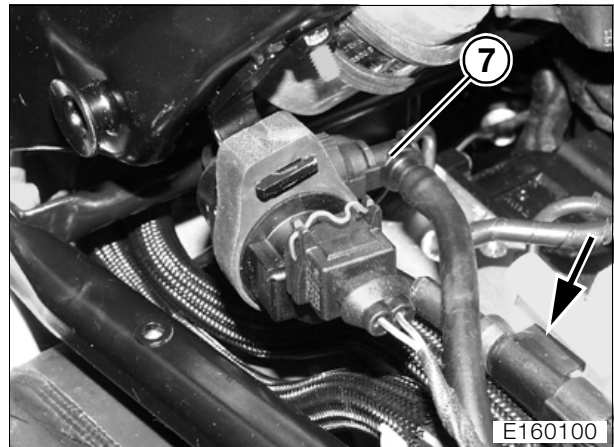
- Close off fuel supply line (1) and the fuel return line (2) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Remove fuel hoses from clips on control-unit holder.



Note:

Do not unplug the BMS control unit.

- Disengage the rubber strap (arrow) and remove 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).



- 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:

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

- Clean the tapped bore in the frame and the threads of the bottom rear frame securing screw, coat threads with **Loctite 2701** and install the screw.
- Make sure that fuel feed hose (1) and fuel return hose (2) are correctly routed.



Warning:

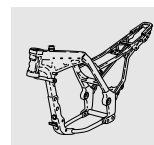
Do not use screw-type hose clamps on the fuel hoses, because they could damage the hoses and result in a fire hazard.

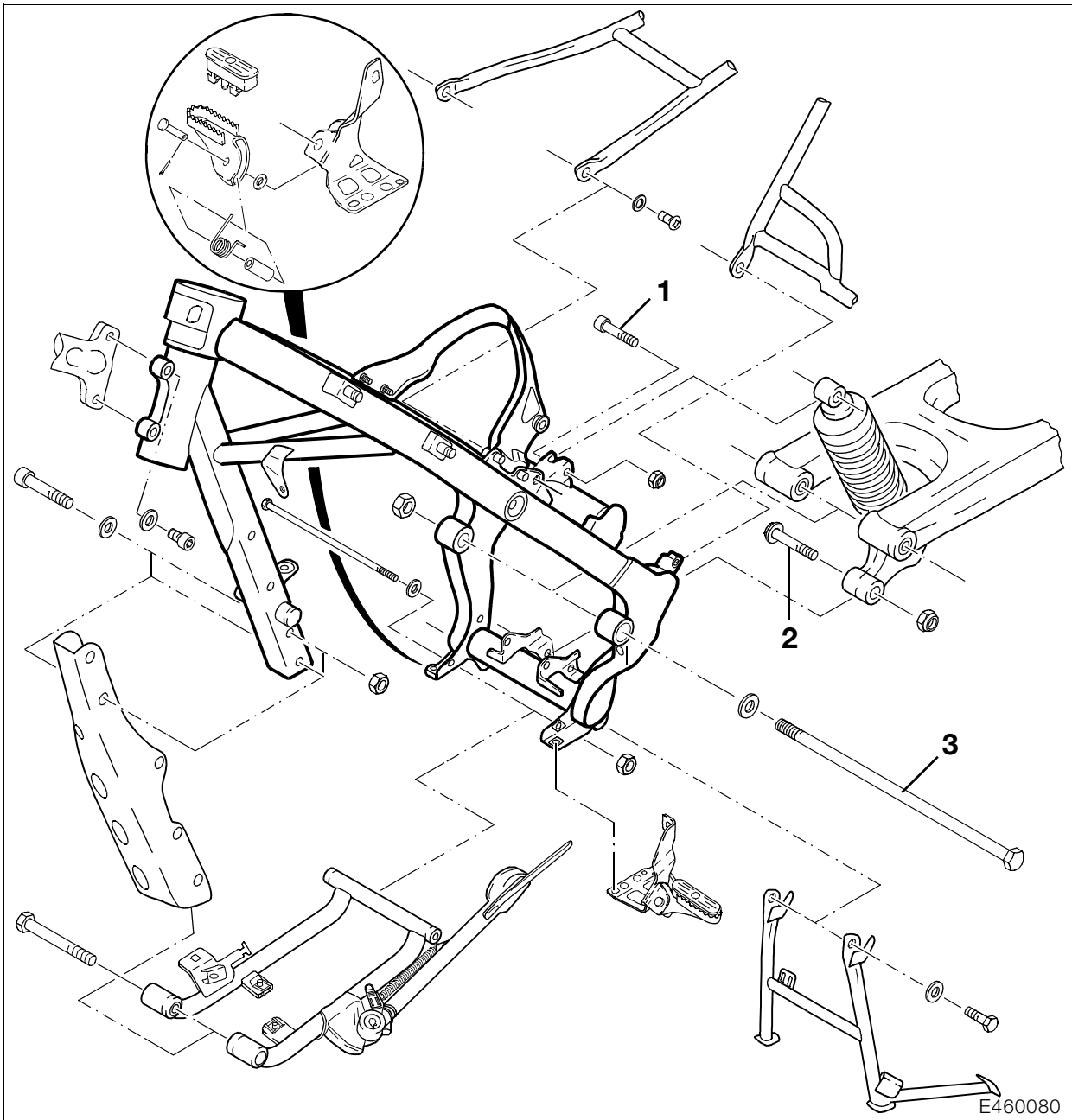
- Close hose clamps with pliers, **BMW No. 13 1 500**.



Tightening torques:

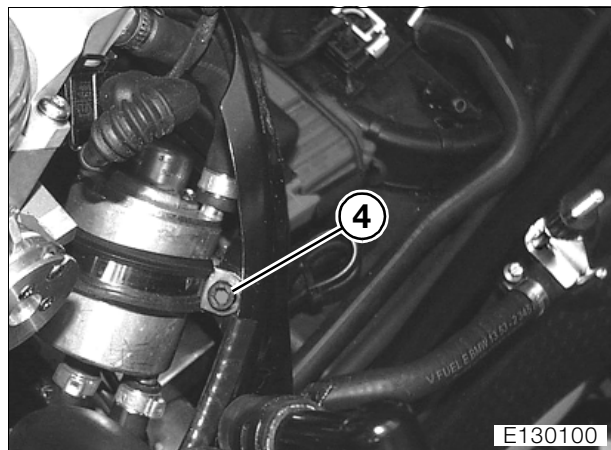
Oxygen sensor to exhaust.....	45 Nm
Exhaust manifold to cylinder head.....	20 Nm
Clamp for silencer	55 Nm
Engine guard to frame.....	9 Nm
Brake fluid reservoir for rear brake to rear frame.....	5 Nm
Rear frame to main frame, top.....	21 Nm
Rear frame to main frame, bottom (clean thread + Loctite 2701).....	21 Nm



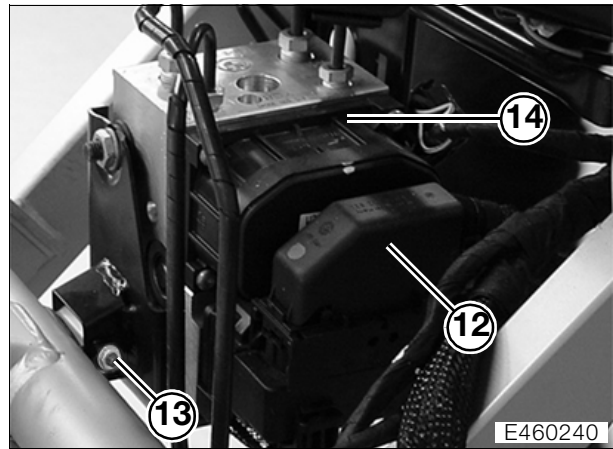
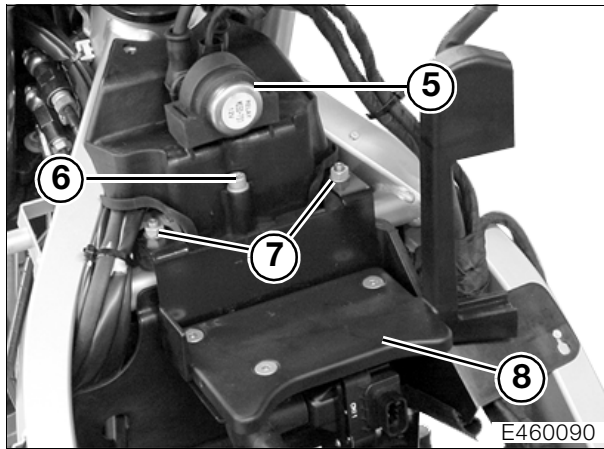


46 51 120 Removing frame

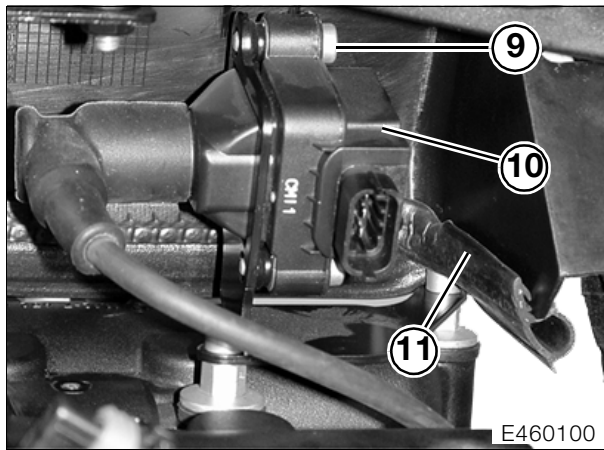
- Remove engine (⇒ 11.21).
- Remove battery (⇒ 61.10).
- Remove throttle stub pipe (⇒ 13.8).
- Remove oil tank.
- Remove rear frame (⇒ 46.14).
- Remove heat shield for exhaust from footrest.



- Slacken fastener (4) of clamp for fuel filter. Remove fuel filter complete with hoses.
- Remove cockpit fairing (⇒ 46.6).

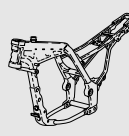


- Remove starter relay (5).
- Release fasteners (7). Remove battery holder (8).
- Remove fastener (6) securing electrics box cover.



- Unclip cable for ABS sensor from holder for pressure modulator.
- Disconnect plug (12) from pressure modulator.
- Remove fastener (13) securing holder.
- Remove pressure modulator with holder (14).
- Remove brake pedal (→ 34.13).
- Remove fastener (1) securing shock absorber at top.
- Remove the fastener (2) securing the angled lever.
- Remove pivot pin (3) of swinging fork.
- Remove swinging fork with shock absorber and rear wheel.
- Remove telescopic fork (→ 31.7).
- Cut through all cable ties securing the wiring harness to the frame.
- Remove the fuse box.
- Remove wiring harness, electrics box, handlebars and upper fork bridge.
- Remove main stand (→ 46.21).

- Release fasteners (9). Remove ignition coil (10).
- Remove spray guard (11).
- Remove front brake lines (→ 34.17).
- Disconnect brake hose from brake cylinder at top.
- Remove rear brake lines (→ 34.19).



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



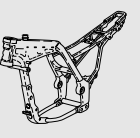
Note:

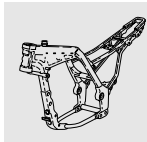
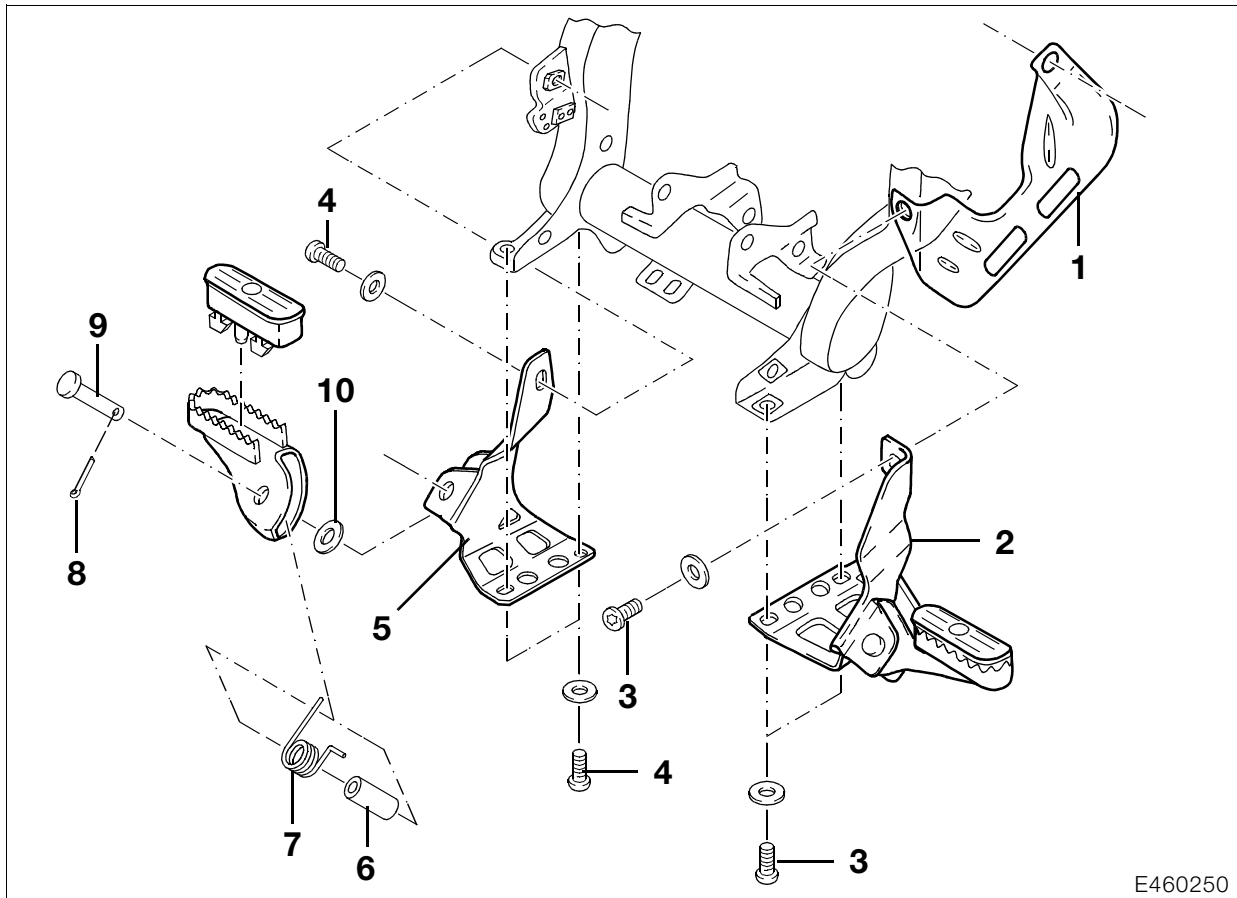
After installing the rear swinging fork, do not fully tighten the stud in the swinging-fork pivot until the engine is installed.
 After installing the brake lines, install the rear frame first, before installing the engine. Subsequent installation is the reverse of the removal procedure.



Tightening torques:

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 thread + Loctite 2701).....	21 Nm
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
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, neutral indicator.....	2 Nm
Frame truss to engine shell	21 Nm
Frame truss to main frame.....	21 Nm
Spring-strut adjusting knob bracket to frame .	9 Nm
Radiator to main frame at top	9 Nm
Swinging-fork 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, adjuster sleeve.....	zero play, max. 5 Nm
Cylinder head to frame, locknut.....	100 Nm
Angled lever to frame	58 Nm + 45°





46 71 061 Removing and installing right footrest

- Remove 3 screws (4).
- Remove footrest (5).
- Remove keeper (8).



Important:
Note spring loading.

- Remove stud (9) and remove spring (7), sleeve (6) and washer (10).
- Installation is the reverse of the removal procedure.



Tightening torques:
Footrest to frame..... 21 Nm

46 71 061 Removing and installing left footrest

- Remove 3 screws (3).
- Remove footrest (2).
- Disassemble the right footrest in the same way as the left footrest.



Note:
When installing, do not forget the heat shield (1).

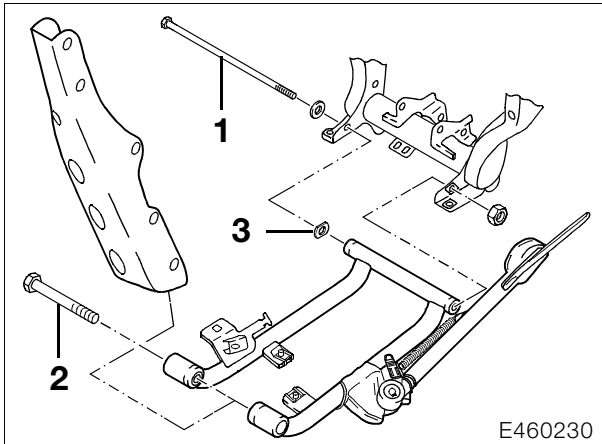
- Installation is the reverse of the removal procedure.



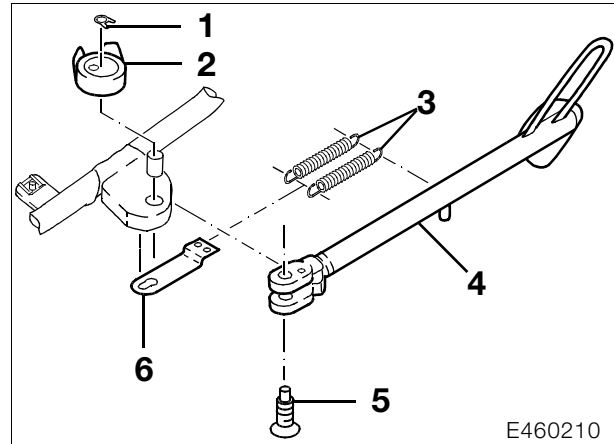
Tightening torques:
Footrest to frame..... 21 Nm

Removing and installing bottom truss

- Remove engine guard (→ 46.8)



46 53 000 Removing and installing side stand



- Disconnect plug of side-stand switch.
- Disconnect plug of oxygen sensor.
- Remove plug from holder.
- Release fasteners (1, 2).
- Installation is the reverse of the removal procedure: pay particular attention to the following.



Note:

When installing, it is essential to ensure that washer or washers (3) (up to 3 washers possible) are reinstalled. Shim the bottom truss correctly if you are unsure of the number or thickness of the washer or washers.

- Install bottom truss with washer (3), shim the assembly correctly if necessary.



Note:

Washer (3) is available in 3 thicknesses.

- To shim the assembly, insert washer or washers until clearance between bottom truss and frame is approx. 0.1 mm (0.004 in).



Tightening torques:

Bottom truss to frame 21 Nm
 Bottom truss to engine shell..... 21 Nm



Important:

Note spring loading.

- Use hook, **BMW No. 46 5 721**, to disengage springs (3). Remove plate (6) with the springs.
- Remove retaining ring (1).
- Remove switch (2).
- Remove screw (5).
- Remove stand (4).
- Installation is the reverse of the removal procedure.



Important:

Install screw with **Loctite 243**.

Lubricant:

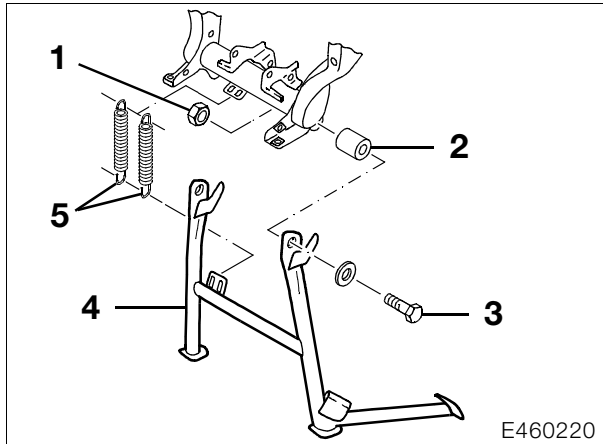
for pivot bushing Staburags NBU 30 PTM



Tightening torques:

Side stand to bottom truss..... 40 Nm

46 52 000 Removing and installing main (centre) stand



Important:
Note spring loading.

- Use hook, **BMW No. 46 5 721**, to disengage springs (5).
- Remove fasteners (1) on left and right.
- Remove the main stand
- Remove spacer sleeve (2) from frame.
- Installation is the reverse of the removal procedure.

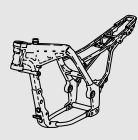
Lubricant:

for spacer sleeve..... Staburags NBU 30 PTM



Tightening torques:

Main stand to frame 41 Nm



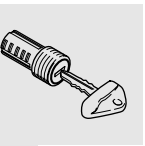
51 Equipment

Contents

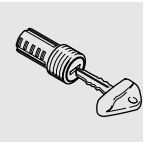
Page

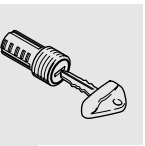
Technical Data	3
Removing and installing ignition switch/steering lock	5
Removing and installing lock barrel	6
Removing and installing lock for rear stowage compartment	6
Removing and installing lock barrel for fuel tank filler cap	6
Replacing mirrors	7





Technical Data	F 650 GS / GS Dakar





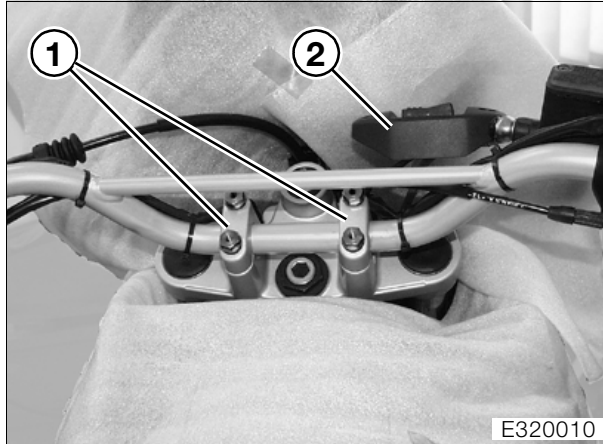
51 25 040 Removing and installing ignition switch/steering lock

- Place motorcycle on its centre stand.

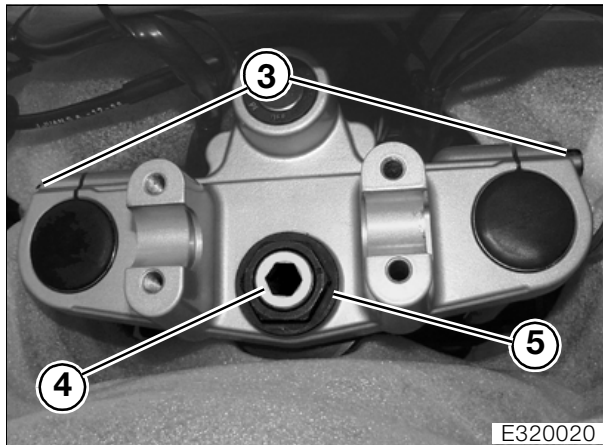


Important:

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

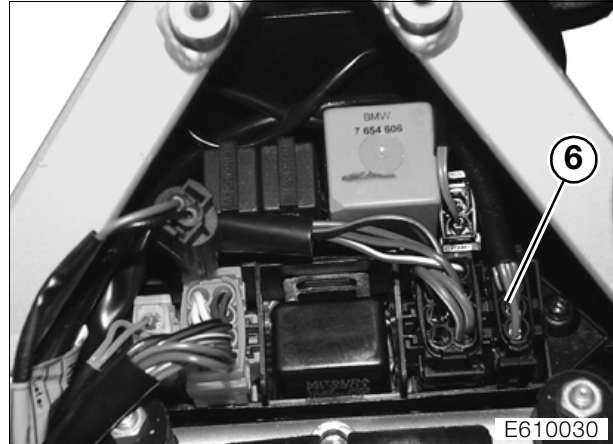


- Remove impact pad (2).
- Remove clamp blocks (1).
- Remove the handlebars and place them in front of the instrument cluster.

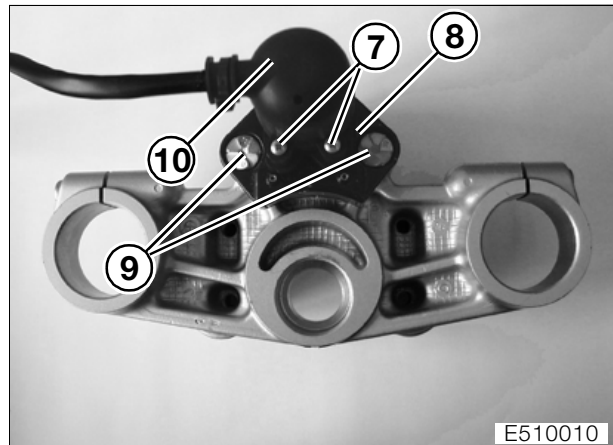


- Unscrew hex nut (5).
- Release clamping screws (3) at upper fork bridge.
- Unclip the clutch cable and the brake hose from their holders.
- Cut through the 2 cable ties at the left of the frame head.

- 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.

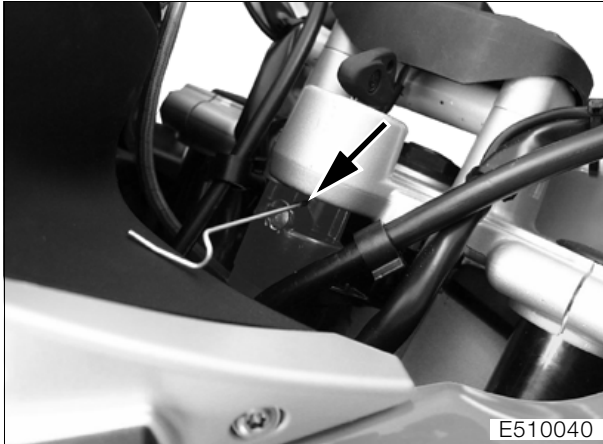


Tightening torque:

Ignition/steering lock to fork bridge	21 Nm
Hexagon nut to counter-tube	65 Nm
Clamp screws for fork bridge	23 Nm
Handlebars to fork bridge	23 Nm

Removing and installing lock barrel

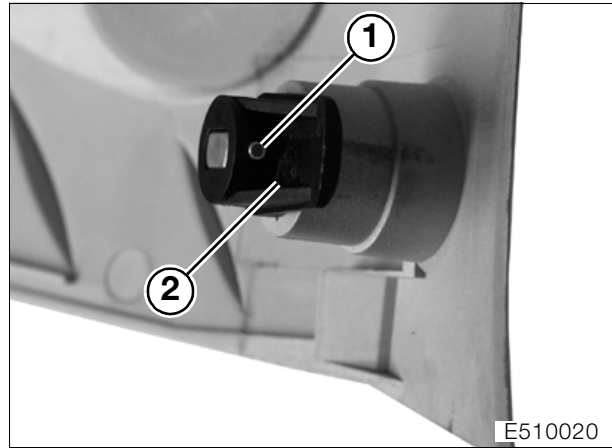
- Place motorcycle on its centre stand.
- Turn the handlebars to the left.
- Turn the ignition key to the ON position.



- 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.

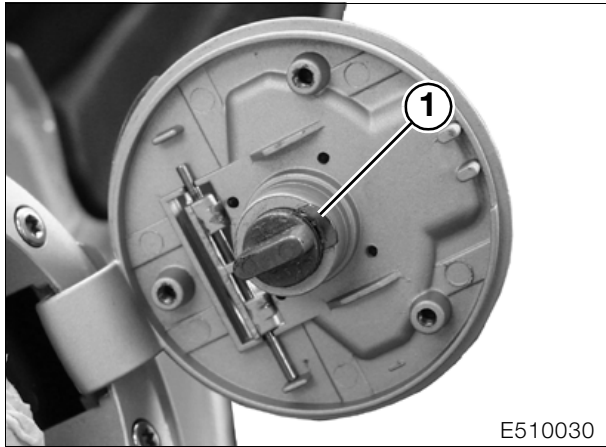
51 25 030 Removing and installing lock barrel for fuel tank filler cap



Note:

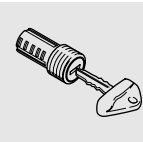
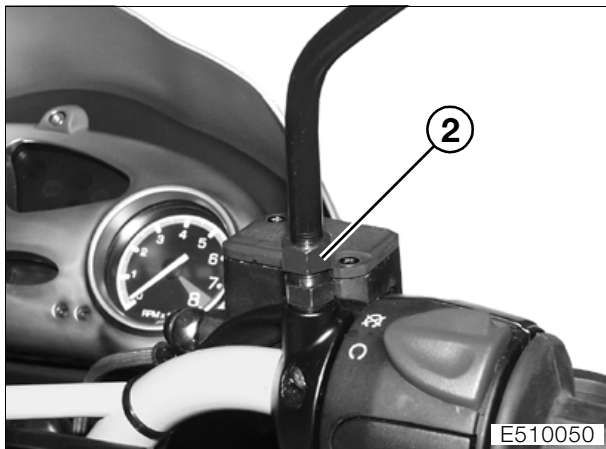
Make sure that screws do not fall into fuel tank: cover fuel tank filler neck with cloth.

- 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 torque:**
 Mirror to handlebar fitting 18 Nm

61 General electrical equipment

Contents

Page

Technical Data	3
Wiring harness	5
View from left	5
View from right	6
[Dakar] General view, left side	7
[Dakar] General view, right side	8
Component positions in electronic equipment box	9
Relay positions in electronic equipment box	9
Connectors, electronics box	9
Removing and installing battery	10
Removing and installing battery carrier	10
Replacing fuses	11
Motorcycle fuses	11
Fuses	11
Removing and installing electronic equipment box	11
Removing and installing coolant-temperature sensor (⇒ 17.9)	11
Removing and installing side stand switch	12
Removing and installing rear-brake switch for brake light	12
Removing and installing front-brake switch for brake light	13
Removing and installing horn	14
Removing and installing neutral-indicator switch	14
Removing and installing front and rear ABS sensors (⇒ 34.14)/(⇒ 34.15)	14



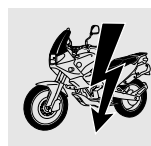
Contents

Page

[GS] Removing and installing voltage regulator	15
[Dakar] Removing and installing voltage regulator	15



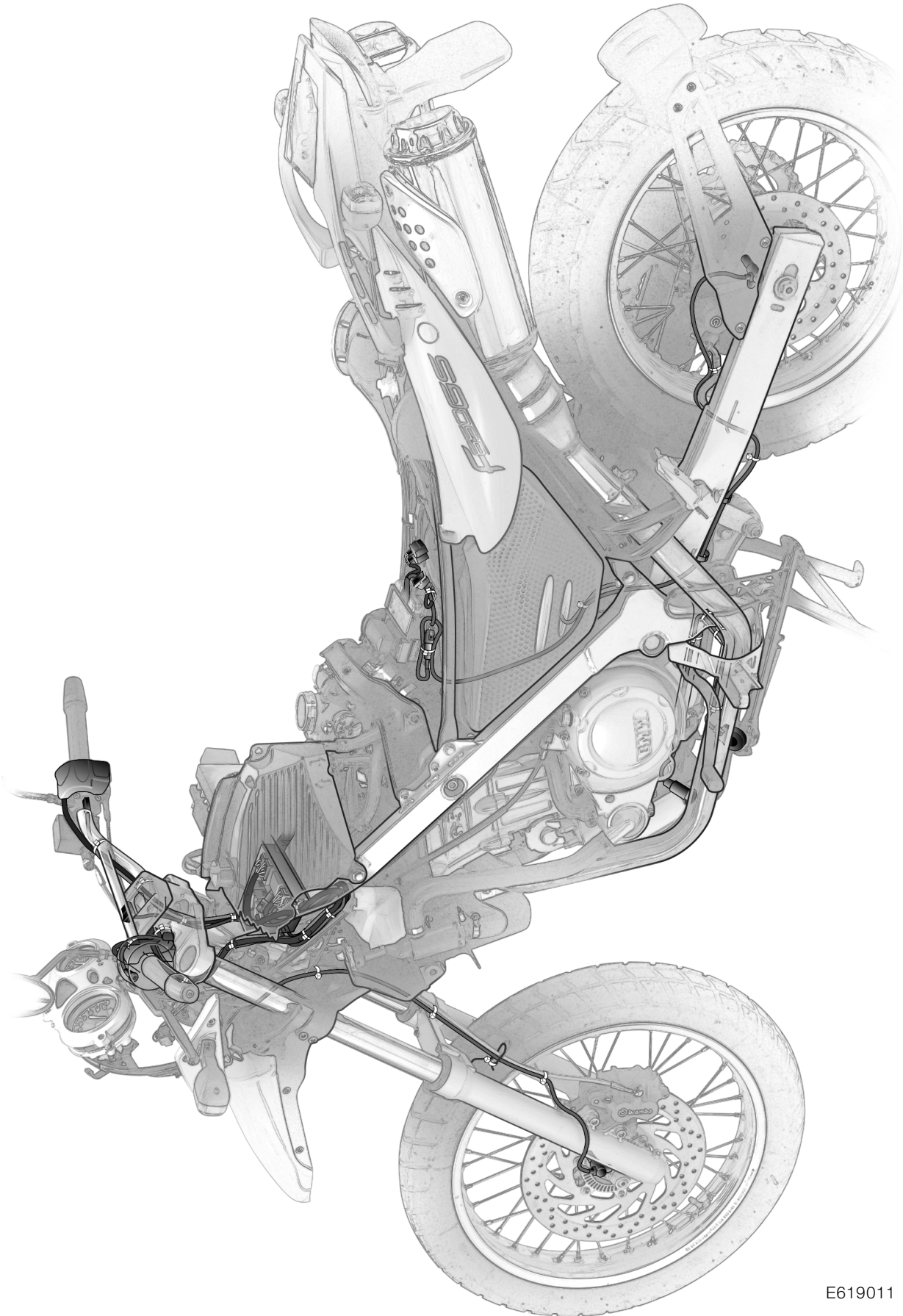
Technical Data		F 650 GS / GS Dakar
General electrical equipment		
Circuit voltage	V	12
Battery	A/h	12





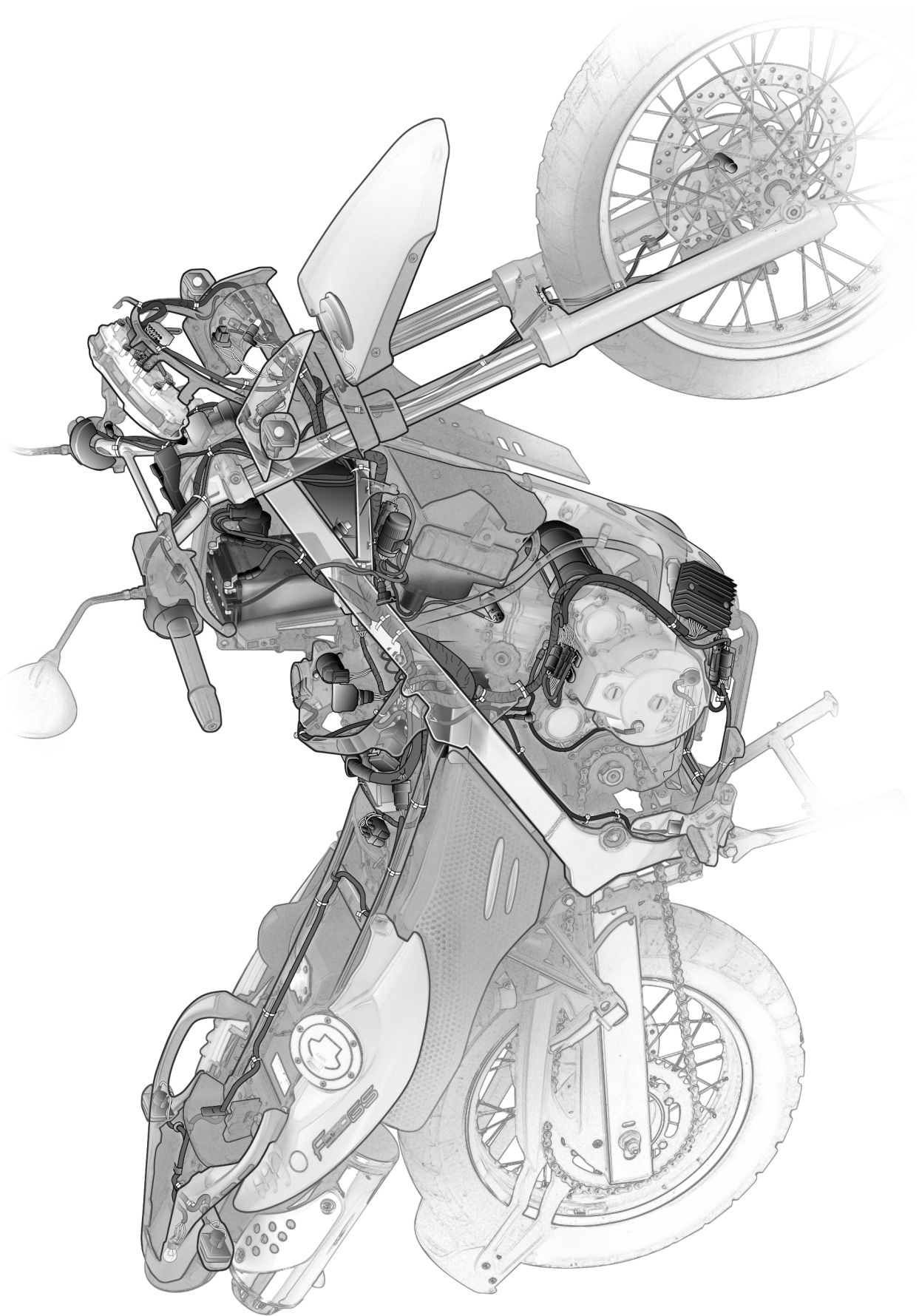
Wiring harness

View from left



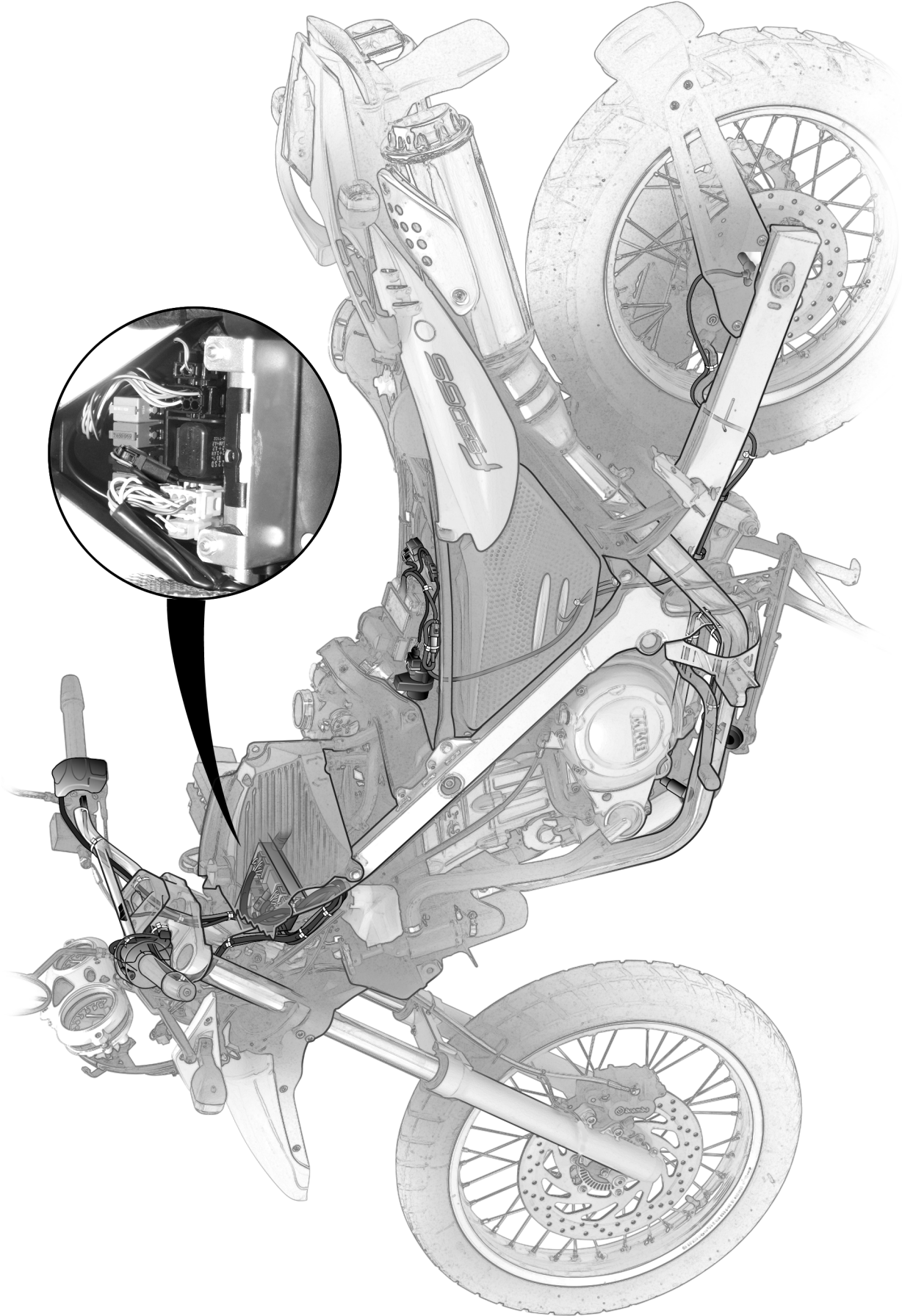
E619011

View from right

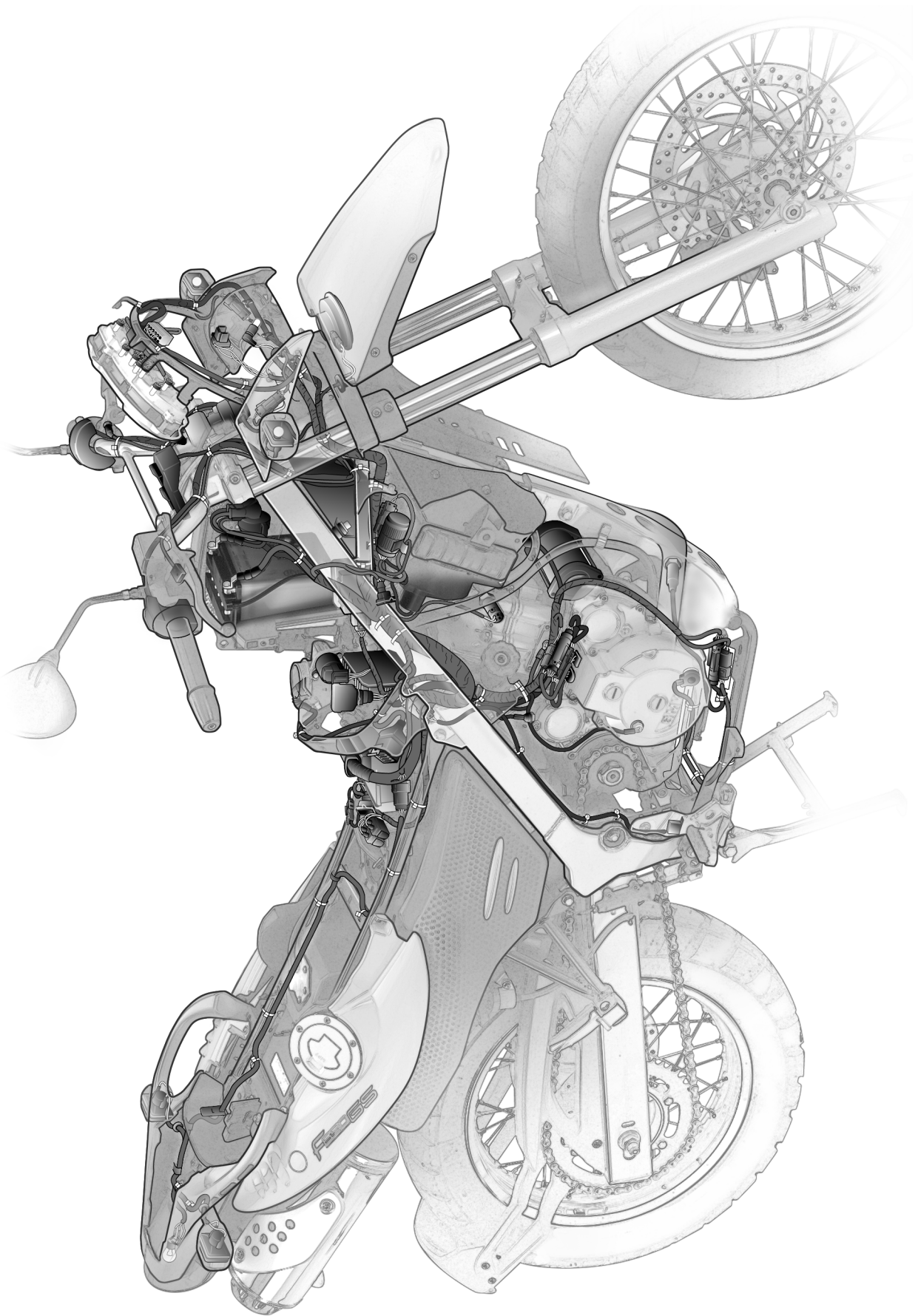


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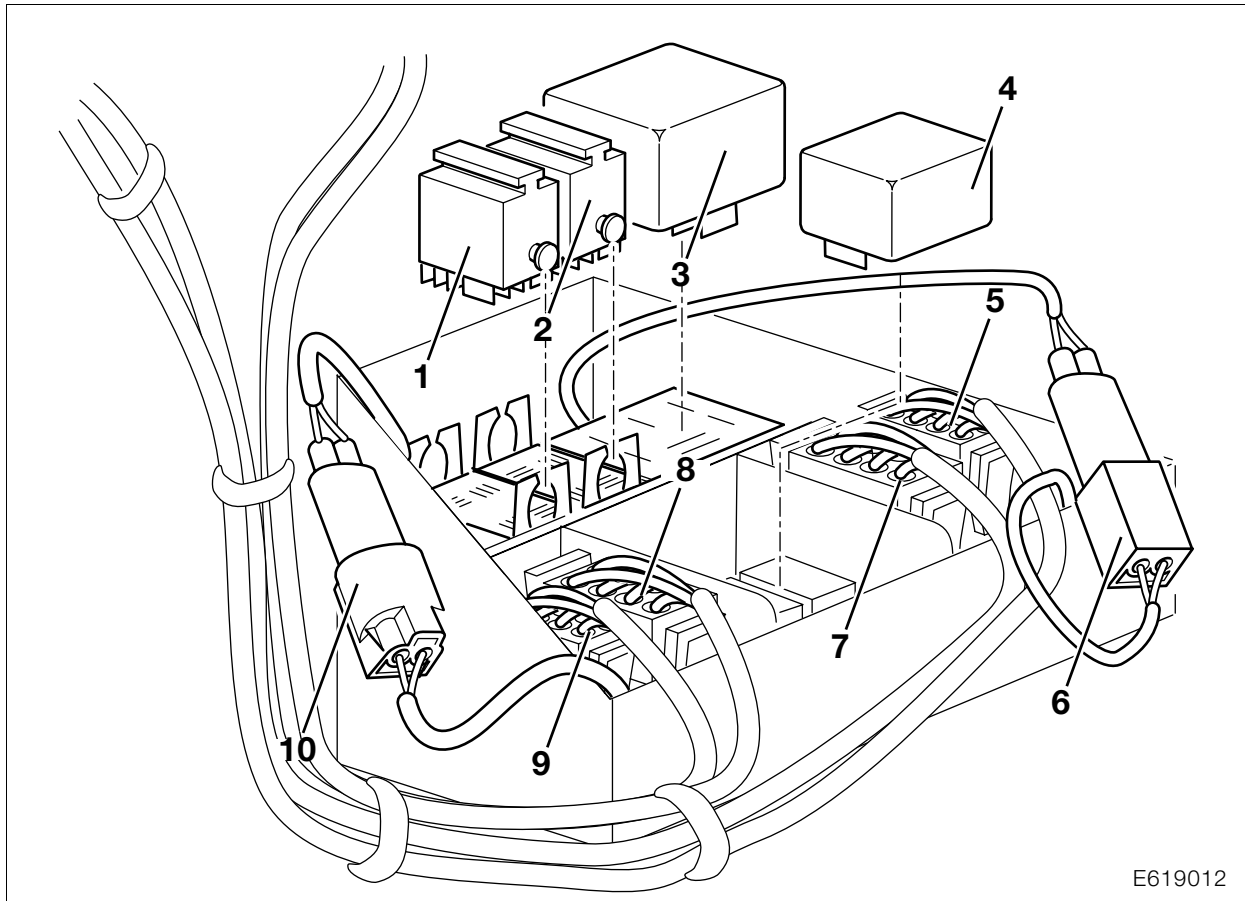
[Dakar] General view, left side



[Dakar] General view, right side



Component positions in electronic



E619012

equipment box

Relay positions in electronic equipment box

- 1 Relief relay
- 2 BMS relay
- 3 Diode relay
- 4 Flasher unit

Connectors, electronics 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.

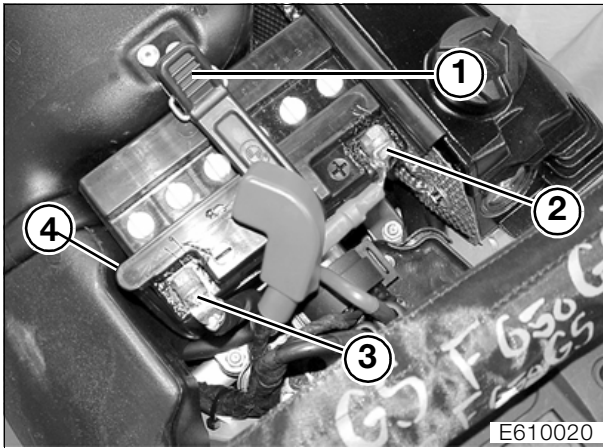
- Remove left, right and centre covers (→ 46.5).



Important:

Disconnect the battery only with the ignition switched off.

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



- Disconnect the earth lead (3) from the battery and insulate it.
- Disconnect positive lead (2) from battery.
- Disengage rubber strap (1) 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

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



Important:

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

61 21 100 Removing and installing battery carrier

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers (→ 46.5).
- Remove the battery.
- Remove intake air pipe (→ 13.5).
- Remove intake air silencer (→ 13.6).
- 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

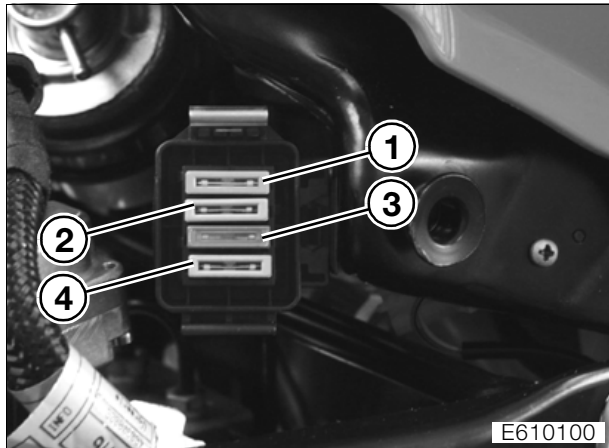


Replacing fuses

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 (→ 61.10).
- Disconnect the expansion tank from the radiator, pull it to one side and leave 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 valve 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:

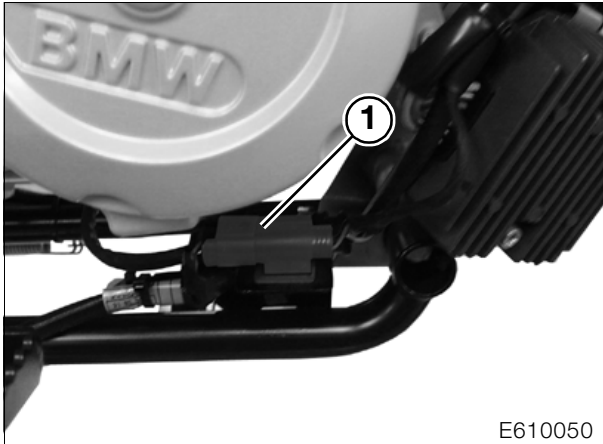
Intake air silencer to retainer	9 Nm
Intake air silencer to oil tank.....	9 Nm
Connecting flange	5 Nm
Fasteners, cover/trim panel for turn indicator .	3 Nm
Lid of electronic equipment box	4 Nm
Electronic equipment box to frame.....	5 Nm
Expansion tank to radiator	9 Nm
Ignition coil to cylinder head.....	9 Nm



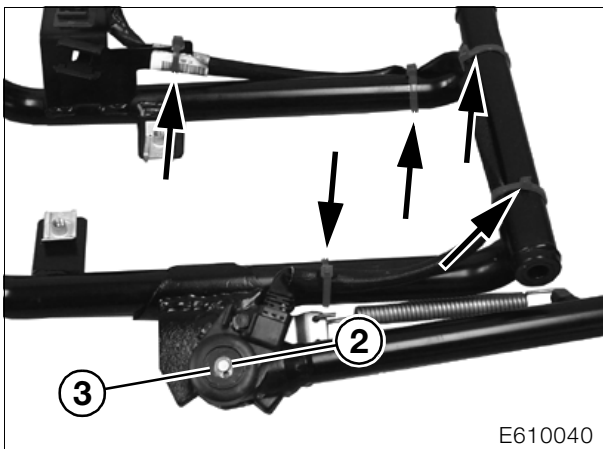
61 31 906 Removing and installing coolant-temperature sensor (→ 17.9)

61 31 302 Removing and installing side stand switch

- Place motorcycle on its centre stand.
- Remove engine guard (→ 46.8).



- Disconnect side-stand switch plug (1) and unclip the plug.
- Disconnect plug of oxygen sensor.
- Remove bottom truss.



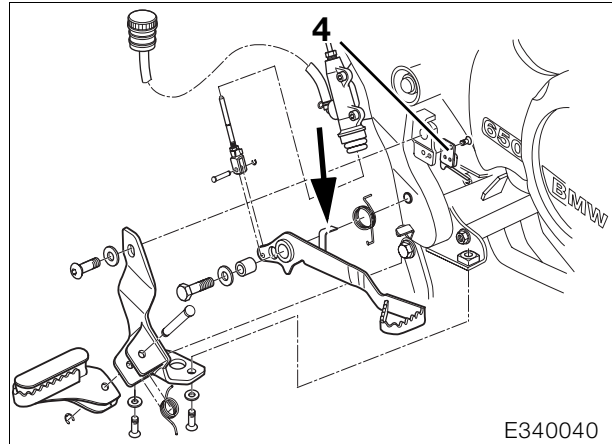
- Cut the cable ties at the bottom truss (arrows).
- Remove retaining ring (2).
- Lift switch (3).
- Disconnect plug of switch (3).
- Installation is the reverse of the removal procedure.

Tightening torques:

Bottom truss to engine shell.....	21 Nm
Bottom truss 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 (→ 46.5).



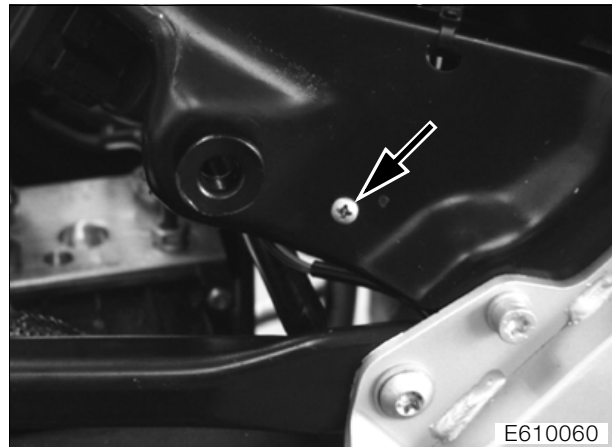
- Remove brake-light switch (4).



Note:

Check protective hose (arrow) on footbrake lever for damage. Replace the hose if it is damaged.

- 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.

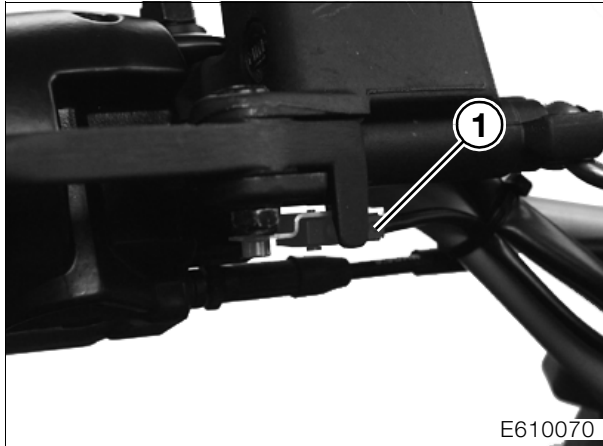


Tightening torques:

Brake light switch, footbrake, to frame 5 Nm

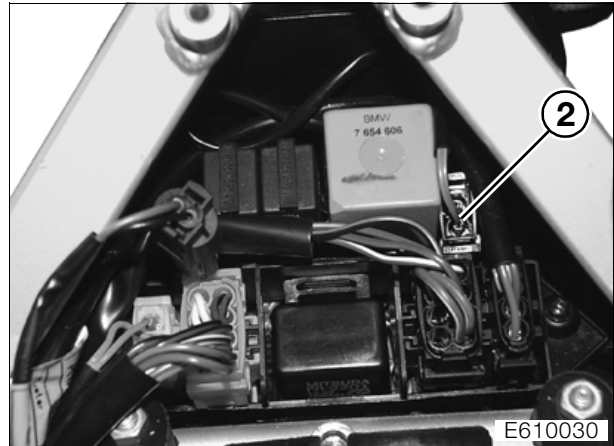
61 31 300 Removing and installing front-brake switch for brake light

- Place motorcycle on its centre stand.
- Remove seat.
- Remove left, right and centre covers (→ 46.5).



- 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.



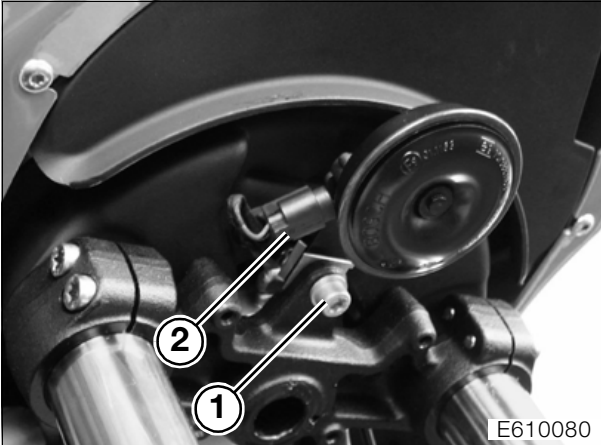
Tightening torques:

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 (→ 46.8).



- 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

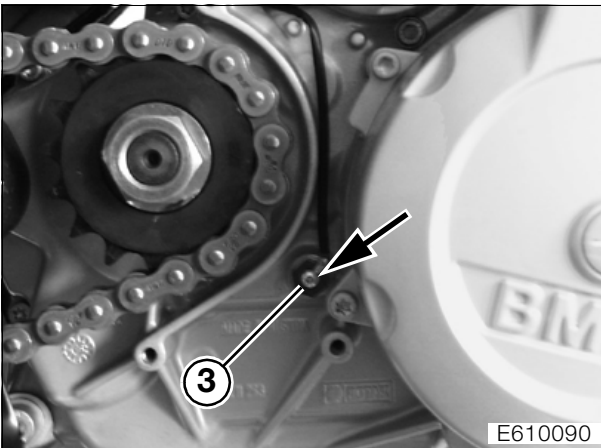
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Clean the threads of the neutral-indicator switch and coat with **Loctite 243**.

Tightening torques:
 Neutral-indicator switch
 (clean thread + Loctite 243) 3 Nm

Removing and installing front and rear ABS sensors (→ 34.14)/(→ 34.15)

61 31 227 Removing and installing neutral-indicator switch

- Remove cover for chain drive sprocket.

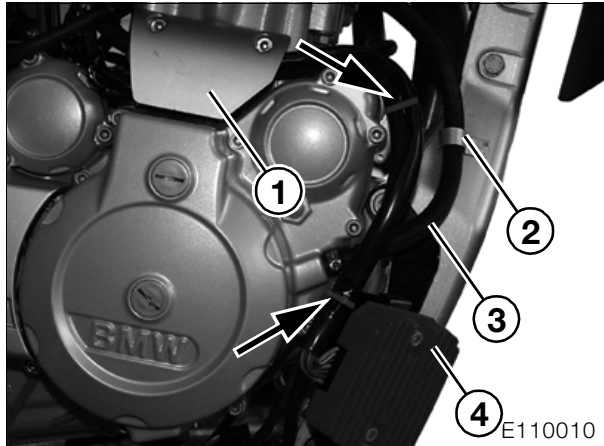


- Remove fastener securing cable to neutral-indicator switch.
- Remove neutral-indicator switch (3).



[GS] Removing and installing voltage regulator

- Place motorcycle on its centre stand.
- Secure front wheel in position.
- Remove seat.
- Disconnect battery negative terminal.
- Remove engine guard (→ 46.8).

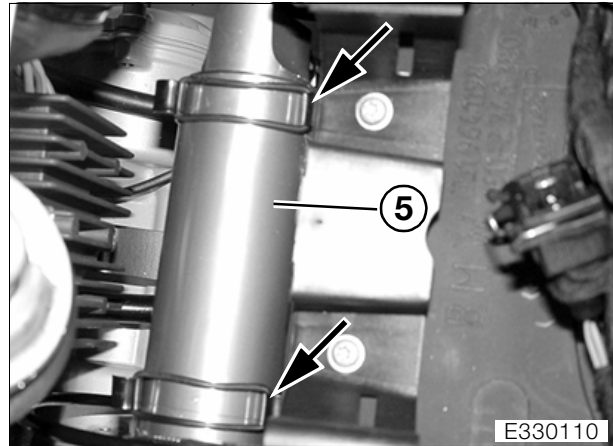


- Remove cable cover (1) from the engine.
- Cut the 2 cable ties (arrow) at the voltage regulator.
- Disconnect the plug of the voltage regulator.
- Installation is the reverse of the removal procedure.

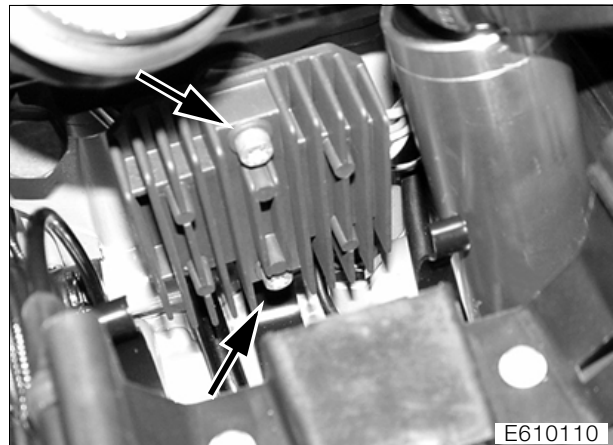
 **Tightening torques:**
Voltage regulator to bracket 7 Nm

[Dakar] Removing and installing voltage regulator


- Place motorcycle on its centre stand.
- Secure front wheel in position.
- Remove seat.
- Disconnect battery negative terminal.
- Remove cable cover (1) from the engine.
- Disconnect the plug of the voltage regulator.
- Remove the BMS control unit from the holder.



- **[Dakar]** Remove rubber element from holder (arrow).
- **[Dakar]** Remove reservoir (5) from holder and lower it to the right.



- Remove the fasteners (arrows) securing the voltage regulator.
- Remove the voltage regulator.
- Installation is the reverse of the removal procedure.

 **Tightening torques:**
Voltage regulator to holder 7 Nm



62 Instruments

Contents

Page

Technical Data	3
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

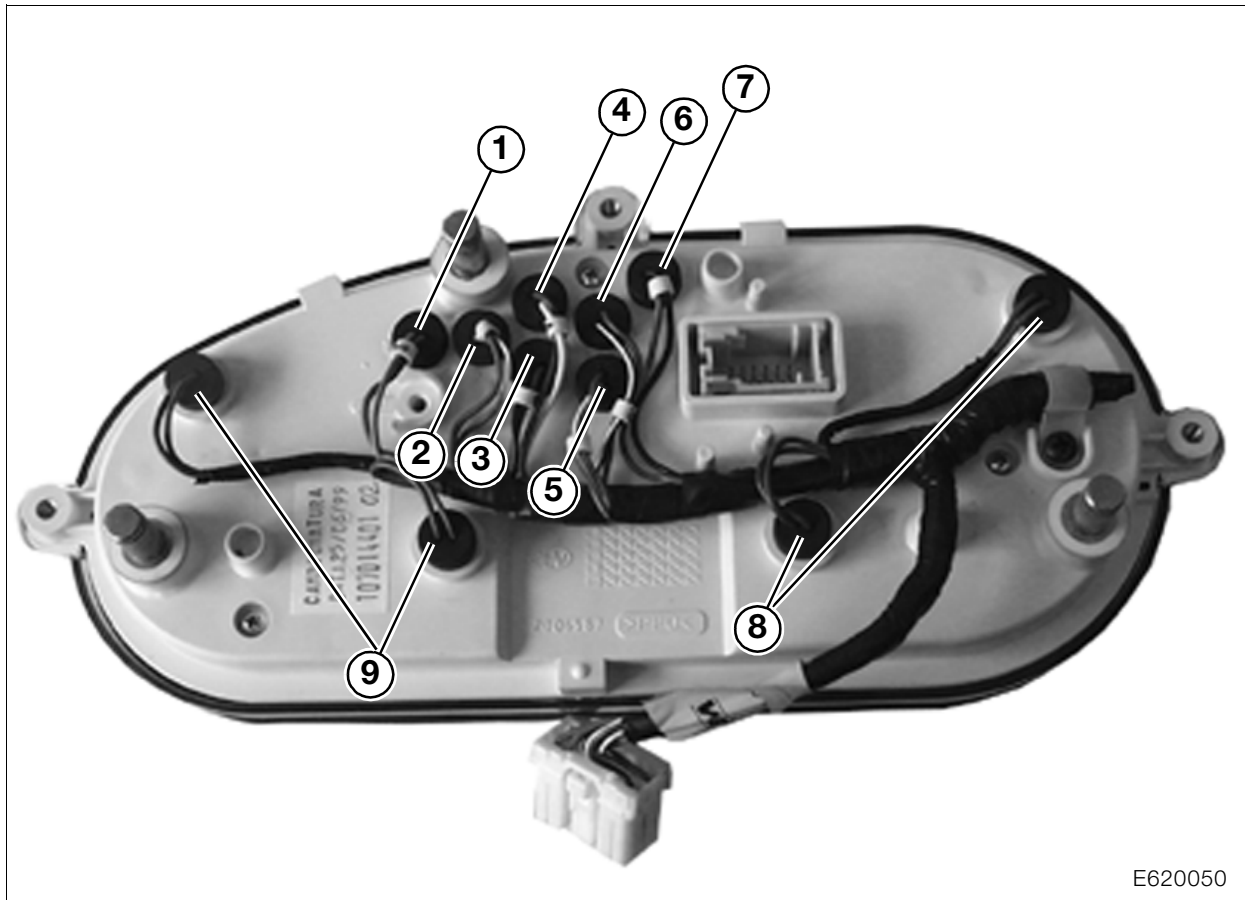




Technical Data	F 650 GS / GS Dakar
Instruments	
Speedometer and revolution counter lighting	W5/1.2 - 12V 1.2W
Telltale and warning lights	
Flashing turn indicator	W5/1.2 - 12V 1.2W
Neutral	W5/1.2 - 12V 1.2W
Oil pressure	W5/1.2 - 12V 1.2W
Water temperature	W5/1.2 - 12V 1.2W
High (main) beam headlight	W5/1.2 - 12V 1.2W
ABS	W5/1.2 - 12V 1.2W
Fuel gauge	W5/1.2 - 12V 1.2W







E620050

Telltale/warning lights

1. Water temperature
2. Oil pressure
3. Neutral
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

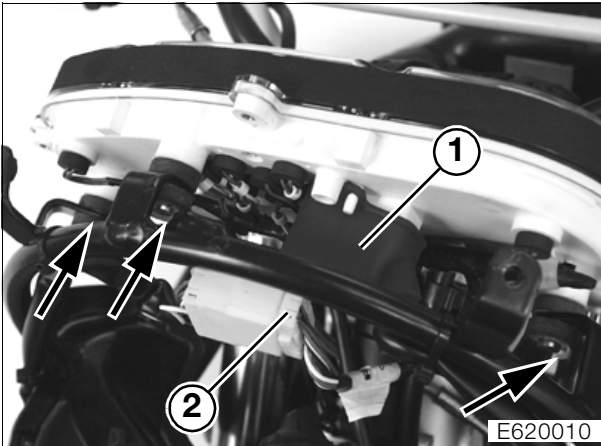
- Place motorcycle on its centre stand.
- Remove left and right covers (→ 46.5).



Note:

Note washers and rubber ring.

- Remove the windscreen.
- 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 latches (arrows) and remove the instrument cluster.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



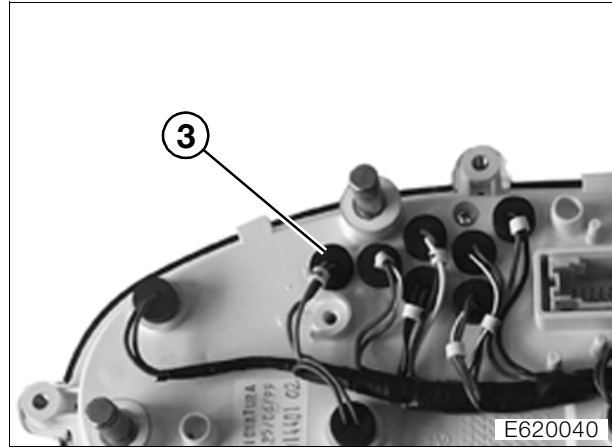
Warning:

After installing the windscreen, check and if necessary adjust the headlight setting.



Replacing telltale/warning lights

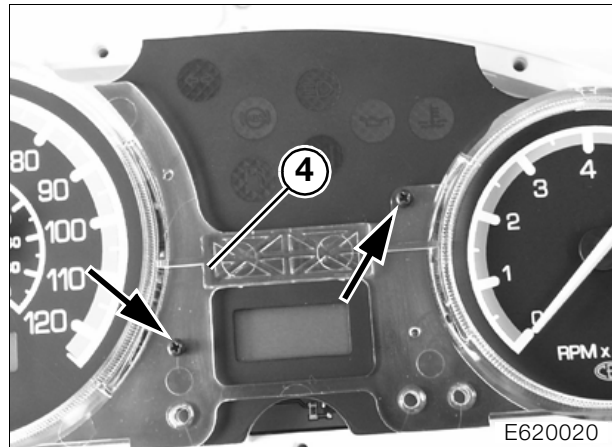
- Remove instrument panel.



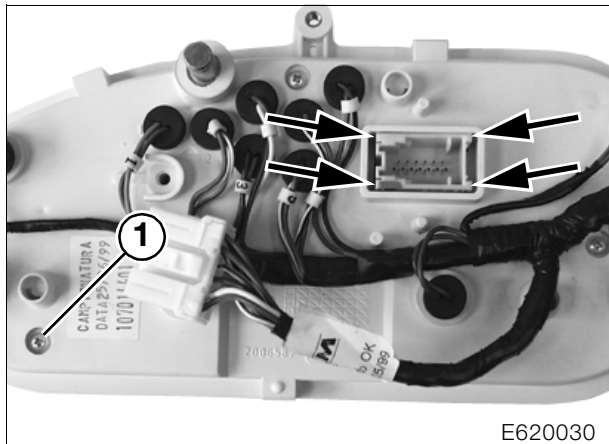
- Remove rubber grommet (3).
- Pull the indicator light out of the socket.
- Installation is the reverse of the removal procedure.

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).

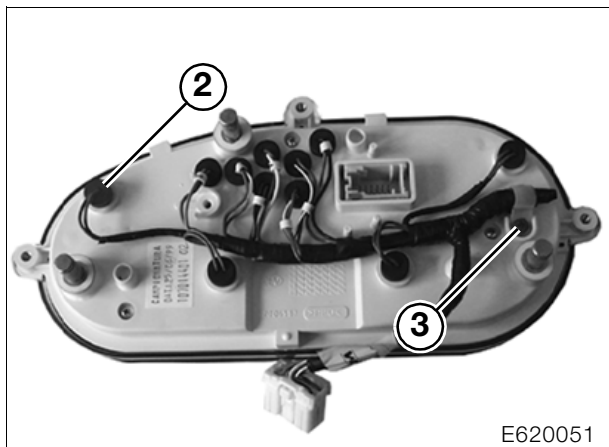


E620030

- 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 cluster (→ 62.6).



E620051

- Pull out the warning lights (2) with the rubber grommets.
- Disconnect the wiring harness (3).
- Installation is the reverse of the removal procedure.



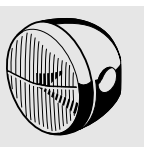
63 Lights

Contents

Page

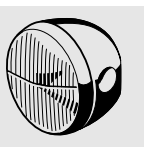
Technical Data	3
Removing and installing headlight	5
Removing and installing rear light	5
Replacing bulb	6
Bulb for low-beam headlight/high-beam headlight	6
Bulb, parking light	6
Flashing turn indicator	7
Rear lights	7
Checking and adjusting headlight beam throw	7
Vertical adjustment	7
Lateral adjustment	7





Technical Data	F 650 GS / GS Dakar
Lights	
Headlight	Halogen headlight with 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







E630020

63 12 090 Removing and installing headlight

- Place motorcycle on its centre stand.
- Remove left and right covers (→ 46.5).



Note:

Note washers and rubber ring.

- Remove the windscreen.
- 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.

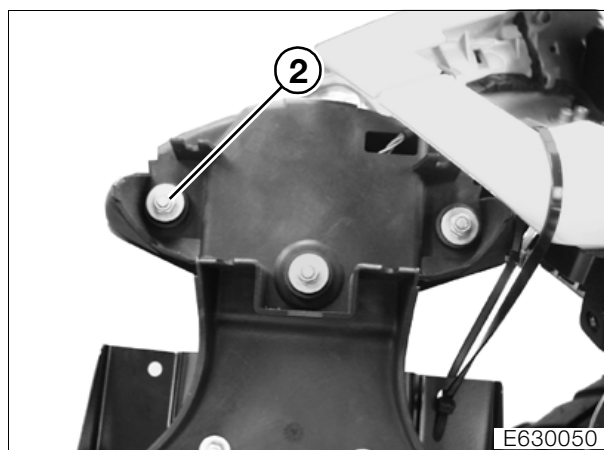


Warning:

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 number plate carrier with cable tie, for example, to rear frame.

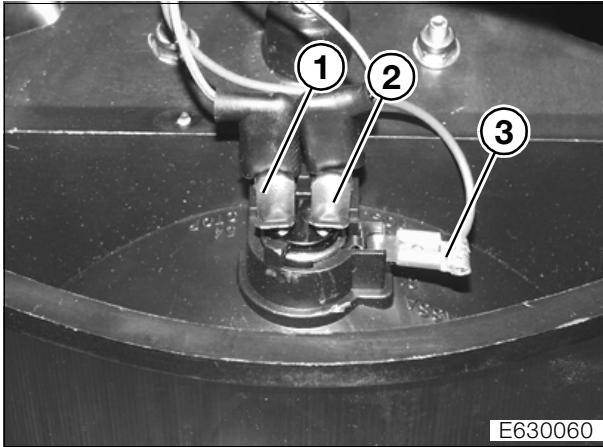


E630050

- 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



Important:

Always switch off the ignition before changing bulbs.

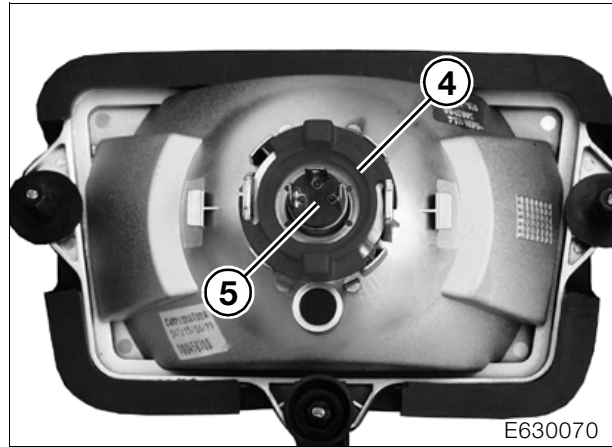


Note:

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.

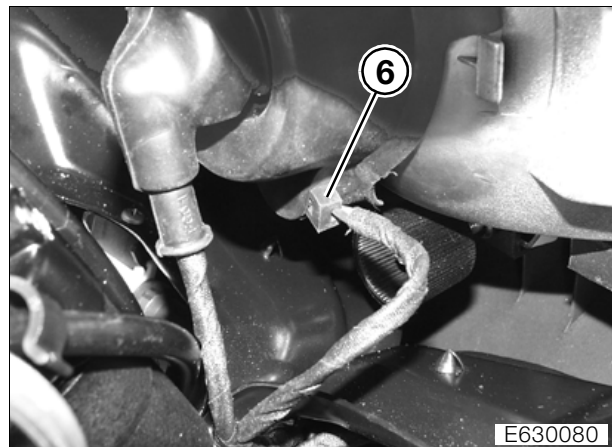


E630070

- 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.

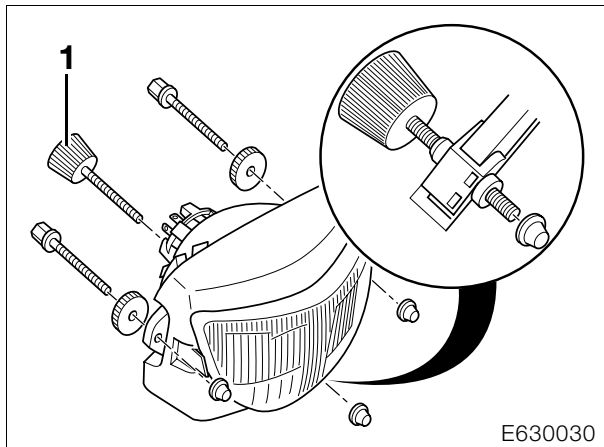
63 99 381 Rear lights

- 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.

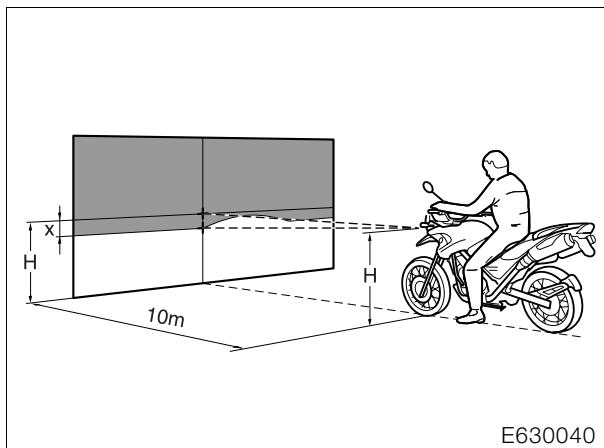
63 10 004 Checking and adjusting headlight beam throw

Vertical adjustment

- Set the spring tension to the basic setting.
- Rider's weight on motorcycle (75 kg/165 lbs).



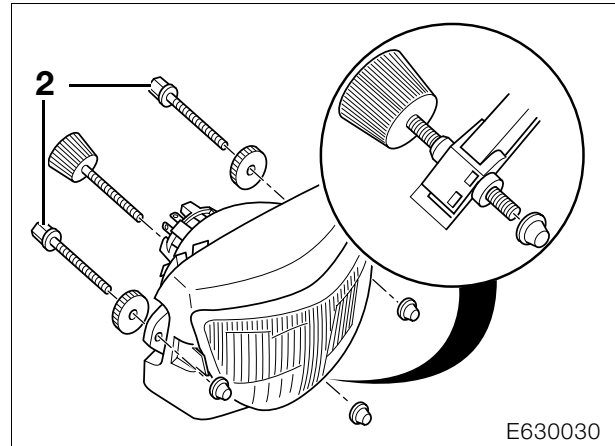
- Manually adjust the headlight throw by turning adjusting screw (1).



Setting for headlight beam adjuster

X20 cm (8 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.

