

Repair Manual

R 80 GS – R 100 R



BMW Motorrad GmbH + Co.
Service Department

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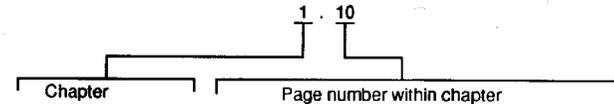
Introduction

This Workshop Manual is intended to ensure that all major maintenance and repair work is carried out expertly. If used regularly by workshop personnel, it will add to the practical and theoretical knowledge provided by the Service Training School, and therefore make it easier to achieve the required high service quality standards.

A new edition will be issued if amendments or additions (supplements) are needed. The sections of the manual concerned will be marked with the new issue date. Microfiches which are rendered out of date as a result should be destroyed without delay.

All information contained in illustrations or descriptions refers to standard production motorcycles or those fitted with Original BMW Accessories and not modified in any other way.

- The Workshop Manual is laid out in the logical working order: removal, stripping down (dismantling), repair, assembly, installation.
- The contents are divided up into separate chapters. The page numbering means:



- The work to be performed during an Inspection is stated in an Inspection and Maintenance Schedule. The various levels of Inspection work are designated with Roman figures: I, II, III. The same designations are used in the work descriptions which follow, so that a continuous work sequence is assured.
- Where necessary, the work descriptions state which BMW special tools are to be used.

When the need arises, repair instructions are also issued in the form of Service Information bulletins. Their contents are incorporated into the next issue of the Workshop Manual. In addition, you are recommended to refer to the illustrated Parts microfiche as a further source of information.

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Service Department – Technical

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SUMMARY OF MAIN GROUPS

New Old	1-3	4	5	6	7	8	9	10	11	12	13	14
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Note:

The form and structure of the Workshop Manual have been revised; the main groups and their numbering have also changed.

Since the contents of individual main groups are closely related, they have now been grouped together into chapters of their own. This makes it easier to locate the required information and gain access to the group concerned.

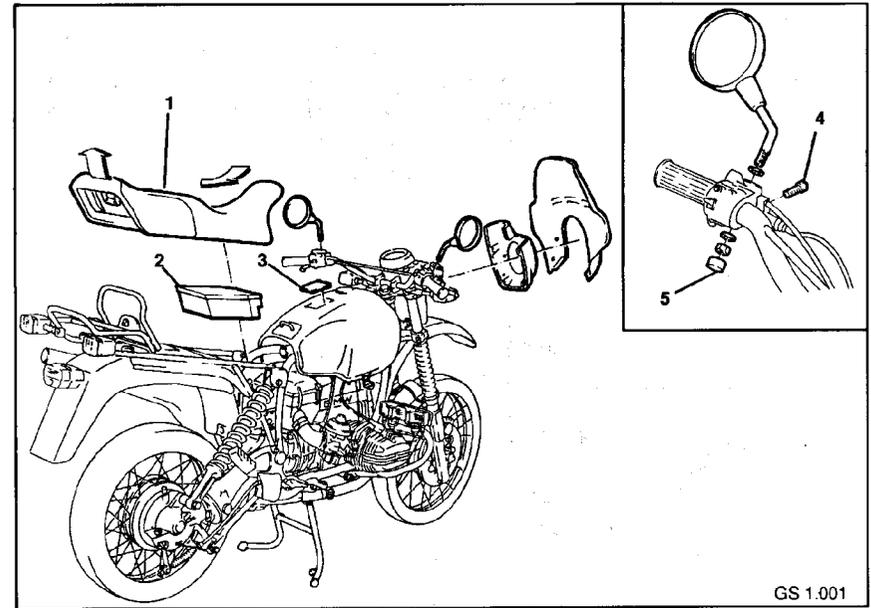
The old and new main group numbers are compared in this summary. The black areas indicate the actual status of the manual.

**1. FITTING OUT
MOTOR CYCLE AND
DELIVERY INSPECTION**

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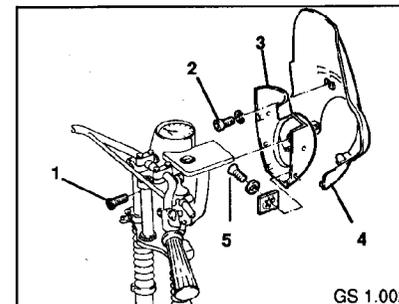
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GS 1.001

1.1 FITTING OUT MOTOR CYCLE

INSTALLING WINDSHIELD



GS 1.002

- Remove windshield (4) from the enclosed carton.
- After slackening the 4 fastening screws (1), take off front section (3) of the headlamp fairing.
- Screw windshield to the front section of the headlamp fairing with 4 fastening screws (5, 2).

- Screw front section of headlamp fairing together with windshield to rear section with four fastening screws (1).

AFFIXING HELMET STICKER

- Affix helmet sticker (3) to the middle of the top of the fuel tank behind the tank cap.

TIGHTENING HANDLEBAR CONTROLS

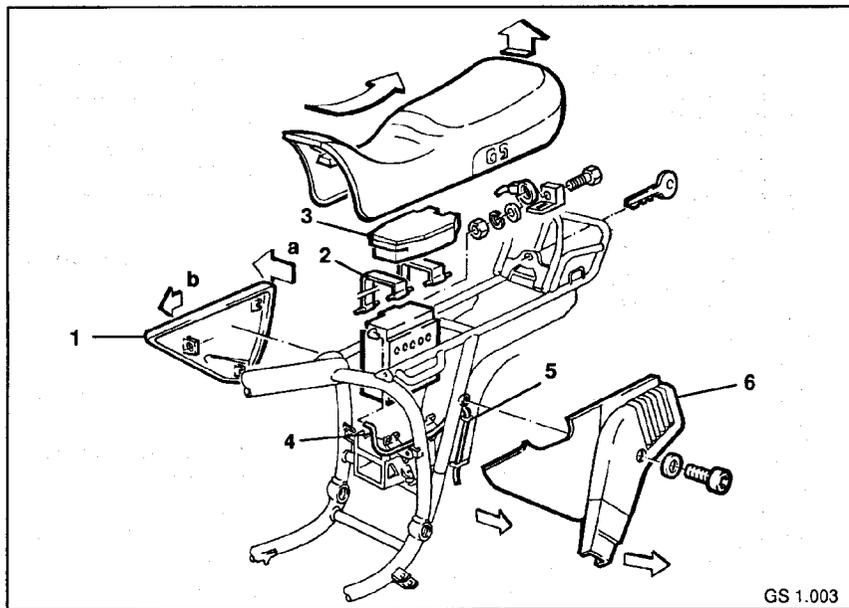
- Align lefthand and righthand handlebar controls ergonomically (fitted on loosely).
- Clamp tight by tightening each on the fastening screws (4).

INSTALLING REAR-VIEW MIRRORS

- Install lefthand/righthand rear-view mirrors in the order shown in illustration.
- Fit on protective cap (5).
- Take off seat (1) after releasing seat lock.
- Check contents of stowage dish (2).
- Checking whether tools in stowage dish and documentation are complete.

Contents of dish: bike tools, breakdown assistance kit, 3 bike keys (1 folding key, 2 ridged keys).

Documentation: Owner's Manual, List of Dealers, First-Aid Guide.



1.2 DELIVERY INSPECTION

NOTE:

The delivery inspection should be performed immediately before handing over the motor cycle to the customer.

REMOVING BATTERY

- Take off seat.
- Remove stowage dish (3).
- Take off righthand battery cover (1) in direction of arrow.
- Lift off left battery cover (6) in direction of arrow, and loosen screw (GS only).
- Detach battery tensiing straps (2).
- Unscrew negative terminal on battery.
- Lift battery up out of mount (withdraw angled vent pipe (4) from battery if necessary).

FILLING BATTERY WITH ELECTROLYTE

CAUTION:

The battery contains sulfuric acid. Avoid acid coming into contact with eyes and skin or clothing. Remedy: wash contact areas with water. If acid has been swallowed, drink large quantities of milk or water.

Contact a doctor without delay. Wash out eyes with water and obtain medical treatment.

Battery gives off explosive gases. Avoid sparking, naked flames and smoking. When working close to batteries, always wear protective goggles.

STORE BATTERIES AWAY FROM THE REACH OF CHILDREN!

Store batteries only in well-ventilated rooms. The filler caps must always be removed.

- Remove plugs from battery.

- Fill battery with pure electrolyte (conforming to VDE 0510, Density: 1.28 kg/l, for tropical countries 1.25 kg/l (related to electrolyte temperature of 20°C) up to specified level ("Max" mark).
- Leave battery to stand for approx. 1 hour, then shake slightly or tip (to vent) and top up electrolyte level to "Max" mark if necessary.
- Screw in plugs loosely (do not tighten fully until after battery is charged).

CAUTION:

After being filled, the dry-charged battery attains only 60% of its rated capacity. It is therefore essential to charge battery. Avoid allowing filled batteries to stand for lengthy period when not in use. Do not fill battery with electrolyte until just before it is to be used.

CHARGING BATTERIES

CAUTION:

Do not exceed a maximum charging current of 10% of battery capacity.

Maximum charging temperature = 40°C.

Example:

25 Ah-battery = charging current 2.5 Amperes
Charging time = 5 ... 10 hours

The charged state of the battery can be checked by measuring the electrolyte density.

Electrolyte density of fully-charged battery = 1.256 ... 1.30 kg/l related to 20°C.

- Shake battery slightly after charging – gas bubbles rise to the surface.
- After the electrolyte has settled, top up with distilled water to "Max" mark, if necessary.
- Screw in plugs tight.
- Install battery.

NOTE:

Ensure vent hose (5) is correctly routed.

CAUTION:

Connect battery positive terminal first, then negative terminal.

- Connect vent line.

CHECKING REAR WHEEL BOLTS ARE TIGHT

Tightening torque:
rear wheel bolt

105 Nm

CHECKING/CORRECTING TIRE INFLATION PRESSURE

Check tire inflation pressure when tires are cold; correct if necessary.

Solo	front	2.2 bar
	rear	2.5 bar
with pillion passenger	front	2.4 bar
	rear	2.9 bar

CHECKING LIGHTING AND SIGNAL SYSTEM

- Main beam, dipped beam, and parking lights;
- Stop, licence plate and turn signal lamps;
- Main beam, battery charge, idling and oil pressure indicator lamps;
- Horn and any optional equipment fitted.

CHECKING/TOPPING UP BRAKE FLUID

Checking brake fluid:

CAUTION:

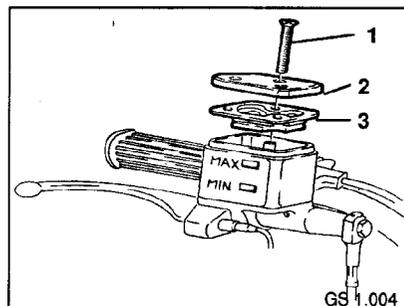
Brake fluid is caustic. Avoid contact with eyes and skin and also with clothing. Protect paintwork from contact with brake fluid.

CAUTION:

The brake fluid level must extend to below "MAX" mark when the reservoir is closed. The brake fluid level must never drop below the "MIN" mark.

Take care when pouring in brake fluid.

Topping up brake fluid



- Slacken the 3 fastening screws (1) and carefully lift lid (2) off the brake fluid reservoir.
- Take off bellows (3).

NOTE:

Use only brake fluid conforming to quality DOT 4 (e.g. ATE brake fluid "SL").

- Top up brake fluid until just below the "MAX" mark.
- Insert bellows, fit on cover and tighten gently with 3 fastening screws.

PERFORMING OPERATIONAL CHECK

- Clutch
- Gearshift
- Steering
- Footbrake
- Handbrake
- Operational instruments; perform test run, if necessary
- Following this, check idle setting of engine, correct if necessary; refer to adjusting carburetor (engine at normal operating temperature).

FINAL VISUAL INSPECTION FOR LEAKS ON:

- Engine
- Transmission
- Rear axle housing
- Telescopic forks and
- Fuel system

Stamp and sign Owner's Manual as confirmation that delivery inspection has been performed.

2. MAINTENANCE AND INSPECTION

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BMW Maintenance and Inspection Schedule

ENGINE AND TRANSMISSION

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Tightening cylinder head nut	X			2.7
Checking rocker arm and play, adjusting if necessary			X	2.8
Adjusting valve clearance	X	X	X	2.9
Checking spark plug electrode gap		X		2.12
Renewing spark plugs			X	2.12
Renewing intake filter			X3)	2.13
Cleaning carburettor float chamber		X	X	2.14
Cleaning fuel cocks4)			X	2.13
Checking clutch play, adjusting if necessary	X		X	2.14
Setting filling point	X		X	2.15
Synchronising carburetors, adjusting cables	X	X	X	2.17
Renewing oil filter	X	X	X1)	2.19
Replacing engine oil at normal operating temperature	X	X	X1)	2.19
Replacing transmission oil at normal operating temperature	X	X	X2)	2.20
Replacing transmission oil in rear wheel drive at normal operating temperature	X		X2)	2.21

Recommendation: Re-grease throttle control and handlebar bearings at least every 3000 km if motor cycle used in extreme conditions*).

*) Invoiced separately

1) at least every six months, every 3 months or at least every 3000 km if motor cycle used only for short trips or at outside temperatures below 0°C

2) at least once a year

3) renew intake filter every 7500 km, or more often if necessary, if motor cycle used in extremely dusty or dirty conditions

4) as a rule every 30,000 km, every 15,000 km if fuel conditions poor

5) at least every 3 months

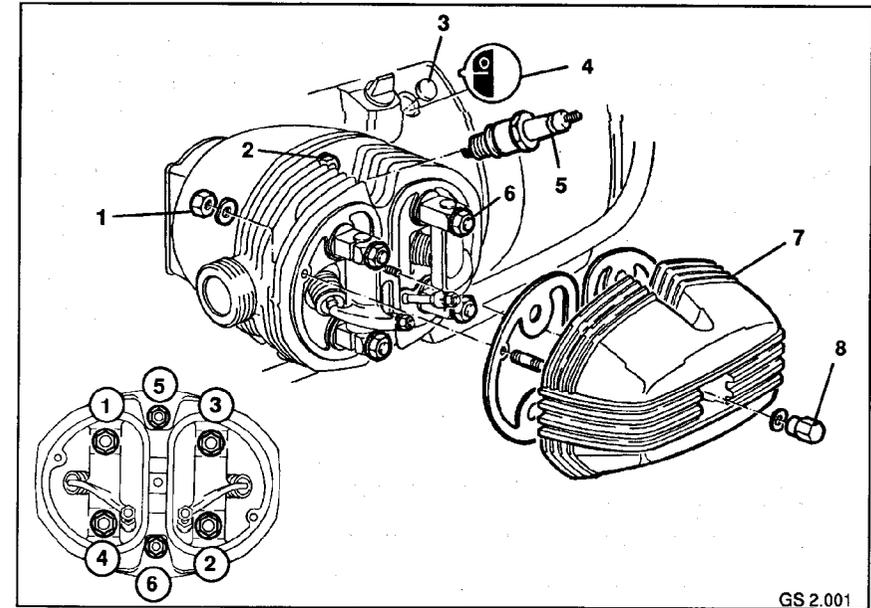
RUNNING GEAR

	I	II	III	Page
	BMW inspection at 1000 km	BMW inspection at 7500 km and every additional 15000 km	BMW service at 15000 km and every additional 15000 km	
Replacing telescopic fork oil	X		X2)	2.21
Checking brake pads and disc for wear, renewing if necessary*)			X	2.22
Checking brake calber for proper operation/leaks, repairing/renewing if necessary	X		X	
Checking/topping up brake fluid level. Changing brake fluid at least once a year*)	X		X	2.24
Checking connections and lines of brake system for leaks, signs of damage and correct position	X		X	
Checking rear brake shoe for wear, renewing if necessary*)			X	2.28
Checking idle travel of rear wheel brake, adjusting if necessary			X	2.30
Checking wheel bearing, renewing if necessary*)			X	2.30
Checking handlebar bearing, adjusting if necessary*)			X	2.31
Adjusting swing arm bearing play			X	2.32
Greasing side stands and 2 nipples for clutch cable		X	X	2.32
Checking electrolyte level of battery, topping up distilled water 5)			X	2.33
Cleaning and greasing battery terminals *)			X	
Checking nuts and bolts for tight fit	X		X2)	2.34
Checking rear wheel bolts for tight fit	X	X	X2)	
Final inspection with examination of road/operational safety	X	X	X2)	2.34

Recommendation: Re-grease throttle control and handlebar bearings at least every 3000 km if motor cycle used in extreme conditions*)

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- 1) at least every six months, every 3 months or at least every 3000 km if motor cycle used only for short trips or at outside temperatures below 0°C
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- 4) as a rule every 30,000 km, every 15,000 km if fuel conditions poor
- 5) at least every 3 months



GS 2.001

2.1 TIGHTENING CYLINDER HEAD NUTS

Tightening cylinder head nuts to the specified tightening torque comprises:

- Checking/adjusting end play of rocker arms (Inspection III)
- Tightening cylinder head nut (Inspection I)
- Adjusting valve (Inspection I, II, III)

TIGHTENING CYLINDER HEAD NUTS (INSPECTION I)

CAUTION:

Engine must be cold (room temperature). After tightening the cylinder heads, always examine valve clearance, adjust if necessary. If leaks are detected between cylinder and cylinder head, examine cylinder head for signs of twisting and scorching on the sealing surfaces.

NOTE:

Collect leak oil in a suitable vessel.

- Slacken cap nut (8) on cylinder head cover (7).
- Slacken two side nuts (1) and take off cylinder head cover.
- Unscrew both spark plugs (5).
- Engage 5th gear.
- Position appropriate piston to compression TDC (TDC = Top Dead Centre) by turning rear wheel.

NOTE:

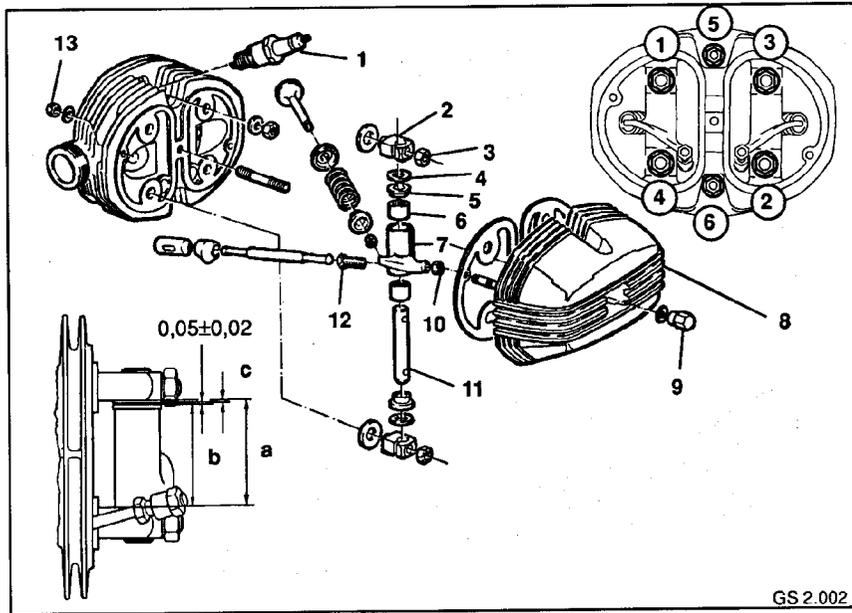
Compression TDC is reached when:

1. The TDC mark (4) appears in inspection hole (3) on the bell housing and
2. Inlet and exhaust valves are closed.

- Tighten collar nuts (6) and fastening nuts (2) in stages, in 3 steps, to specify tightening torque and in the order shown in tightening diagram.
- Repeat operation on 2nd cylinder.

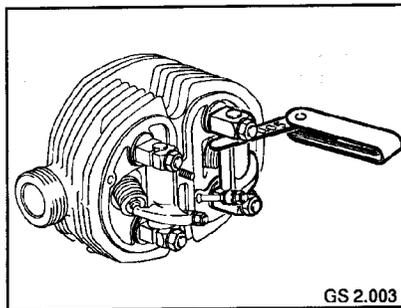
Tightening torque:
Cylinder head nuts

15/25/35 Nm



GS 2.002

**CHECKING/ADJUSTING END PLAY OF
ROCKER ARM (INSPECTION III)**



GS 2.003

a) Checking end play:

- Appropriate piston is set to compression in TDC.
- Use feeler gauge to check end play between Pertinax disc (5) and shim (6).

End play: 0.05 ± 0.02 mm

b) Adjusting end play:

- Measure distance (a) of clamp blocks (2) and note distance.

- Set piston to compression TDC.
- Slacken locking nuts (10) on the rocker arms (7).
- Turn back adjusting screws (12) of the valves far enough to fully relieve both rocker arms.
- Slacken 4 collar nuts (3) on the clamping blocks.
- Take off rocker arm shafts (11) together with clamping blocks and rocker arms.
- Take off clamping blocks and shims (4).
- Measure rocker arm together with Pertinax discs. Note measurement (b).
- Calculate thickness of spacer disc (c).

$$c = a - b - 0.05 \text{ (End play)}$$

CAUTION:

Ensure rocker armshafts and axle clamping blocks are correctly fitted. The punch marking (1) on each shaft must be pointing up and away from the cylinder.

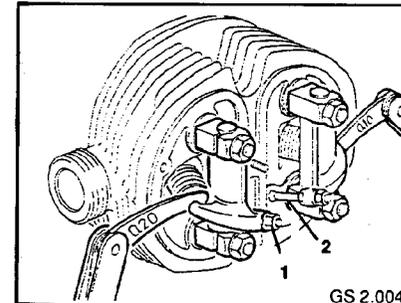
The grooves (2) of the axle clamping blocks must be pointing out the way.

- Tighten collar nut (3) in stages in 3 steps to the specified tightening torque and in the order as shown in the tightening diagram.
 - Re-check end play.
- Repeat operation on second cylinder.

Tightening torque:
Cylinder head nuts

15/25/35 Nm

ADJUSTING VALVE CLEARANCE (Inspection I, II, III)



GS 2.004

- The valve clearance compensates for the different thermal expansions and wear to the individual engine components:
- Incorrect valve clearance is indicated by:
- Poor cold starting behaviour,
- Irregular idling,
- Lack of performance when engine at normal operating temperature and/or
- increased engine noises.

CAUTION:

Adjust valve clearance only when engine cold (room temperature).

- Cylinder head cover is removed.
- Appropriate piston is set to compression TDC.
- Check valve clearance between valve stem and rocker arm with feeler gauge, as shown.
- Slacken locking nut (1).
- Correct valve clearance by turning adjusting screw (2).
- Use combination wrench to prevent adjusting screw (2) from moving.
- Tightening locking nut (1).
- Re-check valve clearance. It must be possible to pull feeler gauge through between valve stem and rocker arm with slight resistance.

Valve clearance:

(Adjust when engine cold)

up to 1000 km	Inlet valve	mm	0.15
	Exhaust valve	mm	0.25
from 1000 km	Inlet valve	mm	0.10
	Exhaust valve	mm	0.20

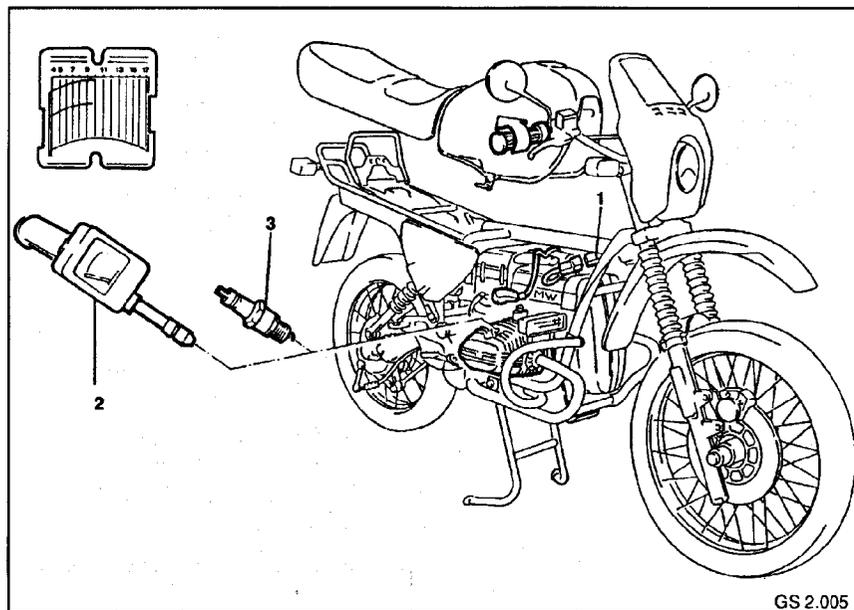
CAUTION:

Clean sealing surface. Install cylinder head cover with gasket in perfect condition. Do not forget washers below the three fastening nuts. Screw in spark plugs in perfect condition.

Repeat operation at other cylinder.

Tightening torque:

Locking nut of valve adjusting screw	20 Nm
Cap nut of cylinder head cover	24 Nm
Spark plug	25 Nm



2.2 TESTING COMPRESSION PRESSURE

NOTE:

- Perform test only when:
1. valves correctly set,
 2. engine at normal operating temperature (to ensure seal between piston, piston rings and cylinder liner) and
 3. battery charged.

CAUTION:

It is essential to interrupt ignition otherwise ignition coil could be destroyed.

- Remove seat.
- Slacken locking clamp of fuel tank mounting (rear).
- Lift off fuel tank rear and prop up.
- Interrupt ignition by disconnecting three-pin plug (1).

- Unscrew spark plugs (3) on both cylinders.
- Hold throttle control in full throttle position.
- Press compression pressure tester (2) firmly into spark plug hole.
- Crank engine with starter until indicated pressure no longer rises.
- Repeat operations on other cylinder.
- Pressure difference between both cylinders must not exceed 1 bar.

Compression pressures:

good	more than	9 bar
normal		7.5 ... 9 bar
poor	less than	7.5 bar

Compression pressure too low:

- Pour a few drops of engine oil into the cylinder.
- Repeat test procedure.
- If compression pressure rises: piston ring is probably worn.

Compression pressure constant:

- Valves and/or piston rings worn.

Compression pressure on both cylinders evenly too low:

- Parts of both cylinders are evenly worn.
- Following completion of test:
- Screw in spark plug on both cylinders.
 - Fit on spark plug connector.
 - Connect three-pin plug.
 - Insert fuel tank into rear lock.
 - Close locking bar.
 - Insert seat into locks at front and rear (lock if necessary).

Tightening torque:

Spark plugs

25 Nm

2.3 SPARK PLUGS

- The spark plug can provide information regarding the ignition and carburettor settings as well as regarding the state and operating conditions of the engine.
- The following procedure should be adopted for examining the spark plug pattern:
- Warm up engine by running for approx. 10 km in medium rpm range.
- Switch off engine before motor cycle has come to a stop.
- Avoid the engine running for a lengthy period at idle throttle before switching off.
- Unscrew spark plugs.

CONDITION OF SPARK PLUGS

Normal:

Insulator base is light-grey to fawn-brown. The thermal state of the spark plug is correct. Engine state, combustion and combustion temperature are in proper order. Carburettor and ignition are correctly set.

Carbon-fouled:

Spark plug covered with soft, dry deposits of soot.

Effects when driving:

- Poor cold starting behaviour.
- Misfiring (creep currents).
- Dark exhaust.

Possible sources of fault:

- Incorrect setting/type of carburettor (too rich mixture).
- Air filter fouled.
- Spark plug too "cold" (incorrect heat rating).
- Frequent short trips.
- Choke does not open fully.

Oil-fouled:

- Electrodes and interior of spark plug coated with black film of oil.

Effects when driving:

- Poor cold starting behaviour.
- Misfiring.

Possible sources of fault:

- Oil in combustion chamber.
- Wear or damage to piston rings, cylinder or valve guides.

Bright (overheated):

Electrode and base of insulator snow-white despite lengthy operation. If severely overheated, centre and ground electrodes will show signs of melting as a result of auto-ignition.

Effects when driving:

- Loss of power.
- Misfiring.
- Total failure (engine damage).

Possible sources of fault:

- Incorrect setting/type of carburettor (mixture too "lean").
- Incorrect ignition setting (ignition excessively advanced).
- Deposits in combustion chamber (which may cause auto-ignition).
- Spark plug too "hot" (incorrect heat rating).

Worn Electrode:

Effects when driving:

- Poor cold starting behaviour.
- Misfiring, principally when accelerating.

Possible sources of fault:

- Spark plugs not changed at correct interval.

ELECTRODE GAP

The electrode gap essentially determines the ignition voltage requirements of the spark plug.

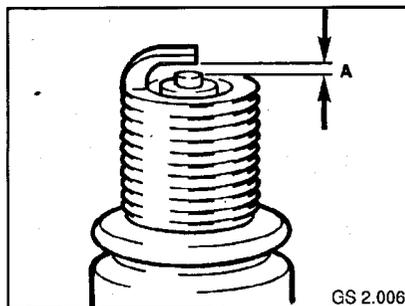
Electrode gap too small:

- Excessive voltage reserve.
- Insufficient mixture reaches the spark gap, resulting in misfiring.

Electrode gap too wide:

- High ignition voltage, low voltage reserves.
- This may cause misfiring.

CHECKING SPARK PLUGS AND ELECTRODE GAP (INSPECTION II)



- Unscrew spark plug.
- Examine spark plug in respect of colour/appearance and for signs of damage.
- Clean spark plug with copper-bristle brush.

CHECKING ELECTRODE GAP WITH FEELER GAUGE OR SPARK PLUG GAUGE:

- Electrode gap is correct if the specified gauge thickness can be drawn through between the electrodes with scarcely perceptible resistance.

Electrode gap $A = 0.6 + 0.1 \text{ mm}$
Wear limit $A \text{ max} = 0.9 \text{ mm}$

- Once the wear limit (A max) has been reached, replace spark plug.

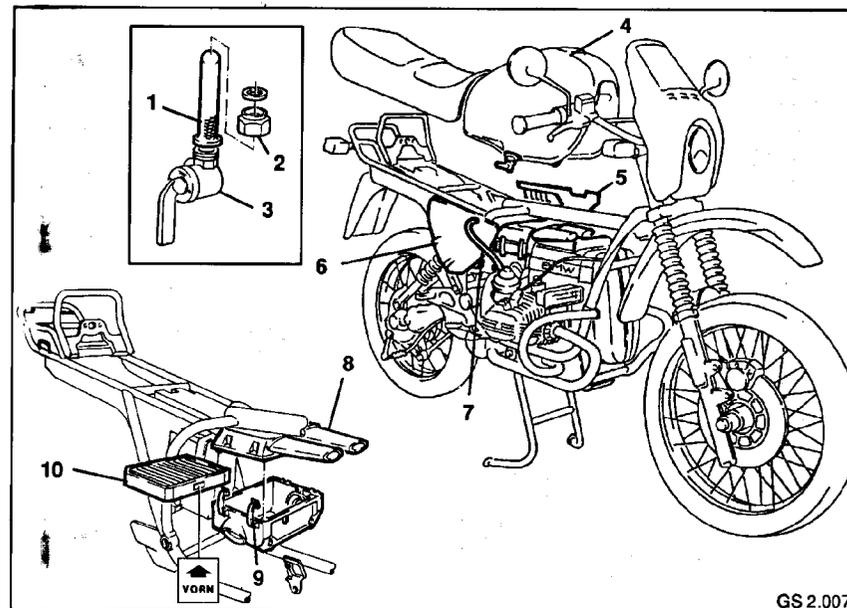
CAUTION:

Do not bend electrode. Risk of electrode fracturing when engine running.

- Screw in spark plug.

Tightening torque:
Spark plug (dry)

25 Nm



2.4 RENEWING AIR FILTER

- Remove lefthand battery cover (5) and righthand cover (6).
- Open the 4 spring clips (9) and lift off top section of air filter (8).
- Take out air cleaner element (10).

NOTE:

Install new air filter element with lettering "vorn" in direction of travel and arrow marking pointing upward.

- Install new air filter element.
- Fit on air filter top section and secure with four spring clips.

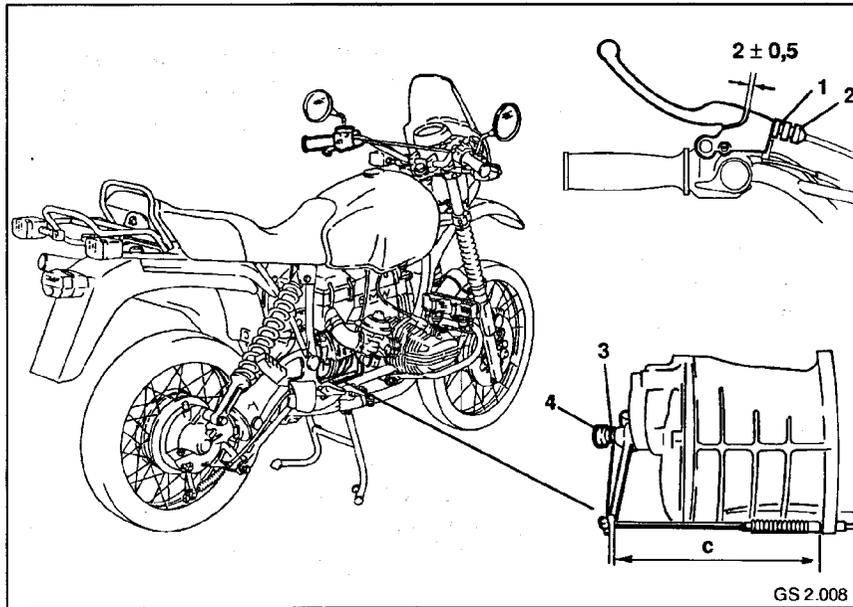
2.5 CLEANING FUEL COCKS

- Drain fuel tank (4).
- Slacken the union nut (2) and take fuel cock (3) off the fuel line.
- Unscrew union nut from fuel cock and take off fuel strainer (1).
- Clean fuel strainer with fuel.

CAUTION:

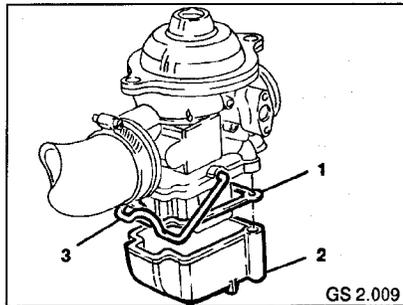
Examine sealing ring for possible signs of damage.

- Blow fuel strainer dry with compressed air and re-install.



GS 2.008

2.6 CLEANING CARBURETTOR FLOAT HOUSING (Inspection II, III)



GS 2.009

- Use a screwdriver to lever spring clamp (3) on the carburettor down off the float housing (2).
- Take off float housing, drain and clean.
- Install float housing, ensuring gasket (1) is in proper condition.

2.7 CHECKING/ADJUSTING CLUTCH PLAY (Inspection I, III)

CHECKING CLUTCH PLAY AT HAND LEVER:

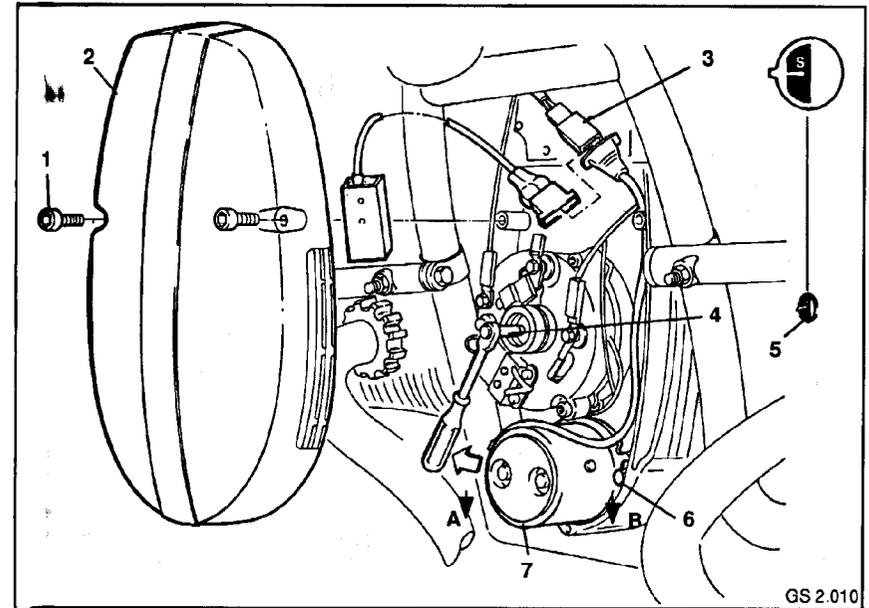
Specified clutch play 2 ± 0.5 mm

ADJUSTING CLUTCH PLAY:

- Slacken locking nut (1) of the Bowden cable adjusting screw (2) at the clutch lever.
- Turn adjusting screw until size "C" is set at the clutch lever at transmission end.
- Setting "C" = $201 + 1$ mm
- Tighten locking nut (1) of the Bowden cable adjusting screw.
- Slacken locking nut (3) of the adjusting screw (4) at transmission end.
- Turn adjusting screw until clutch play at hand lever is 2 ± 0.5 mm.
- Tighten locking nut (3).

Size C

$201 + 1$ mm



GS 2.010

2.8 CHECKING/ADJUSTING FIRING POINT

These motor cycles are fitted with a transistorized coil ignition (TSZ) a performance-enhanced ignition system.

WARNING:

Avoid touching life parts when engine is running. Hazardous!

CHECKING/ADJUSTING FIRING POINT (Static)

- Take off engine guard cover (2) after slackening the 2 hexagon socket screws (1).
- Remove wire clip of 3-pin plug connection (3) (Ignition box).
- Detach plug connection.
- Connect ignition timing device, BMW No. 12 3 650, to the ignition box.
- Unscrew spark plugs.
- Slowly crank engine in direction of arrow at the rotor fastening screw (4) until diode just lights up.

a. Checking firing point:

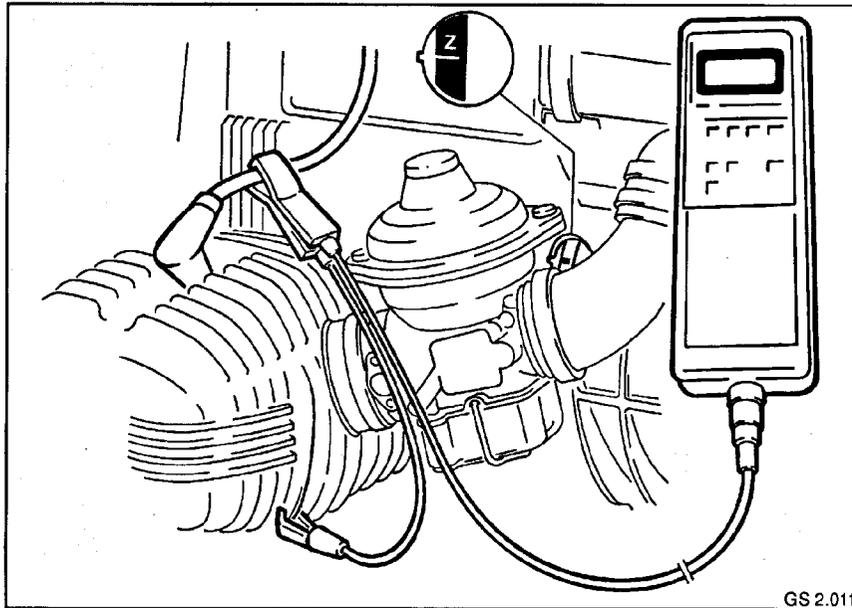
- Remove protective cap from inspection hole (5) on engine housing.
- Middle stroke of flywheel marking "S" must be aligned with the inspection hole marking (notch on engine housing) once the diode on the ignition timing device just lights up.

b. Settling firing point:

- Crank engine in direction of arrow at rotor fastening screw (4) until inspection hole marking and flywheel "S" are aligned.
- Slacken 2 fastening screws (6) on ignition box (7).
- Turn ignition box until diode on ignition timing device just lights up.

Turning in direction A = Ignition advanced
Turning in direction B = Ignition retarded

- Tighten both fastening screws.
- Re-check firing point.



GS 2.011

Following end of adjustment and check:

- Detach ignition timing device/ignition box plug connection.
- Re-create plug connection to engine cable harness.
- Fit on wire clip.
- Attach engine guard cover with two hexagon sockets.
- Screw in spark plugs and tighten to specified tightening torque.
- Plug in spark plug connector.
- Close inspection hole with protector cap.

Tightening torque:

Spark plug (dry)

25 Nm

CHECKING/SETTING FIRING POINT (Dynamic)

a. Checking firing point:

- Clip trigger sensor of BMW Diagnosis Tester over ignition cable.
- Connect ground cable to chassis with clamping tongues.
- Remove protective rubber cap from inspection hole in engine housing.
- Start engine.
- Maintain engine speed at 3500 rpm.
- Strobe flywheel with timing strobe through inspection hole.

- Line of flywheel marking "Z" must be aligned with inspection hole marking (notch).

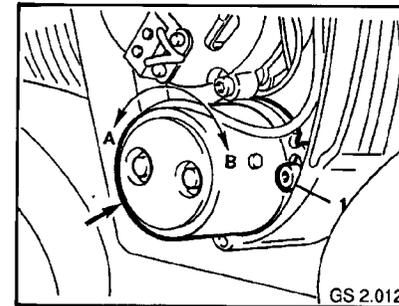
Line above notch = Ignition advanced
below notch = Ignition retarded

Full ignition advance (from 3000 rpm) = 32° BTDC

- Again strobe flywheel with timing strobe at idling speed (800 ... 1100 rpm).
- Line of flywheel marking "S" must be aligned with inspection hole marking (notch).

Static firing point = 6° BTDC (at idling speed)

b. Setting firing point:



GS 2.012

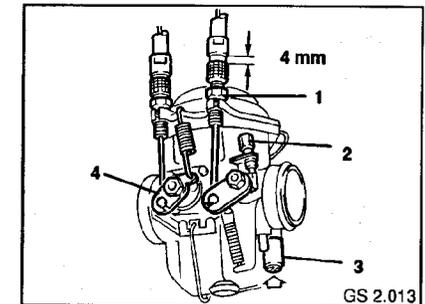
- Remove engine protective cover.
- Slacken 2 fastening screws (1) of the ignition box.
- Turn ignition box until marking (flywheel/inspection hole) are aligned when strobed with timing strobe.

Turning in direction A = Ignition advanced
Turning in direction B = Ignition retarded

- Tighten fastening screws of the ignition box.
- Attach engine protective cover.
- Seal inspection hole with protective cap.

2.9 SYNCHRONISING CARBURETTORS ADJUSTING CABLES (Inspection I, II, III)

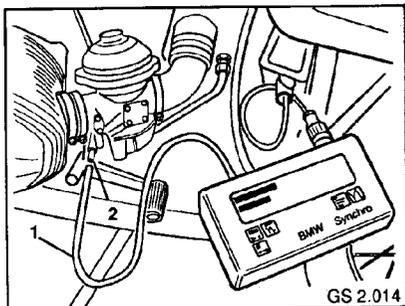
BASIC SETTING OF CARBURETTOR



GS 2.013

- Warm up engine until it is at normal operating temperature (approx. 80°C oil temperature e.g. measured at dipstick).
- Provisionally set throttle cable play of both carburettors to approx. 4 mm with adjusting screw (1) (to ensure throttle valves do not stick on the throttle cables but close fully).
- Adjust cable of starter device of both carburettors so that the starter lever (4) is pushed into its end position when choke is closed.
- Gently screw in idle mixture regulating screw (3) on both carburettors as far as the stop.
- Following this, unscrew both regulating screws evenly approx. 3/4 turns.
- Unscrew throttle valve stop screw (2) of both carburettors until they are touching the throttle valve lever.
- Following this, screw in both stop screws evenly approx. 1/2 turns.

SYNCHRONISING CARBURETTORS WITHOUT CO MEASUREMENT



- Remove screw plug on both carburetors from the vacuum connection or detach PAS hose.
- Attach synchrotest connecting hoses (1), BMW No. 13 0 800, to both carburetors' vacuum connection (2).
- Connect synchrotester to the motorcycle battery via the appropriate adapter cable.
- Start engine and run at idle throttle.
- Set provisional idling speed to approx. 900 rpm by evenly turning the throttle valves top screw.

NOTE:

The idle mixture can be most accurately adjusted in this rpm range, i.e. the engine reacts very sensitively to adjustment of the idle mixture regulating screw.

- Check synchronous operation of carburetors with Synchrotester.
- Screw in idle mixture regulating screw until engine speed begins to drop.
- Following this, unscrew idle mixture screw 1/8 ... 1/4 turns.
- Repeat adjustment operation on second carburettor.
- When doing this, continuously check synchronous operation of carburetors with Synchrotester.

If idling speed is not in the specified range of 800 ... 1100 rpm, repeat adjustment operation (correcting idling speed / adjusting idle mixture).

SYNCHRONISING CARBURETTORS WITH CO MEASUREMENT

- Perform basic carburettor adjustment.
- Switch CO analyzer as stated in manufacturer's instructions.
- Insert probe approx. 30 cm into final silencer.
- Screw in or unscrew idle mixture regulating screw until specified CO reading is obtained.
- Repeat adjustment operation on second carburettor.
- Continuously check synchronous operation of carburetors with Synchrotester when adjusting.

If the idling speed is now not in the specified range of 800 ... 1100 rpm, repeat adjustment operation (correctly idling speed / adjusting idle mixture).

Idle CO-level

R 80 GS

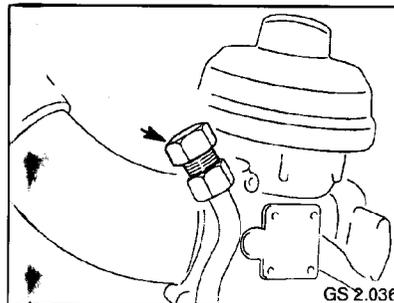
R 100 GS, R 100 R

2,5 ± 1,5% by vol.

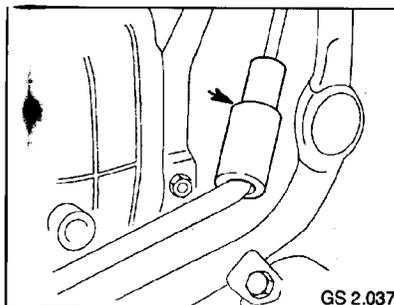
1,0 ± 0,5% by vol.

SYNCHRONIZING CARBURETTORS WITH CO MEASUREMENT FOR PAS

- The engine must be at its regular operating temperature.
- Perform basic carburettor adjustment.
- Detach both PAS lines from the air cleaner housing.



- Use screw plug, BMW No. 13 0 900, (arrow) to seal one line.



- Connect the open line with adapter, BMW No. 13 0 910 (arrow), to the CO tester measuring probe.
- Tighten idle mixture adjustment screw (leaner mixture) or loosen it (richer mixture) at the corresponding carburettor until the specified CO value is reached.
- Move to the other side of the motorcycle and adjust the second carburettor in the same way.
- Use the synchrotester to check carburettor synchronization continuously.

If the idling speed is not in the specified range, repeat the adjustment procedure (correcting idling speed / adjusting idle mixture).

Idle speed CO value

11100 GS

11 80 GS2.5

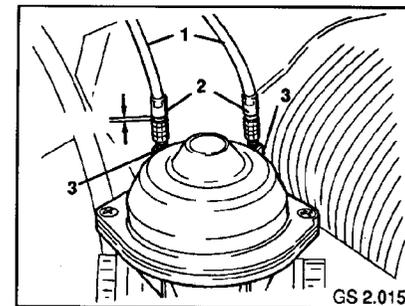
Idle speed

1 ± 0.5 Vol %

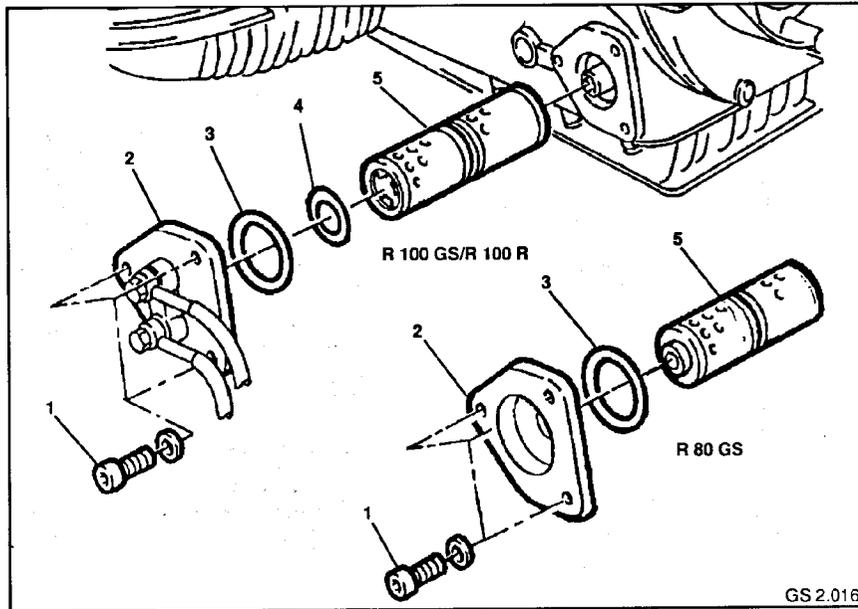
+/- 1.5 Vol %

800...1100 min⁻¹

FINAL ADJUSTMENT OF THE THROTTLE CABLES

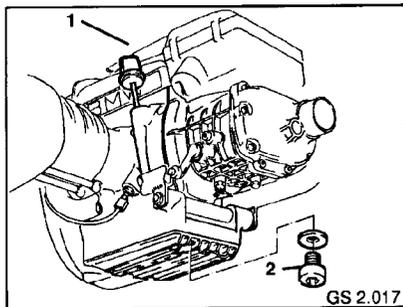


- Adjust both carburetors' throttle cables (1) to 0.5 ... 1.0 mm play at adjusting screw (2).
- Slightly increase engine speed using the twistrip.
- Use adjusting screw (2) to adjust both carburetors' throttle cables so that the mercury columns in the synchrotester show the same level.
- Tighten adjusting screw with locknut (3).



2.10 CHANGING OIL AND OIL FILTER IN ENGINE (Inspection I, II, III)

DRAINING ENGINE OIL



NOTE:

Change engine oil only when engine at normal operating temperature.

- Unscrew dipstick (1).
- Place suitable draining vessel below oil opening.

- Allow engine oil to flow out.
- Screw in oil drain plug with new sealing ring and tighten to specified tightening top.

CHANGING OIL FILTER

- Slacken the 3 fastening screws (1) and take cover (2) off oil filter housing.
- Drain oil from oil cooler (use compressed air, if necessary, to force out oil).
- Take O-ring (3,4) off cover.
- Withdraw oil filter cartridge (5) from the intake manifold.
- Fit new oil filter cartridge onto intake manifold with collar (5) facing engine.
- Fit on cover with new O-ring (3,4) and tighten with three fastening screws.
- Change the oil filter in the same way on the R 80 GS, but note that O-ring (4) is not fitted.

POURING IN ENGINE OIL

- Pour in specified quantity of fresh engine oil.
- Screw in dipstick (1)
- Run engine briefly.

NOTE:

Dipstick is only inserted into filler opening for checking oil level, and not screwed in.

- Wait approximately 5 minutes and then check oil level on dipstick.

CAUTION:

Never pour in engine oil to above "MAX" mark.

- Top up missing quantity of oil.
- Quantity of oil between "MIN" and "MAX" marks = 0.85 l.

Capacity of engine:

R 80 GS/R 100 GS	2.00 l
with oil filter change R 80 GS/R 100 GS	2.25 l

Tightening torque:

Oil drain plug (engine)	30 Nm
-------------------------	-------

torque.

- Pour in fresh transmission oil to bottom edge of filler hole.
- Screw in oil filler plug and tighten to specified tightening torque.

Capacity of transmission

0.80 l

Tightening torque:

Oil drain plug (transmission)	26 Nm
Oil filter plug (transmission)	31 Nm

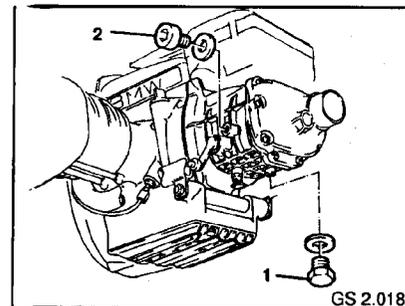
Grades of transmission oil: Proprietary Hypoid transmission oil of API Class GL 5. Useability of the particular viscosity classes is limited by the ambient temperature:

above	5 °C	SAE 90
below	5 °C	SAE 80
or alternatively SAE 80W90		

CAUTION:

Use of other grades and classes of oil in the transmission may result in premature damage to the gears.

2.11 CHANGING OIL IN TRANSMISSION (Inspection I, II)

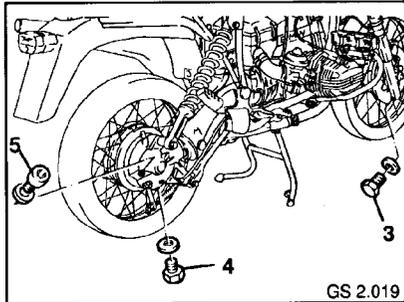


NOTE:

Change transmission oil only when transmission at normal operating temperature.

- Place suitable collecting vessel below oil drain opening.
- Slacken oil drain plug (1).
- Slacken oil filler plug (2).
- Allow transmission oil to flow out.
- Fit new sealing ring to oil drain plug, screw in oil drain plug and tighten to specified

2.12 CHANGING TRANSMISSION OIL IN REAR WHEEL DRIVE (Inspection I, III)



NOTE:

Change rear wheel drive oil only when rear wheel drive at normal operating temperature.

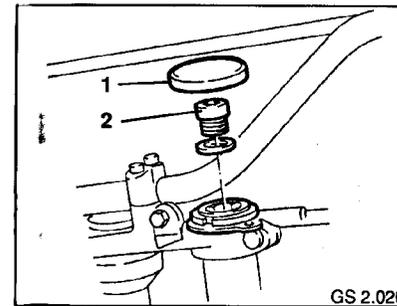
- Place suitable collecting vessel below oil drain opening.

- Unscrew oil drain plug (4).
- Unscrew oil inspection and filler plug (5).
- Allow transmission oil to flow out.
- Fit new sealing ring onto oil drain plug, screw in oil drain plug and tighten to specified torque.
- Pour specified quantity of transmission oil into rear wheel drive.
- Fit new sealing ring onto oil inspection and filler plug and screw in plug. Tighten to specified tightening torque.

Capacity of rear wheel drive 0.26 l

Tightening torque:
 Oil drain plug (rear wheel drive) 23 Nm
 Oil filler plug (rear wheel drive) 23 Nm

2.13 CHANGING OIL IN TELESCOPIC FORK (Inspection I, III)



- Fit on fuel tank guard, BMW No. 16 1 600.
- Take off protective caps (1) on the top of the stanchions.
- Unscrew oil filler plugs (2) on left and right and take off sealing rings.
- Place suitable collecting vessels below the lefthand and righthand oil drain openings.
- Unscrew lefthand and righthand oil drain plugs (3).
- Allow telescopic fork oil to drain out.
- Following this, compress telescopic forks several times to pump out remaining oil.
- Fit new sealing ring onto oil drain plugs and screw in plugs.
- Tighten oil drain plugs gently to specified tightening torque.
- Pour in precisely gauged, specified quantities of fork oil into righthand and lefthand telescopic forks using a funnel.
- Fit new sealing ring onto oil filler plug and screw in plug. Tighten to specified tightening torque.

NOTE:

After filling the telescopic forks, bleed shock absorbers by compressing and releasing (5 ... 10 strokes) until full damping is felt).

Oil grades for telescopic forks:
 Esso Komfort

Capacity of telescopic forks:GS
 left 0.41 l
 right 0.44 l

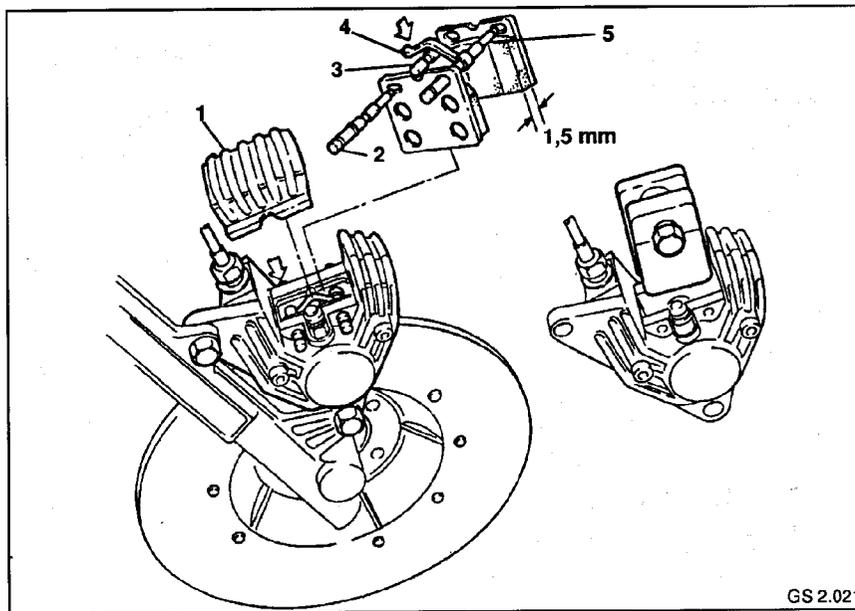
Tightening torque:GS

Oil filler plug (telescopic fork) 10.5 Nm
 Mod.91 14 Nm
 Oil drain plug (telescopic fork) 6 Nm
 Mod.91 5 Nm

Capacity of telescopic forks:R 100 R
 left, right 0.41 l

Tightening torque:R 100 R

Oil filler plug (telescopic fork) 10 Nm
 Oil drain plug (telescopic fork) 9 Nm



2.14 CHECKING FRONT BRAKE PADS FOR WEAR/RENEWING (Inspection III)

CHECKING BRAKE PAD FOR WEAR

- Use a screwdriver to lever plastic cap (1) off the brake caliper.
- Perform a visual check of brake pad thickness.

Minimum pad thickness

1.5 mm

NOTE:

The brake pad must be replaced in time to avoid scoring on the brake disc!

REMOVING BRAKE PADS GS

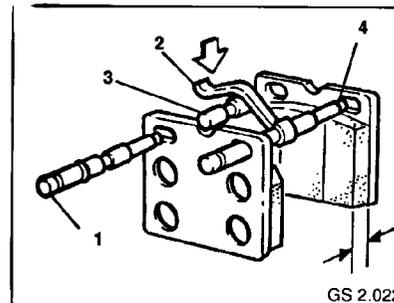
- Use a screwdriver to lever plastic cap off the brake caliper.
- Use a punch to knock locking pin (2) out of brake caliper in direction of arrow.
- Withdraw pin (3).
- Use a punch to knock out locking pin (5) in direction of arrow.
- Withdraw spring clip (4).
- Use flat pliers to withdraw brake pads up the way.

INSTALLING BRAKE PADS GS

NOTE:

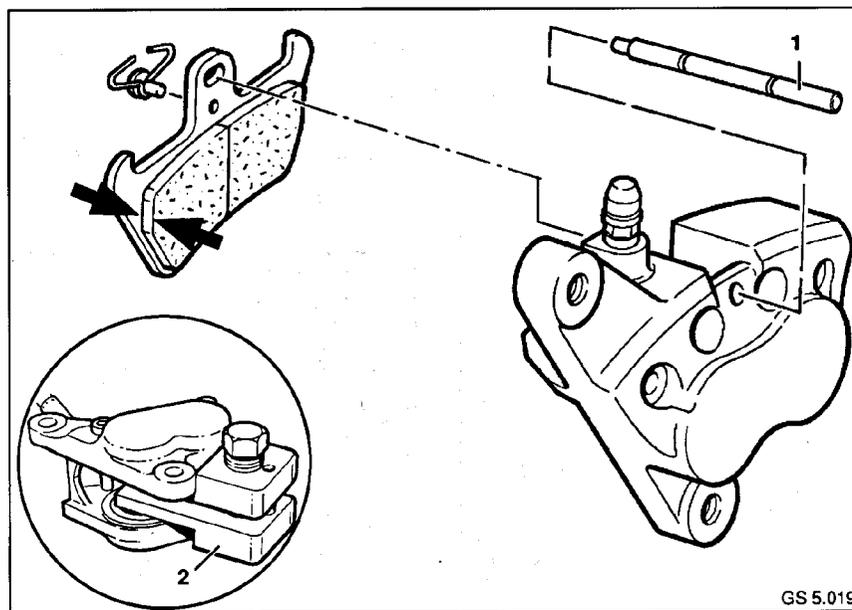
New brake pads have to match to the brake surface. Good brake pad contact pattern is achieved by breaking frequently and cautiously in the initial phase. This avoids a glazed surface resulting from local excess of stresses.

- Use piston resetting device, BMW No. 34 1 500, to press back brake piston.



- Clean seat of brake pads.

- Insert brake pads in brake caliper.
- Insert spring clip (2) and push locking pin (4) through brake pads and eye of spring clip. Knock in with punch.
- Insert pin (3).
- Press down spring clip and insert pin (1). Knock in punch.
- Fit plastic cap (1) onto brake caliper.



REMOVING / FITTING FRONT BRAKE PADS – R 100R

- Remove brake caliper.
- Knock out retaining pin (1).
- Press brake pads down and remove.

CAUTION:

Do not continue to use below minimum brake pad thickness (arrow)!
Replace pads in pairs!

*Minimum brake pad thickness:
Thickness on backing plate*

1.5 mm

- Install pads in reverse order of work.

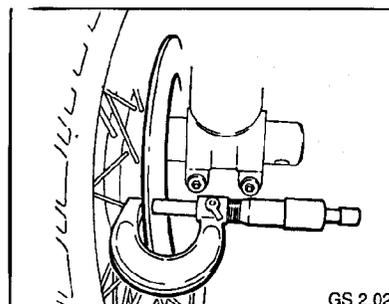
NOTE:

Installation:
Press brake pistons back fully using piston reset device, BMW No. 34 1 500 (2).

*Tightening torque:
Brake caliper to slider tube*

32 Nm

2.15 CHECKING BRAKE DISCS (Inspection II)



NOTE:

Brake discs as a rule have a long life and only require to be replaced if they show signs of severe scoring or deformation.

- Examine brake discs carefully for signs of cracks or other damage.

CHECKING THICKNESS OF BRAKE DISCS:

- Measure thickness of brake discs at various points with a micrometer screw.

<i>Thickness of brake disc</i>	<i>5.0 + 0.4 mm</i>
<i>Wear limit</i>	<i>4.4 mm</i>
<i>Mod.91, R 100 R</i>	<i>4.5 mm</i>

Following this, check brake and brake lines to ensure that they operate properly, are correctly laid and do not show signs of leaks. Repair/renew any damaged parts.
(Inspection I, III)

2.16 CHECKING/TOPPING UP BRAKE FLUID LEVEL (Inspection I, III)

WARNING:

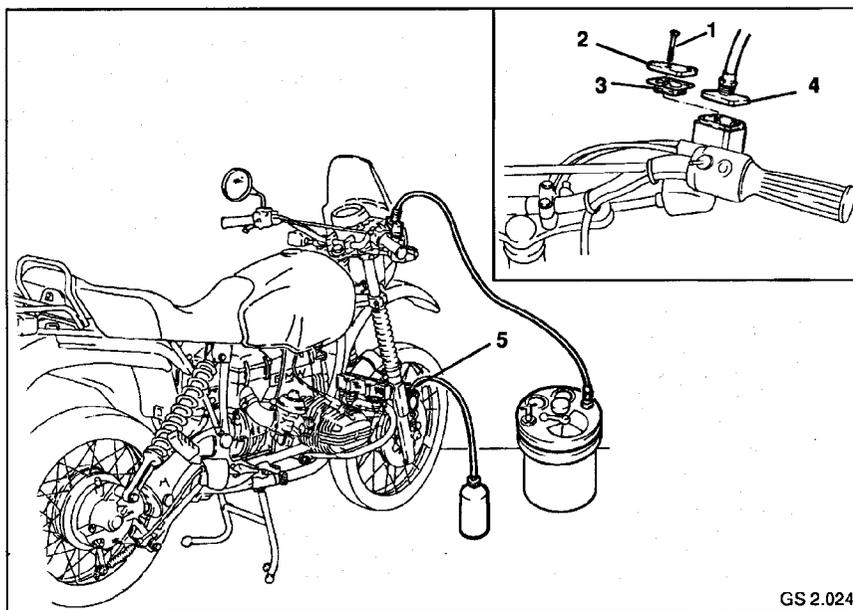
Brake fluid is extremely harmful to health and must therefore never be stored in beverage bottles. If brake fluid is inadvertently swallowed, the person concerned should receive medical attention without delay.

CAUTION:

Brake fluid is hygroscopic (absorbs water), and should therefore be renewed annually. Brake fluid which has run out or has been pumped out should never be used for replenishing system (impurities). Keep brake fluid away from paintwork and painted surfaces. Brake fluid contains elements which act as effective paint strippers.

a. Checking brake fluid level:

- Check brake fluid level at transparent reservoir.
- Never allow the brake fluid to drop below "MIN" mark to prevent air being pumped into the brake system.



b. Topping up brake fluid level:

CAUTION:

Do not allow brake fluid to come into contact with the paintwork of the motorcycle. Brake fluid strips the paint.

- Slacken three fastening screws (1) of the reservoir cover.
- Take off reservoir cover (2) and diaphragm (3).
- Top up brake fluid as far as the "MAX" mark.
- Fit on diaphragm and reservoir cover.
- Tighten three fastening screws gently.

Grade of brake fluid:
Only brake fluids of quality class DOT 4 (e.g. ATE brake fluid "SL" may be used).

2.17 CHANGING BRAKE FLUID

CAUTION:

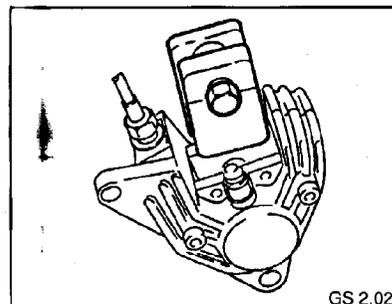
For safety reasons, the brake fluid must be replaced at least once a year.

Brake fluid is subject to high thermal stresses (alternating effect), which promotes a natural ageing process.

By virtue of its hygroscopic nature, brake fluid absorbs moisture from the surrounding air, which can result in its boiling point dropping to a dangerous level.

- Remove front brake pads.
- Take the three fastening screws (1) out of cover (2) of the brake fluid reservoir.

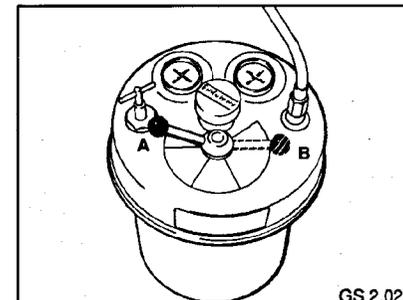
- Take off cover and diaphragm (3).
- Screw appropriate adaptor (4) with rubber seal onto brake fluid reservoir.
- Connect hose of bleeder to brake fluid reservoir.
- Connect line from overflow reservoir to bleeder screw (5).



- Use piston resetting device, BMW No. 34 1 500, to press back brake piston fully.
- Use spacer, BMW No. 34 1 510 (GS) or BMW No. 34 1 520 (R 100R) to secure brake piston in this position.
- Connect hose of bleeder to brake fluid reservoir.
- Move lever of bleeder to operating position (A) "Operating with compressed air".
- Open bleeder screw (5).
- Allow all of the brake fluid to flow out.
- Move lever on bleeder to operating position (B) "Operating with brake fluid".
- Open bleeder screw and hold open until brake fluid flows out free of bubbles.
- Close bleeder screw.
- Drain pressure from bleeder.
- Install brake pads.
- Move handlebar to full left and right lock while at the same time operating the brakes several times.
- Perform operational check of brake system.

2.18 BLEEDING FRONT WHEEL BRAKE SYSTEM

BLEEDING FRONT WHEEL BRAKE SYSTEM WITH BLEEDER



CAUTION:

Do not allow brake fluid to come into contact with the paintwork of the motorcycle. Brake fluid strips the paint.

- Remove brake pads.
- Connect up bleeder as described in 2.18.
- Connect line from overflow reservoir to bleeder screw (5).
- Use piston resetting device, BMW No. 34 1 500, to press back brake piston fully.
- Use spacer, BMW No. 34 1 510, to fix brake piston in this position.
- Connect hose of bleeder to brake fluid reservoir.
- Move lever on bleeder to operating position (B) "Operating with brake fluid".
- Open bleeder screw and hold open until brake fluid flows out free of bubbles.
- Close bleeder screw.
- Drain pressure from bleeder.
- Repeat procedure on the second bleeder screw.
- Install brake pads.
- Turn handlebars from left to right lock while at the same time operating the brakes several times.
- Perform operational check of the brake system.

BLEEDING FRONT WHEEL BRAKE USING HANDBRAKE LEVER

CAUTION:

Do not allow brake fluid to come into contact with the paint work of the motorcycle. Brake fluid strips the paint.

- Remove front brake pads.
- Slacken 3 fastening screws on the brake fluid reservoir.
- Take off cover and diaphragm.
- Fill up brake fluid to the "MAX" mark.
- Connect line from overflow reservoir to bleeder screw (5).
- Use piston resetting device, BMW No. 34 1 500, to press back brake piston fully.
- Use spacer, BMW No. 34 1 510, to fix brake piston in this position.
- Apply handbrake lever several times until brake pressure can be felt.
- Hold handbrake lever under pressure, open bleeder screw while at the same time firmly pulling on handbrake lever.

CAUTION:

Do not release handbrake lever until bleeder screw is closed.

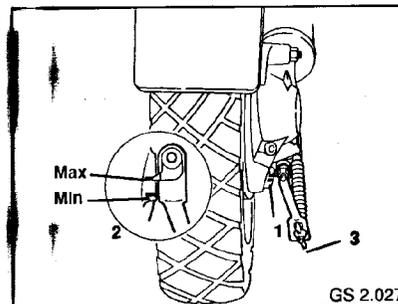
- Close bleeder screw (5) and release handbrake lever.
- Repeat this operation until brake fluid flows out at the bleeder screw free of bubbles.
- Tighten bleeder screw.
- Install brake pads.
- Perform operational check.

CAUTION:

The brake fluid must not drop below the "MIN" mark during the bleeding operation otherwise air will be drawn into the brake system. In this case, the bleeding operation has to be repeated.

2 19 CHECKING REAR BRAKE PADS FOR WEAR/RENEWING BRAKE SHOE IF NECESSARY (Inspection III)

CHECKING REAR BRAKE PADS FOR WEAR



- Check wear indicator on rear wheel drive.
- If, by adjusting the brake with the wing nut (3), the arrow (1) is pointing to the mark (2) on the rear wheel drive, it is necessary to check the thickness of the brake pads.

- Withdraw 3 protective caps (8) from hub and perform a visual check of brake pad thickness.

Minimum pad thickness 1.5 mm

NOTE:

The brake pads must be renewed in time to prevent scoring on the brake drum.

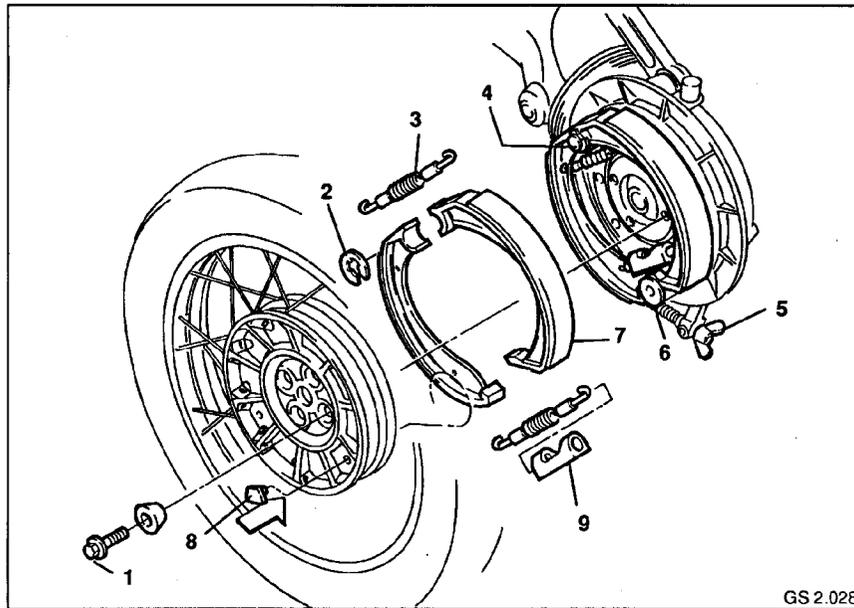
RENEWING REAR BRAKE SHOE

a. Removing rear wheel

- Place motorcycle on kickstands.
- Place a support below the leading silencer to prevent motorcycle from toppling over.
- Slacken wing nut (5) of the brake linkage.
- Engage 1st gear.
- Slacken four wheel bolts (1).
- Withdraw rear wheel to the rear left.

NOTE:

If gear bag mounts are fitted, either remove rear wheel down the way (hoist) or remove the left hand gear bag mount.



GS 2.028

WARNING:

If the following method is employed, it is essential to ensure that the kickstands cannot fold up (e.g. by tying to front wheel).

If two persons are available, it is then possible to tilt the motorcycle to the right on its front wheel and kickstands. The rear wheel can then be removed to the bottom left.

b. Renewing rear brake shoe:

- Rear wheel is removed.
- Unscrew wing nut (5) on brake linkage completely.
- Remove locking ring (2) from brake anchor (4).
- Use a screwdriver to lever top brake shoe off rear wheel drive.
- Take off brake shoe (7) together with springs (3) and damping rubber.
- Apply a light coat of Molykote grease to brake anchor (4) and brake cam (6).

CAUTION:

Attach external tension springs!

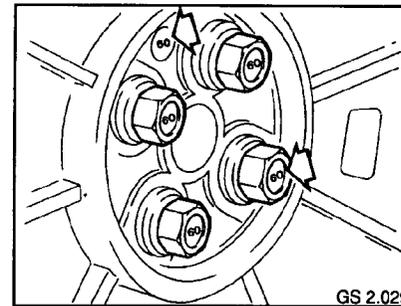
- Fit damping rubber (9) onto rear tension springs. The rear flat side rests against the brake shoes and the brake cam.
- Connect brake shoes with tension springs.
- Fit brake shoes onto brake anchor (4) and brake cam at the same time.
- Open up brake shoes against the spring pressure and push onto brake anchor and brake cam.
- Fit locking ring onto brake anchor (4).

c. Checking brake drum for wear:

- Clean brake drum in rear wheel and check for signs of wear and scoring.
- If severe scoring is present, re-turn the brake drum.
- Pay attention to wear limits.

Brake drum dia.: 200 + 0.185 mm (H10)
Wear limit dia.: 201.2 mm

d. Installing rear wheel:



GS 2.029

- Thoroughly clean hub centre ring and contact surfaces of wheel hub.

CAUTION:

Use only wheel bolts with the length index 60 (arrow). Rear wheel and wheel bolt heads are marked accordingly.

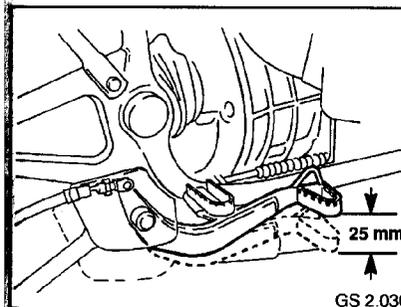
- Tighten wheel bolts to specified tightening torque.
- Adjust play of foot brake lever.

Tightening torque:

Rear wheel bolts

105 Nm

2.20 CHECKING/ADJUSTING FOOT BRAKE LEVER PLAY (Inspection III)



GS 2.030

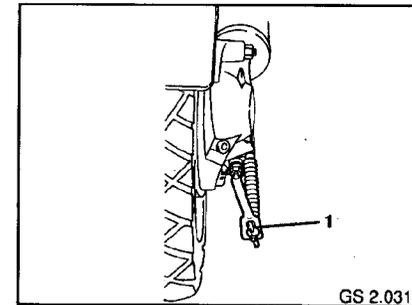
CHECKING FOOT BRAKE LEVER PLAY:

- Foot brake lever play is measured between rest position and braking point.

Foot brake lever play

approx. 25 mm

ADJUSTING FOOT BRAKE LEVER PLAY



GS 2.031

- Turn wing nut (1) on brake tie rod clockwise until the rear wheel just begins to brake.
- Turn wing nut back 3 ...4 turns (corresponds to approx. 25 mm foot brake lever travel).

2.21 CHECKING REAR WHEEL FOR TILT PLAY (Inspection III)

NOTE:

Do not check tilt play when rear wheel drive is at normal operating temperature.

- Tilt rear wheel back and forward over wheel axis.
- If play is perceptible, re-space rear wheel or replace bearings.

2.22 CHECKING FRONT WHEEL BEARING (Inspection III)

- Relieve load on front wheel.
- Tilt front wheel back and forward over wheel axis.
- There must not be any play perceptible.
- If play is determined in the wheel bearing, replace the bearings.

2.23 CHECKING/ADJUSTING STEERING BEARING PLAY (Inspection III)

CHECKING STEERING BEARING PLAY

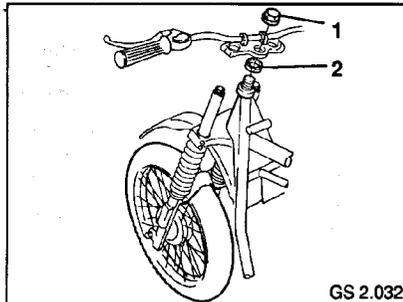
- Place motorcycle on kickstands.
- Front wheel and steering free to move.
- If steering is knocked slightly, it must move by itself to left/right.
- If the steering stops
 - bearing too tight, adjust bearing play.
 - Steering locks in middle position
 - bearing faulty. Renew steering bearings.

ADJUSTING STEERING BEARING PLAY

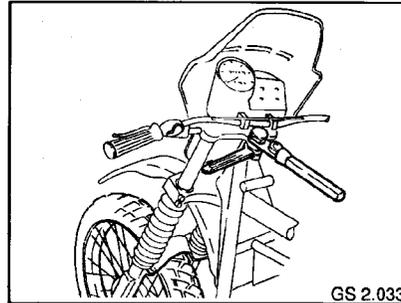
WARNING:

Bearing play which is too loosely set causes shimmy at low speeds.

Bearing play which is too tightly set causes hunting at high speeds.



- Take off fuel tank. Slacken cap nut (1).
- Slacken slotted nut (2) with hook wrench.
- Relieve stress on bearings by striking the cap nut (with plastic-headed hammer).
- Tighten slotted nut (2) gently with hook wrench until steering bearings are located free of play in the bearing shells.
- Steering bearing is exactly set if
 - no tilt play is perceptible around the vertical axis.
 - the front wheel falls easily away from middle position to right/left lock (when motor cycle on stands). Ensure steering moves freely (cable harness, Bowden cables etc.).



- Tighten cap nut with special tool BMW No. 31 4 850, and torque wrench. Hold slotted nut in place with hook wrench.
- Re-check steering bearing play, adjust if necessary.

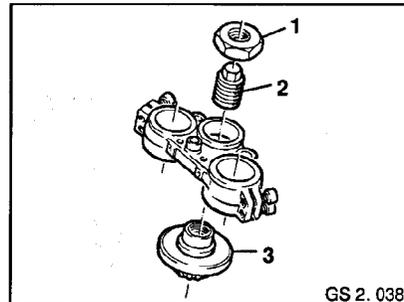
Tightening torque:

Cap nut
Slotted nut

107 Nm

free of play max. 0.5 Nm

ADJUSTING STEERING BEARING CLEARANCE – MOD. 91, R 100R



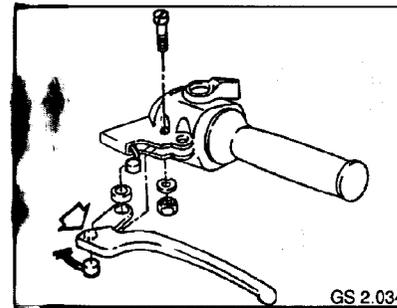
- Use special wrench, BMW No. 31 4 870, to loosen hex nut (1); loosen counter tube (2).
- Use adjusting ring (3) to adjust bearing play; handlebar must swing round easily from the central position to the left or right (motorcycle raised clear of ground).
- Tighten locking tube and secure with hex nut.

Tightening torque:

Locking tube
Hex nut

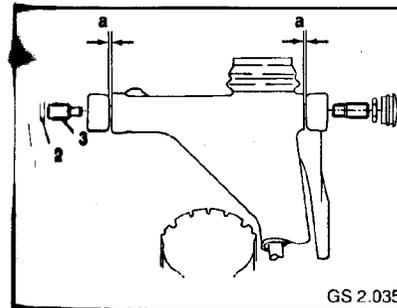
65 Nm
65 Nm

2.24 GREASING CLUTCH CABLE NIPPLES (Inspection II, III)



- Grease bearing points (arrow) of the clutch cable nipples at top and bottom (e.g. Shell Retinax A).
- Slacken bearing screw for clutch hand lever, if necessary.
- Withdraw lever from guide and turn through 180°.

2.25 ADJUSTING SWING ARM BEARING PLAY (Inspection III)



- Lever off cover caps (1) on the swing arm bearings.
- Slacken locking nuts (2) on left and right.
- Tighten both bearing journals (3) to the specified tightening torque to preload bearing.

Tightening torque:

Bearing journal preload

20 Nm

- Slacken both bearing journals and tighten once again to the final tightening torque.

Tightening torque:

Bearing journals

10 Nm

- Tighten locking nuts to specified tightening torque without twisting the bearing journals.

Tightening torque:

Locking nuts

107 Nm

CAUTION:

When performing the adjustment operation, it is essential that the gap size "a" between frame and swing arm is identical on left and right (max. difference = 0.5 mm)

2.26 BATTERY MAINTENANCE

BATTERY FAULTS

Faults in a battery may be caused by an internal short-circuit resulting from a plate short or an interruption in the connections between cells or plates.

An internal short-circuit can be detected by comparing the electrolyte density levels of the individual cells. If sharply fluctuating electrolyte density levels with a density difference > 0.03 kg/l are determined, this indicates a short-circuit. An interruption to the cell or plate connections is recognizable from the voltage collapsing during starting despite the battery being properly charged.

If there is no indication of a battery fault, yet the battery is either always discharged, this indicates:

- low electrolyte density
- no starting power,

or overcharged, this indicates:

- high water consumption,
- there is then a fault in the electrical system. Check alternator, regulator and relays.

COMMISSIONING BATTERY

CAUTION:

The battery contains sulfuric acid. Avoid acid coming into contact with eyes and skin or clothing. Remedy: wash contact areas with water. If acid has been swallowed, drink large quantities of milk or water. Contact a doctor without delay.

Wash out eyes with water and obtain medical treatment.

Battery gives off explosive gases. Avoid sparking, naked flames and smoking. When working close to batteries, always wear protective goggles.

STORE BATTERIES AWAY FROM THE REACH OF CHILDREN!

Store batteries only in well-ventilated rooms. The filler caps must always be removed.

- Remove plugs from battery.
- Fill battery with pure electrolyte (conforming to VDE 0510, Density: 1.28 kg/l, for tropical countries 1.25 kg/l (related to electrolyte temperature of 20°C) up to specified level ("Max" mark).
- Leave battery to stand for approx. 1 hour, then shake slightly or tip (to vent) and top up electrolyte level to "Max" mark if necessary.
- Screw in plugs loosely (do not tighten fully until after battery is charged).

CAUTION:

After being filled, the dry-charged battery attains only 60% of its rated capacity. It is therefore essential to charge battery.

Avoid allowing filled batteries to stand for lengthy period when not in use. Do not fill battery with electrolyte until just before it is to be used.

CHARGING BATTERIES

CAUTION:

Do not exceed a maximum charging current of 10% of battery capacity.

Example:

25 Ah-battery = charging current 2.5 Amperes
Charging time = 5 ... 10 hours

- The charged state of the battery can be checked by measuring the electrolyte density.
- Electrolyte density of fully-charged battery = 1.256 ... 1.30 kg/l related to 20°C.
- Shake battery slightly after charging
 - gas bubbles rise to the surface.
- After the electrolyte has settled, top up with distilled water to "Max" mark, if necessary.
- Screw in plugs tight.

CHECKING /TOPPING UP ELECTROLYTE LEVEL OF BATTERY (INSPECTION III)

- Remove battery.
- Check electrolyte level of battery (visual check).
- If necessary top up electrolyte level with distilled water to the "MAX" mark.
- Check electrolyte level approx. every 3 months.

CAUTION:

It may be necessary to check the electrolyte level more often in warmer climates with higher ambient temperatures in view of the greater losses from evaporation.

- Coat battery terminals with acid protection grease (e.g. Bosch Ft 40 V1).
- Install battery.

CAUTION:

Connect battery positive terminal first of all, then negative terminal.

BATTERY CARE WHEN MOTOR CYCLE STORED OUT OF USE.

- Charge battery with a suitable charger.

CAUTION:

The maximum charge current must not exceed 10% of the battery capacity.

Example:

25 Ah battery = max. charge current 2.5 Amperes
Charging time = 5 ... 10 hours

- Detach ground cable on righthand side of transmission (cardan drive/speedometer output) and isolate.

CAUTION:

If the battery terminals are not disconnected, the motor cycle electronics (clock etc.) will discharge the battery. This may result in the battery being fully discharged and rendered unsuitable for use.

- If the motor cycle is out of use for a lengthy period, re-charge battery every 4 months.
- If the battery terminals have not been disconnected, re-charge at least every 2 months.
- Store batteries in a cool place when not in use.
- Never store batteries when discharged.
- Before re-using battery, it must be fully charged again and the distilled water topped up if necessary.

27 CHECKING NUTS AND BOLTS FOR TIGHT FIT (Inspection I, II, III)

Tightening torque:

Hub axle	33 Nm
Top bolt (stub axle)	15 Nm
Wheel bolts	105 Nm
Pin front/rear	54 Nm
Top	87 Nm
Strut top/bottom	29 Nm
Bottom	47 Nm

In addition, check that the hose strap fastenings on carburetors and bellows of the propeller shaft are tight.

2.28 CONSCIENTIOUSLY PERFORMING FINAL INSPECTION WITH CHECK OF ROAD/OPERATIONAL SAFETY (Inspection I, II, III)

Check of condition:

- Check wheels and tyres.
- Check tyre inflation pressure/correct.

Tyre Inflation pressures (bar):

	front	rear
Solo	2.2	2.5
with pillion passenger	2.4	2.9

Functional check:

Electrical system

- Main beam, dipped beam and parking light.
- Stop, licence plate and turn signal lamps.
- Main beam, battery charge, idling and oil pressure indicator lamps.
- Horn.
- Optional equipment.

Engine, transmission, running gear (conduct test run if necessary)

- Clutch
- Gear shift
- Steering
- Footbrake and handbrake
- Instruments

**3. FUEL, OIL AND
LUBRICANTS
AND
SERVICE DATA
FOR
MAINTENANCE**

Contents	Page
3.1 FUEL, OILS AND LUBRICANTS	3.5
3.2 SERVICE DATA	3.6
3.3 TIGHTENING TORQUES	3.7

3.1 FUEL, OILS AND LUBRICANTS	ALL MODELS
Fuel	Regular unleaded fuel DIN 51607 Minimum octane number 91 (RON) and 82.5 (MON)
Engine oil grades	Proprietary - HD - Oil for spark ignition engines API - Classes SE/CC and SF/CC (refer to viscosity diagram)
Transmission oil grades	Proprietary - Hypoid - Gear oil API - Class GL5 (above 5°C SAE 90, below 5°C SAE 80, or optionally SAE 80W90)
Telescopic fork oil	Esso Komfort
Wheel bearings, steering head bearings, telescopic forks	Retinax A (Taper) roller bearing grease
Dust seals, telescopic forks	Gleitmo 805
Clutch	Staburags NBU 30 PTM (high-performance lubricating paste)
Battery terminals	Acid protection grease (e.g. Bosch Ft 40 V 1)
Brake anchor and brake cam	Molykote grease
Brake fluid grades	DOT 4 (z.B. ATE "SL")
Electrolyte	(conforming to VDE 0510, Density: 1.28 kg/l, for tropical countries 1.25 kg/l, related to 20°C electrolyte temperature)

Engine oil Viscosity diagram
 as a function of outside temperature

