

# Repair Manual



**F 650 CS**

**BMW Motorrad  
After Sales**

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   UX-VS-2

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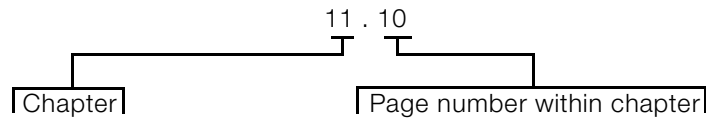
# Introduction

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 toward 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, Disassembling, 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. **[Heated handlebar grips]**.

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

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## Use

Each chapter starts with the list of contents.

The list of contents is followed by the technical data table.

## Key to symbols

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

Special instructions aimed at improving the work procedures



### **Note:**

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

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### **Attention:**

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

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### **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.

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## Contents

The titles of the tasks described in this chapter..... complete with page numbers

## 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 backed off completely and removed

or

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

The term "loosen" or "slacken" means that:

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



### **Tightening torque:**

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

# BMW Motorrad Maintenance schedule F 650 CS



Customer	Licence No.	Mileage	BMW Inspection at 1,000 km/600 miles	BMW Maintenance Service every 10,000 km/6,000 miles	BMW Inspection every 20,000 km/12,000 miles	BMW Annual Service
_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Job Order No. _____	Date _____	Mechanic's signature _____				
Read the fault code memory with the <b>BMW</b> MoDiTeC			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change the engine oil <b>[engine only]</b> while at regular operating temperature and replace the oil filter element			<input type="checkbox"/>			
Change the engine oil <b>[engine and oil tank]</b> while at regular operating temperature and replace the oil filter element <b>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)</b>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clean oil strainer in frame <b>once only at 10,000 km/6,000 miles</b>				<input type="checkbox"/>		
Check the coolant and restore to correct level if necessary			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Grease rubber grommets for cover insert			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Replace the coolant *) <b>every 2 years</b>						<input type="checkbox"/>
Check valve clearances, adjust if necessary *)				<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"/>	<input type="checkbox"/>	
Replace intake air filter <b>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)</b>					<input checked="" type="checkbox"/>	
Replace fuel filter <b>every 40,000 km (24,000 miles)</b>					<input checked="" type="checkbox"/>	
Check clutch play, adjust if necessary			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Examine brake pads and discs for wear, replace if necessary *)				<input type="checkbox"/>	<input type="checkbox"/>	
Check front/rear circuit brake fluid				<input type="checkbox"/>	<input type="checkbox"/>	
Check for operation of brake system and freedom from leaks; repair/replace if necessary *)					<input type="checkbox"/>	
Renew <b>brake fluid</b> at least <b>once a year</b>						<input type="checkbox"/>
[ABS] Replace the primary front/rear brake master cylinder cup *) <b>every 40,000 km (24,000 miles)</b>					<input checked="" type="checkbox"/>	
Replace toothed belt					<input type="checkbox"/>	
Check toothed belt and sprocket, replace if necessary *)					<input type="checkbox"/>	
Check belt tension, adjust if necessary *)			<input type="checkbox"/>	<input type="checkbox"/>		
Check battery acid level, add distilled water if necessary				<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 stand				<input type="checkbox"/>	<input type="checkbox"/>	
Using a torque wrench, check that the screws and nuts of the engine mounts, manifold fastener, the frame threaded fasteners, the rear-frame threaded fasteners, and the eccentric clamp are tightened to specified torque			<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 – Optional equipment – Test ride, if necessary			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

\*) Write up on separate invoice;  Not part of standard service procedure

# BMW Motorrad Pre-delivery check F 650 CS



<p>Customer _____</p> <p>Job Order No. _____</p>	<p>Licence No. _____</p> <p>Mechanic's signature _____</p>	<p><b>BMW Pre-delivery check</b></p>
<p>Check the shipping pallet for damage</p>		
<p>Unpack the motorcycle</p>		<input type="checkbox"/>
<p>Inspect motorcycle for damage</p>		<input type="checkbox"/>
<p>Check complete specification delivery:</p> <ul style="list-style-type: none"> <li>- tools</li> <li>- handbooks and documents</li> <li>- keys</li> <li>- optional extras</li> </ul>		<input type="checkbox"/>
<p>Motorcycle complete</p>		<input type="checkbox"/>
<p>Battery:</p> <ul style="list-style-type: none"> <li>- remove</li> <li>- add battery acid</li> <li>- charge</li> <li>- grease the terminal posts</li> <li>- re-install (mark date)</li> </ul>		<input type="checkbox"/>
<p>Check tyre pressure</p>		<input type="checkbox"/>
<p>Fuel the motorcycle</p>		<input type="checkbox"/>
<p>Safety/operating check as final inspection:</p> <ul style="list-style-type: none"> <li>- Oil inspection</li> <li>- Clutch, gearshift</li> <li>- Steering</li> <li>- Hand brakes and foot brakes</li> <li>- Check lights and signalling equipment, warning and indicator lights, instruments, ABS</li> <li>- Test ride, if necessary</li> </ul>		<input type="checkbox"/>
<p>Confirm delivery inspection in "Maintenance Booklet"</p>		<input type="checkbox"/>
<p>Final cleaning</p>		<input type="checkbox"/>
<p>Vehicle delivered on:</p>		

# BMW Motorrad

## Service data

### F 650 CS



Item	Desired value	Units / Specifications
<b>Oil capacities</b>		
Engine (incl. filter)	0.5 (0.88/0.53)	Litres (Imp. pints/US quarts) Specification: see latest Service Information
Engine (incl. filter) and oil tank	2.5 (4.4/2.64)	Litres (Imp. pints/US quarts) Specification: see latest Service Information
<b>Coolant</b>		
	50% 50%	Water Anti-freeze protection to -25 °C
Cooling system	1.3 (2.29/1.37)	Litres (Imp. pints/US quarts)
Reservoir	0.1 (0.18/0.11)	Litres (Imp. pints/US quarts)
<b>Brake Fluid</b>		
<b>Valve clearance</b>		
		DOT 4
		measured cold (max. 35 °C/95 °F)
Inlet	0.03-0.11 (0.0012-0.004)	mm (in)
Exhaust	0.25-0.33 (0.010-0.013)	mm (in)
<b>Spark plugs</b>		
	NGK DR8 EB	
Electrode gap	0.6...0.7 (0.02...0.03)	mm (in)
<b>Engine idle speed</b>		
	1,400	rpm
<b>Clutch cable play</b>		
Cable at grip	1.0 - 2.0 (0.004 - 0.008)	mm (in)
<b>Tyre pressure</b>		
		tyres cold
Solo front/rear	2.2/2.5 (31.91/36.26)	bar (psi)
fully loaded front/rear	2.2/2.5 (31.91/36.26)	bar (psi)
<b>Tightening torques</b>		
Engine oil drain plug	40	Nm
Oil filter cover	10	Nm
Drain plug, on-frame oil tank	21	Nm
Oil lines to frame	42	Nm
Oil strainer to frame	80	Nm
Water pump drain screw	10	Nm
Vent screw	12	Nm
Expansion tank to radiator	9	Nm
Cylinder head cover	10	Nm
Spark plugs	20	Nm
Camshaft bearing cap	10	Nm
Chain guide	10	Nm (Loctite 243)
Fuel filter to stowage-compartment frame	9	Nm
Intake air pipe to intake air silencer	9	Nm
Suspension strut to angled lever	41	Nm
Eccentric clamp	Initial tightening 10 21	Nm Nm
Brake caliper to swinging arm	21	Nm
Struts to swinging arm	41	Nm
Swinging-fork pivot axle	100	Nm
Adjusting screw steering head bearing	25 Back off through angle of rotation 60	Nm °
Clamp screw for fork bridge steering head	23	Nm
Engine to frame at rear	50	Nm
Cylinder head to frame	41	Nm
Cylinder head to frame, locknut	100	Nm
Engine shell to engine	55	Nm
Engine shell to engine, bottom, with bottom truss	55	Nm
Engine shell to bracing tube	24	Nm
Rear frame to main frame	24	Nm (Loctite 2701)
Exhaust manifold to cylinder head	20	Nm
Silencer to exhaust manifold	55	Nm

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**13 Fuel preparation and control**

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**17 Radiator**

**18 Exhaust system**

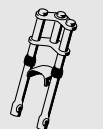
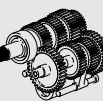
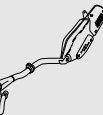
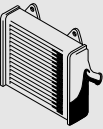
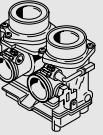
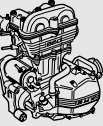
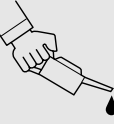
**21 Clutch**

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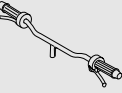
**>> Continuation**



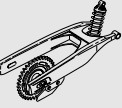


## Group / Chapter

**32 Steering**



**33 Rear wheel drive**



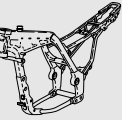
**34 Brakes**



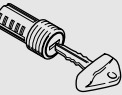
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# 00 Tightening torques, Operating fluids

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## Tightening torques

Model		F 650 CS
<b>Connection</b>		
<b>11 Engine</b>		
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 to countershaft	Nm	140 (clean thread + Loctite 243)
Pressure plate	Nm	10
Magnetic hub to crankshaft	Nm	180 (clean thread + Loctite 243)
Chainwheel to main shaft	Nm	140 (clean thread + Loctite 243)
Signal transmitter	Nm	8
Ignition cover	Nm	10
Cylinder base	Nm	10
Fastener for chain tensioner	Nm	40
<b>Oil circuit</b>		
Oil filter cover	Nm	10
Oil pressure switch	Nm	12 (clean thread + Loctite 243)
Strainer cover to housing half	Nm	8
Drain plug, on-frame oil tank	Nm	21
Engine oil drain plug	Nm	40
Oil supply/oil return lines to engine	Nm	42
Oil pump cover	Nm	6 (clean thread + Loctite 243)
Oil pressure valve	Nm	24
Oil retaining valve	Nm	24
<b>Cylinder head</b>		
Collar nuts for cylinder head	Nm	60
Collar screws for cylinder head	Nm	33
Machine screws (chaincase)	Nm	10
Camshaft bearing cap	Nm	10
Chain sprockets to camshafts	Nm	60 threads oiled
Chain guide to camshaft bearing cap	Nm	10 (clean thread + Loctite 243)





<b>Model</b>		<b>F 650 CS</b>
<b>Connection</b>		
<b>11 Engine</b>		
Cylinder head cover	Nm	10
Machine screw (hole for locating screw)	Nm	25
<b>Model</b>		<b>F 650 CS</b>
<b>Connection</b>		
<b>12 Engine electrics</b>		
Spark plug	Nm	20
Magnetic hub to crankshaft	Nm	180 (clean thread + Loctite 243)
Signal transmitter	Nm	8
Engine block cover, left/right	Nm	10
Starter to clutch cover	Nm	10
Positive lead to starter motor	Nm	9
Positive contact to starter motor	Nm	4
Necked-down bolt, starter housing	Nm	6
Cable cover to engine block	Nm	9
Cable holder to ignition cover	Nm	8
Stator to ignition cover	Nm	10 (clean thread + Loctite 243)
Ignition coil bracket to cylinder head cover	Nm	9

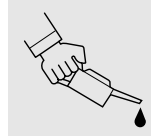
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>13 Fuel preparation and control</b>		
Air intake pipe to cylinder head	Nm	21
Fuel filter to stowage-compartment frame	Nm	9
Injector holder to throttle valve	Nm	5
Fuel hose to injection nozzle holder	Nm	3
Fuel return hose to pump unit	Nm	3
Intake air pipe to intake air silencer	Nm	9
Throttle flap to intake stub	Nm	1
Throttle-valve potentiometer to throttle valve stub	Nm	3
Throttle valve actuator to throttle-valve stub	Nm	5 (clean thread + Loctite 243)
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>16 Fuel tank and lines</b>		
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
Clamps, activated charcoal filter bracket	Nm	9
Fuel pump to fuel tank	Nm	30
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>17 Radiator</b>		
Expansion tank to radiator	Nm	9
Radiator to main frame at top	Nm	9
Fan to fan shroud	Nm	3
Water pump drain screw	Nm	10
Coolant hoses to radiator/engine/frame	Nm	3
Breather hose to expansion tank	Nm	2
Left engine block cover to engine block	Nm	10
Water pump cover	Nm	10
Temperature sensor in cylinder head	Nm	15
Vent screw	Nm	12





<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>18 Exhaust system</b>		
Oxygen sensor to exhaust elbow	Nm	45
Exhaust manifold to cylinder head	Nm	20
Silencer to exhaust manifold (Torca clamp)	Nm	55
Silencer to rear frame	Nm	41
Guards to silencer	Nm	5
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>21 Clutch</b>		
Driver	Nm	140 (clean thread + Loctite 243)
Pressure plate	Nm	10
Engine block cover, left	Nm	10
Release lever to release shaft	Nm	10
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>23 Transmission</b>		
Gear pedal to frame	Nm	21
Shaft lever to selector shaft	Nm	9

<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>27 Chain/belt drive</b>		
Drive sprocket cover to engine	Nm	2
Belt cover to swinging arm	Nm	9
Eccentric clamp	Nm	21
Initial tightening	Nm	10
Belt sprocket to gearbox output shaft	Nm	180 (clean thread + Loctite 638)
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>31 Front fork</b>		
Clamp screws, upper fork bridge and steering head clamp	Nm	23
Clamp screws at lower fork bridge	Nm	23
Bracket to fork leg	Nm	5
Damper retaining screw	Nm	20
Adjusting screw		
Preload	Nm	25
Back off through angle of rotation	°	60
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>32 Steering</b>		
Handlebars to fork bridge	Nm	23
Handlebar weight to handlebar	Nm	9
Handlebar fitting to handlebar	Nm	9
Cover of multi-function switch	Nm	1
Pivot pin of clutch lever	Nm	3
Locknut for pivot pin of clutch lever	Nm	5
Pivot pin of handbrake lever	Nm	7
Locknut of handbrake lever	Nm	7
Guide to fork bridge	Nm	5







Model		F 650 CS
<b>Connection</b>		
<b>33 Rear wheel drive</b>		
Suspension strut to frame	Nm	58
Wrench angle	°	45 ± 15
Suspension strut to angled lever	Nm	41
Swinging-fork pivot axle	Nm	100
Struts to swinging arm	Nm	41
Struts to angled lever	Nm	41
Angled lever to frame	Nm	58
Wrench angle	°	45 ± 15
Belt pulley to damper housing	Nm	28
Damper fastener	Nm	160
Eccentric clamp	Nm	21
Initial tightening	Nm	10
Model		F 650 CS
<b>Connection</b>		
<b>34 Brakes</b>		
Bleed screw to brake caliper front/rear	Nm	7
Brake caliper to fork slider tube	Nm	41
Brake light switch to handlebar fitting	Nm	3
Handlebar fitting to handlebar	Nm	9
Brake light switch to frame	Nm	5
Brake disc to front wheel	Nm	10 (clean thread + Loctite 2701)
Brake disc to rear wheel drive shaft	Nm	11 (clean thread + Loctite 2701)
Brake caliper to swinging arm	Nm	21
Brake master cylinder to main frame	Nm	10
Locknut for fork end to pushrod	Nm	9
Bracket, rear, to main frame	Nm	9 (clean thread + Loctite 2701)
Shroud to frame	Nm	6
Brake fluid reservoir for rear brake to rear frame	Nm	4
Brake pedal to frame	Nm	21
Brake line distributor to main frame	Nm	9

<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>34 Brakes</b>		
<b>Brake lines/hoses</b>		
Brake hose to brake caliper	Nm	18
Brake hose to rear brake caliper	Nm	18
Brake hose to brake lever fitting	Nm	18
Brake hoses to distributor	Nm	18
Brake hose to bracket, rear	Nm	18
Brake line to master brake cylinder, rear wheel	Nm	18
Banjo bolts, brake line	Nm	18
<b>ABS</b>		
ABS sensor front/rear	Nm	9
ABS control unit to holder	Nm	21
Brake lines to ABS control unit	Nm	18
Brake disc and sensor ring to front wheel	Nm	10 (clean thread + Loctite 2701)
Locknut for adjustable stop, brake-light switch	Nm	4
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>36 Wheels and tyres</b>		
Clamp nut, front quick-release axle	Nm	23
Front quick-release axle to fork leg	Nm	30
Wheel nut to drive shaft (wheel side)	Nm	160 Lightly coat the thread with Optimoly TA





Model		F 650 CS
<b>Connection</b>		
<b>46 Frame</b>		
Covers, right and left, to main frame	Nm	2
Covers, right and left, to air guide	Nm	3
Cover, front, to covers, right and left	Nm	1
Cover, front to main frame	Nm	2
Cover, rear, to covers left and right and to stowage-compartment frame	Nm	2
Stowage-compartment rail to stowage-compartment frame	Nm	9
Stowage-compartment frame to main frame	Nm	9
Turn indicators, left and right, to fairing bracket	Nm	3
Instrument cover to fairing holder	Nm	2
Windscreen to windscreen bracket	Nm	2
Windscreen bracket to fairing bracket	Nm	9
Rear trim panels, left and right, to rear frame	Nm	2
Rear trim panels, left and right, to seat lock	Nm	2
Bracket for seat lock to rear frame	Nm	3
Turn indicator, rear, to rear finisher	Nm	3
Rear finisher to rear frame	Nm	9
Number-plate carrier to rear finisher	Nm	9
Spray guard to number-plate carrier	Nm	3
Number-plate carrier to rear mudguard	Nm	3
Cover of number-plate light to number-plate carrier	Nm	1
Grip to rear frame	Nm	9
Luggage carrier to grab handle	Nm	3
<b>Mudguards/wheel guards</b>		
Front mudguard, front section, to front mudguard, rear section	Nm	3
Front mudguard, front section, to slider tube	Nm	3
Front mudguard, rear section, to slider tube	Nm	3
Rear mudguard, front section, to rear frame, front and side	Nm	3
Rear mudguard, front section, to rear frame, rear and centre	Nm	3
Belt cover to swinging arm	Nm	9

<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>46 Frame</b>		
<b>Frame</b>		
Drain plug, on-frame oil tank	Nm	21
Oil strainer to frame	Nm	80
Oil feed and return lines to main frame	Nm	42
Oil tank cover to frame	Nm	5
Footrest rubber to rear footrest	Nm	5
Fairing bracket to main frame	Nm	21
Rear frame to main frame	Nm	24 (clean thread + Loctite 2701)
Engine shell to bracing tube	Nm	25
Side stand to bottom truss	Nm	41
<b>Engine mounts</b>		
Engine shell to engine	Nm	55
Engine shell to engine, bottom, with bottom truss	Nm	55
Engine to frame at rear	Nm	50
Cylinder head to frame	Nm	41
Cylinder head to frame, adjusting sleeve	Nm	zero play, max. 5
Cylinder head to frame, locknut	Nm	100
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>51 Equipment</b>		
Ignition/steering lock to fork bridge, top	Nm	20
Mirror to clamp element	Nm	18
Clamp element to handlebar fitting	Nm	21
Seat hook to rear frame	Nm	9





<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>61 General electrical equipment</b>		
Cable to idle-indicator switch	Nm	1
Idle-indicator switch	Nm	3 (clean thread + Loctite 243)
Cover for hazard warning flasher switch	Nm	5
Clutch switch to handlebar fitting	Nm	5
Positive/ground leads, battery	Nm	7
Ignition/light switch with cap to ignition/ handlebar lock	Nm	1
Voltage regulator to engine shell	Nm	9
Horn to fork bridge	Nm	18 (clean thread + Loctite 243)
Ground terminal, wiring harness to engine block, right	Nm	8
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>62 Instruments</b>		
Instrument cover to instrument cluster	Nm	2
<b>Model</b>	<b>F 650 CS</b>	
<b>Connection</b>		
<b>63 Lights</b>		
Headlight to fairing bracket	Nm	7
Number-plate light to number-plate carrier	Nm	1
Rear light cluster to rear frame	Nm	9

## Table of operating fluids

Item	Use	Order number	Quantity
<b>Lubricant</b>			
Staburags NBU 30 PTM	High-performance lubricating grease	07 55 9 056 992	75 g tube
Optimoly MP 3	High-performance lubricating grease	07 55 9 062 476	100 g tube
Optimoly TA	High-temperature assembly grease	18 21 9 062 599	100 g tube
Silicone grease 300, heavy	Damping grease	07 58 9 058 193	10 g tube
Retinax EP2	Grease	83 22 9 407 845	100 g tube
Contact spray	Contact spray	81 22 9 400 208	300 ml spray
Chain spray	Lubricant	72 60 2 316 676 72 60 2 316 667	50 ml spray 300 ml spray
Shell HDX2	Lubricant	11 00 7 660 830	400 g tube
Klüberpaste 46 MR 401	High-temperature lubricant	11 00 7 660 831	60 g tube
MOLYKOTE 111	Silicon grease	11 00 7 660 832	100 g tube
Tyre mounting paste	Assembly paste	36 32 1 239 263 36 32 1 239 264	2.5 kg 100 g
Never Seez compound	Lubricating paste	83 23 9 407 830	100 g tube
Grease for lock cylinders	Grease	81 22 9 407 421	
Rubber care product	Rubber care	82 14 9 407 015	60 g tube
Long-life lubricant	Lubricant	81 22 9 407 629	250 ml spray
<b>Sealants</b>			
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	07 58 1 465 170	90 g tube
Loctite 574	Surface sealant	81 22 9 407 301	50 ml tube
Loctite 577	Thread locking compound	33 11 2 328 736	5 g tube
Curil K 2	Heat-conductive sealant	81 22 9 400 243	250 g can
<b>Adhesives and retaining agents</b>			
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





Item	Use	Order number	Quantity
<b>Cleaners</b>			
Brake cleaner	Cleaners	83 11 9 407 848	600 ml spray
Normal dilution	Cleaners	51 91 9 057 940	1 l bottle
Metal Polish	Polish for chrome-plated parts	82 14 9 400 890	100 g tube
<b>Testing agents</b>			
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
<b>Installation aid</b>			
BMW chilling spray	Cooling spray	83 19 9 407 762	300 ml spray

# 00 Pre-delivery check

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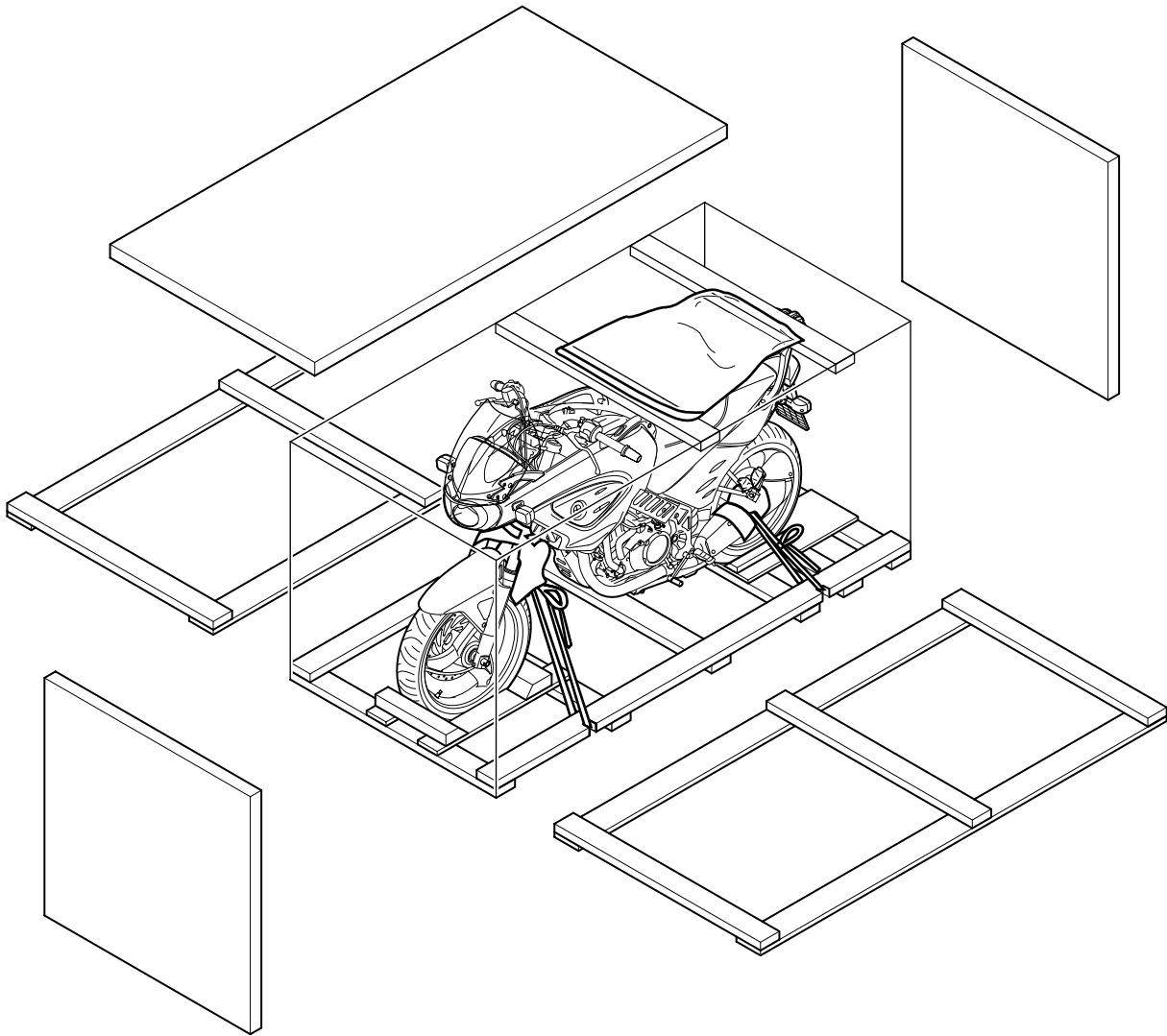
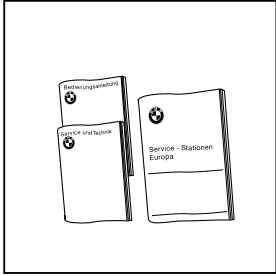
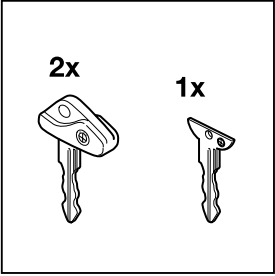
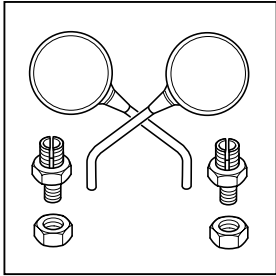
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# General view of crated motorcycle



K14009440

## 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. +49 89/14327-632  
Fax. + 49 89/14327-709

### 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 89/14327-632  
Fax. +49 89 14327-709
- Notify the supplier (e.g. freight company) without delay.

## 00 11 Unpack the motorcycle

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



### Attention:

Do not knock the cross-struts out or the motorcycle may be damaged.

- Remove the end-walls.
- Remove the side-walls.



### Attention:

Make sure that the motorcycle cannot topple.

- Remove the straps at front and rear.



### Attention:

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

- Push the motorcycle forward off the pallet.
- Remove the set of keys from the left rear footrest.
- Dispose of the packing materials in an environmentally responsible manner as described in Circular No. 23/91 - Sales.
- Check the contents of the enclosed pack of items:
  - Mirrors with clamping screws and nuts
  - Rider's Manual
  - Maintenance Instructions
  - Booklet listing service centres in Europe
  - BMW emergency service sticker
  - Handling instructions for batteries

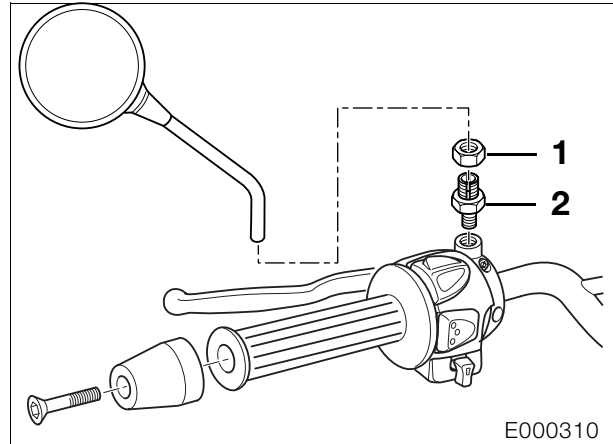
## 00 11 Inspecting motorcycle for damage

- Check for damage.
- Use the “express handling service” to notify BMW Motorrad, UX-VS-1  
Fax: + 49 89-382-33220
- Rectify the fault.
- If parts are needed, order them through the usual channel.
- 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

## Checking that delivery is complete

- All optional extras
- Toolkit:
  - screwdriver, reversible blade
  - crosshead screwdriver, small
  - 3 open-end wrenches  
w/f 8×10, 14, 15
  - spark plug wrench
  - 3 Allen keys  
Torx T15, T25, T30
  - 4 fuses  
7.5 A, 10 A, 15 A, 20 A
  - Breakdown kit
- Documentation
- Vehicle keys, 3 of

## 00 11 Installing remaining items on motorcycle



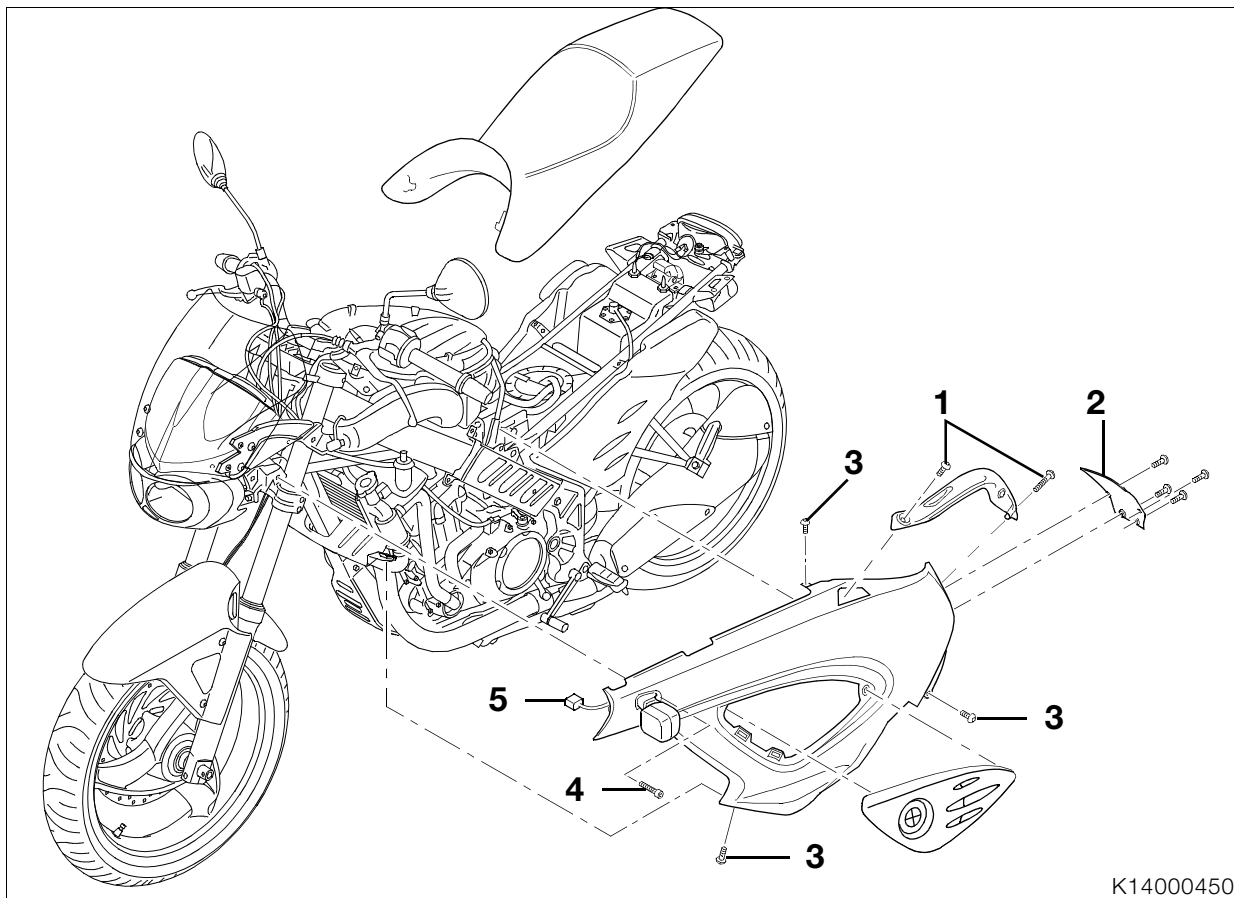
- Fit clamp screw (2) to handlebar fitting.
- Install mirror and secure by tightening nut (1).



### Tightening torque:

Clamp screw to handlebar fitting .....	21 Nm
Union nut for mirror .....	18 Nm

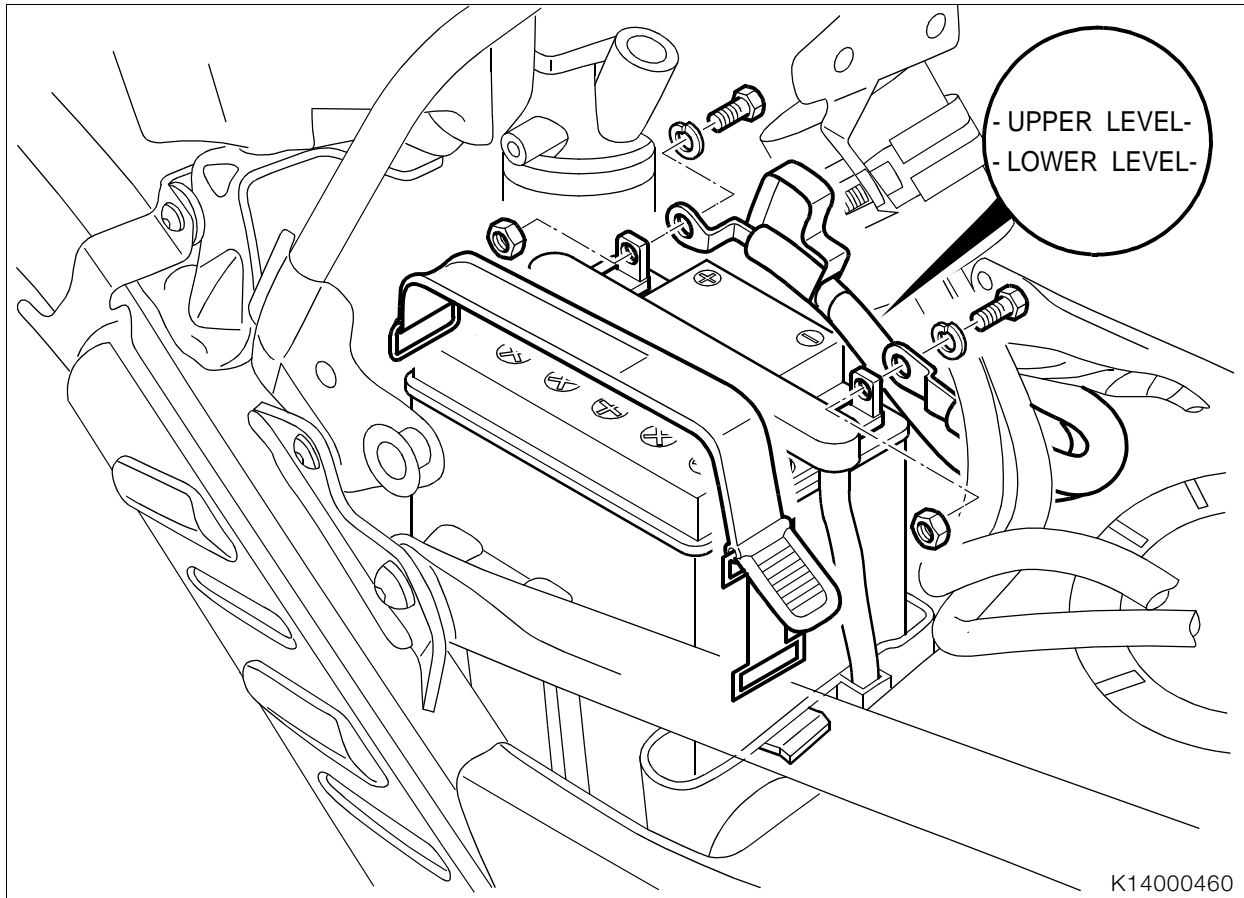




## 61 21 Filling and charging the battery

### 61 21 010 Removing the battery

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove seat.
- Remove securing screws for stowage-compartment rail (1) and remove left stowage-compartment rail; use wrench from toolkit if necessary.
- Remove fasteners of rear cover and remove rear cover (2).
- Disconnect the plug for flashing turn indicator (5).
- Remove securing screw for flashing turn indicator (4).
- Remove screws securing left cover (3).
- Remove the left cover.



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## 61 21 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.
- Fill all the cells with pure battery acid of density 1.28 to the Upper Level mark.
- Allow the battery to stand for approximately 30 minutes.

- The battery does not achieve full charge capacity from being filled, so it has to be charged with a battery charger.



### Note:

Follow the instructions for use supplied with the battery charger.

### Charge current (A)

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

### Charging time

.....5-10 hours

- Battery charge can be measured by checking the density of the battery acid.

### Acid density

Battery fully charged

..... 1.26-1.30 at a temperature of 20 °C (68 °F)

- Shake the battery slightly to allow the gas bubbles to escape.
- Wait until the battery acid has settled, check that no more bubbles rise and if necessary, top up the acid to the max. mark.
- Reinstall the plugs.
- Make a note of the charging date on the battery.



**Attention:**

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

- Install the battery.



**Note:**

When connecting the battery lead, always make sure that the spring washer is between the screw head and the battery lead.

- Apply acid-proof grease to the battery terminal posts.
- Connect the battery breather hose.
- Install the left cover.
- Install the rear cover.
- Install the stowage-compartment rail.
- Install the seat.



**Tightening torque:**

Positive and negative leads to battery .....	7 Nm
Cover, rear, to covers left and right and to stowage-compartment frame .....	2 Nm
Cover, front, to left and right covers .....	1 Nm
Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Turn indicators, left and right, to fairing bracket...	3 Nm
Stowage-compartment railing to stowage-compartment frame.....	9 Nm

## 00 00 Checking engine oil level

- Check whether there is oil in the tank (e.g. dipstick wetted).



**Attention:**

Top up the level if there is no engine oil in the tank.

## Checking tyre pressures

- Check/correct tyre pressures.

**Tyre pressures:**

one-up .....	front 2.2 bar (31.91 psi)
.....	rear 2.5 bar (36.26 psi)
two-up .....	front 2.2 bar (31.91 psi)
.....	rear 2.5 bar (36.26 psi)
two-up + luggage .....	front 2.2 bar (31.91 psi)
.....	rear 2.5 bar (36.26 psi)

## Final inspection and function check

- Clutch
- Check gear shift action.
- Steering
- Handbrake and footbrake
- 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
- Where necessary, check function of optional extras:
- ABS: perform starting test. The ABS warning light comes on if there is a fault in the system and the vehicle is ridden for at least 10 seconds at a speed in excess of 30 km/h (18.64 miles).
- If necessary, take the motorcycle for a test ride.
- Confirm pre-delivery check in “Maintenance Instructions”
- See “Checking motorcycle for damage” if anything is unsatisfactory.

## 00 11 459 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.

## Handover

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
  - How to check the 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
  - How to check the oil level in accordance with the vehicle documentation







# 00 Maintenance

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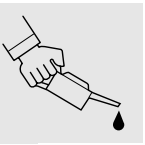


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## Key to maintenance intervals

Maintenance tasks 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 30,000 km ... 50,000 km ... 70,000 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 maintenance tasks 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.

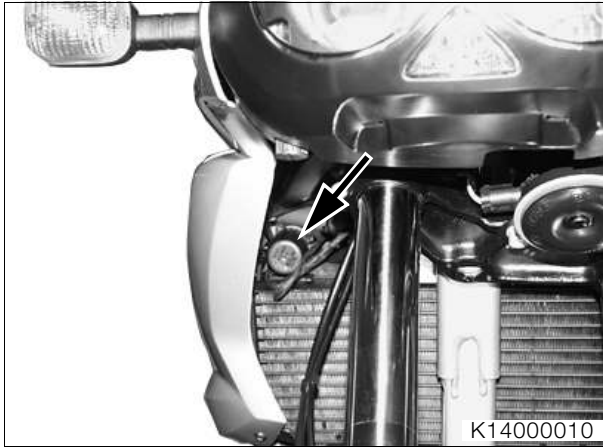
In this Repair Manual, the individual maintenance intervals are shown by the following codes:

- 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)



- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Unclip diagnosis plug (arrow) behind cover on right.
- Connect the diagnosis unit to the diagnosis plug.
- Read out the fault memory.
- Perform any repair work indicated.

## 00 11 209 Changing the engine oil [engine only] and oil filter element

(Inspection I)



### Note:

If an engine failure occurs, the oil tank and feed line must be flushed with thin oil, and then blown through with compressed air (→ 11.17).

### 00 11 209 Preparatory work

- Remove cover for belt sprocket from engine.
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.

### 00 11 209 Draining engine oil

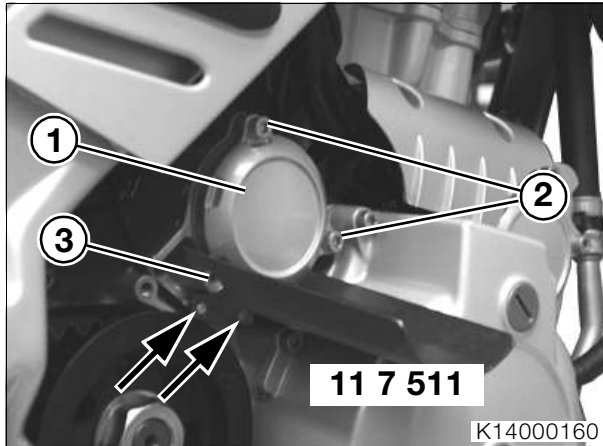


### Warning:

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.
- 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.



### Attention:

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 belt sprocket cover at this stage, if other maintenance work has to be performed on assemblies normally concealed by this component.



### Tightening torque:

Oil filter cover ..... 10 Nm  
Sprocket cover to engine ..... 2 Nm

## 00 11 215 Filling with engine oil

- Install the oil drain plug in the engine with a new sealing ring and tighten.
- Fill the oil tank with 0.5 l (0.88 Imp. pints/0.53 US quarts) of engine oil and install the filler cap.



### Note:

The requisite quantity of oil is 0.5 (0.88 Imp. pints/0.53 US quarts) to 1,5 l (2.64 Imp. pints/1.59 US quarts), depending on operating status.



### Warning:

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

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



### Warning:

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

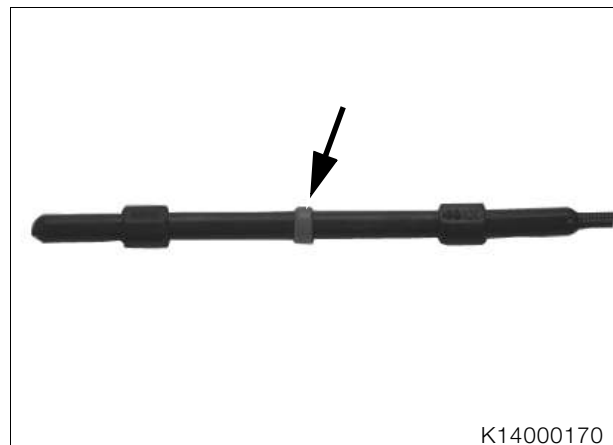
- Check the oil level with the engine at operating temperature, proceeding as follows:



### Note:

Lower the dipstick into the oil filler neck, but do not engage the threads.

1. Make sure the engine is at operating temperature, and allow it to idle for 1 minute.
2. Switch off the engine and check the oil level with the dipstick.



3. Top up the engine oil if necessary, but no higher than the midway mark (arrow) and repeat steps 1) to 3).



**Attention:**

Do not use synthetic oils.

**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.

**Capacity, engine:**

with filter replacement ..... 0.5 l  
.....(0.88 Imp. pints/0.53 US quarts)

**Tightening torque:**

Oil drain plug, engine ..... 40 Nm

## 00 11 215 Changing the engine oil [engine and oil tank] and oil filter element

(Inspections II, III and IV)

**Note:**

If an engine failure occurs, the oil tank and feed line must be flushed with thin oil, and then blown through with compressed air (→ 11.17).

### 00 11 215 Preparatory work

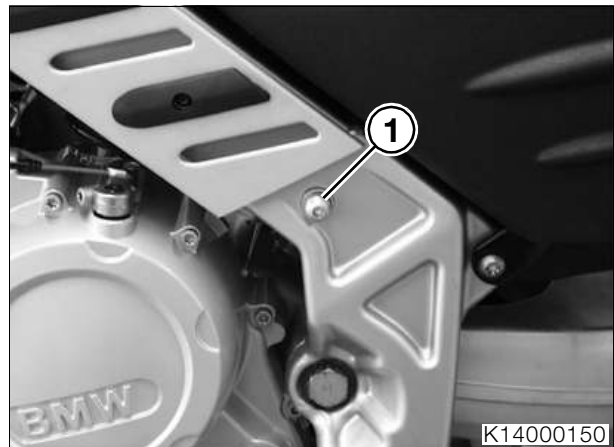
- Place motorcycle on side stand.
- Remove cover for belt sprocket from engine.

### 00 11 215 Draining engine oil

**Warning:**

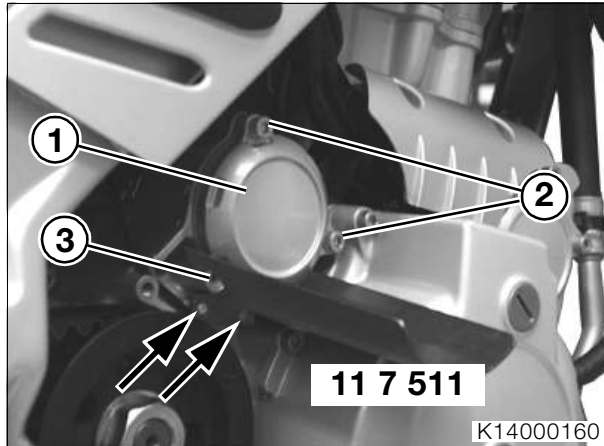
Observe the hazard avoidance instructions for running internal combustion engines in enclosed spaces.

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



- Remove the filler cap from the oil tank.
- Remove the oil drain plug from the frame (1).
- Fully drain the oil.
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620.**
- 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.

### **Attention:**

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 belt sprocket cover at this stage, if other maintenance work has to be performed on assemblies normally concealed by this component.

### **Tightening torque:**

Oil filter cover ..... 10 Nm  
Sprocket cover to engine ..... 2 Nm

## 00 11 215 Filling with engine oil

- Install the oil drain plug in the frame 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:**

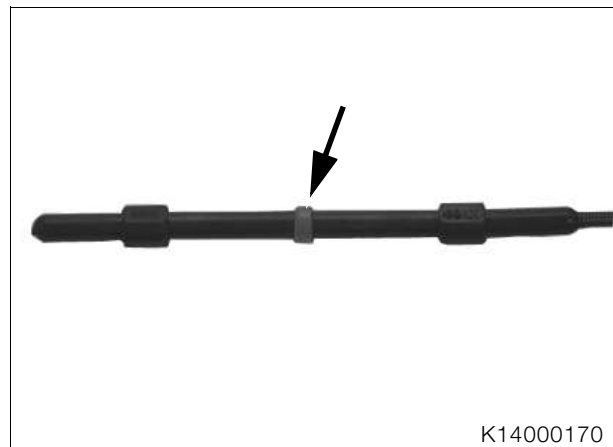
Observe the hazard avoidance instructions for running internal combustion engines in enclosed spaces.

- Run the engine for thirty seconds.
- Add another 0.5 l (0.88 Imp. pints/0.53 US quarts) of engine oil to the oil tank.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Check the oil level with the engine at operating temperature, proceeding as follows:

### **Note:**

Lower the dipstick into the oil filler neck, but do not engage the threads.

1. Make sure the engine is at operating temperature, and allow it to idle for 1 minute.
2. Switch off the engine and check the oil level with the dipstick.



3. Top up the engine oil if necessary, but no higher than the midway mark (arrow) and repeat steps 1) to 3).

**Attention:**

Do not use synthetic oils.

**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.

**Capacities, engine and oil tank:**

with filter replacement ..... 2.5 l  
.....(4.40 Imp. pints/2.64 US quarts)

**Tightening torque:**

Oil drain plug, engine ..... 40 Nm  
Drain plug, frame oil tank..... 21 Nm

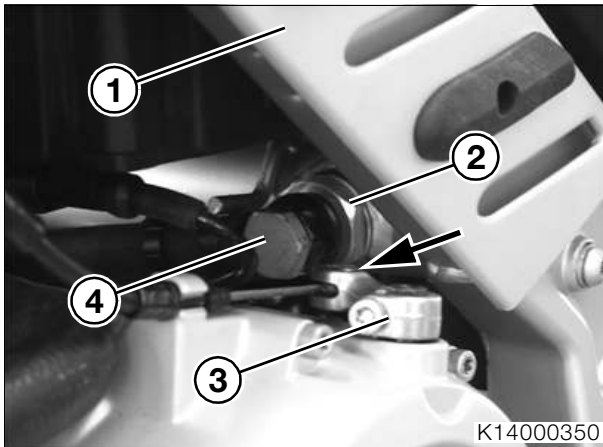
**Tightening torque:**

Oil drain plug, engine ..... 40 Nm  
Oil drain plug, frame oil tank..... 21 Nm  
Oil line to frame ..... 42 Nm  
Oil strainer to frame..... 80 Nm  
Oil tank cover to frame ..... 5 Nm  
Right and left covers to main frame ..... 2 Nm  
Right and left covers to air duct ..... 3 Nm  
Right and left covers to cover, front ..... 1 Nm  
Right and left turn indicators to fairing bracket..... 3 Nm  
Cover, rear, to right and left covers and stowage-compartment frame ..... 2 Nm  
Stowage-compartment rail to stowage-compartment frame..... 9 Nm  
Release lever to release shaft..... 10 Nm

**Cleaning oil strainer in frame**

(Inspection II, once only)

- Drain engine oil (➡ 00.32).
- Remove left cover (➡ 46.6).

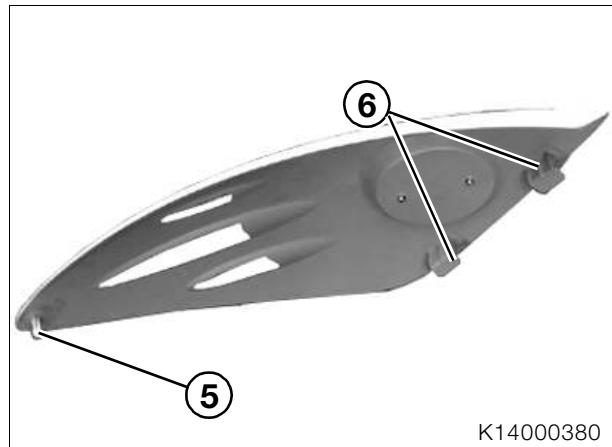


- Remove oil-tank cover (1).
- Disengage clutch cable (arrow).
- Remove release lever (3).
- Disconnect oil line (4).
- Remove oil strainer (2) and clean it with compressed air.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Always install new seals for the oil line and oil strainer.
- Adjust clutch play (➡ 00.45).

**Greasing rubber grommets for cover insert**

(Inspections I, II, III and IV)

- Remove cover inserts.



- Coat pin (5) and hook (6) with **rubber care product**.
- Install cover insert.

## Checking coolant, topping up if necessary

(Inspections I, II and III)



### Attention:

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

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Check coolant level through the slot in the insert in the left cover.
- Top up the coolant if the level is below the MIN mark.

## Adding coolant

- Remove cover insert from left cover.



### Attention:

Anti-freeze protection must be guaranteed to at least -30 °C (-22 °F). Use only nitrite-free long-term antifreeze and corrosion inhibitor. When the engine is cold, do not top up expansion tank past the MIN mark (B).

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



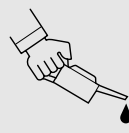
### Note:

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

- Check coolant level in expansion tank.
- If the coolant level is below the MIN mark, top up coolant to the MIN mark.

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

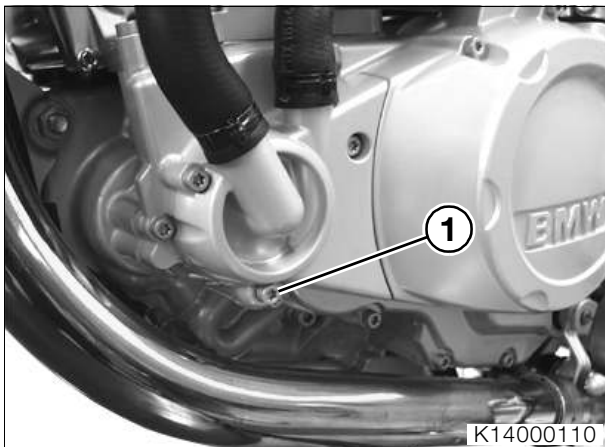
- Installation is the reverse of the removal procedure.



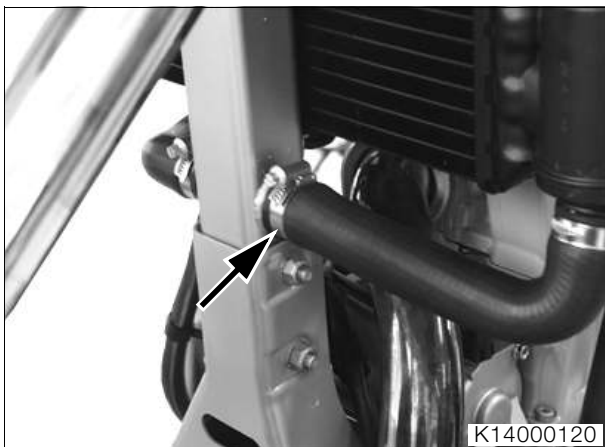
## 17 00 035 Changing coolant

(Inspection IV, every 2 years)

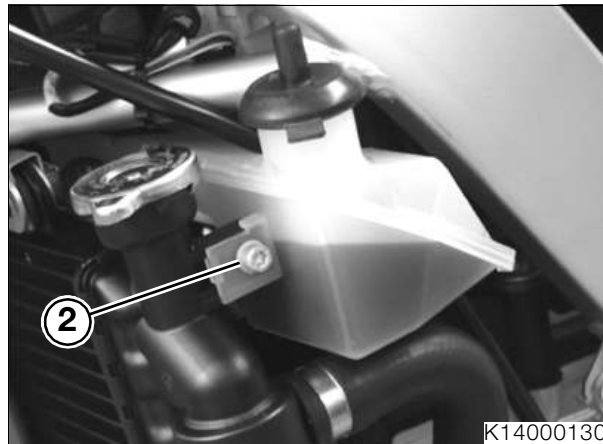
- Remove left cover (→ 46.6).
- Place motorcycle on side stand.
- Position a drip tray beneath the engine.



- 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.



- Remove fastener (2), lift out the expansion tank and drain off all coolant.



### Attention:

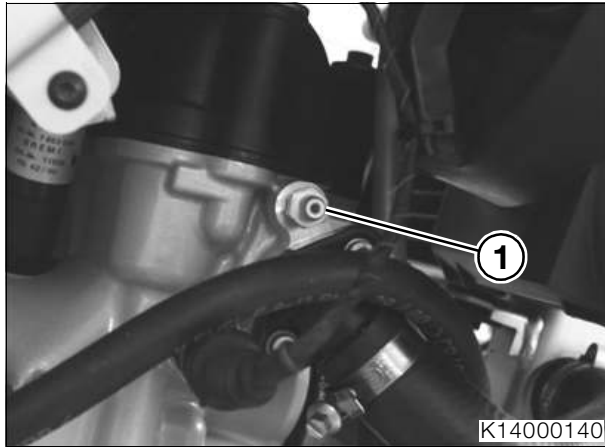
Dispose of old coolant in an environmentally compatible manner.



### Note:

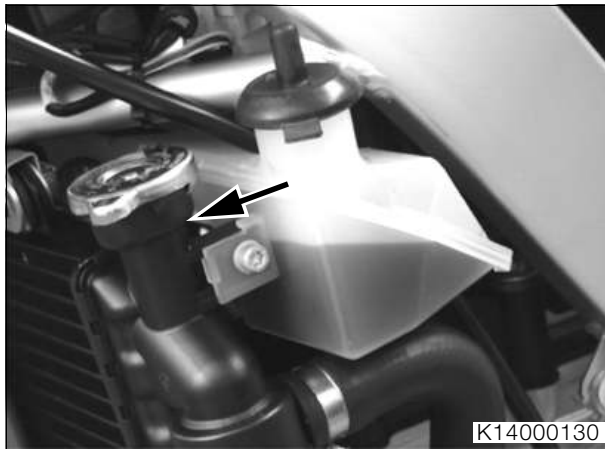
Do not install and refill the coolant expansion tank if valve clearance still has to be checked.

- Install the expansion tank.
- Install the drain plug with a new sealing ring and tighten.
- Tighten hose clamp securing coolant hose.
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620.**



K14000140

- 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).



K14000130

- Top up coolant until the level reaches the top of the filler neck (arrow).
- Top up expansion tank to the MIN mark.

**Filling capacity**

Cooling system .....	1.3 l
.....	(2.29 Imp. pints/1.37 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 torque:**

Stowage-compartment rail to stowage-compartment frame .....	9 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Right and left covers to air duct .....	3 Nm
Right and left covers to main frame .....	2 Nm
Right and left covers to cover, front .....	1 Nm
Right and left turn indicators to fairing bracket	3 Nm
Drain plug, water pump .....	10 Nm
Expansion tank to radiator .....	9 Nm
Bleed screw .....	12 Nm
Coolant hose to frame .....	3 Nm

## 00 11 602 Checking and adjusting valve clearances

(Inspections II and III)

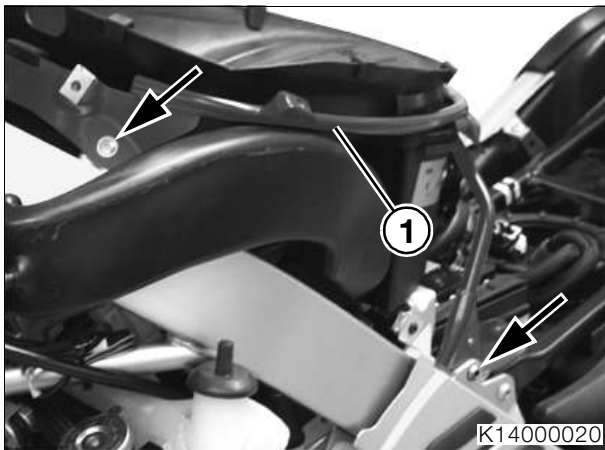
### 0011601 Checking valve clearances

#### Preparatory work

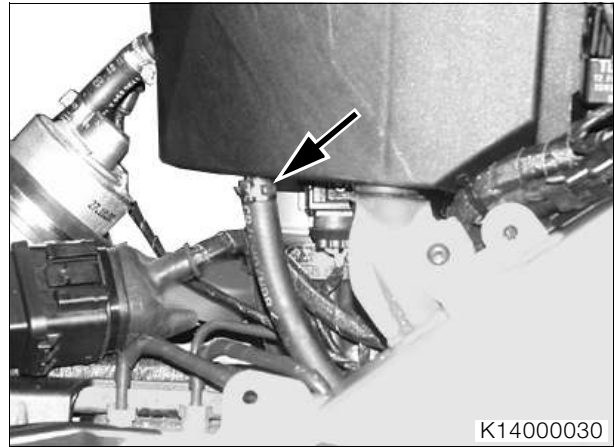
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the left, right and front covers (→ 46.6).

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

- Push up the tab to pull the fuse box from the holder.
- Remove the fuel filter from the stowage-compartment frame.

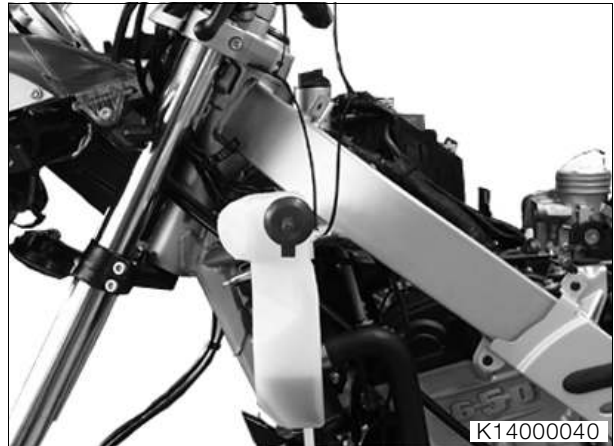


- Remove fasteners securing stowage-compartment frame to main frame (arrows).
- Remove stowage-compartment frame (1).



- Disengage the clamp (arrow) securing the breather hose and disconnect the hose from the intake air silencer.
- Carefully disconnect the intake air silencer from the throttle flap stub.
- Disengage the intake air pipe with rubber grommet from the link.
- Pull the intake air silencer with intake air pipe to the rear to remove, disconnecting the plug for the intake-air temperature sensor.
- Cover/seal the throttle flap stub.

#### Exposing the radiator

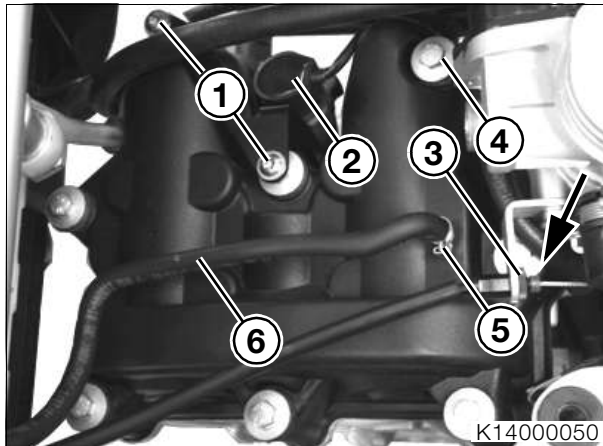


#### Note:

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

- Disconnect the expansion tank from the radiator, pull it to one side and temporarily secure it to the handlebar with a cable tie or similar.
- Protect the interior of the radiator with cardboard or similar.

## Exposing cylinder head



- Remove fasteners securing bracket (1) of ignition coil, pull bracket complete with ignition coil (2) forward and lay it down.
- Remove rubber cap (arrow).
- Release knurled nut (3).
- Disengage throttle cable from adapter.
- Use pliers, **BMW No. 17 5 500**, to release hose clip (5) and disconnect cylinder-head breather hose (6).
- Remove spark plug.



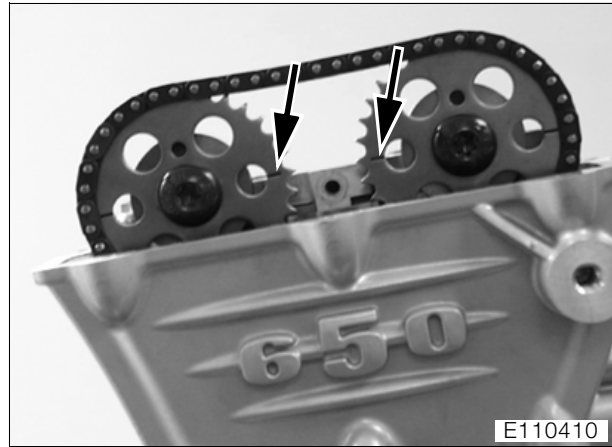
### Note:

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

- Remove 8 fasteners (4) and remove the cylinder-head cover with gasket.

### Turning crankshaft to TDC position

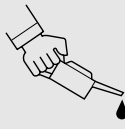
- Remove the central threaded plug in the magnet housing.



### Note:

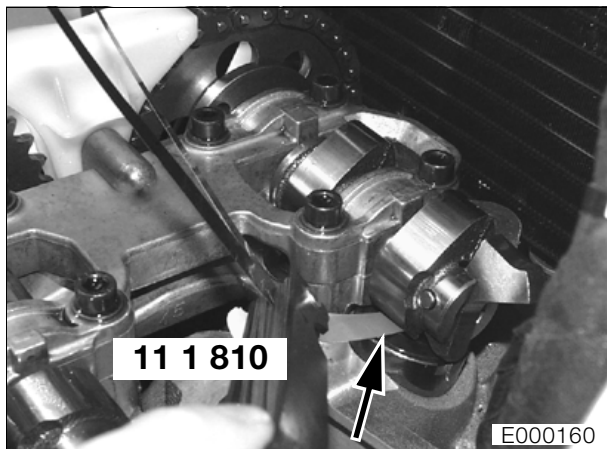
TDC position: Marks on the timing-chain sprockets (arrows) must be parallel with the cylinder head, the bores in the timing-chain sprockets are at the top.

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





## Checking valve clearance

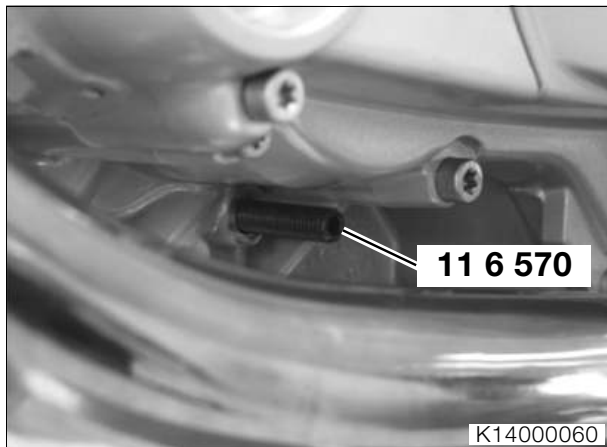


- Use feeler gauges, **BMW No. 11 1 810**, to measure valve clearances.
- Make a note of the valve clearances, or adjust them if necessary.

### Valve clearances:

Inlet valve ..... 0.03...0.11 mm (0.0012...0.0043 in)  
 Exhaust valve .. 0.25...0.33 mm (0.0098...0.0130 in)

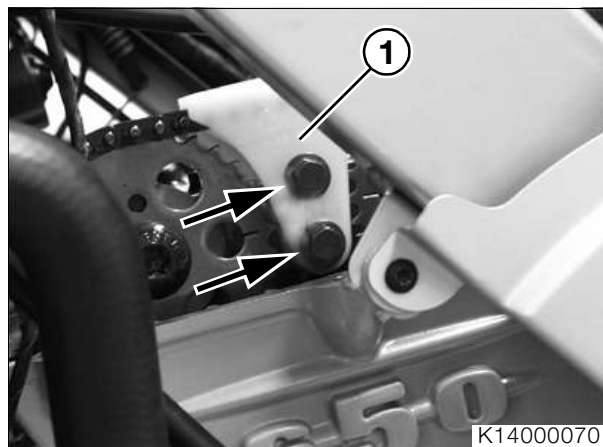
## 00 11 602 Adjusting valve clearances



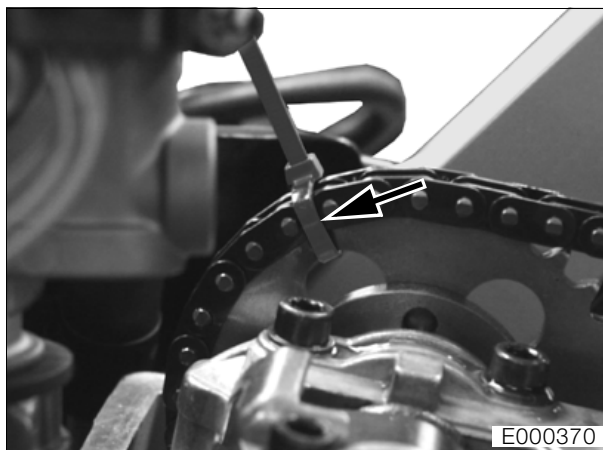
### Note:

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).



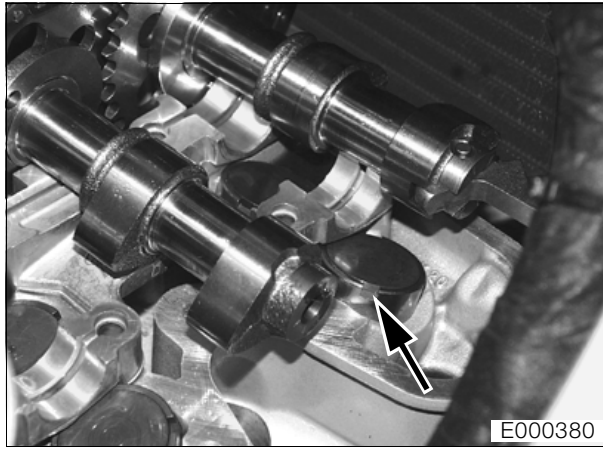
- Use cable ties (arrow) to secure the timing chain to both sprockets.
- Remove the upper section of the camshaft carrier.



### Attention:

Oil the camshafts to facilitate their removal and installation.

- 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.



**Attention:**

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 must be 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 ..... 0.03...0.11 mm (0.0012...0.0043 in)  
 Exhaust valve .. 0.25...0.33 mm (0.0098...0.0130 in)



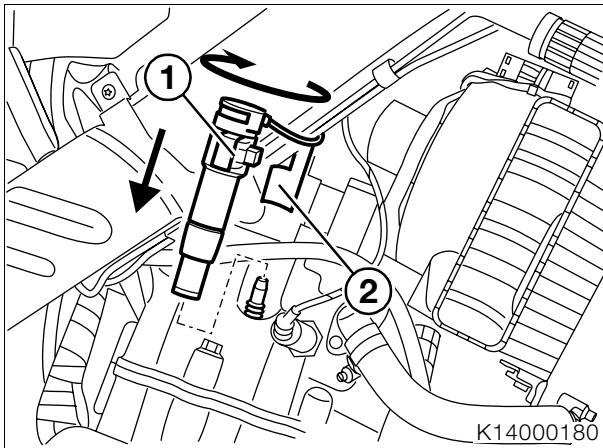
**Tightening torque:**

Stowage-compartment rail to  
 stowage-compartment frame ..... 9 Nm  
 Cover, rear, to left and right covers and  
 stowage-compartment frame ..... 2 Nm  
 Right and left covers to air duct ..... 3 Nm  
 Right and left covers to main frame ..... 2 Nm  
 Right and left covers to cover, front ..... 1 Nm  
 Right and left turn indicators to fairing bracket 3 Nm  
 Cover, front, to main frame ..... 2 Nm  
 Fuel filter to stowage-compartment frame ..... 9 Nm  
 Stowage-compartment frame to main frame .. 9 Nm  
 Cylinder head cover to cylinder head ..... 10 Nm  
 Bracket for ignition coil to cylinder head ..... 9 Nm  
 Spark plug in cylinder head ..... 20 Nm  
 Expansion tank to radiator ..... 9 Nm  
 Camshaft bearing cap to cylinder head ..... 10 Nm  
 Chain guide to bearing cap  
 (clean thread + Loctite 243) ..... 10 Nm  
 Socket-head screw (bore for  
 locating screw) ..... 25 Nm

## 00 12 620 Replacing spark plug

### (Inspection III)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover (→ 46.6).



- Twist rubber ring (1) to release ignition coil from bracket (2).
- Disconnect the ignition coil from the spark plug.
- Remove the spark plug with the w/f 18 socket wrench.
- Installation is the reverse of the removal procedure.

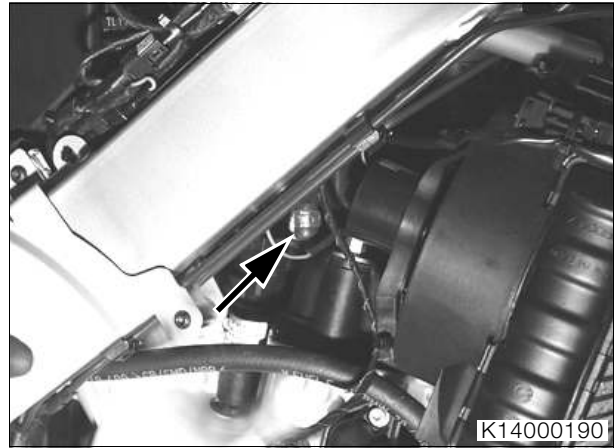
#### **Tightening torque:**

Spark plug.....	20 Nm
Right and left covers to main frame .....	2 Nm
Right and left covers to air duct.....	3 Nm
Right and left covers to cover, front.....	1 Nm
Right and left turn indicators to fairing bracket	3 Nm
Cover, rear, to right and left covers and stowage-compartment frame .....	2 Nm
Stowage-compartment rail to stowage-compartment frame .....	9 Nm

## Emptying drain from intake air silencer

### (Inspections I, II and III)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover (→ 46.6).
- Have a funnel and drip tray ready.



- Open the hose clamp and remove the cap (arrow).

#### **Attention:**

Dispose of used oil in an environmentally compatible manner.

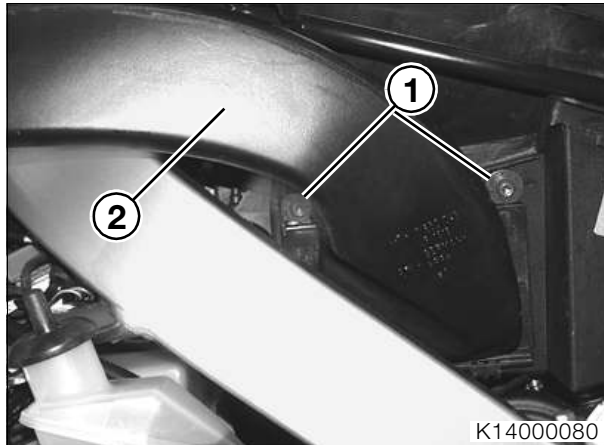
#### **Tightening torque:**

Stowage-compartment rail to stowage-compartment frame.....	9 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Right and left covers to air duct .....	3 Nm
Right and left covers to main frame.....	2 Nm
Cover, front, to right and left covers .....	1 Nm
Right and left turn indicators to fairing bracket	3 Nm

## 00 13 630 Replacing air cleaner element

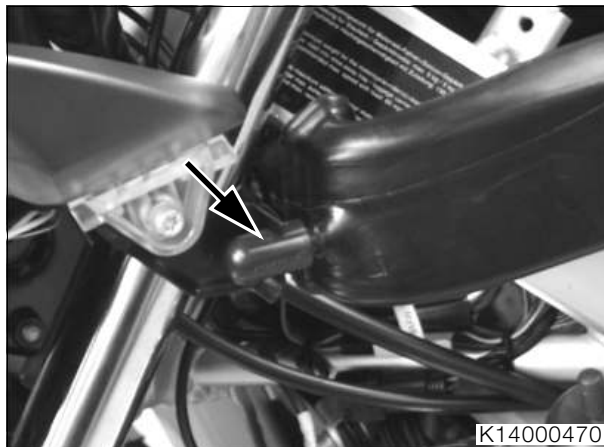
### (Inspection III)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover (→ 46.6).



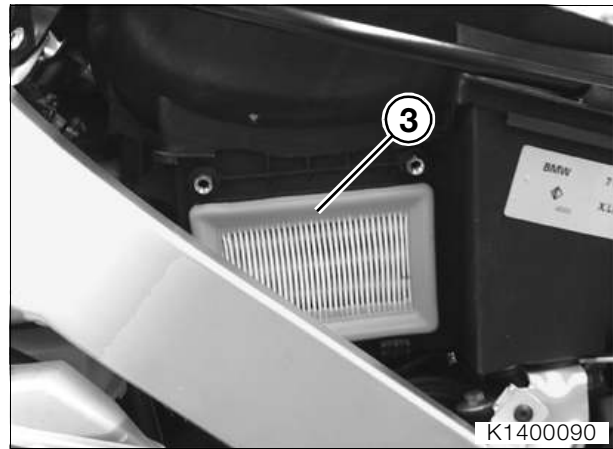
K14000080

- Remove the fasteners securing the intake pipe to intake air silencer (1).
- Swing intake pipe (2) to the side and lift it up and out of the hook.



K14000470

- Disengage the intake air pipe with rubber grommet (arrow) from the link at the front.



K1400090



#### Note:

Compressing the front part of the air filter element facilitates removal.

- Remove air filter element (3).
- Clean the intake air silencer.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



#### Note:

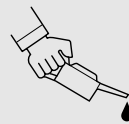
Compressing the front part of the air filter element facilitates installation.

- Engage the intake pipe in the hook of the intake air silencer at the bottom and tilt it up.



#### Tightening torque:

Stowage-compartment rail to stowage-compartment frame ..... 9 Nm  
 Cover, rear, to right and left covers and stowage-compartment frame ..... 2 Nm  
 Right and left covers to air duct ..... 2 Nm  
 Right and left covers to main frame ..... 2 Nm  
 Cover, front, to right and left covers ..... 1 Nm  
 Right and left turn indicators to fairing bracket 3 Nm  
 Intake air pipe to intake air silencer ..... 9 Nm



## 0016617 Replacing fuel filter

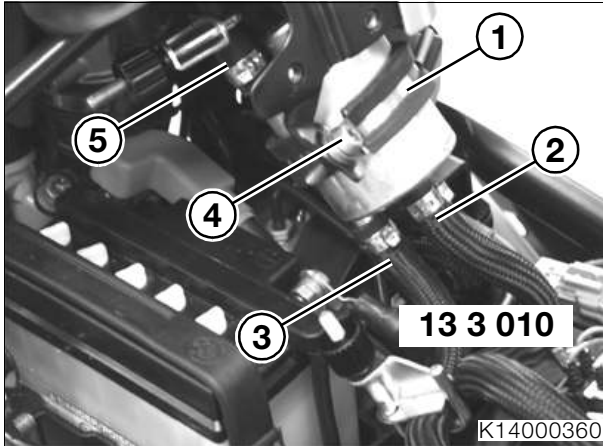
(Inspection III, every 40,000 km/24,000 miles)



### Warning:

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

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover (→ 46.6).



- Remove the fastener securing the fuel filter to the stowage-compartment frame (4).
- Close off fuel supply line (3) 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 (2, 3, 5) from the filter.
- Remove clamp (1) from the fuel filter.

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



### Attention:

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

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

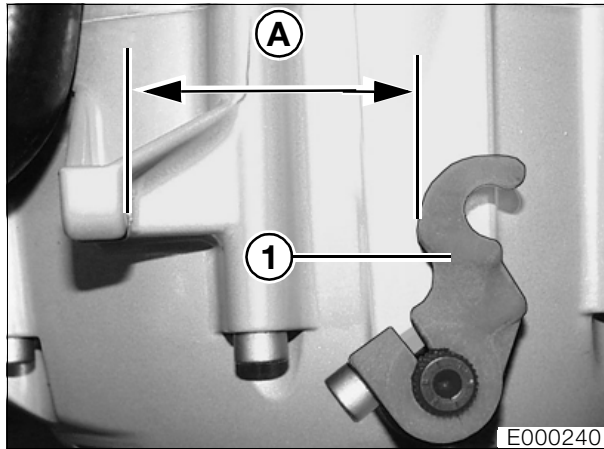


### Tightening torque:

Stowage-compartment rail to stowage-compartment frame..... 9 Nm  
Cover, rear, to right and left covers and stowage-compartment frame ..... 2 Nm  
Right and left covers to air duct ..... 3 Nm  
Right and left covers to main frame ..... 2 Nm  
Cover, front, to right and left covers ..... 1 Nm  
Right and left turn indicators to fairing bracket 3 Nm  
Fuel filter to stowage-compartment frame ..... 9 Nm

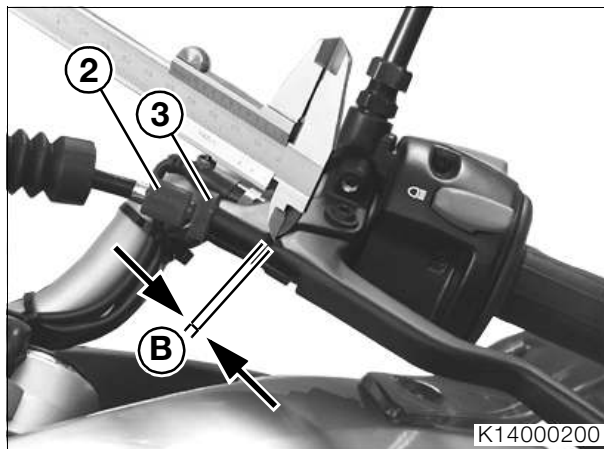
## 21 00 004 Checking clutch play, adjusting if necessary

(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 (1.8504...2.0473 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 (0.0394...0.0787 in)

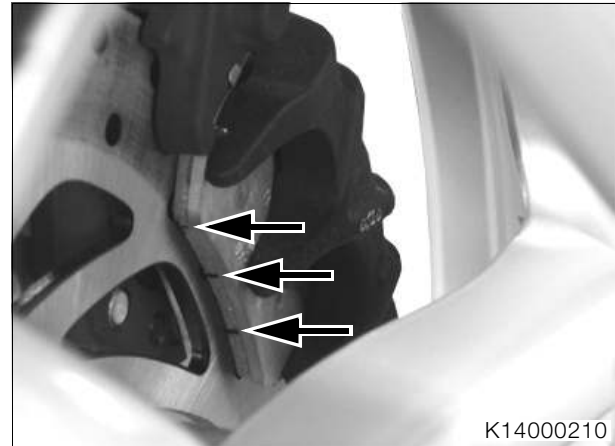
 **Tightening torque:**  
Release lever to release shaft..... 10 Nm

## Checking brake pads and discs for wear, replacing if necessary

(Inspections II and III)

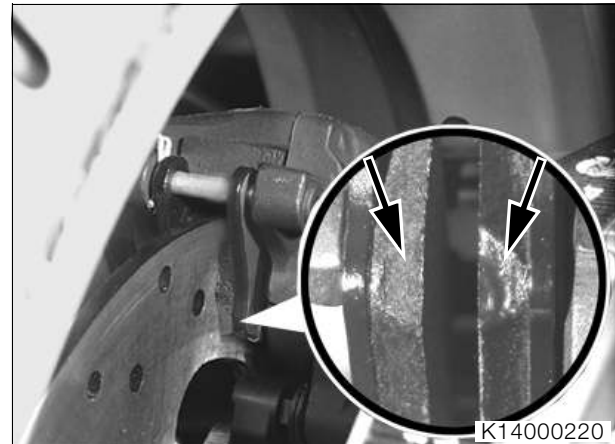
Checking brake pads for wear

**Brake pads, front brake**

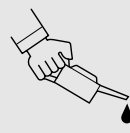


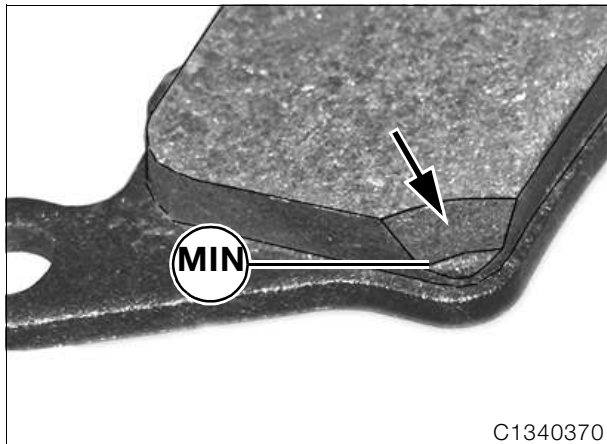
- Visually inspect the brake pads.
  - Replace the brake pads if wear marks (arrows) are no longer clearly visible.

**Brake pads, rear brake**



- Visually inspect the brake pads.
  - Replace the brake pads if wear marks (arrows) are no longer clearly visible.





### Minimum lining thickness

The brake pads have a clearly visible chamfer (arrow) as wear indicator.

## Replacing brake pads

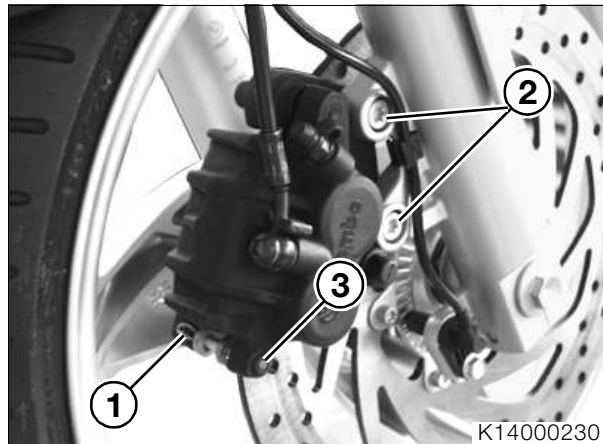


### Attention:

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

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Press the brake caliper against the brake disc in order to force the piston back.



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

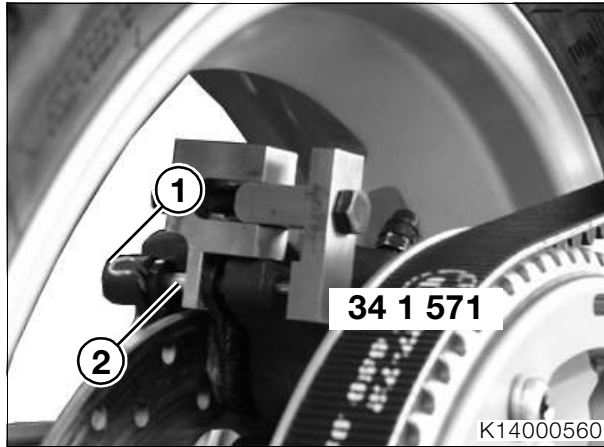


### Tightening torque:

Brake caliper to 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).
- Remove retaining pin (2) with press-out tool, **BMW No. 34 1 571**.
- Remove brake pads.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



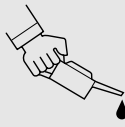
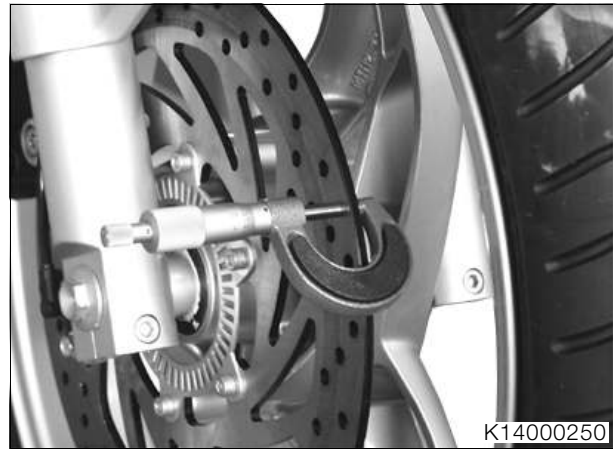
#### Note:

Remove the silencer prior to installation of the retaining pin (→ 18.5).

- Operate brake several times until brake pads are bedded.

### Checking the brake discs

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



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

#### Brake disc wear limit

Front brake disc ..... 4.5 mm (0.1772 in)  
Rear brake disc ..... 4.5 mm (0.1772 in)



## Checking brake fluid level at front and rear

(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.

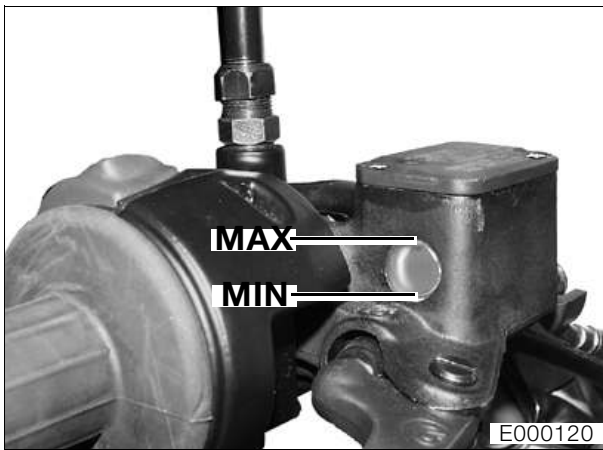
It is not normally necessary to top up the fluid to accommodate lining wear.

A level below MIN indicates the possibility of other faults.



### Brake fluid level (front brake)

#### Checking brake fluid level (front brake)



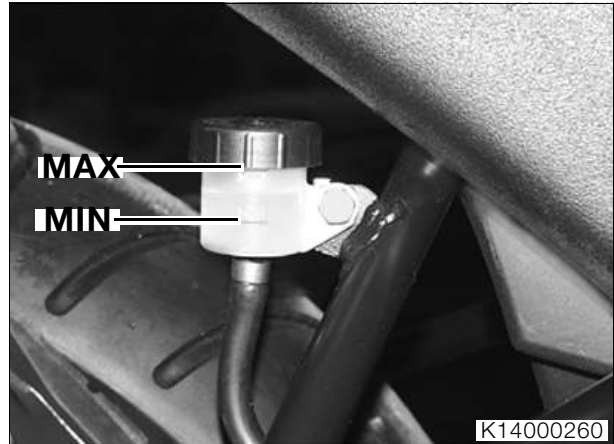
- Support the motorcycle on its side stand.
- Move the handlebars to the straight-ahead position.
- The brake fluid must be between the top edge and the bottom edge of the sight glass.

**Brake fluid**.....DOT 4

### Brake fluid level (rear brake)

#### Checking brake fluid level (rear brake)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



Maximum level ..... **"MAX"**  
 Minimum level ..... **"MIN"**

**Brake fluid** .....DOT 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)



### Attention:

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

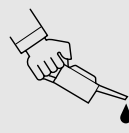
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.



### Note:

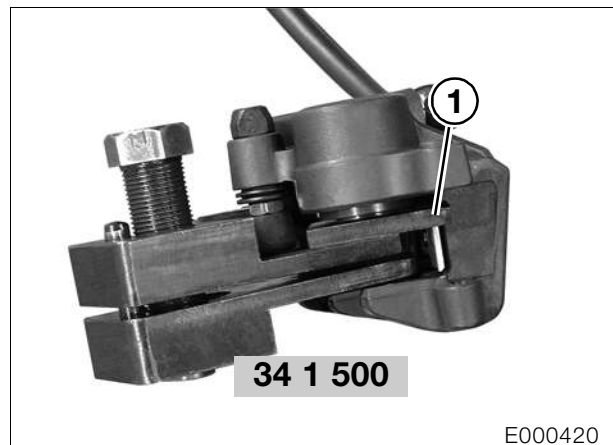
This description applies for the brake filling and bleeding unit with extraction of the brake fluid by a partial vacuum at the brake caliper.

If other devices are used, comply with their manufacturers' instructions.

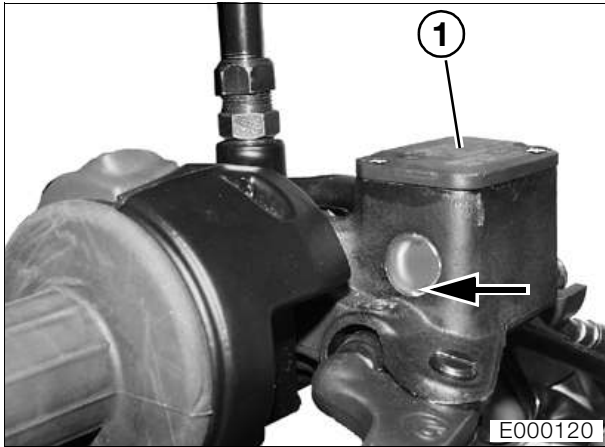


## Changing brake fluid and bleeding brake system (front brakes)

- Remove the brake pads (→ 00.46).



- Using special tool, **BMW No. 34 1 500**, and strips of metal sheet (1) (approx. 7 mm/0.2756 in thick), force back the brake pads.



- Support the motorcycle on its side stand.
- Move the handlebars to the straight-ahead position.
- Remove cap (1) with rubber diaphragm, draw off the old brake fluid and clean the reservoir.
- Top up the brake fluid in the reservoir to the specified level.
- Connect the brake bleeding device to the bleed screw on the brake caliper.
- Open the bleed screw by half a turn.

**! Attention:**

While bleeding the system, do not allow the brake fluid level to drop below the bottom edge 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.
- Add brake fluid up to the top of the sight glass.

**Note:**

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

**! Attention:**

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**.

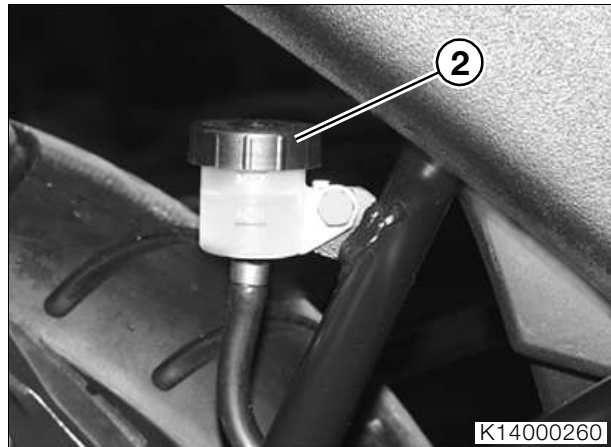
**Brake fluid** ..... DOT 4

**Tightening torque:**

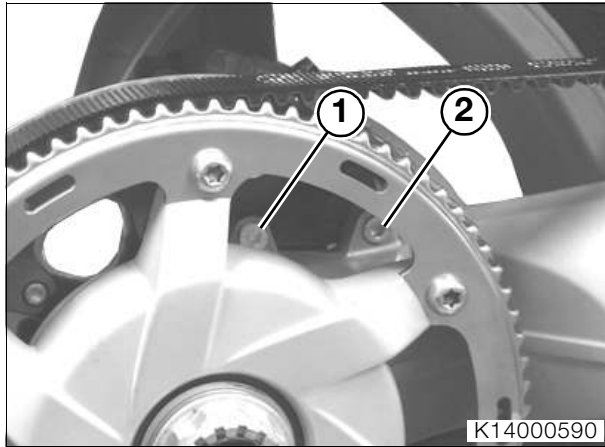
Bleed screw ..... 7 Nm

**Changing brake fluid and bleeding brake system (rear brakes)**

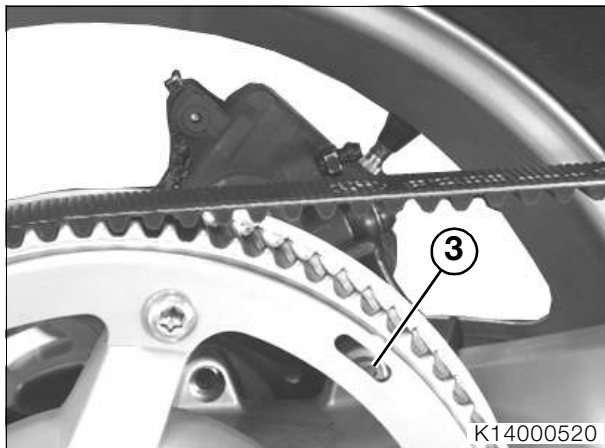
- Press the brake caliper against the brake disc in order to force the piston back.



- Remove cap (2) with rubber diaphragm, draw off the old brake fluid and clean the reservoir.
- Top up the brake fluid in the reservoir to the specified level.



- Slacken threaded fasteners at front of brake caliper (2) and swinging arm.
- Remove rear securing screw (1).



- Tilt the brake caliper forward.
- Tighten front securing screw (3).
- Connect the brake bleeding device to the bleed screw on the brake caliper.
- Open the bleed screw by half a turn.

**⚠ Attention:**

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.
- Top up the brake fluid until the level reaches the "MAX" mark.



**Note:**

**[ABS]** Place rubber diaphragm and reservoir cap in position.



**Attention:**

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** ..... DOT 4



**Tightening torque:**

Bleed screw ..... 7 Nm  
 Brake caliper to swinging arm ..... 21 Nm

## Replacing primary sealing boot, front brake master cylinder

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

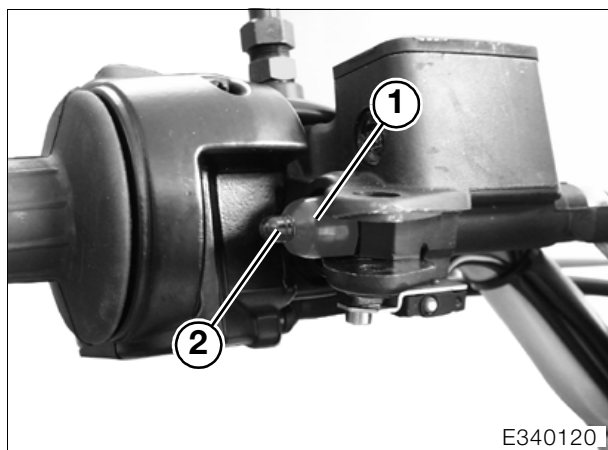
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



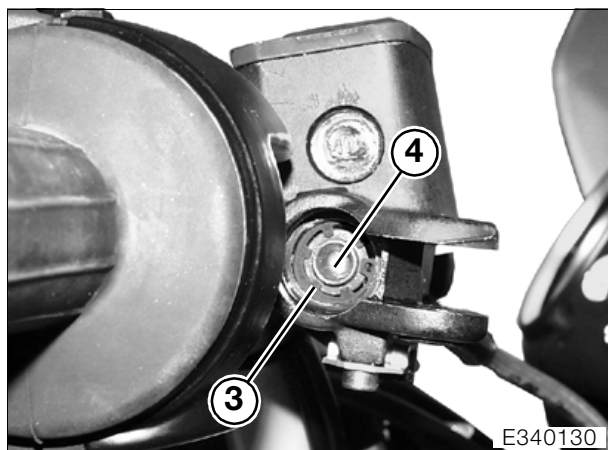
### Attention:

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

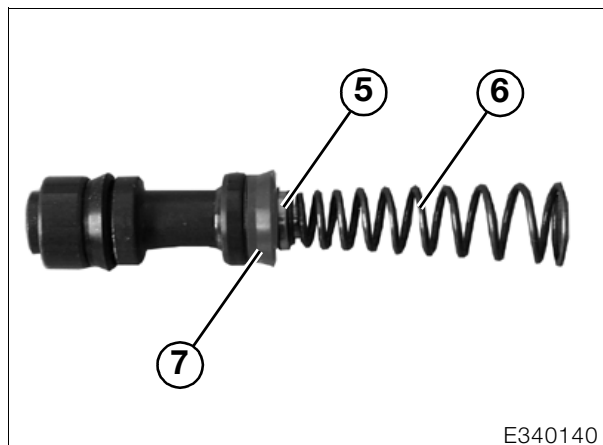
- Drain the front brake system.
- Remove the hand-brake lever.



- 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).



### Attention:

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.



### Attention:

Sealing lips of the boots toward the pressure chamber.

- Install new front boot.
- Prior to installation, coat the brake piston and the boots with the assembly fluid supplied.
- Lightly grease the thrust pin with **Shell Retinax A**.
- Fill and bleed the brake system (→ 00.49).



### Tightening torque:

Pivot pin, handbrake lever ..... 7 Nm  
Locknut, 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)

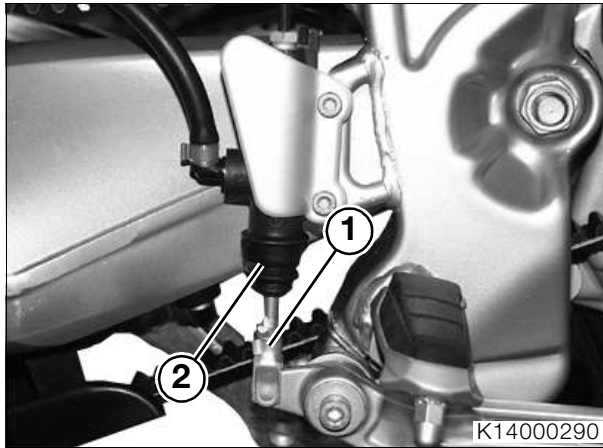
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



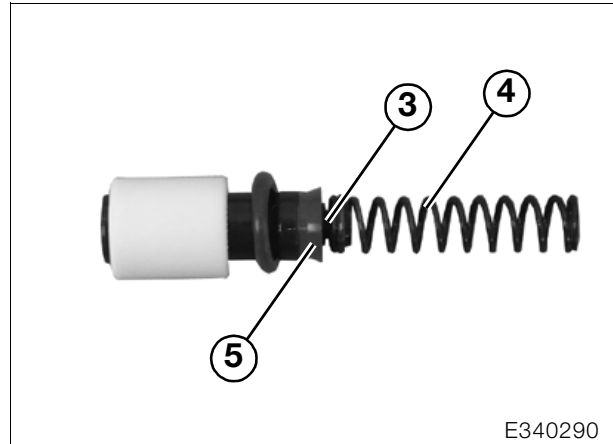
### Attention:

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

- Drain the rear brake system.



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



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



### Attention:

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.



### Attention:

Sealing lip of the boot toward the pressure chamber.

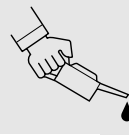
- Install new front boot.
- Prior to installation, coat the brake piston and the boots with the assembly fluid supplied.
- Lightly grease the thrust rod with **Shell Retinax A**.



### Attention:

When bleeding a brake system drained beforehand, always operate the brake lever to the full extent of its travel several times during the procedure.

- Fill and bleed the brake system (→ 00.50).



## Checking toothed belt pulley and sprocket, replacing if necessary

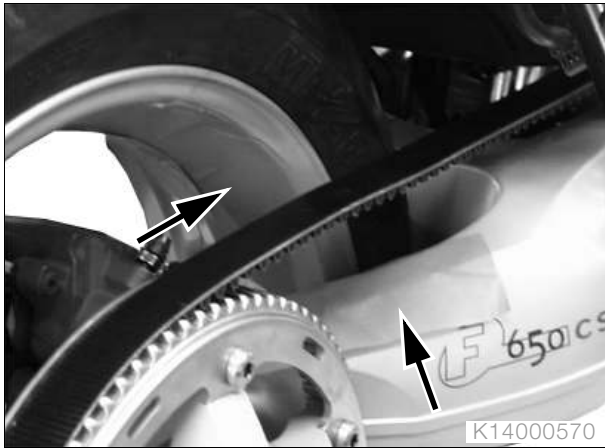
### (Inspection III)

- Remove the sprocket cover.
- Check toothed belt pulley and sprocket for damaged teeth and indentations caused by hard objects; replace if necessary.

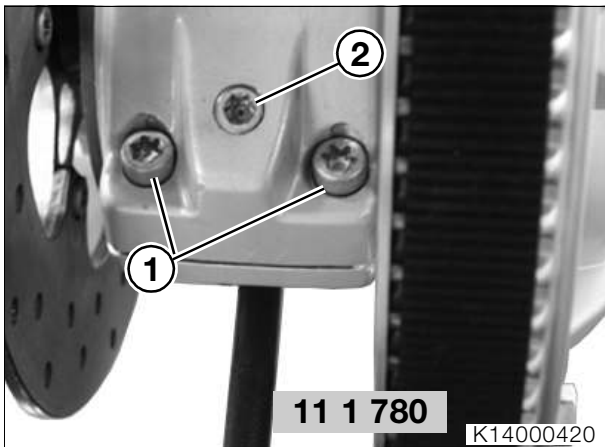
## Replacing toothed belt

### (Inspection III)

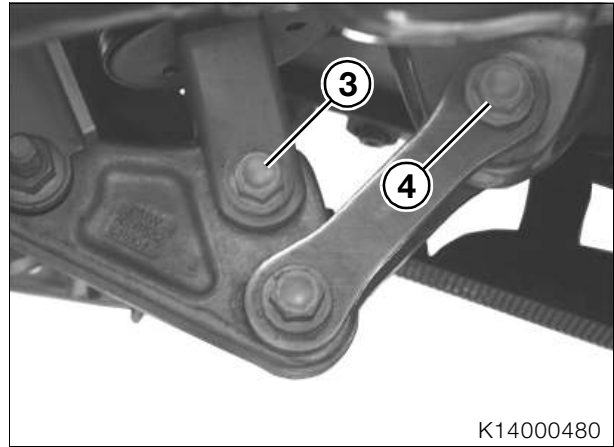
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



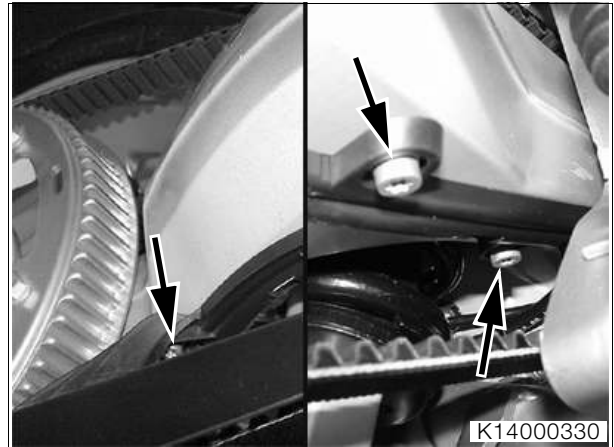
- Affix masking tape to rim and swinging arm (arrows)
- Remove cover for belt drive sprocket.



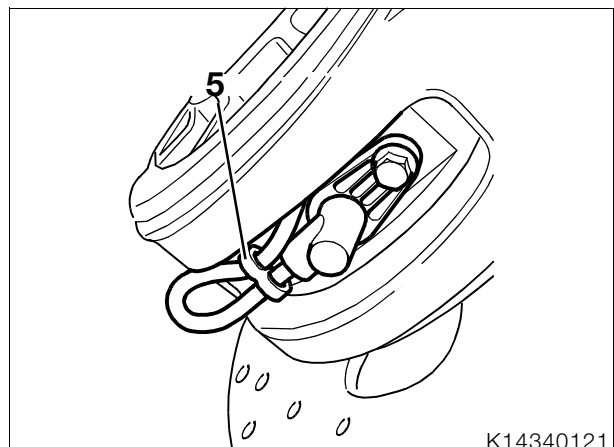
- Back off screws of eccentric clamp (1) by 0.5 to 1 turn.
- Back off adjusting screw (2) several turns.
- Relieve tension on belt by backing off eccentric with punch, **BMW No. 11 1 780**.
- Remove the brake caliper from the swinging arm.



- Remove the fastener securing the angled lever to spring strut (3).
- Remove the fastener securing the strut to the swinging arm (4).
- Remove the belt from the belt pulley.



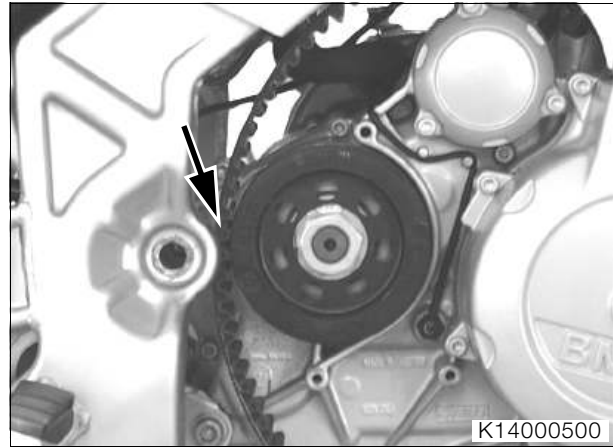
- Remove fasteners securing belt cover (arrows).



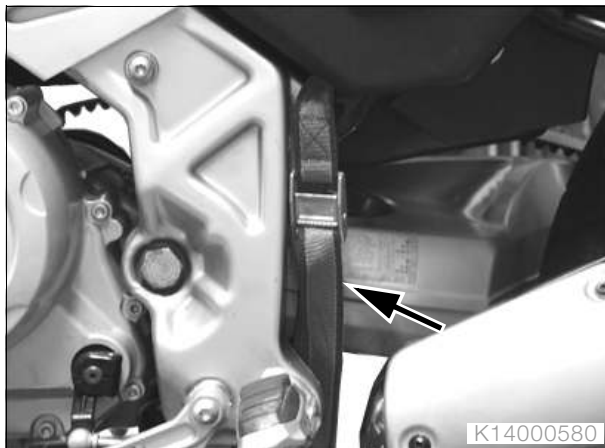
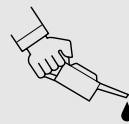
- Unclip clip (5) from ABS sensor cable.



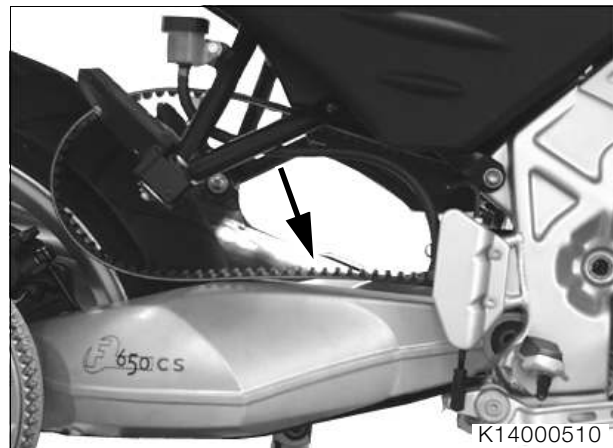
- Use a strap to secure the rear wheel to the rear frame (arrow).
- Remove the belt from the belt sprocket.



- Working from the front, pass the new belt between the frame and the belt pulley (arrow).



- Use a strap to secure the swinging arm at the front (arrow).
- Remove the swinging arm pivot shaft.
- Press swinging arm with rear wheel back and to the left, while pressing the brake caliper forward.
- Pull the belt forward and remove.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



- Slide the belt onto the swinging arm (arrow).
- Holding the belt vertical, pass it between the swinging arm and the frame.

**Warning:**

Do not bend the belt sharply or twist it. Do not bend the belt through a radius of less than 100 mm (3.9371 in).



**Note:**

Grease the pivot shaft of the swinging arm with **Optimoly TA** before installing. Note the thrust washers when installing the swinging arm.

- Preload the new belt and turn it through three complete revolutions of the belt.
  - Adjust belt tension (➡ 00.56).



**Tightening torque:**

Sprocket cover to engine .....	2 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm
Belt cover to swinging arm .....	9 Nm
Brake caliper to swinging arm .....	21 Nm
Spring strut to angled lever .....	41 Nm
Reaction link to swinging arm.....	41 Nm
Pivot shaft of swinging arm .....	100 Nm



## Checking belt tension, adjusting if necessary

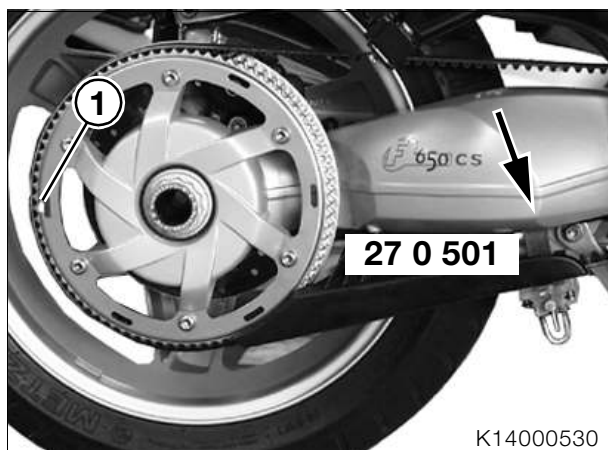
(Inspections I, II and III)

### Checking belt tension

- Place the motorcycle without load on the auxiliary stand, **BMW No. 00 1 620**.

 **Attention:**

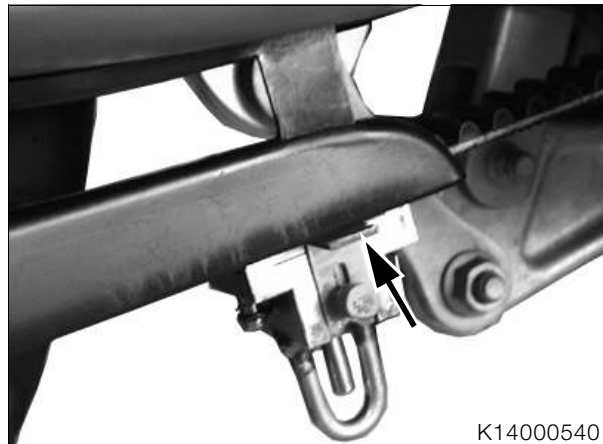
Check belt tension at room temperature only.



 **Attention:**

Coloured mark on belt pulley (1) must point toward the rear when the measuring device is positioned under the corner of the swinging arm. If the coloured mark is no longer visible, vertical runout of the belt pulley must be measured before belt tension can be checked (→ 33.15).

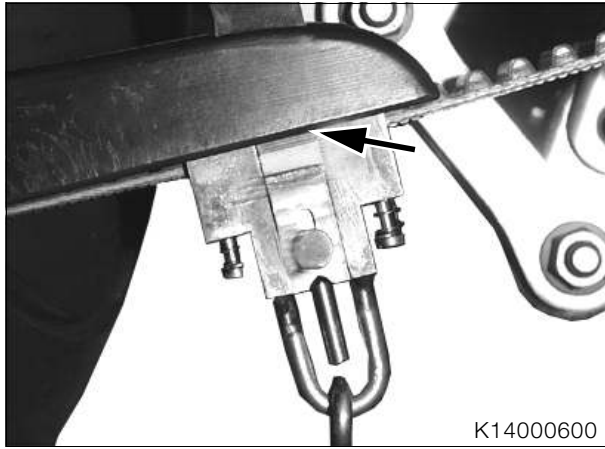
- Mount measuring device, **BMW No. 27 0 501**, on the toothed belt and turn it until it is under the corner (arrow) of the swinging arm.
- Lock the rear wheel.



- Align the scale of the measuring device flush with the bottom edge of the belt cover (arrow).



- Suspend weight, **BMW No. 27 0 502**, from the measuring device.



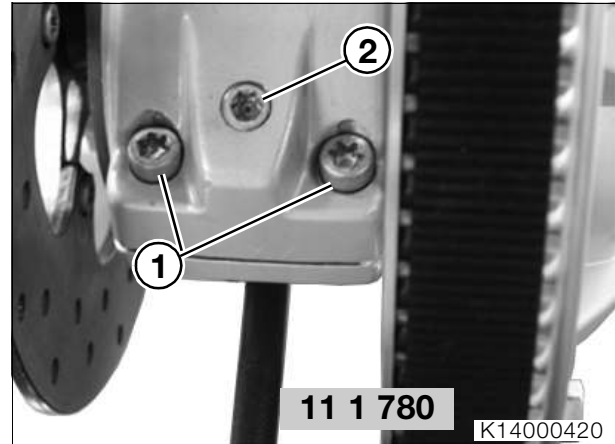
K14000600

- The bottom edge of the belt cover must be inside the green section (arrow) of the scale.
- Adjust belt tension if necessary.

## Adjusting belt tension

### Used belt, new belt

- Place the motorcycle without load on the auxiliary stand, **BMW No. 00 1 620**.



11 1 780

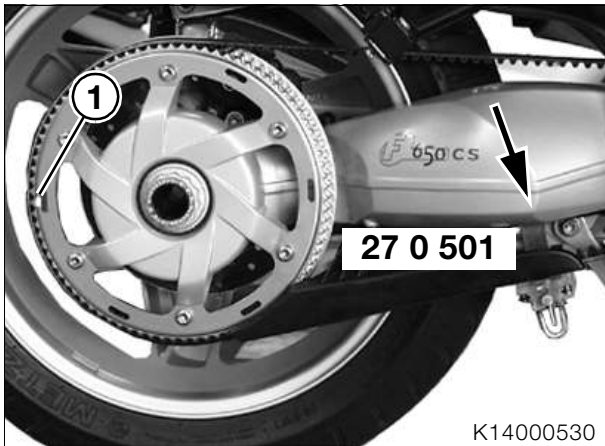
K14000420



### Attention:

If the eccentric clamping screws were backed off 0.5 to 1 turns beforehand, do not slacken them any further.

- Back off screws of eccentric clamp (1) by 0.5 to 1 turn.
- Back off adjusting screw (2) several turns.
- Relieve tension on belt by backing off eccentric with punch, **BMW No. 11 1 780**.



K14000530

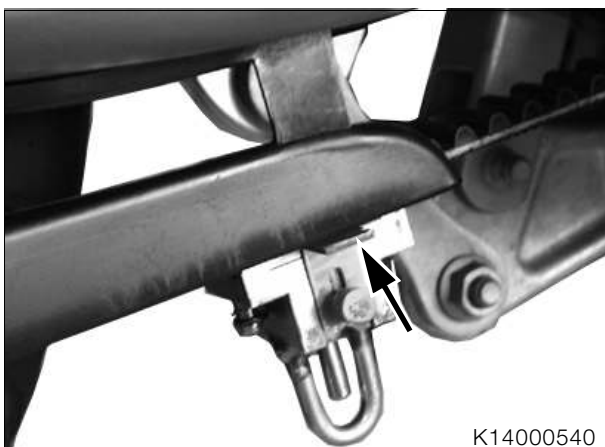


K14000550

**⚠ Attention:**

Coloured mark on belt pulley (1) must point toward the rear when the measuring device is positioned under the corner of the swinging arm. If the coloured mark is no longer visible, vertical run-out of the belt pulley must be measured before belt tension can be checked (→ 33.15).

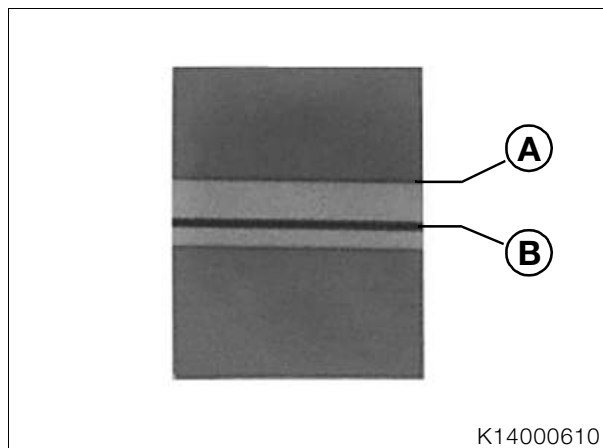
- Mount measuring device, **BMW No. 27 0 501**, on the toothed belt and turn it until it is under the corner (arrow) of the swinging arm.
- Lock the rear wheel.



K14000540

- Align the scale of the measuring device flush with the bottom edge of the belt cover (arrow).

- Suspend weight, **BMW No. 27 0 502**, from the measuring device.



K14000610

**Used belt**

- Tighten the adjusting screw until the boundary of the green/red area (A) on the scale is flush with the bottom edge of the belt cover.

**New belt**

- Tighten the adjusting screw until the black line (B) on the scale is flush with the bottom edge of the belt cover.

- Remove the weight.
- Tighten eccentric clamping screws to specified initial torque.
- Tighten eccentric clamping screws to specified final torque.
- Check that torque wrench clicks at specified final torque on the eccentric clamping screws.

**⚠ Tightening torque:**

Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm

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

(Inspections II, III and IV)



### Warning:

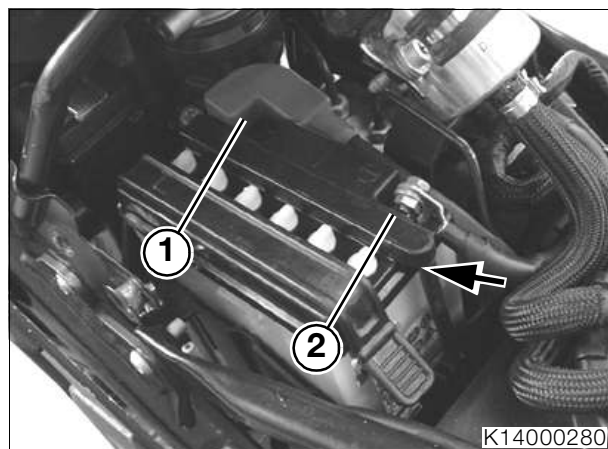
Battery acid is highly caustic. Protect your eyes, face, hands, clothing and the paintwork.

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover.



### Attention:

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



- Release clamping strap.
- Disconnect ground cable (2) from the battery.
- Disconnect the battery breather hose (arrow) from the battery.
- Remove the battery.
- Rest the battery on the fuel tank.
- Disconnect positive lead (1) from battery.

## 61 20 029 Checking battery acid level

- Check the battery fluid level.
- The battery fluid level must be between maximum **“UPPER LEVEL”** and minimum **“LOWER LEVEL”**.

## 61 20 029 Adding distilled water

- Open the battery caps.



### Attention:

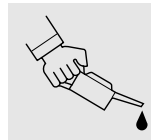
Use only distilled water to top up the acid level in the battery. Never top up with diluted sulphuric acid.

- Top up with distilled water until the fluid level reaches the **“UPPER LEVEL”** mark.
- Firmly retighten the battery caps.
- Installation is the reverse of the removal procedure: pay particular attention to the following.



### Note:

When connecting the battery lead, always make sure that the spring washer is between the screw head and the battery lead.



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

(Inspection IV)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover.
- Remove the battery.



### Attention:

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

- 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.



### Attention:

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



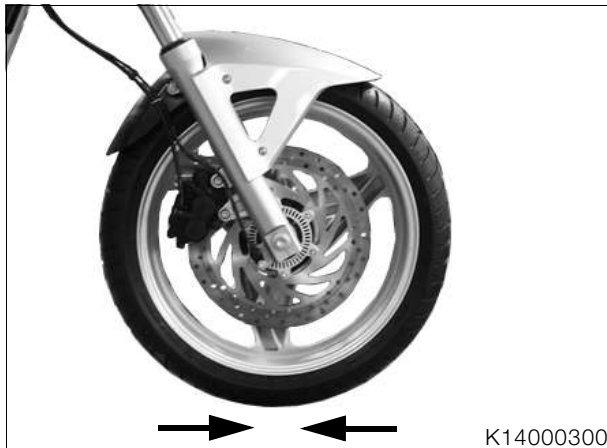
### Note:

When connecting the battery lead, always make sure that the spring washer is between the screw head and the battery lead.

## 32 00 454 Checking and adjusting steering head bearing play, replacing if necessary (Inspections II and III)

### Checking steering head bearing play

- Relieve load on front wheel.



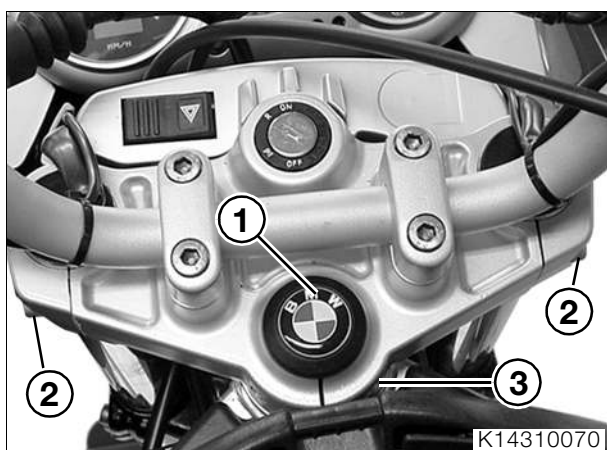
- Move fixed fork tubes forward (arrows).
- Adjust the steering head bearing if play is perceptible.
- Swing the fork legs all the way through their full range of travel and check for points of stiffness.
  - Replace the steering head bearings if there are catches in the movement (→ 31.17).

### 32 00 454 Adjusting steering head bearing play

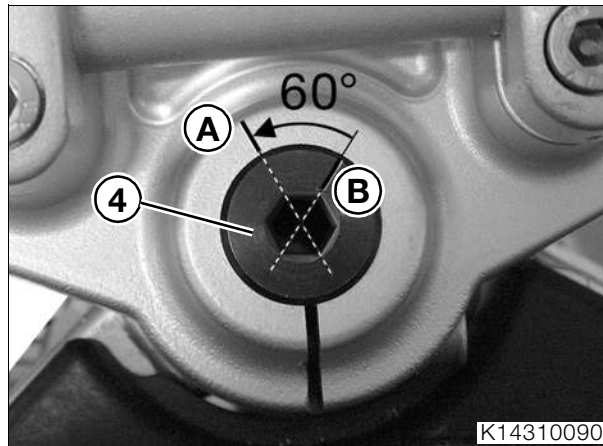


#### Attention:

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



- Remove protective cap (1).
- Release clamping screws (2) at upper fork bridge.
- Slacken clamping screw (3) for the steering tube.



- Slacken adjusting screw (4), then tighten it to 25 Nm.
- Turn forks back and forth twice from lock to lock, and leave the forks at the full left lock position.
- Apply mark "A".
- Apply mark "B".
- Back off the adjusting screw until mark "B" is aligned with mark "A".
- Tighten clamping screw of steering tube.
- Tighten clamping screws of the fork bridge.
- Check play and freedom of movement.
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Raise the front wheel clear of the ground and perform final check.
  - With the front wheel off the ground, the weight of the forks must be enough to turn the steering all the way to the left and right full lock positions as soon as the handlebars are moved away from the straight-ahead position.
  - If local points of stiffness are detected when the handlebar is moved to and fro, renew the steering head bearings.



#### Tightening torque:

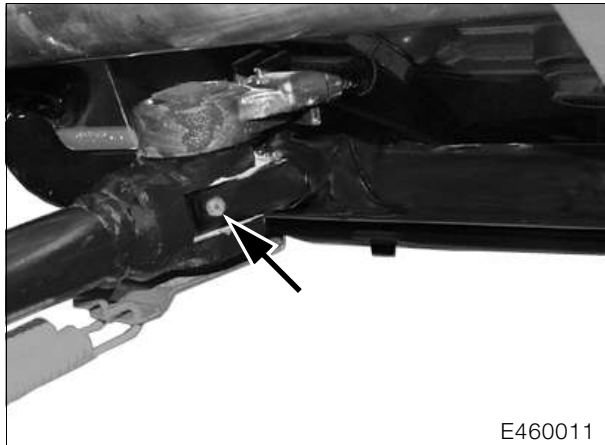
Initial torque of adjusting screw .....	25 Nm
Back off through angle .....	60 °
Clamping screws, fork bridge and steering head .....	23 Nm

## Greasing side stand

(Inspections II and III)

### Side stand

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



- 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.

#### Lubricant:

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

## Checking specified torque of threaded fasteners with torque wrench

(Inspections I, II, III and IV)

- Check the security of the following threaded fasteners:
  - Engine mounting bolts and nuts
  - Threaded fasteners of frame
  - Threaded fasteners of rear frame
  - Eccentric clamp
  - manifold fastener



#### Tightening torque:

Engine to frame at rear .....	50 Nm
Cylinder head to frame .....	41 Nm
Cylinder head to frame, locknut.....	100 Nm
Engine shell to engine .....	55 Nm
Engine shell to engine at bottom with truss..	55 Nm
Engine shell to tube .....	24 Nm
Rear frame to main frame (clean thread + Loctite 2701).....	24 Nm
Eccentric clamp, rear swinging arm Initial torque .....	10 Nm
Final torque .....	21 Nm
Exhaust manifold to cylinder head.....	20 Nm
Silencer to exhaust manifold .....	55 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 (0.0787 in)

Rear wheel ..... 3 mm (0.1181 in)

## Tyre pressures (tyres cold)

### One-up

Front wheel ..... 2.2 bar (31.306 psi)

Rear wheel ..... 2.5 bar (35.575 psi)

### With full load

Front wheel ..... 2.2 bar (31.306 psi)

Rear wheel ..... 2.5 bar (35.575 psi)

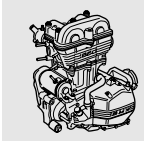
## Roadworthiness check

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

# 11 Engine

## Contents

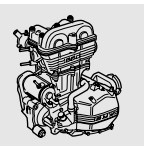
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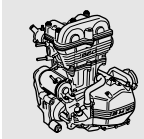
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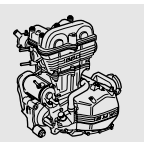


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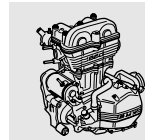
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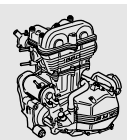
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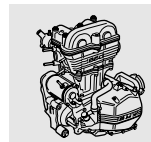
Technical Data 11 Engine		F 650 CS
Engine, general		
Type		Single-cylinder four-stroke, double overhead camshafts driven by roller chain, 4 valves operated by bucket tappets, balancing shaft, liquid-cooled cylinder and cylinder head, integral water pump, 5-speed gearbox and dry sump lubrication.
Cylinder bore	mm (in)	100 (3.94)
Stroke	mm (in)	83.0 (3.27)
Displacement	cc	652
Compression ratio		11.5 : 1
Power output	kW	37 at 6800 rpm/25 at 6500 rpm
Max. torque	Nm	62 at 5500 rpm/50 at 3500 rpm
Idle speed	rpm	1400
Max. continuous engine speed	rpm	7,000
Max. engine speed	rpm	7500
Crankshaft (main) bearings		Plain bearing
Engine lubrication		Dry sump, with oil pump
Cylinder		Light alloy, "Nikasil" coated
Piston		Cast aluminium with 3 rings
Oil filter		Full-flow type
Oil pump		2 trochoid pumps, driven by primary drive
Oil capacity	l (Imp. pints/US quarts)	2.5 (4.4/2.64)
Oil pressure (idle speed)	bar (psi)	Š 0.5 (7.11) (oil temperature 80 °C/176 °F)
Permissible oil consumption	l/100 km (miles per Imp. pint/miles per US quart)	0.1 (0.176/0.1057)
<b>Crank gear</b>		
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 (1.81)
Wear limit		
Main bearing diameter	mm (in)	47.97 (1.9)
Bearing play	mm (in)	0.10 (0.004)
Runout at crankpin		
Clutch side	mm (in)	0.03 (0.0012)
Magnet side	mm (in)	0.05 (0.002)
<b>Connecting rod</b>		
Wear limit, connecting rod		
Radial clearance		
Big-end bore	mm (in)	0.08 (0.031)
Small-end bore	mm (in)	0.05 (0.002)

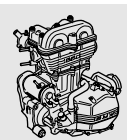




Technical Data 11 Engine		F 650 CS
<b>Big end bearing endplay</b>		
Installed dimension	mm (in)	0.30...0.65 (0.012...0.026)
Wear limit	mm (in)	0.80 (0.031)
<b>Small-end bore</b>		
Installed dimension	mm (in)	22.015...22.025 (0.8668...0.8671)
Wear limit	mm (in)	22.04 (0.868)
<b>Balancing shaft</b>		
Bearing journals		
Wear limit	mm (in)	19.96 (0.79)
<b>Cylinder head</b>		
Camshaft journals, inlet/exhaust		
Wear limit	mm (in)	21.967...21.980 (0.8649...0.8654)
Wear limit	mm (in)	21.950 (0.8642)
Camshaft bearing play, inlet/exhaust		
Wear limit	mm (in)	0.020...0.060 (0.0008...0.0024)
Wear limit	mm (in)	0.090 (0.0035)
<b>Valves</b>		
Valve clearances with engine cold (max. 35 °C/95 °F)		
Inlet valve	mm (in)	0.03...0.11 (0.0012...0.043)
Exhaust valve	mm (in)	0.25...0.33 (0.001...0.013)
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 (1.42)
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 (0.1925)
Exhaust	mm (in)	4.90...4.94 (0.193...0.194)
Wear limit	mm (in)	4.89 (0.1925)
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)
Valve seat angle		
Inlet	°	45
Exhaust	°	45
Included valve angle		
Inlet	°	15
Exhaust	°	18

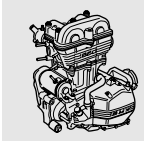
Technical Data 11 Engine		F 650 CS
Valve seat width		
Inlet	mm (in)	1.05...1.35 (0.041...0.053)
Wear limit	mm (in)	1.60 (0.063)
Exhaust	mm (in)	1.25...1.55 (0.049...0.061)
Wear limit	mm (in)	2.2 (0.087)
Valve guide		
Inlet internal dia.	mm (in)	5.006...5.018 (0.1971...0.1976)
Wear limit	mm (in)	5.080 (0.2)
Exhaust internal dia.	mm (in)	5.006...5.018 (0.1971...0.1976)
Wear limit	mm (in)	5.080 (0.2)
Bucket tappets (wear limit)		
Extl. dia.	mm (in)	33.400 (1.315)
Radial play in cylinder head	mm (in)	0.200 (0.0079)
Guide dia. in cylinder head	mm (in)	33.600 (1.322)
<b>Valve spring</b>		
On installation (free length)	mm (in)	min. 40.5 (1.59)
Wear limit	mm (in)	39.0 (1.535)
<b>Camshafts</b>		
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 carrier	mm (in)	22.040 (0.868)
<b>Oil pressure control valve</b>		
Coil spring length, relaxed	mm (in)	min. 14.0 (0.55)
<b>Oil retaining valve</b>		
Coil spring length, relaxed	mm (in)	min. 14.5 (0.57)
<b>Piston</b>		
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 (3.935)
Installed clearance	mm (in)	0.015...0.040 (0.0006...0.0016)
Wear limit	mm (in)	0.090 (0.0035)



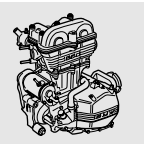


Technical Data 11 Engine		F 650 CS
<b>Piston rings</b>		
Groove 1: square-section ring		
Ring thickness	mm (in)	1.2 (0.047)
Ring height wear limit	mm (in)	1.15 (0.045)
Ring gap	mm (in)	0.2...0.4 (0.008...0.016)
Gap wear limit	mm (in)	1.0 (0.039)
Groove height wear limit	mm (in)	1.30 (0.051)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.006)
Groove 2: stepped micro-taper ring		
Ring thickness	mm (in)	1.5 (0.059)
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 (0.039)
Groove height wear limit	mm (in)	1.6 (0.063)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.0059)
Groove 3: steel-strip oil control ring		
Ring gap	mm (in)	0.2...0.4 (0.008...0.016)
Gap wear limit	mm (in)	1.0 (0.039)
Groove height wear limit	mm (in)	2.6 (0.102)
Ring groove float	mm (in)	0.03...0.065 (0.0012...0.0026)
Ring groove float wear limit	mm (in)	0.15 (0.0059)
<b>Piston pin</b>		
<b>Piston pin dia.</b>		
Wear limit	mm (in)	21.98 (0.865)
Piston pin clearance in conrod bore		
	mm (in)	0.015...0.029 (0.0006...0.0011)
Wear limit	mm (in)	0.050 (0.002)
in bore (piston)		
	mm (in)	0.012...0.021 (0.0005...0.0008)
Wear limit	mm (in)	0.050 (0.002)
<b>Cylinder</b>		
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 (3.9386)
<b>Timing chain</b>		
Wear limit	mm (in)	9.0 (0.354)
Distance from sealing face of plug to piston of chain tensioner		

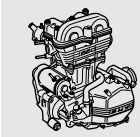
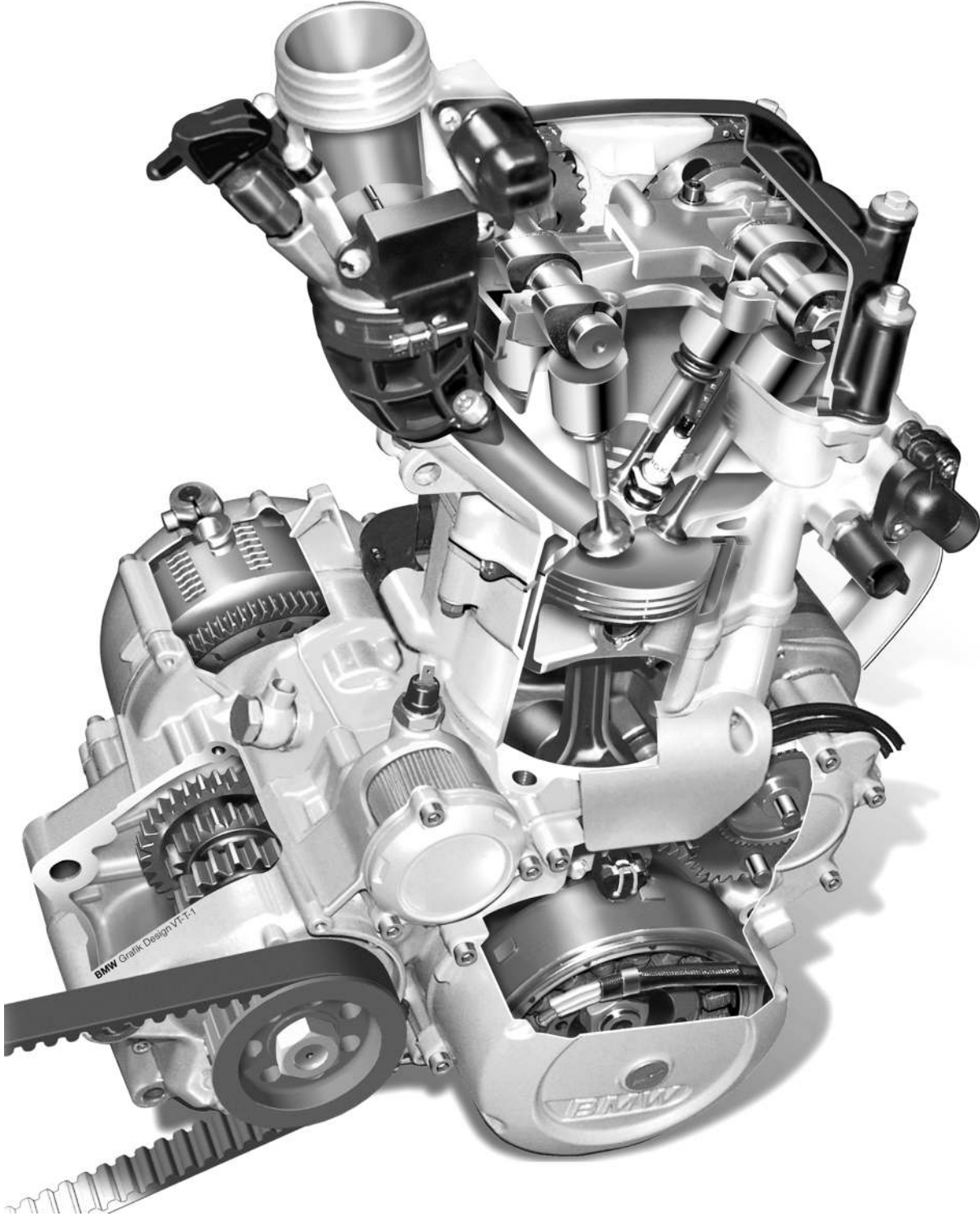
Technical Data 11 Engine		F 650 CS
<b>Clutch and gearbox</b>		
Clutch friction plates (8)		
Installed dimension of each plate	mm (in)	3.45...3.55 (0.136...0.140)
Wear limit, height of cluster (total)	mm (in)	27.5 (1.083)
Clutch springs		
Wear limit at 190 N	mm (in)	27.4 (1.079)
<b>Oil pump</b>		
Oil pumps		primary/secondary
Housing depth (primary)	mm (in)	14 (0.551)
Housing depth (secondary)	mm (in)	19 (0.748)
Wear limit, installed clearance (radial)	mm (in)	0.25 (0.01 )
Wear limit, installed clearance (axial)	mm (in)	0.25 (0.01)

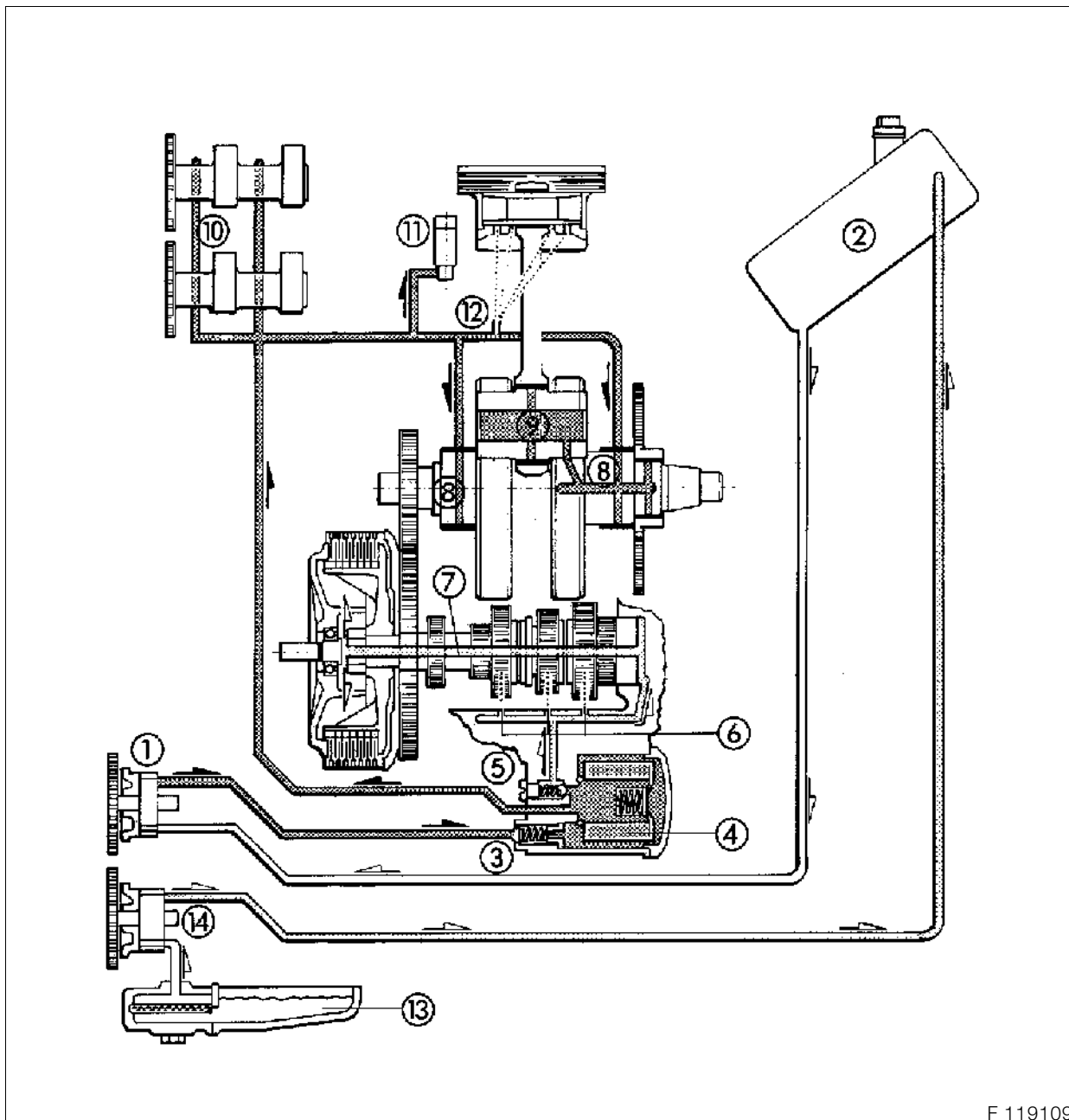
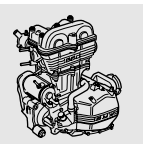






Cutaway view of engine



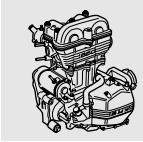
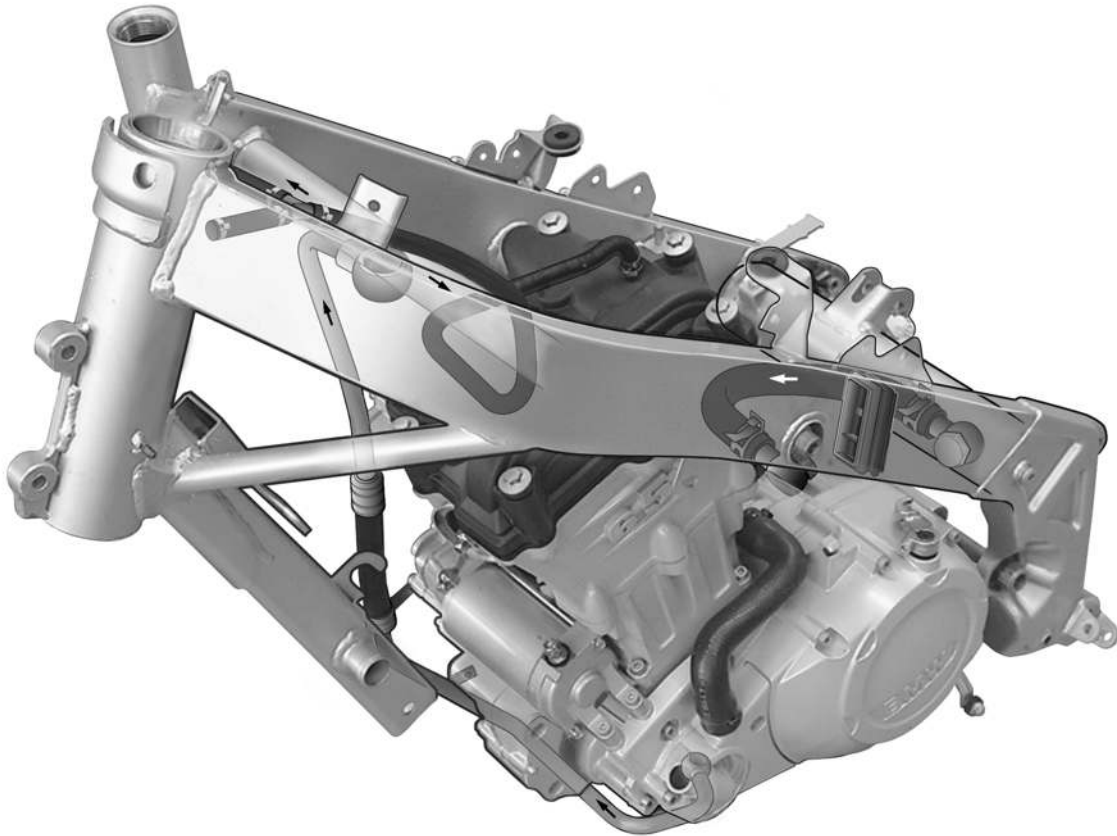


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## Engine oil circuit

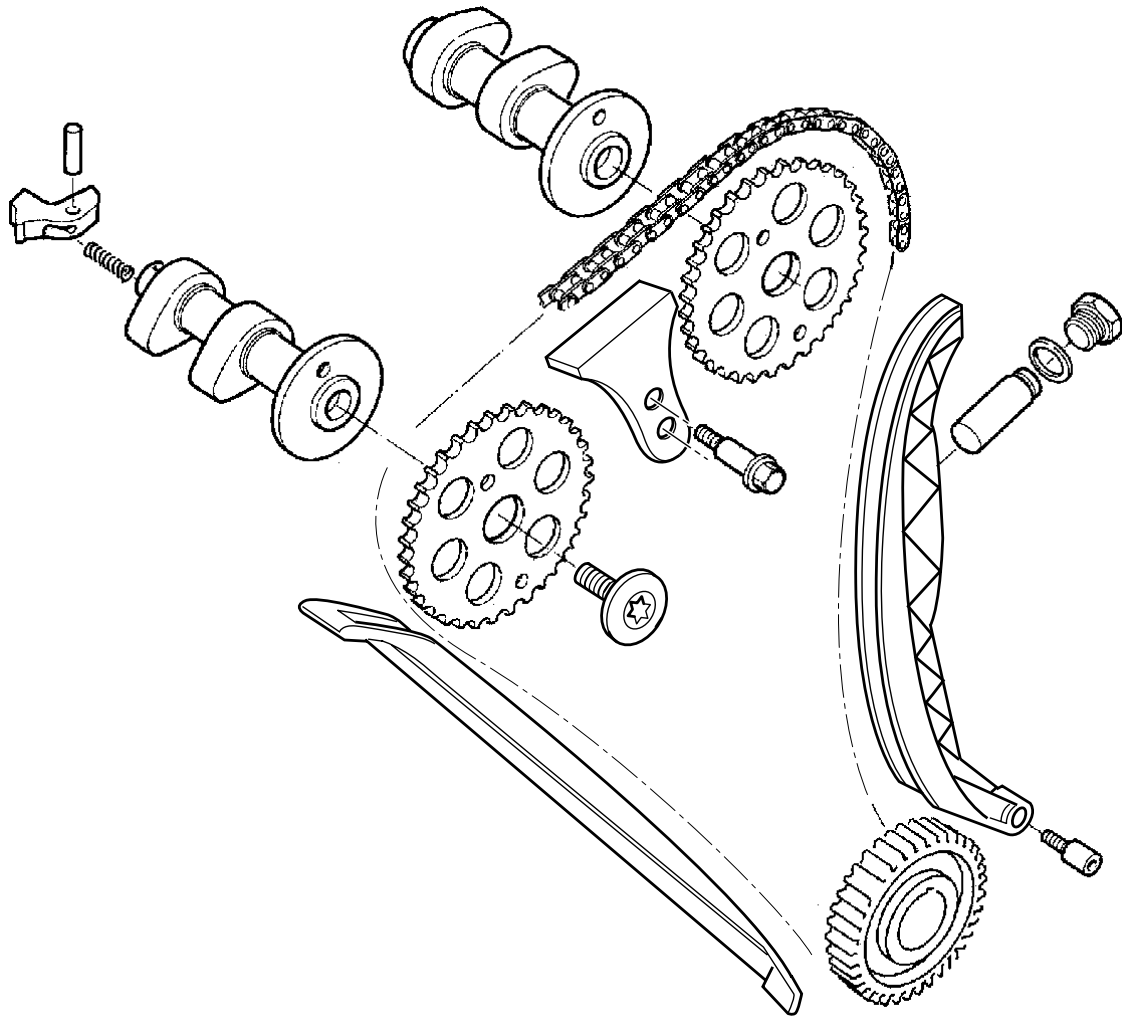
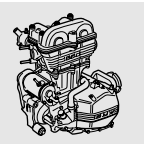
1. Delivery pump
2. Oil tank
3. Check valve
4. Oil filter
5. Control valve
6. Low-pressure line (gearbox)
7. Low-pressure line (clutch)
8. High-pressure line (crankshaft)
9. High-pressure line (big end bearing)
10. High-pressure line (camshafts)
11. Chain tensioner
12. Spray nozzle (for piston)
13. Oil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

**Engine and oil-tank system**



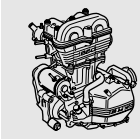
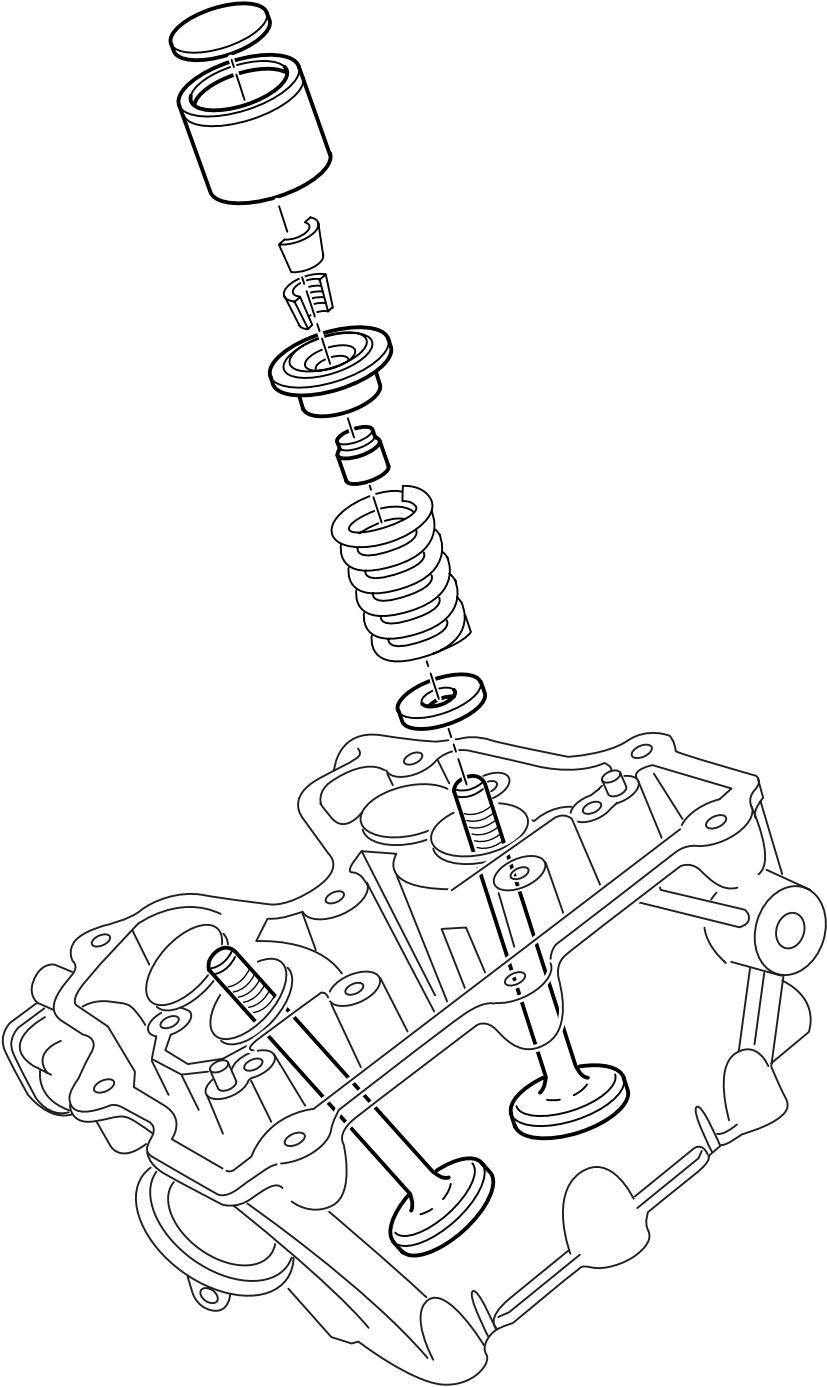
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# Valve gear

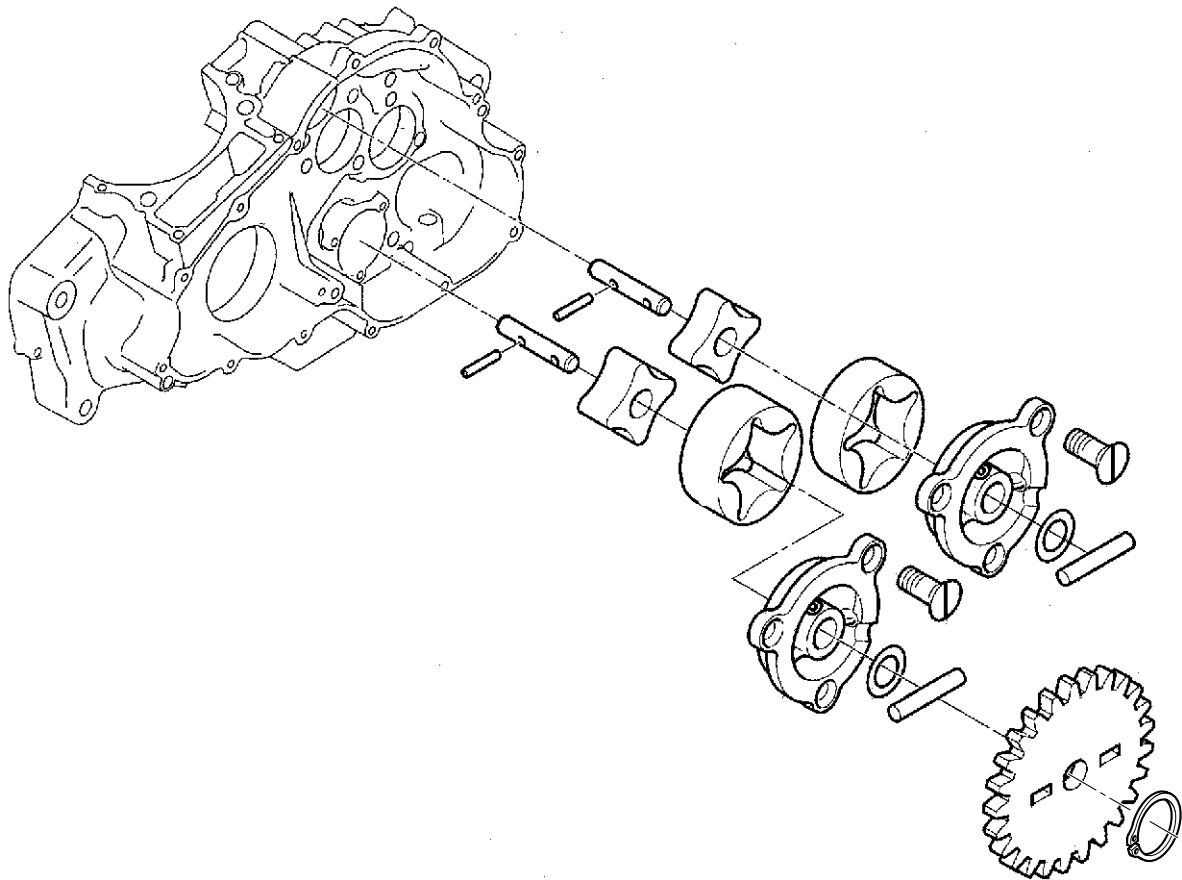
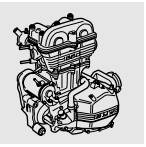


E110440

Valves, components



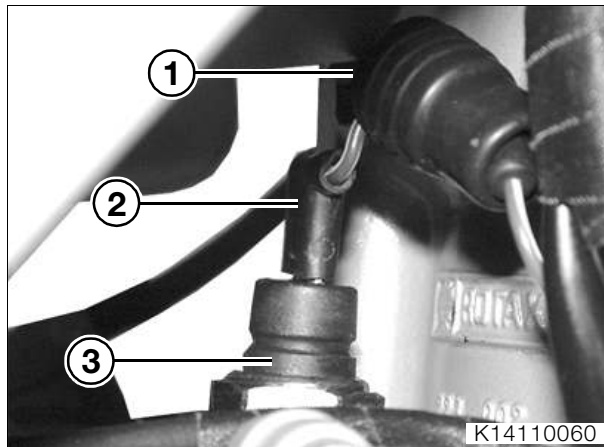
# Oil pumps, components



E110460

## 11 41 Removing and installing oil pressure switch with engine installed

Removing and installing oil pressure switch



- Remove rubber cap (1).
- Disconnect plug (2), without pulling on the cable.
- Remove oil pressure switch (3).
- Installation is the reverse of the removal procedure: pay particular attention to the following.
- Use a new sealing ring.

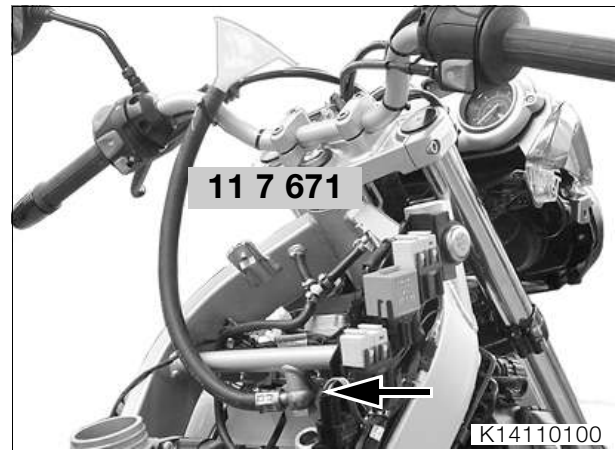


### Tightening torque:

Oil-pressure switch in engine  
(clean threads + Loctite 243 ..... 12 Nm)

## 11 43 Cleaning oil tank and oil lines

- Drain the engine oil from the engine and oil tank (→ 00.30).
- Remove the oil strainer (→ 00.34).
- Remove intake air silencer (→ 13.7).



- Disconnect oil feed and return lines at oil tank and frame at top (arrow).
- Connect flushing hose, **BMW No. 11 7 671**, to oil tank.



### Note:

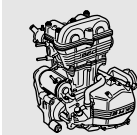
Always use flushing hose, **BMW No. 11 7 671**, to flush the system. This is the only way of ensuring that enough oil flows past the baffle plates and into the frame members.

- Flush the oil tank with thin oil until clean oil emerges at the outlet.
- Remove the oil lines, flush them with thin oil and then blow them through with compressed air.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Install oil lines with new sealing rings.



### Tightening torque:

Stowage-compartment frame to main frame .. 9 Nm  
 Fuel filter to stowage-compartment frame ..... 9 Nm  
 Left and right covers to main frame ..... 2 Nm  
 Left and right covers to air duct..... 3 Nm  
 Left and right covers to cover, front..... 1 Nm  
 Cover, front, to main frame..... 2 Nm  
 Cover, rear, to left and right covers and stowage-compartment frame ..... 2 Nm  
 Left and right turn indicators to fairing bracket 3 Nm  
 Stowage-compartment rail to stowage-compartment frame ..... 9 Nm  
 Oil drain plug, engine ..... 40 Nm  
 Oil drain plug, frame ..... 21 Nm  
 Oil line to frame ..... 42 Nm  
 Oil strainer to frame..... 80 Nm





## 11 12 116 Removing and installing cylinder head, engine installed



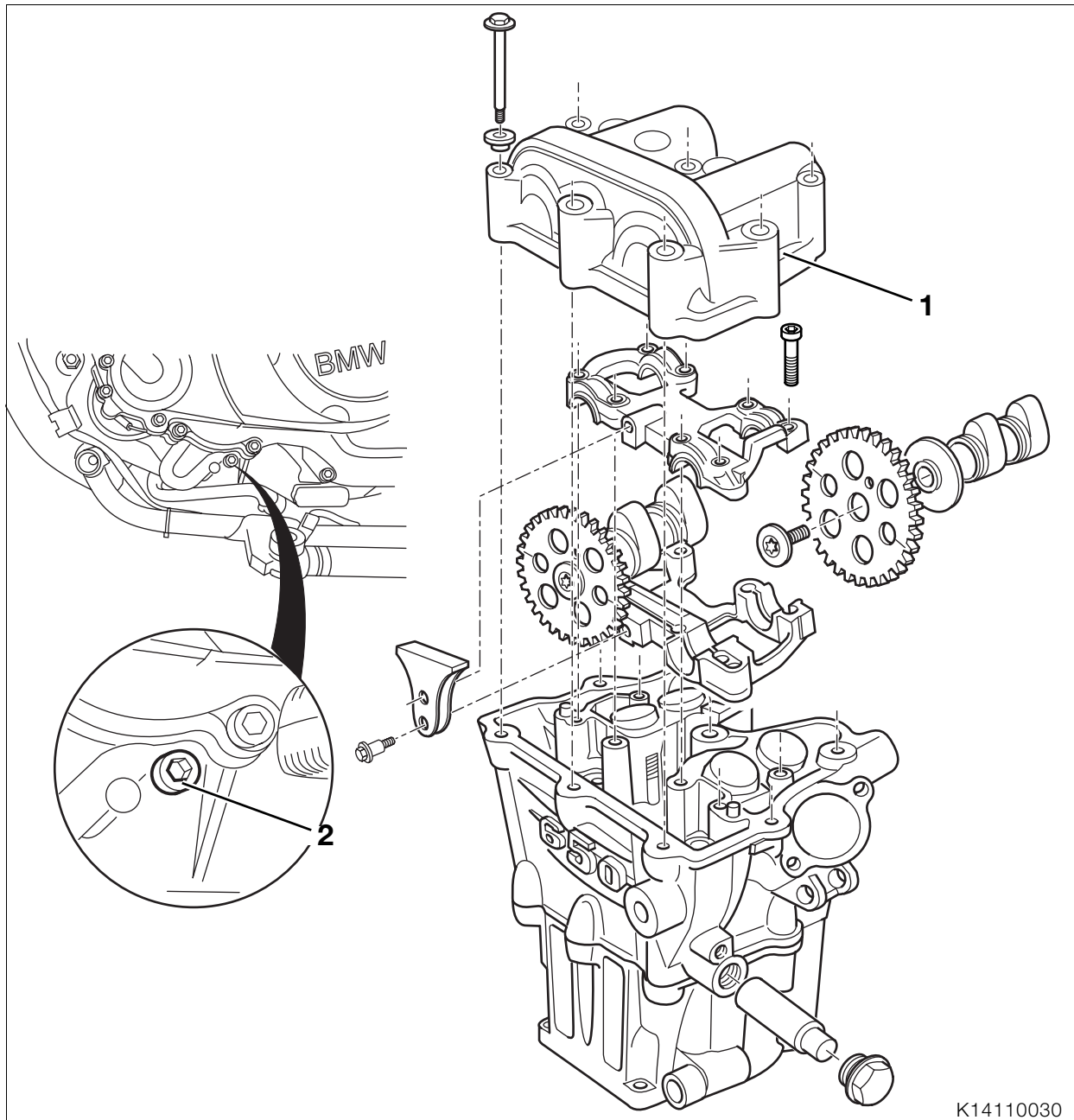
### Attention:

If an engine failure occurs, the oil tank and oil lines must be cleaned (→ 11.17).

### Preparatory work

- Remove the left, right, front and rear covers (→ 46.6).
- Remove the stowage-compartment frame (→ 46.14).
- Disconnect battery.
- Remove exhaust with oxygen sensor (→ 18.5).
- Drain coolant (→ 00.42).
- Drain engine oil.
- Remove starter (→ 12.9).
- Expose radiator and remove fan (→ 17.12).
- Remove the intake air silencer together with the intake air pipe (→ 13.7).
- Remove knurled nut securing throttle cable to throttle flap stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.
- Remove the intake stub from the cylinder head and lay it carefully on the right-hand side, complete with the throttle flap stub.
- Disconnect the ignition coil from the spark plug.
- Remove the fastener securing the ignition-coil bracket and remove the ignition coil complete with bracket.





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- 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 TDC position with an Allen key.

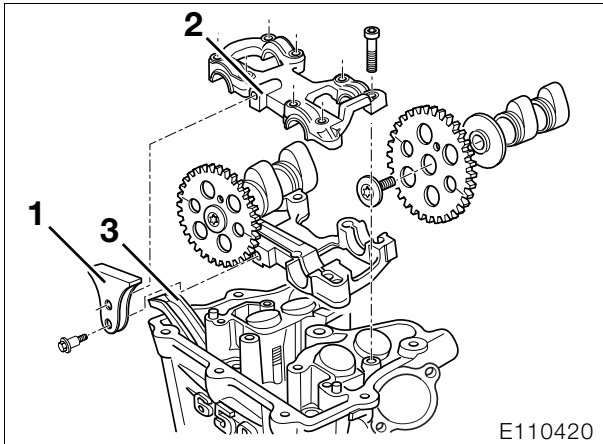


**Note:**

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

- Remove screw (2) close to the oil feed stub pipe and install locking screw, **BMW No. 11 6 570**, to prevent the crankshaft from turning.

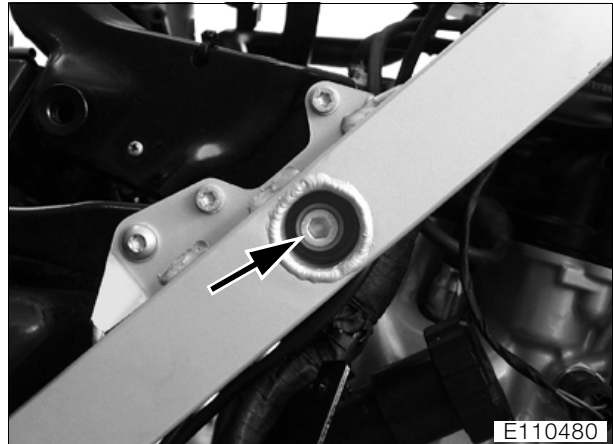
## 11 31 022 Removing camshafts



- Remove 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 right and left frame trim panels (→ 46.14).
- Remove lower section of camshaft carrier.



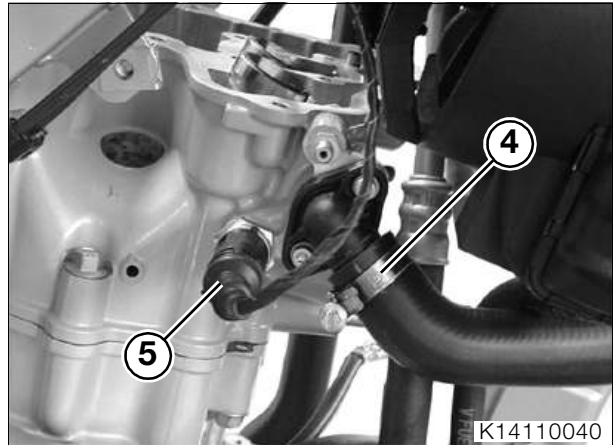
- Remove screws securing cylinder head to frame (arrow).
- Use pin wrench, **BMW No. 11 6 661**, to slacken the locknut.



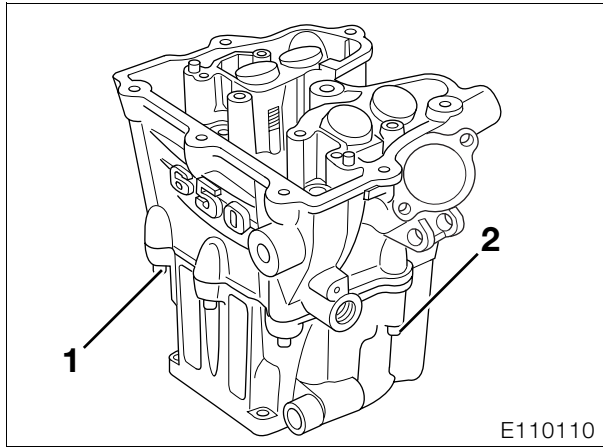
### Note:

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).



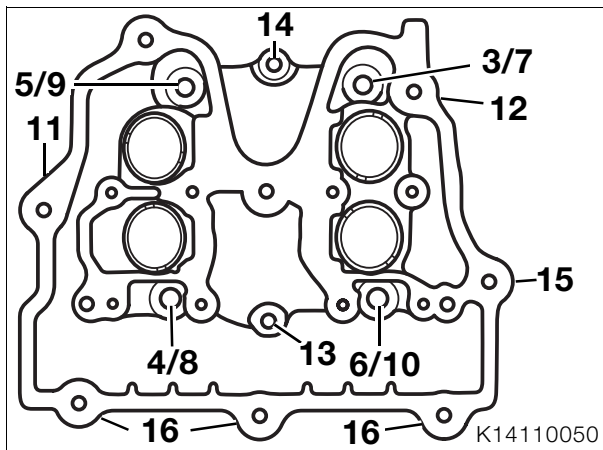
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- Slacken the screw plug for chain tensioner.
- Remove machine screws for chaincase (1).
- If applicable, disconnect plug of oil-pressure sensor.
- If applicable, remove oil pressure switch.
- Remove rear collar screw (2) from cylinder head.
- Remove 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.
- If applicable, install chain tensioner in cylinder head.



**Note:**

Replace cylinder head gasket.



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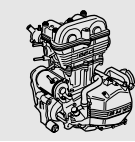
- Initially tighten the collar nuts of the cylinder head to 20 Nm (3-6) and then tighten to 60 Nm (7-10).
- Tighten the fasteners of the cylinder head to cylinder in the sequence as shown (11-16) to specified torque.

- When looping the timing chain over the camshaft sprockets, make sure that the sprockets are at the TDC position.
- Install chain guide rail.
- 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.



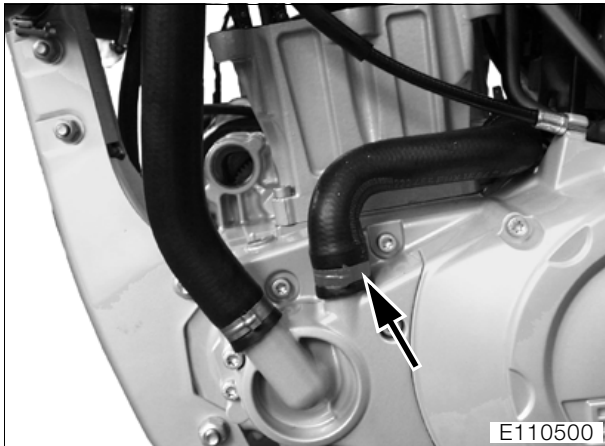
**Tightening torque:**

Silencer to exhaust elbow .....	55 Nm
Exhaust elbow to cylinder head.....	20 Nm
Air intake stub to cylinder head .....	21 Nm
Cylinder head cover to cylinder head .....	10 Nm
Spark plug in cylinder head .....	20 Nm
Rear frame to main frame (clean thread + Loctite 2701).....	24 Nm
Oil flow and return lines to engine .....	42 Nm
Timing-chain tensioner to cylinder head.....	40 Nm
Chain guide to camshaft carrier (clean thread + Loctite 243).....	10 Nm
Camshaft bearing bridge 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
Socket-head screws, chaincase .....	10 Nm
Collar screws, cylinder head .....	33 Nm
Collar screws, cylinder head .....	first stage 20 Nm
..... second stage	60 Nm
Starter to clutch cover.....	10 Nm
Oil pressure switch in engine block (clean thread + Loctite 243).....	12 Nm
Cable cover to engine .....	9 Nm

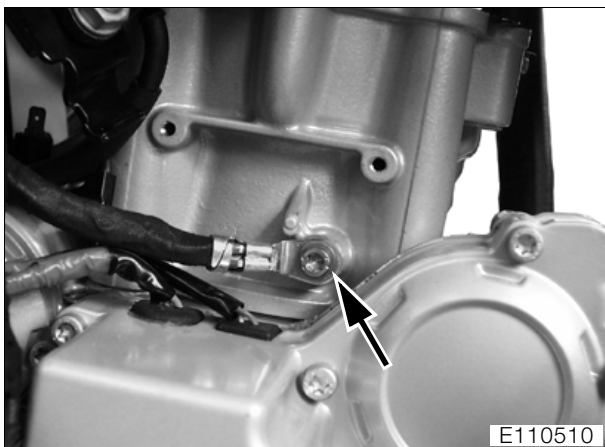


## 11 11 150 Removing cylinder, engine installed

- Remove cylinder head (→ 11.20).



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

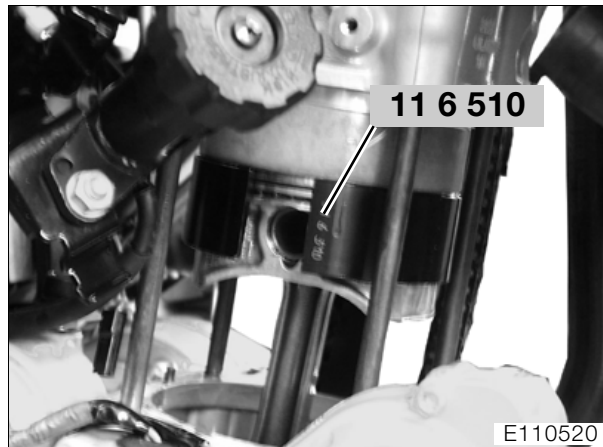


- Remove protective cap.
- Disconnect ground cable (arrow) from cylinder.
- Remove cylinder base screws.
- Push the rear chain guide forward and carefully lift the cylinder clear.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Note:

When installing, use a new cylinder base gasket.



- Space the piston ring gaps at 120°.
- 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 torque:

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

## 11 00 050 Removing engine

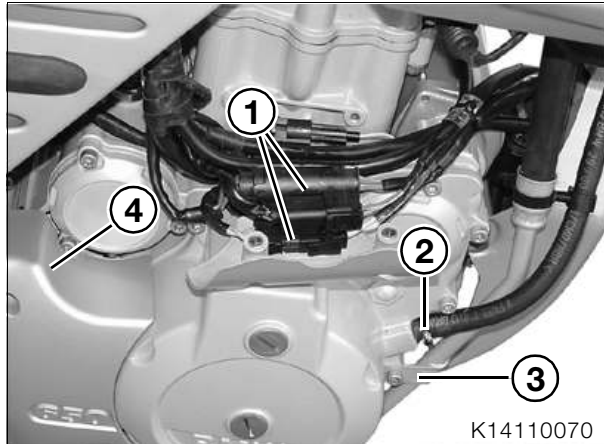


### Attention:

If an engine failure occurs, the oil tank and oil lines must be cleaned (→ 11.17).

## 11 00 050 Preparatory work

- Remove seat.
- Remove left and right covers (→ 46.6).
- Remove frame trim panels (→ 46.14).
- Remove exhaust (→ 18.5).
- Drain coolant (→ 00.42).
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Secure front wheel in position.
- Disconnect battery negative terminal.
- Drain engine oil (→ 00.30).
- Disconnect clutch cable from release lever.
- Disconnect oil feed line from frame.
- Push cable for ABS sensor out of clip on oil feed line.
- Disconnect the oil return line at the bottom.



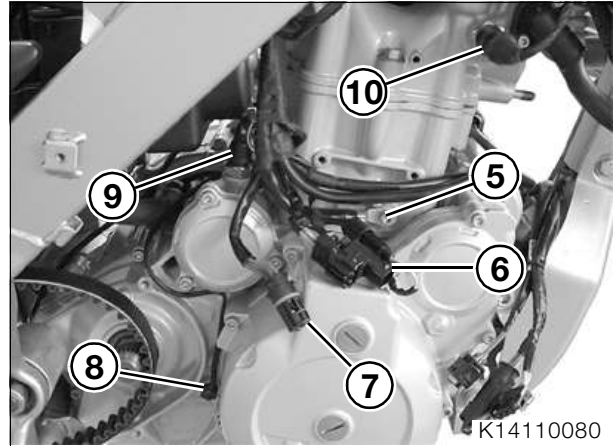
- Remove fastener for oil return line (3).
- Open non-reusable clip (2) at crankcase breather.
- Open clamp securing coolant hose. Disconnect the hose; note that the hose might still contain liquid.
- Tie up the hoses at the front.
- Remove cable cover from the engine.
- Disconnect plugs (1) of voltage regulator.
- Remove cover for belt sprocket (4).



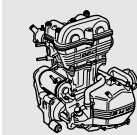
### Note:

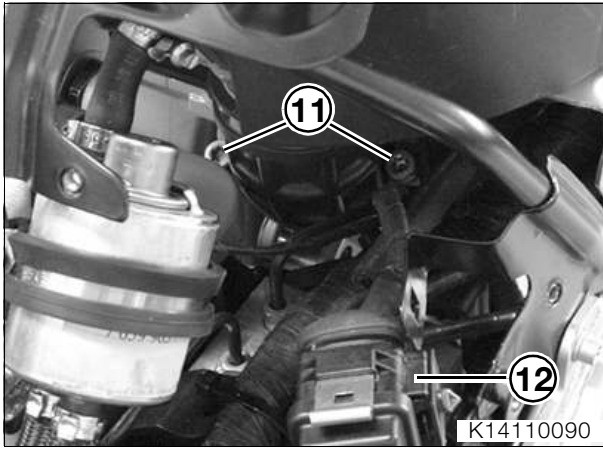
It is not necessary to remove the belt sprocket if the engine is to be replaced. The belt sprocket is included in the scope of supply of the engine. Note that the belt has to be slackened if the belt sprocket is not removed.

- Remove belt sprocket (→ 27.5) or slacken belt (→ 00.54), as applicable.



- Remove ground terminal (5) from the engine.
- Disconnect plug of side-stand switch (7).
- Unscrew connector for neutral indicator (8).
- Disconnect the plug of ignition trigger (6).
- Disconnect plug of oil pressure sensor (9) in oil filter housing.
- Disconnect positive lead from starter motor.
- Cut open 2 cable ties on cable for side-stand switch.
- Disconnect the plug for the temperature sensor (10).
- Remove side-stand bottom truss.





- Disengage fuse box (12).
- Remove fasteners securing intake stub (11) to cylinder head.
- Disconnect integrated ignition coil from spark plug.
- Remove the left-hand coolant hose.
- Remove fasteners for engine shell and remove engine shell with voltage regulator.



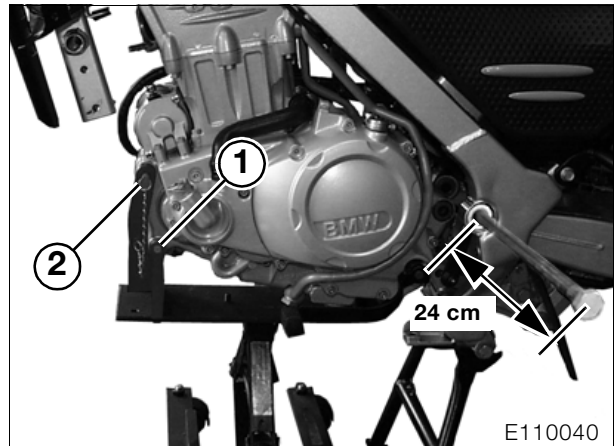
**Note:**

When locating pin, **BMW No. 11 0 661**, is inserted and the floating bearing stud is pulled out 24 cm (9.45 in), the rear swinging arm 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 24 cm (9.45 in) out of the frame.
- Remove bottom rear engine mount fastener.
- Remove the gear shift pedal.

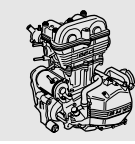
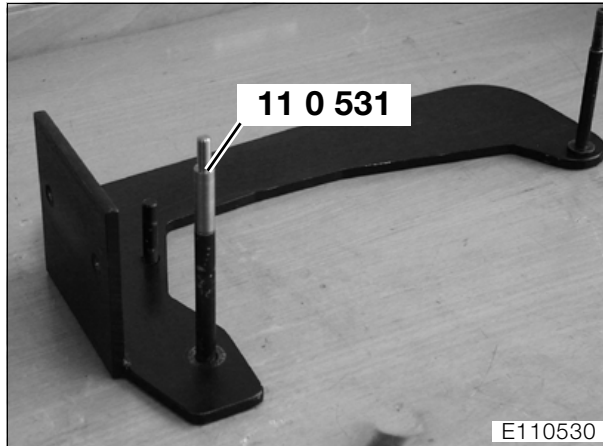
## 11 00 050 Removing engine

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

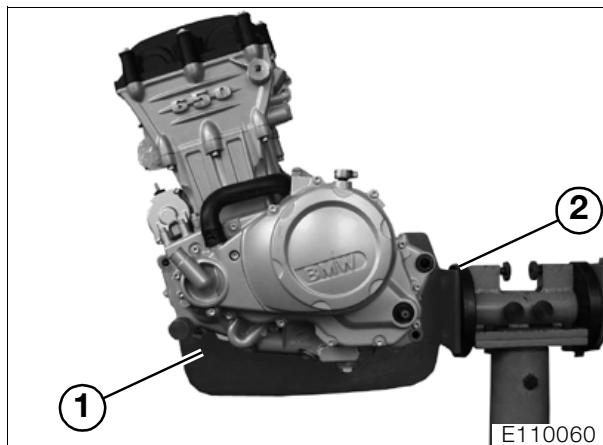


- Secure the engine lifter by installing stud bolt (1) through bottom bore in engine block and securing stud (2) in top bore in engine block.
- Remove screws securing cylinder head to frame on left and right. Use pin wrench, **BMW No. 11 6 661**, to slacken the lock-nuts and back off the adjusting sleeves.
- Working carefully, slightly lower the engine, taking care not to damage the radiator.
- Disconnect the crankcase breather.
- Lower the engine all the way.
- Turn the engine toward the left and push it clear of the motorcycle.

## Transferring engine to assembly frame

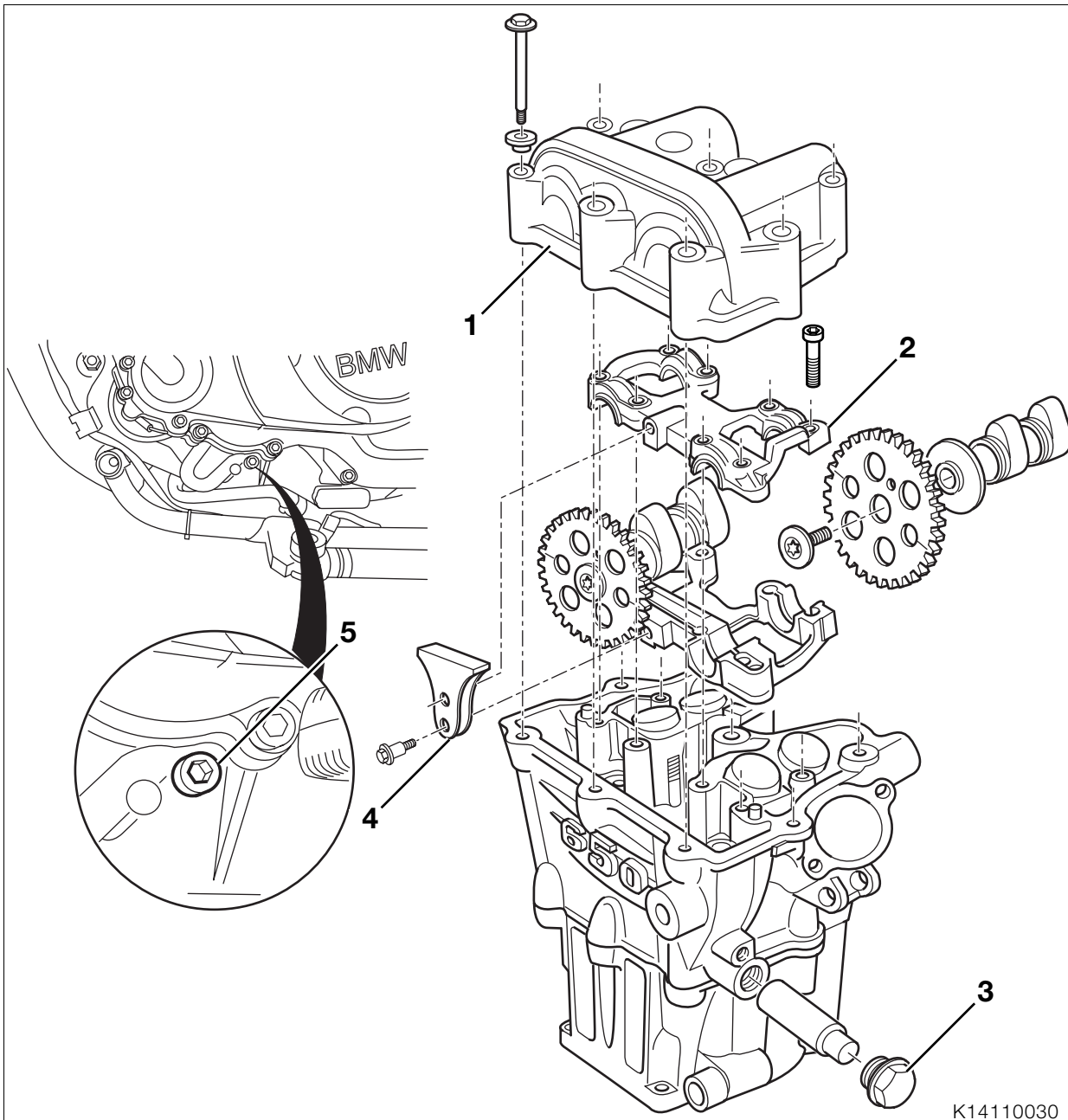
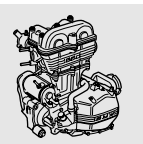


- Secure threaded adapter, **BMW No 11 0 531**, to engine mount.
- Detach the engine from the engine lifter, leaving the engine on the lifting platform.
- Lay the engine on its left side, as viewed in the forward direction of travel.
- Secure engine adapter, **BMW No. 11 0 640**, to the right side of 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

### Attention:

If there is any mechanical damage, the oil tank and the oil lines must be flushed (→ 11.17).

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



### Note:

Check security with Allen key.

## 11 12 516 Removing cylinder head

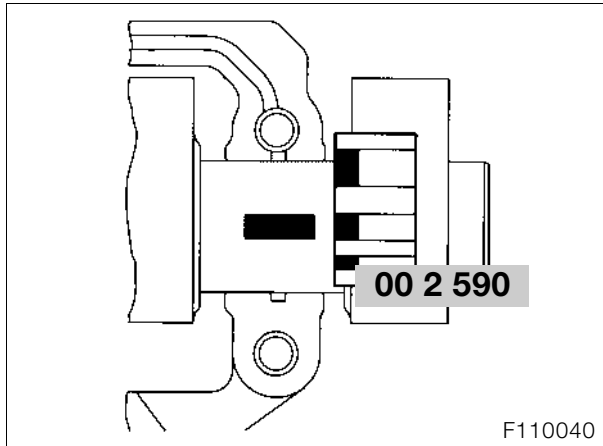
- Remove starter (→ 12.9)
- Remove oil lines.
- Remove cylinder head cover (1).
- Remove spark plug.
- Remove centre screw plug in engine block cover, right.

## 11 31 522 Removing camshafts

- Do not remove chain sprockets unless 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.
- Remove the lower camshaft carrier.

### Checking camshaft for wear



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

#### **Tightening torque:**

Camshaft carrier..... 10 Nm

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

#### **Wear limits:**

Cam height l.....min. 39.25 mm (1.55 in)  
 Cam height E .....min. 39.05 mm (1.54 in)  
 Bearing journal diameter min. 21.950 mm (0.864 in)  
 Bearing diameter in  
 bearing block .....max. 22.040 mm (0.87 in)  
 Bearing play .....max. 0.090 mm (0.004 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

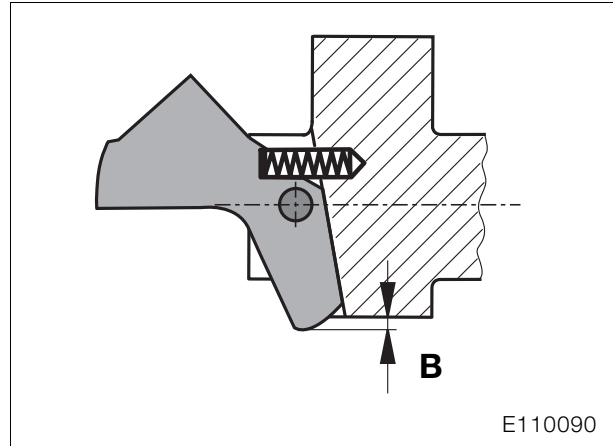
### Checking centrifugal decompressor lever



#### **Note:**

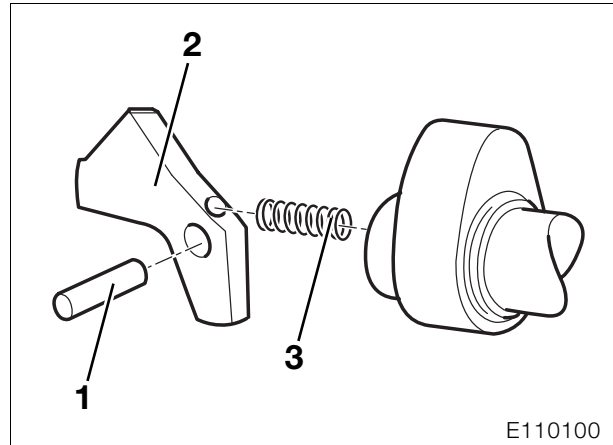
Never stretch the spring, since this alters the preset spring force.

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



Distance "B" ..... 0.6 mm (0.024 in)

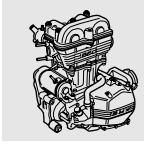
### 11 31 530 Disassembling and assembling the centrifugal decompressor

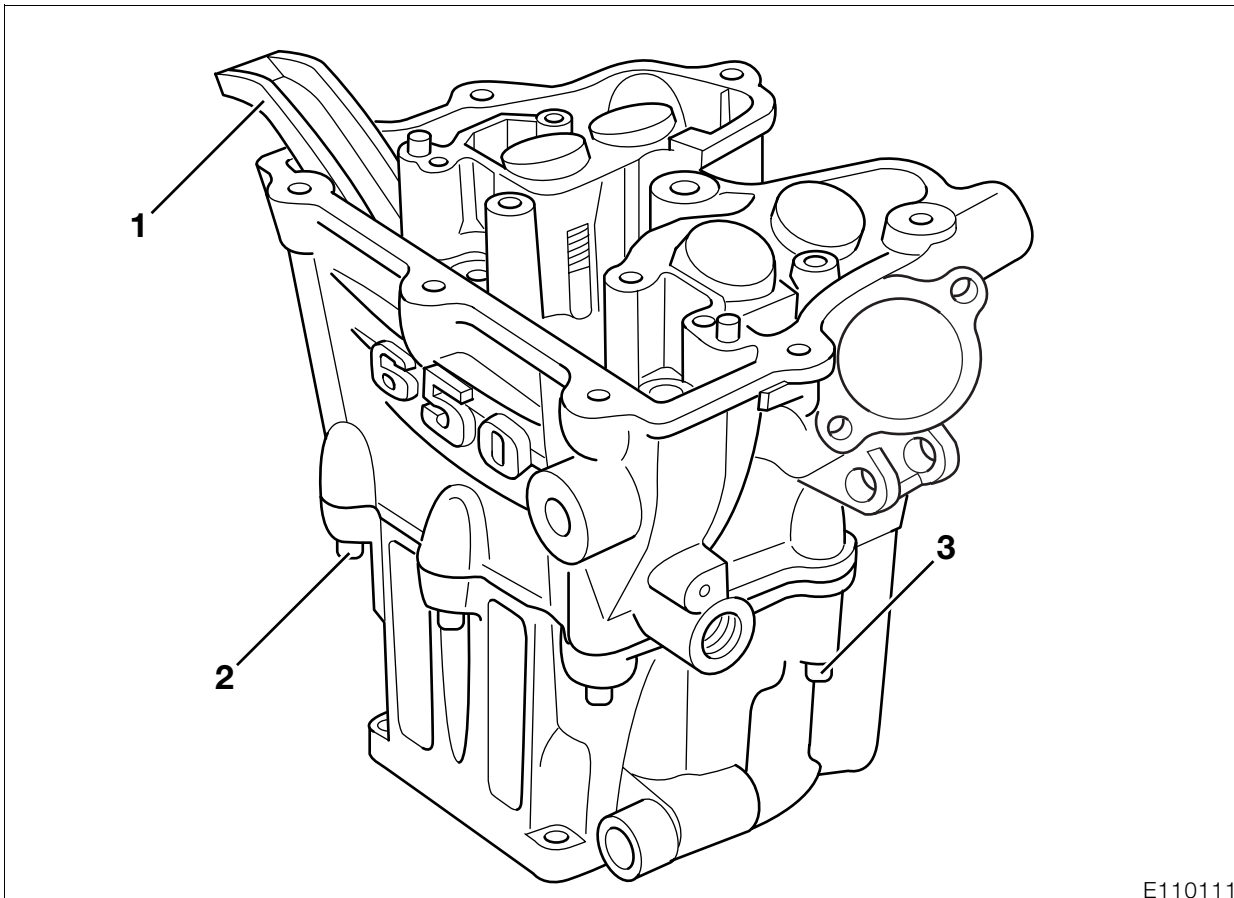
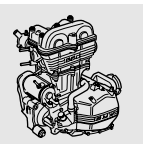


#### **Note:**

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

- 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 ease of movement of centrifugal weight.





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### 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.

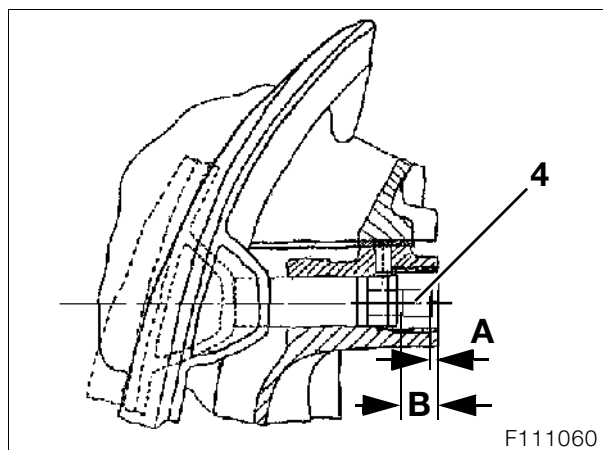


#### Note:

If the cylinder head does not have to be disassembled, do not separate cylinder head from cylinder. In this case the next six 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



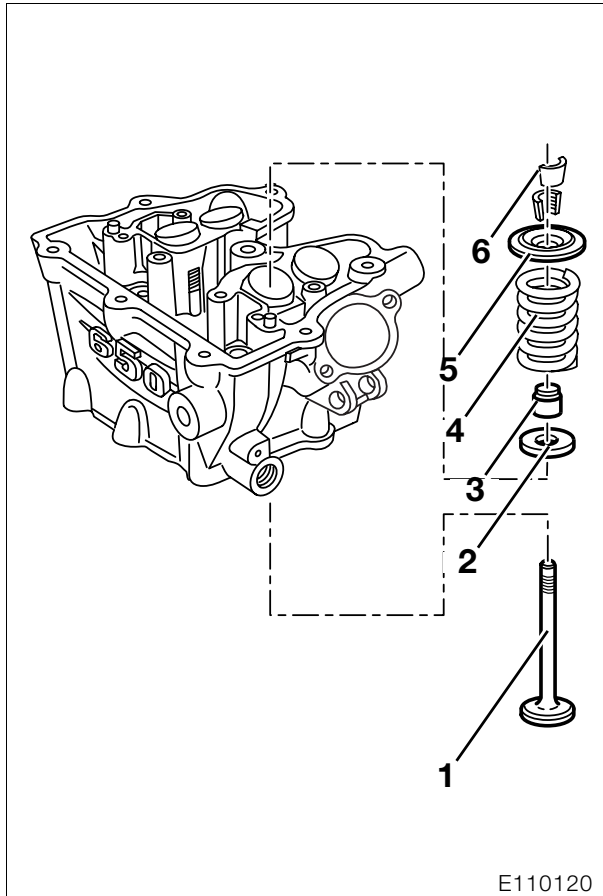
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- Push hydraulic chain tensioner (4) toward the tensioner rail in the guide on the cylinder, until resistance to movement is felt.
- Measure distance "A" from the sealing face to the chain tensioner piston.

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

Distance “B” .....max. 9.0 mm (0.0354 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.

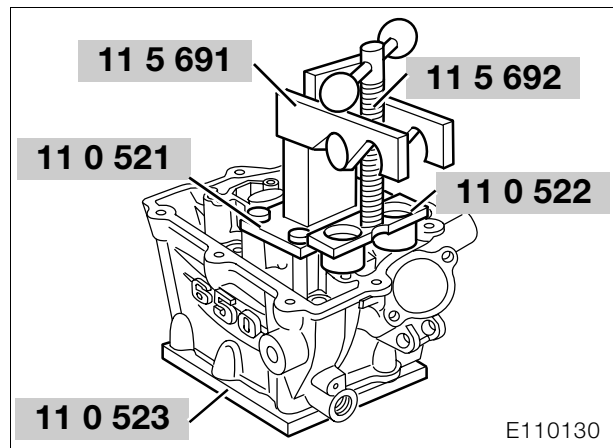
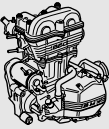
### Bore for bucket tappet

In cylinder head.....max. 33.600 mm (1.32 in)  
Radial clearance, bucket tappets.....max. 0.200 mm (0.008 in)



### Attention:

The bucket tappets must be reinstalled in their original bores, so it is important to mark them accordingly (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**.

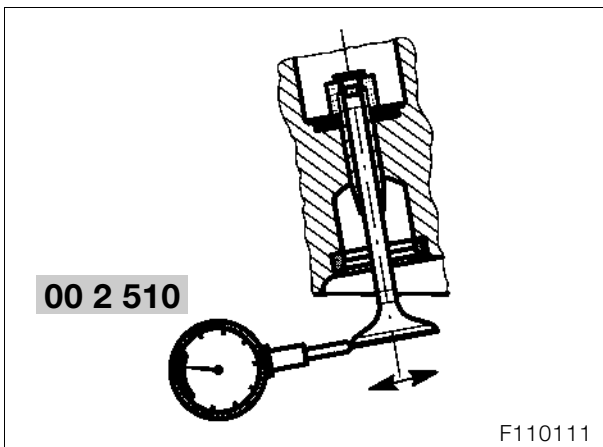


### Note:

When removing the exhaust valves, slip suitable washers (approx. 5 mm (0.2 in) thick) between thrust spindle and thrust plate and dispense with the nut for securing the thrust plate to the thrust spindle.

- 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

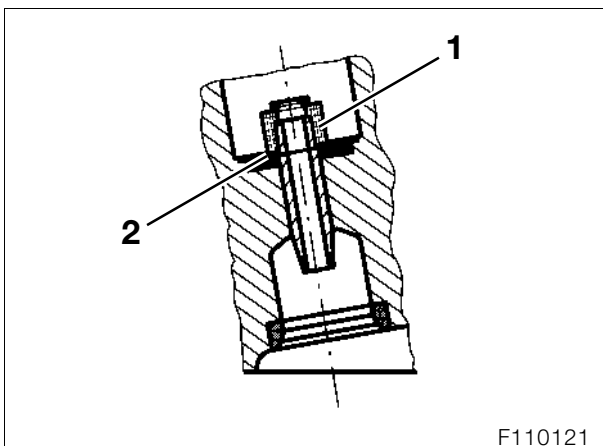


- Insert new valve from combustion chamber side into valve guide until it reaches the valve stem seal.
- Using dial gauge, **BMW No. 00 2 510**, positioned vertically on the valve axis, measure maximum tilt clearance across the camshaft axis.

### Tilt clearance:

Max. tilt clearance ..... 0.4 mm (0.016 in)  
 Inside diameter of  
 valve guide ..... max. 5.080 mm (0.2 in)

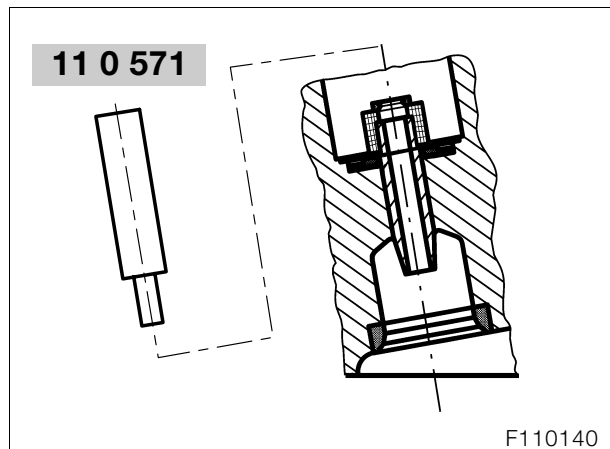
## 11 12 591 Removing valve guide



### ⚠ Attention:

Do not damage sliding surfaces of 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.

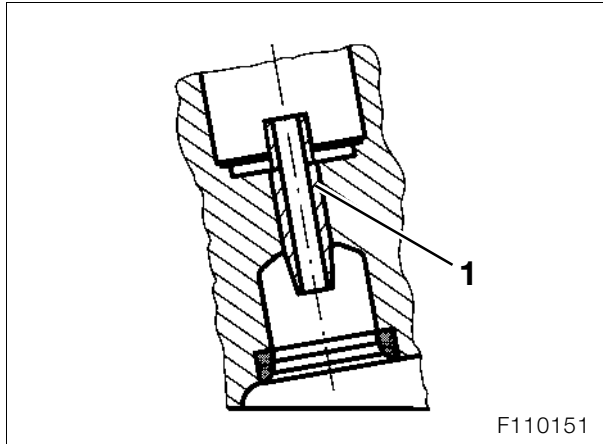
- Use drift, **BMW No. 11 0 571**, to drive out the valve guide toward the combustion chamber.



### Attention:

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)



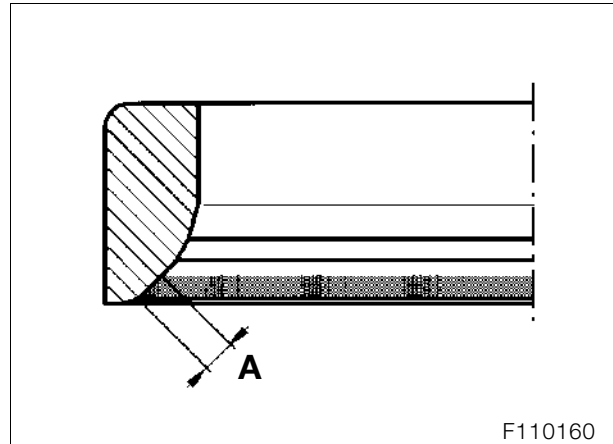
### Note:

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.

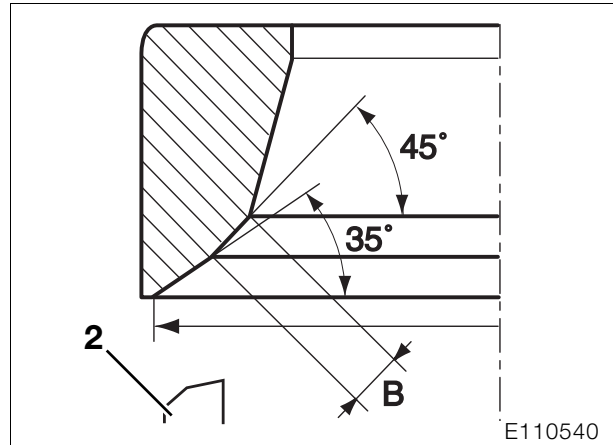


- Check valve seat width "A" and contact pattern for wear.

### Wear limits for valve seat width "A":

Inlet valve ..... 1.6 mm (0.03 in)  
 Exhaust valve ..... 2.2 mm (0.087 in)

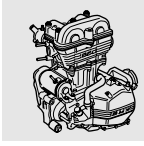
- Once the wear limit of the seat width has been reached, or the contact pattern is no longer perfect, the seat can be remachined.



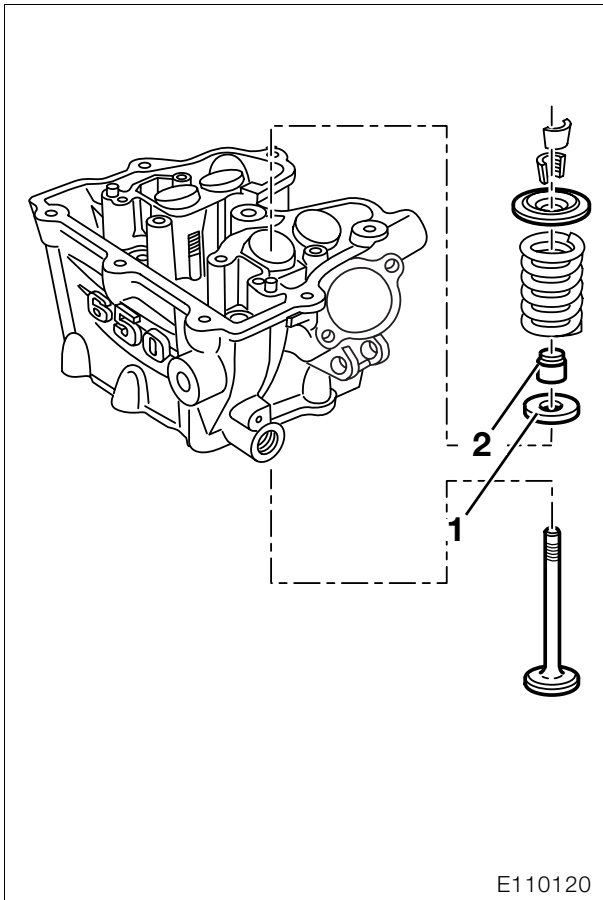
- If necessary, remachine valve seat with valve seat turning tool (2).

### Valve seat width "B":

Inlet valve ..... 1.2 mm  
 Exhaust valve ..... 1.4 mm

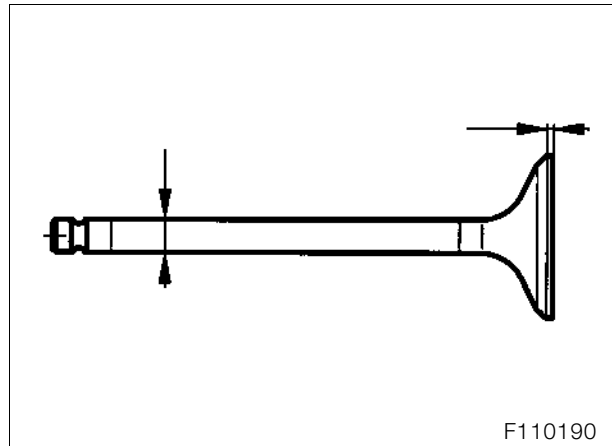


## 11 34 800 Installing valve stem seal



- 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.

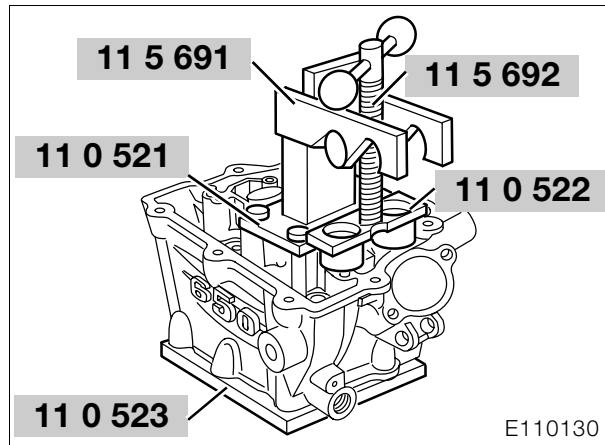
- Check grooves for valve collets.

## 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:**  
When installing the exhaust valves, slip suitable washers (approx. 5 mm (0.2 in) thick) between thrust spindle and thrust plate and dispense with the nut for securing the thrust plate to the thrust spindle.

- Insert the valve collets.



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

- Check bucket tappets for damage and fit to correct valves.

## 11 11 150 Removing cylinder

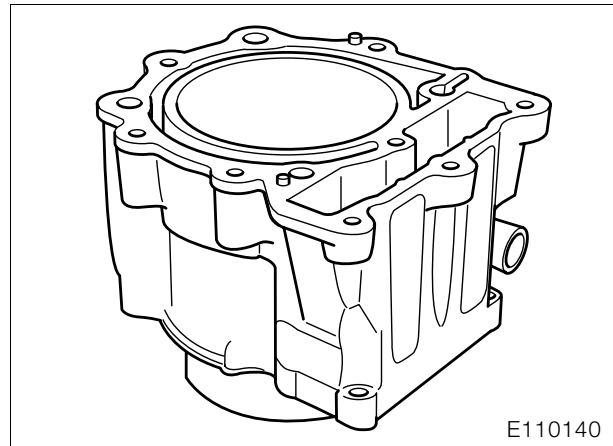
- Separate the cylinder base from the engine block.



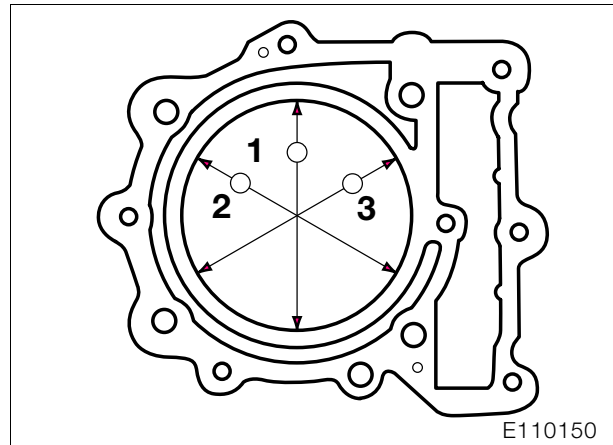
**Attention:**  
When removing cylinder, make sure that the piston does not strike the engine block.

- Remove cylinder.

### Checking cylinder



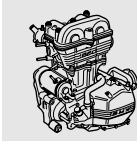
- Check cylinder face and sealing faces for damage and blow out oil ducts for chain tensioner.



- 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 (3.9386 in)





## 11 25 050 Removing piston

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



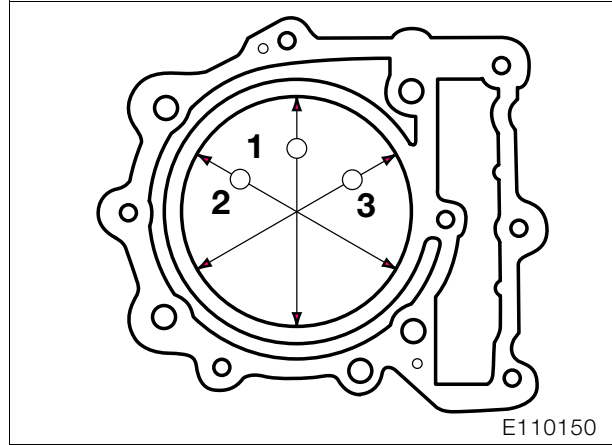
### Note:

Mark exhaust-valve side on piston crown.

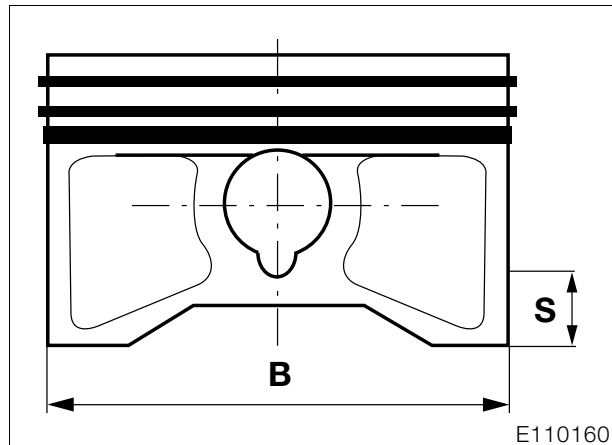
## 11 25 671 Disassembling piston

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

## Determining clearance of piston in cylinder



- Measure cylinder bore at 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"



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



### Note:

#### Determine piston clearance:

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

#### Piston clearance:

When new

..... 0.024...0.040 mm (0.0094...0.00157 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 (0.039 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 in piston, vertical...max. 22.030 mm (0.867 in)

Piston pin dia. ....min. 21.980 mm (0.8654 in)

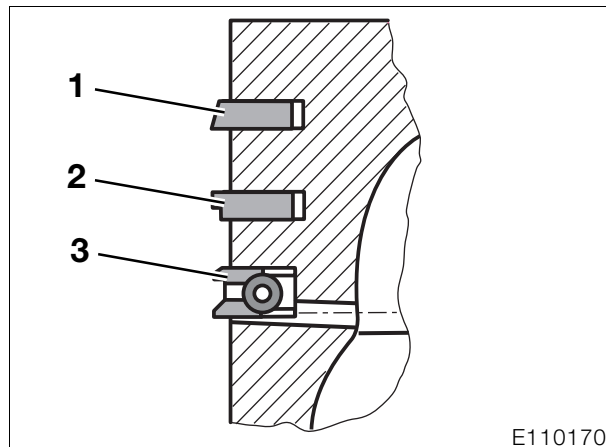
Radial clearance  
in piston .....max. 0.050 mm (0.002 in)

## 11 25 671 Assembling pistons



### Note:

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



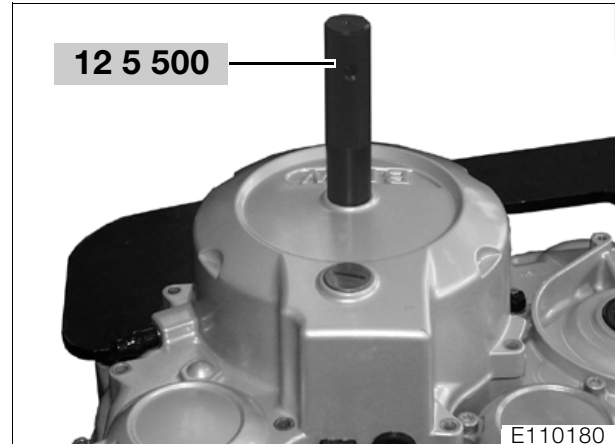
1. Groove for rectangular-section ring
2. Stepped micro-taper ring
3. Groove for spring-steel oil control ring

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

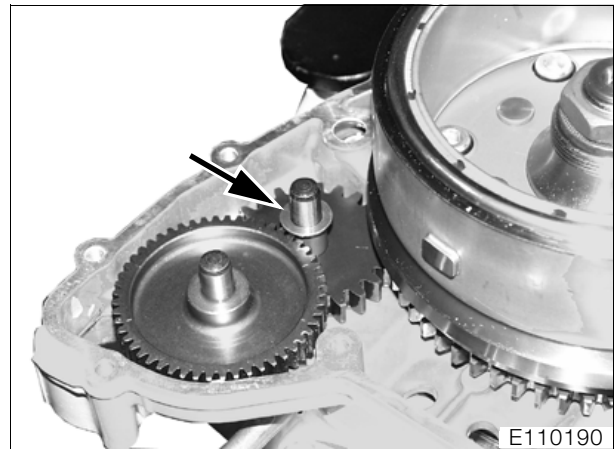
Wear limit, ring float in groove . 0.150 mm (0.006 in)

## 12 11 070 Removing ignition magneto

- Unfasten retainer on right engine housing cover.



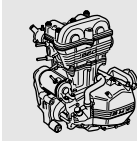
- Remove the central locking screw and install handle, **BMW No. 12 5 500**.

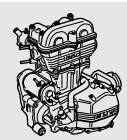


- Remove the cover, noting the thrust washer (arrow).



- If necessary, remove ignition trigger (4).





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

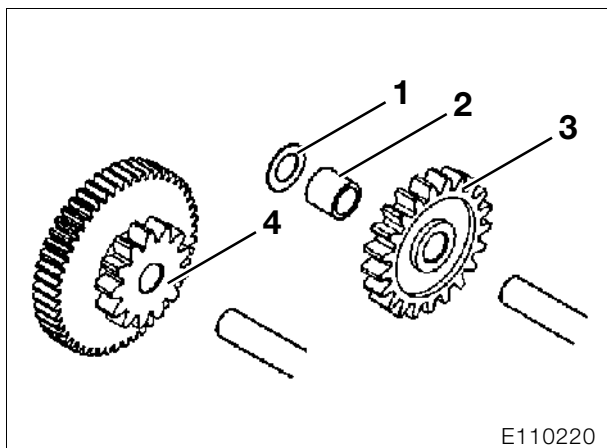


**Note:**

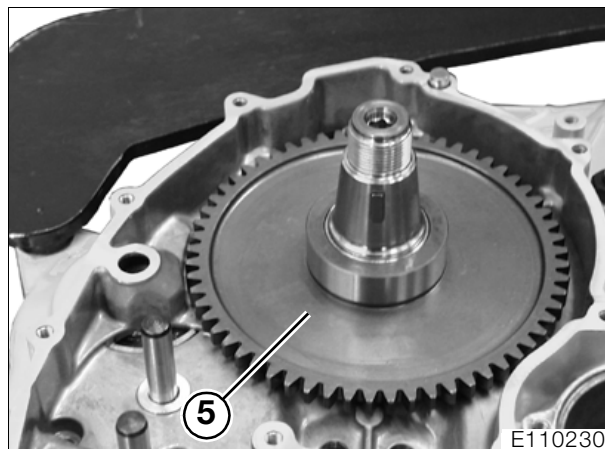
Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

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

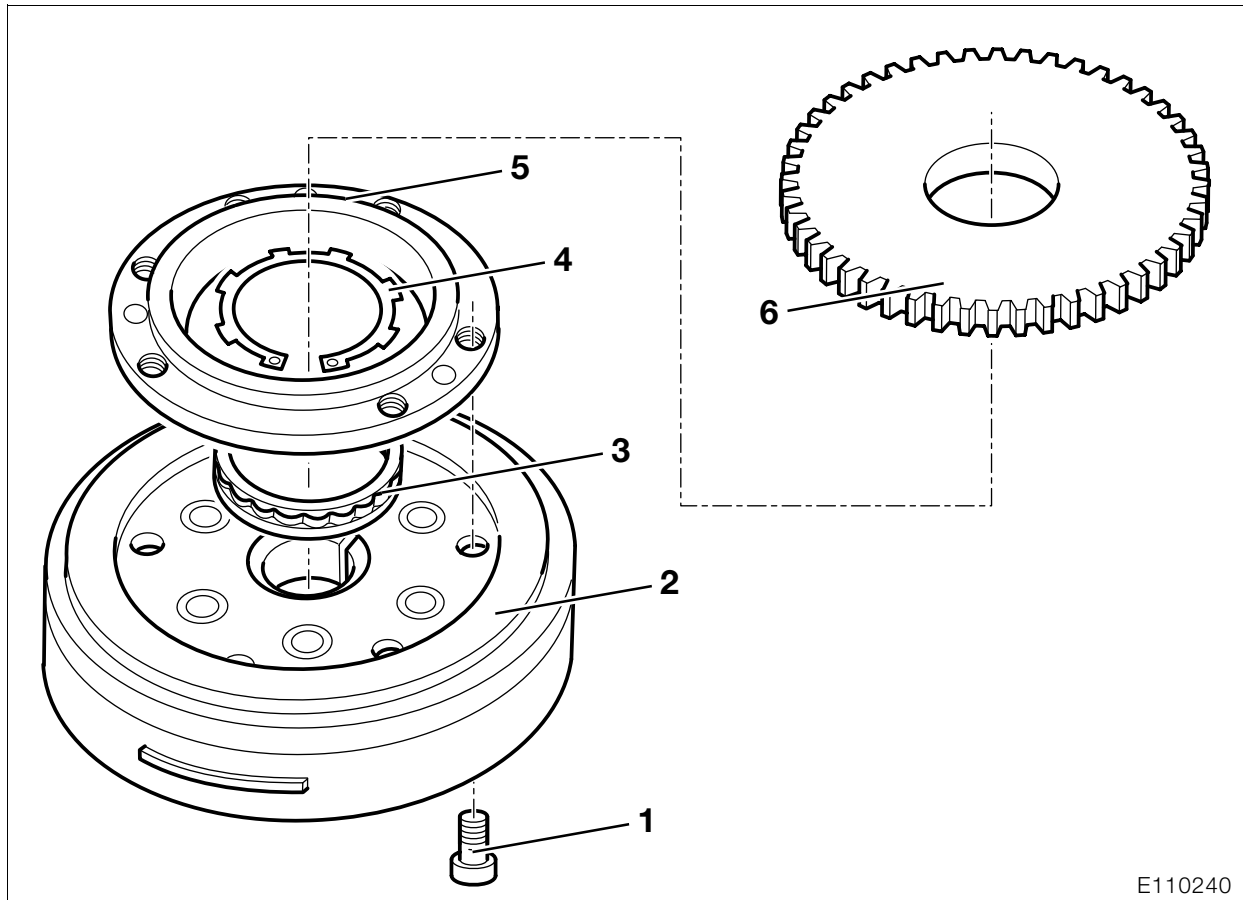
### 11 26 500 Removing countershaft for starter



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



- Remove freewheel gear (5).



E110240

## 12 11 077 Disassembling and assembling freewheel

### Disassembling freewheel

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



#### Warning:

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

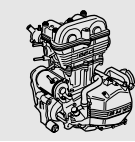
- Release securing screws (1).
- Lift off freewheel housing (5).
- Remove lock ring (4).
- Remove freewheel gear (3).
- Check freewheel housing and freewheel for wear, isolated chatter marks are permissible.

### 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.

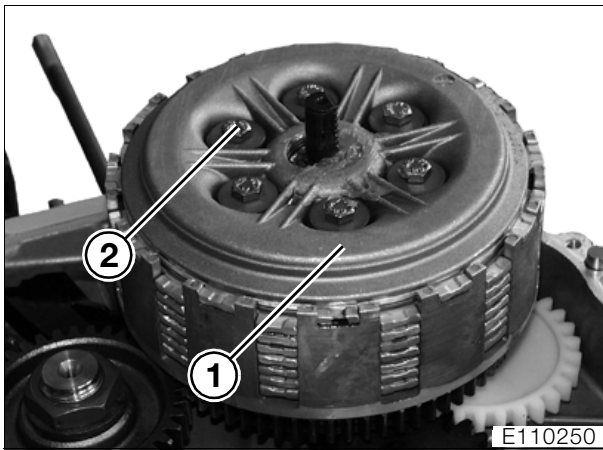
 **Tightening torque:**

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 cover and remove cover.

**Removing pressure plate**



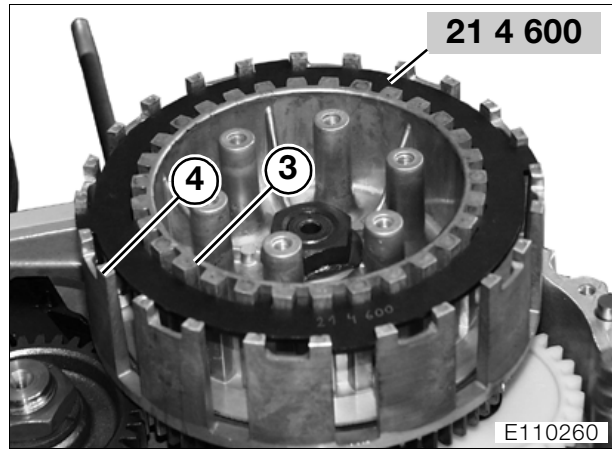
- Remove hex screws (2) in diagonally opposite sequence.
- Lift off complete pressure plate (1).

**Removing clutch plates**

 **Attention:**

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

- Lift 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.

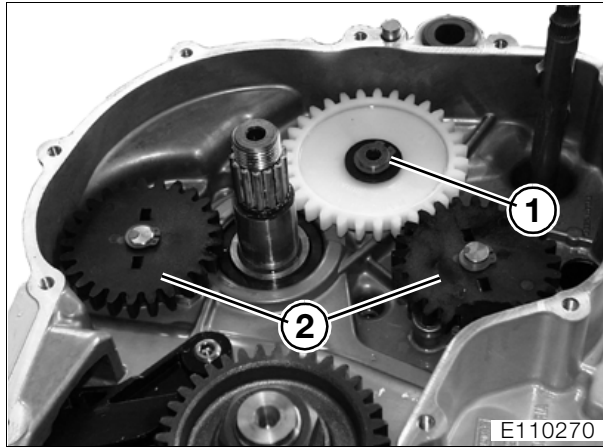
 **Attention:**

Note the backup washer at the bottom.

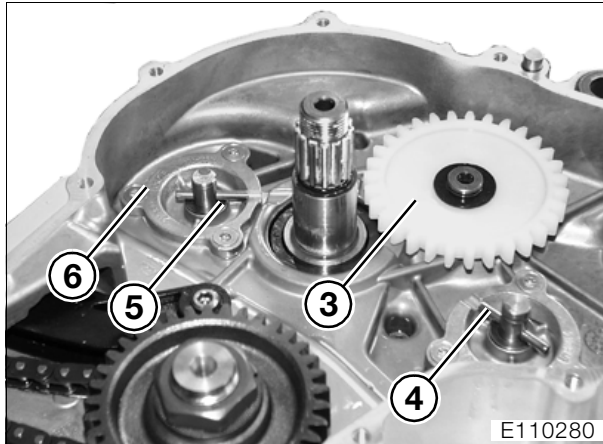
- Pull off needle cages.
- Remove the backup washer.

## 11 41 000 Removing and installing oil pump

### Removing oil pump



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



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

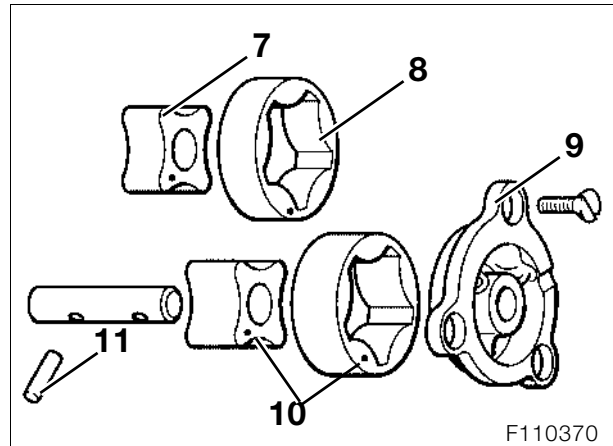
### Inspecting oil pump

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

#### Permissible face runouts between:

Inner rotor and outer rotor ... max. 0.25 mm (0.01 in)  
 Installation clearance, radial  
 ..... max. 0.25 mm (0.01 in)  
 Axial clearance between rotors  
 and cover ..... 0.25 mm (0.01 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:

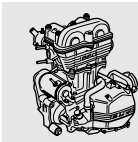
Markings (5) must be visible.

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

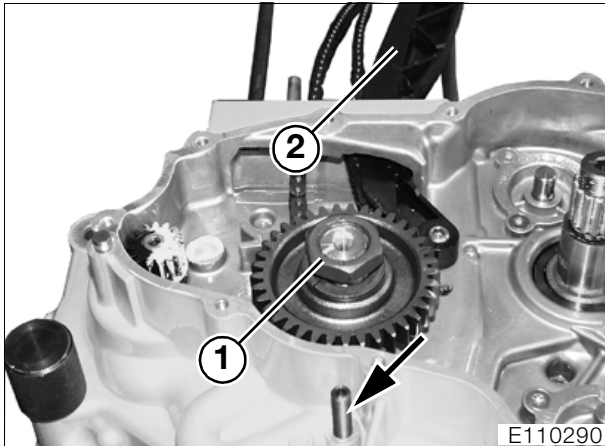


#### Tightening torque:

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



## Removing double drive gear

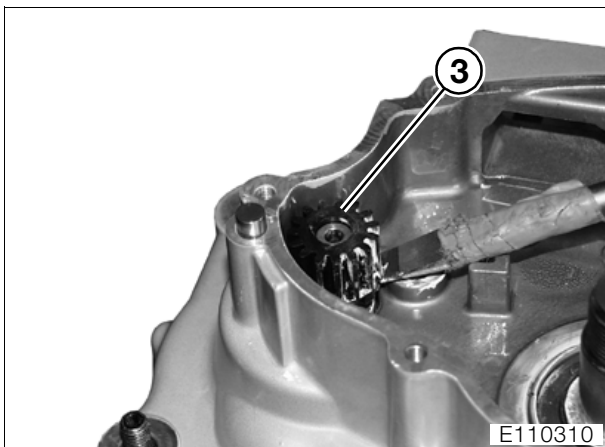


### Note:

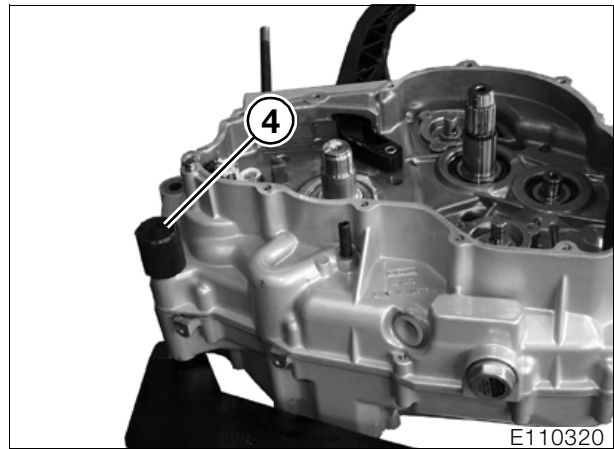
Retaining screw (arrow) must be installed.

- 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 remove two threaded fasteners on base plate for engine block.



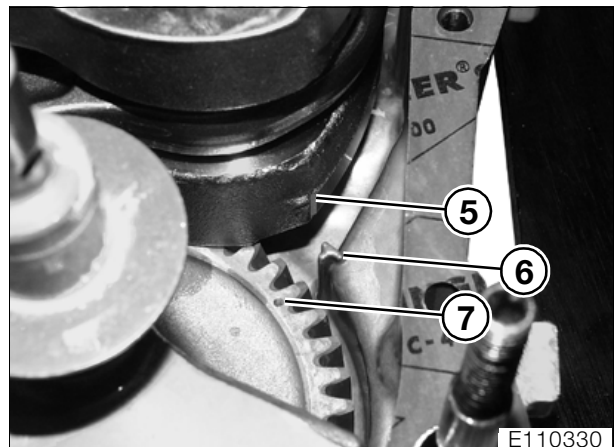
- Swivel assembly fixture so that clutch side is uppermost.
- Remove knurled nuts (4).



### Attention:

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

- Lift off left half of engine block, lightly tapping the mainshaft, countershaft and balancing shaft alternately with 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 journals on crankshaft and conrod for signs of damage and wear.

Bearing journal diameter ..min. 45.97 mm (1.810 in)  
 Radial clearance of main bearing  
 .....max. 0.10 mm (0.004 in)  
 Endplay, conrod/crank cheek  
 .....max. 0.80 mm (0.032 in)  
 Diameter of small-end bore  
 .....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:**

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

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

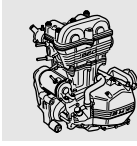
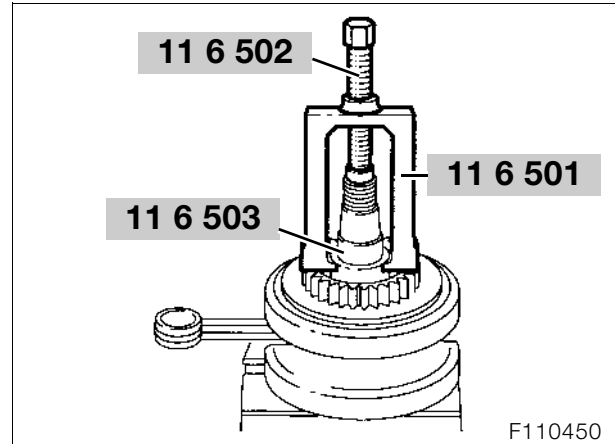


**Note:**

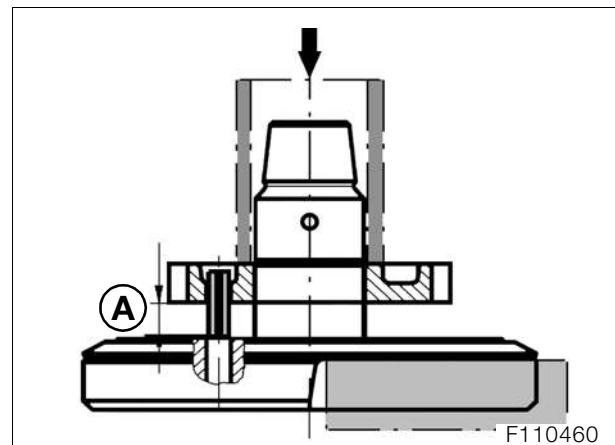
Install the compensating gear with the mark pointing down.

- 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.



**Attention:**

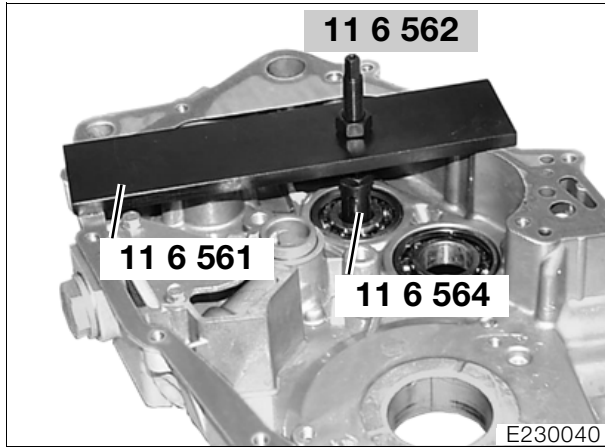
Pin must not protrude from bore in crankshaft gear - this is the support face for the thrust washer.

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

Projection "A" of pin .....max. 18 mm (0.71 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 replace the mainshaft sealing ring.

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



### Note:

The closed ends of the cage must point outward.

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

## 11 11 210 Removing and installing gear-box countershaft bearings



### Note:

To protect the gasket surfaces of the engine block, place the old gasket under the bearing puller. Always replace 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 closed ends of the cage must point outward.

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

### Wear limit values for bearing seats in housing:

#### Magnet side:

Countershaft ..... max. dia. 46.99 mm (1.85 in)

Mainshaft ..... max. dia. 62.02 mm (2.44 in)

#### Clutch side:

Countershaft ..... max. dia. 51.99 mm (2.05 in)

Mainshaft ..... max. dia. 46.99 mm (1.85 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 replace 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.
- Drive out shaft seal from the outside.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Drive in shaft sealing ring with drift, **BMW No. 11 6 550**.



### Note:

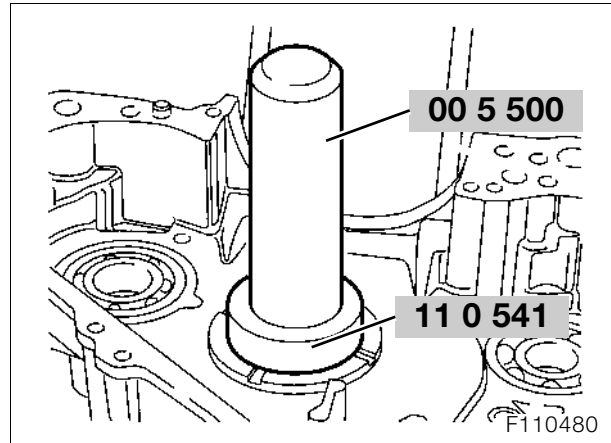
The sealed ends of the cage must point outward.

- 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**.

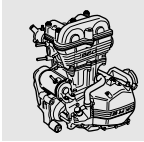
## 11 21 001 Removing and installing main bearings

- Check main bearings for signs of damage and wear.

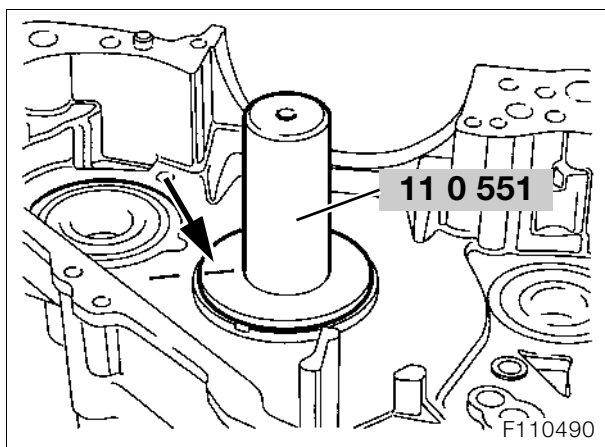
### Removal



- Heat the engine block 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 block to 100 °C (212 °F).
- Align the mark on the drift (arrow) with the mark on the housing.

### **Attention:**

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.

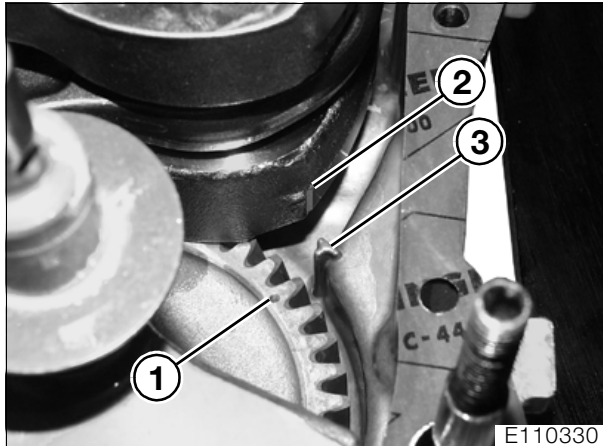
- Coat bearing bushings with **Optimoly TA** and drive in with drift, **BMW No. 11 0 551**, working from the inside.

## 11 00 103 Assembling engine

- Install the gearbox (→ 23.9).

### 11 21 511 Installing crankshaft and balancing shaft

- Secure right side of engine block in engine bracket with magnet side facing downward.



- 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.

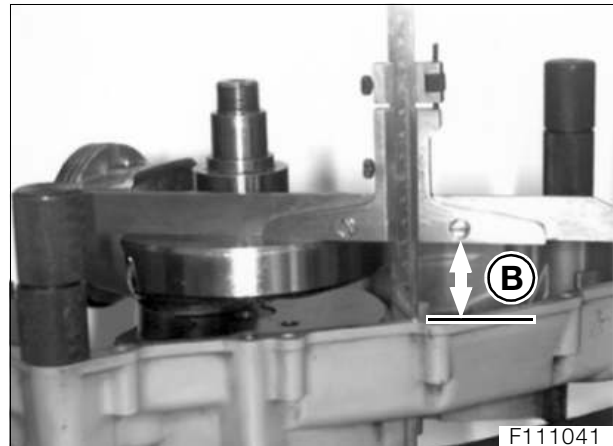


#### Note:

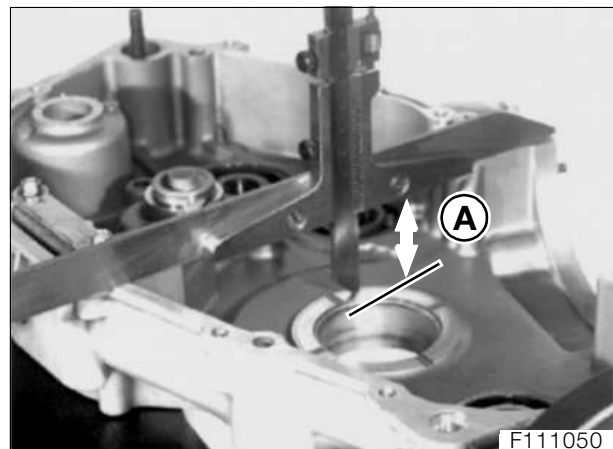
Oil shaft bearing points.  
Re-shim the crankshaft and balancing shaft if the housing or either of the shafts was replaced.

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

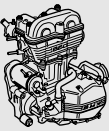
## Shimming crankshaft



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



- Measure distance from left engine block 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 (0.039 in) thick.

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

Crankshaft endplay

..... 0.1...0.3 mm (0.0039...0.0118 in)



**Note:**

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

- Fit left engine block half and install fasteners.



**Note:**

Note the two fasteners in the oil filter housing.

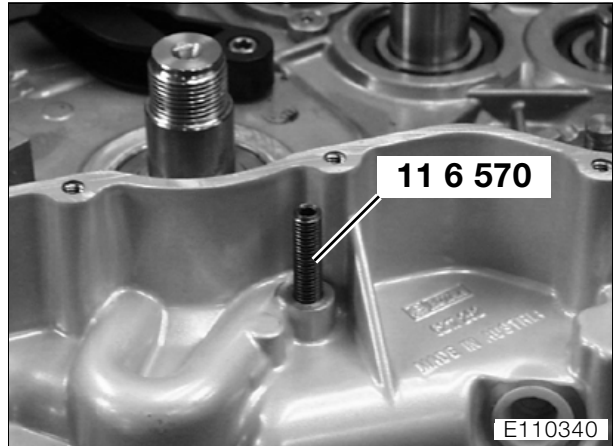
- Cut off protruding gasket.



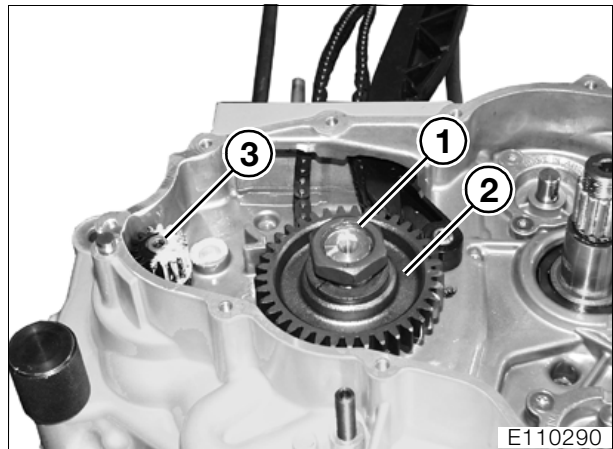
**Tightening torque:**

Fasteners, engine block ..... 10 Nm

## Installing double drive gear



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



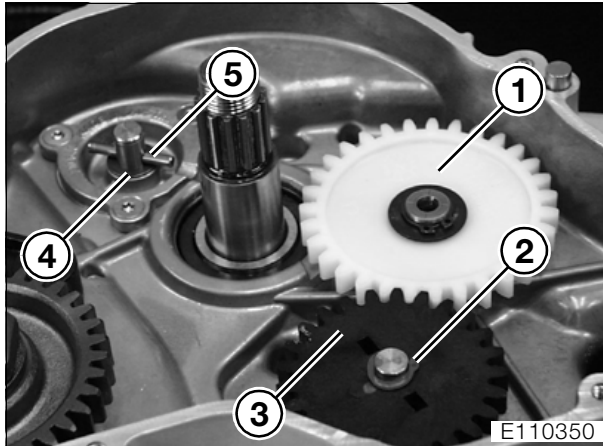
- Insert chain through chain aperture and place around crankshaft.
- Slide double drive gear (2) on to crankshaft.
- Engage chain.
- Install snap ring.
- Clean threads of crankshaft and hexagon nut (1), coat threads with **Loctite 243** and install nut.
- Engage needle roller of water-pump drive gear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



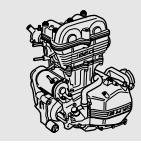
**Tightening torque:**

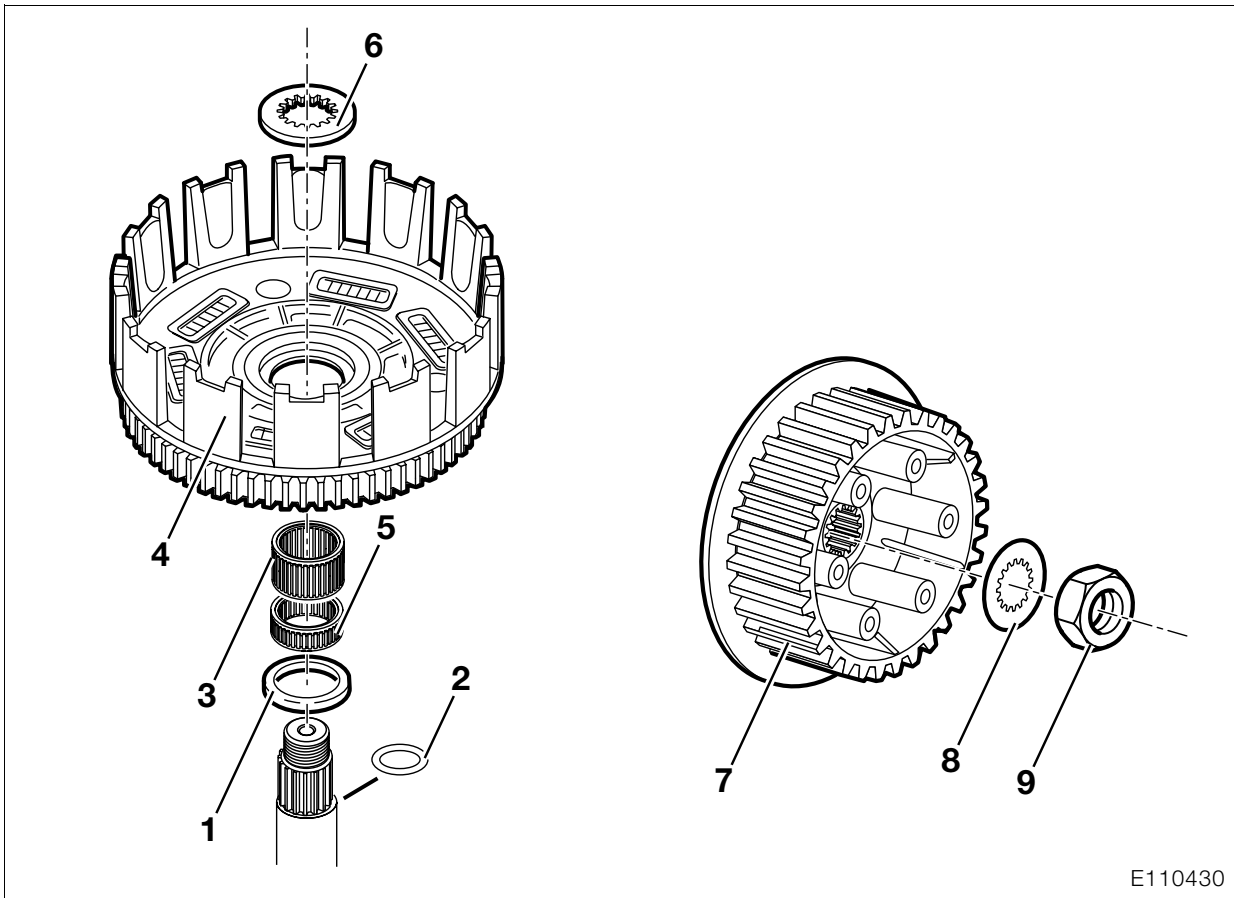
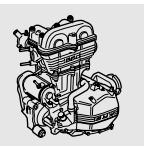
Double drive gear on crankshaft  
(clean thread + Loctite 243)..... 180 Nm

## 11 41 000 Installing oil pump gears



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





E110430

## 21 21 000 Installing clutch

### Installing clutch cage

- Place thrust washer (1) on 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.



E110260

- 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

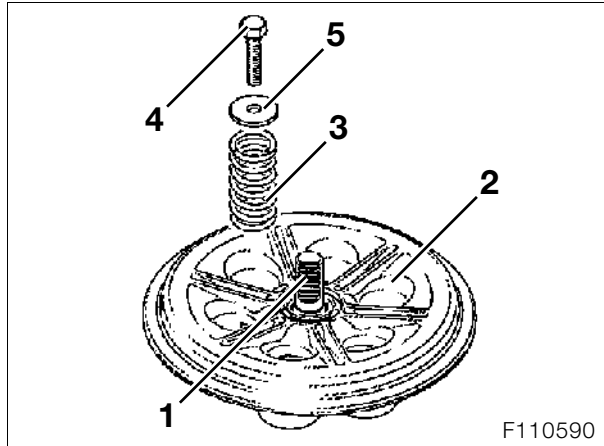
## Installing pressure plate

- Insert the plates, starting with a steel plate. Insert steel plates 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 replaced 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 sealing ring 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**.

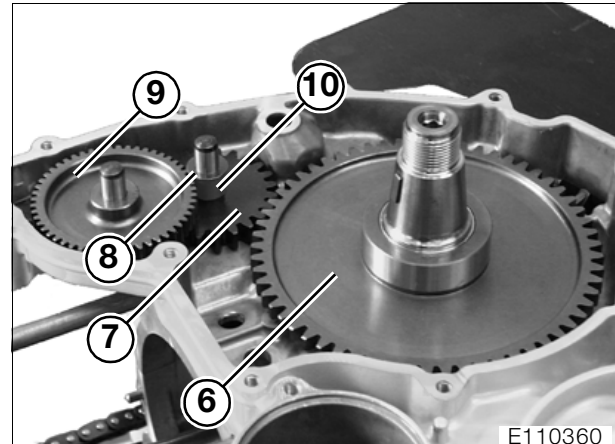


### Tightening torque:

Thrust plate to driver ..... 10 Nm  
 Engine block cover, left ..... 10 Nm

## 11 26 500 Installing countershaft for starter motor

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



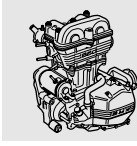
E110360



### 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 starter idler gear (7) on to the straight pin.
- Engage double gear (9) on locating pin.
- Install spacer sleeve (10) and thrust washer (8).





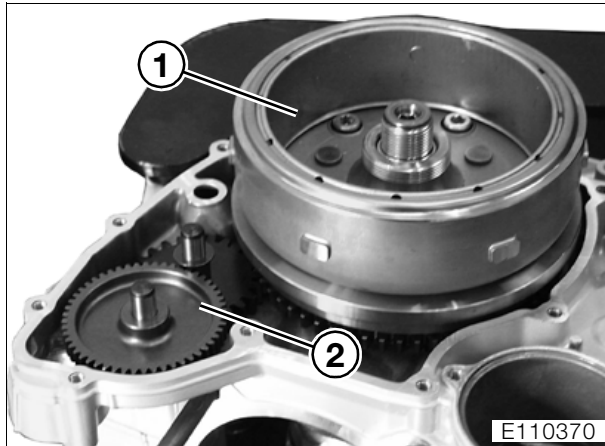
## 12 11 070 Installing magnetic ignition trigger



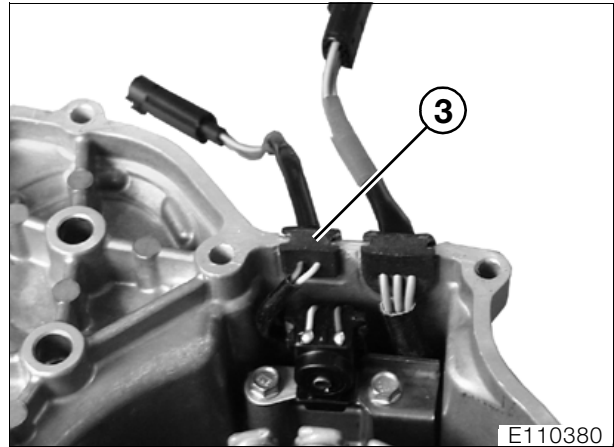
### Attention:

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 coat threads of hex nut with **Loctite 243** and tighten.



- Coat the rubber grommet (3) of the transmitter and the rubber grommet of the stator cable with **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 block cover and install securing screws.
- Remove assembly handle and install cap.



### Tightening torque:

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

## 11 25 050 Installing piston

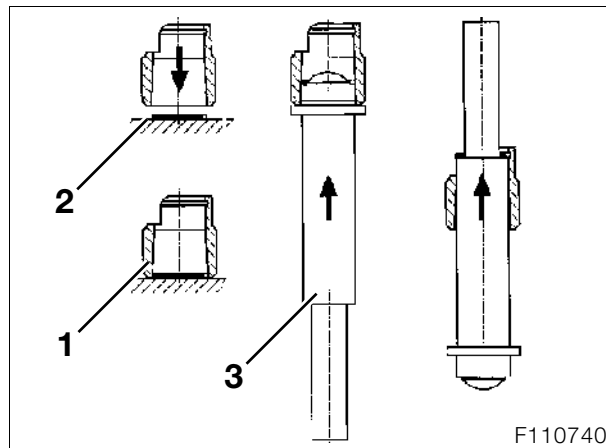
- Coat the small end bore in the crankshaft and the piston pin bore in the piston with **Optimoly MP 3**.



### Attention:

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 slider, **BMW No. 11 6 583**.

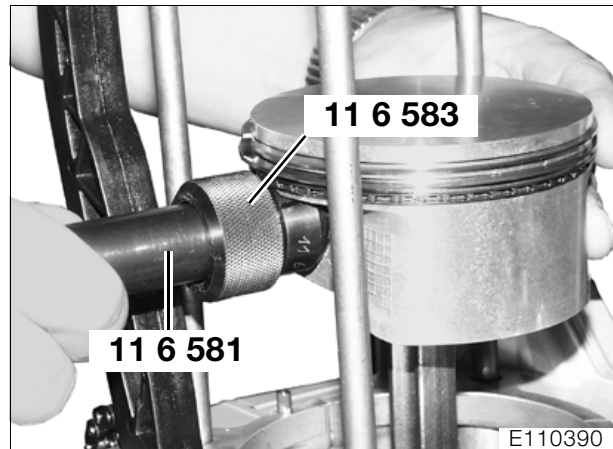


### Note:

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.



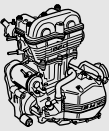
- Position sleeve, **BMW No. 11 6 583**, with installation arbor, **BMW No. 11 6 581**, against piston.



### Attention:

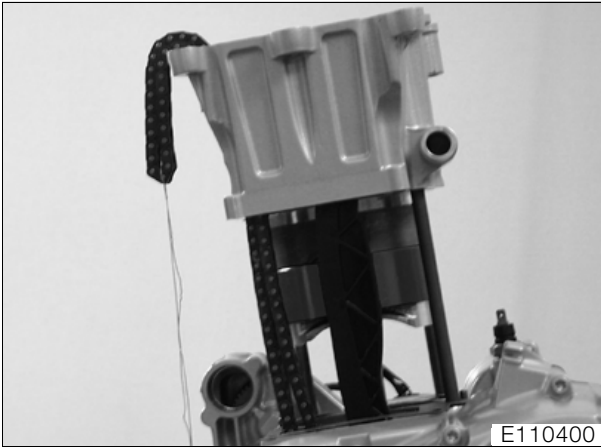
Support side of piston.

- Press piston pin circlip into piston with firm pressure.



## 11 11 150 Installing cylinder

- Fit cylinder base seal on engine block: oil bore must be clear.



- Oil the piston rings, turn them so that the gaps are offset by 120°, 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.
- Hand-tighten fasteners holding cylinder on engine block.

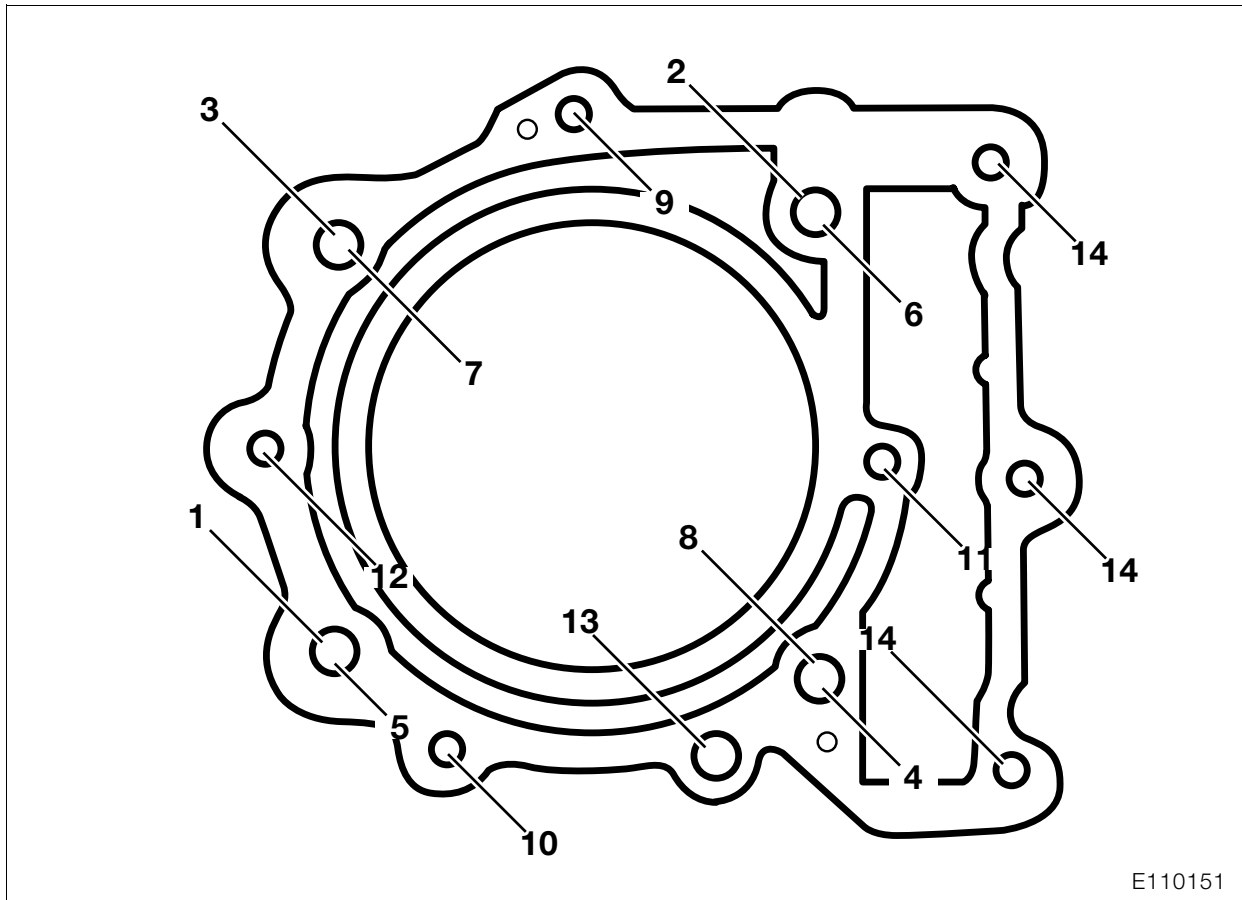
## 11 12 516 Installing cylinder head



### 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.
- Hold the cylinder head and cylinder together by hand-tightening the collar screws and nuts.



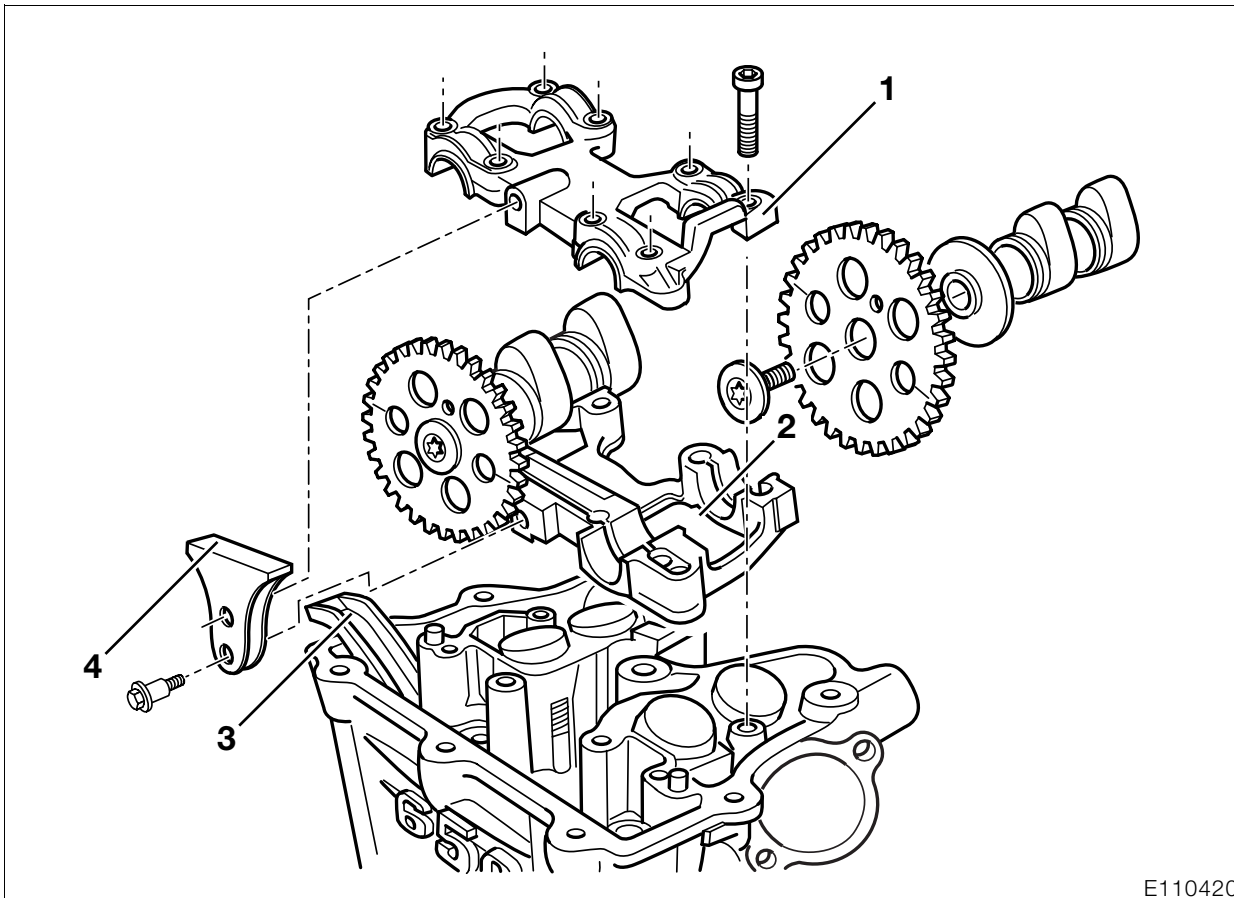
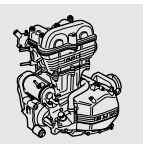
E110151

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



**Tightening torque:**

Socket-head screws, chaincase .....	10 Nm
Collar screws, cylinder head .....	33 Nm
Collar nuts to cylinder head.....	first stage 20 Nm
.....	second stage 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 carrier (1) on cylinder head.
- Fit camshafts with cam lobes facing upward, press down by hand and measure valve clearance with feeler gauge.



**Note:**

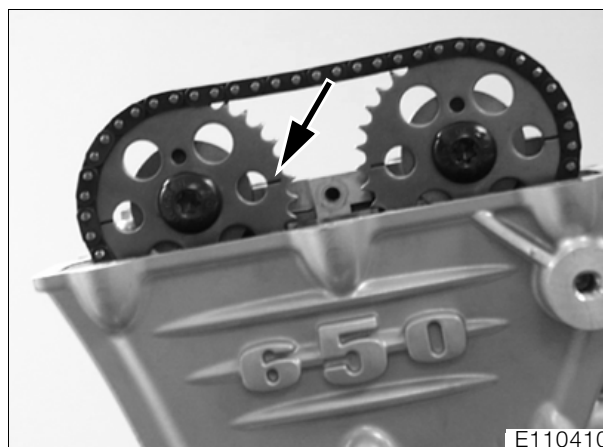
Make sure that the decompressor in the exhaust camshaft does not press against the bucket tappet, otherwise valve clearance will be incorrect.

- 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 ..... 0.03...0.11 mm (0.009...0.0043 in)  
 Exhaust valve .... 0.25...0.33 mm (0.0098...0.013 in)

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



E110410



**Attention:**

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 carrier (2) and tighten.
- Clean the threads of the chain guide fasteners (4), coat with **Loctite 243** and install the fasteners.

- Check valve clearances.
- Install chain tensioner and tighten 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:**

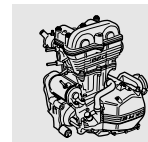
Install the oil return line with the tab at the bottom and the oil feed line with the tab at the top.

- Secure the fuel line to the engine block.
- 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.



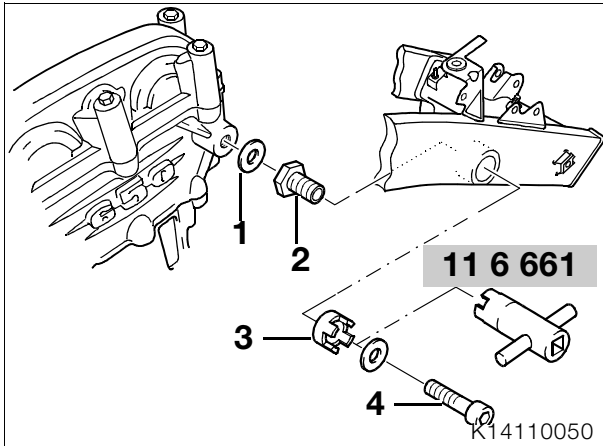
**Tightening torque:**

Camshaft bearing bridge .....	10 Nm
Chain guide to bearing bridge	
(clean thread + Loctite 243).....	10 Nm
Timing-chain tensioner to cylinder head .....	40 Nm
Cylinder head cover to cylinder head .....	10 Nm
Plug in left half of engine block.....	25 Nm
Oil line to engine block	
(with copper sealing ring) .....	42 Nm
Oil line to engine block.....	10 Nm
Spark plug in cylinder head .....	20 Nm
Starter to clutch 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.
- Slightly raise the engine and connect the crankcase breather.
- Continue raising 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 torque:

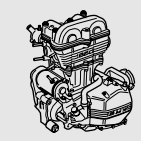
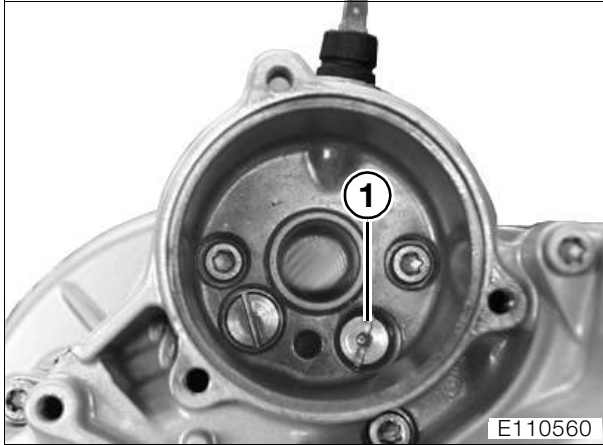
Drain plug, water pump .....	10 Nm
Oil drain plug, engine .....	40 Nm
Oil feed line to main frame .....	42 Nm
Intake stub to cylinder head .....	21 Nm
Exhaust elbow to cylinder head .....	20 Nm
Silencer to exhaust elbow .....	55 Nm
Silencer to rear frame .....	41 Nm
Cable cover to engine .....	9 Nm
Belt sprocket to engine (clean thread + Loctite 638) .....	180 Nm
Sprocket cover to engine .....	2 Nm
Ground terminal to engine block .....	8 Nm
Cable for neutral indicator .....	1 Nm
Engine shell to engine .....	55 Nm
Engine shell to down-tube .....	24 Nm
Engine/bottom truss to main frame .....	50 Nm
Swinging-arm shaft .....	100 Nm
Gearshift pedal to frame .....	21 Nm
Footbrake lever to frame .....	21 Nm
Cylinder head to frame .....	41 Nm
Cylinder head to frame, adjusting sleeve .....	zero play max. 5 Nm
Cylinder head to frame, locknut .....	100 Nm

### Attention:

Never start the engine after it has been disassembled 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

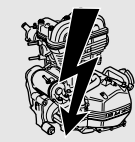


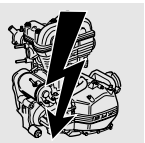
# 12 Engine electrics

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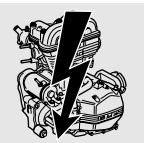
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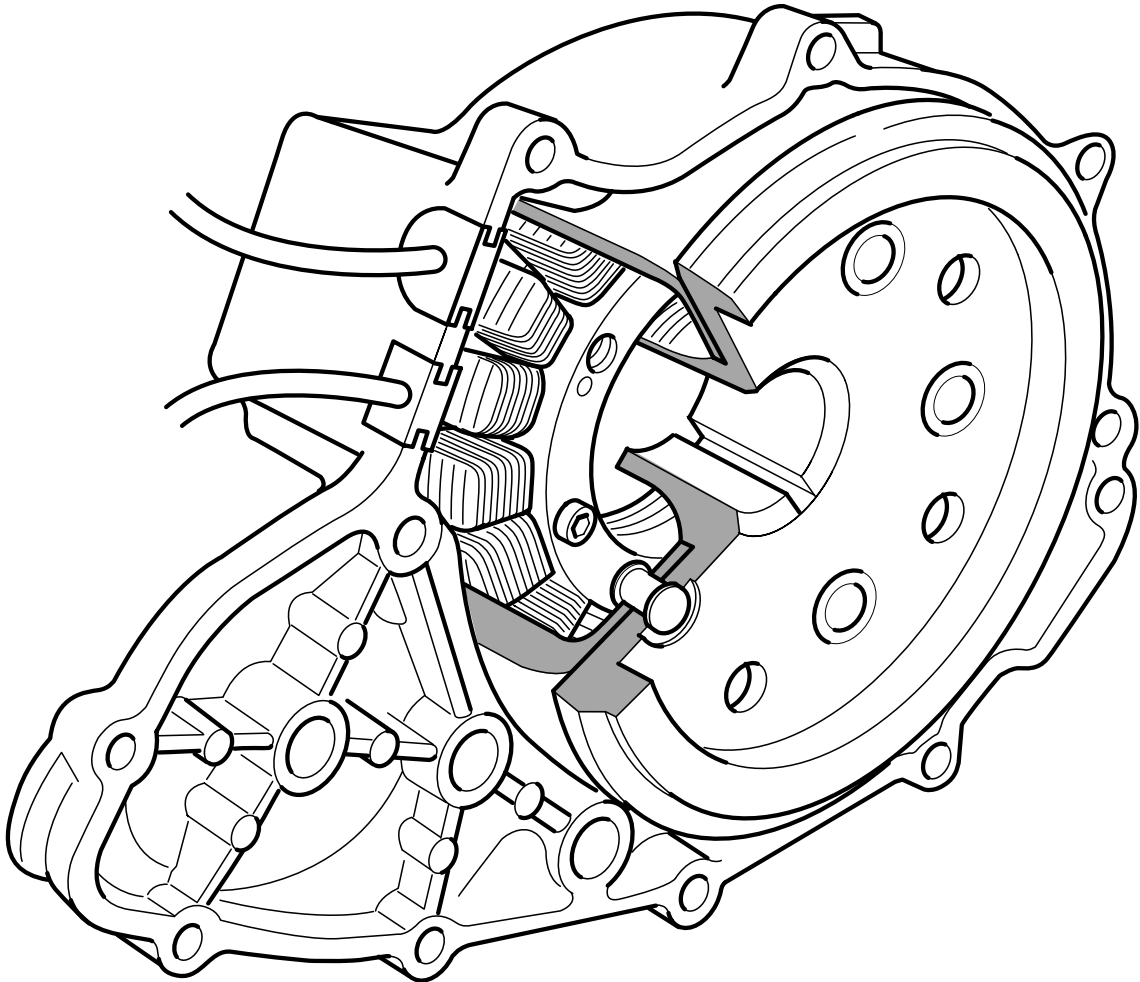


Technical Data12 Engine electrics		F 650 CS
<b>Starter motor</b>		
Type	Electric motor with permanent-magnet excitation, driving crankshaft via countershaft and wedge-block freewheel	
Gear ratio	1:32	
Power rating	kW	0.9
<b>Alternator</b>		
Type	Permanently excited generator, mounted on crankshaft stub	
Gear ratio	1:1	
Drive	Crankshaft	
Maximum output rating	W/V	400 W at 14 V
Maximum current at engine speed 4,000 rpm	A	25
Nominal current at engine speed 2,000 rpm	A	22
Max. operating speed	rpm	7500
<b>Spark plug</b>		
Manufacturer	NGK	
Designation	DR8 EB	
Thread	metric	M12x1.25
Electrode gap	mm (in)	0.6 - 0.7 (0.02-0.03)
Wear limit	mm (in)	0.9 (0.035)
Inductive sensor	$\Omega$	190 - 360
<b>Ignition</b>		
Ignition system	BMS <b>BMW Motorsteuerung</b> (engine management system)	
<b>Ignition coil</b>		
Type	Rod-type coil	
Manufacturer	BREMI	
Resistance		
primary (between terminals 15 and 1)	m $\Omega$	500 - 530
secondary (between terminals 4a and 4b)	k $\Omega$	20

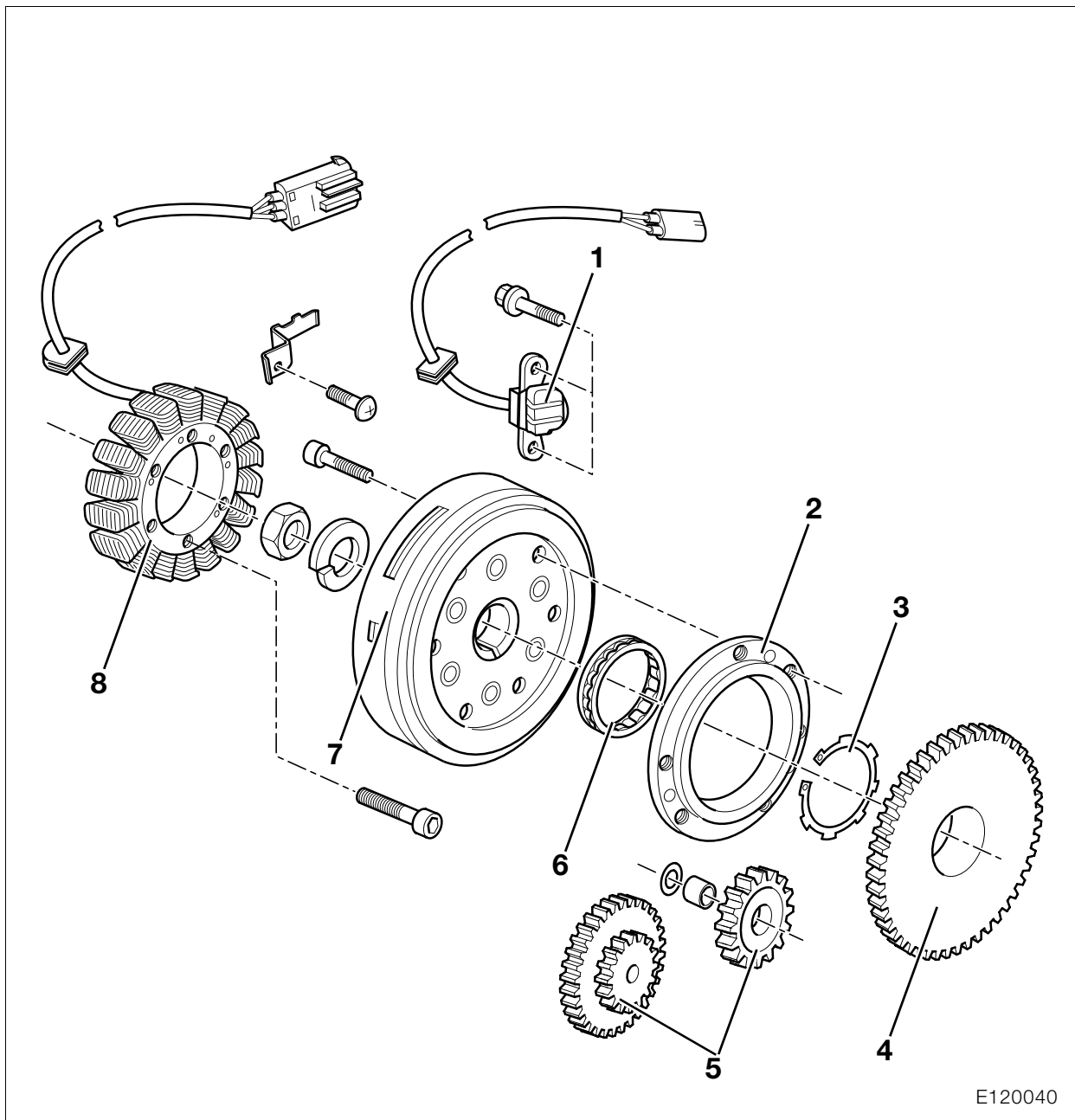




Ignition magneto



## Ignition magneto, components



E120040

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

## 12 11 070 Removing ignition magneto

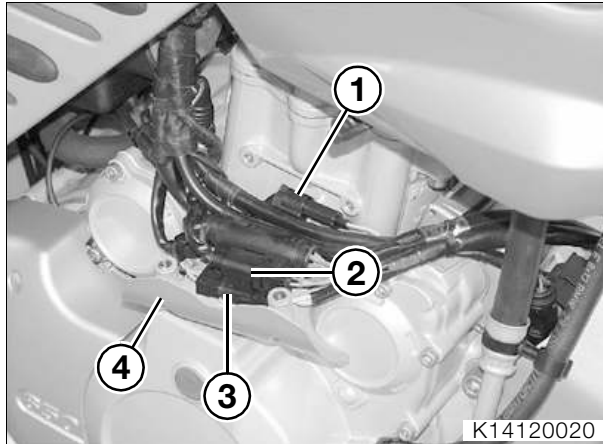


### Attention:

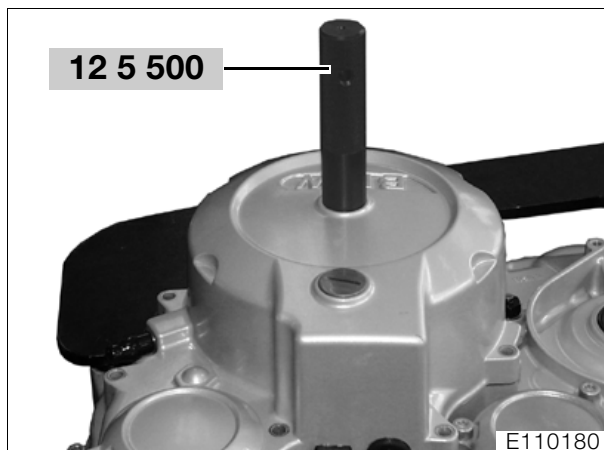
Never disconnect plug connection on ignition system while engine is running.

## 11 14 859 Removing right engine block cover

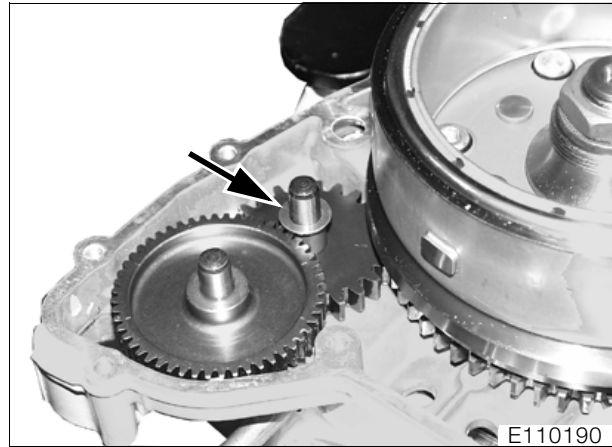
- Remove cable cover (4).



- Disconnect the plug of the stator (3) from connector (2).
- Disconnect the plug of ignition trigger (1).
- Remove fastener securing right engine block cover.



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



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



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



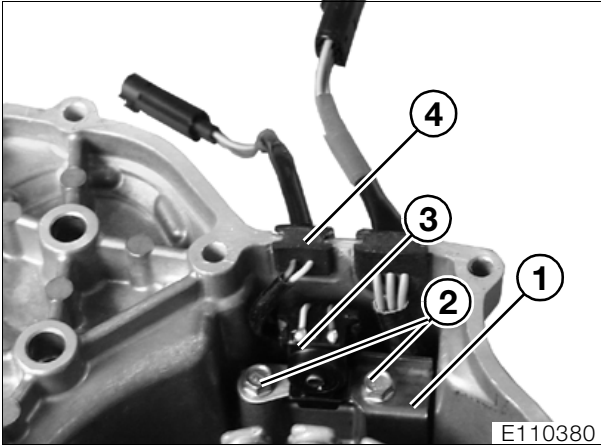
### Note:

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

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



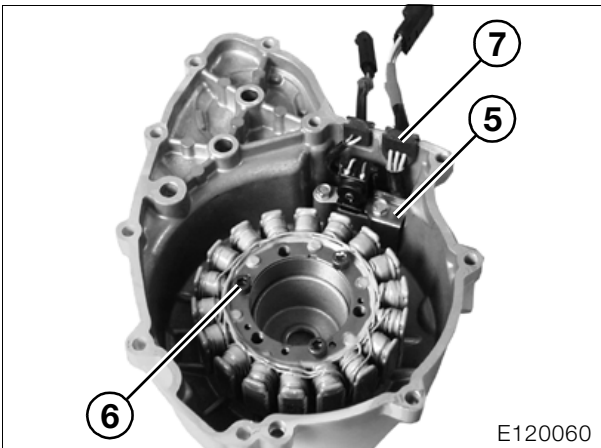
## 12 11 060 Removing and installing ignition trigger



- 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 to 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**.

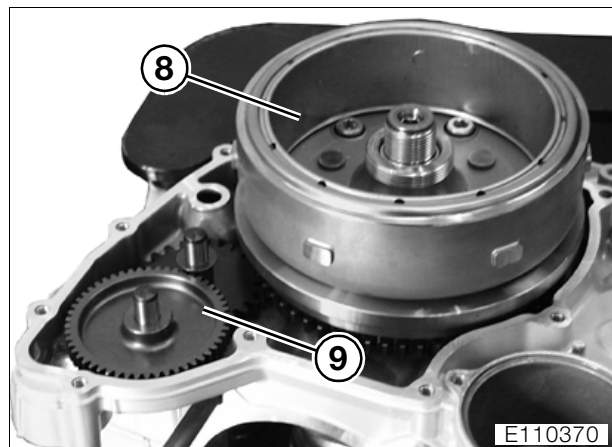
**Tightening torque:**  
Stator to cover  
(clean thread + Loctite 243)..... 10 Nm  
Cable holder to cover..... 8 Nm

## 12 11 070 Installing ignition magneto

### 12 11 070 Installing magnet rotor

**Attention:**  
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.
- Place the snap ring in position, secure the hex nut with **Loctite 243** and tighten it.



- Fit gasket.
- Screw assembly handle, **BMW No. 12 5 500**, into the central hole in the right engine cover.
- Fit right engine block cover and install securing screws.
- Remove assembly handle and install cap.
- 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 block cover, right.....	10 Nm
Cable cover to motor .....	9 Nm

## 12 41 020 Removing and installing, disassembling starter motor

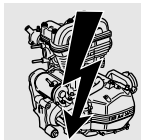
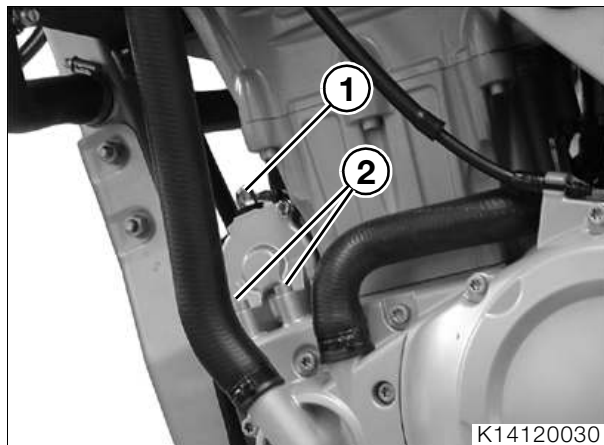
### 12 41 020 Removing and installing starter motor



**Attention:**

Disconnect the negative battery terminal first.

- Disconnect battery negative terminal.
- Remove cable cover



- Disconnect positive lead (1).
- Remove fasteners (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.



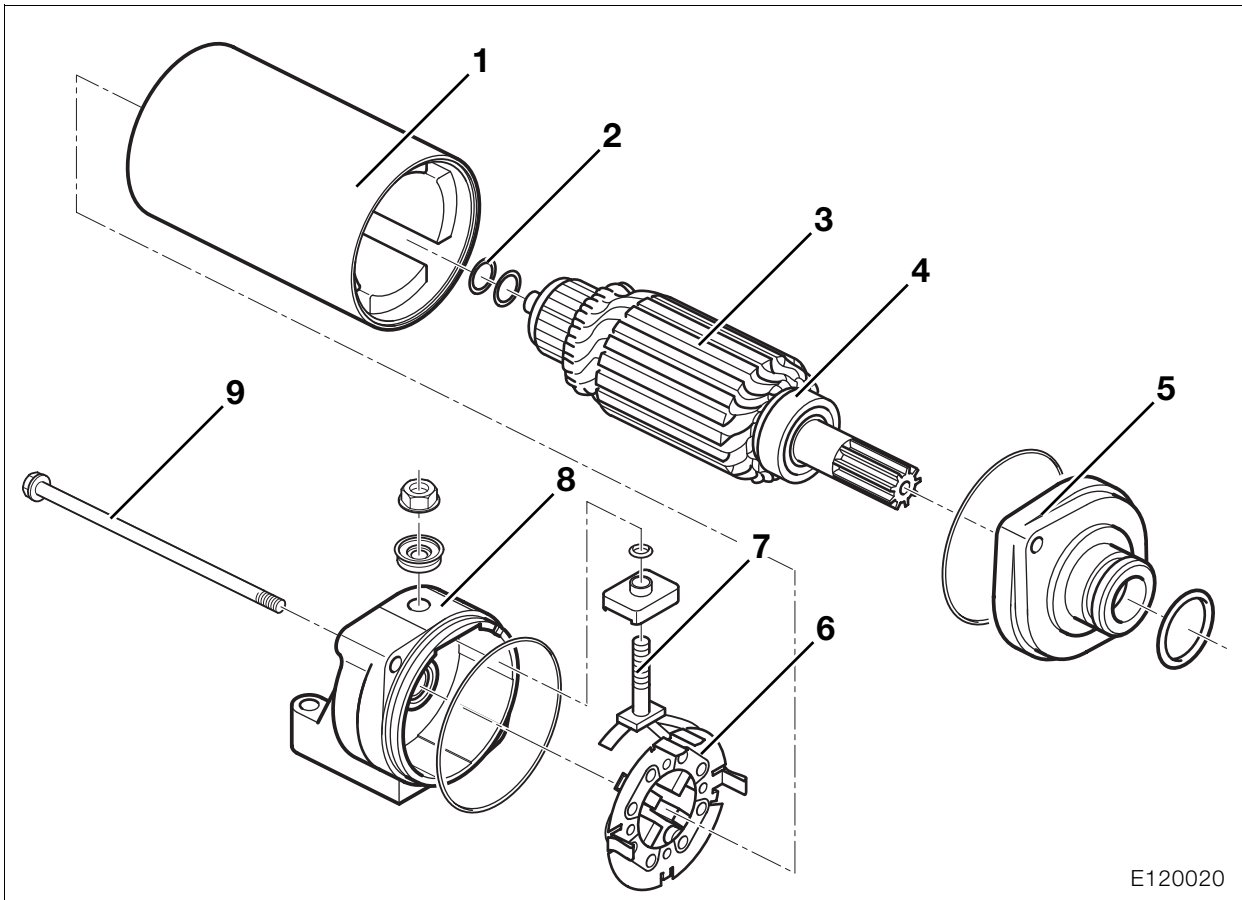
**Attention:**

Connect positive battery terminal (1) first, then the negative terminal.



**Tightening torque:**

Starter to clutch cover.....	10 Nm
Positive cable to starter.....	9 Nm



E120020

## 12 41 103 Disassembling and assembling starter motor

- Remove tie 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 (0.02 in) deeper than the commutator discs: if necessary, remachine with commutator saw.

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



E120070



### Note:

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

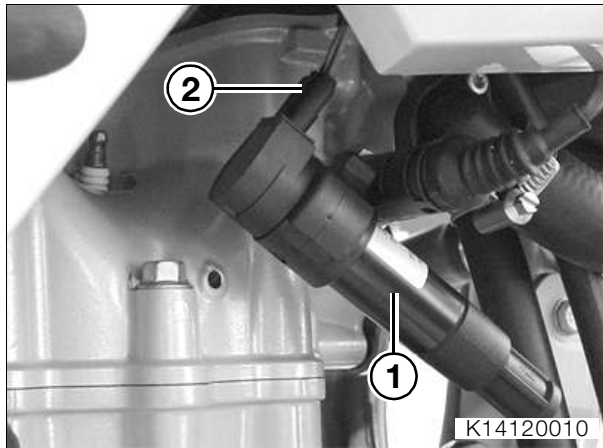


### Tightening torque:

Tie bolt to starter housing ..... 6 Nm  
Positive contact to starter ..... 4 Nm

## 12 12 011 Replacing spark plug (→ 00.42)

## 12 13 000 Removing and installing coil



- Turn ignition coil (1) counter-clockwise and pull up to remove.
- Disconnect ignition cable/coil (2) at plug.
- Installation is the reverse of the removal procedure.

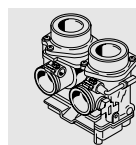


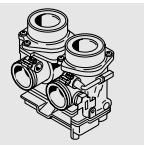
# 13 Fuel preparation and control

## Contents

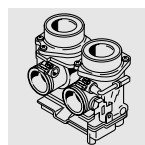
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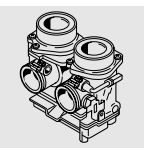
<b>Technical Data</b> .....	3
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Removing and installing air temperature sensor .....	6
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Removing and installing feed and return lines .....	11
Removing and installing line to fuel injector .....	11
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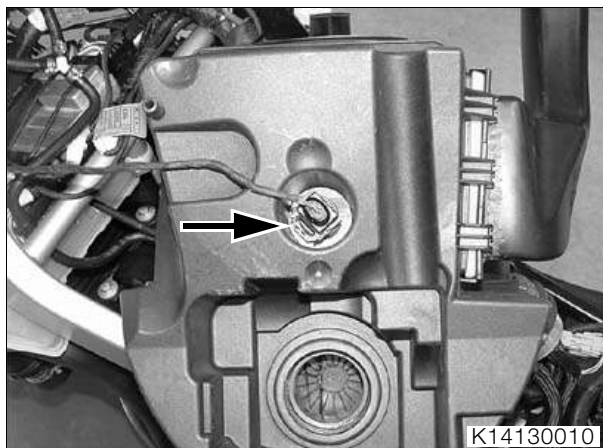
<b>Technical Data</b> <b>13 Fuel preparation and control</b>		<b>F 650 CS</b>
Fuel grade		Regular unleaded, 91 octane (RON)
Mixture preparation		Manifold injection
Fuel pressure	bar (psi)	3.5 ± 0.2 (50.76 ± 2.9)
Speed limitation	rpm	7500
Throttle stub pipe intl. dia.	mm (in)	43 (1.693)
[OE] 34 hp	mm (in)	43 (1.693)
Air filter		Paper filter
Throttle cable play (engine warm)		approx. 1 mm (0.04 in)





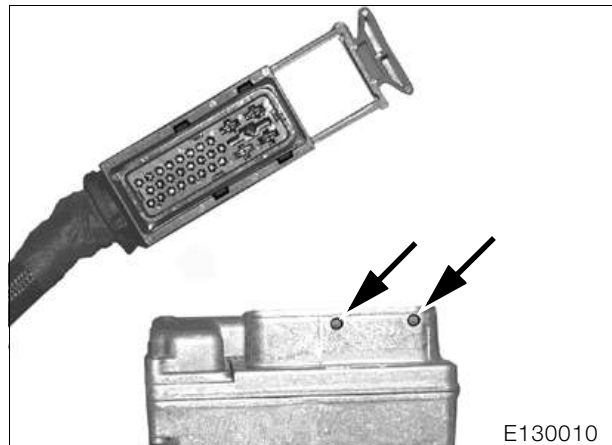
## 13 61 010 Removing and installing BMS control unit

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the left, right and front covers (→ 46.6).
- Push up the tab to pull the fuse box from the holder.
- Remove the fastener securing the fuel filter to the stowage-compartment frame.
- Remove the stowage-compartment frame (→ 46.14).
- Use pliers, **BMW No. 17 5 500**, to release clamp for breather hose and pull the hose off intake air silencer.
- Carefully disconnect the intake air silencer from the throttle flap stub.
- Pull the intake air silencer with intake pipe to the rear to remove, while disengaging the locating pin on the intake pipe with rubber sleeve from the fairing bracket.



- Raise the intake air silencer and disconnect the plug for the air temperature sensor (arrow).
- Cover/seal the throttle flap stub.

- Disengage the retaining strap, pry off the retaining bar, and remove the control unit (carefully pry it off with a screwdriver if necessary).
- Pull the red locking grip forward and at the same time pull the connector up and off the control unit.
- Installation is the reverse of the removal procedure, pay particular attention to the following.

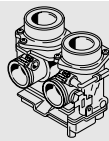


- Push the connector with grooves onto the pins (arrows) on the control unit and close the locking mechanism.



### Tightening torque:

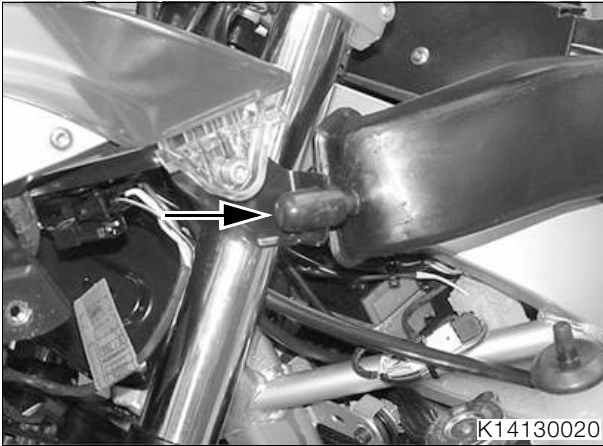
Stowage-compartment frame to main frame ..	9 Nm
Fuel filter to stowage-compartment frame .....	9 Nm
Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket	3 Nm
Stowage-compartment rail to stowage-compartment frame.....	9 Nm





### 13 72 120 Removing and installing intake air pipe

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover (→ 46.6).
- Remove the fasteners securing the intake pipe to the intake air silencer.
- Swing the intake pipe to the side and lift it up and out of the hook, while disengaging the pin at the front with the rubber sleeve from the fairing bracket.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



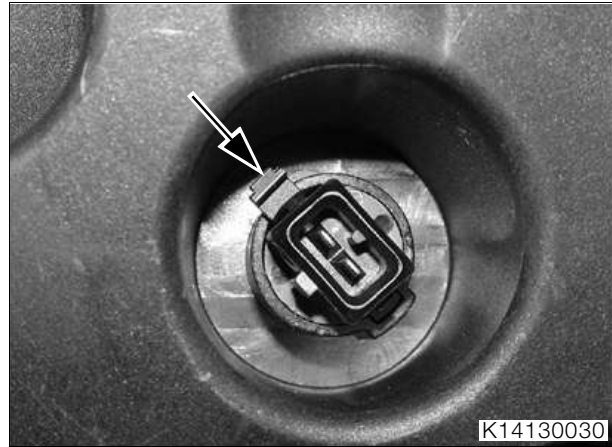
- Slide the pin on the intake air pipe with the rubber grommet (arrow) into the bracket.
- Engage the intake pipe in the hook of the intake air silencer at the bottom and tilt it up.

#### **Tightening torque:**

Intake pipe to	
intake air silencer .....	9 Nm
Left cover to main frame.....	2 Nm
Left cover to air duct .....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and	
stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket	3 Nm
Stowage-compartment rail to stowage-compartment	
frame .....	9 Nm

### 13 62 010 Removing and installing air temperature sensor

- Remove intake air silencer (→ 13.7).

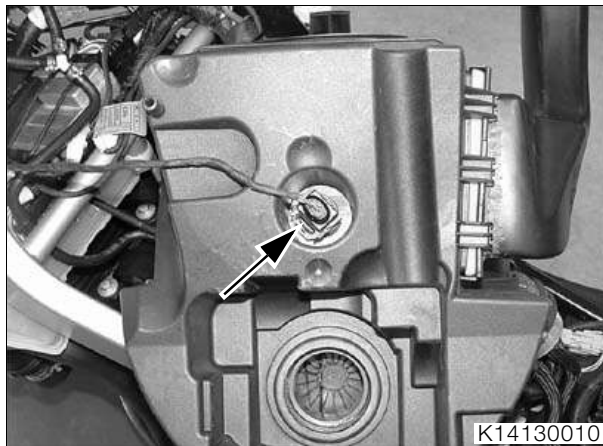


- Press in the lug (arrow) and remove the temperature sensor from the intake air silencer.

### 00 13 630 Replacing air filter element (→ 00.43)

## 13 72 130 Removing and installing intake air silencer

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the left, right and front covers (→ 46.6).
- Push up the tab to pull the fuse box from the holder.
- Remove the fastener securing the fuel filter to the stowage-compartment frame.
- Remove the stowage-compartment frame (→ 46.14).
- Use pliers, **BMW No. 17 5 500**, to release clamp for breather hose and pull the hose off intake air silencer.
- Carefully disconnect the intake air silencer from the throttle flap stub.
- Pull the intake air silencer with intake pipe to the rear to remove, while disengaging the locating pin on the intake pipe with rubber sleeve from the fairing bracket.



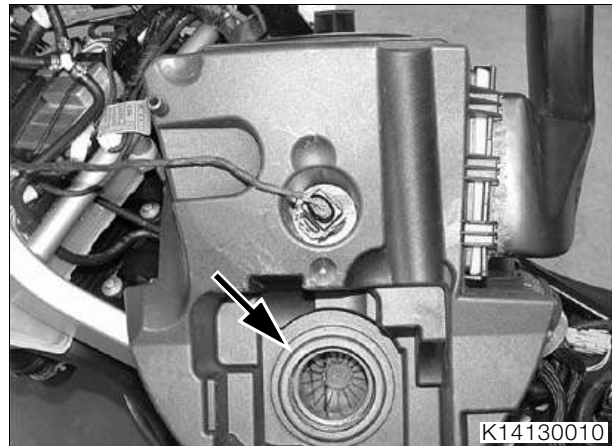
- Raise the intake air silencer and disconnect the plug for the air temperature sensor (arrow).
- Cover/seal the throttle flap stub.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Make sure that the intake pipe is correctly seated on the throttle valve stub.

### **Tightening torque:**

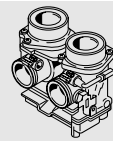
Stowage-compartment frame to main frame ..	9 Nm
Fuel filter to stowage-compartment frame .....	9 Nm
Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket	3 Nm
Stowage-compartment rail to stowage-compartment frame.....	9 Nm

## 13 71 006 Removing and installing intake air pipe

- Remove intake air silencer.

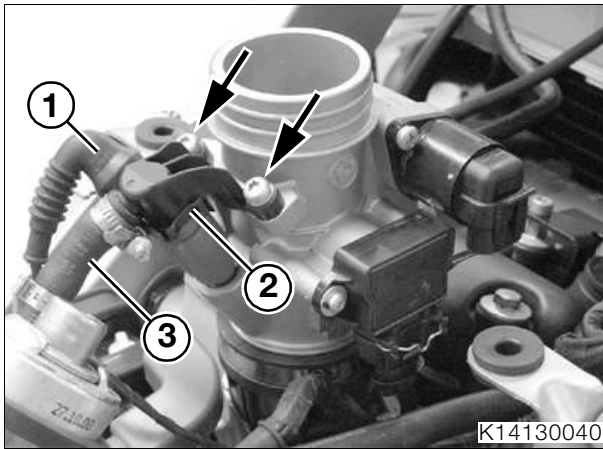


- Carefully open bead (arrow) and slide the intake pipe into the intake air silencer.
- Remove the intake pipe through the aperture for the air filter element.
- Installation is the reverse of the removal procedure.



## 13 64 165 Removing and installing injection nozzle

- Remove intake air silencer (⇒ 13.7).



- 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.
- The plug points toward the left-hand side of the motorcycle.

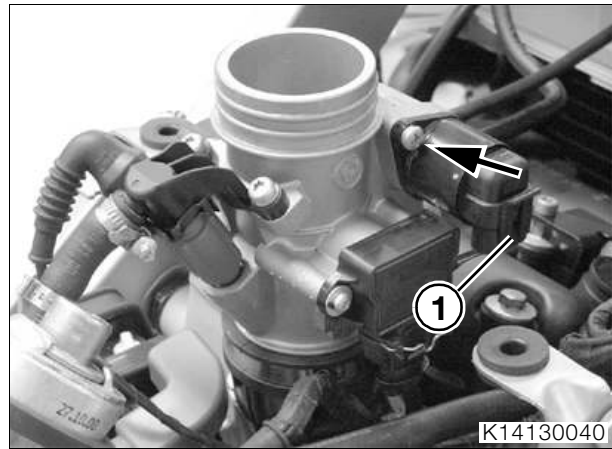


### Tightening torque:

Stowage-compartment frame to main frame .. 9 Nm  
 Fuel filter to stowage-compartment frame ..... 9 Nm  
 Left and right covers to main frame ..... 2 Nm  
 Left and right covers to air duct..... 3 Nm  
 Left and right covers to cover, front..... 1 Nm  
 Cover, front, to main frame..... 2 Nm  
 Cover, rear, to left and right covers and stowage-compartment frame ..... 2 Nm  
 Left and right turn indicators to fairing bracket 3 Nm  
 Stowage-compartment rail to stowage-compartment frame ..... 9 Nm  
 Injection nozzle holder to throttle flap stub ..... 5 Nm  
 Fuel hose to injection nozzle holder..... 3 Nm

## 13 54 020 Removing and installing throttle-valve actuator

- Remove intake air silencer (⇒ 13.7).



- Disconnect plug of throttle-valve actuator (1).
- 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.
- Clean the threads of the securing screws for throttle valve actuator, coat threads with **Loctite 243** and install the screws.

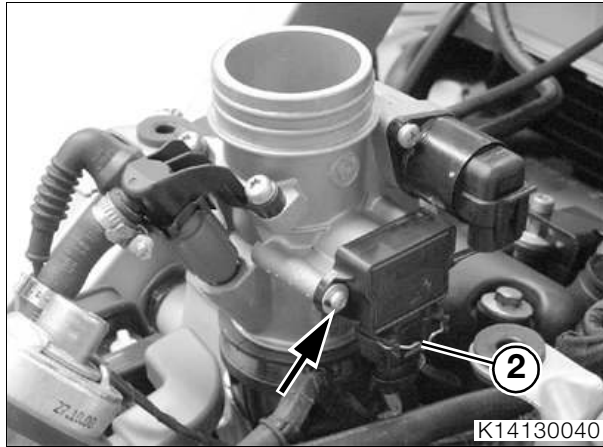


### Tightening torque:

Stowage-compartment frame to main frame .. 9 Nm  
 Fuel filter to stowage-compartment frame ..... 9 Nm  
 Left and right covers to main frame ..... 2 Nm  
 Left and right covers to air duct..... 3 Nm  
 Left and right covers to cover, front..... 1 Nm  
 Cover, front, to main frame..... 2 Nm  
 Cover, rear, to left and right covers and stowage-compartment frame ..... 2 Nm  
 Left and right turn indicators to fairing bracket 3 Nm  
 Stowage-compartment rail to stowage-compartment frame..... 9 Nm  
 Throttle-valve actuator to throttle flap stub (clean thread + Loctite 243)..... 5 Nm

### 13 63 005 Replacing throttle-valve potentiometer

- Remove intake air silencer (→ 13.7).



- Disconnect plug of throttle-valve potentiometer (2).
- 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).

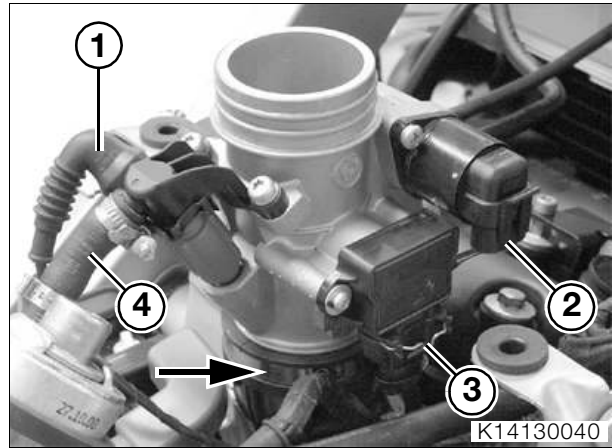


**Tightening torque:**

Throttle valve potentiometer to throttle flap stub ..... 3 Nm

### 13 54 017 Removing and installing throttle flap stub

- Remove intake air silencer (→ 13.7).
- Remove knurled nut securing throttle cable to throttle flap stub and disengage the throttle cable from the guide.
- Disengage throttle cable from adapter.

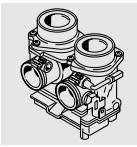


- Disconnect the plugs for fuel injector (1), throttle-valve potentiometer (3) and throttle-valve actuator (2).
- Use a hose clamp, **BMW No. 13 3 010**, to close off fuel line (4).
- Slacken the hose clip securing the fuel line and disconnect the line from the throttle valve stub.
- Slacken hose clip (arrow) on the intake stub.
- Pull the throttle valve stub off the intake stub.
- If necessary, remove fuel-injector holder and fuel injector.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Clean the threads of the securing screws for throttle valve actuator, coat threads with **Loctite 243** and install the screws.



**Tightening torque:**

Throttle valve potentiometer to throttle flap stub ..... 3 Nm  
 Throttle-valve actuator to throttle flap stub  
 (clean threads + Loctite 243) ..... 5 Nm  
 Throttle flap stub to intake stub ..... 1 Nm  
 Fuel hose to injection nozzle holder ..... 3 Nm



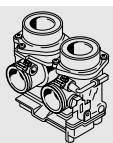
## 13 71 000 Removing and installing intake stub

- Remove throttle stub pipe (→ 13.9).
- Release the two fasteners securing the intake pipe to the cylinder head and remove the intake pipe.
- Remember to clean the sealing faces before re-installing.



### Tightening torque:

Intake stub to cylinder head ..... 21 Nm



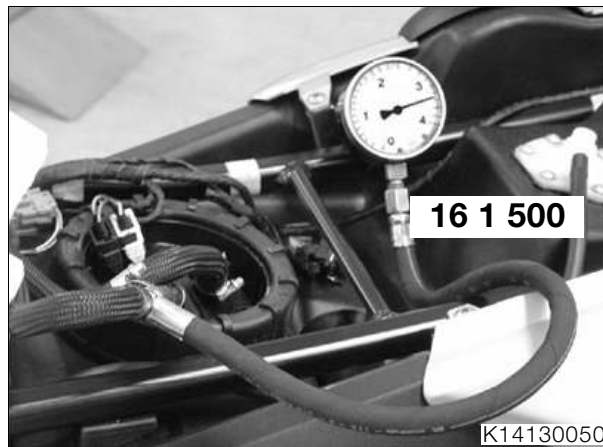
## 13 60 505 Checking fuel pressure



### 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 ± 2.9 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

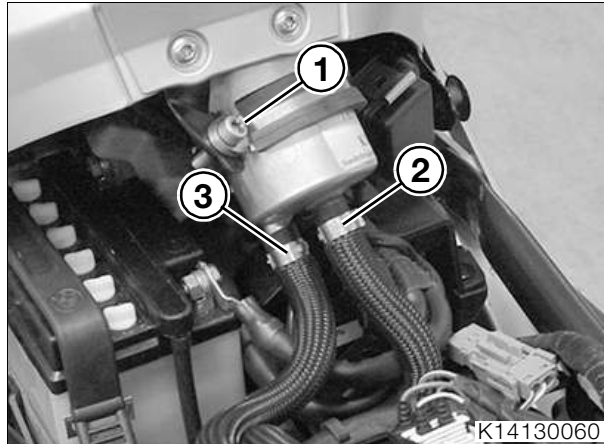


### Warning:

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.



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



### Warning:

Fuel escapes when the hoses are disconnected.

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



### Warning:

Do not use a screw-type hose clamp to connect fuel feed hose (3) to the fuel pump unit. It could damage the hose and result in a fire hazard.



### Attention:

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

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

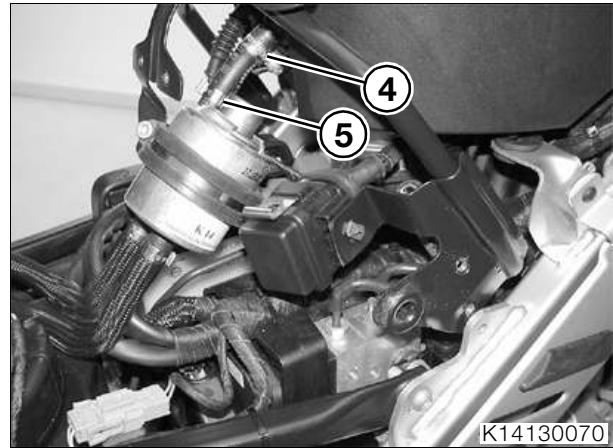


### Tightening torque:

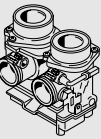
Fuel return hose to pump unit..... 3 Nm

## 13 31 135 Removing and installing line to fuel injector

- Remove seat.
- Remove left, right and centre covers (→ 46.6).
- Use a hose clamp, **BMW No. 13 3 010**, to close off fuel feed line (3).



- 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

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Technical Data 16 Fuel tank		F 650 CS
Fuel tank		
Type		Plastic fuel tank
Fuel grade		Regular unleaded, 91 octane (RON)
Tank capacity (usable)	l (Imp. pints/US quarts)	15 (26.4/15.855)
including reserve of	l (Imp. pints/US quarts)	4 (7.04/4.228)
<b>Fuel pump</b>		
Type		Peripheral-gear pump
Operating voltage	V	7 - 15
Operating 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

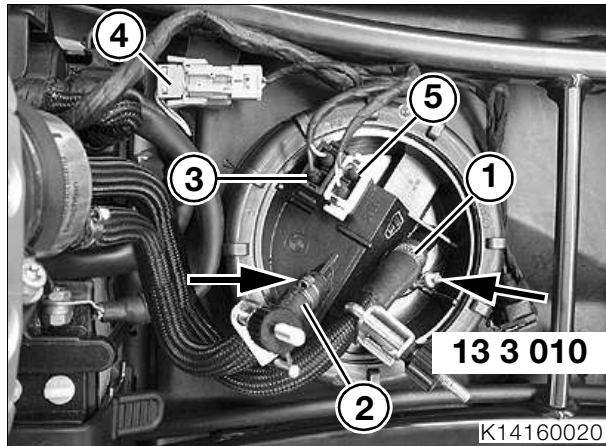


### Attention:

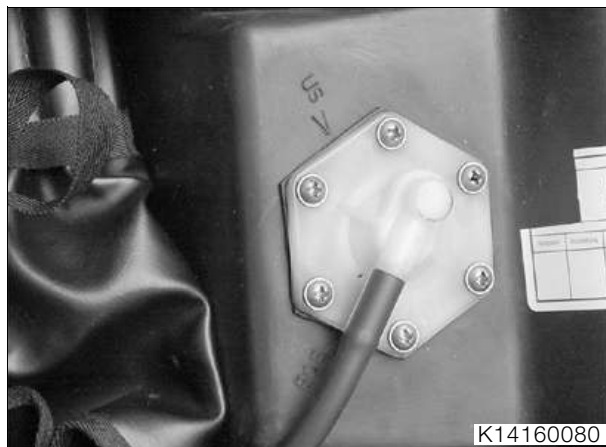
Comply with safety instructions for handling fuel. Disconnect ground lead from battery and insulate.

## 16 11 030 Removing fuel tank

- Remove the seat and the toolkit.
- Secure front wheel in position.
- Remove silencer (→ 18.5).
- Remove brake fluid reservoir from rear frame.



- Close off fuel supply line (2) and the fuel return line (1) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Remove the fastener securing the plug of the brake-light switch (4) to the rear frame.



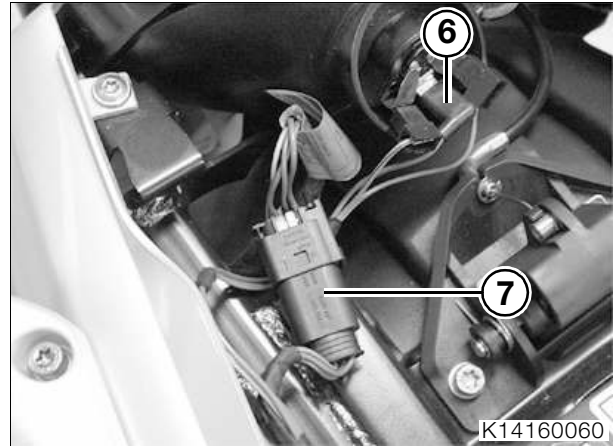
- Disconnect the breather hose from the roll-over valve.

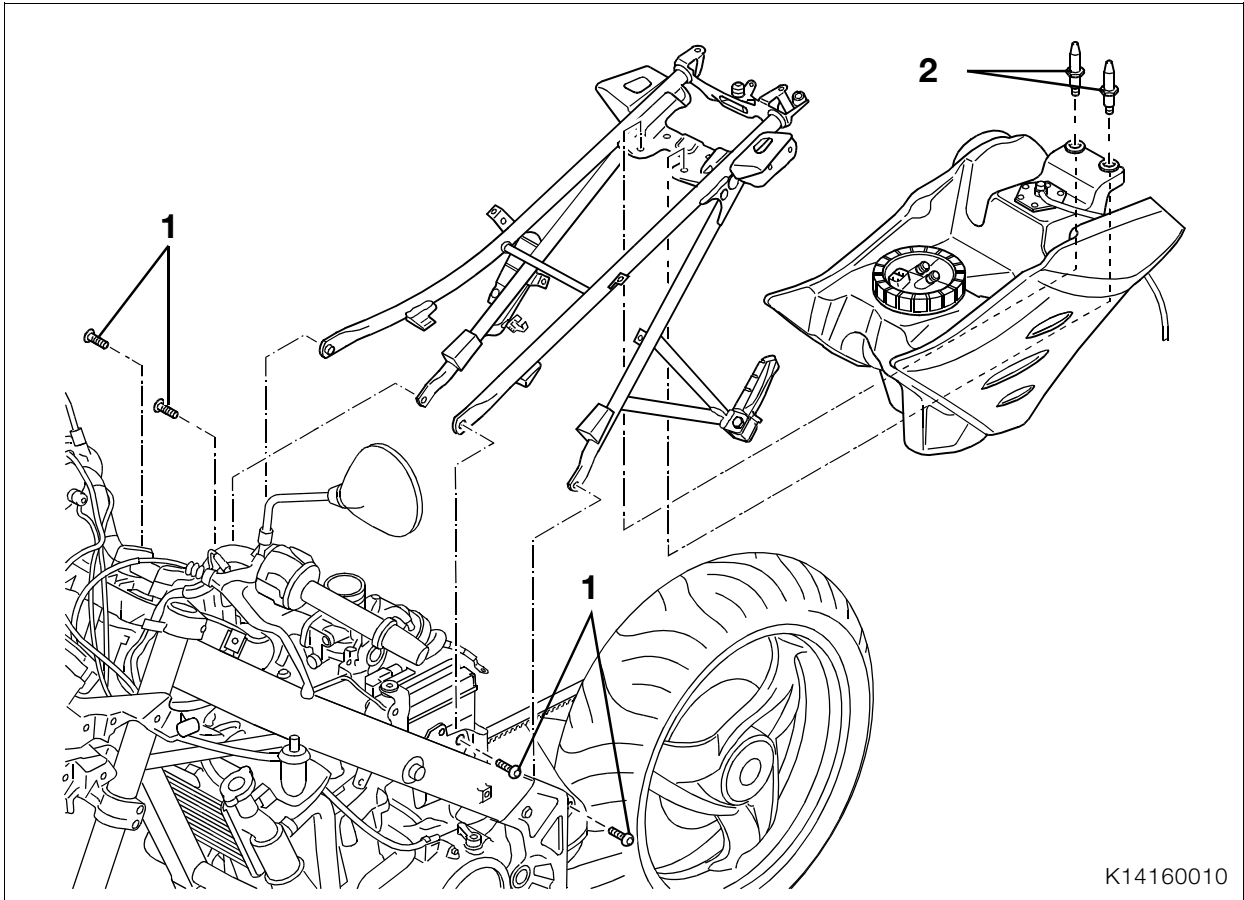


### Note:

Do not unplug the BMS control unit.

- Disconnect the plugs for fuel pump (3) and fuel-level sensor (5).
- Disconnect the plug for turn indicator/number-plate light (7).
- Disconnect 3 plugs (6) for rear light cluster.
- Remove 3 cable ties from rear frame.





K14160010

- Remove 4 fasteners (1) securing rear frame to main frame.

**⚠ Attention:**

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.

- Carefully remove the rear frame complete with the tank.
- If applicable, 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 (2).
- Remove fuel tank.

## 16 11 030 Installing fuel tank

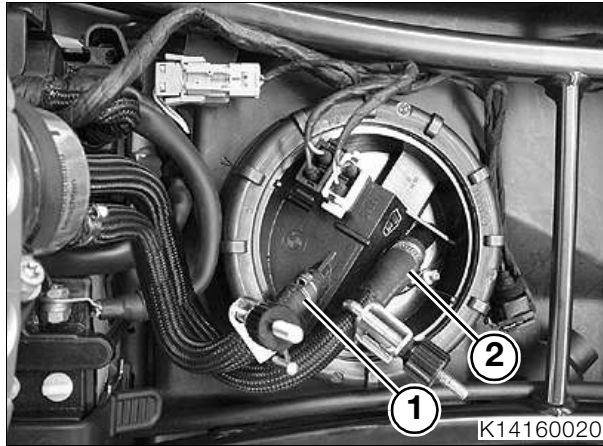
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Attention:

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.



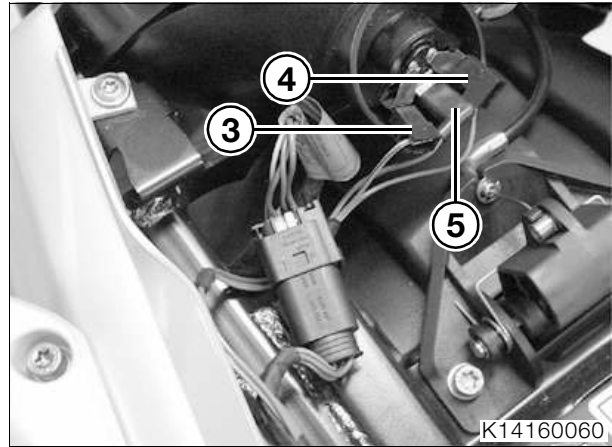
- Make sure that fuel feed hose (1) and fuel return hose (2) are correctly routed.



### Warning:

Do not use a screw-type hose clamp to secure fuel feed hose (1). It could damage the hose and result in a fire hazard.

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



### Colours of the wires in the housing for tail light/brake light

- 3. blue/black
- 4. green/red
- 5. brown

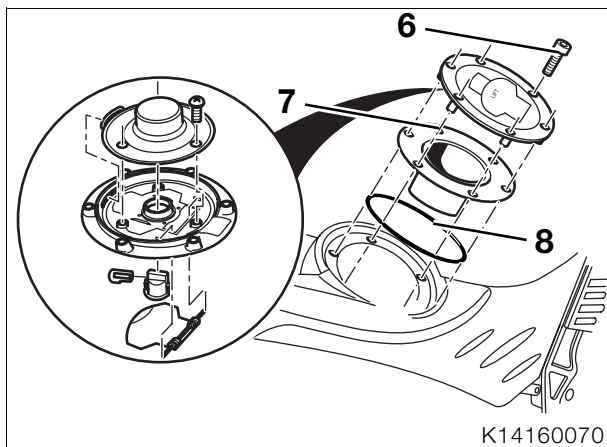


### Tightening torque:

Fuel tank to rear frame .....	21 Nm
Rear frame to main frame (clean thread + Loctite 2701).....	24 Nm
Silencer to rear frame .....	41 Nm
Clamp for silencer .....	55 Nm
Exhaust elbow to cylinder head.....	20 Nm
Rear finisher to rear frame .....	2 Nm
Brake fluid reservoir, rear brake, to rear frame .....	4 Nm



## 16 11 211 Removing and installing fuel filler cap



- Remove fasteners (6) holding the fuel filler cap.
- Remove fuel filler cap together with fuel filler neck (7) and sealing ring (8).
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Check sealing ring (8) for damage, replace if necessary.

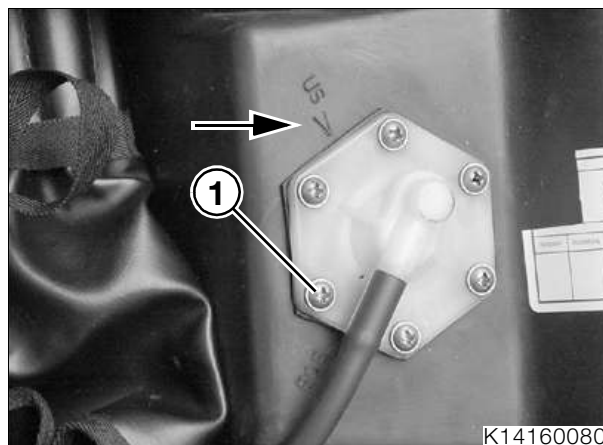


### Tightening torque:

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

## 16 11 222 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.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- **[US]** Align connection of the roll-over valve with mark (arrow).



### Tightening torque:

Roll-over valve to fuel tank ..... 2 Nm



### Note:

The tightening torque of the self-tapping screw for installation of the roll-over valve in a new fuel tank is 2 Nm. The tightening torque when the thread has already been cut is < 2 Nm.

## 16 12 008 Replacing fuel filter (→ 00.44)

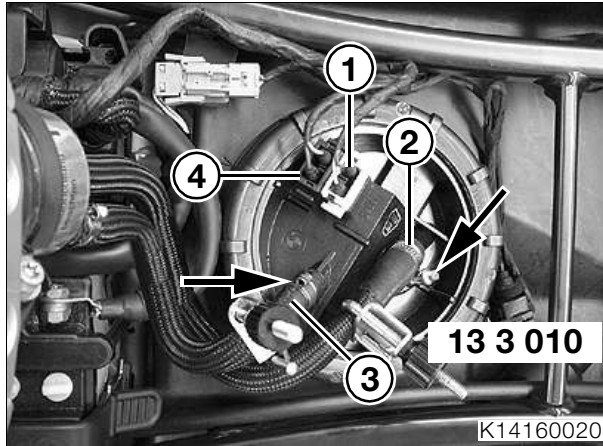
## 16 14 011 Removing and installing fuel pump



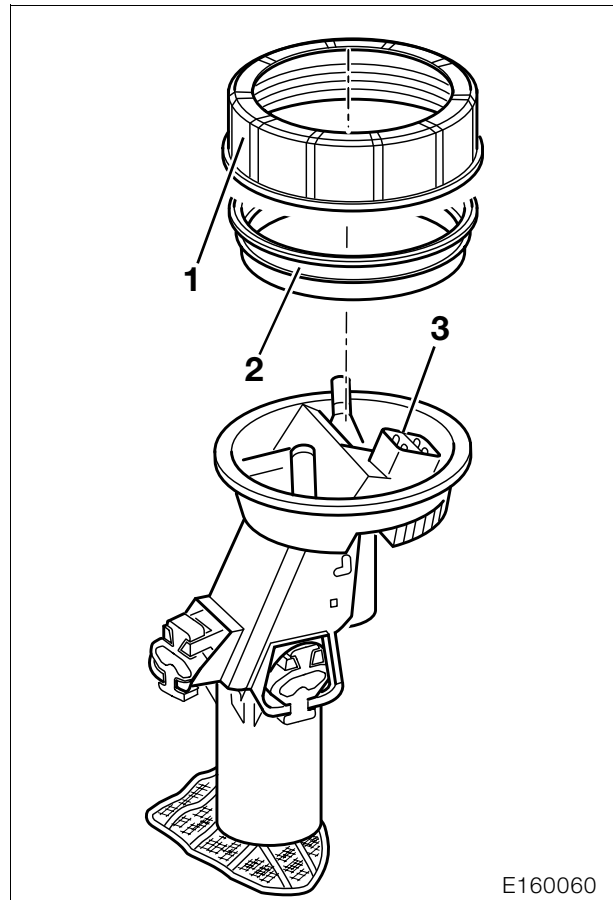
### Attention:

Comply with safety instructions for handling fuel. Disconnect ground lead from battery and insulate.

- Remove seat.



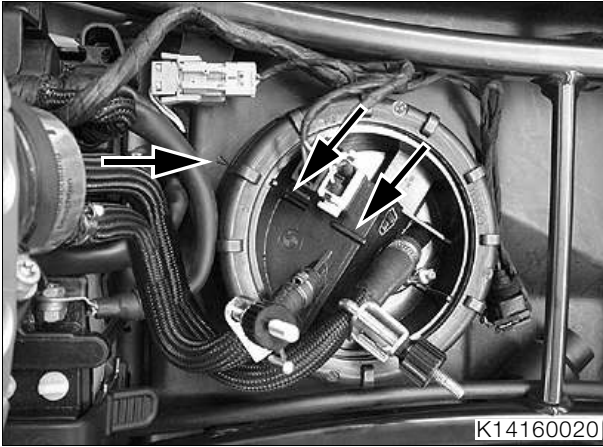
- Disconnect the plugs for fuel-level sensor (1) and fuel pump (4).
- Close off fuel supply line (3) and the fuel return line (2) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.



- Release 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 (ribs on the fuel-pump unit and mark on fuel tank (arrows)) 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 torque:**

Union nut to fuel tank ..... 30 Nm  
 Fuel return hose to pump unit ..... 3 Nm



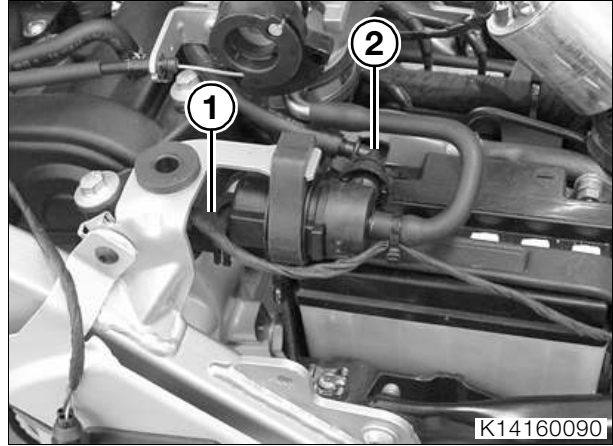
**Note:**

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

## 16 11 Removing and installing fuel-evaporation control valve

**[USA version]**

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove seat.
- Remove the left, right and rear covers (→ 46.6).
- Remove intake air silencer (→ 13.7).



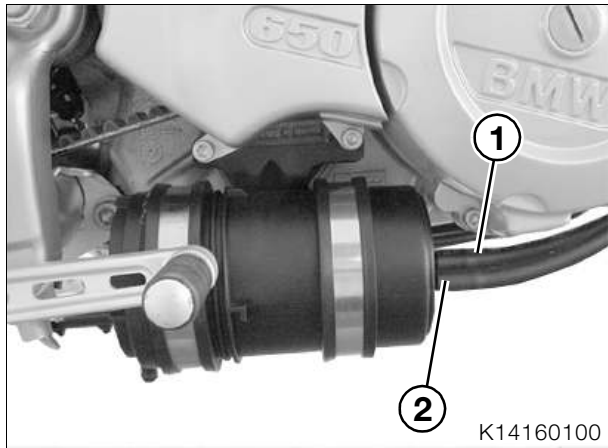
- Remove the timing valve from its holder.
- Open the cable ties.
- Disconnect plug (1) from fuel-evaporation control valve.
- Disconnect the activated charcoal filter from fuel-evaporation control valve (2).
- Disconnect the breather hose from the throttle valve stub to the fuel-evaporation control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



## 16 13 001 Removing and installing activated charcoal filter

### [USA version]

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



- Disconnect the activated charcoal filter from fuel-evaporation control valve (2).
- Disconnect the roll-over valve from activated charcoal filter (1).
- Remove screws securing the holder to the engine block.
- Remove the screws securing the holder to the activated charcoal filter.
- Open the holder and remove the activated charcoal filter.
- Installation is the reverse of the removal procedure.



#### **Tightening torque:**

Retaining clamps, holder to activated charcoal filter.....	9 Nm
Sprocket cover to engine .....	2 Nm

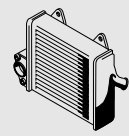


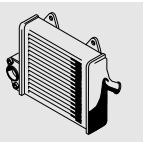
# 17 Radiator

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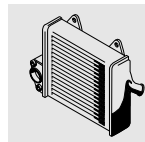
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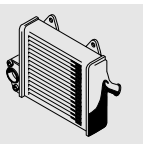
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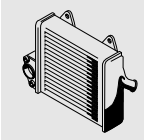


Technical Data 17 Radiator		F 650 CS
Type		U-flow pattern with integral thermostat
Cooling system capacity		
Total capacity	l (Imp. pints/US quarts)	1.3
Coolant circuit	l (Imp. pints/US quarts)	1.2
Coolant expansion tank	l (Imp. pints/US quarts)	0.1
Coolant		Use only nitrite-free long-term antifreeze and corrosion inhibitor.
Coolant mixing ratio	%	Water: 50, antifreeze: 50
Protection against freezing down to	°C (°F)	-25
Thermostat opening temperature	°C (°F)	85 (185)
Fan cut-in temperature	°C (°F)	102
Cut-in temperature for coolant warning light	°C (°F)	118
Opening pressure for pressure relief valve	bar (psi)	1.5 <sup>+0.2</sup> (21.756 <sup>+2.9</sup> )
Cooling system test pressure	bar (psi)	1.5 (21.756)

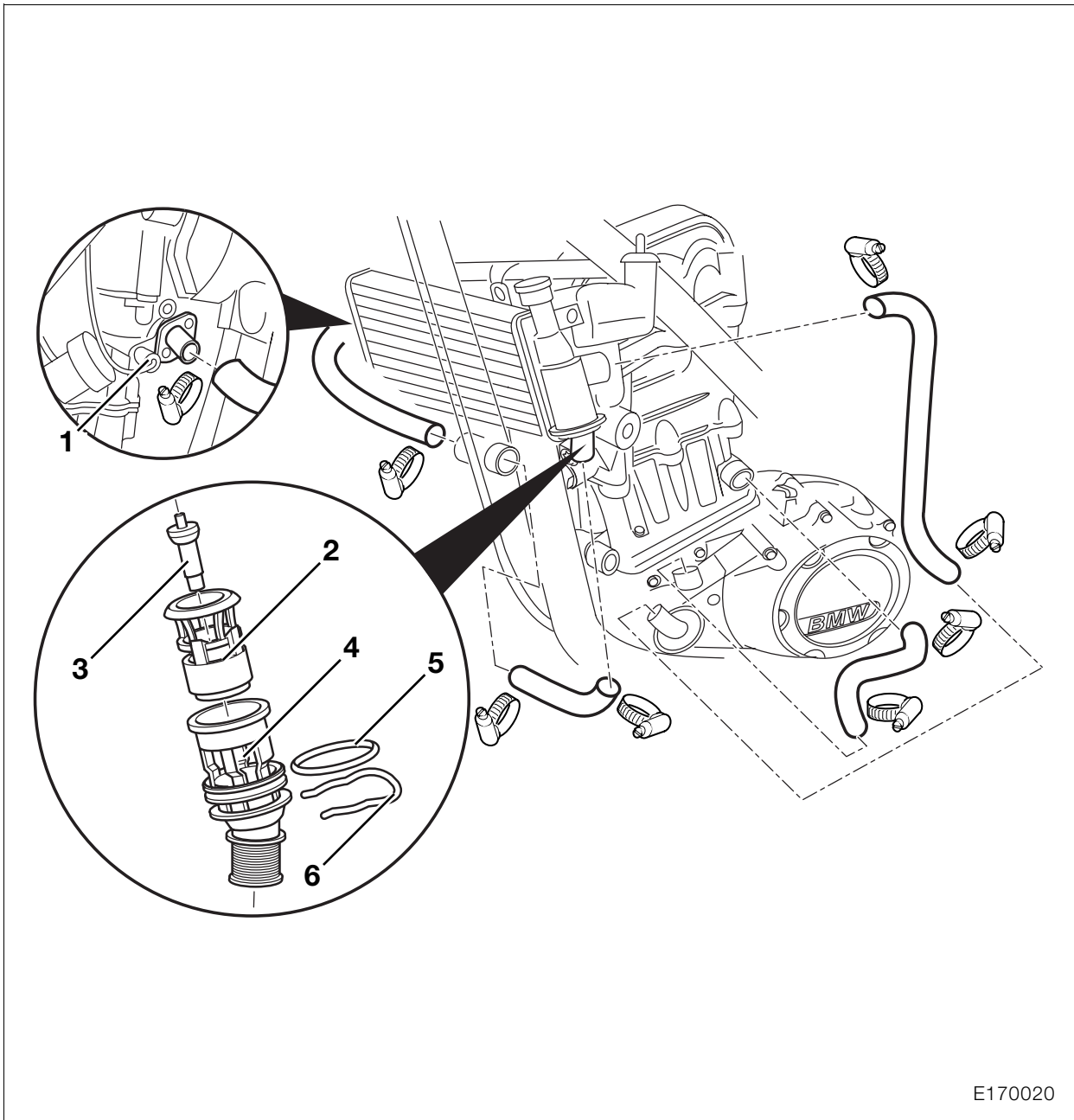




Coolant circuit

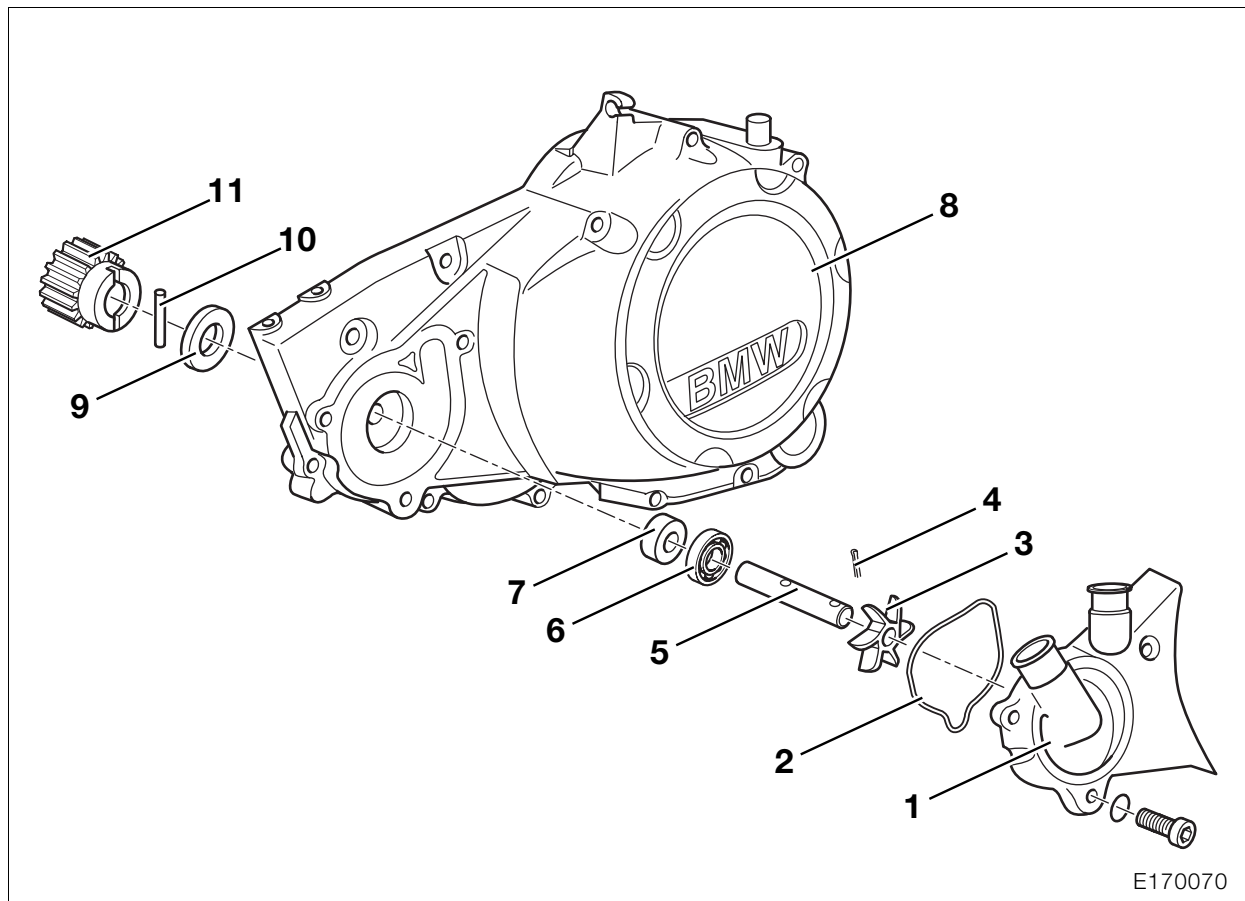


## Thermostat, components



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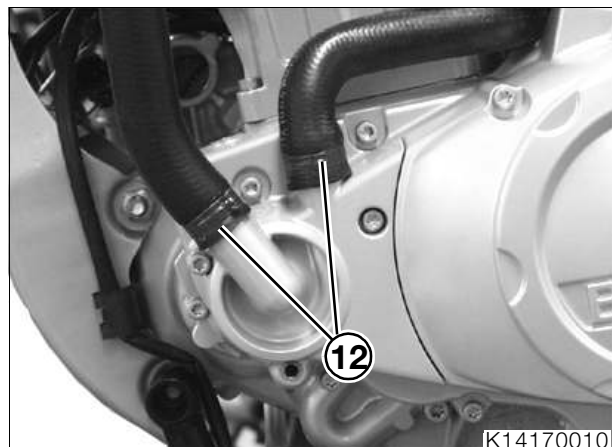
1. Coolant-temperature sensor
2. Thermostat housing
3. Thermostat
4. Cover
5. O-ring
6. Spring clip



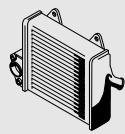
## 11 51 025 Removing and installing coolant pump

### 11 51 025 Removing coolant pump

- Drain coolant (⇒ 00.36).
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Drain the engine oil from the engine (⇒ 00.30).
- Remove complete exhaust system (⇒ 18.5).
- Mark the position of the shift pedal on its shaft.
- Remove the gear shift pedal.
- Remove starter (⇒ 12.9).
- Disengage the clutch cable from the actuating shaft and remove the cable from the guide in the cover.



- Open hose clamps (12) with pliers, **BMW No. 17 5 500**.
- Remove water pump cover (1) with seal (2).
- Remove left engine block cover (8).
- Drive out pin (4) and remove impeller (3).
- Remove shaft (5) with washer (9).
- Remove sealing rings (6, 7).
- If necessary, pull gear (11) off pin (10).





## 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.

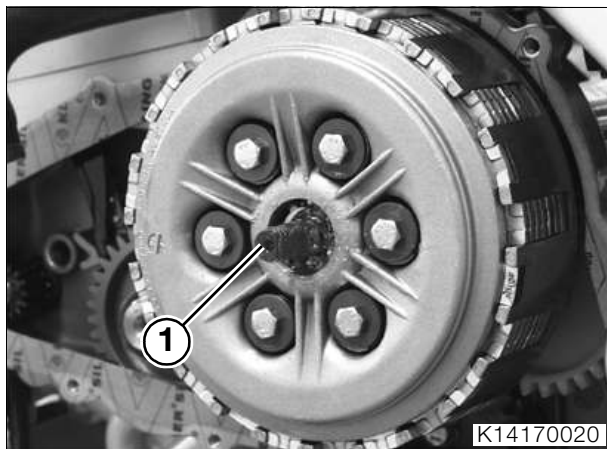
- Coat the sealing lip of the inner sealing ring with **Molykote 111**.
- Drive inner sealing ring onto its seat with drift, **BMW No. 11 6 541**.
- Drive in the outer sealing ring with drift, **BMW No. 11 6 541**, and adapter, **BMW No. 11 6 542**, until flush with the friction face.
- Coat the sealing lip of the outer sealing ring with **Molykote 111**.
- Coat the shaft with **Molykote 111**.
- Install shaft complete with gear and washer in the cover.
- Install impeller wheel with locking pin.



### Note:

Always replace selector shaft sealing ring in clutch cover and seal of cover.

- Remove sealing ring of selector shaft.



- Position thrust head (1) correctly in relation to the release 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.

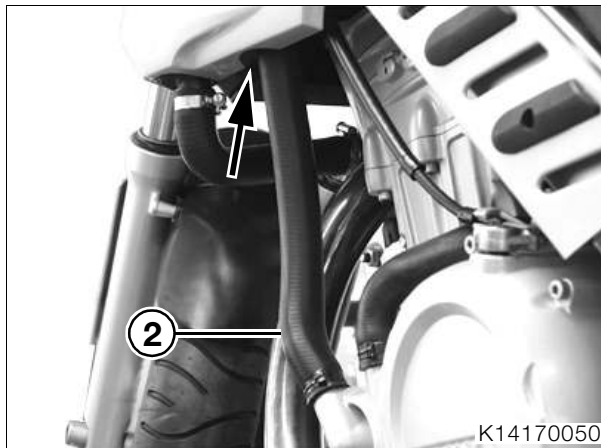
- Install new selector shaft sealing ring in clutch cover with sliding sleeve, **BMW No. 21 4 620**, and drift, **BMW No. 21 4 630**.



### Note:

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

- Replace sealing ring on drain plug.
- Install water pump cover.



### Attention:

Turn hose curvature (2) toward the outside. Check distance from coolant hose to side cover (arrow) (approx. 10 mm).

- Close hose clamps with pliers, **BMW No. 17 5 500**.
- Connect the clutch cable to the release shaft.
- Install the gear shift lever.
  - Install starter motor (➡ 12.9).
  - Install exhaust system (➡ 18.5).
  - Top up engine oil to correct level (➡ 00.31).
  - Top up coolant to correct level (➡ 00.35).

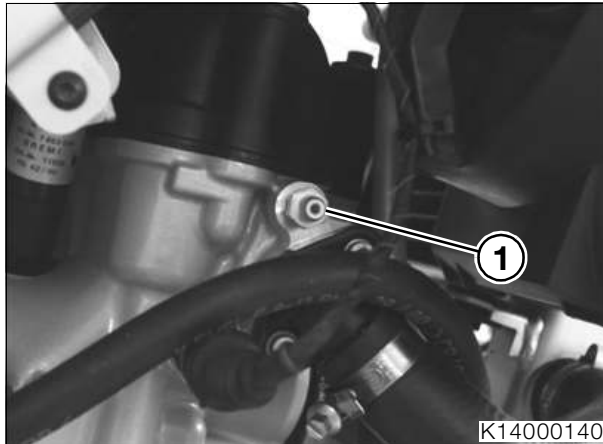


### Tightening torque:

Engine cover, left .....	10 Nm
Cover for water pump .....	10 Nm
Drain plug for water pump .....	10 Nm
Exhaust elbow to cylinder head .....	20 Nm
Silencer to rear frame .....	41 Nm
Selector lever to selector shaft .....	9 Nm
Starter to clutch cover .....	10 Nm
Oil drain plug, engine .....	40 Nm

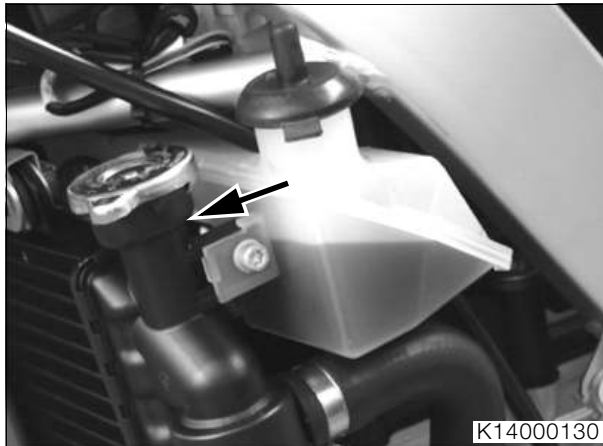
## 17 00 035 Adding coolant

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover (→ 46.6).



K14000140

- 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).



K14000130

- Top up coolant until the level reaches the top of the filler neck (arrow).
- Top up expansion tank to the MIN mark.

### Filling capacity

Cooling system ..... 1.2 l (2.11 imp.pints)  
 In expansion tank ..... + 0.1 l (0.18 imp.pints)

### 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.



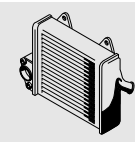
### Note:

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



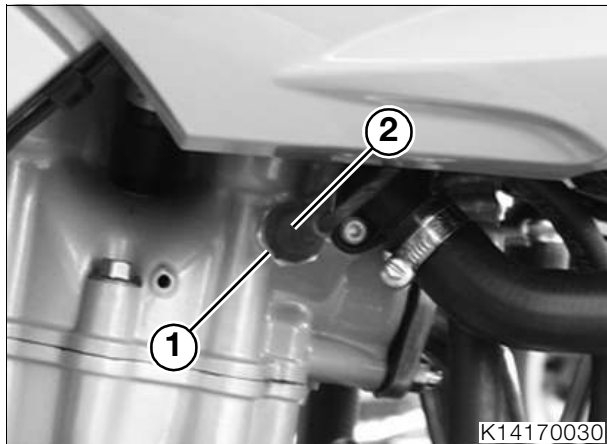
### Tightening torque:

Bleed screw ..... 12 Nm  
 Left and right covers to main frame ..... 2 Nm  
 Left and right covers to air duct..... 3 Nm  
 Left and right covers to cover, front..... 1 Nm  
 Cover, front, to main frame..... 2 Nm  
 Cover, rear, to left and right covers and stowage-compartment frame ..... 2 Nm  
 Left and right turn indicators to fairing bracket 3 Nm  
 Stowage-compartment rail to stowage-compartment frame ..... 9 Nm



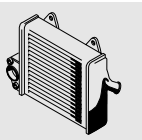
## Removing and installing coolant-temperature sensor

- Drain coolant (→ 00.36).
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



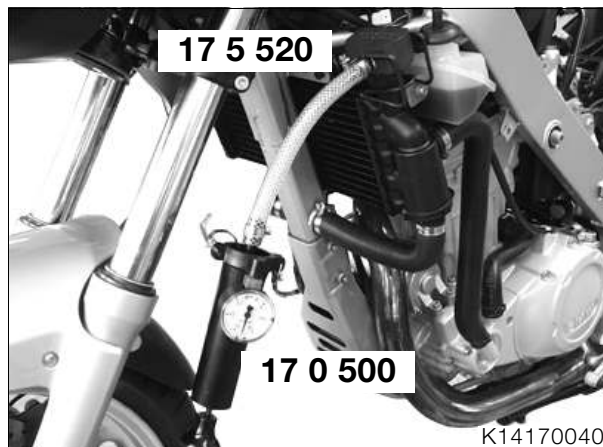
- Disconnect plug of coolant temperature sensor (2).
- Remove coolant-temperature sensor (1).
- Installation is the reverse of the removal procedure.

 **Tightening torque:**  
Temperature sensor ..... 15 Nm



## 17 00 010 Checking cooling system for leaks


- Remove left cover (→ 46.6).
- 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 (21.76 psi)

- Installation is the reverse of the removal procedure.

 **Tightening torque:**

Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket .....	3 Nm
Stowage-compartment rail to stowage-compartment frame.....	9 Nm

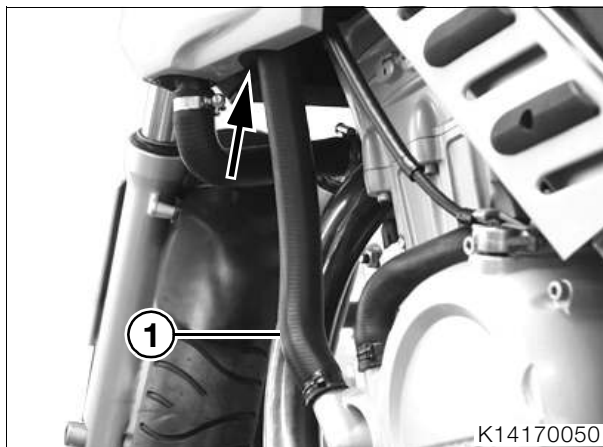
## Removing and installing coolant hoses

### Replacing coolant hose (cylinder head/frame - frame/radiator)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Drain coolant (→ 00.36).
- Remove the right-hand coolant hose.
- Remove the left-hand coolant hose between radiator and frame.
- Installation is the reverse of the removal procedure.

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

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover (→ 46.6).
- Drain coolant (→ 00.36).
- 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.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



#### Attention:

Turn hose curvature (1) toward the outside. Check distance from coolant hose to side cover (arrow) (approx. 10 mm (0.394 in)).

- Close hose clamps with pliers, **BMW No. 17 5 500**.

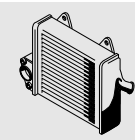
### 17 12 068 Replacing coolant hose (filler bowl/expansion tank)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover (→ 46.6).
- Drain coolant (→ 00.36).
- Disconnect the expansion tank from the radiator and pull it to one side.
- Disconnect the coolant hose from the radiator and the expansion tank.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Close hose clip on radiator with pliers, **BMW No. 17 5 500**.

#### Tightening torque:

Coolant hoses to radiator/engine/frame .....	3 Nm
Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket .....	3 Nm
Stowage-compartment rail to stowage-compartment frame .....	9 Nm

### 17 00 035 Changing coolant (→ 00.36)



## 17 40 000 Removing and installing fan

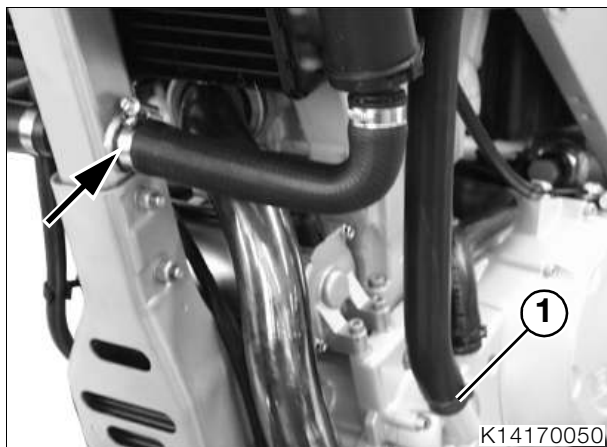
- Remove right cover (→ 46.6).
- Unclip the MoDiTeC plug from its holder.
- Disconnect plug for fan.
- Disengage the clips at top and bottom and remove the fan.
- if necessary, remove fan from fan shroud.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- 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.

### **Tightening torque:**

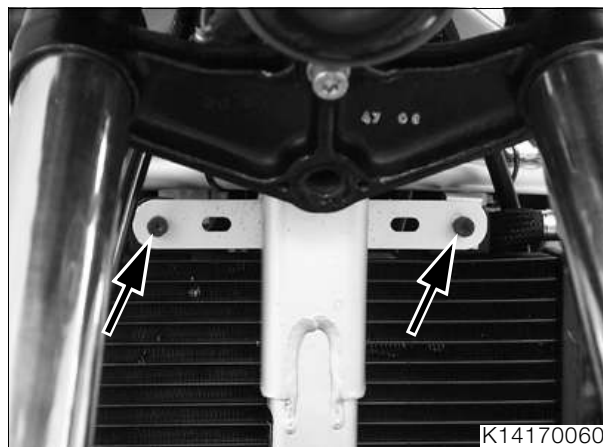
Fan to fan shroud ..... 3 Nm

## 17 11 007 Removing and installing radiator

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left and right covers (→ 46.6).
- Drain coolant (→ 00.36).
- Disconnect the expansion tank from the radiator, pull it to one side and let it dangle from the hose.
- Remove the fan.



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



- Remove the fasteners for the radiator (arrows).

### **Note:**

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

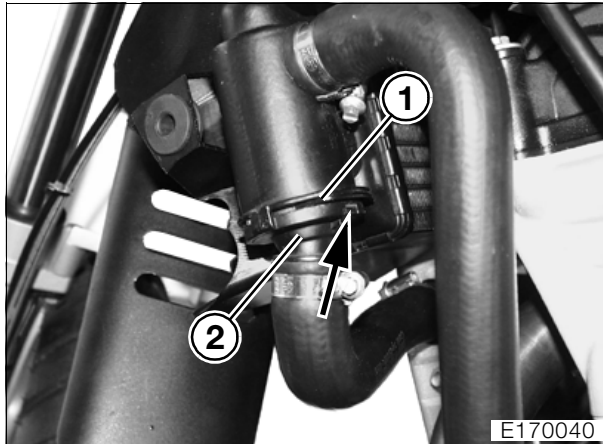
- Pull the radiator complete with expansion tank to the left and remove.
- Installation is the reverse of the removal procedure.

### **Tightening torque:**

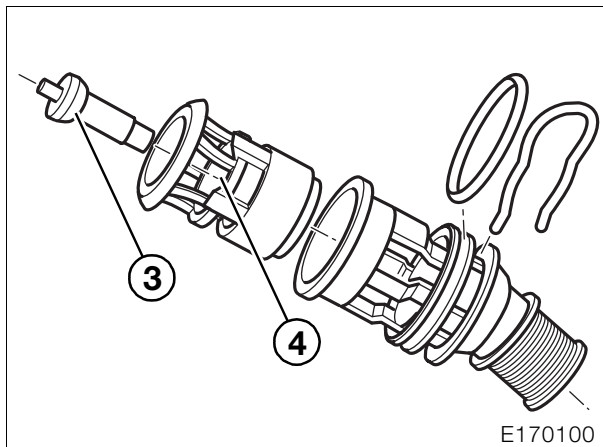
Radiator to main frame ..... 9 Nm  
 Expansion tank to radiator ..... 9 Nm  
 Coolant hoses to radiator/engine/frame ..... 3 Nm  
 Left and right covers to main frame ..... 2 Nm  
 Left and right covers to air duct ..... 3 Nm  
 Left and right covers to cover, front ..... 1 Nm  
 Cover, front, to main frame ..... 2 Nm  
 Cover, rear, to left and right covers and  
 stowage-compartment frame ..... 2 Nm  
 Left and right turn indicators to fairing bracket  
 ..... 3 Nm  
 Stowage-compartment rail to stowage-compartment  
 frame ..... 9 Nm

## 17 11 045 Removing and installing thermostat

- Remove left cover (⇒ 46.6).
- Drain coolant (⇒ 00.36).
- Do not close the radiator cap.



- Remove spring clip (1).
- Use a screwdriver to pry cover (2) out of the groove in the housing (arrow).



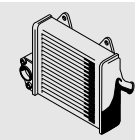
- Remove thermostat insert (4) with thermostat (3) from the housing.



### Note:

Check O-ring for cracks and replace if necessary.

- Installation is the reverse of the removal procedure.

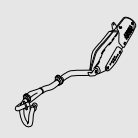


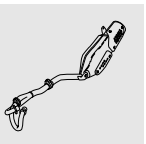
# 18 Exhaust system

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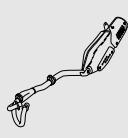
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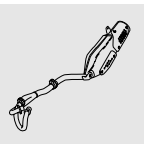


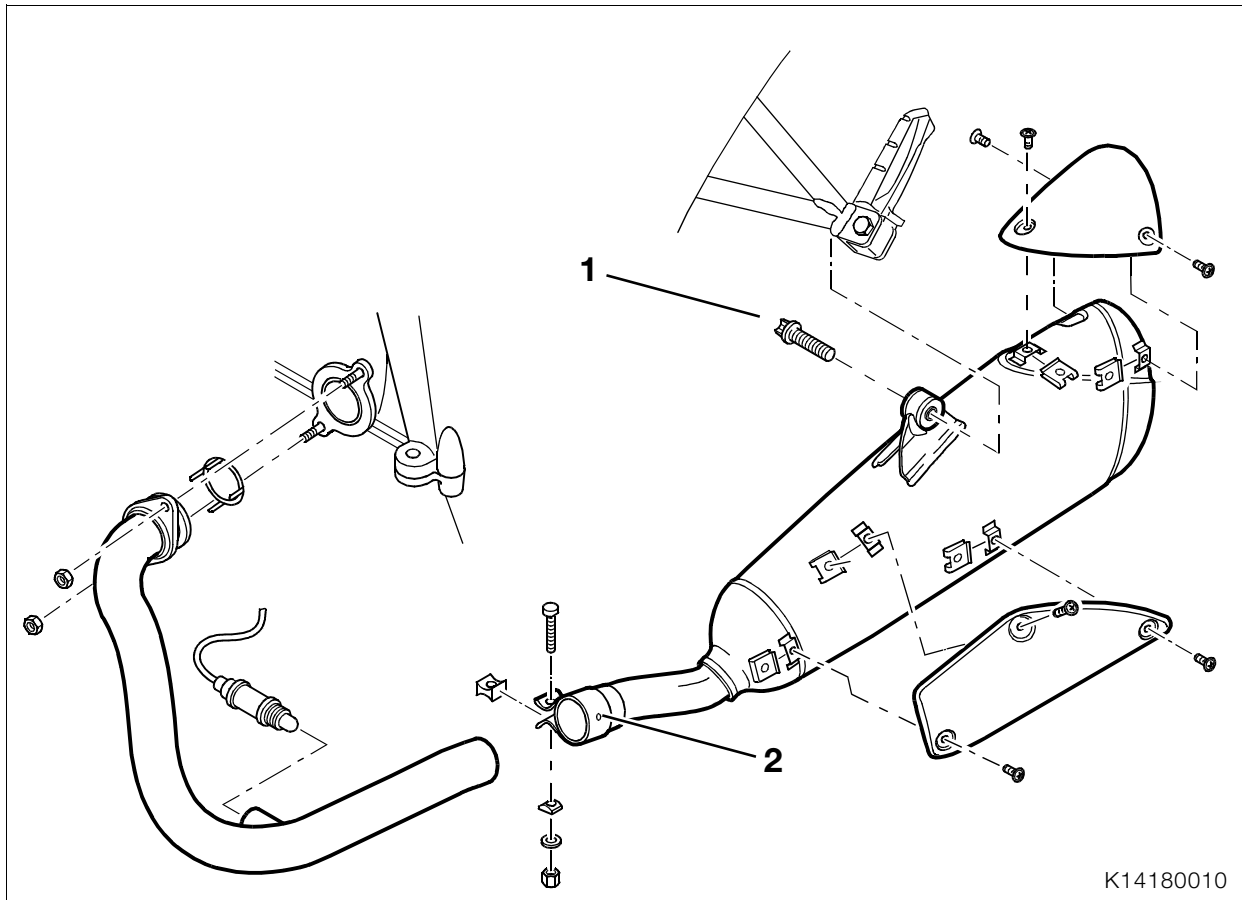




<b>Technical Data 18 Exhaust system</b>	<b>F 650 CS</b>
Type	Combination reflection/absorption system
Emission control	3-way catalytic converter
Silencer (muffler)	Reflection/absorption







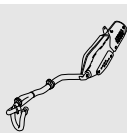
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### 18 00 020 Removing and installing exhaust system

### 18 11 301 Removing and installing silencer (muffler)

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.

- Extend the side stand and slacken clamp (2) for silencer.
- Remove the fastener securing the silencer to the rear frame (1).
- Carefully pull the silencer to the rear and remove, taking care not to scratch the bottom truss and the frame.



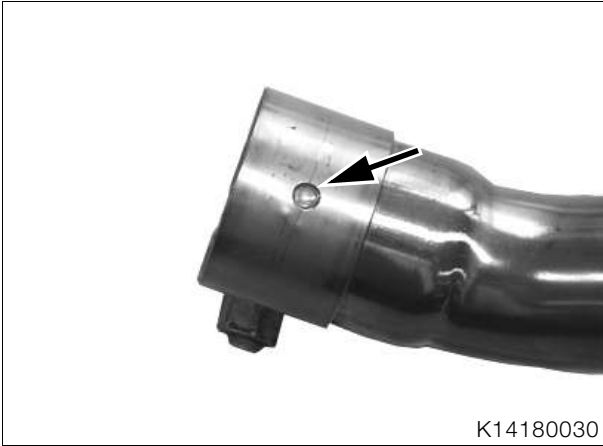
- Use adhesive tape to mask the rim at the silencer (arrow).

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



**Note:**

Before installing it on the silencer, coat the inside of the clamp with **Optimoly TA**.

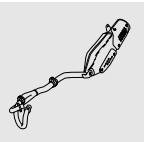


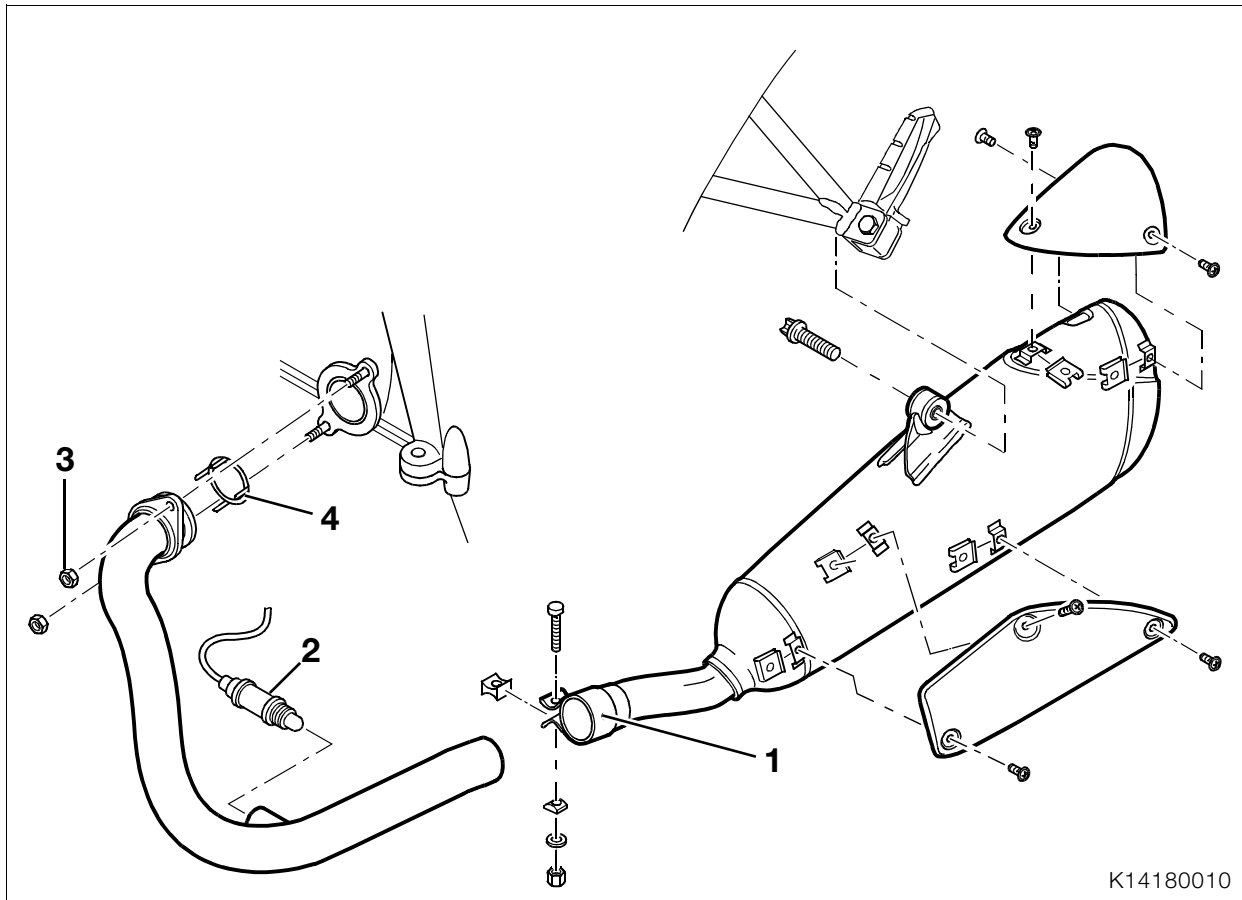
- Make sure that the clamp is correctly positioned (arrow).
- Slide the silencer onto the exhaust elbow, taking care not to scratch the bottom truss and the frame.



**Tightening torque:**

Clamp for silencer ..... 55 Nm  
Silencer to rear frame ..... 41 Nm





K14180010

### 18 11 151 Removing and installing exhaust elbow and oxygen sensor

#### Removing exhaust elbow and oxygen sensor

- Loosen clamp (1) for silencer.
- Disconnect the plug for oxygen sensor (2).
- Extend side stand.
- Remove fasteners (3) securing elbow to cylinder head.
- Remove the exhaust elbow and remove seal (4).
- Remove oxygen sensor (2).

#### Installing exhaust elbow and oxygen sensor

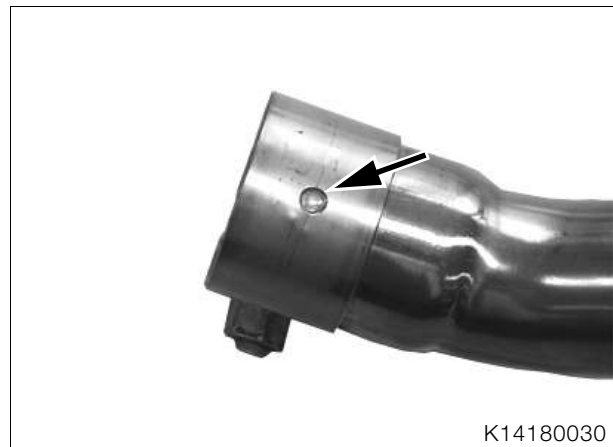


#### Note:

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 elbow.
- Introduce the exhaust elbow into the silencer and into the cylinder head.

- Uniformly tighten the fasteners securing the exhaust elbow to the cylinder head



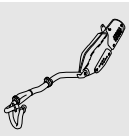
K14180030

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

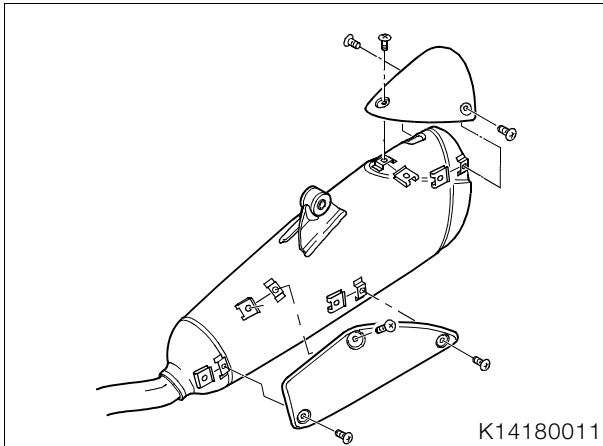


#### Tightening torque:

Oxygen sensor to exhaust.....	45 Nm
Exhaust elbow to cylinder head.....	20 Nm
Clamp for silencer.....	55 Nm



## 18 12 212 Replacing guard for silencer

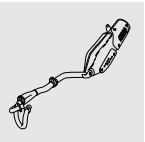


- Remove the fasteners securing the guard to the silencer and remove the guard.
- Installation is the reverse of the removal procedure.



### **Tightening torque:**

Guard to silencer..... 5 Nm

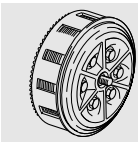


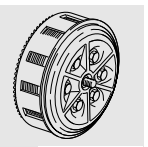
# 21 Clutch

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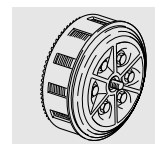
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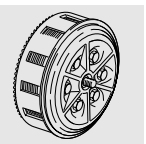




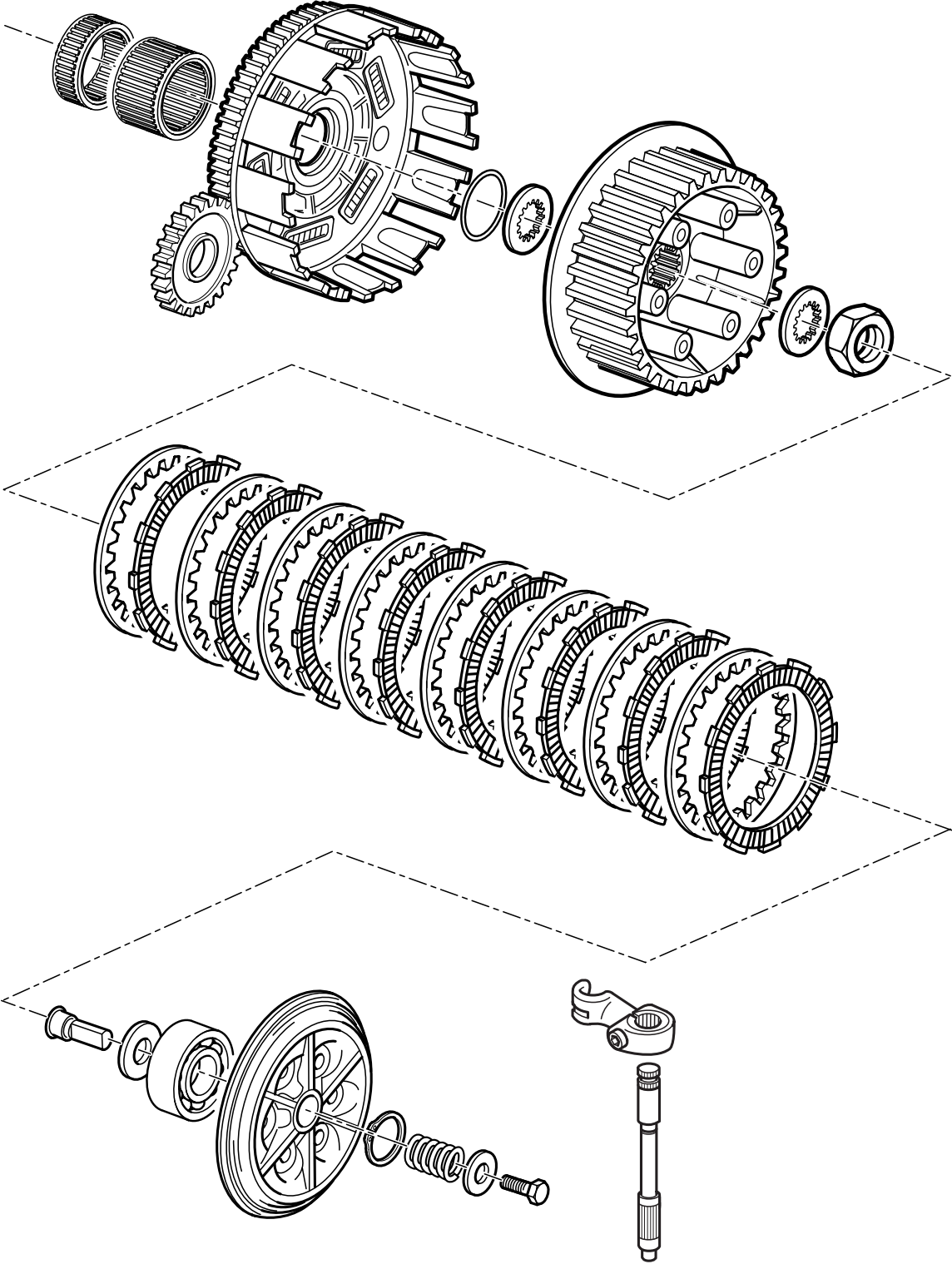


Technical Data 21 Clutch		F 650 CS
Type		Pull-action multi-plate clutch in oilbath
Clutch plate Ø	mm (in)	145 (5.71)
Wear limits		
Lined plate distortion	mm (in)	0.25 (0.01)
Steel plate distortion	mm (in)	0.15 (0.006)
Overall height of lined plates	mm (in)	27.5 (1.083)
Overall height of plate cluster	mm (in)	39.1 (1.539)
Operation		mechanical
Clutch operating clearance at handlebar lever	mm (in)	1.0 - 2.0 (0.039 - 0.079)





Clutch, components

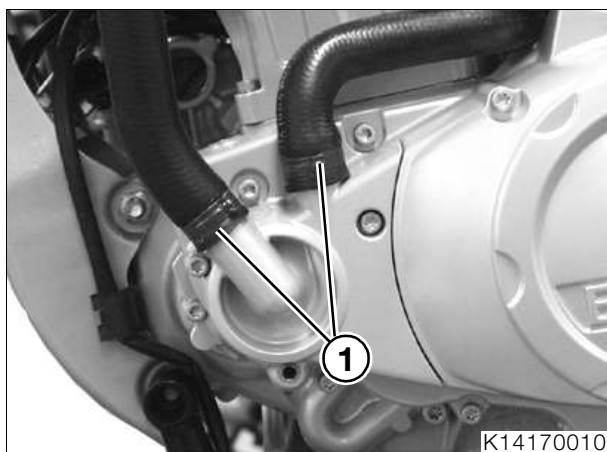


E210010

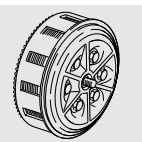
## 21 21 000 Removing and installing clutch

### 21 21 000 Removing clutch

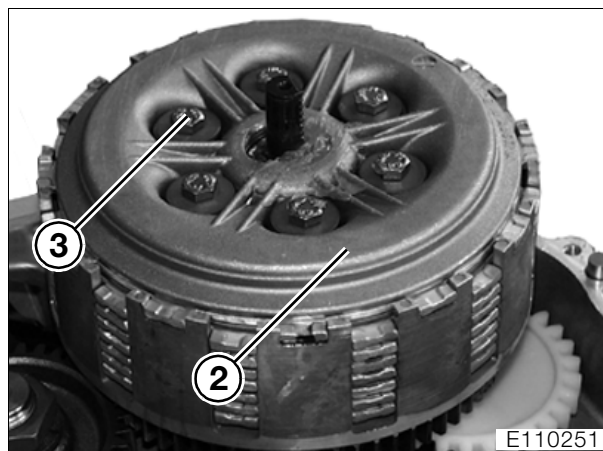
- Drain coolant (→ 00.36).
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Drain the engine oil from the engine (→ 00.30).
- Remove complete exhaust system (→ 18.5).
- Mark the position of the shift pedal on its shaft.
- Remove the gear shift pedal.
- Remove starter (→ 12.9).
- Disengage the clutch cable from the actuating shaft and remove the cable from the guide in the cover.



- Open hose clamps (1) with pliers, **BMW No. 17 5 500**.
- Remove left engine cover.

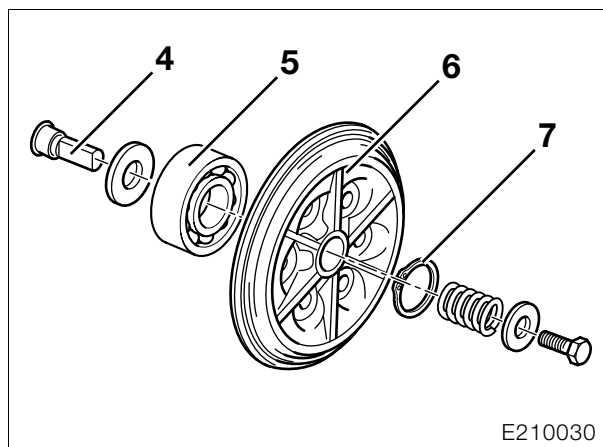


### Removing pressure plate



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

### Disassembling and reassembling pressure plate



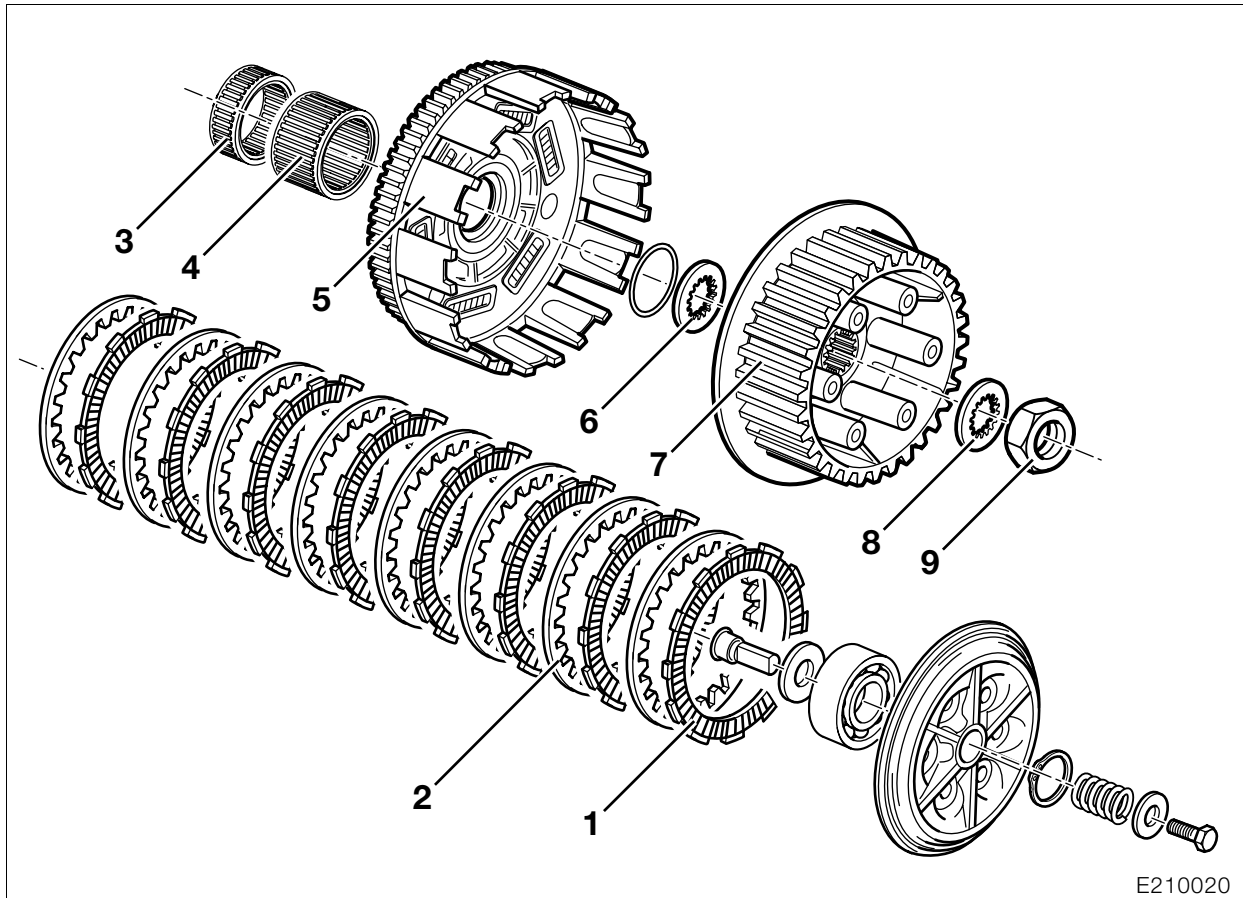
- Remove circlip (7) with circlip pliers.
- Check splines on release head (4).
- Heat pressure plate (6) to 80 °C (176 °F) and drive out grooved ball bearing (5), using a suitable drift (such as a socket, for example).



#### 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 disassembling the clutch plate cluster, mark the order in which the plates are installed.

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



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

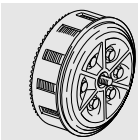
- Remove lock washer (8).

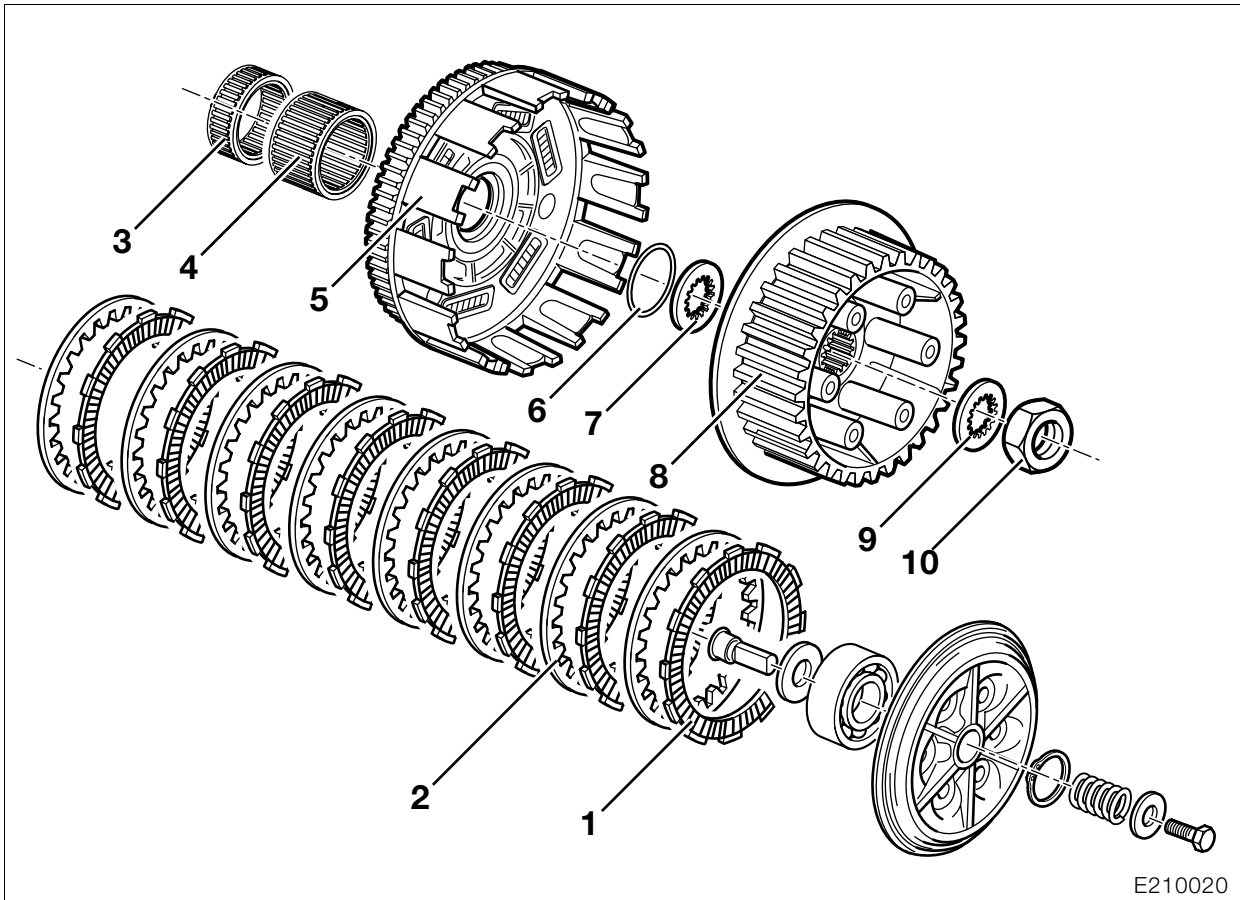


**Note:**

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

- 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)

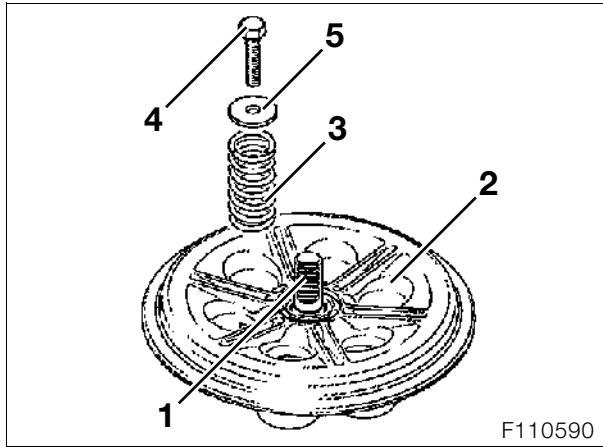
Distortion of lined plates..... 0.25 mm (0.01 in)

Distortion of steel plates..... 0.15 mm >(0.006 in)



#### Tightening torque:

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



F110590

- Install pressure plate (2).



**Note:**

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

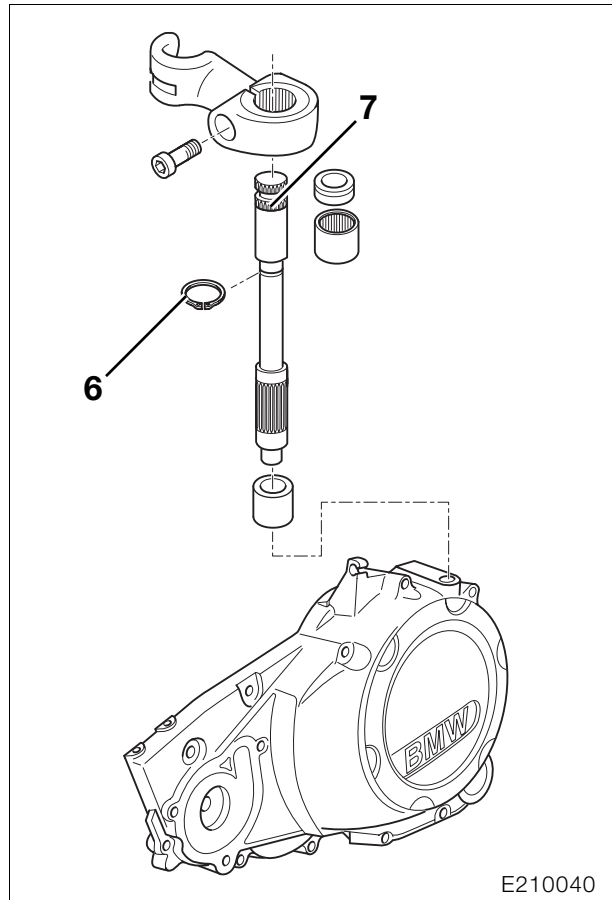
- Install springs (3).
- Uniformly tighten screws (4) with washers (5) in diagonally opposite sequence.
- Position thrust head (1) correctly in relation to the release shaft and hold temporarily in position with grease.



**Tightening torque:**

Thrust plate to driver ..... 10 Nm

**Removing and installing release shaft**



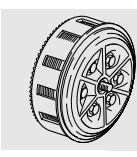
E210040

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



**21 4 610**

E210050



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

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

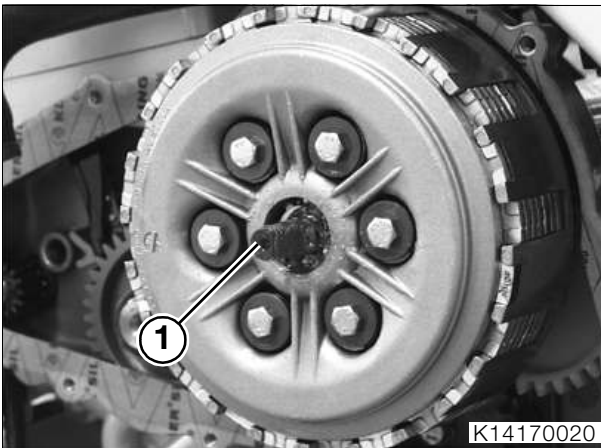
## 21 21 000 Installing clutch



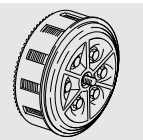
### Note:

Always replace selector shaft sealing ring in clutch cover and seal of cover.

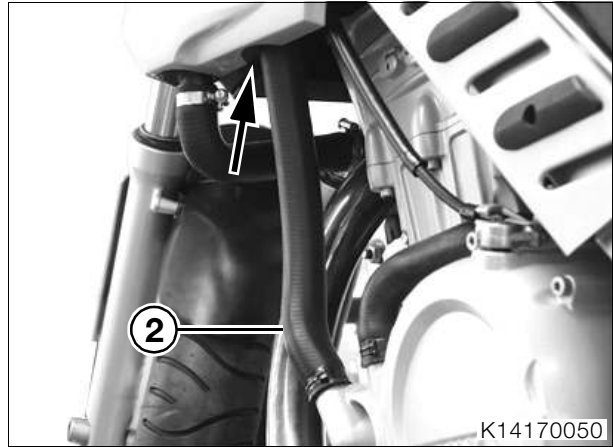
- Remove sealing ring of selector shaft.



- Position thrust head (1) correctly in relation to the release 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.
- Install new selector shaft sealing ring in clutch cover with sliding sleeve, **BMW No. 21 4 620**, and drift, **BMW No. 21 4 630**.



- Replace sealing ring on drain plug.



### Attention:

Turn hose curvature (2) toward the outside. Check distance from coolant hose to side cover (arrow) (approx. 10 mm (0.39 in)).

- Close hose clamps with pliers, **BMW No. 17 5 500**.
- Connect the clutch cable to the release shaft.
- Install the gear shift lever.
  - Install starter motor (➡ 12.9).
  - Install exhaust system (➡ 18.5).
  - Top up engine oil to correct level (➡ 00.31).
  - Top up coolant to correct level (➡ 00.36).



### Tightening torque:

Engine cover, left .....	10 Nm
Cover for water pump .....	10 Nm
Drain plug for water pump .....	10 Nm
Exhaust elbow to cylinder head .....	20 Nm
Silencer to rear frame .....	41 Nm
Selector lever to selector shaft .....	9 Nm
Starter to clutch cover .....	10 Nm
Oil drain plug, engine .....	40 Nm
Release lever to release shaft .....	10 Nm

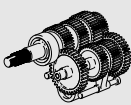


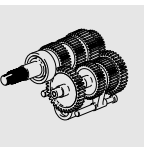
# 23 Gearbox

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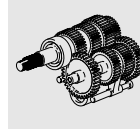
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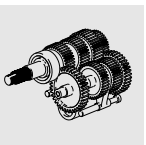
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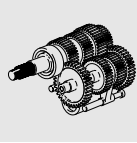
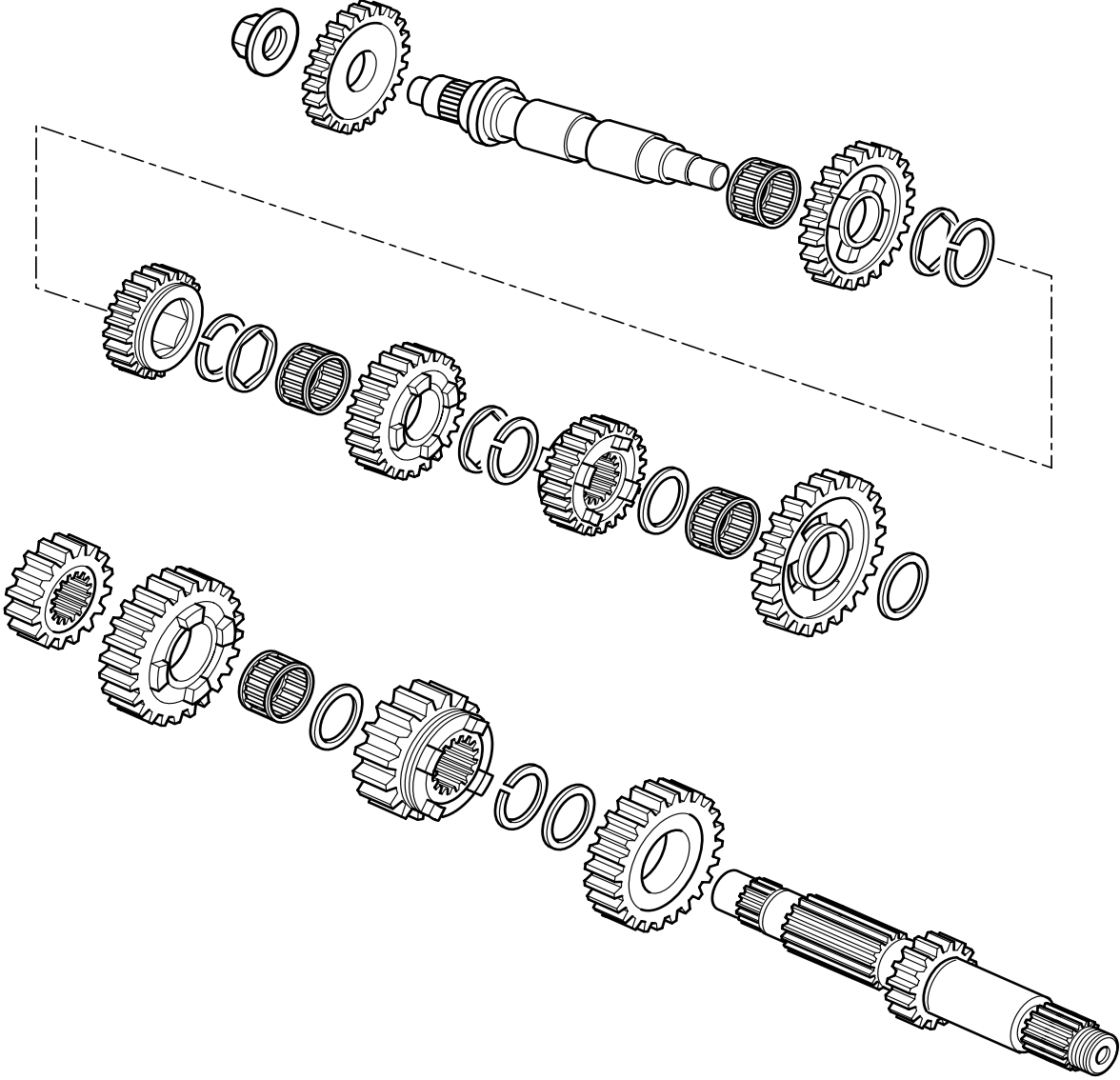


Technical Data 23 Transmission		F 650 CS
Type	5-speed, integrated into engine block	
Gearshift type	Claw action	
<b>Gear ratio</b>		
1st gear	12/33 = 1 : 2.750	
2nd gear	16/28 = 1 : 1.750	
3rd gear	16/21 = 1 : 1.313	
4th gear	22/23 = 1 : 1.045	
5th gear	25/21 = 1 : 0.840	
<b>Engine ratio</b>		
1st gear	1 : 5.352	
2nd gear	1 : 3.406	
3rd gear	1 : 2.555	
4th gear	1 : 2.034	
5th gear	1 : 1.635	
<b>Wear limit values for selector fork</b>		
Selector fork guide journal diameter	mm (in)	5.85 (0.23)
Thickness at contact faces	mm (in)	3.45 (0.136)
<b>Wear limit values for mainshaft</b>		
Shaft diameter, magnet end	mm (in)	24.98 (0.983)
Shaft diameter, clutch end	mm (in)	16.98 (0.669)
<b>Wear limit values for countershaft</b>		
Shaft diameter, magnet end	mm (in)	16.98 (0.669)
Shaft diameter, clutch end	mm (in)	24.97 (0.983)

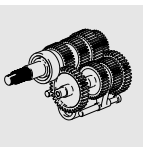
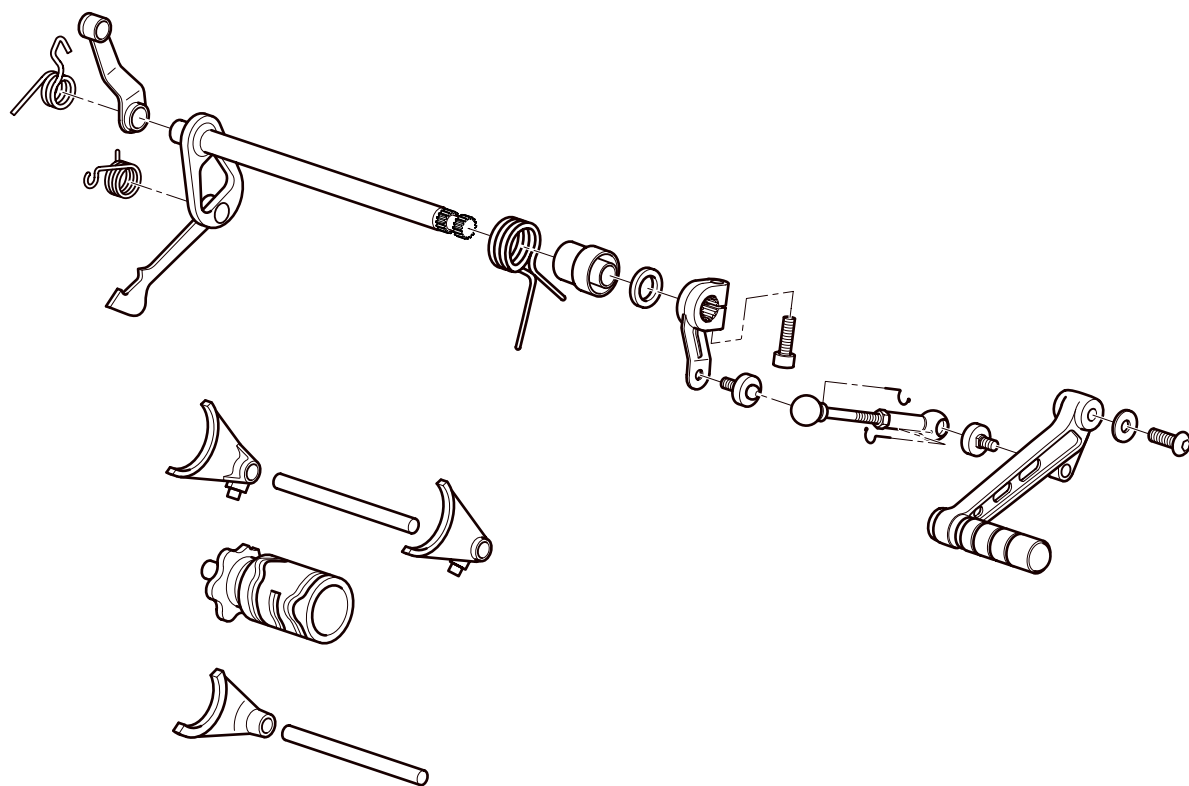




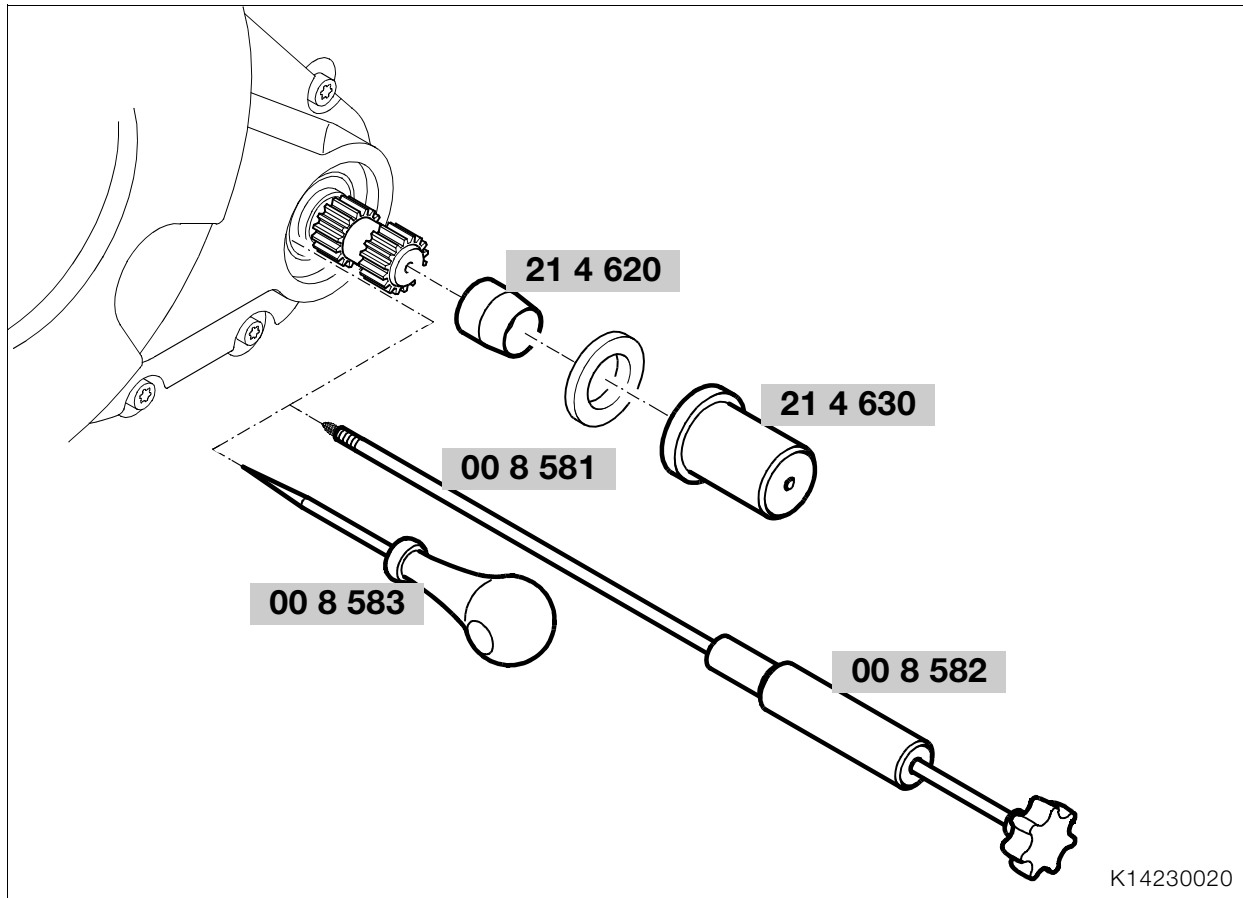
**Gearbox shafts, components**



# Gear shift pedal, components



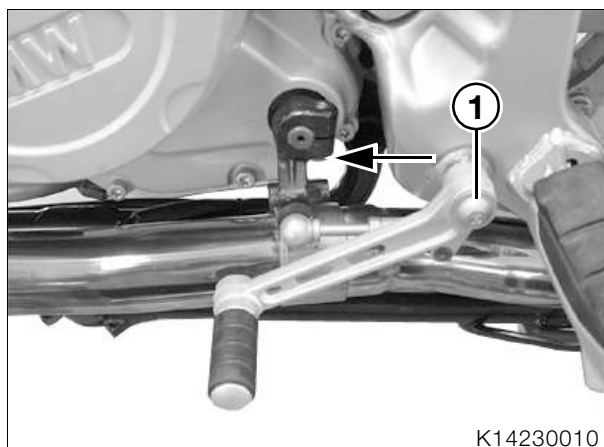
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### 23 00 Replacing shaft sealing rings with engine installed

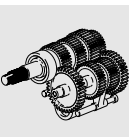
#### 23 00 Replacing sealing ring of selector shaft

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Extend side stand.
- Remove exhaust system (→ 18.5).
- Remove seal.



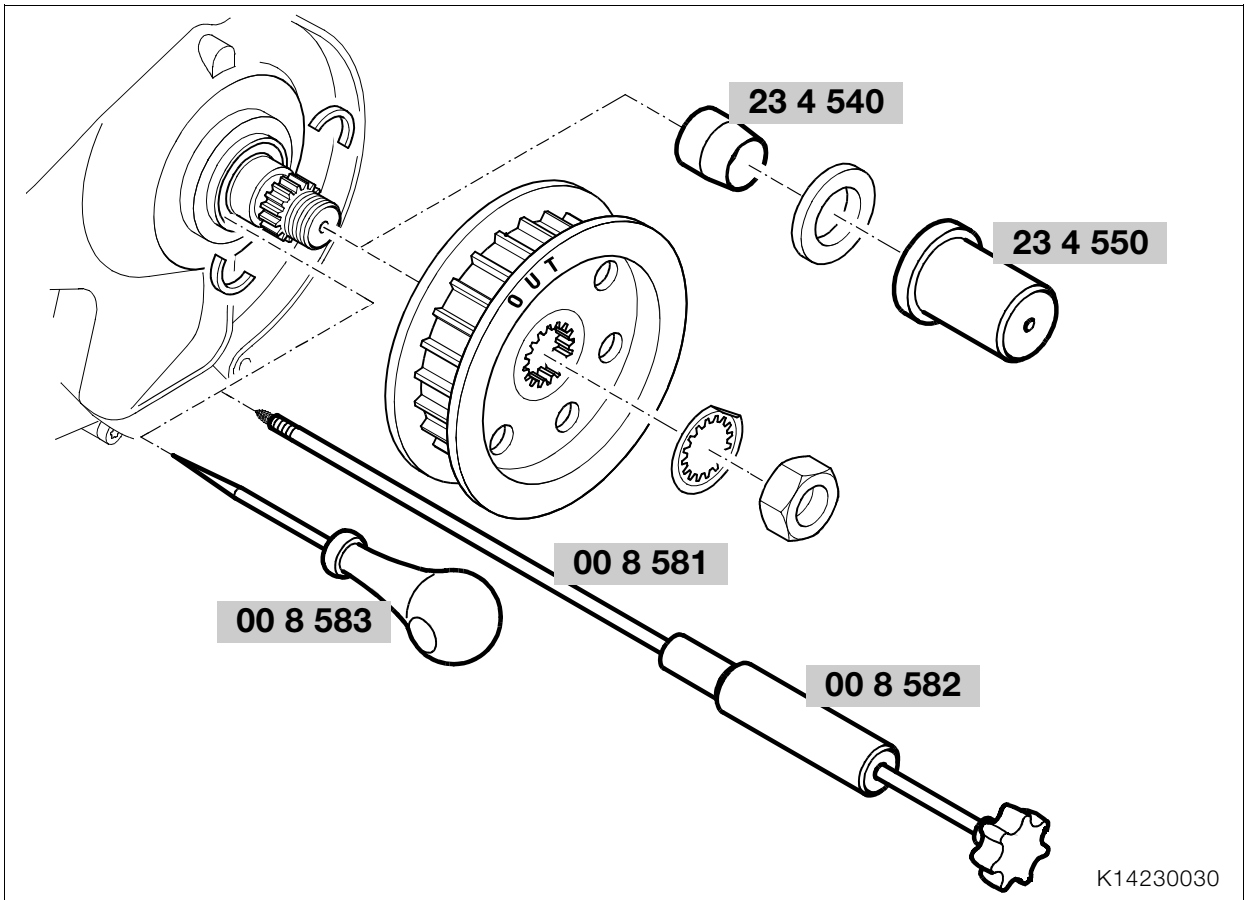
- Slacken screw securing shaft lever (1) to main frame.

- Mark the position of the shaft lever on its shaft.
- Slacken the screw (arrow) on the shaft lever.
- Remove the shaft lever and the gear pedal.
- Pierce the shaft sealing ring with awl, **BMW No. 00 8 583**.
- Screw the pull rod, **BMW No. 00 8 581**, into the pierced hole and use impact weight, **BMW No. 00 8 582**, to remove the shaft sealing ring.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Cover the splines on the selector shaft with slide-on sleeve, **BMW No. 21 4 620**.
- Slide the shaft sealing ring into position.
- Using drift, **BMW No. 21 4 630**, drive in sealing ring.
- The angle between shaft lever and shift linkage is 90°.



#### ⚠ Tightening torque:

Shaft lever to gearshift shaft .....	9 Nm
Shift pedal to main frame .....	21 Nm
Exhaust elbow to cylinder head .....	20 Nm
Silencer to rear frame .....	41 Nm



### 23 00 Replacing shaft sealing ring of belt sprocket

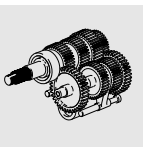
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the belt sprocket (→ 27.5).
- Pierce the shaft sealing ring with awl, **BMW No. 00 8 583**.
- Screw the pull rod, **BMW No. 00 8 581**, into the pierced hole and use impact weight, **BMW No. 00 8 582**, to remove the shaft sealing ring.

- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Cover the splines on the shaft with slide-on sleeve, **BMW No. 23 4 540**.
- Slide the shaft sealing ring into position.
- Using drift, **BMW No. 23 4 550**, drive in sealing ring.

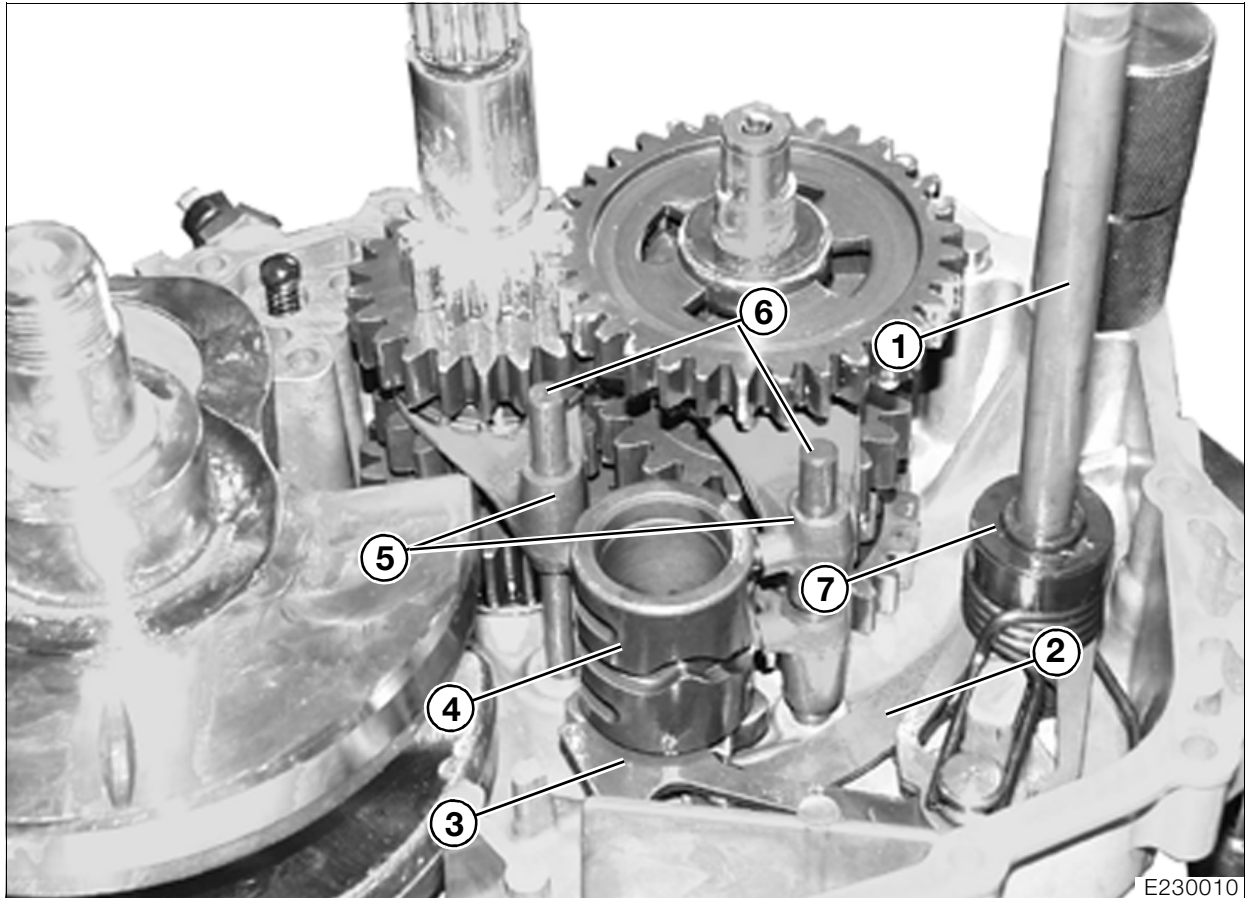


#### ⚠ Tightening torque:

Belt cover to swinging arm.....	9 Nm
Nut of belt sprocket to gearbox output shaft (clean thread + Loctite 638).....	180 Nm
Sprocket cover to engine.....	2 Nm







### 23 00 100 Removing and installing gearbox

#### Attention:

If there is any mechanical damage, the oil tank must be flushed (→ 11.17).

- Remove engine (→ 11.24).
- Disassemble the engine (→ 11.26).

### 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 (1) with shift pawl (3) and thrust washer (7).
- Remove index lever (2) and spring.

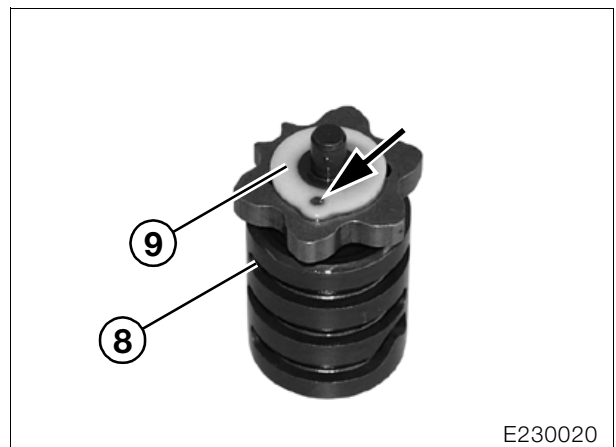
### 23 00 158 Removing selector forks

- Remove guide pins (6) from selector forks.

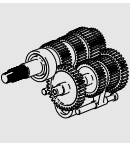
- Swing the selector forks (5) out and remove them.
- Inspect contact surfaces of selector forks and guide pins for signs of wear.

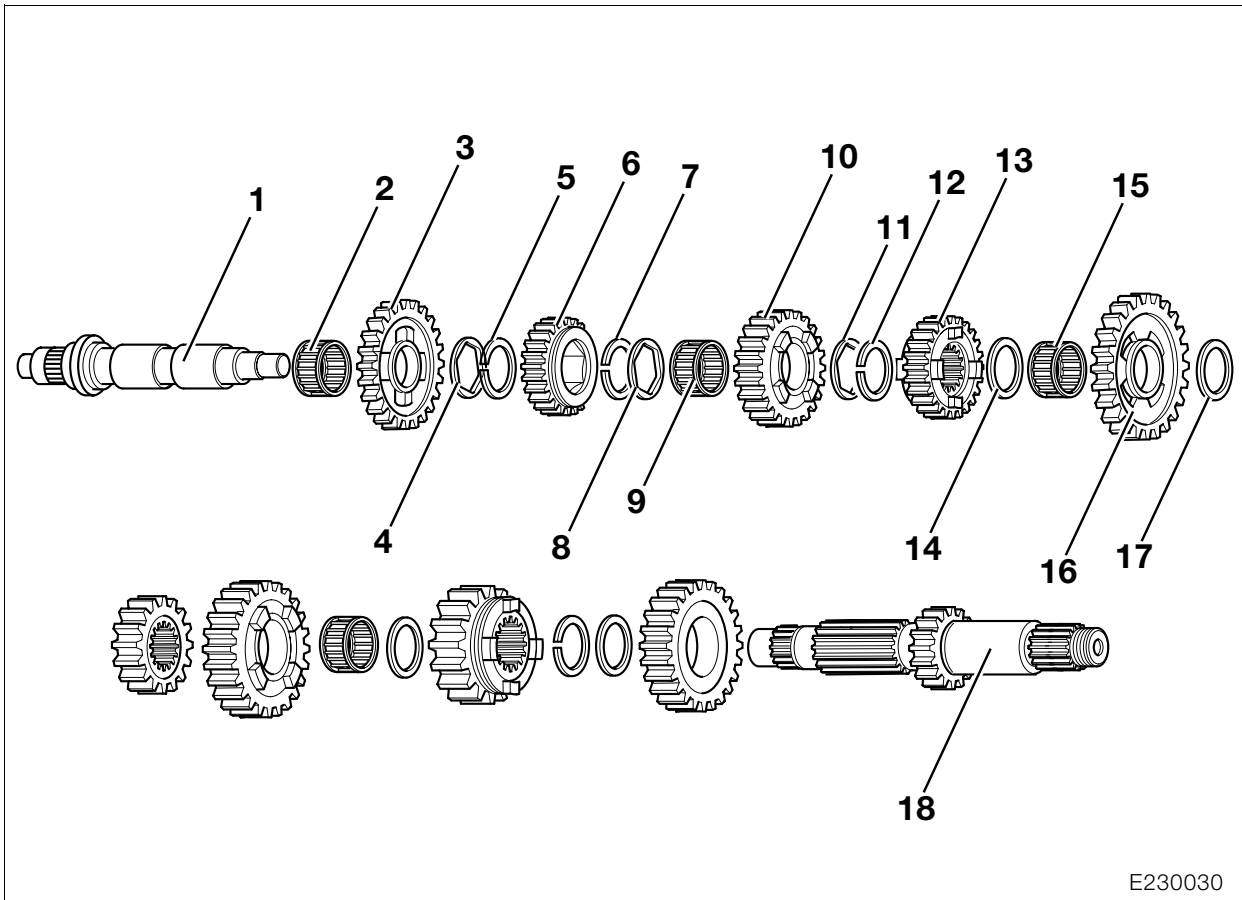
### 23 00 651 Removing selector drum

- Withdraw selector drum (4).



- Inspect selector shaft guide tracks (8) and insulating washer (9) 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 washers (14, 17) off the mainshaft.
- Tap mainshaft (1) and countershaft (18) 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.



### Attention:

Do not alter the stop on 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).



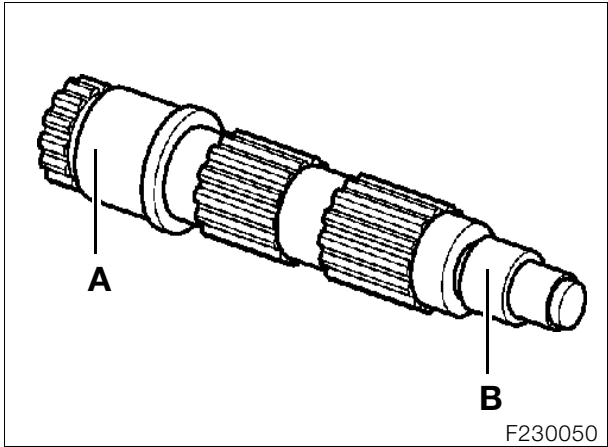
### Note:

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

Make sure that the ring grooves have sharp edges. Always replace circlips and install them only with special pliers, **BMW No. 23 4 500**.

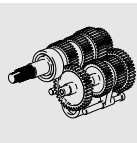
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Position retaining ring (7) approx. 3 mm (0.12 in) below the groove. After installing retaining ring (12), push retaining ring (7) up with gearwheel (6) until the retaining ring is seated in its groove.

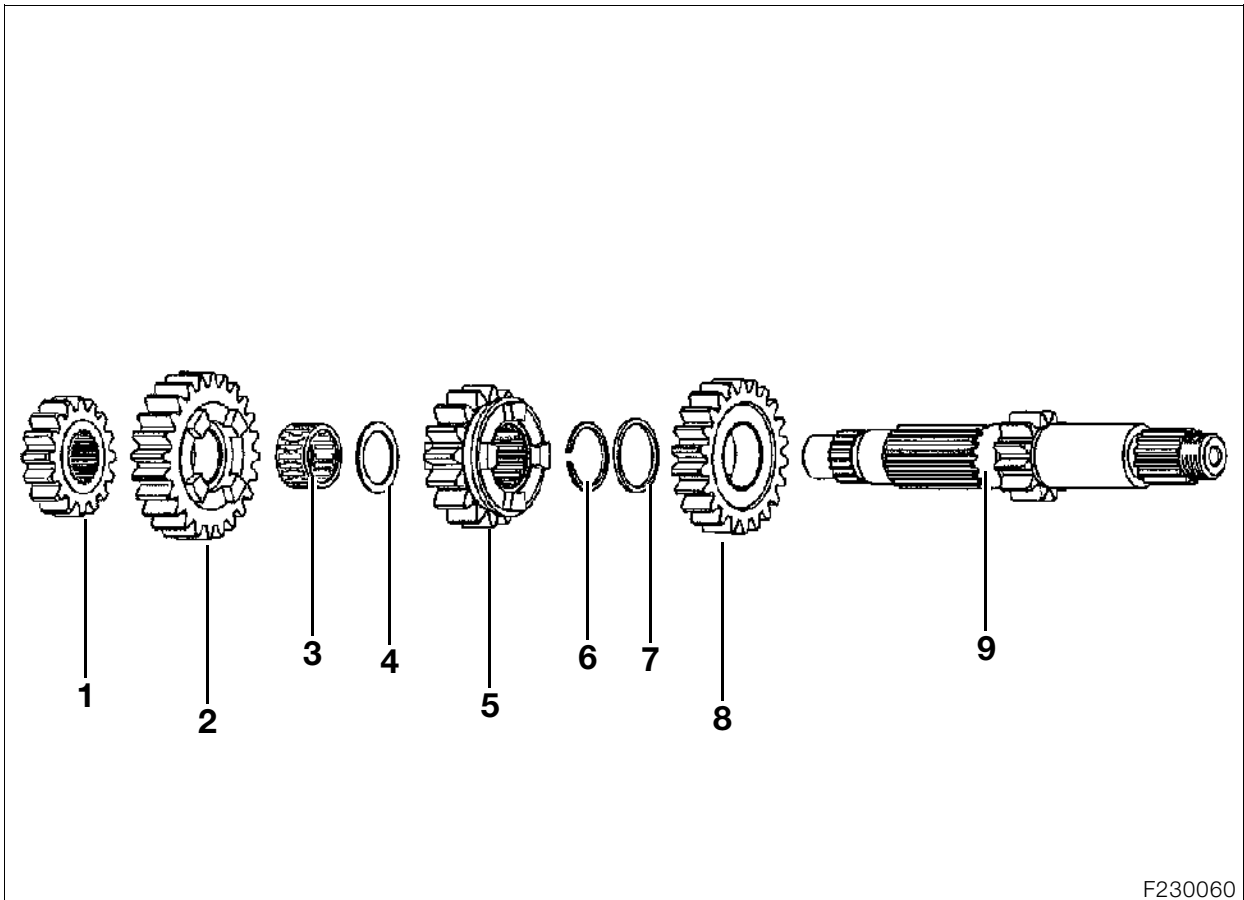
**Checking mainshaft for wear**



**Wear limits:**

"A" shaft diameter, magnet end. 24.98 mm (0.98 in)  
"B" shaft diameter, clutch end... 16.98 mm (0.67 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).



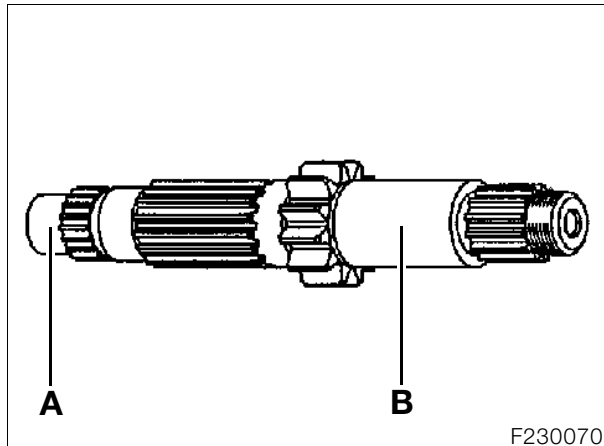
#### Note:

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

Make sure that the ring grooves have sharp edges. Always replace circlips and install them only with special pliers, **BMW No. 23 4 500**.

- Assembly is the reverse of the disassembly procedure.

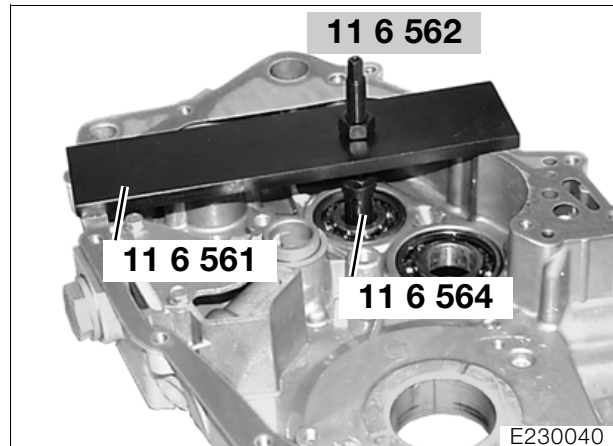
## Checking countershaft for wear



### Wear limits:

"A" shaft diameter, magnet end	.....min. 16.98 mm (0.669 in)
"B" shaft diameter, clutch end	.....min. 24.97 mm (0.983 in)
Inside diameter, bearing seat	.....max. 25.53 mm (1.005 in)
Sliding gear, 4th gear	.....max. 25.53 mm (1.005 in)
Runout	..... 0.02 mm (0.008 in)

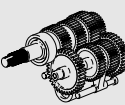
## 11 11 205 Replacing gearbox mainshaft bearings



### Note:

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

#### Magnet end:

Countershaft ..... max. dia. 46.99 mm (1.85 in)

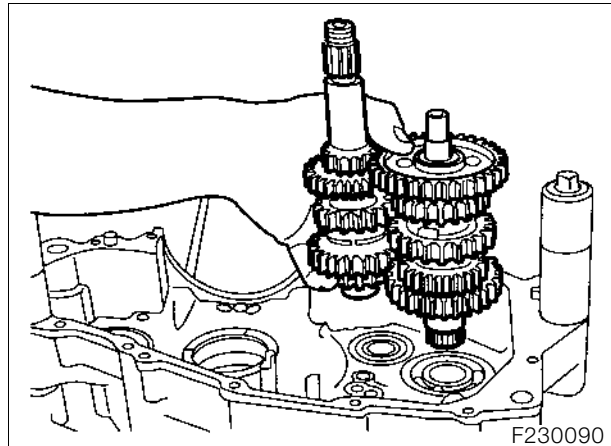
Mainshaft ..... max. dia. 62.02 mm (2.44 in)

#### Clutch end:

Countershaft ..... max. dia. 51.99 mm (2.05 in)

Mainshaft ..... max. dia. 46.99 mm (1.85 in)

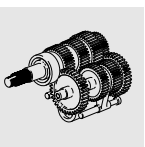
## 23 00 600 Installing gearbox shafts



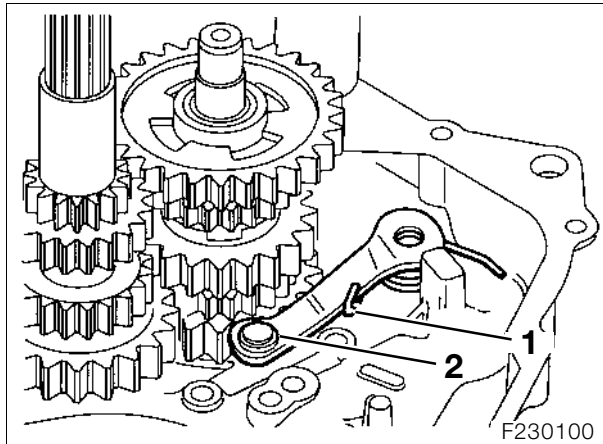
### Note:

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

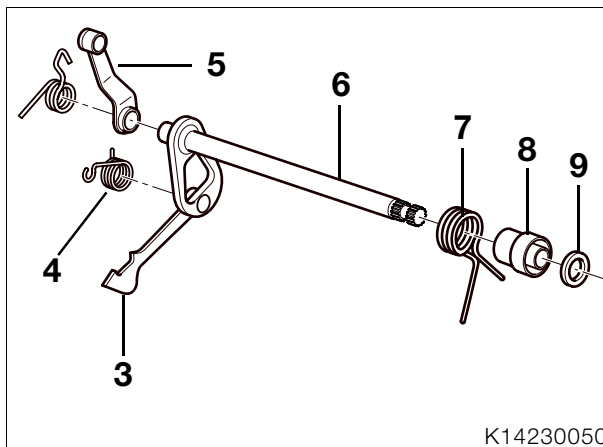
- Install the countershaft and mainshaft together, coating the main bearing journals with **Optimoly MP 3**.
- Drive the shafts in against their seats with light blows of a plastic-faced hammer.



## 23 00 640 Installing selector shaft

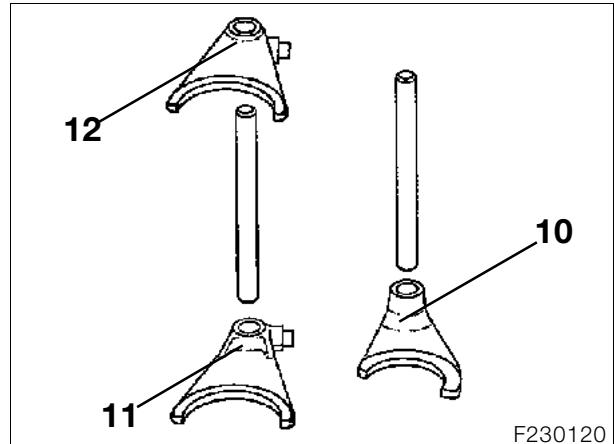


- Install index lever (2) with index spring (1) in housing.

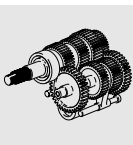


- Attach pawl spring (4) to shift pawl (3).
- Insert selector shaft (6) in housing and secure index lever (5) in position.
- Push hairpin spring (7) with sleeve (8) and thrust washer (9) on to selector shaft (6).
- Engage the hairpin spring on the pivot.

## 23 00 658 Installing selector forks



- Insert selector fork (10) in shift gear of countershaft.
- Insert selector rod and swivel together with the selector fork in the direction of the crankshaft.
- Insert selector forks (11, 12) in the corresponding shift gears of the mainshaft.
- Insert selector rod and swivel it outward together with the selector forks.



## 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.
- Drive the selector shafts onto their seats with light blows of a plastic-faced hammer.



### 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.

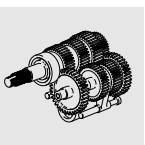
- Check gearbox functions.
- Assemble the engine (→ 11.45).



### Note:

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

- Select all gears once again and move the shift lever slowly to the "0" position.
- Cover the splines on the selector shaft with slide-on sleeve, **BMW No. 21 4 620**.
- Using drift, **BMW No. 21 4 630**, drive in sealing ring.
- Drive in the mainshaft sealing ring with drift, **BMW No. 23 4 550**, and sliding sleeve, **BMW No. 23 4 540**.
- Install the engine (→ 11.56).



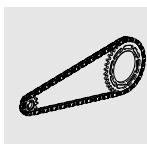


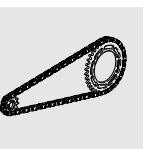
# 27 Chain/belt drive

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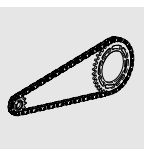
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Removing and installing belt sprocket (→ 33.13) .....	5
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Technical Data 27 Chain/belt drive		F 650 CS
Type		Poly Chain GT, 11M-1892-26
Secondary ratio		$28/82 = 1:2.929$
Number of teeth on belt sprocket		28
Number of teeth on belt drive gear		82
Number of teeth on belt		172
Belt length	mm (in)	1892 (74.49)



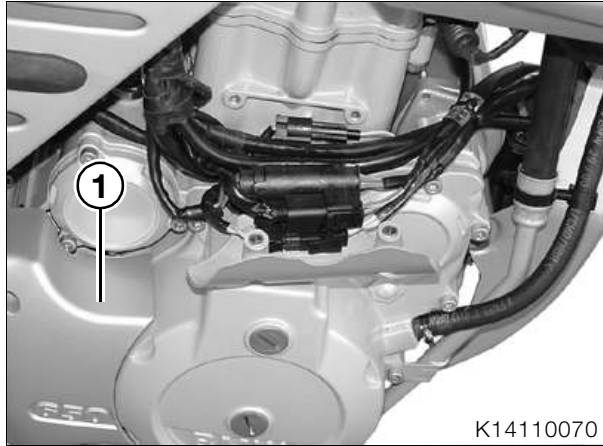


## 27 71 Removing and installing belt, belt drive gear and belt sprocket

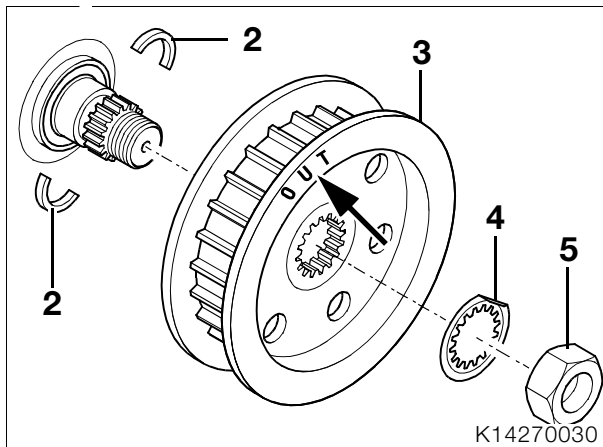
Removing and installing belt (→ 00.54)

Removing and installing belt sprocket (→ 33.13)

Removing and installing belt sprocket



- Remove cover for belt sprocket (1).



- Straighten the tabs of the locking washer (4).



### Warning:

Central nut (5) is secured with **Loctite 638** and considerable torque is required to release it.

- Engage 1st gear, apply the rear brake, and slacken central nut (5).
  - Slacken the belt (→ 00.54).
- Remove belt sprocket (3) and remove two-part thrust washer (2).

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



### Warning:

Do not bend the belt sharply or twist it. Do not bend the belt through a radius of less than 100 mm.

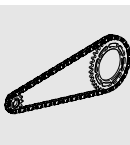
- Lightly coat the mainshaft with **Optimoly MP 3** before installing the belt sprocket.
- Place two-part thrust washer (2) in position, if necessary use a blob of grease to hold the two-part washer in position.
  - The belt sprocket (3) must be installed with the “OUT” marking (arrow) on the outside.
- Loop the belt over the belt sprocket and slide the sprocket onto the mainshaft.
- Install a new locking washer (4).
- Clean threads of central nut (5) and mainshaft, coat threads with **Loctite 638** and install nut.



### Tightening torque:

Sprocket cover to engine .....	2 Nm
Eccentric clamp, rear swinging arm .....	
Initial torque .....	10 Nm
Final torque .....	21 Nm
Belt sprocket to gearbox output shaft (clean thread + Loctite 638).....	180 Nm

## 27 71 Adjust belt tension (→ 00.56).

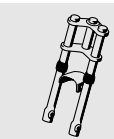


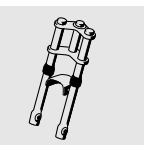
# 31 Front forks

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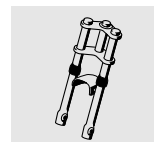
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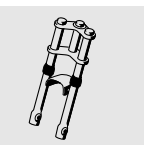




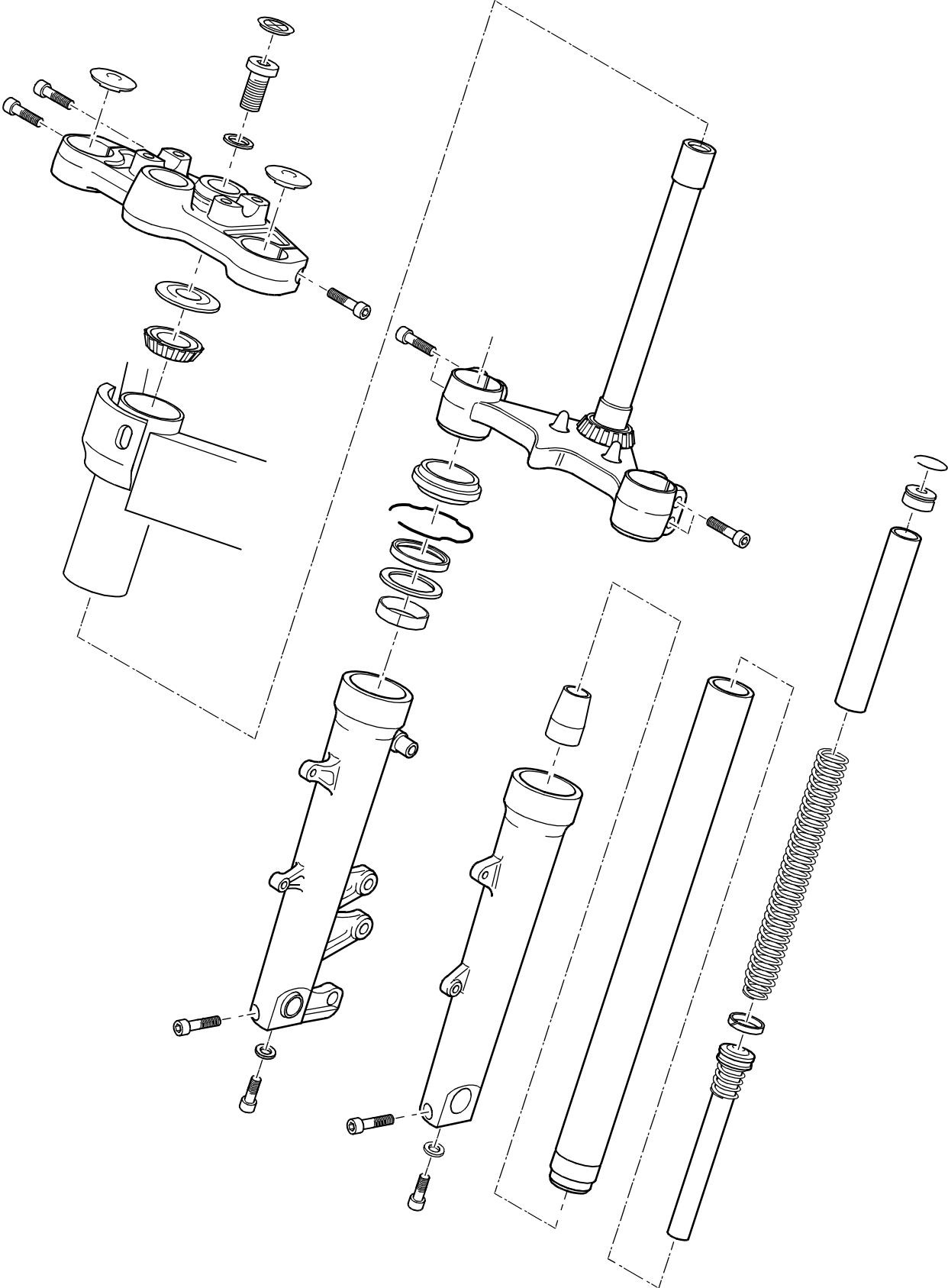
Technical Data 31 Front suspension		F 650 CS
Type		Telescopic fork
<b>Running gear</b>		
Total travel at wheel	mm (in)	125 (4.92)
Castor in normal position (full fuel load and 85 kg rider)	mm (in)	86 (3.39)
Steering lock angle	°	37
<b>Fixed fork tube</b>		
Fixed tube surface		Hard chrome plated
Extl. dia. of fixed fork tubes	mm (in)	41 (1.61)
Fixed fork tube runout limit	mm (in)	0,1 (0.004)
Installed (test) length of fixed tubes	mm (in)	273.5 (10.77)
Grease in sleeve		Retinax EP 2
<b>Fork spring</b>		
Length of suspension spring in fork	mm (in)	365 (14.37)
Wire diameter of suspension spring	mm (in)	4.8 (0.19)
<b>Fork oil</b>		
Approved grades		BMW telescopic-fork oil
Capacity per fork leg		
Initial filling	l (Imp. pints/US quarts)	0.48 (0.85/0.51)
Oil changes	l (Imp. pints/US quarts)	0.47 (0.83/0.50)







Telescopic fork, components



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## 3142 Removing and installing telescopic fork

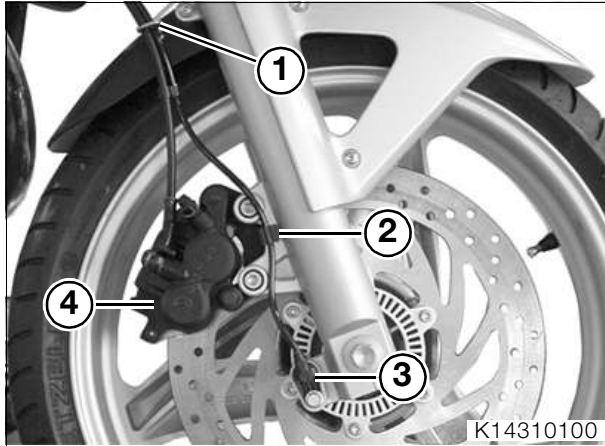
### 3142 Removing telescopic fork



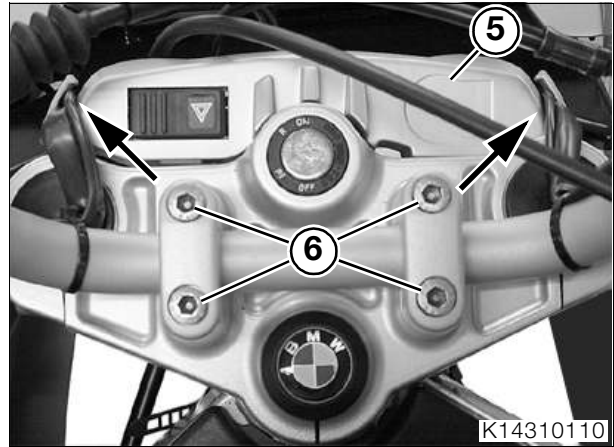
#### Attention:

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

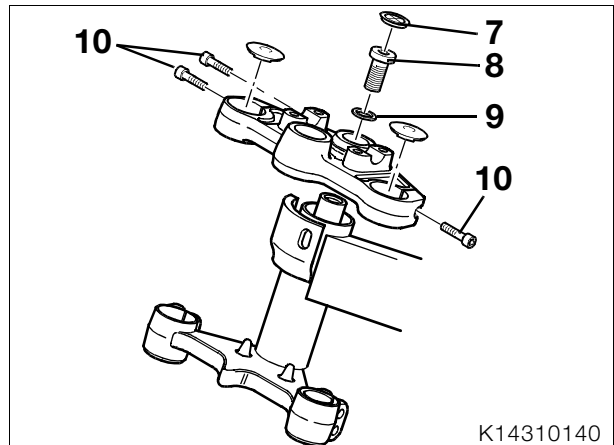
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



- Remove ABS sensor (3) and disengage it from clip (2).
- Remove ABS sensor cable and brake hose from clip (1).
- Release front brake caliper (4) and secure to engine shell with cable ties to keep strain off the brake line.
- Remove front wheel (⇒ 36.5).
- Remove front mudguard (⇒ 46.11).
- Separate plug connector for horn.
- Lay protective apron, **BMW No. 16 1 611**, over the tank.



- **[Hazard warning flashers]** Remove fasteners for cover of hazard warning flasher switch (5) and retaining bar from below. Remove retaining bar.
- **[Hazard warning flashers]** Remove left/right cables from clips (arrows) and lay the cover down on the left-hand side.
- Remove fasteners (6) from handlebars and lay the handlebars down at the front.



- Remove cap (7) and back off adjusting screw (8).
- Remove washer (9).



#### Attention:

When removing the upper fork bridge, secure the front forks so that they cannot slip out.

- Loosen clamp screws of upper fork bridge (10) and remove upper fork bridge.
- Pull front forks down to remove.



### 3142 Installing telescopic fork

- Fit lower fork bridge into steering head.

**⚠ Attention:**

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

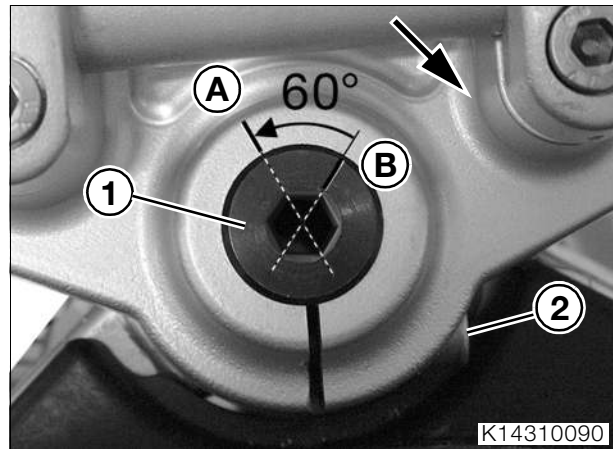
- Fit upper fork bridge and install adjusting screw.



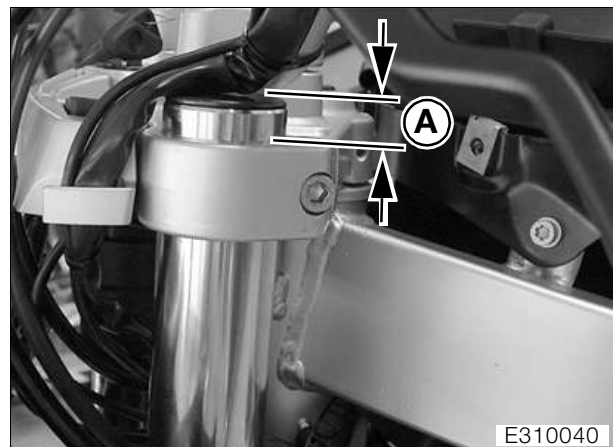
**📌 Note:**

Make sure that throttle cable (1) and clutch cable (2) are correctly routed.

- Slide fixed fork tubes without caps into fork bridges, projection approx. 12 mm (0.472 in) above upper fork bridge.
- Tighten clamp screws at lower fork bridge.



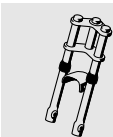
- Slacken adjusting screw (1) and tighten to 25 Nm.
- Turn forks back and forth twice from lock to lock, and leave the forks at the full left lock position.
- Back off adjusting screw through 60°, by applying mark (A) to housing and mark (B) to adjusting screw with felt pen (removable ink) and turning the adjusting screw until the marks are aligned.
- Tighten the clamping screw (2).
- Slacken clamping screws at lower fork bridge.



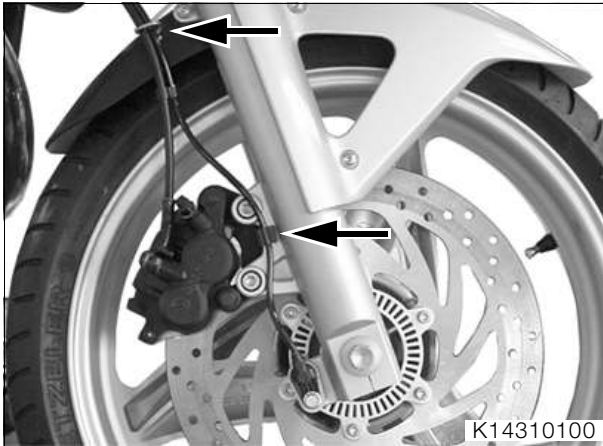
- Slide in fixed fork tubes with caps until projection above upper fork bridge is equal to distance "A".

Distance "A" ..... 12 mm (0.472 in)

- Tighten clamp screws at upper and lower fork bridges.



- Fit caps to fork legs.
- Install handlebars (→ 32.9).
- Check steering head bearing play (→ 00.60).
- Install cover for hazard warning flashers switch and retaining bar and snap cables on left and right into guides.
- Install front mudguard (→ 46.11).
- Install the front wheel (→ 36.5).
- Connect the plug for the horn.



- Install brake caliper and ABS sensor.



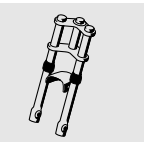
**Note:**

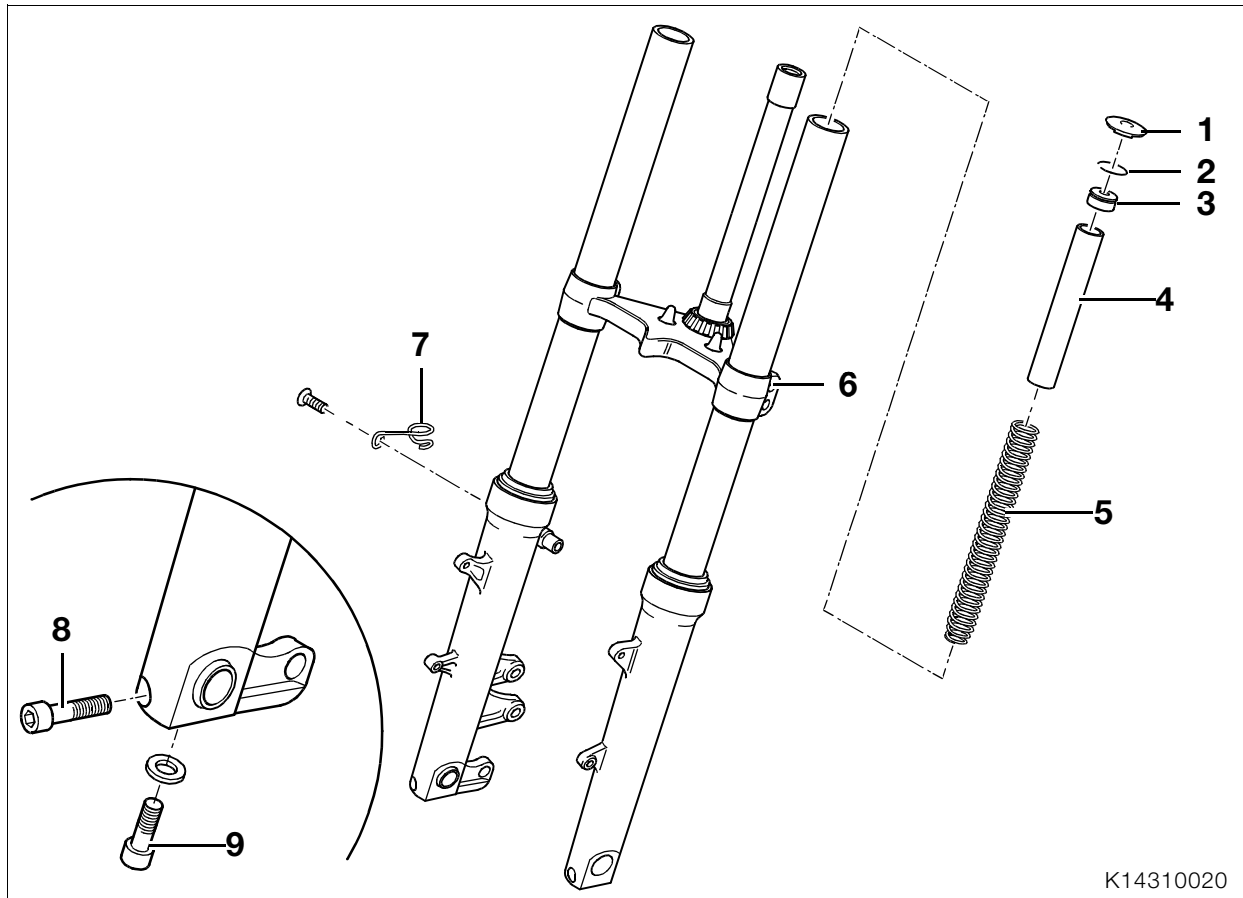
Make sure that ABS sensor cable and brake hose are correctly routed.



**Tightening torque:**

Clamp screws for fork bridge .....	23 Nm
Initial torque of adjusting screw .....	25 Nm
Back off through angle of rotation .....	60°
Handlebar to fork bridge .....	23 Nm
Cover for hazard warning flasher switch .....	5 Nm
Guide to fork bridge .....	5 Nm
Front mudguard to slider tube .....	3 Nm
Front mudguard, front section, to front mudguard, rear section .....	3 Nm
Clamp for quick-release axle, front.....	23 Nm
Quick-release axle, front, to fork leg.....	30 Nm
Brake caliper to slider tube.....	41 Nm
ABS sensor to holder .....	9 Nm





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### 31 42 503 Disassembling telescopic fork

#### Removing fixed tube

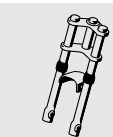
- Remove clamp (7).
- Remove horn.
- Slacken clamping screws (6) at lower fork bridge.
- Remove fixed tube together with slider tube from fork bridge.
- Clamp slider tube in vise with protective jaws.
- Position a drip tray beneath the fixed tube.
- Remove sealing caps (1).

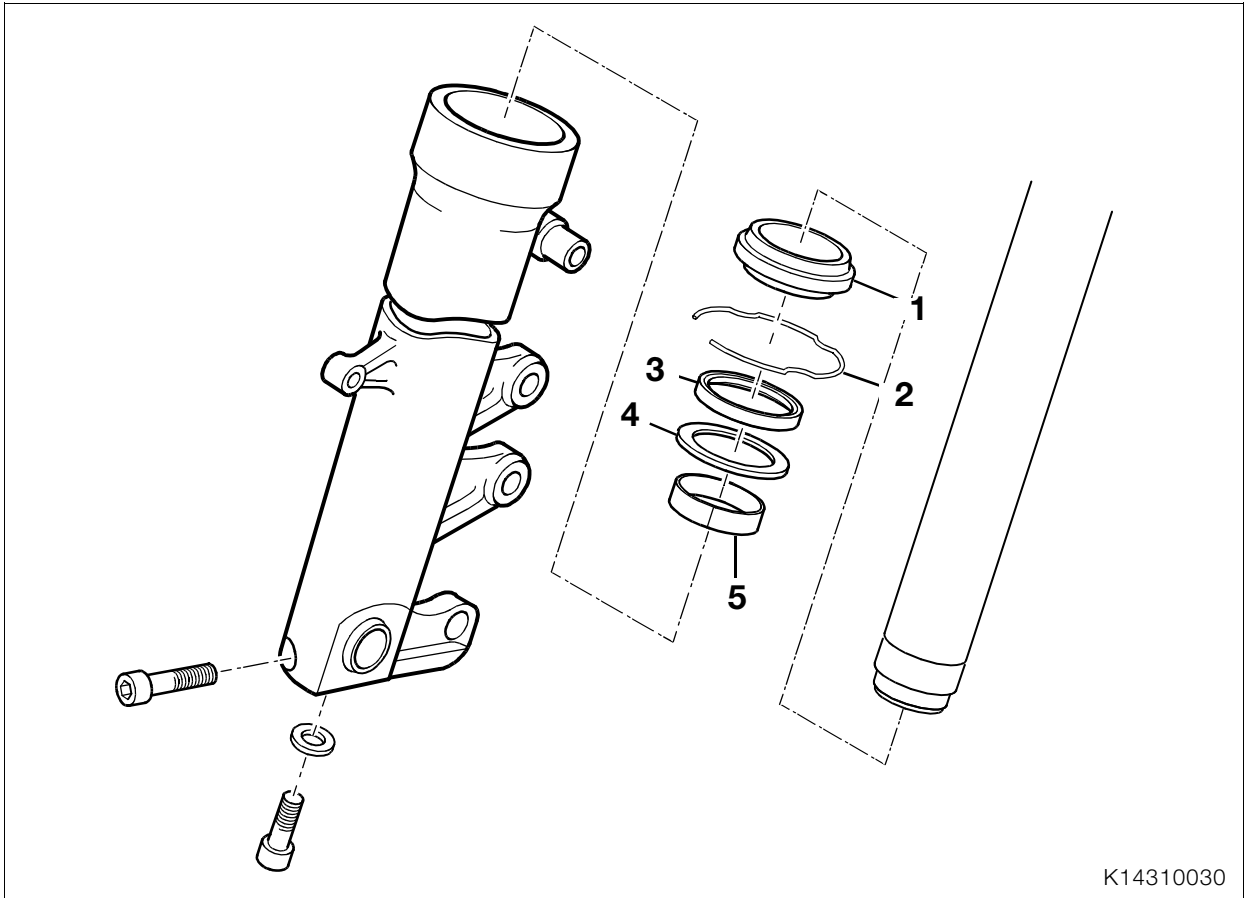


#### Warning:

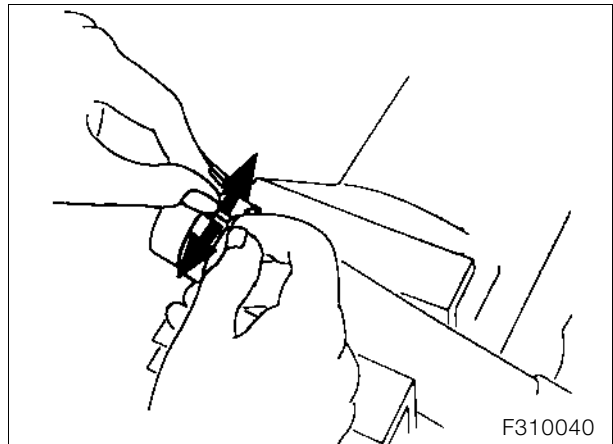
Note that plugs (3) at left and right are spring-loaded. Wear protective goggles when removing and installing.

- Press plug (3) down and remove snap ring (2). Carefully allow the plug to ride up and remove.
- Remove spacer (4) and spring (5) from fixed tube.
- Remove clamp screw (8).
- Release securing screw (9) of damper in slider tube.
- Slowly turn over slider tube, remove the damper from the slider tube and drain all the oil.





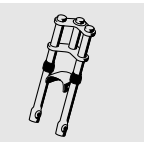
- Clamp slider tube in vise with protective jaws.
- Remove dust cap (1).
- Lever out circlip (2) with screwdriver.
- Push fixed tube slightly into slider tube and, pull sharply to remove fixed tube, sealing ring (3), intermediate ring (4) and slide bush (5) from the slider tube.



**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



### Attention:

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

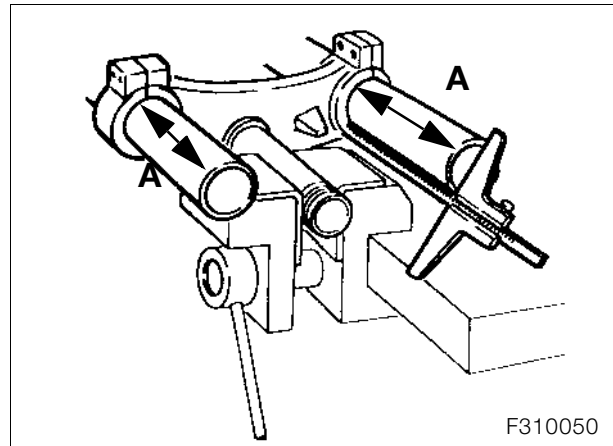


### Note:

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

- Clamp the fork bridge at the steering tube.

## Checking lower fork bridge



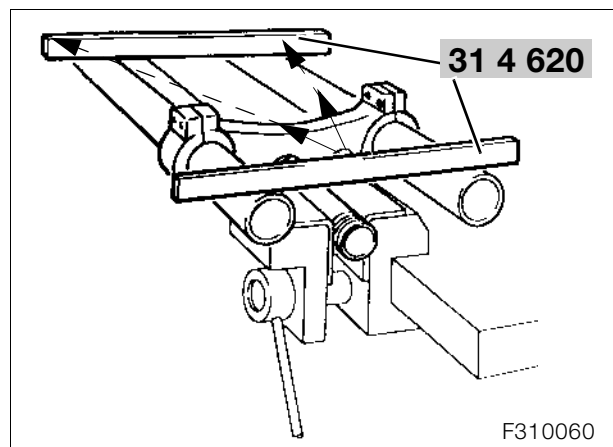
- Install two new fixed tubes with test length **A** in the lower fork bridge.



### Note:

Use fixed tubes with caps installed.

Test length **A**.....273.5 mm



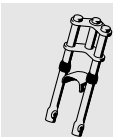
- Place two straight-edges, **BMW No. 31 4 620**, across the upper and lower ends of the fixed tubes.



### Attention:

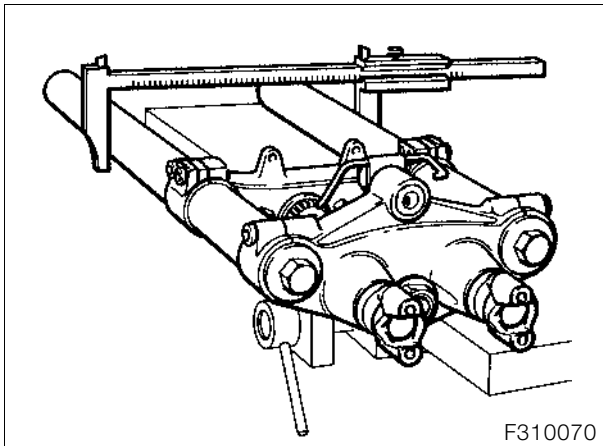
Replace distorted fork bridges.

- Check visually to determine any distortion.





### Checking parallel alignment of fixed tubes

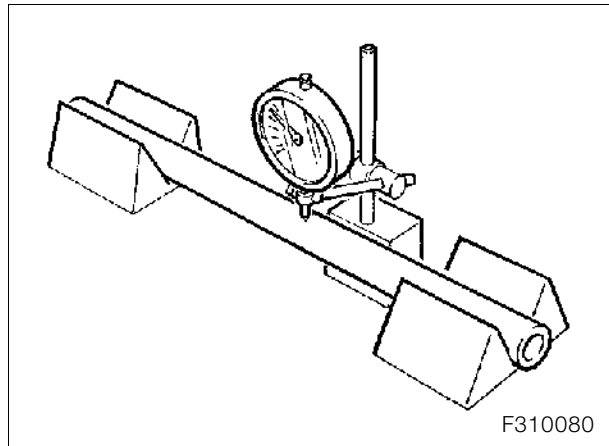


**Note:**

The fork bridge must slide smoothly over the fixed tubes.

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

### Checking fixed tube runout



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

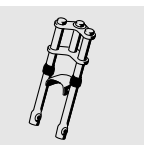


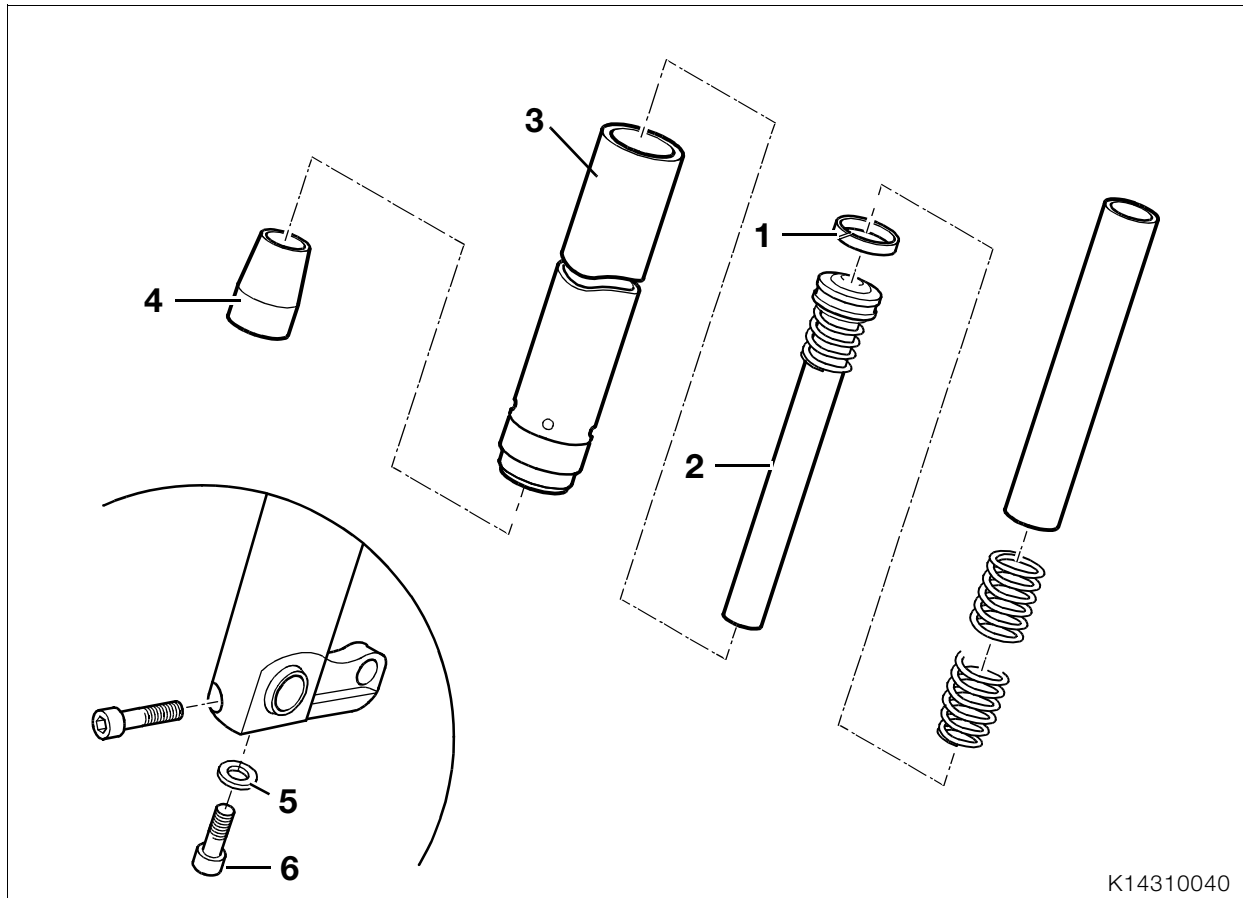
**Warning:**

Do not attempt to straighten bent fixed tubes.

- Rotate fixed tube slowly and check with dial gauge.

Maximum permissible runout of fixed fork tube .....0.1 mm





### 31 42 503 Assembling telescopic fork

#### Assembling fixed tube

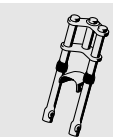
- Fit damper tube (2) with spring and piston ring (1) into fixed tube.
- Fit guide piece (4) onto damper tube (2).

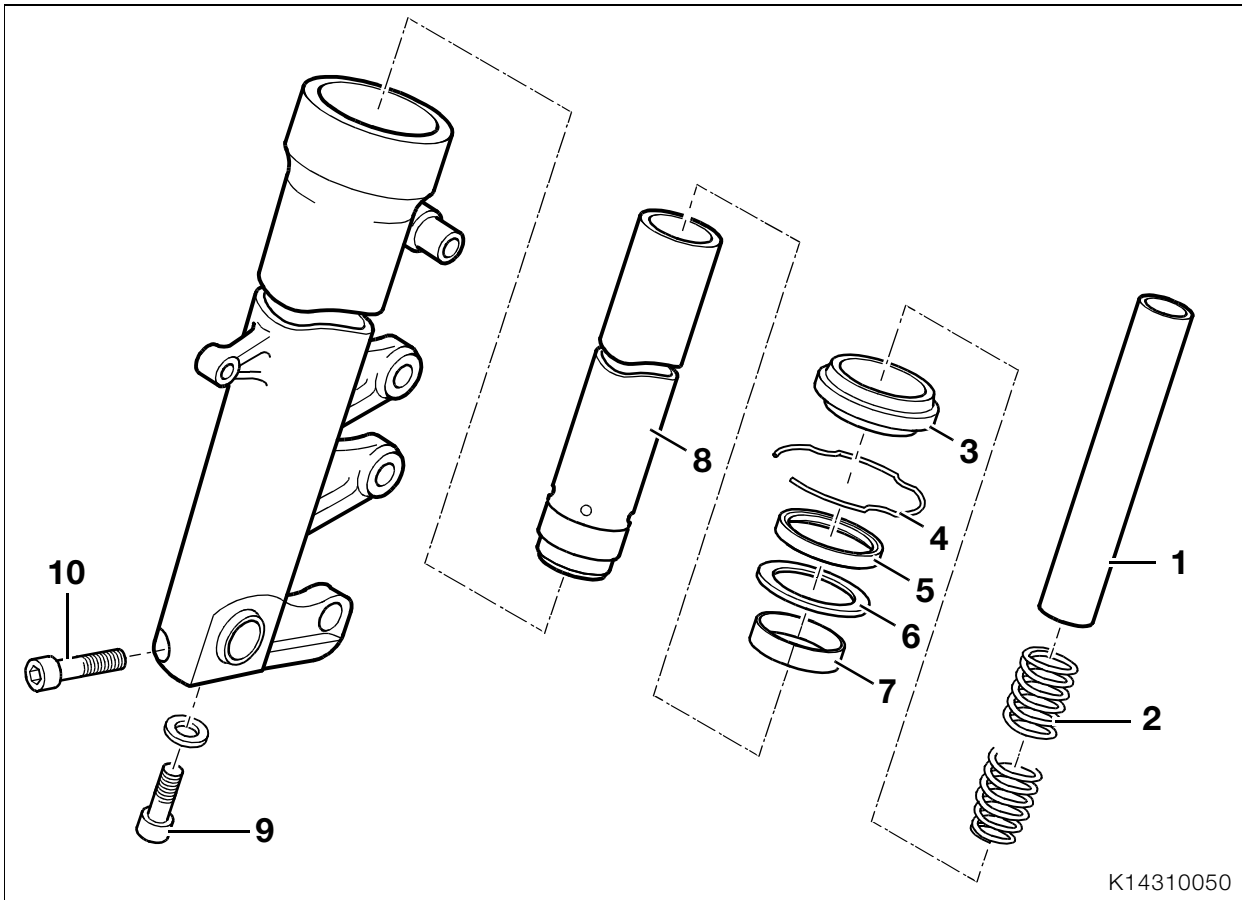


#### Note:

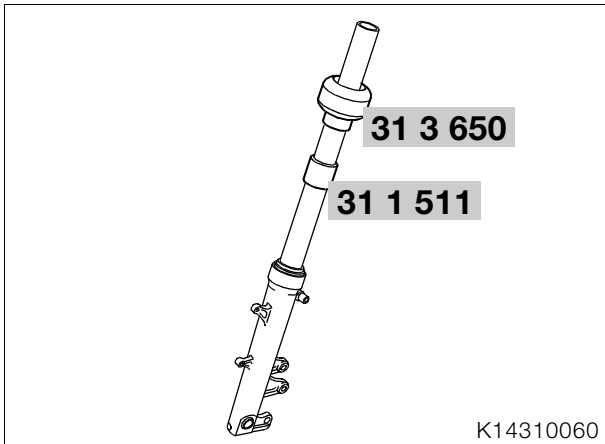
Lightly oil slide bushes with fork oil before assembly.

- Push the fixed tube with the slide bush into the slider tube.
- Loosely insert retaining screw (6) for damper with new sealing ring (5).





K14310050



K14310060



**Note:**

Lightly oil slide bushes with fork oil before assembly.

- Slide upper slide bush (7) over fixed tube and press lightly into the slider tube.
- Carefully drive in the sleeve with drift, **BMW No. 31 3 650**, and sleeve, **BMW No. 31 1 511**.

- Install intermediate ring (6).



**Note:**

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

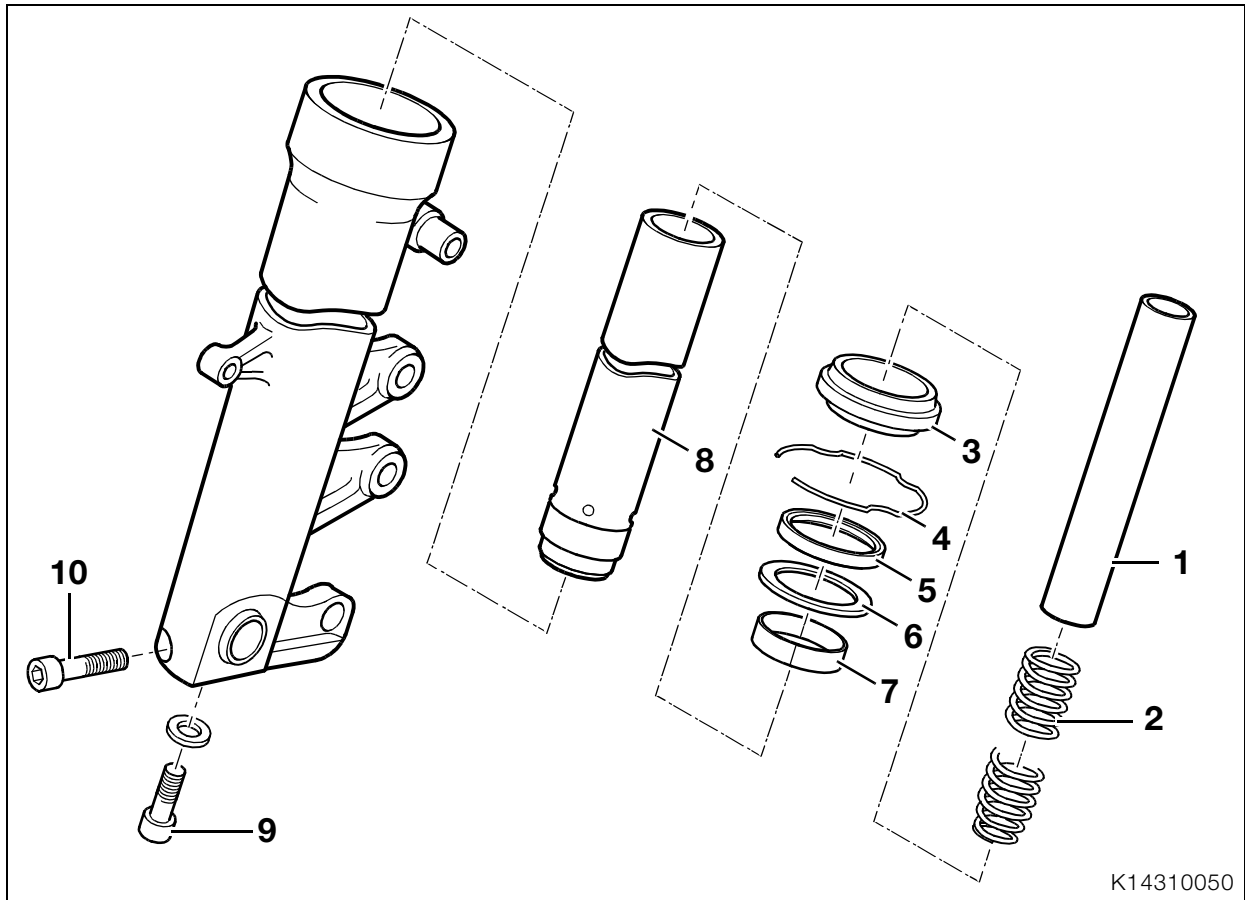
- Drive in radial shaft seal (5) in the same way.
- Install retaining ring (4) in groove over the seal.



**Note:**

Fill the lubricant pocket in dust sleeve (3) with **Shell Retinax EP2**.  
Installed position: the lubricant pocket in the dust sleeve faces inward toward the slider tube.

- Drive dust sleeve (3) into the slider tube with the convex side of drift, **BMW No. 31 3 650**.
- Tighten shock absorber retaining screw (9) in the slider tube.
- Install clamp screw (10), but do not tighten.



- Fill with specified quantity of oil.

**⚠ Attention:**

The taper-wound end of coil spring (2) must 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 (2) into the fixed tube with the taper-wound end of the spring at the bottom.
- Insert spacing sleeve (1).

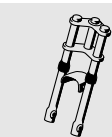
**Capacity per fork leg**

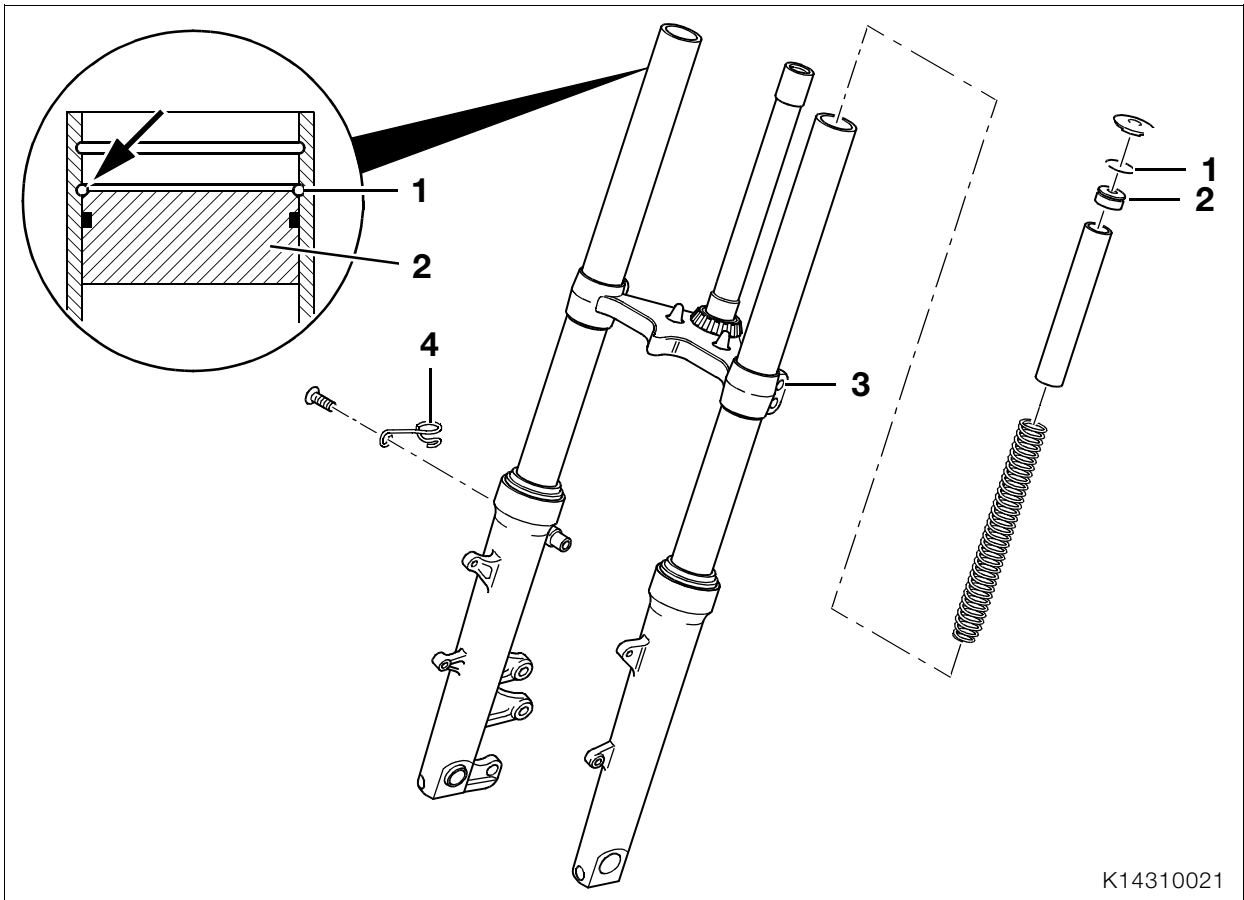
Oil change..... 0.47 l (0.827 imp.pints)  
 Initial filling ..... 0.48 l (0.844 imp.pints)

**Oil grade** .....BMW telescopic-fork oil

**⚠ Tightening torque:**

Securing screw for damper ..... 20 Nm





K14310021



**Note:**

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



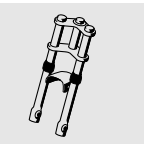
**Warning:**

Plugs are spring-loaded.

- Push in plug (2) and secure by inserting retaining ring (1) in 2nd groove (arrow).

**Complete assembly of telescopic fork.**

- Place lower fork bridge in position. Hand-tighten clamping screws (3).
- Install clamp (4).
- Install horn.



## 31 42 721 Removing and installing steering head bearing

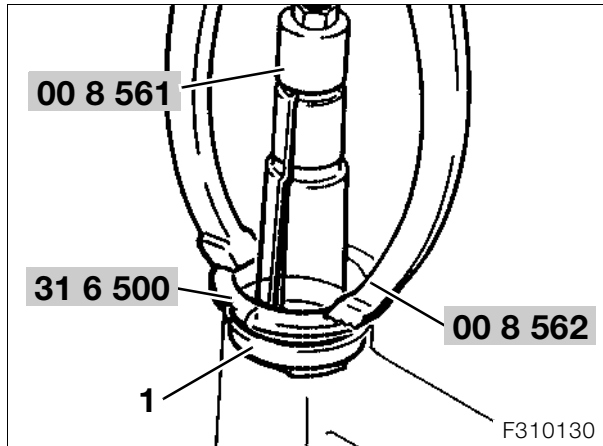
- Remove telescopic fork (⇒ 31.6).

### Upper steering head bearing

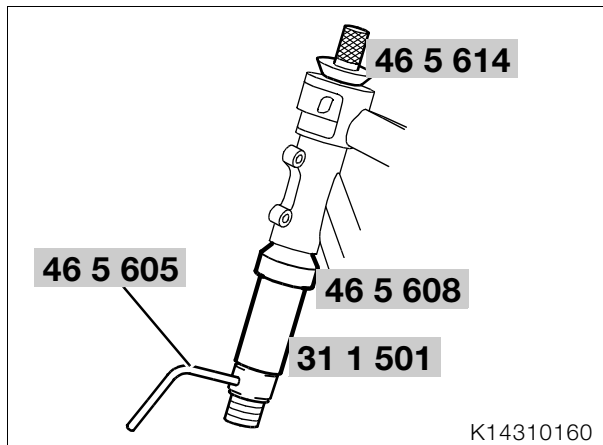
- Remove upper taper roller bearing.

#### ⚠ Attention:

Always replace bearing and outer bearing race together.



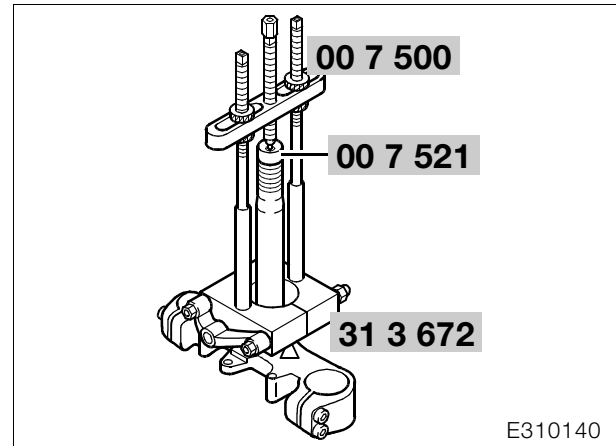
- Pull out bearing outer race (1) with adapter, **BMW No. 00 8 562**, and internal puller, **BMW No. 00 8 561**, and protective ring, **BMW No. 31 6 500**.



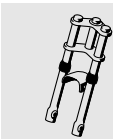
- Install new bearing outer race until seated, using steering head drift, **BMW No. 46 5 614**, tapered adapter, **BMW No. 46 5 608**, sleeve, **BMW No. 31 1 501**, and closure lever, **BMW No. 46 5 605**.

### Lower steering head bearing

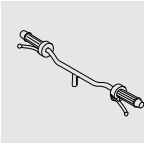
- The procedures for removing and installing the lower outer bearing race are the same as those for the upper race.



- Remove lower fork bridge.
- Use universal puller, **BMW No. 00 7 500**, jaws, **BMW No. 31 3 672**, and thrust piece, **BMW No. 00 7 521**, to pull the bearing off the steering tube.
- Place new dust cap in position.
- Place the new bearing in position and drive it fully home with a suitable drift.
- Adjust steering bearing play (⇒ 00.60).



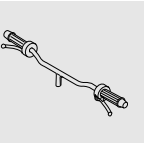
# 32 Steering



## Contents

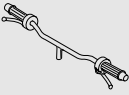
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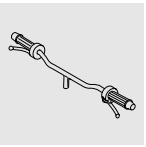
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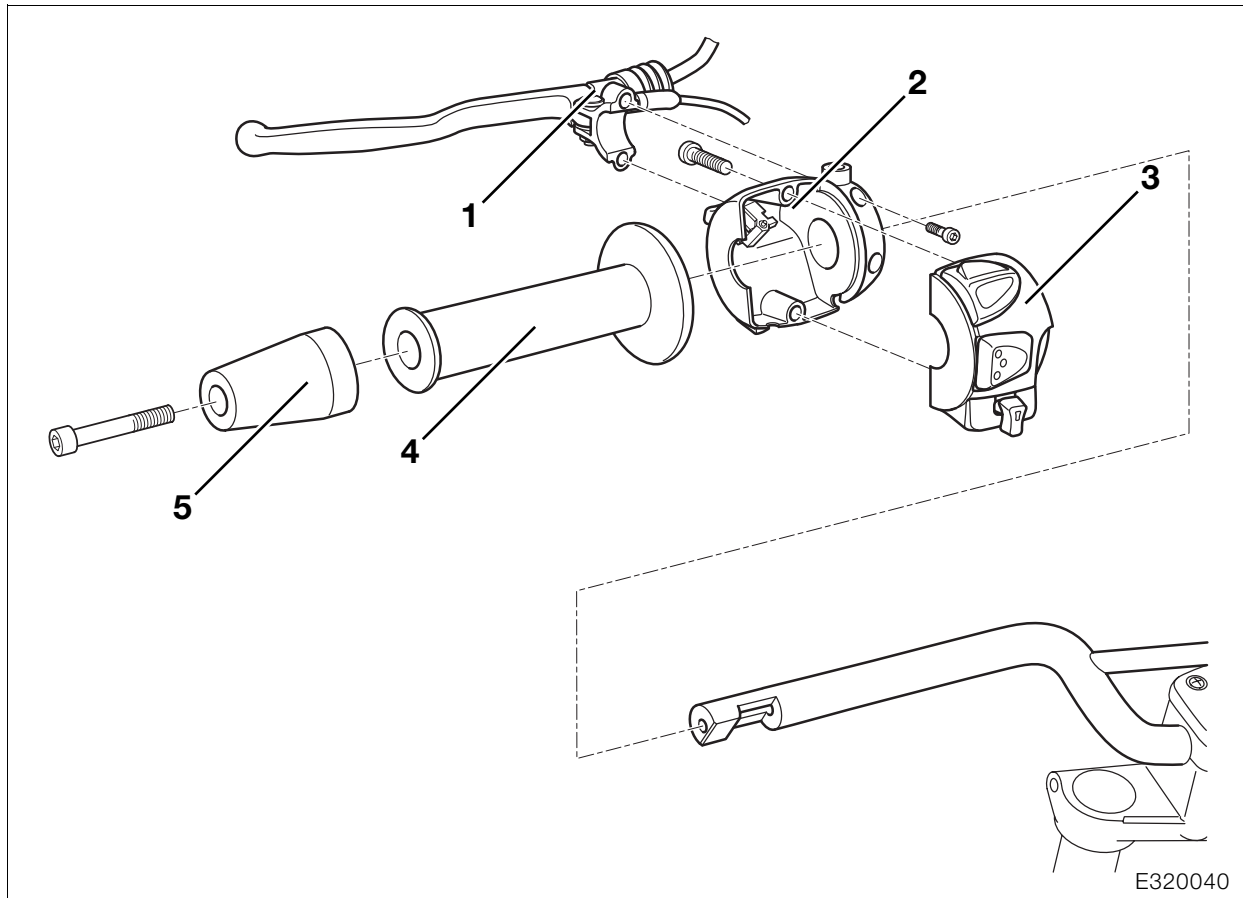




Technical Data 32 Steering		F 650 CS
Type		Tubular steel handlebar
Handlebar tube diameter	mm (in)	22 (0.866)
Steering lock angle	°	37
Handlebar width with weights	mm (in)	831 (32.72)







E320040

## Removing and installing left and right handlebar fittings

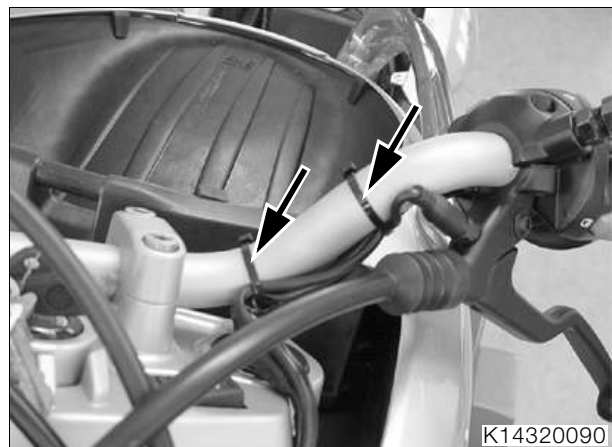


### Note:

To avoid damage, use protective apron, **BMW No. 16 1 600**, to cover the fuel tank.

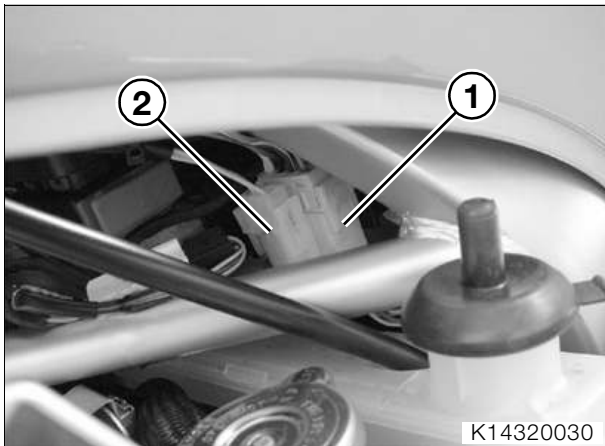
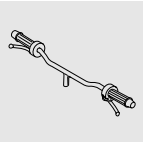
### Removing and installing left handlebar fitting

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove seat.
- Remove left cover insert.
- Remove cover of connector, left (→ 46.9).
- 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).

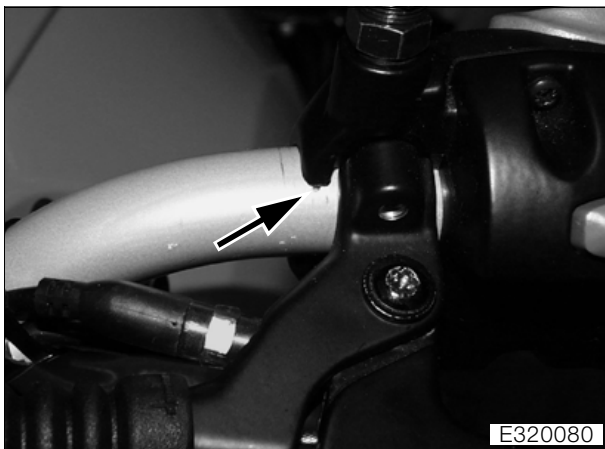


K14320090

- Cut through cable ties (arrows).
- Disengage the cable tie at the frame head.



- Disconnect plug of left-hand multi-function switch (1).
- 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 torque:**

Clutch fitting to handlebar ..... 9 Nm  
 Handlebar weight to handlebar..... 9 Nm

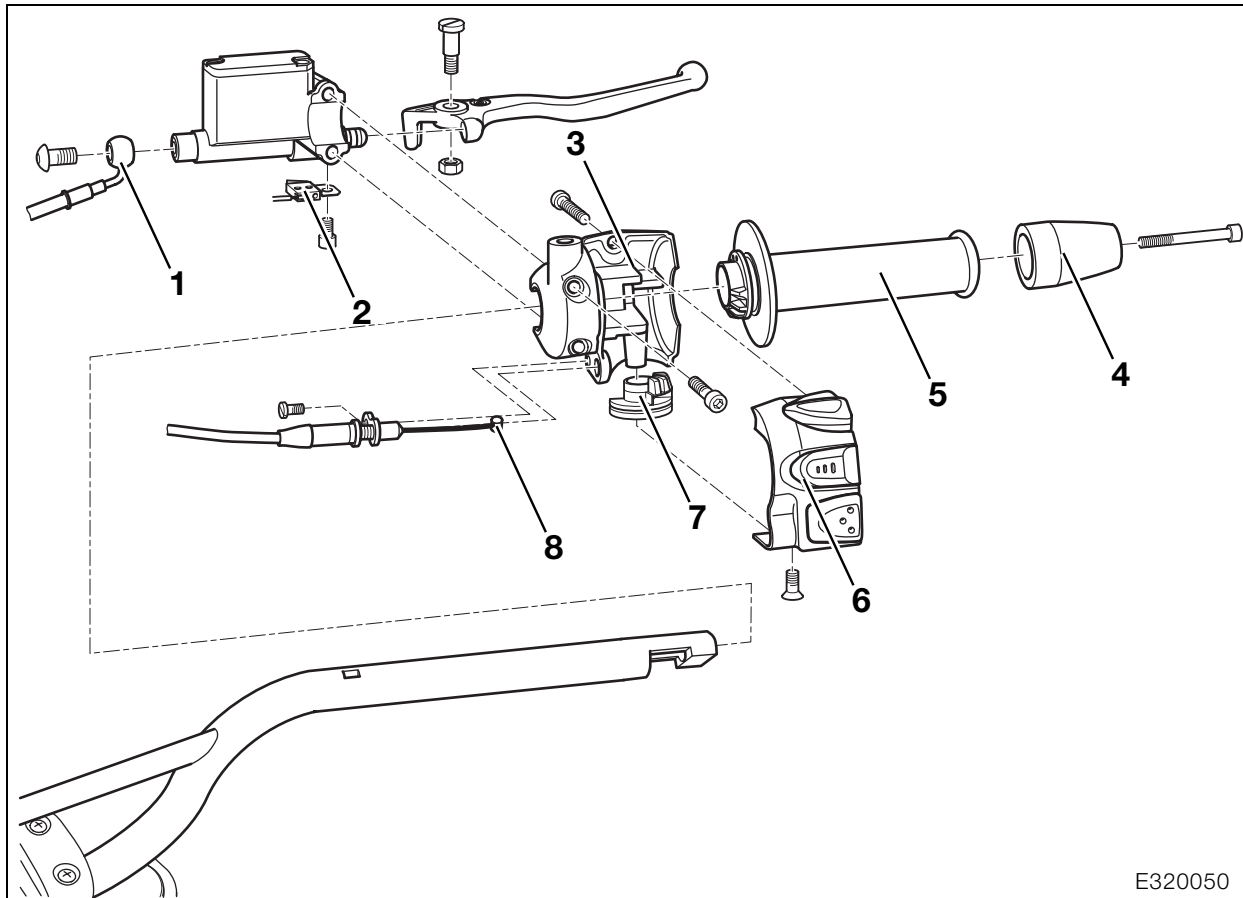
### 61 31 295 Removing and installing clutch switch

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove left cover insert.
- Cut through the cable ties securing the cables at the handlebar and the multi-function switch.
- Disengage the cable tie at the frame head.
- Disconnect plug at clutch switch (2).
- Release fastener securing clutch switch to handlebar fitting.
- Installation is the reverse of the removal procedure.



**Tightening torque:**

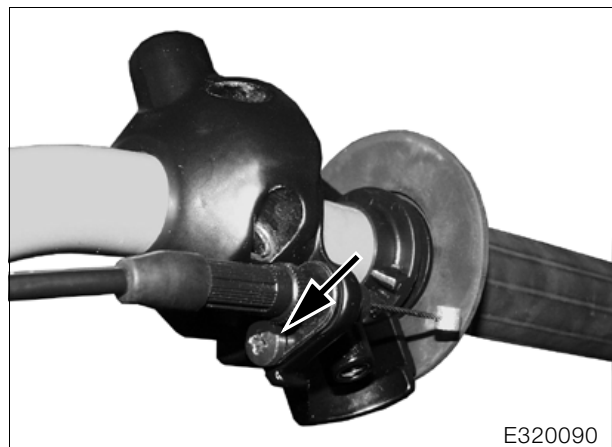
Clutch switch to handlebar fitting ..... 5 Nm



E320050

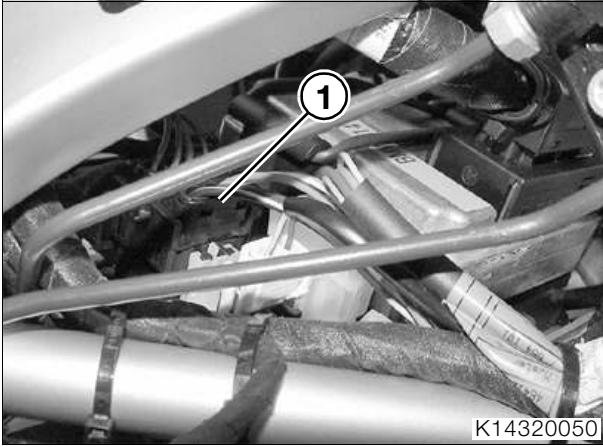
## Removing and installing right handlebar fitting

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover insert.
- Remove cover of connector, right (→ 46.9).
- Cut the cable tie at the handlebar.
- 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.

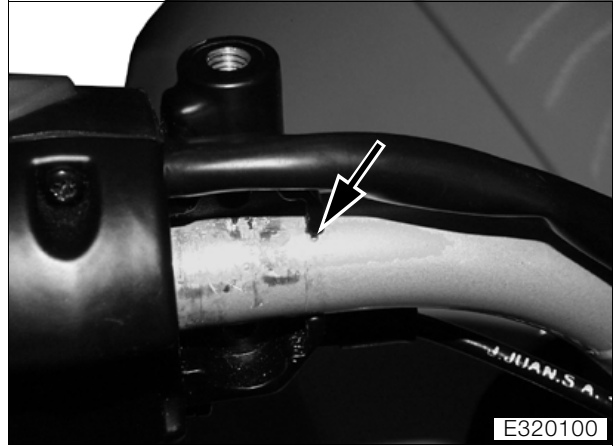


E320090

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

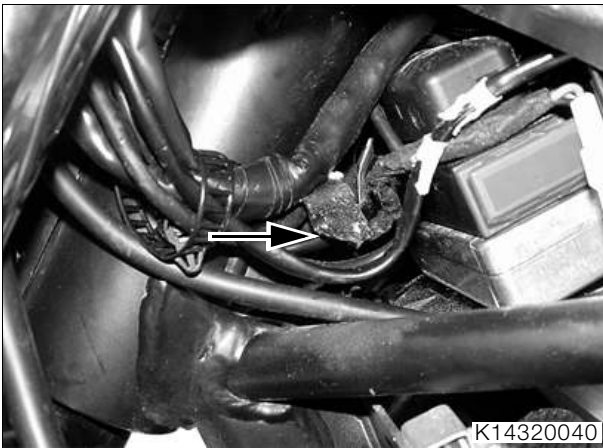


- Disconnect plug of right-hand multi-function switch (1).



**Note:**

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



- Disengage the cable ties (arrow) 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.



**Note:**

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

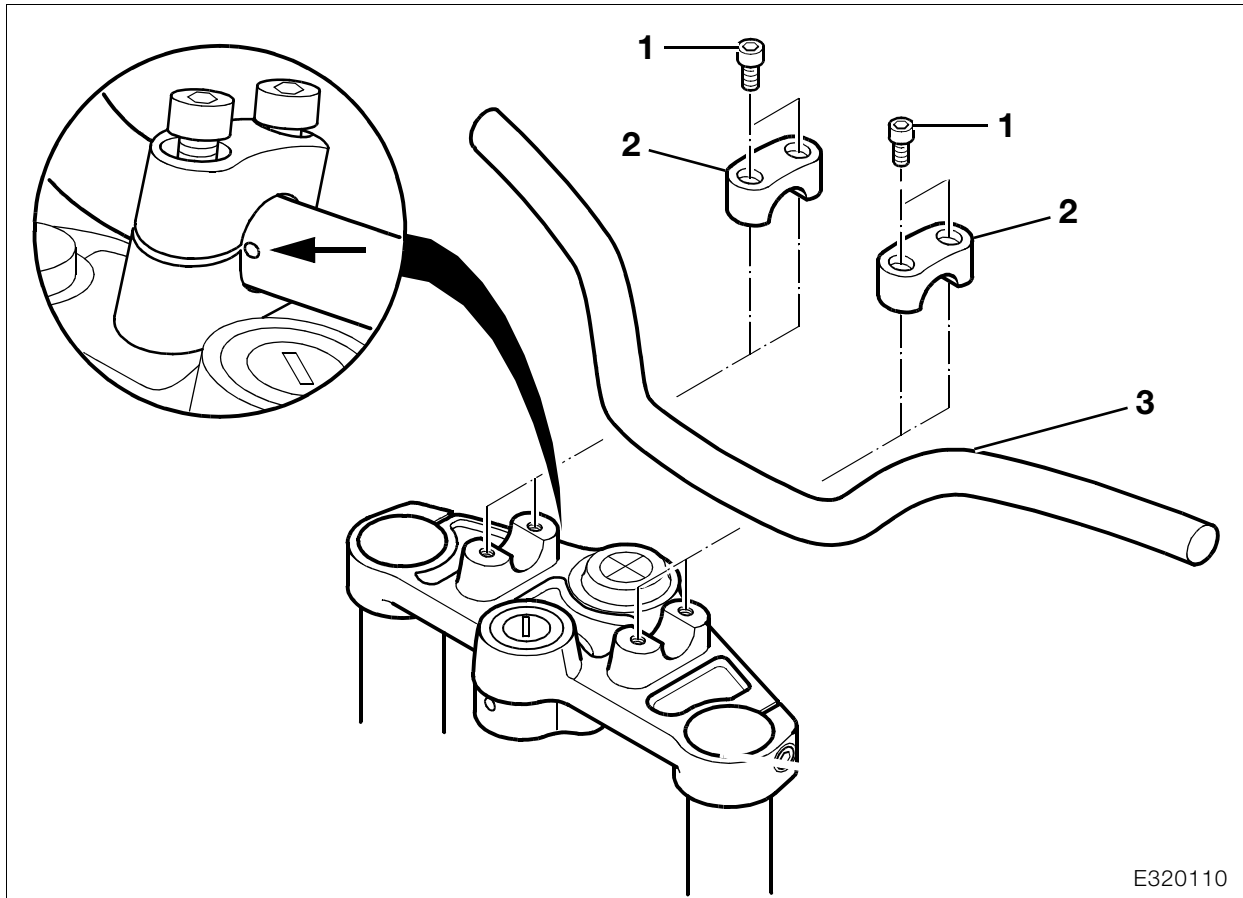
- Position the rotary tube in the groove before mounting it on the handlebar.

Throttle-cable play .....approx. 1 mm (0.040 in)



**Tightening torque:**

Handlebar fitting to handlebar .....	9 Nm
Handlebar weight to handlebar .....	9 Nm



E320110

### 32 71 008 Removing and installing handlebar

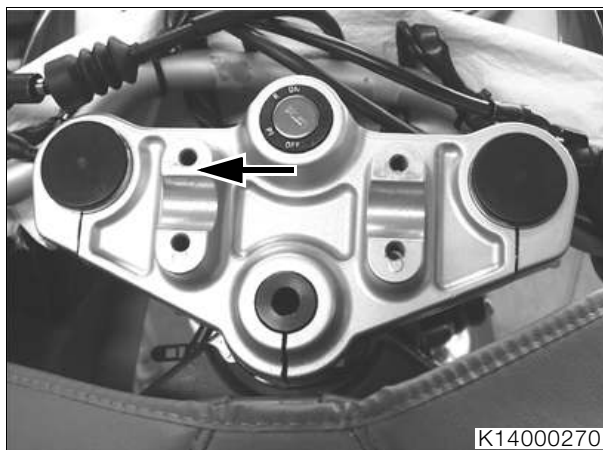
- Remove left handlebar fitting.
- Remove right handlebar fitting.
- Loosen clamping screws (1).
- Remove handlebar (3) together with clamping blocks (2).
- Installation is the reverse of the removal procedure, pay particular attention to the following.

**⚠ Attention:**

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

**📄 Note:**

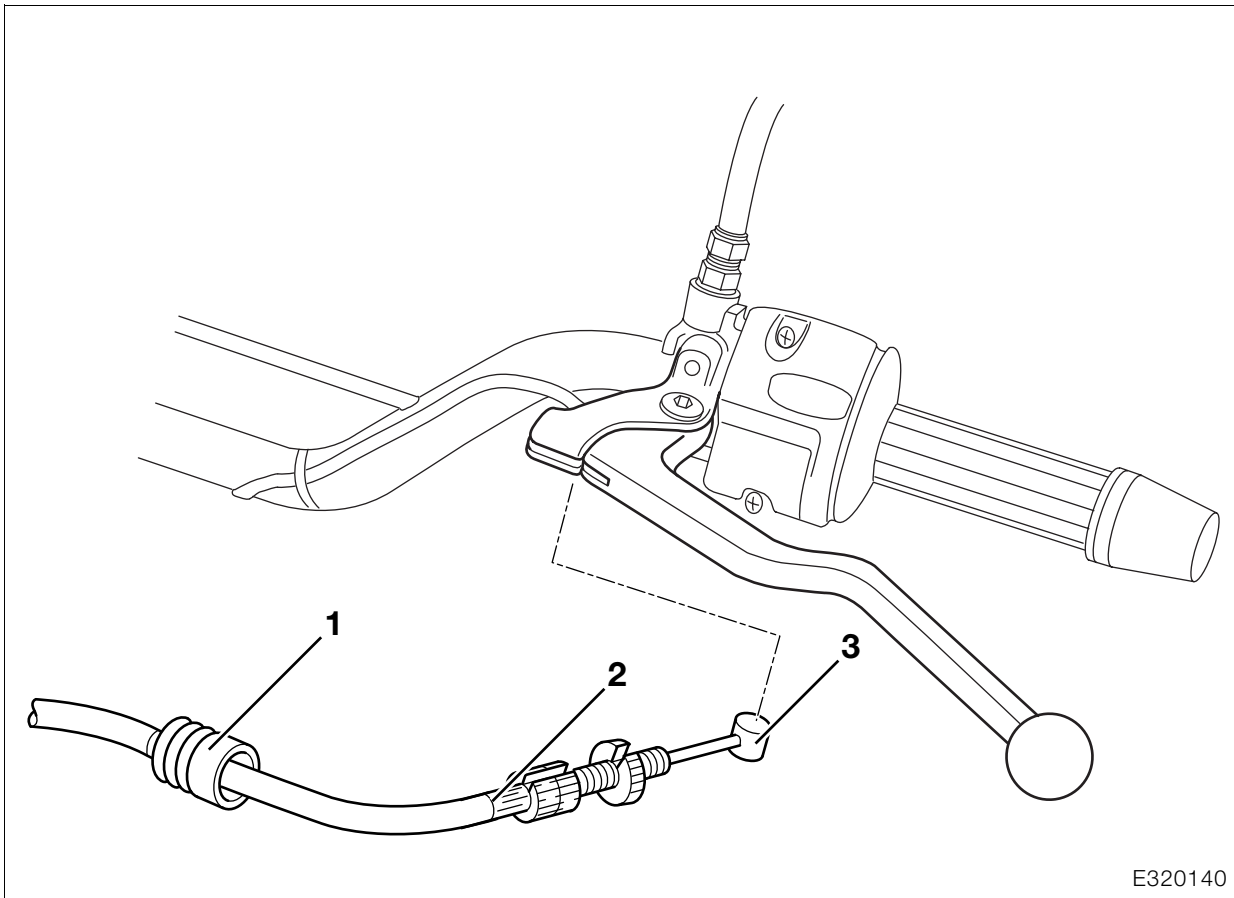
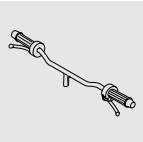
The position of the handlebar is indicated by a punch mark (arrow) on the handlebar.



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

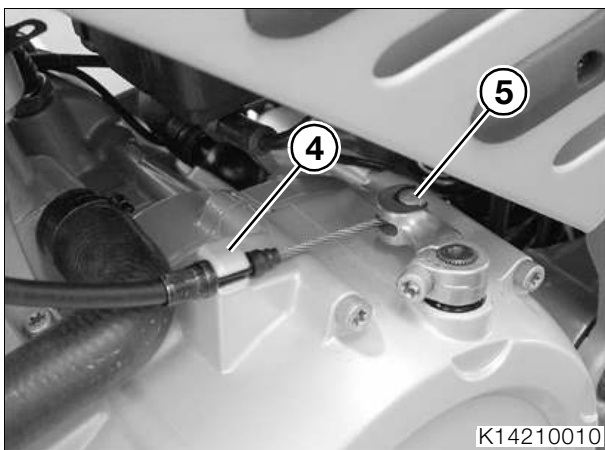
**🔧 Tightening torque:**

Handlebar to fork bridge ..... 23 Nm

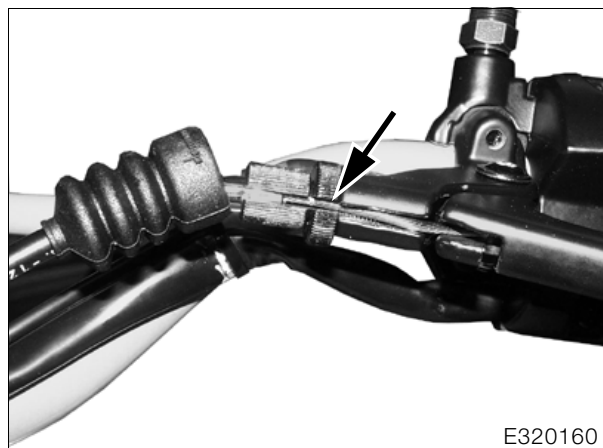


E320140

### 32 72 330 Removing and installing clutch cable



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



- Make sure that slots in adjusting screw, locknut and lever fitting (arrow) are in line.
- Pull back cable shroud (2).
- Pull the cable forward through the slot and disengage nipple (3).
- Pull the cable out to the rear.

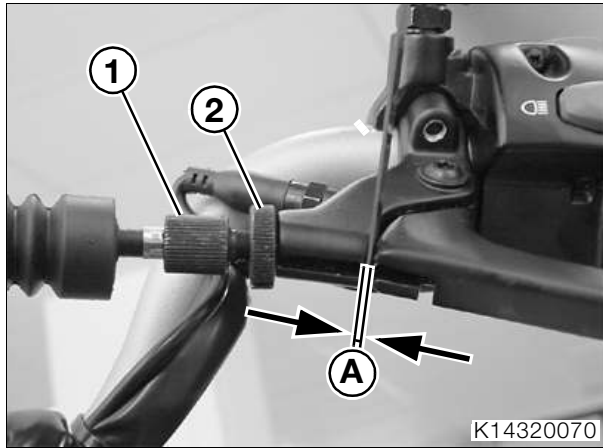


- Installation is the reverse of the removal procedure, pay particular attention to the following.



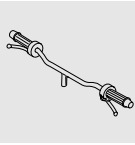
**Attention:**

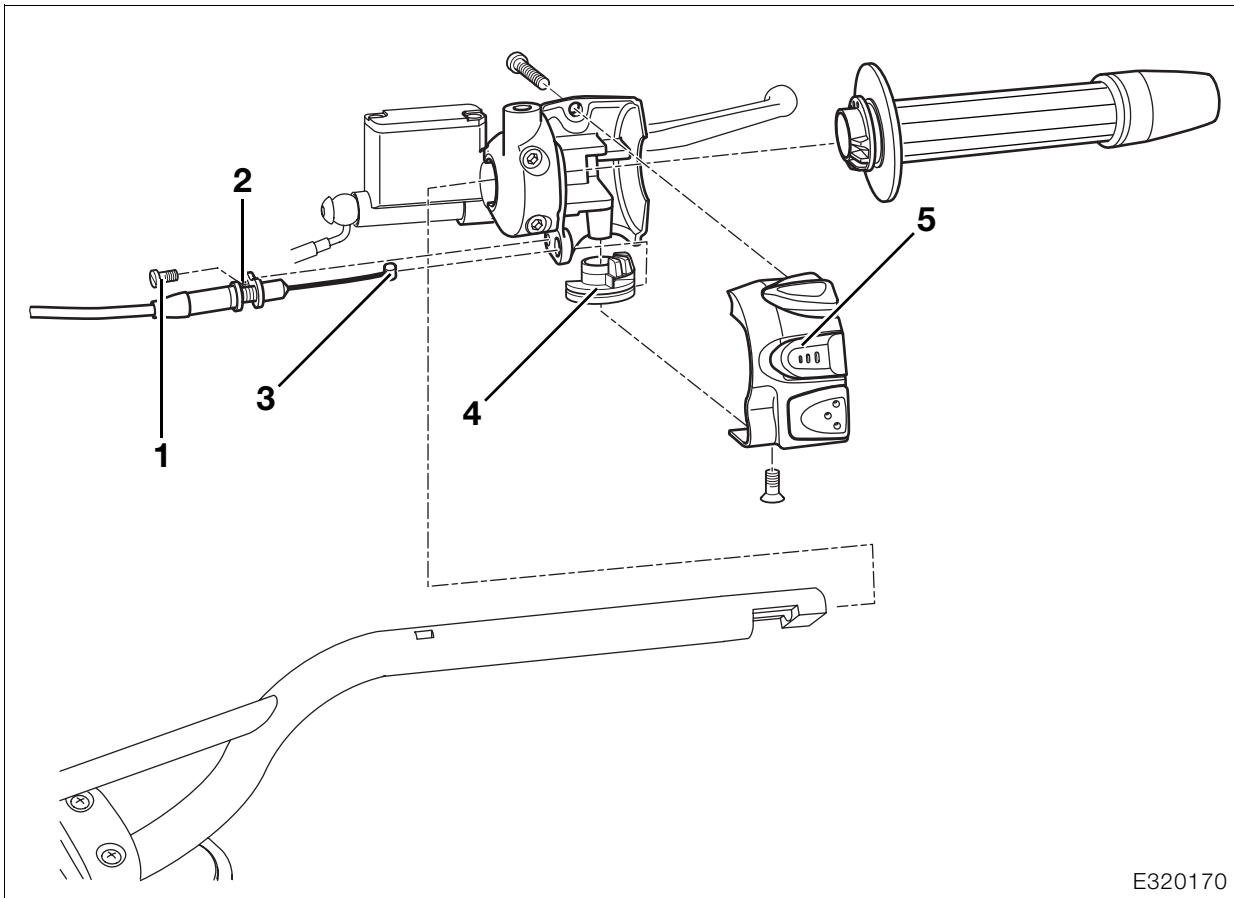
Make sure that the clutch cable is not kinked when installed.



- After installing the cable, adjust clutch clearance by setting distance “A” by turning adjusting screw (1) on the clutch handlebar fitting.
- Lock adjusting screw (1) with knurled nut (2).

Distance “A” ..... 1.0...2.0 mm (0.0394...0.0787)

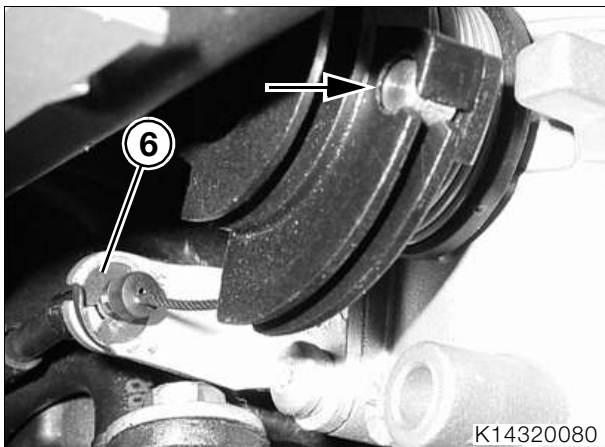




E320170

### 32 72 305 Removing and installing throttle cable

- Remove seat.
- Remove left cover (→ 46.6).



- Disengage throttle cable from adapter (arrow).
- Remove circlip (6) from throttle-cable holder and disengage throttle cable.
- Pull the cable out toward the handlebar.

- Remove cover (5).
- Remove fastener for throttle cable (1) from instrument cluster housing.
- Disengage throttle-cable adapter (4) and disengage nipple (3).
- 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 (2).

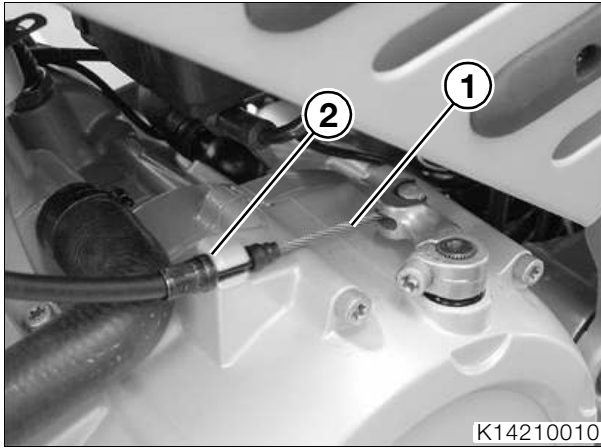
Throttle-cable play .....approx. 1 mm (0.040 in)

 **Tightening torque:**

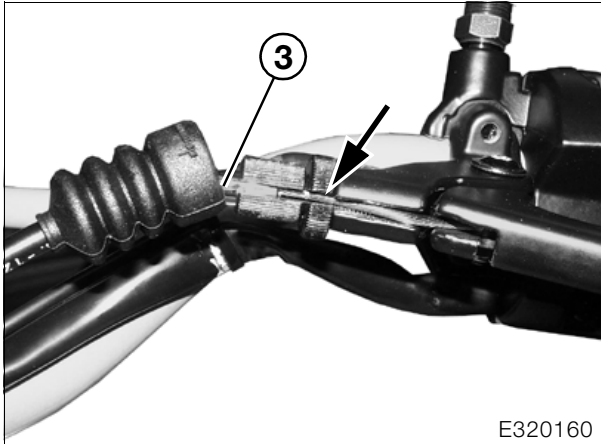
Cover for multi-function switch ..... 1 Nm

## Removing and installing left and right handlebar levers

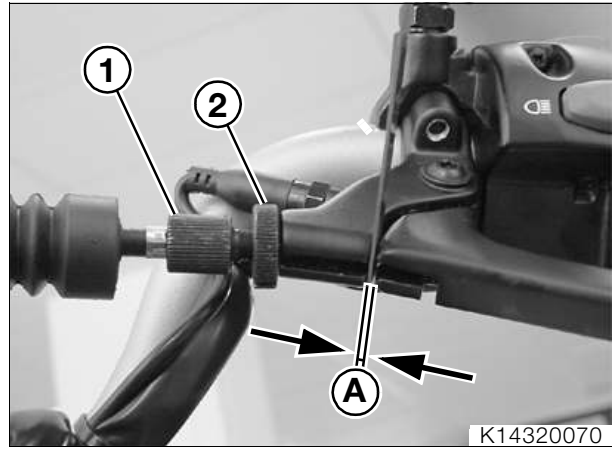
### 32 72 070 Removing and installing left handlebar lever



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



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



- After installing the cable, adjust clutch clearance by setting distance "A" by turning adjusting screw (1) on the clutch handlebar fitting.
- Lock adjusting screw (1) with knurled nut (2).

Distance "A" ..... 1.0...2.0 mm (0.0394...0.0787 in)

#### **Tightening torque:**

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 torque:**

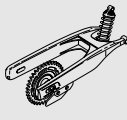
Locknut, handbrake lever ..... 7 Nm  
Pivot pin, handbrake lever ..... 7 Nm

### 32 00 454 Checking and adjusting steering head bearing play, replacing if necessary (→ 00.60)

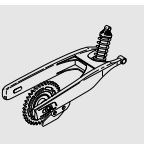
# 33 Rear wheel drive

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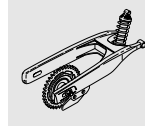
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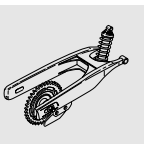


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Technical Data 33 Rear wheel drive		F 650 CS
<b>Rear wheel drive</b>		
Type	Belt drive with damper in special housing	
<b>Swinging arm</b>		
Type	Single-arm cast aluminium swinging arm with cam-adjustable rear wheel axle	
Length of swinging arm (toothed belt installed)	mm (in)	556.8 (21.921)
<b>Rear suspension</b>		
Type	Central suspension strut pivoted to lever system. Extension-stage damping steplessly adjustable	
Total travel at wheel	mm (in)	140 (5.51)





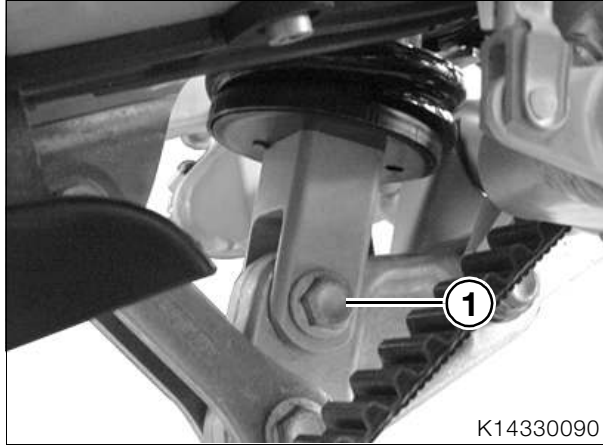
## 33 53 000 Removing and installing suspension strut

- Raise rear frame (→ 46.15).

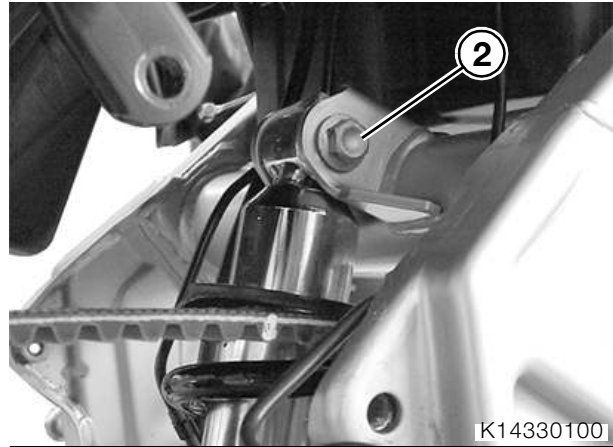


### Note:

Raise the rear frame only far enough to expose the upper eye of the spring strut.



- Take the load off the rear wheel and remove fastener (1) securing the spring strut to the angled lever.



- Remove the fastener securing the spring strut to frame (2).
- Pull the spring strut to the rear and remove.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Warning:

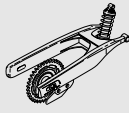
Use a new screw and nut to secure the spring strut to the frame (2).

- 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.

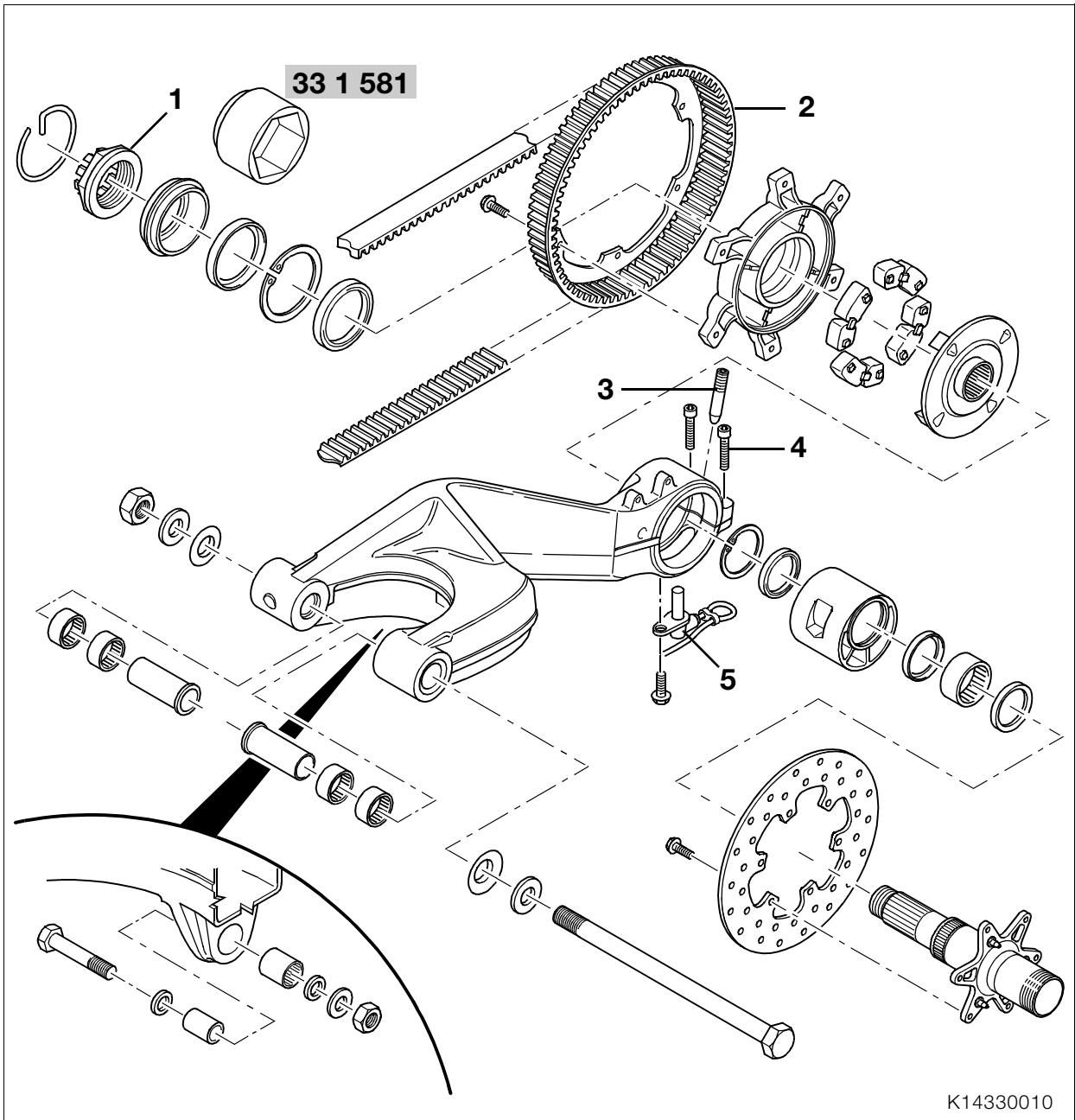


### Tightening torque:

Spring strut to frame	
Initial torque .....	58 Nm
Additional angle of rotation.....	45° ± 15°
Spring strut to angled lever .....	41 Nm
Rear frame to main frame	
(clean thread + Loctite 2701).....	24 Nm
Brake fluid reservoir to rear frame .....	4 Nm
Clamp for silencer.....	55 Nm
Silencer to rear frame.....	41 Nm



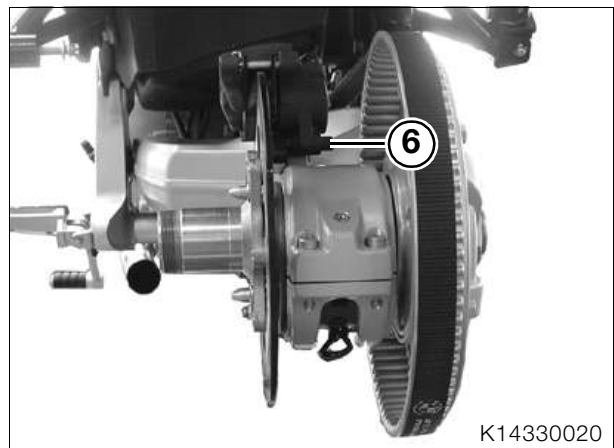




K14330010

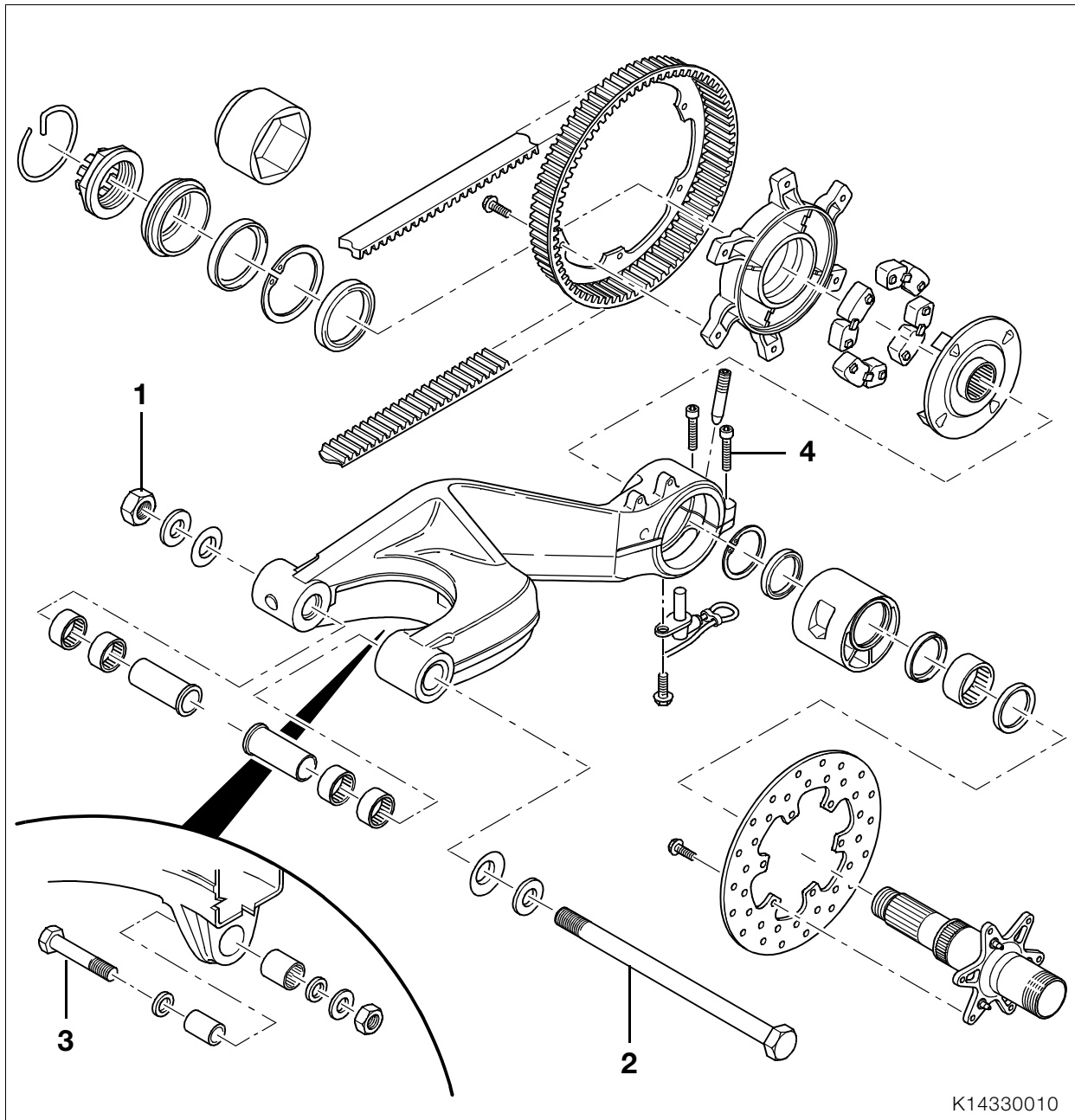
### 33 17 350 Removing and installing rear swinging arm

- Remove rear wheel (→ 36.7).
- Release clamp (4).
- Back off adjusting screw (3).
- Turn the eccentric to slacken the belt and remove the belt.
- Apply the rear brake, and slacken nut (1) with socket, **BMW No. 33 1 581**.
- Remove fasteners securing belt cover.
- Remove pulley (2).
- Remove ABS sensor (5).



K14330020

- Remove fasteners (6) from brake caliper, remove brake caliper and secure to the rear frame at the same height, using cable ties.



K14330010

- Pull the shaft with eccentric to the left and remove.
- Remove the fasteners securing the struts to swinging arm (3).
- Remove nut (1) at swinging arm pivot shaft (2).
- Remove swinging-arm pivot shaft (2).
- Pull the swinging arm to the rear and remove.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Tighten clamping screws as follows:
  - Slightly tighten clamping screws (4) until seated
  - Tighten both clamping screws to initial torque of 10 Nm
  - Tighten both clamping screws to final torque of 21 Nm
  - Recheck that torque wrench clicks at 21 Nm for both clamping screws.



**Note:**

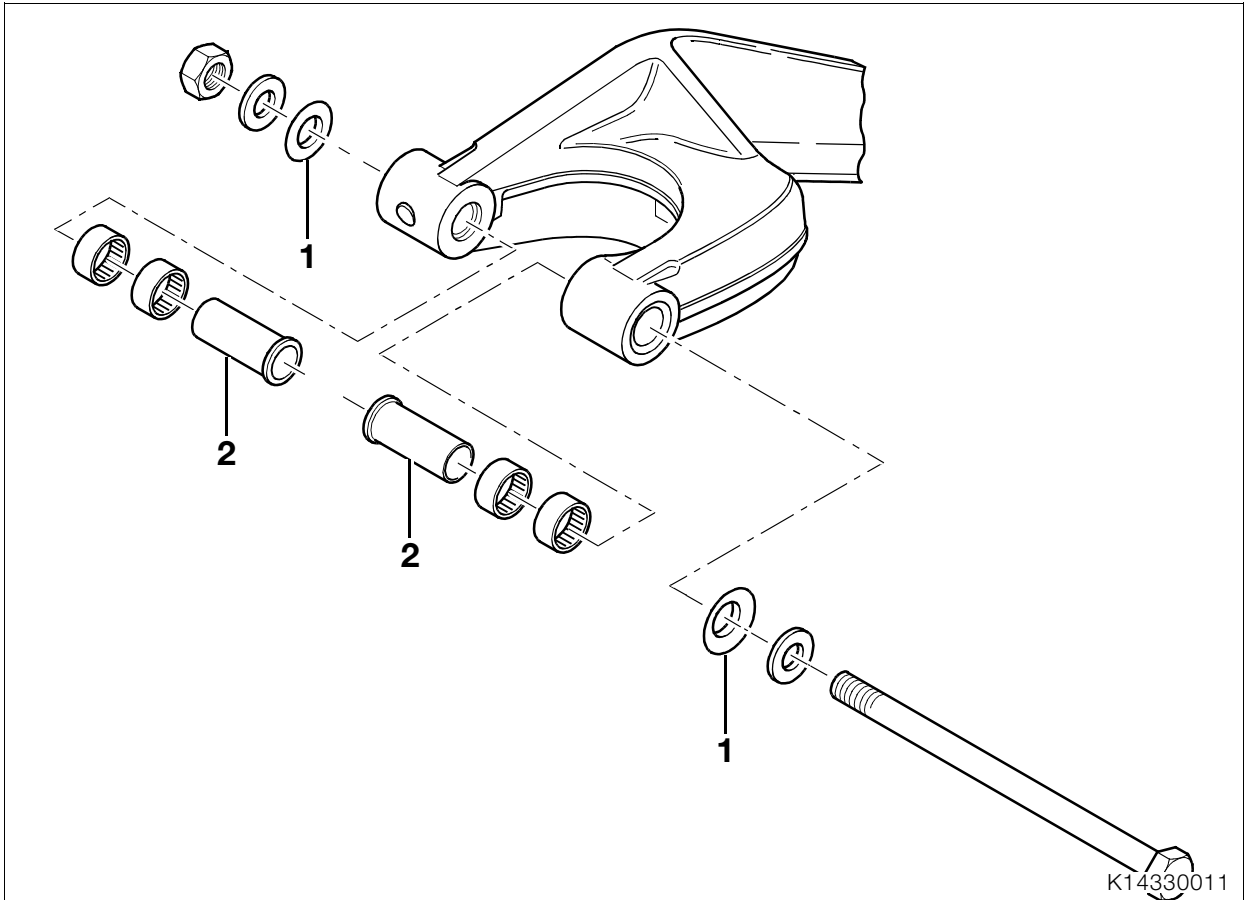
Grease needle bearings with **Shell Retinax EP2**.

- Adjust belt tension (→ 00.56).



**Tightening torque:**

Swinging-arm pivot .....	100 Nm
Reaction link to swinging arm.....	41 Nm
Belt cover to swinging arm .....	9 Nm
ABS sensor to swinging arm .....	9 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm
Damper threaded fastener .....	160 Nm
Wheel nut to drive shaft.....	160 Nm
Brake caliper to swinging arm .....	21 Nm



### 33 17 373 Removing and installing needle roller races in rear swinging arm

#### Removing needle roller races

- Remove protective caps (1).
- Remove bearing bushings (2) from swinging arm.



#### ⚠ Attention:

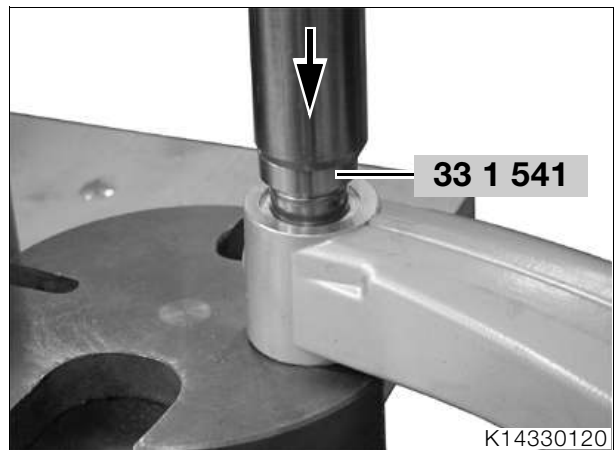
Protect mating faces (arrow) of the swinging arm from scratches by covering with masking tape or similar.

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

#### Installing needle roller races

#### ⚠ Attention:

Install needle roller races with sealing ring to the outside.



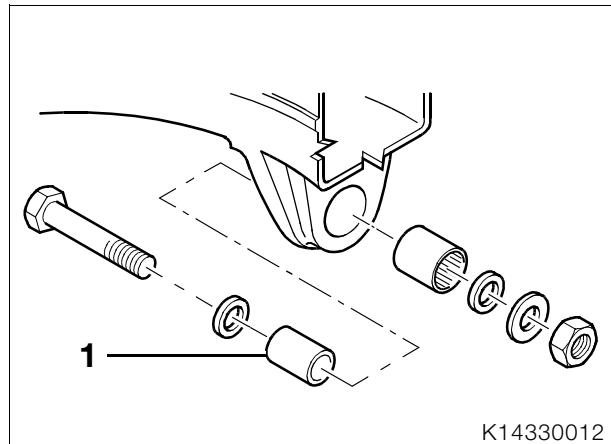
- Heat bearing seats to 100 °C (212 °F).
- Press in the outer needle roller races with drift, **BMW No. 33 1 541**.



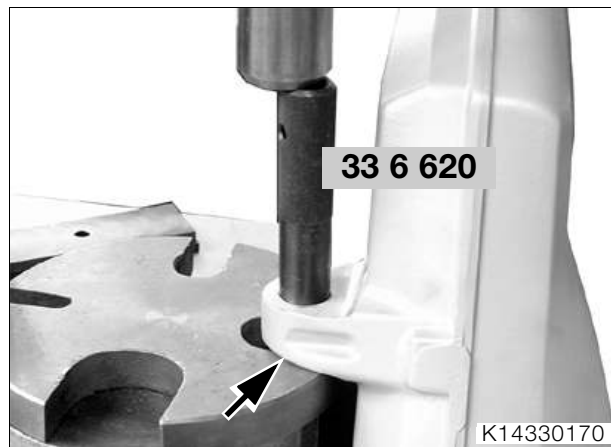
- Press in the inner needle roller races with drift, **BMW No. 33 1 541**, and drift, **BMW No. 33 1 542**.
- Fit bearing bushes into swinging arm.
- Place protective caps in position.

## Removing and installing needle bearings in rear swinging arm

### Removing needle roller bearing



- Remove bearing bushing (1) from swinging arm.
- Lever out the sealing rings with a screwdriver.



### **Attention:**

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

- Press needle bearing out of rear swinging arm with drift, **BMW No. 33 6 620**.

### Installing needle roller bearing

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

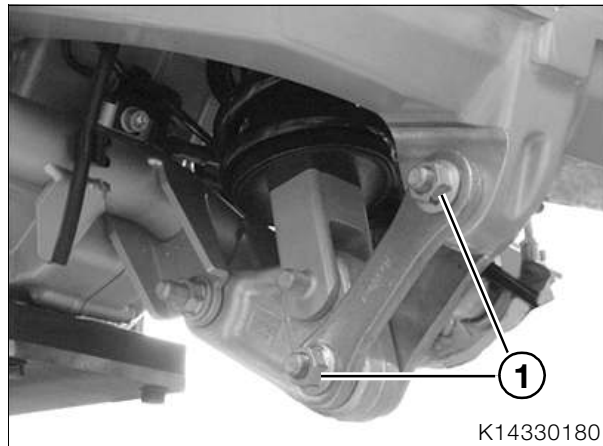


- Press in needle roller bearing with drift, **BMW No. 33 6 671**.



- Install sealing rings with drift, **BMW No. 33 6 671**, and spacing ring, **BMW No. 33 6 672**.
- Fit bearing bushing.

### 33 53 220 Removing and installing reaction link



- Remove nuts (1).
- Slightly raise the rear wheel and pull stud to the right to remove.
- Remove the reaction link.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



#### Note:

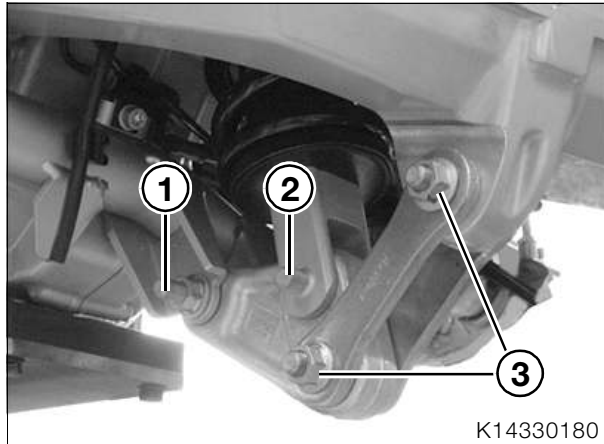
Grease needle bearings with **Shell Retinax EP2**.



#### Tightening torque:

Reaction link to swinging arm..... 41 Nm  
 Reaction link to angled lever ..... 41 Nm

### 33 53 200 Removing and installing angled lever



- Slacken the nuts of the fastener securing the strut 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**.



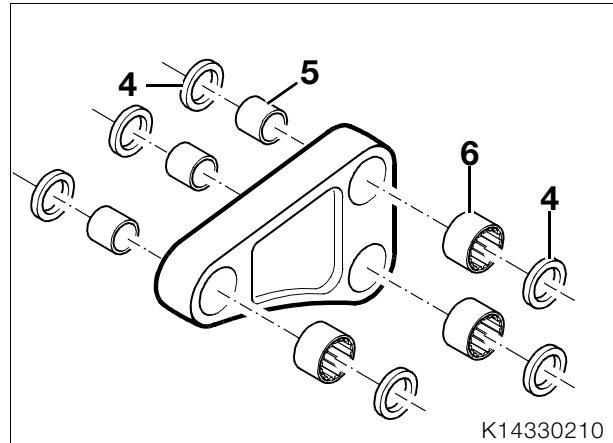
**Tightening torque:**

Angled lever to frame	
Initial torque .....	58 Nm
Additional angle of rotation.....	45° ± 15°
Angled lever to spring strut .....	41 Nm
Angled lever to reaction link .....	41 Nm

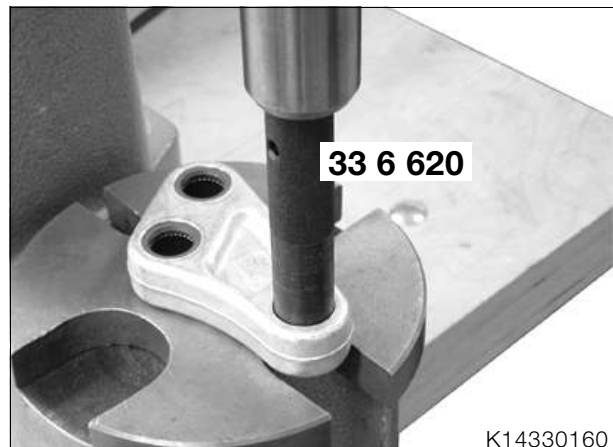
### 33 53 610 Removing and installing needle roller bearings and needle roller races in angled lever

**Removing needle roller bearings and needle roller races**

- Remove angled lever.



- Remove bearing bushings (5).
- Lever out sealing rings (4) with screwdriver.



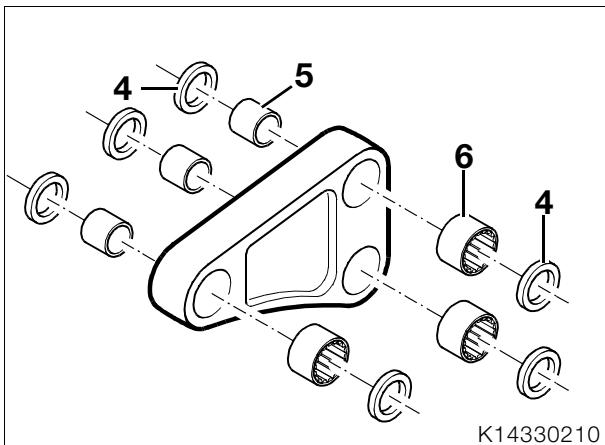
**Note:**

To simplify driving out, heat the angled lever to 80 °C (212 °F). Use temperature measuring device, **BMW No. 00 1 900**, to check the temperature.

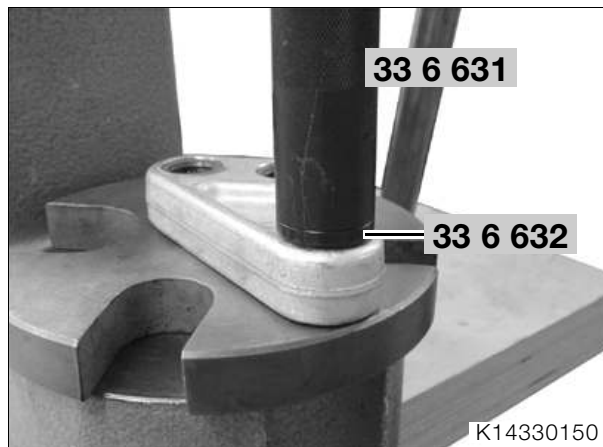
- Press out needle bearing (6) with drift, **BMW No. 33 6 620**.



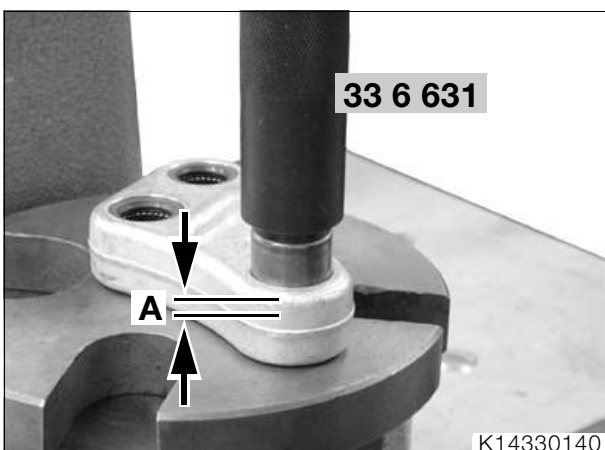
**3353 Installing needle roller bearings and needle roller races**



- Heat bearing seats to 80 °C (212 °F).

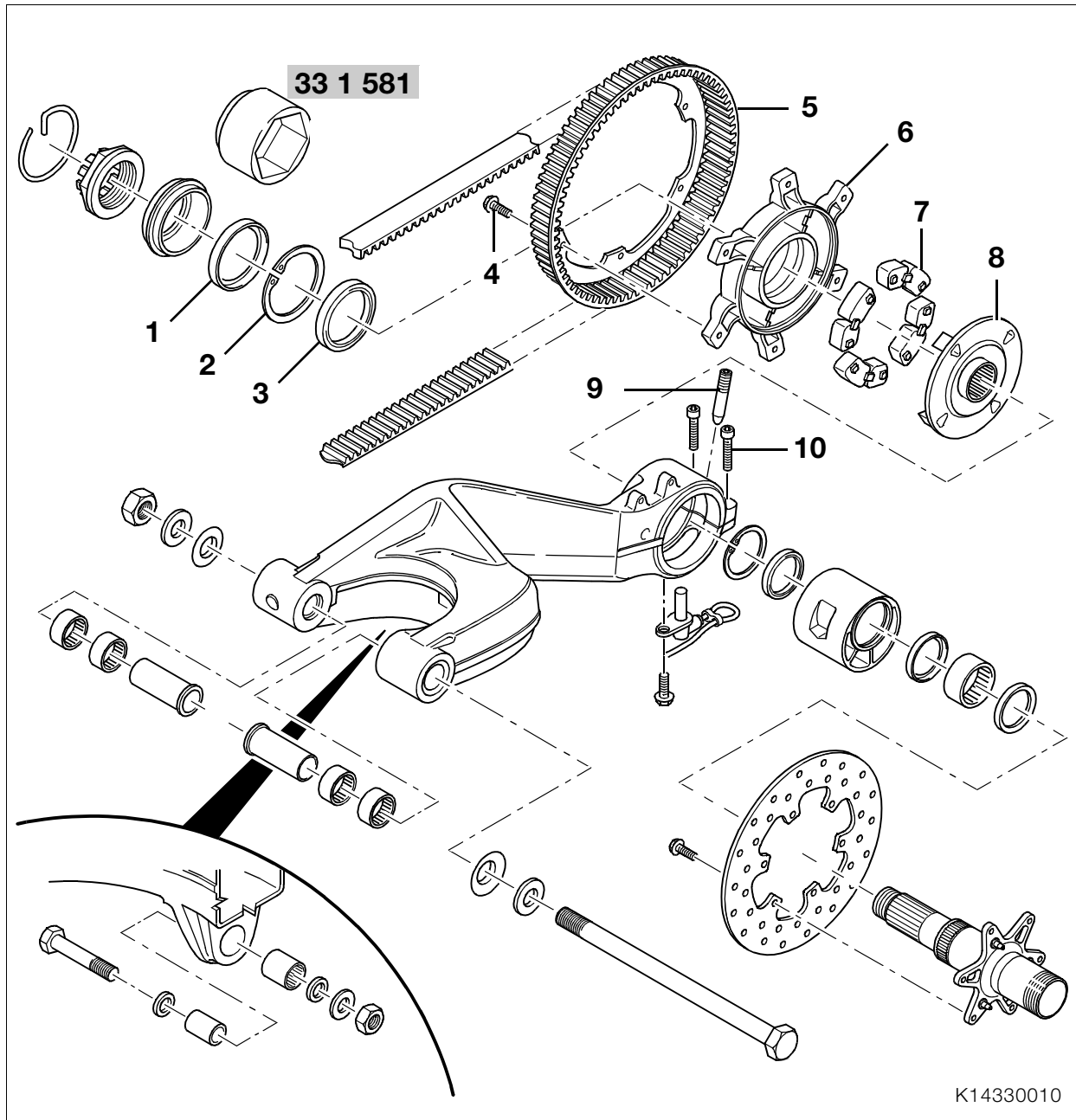


- Press in sealing rings (7) with drift, **BMW No. 33 6 631**, and spacing ring, **BMW No. 33 6 632**.
- Install bearing bushes.



- Press in needle roller bearing (9) with drift, **BMW No. 33 6 631**.

Offset "A" ..... 4 mm (0.1575 in)



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## Removing and installing drive damper

### Removing drive damper

- Release eccentric clamp (10).
- Back off adjusting screw (9).
- Turn the eccentric to slacken the belt.
- Remove the belt from the belt pulley.
- Slacken the rear fastener securing the belt cover.
- Remove the retaining ring.
- Apply the rear brake, and slacken nut (1) with socket, **BMW No. 33 1 581**.
- Remove the pressure piece.
- Remove damper housing (6).
- Remove driver (8).
- Remove damper elements (7).

### Removing pulley

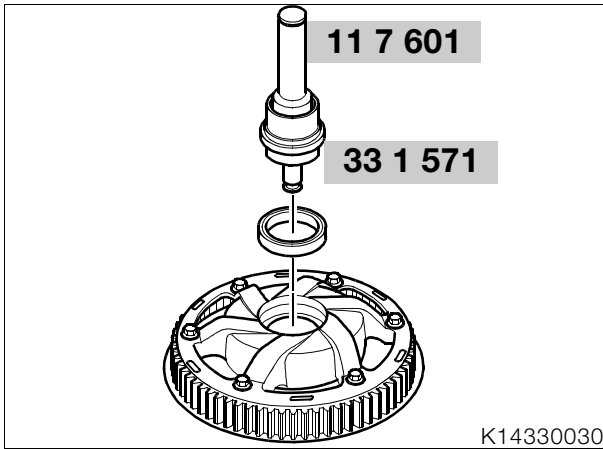
- Slacken 6 screws (4).
- Remove belt pulley (5).

### Disassembling drive damper

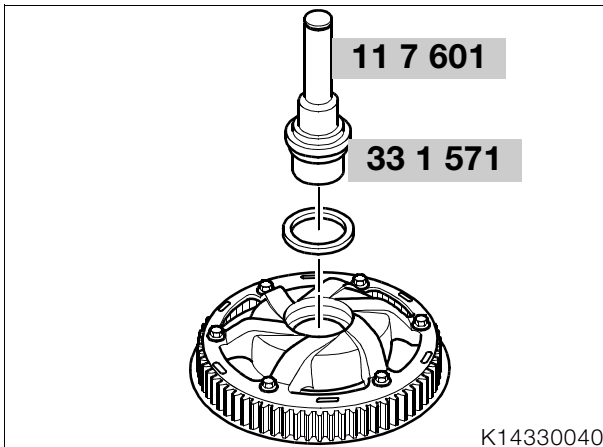
- Lever out shaft sealing ring (1) with screwdriver.
- Take out circlip (2) with circlip pliers.
- Place the damper housing (with bearing stop upward) on 2 wooden supports.
- Heat the damper housing to approx. 80 °C (176 °F), lift it slightly and drop it lightly onto the wooden supports.
- Bearing (3) drops out.



## Assembling drive damper



- Drive in the bearing with drift, **BMW No. 33 1 571**, and handle, **BMW No. 11 7 601**.
- Install retaining ring.



- Remove drift, **BMW No. 33 1 571**, from handle, **BMW No. 11 7 601**, turn it through 180° and reinstall.
- Press in new sealing ring until seated, using drift, **BMW No. 33 1 571**, and handle, **BMW No. 11 7 601**.

## Installing pulley



### Warning:

Mount the belt pulley on the drive damper only when the damper is lying flat.

- Spray the tapped holes in the drive damper and the contact faces on both sides between belt pulley and drive damper with **chain spray**.
- Lay the drive damper flat.
- Carefully position the belt pulley on the drive damper and hand-tighten the securing screws.
- Tighten the securing screws to specified torque in diagonally opposite sequence.
- Turn the drive damper over and spray the projecting ends of the securing screws for the belt pulley with **chain spray**.

## Installing drive damper

- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Grease the splines of the shaft with **Optimoly TA**.
- Spray **long-life lubricant** on the splines in the driver.
- Tighten clamping screws as follows:
  - Slightly tighten clamping screws (10) until seated
  - Tighten both clamping screws to initial torque of 10 Nm
  - Tighten both clamping screws to final torque of 21 Nm
  - Recheck that torque wrench clicks at 21 Nm for both clamping screws.



### Warning:

If belt pulley and/or drive damper is replaced, check runout at belt pulley (→ 33.15).

- Adjust belt tension (→ 00.56).



### Tightening torque:

Belt pulley to damper housing .....	28 Nm
Damper threaded fastener .....	160 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm

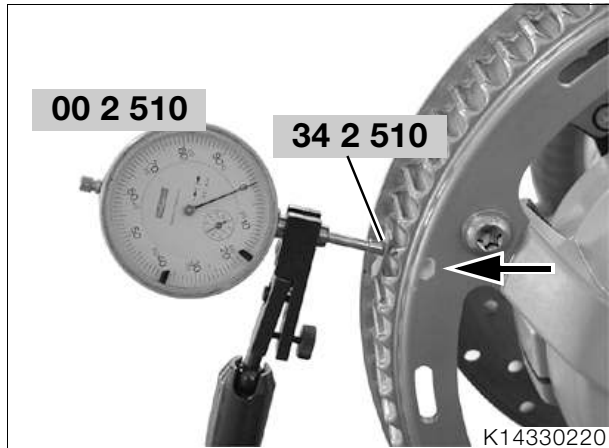
## Measuring runout of belt pulley



### Warning:

If belt pulley and/or drive damper is replaced, runout at the belt pulley has to be measured.

- Back off screws of eccentric clamp by 0.5 to 1 turn.
- Back off the adjusting screw.
- Turn the eccentric to slacken the belt.
- Remove the belt from the belt pulley.



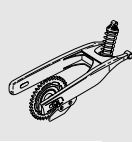
- Remove paint mark, if applicable.
- Secure dial gauge, **BMW No. 00 2 510**, with slide, **BMW No. 34 2 510**, in dial-gauge holder and align with middle of drive shaft.
- Measure the lowest point (minimum) of the teeth of the belt pulley and mark indelibly with paint (arrow).

- Installation is the reverse of the removal procedure, pay particular attention to the following.
  - Adjust belt tension (→ 00.56).



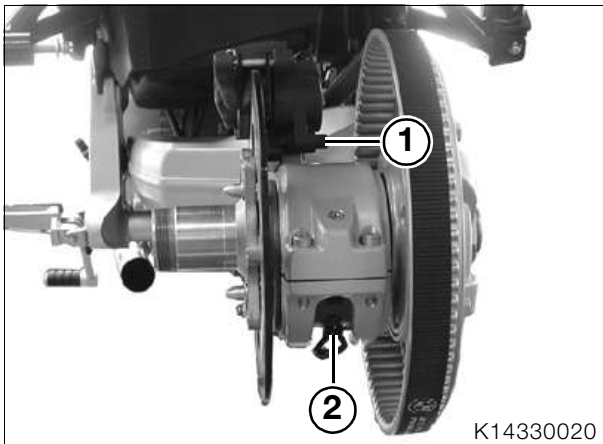
### Tightening torque:

Belt cover to swinging arm .....	9 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm



## Removing and installing eccentric with drive shaft

- Remove rear wheel (➡ 36.7).
- Remove drive damper (➡ 33.13).



- Remove fasteners (1) from brake caliper, remove brake caliper and secure to the rear frame at the same height, using cable ties.
- Remove ABS sensor (2).
- Pull eccentric with drive shaft to the left and clear of the swinging arm.

### Separating eccentric from drive shaft



- Force the eccentric off the drive shaft using bridge, **BMW No. 33 1 552**, thrust piece, **BMW No. 33 1 307**, universal puller, **BMW No. 00 7 500**, and support-plate, **BMW No. 33 1 551**.

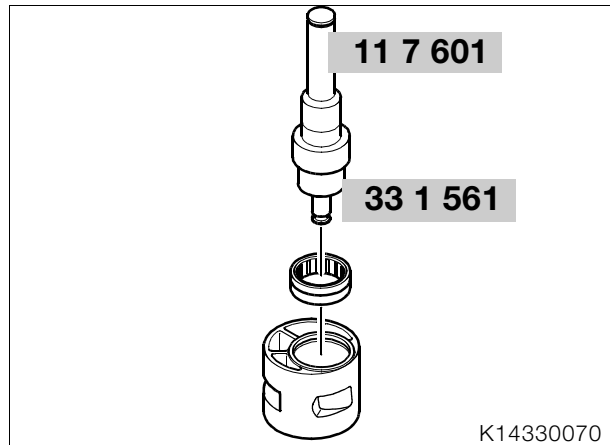


#### Note:

The eccentric can also be separated from the shaft with the aid of an hydraulic press.

## Removing and installing floating bearing of eccentric

- Lever shaft sealing ring out of eccentric with a screwdriver.
- Place the eccentric (with bearing stop upward) on 2 wooden supports.
- Heat the eccentric to approx. 40 °C (104 °F), lift it slightly and drop it lightly onto the wooden supports.
- The bearing drops out.
- Lever out the second shaft seal.



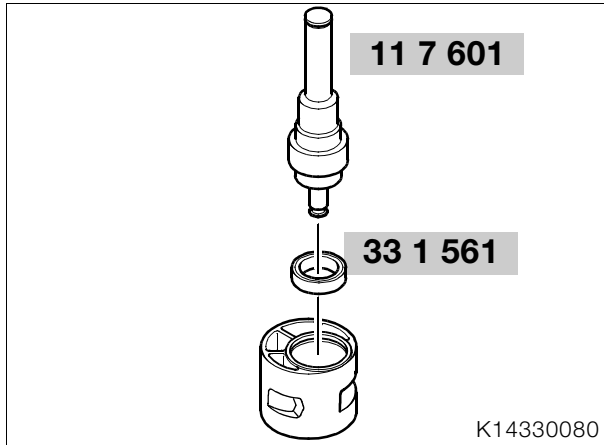
#### Note:

Drift, **BMW No. 33 1 561**, is used for installing the fixed bearing and the floating bearing. Use the appropriate stub end in each case.

- Press in new sealing ring until seated, using drift, **BMW No. 33 1 561**, and handle, **BMW No. 11 7 601**.
- Heat eccentric to approx. 40 °C (104 °F).
- Drive in bearing until seated, using drift, **BMW No. 33 1 561**, and handle, **BMW No. 11 7 601**.
- Press in new second sealing ring until seated, using drift, **BMW No. 33 1 561**, and handle, **BMW No. 11 7 601**.

### Removing and installing fixed bearing of eccentric

- Turn the eccentric over onto the other side.
- Remove the circlip.
- Heat the eccentric to approx. 40 °C (104 °F), lift it slightly and drop it lightly onto the wooden supports.
- The bearing drops out.



#### Note:

Drift, **BMW No. 33 1 561**, is used for installing the fixed bearing and the floating bearing. Use the appropriate stub end in each case.

- Heat eccentric to approx. 40 °C (104 °F).
- Drive in bearing until seated, using drift, **BMW No. 33 1 561**, and handle, **BMW No. 11 7 601**.
- Install the circlip.

### Pressing eccentric onto drive shaft



- Mount the eccentric on the drive shaft using M12 threaded rod, **BMW No. 31 5 691**, plate, **BMW No. 23 4 782**, threaded bushing, **BMW No. 31 5 611**, support, **BMW No. 31 5 696**, and M12 nut with bearing, **BMW No. 31 5 692**.

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



#### Attention:

Working from the left, push the eccentric with drive shaft all the way into the swinging arm until it is seated against the stop.



#### Tightening torque:

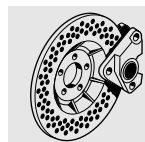
Swinging-arm pivot .....	100 Nm
Reaction link to swinging arm.....	41 Nm
Belt cover to swinging arm .....	9 Nm
ABS sensor to swinging arm .....	9 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm
Damper threaded fastener .....	160 Nm
Wheel nut to drive shaft.....	160 Nm
Brake caliper to swinging arm .....	21 Nm

# 34 Brakes

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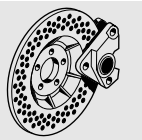
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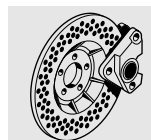
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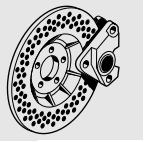
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Technical Data 34 Brakes		F 650 CS
Brake fluid		DOT 4
<b>Front wheel</b>		
Type		Hydraulically actuated 2-piston floating caliper with fixed brake disc
Brake pad lining		Sintered metal
Minimum lining thickness	mm (in)	1 (0.039)
Brake pad surface area	cm <sup>2</sup> (sq in)	45.6 (7.068)
Brake disc dia.	mm (in)	300 (11.81)
Brake disc thickness	mm (in)	5 (0.197)
Minimum thickness of brake discs	mm (in)	4.5 (0.177)
Permissible lateral runout	mm (in)	0.14 (0.0055)
Piston dia. in brake caliper	mm (in)	30/32 (1.18/1.26)
Piston diameter in handlebar lever cylinder	mm (in)	13 (0.512)
<b>Rear wheel</b>		
Type		Hydraulically actuated 1-piston floating caliper with fixed brake disc
Brake pad lining		Organic
Minimum lining thickness	mm (in)	1 (0.039)
Brake pad surface area	cm <sup>2</sup> (sq in)	29.1 (4.51)
Brake disc dia.	mm (in)	240 (9.449)
Brake disc thickness	mm (in)	5 (0.197)
Minimum thickness of brake discs	mm (in)	4.5 (0.177)
Permissible lateral runout	mm (in)	0.14 (0.0055)
Piston dia. in brake caliper	mm (in)	34 (1.339)
Piston dia. in actuating cylinder	mm (in)	13 (0.512)
<b>ABS</b>		
Type		Nippon ABS
Sensor gap, front	mm (in)	max. 1.5 (0.059)
Sensor gap, rear	mm (in)	max. 0.7 (0.028)







## 34 11 021 Removing and installing front brake caliper

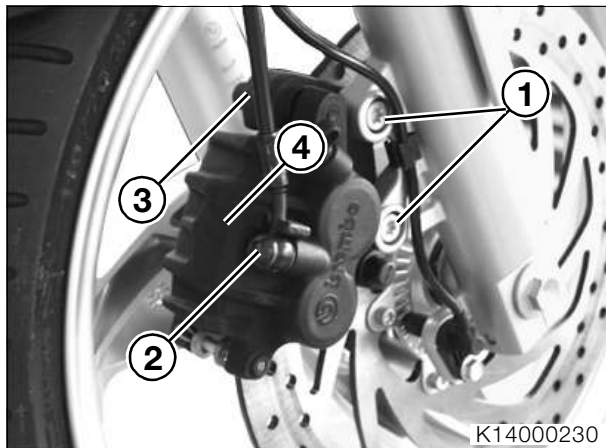
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



### Attention:

Comply with safety instructions for handling brake fluid.

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



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



### Attention:

Do not damage brake pads.

- Installation is the reverse of the removal procedure.



### Note:

Replace sealing rings for brake line.



### Attention:

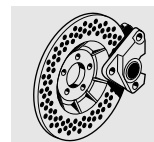
Top up brake fluid and bleed brake system.  
Operate brake several times until brake pads are bedded.

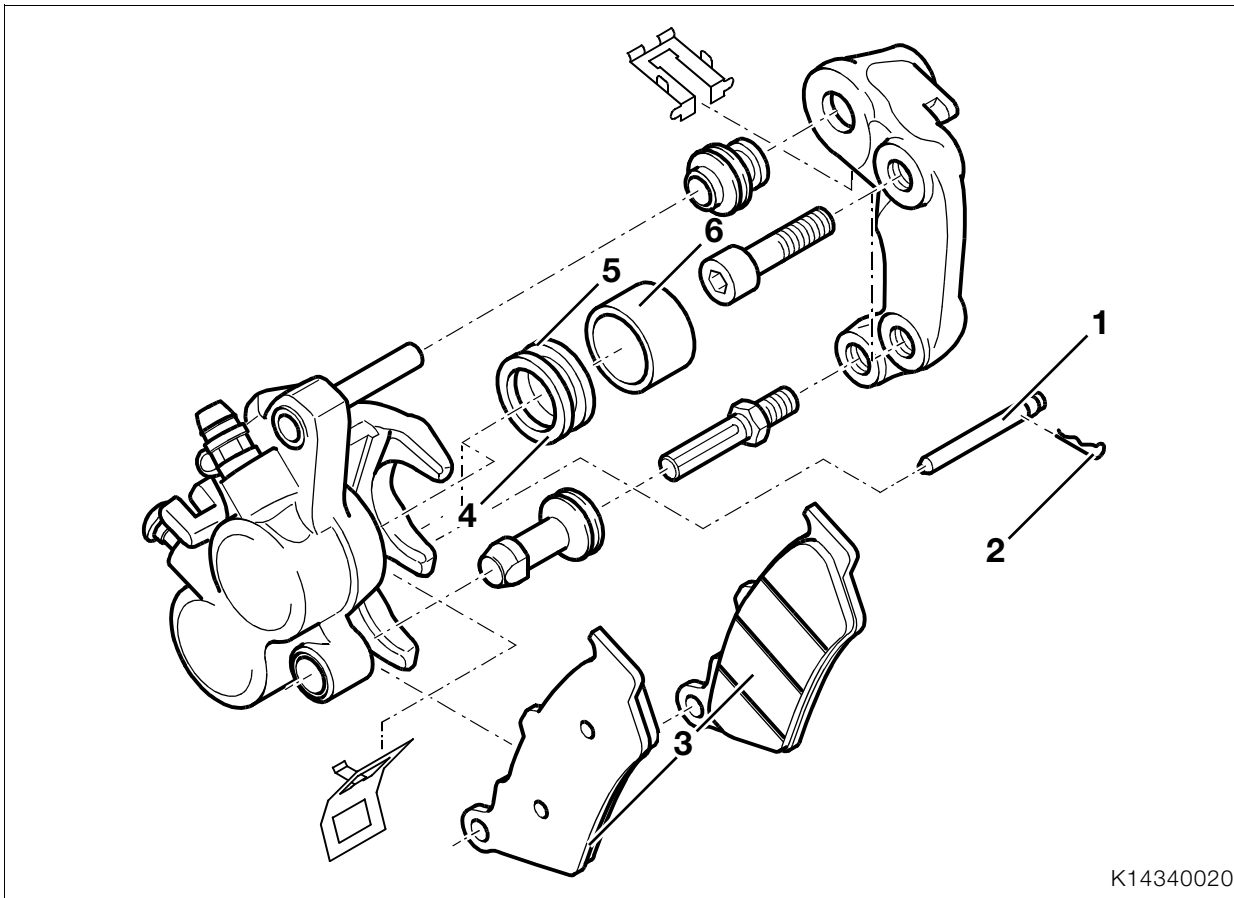


### Tightening torque:

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

## 34 11 008 Removing and installing front brake pads (→ 00.46)





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### 34 11 521 Removing and installing front brake pistons

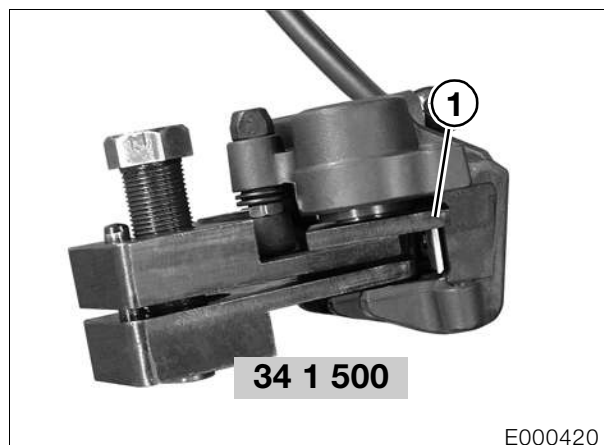
- Remove front brake caliper.
- Remove the split-pin keeper (2) from retaining pin (1).
- Drive the retaining pin out toward the wheel side.
- Pull the brake pads (3) down to remove.
- Insert a piece of cloth between the brake piston and the caliper.



#### Attention:

Do not insert your fingers between the pistons; risk of injury.

- **Carefully** press out brake pistons (6), using a compressed air gun at the brake line connection.
- Remove the two sealing rings (4, 5) from the left and right brake cylinder bores.
- Examine the brake caliper pistons for damage.



E000420

- 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 pistons (6) with the assembly fluid supplied and install.



#### Attention:

Keep the brake pistons parallel with their bores when installing.

- Fully force back the pistons with resetting tool, **BMW No. 34 1 500**, and metal strip (1) (approx. 8 mm thick).
- Install the brake pads.

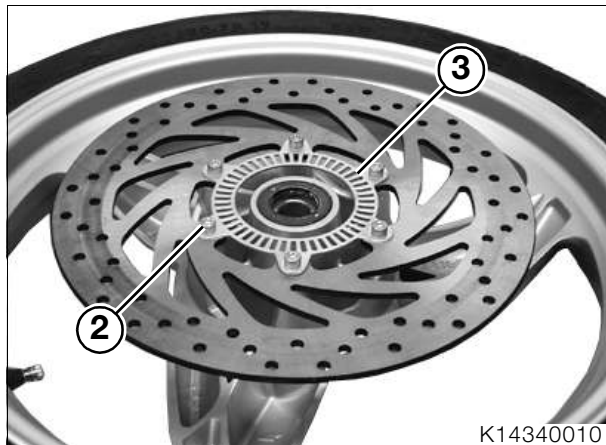
## 34 11 809 Removing and installing front brake disc



### Attention:

Do not operate the brake with the wheel removed.

- Remove front wheel (→ 36.5).



### Note:

Retaining screws (2) are secured with **Loctite 2701** and should be heated if necessary before removal.

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



### Attention:

The inscription on the brake disc must face toward the inside.

- 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 2701** and install the screws.



### Tightening torque:

Brake disc to front wheel hub  
(clean thread + Loctite 2701)..... 10 Nm

## Checking brake disc for wear (→ 00.45)

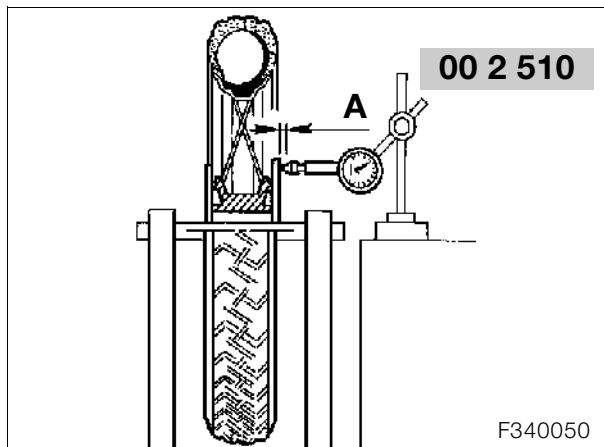
### Checking front brake disc for lateral runout



### Attention:

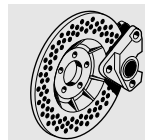
Do not operate the brake with the wheel removed.

- Remove front wheel (→ 36.5).



- Mount front wheel on balancing stand, **BMW No. 36 3 606**, with balancing shaft, **BMW No. 36 3 600**.
- Using dial gauge, **BMW No. 00 2 510**, measure lateral runout.

Lateral runout "A" ..... max. 0.14 mm



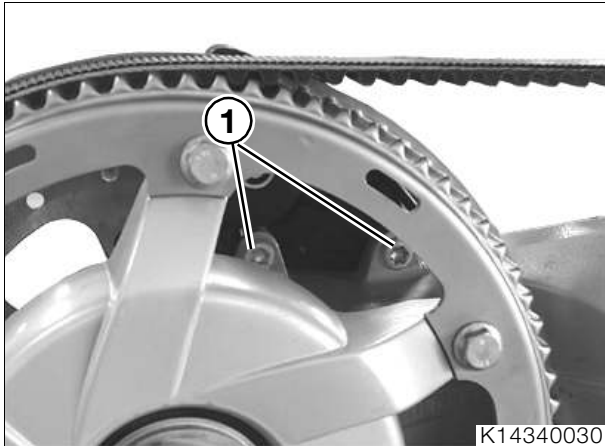
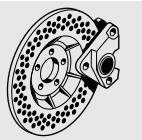
## 34 21 222 Removing and installing rear brake caliper



### Attention:

Comply with safety instructions for handling brake fluid.

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove rear wheel (→ 36.7).
- Press the brake caliper against the brake disc in order to force the piston back
- Disconnect brake line from brake caliper, seal the bore and hook it onto the rear frame.



### Attention:

Do not damage brake pads.

- Remove fasteners of brake caliper (1) and carefully remove the brake caliper from the rear swinging arm.

- Installation is the reverse of the removal procedure.



### Note:

Replace sealing rings for brake line.



### Attention:

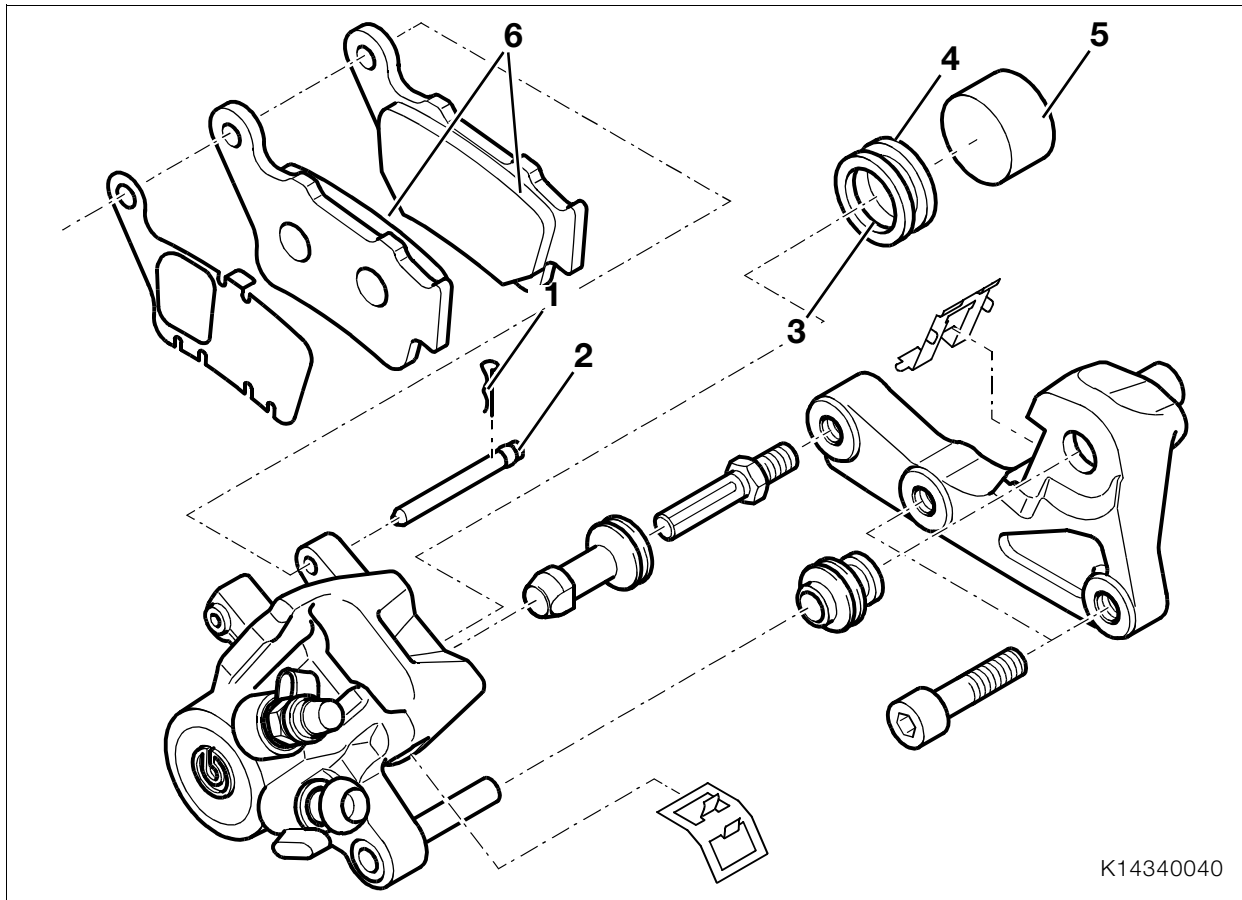
Top up brake fluid and bleed brake system. Operate brake several times until brake pads are bedded.



### Tightening torque:

Brake line to brake caliper..... 18 Nm  
Brake caliper to swinging arm ..... 21 Nm

## 34 21 200 Removing and installing rear brake pads (→ 00.46)



## 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 toward the wheel side.
- Remove brake pads (6).
- Insert a piece of cloth between the brake piston and the caliper.

### Attention:

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 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.

### Attention:

Keep the brake pistons parallel with their bores when installing.

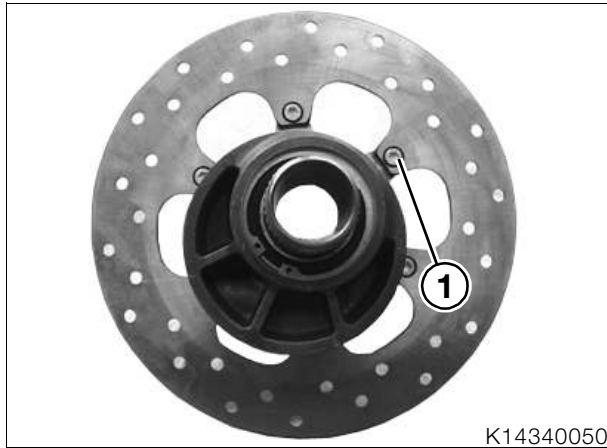
- Using piston compressor **BMW No. 34 1 500**, if necessary, press the pistons fully back.
- Install the brake pads.

## 34 21 301 Removing and installing rear brake disc

### Attention:

Do not operate the brake with the wheel removed.

- Remove rear wheel (→ 36.7).
- Remove rear brake caliper.
- Remove the eccentric (→ 33.16).



### Note:

Retaining screws (1) are secured with **Loctite 2701** 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.

### Attention:

The inscription on the brake disc must face toward the eccentric.

- Clean the threads of the securing screws and rear wheel shaft, coat threads with **Loctite 2701** and install.
- After installing the rear wheel, adjust the belt tension (→ 00.56).

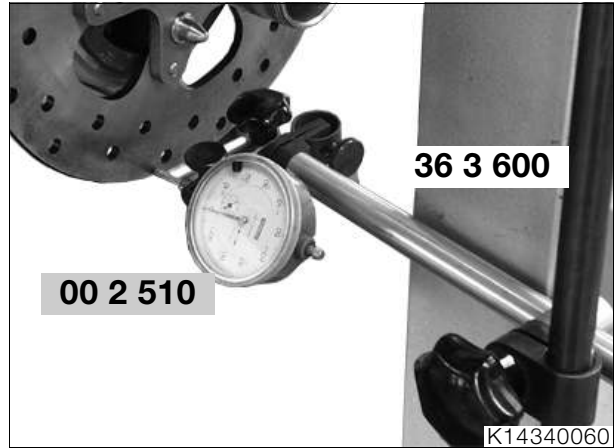
### Tightening torque:

Brake disc to rear wheel drive shaft  
(clean thread + Loctite 2701)..... 11 Nm

## Checking brake disc for wear (→ 00.47)

### Checking rear brake disc for lateral runout

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove rear wheel (→ 36.7).



- Secure dial gauge, **BMW No. 00 2 510**, to balancing jig, **BMW No. 36 3 600**, and measure lateral runout.

Lateral runout.....max. 0.14 mm (0.0055 in)

### Replacing primary sealing boot, front brake master cylinder (→ 00.52)

## Removing and installing front brake master cylinder

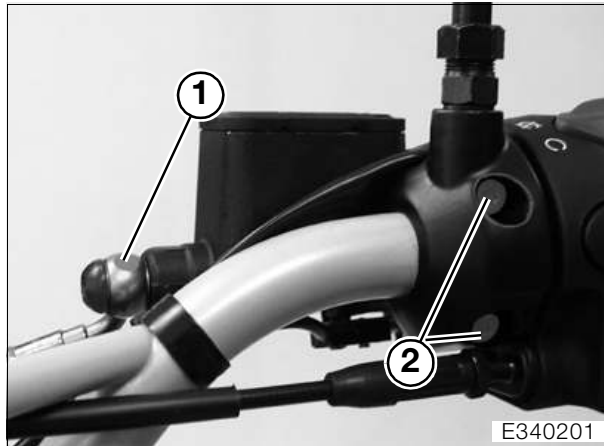
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



### Attention:

Comply with safety instructions for handling brake fluid.

- Drain the brake system.
- Remove brake light switch.



- 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.



### Attention:

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



### Note:

Replace the sealing rings for the brake hose.



### Attention:

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

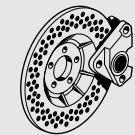


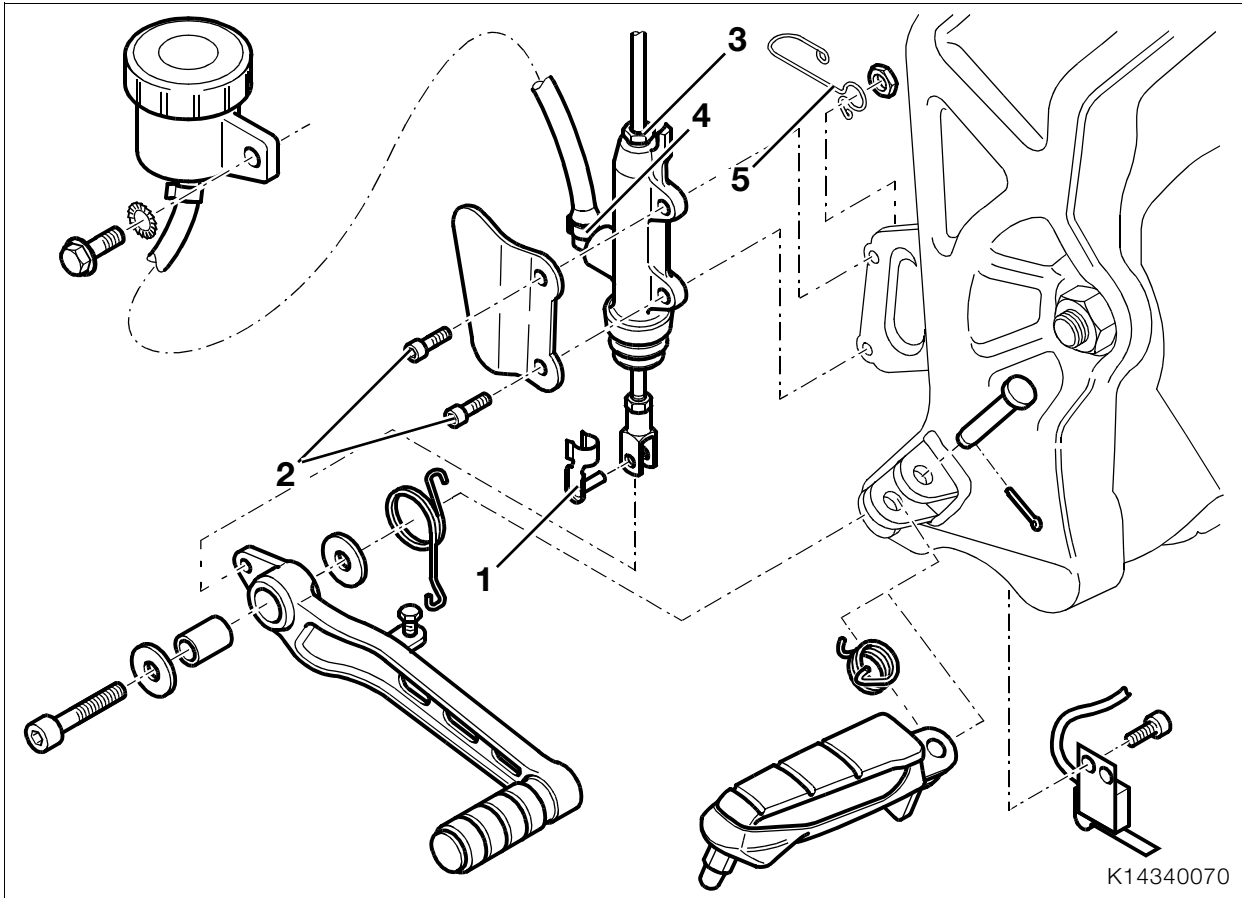
### Tightening torque:

Brake hose to brake master cylinder .....	18 Nm
Handlebar fitting to handlebar .....	9 Nm
Brake-light switch to handlebar fitting .....	3 Nm

## 32 72 119 Removing and installing handbrake lever (→ 32.13)

## Replacing primary sealing boot, rear brake master cylinder (→ 00.53)





### 34 31 001 Removing and installing rear brake master cylinder

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



#### Attention:

Comply with safety instructions for handling brake fluid.  
Do not operate the brake when disassembled.

- Drain the brake system.
- Disengage piston thrust rod (1).
- Disconnect brake line (3).
- Open the hose clamp of the expansion tank (4).
- Remove deflector (5).
- Remove fasteners (2) of brake master cylinder and remove brake master cylinder with cover.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Secure brake line to brake master cylinder.
- Tighten non-reusable hose clip (4) with pliers, **BMW No. 13 1 500**.



#### Attention:

Top up brake fluid and bleed brake system.  
Operate brake several times until brake pads are bedded.  
Check/adjust blow-by clearance at piston rod.



#### Attention:

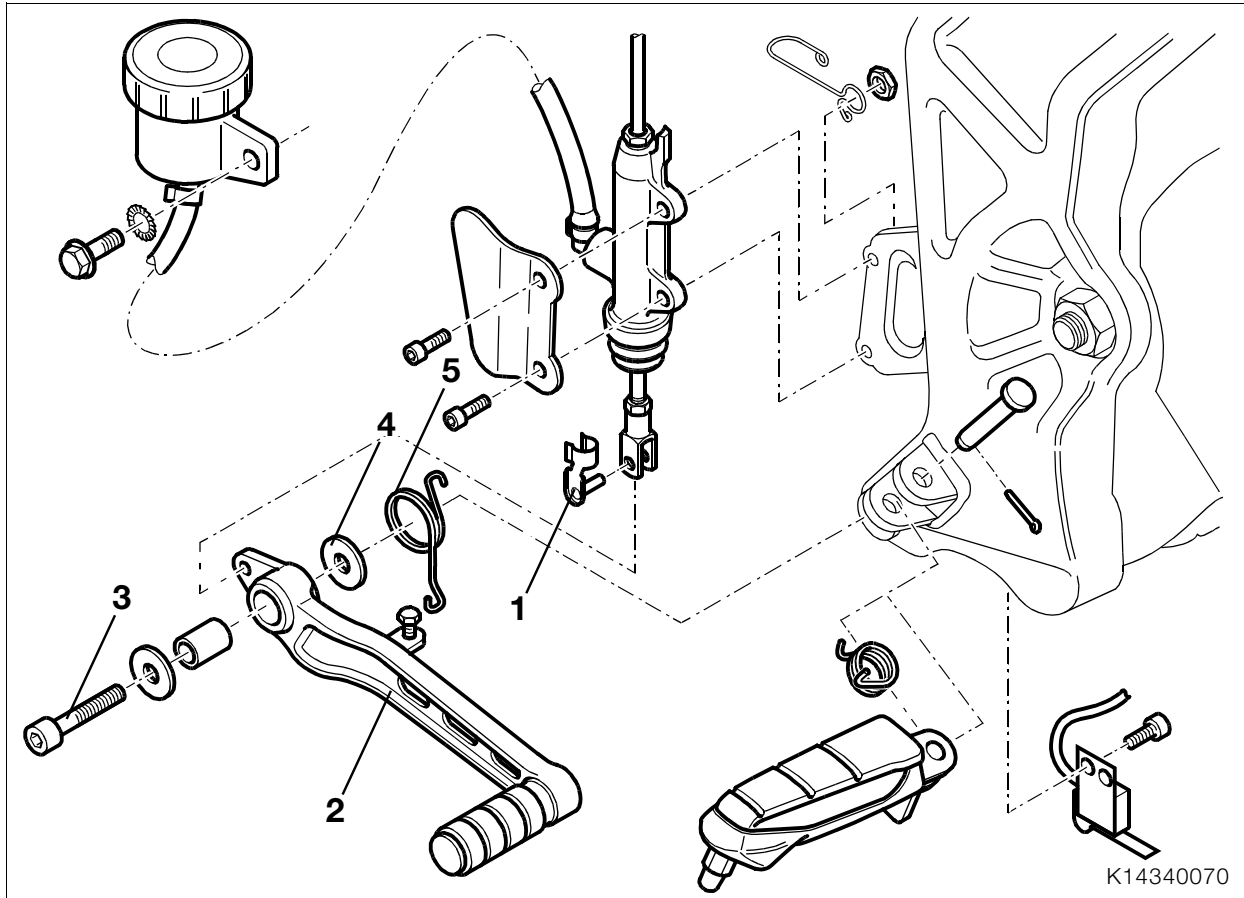
If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.  
If the **BMW MoDiTeC** is not used there is a danger of residual air remaining in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



#### Tightening torque:

Brake line to brake master cylinder ..... 18 Nm  
Master brake cylinder to frame ..... 10 Nm  
Deflector to frame ..... 6 Nm





### 35 21 000 Removing and installing brake pedal

- Disengage piston thrust rod (1).

#### **⚠ Attention:**

Note washer (4) between lever and frame.

- Remove hexagon fit bolt (3).
- Remove footbrake lever (2) with torsion spring (5).
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Grease the bearing bushing with **Staburags NBU 30 PTM**.

#### **⚠ Attention:**

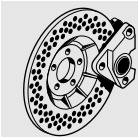
Check/adjust blow-by clearance at piston rod. The brake light must come on as soon as the rear brake begins to take effect.



#### **Tightening torque:**

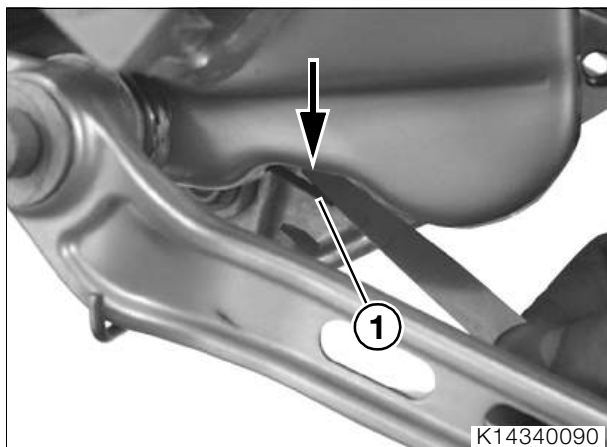
Brake pedal to frame ..... 21 Nm

K14340070



## Checking blow-by clearance at piston thrust rod, adjusting if necessary

### Checking blow-by clearance at piston rod



- Press the footbrake lever.
- Insert feeler gauge between the brake-light switch lever (1) and the stop on the frame (arrow).
- Slowly release the footbrake lever and check play.

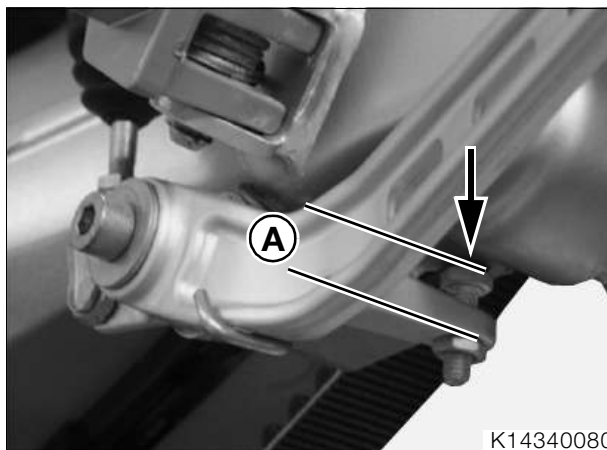
#### Play must be perceptible

Feeler gauge thickness:..... 0.15 mm (0.006 in)

#### No play perceptible

Feeler gauge thickness:..... 0.35 mm (0.0138 in)

### Adjusting play at piston rod

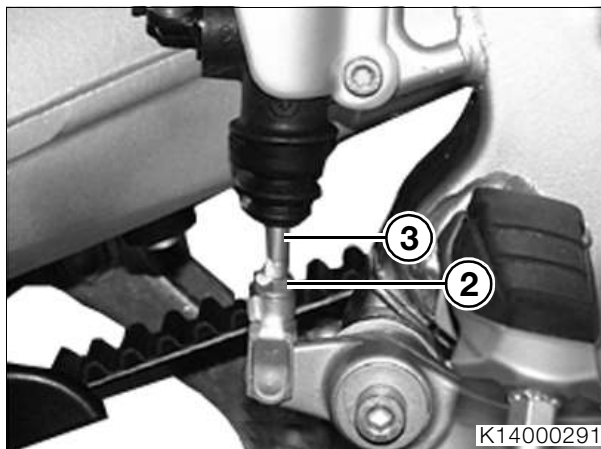


- Set the adjusting screw of the footbrake lever to distance "A".

Distance **A**: .....  $12.2 \pm 0.2$  mm ( $0.48 \pm 0.00787$  in)  
(Bottom edge of footbrake lever to top edge of adjusting screw.)

- Insert feeler gauge between the brake-light switch lever and the stop on the frame (arrow).

Feeler gauge thickness:..... 0.2 mm (0.008 in)



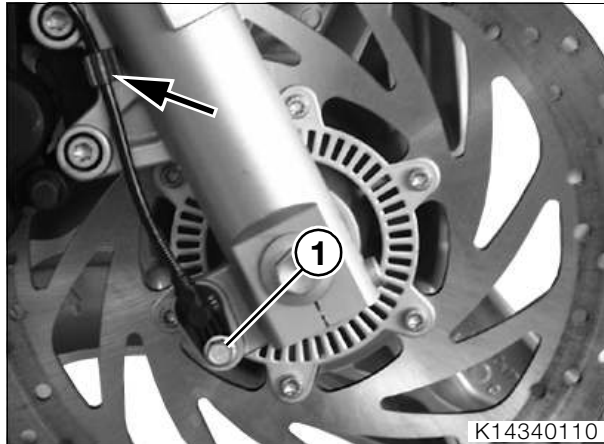
- Unscrew locknut (2).
- Insert piston rod (3), turning it clockwise until play is perceptible.
- Carefully back off piston rod to take up play and tighten locknut.
- Remove the feeler gauge.
- Recheck play.
- Apply coloured sealing lacquer to the locknut.

#### ⚠ Tightening torque:

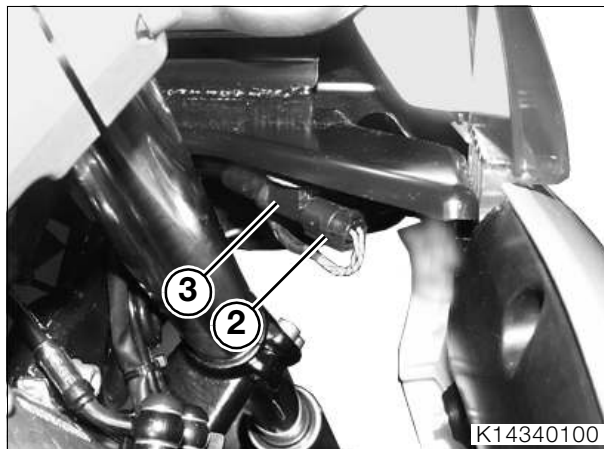
Locknut for adjustable stop,  
brake-light switch..... 4 Nm  
Locknut for thrust rod..... 9 Nm

### 34 52 044 Removing and installing front ABS sensor


- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.




- Remove the fastener securing ABS sensor (1) to the front fork.
- Release ABS sensor cable from clip (arrow).
- Turn the handlebars to the left.



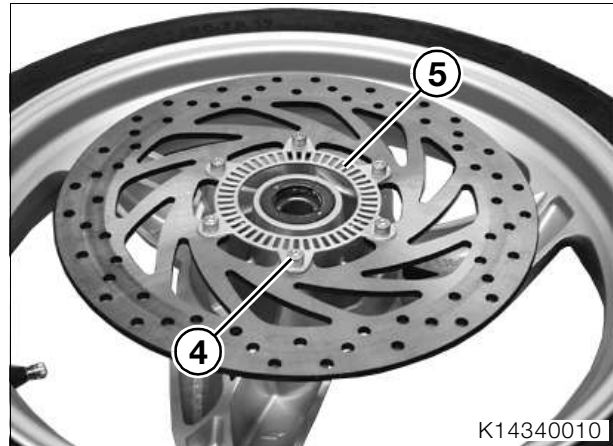
- Disconnect ABS plug (2) and push ABS plug (3) out of the holder by pushing back the lug.
- Remove the sensor cable from the clips on the brake hose.
- Cut through the cable ties at the instrument wiring harness.
- Remove the sensor and the cable.
- Installation is the reverse of the removal procedure.


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

### 34 51 610 Removing and installing front ABS sensor ring


 **Attention:**  
Do not operate the brake with the wheel removed.

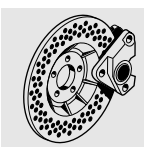
- Remove front wheel (→ 36.5).



 **Note:**  
Retaining screws (4) are secured with **Loctite 2701** and should be heated if necessary before removal.

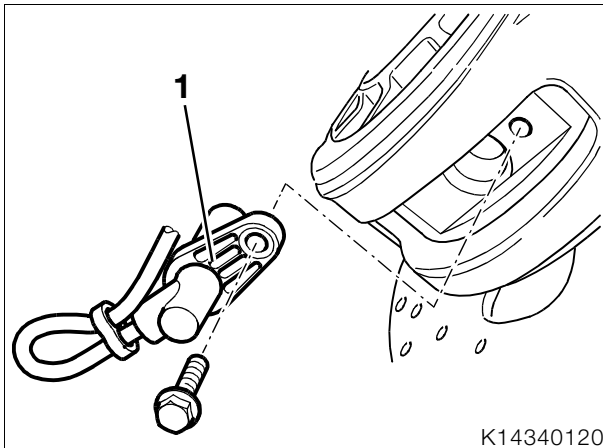
- Remove retaining screws (4) from brake disc.
- Remove sensor ring (5).
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Clean the threads of the securing screws and wheel hub, coat threads with **Loctite 2701** and install the screws.

 **Tightening torque:**  
Brake disc to front wheel hub  
(clean thread + Loctite 2701)..... 10 Nm

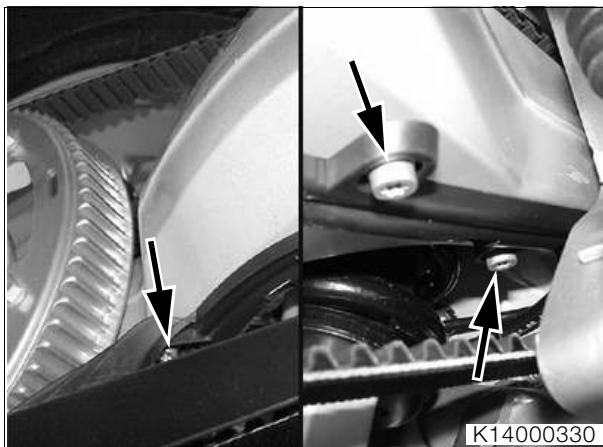


## 34 52 111 Removing and installing rear ABS sensor

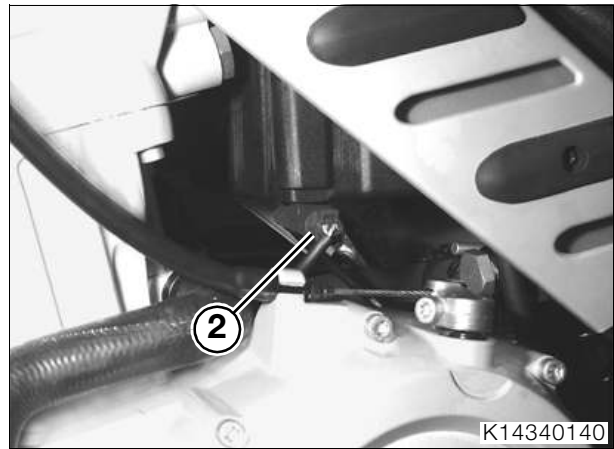
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Slacken the belt (⇒ 00.57).
- Remove the belt from the belt pulley.



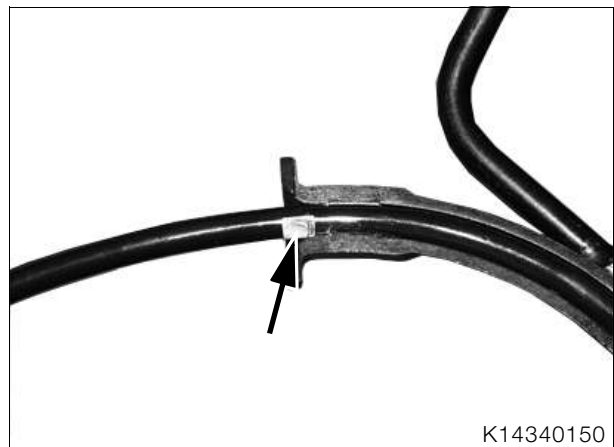
- Remove ABS sensor (1) from the eccentric.



- Remove the fasteners for the belt cover (arrows) and lift the belt cover with lines clear of the swinging arm.
- Remove the ABS sensor cable from belt cover.



- Disconnect ABS plug (2) and push ABS plug out of the holder by pushing back the lug.
- Remove the ABS sensor cable from the clips and pull it aside. Cut the cable ties at the brake hose.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### ⚠ Attention:

The white mark (arrow) on the sensor cable must be aligned with the rear edge of the belt cover.

- Adjust belt tension (⇒ 00.57).

### 🔧 Tightening torque:

ABS sensor in eccentric..... 9 Nm  
 Belt cover to swinging arm..... 9 Nm

## 34 51 050 Removing and installing ABS control unit



### Attention:

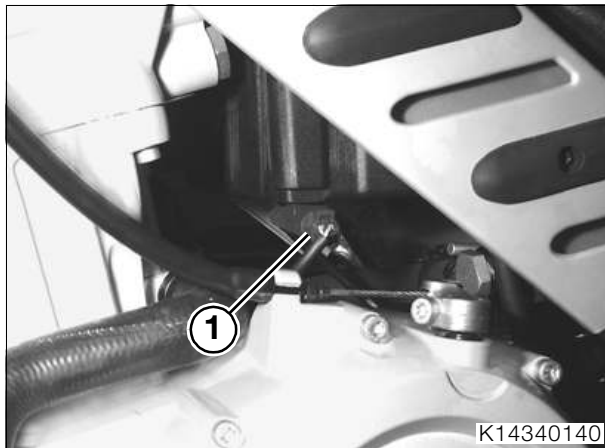
All work on the ABS control unit must be carried out by an authorised BMW workshop.



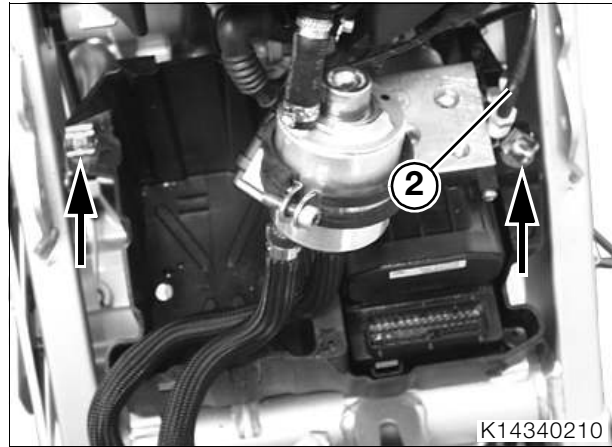
### Attention:

If brake fluid escapes, it may damage paint. Line connections must be protected against dirt penetration; seal or cover ends of lines and ports.

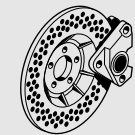
- Remove rear brake lines (→ 34.19).
- Remove front brake lines (→ 34.18).
- Remove the battery breather hose and cable for the brake-light switch out of the holders on the battery holder.



- Disconnect ABS plug (1) and push ABS plug out of the holder by pushing back the lug.



- Release locking washers (arrows).
- Lift the ABS control unit with battery carrier out of the frame, while carefully pushing aside brake line (2) from the control unit to the front master brake cylinder.
- Remove the fasteners securing the control unit to the battery holder and remove the control unit from the battery holder.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Attention:

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



### Attention:

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:

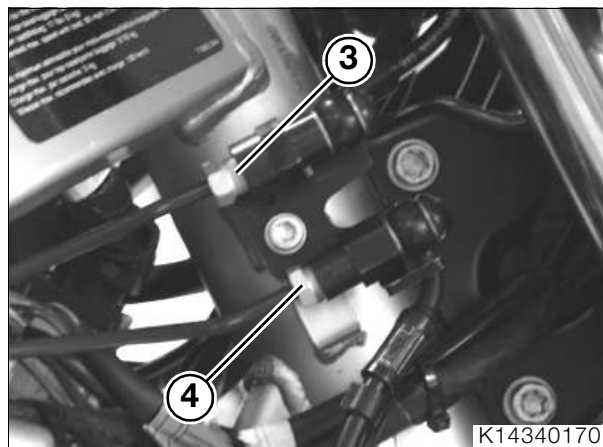
ABS control unit to holder ..... 21 Nm

## Removing and installing front brake lines/hoses (with ABS)

### Attention:

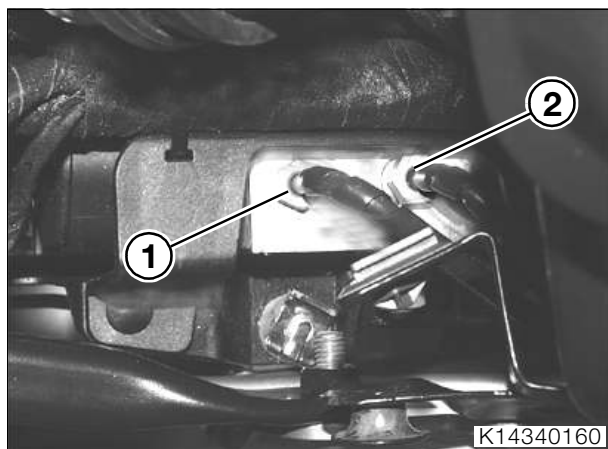
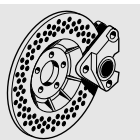
If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

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 the auxiliary stand, **BMW No. 00 1 620**.
- Drain the brake system.
- Remove right cover (→ 46.6).
- Remove cover of connector, right (→ 46.9).
- Remove right oil-tank cover (→ 46.14).
- Push up the tab to pull the fuse box from the holder.



- 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) from adapter.
- Release the brake line from the clips on the frame.
- Remove brake line from control unit to brake caliper.
- Remove control unit with battery holder (→ 34.17).
- Remove brake line from control unit to brake master cylinder.
- Installation is the reverse of the removal procedure, pay particular attention to the following.

### Attention:

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

### Tightening torque:

Brake lines to ABS control unit.....	18 Nm
Brake lines at adapter	
to brake hose.....	18 Nm

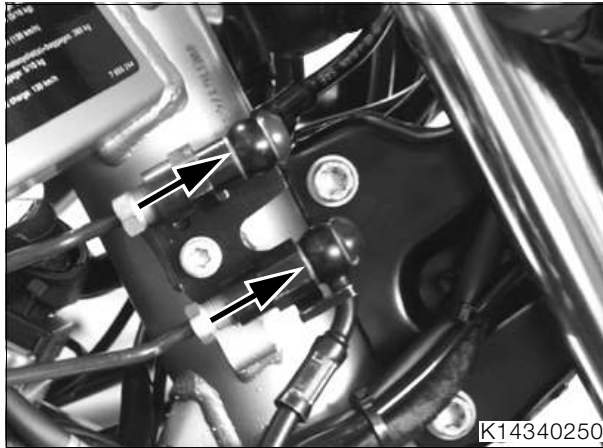
### 34 32 401 Removing and installing front brake hoses

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover (→ 46.6).

#### Attention:

Comply with safety instructions for handling brake fluid.

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



- **[ABS]** Disconnect the brake hoses at the adapter to the brake lines (arrows).
- Remove the brake hose from the clips on the sensor cable.
- Disconnect the brake hose from the brake master cylinder.
- Release the brake hose from the clip on the fork.
- 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.

#### Attention:

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

#### Tightening torque:

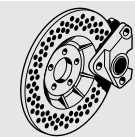
Brake hose to brake master cylinder ..... 18 Nm  
 Brake hose to brake caliper ..... 18 Nm  
 Brake hose to adapter  
 to brake line ..... 18 Nm

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

#### Attention:

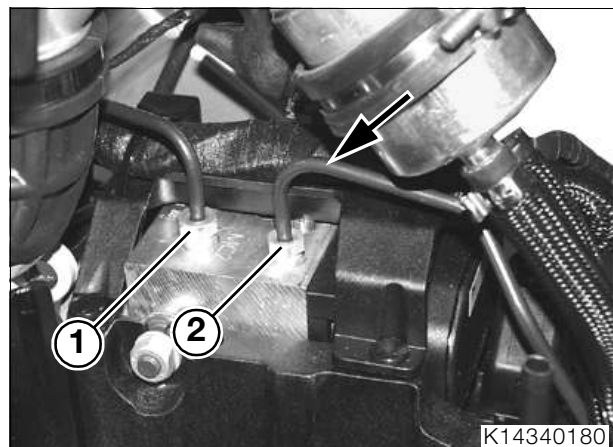
If the vehicle is equipped with **ABS**, the brake system has to be bled using the **BMW MoDiTeC**, and the Control Units, Toolbox ABS, routine; this procedure is supplementary to that described in the Repair Manual.

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

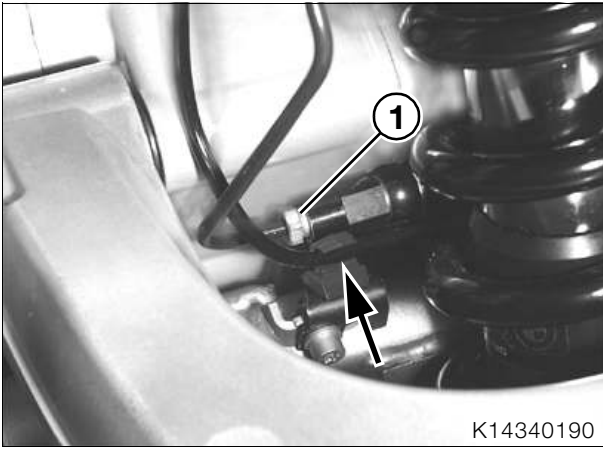


### Removing and installing brake lines

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Drain the brake system.
- Remove the rear frame (→ 46.16).
- Remove the battery (→ 00.20).
- Remove the stowage-compartment frame (→ 46.14).



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



**Note:**

Install new cable ties before installing the cable guide.



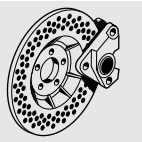
**Attention:**

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



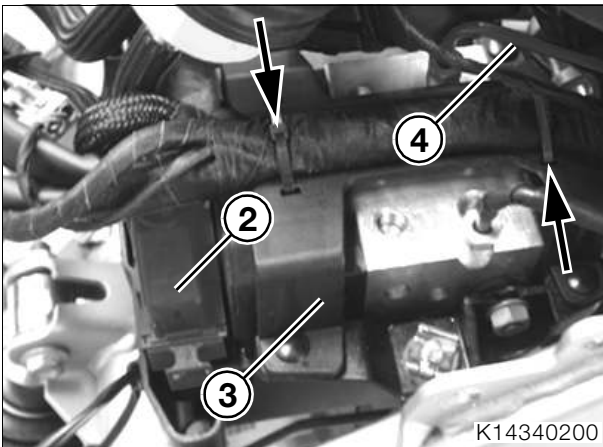
**Tightening torque:**

Brake lines to ABS control unit.....	18 Nm
Brake line to adapter with brake hose.....	18 Nm
Brake line to brake master cylinder .....	18 Nm



- Release ABS sensor cable from holder (arrow).
- Disconnect brake line (1) from adapter.
- Release brake line from clip on frame and from retaining clip on battery breather hose.
- Remove the brake line.
- Disconnect brake line from brake master cylinder.
- Release the brake line from both clips on the frame.

**34 52 080 Removing and installing brake hose**



- Disconnect plug for control unit (2).
- Cut through the cable ties (arrows), push the wiring harness forward and lay it down.
- Remove cable guide (3).
- Remove brake line (4).
- Installation is the reverse of the removal procedure, pay particular attention to the following.

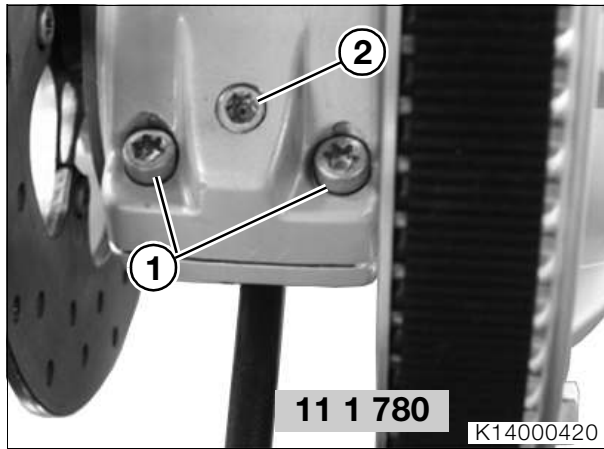


**Note:**

Before removing the silencer, use adhesive tape to mask the rim at the silencer (arrow).

- Remove silencer (→ 18.5).
- Remove rear wheel (→ 36.7).





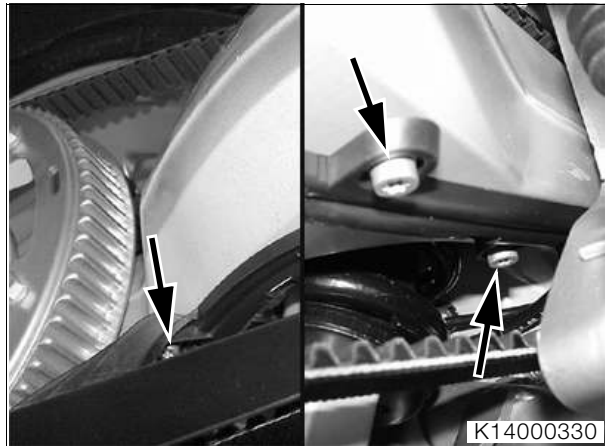
- Back off screws of eccentric clamp (1) by 0.5 to 1 turn.
- Back off adjusting screw (2) several turns.
- Relieve tension on belt by backing off eccentric with punch, **BMW No. 11 1 780**.



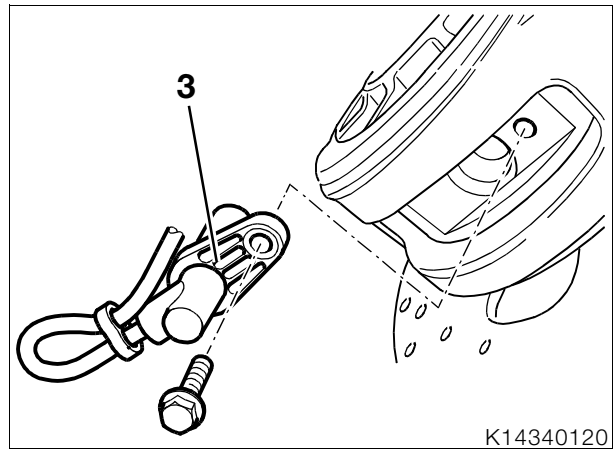
**Warning:**

Do not bend the belt sharply or twist it. Do not bend the belt through a radius of less than 100 mm.

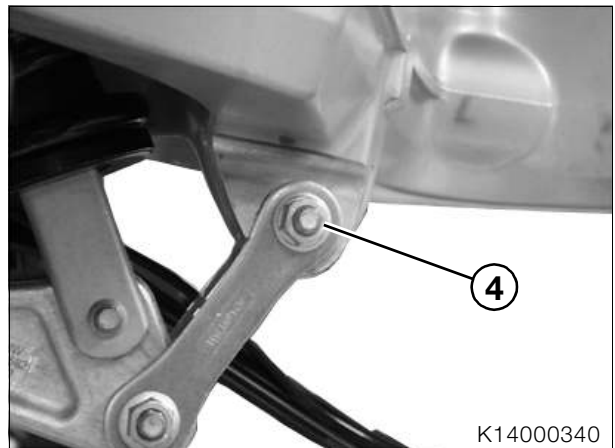
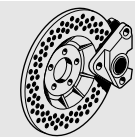
- Remove the belt from the belt pulley.



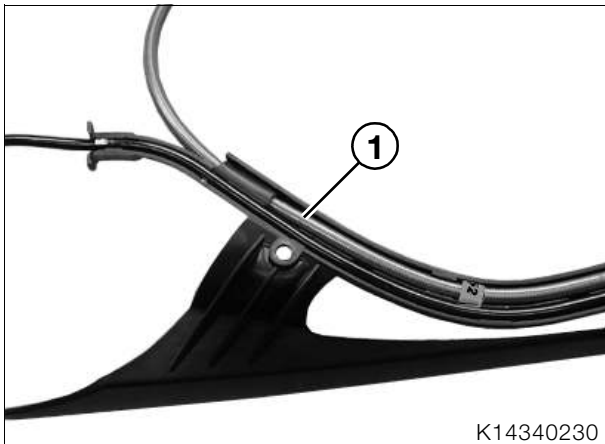
- Remove fasteners securing belt cover (arrows).



- Remove ABS sensor (3) from the eccentric.
- Disconnect brake hose from brake caliper.

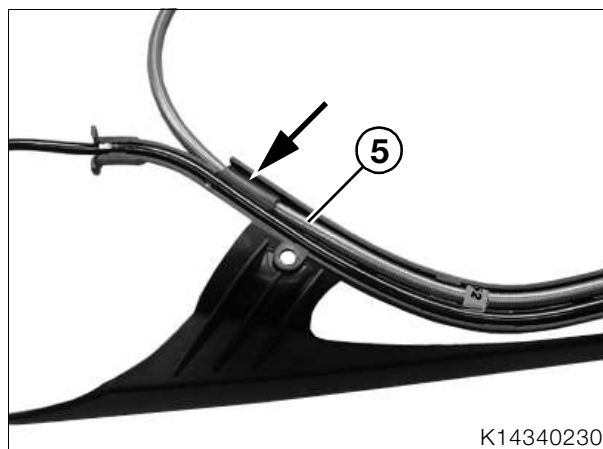


- Remove the fastener securing the strut (4) to the swinging arm.
- Remove the swinging arm pivot shaft.
- Remove the swinging arm.

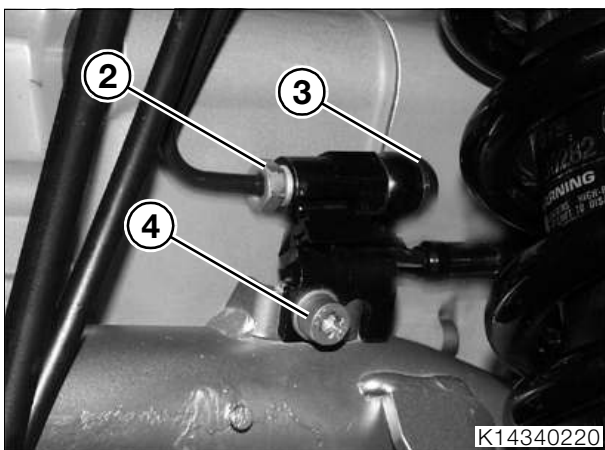
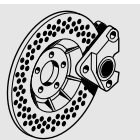


- Unclip brake hose (1) from the belt cover.

- Hold adapter in position and introduce the brake line.
- Tighten the fasteners of adapter, brake hose and brake line.



- Clip brake hose (5) into the belt cover, making sure that the rubber grommet (arrow) is correctly positioned.



- Release ABS sensor cable from holder at adapter.
- Disconnect brake hose (3) from adapter.
- Disconnect brake line (2) from adapter.
- Remove fastener for adapter (4) and remove adapter.
- Installation is the reverse of the removal procedure, pay particular attention to the following.

**Note:**

Replace the sealing rings for the brake hose.

- Connect brake hose to adapter.

**Note:**

Grease the axle of the swinging arm with **Optimoly TA** before installing. Note the thrust washers when installing the swinging arm.

– Adjust belt tension (→ 00.56).

**Note:**

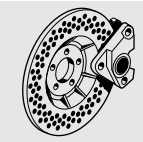
Before installing it on the silencer, coat the inside of the clamp with **Optimoly TA**.

**Tightening torque:**

Silencer to rear frame.....	41 Nm
Silencer to elbow .....	55 Nm
Rear wheel nut .....	160 Nm
Eccentric clamp, rear swinging arm	
Initial torque .....	10 Nm
Final torque .....	21 Nm
Belt cover to swinging arm.....	9 Nm
ABS sensor.....	9 Nm
Brake hose to brake caliper .....	18 Nm
Reaction link to swinging arm.....	41 Nm
Swinging-arm pivot shaft.....	100 Nm
Brake hose to adapter.....	18 Nm
Brake line to adapter.....	18 Nm
Adapter to frame .....	9 Nm

## Checking front ABS sensor ring for runout

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



- Check gap between ABS sensor and sensor ring by inserting feeler gauge at three points offset 120° around the ring.
- Replace the sensor ring if the measured gap is greater than the maximum permissible sensor gap at one or more point (→ 34.15).

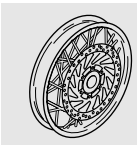
**ABS sensor gap** ..... max. 1.5 mm (0.059 in)

# 36 Wheels and tyres

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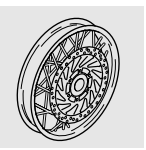
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Technical Data 36 Wheels		F 650 CS	
<b>Front wheel</b>			
Type		Cast light-alloy wheel	
Tyre size		110/70 ZR 17	
Tyre pressures (cold)			
One-up	bar (psi)	2.2 (31.91)	
Two-up	bar (psi)	2.2 (31.91)	
Two-up and luggage	bar (psi)	2.2 (31.91)	
Maximum imbalance	g (oz.)	30 (1.059)	
Rim size		3.00 X 17	
Maximum vertical runout (rim)	mm (in)	0.3 (0.0118)	
Maximum lateral runout (rim)	mm (in)	0.3 (0.0118)	
<b>Rear wheel</b>			
Type		Cast light-alloy wheel	
Tyre size		160/60 ZR 17	
Tyre pressures (cold)			
One-up	bar (psi)	2.5 (36.26)	
Two-up	bar (psi)	2.5 (36.26)	
Two-up and luggage	bar (psi)	2.5 (36.26)	
Maximum imbalance	g (oz.)	30 (1.059)	
Rim size		4.50 X 17	
Maximum vertical runout (rim)	mm (in)	0.3 (0.012)	
Maximum lateral runout (rim)	mm (in)	0.3 (0.012)	

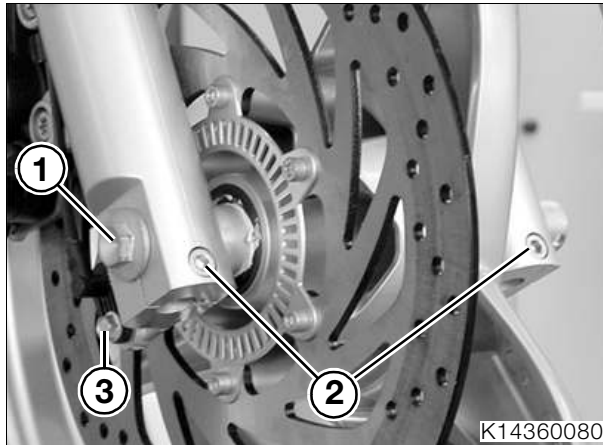




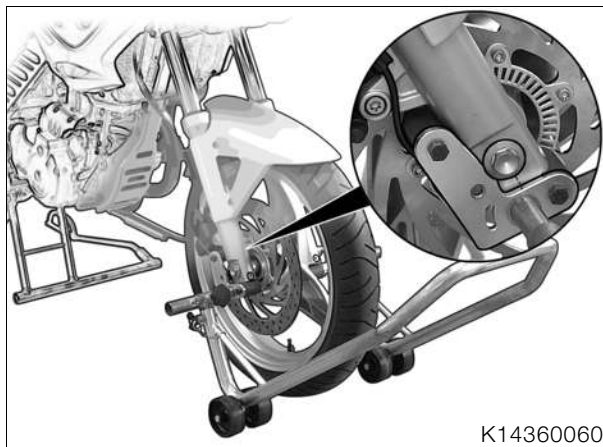
## 36 30 300 Removing and installing front wheel

### 36 30 300 Removing front wheel

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Mask off the rim.



- Remove ABS sensor (3).



- Take load off front wheel/lift clear of ground.

#### **Attention:**

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

- Remove hex bolt (1).
- Slacken clamp screws (2) for the quick-release axle.
- Pull out the quick-release axle, remove the spacers.

#### **Attention:**

Do not operate the handbrake lever when the wheel is removed.

Protect the wheel bearings against dirt and moisture.

Carefully guide the masked front-wheel rim past the brake caliper, taking care not to scrape the rim.

- Roll the front wheel forward to remove.

## 36 30 300 Installing front wheel

#### **Attention:**

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

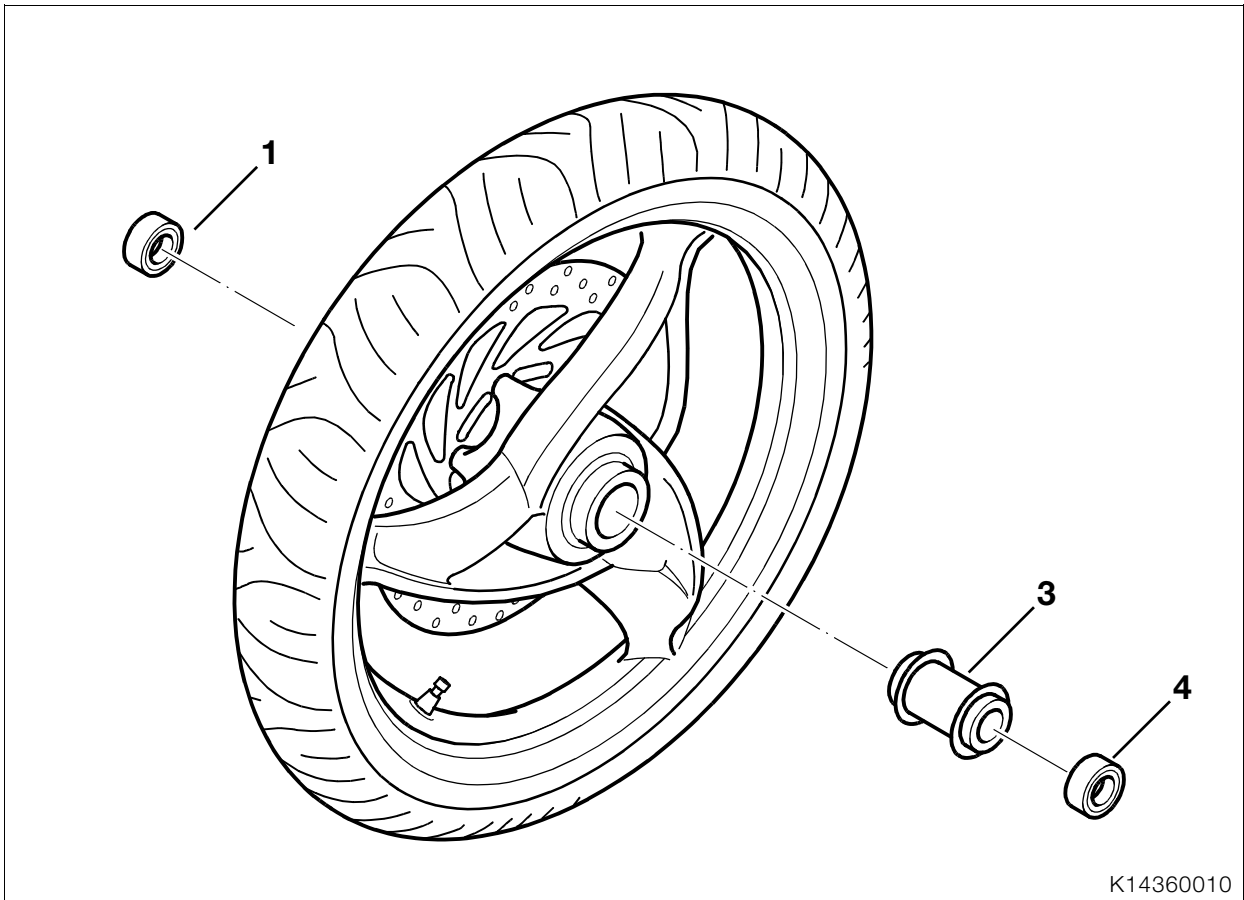
- Clean the quick-release axle and the contact face of the shaft sealing ring and grease them with **Optimoly TA**.
- Install spacer sleeves.
- Insert the front wheel between the telescopic-fork legs.
- Install the quick-release axle with spacer.
- Firmly tighten quick-release axle.
- Lower the front wheel to the ground and, with the handbrake applied, compress the front suspension firmly several times.
- Tighten clamp screws (2) for the quick-release axle.
- Install ABS sensor (3).

#### **Tightening torque:**

Quick-release axle to fork leg ..... 30 Nm  
 Clamp screw for front quick-release axle ..... 23 Nm  
 ABS sensor, front ..... 9 Nm



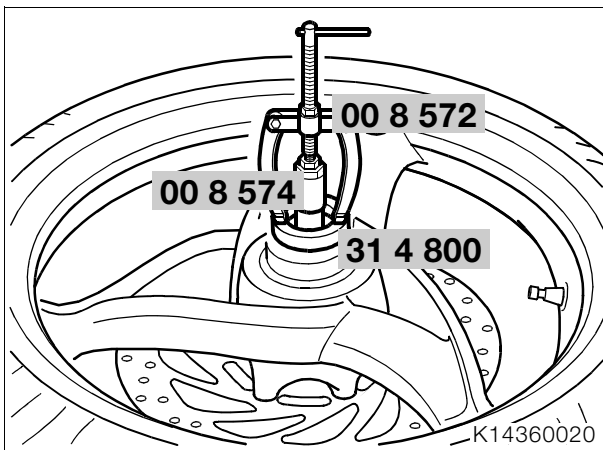




K14360010

### 36 31 851 Removing and installing front wheel bearing

- Remove front wheel.



K14360020



#### Note:

To simplify removal or installation, heat the bearing seat to 100 °C (212 °F).  
To avoid damaging the wheel hub, use variable support ring, **BMW No. 31 4 800**.

#### Removing left-hand wheel bearing

- Lever out the shaft sealing ring with a screwdriver.
- Remove wheel bearing (4) with counter-support, **BMW No. 00 8 572**, internal puller, **BMW No. 00 8 574**, and variable support ring, **BMW No. 31 4 800**.
- Remove spacer sleeve (3).

#### Removing right-hand wheel bearing

- Lever out the shaft sealing ring with a screwdriver.
- Remove bearing (1) with counter-support, **BMW No. 00 8 572**, internal puller, **BMW No. 00 8 574**, and variable support ring, **BMW No. 31 4 800**.

### 36 31 851 Installing wheel bearings

- Clean the bearing seats.



- Drive in left wheel bearing with handle, **BMW No. 00 5 500**, and drift, **BMW No. 36 5 512**.
- Install the spacer bushing.
- Drive in right wheel bearing until seated using handle, **BMW No. 00 5 500**, and drift, **BMW No. 36 5 512**, making sure that wheel is supported only by the left-hand wheel bearing.

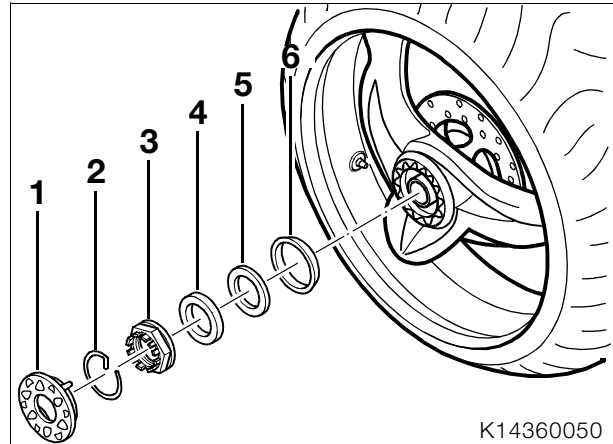


#### Note:

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.

- Install new shaft sealing ring with handle, **BMW No. 00 5 500**, and drift, **BMW No. 36 5 512**.

### 36 30 320 Removing and installing rear wheel



- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove silencer (→ 18.5).
- Remove wheel stud cover (1).
- Remove retaining ring (2).
- Slacken wheel nut (3) with socket, **BMW No. 36 3 681**.
- Remove cup spring (4).
- Remove washer (5).
- Remove taper ring (6).
- Remove the wheel.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Install cup spring (4) with the "OUTSIDE" wording to the outside



#### Attention:

Lightly coat the threads of the rear wheel fastener with **Optimoly TA**.

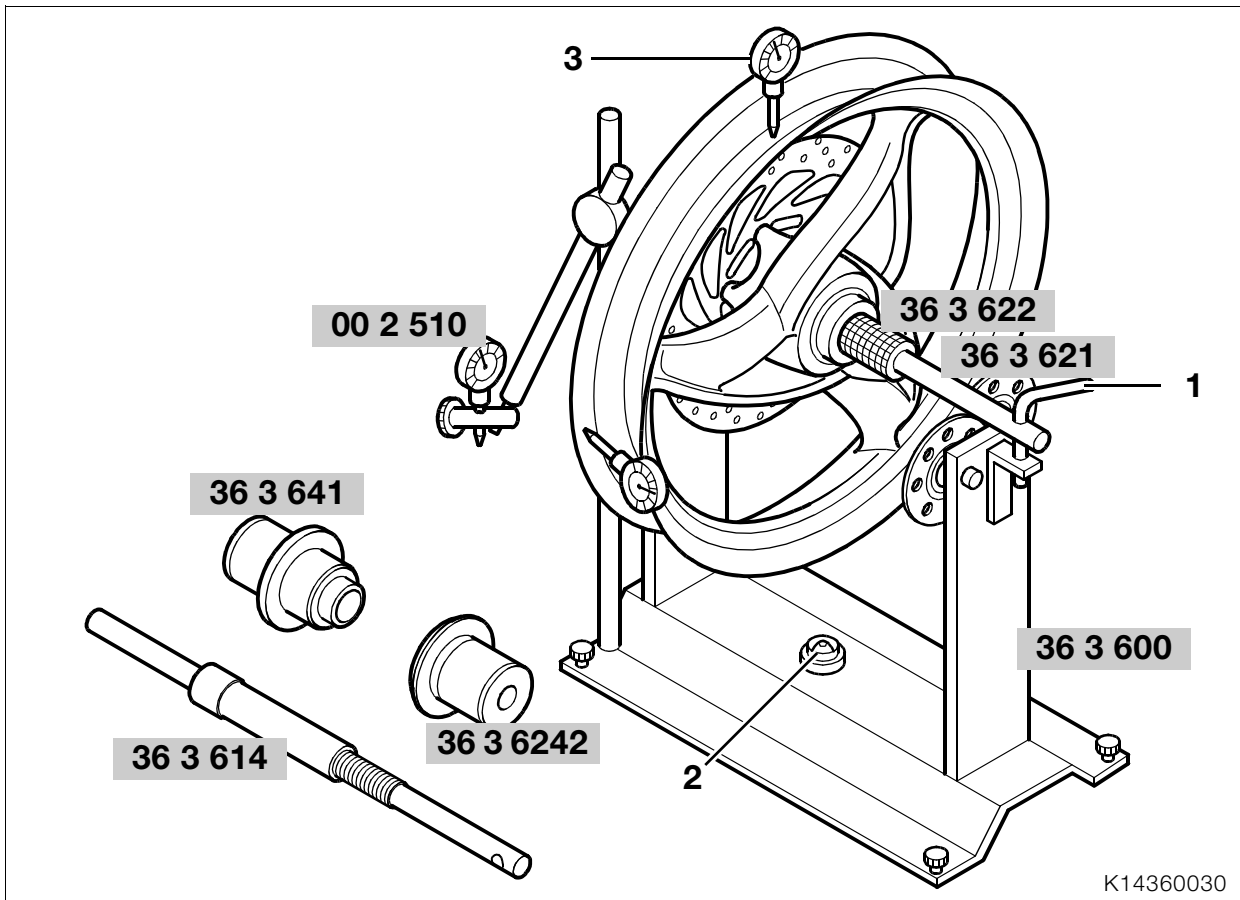
- Check retaining ring (2) for damage; replace if necessary.
- Tighten the wheel nut to the specified torque and continue turning the nut until the pin of the retaining ring can be inserted into the next hole.



#### Tightening torque:

Wheel nut to drive shaft (wheel side),  
(lightly coat the threads with

**Optimoly TA**) ..... 160 Nm



K14360030

### 36 32 528 Checking front and rear wheel rims

- Remove the wheels.

### 36 32 528 Checking rims

- Remove tyre.
- Level the balancing unit, **BMW No. 36 3 600**, at bubble gauge (2) in the baseplate.
- **[Front wheel]** Pass balancing shaft, **BMW No. 36 3 621**, through the wheel bearings and secure with nut, **BMW No. 36 3 622**.



Note:

Lightly oil adapter (cylindrical), **BMW No. 36 3 641**, prior to installation.

- **[Rear wheel]** Pass balancing shaft, **BMW No. 36 3 614**, and adapter (cylindrical), **BMW No. 36 3 641**, through the centre of the hub and secure with adapter (tapered), **BMW No. 36 3 642**.
- Fit wheel on balancing device.
- Use pin (1) to lock the balancing shaft against the balancing stand to prevent the shaft from turning.

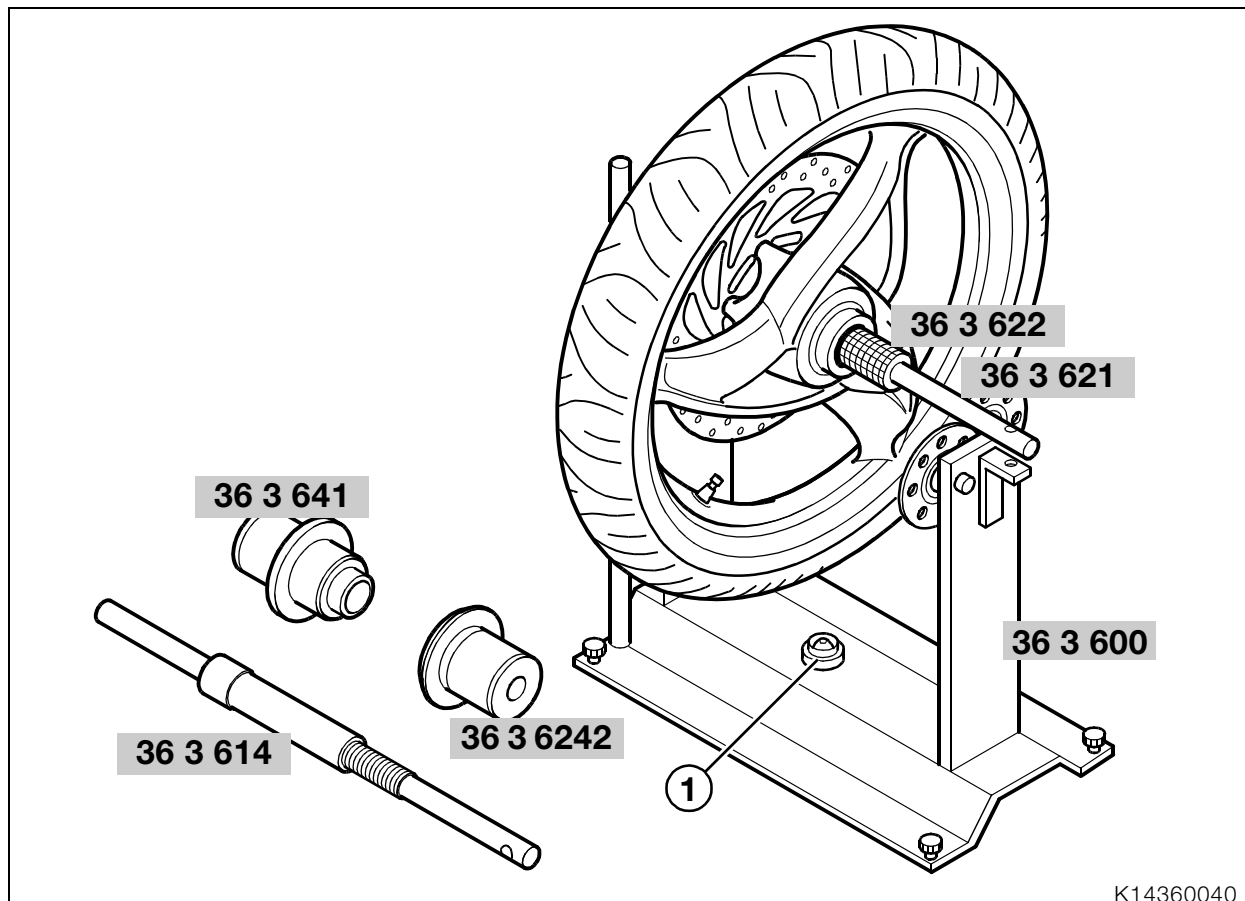


Note:

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 (3), **BMW No. 00 2 510**.

Vertical runout..... max. 0.3 mm (0.0118 in)  
Lateral runout..... max. 0.3 mm (0.0118 in)



K14360040

### 36 30 528 Static balancing of front/rear wheel

- Remove the wheels.
- Level the balancing unit, **BMW No. 36 3 600**, at bubble gauge (1) in the baseplate.
- **[Front wheel]** Pass balancing shaft, **BMW No. 36 3 621**, through the wheel bearings and secure with nut, **BMW No. 36 3 622**.



Note:

Lightly oil adapter (cylindrical), **BMW No. 36 3 641**, prior to installation.

- **[Rear wheel]** Pass balancing shaft, **BMW No. 36 3 614**, and adapter (cylindrical), **BMW No. 36 3 641**, through the centre of the hub and secure with adapter (tapered), **BMW No. 36 3 642**.
- Fit wheel on balancing device.
- Allow wheel to settle.
- Clean the attachment points for the adhesive weights.



**Attention:**

Maximum balance weight 30 grammes (1.059 oz).

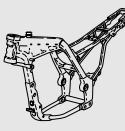
- Affix adhesive weights uniformly spaced on both sides of the rim opposite the wheel's heaviest point.
- Repeat the balancing procedure as a check.

# 46 Frame

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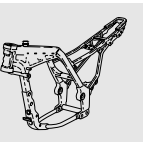
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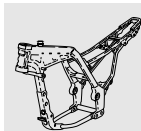
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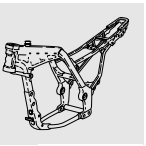
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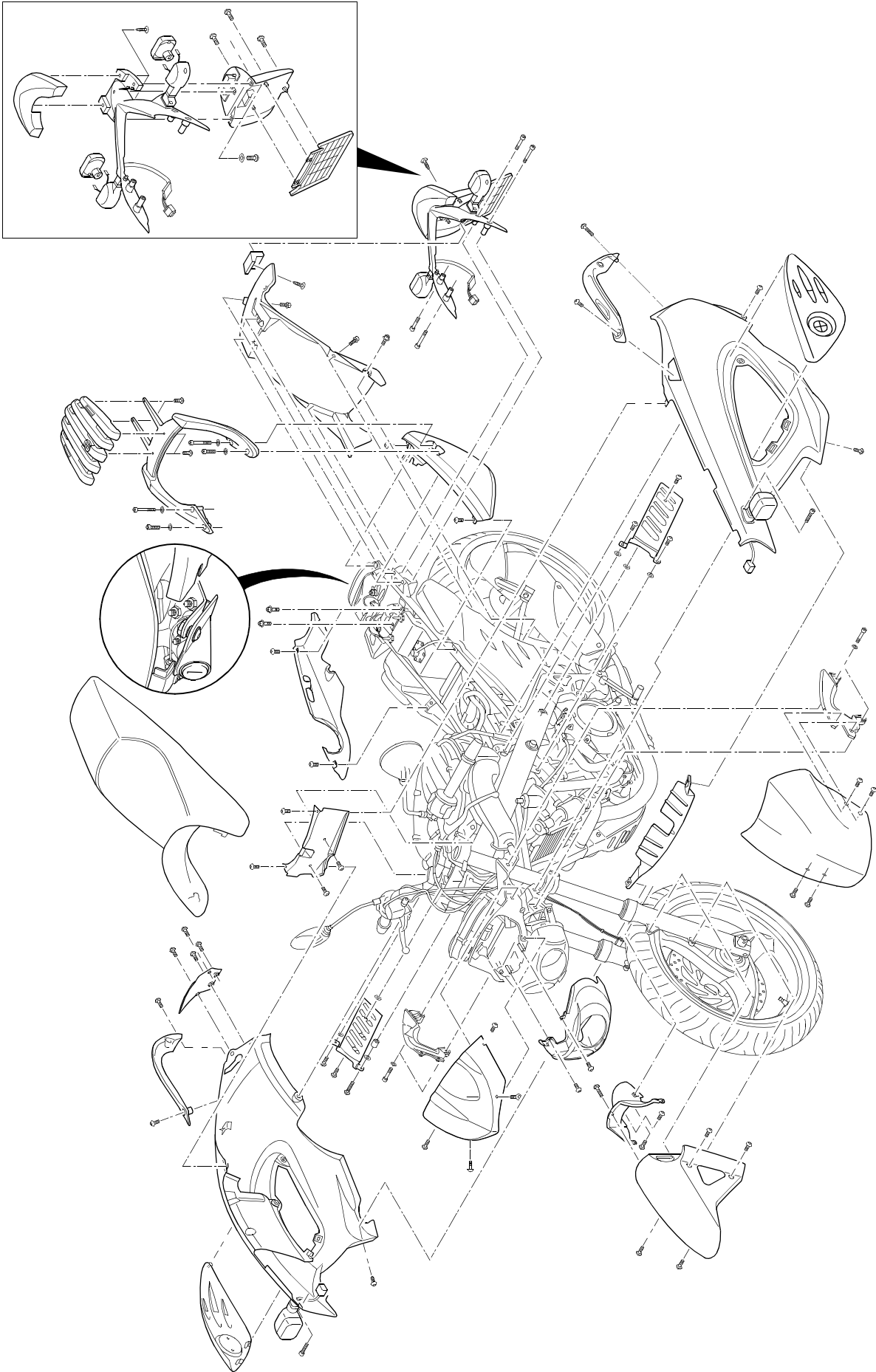
Technical Data 46 Frame		F 650 CS
<b>Frame</b>		
Type	Bridge-type tubular frame with integrated oil tank and bolted on rear frame	
Type plate location	On main frame, at front right	
Frame No. location	On right of steering head	
<b>Dimensions</b>		
Maximum length	mm (in)	2143 (84.37)
Overall height in normal position (full fuel load and 85 kg rider)	mm (in)	1342.5 (52.85)
Overall width (across mirrors)	mm (in)	893.2 (35.17)
Seat height without rider	mm (in)	780 (30.709)
[OE] Low seat	mm (in)	750 (29.53)
Ground clearance in normal position (full fuel load and 85 kg rider)	mm (in)	130 (5.118)
<b>Weights</b>		
Unladen weight, ready for road, tank full (without optional extras)	kg/lbs	187 (412.26)
Dry weight	kg/lbs	170 (374.85)
Permitted gross weight	kg/lbs	370 (815.702)
Maximum payload	kg/lbs	183 (403.442)
<b>Running-gear data</b>		
Wheelbase in normal position (full fuel load and 85 kg rider)	mm (in)	1493 (58.78)
Castor in normal position (full fuel load and 85 kg rider)	mm (in)	86 (3.386)
Steering head angle in normal position (full fuel load and 85 kg rider)	°	62.1 (to road)
Steering lock angle	°	37
Axle load split in normal position (f/r) (full fuel load and 85 kg rider)	%	43.5/56.5
Wheel track offset		
normal	mm (in)	0
max	mm (in)	± 6 (0.236)

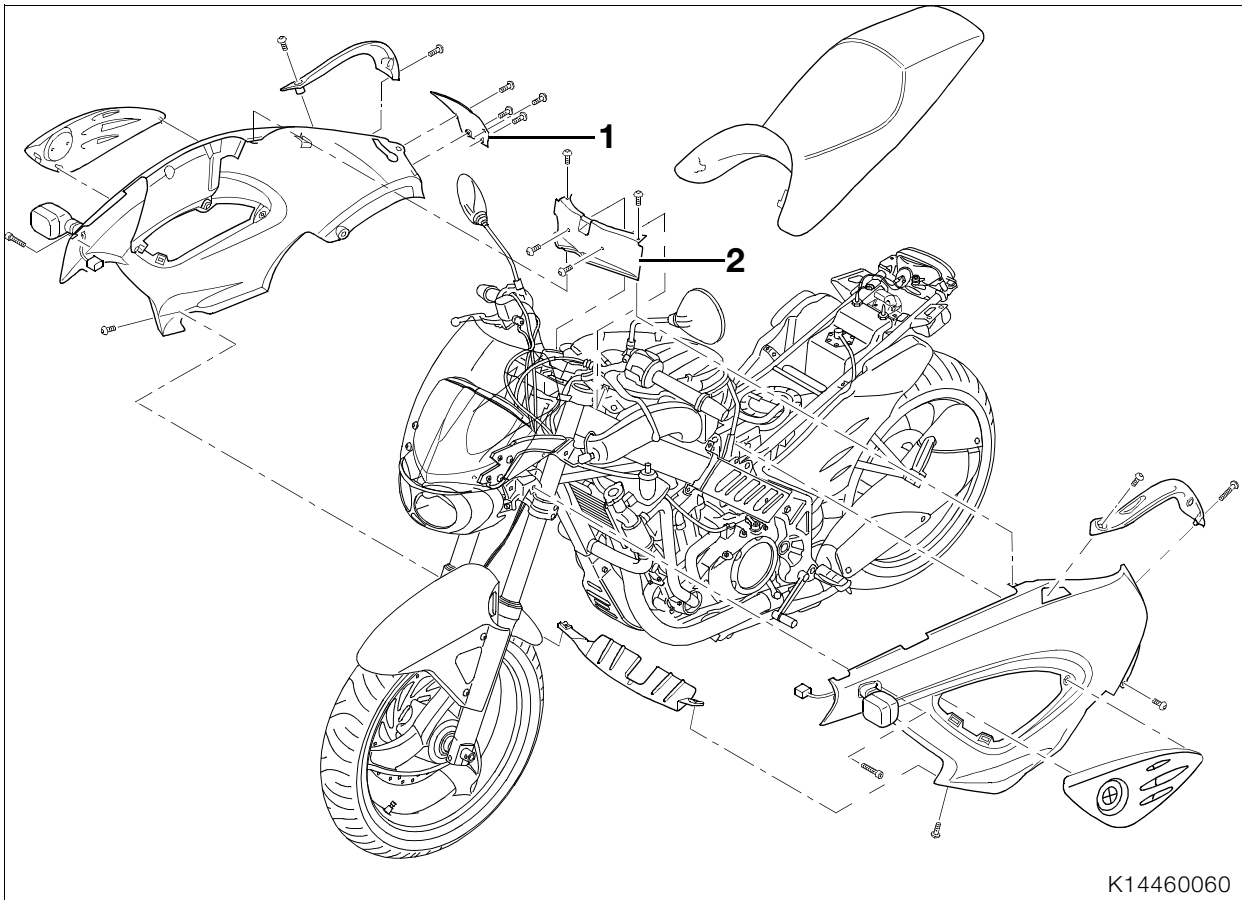






# Overview of trim panels





K14460060

## 46 63 Removing and installing trim panels

### 46 63 Removing and installing left and right covers

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove seat.

#### Removing and installing rear cover

- Remove fasteners of rear cover (1) and remove the rear cover.
- Installation is the reverse of the removal procedure.

#### **Tightening torque:**

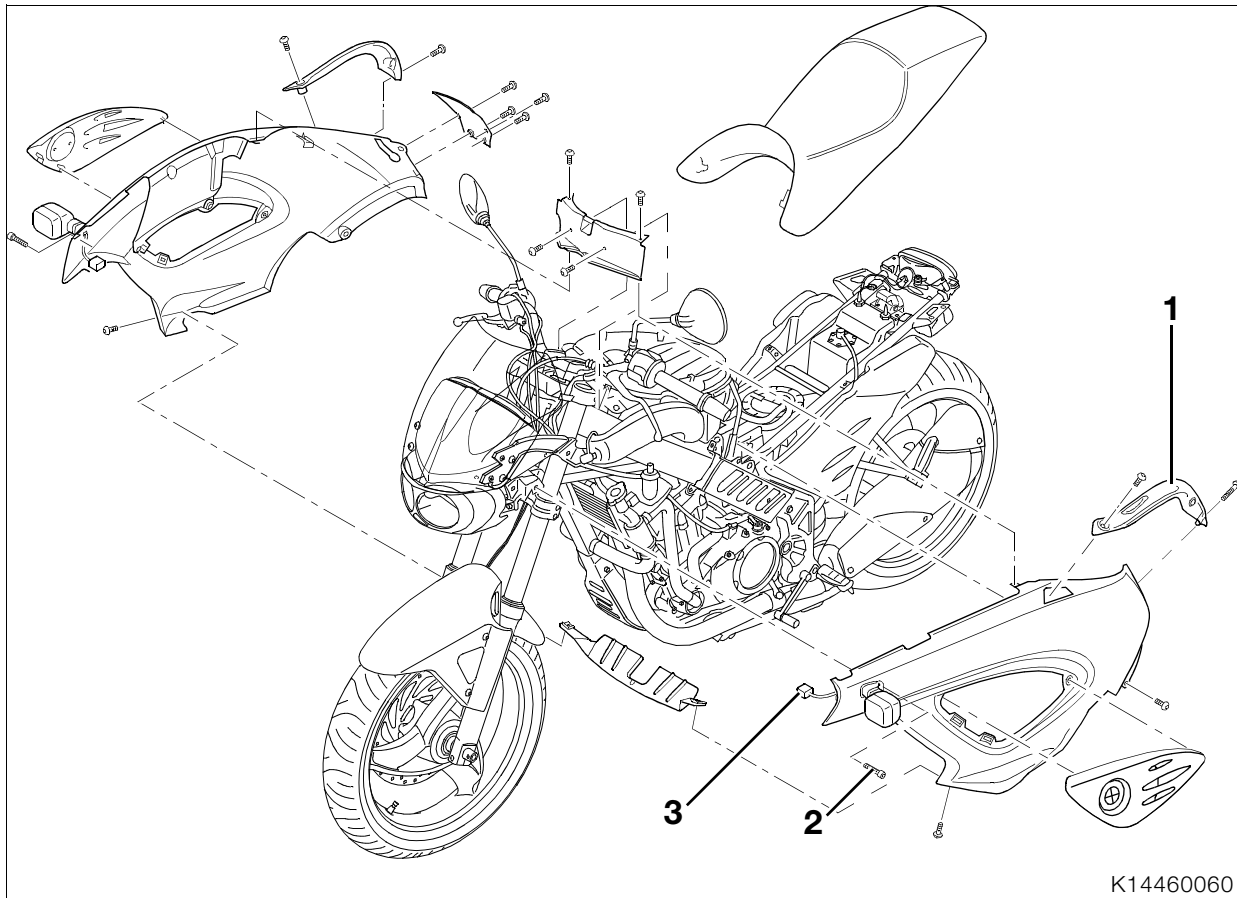
Stowage-compartment rail to stowage-compartment frame ..... 9 Nm  
 Cover, rear, to left and right covers and stowage-compartment frame ..... 2 Nm

#### Removing and installing front cover

- Remove screws (2) securing the front cover.
- Remove the front cover.
- Installation is the reverse of the removal procedure.

#### **Tightening torque:**

Cover, front, to main frame ..... 2 Nm  
 Left and right covers to cover, front ..... 1 Nm



K14460060

### Removing and installing left and right covers

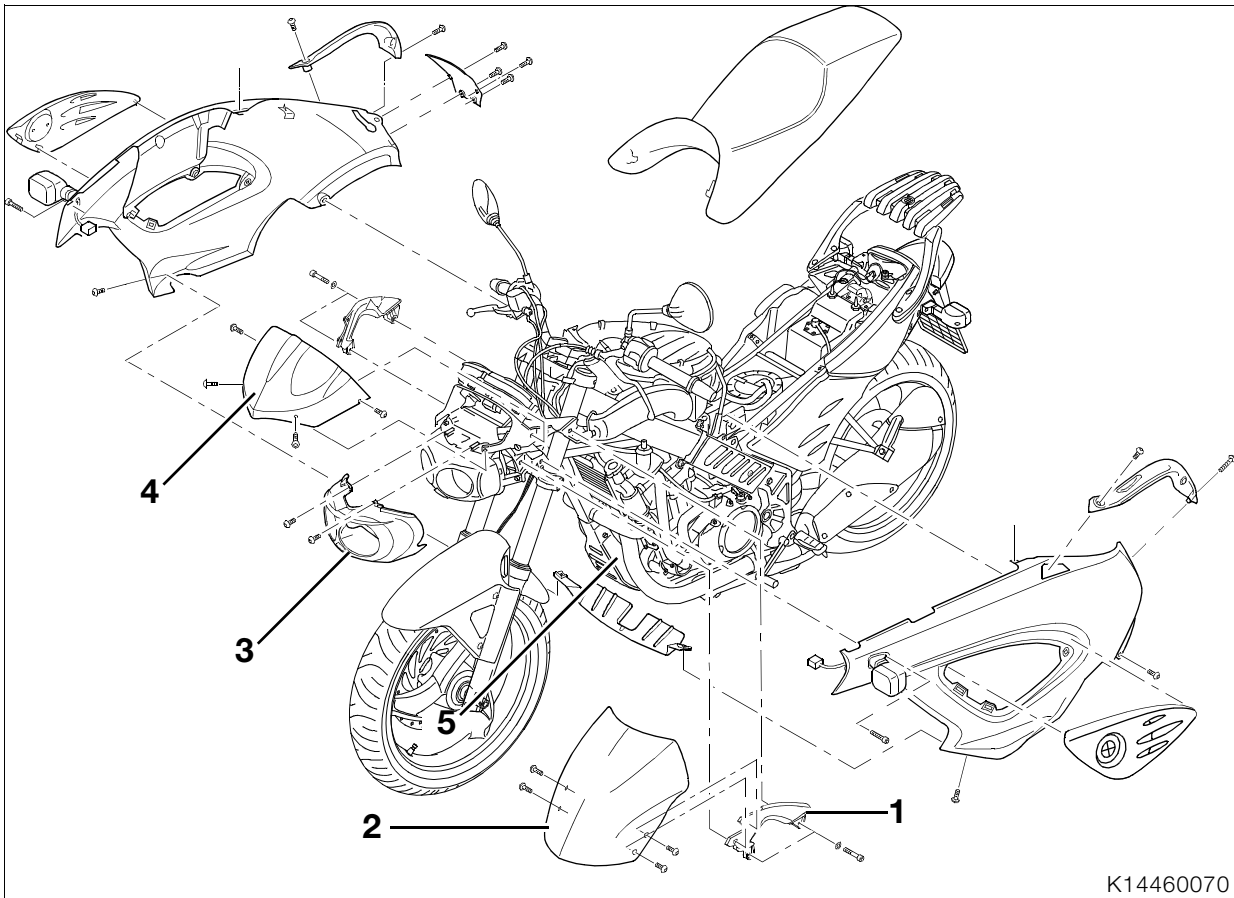
- Remove rear cover.
- Remove securing screws for stowage-compartment rail and remove left/right stowage-compartment rail (1).
- Disconnect the plug for flashing turn indicator (3).
- Remove securing screw for flashing turn indicator (2).
- Remove securing screws for cover.
- Installation is the reverse of the removal procedure, pay particular attention to the following.

### Attention:

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

### Tightening torque:

Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Left and right turn indicators to fairing bracket .....	3 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Stowage-compartment rail to stowage-compartment frame .....	9 Nm



K14460070

### Removing and installing windscreen and windscreen holder

- Remove windscreen fasteners (2) and windscreen.
- Remove left and right covers (→ 46.6).
- Remove fasteners for windscreen holder (1) and remove windscreen holder.
- Installation is the reverse of the removal procedure.



**Tightening torque:**

Windscreen to windscreen holder ..... 2 Nm  
 Windscreen holder to fairing bracket ..... 9 Nm

### 46 63 021 Removing and installing instrument cover

- Remove windscreen.
- Remove fasteners for the instrument surround and remove the surround.
- Remove fasteners for instrument cover (4) and remove the instrument cover.



**Tightening torque:**

Instrument cover to fairing bracket ..... 2 Nm

### Removing and installing headlight surround

- Remove windscreen.
- Slacken the fastener securing the instrument cover.
- Remove the fastener of headlight surround (3) and remove the headlight surround.
- Installation is the reverse of the removal procedure.

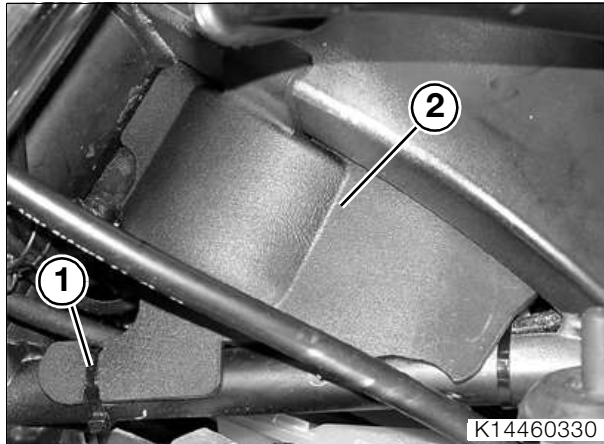


**Tightening torque:**

Headlight surround to headlight ..... 2 Nm

## Removing and installing left/right connector covers

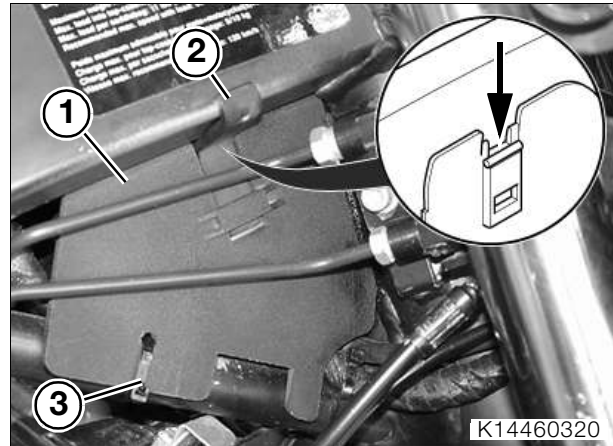
### Removing and installing left connector cover



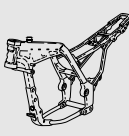
- Open cable tie (1).
- Slightly lift connector cover (2) at the bottom and pull it forward.
- Remove connector cover.
- Position the top of the connector cover against the frame.
- Snap the connector cover into position at the bottom.
- Secure the cable cover with a cable tie.

### Removing and installing right connector cover

- Remove right cover (→ 46.6).

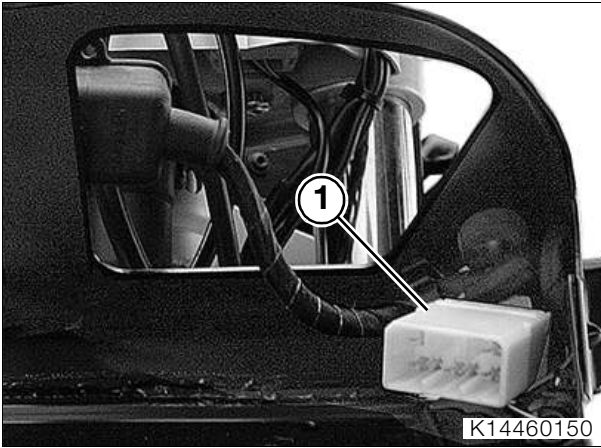


- Open cable tie (3).
- Slightly lift connector cover (1) at the bottom and pull it forward.
- Pull connector cover down and out of securing hook (2).
- Remove securing hook.
- Position the securing hook against the frame and hold it in this position.
- Guide the connector cover up behind the brake lines and engage it in the securing hook, while ensuring that the securing hook is correctly seated (arrow).
- Snap the connector cover into position at the bottom.
- Secure the cable cover with a cable tie.

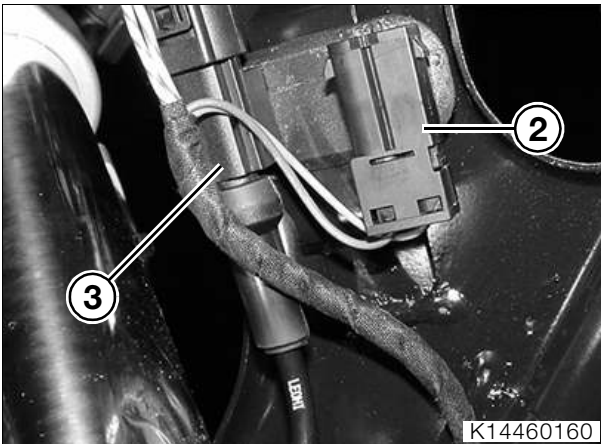


## 46 63 198 Removing and installing fairing bracket

- Remove left and right covers.
- Remove windscreen.
- Remove windscreen holder.
- Remove instrument cover.
- Remove headlight surround.
- Remove headlight (→ 63.5).
- Remove instrument panel (→ 62.6).

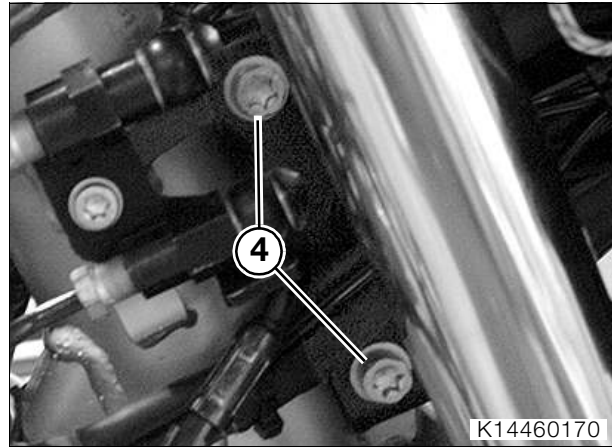


- Unclip plug of instrument cluster (1) from the fairing bracket and pass the cable through the fairing bracket.



- Unclip plug for turn indicator (2) from the fairing bracket.
- **[ABS]** Disconnect plug of front ABS sensor (3) and unclip the plug.

- Cut through cable clip.
- Press cable holder inward to release it.
- Turn the handlebars to the left.



- Remove fasteners securing fairing bracket (4).
- Remove the fairing bracket.
- Installation is the reverse of the removal procedure.

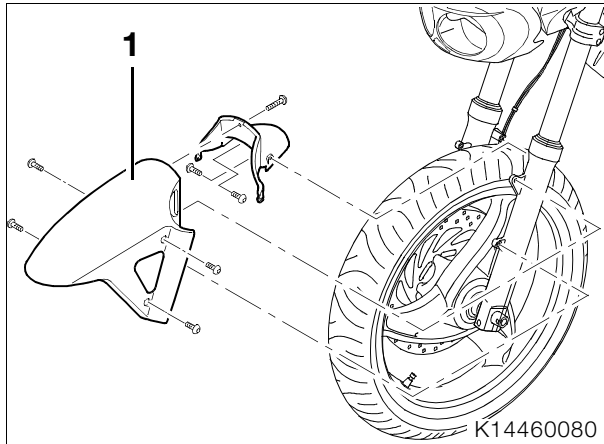


### Tightening torque:

Fairing bracket to main frame ..... 21 Nm

## 46 61 000 Removing and installing front mudguard

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



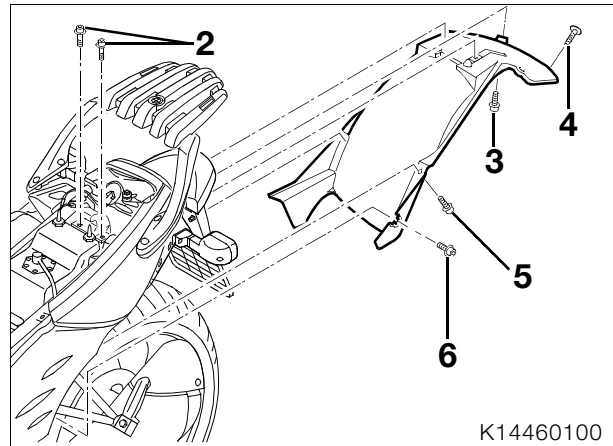
- Remove fasteners securing front section of front mudguard (1).
- Remove front section of front mudguard.
- Remove front wheel (→ 36.5).
- Remove fastener securing rear section of front mudguard.
- Remove rear section of front mudguard.
- Installation is the reverse of the removal procedure.

### **Tightening torque:**

Front mudguard to slider tube ..... 3 Nm  
 Front mudguard, front section, to  
 front mudguard, rear section ..... 3 Nm

## 46 63 Removing and installing rear mudguard

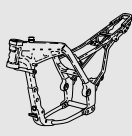
- Remove seat.

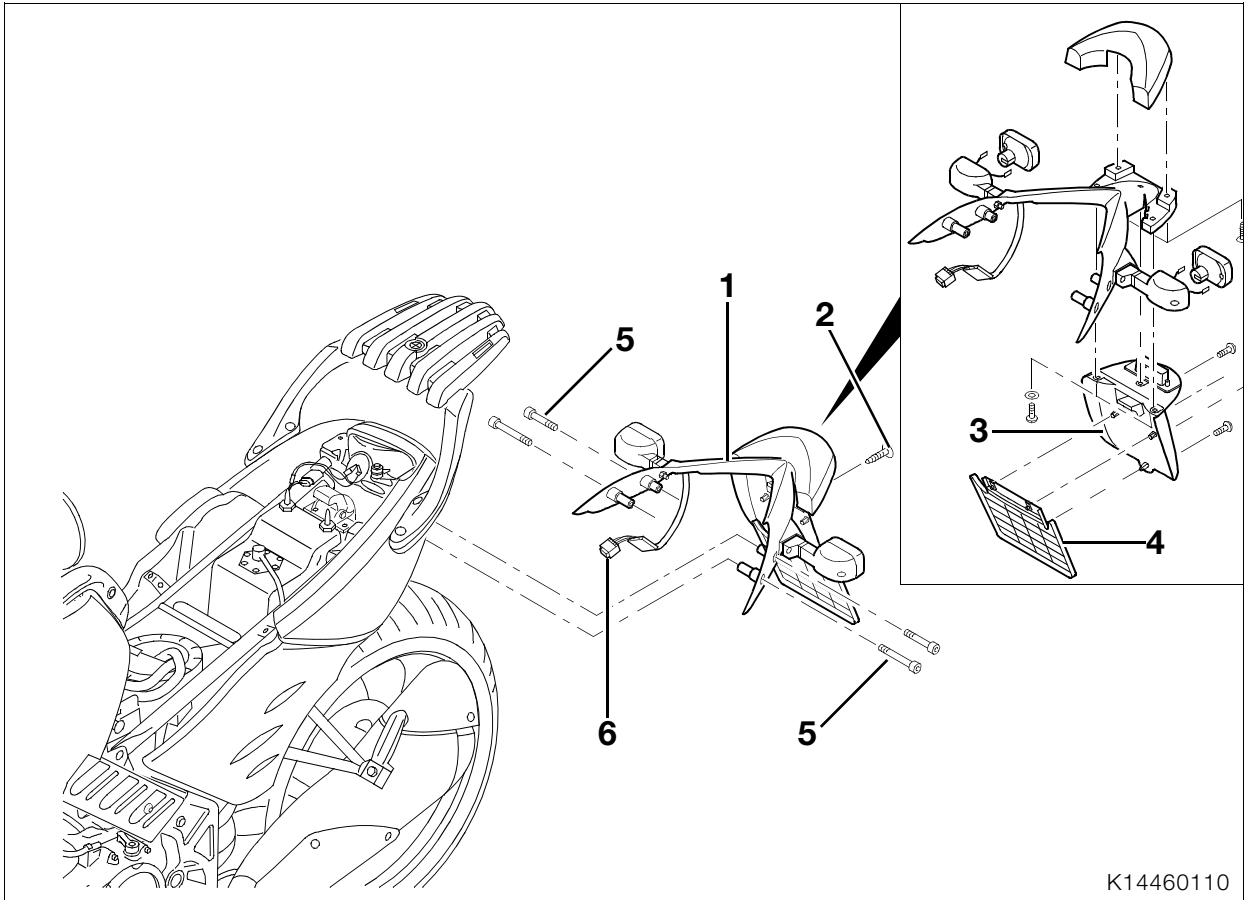


- Remove fastener (4).
- Remove fasteners (2) for seat latch.
- Remove fastener (3).
- Remove fasteners (5).
- Slacken fastener (6).
- Remove mudguard.
- Installation is the reverse of the removal procedure.

### **Tightening torque:**

Mudguard to rear frame ..... 3 Nm





K14460110

**46 62 Removing and installing number-plate carrier**

- Disconnect plug (6).
- Release the fastener (2).
- Remove screws (5) and remove finisher (1).
- Remove turn indicators and number-plate light (⇒ 63.6).
- Installation is the reverse of the removal procedure, note that the screws are of different lengths.

 **Tightening torque:**  
 Handle to rear frame ..... 9 Nm  
 Rear finisher to rear frame ..... 9 Nm


**46 62 Removing and installing spray guard**

- Remove 3 fasteners from spray guard (4).

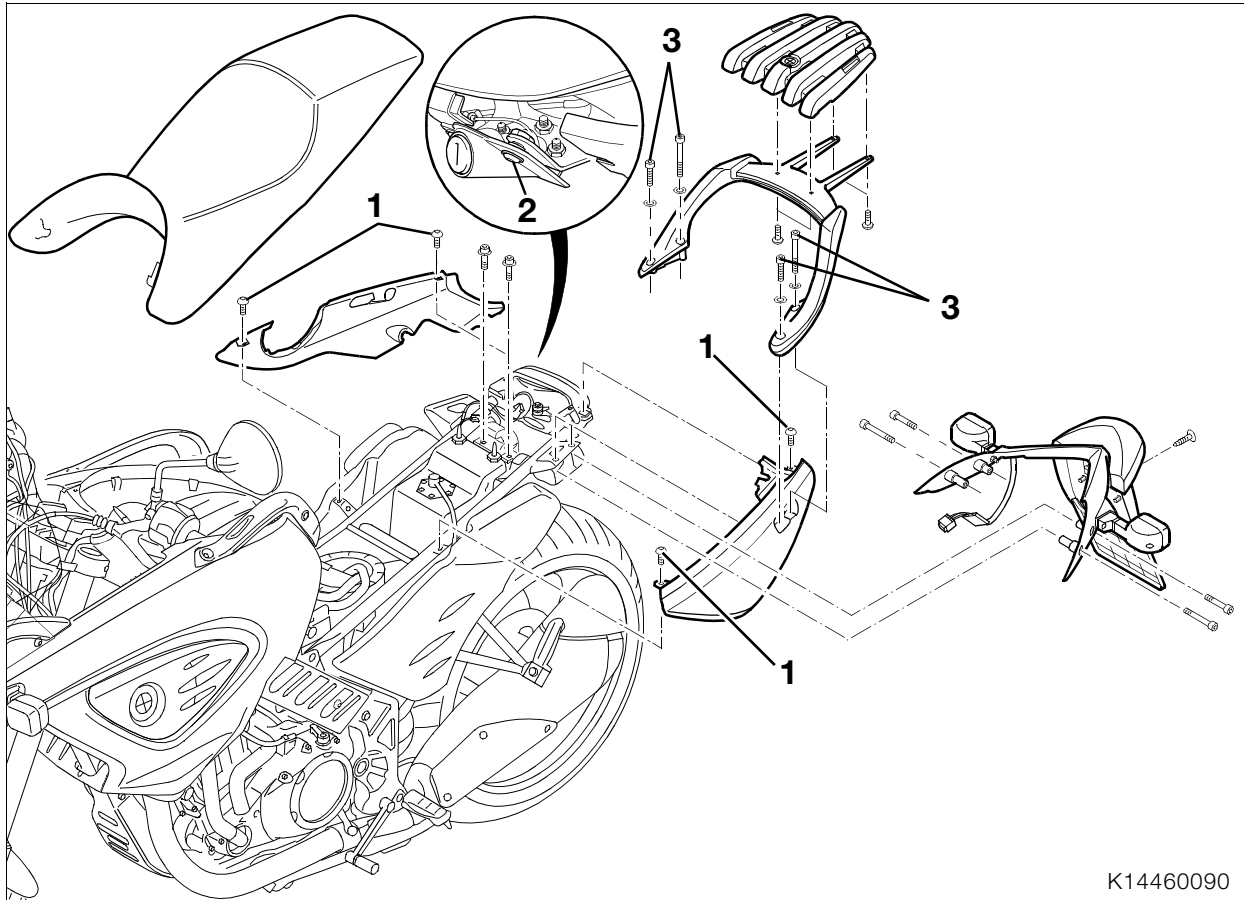
 **Tightening torque:**  
 Spray guard to number-plate carrier ..... 3 Nm

**46 63 Removing and installing number-plate carrier**

- Remove the number plate light (⇒ 63.6).
- Remove 3 fasteners from number-plate carrier (3).

 **Tightening torque:**  
 Number-plate carrier to rear finisher..... 9 Nm







K14460090

#### 46 63 Removing and installing left/right rear trim panel

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove seat.
- Remove luggage rack.

 **Attention:**  
Note washers.

- Remove fasteners of rear panel (1) and slacken screws securing seat lock (2).
- Remove rear panel.
- Installation is the reverse of the removal procedure.

 **Tightening torque:**

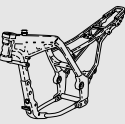
Rear panel to rear frame.....	2 Nm
Rear panel to seat lock .....	2 Nm
Handle to rear frame .....	9 Nm
Rear finisher to rear frame .....	9 Nm

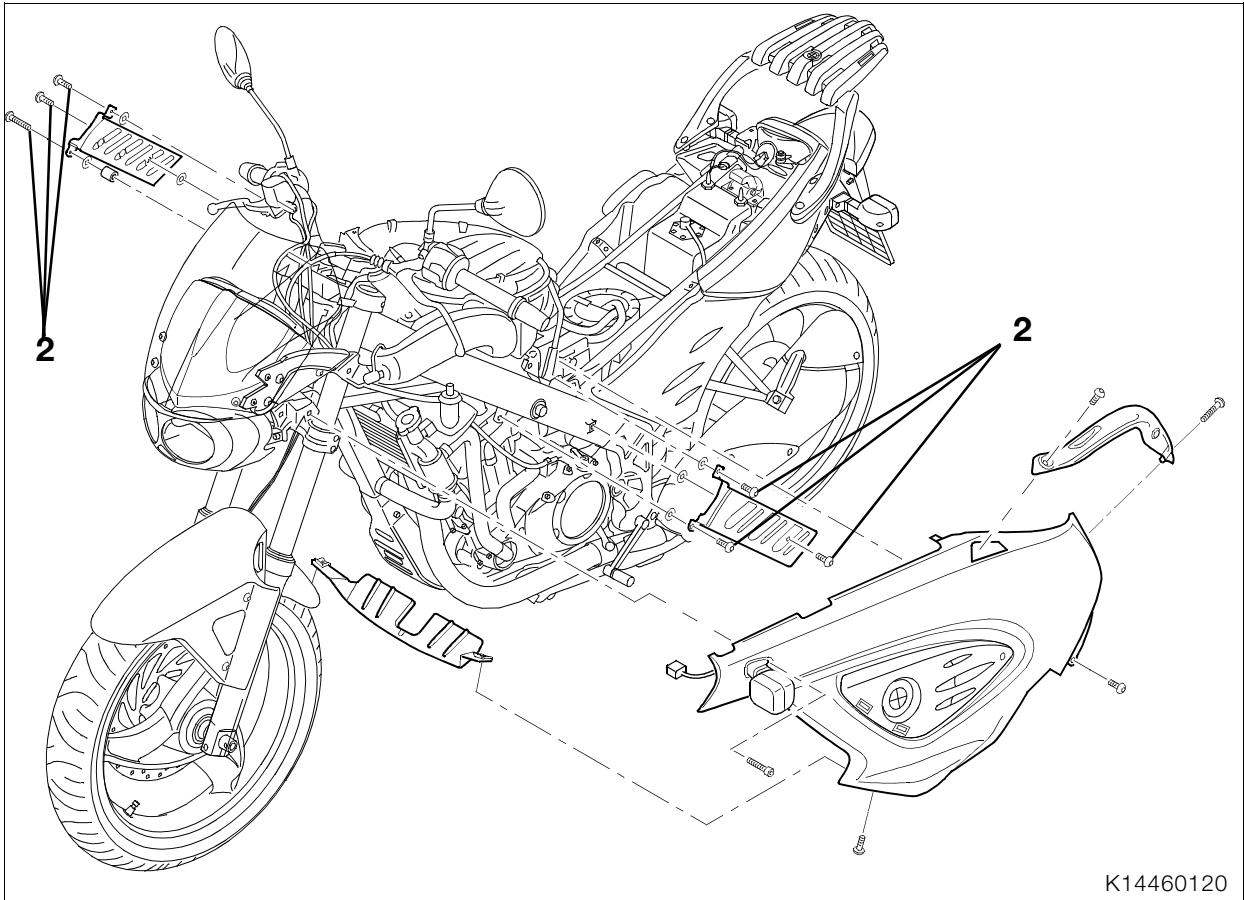
#### 46 54 Removing and installing luggage rack

- Remove screws (3) and remove the luggage rack.
- Installation is the reverse of the removal procedure, note that the screws are of different lengths.

 **Tightening torque:**

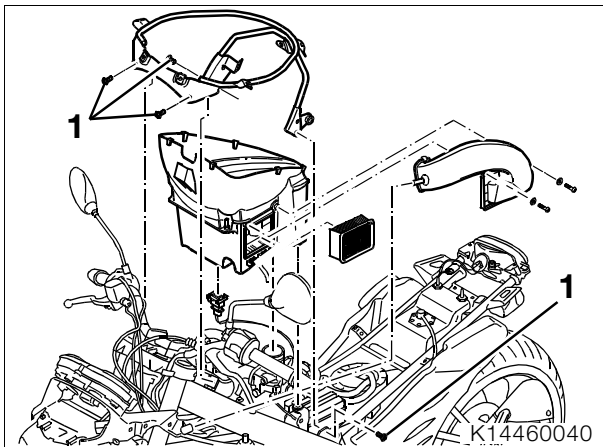
Handle to rear frame .....	9 Nm
----------------------------	------





K14460120

### Removing and installing stowage-compartment frame



K14460040

- Release fasteners (1).
- Remove the stowage-compartment frame.
- Installation is the reverse of the removal procedure.

**Tightening torque:**  
Stowage-compartment frame to frame ..... 9 Nm

### Removing and installing oil-tank trim panels

- Remove seat.
- Remove left and right covers.
- Remove screws (2).
- Remove the trim panel.
- Installation is the reverse of the removal procedure, note the washers and the spacer on the right-hand side.

**Tightening torque:**  
Oil-tank trim to frame ..... 5 Nm

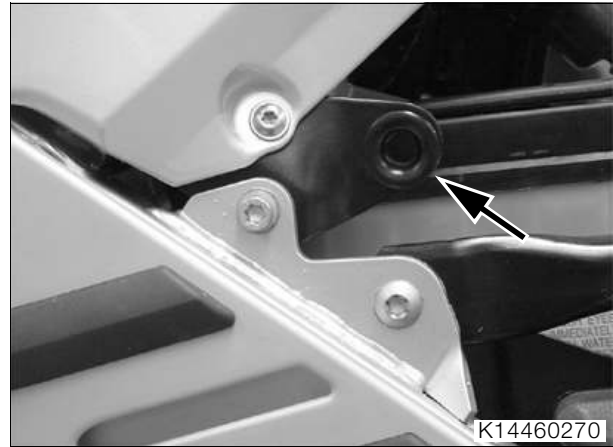
## Raising, removing and installing rear frame

### Raising rear frame

- Remove left and right covers (→ 46.6).
- Remove silencer (→ 18.5).
- Secure front wheel in position.



- Use strap to suspend the rear frame to crane, **BMW No. 46 5 640**.
- Remove brake fluid reservoir from rear frame.
- Remove lower fasteners securing rear frame to main frame.
- Slacken upper fasteners securing rear frame to main frame.



#### Attention:

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 upper eye of the spring strut.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



#### Note:

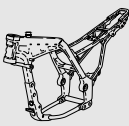
When lowering the rear frame, make sure that the brake line is routed between the front section of the rear mudguard and the rear frame.

- 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.



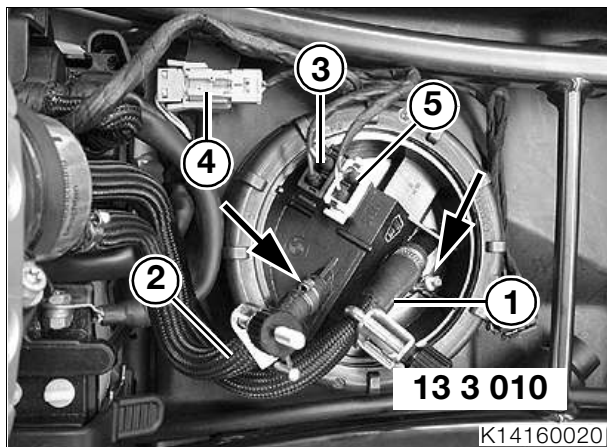
#### Tightening torque:

Rear frame to main frame (clean thread + Loctite 2701).....	24 Nm
Brake fluid reservoir to rear frame .....	4 Nm
Clamp for silencer .....	55 Nm
Silencer to frame .....	41 Nm

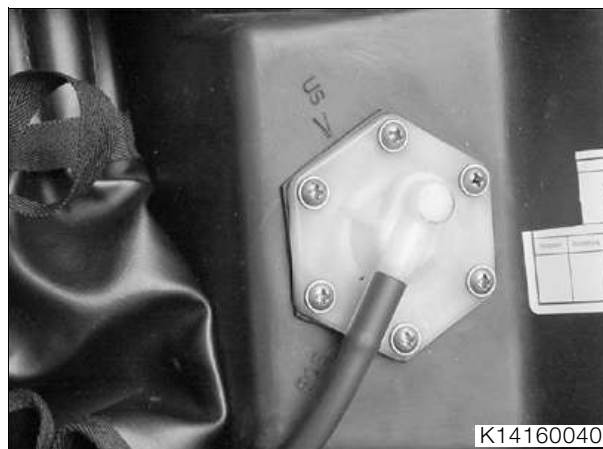


## 46 51 050 Removing and installing rear frame

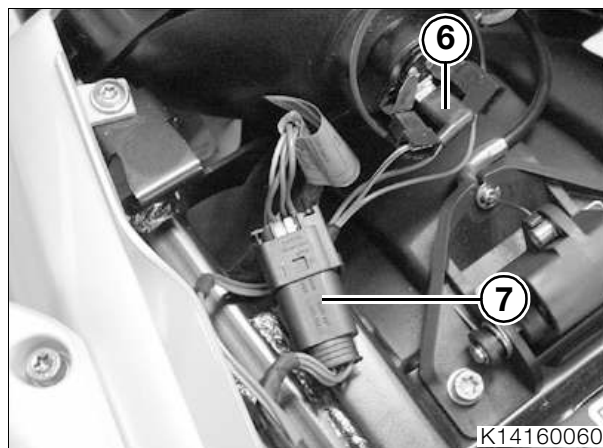
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Secure front wheel in position.
- Remove seat.
- Remove left and right covers (→ 46.6).
- Disconnect battery.
- Remove silencer (→ 18.5).
- Remove brake fluid reservoir from rear frame.



- Close off fuel supply line (2) and the fuel return line (1) with hose clips, **BMW No. 13 3 010**.
- Open the hose clips (arrows) and disconnect the fuel lines from the fuel-pump unit.
- Disconnect the plugs for fuel pump (3) and fuel-level sensor (5).
- Remove the fastener securing the plug of the brake-light switch (4) to the rear frame.

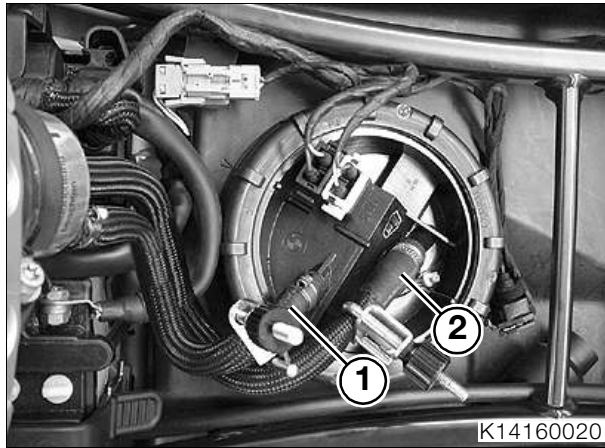


- Disconnect the breather hose from the roll-over valve.



- Disconnect the plug for turn indicator/number-plate light (7).
- Disconnect 3 plugs (6) for rear light cluster.
- Remove 3 cable ties from rear frame.
- **[US]** Disconnect hose from fuel-evaporation control valve.
- Use strap to suspend the rear frame to crane, **BMW No. 46 5 640**.
- 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.
- 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:**

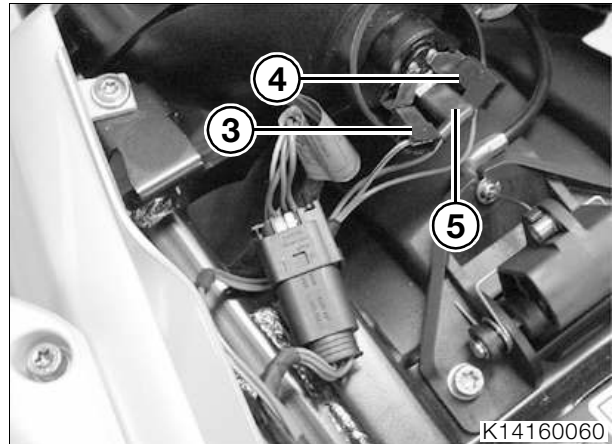
Do not use a screw-type hose clamp to secure fuel feed hose (1). It could damage the hose and result in a fire hazard.

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



**Note:**

Make sure that the rear light and brake light are correctly connected.



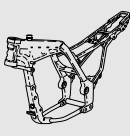
**Colours of the wires in the housing for tail light/brake light**

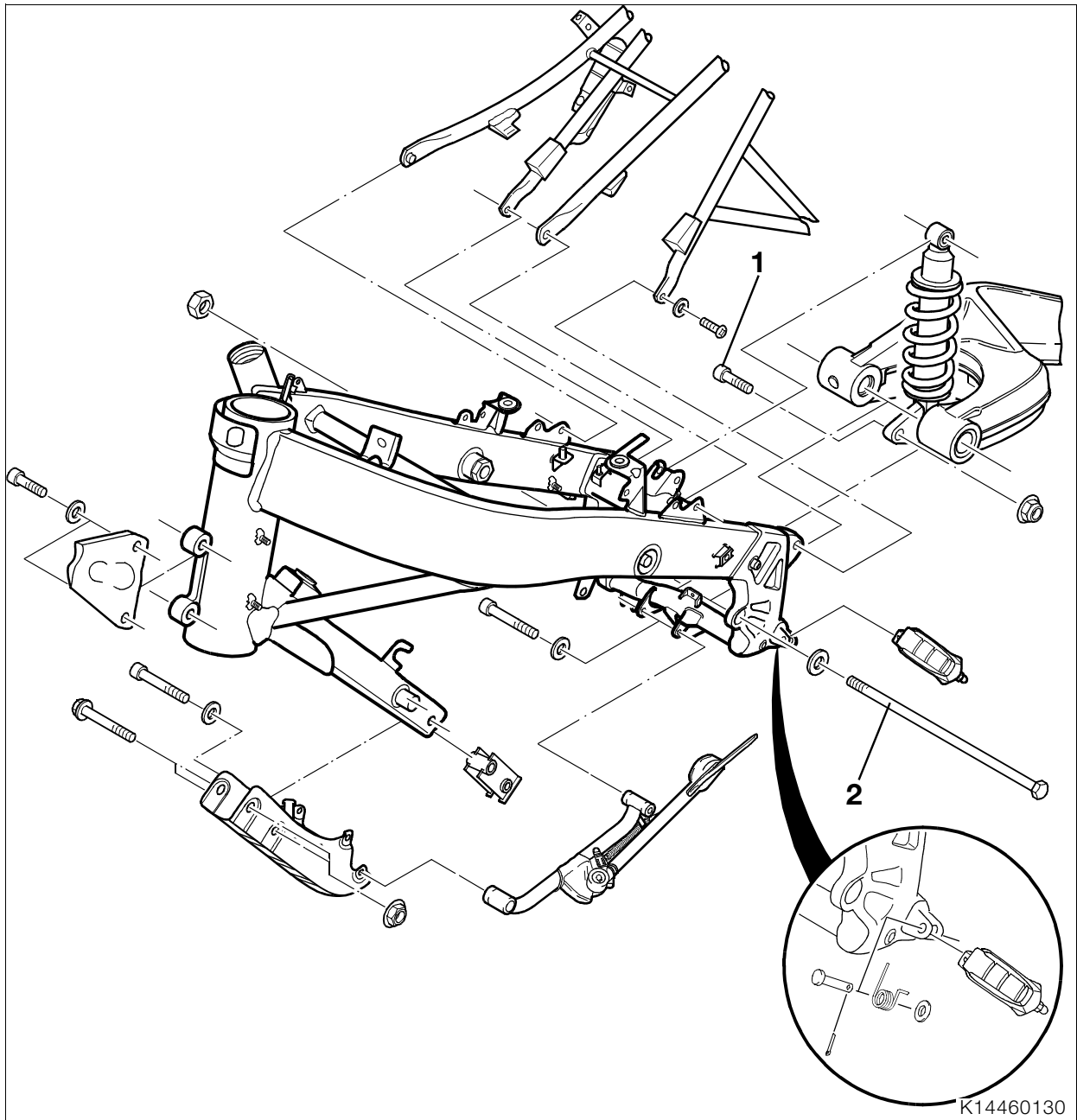
- 3. blue/black
- 4. green/red
- 5. brown



**Tightening torque:**

Clamp for silencer .....	55 Nm
Silencer to rear frame .....	41 Nm
Brake fluid reservoir, rear brake to rear frame .....	4 Nm
Rear frame to main frame (clean thread + Loctite 2701).....	24 Nm



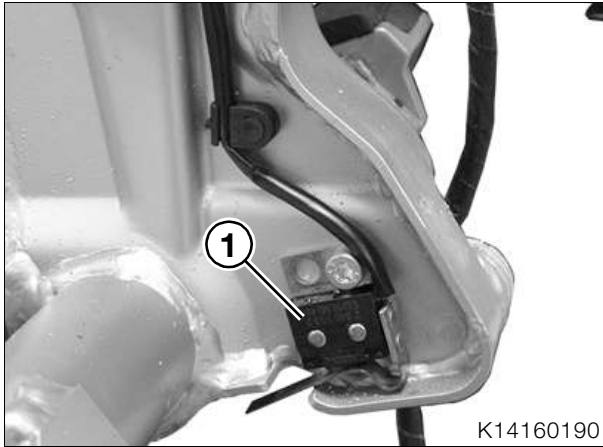


## 46 51 120 Removing frame

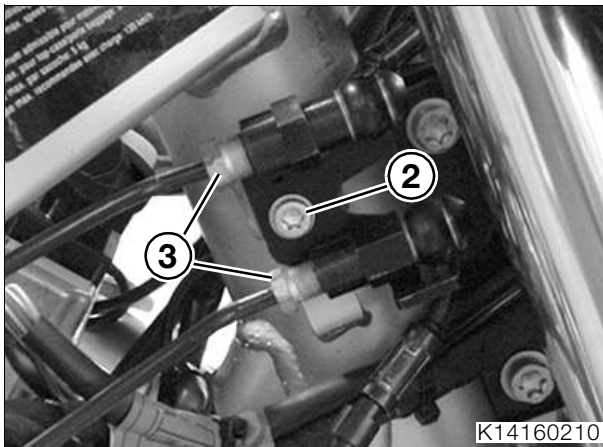
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the battery (⇒ 00.20).
- Remove throttle stub pipe (⇒ 13.9).
- Remove covers of connectors, left and right (⇒ 46.9).
- Remove radiator (⇒ 17.12).
- Remove engine (⇒ 11.23).
- Remove the rear frame (⇒ 46.16).
- Remove fuel filter.
- Remove rear brake lines (⇒ 34.19).

- Remove fastener securing shock absorber at top.
- Remove the fastener (1) securing the angled lever.
- Remove pivot pin (2) of swinging arm.
- Remove swinging arm with shock absorber and rear wheel.
- Remove the left and right footrests.

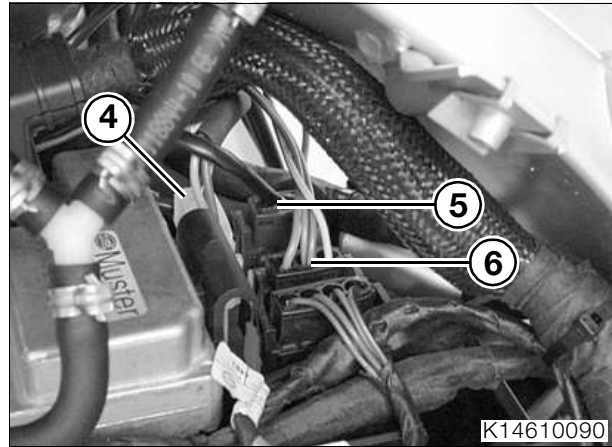
- Remove cable ties at pressure modulator.
- Remove brake cylinder with footbrake lever.
- Remove pressure modulator (→ 34.17).
- Remove the battery holder.



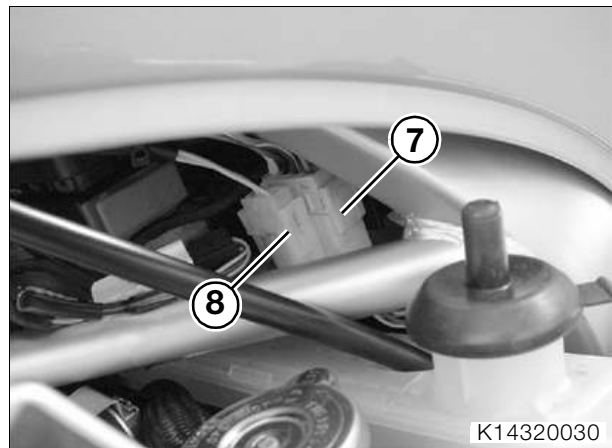
- Remove brake-light switch (1).



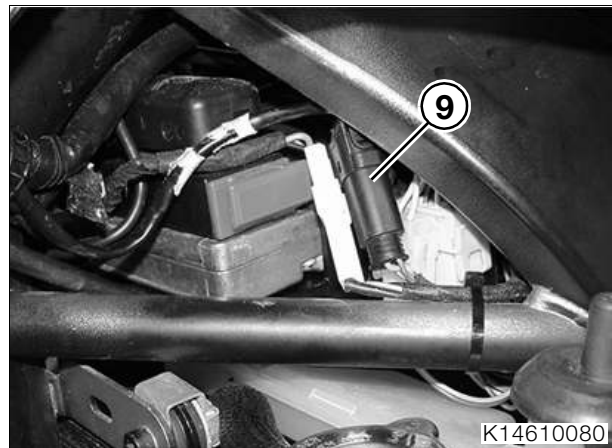
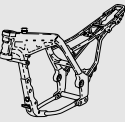
- Disconnect front brake lines from distributor (3).
- Remove fastener (2) for distributor.
- If necessary, disconnect the oil return line from the frame.
- Remove windscreen, windscreen holder and instrument cover.



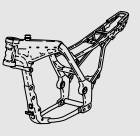
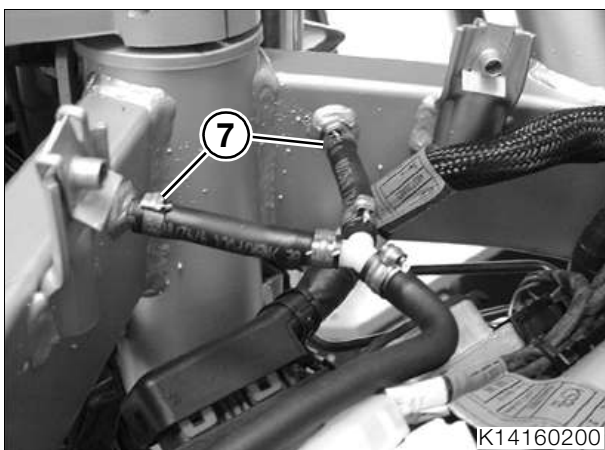
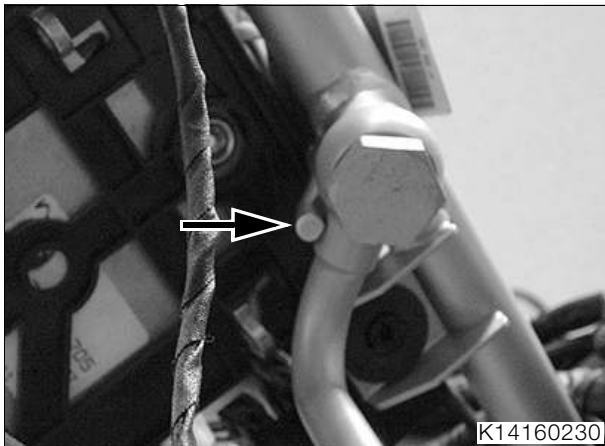
- Disconnect plugs for ignition switch (4), brake-light switch (5) and right multi-function switch (6).



- Disconnect plugs for clutch switch (8) and left multi-function switch (7).



- Disconnect plug for hazard warning flashers (9).
- Remove headlight.
- Disconnect plugs from instrument cluster and pass them through to the rear.



**Tightening torque:**

Brake fluid reservoir, footbrake to rear frame .....	4 Nm
Rear frame to main frame at bottom (clean thread + Loctite 2701).....	24 Nm
Drain plug, water pump .....	10 Nm
Oil drain plug, engine .....	40 Nm
Exhaust elbow to cylinder head.....	20 Nm
Silencer to exhaust elbow .....	55 Nm
Cable cover to engine .....	9 Nm
Belt sprocket to mainshaft (clean thread + Loctite 638).....	180 Nm
Sprocket cover to engine .....	2 Nm
Ground terminal to engine block .....	8 Nm
Cable for neutral indicator .....	1 Nm
Engine shell to bracing tube .....	25 Nm
Engine shell to engine at bottom with truss ..	55 Nm
Side-stand truss to main frame .....	50 Nm
Radiator to main frame at top .....	9 Nm
Swinging-arm pivot shaft.....	100 Nm
Frame to engine at rear .....	50 Nm
Gearshift lever to frame .....	21 Nm
Footbrake lever to frame .....	21 Nm
Cylinder head to frame.....	41 Nm
Cylinder head to frame, adjusting sleeve .....	zero play max. 5 Nm
Cylinder head to frame, locknut.....	100 Nm
Angled lever to frame	
Initial torque .....	58 Nm
Additional angle of rotation.....	45° ± 15°

- Disconnect crankcase breather (7) from the frame.
- Disconnect all cable ties for the wiring harness from the frame and the fairing bracket.
- Remove wiring harness, control-unit holder and relay carrier.
- Suspend frame from crane, **BMW No. 46 5 640**.
  - Remove telescopic fork (→ 31.6).
  - Remove the auxiliary stand.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



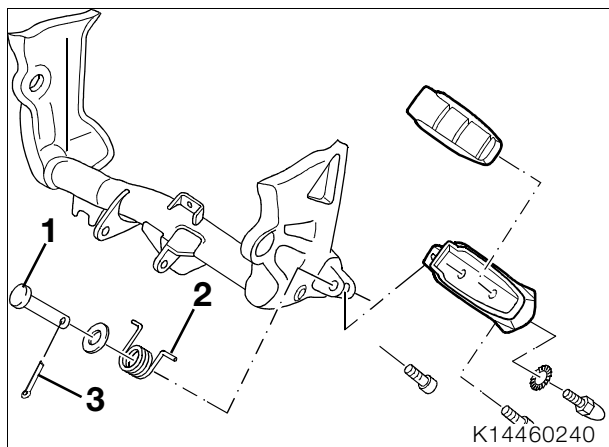
**Note:**

After installing the rear swinging arm, do not fully tighten the stud in the swinging-fork pivot until the engine is installed.

- When installing the oil return line, note stop (arrow).
- Adjust the footbrake light switch after installation (→ 34.14).



**46 71** Removing and installing left and right footrests



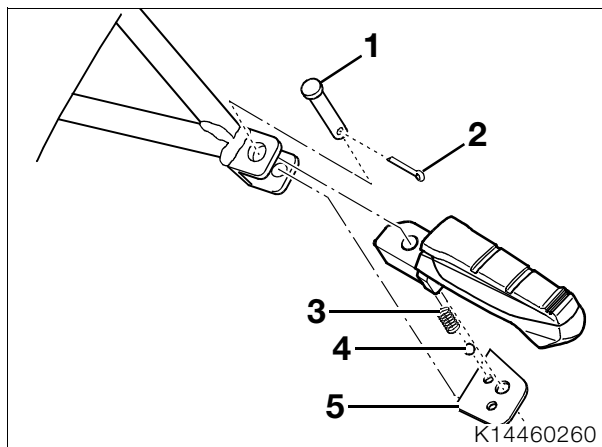
- Remove keeper (3).

**⚠ Attention:**

Note spring loading.

- Remove pin (1), remove spring (2) and footrest.
- Installation is the reverse of the removal procedure.

**46 71 176** Removing and installing rear footrest



- Remove keeper (2).
- Release pin (1).

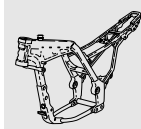
**⚠ Attention:**

Note that ball is spring-loaded.

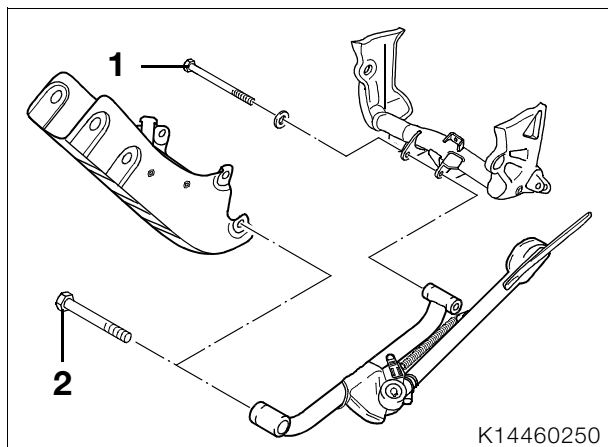
- Remove footrest with locking plate (5), ball (4) and spring (3).
- Installation is the reverse of the removal procedure.

**⚡ Tightening torque:**

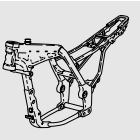
Footrest pad to rear footrest ..... 5 Nm



## 46 51 125 Removing and installing side stand truss



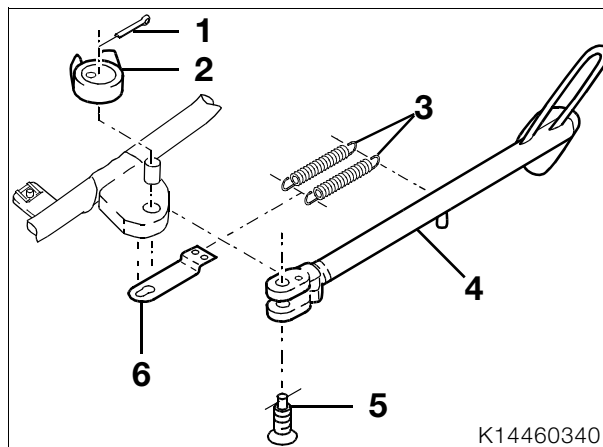
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove exhaust system (→ 18.5).
- Remove cable cover on left-hand side of engine block.
- Disconnect plug of side-stand switch.
- Release fasteners (1, 2).
- Installation is the reverse of the removal procedure.




### **Tightening torque:**


Side-stand truss to frame .....	50 Nm
Engine shell to engine at bottom with truss ..	50 Nm
Exhaust elbow to cylinder head .....	20 Nm
Clamp of silencer to exhaust elbow .....	55 Nm
Silencer to rear frame .....	41 Nm

## 46 53 000 Removing and installing side stand




 **Attention:**  
Note spring loading.

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

 **Attention:**  
Install screw with **Loctite 243**.

**Lubricant:**  
for bearing bushing ..... Staburags NBU 30 PTM

 **Tightening torque:**  
Side stand to bottom truss..... 41 Nm



K14460280

## 46 51 040 Measuring wheel track offset

- Place the motorcycle on a level surface on auxiliary stand, **BMW No. 00 1 620**.
- Place track alignment gauge, **BMW No. 36 3 920**, against the left or right side of the motorcycle.



### Note:

In order to use the track alignment gauge on either the left or right side, simply screw the supports in on the other side.

- Adjust supports (1) so that the track alignment gauge, **BMW No. 36 3 920**, is installed as high as possible and align it horizontally.
- Adjust measuring stops (arrows) until they contact the rim - not the tyre.
- Attach hook (2) to wheel spoke and secure gauge firmly to the wheel.
- Align front wheel parallel with the gauge.
- Measure distance between outer edge of gauge and wheel rim, using depth gauge (3) or ruler, and make a note of the distance.

- Calculate wheel track offset "S".

Wheel track offset "S" is the distance to left or right of the longitudinal axis of the rear wheel from that of the front wheel.

**Track offset (S):** .....0 mm (no offset)

**Permissible wheel track offset (S):**

..... ± 6 mm (0.236 in); datum is 0 mm

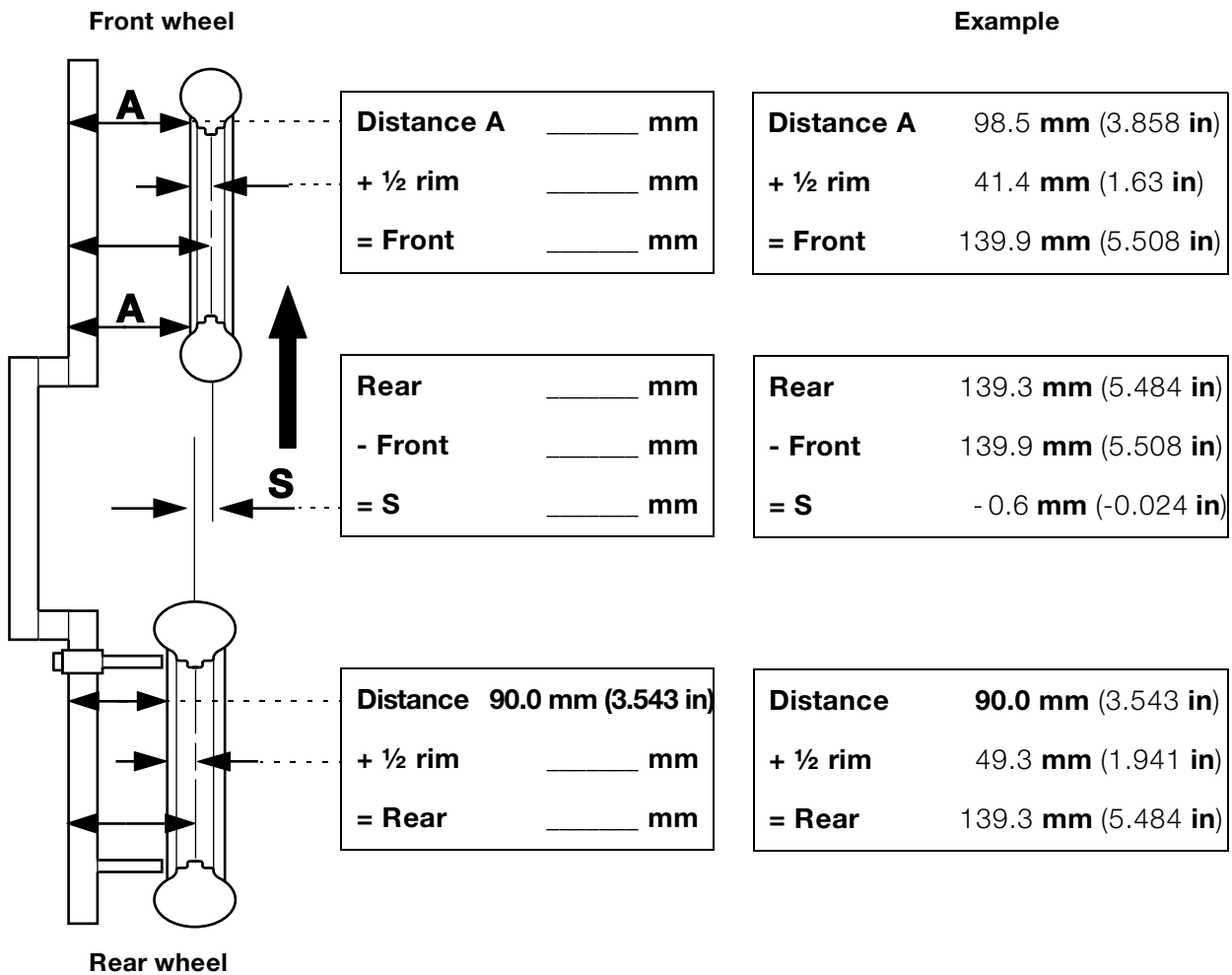


### Note:

**Key to measurement result:**

Negative sign = wheel track offset to left  
Positive sign = wheel track offset to right

# Measurement record, wheel track offset



### Key to measurement result:

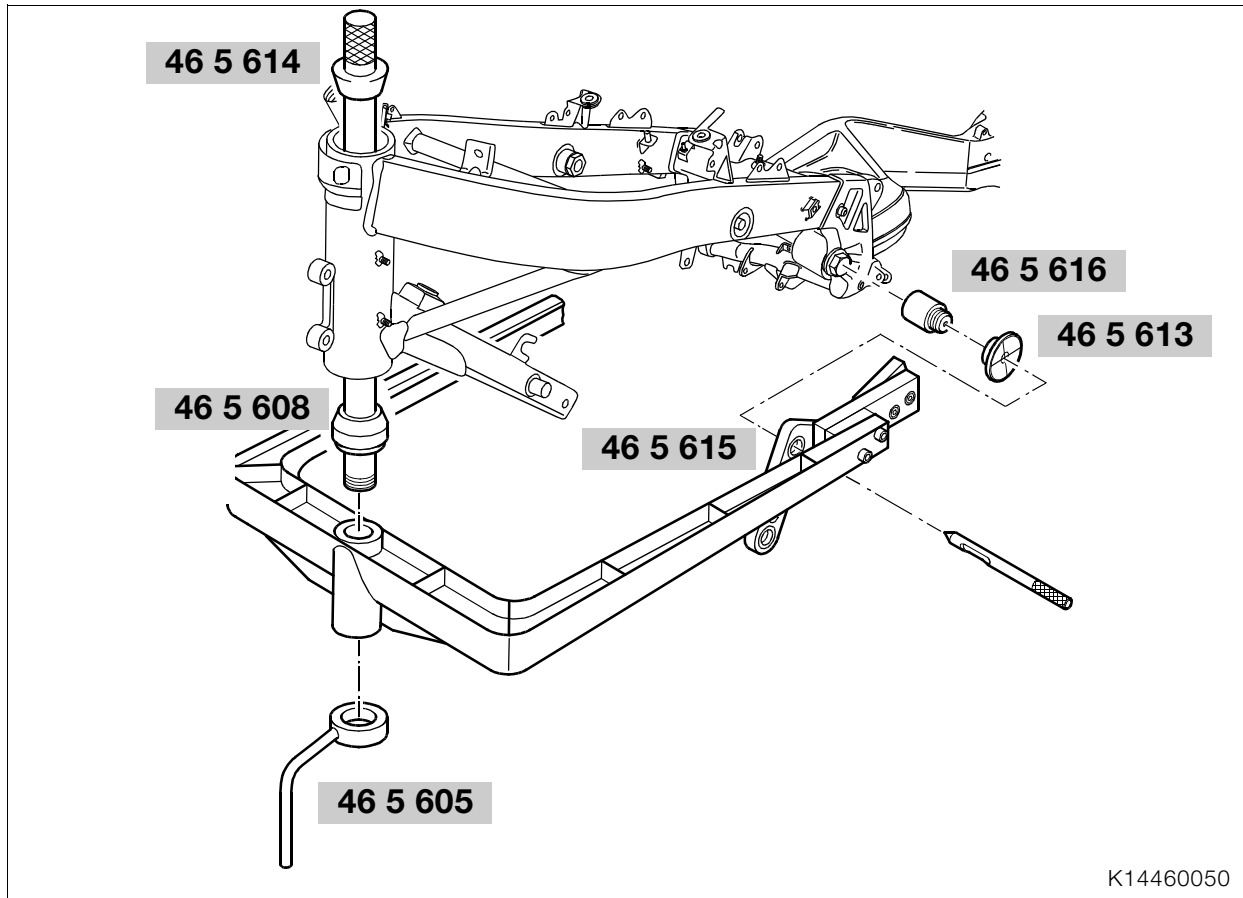
Wheel track offset "S" is the distance to left or right of the longitudinal axis of the rear wheel from that of the front wheel.

Negative sign = wheel track offset to left  
 Positive sign = wheel track offset to right

**Permissible wheel track offset (S):**  
 ..... ± 6 mm (0.236 in); datum is 0 mm

**Measured wheel track offset (S):**  
 \_\_\_\_\_ mm





K14460050

## Checking frame with gauge



### Note:

In the event of an accident or fall, the frame can be subjected to much higher forces than are ever encountered during normal operation. If this situation has occurred, and no changes to the frame can be detected with the naked eye, the frame can be checked with frame alignment test gauge, **BMW No. 46 5 600**, and adapters suitable for the specific motorcycle model.

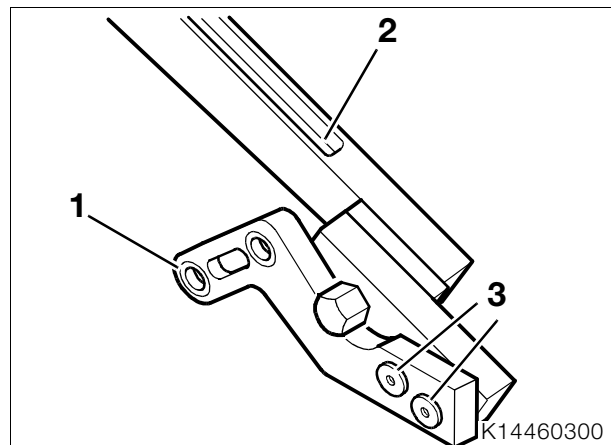
- Remove telescopic fork.
- Remove upper taper roller bearing from steering head.



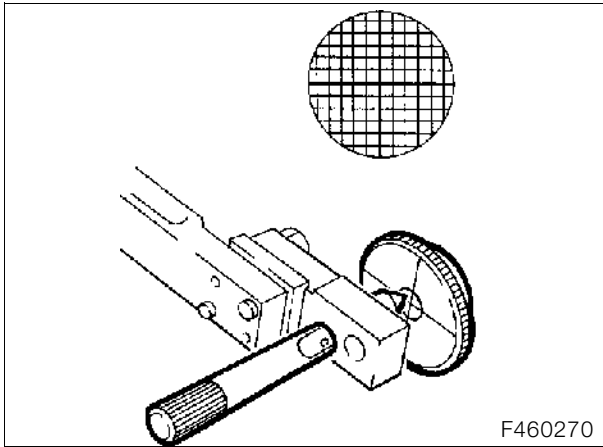
### Note:

Note left and right measuring discs. Arrow on measuring disc must face in forward direction of travel.

- Mount measuring discs, **BMW No. 46 5 613**, with adapter, **BMW No. 46 5 616**, on hex heads of swinging-arm pivot shaft at left and right.
- Align sighting cross so that it is vertical.
- Insert adapter (1), **BMW No. 46 5 615**, into main frame (2) on the inside.
- Press together adapter and basic frame and gently tighten cap screws (3) on outside of adapter.
- Place frame gauge with taper adapter, **BMW No. 46 5 608**, against the steering head from below. Using steering-head pin, **BMW No. 46 5 614**, clamp the gauge and the frame together.



K14460300



- Lightly grease the measuring pins, **BMW No. 46 5 602**, and insert them into the holes in the adapters.



**Note:**

Refer to the latest **BMW Motorcycle Service Information** for information on tolerances.

- Align gauge in such a way that, when measuring tips make gentle contact with the measuring discs, the same value appears on the left and right sides of the measuring drift scale.



**Attention:**

The frame will have to be replaced if the difference is out of tolerance.



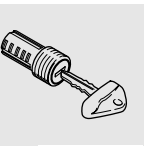
# 51 Equipment

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<b>Removing and installing lock barrel for fuel tank filler cap</b> .....	7
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Technical Data 51 Equipment	F 650 CS





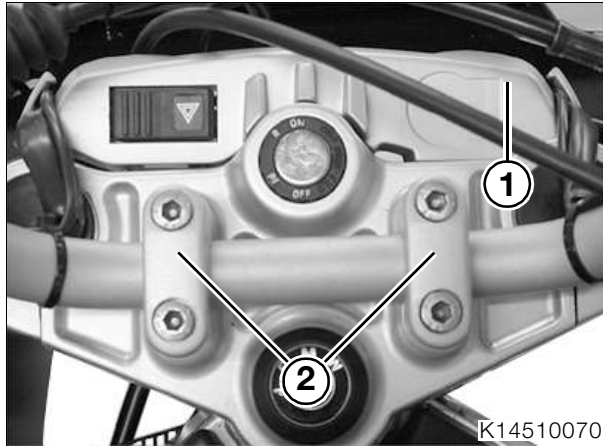
## 51 25 040 Removing and installing ignition switch/steering lock

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove right cover insert.
- Remove cover of connector, right (➔ 46.9).

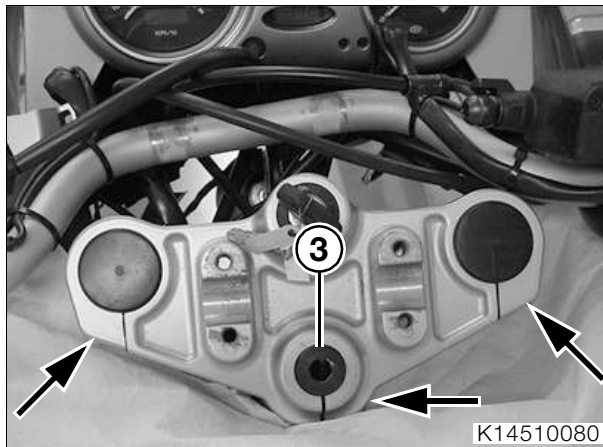


### Attention:

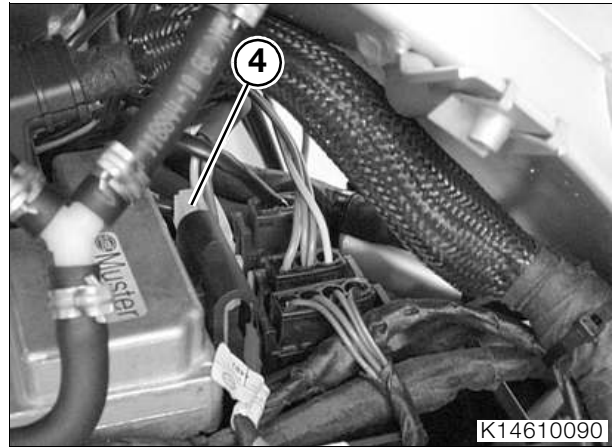
Cover or mask off the instrument cluster and trim to prevent scratches.



- Remove cover for hazard warning flasher switch (1).
- Remove clamp blocks (2).
- Remove the handlebars and place them in front of the instrument cluster.
- Remove cap (BMW badge).

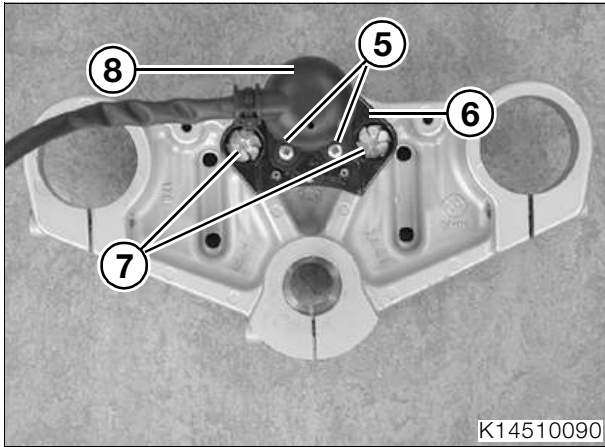


- Remove hex screw (3).
- Slacken 3 clamp screws (arrows) at upper fork bridge.
- Cut through cable ties.



- Disconnect plug for ignition lock (4).
- Remove the cable complete with the plug.
- Remove the upper fork bridge complete with the ignition lock.





- Remove securing screws (5) and remove ignition switch (8).
- Using a 5 mm bit, drill at least 6 mm (0.236 in) into the non-removable screws (9).
- Using an 8 mm bit, drill at least 5 mm (0,197 in) into the non-removable screws.
- Break off the heads of the non-removable screws.
- Remove the ignition lock (6) 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.

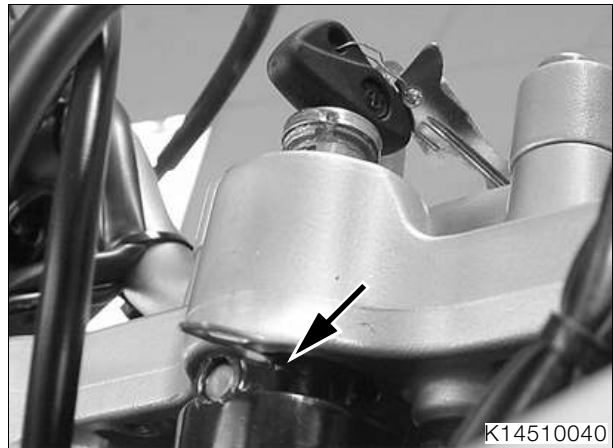


**Tightening torque:**

Ignition/steering lock to fork bridge .....	20 Nm
Clamp screws, fork bridge .....	23 Nm
Handlebars to fork bridge.....	23 Nm

## Removing and installing lock barrel

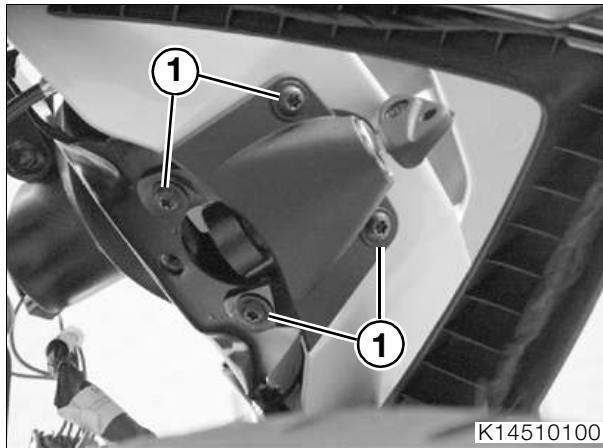
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove cover for hazard warning flasher switch.
- Turn the handlebars to the left.
- Turn the ignition key to the ON position.



- 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.

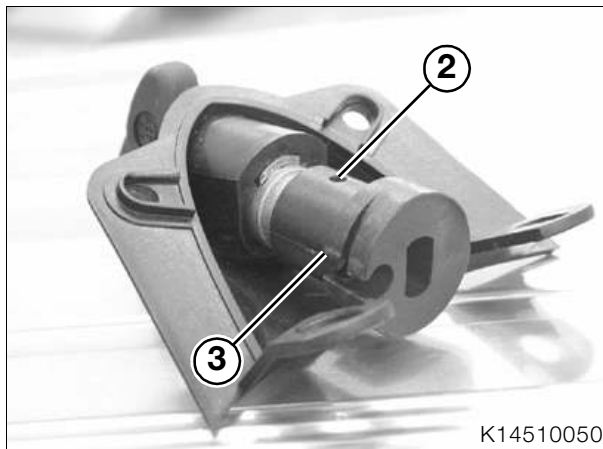
## Removing and installing lock for rear stowage compartment

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove rear mudguard (→ 46.11).



K14510100

- Release 4 fasteners (1).
- Disengage throttle cable.



K14510050

- Use a punch of suitable diameter to drive out pin (2).
- Remove latch (3).
- Press out the lock.
- Installation is the reverse of the removal procedure, pay particular attention to the following.
- Make sure cap is installed correctly.



### Tightening torque:

Holder for lock cylinder to rear frame ..... 3 Nm  
Rear mudguard to rear frame ..... 3 Nm

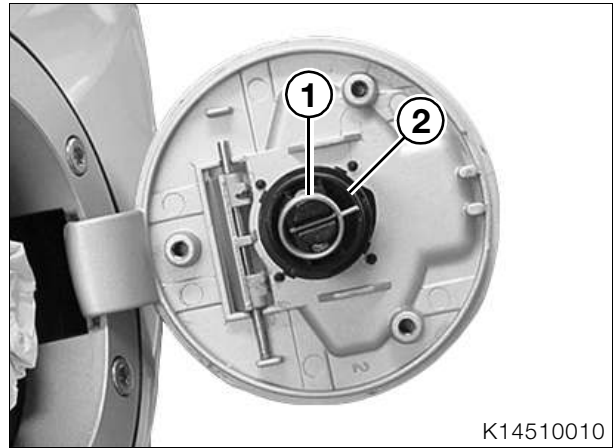
## 51 25 030 Removing and installing lock barrel for fuel tank filler cap



### 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.



K14510010

- Remove spring (1).
- Remove cap (2).

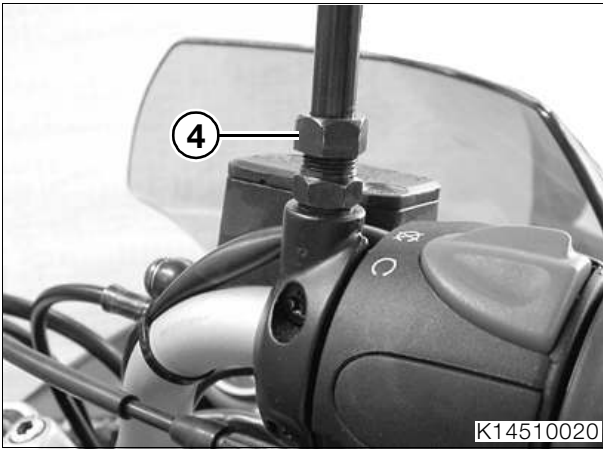


E510030

- Insert key in lock barrel and press down on retainer (3).
- 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, pay particular attention to the following.
- Make sure cap is positioned correctly.
- Spring must engage in groove.



## 51 16 042 Replacing mirrors



- Slacken nut (4).
- Remove the mirror.
- Installation is the reverse of the removal procedure.



### **Tightening torque:**

Mirror to handlebar fitting ..... 18 Nm



# 61 General electrical equipment

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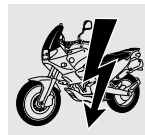
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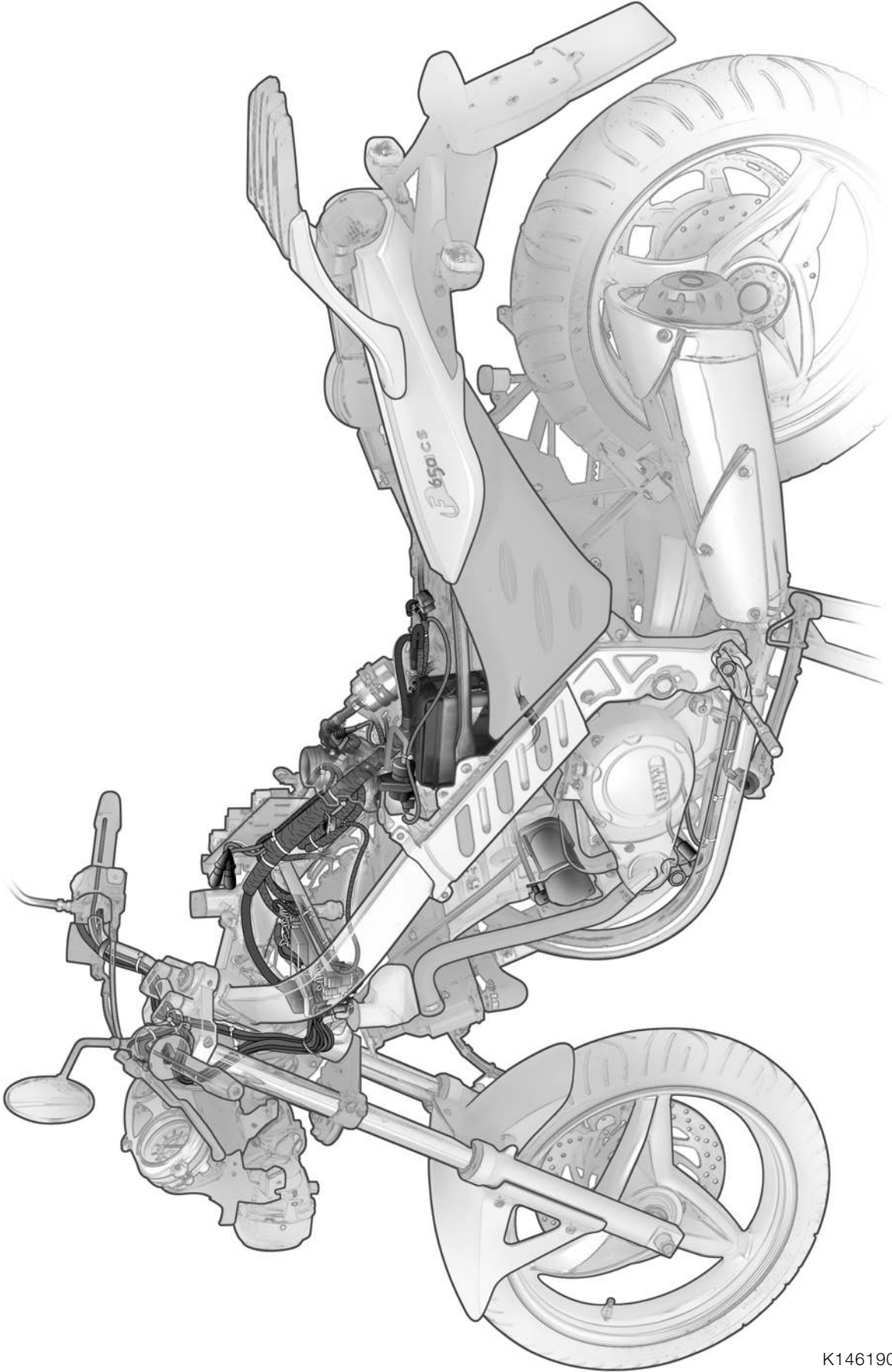
Technical Data 61 Electrical equipment		F 650 CS
<b>Battery</b>		
Voltage	V	12
Rated capacity	A/h	12
Cold-test current	A	80
<b>Fuses</b>	A	7.5; 10; 15; 20





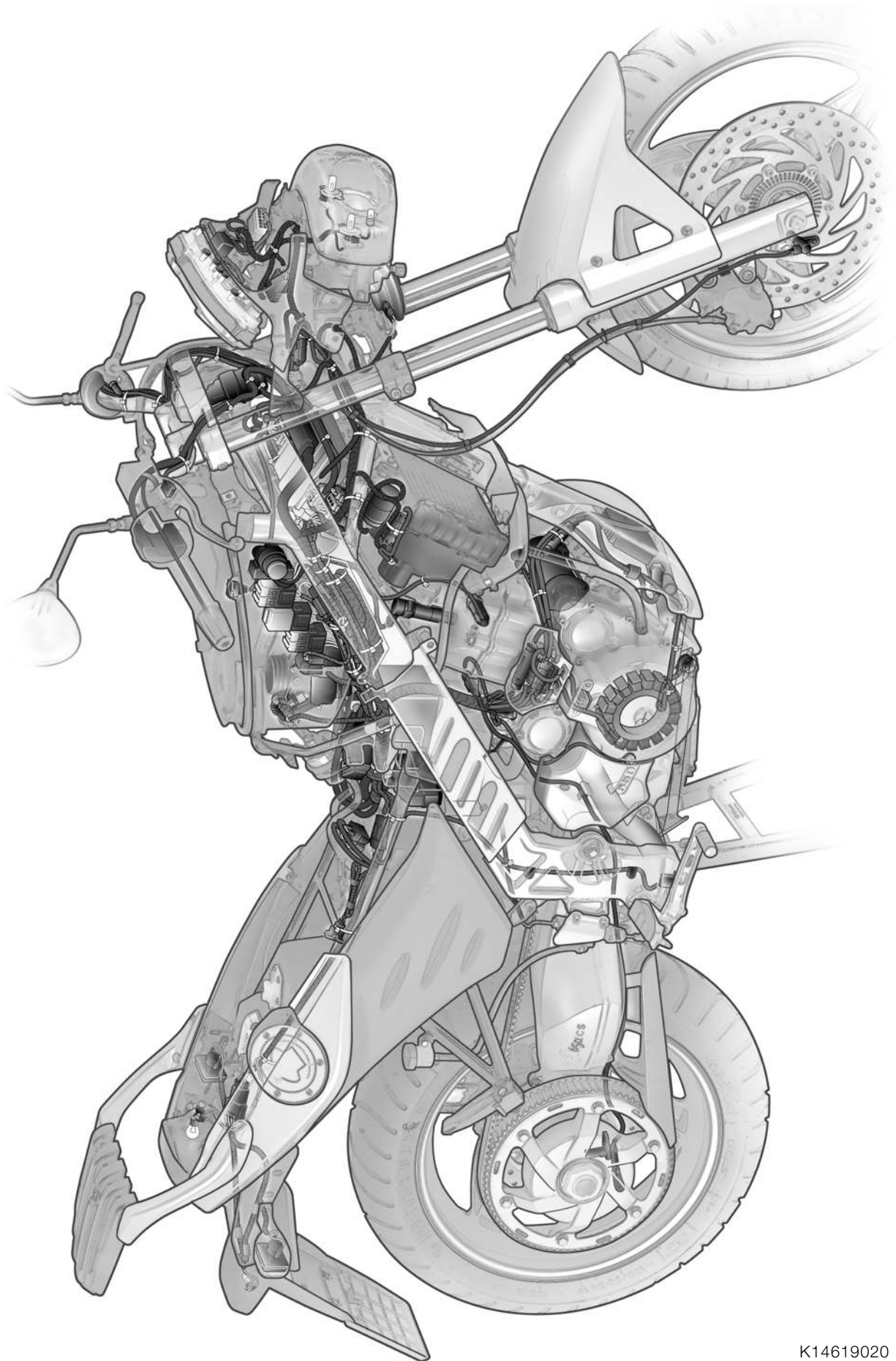
**Wiring harness**

View from left



K14619010

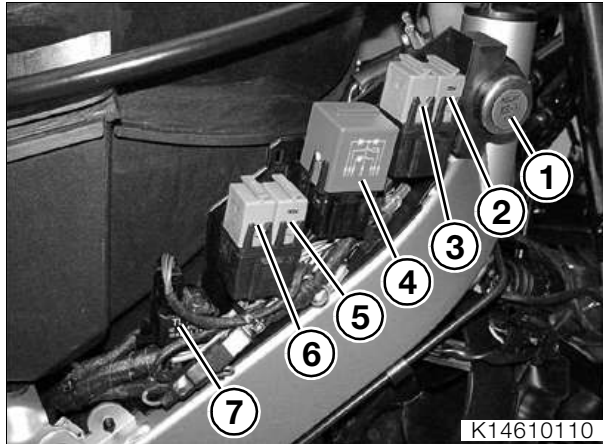
View from right



K14619020

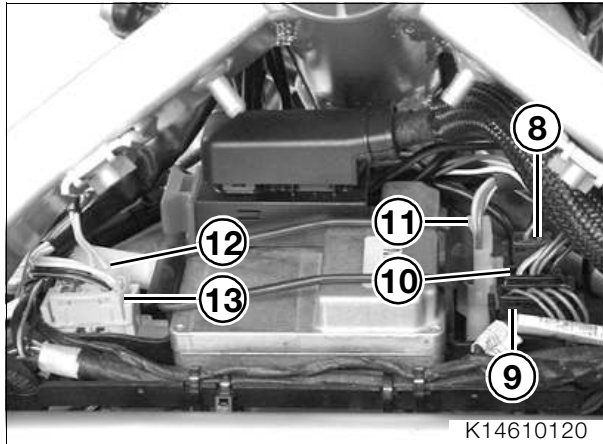
## Component positions in electronic equipment box

Relay positions in electronic equipment box



1. Starter relay
2. Hazard warning flasher relay
3. Flasher relay
4. Diode
5. Relief relay
6. BMS relay
7. Flasher unit

Connectors, electronics box



8. Brake light switch
9. Plug, auxiliary wiring harness
10. Multi-function switch, right
11. Ignition light switch
12. Clutch switch
13. Multi-function switch, left

## 61 21 010 Removing and installing battery (→ 00.20)

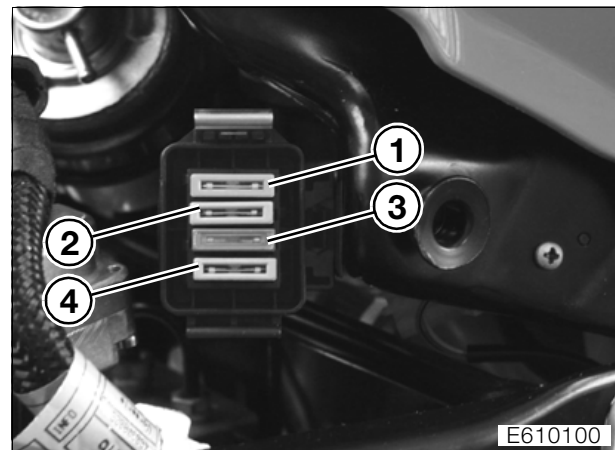
## 61 21 100 Removing and installing battery carrier (→ 34.17)

### Replacing fuses

#### Motorcycle fuses

- Remove seat.
- Open the cover of the fuse box.
- Replace the defective fuse.

#### Fuses

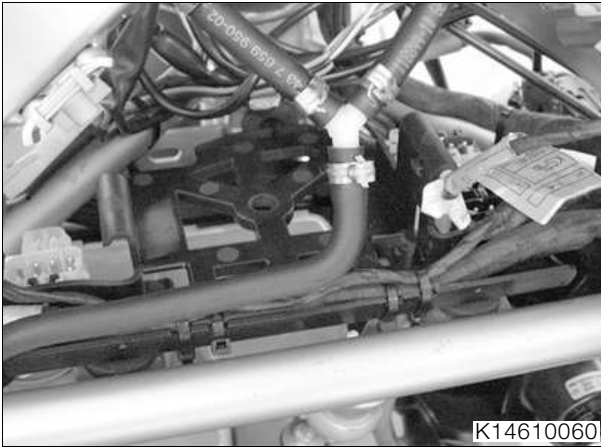


- |   |       |
|---|-------|
| 1. BMS Compact .....  | 20 A  |
| 2. Light, horn, number-plate light .....  | 15 A  |
| 3. Brake light/side light, turn indicator,<br>[OE] heated handlebar grips ..... | 10 A  |
| 4. [OE] Hazard warning flashers.....  | 7.5 A |



## 61 13 011 Removing and installing holder for BMS control unit

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove the BMS control unit.
- Disconnect the plug.



- Push the holder up and out of its front mounting points.
- Pull the electronic equipment box toward the rear and off the pin on the frame.
- Open the cable ties.
- Disconnect plugs on holder at left and right.
- Remove the holder.
- Installation is the reverse of the removal procedure.

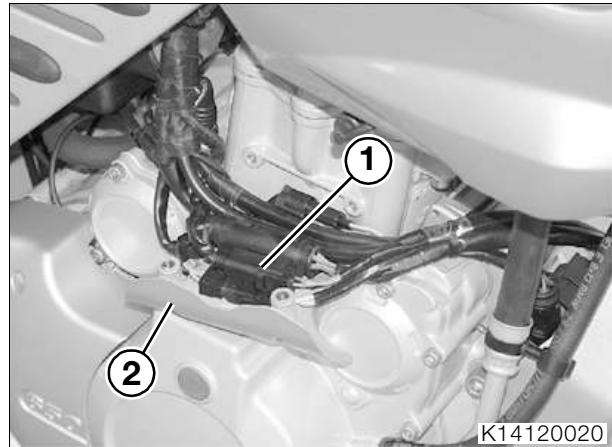
### **Tightening torque:**

Stowage-compartment frame to main frame ..	9 Nm
Fuel filter to stowage-compartment frame .....	9 Nm
Left and right covers to main frame .....	2 Nm
Left and right covers to air duct.....	3 Nm
Left and right covers to cover, front.....	1 Nm
Cover, front, to main frame.....	2 Nm
Cover, rear, to left and right covers and stowage-compartment frame .....	2 Nm
Left and right turn indicators to fairing bracket	3 Nm
Stowage-compartment rail to stowage-compartment frame.....	9 Nm

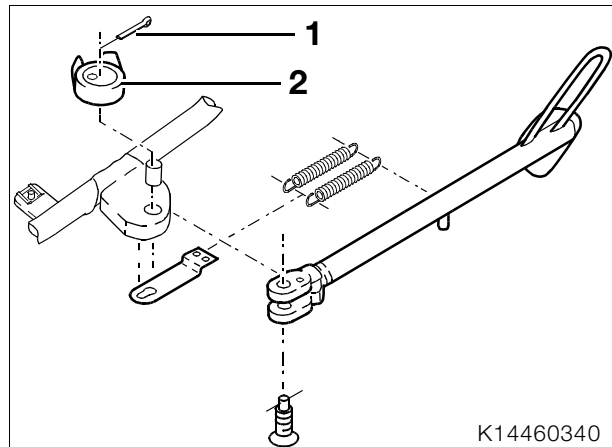
## 61 31 906 Removing and installing coolant-temperature sensor (→ 17.10)

## 61 31 302 Removing and installing side stand switch

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.



- Remove cable cover (2) from engine block.
- Disconnect side-stand switch plug (1) and unclip the plug.
- Open the cable ties.
- Disconnect plug of oxygen sensor.



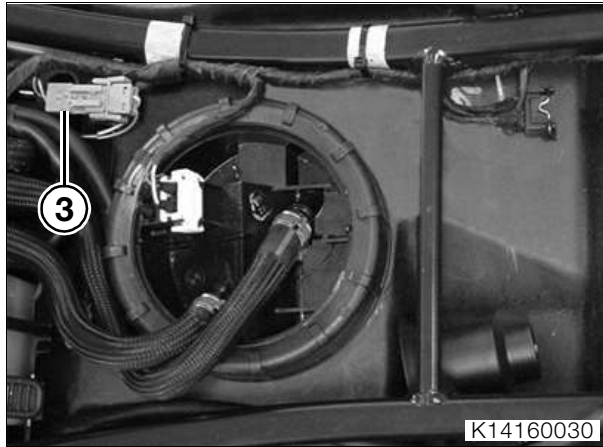
- Remove keeper (1).
- Remove switch (2).
- Installation is the reverse of the removal procedure.

### **Tightening torque:**

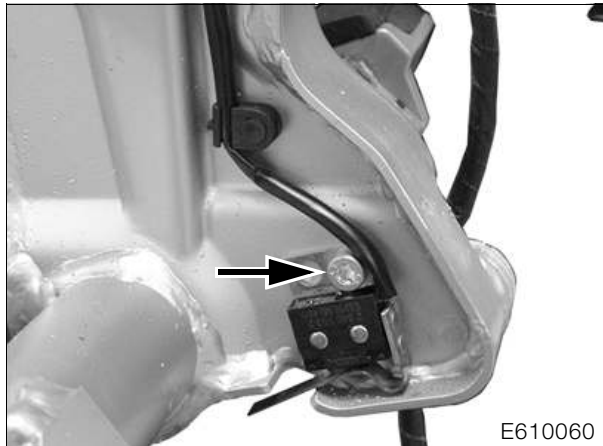
Cable cover to engine block.....	9 Nm
----------------------------------	------

## 61 31 310 Removing and installing rear-brake switch for brake light

- Remove seat.



- Disconnect the brake light switch plug (3) for the rear brake.
- Disengage cable from ABS holder.
- Raise rear frame (→ 46.15).
- Remove the cable from the holders on the frame.
- Cut the cable tie for the switch cable at the brake line.



- Remove the fastener securing the brake-light switch to the frame (arrow).
- Installation is the reverse of the removal procedure.



### Note:

Adjust blow-by clearance after installing the brake-light switch (→ 34.14).

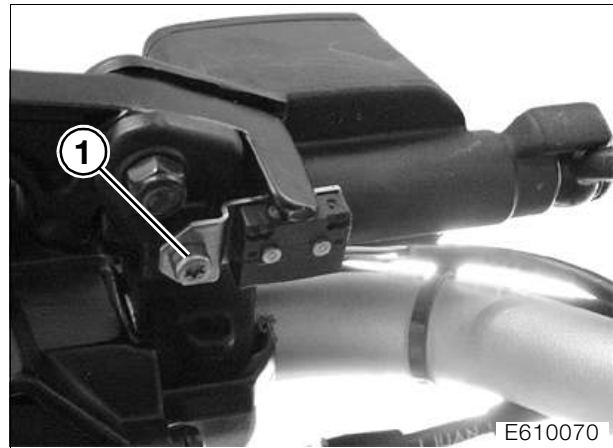


### Tightening torque:

Brake-light switch for rear brake to frame..... 5 Nm

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

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove insert from right cover.
- Remove cover of connector, right (→ 46.9).



- Remove brake light switch (1).
- Open the cable ties.



- Disconnect plug of brake light switch (2).
- Installation is the reverse of the removal procedure.



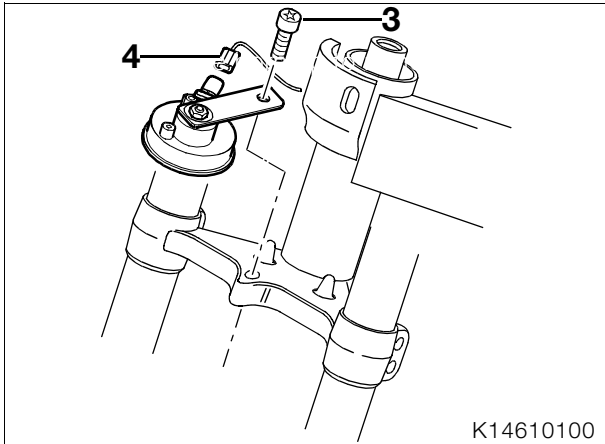
### Tightening torque:

Brake-light switch to handlebar fitting ..... 3 Nm



## 61 33 000 Removing and installing horn

- Remove front mudguard (→ 46.11).

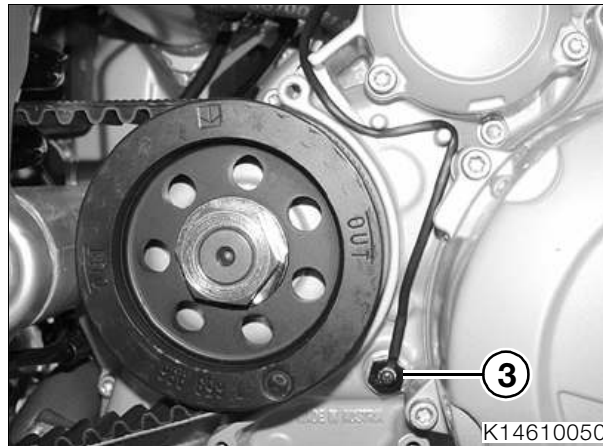


- Disconnect plug for horn (4).
- Remove fastener securing horn (3).
- Installation is the reverse of the removal procedure.


 **Tightening torque:**  
Horn to fork bridge, bottom  
(clean thread + Loctite 243)..... 18 Nm

## 61 31 227 Removing and installing neutral-indicator switch

- Remove cover for belt drive sprocket.



- Remove fastener securing cable to neutral-indicator switch.
- Remove neutral switch (3).
- 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 torque:**  
Switch, neutral indicator  
(clean thread + Loctite 243)..... 3 Nm  
Cable to neutral-indicator switch..... 1 Nm

## Removing and installing front/rear ABS sensors (→ 34.15)/(→ 34.16)





## 12 32 000 Removing and installing voltage regulator

- Remove cable cover on right-hand side of engine block.
- Disconnect the plug of the ignition trigger.
- Disconnect the plug of the stator.
- Open two cable ties.
- Unclip plug of oxygen sensor from holder on engine shell.
- Remove lead for oxygen sensor and cable for side-stand switch from clip at bottom left of engine shell.
- Remove fasteners securing engine shell to top tube and engine.
- Remove voltage regulator from engine shell.
- Installation is the reverse of the removal procedure.

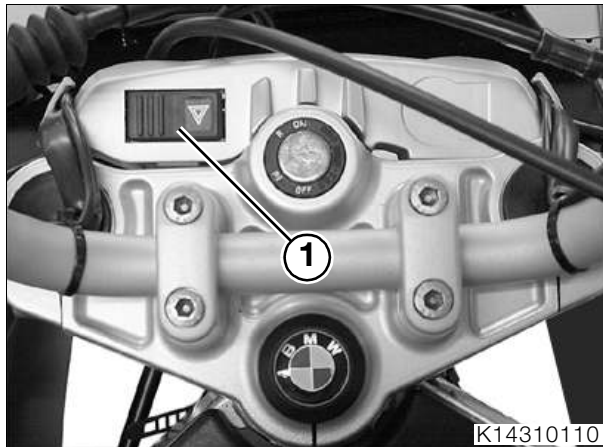


### Tightening torque:

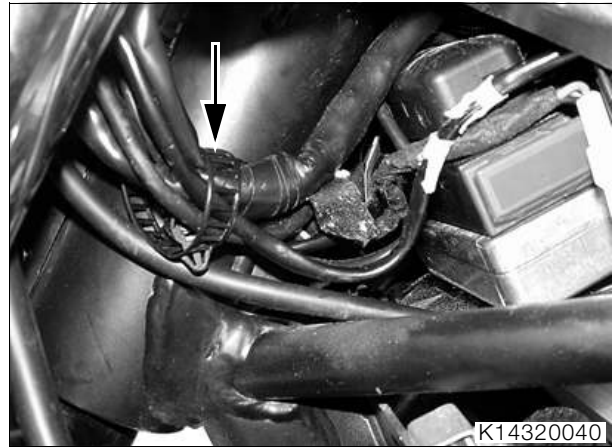
Voltage regulator to engine shell .....	9 Nm
Engine shell to top tube .....	25 Nm
Engine shell to engine .....	50 Nm
Cable cover to engine block.....	9 Nm

## Removing and installing switch for hazard warning flashers

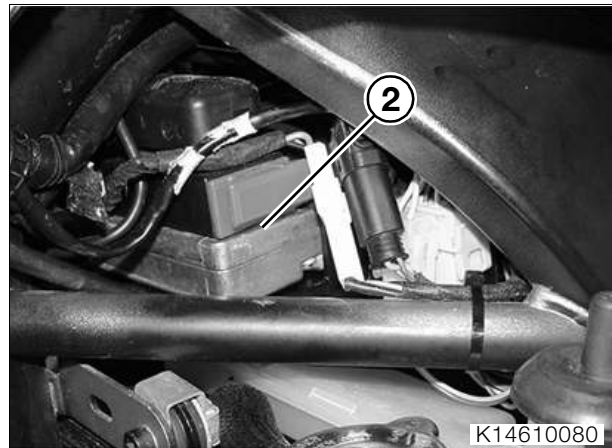
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove insert from left cover.
- Remove cover of connector, left (→ 46.9).



- From below, unclip switch (1) from hazard warning flashers from the insert.
- Open the cable ties.



- Disengage the cable tie at the frame head (arrow).



- Disconnect plug of hazard warning flashers switch (2).
- Remove switch for hazard warning flashers.
- Installation is the reverse of the removal procedure.



# 62 Instruments

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Disassembling and assembling instrument cluster .....	6
Removing and installing wiring harness .....	7

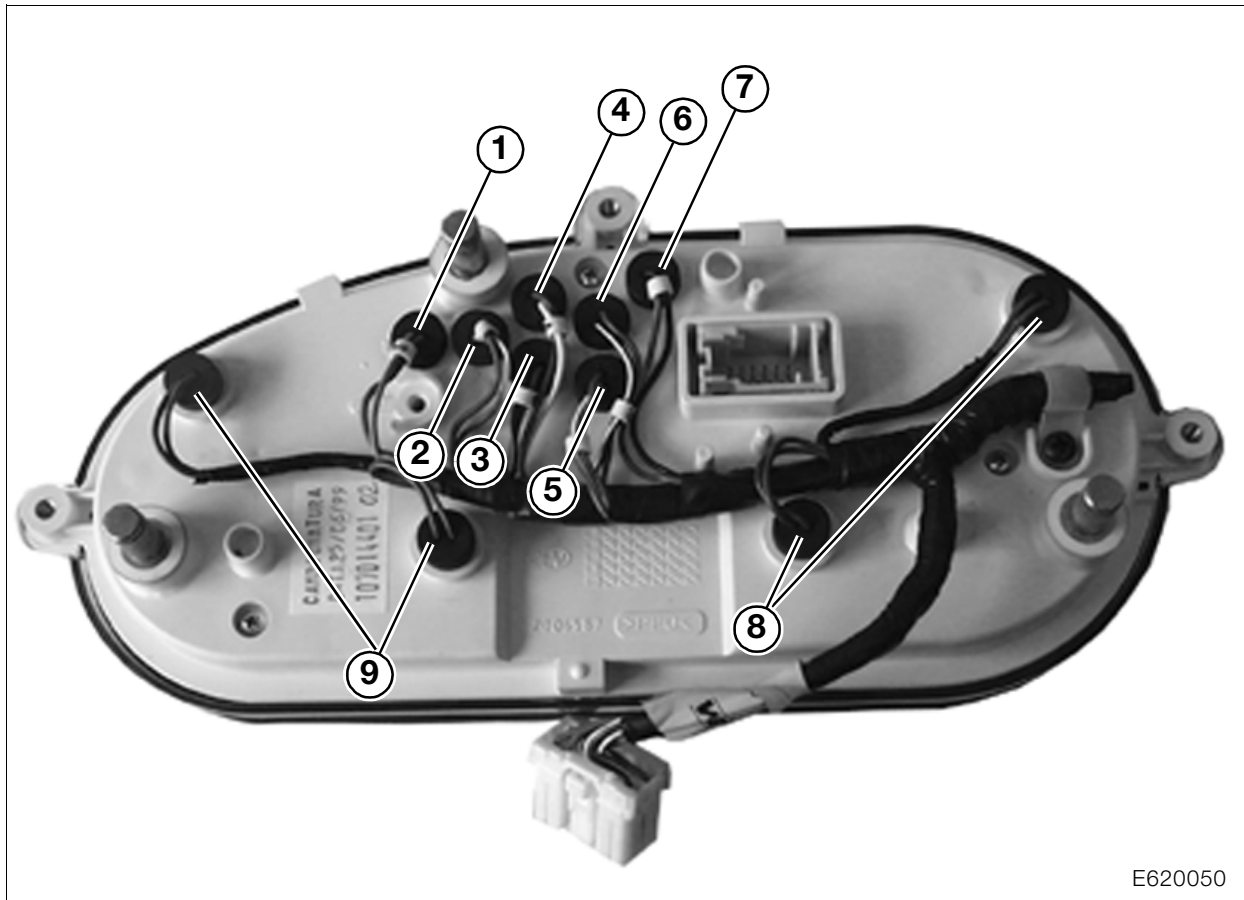




Technical Data 62 Instruments		F 650 CS
<b>Instrument cluster</b>		
Speedometer type		Electronic
Rev. counter type		Electronic
Turn-indicator cancellation		Manual
Instrument lighting		W 5/1.2 - 12 V 1.2 W
<b>Telltale and warning lights</b>		
Flashing turn indicator		W 5/1.2 - 12 V 1.2 W
High (main) beam headlight		W 5/1.2 - 12 V 1.2 W
Neutral		W 5/1.2 - 12 V 1.2 W
Oil pressure		W 5/1.2 - 12 V 1.2 W
Water temperature		W 5/1.2 - 12 V 1.2 W
Fuel gauge		W 5/1.2 - 12 V 1.2 W
ABS warning lights		W 5/1.2 - 12 V 1.2 W







E620050

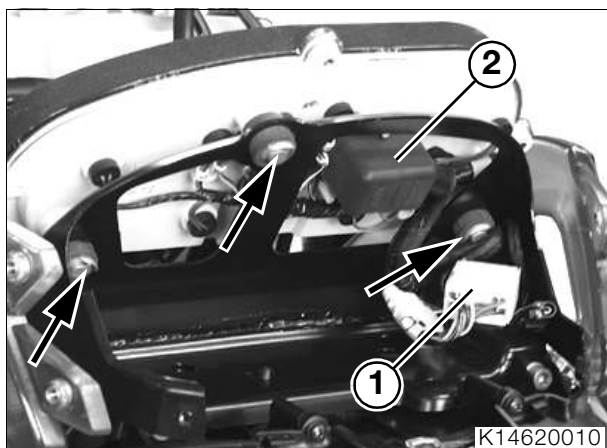
## Telltale/warning lights

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

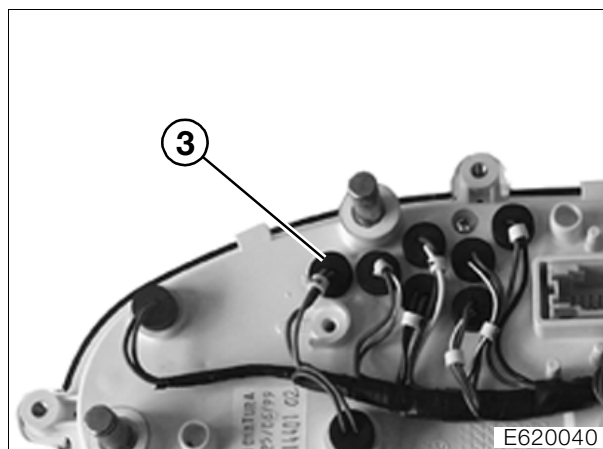
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove instrument cover (→ 46.8).



- Disconnect the plug for the warning lights (1).
- Pull off the rubber boot (2) 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.

## Replacing telltale/warning lights

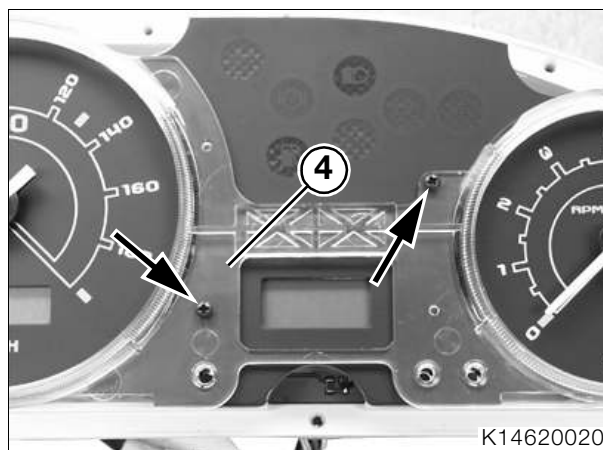
- Remove instrument panel.



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

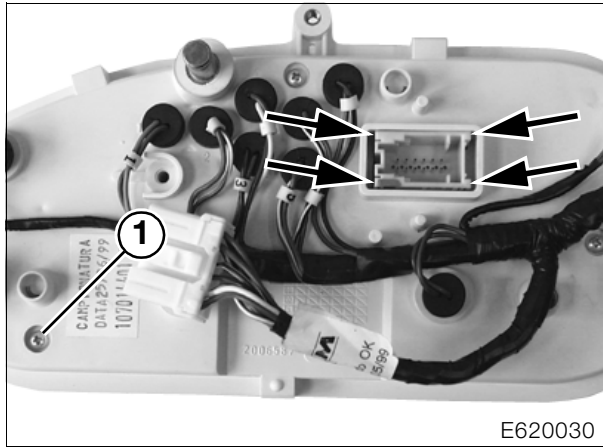
## 62 11 630 Disassembling and assembling instrument cluster

- 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).

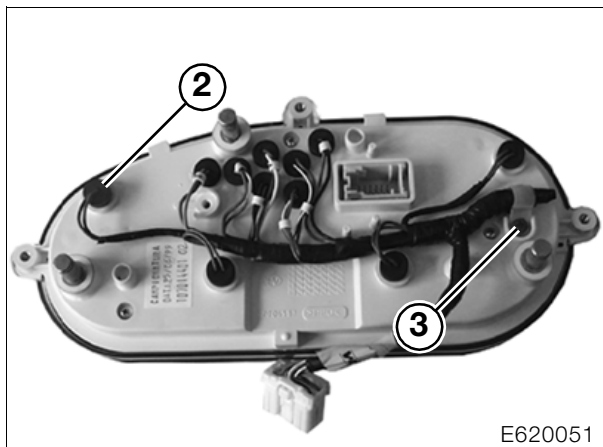




- Remove the 3 securing screws (1) from the rear of the housing.
- Press back the 4 snap locks (arrows) on the plug housing and press out the instrument panel.
- Installation is the reverse of the removal procedure.

### Removing and installing wiring harness

- Remove instrument panel (→ 62.6).



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





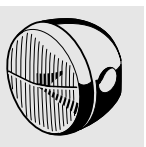
# 63 Lights

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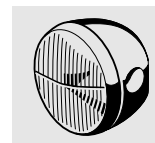
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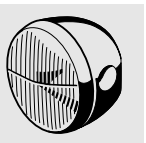
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<b>Removing and installing rear light</b> .....	6
<b>Removing and installing number-plate light</b> .....	6
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Bulb, parking light .....	7
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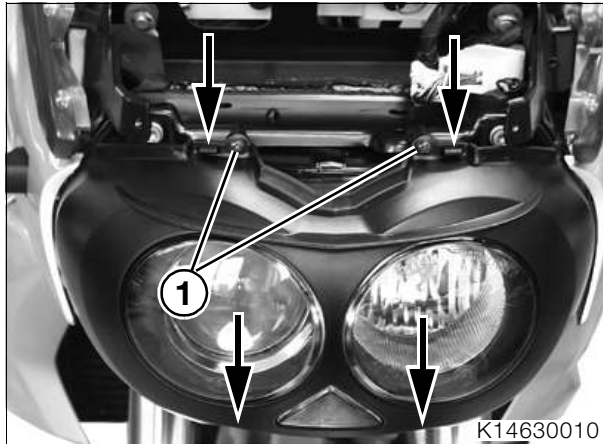
Technical Data 63 Lights	F 650 CS
Headlight type	Twin ellipsoid headlights
<b>Bulbs</b>	
Low (dipped) beam headlight	H3 halogen bulb 12 V 55 W
High (main) beam headlight	H1 halogen bulb 12 V 55 W
Parking light	12 V 5 W
Rear/brake light	12 V 5/21 W Standard designation P 21/5 W
Flashing turn indicator	12 V 10 W Type P 25-1
Number plate light	Halogen bulb 12 V/6 W



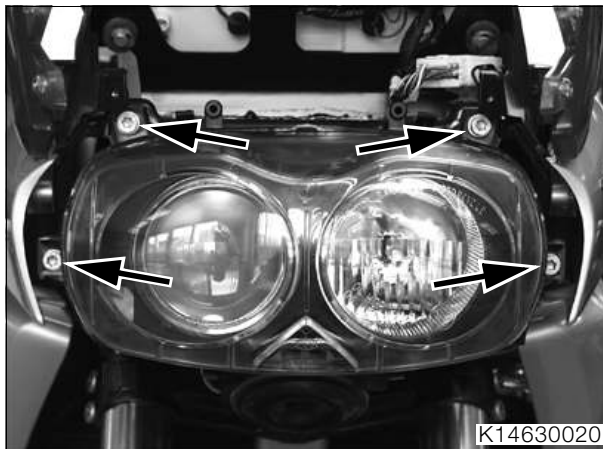


## 63 12 090 Removing and installing headlight

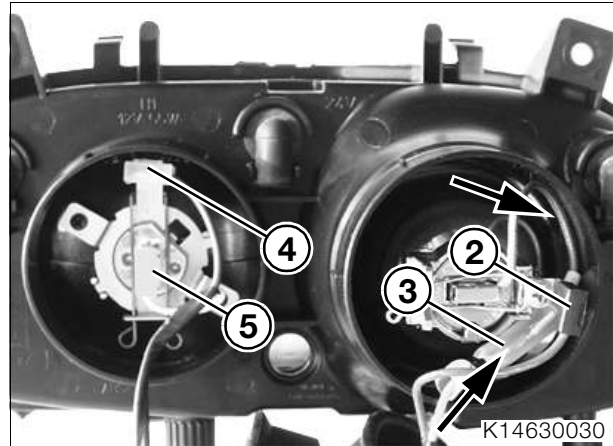
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 620**.
- Remove instrument cover (→ 46.8).



- Remove fasteners of headlight surround (1) and remove the headlight surround from the clip fittings (arrows).



- Remove fasteners for cable headlight housing (arrows).
- Pull bulb holder for side light out of the headlight housing by the cable.
- Disconnect the plugs for low-beam headlight and high-beam headlight.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



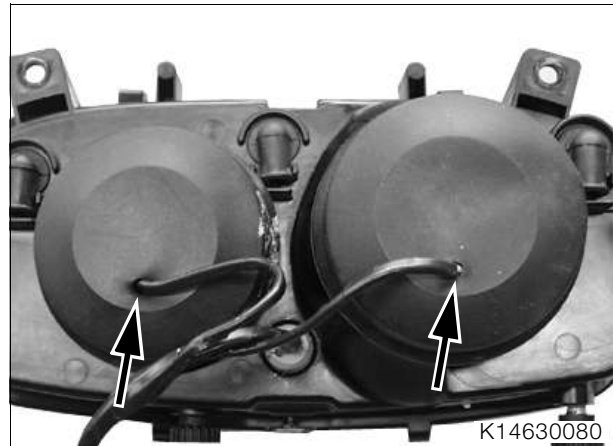
### Cable colours of the contacts for low-beam and high-beam headlights

- 2. brown
- 3. yellow
- 4. brown
- 5. white



### Attention:

Route the cables as shown (arrows).



### Attention:

Cable penetrations in the caps (arrows) must point down.



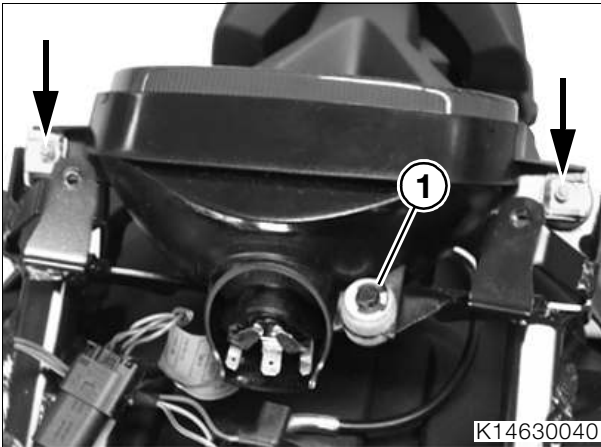
### Tightening torque:

Windscreen to windscreen holder .....	2 Nm
Instrument cover to fairing bracket .....	2 Nm
Headlight housing to fairing bracket .....	7 Nm

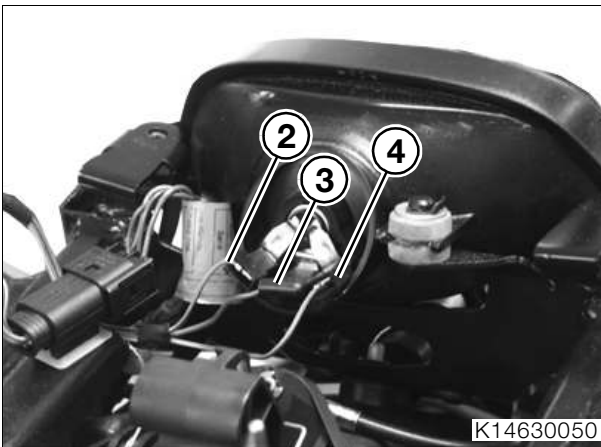


## 63 21 380 Removing and installing rear light

- Remove right and left rear trim panels (→ 46.13).
- Disconnect the plugs of the rear light.




- Remove retaining washer (1).
- Remove the fasteners for the rear light (arrows) and remove the rear light.
- Installation is the reverse of the removal procedure, pay particular attention to the following.

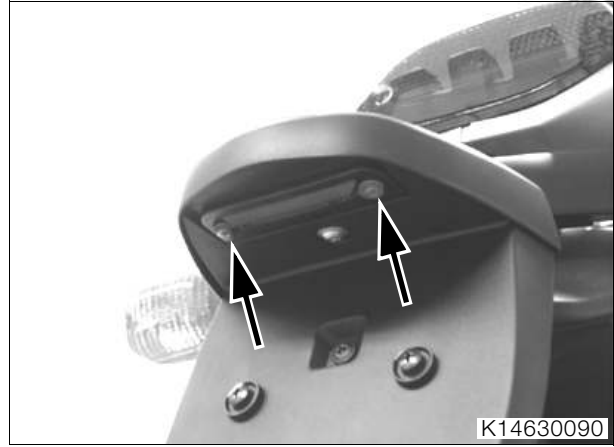


### Colours of the wires in the housing for tail light/brake light

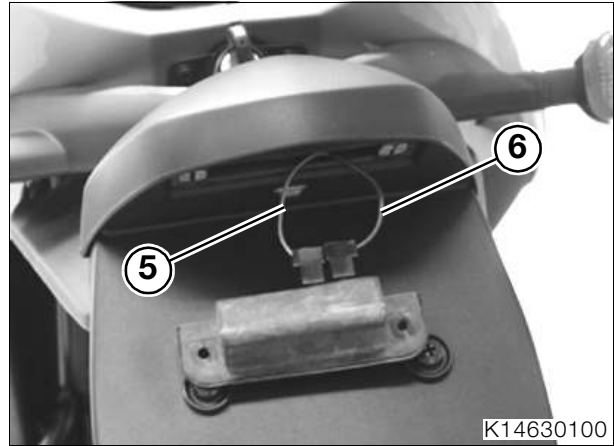
2. blue/black
3. brown
4. green/red

 **Tightening torque:**  
Rear light to rear frame..... 9 Nm

## Removing and installing number-plate light




- Remove fasteners for number-plate light (arrows) and lift out number-plate light.
- Disconnect plugs.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Cable colours of the contacts for the number-plate light

5. green
6. brown

 **Tightening torque:**  
Number-plate light to number-plate carrier .... 1 Nm

## Replacing bulbs



### Attention:

Always switch off the ignition before changing bulbs.

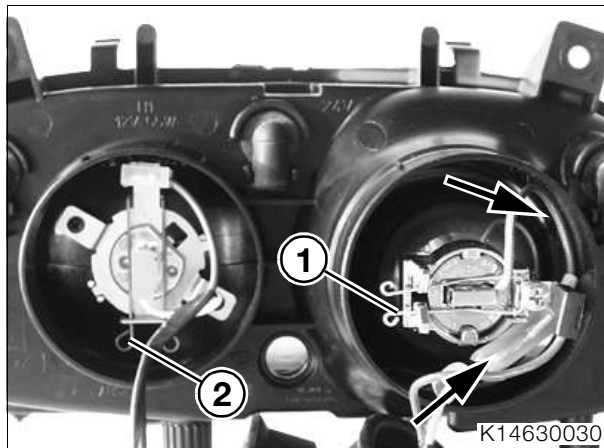


### Note:

Do not touch inside of reflector and glass of bulbs with bare hands.

### 63 12 241 Bulb for low-beam headlight/ high-beam headlight

- Remove caps.



- Disconnect plug.

#### Bulb for low-beam headlight

- Press bow (1) forward and disengage it from the hook.

#### Bulb for high-beam headlight

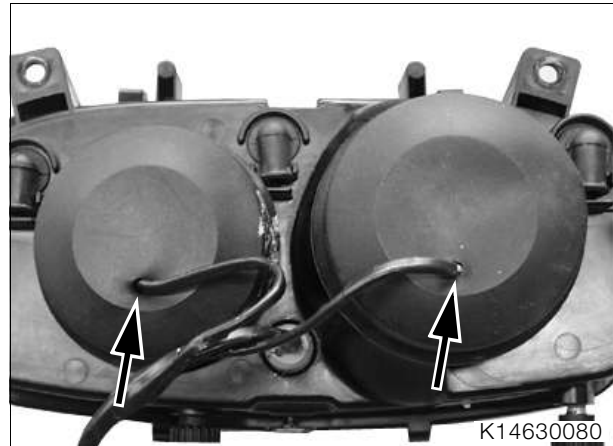
- Press bow (2) forward and disengage it from the hook.
- Remove the bulb.
- Installation is the reverse of the removal procedure, pay particular attention to the following.



### Attention:

Route the cables as shown (arrows).

### Cable colours of the contacts for low-beam and high-beam headlights (→ 63.5)

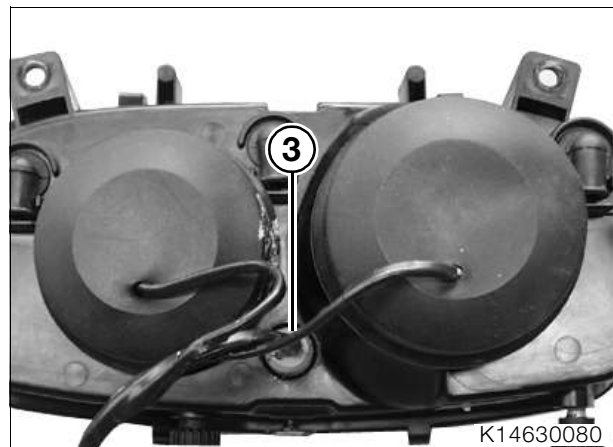


### Attention:

Cable penetrations in the caps (arrows) must point down.

### 63 99 161 Bulb, parking light

- Place motorcycle on its centre stand.



- Pull bulb socket (3) out of the headlight housing by the cable.
- Remove bulb from its socket
- 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.

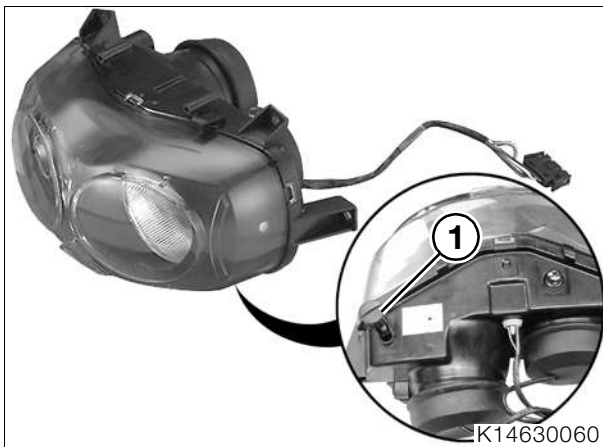
### 63 99 399 Bulb for number-plate light

- Remove the number plate light.
- Lift the rubber cap, press the bulb in and turn it counter-clockwise to disengage.

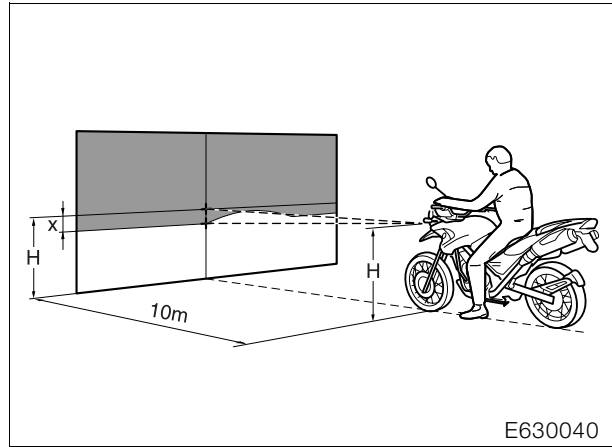
### 63 10 004 Checking and adjusting headlight beam throw

#### Vertical adjustment

- Rider's weight on motorcycle (75 kg/165 lbs).



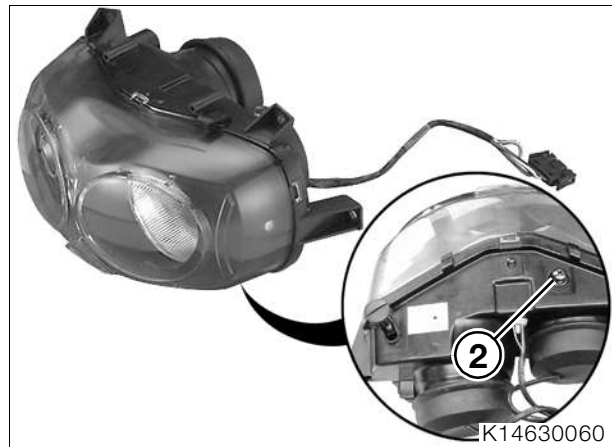
- Manually adjust the headlight throw by turning adjusting screw (1).



#### Setting for headlight beam adjuster

X..... 10 cm (3.93 in) over a distance of 10 m (32.81 ft)

#### Lateral adjustment



- Adjust lateral throw by turning screws (2), if necessary.

