

aprilia

1188 3

00/2004-04

ETV mille

www.serviceaprilia.com

workshop manual



8140776

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0.1 RELEASE 00/2004-04 UPDATE

Issue date of original release (Release 00) and subsequent releases:

Original release (Release 00).....April 2004

0.1.1 MANUAL UPDATES

Always keep manual updated to the latest release you have received.

Add the latest release pages to the manual and destroy all superseded pages (even if they belong to the release before last).

CAUTION

Failure to keep the manual up-to-date or to eliminate superseded pages will make the manual more difficult to consult and creates a risk of improper servicing.

This manual is made up of #10 sections for a total of #376 pages (listed below).

NOTE Please vedi 0.2 (REFERENCE GUIDE) for details of standard page nomenclature and page numbering.

0.1.2 LIST OF MANUAL PAGES AND UPDATE NUMBERS

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2-14 -00	00	2-54 -00	00
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2-18 -00	00	2-58 -00	00
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5-9 -00	00	6-39 -00	00	7-21 -00	00	7-61 -00	00
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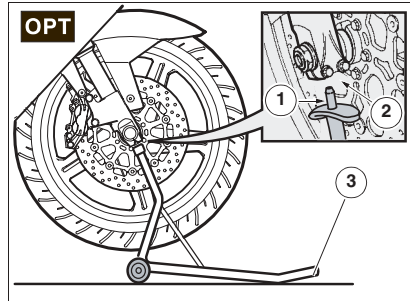
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0.2 REFERENCE GUIDE



- 8 [1.9 PLACING THE MOTORCYCLE ON THE SERVICE STAND
- 9 [1.9.1 PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND **OPT**
- 10 [
 - ◆ Place the motorcycle on the centre stand.
 - ◆ Slide both pins (1) of the front wheel stand into the holes (2) at front fork bottom end of the same time.
 - ◆ Put one foot on the front end of the stand (3).
 - ◆ Press down on stand (3) until it rests fully on the ground.

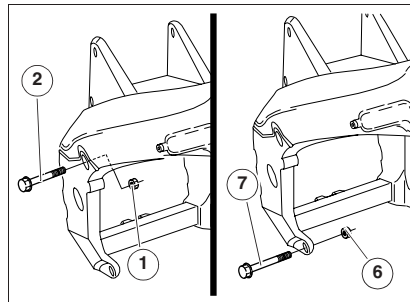


1.9.2 PLACING THE MOTORCYCLE ON THE CENTRE STAND **OPT**

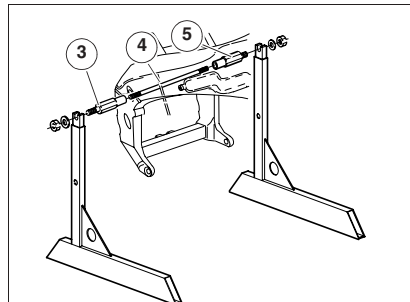
Read paragraph 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Part no. 8140176 (complete stand).

- ◆ Remove the lower fairing, see 7.1.33 (REMOVING THE LOWER FAIRING).
- ◆ Place the motorcycle on the front wheel stand **OPT**, see 1.9.1 (PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND).
- ◆ ★ Hold the nut (1) steady on the inside.
- ◆ ★ Release and remove the rear upper right-hand engine mounting bolt (2).



- 11 [
 - ◆ ★ Hold the nut (1) steady on the inside.
 - ◆ ★ Release and remove the rear upper right-hand engine mounting bolt (2).
- Torque wrench setting for nut (1) / bolt (2): 50 Nm (5,0 kgm).**
- NOTE** The bolt (2) on the left-hand side is longer
- ◆ ★ Collect the nut (1).
 - ◆ Slide the upper right-hand mounting boss (3) into the upper hole on the right-hand side.
 - ◆ Fit the stud bolt (4) into the upper hole on the left-hand side and screw it fully into the mounting boss (3).
 - ◆ Screw the upper left-hand mounting boss (5) fully onto stud bolt (4) and tighten.
 - ◆ ★ Hold the nut (6) on the inside steady.
 - ◆ ★ Release and remove the rear lower engine mounting bolt (7).



- 1) Motorcycle model (or engine type)
- 2) Section title
- 3) Release progressive number ("00" identifies the original release)
- 4) Year and month of issue of relevant release
- 5) Section number
- 6) Page number (pages are numbered sequentially, numbering begins anew in each section)

- 7) Page update number (progressive number)
- 8) Subsection number (progressive number)
- 9) Paragraph number (progressive number)
- 10) Description of operation (always preceded by the lozenge symbol)
- 11) Description of operation: the star means that the operation must be repeated on the opposite side of the motorcycle

0.3 FOREWORD

- This manual provides the information required for normal servicing.
- The information and illustrations contained in this manual are updated through subsequent releases, vedi 0.1 (RELEASE 00/2004-04 UPDATE).
- This manual is intended for use by **aprilia** Dealers and their qualified mechanics. Certain information has been omitted intentionally, as this manual does not purport to provide a comprehensive treatise on mechanics. The persons who will use this manual must be fully conversant with the basics of mechanics and with the basic procedures of motorcycle repair. Repairing or inspecting a motorcycle when one does not possess such basic knowledge or training could result in improper servicing and make the motorcycle unsafe to ride. For the same reason, certain basic precautions have been omitted in the descriptions of repair and inspection procedures. Take special care to avoid damage to motorcycle components or injury to persons. **aprilia s.p.a.**'s mission is to constantly enhance the riding pleasure of final users through the on-going improvement of its products as well as of the relevant technical literature.

All aprilia Points of Sale and Subsidiaries worldwide are kept updated on major engineering changes and modifications to repair procedures. Such changes and modifications are then reflected in the next release of the relevant manual. When in doubt about an inspection or repair procedure, please contact the aprilia Consumer Service (A.C.S.) Department, who will be glad to provide full information on the procedure in question as well as on any updates or engineering changes affecting the motorcycle under consideration.

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Please read 0.4 (REFERENCE MANUALS) for more detailed information.

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DECA s.r.l.
 Via Risorgimento, 23/1 - Lugo (RA) - Italia
 Tel. +39 - 0545 35235
 Fax +39 - 0545 32844
 E-mail: deca@decaweb.it
 www.decaweb.it

On behalf of:
aprilia s.p.a.
 via G. Galilei, 1 - 30033 Noale (VE) - Italy
 Tel. +39 - 041 58 29 111
 Fax +39 - 041 44 10 54
 www.aprilia.com

0.4 REFERENCE MANUALS

0.4.1 ENGINE WORKSHOP MANUALS

aprilia part# (description)	
8140582 (1051-1)	I
8140584 (1053-1)	F
8140585 (1054-1)	D
8140583 (1052-1)	E
8140586 (1055-1)	UK
8140587 (1056-1)	USA

0.4.2 PARTS CATALOGUES

aprilia part# (description)	
3944.....	I F D E UK

0.4.3 SPECIAL TOOLS CATALOGUES

aprilia part# (description)	
001A.....	I F D E UK

0.4.4 OWNER'S MANUALS

aprilia part# (description)	
Model years 2004	
8104595	I F D
8104781	P E UK
8104782	NL DK GR
8104783	CND
8104780	USA

0.5 SAFETY INFORMATION

The following conventions are used to identify safety information throughout the manual.

⚠ This symbol identifies safety-related information. Whenever you see this symbol in the manual or attached to the motorcycle, use utmost care to avoid the risk of injury. Disregarding the instructions identified by this symbol may put your safety, as well as that of other persons or of the motorcycle at risk!

⚠ CAUTION

Disregarding these indications may lead to severe injury or death.

⚠ WARNING

Disregarding these indications may lead to minor injury or motorcycle damage.

NOTE The term "NOTE" in this manual precedes important information or instructions.

0.5.1 GENERAL PRECAUTIONS AND INFORMATION

Follow these instructions closely when repairing, disassembling or reassembling the motorcycle or its components.

⚠ CAUTION

Using bare flames is strictly forbidden when working on the motorcycle. Before servicing or inspecting the motorcycle: stop the engine and remove the key from the ignition switch; allow for the engine and exhaust system to cool down; where possible, lift the motorcycle using adequate equipment placed on firm and level ground. Be careful of any parts of the engine or exhaust system which may still be hot to the touch to avoid scalds or burns.

⚠ CAUTION

Never put any mechanical parts or other vehicle components in your mouth when you have both hands busy. None of the motorcycle components is edible. Some components are harmful to the human body or toxic.

Unless expressly specified otherwise, motorcycle assemblies are refitted or re-assembled by reversing the removal or dismantling procedure. Where a procedure is cross-referred to relevant sections in the manual, proceed sensibly to avoid disturbing any parts unless strictly necessary. Never attempt to polish matte-finished surfaces with lapping compounds.

Never use fuel instead of solvent to clean the motorcycle.

Do not clean any rubber or plastic parts or the seat with alcohol, petrol or solvents. Clean with water and neutral detergent.

Always disconnect the battery negative (-) lead before soldering any electrical components.

When two or more persons service the same motorcycle together, special care must be taken to avoid personal injury.

Read 1.2 (WARNINGS CONCERNING FUEL, LUBRICANTS, COOLANT AND OTHER COMPONENT PARTS) carefully.

0.5.2 BEFORE DISASSEMBLING ANY COMPONENTS

- Clean off all dirt, mud, and dust and clear any foreign objects from the vehicle before disassembling any components.
- Use the model-specific special tools where specified.

0.5.3 DISASSEMBLING THE COMPONENTS

- Never use pliers or similar tools to slacken and/or tighten nuts and bolts. Always use a suitable spanner.
- Mark all connections (hoses, wiring, etc.) with their positions before disconnecting them. Identify each connection using a distinctive symbol or convention.
- Mark each part clearly to avoid confusion when refitting.
- Thoroughly clean and wash any components you have removed using a detergent with low flash point.
- Mated parts should always be refitted together. These parts will have seated themselves against one another in service as a result of normal wear and tear and should never be mixed up with other similar parts on refitting.
- Certain components are matched-pair parts and should always be replaced as a set.
- Keep the motorcycle and its components well away from heat sources.

0.5.4 REASSEMBLING THE COMPONENTS

⚠ WARNING

Never reuse a circlip or snap ring. These parts must always be renewed once they have been disturbed. When fitting a new circlip or snap ring, take care to move the open ends apart just enough to allow fitment to the shaft.

Make a rule to check that a newly -fitted circlip or snap ring has located fully into its groove.

Never clean a bearing with compressed air.

NOTE All bearings must rotate freely with no hardness or noise. Replace any bearings that do not meet these requirements.

- Use ORIGINAL **aprilia** SPARE PARTS only.
- Use the specified lubricants and consumables.
- Where possible, lubricate a part before assembly.
- When tightening nuts and bolts, start with the largest or innermost nut/bolt and observe a cross pattern. Tighten evenly in subsequent steps until achieving the specified torque.
- Replace any self-locking nuts, gaskets, seals, circlips or snap rings, O-rings, split pins, bolts and screws which have a damaged thread.
- Clean all joint surfaces, oil seal edges and gaskets before assembly.
- Apply a light coat of lithium grease along the edges of oil seals. Fit oil seals and bearings with the brand or serial number facing outwards (in view).
- Lubricate the bearings abundantly before assembly.
- Make a rule to check that all components you have fitted are correctly in place.

- After repairing the motorcycle and after each service inspection, perform the preliminary checks, and then operate the motorcycle in a private estate area or in a safe area away from traffic.

0.6 SAFETY INFORMATION

0.6.1 CONVENTIONS USED IN THE MANUAL

- This manual is divided in sections and subsections, each covering a set of the most significant components.
For quick reference, see the summary of sections on page 0-1.
- Unless expressly specified otherwise, assemblies are reassembled by reversing the dismantling procedure.
- The terms "left" and "right" are referred to the motorcycle when viewed from the riding position.
- Motorcycle operation and basic maintenance are covered in the "OWNER'S MANUAL".

★ Any operations preceded by the star symbol must be repeated on the opposite side of the motorcycle.

In this manual any variants are identified with these symbols:

Frame # ZD4DW.....(STARTING FROM MODEL YEAR 2001).

- ASD** AUTOMATIC SWITCH-ON DEVICE
- OPT** Option
- ⚙** Catalysed version

VERSION:

- | | | |
|--------------------------|------------------------|-------------------------------------|
| I Italy | GR Greece | Mal Malaysia |
| UK United Kingdom | NL Netherlands | RCH Chile |
| A Austria | CH Switzerland | HR Croatia |
| P Portugal | DK Denmark | AUS Australia |
| SF Finland | J Japan | USA United States of America |
| B Belgium | SGP Singapore | BR Brazil |
| D Germany | SLO Slovenia | RSA Republic of South Africa |
| F France | IL Israel | NZ New Zealand |
| E Spain | ROK South Korea | CDN Canada |

**0.7 ABBREVIATIONS/SYMBOLS/
CONVENTIONS**

#	= Number	T.C.E.I.	= cheese-headed Allen screw
<	= is less than	T.E.	= hexagonal head
>	= is more than	T.P.	= flat head screw
≤	= is less than or equal to	TDC	= Top Dead Centre
≥	= is more than or equal to	TEST	= diagnostic check
~	= approximately	TSI	= Twin Spark Ignition
∞	= infinite	UPSIDE- DOWN	= inverted fork
°C	= degrees Celsius (centigrade)	V	= Volt
°F	= degrees Fahrenheit	W	= Watt
±	= plus or minus		
A	= Ampere		
AC	= Alternated Current		
Ah	= Ampere per hour		
API	= American Petroleum Institute		
AV/DC	= Anti-Vibration Double Countershaft		
bar	= pressure measurement (1 bar =100 kPa)		
BDC	= Bottom Dead Centre		
CO	= carbon oxide		
CPU	= Central Processing Unit		
cu cm	= cubic centimetres		
DC	= Direct Current		
DIN	= German industrial standards (Deutsche Industrie Norm)		
DOHC	= Double Overhead Camshaft		
ECU	= Electronic Control Unit		
HC	= unburnt hydrocarbons		
HT	= High Tension		
ID	= inner diameter		
ISC	= Idle Speed Control		
ISO	= International Standardization Organization		
kg	= kilograms		
kgm	= kilograms per metre (1 kgm =10 Nm)		
km	= kilometres		
km/h	= kilometres per hour		
kPa	= kiloPascal (1 kPa =0.01 bar)		
KS	= clutch side (from the German "Kupplung seite")		
kW	= kiloWatt		
kΩ	= kiloOhm		
l	= litres		
LAP	= racetrack lap		
LED	= Light Emitting Diode		
m/s	= metres per second		
max	= maximum		
mbar	= millibar (1 mbar =0.1 kPa)		
mi	= miles		
MIN	= minimum		
MPH	= miles per hour		
MS	= flywheel side (from the German "Magnetoseite")		
MΩ	= megaOhm		
N.A.	= Not Available		
N.O.M.M.	= Motor Octane Number		
N.O.R.M.	= Research Octane Number		
Nm	= Newton per metre (1 Nm =0.1 kgm)		
Ø	= Diameter		
OD	= outer diameter		
Ω	= ohm		
PPC	= Pneumatic Power Clutch		
rpm	= revolutions per minute		
SAE	= Society of Automotive Engineers		
T.B.E.I.	= crowned-head Allen screw		

GENERAL INFORMATION

1

GENERAL INFORMATION

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1

1.1 LOCATION OF SERIAL NUMBERS

These numbers are necessary for vehicle registration.

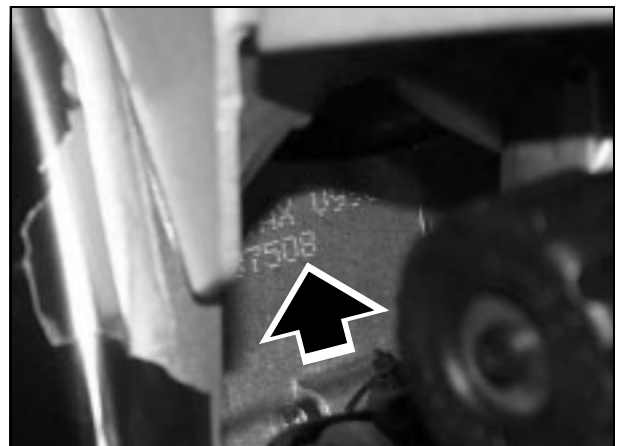
NOTE Altering the identification numbers of vehicle or engine is a legal offence punishable by heavy fines and penalties. In addition, altering the frame number (VIN) results in immediate warranty invalidation.

1.1.1 FRAME NUMBER

The frame number (Vehicle Identification Number) is etched on the right-hand side of the headstock.

1.1.2 ENGINE NUMBER

The engine number is etched at the rear end of engine, in the area near the sprocket.



1.2 WARNINGS CONCERNING FUEL, LUBRICANTS, COOLANT AND OTHER COMPONENT PARTS

1.2.1 FUEL

CAUTION

The fuel used to operate engines is highly flammable and becomes explosive under particular conditions. Refuelling and engine service should take place in a well-ventilated area with the engine stopped.

Do not smoke when refuelling or in the proximity of sources of fuel vapours.

Avoid contact with bare flames, sources of sparks or any other source which may ignite the fuel or lead to explosion.

Take care not to spill fuel out of the filler, or it may ignite when in contact with hot engine parts.

In the event of accidental fuel spillage, make sure the affected area is fully dry before starting the engine. Fuel expands from heat and when left under direct sunlight. Never fill the fuel tank up to the rim.

Tighten the filler cap securely after each refuelling. Avoid contact with skin. Do not inhale vapours. Do not swallow fuel. Do not transfer fuel between different containers using a hose.

DO NOT RELEASE FUEL INTO THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

Use only premium-grade unleaded fuel with a minimum octane rating of 95 (N.O.R.M.) and 85 (N.O.M.M.).

1.2.2 ENGINE OIL

CAUTION

Prolonged or repeated contact with engine oil may cause severe skin damage. Wash your hands thoroughly after handling engine oil.

Do not release into the environment.

Dispose of engine oil through the nearest waste oil reclamation firm or through the supplier.

Wear latex gloves during servicing.

Change engine oil after the first 1000 km (625 mi) and every 7500 km (4687mi) (*), see 2.12 (ENGINE OIL AND FILTER CHANGE) afterwards.

(*) = On motorcycles used in competition trials, oil should be changed every 3750 km (2343 mi).

(Recommended) engine oil, see 1.6 (LUBRICANT CHART)


1.2.3 FRONT FORK FLUID

CAUTION

Prolonged or repeated contact with front fork fluid may cause severe skin damage. Wash your hands thoroughly after handling front fork fluid. Dispose of front fork fluid through the nearest waste oil reclamation firm or through the supplier.

Wear latex gloves during servicing.

Front suspension response can be modified to a certain extent by changing damping settings and/or selecting a particular grade of oil. Standard oil grade is SAE 20 W. Different oil grades can be selected to obtain a particular suspension response. (Choose SAE 5W for a softer suspension, 20W for a stiffer suspension). The two grades can also be mixed in varying solutions to obtain the desired response.

 F.A. has special properties, which enable them to retain virtually the same viscosity regardless of temperature to give constant damping response.

(Recommended) front fork oil, see 1.6 (LUBRICANT CHART).

1.2.4 BRAKE FLUID

NOTE This vehicle is fitted with front and rear disc brakes. Each braking system is operated by an independent hydraulic circuit. The information provided below applies to both braking systems.

CAUTION

Brake fluid is an irritant. Avoid contact with eyes or skin.

In the event of accidental contact, wash affected body parts thoroughly. In the event of accidental contact with eyes, contact an eye specialist or seek medical advice.

DO NOT RELEASE BRAKE FLUID INTO THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

When handling brake fluid, take care not to spill it onto plastic or paint-finished parts or they will damage.

Check brake fluid level every 7,500 km (4687 mi), see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL). See also 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL). Change brake fluid every two years, see 2.20 (CHANGING THE FRONT BRAKE FLUID) and 2.21 (CHANGING THE REAR BRAKE FLUID).

(Recommended) brake fluid, see 1.6 (LUBRICANT CHART).

CAUTION

Do not use any brake fluids other than the specified type. Never mix different types of fluids to top up level, as this will damage the braking system.

Do not use brake fluid from containers which have been kept open or in storage for long periods.

Any sudden changes in play or hardness in the brake levers are warning signs of problems with the hydraulic circuits.

Ensure that the brake discs and brake linings have not become contaminated with oil or grease. This is particularly important after servicing or inspections.

Make sure the brake lines are not twisted or worn.

Prevent accidental ingress of water or dust into the circuit. Wear latex gloves when servicing the hydraulic circuit.

1.2.5 COOLANT

⚠ CAUTION

Coolant is toxic when ingested and is an irritant, contact with eyes or skin may cause irritation. In the event of contact with eyes, rinse repeatedly with abundant water and seek medical advice. In the event of ingestion, induce vomiting, rinse mouth and throat with abundant water and seek medical advice immediately.

DO NOT RELEASE INTO THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

⚠ CAUTION

Take care not to spill coolant onto hot engine parts. It may ignite and produce invisible flames. Wear latex gloves when servicing.

Do not ride when coolant is below the minimum level.

Check coolant level before each ride and every 15000 km (9375 mi), see 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL) as part of routine maintenance. Change coolant every two years, see 2.14 (COOLANT CHANGE).

Coolant mixture is a 50% solution of water and anti-freeze. This is the ideal solution for most operating temperatures and provides good corrosion protection.

This solution is also suited to the warm season, as it is less prone to evaporative loss and will reduce the need for top-ups. In addition, less water evaporation means fewer minerals salts depositing in the radiator, which helps preserve the efficiency of the cooling system.

When temperature drops below zero degrees centigrade, check the cooling system frequently and add more anti-freeze (up to 60% maximum) to the solution.

Use distilled water in the coolant mixture. Tap water will damage the engine.

(Recommended) engine anti-freeze, see 1.6 (LUBRICANT CHART).

Refer to the chart given below and add water with the quantity of anti-freeze to obtain a solution with the desired freezing point:

Freezing point °C	Coolant % of volume
-20°	35
-30°	45
-40°	55

NOTE The different brands of anti-freeze available on the market have varying specifications. Always read product label to determine the degree of protection afforded.

⚠ WARNING

Use only nitrite-free anti-freeze and corrosion inhibitors with a freezing point of -35°C as a minimum.

1.2.6 CLUTCH FLUID

NOTE This vehicle is fitted with a hydraulically operated clutch.

⚠ CAUTION

Clutch fluid is an irritant. Avoid contact with eyes or skin.

In the event of accidental contact, wash affected body parts thoroughly. In the event of accidental contact with eyes, contact an eye specialist or seek medical advice.

DO NOT RELEASE CLUTCH FLUID INTO THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

When handling clutch fluid, take care not to spill it onto plastic or paint-finished parts or they will damage.

Check clutch fluid level every 7,500 km (4687 mi), see 2.17 (CHECKING AND TOPPING UP CLUTCH FLUID LEVEL). Change clutch fluid every two years, see 2.22 (CHANGING THE CLUTCH FLUID).

(Recommended) clutch fluid, see 1.6 (LUBRICANT CHART).

⚠ WARNING

Do not use any clutch fluids other than the specified type. Never mix different types of fluids to top up level, as this will damage the clutch system. Do not use clutch fluid from containers which have been open or kept in storage for long periods. Any sudden changes in play or hardness in the clutch lever are warning signs of problems with the hydraulic circuit.

Make sure the clutch hose is not twisted or worn. Avoid accidental ingress of water or dust into the circuit.

Wear latex gloves when servicing the hydraulic circuit.

1.2.7 CARBON OXIDE

When an operation must be performed with the engine running, position the motorcycle out of doors or in a well-ventilated area. Never operate the engine in an enclosed place.

Use an exhaust emission extraction plant when working indoors.

⚠ CAUTION

Exhaust emissions contain carbon oxide, which is a poisonous gas and may lead to loss of conscience or even death.

Operate the engine out of doors or, if working indoors, use an exhaust emission extraction plant.

1.2.8 HOT COMPONENT PARTS

⚠ CAUTION

The engine and exhaust component parts become hot when the engine is running and will stay hot for some time after the engine has been stopped.

Wear heat gloves before handling these components or allow for the engine and exhaust system to cool down before proceeding.

1.3 RUNNING-IN RECOMMENDATIONS

Proper engine running-in is essential to preserving engine life and performance over time.

Twisty roads and gradients are ideal to break in engine, suspension and brakes effectively.

Varying speed frequently is also recommended. This will vary the amount of stress placed on vehicle components continuously, allowing engine parts to cool down when less stressed. While it is important to put a certain amount of stress to engine components during the running-in period, it is equally important to spare the engine at this stage in vehicle's life.

⚠ WARNING

Top acceleration performance is only obtained after covering the first 1500 km (937 mi).

Observe the following instructions:

- ◆ Avoid harsh accelerations and do not flip the throttle open abruptly when the engine is running at low speed, both during and after the running-in period.
- ◆ Apply the brakes gently and avoid hard, prolonged braking until covering the first 100 km (62 mi).
- ◆ This will allow the brake pad lining to wear in properly rubbing on the brake discs.
- ◆ Never exceed 6000 rpm (see chart) during the first 1000 km (625 mi).

⚠ WARNING

After covering the first 1000 km (625 mi), perform the checks listed in the "post running-in" column of the PERIODIC MAINTENANCE CHART (see 2.1.1). Failure to perform these checks may lead to personal injury to yourself or third persons, or vehicle damage.

- ◆ After the first 1000 km (625 mi) and until covering the first 1500 km (937 mi), a somewhat brisker riding style is acceptable. Vary your speed and use peak acceleration for just a few instants, to allow the different components to become properly seated against one another.
- ◆ Never exceed 7500-rpm engine speed (see table).
- ◆ After 1500 km (937 mi), the engine will be ready for a more demanding use. However, never exceed the maximum engine speed allowed (9000 rpm).

Recommended maximum engine speed	
Distance covered in Km(mi)	rpm
0-1000 (0-625)	5000
1000-1500 (625-937)	6250
over 1500 (937)	8750

1.4 SPARE PARTS

Use original **aprilia** spare parts only to replace original components. Original **aprilia** spare parts are high-quality components designed and built expressly for **aprilia** motorcycles.

⚠ WARNING

Using any parts **OTHER THAN** original **aprilia** parts may lead to loss of performance and damage.

1.5 SPECIFICATIONS

DIMENSIONS	
Overall length	2290 mm
Overall width	876 mm
Overall height (front fairing)	1436 mm
Seat height	825 mm
Wheelbase	1544 mm
Minimum ground clearance	241 mm
Weight in running order (including fuel and coolants)	235 kg
ENGINE	
Type	4-stroke longitudinal 60° V twin-cylinder engine fitted with 4 valves per cylinder and 2 overhead camshafts
Number of cylinders	2
Total displacement	998 cu cm
Max rated crankshaft power	86.5 kW (118 HP) at 9250 rpm
Max rated crankshaft power F	77 kW (104 HP) at 9250 rpm
Max torque	96.5 Nm (9.78 kgm) at 7250 rpm
Max torque F	90 Nm (9.17 kgm) at 7000 rpm
Bore/stroke	97 mm / 67.5 mm
Compression ratio	10.4 ± 0.5: 1
Average piston speed	22,5 m/s at 10000 rpm
Camshaft during intake stroke	242°, valve lift = 9.50 mm
Camshaft during exhaust stroke	242°, valve lift = 9.50 mm
Timing advance (with 1-mm valve clearance) intake valve opens intake valve closes exhaust valve opens exhaust valve closes	25° before TDC 37° after BDC 57° before TDC 5° after BDC
Valve clearance, intake	0.12-0.17 mm
Valve clearance, exhaust	0.23-0.28 mm
# Idling rpm	1200 ± 100 rpm
# Top speed rpm	9000 ± 100 rpm
Ignition	computer ignition management
Starter	electric starter
Spark advance:	5° before TDC upon starting, advance is further increased to suit specific consumption.
Starter motor	12 V / 0.9 kW
Transmission ratio of starter motor	$i = 49/9 * 30/11 * 64/30 = 31.677$
Clutch	hydraulically operated wet multi-plate clutch with control lever on left-hand handlebar and PPC device - # 9 friction plates, 3.5 mm thick - # 9 clutch plates, 1.5 mm thick

CONTINUED ►

Transmission	Mechanical 6-speed transmission with foot control on left-hand side of engine
Lubrication system	Dry-sump lubrication system with remote oil tank, # 2 trochoidal pumps and cooler
Lubrication pressure	min 500 kPa (5 bar) 80 °C (176 °F) max. and 6000 rpm
Air cleaner	with dry filter cartridge
Cooling system	liquid cooling
Transmission ratio of coolant pump	$i_{wp} = 28/27 * 28/28 = 1.037$
Coolant pump delivery rate (when thermal expansion valve is open)	90 l/min at 9000 rpm
Thermal expansion valve starts to open at	65 ± 2 °C (149 ± 5 °F)
Dry engine weight	~ 65 kg
CAPACITIES	
Fuel (including reserve)	25 l
Fuel reserve	4 ± 1 l
Engine oil	oil change 4300 cu cm oil and filter change 4500 cu cm
Front fork oil (each leg)	750 ± 2,5 cu cm
Coolant	2.5 l (50% water + 50% ethylene glycol anti-freeze)
Seat	2
Max carrying load (rider + pillion rider + luggage)	182 kg

DRIVE					
DRIVE RATIOS	Gear	Primary drive ratio 31/60 = 1: 1.935	Secondary drive ratio	Final drive ratio 17/45 = 1: 2.647	Total drive ratio
	1st		14/35 = 1: 2.50		12.804
	2nd		16/28 = 1: 1.750		9.041
	3rd		19/26 = 1: 1.368		7.006
	4th		22/24 = 1: 1.090		5.582
	5th		23/22 = 1: 1.956		4.896
	6th	27/23 = 1: 0.851	4.358		
# Sprocket	17 teeth				
Chain drive	Endless O-ring chain, type 525, size 5/8" x 5/16"				

FUEL SYSTEM	
Type	Fuel injection
Venturi	Ø 47 mm
INDUCTION	
Type	Indirect injection (MULTIPOINT)
Fuel	Premium-grade unleaded petrol, minimum octane rating 95 (N.O.R.M.) and 85 (N.O.M.M.)
FRAME	
Type	Dual-beam design made from light alloy cast members and extruded members
Rake	28°
Trail	129 mm
SUSPENSION	
Front	Adjustable telescopic UPSIDE-DOWN hydraulic fork with Ø 50-mm legs
Travel	175 mm
Rear	Light-alloy swinging arm with differentiated arms profile and adjustable oil/air-sprung mono-shock absorber
Wheel travel	120 mm

CONTINUED ►

BRAKES	
Front	Twin-disc brake with Ø 300-mm floating discs, four-piston calipers with Ø 30-mm/ Ø 32-mm diameter
Rear	Disc brake - Ø 272 mm, dual-piston caliper - Ø 34
WHEELS	
Type	Tubeless tyres rim
Front	2.50 x 19"
Rear	4.00 x 17"

TYRES					
Wheel	Brand	Type	Size	Pressure in kPa (bar)	
				solo riding	rider and pillion passenger
Front (standard)	PIRELLI	SCORPION S/T MT90	110/80R19"	220 (2.2)	250 (2.5)
Rear (standard)	PIRELLI	SCORPION S/T MT90	150/70R17"	250 (2.5)	290 (2.9)
Front (option)	METZELER	TOURANCE	110/80R19"	220 (2.2)	250 (2.5)
Rear (option)	METZELER	TOURANCE	150/70R17"	250 (2.5)	290 (2.9)
Front (alternative)	BRIDGESTONE	TRIAL WING 101 RADIAL F. SPEC. 12MBY	110/80R19"	220 (2,2)	250 (2,5)
Rear (alternative)	BRIDGESTONE	TRIAL WING 152 RADIAL F. SPEC. P1NBJ	150/70R17"	250 (2,5)	290 (2,9)
Front (alternative)	MICHELIN	ANAKEE B 59V M/C TL/TT	110/80R19"	220 (2,2)	250 (2,5)
Rear (alternative)	MICHELIN	ANAKEE B 69V M/C TL/TT	150/70R17"	250 (2,5)	290 (2,9)

SPARK PLUGS	
Standard	NGK R DCPR9E
Electrode gap	0.6 -0.7 mm
Resistance	5 KΩ
ELECTRIC SYSTEM	
Battery rating	12 V - 12 Ah
Main fuses	30 A
Auxiliary fuses	15 A
Generator (permanent-wound magnet type) rating	12 V - 470 W
BULBS	
Low beam/high beam (halogen lamp)	12 V - 60 / 55 W H4 V
Front parking light	12 V - 3 W
Direction indicators	12 V - 21 W
Rear parking light / stop light	12 V - 5 / 21 W
Number plate light	12 V - 5 W
WARNING LIGHTS	
Neutral light	LED
Direction indicators	LED
Low fuel	LED
High beam	LED
Stand light	LED
Engine oil pressure	LED
Diagnostics	LED

1.6 LUBRICANT CHART

LUBRICANT	PRODUCT
Engine oil	EXTRA RAID 4, SAE 15W - 50 or Agip TEC 4T, SAE 15W - 50. As an alternative to recommended oils, top brand oils meeting or exceeding CCMC G-4, A.P.I. S.G. specifications can be used.
Fork oil	F.A. 5W, F.A. 20W; as an alternative, Agip FORK 5W or Agip FORK 20W. When you wish to obtain an intermediate response between those offered by F.A. 5W and F.A. 20W oils or Agip FORK 5W and Agip FORK 20W, oils, you may mix the different products as follows: SAE 10W = F.A. 5W 67% of volume + F.A. 20W 33% of volume, or Agip FORK 5W 67% del volume + Agip FORK 20W 33% of volume. SAE 15W = F.A. 5W 33% of volume + F.A. 20W 67% of volume, or Agip FORK 5W 33% of volume + Agip FORK 20W 67% of volume.
Bearings and other lubrication points	GREASE MP or Agip GREASE 30. As an alternative to recommended grease, use top brand rolling bearing grease that will resist a temperature range of -30°C - +140°C, with dropping point 150°C - 230°C, high corrosion protection, good resistance to water and oxidisation.
Battery lead protection	use neutral grease or Vaseline.
Spray grease for chains	CHAIN SPRAY or Agip CHAIN LUBE
Brake fluid	F.F., DOT 4 (Compatibile DOT 5); Agip BRAKE 5.1 DOT 4 (Compatibile DOT 5). ⚠ CAUTION Use new brake fluid only. Do not mix different makes or types of oil without having checked bases compatibility.

⚠ CAUTION
Use new clutch fluid only.
Clutch fluid (recommended): F.F., DOT 4 (Compatibile DOT 5) ; Agip BRAKE 5.1 DOT 4 (Compatibile DOT 5).

⚠ CAUTION
Use only nitrite-free anti-freeze and corrosion inhibitors with a freezing point of -35°C as a minimum.

⚠ CAUTION
Engine coolant: ECOBLU -40 °C - Agip COOL.








1.7 CONSUMABLES

Use only the products specified below for motorcycle maintenance.

These products have demonstrated suitability for all usage conditions specified by the manufacturer after long-time testing.

NOTE The products for which a part number is given are available at request, see 1.7.2 (PRODUCT APPLICATIONS).

1.7.1 PRODUCT FEATURES

Product	Usage and features
Blue LOCTITE® 243 	Threadlocking adhesive for nuts and bolts up to M36, provides medium-strength fit. Suitable for use on less than perfectly degreased parts. Cure time varies with temperature and substrate up to one hour maximum. Withstands temperatures in the – 55 to 150 °C range (– 99 to 302 °F).
Green LOCTITE® 648 	High-strength retaining compound for bolts. Cure time varies with temperature and substrate up to twelve hours maximum. Withstands temperatures in the – 55 to 175 °C range (– 99 to 347 °F). Mated parts must be heated up to 250 °C (482 °F) before they can be disassembled.
Orange LOCTITE® 574 	Solvent-free sealant. Eliminates the need for gaskets in joints exposed to high friction and where a specified gap needs to be maintained between parts. Liquid sealant, cures within a few hours after assembly when in contact with metal to form a gasket whose surface structure matches mating surfaces. Resists temperatures from – 55 to 200 °C (– 99 to 392 °F), inhibits corrosion of sealed surfaces.
LOCTITE® 8150 	High-temperature assembly paste.
LOCTITE® Anti Seize 15378 	Lubricant and corrosion inhibitor, resists high temperatures. When sprayed on both parts, provides long-term maintenance-free operation of contact surfaces. Inhibits corrosion.
MOLYKOTE® G-n 	Lubricating compound for use on heavy-duty stressed parts, for base lubrication and on fits under pressure to avoid corrosion and sticking. Apply on both contact surfaces.
SILASTIC 732 RTV 	Sealant, prevents ingress of water into flywheel casing.

1.7.2 PRODUCT APPLICATIONS

Product	Part number	Applications
Engine oil (*)	8116050	<ul style="list-style-type: none"> - Swinging arm rivets, instrument panel/front fairing mount, seat subframe and frame (on assembly). - Frame-to-engine and frame-to-swinging arm adjusting bushes (on assembly). - Cable guide screws to frame (on assembly). - Headstock bearings. - Headstock top bush. - Roller bearings of timing idler gear. - Thrust washer of lower balancing shaft. - Clutch disengagement shaft. - Valve stems and buckets. - Valve guide seals. - Casing location of camshafts. - Timing chain tensioner. - Compound starter gear and idler gear pins. - Freewheeling clutch-to-gear contact surfaces. - Inner contact surface of freewheeling clutch.
LOCTITE® 243 (**)	0897651	<ul style="list-style-type: none"> - Steering retaining bush. - Rear brake caliper detent. - Front sprocket. - Rear brake pedal spindle. - Cooling fans to support. - Fuel return line fitting. - Fuel filler cap. - Throttle cable pulley nut. - Throttle cable bracket screws. - Throttle valve spindle nut. - Throttle position sensor screws. - Coolant pump central screw. - Cylinder connecting bracket screws. - Engine casing bearing screws. - Cylinder stud bolts. - Crankshaft position sensor screws. - Index lever and plate screws. - Crankshaft nut. - Timing gear screws. - Nut securing counterweight to upper balancing shaft. - Lower screw of timing idler gear bearing mount.
LOCTITE® 648 (**)	0899788	<ul style="list-style-type: none"> - Coolant pump idler gear shaft. - Engine oil pump plug. - Clutch gear metal plate screws. - Freewheeling clutch to magnet wheel (on assembly). - Freewheeling clutch screws. - Clutch housing nut. - Screw securing counterweight to lower balancing shaft. - Flywheel rotor inner cone. - Flywheel retaining screw.

Product	Part number	Applications
Orange LOCTITE® 574 (**)	0899784	<ul style="list-style-type: none"> - Coolant thermal switch. - Coolant thermistors. - Contact screw of neutral switch. - Outer surface of engine oil pump motor. - Cylinder footprint on crankcase.
LOCTITE® Anti Seize 15378 (**)	0297434	<ul style="list-style-type: none"> - Transmission primary and secondary shaft. - Crankcase locations of transmission primary and secondary shafts. - Crankshaft and balancing shaft. - Crankcase location and spline of transmission primary shaft.
MOLYKOTE® G-n (**)	0297433	<ul style="list-style-type: none"> - Crankcase locations of main bearing sleeves. - Main bearing sleeves. - Crankcase bearing locations. - Coolant pump shaft. - Valve guide seats in cylinder head. - Valve guide edges. - Crankcase locations of crankshaft and balancing shaft bearing sleeves. - Crankcase locations of crankshaft and balancing shaft. - Bores accommodating piston pins. - Camshaft cams. - Starter motor mount.
SILASTIC 732 RTV (**)	0297386	<ul style="list-style-type: none"> - Cable bracket on flywheel cover. - Camshaft sensor cable.
Bimol Grease	481 8116053	<ul style="list-style-type: none"> - Front and rear wheel seals (on assembly). - Swinging arm shaft bearings (on assembly). - Clutch master cylinder actuating rod (on assembly). - Rear wheel shaft thread. - Steering head bearings. - Rear brake master cylinder actuating rod (on assembly). - Rear brake pedal spindle. - Thrust washer of timing idler gear. - Upper balancing shaft seal. - Starter motor gear.
LUBERING Grease ST	8116038	<ul style="list-style-type: none"> - Choke control (on assembly).
AP-LUBE temporary lubricant	-	<ul style="list-style-type: none"> - Handlebar counterweight rubber (on assembly). - Throttle cable adjuster rubbers (on assembly). - Gearshift lever rubber (on assembly). - Lower retaining pins of radiators to rubber mounts (on assembly). - Breather hose to radiator and three-way manifold (on assembly). - Coolant hose couplings to radiators (on assembly). - Water and fuel drain hoses to fuel flange (on assembly). - Throttle body torsion springs (on assembly).
DID CHAIN LUBE Grease		<ul style="list-style-type: none"> - Drive chain.
“Biosolvent” frame detergent	8116031	<ul style="list-style-type: none"> - For washing the engine oil tank.
Cyanoacrilic paste “ACRILON 28”	8116945	<ul style="list-style-type: none"> - Airbox gasket (on assembly).
MOTUL MOTOWASH Degreaser	-	<ul style="list-style-type: none"> - For cleaning frame and swinging arm.

Product	Part number	Applications
Anti-seize compound ANTI-SEIZE MOTAGEPASTE AS 1800	8116043	- Plugs of exhaust take-up points.
Alcohol	-	<ul style="list-style-type: none"> - For cleaning left-hand handlebar before fitting twistgrip. - Radiator breather hoses into T union. - Ignition coil mount rubber (on assembly). - Side body panel rubbers (on assembly). - For cleaning bottom part of engine. - Starter relay rubber (on assembly). - Cush drive to rear wheel sprocket (on assembly). - Engine oil cooler rubbers (on assembly). - Hose coupling to coolant filler cap (on assembly). - For cleaning engine oil tank before decal application. - Instrument panel/front fairing rubbers (on assembly). - Rear brake pedal rubber (on assembly). - Hoses to fuel filter (inside fuel tank) (on assembly). - Coupling connecting coolant radiators (on assembly). - Fuel lines to fuel tank (on assembly). - For cleaning fuel tank before decal application.

(*) = see 1.6 (LUBRICANT CHART).

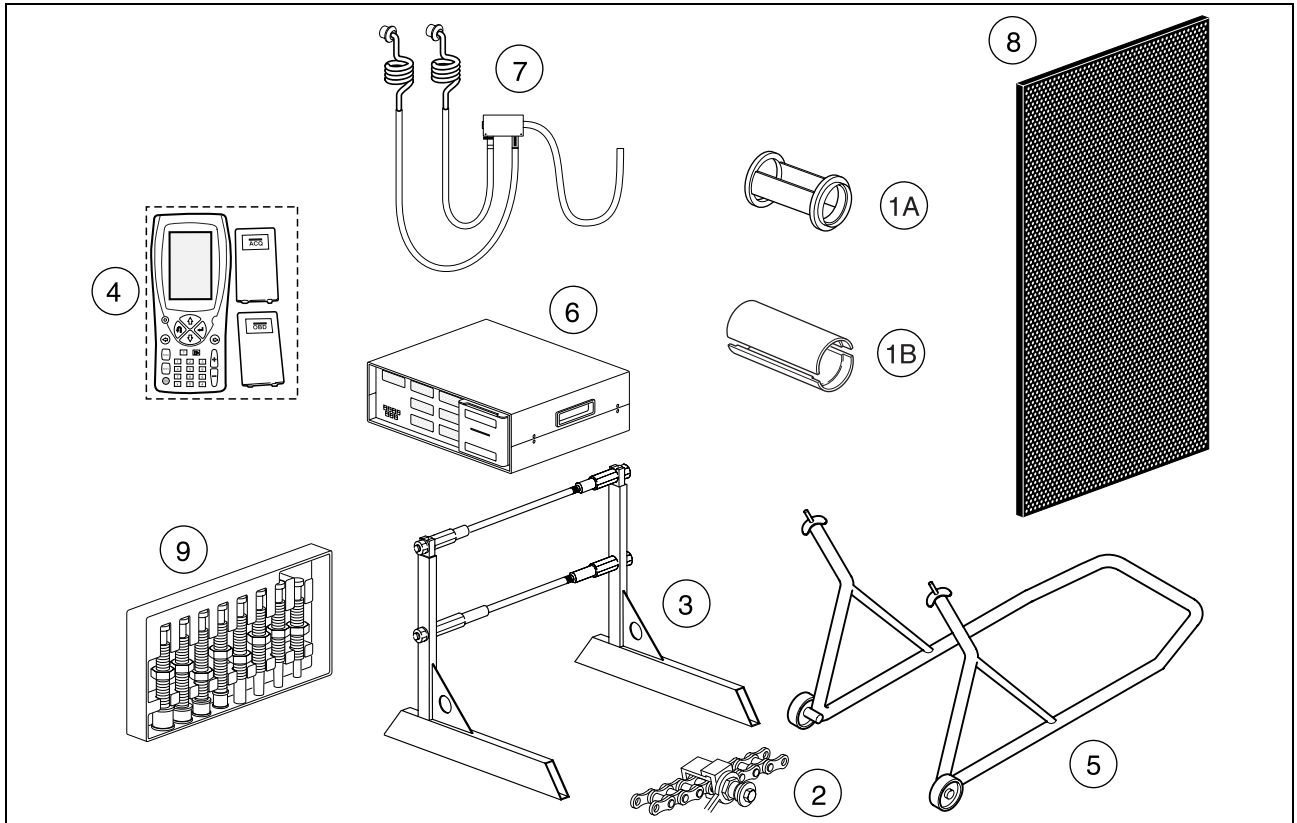
(**) =see 1.7.1 (PRODUCT FEATURES).

1.8 SPECIAL TOOLS

Special tools have been developed to ensure proper disassembly, re-assembly and adjustment without the risk of damaging any components. Using inadequate tools and/or improvised procedures may lead to irreparable damage. Model-specific special tools for this vehicle are listed below. If needed, order the brand-specific special tools (see Special Tools Catalogue).

⚠ WARNING

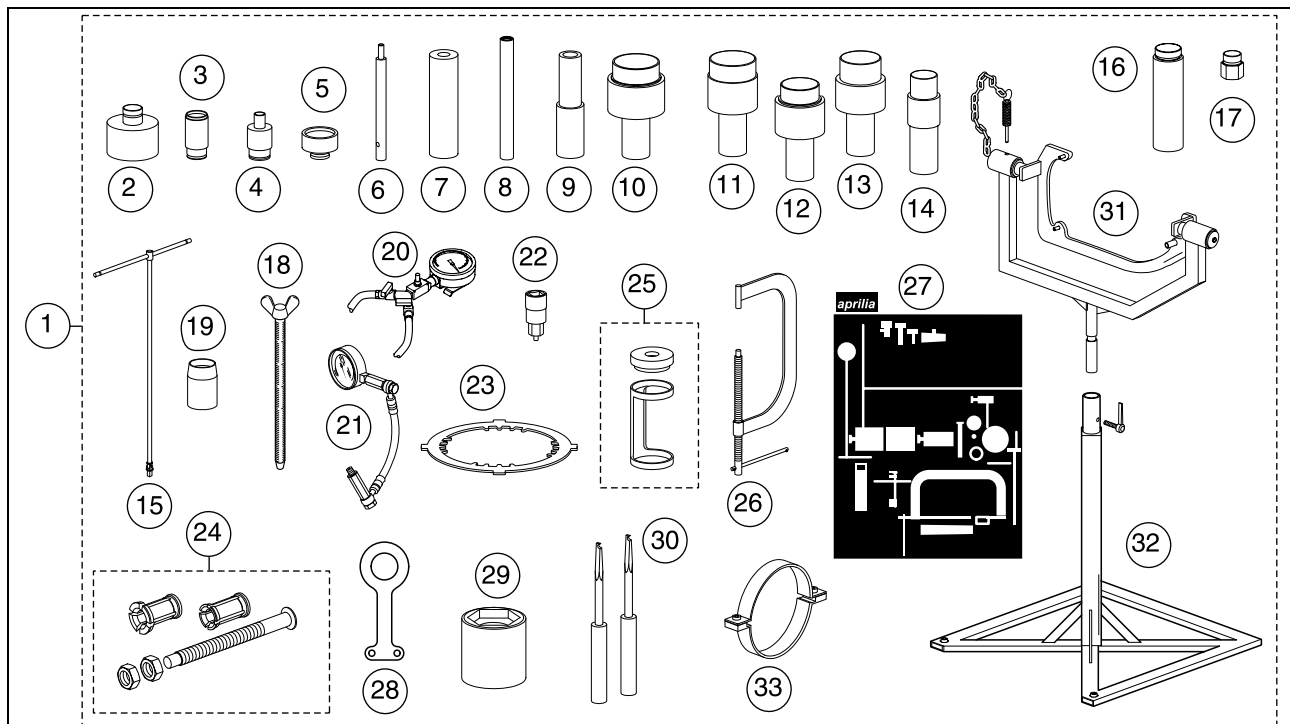
Always read the instructions supplied with the special tools before use.



1.8.1 SUNDRY TOOLS

Ref.	Tool designation and application	Part number
1A	Tool for seal fitment Ø 50 mm	8140580
1B	Split sleeve for fork oil seal fitment Ø 50 mm	8140146
2	Tool for chain removal/fitment	8140192
3	Centre stand	8140176
4	Axone 2000	8140595
5	Front wheel stand	8140195
6	Exhaust emission tester	8140196
7	Emission tester tube kit	8140202
8	Tool board	8140199
9	Bearing extractor kit 10 - 30 mm Ø	8140180

1.8.2 ENGINE TOOLS

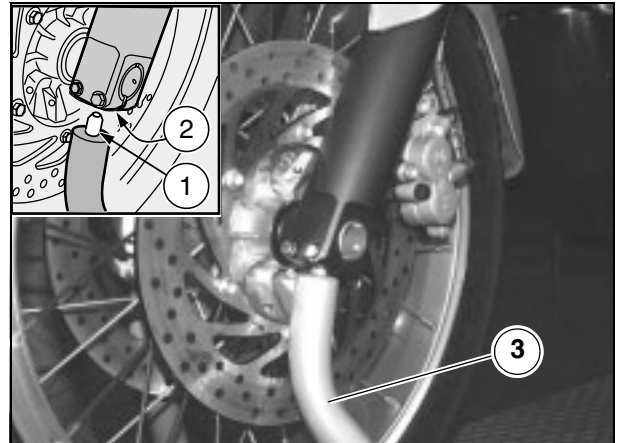


Ref.	Tool designation and application	Part number
1	Full engine tool kit	8140175
2	Drift to fit transmission secondary shaft seal	0277680
3	Drift to fit seal into secondary balancing shaft location	0277660
4	Drift to fit seal into coolant pump shaft location	0277670
5	Drift to fit sliding ring into coolant pump shaft location	0877257
6	Valve guide extractor	0277510
7	Drift for valve guide seal fitment	0277695
8	Drift for valve guide fitment	0277210
9	Drift to fit transmission shaft and clutch shaft seals	8140155
10	Drift to fit main balancing shaft bearing sleeves	0277729
11	Crankshaft bearing sleeve extractor	0277720
12-14	Drifts to fit crankshaft bearing sleeves	0277725
13	Drift to fit clutch cover – crankshaft bearing sleeves	0277727
15	Spark plug tool	8140177
16	Flywheel cover puller	0277252
17	Hexagon nut for flywheel removal	0277780
18	Threaded rod to hold crankshaft in TDC position	0240880
19	Transmission secondary shaft guide sleeve	0277308
20	Vacuum gauge	8140256
21	Fuel/oil pressure gauge	8140181
22	Rotor bolt extractor	8140182
23	Clutch anti-rotation tool	0277881
24	Extractors for clutch cover bearing sleeves	8140156 + 8140157 + 0276377
25	Tool to compress valve springs	0276479
26	Tool for valve removal/fitment	8140179
27	Adhesive template for tool board	8157143
28	Engine lifting eyebolt	8140183
29	Primary drive nut extractor	8140184
30	Clutch plate extractors	8140185
31	Engine stand	8140188
32	Engine stand pedestal	8140187
33	Tool to compress piston rings	8140186

1.9 PLACING THE MOTORCYCLE ON THE SERVICE STANDS

1.9.1 PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND OPT

- ◆ Place the motorcycle on the centre stand OPT.
- ◆ Slide both pins (1) of the front wheel stand (3) into the holes (2) at front fork bottom end at the same time.
- ◆ Put one foot on the front end of the stand (3).
- ◆ Press down on stand (3) until it rests fully on the ground.



1.9.2 PLACING THE MOTORCYCLE ON THE CENTRE STAND OPT

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Part no. 8140176 (complete stand).

- ◆ Place the motorcycle on the front wheel stand OPT, see 1.9.1 (PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND).
- ◆ ★ Hold the nut (1) steady on the inside.
- ◆ ★ Release and remove the rear upper right-hand engine mounting bolt (2).



Torque wrench setting for nut (1) / bolt (2): 50 Nm (5.0 kgm).

NOTE The bolt (2) on the left-hand side is longer.

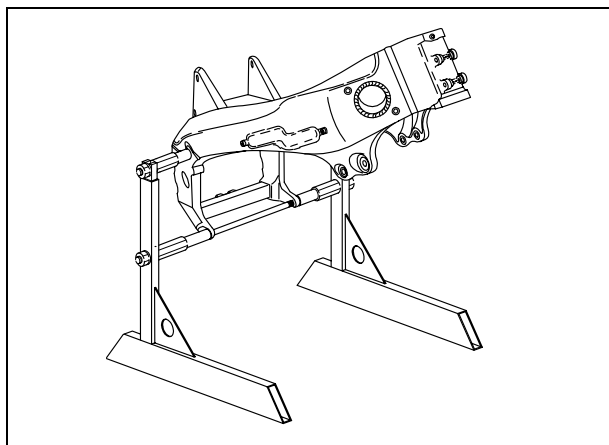
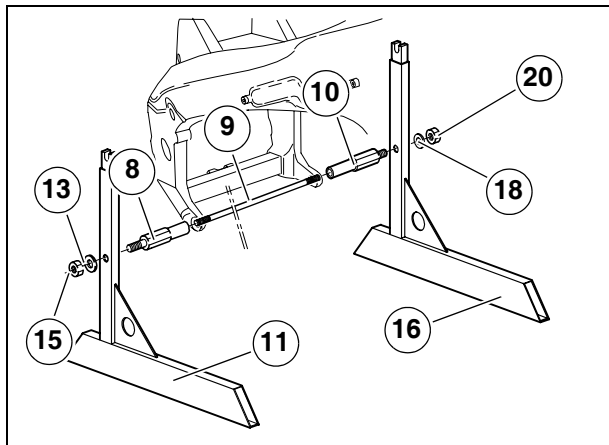
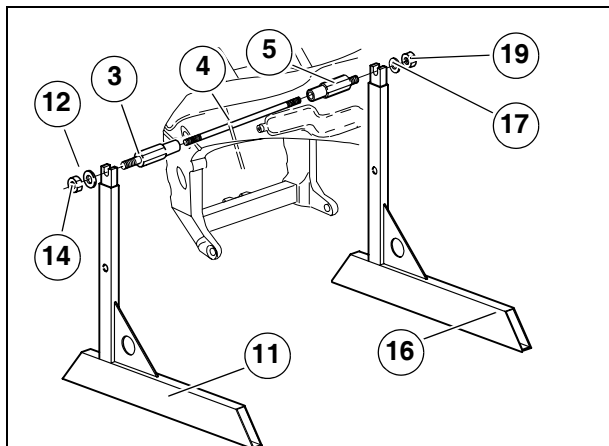
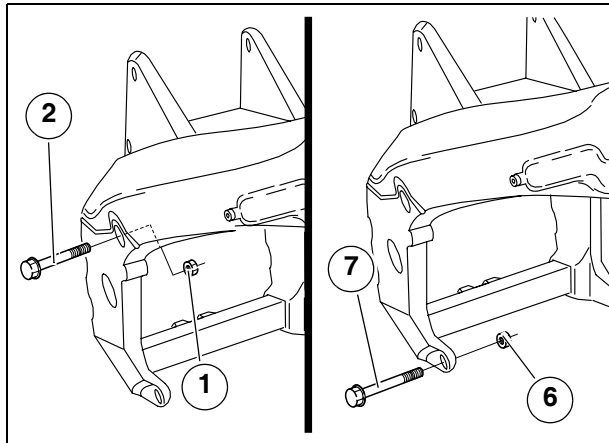
- ◆ ★ Collect the nut (1).
- ◆ Slide the upper right-hand mounting boss (3) into the upper hole on the right-hand side.
- ◆ Fit the stud bolt (4) into the upper hole on the left-hand side and screw it fully into the mounting boss (3).
- ◆ Screw the upper left-hand mounting boss (5) fully onto stud bolt (4) and tighten.
- ◆ ★ Hold the nut (6) on the inside steady.
- ◆ ★ Release and remove the rear lower engine mounting bolt (7).



Torque wrench setting for nut (6) / bolt (7): 50 Nm (5.0 kgm).

NOTE The bolt (7) on the right-hand side is longer.

- ◆ Slide the lower right-hand mounting boss (8) into the lower hole on the right-hand side.
- ◆ Fit the stud bolt (9) into the lower hole on the left-hand side and screw it fully into the mounting boss (8).
- ◆ Screw the lower left-hand mounting boss (10) fully onto stud bolt (9) and tighten.
- ◆ Fit the bracket (11) onto the mounting bosses (3-8). The longer portion of the bracket base must be facing forward.
- ◆ Snug the two washers (12 - 13) and nuts (14 - 15) finger-tight.
- ◆ Tighten both nuts (14 - 15).
- ◆ Fit the bracket (16) onto the mounting bosses (5-10) with the longer portion of the base facing forward.
- ◆ Snug the two washers (17 - 18) and nuts (19 - 20) finger-tight.
- ◆ Tighten both nuts (19 - 20).
- ◆ Remove the wheel stands.



1.10 HOW TO APPLY THE DECALS

Whenever you remove any body parts:

⚠ WARNING

Handle plastic and paint-finished parts with care to avoid scratching or damage.

Proceed carefully.

Do not damage the snap-on tabs and matching recesses.

Strictly follow the instructions below.

We recommend using:

- a medium spatula (1);

NOTE Soft spatulas – such as those commonly used on windscreen wipers - will leave excess water under the decal.

- a sponge or spray dispenser (2) and water.

NOTE Add water with 1-3% detergent and shake to obtain frothing.

Apply the decals as follows:

- ◆ Place a decal (3) on a bench with the adhesive face up.
- ◆ Keep the decal well stretched on the bench and remove the protective film (4).

NOTE A spray dispenser (2) will work best.

If you are using a sponge, dab the decal surface lightly or the adhesive will deteriorate.

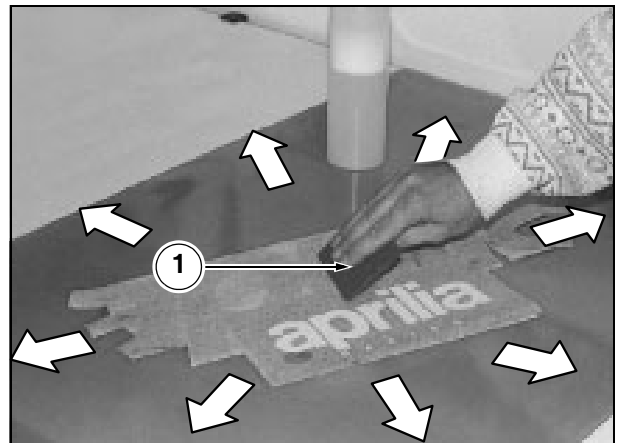
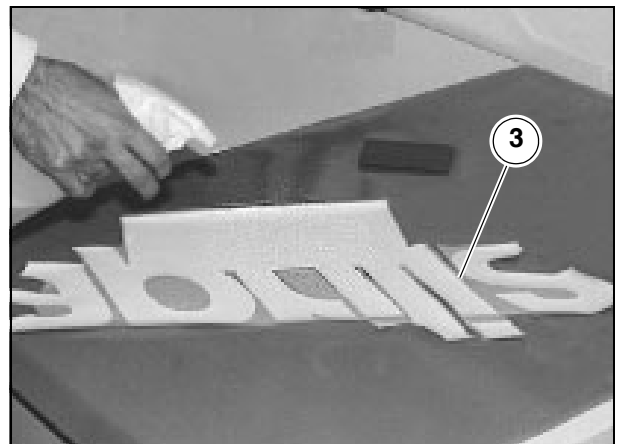
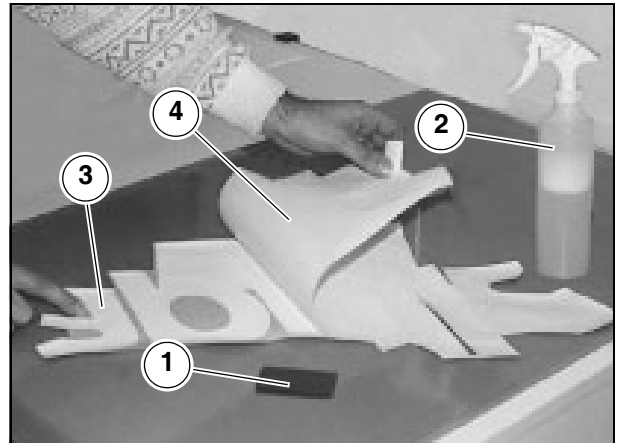
- ◆ Wet the adhesive face with soap water.
- ◆ Place the decal (3) in the proper position on the part you wish to decorate.

NOTE Always apply the spatula to the decal centre and move it towards the edges with regular movements.

- ◆ Rub the spatula (1) across the decal surface pressing moderately until removing excess soap and water from under the decal.

NOTE Take care not to lift the decal corners and edges in the process.

- ◆ Dry up the decal with an absorbent cloth. Apply cloth in the centre and move outwards.
- ◆ Rub the decal using the spatula with firm, regular strokes. Apply the spatula in the centre and move outwards. Take special care with corners and edges to ensure proper adhesion across the whole surface.



NOTE Where decals come with application tape (5)¹, remove tape 20-30 minutes after decal application.

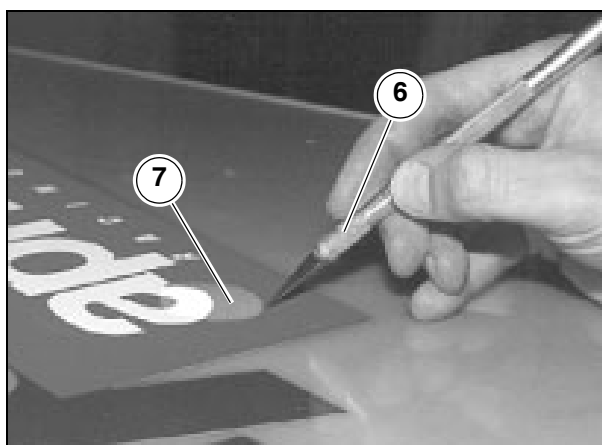
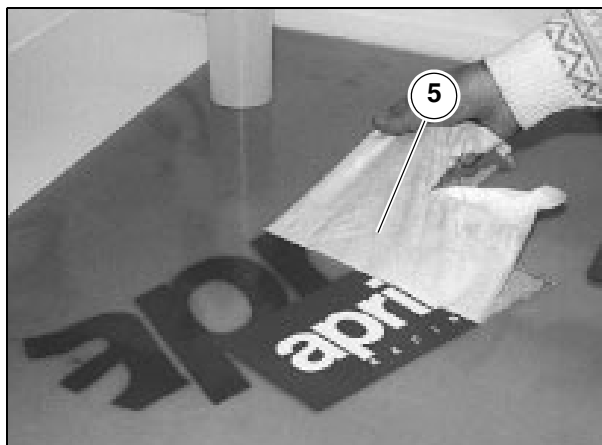
- ◆ Peel off the application tape (5) from decal surface.
- ◆ Pass the spatula across the decal again – particularly over corners and edges – to ensure proper adhesion.

NOTE Decals applied using water will take about 48 hours to stick to part permanently.

- ◆ Once you have removed the application tape, check for any air trapped underneath the decal.

If there are any air bubbles:

- ◆ Prick a hole on the edge (7) of the air bubble using a pin or a cutter (6).
- ◆ Apply the spatula (1) at the opposite end and move it across the bubble to squeeze air out.



1 Application tape is used to facilitate the application of brands and lettering in the proper position and keeps the sticker stiffer during application.

1.11 TORQUE FIGURES

The table below reports the standard torque figures for metric size screws and bolts in accordance with ISO standards.

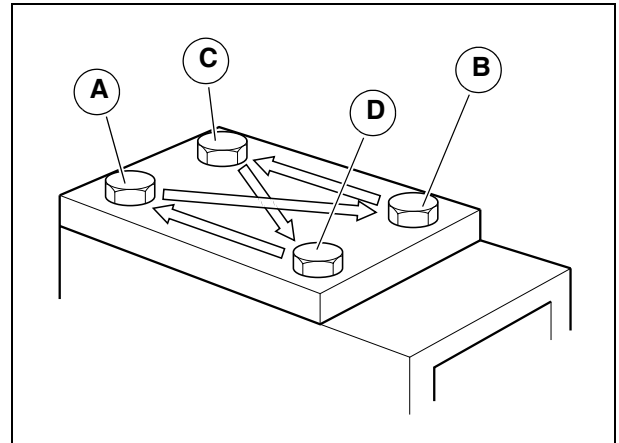
Screw or bolt thread	Spanner	Tightening torque	
		Nm	kgm
M 6	10	6	0.6
M 8	12	15	1.5
M 10	14	30	3.0
M 12	17	55	5.5
M 14	19	85	8.5
M 16	22	130	13.0

For model-specific torque figures, see 2.41 (FASTENERS). Unless otherwise specified, torque figures are intended for application to clean, dry threads at room temperature.

NOTE Follow the instructions below to avoid distortion and/or improper fit:

- ◆ Screw all fasteners finger-tight.
- ◆ Tighten fasteners in a cross pattern - (A) and (B); (C) and (D) - to half the specified torque.
- ◆ Repeat sequence tightening to specified torque.

NOTE This way, the load generated by the fasteners is applied evenly across joint surface.



PERIODIC MAINTENANCE AND
ADJUSTMENTS

2

PERIODIC MAINTENANCE AND ADJUSTMENTS

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Outlined in this section are the recommended procedures for the periodic maintenance of the key components of the motorcycle.

⚠ CAUTION

Before proceeding to maintain or inspect the motorcycle, stop the engine and remove the ignition switch key. Ensure that the engine and exhaust system have cooled down. Wherever possible, place the motorcycle on firm and level ground and lift it using suitable equipment.

Be careful of any parts of the engine or exhaust system which may still be hot. Contact with hot engine or exhaust parts may cause severe burns.

All component parts of the vehicle are inedible.

Do not bite, suck, chew or swallow any vehicle parts.

Unless expressly specified otherwise, reassembly is carried out by reversing the disassembly procedure.

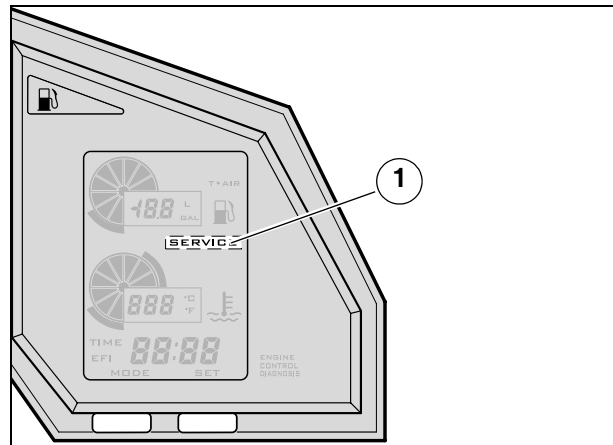
2.1 PERIODIC MAINTENANCE CHART

In order to preserve the motorcycle in sleek running order, **aprilia** recommends that you strictly observe the periodic maintenance intervals recommended for the different component parts.

⚠ WARNING

Upon reaching the first 1000 km (625 mi) and every 7500 km (4687 mi) afterwards, a wording "SERVICE" (1) will appear on the right-hand display.

When this occurs, look up the periodic maintenance chart and perform the required maintenance. Note that motorcycles used in competition trials need to be maintained more frequently, see 2.1.1 (PERIODIC MAINTENANCE CHART).



2.1.1 PERIODIC MAINTENANCE CHART

Component	Post running-in checks [1000 km (625 mi)]	Every 7500 km (4687 mi) or 12 months	Every 15000 km (9375 mi) or 24 months
Rear shock absorber			①
Spark plugs		①	③
Bowden cables	①	①	
Rear suspension linkage system bearings			①
Steering bearings and play	①	①	
Wheel bearings		①	
Brake discs	①	①	
Air filter		①	③
Engine oil filter	③	③	
Engine oil filter (on oil tank)	②		②
Front fork	①		①
Vehicle operation	①	①	
Beam operation / setting		①	
Brakes	①	①	
Cooling system		①	
Light system	①	①	
Safety switches	①	①	
Clutch fluid		①	
	every 2 years: ③		
Brake fluid		①	
	every 2 years: ③		
Coolant			①
	every 2 years: ③		
Front fork oil	After the first 7,500 km (4,687 mi) and every 22,500 km (14,000 mi): ③		
Engine oil	③	③	
Front fork oil seals	After the first 30,000 km (18,750 mi) and then every 22,500 km (14,000 mi): ③		
Brake pads	If worn: ③		
Tyres	①	every 1,000 Km (625 mi): ①	
Tyre pressure (**)	④	every 1,000 Km (625 mi): ④	
Valve clearance adjustment	④		④
Wheels/Tyres	①	①	
Nuts and bolts torque	①	①	
Nipples/spokes tightening	④	④	

Component	Post running-in checks [1000 km (625 mi)]	Every 7500 km (4687 mi) or 12 months	Every 15000 km (9375 mi) or 24 months
Cylinder synchronisation	①	①	
Suspension and set-up	①		①
Engine oil pressure LED light	at each start-up: ①		
Drive chain slack and lubrication	every 1000 km (625 mi): ①		
Fuel pipes		①	every 4 years: ③
Final drive (chain, front and rear sprocket)		①	
Clutch wear		①	
Brake pads wear	①	before each ride and every 2000 km (1250 mi): ①	
① = inspect and clean, set or adjust, lubricate or replace as required; ② = clean; ③ = replace; ④ = set or adjust. Service the motorcycle more frequently when you ride in the rain, on dusty or bumpy roads, or in competition trials.			
() = THESE OPERATIONS CAN BE CARRIED OUT BY THE OWNER (**) = Check every 15 days or at scheduled intervals.			

2.2 LUBRICATION POINTS

Proper lubrication is critical to ensuring smooth operation and preserving vehicle life.

NOTE Before lubricating any part, clean off any oxidation deposits, grease, dirt or dust.

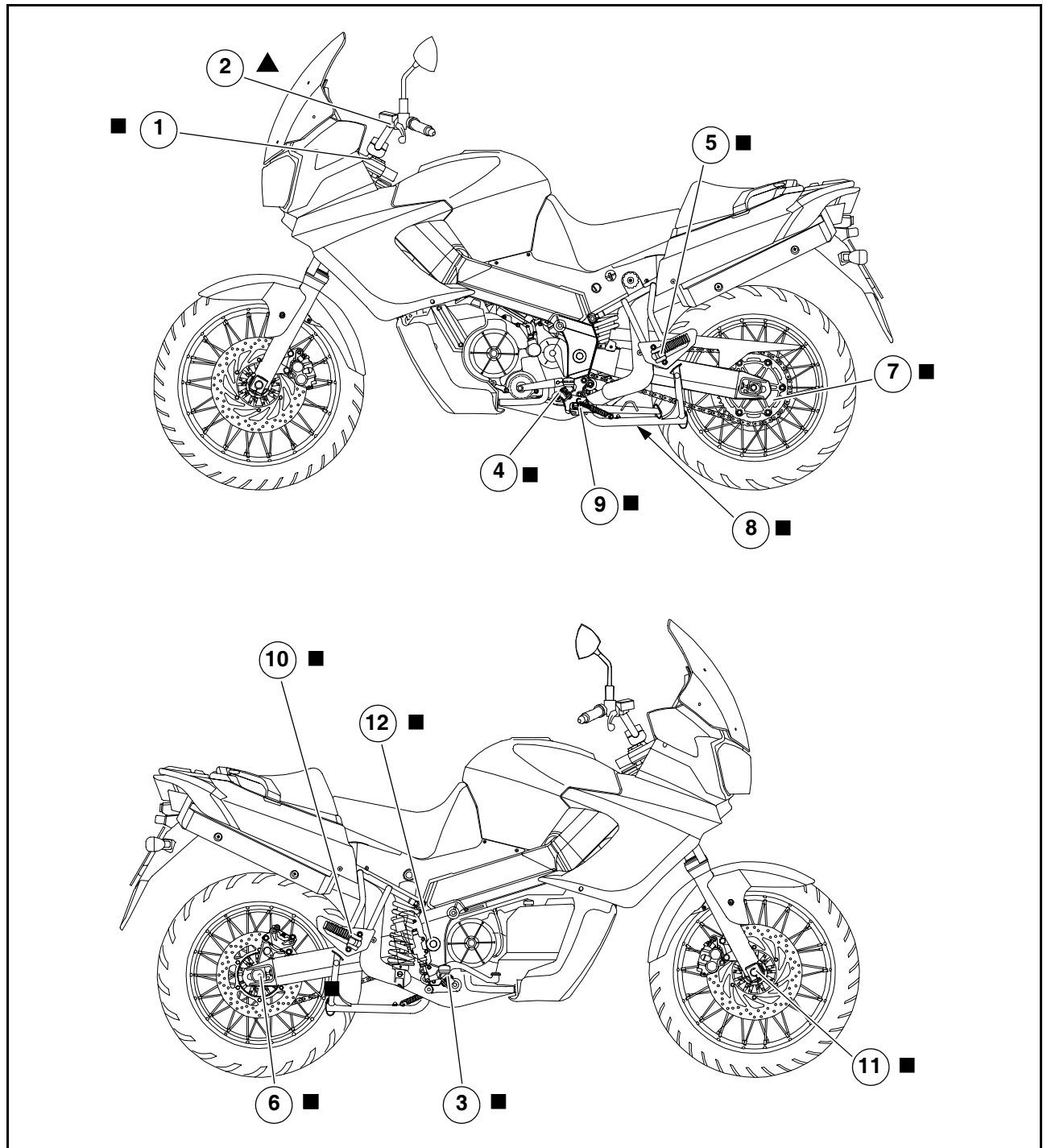
Parts subject to oxidation must be lubricated with engine oil or grease, see 1.6 (LUBRICANT CHART).

Lubrication points are shown in the “LAYOUT OF LUBRICATION POINTS”.

KEY TO THE LAYOUT OF LUBRICATION POINTS

- 1) Steering bearings
- 2) Clutch lever spindle
- 3) Rider right-hand footpeg
- 4) Rider left-hand footpeg
- 5) Passenger left-hand footpeg
- 6) Rear wheel spindle and hub bearings
- 7) Drive chain
- 8) Rear suspension levers
- 9) Side stand spindle
- 10) Passenger right-hand footpeg
- 11) Front wheel spindle and hub bearings
- 12) Swinging arm spindle

■ = Grease
▲ = Oil



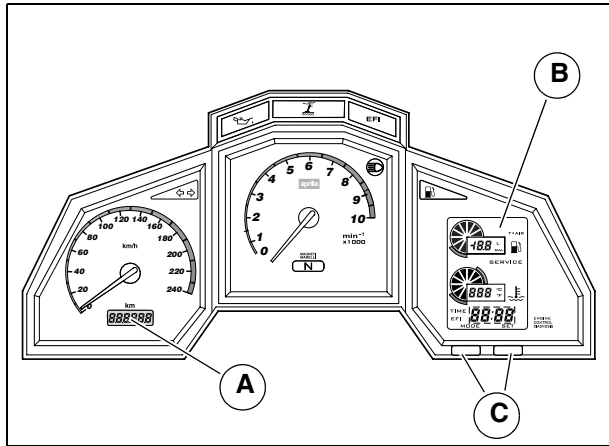
2.3 MULTIFUNCTION COMPUTER

2.3.1 KEY

A Left-hand digital display (odometer, shows total km/miles covered)

B Right-hand multifunction digital display (fuel level/air temperature – coolant temperature – clock/injection diagnostics)

C **SET** and **MODE** programming buttons.



2.3.2 PROGRAMMING BUTTONS

⚠ CAUTION

Perform these operations when the motorcycle is at standstill.

Performing these operations while riding may lead to an accident.

NOTE The instructions given below are referred to the motorcycle with the engine stopped.

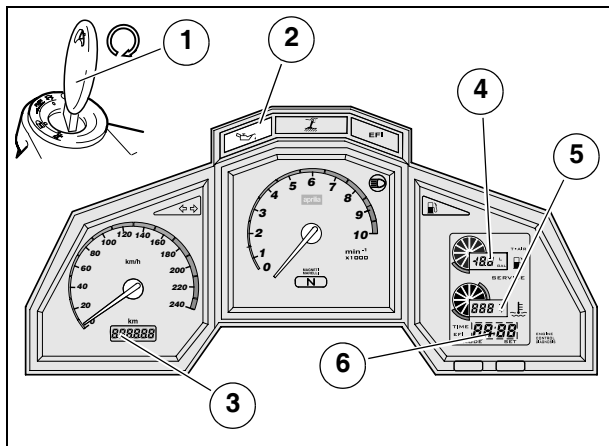
Rotate the ignition switch key (1) to position . The following instrument panel lights will come on within the next three seconds:

- all warning LED lights;
- all backlighting LEDs;
- all segments of the left-hand display;
- all segments and messages of the right-hand multifunction display.

This is part of an auto-test routine of LED, message, segment and instrument operation.

After three seconds, all lights except the oil pressure LED (2) (which stays on until engine is started up) will go out and the display will show:

- total distance covered in kilometres (3);
- fuel level (4);
- coolant temperature (5) [characters "----" are displayed until coolant warms up to 35° C (95° F)];
- time (hours and minutes format) (6).



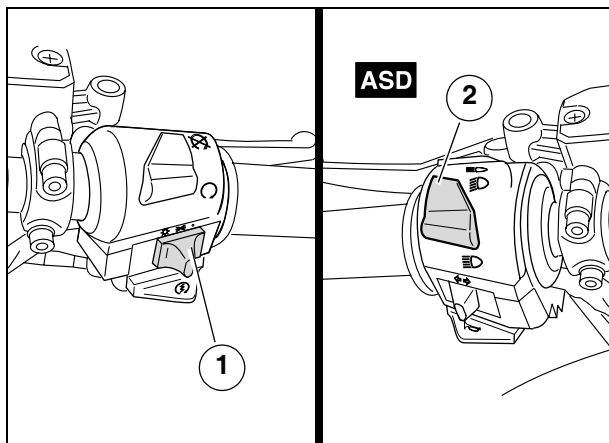
2.3.3 INSTRUMENT PANEL LIGHT INTENSITY

There are three different settings available for instrument panel light intensity: 100%; 60%; 25%.

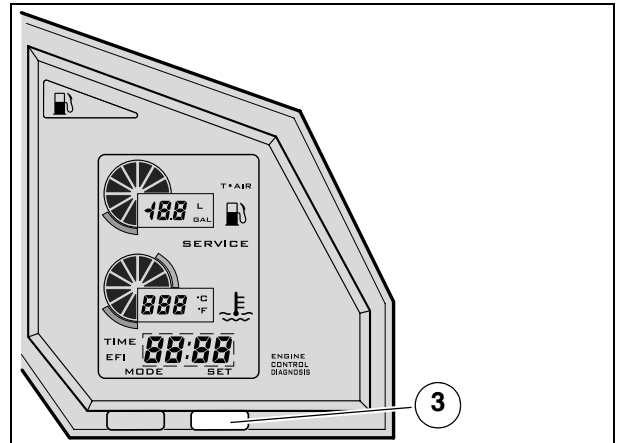
How to set:

- ◆ Set the light switch (1) to " ";
- ◆ **ASD** Set the light dip switch " " - " " (2) to " ".

NOTE Three seconds after the last selection, the **SET** button will revert to odometer/trip meter toggle mode.



- ◆ Set the ignition switch to " \odot " and press the **SET** button (3) repeatedly within the next three seconds to try out the three light settings.
- ◆ Select the desired lighting intensity.



2.3.4 HOW TO TOGGLE BETWEEN ODOMETER/TRIP METER

Left-hand display

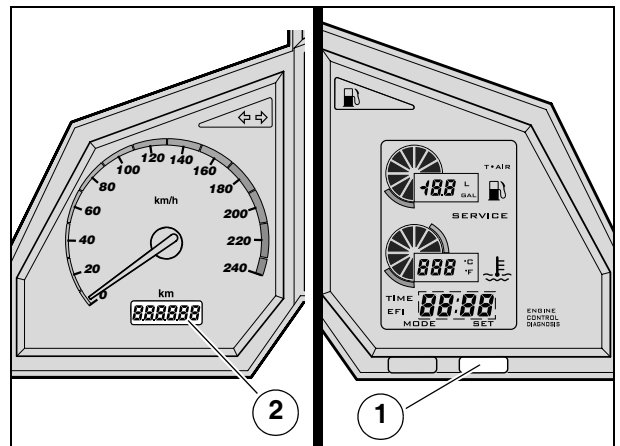
- ◆ Press and release the **SET** button (1). The display will toggle between odometer and trip meter mode, that is, show the motorcycle's total mileage (in kilometres or miles) or the distance covered since the trip meter was last reset.

NOTE Whenever the ignition switch is set to " \odot ", the display will revert to odometer mode (total mileage).

The trip meter is reset to zero as follows:

- ◆ Set display to trip meter mode (see above).
- ◆ Hold down the **SET** button (1) for over three seconds and all segments (2) will be reset to zero.

NOTE The trip meter will reset automatically each time the battery is removed from the vehicle.



2.3.5 MEASUREMENT UNITS (KM/MI, L /GAL, °C/°F)

⚠ WARNING

Measurement units such as km/mi, l /gal, °C/°F are set at the factory depending on country of destination. Factory setting cannot be modified.

2.3.6 SETTING THE CLOCK (HOURS AND MINUTES)

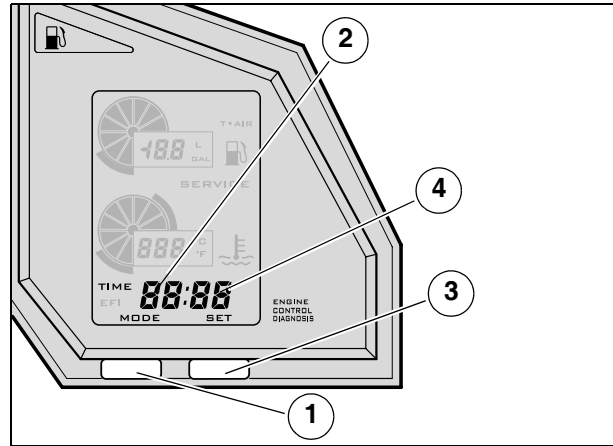
NOTE The clock can only be set when the motorcycle is at standstill.

- ◆ Hold down the **MODE** button (1) for over three seconds. The hour segments (2) will start to flash.

NOTE Press and release the **SET** button (3) alternately to change hours in one-unit increments. Hold down the **SET** button (3) to cycle through hours quickly.

- ◆ Press the **SET** button (3) and set hours.
- ◆ Press and release the **MODE** button (1) to confirm. The minute segments (4) will start to flash.
- ◆ Press the **SET** button (3) and set minutes.
- ◆ Press and release the **MODE** button (1) to confirm.


NOTE The clock will reset automatically whenever the battery is removed from the vehicle.




2.3.7 INSTRUMENT AND INDICATOR CHART

Description		Function
Direction indicator LED light	↔	Flashes when a direction indicator is operated.
High beam LED light	☰	Comes on when headlamp high beam is turned on or when the high beam flasher is operated.
Rev. meter (rpm)		Gives engine speed in rpm. ⚠ WARNING Never exceed maximum engine rpm.
Fuel reserve LED light	🛢	Comes on when fuel level in the tank drops to 4 ± 1 l. Refuel as soon as possible when this light comes on.
Side stand LED light	🦶	Comes on when the side stand is down.
Oil pressure LED light	🛢	Comes on whenever the ignition switch is set to "🔌" and the engine is stopped to test LED operation. ⚠ WARNING If the oil pressure LED "🛢" stays on after engine has been started up, or comes on while the engine is running, it means that pressure in the engine oil circuit is too low.
Neutral LED N light		Comes on when gearbox is in neutral.
Diagnostics LED light	EFI	Comes on and stays on for about three seconds whenever the ignition switch is set to "🔌" to test LED operation. ⚠ WARNING The diagnostics LED "EFI" will flash to indicate that the on-board computer has detected some failure event. This may occur while the engine is running or as soon as the ignition switch is operated. Normally, the engine will keep running though performance may be somewhat impaired. The wording "EFI" only lights up on the multifunction digital display during service inspections by Aprilia Franchised Dealers.
Speedometer (kph)		Gives road speed.

CONTINUED ➤

Description		Function	
Digital display (left-hand side)	Odometer/trip meter (km - mi)	Gives motorcycle's total mileage (in kilometres or miles) or distance covered since last resetting.	
Multifunction digital display (right-hand side)	Fuel level indication 	<p>Gives fuel level in the tank. The display provides both an analogue (scale) and numeric (litres or gallons) indication of fuel quantity. When the tank is full, the total length of the scale is highlighted and a letter "F" appears instead of figures. As fuel level drops, an increasing portion of the scale will go out and the figures (litres or gallons) will decrement. When all segments of the scale are off, flashing "..." characters are displayed instead of fuel quantity and the low fuel LED will start to flash. This means that fuel level has dropped below 4 ± 1 l. Refuel as soon as possible.</p> <p>⚠ WARNING When all segments of the scale are off, flashing figures "8.8" appear instead of fuel quantity and the low fuel LED starts to flash.</p> <p>NOTE The digital sector can be toggled to air temperature indication (T°AIR). The analogue scale is turned off when air temperature is selected.</p>	see 2.3.2 (PROGRAMMING BUTTONS) for instructions on how to toggle between indications.
Multifunction digital display (right-hand side)	Air temperature indication T°AIR	<p>Air temperature indication. Temperature is displayed in the numeric sector (indication in figures). When temperature drops below -20 °C (-4 °F), characters "..." are displayed; as long as temperature is between -20 °C (-4 °F) and 50 °C (122 °F), the exact temperature indication is displayed; when temperature rises above 50 °C (122 °F), the number "50" ("122") is displayed.</p> <p>⚠ CAUTION When temperature is 3 °C (37.4 °F) or less, the digital display indication will start to flash to warn against possible ice. When this is the case, drive at moderate speed, apply the brakes gently and avoid any manoeuvres that may put the motorcycle into a skid. When temperature drops to or below 3 °C (37.4 °F), the display will give a flashing air temperature indication for ten seconds (even if temperature has risen back above 3 °C (37.4 °F) in the meantime). If temperature stays below 3 °C (37.4 °F), the flashing temperature indication will be repeated for three times at five minutes' intervals.</p> <p>⚠ WARNING</p> <p>Note After each flashing sequence, the display will revert to current selection (fuel level or air temperature).</p>	see 2.3.2 (PROGRAMMING BUTTONS) for instructions on how to toggle between indications.

CONTINUED ►

Description		Function	
Multifunction digital display (right-hand side)	Coolant temperature indication (°C / °F) 	Shows engine coolant temperature, see 2.3.2 (PROGRAMMING BUTTONS). The display provides both an analogue (scale) and numeric (°C/°F) temperature indication. Characters "---" are displayed until coolant heats up to 35 °C (97 °F). ⚠ WARNING The cooling fans operate independently of the ignition switch. Whether the engine is running or not, the cooling fans will switch on and off automatically whenever needed. Exceeding the maximum temperature allowed (125 °C or 257 °F) may lead to severe engine damage. If displayed temperature is 116 - 125 °C (241 - 257 °F) and the second last segment of the indicator scale is flashing, stop the engine. Wait for the cooling fans to switch off and check coolant level, see 2.14 (COOLANT CHANGE). When temperature reading is 126 - 135 °C (259 - 275 °F) and the last two segments of the indicator scale are flashing, stop the motorcycle and let the engine idle for a couple of minutes. This will allow coolant to circulate throughout the cooling system. Set the engine kill switch to "⊗" and check coolant level, see 2.14 (COOLANT CHANGE). Do not ride if coolant temperature indication has not gone back to normal after checking level.	see 2.3.2 (PROGRAMMING BUTTONS) for instructions on how to toggle between indications.
	"SERVICE" prompt	A wording "SERVICE" is displayed after the first 1000 km (625 mi) and then every 7500 km (4660 mi). Perform maintenance as specified in the periodic maintenance chart, see 2.1.1 (PERIODIC MAINTENANCE CHART).	
	Clock	Displays time in hours and minutes as pre-set, see 2.3.2 (PROGRAMMING BUTTONS).	

2.4 BATTERY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully .

There are two types of batteries available in the market:

- batteries that **require maintenance**, fitted with cell plugs;
- **maintenance-free** batteries, which have **no** cell plugs as they do not need inspecting or topping-up.

NOTE This motorcycle is fitted with a maintenance-free battery which seldom needs inspecting and may need charging from time to time.

If necessary, replace with a battery of the same type.

See 6.14 (BATTERY) for more details.

WARNING

Be sure to connect each battery lead to the matching terminal.

Set the ignition switch to "⊗" before connecting or disconnecting the battery.

Connect the positive (+) lead first, and then the negative (-) lead.

Disconnect in the reverse order.

NOTE Check battery voltage using a hand-held tester. The battery needs charging when voltage is less than 12V.

When voltage drops below 8V, the on-board computer will not work and will inhibit engine operation.

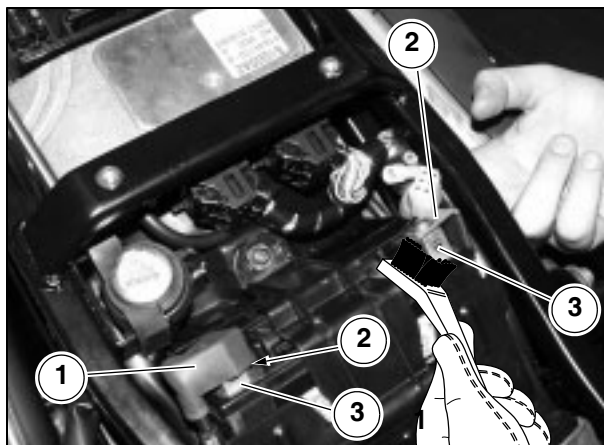
2.4.1 CLEANING AND CHECKING BATTERY TERMINALS AND LEAD CONNECTIONS

Read 2.4 (BATTERY) carefully.

- ◆ Ensure the ignition switch is in the "⊗" position.
- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Slide the red protective cap (1) aside.
- ◆ Check that battery lead connections (2) and battery terminals (3) are:
 - in good condition (free from corrosion or any deposits);
 - coated with neutral grease or vaseline.


If needed:

- ◆ Disconnect the negative (-) and positive (+) leads in the order.
- ◆ Clean off corrosion deposits using a wire brush.
- ◆ Reconnect the positive (+) and negative (-) leads in the order.
- ◆ Coat battery lead connections and terminals with neutral grease or vaseline.
- ◆ Refit the seat, see 7.1.2 (REMOVING THE RIDER SEAT).



2.4.2 CHARGING THE BATTERY

Read 2.4 (BATTERY) carefully.

NOTE You can tell that the battery is nearly flat when you hear a rattling sound from the starter relay when pressing the starter button .

Do not remove the battery plugs or the battery may damage.

- ◆ Remove the battery, see 7.1.7 (BATTERY REMOVAL).
- ◆ Be sure to have a suitable battery charger ready at hand.
- ◆ Set the battery charger to the desired charge rate (see chart below).
- ◆ Connect the battery to the battery charger.

CAUTION

Charge or use the battery in a well-ventilated place. Do not inhale the gases produced by the battery under charging.

- ◆ Switch on the battery charger.

Charge rate	Amperes	Time (hrs)
Regular	1.2	8 - 10
Fast	12	0.5

CAUTION

The battery keeps producing gases for some time after the battery charger has been switched off. Allow 5-10 minutes before proceeding to refit the battery.

2.4.3 LONG INACTIVITY

Read 2.4 (BATTERY) carefully.

WARNING

When the motorcycle is to be left unused for over twenty days, disconnect the 30-Amp fuses, otherwise the multifunction computer will keep drawing current and the battery will deteriorate.

Disconnecting the 30-Amp fuses will reset the digital clock and red line setting.

See 2.3 (MULTIFUNCTION COMPUTER) for instructions on how to set these functions again.

When the vehicle is left unused for over a fortnight, charge the battery to avoid sulphation, see 2.4.2 (CHARGING THE BATTERY).

- ◆ Remove the battery, see 7.1.7 (BATTERY REMOVAL) and store it in a cool, dry place.

To avoid degradation in the wintertime or while the motorcycle is stored away, check battery charge at regular intervals (monthly).

- ◆ Charge the battery fully at normal charge rate, see 2.4.2 (CHARGING THE BATTERY).

NOTE If you are leaving the battery fitted in the motorcycle, disconnect the leads from the terminals.

2.5 ELECTRIC COMPONENTS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Inspect after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

- ◆ Put the motorcycle on the stand.
- ◆ Check all lights for proper operation.
- ◆ Check for proper beam setting, see 6.17 (BEAM HEIGHT SETTING) and 6.18 (BEAM CENTRING).
- ◆ Ensure all connectors are fitted securely in place.
- ◆ Ensure switches are properly fastened and check for proper operation:
 - see 6.8.5 (SIDE STAND SWITCH TEST);
 - see 6.8.7 (TESTING THE SAFETY LOCKOUT SYSTEM SWITCHES).
- ◆ Ensure the air and speedometer sensors are properly fastened and check for proper operation.

WARNING

The sensing area of the sensors must be kept clean. Any mud, dirt deposits, etc. will lead to misreading.

2.6 JUMP-STARTING

Read 2.4 (BATTERY) carefully.

⚠ CAUTION

Jump-starting should be the last resort when the battery is low or dead and cannot be recharged. Do not attempt to start the engine by pushing or towing the motorcycle. The battery of the vehicle that is providing the jump-start must have the same rating as the dead vehicle battery (12V - 12 A, see rating data on battery). Observe the instructions provided below closely or the battery may explode, causing personal injury or damage to property (the electric components of both vehicles might damage).

- ◆ Ensure that the ignition switch is set to "⊗".
- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).

NOTE Do not disconnect the battery leads of the vehicle that is being jump-started.

⚠ WARNING

Never touch the connectors of the different leads or cables together.

- ◆ Slide the red protective cap (1) aside.
- ◆ Attach one jumper cable to the positive (+) terminal of the battery in the starting vehicle (A). Attach the other end of the jumper cable to the positive (+) terminal of the dead vehicle battery (B).
- ◆ Attach the other jumper cable to the negative (-) terminal of the battery in the starting vehicle (A). Attach the other end of the jumper cable to the frame of the vehicle that is being jump-started (B) to provide a ground connection. Select a location well away from the battery.

DO NOT CONNECT ANY CABLES TO THE NEGATIVE (-) TERMINAL.

⚠ CAUTION

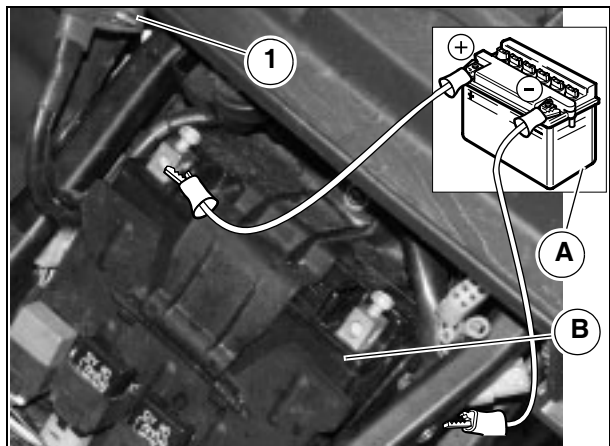
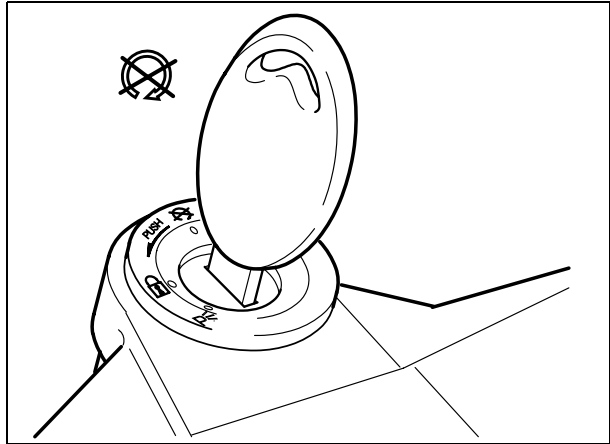
Route the jumper cables well away from any moving parts of either vehicles.

NOTE It is not necessary to stop the engine of the starting vehicle during the jump-starting procedure.

- ◆ Jump-start the dead vehicle.

NOTE If the engine of the dead vehicle does not start right away, stop trying after 10 seconds and wait about one minute before trying again. When the engine starts, keep both vehicles' engines running for about two minutes.

- ◆ Stop both engines and disconnect the jumper cables in reverse order.



2.7 SPARK PLUGS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check the spark plugs every 7500 km (4687 mi) or 8 months. Change them every 15000 Km (9375 mi) or 16 months.

At regular intervals, remove the spark plugs and clean off any carbon deposits or replace them as required.

If the motorcycle is used in competition trials, change spark plugs every 7500 Km (4687 mi).

In order to gain access to the spark plugs:

⚠ CAUTION

Allow the engine to cool down completely before proceeding.

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).

NOTE The motorcycle is fitted with two spark plugs per cylinder.

The procedure outlined below applies to all spark plugs.

Removal and cleaning.

⚠ CAUTION

Never remove a spark plug cap while the engine is running. Shock hazard: the ignition system produces high voltages.

- ◆ Pull the spark plug cap (1) off the spark plug (2).
- ◆ Remove any traces of dirt from the spark plug base.
- ◆ Fit the suitable spark plug tool (supplied with the tool kit) to the spark plug.
- ◆ Fit the 13-mm fork key (supplied with the tool kit) to the hexagon of the spark plug tool.
- ◆ Unscrew and extract the spark plug. Ensure that no dust or foreign matter fall into the cylinder.

⚠ WARNING

This motorcycle uses spark plugs with platinum electrodes.

Do not clean with wire brushes and/or abrasive compounds. Clean with compressed air only.

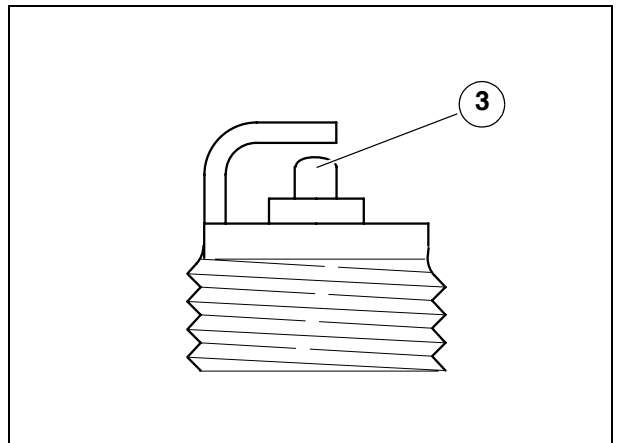
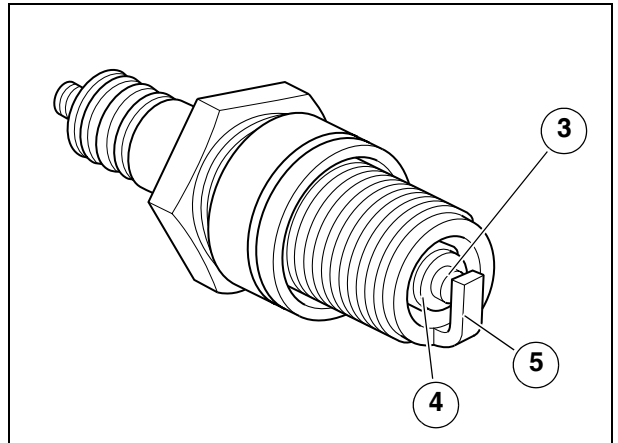
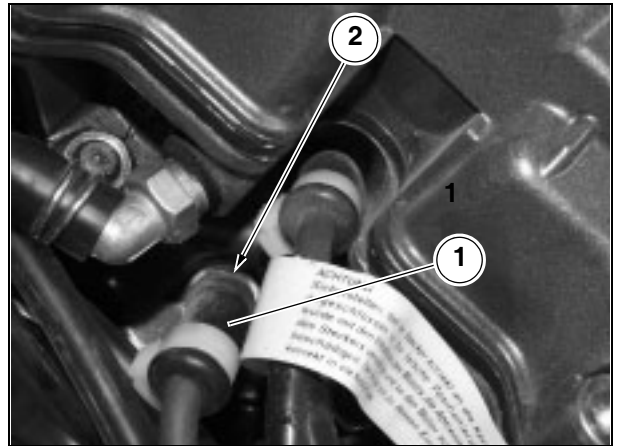
- central electrode (3);
- insulator (4);
- side electrode (5).

- ◆ Check electrodes and insulating material for carbon deposits or corrosion. Blow with an air line if needed.

A spark plug must be changed when: the insulator is cracked; the electrodes show traces of corrosion or exceeding deposits; the tip of the central electrode (3) is worn away and has achieved a radiused contour (see diagram).

Replace with recommended spark plugs only.

**Recommended spark plugs:
NGK R DCPR9E**



⚠ WARNING

Ensure that the replacement spark plug is the suitable length and thread.

A short thread will cause carbon to build up on the thread in the head. When you fit a proper spark plug at a later time, the engine will damage.

Use recommended spark plugs only. A spark plug of the wrong grade may shorten engine life and cause loss of performance.

Use a wire feeler gauge (see diagram) to check air gap between electrodes. Any other tool will damage the platinum coating of the electrodes.

- ◆ Check the electrode gap with a wire feeler gauge. Electrode gap should be 0.6 – 0.7 mm. If it needs adjusting, bend the earth electrode carefully.
- ◆ Make sure the washer is in good condition. Fit the washer and screw the spark plug finger-tight to avoid damaging the thread.
- ◆ Tighten using the supplied tool. Screw in each spark plug by one half turn to compress the washer.



Torque wrench setting for spark plugs: 20 Nm (2.0 kgm).

⚠ WARNING

It is essential to tighten the spark plugs properly. A loose spark plug will cause engine overheating and result in severe damage.

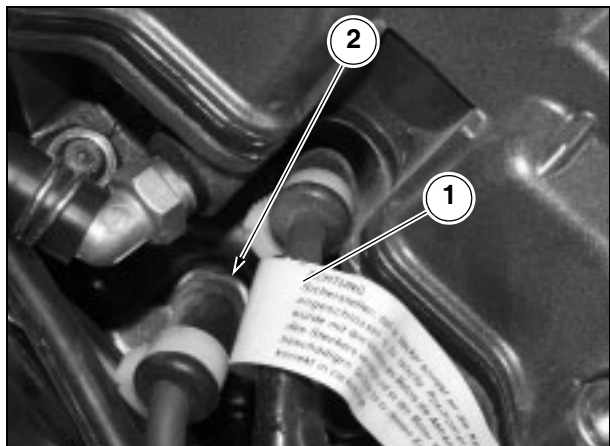
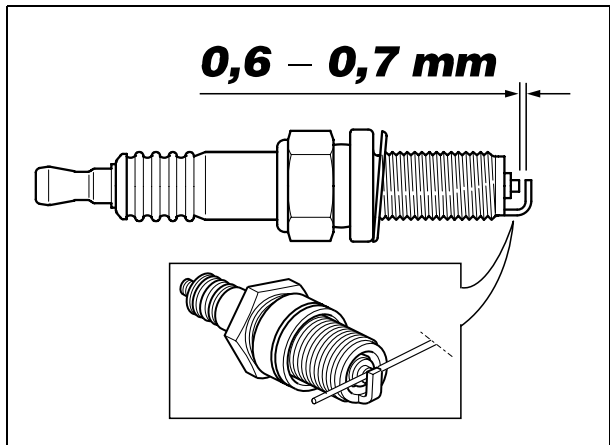
NOTE When reassembling, take care to route the leads of the rear cylinder spark plugs inboard of oil breather hose.

- ◆ Refit the spark plug cap (1) securely onto the spark plug (2), so that it will not work itself loose when exposed to engine vibration.

⚠ CAUTION

Ensure the spark plug cap (1) is properly in place on the spark plug (2).

- ◆ Refit the fuel tank.



2.8 DRAINING THE FUEL TANK

Read 1.2.1 (FUEL) carefully.

CAUTION

Fire hazard.

Allow the engine and exhaust silencers to cool down completely.

Fuel vapours are harmful to human health.

Ensure that the area is properly ventilated before proceeding.

Do not inhale fuel vapours.

Do not smoke or use bare flames.

Do not release fuel into the environment.

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Prepare a container of more than adequate capacity to contain the amount of fuel in the tank. Place the container on the floor on the right-hand side of the motorcycle.

NOTE Before proceeding, be sure to have a hose equipped with a female quick-disconnect fitting ready at hand.

- ◆ Place the free end of the hose into the container you have prepared previously.
- ◆ Fit the female quick-disconnect fitting to the male quick-disconnect fitting (1). The fuel will start to flow out right away.
- ◆ Open the filler cap.
- ◆ Wait until all fuel has drained out of the fuel tank.

Once the fuel tank is empty:

- ◆ Disconnect the hose female fitting from the male fitting (1) by pressing the release button.
- ◆ Refit the fuel tank.
- ◆ Refit the filler cap.



2.9 AIR CLEANER

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check the air cleaner every 7500 km (4687 mi) or 12 months. Change it every 15000 km (9375 mi) or more frequently when you ride on dusty or wet roads.

In this case, clean the air cleaner after each ride following the procedure described below.

⚠ WARNING

Cleaning the filter does not eliminate the need to change the filter at the specified intervals. Do not start the engine when the air cleaner is not in place. Do not clean the filter element with petrol or solvents. These products may cause the fuel to ignite in the fuel system, leading to personal injury and vehicle damage.

NOTE To give access to the cap (1), remove the left-hand side fairing.

- ◆ Every 7,500 km (4,687 mi), remove the cap (1), drain the contents into a container and dispose of it at a collection point.



REMOVAL

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Release and remove the eight retaining screws (2) of the air box cover (3).



Torque wrench setting for screws (2): 3 Nm (0.3 kgm).

- ◆ Take off the air box cover (3).
- ◆ Release and remove the six screws (4).



Torque wrench setting for screws (4): 3 Nm (0.3 kgm).

- ◆ Remove the air cleaner cage (5) with air cleaner (6).
- ◆ Extract the air cleaner (6).
- ◆ Remove the airbox mount (7).

⚠ WARNING

Clean the air cleaner housing thoroughly, taking care to remove any foreign matter. Block off the intake funnels of the throttle body and the air cleaner housing with clean cloths to prevent the ingress of dirt.

On refitting, ensure the cloth or any other objects have been removed from inside the air cleaner housing (8) before installing the air box cover (3).

Make sure the air cleaner is correctly positioned or it will let unfiltered air into the system.

Note that early wear of piston rings and cylinder is frequently due to a defective or badly positioned air cleaner.

CLEANING THE FILTER ELEMENT

⚠ WARNING

Do not use a screwdriver or any other tools on the air cleaner.

- ◆ Hold the air cleaner (6) in a vertical position and tap it repeatedly on a clean bench.
- ◆ If needed, blow the air cleaner (6) with an air line. Aim the gun from the inside of the meshing outwards.

⚠ WARNING

Check the air cleaner for damage while cleaning. Always replace a torn air cleaner.

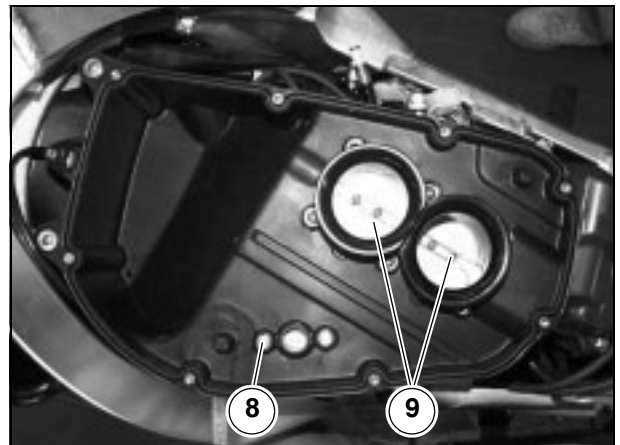
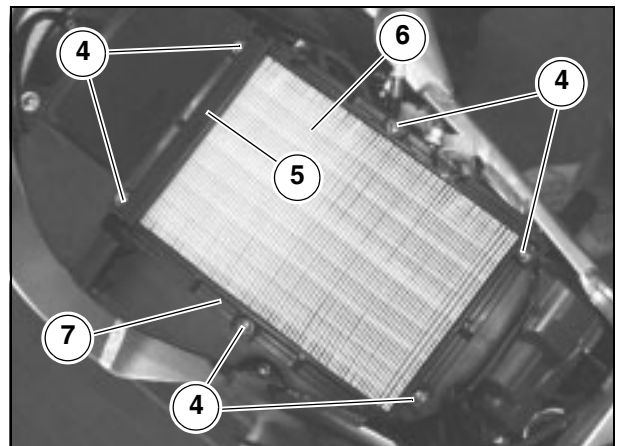
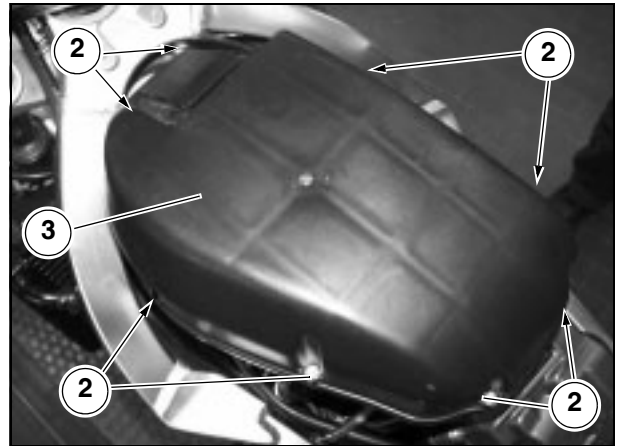
- ◆ Clean the outer surface of the air cleaner (3) with a clean cloth.
- ◆ Clean the inner surface of the housing (8) with a clean cloth.
- ◆ Clean the intake ducts (9).

REPLACEMENT

⚠ WARNING

Never reuse an air cleaner.

- ◆ Replace the air cleaner (6) with a new air cleaner of the same type.



2.10 THROTTLE

Inspect after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

2.10.1 CHECKING FOR THROTTLE PROPER OPERATION

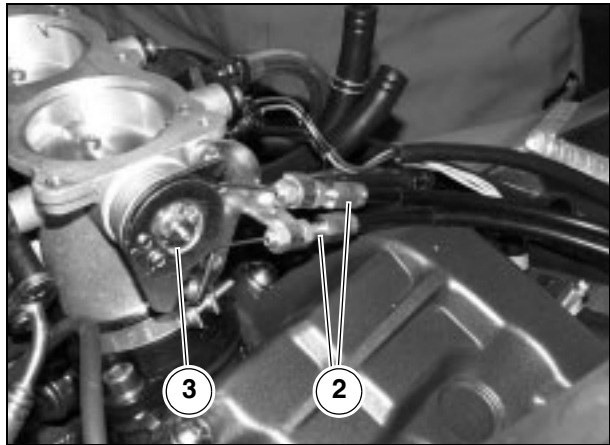
⚠ CAUTION

Throttle operation may be impaired when the throttle cables are damaged, bent in tight turns or twisted. Using the motorcycle in this condition may lead to loss of control while riding.

Turn the handlebars and ensure that idling speed is unaffected by handlebar movement. Open the throttle and ensure that the twistgrip snaps closed smoothly when released.

If needed:

- ◆ Make sure the components listed below are in the proper position and well lubricated:
 - cable housing;
 - twistgrip adjuster (1);
 - throttle body adjusters (2);
 - throttle body axle (3);
 - cable end-caps;
 - throttle control.
- ◆ Check throttle cable play adjustment, see 2.10.3 (THROTTLE CABLE PLAY ADJUSTMENT).



2.10.2 IDLING ADJUSTMENT

Manual adjustment for idling speed is not provided.

Idling is adjusted automatically through a stepper motor (1) that operates a small piston inside an air passage.

The position of the piston inside the air passage is determined by the on-board computer according to three parameters:

- throttle position;
- engine rpm;
- coolant temperature.



2.10.3 THROTTLE CABLE PLAY ADJUSTMENT

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Inspect after the first 1000 km (625 mi) and every 7500 km (4687 mi) afterwards.

Periodically inspect the throttle cables.

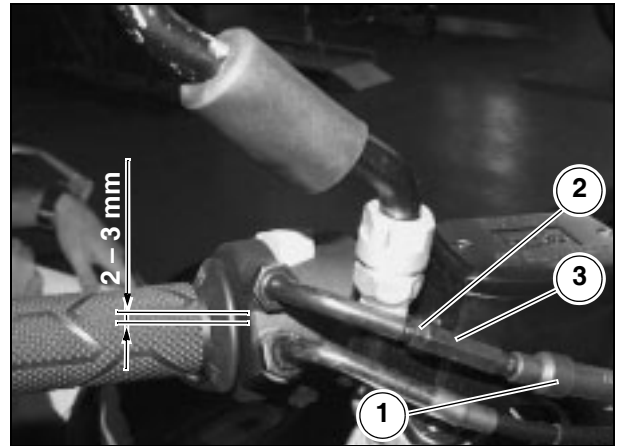
There should be **2–3 mm** free play in the throttle twistgrip cable (measured at twistgrip edge).

If not so:

- ◆ Place the motorcycle on the stand.
- ◆ Take off the rubber gaiter (1).
- ◆ Loosen the locknut (2).
- ◆ Rotate the adjuster (3) until setting the specified free play.
- ◆ After adjusting, tighten the locknut (2) and check free play again.
- ◆ Refit the rubber gaiter (1).

⚠ WARNING

Turn the handlebars and ensure that idling speed is unaffected by handlebar movement. Open the throttle and ensure that the twistgrip springs back to the closed position smoothly when released.



2.11 CHECKING AND TOPPING UP ENGINE OIL LEVEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.2 (ENGINE OIL) carefully.

Check engine oil level at regular intervals. Change oil after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards, see 2.12 (ENGINE OIL AND FILTER CHANGE).

Check oil level as follows:

NOTE Place the motorcycle on firm and level ground and put it on the side stand.

⚠ WARNING

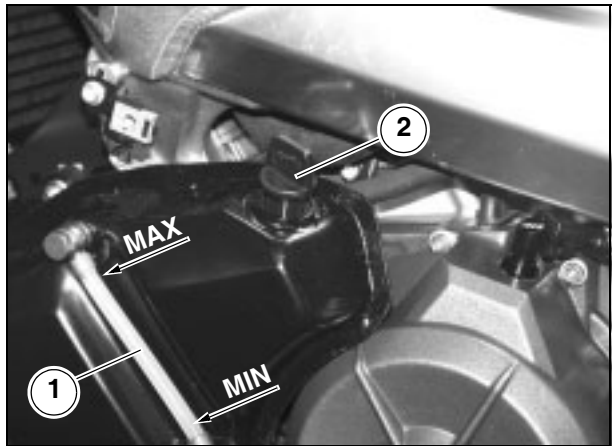
Check engine oil level when the engine is hot. Oil level is lower in a cold engine than in operation and may temporarily drop below "MIN". This is acceptable, unless the oil pressure LED "🛡" is on.

NOTE Do not let the engine idle with the motorcycle standing to warm up the engine and heat up oil to operating temperature. Perform this check after a trip or take a short ride outside town. Normally, covering 15 km (9.5 mi) will be enough to warm up engine oil to operating temperature.

- ◆ Stop the engine.
- ◆ Keep the motorcycle upright with both wheels on the ground.
- ◆ Check oil level in the oil clear hose (1).

MAX = maximum level;
MIN = minimum level.

- ◆ The difference between the "MIN" and "MAX" levels is about 500 cu cm.
- ◆ Correct level is just below the "MAX" mark.



⚠ WARNING

Do not overfill (beyond the "MAX" mark) or let level drop below the "MIN" mark, as this will cause severe engine damage.

Do not add any additives or other products. If you are using a funnel or other tool, ensure that it is perfectly clean.

If needed, top up oil level as follows:

- ◆ Release and remove the filler cap (2).
- ◆ Adjust to correct level, see 1.6 (LUBRICANT CHART).

⚠ WARNING

Do not add any additives or other products. If you are using a funnel or other tool, ensure that it is perfectly clean.

2.12 ENGINE OIL AND FILTER CHANGE

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.2 (ENGINE OIL) carefully.

Check engine oil level at regular intervals. Change oil after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards, see 2.12 (ENGINE OIL AND FILTER CHANGE).

⚠ WARNING

Oil should be changed more frequently when riding in dusty conditions.

On motorcycles used for competition trials, change oil every 3750 km (2343 mi).

OIL AND FILTER CHANGE

NOTE Oil flows more easily when warm. Let the engine warm up for about twenty minutes to facilitate total drainage.

⚠ CAUTION

In order to avoid burns, allow the engine and silencer to cool down completely before proceeding to change oil and filter.

NOTE Place the motorcycle on firm and level ground.

- ◆ Remove the radiator spoiler, see 7.1.24 (REMOVING THE LOWER SUMP GUARD).
- ◆ Place a container (1) under the drain plug (2) located on the tank (3). Container capacity should be greater than 4000 cu cm.
- ◆ Release and remove the drain plug (2) located on the tank (3).
- ◆ Release and remove the filler cap (4).
- ◆ Drain the oil into the container (1). Let the last of the oil drip out for several minutes.
- ◆ Inspect the sealing washer of the drain plug (2) located on the tank (3) and replace it if needed.
- ◆ Refit and tighten the drain plug (2).



Torque wrench setting for drain plug (2): 15 Nm (1.5 kgm).

- ◆ Place the container (1) under the crankcase, under the engine drain plug (5).
- ◆ Undo and remove the engine drain plug (5).
- ◆ Drain the oil into the container (1). Let the last of the oil drip out for several minutes.

⚠ WARNING

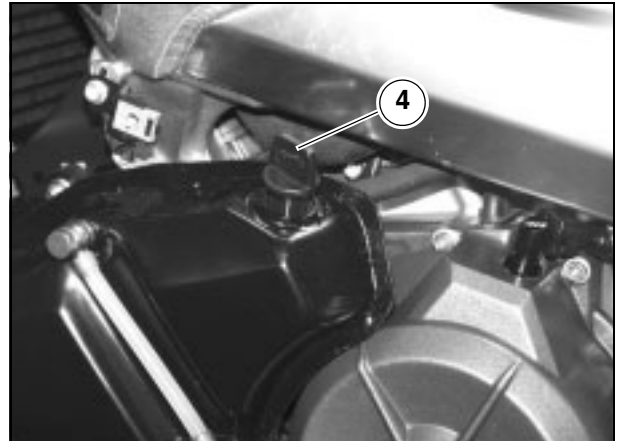
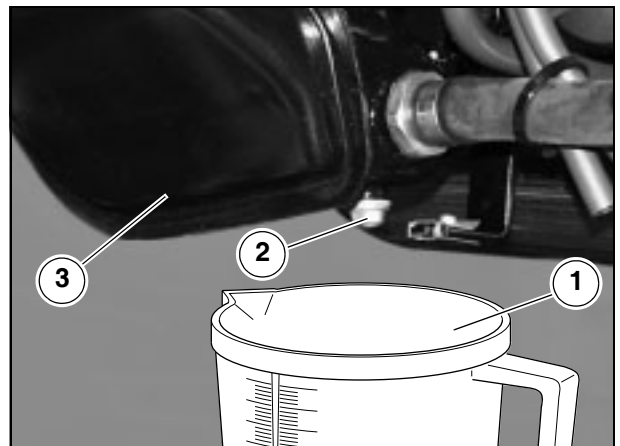
Do not release oil into the environment.

Dispose of oil through a waste oil reclamation firm.

- ◆ Clean off any metal debris sticking to the drain plug (5) magnet. Refit and tighten the plug.



Torque wrench setting for drain plug (5): 20 Nm (2.0 kgm).



ENGINE OIL FILTER CHANGE

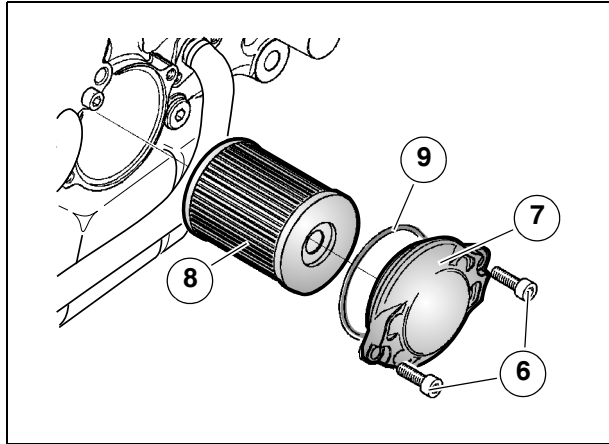
Change the engine oil filter after the first 1000 km (625 mi) and every 7500 km (4687 mi) afterwards (or at each oil change).

- ◆ Release the two screws (6) and remove the guard (7).
- ◆ Remove the engine oil filter (8).

⚠ WARNING

Never reuse an oil filter.

- ◆ Spread a film of oil on the seal (9) of the new engine oil filter.
- ◆ Insert the new oil filter.
- ◆ Refit the guard (7). Refit and tighten the two screws (6).

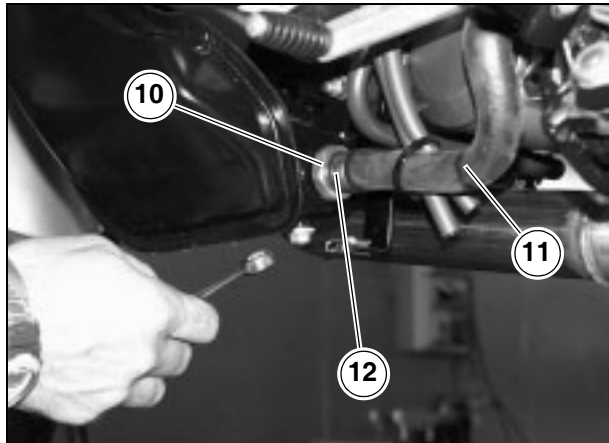


CLEANING THE ENGINE OIL FILTER LOCATED ON THE TANK

Clean the engine oil filter (10) located on the tank every 15000 km (9375 mi) (or every two oil changes).

NOTE Make sure you have the special clip pliers (part no. 0277295) ready at hand. Change all clips when reassembling (use clips of the same type as the original).

- ◆ Slacken the clip (12) and disconnect the hose (11).
- ◆ Release and remove the engine oil filter (10) located on the tank and clean with an air line.
- ◆ Inspect the seal of the engine oil filter (10) located on the tank. Screw in the oil filter and tighten.



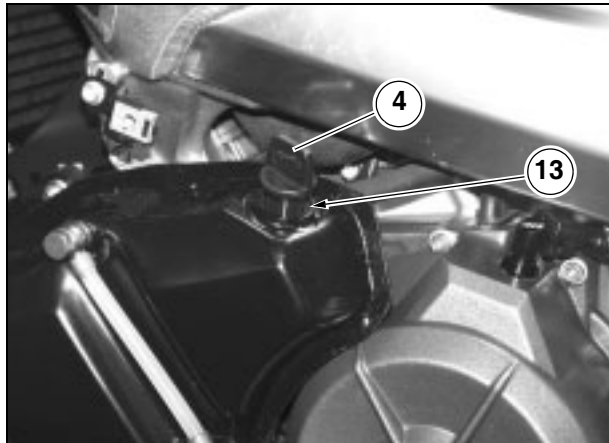
Torque wrench setting for engine oil filter (10) located on the tank: 30 Nm (3.0 kgm).

- ◆ Connect the hose (11). Fit a new clip and tighten.

⚠ WARNING

Do not add any additives or other products. If you are using a funnel or other tool, ensure that it is perfectly clean.

- ◆ Pour about 3500 cu cm of engine oil through the filler opening (13), see 1.6 (LUBRICANT CHART).
- ◆ Refit and tighten the filler cap (4).
- ◆ Start the engine and keep it idling for about one minute to let oil fill all points of the circuit.
- ◆ Check oil level and top up if needed, see 2.11 (CHECKING AND TOPPING UP ENGINE OIL LEVEL).



2.13 CHECKING AND TOPPING UP COOLANT LEVEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.5 (COOLANT) carefully.

Check coolant level before each ride. Change coolant every 2 years.

⚠ WARNING

Check and top up coolant level when the engine is cold.

- ◆ The engine should be off and completely cold.

NOTE Place the motorcycle on firm and level ground.

- ◆ Keep the motorcycle upright with both wheels on the ground.
- ◆ Look through the slot to ensure that coolant level in the expansion reservoir (1) is between the "FULL" and "LOW" marks.

FULL = maximum level

LOW = minimum level

If not so:

- ◆ Release and remove the filler cap (2).

⚠ CAUTION

Coolant is toxic when ingested; contact with eyes or skin may cause irritation.

Do not put your fingers or any tools into the filler opening to check coolant level.

⚠ WARNING

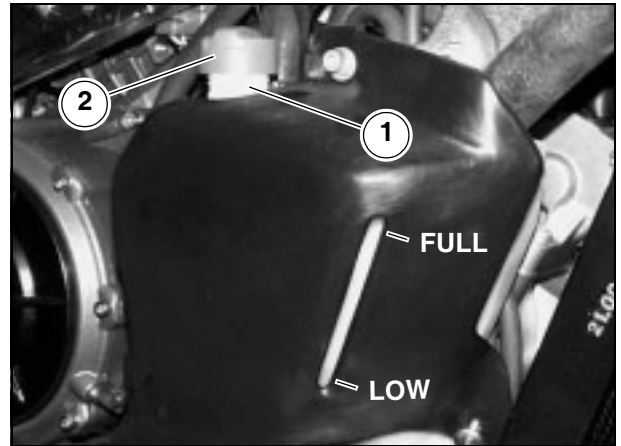
Do not add any additives or other products.

If you are using a funnel or other tool, ensure that it is perfectly clean.

- ◆ Add coolant mixture until bringing level just below the "FULL" mark, see 1.6 (LUBRICANT CHART) for coolant specifications.
- ◆ Never overfill (top up beyond the "FULL" mark), or coolant will leak out when the engine is running.
- ◆ Refit the filler cap (2).

⚠ WARNING

In the event the motorcycle is using up exceeding coolant or the expansion reservoir (1) is empty, check the circuit for leaks.

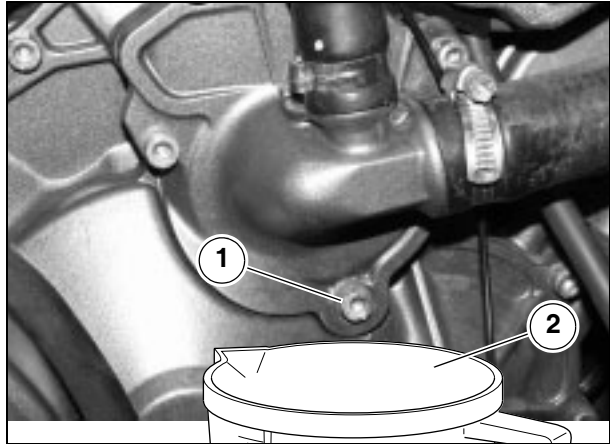


2.14 COOLANT CHANGE

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION), 1.2.5 (COOLANT) and Sect. 5 (COOLING SYSTEM) carefully.

Change coolant every 2 years.

- ◆ Remove both side fairings, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Remove radiator spoiler, see 7.1.23 (REMOVING THE UPPER SUMP GUARD)
- ◆ Remove the expansion reservoir, see 5.6 (REMOVING THE EXPANSION RESERVOIR).
- ◆ Place a container (2) with capacity greater than 2.5 l under the drain plug (1) to collect the coolant.
- ◆ Release and remove the drain plug (1). Collect the aluminium washer.



⚠ WARNING


The coolant in the circuit is under pressure when hot. Do not remove the filler cap (3) while the engine is hot.

- ◆ Remove the filler cap (3) to facilitate drainage.

DO NOT RELEASE COOLANT INTO THE ENVIRONMENT.

NOTE When refitting, smear some LOCTITE® 572 on the threads of the drain plug (1).

- ◆ ★ Refit the drain plug (1) and renew the aluminium washer.

 **Torque wrench setting for drain plug (1): 10 Nm (1 kgm).**

- ◆ Refit the expansion reservoir.
- ◆ Top up coolant level in the expansion reservoir, see 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL).
- ◆ Start the engine and keep it running until the cooling fans switch on. Allow engine to cool down and check coolant level in the expansion reservoir again.
- ◆ Top up if needed, see 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL).

Total quantity:

2.5 litres (including expansion reservoir).

NOTE The cooling system of this motorcycle requires no bleeding.



2.15 CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.4 (BRAKE FLUID) carefully.

Check brake fluid every 7500 km (4687 mi) or 8 months, change it every two years.

⚠ WARNING

Bleed the circuit when the brake lever has exceeding travel or feels soft or whenever you suspect that there might be air trapped in the circuit; see 2.18 (BLEEDING THE BRAKE CIRCUITS).

Plastic or paint-finished parts will damage if brake fluid is spilt on them.

Before each ride, ensure that the brake lines are not twisted or cracked and check the fittings for leaks.

Never top up with or mix different types of silicone or petroleum-based fluids.

Never use brake fluid from containers which have been open or kept in storage for long periods.

Take care to avoid accidental ingress of water or dust into the circuit.

INSPECTION

NOTE Place the motorcycle on firm and level ground.

- ◆ Hold the motorcycle upright with both wheels on the ground.
- ◆ Rotate the handlebars to right full lock so that the fluid in the brake fluid reservoir is level with the rim of the reservoir (1).
- ◆ Check that fluid level in the reservoir is above the "MIN" mark.

MIN = minimum level.

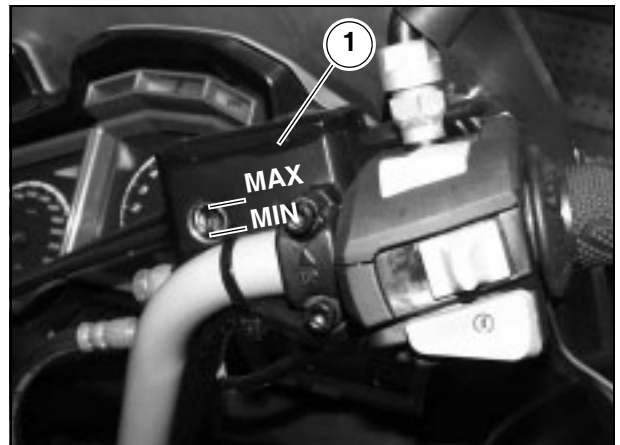
MAX = maximum level.

- ◆ Top up when level is below the "MIN" mark.

⚠ WARNING

Brake fluid level decreases gradually as brake pads wear down.

- ◆ Check brake pads wear, see 2.26 (CHECKING BRAKE PADS FOR WEAR).
- ◆ Unless the brake pads and/or disc need replacing, you may proceed to top up level.



TOP-UP

⚠ WARNING

Danger: brake fluid could leak out.
 Never operate the front brake lever when the screws (2) have been loosened or when the reservoir cover is not in place.

⚠ WARNING

Place a cloth under the brake fluid reservoir to collect any fluid spillage.

- ◆ Release the two screws (2) of the brake fluid reservoir (1) using a short Phillips screwdriver.

⚠ WARNING

Avoid long exposure of brake fluid to air.
 Brake fluid is hygroscopic and will absorb moisture from the air.
 Keep the brake fluid reservoir open JUST LONG ENOUGH to top up level.

- ◆ Lift and remove the cover (3) with the screws (2) in place.
- ◆ Collect the guide cover (4).
- ◆ Remove the seal (5).

⚠ WARNING

Do not rock the motorcycle from side to side when topping up or brake fluid will spill out.

Do not add any additives or other products.

If you are using a funnel or other tool, ensure it is perfectly clean.

NOTE To achieve the "MAX" level, top up to the mark (6) etched inside the brake fluid reservoir (1).

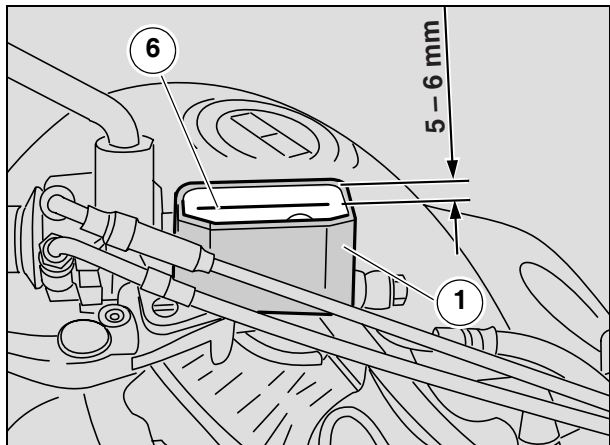
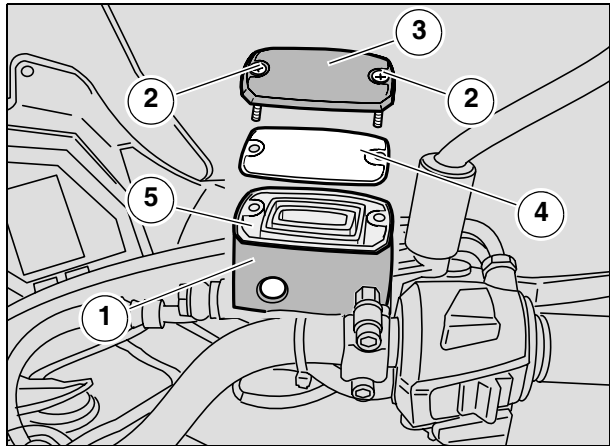
- ◆ Top up the reservoir (1) with brake fluid, see 1.6 (LUBRICANT CHART) until bringing fluid to the correct level.

⚠ WARNING

Do not overfill (top up beyond the "MAX" level). Always renew the brake pads before topping up to "MAX" level.

Do not top up the reservoir up to the "MAX" level when the brake pads are worn down, or fluid will spill out when the brake pads are replaced.

- ◆ Refit the seal (5) into place.
- ◆ Refit the guide cover (4) into place.
- ◆ Refit the cover (3).
- ◆ Fit the screws (2) and tighten.



2.16 CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.4 (BRAKE FLUID) carefully.

Check brake fluid every 7500 km (4687 mi) or 8 months, change it every two years.

⚠ WARNING

Bleed the circuit when the brake lever has exceeding travel or feels spongy or whenever you suspect that there might be air trapped in the circuit; see 2.18 (BLEEDING THE BRAKE CIRCUITS).

Plastic or paint-finished parts will damage if brake fluid is spilt on them.

Before each ride, ensure that the brake lines are not twisted or cracked and check the fittings for leaks.

Never top up with or mix different types of silicone or petroleum-based fluids.

Never use brake fluid from containers which have been open or kept in storage for long periods.

Take care to avoid accidental ingress of water or dust into the circuit.

INSPECTION

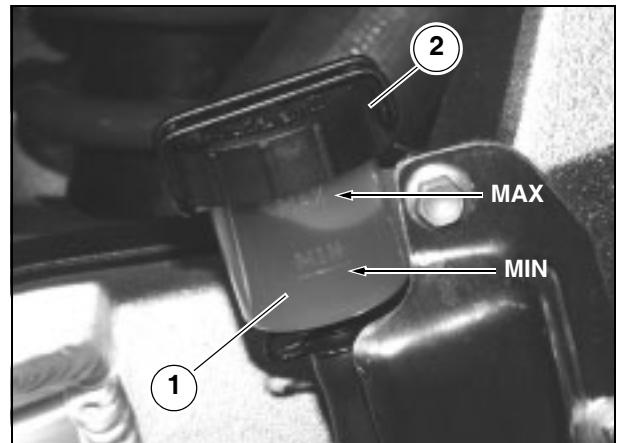
NOTE Place the motorcycle in vertical position so that the fluid level in the reservoir (1) is parallel with the plug (2).

- ◆ Check that fluid level in the reservoir is above the "MIN" mark.

MIN = minimum level.

MAX = maximum level.

- ◆ Top up when level is below the "MIN" mark.



TOP-UP

⚠ WARNING

Danger: brake fluid could leak out.
 Never operate the rear brake lever when the brake fluid reservoir cap has been loosened or is not in place.

⚠ CAUTION

Avoid long exposure of brake fluid to air. Brake fluid is hygroscopic and will absorb moisture from the air.
 Keep the brake fluid reservoir open **JUST LONG ENOUGH** to top up level.

- ◆ Untighten and remove the nut (3).



Torque wrench setting for nut (3): 3 Nm (0,3 kgm).

- ◆ Remove the safety clip (4).

NOTE Ensure that the fluid level is parallel with reservoir edge (in a horizontal position) to avoid spillage.

- ◆ Untighten and remove the plug (2) with seal.

⚠ WARNING

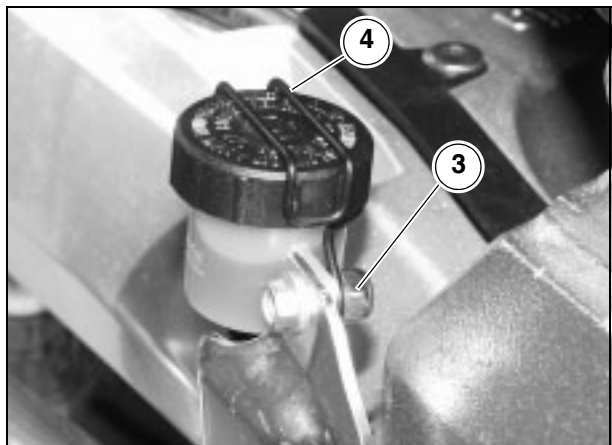
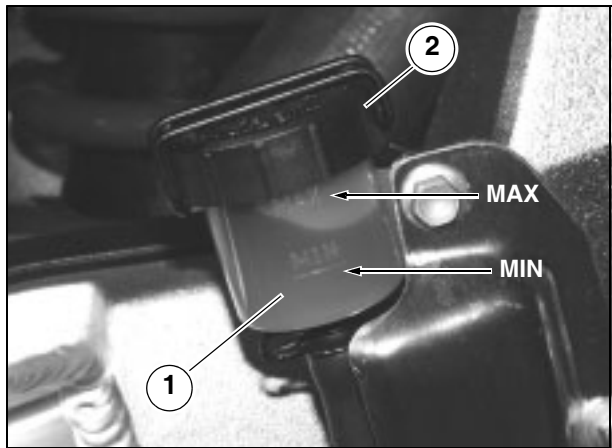
Do not add any additives or other products.
 If you are using a funnel or other tool, ensure it is perfectly clean.

- ◆ Top up the reservoir (1) with brake fluid, see 1.6 (LUBRICANT CHART) until bringing level between the "MIN" and "MAX" marks.

⚠ WARNING

Do not overfill (top up beyond the "MAX" level). Brake fluid level decreases gradually as brake pads wear down. To achieve the correct level, always renew the brake pads before topping up to "MAX" level.

- ◆ Reverse the disassembly procedure to reassemble.



2.17 CHECKING AND TOPPING UP CLUTCH FLUID LEVEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and see 1.2.6 (CLUTCH FLUID) carefully.

Check clutch fluid every 7500 km (4687 mi) or 8 months; change it every two years.

⚠ WARNING

Bleed the circuit when the clutch lever has exceeding travel or feels soft or whenever you suspect that there might be air trapped in the circuit; see 2.19 (BLEEDING THE CLUTCH).

Plastic or paint-finished parts will damage if clutch fluid is spilt on them.

Before each ride, ensure that the clutch lines are not twisted or cracked and check the fittings for leaks.

Never top up with or mix different types of silicone or petroleum-based fluids.

Never use clutch fluid from containers which have been kept open or in storage for long periods.

Take care to avoid accidental ingress of water or dust into the circuit.

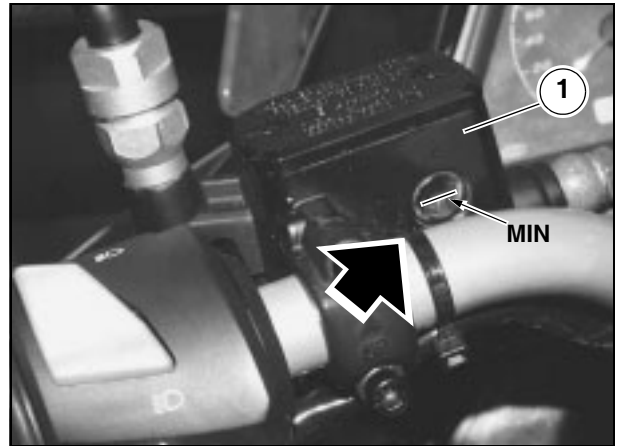
INSPECTION

NOTE Place the motorcycle on the stand.

- ◆ Partially rotate the handlebars to the left so that the fluid level in the reservoir is parallel with the clutch reservoir edge (1).
- ◆ Check that fluid level in the reservoir is above the "MIN" mark.

MIN = minimum level.

- ◆ Top up when level is below the "MIN" mark.



TOP-UP

⚠ WARNING

Danger: clutch fluid could leak out.
Never operate the clutch lever when the clutch fluid reservoir cap has been loosened or is not in place.

⚠ CAUTION

Avoid long exposure of clutch fluid to air.
Clutch fluid is hygroscopic and will absorb moisture from the air.
Keep the clutch fluid reservoir open **JUST LONG ENOUGH** to top up level.

⚠ WARNING

Place a cloth under the clutch fluid reservoir to collect any spillage

- ◆ Release the two screws (2) of the clutch fluid reservoir (1) using a short Phillips screwdriver.

⚠ WARNING

Do not rock the motorcycle from side to side when topping up or clutch fluid will spill out.
Do not add any additives or other products.
If you are using a funnel or other tool, ensure it is perfectly clean.

- ◆ Lift and remove the cover (3) complete with screws (2).
- ◆ Remove the seal (4).

NOTE The "MAX" level is achieved when the sight glass (5) is full. Note that actual level is indicated when the clutch fluid reservoir is level (parallel to the ground).

- ◆ Top up the reservoir (1) with clutch fluid, see 1.6 (LUBRICANT CHART) until bringing level between the "MIN" and "MAX" marks.

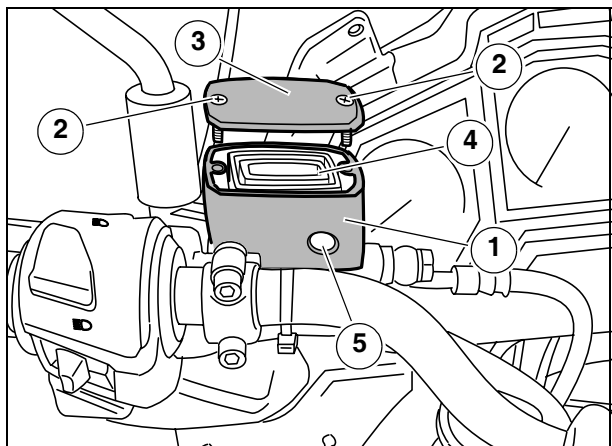
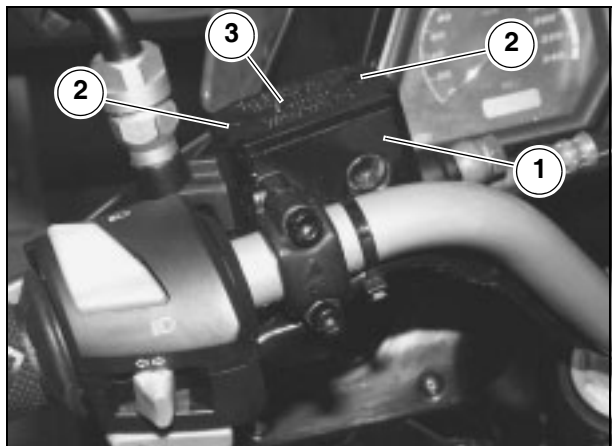
⚠ WARNING

Do not overfill (top up beyond the "MAX" level).

- ◆ Refit the seal (4) in its seat.
- ◆ Refit the cover (3).
- ◆ Fit and tighten the screws (2).

⚠ CAUTION

Check clutch for proper operation.



2.18 BLEEDING THE BRAKE CIRCUITS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.4 (BRAKE FLUID).

See 2.1.1 (PERIODIC MAINTENANCE CHART) for service intervals.

Any air trapped in the hydraulic circuit will act as a cushion and take up most of the pressure applied by the master cylinder. This will hamper the operation of the brake calipers and reduce braking efficiency.

A spongy feel of the brake lever and loss of braking mean that there is air in the circuit.

⚠ CAUTION

This is a dangerous condition that makes the vehicle unsafe to ride. Each time the brakes are removed, it is indispensable to bleed the hydraulic circuit once the brakes have been refitted and the braking system is back to normal operating conditions.

Brake fluid is an irritant. Avoid contact with eyes or skin.

In the event of accidental contact, wash the affected area thoroughly. In the event of contact with eyes, contact an eye specialist or seek medical advice.

DO NOT RELEASE BRAKE FLUID INTO THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

⚠ WARNING

Handle with care: contact with brake fluid will alter the chemical properties of paintwork, plastic and rubber parts, etc.

Wear latex gloves during servicing.

Do not spill brake fluid on plastic or paint-finished parts or they will damage.

NOTE This motorcycle is fitted with two (front and rear) braking systems operated by two independent hydraulic circuits.

The front twin-disc brake is fitted with one disc on either side of the wheel.

The rear single-disc brake is fitted with one disc on the right-hand side of the wheel.

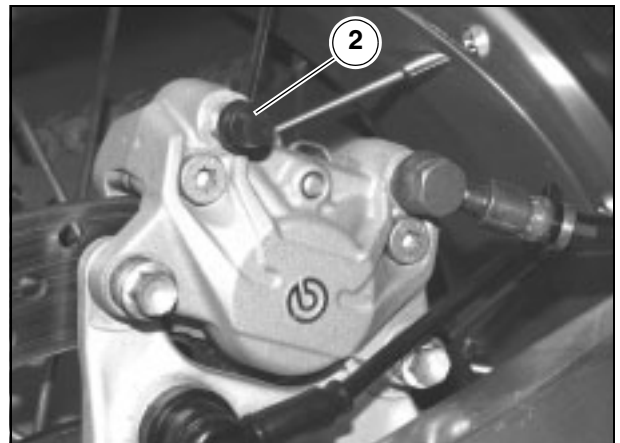
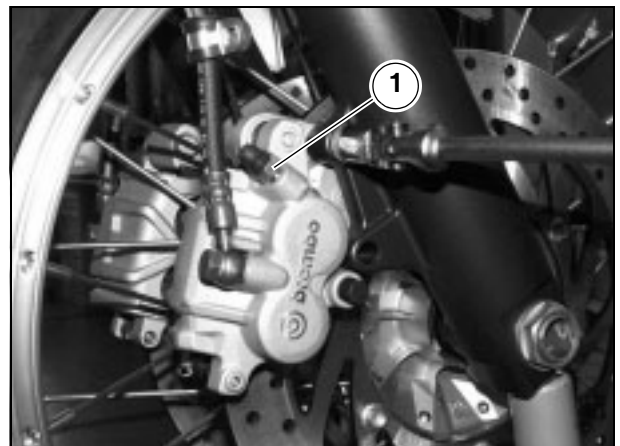
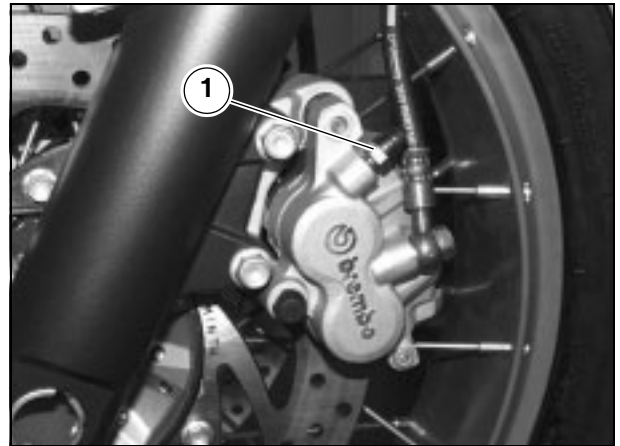
FRONT BRAKING SYSTEM

The front braking system is fitted with two bleed nipples (1), one for each of the front brake calipers.

Repeat the BLEEDING PROCESS for each bleed nipple (1).

REAR BRAKING SYSTEM

The rear braking system is fitted with one bleed nipple (2) located on the rear brake caliper.



HOW TO BLEED THE BRAKING SYSTEM

There are three bleeding procedures to be performed strictly in the order given:

1st – BLEED THE HYDRAULIC CIRCUIT

NOTE Read the description of the hydraulic circuit bleeding procedure for instructions on how to determine whether the brake caliper and the master cylinder need bleeding, too.

2nd – BLEED THE BRAKE CALIPER

3rd – BLEED THE MASTER CYLINDER.

⚠ WARNING

The three bleeding procedures must always be performed in the specified order.

REQUIREMENTS

Before proceeding, ensure the following requirements are met:

NOTE Place the motorcycle on firm and level ground and put it on the side stand.

A the master cylinder is above the oil tube (meaning the total length of the hose) and the brake caliper (C);

B the brake fluid reservoir is above the master cylinder (A);

C the caliper bleed nipple (1-2) is on top of the caliper;

D the oil tube is routed smoothly with no upside-down U-turns.

NOTE In order to bleed the rear braking system, you will first have to remove the rear brake caliper, see 7.8.1 (REMOVING THE REAR SWINGING ARM).

- ♦ Top up brake fluid level in the reservoir, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL) and see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL).
- ♦ Remove the rubber cap.
- ♦ Attach a clear plastic hose to the caliper bleed nipples (1-2). Insert the other end of the hose into a container.
- ♦ Pump the brake lever quickly. Repeat several times, then keep the lever pulled in.
- ♦ Slacken the bleed nipple by one quarter of a turn to let the brake fluid drain into the container. This will remove any tension from the lever and help it travel fully home.
- ♦ Tighten the bleed nipple. Pump the lever repeatedly, then hold in the lever and slacken the bleed nipple again.
- ♦ Repeat process until the fluid draining into the container is totally clear of air bubbles.

NOTE During the bleeding procedure, top up reservoir with brake fluid up to Max level if needed. The reservoir should not be empty during the bleeding procedure or air will enter the system.

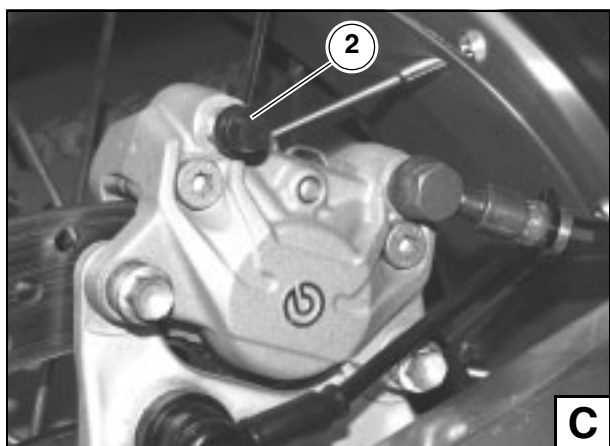
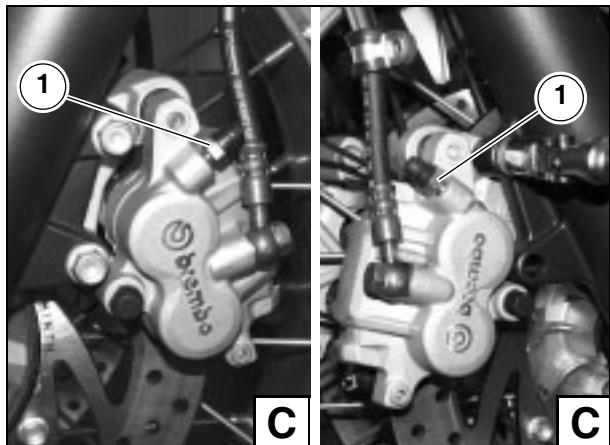
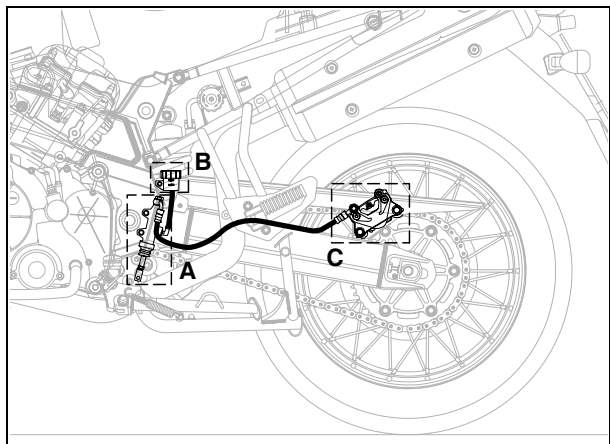
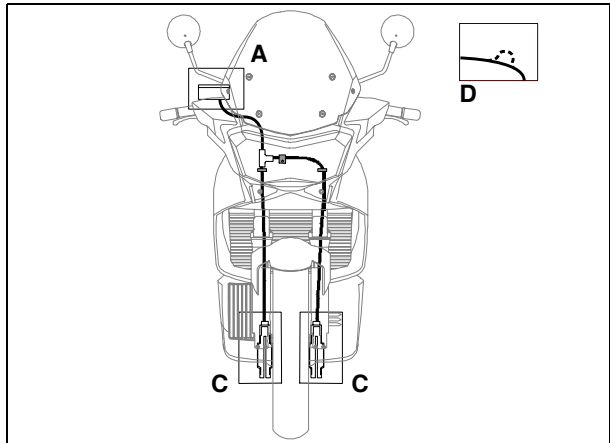
- ♦ Tighten the bleed nipple and disconnect the hose.



Torque wrench setting for bleed nipples (1): 9 Nm (0.9 kgm).



Torque wrench setting for bleed nipple (2): 14 Nm (1.4 kgm).



- ◆ Add brake fluid to the reservoir until bringing fluid up to correct level, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL) and see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL).
- ◆ Refit the rubber cap.

⚠ WARNING

The lever may still feel too soft even after the circuit has been bled and all air expelled from the system. When this is the case, you will have to:

- bleed the brake caliper, see BLEEDING THE BRAKE CALIPER; and
- bleed the brake master cylinder, see BLEEDING THE BRAKE MASTER CYLINDER.

BLEEDING THE BRAKE CALIPER

NOTE During the bleeding operations keep the rear brake pipe as straight as possible.

NOTE Do not work on both braking systems at the same time. The operations refer to a single braking system, but are valid for both (with the differences indicated).

NOTE Do not close the brake fluid reservoir after topping up, since for the bleeding operations it is necessary to top up the brake fluid reservoir more than once.

- ◆ Top up the brake fluid tank, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL) or 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL).

⚠ WARNING

Always wear goggles or a protective screen for the eyes: when the brake lever (or the brake pads) is operated, part of the brake fluid may be sprayed out of the brake fluid reservoir.

⚠ CAUTION

Position a clean cloth under the brake fluid reservoir to protect the components positioned in the surrounding area.

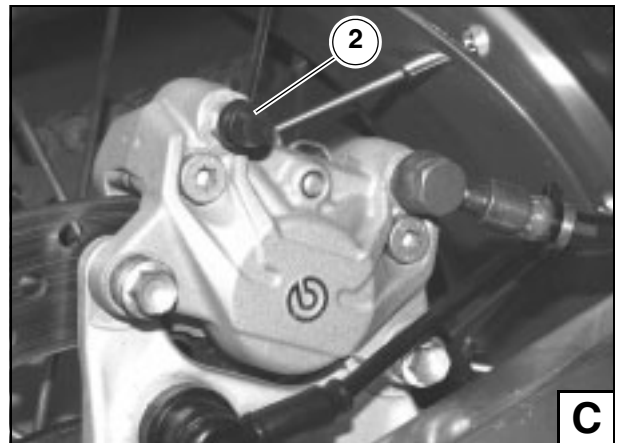
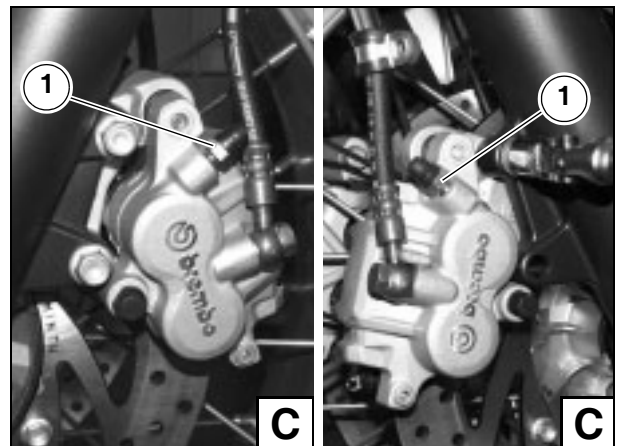
⚠ CAUTION

Make sure that the brake fluid level is always included between the MIN and MAX marks; otherwise, provide for topping up.

⚠ WARNING

The handlebar can be turned only to the right. The brake fluid may flow out of the tank from the tank.

- ◆ Remove the protection cap from the bleeder valve (1-2).
- ◆ Connect a transparent pipe to the bleeder valve (1-2).
- ◆ Position the free end of the transparent pipe (10) into a container (11).



- ◆ ★ Slowly operate the brake lever (for the front brake, or the brake pump rod for the rear brake) more than once, in order to fill the system with brake fluid and to carry out a first partial bleeding.
- ◆ ★ Pull the brake lever (for the front brake, or the brake pump rod for the rear brake) slowly and thoroughly, then keep it completely pulled.

⚠ CAUTION

Check the brake fluid level in the tank. Top up before draining the brake fluid reservoir completely. The complete drainage of the fluid causes the inlet of air into the hydraulic circuit.

NOTE Always keep the brake lever (for the front brake, or the brake pump rod for the rear brake) completely pulled.

⚠ CAUTION

Do not dirty the brake pads or disc with brake fluid.

⚠ CAUTION

Before releasing the brake lever (for the front brake, or the brake pump rod for the rear brake), tighten the bleeder valve (1-2) to prevent air from getting into the hydraulic circuit.

- ◆ ★ Loosen the bleeder a quarter turn so that the clutch fluid flows into the container; this eliminates the tension on the clutch lever, allowing it to touch the handgrip.
- ◆ ★ Tighten the bleeder (1-2).
- ◆ ★ Release the brake lever (for the front brake, or the brake pump rod for the rear brake) and pull it three or four times.
- ◆ Repeat the operations marked with “.”, until no air bubbles can be seen in the brake fluid that flows out of the bleeder valve.

NOTE During the performance of these operations, more and more resistance will be met when operating the brake lever (for the front brake, or the brake pump rod for the rear brake). The resistance is due to the air escape from the braking system.

- ◆ If there are other bleeder valves. Repeat the bleeding operations on the other bleeder valves present in the system.

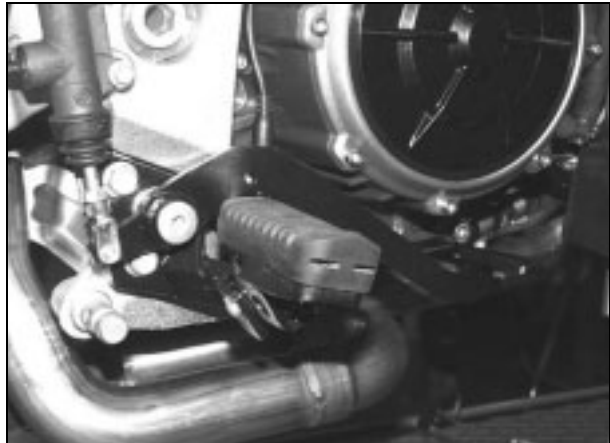
If no air bubbles can be noticed in the brake fluid:

- ◆ If the resistance met when pulling the brake lever (12) (for the front brake, or the brake pump rod for the rear brake) is correct, this means that the system does not need further bleeding.
- ◆ Top up the brake fluid tank, see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKE FLUID) or 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID).
- ◆ Correctly close the rear brake reservoir.

⚠ WARNING

Clean the transparent pipe (for its whole length) and the bleeder valve, removing any residue of brake fluid.

- ◆ Remove the transparent pipe.
- ◆ Tighten the bleeder (1-2) to prescribed driving torque.



- ◆ Position the protection cap on the bleeder valve (1-2).

DO NOT DISPOSE OF THE FLUID IN THE ENVIRONMENT.

- ◆ Empty the container (11) into a suitable receptacle for the collection of used brake fluid.

CHECKS TO BE CARRIED OUT AFTER BLEEDING THE BRAKING SYSTEMS

After bleeding the braking systems, keep to the following indications.

Make sure that the brake discs and the brake pads are completely free of grease or oil.

⚠ CAUTION

Pull the brake lever (for the front brake, or the brake pump rod for the rear brake) repeatedly and verify the correct operation of the braking system.

⚠ CAUTION

Have a test ride at moderate speed in a low-traffic area.

2.19 BLEEDING THE CLUTCH

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.6 (CLUTCH FLUID) carefully.

Bleed the clutch system after the first 1000 km (625 mi) if needed.

Any air trapped in the hydraulic circuit will act as a cushion and take up most of the pressure applied by the master cylinder. This will hamper the operation of the clutch.

A spongy feel of the clutch lever and impaired clutch operation mean that there is air in the circuit.

⚠ WARNING

Handle with care: contact with clutch fluid will alter the chemical properties of paintwork, plastic and rubber parts, etc.

DO NOT RELEASE CLUTCH FLUID INTO THE ENVIRONMENT.

This is a dangerous condition that makes the vehicle unsafe to ride. Each time the clutch master cylinder is removed, it is indispensable to bleed the hydraulic circuit after refitting the master cylinder, when the clutch is back to normal operating conditions. Bleed the clutch as follows:

- ◆ Top up clutch fluid level in the reservoir, see 2.17 (CHECKING AND TOPPING UP CLUTCH FLUID LEVEL).
- ◆ Remove the rubber cap.
- ◆ Attach a clear plastic hose to the bleed nipple (1). Insert the other end of the hose into a container.
- ◆ Pump the clutch lever quickly. Repeat several times, then keep the lever pulled in.
- ◆ Slacken the bleed nipple by one quarter of a turn to let the clutch fluid drain into the container. This will remove any tension from the lever and help it travel fully home.
- ◆ Tighten the bleed nipple (1). Pump the lever repeatedly, then keep it squeezed in and slacken the bleed nipple again.
- ◆ Repeat process until the fluid draining into the container is totally free from air bubbles.

NOTE During the bleeding procedure, top up reservoir with clutch fluid up to Max level if needed. The reservoir should not be empty during the bleeding procedure or air will enter the system.

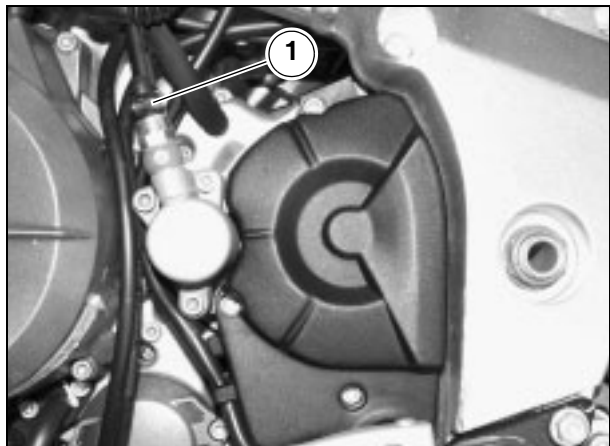
- ◆ Tighten the bleed nipple (1) and disconnect the bleed hose.



Torque wrench setting for bleed nipples (1):

9 Nm (0.9 kgm).

- ◆ Add brake fluid to the reservoir until bringing fluid up to correct level, see 2.17 (CHECKING AND TOPPING UP CLUTCH FLUID LEVEL).
- ◆ Refit the rubber cap.



2.20 CHANGING THE FRONT BRAKE FLUID

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.4 (BRAKE FLUID) carefully.

Change the front brake fluid every two years.

⚠ WARNING

Handle with care: contact with brake fluid will alter the chemical properties of paintwork, plastic and rubber parts, etc.

DO NOT RELEASE BRAKE FLUID INTO THE ENVIRONMENT.

- ◆★ Remove the rubber cap.
- ◆★ Attach a clear plastic hose to the bleed nipple (1). Insert the other end of the hose into a container.
- ◆★ Loosen the bleed nipple (1) by about one turn.

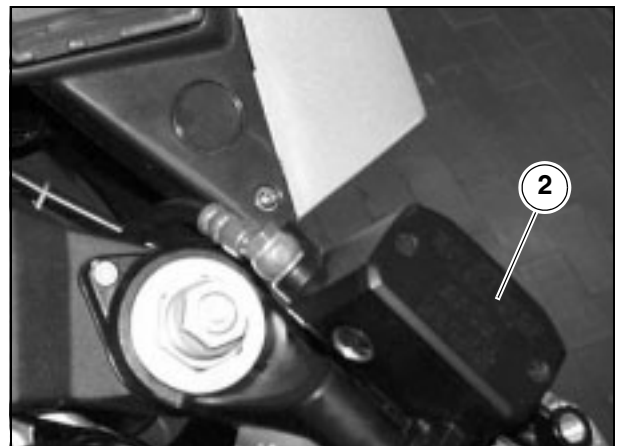
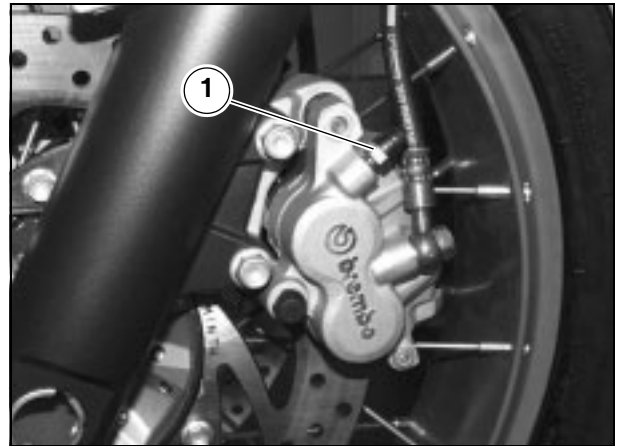
NOTE Ensure that there is fluid in the reservoir at all times during the operation, or you will have to bleed the system when finished, see 2.18 (BLEEDING THE BRAKE CIRCUITS).

- ◆ Keep an eye on the reservoir (2) while fluid drains off. Tighten the bleed nipple (1) before fluid has drained off completely.
- ◆ Top up the reservoir (2), see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL).
- ◆★ Loosen the bleed nipple (1) again by about half turn.
- ◆★ Look at the fluid draining from the hose. When fluid colour changes from dark to a lighter shade, tighten the bleed nipple (1) and disconnect the bleed hose.



Torque wrench setting for bleed nipple (1): 9 Nm (0.9 kgm).

- ◆★ Refit the rubber cap.
- ◆ Add fluid to the reservoir (2) until bringing fluid to the correct level, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL).



2.21 CHANGING THE REAR BRAKE FLUID

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.4 (BRAKE FLUID) carefully.

Change the rear brake fluid every two years.

⚠ WARNING

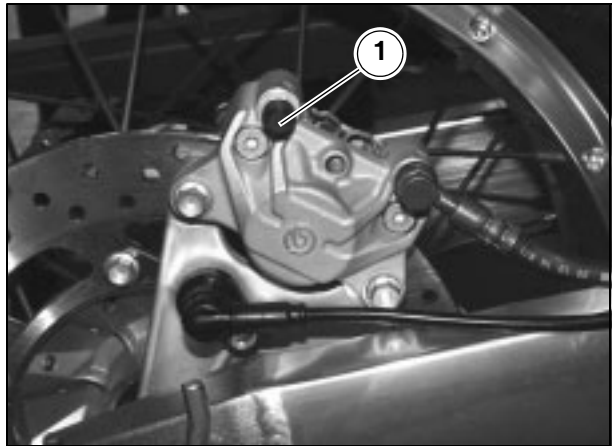
Handle with care: contact with brake fluid will alter the chemical properties of paintwork, plastic and rubber parts, etc.

DO NOT RELEASE BRAKE FLUID INTO THE ENVIRONMENT.

- ◆ Remove the rubber cap.
- ◆ Attach a clear plastic hose to the bleed nipple (1). Insert the other end of the hose into a container.
- ◆ Loosen the bleed nipple (1) by about one turn.

NOTE Ensure that there is fluid in the reservoir (2) at all times during the operation, or you will have to bleed the system when finished, see 2.18 (BLEEDING THE BRAKE CIRCUITS).

- ◆ Keep an eye on the reservoir (2) while fluid drains off. Tighten the bleed nipple (1) before fluid has drained off completely.
- ◆ Top up the reservoir (2), see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL).
- ◆ Loosen the bleed nipple (1) again by about half turn.
- ◆ Look at the fluid draining from the hose. When fluid colour changes from dark to a lighter shade, tighten the bleed nipple (1) and disconnect the bleed hose.



Torque wrench setting for bleed nipple (1): 14 Nm (1.4 kgm).

- ◆ Refit the rubber cap.
- ◆ Add fluid to the reservoir (2) until bringing fluid up to correct level, see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL).

2.22 CHANGING THE CLUTCH FLUID

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.6 (CLUTCH FLUID) carefully.

Change the clutch fluid every two years.

⚠ WARNING

Handle with care: contact with clutch fluid will alter the chemical properties of paintwork, plastic and rubber parts, etc.
DO NOT RELEASE CLUTCH FLUID INTO THE ENVIRONMENT.

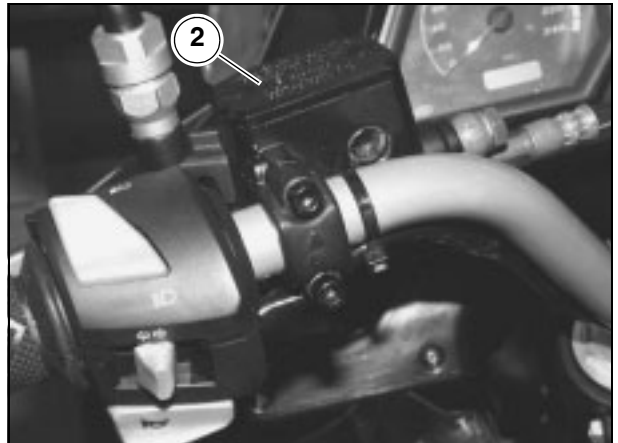
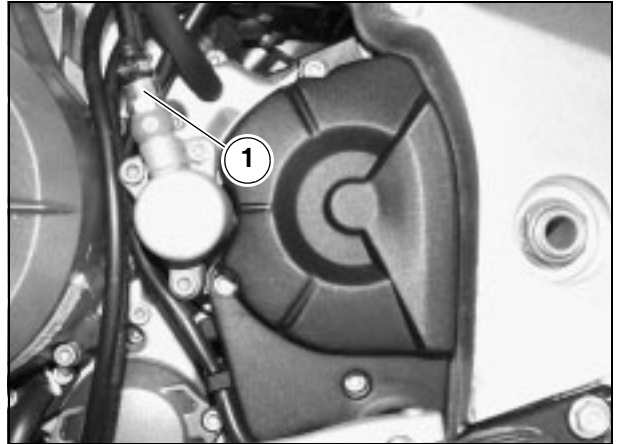
- ◆ Remove the rubber cap.
- ◆ Attach a clear plastic hose to the bleed nipple (1). Insert the other end of the hose into a container.
- ◆ Loosen the bleed nipple (1) by about one turn.

NOTE Ensure that there is fluid in the reservoir (2) at all times during the operation, or you will have to bleed the system when finished, see 2.19 (BLEEDING THE CLUTCH).

- ◆ Keep an eye on the reservoir (2) while fluid drains off. Tighten the bleed nipple (1) before fluid has drained off completely.
- ◆ Top up the reservoir (2), see 2.17 (CHECKING AND TOPPING UP CLUTCH FLUID LEVEL).
- ◆ Loosen the bleed nipple (1) again by about half turn.
- ◆ Look at the fluid draining from the hose. When fluid colour changes from dark to a lighter shade, tighten the bleed nipple (1) and disconnect the bleed hose.

 **Torque wrench setting for bleed nipple (1): 20 Nm (2.0 kgm).**

- ◆ Refit the rubber cap.
- ◆ Add fluid in the reservoir (2) until bringing fluid up to correct level, see 2.17 (CHECKING AND TOPPING UP CLUTCH FLUID LEVEL).



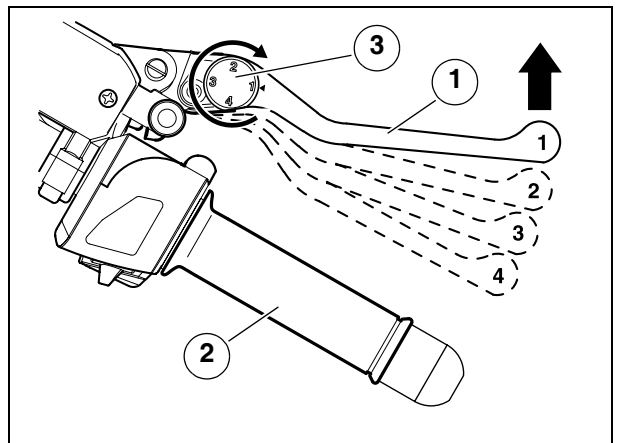
2.23 ADJUSTING THE FRONT BRAKE LEVER AND CLUTCH LEVER

The position of the lever (1) relative to the twistgrip (2) is adjusted by rotating the dial adjuster (3).

Setting “1” gives approximately 105-mm distance between lever and twistgrip. Setting “4” gives about 85-mm distance.

Settings “2” and “3” provide intermediate positions of the lever.

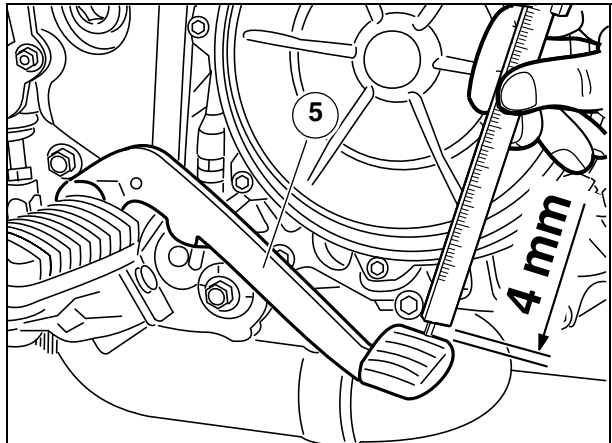
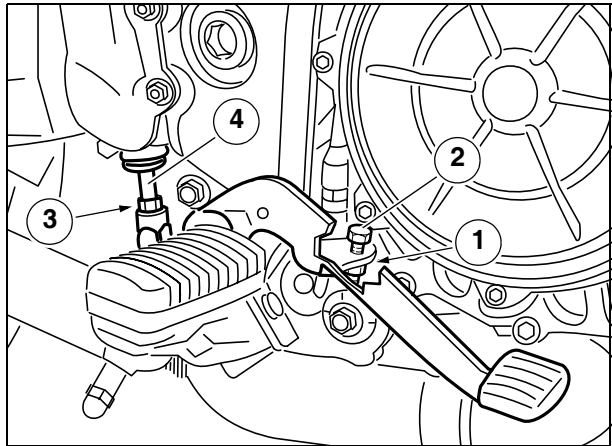
- ◆ Push the lever (1) forward and rotate the dial adjuster (3) until aligning the desired setting mark with the index.



2.24 ADJUSTING REAR BRAKE LEVER PLAY

Rear brake pedal position is set at the factory so as to afford maximum ease of operation. However, the lever may be adjusted to suit rider's preferences as follows:

- ◆ Loosen the locknut (1).
- ◆ Tighten the brake adjuster (2) all the way in.
- ◆ Tighten the locknut (3) fully home onto the master cylinder linkage (4).
- ◆ Tighten the master cylinder linkage (4) fully, then loosen it by 3-4 turns.
- ◆ Loosen the brake adjuster (2) until setting the brake lever at the desired height.
- ◆ Lock out brake adjuster (2) movement by the locknut (1).
- ◆ Loosen the linkage (4) until it touches the master cylinder piston.
- ◆ Tighten the linkage allowing 0.5 –1 mm play between master cylinder linkage (4) and master cylinder piston.



⚠ WARNING

Ensure that the brake lever (5) has some free play, otherwise the brake will stay applied even when the lever is released, leading to early wear of brake pads and discs.

Free play of lever (5): 4 mm (measured at lever end).

- ◆ Lock the master cylinder linkage by the locknut (3).

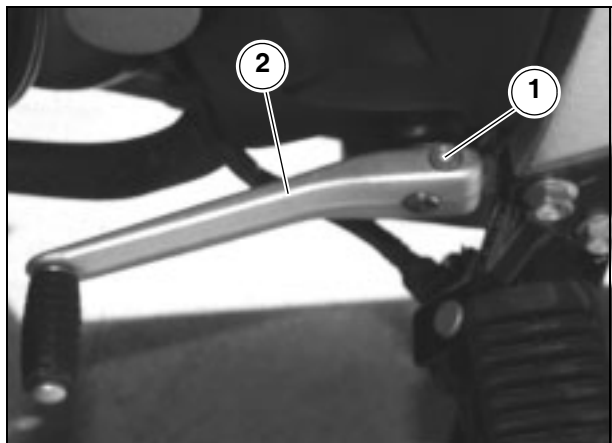
⚠ WARNING

When finished, apply brake and ensure the wheel turns freely when brake is released.

2.25 ADJUSTING THE GEAR SHIFT LEVER

- ◆ Place the vehicle on the stand.
- ◆ Release the screw (1).
- ◆ Rotate the gear shift lever (2) setting the lever at the desired height.
- ◆ Tighten the screw (1).

 Torque wrench setting for screw (1): 10 Nm (1.0 kgm).



2.26 CHECKING BRAKE PADS FOR WEAR

The rate at which brake pads will wear depends on usage, riding style and road surface condition.

NOTE The following information applies to both braking systems.

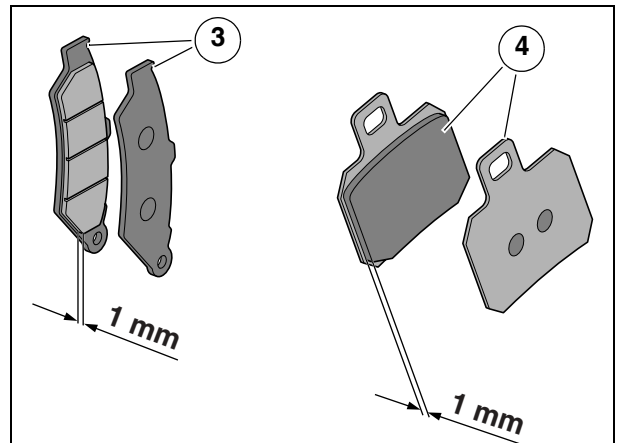
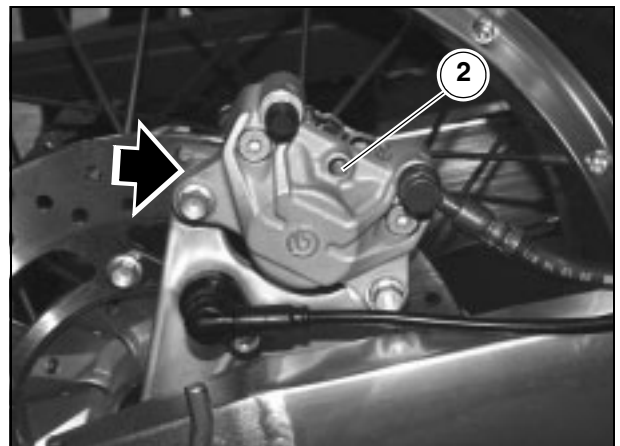
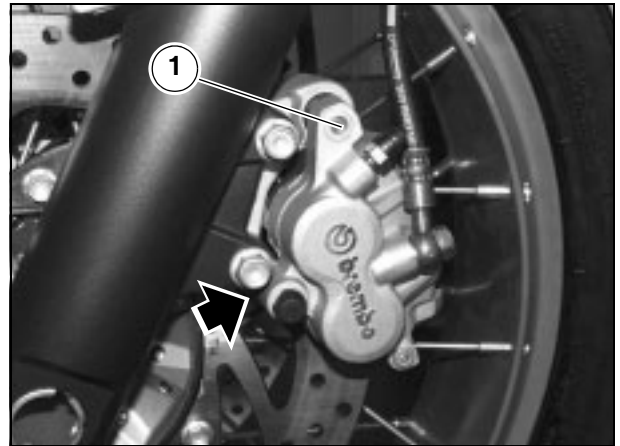
This is a quick inspection procedure to determine brake pads wear:

- ◆ Place the vehicle on the stand.
- ◆ Visually inspect the area between brake disc and brake pads proceeding as follows:
 - from the bottom up at the front end to check the front brake calipers (1);
 - from the bottom up at the rear end to check the rear brake caliper (2).

⚠ WARNING

If brake pads were allowed to wear down until uncovering the metal substrate, metal-to-metal contact with the brake disc would lead to rattle and the brake caliper sparking. This will result in loss of braking and brake disc damage, causing a dangerous riding condition.

- ◆ When the lining material of even just one of the brake pads is worn down to nearly 1 mm, or when one of the wear indicators is worn away, change both brake pads.
 - Front brake pads (3), see 7.4.1 (REPLACING THE BRAKE PADS).
 - Rear brake pads (4), see 7.5.1 (REPLACING THE BRAKE PADS).



2.27 STEERING

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Inspect after the first 1500 km (937 mi) and every 7500 km (4687 mi) or 8 months afterwards.

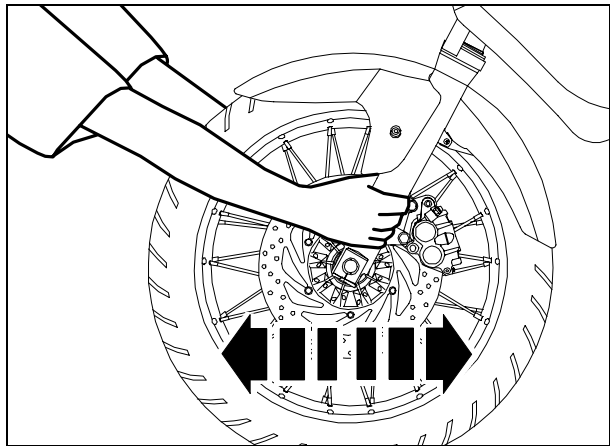
The steering is fitted with rolling bearings to ensure smooth handling.

Proper steering adjustment is vital to smooth steering movement and safe riding.

Any hardness in the steering will impair handling, whereas a soft steering will result in poor stability.

2.27.1 CHECKING PLAY IN THE BEARINGS

- ◆ Place the vehicle on the centre stand **OPT.**
- ◆ Rock the forks back and forth in the direction of travel.
- ◆ If you feel any play, adjust the bearings, see 2.27.2 (ADJUSTING PLAY IN THE BEARINGS).



2.27.2 ADJUSTING PLAY IN THE BEARINGS

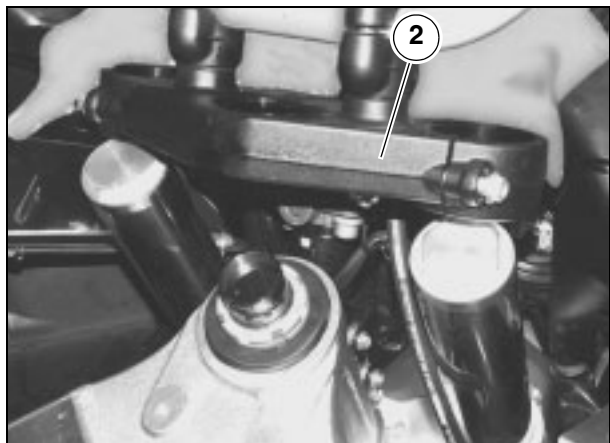
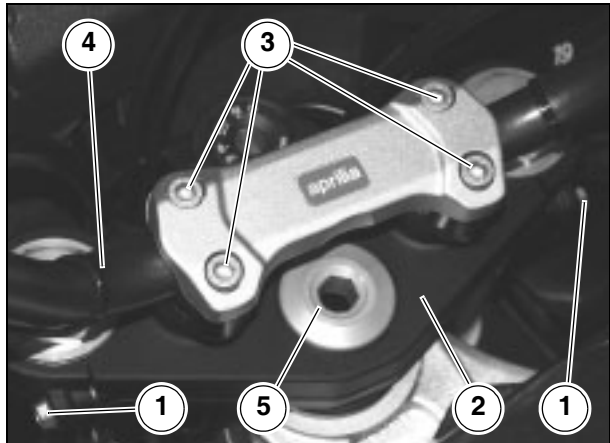
Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Slacken but do not remove the two screws (1) securing the top yoke (2).
- ◆ Slacken but do not remove the four screws (3).
- ◆ Turn the handlebars (4) in the direction of travel.
- ◆ Screw in and tighten the four screws (3).



Torque wrench setting for screws (3): 25 Nm (2.5 kgm).

- ◆ Release and remove the upper bushing (5) and keep the shim.
- ◆ Tap the underside of the top yoke (2) to ease out the top yoke together with handlebars and steering lock switch.
- ◆ Lean the top yoke (2) forward. Place a cloth underneath the top yoke to protect the instrument panel.



- ◆ Straighten the tabs (those bent upwards) of the safety washer (6) using a small flat-blade screwdriver.

NOTE Make sure you have the special tool **OPT** no. 8140203 (socket for steering adjustment) ready at hand.

- ◆ Slacken and remove the ring nut (7) using the special socket.
- ◆ Remove the safety washer (6).

⚠ WARNING

Renew the safety washer (6) on assembly.

- ◆ Screw in the adjuster nut (8) using the special socket to take out play.



Torque wrench setting for adjuster nut (8): 40 Nm (4.0 kgm)

- ◆ Fit the safety washer (6) so that the tabs are lined up with the recesses in the nut (8).
- ◆ Screw the locknut (7) and tighten using the special socket.



Tightening procedure for locknut (7): screw in manually until contact, and then tighten by one quarter of a turn.

NOTE The tabs of the safety washer (6) should be bent upwards.

- ◆ Bend the four tabs of the safety washer (6) upwards over the recesses of the locknut (7).
- ◆ Replace the top yoke (2). Ensure that it becomes properly seated in place.
- ◆ Apply oil (part no. 8116050) to the thread and underside of the bush (5).
- ◆ Tighten the top bush (5). Take care to refit the shim in the proper position.
- ◆ Undo the bush (5) and tighten again to the specified torque to obtain proper tightening.



Torque wrench setting for top bush (5): 100 Nm (10 kgm).

- ◆ Screw in and tighten the two screws (1).



Torque wrench setting for screw (1): 25 Nm (2.5 kgm).

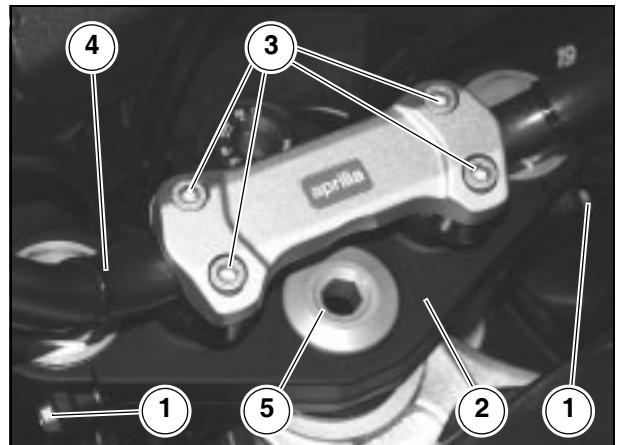
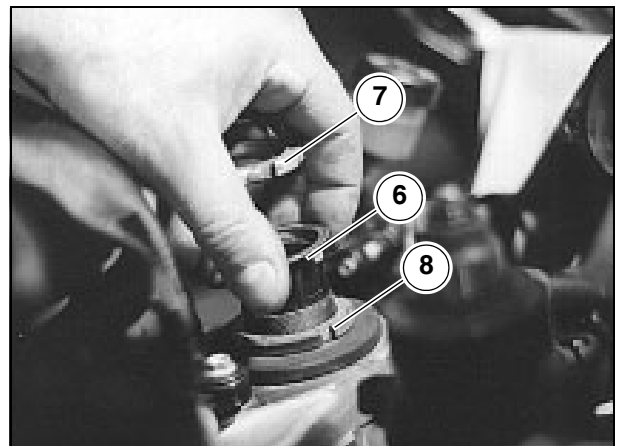
- ◆ Untighten the four screws (3).
- ◆ Place the handlebars (4) in the right position.
- ◆ Lubricate the four screws (3) with oil (part no. 8116050) and tighten.



Torque wrench setting for screws (3): 25 Nm (2.5 kgm).

⚠ WARNING

When finished, ensure that the handlebars turn smoothly or the sliding surfaces will damage resulting in poor handling.



2.28 INSPECTING THE FRONT SUSPENSION

2.28.1 FRONT SUSPENSION

The front suspension is managed by a hydraulic fork, which is held to the steering stem by two yokes. Factory setting is designed to suit the broadest possible range of riding conditions, meaning low and high speed, whether riding solo or carrying a full load.

NOTE Vehicle set-up may not be modified further.

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Change front fork oil after the first 7500 km (4687 mi) and every 22500 km (14000 mi) afterwards.

The following inspections should be performed every 7500 km (4687 mi):

- ◆ Keep the brake lever squeezed in and press down repeatedly on the handlebars to compress the front fork. The front fork should compress in a smooth motion. Inspect the fork legs for any traces of oil.

If the front fork has a tendency to bottom out, oil should be changed, see 7.7.1 (CHANGING FRONT FORK OIL). Check the front fork for oil leaks and inspect the surface of the fork legs for cracks or scoring.

Any damaged components should be repaired or – where repair is not feasible – renewed, see 7.7.3 (DISASSEMBLING THE STANCHION TUBES – SLIDERS).

- ◆ Ensure that all parts are properly tightened and test the front suspension for proper operation.



2.29 REAR SWINGING ARM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Periodically check that the nut-and-spindle assembly and the needle roller bearings of the swinging arm are properly tightened.

Inspection procedure:

- ◆ Place the vehicle on the centre stand **OPT**.
- ◆ Push and pull the rear wheel up and down, then rock it from side to side (see figures).
If you feel any play, adjust the swinging arm, see 2.29.1 (SWINGING ARM ADJUSTMENT).
If this fails to eliminate play, change the bearings, see 7.8.2 (DISMANTLING THE SWINGING ARM).



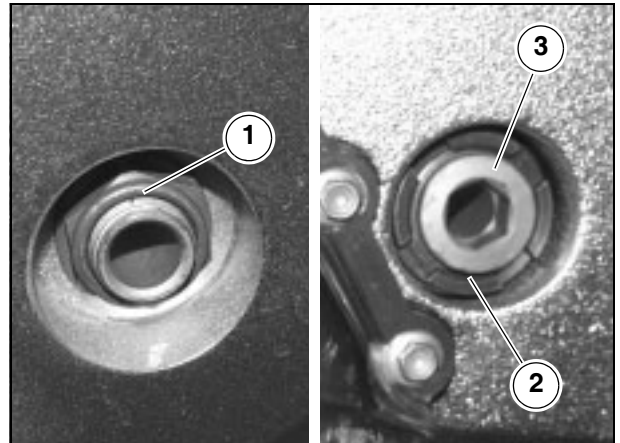
2.29.1 SWINGING ARM ADJUSTMENT

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the vehicle on the centre stand **OPT**.
- ◆ Undo the nut (1) fully.

NOTE Make sure to have the special tool **OPT** no. 8140203 (socket for swinging arm spindle – engine mount adjustment).

- ◆ Slacken the lockring (2) fully using the special socket.
- ◆ Working from the right-hand side of the motorcycle, rotate the swinging arm spindle (3) clockwise. The adjusting bush (4) will rotate with the spindle and push the swinging arm fully home.



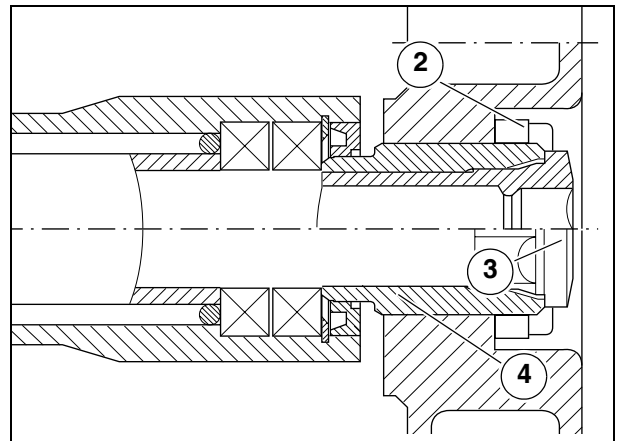
 **Torque wrench setting for spindle (3): 12 Nm (1.2 kgm).**

- ◆ Tighten the lockring (2) using the special socket.

 **Torque wrench setting for lockring (2): 60 Nm (6 kgm).**

- ◆ Tighten the nut (1).

 **Torque wrench setting for nut (1): 90 Nm (9.0 kgm).**



2.30 REAR SUSPENSION INSPECTION

2.30.1 REAR SUSPENSION

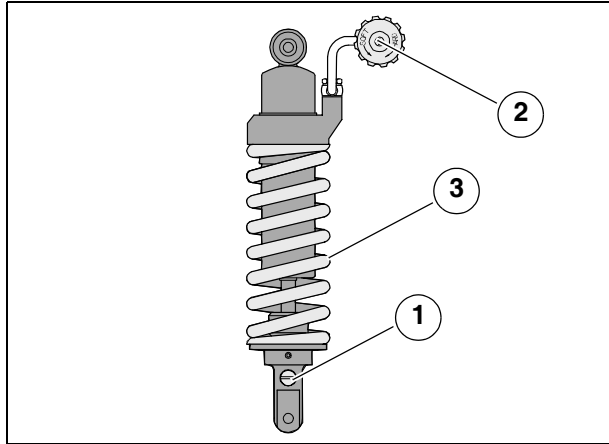
The rear suspension is managed by a spring/damper unit that is connected to the frame and to the rear swinging arm through silent-blocks and a linkage system, respectively.

To modify vehicle response, the rear shock absorber is fitted with an adjuster screw (1) which controls rebound damping and an adjuster knob (2) which controls spring preload (3).

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check after the first 1000 km (625 mi) and every 15000 km (9375 mi) or 16 months afterwards.

- ◆ Ensure that all parts are properly tightened and check the joints of the rear suspension for proper operation.



2.30.2 REAR SHOCK ABSORBER ADJUSTMENT

Factory setting is designed to suit the broadest possible range or riding conditions, meaning low and high speed, whether riding solo or carrying a full load.

However, rear suspension setting may be modified to suit specific needs in accordance with vehicle usage.

⚠ CAUTION

Before setting adjusters, let the engine and the silencer to cool down completely.

⚠ WARNING

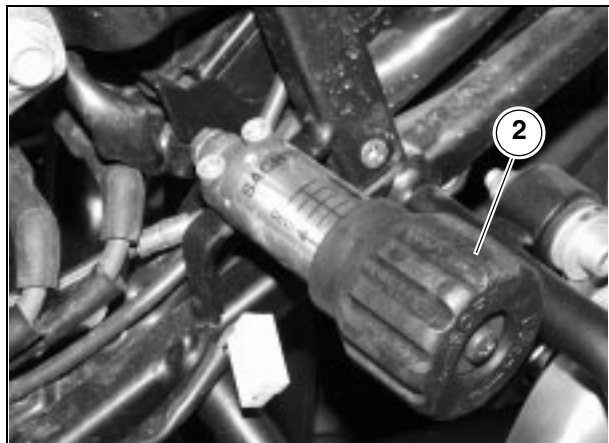
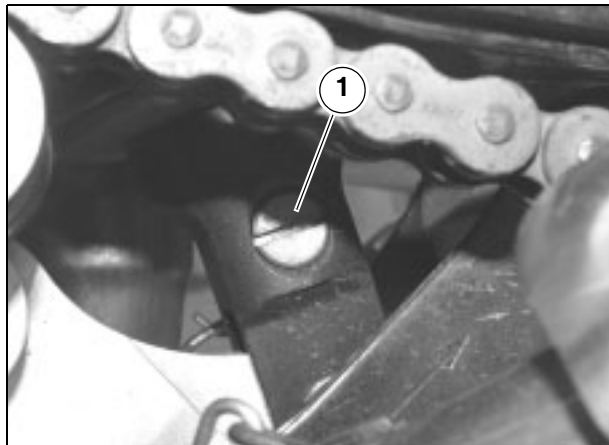
Before adjusting, set both adjusters to the stiffest settings. This means that both adjuster screw (1) and adjuster knob (2) should be turned fully clockwise. Do not force the adjuster screw (1) beyond its limit stop or you may strip the thread.

Ensure that the adjuster screw (1) is always set precisely at a click position. It should never be in an intermediate position.

- ◆ Turn the adjuster screw (1) to set rebound damping (see table).
- ◆ Turn the adjuster knob (2) to set compression damping (see table).

⚠ WARNING

Spring preload and rebound damping of the rear shock absorber should be set to suit vehicle usage. When spring preload is increased, rebound damping should be increased accordingly to avoid unexpected jerking when riding.



Rotate the adjuster screw (1) gradually by 2-3 click positions at a time. Rotate the adjuster knob (2) by 5-6 click positions at a time.

Test ride the vehicle on the road repeatedly until achieving ideal setting.

Never remove the capscrew (4) or attempt to service the valve located underneath. The shock absorber contains nitrogen, which would leak out if capscrew or valve were disturbed. This would impair shock absorber operation and lead to an accident.

SETTING OPTIONS

Standard setting:

standard load conditions (for instance, rider and luggage).

Setting for riding with a passenger:

heavy load conditions (for instance, rider, passenger and luggage).

REAR SHOCK ABSORBER SETTING CHART

Rear suspension	Standard setting	Setting for riding with a passenger
Rebound damping (1)	fully tightened (*) turn out (**) by 12 click positions	screw in fully (*); turn out (**) by 8 clicks
Spring preload, knob (2)	fully slackened (**) tighten (*) by 18 click positions	turn out fully (**); turn in (*) by 54 clicks

(*) =clockwise
(**) =anti-clockwise

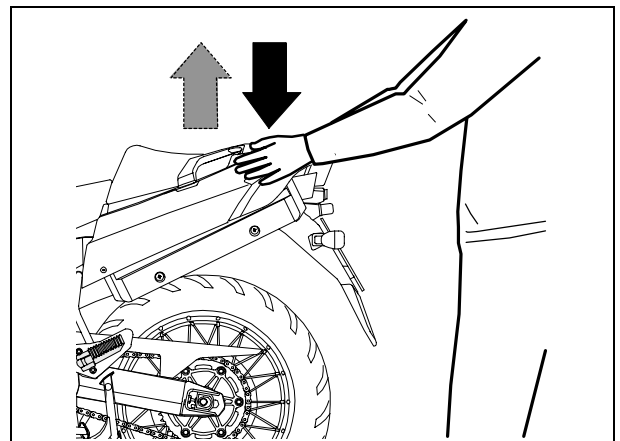
2.30.3 INSPECTING THE REAR SUSPENSION LINKAGE SYSTEM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check bearings every 30000 km (18641 mi).

NOTE An assistant will be required to keep the vehicle upright during the procedure.

- ◆ Hold the tail of the motorcycle firmly with your hand. Press down and release repeatedly.
- ◆ If you feel any hardness or play, or hear squeaking noises, change the bearings of the rear suspension linkage system, see 7.9.2 (REMOVING THE REAR SUSPENSION LINKAGES).



- ◆ Press down the vehicle tail. If the tail is slow to spring back up when released, check rear suspension adjustment, see 2.30.2 (REAR SHOCK ABSORBER ADJUSTMENT).

If the problem persists, it means that the shock absorber is depressurised. Charge the shock absorber.

2.31 FRONT WHEEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check every 7500 km (4687 mi).

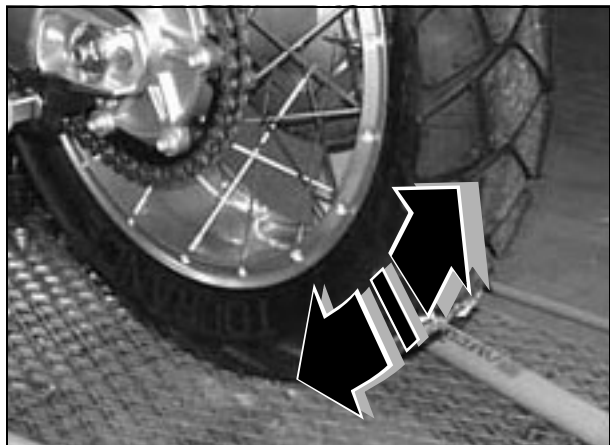
- ◆ Place the vehicle on the front wheel stand **OPT** , see 1.9.1 (PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND).
- ◆ Rotate the wheel manually in both directions.
- ◆ The wheel should be spinning smoothly, with no hardness or unusual noise. If not so, change the bearings, see 7.2.2 (WHEEL REMOVAL).
- ◆ If you detect any wobble, inspect wheel and tyre, see 7.2.4 (WHEEL COMPONENT INSPECTION).
- ◆ A spinning wheel that always stops in exactly the same position needs balancing.

2.32 REAR WHEEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check every 7500 km (4687 mi).

- ◆ Place the vehicle on the centre stand **OPT** .
- ◆ Rotate the wheel manually in both directions.
- ◆ The wheel should be spinning smoothly, with no hardness or unusual noise. If not so, change the bearings, see 7.2.2 (WHEEL REMOVAL).
- ◆ If you detect any wobble, inspect wheel and tyre, see 7.2.4 (WHEEL COMPONENT INSPECTION).
- ◆ A spinning wheel that always stops in exactly the same position needs balancing.



2.33 ADJUSTING WHEEL SPOKE TENSION

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check after the first 1000 Km (621 mi) and every 7500 km (4660 mi) afterwards.

- ◆ Place the motorcycle on the stand.

NOTE Spoke tension can be adjusted with the wheel installed.

Wheel spokes feature a nipple (1) and a grub screw (2). The nipple is used to adjust spoke tension, whereas the grub screw, when tightened into the nipple, levers on the wheel spoke (3) thereby locking out nipple rotation (1).

⚠ WARNING

Even when the wheel spokes (3) are at the correct tension, some nipples may still have worked themselves loose.

- ◆ Determine which wheel spokes (3) need tensioning up.

NOTE The procedure described below is referred to one spoke.

- ◆ Loosen the grub screw (2).

- ◆ Work the nipple (1) so as to set the spoke (3) to the correct tension:

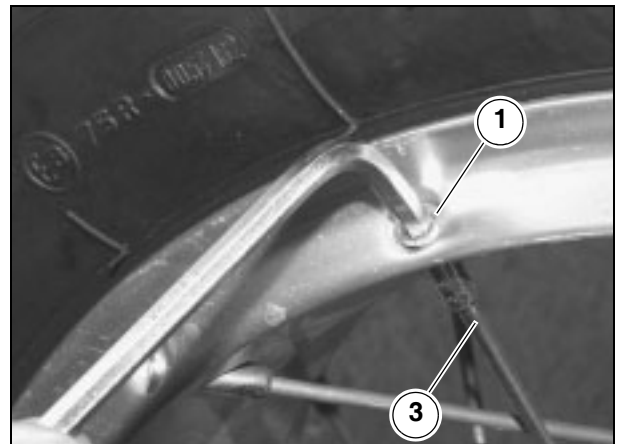
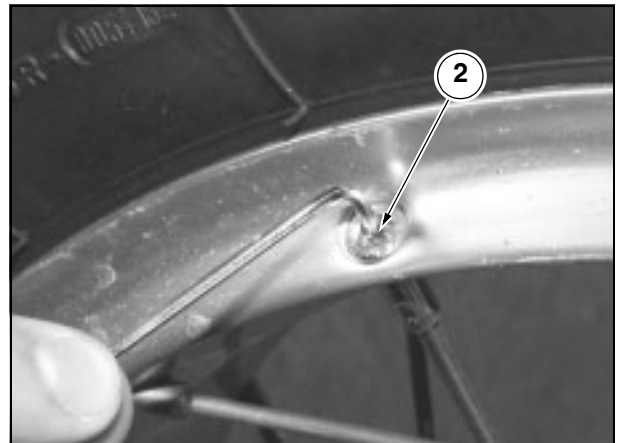
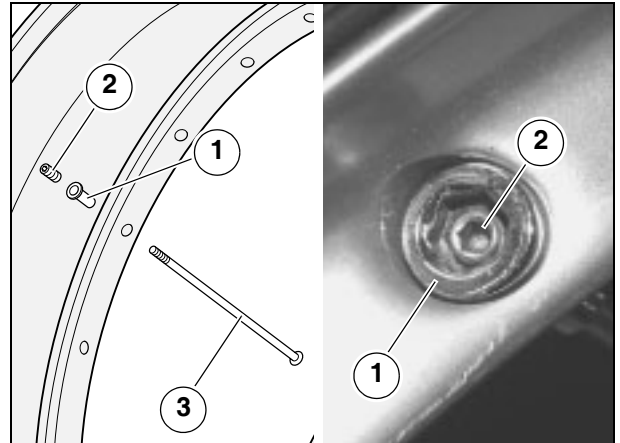
- tighten to tension up the spoke (3);
- loosen to slacken the spoke (3).

NOTE If nipple adjustment (1) is ineffective, loosen the grub screw (2) again.

- ◆ Tighten the grub screw (2) without using exceeding force.
- ◆ Repeat the process for all spokes in the order.
- ◆ When you have adjusted the wheel spokes, check wheel rim axial and radial run-out.

⚠ CAUTION

It is essential that all wheel spoke nipples be tightened securely so as to lock out rotation. A nipple which works itself loose will affect wheel spoke tension, making the wheel unsafe in operation and impairing motorcycle stability.



2.34 EXHAUST MANIFOLD NUTS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Tighten the exhaust manifold nuts after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

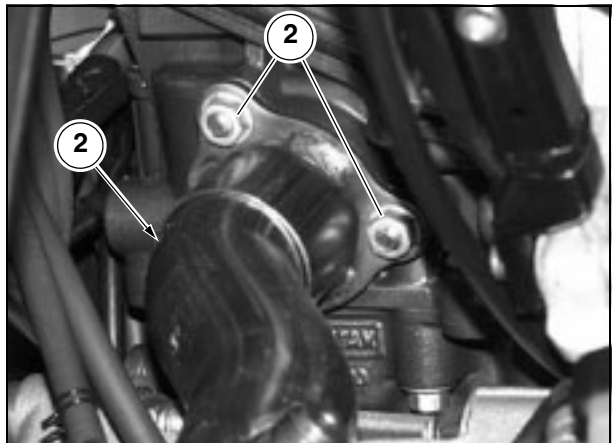
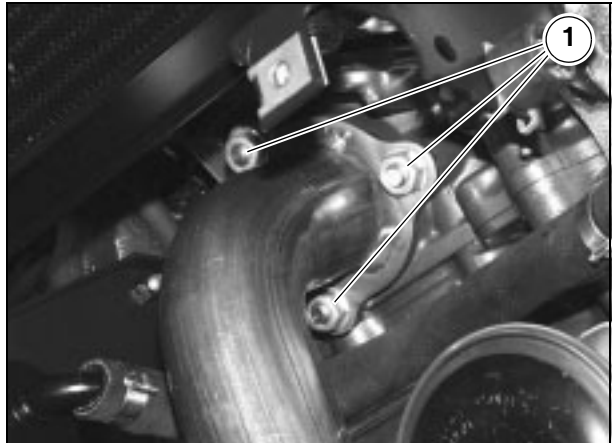
⚠ CAUTION

Let the engine cool down completely.

- ◆ Remove the upper sump guard, see 7.1.23 (REMOVING THE UPPER SUMP GUARD).
- ◆ Tighten the three nuts (1) of the front cylinder exhaust manifold to the specified torque.
- ◆ Tighten the three nuts (2) of the rear cylinder exhaust manifold to the specified torque.



Torque wrench setting for nuts (1-2): 25 Nm (2.5 kgm).



2.35 DRIVE CHAIN

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Inspect and lubricate as required every 1000 km (625 mi). The vehicle is fitted with an endless chain that has no master link.

Chain type: 525

⚠ WARNING

The drive chain links are fitted with O-rings that retain the grease inside. Use the utmost care when adjusting, lubricating, washing or replacing the chain.

- ◆ Place the vehicle on the side stand.
- ◆ Put the gearbox in neutral.
- ◆ Rotate the rear wheel manually and slowly.
- ◆ Visually inspect chain, front and rear sprockets looking for:
 - damaged chain rollers;
 - loose chain link pins;
 - dry, rusty, warped or seized links;
 - exceeding wear;
 - missing O-rings;
 - exceedingly worn or damaged sprocket teeth.

⚠ WARNING

If chain rollers are damaged, chain link pins are loose and/or any O-rings are missing or deteriorated, renew the drive chain and the front and rear sprockets as a set, see 7.3.3 (DISMANTLING THE FINAL DRIVE ASSEMBLY).

2.35.1 CHAIN SLACK INSPECTION

To check chain slack:

- ◆ Place the vehicle on the side stand.
- ◆ Put the gearbox in neutral.
- ◆ Check chain slack in the lower straight portion of chain. The vertical movement of the chain midway between the sprockets should be approximately 15 mm.
- ◆ Wheel the motorcycle forward to check slack at various sections of the chain. Slack should be the same throughout one full turn of the wheel.

⚠ WARNING

If slack is greater at particular positions of the chain, it means that some links are warped or have seized. To prevent seizure, lubricate the chain frequently, see 2.41.1 (CLEANING AND LUBRICATION).

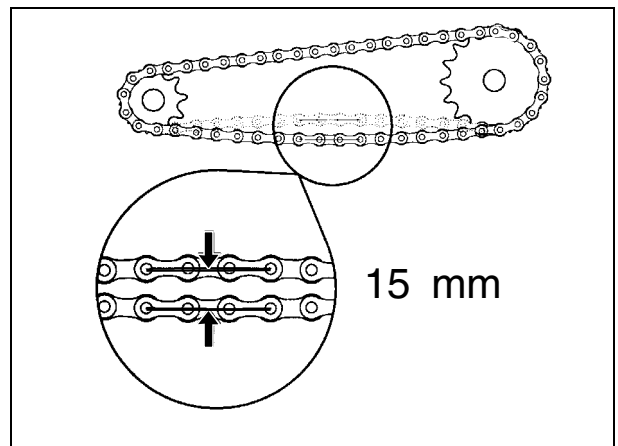
Chain slack must be adjusted whenever it differs from the specified 15 mm, regardless of whether it is greater or less than the 15-mm service limit, even when it is consistent at all positions of the chain. See 2.35.3 (CHAIN SLACK ADJUSTMENT).

⚠ WARNING

Exceeding slack in the chain may cause the chain to rattle or knock, resulting in a worn chain slider and guide.

Improper maintenance may lead to early wear of the chain and/or sprocket damage.

Service the final drive more frequently when the motorcycle is used in demanding conditions or on dusty/muddy roads.

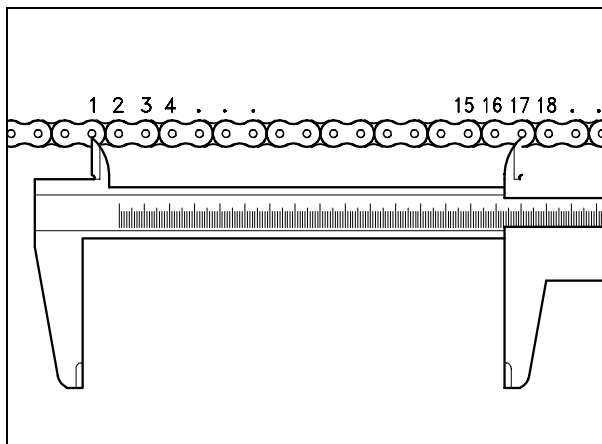


2.35.2 CHECKING CHAIN AND SPROCKETS FOR WEAR

- ◆ Stretch the chain taut, see 2.35.3 (CHAIN SLACK ADJUSTMENT) .
- ◆ Count 17 link pins (16 link-to-link sections) along one portion of the chain and measure the distance between the 1st and the 17th link.

Replace the chain if the length measured exceeds the limit specified below, see 7.10 (DISMANTLING THE DRIVE CHAIN).

Service limit: 255.5 mm (0.5% MAX).



2.35.3 CHAIN SLACK ADJUSTMENT

If the chain needs adjusting after the inspection, proceed as follows:

- ◆ Place the motorcycle on the centre stand **OPT.**
- ◆ Slacken the nut (1).

NOTE The fixed reference marks (2) and (3) inside the seats of the chain tensioner sliders on the swinging arm sides before the wheel spindle facilitate correct wheel centring.


- ◆ Slacken the two locknuts (4).
- ◆ Work the adjusters (5) until obtaining the correct chain slack. Make sure the adjusters are set at the same marks (2-3) on both sides of the motorcycle.

NOTE Lubricate the threads with oil (part no. 8116050).

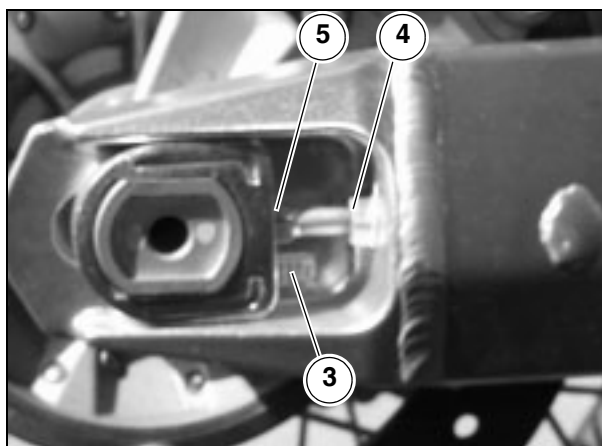
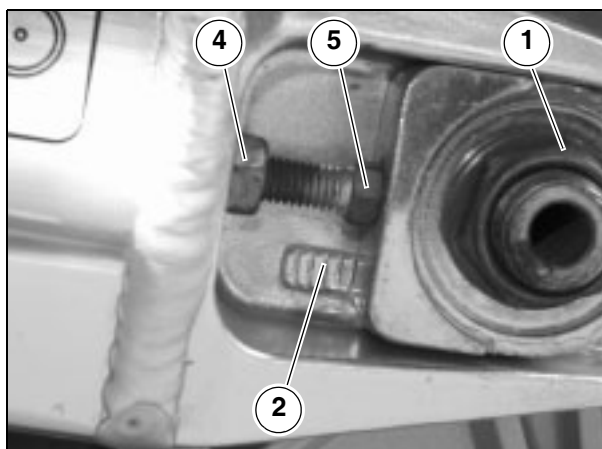
- ◆ Tighten the two locknuts (4).

 **Torque wrench setting for locknuts (4): 10 Nm (1.0 kgm).**

- ◆ Tighten the nut (1).

 **Nut to wheel spindle (1) torque wrench setting: 90 Nm (9.0 kgm).**

- ◆ Check chain slack, see 2.35.1 (CHAIN SLACK INSPECTION).



2.35.4 CLEANING AND LUBRICATION

Never wash the drive chain using steam cleaners, high-pressure water nozzles or highly flammable solvents.

- ◆ Wash the drive chain with fuel oil or kerosene.

NOTE If the chain tends to become rusty quickly, service more frequently.

WARNING

Do not use trichloroethylene, petrol or similar products: these products may be too aggressive for this type of chain or, more important, they may damage the O-rings that retain the grease in the gaps between rollers and pins.

Lubricate the chain every 1000 km (625 mi) and whenever it seems appropriate.

- ◆ Leave the chain to dry, then spray with aerosol lubricant for O-ring chains, see 1.6 (LUBRICANT CHART).

NOTE Do not ride when you have only just lubricated the chain. Centrifugal force would cause the newly applied lubricant to fly all over adjacent vehicle parts.

WARNING

The chain lubricants available on the market may contain aggressive substances which will damage the chain O-rings.

Standard chain type is 525.

WARNING

Replace with a chain of the same type.

2.35.5 DRIVE CHAIN GUIDE PLATE INSPECTION

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

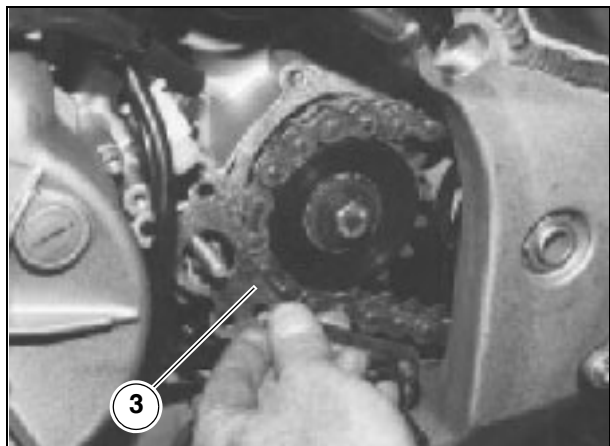
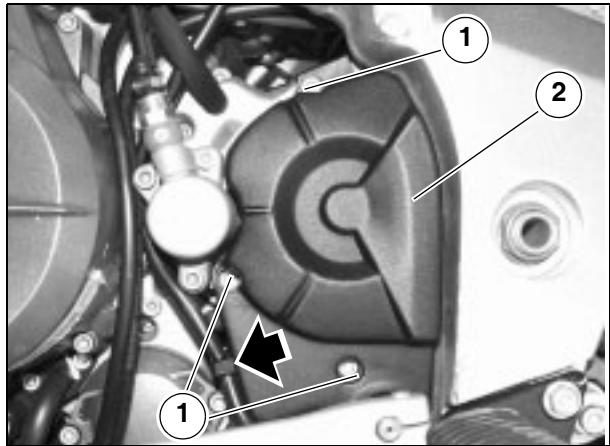
- ◆ Place the vehicle on the stand.
- ◆ Remove the gear shift lever, see 7.1.39 (REMOVING THE GEAR SHIFT LEVER ASSEMBLY)
- ◆ Remove the clutch slave cylinder, see 3.2.1 (CLUTCH SLAVE CYLINDER REMOVAL)
- ◆ Undo and remove the three screws (1).



Torque wrench setting for screws (1): 10 Nm (1.0 kgm).

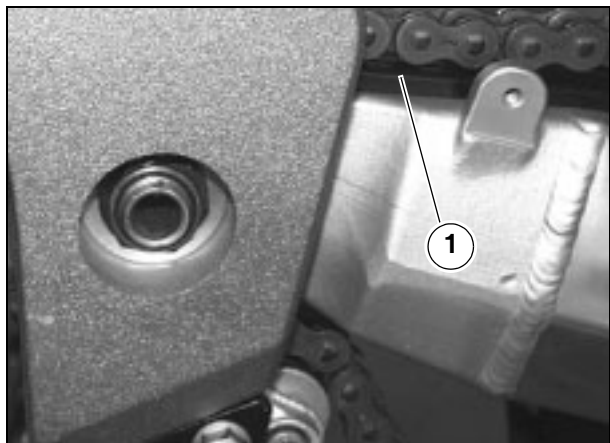
NOTE Release the wire of the side stand switch from its retainer.

- ◆ Remove the sprocket cover (2).
- ◆ Remove the guide plate (3).
- ◆ Check the guide plate (3) for damage or wear. Replace as required.



2.35.6 CHAIN SLIDER INSPECTION

- ◆ Place the vehicle on the stand.
- ◆ Check the chain slider (1) for damage or wear. Replace as required, see 7.1.48 (REMOVING THE DRIVE CHAIN SLIDER).



2.36 TYRES

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check tyre condition after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

Tyre inflation pressures should be checked monthly with the tyres at room temperature.

This vehicle is fitted with tubeless tyres.

TREAD CONDITION

⚠ WARNING

Inspect tread surface and check for wear. Badly worn tyres adversely affect traction and handling.

Always change a worn tyre. A tyre that becomes punctured in the tread area should be changed when the puncture is larger than 5 mm.

Some of the tyre types approved for this vehicle are fitted with wear indicators.

There are various types of wear indicators.

Enquire about correct wear inspection procedure with your supplier.

Never use tube tyres on tubeless tyre rims, or viceversa.

Always check that the caps are in place on the valves (1), or the tyres may deflate suddenly.

Tyre replacement and repair, and wheel servicing and balancing are delicate operations. They should be carried out using adequate tools and are best left to experienced mechanics.

MINIMUM RECOMMENDED TREAD DEPTH (A):

front and rear tyre2 mm (USA 3 mm).

INFLATION PRESSURES

Check the tyre inflation pressures at regular intervals when the tyres are cold.

Checking pressure on hot tyres will result in inaccurate measurement.

Take care to check tyre pressures before and after a long journey.

An overinflated tyre will provide a harsh ride, reduce riding comfort and stability when cornering.

An underinflated tyre will extend the contact patch to include a larger portion of the tyre wall (2). When this is the case, the tyre may slip on or become separated from the rim, leading to loss of control. The tyre may even jump off the rim under hard braking.

Lastly, the vehicle may skid in a bend.

See 1.5 (SPECIFICATIONS) for inflation pressures.

⚠ WARNING

The wheel must be balanced after each tyre repair.

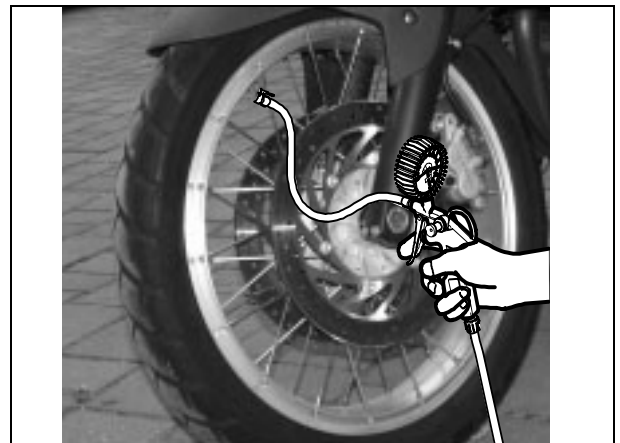
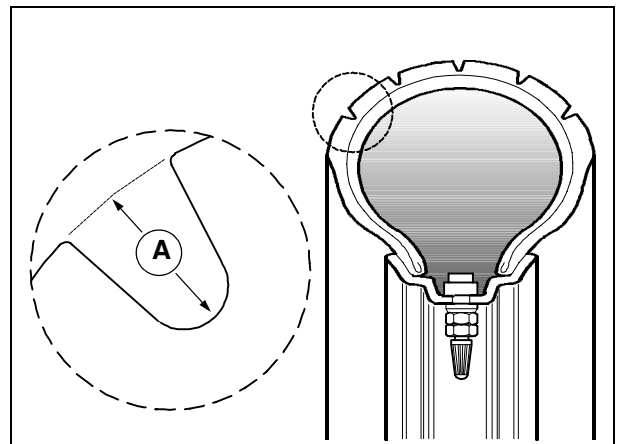
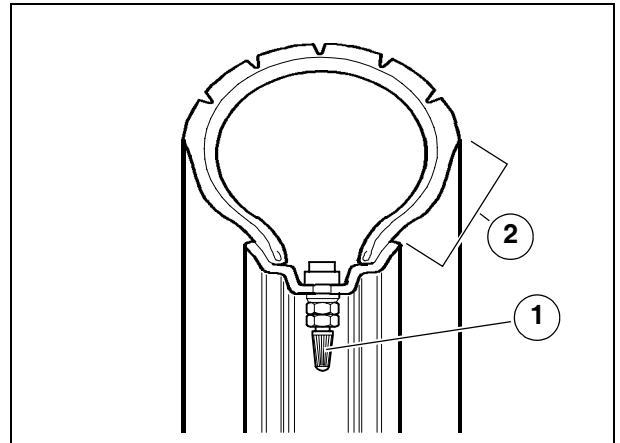
New tyres may be coated with an oily film. Drive carefully until covering several kilometres.

Never apply non-specific products to the tyres.

Approved tyre sizes are reported in the registration document. Installing non-approved tyres is a legal offence.

Using tyres other than the specified sizes may change vehicle behaviour, impair handling and make the vehicle unsafe to ride.

Use only the first-equipment tyre types selected by aprilia, see 1.5 (SPECIFICATIONS).



2.37 FUEL LINES

Read 1.2.1 (FUEL) carefully.

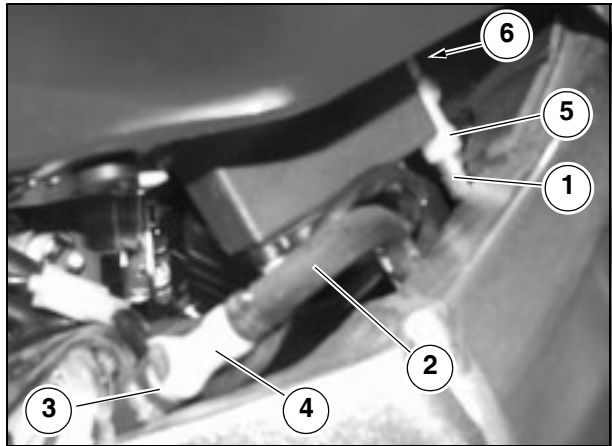
Check the fuel lines every 7500 km (4687 mi) or 8 months.

Renew every four years.

- Always change a worn, cracked or damaged fuel line.
- High-pressure delivery pipe (1) [~ 450 kpa (4,5 bar)].
- Return pipe (2).

NOTE Ensure that the male quick-disconnect fittings (3-5) are properly seated in the female quick-disconnect fittings (4-6).

See Section 4 (FUEL SYSTEM) for more details.



2.38 BRAKE AND CLUTCH LINES

Read 1.2.4 (BRAKE FLUID) and 1.2.6 (CLUTCH FLUID) carefully.

Check the brake and clutch lines every 7500 km (4687 mi) or 8 months.

Renew every four years.

Always change a worn, cracked or damaged line.

2.39 COOLANT PIPES

Read 1.2.5 (COOLANT) carefully.

Check the coolant pipes every 7500 km (4687 mi) or 8 months.

Always change a worn, cracked or damaged coolant pipe.

2.40 MAINTAINING FASTENERS AT THE CORRECT TIGHTENING TORQUE

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Check after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

Ensure that all fasteners are properly tightened. Take special care with safety-related items, namely:

- handlebars secured to top yoke;
- front brake lever;
- clutch lever;
- fuel delivery pipe;
- front fork to yoke;
- front fork to front wheel spindle clamps;
- front wheel;
- front brake line fittings;
- front brake discs;
- front brake calipers;
- engine;
- sprocket;
- rear brake lever;
- swinging arm;
- swinging arm linkage system;
- rear shock absorber;
- rear wheel;
- rear brake disc;
- rear brake caliper;
- rear brake line fittings.

WARNING

All fasteners must be tightened to the specified torque. Use LOCTITE ONLY where specified, see 2.41 (FASTENERS).

Lubricate only those parts indicated in the relevant chart, see 2.41 (FASTENERS).

2.41 FASTENERS

Check and tighten as required after the first 1000 km (625 mi) and every 7500 km (4687 mi) or 8 months afterwards.

⚠ WARNING

The fasteners reported in the chart must be tightened to the specified torque using a torque wrench and applying LOCTITE® where specified.

Safety-related items () are in brackets.

KEY	
L243	Apply LOCTITE® 243
L518	Apply LOCTITE® 518
L572	Apply LOCTITE® 572
L574	Apply LOCTITE® 574
L648	Apply LOCTITE® 648
man.	Manual fastening
Ingr.	Grease underside
lub	Lubricate
sil	Black silicone (part no. 8216005)
Vs	For shear bolts
Olio	Lubricate with oil (part no. 8116050)
cat	Only for models with catalytic converter
nocat	Only for models w/o catalytic converter
Ing1	Lubricate with antiseize grease
Ing2	Lubricate with grease (part no. 8116053)

ENGINE					
Engine to frame					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Front mounting bolts	2+2	M10	50	5.0	
Upper and lower rear mounting bolts on left-hand side	2	M10	50	5.0	
Upper and lower rear mounting bolts on right-hand side of adjuster bush	2	M20x1.5	6	0.6	Oil
Upper and lower rear mounting bolts on right -hand side of locknut	2	M20x1.5	50	5.0	
Upper and lower rear mounting bolts on right-hand side of screw	2	M10	50	5.0	
Parts installed to engine					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Engine oil inlet flange	2	M6	10	1.0	
Engine oil outlet flange	2	M6	10	1.0	
Sprocket to transmission output shaft	1	M10	50	5.0	L243
Clutch slave cylinder	3	M6	10	1.0	
Sprocket cover	3	M6	10	1.0	

CONTINUED ►

Fuel delivery pipe to throttle body	2	M5	5	0.5	
Gear shift lever	1	M6	10	1.0	
FRAME					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Seat subframe top mounting point	2	M10	50	5.0	
Seat subframe bottom mounting point	2	M10	50	5.0	
Fairing subframe fixings	2	M6	12	1.2	
Fairing side plate	2	M6	10	1.0	
Chain roller screw	1	M8	25	2.5	
REAR SWINGING ARM					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Swinging arm spindle adjuster bush	1	M30x1.5	12	1.2	Oil
Swinging arm spindle lockring	1	M30x1.5	60	6.0	
Swinging arm spindle nut	1	M20x1.5	90	9.0	
Caliper carrier retaining pin	1	M12x1.75	50	5.0	L243
Chain slider to swinging arm	2	M5	5	0.5	
Chain guard to swinging arm	4	M5	5	0.5	
Brake hose bracket fixing	1	M5	5	0.5	
Locknut screw chain tensioner fixing	2	M8	10	1.0	Oil
FOOTPEGS AND STAND					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Rider footpeg brackets to frame	5	M10	50	5.0	Oil
Passenger footpeg brackets to frame	4	M8	25	2.5	
Sliding pin	2	M8	25	2.5	L243
Side stand pivot bolt	1	M10	10	1.0	
Side stand locknut	1	M10	30	3.0	
Rotary switch retaining bolt	1	M6	10	1.0	L243
Side stand retaining bolt	3	M10	50	5.0	
Side stand padlock pin	1	M10	50	5.0	Oil
FRONT SUSPENSION					
Front fork					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Top yoke to fork legs	1+1	M8	25	2.5	
Bottom yoke to fork legs	2+2	M8	25	2.5	
Headstock nut	1	M35x1	40	4.0	
Headstock locknut	1	M35x1	man. +90°		
Top yoke fixing cap	1	M29x1	100	10.0	Oil
Fork yoke bottom cover	2+2	M6	10	1.0	

CONTINUED ►

REAR SUSPENSION					
Shock absorber					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Shock absorber to frame	1	M10	45	4.5	
Linkage system					
Single linkage to frame	1	M10	45	4.5	
Single / dual linkage to frame	1	M10	45	4.5	
Dual linkage to swinging arm	1	M10	45	4.5	
Dual linkage to shock absorber	1	M10	45	4.0	
ELECTRICAL SYSTEM					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Battery closure bracket fixing	1	M6	5	0.5	
Horn mount fixing	2	M6	10	1.0	
Horn fixing	1	M8	25	2.5	
Speed sensor fixing	1	M6	10	1.0	
ECU fixings	2	M6	5	0.5	
Rectifier fixings	2	M6	10	1.0	
Front brake light switch fixing	1	M4	2	0.2	
Fuse box and relay to dashboard/front fairing bracket	4	M6	5	0.5	
Relay cable to starter motor	1	M6	5	0.5	
Ground connection to engine	2	M6	10	1.0	
Cables to relay	2	M6	4	0.4	
AIRBOX					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Airbox cover fixings	8	M5	3	0.3	
Airbox to throttle body	6	M6	7	0.7	Oil
Intake funnels to airbox	4	SWP3,9	1.5	0.15	
Idling control stepper motor	2	M5	2.5	0.25	L243
Air temperature sensor	1	M10x1,25	man. + 90°		
Air cleaner to airbox	6	SWP5	3	0.3	
FRONT WHEEL					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Wheel spindle nut	1	M25x1,5	80	8.0	Ing2
Wheel spindle bosses on forks	4	M6	10	1.0	
REAR WHEEL					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Rear sprocket to flange	1	M10	50	5.0	
Wheel spindle nut	1	M20x1,5	90	9.0	Ing2
COOLING SYSTEM					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Radiator fixing	2	M6	10	1.0	Oil

CONTINUED ►

Lower radiator brackets to frame fixing	4	M6	10	1.0	
Cooling fan to radiator	3	TCB 4.2	1	0.1	L243
Expansion reservoir fixing	1	M6	10	1.0	
Expansion reservoir guard fixing	1	M5	3	0.3	
Expansion reservoir cap fixing	1	M28x3	man.		
Hose clips (part no. 8104097)	2	M5	3	0.3	
BRAKING SYSTEMS					
Front braking system					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Right-hand and left-hand brake caliper fixings	2+2	M10x1,25	50	5.0	Oil
Brake disc fixings	6+6	M8	25	2.5	L243
Front brake line fixings	3	M10x1	20	2.0	
Rear braking system					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Rear brake lever fixing	1	M8	20	2.0	L243 Ing2
Rear brake rod locknut	1	M6	man.		
Locknut for rear brake lever height adjustment	1	M6	man.		
Rear brake caliper	2	M8	25	2.5	
Brake disc fixings	6	M8	25	2.5	L243
Brake master cylinder and guard fixings	2	M6	10	1.0	
Brake fluid reservoir fixing	1	M6	3	0.3	
Rear brake hose fixings	2	M10x1	20	2.0	
Clutch hose fixings	2	M10x1	20	2.0	
EXHAUST SYSTEM					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Exhaust pipes to engine fixings	3+3	M8	25	2.5	
Silencer to seat subframe	4	M8	25	2.5	
Silencer guard	8	M6	10	1.0	
Exhaust pipe guard	4	M6	10	1.0	nocat
Exhaust pipe guard	4	M6	8	0.8	cat L243
Lambda probe	1	M18x1.5	40	4.0	cat Ing1
FUEL TANK					
Fuel pump flange					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Fuel delivery pipe to flange	1	1/4 NPT	10	1.0	L243
Fuel tank					
Filler cap to fuel tank	7	M5	6	0.6	
Fuel pump flange to fuel tank	7	M5	6	0.6	L518
Front tank to frame fixings	2	M6	10	1.0	

CONTINUED ►

Rear tank to frame fixings	2	M6	10	1.0	
Engine oil tank and cooler					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Oil tank fixings	3	M6	8	0.8	
Oil filter tang	1	M25x1.5	30	3.0	
Oil drain plug	1	M8	15	1.5	
Oil sight glass fixings	2	M10x1	20	2.0	
Oil cooler fixings	3	M6	10	1.0	
Oil cooler plate fixing	1	M6	10	1.0	
SEAT					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Rider seat fixings	2	M6	10	1.0	
BODYWORK					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Front fairing glass	4	M5	4	0.4	
Front fairing glass with fairing centre panel to subframe	4	M5	5	0.5	
Cockpit fascia panels to fairing centre panel	7	SWP 2.9	1	0.1	
Cockpit fascia panels with fairing centre panel, fuse cover and fairing centre closing panel	8	M4	1	0.1	
Front fairing glass side mount fixings	4	SWP 3.9	1	0.1	
Front mudguard to fork	2	M5	5	0.5	
Front mudguard to clips	2	M5	4	0.4	
Radiator spoiler and sump guard to radiator bottom bracket	2	M5	5	0.5	
Sump guard bottom fixings	2	M5	5	0.5	
Side fairing to fuel tank	4	M5	5	0.5	
Side fairing to frame plate	2	M5	5	0.5	
Radiator conveyors to fairing side element	8	SWP3.9	1	0.1	
Fairing side elements to radiator spoiler	2	M5	5	0.5	
Clear closing panel to fairing side element	6	SWP3.9	1	0.1	
Luggage rack and handle	6	M8	25	2.5	
Number plate bracket top fixings	2	M8	25	2.5	
Number plate bracket bottom fixings	2	M6	5	0.5	
Seat subframe lock fixings	6	M6	6	0.6	
Rear side body panel to luggage rack	4	M5	4	0.4	
Rear side body panel to side body panel closing	2	M5	4	0.4	
Side body panel closing to seat subframe	4	M5	3,5	0.35	
Side body panel closing bottom fixings	2	M6	6	0.6	
Shock absorber guard fixings	2	M6	5	0.5	
LIGHTS / INSTRUMENT PANEL					
Description	Qty.	Screw/nut	Nm	kgm	Note
Headlight to clips	2	TCB 5.5	4	0.4	

CONTINUED ►

Headlight to lugs	2	TCB 5.5	2	0.2	
Tail light fixings	3	M6	5	0.5	
Front turn indicator fixings	2	M4	1	0.1	
Rear turn indicator fixings	2	M6	5	0.5	
Cockpit to bridge	4	M6	8	0.8	
Number plate light fixings	2	M5	3	0.3	
Cat's eye fixing	2	M4	3	0.3	
IGNITION SWITCH AND LOCK					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Ignition switch unit fixing	1	M8	25	2.5	Vs
Ignition switch unit fixing	1	M8	25	2.5	
Lock fixing	2	M6	7	0.7	
HANDLEBARS AND CONTROLS					
Description	Qty.	Screw/nut	Nm	kgm	Notes
Vibration-damping weights	2	M6	10	1.0	
Handlebars bridge	4	M8	25	2.5	Oil
Left-hand light dip switch	2	M6	10	1.0	
Right-hand light dip switch	2	M5	2	0.2	Oil
Front brake control	2	M6	10	1.0	
Clutch control	2	M6	8	0.8	

Steel / aluminium fastening screws with similar coefficient of elasticity

SCREW	Nm	kgm
M4	3	0.3
M5	6	0.6
M6	12	1.2
M8	25	2.5
M10	50	5.0
M12	80	8.0

2.41.1 CLEANING AND LUBRICATION

Never wash the drive chain using steam cleaners, high-pressure water nozzles or highly flammable solvents.

◆ Wash the drive chain with fuel oil or kerosene.
If the chain tends to become rusty quickly, service more frequently.

WARNING

Do not use trichlorethylene, petrol or similar products: these products may be too aggressive for this type of chain or, more important, they may damage the O-rings that retain the grease in the gaps between rollers and pins.

ENGINE

3

ENGINE**CONTENTS**

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3.1 SPECIFICATIONS AND TECHNICAL INFORMATION

3.1.1 TECHNICAL DATA

See 1.5 (SPECIFICATIONS).

3.1.2 MAINTENANCE INTERVALS

See 2.1.1 (PERIODIC MAINTENANCE CHART).

3.1.3 TROUBLESHOOTING

See 8.1 (TROUBLESHOOTING).

3.1.4 SEALANTS

See 1.7 (CONSUMABLES).

3.1.5 LUBRICANTS

See 1.6 (LUBRICANT CHART).

3.1.6 SPECIAL TOOLS

See 1.8 (SPECIAL TOOLS).

3.1.7 TORQUE FIGURES

See 2.41 (FASTENERS).

3.1.8 PRECONDITIONS FOR MAINTENANCE AND REPAIR WORK

CAUTION

The engine weighs 67 kg approximately and must be supported adequately upon installation. Handle using lifting equipment of adequate weight capacity and consider the centre of gravity of the engine. Be careful of any projecting parts or sharp edges to avoid injury from squeezing or cutting.

WARNING

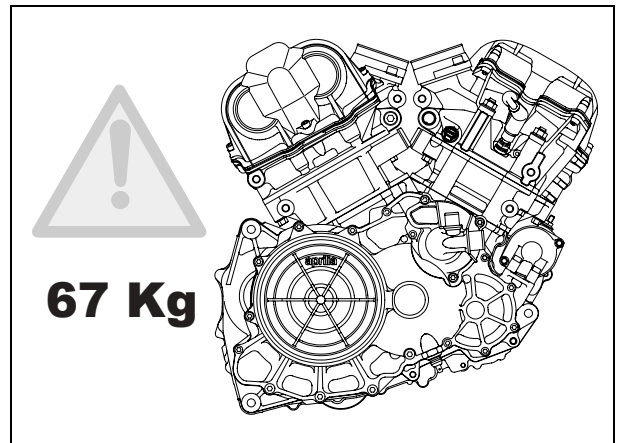
In order to maintain the motorcycle engine and systems, a thorough knowledge of the motorcycle is required. In addition, always use the special tools specified.

All maintenance and repair work must be undertaken by a suitably trained technician.

NOTE Observe the manufacturer's instructions and recommendations.

3.1.9 GENERAL MAINTENANCE AND REPAIR INSTRUCTIONS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.



3.2 ENGINE COMPONENTS THAT CAN BE REMOVED WITH THE ENGINE INSTALLED IN THE FRAME

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

The parts listed below can be removed leaving the engine in the frame.

⚠ WARNING

Necessary removal procedures are listed in the proper sequence in this section.

Certain procedures include cross-references to relevant sections of the manual. Some of the operations described there may not be strictly required for the job at hand. Proceed sensibly to avoid redundant work, that is, always make sure you really need to remove a particular component before proceeding.

Perform the minimum operations required to give access to the component to be serviced.

TOP END

- Valve cover (1), see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Valve cover (2), cylinder head, rear cylinder and piston, see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Front (3) and rear (4) cylinder intake flanges.
- Camshaft position sensor and camshafts, see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Timing chain, chain tensioner and front and rear cylinder timing drive assembly, see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Valves, see 0.4.1 (ENGINE WORKSHOP MANUALS)..

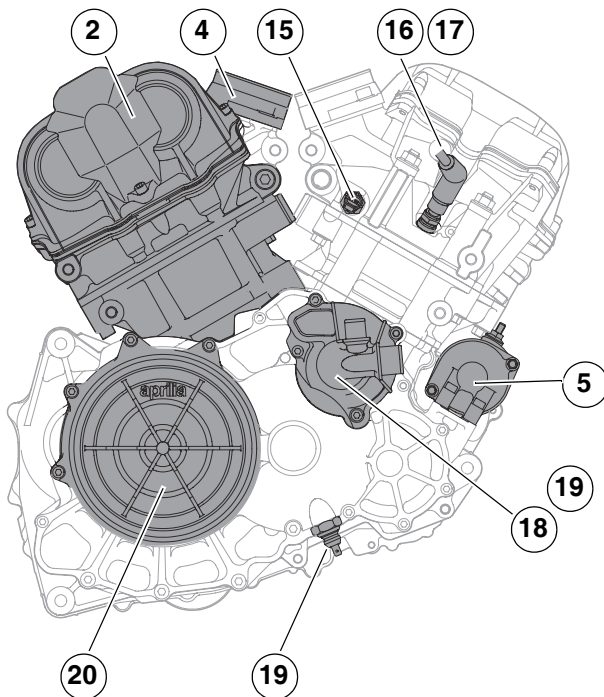
FRONT END

- Front cylinder exhaust pipe, see 7.1.42 (REMOVING THE EXHAUST PIPES).
- Starter motor (5), see 0.4.1 (ENGINE WORKSHOP MANUALS).

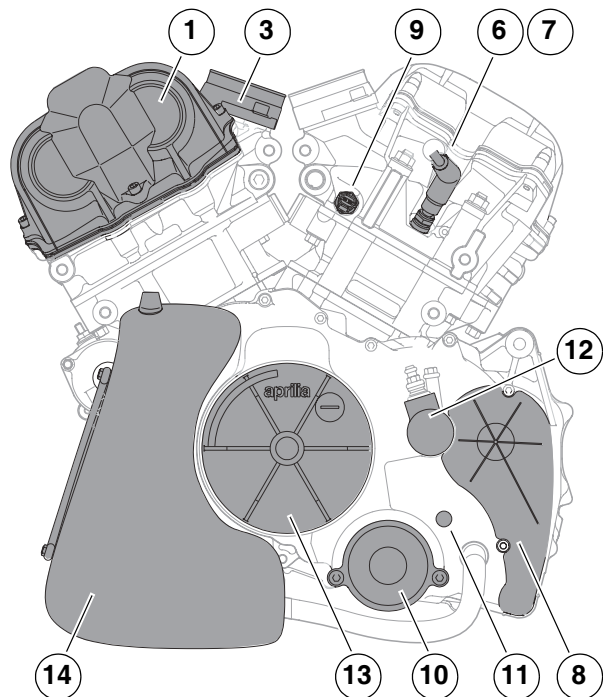
REAR END

- Exhaust removal, see 7.1.41 (EXHAUST SILENCER REMOVAL).

RIGHT SIDE



LEFT SIDE

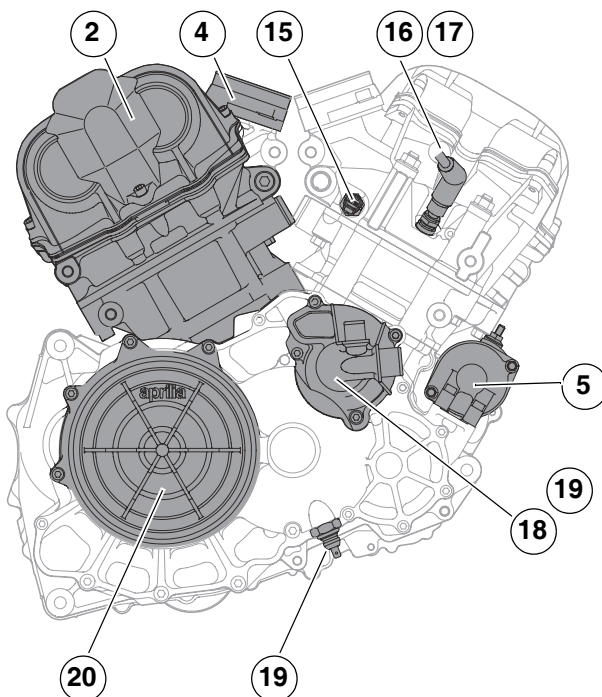
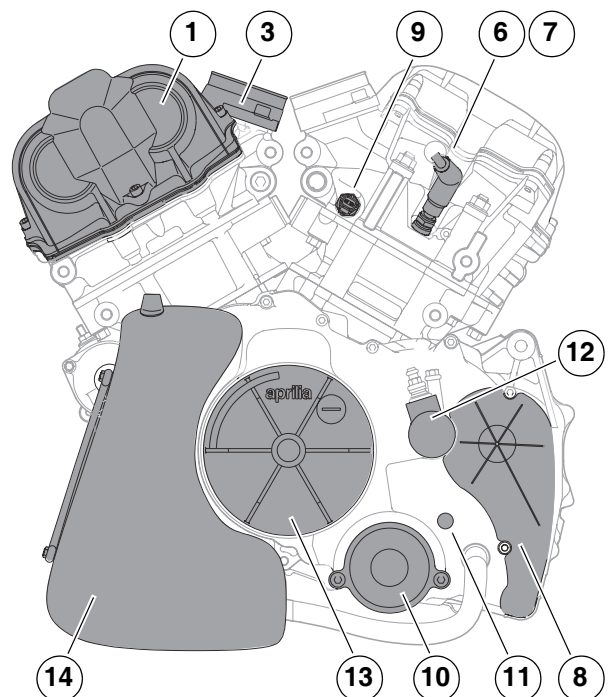


LEFT-HAND SIDE

- Rear cylinder spark plugs (6-7), see 2.7 (SPARK PLUGS).
- Drive sprocket cover (8), see 2.35.5 (DRIVE CHAIN GUIDE PLATE INSPECTION).
- Gear shift lever, see 7.1.39 (REMOVING THE GEAR SHIFT LEVER ASSEMBLY).
- Rear cylinder coolant thermistor (9), see 5.4 (REMOVING THE COOLANT THERMISTORS).
- Engine oil filter (10), see 2.12 (ENGINE OIL AND FILTER CHANGE).
- Neutral switch (11).
- Clutch slave cylinder (12), see 3.2.1 (CLUTCH SLAVE CYLINDER REMOVAL).
- Flywheel cover (13) and ignition system, see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Engine oil tank (14), see 7.1.44 (REMOVING THE ENGINE OIL TANK)..

RIGHT-HAND SIDE

- Front cylinder coolant thermistor (15), see 5.4 (REMOVING THE COOLANT THERMISTORS).
- Front cylinder spark plugs (16-17), see 2.7 (SPARK PLUGS).
- Coolant pump (18), see 0.4.1 (ENGINE WORKSHOP MANUALS).
- Engine oil pressure sensor (19).
- Clutch cover (20) and clutch assembly, see 0.4.1 (ENGINE WORKSHOP MANUALS).

RIGHT SIDE**LEFT SIDE**

3.2.1 CLUTCH SLAVE CYLINDER REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.6 (CLUTCH FLUID) carefully.

- ◆ Release and remove the screws (1).



Torque wrench setting for screws (1): 10 Nm (1.0 kgm).

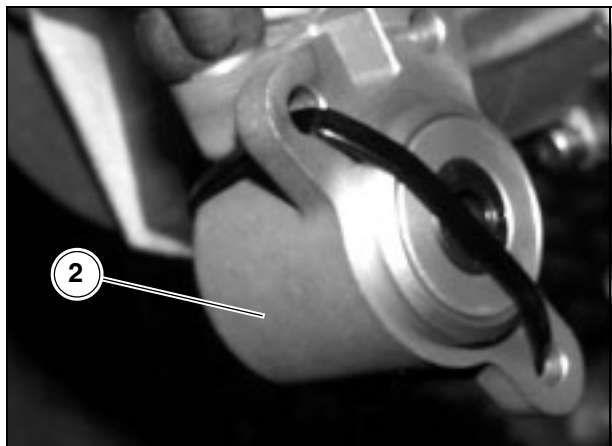
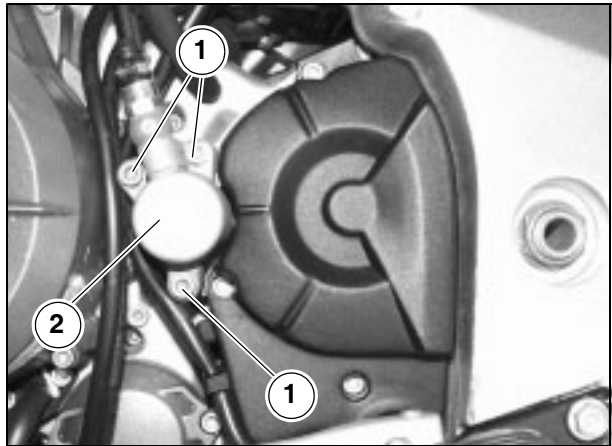
- ◆ Withdraw the slave cylinder assembly (2).

⚠ WARNING

Pull gently, as the slave cylinder (2) is still connected to the clutch line.

Never operate the clutch lever with the slave cylinder (2) removed, or the piston may fall out leading to loss of clutch fluid.

To be on the safe side, secure the piston with a plastic clip (see picture).



3.3 TAKING THE ENGINE OUT OF THE FRAME

⚠ WARNING

Engine removal must be undertaken at an Authorised Service Centre or an Authorised Aprilia Dealer.

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

⚠ WARNING


Engine removal is a complex operation. Plan work ahead and identify the locations of affected parts on the vehicle before proceeding.

Necessary removal procedures are listed in the proper sequence in this section.

Certain procedures include cross-references to relevant sections of the manual. Some of the operations described there may not be strictly required for the job at hand. Proceed sensibly to avoid redundant work, that is, always make sure you really need to remove a particular component before proceeding. Perform the minimum operations required to give access to the component to be serviced.

The engine is removed by lowering it from the frame. Make sure to have all necessary equipment ready at hand and in place before proceeding.

Dry engine weight: approximately 67 Kg.

- ◆ Set the ignition switch to “”.
- ◆ Place the motorcycle on the centre stand **OPT**.
- ◆ Disconnect the battery negative lead (-) first, then the positive lead (+).

⚠ WARNING

Reverse the order when reconnecting the leads (positive (+) lead first, then negative (-) lead).

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Remove the fairings, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Remove the right-hand lower fairing, see 7.1.3 (REMOVING THE SIDE BODY PANELS)
- ◆ Remove the radiator spoiler, see 7.1.23 (REMOVING THE UPPER SUMP GUARD) and see 7.1.24 (REMOVING THE LOWER SUMP GUARD).
- ◆ Remove the throttle body assembly, see 4.8.1 (THROTTLE BODY REMOVAL).

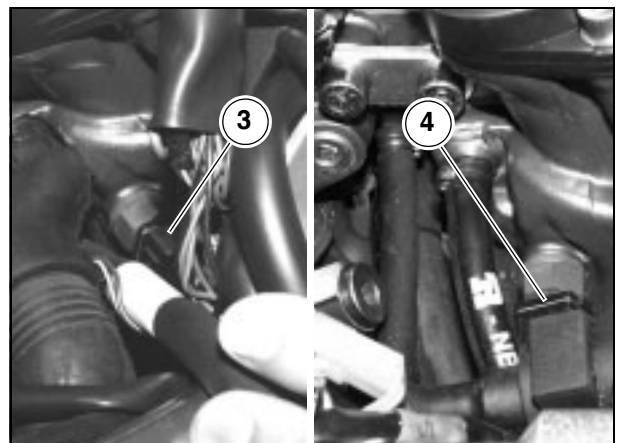
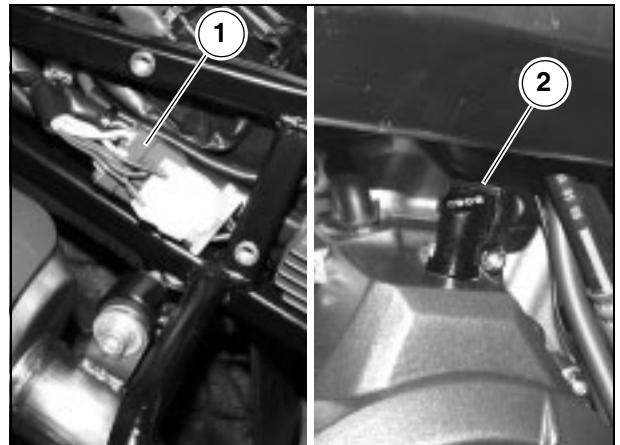
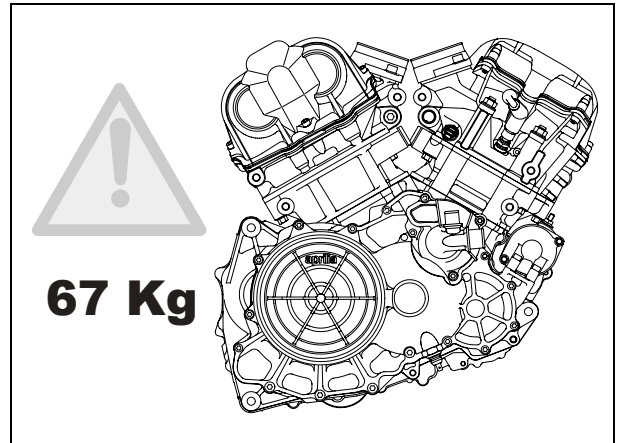
⚠ WARNING

Mark all wires with their original positions to avoid confusing them when refitting.

- ◆ Disconnect the following electrical connectors in the order:
 - generator (1);
 - crankshaft position sensor (2);
 - front cylinder coolant thermistor (3);
 - rear cylinder coolant thermistor (4).

⚠ WARNING

Make sure to fit each connector to the matching connector on assembly.

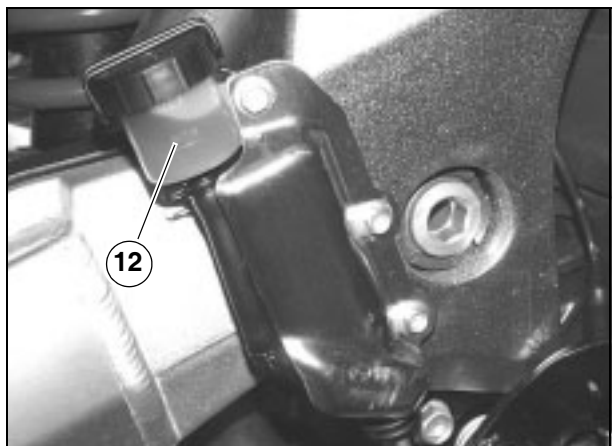
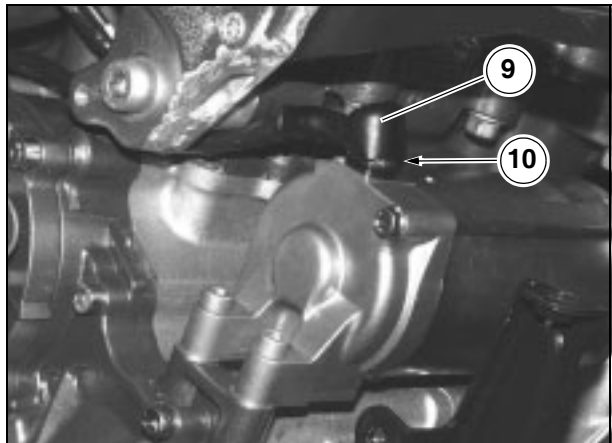
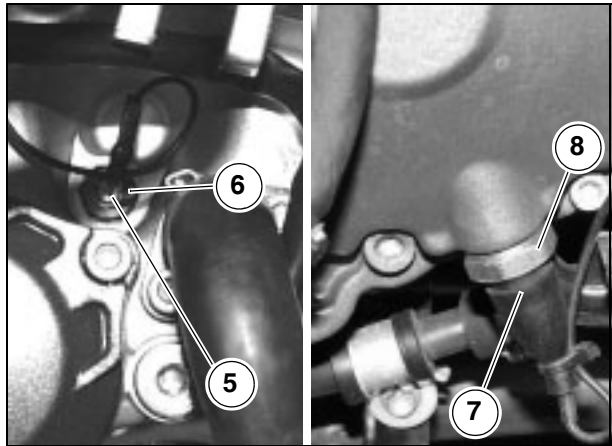


- ◆ Release and remove the screw (5). Disconnect the lead of the neutral switch (6).
- ◆ Remove the expansion reservoir, see 5.6 (REMOVING THE EXPANSION RESERVOIR).
- ◆ Slip off the dust cap (7) and disconnect the lead of the engine oil pressure sensor (8) at sensor end.
- ◆ Slip off the dust cap (9), undo and remove the nut (10), collect the washer and disconnect the starter motor lead.

⚠ WARNING

The brake fluid reservoir (12) must remain in a vertical position at all times to avoid loss of brake fluid.

- ◆ Remove the clutch slave cylinder, see 3.2.1 (CLUTCH SLAVE CYLINDER REMOVAL).
- ◆ Remove the drive sprocket, see 7.8.1 (REMOVING THE REAR SWINGING ARM).
- ◆ Remove the gear shift lever, see 7.1.40 (REMOVING THE REAR BRAKE LEVER).



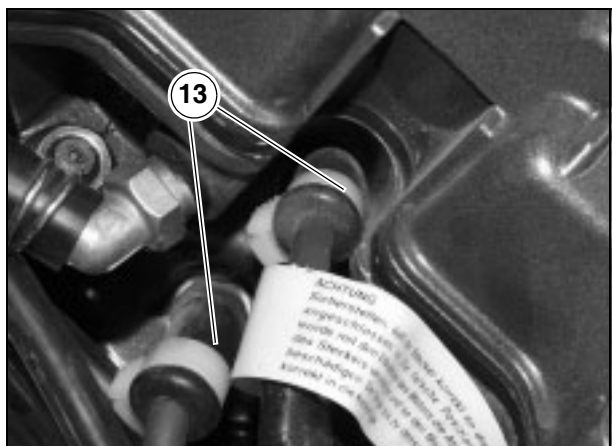
- ◆ ★ Pull the spark plug caps off the plugs (13).

⚠ WARNING

Clean the outer surface of engine with a degreasing detergent, brushes and rags.

Ensure that no rubber or plastic parts come in contact with detergents and corrosive or penetrating solvents.

Should you need a steam cleaner, do not direct water, steam or high-pressure air jets towards any of the following parts: wheel hubs, controls on right and left handlebars, brake master cylinders, instruments and indicators, silencer outlets, glove compartment, ignition switch/steering lock, electrical components.



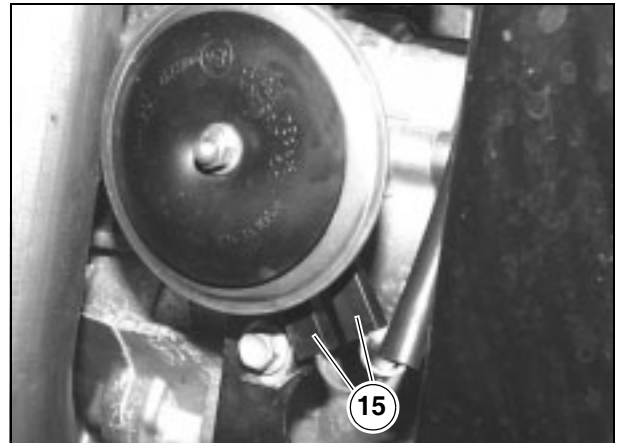
- ◆ Clean the outer surface of the engine thoroughly.
- ◆ Remove the exhaust pipes, see 7.1.42 (REMOVING THE EXHAUST PIPES).
- ◆ Disconnect the cooling fan connector (14).



- ◆ Disconnect the warning horn wiring (15).

⚠ WARNING

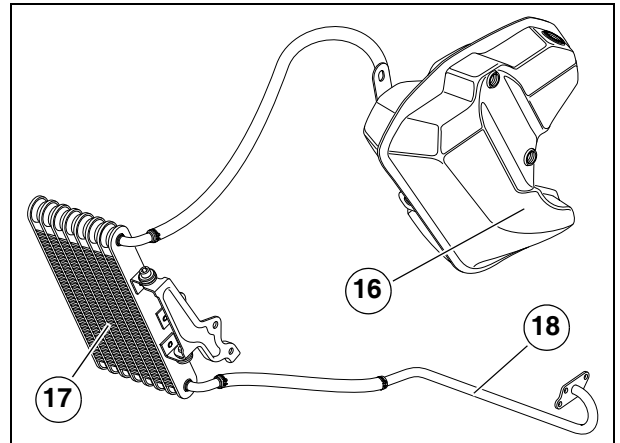
Take care to refit each connector to the matching connector on assembly.



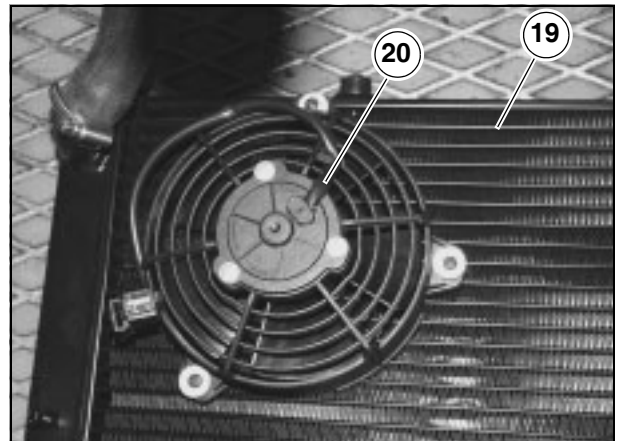
⚠ WARNING

Mark hose and pipes with their relative positions to avoid confusing them when refitting.

- ◆ Remove the engine oil tank (16) - see 7.1.44 (REMOVING THE ENGINE OIL TANK), together with the engine oil cooler (17) - see 7.1.45 (OIL COOLER REMOVAL), by disconnecting the pipe (18) at engine end.



- ◆ Remove the radiator (19) together with cooling fan (20), see 5.2 (REMOVING THE RADIATOR).
- ◆ Remove the thermal expansion valve, see 5.5 (REMOVING THE THERMAL EXPANSION VALVE).



NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips on assembly. Use clips of the same type fitted originally.

- ◆ Release the head of the hose clip (22).
- ◆ Pull the hose coupling (21) off the coolant pump.

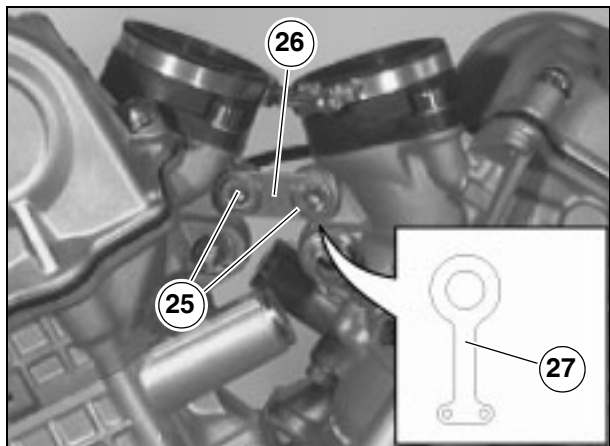
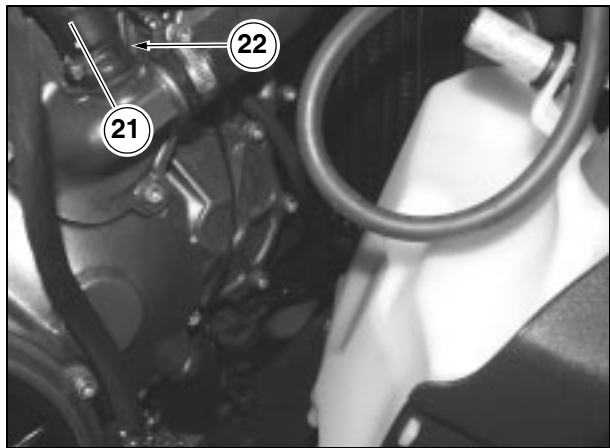
⚠ WARNING

Release all clips securing the wires and hoses, tracing each wire or hose up to opposite end. Make sure to have enough new clips ready at hand to secure wires and hoses properly when refitting. Block off all openings of engine and hoses to prevent the ingress of dirt.

- ◆ Collect all wires in a bundle and fasten with adhesive tape at a safe location where they will not be disturbed when you remove the engine.
- ◆ Release and remove the screws (25). Collect the plate (26).



Torque wrench setting for screws (25): 40 Nm (4.0 kgm).



NOTE Make sure to have the special tool **OPT** (27), part no. 8140183 (engine lifting eyebolt), a hoist (24) and suitable slings (23) ready at hand.

⚠ CAUTION

Hoist (24) and slings (23) must have adequate weight capacity in order to lift and handle the engine safely. The engine weighs approximately 67 kg.

- ◆ Install the engine lifting eyebolt (27) (part no. 8140183) and secure it in place using the screws (25).
- ◆ Hook the slings (23) to the hoist (24) and the eyebolt (27) as shown in the picture.

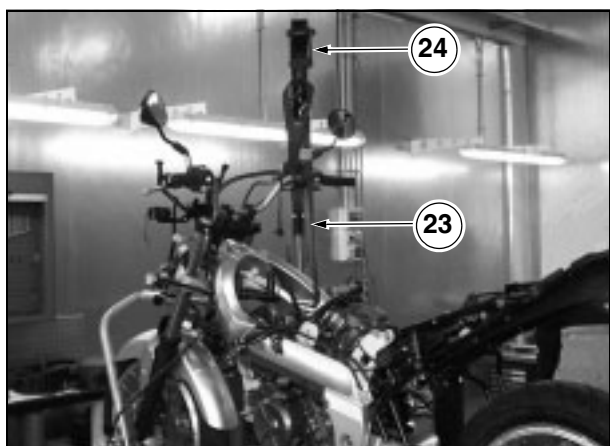
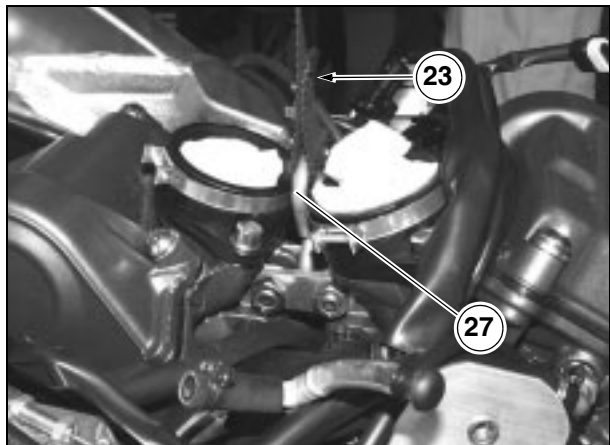
⚠ CAUTION

Ensure that eyebolt, slings and hoist are connected securely and stable before proceeding to the next operations. This is to ensure that the engine is lifted and handled in full safety.

- ◆ Raise the hoist arm (24) until stretching the slings (23) taut.

⚠ WARNING

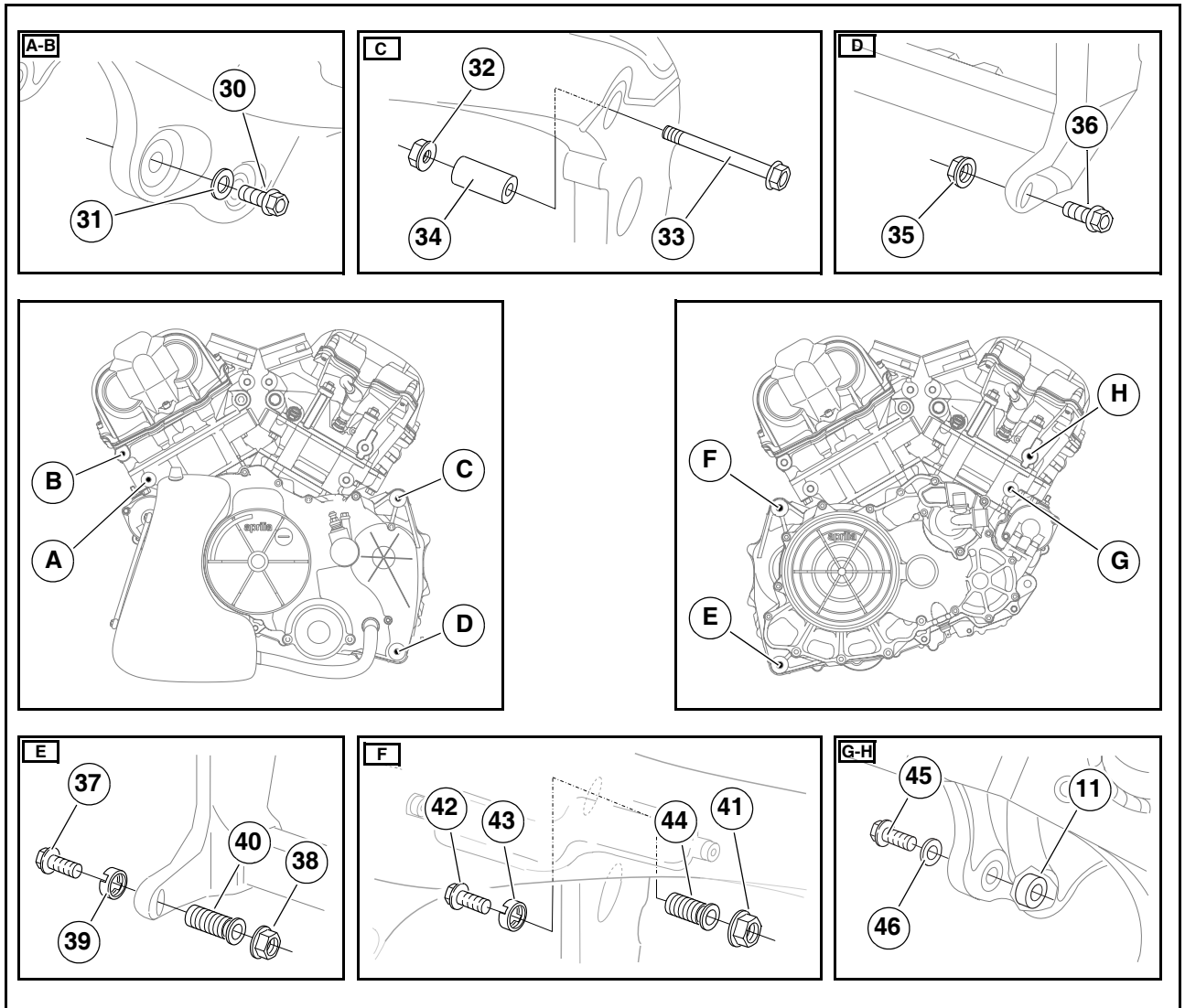
Raise the hoist arm (24) just enough to support the engine during removal of the engine-to-frame fixings.



NOTE Engine-to-frame fixings must be removed in this order:

LEFT-HAND SIDE: A → B → C → D.


RIGHT-HAND SIDE: E → F → G → H.




- ◆ Release and remove the two screws (30) and collect the washers (31).

 **Torque wrench setting for screws (30): 50 Nm (5.0 kgm).**


- ◆ Hold the check nut (32) steady. Release and remove the screw (33).

 **Torque wrench setting for check nut (32) and screw (33): 50 Nm (5.0 kgm).**

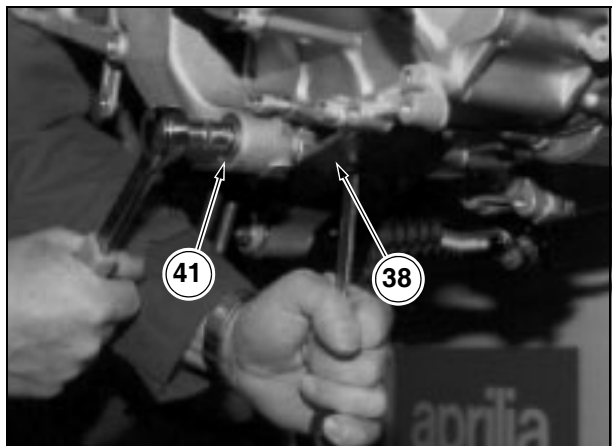
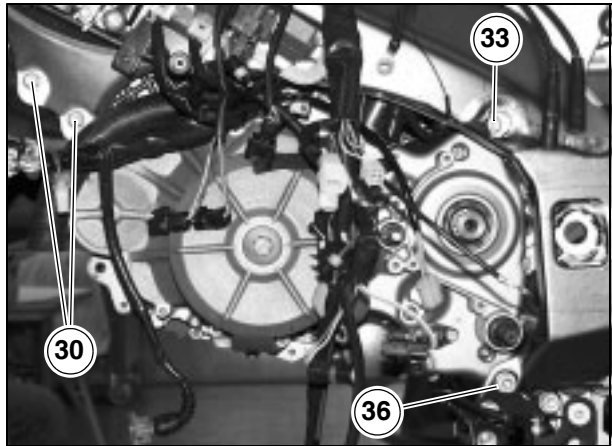
- ◆ Collect the spacer (34).
- ◆ Hold the check nut (35) steady. Release and remove the screw (36).

 **Torque wrench setting for check nut (35) and screw (36): 50 Nm (5.0 kgm).**


- ◆ Hold the check nut (38) steady. Release and remove the screw (37).

 **Torque wrench setting for check nut (38) and screw (37): 50 Nm (5.0 kgm).**

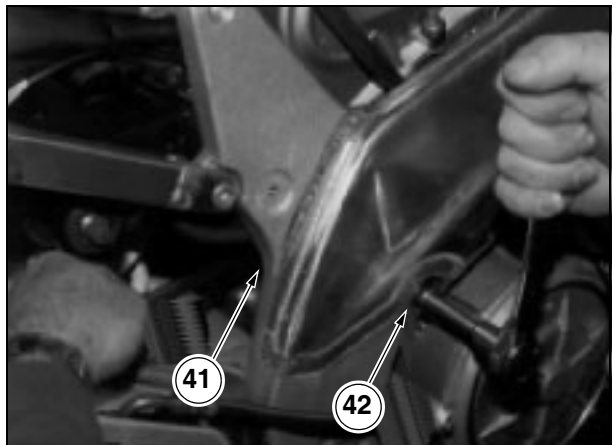
NOTE On assembly lubricate the screw (37) with oil (part no. 8116050).



- ◆ Hold the check nut (41) steady. Release and remove the screw (42).

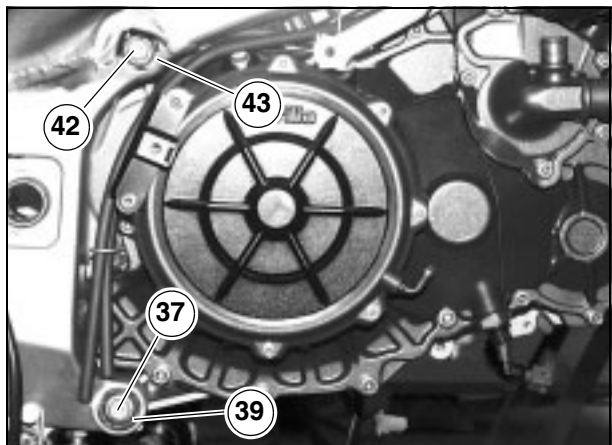
 **Torque wrench setting for check nut (41) and screw (42): 50 Nm (5.0 kgm).**

NOTE On assembly lubricate the screw (42) with oil (part no. 8116050).



- ◆ Slacken and remove the locknuts (43 - 39) using the special socket (28) (cod. 8140203).

 **Torque wrench setting for locknuts (43 - 39): 50 Nm (5.0 kgm).**



- ◆ Screw out the adjusting bushes (40 - 44) until bringing them fully home in the frame.



Torque wrench setting for adjusting bushes (40 - 44): 10 Nm (1.0 kgm).

⚠ WARNING

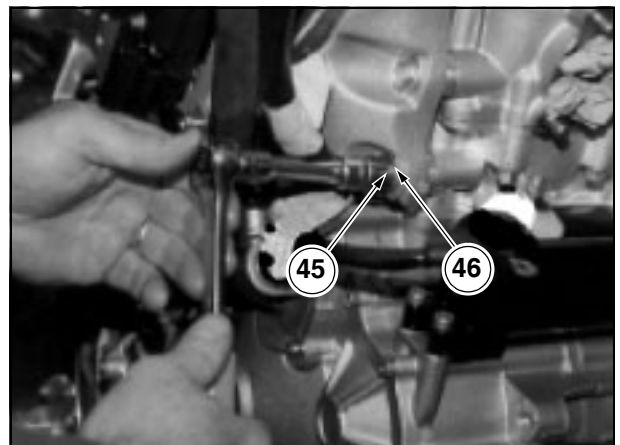
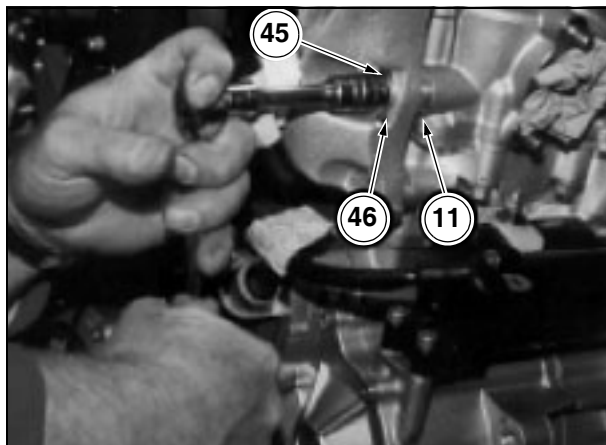
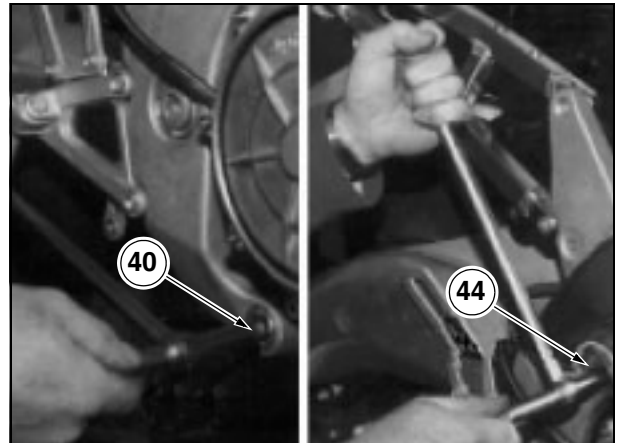
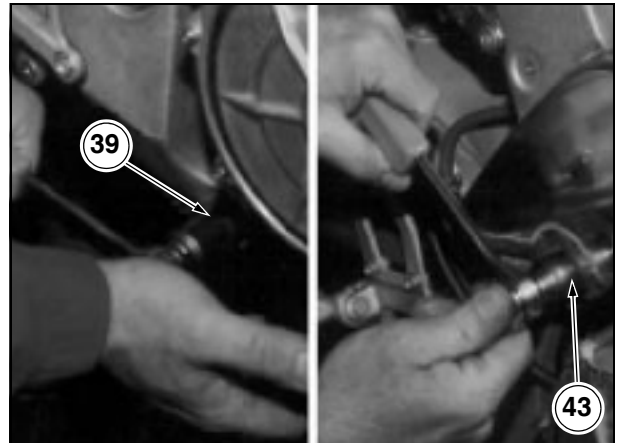
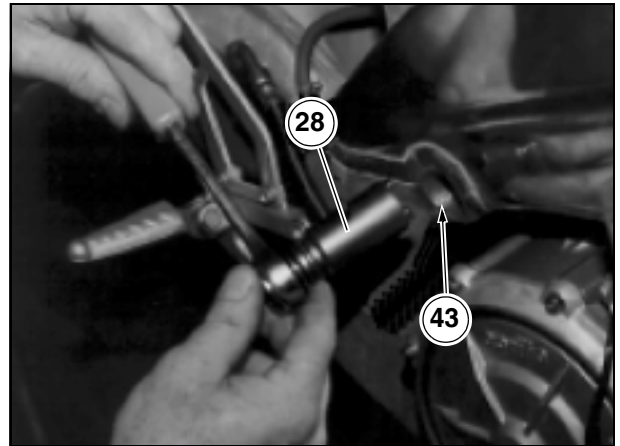
On assembly, screw in the adjusting bushes (40 - 44) manually until bringing them fully home in the engine and then tighten to the specified torque.

- ◆ Hold the check nut (38) steady. Release and remove the screw (37).
- ◆ Hold the check nut (41) steady. Release and remove the screw (42).
- ◆ Ensure that the slings (23) are taut.
- ◆ Release and remove the two screws (45) and collect the washers (46).



Torque wrench setting for screws (45): 50 Nm (5.0 kgm).

- ◆ Collect the two shims (11).



⚠ CAUTION

The engine is now supported on the hoist only. All fixings have been removed.

Handle with care. Be careful to avoid injury to your hands, arms and legs.

Clear all tools from the area. Thoroughly clean the area of the floor where the engine is to be placed.

- ◆ Raise the hoist arm by a few millimetres to ease the engine off the frame.
- ◆ Lower the hoist arm until placing the engine on the floor.
- ◆ Secure the engine to prevent it falling over.
- ◆ Release the hoist slings (23).
- ◆ Remove the slings (23) from the frame.
- ◆ Move the engine aside from under the frame.
- ◆ Fasten the slings (23) to the engine again.



NOTE If the engine needs servicing, place it in the special stand (29) (part no. 8140187 + 8140188).

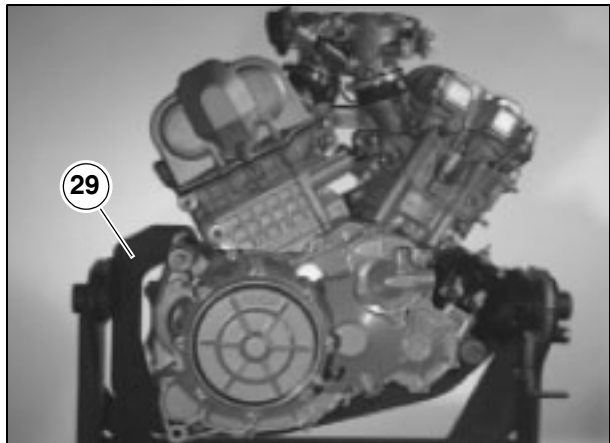
⚠ WARNING

Unless you need to service the engine, it will be safer when left on the floor, still fastened to slings (23) and hoist.

- ◆ Clean the outer surface of the engine thoroughly.

⚠ WARNING

Clean the outer surface of the engine with a degreasing detergent, brushes and rags. Ensure that no rubber or plastic parts come in contact with detergents and corrosive or penetrating solvents.



3.4 FITTING THE ENGINE IN THE FRAME

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

NOTE To refit the engine in the frame, reverse the removal procedure, see 3.3 (TAKING THE ENGINE OUT OF THE FRAME).

Before proceeding, however, you will have to perform the operations detailed below.

⚠ CAUTION

Handle with care.

Be careful to avoid injury to hands, arms and legs.

- ◆ Ensure that the adjusting bushes (1 - 2) are fully home in the frame.
- ◆ Shift the engine gradually, with minimal movements, until engine fixing holes align perfectly with those on the frame (A - B - C - D).

Once the engine is back into frame, perform the following operations.

- ◆ Ensure that all engine mounting bolts and nuts are at the correct torque.
- ◆ Top up coolant level, see 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL).
- ◆ Top up engine oil level, see 2.11 (CHECKING AND TOPPING UP ENGINE OIL LEVEL).
- ◆ If you have overhauled the engine, bleed the engine oil circuit and check oil pressure, see 0.4.1 (ENGINE WORKSHOP MANUALS).
- ◆ Check chain slack and adjust as required, see 2.35.1 (CHAIN SLACK INSPECTION) and 2.35.3 (CHAIN SLACK ADJUSTMENT).

⚠ WARNING

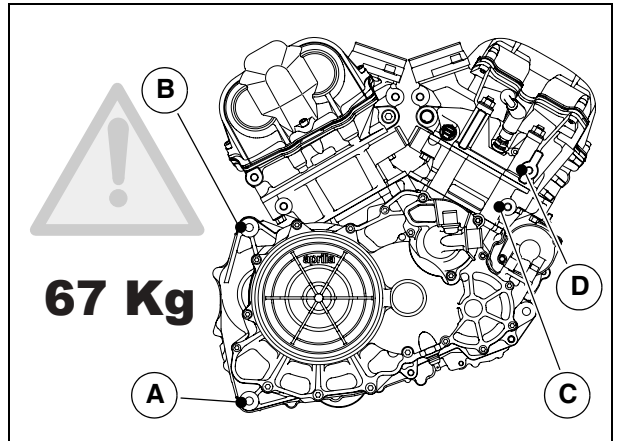
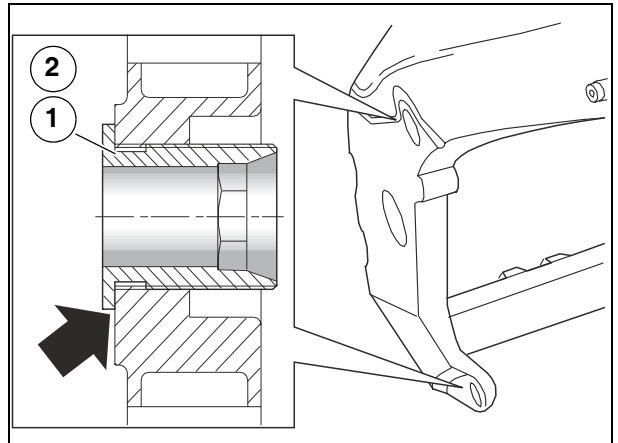
Inspect any parts you have removed, paying special attention to these components:

- wiring must be properly fastened with wire ties.

⚠ WARNING

Wires and hoses must not be twisted and/or trapped under other parts.

- Electrical connectors must be fitted to the matching connectors;
- hoses, pipes and couplings must be securely in place and fastened with suitable clips;
- throttle and cold-start cables must slide smoothly inside their housings and must not bind when handlebars are turned;
- gear shift lever must be properly positioned;
- rear brake lever must be properly positioned.



FUEL SYSTEM

4

FUEL SYSTEM

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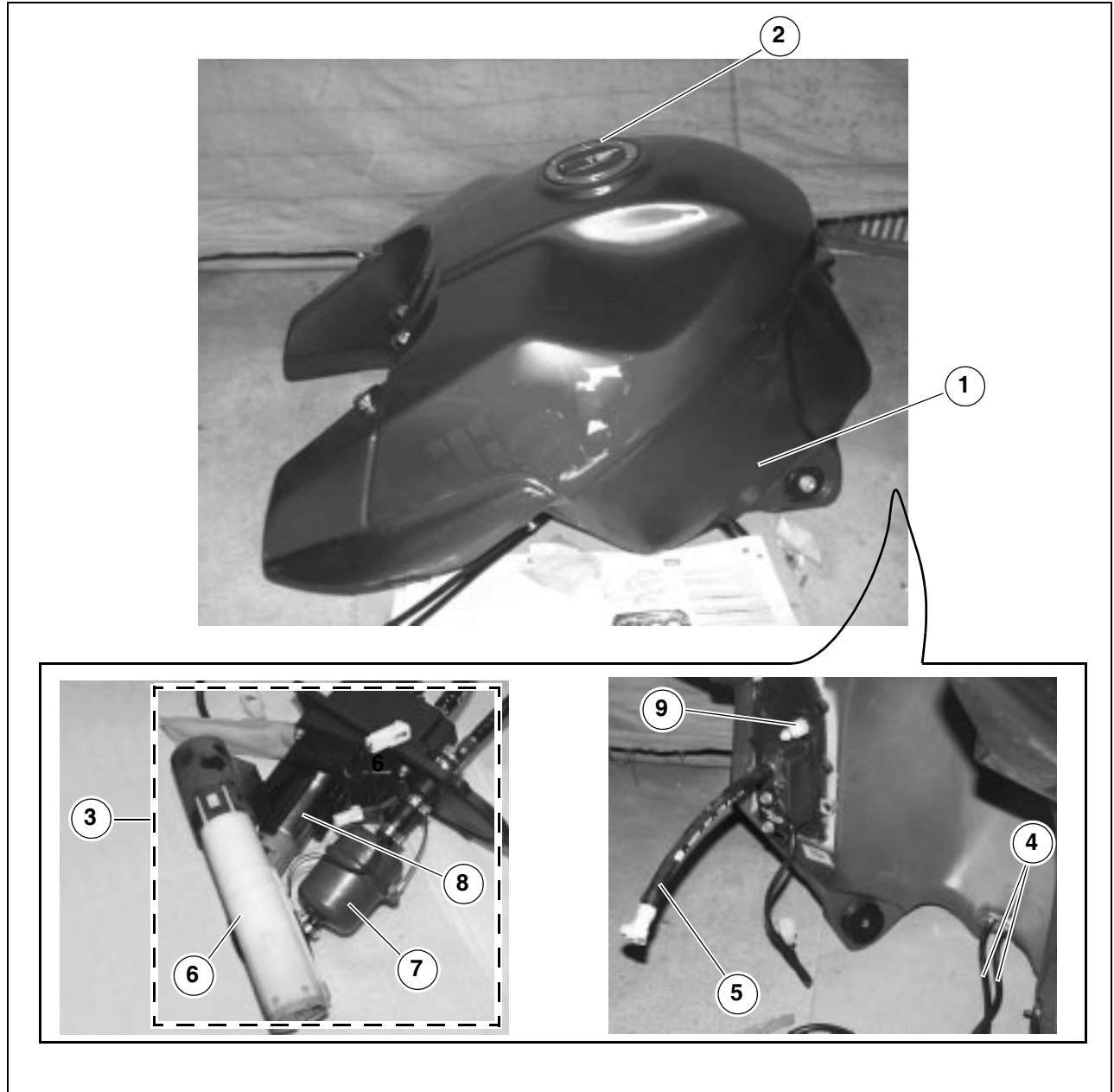
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4

4.1 FUEL TANK

The fuel tank is fitted with a top-mounted filler cap, whereas the tank bottom accommodates the following components:

- ◆ the fuel pump assembly;
- ◆ a drain hose to drain water from the filler cap when it rains or after washing;
- ◆ a drain hose to drain fuel from the tank for the event it is overfilled.



Key

- | | |
|-----------------------|-------------------------|
| 1) Fuel tank | 6) Fuel sensor |
| 2) Filler cap | 7) Fuel delivery filter |
| 3) Fuel pump assembly | 8) Fuel pump |
| 4) Drain hoses | 9) Fuel delivery hose |
| 5) Fuel return hose | |

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.1 (FUEL) carefully.

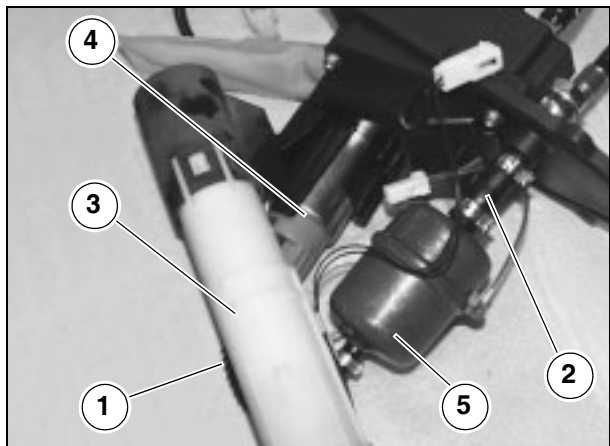
⚠ CAUTION

Fuel vapours are harmful to human health. Ensure that the area is well ventilated before proceeding.
 Do not inhale fuel vapours.
 Avoid contact with skin.
 Do not smoke or use bare flames.
 Do not release fuel into the environment.

4.1.1 MAINTENANCE

- ◆ Each time the fuel pump assembly is removed, see 4.3 (REMOVING THE FUEL PUMP ASSEMBLY), it is recommended that you inspect the hoses (1 - 2) and test:
 - fuel sensor (3), see 6.10.5 (FUEL SENSOR); and
 - fuel pump (4), see 6.7.2 (FUEL PUMP TEST) for proper operation.
- ◆ Change the fuel delivery filter (5).

NOTE It is recommended that you also wash the fuel tank thoroughly.



4.1.2 INSPECTING THE FUEL LINES

Check the fuel lines every 7500 km (4687 mi) or 8 months; renew every 4 years.

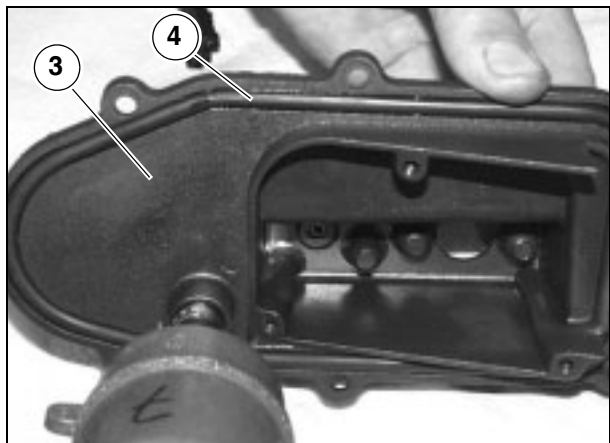
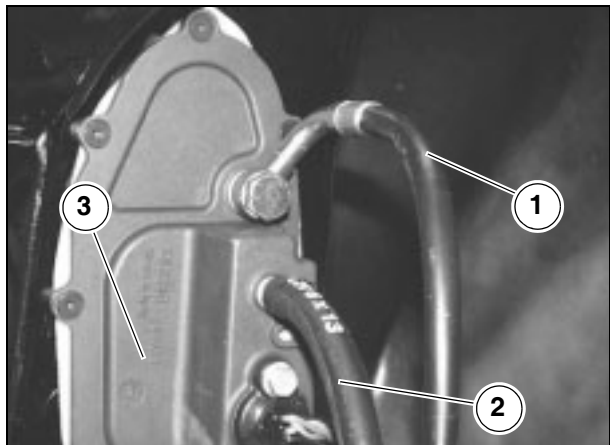
⚠ CAUTION

Pay special attention to the delivery (1) and return (2) hoses and fittings. The operating pressure of the delivery hose (1) is approximately 450 Kpa (4.5 bar).

Always renew a cracked or cut fuel hose. If fuel leaks past the flange (3), it means that the O-ring (4) might be damaged. When this is the case:

- ◆ Remove the fuel pump assembly, see 4.3 (REMOVING THE FUEL PUMP ASSEMBLY). Inspect the O-ring and replace as required.

NOTE On assembly, apply LOCTITE® 518 to the O-ring (4). See 6.7.2 (FUEL PUMP TEST) for more details.



4.2 DRAINING THE FUEL TANK

See 2.8 (DRAINING THE FUEL TANK) for instructions on how to drain the fuel tank.

4.3 REMOVING THE FUEL PUMP ASSEMBLY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION), 1.2.1 (FUEL) and 4.1.1 (MAINTENANCE) carefully.

- ◆ Drain the fuel tank. Refer to the first eleven steps described in subsection 2.8 (DRAINING THE FUEL TANK).
- ◆ Release and remove the six screws (1).
- ◆ Release the screw (2).
- ◆ Rotate the fuel pipe fitting (3).
- ◆ Release and remove the screw (4).

NOTE On assembly, turn in all screws until finger tight, and then tighten to the specified torque in a cross pattern.



Torque wrench setting for screws (1-4): 6 Nm (0.6 kgm).



Torque wrench setting for screws (2): 10 Nm (1.0 kgm).

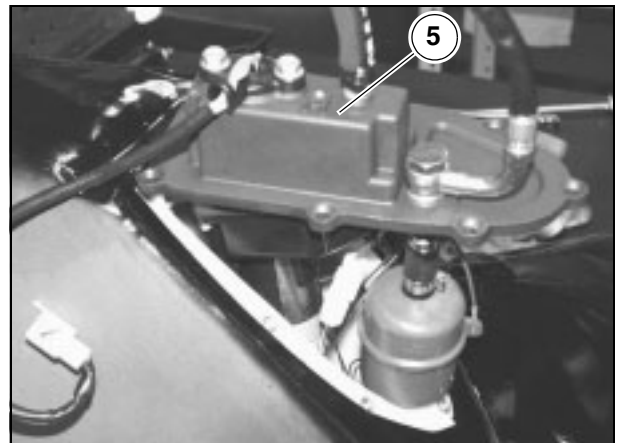
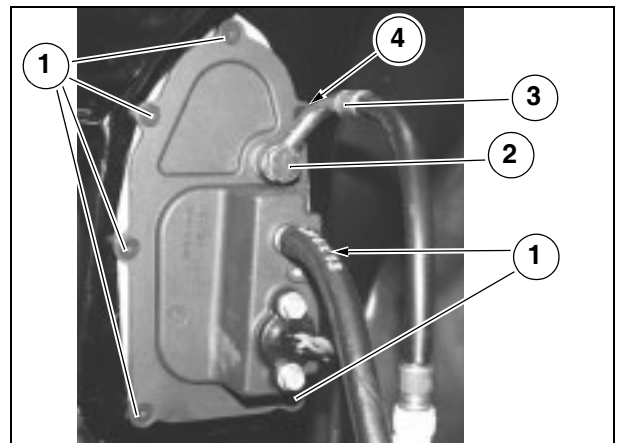
⚠ WARNING

On assembly, apply LOCTITE® 518 to the thread of screws (1-4).

On assembly, apply LOCTITE® 243 to the thread of the screw (2).

Take care not to damage the fuel lines and the fuel sensor when removing the fuel pump assembly (5).

- ◆ Remove the fuel pump assembly (5).



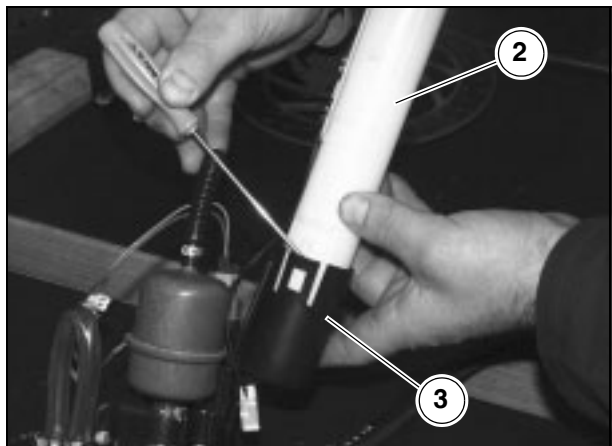
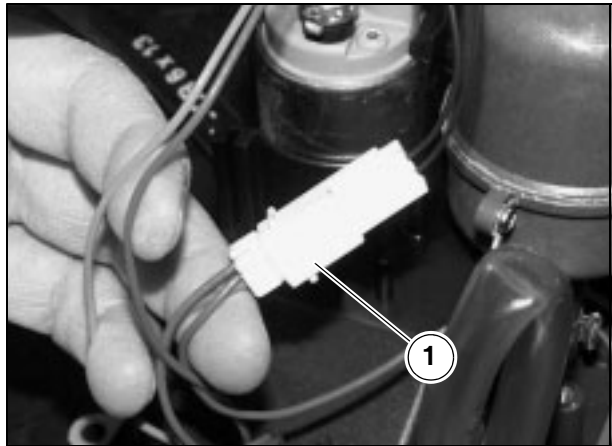
4.4 REMOVING THE FUEL SENSOR

- ◆ Remove the fuel pump assembly, see 4.3 (REMOVING THE FUEL PUMP ASSEMBLY).
- ◆ Disconnect the connector (1).

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Ease the fuel sensor (2) out of the mount (3) levering with a screwdriver.



4.5 REMOVING THE FUEL DELIVERY FILTER

- ◆ Remove the fuel pump assembly, see 4.3 (REMOVING THE FUEL PUMP ASSEMBLY).
- ◆ Release and remove the screw (6) to release the ground cable.

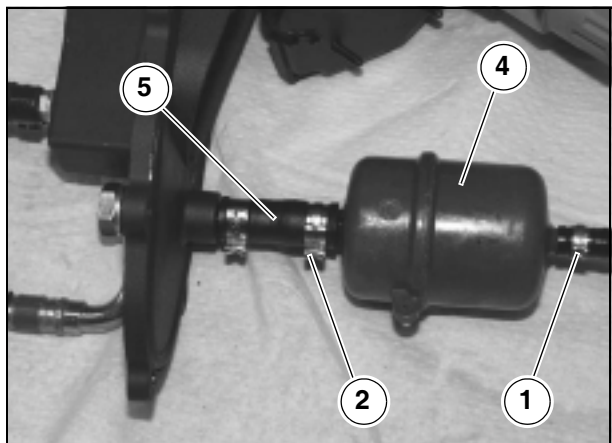
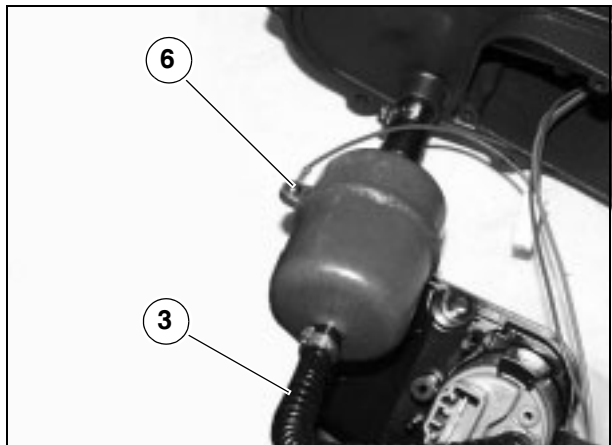
NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips on assembly. Use clips of the same type fitted originally.

- ◆ Release the head of the hose securing clip (1-2).
- ◆ Pull the hose (3) off the filter (4).
- ◆ Detach the filter (4) from the hose (5).

⚠ WARNING

Never reuse a fuel filter.

- ◆ Install a new filter (4) of the same type fitted originally.



4.6 FUEL PUMP REMOVAL

- ◆ Remove the fuel pump assembly, see 4.3 (REMOVING THE FUEL PUMP ASSEMBLY).
- ◆ Disconnect the connector (1).

⚠ WARNING

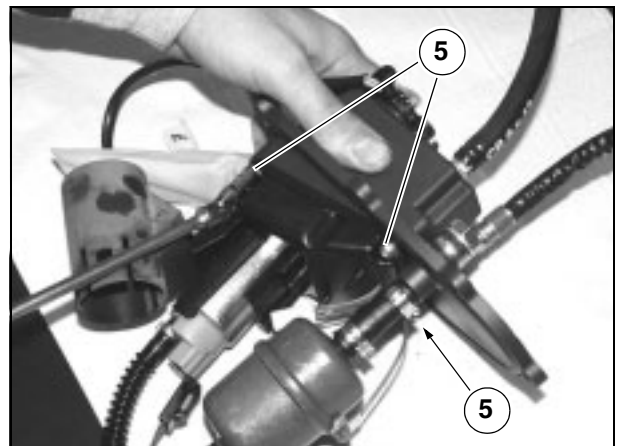
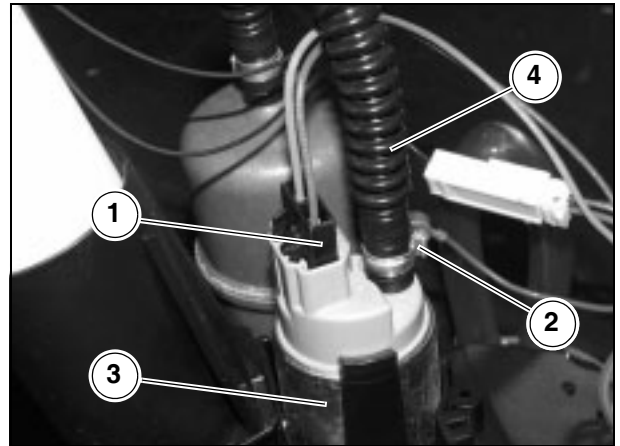
Make sure to refit the connector (1) to the matching connector on assembly.

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips on assembly. Use clips of the same type fitted originally.

- ◆ Release the clip head (2).
- ◆ Detach the fuel hose (4) from the pump (3).
- ◆ Release and remove the three screws (5).

⚠ WARNING

Take care not to pull or twist any electrical wires when performing the operations described below.



- ◆ Remove the circlip (6) from the mesh filter (7).

⚠ WARNING

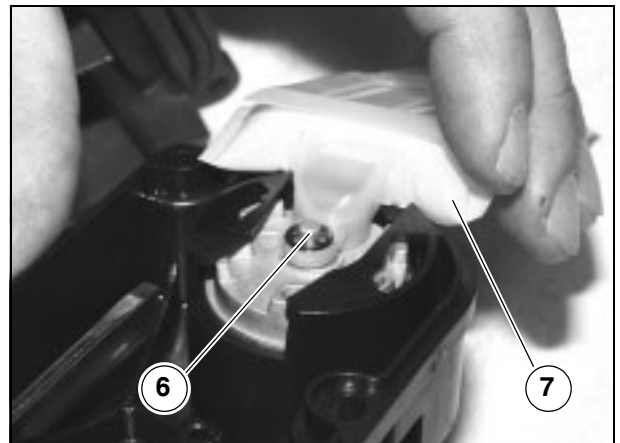
Install a new circlip (6) of the same type on assembly.

- ◆ Remove the mesh filter (7).

⚠ WARNING

Remove any residue or build-up from the meshing (7) blowing with compressed air .

- ◆ Withdraw the fuel pump (3) from the opposite end using a screwdriver.



4.7 ENGINE MANAGEMENT

4.7.1 GENERAL INFORMATION

Engine operation is managed by an on-board computer (Engine Control Unit) to guarantee optimal ignition and fuel injection.

- ◆ Ignition is managed according to consumption.
The ECU determines the exact ignition timing according to engine rpm and throttle position (the latter gives a measure of intake air quantity).
- ◆ The ECU determines injection timing (quantity of fuel) according to rpm, throttle signal (quantity of air, pressure in the intake duct) and to the correction factors signalled by the various sensors.
- ◆ At each start-up, the ECU tests sensors and ignition coils for proper operation. Any fault detected at this time will turn on a flashing "EFI" message on the display.
- ◆ Safety devices built into the ECU shut down the ignition and fuel injection systems whenever engine speed rises beyond the maximum rpm allowed, that is 10,500 rpm, or when the motorcycle falls over. When the motorcycle is on the side stand and a gear is engaged, ignition is inhibited to prevent the rider moving off in a dangerous condition.

WARNING

Any changes or modifications to the exhaust system, intake system or Engine Control Unit may result in severe engine damage. Installing, making changes to or using any parts other than original parts makes all warranty rights null and void. The Manufacturer shall not be liable for any resulting damage to property or injury to persons.

4.7.2 SENSORS

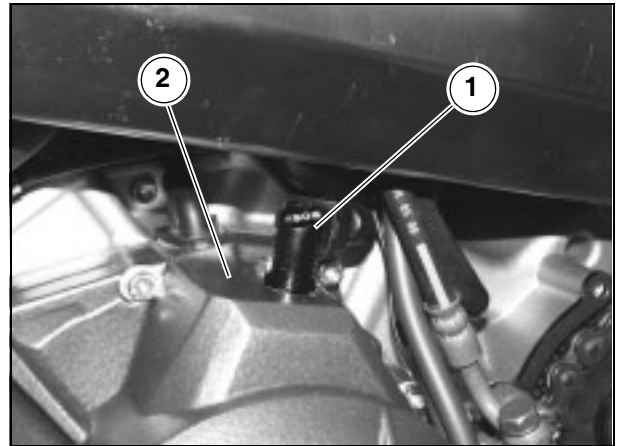
Flywheel pick-up (1)

Location: housed in flywheel cover (2).

This sensor detects the movement of a pre-determined phonic wheel on the crankshaft. The phonic wheel is characterised by an individual length, which is three times the distance/air gap, to provide a reference point on the wheel. This reference point is used to determine crankshaft position.

In four-stroke engines, this individual reference point is not sufficient to determine whether a cylinder that is approaching the top dead centre (TDC) position is in the combustion or exhaust stroke. Such accuracy requires more details of the position, which are obtained through a particular engine speed variation strategy.

Engine position information is used to determine engine speed and to control those operations that need to be synchronised with engine rotation, such as fuel injection.



Atmospheric pressure sensor

Location: built into Engine Control Unit (3).

This is a piezoelectric sensor. The sensor is connected to the air space through a narrow tube and measures absolute air pressure. The take-up point is located in a suitable position where pressure variation due to engine induction is at a minimum. Nominal pressure inside the air space is equal to atmospheric pressure. The pressure in the air space compensates for any load variations within the fuel system.

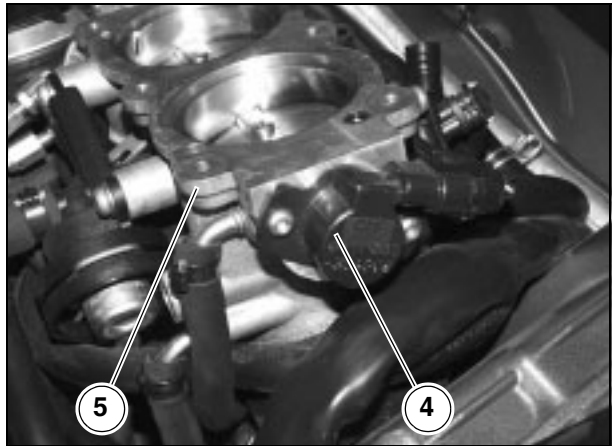


Throttle position sensor (4)

Location: throttle body (5).

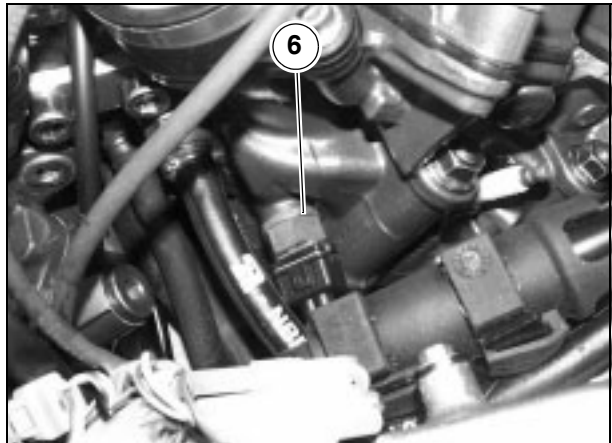
This sensor is a potentiometer. Throttle position is determined by comparing output voltage to supply voltage (rating is 5 V) for greater accuracy.

As the throttle opens, the sensor output voltage increases in a linear pattern. The throttle provides the most effective means to control engine operation, as it determines how much air is let through for the engine to take in. The position (or angle) of throttle is used to determine load and tells the system whether the rider is trying to accelerate or slow down.



Engine temperature sensor (6)

The engine temperature sensor is a negative-resistance thermistor. This means that sensor resistance decreases as temperature increases. The sensor is conveniently located to provide an accurate indication of engine operating temperature. The EMS compensates for the varying engine characteristic in the different engine temperature ranges. This is because an engine needs varying amounts of fuel depending on whether it is started up from cold or when already warm.



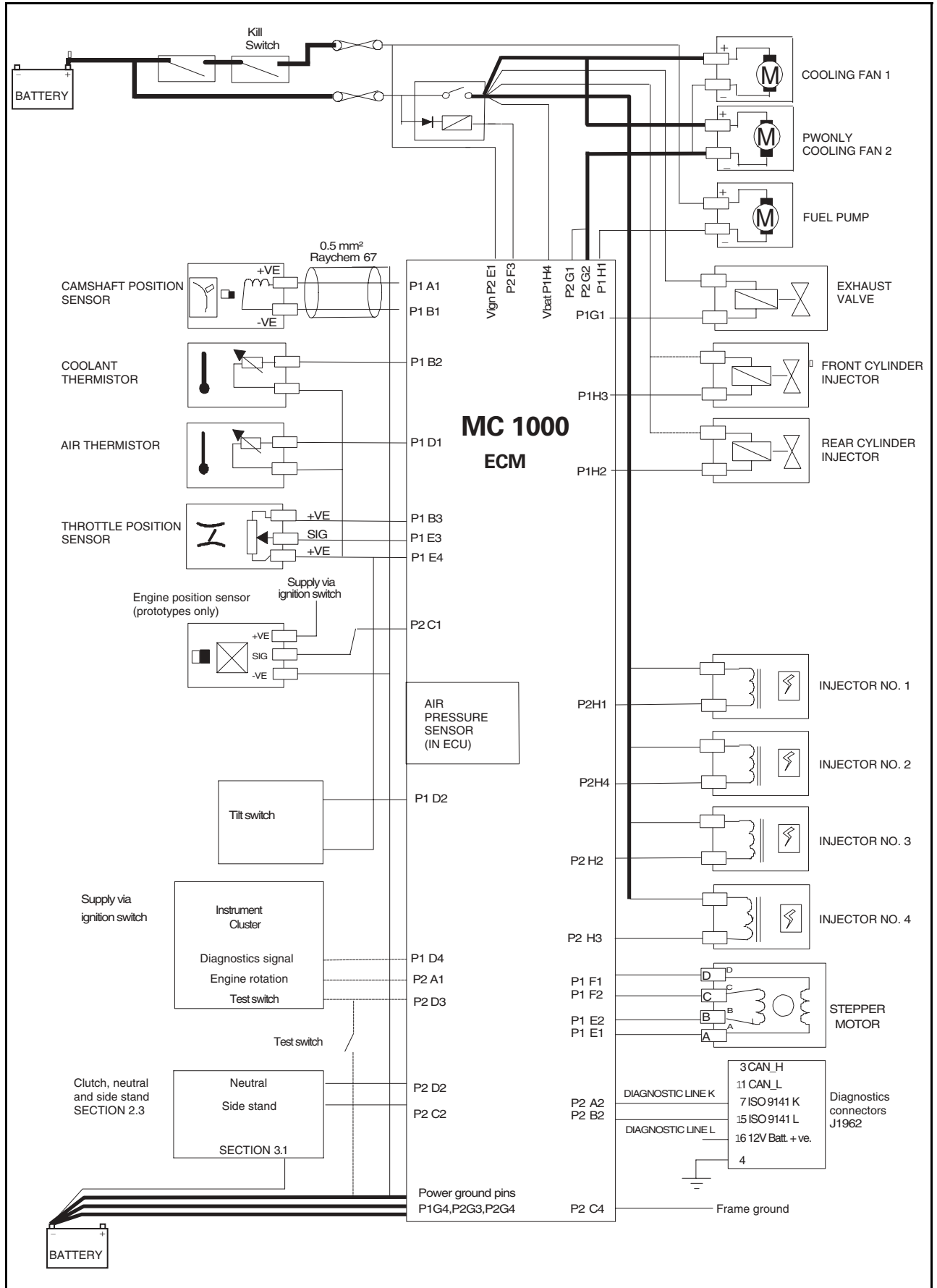
Intake air temperature sensor

Location: air box (7).

The density of intake air varies with air temperature. This affects engine useful load and subsequently the amount of fuel required. An additional adjustment is needed to minimise the risk of knocking due to hot intake air.

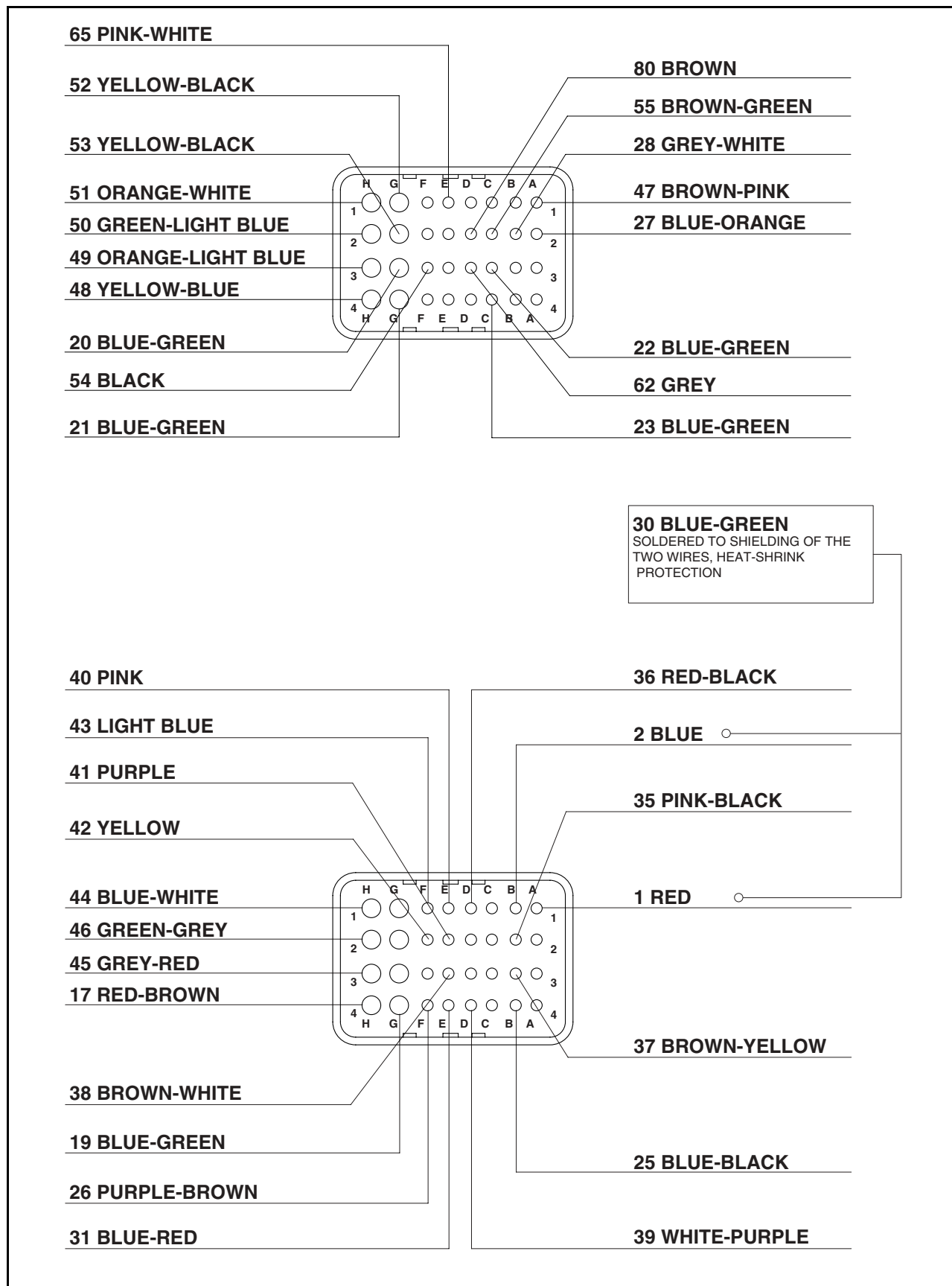


4.7.3 FUEL INJECTION LAYOUT



4.7.4 ENGINE CONTROL UNIT CONNECTORS

See 6.6 (HOOK-UP DIAGRAM OF ENGINE CONTROL UNIT) for more details.



4.7.5 AUTOMATIC OPERATION TEST

See 6.5 (IGNITION/INJECTION SYSTEM).

**4.7.6 ELECTRONIC SYSTEM TROUBLESHOOTING
BASED ON DISPLAY INFORMATION****⚠ CAUTION**

Be careful: the ignition system is under high voltage. Never disconnect the connectors while the engine is running.

Unless expressly specified otherwise in the relevant sections of the manual, always take the following precautions before servicing the ignition system: set the ignition switch to “⊗” and disconnect the battery (disconnect the battery negative lead “-” first).

⚠ WARNING

All measurements must be taken with the components at 20°C (68°F).

General troubleshooting advice: locate fault and remove defective component.

◆ When the “EFI” light comes on while riding, it means that the engine control unit has detected a fault.

FAULT CODE TABLE:

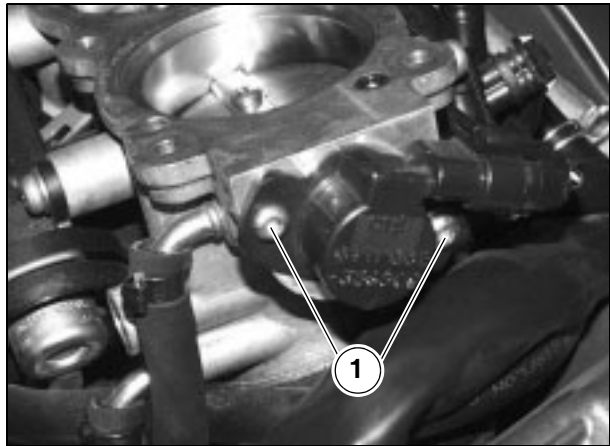
Fault code	Description of fault
12	Crankshaft position sensor (pick-up) fault
15	Throttle position sensor (TPS) fault
18	CALIFORNIA ONLY
21	Engine temperature sensor fault
22	Air temperature sensor fault
23	Atmospheric pressure sensor fault
33	Coil no. 1 fault
34	Coil no. 2 fault
35	Coil no. 3 fault
36	Coil no. 4 fault
41	Bank angle sensor signal fault
42	Injector no. 1 fault
43	Injector no. 2 fault

4.8 THROTTLE BODY

⚠ WARNING

The throttle body linkage cannot be adjusted or removed individually. In the event of a malfunction, replace the complete throttle body assembly, see 4.8.1 (THROTTLE BODY REMOVAL).

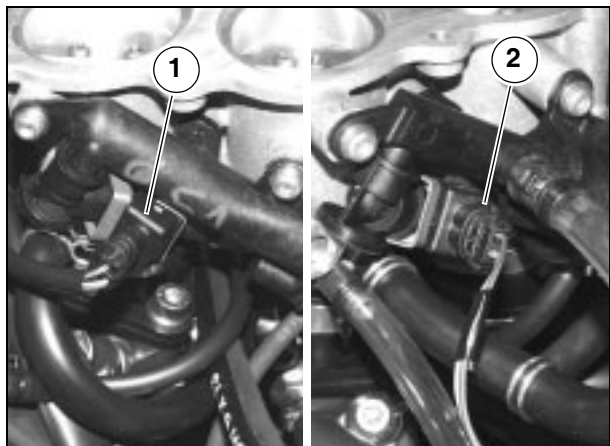
The two screws M4x12 (1) securing the throttle position sensor are coated with paint at the factory and may only be removed when replacing the sensor.



4.8.1 THROTTLE BODY REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Partially remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Remove the airbox, see 7.1.6 (AIRBOX REMOVAL).
- ◆ Disconnect the connectors of:
 - - right-hand injector (1);
 - - left-hand injector (2);
 - - throttle position sensor (3).

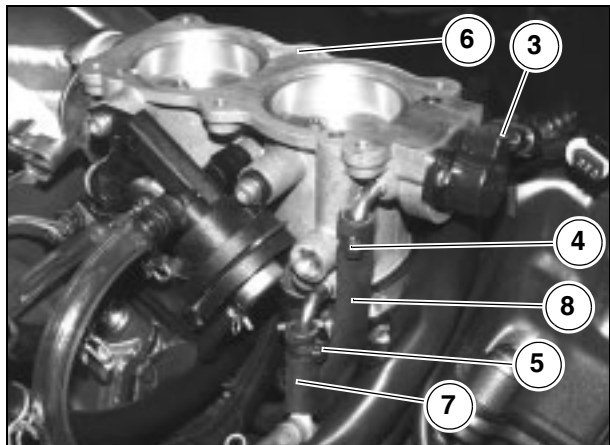


⚠ WARNING

Make sure to refit the connectors to the matching connectors on assembly.

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips on assembly. Use clips of the same type fitted originally.

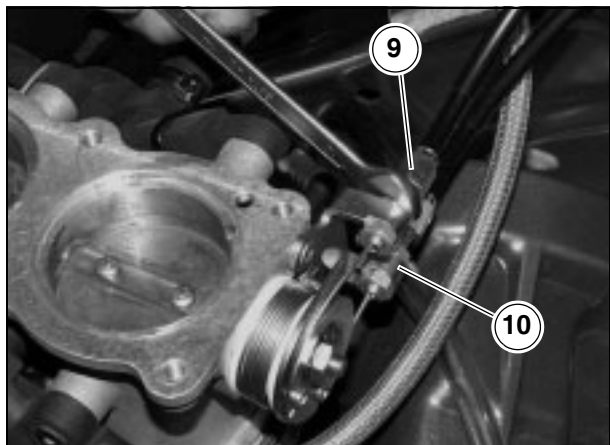
- ◆ Release the heads of the clips (4-5).
- ◆ Disconnect the hoses (7-8) from the throttle body (6).



- ◆ Disconnect the two throttle cables (9-10).

⚠ WARNING

Ensure that the two cable adjusters are correctly fastened to the matching connections on assembly. Check for play and adjust as required, see 2.10.3 (THROTTLE CABLE PLAY ADJUSTMENT).



- ◆ Move apart the clip (15).
- ◆ Disconnect the pressure regulator tube (11).
- ◆ Slacken the two clips (14 - 13).

⚠ WARNING

Clean the two intake flanges thoroughly before removing the throttle body, or dirt may fall into the cylinders.

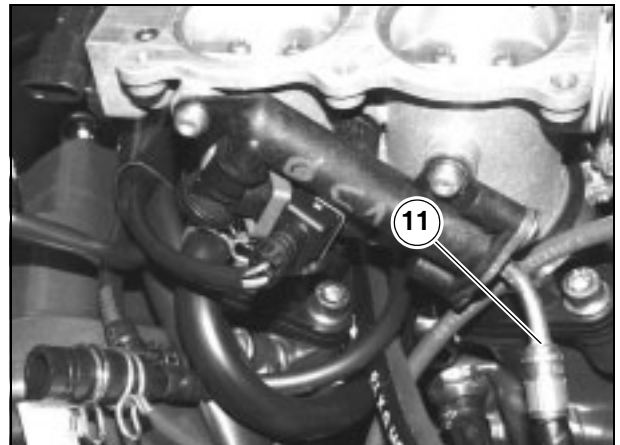
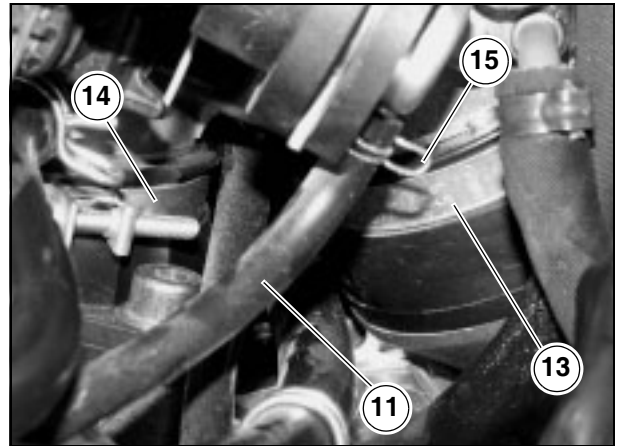
- ◆ Grasp the throttle body (6) firmly, ease it out in small alternating motions and then lift clear of the intake manifolds.
- ◆ Place the throttle body assembly (6) on a clean surface.
- ◆ Block off the intake manifolds to prevent dirt entering into the cylinders.

⚠ WARNING

On assembly:

- Ensure the fuel delivery hose (12) is not twisted and is routed clear of any components that might trap it underneath. Renew the hose if damaged or deteriorated.
- Route the fuel delivery hose (12) between the two intake flanges, then under the throttle body and up to the opposite (right-hand) side of the throttle body (6).
- The throttle body (6) must be properly seated on the intake flanges.
- The clips (14 - 13) must be tightened securely.

In the event the throttle body (6) has been replaced, set the throttle position sensor. See 4.10.6 (SETTING THE THROTTLE POSITION SENSOR).



4.8.2 REMOVING THE INJECTORS

See 4.8.1 (THROTTLE BODY REMOVAL).

See 6.6.1 (INJECTOR TEST) for inspection instructions.

4.9 DISMANTLING THE THROTTLE BODY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Drain the fuel tank, see 2.8 (DRAINING THE FUEL TANK).
- ◆ Remove the throttle body assembly, see 4.8.1 (THROTTLE BODY REMOVAL).
- ◆ Release and remove the two screws (1).



Torque wrench setting for screws (1): 3.5 Nm (0.35 kgm).

- ◆ Remove the fuel pressure regulator (2) together with O-ring (3), left-hand injector (4) and O-ring (5).
- ◆ Release and remove the two screws (6).



Torque wrench setting for screws (6): 3.5 Nm (0.35 kgm).

- ◆ Remove the fuel duct (7) together with O-ring (8), right-hand injector (9) and O-ring (10).

- ◆ Release and remove the two screws (11).



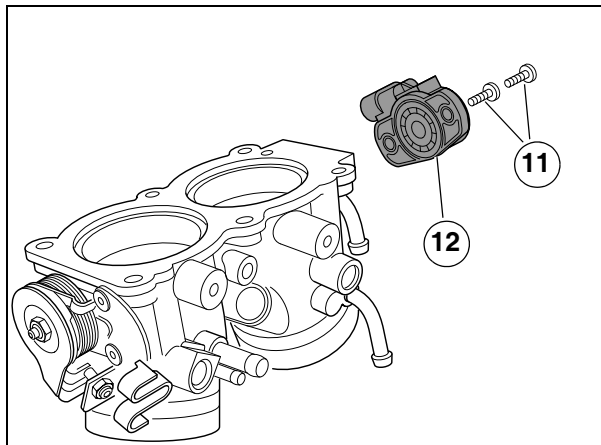
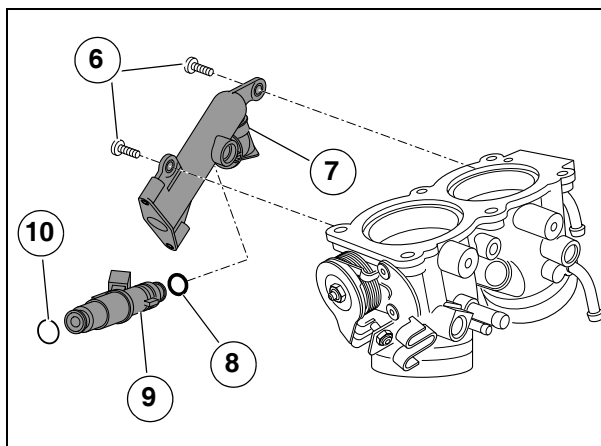
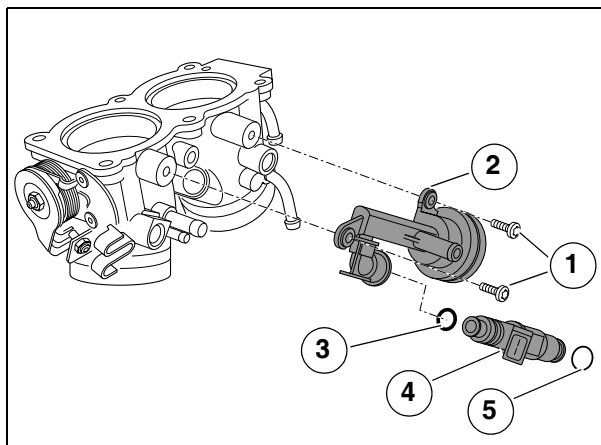
Torque wrench setting for screws (11): 1.2 Nm (0.12 kgm).

- ◆ Remove the potentiometer (12).

NOTE Renew all seals on assembly. Spare seals are included in the repair kit.

⚠ WARNING

The throttle body linkage cannot be adjusted or removed individually. In the event of a malfunction, replace the throttle body assembly, see 4.8.1 (THROTTLE BODY REMOVAL).



4.10 THROTTLE BODY INSPECTION

4.10.1 TESTING INJECTOR OPERATION

⚠ CAUTION

Fuel is explosive and highly flammable.

Keep fuel away from any sources of ignition, heat or flames.

NOTE Injectors may also be inspected in the machine.

Check the following components:

- wiring and connections;
- injector or ECU injection signal, see 6.5 (IGNITION/ INJECTION SYSTEM).

Injector resistance test:

See 6.6.1 (INJECTOR TEST).

4.10.2 THROTTLE BODY

⚠ WARNING

Use only neutral detergents.

Clean with a sealing compound remover, a degreaser or a detergent for cold cleaning.

- ◆ Blow all openings and ducts of the throttle body with compressed air.

4.10.3 THROTTLE POSITION SENSOR

⚠ WARNING

The two socket-head screws securing the throttle position sensor (potentiometer) (1) are coated with paint at the factory and must not be disturbed. The throttle position sensor can only be set when installed from new, that is when it is replaced.

- ◆ Position the throttle position sensor (1) to the throttle spindle. Place the sensor in a horizontal position and rotate downwards.

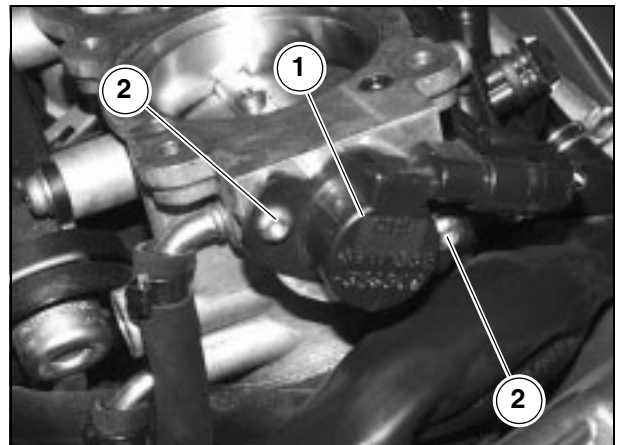
NOTE Apply LOCTITE® 243 to the threads of the screws (2).

- ◆ Tighten the two screws M4x12 (2).



Torque wrench setting for screws (2): 3.5 Nm (0.35 kgm).

- ◆ Position the throttle position sensor (1), 4.10.6 (SETTING THE THROTTLE POSITION SENSOR).



4.10.4 CYLINDER SYNCHRONISATION

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.1 (FUEL) carefully.

Erratic idling is a sign of improper cylinder synchronisation.

The cylinders must be synchronised before setting the CO rate, see 4.10.5 (SETTING THE CO RATE).

- ◆ Take a short ride (allow a few kilometres' riding distance) to warm engine up to normal operating temperature.

⚠ WARNING

The cylinders must be synchronised with a hot engine:

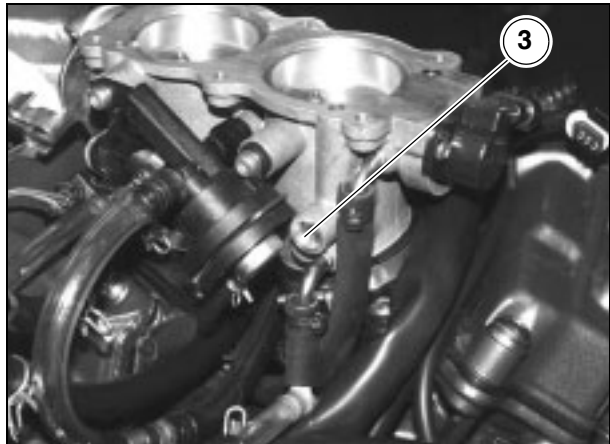
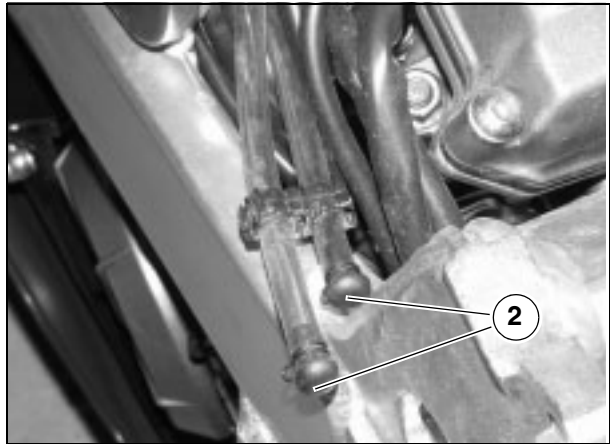
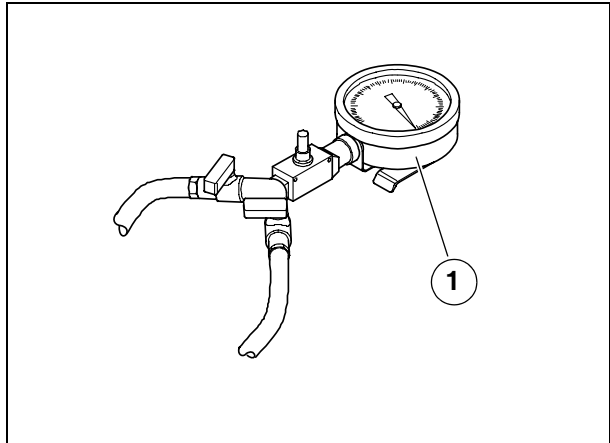
- ◆ Coolant temperature should be 80-100 °C (176-212 °F).
- ◆ Room temperature should be 20-30 °C (68-86 °F).

NOTE Make sure to have a vacuum gauge (1) ready at hand **OPT**.

⚠ CAUTION

Fuel vapours are harmful to human health. Ensure the room is well ventilated before proceeding. Do not inhale fuel vapours. Avoid contact with skin. Do not smoke or use bare flames. Do not release fuel into the environment.

- ◆ Remove the left-hand lower panel, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ◆ Extract the two service hoses (2) located under the side panel on the left-hand side of the motorcycle.
- ◆ Take off the blanking caps and connect the two service hoses (2) to the vacuum gauge lines (1) using two 6-mm fittings.
- ◆ Turn the two air by-pass screws (3) of the throttle body fully in.
- ◆ Turn one of the by-pass screws (3) – the other one must be turned in fully during the whole procedure – until the meter Led is on the zero line in the centre of the screen.



4.10.5 SETTING THE CO RATE

Remove the radiator spoiler, see 7.1.24 (REMOVING THE LOWER SUMP GUARD).

WARNING

The CO rate must be set with a hot engine.

◆ Coolant temperature should be 75-90 °C (167-194 °F).

NOTE Make sure to have the following special tools ready at hand **OPT.**:

- exhaust emission analyser (1) (part no. 8140196);
- analyser tubing kit (2) (part no. 8140202);
- meter Axone 2000 (5) (part no. 8140595).

CAUTION

Fuel vapours are harmful to human health. Ensure the room is well ventilated before proceeding. Do not inhale fuel vapours. Avoid contact with skin. Do not smoke or use bare flames. Do not release fuel into the environment.

◆ Release and remove the two capscrews (3-4) on the front and rear exhaust pipes.

NOTE Apply LOCTITE® 8150 to the threads of the capscrews (3-4) before refitting.

◆ Connect the analyser tubes supplied with the kit (2) as follows:

- attach the two pipes to the take-up points on the exhaust pipes;
- connect the other tube to the exhaust emission analyser (1).
- ◆ Ensure that idling speed is 1250 ± 100 rpm. Adjust if needed, see 2.10.2 (IDLING ADJUSTMENT).
- ◆ The analyser (1) should give the same CO reading for both cylinders. In addition, the CO reading should comply with the specified value.

Specified CO rate for both cylinders:

- 1.5 - 2% at 1250 ± 100 rpm.

Specified CO rate for both cylinders ^{USA}:

- 1 – 1.5% at 1250 ± 100 rpm.

◆ Insert the "OBD" module (7) into the meter Axone 2000.

◆ Remove the pillion seat, see 7.1.1 (RELEASING/ LOCKING THE PASSENGER SEAT).

◆ Connect the meter Axone 2000 (5) to the connector (6) placed underneath the seat. To feed the meter Axone 2000 (5), connect to the motorcycle battery.

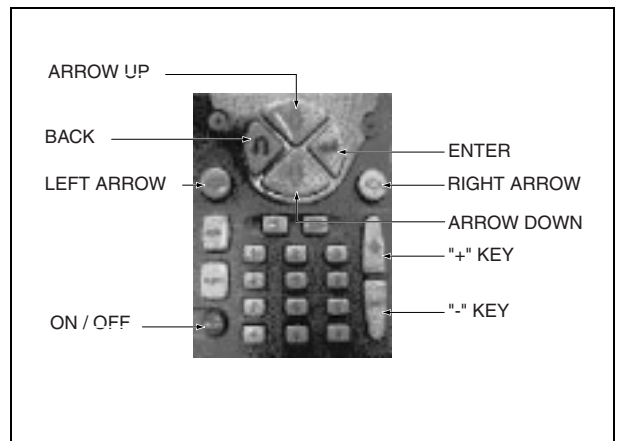
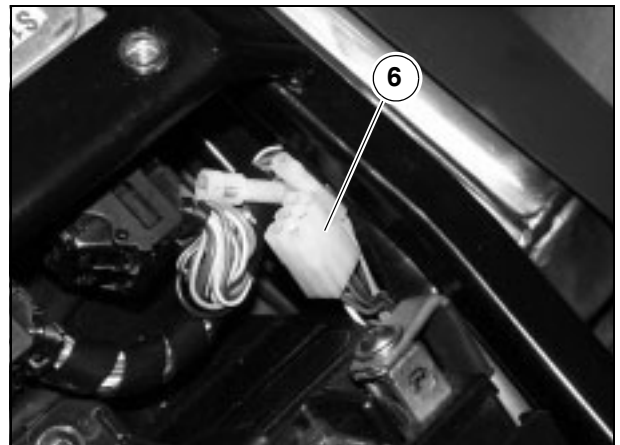
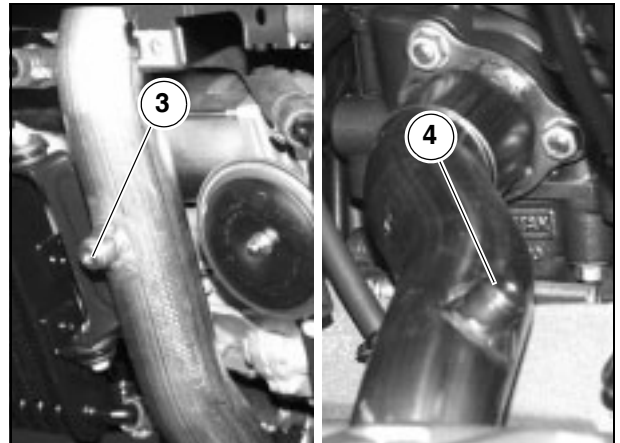
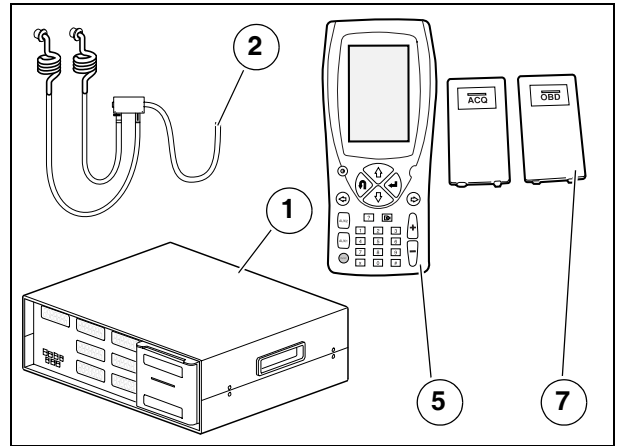
◆ Begin with the rear cylinder.

◆ Turn on the Axone 2000 (5) pressing the red on/off button.

◆ Select the Auto-diagnosis icon on the display and press the Enter key.

◆ The screen that appears next holds a set of ECU parameters.

◆ Press the + key or the – key and select the option "Idle fuelling adjustment" using the UP and DOWN arrow keys. Press Enter to confirm.



- ◆ The top portion of the display shows a parameter given in percentage. This is not the CO rate. Do not compare this parameter with the CO reading displayed by the exhaust emission analyser (1).
- ◆ Press the UP and DOWN arrow keys to modify the parameter on the Axone 2000 display as required. Increase this parameter to extend injection duration. This will enrich the fuel mixture and the CO rate will increase accordingly. Conversely, decrease the parameter to decrease the CO rate.

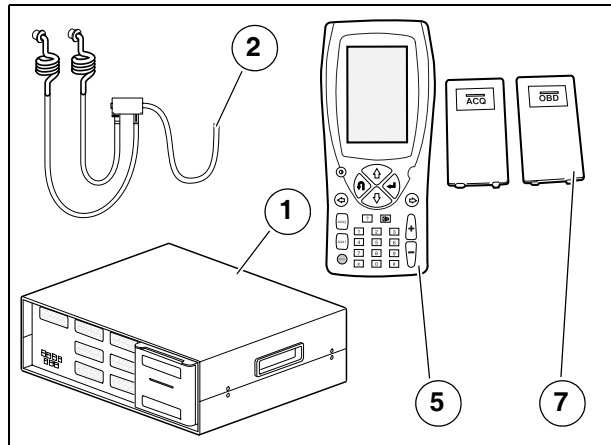
⚠ WARNING

Adjust gradually. Press the key a couple of times (two or three maximum), and then wait for the CO reading on the analyser display (1) to stabilise.

Ensure that the tubing (2) used to connect motorcycle exhaust to analyser is the adequate length (1.5 m to 3 m).

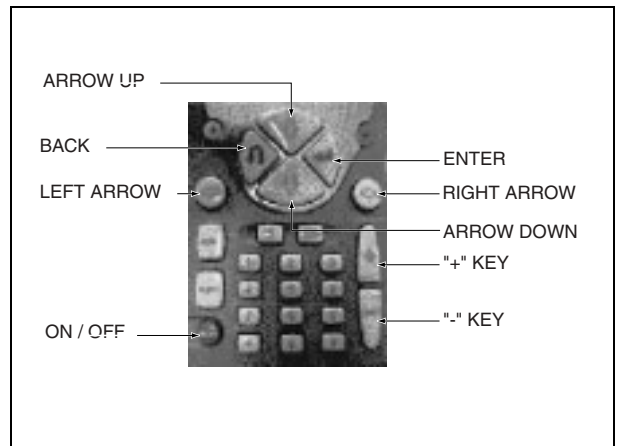
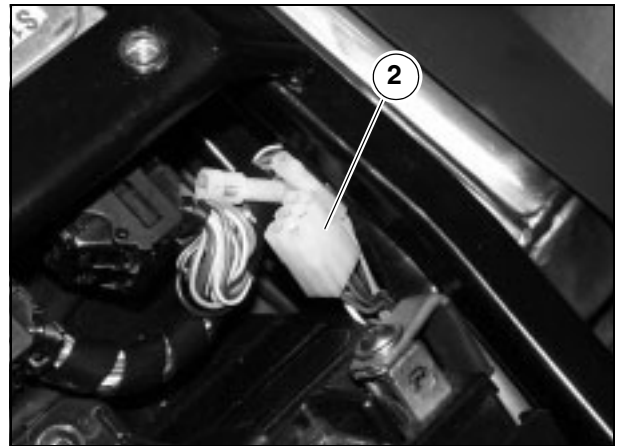
Check the CO rate on both exhaust pipes. The difference between the two readings should not exceed 1%.

NOTE If all attempts to set the CO rate to the specified value fail, change the spark plugs, see 2.7 (SPARK PLUGS).



4.10.6 SETTING THE THROTTLE POSITION SENSOR

- ◆ Remove the pillion seat, see 7.1.1 .
- ◆ Connect the meter Axone 2000 (1) **OPT** to the connector (2) placed underneath the seat. To feed the meter Axone 2000 (1), connect to the motorcycle battery.
- ◆ Start the engine.
- ◆ Turn on the Axone 2000 (1) pressing the red on/off button.
- ◆ Select the Auto-diagnosis icon on the display and press the Enter key.
- ◆ The screen that appears next holds a set of ECU parameters.
- ◆ Press the + key or the – key and select the option “Closed Throttle Position” using the UP and DOWN arrow keys. Press Enter to confirm.
- ◆ A reference parameter for throttle alignment appears in the top portion of the display. Use the UP arrow key to increase the parameter until it stabilises. When this occurs, the Engine Control Unit will recognise a steady idling condition and switch to auto-adaptive mode.
- ◆ Press the Enter key and exit the menu.



COOLING SYSTEM

5

COOLING SYSTEM

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**5.6 REMOVING THE EXPANSION
RESERVOIR..... 5-9-00**

5

5.1 DESCRIPTION

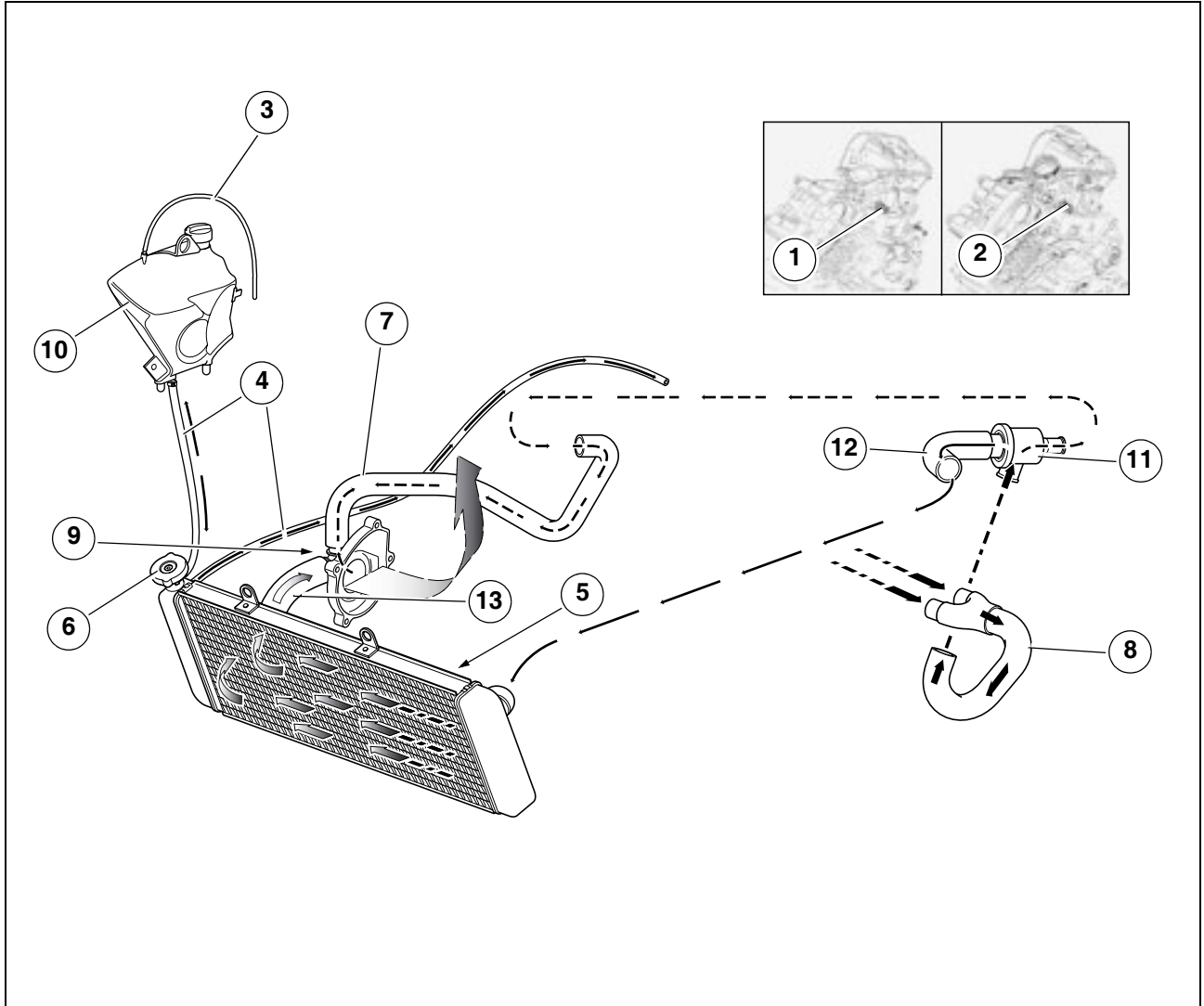
An engine-driven centrifugal pump accommodated in the engine circulates coolant through the system. The pump takes in the coolant and directs it through the ducts into the cylinders and cylinder heads to cool down engine internals.

At engine outlet end, coolant is directed through different routes depending on engine temperature.

When coolant expands from heat, the expansion reservoir takes up excess coolant.

“LOW” and “FULL” level marks facilitate coolant level inspection and top-up, see 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL).

See 1.2.5 (COOLANT) for more details on coolant.



Key

- 1) Front cylinder thermistor
- 2) Rear cylinder thermistor
- 3) Breather tube
- 4) Balance tubing
- 5) Cooling fan
- 6) Filler cap
- 7) Engine to thermal expansion valve pipe (on right-hand side of engine)
- 8) Cylinder pipe – three-way manifold
- 9) Centrifugal pump
- 10) Expansion reservoir

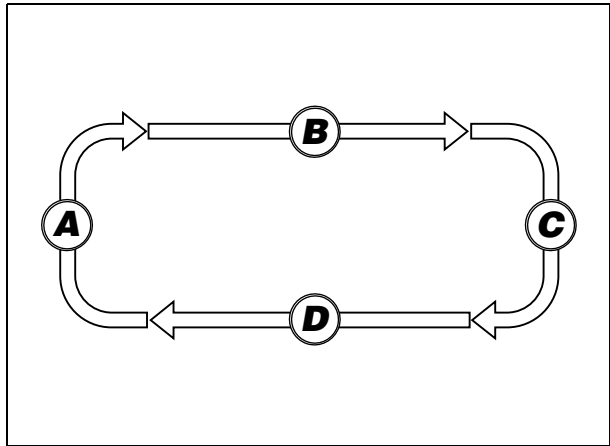
- 11) Three-way thermal expansion valve (heat-sensitive wax pellet type)
- 12) Thermal expansion valve coupling to radiator
- 13) Radiator coupling to thermal expansion valve

- - - ➔ = Coolant flows in this direction when thermal expansion valve is open

————➔ = Coolant flows in this direction when thermal expansion valve is closed

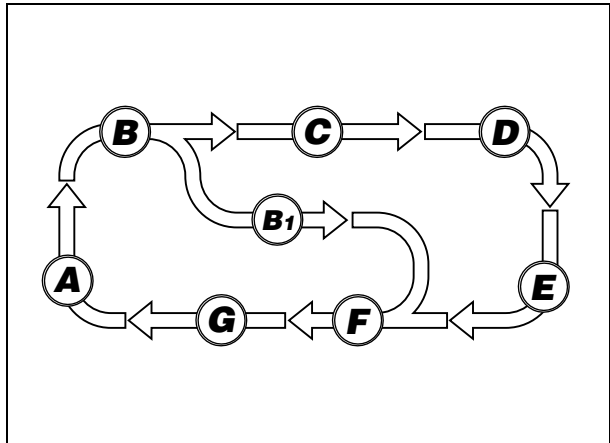
Coolant circulation when coolant temperature is below 75°C (167 °F).

The pump circulates coolant to the ducts (thermistors detect temperature, temperature reading appears on right-hand display of instrument panel) – coolant flows out of ducts (on right-hand side of engine) to thermal expansion valve (valve is fully closed) and back to the pump.



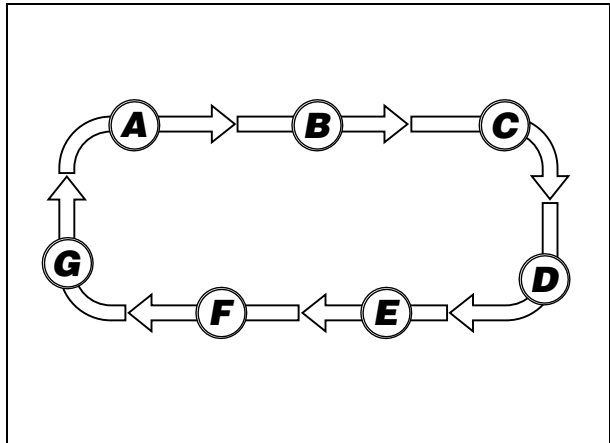
Coolant circulation when coolant temperature is between 75°C (167 °F) and 80°C (176 °F).

The pump circulates coolant to the ducts (thermistors detect temperature, temperature reading appears on right-hand display of instrument panel) – coolant flows out of ducts (at the same time, coolant flows out of duct on right-hand side of engine, and direct to thermal expansion valve) to three-way manifold of left radiator – through right radiator – to thermal expansion valve (valve is opening gradually) and back to the pump.



Coolant circulation when coolant temperature exceeds 80°C (176 °F).

The pump circulates coolant to the ducts (thermistors detect temperature, temperature reading appears on right-hand display of instrument panel) – coolant flows out of ducts - three-way manifold (thermal switch detects temperature; switch signals cooling fan to turn on when temperature exceeds 100°C (212 °F)/to shut down when temperature drops below 85°C (185 °F) – through left radiator – through right radiator – to thermal expansion valve (valve is fully open) and back to pump.



⚠ WARNING

When the ignition switch is set to “”, the cooling fans switch off regardless of coolant temperature.

5.2 REMOVING THE RADIATOR

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.5 (COOLANT) carefully.

- ◆ Set the ignition switch to "OFF".
- ◆ Drain all coolant from the cooling circuit, see 2.14 (COOLANT CHANGE).
- ◆ Remove the fairings, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Remove the radiator spoiler, see 7.1.23 (REMOVING THE UPPER SUMP GUARD).
- ◆ Slacken the clip (1) and slide it out of the way.
- ◆ Detach the hose (2) from the radiator (3).

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. On refitting, renew all clips using the same type fitted originally.

- ◆ Release the head of the hose clip (4).
- ◆ Detach the tubes (5-6) from the radiator (3).
- ◆ Working from the left side, slacken the clip (7) and slide it out of the way.
- ◆ Detach the hose (8) from the radiator (3).
- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Disconnect the connector (9).

⚠ WARNING

Make sure to refit the connector (9) to the matching connector on assembly.

- ◆ Release and remove the two screws (11). Collect the bushes and seals (10), where fitted.



Torque wrench setting for screws (11): 10 Nm (1 kgm).

NOTE On assembly, lubricate the screws (11) with oil (part no. 8116050).

Change the seals (10) if damaged.

⚠ WARNING

Handle the radiator carefully taking care not to damage the fins.

- ◆ Tilt the radiator (3) slightly forward and lift until the two bottom mounting lugs are clear of their holes in the radiator bracket (12).
- ◆ Remove the radiator (3) complete with cooling fan.

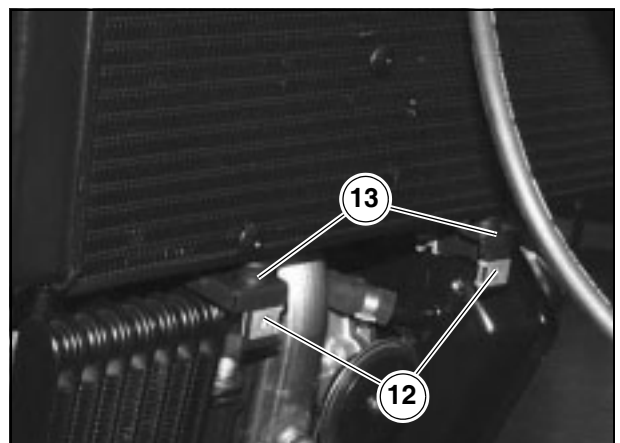
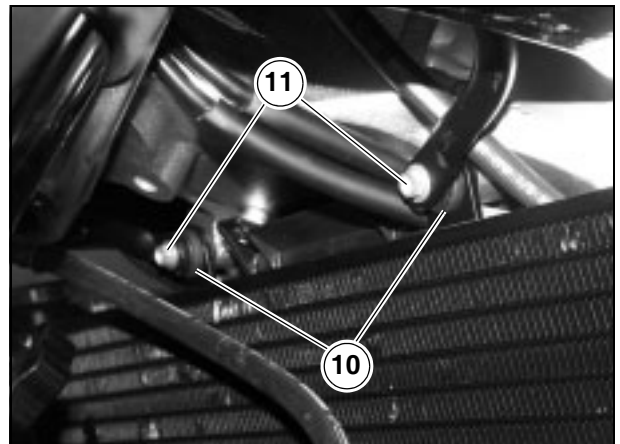
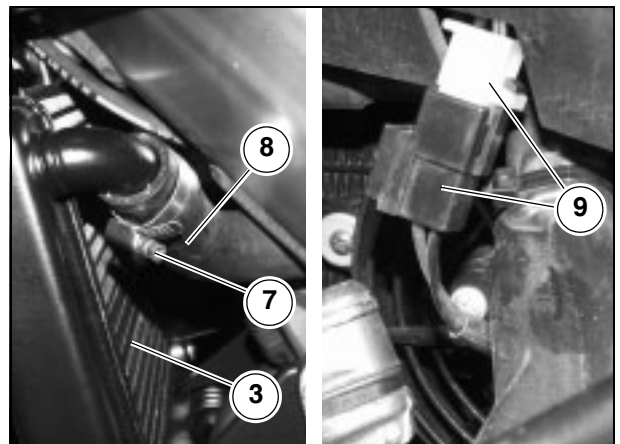
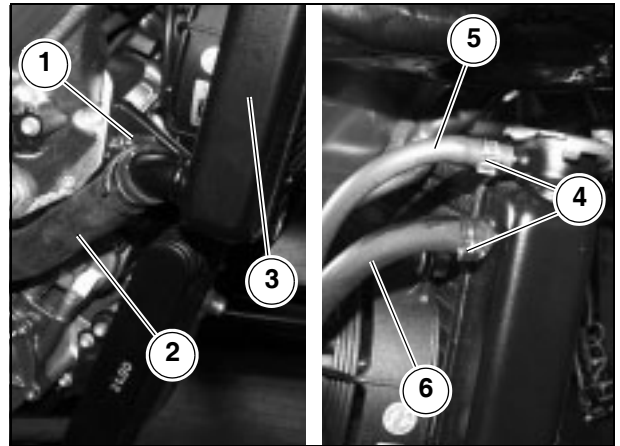
⚠ WARNING

Block off the openings of the hoses to prevent the ingress of dirt.

NOTE Change the grommets (13) if damaged.

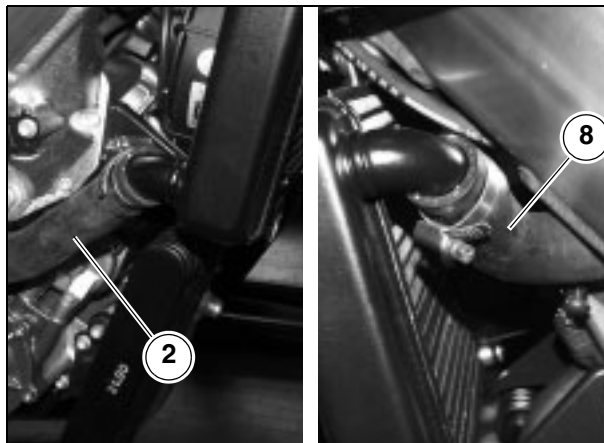
If necessary:

- ◆ Remove the cooling fan, see 5.3 (REMOVING THE COOLING FAN).



⚠ WARNING

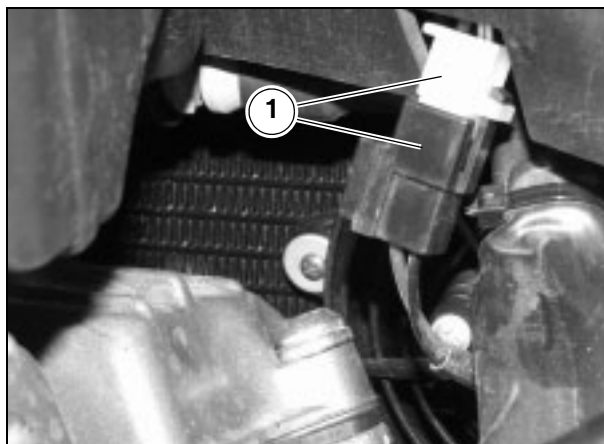
Remove any build-up, dirt, etc. caught between the radiator fins blowing with compressed air. Straighten any bent fins using a small Phillips screwdriver. Renew the hoses (2-8) if cracked or sheared. Before refitting the radiator, wash it inside using clean water only.



5.3 REMOVING THE COOLING FAN

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Set the ignition switch to “”.
- ◆ Remove the right-hand side fairing, see 7.1.18 (REMOVING THE FRONT FAIRING)
- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Disconnect the connector (1).



⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Release and remove the three screws (2).



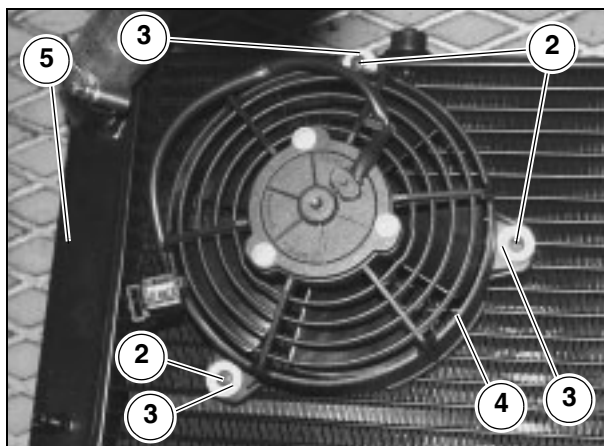
Torque wrench setting for screws (2): 1 Nm (0.1 kgm).

NOTE On assembly, apply LOCTITE® 243 to the thread of the three screws (2).

- ◆ Collect the three vibration-damping rubbers (3).

NOTE Change the rubbers (3) if damaged.

- ◆ Tilt the cooling fan assembly (4) slightly backwards while pulling in an outward direction until releasing the lug on the inside face from its seat in the radiator (5).
- ◆ Remove the cooling fan (4).



If necessary:

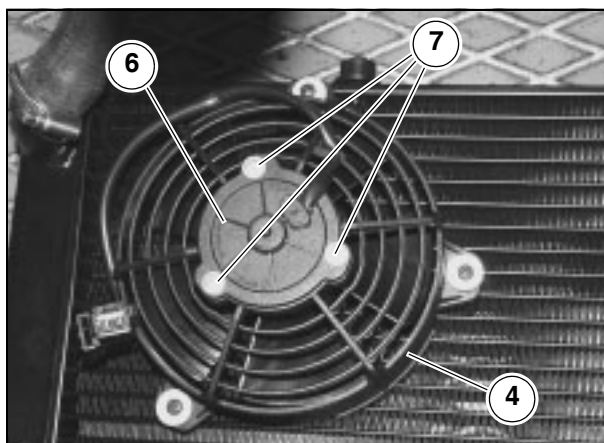
- ◆ Release and remove the three screws (7) and collect the washers.



Torque wrench setting for screws (7): 1 Nm (0.1 kgm).

- ◆ Remove the cover (6).
- ◆ Withdraw the guard (8).

Please read 6.9 (COOLING FAN) for more details of the cooling fan.



5.4 REMOVING THE COOLANT THERMISTORS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.5 (COOLANT) carefully.

NOTE The procedure described below applies to both thermistors.

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Slacken the two clips (1-2).

⚠ WARNING

The throttle body (3) is still connected to wires and tubes, proceed carefully when removing it.

- ◆ Grasp the throttle body (3) complete with airbox firmly, ease it out in small alternating motions and lift until releasing the throttle body from the intake flanges.
- ◆ Slide the assembly aside, placing it on the left-hand side of the motorcycle.
- ◆ Disconnect the connector (4).

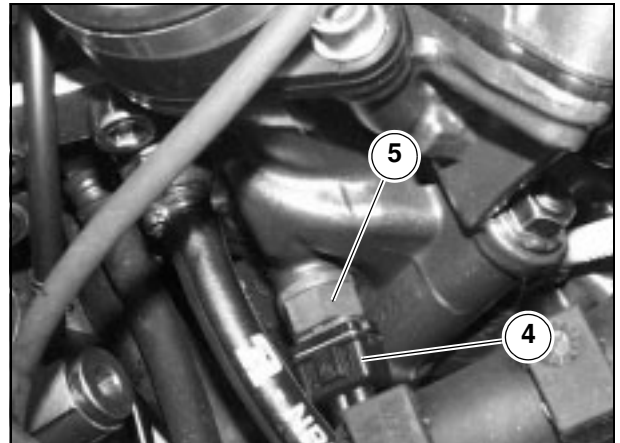
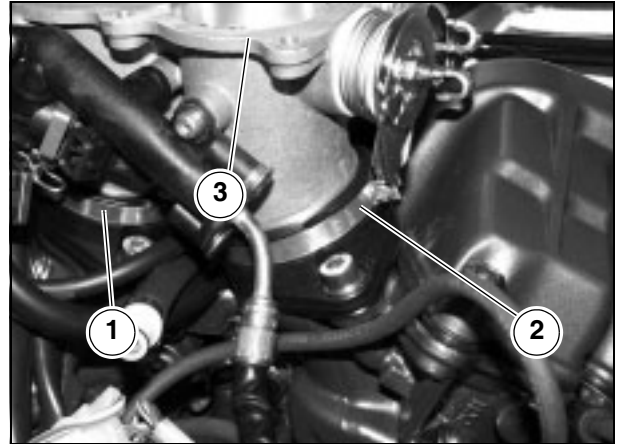
⚠ WARNING

Make sure to refit the connector (4) to the matching connector on assembly.

- ◆ Release and remove the thermistor (5).
- ◆ Collect a new thermistor and apply LOCTITE® 574 to the thread.
- ◆ Screw in the new thermistor (5) until finger tight then tighten.
- ◆ If any coolant has been spilled out during the process, top up level when finished. See 2.13 (CHECKING AND TOPPING UP COOLANT LEVEL).

NOTE Remove the other thermistor, if needed.

See 6.6.5 (COOLANT THERMISTOR TEST) for more details of the thermistors.



5.5 REMOVING THE THERMAL EXPANSION VALVE

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.5 (COOLANT) carefully.

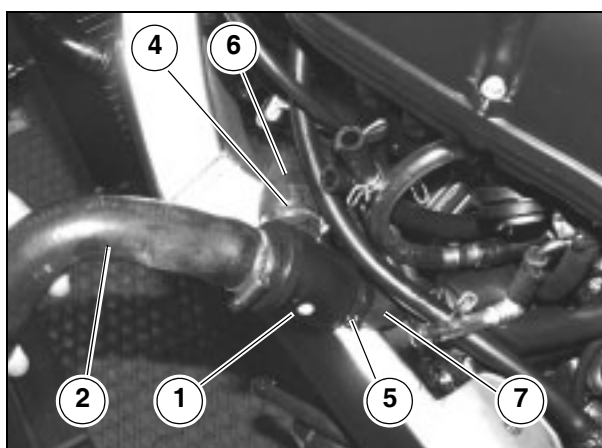
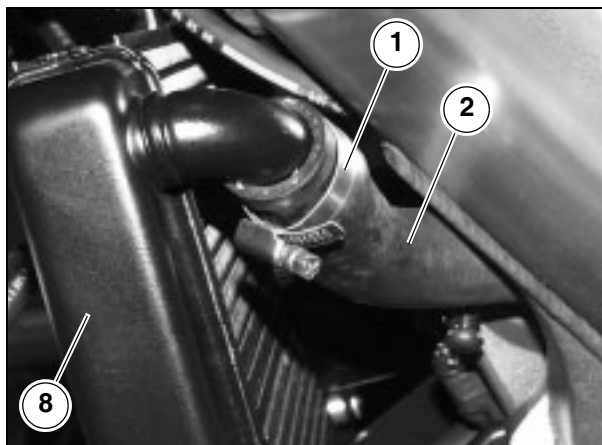
♦ Drain the cooling system, see 2.14 (COOLANT CHANGE).

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. On refitting, renew all clips using the same type fitted originally.

- ♦ Loosen the clip (1).
- ♦ Slide out the hose (2) at the radiator (8).
- ♦ Loosen the clip (4).
- ♦ Loosen the head of the hose clip (5).
- ♦ Grasp the thermal expansion valve (3) and pull it clear of the two hoses (6-7) in small motions.

⚠ WARNING

Block off the openings of the hoses to prevent the ingress of dirt.



5.6 REMOVING THE EXPANSION RESERVOIR

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.5 (COOLANT) carefully.

- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. On refitting, renew all clips using the same type fitted originally.

- ◆ Loosen the head of the hose clip (1).
- ◆ Detach the hose (2) from the radiator (3).
- ◆ Bend the hose (2) over and secure it to the top of the expansion reservoir using adhesive tape.
- ◆ Release and remove the screw (5).



Torque wrench setting for screw (5): 3 Nm (0.3 kgm).

- ◆ Release and remove the screw (4) securing the expansion reservoir.



Torque wrench setting for screw (4): 10 Nm (1.4 kgm).

- ◆ Lift the expansion reservoir (7).
- ◆ Release the hose (2) from the hose fastener.

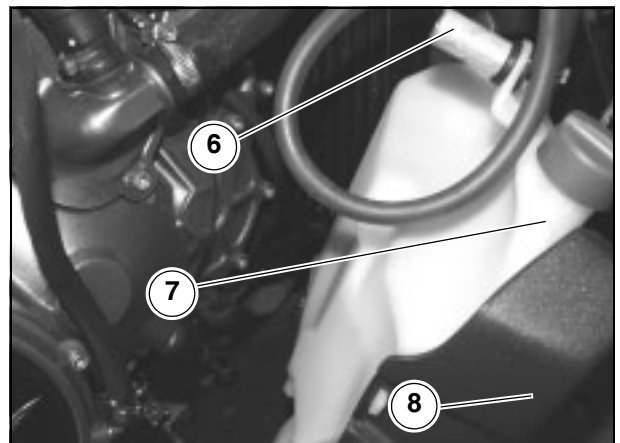
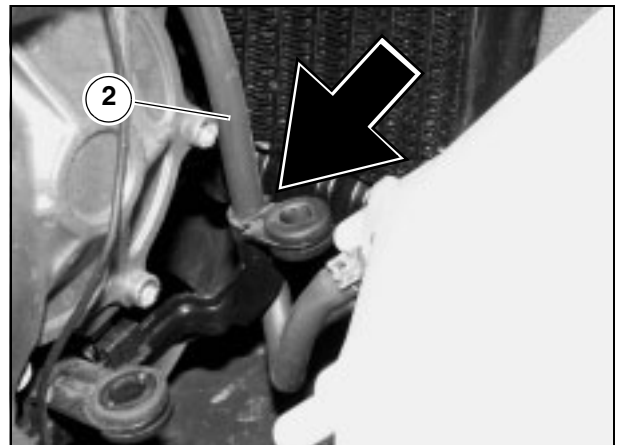
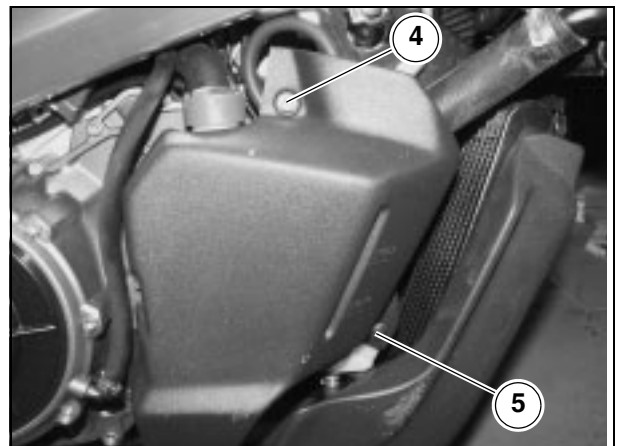
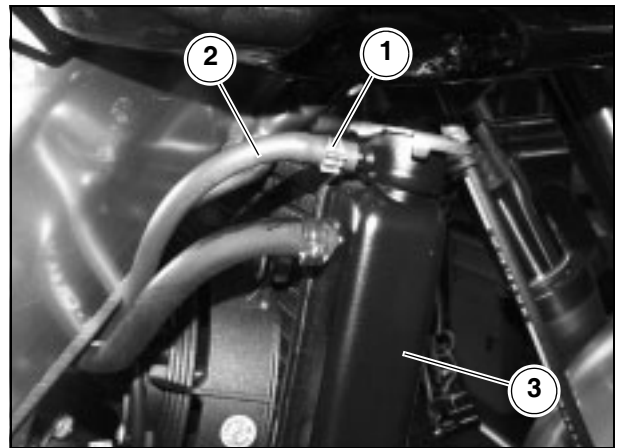
⚠ WARNING

When refitting, place the hose (2) in the correct position.

- ◆ Remove the expansion reservoir (7) with seal (8) and spacer (6) keeping it level.

⚠ WARNING

Coolant is harmful to the human body.
Store the expansion reservoir (7) in a safe place.
KEEP AWAY FROM CHILDREN.



ELECTRICAL SYSTEM

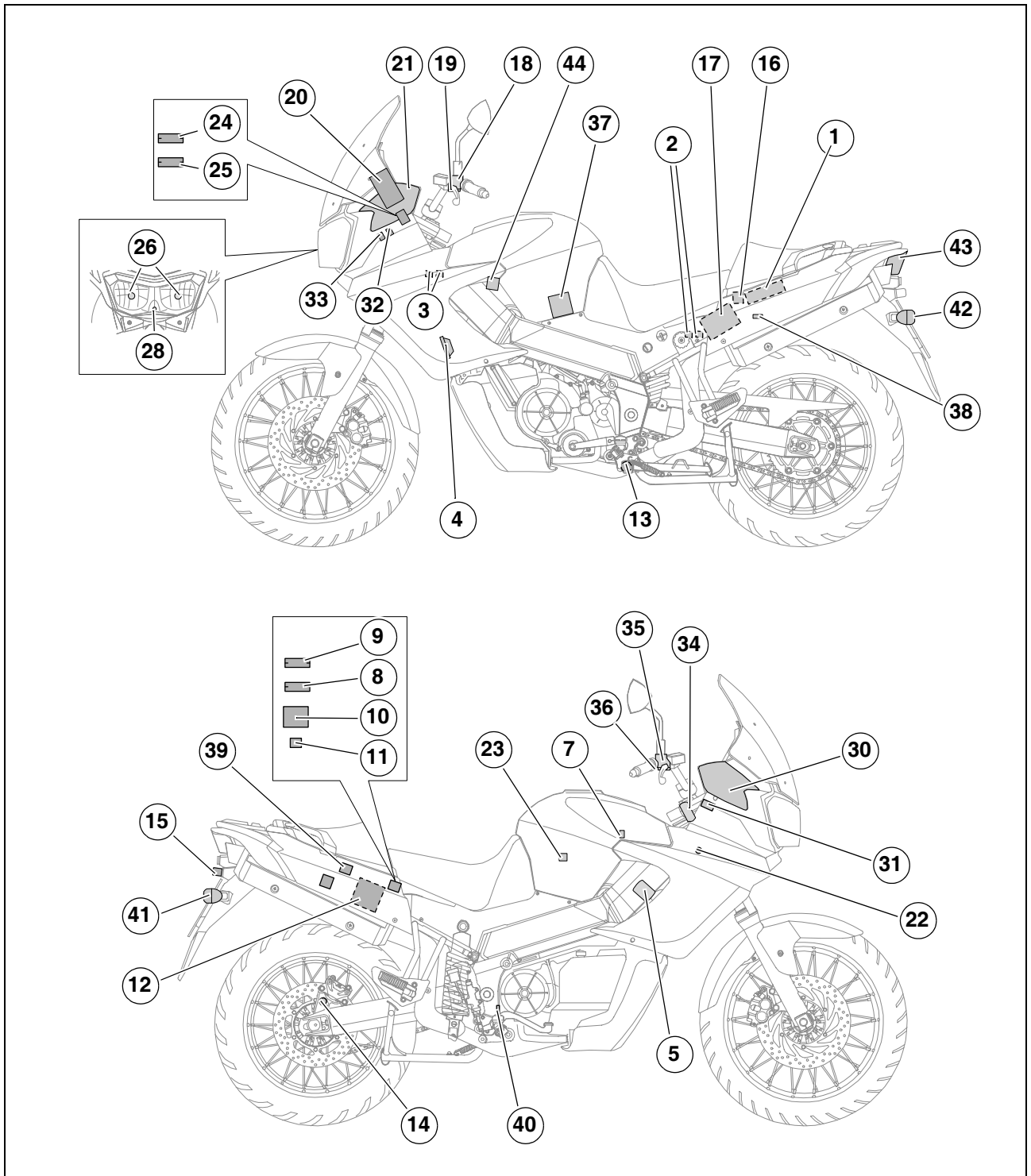
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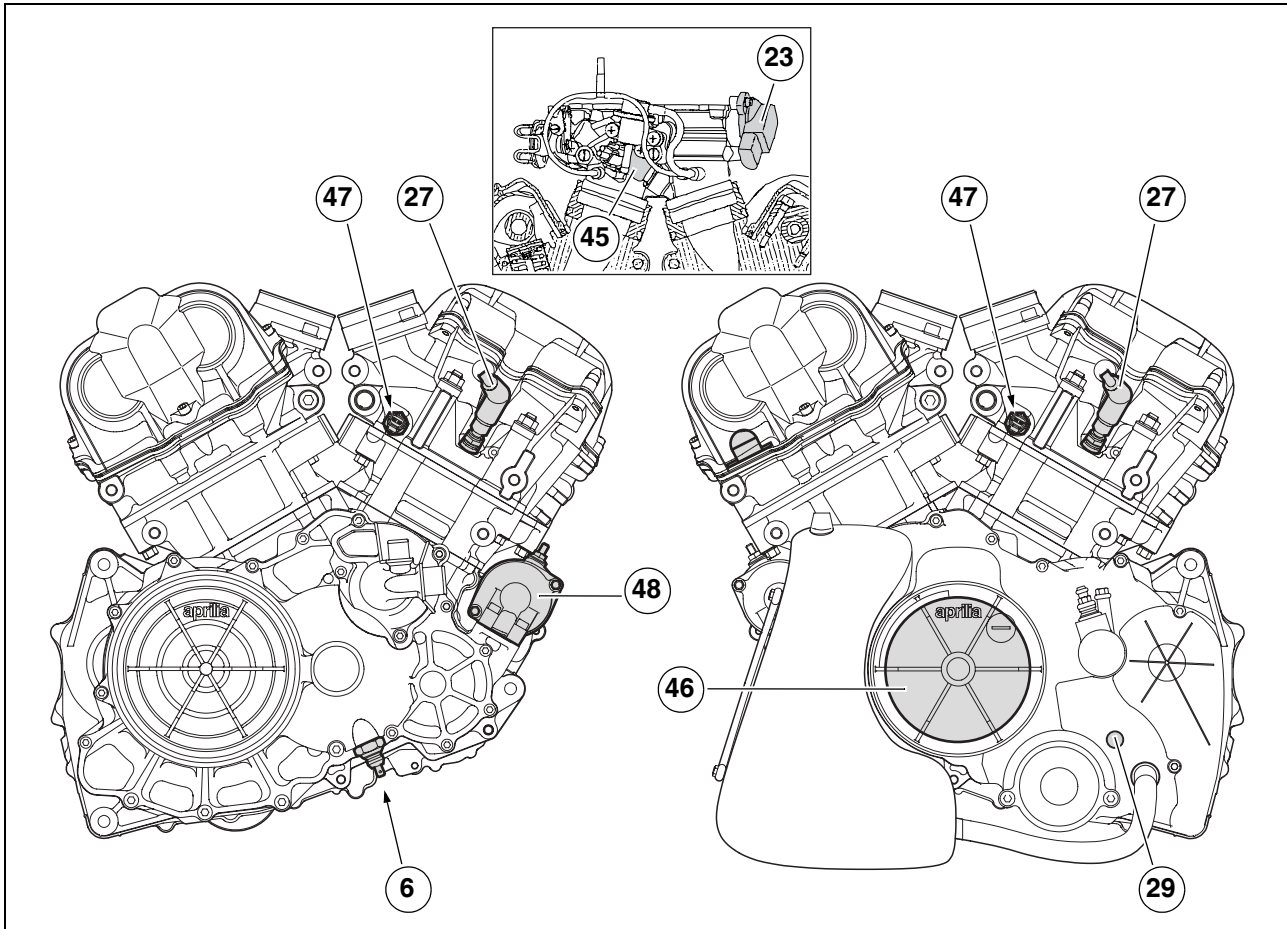
ELECTRICAL SYSTEM

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6.1 LAYOUT OF ELECTRICAL COMPONENTS



**Key**

- | | |
|--------------------------------|--|
| 1) Engine Control Unit | 27) Spark plugs |
| 2) Front cylinder coils | 28) Front parking light bulb |
| 3) Rear cylinder coils | 29) Neutral switch |
| 4) Warning horn | 30) Front right indicator |
| 5) Cooling fan | 31) Auxiliary fuses (15 A) |
| 6) Oil pressure sensor | 32) Flasher |
| 7) Intake air thermistor | 33) Bank angle sensor |
| 8) Fuel pump relay | 34) Ignition switch |
| 9) Engine cutout relay | 35) Right-hand light dip switch |
| 10) Injection relay | 36) Front brake light switch |
| 11) Diode module | 37) Fuel sensor /pump assembly |
| 12) Rectifier | 38) Test and diagnostics connector |
| 13) Side stand switch | 39) Main fuses (30 A) |
| 14) Speed sensor | 40) Rear brake light switch |
| 15) Number plate light | 41) Rear right indicator |
| 16) Starter relay | 42) Rear left indicator |
| 17) Battery | 43) Tail light |
| 18) Left-hand light dip switch | 44) Stepper motor (automatic air adjustment) |
| 19) Clutch switch | 45) Injector |
| 20) Instrument panel | 46) Pick-up flywheel |
| 21) Front left indicator | 47) Coolant thermistor |
| 22) Air temperature sensor | 48) Starter motor |
| 23) Throttle position sensor | |
| 24) Low beam relay | |
| 25) High beam relay | |
| 26) High beam/low beam bulbs | |

6.2 FOREWORD

Please read the following information before reading this section.

NOTE For ease of reference, the same numbering is used in the specific wiring diagrams and in the general schematics.

6.2.1 WIRING COLOUR CODES

Ar	Orange
Az	Light blue
B	Blue
Bi	White
G	Yellow
Gr	Grey
M	Brown
N	Black
R	Red
Ro	Pink
V	Green
Vi	Purple

6.2.2 ELECTRICAL CONNECTORS

Disconnect the electrical connectors as follows:

- ◆ Press down on the locking tab, where fitted.

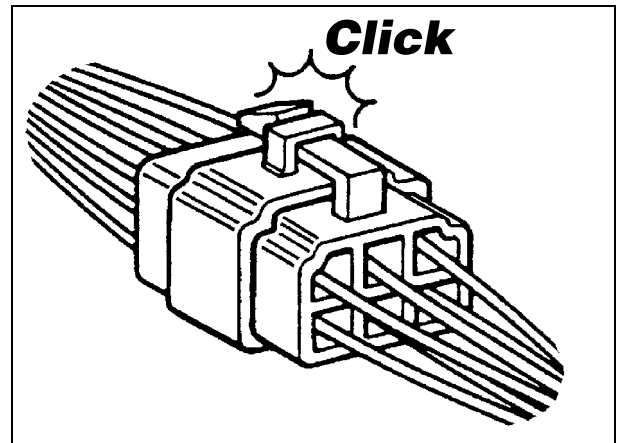
⚠ WARNING

Never separate two connectors by pulling on the wiring.

- ◆ Grasp both connectors and pull them in opposite directions until they become separated.
- ◆ Remove any dirt, rust, moisture, etc. from inside the connector blowing with compressed air.
- ◆ Ensure that the wires are securely crimped to the terminals inside each connector.

NOTE A connector will only locate properly into the matching connector when it is inserted in the correct mounting position.

- ◆ When refitting, reconnect the two connectors and ensure that they become fully engaged (where fitted, the locking tab will click audibly into place).



6.3 CHARGE SYSTEM INSPECTION

6.3.1 CHECKING CHARGE VOLTAGE

- ◆ Check battery voltage, see 2.4.2 (CHARGING THE BATTERY).
- ◆ Start the engine and rev it up to 4000 rpm.
- ◆ Set the light switch to “☀” and the light dip switch to “☾”.
- ◆ **ASD** Set the light dip switch to “☾”.
- ◆ Measure DC voltage across the positive (+) and negative (-) battery terminals using a multimeter.

If the reading found is less than 13 V or more than 15 V:

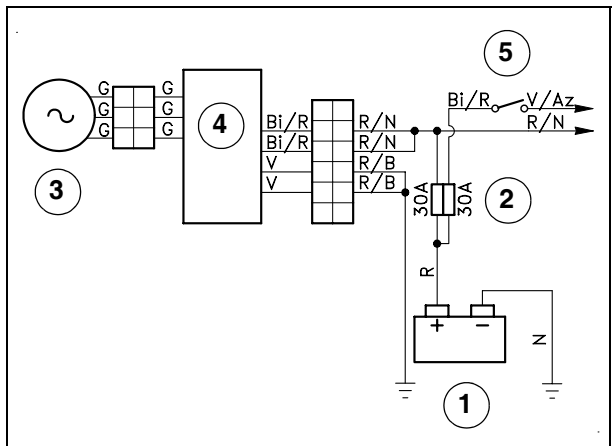
- ◆ Test alternator operation under no-load conditions and check for continuity, see 6.3.2 (ALTERNATOR LOADLESS OPERATION TEST) and 6.3.4 (ALTERNATOR CONTINUITY TEST); and test the rectifier, see 6.3.5 (RECTIFIER TEST).

Key to the diagram

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the different components.

- 1) Battery
- 2) Main fuses (30 A)
- 3) Generator
- 4) Rectifier
- 5) Ignition switch (☉ - ☀ - ☾ - P-E)

Correct charge voltage:
13 - 15 V(DC) at 4000 rpm.



6.3.2 ALTERNATOR LOADLESS OPERATION TEST

- ◆ Remove the right-hand lower fairing, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ◆ Disconnect the three-way connector (1) (coloured brown) of the rectifier wiring.

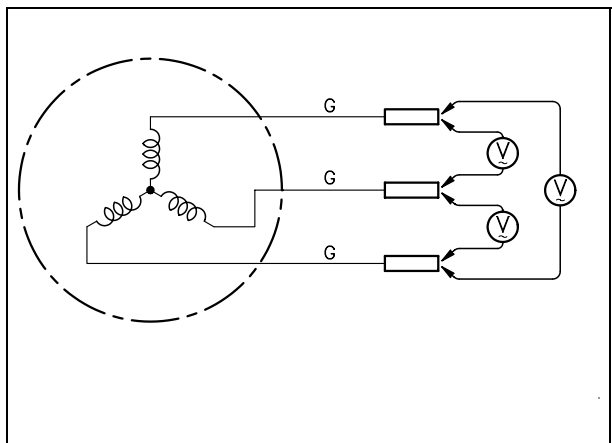
⚠ WARNING

Make sure to refit the connector (1) to its matching connector on assembly.

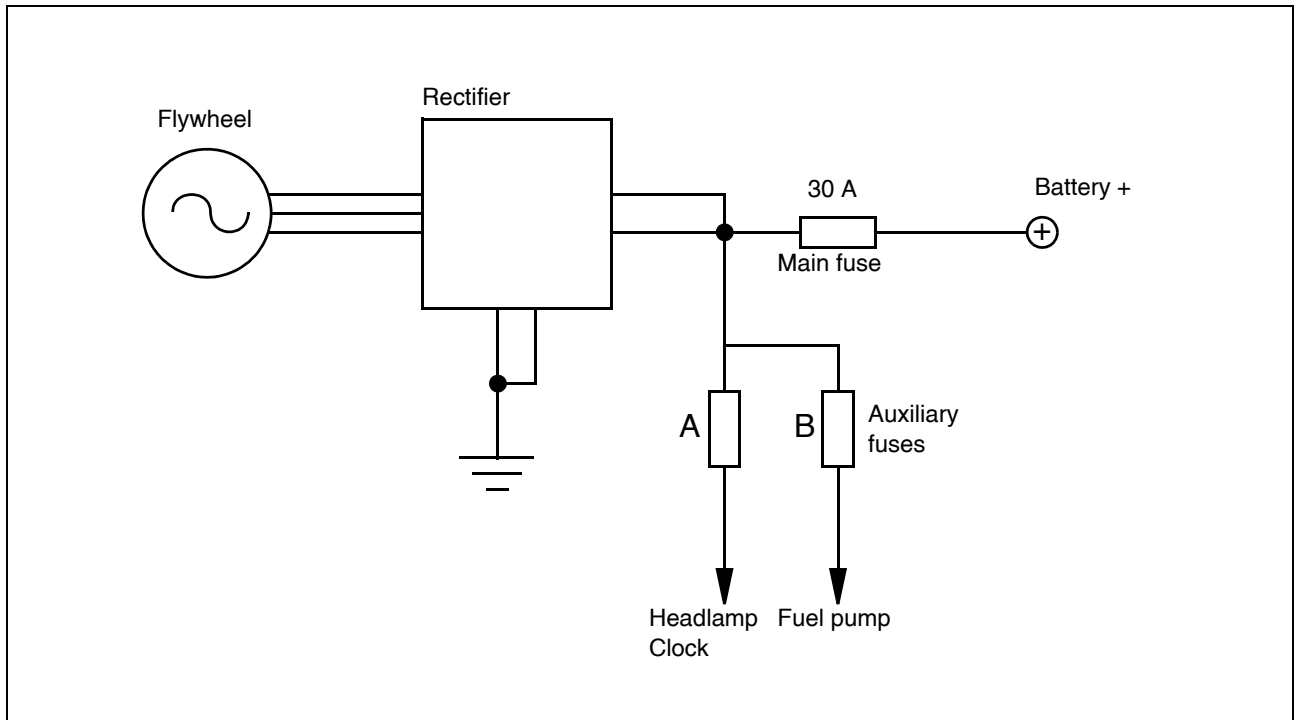
- ◆ Start the engine and rev it up to 4000 rpm.
- ◆ Measure DC voltage across the three inner male terminals [yellow (G) wires] using a multimeter. Test across all terminals alternately.

Any reading below 60 V indicates a faulty alternator. Replace the alternator.

Correct loadless voltage:
over 60 DC Volts at 4000 rpm.



6.3.3 CHARGE SYSTEM LAYOUT



6.3.4 ALTERNATOR CONTINUITY TEST

With the engine off:

- ◆ Remove the right-hand lower fairing, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ◆ Disconnect the three-way connector (1) (coloured brown) of the rectifier wiring.

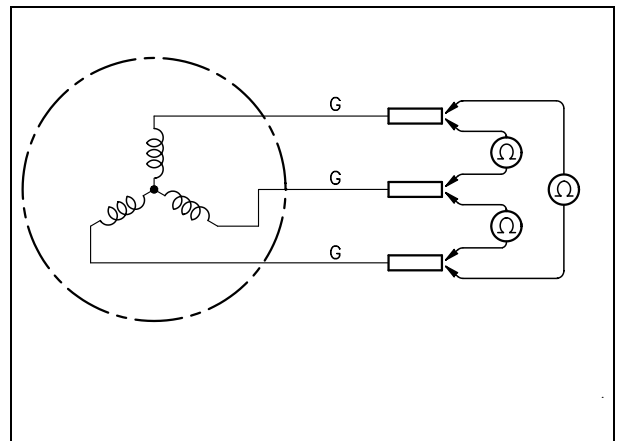
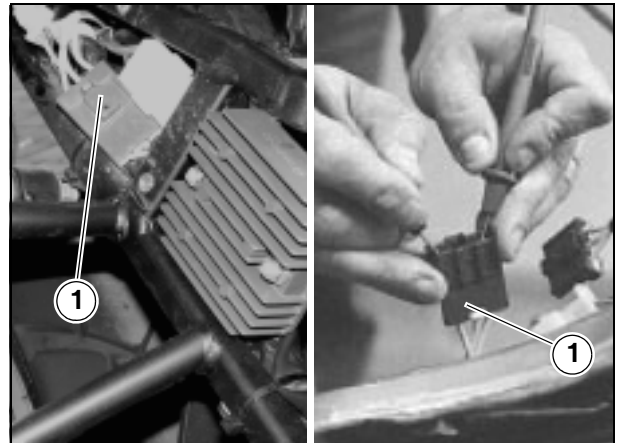
⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Set the multimeter to the Ω range and check for continuity across stator wires [that is, across the inner female terminals, yellow (G) wires].
Check stator mount insulation.

Correct resistance reading: 0.1 – 1 Ω

Correct resistance reading between wires and stator mount: ∞ .



6.3.5 RECTIFIER TEST

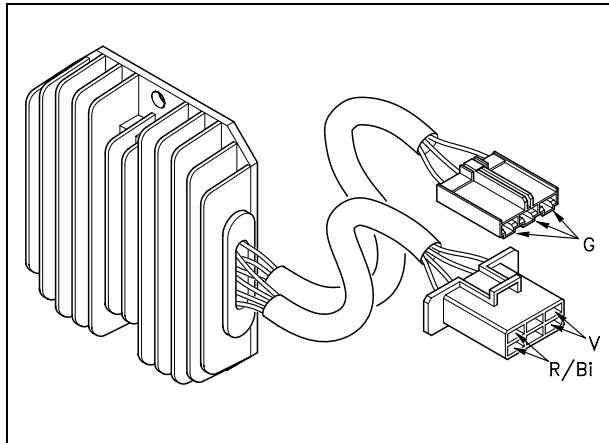
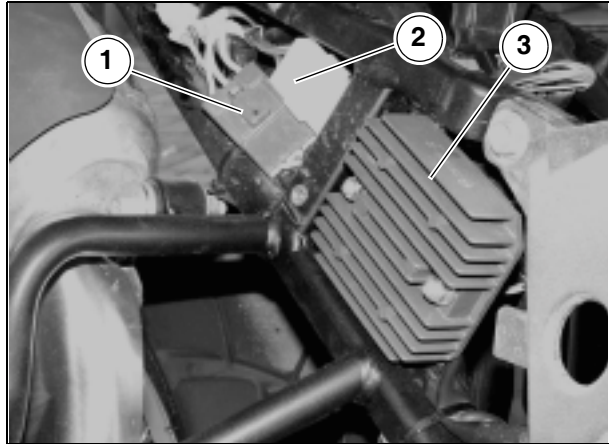
- ◆ Remove the right-hand lower fairing, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ◆ Disconnect the three-way connector (1) (coloured brown).
- ◆ Disconnect the six-way connector (2) (coloured white).

⚠ WARNING

Make sure to refit the connectors (1-2) to the matching connectors on assembly.

- ◆ Set a multimeter to the x 1 MΩ range. Measure resistance across the wires listed in the table below. Measure at rectifier end (inner male terminals).

NOTE The green (V) and white/red (Bi/R) leads are connected together. Measure across either one of them when testing.



		Multimeter positive terminal (+) on:				
		G	G	G	V	R/Bi
Multimeter negative terminal (-) on:	G	∞	∞	∞	2 - ∞	∞
	G	∞	∞	∞	2 - ∞	∞
	G	∞	∞	∞	2 - ∞	∞
	V	∞	∞	∞		∞
	R/Bi	2 - ∞	2 - ∞	2 - ∞	3 - ∞	

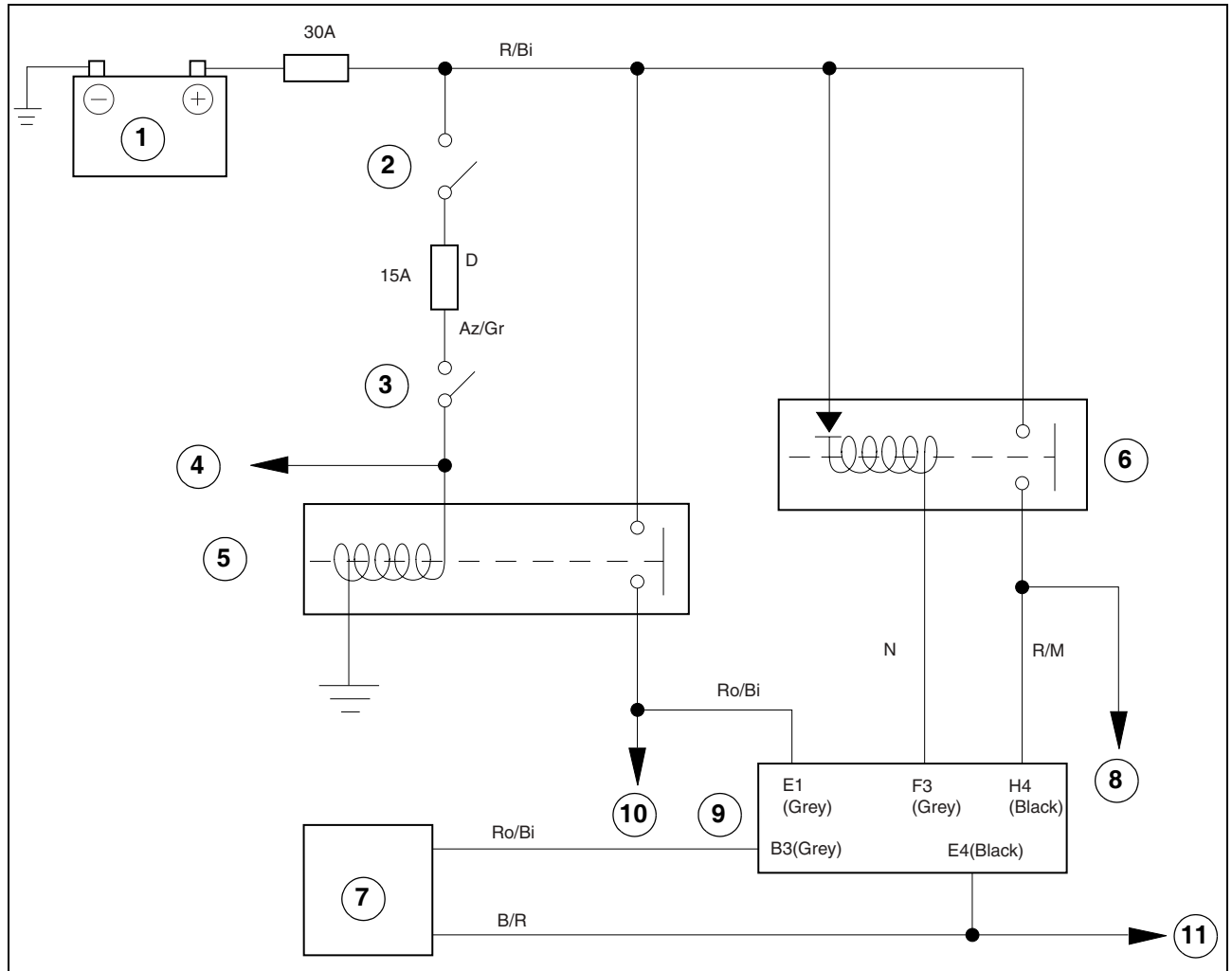
⚠ WARNING

This test method provides an approximate measure of resistance. Where possible, fit a substitute rectifier known to be in good working order to test the charge system.

If the reading found deviates from the specified value, change the rectifier (3), see 7.1.49 (REAR SUBFRAME REMOVAL).

6.4 INJECTION SYSTEM

6.4.1 INJECTION SUPPLY WIRING DIAGRAM



Key:

- | | |
|------------------------|---|
| 1) Battery | 7) Bank angle sensor |
| 2) Key-operated switch | 8) Power supply to injectors, fans, coils, purge valve ^{USA} |
| 3) Kill switch | 9) ECU |
| 4) Starter button | 10) To fuel pump relay |
| 5) Engine cutout relay | 11) Throttle position sensor, thermistors |
| 6) Injection relay | |

6.4.2 TROUBLESHOOTING

- ◆ Check that the 30-A main fuse and the 15-A fuse “D” are in good condition.
- ◆ Test kill switch device operation, see 6.8 (SAFETY LOCKOUT SYSTEM). Test key-operated switch operation, see 6.5 (IGNITION/INJECTION SYSTEM).
- ◆ Test the engine cutout relay for proper operation, see 6.7.3 (TEST OF FUEL PUMP RELAY AND ENGINE CUTOUT RELAY).
- ◆ Test the injection relay, see 6.4.3 (INJECTION RELAY TEST).
- ◆ Test the bank angle sensor, see 6.4.4 (BANK ANGLE SENSOR TEST).

6.4.3 INJECTION RELAY TEST

Test the relay for proper operation as follows:

- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Feed 12 Volts to the two male terminals (85-86).
- ◆ Check continuity between the other two terminals (87-30) using a multimeter set to the Ohm range.

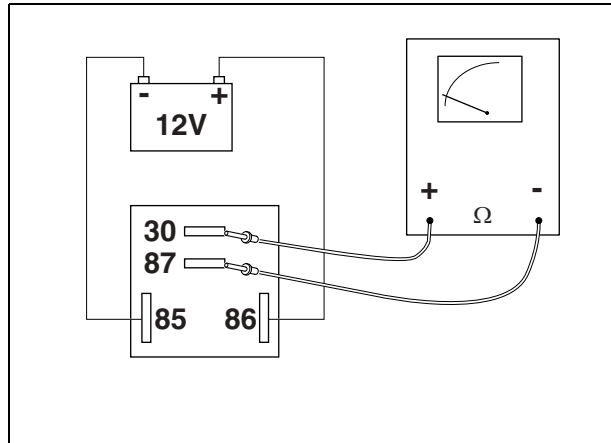
Correct reading when relay is fed: 0 Ω

Correct reading when relay is not fed: ∞ Ω

Change the relay if the reading found deviates from the specified reading.

⚠ WARNING

The relay accommodates a diode. Observe polarity when feeding the relay. Connect the terminal (86) to “+” and the terminal (85) to “-”.



6.4.4 BANK ANGLE SENSOR TEST

- ◆ Remove the front fairing, see 7.1.20 (HEADLIGHT REMOVAL).

Ensure that the sensor (1) is installed correctly. The arrow printed on the rubber should be faced upward.

- ◆ Disconnect the (white-grey) two-way connector (2) and measure resistance across the terminals at sensor end.

⚠ WARNING

Make sure to refit the connector (2) to the matching connector on assembly.

- ◆ Use a multimeter set to the 100 kΩ range to measure resistance across the terminals of the black and white/black leads (N - Bi/N).

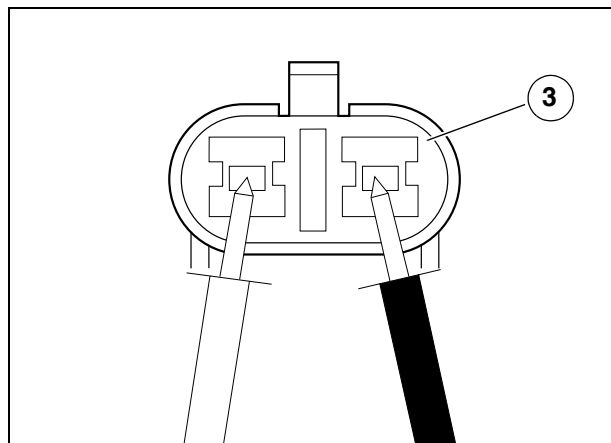
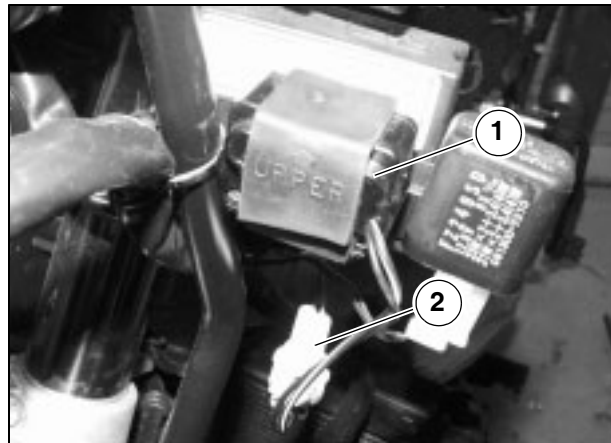
Correct resistance reading: 62 kΩ ± 10%.

- ◆ Take sensor (1) and rubber out of the mount. Tilt the sensor to one side at an angle greater than 45° (this simulates a condition in which the motorcycle is lying on the ground).

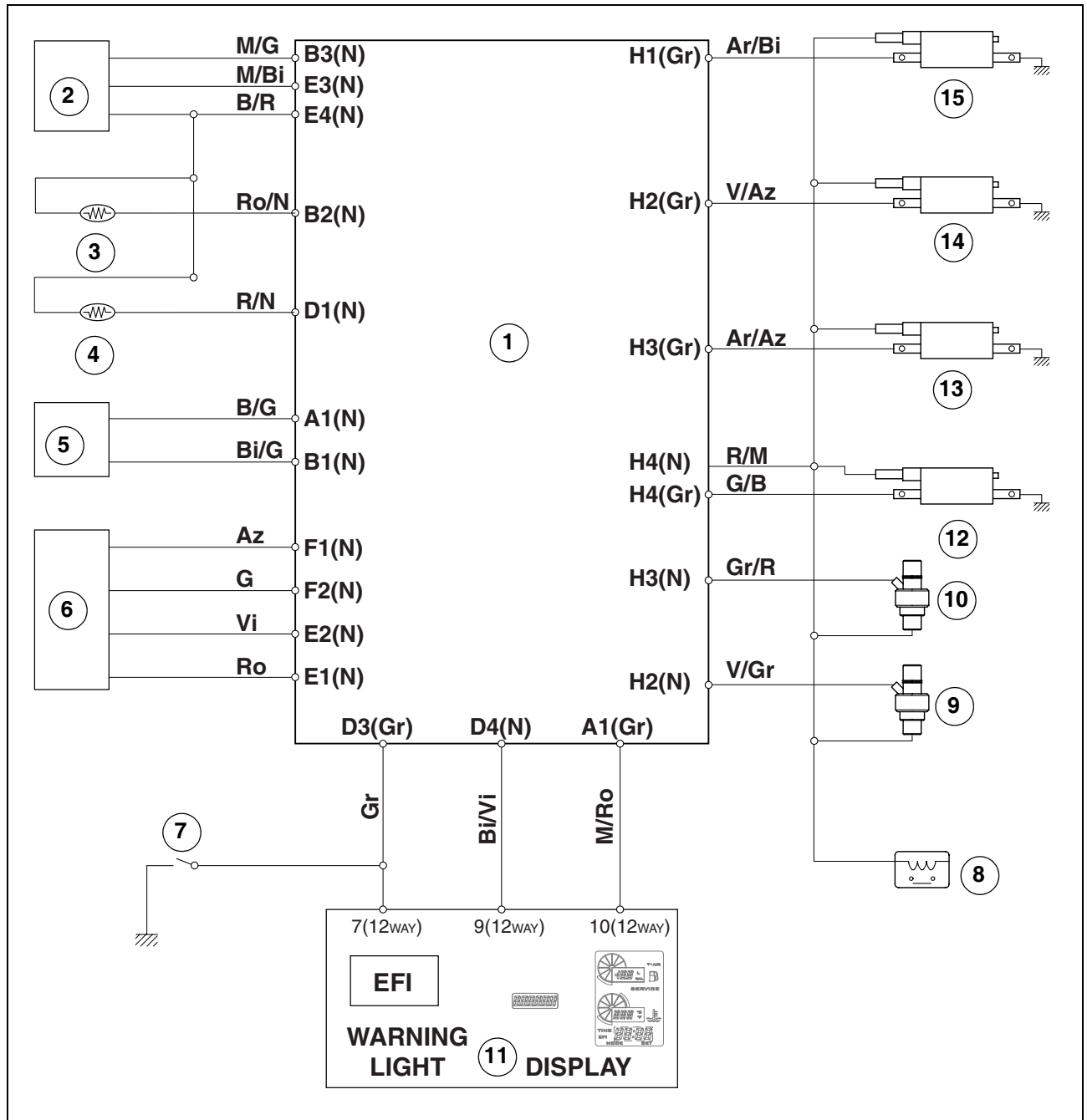
Correct reading: 0 - 1 kΩ.

NOTE If sensor operation deviates from the above limit, replace with a sensor of the same type fitted originally.

- ◆ Repeat the measurement tilting the sensor (1) to the other side.



6.5 IGNITION/INJECTION SYSTEM

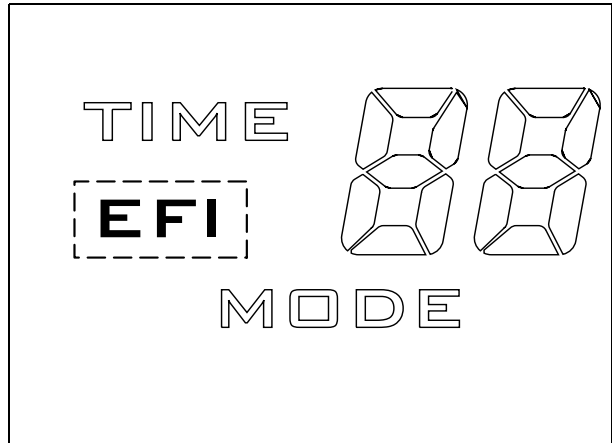


Key

- | | |
|-----------------------------------|---|
| 1) Engine Control Unit (ECU) | 5) Rear cylinder injector |
| 2) Throttle position sensor | 10) Front cylinder injector |
| 3) Coolant thermistor | 11) Instrument panel |
| 4) Injection air thermistor | 12) Rear cylinder coil – centre spark plug |
| 5) Rpm sensor | 13) Rear cylinder coil – side spark plug |
| 6) Automatic air adjustment motor | 14) Front cylinder coil – side spark plug |
| 7) Test connector | 15) Front cylinder coil – centre spark plug |
| 8) Injection relay | |

6.5.1 TROUBLESHOOTING

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "○".
- ◆ The wording "EFI" will appear on the display for about three seconds.
- ◆ If the "EFI" light goes out, it means that the Ecu has detected no faults.



6.5.2 IN THE EVENT OF A FAULT

- ◆ You have performed the operations described in subsection 6.5.1 (TROUBLESHOOTING); the wording "EFI" stays on and the wording "Off" appears in the clock field: the battery is likely to be flat.
- ◆ You have performed the operations described in subsection 6.5.1 (TROUBLESHOOTING); the wording "EFI" stays on: the starter motor operates, but the engine will not start up.
- ◆ You have performed the operations described in subsection 6.5.1 (TROUBLESHOOTING); the wording "EFI" is flashing: check the sensors.

6.5.3 FAULT CODES

- ◆ Lift the seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Connect the two test connectors (1) located on the right-hand side of the motorcycle.
- ◆ Look at the fault codes displayed in the clock field.
- ◆ Check with the fault code chart for possible causes of the problem.



FAULT CODE CHART:

FAULT CODE	AFFECTED COMPONENT	CAUSE
12	Crankshaft position sensor (pick-up)	- Sensor disconnected. - Sensor broken. - Wiring fault.
15	Throttle position sensor (TPS)	
21	Engine temperature sensor	
22	Air temperature sensor	
23	Atmospheric pressure sensor	- Sensor fault.
33	Coil no. 1	- Coil fault; coil disconnected from wiring.
34	Coil no. 2	
35	Coil no. 3	
36	Coil no. 4	
42	Injector no. 1	- Injector fault; injector disconnected from wiring.
43	Injector no. 2	

6.5.4 ELECTRONIC SYSTEM TROUBLESHOOTING BASED ON DISPLAY INFORMATION

⚠ WARNING

The ignition system produces high voltages. Be careful: shock hazard!

Never disconnect the connectors while the engine is running.

Unless expressly specified otherwise in the relevant sections of the manual, always set the ignition switch to "⊗" and disconnect the battery (negative "-" lead first) before servicing the ignition system.

⚠ WARNING

All measurements must be taken with the components at 20°C (68°F). General troubleshooting advice: locate fault and remove defective component immediately.

Perform the checks described in the subsections listed below:

- 6.6.7 (CRANKSHAFT POSITION SENSOR TEST);
- 6.6.3 (THROTTLE POSITION SENSOR TEST);
- 6.6.5 (COOLANT THERMISTOR TEST).

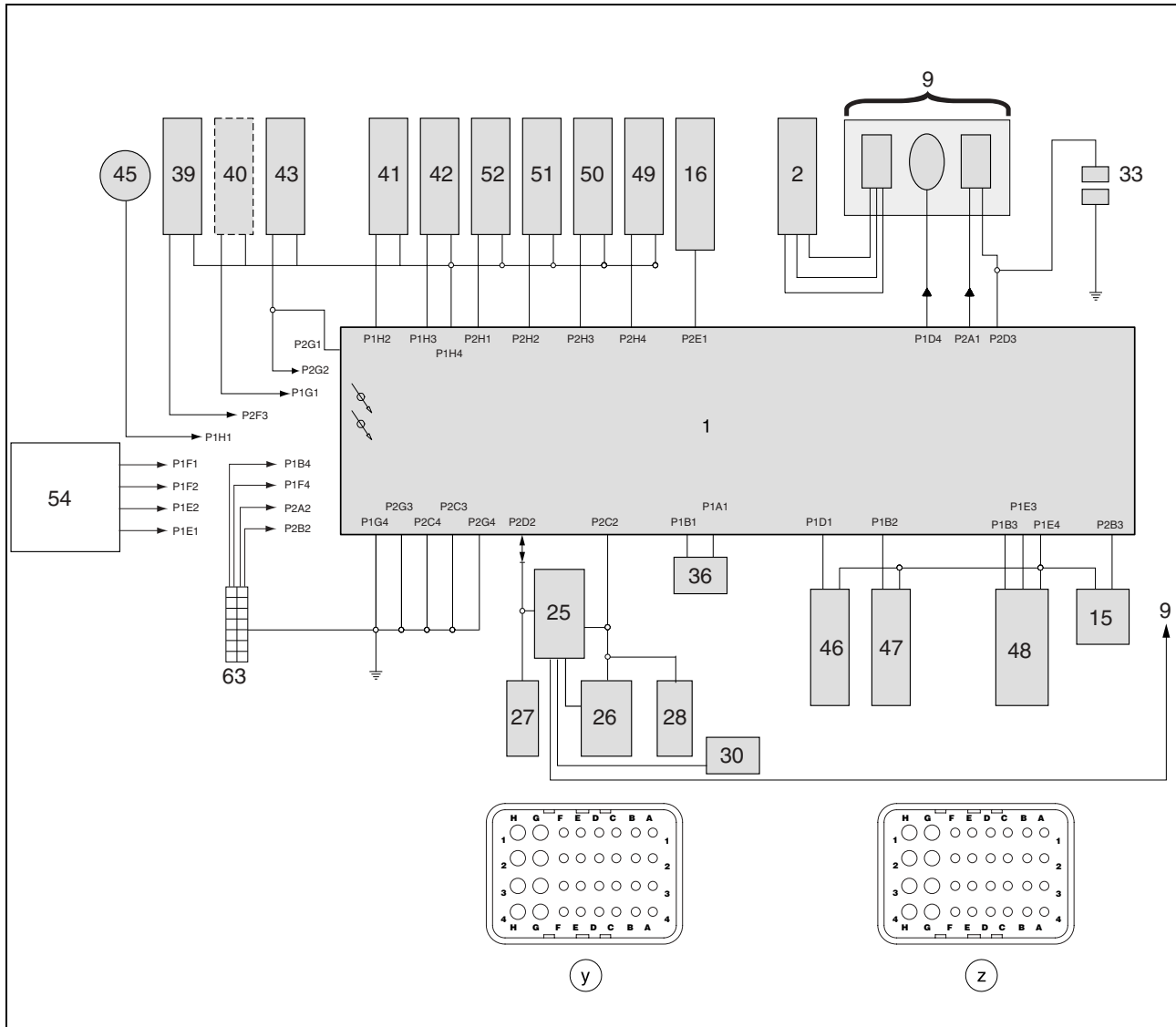
If the engine does not start and the vehicle diagnostic system indicates no faults, check the following components in the order:

- check the fuel pump for proper operation, see 6.7.2 (FUEL PUMP TEST);
- check the injectors for proper operation, see 6.6.1 (INJECTOR TEST);
- ensure that the anti-theft system connector is properly connected (this will be the white connector under the passenger seat);
- check the ignition switch for proper operation, see 6.13.2 (SWITCHES);
- check the engine kill switch for proper operation, see 6.13.2 (SWITCHES);
- check the condition of the 30-A main FUSES AND 15-A AUXILIARY FUSES, see 6.16 (REPLACING THE FUSES);
- check the engine cutout relay for proper operation, see 6.7.3 (TEST OF FUEL PUMP RELAY AND ENGINE CUTOUT RELAY);
- check for proper operation of the battery, see 2.4 (BATTERY) and 6.14 (BATTERY);
- check for proper OPERATION OF THE SAFETY LOCKOUT SYSTEM, see 6.8 (SAFETY LOCKOUT SYSTEM);
- check the bank angle sensor for proper operation, see 6.4.4 (BANK ANGLE SENSOR TEST).

6.6 HOOK-UP DIAGRAM OF ENGINE CONTROL UNIT

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the different components.

Please read 4.7.4 (ENGINE CONTROL UNIT CONNECTORS) for more detailed information.



NOTE The letters (y) and (z) used in the diagram identify the terminals of the two connectors:

- Y) Ecu connector (32-way).
- Z) Ecu connector (32-way).

Position	Component	Connector	Terminal #	Rating	Wiring colour
9	Instrument panel	P1	D4		Bi/Vi
		P2	A1		M/Ro
15	Bank angle sensor	P2	E1		Ro/Bi
16	Fuel pump relay	P2	E1		Ro/Bi
25	Diode module	P2	C2		M/V
		P2	D2		M
26	Clutch switch	P2	C2		M/V
27	Neutral switch	P2	D2		M
28	Side stand	P2	C2		M/V
30	Starter relay	-	-		-
33	TEST connectors	P2	D3		Gr
36	Crankshaft position sensor	P1	B1	150 - 300 Ω	Bi/G
		P1	A1		B/G
39	Injection relay	P1	H4		M/R
		P2	F3		N
40	Purge Valve (California only)	P1	G1		M/Vi
		P1	H4		M/R
41	Rear cylinder injector	P1	H4	11 - 17 Ω	M/R
		P1	H2		V/Gr
42	Front cylinder injector	P1	H4	11 - 17 Ω	M/R
		P1	H3		Gr/R
43	Cooling fan	P1	H4		M/R
		P2	G2		G/N
		P2	G1		G/N
45	Fuel pump	P1	H1		B/Bi
46	Air thermistor	P1	E4		B/R
		P1	D1		R/N
47	Coolant thermistor	P1	E4	1.9 - 2.9 k Ω	B/R
		P1	B2		Ro/N
48	Throttle position sensor	P1	E4	2.8 - 3.4 k Ω (varies with angle)	B/R
		P1	E3		M/Bi
		P1	B3		M/G
49	Rear cylinder coil	P1	H4	4 - 5 Ω	M/R
		P2	H4		G/B
50	Rear cylinder coil	P1	H4	4 - 5 Ω	M/R
		P2	H3		Ar/Az
51	Front cylinder coil	P1	H4	4 - 5 Ω	M/R
		P2	H2		V/Az
52	Front cylinder coil	P1	H4	4 - 5 Ω	M/R
		P2	H1		Ar/Bi
54	Idling adjustment motor	P1	F1		Az
		P1	F2		G
		P1	E2		Vi
		P1	E1		Ro
63	Diagnostics connector	P1	G4		B/V
		P1	B4		B/N
		P1	F4		Vi/M
		P2	A2		B/Ar
		P2	B2		Gr/Bi

6.6.1 INJECTOR TEST

With the engine off:

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).

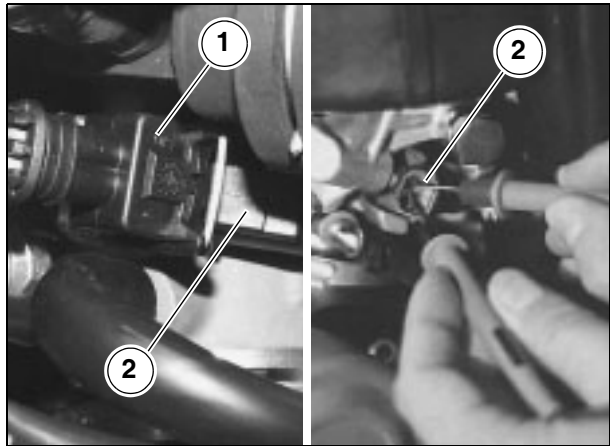
NOTE The procedure described below applies to both injectors.

- ◆ Disconnect the two-way connector (1) (coloured black) and measure the resistance across the terminals at the injector end.
- ◆ Measure the resistance across injector terminals using a multimeter set to the $\times 100 \Omega$ range.

Correct reading: $11.5 - 13 \Omega$ at 20°C (68°F).

Replace the injector (2) when detected reading indicates infinite resistance (∞) or is below the specified range.

- ◆ Repeat the test with the other injector.



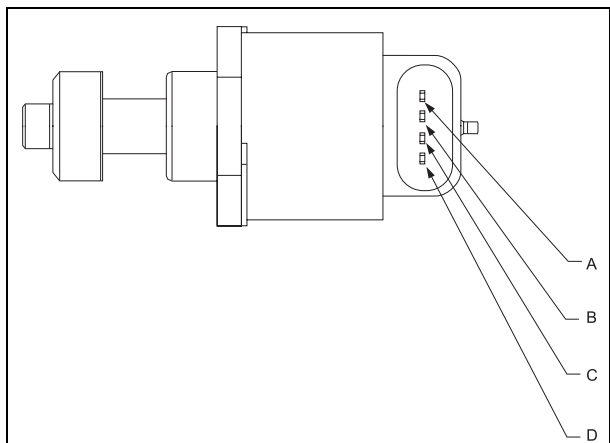
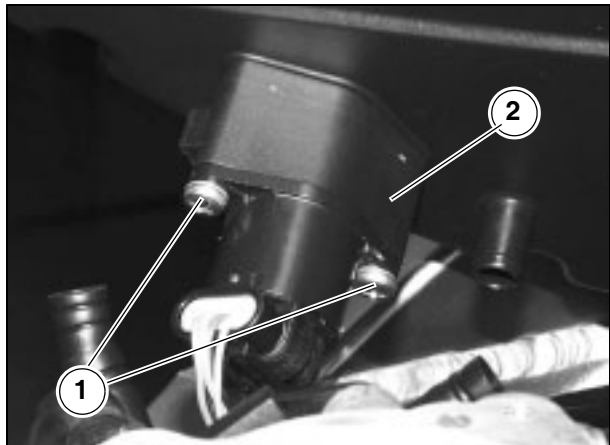
6.6.2 AUTOMATIC AIR ADJUSTMENT MOTOR

- ◆ Lift the airbox, see 7.1.6 (AIRBOX REMOVAL).

NOTE This is a stepper motor that opens and closes some particular air passages to make the air/fuel mixture richer or leaner.

To test the stepper motor (2) for proper operation:

- ◆ Release and remove the two screws (1) and remove the motor from the airbox.
- ◆ Set the ignition switch key to “○” and then right away to “⊗”. When the key is set to “⊗”, an automatic set-up procedure takes place during which the small white cylinder travels fully out (about 28.5 mm) and then backs off by a few millimetres (about 19.6 mm).
- ◆ When this is not the case, measure the resistance between the two coils using a multimeter set to the Ohm range:
 - check across pins A and D, correct reading is: $50 \Omega \pm 10\%$;
 - check across pins B and C, correct reading is: $50 \Omega \pm 10\%$;
 - across the other pins: infinite resistance (∞).



6.6.3 THROTTLE POSITION SENSOR TEST

With the engine off:

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Disconnect the three-way connector (coloured black) (1).

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Set the ignition switch to "⊗".
- ◆ Measure the resistance across the terminals of the potentiometer (2) (Tps) using a multimeter set to the $k\Omega$ range.

MEASUREMENT (A)

Resistance between terminals A and B, regardless of throttle position:

Correct reading: $1.2\ k\Omega \pm 10\%$.

MEASUREMENT (B)

Resistance between terminals A and C:

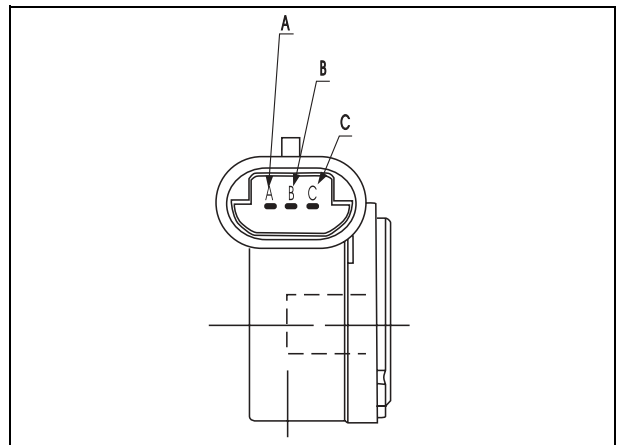
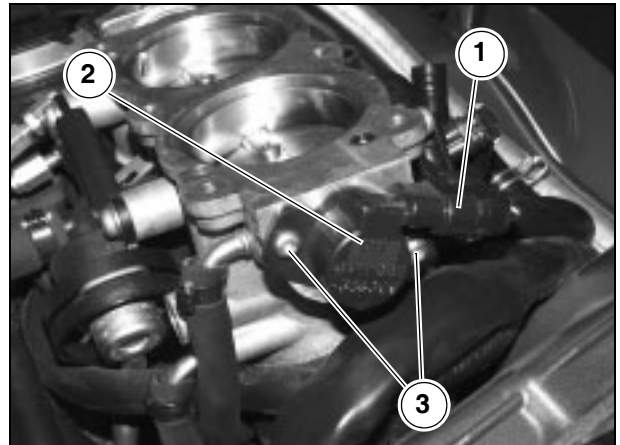
Begin with the throttles fully closed and open gradually until the throttles are fully open; resistance should increase as follows:

Correct reading: from $1.2\ k\Omega$ to $2.4\ k\Omega \pm 10\%$.

NOTE The two screws (3) are retained with LOCTITE® 243. Heat up with hot air to facilitate removal.

- ◆ Release and remove the screws (3).
- ◆ Remove the potentiometer (2).

Replace the potentiometer (2) when resistance readings are outside the specified range.



6.6.4 AIR THERMISTOR TEST

- ◆ Remove the air box, see 7.1.6 (AIRBOX REMOVAL).
- ◆ Disconnect the two-way connector (1) (coloured green).

⚠ WARNING

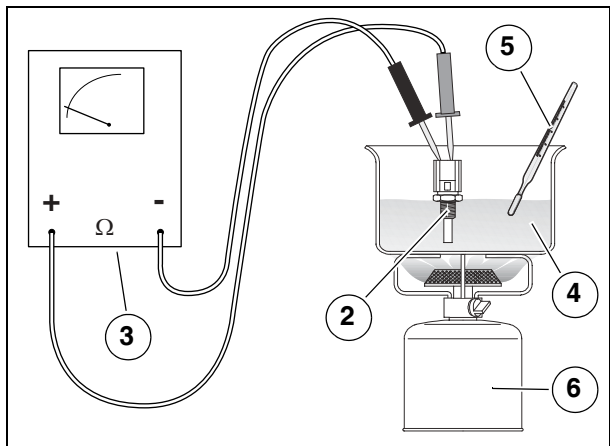
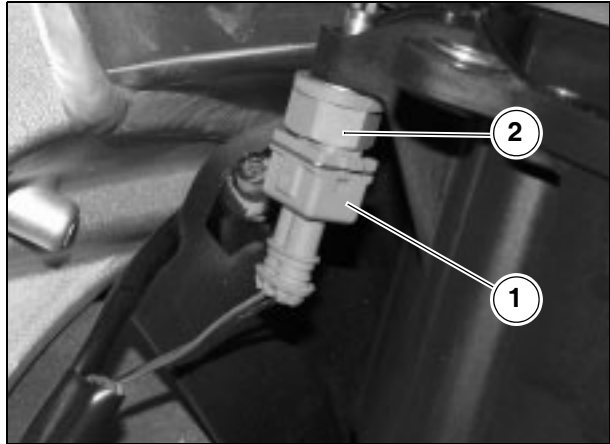
Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Remove the thermistor (2).
- ◆ Attach the leads of a multimeter (3) set to the Ohm range to the thermistor (2) as shown in the diagram.
- ◆ Suspend the thermistor in a container (4) filled with water.
- ◆ Suspend a thermometer (5) with a 0 -150°C (32 - 302°F) range in the container.
- ◆ Place the container on a gas burner (6) and heat up the water gradually.
- ◆ Check the temperature reading of the thermometer (5) and the thermistor output indicated by the multimeter.

Thermistor output should vary with temperature as indicated in the table below.

Water temperature		Correct reading (W) (± 10%)
(°C)	(°F)	
0	32	5457
20	68	2375
40	104	1111
60	140	563.8
80	176	306.4
100	212	176.7

NOTE If standard values do not change or are too different with respect to those in the table while temperature changes, replace the thermistor (2).



6.6.5 COOLANT THERMISTOR TEST

NOTE The temperature reading detected by the front cylinder thermistor (on right-hand side) is sent to the right-hand display; the temperature reading detected by the rear cylinder thermistor (on left-hand side) is transmitted to the Ecu.

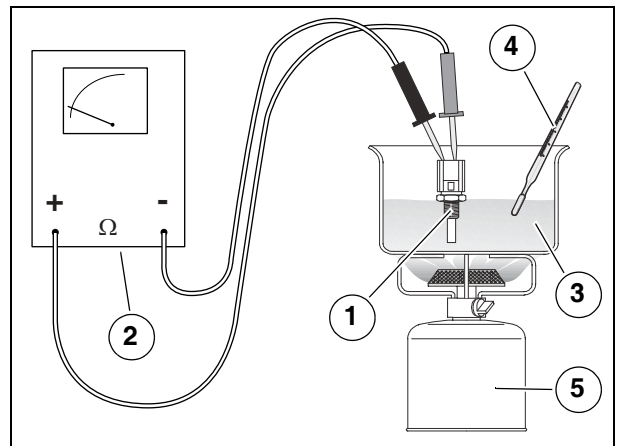
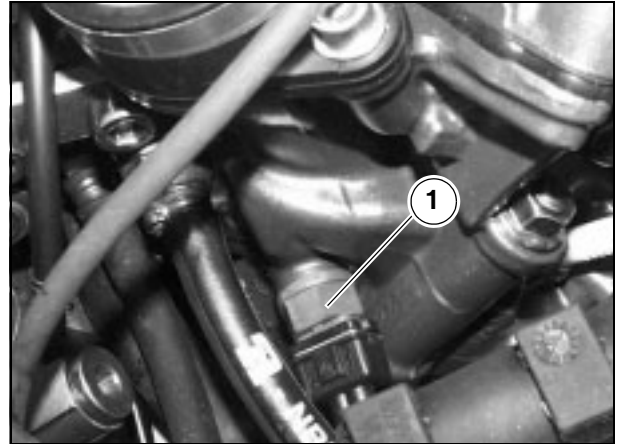
- ◆ Remove the thermistor (1), see 5.4 (REMOVING THE COOLANT THERMISTORS).
- ◆ Set a multimeter (2) to the Ohm range and attach the multimeter leads to the thermistor (1) as shown in the figure.
- ◆ Suspend the thermistor (1) in a container (3) filled with coolant.
- ◆ Suspend a thermometer (4) with a 0 -150°C (32 - 302°F) range in the container.
- ◆ Place the container on a gas burner (5) and heat up the coolant gradually.
- ◆ Check the temperature reading of the thermometer (4) and the thermistor (1) output indicated by the multimeter.

Thermistor output should vary with temperature as indicated in the table below.

Coolant temperature		Correct reading (W) (± 10%)
(°C)	(°F)	
0	32	5896
20	68	2500
40	104	1175
60	140	595.5
80	176	322.5
100	212	186.6

NOTE If standard values do not change or are too different with respect to those in the table while temperature changes, replace the thermistor (1).

- ◆ Repeat the same procedure for the other thermistor.



6.6.6 IGNITION COIL TEST

- ◆ Remove the air box to inspect front ignition coils, see 7.1.6 (AIRBOX REMOVAL).
- ◆ Remove the seat to inspect rear ignition coils, see 7.1.2 (REMOVING THE RIDER SEAT).

NOTE The procedure described below applies to all ignition coils.

- ◆ Disconnect the connector (1) at the ignition coil (2).

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Disconnect the wiring from the coil (2).
- ◆ Check resistance using a multimeter. Observe the layout (A) and (B) in the diagram for meter connection.

Check for continuity of the primary and secondary windings.

The resistance readings found need not match standard values exactly. If the windings are in good working order, resistance readings should approximate the standard values.

Standard values:

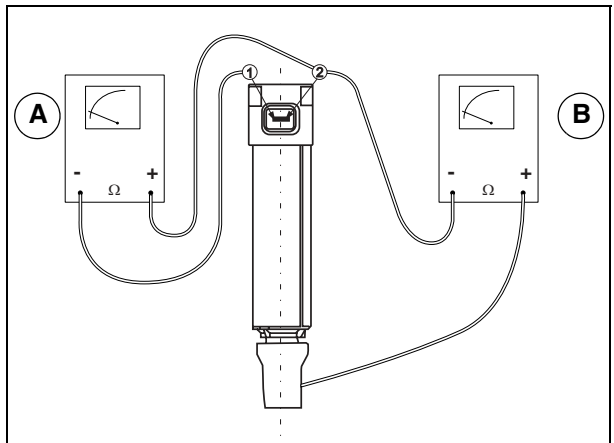
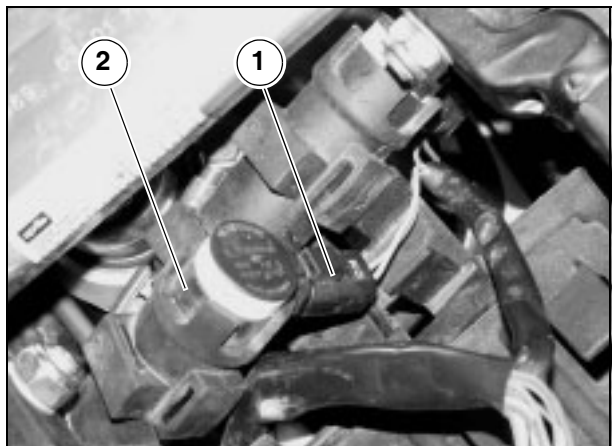
layout (A): $0.6\Omega \pm 10\%$;

layout (B): $10\text{ k}\Omega \pm 10\%$.

⚠ WARNING

This test method provides an approximate indication. When possible, fit a substitute coil known to be in good working order to confirm proper operation.

- ◆ Repeat test with the other coils.



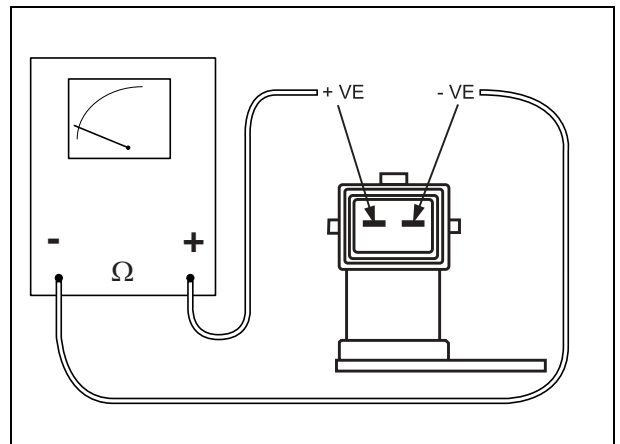
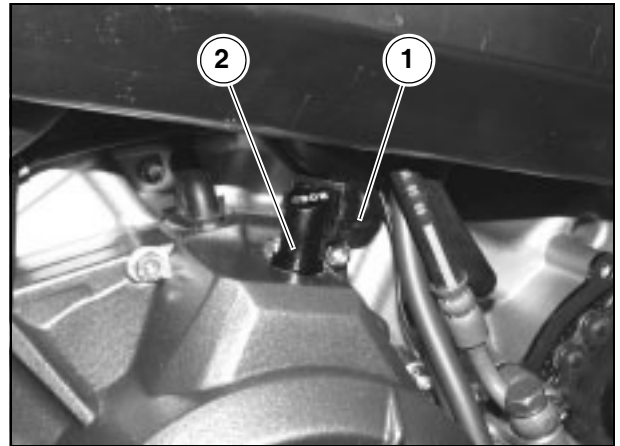
6.6.7 CRANKSHAFT POSITION SENSOR TEST

With the engine off:

- ◆ Disconnect the two-way connector (1) and attach the multimeter leads direct to the sensor (2).
- ◆ Set the multimeter to the x 1000 Ω range and measure resistance across sensor terminals. Observe terminal polarity (see diagram).

Correct reading: 560 $\Omega \pm 10\%$.

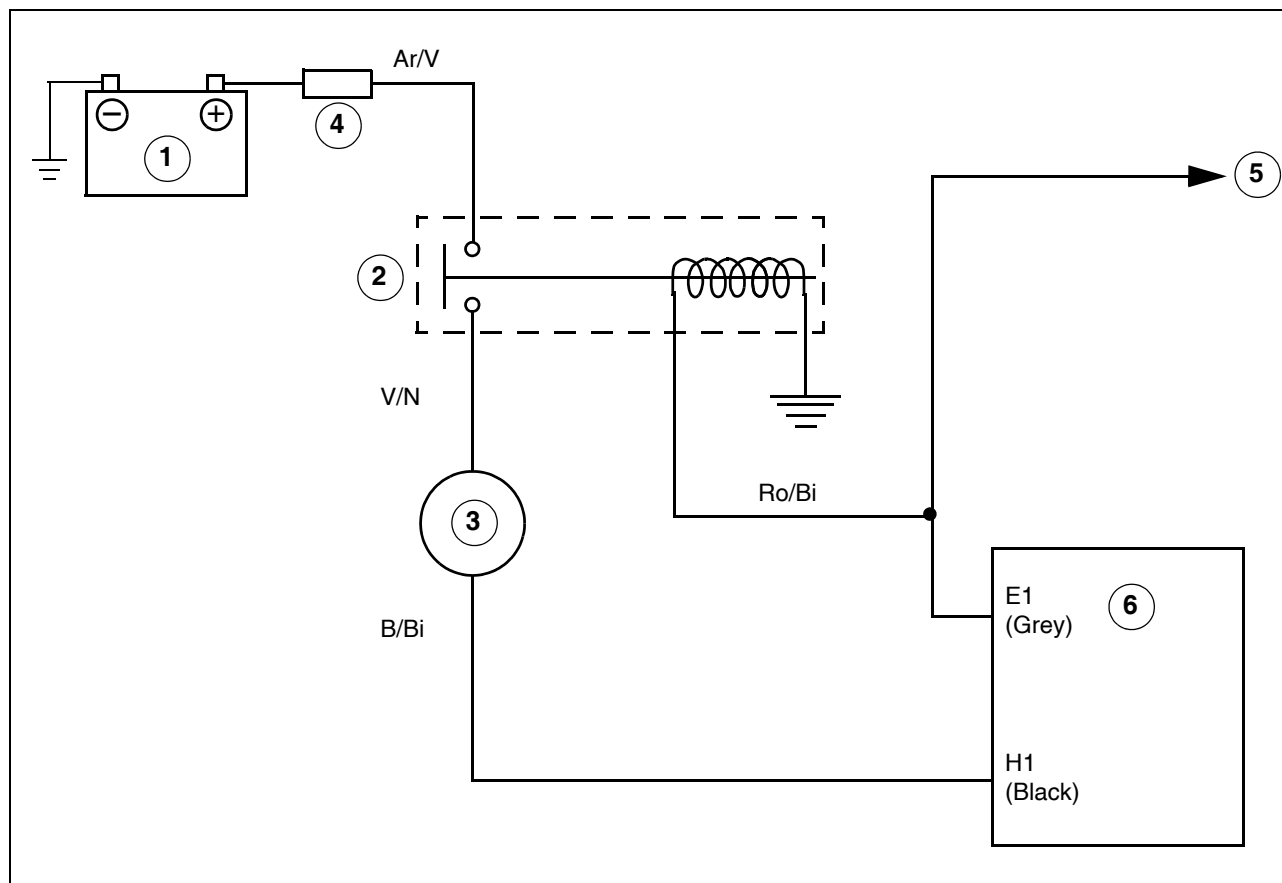
- ◆ Replace sensor when infinite resistance is detected or when the reading found is below the specified range.



6.7 FUEL PUMP SYSTEM

6.7.1 WIRING DIAGRAM

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.

**Key:**

- 1) Battery
- 2) Fuel pump relay
- 3) Pump
- 4) Fuse
- 5) Engine cutout relay
- 6) Ecu

6.7.2 FUEL PUMP TEST

To test fuel pump operation:

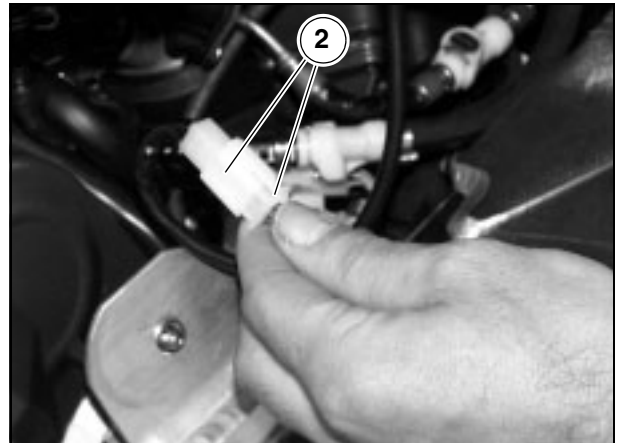
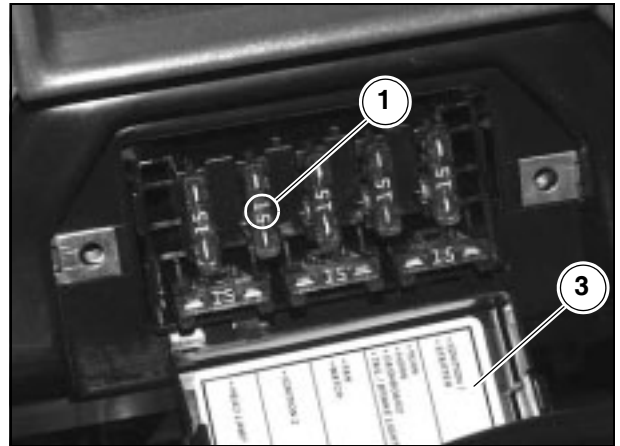
- ◆ Take off the cover (3) of the auxiliary fuse box.
- ◆ Check the fuse (1).
- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).

- ◆ Disconnect the four-way connector (2) located on the left-hand side of the vehicle.

⚠ WARNING

Make sure to refit the connector (2) to the matching connector on assembly.

- ◆ Feed 12 (DC)V to the green (V) positive (+) lead and the blue (B) negative (-) lead (at the pump assembly end).
- ◆ The pump should start running (it should give off a typical whirring sound). Check pressure on the pressure gauge. Delivery pressure should be at least 350 kPa (3.5 bar).



6.7.3 TEST OF FUEL PUMP RELAY AND ENGINE CUTOFF RELAY

To test relay operation:

- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Disconnect the four-way connector (1) (coloured white) from the relay (2).

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Feed 12 Volts to the two inner male terminals (A-B).
- ◆ Check for continuity between the other two terminals (C-D) using a multimeter set to the Ohm range.

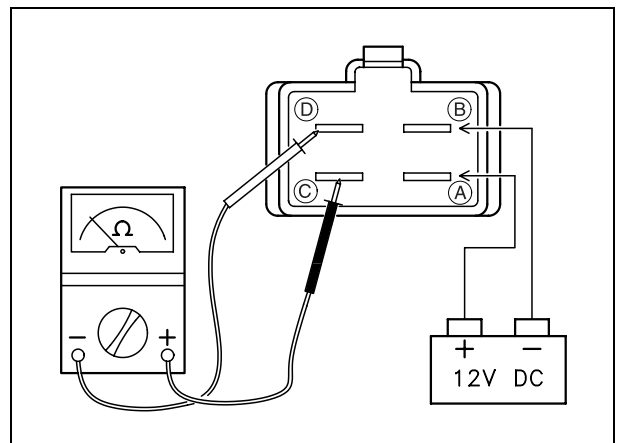
Correct reading when relay is fed : 0 Ω.

Correct reading when relay is not fed: ∞ Ω

Replace the relay (2) if the readings obtained deviate from those specified.

When all components are found to be operating properly, perform these checks:

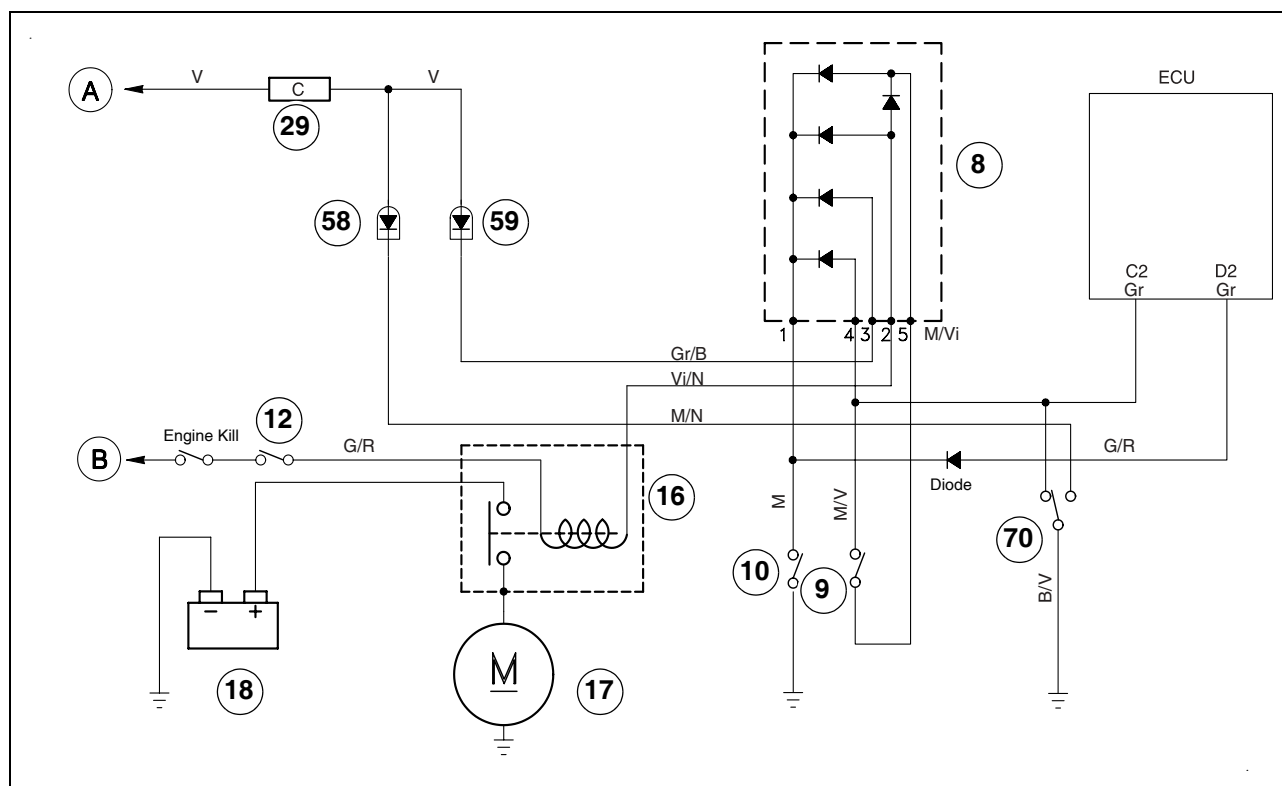
- Check bank angle sensor, see 6.4.4 (BANK ANGLE SENSOR TEST).
- Ensure that wires are connected correctly.



6.8 SAFETY LOCKOUT SYSTEM

6.8.1 WIRING DIAGRAM


NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



Key to diagram

- 8) Diode module
- 9) Clutch lever switch
- 10) Neutral light switch
- 12) Start button
- 16) Starter relay
- 17) Starter motor
- 18) Battery
- 29) Auxiliary fuses (15 A)
- 58) Side stand light (LED)
- 59) Neutral light (LED)
- 70) Side stand switch
- A) To battery / ignition switch
- B) To auxiliary fuses (15 A)

6.8.2 SAFETY LOCKOUT SYSTEM OPERATION

NOTE When the engine kill switch is set to “”, the starter motor will not run.

TRANSMISSION	SIDE STAND	CLUTCH LEVER	STAND LIGHT	IGNITION ENGINE	STARTER MOTOR
NEUTRAL ENGAGED	UP	PULLED IN	OFF	OPERATES	RUNS
		RELEASED			
	DOWN	PULLED IN	ON		
		RELEASED			
GEAR ENGAGED	UP	PULLED IN	OFF	OPERATES	RUNS
		RELEASED			
	DOWN	PULLED IN	ON	LOCKED OUT	LOCKED OUT
		RELEASED			

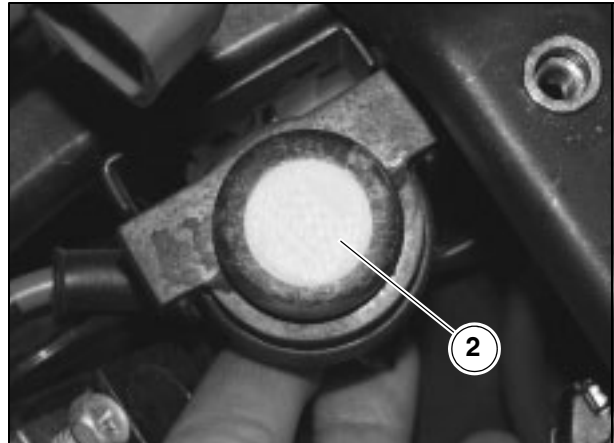
6.8.3 STARTER RELAY TEST

To test relay operation:

- ◆ Remove the plate under the seat, see 7.1.31 (REMOVING THE SEAT LOWER MOULDED COVER).
- ◆ Lift the starter relay (2).

⚠ WARNING

Replace the rubber seal if damaged.

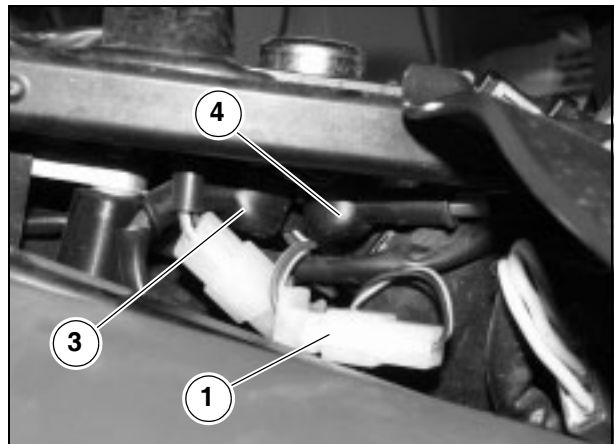


- ◆ Disconnect the two-way connector (1) (coloured white).

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

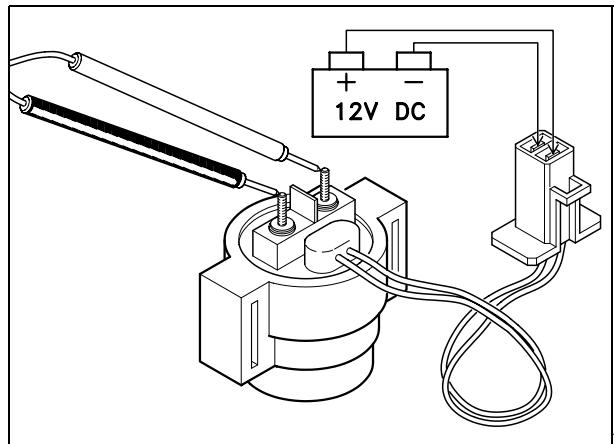
- ◆ Lift the relay (2) until it is clear of its retainers.
 - ◆ Slide off the two rubber boots (3-4).
 - ◆ Disconnect the wiring from the terminals of the relay (2).
- ◆ Feed 12 Volts to the two inner terminals in the connector (1) at the relay end.
- ◆ Check for continuity between the two contact screws of the relay (2) using a multimeter set to the Ohm range.



Correct reading when relay is fed: 0Ω .

Correct reading when relay is not fed: $\infty \Omega$

Replace the relay (2) if the readings obtained deviate from those specified.



6.8.4 DIODE TEST

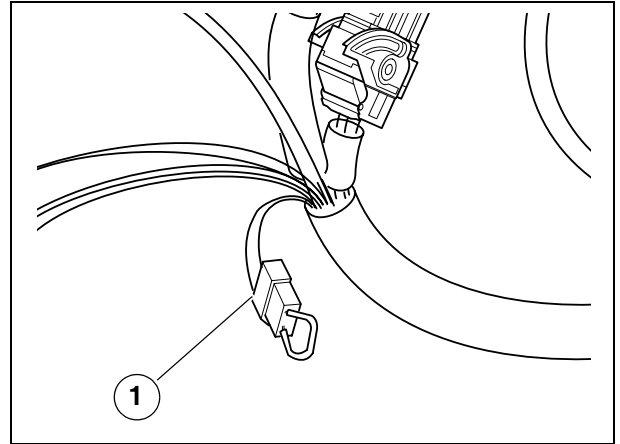
To test diode operation:

- ◆ Remove the left-hand side fairing, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Disconnect the two-way connector (1) (coloured white) located under the left-hand fairing panel, near the ECU.

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

Place a multimeter in the diode-test mode and measure across the two male terminals accommodated inside the diode as shown in the diagrams.



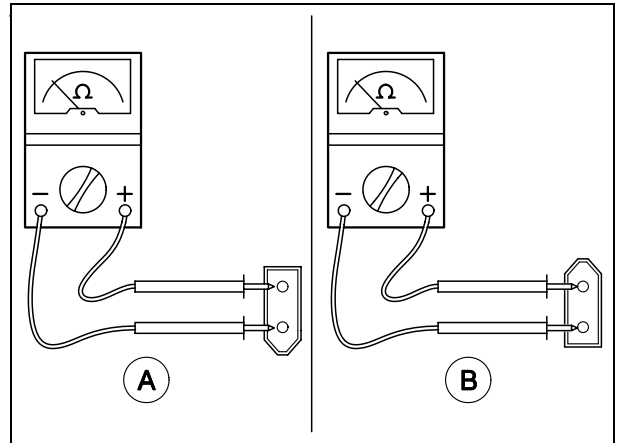
Correct reading (layout A): 0 – 1 Ω.

Correct reading (layout B): ∞

When there is no multimeter including a diode-test feature available, feed 12 Volts to the diode, fit a 12 V - 2 W bulb to the positive lead and connect the leads to the diode as shown in the diagrams.

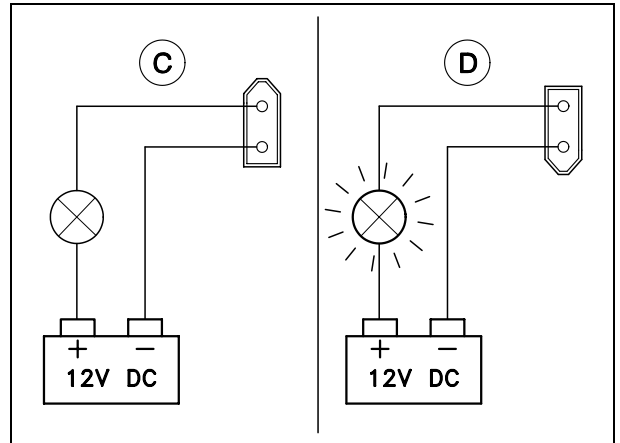
⚠ WARNING

Do not use a bulb rated higher than 2 W or the diode will damage.



Test (C): the bulb stays off.

Test (D): the bulb comes on.



6.8.5 SIDE STAND SWITCH TEST

Ensure that there is no obstruction to side stand (1) rotation.

Check for the following:


- ◆ Inspect the springs (2) for any sign of damage, wear, rust or weakening.
- ◆ The side stand should rotate freely. Grease the joint if needed, see 1.6 (LUBRICANT CHART).

The side stand (1) is fitted with a safety switch (3) that inhibits ignition or shuts down the engine whenever a gear is engaged while the side stand (1) is down.

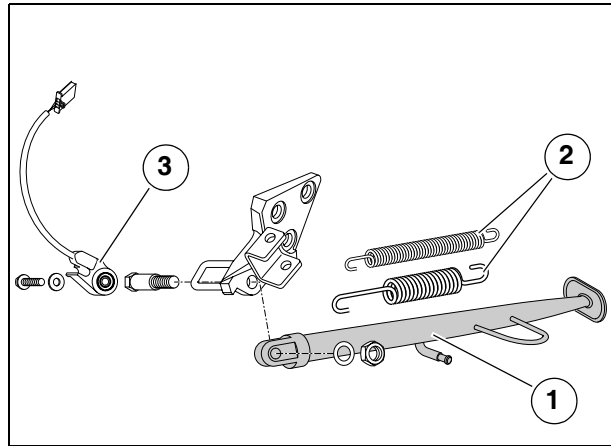
To test safety switch (3) operation:

- ◆ Sit astride the motorcycle.
- ◆ Raise the side stand (1).
- ◆ Start the engine.
- ◆ With the throttle twistgrip released and the engine idling, pull the clutch lever all the way in. Push down on gear shift lever to engage the first gear.
- ◆ Lower the side stand (1). This should cause the safety switch (3) to cut in.

This is what should happen next:

- the engine should stop;
- the side stand light “” on the instrument panel should light up.

When this is not the case, replace the switch (3).



6.8.6 DIODE MODULE TEST

- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT)
- ◆ Disconnect the five-way connector (1) (coloured white) from the module (2).

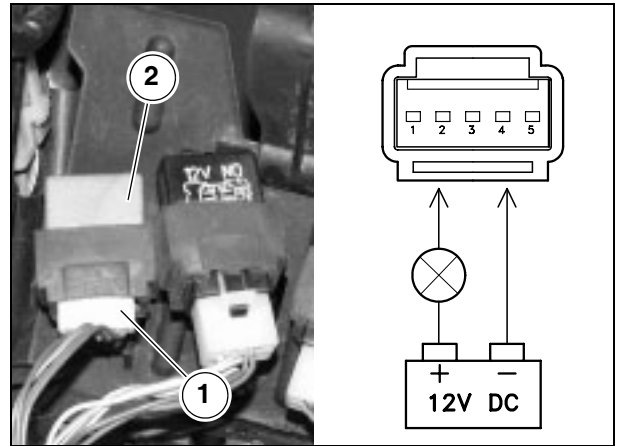
⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Apply 12 Volts to the various terminals, with a 12 V - 2 W bulb fitted to the positive (+) lead as shown.

⚠ WARNING

Do not use a bulb rated higher than 2 W or the module will damage.



- \ +	1	2	3	4	5
1		☀	☀	☀	☀
2	●		●	●	●
3	●	●		●	●
4	●	●			●
5	●	☀	●	●	

⚠ WARNING



The bulb should illuminate as indicated in the chart. If not so, replace the module (2).

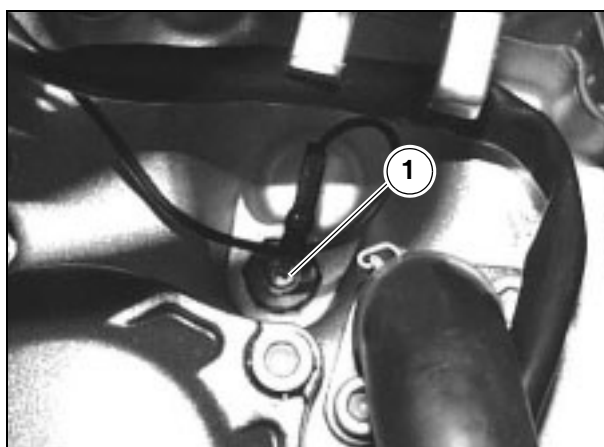
6.8.7 TESTING THE SAFETY LOCKOUT SYSTEM SWITCHES

Check for switch continuity using a multimeter. Please refer to the relevant diagram.

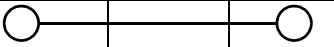
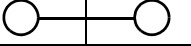
Replace any switch found to deviate from the specified mode of operation.

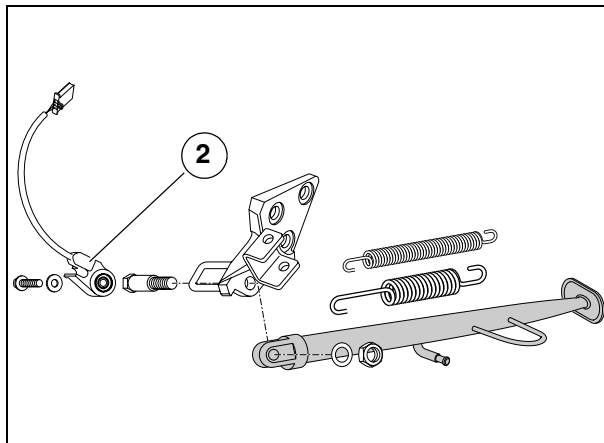
1) NEUTRAL SWITCH

Position	Leads	
	Screw	
Neutral		




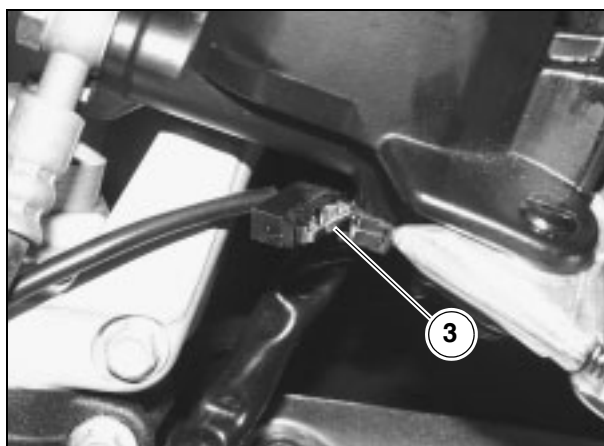
2) SIDE STAND SWITCH

Position	Leads		
	M	V	N
Down			
Up			



3) CLUTCH LEVER SWITCH

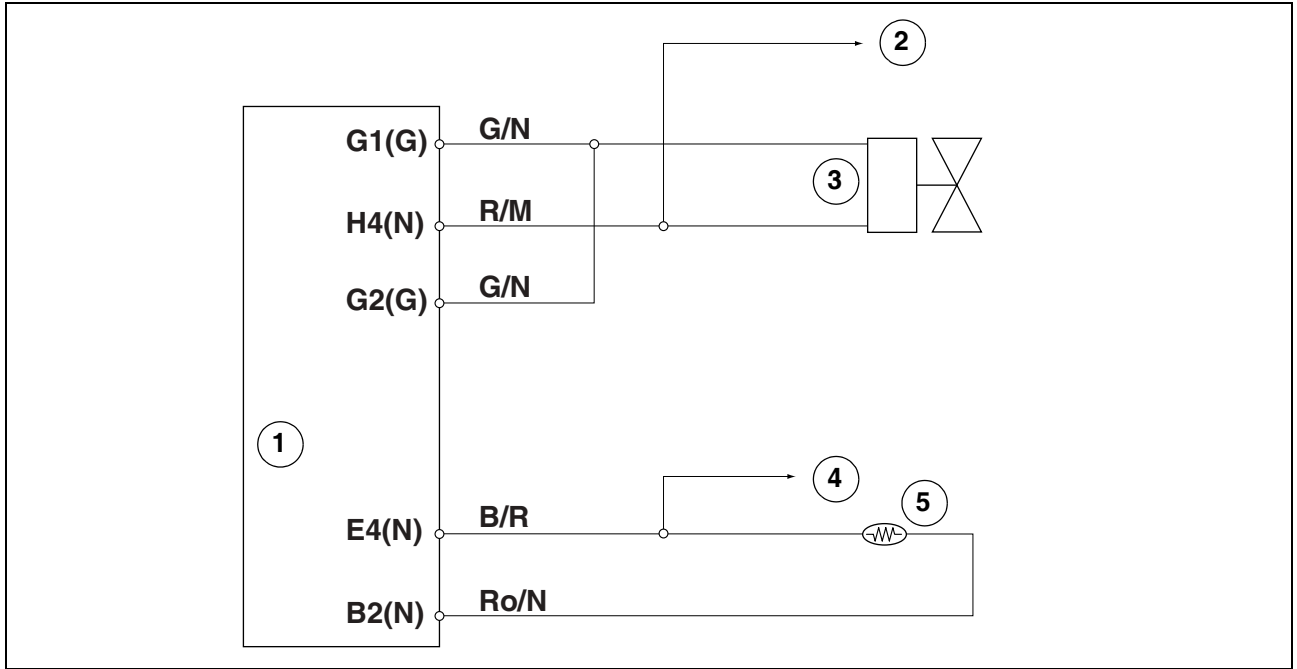
Position	Leads	
	Gr	M
Activated		



6.9 COOLING FAN

6.9.1 WIRING DIAGRAM

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



Key

- 1) Electronic Control Unit
- 2) Injection relay
- 3) Fan
- 4) Throttle position sensor
- 5) Coolant thermistor

6.9.2 COOLING FAN TEST

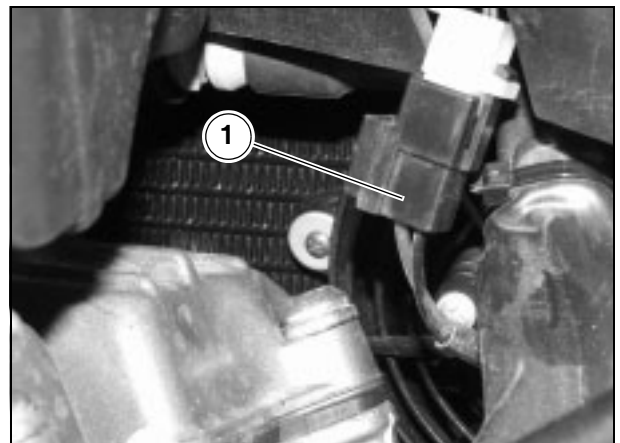
◆ Perform the first three steps of the procedure described in subsection 5.3 (REMOVING THE COOLING FAN).

NOTE Make sure to have a 12-V battery ready at hand.

- ◆ Attach the black connector (1) to the battery.
- ◆ Ensure that the fan turns freely.

If the fan is working properly, check the following:

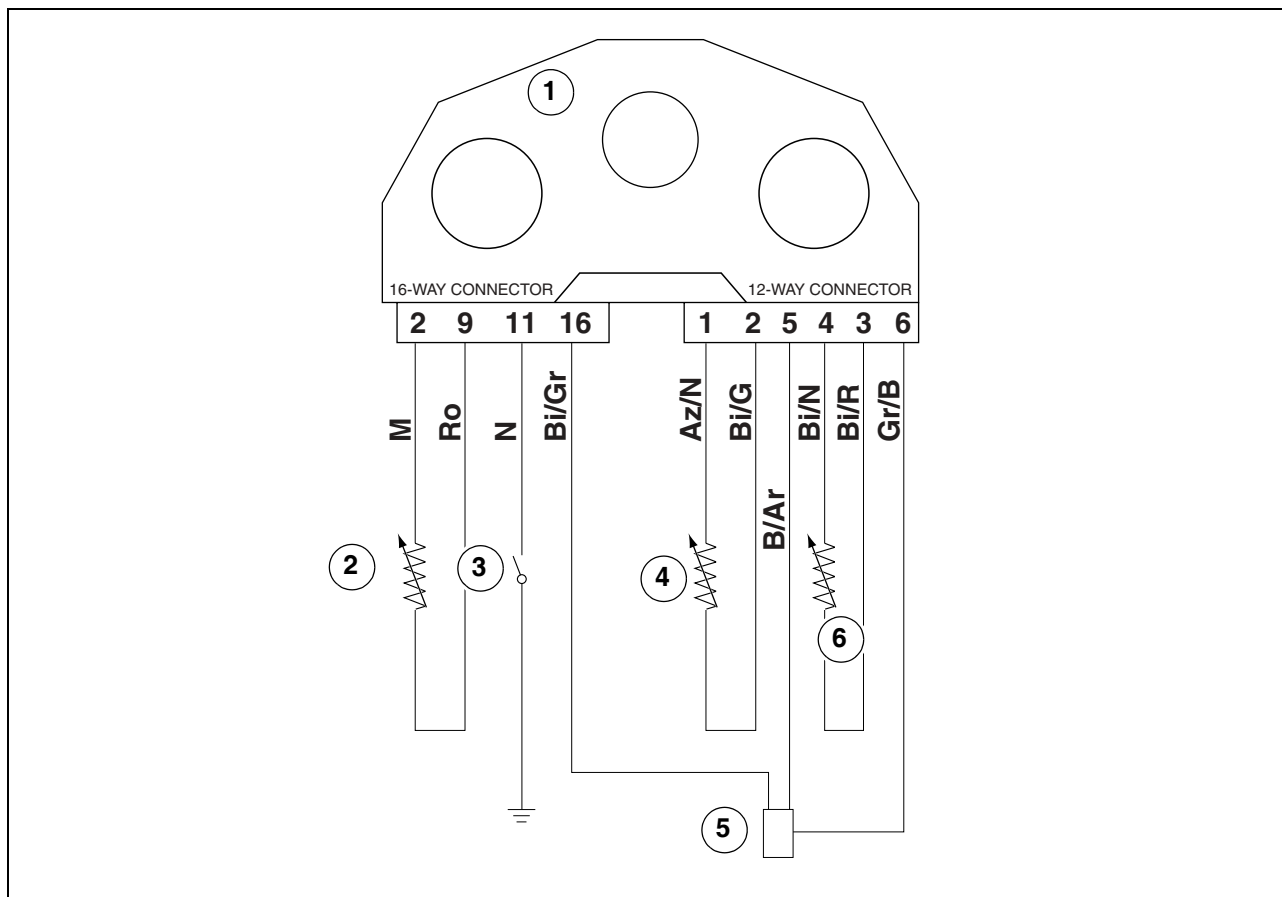
- coolant thermistor, see 6.6.5 (COOLANT THERMISTOR TEST);
- ignition system power supply;
- proper connection at Ecu end.



6.10 SAFETY LOCKOUT SYSTEM

6.10.1 WIRING DIAGRAM

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



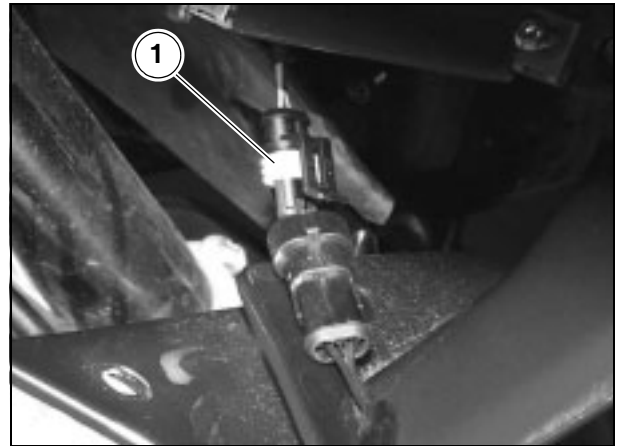
Key:

- 1) Instrument panel
- 2) Ambient temperature sensor
- 3) Oil pressure sensor
- 4) Fuel sensor
- 5) Speed sensor
- 6) Coolant temperature sensor

6.10.2 AIR TEMPERATURE SENSOR

To test air temperature sensor operation:

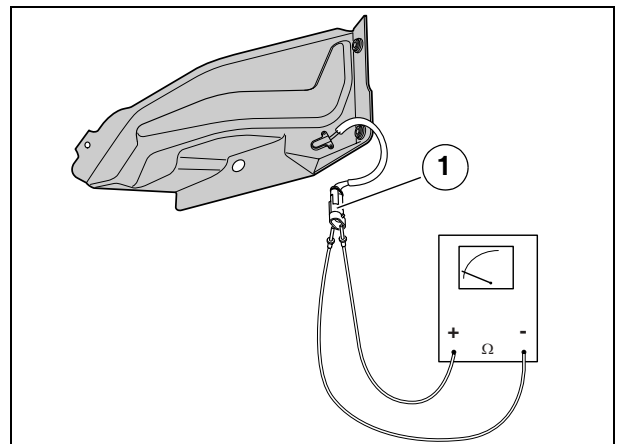
- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Disconnect the two-way connector (1).
- ◆ Test sensor in a controlled environment at an ambient temperature of 20°C (68°F).



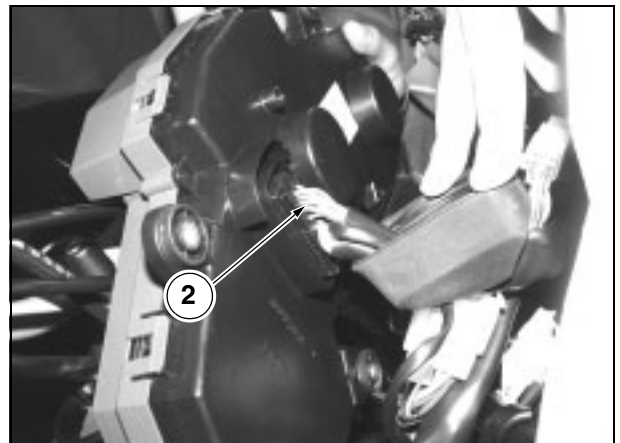
- ◆ Measure resistance across the terminals of connector (1) using an ohmmeter set to a 0-20kΩ range.

Correct reading: 12.200 kΩ – 12.700 kΩ.

If the air temperature sensor is operating properly, check the instrument panel as follows:



- ◆ Disconnect the sixteen-way connector (2), see 7.1.19 (REMOVING THE INSTRUMENT PANEL).
- ◆ Apply 12.4 kΩ across terminals 2 and 9.
- ◆ A properly working instrument panel will give a temperature reading of 20 ± 1°C (68 ± 3°F).





6.10.3 ENGINE OIL PRESSURE SENSOR

- ◆ Remove the expansion reservoir, see 5.6 (REMOVING THE EXPANSION RESERVOIR).
- ◆ Disconnect the terminal (1) from the sensor (2) and connect it to ground.

⚠ WARNING

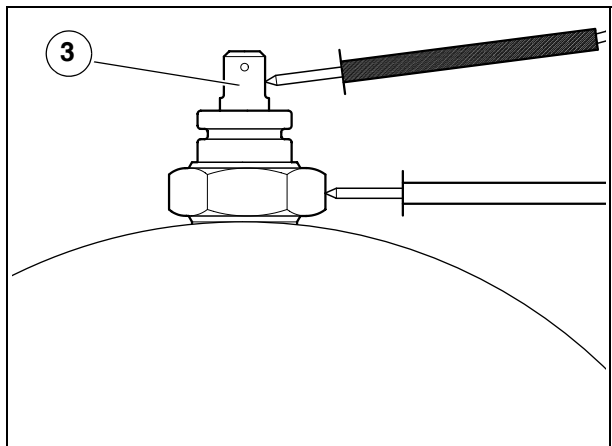
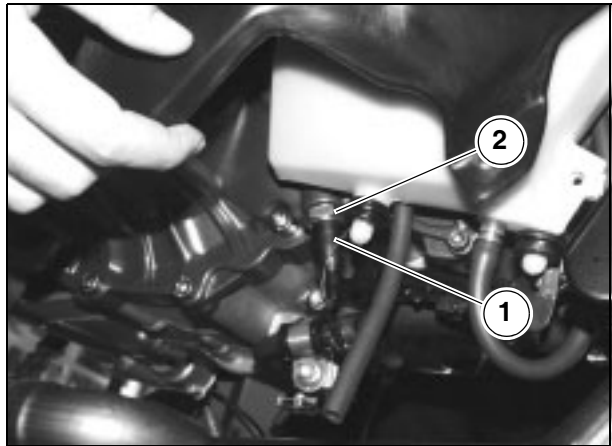
Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ With the ignition switch set to “()”, the red engine oil LED “” should light up.
- ◆ If the LED “” does not light up, check sensor for proper operation.
- ◆ Check for continuity between the terminal tab (3) and sensor housing (2) using a multimeter set to a x 100Ω range (see diagram).

Correct reading with the engine off: 0Ω

Correct reading with the engine running: ∞ Ω

If the readings found deviate from those specified, ensure that engine oil is at the correct level, see 2.11 (CHECKING AND TOPPING UP ENGINE OIL LEVEL). If the problem persists, replace the sensor (2).



6.10.4 SPEED SENSOR

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Ensure that the speed sensor connector (1) is connected properly to the matching connector.
- ◆ Remove the front fairing, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Ensure that the instrument panel connectors (2) are connected properly to the matching connectors.
- ◆ Check the distance between speed sensor (3) and the six mounting screws (4) of the rear brake disc.

Distance between sensor (3) and screws (4): 1.5 ± 1mm

- ◆ Ensure that all six screws (4) are in place.

With the engine stopped, set the ignition switch to the "ⓘ" position and perform the following tests:

1st test

- ◆ Do not disconnect the speed sensor (1), attach a multimeter to the motorcycle and measure voltage across the green / violet (V/Vi) and blue / orange (B/Ar) leads.

Correct reading: > 9VDC.

2nd test

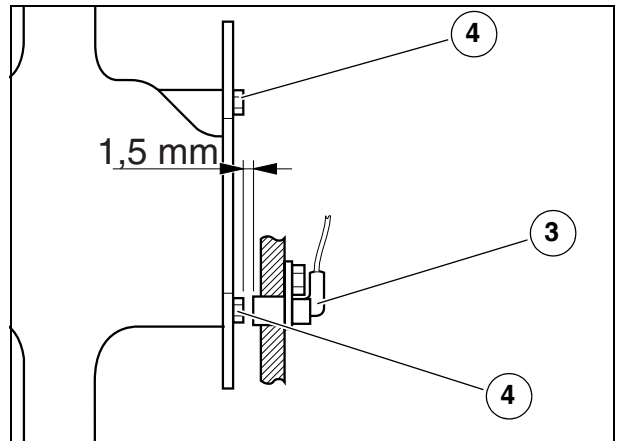
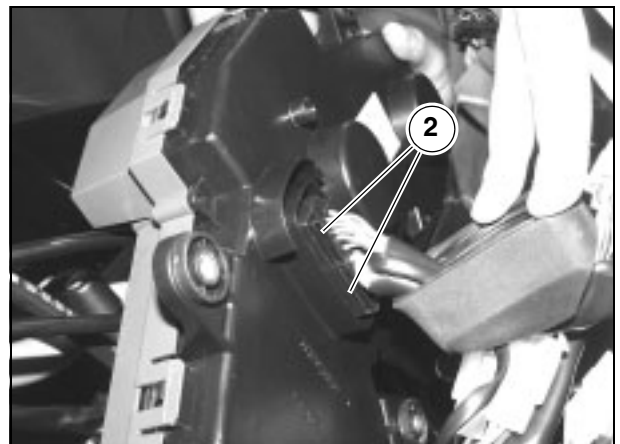
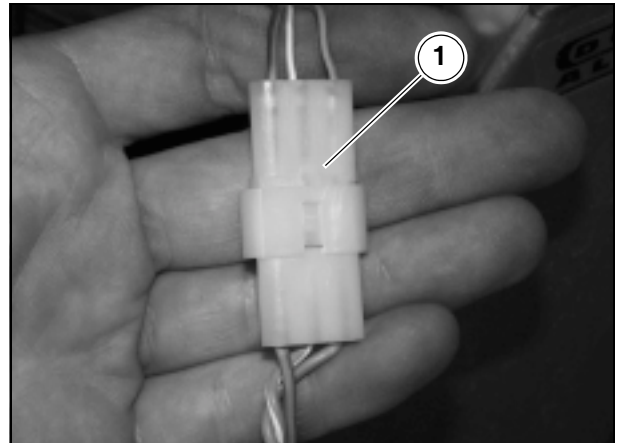
- ◆ Do not disconnect the speed sensor (1), attach a multimeter to the motorcycle and measure voltage across the grey / white (Gr/Bi) and blue / orange (B/Ar) leads.

Correct reading: > 6VDC.

3rd test

- ◆ Place the motorcycle on the centre stand **OPT**.
- ◆ Place the transmission in neutral.
- ◆ Perform the 2nd test.
- ◆ Rotate the rear wheel manually until one of the six screws (4) is before the sensor (3).
- ◆ The multimeter will read **zero V** for about two seconds and then the reading will rise back to **> 6V**.

- If the 1st test turns out a wrong reading, disconnect the sensor (3) and repeat the 1st test. Another reading outside the limits indicates a faulty instrument panel. Replace the instrument panel with one known to operate correctly, see 7.1.19 (REMOVING THE INSTRUMENT PANEL);
- If the 1st test turns out a correct reading and the 2nd test gives a wrong reading, it means that the sensor (3) is faulty and must be replaced.
- If the 1st and 2nd tests give correct readings and the 3rd test turns out a wrong reading, it means that the sensor (3) is faulty and must be replaced.
- If all three tests give correct readings and no speed indication appears on the instrument panel LH display, the instrument panel is faulty. Replace the instrument panel with one known to operate correctly, see 7.1.19 (REMOVING THE INSTRUMENT PANEL);



6.10.5 FUEL SENSOR

Test sensor operation as follows:

- ◆ Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Disconnect the white four-way connector (1) placed underneath the fuel tank (on the left-hand side).
- ◆ Measure resistance across the orange and black wires at sensor end.

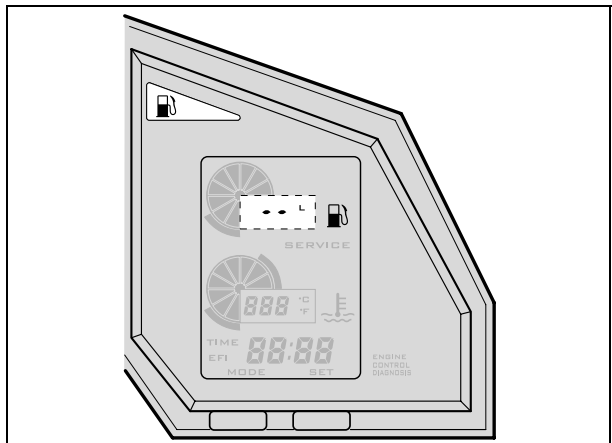
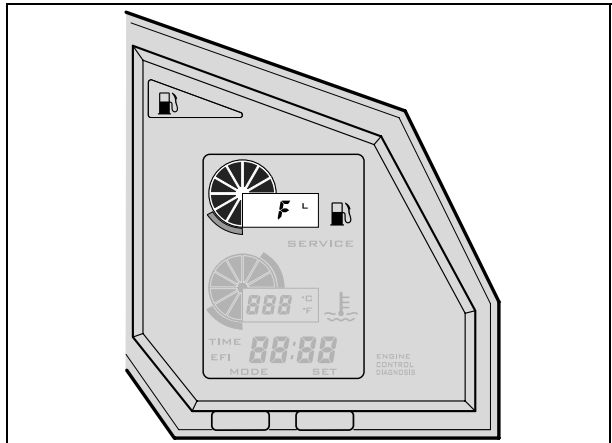
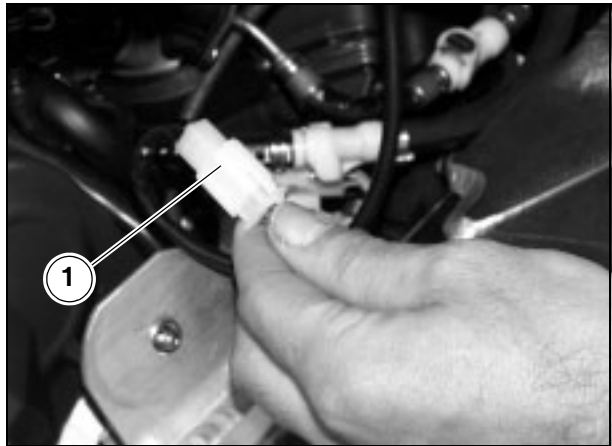
Correct reading with a full tank: less than 14 Ω
Correct reading with empty tank: between 240 and 400 Ω

NOTE Replace the fuel sensor if the readings obtained deviate from the specified limits.

If detected readings are correct, test instrument panel operation by connecting a resistor across the orange/black and white/yellow leads of the four-way connector (1) at the main wiring harness.

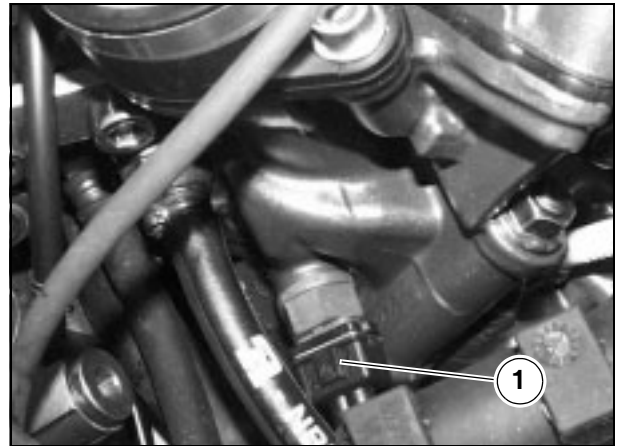
- With 10 Ω resistor:
9 sectors light up and litre indication reads "F".

- With 250 Ω resistor:
all sectors off, litre indication reads "- -" and is flashing, low fuel light is on.



6.10.6 COOLANT TEMPERATURE SENSOR

- ◆ Test sensor operation, see 6.6.5 (COOLANT THERMISTOR TEST).
- ◆ Test instrument panel operation by connecting a resistor across the white/black and white/red leads of the two-way connector (1):



With 90 Ω resistor:

Panel indication: 9 sectors light up (the last two sectors will be flashing).

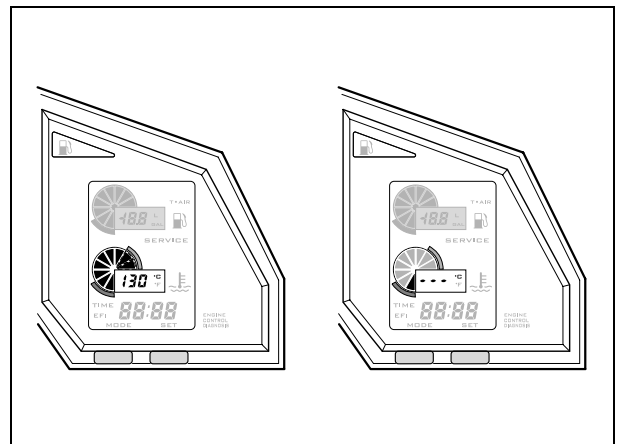
Temperature indication in degrees:

- from 126°C to 135°C;
- from 258.8°F to 275°F.

With 1600 Ω resistor:

Panel indication: 1 sector on;

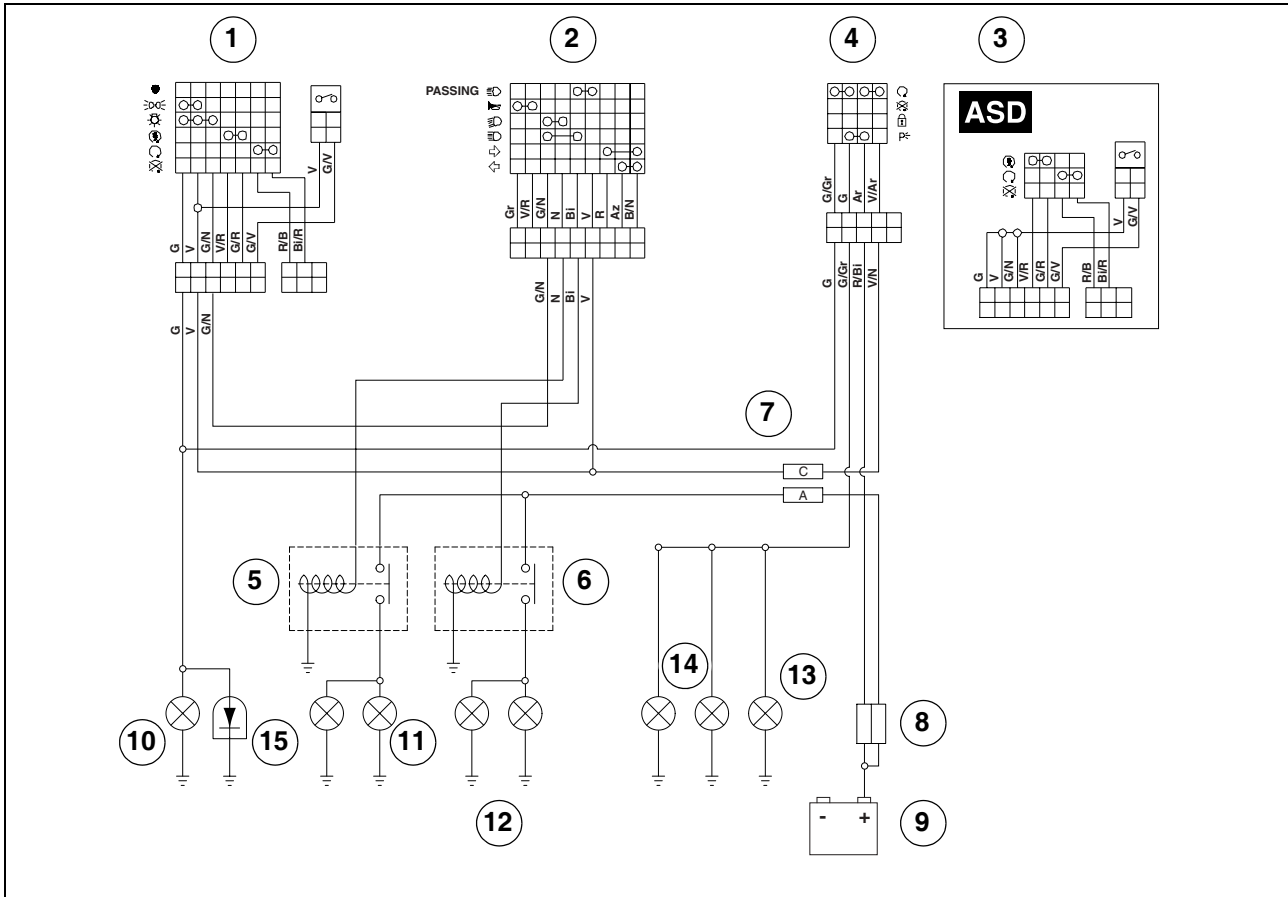
Temperature indication in degrees: “---”.



6.11 LIGHT SYSTEM

6.11.1 WIRING DIAGRAM

See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



Key:

- | | |
|--|------------------------------------|
| 1) Right-hand light dip switch | 8) 30-A fuses |
| 2) Left-hand light dip switch | 9) Battery |
| 3) Right-hand light dip switch on version ASD | 10) Number plate light |
| 4) Key-operated switch | 11) Low beam |
| 5) Low beam relay | 12) High beam |
| 6) High beam relay | 13) Front parking light |
| 7) 15-A fuses | 14) Rear parking light |
| | 15) Instrument panel lighting Leds |

6.11.2 LIGHT RELAY TEST

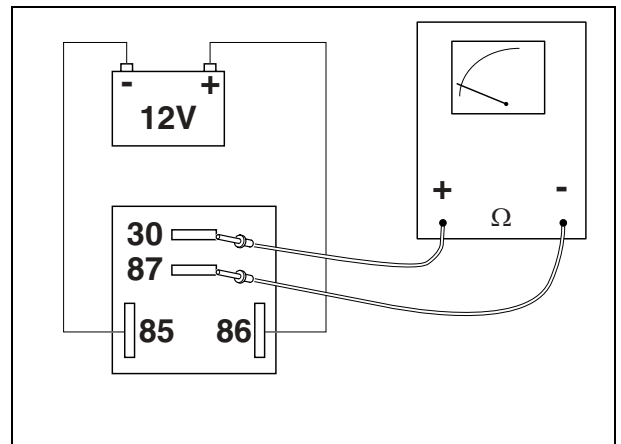
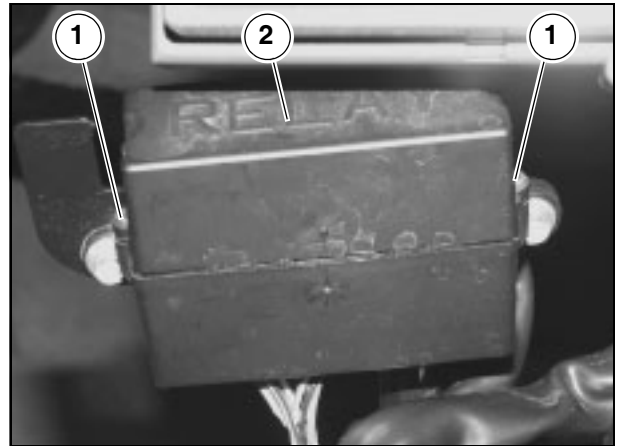
To check for proper operation of the relays:

- ◆ Remove the headlight, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Release and remove the two screws (1).
- ◆ Remove the relay box cover (2).
- ◆ Remove the relay to be tested.
- ◆ Feed 12 Volts to the two male terminals (85-86).
- ◆ Check for continuity between the other two terminals (87-30) using a multimeter set to the Ohm range.

Correct reading when relay is fed: 0Ω

Correct reading when relay is not fed: $\infty\Omega$

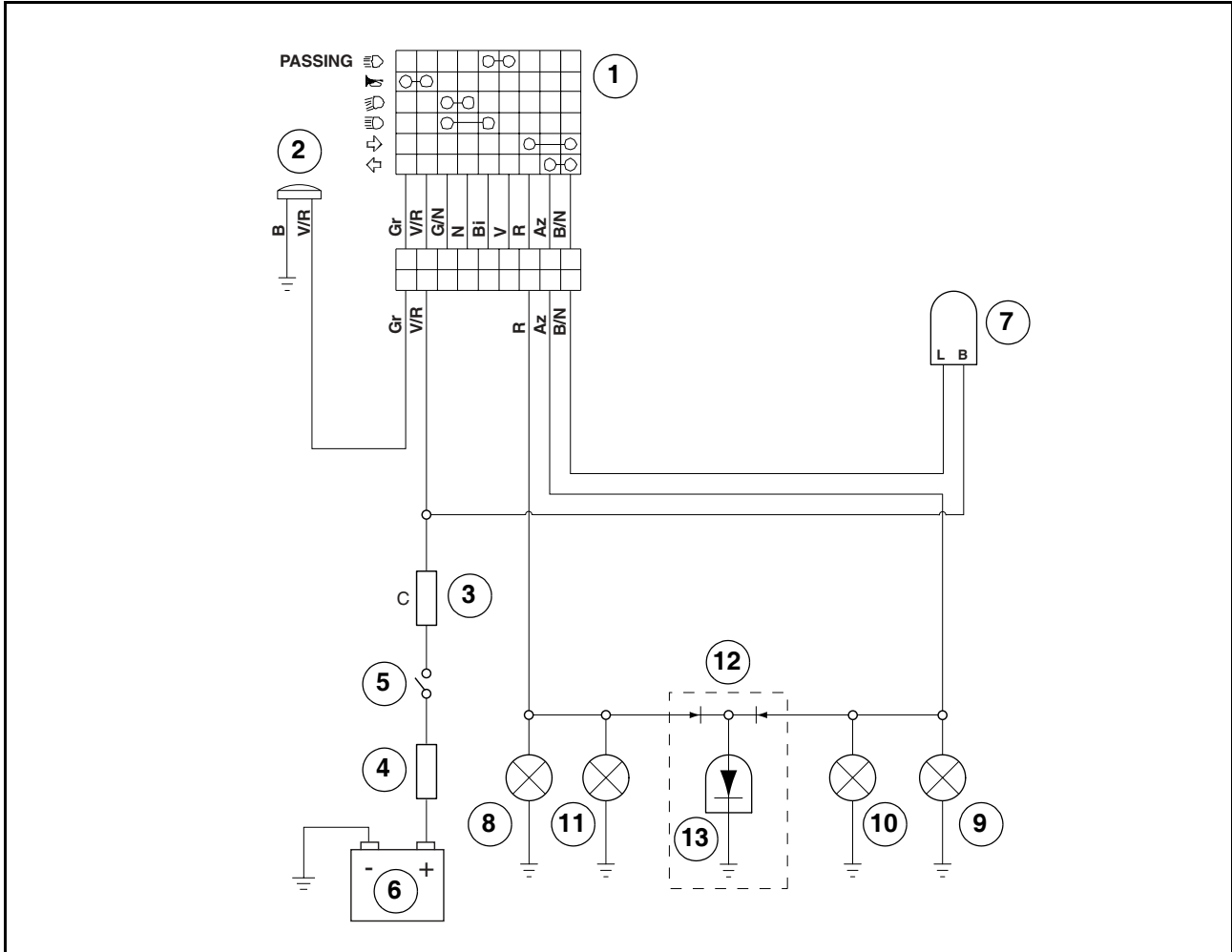
Change the relay when detected readings deviate from those specified.



6.12 VISUAL AND ACOUSTIC SIGNALLING SYSTEM

6.12.1 WIRING DIAGRAM

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



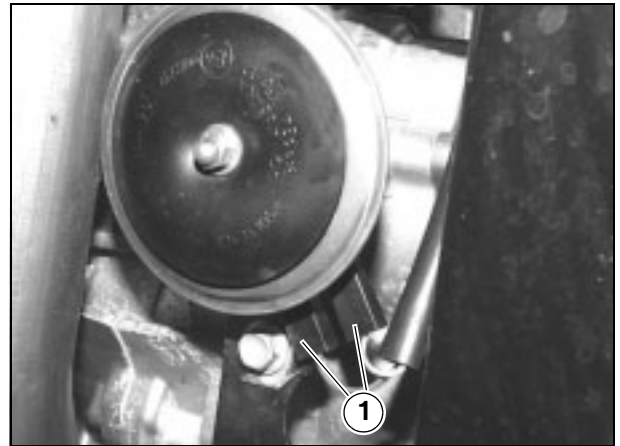
Key:

- 1) Left-hand light dip switch
- 2) Warning horn
- 3) 15-A fuse
- 4) 30-A fuse
- 5) Key-operated switch
- 6) Battery
- 7) Flasher
- 8) Rear right indicator bulb
- 9) Rear left indicator bulb
- 10) Front right indicator bulb
- 11) Front left indicator bulb
- 12) Instrument panel
- 13) Indicator repeater light (LED)

6.12.2 WARNING HORN TEST

To test warning horn operation:

- ◆ Perform the first three steps of the procedure described in subsection 7.1.25 (WARNING HORN REMOVAL).
- ◆ Feed 12 Volts to the two connectors of the warning horn (1).
- ◆ Adjust through the adjuster screw if needed.



6.12.3 FLASHER TEST

When none of the direction indicators is working, there might be a problem with the flasher.

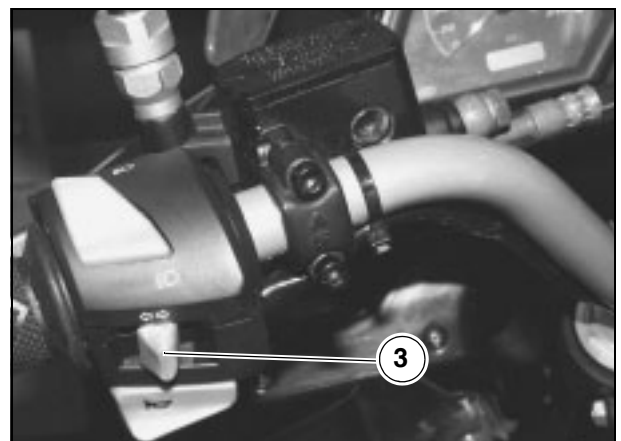
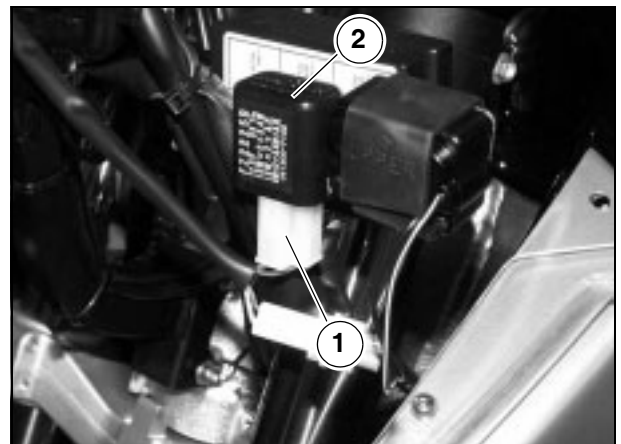
To test flasher operation:

- ◆ Remove the front fairing, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Disconnect the connector (1) of the flasher (2).
- ◆ Fit a jumper to the connector (1).
- ◆ Operate the direction indicator control (3).

If the indicator lights come on but do not flash, replace the flasher (2).

- ◆ It may also be necessary to check:
 - the 30-A main fuses and the electrical system.

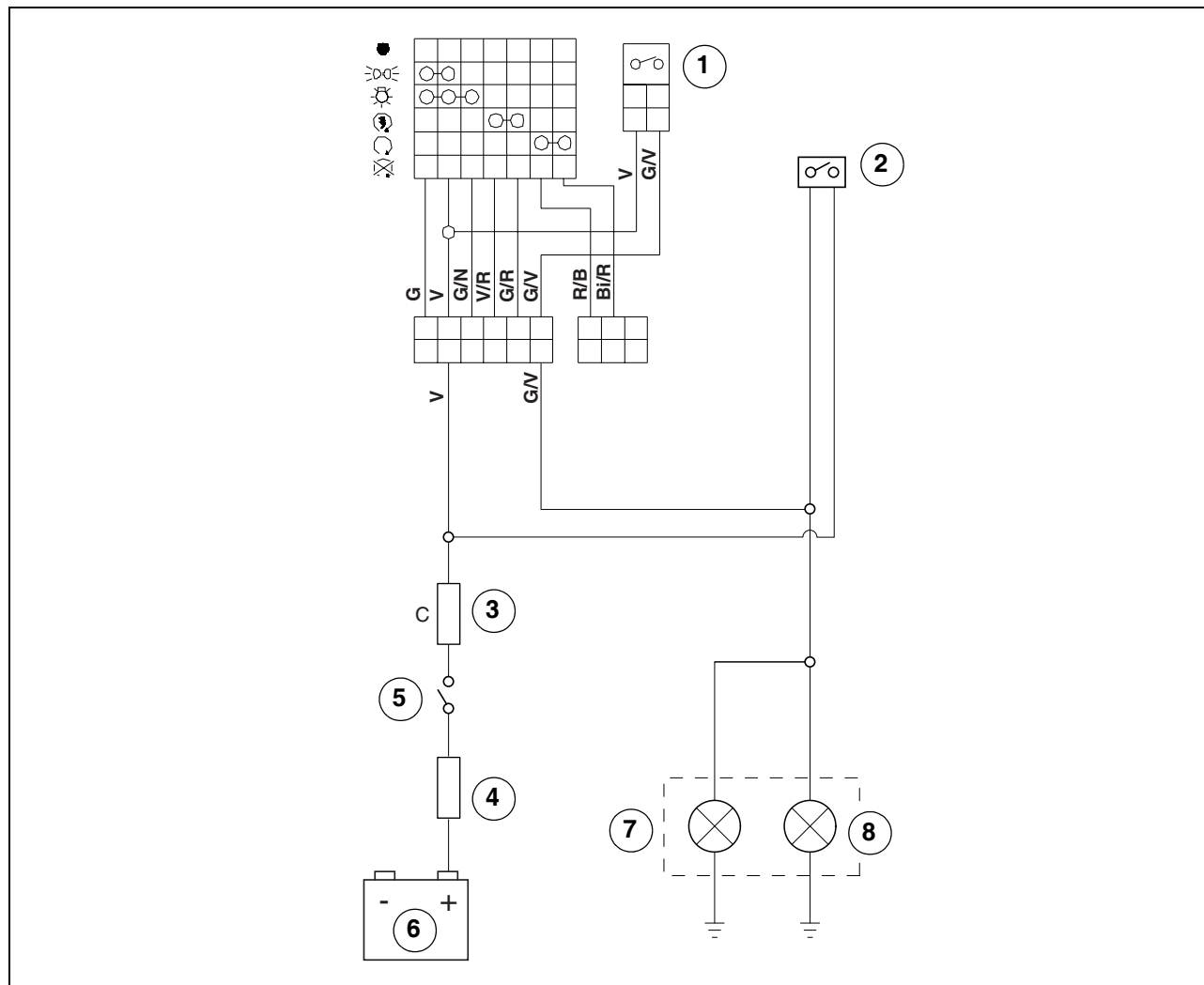
When the bulb of a direction indicator burns out, each time the control (3) is operated the other bulb and the repeater light on the instrument panel will come on but will not flash.



6.13 VISUAL AND ACOUSTIC SIGNALLING SYSTEM

6.13.1 WIRING DIAGRAM

NOTE See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the components.



Key:


- 1) Front brake light switch
- 2) Rear brake light switch
- 3) 15-A fuse
- 4) 30-A fuse
- 5) Key-operated switch
- 6) Battery
- 7) Tail light
- 8) Brake lights

6.13.2 SWITCHES

Check switches for continuity using a multimeter. Please refer to the relevant diagram.

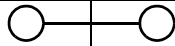
Replace any switch found to deviate from the specified mode of operation.

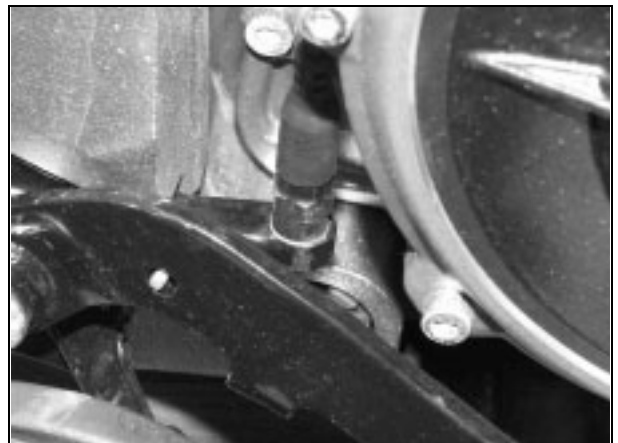
1) FRONT BRAKE LIGHT SWITCH

Position	Wires	
	Gr	M
Activated		



2) REAR BRAKE LIGHT SWITCH

Position	Wires	
	Gr	M
Activated		



6.14 BATTERY

NOTE This motorcycle is equipped with a maintenance-free battery that only needs to be inspected and charged from time to time.

In the event the battery needs replacing, install a battery of the same type and rating.

Battery rating: 12V - 12 Ah

Read 2.4 (BATTERY) carefully.



6.14.1 FIRST-TIME INSTALLATION

◆ Remove the battery from the motorcycle, see 7.1.7 (BATTERY REMOVAL).

⚠ CAUTION

Battery electrolyte fluid is toxic and caustic. It contains sulphuric acid and can cause burns if spilled on the skin.

Wear protective clothing, a face shield and/or protective goggles when handling battery fluid.

If any battery fluid gets on your skin, rinse the affected area with abundant fresh water.

If battery fluid is spilled into your eyes, flush with abundant water for fifteen minutes and contact an eye specialist immediately.

If battery fluid is swallowed accidentally, drink abundant water or milk. Seek medical attention immediately and keep drinking magnesia milk or vegetable oil in the meantime.

The battery gives off explosive gases. Keep the battery well away from any sources of ignition, such as flames, sparks, or any heat sources. Do not smoke near the battery.

Provide adequate ventilation when charging or using the battery. Do not inhale the gases produced by the battery under charging.

KEEP AWAY FROM CHILDREN.

Battery fluid is corrosive.

Avoid spillage. Take special care not to spill battery fluid on plastic parts.

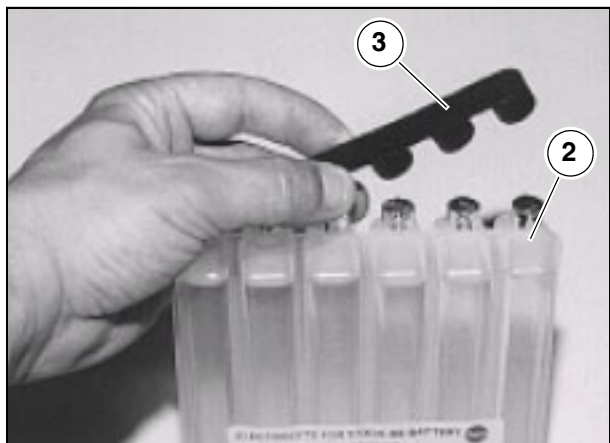
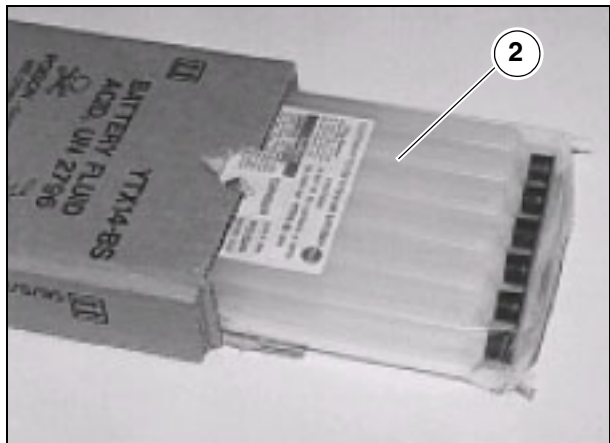
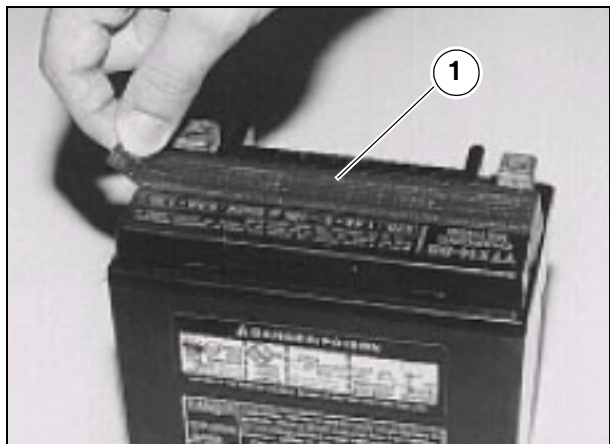
⚠ WARNING

Ensure that the electrolyte fluid you are using is the suitable type for your battery.

- ◆ Place the battery on a level surface.
- ◆ Peel off the self-adhesive seal (1).
- ◆ Take the electrolyte container out of the box. The container has six cells (2) and is packed in a sealed bag.
- ◆ Unpack the container (2).

NOTE The container caps (3) double as battery cell caps. Be sure to retain them and keep them handy.

- ◆ Take off the caps (3) from the top end of the container (2).



⚠ WARNING

Do not cut or prick the sealed ends of the container (2).

- ◆ Turn over the container (2) and place the sealed ends over the openings of the battery cells.
- ◆ Press down on the container (2) to break the seals and let the fluid flow into the battery cells.

NOTE Ensure that the container (2) is perfectly vertical to facilitate drainage.

- ◆ Leave the container (2) in place for about twenty minutes and ensure that the fluid is flowing into the battery.

⚠ WARNING

Do not remove the container (2) unless all fluid has drained out.

- ◆ If there is still some fluid left in the container (2) after twenty minutes, tap the uppermost end of the container with your fingers to obtain complete drainage.
- ◆ Lift the container (2) carefully to release it from the battery.

- ◆ Place the caps (3) over the battery cell openings.
- ◆ Press down firmly until the underside (3) of the cap strip contacts battery top face.

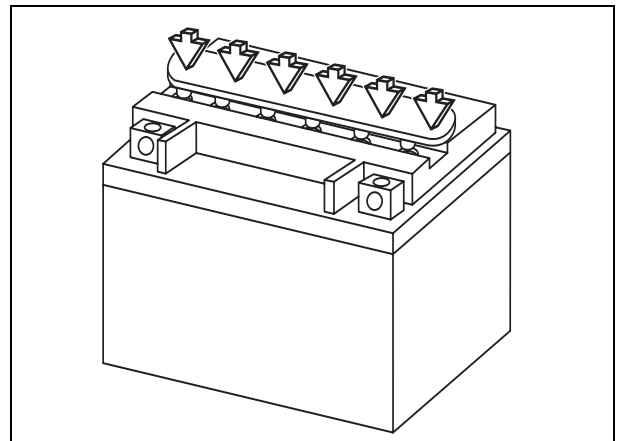
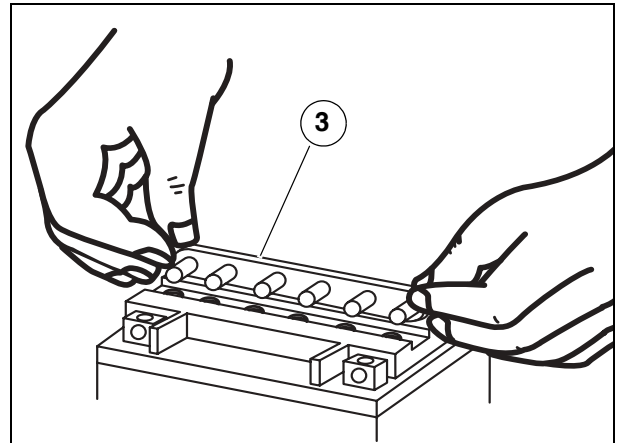
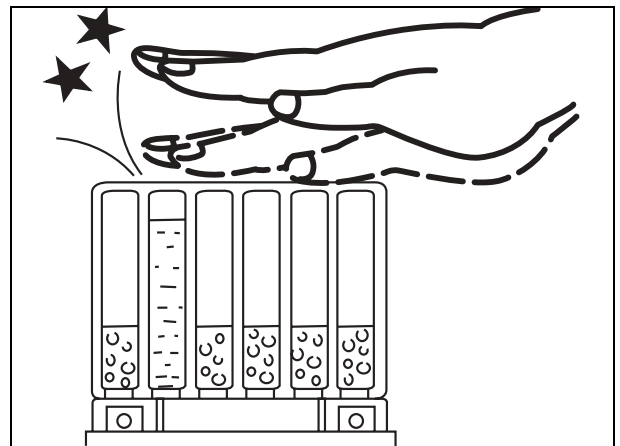
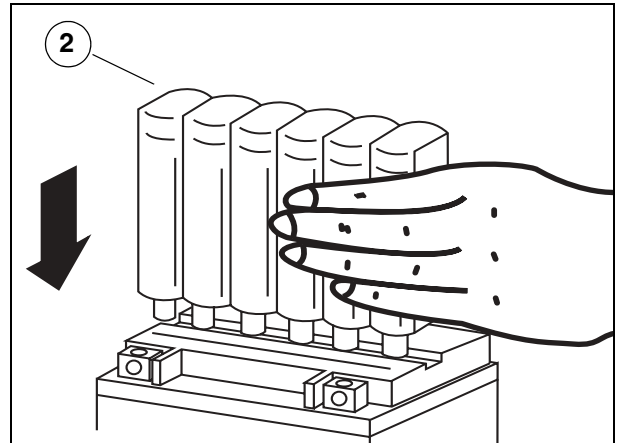
⚠ WARNING

Never remove the caps (3).

- ◆ Connect the battery to a battery charger.
- ◆ Charge the battery at normal charge rate (see chart).

Charge rate	Ampere rating	Charge time (hours)
Normal	1.2	8 -10
Fast	12	0.5

- ◆ Refit the battery just before delivering the motorcycle to end user.



6.14.2 MAINTENANCE

- ◆ If the motorcycle is left unriden for over fifteen days, charge the battery at normal charge rate to avoid sulphation, see 2.4.2 (CHARGING THE BATTERY).
- ◆ Apply a light coat of neutral grease or vaseline to the battery terminals.

6.14.3 INSPECTION

In the event of abnormal operation, check the charge system first, see 6.3 (CHARGE SYSTEM INSPECTION).

In addition, check for the following:

- ◆ Inspect the battery for any sign of damage (such as a cracked housing) and check for fluid leaks.
- ◆ Ensure that the battery leads are securely fixed to the terminals.
- ◆ Charge at normal charge rate for at least 10 hours.

WARNING

After charging, check loadless voltage. Replace the battery when loadless voltage is less than 12 V.

6.14.4 RETURN UNDER WARRANTY


The warranty is invalidated when:

- ◆ the battery is damaged (dented housing, bent terminals, etc.);
- ◆ the battery is affected by extensive sulphation (normally due to improper installation procedure and/or use).

6.15 BULB REPLACEMENT

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

⚠ WARNING

Before proceeding to change a bulb, rotate the ignition switch to “” and wait for some minutes to allow it to cool down.

Wear clean gloves or use a clean, dry cloth to handle bulbs.

Do not put your fingerprints on a bulb, as this may cause overheating leading to failure.

If you touch a bulb with your fingers, remove any fingerprints with alcohol to avoid early failure.

DO NOT PULL ON THE WIRING.

6.15.1 HEADLIGHT BULB REPLACEMENT

◆ Place the motorcycle on the stand.

NOTE Check the fuses, see 6.16 (REPLACING THE FUSES) before changing a bulb.

The headlight accommodates:

- two high beam/low beam bulbs (1) (one on each side);
- one parking light bulb (2) (at the bottom).

Replacement:

HIGH BEAM / LOW BEAM BULBS

NOTE Work on the side where the burnt-out bulb is located.

NOTE Disconnect one connector at a time to avoid confusing the various connectors when refitting.

When two connectors must be removed at the same time, mark them with their positions and make sure to refit them in the correct positions on assembly.

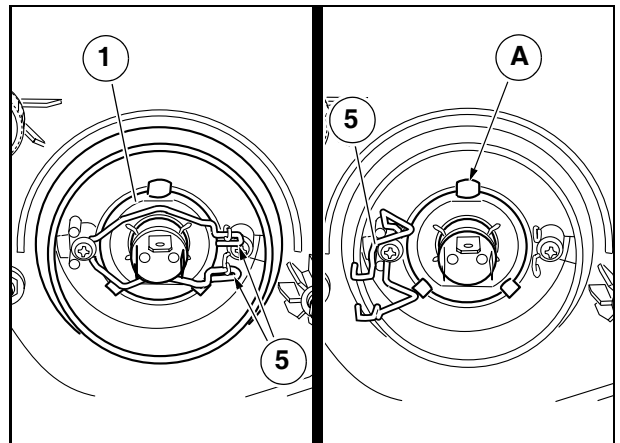
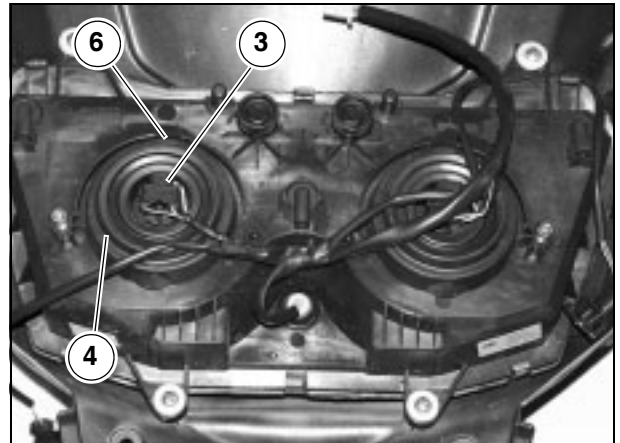
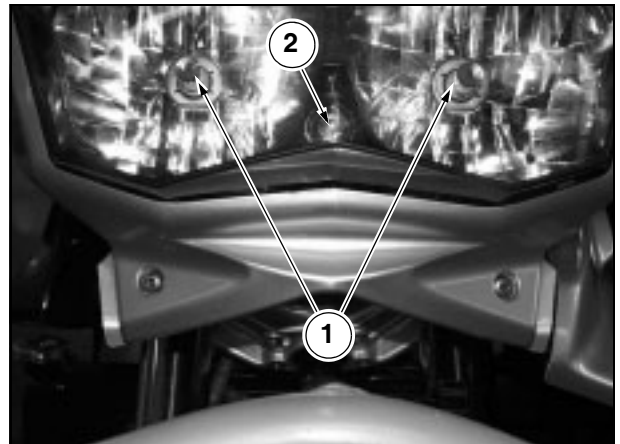
⚠ WARNING

Never pull on the wiring to disconnect a bulb connector.

- ◆ Grasp the connector (3) of the bulb to be replaced, pull off and disconnect the connector from the bulb (1).
- ◆ Pull off the dust cover (4) with your fingers.
- ◆ Release the retainer (5) at the rear of the bulb holder.
- ◆ Extract the bulb (1) from the holder.

NOTE Make sure the locating pegs (A) locate properly into the holder when fitting the bulb.

When refitting, position the dust cover (4) with its key (6) facing upwards.

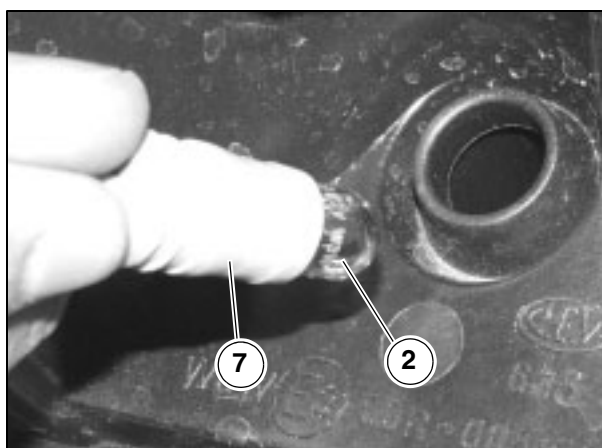


PARKING LIGHT BULB

⚠ WARNING

Do not pull on the wiring to extract the bulb holder.

- ◆ Grasp the parking light bulb holder (7) and pull to extract.
- ◆ Remove the bulb (2) and fit a new bulb of equal rating.



6.15.2 REPLACING THE FRONT DIRECTION INDICATOR BULBS

- ◆ Place the motorcycle on the stand.
- ◆ Release and remove the three screws (1).

⚠ WARNING

Handle plastic and painted components with care, do not strike or damage them.

- ◆ Remove the lens (2).

⚠ WARNING

Ensure that the lens locates properly to the housing when refitting. Tighten the screw (1) carefully. Do not overtighten or the lens will damage.

- ◆ Push down the bulb (3) gently and twist anti-clockwise.
- ◆ Extract the bulb (3) from the bulb holder.

⚠ WARNING

When fitting the bulb, ensure that the two locating pegs locate properly into the slots in the bulb holder.

- ◆ Install a new bulb of equal rating.

NOTE Ensure that the seal (4) locates properly when refitting.



6.15.3 REPLACING THE REAR DIRECTION INDICATOR BULBS

- ◆ Place the motorcycle on the stand.
- ◆ Release and remove the screw (1).

⚠ WARNING

The lens is retained by a locating peg. Remove carefully or the locating peg might break off.

- ◆ Remove the lens (2).

⚠ WARNING

Ensure that the lens locates properly to the housing when refitting. Tighten the screw (1) carefully. Do not overtighten or the lens will damage.

- ◆ Push down the bulb (3) gently and twist anti-clockwise.
- ◆ Extract the bulb (3) from the bulb holder.

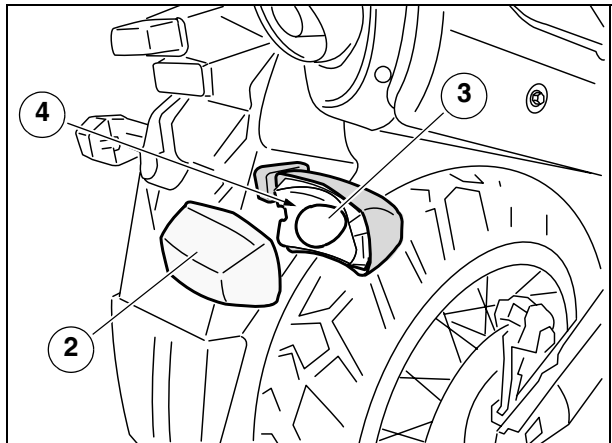
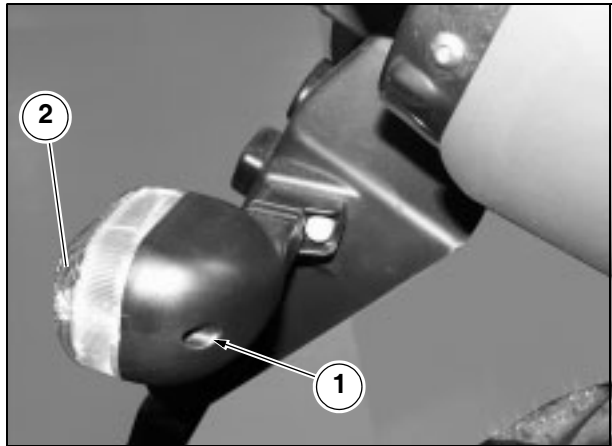
⚠ WARNING

When fitting the bulb, ensure that the two locating pegs locate properly into the slots in the bulb holder.

- ◆ Install a new bulb of equal rating.

⚠ WARNING

If the bulb holder (4) slips out of its seat, refit it correctly so that the slotted opening of the bulb holder matches the screw hole.



6.15.4 TAIL LIGHT BULB REPLACEMENT

The tail light accommodates:

- two bulbs for parking / brake lights (1).

To replace a bulb:

Before changing a bulb, check the BRAKE light switches for proper operation, see 6.13.2 (SWITCHES).

NOTE The procedure described below applies to both bulbs.

⚠ CAUTION

Allow for the exhaust silencer to cool down completely.

- ◆ Put the motorcycle on the stand.
- ◆ Release and remove the two screws (2).
- ◆ Remove the protective shield (3).

⚠ WARNING

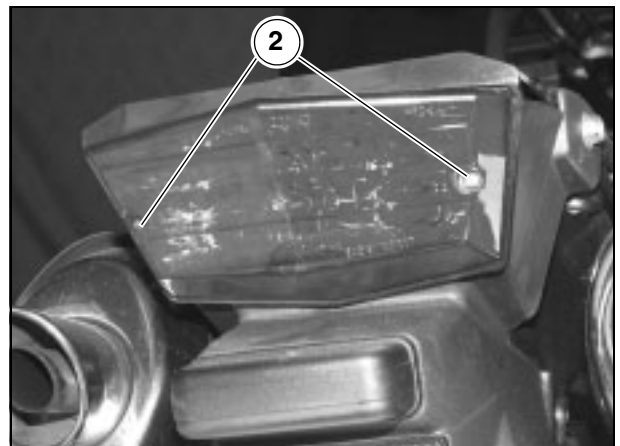
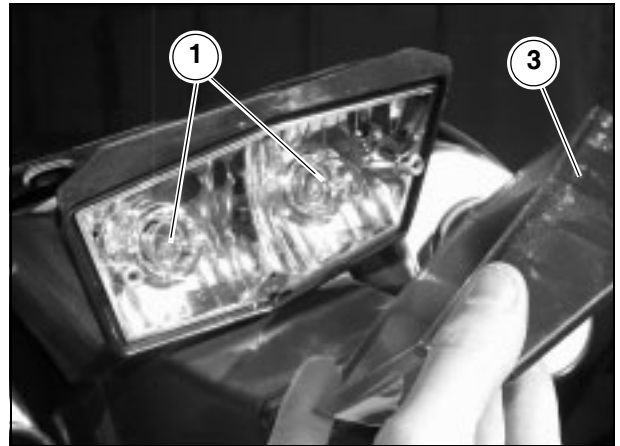
On refitting, locate the protective shield correctly into its seat. Tighten the screws (2) gradually. Do not overtighten or the protective shield will damage.

- ◆ Push down on the bulb (1) lightly and twist anti-clockwise.
- ◆ Extract the bulb (1) from the bulb holder.

⚠ WARNING

When fitting the bulb, ensure that the two locating pegs locate properly into the slots in the bulb holder.

- ◆ Install a new bulb of equal rating.



6.15.5 TAIL LIGHT BULB REPLACEMENT

- ◆ Place the motorcycle on the stand.

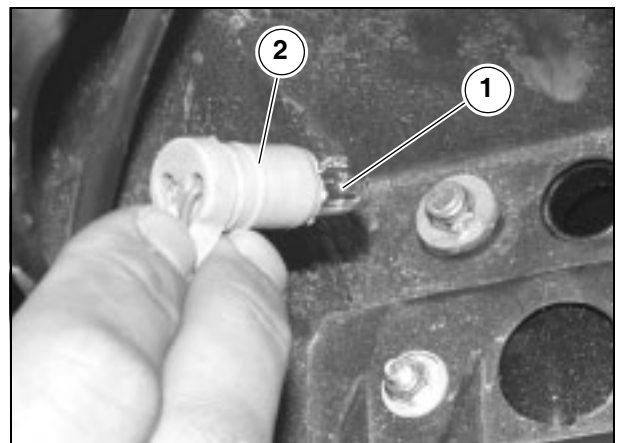
⚠ CAUTION

Allow for the engine to cool down completely.

⚠ WARNING

Do not pull on the wiring to extract the bulb holder.

- ◆ Grasp the bulb holder (2) from behind the number plate bracket. Pull the bulb holder to extract.
- ◆ Extract the bulb (1) and install a new bulb of equal rating.



6.16 REPLACING THE FUSES

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.


⚠ WARNING

Never attempt to repair a defective fuse.
 Never use a fuse of a rating other than specified.
 This could damage the electrical system or cause a short circuit, with the risk of fire.

NOTE When the fuses fitted in a particular position keep blowing frequently, there might be a short circuit or overloading.

Checking the fuses is recommended whenever an electrical component fails to operate or is malfunctioning, or when the engine does not start.
 Check the 15-A auxiliary fuses first and then the 30-A main fuses.

Inspection:

- ◆ Set the ignition switch to “”. This will prevent accidental short circuits.
- ◆ Take off the cover of the auxiliary fuse box (1).
- ◆ Extract all fuses one by one and check for blown fuses. A blown fuse is identified by the link bar (2) in the centre being divided.
- ◆ When you find a blown fuse, determine and rectify the cause (if possible) before fitting a new fuse.
- ◆ Replace any failed fuses with a fuse of equal current rating.

NOTE When you use one of the spare fuses, remember to add a new fuse of equal rating to the fuse box.

- ◆ Remove the seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Repeat the process for the main fuses.

NOTE When the 30-A fuses are removed, the digital clock will be reset to zero. Please see 2.3 (MULTIFUNCTION COMPUTER) for instructions on how to set clock again.

ARRANGEMENT OF 15-A AUXILIARY FUSES

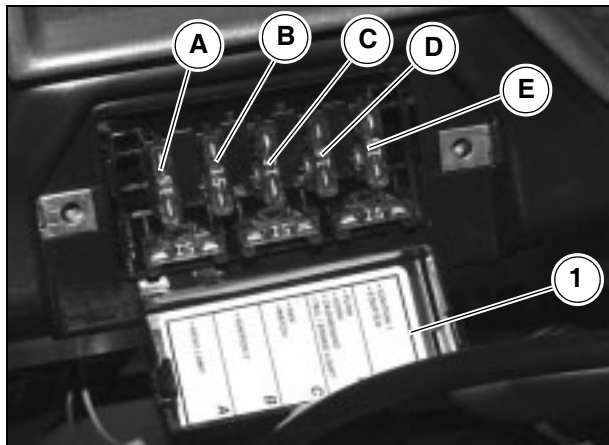
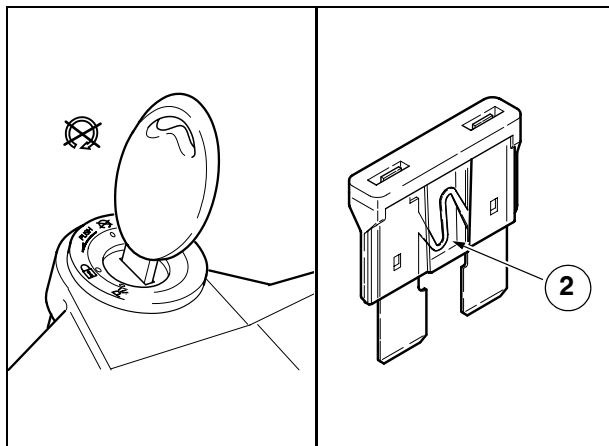
- A Headlight, clock.
- B Fuel pump.
- C Parking lights, rear brake lights, warning horn, direction indicators and instrument panel.
- D From ignition switch to: starter, safety lockout system.
- E Free.

NOTE The fuse box accommodates three spare fuses.

ARRANGEMENT OF 30-A MAIN FUSES

- F From battery to: rectifier, fuse A, fuse B and fuse E.
- G From battery to: ignition switch, fuse C and fuse D.

NOTE There is one spare fuse.



6.17 BEAM HEIGHT SETTING

The headlight is made up of two light units:

- Rh headlight unit (1);
- Lh headlight unit (2).

Each light unit has independent adjusters for beam setting.

Adjust both light units and then ensure:

- that the beam is uniform;
- that there are no dark spots.

NOTE Beam inspection procedures may vary from country to country. Observe the law in force in the country of the user.

To set beam height:

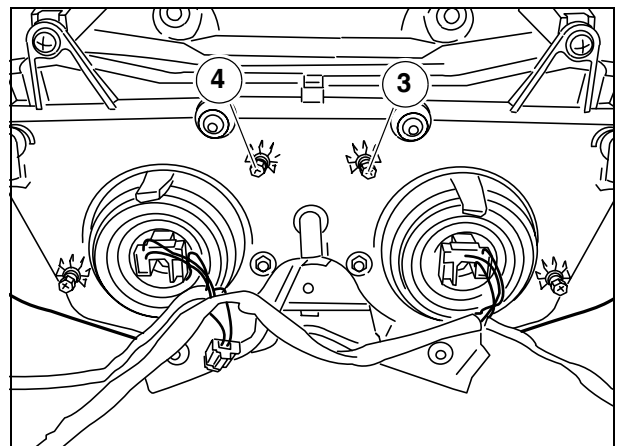
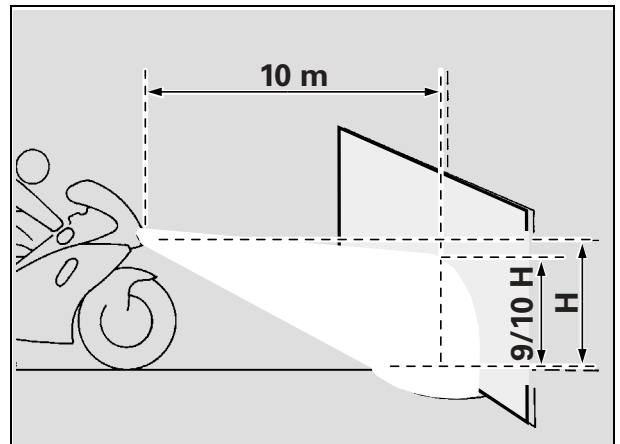
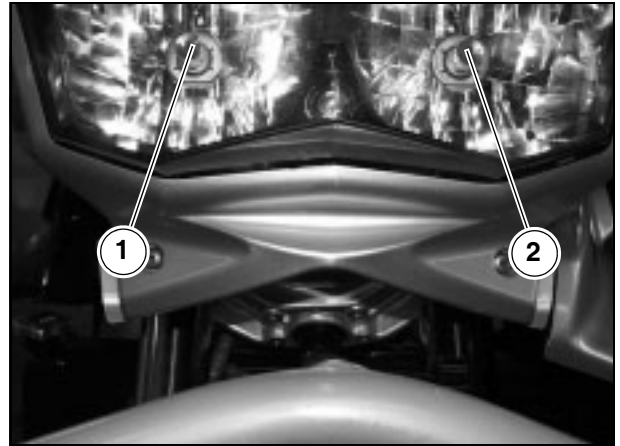
NOTE The instructions below apply to both light units.

- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Sit astride the motorcycle.
- ◆ **Right-hand headlight unit (1):** Working on the rear right-hand side of the front fairing, rotate the adjuster wheel (3):
ROTATE CLOCKWISE to lower the beam;
ROTATE ANTI-CLOCKWISE to raise the beam.
- ◆ **Left-hand headlight unit (2):** Proceed as for right-hand unit adjustment, however, rotate the adjuster wheel (4).

When finished:

⚠ CAUTION

Check for proper beam height setting.



6.18 BEAM CENTRING USA

NOTE Beam inspection procedures may vary from country to country. Observe the law in force in the country of the user.

The headlight is made up of two light units:

- Rh headlight unit (1);
- Lh headlight unit (2).

Each light unit has independent adjusters for beam setting.

Adjust both light units and then ensure:

- that the beam is uniform;
- that there are no dark spots.

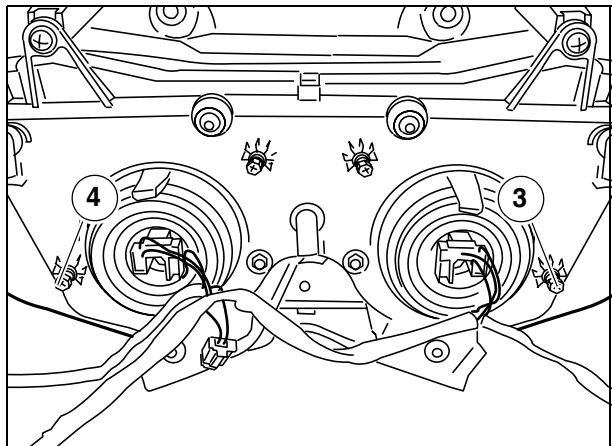
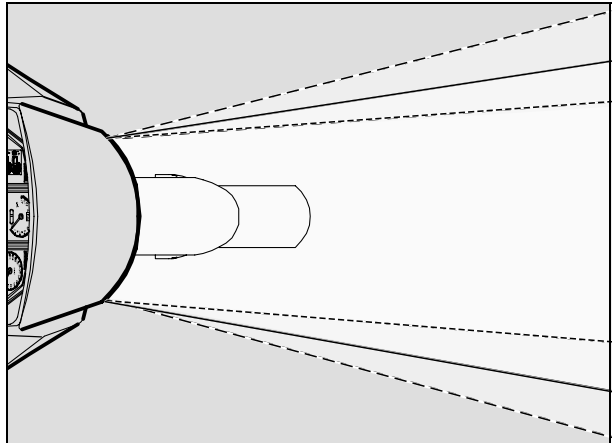
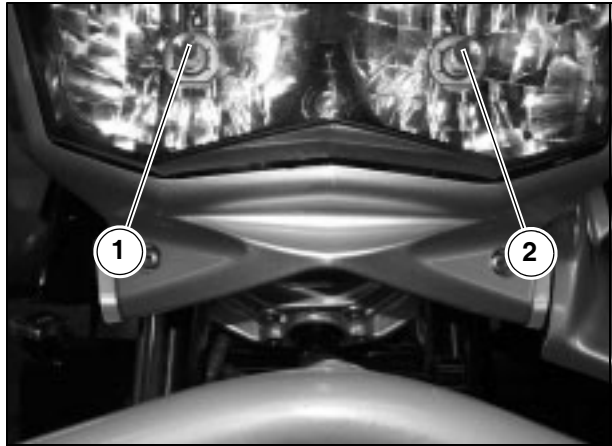
To set the beam:

- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Sit astride the motorcycle.
- ◆ **Right-hand headlight unit (1):** Working on the rear right-hand side of the front fairing, turn the adjuster (3) using a screwdriver:
TIGHTEN (turn clockwise) to move the beam to the right;
SLACKEN (turn anti-clockwise) to move the beam to the left.
- ◆ **Left-hand headlight unit (2):** Working on the rear left-hand side of the front fairing, turn the adjuster (4) using a screwdriver:
TIGHTEN (turn clockwise) to move the beam to the right;
SLACKEN (turn anti-clockwise) to move the beam to the left.

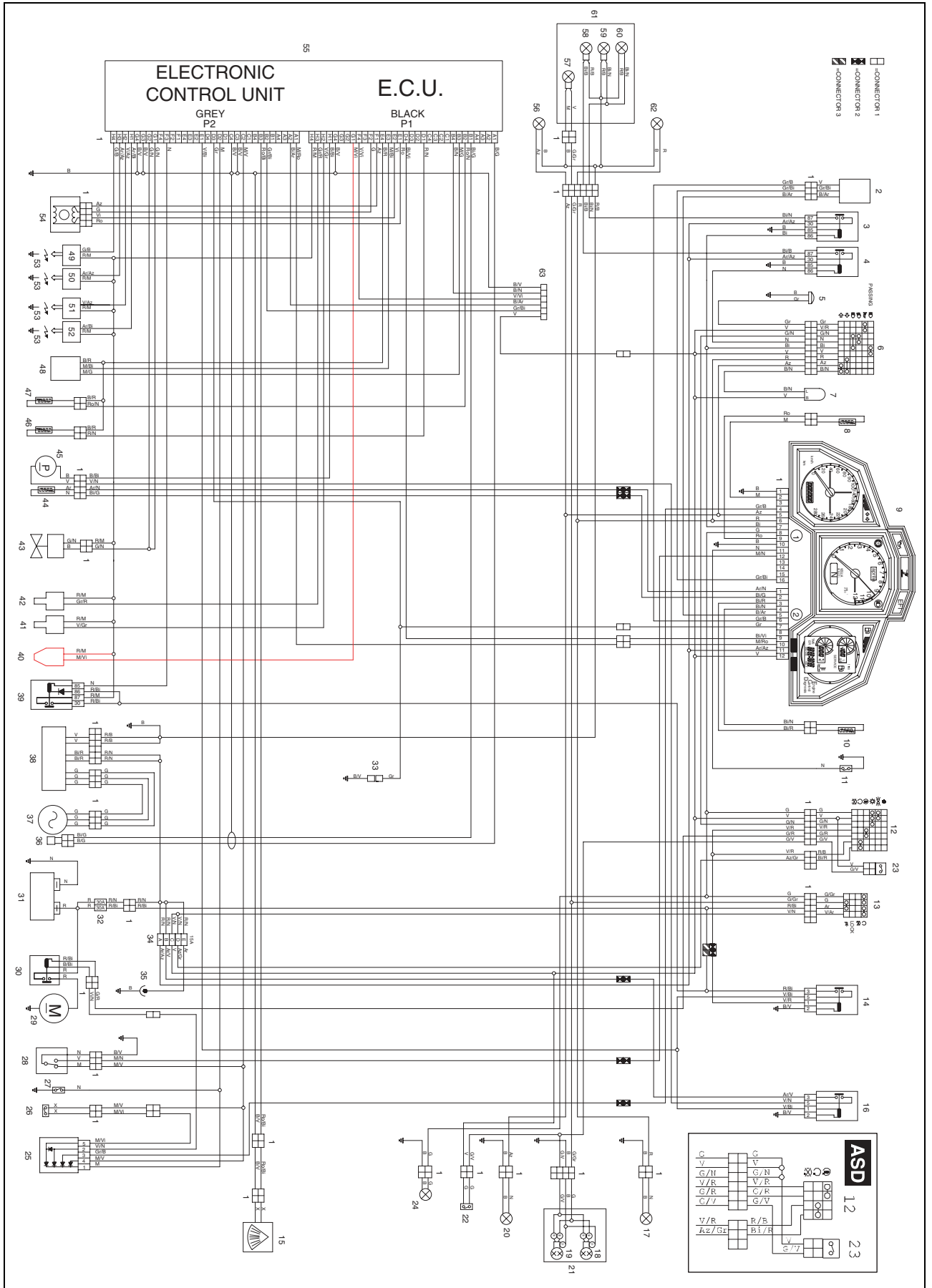
When finished:

⚠ CAUTION

Check for proper beam height setting.



6.19 WIRING DIAGRAM - ETV MILLE



Key:

- | | |
|---|--|
| 1) Multi-pin connectors | 35) – |
| 2) Speed sensor | 36) Pick-up |
| 3) High beam relay | 37) Generator |
| 4) Low beam relay | 38) Rectifier |
| 5) Warning horn | 39) Injection relay |
| 6) Left-hand light dip switch | 40) – |
| 7) Flasher | 41) Rear cylinder injector |
| 8) Air thermistor (instrument panel) | 42) Front cylinder injector |
| 9) Instrument panel | 43) Cooling fan |
| 10) Coolant temperature thermistor (instrument panel) | 44) Low fuel sensor |
| 11) Engine oil pressure switch | 45) Fuel pump |
| 12) Right-hand light dip switch | 46) Air thermistor (Engine Control Unit) |
| 13) Ignition switch | 47) Coolant temperature thermistor (Engine Control Unit) |
| 14) Engine cutout relay | 48) Throttle position sensor |
| 15) Bank angle sensor | 49) Rear cylinder coil |
| 16) Fuel pump relay | 50) Rear cylinder coil |
| 17) Rear direction indicator, right | 51) Front cylinder coil |
| 18) Parking light/rear brake light bulb | 52) Front cylinder coil |
| 19) Parking light/rear brake light bulb | 53) Spark plugs |
| 20) Rear direction indicator, left | 54) Automatic air adjustment |
| 21) Tail light | 55) Engine Control Unit |
| 22) Rear brake light switch | 56) Front direction indicator, left |
| 23) Front brake light switch | 57) Front parking light bulb |
| 24) Number plate light bulb | 58) Low beam bulb |
| 25) Diode module | 59) High beam bulbs |
| 26) Clutch lever switch | 60) High beam bulb |
| 27) Neutral switch | 61) Headlight |
| 28) Side stand switch | 62) Front direction indicator, right |
| 29) Starter motor | 63) Low fuel Led warning light |
| 30) Starter relay | 64) Side stand down Led warning light |
| 31) Battery | 65) Neutral Led warning light |
| 32) Main fuses (30A) (ignition) | 66) Indicator Led repeater light |
| 33) Test connectors | 67) Engine oil pressure Led warning light |
| 34) Auxiliary fuses (15A) | 68) High beam Led warning light |
| A – headlight, clock | 69) Diagnostics Led warning light |
| B – fuel pump | 70) Rev. counter |
| C – parking lights, rear brake lights, warning horn,
direction indicators and instrument panel | 71) Multifunction display (on right-hand side) |
| D – starter, safety lockout system | 72) Multifunction display (on left-hand side) |
| E – spare | 73) Diagnostics connector |
| | 74) Diode |

CHASSIS

7

CHASSIS

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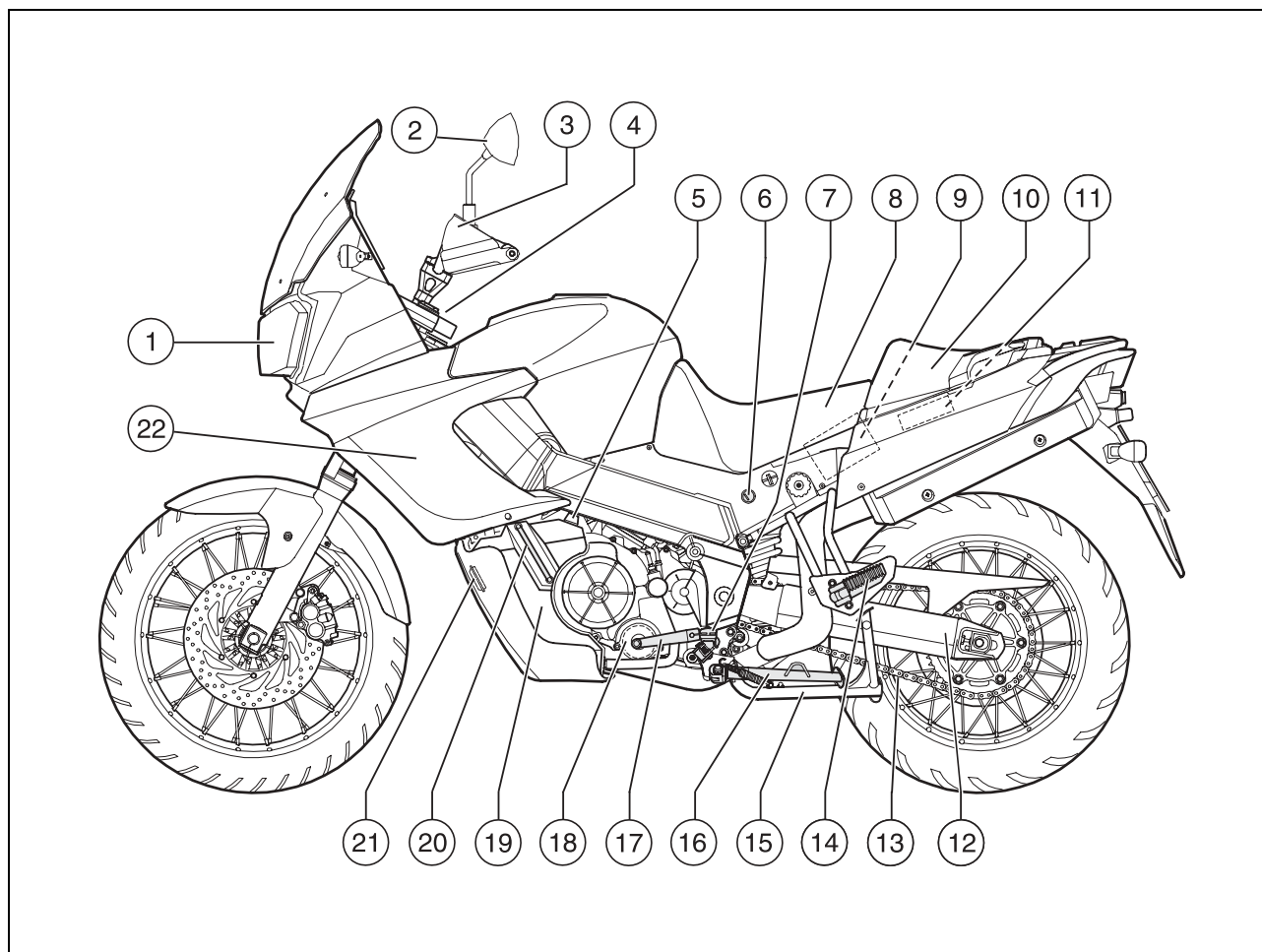
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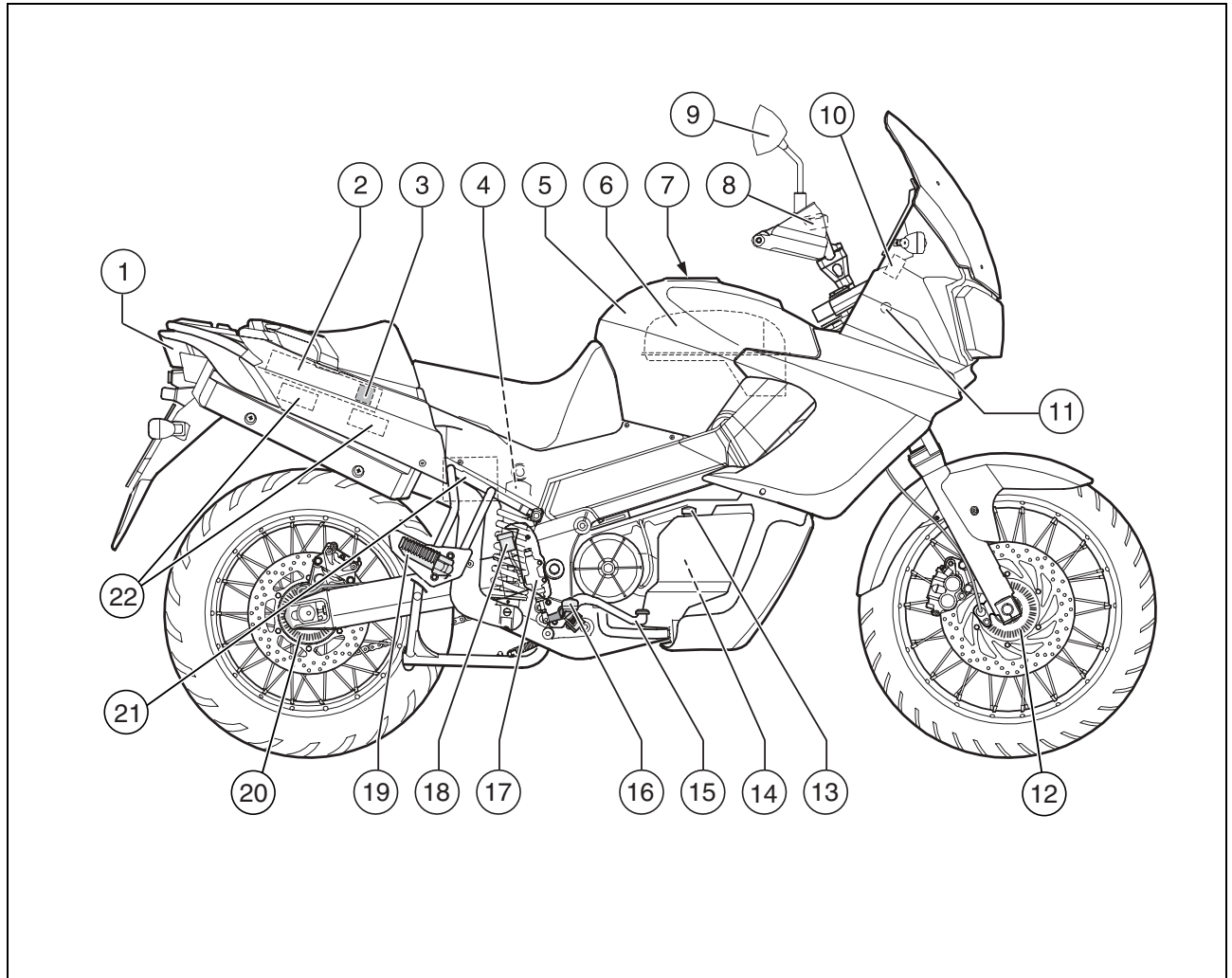
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7.1 BODYWORK

**Key:**

- | | |
|---|---|
| 1) Headlight | 12) Rear fork |
| 2) Left rear-view mirror | 13) Drive chain |
| 3) Clutch fluid reservoir | 14) Passenger left footrest (snapping, closed/open) |
| 4) Ignition switch/steering lock/parking lights | 15) Centre stand OPT |
| 5) Engine oil tank cap | 16) Side stand |
| 6) Saddle lock | 17) Shifting lever |
| 7) Rider left footrest | 18) Engine oil filter |
| 8) Rider saddle | 19) Engine oil tank |
| 9) Battery | 20) Engine oil level |
| 10) Passenger seat | 21) Horn |
| 11) Electronic unit | 22) Left fairing |

**Key:**

- | | |
|----------------------------------|--|
| 1) Rear light | 12) Front phonic wheel |
| 2) Glove/tool kit compartment | 13) Coolant expansion tank cap |
| 3) Main fuse carrier (30A) | 14) Coolant expansion |
| 4) Rear shock absorber | 15) Rear brake control lever |
| 5) Fuel tank | 16) Rider right footrest |
| 6) Air cleaner | 17) Rear brake pump |
| 7) Fuel tank filler cap | 18) Rear brake fluid tank |
| 8) Front brake fluid tank | 19) Passenger right footrest (snapping, closed/open) |
| 9) Right rear-view mirror | 20) Rear phonic wheel |
| 10) Secondary fuse carrier (15A) | 21) ABS control unit |
| 11) Air temperature sensor | 22) ABS fuses |

7.1.1 RELEASING/LOCKING THE PASSENGER SEAT

- ◆ Place the motorcycle on the stand.
- ◆ Insert the key (1) into the seat lock.
- ◆ Rotate the key (1) clockwise. Lift the seat (2) and remove in a rearward motion.

NOTE The glove/tool kit compartment is located under the passenger seat.

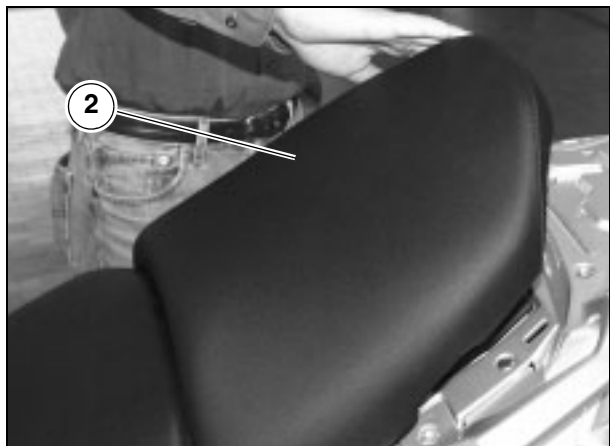
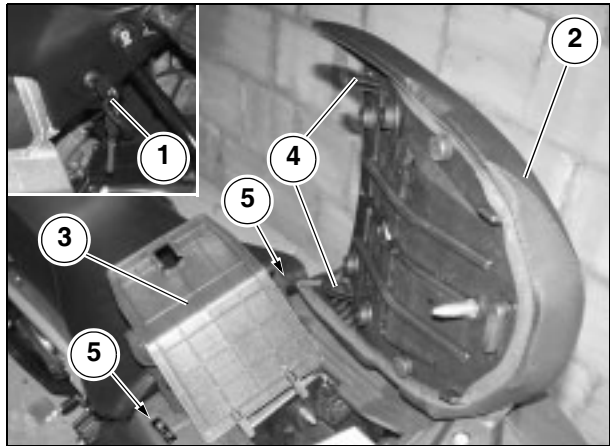
To access the glove/tool compartment:

- ◆ Remove the glove/tool compartment cover (3).

To lock the seat (2):

NOTE Before lowering and locking the seat (2) in position, ensure that the key is not stored in the glove/tool kit compartment.

- ◆ Slide the two front lugs (4) into their seats (5).
- ◆ Lower the seat (2) and press down. The seat lock should click audibly into the locked position.



⚠ CAUTION

Ensure that the seat (2) is locked securely in place before riding.

7.1.2 REMOVING THE RIDER SEAT

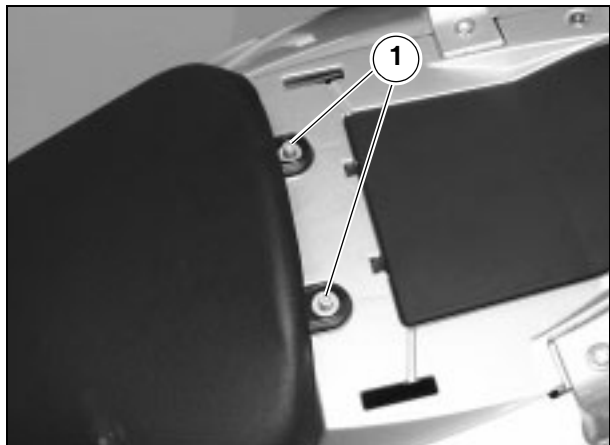
- ◆ Remove the passenger seat, see 7.1.1 (RELEASING/LOCKING THE PASSENGER SEAT).
- ◆ Release and remove the two screws (1) and collect the bushes.



Torque wrench setting for screws (1): 12 Nm (1.2 kgm).

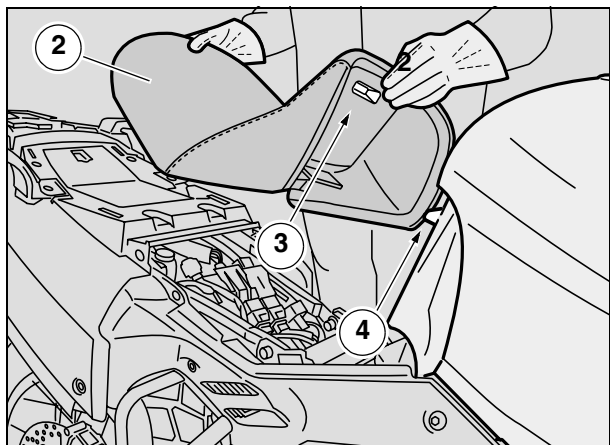
- ◆ Lift and remove the seat (2).

NOTE Make sure the recess (3) and the lug (4) locate correctly when refitting the seat.



⚠ CAUTION

Ensure that the seat (2) is correctly positioned and locked securely in place before riding.

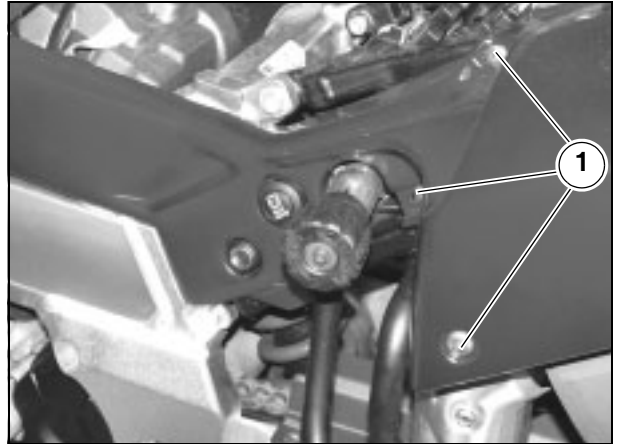


7.1.3 REMOVING THE SIDE BODY PANELS

- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Release and remove the three screws (1).



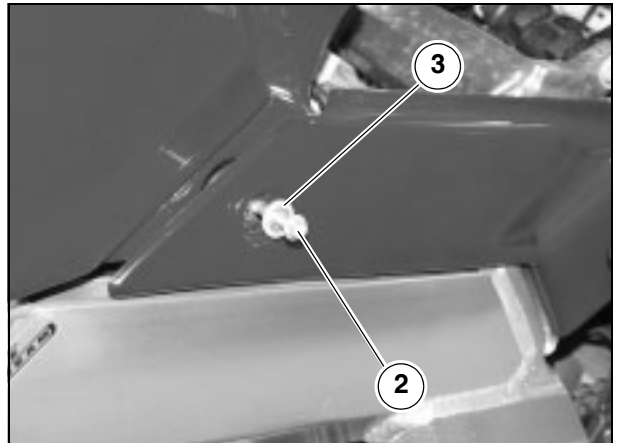
Torque wrench setting for screws (1): 5 Nm (0.5 kgm).



- ◆ Release and remove the screw (2) and collect the washer (3).



Torque wrench setting for screw (2): 10 Nm (1 kgm).



- ◆ Slacken the screw (4).



Torque wrench setting for screw (4): 6 Nm (0.6 kgm).

NOTE The next three steps are only necessary when removing the left side body panel.

- ◆ Move aside the left side body panel (5).
- ◆ Disconnect the connector (6) from the power socket.

⚠ WARNING

Ensure that the connector (6) is fitted to the matching connector on assembly.

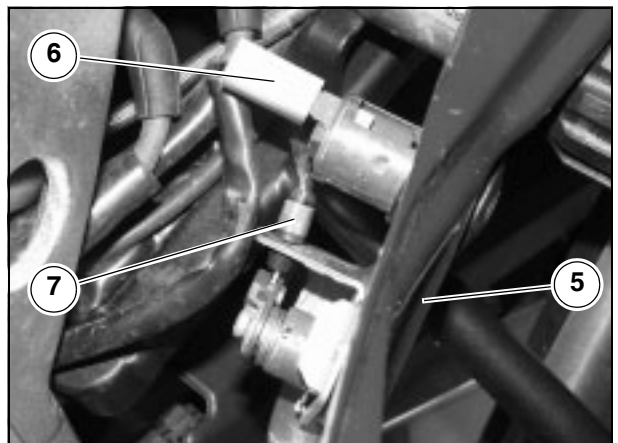
- ◆ Release the seat anchoring cable (7).

⚠ WARNING

Ensure that the seat anchoring cable (7) is fastened securely to the seat on assembly.

- ◆ Remove the side body panel.

NOTE Repeat the process for the other side body panel if needed.



7.1.4 REMOVING THE FUEL TANK

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION), 1.2.1 (FUEL) and 4.1 (FUEL TANK) carefully.

⚠ CAUTION

Fire hazard!

Allow for the engine and exhaust silencer to cool down completely.

Fuel vapours are harmful to human health.

Ensure that the room is well ventilated before proceeding.

Do not inhale fuel vapours.

Do not smoke or use bare flames near fuel vapours.

DO NOT RELEASE FUEL INTO THE ENVIRONMENT.

⚠ WARNING

Do not drain all or part of the fuel from the fuel tank, as this would damage the fuel tank inner components or the fuel pump components.

Always make sure the fuel tank filler cap is closed securely.

- ◆ Remove the seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Release and remove the two front mounting bolts (1) of the fuel tank (2) and collect bushes and washers.



Torque wrench setting for bolts (1): 10 Nm (1.0 kgm).

- ◆ ★ Release and remove the screw (3).



Torque wrench setting for screw (3): 5 Nm (0.5 kgm).

- ◆ ★ Release and remove the screw (4).



Torque wrench setting for screw (4): 5 Nm (0.5 kgm).

- ◆ ★ Release and remove the screw (5) and collect bush and washer.

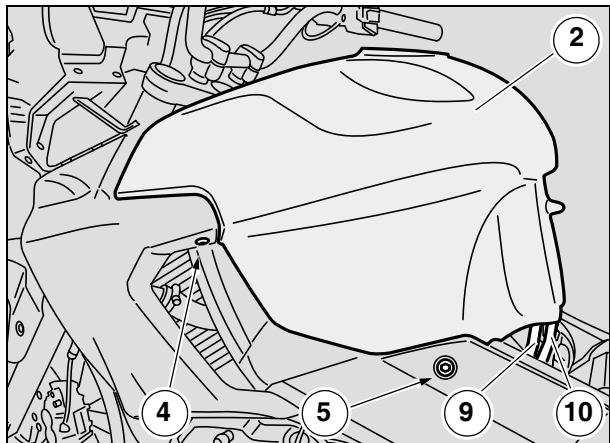
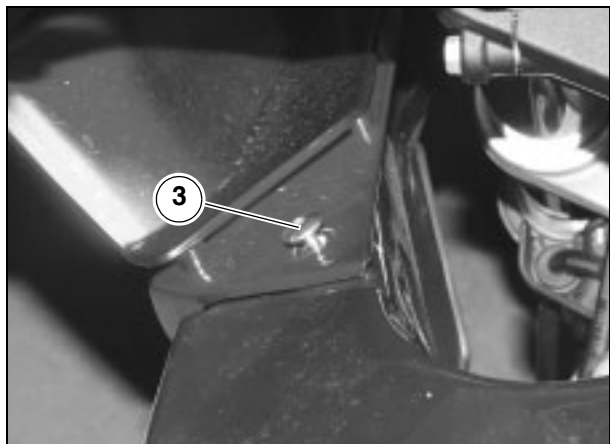
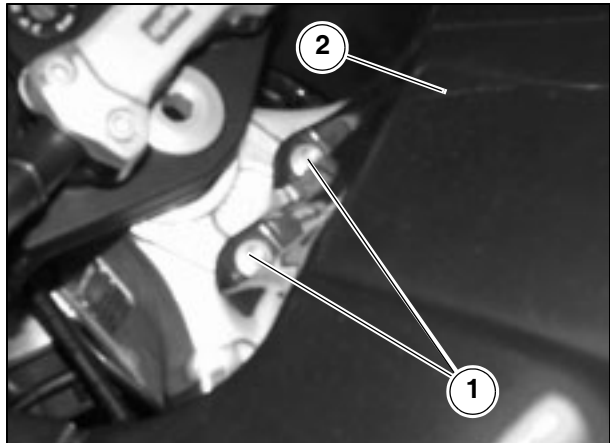


Torque wrench setting for screw (5): 10 Nm (1 kgm).

⚠ WARNING

Handle plastic and paint-finished parts with care to avoid scratching or damage.

- ◆ Lift the fuel tank (2) and pull slightly in a rearward motion until the front end of the tank is resting on the airbox.
- ◆ Stand on the left side of the motorcycle.



- ◆ Disconnect the fuel pump connector (6).

⚠ WARNING

Ensure that the connector (6) is fitted to the matching connector on assembly.

⚠ CAUTION

A small amount of fuel will spill out of the quick-disconnect fittings (7-8) when they are disconnected. Place a clean cloth under the fittings to collect the spillage.

- ◆ Release and disconnect the quick-disconnect fittings (7-8).

⚠ CAUTION

On refitting, ensure that the quick-disconnect fittings (7-8) are re-connected properly.

NOTE Make a note of the routing of the pipes (9) and (10) to position them correctly when refitting the fuel tank.

⚠ WARNING

Do not disconnect the pipes (9-10) from the fuel tank.

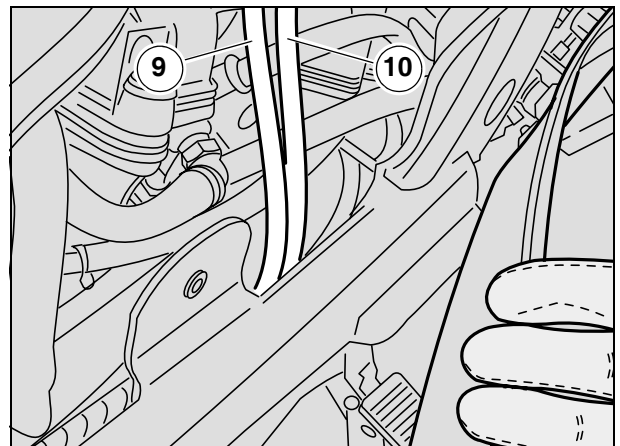
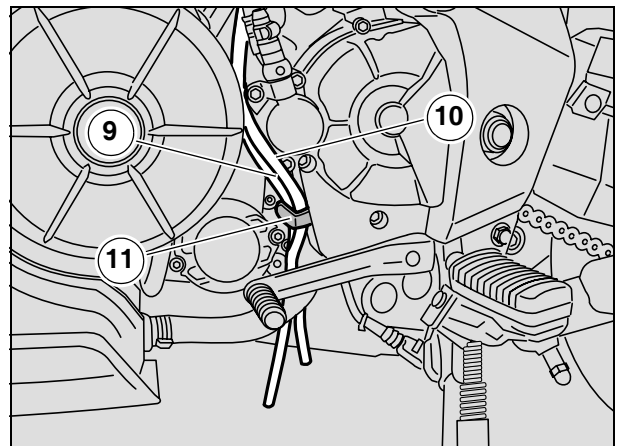
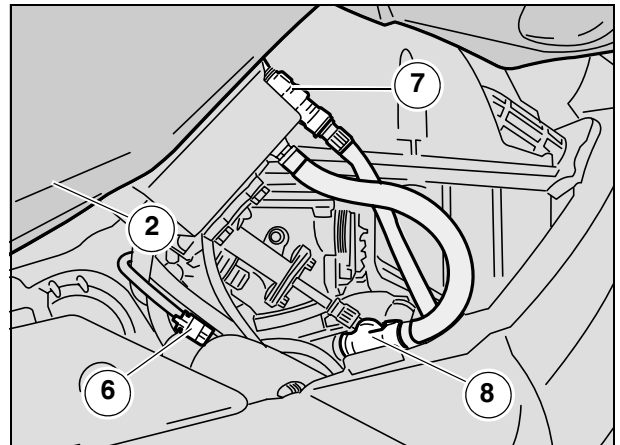
- ◆ Release the pipes (9-10) from the retainer (11) on the sprocket cover.

⚠ WARNING

Do not exert exceeding force on the pipes.

- ◆ Grasp the fuel tank (2) and remove it while gently easing off the pipes (9-10).

NOTE Make sure the pipes (9-10) are routed correctly on assembly.



7.1.5 FUEL TANK FILLER CAP REMOVAL

Read 1.2.1 (FUEL) and 4.1 (FUEL TANK) carefully.

⚠ CAUTION

Fuel vapours are harmful to human health. Ensure that the room is well ventilated before proceeding.

Do not inhale fuel vapours.

Do not smoke or use bare flames near fuel vapours.

Do not release fuel into the environment.

FIRE AND/OR EXPLOSION HAZARD!

- ◆ Place the motorcycle on the stand.
- ◆ Release and remove the three screws (1).



Torque wrench setting for screws (1): 6 Nm (0.6 kgm).

NOTE The other three screws are there for aesthetic purposes only and can be left in place.

- ◆ Open the filler cap (2).

⚠ WARNING

Be careful when removing the screw (3). Take care not to drop it into the fuel tank.

- ◆ Release and remove the screw (3).

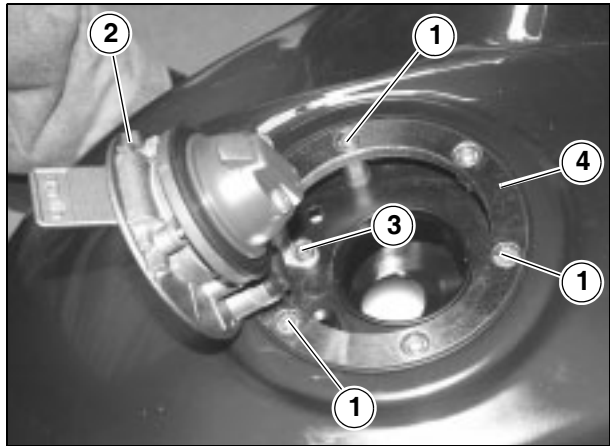


Torque wrench setting for the screw (3): 6 Nm (0.6 kgm).

- ◆ Remove the filler cap (2) together with the ring nut (4).

⚠ WARNING

Block off the filler opening to prevent the ingress of dirt.



7.1.6 AIRBOX REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove the air cleaner, see 2.9 (AIR CLEANER).
- ◆ Release the clip (1) and detach the hose (2).
- ◆ Release the two clips (3) and detach the two hoses (4).
- ◆ Release the clip (5) and detach the oil breather pipe (6).
- ◆ Disconnect the connector (7) from the stepper motor.

⚠ WARNING

Make sure the connector (7) is properly fitted to the matching connector on assembly.

- ◆ Release and remove the two screws (10).



Torque wrench setting for screws (10): 2 Nm (0.2 kgm).

- ◆ Release the six screws (8).

NOTE Lubricate the six screws (8) with oil (part no. 8116050) on assembly.



Torque wrench setting for screws (8): 2 Nm (0.2 kgm).

- ◆ Lift the airbox (9) and disconnect the connector (11).

⚠ WARNING

Make sure the connector (11) is properly fitted to the matching connector on assembly.

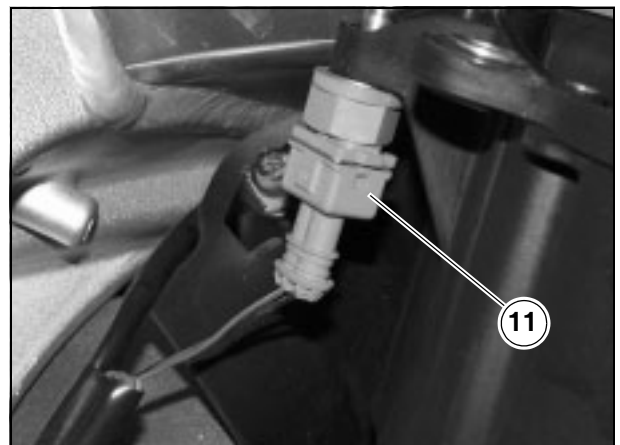
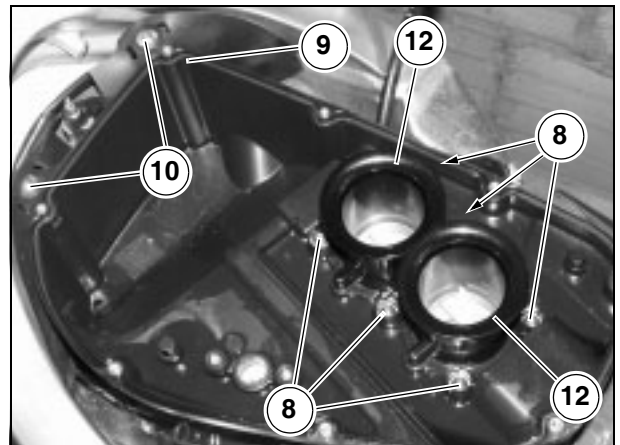
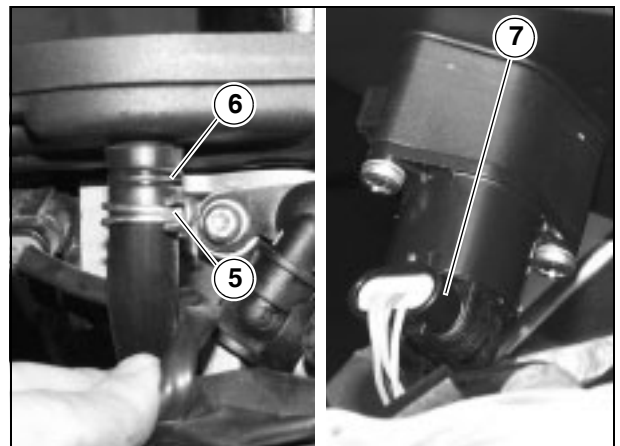
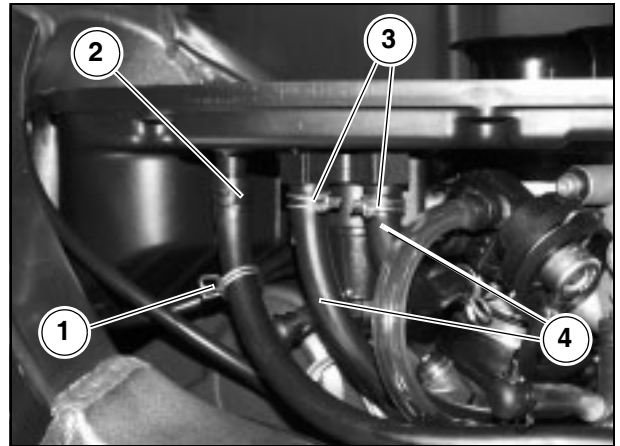
- ◆ Remove the airbox (9).

⚠ WARNING

Block off the openings with a clean cloth to prevent the ingress of debris into the intake ducts.

Ensure that the airbox (9) is fully home on the throttle body.

If the two intake funnels (12) have been removed, ensure that the two O-rings are correctly seated in place to prevent the ingress of debris into the engine.



7.1.7 BATTERY REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.4 (BATTERY) carefully.

NOTE When the battery is removed, the digital clock and red line setting will be reset to zero.

See 2.3 (MULTIFUNCTION COMPUTER) for instructions on how to set clock and red line.

- ◆ Set the ignition switch to "⊗".
- ◆ Remove the seat lower moulded cover, see 7.1.31 (REMOVING THE SEAT LOWER MOULDED COVER).
- ◆ Release and remove the negative (-) terminal screw (1).
- ◆ Slide the negative lead (2) aside.
- ◆ Lift the red protective cap (3).
- ◆ Release and remove the positive (+) terminal screw (4).
- ◆ Slide the positive lead (5) aside.

⚠ WARNING

Do not pull on the wiring.

- ◆ Release and remove the screw (6). Keep the nut (9) and the bush (10).



Torque wrench setting for screw (6): 5 Nm (0.5 kgm).

- ◆ Raise the battery retaining bracket (7).
- ◆ Grasp the battery (8) firmly and lift it out of its mount.

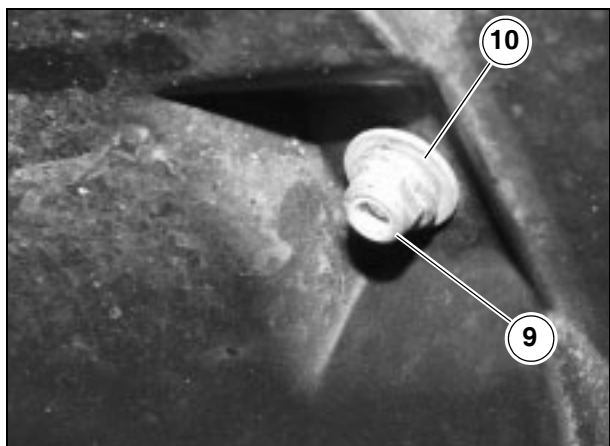
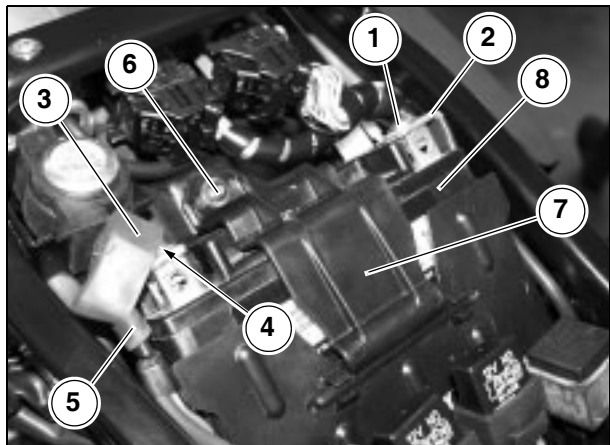
⚠ CAUTION

Once removed, the battery must be stored in a safe place out of the reach of children.

⚠ WARNING

On refitting, connect the positive (+) lead first, then the negative (-) lead.

NOTE Replace the rubber section resting on the battery if damaged.



7.1.8 REMOVING THE ENGINE CONTROL UNIT

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Set the ignition switch to "⊗".
- ◆ Remove the passenger seat, Read 7.1.1 (RELEASING/LOCKING THE PASSENGER SEAT).
- ◆ Disconnect the two connectors (1) from the Ecu (2).

⚠ WARNING

Make sure the two connectors (1) are properly fitted to the matching connectors on assembly.

- ◆ Release and remove the two screws (3).

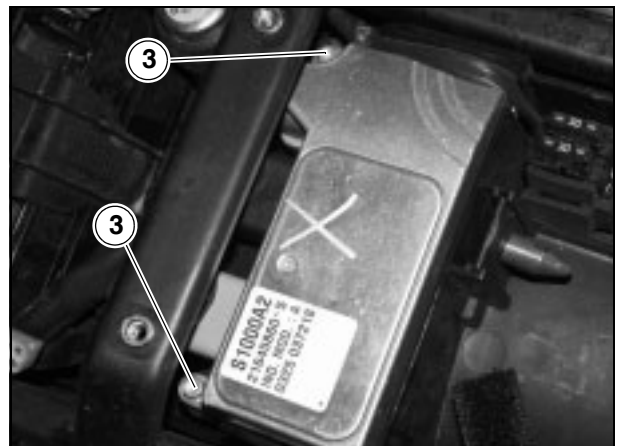
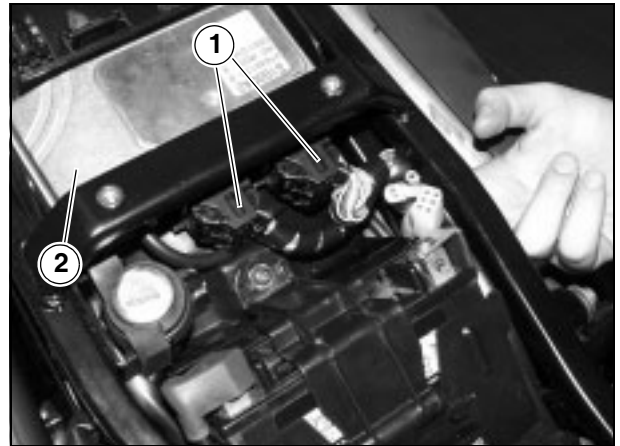


Torque wrench setting for screws (3): 5 Nm (0.5 kgm).

- ◆ Lift and remove the Ecu (2) from the rider seat.

⚠ WARNING

Each time the Engine Control Unit (2) is replaced, the throttle position sensor has to be set, see 4.10.3 (THROTTLE POSITION SENSOR).



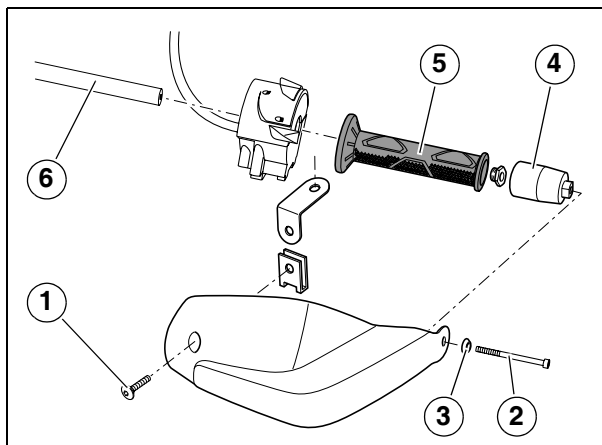
7.1.9 REMOVING THE LEFT HANDLEBAR GRIP

- ◆ Unscrew and remove the screw (1).
- ◆ Unscrew and remove the screw (2).



Tightening torque of the screws (2): 10 Nm (1.0 kgm).

- ◆ Collect the cup (3).
- ◆ Remove the hand guard.
- ◆ Remove the counterweight (4).
- ◆ Slide the nozzle of an air gun between grip (5) and handlebar (6).
- ◆ Operate the gun while rotating the nozzle. Grasp the grip (5) with the other hand and pull to extract.



7.1.10 REMOVING THE CLUTCH CONTROL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Release and remove the two screws (1) securing the clutch control (2).



Torque wrench setting for screws (1): 10 Nm (1.0 kgm).

- ◆ Remove the clip (6).

NOTE Make sure to have enough spare clips ready at hand to replace the original ones.

- ◆ Remove the clamp (3) and slide the clutch control (2) aside.

NOTE The clamp (3) has an arrow etched in the top section. Refit the clamp with the arrow pointing upwards.

When the clutch control (2) has to be taken off the handlebar:

- ◆ Perform the first three steps of the procedure described in subsection 2.20 (CHANGING THE FRONT BRAKE FLUID).
- ◆ When all fluid has drained out, release and remove the screw (4) and collect the two sealing washers.



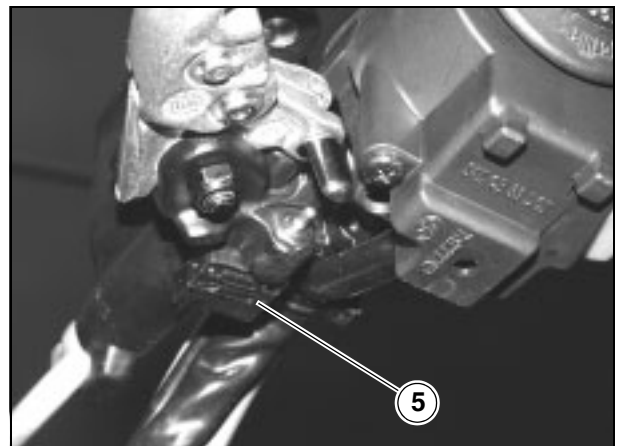
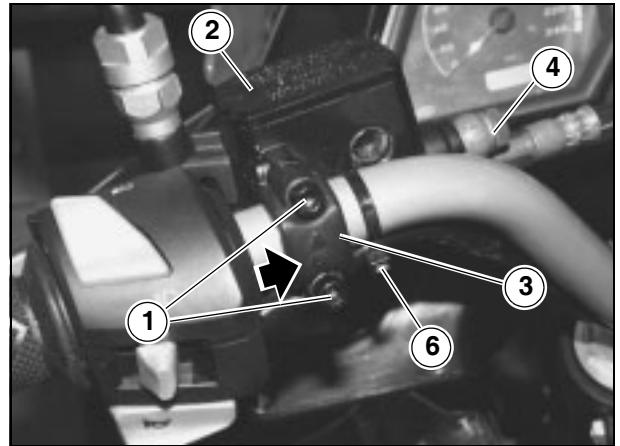
Torque wrench setting for screw (4): 20 Nm (2.0 kgm).

⚠ WARNING

Renew the two sealing washers on assembly. Use washers of the same type fitted originally.

- ◆ Lever the clutch switch (5) with a small flat-blade screwdriver until releasing it from the two retainers on the clutch control (2).
- ◆ Remove the clutch control (2).

If the clutch slave cylinder has to be removed, see 3.2.1 (CLUTCH SLAVE CYLINDER REMOVAL).



7.1.11 REMOVING THE LEFT-HAND HANDLEBAR SWITCHGEAR

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Release and remove the two screws (1) that retain the housing halves (2-3) at the bottom end.



Torque wrench setting for screws (1): 2 Nm (0.2 kgm).

- ◆ Separate the housing halves (2-3).

⚠ WARNING

Refit the bottom housing half (2) first on assembly. Ensure that the locating peg locates into the hole in the left-hand handlebar.

- ◆ Remove the headlight, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Release the wiring harness from the clips (4).

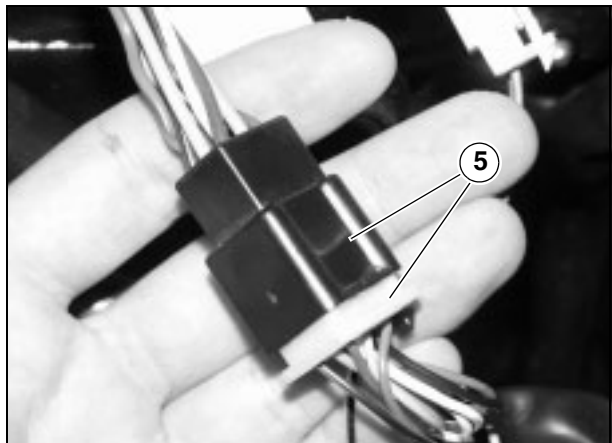
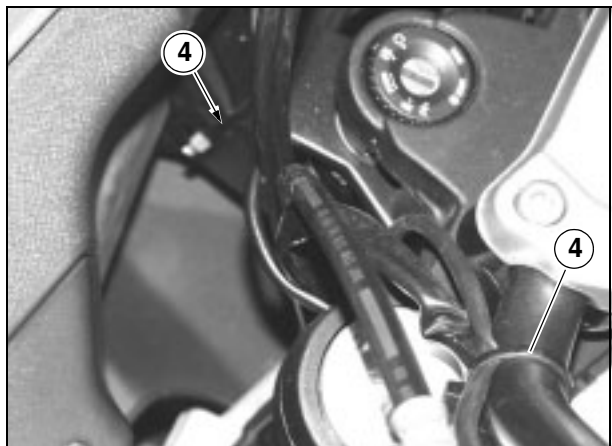
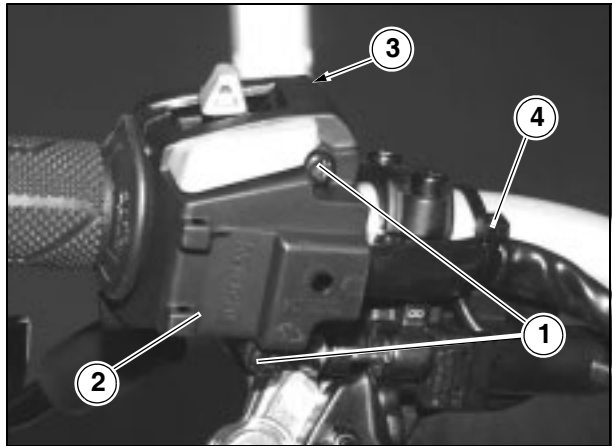
NOTE Make sure to have enough spare clips ready at hand to secure the harness properly on refitting.

- ◆ Disconnect the connector (5) of the left-hand light dip switch.

⚠ WARNING

Make sure to refit the connector (5) to the matching connector on assembly.

- ◆ Remove the two housing halves (2-3).



7.1.12 REMOVING THE THROTTLE CONTROL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Perform the first five steps described in subsection 7.1.9 (REMOVING THE LEFT HANDLEBAR GRIP).
- ◆ Release and remove the two screws (1).



Torque wrench setting for screws (1): 2 Nm (0.2 kgm).

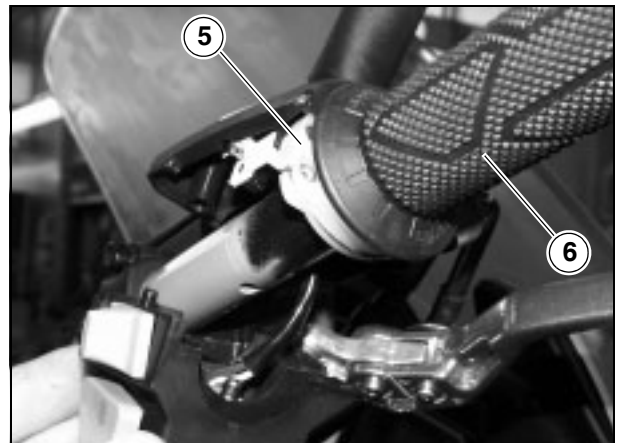
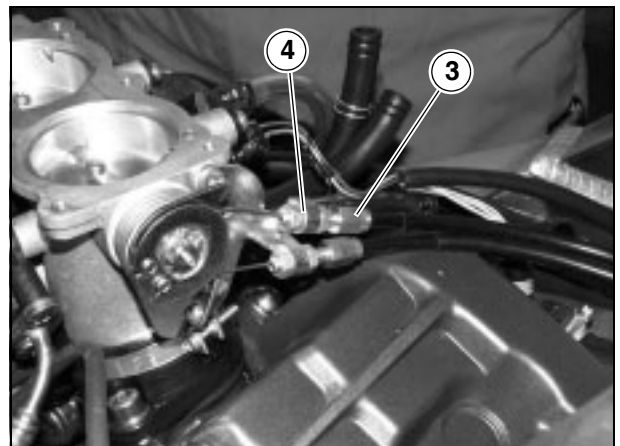
- ◆ Remove the rear housing half (2) of the throttle control.
- ◆ Remove the airbox, see 7.1.6 (AIRBOX REMOVAL).
- ◆ Slacken the locknut (3).
- ◆ Release the throttle cable adjuster (4) from the throttle cable anchor point.
- ◆ Disconnect the throttle cable.
- ◆ Repeat the last three steps for the other throttle cable.

⚠ WARNING

On refitting, ensure that both throttle cable adjusters are fastened securely to their anchor points. Check free play and adjust if needed. See 2.10.3 (THROTTLE CABLE PLAY ADJUSTMENT).

- ◆ Slide the pulley (5) aside and disconnect the two throttle cables.
- ◆ Remove the throttle twistgrip (6).

NOTE Lubricate the handlebar right-hand side with oil (part no. 8116050) on assembly.



7.1.13 REMOVING THE FRONT BRAKE CONTROL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Release and remove the two clamp screws (2) securing the front brake control (3).



Torque wrench setting for screws (2): 10 Nm (1 kgm).

- ◆ Remove the clip (6).

NOTE Make sure to have enough spare clips ready at hand to replace the original ones.

- ◆ Remove the clamp (1) and slide the front brake control (3) aside. The front brake control is still retained by the hose.

NOTE The clamp (1) has an arrow etched in the top section. Refit the clamp with the arrow pointing upwards.

When the front brake control (3) has to be taken off the handlebar:

- ◆ Perform the first three steps of the procedure described in subsection 2.20 (CHANGING THE FRONT BRAKE FLUID).
- ◆ When all fluid has drained out, release and remove the screw (4) and collect the two sealing washers.

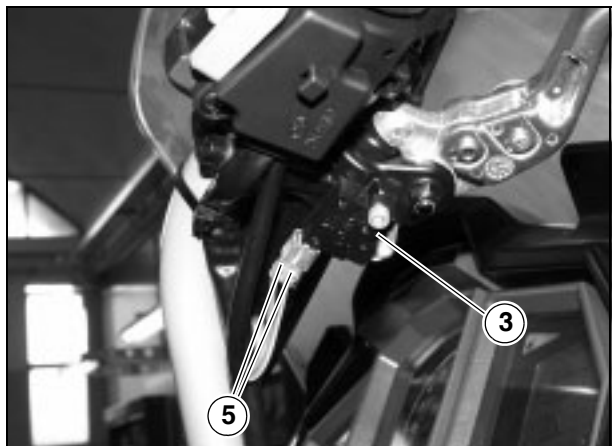
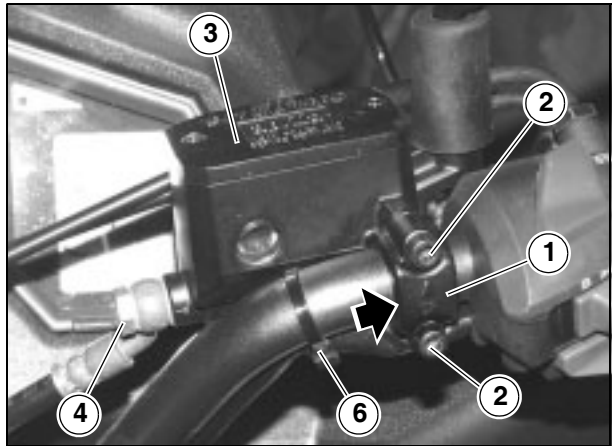


Torque wrench setting for the screw (4): 20 Nm (2.0 kgm).

⚠ WARNING

Renew the two sealing washers on assembly. Use washers of the same type fitted originally.

- ◆ Lever the two front brake light switches (5) with a small flat-blade screwdriver until it is clear of the retainers on the front brake control (3).
- ◆ Remove the front brake control (3).



7.1.14 REMOVING THE RIGHT-HAND HANDLEBAR SWITCHGEAR

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Remove the headlight, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Disconnect the two connectors (1) of the right-hand light dip switch and front brake.

⚠ WARNING

Make sure to refit the connectors (1) to the matching connectors on assembly.

- ◆ Disconnect the connectors (2).

⚠ WARNING

Make sure to refit the connectors (2) to the matching connectors on assembly.

- ◆ Release the wiring from the clips (7).

NOTE You will have to renew all clips on assembly. Make sure to have enough spare clips ready at hand.

- ◆ Release and remove the two bolts (3-4) that secure the two housing halves (5-6) at the bottom end.



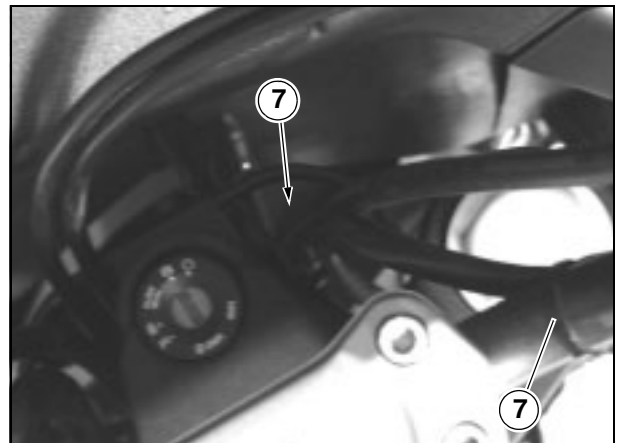
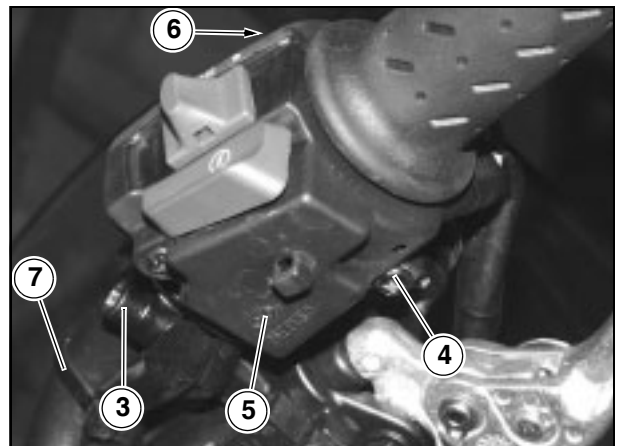
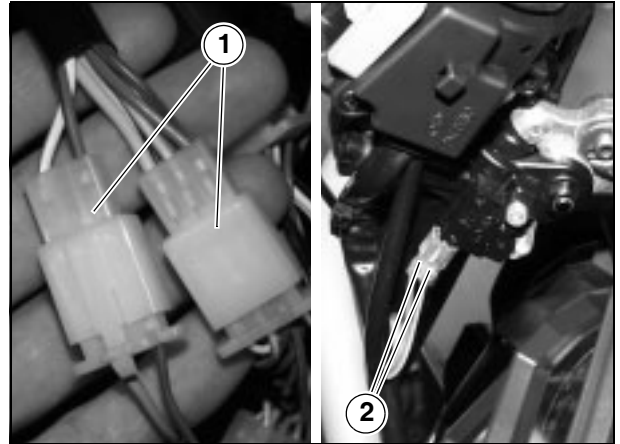
Torque wrench setting for bolts (3-4): 2 Nm (0.2 kgm).

NOTE The shorter screw (3) is fitted at the front end. Ensure it is correctly positioned on assembly.

- ◆ Separate and remove the two housing halves (5-6).

⚠ WARNING

Refit the bottom housing half (5) first on assembly. Ensure that the locating peg locates into the hole in the handlebar.



7.1.15 REMOVING THE IGNITION SWITCH/STEERING LOCK

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Remove the top yoke, see 2.27.2 (ADJUSTING PLAY IN THE BEARINGS).
- ◆ Remove the headlight, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Disconnect connector (1) of the ignition switch assembly at the main wiring harness.

⚠ WARNING

Make sure to refit the connector (1) to the matching connector on assembly.

- ◆ Release and remove the two screws (2).
- ◆ Withdraw the switch (3) from the bottom.

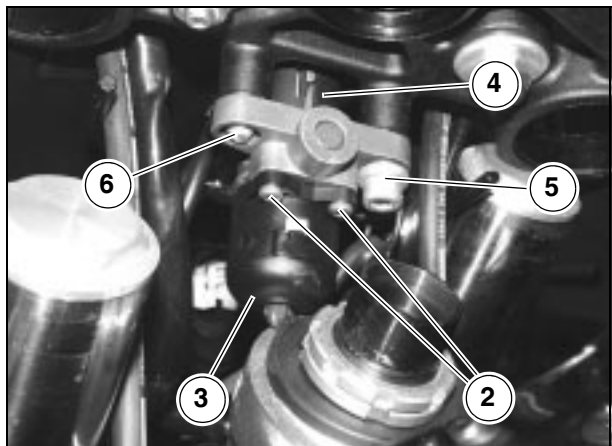
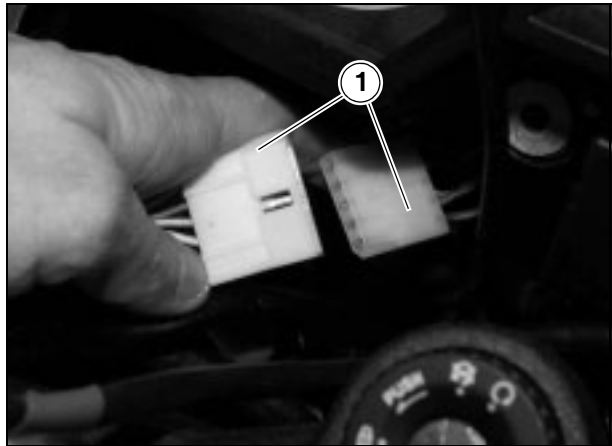
In the event you need to remove the ignition switch/steering lock (4) completely:

- ◆ Perform the first four steps outlined above.
- ◆ Release and remove the two screws (5-6).



Torque wrench setting for screws (5-6): 25 Nm (2.5 kgm).

- ◆ Withdraw the ignition switch/steering lock (4) from the bottom. Collect the wire retainer and washer if needed.



7.1.16 REMOVING THE HANDLEBAR

- ◆ ★ Remove the two clips (1).

NOTE You will have to renew the clips on assembly. Make sure to have enough spare clips ready at hand.

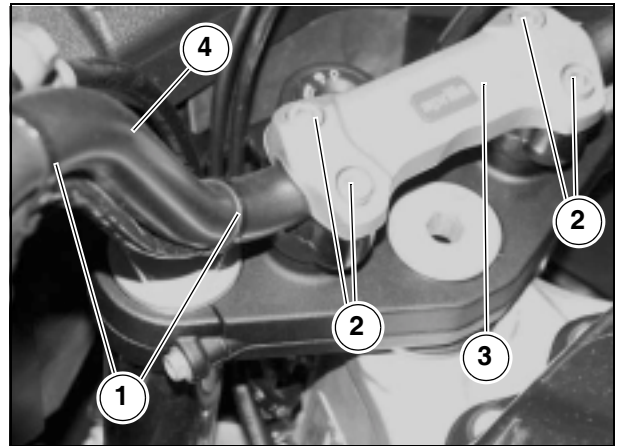
- ◆ Remove the clutch control, see 7.1.10 (REMOVING THE CLUTCH CONTROL).
- ◆ Remove the front brake control, see 7.1.13 (REMOVING THE FRONT BRAKE CONTROL)
- ◆ Remove the electric controls, see 7.1.11 (REMOVING THE LEFT-HAND HANDLEBAR SWITCHGEAR) and 7.1.14 (REMOVING THE RIGHT-HAND HANDLEBAR SWITCHGEAR).
- ◆ Remove the throttle control, see 7.1.12 (REMOVING THE THROTTLE CONTROL).
- ◆ Release and remove the four screws (2).



Torque wrench setting for screw (2): 25 Nm (2.5 kgm).

NOTE Lubricate the four screws (2) with oil (part no. 8116050) on assembly.

- ◆ Remove the plate (3).
- ◆ Remove the handlebar (4) together with left grip and counterweight.



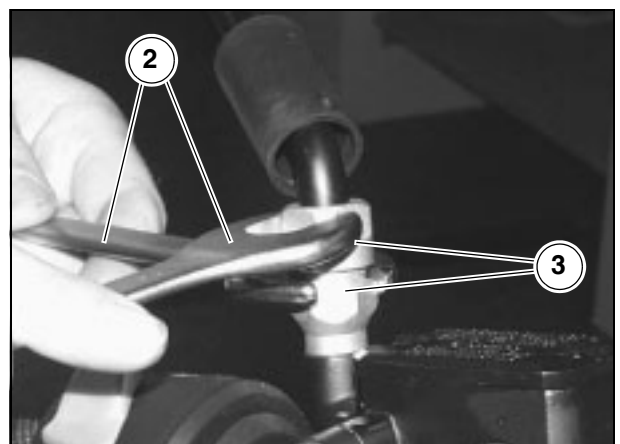
7.1.17 REMOVING THE REARVIEW MIRRORS

- ◆ Place the motorcycle on the stand.
- ◆ Slip off the protective cap (1).
- ◆ Apply two spanners (2) to nut and locknut (3).
- ◆ Release and remove the mirror.

NOTE Repeat the process to remove the other mirror, if needed.

⚠ WARNING

After refitting the rearview mirrors, adjust mirror position and tighten the nuts to hold the mirrors securely in position.



7.1.18 REMOVING THE FRONT FAIRING

- ◆ Unscrew and remove the four bolts that secure the windshield – front fairing.
- ◆ Remove the windshield – front fairing.
- ◆ Unscrew and remove the four bolts that secure the upper dashboard bracket.
- ◆ Remove the upper dashboard bracket.
- ◆ Unscrew and remove the four bolts that secure the lower dashboard bracket.
- ◆ Remove the lower dashboard bracket.



- ◆ Work on both sides, and remove the two lower fixing bolts.
- ◆ Remove both side covers.



7.1.19 REMOVING THE INSTRUMENT PANEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Release and remove the four fastening screws (1).



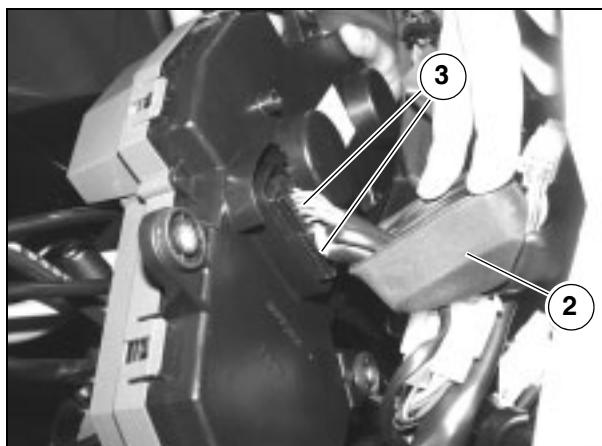
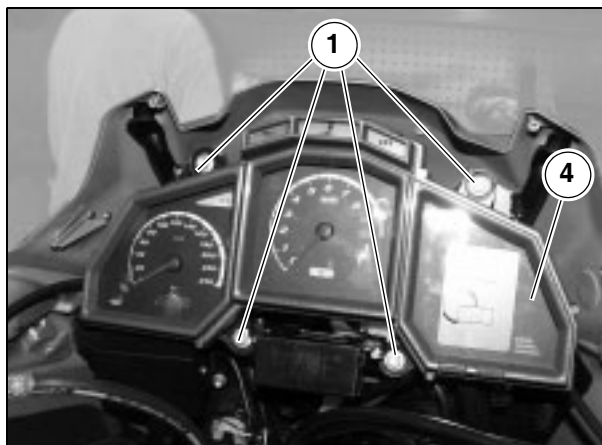
Torque wrench setting for screws (1): 8 Nm (0.8 kgm).

- ◆ Ease out the instrument panel (4).
- ◆ Slide back the protection sleeve (2) and disconnect the two connectors (3).

⚠ WARNING

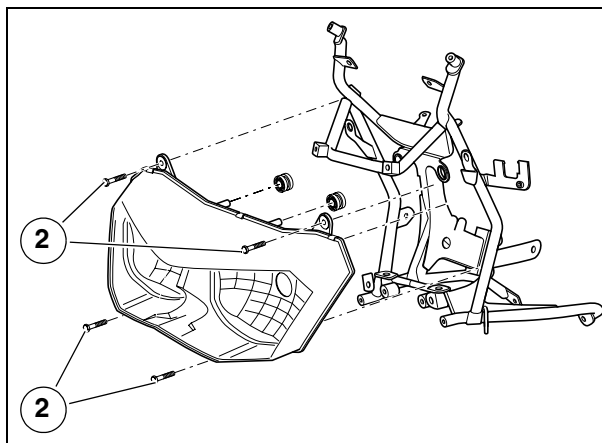
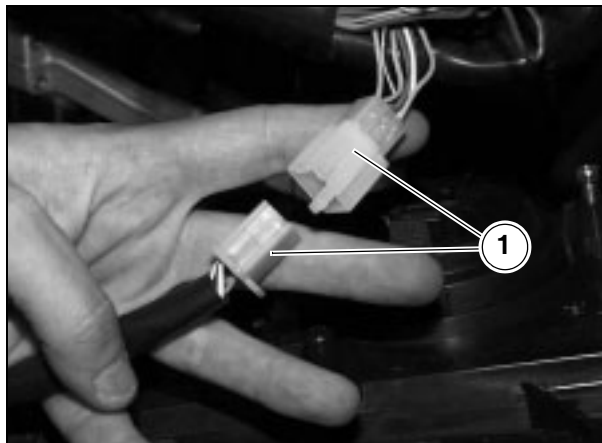
Make sure to refit the connectors (3) to the matching connectors on assembly.

- ◆ Remove the instrument panel (4).



7.1.20 HEADLIGHT REMOVAL

- ◆ Remove the front fairing panel, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Disconnect the light connector (1) from the main wiring harness.
- ◆ Unscrew and remove the four screws (2) retaining the headlight to the front subframe.
- ◆ Remove the headlight.



7.1.21 REMOVING THE FRONT MUDGUARD

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the centre stand.
- ◆ ★ Release and remove the screw (1).



Torque wrench setting for screw (1): 5 Nm (0.5 kgm).

- ◆ Release and remove the screw (3).

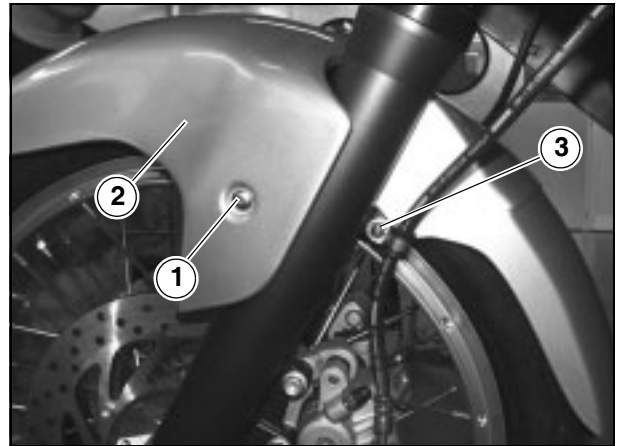


Torque wrench setting for screw (3): 4 Nm (0.4 kgm).

WARNING

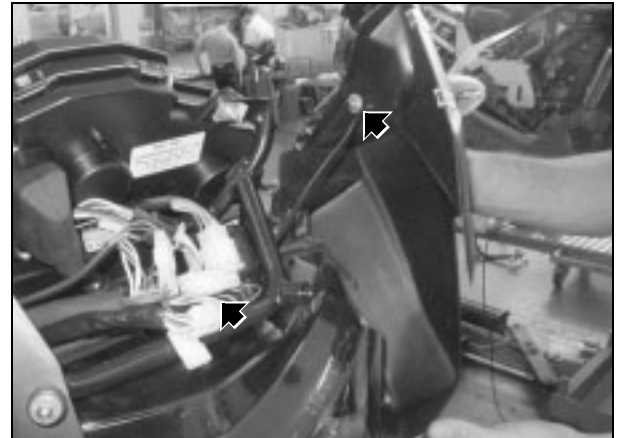
Handle all plastic and paint-finished parts with care to avoid scratching or damage.

- ◆ Withdraw the mudguard (2) from the front.



7.1.22 REMOVING THE FRONT INDICATORS

- ◆ Remove the side fairing, complete with the indicator see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Disconnect the electrical connector for the relevant indicator.
- ◆ Unscrew the indicator fixing bolt, holding the locknut with a suitable set spanner.
- ◆ Remove the indicator.



7.1.23 REMOVING THE UPPER SUMP GUARD

- ◆ Unscrew and remove the five fixing screws (two on each side and one in the front).
- ◆ Remove the upper sump guard.

**7.1.24 REMOVING THE LOWER SUMP GUARD**

- ◆ Unscrew and remove the four fixing screws.
- ◆ Remove the lower sump guard.

**7.1.25 WARNING HORN REMOVAL**

- ◆ Remove the radiator spoiler, see 7.1.24 (REMOVING THE LOWER SUMP GUARD).
- ◆ Disconnect the two connectors (1).

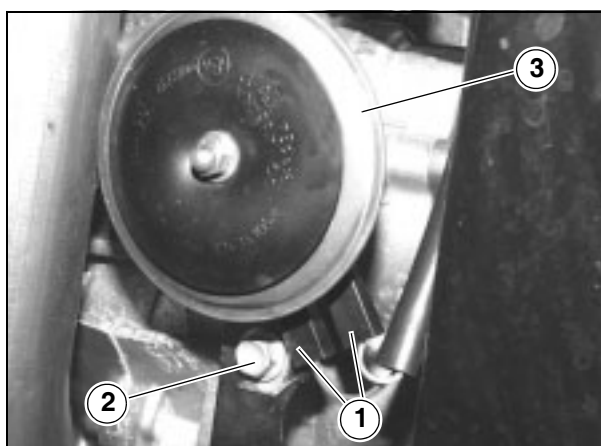
⚠ WARNING

Ensure that both connectors (1) are fitted to the matching connectors on assembly.

- ◆ Release and remove the screw (2).

 Torque wrench setting for screw (2): 25 Nm (2.5 kgm).

- ◆ Remove the horn (3).



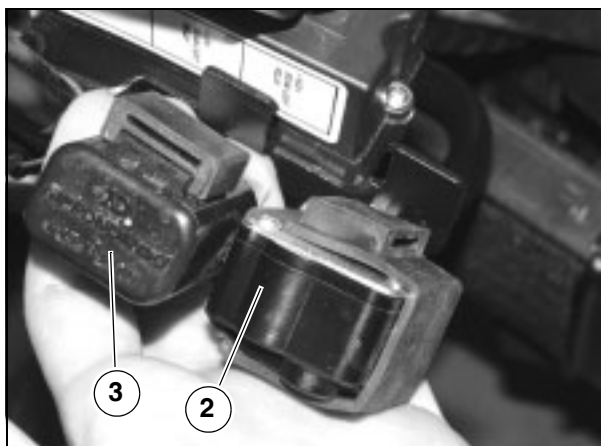
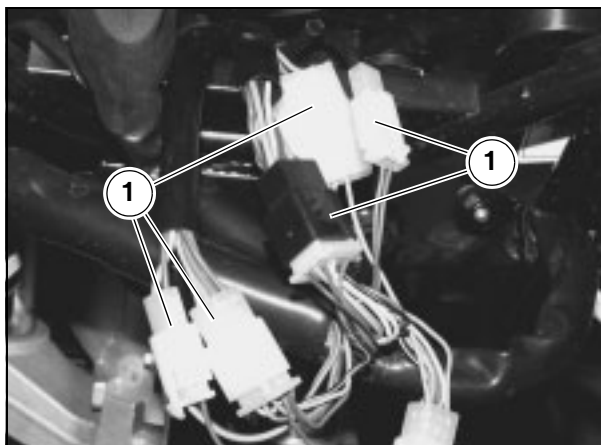
7.1.26 REMOVING THE INSTRUMENT PANEL/FRONT FAIRING SUBFRAME

- ◆ Place the motorcycle on the stand.
- ◆ Remove the fairings, see 7.1.18 (REMOVING THE FRONT FAIRING).
- ◆ Remove the headlight, see 7.1.20 (HEADLIGHT REMOVAL).
- ◆ Remove the instrument panel, see 7.1.19 (REMOVING THE INSTRUMENT PANEL).
- ◆ Disconnect the five connectors (1).

⚠ WARNING

Ensure that the connectors (1) are fitted to the matching connectors on assembly.

- ◆ Extract the bank angle sensor (2) and the flasher (3) from their mounts but leave them connected to the wiring.

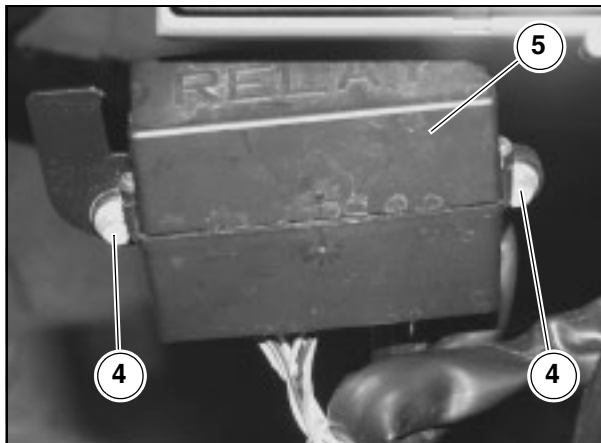


- ◆ Release and remove the two screws (4)



Torque wrench setting for screws (4): 5 Nm (0.5 kgm).

- ◆ Remove the relay box (5).

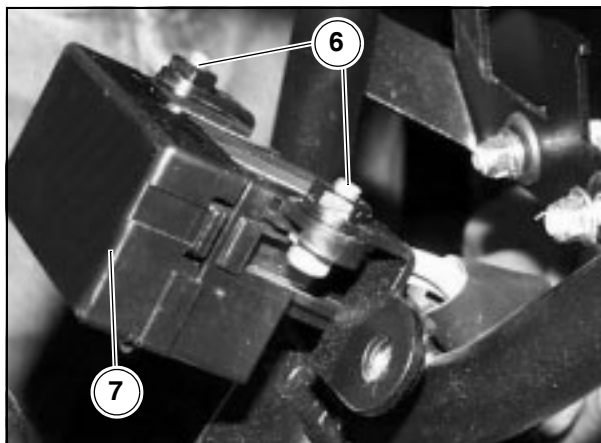


- ◆ Release and remove the two screws (6).



Torque wrench setting for screws (6): 5 Nm (0.5 kgm).


- ◆ Remove the fuse box (7).

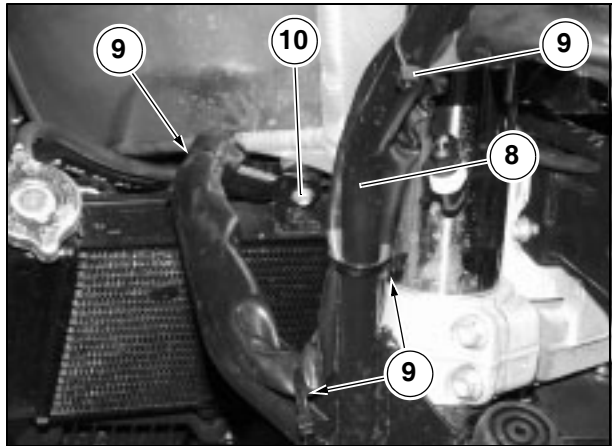


- ◆ Remove all the clips (9) retaining the wiring harness to release the instrument panel/front fairing subframe (8).

NOTE You will have to renew all the clips on assembly. Make sure to have enough spare clips ready at hand.

- ◆ ★ Release and remove the screw (10).

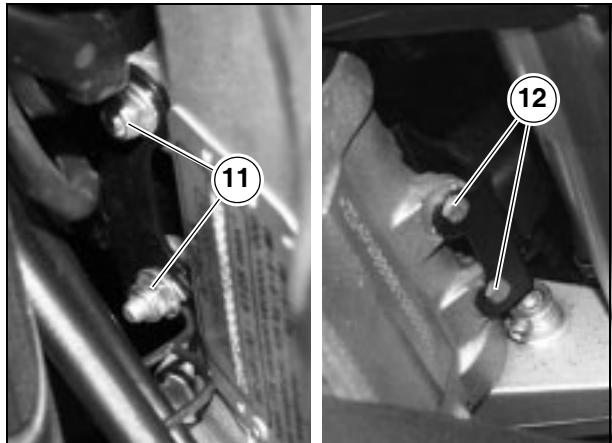
 **Torque wrench setting for screw (10): 10 Nm (1.0 kgm).**



- ◆ Release and remove the two nuts (11).

 **Torque wrench setting for nuts (11): 10 Nm (1.0 kgm).**

- ◆ Withdraw the two screws (12) from the opposite side.
- ◆ Remove the instrument panel/front fairing subframe (8).



7.1.27 REMOVING THE FRONT FAIRING LOWER LOCKUP

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

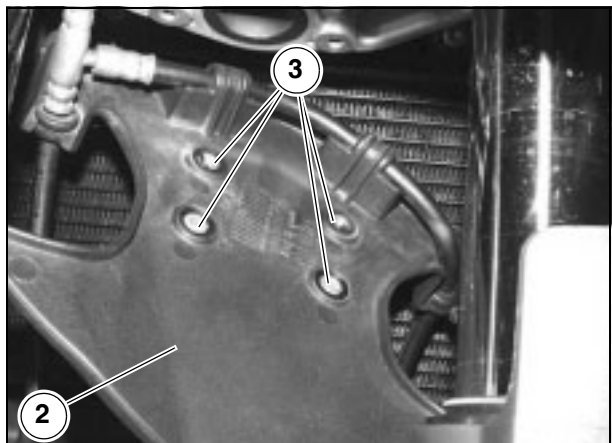
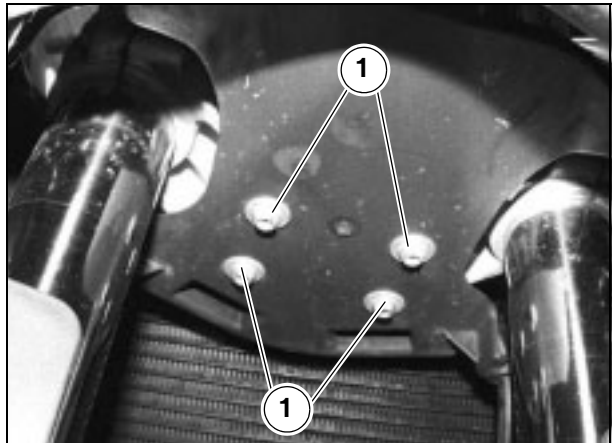
- ◆ Place the motorcycle on the stand.
- ◆ Release and remove the four screws (1).

 **Torque wrench setting for screws (1): 10 Nm (1.0 kgm).**

⚠ WARNING

Take care not to damage the brake hoses. Handle plastic and paint-finished parts with care to avoid scratching or damage.

- ◆ Remove the brake hoses from the front fairing lower lockup (2).
- ◆ Remove the front fairing lower lockup (2) together with the bushes (3).

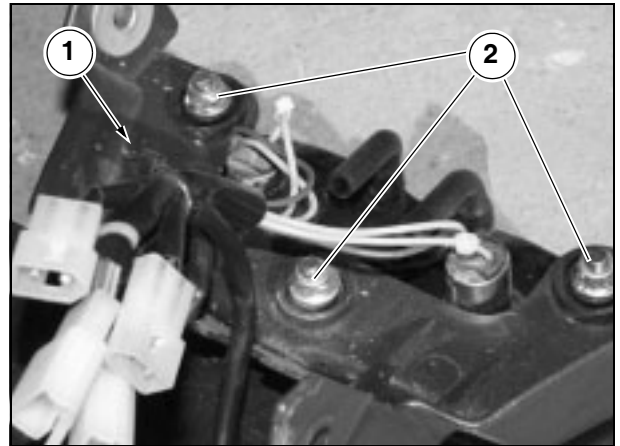


7.1.28 TAIL LIGHT REMOVAL

- ◆ Remove the number plate bracket, see 7.1.34 (REMOVING THE NUMBER PLATE BRACKET)
- ◆ Release the wiring from the clips (1).

NOTE You will have to renew all the clips on assembly. Make sure to have enough spare clips ready at hand.

- ◆ Undo and remove the three nuts (2).
- ◆ Remove the tail light.

**7.1.29 GRAB RAIL REMOVAL**

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

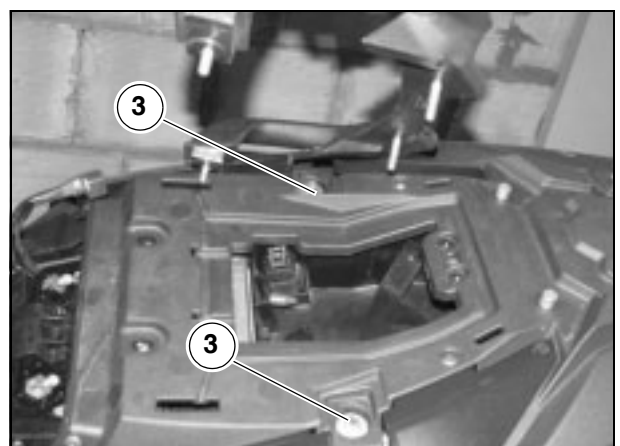
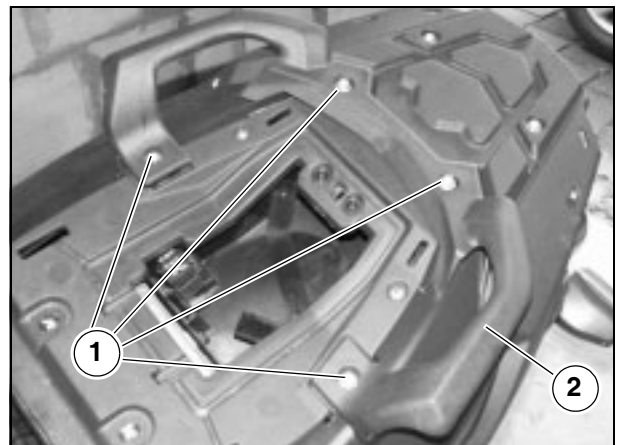
- ◆ Remove the passenger seat, see 7.1.1 (RELEASING/ LOCKING THE PASSENGER SEAT).
- ◆ Release and remove the four screws (1).



Torque wrench setting for screws (1): 25 Nm (2.5 kgm).

- ◆ Remove the grab rail (2).

- ◆ Collect the two bushes (3).



7.1.30 REMOVING THE PASSENGER SEAT LOCK

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Lift the seat lower moulded cover, see 7.1.31 (REMOVING THE SEAT LOWER MOULDED COVER).
- ◆ Prise the clip (2) open with a screwdriver to release the seat releasing cable (1).

⚠ WARNING

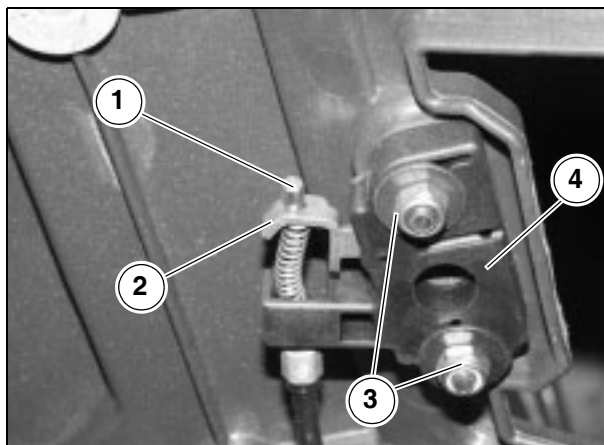
Ensure that the cable (1) is routed correctly and is not twisted on assembly.

- ◆ Release and remove the two nuts (3) that retain the lock (4) and collect the two screws on the opposite side.



Torque wrench setting for nuts (3): 7 Nm (0.7 kgm).

- ◆ Remove the passenger seat lock (4).



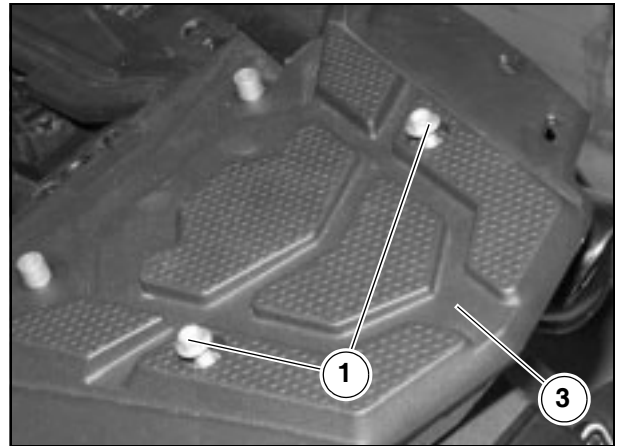
7.1.31 REMOVING THE SEAT LOWER MOULDED COVER

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove the rider seat, see 7.1.2 (REMOVING THE RIDER SEAT).
- ◆ Remove the grab rail, see 7.1.29 (GRAB RAIL REMOVAL).
- ◆ Release and remove the two front retaining screws (1).



Torque wrench setting for screws (1): 25 Nm (2.5 kgm).

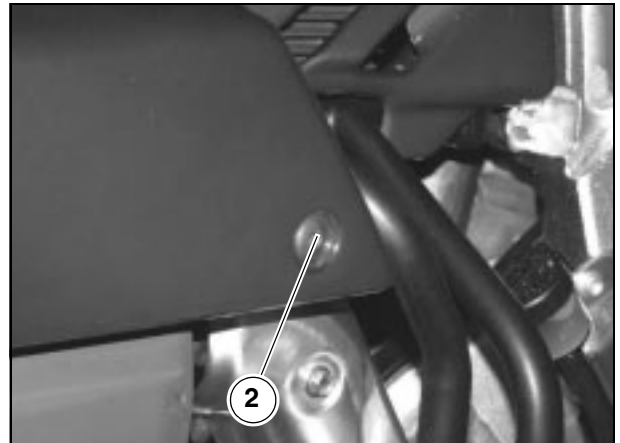


- ◆★ Release and remove the screw (2).



Torque wrench setting for screw (2): 5 Nm (0.5 kgm).

- ◆ Lift the seat lower moulded cover (3).

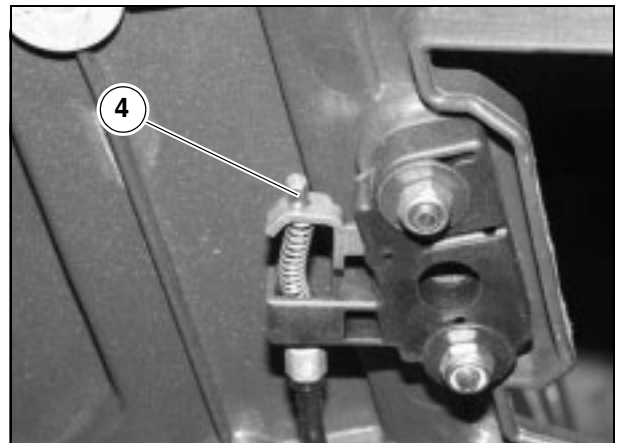


- ◆ Release the passenger seat releasing cable (4).

⚠ WARNING

Ensure that the cable (4) is routed correctly and is not twisted on assembly.

- ◆ Remove the seat lower moulded cover (3).



7.1.32 REMOVING THE REAR DIRECTION INDICATORS

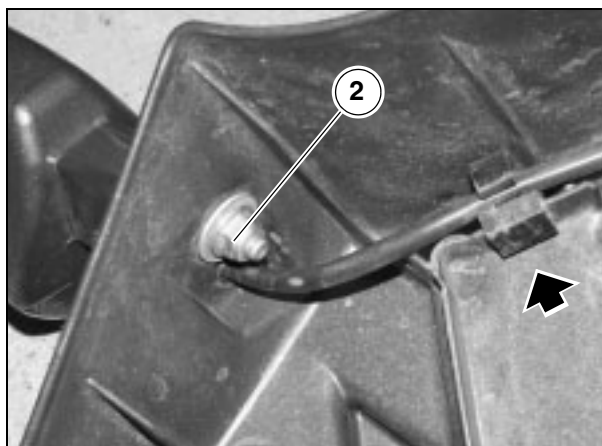
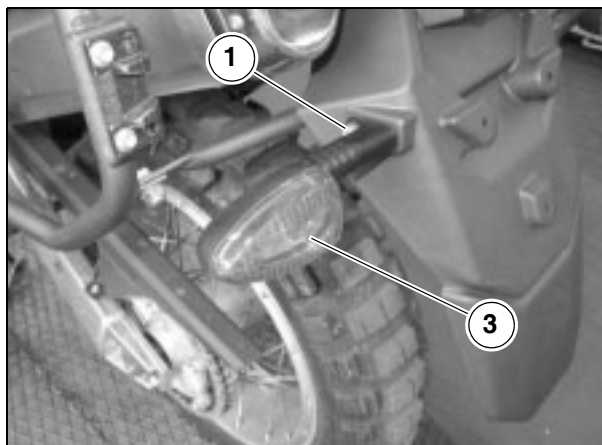
- ◆ Perform the first two steps of the procedure described in subsection 7.1.28 (TAIL LIGHT REMOVAL).
- ◆ Release and remove the screw (1) and collect the nut (2).
- ◆ Release the cable from its mounting point.

⚠ WARNING

On refitting, make sure the cable locates correctly into its mounting point.

- ◆ Remove the direction indicator (3).

NOTE Repeat the process for the other direction indicator if needed.

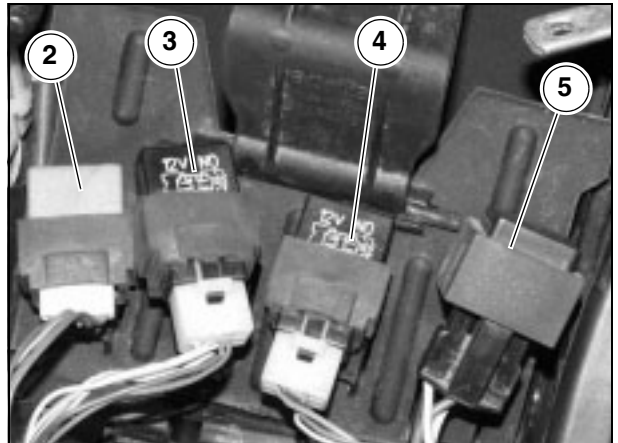


7.1.33 REMOVING THE SEAT END COVER

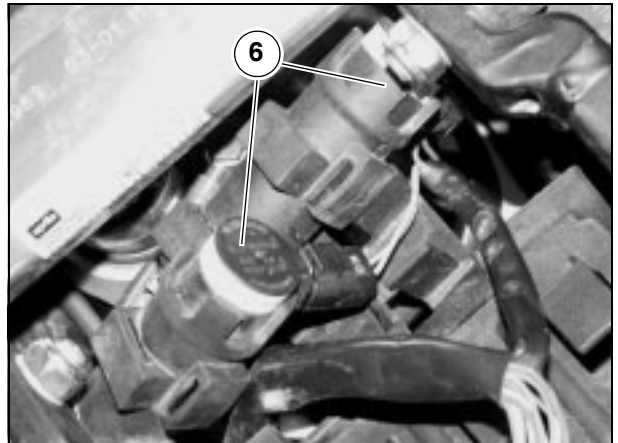
- ◆ Lift the seat lower moulded cover, see 7.1.31 (REMOVING THE SEAT LOWER MOULDED COVER).
- ◆ Remove the battery, see 7.1.7 (BATTERY REMOVAL)
- ◆ Remove the Engine Control Unit, see 7.1.8 (REMOVING THE ENGINE CONTROL UNIT)
- ◆ Remove the number plate bracket, see 7.1.34 (REMOVING THE NUMBER PLATE BRACKET)
- ◆ Take the tool kit and any personal belongings out of the glove compartment.
- ◆ Release the fuse carrier (1) from its mount.



- ◆ Release diode module (2), engine cutout relay (3), fuel pump relay (4) and fuel injection relay (5) from their mounts.



- ◆ Release the two rear coils (6) from their mounts.

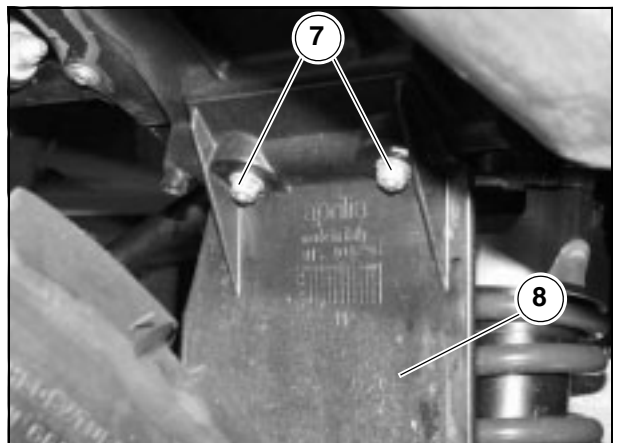


- ◆ Undo and remove the two nuts (7).



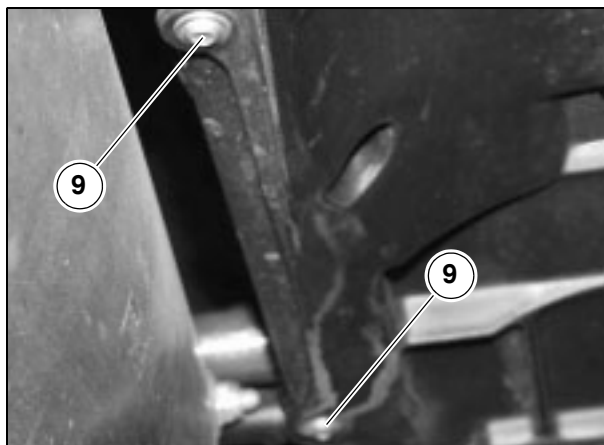
Torque wrench setting for nuts (7): 5 Nm (0.5 kgm).

- ◆ Remove the splashguard (8).




- ◆ Release and remove the two screws (9).

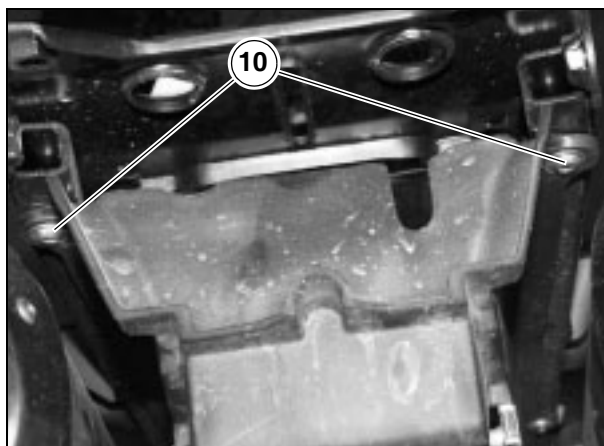
 **Torque wrench setting for screws (9): 6 Nm (0.6 kgm).**



- ◆ Release and remove the two screws (10).

 **Torque wrench setting for screws (10): 6 Nm (0.6 kgm).**

- ◆ Remove the seat end cover pulling in a rearward motion.

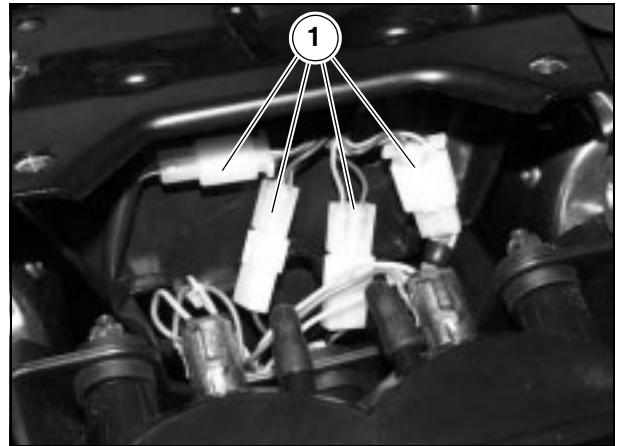


7.1.34 REMOVING THE NUMBER PLATE BRACKET

- ◆ Place the motorcycle on the stand.
- ◆ Set the ignition switch to "OFF".
- ◆ Remove the seat lower moulded cover, see 7.1.31 (REMOVING THE SEAT LOWER MOULDED COVER).
- ◆ Disconnect the four connectors (1).

⚠ WARNING

Make sure to refit the connectors (1) to the matching connectors on assembly.



- ◆★ Release and remove the screw (2).

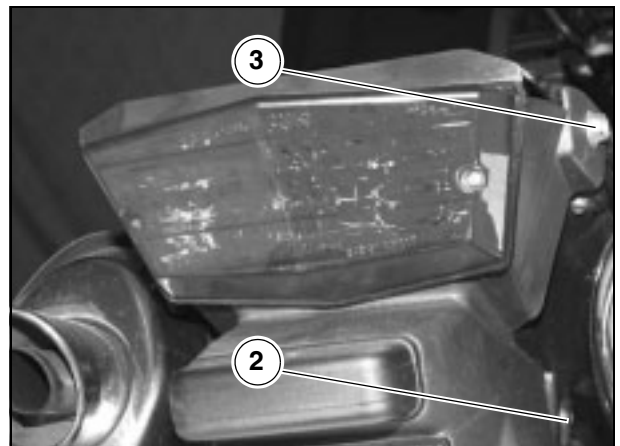


Torque wrench setting for screw (2): 5 Nm (0.5 kgm).

- ◆★ Release and remove the screw (3).

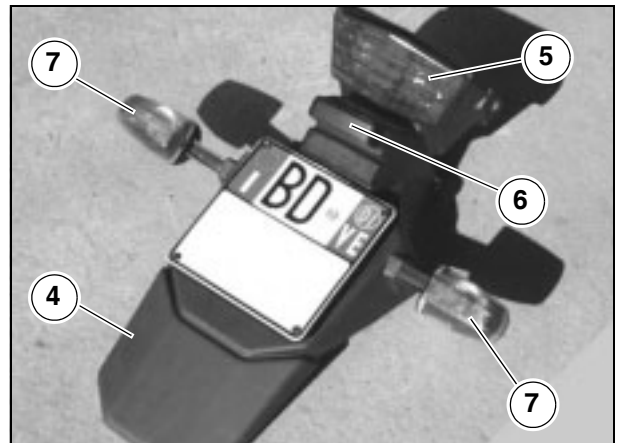


Torque wrench setting for screw (3): 25 Nm (2.5 kgm).



- ◆ Remove the number plate bracket (4) together with tail light (5), number plate light (6) and rear direction indicators (7).

NOTE If needed, the individual components can be separated.



7.1.35 REMOVING THE PASSENGER FOOTPEGS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.

⚠ CAUTION

Allow the engine and exhaust silencer to cool down completely.

- ◆ Release and remove the two screws (1).



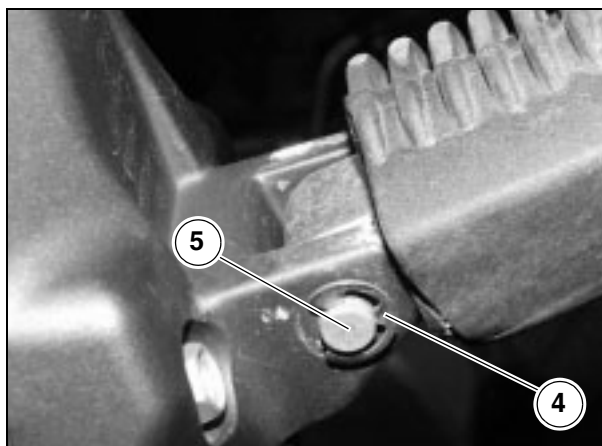
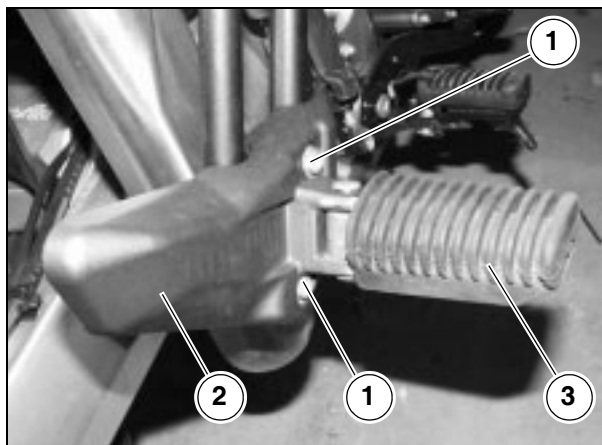
Torque wrench setting for screws (1): 25 Nm (2.5 kgm).

- ◆ Remove the heat guard (2) complete with footpeg (3).

If needed:

- ◆ Remove the retaining ring (4).
- ◆ Withdraw the spindle (5).
- ◆ Remove the footpeg (3).

NOTE Repeat process to remove the other passenger footpeg, if needed.



7.1.36 REMOVING THE LEFT-HAND RIDER FOOTPEG BRACKET

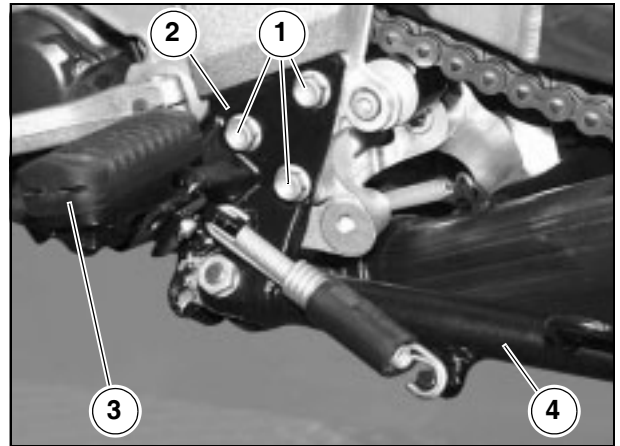
- ◆ Perform the steps marked with an “●” described in subsection see 7.1.43 (SIDE STAND REMOVAL).
- ◆ Release and remove the three screws (1).

NOTE Lubricate the screws (1) with oil (part no. 8116050) on assembly.



Torque wrench setting for screws (1): 50 Nm (5.0 kgm).

- ◆ Remove the left-hand rider footpeg bracket (2) complete with left-hand rider footpeg (3) and side stand (4).



7.1.37 REMOVING THE RIGHT-HAND RIDER FOOTPEG BRACKET

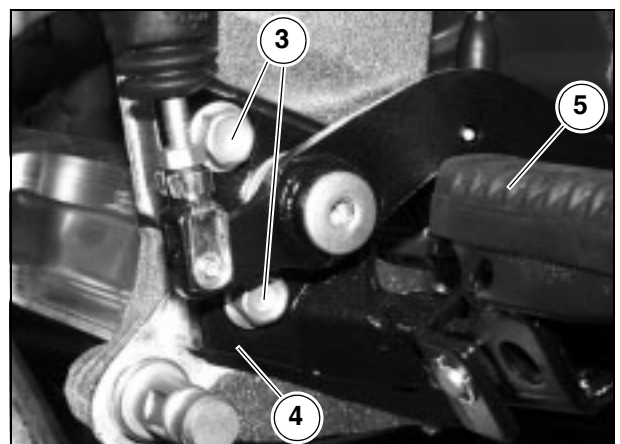
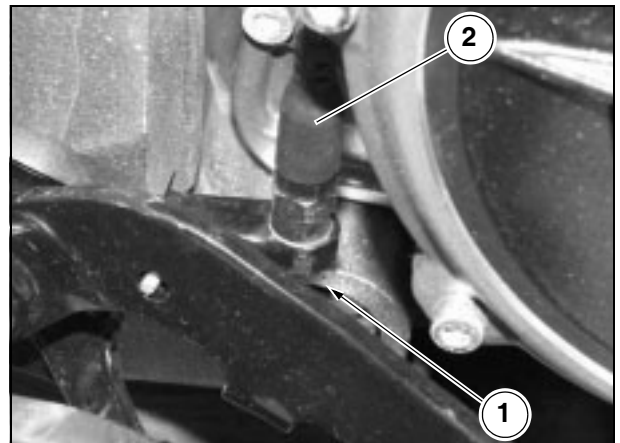
- ◆ Remove the rear brake lever, see subsection 7.1.40 (REMOVING THE REAR BRAKE LEVER).
- ◆ Undo and remove the nut (1).
- ◆ Remove the rear brake light switch (2).
- ◆ Release and remove the two screws (3).

NOTE Lubricate the screws (3) with oil (part no. 8116050) on assembly.



Torque wrench setting for screws (3): 50 Nm (5.0 kgm).

- ◆ Remove the right-hand rider footpeg bracket (4) complete with right-hand rider footpeg (5).



7.1.38 REMOVING THE RIDER FOOTPEG

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

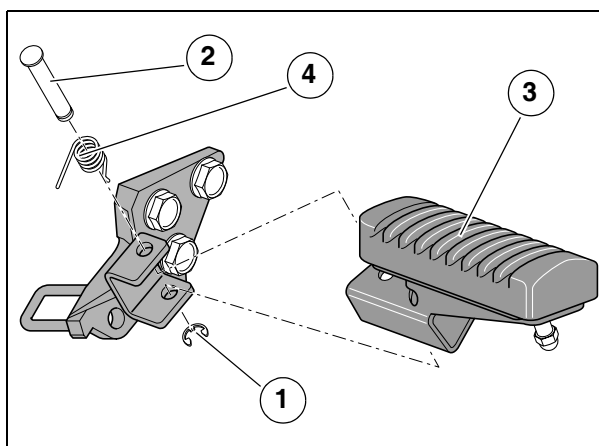
- ◆ Place the motorcycle on the stand.

⚠ CAUTION

Allow for the engine and exhaust silencer to cool down completely.

- ◆ Remove the retaining ring (1).
- ◆ Withdraw the spindle (2).
- ◆ Collect footpeg (3) and spring (4).

NOTE Repeat the process to remove the other rider footpeg if needed.



7.1.39 REMOVING THE GEAR SHIFT LEVER ASSEMBLY

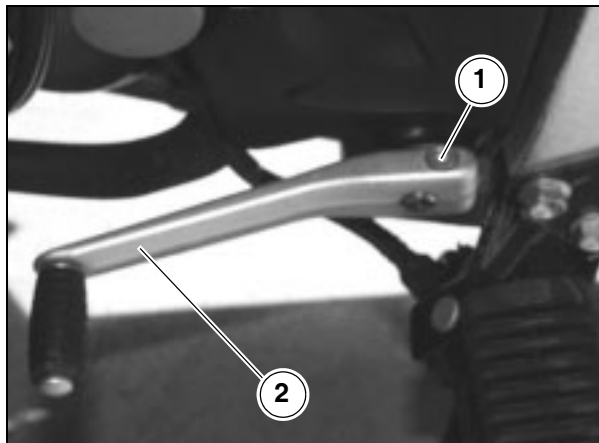
⚠ WARNING

Mark lever and spindle before removal to ensure they are refitted in the correct position on assembly.

- ◆ Place the motorcycle on the centre stand.
- ◆ Slacken the screw (1) and slide the gear shift lever (2) off the spindle.



Torque wrench setting for screws (1): 10 Nm (1.0 kgm).



7.1.40 REMOVING THE REAR BRAKE LEVER

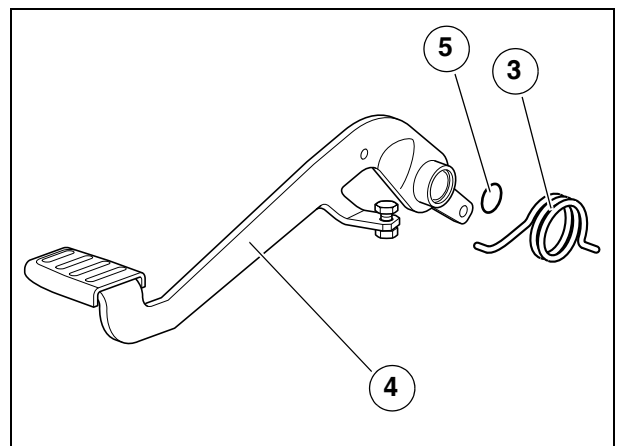
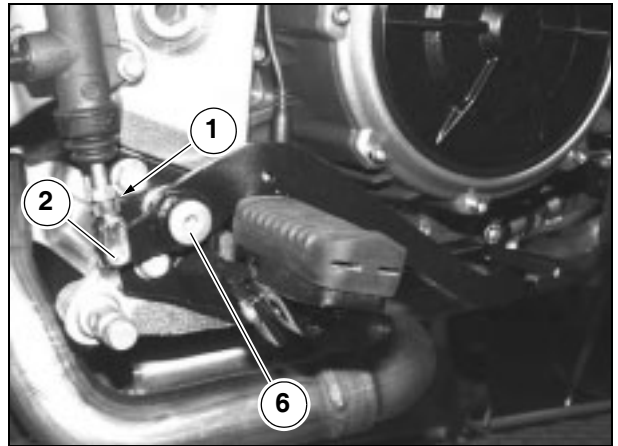
Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Move the safety ring (1) aside.
- ◆ Rotate the pin (2) of the clevis pin fork downwards.
- ◆ Withdraw the pin (2) of the clevis pin fork.
- ◆ Unhook the spring (3) from the lever (4) and collect the seal (5).
- ◆ Release and remove the pivot bolt (6) and collect the O-ring.
- ◆ Remove the lever (4).

NOTE Apply LOCTITE® 243 to the thread of the pivot bolt (6) on assembly.



Torque wrench setting for pivot bolt (6): 20 Nm (2.0 kgm).



7.1.41 EXHAUST SILENCER REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.

CAUTION

Allow the engine and exhaust silencer to cool down completely.

- ◆ Release the spring (1) from the hooks on the exhaust silencer (3).

WARNING

Inspect the spring (1) and replace as required.

- ◆ Release and remove the two screws (2). Hold the two nuts (4) on the opposite side steady to aid removal.



Torque wrench setting for nuts (4): 25 Nm (2.5 kgm).

- ◆ Collect the six washers (5), the four rubbers (6) and the two spacers (7).
- ◆ Change the rubbers (6) if damaged.
- ◆ Twist the exhaust silencer (3) slightly in both directions to eliminate any resistance due to scale accumulation.
- ◆ Withdraw the exhaust silencer (3) until removing it completely.

WARNING

Block off the exhaust pipe opening to prevent the ingress of dirt.

If needed, remove the guards as follows:

- ◆ Release and remove the four screws (8) and collect the washers (9).

NOTE Apply LOCTITE® 243 to the four screws (8) on assembly.



Torque wrench setting for screws (8) (for models not equipped with catalytic converter part no. 68200): 10 Nm (1.0 kgm).



Torque wrench setting for screws (8) (for models equipped with catalytic converter part no. 68201): 8 Nm (0.8 kgm).

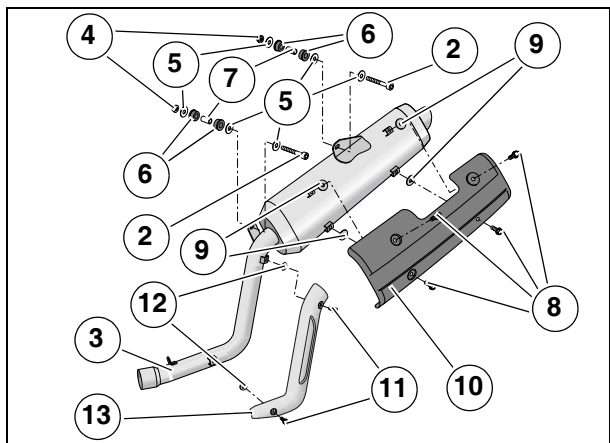
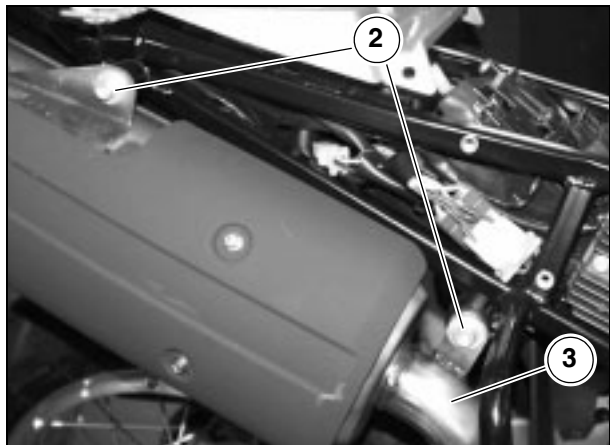
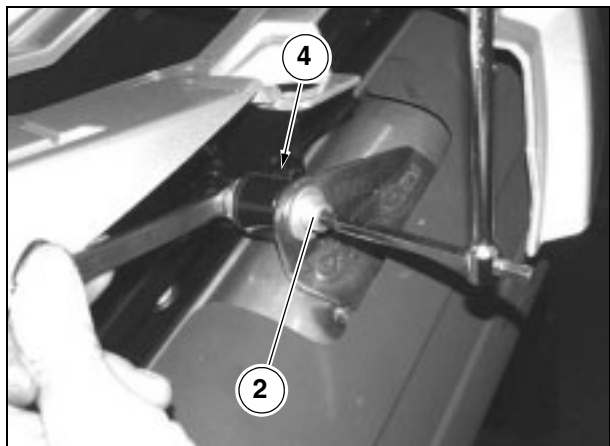
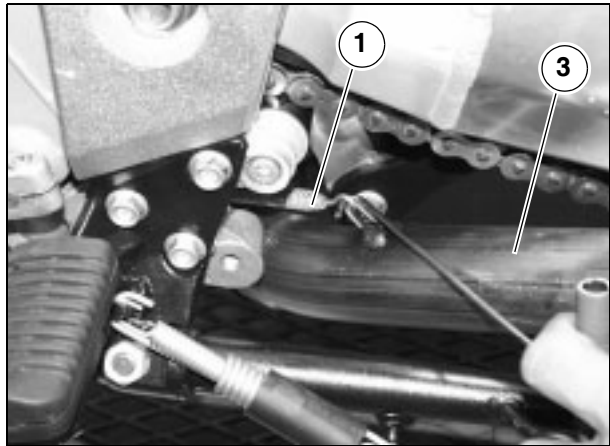
- ◆ Remove the silencer guard (10).
- ◆ Release and remove the two screws (11) and collect the washers (12).



Torque wrench setting for screws (11): 10 Nm (1.0 kgm).

- ◆ Remove the exhaust pipe guard (13).

NOTE Repeat process for the other exhaust silencer, if needed.



7.1.42 REMOVING THE EXHAUST PIPES

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

CAUTION

Allow the engine to cool down to ambient temperature.

- ◆ Remove the exhaust silencer, see 7.1.41 (EXHAUST SILENCER REMOVAL).
- ◆ Remove the radiator spoiler, see 7.1.23 (REMOVING THE UPPER SUMP GUARD) and see 7.1.24 (REMOVING THE LOWER SUMP GUARD).
- ◆ Release the spring (1) from the hook on the exhaust pipe (2).
- ◆ Remove the spring (1).

WARNING

Inspect the spring (1) and replace as required.

- ◆ Undo and remove the three nuts (3) that secure the exhaust pipe flange (4) to the front cylinder.

 Torque wrench setting for nuts (3): 25 Nm (2.5 kgm).

- ◆ Undo and remove the three nuts (6) that secure the exhaust pipe flange (2) to the rear cylinder.

 Torque wrench setting for nuts (6): 25 Nm (2.5 kgm).

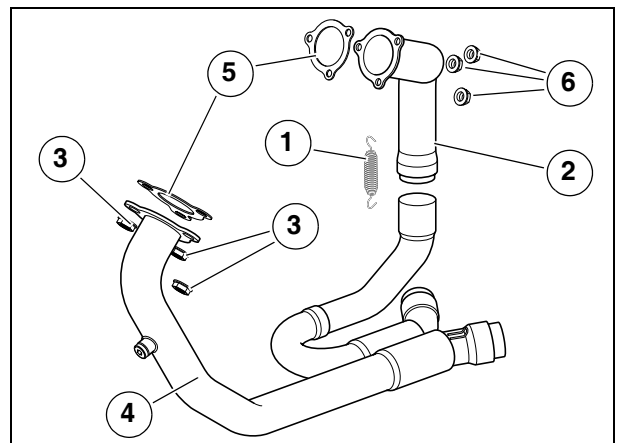
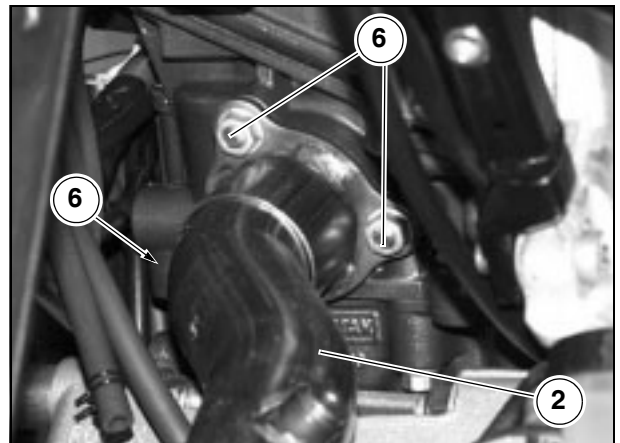
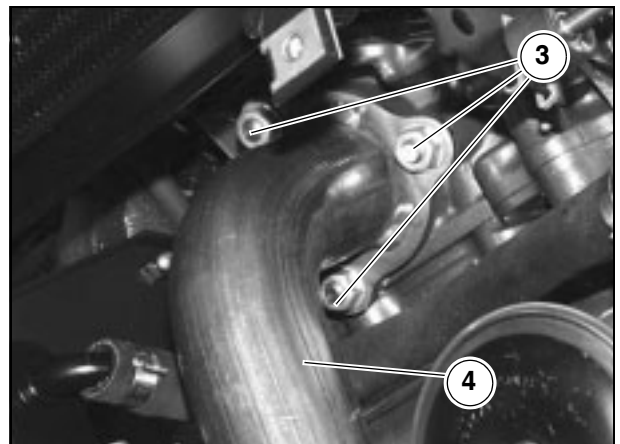
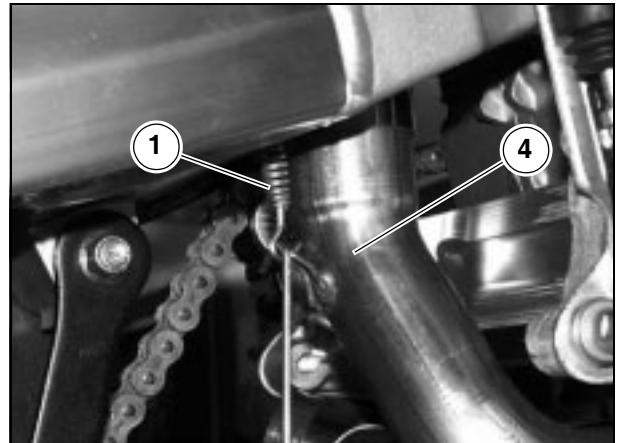
WARNING

Pull gently when separating the exhaust pipes (4 - 2) from the cylinders, or the stud bolt threads will damage.

- ◆ Twist the exhaust pipe (2) slightly in both direction and pull until lifting it off the exhaust pipe (4).
- ◆ Detach the exhaust pipe (2) from the rear cylinder.
- ◆ Move the exhaust pipe (4) forward until sliding the flange off the front cylinder stud bolts.
- ◆ Detach the exhaust pipe (4) from the front cylinder.

WARNING

Inspect the two gaskets (5) and renew them as required. Use the same type fitted originally. Block off the engine exhaust outlets to prevent the ingress of dirt.



7.1.43 SIDE STAND REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the centre stand **OPT**.

⚠ WARNING

Take care not to damage the switch (1).
The nut (2) should never be disturbed while the switch (1) is in place.

- ◆● Remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆● Disconnect the connector (3) from the main wiring harness.

⚠ WARNING

Ensure that the connector (3) is fitted to the matching connector on assembly.

- ◆● Release the wire from the hook.

⚠ WARNING

Make sure to route the wire correctly when refitting.

- ◆ Release the two springs (4).
- ◆ Undo and remove the nut (2) and collect the washers (5).



Torque wrench setting for nut (2): 30 Nm (3.0 kgm).

- ◆ Release and remove the pivot bolt (7) complete with stand switch (1).
- ◆ Remove the stand (6).

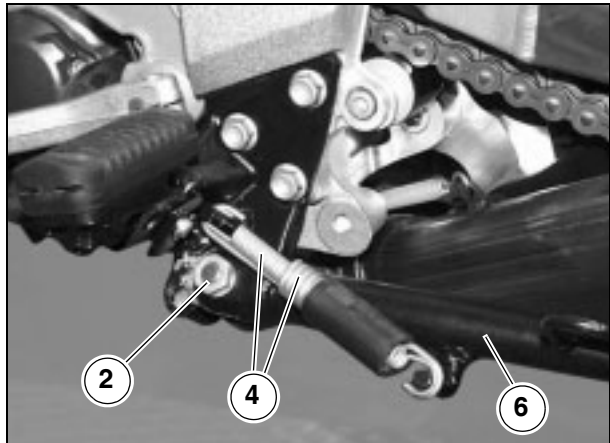
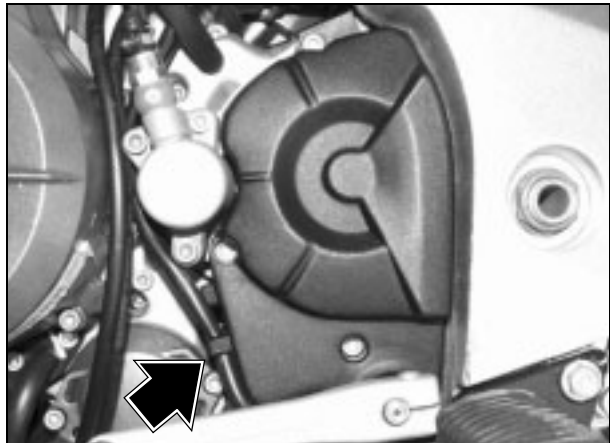
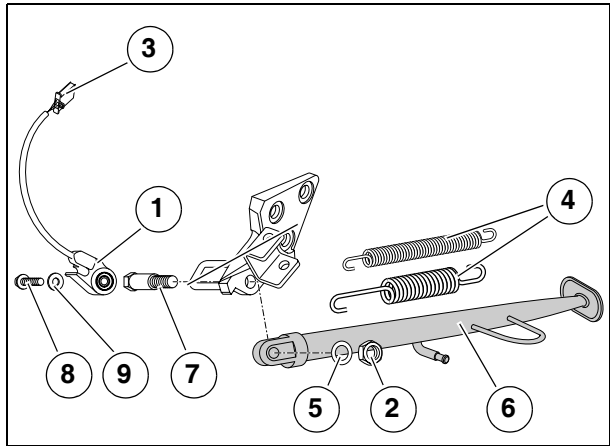
If you need to remove the side stand switch (1) only:

- ◆ Perform the steps identified with an "●".
- ◆ Release and remove the screw (8) and collect the washer (9).

⚠ WARNING

Apply **LOCTITE® 243** to the thread of screw (8) on assembly.

- ◆ Remove the switch (1).



7.1.44 REMOVING THE ENGINE OIL TANK

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.2 (ENGINE OIL) carefully.

- ◆ Drain all engine oil, see 2.12 (ENGINE OIL AND FILTER CHANGE).
- ◆ Remove the upper sump guard, see 7.1.23 (REMOVING THE UPPER SUMP GUARD).
- ◆ Undo and remove the three nuts (1).



Torque wrench setting for nuts (1): 8 Nm (0.8 kgm).

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips using new clips of the same type fitted originally on assembly.

- ◆ Release the clip (2).
- ◆ Detach the hose (3) from the engine oil filter (4).
- ◆ Tilt the oil tank (9).
- ◆ Release the two clips (5-6).
- ◆ Withdraw the hoses (7-8).
- ◆ Remove the oil tank (9).
- ◆ Release and remove the engine oil filter (4) fitted to the tank and blow it with compressed air.
- ◆ Check the seal of the engine oil filter (4) fitted to the tank (9). Refit and tighten the filter.



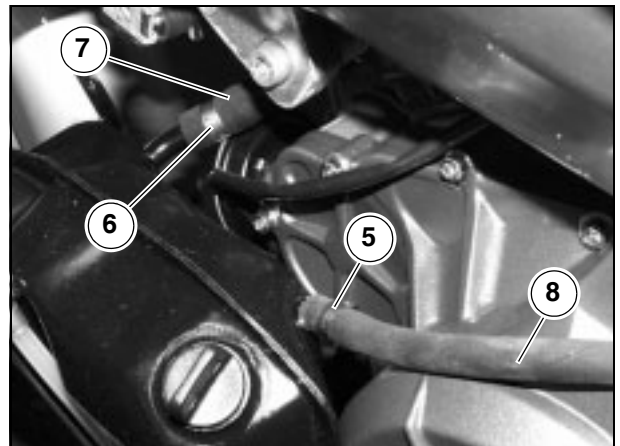
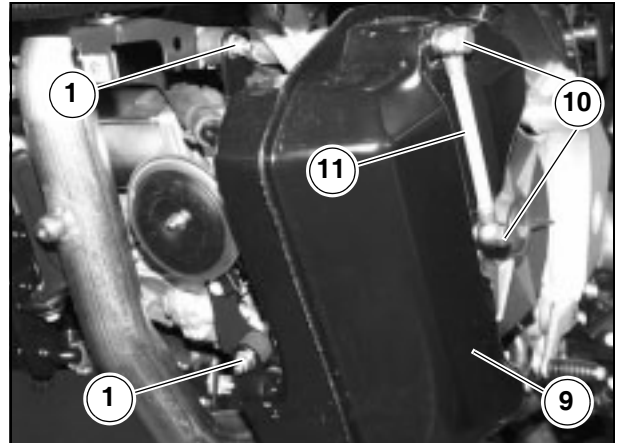
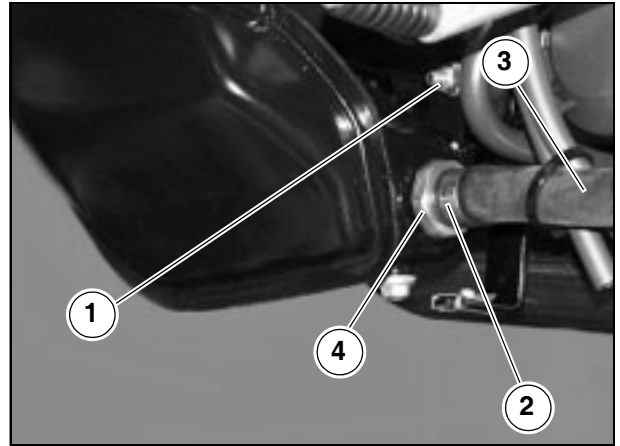
Torque wrench setting for engine oil tank (9) filter (4): 30 Nm (3.0 kgm).

- ◆ If needed, release and remove the two screws (10) to extract the oil sight glass (11) and collect the seals.



Torque wrench setting for screws (10): 20 Nm (2.0 kgm).

NOTE Replace oil sight glass (11) and seals if damaged.



7.1.45 OIL COOLER REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 1.2.2 (ENGINE OIL) carefully.

- ◆ Drain all engine oil, see 2.12 (ENGINE OIL AND FILTER CHANGE).

NOTE Make sure to have the special clip pliers (part no. 0277295) ready at hand. Renew all clips using new clips of the same type fitted originally on assembly.

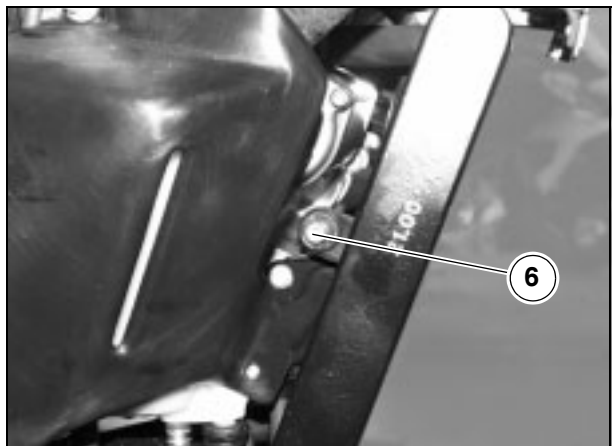
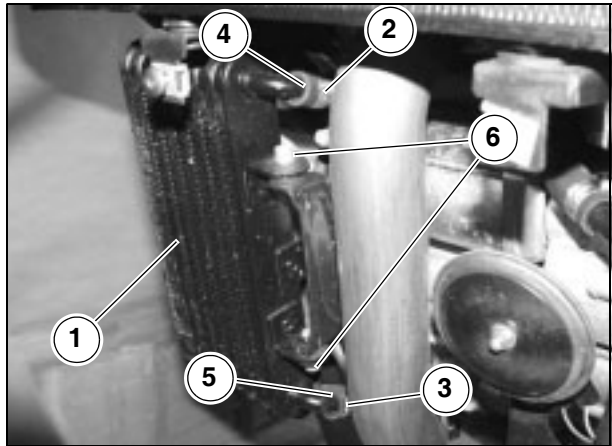
- ◆ Release the clips (2-3).
- ◆ Withdraw the hoses (4-5).
- ◆ Release and remove the three retaining screws (6).



Torque wrench setting for screws (6): 10 Nm (1.0 kgm).

NOTE Replace the seals if damaged.

- ◆ Remove the oil cooler (1).



7.1.46 UPPER CHAIN GUARD REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Release and remove the screw (1).



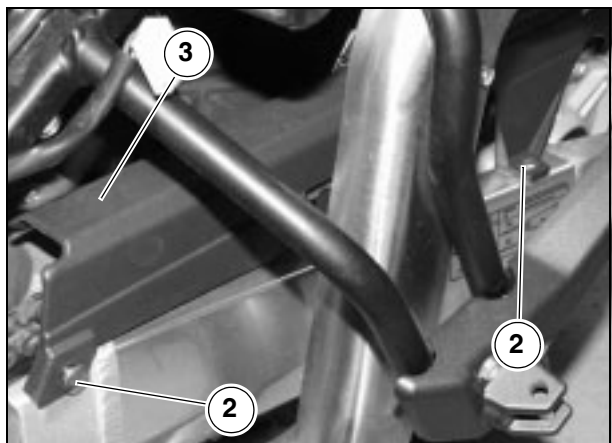
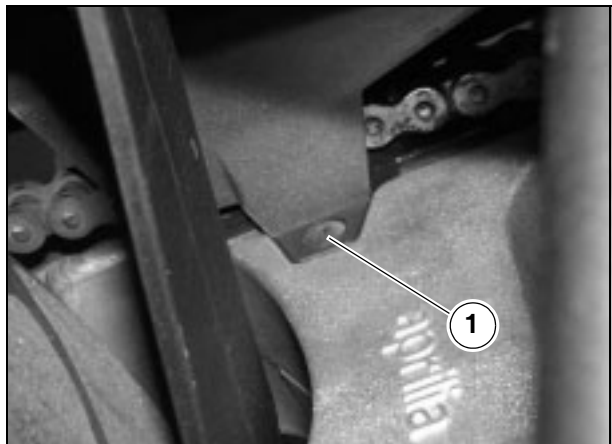
Torque wrench setting for screw (1): 5 Nm (0.5 kgm).

- ◆ Release and remove the two screws (2).



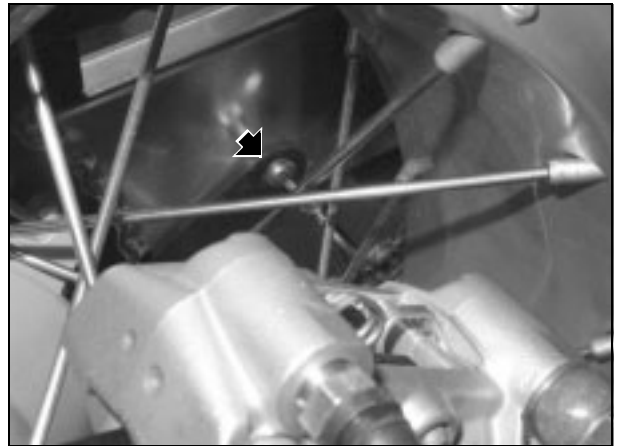
Torque wrench setting for screws (2): 5 Nm (0.5 kgm).

- ◆ Remove the chain guard (3).



7.1.47 REMOVING THE CHAIN GUARD

- ◆ Unscrew and remove the front fixing screw.
- ◆ Unscrew and remove the lower fixing screw.
- ◆ Remove the guard.



7.1.48 REMOVING THE DRIVE CHAIN SLIDER

- ◆ Remove the guide plate, see 2.35.5 (DRIVE CHAIN GUIDE PLATE INSPECTION).

NOTE Engage the first gear to lock out sprocket (4) movement while turning out the screw (1).

- ◆ Release and remove the screw (1) and collect the two washers (2-3).

NOTE Apply LOCTITE® 243 to the thread of the screw (1) on assembly.



Torque wrench setting for screw (1): 50 Nm (5 kgm).

NOTE Slacken the drive chain a bit to facilitate removal of the drive sprocket (4). See 2.35.3 (CHAIN SLACK ADJUSTMENT).

- ◆ Withdraw the drive sprocket (4) together with the chain from the shaft.
- ◆ Remove the drive sprocket (4).

NOTE Apply LOCTITE® Anti-Seize to the inner tooting of the drive sprocket (4) on assembly.

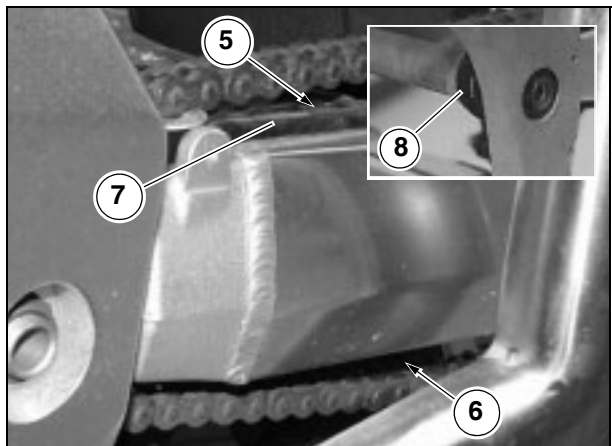
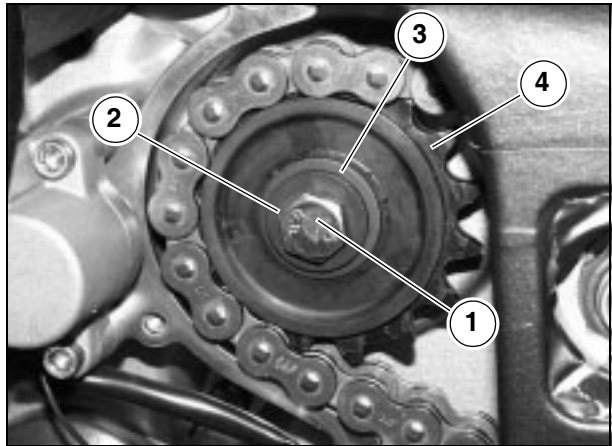
- ◆ Remove the upper chain guard, see 7.1.46 (UPPER CHAIN GUARD REMOVAL).
- ◆ Release and remove the screws (5-6).



Torque wrench setting for screws (5-6): 5 Nm (0.5 kgm).

- ◆ Pull the chain slider (7) from the front to remove.

NOTE Ensure that the slider recess (7) locates on the seat (8) on the swinging arm on assembly. Apply LOCTITE® 243.



7.1.49 REAR SUBFRAME REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove both side body panels, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ◆ Remove the seat lower moulded cover, see 7.1.33 (REMOVING THE SEAT END COVER).
- ◆ Remove the exhaust pipes, see 7.1.42 (REMOVING THE EXHAUST PIPES).
- ◆ Disconnect the two connectors (2).

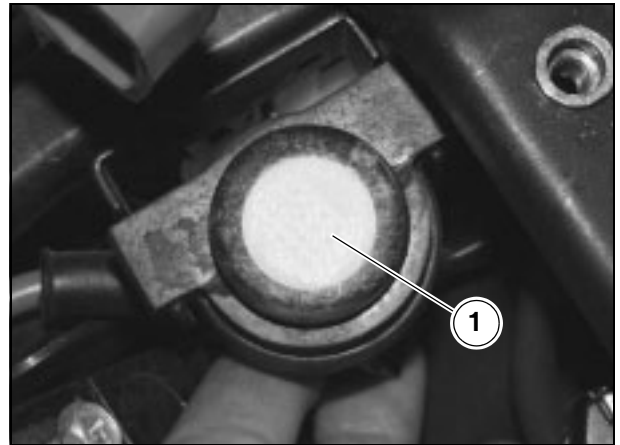
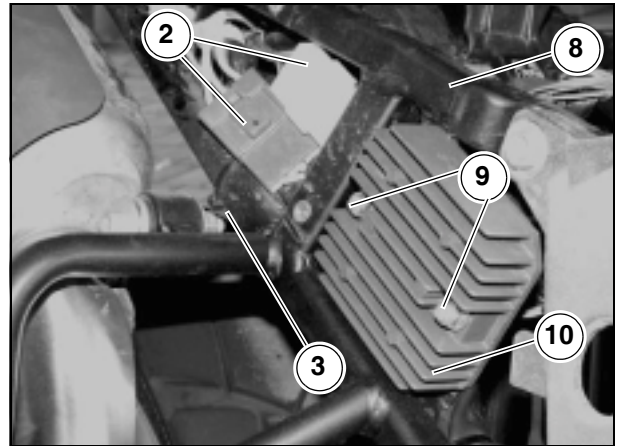
⚠ WARNING

Ensure that the two connectors (2) are fitted to the matching connectors on assembly.

- ◆ Release and remove the two screws (9).
- ◆ Remove the rectifier (10).
- ◆ Release the wire from the clips (3).

NOTE You will have to renew all the clips on refitting. Make sure to have enough spare clips ready at hand.

- ◆ Release the starter relay housing (1) from its mount.



- ◆ Release and remove the two screws (4) from the shock absorber adjuster knob (5).
- ◆ Move aside the shock absorber adjuster knob (5).

⚠ WARNING

Take care not to damage the shock absorber hose.

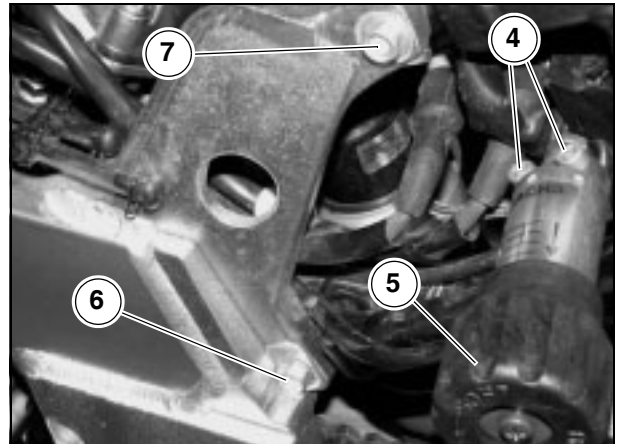
- ◆ ★ Release and remove the lower screw (6).

 Torque wrench setting for screw (6): 50 Nm (5.0 kgm).

- ◆ ★ Release and remove the upper screw (7).

 Torque wrench setting for screw (7): 50 Nm (5.0 kgm).

- ◆ Remove the rear subframe (8) complete with passenger footpeg brackets.



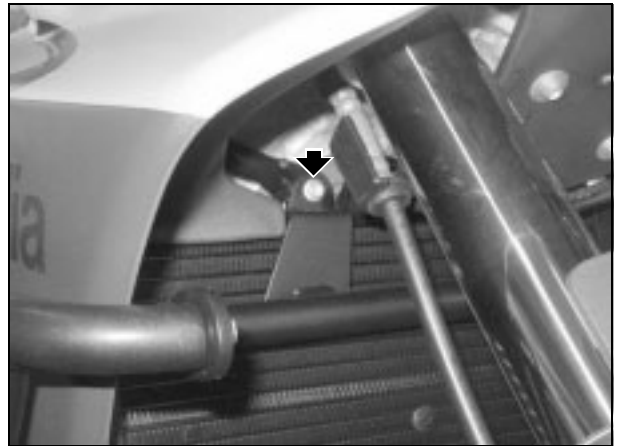
7.1.50 REMOVING THE SIDE GUARDS

- ◆ Unscrew and remove the rear screw and bush.
- ◆ Unscrew and remove the front fixing screw.
- ◆ Remove the side guard.



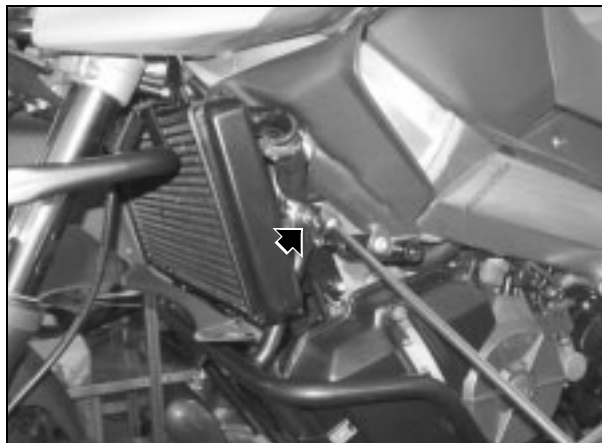
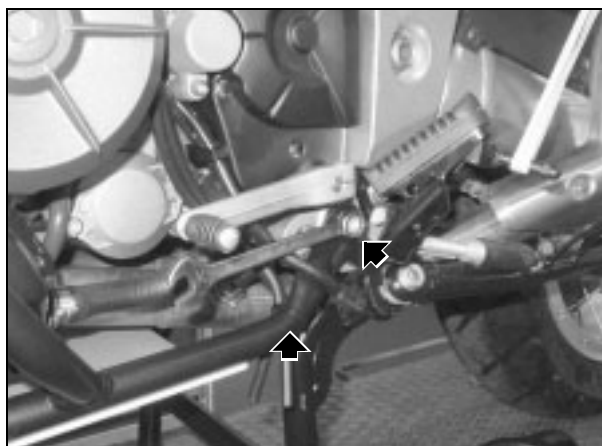
7.1.51 REMOVING THE INNER GUARD

- ◆ Unscrew and remove the two rear screws.
- ◆ Unscrew and remove the two front screws.
- ◆ Remove the inner guard.



7.1.52 REMOVING THE SUMP GUARD PROTECTION

- ◆ Remove the side guards see 7.1.50 (REMOVING THE SIDE GUARDS).
- ◆ Remove the two side fairings.
- ◆ Remove the upper sump guard see 7.1.23 (REMOVING THE UPPER SUMP GUARD).
- ◆ Remove the lower sump guard see 7.1.24 (REMOVING THE LOWER SUMP GUARD).
- ◆ Remove the hose clamp that holds the breather pipes on the left.
- ◆ Unscrew and remove the two rear fixing bolts.
- ◆ Unscrew and remove the two front fixing bolts.
- ◆ Remove the sump guard protection.



7.1.53 FRAME REMOVAL

⚠ WARNING

Frame (1) removal must be carried out at an Authorised Service Centre or by Authorised aprilia Dealers.

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

⚠ WARNING

Frame (1) removal is a complex operation. Plan work ahead and locate affected parts on the vehicle before proceeding.

Removal procedures are listed in the proper sequence in this section.

Each procedure is cross-referred to the relevant section of the manual and some of the operations described there may not be necessary for the job at hand. To avoid redundant work, always make sure you really need to remove a particular component before proceeding.

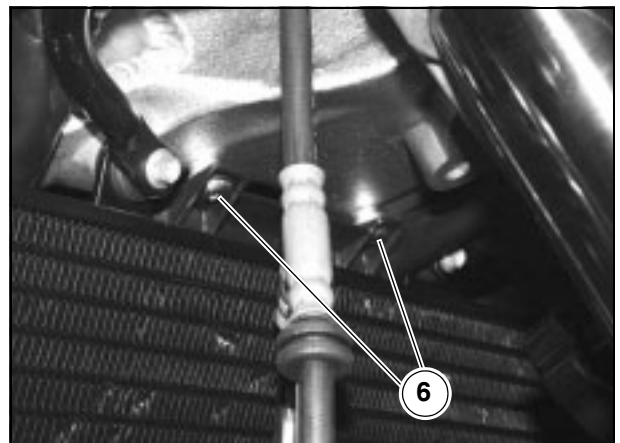
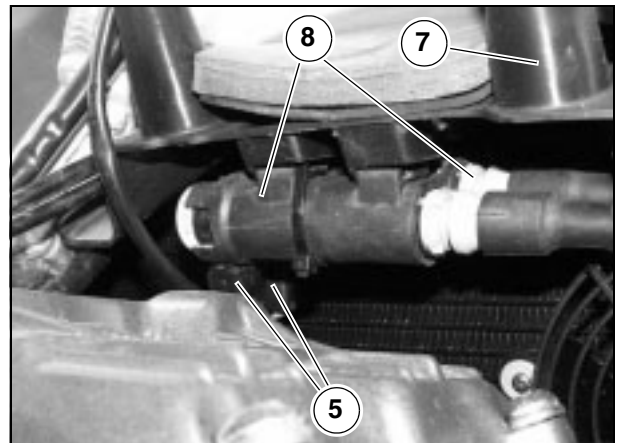
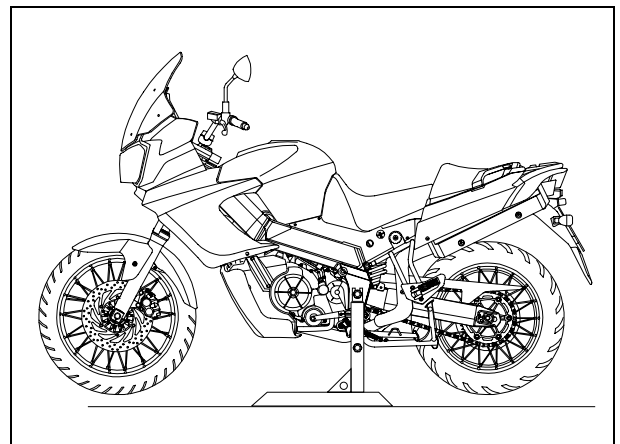
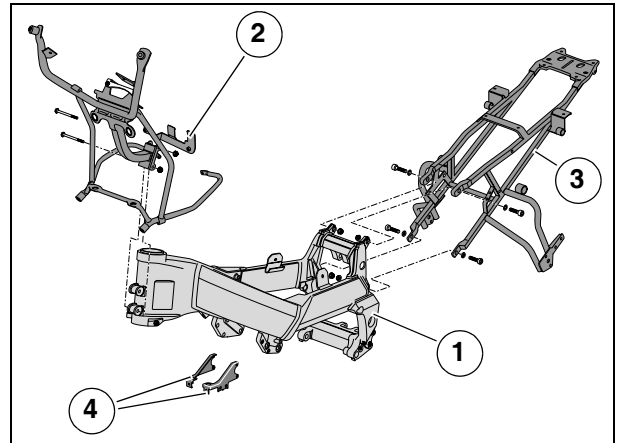
Be sure to perform just the operations strictly required to give access to the component to be removed.

- ◆ Remove the engine, see 3.3 (TAKING THE ENGINE OUT OF THE FRAME).
- ◆ Place the motorcycle on the special centre stand **OPT**, see 1.9.2 (PLACING THE MOTORCYCLE ON THE CENTRE STAND).
- ◆ Remove the front end complete with front wheel assembly, see 7.6.1 (HEADSTOCK REMOVAL).
- ◆ Remove the instrument panel subframe (2), see 7.1.26 (REMOVING THE INSTRUMENT PANEL/Front FAIRING SUBFRAME).
- ◆ Remove the complete rear subframe (3), see 7.1.49 (REAR SUBFRAME REMOVAL).
- ◆ Remove the tail end complete with rear wheel assembly, see 7.8.1 (REMOVING THE REAR SWINGING ARM).
- ◆ Remove the rear shock absorber, see 7.9.1 (REAR SHOCK ABSORBER REMOVAL).
- ◆ Disconnect the two connectors (5).

⚠ WARNING

Ensure the terminals are refitted to the matching connectors on assembly.

- ◆ Release and remove the two screws (6).
- ◆ Remove the subframe (7) with front coils (8).



- ◆ ★ Release and remove the two screws (9).

 **Torque wrench setting for screws (9): 10 Nm (1.0 kgm).**

- ◆ Remove the two cooler supports (4).
- ◆ ★ Release and remove the screw (10).

 **Torque wrench setting for screw (10): 12 Nm (1.2 kgm).**

- ◆ ★ Remove the fairing side securing plate (11).
- ◆ Remove the right-hand rider footpeg bracket, see 7.1.37 (REMOVING THE RIGHT-HAND RIDER FOOTPEG BRACKET)

⚠ WARNING

Release all wiring clips along the whole length of the wiring.
 Make sure to have enough spare clips to secure the wiring on assembly.

- ◆ Disconnect the connector (15) of the side stand switch.

⚠ WARNING

Make sure to refit the connector to the matching connector (15) on assembly.

⚠ WARNING

Use great care when removing the side stand bracket (13) or you might damage the switch.

- ◆ Release and remove the three screws (12).
- ◆ Remove the left-hand rider footpeg bracket (13) complete with side stand (14) and switch.

 **Torque wrench setting for screws (12): 50 Nm (5.0 kgm).**

NOTE Lubricate the screws (12) with oil (part no. 8116050) on assembly.

- ◆ Place the frame (1) in a sling and hook the slings to a hoist to support the frame.

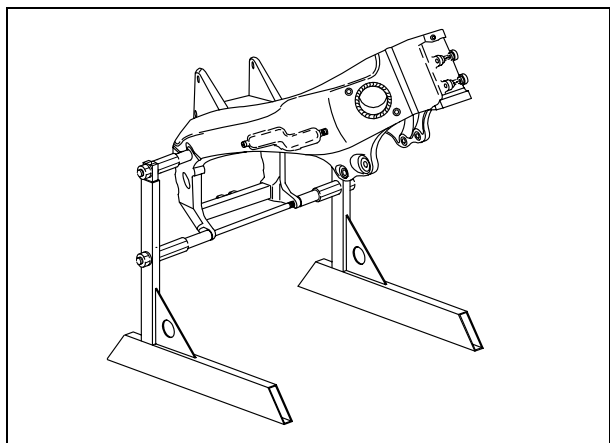
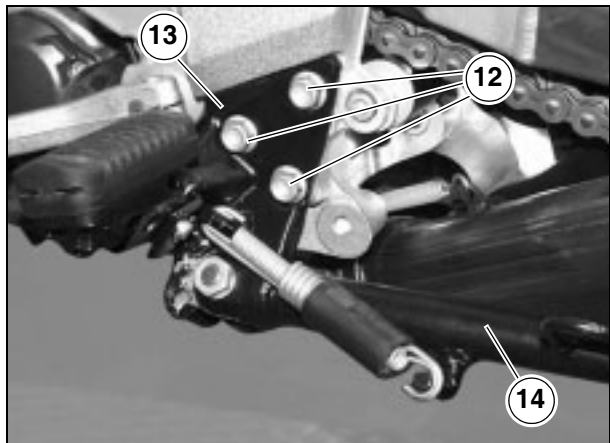
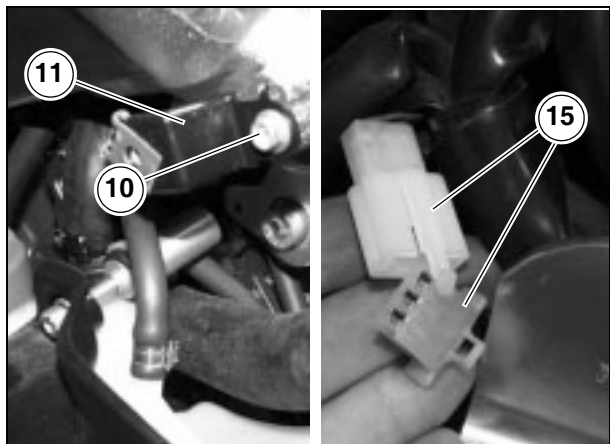
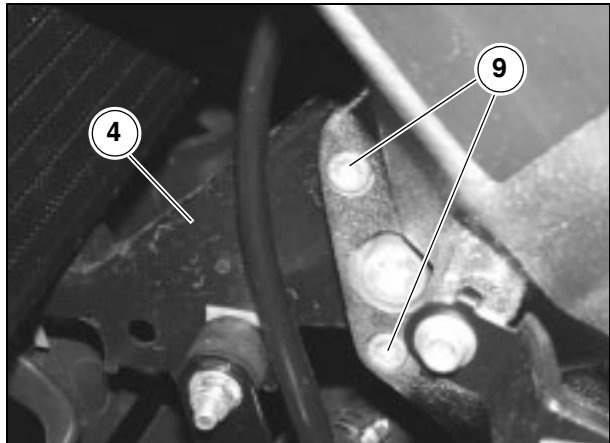
⚠ WARNING

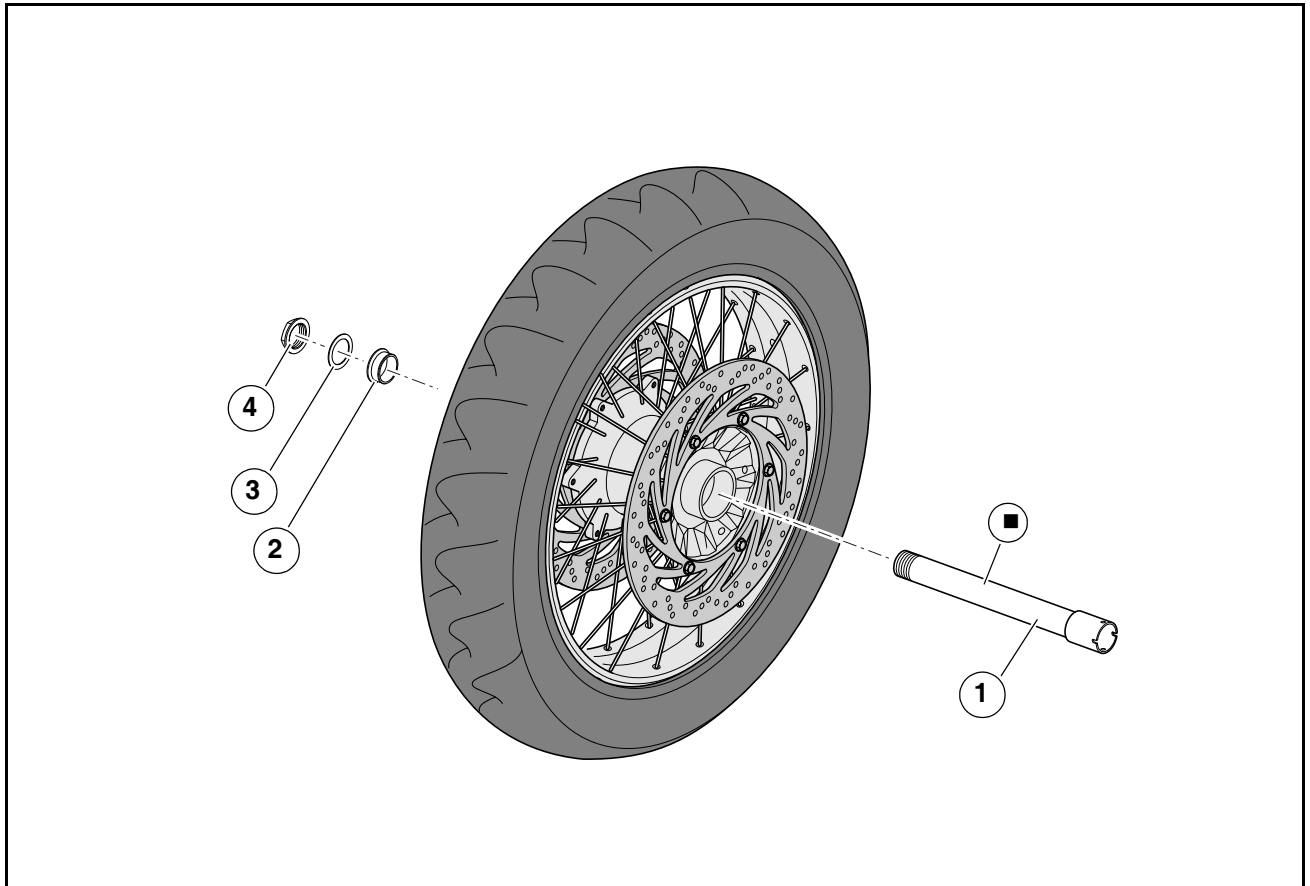
Slings and hoist must have adequate carrying capacity to support the frame (1) in full safety.
 Frame weight: 9.9 Kg.

- ◆ Lift the frame (1) just enough to allow removal of the centre stand OPT.

After re-installing the frame, check the following:

- ◆ Ensure that all components are fastened securely.
- ◆ Check that wiring and cables are properly routed and fastened.
- ◆ Ensure that all connectors are properly fitted to the matching connectors.
- ◆ Turn the handlebars and check that cables and tubes do not bind.



7.2 FRONT WHEEL**Key**

- 1) Wheel spindle
- 2) Spacer
- 3) Washer
- 4) Nut

■ = GREASE, see 1.6 (LUBRICANT CHART).

7.2.1 ADJUSTING WHEEL SPOKE TENSION

See 2.33 (ADJUSTING WHEEL SPOKE TENSION)

7.2.2 WHEEL REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.31 (FRONT WHEEL) carefully.

⚠ WARNING

Use great care when removing the wheel to avoid damaging the brake lines, brake discs and brake pads.

- ◆ Place the motorcycle on the front wheel stand **OPT**, see 1.9.1 (PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND).

⚠ WARNING

Ensure that the motorcycle is safely supported and stable.

- ◆ Have an assistant hold the handlebars steady in position as in forward travel so that the steering cannot move.
- ◆ ★ Release and remove the two mounting bolts (1) of the front brake caliper (2).



Torque wrench setting for caliper mounting bolts (1): 50 Nm (5.0 kgm).

- ◆ ★ Remove the brake caliper (2) from the brake disc, but leave the caliper (3) attached to the brake line.

⚠ WARNING

Do not operate the front brake lever when the calipers are not in place, or the pistons might fall out leading to brake fluid spillage.

- ◆ Undo and remove the nut (4) and collect the washer and the spacer.



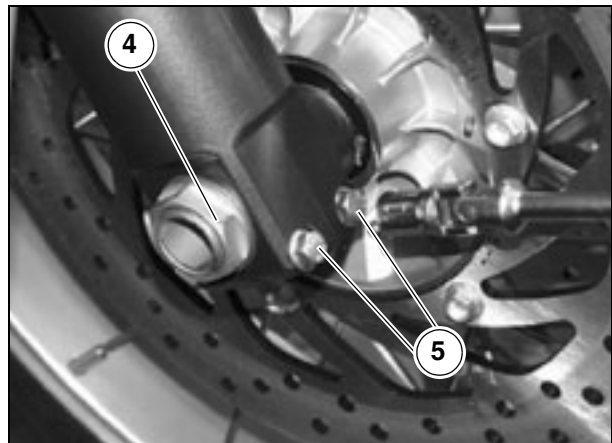
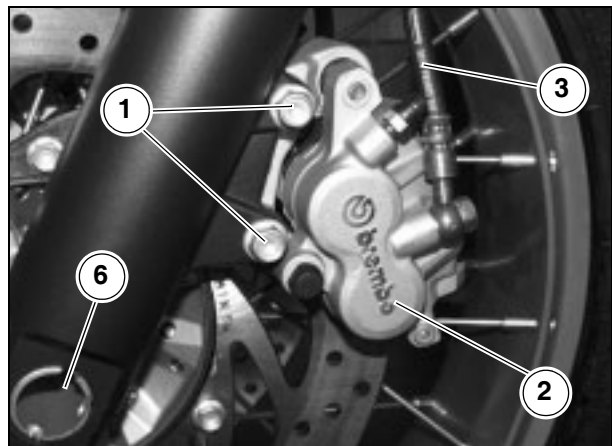
Torque wrench setting for wheel hub nut (4): 80 Nm (8.0 kgm).

- ◆ Slacken but do not remove the two wheel spindle clamp bolts (5).



Torque wrench setting for wheel spindle clamp bolts (5): 10 Nm (1.0 kgm).

- ◆ Withdraw the wheel spindle (6) from the left-hand side.
- ◆ Remove the wheel hub if needed; see 7.2.3 (WHEEL HUB DISASSEMBLY).



7.2.3 WHEEL HUB DISASSEMBLY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove the wheel, see 7.2.2 (WHEEL REMOVAL).
- ◆ Clean the wheel hub at both ends with a cloth.
- ◆ Remove the seal (1).
- ◆ Remove the left-hand bearing (2) using a suitable bearing extractor.
- ◆ Remove the circlip (3).
- ◆ Remove the right-hand bearing (4) using a suitable bearing extractor.

⚠ WARNING

Inspect the bearings after each removal and replace as required. See 7.2.4 (WHEEL COMPONENT INSPECTION).

- ◆ Collect the inner spacer (5).
- ◆ Clean the hub bore thoroughly.

NOTE Wash all components using clean detergent.

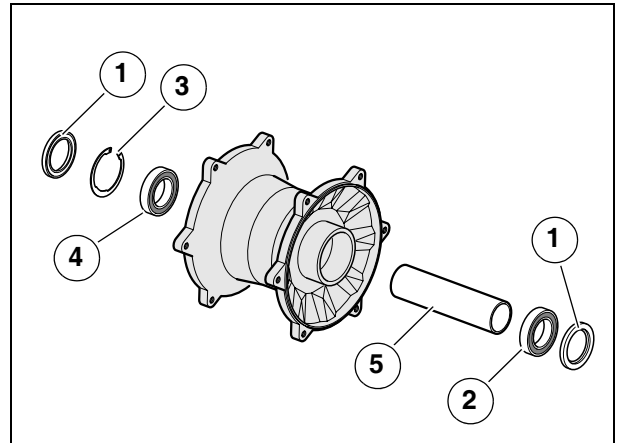
⚠ WARNING

Refit the bearings using a drift with the same diameter as the bearing outer ring.

Do not tap the balls or the inner ring.

Ensure that:

- the right-hand bearing (4) is fully home in the hub;
- the spacer (5) is fully home on the right-hand bearing (4);
- the left-hand bearing (2) is fully home on the spacer (5).



7.2.4 WHEEL COMPONENT INSPECTION

⚠ WARNING

Check that all components are in perfect condition. Inspect the following components with special care.

BEARINGS

- ◆ Rotate the inner ring (1) manually. The ring should turn smoothly, with no hardness or noise. There should be no end float. Replace any bearings that do not meet the above requirements.

SEALS

- ◆ Inspect the seals for damage or wear and replace as required.

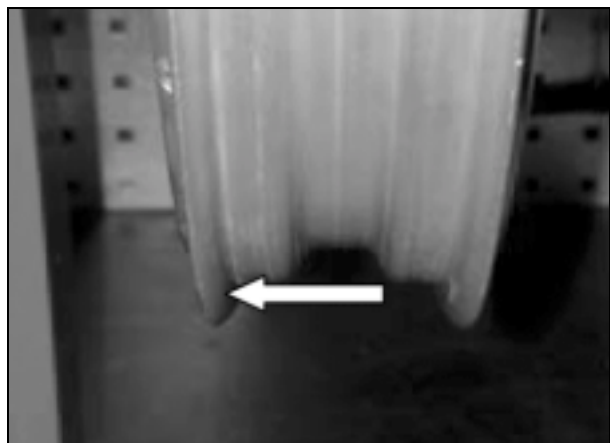
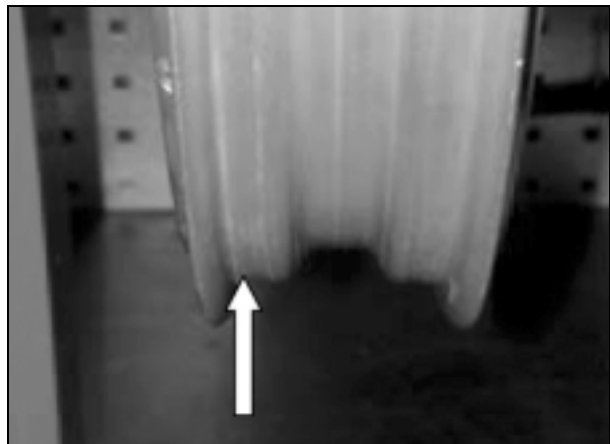
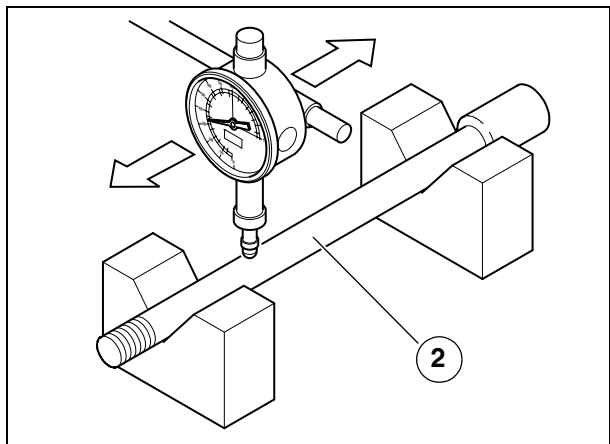
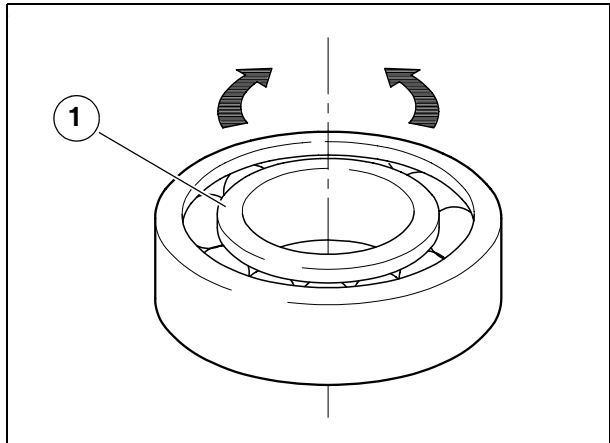
WHEEL SPINDLE

- ◆ Check spindle (2) run-out using a dial gauge. Replace the spindle (2) when run-out exceeds the maximum limit allowed.
Wheel spindle run-out limit: 0.25 mm.

WHEEL RIM

- ◆ Use a dial gauge to ensure that wheel rim radial and axial run-out does not exceed the maximum limit allowed. Exceeding run-out is normally due to worn or damaged bearings. Replace the bearings first, then re-check run-out. Replace the wheel rim if it still exceeds the maximum limit allowed.

Wheel rim radial and axial run-out limit: 1,2 mm.



7.2.5 REFITTING THE WHEEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

⚠ WARNING

Use great care when refitting the wheel to avoid damaging the brake lines, brake discs and brake pads. The arrow mark on the wheel side points in the direction of rotation. Make sure to refit the wheel in the correct direction: the arrow mark must be on the motorcycle left-hand side.

- ◆ Place the motorcycle on the front wheel stand OPT, see 1.9.1 (PLACING THE MOTORCYCLE ON THE FRONT WHEEL STAND)
- ◆ Smear a light coat of grease (part no. 8116053) over the total length of the wheel spindle (1).
- ◆ Place the wheel between the fork legs.

⚠ WARNING

Do not attempt to align the holes by putting your fingers into the holes. This could result in severe personal injury.

- ◆ Move the wheel until the wheel hub bore aligns with the holes in the forks.
- ◆ Slide the wheel spindle (1) fully home.
- ◆ Fit the washer and screw the nut (2) hand-tight.
- ◆ Tighten the two wheel spindle clamp bolts (3) to prevent wheel spindle (1) rotation.



Torque wrench setting for wheel spindle clamp bolts (3): 10 Nm (1.0 kgm).

- ◆ Tighten the nut (2) to the specified torque.



Torque wrench setting for wheel hub nut (2): 80 Nm (8.0 kgm).

- ◆ Tighten the two wheel spindle clamp bolts (4) to the specified torque.



Torque wrench setting for wheel spindle clamp bolts (4): 10 Nm (1.0 kgm).

⚠ WARNING

Use great care or you might damage the brake pads.

- ◆★ Fit the brake caliper (5) to the brake disc with the mounting holes aligned with the holes in the caliper carrier.

⚠ WARNING

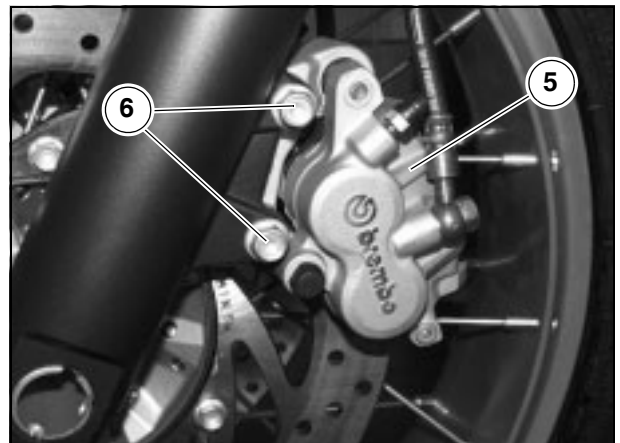
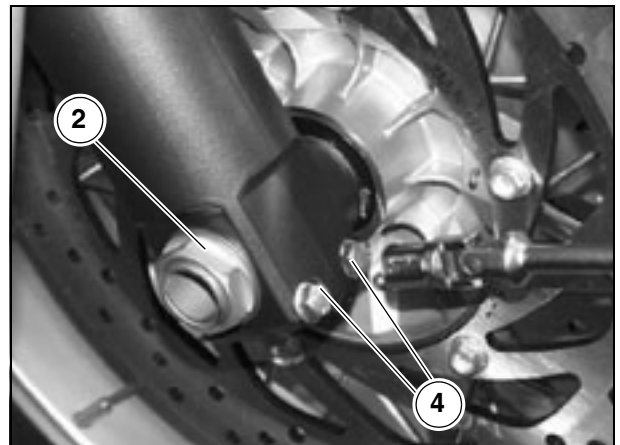
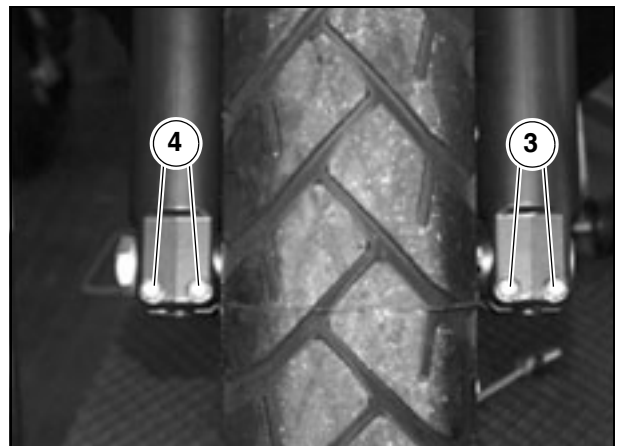
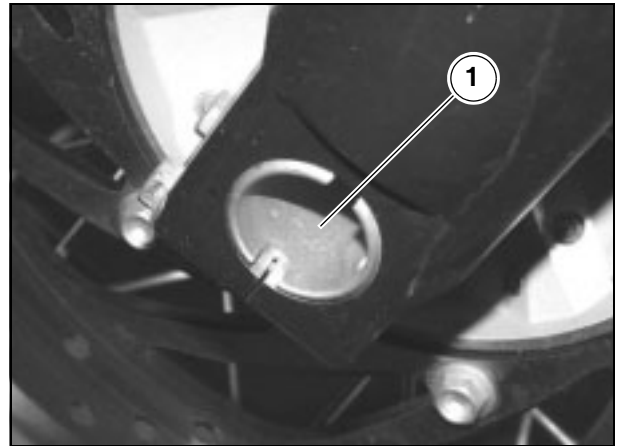
Replace both caliper (5) mounting bolts (6) with new bolts of the same type fitted originally. Lubricate with oil (part no. 8116050).

- ◆★ Start the two caliper mounting bolts (6) in their holes and tighten to the specified torque.



Torque wrench setting for caliper mounting bolts (6): 50 Nm (5.0 kgm).

- ◆ Slacken the two wheel spindle clamp bolts (3).



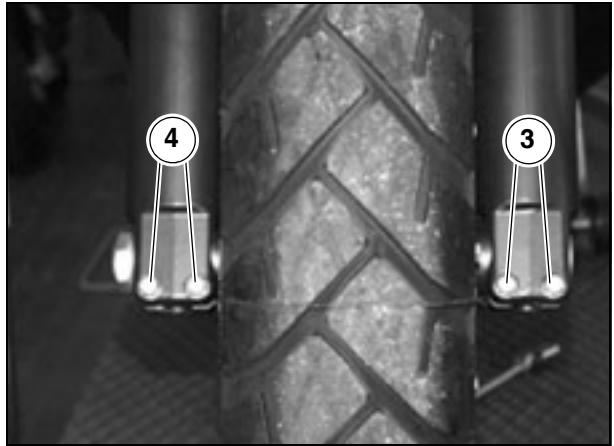
- ◆ Hold in the front brake lever and press down on the handlebars repeatedly to pump the front fork up and down.
This will allow the fork legs to seat themselves properly.
- ◆ Tighten the two wheel spindle clamp bolts (3).

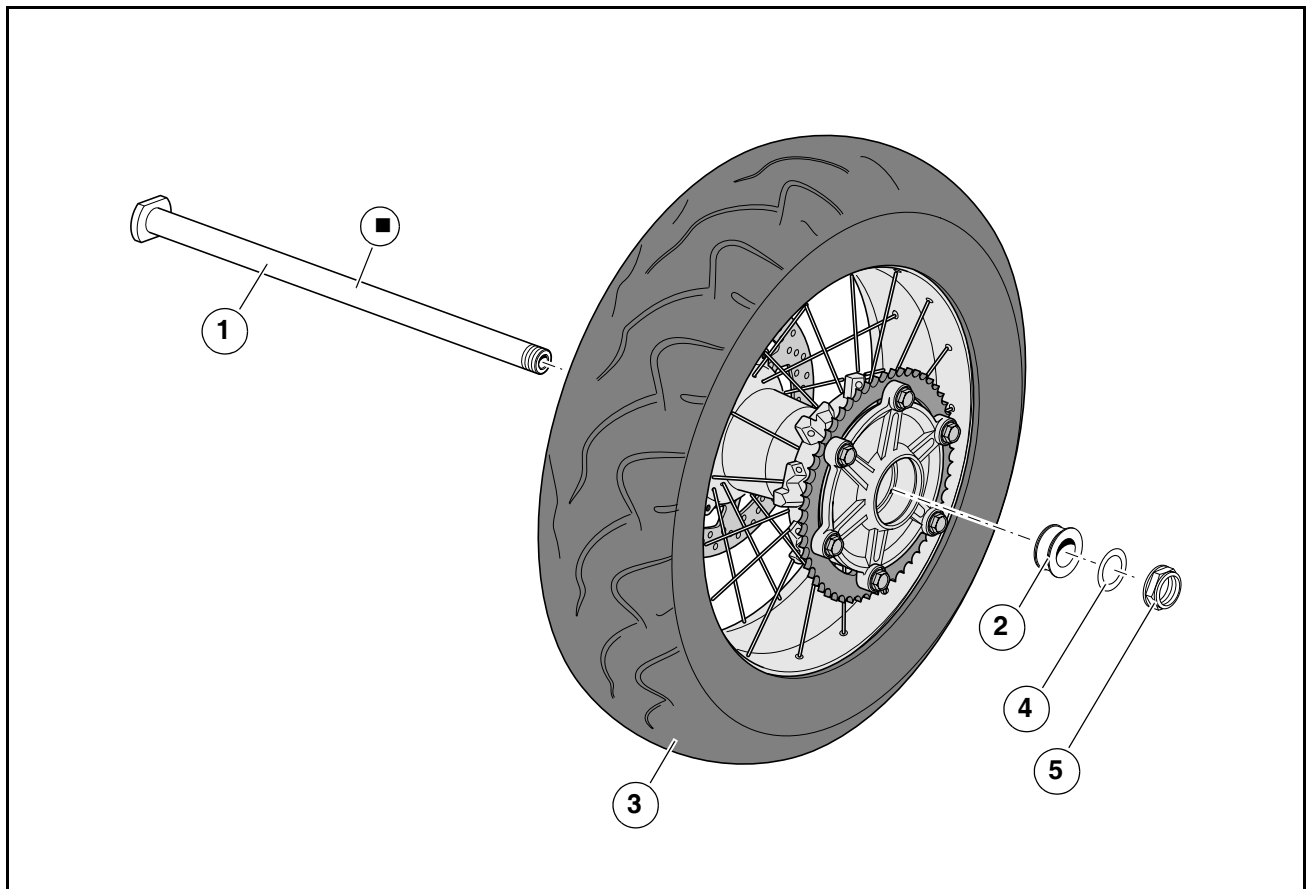


Torque wrench setting for wheel spindle clamp bolts (3): 10 Nm (1.0 kgm).

⚠ WARNING

After refitting the wheel, work the front brake lever repeatedly and check for proper operation of the brake. Ensure that the wheel is properly centred and balanced.



7.3 REAR WHEEL**Key**

- 1) Wheel spindle
- 2) Spacer
- 3) Wheel
- 4) Washer
- 5) Nut

■ = GREASE, see 1.6 (LUBRICANT CHART).

7.3.1 ADJUSTING WHEEL SPOKE TENSION

See 2.33 (ADJUSTING WHEEL SPOKE TENSION)

7.3.2 WHEEL REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and see 2.32 (REAR WHEEL) carefully.

⚠ CAUTION

Allow the engine and exhaust silencer to cool down completely.

Use great care when removing the wheel to avoid damaging the brake hoses, brake discs, brake pads and speed sensor cable.

- ◆ Place the motorcycle on the centre stand **OPT.**
- ◆ Undo and remove the nut (1) and collect the washer.



Torque wrench setting for wheel nut (1): 90 Nm (9.0 kgm).

Set the drive chain (3) to full slack, see 2.35.3 (CHAIN SLACK ADJUSTMENT).

- ◆ Withdraw the wheel spindle (2) from the right-hand side.
- ◆ Push the wheel forward and take the drive chain (3) off the rear sprocket (4).

⚠ WARNING

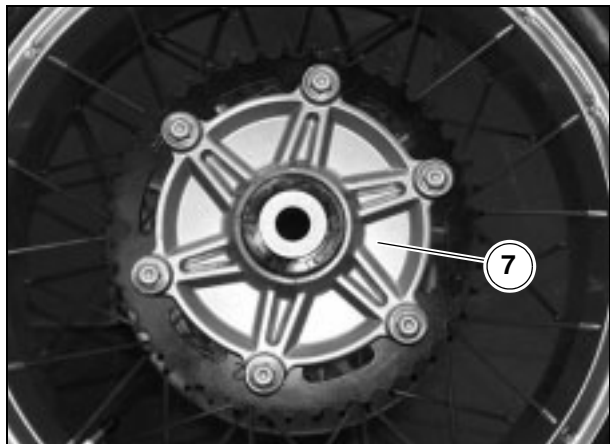
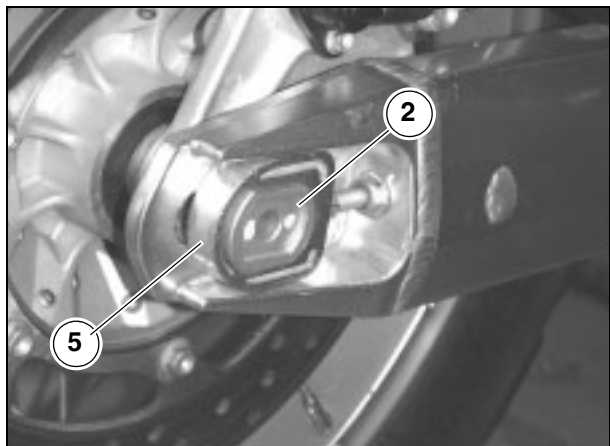
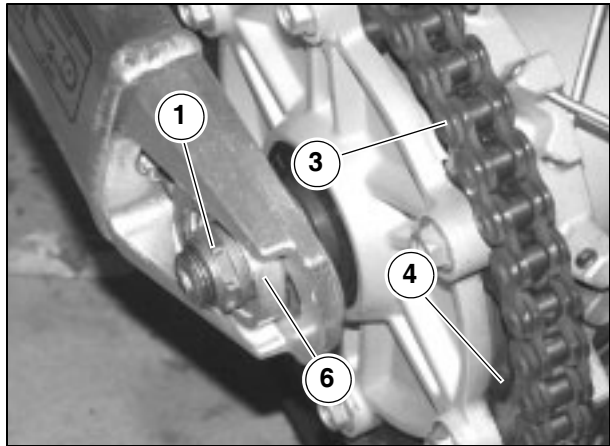
Note the positions of the chain tensioner sliders (5-6) to ensure they are refitted at the correct locations on assembly.

- ◆ Remove the right-hand (5) and left-hand (6) chain tensioner sliders.
- ◆ Remove the wheel pulling in a rearward motion.

⚠ WARNING

Do not operate the rear brake lever with the wheel removed, or the brake caliper pistons might fall out leading to brake fluid spillage.

- ◆ Grasp the complete final drive assembly (7) and withdraw it from the wheel.
- ◆ Inspect the components, see 7.3.5 (COMPONENT INSPECTION).
- ◆ If needed, dismantle the final drive assembly, see 7.3.3 (DISMANTLING THE FINAL DRIVE ASSEMBLY) and the wheel, see 7.3.4 (WHEEL HUB DISASSEMBLY).



7.3.3 DISMANTLING THE FINAL DRIVE ASSEMBLY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

Remove the wheel, see 7.3.2 (WHEEL REMOVAL).

NOTE If you just need to remove the rear chain sprocket, omit the next seven steps.

- ◆ Clean both ends of the hub with a clean cloth.
- ◆ Remove the left-hand spacer (1).

⚠ WARNING

The left-hand spacer (1) must be refitted with the larger diameter end facing the swinging arm left-hand side.

- ◆ Remove the oil seal (2).
- ◆ Remove the circlip (3).
- ◆ Position a suitable drift to the spacer (4) and tap to knock out the bearing (5).
- ◆ Extract the bearing (5) from the spacer (4).

⚠ WARNING

Inspect the bearings after each removal and replace as required.

- ◆ Clean the hub bore thoroughly.

NOTE Wash all components using clean detergent.

⚠ WARNING

Refit the bearings using a drift with the same diameter as the bearing outer ring. Do not tap the balls or the inner ring. Ensure that the inboard bearing (5) is fully home in the hub.

If needed:

- ◆ Release and remove the six bolts (6).
- ◆ Collect the nuts (7) and washers (8).
- ◆ Remove the rear chain sprocket (9).
- ◆ Clean the sprocket seat (9) and the sprocket carrier (10) thoroughly.

⚠ WARNING

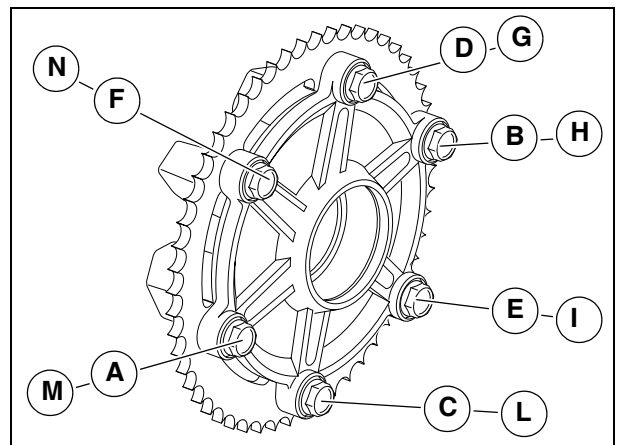
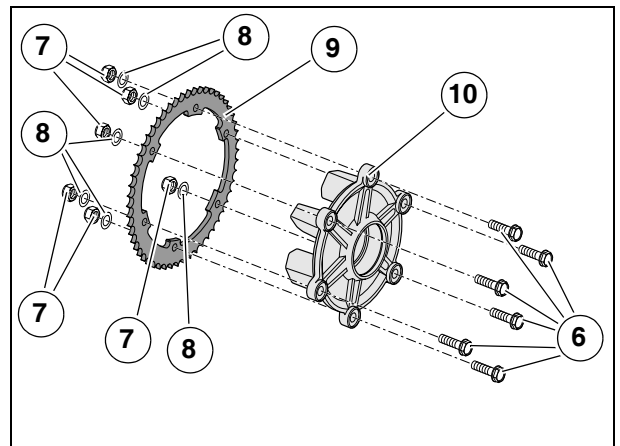
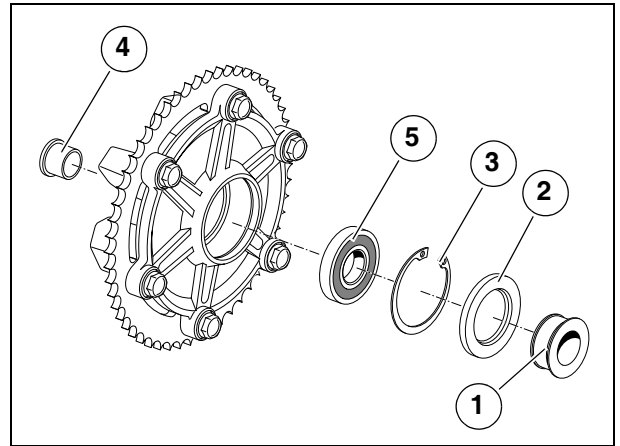
When refitting the rear chain sprocket (9), tighten the nuts (7) with the sprocket carrier (10) removed from the wheel.

Tighten in two steps as shown in the figure.

1st step (tighten) = A-B-C-D-E-F.

2nd step (check) = G-H-I-L-M-N.

 Torque wrench setting for nuts (7): 50 Nm (5.0 kgm).



7.3.4 WHEEL HUB DISASSEMBLY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ◆ Remove the wheel, see 7.3.2 (WHEEL REMOVAL).
- ◆ Clean the wheel hub at both ends with a cloth.
- ◆ Remove the seal (1).
- ◆ Remove the circlip (2).
- ◆ Remove the left-hand bearing (3) first and then the right-hand bearing (4) using a suitable bearing extractor.

⚠ WARNING

Inspect the bearings after each removal and replace as required.

- ◆ Collect the inner spacer (5).
- ◆ Clean the hub bore thoroughly.

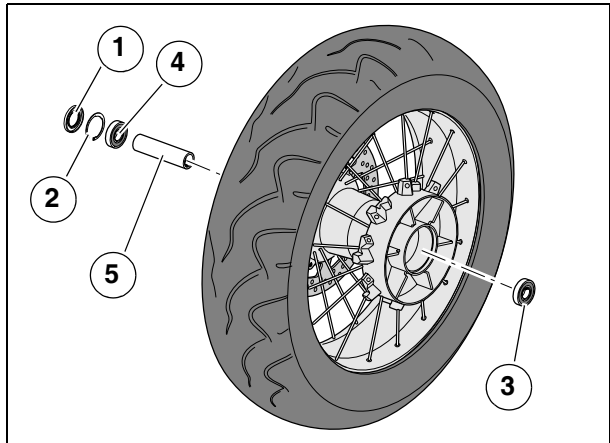
NOTE Wash all components using clean detergent.

⚠ WARNING

Refit the bearings using a drift with the same diameter as the bearing outer ring.

Do not tap the balls or the inner ring.

Ensure that the inner bearing (4) is fully home.



7.3.5 COMPONENT INSPECTION

⚠ WARNING

Ensure that all components are in perfect condition. Check the following components with special care.

Bearings, seals, wheel spindle and wheel rim, see 7.2.4 (WHEEL COMPONENT INSPECTION).

CUSH DRIVE

- ◆ Inspect the cush drive rubbers (1) for damage or wear. Replace as required.
- ◆ Fit the cush drive rubbers (1) to the wheel hub.
- ◆ Place the final drive assembly (2) on the wheel and rotate the rear chain sprocket (3) by hand in both directions. Check the play between cush drive rubbers (1) and wheel hub. In the event excess play is found, replace all cush drive rubbers (1)

REAR CHAIN SPROCKET

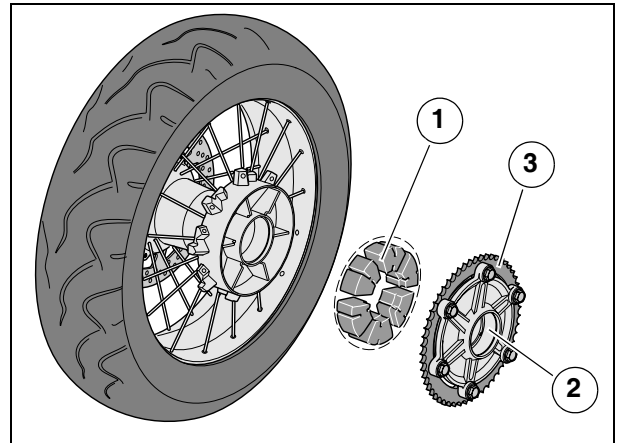
- ◆ Check the tothing of front and rear (3) chain sprockets for wear. In the event excess wear is found, replace front and rear chain sprockets and drive chain as a set; see 7.3.3 (DISMANTLING THE FINAL DRIVE ASSEMBLY) and see 7.10 (DISMANTLING THE DRIVE CHAIN).

⚠ WARNING

Drive chain and front and rear chain sprockets must always be replaced as a set. Failure to do so will lead to early wear of the newly fitted component(s).

TYRE

- ◆ Check tyre condition, see 2.36 (TYRES).



7.3.6 REFITTING THE WHEEL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

⚠ WARNING

Ensure that the brake caliper (2) carrier (3) is in the correct position before proceeding to refit the wheel. The brake caliper carrier is positioned correctly when the lug (3) on the inner face of the swinging arm right-hand side locates into the slot in the carrier.

Proceed carefully when positioning the brake disc to the brake caliper.

Use great care when refitting the wheel to avoid damaging the brake hose, brake disc, brake pads and speed sensor cable.

- ♦ Apply a thin coat of grease (part no. 8116053) over the whole length of the wheel spindle (4).
- ♦ Locate the two chain tensioner sliders – right-hand (5) and left-hand (6) – to the seats in both sides of the swinging arm.
- ♦ Position the wheel to the swinging arm.
- ♦ Push the wheel forward and wrap the drive chain (7) around the rear chain sprocket (8).

⚠ CAUTION

Do not attempt to align the holes by putting your fingers into the holes. This could result in severe personal injury.

- ♦ Move the wheel backward until the wheel hub bore aligns with the holes in the swinging arm.
- ♦ Rotate the brake caliper carrier (1) complete with brake caliper (2). The carrier will pivot on the retaining pin (3). Continue until the holes are aligned.
- ♦ Fit the wheel spindle (4) from the right-hand side and push it fully home.

NOTE Make sure the wheel spindle (4) is fully home. The spindle head must locate into the seat in the right-hand chain slider (5).

- ♦ Fit the washer and tighten the nut (9) manually.
- ♦ Check chain slack, see 2.35.1 (CHAIN SLACK INSPECTION).
- ♦ Tighten the nut (9).

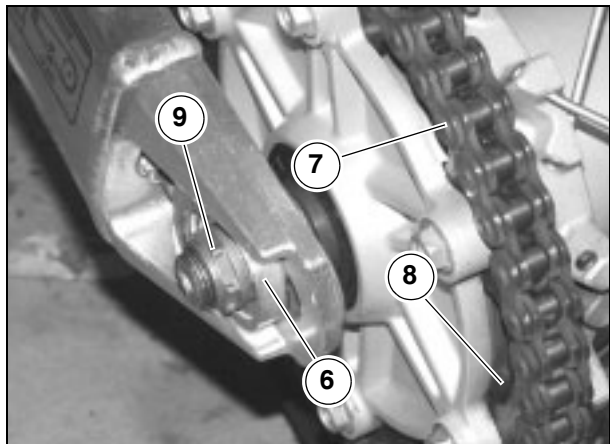
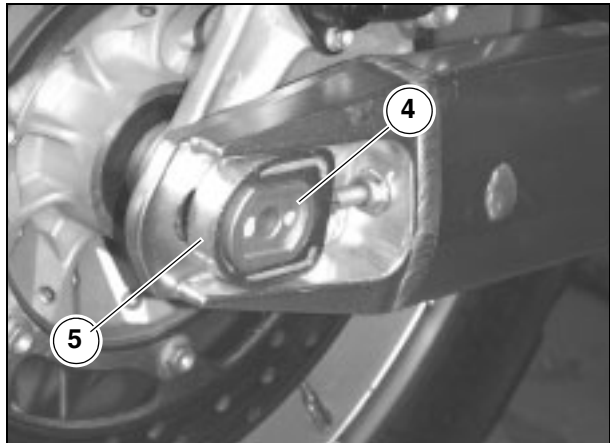
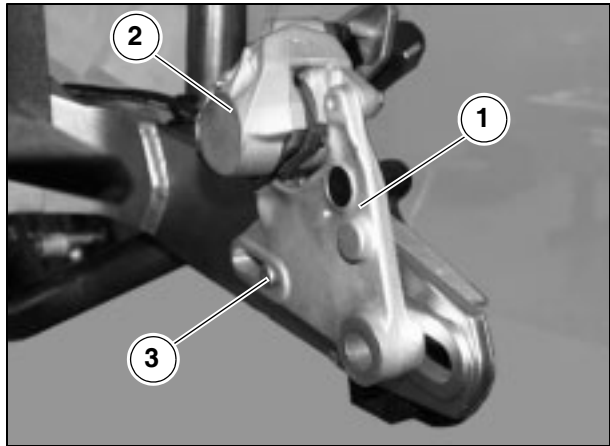


Torque wrench setting for nut (9): 90 Nm (9.0 kgm).

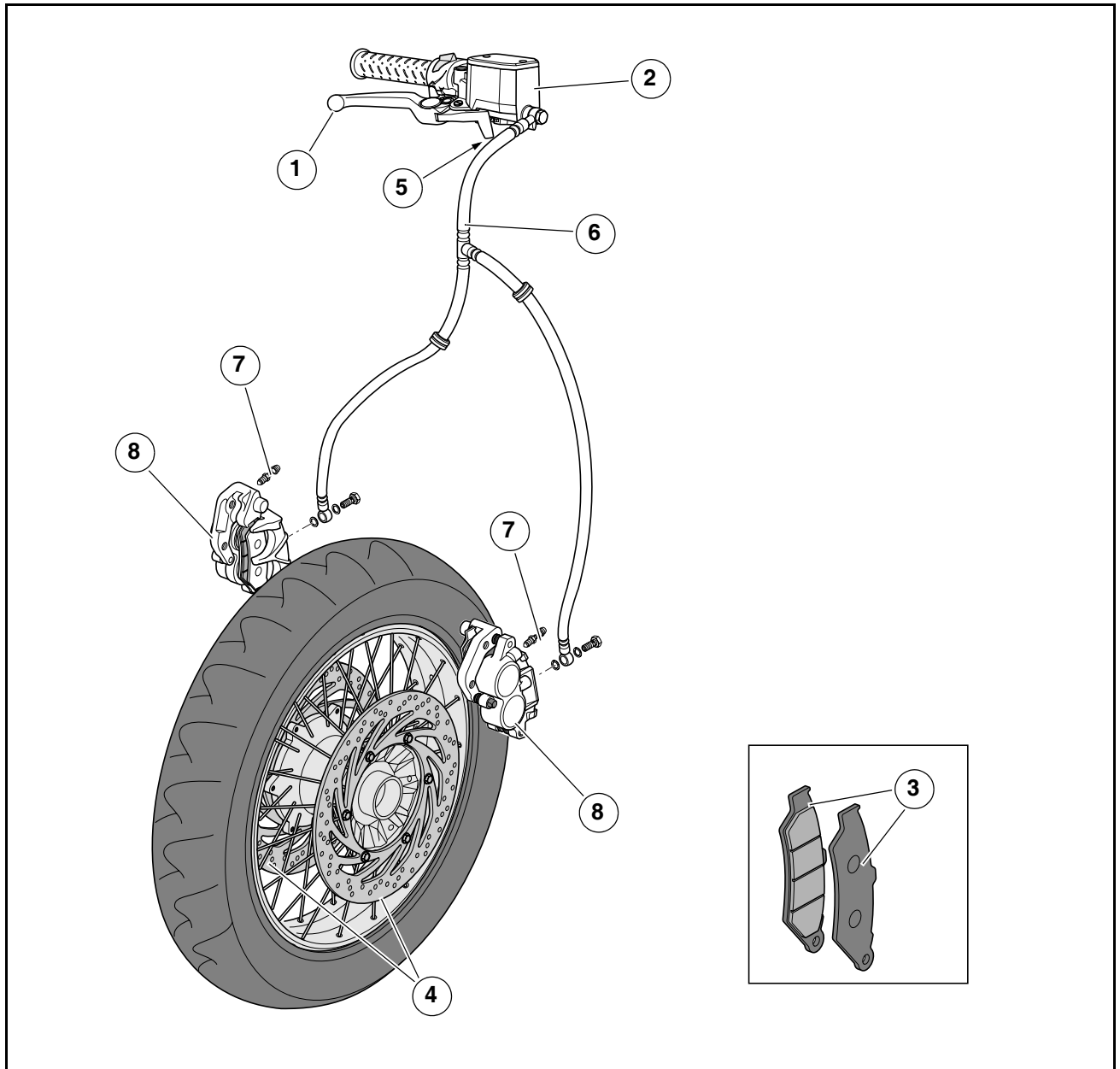
⚠ WARNING

After refitting the wheel, work the rear brake lever repeatedly and check for proper operation of the brake.

Ensure that the wheel is properly centred and balanced.



7.4 FRONT BRAKE

**Key:**

- 1) Brake lever
- 2) Brake master cylinder
- 3) Brake pads
- 4) Brake discs
- 5) Brake light switch
- 6) Brake hoses, master cylinder to calipers
- 7) Bleed nipples
- 8) Brake calipers

The front brake is discussed in further detail in the following sections:

- see 1.2.4 (BRAKE FLUID);
- see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL);
- see 2.18 (BLEEDING THE BRAKE CIRCUITS);
- see 2.26 (CHECKING BRAKE PADS FOR WEAR);
- see 8.4.5 (FRONT BRAKING SYSTEM).

⚠ WARNING

The two caliper mounting bolts must be replaced with new bolts of the same type each time the caliper is removed.

7.4.1 REPLACING THE BRAKE PADS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.26 (CHECKING BRAKE PADS FOR WEAR) carefully.

- ◆ Place the motorcycle on the stand.

NOTE The operations described below apply to both brake calipers.

- ◆ Release and remove the two nuts (1).



Torque wrench setting for screws (1): 50 Nm (5.0 kgm).

- ◆ Slide the brake caliper (2) off the disc.
- ◆ Slide out the elastic stop (5).
- ◆ Remove the spindle (3).

NOTE Push one brake pad in a side-to-side motion using a pair of pliers to remove any pressure from the pistons and facilitate brake pad extraction. Repeat with the other brake pad.

- ◆ Extract both brake pads (4).

⚠ WARNING

Do not operate the brake lever with the brake pads removed, or the brake caliper pistons might fall out leading to loss of brake fluid.

- ◆ Fit new brake pads taking care to align the holes with the caliper holes.

⚠ WARNING

The brake pads must always be replaced in pairs. Ensure they become properly seated in the brake caliper.

- ◆ Refit the spindle (3).
- ◆ Insert the elastic stop (5).
- ◆ Refit the brake caliper (2) to the disc.

⚠ WARNING

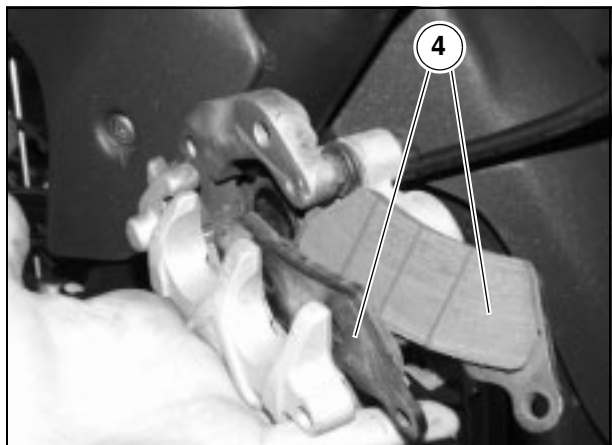
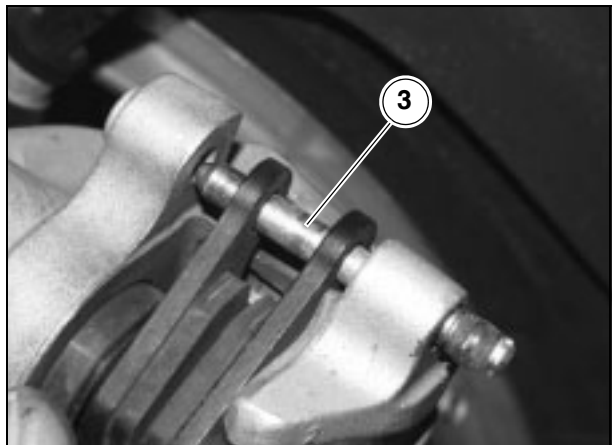
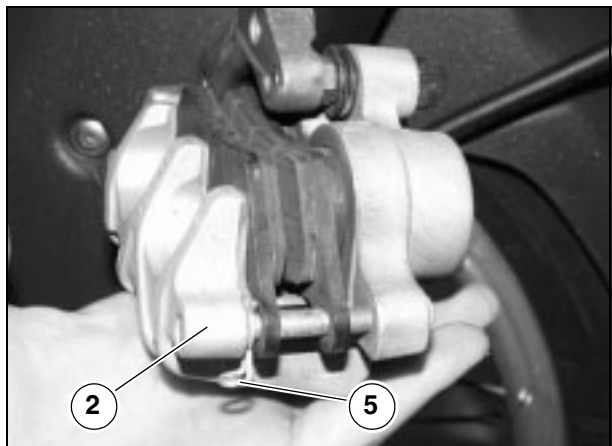
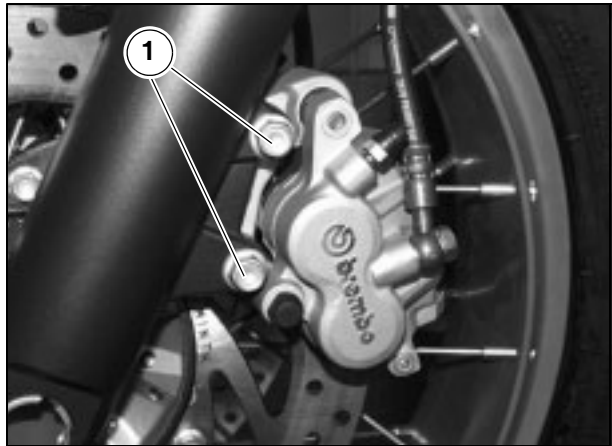
Renew both brake caliper (2) mounting bolts (1) using new bolts of the same type fitted originally. Lubricate with oil (part no. 8116050).

- ◆★ Start the new brake caliper mounting bolts (1) in their holes and tighten to the specified torque.



Torque wrench setting for brake caliper bolts (1): 50 Nm (5.0 kgm)

- ◆ Check brake fluid level, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL).



7.4.2 BRAKE DISC INSPECTION

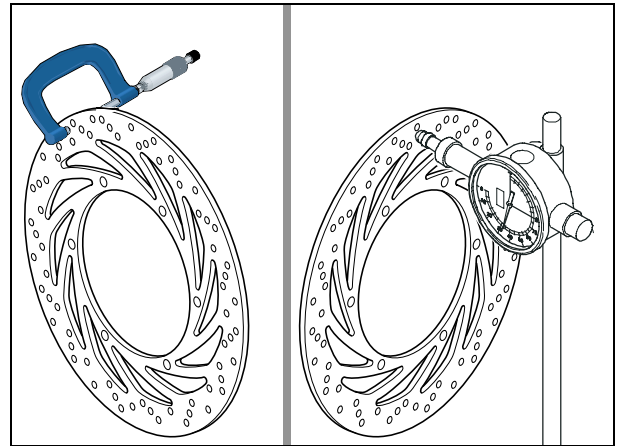
NOTE The operations described below are to be performed with the brake discs installed to the wheel and apply to both brake discs.

- ◆ Check for wear measuring disc thickness with a micrometer gauge at different positions along the disc. When a disc is worn beyond the service limit even at just one position, the disc must be replaced.

Service limit: 4.5 mm.

- ◆ Check for disc run-out using a dial gauge. Replace disc when the maximum run-out measured exceeds the disc run-out limit; see 7.4.3 (BRAKE DISC REMOVAL).

Disc run-out limit: 0.3 mm.



7.4.3 BRAKE DISC REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

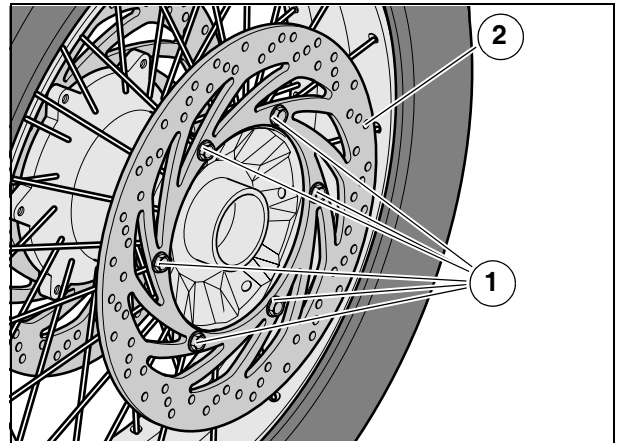
- ◆ Remove the front wheel, see 7.2.2 (WHEEL REMOVAL).

NOTE The operations described below apply to both brake discs.

The screws (1) are retained with LOCTITE® 243. Use of an air gun is recommended to release the screws.

- ◆ Release and remove the six brake disc screws (1).

Torque wrench setting for screws (1): 25 Nm (2.5 kgm).

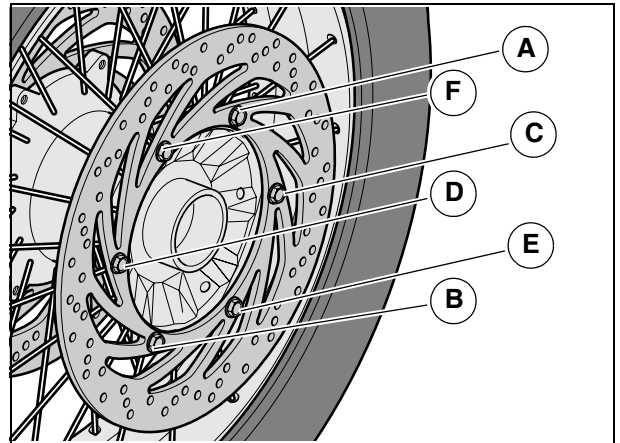


⚠ WARNING

Apply LOCTITE® 243 to the threads of the brake disc screws (1) on assembly.

NOTE To refit, start all screws (1) manually in their holes and tighten in a cross pattern observing this sequence: A-B-C-D-E-F.

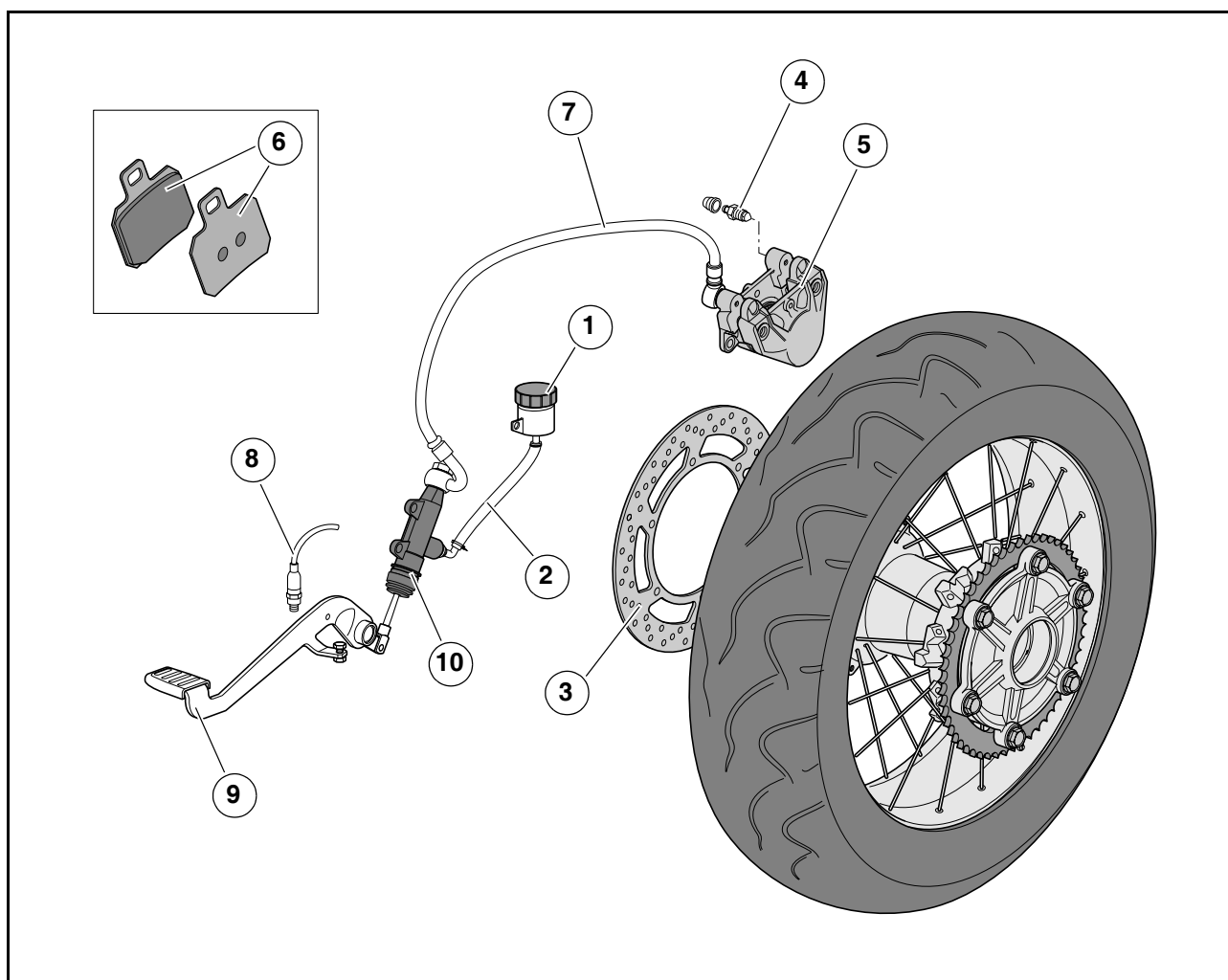
- ◆ Remove the brake disc (2).



7.4.4 REMOVING THE BRAKE MASTER CYLINDER

See 7.1.13 (REMOVING THE FRONT BRAKE CONTROL).

7.5 REAR BRAKE

**Key:**

- 1) Brake fluid reservoir
- 2) Brake hose, reservoir to master cylinder
- 3) Brake disc
- 4) Bleed nipple
- 5) Brake caliper
- 6) Brake pads
- 7) Brake hose, master cylinder to caliper
- 8) Rear brake light switch
- 9) Brake pedal
- 10) Brake master cylinder

The rear brake is discussed in further detail in the following sections:

- see 1.2.4 (BRAKE FLUID);
- see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL);
- see 2.18 (BLEEDING THE BRAKE CIRCUITS);
- see 2.24 (ADJUSTING REAR BRAKE LEVER PLAY);
- see 2.26 (CHECKING BRAKE PADS FOR WEAR);
- see 8.4.6 (REAR BRAKING SYSTEM).

⚠ WARNING

The two caliper mounting bolts must be replaced with new bolts of the same type each time the caliper is removed.

7.5.1 REPLACING THE BRAKE PADS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.26 (CHECKING BRAKE PADS FOR WEAR) carefully.

- ◆ Place the motorcycle on the stand.
- ◆ Release the brake hose from the clip (5).

⚠ WARNING

You will have to renew the clips on refitting. Make sure to have enough spare clips ready at hand.

- ◆ Release and remove the two bolts (1).

⚠ WARNING

When refitting the brake caliper, replace the caliper mounting bolts (1) with two bolts of the same type fitted originally.



Torque wrench setting for bolts (1): 25 Nm (2.5 kgm).

- ◆ Release and remove the two screws (6).

⚠ WARNING

Note the position of the retaining clip (9) before removing the caliper half (8). The clip must be refitted in the original position and direction on assembly.

- ◆ Take apart the two caliper halves (7-8).
- ◆ Collect the retaining clip (9).
- ◆ Extract the two brake pads (2).

⚠ WARNING

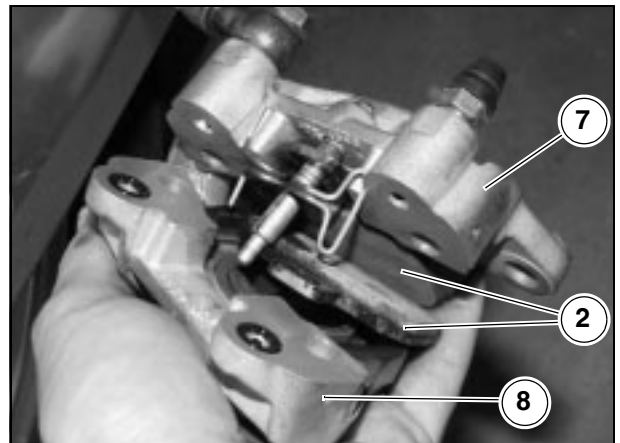
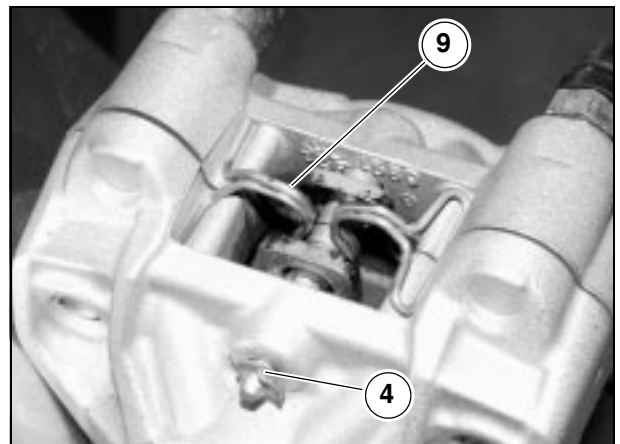
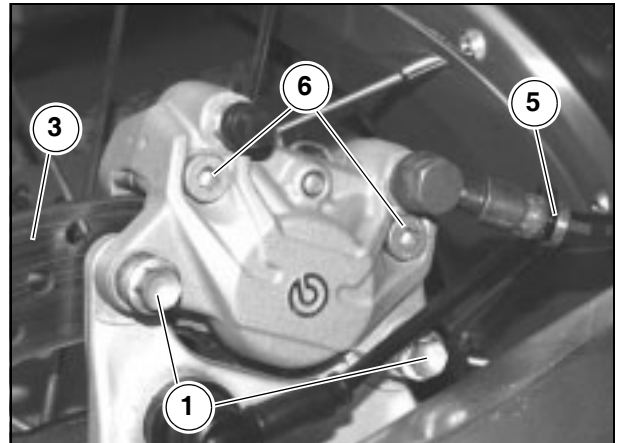
Do not operate the brake lever after removing the brake pads (2), or the pistons might fall out leading to brake fluid spillage.

- ◆ Fit two new pads. Make sure the pad holes match the caliper holes.

⚠ WARNING

The brake pads must always be replaced together. Ensure they become properly seated in the brake caliper.

- ◆ Position the retaining clip (9).
- ◆ Hold the retaining clip (9) pressed into its seat and insert the caliper half (8).
- ◆ Tighten the two screws (6).
- ◆ Fit the retaining ring (4).
- ◆ Check brake fluid level, 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL)



7.5.2 BRAKE DISC INSPECTION

NOTE These operations are to be performed with the brake disc installed to the wheel.

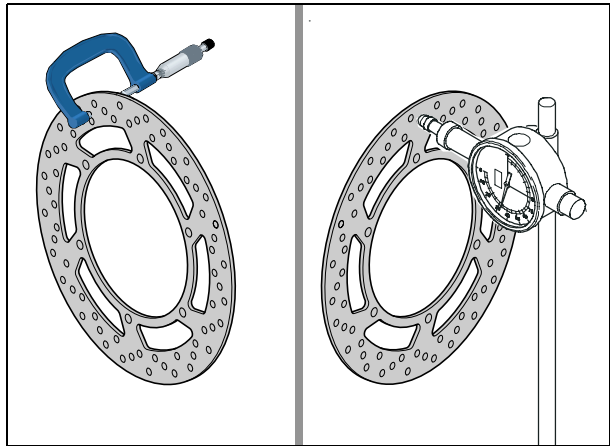
- ♦ Check for wear measuring disc thickness with a micrometer gauge at different positions along the disc.

NOTE Replace the disc if worn beyond the service limit even at just one position. See 7.5.3 (BRAKE DISC REMOVAL).

Service limit: 4.5 mm.

- ♦ Check for disc run-out using a dial gauge. Replace disc when the maximum run-out measured exceeds the disc run-out limit; see 7.5.3 (BRAKE DISC REMOVAL).

Disc run-out limit: 0.3 mm.



7.5.3 BRAKE DISC REMOVAL

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ♦ Remove the rear wheel, see 7.3.2 (WHEEL REMOVAL).

NOTE The screws (1) are retained with LOCTITE® 243. Use of an air gun is recommended to release the screws.

- ♦ Release and remove the six screws (1).

⚠ WARNING

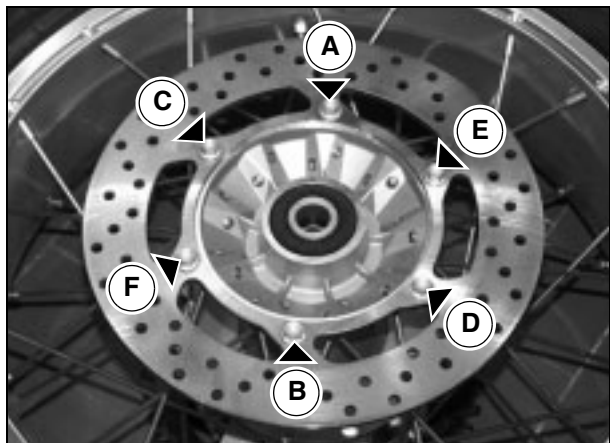
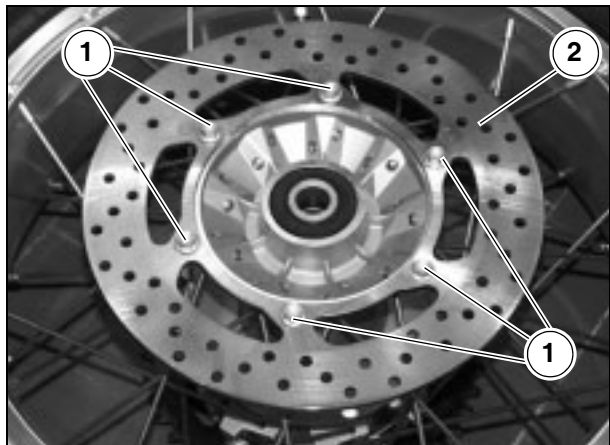
Apply LOCTITE® 243 to the threads of the brake disc screws (1) on assembly.

NOTE To refit, start all screws manually in their holes and tighten in a cross pattern observing this sequence: A-B-C-D-E-F.



Torque wrench setting for brake disc screws (1): 25 Nm (2.5 kgm).

- ♦ Remove the brake disc (2).



7.5.4 REMOVING THE BRAKE MASTER CYLINDER

- ◆ Perform the first three steps of the procedure described in subsection 2.21 (CHANGING THE REAR BRAKE FLUID).
- ◆ Release and remove the two screws (4).



Torque wrench setting for screws (4): 10 Nm (1.0 kgm).

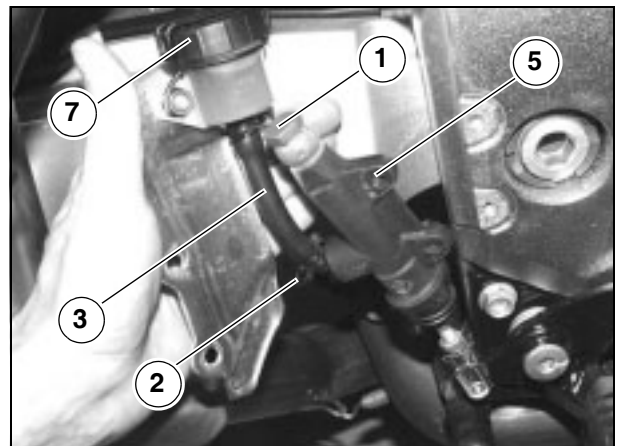
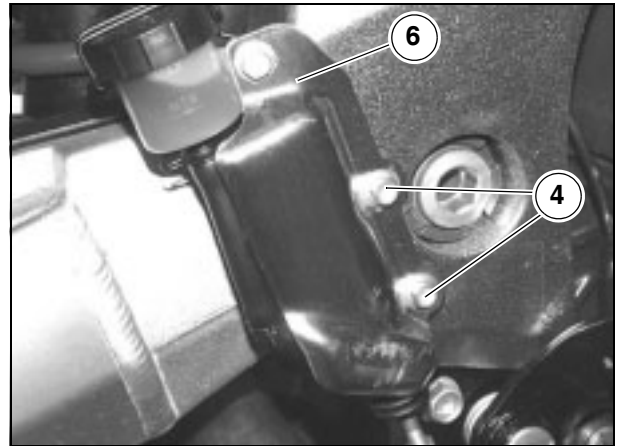
- ◆ Slide the master cylinder guard (6) aside.
- ◆ When all fluid has drained out, release and remove the screw (1) and collect the two sealing washers.



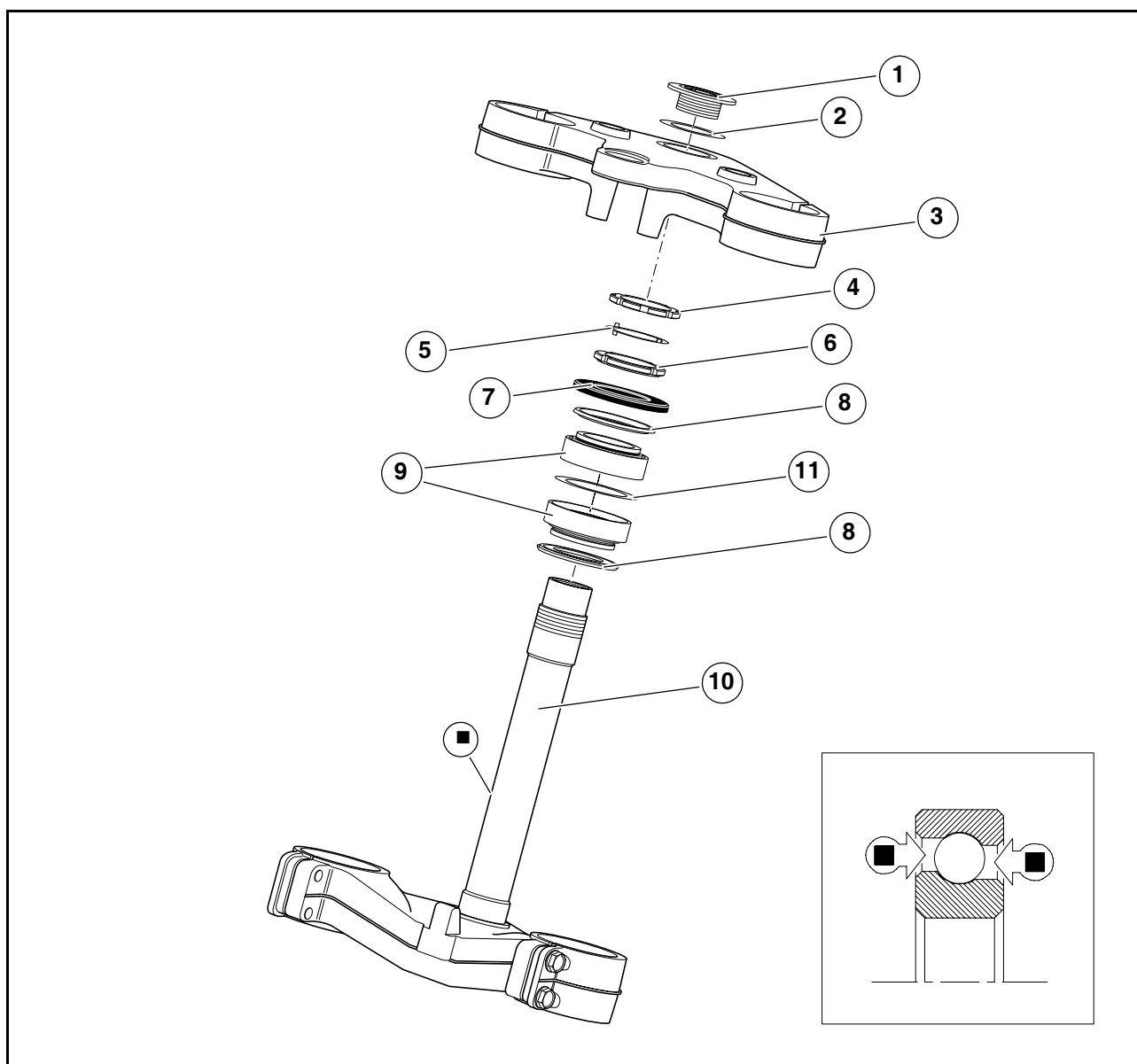
Torque wrench setting for screw (1): 20 Nm (2.0 kgm).

- ◆ Perform the first four steps of the procedure described in subsection 7.1.40 (REMOVING THE REAR BRAKE LEVER).
- ◆ Slacken the hose clip (2) and slide it aside.
- ◆ Detach the hose (3) from the fitting at master cylinder end.
- ◆ Remove the rear brake fluid reservoir (7) together with master cylinder guard (6) and hose (3).
- ◆ Remove the master cylinder (5).

NOTE After re-assembly, top up brake fluid level, see 2.16 (CHECKING AND TOPPING UP REAR BRAKE FLUID LEVEL) and bleed the brake, see 2.18 (BLEEDING THE BRAKE CIRCUITS).



7.6 STEERING



Key:

- 1) Top bush
- 2) Washer
- 3) Top yoke
- 4) Lockring
- 5) Locking washer
- 6) Adjusting ring
- 7) Protection cap
- 8) Dust seal
- 9) Bearings
- 10) Bottom yoke
- 11) Washer

■ = GREASE, see 1.6 (LUBRICANT CHART).

The steering is discussed in further detail in the following sections:

- see 2.27 (STEERING);
- see 2.28 (INSPECTING THE FRONT SUSPENSION).

7.6.1 HEADSTOCK REMOVAL

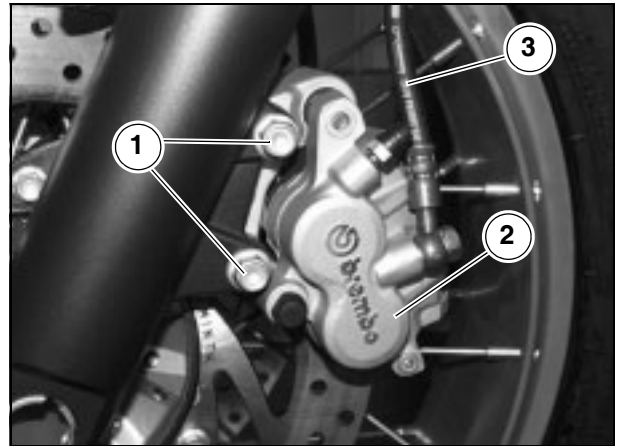
Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.27 (STEERING) carefully.

- ◆ Place the motorcycle on a lift with the front wheel protruding over the runway edge. Put the motorcycle on the centre stand **OPT**.
- ◆ Place a support under the front wheel.
- ◆ ★ Release and remove the two mounting bolts (1) of the front brake caliper (2).



Torque wrench setting for bolts (1): 50 Nm (5.0 kgm).

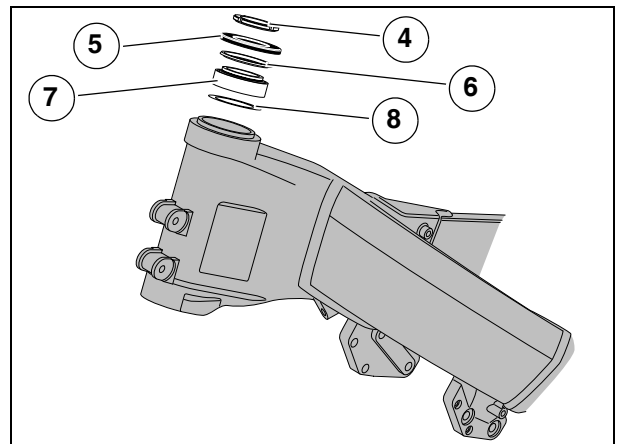
- ◆ ★ Slide the brake caliper (2) off the brake disc. Leave the caliper connected to the hose (3).



⚠ WARNING

Do not operate the front brake lever after removing the brake calipers, or the pistons might fall out leading to brake fluid spillage.

- ◆ Perform the first ten steps of the procedure described in subsection 2.27.2 (ADJUSTING PLAY IN THE BEARINGS).
- ◆ Use the special socket **OPT** to slacken and remove the adjusting ring (4).



⚠ WARNING

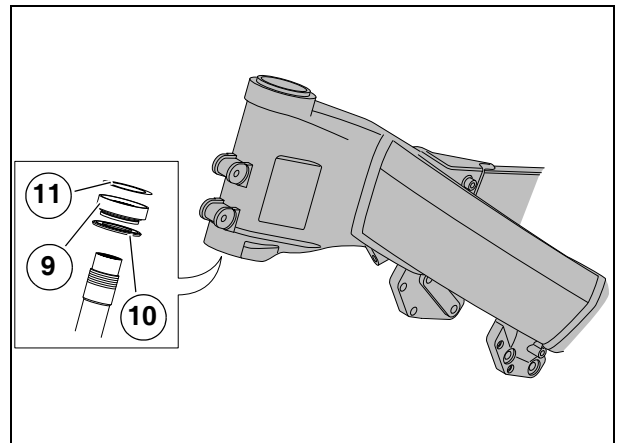
The front end is heavy. An assistant will be required to support it.

When working with an assistant, plan the whole procedure carefully together.

Proceed with the utmost care when removing the headstock.

Make sure the brake hose does not snag on any parts during the process.

- ◆ While the assistant holds the front end steady, raise the lift gradually until the steering stem slides off the headstock.
- ◆ Collect the dust seal (5).
- ◆ Remove the top dust seal (6).
- ◆ Remove the bearing (7).
- ◆ Remove the washer (8).
- ◆ Extract the bottom bearing (9), the bottom dust ring (10) and the washer (11) using a suitable extractor.



⚠ WARNING

On assembly, refit the bearings using a drift with the same diameter as the bearing outer ring.

Do not tap the balls and/or the inner ring.

Ensure that the bearings slide fully home.

Wash all components with clean detergent.

7.6.2 COMPONENT INSPECTION

⚠ WARNING

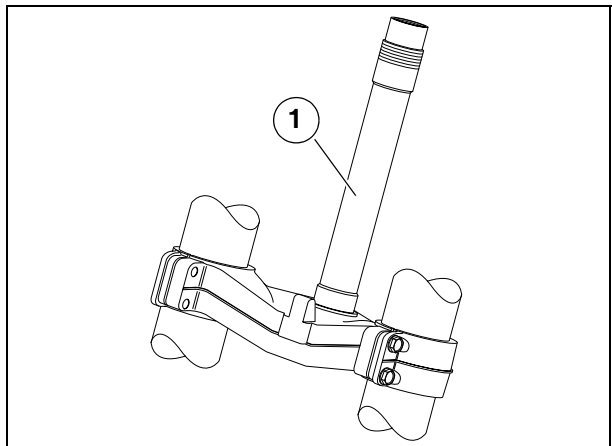
Check that all components are in perfect condition. Pay special attention to the following components:

Bearings and seals, see 7.2.4 (WHEEL COMPONENT INSPECTION).

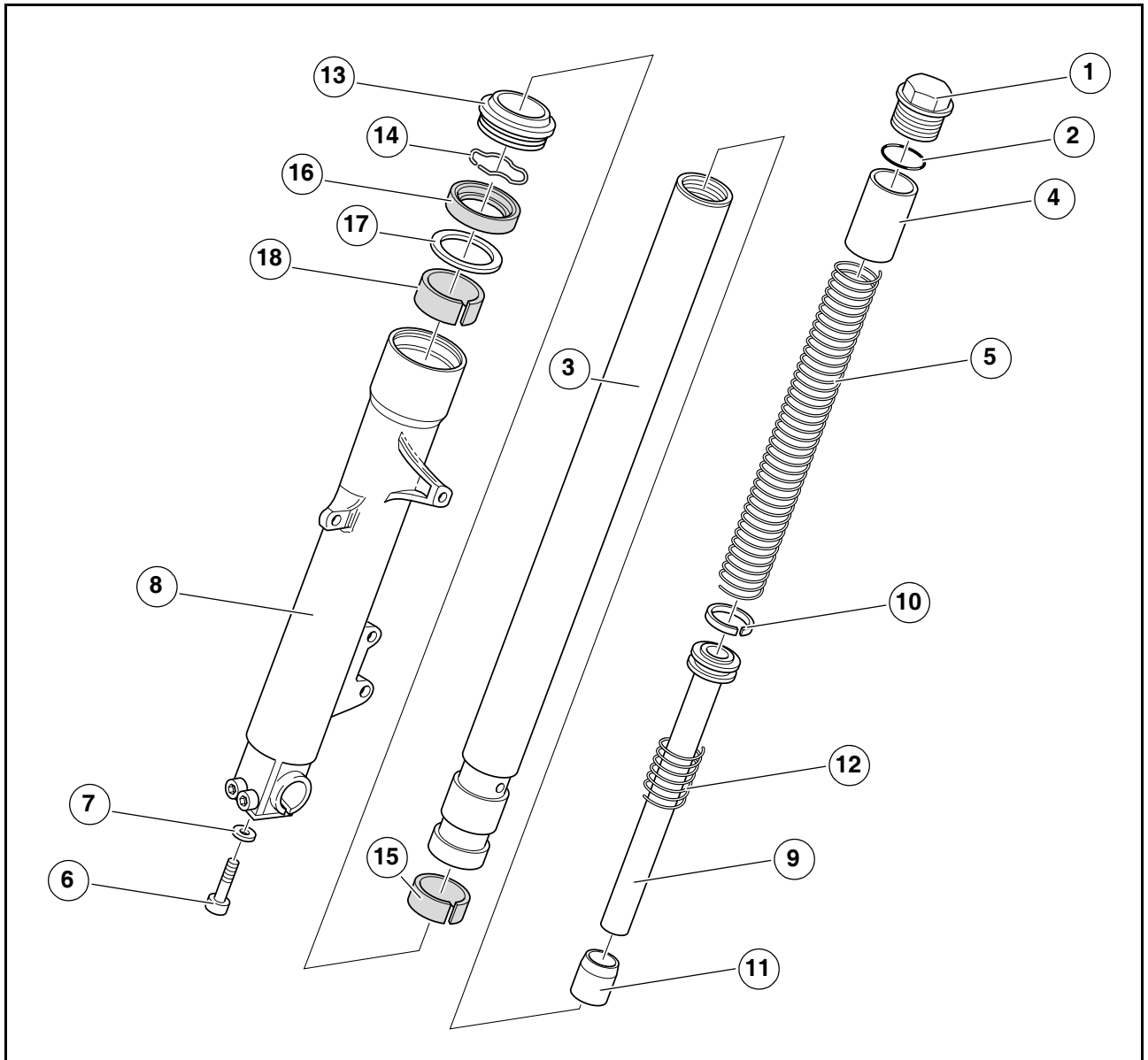
7.6.3 HEADSTOCK RE-ASSEMBLY

NOTE Place motorcycle and headstock in the same position as for removal. Reverse the removal procedure to assemble.

- ◆ Smear a light coat of grease over the total length of the stem (1), see 1.6 (LUBRICANT CHART).
- ◆ Before finally tightening the adjusting ring (2), turn the steering in both directions repeatedly. This will allow the bearings to seat themselves properly.
- ◆ Adjust play in the bearings, see 2.27.2 (ADJUSTING PLAY IN THE BEARINGS).
- ◆ Turn the handlebars to ensure that cables and hoses do not bind. Ensure that cables and hoses are not twisted or twisted around one another.
- ◆ Top up brake fluid level, see 2.15 (CHECKING AND TOPPING UP FRONT BRAKE FLUID LEVEL).



7.7 FRONT FORK



Key:

- | | |
|------------------------------|--------------------|
| 1) Top cap | 10) Oil seal |
| 2) O-ring | 11) Bush |
| 3) Slider | 12) Spring |
| 4) Spacer tube | 13) Dust seal |
| 5) Spring | 14) Retaining ring |
| 6) Capscrew | 15) Guide ring |
| 7) Washer | 16) Oil seal |
| 8) Stanchion tube | 17) Washer |
| 9) Damping cylinder assembly | 18) Guide bush |

7.7.1 CHANGING FRONT FORK OIL

Read 1.2.3 (FRONT FORK FLUID) carefully.

- ◆ Perform the operations identified with the symbol “●” described in subsection 7.7.3 (DISASSEMBLING THE STANCHION TUBES – SLIDERS).
- ◆ Perform the operations identified with the symbol “●” described in subsection 7.7.5 (STANCHION TUBE – SLIDER ASSEMBLY).

7.7.2 REMOVING THE STANCHION TUBES – SLIDERS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.27 (STEERING) carefully.

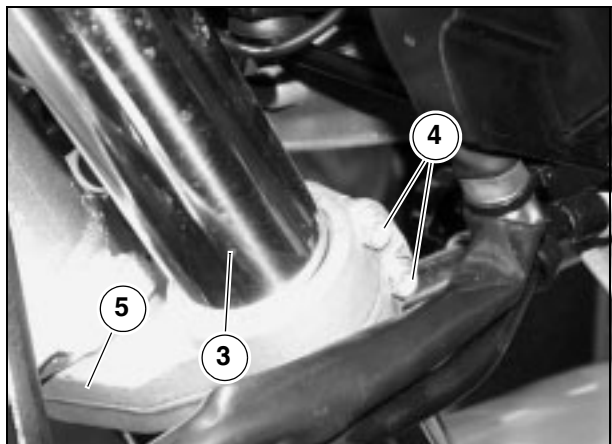
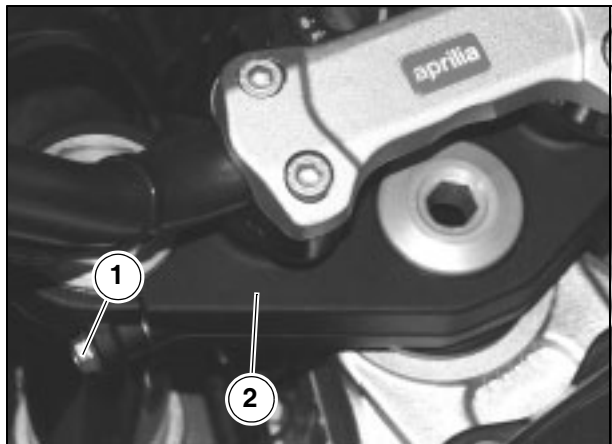
NOTE The operations described below apply to both fork legs.

⚠ WARNING

Service the fork legs one at a time. Always refit a fork leg in the correct position before removing the other.

- ◆ Place the motorcycle on a lift with the front wheel protruding over the runway edge. Put the motorcycle on the centre stand **OPT**.
- ◆ Secure the tail section to the runway with suitable belts so to raise the front wheel.
- ◆ Remove the front wheel, see 7.2.2 (WHEEL REMOVAL). It is not necessary to use a front wheel stand **OPT** in this case.
- ◆ Remove the front mudguard, see 7.1.21 (REMOVING THE FRONT MUDGUARD).
- ◆ Slacken the top yoke clamp bolt (1) securing the top yoke (2) to the fork slider (3).
- ◆ Slacken the two bolts (4) securing the bottom yoke (5) to the fork slider (3).
- ◆ Slide out the stanchion tube (6) with slider (3).

NOTE Remove the other fork leg if needed.



7.7.3 DISASSEMBLING THE STANCHION TUBES – SLIDERS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION), 1.2.3 (FRONT FORK FLUID) and 2.28 (INSPECTING THE FRONT SUSPENSION) carefully.

NOTE The same internal components are used in both fork legs. The operations described below apply to both fork legs. The operations identified with the symbol “●” also apply to the front fork oil change procedure.

- Remove the stanchion-and-slider assembly, see 7.7.2 (REMOVING THE STANCHION TUBES – SLIDERS).
- Clean stanchion and slider thoroughly.

NOTE Make sure to have a container having a capacity greater than 750 cu. cm. ready at hand before proceeding.

⚠ WARNING

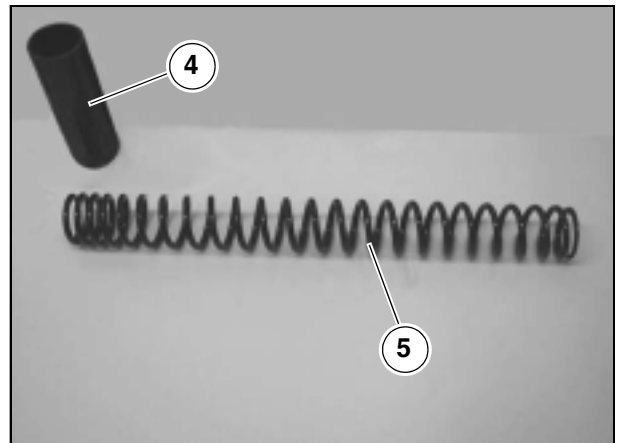
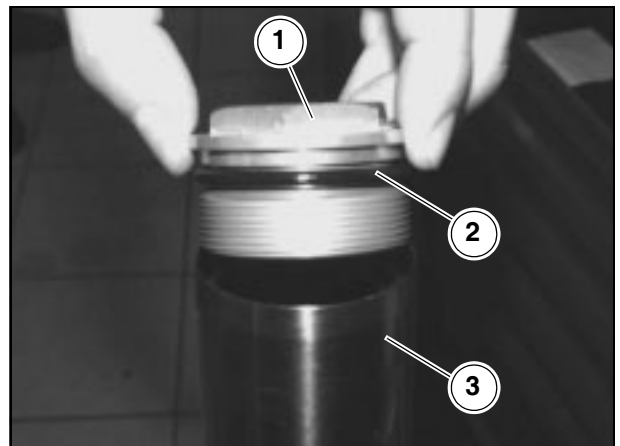
Use utmost care during the disassembly procedure.

- Place the slider (3) in a vice with soft jaws. Slacken the top cap (1) using an Allen socket. Take care not to damage the O-ring (2) during removal. Push the stanchion into the slider.

⚠ WARNING

The stanchion-and-slider assembly contains oil. Do not turn it over or tilt it exceedingly during removal.

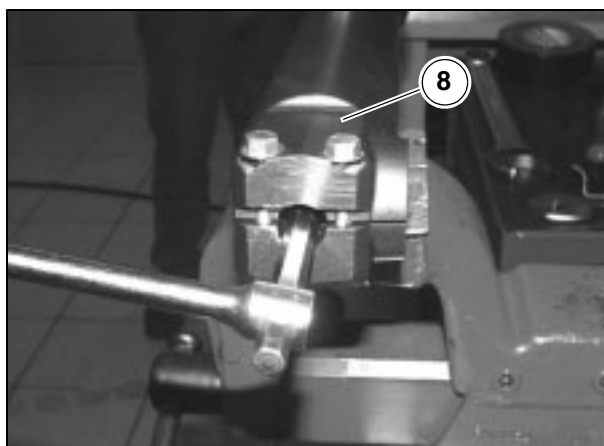
- Withdraw the spacer tube (4) and the spring (5) from inside the slider. Let any oil sticking to spring and spacer tube drip back into the slider. That way, you will not need to top up level or change oil later on.



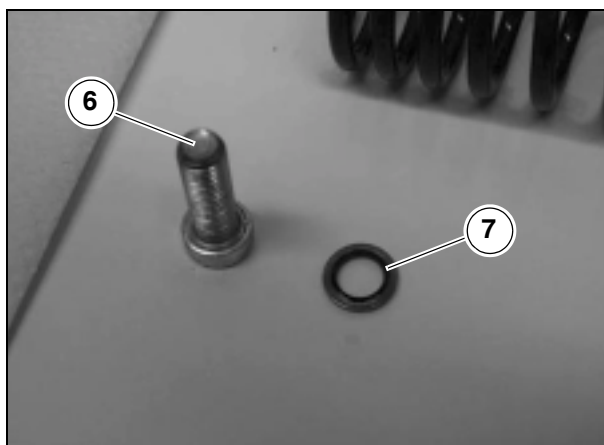
- Drain the oil into the container as shown in the figure.



- ◆ Place the stanchion (8) in a vice with soft (aluminium) jaws.

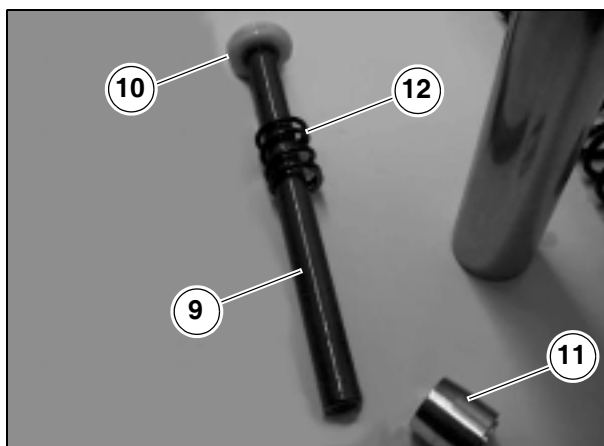


- ◆ Release and remove the capscrew (6) and collect the copper washer (7).

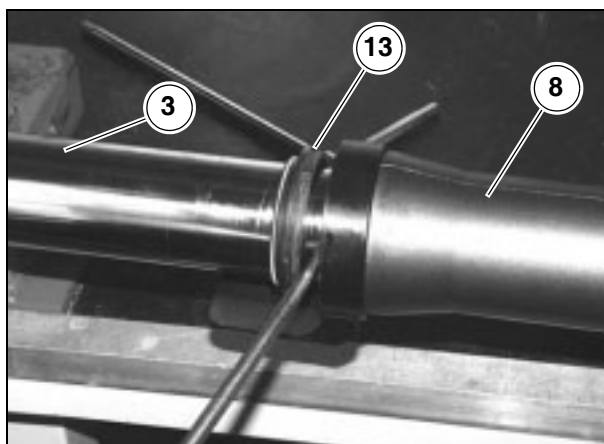


- ◆ Extract the damping cylinder (9) complete with oil seal (10), bush (11) and spring (12) from the slider (3).

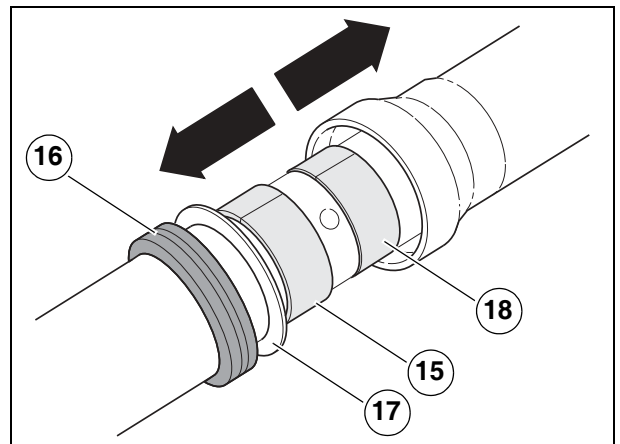
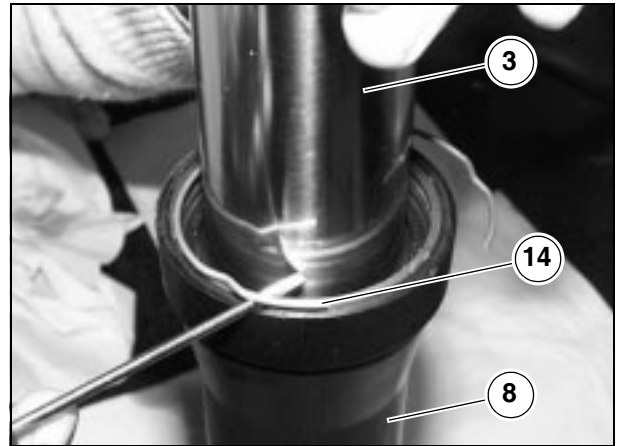
NOTE Replace the whole damping cylinder assembly (9) if damaged. The only component that can be replaced individually is the oil seal (10).



- ◆ Prise off the dust seal (13) using a flat-blade screwdriver.



- ♦ Use a thin screwdriver to prise off the retaining ring (14) located inside the stanchion (8).
- ♦ Grasp the slider (3) and pull firmly to separate it from the stanchion (8).
- ♦ The guide ring (15) acts as a stopper and will draw oil seal (16), washer (17) and guide bush (18) out of the stanchion (8) when it is extracted.
- ♦ Use a small screwdriver to take guide ring (15) and guide bush (18) apart. This will release the washer (17) and oil seal (16) from the slider (3).



7.7.4 COMPONENT INSPECTION

STANCHION TUBE

- ♦ Inspect the sliding surface for scoring and/or scratching. Eliminate minor scoring with wet sand paper (grain size 1). Replace the stanchion (1) if badly scored.
- ♦ Check for stanchion buckling (1) using a dial gauge. Replace the stanchion if buckled beyond the service limit.

Service limit: 0.2 mm.

⚠ WARNING

Never attempt to straighten a buckled stanchion as this would weaken the overall structure leading to a dangerous riding condition.

SLIDER

- ♦ Inspect for damage and/or cracking. Replace if damaged.

SPRING

- ♦ Check spring condition (2) and length.
- ♦ Replace the spring (2) if stretched beyond the service limit.

Minimum length of the uncompressed spring: 400 mm.

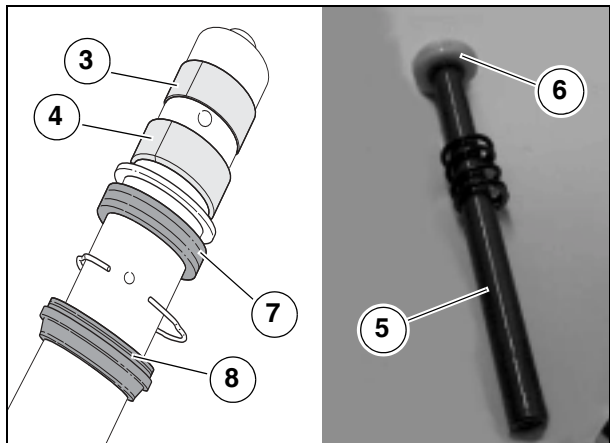
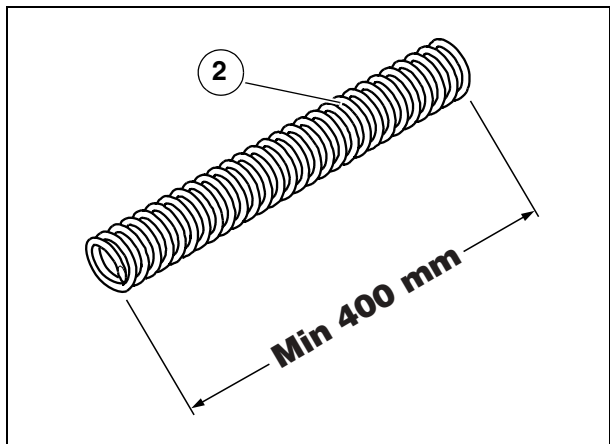
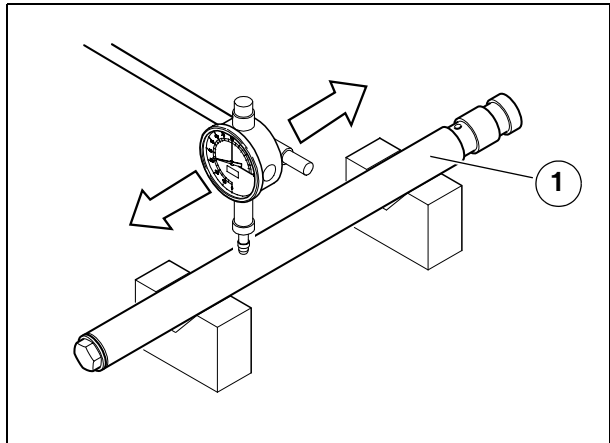
- ♦ Check the condition of the following components:
 - guide ring (3);
 - guide bush (4);
 - damping cylinder (5);
 - oil seal (6).

Replace any component which shows excessive wear or damage.

⚠ WARNING

Clean off any debris collected by the bushes taking care not to scratch the bush surface.

- ♦ Renew the following components on assembly:
 - oil seal (7);
 - dust seal (8);
 - both O-ring fitted to the top cap (9).



7.7.5 STANCHION TUBE – SLIDER ASSEMBLY

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION), 1.2.3 (FRONT FORK FLUID) and 2.28 (INSPECTING THE FRONT SUSPENSION) carefully.

NOTE The operations identified by the symbol “●” also apply to the fork oil change procedure.

WARNING

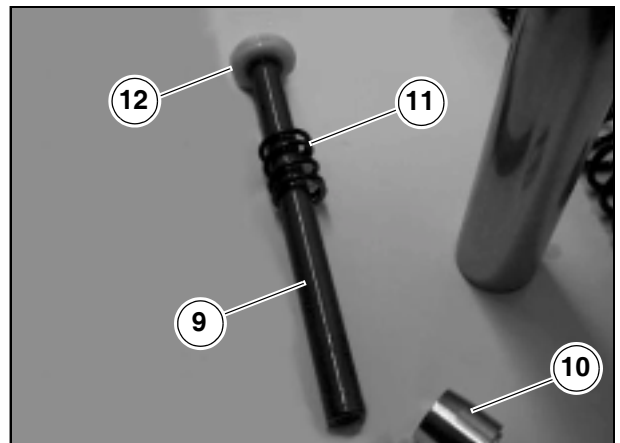
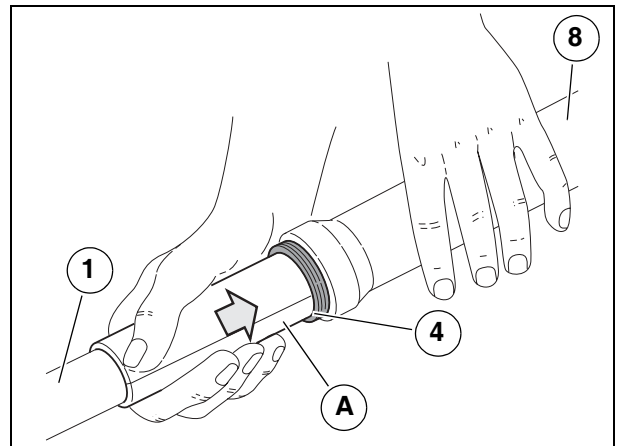
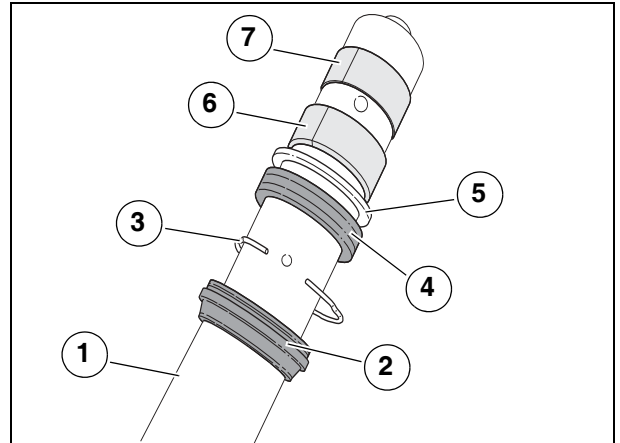
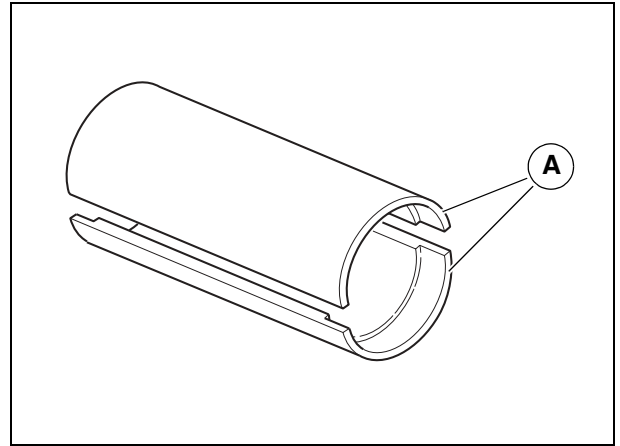
Take great care when reassembling stanchion and slider. Inspect all sliding surfaces for signs of wear, scoring, etc. Replace any damaged components. Take care to prevent the ingress of dirt inside the slider (1) and the stanchion (8).

Never reuse the oil you have drained from the fork. Always renew all seals, see 7.7.4 (COMPONENT INSPECTION).

Use utmost care during the re-assembly procedure.

NOTE Make sure to have the special tool **OPT** (A) ready at hand before proceeding. Apply a light film of fork oil to the bushes and seals before assembly. See 1.6 (LUBRICANT CHART).

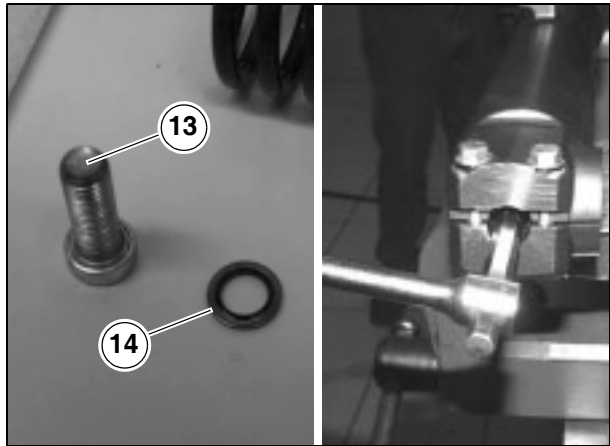
- ◆ Install the components to the slider (1) in the order:
 - dust seal (2);
 - retaining ring (3);
 - oil seal (4) (lubricate before fitment);
 - washer (5);
 - guide bush (6)
 - guide ring (7).
- ◆ Place the stanchion (8) in a vice with soft (aluminium) jaws.
- ◆ Locate the slider (1) to the stanchion (8) and then push the guide bush (6) and the washer (5) fully home on the stanchion.
- ◆ Use the special tool (A) to drive the oil seal (4) fully home into the stanchion. Install the retaining ring (3) and the dust seal (2).
- ◆ Push the damping cylinder (9) complete with bush (10), spring (11) and oil seal (12) all the way into the slider (1).



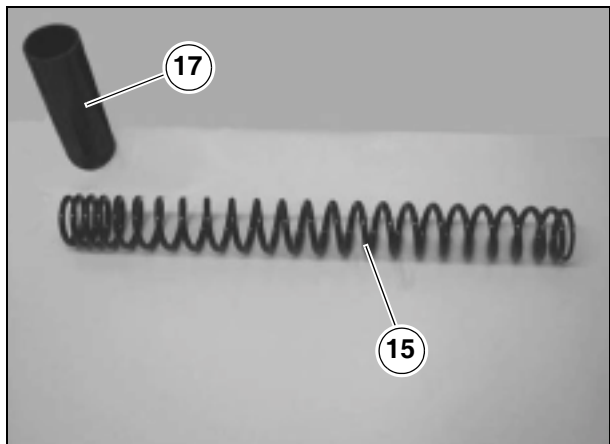
- ♦ Fit the copper washer (14) to the capscrew (13).
- ♦ Start the capscrew (13) in its hole and tighten to the specified torque.



Torque wrench setting for capscrew (13): 50 Nm (5.0 kgm).



- ♦ Insert the spring (15) into the slider (1).



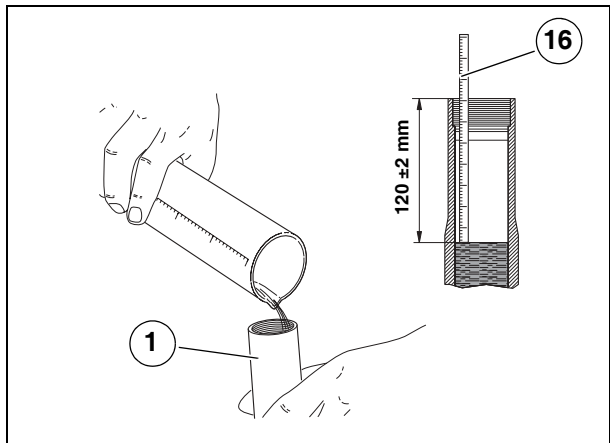
- ♦● Pour front fork fluid into the slider (1) up to correct level. See 1.6 (LUBRICANT CHART) for specifications. Measure level fitting a graduated rod (16) into the slider (1).

Oil quantity: 750 ± 2.5 cu. cm.

Oil level: 120 ± 2 mm (from slider edge).

NOTE The slider (1) must be perfectly vertical to ensure accurate measurement. Oil level must be the same in both fork legs.

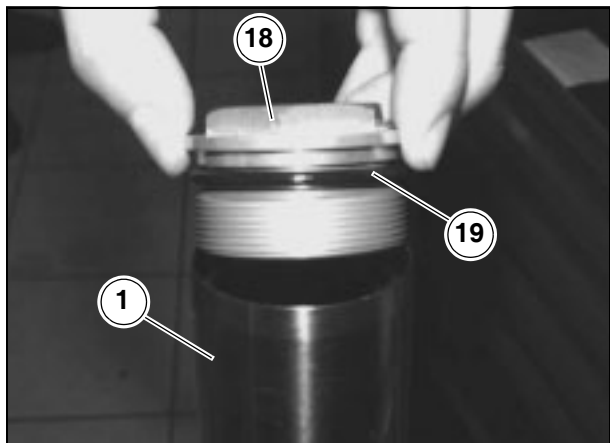
- ♦● Insert the spacer tube (17) into the slider (1).



- ♦● Make sure the O-ring (19) is fitted to the slider top cap (18).
- ♦● Start the slider top cap (18) in the slider (1) and tighten to the specified torque.



Torque wrench setting for slider top cap (18): 20 Nm (2.0 kgm).



7.7.6 INSTALLING STANCHIONS AND SLIDERS

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.28 (INSPECTING THE FRONT SUSPENSION) carefully.

- ♦ Insert the slider (1) complete with stanchion (2) through the bottom yoke (3) and the top yoke (4).
- ♦ Insert the wheel spindle (5) into both fork legs to keep the holes in the stanchions (2) aligned.
- ♦ Ensure that the slider (1) is properly seated in the top (4) and bottom yokes (3).
- ♦ Tighten the two bolts (6) securing the bottom yoke (3) to the slider (1).



Torque wrench setting for bolts (6): 25 Nm (2.5 kgm).

- ♦ Tighten the bolt (7) securing the top yoke (4) to the slider (1).



Torque wrench setting for bolt (7): 25 Nm (2.5 kgm).

- ♦ Withdraw the wheel spindle (5).
- ♦ Refit the wheel, see 7.2.2 (WHEEL REMOVAL).

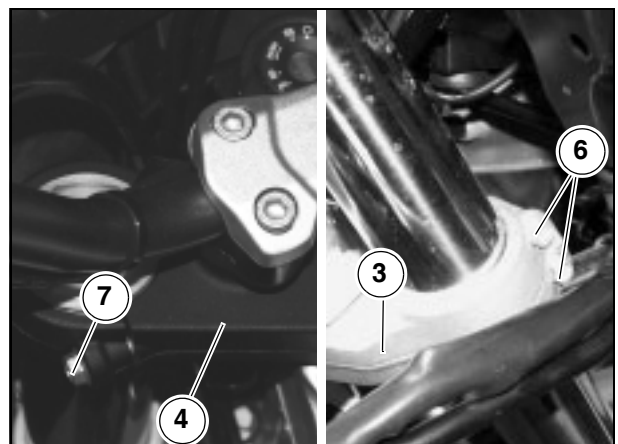
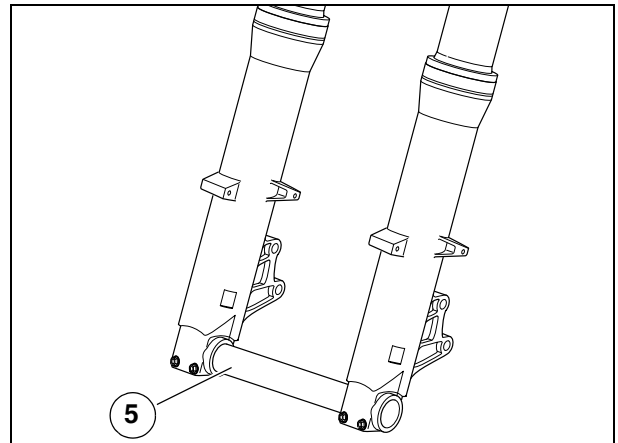
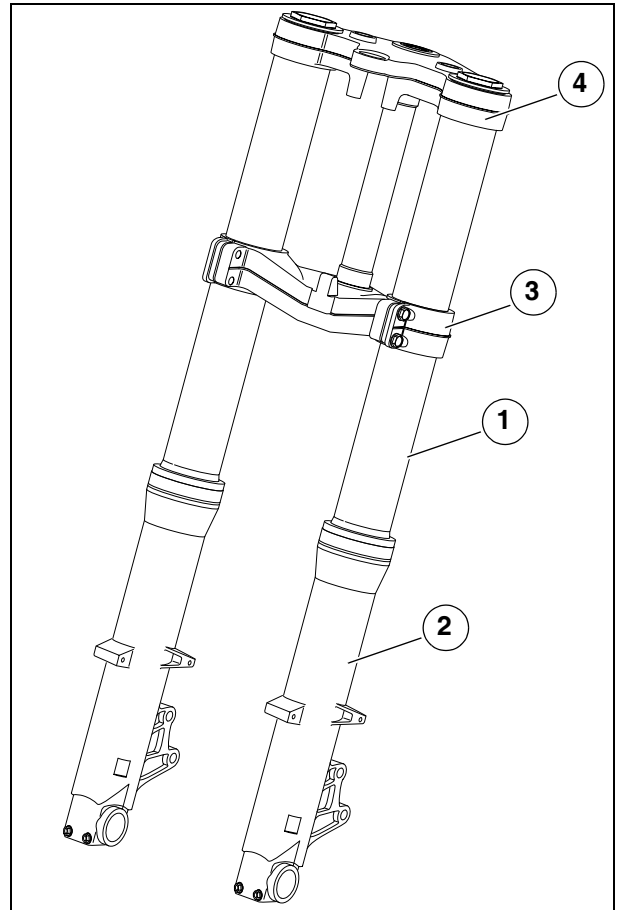
⚠ WARNING

When finished, operate the front brake and press down on the fork repeatedly.

Fork operation should smooth and progressive. There must be no traces of oil on the fork legs.

⚠ CAUTION

Check front suspension setting before riding the motorcycle.

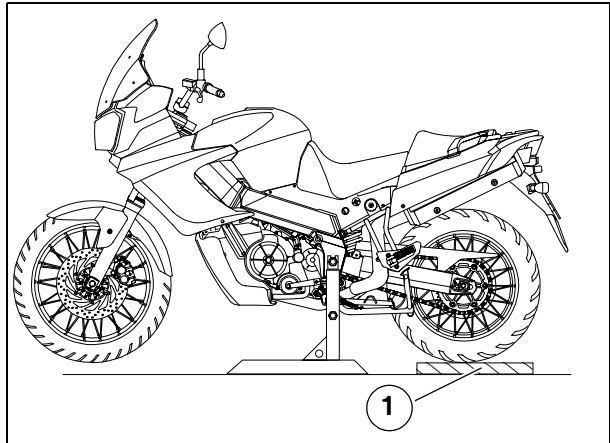



7.8 REAR SWINGING ARM

7.8.1 REMOVING THE REAR SWINGING ARM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.29 (REAR SWINGING ARM) carefully.

- ♦ Place the motorcycle on the centre stand **OPT**, see 1.9.2 (PLACING THE MOTORCYCLE ON THE CENTRE STAND).
- ♦ Place a support (1) under the rear wheel. The wheel must be resting lightly on the support and the rear shock absorber must not be compressed.
- ♦ Release and remove the screw (7).

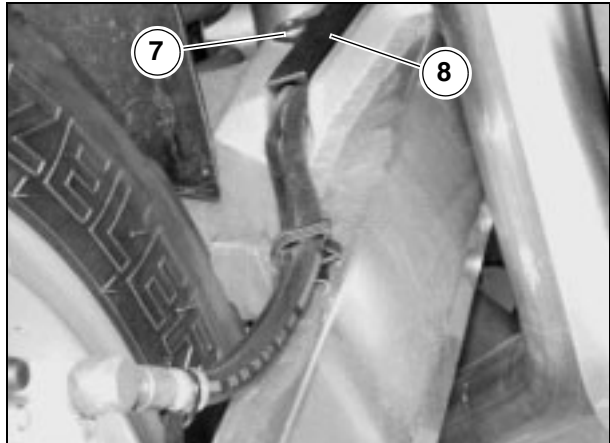


 **Torque wrench setting for screw (7): 5 Nm (0.5 kgm).**

- ♦ Remove the tube retainer (8).
- ♦ Release the brake hose and the speed sensor cone from the clips.

NOTE The clips must be renewed on assembly. Make sure to have enough spare clips ready at hand.

- ♦ Release and remove the two mounting bolts (2) of the rear brake caliper (3).

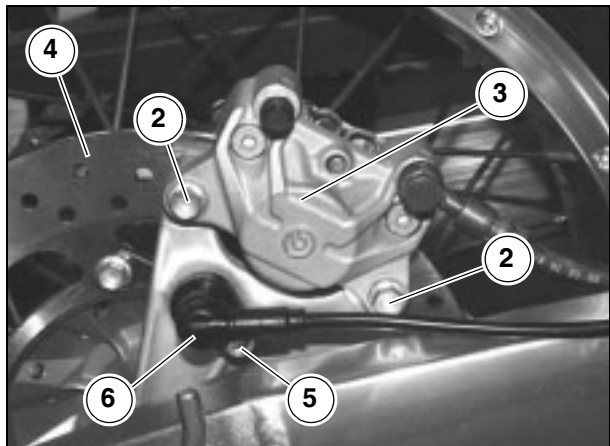


⚠ WARNING
On refitting, replace the two caliper (3) mounting bolts (2) with new bolts of the same type fitted originally.

 **Torque wrench setting for bolts (2): 25 Nm (2.5 kgm).**

⚠ WARNING
Take care not to damage the brake hose, brake disc and brake pads during removal.

- ♦ Slide the brake caliper (3) off the brake disc (4).

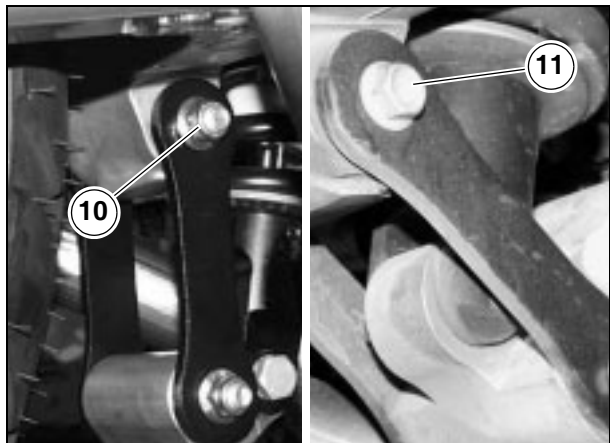


⚠ WARNING
Do not operate the rear brake lever when the caliper is not in place, or the caliper piston might fall out leading to brake fluid spillage.

- ♦ Release and remove the screw (5) that secures the speed sensor (6).

 **Torque wrench setting for screw (5): 10 Nm (1.0 kgm).**

- ♦ Ease off brake caliper (3) and speed sensor (6) and place them gently on the floor beside the wheel. Leave the caliper attached to the hose and the sensor connected to the wiring.
- ♦ Release and remove the nut (10).



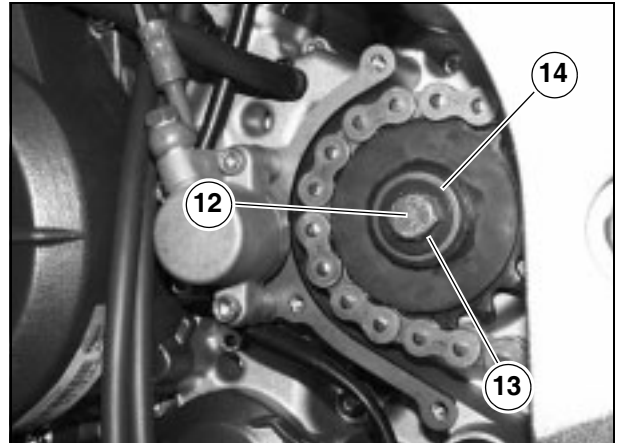
 **Torque wrench setting for nut (10): 45 Nm (4.5 kgm).**

- ♦ Withdraw the retaining pin (11) of the double connecting link of the swinging arm.

- ◆ Remove the sprocket cover, see 2.35.5 (DRIVE CHAIN GUIDE PLATE INSPECTION).
- ◆ Release and remove the screw (12) and collect the two washers (13-14).



Torque wrench setting for screw (12): 50 Nm (5.0 kgm).



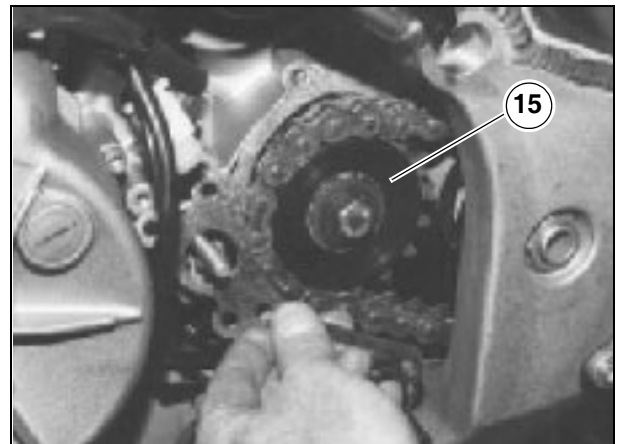
- ◆ Slide the front chain sprocket (15) complete with chain off the shaft.

NOTE Put some slack in the chain to aid sprocket (15) removal, see 2.35.3 (CHAIN SLACK ADJUSTMENT).

- ◆ Remove the front chain sprocket (15).
- ◆ Release and remove the nut (16).

NOTE Make sure to have the special tool **OPT** part no. 8140203 (socket for swinging arm-engine fixings adjustment) ready at hand.

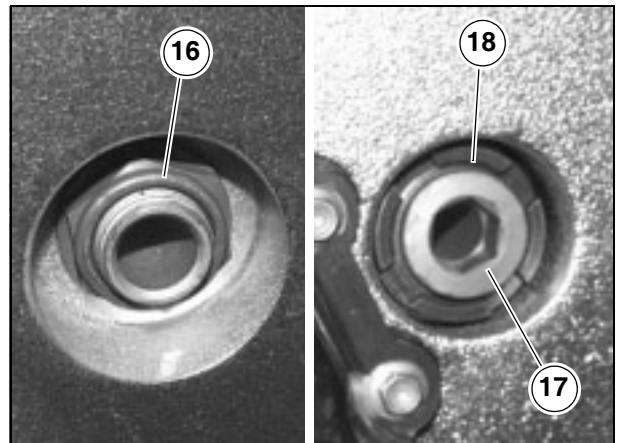
- ◆ Use the special tool (socket) to release and remove the lockring (18).
- ◆ Working from the right-hand side of the motorcycle, rotate the swinging arm spindle (17) anti-clockwise. The spindle will draw the adjusting ring (9) until it works itself loose.



⚠ WARNING

The tail section is heavy. An assistant will be required to perform the following operations. When working with an assistant, plan the whole procedure carefully together. Use utmost care when removing the swinging arm. Support the swinging arm at the front end or it might fall to the ground.

- ◆ Support the swinging at the front end. At the same time, withdraw the swinging arm spindle (17) from the right-hand side.

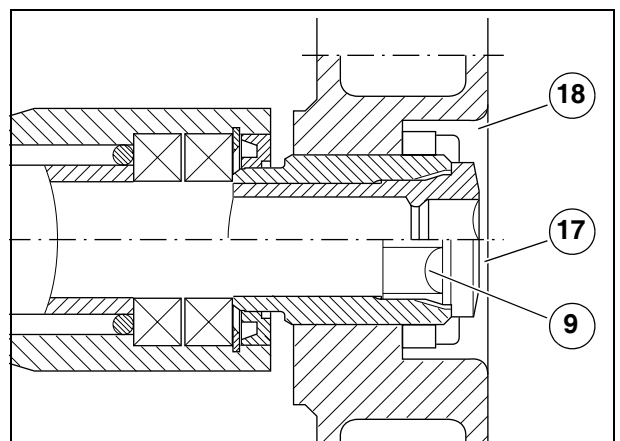


⚠ WARNING

Ensure that the drive chain does not snag on any parts while removing the tail section.

- ◆ Remove the swinging arm complete with wheel spindle in a rearward motion.
- ◆ Slide the adjusting ring (9) off the spindle (17).

NOTE Remove the rear wheel if needed. See 7.3.2 (WHEEL REMOVAL).



7.8.2 DISMANTLING THE SWINGING ARM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ♦ Remove the swinging arm, see 7.8.1 (REMOVING THE REAR SWINGING ARM).
- ♦ Clean both sides of the bearing housings using a cloth.
- ♦ Withdraw the bush (1).
- ♦ Remove the seal (2).
- ♦ Remove the seal (3).
- ♦ Remove the snap ring (4).
- ♦ Remove the two bearings (5) and the roller bearing (6) using a suitable extractor.

⚠ WARNING

Inspect the bearings after each removal. Replace as required.

- ♦ Remove the inner spacer (7) and collect the two O-rings (8).
- ♦ Remove the inner spacer (9).
- ♦ Remove the seals (10).
- ♦ Remove the two roller bearings (11) using a suitable extractor.

⚠ WARNING

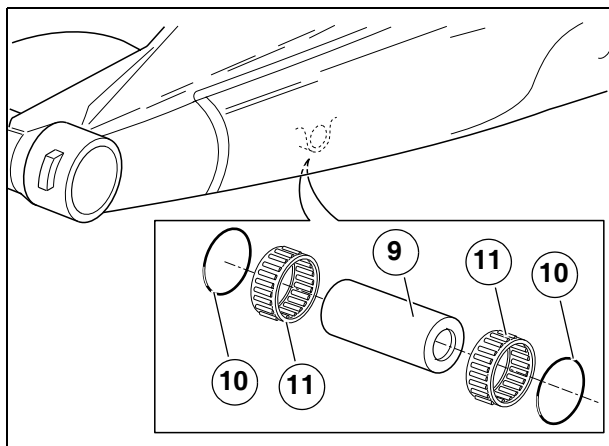
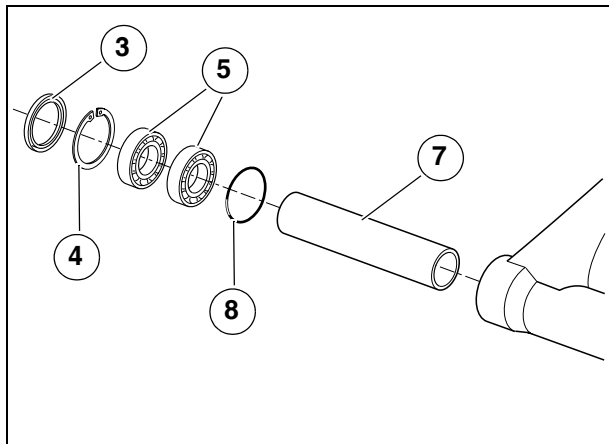
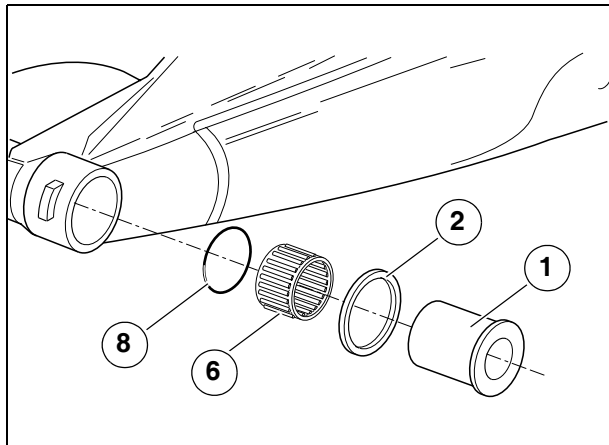
Inspect the bearings after each removal. Replace as required.

- ♦ Clean the inside of the bearing housings thoroughly.

NOTE Wash all components with clean detergent.

⚠ WARNING

On assembly, fit the bearings using a drift with the same diameter as the bearing outer ring. Do not tap the balls or the inner ring.



7.8.3 COMPONENT INSPECTION

⚠ WARNING

Visually inspect all components for distortion, damage, cracking and denting.

Replace any damaged components.

BEARINGS

- ♦ Rotate the inner ring (1) of each ball bearing manually. Rotate the bearing needle rollers. Inner ring and rollers must rotate smoothly, with no hardness or noise. There should be no end float. Replace any bearings that do not meet these requirements.

⚠ WARNING

Apply grease to the bearing balls (on the sides of each bearing) and needle rollers, see 1.6 (LUBRICANT CHART).

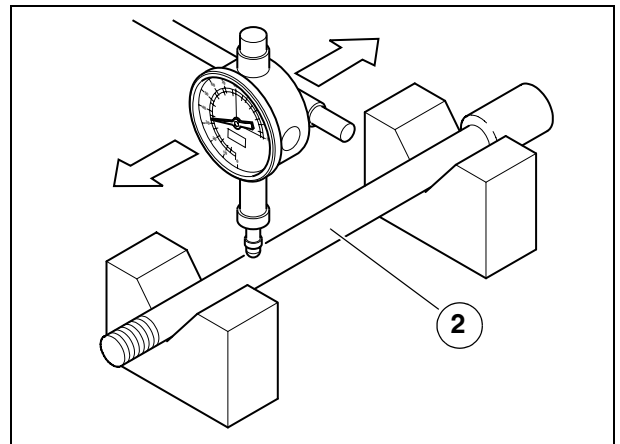
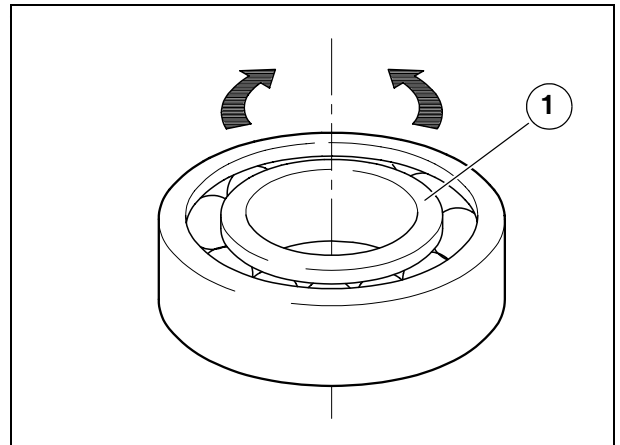
SEALS

- ♦ Check the condition of the seals. Replace any damaged or worn seals.

SWINGING ARM SPINDLE

- ♦ Check spindle (2) run-out using a dial gauge. Replace spindle (2) when run-out exceeds the allowed limit.

Spindle run-out limit: 0.3 mm.



7.8.4 INSTALLING THE SWINGING ARM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.29.1 (SWINGING ARM ADJUSTMENT) carefully.

- ♦ Lubricate the thread of the swinging arm spindle (1), with oil (part no. 8116050).
- ♦ Fit the adjusting bush (2) and screw it hand-tight.

NOTE The adjusting bush (2) must not protrude over the inner edge of its location in the frame.

- ♦ Position the drive chain (3) to the front (left-hand) end of the swinging arm and secure it in place with adhesive tape.

⚠ WARNING

The tail section is heavy. An assistant will be required to perform the following operations. When working with an assistant, plan the whole procedure carefully together.

- ♦ Support the swinging arm at the front end, position it properly to align the holes and slide the spindle (1) fully home.

NOTE Ensure that the hexagon of the spindle head (1) locates correctly into the adjusting bush (2).

- ♦ Fit the lockring (4) and turn in manually by a few turns.
- ♦ Fit the nut (5) to the spindle (1). Screw the nut hand-tight.
- ♦ Adjust the swinging arm, see 2.29.1 (SWINGING ARM ADJUSTMENT).
- ♦ Remove the adhesive tape to release the drive chain (3).
- ♦ Wrap the chain (3) around the drive sprocket (6).

NOTE Apply LOCTITE® Anti-Seize to the inner tooting of the drive sprocket (6).

- ♦ Fit the sprocket (6) with the chain (3) to the spindle.

NOTE Apply LOCTITE® 243 to the thread of the screw (8)

- ♦ Fit the washer (9) and the washer (7) to the screw (8).
- ♦ Start the screw (8) into its hole and tighten to the specified torque.



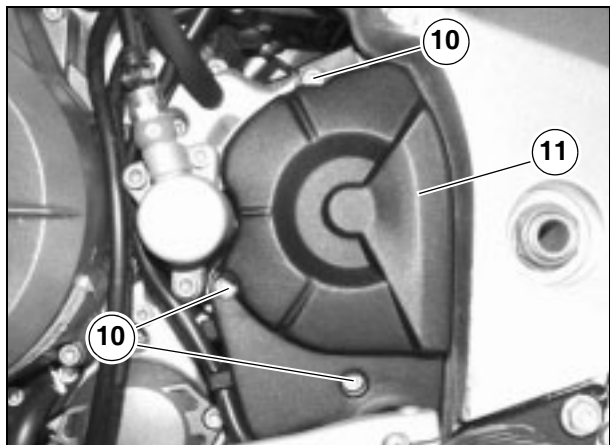
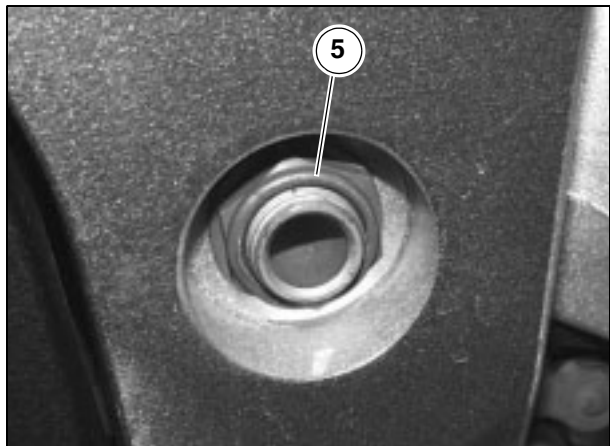
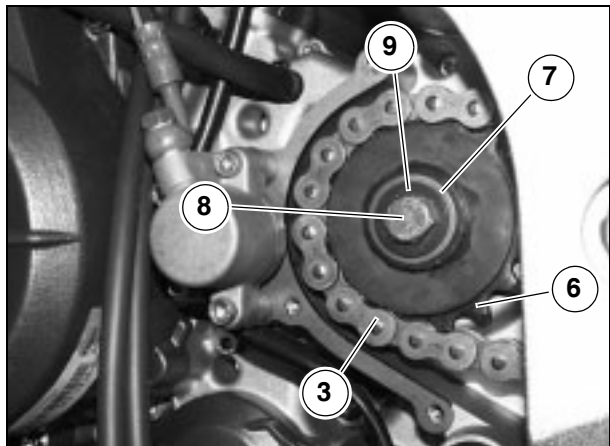
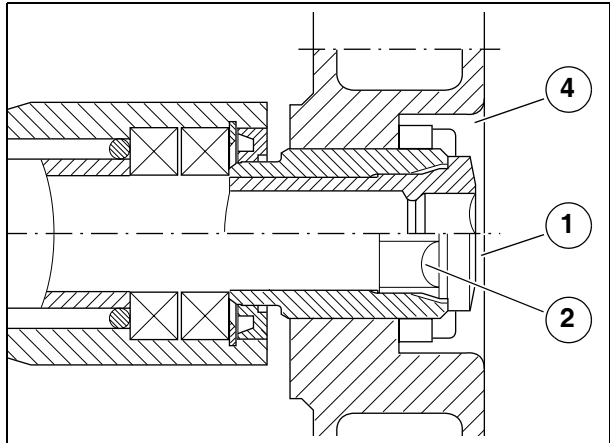
Torque wrench setting for screw (8): 50 Nm (5.0 kgm).

- ♦ Refit the sprocket cover (11).
- ♦ Start the three screws (10) in their holes and tighteh to the specified torque.



Torque wrench setting for screws (10): 10 Nm (1.0 kgm).

- ♦ Adjust drive chain slack, see 2.35.3 (CHAIN SLACK ADJUSTMENT)



- ♦ Slide in the spindle (12) and place the double connecting link on the swingarm.
- ♦ Tighten the nut (13).



Torque wrench setting for nut (13): 45 Nm (4.5 kgm).

- ♦ Fit the rear brake caliper (14) to the brake disc.

⚠ WARNING

Replace the brake caliper (14) mounting bolts (15) with new bolts of the same type fitted originally.

- ♦ Tighten the two bolts (15).



Torque wrench setting for bolts (15): 25 Nm (2.5 kgm).

- ♦ Place the speed sensor (16) in its seat.
- ♦ Tighten the screw (17).

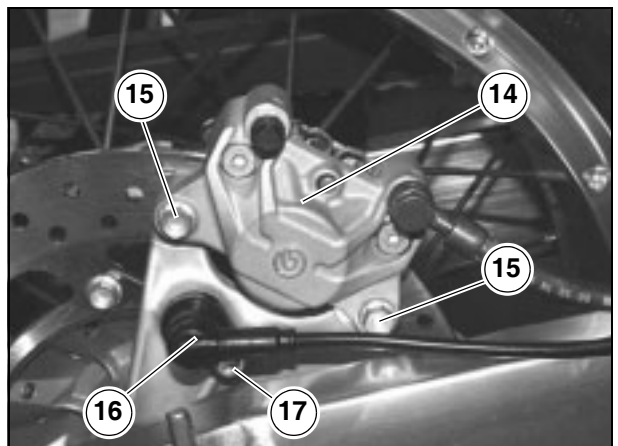
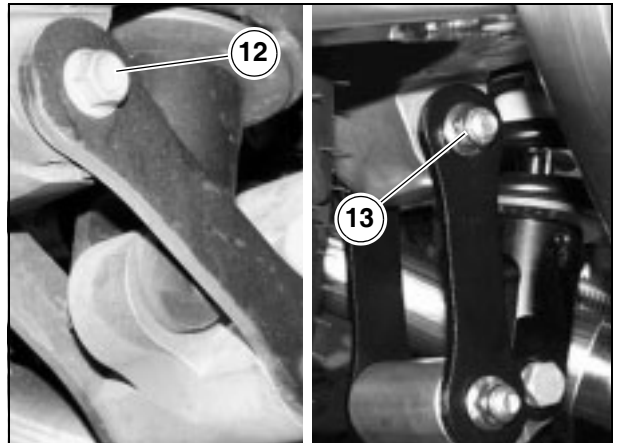


Torque wrench setting for screw (17): 12 Nm (1.2 kgm).

- ♦ Place the brake hose and the speed sensor cable in their seats on the swingarm.
- ♦ Secure the speed sensor cable to the brake hose using a plastic clip (18).
- ♦ Position the hose retainer (19).
- ♦ Tighten the screw (20).



Torque wrench setting for screw (20): 4 Nm (0.4 kgm).

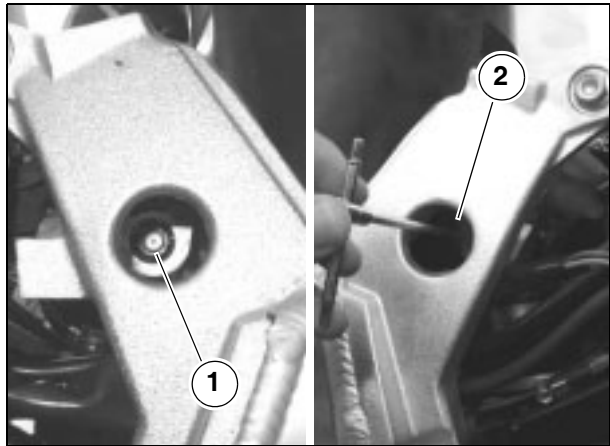


7.9 REAR SUSPENSION

7.9.1 REAR SHOCK ABSORBER REMOVAL

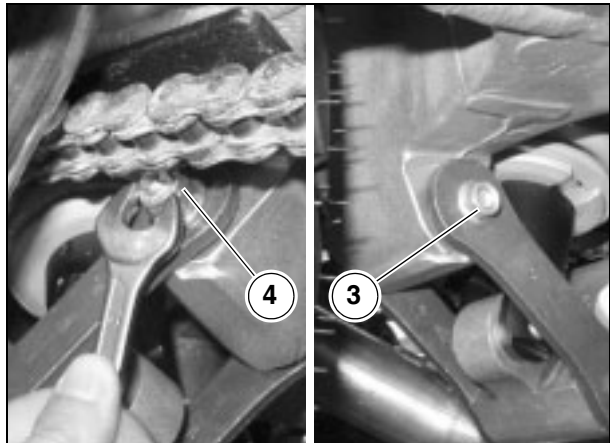
Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.30.1 (REAR SUSPENSION) carefully.

- ♦ Place the motorcycle on the centre stand **OPT**.
- ♦ Place a support under the rear wheel. The wheel must be resting lightly on the support and the rear shock absorber must not be compressed.
- ♦ Remove the side body panels, see 7.1.3 (REMOVING THE SIDE BODY PANELS).
- ♦ Working on the right-hand side of the motorcycle, undo and remove the nut (1). Push out the bolt (2) but not quite all the way.



 **Torque wrench setting for nut (1): 45 Nm (4.5 kgm).**

- ♦ Withdraw the bolt (2) from the opposite side.
- ♦ Release and remove the nut (4).



 **Torque wrench setting for nut (4): 45 Nm (4.5 kgm).**

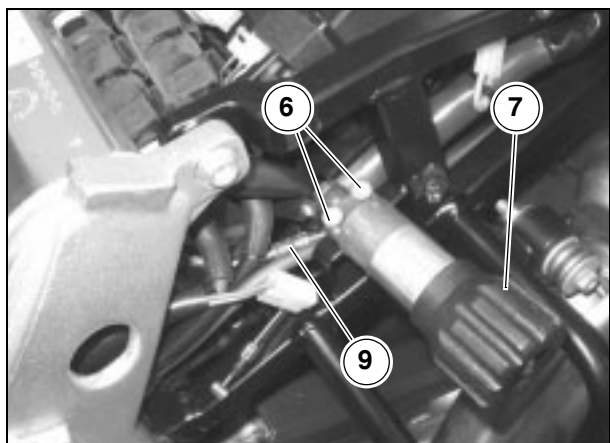
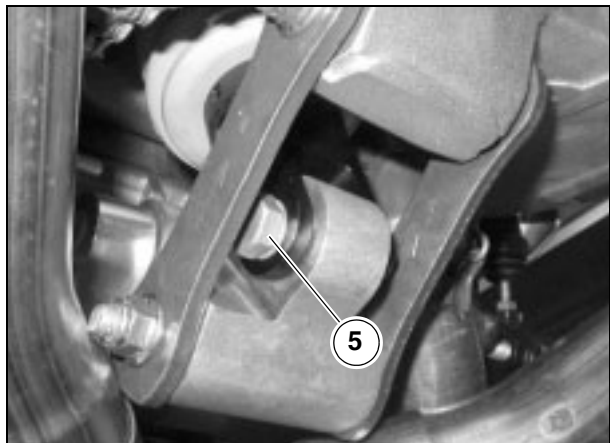
- ♦ Withdraw the pivot bolt (3) that secures the link to the swinging arm from the opposite.
- ♦ Working on the right-hand side of the motorcycle, release and remove the bolt (5) and collect the washer.

 **Torque wrench setting for bolt (5): 40 Nm (4.0 kgm).**

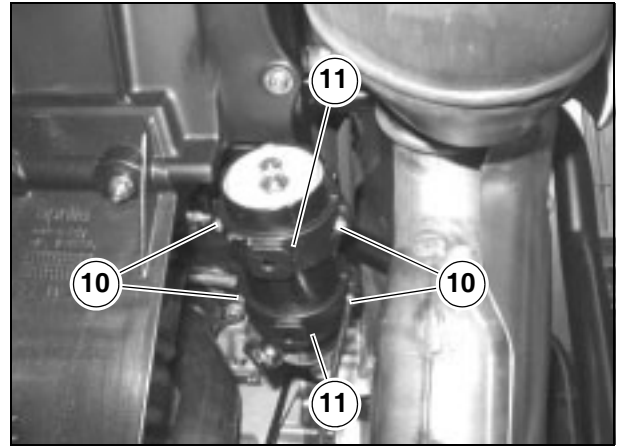
⚠ WARNING

The shock absorber contains pressurised nitrogen. Keep it well away from flames and/or heat sources to avoid a risk of explosion.

- ♦ Release and remove the two screws (6).
- ♦ Move aside the knob (7). The knob is still retained to the shock absorber (8) by the hose (9).



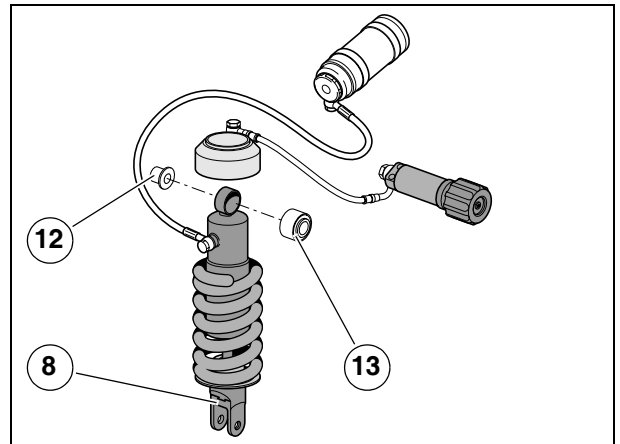
- ♦ Unscrew and remove the four screws (10).
- ♦ Remove the two clamps (11).
- ♦ Move the reservoir aside.



- ♦ Grasp the shock absorber (8) and remove in a downward motion.
- ♦ Withdraw the spacer (12) on the shock absorber upper fork.
- ♦ Withdraw the silentbloc (13) on the shock absorber upper connection.

NOTE Wash all components with clean detergents.

- ♦ Inspect all components, see 7.9.4 (COMPONENT INSPECTION).



7.9.2 REMOVING THE REAR SUSPENSION LINKAGES

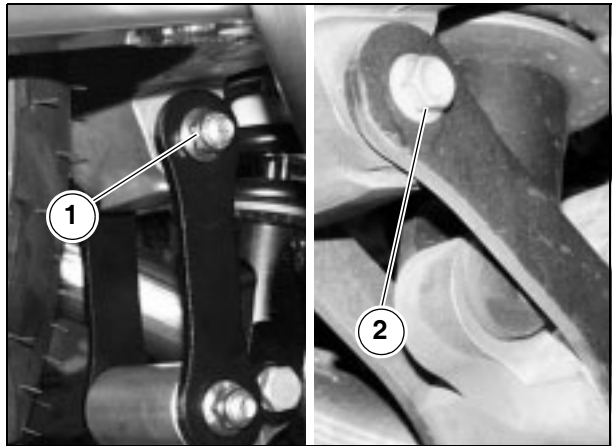
Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.30.1 (REAR SUSPENSION) carefully.

- ♦ Working from the left-hand side of the motorcycle, release and remove the nut (1).



Torque wrench setting for nut (1): 45 Nm (4.5 kgm).

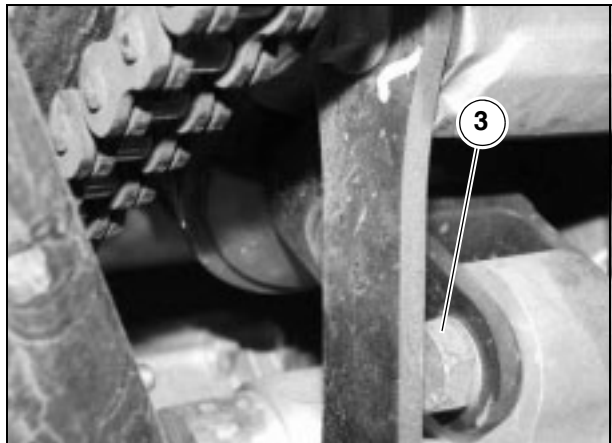
- ♦ Withdraw the bolt (2) from the opposite side.



- ♦ Release and remove the nut (3). Collect the washer.



Torque wrench setting for nut (3): 40 Nm (4.0 kgm).

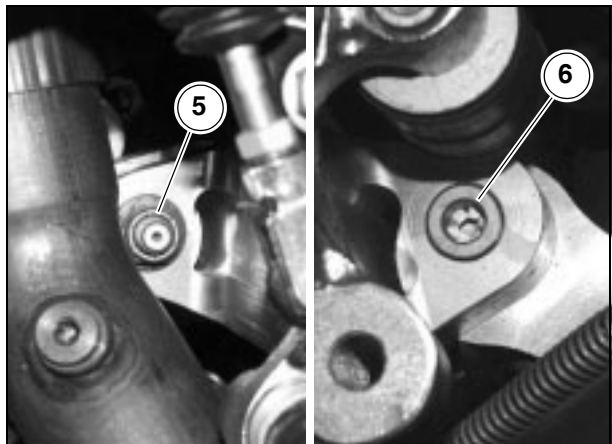


- ♦ Working from the right-hand side of the motorcycle, release and remove the nut (5).



Torque wrench setting for nut (5): 45 Nm (4.5 kgm).

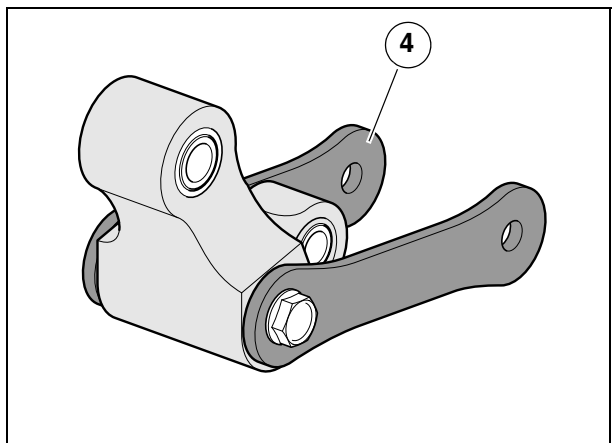
- ♦ Withdraw the bolt (6) from the opposite side.



- ♦ Remove the complete linkage system (4) of the rear suspension.

NOTE Grease all pivot points of the linkages when refitting, see 1.6 (LUBRICANT CHART). Take care to refit all parts in the correct position and test all joints for smooth operation several times.

- ♦ Inspect the linkage system after assembly, see 2.30.3 (INSPECTING THE REAR SUSPENSION LINKAGE SYSTEM).



7.9.3 DISMANTLING THE REAR SUSPENSION LINKAGE SYSTEM

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) carefully.

- ♦ Release and remove the nut (1).



Torque wrench setting for nut (1): 45 Nm (4.5 kgm).

- ♦ Withdraw the bolt (2).
- ♦ Remove the two double connecting links (3-4).
- ♦ Remove the two seals (5).
- ♦ Collect the inner spacer (7).
- ♦ Remove the two roller bearings (6) using a suitable extractor.
- ♦ Remove the two seals (8).
- ♦ Remove the inner spacer (9).
- ♦ Remove the two roller bearings (10) using a suitable extractor.
- ♦ Remove the two seals (12).
- ♦ Collect the inner spacer (13).
- ♦ Remove the roller bearing (14) using a suitable extractor.

NOTE Wash all components using clean detergent.

NOTE On refitting, connect the linkage (11) to the double connecting links (3-4) as shown in the diagram. The arrow marks on the double connecting links (arrowed in the diagram) must be placed uppermost, facing outside and pointing in the direction of travel.

7.9.4 COMPONENT INSPECTION

⚠ WARNING

Visually inspect all components for distortion, damage, cracking and denting.
Replace any damaged components.

BEARINGS

- ♦ Rotate the bearing needle rollers manually. They must rotate smoothly, with no hardness or noise. There should be no end float.
Replace any bearings that do not meet these requirements.

⚠ WARNING

Apply grease to the bearing needle rollers, see 1.6 (LUBRICANT CHART).

SEALS

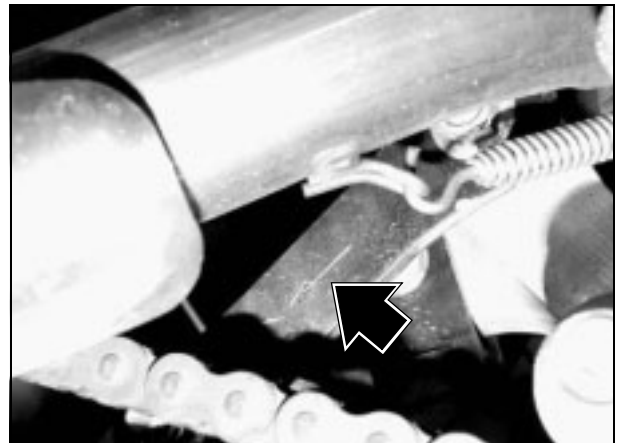
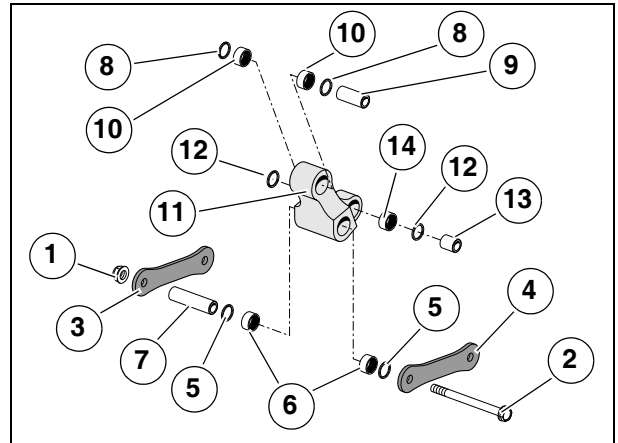
- ♦ Check the condition of the seals. Replace any damaged or worn seals.

SHOCK ABSORBER

- ♦ Inspect the shock absorber for oil leaks. Shock absorber travel should be smooth and progressive.
Replace the shock absorber if does not meet these requirements.

⚠ CAUTION

The shock absorber contains pressurised nitrogen. Keep it well away from flames and/or heat sources to avoid a risk of explosion.



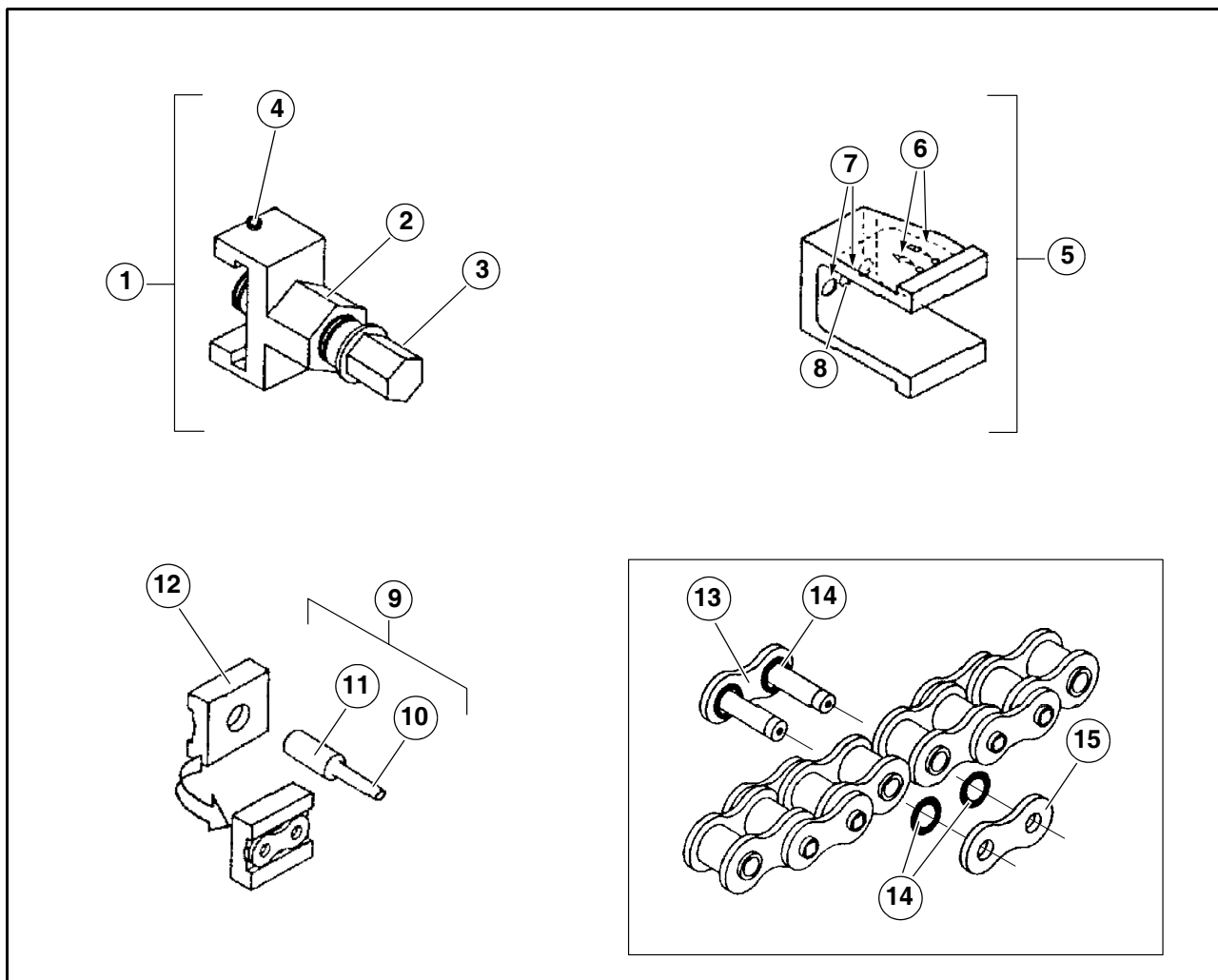
7.10 DISMANTLING THE DRIVE CHAIN

7.10.1 CHAIN TOOL

NOTE This special tool (part no. 8140192) doubles as rivet extractor and chain tool and is specific for rivet-type chains.

⚠ WARNING

Use only rivet-type chains on this motorcycle.



Key to tool diagram:

- 1) Tool main body
- 2) Hex nut (width across flats: 27 mm)
- 3) Hexagon head screw (width across flats: 19 mm)
- 4) Locating peg
- 5) Rivet tool
- 6) Reference marks "A" and "B"
- 7) Rivet holes
- 8) Rivet exit hole
- 9) Driving pin
- 10) Extractor end
- 11) Driving end
- 12) Supporting plate

Key to chain diagram:

- 13) Connecting link plate
- 14) O-rings
- 15) Outer link plate

7.10.2 BREAKING THE CHAIN

Read 0.5.1 (GENERAL PRECAUTIONS AND INFORMATION) and 2.35 (DRIVE CHAIN) carefully.

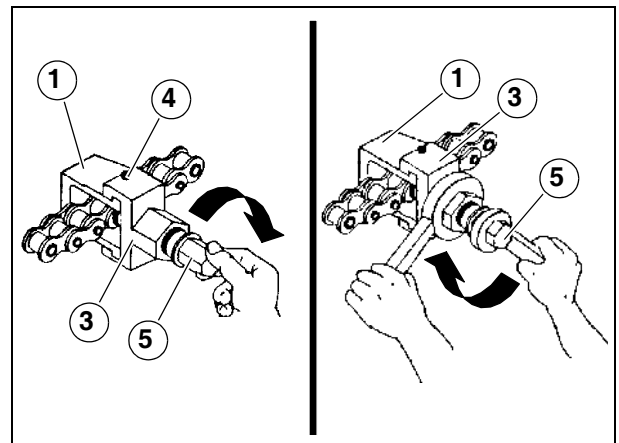
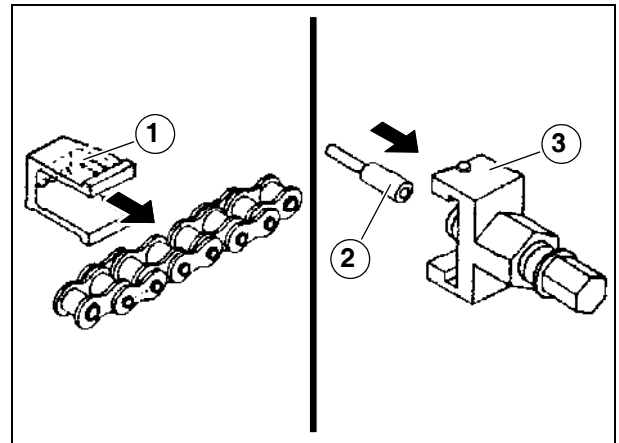
- ♦ Remove the front sprocket cover, see 2.35.5 (DRIVE CHAIN GUIDE PLATE INSPECTION).
- ♦ Slacken the chain, see 2.35.3 (CHAIN SLACK ADJUSTMENT).
- ♦ Place the motorcycle on the centre stand **OPT**.

NOTE Make sure that the chain tool is suitable for the type of chain installed to the motorcycle and is the adequate size for the chain links.

- ♦ Fit the rivet tool (1) to the lower portion of the chain, midway between front and rear sprocket.
- ♦ Move the rivet tool (1) until that the (centre) exit hole aligns with the rivet you wish to extract.
- ♦ Fit the driving pin (2) to the tool body (3), with the larger diameter end facing into the tool body.
- ♦ Fit the tool body (3) to the rivet tool (1).
- ♦ Move the tool body (3) until the locating peg (4) lines up with the mark "A" on the rivet tool (1).
- ♦ Turn in the screw (5) manually until the driving pin (2) contacts the rivet to be extracted.

NOTE Make sure that the driving pin (2) is perfectly centred to the rivet to be pushed out.

- ♦ Fit a 27-mm spanner to the hex nut on the tool body (3) to hold the body steady.
- ♦ Tighten the screw (5) using a 19-mm spanner until pushing the rivet clear of the chain.
- ♦ Slacken the screw (5).
- ♦ Repeat the process for the adjacent rivet on the same link.
- ♦ Remove the components of the dismantled link and collect the four O-rings.
- ♦ Remove the chain.



⚠ WARNING

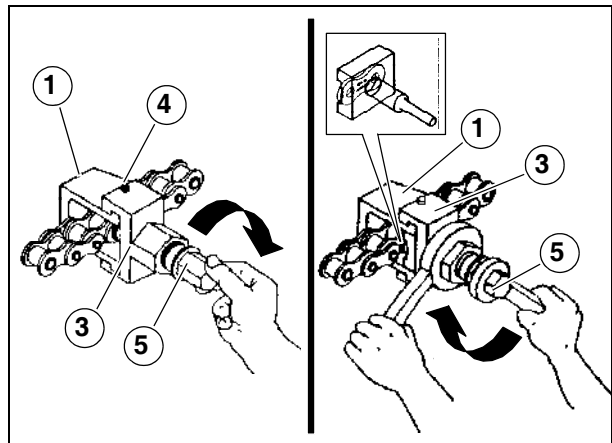
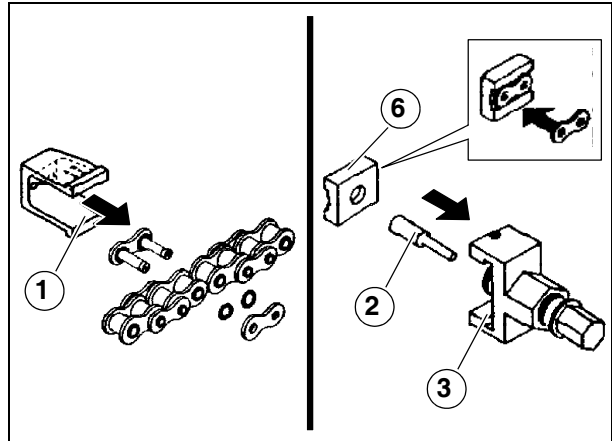
When the chain is worn, replace chain and front and rear sprockets as a set. See 7.3.3 (DISMANTLING THE FINAL DRIVE ASSEMBLY).

7.10.3 FITTING THE CONNECTING LINK

⚠ WARNING

Make sure that the connecting link is the same type as the chain.

- ♦ Wrap the chain around the sprockets. The chain open ends should be lowermost midway between the front and rear sprockets.
- ♦ Fit the two O-rings to the pins of the connecting link. Grease the two pins of the connecting link, see 1.6 (LUBRICANT CHART).
- ♦ Join the two ends of the chain and slide the pins of the connecting link in place. Fit the two O-rings at the end of the pins.
- ♦ Fit the outer link plate to the pins.
- ♦ Fit the supporting plate (6) to the outer link plate.
- ♦ Fit the rivet tool (1) to the chain.
- ♦ Move the rivet tool (1) until the tool side holes align with the heads of the connecting link pins.
- ♦ Fit the driving pin (2) to the tool body (3) with the smaller diameter end facing into the body.
- ♦ Fit the tool body (3) to the rivet tool (1).
- ♦ Move the tool body (3) until the locating peg (4) lines up with the mark "A".
- ♦ Tighten the screw (5) manually until the driving pin (2) contacts the supporting plate (6).
- ♦ Fit a 27-mm spanner to the hex nut of the tool body (3) to hold the tool body steady.
- ♦ Turn the screw (5) all the way in using a 19-mm spanner.



7.10.4 RIVETING THE LINK

With the tool in position on the chain:

- ◆ Slacken the screw (1).
- ◆ Remove the tool body (2) from the rivet tool (3).
- ◆ Remove the supporting plate (4).
- ◆ Refit the tool body (2) to the rivet tool (3).
- ◆ Move the tool body (2) until the locating peg (5) lines up with the mark "B" on the rivet tool (3).
- ◆ Tighten the screw (1) manually until the driving pin (6) contacts the rivet.

NOTE Make sure that the driving pin (6) is perfectly aligned with the rivet.

⚠ WARNING

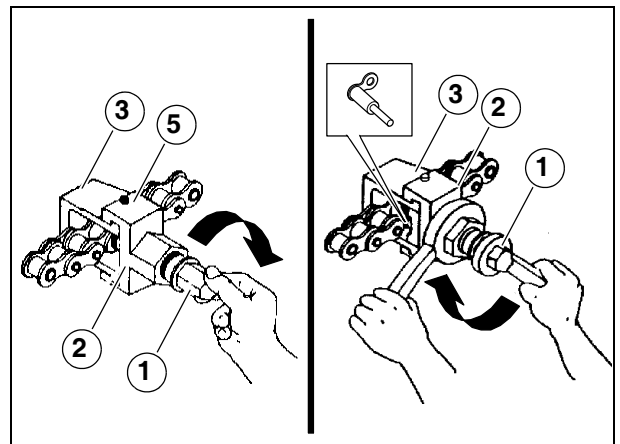
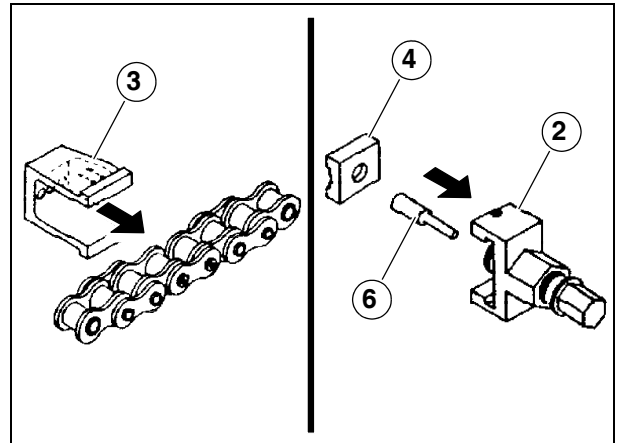
Wear protective goggles or a face shield.

- ◆ Fit a 27-mm spanner to the hex nut on the tool body (2) to hold the tool body steady.
- ◆ Tighten the screw (1) using a 19-mm spanner until squeezing the rivet end.

⚠ WARNING

Ensure that the rivet is fastened securely. The closing head of the rivet must be evenly in contact with the outer link plate and its maximum diameter must be 5.65 ± 0.15 mm.

- ◆ Turn out the screw (1).
- ◆ Repeat process for the next rivet on the same link.



REPAIR INFORMATION

8

REPAIR INFORMATION

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8.1 TROUBLESHOOTING

⚠ WARNING

Any faults in the ignition coils, crankshaft position sensor, camshaft sensor, pressure sensors and THERMISTORS are automatically detected by the Engine Control Unit, which turns on a flashing "EFI" message on the multifunction display.

Troubleshooting of these components is covered in section 4 (FUEL SYSTEM) and section (ELECTRICAL SYSTEM). For this reason, these components are omitted from the troubleshooting charts in the following pages.

NOTE Some of the operations listed in the chart below are marked with an asterisk (*). Please refer to the relevant Engine Workshop Manual before performing these operations. See 0.4.1 (ENGINE WORKSHOP MANUALS).

8.1.1 ENGINE

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Engine does not start or is difficult to start	Set the engine kill switch to ☒	Set to ○ and press
	Safety lockout system has cut in	Check and rectify as required
	Bank angle sensor faulty	Replace
	Breather hole in fuel filler cap obstructed	Clean
	Battery low	Charge the battery
	Battery damaged	Replace
	Freewheeling clutch or freewheeling clutch gear worn or defective	Replace (*)
	Compound gear or starter motor idler gear worn or defective	Replace (*)
	Starter motor tothing broken	Replace (*)
	Foul spark plugs	Replace
	Wet spark plugs	Clean or replace
	Loose spark plugs	Tighten
	Spark plugs do not meet specification	Replace
	Fuel filters or fuel delivery hose clogged	Clean or replace
	Fuel pump, relay or wiring fault	Replace
	Fuel pressure regulator fault	Replace
	Faulty injectors	Replace
Incorrect valve clearance	Adjust (*)	

CONTINUED ►

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Engine does not hold idling speed	Idling speed setting too low	Adjust
	Air cleaner clogged	Clean
	Intake hose leaking	Replace
	Cylinders incorrectly synchronised	Synchronise the cylinders
	Throttle spindle/housing worn	Replace
	See also "Engine does not start or is difficult to start " for other possible causes	
Erratic engine speed at high rpm	A clogged fuel outlet fitting causes poor fuel delivery to injector	Clean fuel system and refuel
	Air scoops and intake ducts obstructed	Check
	Air flows past throttle body or intake hose	Replace
	Fuel pressure too low	Clean fuel system or replace pump
	Fuel pump faulty	Replace
	Camshafts worn	Replace (*)
	See also "Engine does not start or is difficult to start " for other possible causes	
Loss of power	Foul spark plugs	Clean or replace
	Spark plugs do not meet specification	Replace
	Valve clearance too tight	Adjust (*)
	Exhaust system defective	Replace
	Valve timing incorrectly adjusted	Adjust (*)
	Valve springs defective	Replace (*)
	Valve seats leaking	Re-cut valve seats (*)
	Intake hose or intake system leaking	Replace
	Clutch slips	Replace clutch plates and springs (*)
	Engine oil does not meet specification	Use the specified engine oil
	Air cleaner clogged	Replace
	Fuel pump defective	Replace
	Fuel pressure too low	Replace fuel pressure regulator or check pump
	Dirty injector	Replace
	Piston rings worn	Replace (*)
	See also "Engine produces exceeding exhaust fumes/blue smoke" and "Clutch slips" for other possible causes	

CONTINUED ►

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Engine overheats	Coolant level too low, cooling system leaking	Top up coolant level, pressure-test the system
	Coolant does not meet specification	Use the specified coolant
	Radiator clogged or coolant hose clogged	Clean
	Air in the cooling system	Bleed the system
	Cooling fan motor faulty	Repair or replace
	Coolant pump or coolant pump control faulty	Replace (*)
	Insufficient oil in the system	Top up engine oil level
	Oil pump or oil pump control faulty; oil circuit obstructed	Replace or clean (*)
	Engine oil does not meet specification	Use the specified engine oil
	Intake hose or intake system leaking	Replace
	Faulty injector	Replace
	Cylinder head gasket defective	Replace (*)
Engine produces exceeding exhaust fumes/ blue smoke	Clutch membrane leaking	Replace (*)
	Valve stem seals worn	Replace (*)
	Valve stems or valve guides worn	Replace (*)
	Cylinder barrel scratched or scored	Replace (*)
	Piston rings or cylinder worn	Replace (*)
	Cylinder head gasket leaking	Replace (*)
Engine vibration	Engine fixings loose	Tighten
	Bearing or bearing housing worn	Replace
	Balancing shafts incorrectly timed	Adjust (*)
Low engine oil pressure (Led light on)	Insufficient oil in the system	Top up with engine oil
	Oil does not meet specification	Replace
	Oil pressure sensor faulty	Replace (*)
	Oil pressure relief valve clogged or defective (valve stays open)	Clean or replace (*)
	Oil pump control faulty	Replace (*)
	Oil pump worn	Replace (*)

CONTINUED ►

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Engine is noisy	Noise seems to come from the timing system	
	Chain slider worn	Replace (*)
	Valve clearance too loose	Adjust (*)
	Valve springs worn or broken	Replace (*)
	Valve buckets or camshaft worn	Replace (*)
	Timing chain worn	Replace (*)
	Timing gears worn	Replace (*)
	Timing chain tension adjuster defective	Replace (*)
	Noise seems to come from the piston	
	Piston pin, bore or connecting rod worn	Replace (*)
	Piston rings or grooves worn or broken	Replace (*)
	Noise seems to come from the clutch or clutch housing	
	Clutch plates worn	Replace (*)
	Clutch housing worn	Replace (*)
	Too much play in the clutch housing cush drive	Replace (*)
	Noise occurs when clutch is operated – grooved ball bearings in the supporting plate faulty	Replace (*)
	Primary drive worn or broken	Replace (*)
	Noise seems to come from the flywheel casing	
	Timing gears worn or broken	Replace (*)
	Noise seems to come from the crankpin/con-rod assembly	
	Connecting rod bearings worn	Replace (*)
	Crankshaft bearing sleeves or balancing shaft bearings worn	Replace (*)
	Noise seems to come from the transmission	
	Transmission gears or shafts worn or broken	Replace (*)
	Primary gear set worn	Replace (*)
	Transmission bearings worn	Replace (*)
	Noise upon engine starting	
	Freewheeling clutch gear or housing worn or defective	Replace (*)
	Compound gear or starter motor idler gear worn	Replace (*)
	Starter motor toothing broken	Replace (*)
Clutch slips	Clutch plates worn or warped	Replace (*)
	Clutch springs worn	Replace (*)
	Supporting plate worn or warped	Replace (*)
	Engine oil does not meet specification	Use the specified engine oil
	Clutch hydraulic control faulty	Replace

CONTINUED ►

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Clutch does not disengage	Fluid level in the reservoir	Check
	Engine oil does not meet specification	Use the specified engine oil
	Clutch plates stick	Clean or replace (*)
	Clutch plates or supporting plate warped	Replace (*)
	Clutch hydraulic control faulty	Replace
	Clutch housing worn	Replace (*)
Clutch jams during engagement	Clutch plates worn or warped	Replace (*)
	Lined plates enlarged the housing grooves	Replace clutch housing (*)
	Clutch plates enlarged the driving plate grooves	Replace driving plate (*)
	Thrust face of clutch housing or supporting plate worn	Replace (*)
Gears do not engage or are hard to engage	Transmission gear dogs worn	Replace (*)
	Transmission shafts worn	Replace (*)
	Selector shaft mechanism faulty	Repair or replace (*)
	Selector forks worn or distorted	Replace (*)
	See also "Clutch does not disengage" for other possible causes	
Gears slip out upon starting or under harsh acceleration	Selector gears worn	Replace (*)
	Selector forks worn or distorted	Replace (*)
	Guide springs worn or broken	Replace (*)
	Up/downshift is rough or gear does not engage fully; gear shift lever distorted or improperly adjusted	Push down gear shift pedal all the way when changing gears; replace gear shift lever (*)
Spark plugs overheated, burnt out or foul	Spark plugs do not meet specification	Replace
	Spark plugs loose	Tighten
	Intake hose or intake system leaking	Replace
	Fuel system faulty	Repair or replace
Alternator does not charge battery or charges battery improperly	Battery faulty	Replace battery
	Rectifier faulty	Replace
	Power failure, short circuit or alternator windings discharging to ground	Replace
	Wiring interrupted or shorted, loose connections	Repair, replace or tighten

8.1.2 ELECTRICAL SYSTEM

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Spark plugs collect carbon build-up soon after fitment	Incorrect engine oil level	Check
	Fuel not adequate	Use the specified fuel
	Air cleaner dirty	Clean
Spark plugs foul soon after fitment	Incorrect engine oil level	Check
	Piston rings worn	Replace (*)
	Piston(s) or cylinder(s) worn	Replace (*)
Spark plug electrodes overheated or burnt out	Engine overheating	Adjust
	Loose spark plugs	Tighten
Alternator provides no charge current	Connection terminals interrupted, shorted or loose	Repair, replace or tighten
	Alternator coils shorted, discharging to ground or interrupted	Replace
	Regulator/rectifier shorted or faulty	Replace
Alternator output current below specified value	Terminals prone to short-circuiting, interrupting or moving apart	Repair or tighten
	Alternator stator coils discharging to ground or interrupted	Replace
	Regulator/rectifier faulty	Replace
	Battery faulty	Replace
Alternator is overcharging the battery	Short-circuit inside battery	Repair or replace
	Regulator/rectifier damaged or faulty	Replace
	Ground of regulator/rectifier erratic	Replace
Erratic charge	Terminal insulator worn due to vibration causes transient short-circuits	Repair or replace
	Short-circuits inside generator	Replace (*)
	Regulator/rectifier faulty	Replace

8.1.3 BATTERY

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Battery runs flat too fast	Charge system faulty	Check alternator, regulator/rectifier, circuit connections and rectify to obtain proper charge
	Overcharging destroyed a large part of the active material in the battery cells	Replace battery and repair charge system
	Exceeding deposit build-up leads to short-circuits in the battery	Replace battery
	Battery is due for replacement	Replace battery
Battery polarity reversal	Battery improperly connected to electrical system	Replace battery; make sure to connect it properly

8.1.4 BRAKES

TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Loss of braking	Brake hydraulic system leaking	Repair or replace
	Brake pads worn	Replace brake pads
	Contact surfaces of brake pads contaminated with oil, grease or brake fluid	Replace brake pads
	Brake discs worn	Replace disc
	Air in the hydraulic circuit	Bleed the circuit
	Brake discs contaminated with oil, grease or brake fluid	Clean
	Foreign matter in brake fluid	Change brake fluid
	Return hole of brake master cylinder obstructed	Dismantle and clean brake master cylinder
Brake squeals	Contact surfaces of brake pads vitrified	Sand brake pads
	Brake pads incorrectly installed	Install brake pads correctly
	Wheel hub bearing damaged	Replace
	Front or rear wheel spindle loose	Tighten to the specified torque
	Brake pads worn	Replace
Brake lever has exceeding travel	Air in the hydraulic circuit	Bleed the circuit
	Brake fluid level low	Replace
	Brake fluid does not meet specification	Replace
	Brake caliper pistons jammed	Dismantle and clean
Brake fluid leakage	Fittings loose	Tighten to the specified torque
	Hoses cracked	Replace
	Piston and/or body damaged	Replace piston and/or body

8.1.5 CHASSIS

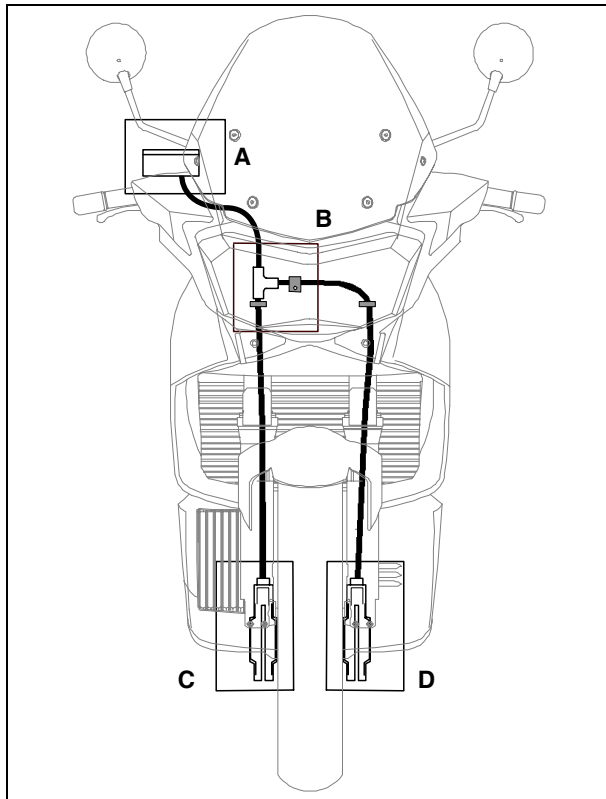
TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Steering is tight	Adjusting ring overtightened	Adjust
	Steering bearings damaged	Replace
	Steering stem distorted	Replace
	Front tyre underinflated	Rectify
	Hardness in steering damper	Replace
Steering is not smooth	Steering bearings damaged	Replace
Handlebars shake	Uneven front fork settings	Adjust
	Front fork buckled	Replace
	Front wheel rim and/or tyre warped	Replace
	Front/rear wheel imbalanced	Balance

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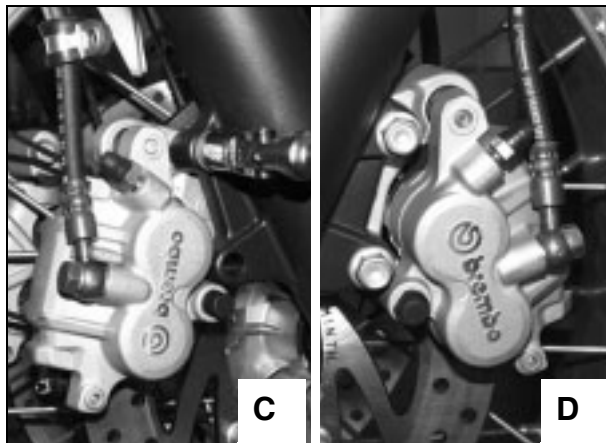
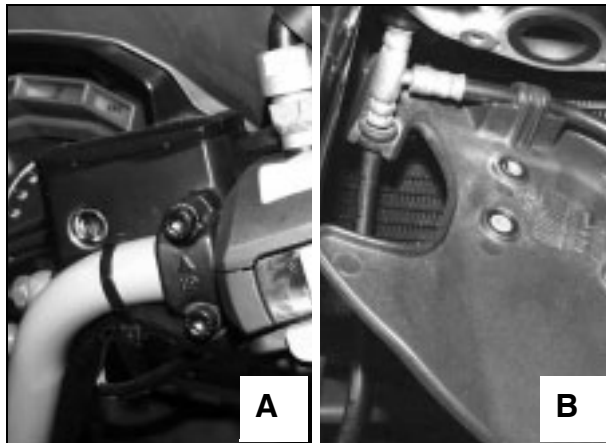
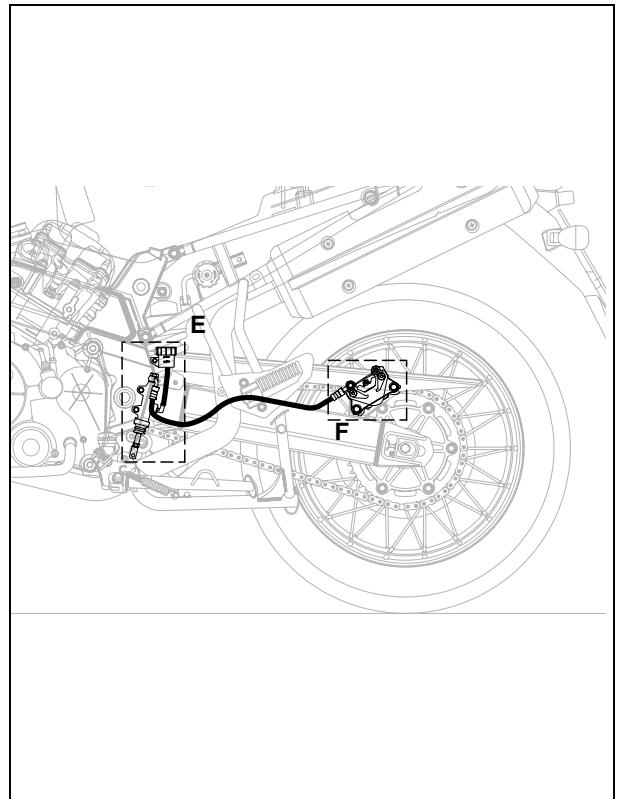
TROUBLE	SYMPTOM AND POSSIBLE CAUSE	REMEDY
Front wheel wobbles	Wheel rim warped	Replace
	Wheel hub bearings worn	Replace
	Tyre defective or does not meet specification	Replace
	Wheel spindle nut loose	Tighten
	Front fork oil does not meet specification	Change
Front fork too soft	Fork incorrectly adjusted	Adjust
	Springs yielded	Replace
	Front fork oil level low	Top up
	Front fork oil spent	Change
Front fork too stiff	Front fork incorrectly adjusted	Adjust
	Front fork oil does not meet specification (viscosity too high)	Change
	Front fork overfilled	Remove excess oil
Front fork is noisy	Low oil level	Top up
	Bolts and nuts of suspension mountings loose	Tighten
Rear wheel wobbles	Wheel rim warped	Replace
	Wheel hub bearings worn	Replace
	Tyre defective or does not meet specification	Replace
	Swinging arm bearings worn	Replace
	Suspension bolts and nuts loose	Replace
	Rear wheel nut loose	Tighten
Rear suspension too soft	Shock absorber spring yielded	Replace
	Adjusters incorrectly set	Adjust
	Shock absorber is leaking oil	Replace
	Shock absorber is leaking nitrogen	Replace
Rear suspension too stiff	Adjusters incorrectly set	Adjust
	Shock absorber pivot bolt distorted	Replace
	Swinging arm distorted	Replace
	Swinging arm bearings worn	Replace
	Suspension roller bearings worn	Replace
Rear suspension noisy	Suspension bolts and nuts loose	Tighten
	Swinging arm bearings worn	Replace
	Suspension roller bearings worn	Replace

8.2 ROUTING AND CONNECTIONS OF WIRING, CABLES AND HOSES

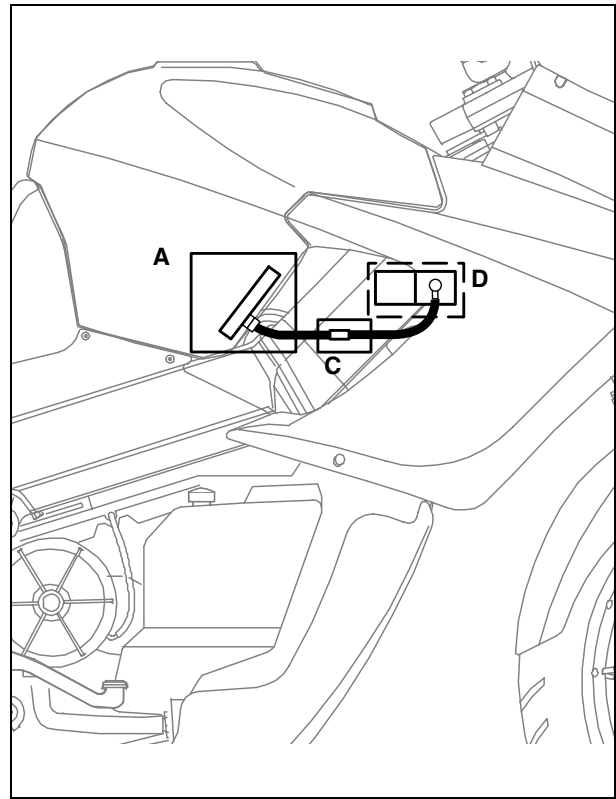
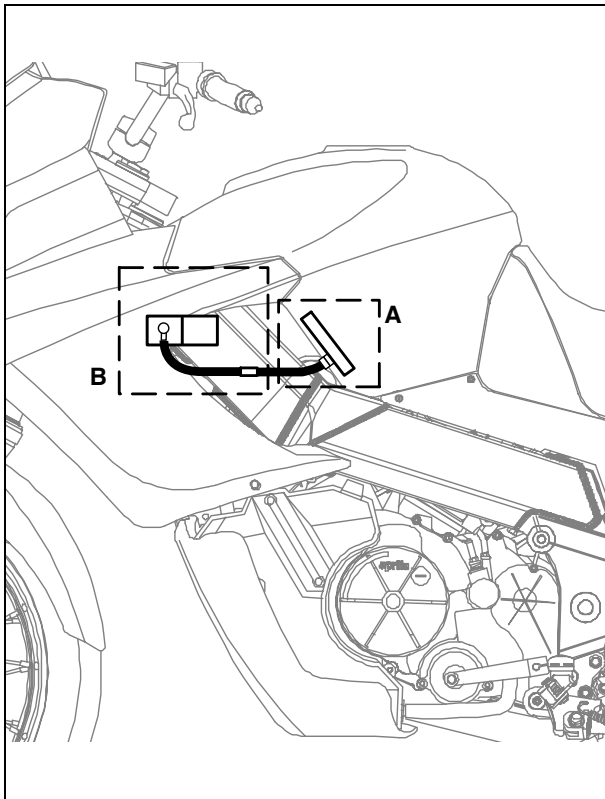
8.2.1 FRONT BRAKE HOSES



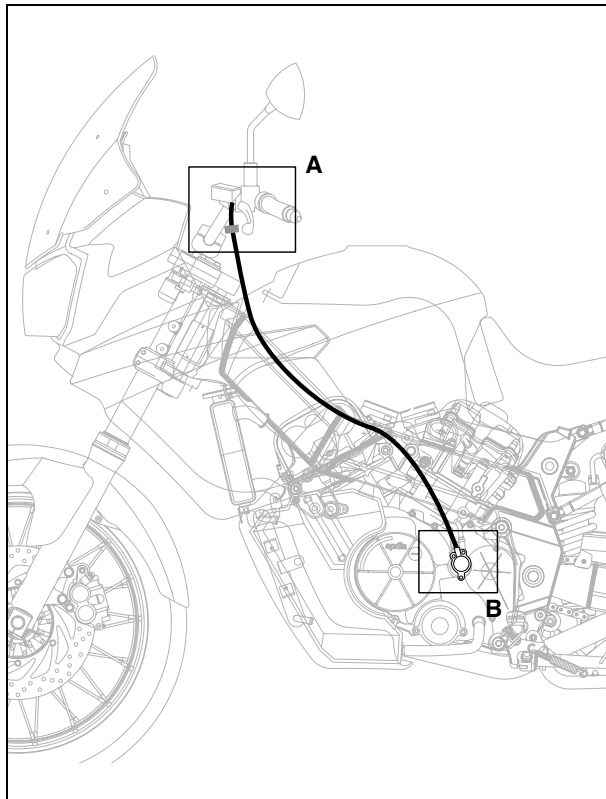
8.2.2 REAR BRAKE HOSES



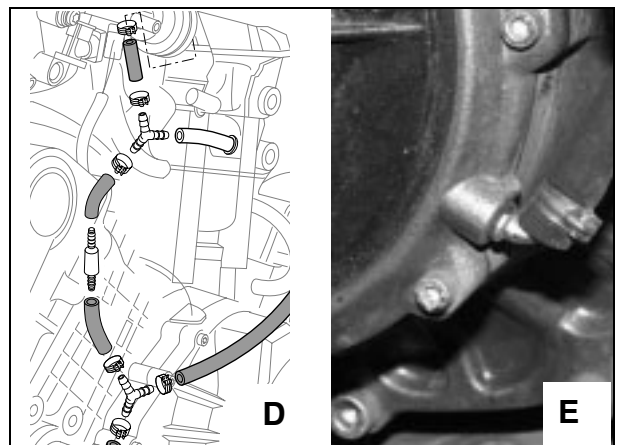
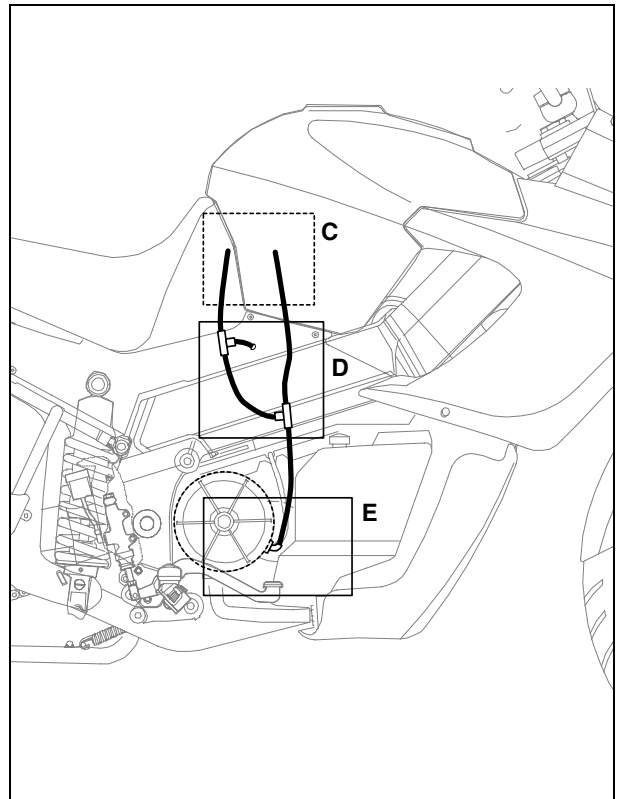
8.2.3 FUEL SYSTEM HOSES



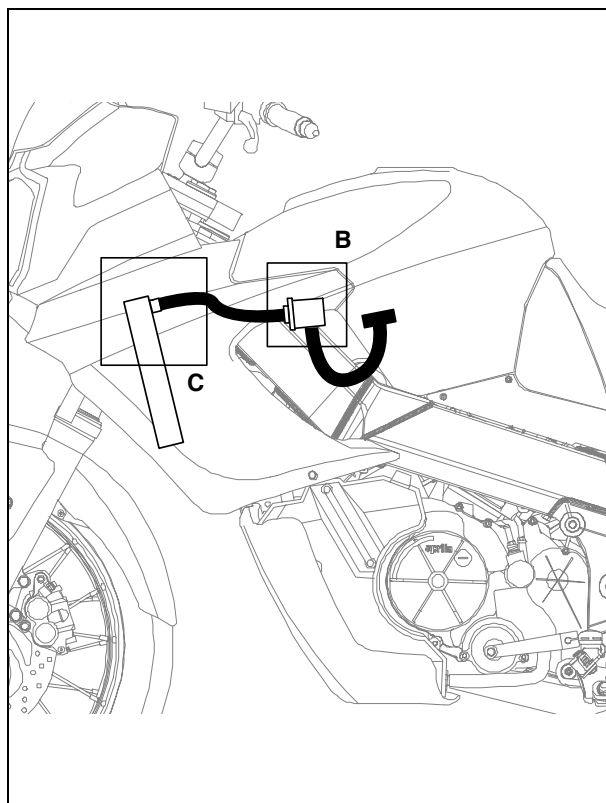
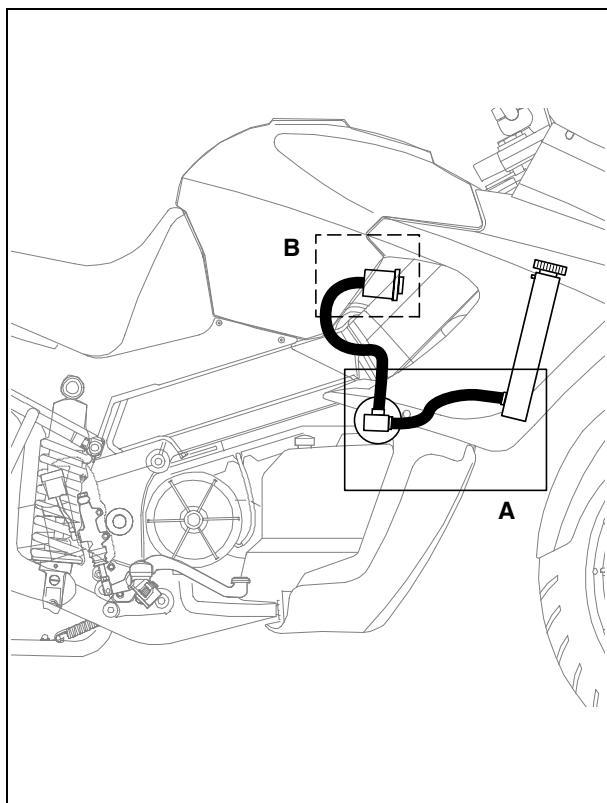
8.2.4 CLUTCH HOSE



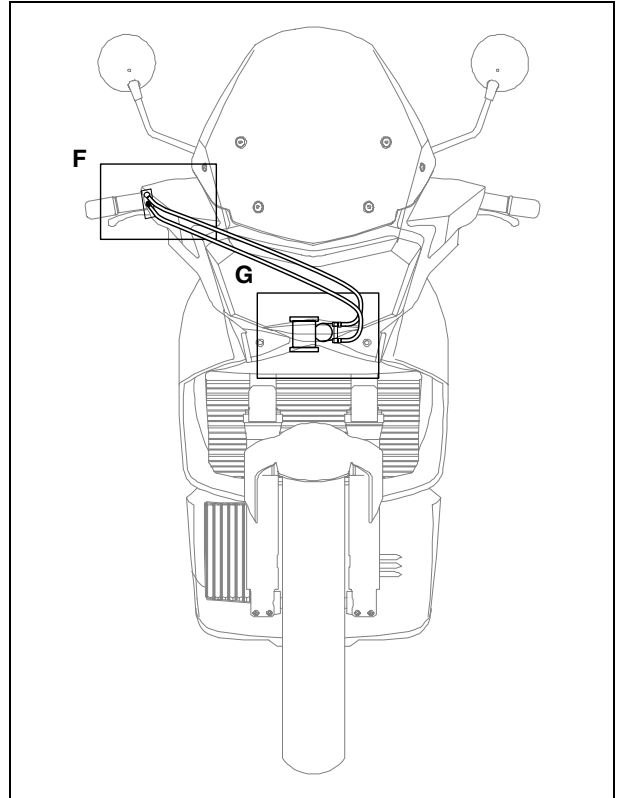
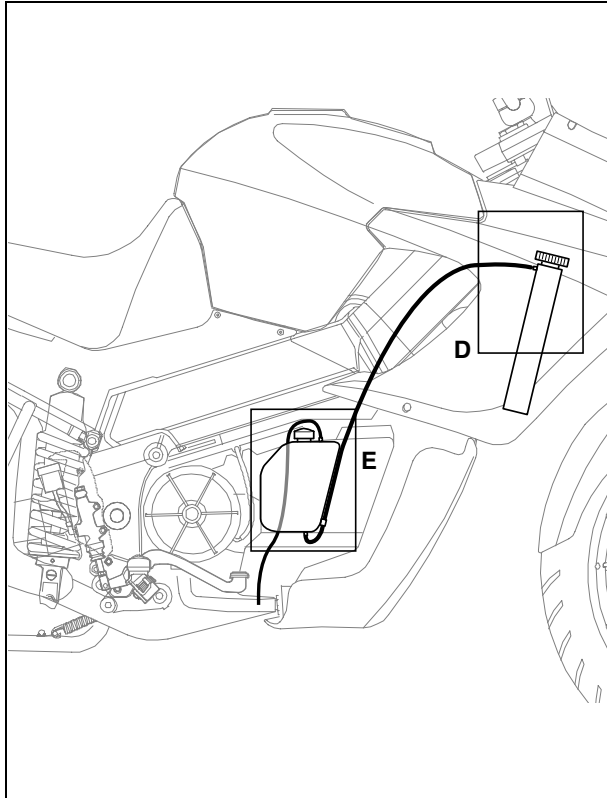
8.2.5 PRESSURE TUBES FOR PPC DEVICE



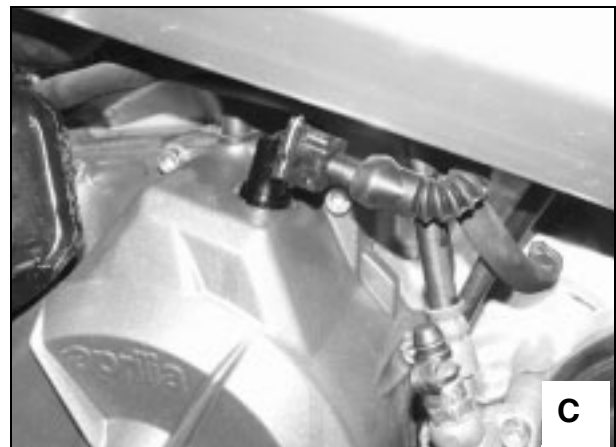
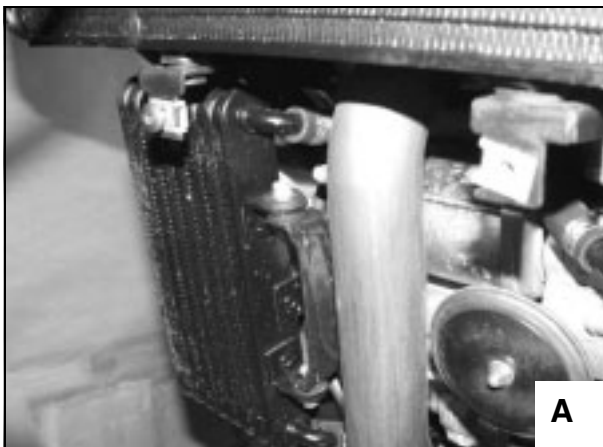
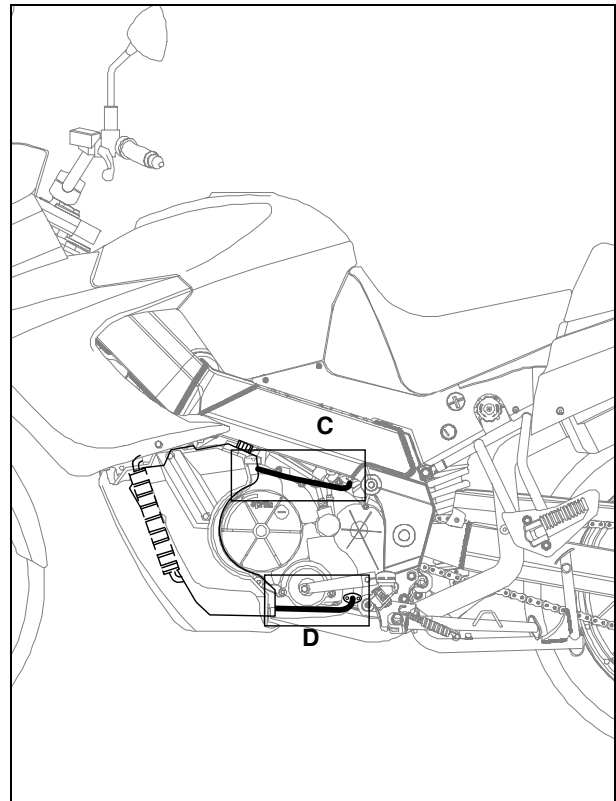
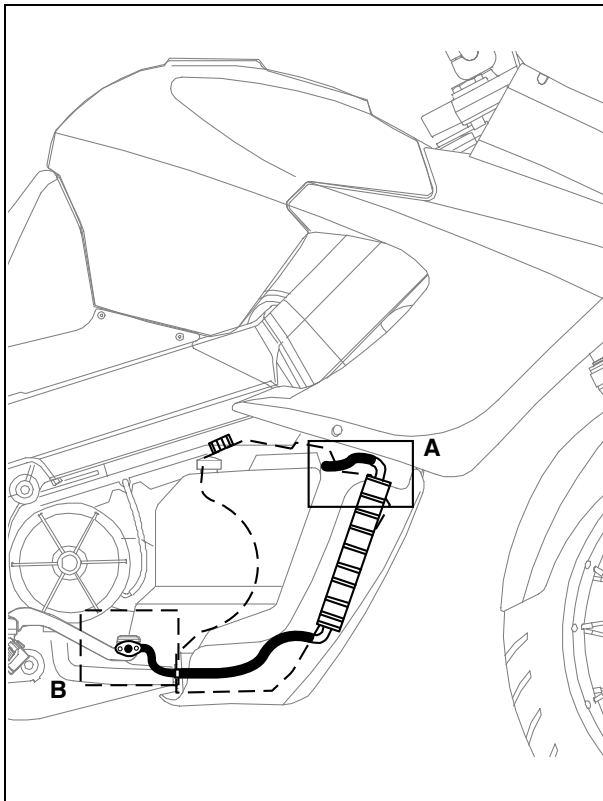
8.2.6 COOLING SYSTEM TUBES



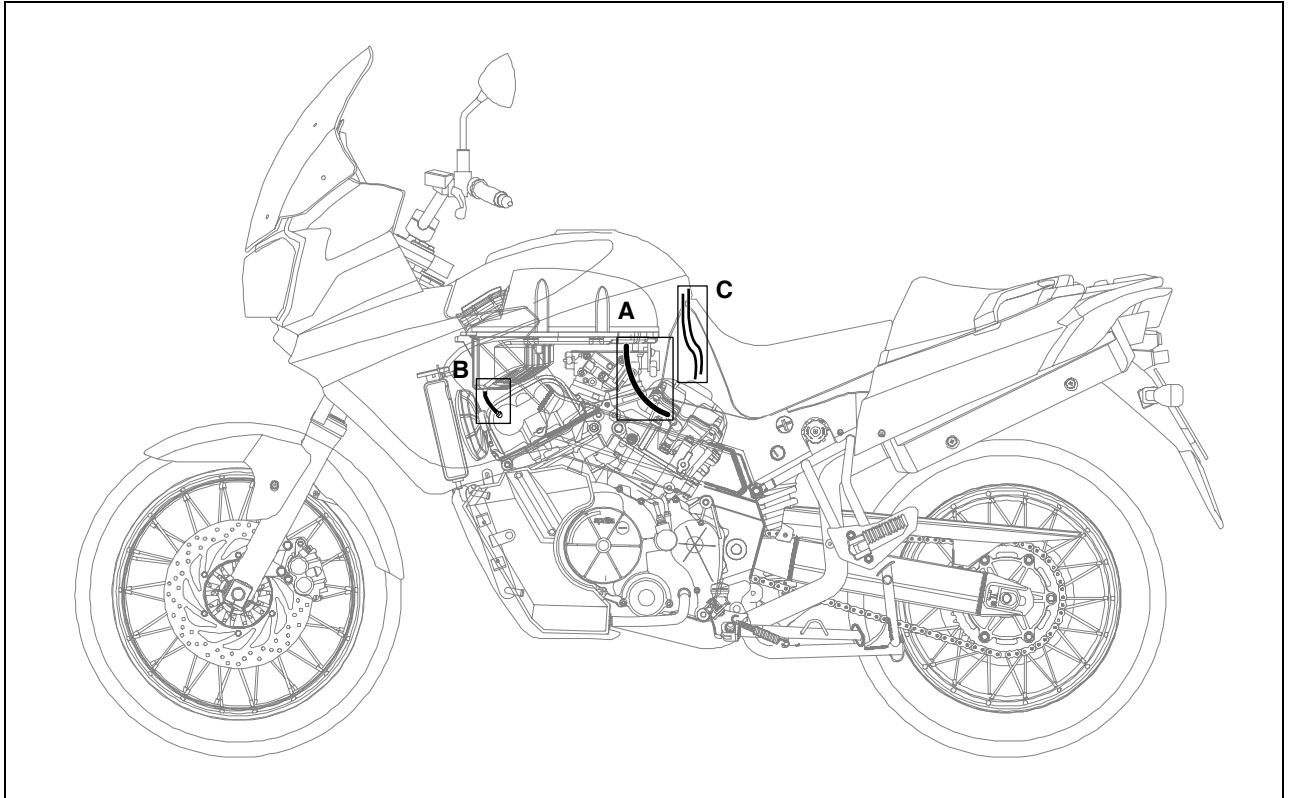
8.2.7 THROTTLE CABLES



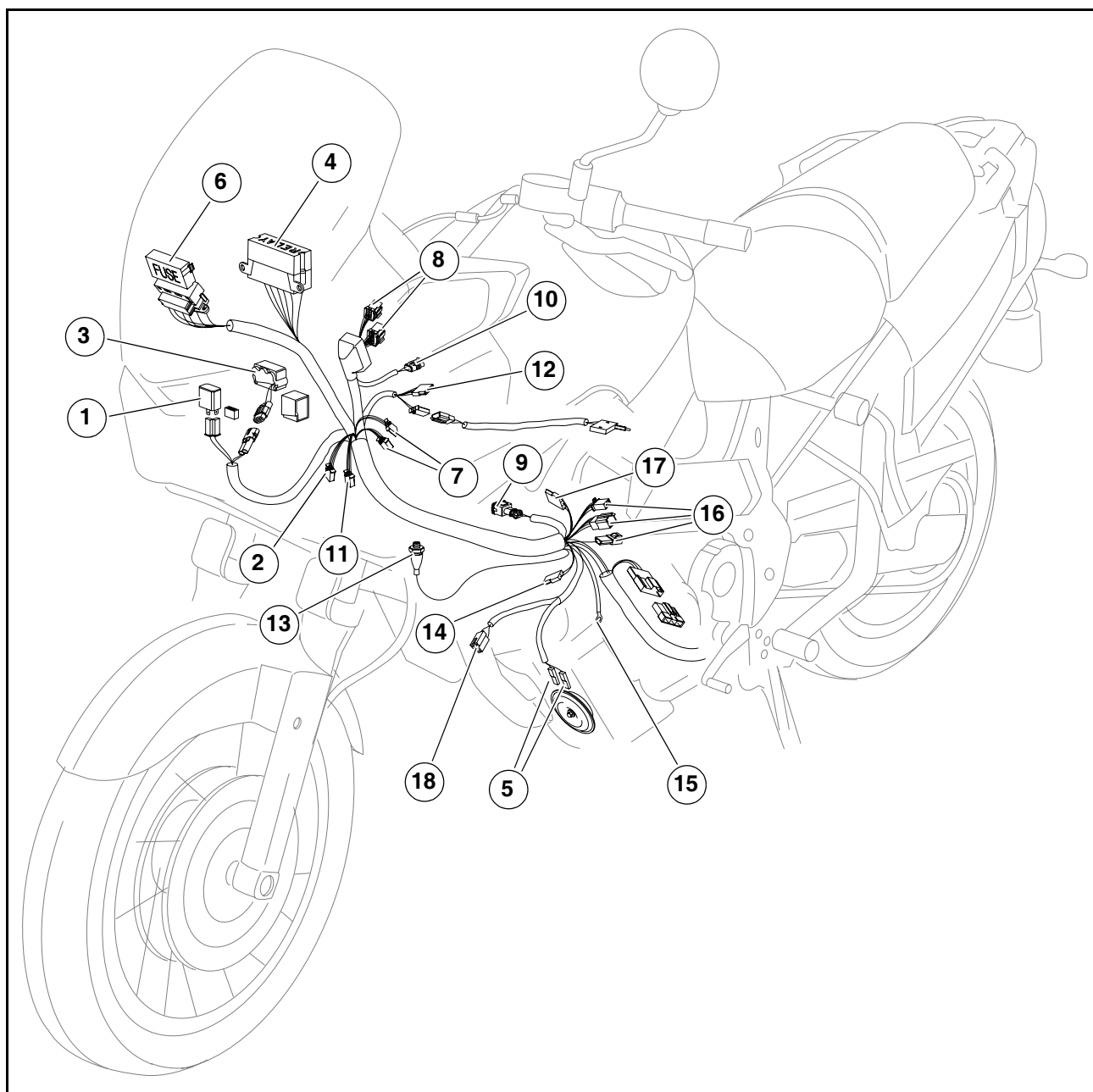
8.2.8 ENGINE OIL TUBES



8.2.9 BREATHER AND DRAIN HOSES

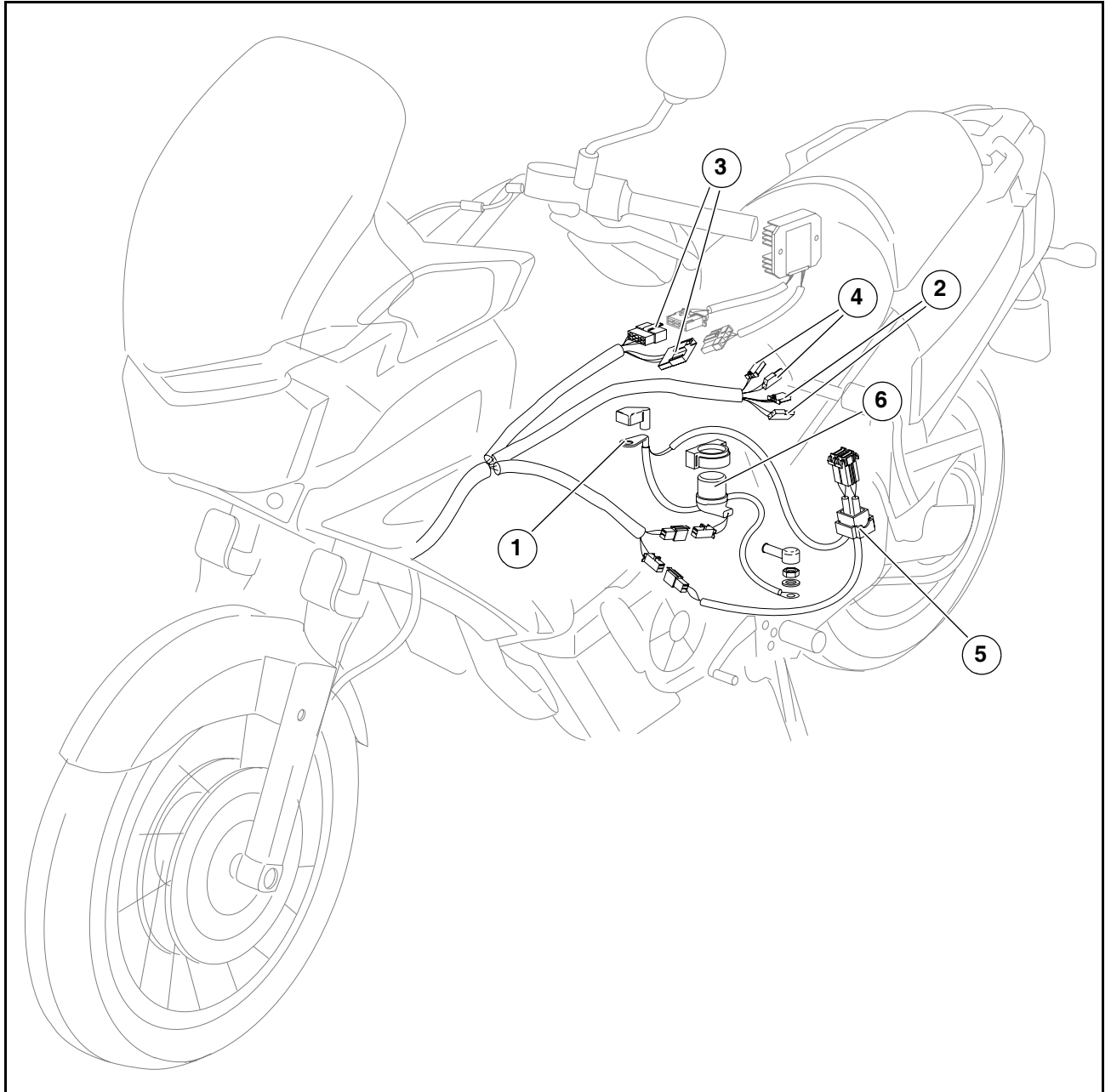


8.2.10 WIRING

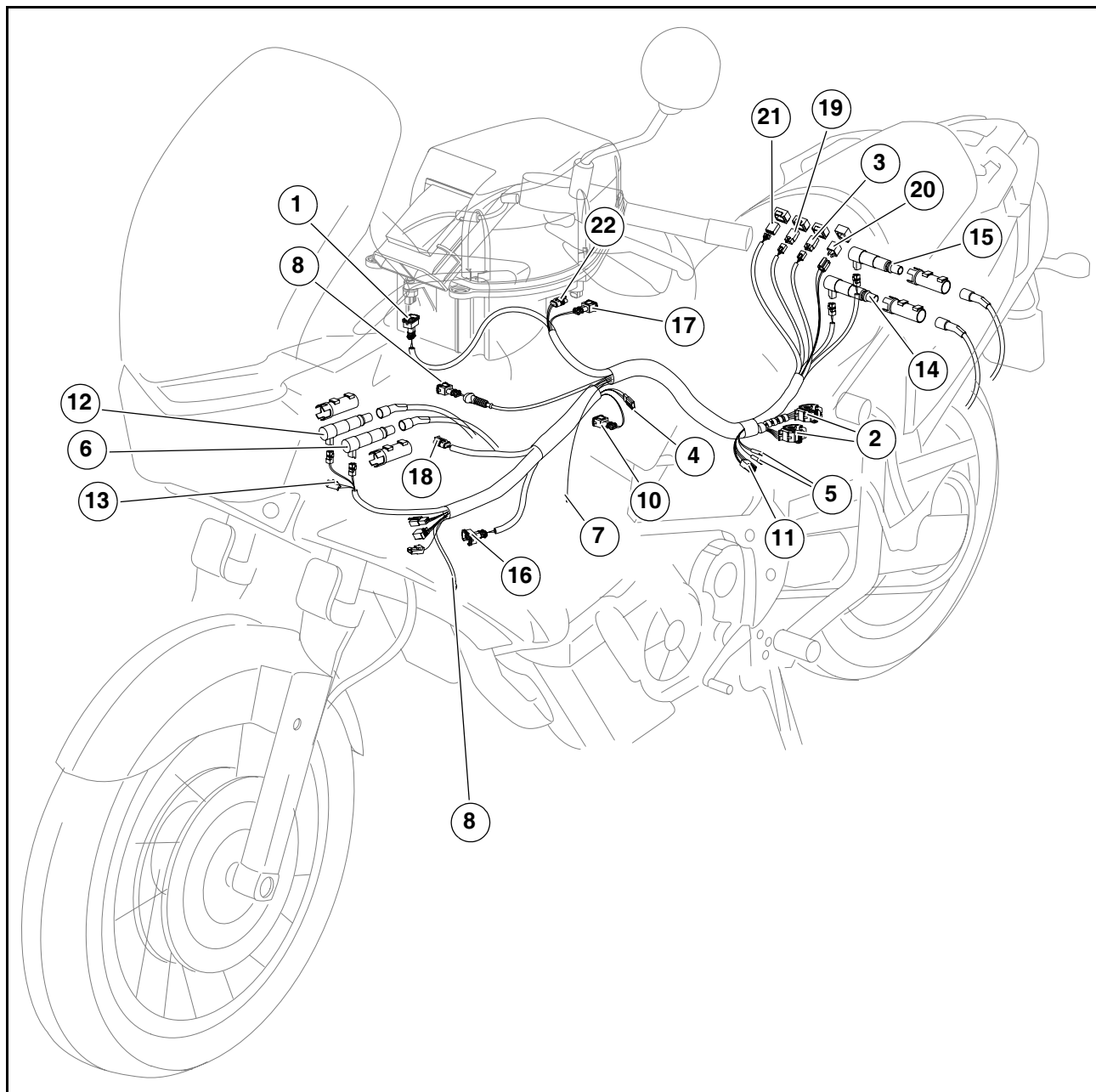


Key

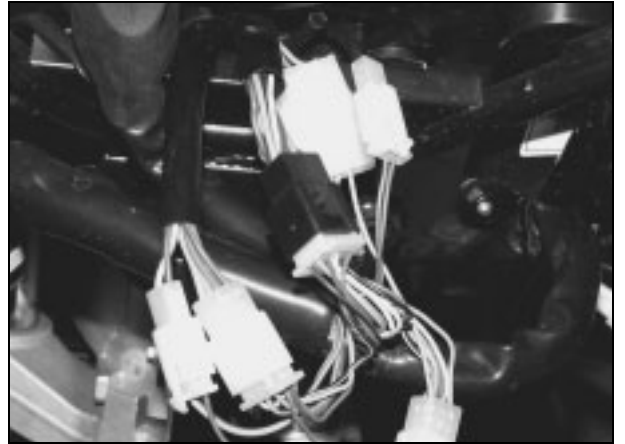
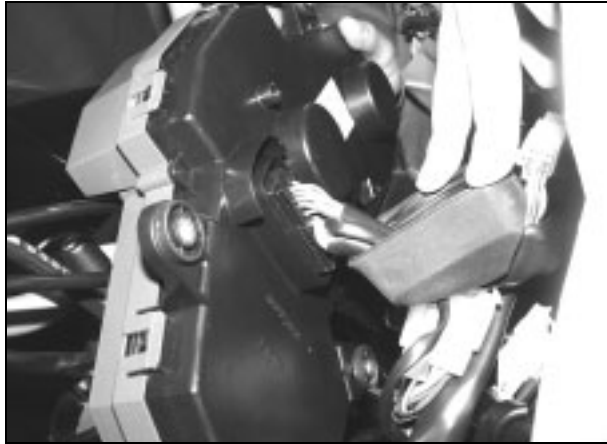
- | | |
|--|--|
| 1) Flasher | 10) Air temperature sensor |
| 2) Headlight | 11) Left-hand light dip switch connector |
| 3) Bank angle sensor | 12) Light dip/steering lock switch |
| 4) Light relay | 13) Oil pressure sensor |
| 5) Warning horn | 14) Rear brake light |
| 6) Auxiliary fuse box | 15) Engine ground |
| 7) Right-hand light dip switch connector | 16) Fuel injection connectors |
| 8) Instrument panel connectors | 17) Speed sensor |
| 9) Throttle position sensor | 18) Power outlet |

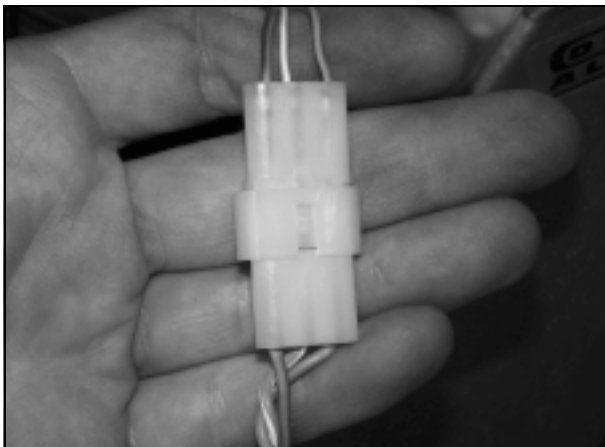
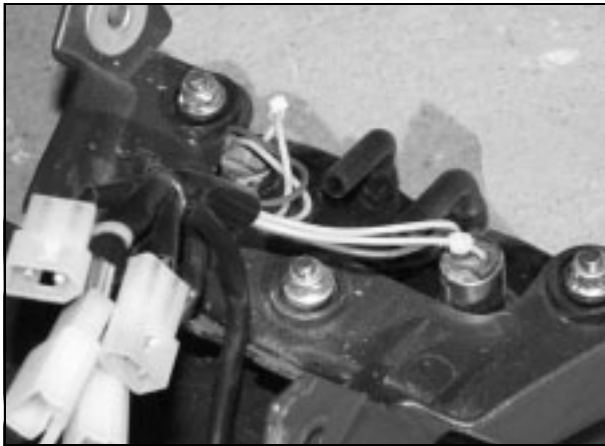
**Key**

- 1) Battery positive terminal
- 2) Rear direction indicator
- 3) Rectifier
- 4) Tail light and number plate light
- 5) Main fuses
- 6) Starter relay

**Key**

- | | |
|--------------------------------|------------------------------------|
| 1) Air thermistor | 12) Front cylinder coil no. "1" |
| 2) Engine Control Unit | 13) Front cylinder coil no. "2" |
| 3) Fuel pump relay | 14) Rear cylinder coil no. "1" |
| 4) Side stand switch | 15) Rear cylinder coil no. "2" |
| 5) Test connectors | 16) Front cylinder injector |
| 6) Cooling fan connector | 17) Rear cylinder injector |
| 7) Neutral sensor | 18) Throttle position sensor |
| 8) Engine ground | 19) Engine stop relay |
| 9) Pick-up | 20) Fuel injection relay |
| 10) Coolant temperature sensor | 21) Diode module |
| 11) Diagnosis connector | 22) Automatic air adjustment motor |





8.3 ELECTRICAL SYSTEM INSPECTION

See 6.1 (LAYOUT OF ELECTRICAL COMPONENTS) for the location of the various components.
See 8.2.10 (WIRING).

8.3.1 SPARK PLUGS (NO SPARK)

Firstly:

- Check the 15-A auxiliary fuses.
- Check the spark plugs.

Secondly:

- Check 30-A main fuses.
- See 6.6.6 (IGNITION COIL TEST).

Thirdly:

See 6.6.7 (CRANKSHAFT POSITION SENSOR TEST).

8.3.2 PROBLEMS WITH BATTERY CHARGING

- See 6.3.1 (CHECKING CHARGE VOLTAGE).
- See 6.3.2 (ALTERNATOR LOADLESS OPERATION TEST).
- See 6.3.4 (ALTERNATOR CONTINUITY TEST).
- See 6.3.5 (RECTIFIER TEST).
- See 6.14 (BATTERY).

8.3.3 PROBLEMS WITH IGNITION AND/OR STARTING

Check the on-board diagnostics system, see 6.4.2 (TROUBLESHOOTING) (IF THE ENGINE DOES NOT START).

In addition:

- See 6.6.6 (IGNITION COIL TEST).
- See 6.6.7 (CRANKSHAFT POSITION SENSOR TEST).
- See 6.4.4 (BANK ANGLE SENSOR TEST).
- See 6.6.4 (AIR THERMISTOR TEST).
- See 6.6.5 (COOLANT THERMISTOR TEST).
- See 6.6.3 (THROTTLE POSITION SENSOR TEST).
- See 6.6.1 (INJECTOR TEST).
- See 6.7.2 (FUEL PUMP TEST).
- See 6.7.3 (TEST OF FUEL PUMP RELAY AND ENGINE CUTOFF RELAY).
- See 6.8.2 (SAFETY LOCKOUT SYSTEM OPERATION).
- See 6.8.3 (STARTER RELAY TEST).
- See 6.8.5 (SIDE STAND SWITCH TEST).
- See 6.8.6 (DIODE MODULE TEST).
- See 6.8 (SAFETY LOCKOUT SYSTEM).
- See 6.14 (BATTERY).

8.3.4 PROBLEMS WITH THE AUXILIARY SYSTEMS

- See 6.11.2 (LIGHT RELAY TEST).
- See 6.8.4 (DIODE TEST).
- See 6.9.2 (COOLING FAN TEST).
- See 6.6.5 (COOLANT THERMISTOR TEST).
- See 6.5.4 (ELECTRONIC SYSTEM TROUBLESHOOTING BASED ON DISPLAY INFORMATION).
- See 6.10.3 (ENGINE OIL PRESSURE SENSOR).
- See 6.10 (SAFETY LOCKOUT SYSTEM).

8.4 ELECTRICAL SYSTEM INSPECTION**8.4.1 ENGINE**

See Section 3 (ENGINE) for technical information on and specifications of engine components.

8.4.2 THROTTLE BODY COMPONENTS

See 4.8 (THROTTLE BODY) for technical information on and specifications of engine components.

8.4.3 FUEL SYSTEM

- Inlet/outlet hoses of pressure filter (ID = 7.5 mm; OD = 14.5 mm) are made from NBR-SF-NBR to DIN 73379 specification.
- High-pressure delivery hose is made from TEFLON, with inlaid metal braiding and eyelet terminals.
- Low-pressure return hose (ID = 6 mm; OD = 12 mm) is made from NBR-SF-NEOPRENE to DIN 73379 specification.

8.4.4 ELECTRICAL SYSTEM

See 1.5 (SPECIFICATIONS). See also Section 6 (ELECTRICAL SYSTEM).

8.4.5 FRONT BRAKING SYSTEM

- Brake discs = steel.
- Disc thickness = 5 mm (service limit: 4.5 mm).
- Disc diameter = 300 mm.
- Number of caliper pistons = 4 opposite pistons.
- Diameter of caliper pistons = 30 mm (lower pistons) + 34 mm (upper pistons).
- Brake pads = sintered.
- Brake pad lining (standard) = TOSHIBA TT 2802.
- Brake pad lining (option) = FERIT/FERODO ID 450.
- Brake pad surface = 23.68 sq. cm.
- Rubber hose diameter (standard) = OD 10 mm; ID 3.2 mm.
- Diameter of metal-braided hoses (option) = OD 7 mm; ID 3.2 mm.
- Master cylinder diameter = 16 mm.

8.4.6 REAR BRAKING SYSTEM

- Brake disc = steel.
- Disc thickness = 5 mm (service limit: 4.5 mm).
- Disc diameter = 255 mm.
- Number of caliper pistons = 2 opposite pistons.
- Diameter of caliper pistons = 28 mm.
- Brake pad lining (standard) = FERIT/FERODO ID 450.
- Brake pad lining (option) = TOSHIBA TTH38GF FERIT/FERODO ID 450/452/459.
- Brake pad surface = 16 sq. cm.
- Rubber hose diameter (standard) = OD 10 mm; ID 3.2 mm.
- Diameter of metal-braided hoses (option) = OD 7 mm; ID 3.2 mm.
- Master cylinder diameter = 11 mm.

8.4.7 COOLING SYSTEM

See Section 5 (COOLING SYSTEM).

Operating pressure 90-120 kPa (0.9-1.2 bar).

8.4.8 WHEELS

Wheel rims:

See 1.5 (SPECIFICATIONS).

Wheel rim run-out limit:

See 7.2.4 (WHEEL COMPONENT INSPECTION).

Wheel spindle run-out limit:

See 7.2.4 (WHEEL COMPONENT INSPECTION).

Tyres:

See 1.5 (SPECIFICATIONS).

8.4.9 FRONT SUSPENSION

See 1.5 (SPECIFICATIONS); 2.28.1 (FRONT SUSPENSION); and 7.7 (FRONT FORK).

8.4.10 REAR SUSPENSION

See 1.5 (SPECIFICATIONS); 2.28.1 (FRONT SUSPENSION); 7.8 (REAR SWINGING ARM); and 7.9 (REAR SUSPENSION).

8.4.11 STEERING

See 2.27.1 (CHECKING PLAY IN THE BEARINGS) and 7.6 (STEERING).

8.4.12 CAPACITIES – FLUID SPECIFICATIONS

See 1.5 (SPECIFICATIONS) and 1.6 (LUBRICANT CHART).

8.4.13 CHASSIS (FRAME / SEAT SUBFRAME / INSTRUMENT PANEL MOUNT)

- Frame / Seat subframe / Instrument panel mount material = light alloy
- Frame weight = 9.9 kg.
- Frame torsional rigidity = 6,500 Nm/° (650 kgm/°).
- Rake = 26°.
- Trail = 97 mm.
- Seat subframe weight = 2.3 kg.
- Instrument panel mount weight = 0.750 kg.

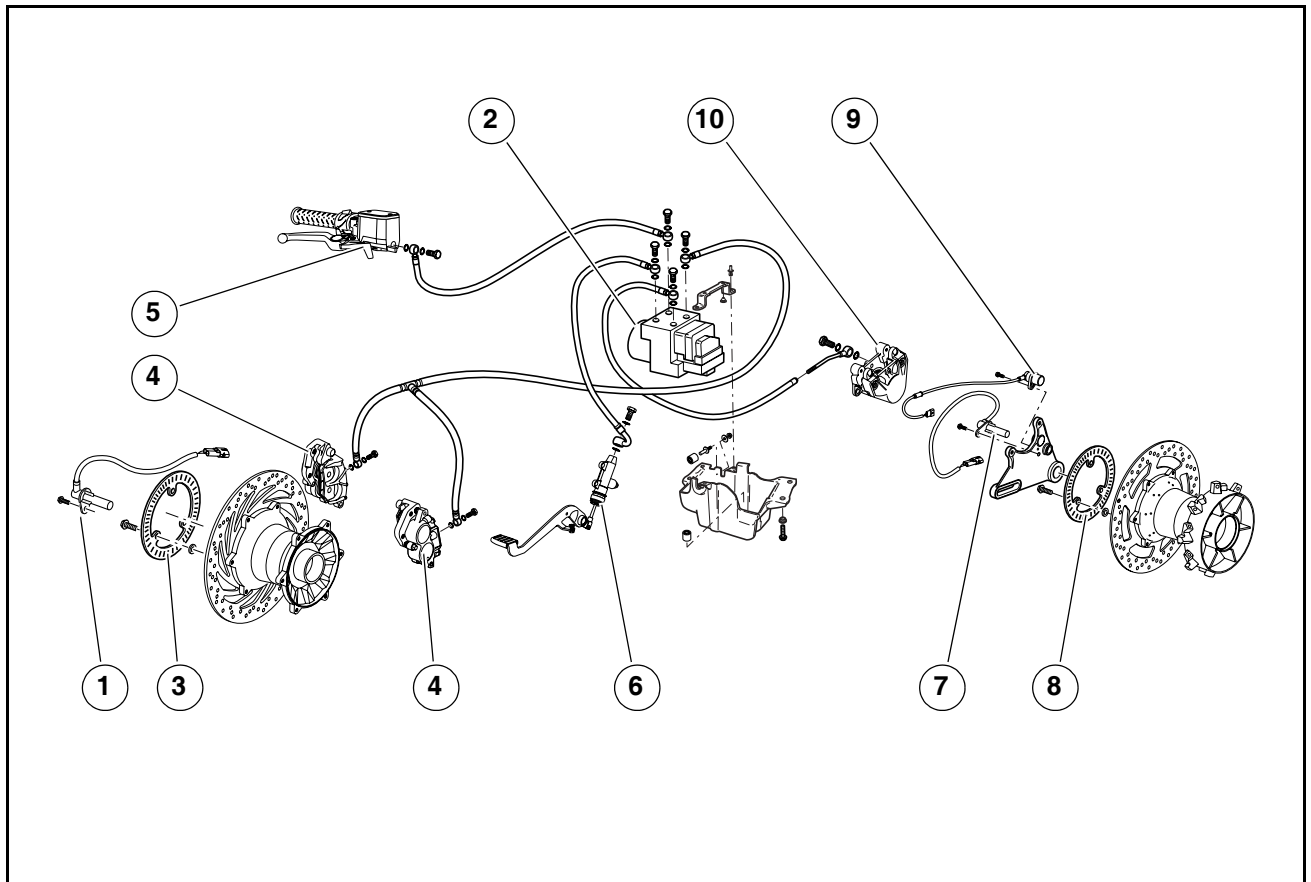
ABS

9

ABS**CONTENTS**

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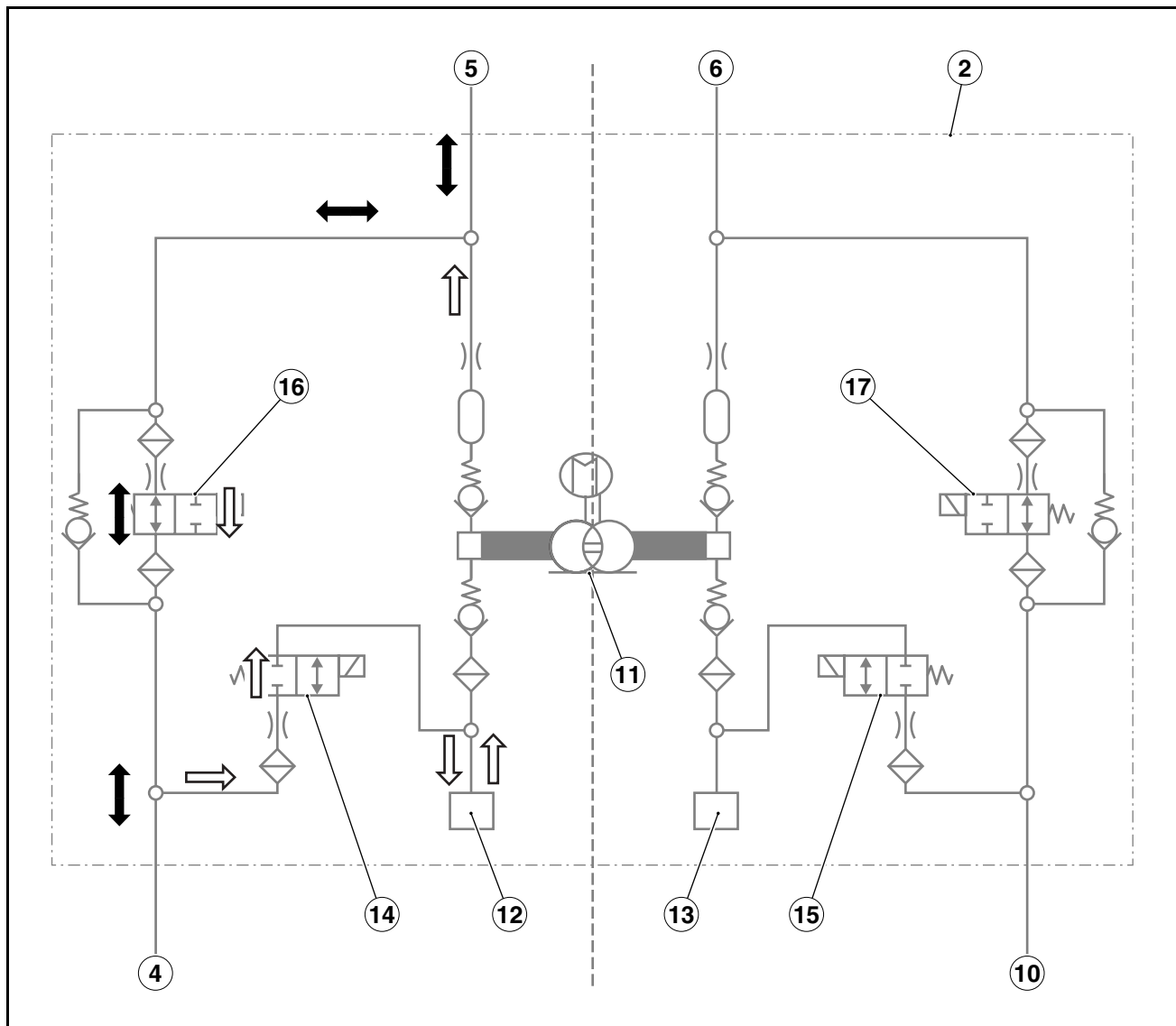
9.1 ABS

**Key:**

- 1) Front wheel sensor
- 2) ABS controller
- 3) Front phonic wheel
- 4) Front brake calliper
- 5) Front brake master cylinder
- 6) Rear brake master cylinder
- 7) Rear wheel sensor
- 8) Rear phonic wheel
- 9) Speed sensor
- 10) Rear brake master cylinder

CAUTION See the following page for a diagram of the ABS controller.

DIAGRAM OF THE ABS CONTROL UNIT



Key:

The black arrow shows brake fluid path when the ABS system is not in operation.
 The white arrow shows brake fluid path when the ABS system is operating.

- 2) ABS controller
- 4) Front brake callipers
- 5) Front brake master cylinder
- 6) Rear brake master cylinder
- 10) Rear brake calliper
- 11) ABS pump
- 12) Front reservoir
- 13) Rear reservoir
- 14) Front dump valve
- 15) Rear dump valve
- 16) Front isolator valve
- 17) Rear isolator valve

ABS OPERATION

General information:

- The front and rear circuits are identical.
- The ABS isolator valve (16-17) is normally open and is closed when the system activates to prevent wheel lockout.
- The dump valve (14-15) is normally closed and is opened when the system activates to prevent wheel lockout.
- When the system is in the stand-by mode, the ABS controller monitors wheel speed to detect possible wheel skidding.
- When in the stand-by mode, the system does not affect braking and brake application is controlled by the rider as in conventional (non ABS equipped) braking systems.

Phases of ABS operation (the following description is referred to the front braking circuit, but applies to the rear braking circuit as well):

- 1) Initial brake application: the rider applies the brake as in conventional braking.
- 2) ABS detects a dangerous condition (wheel starting to skid): The system closes the isolator valve (16) and opens the dump valve (14) at the same time. At this stage, the rider has no control over brake pressure and the ABS releases some of the pressure in the callipers (4). Excess fluid is diverted into the front reservoir (12) until the ABS pump (11) switches on automatically to pump the fluid back to the reservoir (5).
- 3) ABS maintains low pressure: pressure in the callipers (4) is kept low until the wheel regains normal speed/traction. The fluid removed from the calliper (4) is restored to the circuit at the portion between the brake master cylinder (5) and the ABS isolator valve (16).
- 4) ABS restores pressure: the isolator valve (16) is opened briefly as many times as needed to increase pressure in the callipers (4) until achieving maximum deceleration. At this time, ABS restores brake control to the rider.
- 5) The whole process is repeated until wheel traction is restored or the vehicle is stopped.

9.1.1 DESCRIPTION

The anti-lock brake system prevents wheel lockout in emergency braking, thereby ensuring greater stability under braking as compared to conventional braking systems. Under particular conditions, operating the brake may lead to wheel lockout and loss of traction, which makes it very difficult to maintain steering control. A position sensor (1) "reads" a phonic wheel (2) mounted to the vehicle wheel to determine whether the wheel is rolling or is locked. A control unit (3) adjusts the pressure inside the brake circuit based on sensor signals.

CAUTION When ABS is working, the rider will feel a vibration on the brake lever.

⚠ CAUTION

Anti-lock brakes cannot avoid a fall when braking in a bend. Emergency braking with the vehicle leaned over, with the handlebar turned, when riding on uneven or slippery surfaces or anyway in a poor grip situation will make the vehicle unstable and difficult to control. Ride carefully, apply the brakes gradually and be ready for the unexpected. Remember that your ABS cannot defy the laws of physics a vehicle braking in a bend is subject to. When the sensors (1) detect a significant difference in the speed of the front and rear wheel (as in a wheelie, for instance), the ABS may read this as a dangerous condition. When this is the case, one of the following things may happen:

- The ABS activates and releases pressure from the caliper until the affected wheel regains the same speed as the other wheel. During that instant, the rider has no control over brake pressure.
- If speed difference persists, the system may see this as a fault and disable ABS. The brake then operates like a conventional brake.

When the engine is started, the light (6) comes on and should go out after about 3 seconds. If the light stays on, it means that a malfunction has been detected and the ABS is switched off.

Riding with the ABS on

The light (6) stays off. In the event of a fault, the light comes on steady to alert the rider. The ABS is switched off automatically.

Riding with the ABS off

The light (6) will be flashing. How to disable the ABS. To disable the ABS with the engine running and the motorcycle at standstill, wait for the light to go out and press the switch (7). Hold down the switch until the light begins to flash and then release it before the light can flash 5 times. To enable the ABS, stop the motorcycle and the engine and repeat the process.

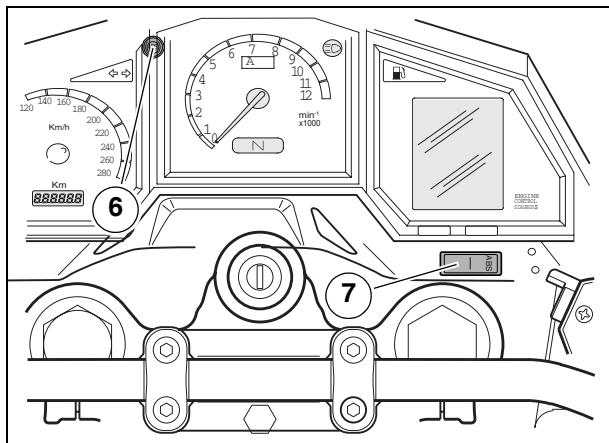
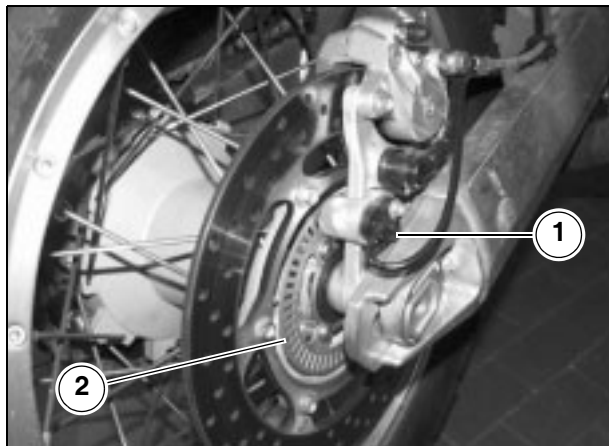
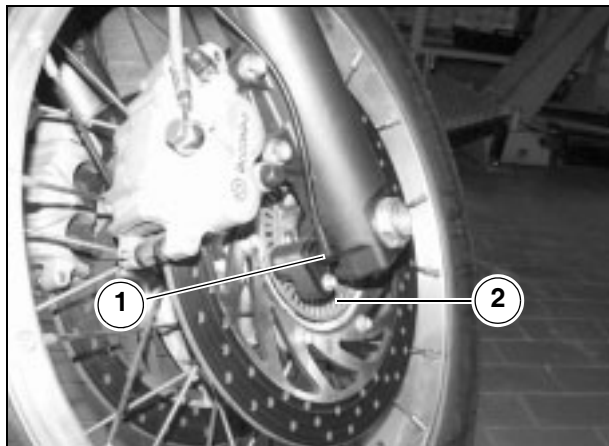
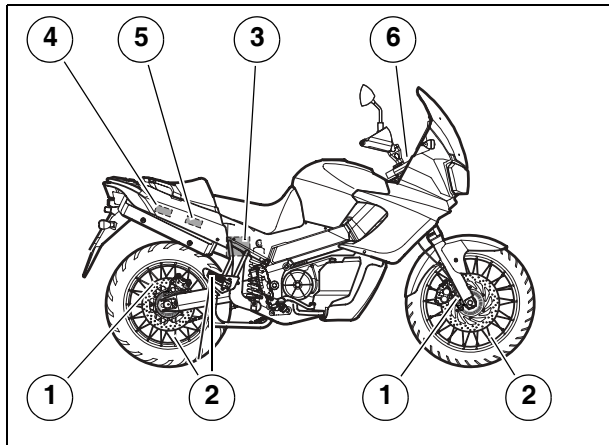
30-A fuse (4)

This fuse protects: Power section of the ABS controller

10-A fuse (5)

This fuse protects: ABS controller

ABS operation is based on the speed of the front and rear wheel detected by the corresponding sensors. Be careful to avoid damage to the phonic wheels (2) when servicing the vehicle wheels or adjacent components. A damaged phonic wheel may impair correct ABS operation.



CAUTION Using other than original spare parts such as brake pads and discs on ABS equipped vehicles may impair braking efficiency and compromise safety. It is important to check that both tyres are at the correct inflation pressure. Both tyres must be at the same pressure. The ABS may respond unpredictably when the vehicle is used for sports riding. Turn off your ABS before any such use.

9.1.2 COMPONENT MAINTENANCE

The vehicle is equipped with a two-channel ABS that monitors both the front and rear wheel.

Check sensor gap at regular intervals, after each wheel removal and after replacing a phonic wheel (2) or a wheel sensor (1). Air gap should be the same at all positions of the phonic wheel (through 360°). Measure air gap between sensor (1) and phonic wheel (2) using a feeler gauge at three locations spaced 120° apart. Correct readings must be within the following ranges:

Front **0,4 - 1,85 mm (0.016 – 0.073 in)**;

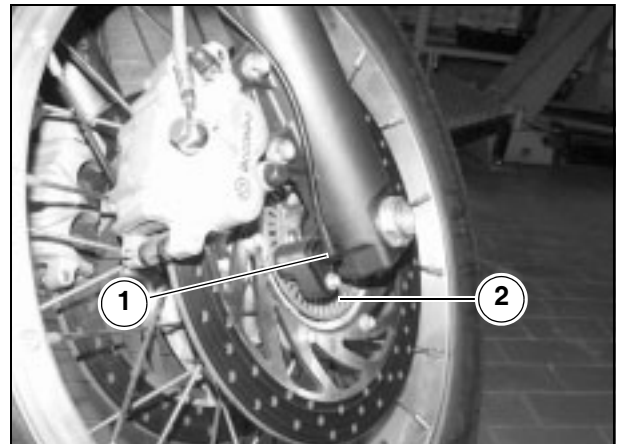
Rear **0,7 - 1,80 mm (0.028 – 0.071 in)**;

CAUTION If measured gap is outside the allowed range, change the sensor (1) and/or the phonic wheel (2) and check again, making sure all measurements are within the specified range.

CLEANING THE PHONIC WHEELS (2)

It is important to make sure the phonic wheels (2) are clean at all times.

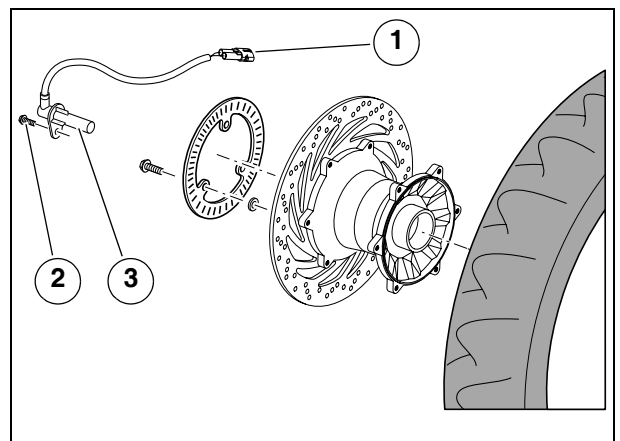
If not so, gently remove any dirt with a cloth or a wire brush. Avoid using solvents or abrasive products. When using an air line or a water cleaner, do not aim the nozzle directly at the phonic wheel (2).



9.1.3 REPLACING THE FRONT WHEEL SENSOR

- ◆ Disconnect the connector (1) of the wheel sensor (3) from the main wiring harness.
- ◆ Unscrew and remove the screw (2) and remove the front wheel sensor (3).

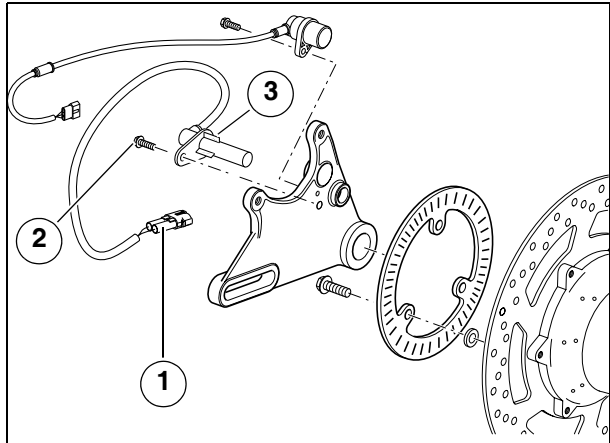
CAUTION On refitting, make sure the mating surfaces of sensor (3) and sensor housing are smooth and clean. Always check the gap between sensor (3) and phonic wheel, vedi 9.1.2 (COMPONENT MAINTENANCE).



9.1.4 REPLACING THE REAR WHEEL SENSOR

- ♦ Disconnect the connector (1) of the rear wheel (3) from the main wiring harness.
- ♦ Unscrew and remove the screw (2) and remove the rear wheel sensor (3)

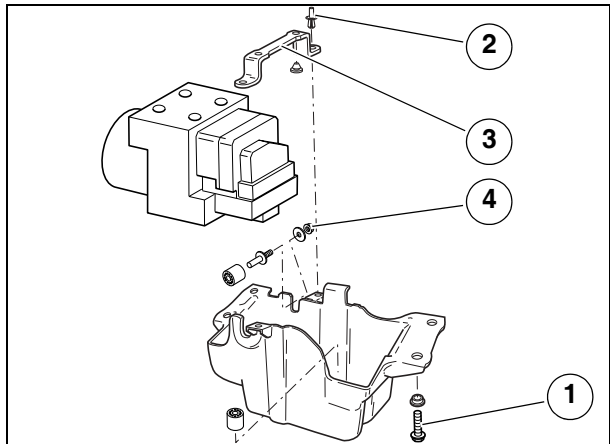
CAUTION On refitting, make sure the mating surfaces of sensor (3) and sensor housing are smooth and clean. Always check the gap between sensor (3) and phonic wheel, vedi 9.1.2 (COMPONENT MAINTENANCE).



9.1.5 REMOVING THE ABS CONTROLLER

- ♦ Disconnect the brake lines from brake cylinders and callipers and drain all brake fluid contained in the lines into a container.
- ♦ Unscrew and remove all four screws (1) and collect the bushes.
- ♦ Lower the ABS controller.
- ♦ Remove the two expanding inserts (2).
- ♦ Remove the bracket retaining the ABS controller (3).
- ♦ Loosen the two nuts (4).
- ♦ Remove the controller plastic guard.
- ♦ Disconnect the electric connector and move aside the wiring.
- ♦ Note the positions of the hoses to ensure correct reassembly.
- ♦ Unscrew and remove the four screws (5) securing the brake hoses to the ABS controller.
- ♦ Extract the ABS controller from the side to remove.

CAUTION Do not take the ABS controller apart. In the event of malfunction, replace the unit as a whole. Spare ABS controllers come filled with brake fluid. After installation, fill and bleed the brake circuit as you would for regular braking systems.

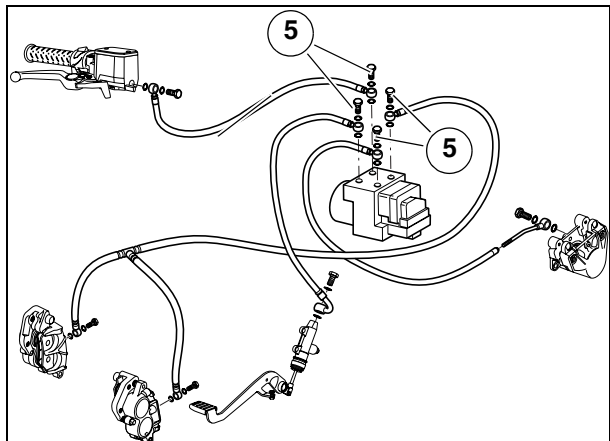


⚠ WARNING

Incorrect hose installation may lead to loss of braking.
Change the sealing washers at all unions before tightening.



Tightening torque of controller hose retaining screws (5):
M10 25Nm (2,5 kgm).
M12 32Nm (3,2 kgm).



9.1.6 BLEEDING ABS EQUIPPED BRAKES

CAUTION Change brake fluid in both circuits every 2 years.

Bleed the braking system whenever the base brake (outside the ABS controller) feels spongy. Follow the standard bleeding procedure, vedi 2.18 (BLEEDING THE BRAKE CIRCUITS).

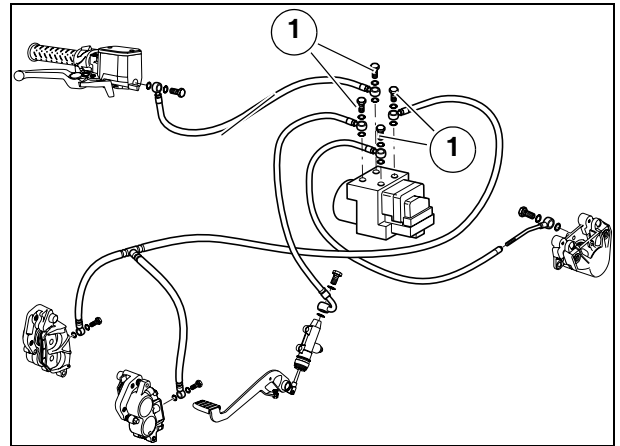
CAUTION We recommend using a pressurised brake bleeder to speed up the bleeding procedure.

In the event some air is trapped in the portion of hose connecting controller and front brake callipers, move the calliper pistons apart to push air back into the reservoir.

⚠ WARNING

Do not unscrew the four screws (1) on the ABS controller unless you need to replace the controller.

CAUTION If the ABS controller needs replacing, please note that spare ABS controllers come filled with brake fluid. After installation, fill and bleed the brake circuit as you would for regular braking systems.



9.1.7 TROUBLESHOOTING

- When the key is turned to ON, the panel light comes on during the initial test routine and then – if the ABS is on – goes out.
- When the controller ground pins are not connected, the light stays on steady (fault not detected by control unit), meaning that the ABS is off.
- With the Axone tester connected, the ABS will be off and the light comes on because the controller goes into diagnostic mode.
- An interrupted or missing brake light or an interrupted diode are indicated by a front or rear brake lever fault.
- If the 10-A fuse is interrupted, the ABS light on the panel comes on and communication with Axone cannot be established.
- If the 30-A fuse is interrupted, the ABS light on the panel comes on and communication with Axone is established anyway.

TROUBLESHOOTING TABLE						
Fault description	ABS light On/Off	ABS On/Off	AXONE Fault	Bosch Code	Inspections	Remedy
No power supply at controller pin 15	ONI	OFF	Axone FAILS to establish communication with controller	-	10-A fuse or wiring across fuse and ignition key block	Repair fuse or wiring
No ground at controller pins 16 and 19	ONI	OFF	Axone NON entra in comunicazione con la centralina	-	Check ground connection to battery	Connect wiring correctly
Controller is misreading speed sensor electric signals	ONI	OFF	Front/rear speed sensor closed/open circuit	33/31	Sensor disconnected	Connect sensor
					Sensor wiring shorted	Change sensor/wiring
					Sensor wiring interrupted	Change sensor/wiring
Controller is detecting an abnormal condition in the speed sensor signals: for instance noise, drop in signal intensity, continued difference between the speeds of the two wheels, etc....	ONI	OFF	Front/rear speed sensor consistency	34/32/24	Exceeding air gap	Set correct gap over full circle of phonic wheel
					Phonic wheel warped	Change phonic wheel
					Speed sensor badly positioned or failed	Set sensor in correct position or change sensor
					Phonic wheel warped	Change phonic wheel
					Wrong tyre size	Install approved tyres
					Tyres unevenly worn or not at same pressure	Use tyres that are evenly worn and at the specified inflation pressures
					Sports riding (long wheelie)	
Abnormal valve operation	ONI	OFF	Rear/front isolator/dump valve	54/49/52/48	Feed 12 V at pin 18 and check controller connector for oxidation	Repair wiring or connector
					Valve failed	Change ABS controller

TROUBLESHOOTING TABLE						
Abnormal ABS pump operation	ON	OFF	Recirculation pump	15	Connect 12 V to pin 17 and ground to pin 16 and check controller connector for oxidation	Repair wiring or connector
					ABS pump failed	Change ABS controller
Abnormal operation of ABS valve relay or no power supply at controller pins 17 and 18	ON	OFF	ABS valve relay (if problem is power supply, it may take some time before fault is detected)	14	Check controller connector and 30-A fuse for continuity or check corresponding wiring brought from key block	Repair connector, fuse or wiring
					Valve relay failed	Change ABS controller
Controller anomaly	ON	OFF	Controller	21	ECU failed	Change ABS controller
Abnormal power supply voltage	ON	OFF/ON *	Power supply voltage (fault is stored only when road speed exceeds 6 kph)	58	Voltage too low	Charge/change battery
					Voltage too high	Voltage regulator failed
Brake switch failure or bulb/diode interrupted	OFF	ON	Front lever	25	Stop light bulb failed	Change bulb
					BLS line interrupted	Change wiring
Brake switch failure or bulb/diode interrupted	OFF	ON	Rear lever	26	Stop light bulb failed	Change bulb
					BLS line interrupted	Change wiring

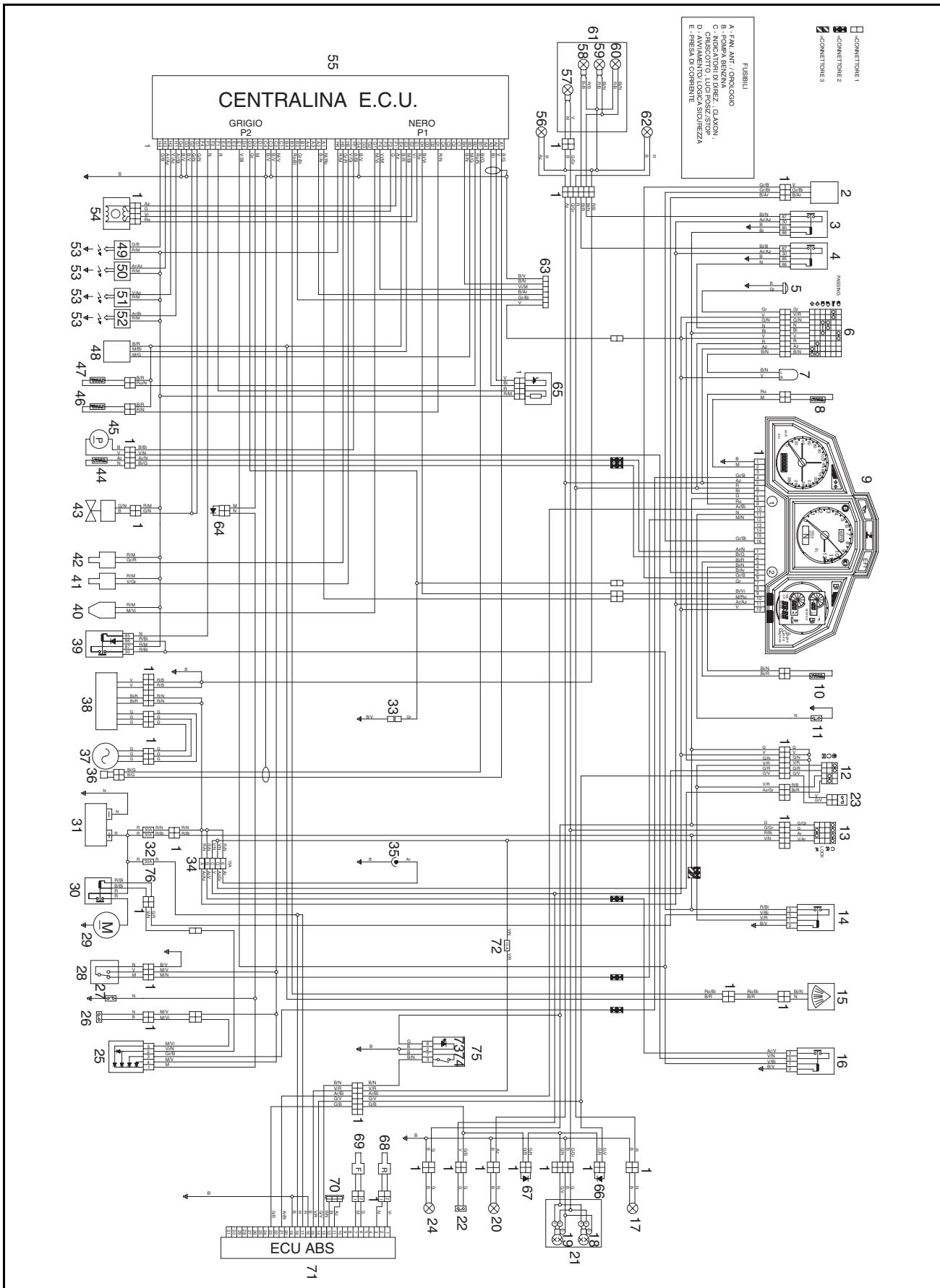
* OFF if voltage measurement remains below 9.9 V or above 17.2 V

AXONE SCREENS ON ETV CAPONORD ABS AXONE 5.0.1 OR SUBSEQUENT VERSIONS

SCREEN	DESCRIPTION	INDICATIVE VALUES	MEASUREMENT UNIT	REMARKS
ISO				
	Controller code	29033		
	Model	ETV1000_310103S		
	Date of manufacture			Date of manufacture of ABS controller
VIEW MOTOR PARAMETERS				
	Front wheel speed		Kph	Wheel at standstill will give a 2 Kph reading (minimum signal voltage)
	Rear wheel speed		Kph	Wheel at standstill will give a 2 Kph reading (minimum signal voltage)
	Battery voltage		V	
DEVICE STATUS				
	ABS valve relay	ON/OFF		Normally ON
	Front lever	ON/OFF		ON when lever is operated
	Rear lever	ON/OFF		ON when lever is operated
	ABS switch	ON/OFF		OFF if system was not turned off before connection with Axone; in the opposite case, OFF
DEVICE ACTUATION				
	Delete faults			
	ABS light			Holding down the key with Axone connected will display the opposite status as current status. Example: current status is ON; holding down the key will give an OFF reading.
DISPLAY ERRORS				
	Rear lever			See "Troubleshooting table"
	Front lever			See "Troubleshooting table"
	Front speed sensor closed/open circuit			See "Troubleshooting table"
	Rear speed sensor closed/open circuit			See "Troubleshooting table"
	Front speed sensor consistency			See "Troubleshooting table"
	Rear speed sensor consistency			See "Troubleshooting table"
	Recirculation pump			See "Troubleshooting table"

	ABS valve relay			See "Troubleshooting table"
	Front isolator valve			See "Troubleshooting table"
	Rear isolator valve			See "Troubleshooting table"
	Front dump valve			See "Troubleshooting table"
	Rear dump valve			See "Troubleshooting table"
	Controller			See "Troubleshooting table"

9.2 WIRING DIAGRAM



Key:

- | | |
|--|-------------------------------|
| 1) Multi-pin connectors | 58) Low beam bulb |
| 2) Speed sensor | 59) High beam bulb |
| 3) High beam relay | 60) High beam bulb |
| 4) Low beam relay | 61) Headlight |
| 5) Warning horn | 62) Front right indicator |
| 6) Left dimmer switch | 63) Diagnostic socket |
| 7) Flasher | 64) Diode |
| 8) Air thermistor (panel) | 65) Lambda sensor |
| 9) Instrument panel | 66) Brake light diode 1 |
| 10) Coolant thermistor (panel) | 67) Brake light diode 2 |
| 11) Engine oil pressure sensor | 68) Rear wheel speed sensor |
| 12) Right dimmer switch | 69) Front wheel speed sensor |
| 13) Ignition switch | 70) ECU BAS diagnostic socket |
| 14) Engine cut-off relay | 71) ABS controller |
| 15) Fall sensor | 72) ABS fuse |
| 16) Fuel pump relay | 73) LED diode |
| 17) Rear right indicator | 74) ABS override button |
| 18) Rear parking/brake light bulb | 75) ABS switch body (backlit) |
| 19) Rear parking/brake light bulb | 76) ABS pump fuse |
| 20) Rear left indicator | |
| 21) Tail light | |
| 22) Rear brake light switch | |
| 23) Front brake light switch | |
| 24) Number plate light | |
| 25) Diode module | |
| 26) Clutch lever switch | |
| 27) Neutral switch | |
| 28) Side stand switch | |
| 29) Starter motor | |
| 30) Starter relay | |
| 31) Battery | |
| 32) Main fuses (30A) (ignition) | |
| 33) TEST connectors | |
| 34) Auxiliary fuses (15A) | |
| A - headlight, clock | |
| B - fuel pump | |
| C - parking lights, rear brake lights, warning horn, direction indicators and instrument panel | |
| D - starter, starting interlock relay | |
| E - free | |
| 35) Power outlet | |
| 36) Pick-up | |
| 37) Flywheel | |
| 38) Voltage regulator | |
| 39) Injection relay | |
| 40) Purge valve (California only) | |
| 41) Rear cylinder injector | |
| 42) Front cylinder injector | |
| 43) Cooling fans | |
| 44) Fuel reserve sensor | |
| 45) Fuel pump | |
| 46) Air thermistor (ECU) | |
| 47) Coolant thermistor (ECU) | |
| 48) Throttle position sensor | |
| 49) Rear cylinder coil | |
| 50) Rear cylinder coil | |
| 51) Front cylinder coil | |
| 52) Front cylinder coil | |
| 53) Spark plugs | |
| 54) Automatic choke | |
| 55) Engine Control Unit | |
| 56) Front left indicator | |
| 57) Front parking light bulb | |

WIRE COLOUR CODING

Ar	Orange
Az	Light blue
B	Blue
Bi	White
G	Yellow
Gr	Grey
M	Brown
N	Black
R	Red
V	Green
Vi	Violet
Ro	Pink



aprilia s.p.a.
via G. Galilei, 1
30033 Noale (VE) Italy
tel. +39 041.5829111
fax +39 041.5829190
www.aprilia.com
www.serviceaprilia.com