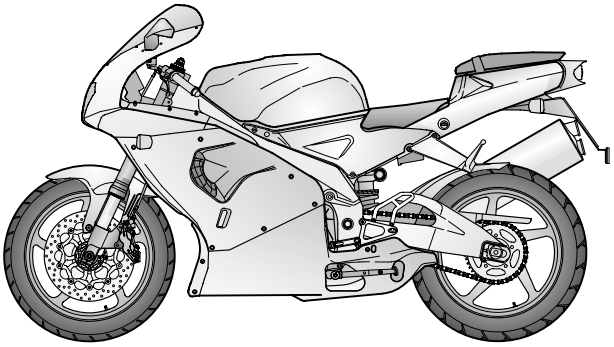
aprilia

Service and repair manual

aprilia part # 8140172

RSV mille



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0.1 FOREWORD

– This manual supplies the main information for normal servicing procedures.
– The information and illustrations contained in this manual are updated to the moment of its publication.
– Before consulting the manual, check the vehicle model and the relevant updates in section 9 “UPDATES”.
– This publication is intended for the **aprilia** Dealers and their qualified engineers; many notions were voluntarily omitted, because they were considered superfluous. Since it is not possible to include complete mechanical information in this publication, the persons using this manual must have a basic mechanical training and a basic knowledge of the procedures regarding motor vehicles repair systems.
Without this knowledge, the repair or servicing of the vehicle may be ineffective or even dangerous.
The manual does not describe all the procedures for the repair and servicing of the vehicle in detail, therefore it is important to be particularly careful, in order to avoid any damage to components and persons.
In order to grant its customers more and more satisfaction in the use of the vehicle, **aprilia s.p.a.** will keep improving its products and the relevant documentation. The main technical modifications and the modifications in the vehicle repair procedures are communicated to all **aprilia** Outlets and Branches the world over.
These modifications will be described in the successive editions of this manual.
In case of need or in case there are any doubts regarding the repair and servicing procedures, contact the **aprilia** Consumer Service (A.C.S.), which will give you any information required and will also inform you about any updating and technical modifications of the vehicle.
For further information, refer to:
– SPARE PARTS CATALOGUE # 390 W;
– use and maintenance manual (**aprilia** part # 8102857 and 8102859);
– special tools manual.

aprilia s.p.a. reserves the right to modify its models at any time, without prejudice to the main characteristics here described.

The mention to products or services supplied by third parties is made only for information purposes and it isn't binding in any case.
aprilia takes no responsibility as to the performance or use of said products.

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0.2 SAFETY WARNINGS

The following precautionary warnings are used throughout this manual in order to convey the following messages:

⚠ Safety warning.
When you find this symbol on the vehicle or in the manual, be careful to the potential risk of personal injury.
Non-compliance with the indications given in the messages preceded by this symbol may result in grave risks for your and other people’s safety and for the vehicle!

⚠ WARNING

Indicates a potential hazard which may result in serious injury or even death.

⚠ CAUTION

Indicates a potential hazard which may result in minor personal injury or damage to the vehicle.

NOTE The word “NOTE” in this manual precedes important information or instructions.

0.2.1 PRECAUTIONS AND GENERAL INFORMATIONS

Follow with care these recommendations when repairing, disassembling and reassembling the vehicle.

⚠ WARNING

The use of naked flames is forbidden for any type of operation.
Before commencing any service or inspection operation on the vehicle, switch off the engine and remove the key, wait until the engine and the exhaust system have cooled down and, if possible, raise the vehicle with the suitable equipment onto firm flat ground.
In order to avoid burns, be careful not to touch any parts of engine or exhaust system which have not cooled down completely.

The vehicle is constructed of inedible parts.
Do not bite, suck, chew or swallow any part of the vehicle for any reason whatever.

If not expressly described, the reassembly of the units is carried out by reversing the order of operations.

Any reference to operations from other chapters must be interpreted logically in order to avoid components being removed unnecessarily.

Never use fuel as a solvent for cleaning the vehicle.

Disconnect the negative cable (–) from the battery when electric welding.

When two or more persons are working together, make sure that each is working in safe conditions.

BEFORE DISASSEMBLY

– Remove any dirt, mud, dust and foreign matters from the vehicle before disassembling the components.
– Use, when necessary, the special tools designed for this vehicle.

DISASSEMBLING THE COMPONENTS

– Do not loosen and/or tighten the screws and nuts using pliers or other tools: instead, always use the proper spanner.
– Before disconnecting the joints (pipes, cables, etc.), mark the positions on all of them and mark them with different distinguishing signs.
  Each piece must be marked clearly, in order not to have problems during installation.
– Clean and wash carefully any disassembled parts with low inflammability detergents.
– Keep the parts that are used in pairs together, since they have adapted to each other following the normal wear.
  Some components must be used together or replaced completely.
– Keep away from heat sources.

REASSEMBLING THE COMPONENTS

⚠ CAUTION

Never use a seeger ring twice. When a seeger ring is removed, it must be replaced with a new one.
When assembling a new seeger ring be careful not to stretch its ends more than strictly necessary to put it on the shaft.
After installing a seeger ring, make sure that it is completely and firmly inserted in its seat.

Do not use compressed air to clean the bearings.

NOTE The bearings must rotate freely, without halting a/o noise otherwise they must be replaced.

– Use only original **aprilia** SPARE PARTS.
– Use the recommended lubricants.
– Whenever possible, lubricate the parts before reassembly.
– When tightening screws and nuts, begin with those having greater diameters or with inner ones, proceeding diagonally.
  Tighten screws or nuts in successive passages before applying driving torque.
– Always replace lock nuts, seals, sealing rings, snap rings, O-rings, split pins and screws, whenever the thread appears damaged, with new ones.
– Before the assembly, clean all the connection surfaces, the oil seal edges and the gaskets.
  Apply a thin layer of lithium-based grease on the oil seal edges.
  Put back the oil seals and the bearings with the mark or serial number facing towards the outside (visible side).
– When installing the bearings, lubricate them abundantly.
– Make sure that each component has been reassembled correctly.
– After a repair or periodic maintenance operation, carry out the preliminary checks and test the vehicle in a private area or, in any case, in a low-traffic area.

0.3 HOW TO USE YOUR SERVICE AND REPAIR MANUAL

ADVICE FOR CONSULTATION

– This manual is divided into section and chapters, each one of which corresponds to a category of main components.
  To consult them, see the INDEX.
– If not expressly indicated otherwise, for the reassembly of the units repeat the disassembly operations in reverse order.
– The terms “right” and “left” are referred to the rider seated on the vehicle in the normal riding position.
– For normal maintenance operations and for the use of the vehicle, consult the “USE AND MAINTENANCE” manual.

★ **The operations preceded by this symbol must be repeated on the opposite side of the vehicle.**

In this manual the various versions are indicated by the following symbols:

ASD automatic light switching version (Automatic Switch-on Device)

OPT optional

VERSION:

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

NOTE

GENERAL INFORMATION 1

GENERAL INFORMATION

1

TABLE OF CONTENTS

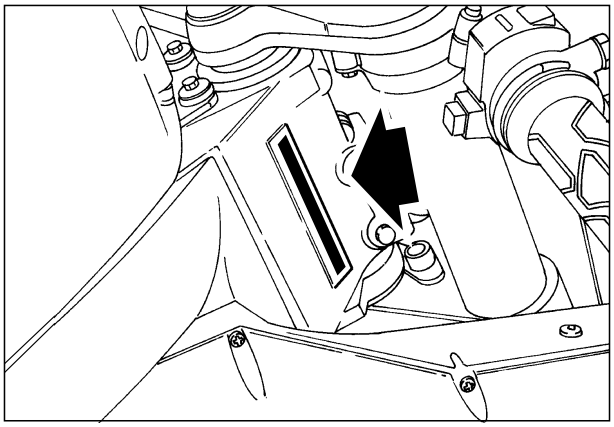
1.1 POSITION OF THE SERIAL NUMBERS

These numbers are necessary for the registration of the vehicle.

NOTE Do not alter the identification numbers if you do not want to incur severe penal and administrative sanctions. In particular, the alteration of the frame number results in the immediate invalidity of the guarantee.

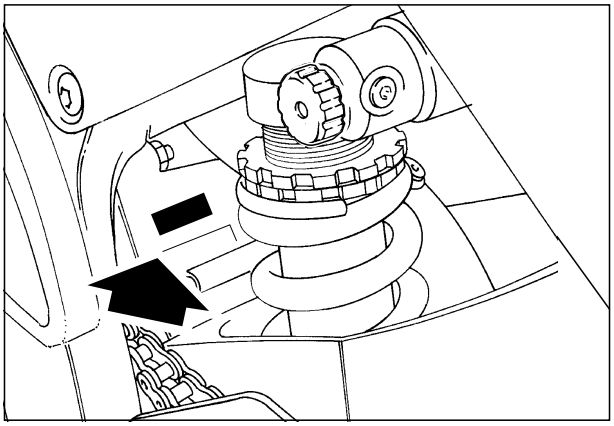
1.1.1 FRAME NUMBER

The frame number is stamped on the right side of the steering column.



1.1.2 ENGINE NUMBER

The engine number is stamped on the rear part of the engine, near the pinion.



1.2 INSTRUCTIONS FOR USE OF FUEL, LUBRICANTS, COOLANT AND OTHER COMPONENTS

1.2.1 FUEL

⚠ WARNING

The fuel used for internal combustion engines is extremely inflammable and in particular conditions it can become explosive.
It is important to carry out the refuelling and the maintenance operations in a well-ventilated area, with the engine off.
Do not smoke while refuelling or near fuel vapours, in any case avoid any contact with naked flames, sparks and any other heat source to prevent the fuel from catching fire or from exploding.

Further, prevent fuel from flowing out of the fuel filler, as it could catch fire when getting in contact with the red-hot surfaces of the engine.
In case some fuel has accidentally been spilt, make sure that the area has completely dried and before starting the vehicle verify that there is no fuel inside the fuel filler neck.
Since petrol expands under the heat of the sun and due to the effects of sun radiation, never fill the tank to the brim.
Screw the plug up carefully after refuelling.
Avoid any contact of the fuel with the skin and the inhalation of vapours; do not swallow fuel or pour it from a receptacle into another by means of a tube.

DO NOT DISPOSE OF FUEL IN THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

Use only unleaded premium grade petrol, min. O.N. 95 (N.O.R.M.) and 85 (N.O.M.M.).

1.2.2 ENGINE OIL

⚠ WARNING

Engine oil may cause serious damage to the skin if handled daily and for long periods.
It is advisable to wash your hands thoroughly after using.
Do not dispose of oil in the environment.
Deliver it to or have it collected by the nearest used oil recovery firm or by the supplier.

In case any maintenance operation has to be carried out, it is advisable to use latex gloves.

Change engine oil after the first 1000 km (625 mi) and successively every 7500 km (4687 mi) (*), see 2.14 (CHANGING THE ENGINE OIL AND THE OIL FILTER).

(*) = In case of use on racetracks, change every 3750 km (2343 mi).

Engine oil (recommended):

IP EXTRA RAID 4, SAE 15W - 50 or

Agip TEC 4T, SAE 15 W - 50 .

As an alternative to the recommended oil, it is possible to use high-quality oils with characteristics in compliance with or superior to the CCMC G-4, A.P.I. SG. specifications.

1.2.3 FORK OIL

⚠ WARNING

Fork oil may cause serious damage to the skin if handled daily and for long periods.
It is advisable to wash your hands thoroughly after using.
Do not dispose of oil in the environment.
Deliver it to or have it collected by the nearest used oil recovery firm or by the supplier.

In case any maintenance operation has to be carried out, it is advisable to use latex gloves.

By changing the damper settings and/or the viscosity of the oil contained in them, the suspension response may be altered partially.

Standard oil viscosity: SAE 20 W.

The viscosity ratings which can be chosen based on the type of fork stiffness desired (SAE 5W soft, 20W stiff).

The two products can be used in different percentages until the desired response is obtained.

One of the properties of IP F.A. and Agip FORK is that their viscosity alters little with changes in temperature and their damping response therefore remains constant.

Fork oil (recommended):

Fork oil IP F.A. 5W or IP F.A. 20W;
as an alternative Agip FORK 5W or Agip FORK 20W.
If you need an oil with intermediate characteristics in comparison with the IP F.A. 5W and IP F.A. 20W or Agip FORK 5W and Agip FORK 20W, these can be mixed as indicated below:

SAE 10W = IP F.A. 5W 67% of the volume, + IP F.A. 20W 33% of the volume or Agip FORK 5W 67% of the volume, + Agip FORK 20W 33% of the volume.

SAE 15W = IP F.A. 5W 33% of the volume, + IP F.A. 20W 67% of the volume or Agip FORK 5W 33% of the volume, + Agip FORK 20W 67% of the volume.

1.2.4 BRAKE FLUID

NOTE This vehicle is provided with front and rear disc brakes, with separate hydraulic circuits.
The following information refers to a single braking system, but is valid for both.

⚠ WARNING

Brake fluid may cause irritation if it comes into contact with the skin or eyes.
Carefully wash the part of the body that has come into contact with the fluid.
Consult an oculist or a physician if the fluid comes into contact with your eyes.

DO NOT DISPOSE OF BRAKE FLUID IN THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

When using the brake fluid, take care not to spill it on the plastic or painted parts, since it can damage them.

Every 7500 km (4687 mi) check the level of the brake fluid, see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKES FLUID) and 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID); change the fluid every two years, see 2.22 (CHANGING THE FRONT BRAKE FLUID) and 2.23 (CHANGING THE REAR BRAKE FLUID).

Brake fluid (recommended):

IP F.F., DOT 5 (compatible DOT 4) or

Agip BRAKE 5.1, DOT 5 (compatible DOT 4).

⚠ CAUTION

To avoid serious damage to the braking system, do not use fluids other than the recommended ones nor mix different fluids for topping up.
Do not use brake fluid taken from old or already opened containers.
Sudden variations in clearance or an elastic resistance in the brake levers may be due to trouble in the hydraulic circuits.
Make sure that the brake discs and the friction pads are completely free of grease or oil, especially after maintenance or checking operations.
Check that the brake hoses are not twisted or worn.
Make sure that neither water nor dust accidentally enter the circuit.

In case maintenance operations are to be performed on the hydraulic circuit, it is advisable to use latex gloves.

1.2.5 COOLANT

⚠ WARNING

The coolant is noxious: do not swallow it; if the coolant gets in contact with the skin or the eyes, it can cause serious irritations.
If the coolant gets in contact with your skin or eyes, rinse with plenty of water and consult a doctor.
If it is swallowed, induce vomit, rinse mouth and throat with plenty of water and consult a doctor without delay.

KEEP AWAY FROM CHILDREN.

DO NOT DISPOSE OF THE COOLANT IN THE ENVIRONMENT.

⚠ WARNING

Be careful not to spill the coolant on the red-hot parts of the engine: it may catch fire and send out invisible flames.
In case maintenance operations are to be performed, it is advisable to use latex gloves.

Do not use the vehicle if the brake fluid is below the minimum level.

Before setting off, and every 15000 km (9375 mi), check the level of the coolant, see 2.15 (CHECKING AND TOPPING UP COOLANT); change the coolant every two years, see 2.16 (CHANGING THE COOLANT).

The coolant is composed of 50% water and 50% antifreeze. This mixture is ideal for most running temperatures and ensures good protection against corrosion.

It is advisable to keep the same mixture in the hot season as well, since in this way losses due to evaporation are reduced and it is not necessary to top up so frequently.
The mineral salt deposits left in the radiator by evaporated water are thus lessened and the efficiency of the cooling system remains unaltered.

If the outdoor temperature is below 0°, check th cooling circuit frequently and inf necessary increase the antifreeze concentration (up to maximum 60%).

Use distilled water for the cooling solution so as not to damage the engine.

Engine coolant (recommended):

IP ECOBLU - 40°C or Agip COOL.

On the basis of the desired freezing temperature of the coolant mixture, add to the water the percentage of coolant indicated in the following table:

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

NOTE The characteristics of the various antifreeze liquids are different. Be sure to read the label on the product to learn the degree of protection it guarantees.

⚠ CAUTION

Use only antifreeze and anticorrosive without nitrite in order to ensure protection at at least -35°C.

1.2.6 CLUTCH FLUID

NOTE This vehicle is provided with hydraulic clutch control.

⚠ WARNING

If the clutch fluid gets in contact with the skin or the eyes, it can cause serious irritations.
Carefully wash the parts of your body that get in contact with the liquid.
Consult a doctor or an oculist if the liquid gets in contact with your eyes.

DO NOT DISPOSE OF THE CLUTCH FLUID IN THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

When using the clutch fluid, take care not to spill it on the plastic and painted parts, since it damages them.

Every 7500 km (4687 mi) check the level of the clutch fluid, see 2.19 (CHECKING AND TOPPING UP THE CLUTCH FLUID); change the fluid every two years, see 2.24 (CHANGING THE CLUTCH FLUID).

Clutch fluid (recommended):

IP F.F., DOT 5 (compatible DOT 4) or
Agip BRAKE 5.1, DOT 5 (compatible DOT 4).

⚠ CAUTION

To avoid serious damage to the system, do not use fluids other than the recommended ones nor mix different fluids for topping up.
Do not use clutch fluid taken from old or already opened containers.

Sudden variations in clearance or an elastic resistance in the clutch levers may be due to trouble in the hydraulic circuits.
Check that the clutch hoses are not twisted or worn.
Make sure that neither water nor dust accidentally enter the circuit.

In case maintenance operations are to be performed on the hydraulic circuit, it is advisable to use latex gloves.

1.2.7 CARBON MONOXIDE

If it is necessary to let the engine run in order to carry out some work, make sure that the area in which you are operating is properly ventilated.
Never run the engine in enclosed spaces.
If it is necessary to work indoors, use an exhaust evacuation system.

⚠ WARNING

The exhaust fumes contain carbon monoxide, a poisonous gas that can cause loss of consciousness and even death.

Run the engine in an open area or, if it is necessary to work indoors, use an exhaust evacuation system.

1.2.8 HOT COMPONENTS

⚠ WARNING

The engine and the components of the exhaust system become very hot and remain hot for some time after the engine has been stopped.

Before handling these components, wear insulating gloves or wait until the engine and the exhaust system have cooled down.

1.3 RUNNING-IN RULES

The running-in of the engine is essential to ensure its duration and correct functioning.
If possible, drive on hilly roads or roads with many curves where the engine, the suspensions and the brakes are submitted to a more efficacious running-in.

During running-in, change speed.
In this way the components are first “loaded” and then “relieved” and the engine parts can thus cool down.
Even if it is important to stress the engine components during running-in, take care not to exceed.

⚠ CAUTION

Only after the first 1500 km (937 mi) of running-in is it possible to obtain the best performance.

Keep in mind these important indications:

- Do not open the throttle completely if the speed is low, both during and after the running-in.
- During the first 100 km (62 mi) put on the brakes with caution, avoiding sharp and prolonged brakings. This ensures a correct bedding-in of the pads on the brake disc.
- During the first 1000 km (625 mi) never exceed 6000 rpm.

⚠ CAUTION

After the first 1000 km (625 mi) perform the checking operations indicated in the “after running-in” column, see 2.1.1 (REGULAR SERVICE INTERVALS CHART) in order to avoid injuring yourself or others a/o damaging the vehicle.

- Between the first 1000 (625 mi) and 1500 km (937 mi) drive more briskly, change speed and use the maximum acceleration only for a few seconds, in order to ensure better coupling of the components; never exceed 7500 rpm (see table).
- After the first 1500 km (937 mi) you can expect better performance from the engine, however, without exceeding the maximum allowed (10500 rpm).

Engine maximum rpm recommended	
Mileage km (mi)	**rpm**
0 – 1000 (0 – 625)	6000
1000 – 1500 (625 – 937)	7500
over 1500 (937)	10500

1.4 SPARE PARTS

For any replacement, use **aprilia** Genuine Spare Parts only.
aprilia Genuine Spare Parts are high-quality parts, expressly designed and manufactured for **aprilia** vehicles.

⚠ CAUTION

Failure to use aprilia Genuine Spare Parts may result in incorrect performance and damages.

1.5 TECHNICAL SPECIFICATIONS

DIMENSIONS	
Max. length	2080 mm
Max. length (with number plate-holder extension) OPT	2140 mm
Max. width	720 mm
Max. height (front part of the fairing included)	1170 mm
Seat height	820 mm
Distance between centres	1415 mm
Min. ground clearance	130 mm
Weight ready for starting (fuel and fluid included)	221 kg

ENGINE	
Type	60° longitudinal V-type, two-cylinder, 4-stroke, with 4 valves per cylinder, DOHC.
Number of cylinders	2
Total displacement	997.6 cm^3
Max. rated power (to driving shaft)	86.5 kW (116 HP) at 9250 rpm
Max. rated power (to driving shaft) (F)	70 kW (94 HP) at 9250 rpm
Max. torque	93 Nm (9.3 kgm) at 7000 rpm
Max. torque (F)	82 Nm (8.2 kgm) at 7250 rpm
Bore / stroke	97 mm / 67.5 mm
Compression ratio	11.4 ± 0.5 : 1
Average piston speed	22.5 m/s at 10000 rpm
Camshaft during intake stroke	262°, valve lifting= 10.6 mm
Camshaft during exhaust stroke	259°, valve lifting= 10.6 mm
Valve advance (with valve clearance 1mm) opening during intake stroke closing during intake stroke opening during exhaust stroke closing during exhaust stroke	20° before TDC 62° after BDC 64° before TDC 15° after BDC
Valve clearance during intake stroke	0.12-0.17 mm
Valve clearance during exhaust stroke	0.23-0.28 mm
Engine revolutions at minimum rpm	1250 ± 100 rpm
Engine revolutions at peak rpm	10250 ± 100 rpm
Ignition	electronically controlled
Starting	electric
Spark advance	At start: 5° before TDC, additional advance depending on specific consumption levels
Starter motor	12 V / 0.9 kW
Starter motor gear ratio	i= 49/9 * 30/11 * 64/30 = 31.677
Clutch	multidisc in oil bath, with hydraulic control on the left side of the handlebar and PPC device - # 9 lined discs; thick 3.5 mm - # 9 internal discs; thick 1.5 mm
Gear	mechanical, 6 gears with foot control on the left side of the engine

FOLLOW ❯

FOLLOW ❱

ENGINE	
Lubrication system	dry pan with separate oil tank, 2 trochoidal pumps and cooling radiator
Lubrication pressure	min 500 kPa (5 bar) at max 80 °C (176 °F) and 6000 rpm
Air cleaner	with dry filter cartridge
Cooling	liquid-cooled
Coolant pump gear ratio	i_{wp}= 28/27 * 28/28 = 1.037
Coolant pump delivery (with thermal expansion valve open)	90 ℓ/min and 9000 rpm
Thermal expansion valve opening start temperature	65 ± 2 °C (149 ± 5 °F)
Engine dry weight	~ 65 kg

CAPACITY	
Fuel (reserve included)	20 ℓ
Fuel reserve	4.5 ± 1 ℓ
Engine oil	oil change 3700 cm^3 - oil and oil filter change 3900 cm^3
Fork oil (per rod)	520 ± 2.5 cm^3
Coolant	2.5 ℓ (50% water + 50% antifreeze with ethylene glycol)
Seats	2
Vehicle max. load (driver + passenger + luggage)	182 kg

DRIVE					
GEAR RATIOS	Ratio	Primary	Secondary	Final ratio	Total ratio
	1st	31/60 = 1 : 1.935	14/35 = 1 : 2.500	17/42 = 1 : 2.470	11.948
	2nd		16/28 = 1 : 1.750		8.368
	3rd		19/26 = 1 : 1.368		6.543
	4th		22/24 = 1 : 1.090		5.216
	5th		23/22 = 1 : 0.956		4.573
	6th		27/23 = 1 : 0.851		4.073
# sprocket teeth			17		
Drive chain			endless type (with no connection link) with sealed links, model 525, dimensions 5/8" x 5/16"		

FUEL SUPPLY SYSTEM	
Type	electronic injection
Choke	Ø 51 mm

FUEL SUPPLY	
Type	indirect injection (MULTIPOINT)
Fuel	premium grade unleaded petrol, min. O.N. 95 (N.O.R.M.) and 85 (N.O.M.M.)

FRAME	
Type	two-beam frame with light alloy cast elements and extruded elements
Steering inclination angle	25°
Fore stroke	97 mm

SUSPENSIONS	
Front	UPSIDE-DOWN telescopic adjustable fork with hydraulic operation, rod Ø 43 mm
Stroke	127 mm
Rear	oscillating rear fork in light alloy with differentiated profile arms and hydropneumatic adjustable mono-shock absorber
Wheel stroke	135 mm

BRAKES	
Front	with double floating disc - Ø 320 mm, calipers with four pins with differentiated diameter
Rear	disc brake - Ø 220 mm, caliper with double pin

WHEEL RIMS	
Type	in light alloy with withdrawable pin
Front	3.50 x 17"
Rear	6.00 x 17"

FOLLOW ❱

FOLLOW ❱

TYRES										
Wheel	**Make**	**Model**	**Type**	**Size**	**Recommended**		**Alternative**	**Pressure kPa (bar)**		
								▲		⁘
								Solo rider	**Rider and passenger**	**Solo rider**
Front	PIRELLI	DRAGON EVO	MTR21 CORSA	120/70-ZR17"	▲	⁘	–	220 (2.2)	240 (2.4)	220-230 (2.2-2.3)
Rear	PIRELLI	DRAGON EVO	MTR22 CORSA	190/50-ZR17"	–	–	▲	250 (2.5)	270 (2.7)	–
Front (series)	**PIRELLI**	**DRAGON EVO**	**MTR21 CORSA**	**120/65-ZR17"**	▲	⁘	**–**	**220 (2.2)**	**240 (2,4)**	**220-230 (2.2-2.3)**
Rear (series)	**PIRELLI**	**DRAGON EVO**	**MTR22 CORSA**	**180/55-ZR17"**	▲	**–**	**–**	**250 (2.5)**	**270 (2.7)**	**–**
Rear	PIRELLI	DRAGON EVO	MTR22 CORSA (SC2)	180/55-ZR17"	–	⁘	–	–	–	200-210 (2.0-2.1)
Front	PIRELLI	DRAGON	MTR01 CORSA	120/70-ZR17"	▲	–	–	220 (2.2)	240 (2.4)	–
Rear	PIRELLI	DRAGON	MTR08 CORSA	180/55-ZR17"	▲	–	–	250 (2.5)	270 (2.7)	–
Front	METZELER	RACING	MEZ3B	120/70-17"	–	–	▲	220 (2.2)	240 (2.4)	–
Rear	METZELER	RACING	MEZ3A	190/50-17"	–	–	▲	250 (2.5)	270 (2.7)	–
Front	METZELER	STELL RADIAL	MEZ3	120/65-17"	▲	⁘	–	–	–	–
Rear	METZELER	STELL RADIAL	MEZ3	180/55-17"	▲	–	–	–	–	–
Rear	METZELER	STELL RADIAL	MEZ3	180/55-17"	▲	⁘	–	–	–	–
Front	MICHELIN	HI-SPORT	TX15D	120/70-17"	–	–	▲	220 (2.2)	240 (2.4)	–
Rear	MICHELIN	HI-SPORT	TX25	190/50-17"	–	–	▲	250 (2.5)	270 (2.7)	–
Front	MICHELIN	PILOT RACE	–	120/70-ZR17"	▲	⁘	–	220 (2.2)	240 (2.4)	200 (2.0)
Rear	MICHELIN	PILOT RACE	–	180/55-ZR17"	▲	⁘	–	250 (2.5)	270 (2.7)	190 (1.9)
Front	MICHELIN	PILOT SPORT	–	120/65-ZR17"	▲	–	–	220 (2.2)	240 (2.4)	–
Rear	MICHELIN	PILOT SPORT	–	190/50-ZR17"	▲	–	–	250 (2.5)	270 (2.7)	–
Front	DUNLOP	SPORTMAX	D207FRR	120/70-17"	▲	⁘	–	220 (2.2)	240 (2.4)	210 (2.1)
Rear	DUNLOP	SPORTMAX	D207RR	190/50-17"	▲	⁘	–	250 (2.5)	270 (2.7)	190-200 (1.9-2.0)
Front	BRIDGESTONE	BATTLAX	BT56	120/70-17"	–	–	▲	220 (2.2)	240 (2.4)	–
Rear	BRIDGESTONE	BATTLAX	BT56	190/50-17"	–	–	▲	250 (2.5)	270 (2.7)	–

▲ = Normal use ; ⁘ = Use on racetracks

SPARK PLUGS	
Standard	NGK R DCPR9E
Alternative	NGK R DCPR8E
Spark plug gap	0.6 – 0.7 mm
Resistance	5 kΩ

ELECTRIC SYSTEM	
Battery	12 V - 12 Ah
Main fuses	30 A
Secondary fuses	15 A
Generator (with permanent magnet)	12 V - 400 W
Starting motor	12 V / 0.9 kW

FOLLOW ❱

FOLLOW ❱

BULBS	
Low beam (halogen)	12 V - 55 / 55 W H4
High beam (halogen)	12 V - 60 W H3
Front parking light	12 V - 5 W
Direction indicators	12 V - 10 W
Rear parking light / number plate light / stoplight	12 V - 5/21 W
Revolution counter	12 V - 2 W
Left multifunction display	12 V - 2 W
Right multifunction display	12 V - 2 W

WARNING LIGHTS	
Neutral	12 V - 3 W
Direction indicators	12 V - 3 W
Fuel reserve	12 V - 3 W
High beam	12 V - 2 W
Stand down	12 V - 3 W
Engine oil pressure	LED
Red line	LED

1.6 LUBRICANT CHART

Engine oil (recommended): IP EXTRA RAID 4, SAE 15W - 50 or Agip TEC 4T SAE 15W - 50.
As an alternative to the recommended oil, it is possible to use high-quality oils with characteristics in compliance with or superior to the CCMC G-4, A.P.I. SG specifications.

Fork oil (recommended): IP F.A. 5W or IP F.A. 20 W fork oil;
an alternative Agip FORK 5W or Agip FORK 20W fork oil.
If you need an oil with intermediate characteristics in comparison with the IP F.A. 5W and IP F.A. 20 W or Agip FORK 5W and Agip FORK 20W, these can be mixed as indicated below:

SAE 10W = IP F.A. 5W 67% of the volume, + IP F.A. 20W 33% of the volume or
Agip FORK 5W 67% of the volume + Agip FORK 20W 33% of the volume.

SAE 15W = IP F.A. 5W 33% of the volume, + IP F.A. 20W 67% of the volume or
Agip FORK 5W 33% of the volume + Agip FORK 20W 67% of the volume.

Bearings and other lubrication points (recommended): IP AUTOGREASE MP or Agip GREASE 30.
As an alternative to the recommended product, use high-quality grease for rolling bearings, working temperature range -30 °C…+140 °C, dripping point 150 °C…230 °C, high protection against corrosion, good resistance to water and oxidation.

Protection of the battery poles: neutral grease or vaseline.

Spray grease for chains (recommended): IP CHAIN SPRAY or Agip CHAIN LUBE.

⚠ WARNING

Use new brake fluid only.

Brake fluid (recommended): IP F.F., DOT 5 (DOT 4 compatible) or Agip BRAKE 5.1, DOT 5 (DOT 4 compatible).

⚠ WARNING

Use new clutch fluid only.

Clutch fluid (recommended): IP F.F., DOT 5 (DOT 4 compatible) or Agip BRAKE 5.1, DOT 5 (DOT 4 compatible).

⚠ WARNING

Use only antifreeze and anticorrosive without nitrite, ensuring protection at -35 °C at least.

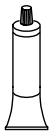
Engine coolant (recommended): IP ECOBLU -40 °C or Agip COOL.

1.7 CONSUMABLES

Only use the products given below for any maintenance work. The materials mentioned have been tested for many years and are suitable for all the application conditions indicated by the manufacturer.

NOTE The consumables, which are coded, are available on application, see 1.7.2 (USE OF CONSUMABLES).

1.7.1 PRODUCT PROPERTIES

Product	Use and properties
LOCTITE® 243 blue 	Adhesive in paste for screws and nuts up to M36 and for couplings with medium hold. It can be used on parts which have not been completely degreased. The hardening time depends on the temperature and the material (maximum one hour). Resistance to temperatures in the range – 55 to 150 °C (– 99 to 302 °F)
LOCTITE® 648 green 	Paste for strong fastening of screws. The hardening time depends on the temperature and the material (maximum twelve hours). Resistance to temperatures in the range -55 to 175 °C (– 99 to 347 °F). In order to release the part glued, it may be necessary to heat the coupled parts to a temperature of 250 °C (482 °F).
LOCTITE® 574 orange 	Solvent-free seal in paste, to be used instead of seals where there is a high friction factor and where a precise distance is required between the two components. Applied in its liquid state, it hardens after assembly on contact with the metal within a few hours. A seal is created whose surface structure adapts to the surfaces to be sealed. Resistance to temperatures in the range – 55 to 200 °C (– 99 to 392 °F); where applied, it seals the surfaces against corrosion.
LOCTITE® 8150 	Paste to be used on components subjected to high temperature.
LOCTITE® Anti Seize 15378 	Lubricant and anticorodal resistant to high temperatures. It must be sprayed on both components and makes sure the sliding surfaces remain maintenance free for a long time. It prevents corrosion.
MOLYKOTE® G-n 	Lubricating paste to be used on support points subjected to heavy loads, for standard lubrication and on couplings under pressure, in order to prevent corrosion which would prevent subsequent disassembly. To apply on the two surfaces.
SILASTIC 732 RTV 	It is used as a sealant, preventing water from getting inside the flywheel cover.

1.7.2 USE OF CONSUMABLES

Product	Code	Description of use
Engine oil (*)	8116050	– Assembly of rivets on fork, dashboard/front fairing mount, saddle support and frame. – Assembly of frame/engine and frame/fork adjusting bushes. – Assembly of fairlead screws on frame. – Insertion of steering head bearings. – Steering head upper bush. – On timing intermediate gear roller bearings. – On lower countershaft thrust washer. – Clutch disengaging shaft. – On valve stems and valve lifter buckets. – On valve guide oil seals. – On camshaft housings. – On the timing chain tightener. – On double starter gear and idler gear pins. – On the freewheel gear/freewheel contact surface. – On the freewheel inner contact surface.
LOCTITE® 243 (**)	0897651	– Fastening of steering shock absorber bush. – Fastening of rear brake caliper lock pin. – Fastening of pinion. – Fastening of rear brake lever pin. – Fastening of cooling electrofan on support. – Fastening of fuel return pipe connection. – Fastening of fuel filler cap. – Throttle cable pullet fastening nut. – Throttle cable support bracket fastening screws. – Throttle valve pin fastening nut. – Throttle valve potentiometer fastening screws. – On coolant pump centre fastening screw. – On cylinder joining bracket fastening screws. – On engine half-casing bearing lock screws. – On cylinder fastening studs. – On driving shaft position sensor fastening screws. – On index lever and plate fastening screws. – On driving shaft fastening nut. – On timing gear fastening screws. – On upper countershaft counterweight fastening nut. – On intermediate timing gear bearing support lower fastening screw.
LOCTITE® 648 (**)	0899788	– On coolant pump idler gear pin. – On engine oil pump plug. – On clutch gear metal slip fastening screws. – Assembly freewheel on magnetic wheel. – On freewheel fastening screws. – On clutch housing fastening nut. – On lower countershaft counterweight fastening screw. – On flywheel rotor inner cone. – On flywheel fastening screw.

FOLLOW ❱

FOLLOW

Product	Code	Description of use
LOCTITE® 574 orange (**)	0899784	– Fastening of coolant thermal switch. – Fastening of coolant thermistors. – On neutral gear switch contact screw. – On the outer surface of the engine oil pump motor. – On the cylinder's base where it rests on the engine casing.
LOCTITE® Anti Seize 15378 (**)	0297434	– On gearshift primary and secondary shaft. – On gearshift primary and secondary shaft housings. – On driving shaft and countershaft. – On the gearshift primary shaft housing and toothing.
MOLYKOTE® G-n (**)	0297433	– On main bush housings. – On main bushes. – On engine casing bearing housings. – On coolant pump shaft. – On valve guide slots on the head. – On valve guide edges. – On driving shaft and countershaft bush housings. – On driving shaft and countershaft housings. – On connecting rod/piston pin slots. – On camshaft cams. – On starter motor fastening housing.
SILASTIC 732 RTV (**)	0297386	– On cable bracket on flywheel cover. – On camshaft sensor cable.
Bimol Grease 481	8116053	– Assembly of front and rear wheel seals. – Assembly of fork pin bearings. – Assembly of clutch pump control rod. – On rear wheel pin thread. – On steering head bearings. – Assembly of rear brake pump control rod. – On rear brake lever pin. – On intermediate timing gear thrust washer. – Upper countershaft oil seal. – Starter motor gear.
LUBERING ST grease	8116038	– Assembly of cold-start control.
AP-LUBE temporary lubricant	-	– Assembly of handlebar counterweights rubber element. – Assembly of throttle cable adjuster rubber elements. – Assembly of rubber element on gearshift lever. – Insertion of radiator lower pins on supporting rubber elements. – Assembly of breather pipe on radiator and three-way manifold. – Assembly of coolant couplings on radiators. – Assembly of water and fuel drainage pipes on fuel pump flange. – Assembly of throttle body torsion springs.
DID CHAIN LUBE grease		– Lubrication of driving chain.
"Biosolvent" frame detergent	8116031	– Washing of engine oil tank.
"ACRILON 28" cyanoacrylic glue	8116945	– Assembly of air filter casing seal.
MOTUL MOTOWASH degreaser	-	– Cleaning of frame and fork.

FOLLOW

FOLLOW

Product	Code	Description of use
ANTI-SEIZE MOTAGEPASTE AS 1800 antiscuff paste	8116043	– Assembly of plugs for checking CO on exhaust pipes.
Alcohol	-	– Cleaning of left handlebar prior to assembly of grip. – Insertion of radiator breather pipes on “T” union. – Assembly of HV coil support rubber element. – Assembly of side fairing rubber elements. – Cleaning of lower part of engine. – Assembly of start relay rubber element. – Assembly of flexible couplings on rear wheel sprocket. – Assembly of rubber elements on engine oil radiator. – Assembly of coupling on coolant filler. – Cleaning of engine oil tank prior to application of transfers. – Assembly of dashboard/front fairing mount rubber elements. – Assembly of rubber element on rear brake lever. – Assembly of pipes on fuel filter (inside tank). – Assembly of coolant radiator union coupling. – Assembly of fuel pipes on tank. – Cleaning of fuel tank prior to application of transfers.

(*) = see 1.6 (LUBRICANT CHART).

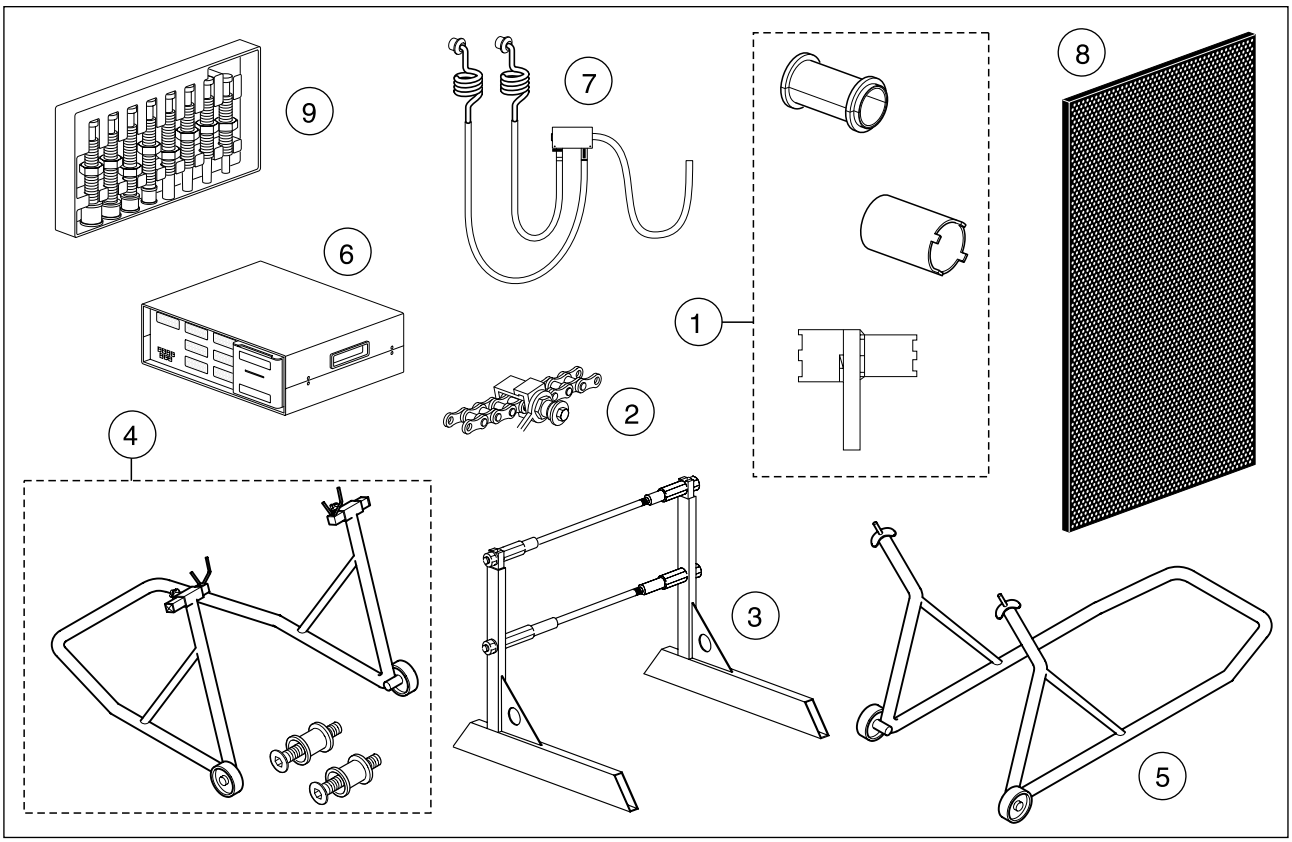
(**) = see 1.7.1 (PRODUCT PROPERTIES).

1.8 SPECIAL TOOLS OPT

In order to perform assembly, reassembly and settings correctly, special tools suitable for the task must be used. The use of special tools avoids the potential risk of damage as a result of inappropriate tools and/or improvised methods.
Below is a list of the special tools designed especially for this specific vehicle.
When ordering generic special tools, refer to the special tools manual.

⚠ CAUTION

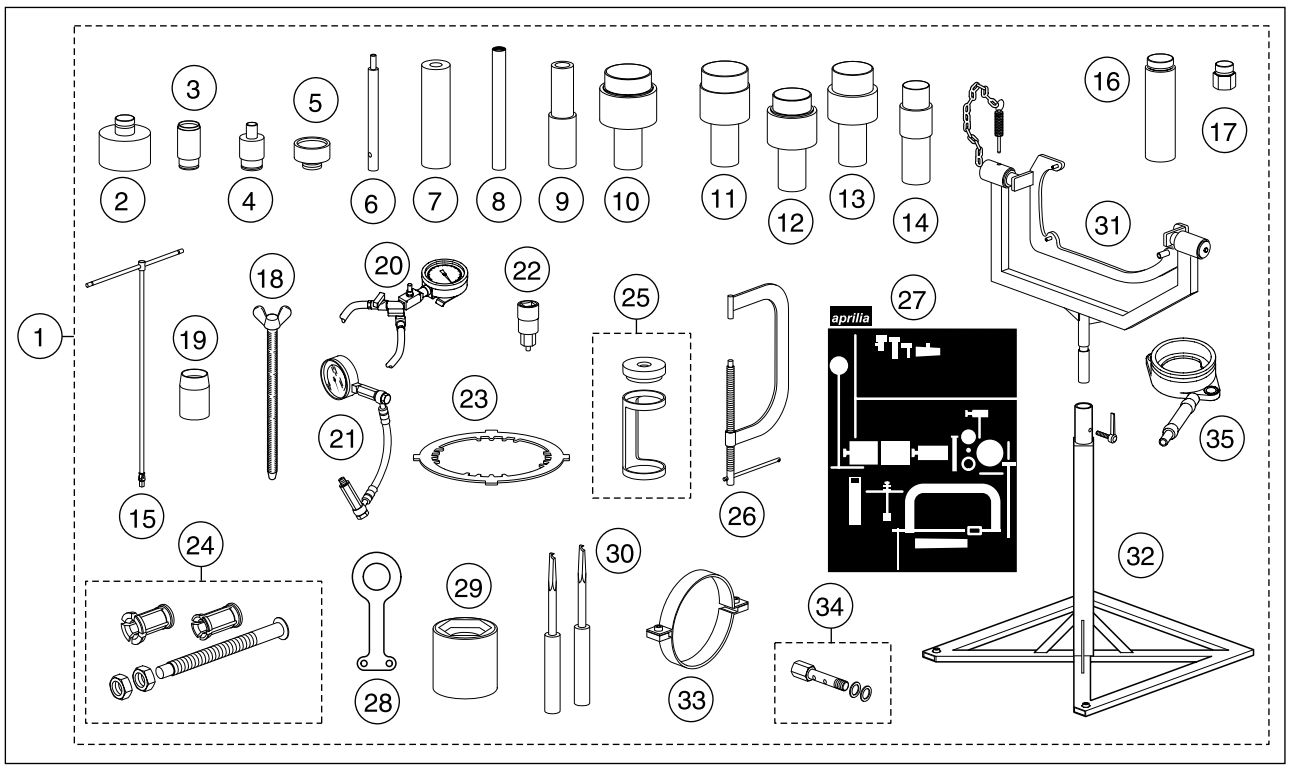
Before using the special tools, consult any documents attached.



1.8.1 MISCELLANEOUS TOOLS

Pos.	Tool description and function	Code
1	Complete tool kit for frame parts including: – semi-shells for assembling oil seals, front fork – socket spanner for adjusting steering – socket spanner for adjusting fork pin - engine mounts	8140203
2	Chain disassembly/reassembly tool	8140192
3	Centre stand	8140176
4	Rear support stand	8140194
5	Front support stand	8140195
6	Exhaust fume analyser	8140196
7	Exhaust fume analyser pipe kit	8140202
8	Tool holder panel	8140199
9	Kit for bearings in the range Ø10 mm to Ø 30 mm	8140180

1.8.2 ENGINE TOOLS

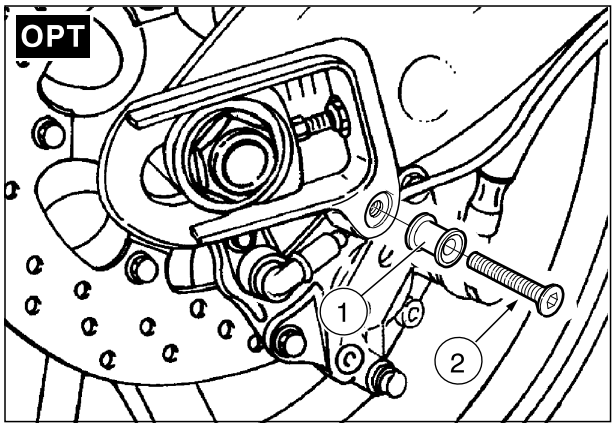


Pos.	Tool description and function	Codice
1	**Complete tool kit for engine including**	**8140175**
2	Gearshift secondary shaft oil seal assembly pad	0277680
3	Secondary countershaft oil seal assembly pad	0277660
4	Coolant pump shaft housing oil seal assembly pad	0277670
5	Coolant pump shaft housing sliding ring assembly pad	0877257
6	Valve guide disassembly pad	0277510
7	Valve guide oil seal assembly pad	0277695
8	Valve guide assembly pad	0277210
9	Gearshift shaft oil seal - clutch shaft oil seal assembly pad	8140155
10	Main countershaft bush inserter pad	0277729
11	Driving shaft sleeve puller** pad	0277720
12-14	Driving shaft bush inserter pad	0277725
13	Driving shaft - clutch cover bush inserter pad	0277727
15	Plug socket spanner	8140177
16	Tool for removal flywheel cover	0277252
17	Flywheel removal hexagonal bolt	0277780
18	Threaded pin for retaining the driving shaft at TDC	0240880
19	Gearshift secondary shaft guide bush	0277308
20	Vacuometer	8140256
21	Fuel - oil pressure gauge	8140181
22	Rotor bolt removal bush	8140182
23	Clutch blocking tool	0277881
24	Clutch cover sleeve puller**	8140156 + 8140157 + 0276377
25	Valves spring-pusher tool	0276479
26	Valves disassembly and reassembly bow	8140179
27	Adhesive for tool holder panel	8157143
28	Engine lifting eye hook	8140183
29	Primary transmission nut disassembly bush	8140184
30	Clutch disc** extraction hook lever	8140185
31	Engine support	8140188
32	Engine support stand	8140187
33	Piston ring compression tool	8140186
34	Perforated bolt for fuel pressure test	8140197
35	Intake flange for vacuometer	8140267

1.9 POSITIONING THE VEHICLE ON THE SUPPORT STAND

1.9.1 ASSEMBLING THE PINS FOR THE REAR SUPPORT STAND OPT

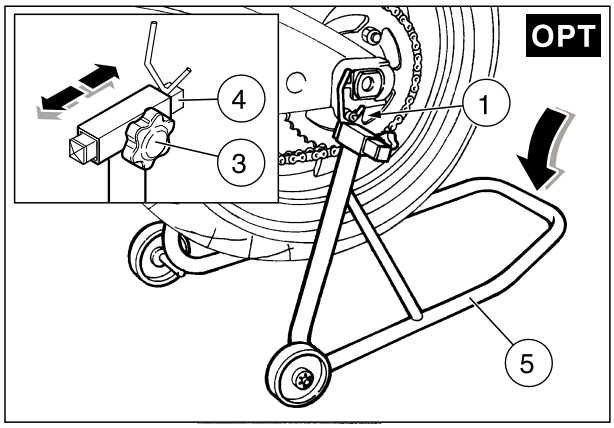
cod. 8140194 (stand + pin).



- ◆ Position the vehicle on the side stand on firm and level ground.
- ◆ ★ Position the pin (1) on the appropriate seat on the rear fork.
- ◆ ★ Screw and tighten the screw (2) in the appropriate threaded hole in the rear for.

1.9.2 POSITIONING THE VEHICLE ON THE REAR SUPPORT STAND OPT

cod. 8140194 (stand + pin).



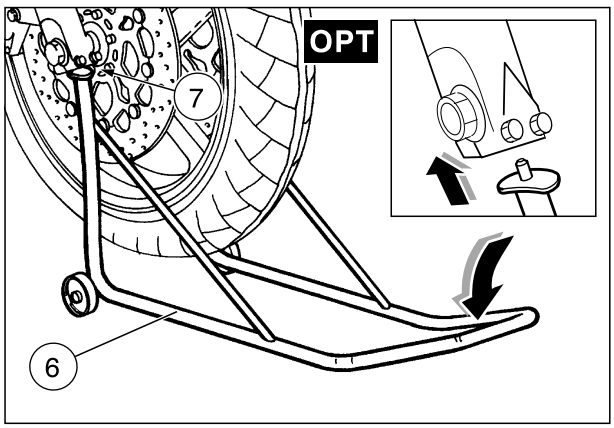
- ◆ Fit the relevant pins, see 1.9.1 (ASSEMBLING THE PINS FOR THE REAR SUPPORT STAND OPT).

NOTE Have someone help you keep the vehicle in vertical position with the two wheels on the ground.

- ◆ ★ Loosen the knob (3).
- ◆ ★ Move the fork support (4), positioning it so that the width corresponds to the distance between the two pins (1) on the rear fork.
- ◆ ★ Tighten the knob (3).
- ◆ At the same time introduce the two fork-shaped seats (4) of the stand (5) under the two pins (1) provided on the vehicle.
- ◆ Rest one foot on the rear part of the stand (5).
- ◆ Push the stand (5) downwards until it reaches the end of its stroke.

1.9.3 POSITIONING THE VEHICLE ON THE FRONT SUPPORT STAND OPT

cod. 8140195 (stand).



- ◆ Position the vehicle on the appropriate rear support stand, see 1.9.2 (POSITIONING THE VEHICLE ON THE REAR SUPPORT STAND OPT).
- ◆ Insert the two ends of the stand (6) in the two holes (7) positioned on the lower ends of the front fork.
- ◆ Rest one foot on the front part of the stand (6).
- ◆ Push the stand (6) downwards until it reaches the end of its stroke.

1.9.4 SETTING THE VEHICLE ON THE CENTRE SUPPORT STAND OPT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

cod. 8140176 (complete stand).

- Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- Set the vehicle on the relevant front support stand, see 1.9.3 (SETTING THE VEHICLE ON THE FRONT SUPPORT STAND OPT).
- ★ Hold the nut on the inside (1) still.
- ★ Unscrew and remove the engine upper rear fastening screw (2).

Driving torque of nut (1) / screw (2): 50 Nm (5.0 kgm).

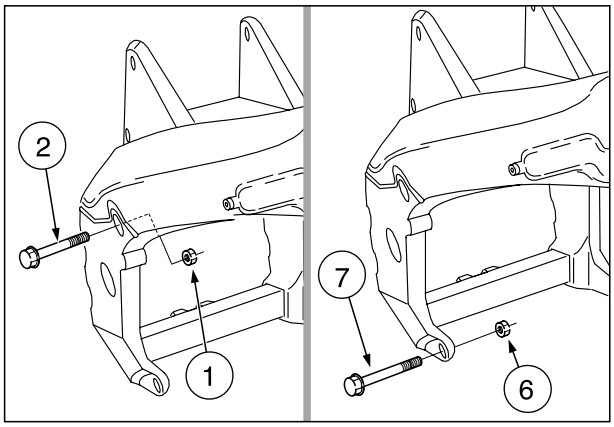
NOTE The screw (2) on the left-hand side is longer.

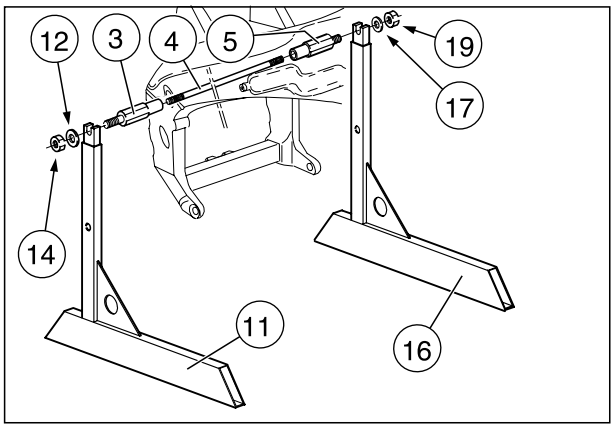
- ★ Retrieve the nut (1).
- Insert the upper right support pin (3) in the upper hole on the right-hand side.
- Insert the stud bolt (4) in the upper hole on the left-hand side and screw it all the way onto the pin (3).
- Screw the upper left support pin (5) all the way onto the stud bolt (4) and tighten.
- ★ Hold the nut on the inside (6) still.
- ★ Unscrew and remove the engine lower rear fastening screw (7).

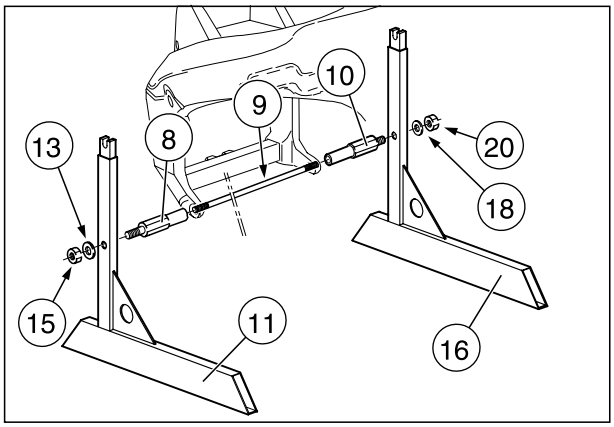
Driving torque of nut (6) / screw (7): 50 Nm (5.0 kgm).

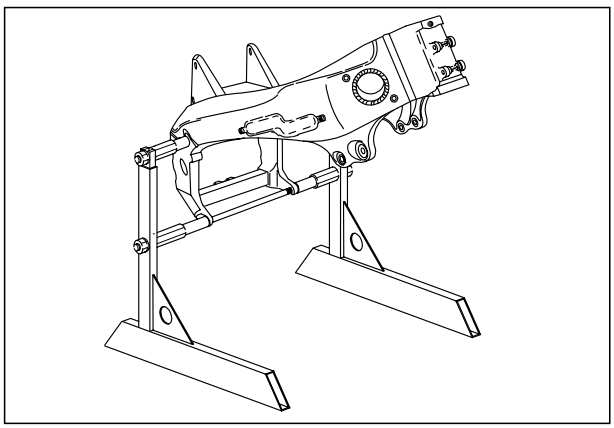
NOTE The screw (7) on the right-hand side is longer.

- Insert the lower right support pin (8) in the lower hole on the right-hand side.
- Insert the stud bolt (9) in the lower hole on the left-hand side and screw it all the way onto the pin (8).
- Screw the lower left support pin (10) all the way onto the stud bolt (9) and tighten.
- Place the support bracket (11) with the longer side of the base facing forwards, on the two support pins (5 - 10).
- Insert the two washers (12 - 13) and two nuts (14 - 15), screwing them on by hand.
- Tighten the two nuts (14-15).
- Place the support bracket (16) with the longer side of the base facing forwards, on the two support pins (5 - 10).
- Insert the two washers (17 - 18) and two nuts (19 - 20), screwing them on by hand.
- Tighten the two nuts (19 - 20).
- Remove the front and rear support stands.









1.10 INSTRUCTIONS FOR APPLYING TRANSFERS

When removing parts of the frame :

⚠ CAUTION

Handle plastic and painted parts carefully so not to scratch or damage them.
Perform the work with the utmost care.
Do not damage the tabs and/or the slots into which they are inserted.

When applying the transfers, follow the instructions given below carefully.

It is advisable to use the following tools:

– relatively stiff spatula (1);

NOTE Generally, soft, squeegee-type spatulas do not remove enough water from under the transfer.

– sponge or sprayer (2) with water.

NOTE Add detergent to the water (1 - 3%) and shake until you get soap bubbles.

Apply as follows:

◆ Place the transfer (3) upside down on a work surface.
◆ Keeping the transfer spread out on the work surface, remove the protective backing (4) completely.

NOTE It is advisable to use a sprayer (2).
When using a sponge, dab the surface with the sponge, without pressing hard so as to avoid damaging the adhesive.

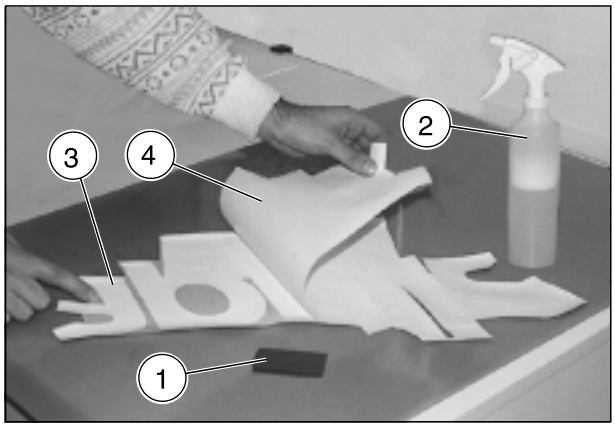
◆ Wet the surface of the adhesive with soapy water.
◆ Apply the transfer (3) on the surface to be decorated and move it into the right position.

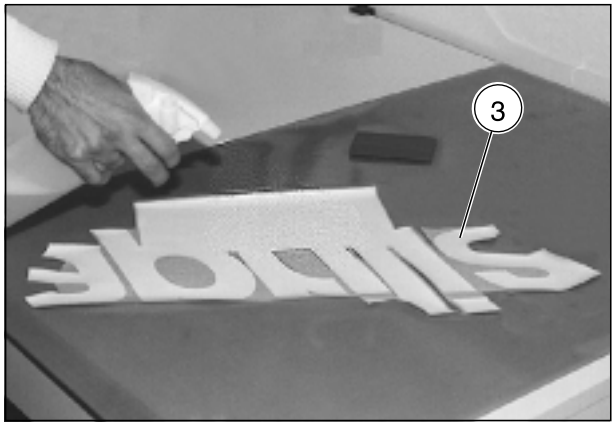
NOTE Always move the spatula in constant strokes from the centre of the transfer out.

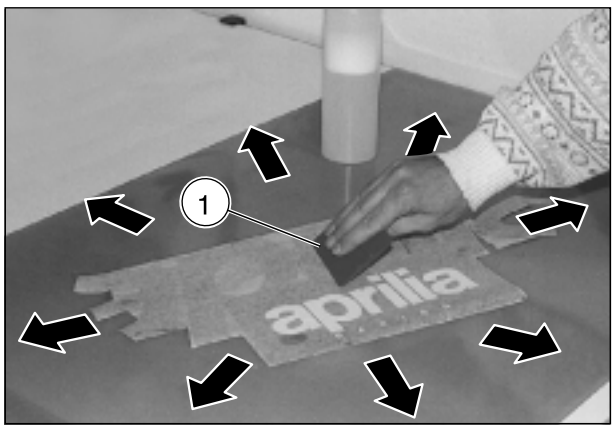
◆ Using the spatula (1), press down reasonably hard and move the spatula across the surface of the transfer until the excess soap and water has been removed from underneath.

NOTE Do not lift the corners and/or sides of the transfer.

◆ Use an absorbent cloth and, working from the centre out, dry the transfer.
◆ Move the spatula over the transfer again with firm, even strokes, pressing down as hard as possible.
Move the spatula in strokes from the centre out, taking special care with the corners and sides to make sure the whole surface sticks evenly.







NOTE Where the transfer features application tape (5)*, the tape must be removed 20-30 minutes after the application of the transfer.

* The application tape is used to facilitate the application of trademarks and letters, arranging them in the correct place on the surface to be decorated, and to give the self-adhesive more body during application.

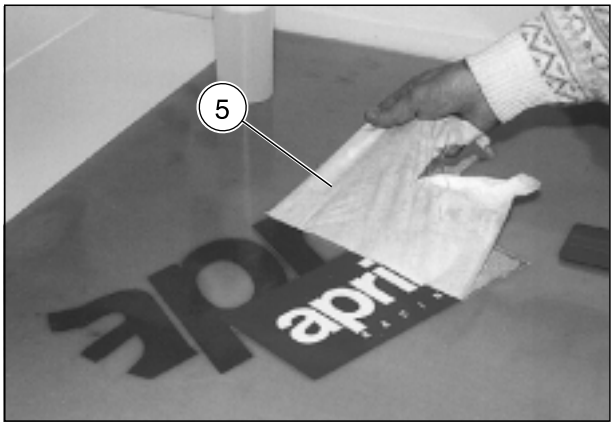
◆ Remove the application tape (5) from the surface of the transfer.
◆ In order to assure good adhesion, move the spatula over the transfer again, concentrating in particular on the edges and corners.

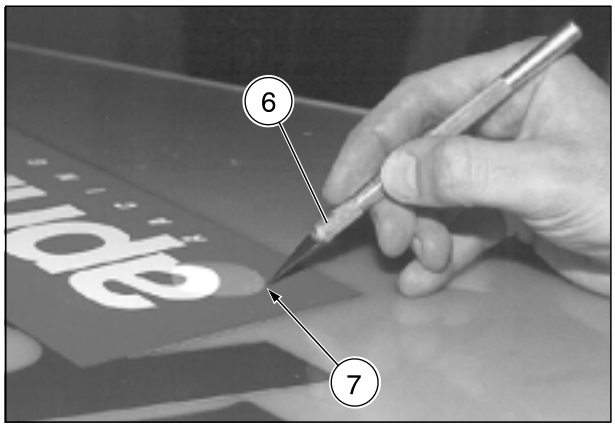
NOTE With the wet method, the final level of the transfer is reached approx. 48 hours after application.

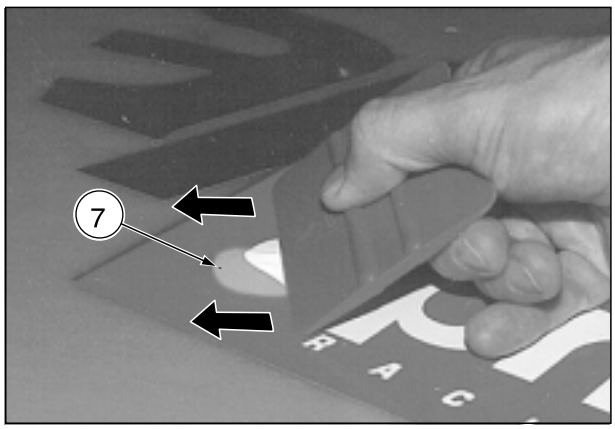
◆ Once the application tape has been removed, make sure there are no air bubbles anywhere on the surface.

In the event air bubbles are encountered:

◆ Use a pin or paper cutter (6) to make a hole in the edge (7) of the air bubble.
◆ Using the spatula (1), work from the edge opposite the hole and push the bubble so the air escapes.







1.11 GENERAL SPECIFICATIONS OF THE DRIVING TORQUES

The following table indicates the standard driving torques for screws and bolts with metric ISO thread.

Screw or bolt thread	Spanner	Driving 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

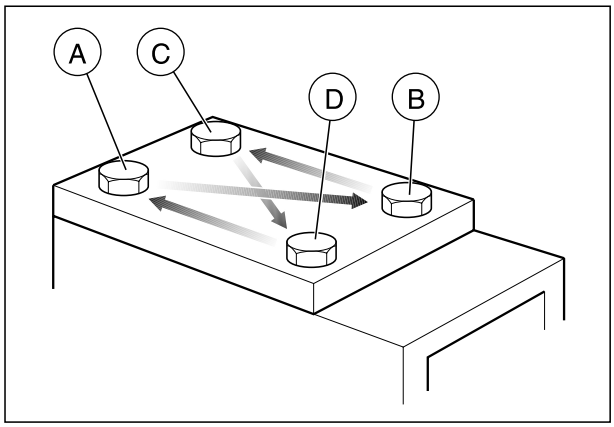
For specific joints or couplings of the vehicle, see 2.41 (FASTENING ELEMENTS).

If not specified otherwise, the indicated driving torques are valid for clean and dry threads, at room temperature.

NOTE In order to avoid any deformation and/or imperfect coupling, tighten the screws or bolts by proceeding as described below:

- Manually screw all the fastening elements.
- Applying half the prescribed driving torque, tighten the elements that are diametrically opposite each other: (A) and (B); (C) and (D).
- Repeat the previous operation by applying the prescribed driving torque.

NOTE In this way the pressure exerted by the fastening elements will be uniformly distributed on the joint surface.



1.12 ABBREVIATIONS / SYMBOLS / INITIALS

#	=	number
<	=	is less than
>	=	is greater than
≤	=	is equal to or less than
≥	=	is equal to or greater than
~	=	approximately
∞	=	infinity
°C	=	degrees centigrade
°F	=	degrees Fahrenheit
±	=	plus or minus
a.c.	=	alternating current
A	=	ampere
Ah	=	ampere-hour
API	=	American Petroleum Institute
HV	=	high voltage
AV/DC	=	AntiVibration Double Countershaft
bar	=	unit of pressure (1 bar = 100 kPa)
BDC	=	bottom dead centre
cm^3	=	cubic centimetres
CO	=	carbon monoxide
CPU	=	Central Processing Unit
d.c.	=	direct current
DIN	=	Deutsche Industrie Norm
DOHC	=	Double Overhead Camshaft
ECU	=	Engine Control Unit
rpm	=	revolutions per minute
HC	=	unburnt hydrocarbons
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
kΩ	=	kilo-ohms
kPa	=	kiloPascal (1 kPa = 0.01 bar)
kW	=	kilowatt
KS	=	Clutch side
ℓ	=	litres
LAP	=	lap (race course)
LED	=	light emitting diode
m/s	=	metres / second
MAX	=	maximum
mi	=	mile
MIN	=	minimum
MPH	=	miles per hour
MS	=	Flywheel side
MΩ	=	megaohm
N.O.M.M.	=	“Motor” method octane number
N.O.R.M.	=	“Research” method octane number
Nm	=	Newton-meter (1 Nm = 0.1 kgm)
Ω	=	ohm
PPC	=	Pneumatic Power Clutch
SAE	=	Society of Automotive Engineers
TEST	=	diagnostics test
T.C.E.I.	=	Allen
T.E.	=	hex-head
TDC	=	top dead centre
T.P.	=	flat head
TSI	=	Twin Spark Ignition
UPSIDE-DOWN	=	upside-down rods
V	=	Volt
W	=	Watt
Ø	=	diameter
mbar	=	millibar (1mbar = 0.1 kPa)

SERVICE AND SETTING UP 2

SERVICE AND SETTING UP

TABLE OF CONTENTS

This section describes the procedures for periodic service on the principal components of the vehicle.

⚠ WARNING

Before beginning any service operations or inspection of the vehicle, switch off the engine and remove the key, wait until the engine and the exhaust system have cooled down and, if possible, lift the vehicles with the proper equipment onto firm and flat ground.

In order to avoid burns, be careful not to touch any parts of the engine or exhaust system which have not cooled down completely.

The vehicle is constructed of non-edible parts.
Do not bite, suck, chew or low any part of the vehicle for any reason whatever.

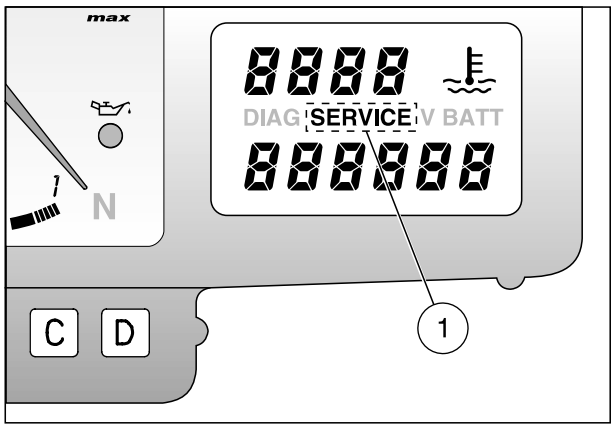
If not expressly described otherwise, reassembly of the units is carried out repeating the disassembly operations in the reverse order.

2.1 PERIODIC SERVICE PLAN

aprilia recommends respecting the intervals indicated for the periodic service on the various components in order to ensure the best operating conditions of the vehicle.

⚠ CAUTION

After the first 1000 km (625 mi) and successively every 7500 km (4687 mi), the writing "SERVICE" (1) appears on the right display.
In this case, carry out the operations prescribed in the periodic service plan. If the bike is being used for competition, perform the operations more frequently, see 2.1.1 (REGULAR SERVICE INTERVALS CHART).



2.1.1 REGULAR SERVICE INTERVALS CHART

Component	After running-in [1000 km (625 mi)]	Every 7500 km (4687 mi) or 8 months	Every 15000 km (9375 mi) or 16 months
Spark plugs		① (*)	③(*)
Stand	①	①	
Throttle cables	①	①	
Rear suspension linkage bearings			①
Steering bearings and steering	①	①	
Wheel bearings		①	
Air filter		①	③
Engine oil filter	③	③ (*)	
Engine oil filter (on oil tank)	②		②
Fork		①	
Light operation/direction		①	
Tappet clearance	④		④
Throttle body pin greasing	①	①	
Braking systems	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		
Fork oil	After the frist 7500 km (4687 mi) and every 22500 km (14000 mi): ③		
Engine oil	③	③ (*)	
Brake pads	if worn: ③		
Tyres	①	every 1000 km (625 mi): ①	
Tyre pressure	④	every 15 days: ①	
Engine idling rpm	④	④	
Nut, bolt, screw tightening	①	①	
Cylinders synchronization	①	①	
Suspensions and attitude	①		①
Engine oil pressure warning light LED	at every start: ①		
Brake fluid bleeding	①		
Clutch fluid bleeding	①		
Drive chain tension and lubrication	every 1000 km (625 mi): ①		
Battery terminals	①	①	
Fuel pipes		①	every 4 years: ③
Brakes and clutch pipes		①	every 4 years: ③
Cooling system pipes		①	
Brake pad wear	before every trip and every 7500 km (4687 mi): ①		

① = check and clean, adjust, lubricate or change, if necessary; ② = clean; ③ = change; ④ = adjust.
Perform the maintenance operations with doubled frequency if the vehicle is used in rainy or dusty areas, on uneven surfaces or on racetracks.

( ) =OPERATIONS WHICH CAN BE CARRIED OUT EVEN BY THE USER

(*) = In case of use on racetracks, change every 3750 km (2343 mi).

2.2 POINTS REQUIRING LUBRICATION

Correct lubrication is important for good performance and the long life of the vehicle.

NOTE Before lubricating, completely clean all parts, removing rust, grease, dirt and dust.
The exposed parts subject to rust are to be lubricated with motor oil or grease. See 1.6 (LUBRICANT CHART).

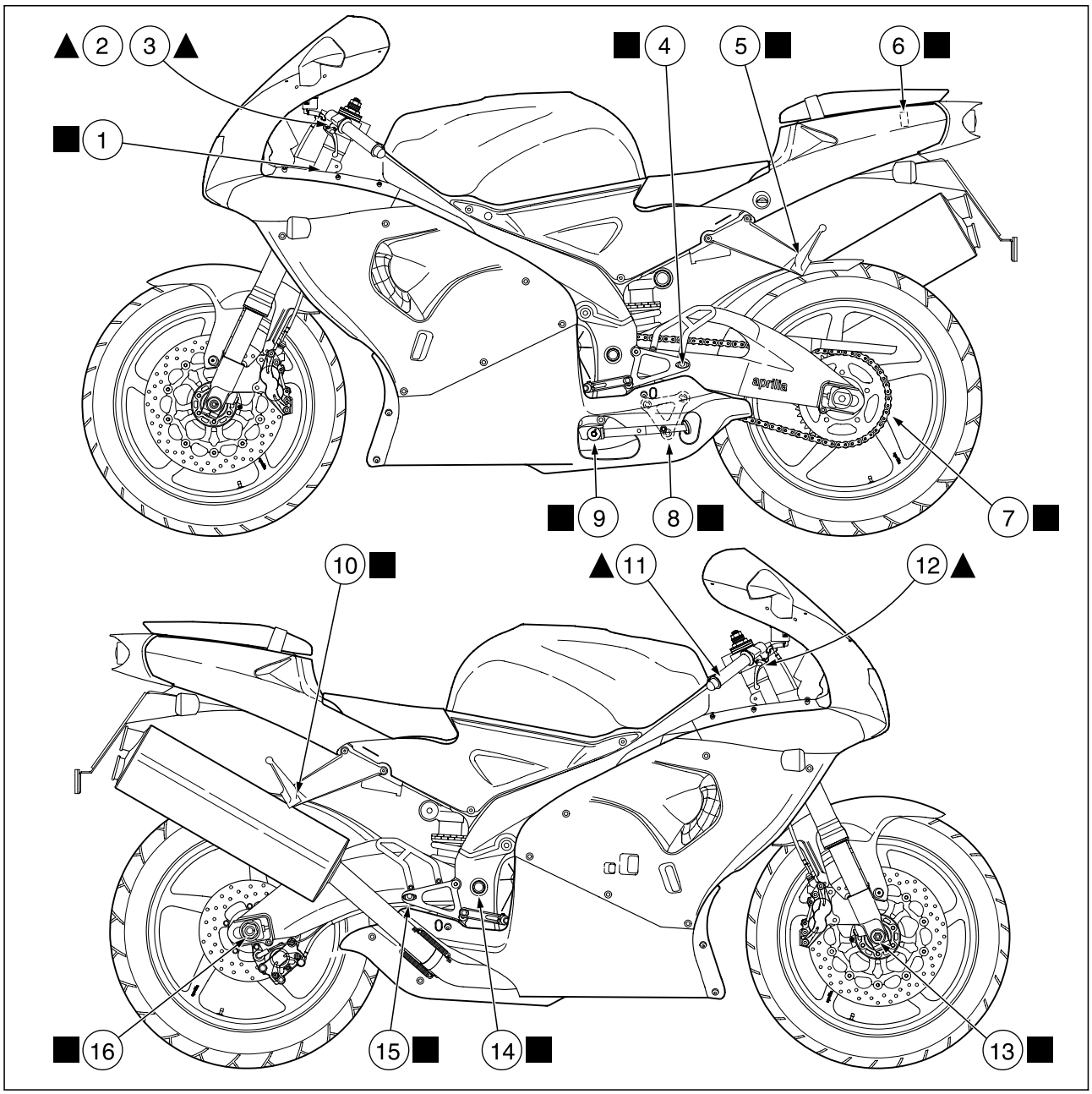
The points to be lubricated are indicated in the "LUBRICATION CHART".

LUBRICATION CHART KEY

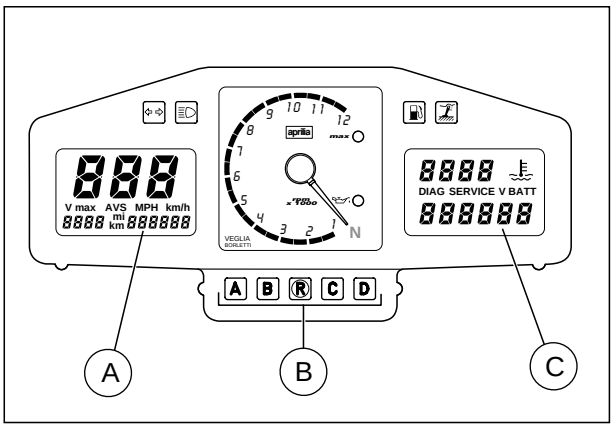
1) Steering bearings
2) Clutch lever pin
3) Lever cable for cold starting
4) Rider left footrest pin
5) Passenger left footrest pin
6) Passenger seat lock
7) Driving chain
8) Rear suspension leverage
9) Side stand pin
10) Passenger right footrest pin
11) Throttle grip
12) Accelerator cables
13) Front wheel pin and bearings
14) Rear fork pin
15) Rider right footrest pin
16) Rear wheel pin and bearings

■ = Grease
▲ = Oil

LUBRICATION CHART



2.3 MULTIFUNCTION COMPUTER



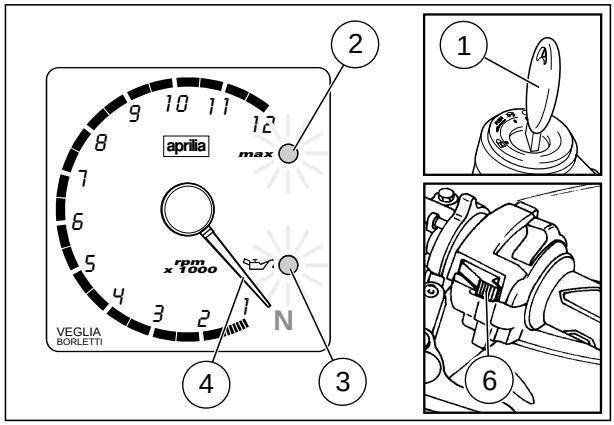
KEY

A) Left multifunction digital display (speedometer - odometer).
B) Multifunction computer programming push buttons.
C) Right multifunction digital display (coolant temperature - clock - battery voltage - chronometer - diagnostic).

When the ignition key (1) is rotated to position "○", the following warning lights come on on the dashboard:

– red line warning light LED "***max***" (2);
– red engine oil pressure warning light LED "🛢" (3), which remains on until the engine starts.

The pointer (4) of the revolution counter shifts to the maximum value (rpm) set by the user.
After about three seconds the red line warning light LED "***max***" (2) goes off; the pointer (4) of the revolution counter returns to its initial position.
The writing "EFI" (5) appears on the right side of the multifunction display for three seconds.
In this way the component operation is tested.



⚠ CAUTION

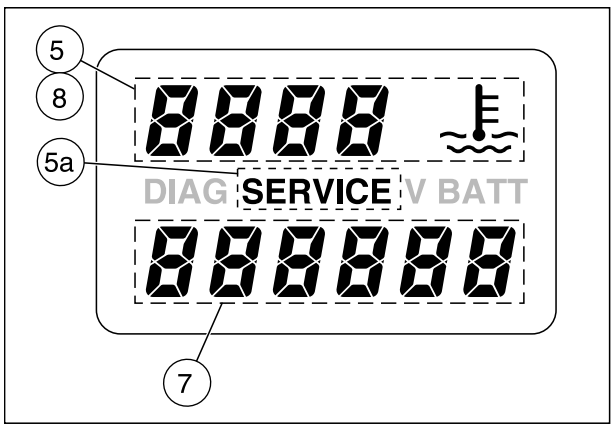
After the first 1000 km (625 mi) and successively every 7500 km (4687 mi), the writing "SERVICE" (5a) appears on the right display.
In this case, carry out the operations prescribed in the periodic service plan, see 2.1.1 (REGULAR SERVICE INTERVALS CHART).
To make the writing "SERVICE" disappear, press the "LAP" push button (6) and then the push button R and keep them pressed for about five seconds.

With the ignition key (1) in position "○" the standard settings on the dashboard are the following:

Right display: Clock (7), coolant temperature in °C (8).

Left display: Instantaneous speed in km/h (9), trip 1 (trip odometer) (10), total kilometres/miles odometer (11).

Upon installation of the battery or of the 30A main fuses:
– the revolution counter pointer (4) makes twelve clockwise clicks, thus checking the operation of the revolution counter itself;
– the instantaneous, maximum and average speed function is set in "**km/h**";
– the coolant temperature is set in °C;
– the digital clock is set to zero;
– the red line is set at 6000 rpm, indicated by the coming on of the red line warning light LED "***max*** " (red) (2).

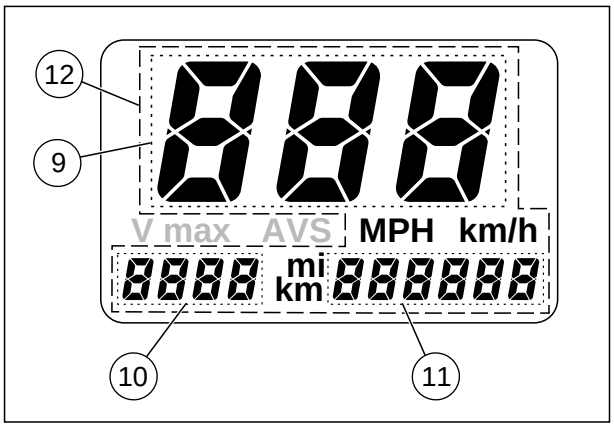


NOTE If necessary, carry out the appropriate adjustments.

2.3.1 SEGMENT OPERATION CHECK

◆ Press the push buttons A and B at the same time.
◆ Rotate the ignition key (1) from position "⊠" to position "○".

All the segments will remain on until the push buttons A and B are released.



2.3.2 SWITCHING FROM km TO mi (from km/h to MPH) AND VICEVERSA (LEFT DISPLAY)

◆ Press the push button A until, after about five seconds, all the writings (12) on the left display start blinking.
◆ Release the push button A.
◆ Press the push button B to change the unit of measurement from "**km**" to "**mi**" (from "**km / h**" to "**MPH**") or viceversa.

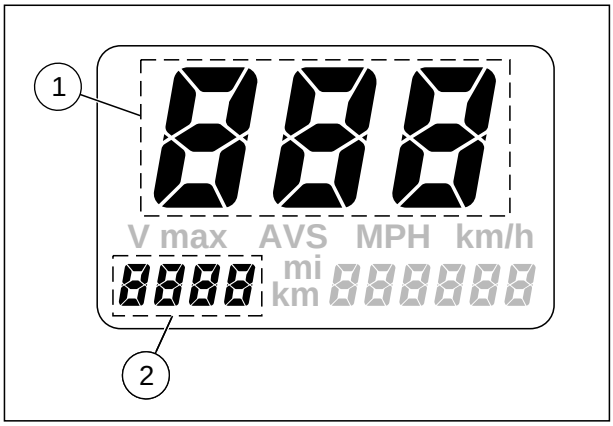
◆ To confirm the setting, press the push button **A** for about five seconds.

2.3.3 SETTING THE INSTANTANEOUS, MAXIMUM AND AVERAGE SPEED (LEFT DISPLAY)

NOTE Two seconds after the vehicle has started moving, the instantaneous speed is automatically shown on the display, even if a different function is set.

When the ignition key is rotated to position "○", the instantaneous speed (1) and the partial number of kilometres/miles covered "trip 1" (2) appear on the left display.

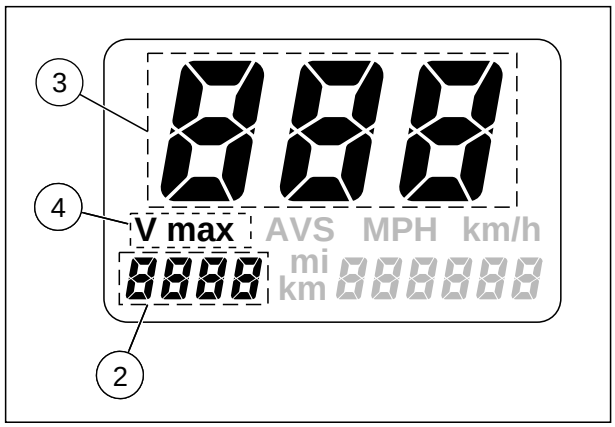
Resetting "trip 1" (2): with the odometer set on the instantaneous speed function, press the push button **R** for about two seconds.



◆ To display the maximum speed (3) and the distance "trip 1" (2), press the push button **B** for about one second.
The writing "**V max**" (4), the maximum speed (3) and the distance "trip 1" (2) are displayed.

Resetting the maximum speed (3): with the odometer set on the "**V max**" function, press the push button **R** for about two seconds.

NOTE The measurement of the maximum speed is relevant to the distance covered from the last setting to zero of the maximum speed itself.
The distance "trip 1" (2) shown on the display indicates the number of kilometres/miles covered from the last setting to zero, to the distance "trip 1".

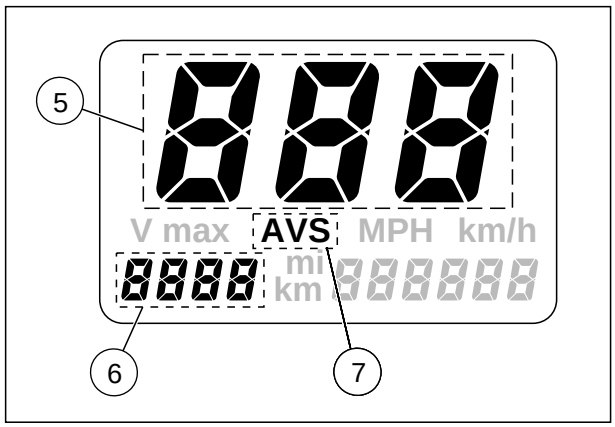


◆ To display the average speed (5) and the distance "trip 2" (6), press the push button **B** again for about 1 second.
The writing "**AVS**" (7), the average speed (5) and the distance "trip 2" (6) are displayed.

Resetting the average speed (5) and the distance "trip 2" (6): with the odometer set on the "**AVS**" function, press the push button **R** for about one second.

NOTE The measurement of the average speed is relevant to the distance "trip 2" (odometer).
The distance "trip 2" (6) shown on the display indicates the number of kilometres/miles covered from the last setting to zero. If more than 1000 km (625 mi) are covered without setting "trip 2" to zero, the value of the average speed will be wrong.

◆ To display the instantaneous speed (1) and the distance "trip 1" (2), press the push button **B** again.



2.3.4 SETTING THE RED LINE THRESHOLD (WITH ENGINE OFF ONLY)

When the maximum rpm set is exceeded, the red line warning light LED "*max*" (2) positioned on the dashboard starts blinking.

If the push button **C** is pressed for less than one second, the pointer of the revolution counter (1) shifts to the red line value set for three seconds, after which it returns to its initial position.

For the setting:

- Press the push button **C**, release it and press it again **C** within three seconds.
  The pointer (1) moves increasing the value by 1000 rpm at each click, as long as **C** is kept pressed; when it has reached the maximum value, it starts again from the beginning.
- Press the push button **C** until the desired rpm value has been set.
- If the push button **C** is released and then pressed again within three seconds, intermittently, the pointer (1) moves increasing the value by 100 rpm at each click; when it has reached the maximum value, it starts again from the beginning.

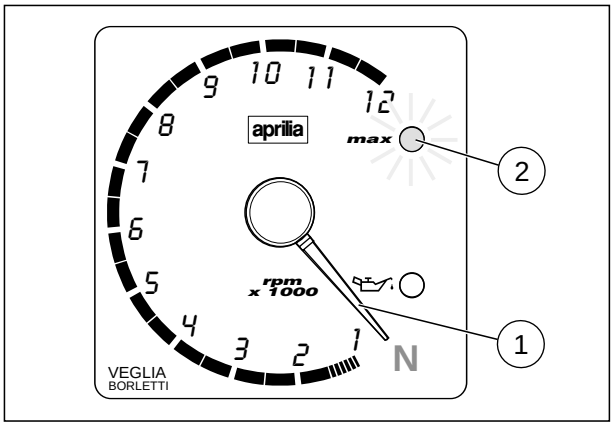
NOTE It is not possible to set the red line at values lower than 2000 rpm or higher than 12000 rpm.

⚠ CAUTION

Never exceed the recommended rpm, see table.

- To confirm, release the push button **C**.
  After three seconds, the red line threshold setting is stored.

NOTE The setting is confirmed by the coming on of the red line warning light LED "***max***" (2).



Engine maximum rpm recommended	
Mileage km (mi)	**rpm**
0–1000 (0–625)	6000
1000–1500 (625–937)	7500
oltre 1500 (937)	10500

2.3.5 MULTIFUNCTION (RIGHT DISPLAY)

The right display (multifunction) includes the coolant temperature in °C (°F) and the digital clock as standard settings.

NOTE When the engine is cold, the writing **"cold"** blinks.

By pressing the push button **D**, the following functions can be obtained in sequence:

Standard setting: temperature in °C and digital clock

↓ **D**

Battery voltage (V BATT)

↓ **D**

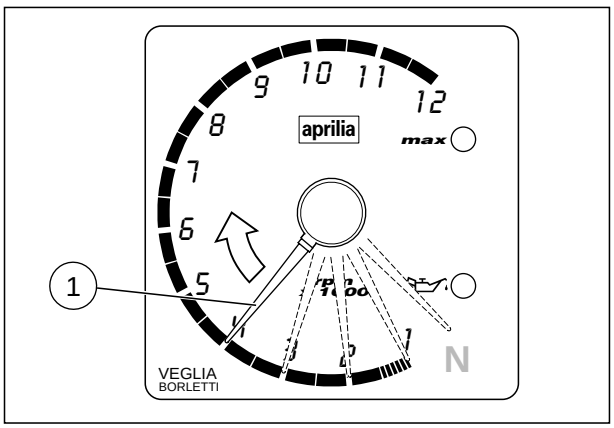
Hour setting

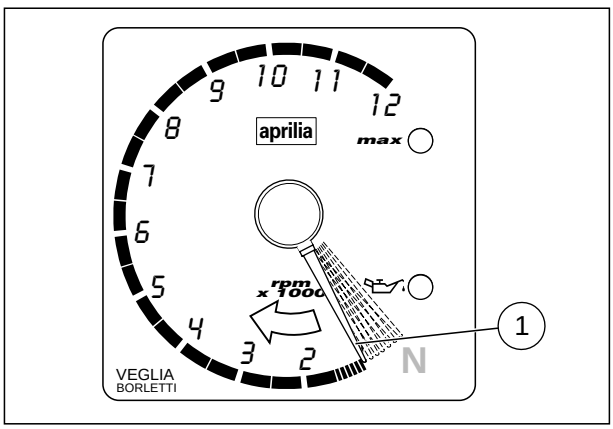
↓ **D**

Minute setting

↓ **D**

°C or °F setting





2.3.6 STANDARD SETTING: COOLANT TEMPERATURE AND DIGITAL CLOCK

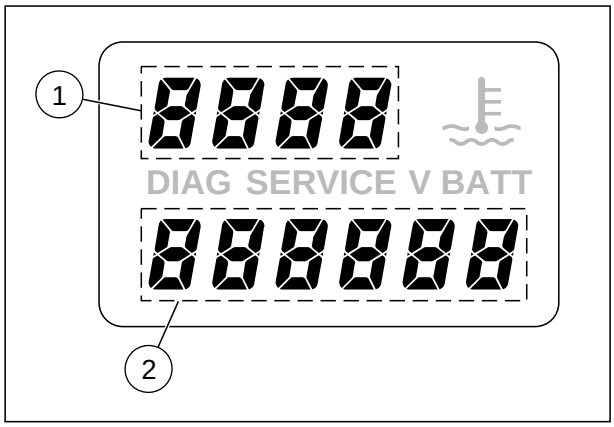
The coolant temperature value (1) is shown in the upper part of the right display.
It is possible to switch from °C to °F and viceversa, see 2.3.10 (SETTING °C OR °F).

– When the temperature is below 35°C (95°F), the writing "cold" (1) blinks on the right display.
– When the temperature is over 115°C (239°F), the value (1) blinks on the right display, even if a function different from the standard setting has been set.
– When the temperature is over 130°C (266°F), the writing "LLL" (1) appears on the right display.

NOTE If the writing "LLL" is displayed with a temperature below 130°C (266°F), there may be a failure of the electric circuit, see 6.10.3 (COOLANT TEMPERATURE DISPLAY).

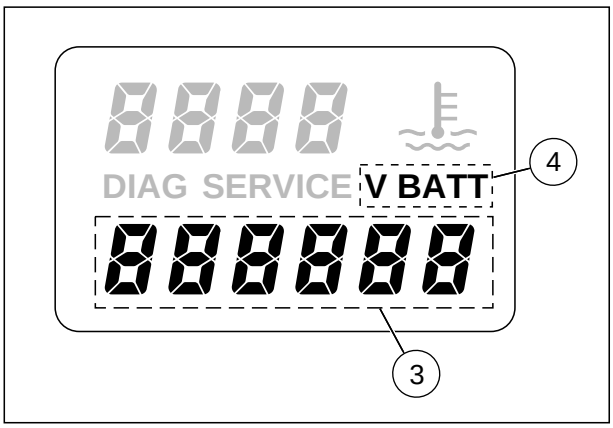
Thermometer range on the display:
35 – 130°C (95 – 266 °F).

The digital clock (2) appears in the lower part of the right display.
To set or modify hour and minutes, see 2.3.8 (SETTING THE HOUR) and 2.3.9 (SETTING THE MINUTES).



2.3.7 BATTERY VOLTAGE - VBATT

◆ If the push button D is pressed once, the battery voltage expressed in volt (3) appears in the lower part of the right display, while the coolant temperature (1) is displayed in the upper part.
The writing "**V BATT**" (4) is displayed.
The recharge circuit functions correctly if at 4000 rpm the battery voltage with low beam on is included between 13 and 15 V.



2.3.8 SETTING THE HOUR

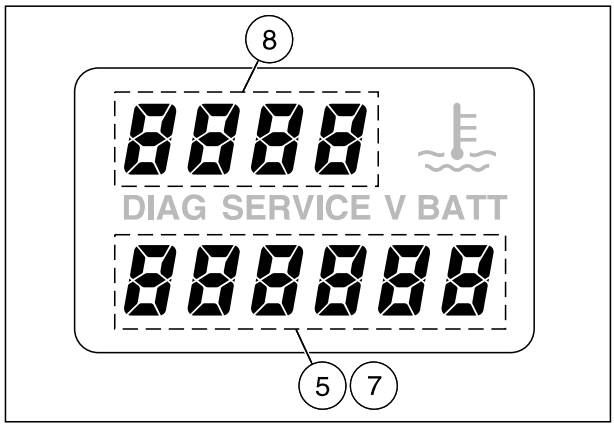
◆ When the push button D is pressed for the second time, the hour segments (5) start blinking in the lower part of the right display (digital clock).
◆ To modify the hour setting, press the "LAP" push button (6) on the left part of the handlebar.
◆ To confirm the hour setting, press the push button D.

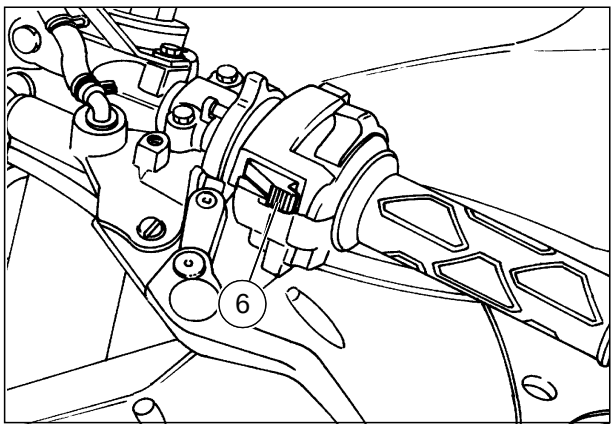
2.3.9 SETTING THE MINUTES

◆ When the push button D is pressed for the third time, the minute segments (7) start blinking in the lower part of the right display (digital clock).
◆ To modify the minute setting, press the "LAP" push button (6) on the left part of the handlebar.
◆ To confirm the minute setting, press the push button D.

2.3.10 SETTING °C OR °F

◆ When the push button D is pressed for the fourth time, the segments of the coolant temperature in °C or °F (8) start blinking in the upper part of the display.
◆ To modify from °C to °F setting, or vice versa, press the "LAP" push button (6) on the left part of the handlebar.
◆ To confirm the setting, press the push button D.





2.3.11 CHRONOMETER (RIGHT DISPLAY)

The chronometer makes it possible to measure the time per lap with the vehicle on a racetrack and to store the data, in such a way as to be able to consult them successively.

When the “CHRONOMETER” function has been selected, it is not possible to recall the following functions:

– maximum speed “**V max**”;
– average speed “**AVS**”;
– distance “trip 2”.

◆ To operate the chronometer, press the “LAP” push button (1) and, within seven seconds, the push button **D**.
◆ To start timing, press the “LAP” push button (1) and release it immediately.
◆ To store the time acquired, press the “LAP” push button (1).

The “LAP” push button (1) is not enabled for ten seconds and the last time stored (2) is shown on the display.
After which, the chronometer with the current timing (3) is displayed, starting from ten seconds.

◆ To display the first time stored (4), press the push button **B**.
◆ To be able to see the stored times in sequence, press the “LAP” push button (1).
The writings L1, L2, L3, L4, etc. (5) are displayed.
◆ To start timing again, press the push button **B**.

NOTE It is possible to store max. forty times, after which the “LAP” push button (1) is not effective any longer.

◆ To set the memory to zero, press the push button **A** and the “LAP” push button (1) at the same time for two seconds.
◆ To leave the chronometer function, press the “LAP” push button (1) and the push button **D**.

The coolant temperature (6) and the digital clock (7) appear on the right display (multifunction).

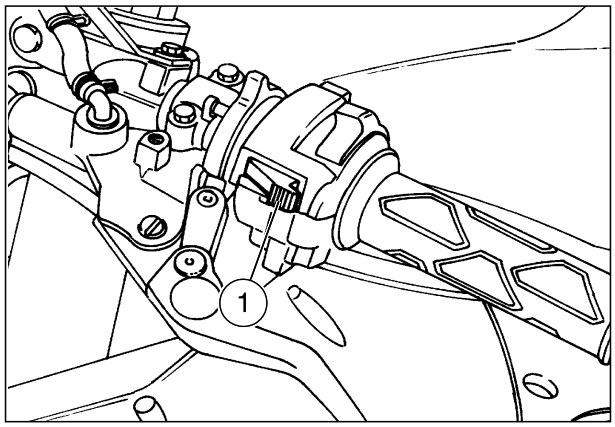
NOTE When the engine is cold, the writing “cold” is displayed.

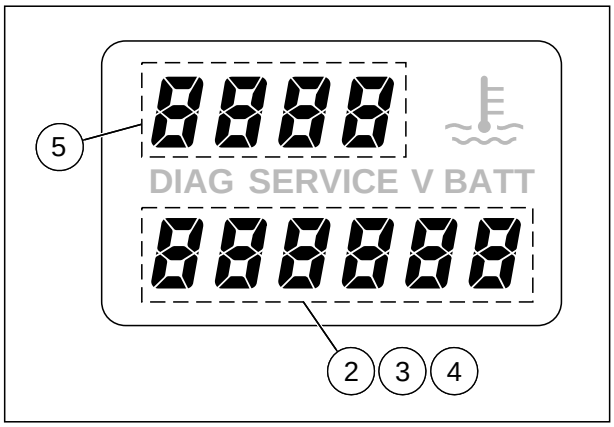
2.3.12 DIAGNOSTICS

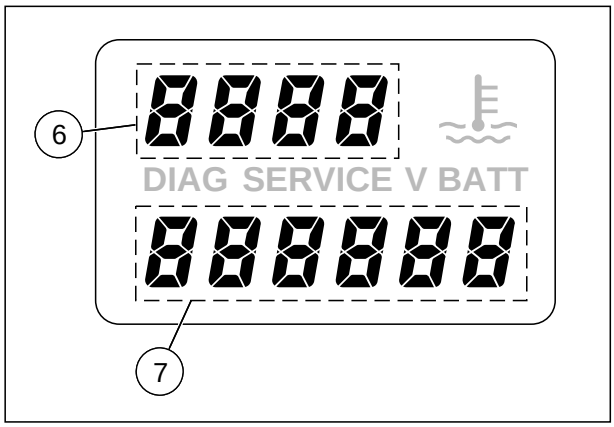
Whenever the ignition switch is turned to position “○”, the writing “EFI” is displayed for about three seconds.

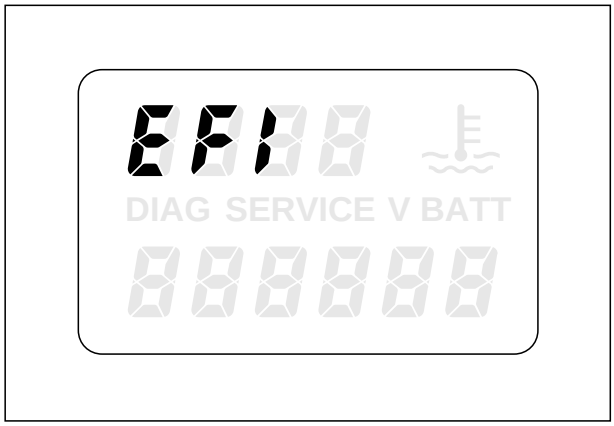
⚠ CAUTION

If the writing “EFI” is displayed during the normal operation of the engine, this means that the electronic unit has detected an anomaly.
In many cases, the engine keeps running with reduced performance levels, see 6.4 (IGNITION SYSTEM).









2.4 BATTERY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

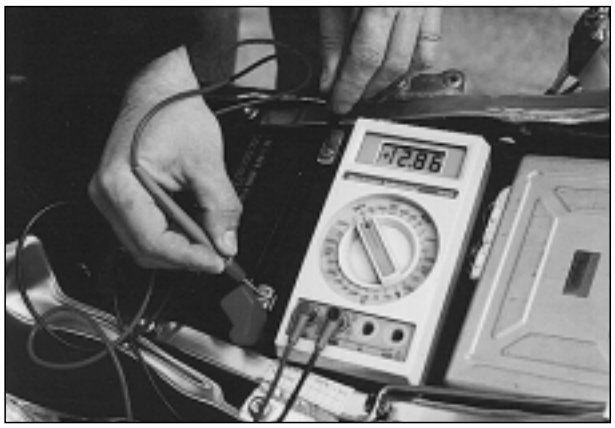
There are two kinds of commercially available batteries:
– batteries requiring **maintenance** featuring cell plugs;
– **maintenance-free** batteries with no cell plugs as they do not call for the electrolyte level to be checked and topped up.

NOTE This vehicle is provided with a maintenance-free battery and no operation is necessary, excepting occasional checks and the recharge when required.

When changing batteries, replace with a battery of the same type.
For further information, see 6.11 (BATTERY).

⚠ CAUTION

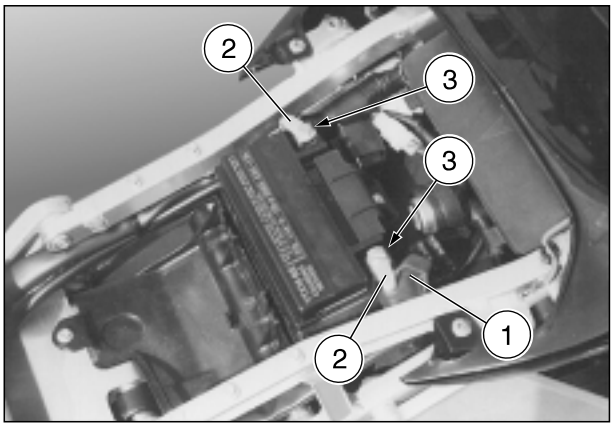
Never invert the connection of the battery cables.
Connect and disconnect the battery with the ignition switch in position "⊗", otherwise some components may be damaged.
Connect first the positive cable (+) and then the negative cable (–).
Disconnect following the reverse order.



NOTE Check battery voltage with a portable tester. If voltage is less than 12V, the battery must be recharged. If the voltage drops below 8V, the electronic unit is not working and is preventing engine operation.

2.4.1 CHECKING AND CLEANING THE TERMINALS

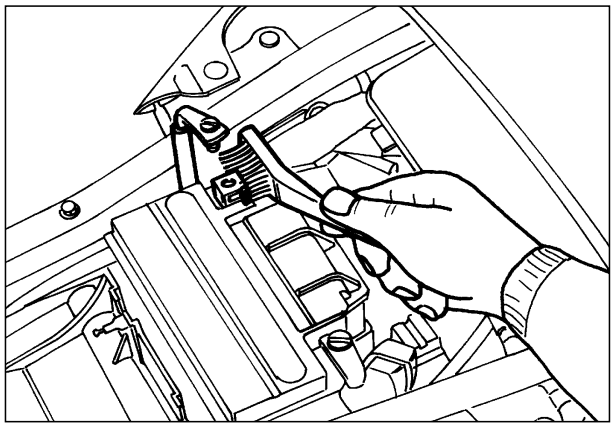
Carefully read 2.4 (BATTERY).



◆ Turn the ignition switch to position "⊗".
◆ Remove the rider saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).
◆ Remove the red protection element (1).
◆ Make sure that the cable terminals (2) and the battery terminals (3) are:
  – in good conditions (and not corroded or covered with deposits);
  – covered with neutral grease or vaseline.

If necessary:

◆ Disconnect first the negative (**–**) and then the positive cable (**+**).
◆ Brush with a wire brush to eliminate any sign of corrosion.
◆ Reconnect first the positive (**+**) and then the negative cable (**–**).
◆ Cover the terminals of the cables and of the battery with neutral grease or vaseline.
◆ Put back the saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).



2.4.2 RECHARGING THE BATTERY

Carefully read 2.4 (BATTERY).

NOTE If the start relay emits a vibration-type noise when the start pushbutton is pressed "Ⓢ", it is a sure sign that the battery is almost completely flat.

NOTE Do not remove the battery plugs: without plugs the battery may be damaged.

- Remove the battery, see 7.1.8 (REMOVING THE BATTERY).
- Prepare an appropriate battery charger.
- Set the charger for the desired type of recharge (see table).
- Connect the battery with a battery charger.

⚠ WARNING

During the recharging or the use, make sure that the room is properly ventilated and avoid inhaling the gases released during the recharging.

- Switch on the battery charger.

Recharge	Voltage (amp)	Time (hours)
Normal	1.2	8 - 10
Quick	12	0.5

⚠ WARNING

Reassemble the battery only 5/10 minutes after disconnecting the recharge apparatus, since the battery continues to produce gas for a short lapse of time.

2.4.3 LONG INACTIVITY OF THE BATTERY

Carefully read 2.4 (BATTERY).

⚠ CAUTION

If the vehicle remains unused for more than twenty days, disconnect the 30A fuses, in order to avoid the deterioration of the battery caused by the current consumption due to the multifunction computer.

The removal of the 30A fuses requires the setting to zero of the following functions: digital clock and red line setting.

To reset these functions, see 2.3 (MULTIFUNCTION COMPUTER).

If the vehicle remains unused for more than fifteen days, it is necessary to recharge the battery, in order to prevent its sulphation, see 2.4.2 (RECHARGING THE BATTERY):

- Remove the battery, see 7.1.8 (REMOVING THE BATTERY) and put it in a cool and dry place.

It is important to check the charge periodically (about once a month), during the winter or when the vehicle remains unused, in order to prevent the deterioration of the battery.

- Recharge it completely with a normal charge, see 2.4.2 (RECHARGING THE BATTERY).

If the battery remains on the vehicle, disconnect the cables from the terminals.

2.5 ELECTRIC COMPONENTS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

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

- Position the vehicle on the stand.
- Check all the lighting devices are working.
- Check the direction of the headlight beam is correct, see 6.13 (ADJUSTING THE VERTICAL HEADLIGHT BEAM) and 6.14 (ADJUSTING THE HORIZONTAL HEADLIGHT BEAM (USA)).
- Make sure all connectors are inserted properly.
- Make sure all switches are correctly fastened and in proper working order, see:
  - 6.6.4 (CHECKING THE SIDE STAND AND THE SAFETY SWITCH).
  - 6.16 (CHECKING THE SWITCHES).
- Make sure the air sensor and speedometer sensor are correctly fastened and in proper working order.

⚠ CAUTION

The sensitive area on the sensors must be kept clean at all times.
Any mud, dirt etc. on them is liable to alter the measurements and the subsequent data transfer.

2.6 JUMP-STARTING

Carefully read 2.4 (BATTERY).

⚠ WARNING

The vehicle should only be jump-started when the vehicles battery is partially/completely flat and recharging is not possible.
Do not attempt to start the vehicle by pushing or towing it.

The vehicle providing assistance must have a battery (the recharge source) with exactly the same rated voltage (data to be found on the battery) as the battery of the vehicle to be started (12V - 12 Ah).

Follow the procedure below to the letter so as to avoid the danger of the battery exploding and possibly injuring people and/or property (this is liable to compromise the electric components of both vehicles).

- Make sure the ignition switch is set to "⊛".
- Remove the riders saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).

NOTE The cables of the battery of the vehicle to be started must not be disconnected.

⚠ CAUTION

Take care never to let the clamps of one cable touch those of another.

- Remove the red protection element (1).
- Connect one end of jump lead to the positive pole (**+**) of the battery on the vehicle providing assistance (A); and the other end on the positive pole (**+**) of the battery on the vehicle to be started (B).
- Connect one end of the other jump lead to the negative pole **(–)** of the battery on the vehicle providing assistance (A); and earth the other end on the frame (far from the battery) of the vehicle to be started (B).

  DO NOT CONNECT TO THE NEGATIVE POLE (–).

⚠ WARNING

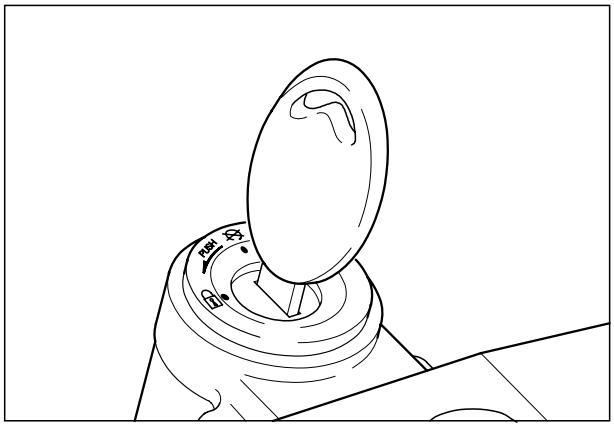
The jump leads must not be placed near any moving parts on either vehicle.

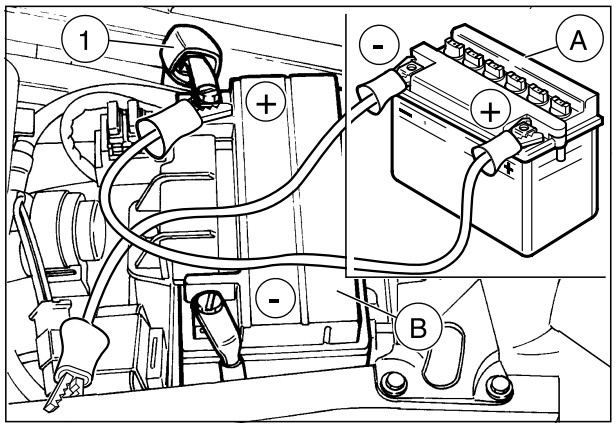
NOTE During the starting phase, the vehicle providing assistance may be kept running.

- Start the vehicle.

NOTE Attempt to start the vehicle for no more than ten seconds at a time, where necessary, repeating the attempt at intervals of approx. one minute.
Once started, keep both engines running for approx. two minutes.

- Stop both engines and disconnect the jump leads following the same procedure in reverse order.





2.7 SPARK PLUGS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

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

Periodically remove the spark plugs and clean them carefully, removing carbon deposits; change them if necessary.
In case of use on racetracks, change the spark plugs every 3750 km (2343 mi).

To reach the spark plugs:

⚠ WARNING

Allow the engine to cool down until it reaches room temperature.

◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).

NOTE The vehicle is equipped with two spark plugs per cylinder.
The following operations refer to one spark plug only, but are valid for both.

To remove and clean the spark plug, proceed as follows:

⚠ WARNING

Never disconnect the spark plug cap with the engine running, since you may get an electric shock from the ignition system.

◆ Remove the cap (1) of the spark plug (2).
◆ Remove any trace of dirt from the spark plug base.
◆ Introduce the special spanner provided in the tool kit on the spark plug.
◆ Insert the 13 mm fork spanner provided in the tool kit in the hexagonal seat of the spark plug spanner.
◆ Unscrew the spark plug and extract it from its seat, taking care to prevent dust or other substances from getting inside the cylinder.

⚠ CAUTION

This vehicle is fitted with spark plugs featuring platinum-type electrodes.
When cleaning, do not use wire brushes and/or abrasive products. Use e jet of compressed air only.

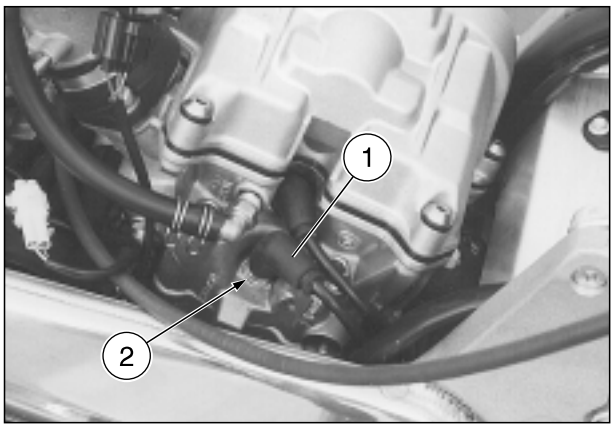
– centre electrode (3);
– insulator(4);
– side electrode (5).

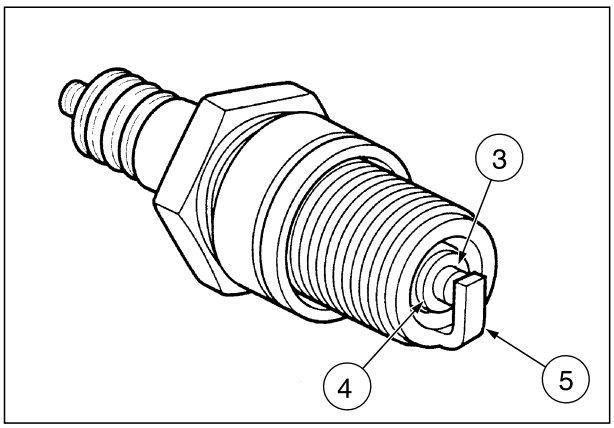
◆ Make sure the spark plug's electrodes and insulator are free of carbon deposits and do not feature signs of corrosion.
Where necessary, clean with a jet of compressed air.

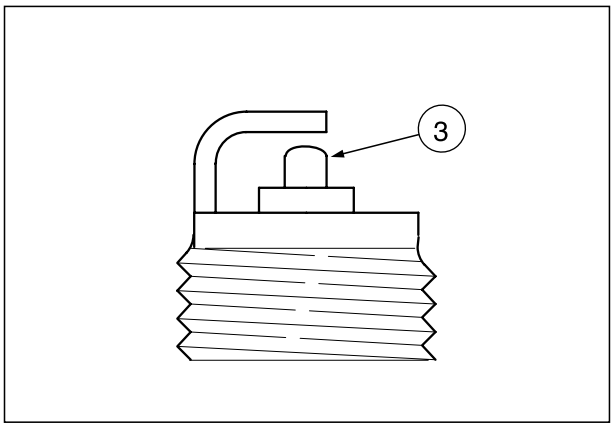
If the spark plug should feature cracks on the insulator, corroded electrodes or excessive deposits, or if the centre electrode (3) has a rounded end (see figure), the spark plug must be replaced.
You are strongly advised to replace spark plugs with standard plugs.

Recommended spark plugs:

NGK R DCPR9E
(alternatively NGK R DCPR8E).





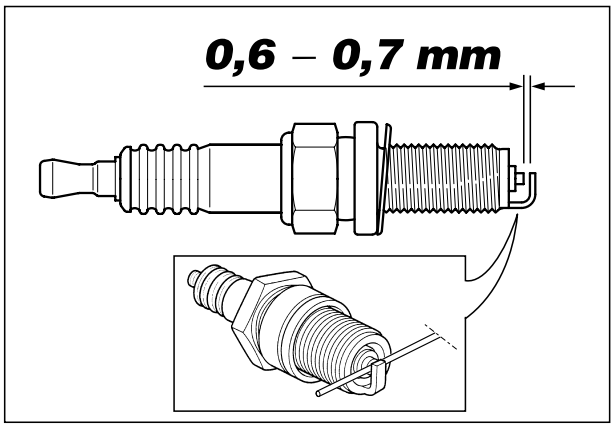


⚠ CAUTION

When replacing a spark plug, check the pitch and length of the thread.
If the threaded part is too short, carbon deposits will settle on the thread seat and may result in damage to the engine when the correct one is positioned back in place.

Only use the recommended spark plug type, otherwise the performance and service life of the engine may be compromised.

Use a feeler gauge (see figure) to check the distance between the electrodes to avoid damaging the platinum coating.

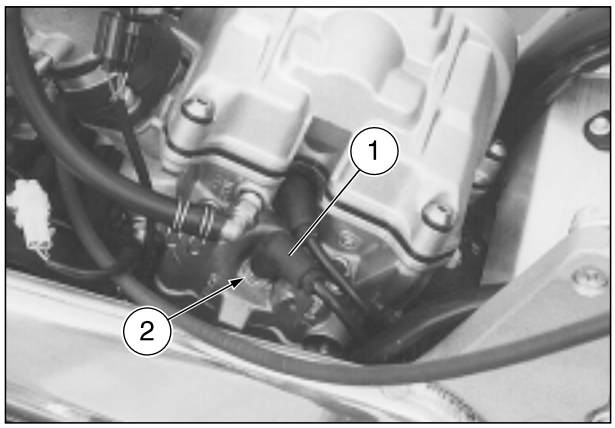


- Check the distance between the electrodes with a feeler gauge. The gap must be in the range **0.6 – 0.7 mm.** Where necessary, adjust it by carefully bending the ground electrode.
- Make sure the washer is in a good state of repair. With the washer fitted, screw the spark plug on by hand to avoid damaging the threads.
- Tighten the spark plug by means of the spanner you will find in the tool kit, giving it half a turn to compress the washer.

Spark plug driving torque: 20 Nm (2.0 kgm).

⚠ CAUTION

The spark plug must be well tightened, otherwise the engine may overheat and be seriously damaged.



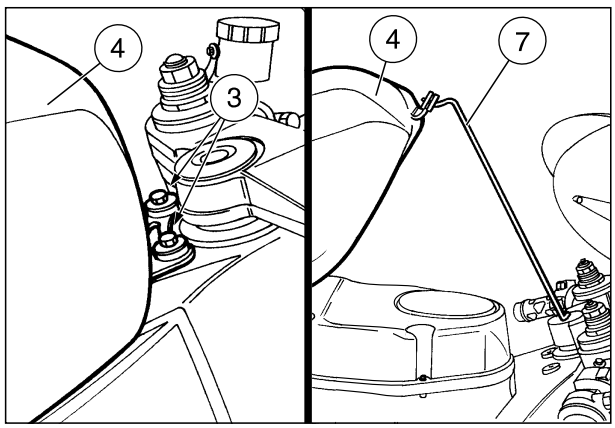
- Position the spark plug cap (1) properly, so that it does not come off due to the vibrations of the engine.
- Put back the fuel tank.

2.8 LIFTING THE FUEL TANK

Carefully read 1.2.1 (FUEL).

⚠ WARNING

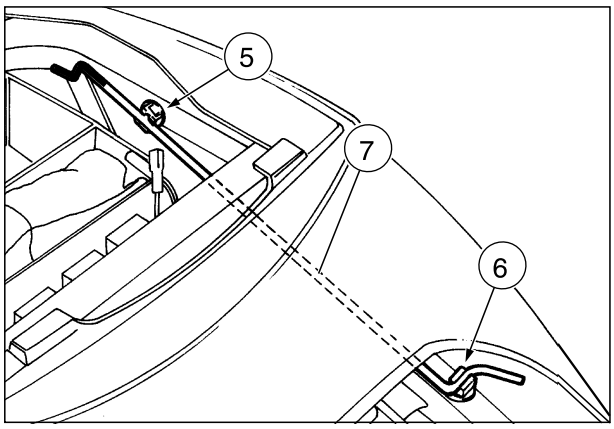
Risk of fire.
Wait until the engine and the exhaust silencer have completely cooled down.



- Remove the passenger seat, see 7.1.2 (UNLOCKING / LOCKING THE PASSENGER SEAT).
- Remove the rider saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).
- Unscrew and remove the two screws (3) that fasten the front part of the fuel tank (4).
- Remove the fuel tank support rod (7) from the relevant anchorage seats (5-6).

NOTE The rubber-covered end of the rod (7) must be introduced in the central hole of the steering pin.

- Lift the front part of the fuel tank (4) and introduce the rod (7) as indicated in the figure.



2.9 DRAINING THE FUEL TANK

Carefully read 1.2.1 (FUEL).

⚠ WARNING

Fire hazard.
Wait until the engine and exhaust silencer have completely cooled down.

Fuel vapours are harmful for health.
Before proceeding, make sure that the room in which you are working is properly ventilated.

Do not inhale fuel vapours.
Do not smoke or use naked flames.

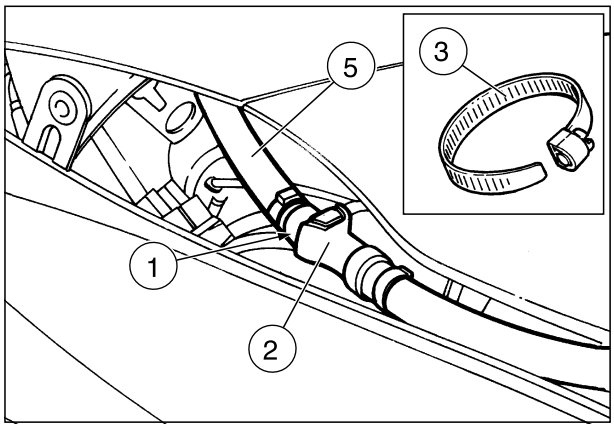
Do not pollute the environment with the incorrect disposal of fuel.

- Switch off the engine and allow it to cool.
- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Procure a container with a capacity greater than the amount of petrol in the tank and place it on the floor on the left-hand side of the vehicle.

NOTE Place a cloth under the male quick-release coupling (1) to catch any fuel spills.

- Disconnect the male quick-release coupling (1) from the receptacle (2) by pressing the relevant button.

NOTE Procure a screwdriver-type pipe clamp (3) to replace the original one (of a special type).

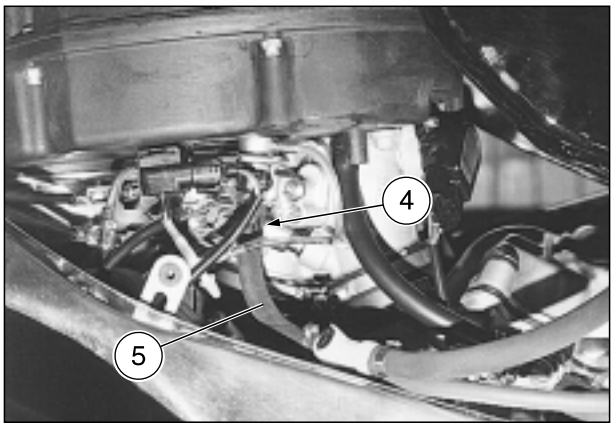


- Loosen the clamp (4) and disconnect the pipe (5).
- Place the free end of the pipe (5) inside the container prepared beforehand.
- Insert the male quick-release coupling (1) of the pipe (5) all the way into the quick-release receptacle (2). The petrol starts draining out immediately.
- Open the tank cap.
- Wait until all the petrol has drained out of the tank.

Once all the petrol has drained out:

- Refit the free end of the pipe (5), securing it in place using the clamp (3).
- Insert the male quick-release coupling (1) into the receptacle (2).

NOTE Make sure the male quick-release coupling (1) has been correctly inserted into the receptacle (2).



- Refit the fuel tank.
- Close the tank cap again.

2.10 AIR CLEANER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check the air cleaner every 7500 (4687 mi)km or 8 months, change it every 15000 km (9375 mi) or more frequently if the vehicle is used on dusty or wet roads.
It is possible to clean the air cleaner partially after using the vehicle on this kind of roads.

⚠ CAUTION

The partial cleaning of the filter does not exclude or postpone the replacement of the filter itself.

Do not start the engine if the air cleaner has been removed.

Do not clean the filtering element with petrol or solvents, since they may cause a fire in the fuel supply system, with serious danger for the persons in the vicinity and for the vehicle.

REMOVAL

- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Unscrew and remove the seven screws (1) that fasten the filter case cover (2).
- Remove the filter case cover (2).
- Extract the air cleaner (3)

⚠ CAUTION

Plug the opening with a clean cloth, in order to prevent any foreign matter to get ito.

PARTIAL CLEANING

⚠ CAUTION

Do not press or strike the metal net of the air cleaner (3). Do not use screwdrivers or alike.

- Seize the air cleaner (3) vertically and strike it more than once on a clean surface.
- If necessary, clean the air cleaner (3) with a compressed air jet (directing it from the inside towards the outside of the filter).
- Clean the outer part of the air cleaner, (3) with a clean cloth.

CHANGING

- Replace the air cleaner (3) with a new one of the same type.
- Every 7500 km (4687 mi), remove the plug (4). Empty its content into a container and deliver it to a salvage centre.

⚠ CAUTION

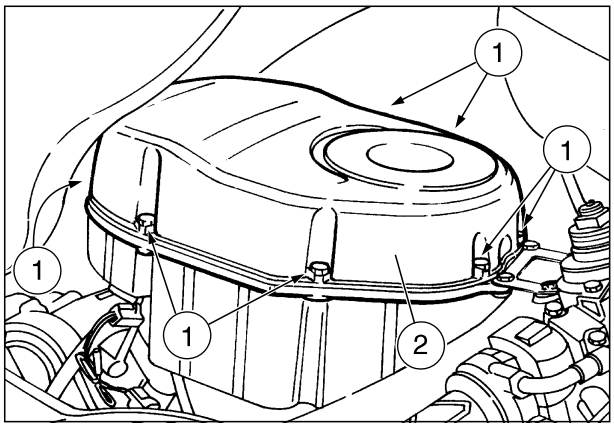
When cleaning the filtering element, make sure that there are no tears.
Otherwise, change the filtering element.

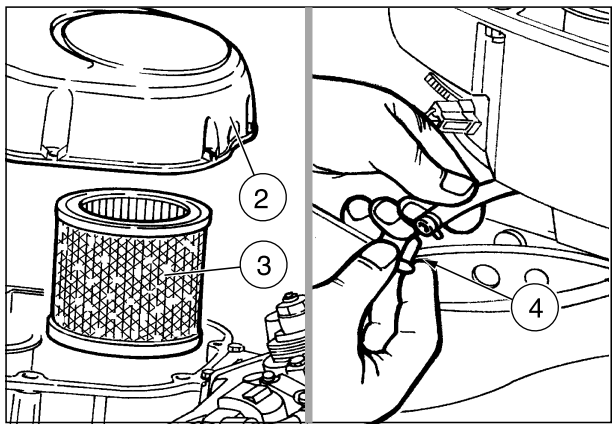
Make sure that the filtering element is positioned correctly, in such a way as to prevent non-filtered air from entering.
Remember that the untimely wear of the piston segments and the cylinder may be caused by a faulty or uncorrectly positioned filtering element.

⚠ CAUTION

If the vehicle is used in dusty areas, clean the filtering element more frequently.

Using the vehicle without the filtering element, or with the element damaged, considerably increases wear and tear on the engine.
Make sure the filtering element is always in perfect condition.
The life of the engine depends, for the most part, on this component.





2.11 ACCELERATOR

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

2.11.1 CHECKING THE OPERATION OF THE ACCELERATOR CONTROL

⚠ WARNING

The use of the vehicle with damaged, excessively bent or twisted accelerator cable may hinder the regular operation of the accelerator and make you lose control of the vehicle while riding.

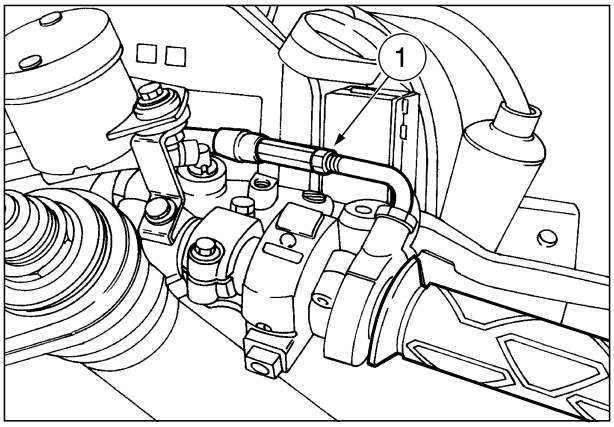
Make sure that the rotation of the handlebar does not modify the engine idle speed and that the throttle grip returns smoothly and automatically to its original position after being released.

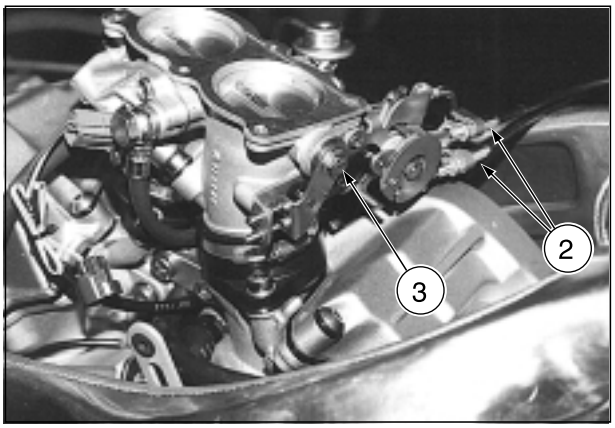
If necessary, proceed as follows:

NOTE For the lubrication of the components use the specific lubricant available on the market.

◆ Check the correct position and the lubrication of the following components:
  – sheath;
  – throttle grip adjuster (1);
  – throttle body adjuster (2);
  – throttle body pin (3);
  – cable couplings (ends);
  – accelerator control.

◆ Check the idle speed, 2.11.2 (IDLING ADJUSTMENT).
◆ Check the accelerator control adjustment, 2.11.3 (ADJUSTING THE ACCELERATOR CONTROL).



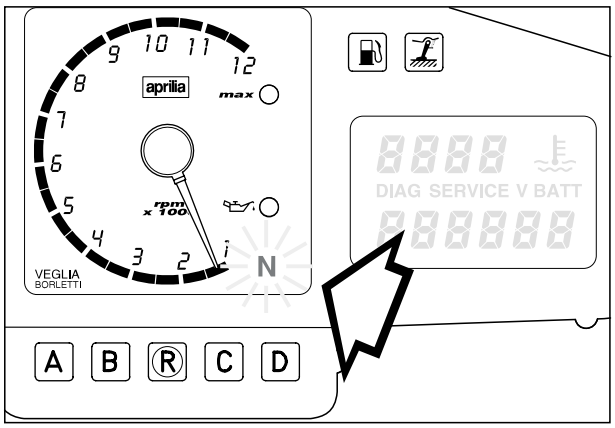


2.11.2 IDLING ADJUSTMENT

Adjust the idling every time it is irregular.

To carry out this operation, proceed as follows:

◆ Ride for a few miles until reaching the normal running temperature.
◆ Position the gear lever in neutral (green warning light “N” on).
◆ Check the engine idling rpm on the revolution counter. The engine idling speed must be about 1250 ± 100 rpm.



If necessary:

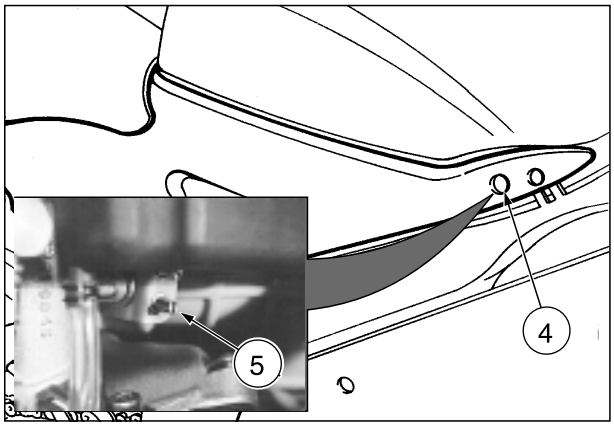
◆ Position the vehicle on the stand.
◆ Introduce a small cut-headed screwdriver in the appropriate hole (4) provided on the right side cover.
◆ Turn the adjusting knob (5).

– BY SCREWING IT (clockwise), you increase the rpm.

– BY UNSCREWING IT (anticlockwise), you decrease the rpm.

◆ Twist the throttle grip, accelerating and decelerating a few times to make sure that it functions correctly and to check if the idling speed is constant.

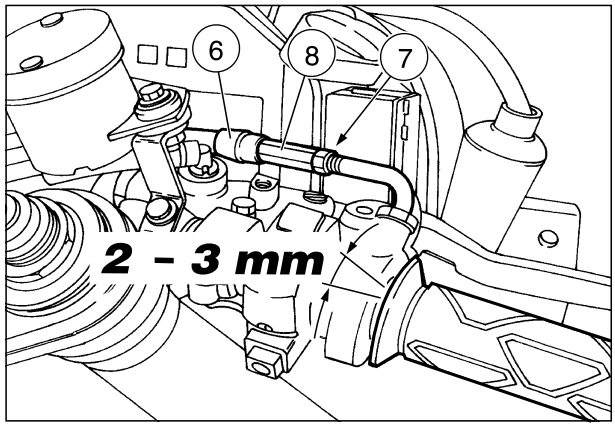
For other informations, see section 4 (FUEL SUPPLY SYSTEM).



2.11.3 ADJUSTING THE ACCELERATOR CONTROL

The idle stroke of the throttle grip must be **2 – 3 mm**, measured on the edge of the grip itself.
If this is not the case, proceed as follows:

- Position the vehicle on the side stand.
- Withdraw the protection element (6).
- Loosen the lock nut (7).
- Rotate the adjuster (8) in such a way as to restore the prescribed value.
- After the adjustment, tighten the lock nut (7) and check the idle stroke again.
- Put back the protection element (6).



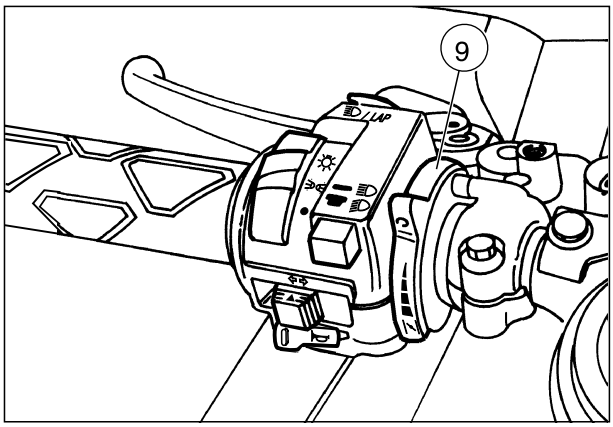
⚠ CAUTION

After the adjustment, make sure that the rotation of the handlebar does not modify the engine idling rpm and that the throttle grip returns smoothly and automatically to its original position after being released.

2.12 COLD START CABLE

The cold start cable must be adjusted so that the hand lever (9) has **2 – 3 mm** of freeplay; if adjustment is necessary, proceed as follows:

- Position the vehicle on the stand.
- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Loosen the lock nut (10).
- Rotate the adjuster (11) in order to restore the prescribed value.
- After this adjustment, tighten the lock nut (10) and check the freeplay once again.



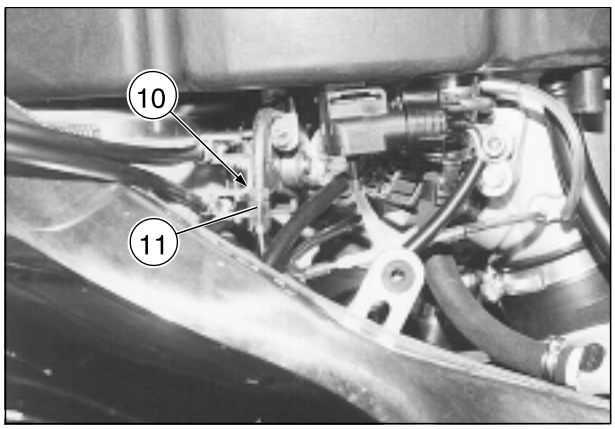
⚠ CAUTION

Once the adjustment has been made, check that the rotation of the handlebar does not influence the engine rpm.

2.13 CHECKING THE ENGINE OIL LEVEL AND TOPPING UP

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.2 (ENGINE OIL).

Periodically check the engine oil level, change the oil after the first 1000 km (625 mi) and successively every 7500 km (4687 mi), or 8 months, see 2.14 (CHANGING THE ENGINE OIL AND THE OIL FILTER).



To carry out the checking:

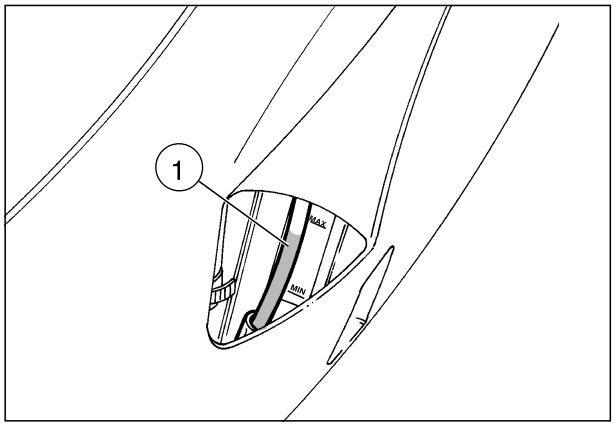
NOTE Position the vehicle on the side stand on firm and level ground.

⚠ CAUTION

The engine oil level must be checked with warm engine.
If the check is carried out with cold engine, the oil level may temporarily lower below the "MIN" mark.

This is not a problem, provided that the engine oil pressure warning light LED "🛢" does not come on.

◆ Start the engine.
◆ Allow the engine to idle for about 15-20 minutes, or ride the vehicle on a country road for approximately 15 km (9.5 mi).
◆ Stop the engine.
◆ Keep the vehicle in vertical position, with the two wheels resting on the ground.
◆ Check the oil level in the transparent pipe (1) through the appropriate slot provided on the left fairing.
MAX =maximum level
MIN = minimum level.
The difference between "**MAX**" and "**MIN**" amounts to approximately 500 cm³.
◆ The level is correct when the oil almost reaches the "**MAX**" mark.

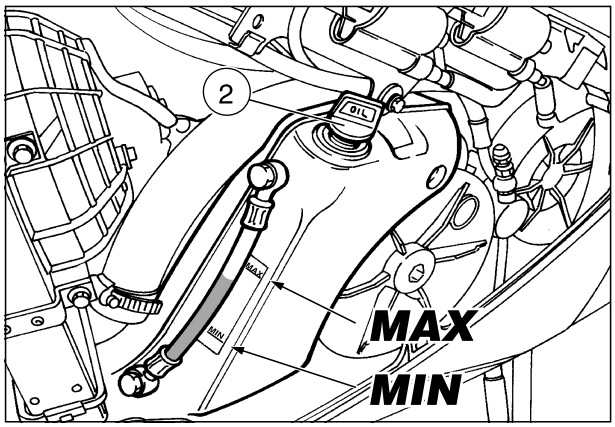


⚠ CAUTION

Never exceed the "MAX" mark, nor leave the oil below the "MIN" mark, in order to avoid serious damage to the engine.
Do not put additives or other substances into the oil.
If you use a funnel or other similar items, make sure that they are perfectly clean.

If necessary, top up the engine oil by proceeding as follows:

◆ Remove the left fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
◆ Unscrew and remove the filling cap (2).
◆ Top up the tank and restore the correct level, see 1.6 (LUBRICANT CHART).



2.14 CHANGING THE ENGINE OIL AND THE OIL FILTER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.2 (ENGINE OIL).

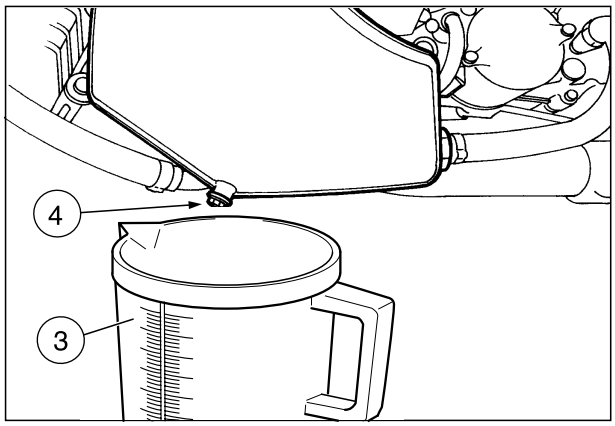
Periodically check the engine oil level, see 2.13 (CHECKING THE ENGINE OIL LEVEL AND TOPPING UP) change the oil after the first 1000 km (625 mi) and successively every 7500 km (4687 mi) or 8 month.

⚠ CAUTION

If the vehicle is used in dusty areas, change the oil more frequently.
In case of use on racetracks, change every 3750 km (2343 mi).

TO CHANGE

NOTE The oil flows out completely and without problems when it is warm and therefore more fluid: to achieve this condition, the engine should run for approximately twenty minutes.



⚠ WARNING

When warmed up, the engine contains hot oil; therefore, while carrying out the operations described here below be particularly careful, in order to avoid burns.

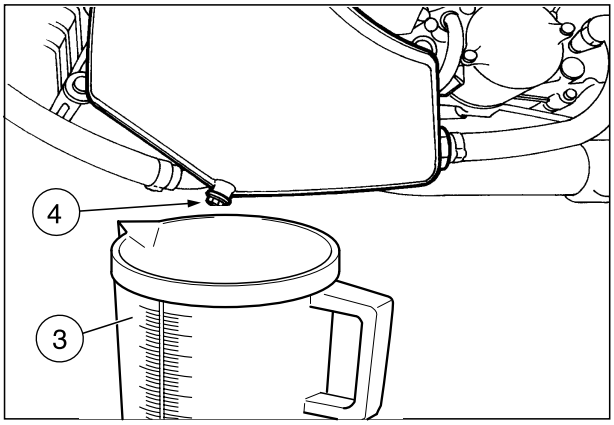
NOTE Position the vehicle on the side stand on firm and level ground.

◆ Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
◆ Position a container (3) with more than 4000 cm³ capacity in correspondence with the drain plug (4) positioned on the tank.
◆ Unscrew and remove the drain plug (4) positioned on the tank.
◆ Unscrew and remove the filling cap (2).
◆ Drain the oil and let it drop for a few minutes inside the container (3).

◆ Check and if necessary replace the sealing washer of the drain plug (4) positioned on the tank.
◆ Screw and tighten the drain plug (4) on the tank.

Drain plug (4) driving torque: 15 Nm (1.5 kgm).

◆ Move the container (3) and position it under the engine base, in correspondence with the drain plug positioned on the engine (5).
◆ Unscrew and remove the drain plug positioned on the engine (5).
◆ Drain the oil and let it drip inside the container (3) for a few minutes.

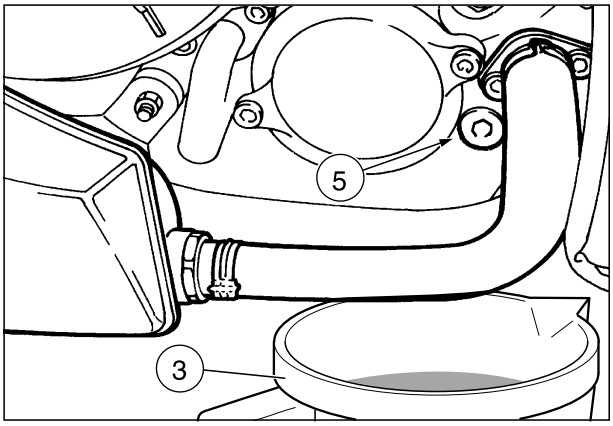


⚠ CAUTION

Do not dispose of the oil in the environment.
Put it in a sealed container and take it to the filling station where you usually buy it or to an oil salvage center.

◆ Remove the metal residues from the drain plug (5) magnet.
◆ Screw and tighten the drain plug (5).

Driving torque of the drain plug (5) positioned on the engine: 12 Nm (1.2 kgm).



CHANGING THE ENGINE OIL FILTER

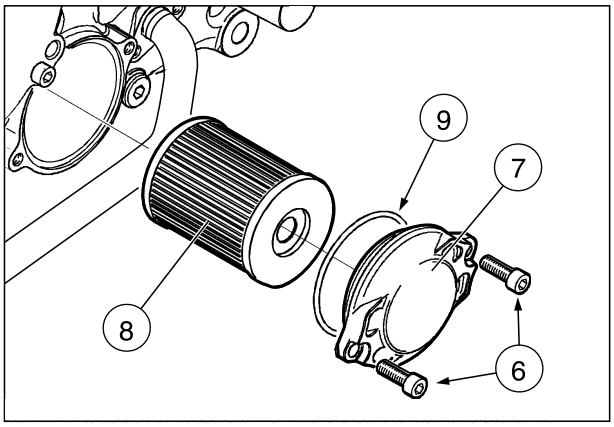
Change the engine oil filter after the first 1000 km (625 mi) and successively every 7500 km (4687 mi) (or every time you change the oil).

◆ Unscrew the two screws (6) and remove the cover (7).
◆ Remove the engine oil filter (8).

⚠ CAUTION

Do not use filters that have already been used.

◆ Spread an oil film on the sealing ring (9) of the new engine oil filter.
◆ Fit the new engine oil filter.
◆ Put back the cover (7), screw and tighten the two screws (6).



CLEANING THE ENGINE OIL FILTER ON THE TANK

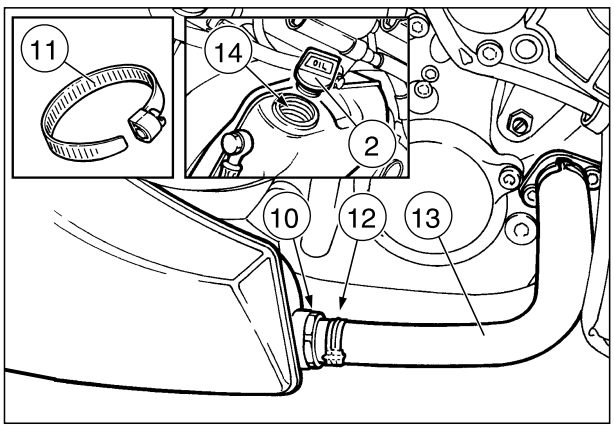
Clean the engine oil filter (10) on the tank every 15000 km (9375 mi) (or every two engine oil changes).

NOTE Prepare a pipe clamp (11) to replace the original one (special type).

◆ Loosen the clamp (12) and disconnect the pipe (13).
◆ Unscrew and remove the engine oil filter (10) positioned on the tank and clean it with a jet of compressed air.
◆ Check the seal of the engine oil filter (10) positioned on the tank; screw and tighten it.

Engine oil filter (10) driving torque: 30 Nm (3.0 kgm).

◆ Connect the pipe (13) and tighten the new clamp (11).



⚠ CAUTION

Do not put additives or other substances into the oil.
If you use a funnel or other similar items, make sure that they are perfectly clean.

◆ Pour about 3500 cm³ of engine oil through the filling opening (14), see 1.6 (LUBRICANT CHART).
◆ Tighten the filling cap (2).
◆ Start the engine and let it idle for about one minute, in order to ensure the filling up of the engine oil circuit.
◆ Check the oil level and top up if necessary, see 2.13 (CHECKING THE ENGINE OIL LEVEL AND TOPPING UP).

2.15 CHECKING AND TOPPING UP COOLANT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

Before departure, check the coolant level, change it every two years.

⚠ CAUTION

Check the coolant level and top up the expansion tank with cold engine.

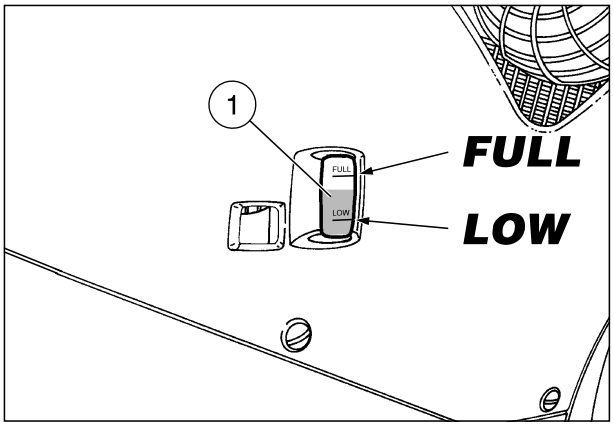
◆ Stop the engine and wait until it has cooled down.

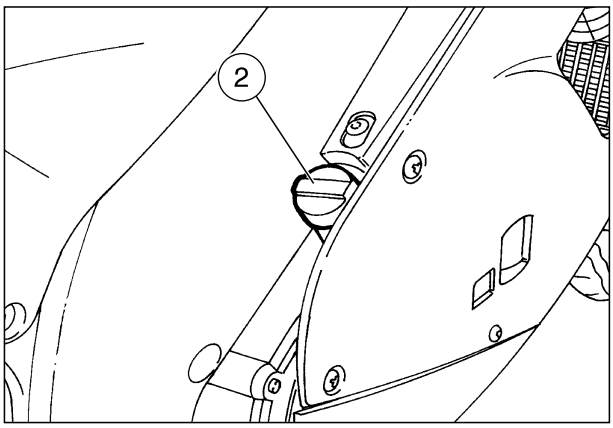
NOTE Position the vehicle on the side stand on firm and level ground.

◆ Keep the vehicle in vertical position, with the two wheels resting on the ground.
◆ Make sure that the coolant contained in the expansion tank (1) is included between the "**FULL**" and "**LOW**" marks, by checking through the appropriate slot on the right fairing.

If not, proceed as follows:

◆ Unscrew and remove the cap (2).





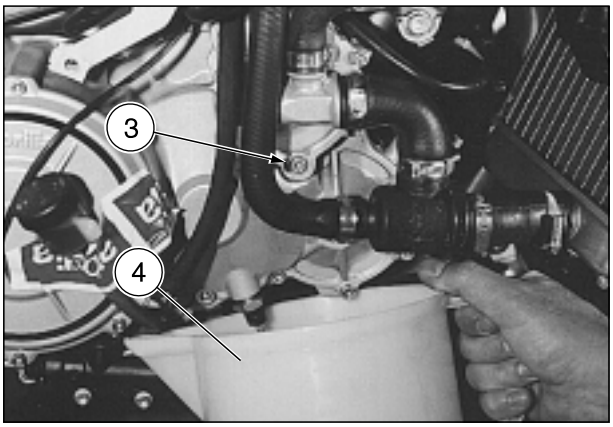
⚠ WARNING

The coolant is noxious: do not swallow it; if the coolant gets in contact with the skin or the eyes, it can cause serious irritations.
Do not use your fingers or any other object to check if there is enough coolant.

⚠ CAUTION

Do not put additives or other subtances into the fluid. If you use a funnel or other similar items, make sure that they are perfectly clean.

◆ Top up the expansion tank by adding coolant, see 1.6 (LUBRICANT CHART), until this almost reaches the "**FULL**" level.
Do not exceed this level, otherwise the coolant will flow out while the engine is running.
◆ Put back the filling cap (2).



⚠ CAUTION

In case of excessive consumption of coolant and in case the tank (1) remains empty, make sure that there are no leaks in the circuit.

2.16 CHANGING THE COOLANT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

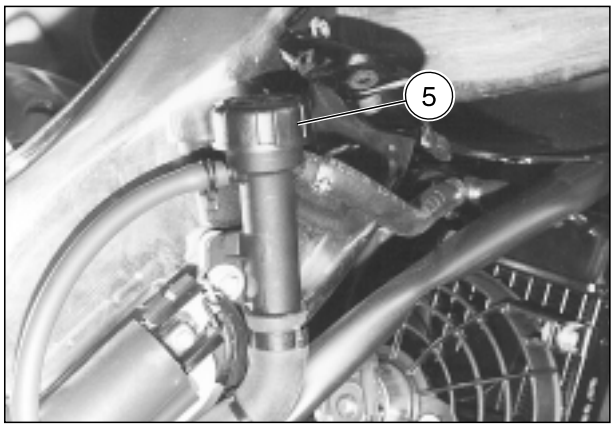
Replace the coolant every two years.

◆ Remove the upper panel of the right side fairing, see 7.1.27 (REMOVING THE SIDE FAIRING UPPER PANELS).
◆ Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
◆ Remove the expansion tank, see 5.9 (REMOVING THE EXPANSION TANK).
◆ Place a container (4) under the drain screw (3) to catch the coolant (capacity over 2.5 ℓ).
◆ Unscrew and remove the drain screw (3) retrieving the copper washer.

⚠ CAUTION

Do not remove the filler cap (5) when the engine is hot as the coolant is under pressure and is very hot.

◆ Remove the filler cap (5) followed by the expansion tank cap (2) to help the coolant out.



◆ Once all the coolant has drained out, move the container (4) under the right-hand radiator.
◆ Unscrew and remove the drain plug (6), retrieving the aluminium washer.
◆ Once all the coolant has drained out, move the container under the left-hand radiator.
◆ Unscrew and remove the drain plug (7), retrieving the aluminium washer.

DO NOT DISPOSE OF COOLANT IN THE ENVIRONMENT.

NOTE When reassembling, apply LOCTITE® 574 on the thread of the drain screw (3).

◆ Reassemble the drain screw (3) with a new copper washer.

Driving torque of drain screw (3): 12 Nm (1.2 kgm).

NOTE When reassembling, apply LOCTITE® 572 on the thread of the drain plug (6-7).

◆ Reassemble the two radiator drain plugs (6-7) with two new aluminium washers.

Driving torque of drain plugs (6-7): 10 Nm (1.0 kgm).

◆ Top up through the filler neck (8) until full.
◆ Squeeze and release the couplings (9-10) a few times with your hands so as to create a slight pressure and enable the coolant to flow into the pipes.
◆ Top up again until full.

NOTE The level is correct when the coolant stabilizes immediately below the filler neck (8).

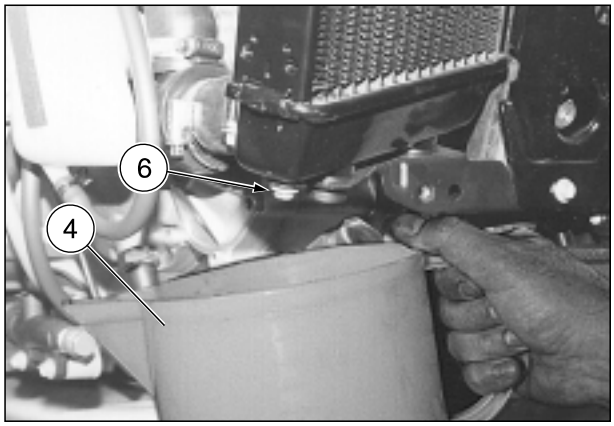
◆ Refit the filler cap (5).
◆ Top up the coolant in the expansion tank, see 2.15 (CHECKING AND TOPPING UP COOLANT).
◆ Start the engine and let it run for a few minutes, then allow it to cool and check the level of coolant in the expansion tank again.
◆ If necessary, top up, see 2.15 (CHECKING AND TOPPING UP COOLANT).

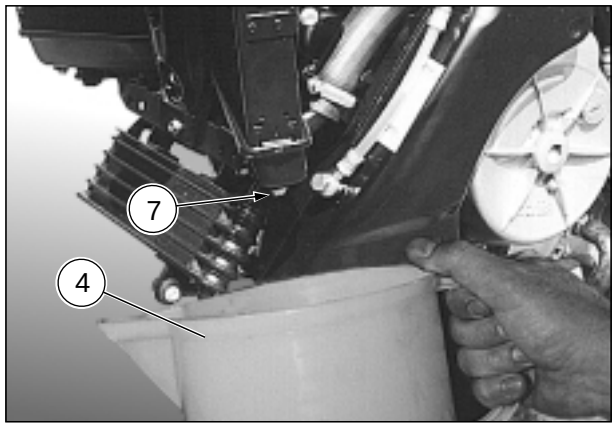
Total quantity:

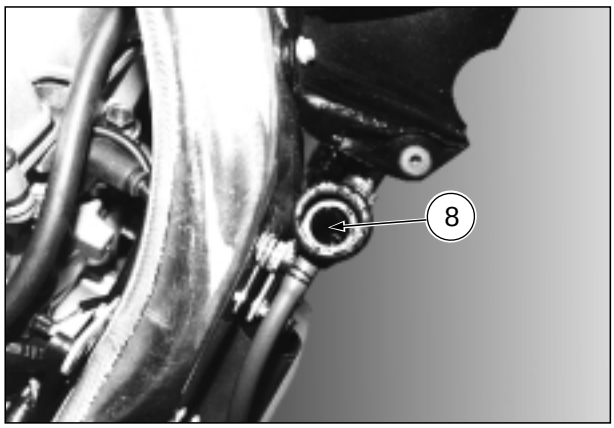
2.5 ℓ (including the expansion tank).

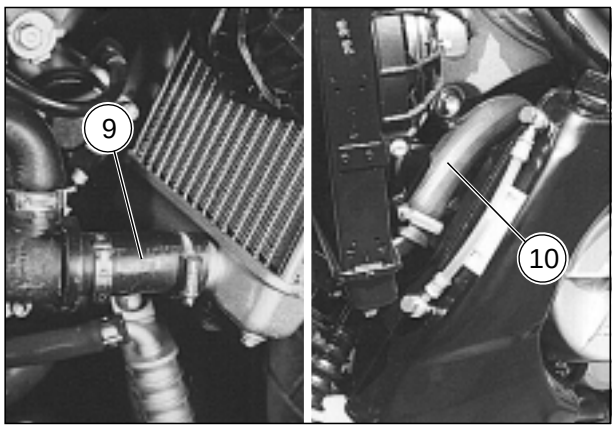
NOTE The bleeding of the system is not required for this vehicle.

For further information, see section 5 (COOLING SYSTEM).









2.17 CHECKING AND TOPPING UP THE FRONT BRAKES FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.4 (BRAKE FLUID).

Check the brakes fluid every 7500 km (4687 mi) or 8 months , change it every two yars.

⚠ CAUTION

If the brake lever features excessive free play, if it is excessively spongy or in the event of air bubbles in the circuit, bleed the system, see 2.20 (BLEEDING THE BRAKING SYSTEMS).

The leak of brake fluid damages painted or plastic surfaces.
Before setting out, make sure that the hoses are not twisted or holed and that there are no leakage from the connectors.

Do not use or mix different types of silicone or oil-based liquids. Do not use brake fluids taken from old containers, or not sealed.

Make sure that neither water nor dust accidentally enter the circuit.

CHECKING

NOTE Position the vehicle on the side stand on firm and level ground.

- Position the vehicle on the stand.
- Rotate the handlebar completely rightwards.
- Make sure that the fluid level exceeds the "**MIN**" mark, provide for topping up.

  MIN = minimum level.
  MAX= maximum level
- If the fluid does not reach at least the "**MIN**" mark, provide for topping up.

TOPPING UP

⚠ CAUTION

The brake fluid may flow out of the tank.
Do not operate the front brake lever if the screws (1) are loose or, most important, if the brake fluid tank cover has been removed.

- Unscrew the two screws (1) of the brake reservoir (2) by means of a short, cross-headed screwdriver.

⚠ WARNING

Avoid any prolonged exposure of the brake fluid to the air.

The brake fluid is hygroscopic and when in contact with the air it absorbs its humidity.
Leave the brake fluid tank open ONLY for the time necessary for topping up.

- Raise and remove the cover (3) together with the screws (1) and the gasket (4).

NOTE In order not to spill the brake fluid while topping up, do not shake the vehicle.

⚠ CAUTION

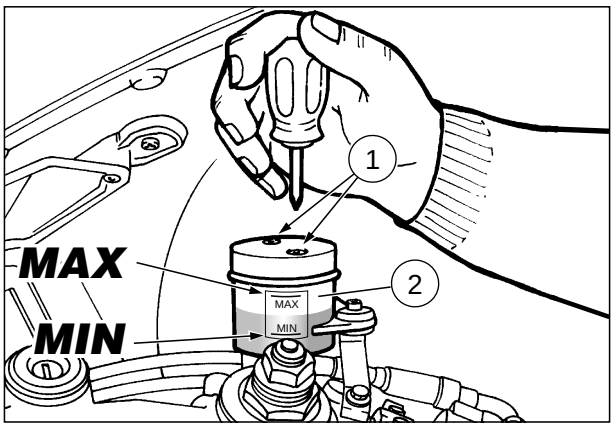
Do not put additives or other subtances into the fluid. If you use a funnel or other similar items, make sure that they are perfectly clean.

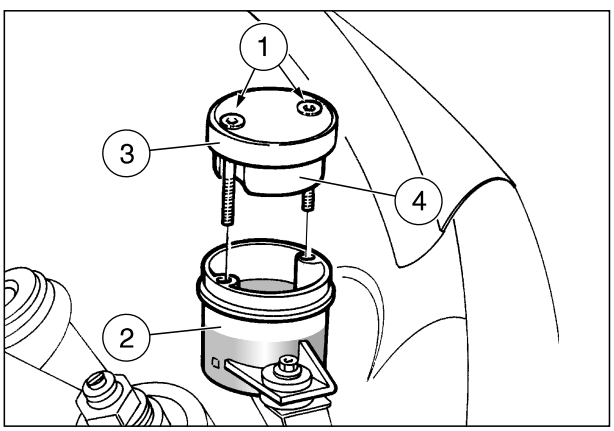
- Fill the tank (2) with brake fluid, see 1.6 (LUBRICANT CHART), until reaching the correct level between the "**MIN**" and "**MAX**" marks.

⚠ CAUTION

When topping up, never exceed the "MAX" level.
It is advisable to top up until reaching the "MAX" level only with new pads.
When the disc pads wear out, the level of the fluid decreases progressively to compensate for their wear.

- To reassemble the components, follow the reverse order.





2.18 CHECKING AND TOPPING UP THE REAR BRAKE FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.4 (BRAKE FLUID).

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

⚠ CAUTION

If the brake lever features excessive free play, if it is excessively spongy or in the event of air bubbles in the circuit, bleed the system, see 2.20 (BLEEDING THE BRAKING SYSTEMS).

The leak of brake fluid damages painted or plastic surfaces.
Before setting out, make sure that the hoses are not twisted or holed and that there are no leakage from the connectors.

Do not use or mix different types of silicone or oil-based liquids.
Do not use brake fluids taken from old containers, or not sealed.

Make sure that neither water nor dust accidentally enter the circuit.

CHECKING

NOTE Position the vehicle on the side stand on firm and level ground.

- Keep the vehicle in vertical position, so that the fluid contained in the tank (1) is parallel to the plug (2).
- Make sure that the brake fluid contained in the reservoir exceeds the "**MIN**" mark, by checking through the appropriate slot on the right fairing.

  MIN = minimum level.
  MAX= maximum level.
- If the fluid does not reach at least the "**MIN**" mark, provide for topping up.

TOPPING UP

- Remove the right fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).

⚠ CAUTION

The brake fluid may flow out of the tank.

Do not operate the rear brake lever if the brake fluid tank plug is loose or has been removed.

- Unscrew the screw (3) completely.
- Slightly move the whole reservoir (1) outwards.

⚠ WARNING

Avoid any prolonged exposure of the brake fluid to the air.

The brake fluid is hygroscopic and when in contact with the air it absorbs its humidity.
Leave the brake fluid tank open ONLY for the time necessary for topping up.

- Unscrew and remove the plug (2).

NOTE In order not to spill the brake fluid while topping up, keep the fluid in the tank parallel to the tank rim (in horizontal position).

- Remove the gasket (4).

⚠ CAUTION

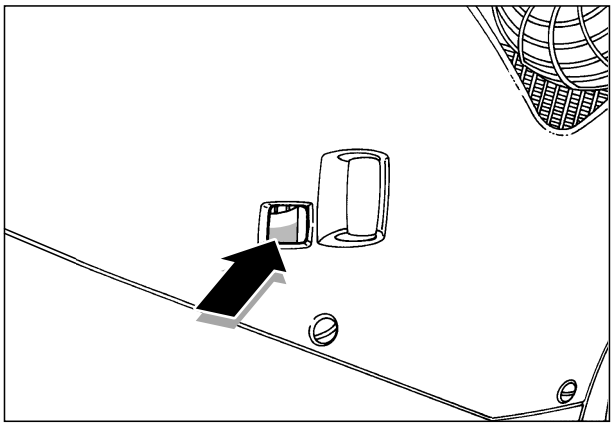
Do not put additives or other subtances into the fluid. If you use a funnel or other similar items, make sure that they are perfectly clean.

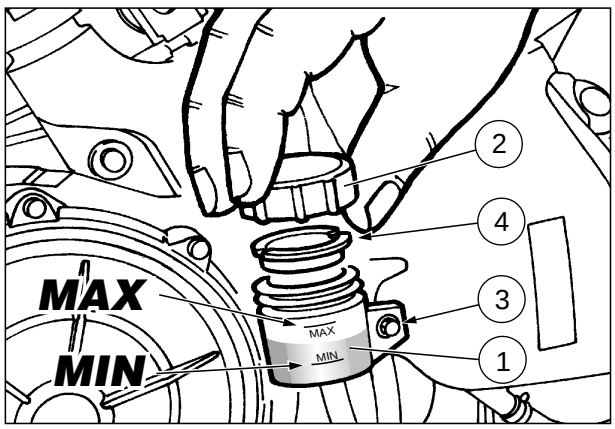
- Top up the reservoir (1) by adding brake fluid, see 1.6 (LUBRICANT CHART), until reaching the correct level included between the "**MIN**" and "**MAX**" marks.

⚠ CAUTION

It is advisable to top up until reaching the "MAX" level only with new pads.
When the disc pads wear out, the level of the fluid decreases progressively to compensate for their wear.

- To reassemble the components, follow the reverse order.





2.19 CHECKING AND TOPPING UP THE CLUTCH FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.6 (CLUTCH FLUID).

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

⚠ CAUTION

If the clutch control lever features excessive free play, if it is excessively spongy or in the event of air bubbles in the circuit, bleed the system, see 2.21 (BLEEDING THE CLUTCH SYSTEMS).

The leak of cluth fluid damages painted or plastic surfaces.
Before setting out, make sure that the hoses are not twisted or holed and that there are no leakage from the connectors.

Do not use or mix different types of silicone or oil-based liquids.
Do not use clutch fluids taken from old containers, or not sealed.

Make sure that neither water nor dust accidentally enter the circuit.

CHECKING

NOTE Position the vehicle on the side stand on firm and level ground.

- Keep the vehicle in vertical position, so that the fluid contained in the tank (1) is parallel to the plug (2).
- Make sure that the fluid level exceeds the "**MIN**" mark.

  MIN = minimum level
  MAX= maximum level
- If the fluid does not reach the "**MIN**" mark, provide for topping up.

TOPPING UP

⚠ CAUTION

The fluid may flow out.
Do not operate the clutch control lever if the reservoir plug is loose or has been removed.

⚠ WARNING

Avoid any prolonged exposure of the clutch fluid to the air.
The clutch fluid is hygroscopic and when in contact with the air it absorbs its humidity.
Leave the clutch fluid tank open ONLY for the time necessary for topping up.

- Unscrew and remove the plug (2).

NOTE Do not shake the vehicle, in order not to spill fluid while topping up.

- Remove the gasket (3).

⚠ CAUTION

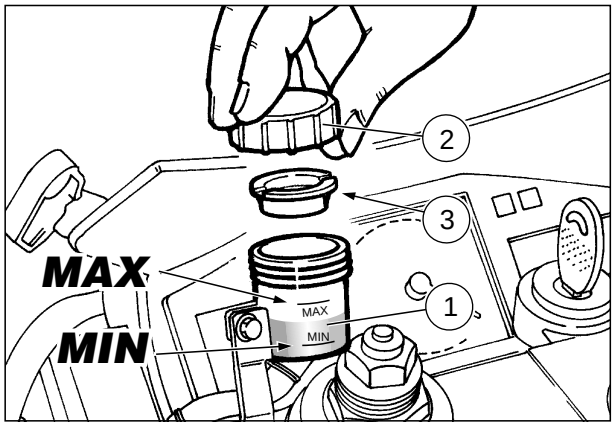
Do not put additives or other subtances into the fluid.
If you use a funnel or other similar items, make sure that they are perfectly clean.

- Top up the reservoir (1) by adding clutch fluid, see 1.6 (LUBRICANT CHART), until reaching the correct level included between the "**MIN**" and "**MAX**" marks.

⚠ CAUTION

Do not exceed the "MAX" mark while topping up.

- To reassemble the components, follow the reverse order.



2.20 BLEEDING THE BRAKING SYSTEMS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.4 (BRAKE FLUID).

Bleed the braking system after the first 1000 km (625 mi). The air present in the hydraulic system acts as a bearing, absorbing most of the pressure exerted by the brake pump and reducing the effectiveness of the caliper action during braking.
The presence of air is revealed by the “sponginess” of the brake lever and by the reduced braking capacity.

⚠ CAUTION

Handle brake fluid with care; it may chemically alter painted surfaces and the parts in plastic, rubber, etc.

DO NOT DISPOSE OF BRAKE FLUID IN THE ENVIRONMENT.

⚠ WARNING

Considering the danger for both rider and vehicle, it is absolutely essential to bleed the hydraulic circuit once the brakes have been refitted and the braking system restored to its normal conditions. Proceed as follows:

NOTE Only for the front braking system.
First bleed the system using the bleeder (1) located on the pump, and then using the one (2) located on the caliper.

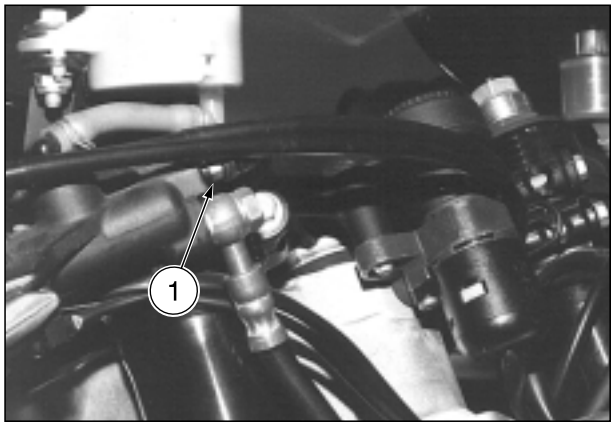
- Top up the brake fluid tank, see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKES FLUID) and 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID).
- Remove the plastic protection cap.
- Insert a transparent plastic tube on the bleeder (1) on the pump and then on the bleeder (2) or (3) on the caliper and put the other end of the tube in a container.
- Rapidly pull and release the brake lever several times, then keep it completely pulled.
- Loosen the bleeder a quarter turn so that the brake fluid flows into the container; this eliminates the tension on the brake lever, allowing it to touch the handgrip.
- Tighten the bleeder (1), pull the lever several times, then keep it completely pulled and unscrew the bleeding screw again.
- Repeat this operation until the liquid flowing into the container is completely free of air bubbles.

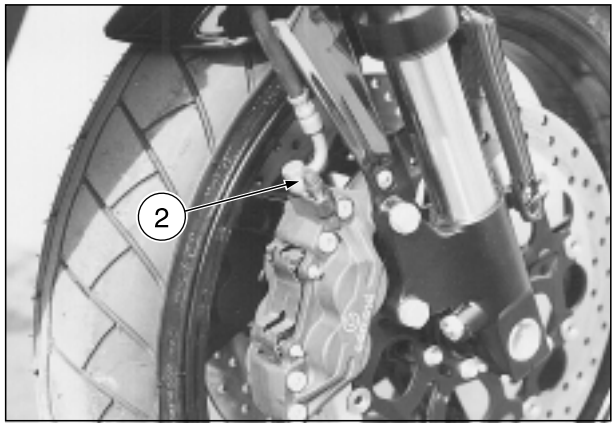
NOTE During the bleeding of the braking system, fill the tank with as much brake fluid as needed.
Make sure that the brake fluid is always present in the tank during the operation.

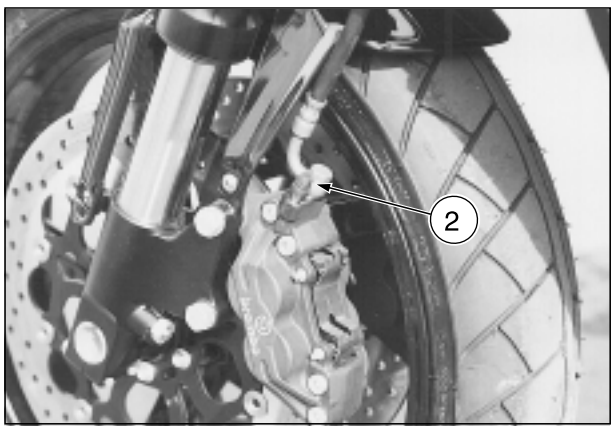
- Tighten the bleeder and remove the plastic tube.

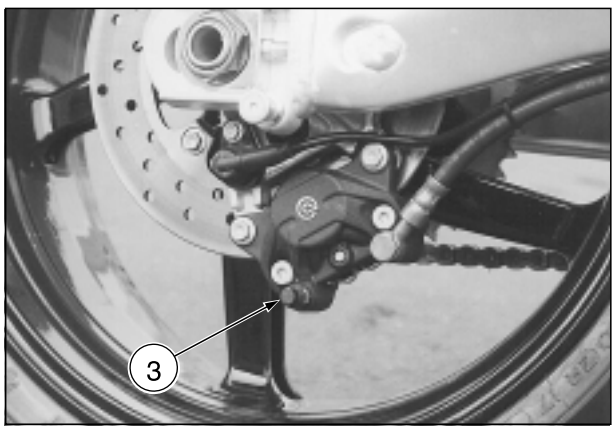
Driving torque of bleeder (1): 15 Nm (1.5 kgm).

- Top up the brake fluid tank to the right level, see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKES FLUID) and 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID).
- Refit the rubber protection cap.









2.21 BLEEDING THE CLUTCH SYSTEMS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.6 (CLUTCH FLUID).

Bleed the braking system after the first 1000 km (625 mi). The air present in the hydraulic system acts as a bearing, absorbing most of the pressure exerted by the brake pump and reducing the effectiveness of the clutch cylinder.
The presence of air is revealed by the “sponginess” of the clutch lever and by the reduced the capacity.

⚠ CAUTION

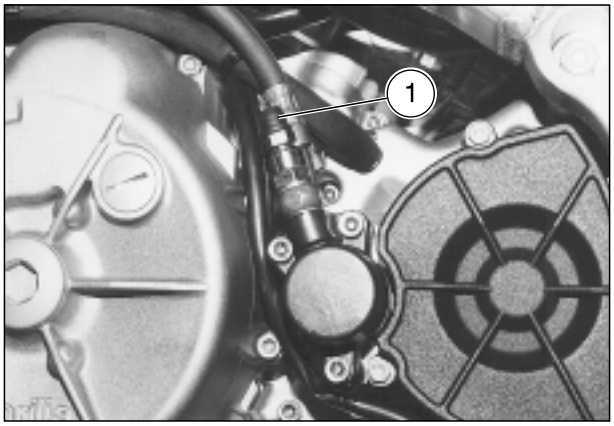
Handle clutch fluid with care; it may chemically alter painted surfaces and the parts in plastic, rubber, etc.

DO NOT DISPOSE OF CLUTCH FLUID IN THE ENVIRONMENT.

⚠ WARNING

Considering the danger for both rider and vehicle, it is absolutely essential to bleed the hydraulic circuit once the clutch cylinder have been refitted and the system restored to its normal conditions. Proceed as follows:

- Top up the clutch fluid tank, see 2.19 (CHECKING AND TOPPING UP THE CLUTCH FLUID) .
- Remove the left side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Remove the plastic protection cap.
- Insert a transparent plastic tube on the bleeder (1) and put the other end of the tube in a container.
- Rapidly pull and release the clutch lever several times, then keep it completely pulled.
- 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), pull the lever several times, then keep it completely pulled and unscrew the bleeding screw again.
- Repeat this operation until the liquid flowing into the container is completely free of air bubbles.



NOTE During the bleeding of the clutch system, fill the tank with as much clutch fluid as needed.
Make sure that the clutch fluid is always present in the tank during the operation.

- Tighten the bleeder and remove the plastic tube.

Driving torque of bleeder (1): 15 Nm (1.5 kgm).

- Top up the clutch fluid tank to the right level, see 2.19 (CHECKING AND TOPPING UP THE CLUTCH FLUID).
- Refit the rubber protection cap.

2.22 CHANGING THE FRONT BRAKE FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.4 (BRAKE FLUID).

Change the front brake fluid every two year.

⚠ CAUTION

Handle brake fluid with care; it may chemically alter painted surfaces and the parts in plastic, rubber, etc.

DO NOT DISPOSE OF BRAKE FLUID IN THE ENVIRONMENT.

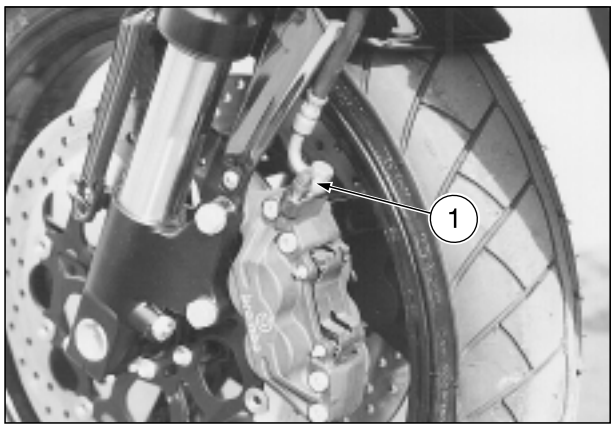
- ◆ ★ Remove the plastic protection cap.
- ◆ ★ Insert a transparent plastic tube on the bleeder (1) of the caliper and put the other end of the tube in a container.
- ◆ ★ Loosen the bleeder (1) approx. one turn.

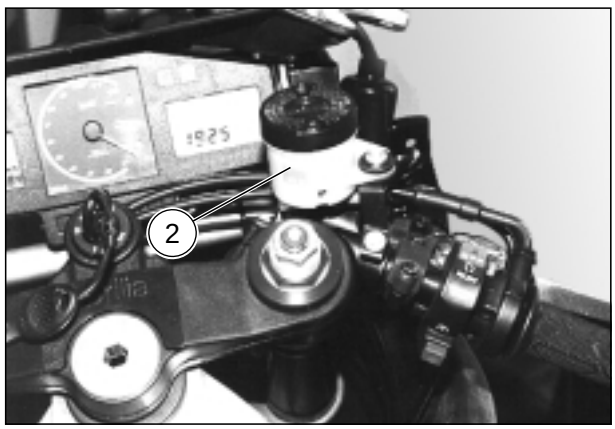
NOTE Make sure that there is always fluid in the tank during the operation; otherwise, once finished, the braking system will need bleeding, see 2.20 (BLEEDING THE BRAKING SYSTEMS).

- ◆ Keep an eye on the tank (2) as the fluid flows out and tighten the bleeder (1) before it empties entirely.
- ◆ Top up the tank (2), see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKES FLUID).
- ◆ ★ Loosen the bleeder (1) again approx. half a turn.
- ◆ ★ Watch as the liquid flows out through the tube and as soon as the colour of the fluid starts to change (from dark to light), tighten the bleeder (1) again and remove the tube.

Driving torque of bleeder (1): 15 Nm (1.5 kgm).

- ◆ ★ Refit the rubber protection cap.
- ◆ Top up the brake fluid tank (2) to the right level, see 2.17 (CHECKING AND TOPPING UP THE FRONT BRAKES FLUID).





2.23 CHANGING THE REAR BRAKE FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.4 (BRAKE FLUID).

Change the rear brake fluid every two year.

⚠ CAUTION

Handle brake fluid with care; it may chemically alter painted surfaces and the parts in plastic, rubber, etc.

DO NOT DISPOSE OF BRAKE FLUID IN THE ENVIRONMENT.

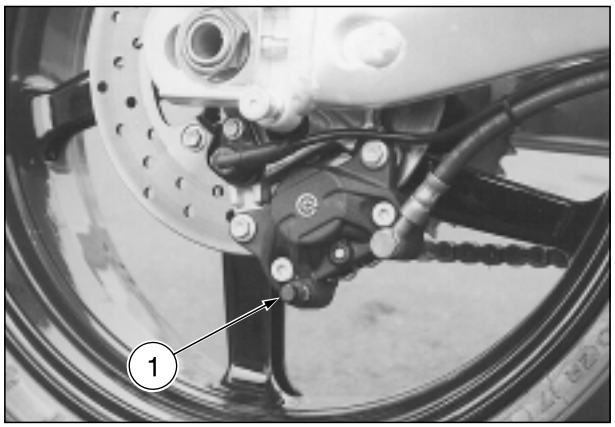
- Remove the plastic protection cap.
- Insert a transparent plastic tube on the bleeder (1) of the caliper and put the other end of the tube in a container.
- Loosen the bleeder (1) approx. one turn.

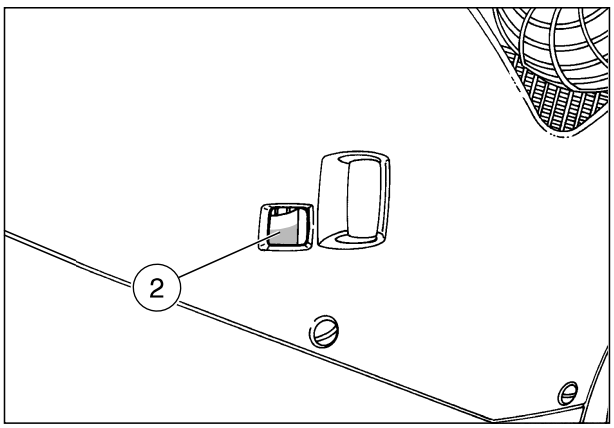
NOTE Make sure that there is always fluid in the tank during the operation; otherwise, once finished, the braking system will need bleeding, see 2.20 (BLEEDING THE BRAKING SYSTEMS).

- Keep an eye on the tank (2) as the fluid flows out and tighten the bleeder (1) before it empties entirely.
- Top up the tank (2), see 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID).
- Loosen the bleeder (1) again approx. half a turn.
- Watch as the liquid flows out through the tube and as soon as the colour of the fluid starts to change (from dark to light), tighten the bleeder (1) again and remove the tube.

Driving torque of bleeder (1): 15 Nm (1.5 kgm).

- Refit the rubber protection cap.
- Top up the brake fluid tank (2) to the right level, see 2.18 (CHECKING AND TOPPING UP THE REAR BRAKE FLUID).





2.24 CHANGING THE CLUTCH FLUID

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.6 (CLUTCH FLUID).

Change the clutch fluid every two year.

⚠ CAUTION

Handle clutch fluid with care; it may chemically alter painted surfaces and the parts in plastic, rubber, etc.

DO NOT DISPOSE OF CLUTCH FLUID IN THE ENVIRONMENT.

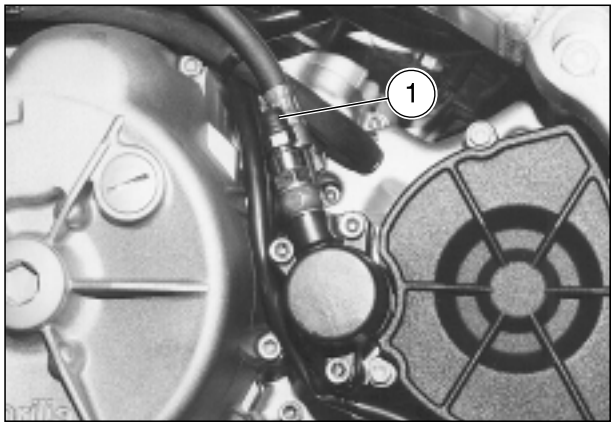
- ◆ Remove the plastic protection cap.
- ◆ Insert a transparent plastic tube on the bleeder (1) and put the other end of the tube in a container.
- ◆ Loosen the bleeder (1) approx. one turn.

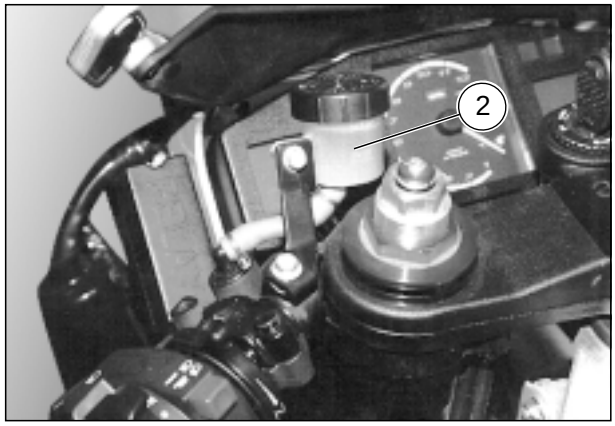
NOTE Make sure that there is always fluid in the tank during the operation; otherwise, once finished, the clutch system will need bleeding, see 2.21 (BLEEDING THE CLUTCH SYSTEMS).

- ◆ Keep an eye on the tank (2) as the fluid flows out and tighten the bleeder (1) before it empties entirely.
- ◆ Top up the tank (2), see 2.19 (CHECKING AND TOPPING UP THE CLUTCH FLUID).
- ◆ Loosen the bleeder (1) again approx. half a turn.
- ◆ Watch as the liquid flows out through the tube and as soon as the colour of the fluid starts to change (from dark to light), tighten the bleeder (1) again and remove the tube.

Driving torque of bleeder (1): 15 Nm (1.5 kgm).

- ◆ Refit the rubber protection cap.
- ◆ Top up the fluid tank (2) to the right level, see 2.19 (CHECKING AND TOPPING UP THE CLUTCH FLUID).

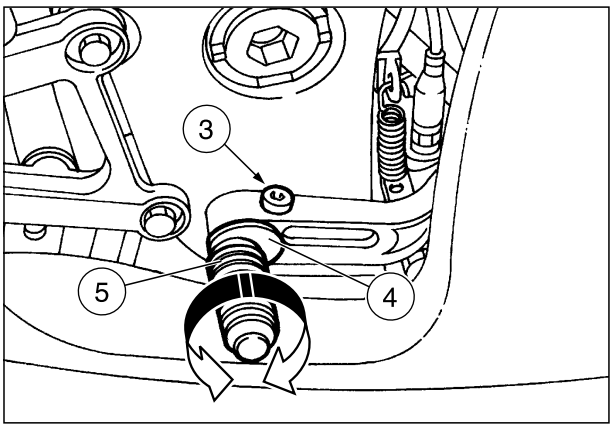




2.25 ADJUSTING THE REAR BRAKE CONTROL LEVER AND THE GEAR LEVER

The control levers are positioned ergonomically during the assembly of the vehicle.
If necessary, it is possible to adjust the position of the levers.

- ◆ Position the vehicle on the side stand on firm and level ground.
- ◆ Partially unscrew the screw (3).
- ◆ Rotate the eccentric (4) in order to find the optimal position of the pedal (5).
- ◆ Tighten the screw (3) and make sure that the eccentric is stable in its position.

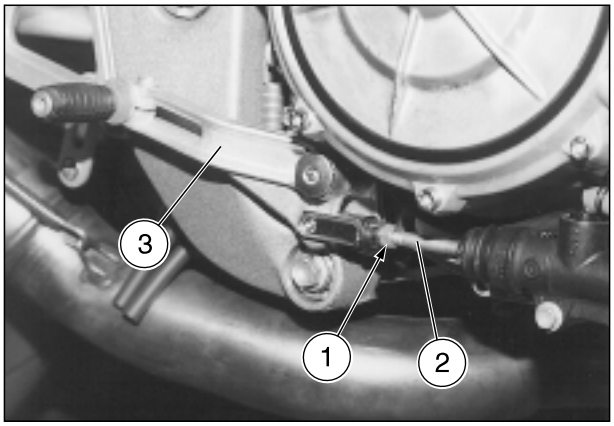


2.26 ADJUSTING THE REAR BRAKE CONTROL LEVER CLEARANCE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

The brake control lever is positioned ergonomically during the assembly of the vehicle.
If necessary, it is possible to adjust the brake control lever clearance:

- Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- Tighten the lock nut (1).
- Unscrew the pump control rod (2) to ensure a minimum clearance of **0.5 – 1 mm** between the rod and the pump piston.

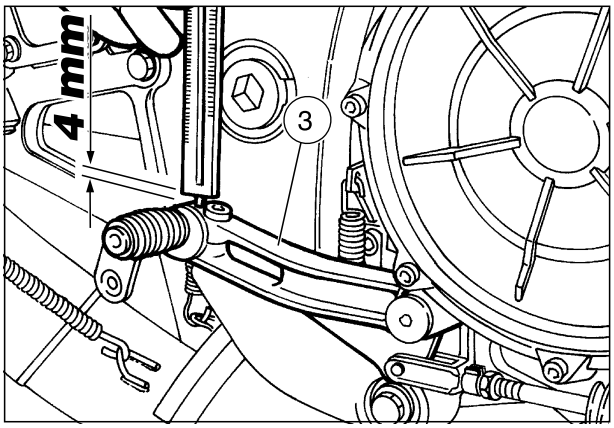


⚠ CAUTION

Make sure that there is a certain idle stroke in the movement of the lever, to prevent the brake from remaining applied and the consequent untimely wear of the braking elements.

Lever (3) idle stroke:

4 mm (measured at the lever end).



- Lock the pump control rod by means of the lock nut (1).

⚠ CAUTION

After the adjustment, make sure that the wheel rotates freely with released brake.

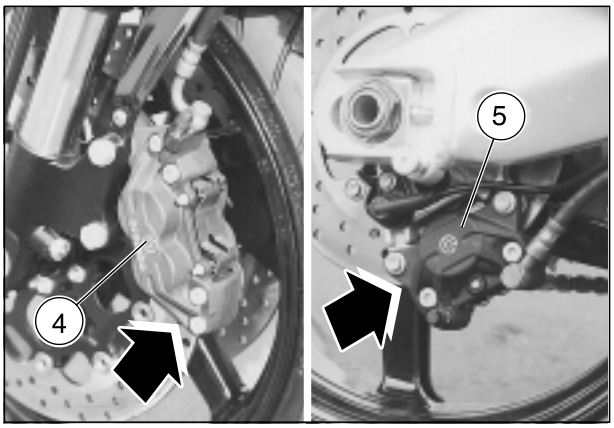
2.27 CHECKING THE BRAKE PAD WEAR

The wear of the disc brake pads depends on the use, on the kind of drive and on the road.

NOTE The following information refer to a single braking system, but are valid for both.

To carry out a rapid checking of the wear of the pads, proceed as follows:

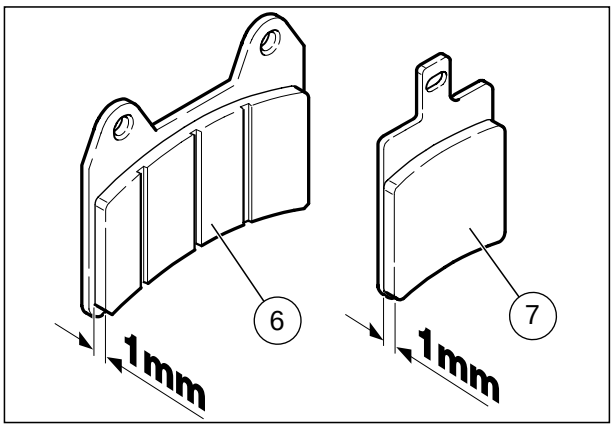
- Position the vehicle on the side stand on firm and level ground.
- Carry out a visual check between the disc and the pads, proceeding:
  - from below, on the front part, for the front brake calipers (4);
  - from below, on the rear part, for the rear brake caliper (5).



⚠ CAUTION

The excessive wear of the friction material would cause the contact of the pad metal support with the disc, with consequent metallic noise and production of sparks from the caliper; braking efficiency, safety and soundness of the disc would thus be negatively affected.

- If the thickness of the friction material (even of one pad only) has reduced to about **1 mm** (or if even only one of the wear indicators is not visible any longer), change both pads.
  - Front pad (6), see 7.5.1 (CHANGING THE BRAKES PADS).
  - Rear pad (7) see 7.6.1 (CHANGING THE BRAKE PADS).

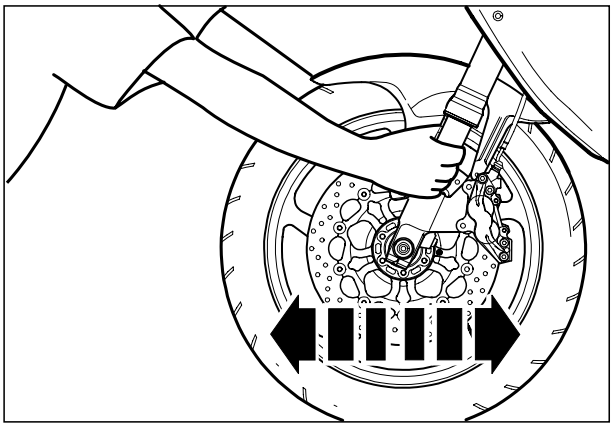


2.28 STEERING

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

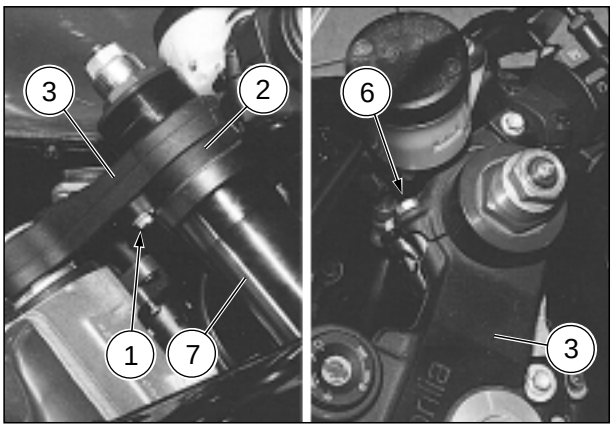
Check after the first 1500 km (937 mi) and then after every 7500 km (4687 mi) or 8 months.

To assure improved handling, the steering is equipped with rolling bearings.
The steering must be adjusted correctly to provide smooth rotation of the handlebar and safe driving.
Tight steering hinders the smooth rotation of the handlebar whereas slack steering implies inadequate stability.



2.28.1 CHECKING THE BEARING SLACK

- Position the vehicle on the relevant centre support stand, see 1.9.4 (SETTING THE VEHICLE ON THE CENTRE SUPPORT STAND OPT).
- Shake the fork in the direction of travel.
- In the event any slack is encountered, adjust the steering.

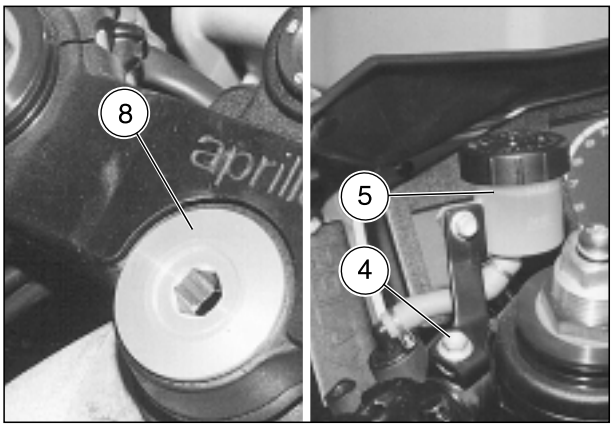


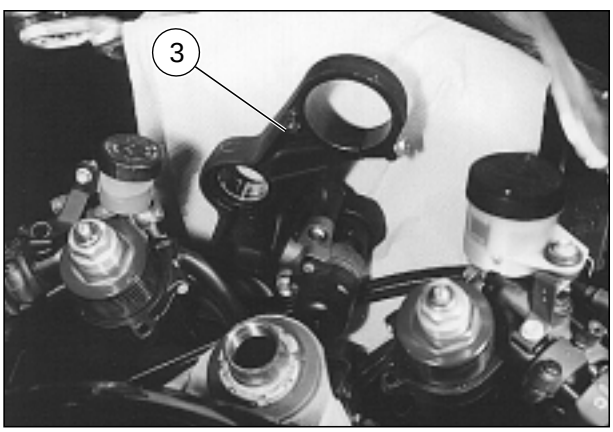
2.28.2 ADJUSTING THE BEARING SLACK

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following procedure does not necessarily have to be performed with the front fairing removed, though it is advisable to remove it in order to gain more room for manoeuvre, see 7.1.20 (REMOVING THE FRONT PART OF THE FAIRING).

- ★ Unscrew and remove the screw (1) securing the handlebar (2) to the upper plate (3).
- Partially unscrew the screw (4) fastening the clutch fluid tank (5).
- Move the clutch fluid tank (5) sideways.
- ★ Unscrew the screw (6) securing the upper plate (3) to the front fork (7).
- Unscrew and remove the upper bush (8).
- Using a plastic hammer, tap the upper plate (3), complete with ignition switch /steering lock, from underneath until it is pushed off upwards.
- Bend the upper plate (3) over forwards, placing a cloth between it and the dashboard to avoid damage.





◆ Use a small flat-tip screwdriver to straighten the tabs (those bent upwards) of the tab washer (9).

NOTE Have the special tool OPT to hand cod. 8140203 (socket spanner for adjusting steering).

◆ Use the special setscrew spanner to loosen and remove the lock ring (10).
◆ Remove the tab washer (9).

⚠ CAUTION

When reassembling, the tab washer (9) must be replaced.

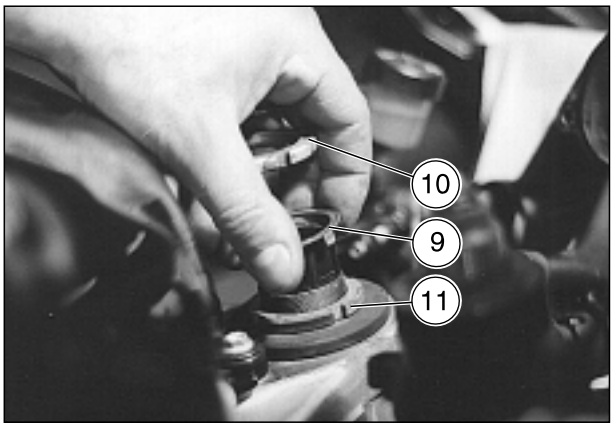
◆ Use the special setscrew spanner to tighten the adjuster ring (11) and eliminate the slack.

Driving torque of adjuster ring (11): 40 Nm (4.0 kgm).

◆ Refit the tab washer (9), making sure the tabs coincide with the grooved sectors of the metal ring (11).
◆ Use the special setscrew spanner to screw on and tighten the lock ring (10).

Tightening of lock ring (10):

manual until contact + 1/4 turn.



NOTE Bend the tabs of the tab washer (9) upwards.

◆ Bend the four tabs of the tab washer (9) upwards onto the grooved sectors of the lock ring (10).
◆ Refit the upper plate (3), making sure it is correctly housed.
◆ Lubricate the thread and base on which the bush (8) rests using motor oil, see1.6 (LUBRICANT CHART).
◆ Screw on and tighten the upper bush (8).

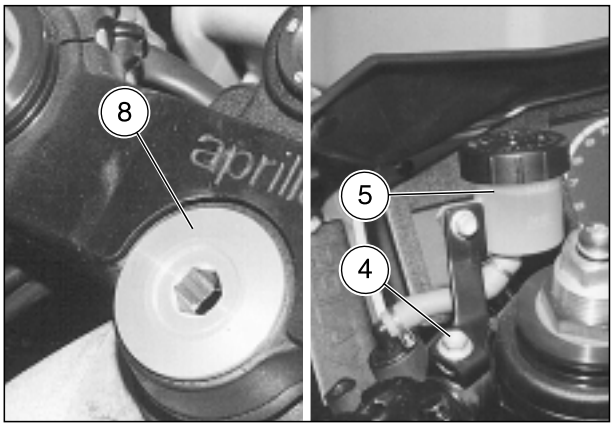
Driving torque of upper bush (8): 80 Nm (8.0 kgm).

◆ ★ Screw on and tighten the screw (6).

Driving torque of screw (6): 25 Nm (2.5 kgm).

◆ ★ Screw on and tighten the screw (1).

Driving torque of screw (1): 12 Nm (1.2 kgm).

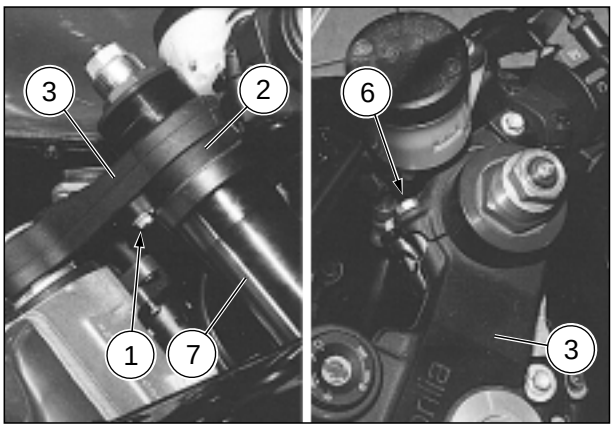


◆ Refit the clutch fluid tank (5).
◆ Tighten the screw (4).

Driving torque of screw (4): 12 Nm (1.2 kgm).

⚠ CAUTION

Once the operation is complete, make sure that the rotation of the handlebar is smooth in order to avoid damage to the balls and the loss of manoeuvrability of the vehicle.



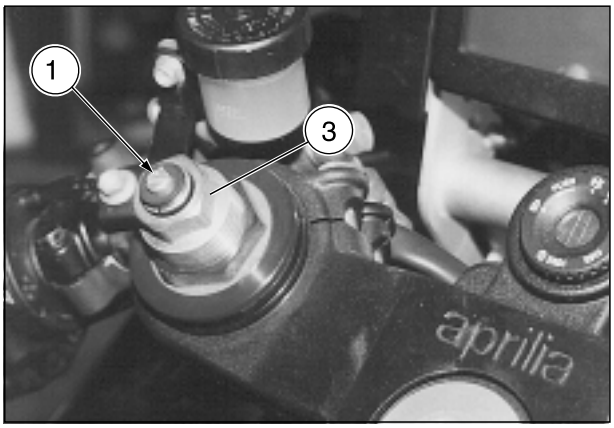
2.29 INSPECTING THE FRONT AND REAR SUSPENSION

2.29.1 FRONT SUSPENSION

The front suspension consists of an hydraulic fork connected to the steering column by means of two plates.

For the setting of the vehicle attitude, each rod of the fork is provided with an upper screw (1) for the adjustment of the hydraulic braking with extended shock absorber, a lower screw (2) for the adjustment of the hydraulic braking with compressed shock absorber and an upper nut (3) for the adjustment of the spring preload.

The riding position of the vehicle can be further altered by varying the height of the forecarriage.



Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

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

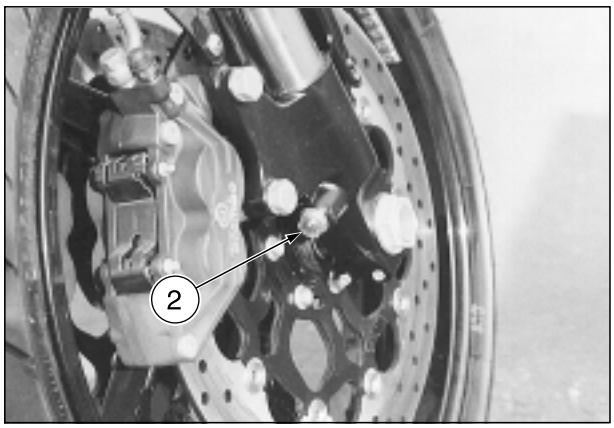
Every 7500 km (4687 mi), carry out the following checking operations:

- With pulled front brake lever, press the handlebar repeatedly, thrusting the fork downwards.
  The stroke must be gentle and there must be no trace of oil on the rods.

If the fork tends to “bottom out”, carry out a adjusting, see 2.29.2 (ADJUSTING THE FRONT FORK) and the oil must be changed if necessary, see 7.8.1 (CHANGING THE FORK OIL).

Make sure the fork does not feature oil leaks and that the outer surface of the tubes is not marked with scratches or grooves.
If this is the case, replace all the damaged parts that cannot be repaired, see 7.8.3 (DISASSEMBLING THE WHEEL-HOLDER TUBE - SLIDER UNIT).

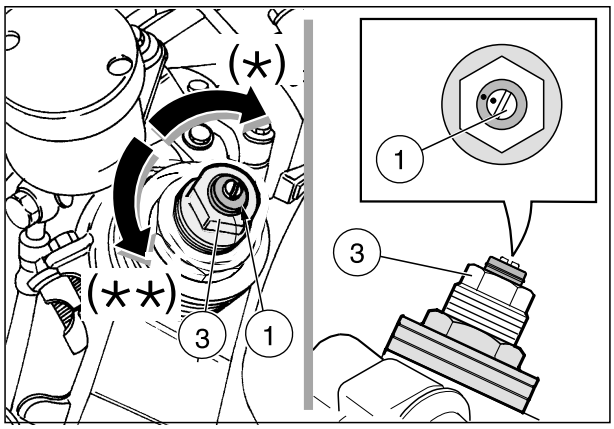
- Check the fastening of all the components and the functionality of the front suspension joints.

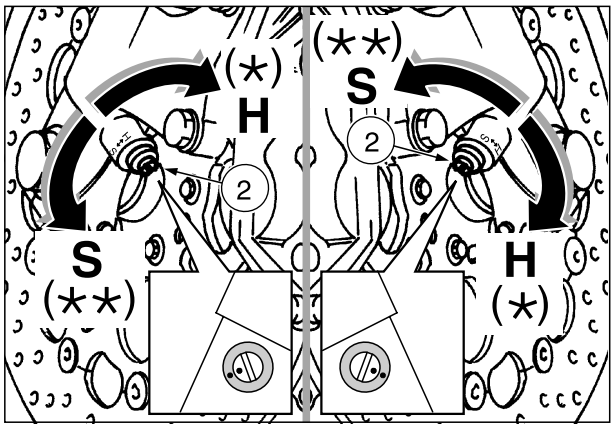


2.29.2 ADJUSTING THE FRONT FORK

The standard setting of the front fork is such as to satisfy most driving conditions at low and high speed, either with reduced load and full load.

However, it is also possible to adjust the setting according to the intended use of the vehicle.





⚠ CAUTION

For the adjustment, always start from the most rigid setting [complete clockwise rotation of the adjusters (1-2)].
Do not rotate the adjusters (1-2) beyond their limit position, to avoid damaging the thread.

Use the notches (1-2) provided on the adjusters as reference marks for the adjustment of the hydraulic braking with compressed and extended shock absorber.

Give the adjusters (1-2) 1/8 turn at a time and turn the adjusting nut (3) one notch at a time.
Test the vehicle repeatedly on the road, until obtaining the optimal adjustment.

Set the same spring preload and hydraulic braking for both rods: a different setting of the rods decreases the stability of the vehicle while riding.

When the spring preload is increased, it is necessary to increase also the hydraulic braking, in order to avoid sudden jerks while riding.

Front suspension	Standard adjustment	Adjustment for racetrack use	Possible adjustments
Hydraulic adjustment with extended shock absorber, screw (1)	from completely closed (*), open giving 1.5 turns (**)	from completely closed (*), open giving 1 turn (**)	from 0 to 2.5 turns
Hydraulic adjustment with compressed shock absorber, screw (2)	from completely closed (*) (H), open giving 1.5 turns (**) (S)	from completely closed (*) (H), open giving 1 turn (**) (S)	from 0 to 2.25 turns
Spring preload, nut (3)	at the 5th notch	at the 4th notch	from 10 to 25 turns

(*) = clockwise
(**) = anticlockwise

2.29.3 ADJUSTING THE HEIGHT OF THE FORECARRIAGE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Position the vehicle on the relevant centre support stand, see 1.9.4 (SETTING THE VEHICLE ON THE CENTRE STAND OPT).

NOTE Procure suitable shims to place between the front tyre and the support (1).
The number of shims depends on the desired riding position (maximum number: six, like the number of possible variations, 4 mm at a time).

Thickness for each element: 4 mm.

◆ Place a support (1) under the front tyre so as to keep the forecarriage in place once it is released.
◆ ★ Loosen the two screws (2) securing the lower plate (3) to the slider (4).

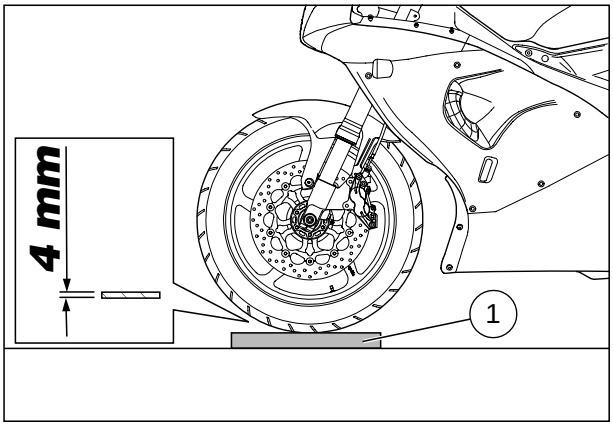
Driving torque of screw (2): 25 Nm (2.5 kgm).

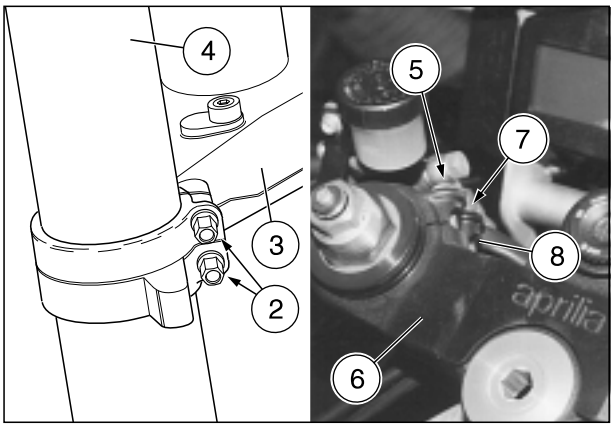
◆ ★ Loosen the screw (5) securing the upper plate (6) to the slider (4).

Driving torque of screw (5): 25 Nm (2.5 kgm).

◆ ★ Loosen the screw (7) securing the handlebar (8) to the slider (4).

Driving torque of screw (7): 25 Nm (2.5 kgm).





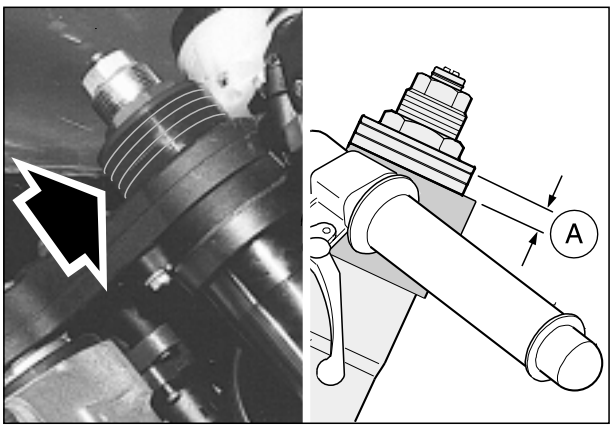
⚠ CAUTION

Due to the weight of the forecarriage, the following operations require the assistance of another operator.
Agree on the operating procedures in advance.
The removal must be carried out with the greatest care.

◆ Grip the forecarriage firmly and lift it slightly in the direction in which the sliders (4) are inserted on the two fastening plates (3-6).
◆ Place one or more of the shims between the tyre and the support (1) depending on the desired variation.
◆ Release the forecarriage.

NOTE There are six notches to be found in the upper part of each fork slider, to be used as reference for the six different positions possible (see figure).

◆ Make sure the notch in the fork sliders which the upper plate is lined up with corresponds to the desired variation.



⚠ CAUTION

The upper plate must be lined up with the same reference notch on both fork sliders.

Any variation, whether up or down, must always be made in the range between the first reference notch and the last.

Front suspension	Standard adjustment	Adjustment for race-track use	Possible adjustments
Protrusion of the rods (A) from the upper plate (plug excluded)	8 mm (2 notches)	12 mm (3 notches)	2 - 4 notches

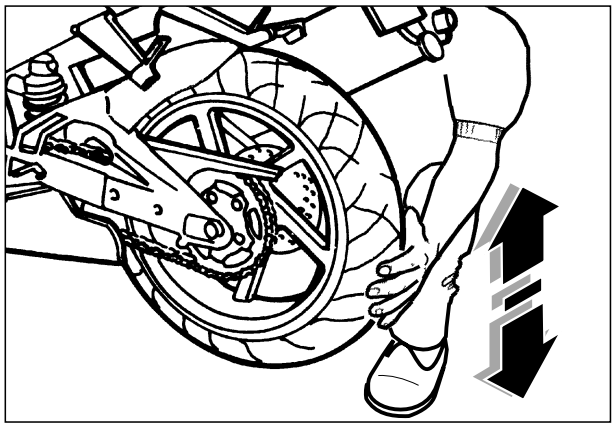
2.30 REAR FORK

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Periodically check the tightening of the nut/ pin and of the needle bearings of the rear fork.

To carry out this operation, proceed as follows:

- ◆ Position the vehicle on the relevant centre support stand, see 1.9.4 (SETTING THE VEHICLE ON THE CENTRE STAND OPT).
- ◆ Shake the fork in the direction of travel (see figure).
  If you find any slack, adjust the rear fork, see 2.30.1 (ADJUSTING THE REAR FORK).
  If the slack persists, adjust the bearings, see 7.9.2 (DISASSEMBLING THE REAR FORK).



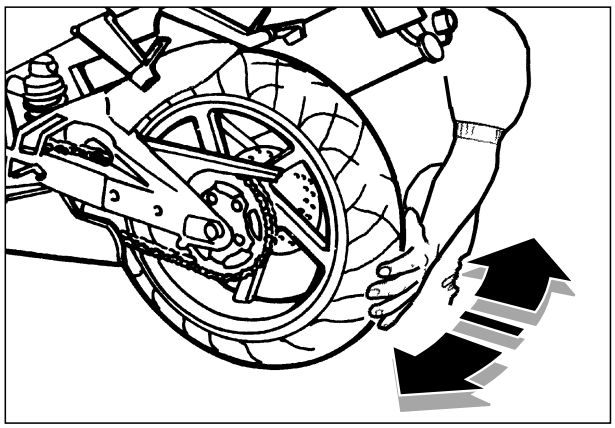
2.30.1 ADJUSTING THE REAR FORK

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Position the vehicle on the relevant centre support stand, see 1.9.4 (SETTING THE VEHICLE ON THE CENTRE SUPPORT STAND OPT).
- ◆ Loosen the nut (1) completely.

NOTE Have the special tool OPT to hand cod. 8140203 (socket spanner for adjusting fork pin – engine mounts).

- ◆ Use the special setscrew spanner to loosen the lock ring (2) completely.
- ◆ Working from the right-hand side of the vehicle, rotate the fork pin (3) clockwise, which will cause the bush (4) to rotate with it, in turn pushing the fork to its stop.



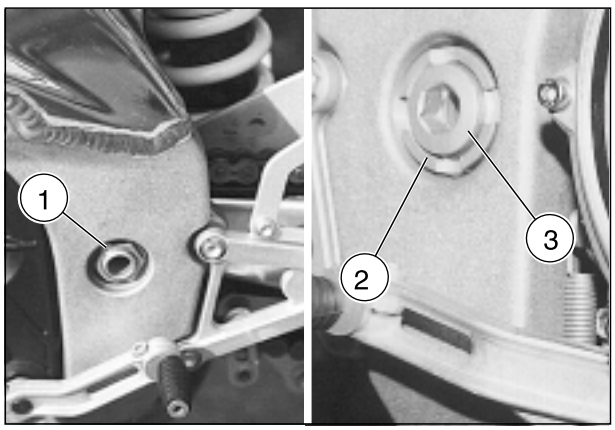
Driving torque to be applied on the pin (3): 12 Nm (1.2 kgm).

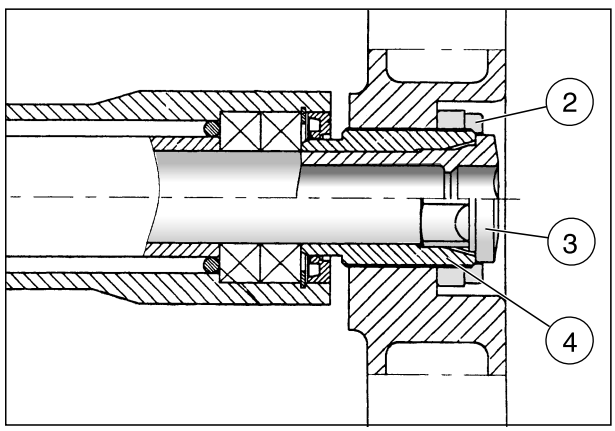
- ◆ Use the special setscrew spanner to tighten the lock ring (2).

Driving torque of lock ring (2): 60 Nm (6.0 kgm).

- ◆ Tighten the nut (1).

Driving torque of nut (1): 90 Nm (9.0 kgm).





2.31 INSPECTING THE REAR SUSPENSION

2.31.1 REAR SUSPENSION

The rear suspension consists of a spring-shock absorber unit, fixed to the frame by means of a uni-ball and to the rear fork by means of lever systems.

For the setting of the vehicle attitude, the shock absorber is provided with a screw adjuster (1) for the adjustment of the hydraulic braking with extended shock absorber; a knob adjuster (2) for the adjustment of the hydraulic braking with compressed shock absorber; a ring nut for the adjustment of the spring preload (3) and a locking ring nut (4).
The riding position of the vehicle can be further altered by varying the height of the rear axle by adjusting the lock nut (5) and adjuster nut (6).

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

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

- Check all the rear suspension joints are working properly and that the relevant components are properly tightened.

2.31.2 ADJUSTING THE REAR SHOCK ABSORBER

The standard setting of the rear shock absorber is such as to satisfy most driving conditions at low and high speed, either with reduced load and full load.
However, it is also possible to adjust the setting according to the intended use of the vehicle.

⚠ CAUTION

For the adjustment, always start from the most rigid setting; screw adjuster (1) and knob adjuster (2) completely rotated clockwise.
Do not rotate the screw adjuster (1) beyond its limit position, to avoid damaging the thread.
Make sure that the screw adjuster (1) always snaps and is not in any intermediate position.

- Slightly unscrew the locking ring nut (4) by means of the appropriate spanner.
- Act on the adjusting ring nut (3) (shock absorber spring preload adjustment) (see figure).
- After the adjustment, tighten the metal ring (4).
- Adjust the hydraulic braking with extended shock absorber by means of the screw (1) (see table).
- Adjust the knob (2) to adjust the hydraulic braking with compressed shock absorber (see table).

To vary the attitude of the vehicle, proceed as follows:

- Moderately loosen the lock nut (5).

NOTE Rotate the adjuster (6) by giving it one turn at a time, so that the adjusting screw (1) is always on the left side of the vehicle.

- Act on the adjuster (6) (see table).

⚠ CAUTION

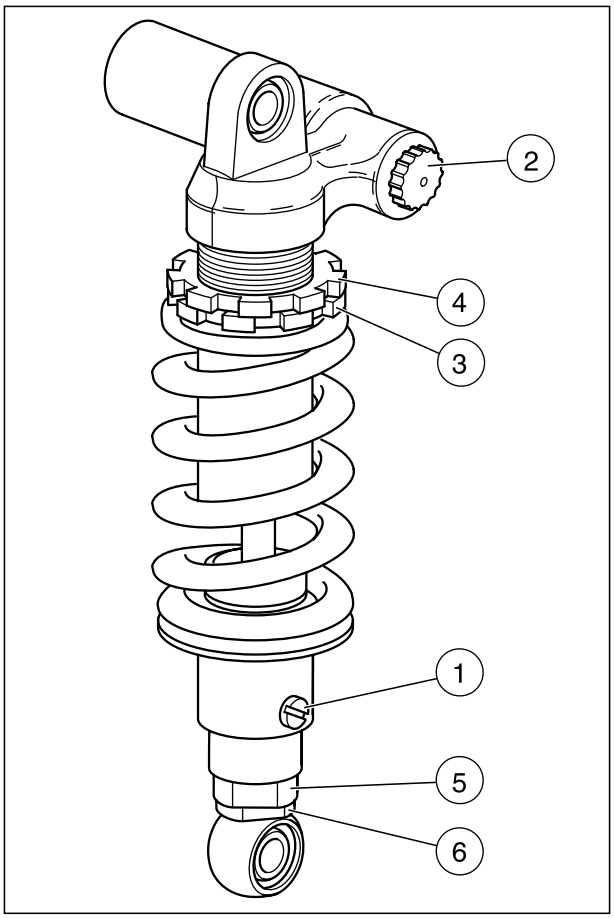
The lock nut (5) must be tightened with the indicated driving torque.

- After the adjustment, tighten the lock nut (5).

Lock nut (5) driving torque: 40 Nm (4.0 kgm)

⚠ CAUTION

Adjust the spring preload and the hydraulic braking with extended shock absorber according to the conditions of use of the vehicle.
When the spring preload is increased, it is necessary to increase also the hydraulic braking with extended shock absorber, in order to avoid sudden jerks while riding.



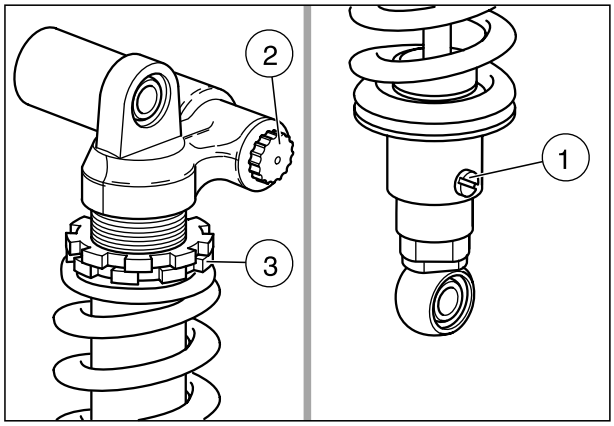
⚠ CAUTION

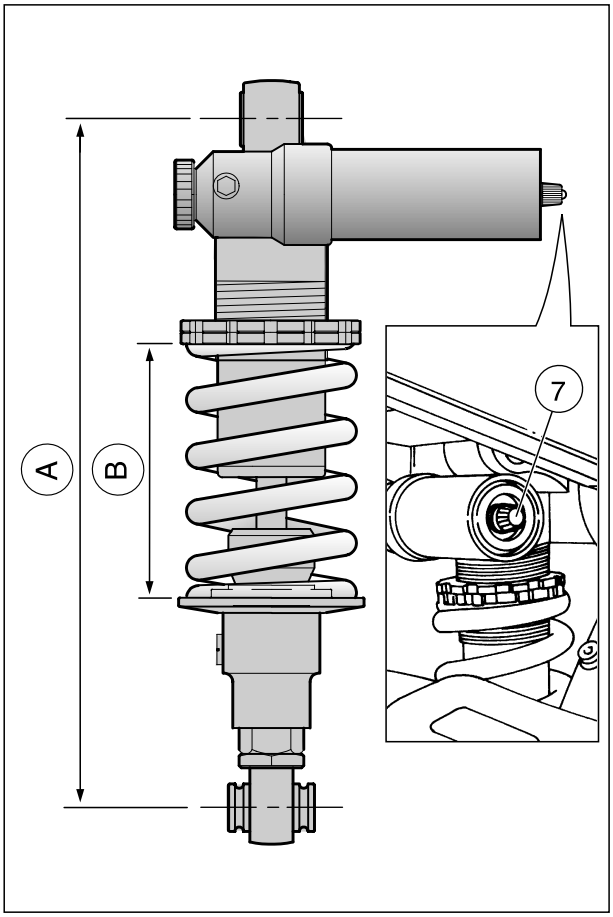
Adjust the spring preload and the hydraulic braking with extended shock absorber according to the conditions of use of the vehicle.

When the spring preload is increased, it is necessary to increase also the hydraulic braking with extended shock absorber, in order to avoid sudden jerks while riding.

Turn the screw adjuster (1) 2-3 clicks at a time, the knob adjuster (2) 5-6 clicks at a time and the adjusting ring nut (3) one turn at a time.
Test the vehicle repeatedly on the road, until obtaining the optimal adjustment.

To avoid affecting the operation of the shock absorber, neither remove the plug (7), nor adjust the underlying valve, since this may cause nitrogen to flow out, with consequent risk of accidents.





Rear suspension	Standard adjustment	Adjustment for racetrack use	Possible adjustments
Shock absorber distance between centers (A)	322 ± 1 mm	322 ± 1 mm	from 320 to 327 mm
Spring length (preloaded) (B)	130 mm	128 mm	from 128 to 132 mm
Adjustment with extended shock absorber, screw (1)	from completely closed (*), open giving 14 clicks (**)	from completely closed (*), open giving 7-9 clicks (**)	completely open: 25 clicks
Adjustment with compressed shock absorber, knob (2)	from completely closed (*), open giving 45 clicks (**)	from completely closed (*), open giving 20-30 clicks (**)	completely open: 45 clicks

(*) = clockwise
(**) = anticlockwise

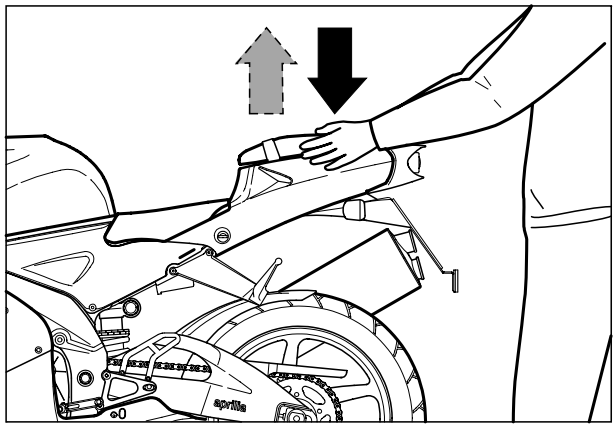
2.31.3 CHECKING THE REAR SUSPENSION LINKAGE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check the conditions of the bearings every 30000 km (18750 mi).

NOTE Have someone help you keep the vehicle upright during this operation.

- Grip the rear part of the vehicle firmly (see figure), press down and release a few times.
- If the movement is not smooth and is accompanied by squeaks and/or if you notice any slack, change the bearings of the rear suspension linkage, see 7.10.2 (DISASSEMBLING THE REAR SUSPENSION LINKAGE).
- If, after you pressed the vehicle downwards, it returns to its original position very slowly, check if the rear suspension is adjusted correctly, see 2.31.2 (ADJUSTING THE REAR SHOCK ABSORBER).
- If, after the adjustment, the defect persists, this means that the shock absorber bumps through and must therefore be reloaded.

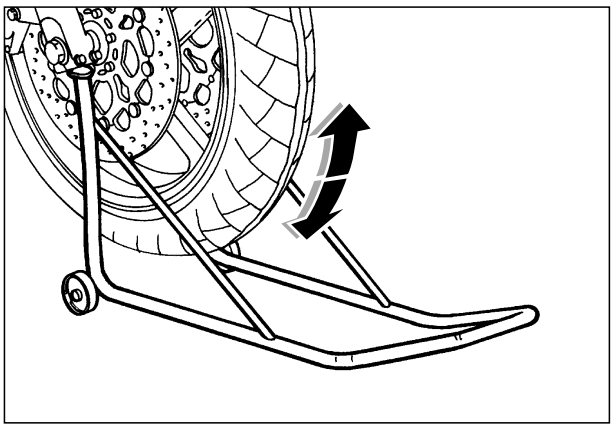


2.32 FRONT WHEEL

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check every 7500 km (4687 mi).

- Position the vehicle on the special front support stand OPT.
- Spin the wheel in either direction by hand.
- Make sure that the wheel rotation is regular and that there are no obstacles or noise, otherwise change the bearings, see 7.2.2 (DISASSEMBLING THE WHEEL).
- Should any wobbling be noticed as the wheel spins, check the relevant components, see 7.2.3 (CHECKING THE COMPONENTS).
- If, after various spins, the wheel continues to stop in the same place, the wheel needs balancing.

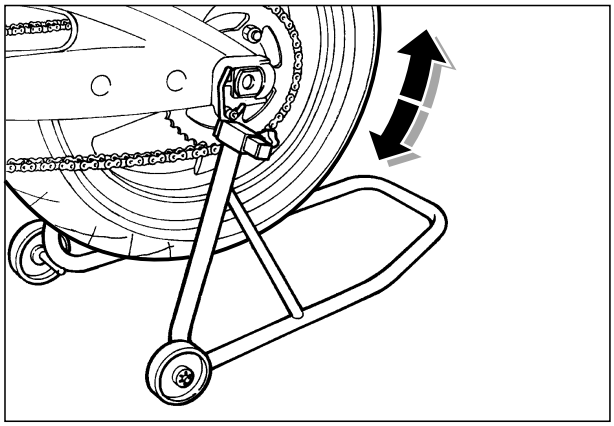


2.33 REAR WHEEL

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check every 7500 km (4687 mi).

- Position the vehicle on the special rear support stand OPT.
- Spin the wheel in either direction by hand.
- Make sure that the wheel rotation is regular and that there are no obstacles or noise, otherwise change the bearings, see 7.2.2 (DISASSEMBLING THE WHEEL).
- Should any wobbling be noticed as the wheel spins, check the relevant components, see 7.2.3 (CHECKING THE COMPONENTS).
- If, after various spins, the wheel continues to stop in the same place, the wheel needs balancing.



2.34 EXHAUST MANIFOLD NUTS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

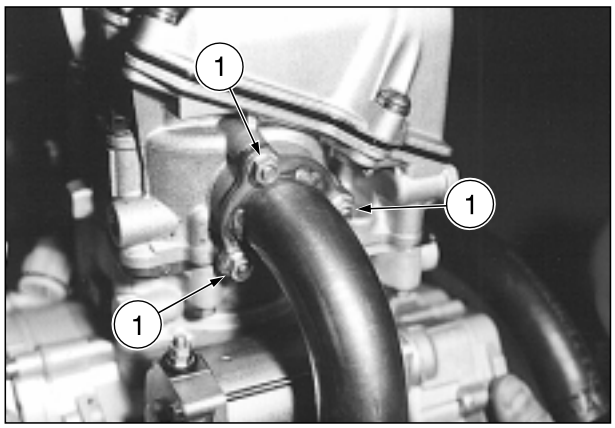
Tighten the exhaust manifold nuts after the first 1000 km (625 mi) and then every 7500 km (4687 mi) or 8 months.

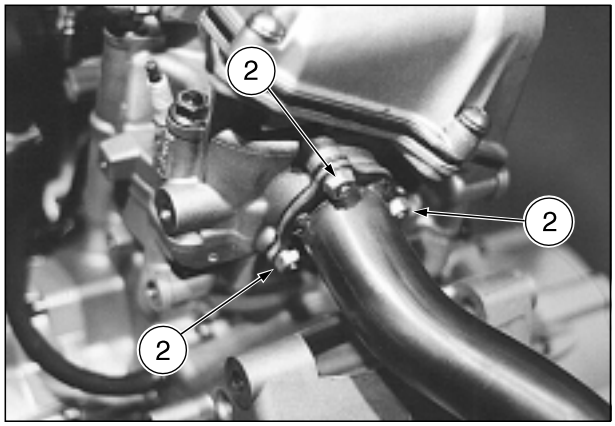
⚠ WARNING

Allow the engine to cool to room temperature.

- Remove the side fairings, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Remove the front grille, see 7.1.33 (REMOVING THE RADIATOR SPOILER).
- Torque the three nuts (1) of the front cylinder exhaust manifold to specification.
- Torque the three nuts (2) of the rear cylinder exhaust manifold to specification.

Driving torque of nuts: 25 Nm (2.5 kgm).





2.35 DRIVE CHAIN

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check and, where necessary, lubricate every 1000 km (625 mi).

The vehicle is equipped with an endless chain, in which a ring link joint is not used.

Chain type: 525

⚠ CAUTION

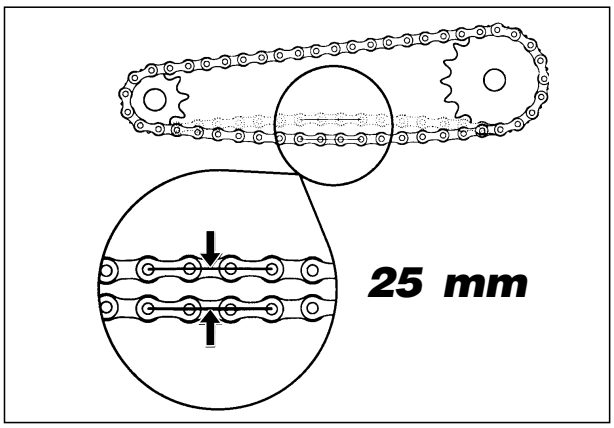
The drive chain is provided with O rings among the links, in order to keep the grease inside them.
Carry out the adjustment, lubrication, cleaning and change of the chain with great care.

- ◆ Position the vehicle on the appropriate rear support stand OPT.
- ◆ Position the shifting lever in neutral.
- ◆ Turn the rear wheel slowly by hand.
- ◆ Further, check the chain and sprockets and make sure that they do not present:

– damaged rollers;
– loose pins;
– dry, rusty, crushed or seized links;
– excessive wear;
– lacking O rings;
– sprocket or teeth excessively worn or damaged.

⚠ CAUTION

If the chain rollers are damaged, the pins are loose and/or the O rings are damaged or lacking, it is necessary to change the whole chain unit (both sprockets and chain), see 7.3.2 (DISASSEMBLING THE FINAL DRIVE UNIT).



2.35.1 CHECKING THE SLACK

To check the slack, proceed as follows:

- ◆ Position the vehicle on the appropriate rear support stand OPT.
- ◆ Position the shifting lever in neutral.
- ◆ Make sure that the vertical oscillation, in an intermediate point between pinion and crown in the lower part of the chain, is about **25 mm**.
- ◆ Move the vehicle forwards, or turn the wheel, in order to be able to check the vertical oscillation of the chain even when the wheel turns; the slack must be constant in all the rotation phases of the wheel.

⚠ CAUTION

If in some positions the slack is higher than in others, this means that there are crushed or seized links.
To prevent the risk of seizures, lubricate the chain frequently, see 2.35.4 (CLEANING AND LUBRICATION).

If the slack is uniform, but higher or lower than **25 mm**, adjust it, see 2.35.3 (ADJUSTMENT).

⚠ CAUTION

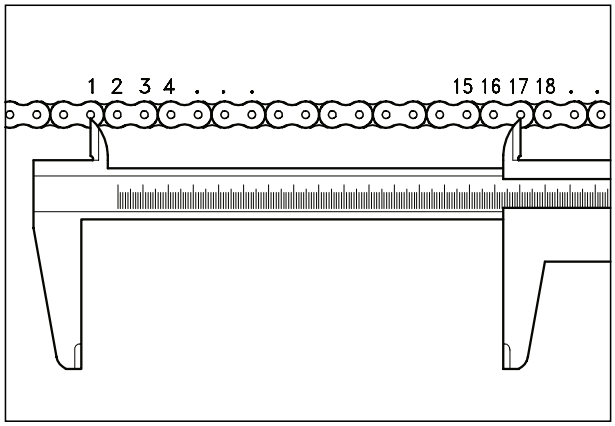
An excessive slackening of the chain may cause noise or make the chain rattle, with consequent wear of the shoe and of the chain guide plate.

Incorrect maintenance may cause the untimely wear of the chain and/or damages to the pinion and/or the crown.
Carry out the maintenance operations more frequently if you use the vehicle in difficult conditions or on dusty and/or muddy roads.

2.35.2 CHECKING THE DRIVING CHAIN, PINION AND SPROCKET WEAR

◆ To put a driving chain under tension, see 2.35.3 (ADJUSTMENT).
◆ Count 17 pins (16 steps) on a branch of the chain and measure the distance between the two end pins.
If the distance is larger than the limit indicated below, replace the chain, see 7.11 (DISASSEMBLING THE DRIVING CHAIN).

Limit of wear: 255.5 mm (MAX 0.5%).



2.35.3 ADJUSTMENT

If after the check it is necessary to adjust the chain tension, proceed as follows:

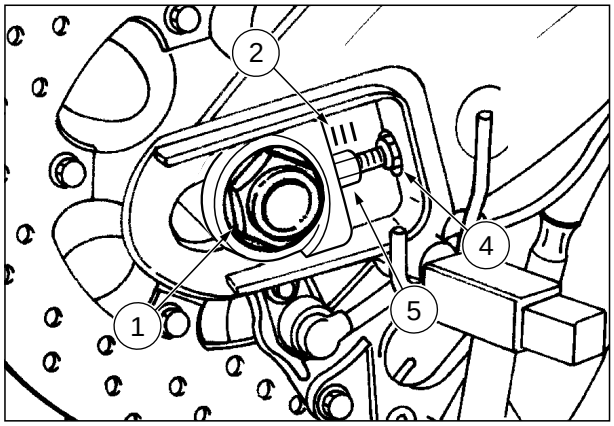
◆ Position the vehicle on the appropriate rear support stand OPT.
◆ Loosen the nut (1) completely.

NOTE For the wheel centering fixed reference marks (2-3) are provided, which can be seen inside the chain tightener seats on the rear fork arms, before the wheel pin.

◆ Loosen the two lock nuts (4).
◆ Act on the adjusters (5) and adjust the chain slack, making sure that the reference marks (2-3) are correctly positioned on both sides of the vehicle.
◆ Tighten the two lock nuts (4).
◆ Tighten the nut (1).

Wheel nut driving torque: 120 Nm (12.0 kgm).

◆ Check the chain slack, see 2.35.1 (CHECKING THE SLACK).



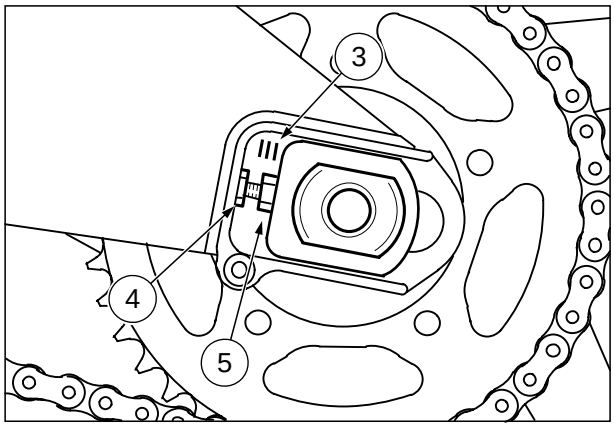
2.35.4 CLEANING AND LUBRICATION

Never wash the chain with water jets, steam jets, high-pressure water jets and highly inflammable solvents.

◆ Wash the chain with naphtha or kerosene.
If it tends to rust quickly, intensify the maintenance intervals.

⚠ CAUTION

Do not use trichloroethylene, petrol, or other similar liquids: their dissolving power may be excessive for this chain and, even more important, they are liable to damage the O-rings that hold the grease in the gaps between the rollers and the pins.



Lubricate the chain every 1000 km (625 mi) or whenever necessary.

◆ After washing the chain and letting it dry, lubricate it with spray grease for chains provided with sealing rings, see 1.6 (LUBRICANT CHART).

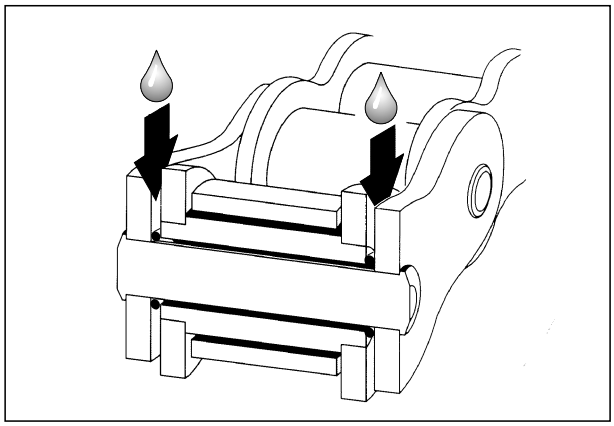
NOTE Do not use the vehicle soon after lubricating the chain, since due to the centrifugal force the lubricant would be sprayed outwards and dirty the surrounding areas.

⚠ CAUTION

Commercially available lubricants for chains may contain substances which are damaging for the chains O-rings.

The standard chain is of the type 525.

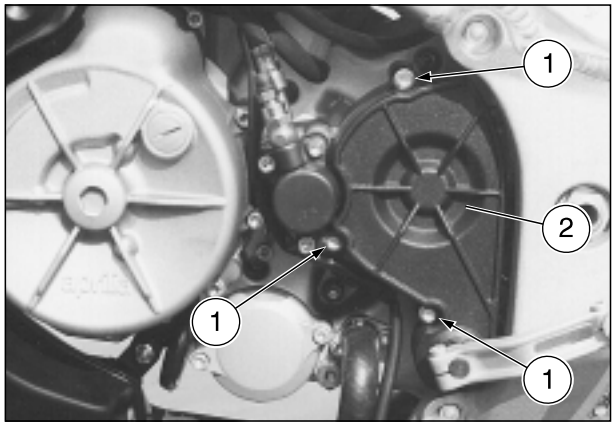
When replacing the chain, you are strongly recommended to use a chain of the exact same type.



2.35.5 INSPECTING THE DRIVING CHAIN GUIDE PLATE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

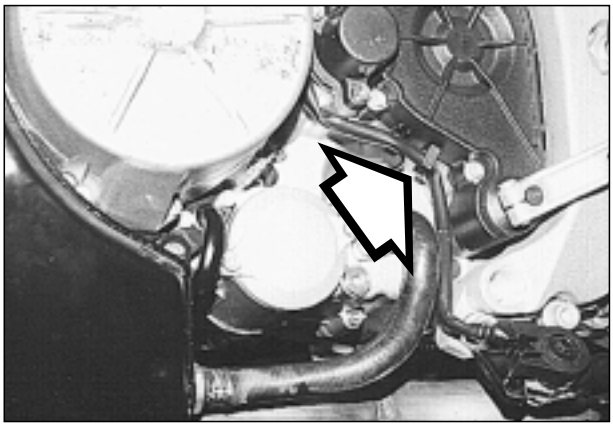
- ◆ Position the vehicle on the stand.
- ◆ Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- ◆ Remove the clutch lever, see 3.2.2 (REMOVING THE GEARSHIFT PEDAL).
- ◆ Remove the clutch control cylinder, see 3.2.3 (REMOVING THE CLUTCH CONTROL CYLINDER).
- ◆ Unscrew and remove the three screws (1).

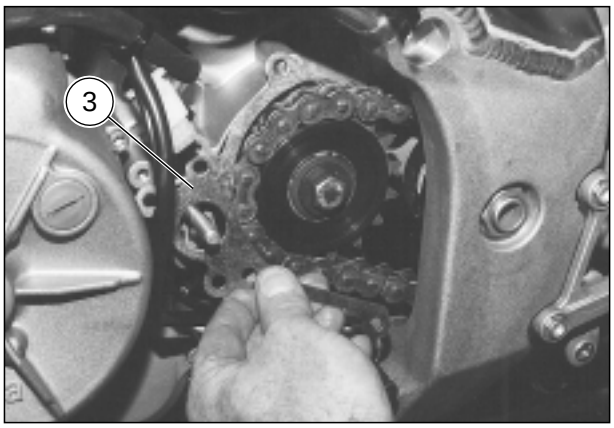


Driving torque of screws (1): 12 Nm (1.2 kgm).

NOTE Release the cable of the side stand switch from the clip.

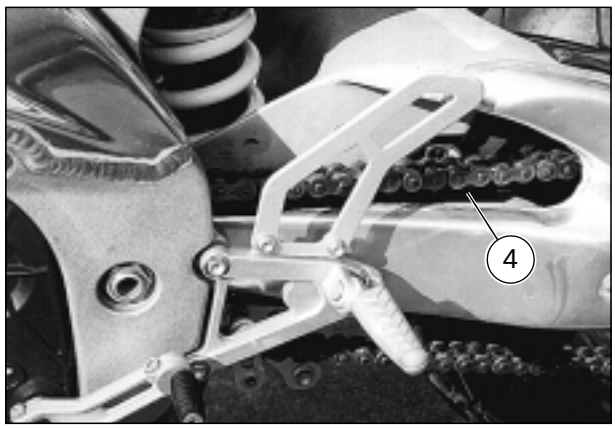
- ◆ Remove the pinion protection case (2).
- ◆ Remove the guide plate (3).
- ◆ Make sure the guide plate (3) is not worn or damaged; if so, replace with a new one.





2.35.6 INSPECTING THE DRIVING CHAIN SHOE

- ◆ Position the vehicle on the stand.
- ◆ Make sure the shoe (4) is not worn or damaged; if so, replace with a new one, see 7.1.51 (REMOVING THE DRIVING CHAIN SHOE).



2.36 TYRES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check condition of tyres after the first 1000 km (625 mi) and then after every 7500 km (4687 mi) or 8 months.
The inflation pressure must be checked every month and at room temperature.

This vehicle is provided with tubeless tyres.

2.36.1 CONDITION OF TREAD

⚠ CAUTION

Check the surface and the wear of the tyres, since tyres in bad conditions can impair both the grip and the controllability of the vehicle.
Change the tyre when it is worn out or in case of puncture on the tread side, if the puncture is larger than 5 mm.

Some types of tyres homologated for this vehicle are provided with wear indicators.
There are several kinds of wear indicators.
For more information on how to check the wear, contact your Dealer.

Do not install tyres with air tube on rims for tubeless tyres and viceversa.

Make sure that the inflation valves (1) always have their sealing caps on, to prevent the tyres from suddenly going flat.

Change, repair, maintenance and balancing operations are very important and therefore they must be performed by qualified technicians with appropriate tools.

MINIMUM TREAD DEPTH LIMIT (A):

front and rear ..... 2 mm (USA 3 mm).

2.36.2 INFLATION PRESSURE

⚠ CAUTION

Periodically check the tyre inflation pressure at room temperature.
If the tyres are hot, the measurement is not correct.
Carry out the measurement especially before and after long rides.
If the inflation pressure is too high, the ground unevenness cannot be dampened and is therefore transmitted to the handlebar, thus compromising the driving comfort and reducing the road holding during turns.
If, on the contrary, the inflation pressure is too low, the tyre sides (2) are under greater stress and the tyre itself may slip on the rim or it may become loose, with consequent loss of control of the vehicle.
In case of sudden braking the tyres could even come off the rims.

Further, the vehicle could skid while turning.

Inflation pressure

Front: ..... 220 kPa (2.2 bar)
[at full load 240±10 kPa (2.4 ±0,1 bar)]

Rear: ..... 250 kPa (2.5 bar)
[at full load 270±10 kPa (2.7±0,1 bar)]

⚠ CAUTION

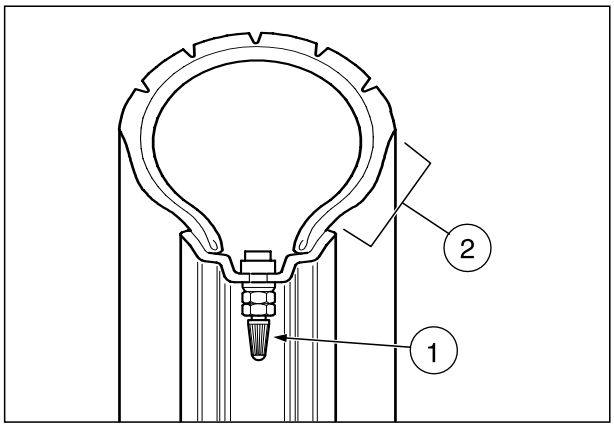
After repairing a tyre, have the wheels balanced.

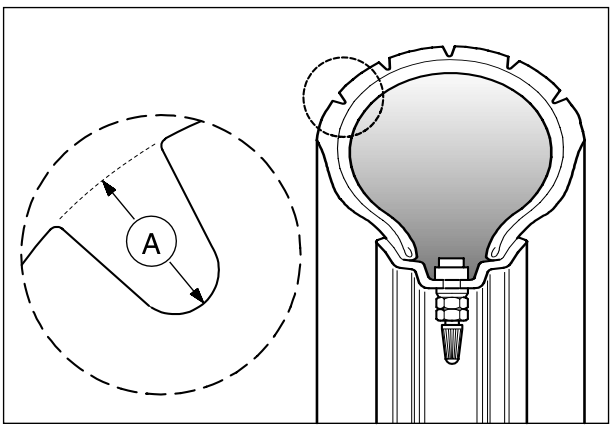
If the tyres are new, they may still be covered with a slippery film: drive carefully for the first miles.
Do not oil the tyres with unsuitable fluids.

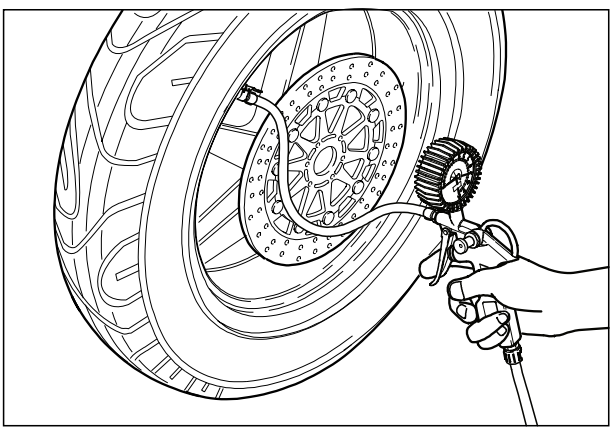
⚠ CAUTION

The size of the tyres is indicated in the log-book and any dissimilarity is punishable by law.
Using tyres with different dimensions may cause the instability of the vehicle, endangering its driving safety and manoeuvrability.
Use only tyres recommended by aprilia, see 1.5 (TECHNICAL SPECIFICATIONS).

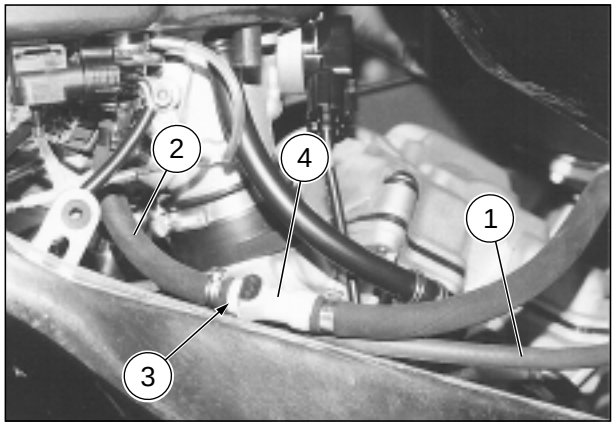
For further information, see 7.4 (TYRES).







2.37 FUEL PIPES



Carefully read 1.2.1 (FUEL).

Check the fuel pipes every 7500 km (4687 mi) or 8 months.
Replace every four years.

If you should encounter signs of wear, cracking, etc., replace the fuel pipes.

– High-pressure delivery pipe [~ 450 kpa (4.5 bar)].
– Return pipe (2).

NOTE Make sure the male quick-release coupling (3) is properly inserted in the receptacle (4).

For further details see section 4 (FUEL SYSTEM).

2.38 BRAKE AND CLUTCH PIPES

Carefully read 1.2.4 (BRAKE FLUID) and 1.2.6 (CLUTCH FLUID).

Check the pipes every 7500 km (4687 mi) or 8 months.
Replace every four years.

If you should encounter signs of wear, cracking, etc., replace the pipes.

2.39 COOLING SYSTEM PIPES

Carefully read 1.2.5 (COOLANT).

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

If you should encounter signs of wear, cracking, etc., replace the cooling system pipes.

2.40 TIGHTENING NUTS AND SCREWS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

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

Check all the fastening elements carefully, especially all those components essential for safety, i.e.:

– right/left handlebar;
– front brake lever;
– clutch lever;
– fuel delivery pipe;
– front fork to plates;
– front fork / wheel pin clamps;
– front wheel;
– front brake pipe fittings;
– front brake discs;
– front brake calipers;
– engine;
– pinion;
– rear brake lever;
– rear fork;
– rear fork leverage;
– rear shock absorber;
– rear wheel;
– rear brake disc;
– rear brake caliper;
– rear brake pipe fittings.

⚠ CAUTION

The fastening elements must be torqued to specification and LOCTITE® applied, where indicated, see 2.41 (FASTENING ELEMENTS).

2.41 FASTENING ELEMENTS

Check, and where necessary, tighten after the first 1000 km (625 mi) and then every 7500 km (4687 mi) or 8 months.

⚠ CAUTION

The fastening elements featured in the table must be torqued to specification using a torque spanner and LOCTITE® applied, where indicated.
The elements marked ( ) are particularly important for safety.

ENGINE					
Fastening of engine to frame					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Front connection	2+2	M10	40	4.0	
Left-side upper and lower rear connection	2	M10	50	5.0	
Adjusting bush right-side upper and lower rear connection	2	M20x1.5	12	1.2	
Lock ring right-side upper and lower rear connection	2	M20x1.5	50	5.0	
Screw right-side upper and lower rear connection	2	M10	50	5.0	

Elements fastened to the engine					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Engine oil inlet flange	2	M6	12	1.2	
Engine oil drain plug	2	M6	12	1.2	
Rear brake lever mount fastening	1	M6	10	1.0	
	1	M8	17	1.7	
Rear brake pump mount fastening	2	M8	17	1.7	
Pinion fastening	1	M10	50	5.0	L243
Clutch control cylinder fastening	3	M6	12	1.2	
Pinion case fastening	3	M6	6	0.6	
Fastening of fuel delivery pipe to throttle body	1	M12x1.5	22	2.2	
Coolant drain screw	1	M6	10	1.0	
Coolant thermistors	2	M14	30	3.0	

Carter					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Grooved ball bearings for selector roller / MS casing	1	Screw T.P. M6 x 13	11	1.1	L243
Grooved ball bearings for selector roller / KS casing	1	Screw T.P. M6 x 13	11	1.1	L243
Grooved ball bearings for propeller shaft / KS casing	2	Screw T.P. M6 x 13	11	1.1	L243
Coolant pump idler gear / KS casing	1	Pin 10	–	–	L648
MS casing / KS casing	13	Screw T.C.E.I. M6 x 65	11	1.1	
MS casing / KS casing	1	Screw T.C.E.I. M6 x 80	11	1.1	
MS casing / KS casing	5	Screw T.C.E.I. M6 x 45	11	1.1	
MS casing / KS casing	1	Screw T.C.E.I. M6 x 25	11	1.1	
Casing	1	Magnetic screw M12 x 1.5	20	2.0	
Casing	1	Contact screw M10	4	0.4	L574
Oil filter cover	2	Screw T.C.E.I. M6 x 20	11	1.1	
Casing / injector 75	1	Screw T.C.E.I. M6 x 10	6	0.6	
Bearing flange KS / MS	2	Screw T.E. M8 x 45	25	2.5	
Bearing flange KS	2	Screw T.E. M8 x 25	25	2.5	
Bearing flange MS	1	Screw T.C.E.I. M8 x 20	25	2.5	
Bearing flange MS	1	Screw T.C.E.I. M6 x 20	11	1.1	L243

FOLLOW ❱

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Driving shaft, countershaft, gearshift					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Positioning lever / positioner disc	2	Screw T.C.E.I. M6 x 20	11	1.1	L243
Differential shaft under KS	1	Nut M22 x 1.5	150	15.0	
KS driving shaft	1	Nut M33 x 1.5	230	23.0	L243
Countershaft under MS	1	Screw T.C.E.I. M10 x 20	50	5.0	L648

Oil pump					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Oil pump	1	Without head screw with double diameter M12 x 1.5	-	-	L648 Calking
Oil pump casing	1	-	-	-	Upper and lower surfaces: L574
Oil pump lid	4	Screw T.C.E.I. M6 x 45	11	1.1	

Clutch					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Secondary KS shaft	1	Nut M24 x 1.5	170	17.0	L648
Clutch spring	6	Screw T.E. M6 x 25	11	1.1	
Disengagement rod	1	Locking nutM12	30	3.0	
Complete diaphragm ring	8	Screw T.C.E.I. M5 x 20	5	0.5	
Clutch gear / clutch housing	3	Screw T.E. M8 x 16	30	3.0	L648

Head, cylinders					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Camshaft support / head “1” (front)	8	Screw T.C.E.I. M6 x 30	11	1.1	
Head “1” (front)	2	Exhaust pipe M18 x 1.5	Manual tightening		L243
Head “2” (rear)	1	Exhaust pipe M18 x 1.5	Manual tightening		L243
Camshaft support / head “2” (rear)	4	Screw T.C.E.I. M6 x 30	11	1.1	
Camshaft support / head “2” (rear)	2	Screw T.C.E.I. M6 x 45	11	1.1	
Camshaft support / head “2” (rear)	2	Screw T.C.E.I. M6 x 55	11	1.1	
Head “2” (rear)	1	Plug screw M18 x 1.5	Manual tightening		L243
Head / exhaust	6	Stud bolt M8 x 16/20	10	1.0	L648
Head “2” (rear)	1	Angular union	-	-	L574
Head / case	8	Stud bolt M10 x 171	10	1.0	L243
Cylinder / head	8	T.E. screws with shoulder M8 x 45	Not varnished cylinder version 28-30 Nm (2.9-3.0 Kgm) Varnished cylinder version 25-28 Nm (2.5-2.8 Kgm)		
Head / stud bolt	8	Nut M10	Not varnished head version 58 Nm (5.8 Kgm) Varnished head version 50-55 Nm (5.0-5.5 Kgm) Varnished head version (with nut on outer side) 58 Nm (5.8 Kgm)		
Head / chain compartment	4	Screw T.C.E.I. M6 x 100	12	1.2	
Head “2” (rear) / bearing flange	2	Screw T.E. M6 x 35	11	1.1	
Head “2” (rear) / bearing flange	2	Screw T.E. M6 x 20	11	1.1	

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Description	Q.ty	Screw / nut	Nm	kgm	Note
Head “2” (rear) / differential transmission - exhaust camshaft	3	Screw T.E. M6 x 14	11	1.1	L243
Drive gear / induction camshaft	6	Screw T.C.E.I. M6 x 11.5	11	1.1	L243
Head “1” (front) / gear - exhaust camshaft	3	Screw T.C.E.I. M6 x 11.5	11	1.1	L243
Head “2” (rear) /differential transmission upper side	1	Nut M14 x 1	50	5.0	L243
Valve cover	10	Spacer screw M6 x 23	9	0.9	
Head “1” (front) / chain guide shoe	2	Spacer screw M6 x 16	11	1.1	
Head	4	Spark plug	18	1.8	
Induction flange	4	Screw T.C.E.I. M8 x 25	19	1.9	
Cylinder / chain tightener	2	Plug screw M16 x 1.5	30	3.0	
Head “1” (front)	1	Coolant temperature thermistor	20	2.0	
Head “2” (rear)	1	Coolant temperature thermistor	20	2.0	
Cylinder bracket support shoe	2	Screw T.C.E.I. M10 x 40	40	4.0	
Cylinder bracket support shoe	2	Nut M10	40	4.0	L243

Ignition system, starter motor

Description	Q.ty	Screw / nut	Nm	kgm	Note
Driving shaft position sensor / flywheel cover	2	Taptite screw M6 x 16	11	1.1	
Flywheel cover / generator	3	Screw T.C.E.I M6 x 40	11	1.1	L243
Magnetic gear - unidirectional case	–	–	–	–	L648
Free wheel flange	3	Screw T.C.E.I M8 x 16	30	3.0	L648
Magnetic gear cone	–	–	–	–	L648
Ignition / driving shaft	1	Screw T.C.E.I M16 x 30	130	13.0	L648
Ignition device cover / MS casing	12	Screw T.C.E.I M6 x 35	11	1.1	
Ignition device cover	1	Plug screw M24 x 1.5	3	0.3	
Camshaft position sensor / head “1” (front)	2	Taptite screw M5 x 12	4	0.4	L243
Starter motor	2	Screw T.C.E.I M6 x 30	11	1.1	

Clutch cover, coolant pump

Description	Q.ty	Screw / nut	Nm	kgm	Note
Coolant pump	1	Impeller	Manual tightening		
Clutch cover	1	Oil pressure switch M10 x 1	15	1.5	L243
Coolant pump casing	1	Screw T.C.E.I M6 x 25	11	1.1	
Coolant pump casing	3	Screw T.C.E.I M6 x 55	11	1.1	L243 only for left central screw
Clutch cover	11	Screw T.C.E.I M6 x 35	11	1.1	
Clutch cover	3	Screw T.C.E.I M8 x 40	19	1.9	
Clutch cover	1	Screw T.C.E.I M8 x 65	19	1.9	

REAR FORK

Description	Q.ty	Screw / nut	Nm	kgm	Note
Fork pin metal ring	1	M30x1.5	12	1.2	
Fork pin lock ring	1	M30x1.5	60	6.0	
Fork pin nut	1	M20x1.5	90	9.0	
Caliper mount locking pin	1	M12	50	5.0	L243
Chain tightener screw and nut	1+1	M8	man.		
Brake pipe grommet fastening	2	M5	4	0.4	
Chain case fastening	2	M5	4	0.4	
Chain tightener shoe fastening	2	M5	2	0.2	
Rear mudguard fastening	2+2	M5	3	0.3	

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SIDE STAND					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of stand plate to frame	2	M10	40	4.0	
Stand fastening pin	1	M10x1.25	10	1.0	
Switch fastening screw	1	M6	10	1.0	
Lock nut	1	M10x1.25	25	2.5	

FRONT SUSPENSION					
Front fork					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of upper plate on fork tubes	1+1	M8	25	2.5	
Fastening of upper plate on fork tubes	2+2	M8	25	2.5	
Steering head metal ring	1	M35x1	40	4.0	
Steering head lock ring	1	M35x1	man. +90°		
Upper plate fastening bush	1	M29x1	80	8.0	
Lower plate travel-end bush fastening screw	1+1	M8	22	2.2	
Closing of fork / wheel pin clamps	2-2	M8	22	2.2	

Steering shock absorbers					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of shock absorber collar on dashboard/front fairing mount	1	M6	12	1.2	
Tube end lock nut	1	M8	12	1.2	
Screw fastening collar on shock absorber	1	M5	5	0.5	
Fastening of shock absorber tube on lower plate	1	M6	12	1.2	

REAR SUSPENSION					
Shock absorber					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of shock absorber to frame	1	M10	50	5.0	

Linkage					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of single connecting rod to frame	1	M10	50	5.0	
Fastening of single/double connecting rod to frame	1	M10	50	5.0	
Fastening of double connecting rod fork	1	M10	50	5.0	
Fastening of double connecting rod / shock absorber	1	M10	50	5.0	

ELECTRICAL SYSTEM					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of battery clamping bracket	1	M6	12	1.2	
Fastening of horn mount	1	M8x1.25	25	2.5	
Fastening of speed sensor on rear brake caliper mount	1	M6	12	1.2	
Fastening of rear indicators	2	M6	2-3	0.2-0.3	
Fastening of electronic unit protection case	3	SWP3.9	1	0.1	
Fastening of voltage regulator	2	M6	12	1.2	
Fastening of front indicators	2	M6	2-3	0.2-0.3	
Fastening of coil to mount	8	M5	5	0.5	
Fastening of rear light to rear fairing end	2	SWP3.9	1.5	0.15	
Fastening of headlight to front fairing	3	SWP3.9	1.5	0.15	
	1	M6	4	0.4	
Fastening of relay box to dashboard/front fairing mount	2	M6	4	0.4	
Fastening of fuse box to dashboard/front fairing mount	2	M6	3	0.3	
Fastening of earth to frame	1	M6	12	1.2	

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AIR FILTER CASING					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of air filter casing cover	7	M5	4	0.4	
Fastening of air filter casing to throttle body	6	M6	8	0.8	
Fastening of intake conveyors	4	SWP3.9	1	0.1	
Fastening of air sensor support plate	1	SWP3.9	1.5	0.15	

FRONT WHEEL					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Wheel pin nut	1	M25x1.5	80	8.0	

REAR WHEEL					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of sprocket on sprocket holder	5	M10	50	5.0	
Wheel pin nut	1	M25x1.5	120	12.0	

COOLING SYSTEM					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Thermal switch on 3-way manifold	1	M14x1.5	30	3.0	L572
Fastening of electrofan mount	2+2	M6	6	0.6	
Fastening of electrofan motor to mount	3+3	M4	2	0.2	L243
Radiator coolant drain screws	1+1	M6	10	1.0	L572
Fastening of expansion tank to coils mount	2	M6	10	1.0	
Fastening of expansion tank cap	1	M28x3	man.		
Fastening of coolant filler neck	1	M6	10	1.0	

BRAKING SYSTEMS					
Front system					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of right and left brake caliper	2+2	M10x1.25	50	5.0	
Fastening of brake fluid tank	1	M6	5	0.5	
Fastening of brake fluid tank bracket	1	M6	12	1.2	
Fastening of brake discs	6+6	M8	30	3.0	L243
Fastening of front brake pipe	1	M10x1	20	2.0	
Brake fluid bleeder	3	M10x1	10	1.0	

Rear system					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Brake caliper fastening	2	M8	25	2.5	
Brake lever pin	1	M8	15	1.5	L243
Fastening of brake fluid tank	1	M5	1	0.1	
Brake pump fastening	2	M6	12	1.2	
Brake rod lock nut	1	M6	man.		
Brake disc fastening	5	M8	30	3.0	L243
Brake pipe fastening	1	M10x1	20	2.0	

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CLUTCH CONTROL					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of clutch fluid pipe	1	M10x1	20	2.0	
Fastening of fluid tank bracket	1	M6	12	1.2	
Fastening of clutch fluid tank on mount	1	M5	3	0.3	
Clutch fluid bleeder	1	M10x1	10	1.0	

EXHAUST SYSTEM					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of exhaust pipes to engine	3+3	M8	25	2.5	
Exhaust silencer fastening	1	M8	25	2.5	

FUEL TANK					
Fuel pump flange					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fuel return fitting	1	M6	6	0.6	L243
Fastening of pump mount to flange	3	M5	4	0.4	
Fastening of electric terminals on flange	2	M5	5	0.5	
Closing of fuel return	1	M6	10	1.0	L243
Fastening of fuel delivery pipe on flange	1	M12x1.5	22	2.2	
Petrol level sensor on pump mount	2	SWP 2.9x12	1.5	0.15	
Fastening of fuel pump cables on flange	2	M6	10	1.0	

Tank					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of cap on tank	3	M5	5	0.5	
Fastening of fuel pump flange on tank	8	M5	7	0.7	
Fastening of tank front on frame	2	M6	12	1.2	
Fastening of tank rear on mount	1	M6	12	1.2	

ENGINE OIL TANK AND RADIATOR					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Tank upper fastening screw	1	M6	10	1.0	
Tank fastening nuts	2	M6	10	1.0	
Oil filter	1	M20x1.5	30	3.0	
Oil drain plug	1	M8	15	1.5	
Oil level pipe fittings	2	M10x1	20	2.0	
Radiator fastening screws	3	M6	12	1.2	

FOLLOW ❱

FOLLOW ❱

FRAME / FAIRINGS					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Radiator spoiler fastening	3	M6	5	0.5	
Fastening of number plate holder to rear mudguard extension	2	M5	2	0.2	
Fastening of reflector holder to number plate holder	2	M5	6	0.6	
Front mudguard fastening	4	M5	5	0.5	
Rearview mirror fastening screws	1+1	M6	8	0.8	
Fastening of rearview mirror mounts and front fairing to mount	4	M6	5	0.5	
Lower fastening of front fairing to conveyors	2	M5	4	0.4	
Lower fastening of front fairing (on upper part)	2	M5	4	0.4	
Fastening of conveyor covers	14	SWP 3.9	2	0.2	
Fastening of conveyors to frame and mount	6	M6	5	0.5	
Fastening of side fairing upper panel	2+2	M5	front 1 rear 2	0.1 0.2	
Fastening of dashboards upper protection moulding	4	M5	2	0.2	
Fastening of lower fairing to frame	4	M6	5	0.5	
Fastening of silencer protection to lower fairing	2	M6	5	0.5	
Fastening of sides	4	M6	5	0.5	
Fastening of saddle support bush and lower moulded cover	2	M6	5	0.5	
Fastening of saddle support lower moulded cover	4	M6	4	0.4	
Fastening of rear fairing to saddle support lower moulded cover	6	M5	2	0.2	
Fastening of rear fairing end to rear fairing	2+2	M5	upper 5 lower 3	0.5 0.3	
Fastening of rear fairing / passenger grab strap	2	M6	12	1.2	
Fastening of internal fairing and side fairing	8	SWP 2.9	1	0.1	
Fastening of dashboard to mount	3	M6	5	0.5	
Fastening of riders's saddle	2	M6	12	1.2	
Fastening of riders's saddle front mount	4	M6	12	1.2	
Fastening of passenger seat lock	2	M6	10	1.0	
Fastening of passenger seat lock key-operated control	2	M6	12	1.2	
Fastening of passenger footrest supports	4	M8	25	2.5	
Fastening of riders's footrest supports	4	M8	25	2.5	
Fastening of riders's footrest protection	4	M5	6	0.6	
Fastening of rear mudguard	4	M5	6	0.6	
Fastening of saddle support	4	M10	50	5.0	
Fastening of coil mounts	4	M6	12	1.2	

FOLLOW ❱

FOLLOW ❱

RIGHT/LEFT HANDLEBARS AND CONTROLS					
Description	**Q.ty**	**Screw / nut**	**Nm**	**kgm**	**Note**
Fastening of anti-vibration weights	2	M6	12	1.2	
Anti-vibration weights metal ring	2	M18x1	35	3.5	
Fastening of right/left handlebars to the fork	2	M8	25	2.5	
Handlebars lock screw	2	M6	12	1.2	
Fastening of left dimmer switch	1	M5	1.5	0.15	
Fastening of right dimmer switch	1	M4	1	0.1	
Fastening of front brake lever	2	M5	8	0.8	
Fastening of clutch lever	2	M5	8	0.8	

Notes:

L243 = fasten with LOCTITE® 243
L572 = fasten with LOCTITE® 572
L574 = fasten with LOCTITE® 574
L648 = fasten with LOCTITE® 648
man. = fasten by hand

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

ENGINE 3

ENGINE

TABLE OF CONTENTS

3.1 TECHNICAL INFORMATION

3.1.1 TECHNICAL DATA

See 1.5 (TECHNICAL SPECIFICATIONS).

3.1.2 MAINTENANCE INTERVALS

See 2.1.1 (REGULAR SERVICE INTERVALS 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 OPT).

3.1.7 DRIVING TORQUE

See 2.41 (FASTENING ELEMENTS).

3.1.8 PRECONDITIONS TO BE MET WHEN PERFORMING MAINTENANCE AND REPAIR WORK

⚠ WARNING

During the assembly phase, bear in mind the engines weight (approx. 65 kg) and centre of gravity: support accordingly.

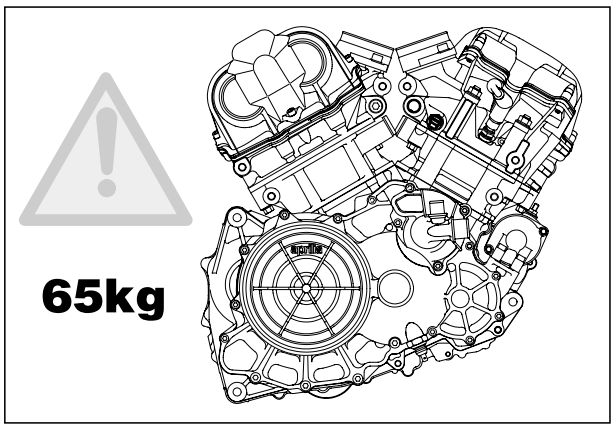
Take care around any potentially hazardous points where you might be squashed or cut.

⚠ CAUTION

The maintenance of engines and systems calls for specific experience and the use of special tools.

Any maintenance and repair work must be performed by suitably trained technical personnel only.

NOTE Comply with the instructions furnished by the manufacturer of the vehicle.



3.1.9 GENERAL INDICATIONS ON MAINTENANCE AND REPAIR WORK

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

3.2 ENGINE PARTS WHICH CAN BE DISASSEMBLED WITHOUT REMOVING THE ENGINE FROM THE FRAME

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

The parts underlined can be removed and refitted without removing the engine from the frame.

⚠ CAUTION

This chapter describes the relevant procedures progressively and in sequential order.

Any reference to operations from other chapters must be interpreted logically in order to avoid components being removed unnecessarily.

Only perform those operations necessary to remove the component in question.

TOP SIDE

– Tappet cover (1), see 3.5.3 [DISASSEMBLING CYLINDER “1” (FRONT), HEAD AND PISTON].
– Tappet cover (2), head, cylinder and rear piston, see 3.5.4 [DISASSEMBLING CYLINDER “2” (REAR), HEAD AND PISTON].
– Front (3) and rear (4) cylinder intake flange.
– Camshaft position sensor and camshafts, see 3.6.23 (HEAD AND CAMSHAFTS - DISASSEMBLY).
– Chain, chain tightener and front and rear cylinder timing drive assembly, see 3.5.6 [DISASSEMBLING CYLINDER “1” (FRONT) TIMING DRIVE ASSEMBLY] and 3.5.11 [DISASSEMBLING CYLINDER “2” (REAR) TIMING DRIVE ASSEMBLY].
– Valves, see 3.6.24 (DISASSEMBLING THE INTAKE AND EXHAUST VALVES).

FRONT SIDE

– Front cylindrical exhaust pipe, see 3.2.1 (REMOVING THE EXHAUST PIPES).
– Starter motor (5), see 3.5.2 (REMOVING THE STARTER MOTOR).

REAR SIDE

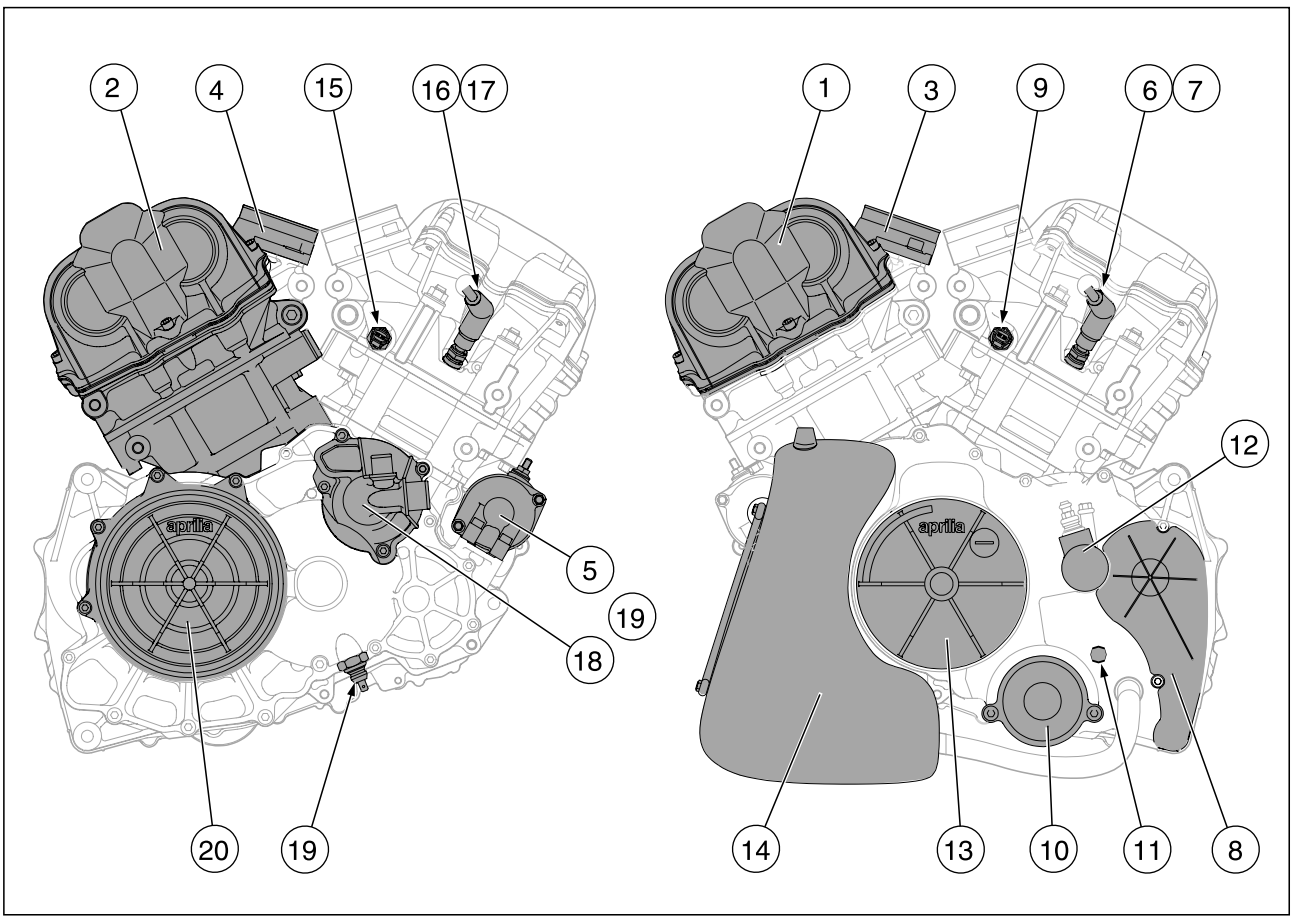
– Rear cylindrical exhaust pipe, see 3.2.1 (REMOVING THE EXHAUST PIPES).

LEFT SIDE

– Rear cylinder spark plugs (6-7), see 2.7 (SPARK PLUGS).
– Drive pinion protection case (8), see 2.35.2 (CHECKING THE DRIVING CHAIN, PINION AND SPROCKET WEAR).
– Gearshift lever, see 3.2.2 (REMOVING THE GEARSHIFT PEDAL).
– Rear cylinder coolant thermistor (9), see 5.5 (REMOVING THE COOLANT THERMISTORS).
– Engine oil filter (10), see 2.14 (CHANGING THE ENGINE OIL AND THE OIL FILTER).
– Neutral gear switch (11).
– Clutch control cylinder (12), see 3.2.3 (REMOVING THE CLUTCH CONTROL CYLINDER).
– Flywheel cover (13) and ignition system, see 3.5.5 (REMOVING THE FLYWHEEL COVER AND IGNITION SYSTEM).
– Engine oil tank (14), see 7.1.49 (REMOVING THE ENGINE OIL TANK).

RIGHT SIDE

– Front cylinder coolant thermistor (15), see 5.5 (REMOVING THE COOLANT THERMISTORS).
– Front cylinder spark plugs (16 - 17), see 2.7 (SPARK PLUGS).
– Coolant pump (18), see 3.6.21 (COOLANT PUMP).
– Engine oil pressure sensor (19).
– Clutch cover (20) and clutch assembly, see 3.5.8 (REMOVING THE CLUTCH COVER) and 3.5.9 (DISASSEMBLING THE CLUTCH).



3.2.1 REMOVING THE EXHAUST PIPES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ WARNING

Allow the engine to cool to room temperature.

- ◆ Remove the exhaust silencer, see 7.1.47 (REMOVING THE EXHAUST SILENCER).
- ◆ Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- ◆ Remove the radiator spoiler, see 7.1.33 (REMOVING THE RADIATOR SPOILER).
- ◆ Unhook the two springs (1 - 2) from the relevant hooks on the exhaust manifold (3).
- ◆ Remove the two springs (1 - 2).

⚠ CAUTION

Check the two springs (1 - 2) and, where necessary, replace them.

- ◆ Loosen and remove the three nuts (4) fastening the flange of the exhaust pipe (5) to the front cylinder.

  Driving torque of nuts (4): 25 Nm (2.5 kgm).

- ◆ Loosen and remove the three nuts (6) fastening the flange of the exhaust pipe (7) to the rear cylinder.

  Driving torque of nuts (6): 25 Nm (2.5 kgm).

⚠ CAUTION

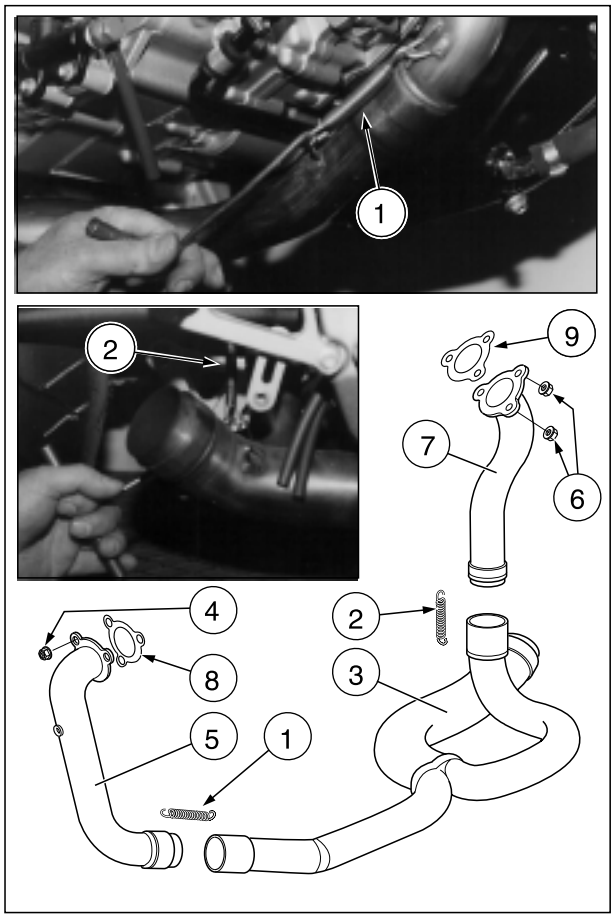
When slipping the exhaust pipes (5 - 7) off the relevant cylinders, take care not to damage the thread of the fastening stud bolts.

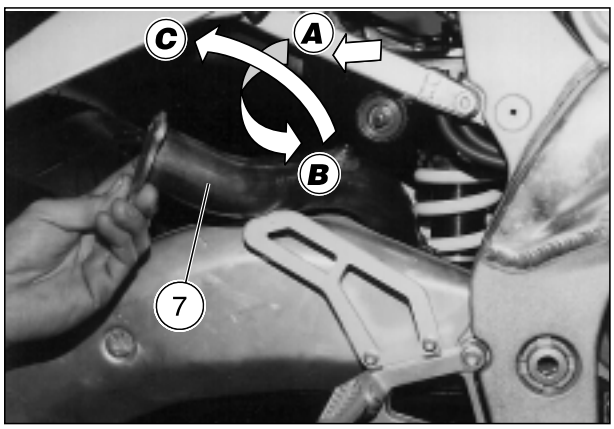
- ◆ Move the exhaust manifold (3), together with the exhaust pipe (7), back and slightly downwards until the exhaust pipes flange is released from the stud bolts on the rear cylinder.
- ◆ Twisting gradually one way and the other, lift the exhaust pipe (7) until it slides off the exhaust manifold (3).
- ◆ Turn the exhaust pipe (7) and remove it as illustrated.
- ◆ Twisting gradually one way and the other, slip the exhaust manifold (3) off the exhaust pipe (5).
- ◆ Move the exhaust pipe (5) forwards until the flange is released from the stud bolts on the front cylinder.
- ◆ Turn the exhaust pipe (5) and remove it as illustrated.

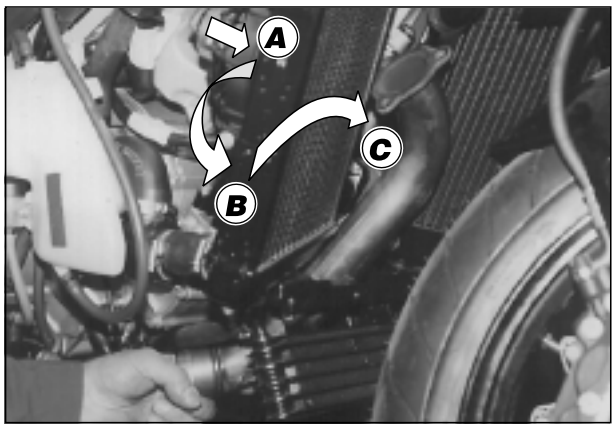
⚠ CAUTION

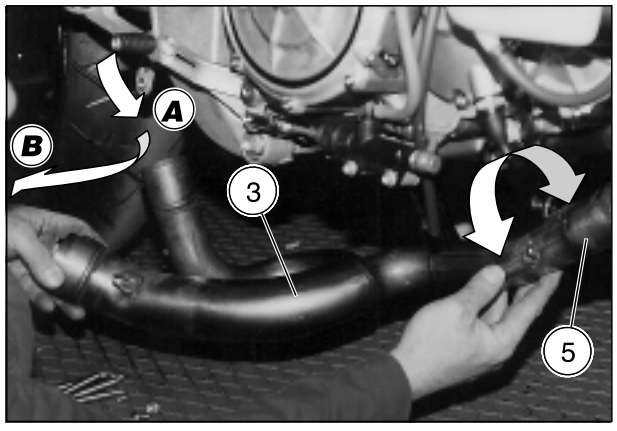
Check and, where necessary, replace the gaskets (8 - 9) with two new ones of the same type.

Plug the engines exhaust pipe openings so as to prevent any foreign bodies entering.

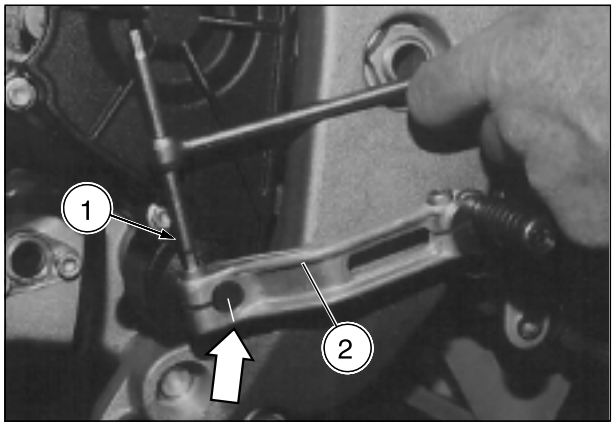








3.2.2 REMOVING THE GEARSHIFT PEDAL

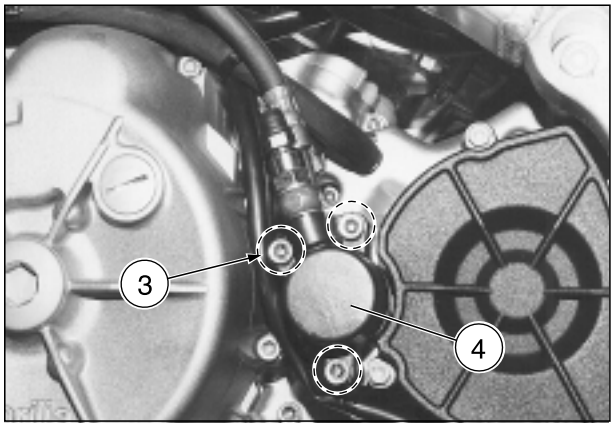


⚠ CAUTION

Before removing the gearshift pedal, mark the pedal and shaft (see figure) so that it can be refitted correctly.

- ◆ Position the vehicle on the stand.
- ◆ Loosen and remove the screw (1).
- ◆ Slide off the gearshift pedal (2).

3.2.3 REMOVING THE CLUTCH CONTROL CYLINDER

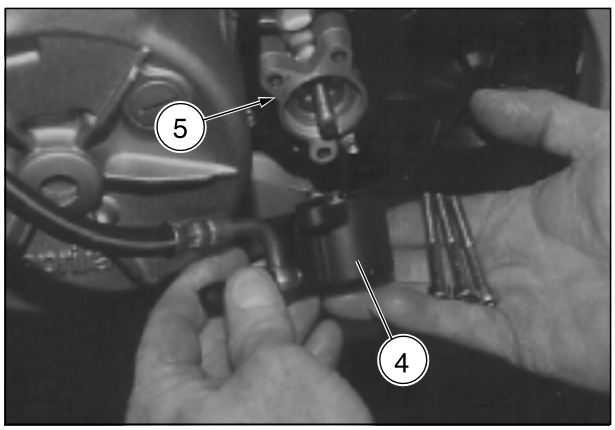


Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.6 (CLUTCH FLUID).

- ◆ Remove the left side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- ◆ Unscrew and remove the screws (3).

Driving torque of screws (3): 12 Nm (1.2 kgm).

- ◆ Slide off the cylinder (4).



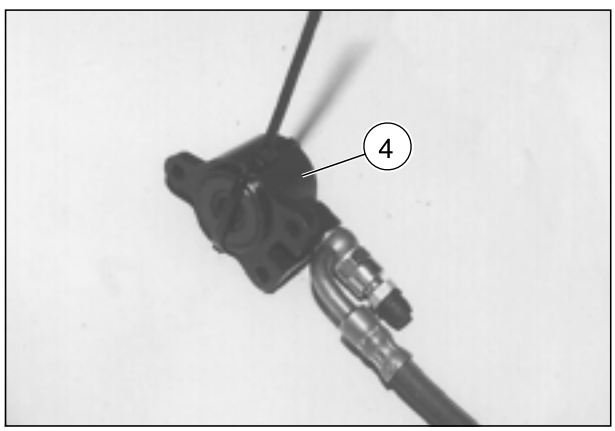
⚠ CAUTION

Perform the operations with the utmost care: the cylinder (4) remains connected to the pipe.

Once the cylinder (4) has been removed, do not pull the clutch lever as the piston is liable to come out of its slot, resulting in the spillage of clutch fluid.

For safetys sake, secure the piston, locking it in place with a plastic clamp (see figure).

- ◆ Where necessary, remove the flange (5).



3.3 REMOVING THE WHOLE ENGINE FROM THE FRAME

⚠ CAUTION

The engine must be removed by an authorized centre or by an aprilia Official Dealer only.

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

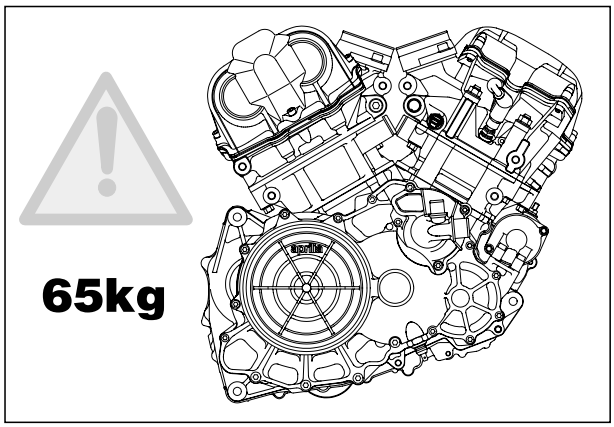
The removal of the engine is a particularly complex operation. Therefore, inspect the vehicle carefully before proceeding.

This chapter describes the relevant procedures progressively and in sequential order.
Any reference to operations from other chapters must be interpreted logically in order to avoid components being removed unnecessarily.

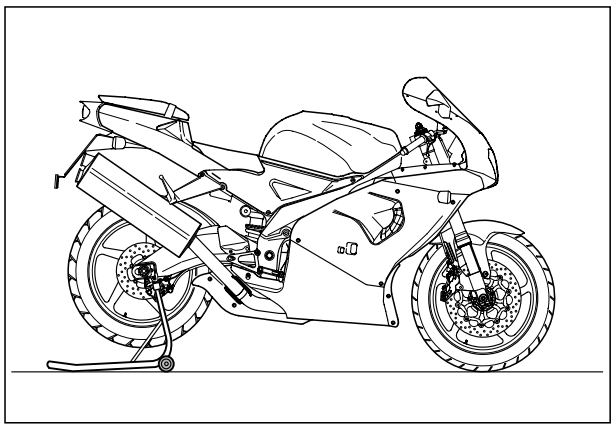
Only perform those operations necessary to remove the component in question.

Before going ahead with the following operations, bear in mind that the engine must be removed from the frame from underneath; the equipment for the job must therefore be gathered and set in place beforehand.

Dry weight of the engine ~ 65 kg.



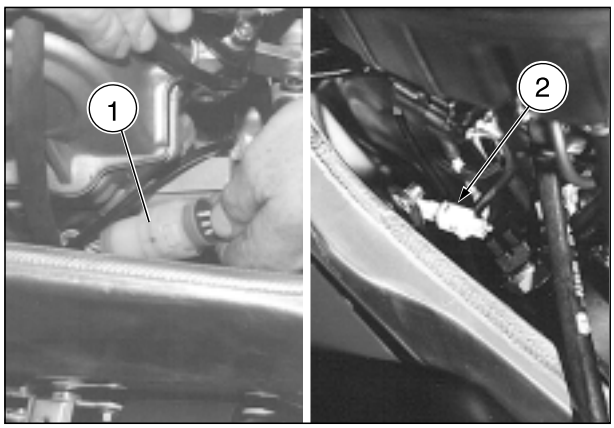
- Turn the ignition switch to position "⚿".
- Position the vehicle on the relevant rear support stands OPT.
- Disconnect the negative cable (**–**) and positive cable (**+**) from the battery, in that order.



⚠ CAUTION

When refitting, first connect the positive cable (+) and then the negative one (–).

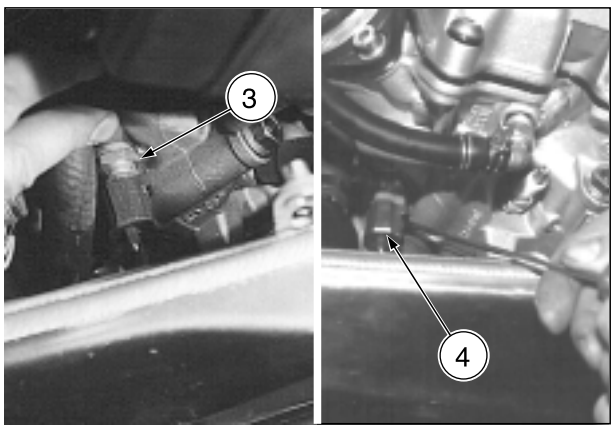
- Remove the fuel tank, see 7.1.5 (COMPLETE REMOVAL OF THE FUEL TANK).
- Remove the two side fairings, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- Remove the radiator spoiler, see 7.1.33 (REMOVING THE RADIATOR SPOILER).



⚠ CAUTION

Mark the cables so as to prevent them being mixed up by mistake during refitting.

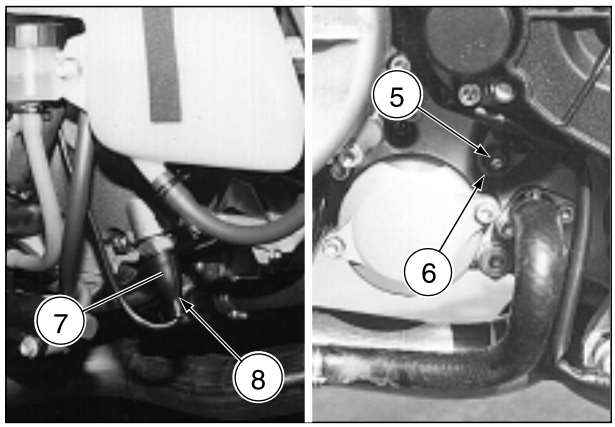
- Disconnect the following electric connectors in the order given:
  - generator (1);
  - camshaft position sensor (2);
  - front cylinder coolant thermistor (3);
  - rear cylinder coolant thermistor (4).



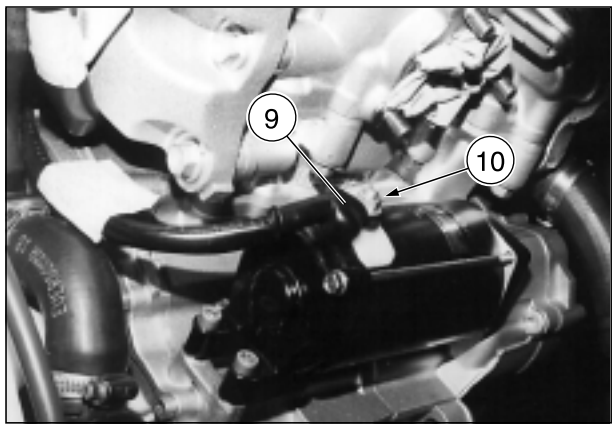
⚠ CAUTION

When refitting, make sure the electric connectors are plugged in properly.

◆ Unscrew and remove the screw (5) and disconnect the cable from the “neutral” gear switch (6).
◆ Move the protection element (7) aside and disconnect the cable from the engine oil pressure sensor (8).



◆ Move the protection element (9) aside, unscrew and remove the nut (10), recover the washer and disconnect the starter motor cable.
◆ Remove the rear brake lever and relevant mount (11), see 7.1.46 (REMOVING THE REAR BRAKE LEVER).



⚠ CAUTION

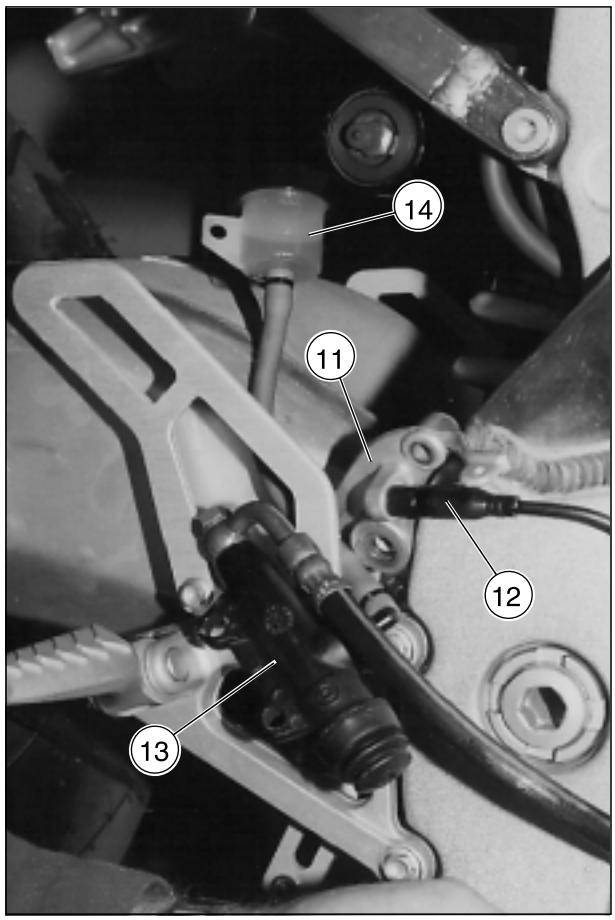
Move the mount (11) and secure it in place, taking extreme care as it remains connected to the electric cable by means of the brake light switch (12).

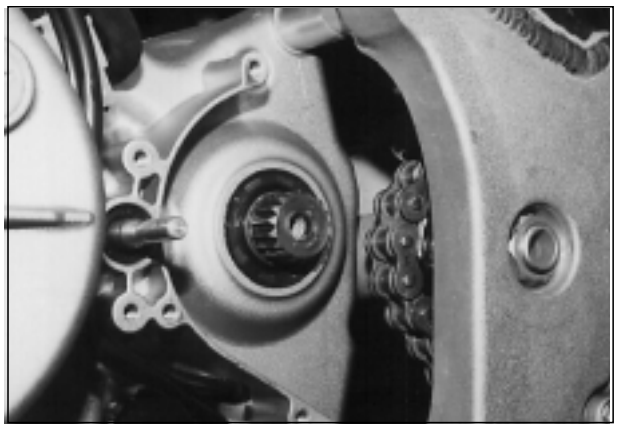
◆ Remove the rear brake pump (13), see 7.6.4 (REMOVING THE BRAKE PUMP).

⚠ CAUTION

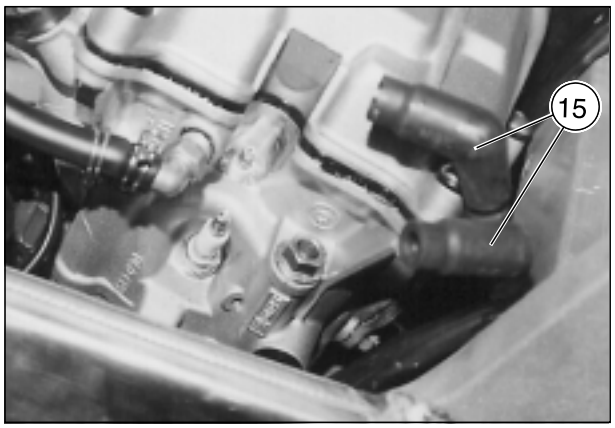
Move the rear brake pump (13) and secure it in place, taking extreme care as it remains connected to the brake fluid pipes.
The brake fluid tank (14) must be held vertically to prevent the fluid spilling out.

◆ Remove the clutch control cylinder, see 3.2.3 (REMOVING THE CLUTCH CONTROL CYLINDER).
◆ Remove the drive pinion, see 7.1.51 (REMOVING THE DRIVING CHAIN SHOE).
◆ Remove the gearshift lever, see 3.2.2 (REMOVING THE GEARSHIFT PEDAL).
◆ Remove the expansion tank, see 5.9 (REMOVING THE EXPANSION TANK).





◆ ★ Disconnect the spark plug caps (15).



⚠ CAUTION

Use a degreasing detergent, brushes and rags to clean the engines outer surfaces.
Avoid damaging rubber and plastic parts with corrosive or penetrating detergents and solvents.

Should the use of a steam cleaner prove necessary, do not point the high-pressure jets of water, steam or air at the following parts: wheel hubs, controls on the right and left handlebars, brake pumps, instruments and gauges, silencer openings, document compartment, ignition switch/steering lock, electrical components.

◆ Clean the outside of the engine thoroughly.
◆ Remove the exhaust pipes, see 3.2.1 (REMOVING THE EXHAUST PIPES).
◆ ★ Disconnect the electric connector (20) from the electrofan.
◆ Disconnect the electric cables from the horn.

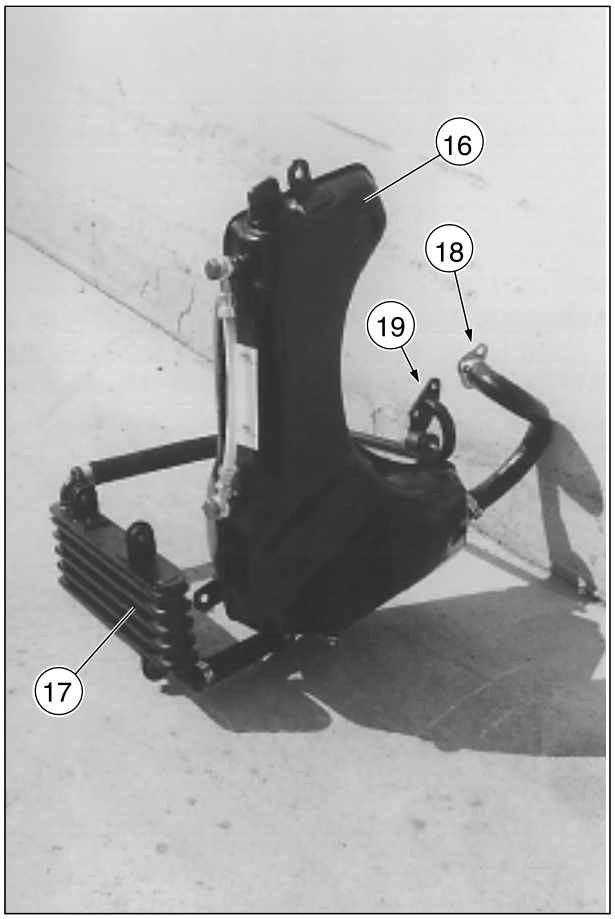
⚠ CAUTION

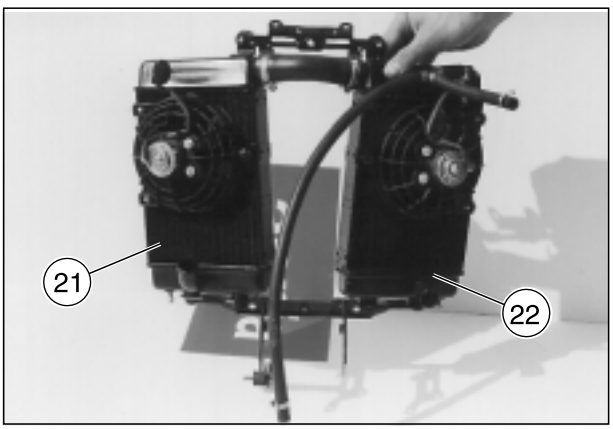
When refitting, make sure the electric connectors are plugged in properly.

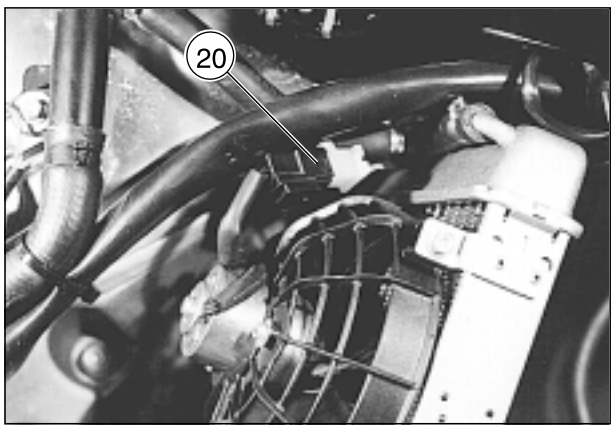
⚠ CAUTION

Mark the coupling and pipes so as to prevent them being swapped over by mistake during refitting.

◆ Remove the engine oil tank (16), see 7.1.49 (REMOVING THE ENGINE OIL TANK) together with the engine oil radiator (17), see 7.1.50 (REMOVING THE ENGINE OIL RADIATOR), disconnecting the pipes connecting them to the engine (18 - 19).
◆ Remove the radiators (21 - 22) joined together, see 5.2 (REMOVING THE RADIATORS), complete with electrofans, horn and mounts.







◆ Remove the complete throttle body (23), see 4.8.2 (REMOVING THE THROTTLE BODY).

NOTE The three-way manifold (24) may be kept fitted. Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ To release the head off the pipe clamp (25 - 26 - 27).
◆ Remove the complete thermal expansion valve (28), see 5.6 (REMOVING THE THERMAL EXPANSION VALVE) together with the three couplings.
◆ Slip the coupling (29) off the coolant pump.

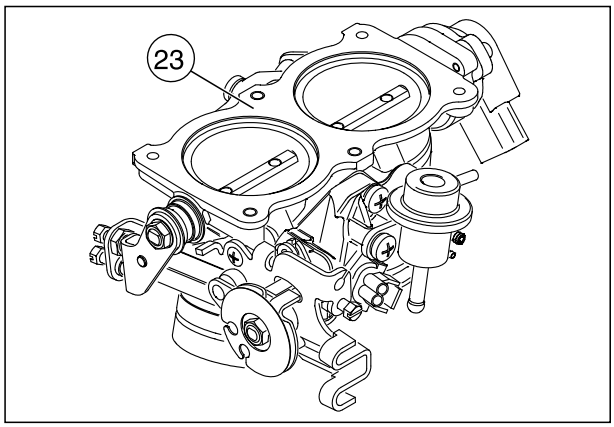
⚠ CAUTION

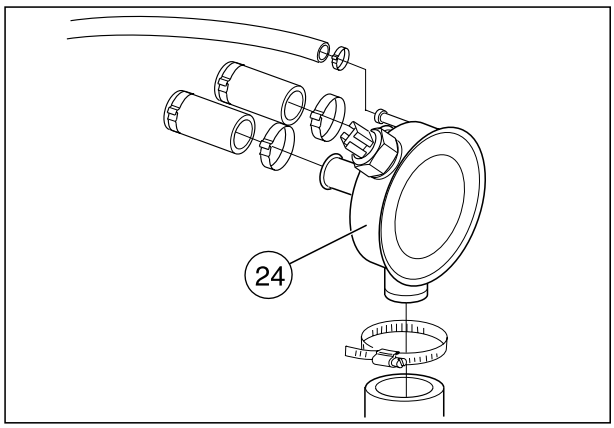
Free all the cables and pipes from the respective clamps located at intervals along their routes.

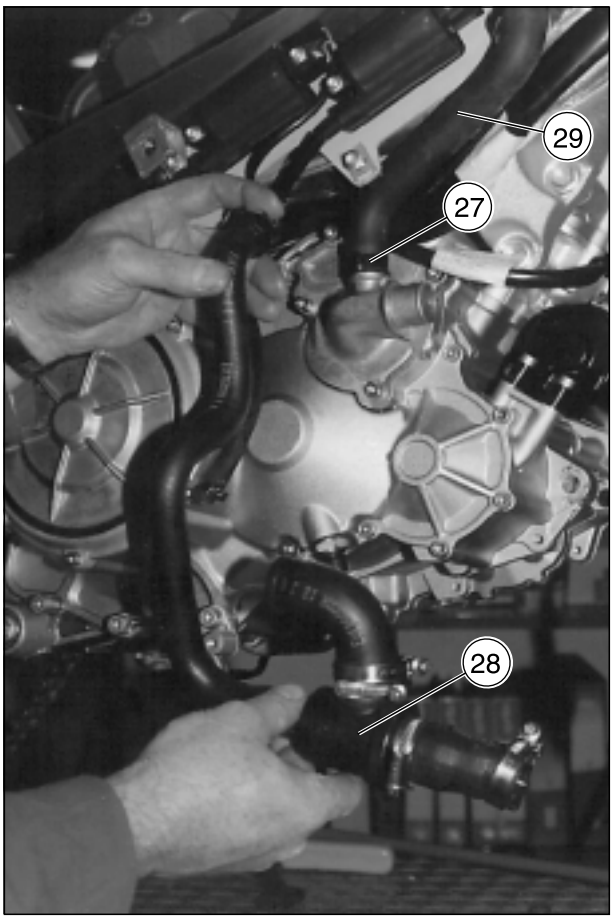
Procure an equal number of clamps to be used for refitting.

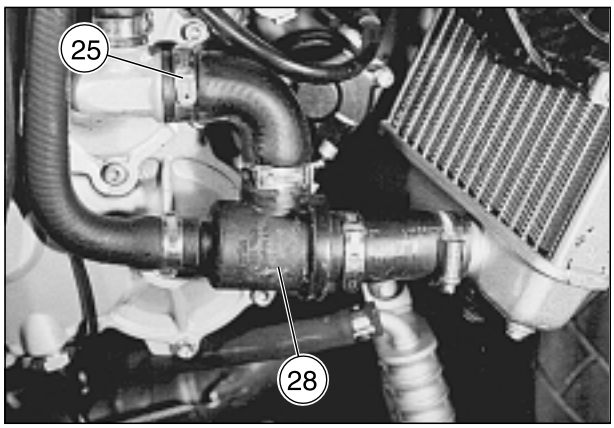
Plug all openings on the engine, pipes and couplings to prevent foreign bodies getting in.

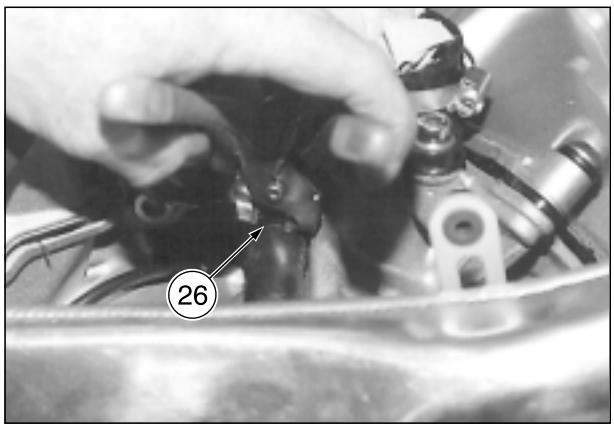
◆ Gather the electric cables together and secure them in place with adhesive tape so that they do not get in the way of the engine being lifted out from underneath.







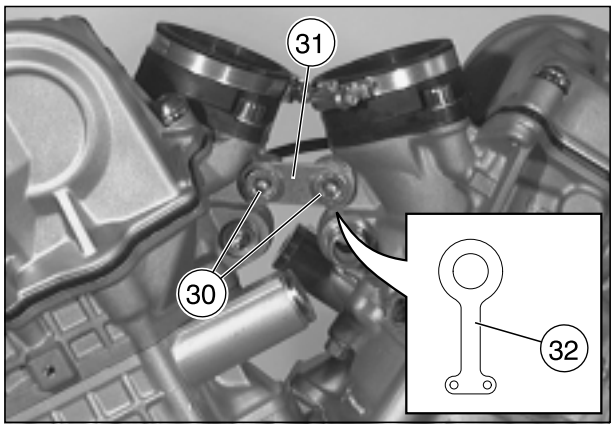




◆ Unscrew and remove the screws (30) and recover the plate (31).

Driving torque of screws (30): 40 Nm (4.0 kgm).

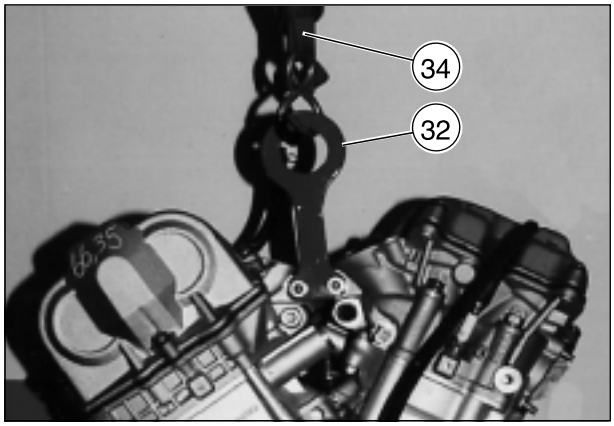
NOTE Have the appropriate special tool OPT (32) to hand cod. 8140183 (engine lifting eye hook), a hoist (33) and bands (34) for the lifting operation.



⚠ WARNING

The hoist (33) and the bands (34) for the lifting operation must be suitable for safely bearing the weight of the engine. The engine weight approx. 65 kg.

◆ Fasten the special engine lifting hook on and secure it in place with the screws (30).



◆ Hook the bands (34) onto the hoist (33) and the hook (32) as illustrated.

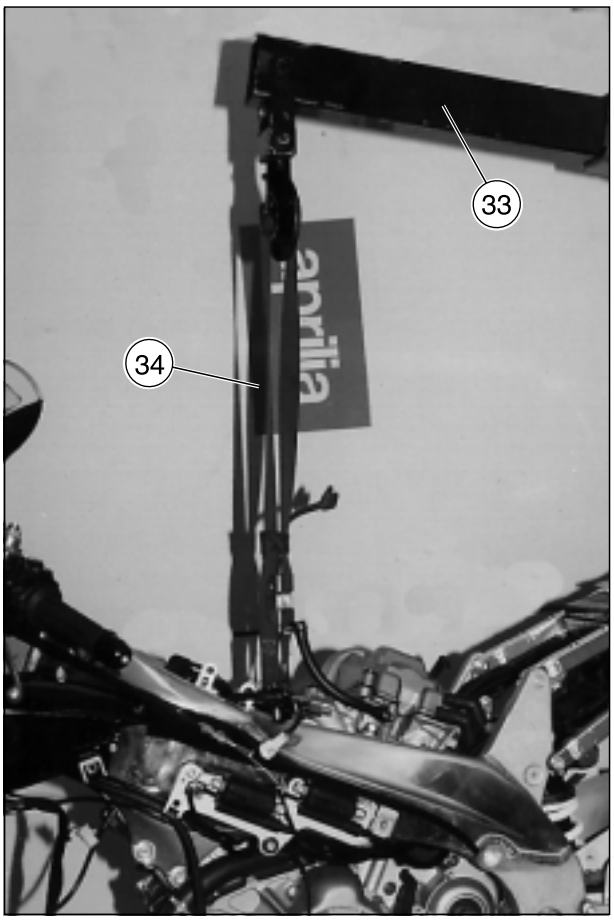
⚠ WARNING

The entire engine and hoist setup must be stable, ensuring that the subsequent operations can be performed safety.

◆ Lift the hoist arm (33) until the bands (34) are taught.

⚠ CAUTION

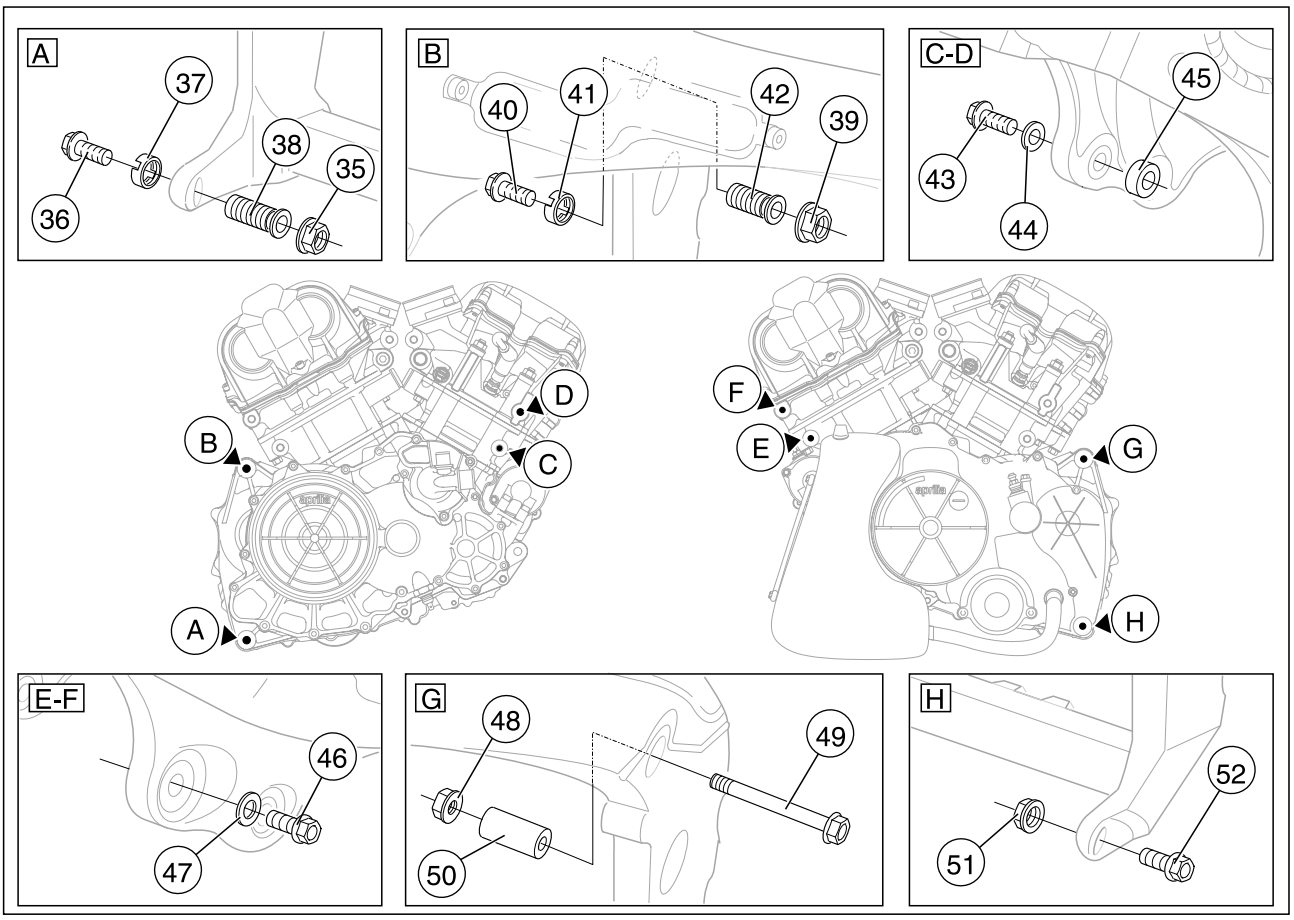
The hoist arm (33) must be lifted just enough for the engine to be held in place during the removal of the elements fastening it to the frame.



NOTE The elements fastening the engine to the frame must be removed in the order given:

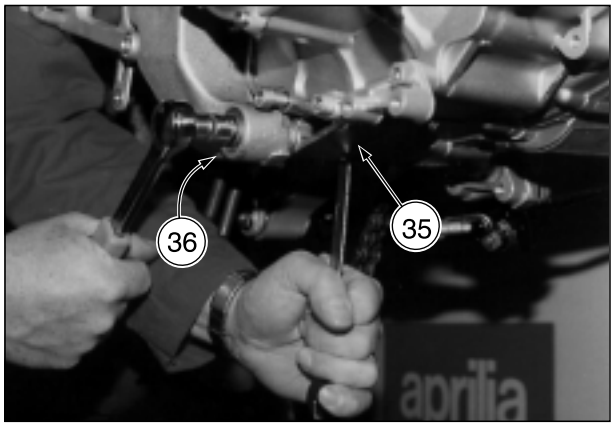
RIGHT SIDE → A → B → C → D.

LEFT SIDE → E → F → G → H.



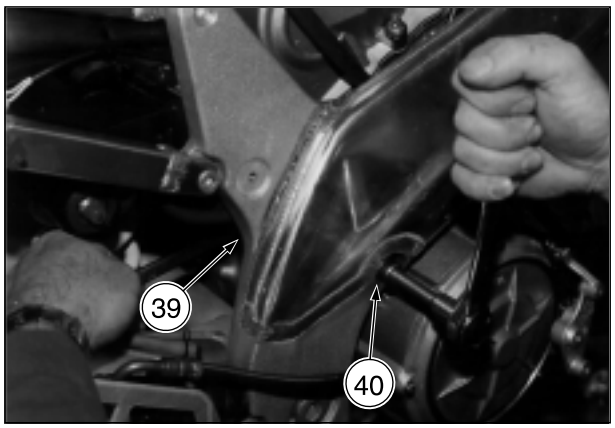
◆ Holding the inside nut (35) still, loosen the screw (36).

Driving torque of nut (35) and screw (36): 50 Nm (5.0 kgm).



◆ Holding the inside nut (39) still, loosen the screw (40).

Driving torque of nut (39) and screw (40): 50 Nm (5.0 kgm).

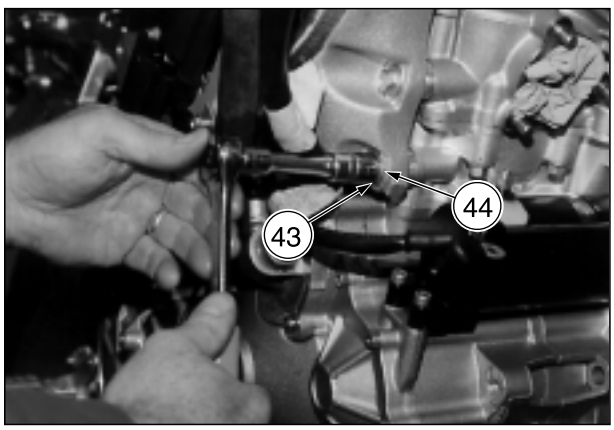


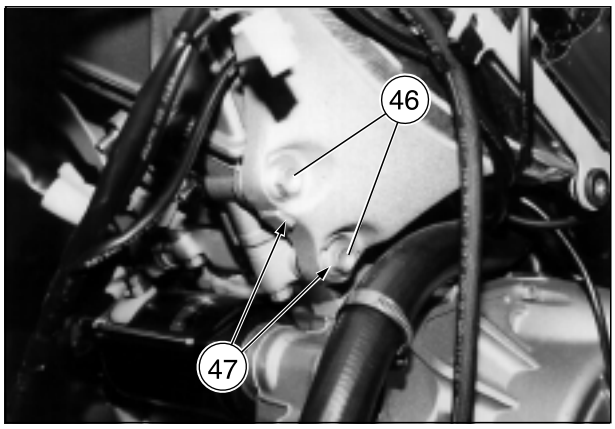
◆ Unscrew and remove the two screws (43) and recover the relevant washers (44).

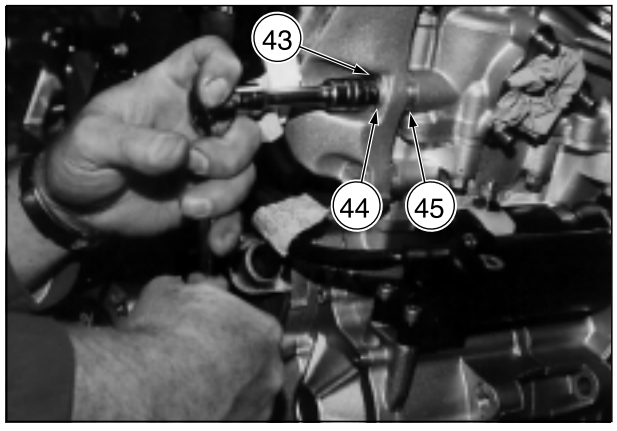
Driving torque of screws (43): 40 Nm (4.0 kgm).

◆ Recover the two spacers (45).
◆ Unscrew and remove the two screws (46) and recover the washers (47).

Driving torque of screws (46): 40 Nm (4.0 kgm).





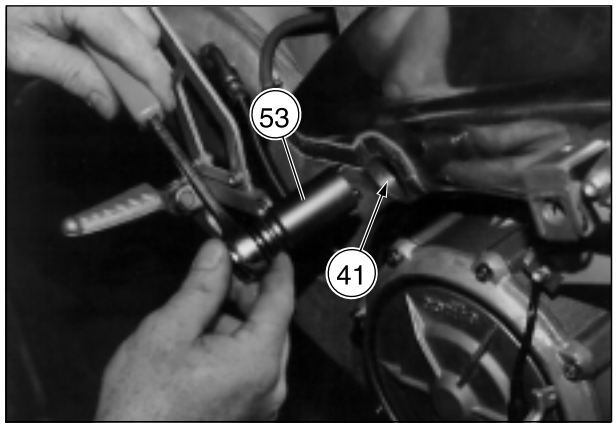


◆ Use the special setscrew spanner OPT (53) (cod. 8140203) to loosen and remove the lock rings (41 - 37).

Driving torque of lock rings (41 - 37): 50 Nm (5.0 kgm).

◆ Unscrew the adjusting bushes (38 - 42) all the way until they touch the frame.

Driving torque of adjusting bushes (38 - 42): 10 Nm (1.0 kgm).



⚠ CAUTION

When reassembling, screw the adjusting bushes (38 - 42) on by hand all the way until they touch the engine before torquing them to specification.

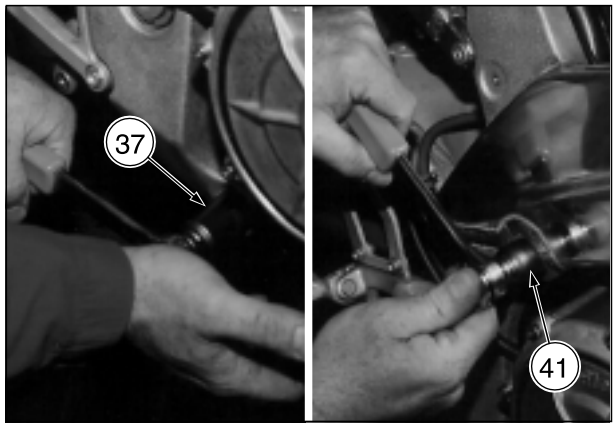
◆ Holding the inside nut (35) still, loosen and remove the screw (36).
◆ Holding the inside nut (39) still, loosen and remove the screw (40).
◆ Holding the inside nut (51) still, loosen and remove the screw (52).

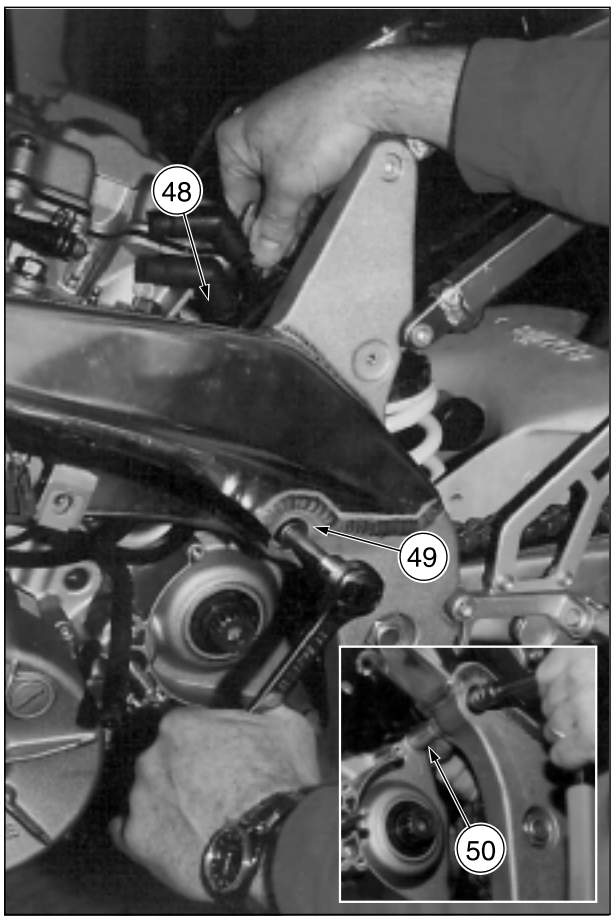
Driving torque of nut (51) and screw (52): 50 Nm (5.0 kgm).

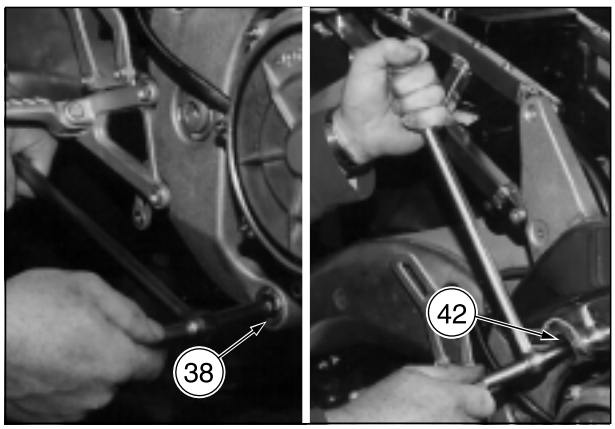
◆ Holding the inside nut (48) still, loosen and remove the screw (49).

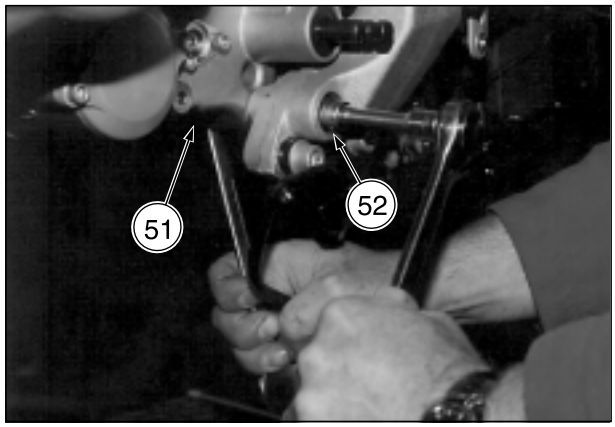
Driving torque of nut (48) and screw (49): 50 Nm (5.0 kgm).

◆ Recover the spacer (50).









⚠ WARNING

The engine is now freed and has nothing fastening it.

Handle with care: watch your fingers and limbs.

Clear the floor, on which the engine is to be set down, of any tools and clean thoroughly.

- ◆ Lift the hoist arm by a few millimeters in order to “release” the engine from the frame.
- ◆ Lower the hoist arm until the engine is gently set down on the floor.
- ◆ Secure the engine so that it does not fall over if poorly balanced.
- ◆ Unhook the bands (34) from the hoist.
- ◆ Slide the bands (34) out from the frame.
- ◆ Move the engine from under the frame.
- ◆ Hook the bands (34) back up to the engine.

NOTE If the engine is to be worked on, set it on the relevant stand OPT (54) (cod. 8140187 + 8140188).

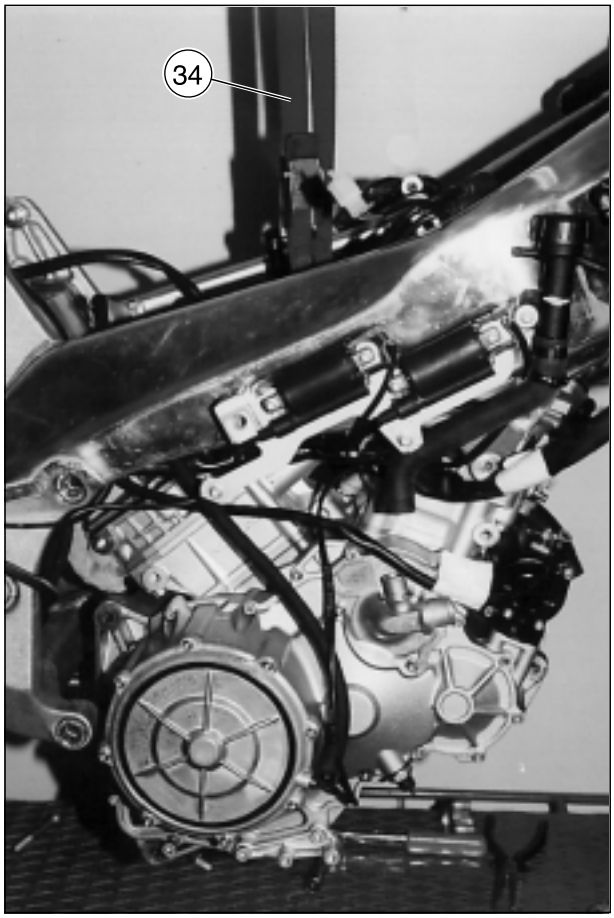
⚠ CAUTION

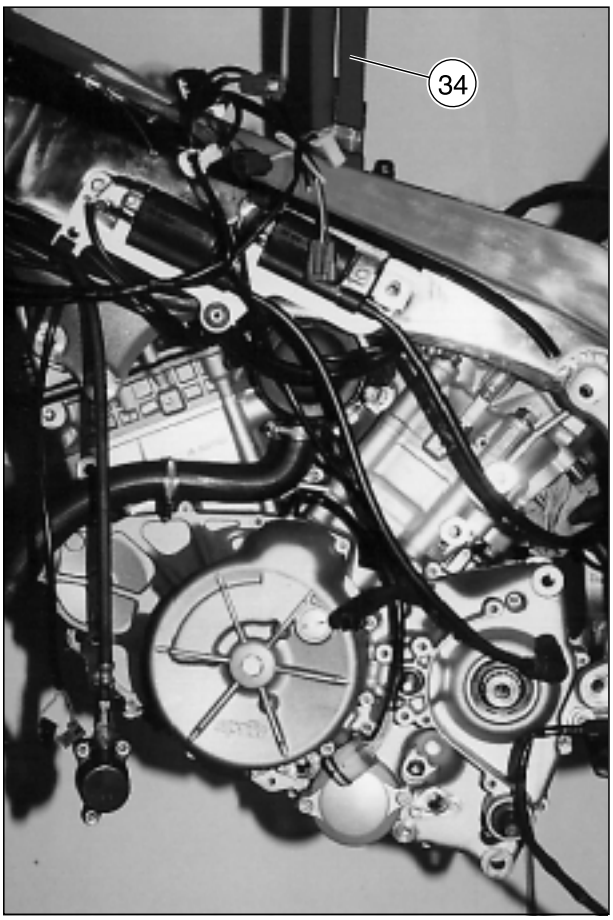
If no work is to be performed on the engine, leave it rested on the floor and attached to the bands (34) and hoist for extra safety.

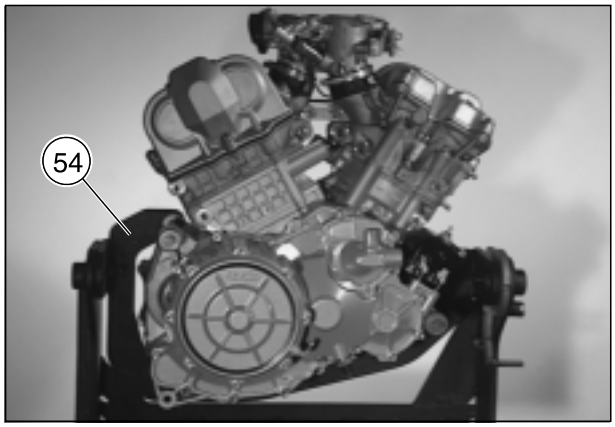
- ◆ Clean the outside of the engine thoroughly.

⚠ CAUTION

Use a detergent, brushes and rags to clean the engines outer surfaces.
Avoid damaging rubber and plastic parts with corrosive or penetrating detergents and solvents.



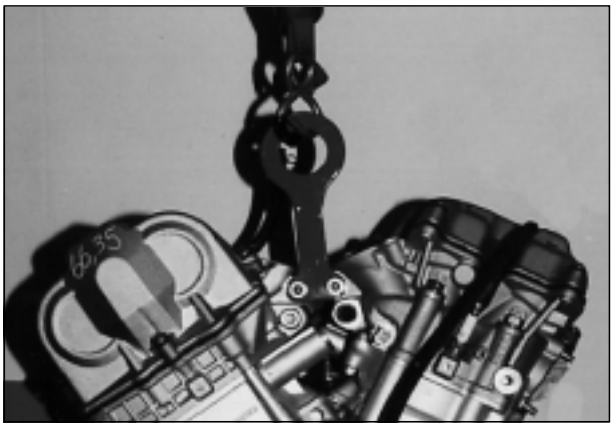




3.4 REFITTING THE WHOLE ENGINE ON THE FRAME

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

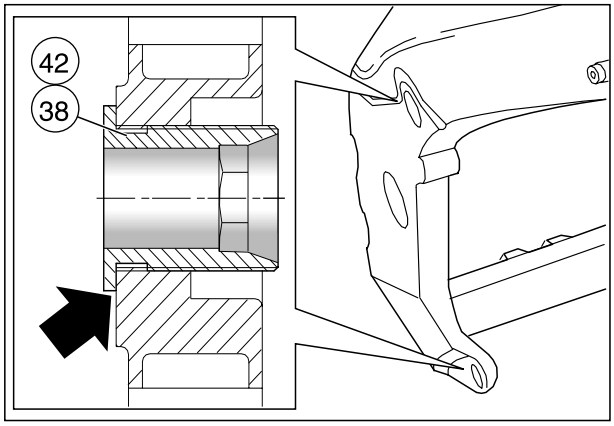
NOTE In order to refit the whole engine on the frame, the same procedure used for its removal must be followed in the reverse order, see 3.3 (REMOVING THE WHOLE ENGINE FROM THE FRAME).
Nonetheless, before commencing, the operations indicated below must be performed.



⚠ WARNING

Handle with care.
Watch your fingers and limbs.

- Make sure the adjusting bushes (38 - 42) are unscrewed all the way so that they touch the frame.
- Nudge the engine along gradually until the engine/frame fastening holes (A - B - C - D) are perfectly aligned.



Once the engine refitting procedure is complete, perform the operations indicated below.

- Make sure all the nuts/screws securing the engine are properly torqued.
- Top up the coolant, see 2.15 (CHECKING AND TOPPING UP COOLANT).
- Top up the motor oil, see 2.13 (CHECKING THE ENGINE OIL LEVEL AND TOPPING UP).
- If the engine has been overhauled, bleed the engine oil circuit, see 3.8.1 (BLEEDING THE ENGINE OIL CIRCUIT) and check the engine oil pressure, 3.8.2 (CHECKING THE ENGINE OIL PRESSURE).
- Check the driving chain is taught and, where necessary, adjust, see 2.35.1 (CHECKING THE SLACK) and 2.35.3 (ADJUSTMENT).

⚠ CAUTION

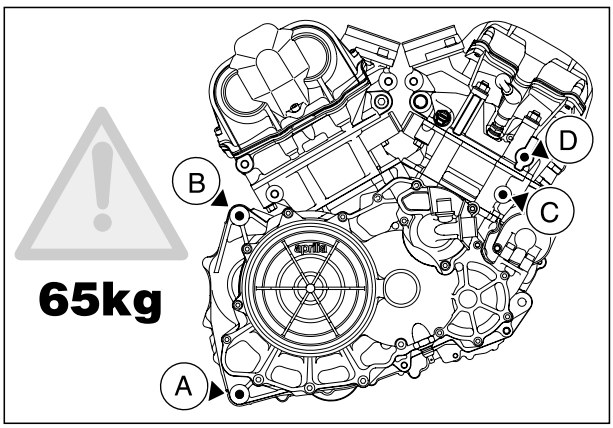
Perform a general check of all the components affected by the procedure, in particular make sure:

– the electric cables are fastened with relevant clamps;

⚠ CAUTION

None of the cables must be twisted and/or squashed.

– the electric connectors are plugged in properly;
– the pipes and couplings are connected properly and secured with relevant clamps;
– the throttle cable and cold-start cable slide freely and are not pulled too tight when the handlebar is turned;
– the gearshift lever is positioned correctly;
– the rear brake lever is positioned correctly.



3.5 DISASSEMBLING THE ENGINE

⚠ CAUTION

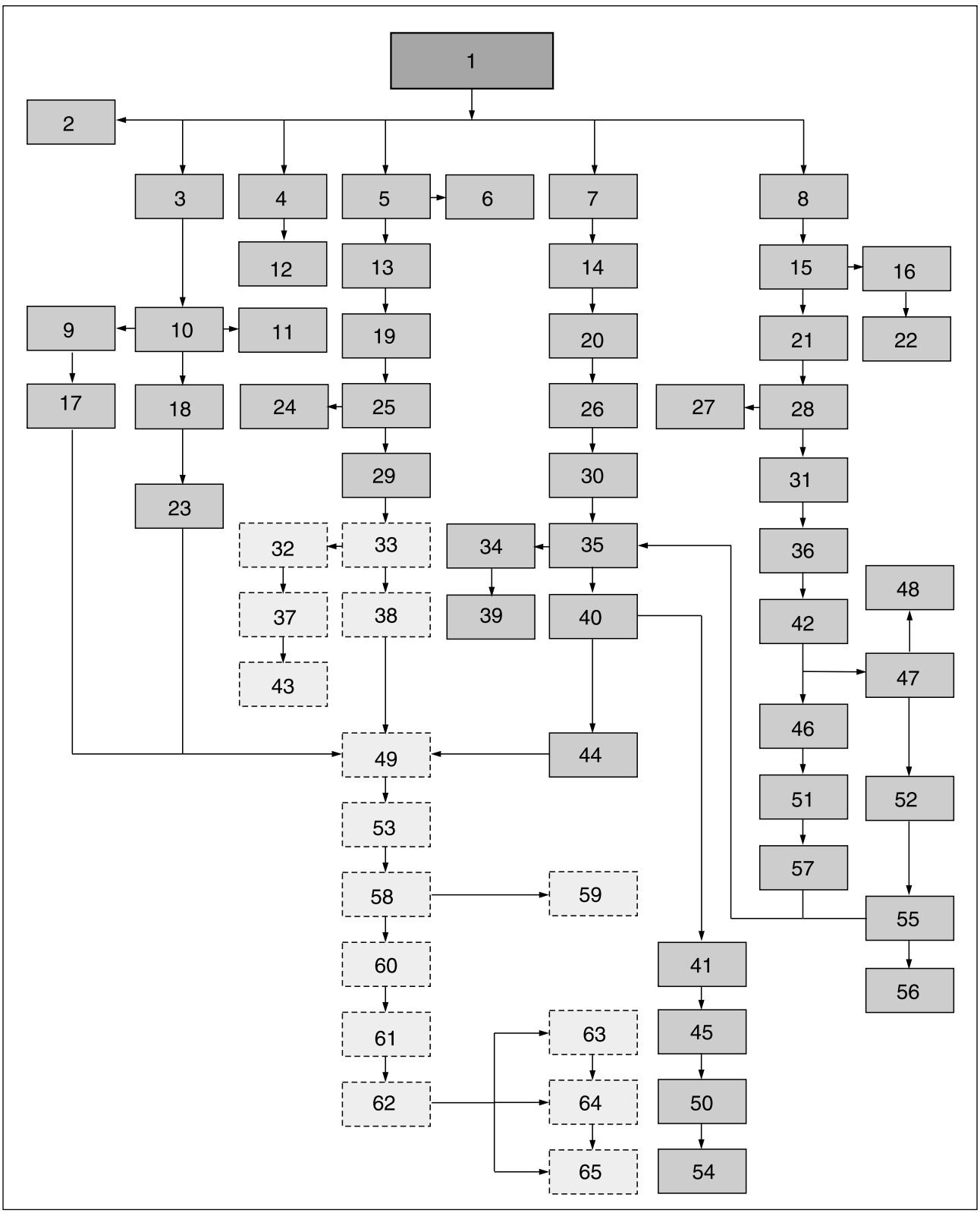
Any components removed must be set aside in groups according to the respective assembly position in order to make sure they are subsequently refitted in the right place.

NOTE Before going ahead with the disassembly of the engine, gather the appropriate special tools, see 1.8.2 (ENGINE TOOLS).

3.5.1 ENGINE DISASSEMBLY SEQUENCE

NOTE This diagram shows the operations to be performed and the sequence to be followed when disassembling the engine parts.

In order to remove the parts outlined with short dashes, ( ) the engine must be removed from the frame.



Key

1) Engine
2) Starter motor
3) Flywheel cover
4) Oil filter cover
5) Cylinder “1” tappet cover
6) Camshaft position sensor
7) Cylinder “2” tappet cover
8) Complete diaphragm cover
9) Stator
10) Magnetic wheel
11) Clutch
12) Oil filter cartridge
13) Cylinder “1” TDC position
14) Cylinder “2” TDC position
15) Diaphragm
16) Complete support plate and disengagement rod
17) Driving shaft position sensor
18) Starter motor transmission
19) Cylinder “1” timing chain tightener
20) Top side differential transmission
21) Coolant pump lid
22) Clutch discs
23) Cylinder “1” drive assembly
24) Cylinder “1” camshafts
25) Cylinder “1” timing drive gears
26) Cylinder “2” timing chain tightener
27) Coolant pump
28) Clutch cover
29) Cylinder “1” timing chain
30) Cylinder “2” timing drive gears
31) Complete support plate and disengagement rod
32) Cylinder “1” head
33) Cylinder “1” head with cylinder
34) Cylinder “2” top side countershaft
35) Cylinder “2” timing chain
36) Clutch discs
37) Cylinder “1” camshafts
38) Cylinder “1” piston
39) Cylinder “2” camshafts
40) Cylinder “2” head with cylinder
41) Cylinder “2” head
42) Primary transmission
43) Cylinder “1” valves
44) Cylinder “2” piston
45) Cylinder “2” top side countershaft
46) Countershaft gear
47) Oil pump gear
48) Oil pump
49) Remove the engine half-casing
50) Cylinder “2” camshafts
51) Coolant pump transmission
52) Complete gearshift shaft
53) Countershaft
54) Cylinder “2” valves
55) Index plate
56) Index lever
57) Cylinder “2” drive assembly
58) Driving shaft
59) Connecting rod
60) Gearshift rods
61) Gearshift fork
62) Gearshift, shift cam
63) Drive gears
64) Gearshift bearings
65) Driving shaft, countershaft bearings

- Cylinder “1” = front cylinder

- Cylinder “2” = rear cylinder

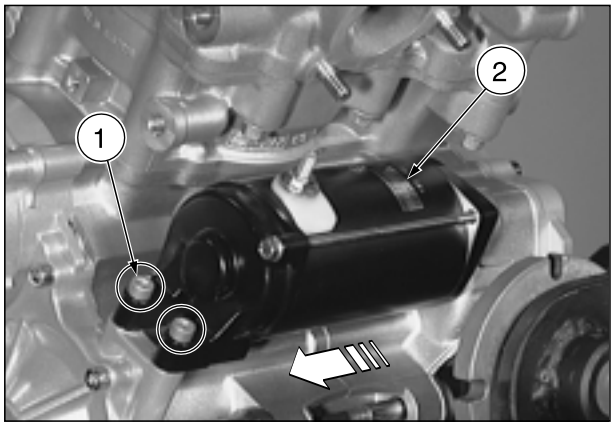
3.5.2 REMOVING THE STARTER MOTOR

NOTE The operations below can be performed without removing the engine from the frame.

- Move the protection element aside, unscrew and remove the nut, recover the washer and disconnect the cable of the starter motor.
- Unscrew and remove the two M6 T.C.E.I. screws (1).

Driving torque of screws (1): 11 Nm (1.1 kgm).

- Pull out the starter motor (2).



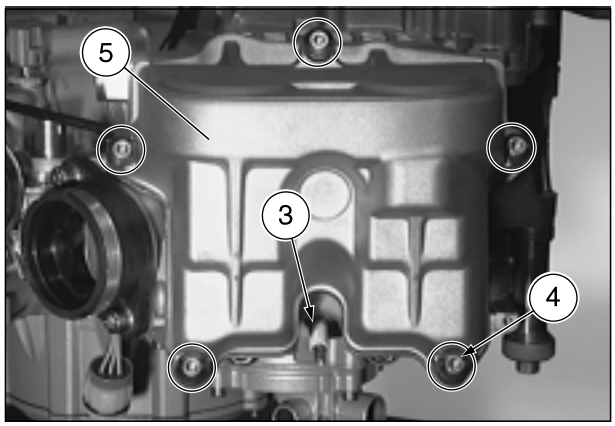
3.5.3 DISASSEMBLING CYLINDER "1" (FRONT), HEAD AND PISTON

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

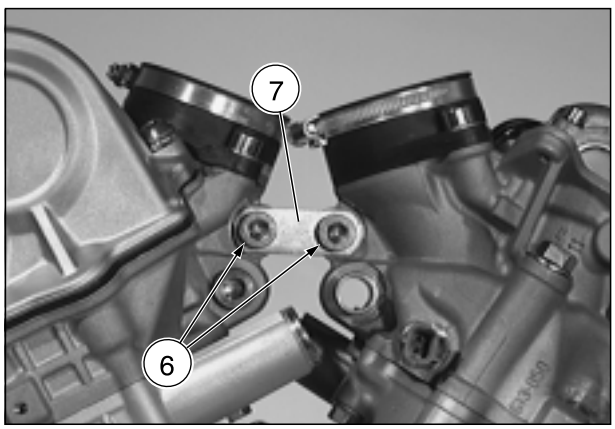
⚠ CAUTION

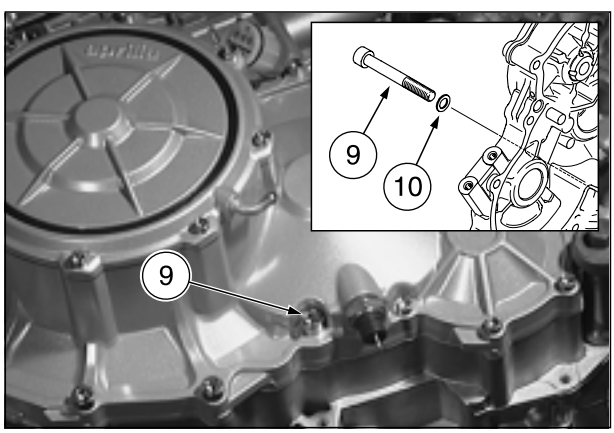
The head must be disassembled together with the cylinder.
This is the only way in which the head can be detached from the actual cylinder.

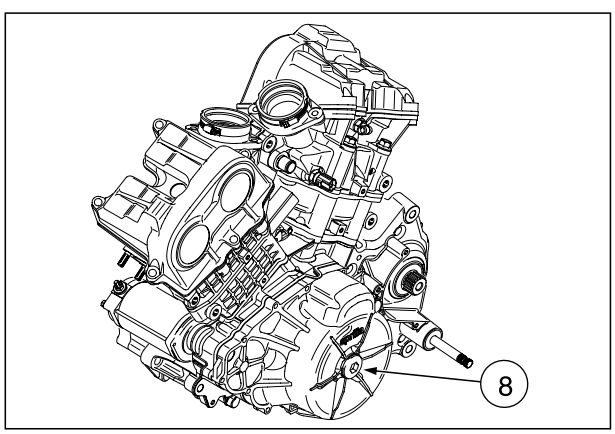
- Remove the two spark plugs (3) from the head, see 2.7 (SPARK PLUGS).
- Unscrew and remove the five complete M6 spacer screws (4) and remove the head cover (5) together with the respective gasket.



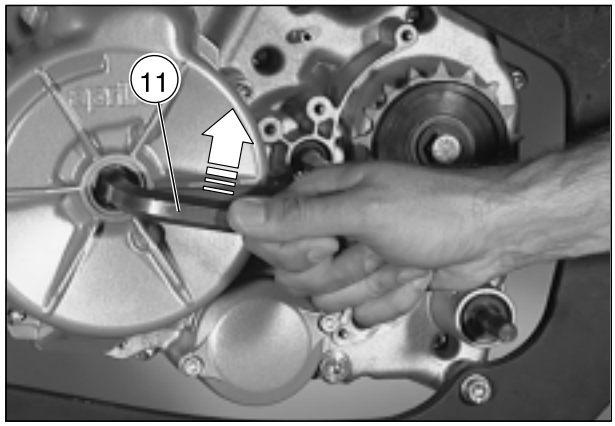
- Unscrew and remove the two M10 T.C.E.I. screws (6) and remove the support bracket (7).
- Remove the closing screw, made from plastic, complete with O-ring housed in the centre of the flywheel cover (8).
- Remove the M8 T.C.E.I. screw (9) complete with seal (10).







◆ Use a size 14 bent hexagon-head driver to turn the driving shaft anticlockwise (11) until the piston “1” is at TDC (ignition).

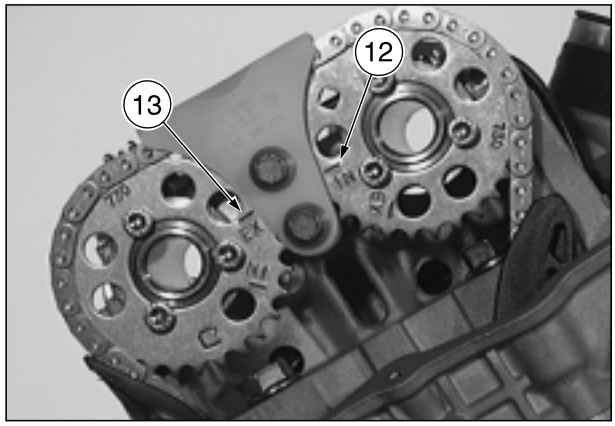


NOTE At the TDC (ignition), the reference marks “**IN**” (12) and “**EX**” (13) of the two gears prove parallel to the head uncoupling surface, and face each other.

NOTE Have the appropriate special tool OPT (14) to hand, (cod. 0240 880 threaded pin for retaining the driving shaft at TDC).

◆ Screw the special tool (14) into the slot previously occupied by the M8 T.C.E.I. screw (9) by hand so that you can feel it fit perfectly inside the driving shaft fastening slot.

NOTE Turn the driving shaft both ways to make sure that the threaded bolt is engaged perfectly.
The bolt should not be overtightened:
max. 5 Nm (0.5 kgm).

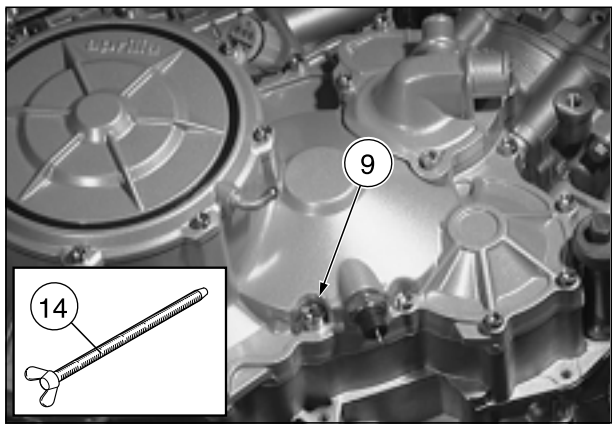


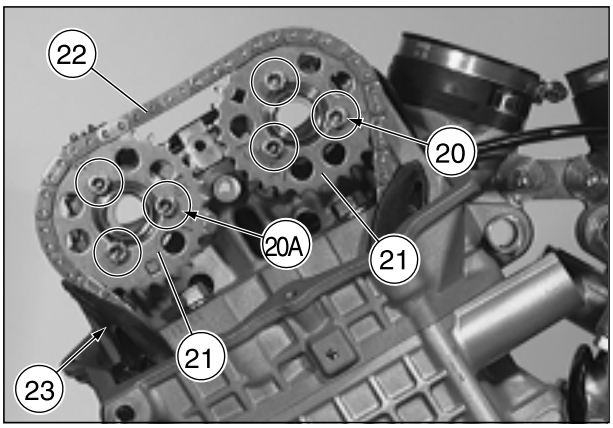
◆ Unscrew and remove the closing screw (15) complete with seal (16) and remove the complete chain tightener (17).
◆ Unscrew and remove the two M6 spacer screws (18) and remove the chain guide bracket (19).
◆ Unscrew and remove the three M6x10 T.C.E.I. screws (20).

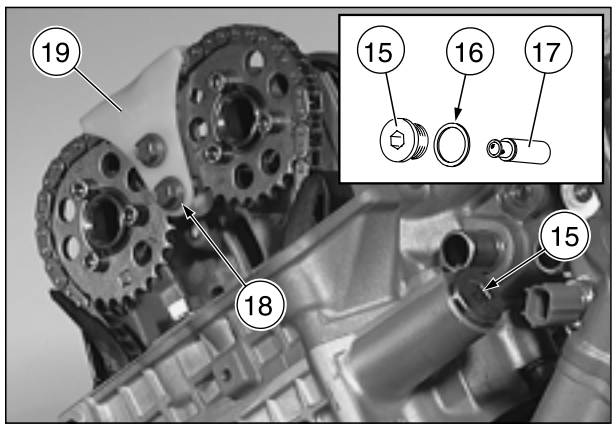
⚠ WARNING

Before removal, the three T.C.E.I. M6 x 14 screws (20A) must be marked so that they are refitted in the right place; danger of major engine damage and physical injury.

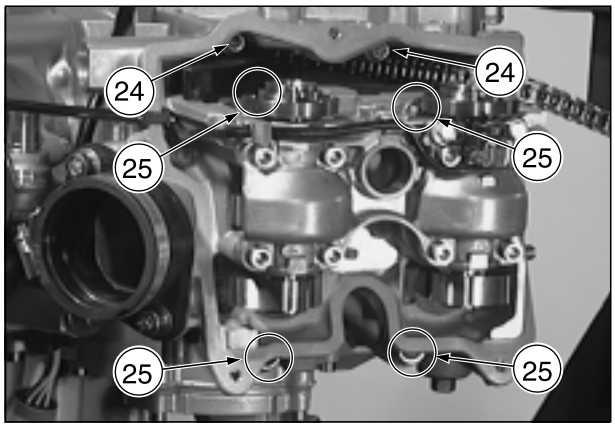
◆ Unscrew and remove the three M6 x 14 T.C.E.I. screws (20A).
◆ Remove the two gears (21).
◆ Let the timing chain (22) drop into the cylinders chain compartment.
◆ Pull the chain guide shoe (23) out from above.







◆ Unscrew and remove the two M6 T.C.E.I. screws (24).
◆ Unscrew and remove the four M10 nuts (25).



⚠ WARNING

Be careful to avoid possible injury caused by allowing hands to get trapped between the cylinder and the stud bolts (28).

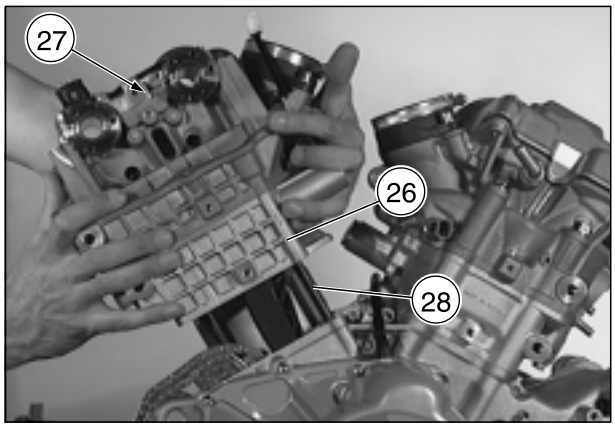
◆ Remove the cylinder (26) together with the complete head (27).

⚠ CAUTION

When removing the cylinder, take care not to damage the cylinder.
Be careful to keep the two locating dowels (29) from dropping inside the crankcase.

NOTE See 3.6.23 (HEAD AND CAMSHAFT) for instructions on taking the complete head apart.

◆ Cover the opening in the base with a clean cloth.
◆ Remove the cylinder base gasket from its slot and pull out the two locating dowels (29).



⚠ CAUTION

Do not apply any mechanical markings.

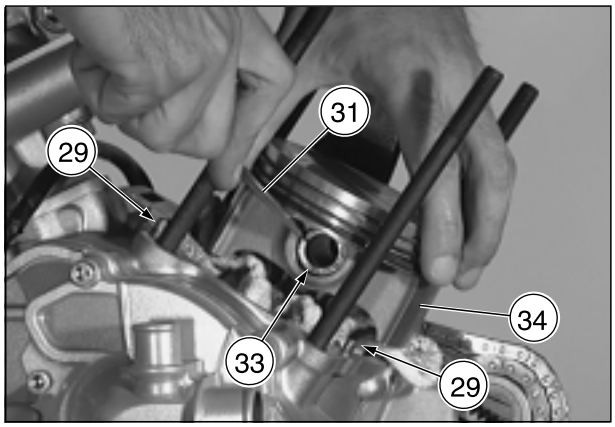
◆ Use a felt pen to mark the piston crown on the exhaust side (30) to remind you which direction it should be reassembled in.
In the same way, mark both the piston and the cylinder with a "**1**" so that the two components can be reconnected in the same point.

⚠ CAUTION

In order to prevent unbalanced forces, the axis of the pistons' gudgeon pin is positioned off-centre, towards the front of the vehicle.

When reassembling, the piston must be positioned on the connecting rod facing the right way.

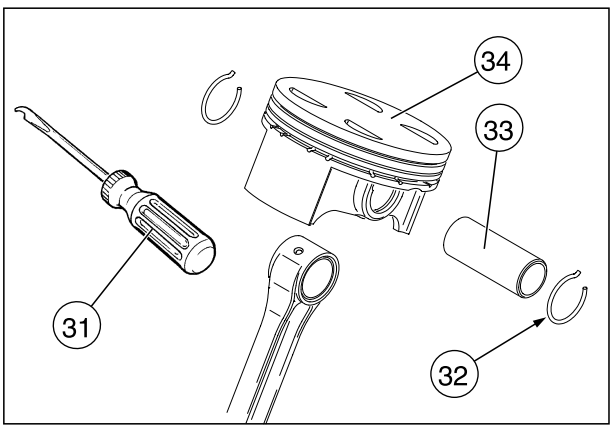
◆ Use a sharp screwdriver (31) to remove the seeger ring (32) (securing the gudgeon pin).
◆ Use a special drift to push out the gudgeon pin (33).

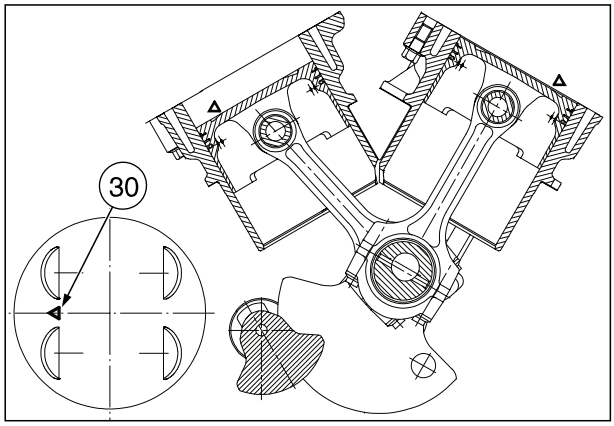


⚠ CAUTION

Hold the piston in one hand so that the connecting rod bush is not tilted and hence damaged.

◆ Remove the piston (34).





3.5.4 DISASSEMBLING CYLINDER “2” (REAR), HEAD AND PISTON

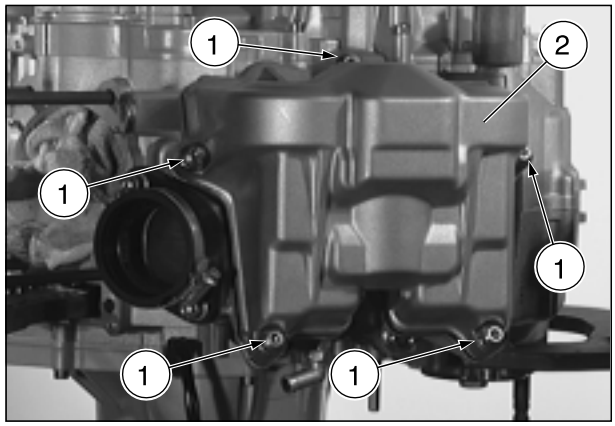
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following operations can be performed without removing the engine from the frame.

⚠ WARNING

The head must be disassembled together with the cylinder.
This is the only way in which the head can be detached from the actual cylinder.

- Remove the two spark plugs from the head, see 2.7 (SPARK PLUGS).
- Unscrew and remove the five complete M6 spacer screws (1) and remove the head cover (2) together with the relevant gasket.
- Remove the closing screw, made from plastic, complete with O-ring housed in the centre of the flywheel cover (3).
- Remove the M8 T.C.E.I. screw (4) complete with seal.



⚠ CAUTION

When turning the driving shaft, guide the connecting rod and timing chain of cylinder “1” so as to prevent them from getting stuck inside the housing.

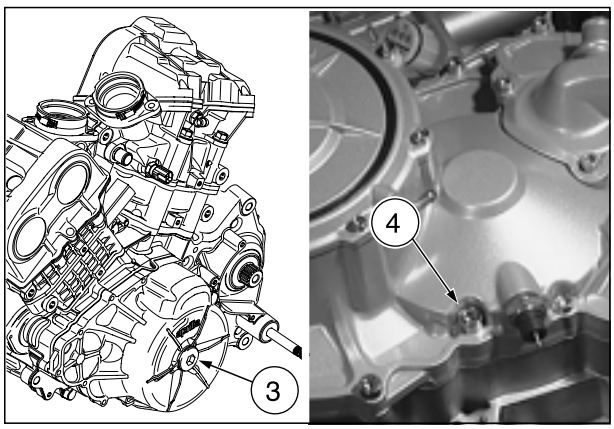
- Use a size 14 bent hexagon-head driver (5) to turn the driving shaft anticlockwise approx. 300° so that piston “**2**” is at **TDC** (ignition).

NOTE At the TDC (ignition), the reference marks “**IN**” (6) and “**EX**” (7) of the two gears prove parallel to the head uncoupling surface, and face each other.

- Screw the M8 threaded bolt (8) on by hand so that you can feel it fit perfectly inside the driving shaft fastening slot.

NOTE Turn the driving shaft both ways to make sure that the threaded bolt is engaged perfectly.
The bolt should not be overtightened; **max. 5 Nm (0.5 kgm).**

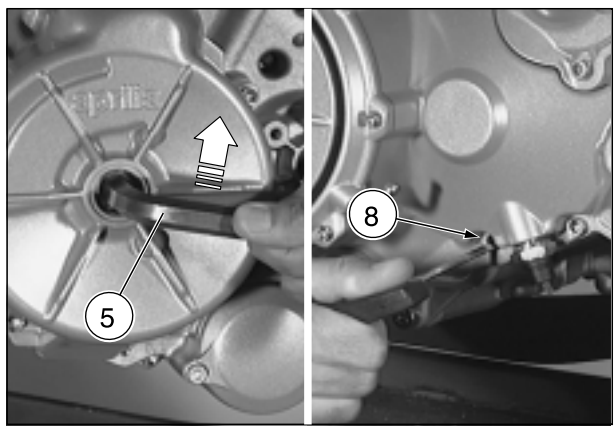
- Insert an appropriate drift (diam. 7.5 mm) (9) in the countershaft hole (10).
- Unscrew and remove the M14x1 nut (11).

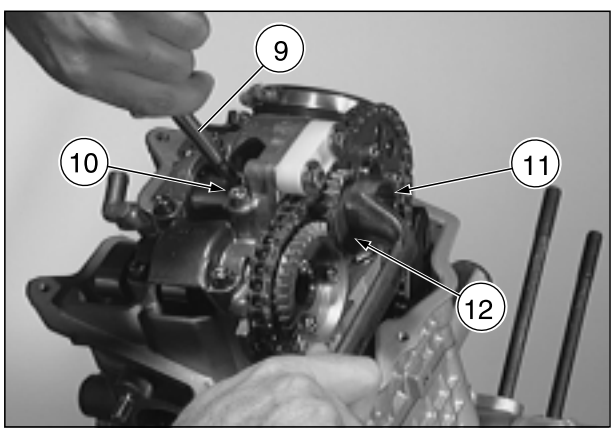


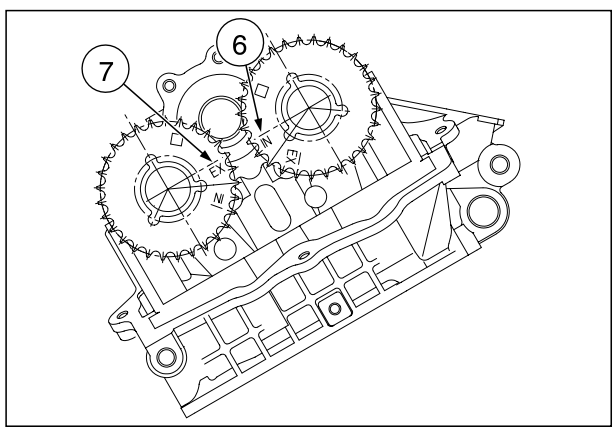
⚠ CAUTION

When loosening the T.E. nut (11), counter the force with the drift (9) so as not to strain the driving chain.

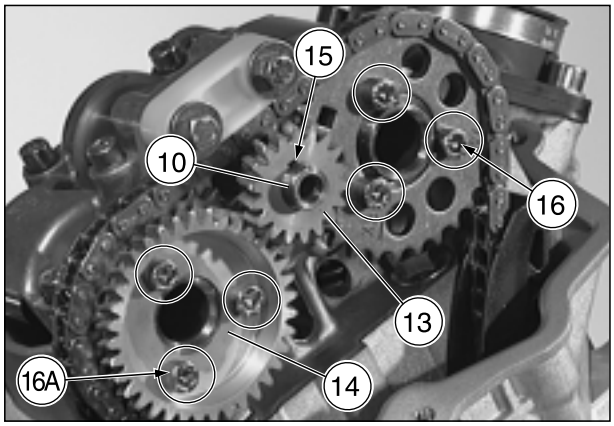
- Remove the counterweight (12) from the countershaft.







◆ Slide the gear (13) out a couple of millimetres so that it no longer mates with the driving gear (14).
◆ Remove the gear (13) complete with key (15).



⚠ CAUTION

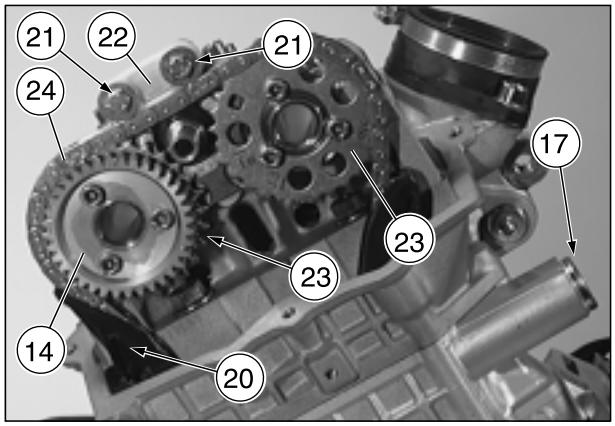
Be careful to keep the key (15) from dropping into the chain compartment. Cover the chain compartment with a clean cloth.

◆ Unscrew and remove the three M6 x 10 T.C.E.I. screws (16).

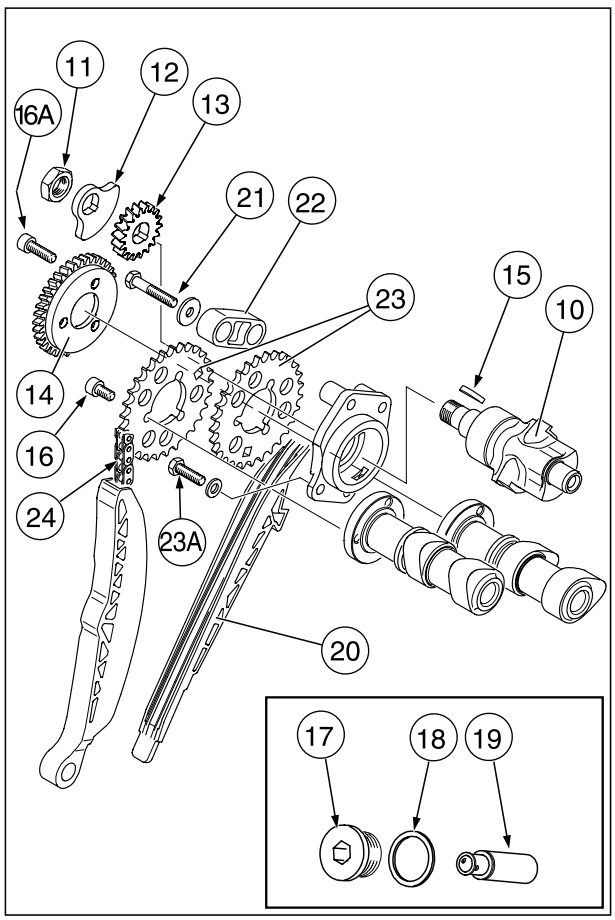
⚠ WARNING

Before removal, the three T.C.E.I. M6 x 14 screws (16A) must be marked so that they are refitted in the right place; danger of major engine damage and physical injury.

◆ Unscrew and remove the three M6 x 14 T.C.E.I. screws (16A).
◆ Unscrew and remove the closing screw (17) complete with seal (18) and remove the complete chain tightener (19).

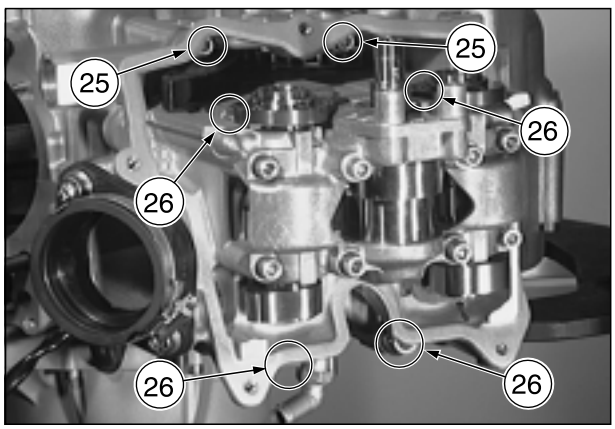


◆ Pull the chain guide shoe (20) out from above.
◆ Unscrew and remove the two M6 T.C.E.I. screws (21) with the relevant washers and remove the chain guide (22).
◆ Remove both the driving gear (14) and the two gears (23).
◆ Unscrew and remove the two M6 T.C.E.I. screws (23A).
◆ Slide out the upper countershaft (10), rotating it upwards.



NOTE Set the two gears (23) aside so that they are not mixed up and can later be refitted in the right place (the two gears are identical).

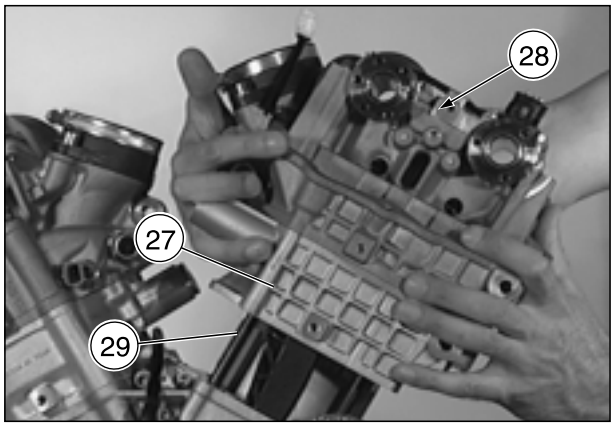
◆ Let the timing chain (24) drop into the cylinders chain compartment.
◆ Unscrew and remove the two M6 T.C.E.I. screws (25) and four M10 nuts (26).



⚠ WARNING

Be careful to avoid possible injury caused by allowing hands to get trapped between the cylinder and the stud bolts (29).

◆ Remove the cylinder (27) together with the complete head (28).

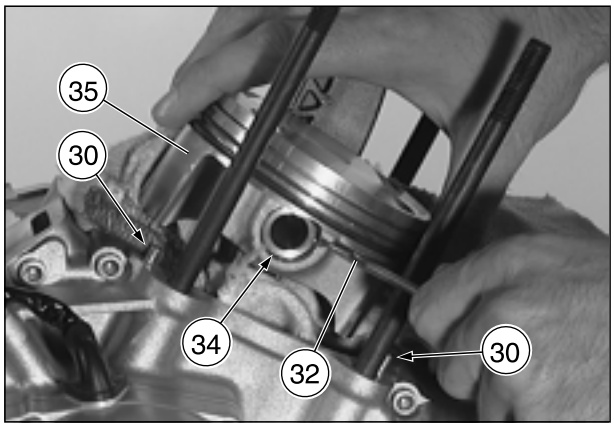


⚠ CAUTION

When removing the cylinder, take care not to damage the cylinder.
Be careful to keep the two locating dowels (30) from dropping inside the crankcase.

NOTE See 3.6.23 (HEAD AND CAMSHAFT) for instructions on taking the complete head apart.

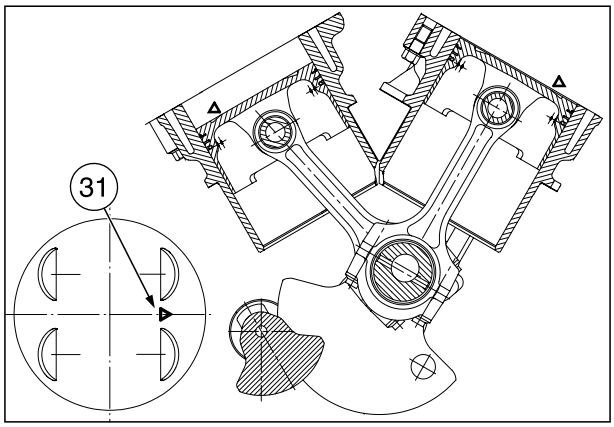
◆ Cover the opening in the base with a clean cloth.
◆ Remove the cylinder base gasket from its slot and pull out the two locating dowels (30).



⚠ CAUTION

Do not apply any mechanical markings.

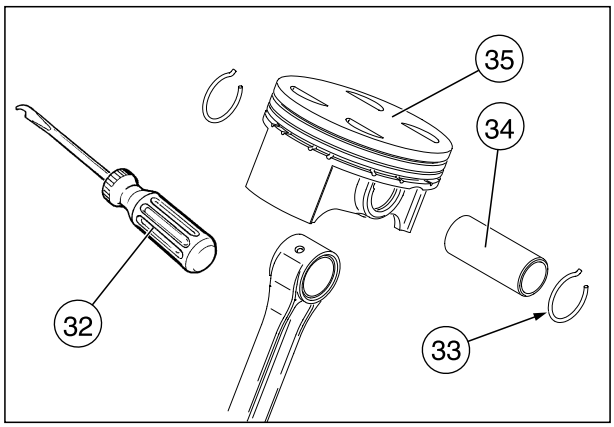
◆ Use a felt pen to mark the piston crown on the exhaust side (31) to remind you which direction it should be assembled in.
In the same way, mark both the piston and the cylinder with a "**1**" so that the two components can be reconnected in the same point.
◆ Use a sharp screwdriver (32) to remove the seeger ring (33) (securing the gudgeon pin).
◆ Use a special drift to push out the gudgeon pin (34).



⚠ CAUTION

Hold the piston in one hand so that the connecting rod bush is not tilted and hence damaged.

◆ Remove the piston (35).



3.5.5 REMOVING THE FLYWHEEL COVER AND IGNITION SYSTEM

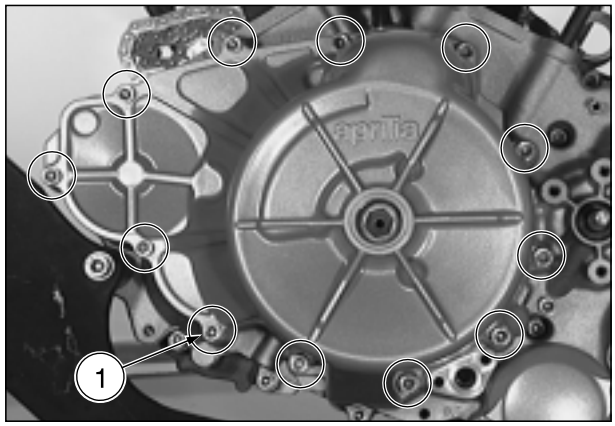
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following operations can be performed without removing the engine from the frame.

⚠ WARNING

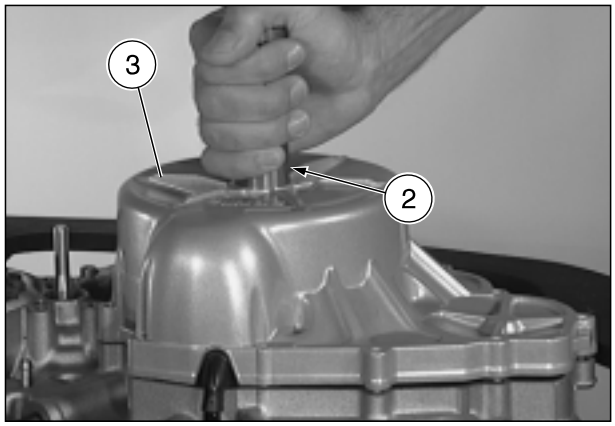
When performing work on the ignition system:

- **switch off the engine;**
- **disconnect the battery: always disconnect the negative pole (–) first;**
- **disconnect all the electrical connections;**
- **drain the engine oil tank completely, see 2.14 (CHANGING THE ENGINE OIL AND THE OIL FILTER).**
- **secure the driving shaft at TDC;**
- **unscrew and remove the twelve M6 T.C.E.I. screws (1).**



NOTE Have the appropriate special tool OPT (2) to hand cod. 0277252 (tool for disassembling the flywheel cover).

- Screw the special tool (2) onto the flywheel cover (3).
- Lift the flywheel cover (3).
- Remove the gasket (4).

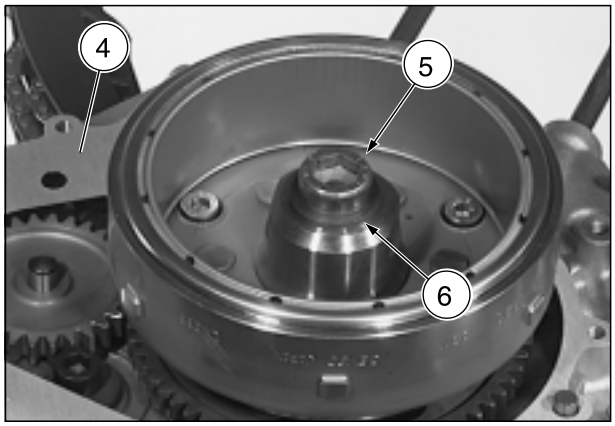


NOTE The driving shaft must be retained at the TDC of piston “1” or piston “2”.

- Unscrew and remove the M14 T.C.E.I. screw (5) and remove the washer (6).

NOTE Have the appropriate special tool OPT (7) to hand (cod. 0277780 - flywheel removal bolt).

- Screw the special tool (7) into the thread of the flywheel (8).

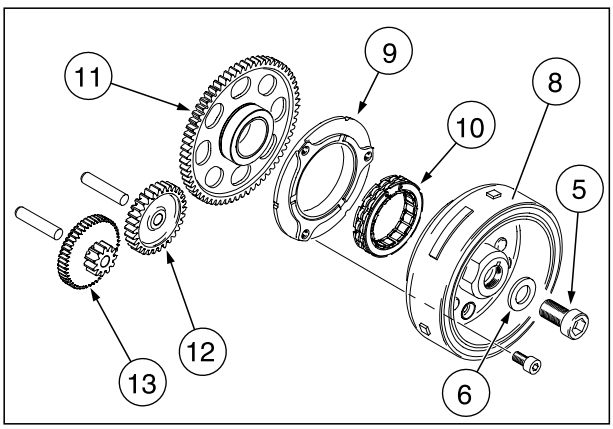


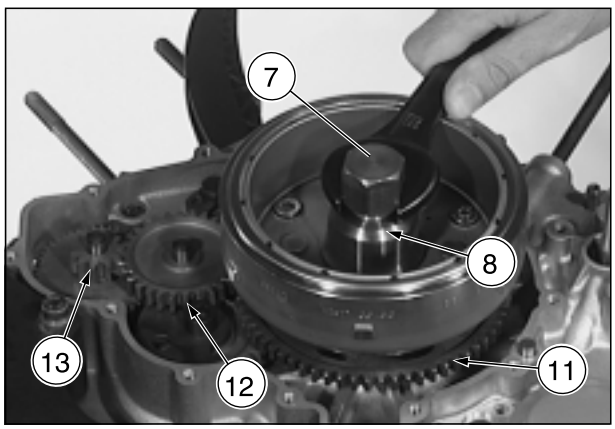
⚠ CAUTION

Do not heat the hub of the magneto flywheel (8) over a flame; instead use a suitable jet of warm air.

NOTE Heat, for five-ten minutes, the hub of the magneto flywheel (8) with a jet of warm air since the cone is also fastened with LOCTITE® 648.

- Remove the flywheel with the freewheel flange (9), the freewheel (10) and the freewheel mechanism (11).
- Remove the starter idler gear (12) and double gear (13).



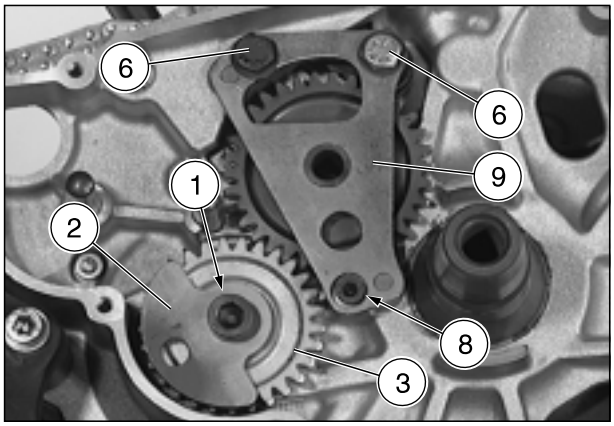


3.5.6 DISASSEMBLING CYLINDER “1” (FRONT) TIMING DRIVE ASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following operations can be performed without removing the engine from the frame.

- ◆ Unscrew and remove the M10 T.C.E.I. screw (1).
- ◆ Remove the external counterweight (2), the drive pinion (3), the internal counterweight (4) and the countershaft key (5).
- ◆ Unscrew and remove the two M8 T.E. screws (6) and remove both spring washers (7).
- ◆ Unscrew and remove the M6 T.C.E.I. screw (8) and remove the complete roller bearing flange (9).



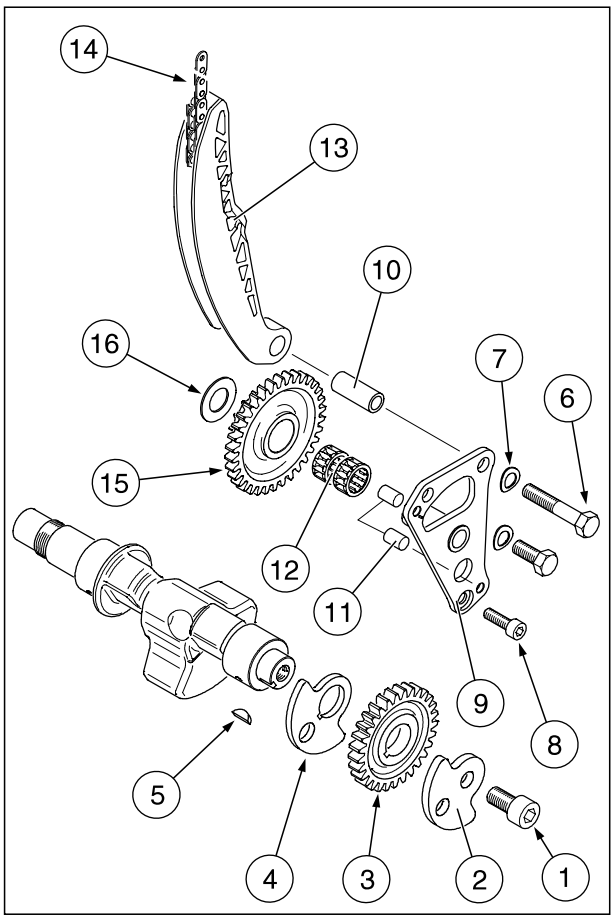
NOTE The cylinder and the head are still fitted on the engine. In order to remove the timing chain (14), the chain tightener and camshaft gears must be removed, see 3.5.3 [DISASSEMBLING CYLINDER “1” (FRONT), HEAD AND PISTON].

NOTE During disassembly of the roller bearing flange (9), there is no need to remove the components (10-11-12) from the actual flange.

- ◆ Pull out the spacer bush (10), the two locating dowels (11) and two roller bearings (12).

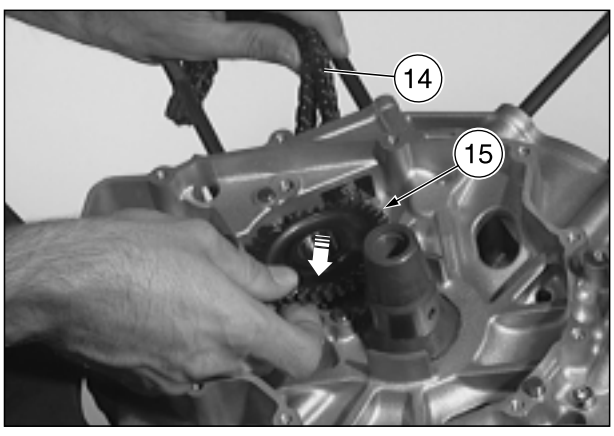
NOTE As of engine # 527354, the locating dowels (11) are no longer fitted: centring is achieved with the aid of the flange (9).

- ◆ Remove the chain tightener shoe (13), pulling it out from above.



NOTE Mark the timing chain (14) with a coloured dot so that you are sure to refit it with the same direction of rotation.

- ◆ Pull the timing chain (14) out from below, complete with the idler gear (15), and remove the washer (16).



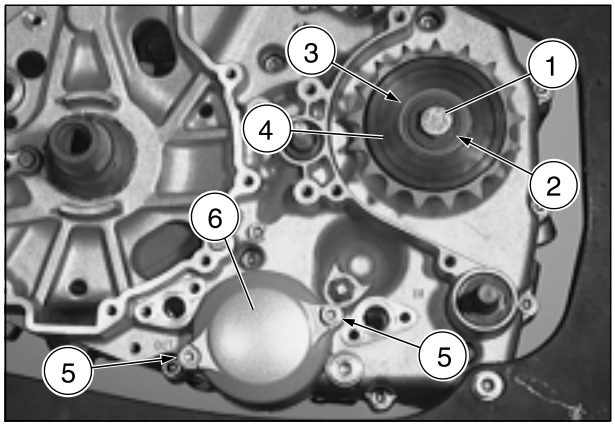
3.5.7 REMOVING THE DRIVING CHAIN PINION AND OIL FILTER CARTRIDGE

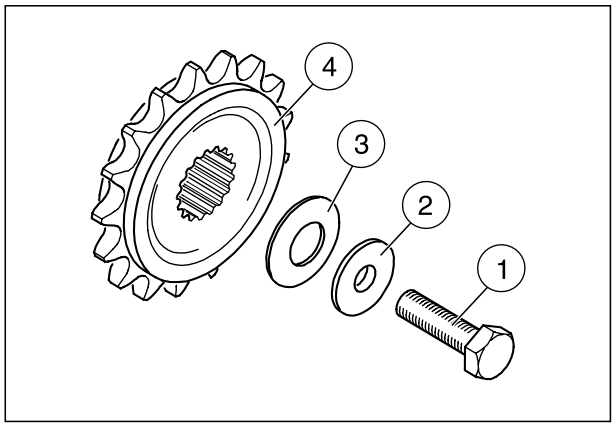
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following operations can be performed without removing the engine from the frame.

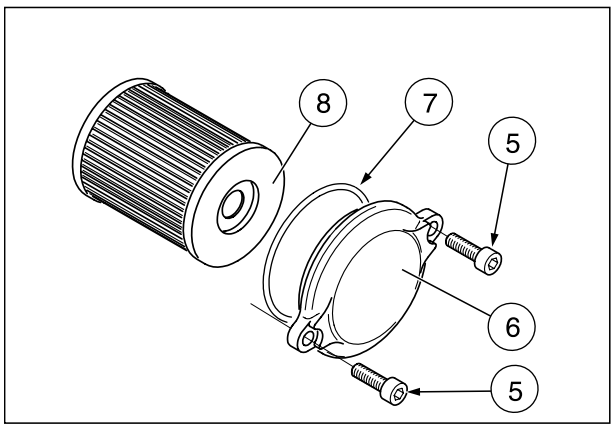
- ◆ Unscrew and remove the M10 T.E. screw (1).
- ◆ Remove the washer (2), the spring washer (3) and the pinion (4).

NOTE Where necessary, use the universal sleeve puller to remove the pinion, taking care not to damage the secondary shaft.





- ◆ Unscrew and remove the two M6 T.C.E.I. screws (5).
- ◆ Remove the cover of the oil filter (6) and the O-ring (7).
- ◆ Remove the oil filter cartridge (8) from the filter housing.

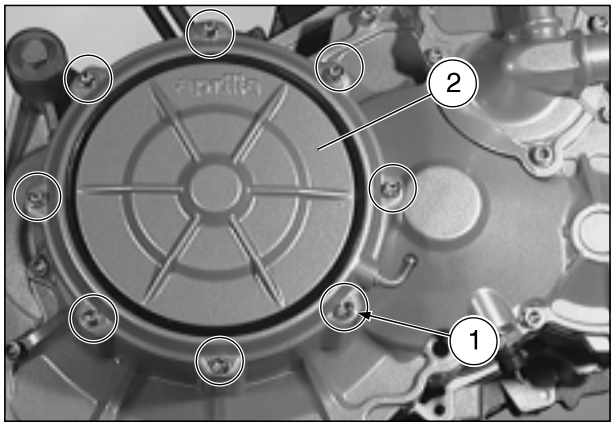


3.5.8 REMOVING THE CLUTCH COVER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

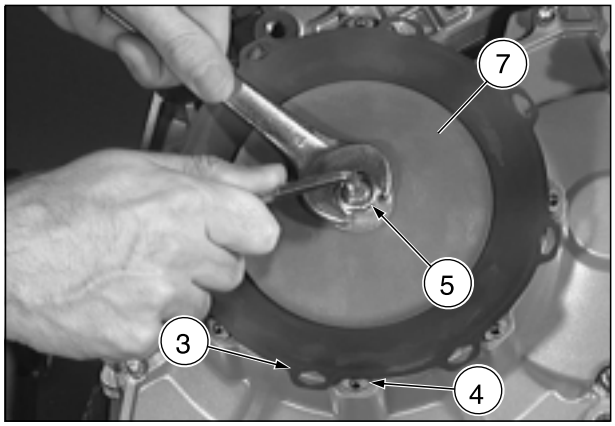
NOTE The following operations can be performed without removing the engine from the frame.

- Unscrew and remove the eight M5 T.C.E.I. screws (1) and remove the complete diaphragm cover (2).
- Remove the diaphragm (3) from the clutch cover retainers (4) and turn it approx. 20°.
- Unscrew and remove the M12 stop nut (5) and remove the washer (6), cup (7), diaphragm (3), support ring (8) and the washer (9).



NOTE In order to unscrew and remove the M12 stop nut (5), the clutch disengaging shaft must be held still with a bent hexagon-head driver.

- Unscrew and remove the four M6 T.C.E.I. screws (10) and remove the coolant pump casing (11) complete with shaped seal.



NOTE The lower T.C.E.I. screw (12) (coolant drain plug) also features a seal.

See 3.6.21 (COOLANT PUMP) for instructions on disassembling the coolant pump.

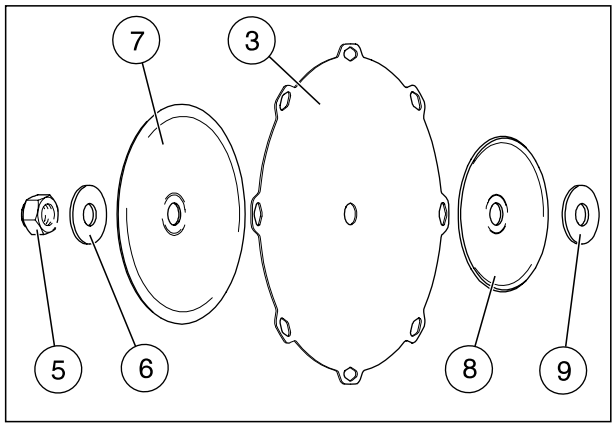
NOTE If the M8 T.C.E.I. screw (15) has not been previously removed, to retain the shaft at TDC, this screw must also be removed.

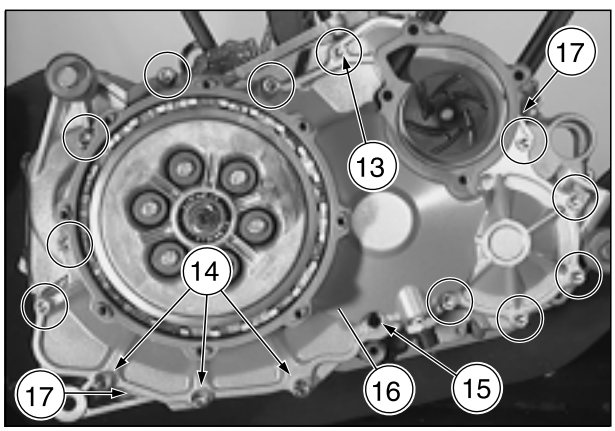
- Unscrew and remove the eleven M6 T.C.E.I. screws (13) and the three M8 T.C.E.I. screws (14).

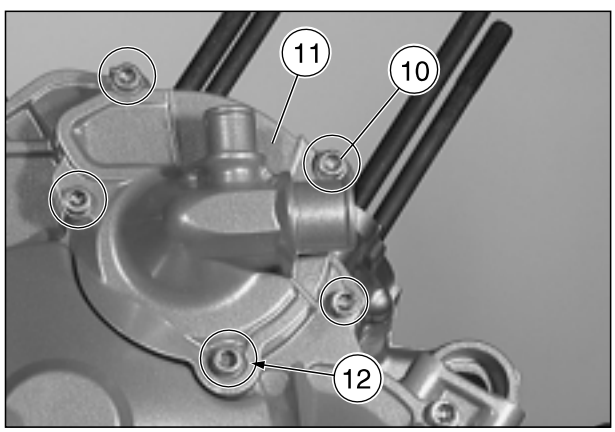
⚠ CAUTION

Be careful not to damage the gasket surfaces when lifting the clutch cover.

- Lift the clutch cover (16) carefully, using a screwdriver to work the pull-out tabs (17), and remove it.
- Remove the gasket.







3.5.9 DISASSEMBLING THE CLUTCH

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following operations can be performed without removing the engine from the frame.

NOTE The driving shaft must be retained at TDC, see 3.5.3 [DISASSEMBLING CYLINDER "1" (FRONT), HEAD AND PISTON].

- Unscrew and remove the six M6 T.E. screws (1).
- Remove the washer (2), clutch springs (3) and support cups (4).
- Remove the complete clutch disengaging shaft (5).

NOTE Have the special tools OPT (9) to hand (cod. 8140185 - clutch disc extraction hook levers).

NOTE The lower clutch discs can only be removed individually with the aid of the appropriate hook levers (9).

- Remove the lined discs (6) and steel discs (7) from the clutch housing (8).

NOTE Have the appropriate special tool OPT (10) to hand (cod. 0277881 - clutch blocking tool).

- Insert the clutch blocking tool (10) in the clutch housing (8) and on the clutch hub (11).

⚠ CAUTION

Insert the clutch blocking tool all the way into the clutch drum so as not to damage the basket when loosening the T.E. nut.

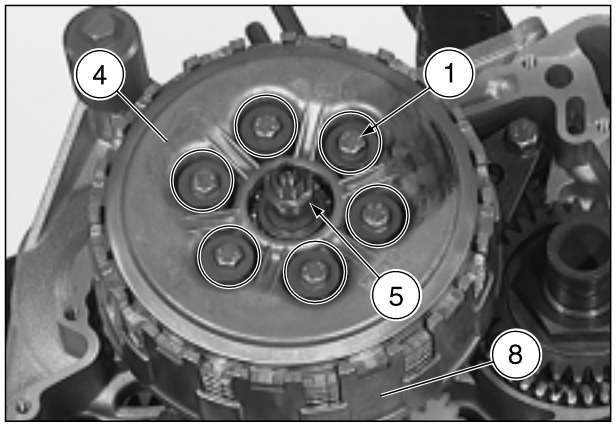
- Unscrew and remove the M24x1.5 T.E. nut (12).
- Remove the clutch blocking tool (10), spring washer (13) and clutch hub (11).
- Remove the complete clutch housing (8) and the thrust ring (14).

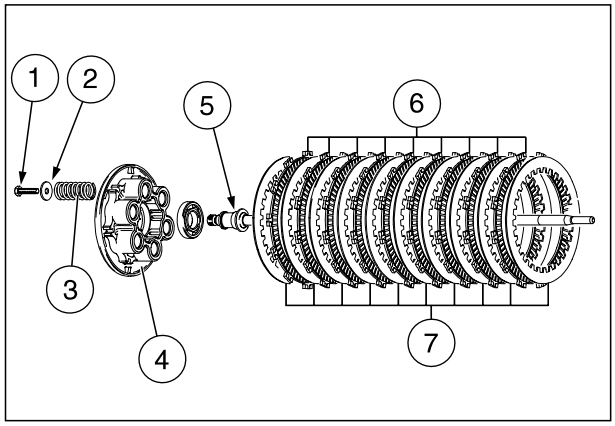
NOTE The oil pump gear (15) is hooked onto the support plate (16) of the complete clutch housing (8).
Take the complete clutch housing apart, see 3.6.17 (CLUTCH AND PRIMARY TRANSMISSION ASSEMBLY).

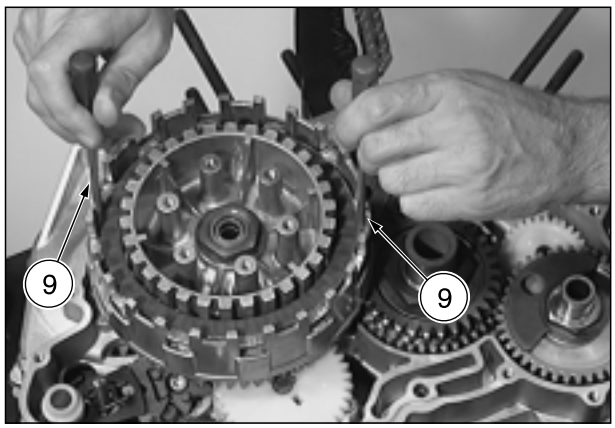
⚠ CAUTION

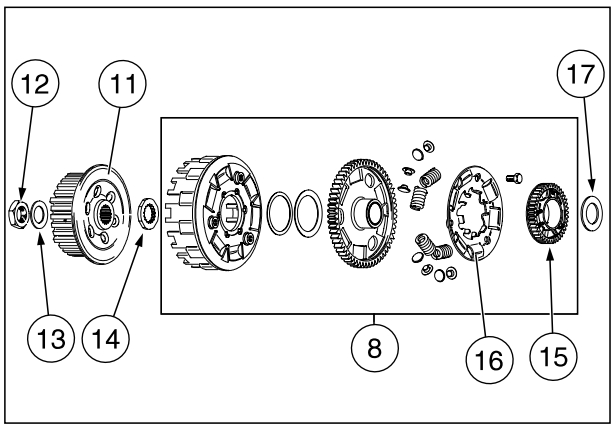
Once disassembled, the oil pump gear (15) must always be replaced.

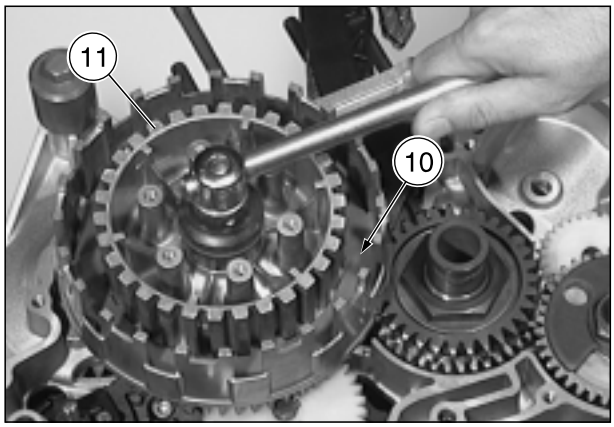
- Remove the washer (17) from the primary shaft.







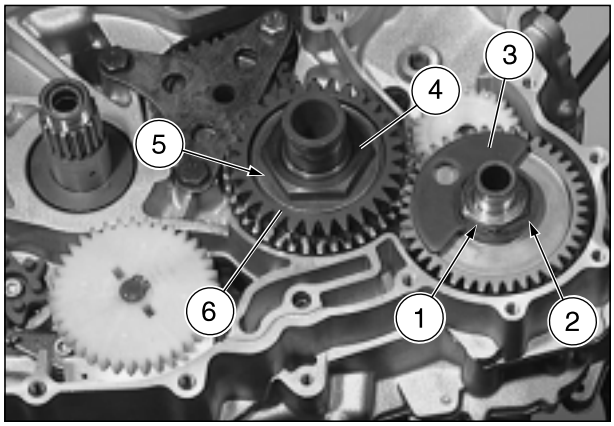




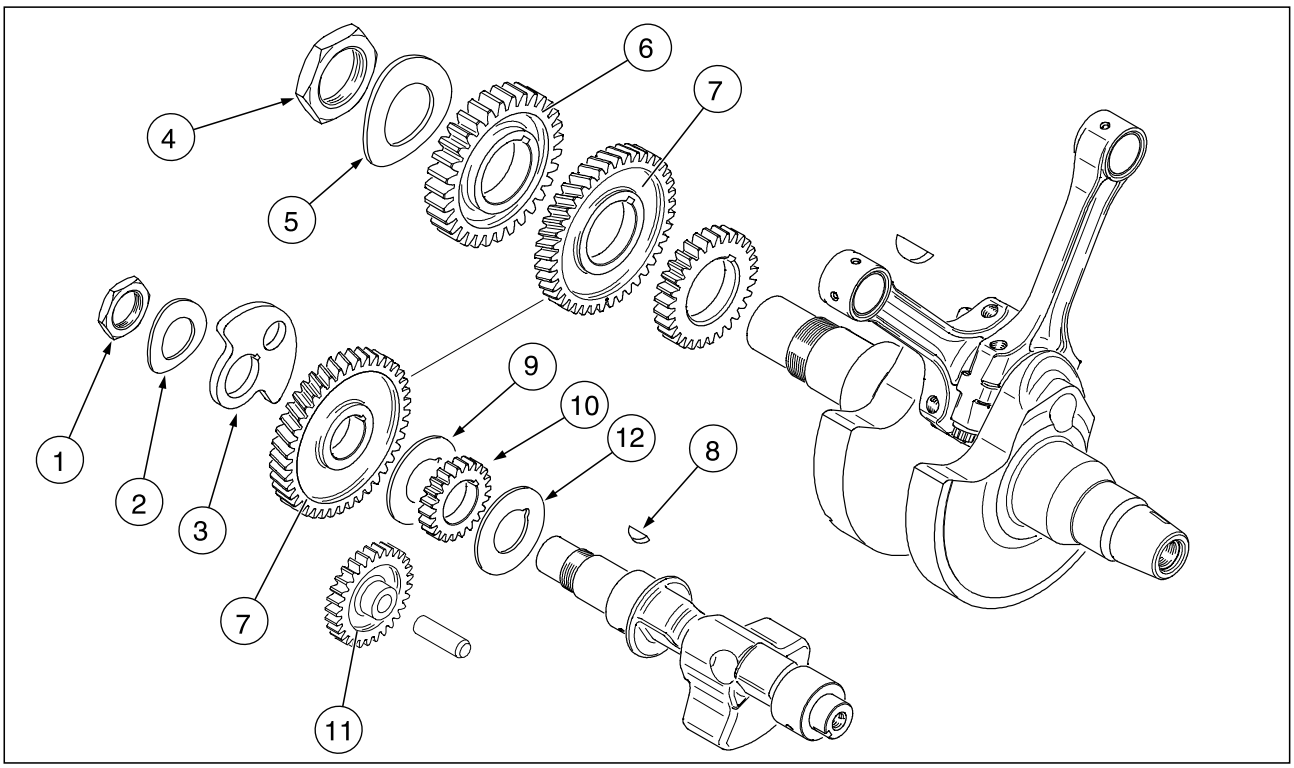
3.5.10 DISASSEMBLING THE COUNTERSHAFT MECHANISM AND PRIMARY TRANSMISSION

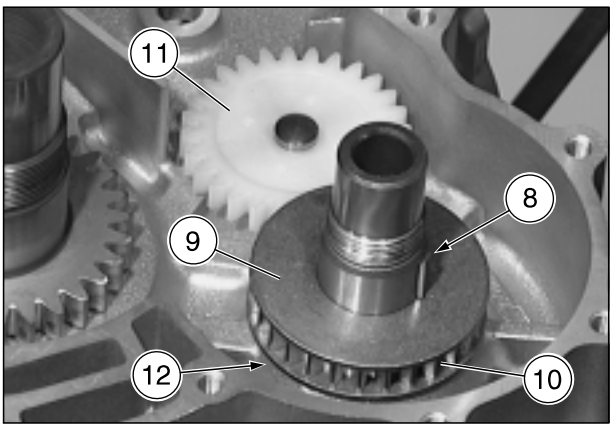
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

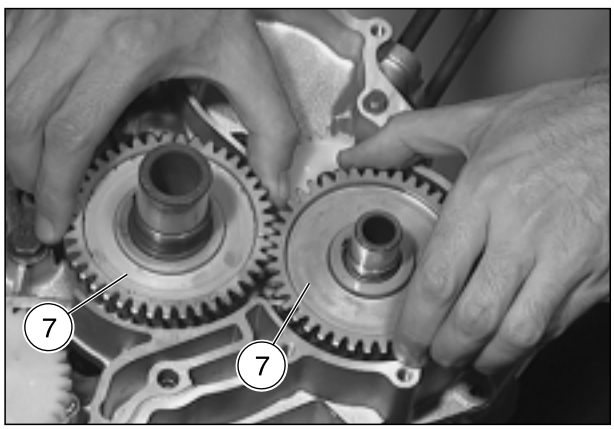
NOTE The driving shaft must be retained at TDC, see 3.5.3 [DISASSEMBLING CYLINDER "1" (FRONT), HEAD AND PISTON].



- Unscrew and remove the M22x1.5 T.E. nut (1), remove the spring washer (2) and countershaft counterweight (3).
- Unscrew and remove the M33x1.5 T.E. nut (4) and remove the spring washer (5).
- Remove the drive gear (6) from the driving shaft.
- Remove the differential gears (7) from the driving shaft and countershaft together.
- Detach the key (8), the upper washer (9) and coolant pump gear (10) from the countershaft.
- Remove the coolant pump idler gear (11).
- Detach the lower washer (12) from the countershaft.



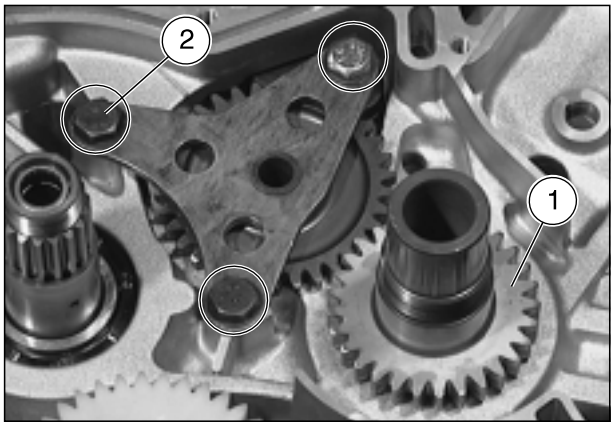




3.5.11 DISASSEMBLING CYLINDER “2” (REAR) TIMING DRIVE ASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Remove the drive gear (1) from the driving shaft.
- ◆ Unscrew and remove the three M8 T.E. screws (2) and detach the lock washers (3).

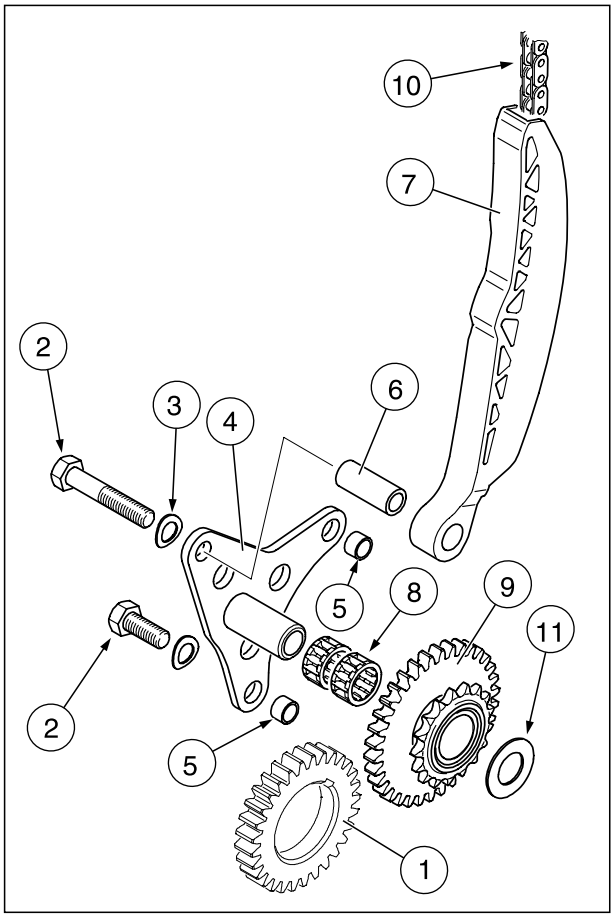


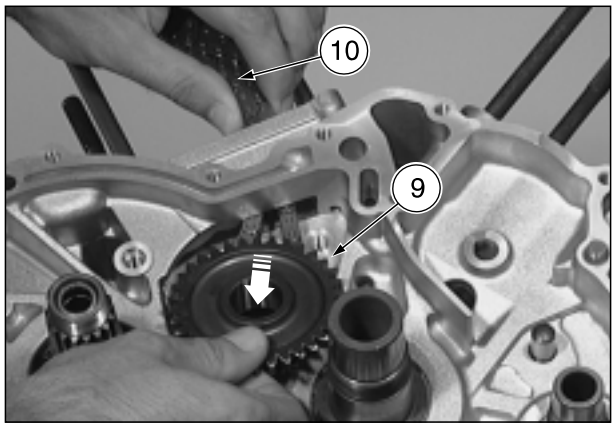
NOTE The cylinder and the head are still fitted on the engine. In order to remove the timing chain (10), the chain tightener and camshaft gears must be removed, see 3.5.4 [DISASSEMBLING CYLINDER “2” (REAR), HEAD AND PISTON].

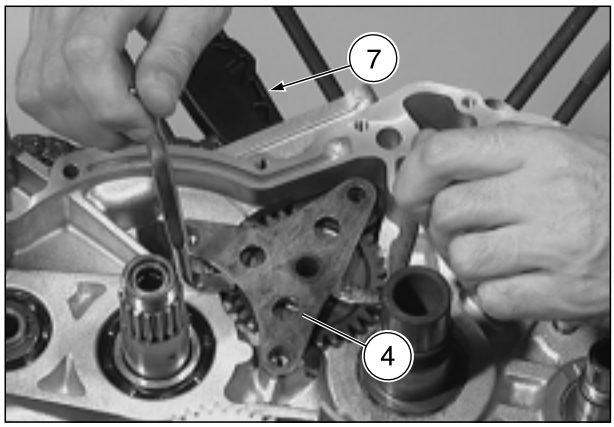
- ◆ Remove the complete roller bearing flange (4) together with the two calibrated bushes (5) and spacer bush (6).
- ◆ Remove the chain tightener shoe (7), pulling it out from above.
- ◆ Remove the two roller bearings (8).
- ◆ Remove the intermediate drive gear (9) and timing chain (10), pulling both out together downwards.

NOTE Mark the timing chain (10) with a coloured dot so that you are sure to refit it with the same direction of rotation.

- ◆ Remove the washer (11).



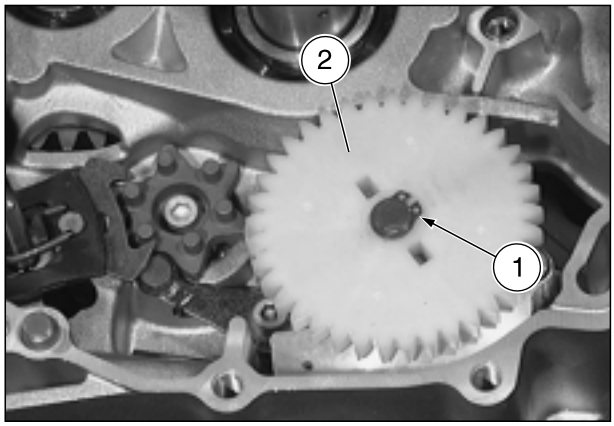




3.5.12 DISASSEMBLING THE OIL PUMP

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Remove the seeger ring (1).
- ◆ Slide the oil pump gear (2) up and off.



⚠ CAUTION

Once disassembled, the oil pump gear (2) must always be replaced.

NOTE Turn the oil pump shaft so that the pin can be slid out through the slot on the pump cover (5).

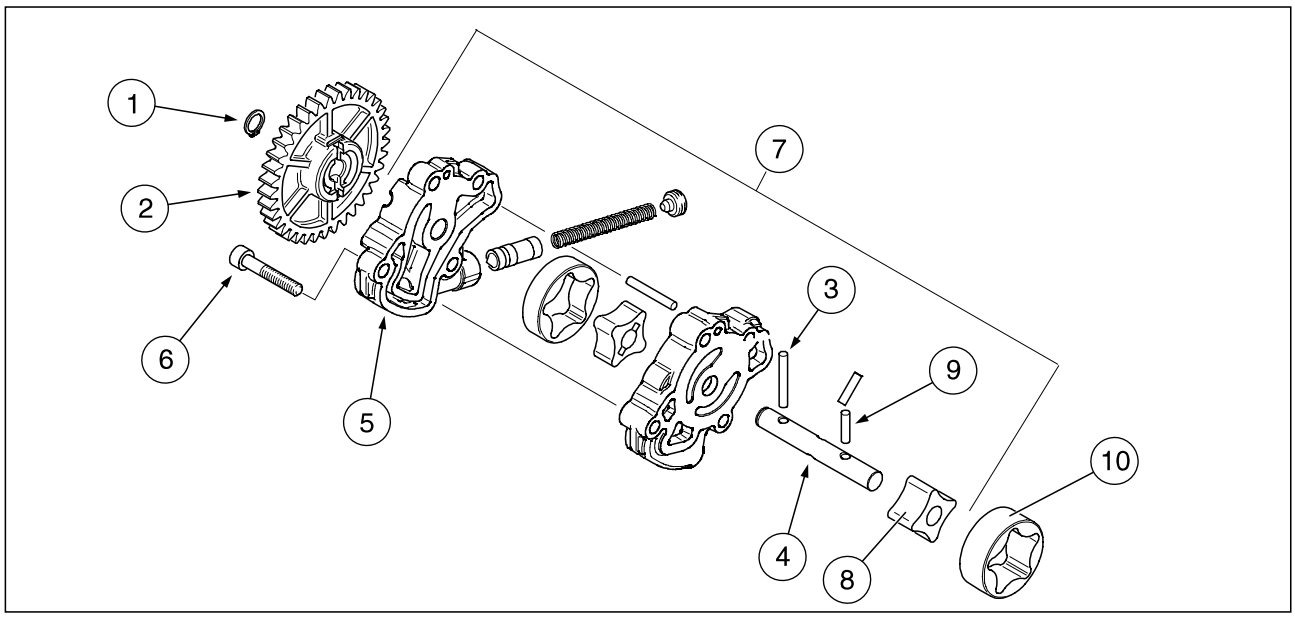
- ◆ Slide the pin (3) out of the oil pump shaft (4).
- ◆ Unscrew and remove the four M6 T.C.E.I. screws (6) and remove the complete oil pump (7) from the engine casing.

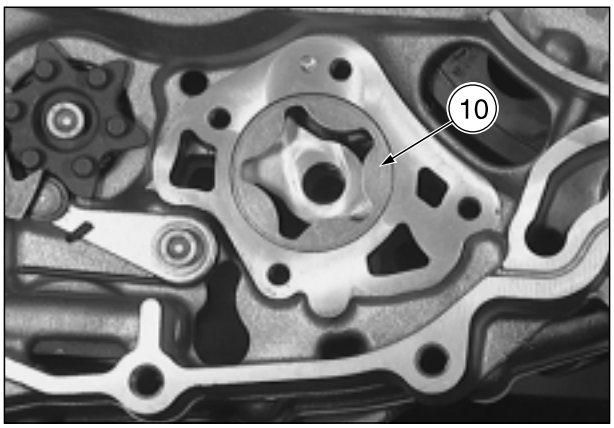
⚠ WARNING

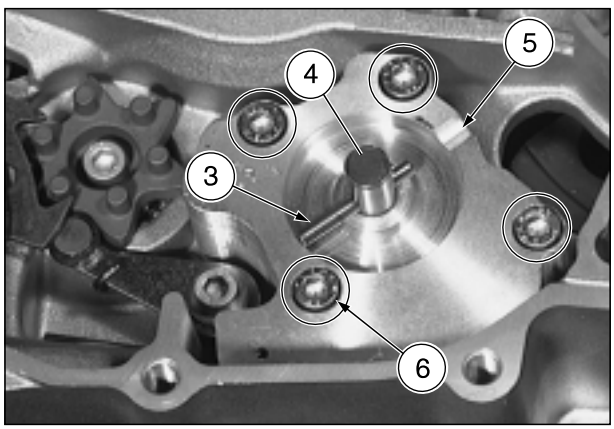
When removing the whole oil pump (7), it is advisable to leave the inside rotor (8) and pin (9) fitted since there is a danger of the pin (9) falling into the oil sump.

- ◆ Remove the suction pumps external rotor (10) from the engine casing.

NOTE Take the oil pump apart, see 3.6.10 (OIL PUMP AND OIL PUMP DRIVE ASSEMBLY).







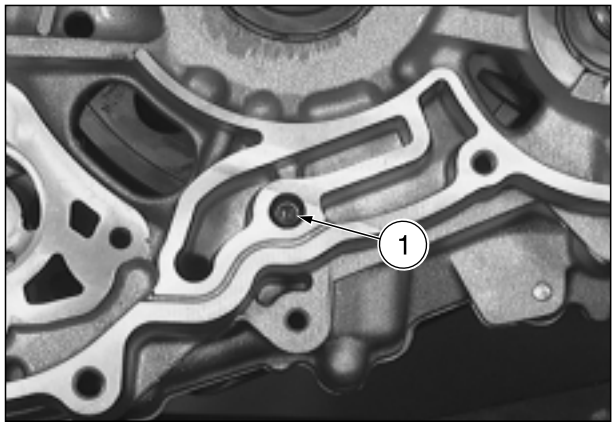
3.5.13 DISASSEMBLING THE GEAR SELECTION MECHANISM

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

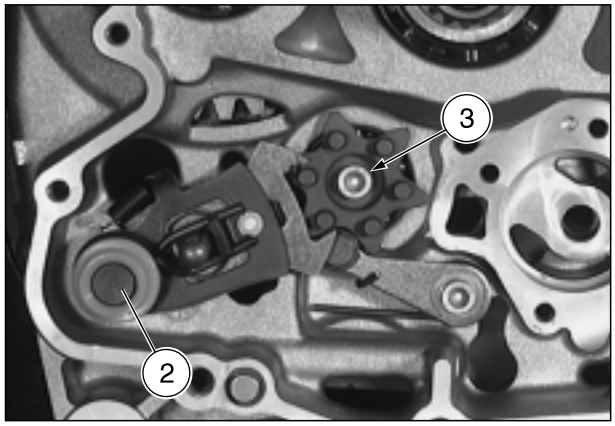
◆ Unscrew the threaded pin M8 (1) retaining the driving shaft at TDC.

NOTE Turn the driving shafts by hand to enable the gear to engage.

◆ Engage 6th gear.

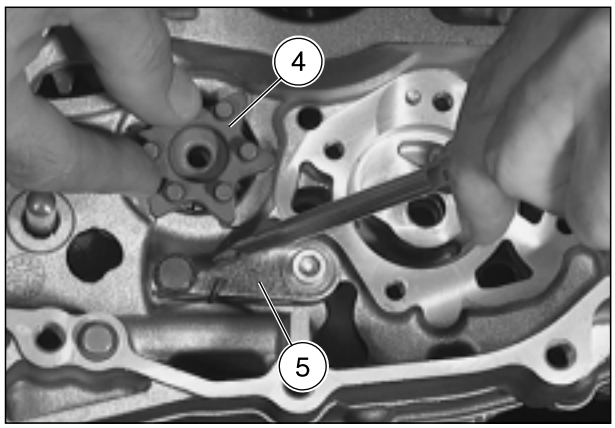


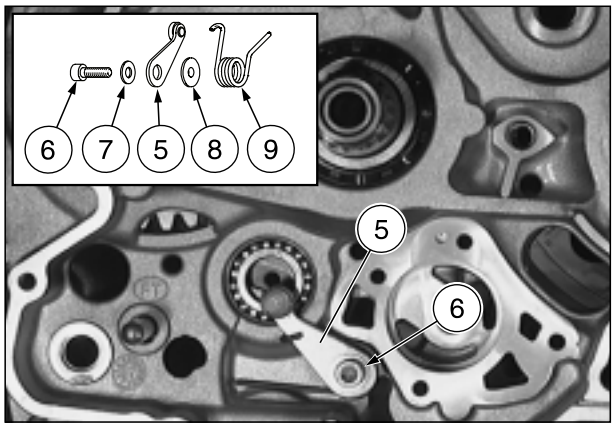
◆ Remove the complete selector shaft (2).
◆ Unscrew and remove the M6 T.C.E.I. screw (3) and remove the index plate (4).



NOTE Use a screwdriver to push the complete positioning lever (5) down to make it easier to remove the index plate.

◆ Unscrew and remove the M6 T.C.E.I. screw (6) and remove the washer (7), positioning lever (5), graduated ring (8) and positioning spring (9).

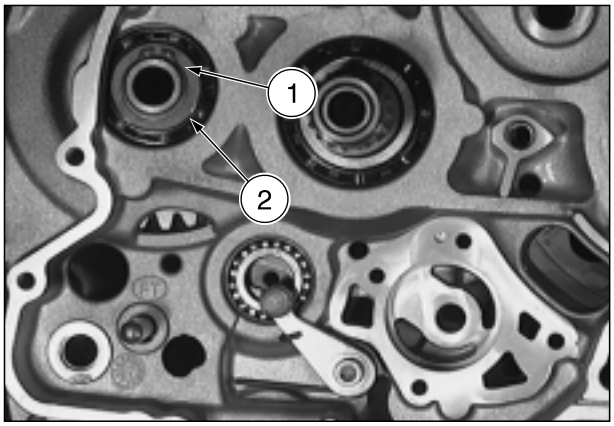




3.5.14 SPLITTING THE ENGINE CASING OPEN

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

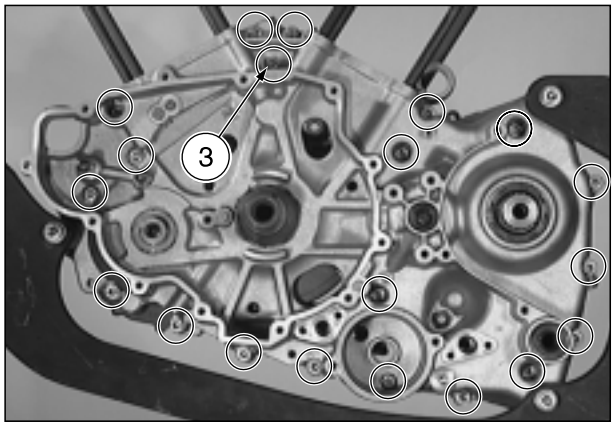
- ◆ Take the seeger ring (1) and thrust washer (2) off the secondary shaft.
- ◆ Unscrew and remove the twenty M6 T.C.E.I. screws (3).



⚠ CAUTION

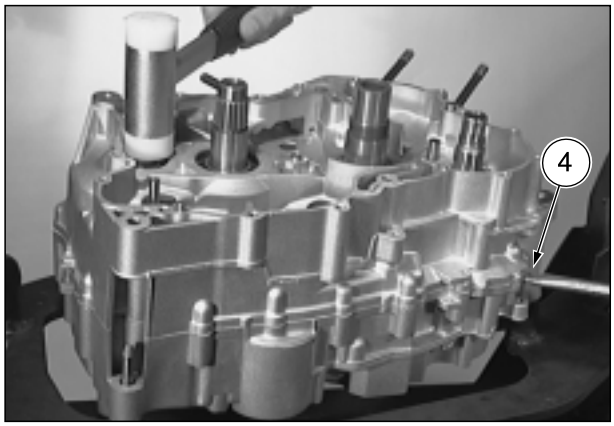
Comply with the following instructions:

- **– Use a plastic hammer to strike the primary and secondary shafts alternately until they are embedded in the flywheel side half of the engine casing.**
- **– Make sure the engine half-casing is lifted parallel to the surface so that the main bearings are not tilted and hence damaged.**
- **– Where necessary, use a screwdriver, inserted in the appropriate points (4), to help prise them apart.**
- **– Take your time and work with extreme care.**
- **– Never strike the gasket surface.**
- **– Do not use excessive force.**
- **– Should it prove impossible to separate the two halves of the casing, check for any screws which have not been loosened.**



NOTE When lifting the engine half-casing, the washers of the secondary shaft may be attached on the inside of the clutch side half of the engine casing.

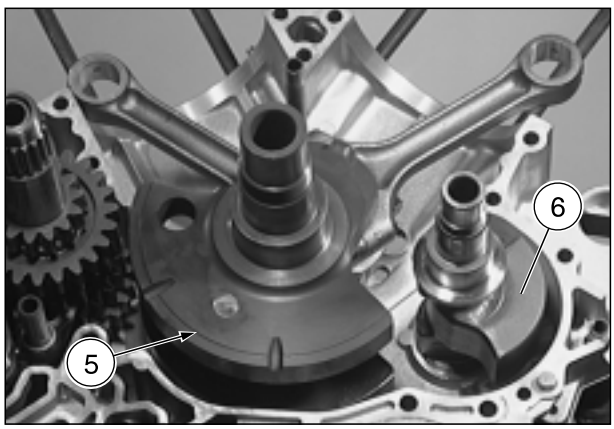
- ◆ Split the two sections of the engine casing apart by lifting the clutch side section.



3.5.15 DISASSEMBLING THE DRIVING SHAFT AND COUNTERSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

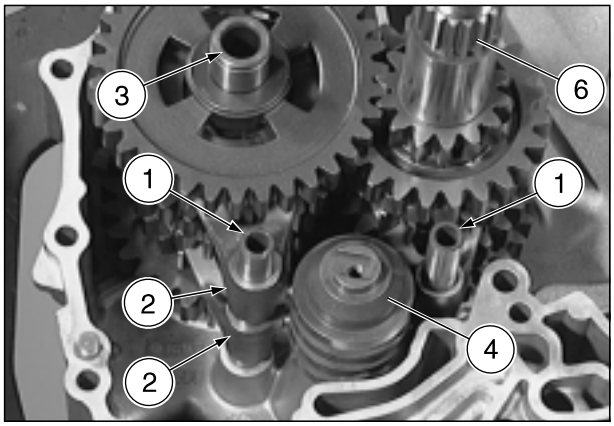
- ◆ Turn the driving shaft (5) so that it does not mate with the countershaft (6).
- ◆ Remove the countershaft (6).
- ◆ Remove the driving shaft (5).



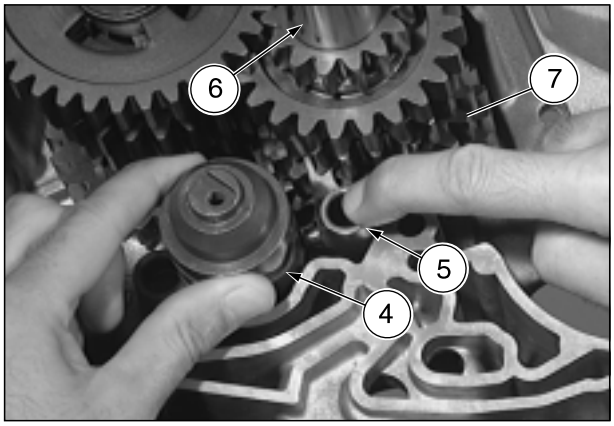
3.5.16 DISASSEMBLING THE GEARSHIFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Remove the two spindles (1).
- ◆ Turn both gearshift forks (2) of the secondary shaft (3) outwards, moving them away from the guides of the selector cylinder (4), and remove them.



- ◆ Turn the gearshift fork (5) of the primary shaft (6) outwards, moving it away from the guide of the selector cylinder (4), and remove the selector cylinder.
- ◆ Push the 3rd and 4th gear selector gear (7) upwards and remove the fork (5) from the primary shaft.
- ◆ Set the engine half-casing upright on the assembly bench.



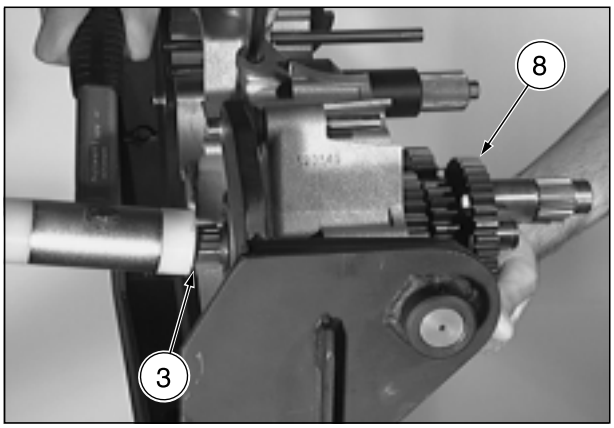
NOTE Keep both the secondary shaft and primary shaft still with one hand whilst tapping the secondary shaft (3) with a plastic hammer, working from the outside. This forces the two shafts out of their relevant housings complete with the gearshift gears.

- ◆ Disassemble the gearshift (8).

⚠ CAUTION

The secondary shafts seal is inevitably damaged whilst disassembling the gearshift and must, therefore, be replaced.

NOTE Take the gearshift apart, see 3.6.15 (GEARSHIFT).



3.6 WORK ON THE INDIVIDUAL PARTS

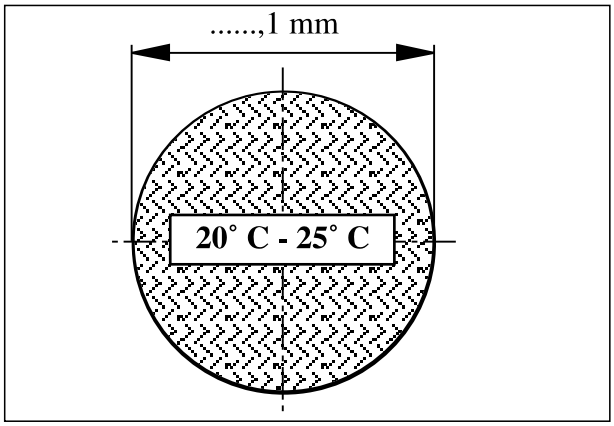
⚠ WARNING

Take care not to burn yourself when handling hot engine parts.

⚠ CAUTION

If any of the components has exceeded one of the wear limits or if, during the visual inspection of a component, a defect is detected liable to compromise the operation of the engine, said component must be replaced.

If the measurement values indicated are precise to one tenth of a millimetre or over, the temperature of the component must be in the range 20 to 25 °C (68 to 77 °F).



3.6.1 ENGINE CASING

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

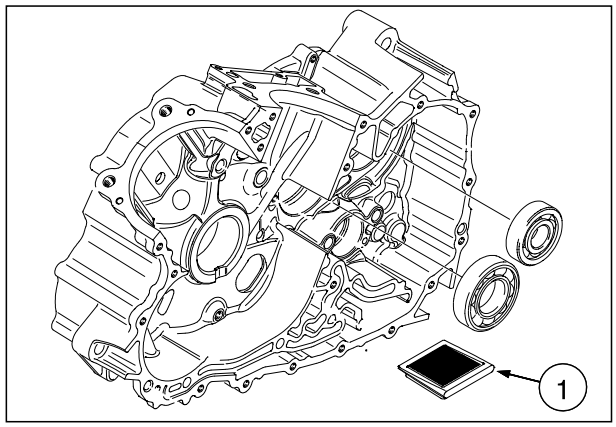
Do not use anti-sealer products, degreasers or cold detergents.

- ◆ Clean the two sections of the engine casing, ball bearings and all bearing housings thoroughly with a gentle solvent.
- ◆ Clean all the gasket surfaces and check for damage.

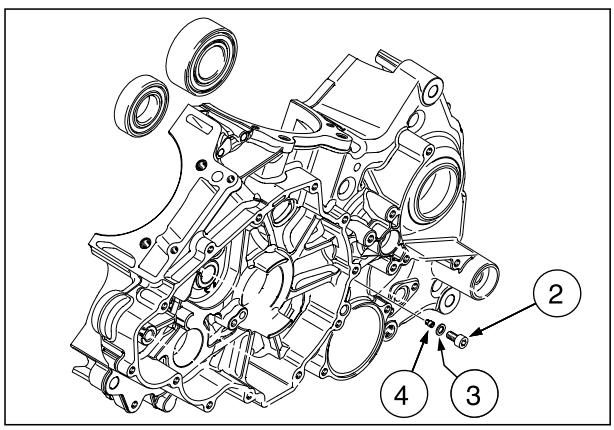
NOTE Place the two halves of the engine half-casing on a flat surface to prevent damage.

- ◆ Make sure the two halves of the engine half-casing do not feature cracks or signs of damage.
- ◆ Make sure all the threads are in a perfect state of repair.
- ◆ Make sure all the oil seals remaining in their slots are not worn or damaged.
- ◆ Check the slack of all the ball bearings and make sure they slide smoothly and are not distorted in any way.

NOTE Use motor oil to lubricate the ball bearings before performing the check.
If the inner race does not turn easily and silently, or if it makes a noise, it means the bearing is defective and needs replacing.

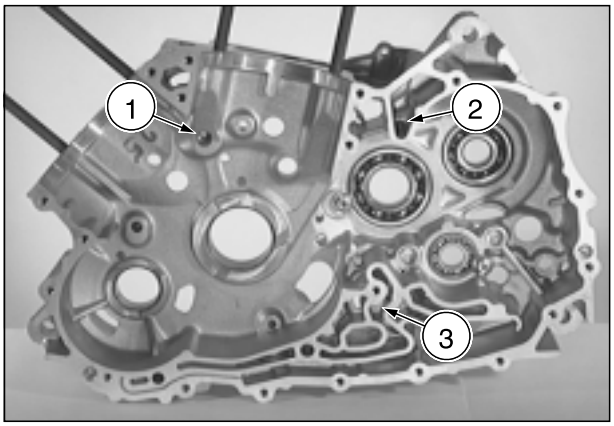


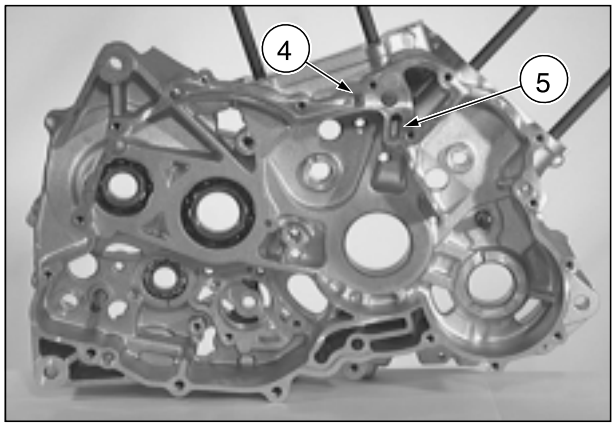
- ◆ Remove the oil gauze (1).
- ◆ Clean the oil gauze with naphta and check the mesh of the gauze for possible signs of damage.
- ◆ Unscrew and remove the M6 T.C.E.I. screw (2), the seal (3) and the nozzle (4).

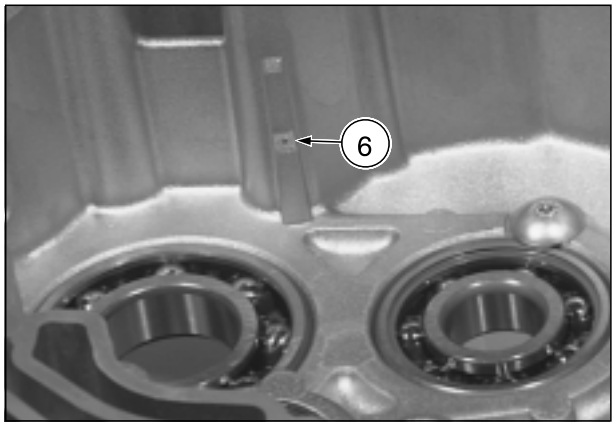


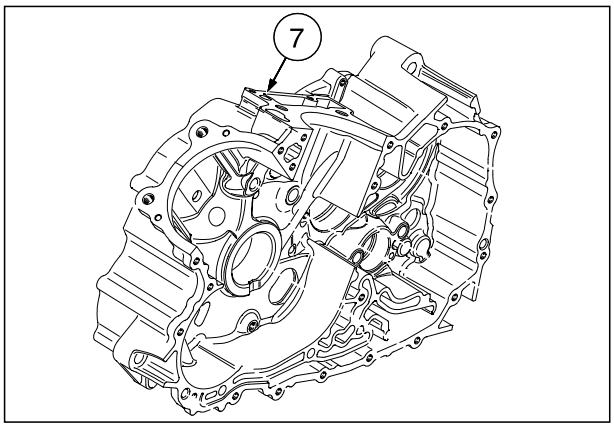
◆ Make sure the galleries are clear in all the lubrication holes (1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18) in the two halves of the casing and, where necessary, clean them by blowing a jet of compressed air inside.

3.6.2 ENGINE HALF-CASING, CLUTCH SIDE

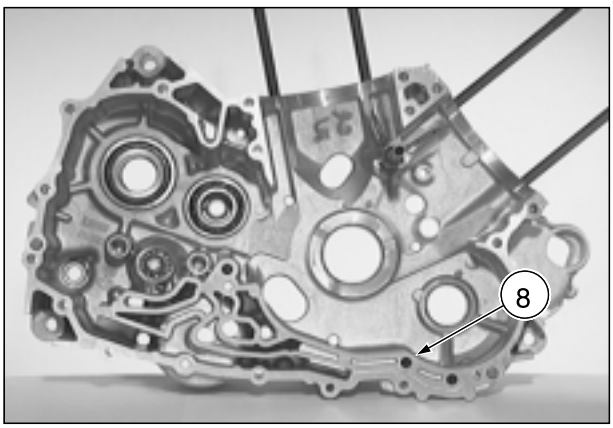


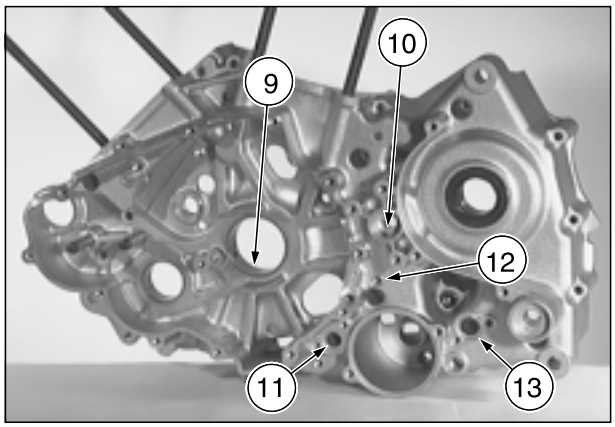


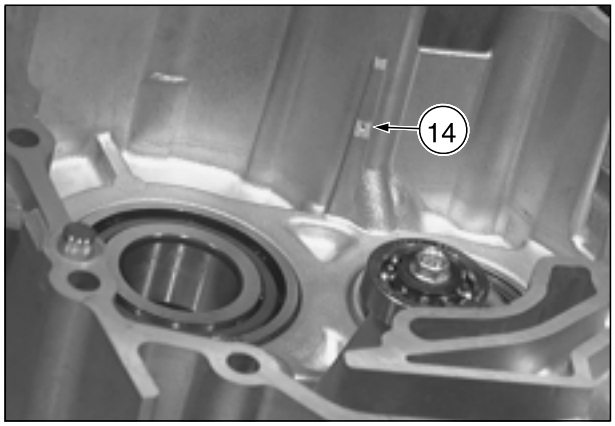


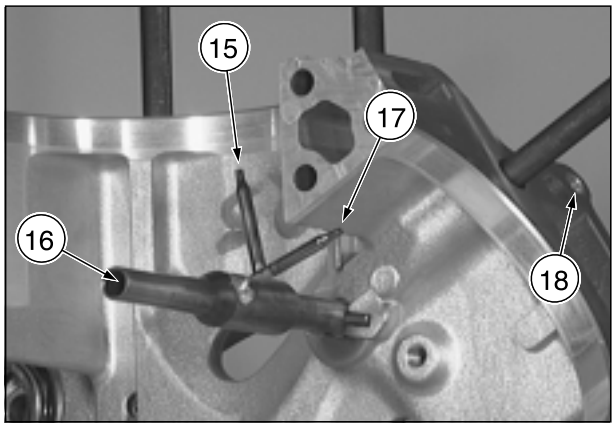


3.6.3 ENGINE HALF-CASING, FLYWHEEL SIDE









3.6.4 ENGINE HALF-CASING - BALL BEARINGS AND OIL SEALS

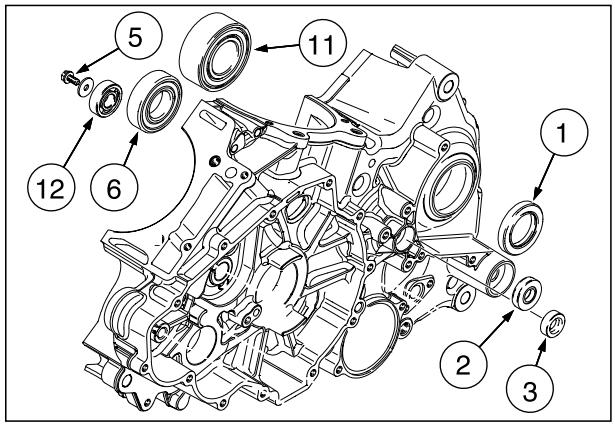
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

DISASSEMBLY

NOTE The oil seals can be disassembled and assembled without removing the engine from the vehicle.

◆ In order to remove and insert the ball bearings, heat the engine casing to a temperature of approx. **80 - 100 °C (176 - 212 °F).**
◆ Lift and take out the oil seals:

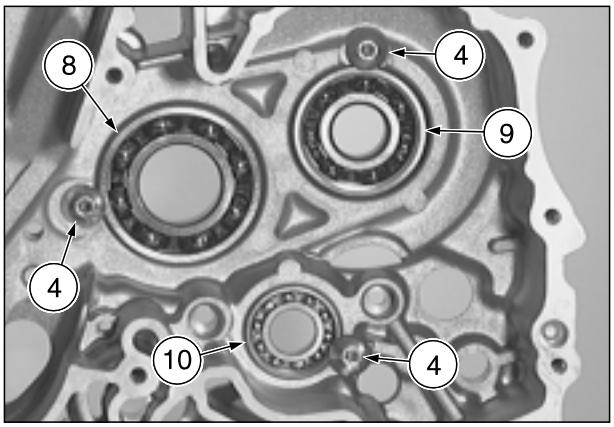
– secondary gearshift shaft (1);
– selector shaft (2);
– clutch disengaging shaft (3).



NOTE As a rule, the disassembled oil seals should be replaced.

◆ Unscrew and remove the M6 FH screws (4) securing the ball bearings.
◆ Remove the M6 x 13 flanged-head screw (5).

NOTE In order to avoid damaging the gasket surface, an old engine casing gasket should be placed underneath the puller plate.

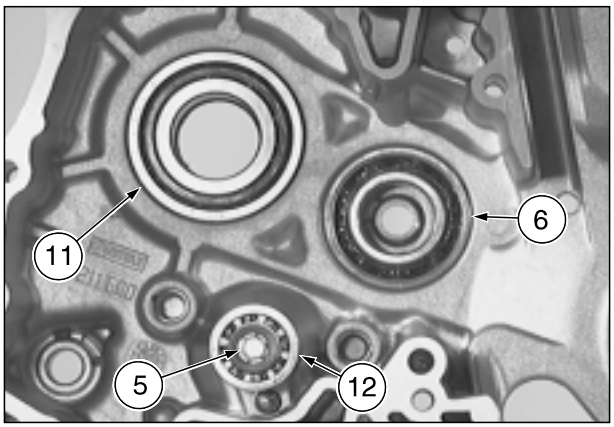


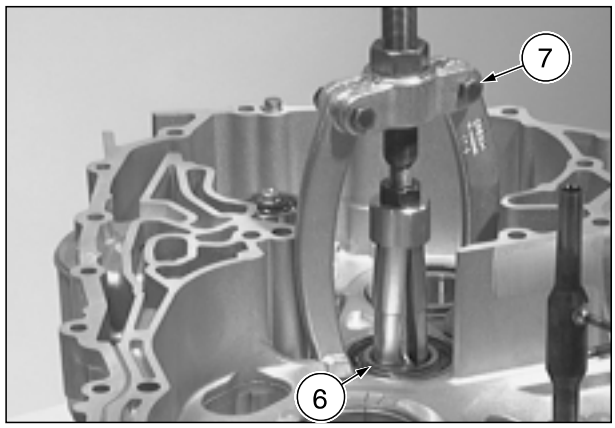
◆ Remove the primary shaft ball bearings (6) with the aid of a universal sleeve puller (7).
◆ Remove the ball bearings using the relevant drift.

– gearshift primary shaft (8), clutch side;
– gearshift secondary shaft (9), clutch side;
– shift cam (10), clutch side;
– gearshift secondary shaft (11), flywheel side.

◆ Remove the shift cam ball bearings (12).

NOTE As a rule, the disassembled ball bearings should be replaced.





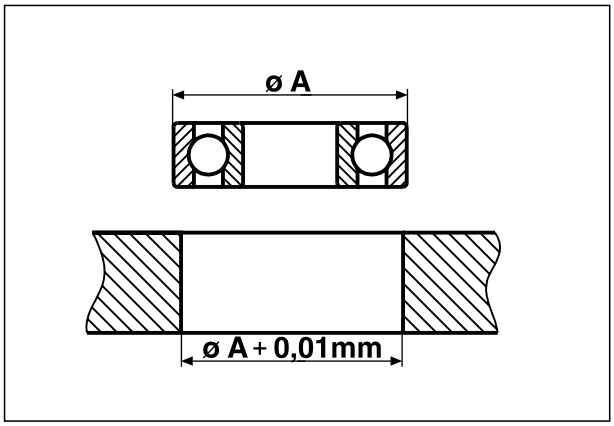
ASSEMBLY

◆ Check the interference between the bearing and the engine casing hole.

Interference “A” min. 0.01 mm.

◆ Lubricate the external diameter of the bearings slightly and, with due care, fit them all the way in on the outer ring using a suitable assembly punch:

– gearshift primary shaft (6), flywheel side;
– gearshift primary shaft (8), clutch side;
– gearshift secondary shaft (9), clutch side;
– shift cam (10), clutch side;
– gearshift secondary shaft (11), flywheel side.



⚠ CAUTION

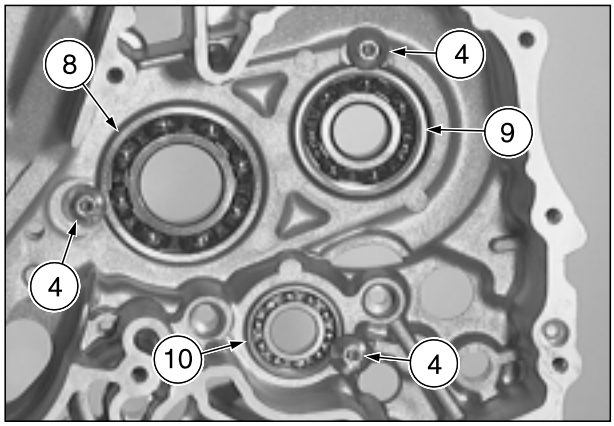
The sealing washer of the gearshift primary shaft ball bearing (6), flywheel side, must face outwards.

NOTE As a rule, the disassembled ball bearings should be replaced.

◆ Lubricate the internal diameter of the shift cam ball bearing (12), flywheel side, slightly and, with due care, fit it all the way in on the inner ring using a suitable assembly punch.
◆ Apply LOCTITE® 243 on the screws (4, 5) securing the ball bearings and screw them into the engine casing.

Driving torque of M6 T.P. screw (4): 11 Nm (1.1 kgm).

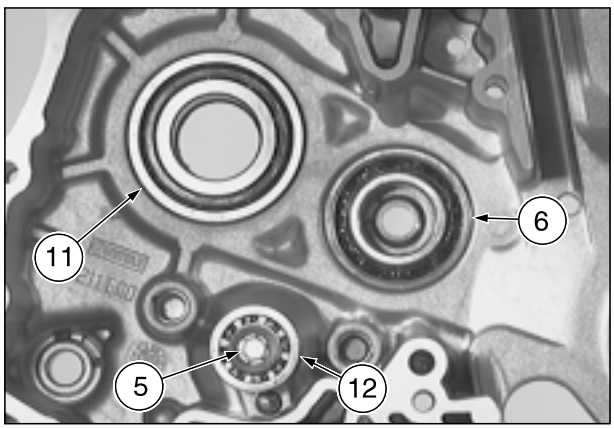
Driving torque of M5x10 flanged-head screw (5): 11 Nm (1.1 kgm).



NOTE Have the appropriate special tools OPT below to hand:

– (13) cod. 8140070 handle for pads;
– (14) cod. 0277680 (gearshift secondary shaft oil seal assembly pad);
– (15) cod. 8140155 (gearshift shaft oil seal - clutch shaft oil seal assembly pad).

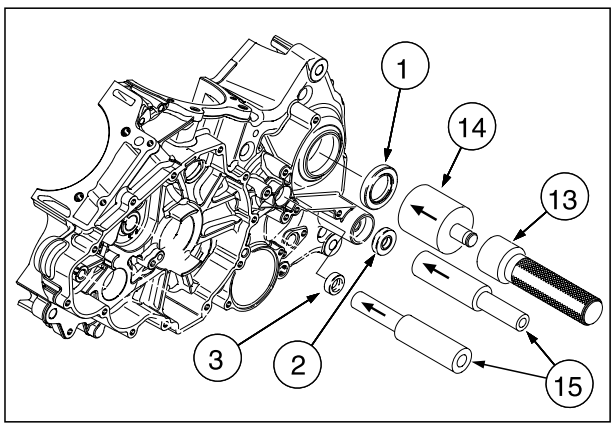
NOTE Before assembling the shaft sealing rings, their external diameter must be lubricated slightly.
The closed side of the shaft sealing rings must face outwards.
Grease the sealing lips.



⚠ CAUTION

The oil seal (1) of the secondary shaft must not touch the inner race of the bearing in any way as this would result in damage.

◆ Insert the oil seal (1) flush with the engine casing using the assembly pad (14).
◆ Insert the shaft sealing rings (2 - 3) all the way using the assembly pad (15).



3.6.5 ENGINE HALF-CASING - MAIN BUSHES, DRIVING SHAFT AND COUNTERSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

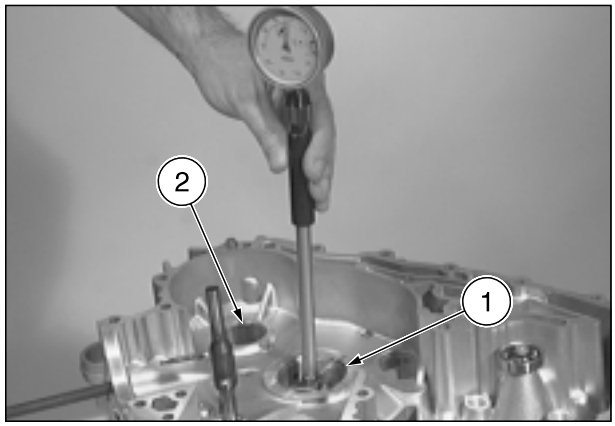
⚠ CAUTION

The main bushes may only be replaced by authorized repair shops suitably skilled in the use of the relevant measuring equipment and tools.

- ◆ Check for any damage and signs of rolling or grooves on the bearings sliding surfaces or on the thrust-bearing surfaces of the driving shaft and countershaft.
- ◆ Measure the internal diameter.

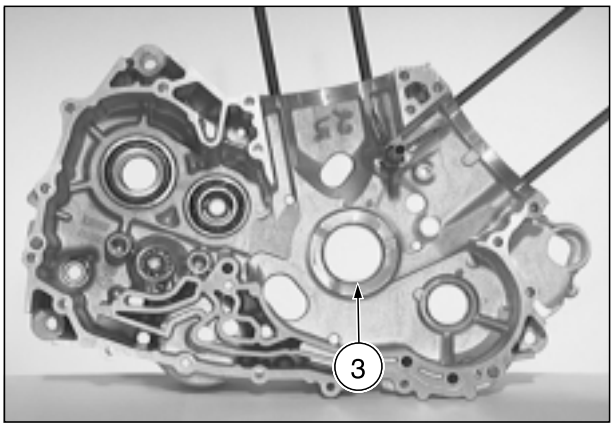
Driving shaft (1): wear limit Ø 46.035 mm.

Countershaft (2): wear limit Ø 32.060 mm.



⚠ CAUTION

Take a number of measurements, especially in the direction of the axis of both cylinders. None of the values must exceed the limit value.

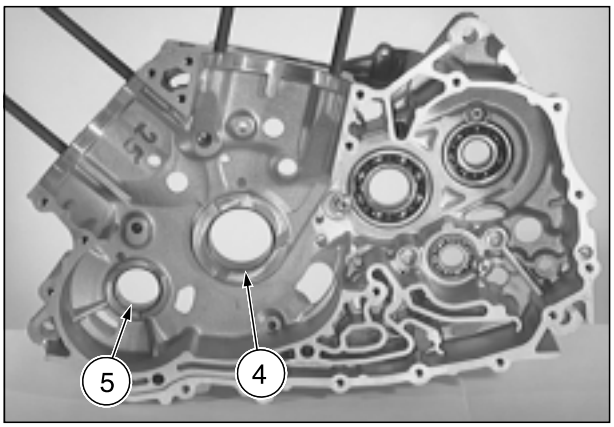


⚠ CAUTION

Measure the radial play of the driving shaft and countershaft, see 3.6.11 (DRIVING SHAFT) and 3.6.14 (COUNTERSHAFT AND COUNTERSHAFT MECHANISM).

- ◆ Check for signs of wear or slipping on the axial thrust-bearing surfaces (3 - 4), for the driving shaft, in both halves of the casing.

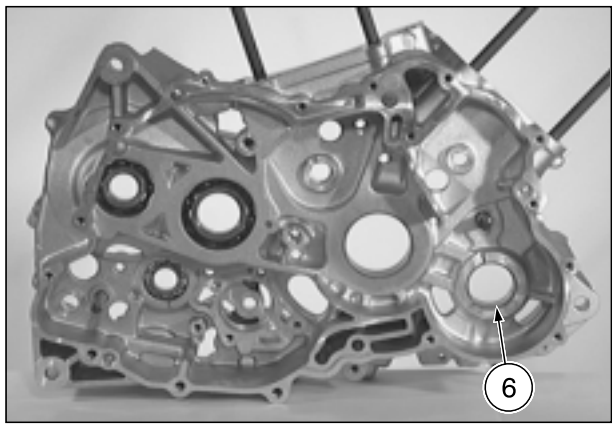
End play of the driving shaft:
wear limit max. 0.5 mm.



- ◆ Check for signs of wear or slipping on the axial thrust-bearing surfaces (5 - 6), for the countershaft, in the clutch side half of the casing.

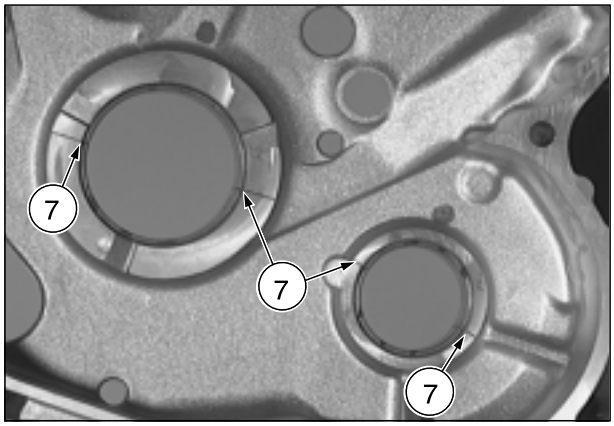
End play of the counter shaft:
wear limit max. 0.3 mm.

NOTE Since they are installed, determine the end play of the driving shaft and/or countershaft with a comparator.



DISASSEMBLY

◆ Use a felt pen to mark the contact surfaces (7) of the main bushes on both halves of the engine casing so as to provide an external visual reference.



⚠ CAUTION

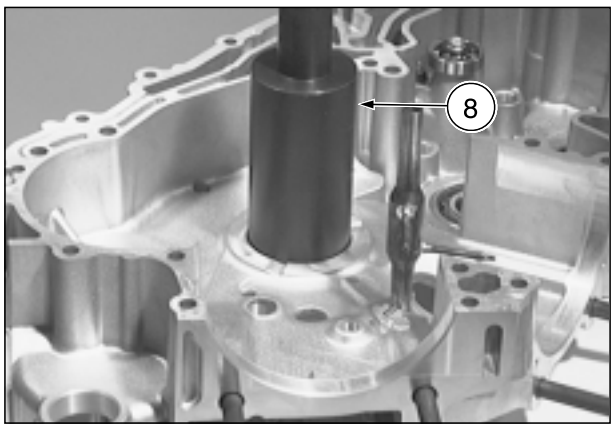
Do not perform any mechanical markings.

NOTE Have the following appropriate special tools OPT to hand:

– (8) cod. 0277720 (driving shaft sleeve puller pad);
– (9) cod. 2777530 (countershaft sleeve puller pad).

◆ Heat the engine casing to **approx. 150 °C (302 °F)** for approx. fifteen minutes**.**

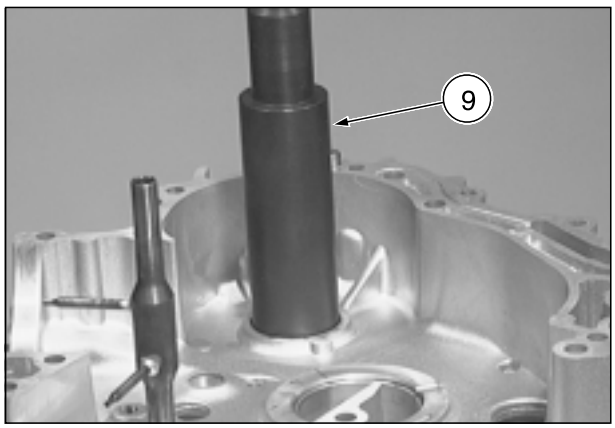
◆ Remove the main bushes from the inside out, setting them on a press and using the assembly pads (8 - 9).



⚠ CAUTION

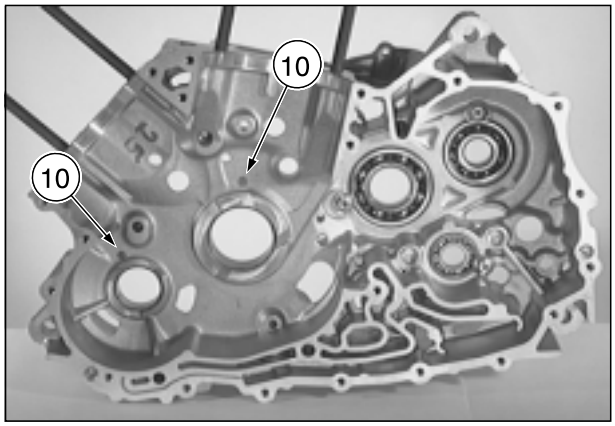
In order to insert and remove the main bushes, the engine casing must be supported by applying a spacer tube around the main bush housing on the outside for the engine to rest on.

NOTE As a rule, the disassembled main bushes should be replaced in pairs.



ASSEMBLY

- Clean the diameter of the main bush housing inside the engine casing.
- Determine the main bush size group based on the coloured markings (10) on the engine casing.



⚠ CAUTION

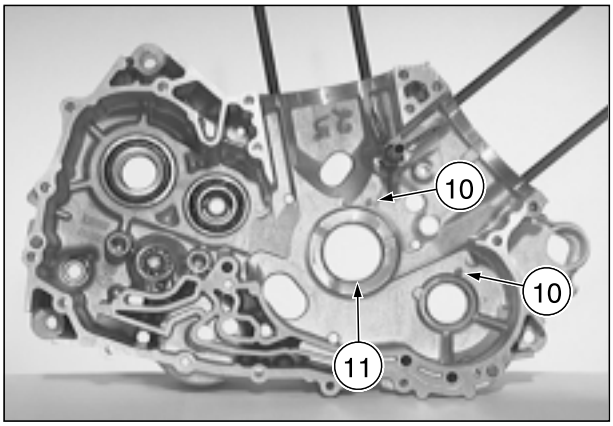
The lower main bush (11) of the driving shaft, flywheel side, features a lubrication hole.

NOTE The size group of the main bushes is also marked with a coloured dot.

- If the coloured marking applied on the engine casing is no longer clearly legible, calculate the diameter based on the average of a number of different measurements.

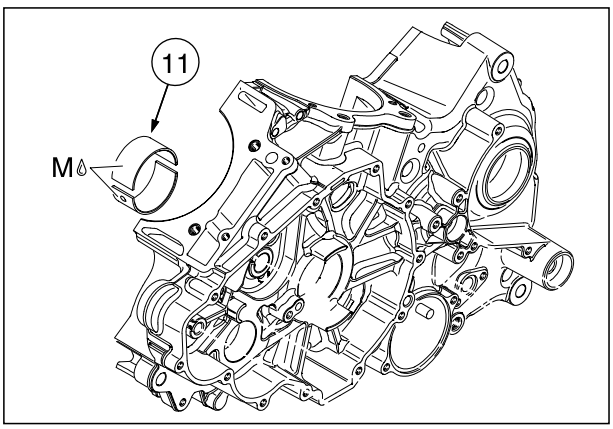
⚠ CAUTION

Take a number of measurements, especially in the direction of the axis of both cylinders.



Driving shaft		
Hole in the engine casing	**Main bushes marking**	**Engine casing marking**
Ø49.899 - Ø49.908 mm	**red**	**red**
Ø49.908 - Ø49.918 mm	**blue**	**blue**
Ø49.918 - Ø49.929 mm	**yellow**	**yellow**

Countershaft		
Hole in the engine casing	**Main bushes marking**	**Engine casing marking**
Ø35.909 - Ø35.918 mm	**red**	**red**
Ø35.918 - Ø35.928 mm	**blue**	**blue**
Ø35.928 - Ø35.939 mm	**yellow**	**yellow**

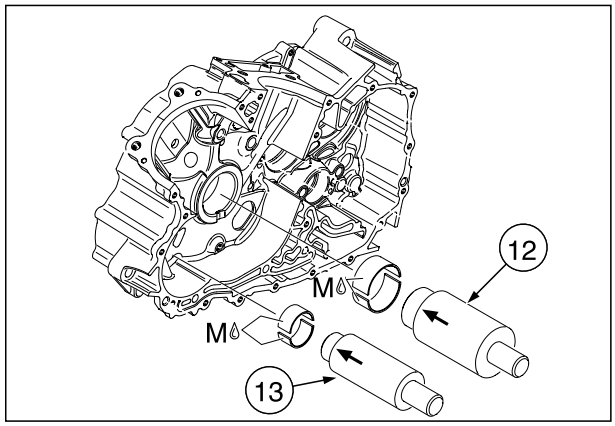


M = MOLYKOTE® G-N.

NOTE Have the appropriate special tools OPT to hand:

– (12) cod. 0277725 (driving shaft bush inserter pad);
– (13) cod. 0277537 (countershaft bush inserter pad).

◆ Heat the engine casing to **approx. 150° C (302° F)**.
◆ Coat the main bushes and bearing housings inside the engine casing with MOLYKOTE® G-N.
◆ Place the driving shaft and countershaft main bushes on the assembly pads (12 - 13) and fasten them with an O-ring (14) suitable for the purpose.
◆ Line up the contact surface of the main bushes with the previously applied coloured marking (7).
◆ With due care, insert the main bushes on a press, working from the inside out, until the installer punch touches.
◆ Remove the O-ring (14) before the installer punch makes contact.

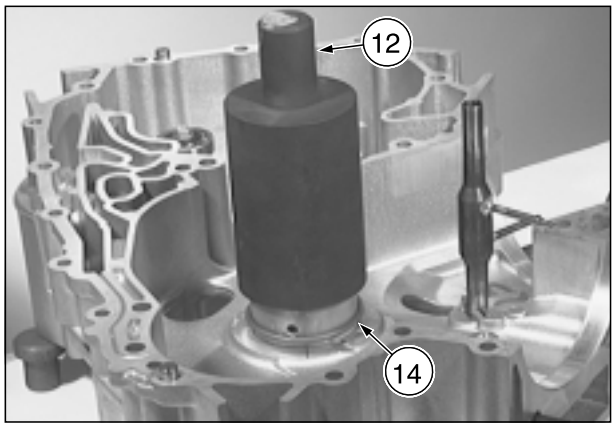


⚠ CAUTION

In order to insert and remove the main bushes, the engine casing must be supported by applying a spacer tube around the main bush housing.

◆ The lower main bush of the driving shaft, flywheel side, features a lubrication hole (11).

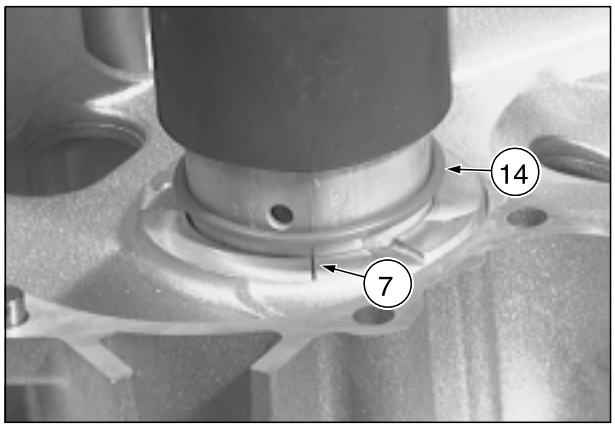
Once assembled, make sure the lubrication hole (11) on the main bush is lined up with the engine casing.
◆ The main bushes (1) of the driving shaft are fitted so that they are **2.0 mm** further down than the thrust-bearing surfaces (3 - 4).
◆ The main bushes (2) of the countershaft are fitted so that they are **1.5 mm** further down than the thrust-bearing surface (5).

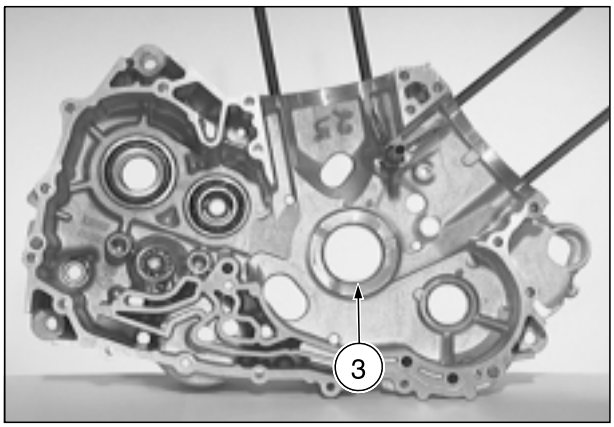


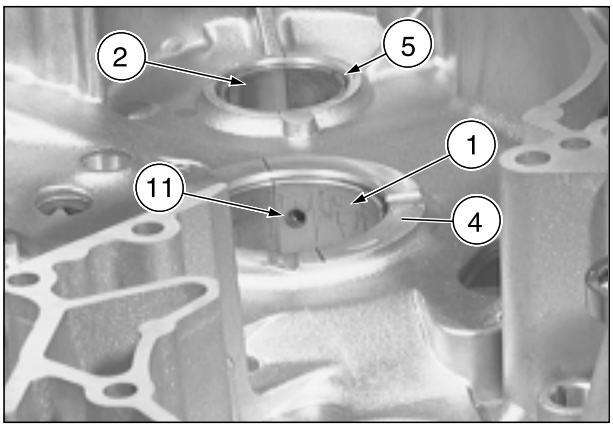
⚠ CAUTION

Should the main bushes be assembled incorrectly, they must be removed using the disassembly punch, as described above.
Disassembled main bushes must not be reused.

M = MOLYKOTE® G-N.





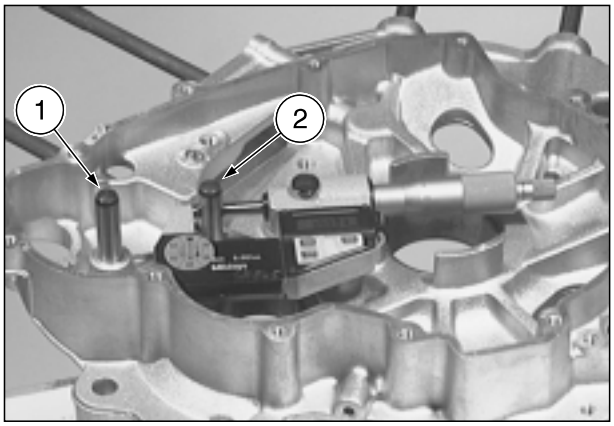


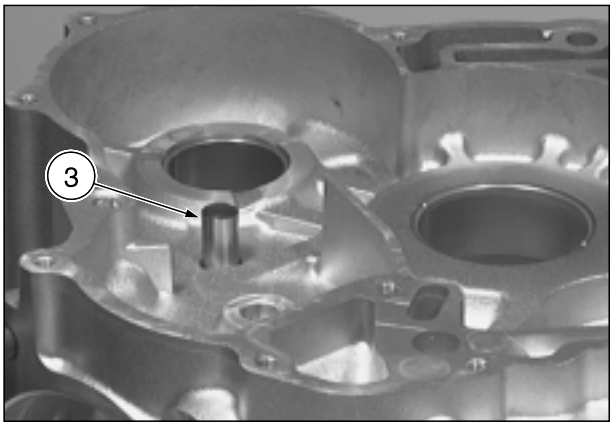
3.6.6 REPLACING THE ENGINE HALF-CASING CYLINDRICAL PINS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Use a micrometer to check the wear of the cylindrical pins (1, 2) of the starter motor drive assembly and (3) coolant pump idler gear.

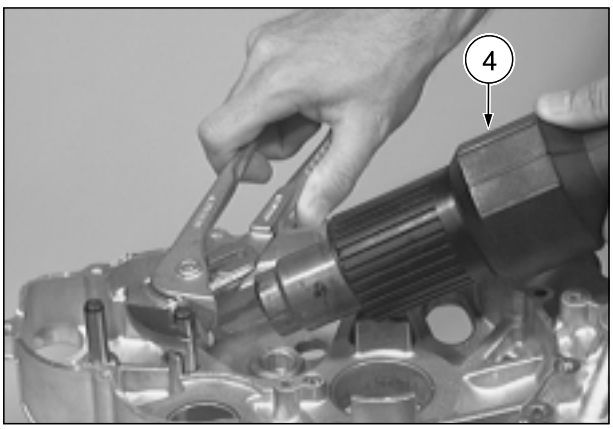
Wear limit Ø 9.990 mm





DISASSEMBLY

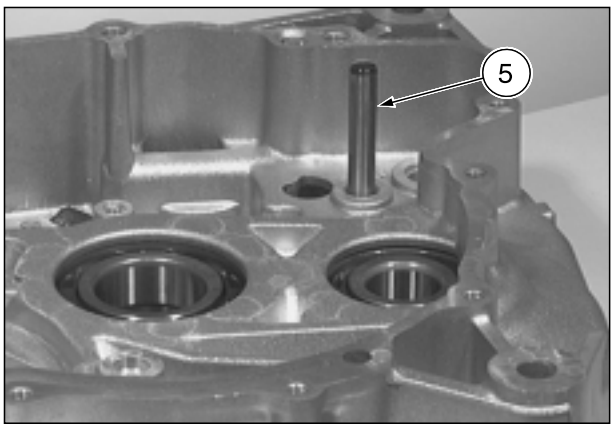
◆ Should the cylindrical pin prove worn, during disassembly, heat the peripheral range of the cylindrical pin slot on the outer wall of the engine half-casing with a jet of hot air (4) (approx. 100 °C - 212 °F); next, pull the cylindrical pin out with a pair of pliers, rotating it upwards.



ASSEMBLY

◆ With due care, insert the cylindrical pins all the way in using a plastic hammer. Coat the cylindrical pin (3) of the coolant pump idler gear with LOCTITE® 648.

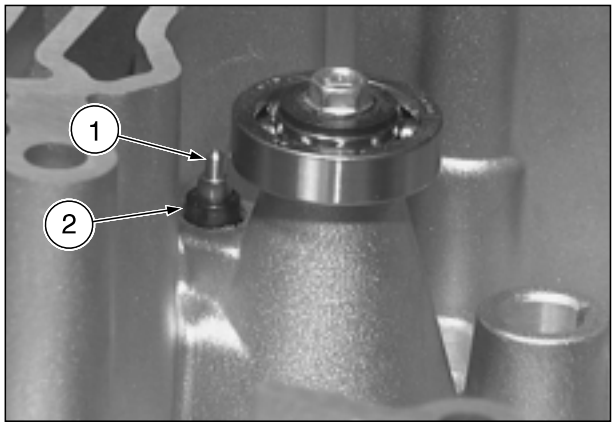
NOTE Insert the cylindrical pin (5) of the needle spring with the chamfered part external.



3.6.7 NEUTRAL GEAR INDICATION

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Make sure the contact pin (1) of the contact screw (2) slides smoothly and check the preloading of the spring.



⚠ CAUTION

The cap on the pin must not be worn.
Where necessary, replace the contact screw.

◆ If the contact screw (2) is replaced, it must be coated with LOCTITE® 574.

Driving torque of contact screw (2):
4 Nm (0.4 kgm).

3.6.8 ASSEMBLING THE ENGINE HALF-CASING

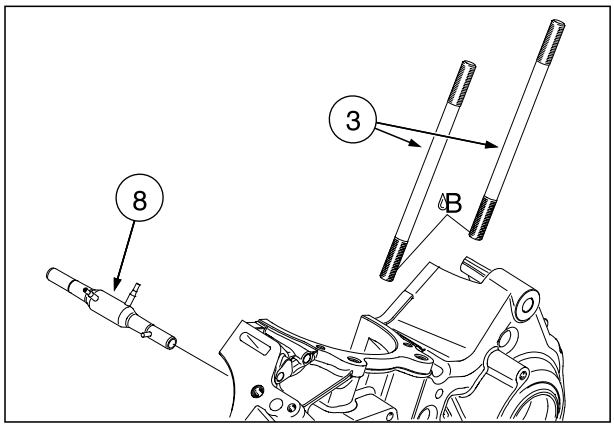
◆ Should a stud bolt (3) need replacing, coated with LOCTITE® 243 and the new one must be screwed on all the way.

Driving torque of stud bolt (3): 10 Nm (1.0 kgm).

◆ Screw on the nozzle (4).
◆ Fasten the M6 T.C.E.I. screw (5) together with the seal (6).

Driving torque of screw (5): 6 Nm (0.6 kgm).

◆ Insert the oil gauze (7).



3.6.9 COMPLETE OIL-SPRAY PIPE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

DISASSEMBLY

◆ Heat the peripheral range of the oil-spray pipe (8) on the engine casing using a jet of hot air (approx. 100 °C - 212 °F) before removing it using a pair of pliers to rotate it up and out.

ASSEMBLY

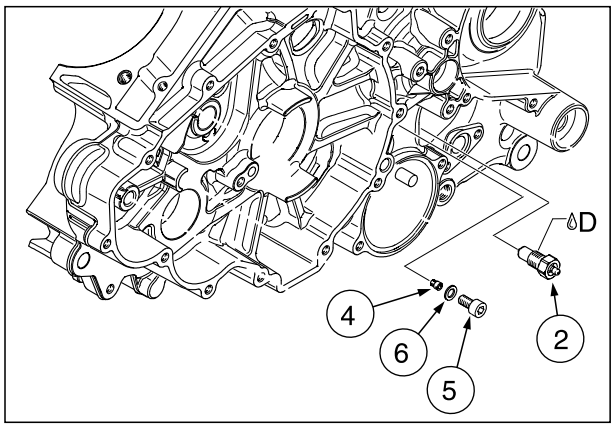
NOTE There is a special slot (9) incorporated into the engine casing for correctly housing the oil-spray pipe (8).

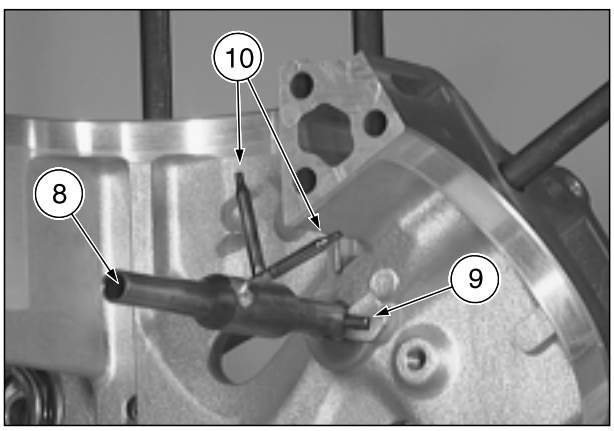
⚠ CAUTION

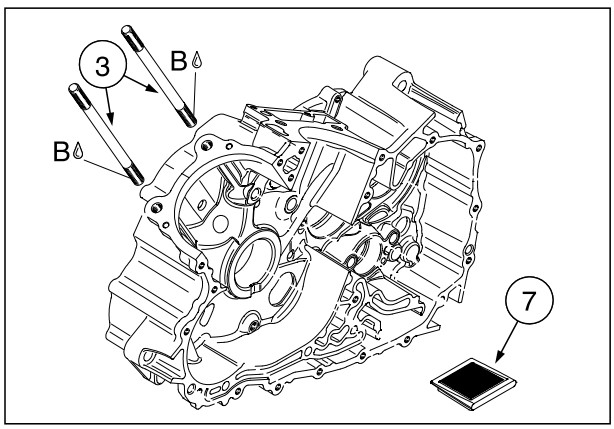
Take care not to damage the nozzles (10).

◆ Keep the oil-spray pipe (8) in place and insert it into the engine casing, flywheel side (9).

D = LOCTITE® 574.
B = LOCTITE® 243.







3.6.10 OIL PUMP AND OIL PUMP DRIVE ASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

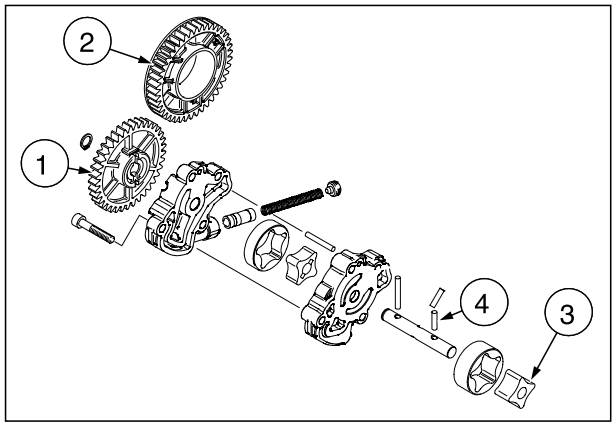
⚠ CAUTION

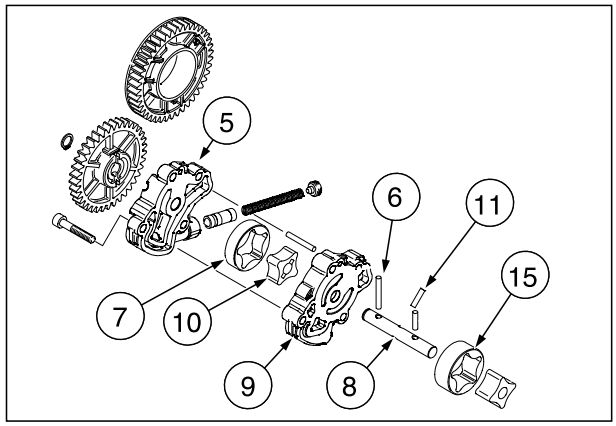
The oil pump gears, both driving (1) and driven (2), must always be replaced once they have been disassembled.

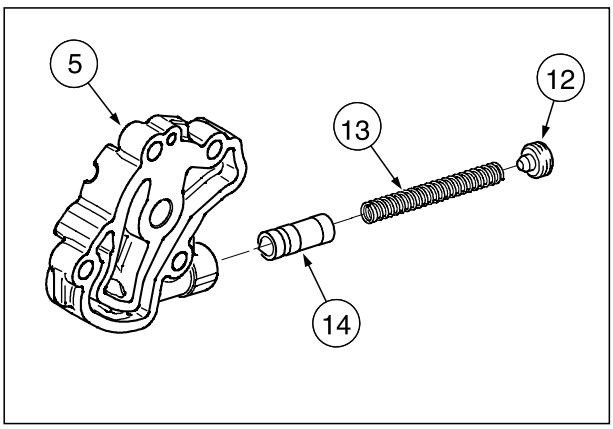
NOTE The oil pump drive gear (1) is attached to the support plate of the complete clutch housing.

TAKING THE OIL PUMP APART

- Remove the suction pumps internal rotor (3) from the oil pump shaft.
- Remove the pin (4).
- Slip off the oil pump lid (5) and pin (6).
- Remove the pressure pumps external rotor (7).
- Remove the oil pump shaft (8) from the pressure pump casing (9).
- Remove the pressure pumps internal rotor (10) and pin (11).
- Unscrew the plug (12) and remove the compression spring (13) with the adjusting piston (14).







CHECKING THE OIL PUMP

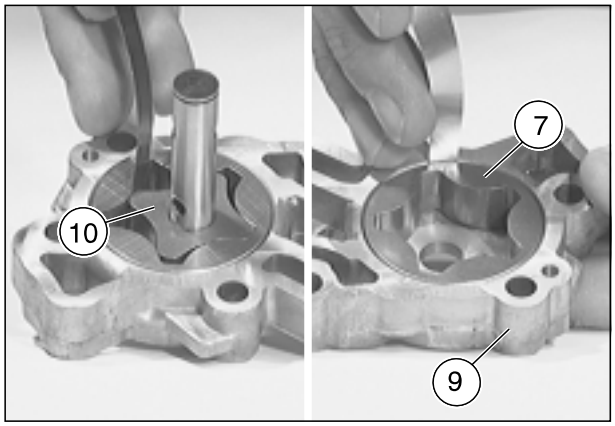
◆ Check the oil pump rotors, the sliding surfaces of the external rotors in both pump casings and the thrust-bearing surfaces for any signs of grooving.
◆ Measure the play between the external rotors (7 - 15), the engine casing (16) and the pressure pump casing (9) using a feeler gauge.

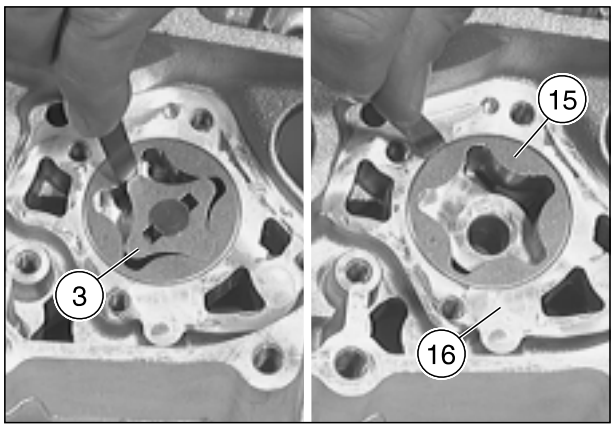
Wear limit max. 0.25 mm.

◆ Measure the end play (17) of the rotors.

Wear limit max. 0.15 mm.

NOTE If the play exceeds one of the two wear limits, the defective component must be replaced.





◆ Make sure the adjusting piston (14) slides smoothly in the oil pump lid.
◆ Check the adjusting piston and oil pump lid for any signs of wear:

– adjusting piston (14);

wear limit (18) min. Ø 9.975 mm;

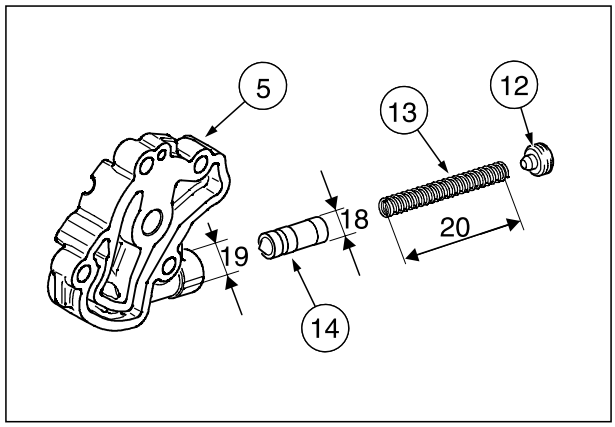
– oil pump lid (5);

wear limit (19) max. Ø 10.035 mm;

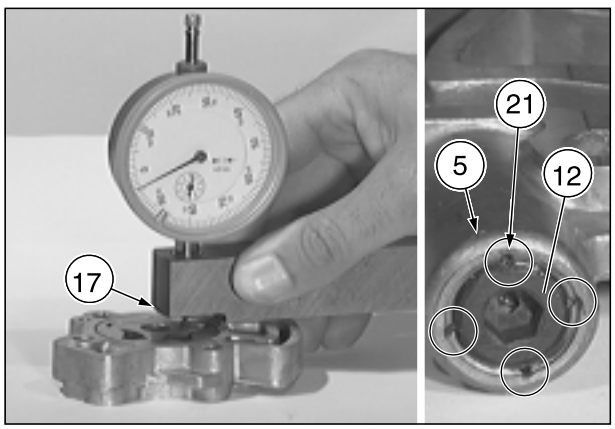
– compression spring (13);

minimum lenght of the spring (20) when not compressed: 56,0 mm.

◆ Engage the adjusting piston (14) with the cone end facing forwards and insert the compression spring in the slot on the oil pump lid (5).



◆ Apply LOCTITE® 648 on the caps thread (12).
◆ Screw on the cap (12) 2 mm further in than the outer edge of the neck of the oil pump lid (5) and secure it in place by punching in four more points (21).

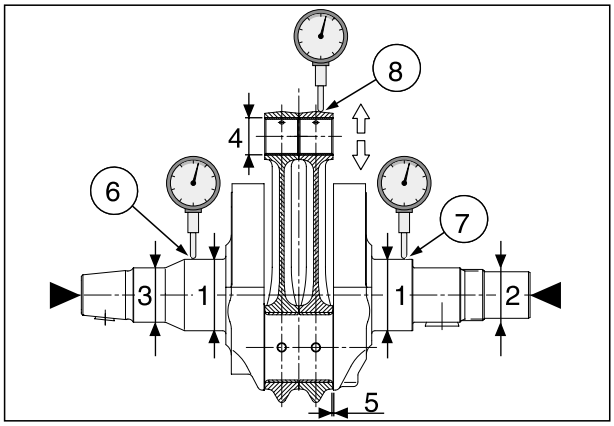


3.6.11 DRIVING SHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check the wear of the driving shaft:

– section for main bushes (1);
wear limit min. Ø 45.955 mm;
– section for support bushes (2);
wear limit min. Ø 29.970 mm;
– housing of the freewheel gear bearing (3)
wear limit min. Ø 34.960mm;
– connecting rod small end (4);
wear limit max. Ø 22.030 mm;
– end play between connecting rod and crank arm (5);
wear limit max. 0.60 mm;
– driving shaft eccentricity, flywheel side (6);
limit max. 0.020mm;
– driving shaft eccentricity, clutch side (7);
limit max. 0.020 mm.



NOTE Measure the eccentricity of the driving shaft between the ends.

End play of the driving shaft max. 0.5 mm.

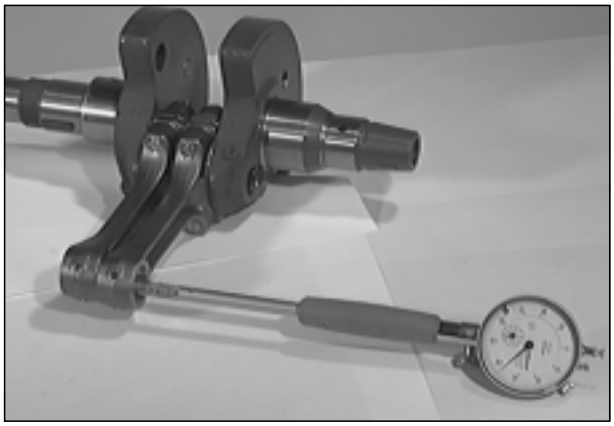
NOTE Use a comparator to determine the end play of the driving shaft once the two halves of the casing are coupled.

◆ Determine the radial play (8) from the eye of the connecting rod with a comparator.

Wear limit: max. 0.060 mm.

◆ Measure the radial play of the two main bush halves (1).

Max. permissible radial play 0.060 mm.



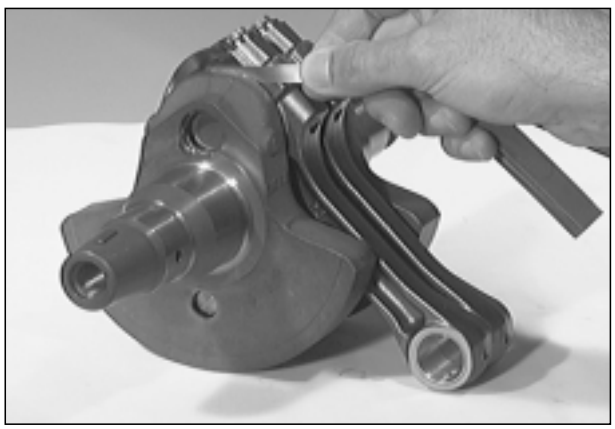
NOTE If the max. permissible radial play is exceeded, the worn part must be replaced.

The radial play is determined based on the following values:

maximum value of the main bushes diameter in the engine casing minus the driving shaft diameter at the main bush housing.

◆ Measure the main bush diameter, see 3.6.5 (ENGINE HALF-CASING - MAIN BUSHES, DRIVING SHAFT AND COUNTERSHAFT).
◆ Measure the radial play of the support bushes (2).

Permissible radial play max. 0.065 mm.



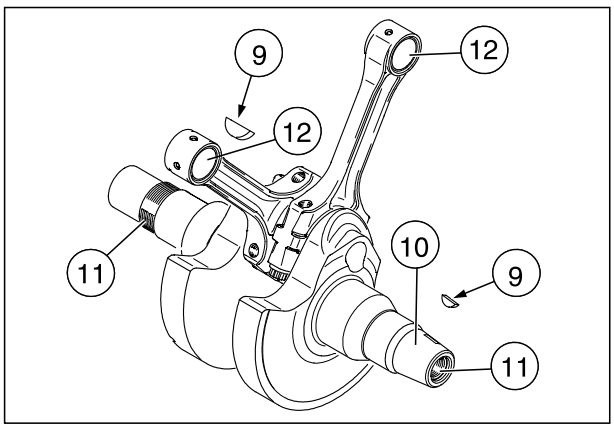
NOTE The radial play of the support bushes is calculated based on the following values:

maximum value of the diameter of the bushes in the clutch cover minus the diameter of the driving shaft in the support bushes area.

◆ Measure the support bush diameter, see 3.5.8 (REMOVING THE CLUTCH COVER).

⚠ CAUTION

If the max. permissible radial play is exceeded, the worn part must be replaced.



The following components must also be checked for wear or broken material:

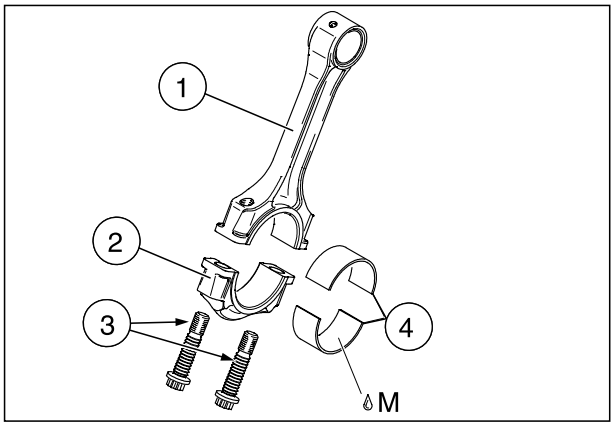
◆ Key (9) and grooves in the driving shaft.
◆ Colouring of a bearing housing.
◆ Cone surface (10) of the driving shaft section on the flywheel side.
◆ Clean the thread (11) of any LOCTITE® residues and make sure it is in a perfect state of repair.
◆ Check to make sure the bush (12) inside the connecting rod small end is correctly installed and centred (on the longitudinal axis).

3.6.12 DISASSEMBLING THE CONNECTING RODS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Before disassembling the connecting rods (1) and covers (2), mark them so they are refitted in the same position (cylinder "1" and "2") and with the same direction of rotation.



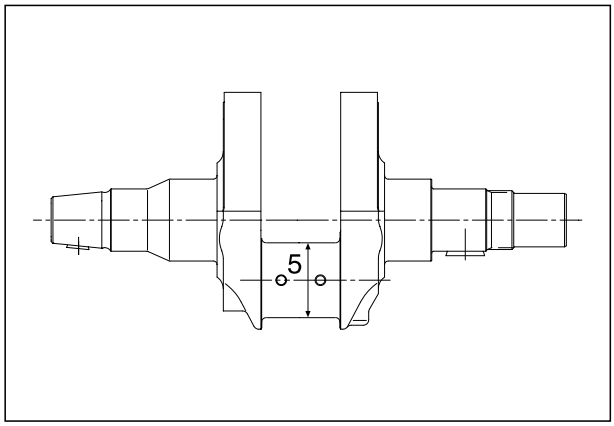
- Unscrew and remove the M10x1 connecting rod screws (3) and detach the connecting rod cover (2), tapping lightly with a plastic hammer.
- Remove the connecting rod screws with the cover and connecting rod (1).
- Clean the driving shaft lubrication holes.
- Check the bushes (4) for signs of wear, distortion and altered colouring.
- Check the connecting rod housing for wear:

  – connecting rod pins (5);

  wear limit min. Ø 41.98 mm;

  – connecting rod big end (6);

  wear limit max. Ø 42.050 mm.



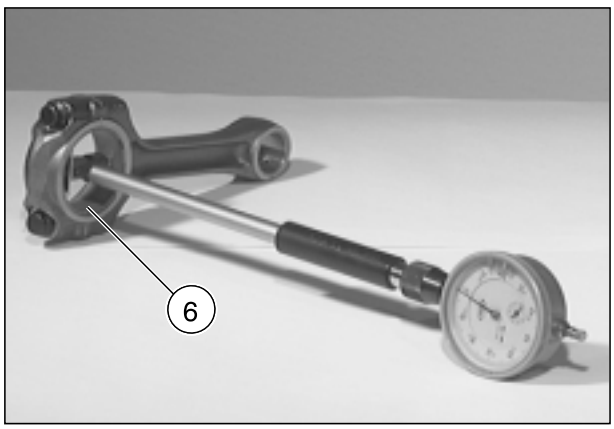
⚠ CAUTION

Measure the diameter of the connecting rod big end. Fasten the cover (2) with the connecting rod M10x1 screws (3).

Driving torque screws (3): see 3.6.13 (REPLACING AND INSTALLING THE CONNECTING RODS).

⚠ CAUTION

The fastening of the connecting rod M10x1 screws (3) will require the use of a setting dial (7) and a fitting for a size 12 socket spanner.



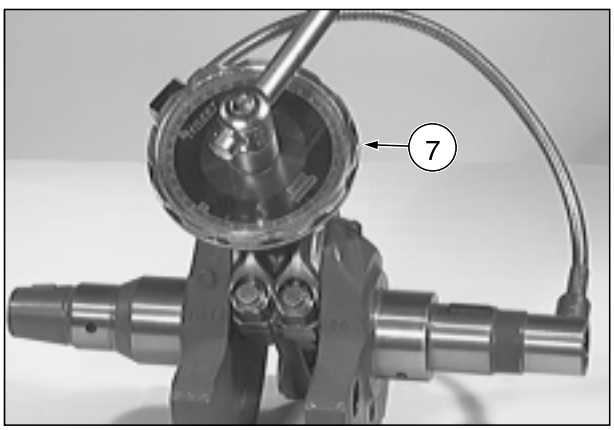
NOTE None of the values may exceed the limit value. In the event of wear, the whole connecting rod, complete with cover, must be replaced.

- Measure the radial play of the connecting rod big end (6).

  Wear limit max. Ø 0.070 mm.

NOTE The radial play of the driving shaft is calculated based on the following values:
maximum value of the diameter of the bushes minus the diameter of the coupling shaft.

NOTE The radial play of the connecting rod big end may also be measured with the aid of a plastic gauge.
If a plastic gauge is used, the connecting rod must be kept still.



3.6.13 REPLACING AND INSTALLING THE CONNECTING RODS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

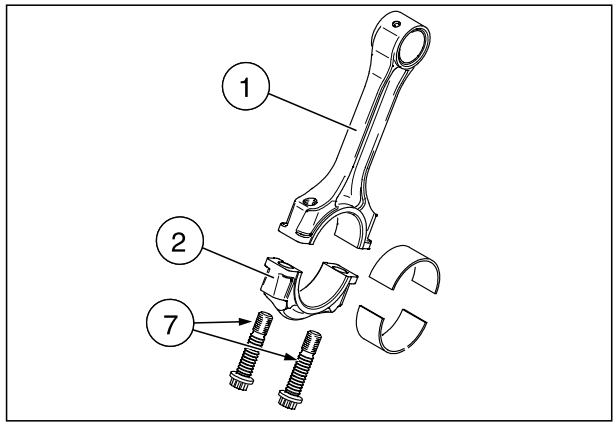
NOTE The complete connecting rods supplied as spare parts include bushes in all three sizes (see table). The bushes are marked, according to size, in red, blue and yellow (4).

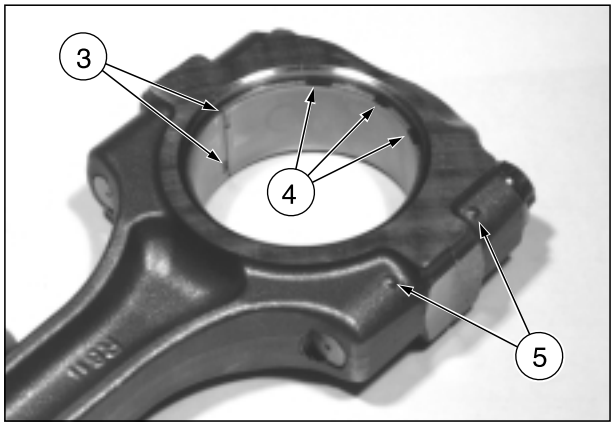
- ◆ Insert the bushes with the minimum thickness (red) between the connecting rod (1) and the cover (2), taking care to position them correctly (3). Line the bushes up on a flat surface.
- ◆ Insert the connecting rod and cover on the driving shaft so that the two reference points (5) and piece number (6) coincide on the two connecting rods.
- ◆ Fasten the cover (2) with the old M10x1 screws (7) in three phases.

1st pre-tightening phase:
– tighten the two screws with a driving torque of 2 Nm (0.2 kgm).

2nd tightening phase:
– tighten the two screws with a driving torque of 30 Nm (3.0 kgm).

3rd final tightening phase:
– tighten the two screws by 70°.





⚠ CAUTION

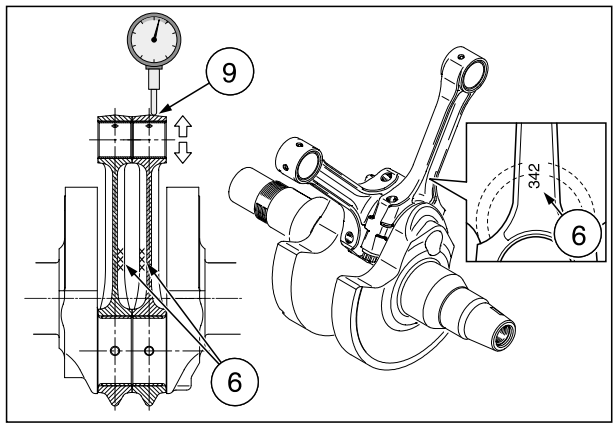
The fastening of the M10x1 screws (7) will require the use of a goniometer (8) and a ring socket spanner.

- ◆ Measure the radial play (9) of the connecting rod end with a comparator.

Radial play 0.020 - 0.045 mm.

If the radial play is greater than 0.045 mm, the bushes of the size corresponding to the colours blue or yellow must be chosen based on the following table, and must be inserted in place of the red bushes.

Bush colour	Thickness (mm)
Red	1.471 - 1.476
Blue	1.476 - 1.481
Yellow	1.481 - 1.486



- ◆ Unscrew the screws (7).
- ◆ Lubricate the bushes and pins.

NOTE Use new M10x1 screws (7) only.

- ◆ Lubricate the supporting surfaces of the heads of the new screws (7).
- ◆ Fasten the cover (2) in the three phases described above, using the two new M10x1 screws (7).

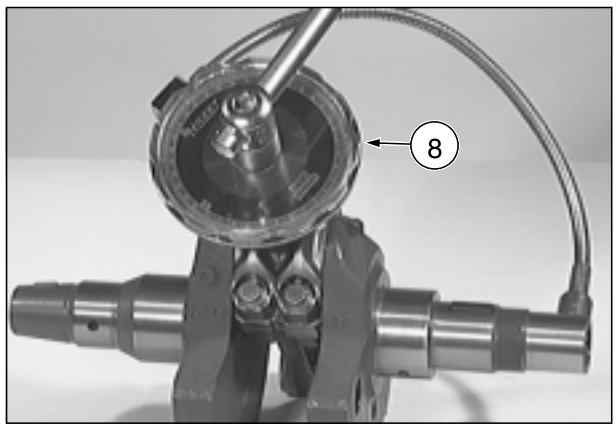
⚠ CAUTION

The fastening of the M10x1 screws (7) will require the use of a goniometer (8) and a ring socket spanner.

- ◆ Check the radial play (9) again.

Radial play 0.020 - 0.045 mm.

- ◆ Make sure the connecting rods do not encounter any friction during the stroke.



3.6.14 COUNTERSHAFT AND COUNTERSHAFT MECHANISM

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

Check the wear of the countershaft:

– housing of bush (1);

wear limit min. Ø 31.980 mm;

– housing of thrust support bush (2);

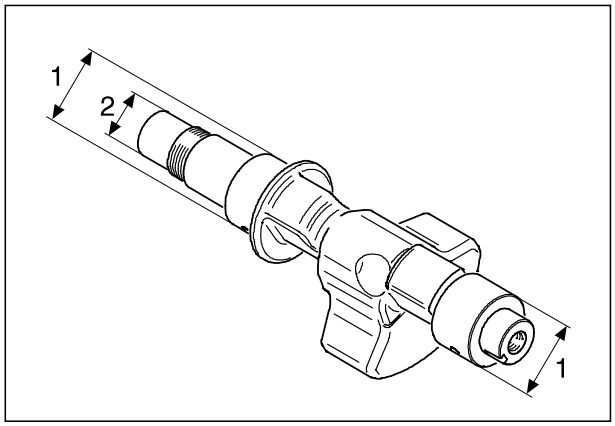
wear limit min. Ø 19.990 mm;

– housing of bush (1);

permissible radial play min. Ø 0.060 mm;

– housing of support bush (2);

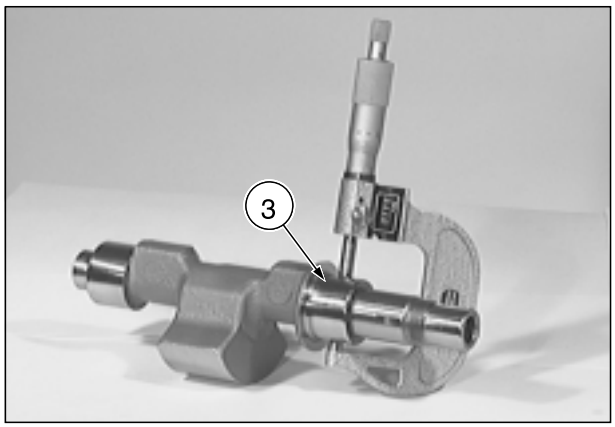
permissible radial play min. Ø 0.060 mm.



NOTE The radial play of the countershaft is determined based on the following values:

maximum value of the main bush diameter in the engine casing or in the clutch cover minus the value of the bearing housing (1) or the support bush housing (2) of the countershaft.

Measure the main bush diameter, see 3.6.5 (ENGINE HALF-CASING - MAIN BUSHES, DRIVING SHAFT AND COUNTERSHAFT) and 3.5.8 (REMOVING THE CLUTCH COVER).



NOTE If the max. permissible radial play is exceeded, the worn part must be replaced.

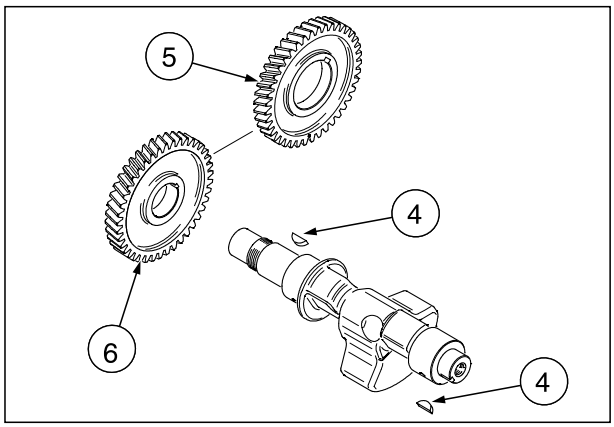
Permissible radial play of the countershaft max. 0.30 mm.

NOTE Once the two halves of the engine casing have been coupled, check the end play of the countershaft with a comparator.

The following components must also be checked for wear or broken material:

– axial thrust-bearing surfaces (3);
– key (4) and grooves in the countershaft;
– colouring of a bush housing.

◆ Clean the thread of any LOCTITE® residues and make sure it is in a perfect state of repair.
◆ Check the sides of the teeth of the driving gear (5) and driven gear (6) for any signs of broken material or distortion.



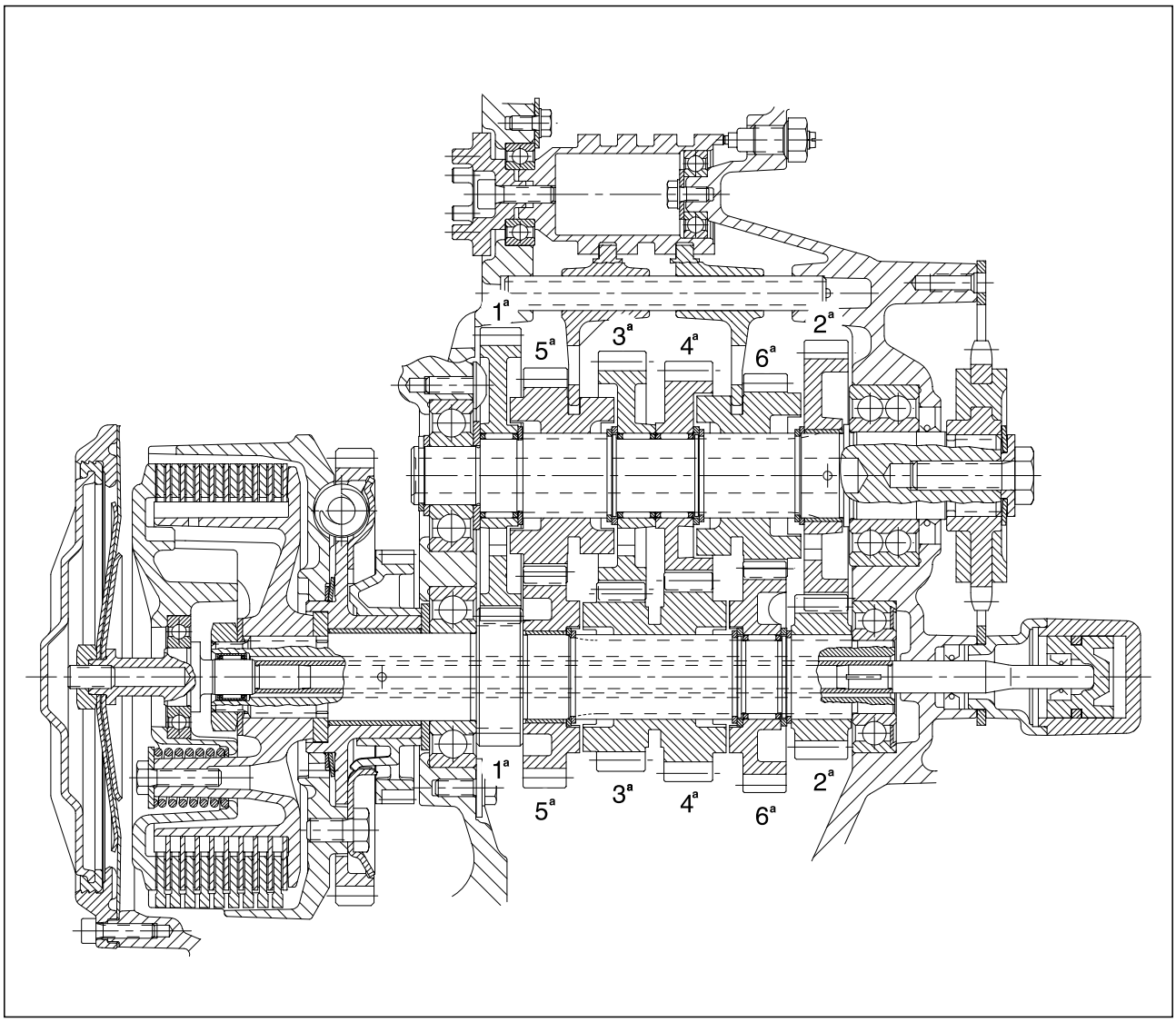
NOTE In order to check the main bushes, see 3.6.5 (ENGINE HALF-CASING - MAIN BUSHES, DRIVING SHAFT AND COUNTERSHAFT) and 3.5.8 (REMOVING THE CLUTCH COVER).

3.6.15 GEARSHIFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

When taking the gearshift apart, set the disassembled components down according to the assembly position, assigning them to the corresponding shaft so as to be sure they are reassembled and installed correctly.
Following disassembly, the seeger rings must always be replaced.

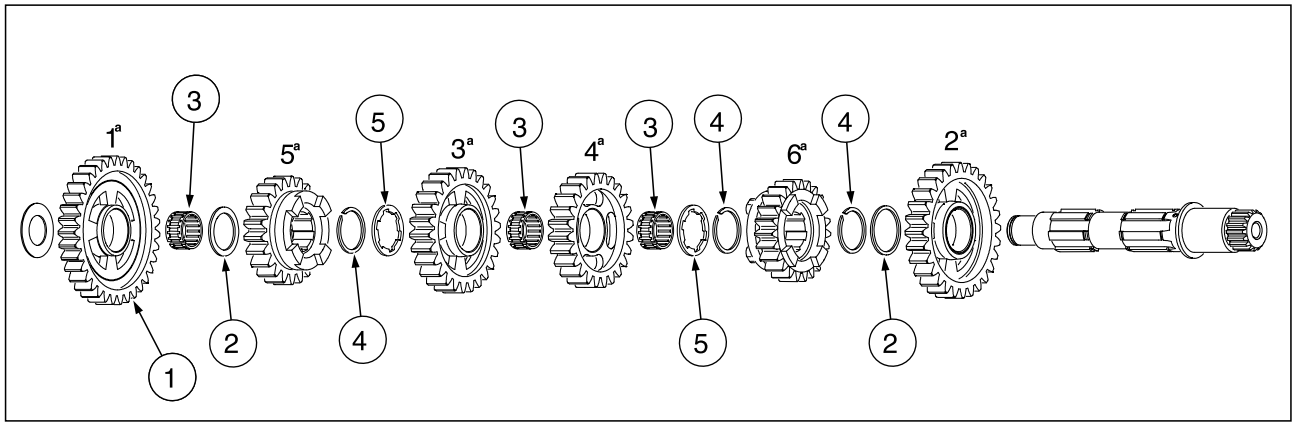


TAKING THE GEARSHIFT APART

Secondary shaft

Use crimpers to remove the seeger rings (4).

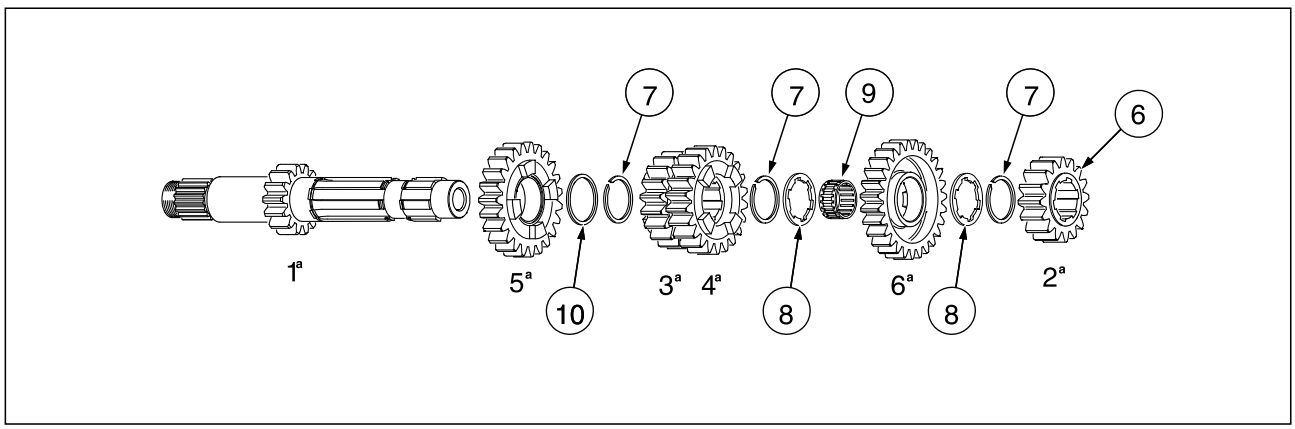
◆ Remove the gearshift gears from the secondary shaft, starting with the idle gear of 1st gear (1) and then moving on to the shim washers (2), roller cages (3), seeger rings (4) and shim rings (5).



Primary shaft

Use crimpers to remove the seeger rings (7).

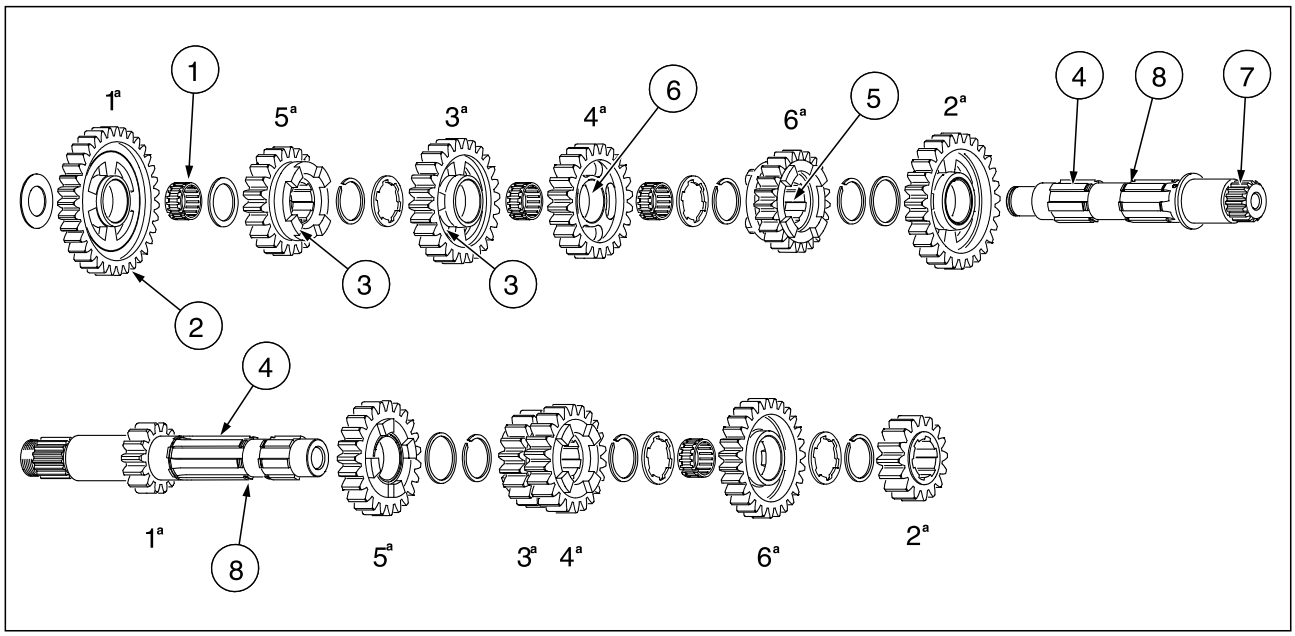
◆ Remove the gears from the primary shaft, starting with the fixed gear of 2nd gear (6) and then moving on to the seeger rings (7), shim rings (8), the roller bearing (9) and shim washer (10).



◆ Check the following components for wear:
– roller bearings (1);
– sides of the teeth (2) of all gears.

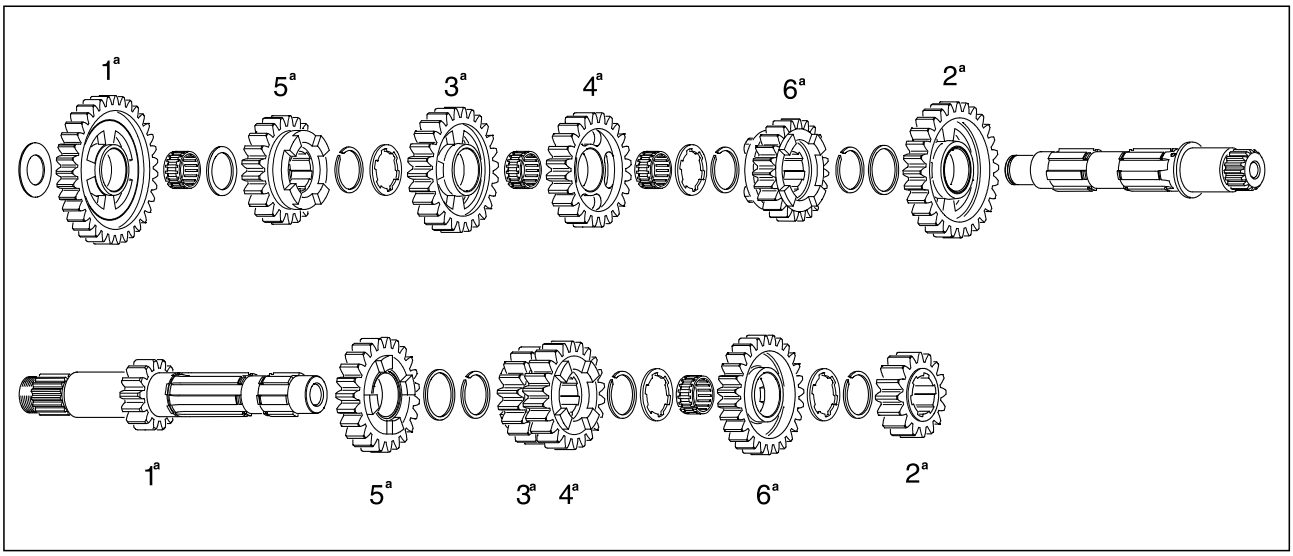
NOTE Small grey marks and tiny hollows are tolerated up to a maximum corresponding to approx. 0.5% of the sides surface area.

– engagement teeth (3) and mating slots of gearshift gears;
– profile for spline shafts (4) of the secondary shaft and primary shaft;
– check all the gear selection gears (5), both on the secondary shaft and primary shaft, slide smoothly;
– housings of the idle gear bearings (6);
– triangular tooth profile (7) of the chain pinion;
– the grooves for seeger rings (8) on the secondary shaft and on the primary shaft must have sharp edges.



◆ Check the housings of the secondary shaft and primary shaft for wear:

– **wear limit (9) min. Ø 19.972 mm;**
– **wear limit (10) min. Ø 29.915 mm;**
– **wear limit (11) min. Ø 29.965 mm;**
– **wear limit (12) min. Ø 24.972 mm;**
– **wear limit (13) min. Ø 29.03 mm;**
– **wear limit (14) min. Ø 24.978 mm;**
– **permissible eccentricity (15) max. Ø 0.02 mm.**



NOTE Should the sides of the teeth be worn, the relevant pair of gears must be replaced.
Should the engagement teeth or mating slots prove worn, the relevant gears must be replaced, mating with each other.

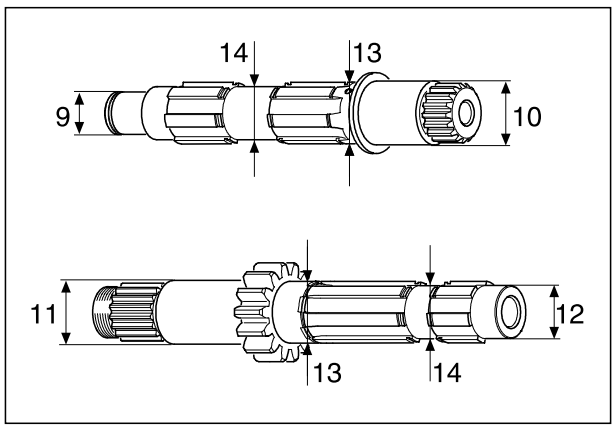
◆ Check the internal diameter of the idle gears of 3rd, 4th and 6th gear.

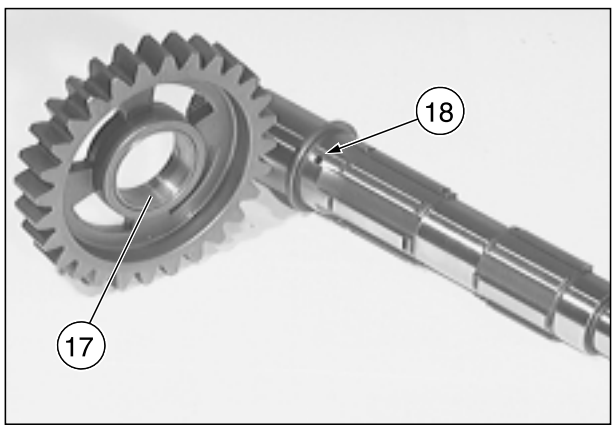
Wear limit (16) max. Ø 29.022 mm.

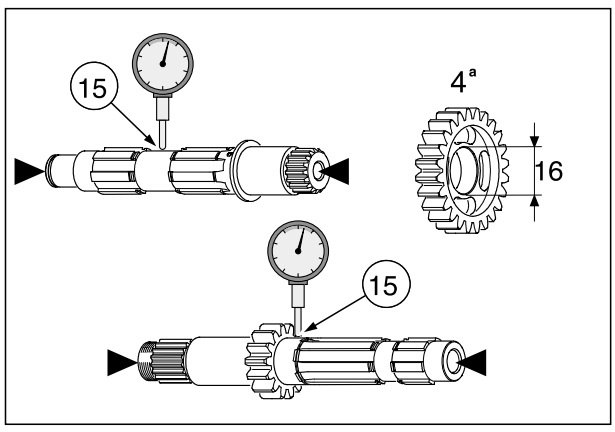
◆ Check for any signs of rolling or grooves on the bushes of the idle gears of 2nd (17) and 5th gear, and measure the internal diameter of the gears.
◆ Check for any signs of rolling or grooves on the bushes of the idle gears (15 - 16), and measure the internal diameter of the bearings.

Wear limit max. Ø 29.125 mm.

◆ Make sure the lubrication hole (18) of the secondary shaft is clear.

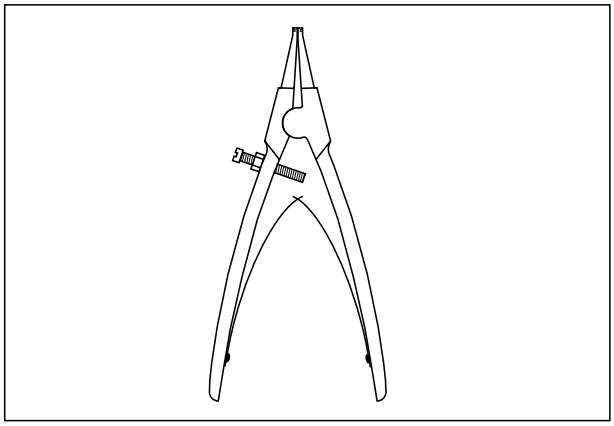






ASSEMBLY

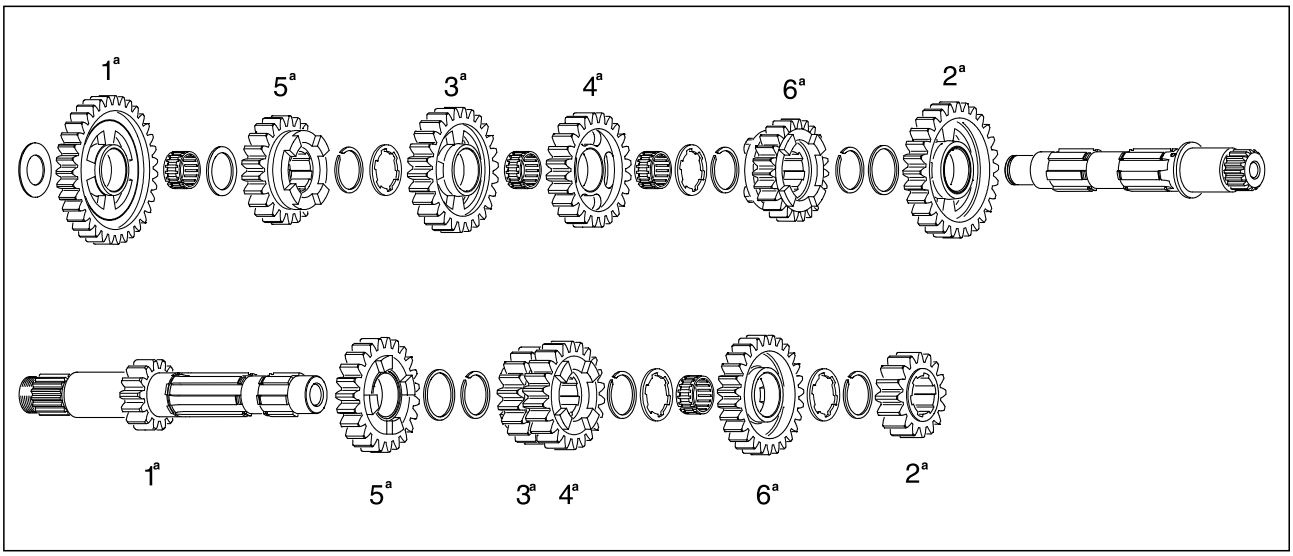
- Oil the secondary shaft, primary shaft, gearshift gears and roller bearings slightly.
- Reassemble the secondary shaft and primary shaft in the reverse order.
- Fit the seeger ring, using the plier for seeger ring only.



⚠ CAUTION

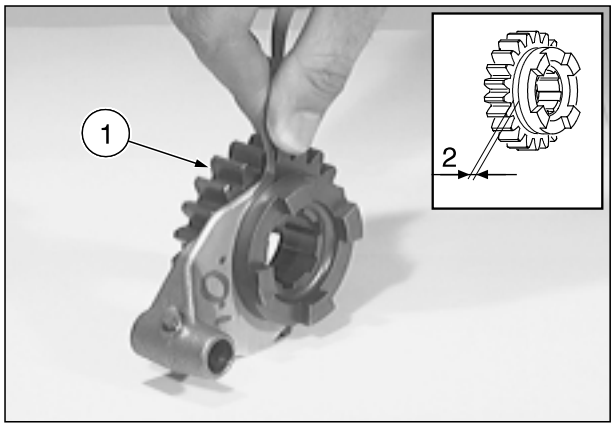
Do not reuse the seeger rings.
The seeger rings must be replaced every time the gearshift is taken apart.
Pull the ends of the seeger rings apart just enough to be able to slide the ring onto the shaft.
If the seeger ring is pulled apart two much, its locking effect is irreparably reduced.
Make sure the seeger rings are properly installed in the corresponding groove.

- Once the two gearshift shafts have been assembled, make sure the gears turn smoothly.



3.6.16 GEAR SELECTION

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).



◆ Check the end play (1) of the gearshift forks inside the corresponding grooves in the selection gears.

Wear limit max. 0.15 mm.

NOTE If the wear limit is exceeded, you must determine which component needs replacing by checking the gearshift forks and selection gears.

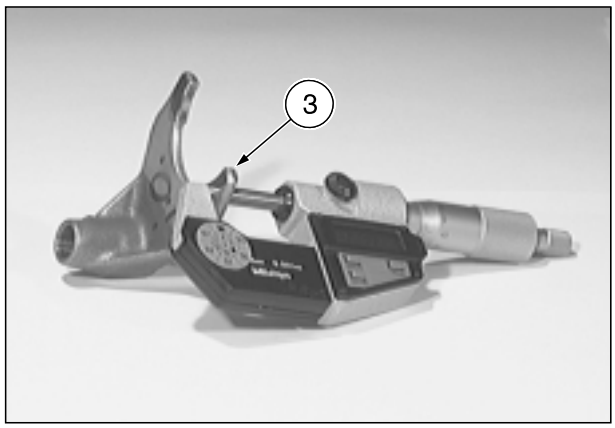
◆ Width of the groove (2) of the selection gears.

Wear limit max. 4.35 mm.

◆ Thickness (3) of the gearshift forks. Check the degree of wear on the chromium-plated thrust-bearing surfaces of the gearshift forks.

Wear limit max. 3.950 mm.

NOTE If the chromium finish is missing in some points, replace the fork in question.



◆ Check the diameters (4) of the gearshift fork guide pins.

Wear limit min. Ø 5.850 mm.

◆ Check the eccentricity of the two fork shafts (5).

Max. permissible eccentricity 0.02 mm.

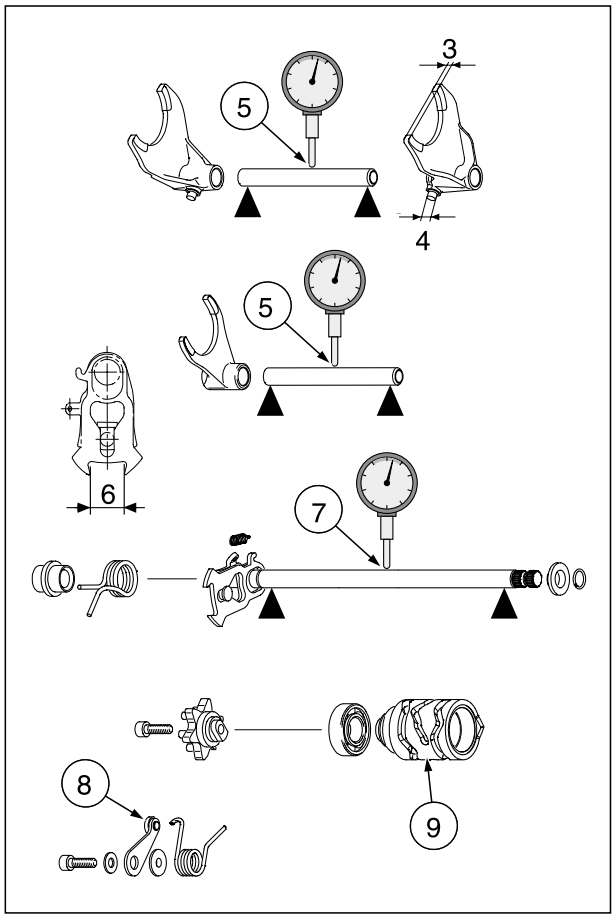
◆ Check the wear of the ratchet gear in the area in which it comes into contact with the index plate pins.

Wear limit (6): visual inspection.

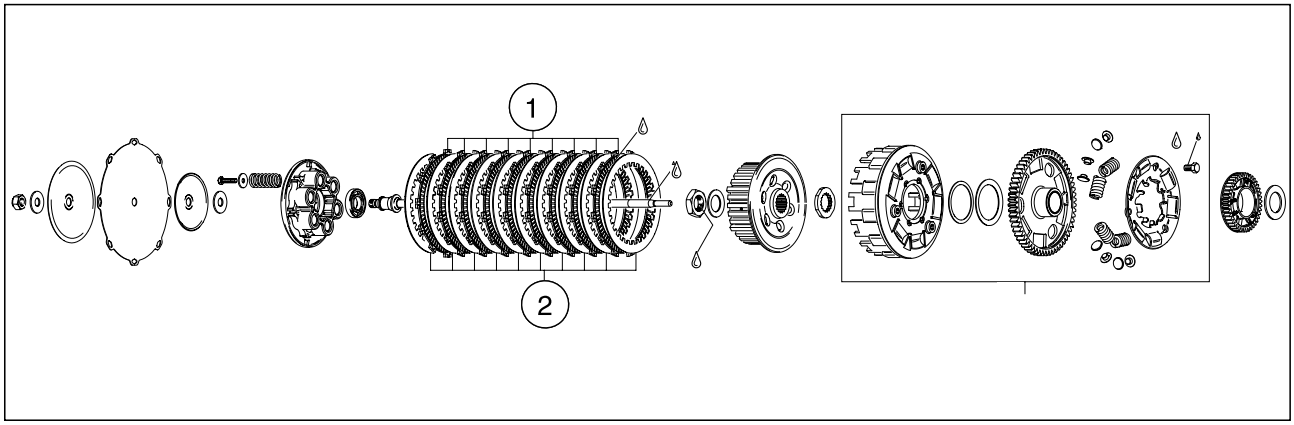
◆ Check the eccentricity of the selector shaft (7) and also check for any signs of rolling on the sliding surface of the shaft sealing ring.

Max. permissible eccentricity 0.25 mm.

◆ The roller (8) of the positioning lever must turn freely.
◆ Check the wear of the guide tracks (9) of the shift cam.



3.6.17 CLUTCH AND PRIMARY TRANSMISSION ASSEMBLY



Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

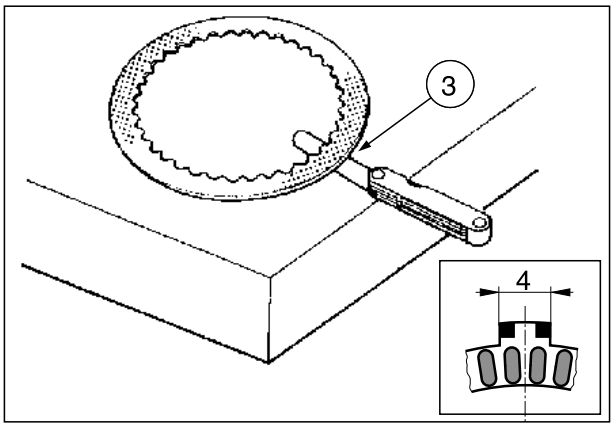
◆ Check the lined discs (1) and steel discs (2) for cracks or any distortion (3) by placing them on a flat surface.

Max. permissible distortion (3): 0.15 mm.

NOTE The inside discs (2) must not feature grooves or temper colours.

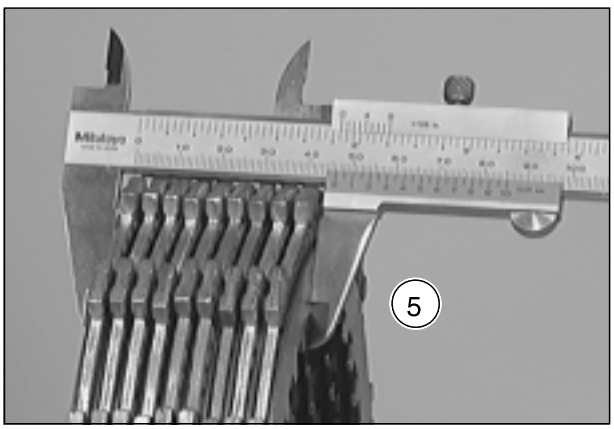
◆ Measure the width (4) of the driving element and the thickness of the lined discs (1).
◆ Measure the set of the nine lined discs.

Wear limit min. 30.9 mm.



◆ Measure the set of discs with all the discs together (5) (made up of 10 steel discs and 9 lined discs).

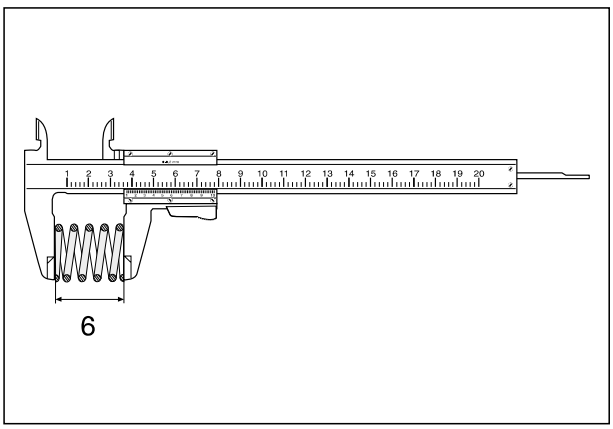
Wear limit (5) min. 46.3 mm.



◆ Measure the length of the individual clutch springs (6) in the released position.

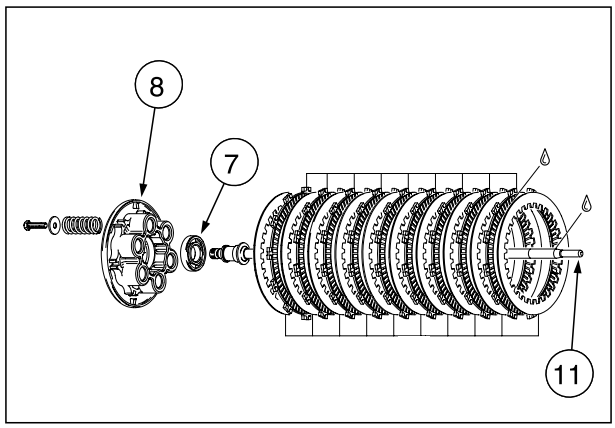
Wear limit (6) min. 44.0 mm.

NOTE You are strongly recommended to replace all the clutch springs together with the set of lined discs.



◆ Check the smoothness and slack of the ball bearings (7) on the spring plate (8) and, where necessary, replace them.

NOTE When removing and refitting the ball bearings, heat the spring plate to 80 - 100 °C (176 - 212 °F) and use a suitable assembly punch.



◆ Check the compression surface (9) of the spring plate (8) for signs of wear and make sure it is flat.

Max. permissible distortion (9): 0.1 mm.

◆ Check the depth (10) of the spring plate.

Wear limit (10) max. 33.5 mm.

◆ Check the eccentricity of the disengaging shaft (11), also checking for signs of rolling on the oil seal sliding surface.
◆ Check the diaphragm (12) for cracks and, where necessary, replace it.
◆ Check the guide grooves on the clutch housing (13) and the external toothing of the clutch hub (14) for any dents (15).

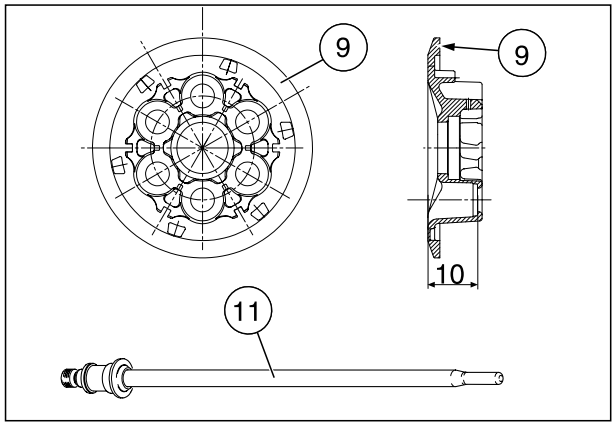
Max. dent depth (15): 0.3 mm.

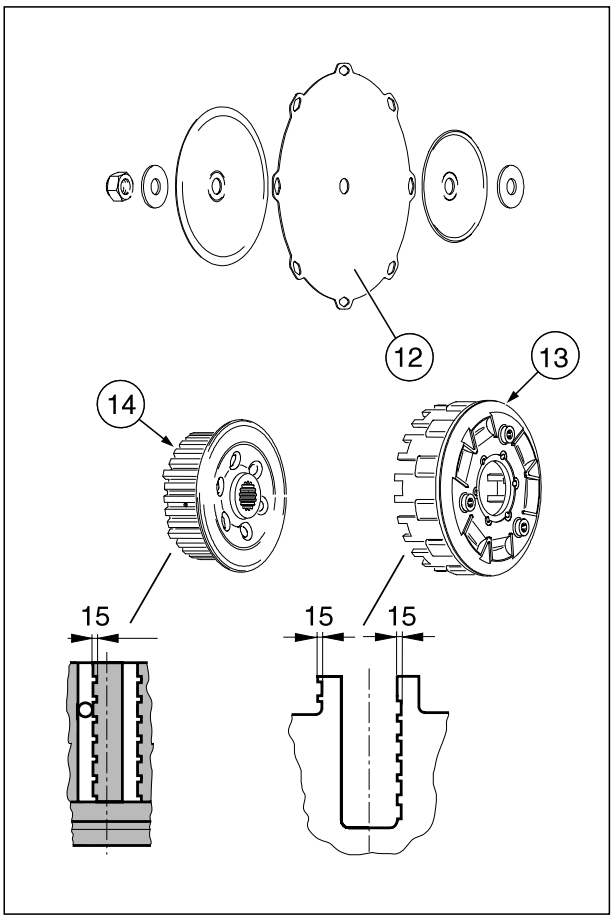
◆ Check the bush of the clutch gear (16) for grooves and damage; measure the internal diameter.

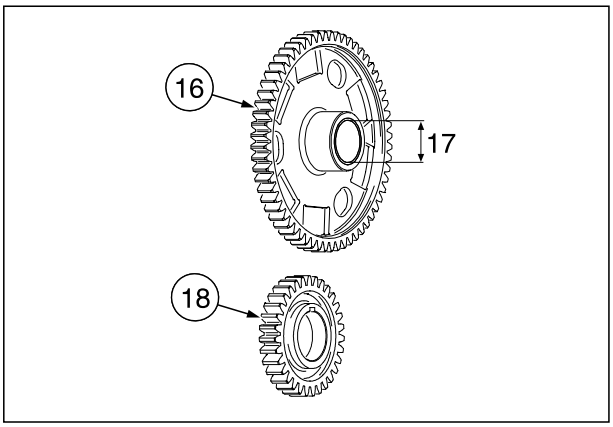
Wear limit (17) max. Ø 30.060 mm.

◆ Check the sides of the clutch gear teeth (16) and drive gear teeth (18) for signs of broken material or distortion.

NOTE Should the clutch gear or drive gear be worn, the primary transmission assembly pair must be replaced.



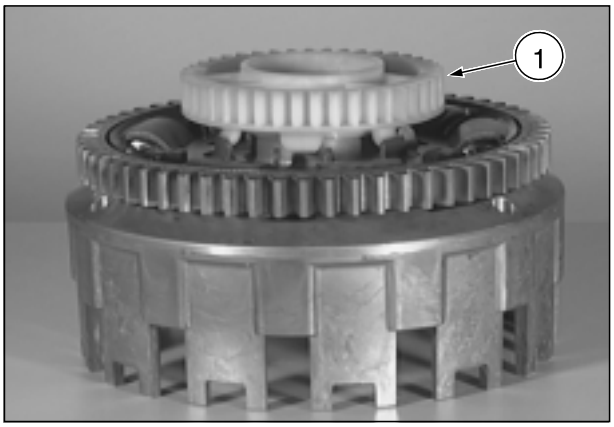




3.6.18 DISASSEMBLING THE COMPLETE CLUTCH HOUSING

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Slip off the oil pump drive gear (1).



⚠ CAUTION

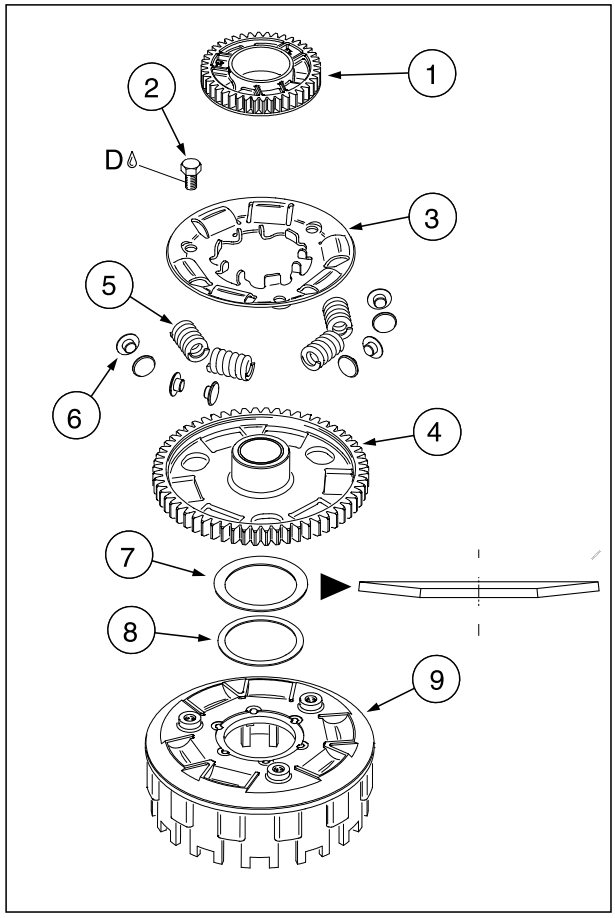
The oil pump drive gear (1) must always be replaced once it has been disassembled.

◆ Unscrew and remove the three M8 T.E. screws (2) and remove the support plate (3).
◆ Remove the six compression rings (5) together with the twelve spring pins (6) from the clutch gear (4).
◆ Remove the clutch gear (4) with the spring washer (7) and the washer (8) from the clutch housing (9).

NOTE You are strongly recommended to replace all the compression springs (5) and spring pins (6) together.

◆ Measure the length of the spring housing in the clutch housing (9).

Wear limit (10) max. 32.65 mm.



ASSEMBLY

◆ Insert the washer (8) and the spring washer (7) on the clutch housing (9).

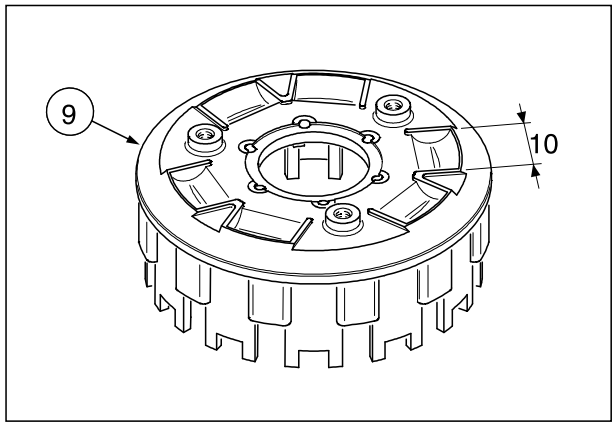
⚠ CAUTION

Make sure the spring washer is positioned correctly. Fit it with the concavity facing the clutch gear (4).

◆ Place the clutch gear (4) on the clutch housing and insert the six compression springs (5) in the clutch gear slot using the two spring pins (6) respectively.
◆ Coat the M8 T.E. screws (2) with LOCTITE® 648.
◆ Apply the support plate (3) on the clutch gear (4) and fasten it with the three M8x16 T.E. screws (2).

Driving torque of screws (2): 30 Nm (3.0 kgm).

D = LOCTITE® 648.



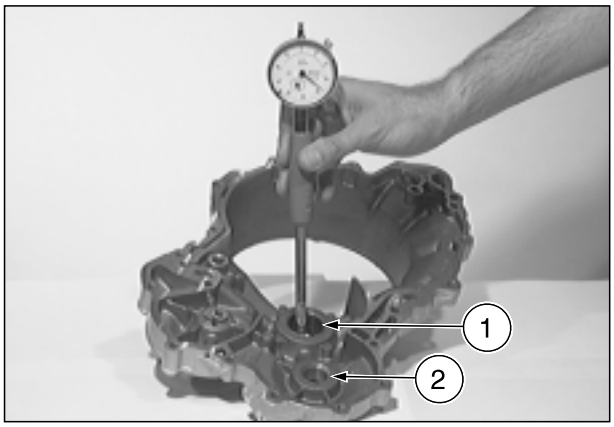
3.6.19 CLUTCH COVER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Check the gasket surface for signs of damage and check the whole thread to make sure it is in a perfect state of repair.
- ◆ Check the support bushes of the driving shaft (1) and countershaft (2) for signs of rolling or grooves.
- ◆ Measure the diameter of the two support bushes.

– Driving shaft bushes:
wear limit Ø 30.040 mm.

– Countershaft bushes:
wear limit Ø 20.060 mm.



⚠ CAUTION

Take a number of measurements, especially in the direction of the axis of both cylinders.
None of the values must exceed the limit value.

- ◆ Measure the radial play of the driving shaft and countershaft, see 3.6.5 (ENGINE HALF-CASING - MAIN BUSHES, DRIVING SHAFT AND COUNTERSHAFT).

3.6.20 SUPPORT BUSHES

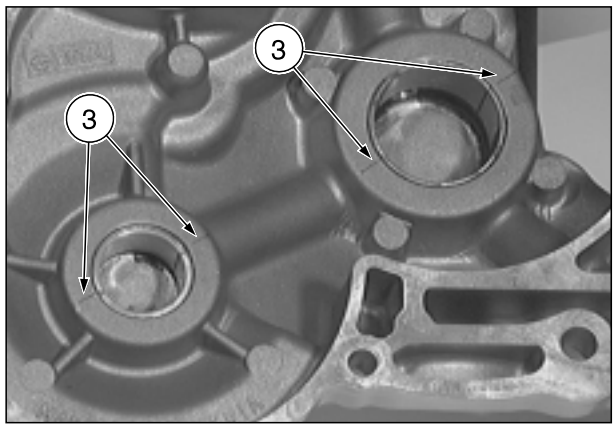
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

DISASSEMBLY

- ◆ Mark the contact surface (3) of the two bushes on the clutch cover.

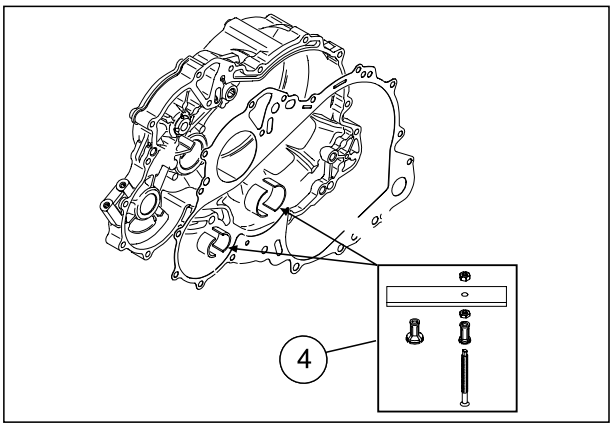
NOTE Have the appropriate special tool OPT (4) to hand (cod. 8140156 + 8140157 + 0276377 - clutch cover sleeve puller).

- ◆ Remove the main bushes with the special tool (4).



⚠ CAUTION

As a rule, the main bushes should all be replaced together.

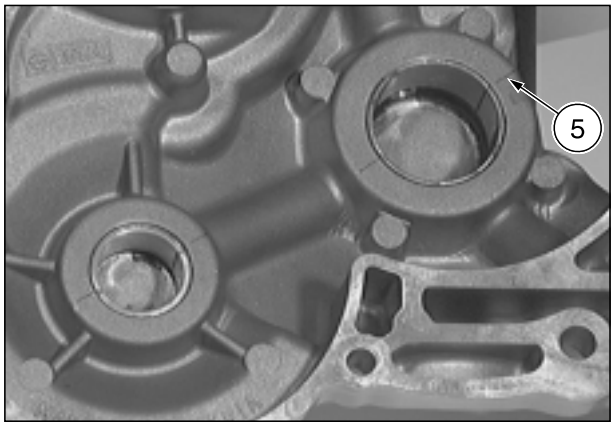


ASSEMBLY

- Clean the diameter of the main bush housing and the lubrication hole between the bush housings inside the clutch cover.
- Determine the driving shaft bushes size group based on the coloured markings (5) on the clutch cover.

NOTE The size group of the main bushes is also marked with a coloured dot.

- If the coloured marking applied on the clutch cover is no longer clearly legible, calculate the diameter based on the average of a number of different measurements.



⚠ CAUTION

Take a number of measurements, especially in the direction of the axis of both cylinders.

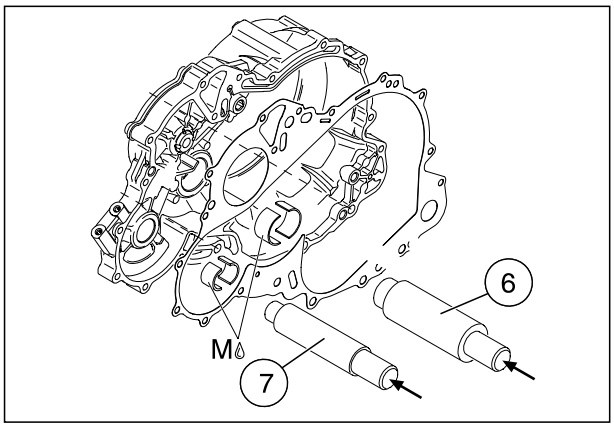
Hole in the clutch cover	Bush cover marking	Clutch cover marking
Ø32.921 - Ø32.930 mm	red	red
Ø32.930 - Ø32.940 mm	blue	blue
Ø32.940 - Ø32.951 mm	yellow	yellow

- Heat the engine casing to approx. 130 °C (266 °F).
- Coat the main bushes and the bush housings in the clutch cover with MOLYKOTE® G-N.

NOTE Have the appropriate special tools OPT to hand:

– (6) cod. 0277727 (clutch cover driving shaft bush inserter pad);
– (7) cod. 0277729 (main countershaft bush inserter pad).

- Place the driving shaft and countershaft main bushes on the inserter pads (6 - 7), using a suitable O-ring (8) to hold them in place.
- Line up the contact surface of the main bushes with the previously applied coloured marking (3).
- With due care, insert the main bushes on a press until the installer punch touches.

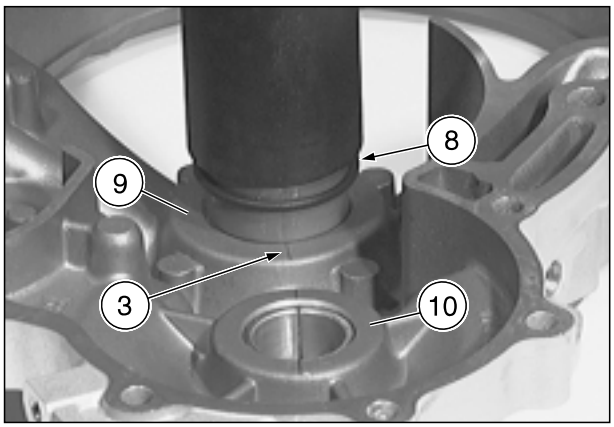


⚠ CAUTION

In order to insert the bushes, the clutch cover must be supported around the bush housing.

- Remove the O-ring (8) before the installer punch makes contact.

– The driving shaft main bushes must be **flush** with the thrust-bearing surface (9).
– The countershaft bushes are assembled **1.0 mm further down** with respect to the thrust-bearing surface (10).



⚠ CAUTION

Once disassembled, the bushes must not be reused.

M = MOLYKOTE® G-N.

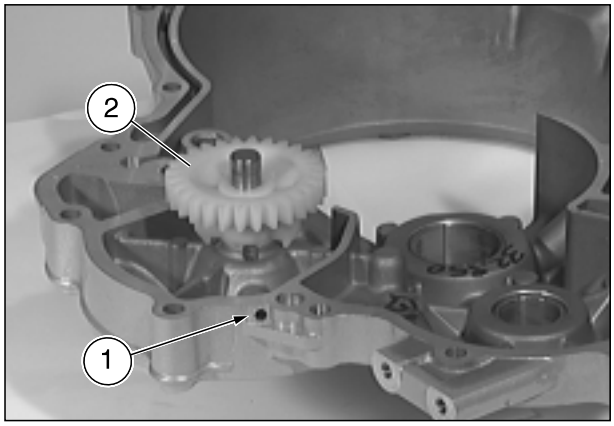
3.6.21 COOLANT PUMP

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

The coolant pump only needs disassembling in the event of oil or coolant leakage.

◆ Check the drainage hole (1) for any signs of oil or coolant leakage.



DISASSEMBLY

◆ Hold the coolant pump gear (2) still whilst unscrewing the impeller (3).
◆ Slide the coolant pump gear (2) up and off, and remove the pin (4) together with the washer (5).

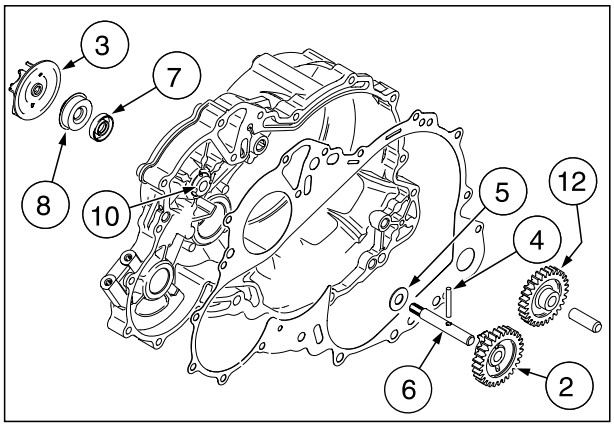
⚠ CAUTION

Take care not to damage the thread of the coolant pump shaft.

◆ Remove the coolant pump shaft (6) in the direction of the coolant pump gear (2).

NOTE Two holes are to be found in the clutch cover for the purpose of disassembly.

◆ Remove the oil seal (7), together with the sliding sealing ring (8), with a hole punch (9).



INSPECTION

◆ Check the impeller (3) for signs of damage or distortion and, where necessary, replace it.
◆ Check the coolant pump shaft (6) for signs of rolling around the oil seal sliding area and, where necessary, replace it.
◆ Measure the coolant pump shaft housing slot (10) on the clutch cover.

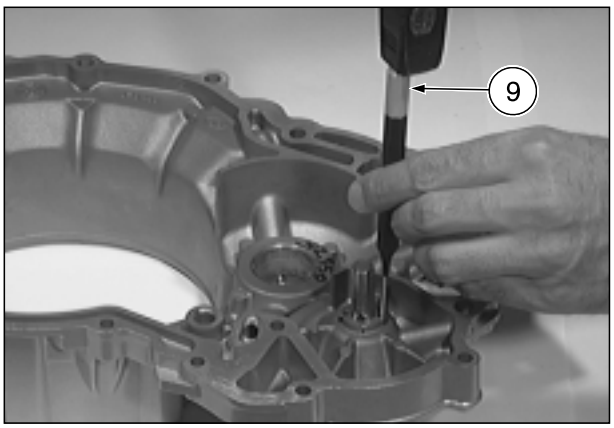
Slot wear limit (10) max. Ø 10.10 mm.

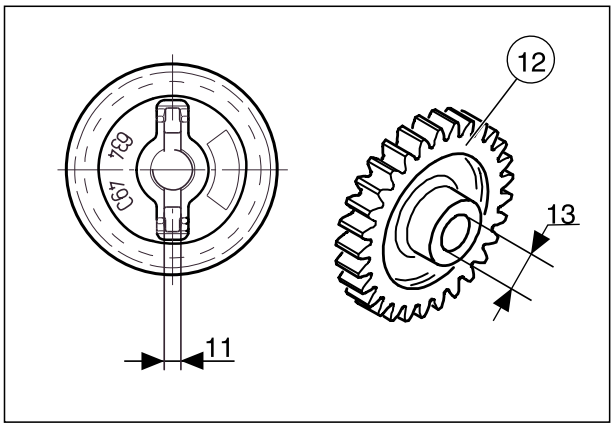
◆ Check the teeth of the coolant pump gear (2) for signs of damage or broken material and check the distance of the grooves protruding from the central slot (11) due to accommodate the pin.

Groove wear limit (11) max. Ø 3.70 mm.

◆ Check the teeth of the coolant pump idler gear (12) for signs of damage or broken material.
◆ Measure the housing slot (13).

Slot wear limit (13) max. Ø 10.22 mm.

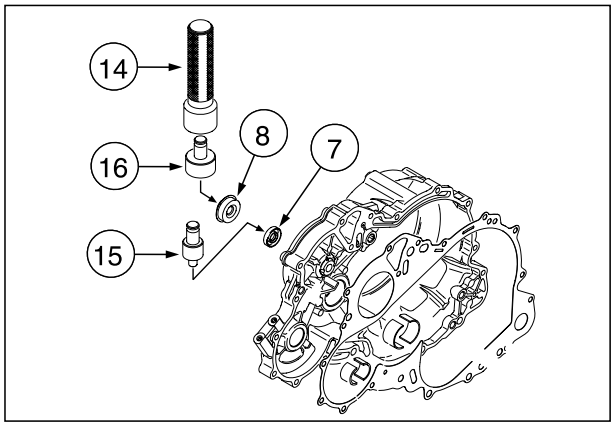




ASSEMBLY

NOTE Have the appropriate special tools OPT to hand:

– (14) handle for pads;
– (15) cod. 0277670 (coolant pump shaft housing oil seal assembly pad);
– (16) cod. 0877257 (coolant pump shaft housing sliding ring assembly pad).



NOTE The closed side of the oil seal must be fitted so that it faces the impeller (3).

◆ Insert the oil seal (7) all the way into the slot using the assembly punch.

NOTE The closed side of the oil seal must be fitted so that it faces the impeller (3).

◆ Insert the sliding sealing ring (8) all the way in using the assembly pad.

⚠ CAUTION

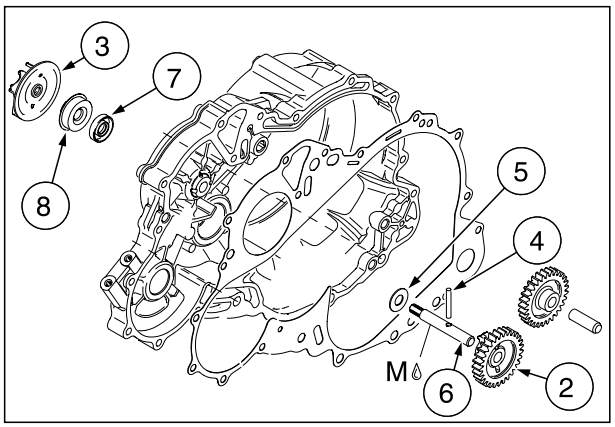
Take care not to damage the impeller (3).

◆ Screw the impeller (3) firmly onto the coolant pump shaft (6).
◆ Coat the coolant pump shaft (6) with MOLYKOTE® G-N and insert it from the outside all the way onto the oil seal assembly.
◆ Install the washer (5) on the coolant pump shaft.
◆ Install the pin (4) in the coolant pump shaft slot and engage the coolant pump gear (2).

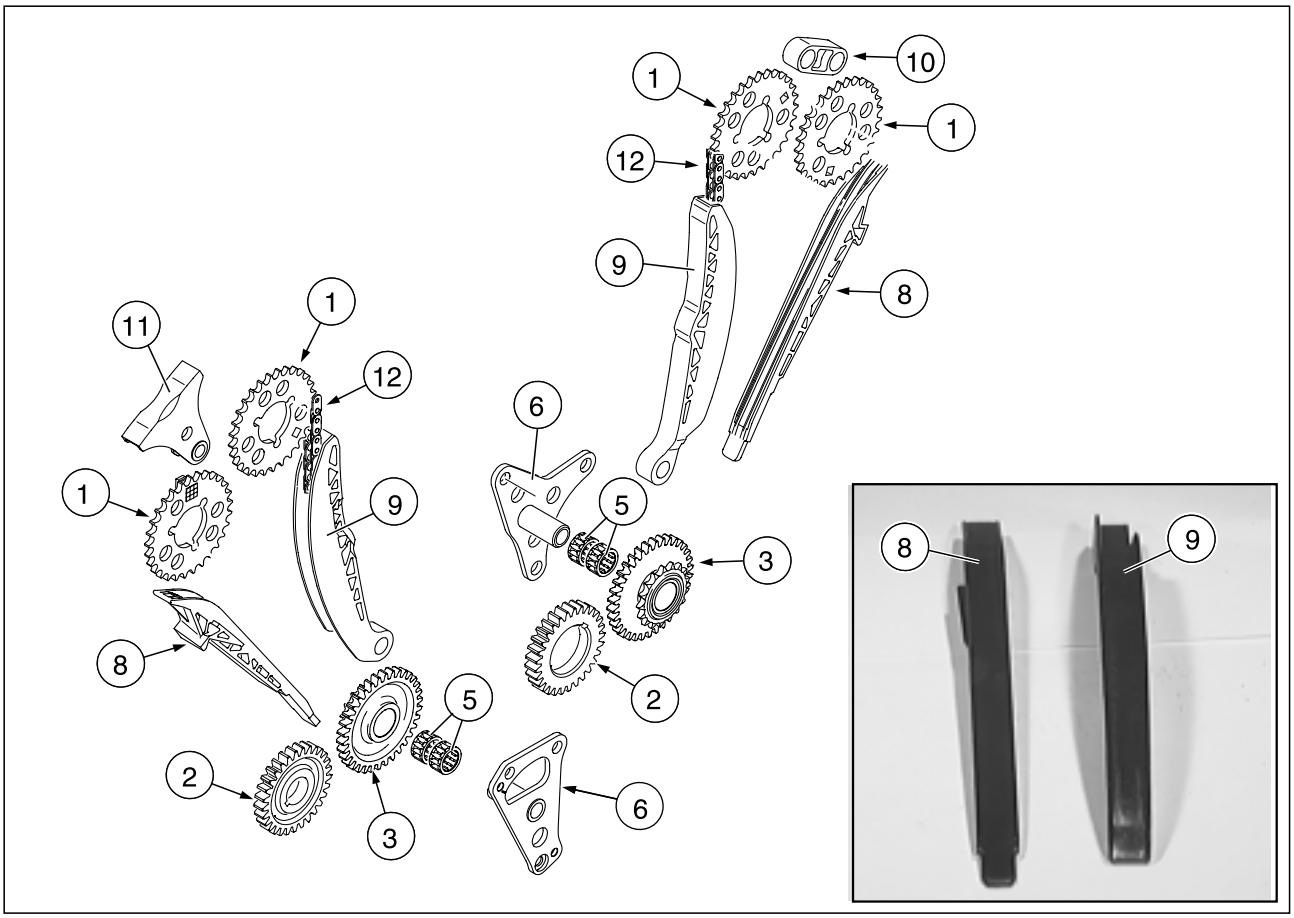
NOTE You must feel the pin is perfectly inserted in the slot in the coolant pump gear.

◆ Tighten the impeller (3) by hand, holding the coolant pump gear (2) still.

M = MOLYKOTE® G-N.



3.6.22 TIMING DRIVE ASSEMBLY



⚠ CAUTION

Set the cylinder "1" and "2" timing drive assemblies aside in distinct groups so that you are sure to refit the parts in the same housing when it comes to reassembly.

- Check the sides of the timing gear (1), drive gears (2) and intermediate drive gears (3) for broken materials or distortion.
- Check the slots of the idler gears (3) for wear.

Wear limit (4) max. 20.015 mm.

- Check the roller bearings (5) for wear.
- Check the two bearing flanges (6) for wear around the sliding area of the roller bearings (5).

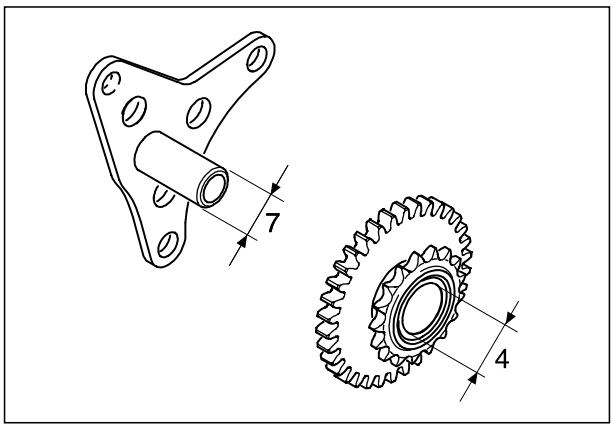
Wear limit (7) max. 15.98 mm.

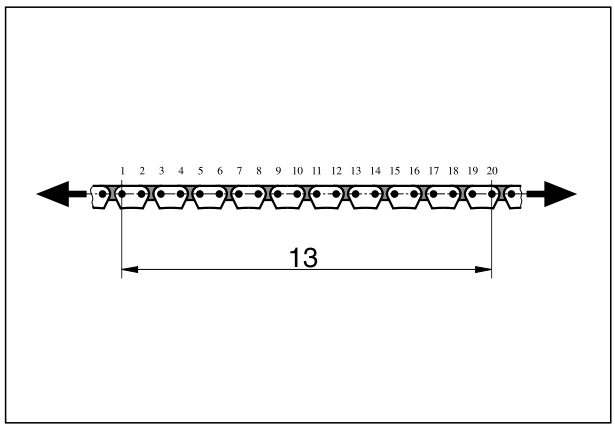
- Check the chain guide shoe (8), chain tightener shoe (9), chain guide (10) and chain guide bracket (11) for any traces of rolling.

Max. depth of the rolling traces: 1.2 mm.

- Check the teeth of the two timing chains (12) for any signs of distortion.
- Check the length of the timing chain (13) over a distance of 20 pins.

Wear limit max. 166.2 mm.



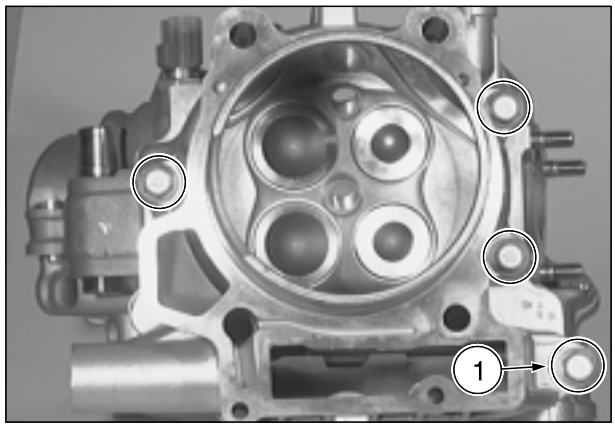


3.6.23 HEAD AND CAMSHAFT

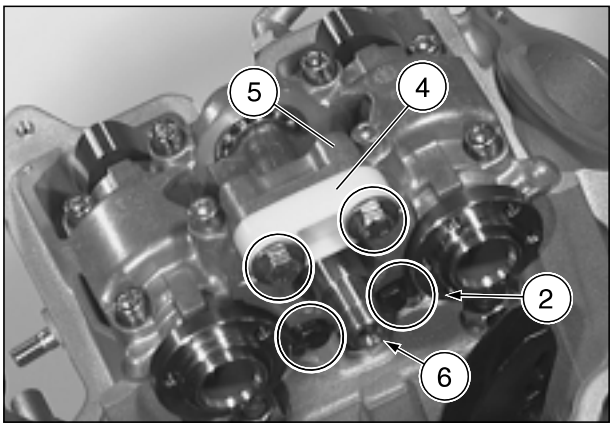
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

ASSEMBLY

◆ Unscrew and remove the four shouldered M8 screws (1) respectively and remove head "**1**" and "**2**" from the cylinder.

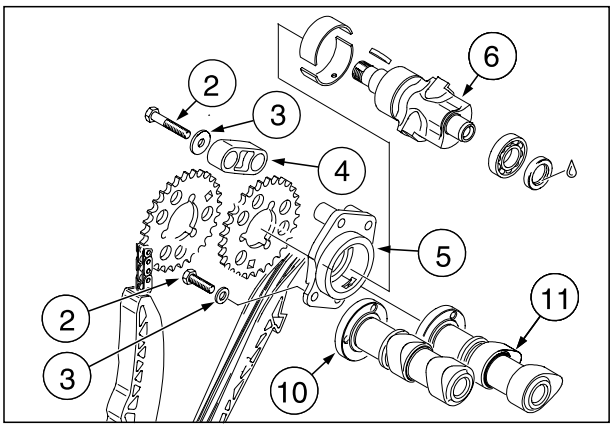


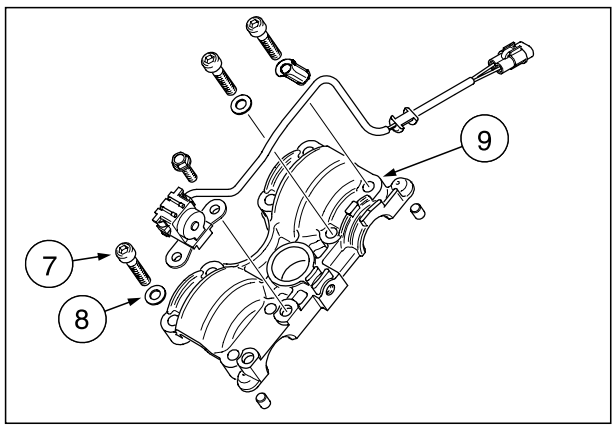
◆ Unscrew and remove the four M6 T.C.E.I. screws (2) together with the respective washers (3) from head "**2**" and remove the chain guide (4) and the bush plate (5).
◆ Remove the upper countershaft (6) from head "**2**".
◆ nscrew and remove the eight M6 T.C.E.I. screws (7), together with the respective washers (8), and remove the camshaft U bolt (9) from head "**1**" and "**2**".

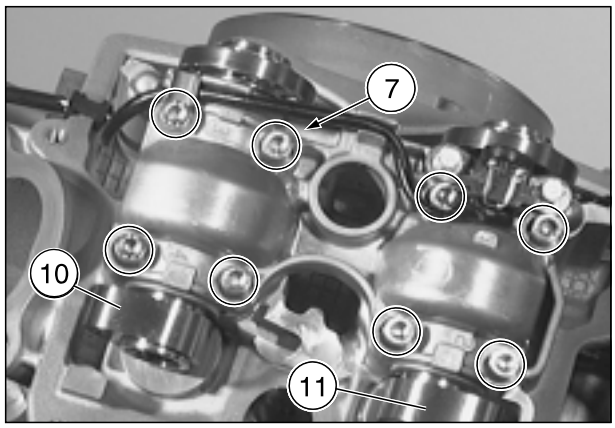


◆ Remove the intake camshaft (10) and exhaust camshaft (11) from head "**1**" and "**2**".

NOTE Set the disassembled components aside in groups according to the respective head so you are sure to refit them in the same position when it comes to reassembly.







3.6.24 DISASSEMBLING THE INTAKE AND EXHAUST VALVES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Before disassembling the valves, check head pressure loss on a plate (Bosch or Suntester).
If the pressure loss is less than 5%, valve tightness is correct.

⚠ CAUTION

During the disassembly of the exhaust and intake valves, set aside the valve spring, valve spring housings and valve cotters and mark them accordingly based on the assembly position and the part they belong to, so that the same order is followed when the components are refitted.

◆ Remove the valve lifter buckets (1) and the adjusting shims (2).

NOTE have the appropriate special tools OPT to hand :

– (5) cod. 8140179 (valve disassembly and reassembly bow);
– (6) cod. 0276479 (valve spring compression tool);

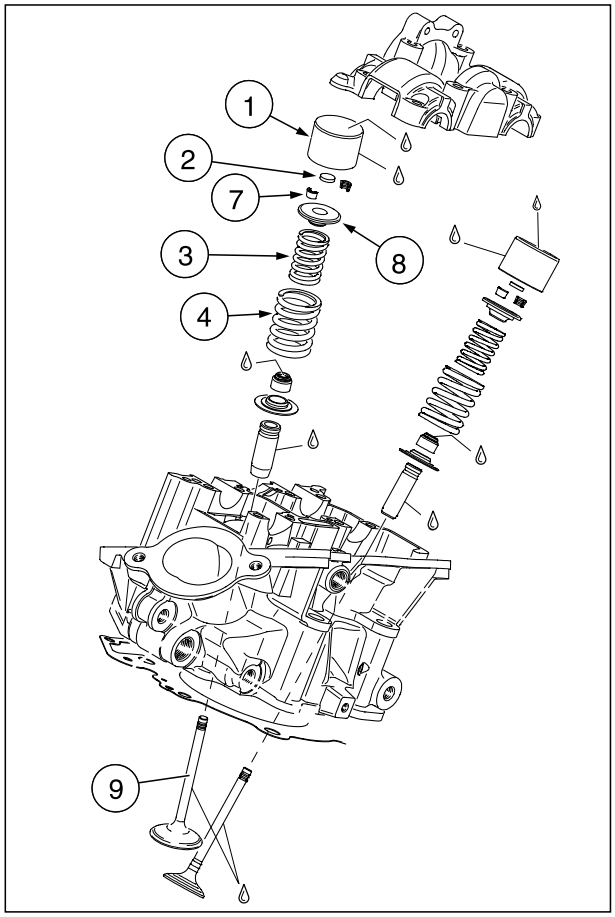
◆ Compress the valve springs (3 - 4) using the clamping bow (5) and a valve spring compressor fitting (6), and remove the valve cotters (7).
◆ Release the valve springs (3 - 4).
◆ Remove the valve spring housings (8) of the two valve springs (3 - 4) and remove the valves (9).
◆ Clean the combustion chamber, removing the residual combustion products and the deposits from the cooling cavity.
◆ Check the thread of the spark plugs and the fastening thread, making sure they are in a perfect state of repair.
◆ Check that the oil galleries are clear and, where necessary, clean them by blowing a jet of compressed air inside.
◆ Check the gasket surfaces for any signs of damage and make sure they are flat.

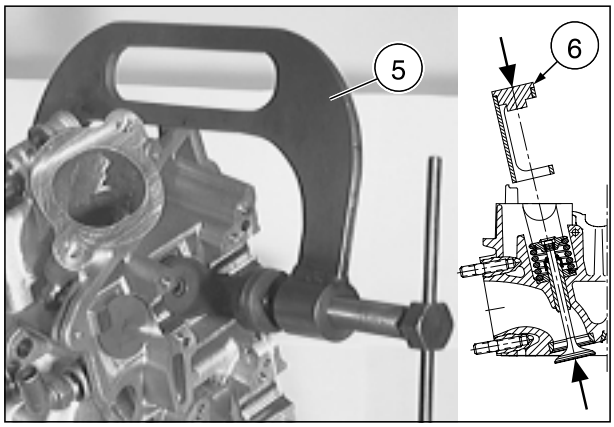
Max. permissible distortion: 0.03 mm.

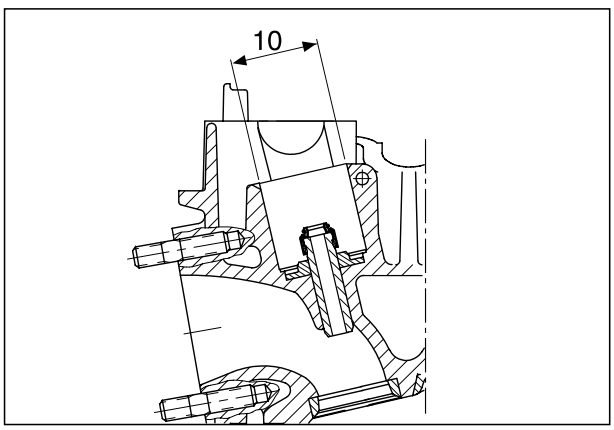
NOTE Where necessary, trim the gasket surfaces on a plate suitable for the purpose.

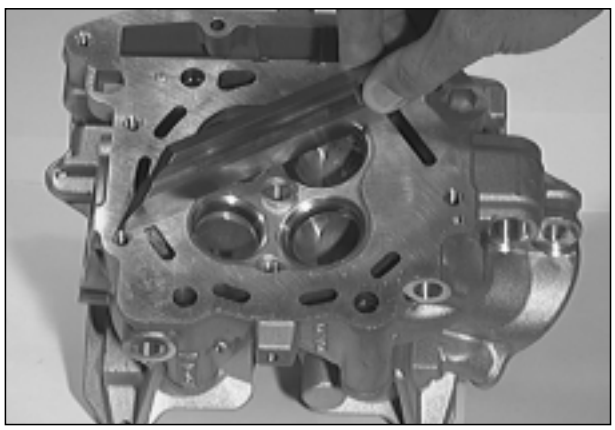
◆ Make sure the valve bucket (1) and guide in the head are in a perfect state of repair.

– Bucket slot in the head (10):
wear limit: max. Ø 33.58 mm;
– Bucket (1):
wear limit: min. Ø 33.44 mm;
– Bucket radial play (1)
wear limit: max. Ø 0.08 mm.









3.6.25 CAMSHAFT AND CAMSHAFT BUSHES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Check the cams (1) for broken material, signs of distortion or wear and, where necessary, replace the camshaft.

Measure the play of the camshafts:

◆ Place the camshafts in the head.
◆ Apply a plastic gauge (2) on the bearing housings of the camshafts.
◆ Apply the U bolts according to which shaft they are assigned to and fasten them with the M6 T.C.E.I. screws.

Driving torque: 10 Nm (1.0 kgm).

◆ Remove the T.C.E.I. screws and the U bolts.
◆ Measure the maximum width of the pressed plastic gauge with the corresponding graduated scale (3).

Wear limit: max. 0.060 mm.

◆ If the wear limit is exceeded, the bush housings on the camshafts and on the head must be measured, and the worn part replaced.

– Camshaft bush housings:
wear limit (4): min. Ø 23.950 mm;

– Head bush housings:
wear limit: max. Ø 24.040 mm;

◆ Insert the intake and exhaust camshafts in the respective housings in the head and measure the end play with a comparator.

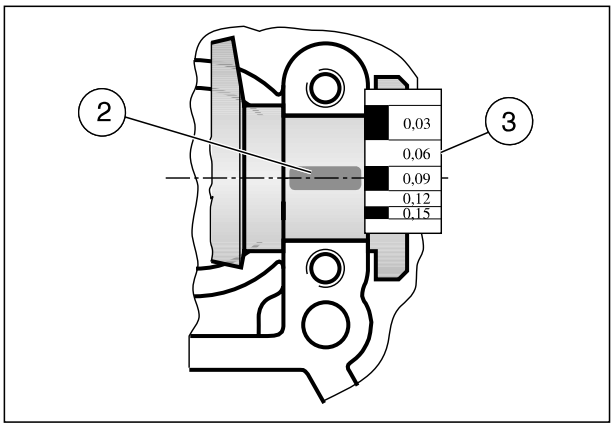
– End play of the camshafts:
wear limit: max. 0.40 mm.

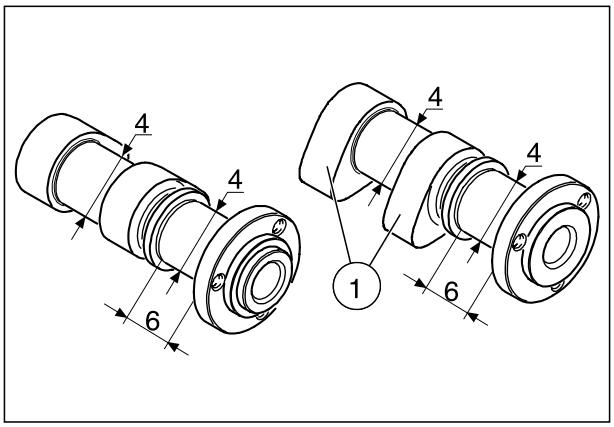
◆ If the wear limit is exceeded, the axial contact surfaces, both of the camshafts and in the head, must be measured and the worn part replaced.

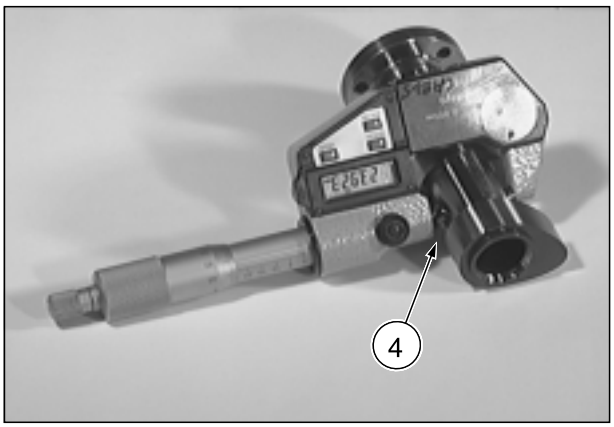
– Axial contact surfaces, (6) camshafts:
wear limit: max. 27.77 mm;

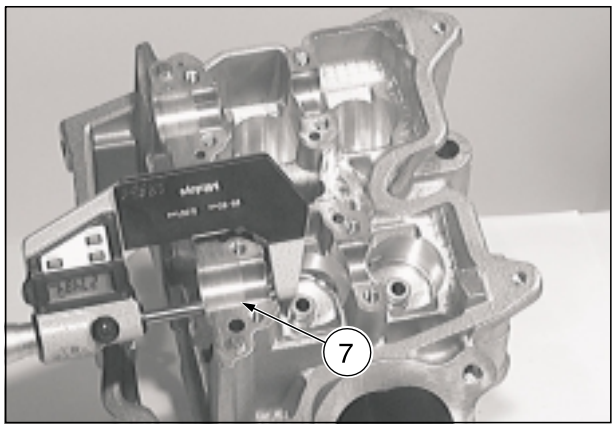
– Axial contact surfaces, (7) head:
wear limit: min. 27.10 mm.

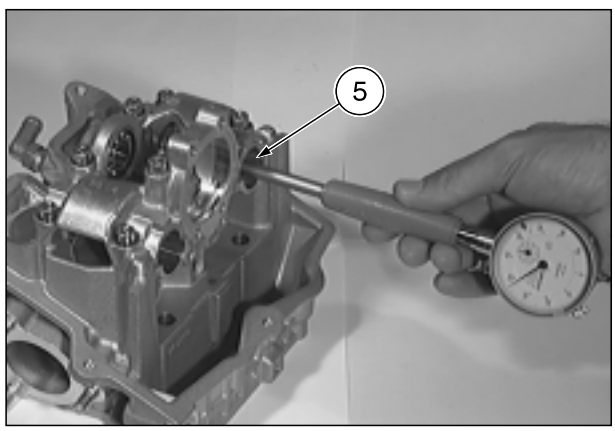
NOTE If the camshaft is replaced, the buckets must also be changed.











3.6.26 UPPER COUNTERSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Check the countershaft for wear.

NOTE The bush housing (1) is slightly tapered, hence the measurement must be taken half way along the housing.

– Bush housing (1):
wear limit: min. Ø 34.98 mm;

– Ball bearing pin (2):
wear limit: min. Ø 14.97 mm.

NOTE The bush (3) is slightly tapered.

◆ Check the internal diameter (3) of the bushes in the plate and check for wear or cracks.

NOTE Install the countershaft and measure the radial play with a comparator.

◆ Measure the radial play of the bush.

Max. permissible radial play 0.70 mm.

◆ If the maximum permissible radial play is exceeded, the worn part must be replaced.

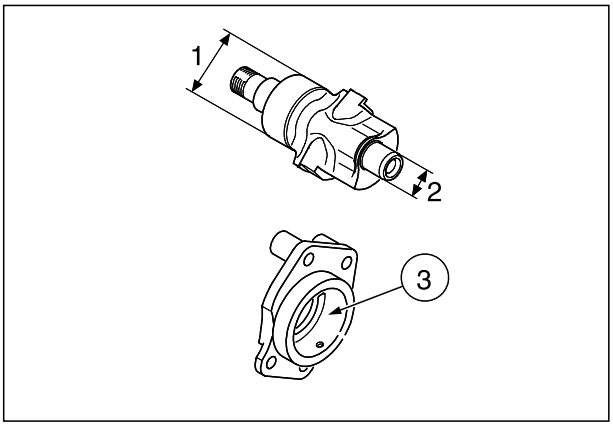
NOTE Should the bushes be worn, the whole bush plate must be replaced.

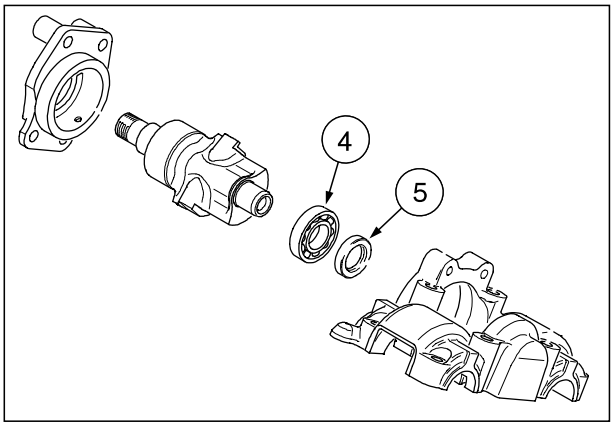
◆ Install the countershaft in the head (2) (rear) and measure the end play with a comparator.

Wear limit: max. 0.040 mm.

NOTE If the end play wear limit is exceeded, replace the bush plate.

◆ Install the countershaft in head “2”, see 3.7.12 [ASSEMBLING HEAD “2” (REAR) CAMSHAFT].

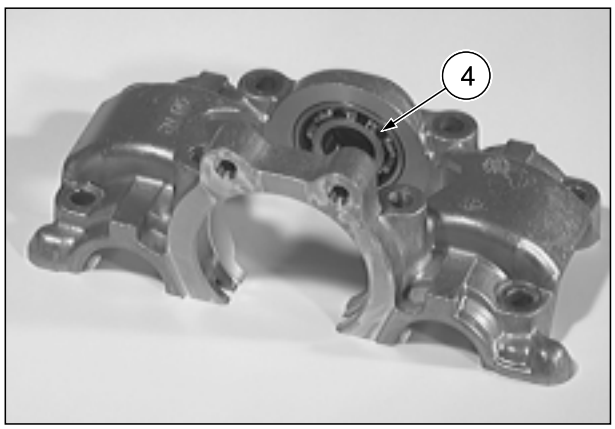




◆ Make sure the ball bearing (4) in the U bolt slides smoothly and does not feature pitting, and check slack.

NOTE Oil the ball bearings with motor oil before performing the check.
If the inner race does not turn easily and silently, or if it makes a noise, it means the bearing is defective and needs replacing.

◆ Check the oil seal (5) behind the ball bearing (4) for any wear or signs of damage.



3.6.27 DISASSEMBLING AND ASSEMBLING THE UPPER COUNTERSHAFT BALL BEARINGS AND OIL SEAL

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE Have the appropriate special tools OPT to hand:

– (6) cod. 8140156 + 8140157 + 0276377 (clutch cover sleeve puller);
– (7) handle for pads;
– (8) cod. 877257 (coolant pump shaft housing sliding ring assembly pad).

◆ Heat the camshaft U bolt to approx. 80 - 100 °C (176 - 212 °F).

NOTE Take care not to damage the camshaft U bolt.

◆ Remove the ball bearings (4) with the puller plate (6) and with the expansion sleeve suitable for the bearing.

NOTE As a rule, the ball bearings and the oil seals should be replaced.

◆ Lift the oil seal (5).

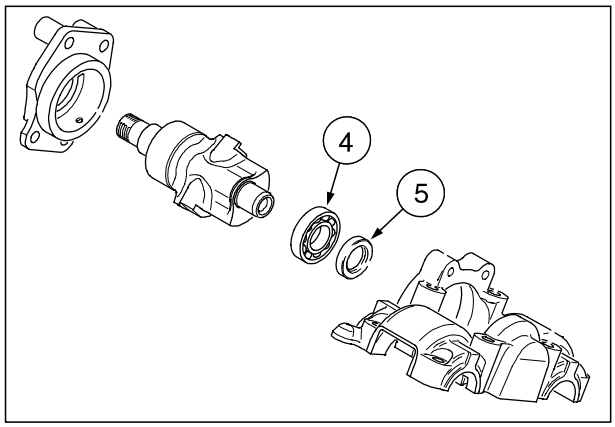
NOTE Before assembling, oil the external diameter of the oil seal slightly.
The closed side of the oil seal must face outwards.
Grease the sealing lips.

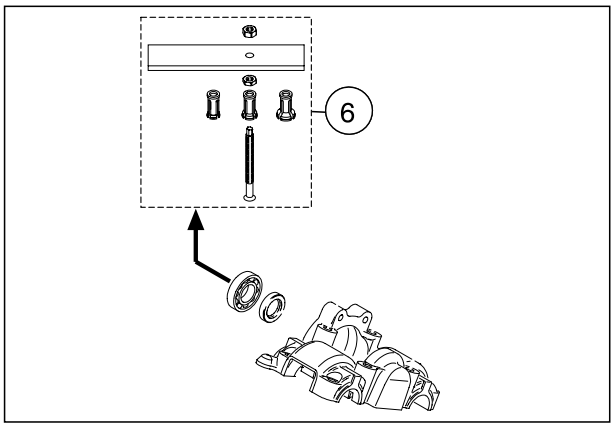
⚠ CAUTION

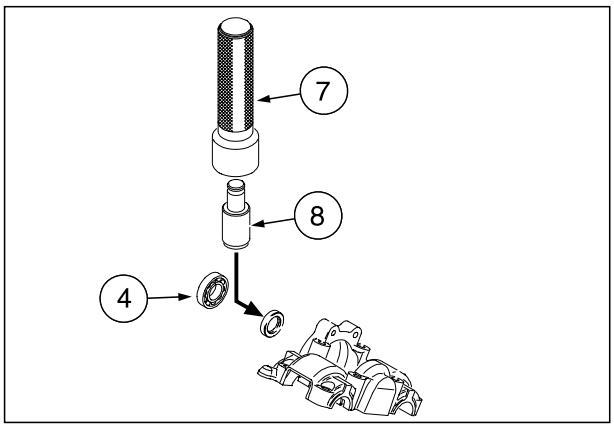
In order to avoid damaging the ball bearing, under no circumstances should the oil seal touch the bearings inner race.

◆ Insert the oil seal (5) all the way in using the assembly punch.
◆ Oil the external diameter of the ball bearing (4) slightly and insert it all the way onto the outer ring with a suitable assembly punch.
◆ Check the ball bearing housing (4) on the U bolt for signs of wear.

Interference: min. Ø 0.030 mm.







3.6.28 VALVE GUIDE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Use a dial gauge to measure the wear of the valve guide (1).

Wear limit (2): max. Ø 6.05 mm.

NOTE If the valve guide is worn, it can be replaced.

ASSEMBLY AND DISASSEMBLY

◆ Slip off the valve stem seal (3) and remove the valve spring shim (4).

NOTE Replace the valve stem seal (3).

◆ To eliminate the valve guide with a reamer (5) as far as the start of the notch (6).

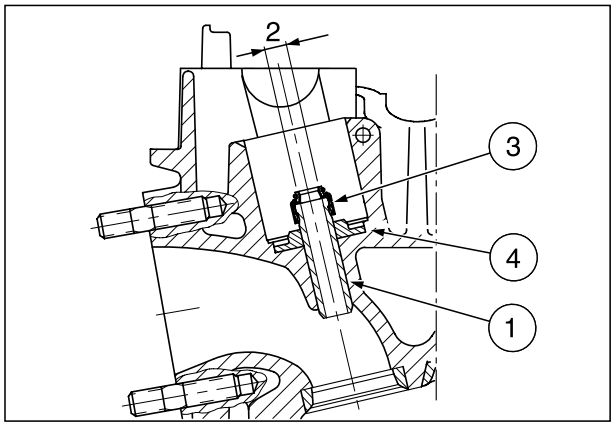
NOTE The sharp edge of the valve guide must be eliminated as, otherwise, the head slot is in danger of being to slide when the valve guide is removed.

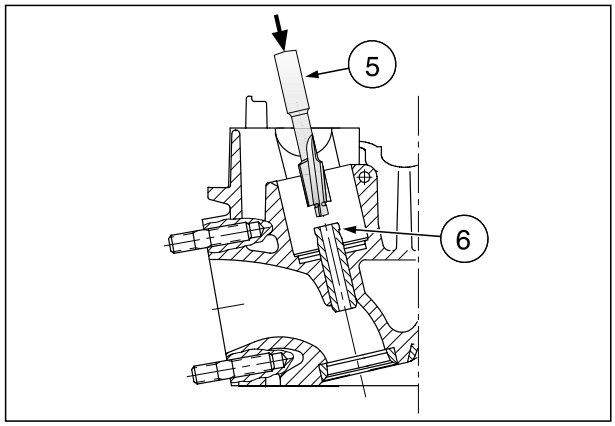
Have the appropriate special tool OPT (7) to hand (cod. 0277510 valve guide disassembly pad).

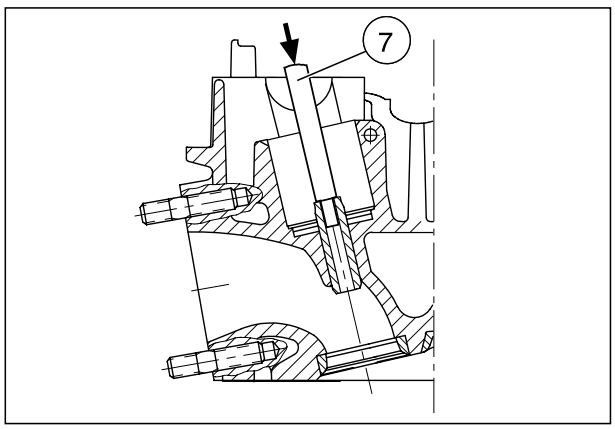
NOTE Do not heat the head.

◆ Use the pad (7) to remove the rest of the guide valve in the direction of the exhaust manifold.
◆ Check the valve guide slot for tailings.

NOTE Should any signs of picking-up be encountered, the head must be replaced.







⚠ CAUTION

La testata o il guidavalvola si danneggia se non si usa il MOLYKOTE® G-N.

◆ Apply a coat of MOLYKOTE® G-N on the head hole and on the valve guide assembly edge.

NOTE Have the appropriate special tool OPT (8) to hand (cod. 0277695 valve guide oil seal assembly pad).

◆ Using the assembly pad (8), insert the new valve guide in the head, working from the oil chamber towards the combustion chamber until the assembly punch reaches a level position.

NOTE The exhaust valve and intake valve guides are different.
The difference consists in the fact that the intake valve guide has a longer smoothed surface (9).

◆ Check how much the head (10) of the valve guide protrudes on the camshaft side.

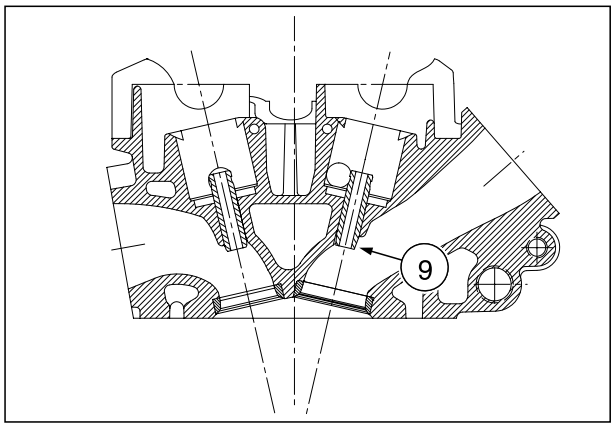
(10) Protrusion = 13.3 ± 0.2 mm.

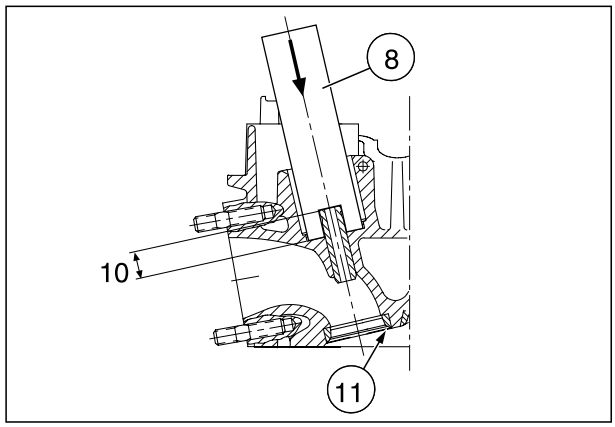
◆ Bore the valve guide with a ∅ **6 F7** reamer.

Hole of the valve guide Ø 6.006 – 6.018 mm.

NOTE Use cutting fluid only to lubricate the reamer.
The reamer should only be turned in the cutting direction, never in the opposite direction, and cleaned of tailings at frequent intervals, again always removing it in the direction of the cut.

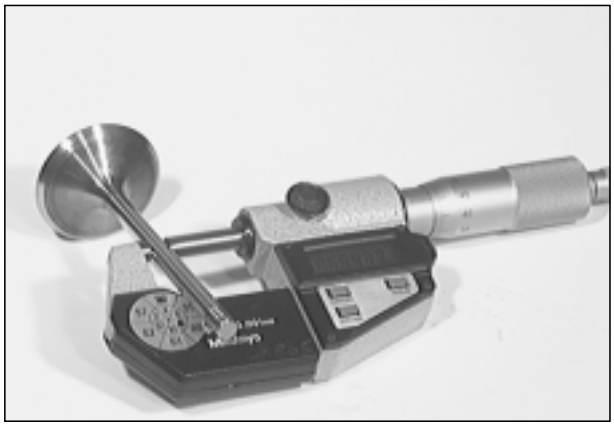
◆ Having bored the valve guide, clean the head thoroughly and grind the valve seat (11), smoothing the valve seat with a valve seat reconditioning device, and grind the valve, see 3.6.29 (VALVES - VALVE SEATS).
◆ Check the contact mark using the relevant marking paste (Prussian blue).





3.6.29 VALVES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).



⚠ CAUTION

The seat (1) on the head of the valve is reinforced by means of inductive hardening.
For this reason, the seat cannot be reground and, instead, the valve must be replaced.
Grinding with abrasive paste is nonetheless permitted, whilst it is prohibited to regrind a valve at the end on the valve stem.

- ◆ Clean the valves of all residual combustion products.
- ◆ Check the seat (1) on the valve head with a line. The surface of the seat must not be concave; where necessary, replace it.
- ◆ Check the diameter of the stem with a micrometer:

– intake valve:
wear limit (2) min. Ø 5.950 mm;

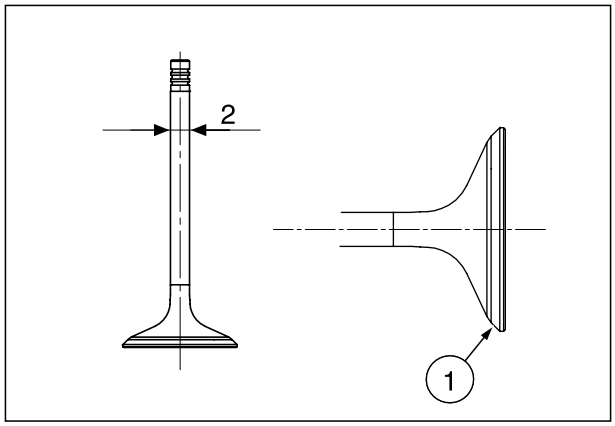
– exhaust valve:
wear limit (2) min. Ø 5.935 mm.

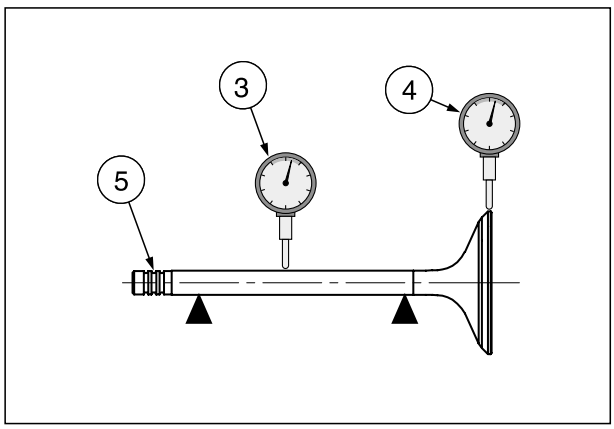
- ◆ Check the eccentricity of the valve:

– valve stem:
permissible eccentricity (3) max. 0.05 mm;

– valve head:
permissible eccentricity (4) max. 0.05 mm.

- ◆ Check whether the fastening grooves (5) of the valve cotters are in a perfect state of repair.





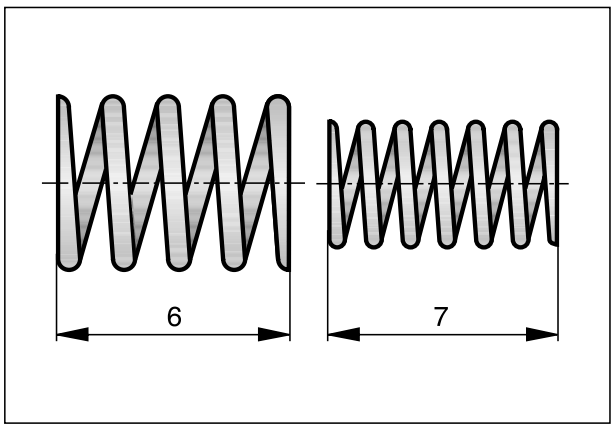
VALVE SPRINGS

- ◆ Measure and visually inspect the valve springs to check for breakage, distortion or loss of tension; measure the length of the springs in the release position.

– Valve springs:
wear limit (6) min. 43.4 mm;

– Valve springs:
wear limit (7) min. 40.9 mm.

NOTE Worn spring valves may result in a reduction in engine power and increased noise from the valve assembly.



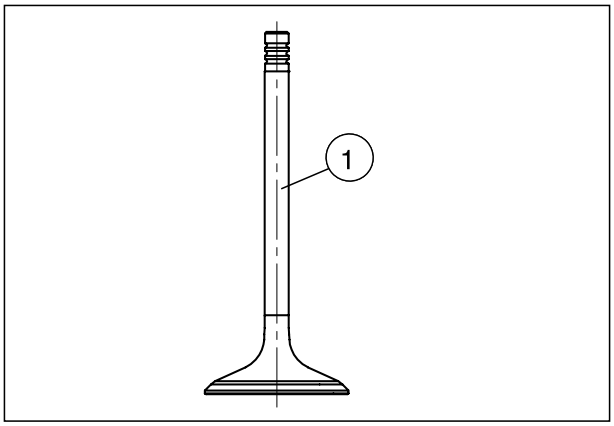
VALVE SEATS

- ◆ Coat the valve seat surfaces with marking paste (Prussian blue).
- ◆ Insert the corresponding valve (1) and turn the valve, pressing down slightly with a valve grinder.
- ◆ Check the width of the valve seat (2-3) and the contact mark, checking for any signs of wear.

– Intake valve:
wear limit (2) max. 1.6 mm;

– Exhaust valve:
wear limit (3) max. 1.8 mm.

NOTE The circular contact mark on the valve seat and valve surfaces must be continuous and unbroken.
If the width of the valve seat exceeds the wear limit or if the valve seat surface is not continuous, the valve seat can be ground.



GRINDING THE VALVE SEATS

A = intake
B = exhaust

NOTE The valve seats can be ground with a valve seat grinding device centred in the valve guide.

- ◆ Perform grinding at **45°** with the valve seat grinding device until the whole valve seat is covered in tailing. During this operation, make sure no more material than necessary is removed.
- ◆ Lastly, grind at **35°** until the given diameter (4-5) is obtained.

– **Intake valve (4) Ø 35.3 mm;**

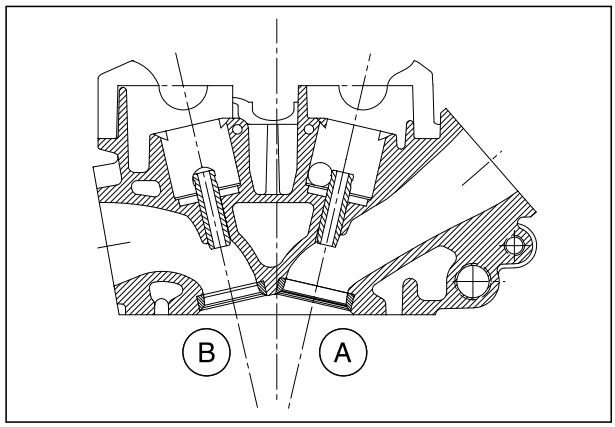
– **Exhaust valve (5) Ø 30.3 mm.**

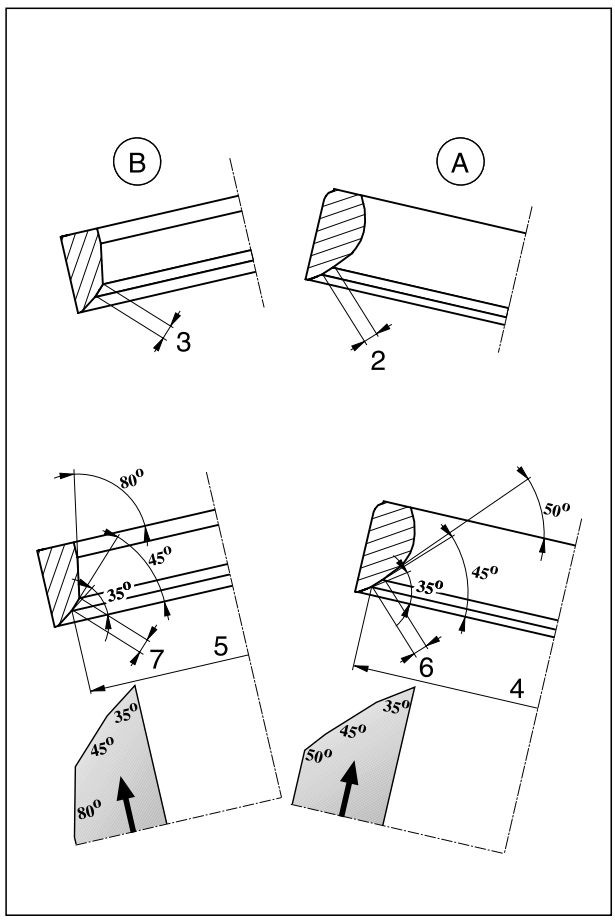
- ◆ Next, grind the intake valve at **50°** and the exhaust valve at **80°** with the grinding device until the given width (6-7) for the valve seat surface is obtained.

– **Intake valve (6) 1.05 - 1.35 mm;**

– **Exhaust valve (7) 1.25 - 1.55 mm.**

- ◆ Grind the valve (1) with the valve grinder and the valve grinder paste.





ASSEMBLING THE VALVES IN THE HEAD

NOTE Have the appropriate special tools OPT to hand:

– (3) cod. 0277210 (valve guide assembly pad):
– (8) cod. 0276479 (valve spring compression tool);
– (9) cod. 8140179 (valve disassembly and reassembly bow).

⚠ CAUTION

During assembly, make sure the valves and valve lifter buckets are refitted where they belong inside the head.

◆ Insert the valve spring housing cap (1) through the valve guide.
◆ Fit a new valve stem oil seal (2) with the assembly pad (3).
◆ Oil the valve stem and carefully insert the valve (4) inside the valve guide.

NOTE Take care not to damage the valve stem oil seal (2).

◆ Check head pressure loss on a plate (Bosch or Suntester).

NOTE If the pressure loss is less than 7%, this means valve tightness is correct.

◆ Fit the valve springs (5-6) and valve spring caps (7).

NOTE The intake and exhaust valve springs are identical, but must always be fitted so that the coloured marking is at the top since the winding of the springs is progressive.

◆ Preload the valve springs with the spring compressor (8) and special clamping device (9) and insert them in the valve cotters (10).

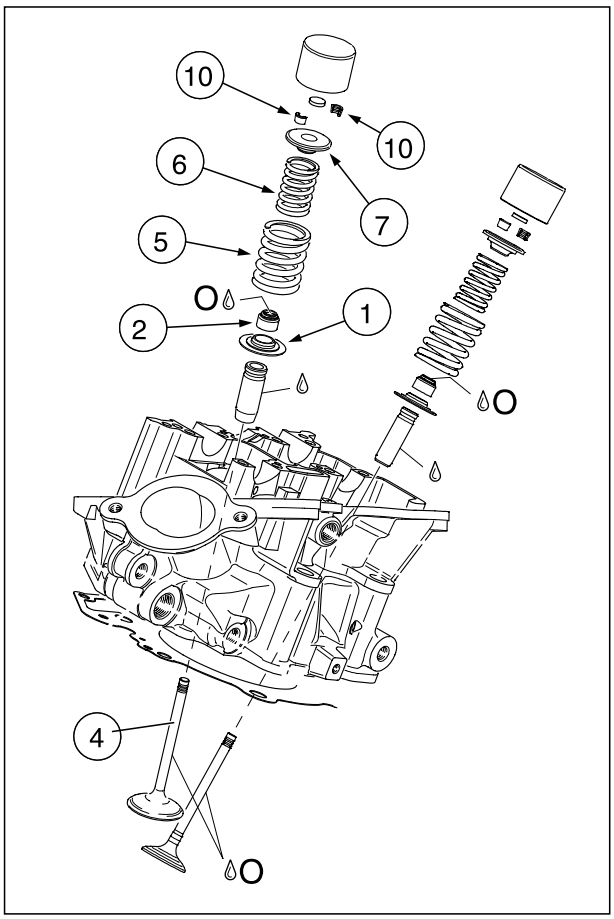
NOTE Apply grease on the valve cotters (10) to make assembly easier.

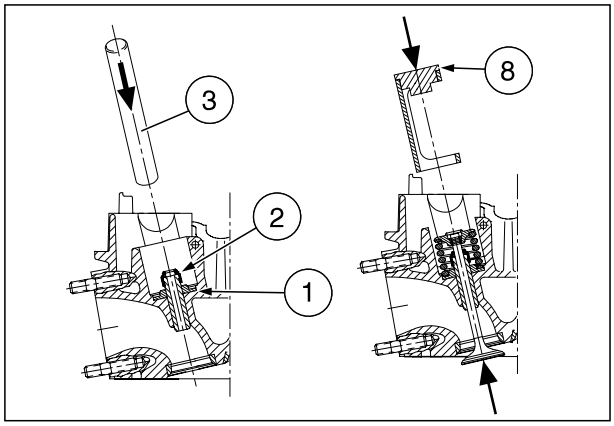
◆ When releasing the clamping device (9), make sure the valve cotters (10) are inserted perfectly in the valve grooves.
Where necessary, use a plastic hammer to tap them in gently.

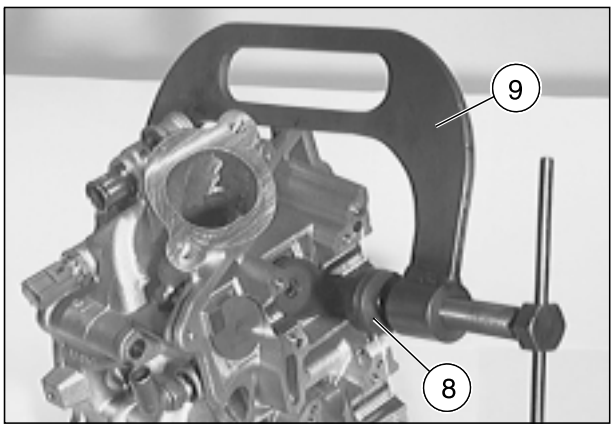
⚠ CAUTION

Make sure the valve springs are inserted properly. If the valves are fitted obliquely, they will inevitably cause the valve stems to break.

O = Motor oil.







3.6.30 CYLINDER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

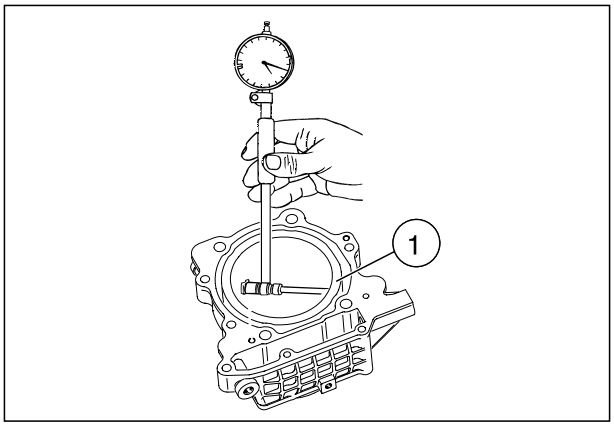
◆ All the gasket surfaces must be cleaned and flat. Flatness of the gasket surfaces:

Max. permissible distortion: 0.04 mm.

◆ Make sure all the threads are in a perfect state of repair.
◆ Examine the sliding surface of the cylinder to check for any friction and scratches, and check whether the gasket surfaces feature signs of damage.

NOTE If there are evident grooves on the nikasil lining inside the cylinder, replace the cylinder complete with piston.

◆ Clean the cylinders cooling cavity of any lime scale.
◆ Measure the bore of the cylinder in 3 places at a distance of **45 mm** from the upper edge (1); consider the highest value for the wear limit.

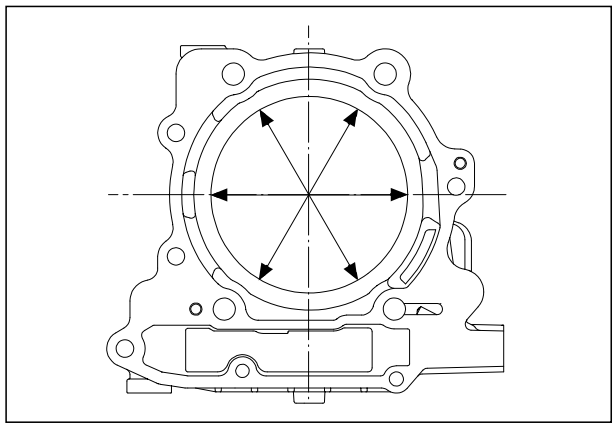


– Cylinder “A” dimension when new:
bore Ø 97.000 - 97.012 mm.

wear limit: max. Ø 97.027 mm.

– Cylinder “B” dimension when new:
bore Ø 97.012 - 97.025 mm.

wear limit: max. Ø 97.040 mm.



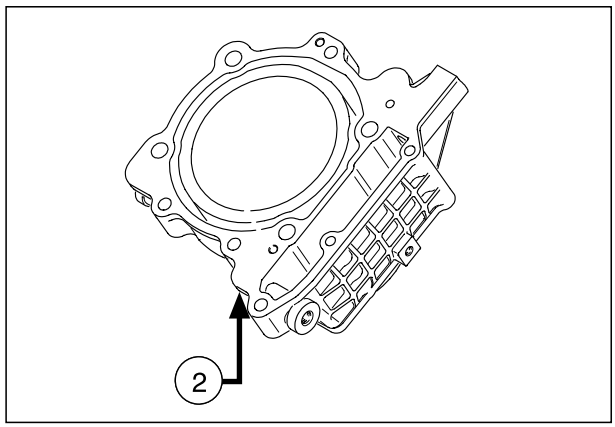
NOTE The size group “A” or “B” is punched onto the lower side of the cylinder (2).

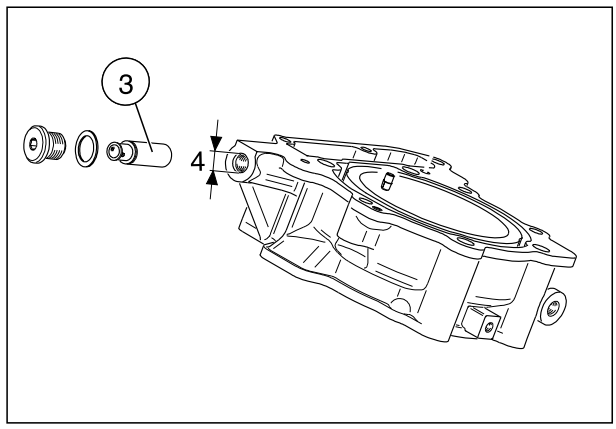
NOTE In order to assess the wear limit, the assembly play must be determined, see 3.6.31 (PISTON AND GUDGEON PIN).

◆ Make sure the chain tightener (3) and the guide in the cylinder are in a perfect state of repair.

Chain tightener (3) / hole on the cylinder clearance (4):
wear limit (hole diameter - chain tightener diameter): max. 0.08 mm;

Hole for chain tightener in the cylinder:
wear limit (4): max. Ø 14.07 mm.



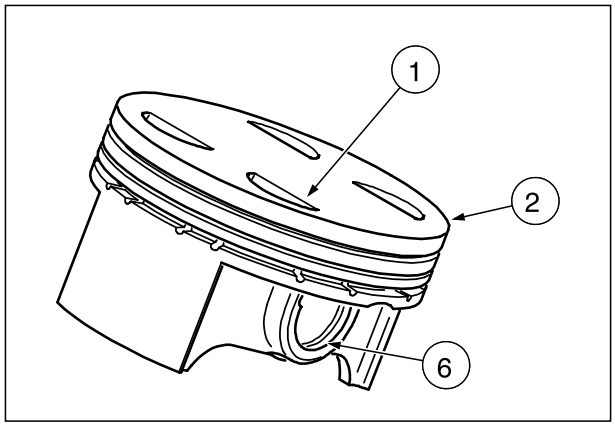


3.6.31 PISTON AND GUDGEON PIN

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Clean the piston crown (1) and the area above the upper piston ring (2) of any residual combustion products.
- ◆ Check the piston for any cracks and the sliding surface of the piston for signs of compression (picking-up). Where necessary, replace the piston.

NOTE Minor ridging on the piston lining is tolerable.

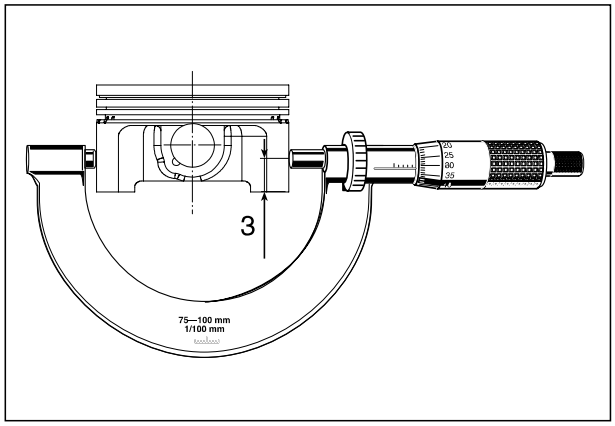


- ◆ Measure the piston diameter at a height of **10 mm** (3) across the gudgeon pin axis, using an external micrometer.

"Red" piston:
wear limit min. Ø 96.918 mm.

"Green" piston:
wear limit min. Ø 96.930 mm.

Piston play - measurement:
piston play =cylinder diameter minus piston diameter
wear limit max. 0.090 mm.



NOTE If the wear limit is exceeded, a new piston must be used or the cylinder replaced, complete with piston.
If the piston is replaced, the two seeger rings securing the gudgeon pins must always be replaced, along with the actual gudgeon pins.

Take special care when matching the cylinder - piston:

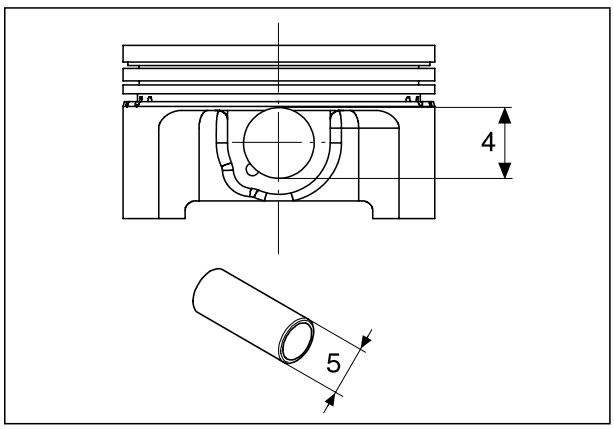
"Red" piston - Cylinder "A".
"Green" piston - Cylinder "B".

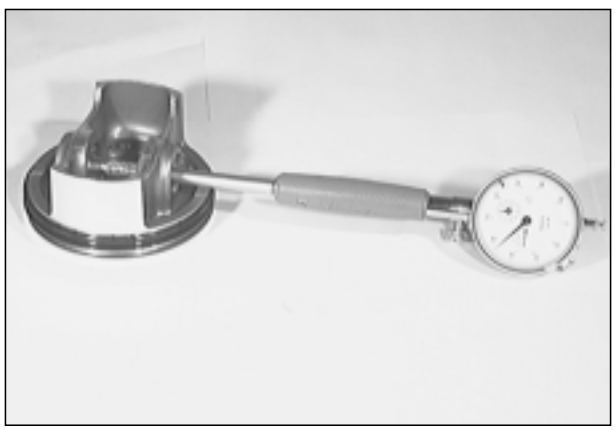
- ◆ Use an external micrometer to measure the diameter of the gudgeon pin hole in the piston in the direction of lift and the diameter of the gudgeon pin at either end as well as in the middle.

– Gudgeon pin hole in the direction of lift:
wear limit (4) max. Ø 22.018 mm.

– Gudgeon pin:
wear limit (5) min Ø 21.998 mm.

- ◆ Check the wear of the gudgeon pin seeger rings with the bent ends.





◆ Use a feeler gauge to measure the end play (7-8-9) of the piston rings inside the grooves.

– L-section ring
wear limit (7) max. 0.12 mm;

– Tapered protruding ring:
wear limit (8) max. 0.12 mm;

– Scraper ring
wear limit (9) max. 0.10 mm.

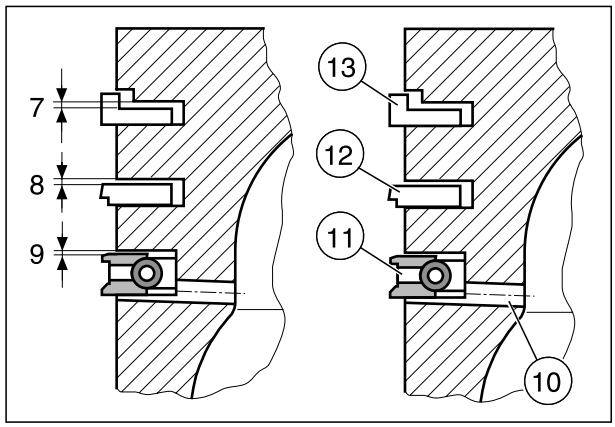
⚠ CAUTION

The piston rings are fragile.

◆ Carefully remove the piston rings from the piston.

NOTE The piston ring groove can be cleaned using a scraper or an old piston ring.

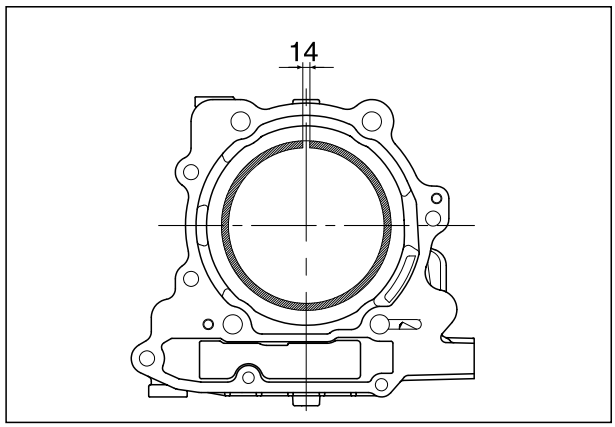
◆ Clean the piston ring grooves and the oil return holes (10) in the scraper ring groove, then blow a jet of compressed air inside.
◆ Check the scraper ring (11), the tapered protruding ring (12) and the L-section ring (13) to make sure the sliding surface is cleaned.



◆ Measure the piston ring gap (14) with a feeler gauge.

wear limit max. 1.00 mm.

NOTE In order to measure the gap required, insert the piston ring in the cylinder and push it inside so that it is lined up with the piston.
The cylinder bore must not feature any signs of wear.



◆ Measure the thickness of the rings with a micrometer.

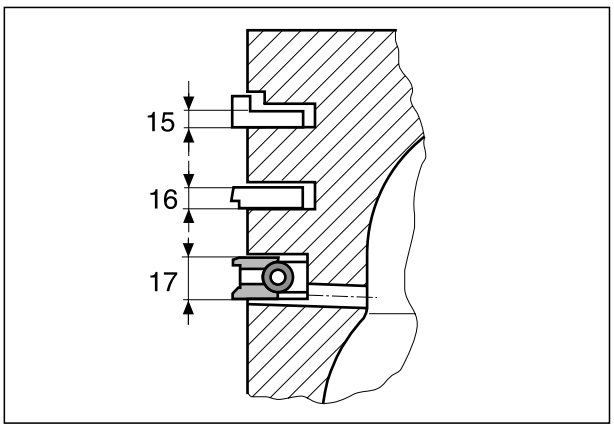
– L-section ring:
wear limit (15) min. 0.85 mm;

– Tapered protruding ring:
wear limit (16) min. 1.20 mm;

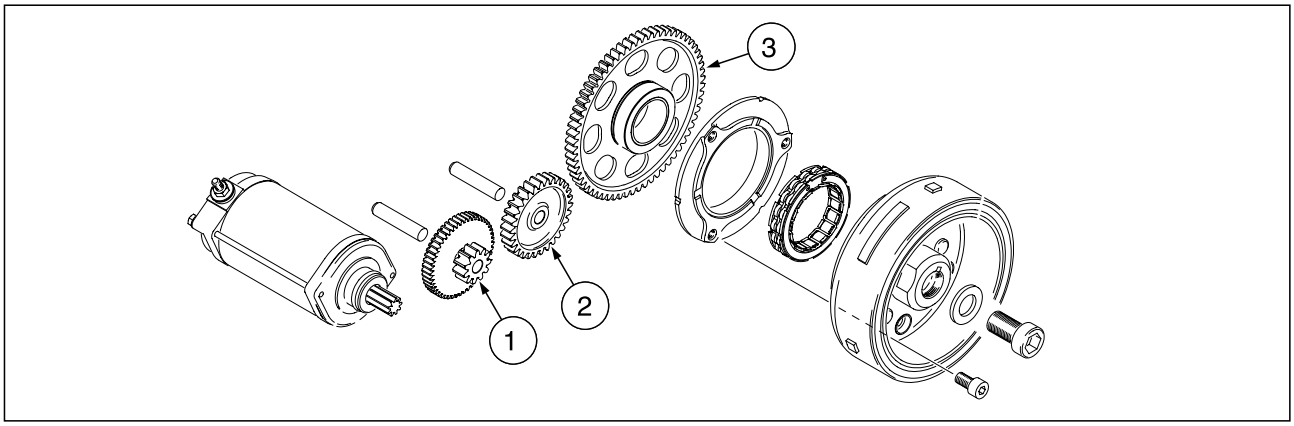
– Scraper ring:
wear limit (17) min. 2.45 mm.

◆ Fit the scraper ring (11), the tapered protruding ring (12) and the L-section ring (13) from the bottom up; the word “TOP” on the rings must face up.

NOTE Rotate the piston rings so that the three gaps are staggered by approx. 120°.



3.6.32 STARTER MOTOR DRIVE ASSEMBLY



Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

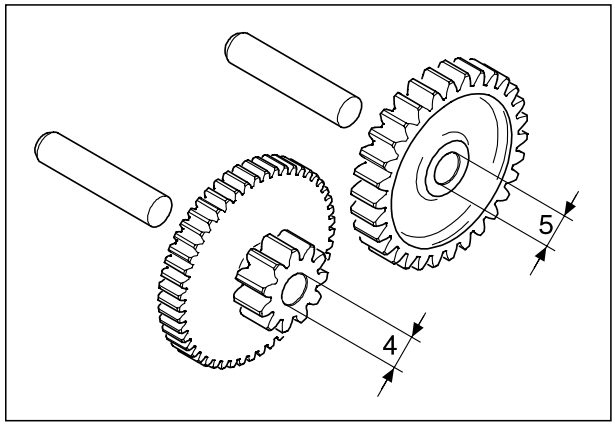
NOTE If the toothing of the double starter gear is distorted, the toothing of the starter motor must also be checked.

- ◆ Check the toothing of the double starter gear (1), idler gear (2) and the freewheel gear (3) for broken material or distortion.
- ◆ Check the bush of the freewheel gear (3) for signs of rolling and grooves.
- ◆ Measure the gear bearing diameter.

– Double starter gear:
wear limit (4) max. Ø 10.10 mm.

– Idler gear:
wear limit (5) max. Ø 10.08 mm.

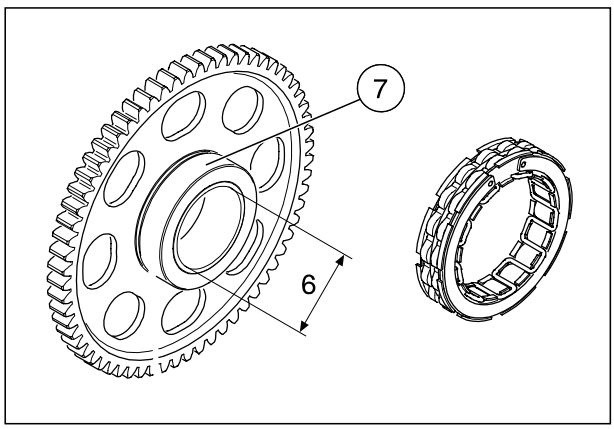
– Freewheel gear (6):
wear limit max. Ø 35.07 mm.



NOTE The bush inside the freewheel gear (3) must be inserted so that it is fixed and unable to move freely.

Should signs of distortion be encountered on the sliding surface, or materials found to be broken, the freewheel gear must be replaced.

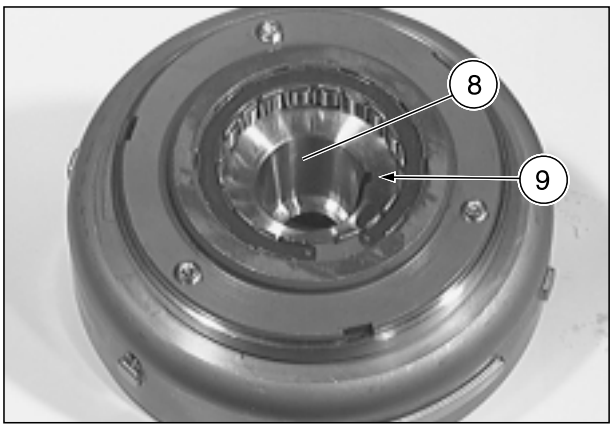
- ◆ Check the sliding surface (7) of the freewheel for wear.



- ◆ Clean the cone (8) of the magnetic hub of any LOCTITE® residues.

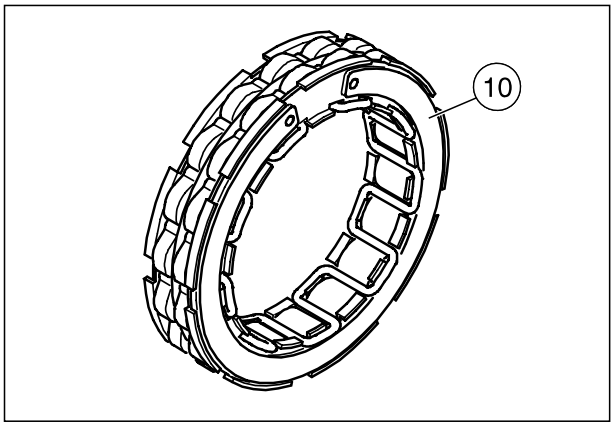
NOTE If the cone or slot for the key are damaged, the magnetic hub must be replaced.

- ◆ Make sure the cone (8) and the slot (9) for the key are in a perfect state of repair.



◆ Remove the freewheel (10) from the relevant housing (11) and check the rollers of the freewheel (10) for signs of wear.
◆ Check whether the external helical spring is preloaded enough to keep the rollers in place.
◆ Check the sliding surface of the freewheel inside the relevant housing (11) for signs of wear.

NOTE Should the sliding surface feature signs of distortion or deep grooves, the freewheel housing must be replaced.



FREEWHEEL HOUSING - DISASSEMBLY

◆ Unscrew and remove the three M8x16 T.C.E.I. screws (12) and detach the freewheel housing (11) from the magnetic wheel (13).

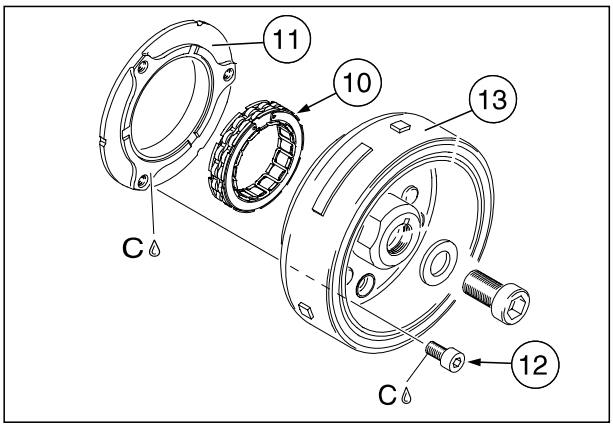
FREEWHEEL HOUSING - ASSEMBLY

⚠ CAUTION

Use LOCTITE® 648 on the flat surface of the housing (11).

◆ Apply a coat of LOCTITE® 648 on the flat surface of the freewheel housing (11) and place it in the centre of the magnetic wheel (13).
◆ Apply a coat of LOCTITE® 648 on the three M8x16 cheese-headed screws (12) and screw the freewheel housing onto the magnetic wheel.

Driving torque of screws (12): 30 Nm (3.0 kgm).



C = LOCTITE® 648.

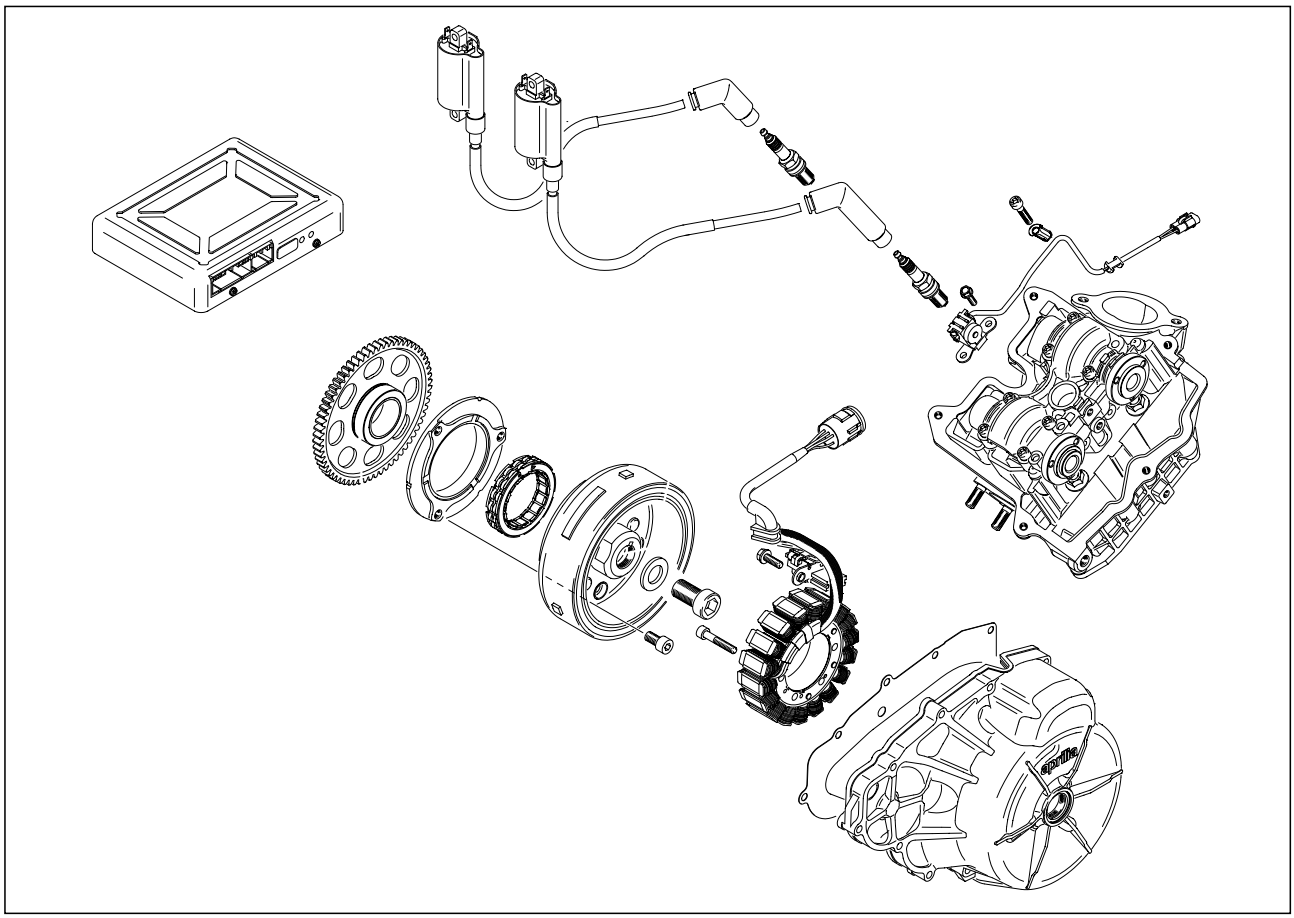
3.6.33 IGNITION GENERATOR

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The ignition generator produces alternating current which is then transformed into direct current by the regulator/rectifier, which then charges the battery.

⚠ WARNING

Before performing any repair work on the ignition generator, take out the ignition key and disconnect the battery, disconnecting the negative pole (–) first. Take care around the high voltage in the ignition generator.

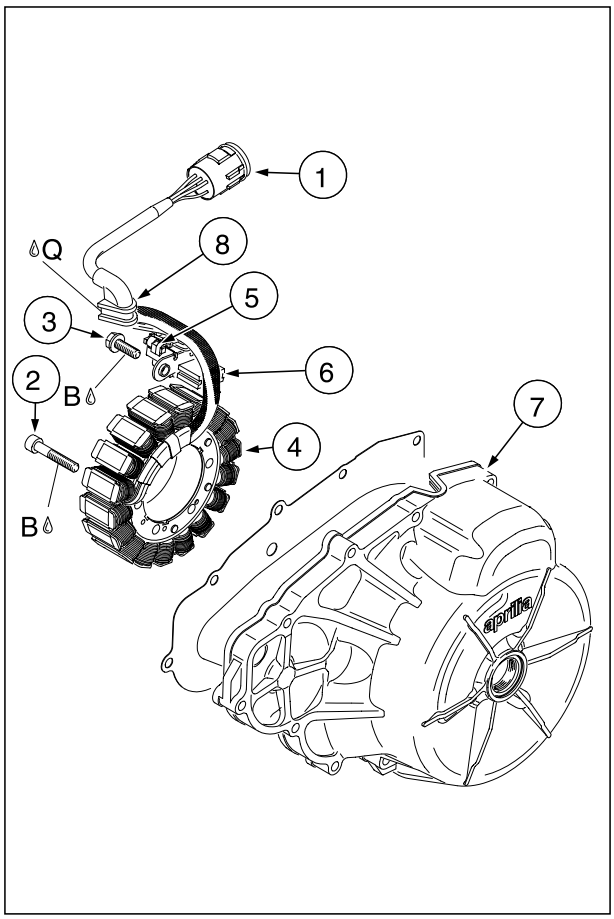


STATOR

- Disconnect the ignition generator connector (1) from the electric wiring.
- Use an ammeter to measure the resistance between the three output connections to be found on the connector (yellow cables).

– **Standard resistance value in the range 0.2 - 0.5 Ω at 20 °C (68 °F).**

NOTE If the resistance value does not fall within this range, the stator must be replaced.



Disassembling the stator

- Unscrew and remove the stators three M6 T.C.E.I. screws (2) and the two M6 screws (3) of the driving shaft position sensor.
- Remove the stator (4) with the driving shaft position sensor (5) from the flywheel cover (7), along with the cable bracket (6).
- Check the flywheel cover (7) is flat and make sure it features no signs of damage on the gasket surfaces.

Assembling the stator

- Insert the stator in the flywheel cover and fasten it with the three M6 T.C.E.I. screws (2), coating the screws with LOCTITE® 243.

Driving torque: 11 Nm (1.1 kgm).

- Coat the cable rubber (8) with SILASTIC 732 RTV and place it in the ignition cover.
- Coat the two screws (3) with LOCTITE® 243.
- Fit the driving shaft position sensor (5) in place and fasten it with the two M6 screws (3).

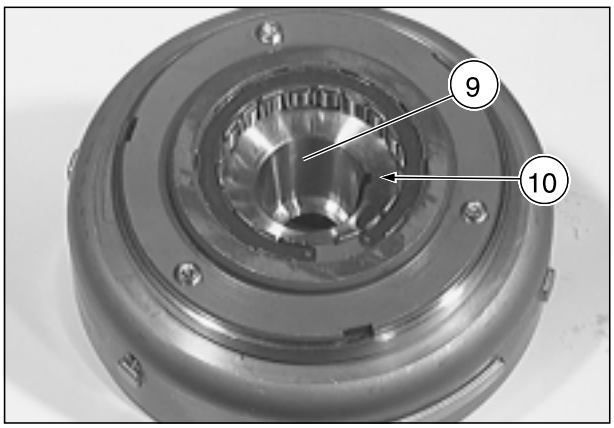
Driving torque of screws (3): 11 Nm (1.1 kgm).

Magnetic wheel:

- Clean the magnetic hub cone (9) of any LOCTITE® residues.
- Make sure the cone (9) and the slot (10) for the key are in a perfect state of repair.

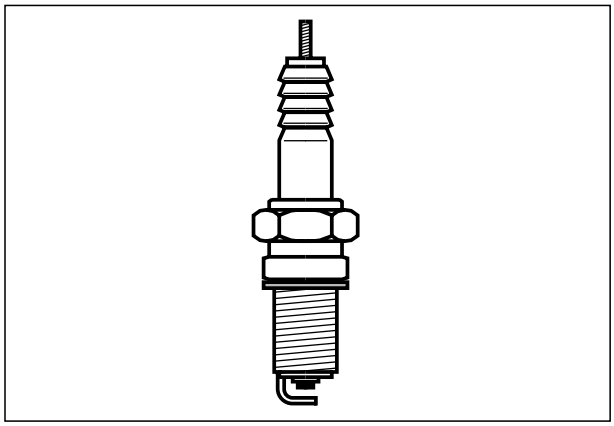
NOTE If the cone or the slot for the key are damaged, the magnetic hub must be replaced.

Q = SILASTIC 732 RTV.
B = LOCTITE® 243.



3.6.34 SPARK PLUGS

See 2.7 (Spark plugs).

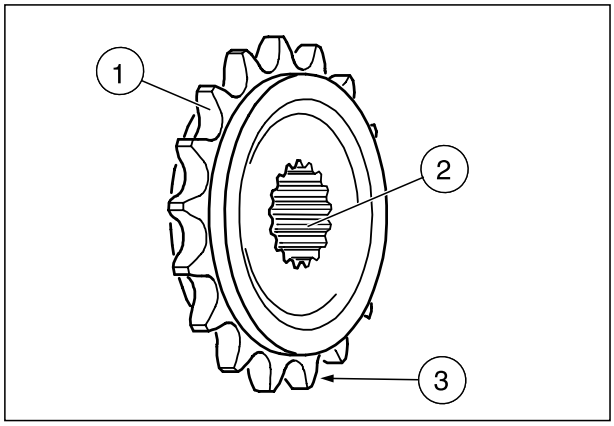


3.6.35 DRIVING CHAIN PINION

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Remove the drive pinion (1), see 7.9.1 (REMOVING THE REAR FORK).
- Check the pinions internal toothing (2) for wear.
- Check the pinions external toothing (3) for wear and signs of distortion.

NOTE If the toothing of the driving chain is worn, the chain pinion must be replaced together with the driving chain.



3.6.36 STARTER MOTOR

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Remove the starter motor, see 3.5.2 (REMOVING THE STARTER MOTOR).

NOTE The starter motor is not normally subject to any particular wear and tear.
In the event the carbon brushes are worn, they can be replaced using the available repair kit; if not, replace the complete starter motor.

- Check the starter motors toothing (4) for broken materials, wear and distortion.

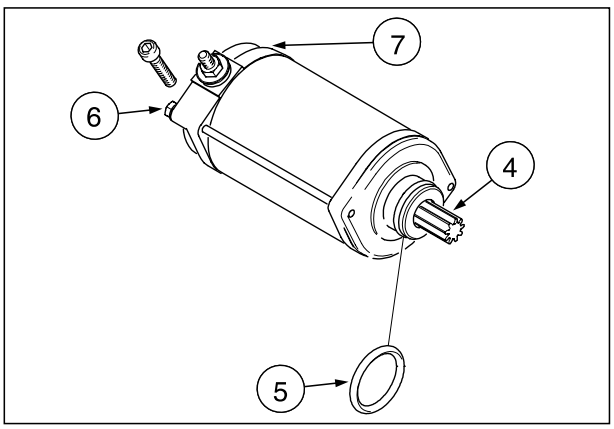
NOTE Where necessary, replace the starter motor.

- Check the starter motor mount O-ring (5) for wear and any signs of damage, and replace it.
- Unscrew and remove the two M6 T.E. screws (6) and remove the complete rear cover (7).
- The four carbon brushes must be allowed to move freely.
- Check the preloading of the brush springs.
- Check the length of the carbon brushes.

Wear limit min. 8.0 mm.

NOTE Kits are available containing rear covers complete with carbon brushes and seals.

- Fasten the complete rear cover with the two M6 T.E. screws (6).



3.7 REASSEMBLING THE ENGINE

Carefully read 3.5.1 (ENGINE DISASSEMBLY SEQUENCE).

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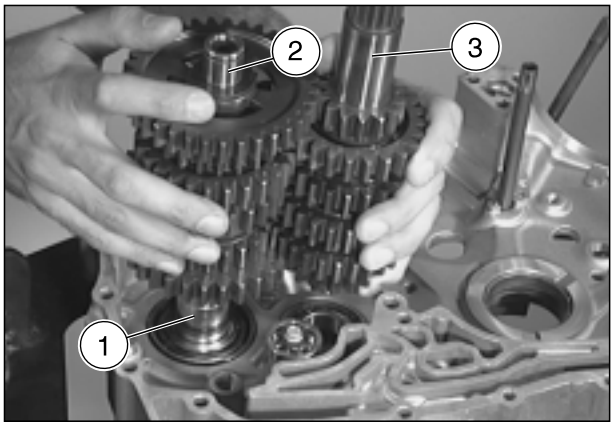
⚠ WARNING

Touching the engine while hot may cause burns.

⚠ CAUTION

When repairing the engine, always replace all the previously disassembled gaskets, seeger rings, O-rings and seals.

Unless otherwise indicated, lubricate all the moving and sliding parts.



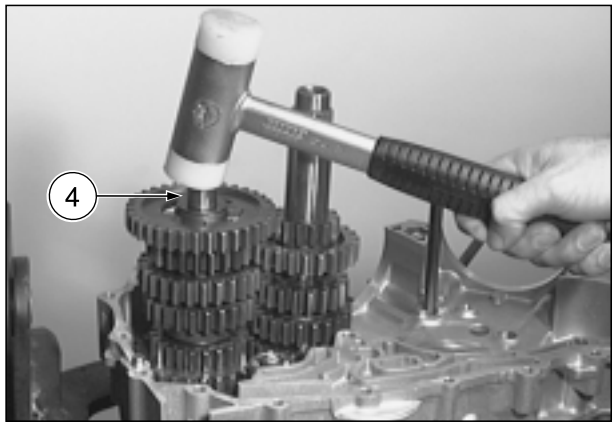
3.7.1 ASSEMBLING THE GEARSHIFT

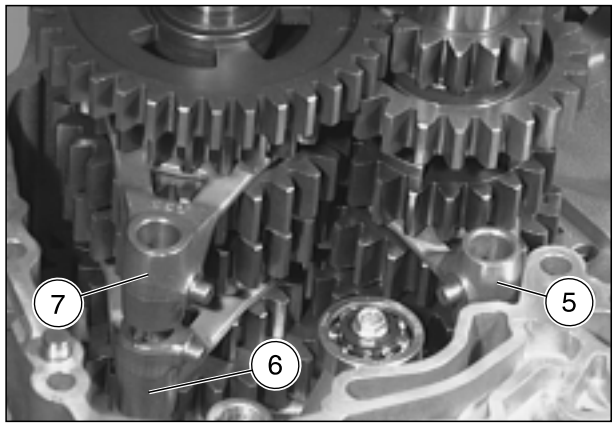
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

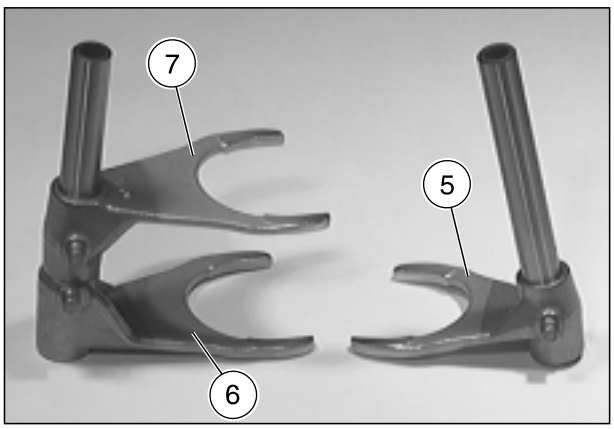
NOTE Assemble the gears on the driving shafts, see 3.6.15 (GEARSHIFT - ASSEMBLY).

NOTE Have the appropriate special tool OPT (1) to hand (cod. 0277308 gearshift secondary shaft guide bush).

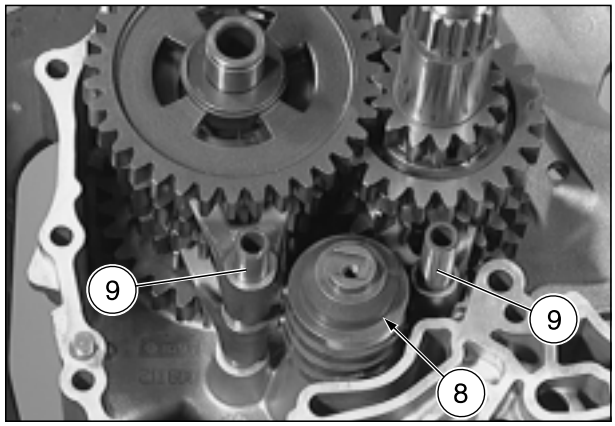
- Insert the guide bush (1) on top of the gear of the secondary shaft (2).
- Grease the secondary shaft seal between the two lips.
- Apply a coat of LOCTITE® Anti Seize on the housings of the secondary shaft (2) and primary shaft (3).
- Insert the primary shaft (3) in the housing in the flywheel side half of the engine casing.
- Insert the secondary shaft (2) in the housing in the flywheel side half of the engine casing.
- Insert the complete gearshift assembly in its housing, tapping the two shafts lightly all the way in with a plastic hammer.
- Insert the washer (4) on the secondary shaft (2).
- Oil the fork of 5th and 6th gear (5) and insert it in the selector gear of the primary shaft (3).
- Oil the fork of 2nd and 4th gear (6) and the fork of 1st and 3rd gear (7) and insert them in the respective selector gears of the secondary shaft (2).







◆ Oil the shift cam (8) and insert it in the relevant slot in the casing.
◆ Attach the 3 gearshift forks inside the respective guides of the shift cam (8).
◆ Insert the two gearshift rods (9), pushing them all the way into the respective slots in the flywheel side half of the engine casing.

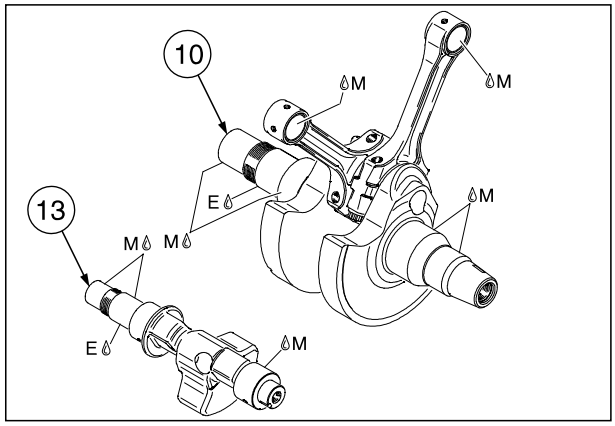


3.7.2 ASSEMBLING THE DRIVING SHAFT AND COUNTERSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Apply a coat of MOLYKOTE® G-N on the housings of the bushes for the driving shaft and countershaft.
◆ Insert the driving shaft (10) in the housing in the flywheel side half of the engine casing.

NOTE Position the lower connecting rod (11) towards cylinder “2” (rear) and the upper connecting rod (12) towards cylinder “1” (front).



⚠ CAUTION

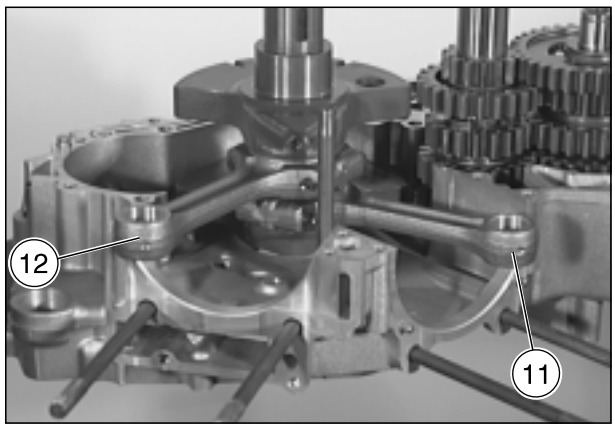
Do not tilt the driving shaft during insertion so as to avoid damaging the main bushes inside the housing.

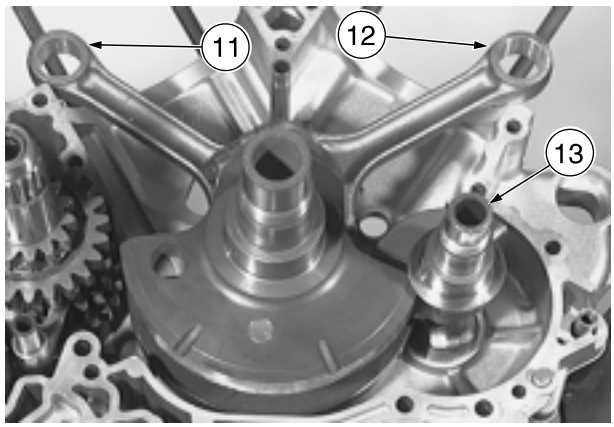
◆ Insert the countershaft (13) in the relevant housing.

⚠ CAUTION

Do not tilt the countershaft during insertion so as to avoid damaging the bearing bushes inside the housing.

M = MOLYKOTE® G-N.
E = LOCTITE® Anti Seize.





3.7.3 ASSEMBLING THE ENGINE CASING

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Use a new gasket.

◆ Apply the engine casing gasket (1) on the flywheel side half of the engine casing.

NOTE The engine casing gasket must coincide with all the engine casing holes over the whole area.
Grease may be applied on the gasket to prevent the movement.
Work with extreme care to assure a perfect seal.

◆ Make sure the washer (2) is on the driving shaft.
◆ Coat the housings of the secondary shaft (3) and primary shaft (4) with LOCTITE® Anti Seize.
◆ Coat the housings of the driving shaft (5) and countershaft (6) with MOLYKOTE® G-N.
◆ Make sure the oil-spray pipe (7) is fitted.
◆ Make sure the oil gauze is inserted in the clutch side half of the engine casing.
◆ Install the clutch side half of the engine casing (8) on the flywheel side half.

NOTE Where necessary, use a plastic hammer to tap on the casing rib, near of the shaft.
Take care not to damage the gasket surface of the clutch cover (9).

◆ Rotate the engine casing towards the clutch side.

⚠ CAUTION

Screw on the screws in a crisscross pattern, tightening them gradually.

◆ Screw the twenty M6 T.C.E.I. screws onto the engine casing, i.e.:
  – thirteen M6x65 screws (10);
  – five M6x45 screws (11);
  – one M6x80 screw (12);
  – one M6x25 screw (13).

Driving torque of screws (10-11-12-13):
11 Nm (1.1 kgm)

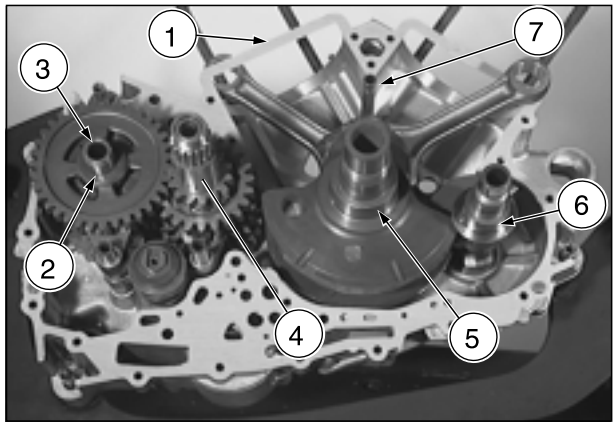
NOTE Having tightened the engine casing screws, make sure the driving shaft, countershaft, primary shaft and secondary shaft can turn slightly.

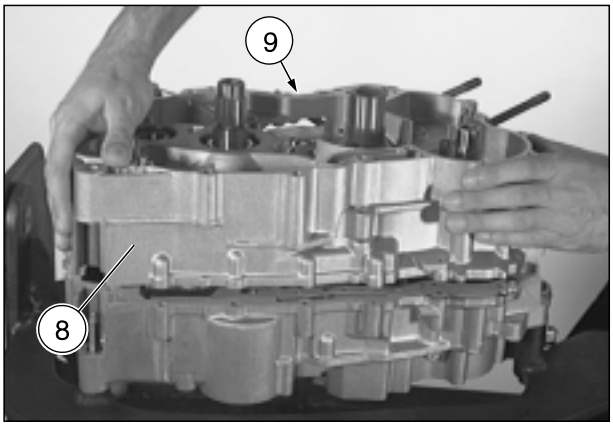
◆ Check the end play of the driving shaft with a comparator.

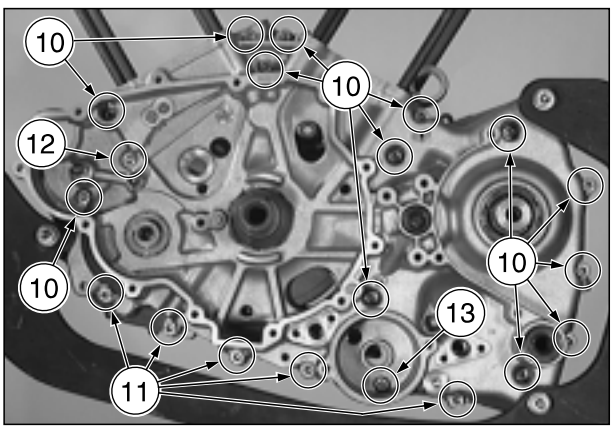
Wear limit: max. 0.5 mm.

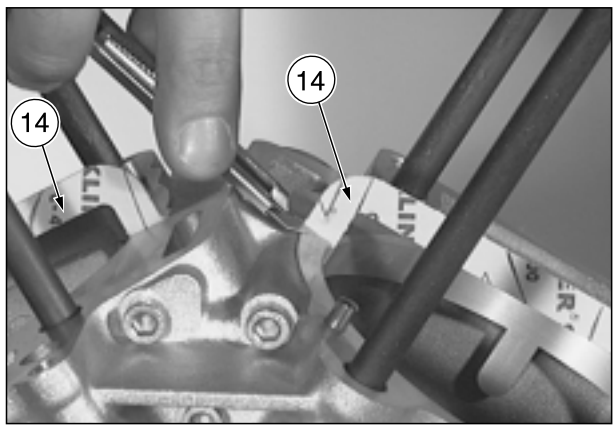
NOTE Cover the engine compartment with a clean cloth.

◆ Use a paper cutter to cut the parts of the gasket sticking out from the engine casing (14) around the cylinder flange and where the cylinder is centred.









◆ Screw on the magnetic plug (15).

Driving torque of magnetic plug (15): 20 Nm (2.0 kgm).

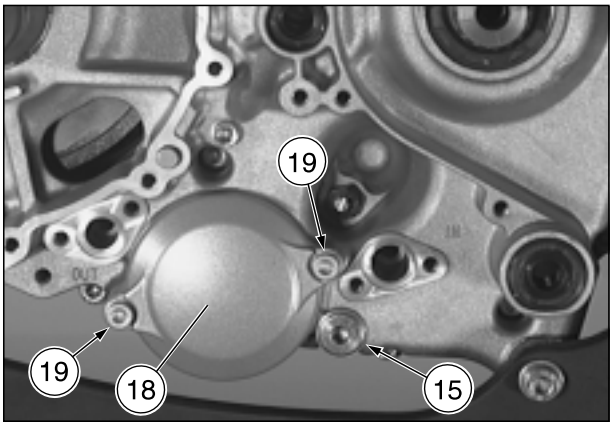
◆ Insert a new oil filter cartridge (16) in the housing in the casing.

⚠ CAUTION

Having changed the oil and oil filter, the engine must be started for approx. 15-20 seconds with the injectors disconnected to enable the oil pipes to fill.

◆ Insert the O-ring (17) in the slot on the oil filter cover (18) and fasten the oil filter cover with the two T.C.E.I. M6 screws (19).

Driving torque of screws (19): 11 Nm (1.1 kgm).



3.7.4 ASSEMBLING THE GEAR SELECTION MECHANISM

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE Lock the M6 T.C.E.I. screw (24) in place with a LOCTITE® 243 product.

◆ Fit the index spring (20), shim (21), index lever (22) and washer (23) and secure them with the M6 T.C.E.I. screw (24).

Driving torque of screw (24): 11 Nm (1.1 kgm).

NOTE Lock the M6 T.C.E.I. screw (27) in place with a LOCTITE® 243 product.

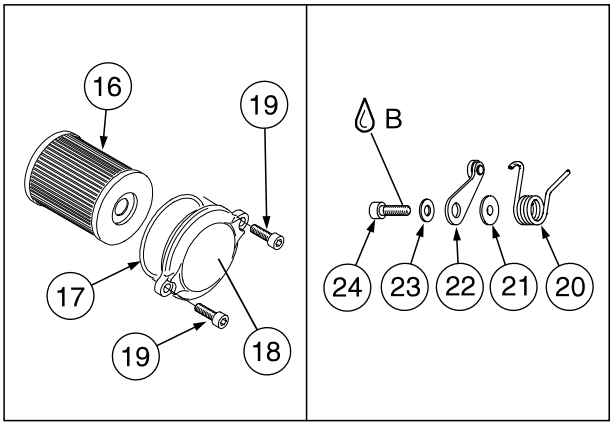
◆ Press the index lever (22) down and insert the index plate (25) in the shift cam slot (26), fastening it with the M6 T.C.E.I. screw (27).

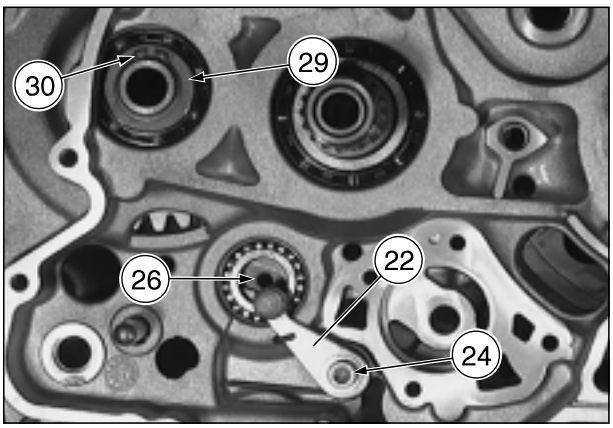
Driving torque of screw (27): 11 Nm (1.1 kgm).

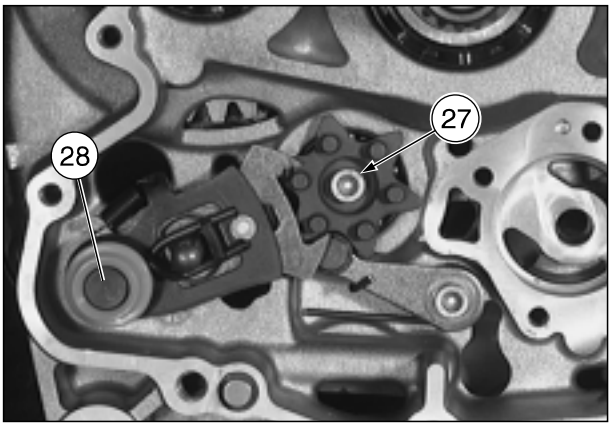
◆ Oil the complete gearshift shaft (28) and insert it in the relevant housing.
◆ Insert the thrust washer (29) and insert the seeger ring (30) in the groove of the secondary shaft.

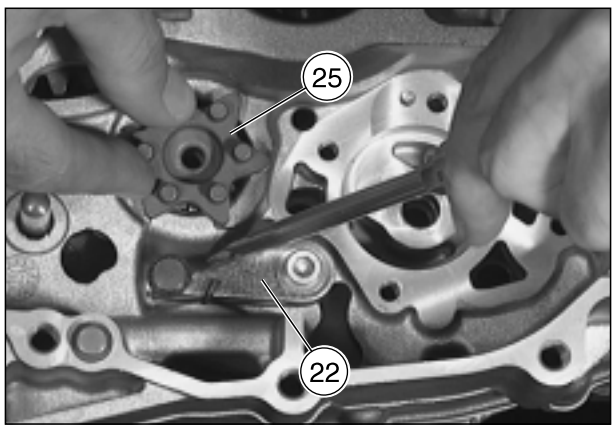
NOTE Always replace the seeger ring. Make sure the ends are not pulled apart more than necessary (use a pair of pliers for seegar ring).

B = LOCTITE® 243.









3.7.5 CHECKING THE GEAR SELECTION MECHANISM

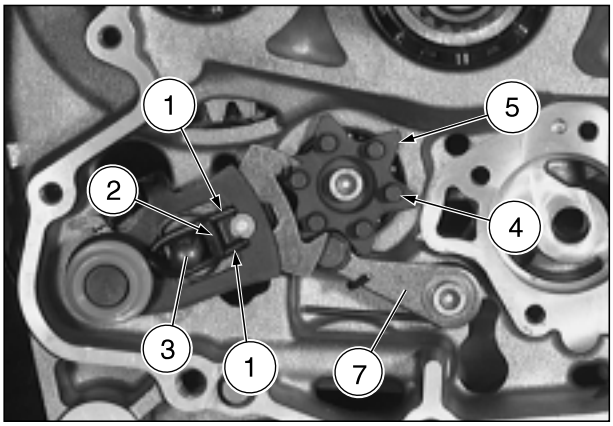
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

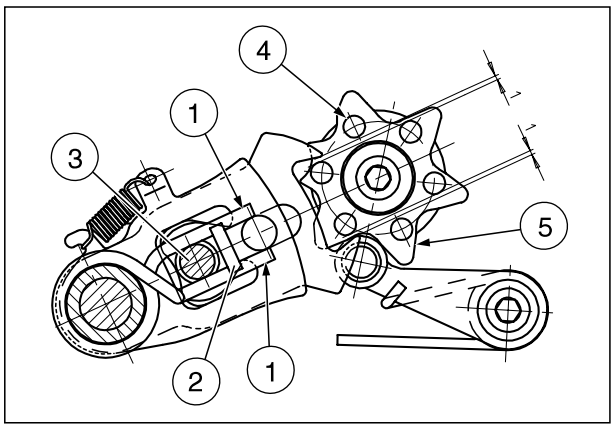
◆ Make sure the needle spring (1) in the rotating lever (2) and in the cylindrical pin (3) features no slack.

NOTE If this is not the case, one of the needle springs (1) end must be bent.

◆ Engage all the gears and make sure the drive pins (4) of the index plate (5) are in the central position.

NOTE If this is not the case, one of the needle springs (1) end must be bent.

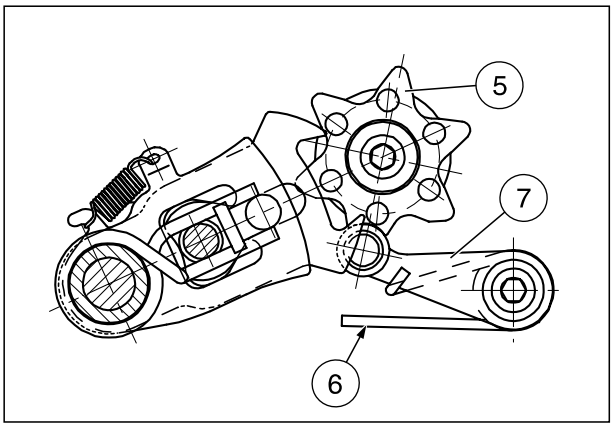




◆ Check the preloading of the positioning spring (6). It must be quite hard to lift the positioning lever (7) of the shift cam index plate (5).

NOTE Rotating the shift cam must cause the positioning spring (6) to push the positioning lever (7) into the relevant slot on the index plate (5).

◆ Put the gearshift into neutral and make sure all the gearshift gears turn freely.



3.7.6 ASSEMBLING THE OIL PUMP

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Make sure the LOCTITE® product does not get inside the suction pump hole.

- Apply a thin film of LOCTITE® 574 on the gasket surface (1) of the oil pump casing.
- Insert the duly oiled external rotor (2) in the slot in the casing.

NOTE The reference point must face down (towards the engine casing).

- Insert the pin (3) in the last hole at the bottom of the oil pump shaft (4).
- Insert the internal rotor (5) in the oil pump shaft (4), with the housing slot facing up.
- Insert the oil pump shaft (4) in the casing, complete with internal rotor.

⚠ CAUTION

Make sure the LOCTITE® product does not get inside the pressure pump hole.

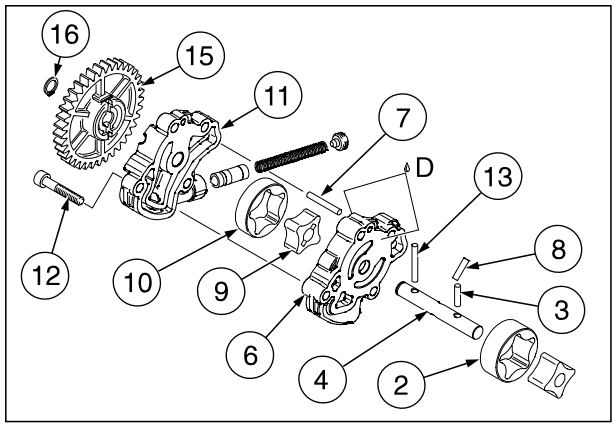
- Apply a thin film of LOCTITE® 574 on the external gasket surface of the oil pump casing (6) and install it on the oil pump shaft (4).
- Fasten the oil pump casing (6), complete with pin (7), inside the casing.
- Insert the pin (8) in the central hole of the oil pump shaft.
- Insert the duly oiled internal rotor (9) of the pressure pump on the oil pump shaft, with the driving groove facing down.
- Insert the duly oiled external rotor (10) in the oil pump casing.
- Fasten the oil pump cover (11) with the four T.C.E.I. screws (12).

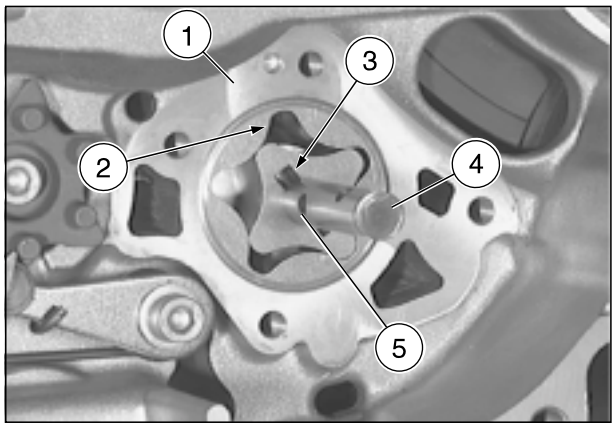
Driving torque of screws (12): 11 Nm (1.1 kgm).

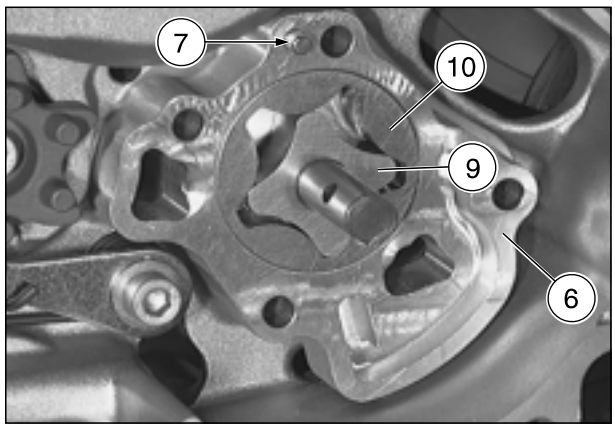
- Insert the pin (13) in the hole of the oil pump shaft.

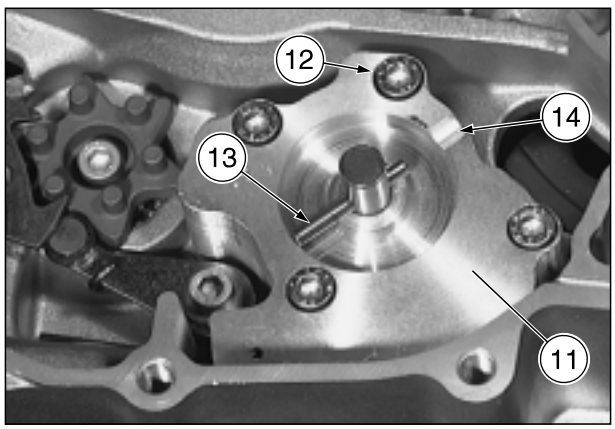
NOTE The oil pump cover features a groove (14) enabling the pin to be fitted.
Line the pin up with the centre of the oil pump shaft.

D = LOCTITE® 574.









⚠ CAUTION

Once disassembled, the oil pump gear must always be replaced.

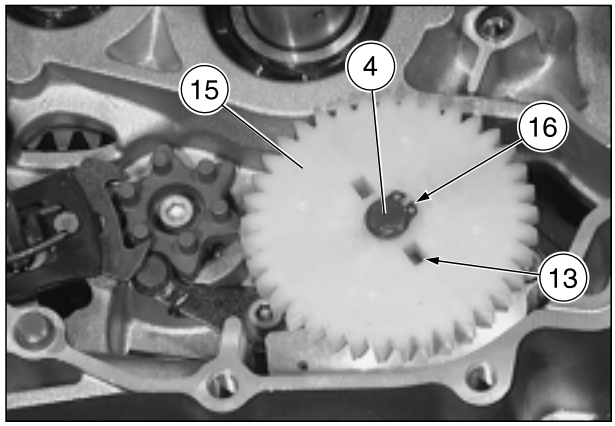
◆ Fit a new oil pump gear (15).

NOTE You must feel the pin (13) engaging perfectly inside the groove on the oil pump gear.

◆ Fit the seeger ring (16) in the groove of the oil pump shaft.

NOTE Make sure the seeger ring is inserted all the way into the groove.
Make sure the ends are not pulled apart any more than necessary.

◆ Check the rotation and end play of the oil pump shaft (4).



3.7.7 ASSEMBLING THE DRIVE ASSEMBLY "2" (REAR)

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Turn the driving shaft so that the connecting rod of cylinder "**2**" (rear) is at TDC.

NOTE Have the appropriate special tool OPT (17) to hand (cod. 0240880 threaded bolt for retaining the driving shaft at TDC).

◆ Lock the driving shaft in place with the threaded bolt (17).

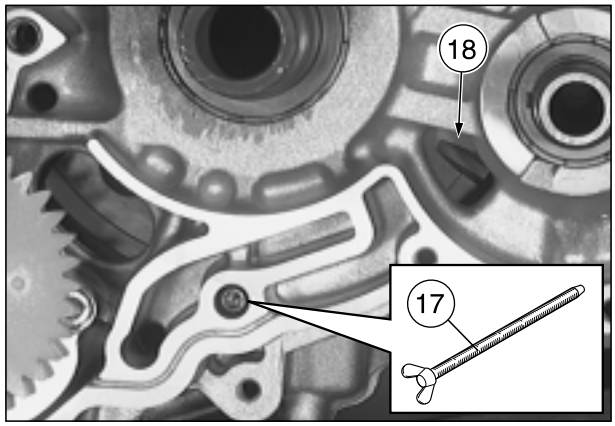
NOTE When cylinder "2" is at TDC, the fastening slot (18) of cylinder "1" is visible through the gap under the countershaft.
The threaded bolt (17) must never be overtightened; **max. 5 Nm (0.5 kgm).**

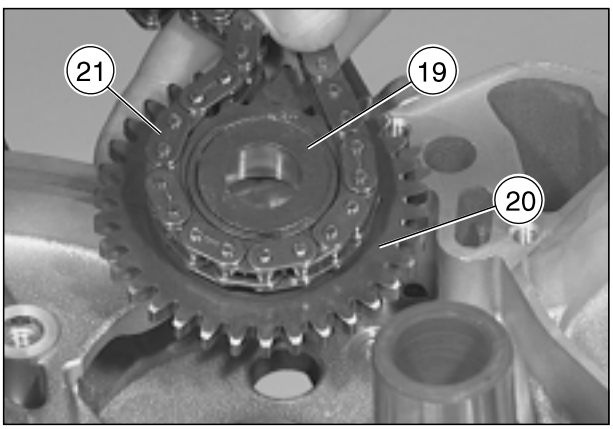
◆ Use grease to assure adherence between the thrust washer (19) and the intermediate drive gear (20).

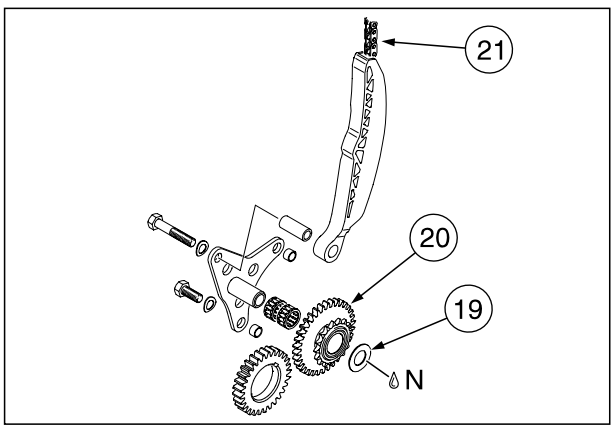
NOTE Hook up the timing chain (21) based on the reference marking applied during its disassembly.

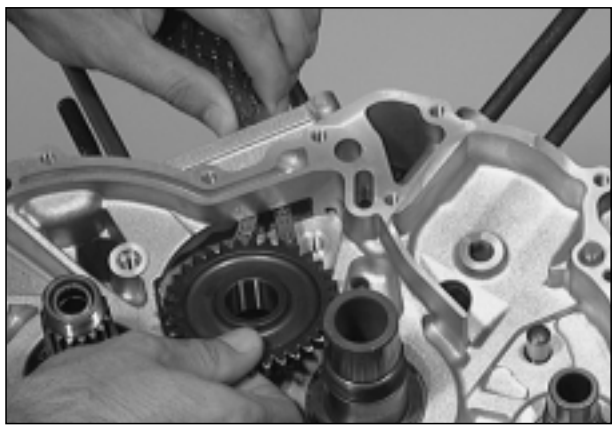
◆ Place the timing chain (21) around the intermediate drive gear (20), guiding both through the chain compartment and inserting them in the housing.

N = Lubricating grease.









◆ Guide the chain tightener shoe (22) through the chain compartment and fasten it in the housing by means of the spacer bush (23).
◆ Oil the two roller bearings (24) and push them onto the bearing pins of the bearing flange (25).

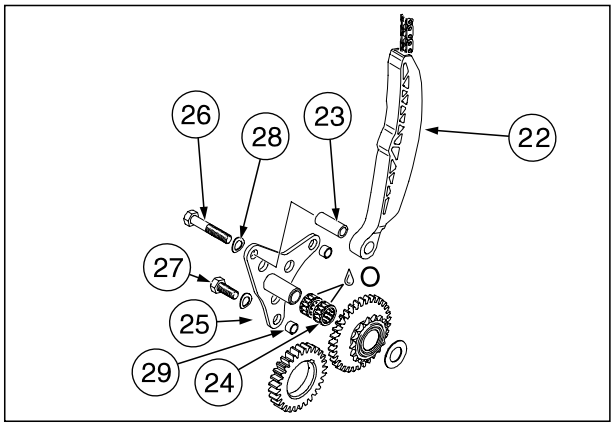
NOTE Insert the bearing flange all the way in, tapping gently with a plastic hammer.
The two calibrated bushes (29) must previously have been fastened in the casing.

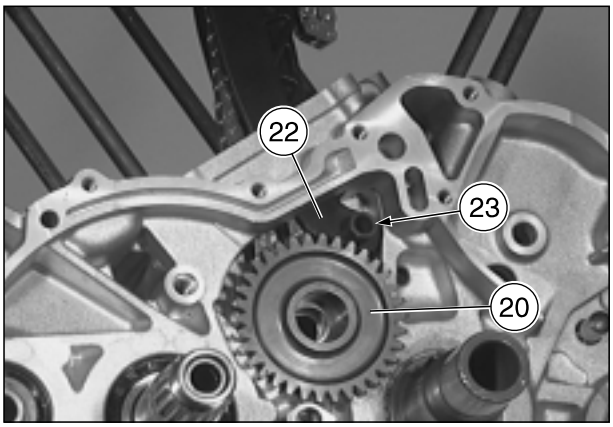
◆ Insert the bearing flange (25) and fasten it using the three M8 T.C.E.I. screws (26-27) and the spring washers (28), i.e.:
  – two M8x45 screws (26);
  – one M8x20 screw (27).

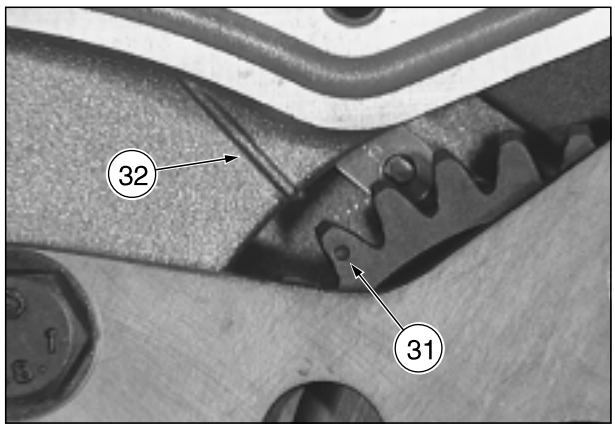
Driving torque of screws (26-27): 25 Nm (2.5 kgm).

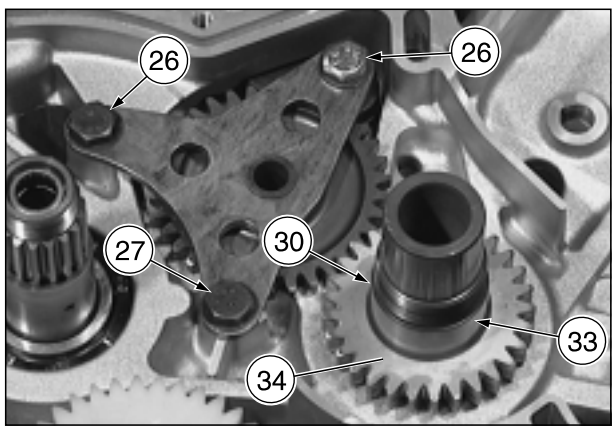
O = Motor oil.

◆ Check the rotation of the intermediate drive gear.
◆ Insert the key (30) in the driving shaft.
◆ The reference mark (31) on the intermediate drive gear must coincide with the reference mark (32) on the casing.
◆ Apply a coat of LOCTITE® Anti Seize on the end of the driving shaft (33).
◆ Push the drive gear (34) onto the driving shaft.







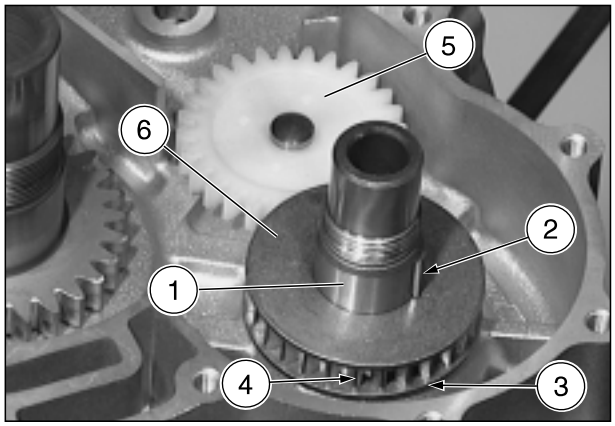


3.7.8 ASSEMBLING THE COOLANT PUMP DRIVE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Coat the end of the countershaft (1) with LOCTITE® Anti Seize.
- ◆ Oil the housing at the end of the countershaft.
- ◆ Insert the key (2) in the countershaft.
- ◆ Insert the washer (3) with the flared side facing down.
- ◆ Install the coolant pump gear (4) on the countershaft.
- ◆ Insert the coolant pump idler gear (5) on the cylindrical pin.
- ◆ Insert the washer (6) to the countershaft.
- ◆ Install the driving gear (7) on the driving shaft.

NOTE The reference point must be visible.



- ◆ Insert the gear (8) on the countershaft.

NOTE The reference point must be visible and must coincide with the reference mark on the driving gear.

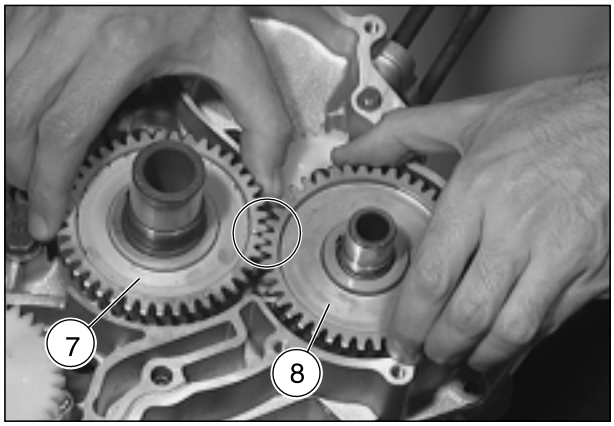
- ◆ Lift the countershaft all the way in the axial direction and insert the counterweight (9) onto the countershaft.

NOTE The counterweight notch (10) must be engaged by the end of the key (2).

- ◆ Insert the spring washer (11) and tighten the M22x1.5 T.E. screw (12).

Driving torque of screw (12): 150 Nm (15.0 kgm).

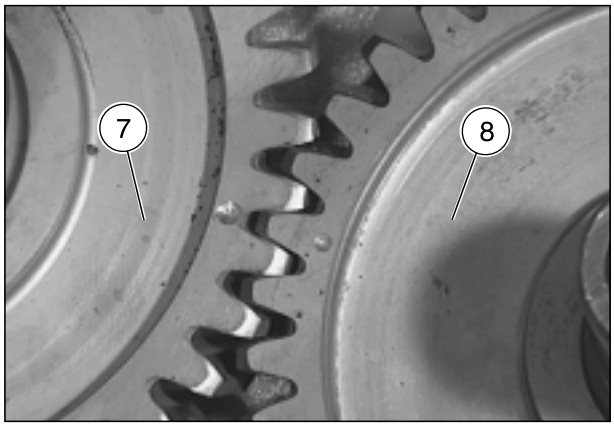
NOTE Make sure the position of the hole for the counterweight (9) is more or less at 10 oclock.

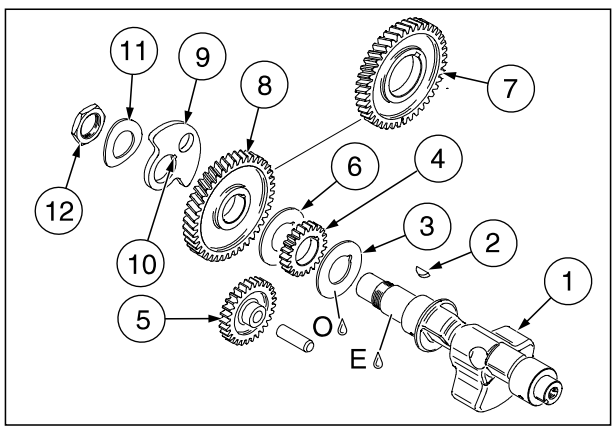


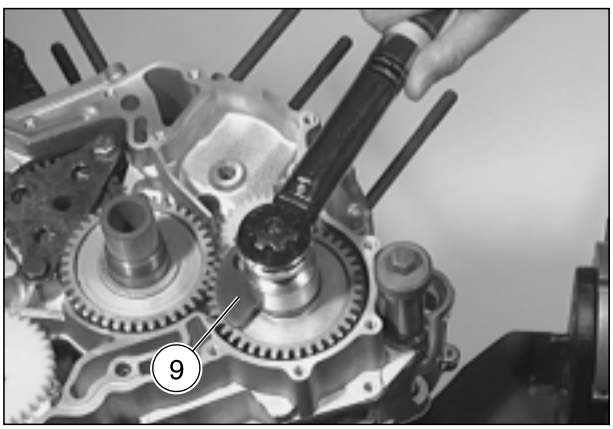
- ◆ Check the end play of the countershaft with a comparator.

Wear limit: max. 0.3 mm.

O = Motor oil.
E = LOCTITE® Anti Seize.







3.7.9 ASSEMBLING THE PRIMARY TRANSMISSION AND CLUTCH

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

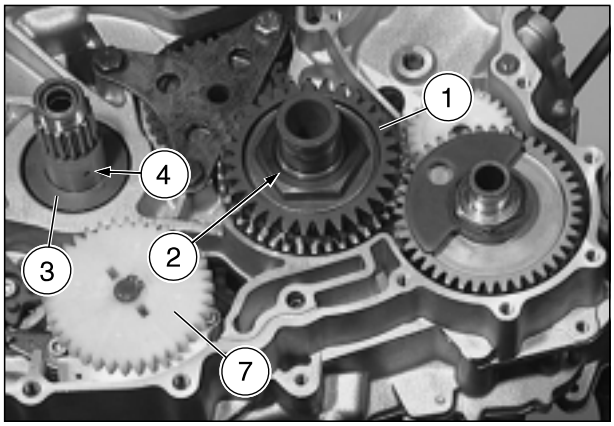
◆ Coat the end of the driving shaft with LOCTITE® Anti Seize.

NOTE The collar of the drive gear must face down.

◆ Insert the drive gear (1) on the driving shaft.
◆ Fit the spring washer, then fasten and tighten the M33x1.5 T.E. nut (2), coating it with LOCTITE® 243.

Driving torque of nut (2): 230 Nm (23.0 kgm).

◆ Insert the washer (3) on the primary shaft.
◆ Coat the housing and toothing of the primary shaft (4) with LOCTITE® Anti Seize.



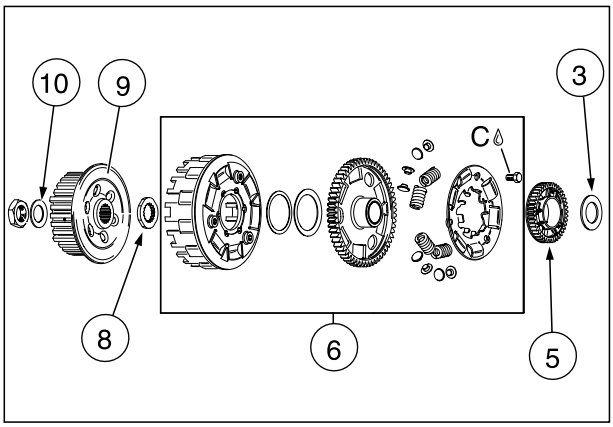
⚠ CAUTION

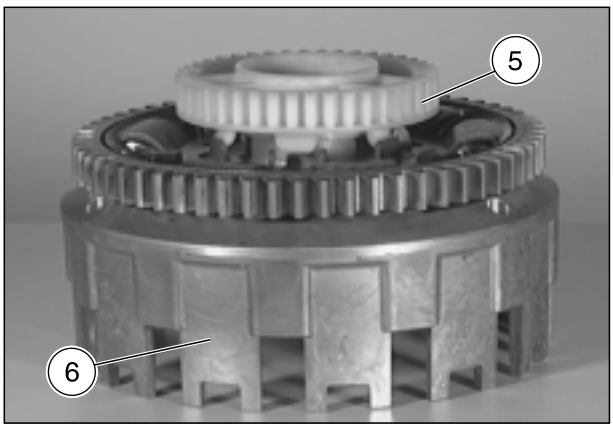
Once disassembled, always replace the oil pump gear.

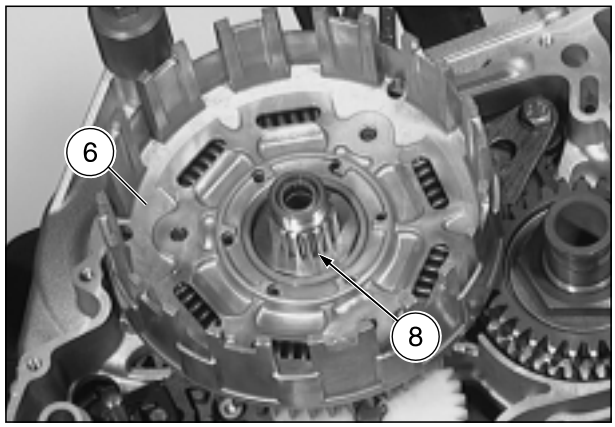
◆ Place a new oil pump gear (5) on the preassembled clutch drum (6) and engage it.
◆ Insert the preassembled clutch drum (6) on the primary shaft (4).

NOTE Turn the oil pump gear (7) so that the toothing mates with the toothing of the pinion (5).

◆ Fit the serrated thrust ring (8), the clutch hub (9) and the spring washer (10) on the primary shaft.

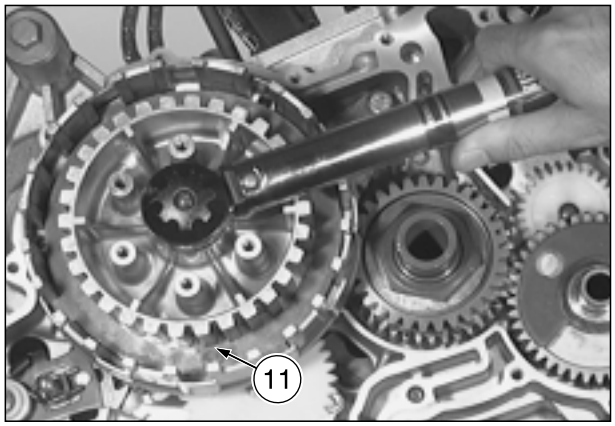






NOTE Have the appropriate special tool OPT to hand (cod. 0277281 clutch blocking tool).

◆ Insert the clutch blocking tool (11).



⚠ CAUTION

Insert the clutch blocking tool (11) all the way in to the clutch basket so as not to damage the basket when the nut (12) is tightened.

◆ Screw on and tighten the T.E. nut (12), coating it with LOCTITE® 648.

Driving torque of nut (12): 170 Nm (17.0 kgm).

◆ Insert the clutch discs, starting with a steel one (13).
◆ Insert a steel disc (13) followed by a lined disc (14), and continuing alternately.

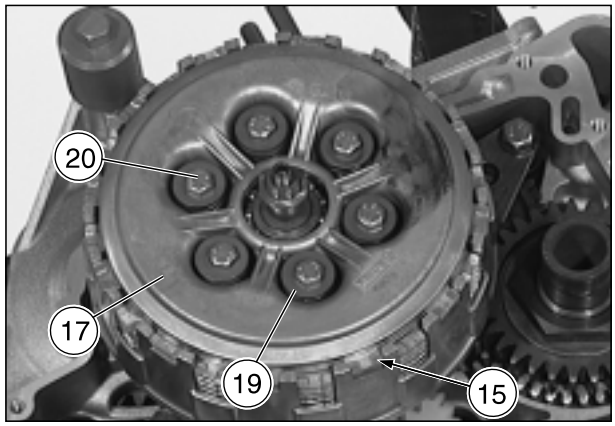
NOTE The first lined disc at the top (15) must be inserted in the staggered groove.

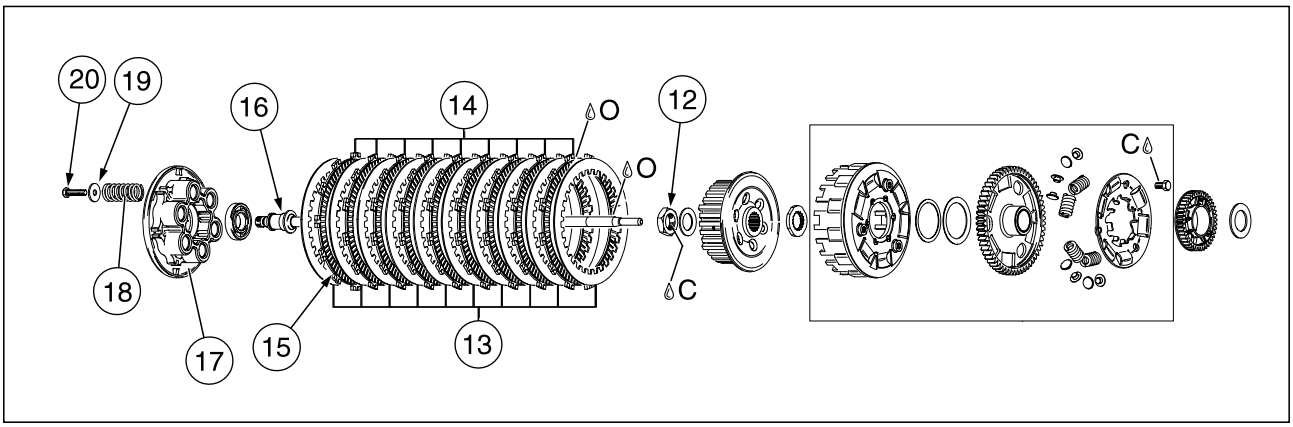
The top lined disc (15) is recognizable as it has a dot punched onto it.
Make sure this disc does not feature any slack, though it must not be locked in place.

◆ Oil the friction disengaging shaft (16) and insert it in the primary shaft hole.
◆ Insert the spring plate (17).
◆ Insert the six clutch springs (18) in the spring plate and fasten them with the six washers (19) and the M6 T.C.E.I. screws (20).

Driving torque of screws (20): 11 Nm (1.1 kgm).

C = LOCTITE® 648.
O = Motor oil.



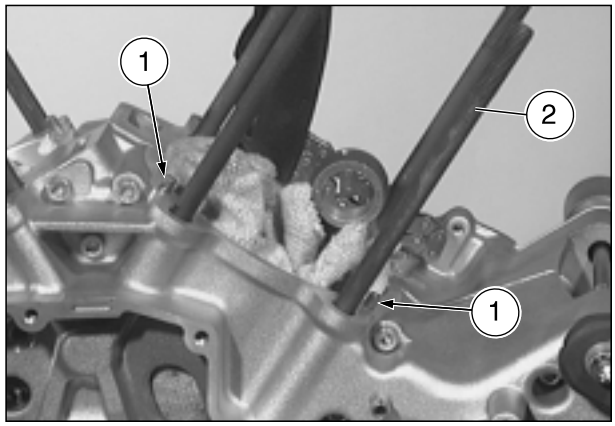


3.7.10 ASSEMBLING THE PISTON AND CYLINDER "2" (REAR)

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Cover the engine compartment with a cloth.
- ◆ Insert the two locating dowels (1).
- ◆ Coat the four M10 stud bolts (2) with LOCTITE® 243 and screw them onto the engine casing.

Driving torque of stud bolts (2): 10 Nm (1.0 Kgm)



- ◆ Coat the connecting rod small end and the hole of the gudgeon pin inside the piston with MOLYKOTE® G-N.
- ◆ Install the piston (3) on the connecting rod and push the gudgeon pin (4) in, using a punch suitable for the job.

⚠ CAUTION

Observe the assembly direction indicated by the previously applied reference mark.

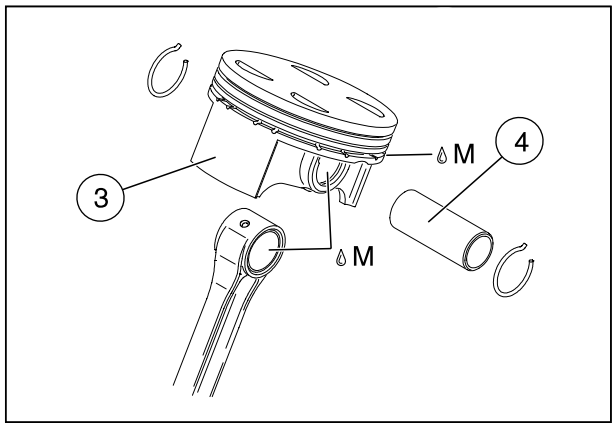
If a new piston is used, the "red" or "green" reference point (5) on the piston crown must face in the direction of the exhaust (6), (only for "2" cylinder).

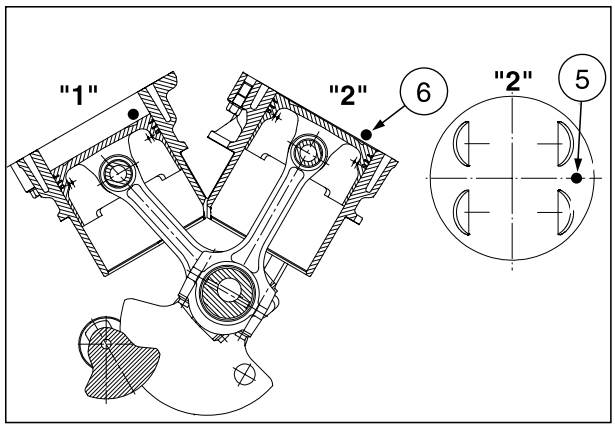
- ◆ Take special care when matching the cylinder - piston:

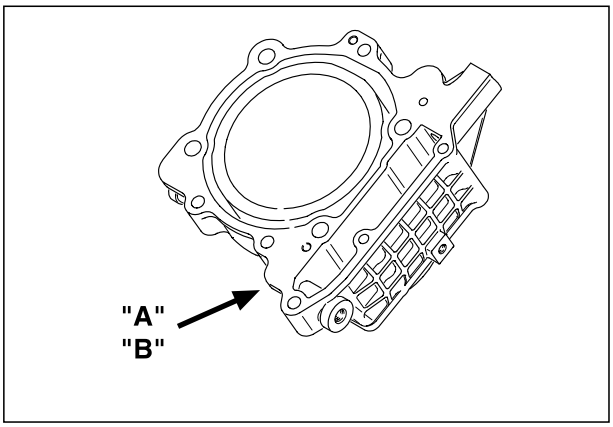
– "Red" piston - cylinder "A";
– "Green" piston - cylinder "B".

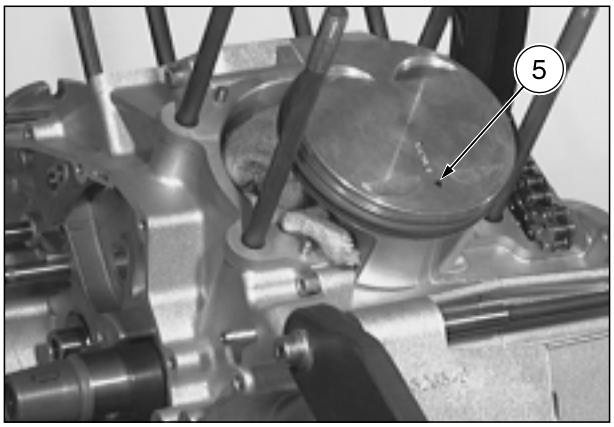
NOTE The cylinders size group "A" or "B" is stamped onto the lower side of the actual cylinder in the timing chain compartment area.

M = MOLYKOTE® G-N.





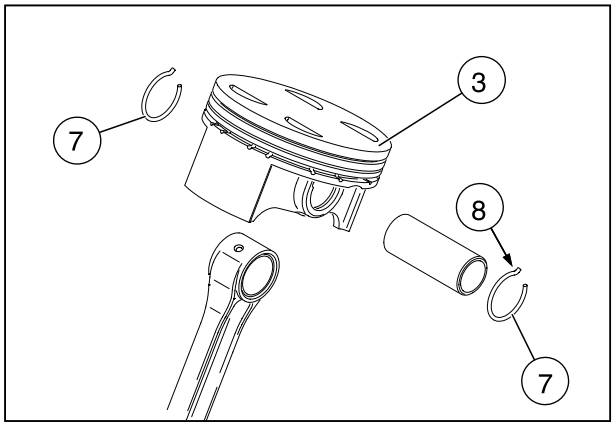




⚠ CAUTION

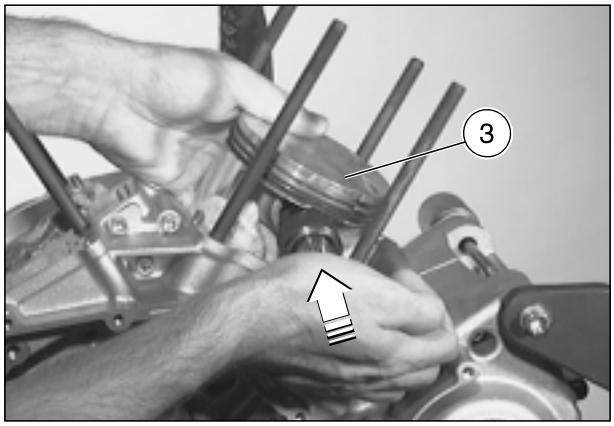
Use new bent-end gudgeon pin seeger rings (7) only.

◆ Insert the gudgeon pin seeger ring (7) in the piston, pushing down hard.

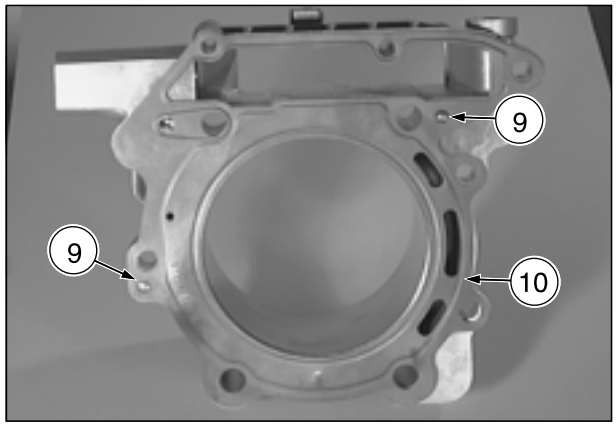


NOTE Support the piston (3).
Make sure the two gudgeon pin seeger rings are inserted perfectly in the groove of the piston and that the hook (8) is inserted in the slot of the actual piston.

◆ Where necessary, fit the second gudgeon pin seeger ring (7), repeating the same procedure as described above.



◆ Insert the two locating dowels (9) in the cylinder.



⚠ CAUTION

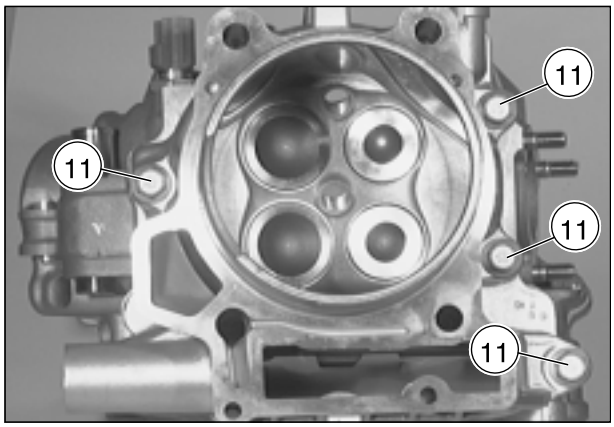
Use a new head gasket.

◆ Fit the head gasket (10) in place.
◆ Place the preassembled head in the cylinder and tighten it on with the four shouldered T.E. screws (11).

– Non-painted cylinder version
Driving torque of screws (11):
28-30 Nm (2.8-3.0 kgm)

– Painted cylinder version
Driving torque of screws (11):
25-28 Nm (2.5-2.8 kgm)

◆ Apply a coat of LOCTITE® 574 on the casing around the gasket surface of the cylinder base gasket in the area of the line separating the two sections of the casing.
◆ Apply the cylinder base gasket on the casing.
◆ Oil the piston and the respective piston rings.
◆ Turn the piston rings so that the meeting ends of the three rings are staggered by approx. 120°.

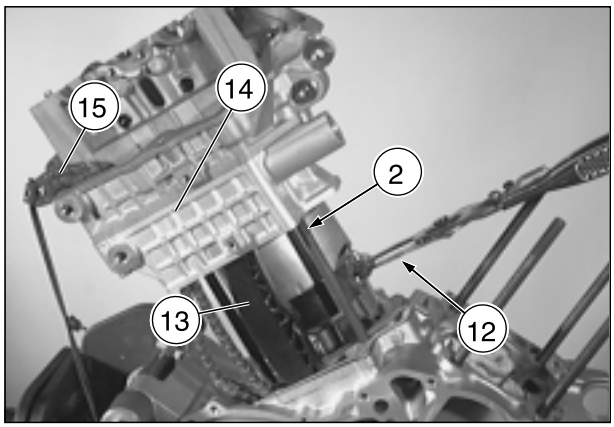


NOTE Have the appropriate special tool OPT (12) to hand (cod. 8140186 - piston ring compression tool).

◆ Lower the ring compressor (12) or piston ring pliers over the piston to preload the piston rings.
◆ Place the chain tightener shoe (13) in the chain compartment of the cylinder (14) and push the cylinder over the piston so that the ring compressor is pushed down.
◆ Remove the ring compressor (12).
◆ Insert the timing chain (15) through the cylinders chain compartment.

NOTE The timing chain can be guided inside using an O-ring or similar device to aid assembly.

◆ Place the cylinder (14) on the engine casing, pushing it in all the way.
◆ Oil the thread of the stud bolts (2) and the contact surfaces.



NOTE Screw on the M10 T.E. nuts (16) and M6 T.C.E.I. screws (17) evenly and gradually, working in a crisscross pattern.

◆ Secure the cylinder together with the head with the four M10 T.E. nuts (16) and two M6 T.C.E.I. screws (17).

Non-painted head version:

– four M10 T.E. nuts (16), driving torque 58 Nm (5.8 kgm);

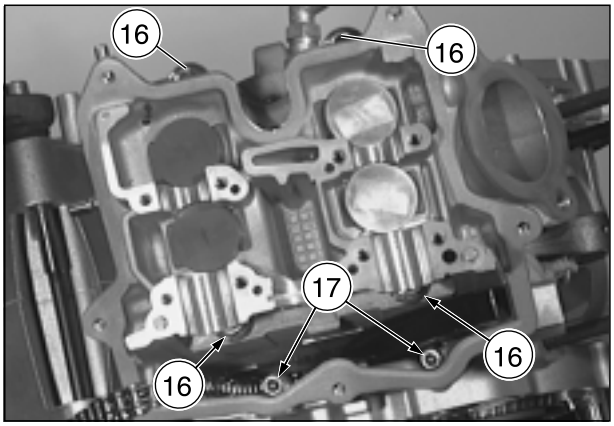
– two M6 T.C.E.I. screws (17), driving torque 12 Nm (1.2 kgm).

Painted head version:

– two M10 T.E. nuts (16), external, driving torque 50-55 Nm (5.0-5.5 kgm);

– two M10 T.E. nuts (16), chain compartment side, driving torque 58 Nm (5.8 kgm);

– two M6 T.C.E.I. screws (17), driving torque 12 Nm (1.2 kgm).



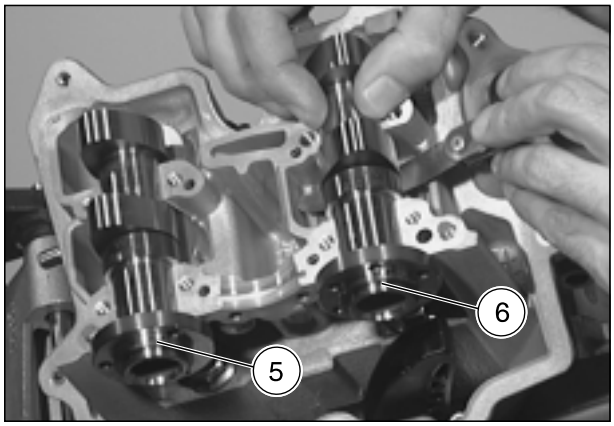
3.7.11 ADJUSTING VALVE CLEARANCE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Check and, where necessary, adjust the valve clearance:
- **at periodic intervals, see 2.1.1 (REGULAR SERVICE INTERVALS CHART);**
- **every time the timing drive assembly is repaired or taken apart.;**
- **every time the head or camshaft is taken apart.**

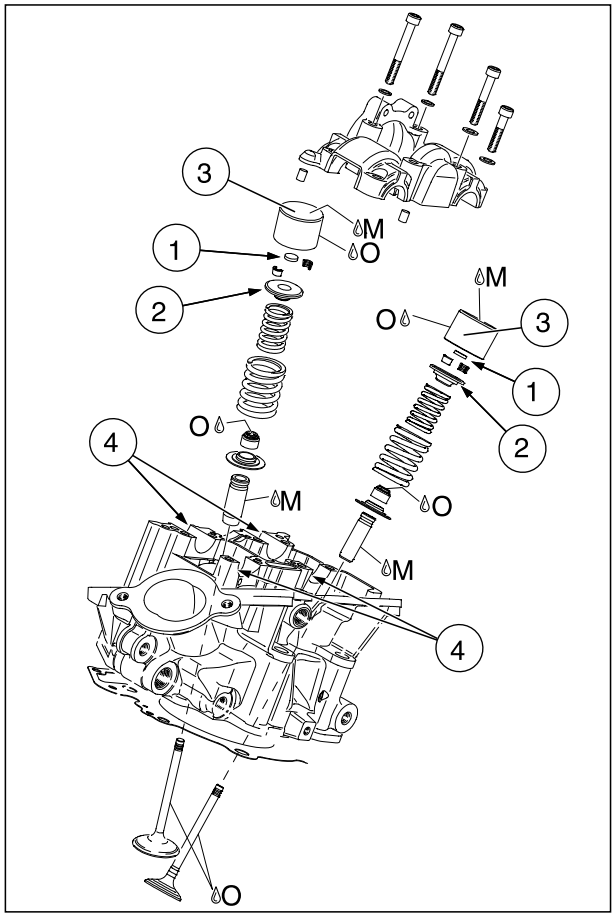
The valve clearance adjustment must be performed with the engine at room temperature.



NOTE The size is stamped on the adjustment shim. Insert the adjustment shims with the writing facing down. Before fitting them, always measure the adjustment shims with a micrometer.

- Insert the adjustment shims (1) in the valve spring housings (2).
- Oil the external diameter of the four valve lifter buckets (3) and insert them in the head.
- Oil the four camshaft bushes (4) inside the head.
- Fit the exhaust camshaft (5) and intake camshaft (6) with the cam lobe facing up.

NOTE Difference on exhaust and intake camshafts:
- up to engine # 524 388, the exhaust camshaft features a double shoulder (7);
- as of engine # 524 389, the intake camshaft features a distinguishing groove (R).



- Insert the camshaft by hand and measure the valve clearance with a feeler gauge.
- Make a note of the value of the valve clearance measured.
- Measure the difference between the desired value and the actual value.

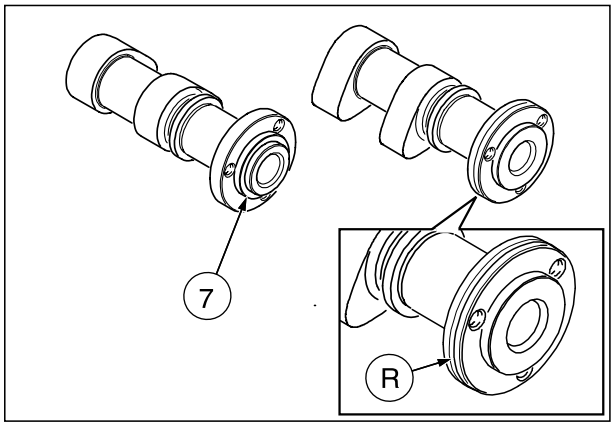
Valve clearance:

- **intake valve 0.12 - 0.17 mm;**
- **exhaust valve 0.23 - 0.28 mm.**

- Where necessary, replace the adjustment shim (1).

⚠ CAUTION
- **Intake valve: the 0.15 mm gauge must be inserted whilst the 0.20 mm one does not need to be inserted.**
- **Exhaust valve: the 0.25 mm gauge must be inserted whilst the 0.30 mm one does not need to be inserted.**

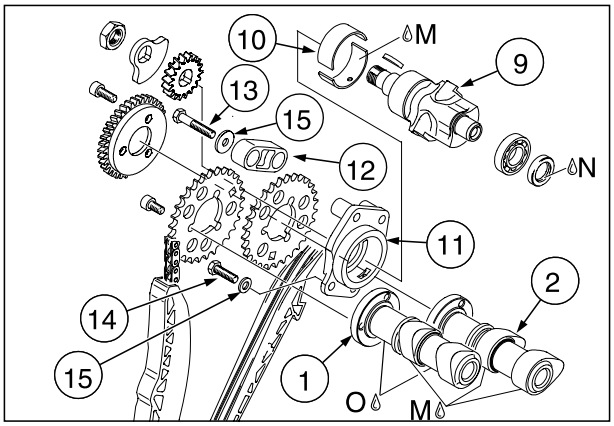
M = MOLYKOTE® G-N.
O = Motor oil.



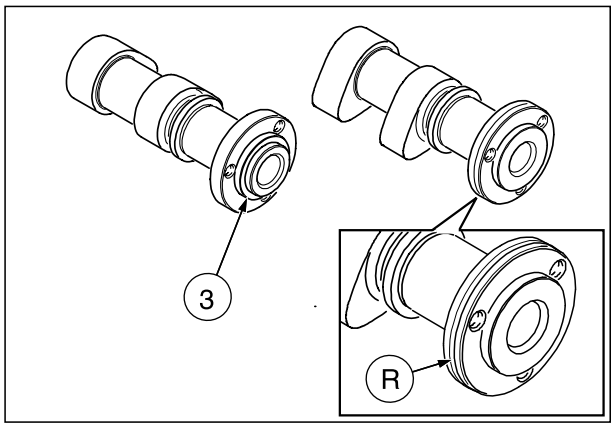
3.7.12 ASSEMBLING HEAD "2" (REAR) CAMSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Adjust the valve clearance, see 3.7.11 (ADJUSTING VALVE CLEARANCE).
- ◆ Oil the housings of the output camshaft (1) and input camshaft (2).
- ◆ Coat the cams with MOLYKOTE® G-N and insert the camshafts in the head.



NOTE Difference on exhaust and intake camshafts:
– up to engine # 524 388, the exhaust camshaft features a double shoulder (3);
– as of engine # 524 389, the intake camshaft features a distinguishing groove (R).



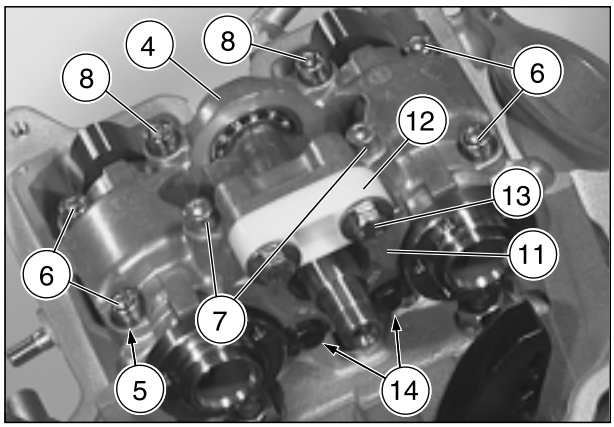
NOTE Tighten the camshaft U bolt gradually, starting from the inside and working in a crisscross pattern.

- ◆ Fasten the main U bolt of the camshaft (4) with the four washers (5) and the eight M6 T.C.E.I. screws (6, 7, 8):
  - – four M6x30 T.C.E.I. screws (6);
  - – two M6x45 T.C.E.I. screws (7);
  - – two M6x55 T.C.E.I. screws (8).

Driving torque of screws (6-7-8): 11 Nm (1.1 kgm).

- ◆ Insert the countershaft (9).
- ◆ Coat both countershaft bushes (10) with MOLYKOTE® G-N .
- ◆ Insert the bush flange (11).
- ◆ Fit the chain guide (12) on the bush flange.
- ◆ Fasten the bush flange (11) with the four M6 T.E. screws (13 - 14) and the four washers (15):
  - – two M6x35 T.E. screws (13);
  - – two M6x20 T.E. screws (14).

Driving torque of screws (13-14): 11 Nm (1.1 kgm).



M = MOLYKOTE® G-N.
O = Motor oil.
N = Lubricating grease.

3.7.13 ASSEMBLING HEAD “2” (REAR) TIMING DRIVE ASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The driving shaft must be locked at TDC of cylinder “2” (rear), see 3.5.11 [DISASSEMBLING CYLINDER “2” (REAR) TIMING DRIVE ASSEMBLY].

- Turn the camshafts so that the cam lobes (1) point away from each other.
- Fit the timing gear (2) in the output camshaft (3) and line up the holes.

NOTE In order to make assembly easier, the timing gear can be secured in place temporarily with an M6 T.C.E.I. screw.

- Turn the timing gear (2) with the exhaust camshaft (3) until the “**EX**” reference mark (4) faces the centre of the intake camshaft.
- Place the timing chain (5) over the timing gear (2) and under the chain guide (6).

NOTE The timing chain must be taught on the traction side (7).

- Engage the second timing gear (8) in the timing chain so that the “**IN**” reference mark (9) faces the “**EX**” reference mark (4) of the exhaust camshaft timing gear.
- In this position, push the timing gear (8) onto the intake camshaft and line up the holes of the timing gear with those on the camshaft.

⚠ WARNING

The three T.C.E.I. M6 x 14 (11) screws must only be used for fastening the timing gear (10); danger of major engine damage and physical injury.

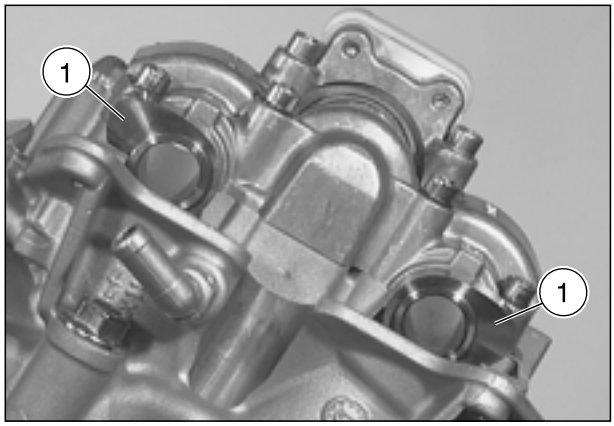
- Push the timing gear (10) onto the exhaust camshaft and fasten it with the three M6x14 T.C.E.I. screws (11).
- Fasten the M6 T.C.E.I. screws (11), coating them with LOCTITE® 243.

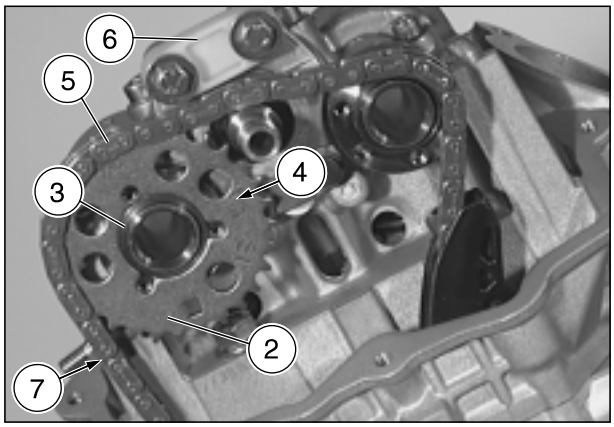
Driving torque of screws (11): 11 Nm (1.1 kgm).

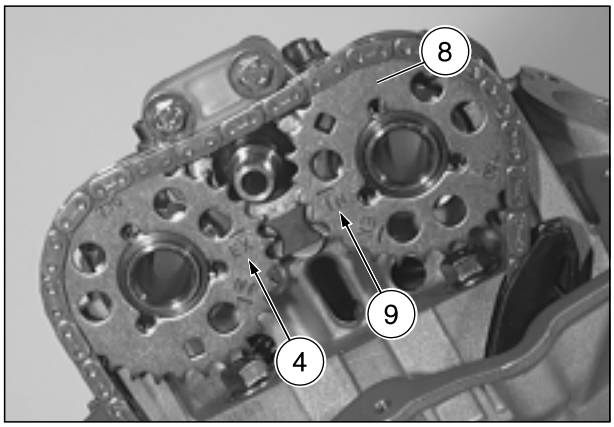
- Secure the timing gear of the intake camshaft with three M6x10 T.C.E.I. screws (12), fastening the T.C.E.I. screws with a coat of LOCTITE® 243.

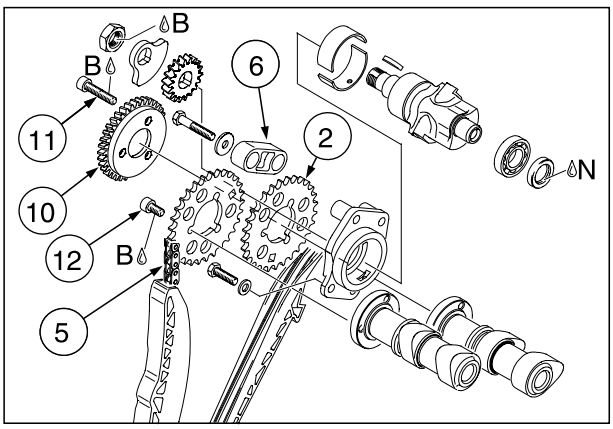
Driving torque of screws (12): 11 Nm (1.1 kgm).

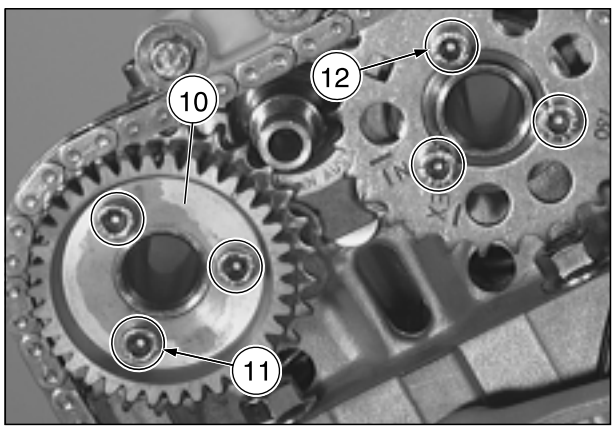
B = LOCTITE® 243.
N = Lubricating grease.





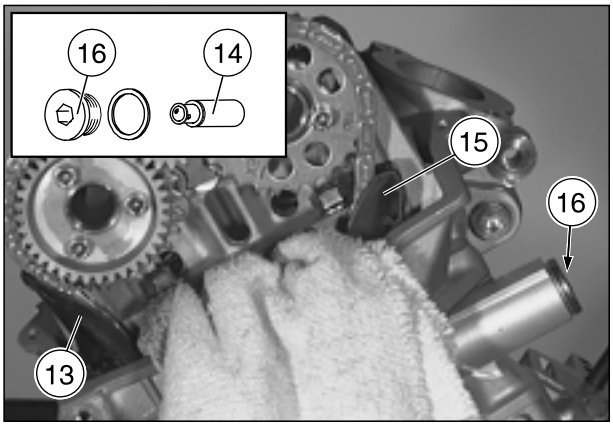






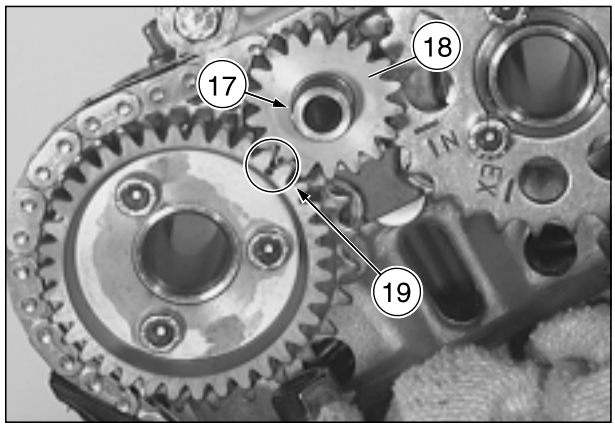
◆ Insert the chain guide (13) as far as it will go.
◆ Oil the chain tightener (14) and fit it in the cylinder with the closed end facing the chain tightener shoe (15).
◆ Screw on the M18x1 T.E. screw (16) complete with seal.

Driving torque of screw (16): 20 Nm (2.0 kgm).



NOTE Be careful to keep the key from dropping into the chain compartment.
Cover the chain compartment accordingly.

◆ Insert the key (17) in the slot on the countershaft.
◆ Push the differential gear (18) onto the countershaft so that the two reference marks (19) are lined up with each other.



NOTE Make sure the sharp-edged side of the counterweight faces the countershaft.

◆ Push the counterweight (20) onto the countershaft.
◆ Fasten the M14x1 T.E. nut (21) with a coat of LOCTITE® 243 and tighten it.

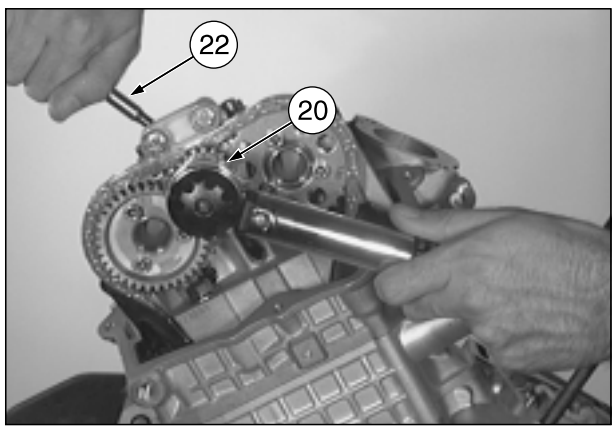
Driving torque of nut (21): 50 Nm (5.0 kgm).

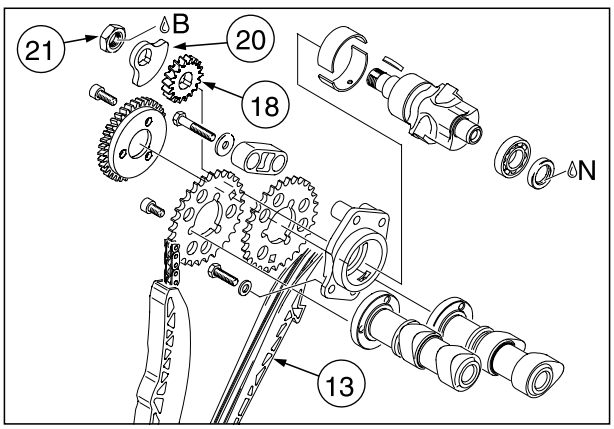
⚠ CAUTION

Hold the countershaft still using a punch (22) suitable for the job.

◆ Coat the valve lifter bucket and camshaft cams with MOLYKOTE® G-N.

B = LOCTITE® 243.
N = Lubricating grease.





3.7.14 ASSEMBLING HEAD “1” TIMING DRIVE ASSEMBLY

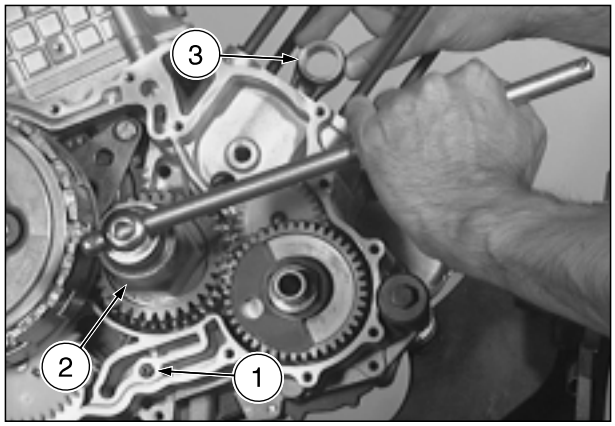
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Unscrew the threaded bolt (1) for retaining the shaft at TDC and turn the driving shaft (2) 300° anticlockwise so that the connecting rod (3) of cylinder “1” is at TDC.

NOTE Move the connecting rod (3) to a central position so that it is not tilted in the casing.

◆ Screw the threaded bolt (1) back on.

NOTE Make sure the threaded bolt is inserted properly in the driving shaft handwheel slot.
The threaded bolt (1) must not be overtightened: **max. 5 Nm (0.5 kgm).**



◆ Where necessary, press hard to insert the two locating dowels (4) in the casing.

NOTE As of engine # 527 354, the locating dowels (4) are no longer fitted; centring is achieved with the aid of the bearing support flange (11).

◆ Using an amount of grease, place the thrust washer (5) on the intermediate timing gear (6).
◆ Place the timing chain (7) around the intermediate timing gear (6), guiding both through the chain compartment and seating them.

NOTE Attach the timing chain (7) based on the reference mark applied during disassembly.

◆ Guide the chain tightener shoe (8) though the chain compartment and fasten it in the housing by means of the spacer sleeve (9).
◆ Oil the two roller bearings (10) and push them onto the pin of the bearing support flange (11).
◆ Insert the bearing support flange (11) push it on as far as it will go, tapping it with a hammer.

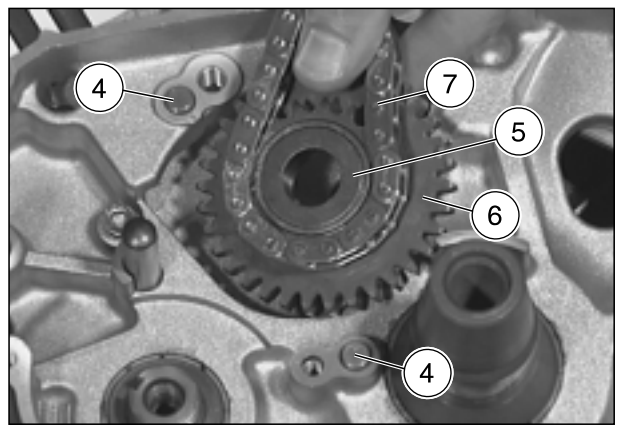
NOTE Coat the M6 T.C.E.I. screw (15) with a coat of LOCTITE® 243.

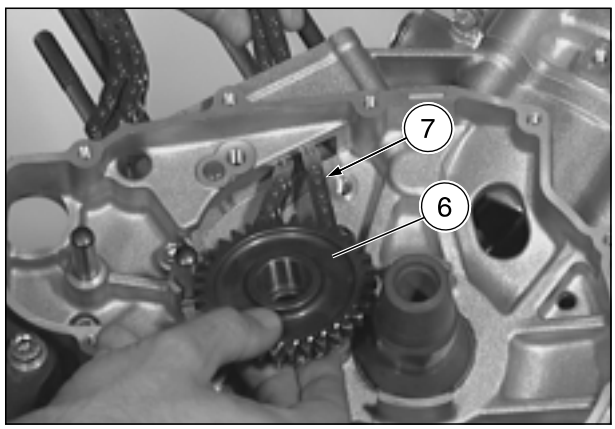
◆ Insert the bearing flange (11) and fasten it with the two M8 T.E. screws (12, 13), with the spring washers (14) and with the M6 T.C.E.I. screw (15).
– one M8x20 T.E. screw (12).
– one M8x45 T.E. screw (13).
– one M6x20 T.C.E.I. screw (15).

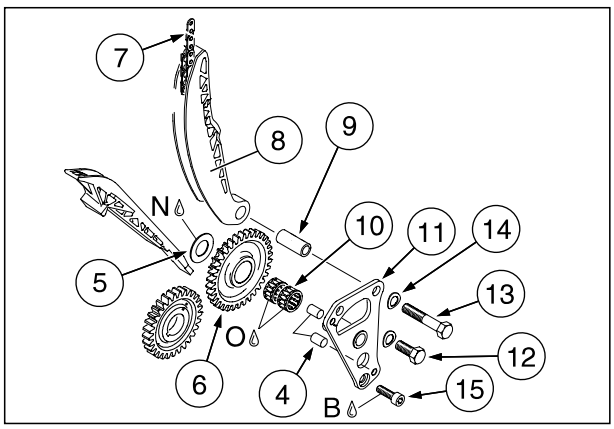
Driving torque:

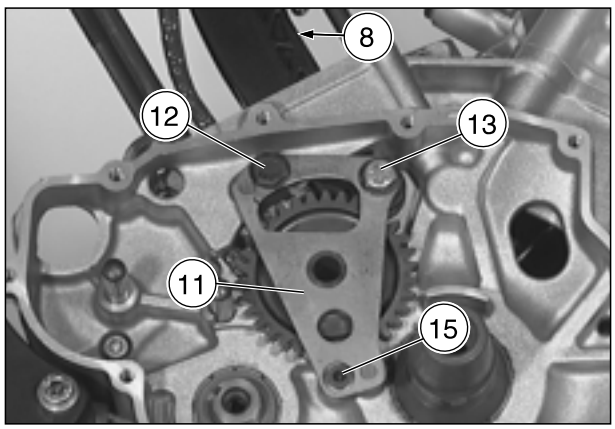
– M8 T.E. screws (12-13): 25 Nm (2.5 kgm);
– M6 T.C.E.I. screws (15): 11 Nm (1.1 kgm).

B = LOCTITE® 243.
O = Motor oil.
N = Lubricating grease.

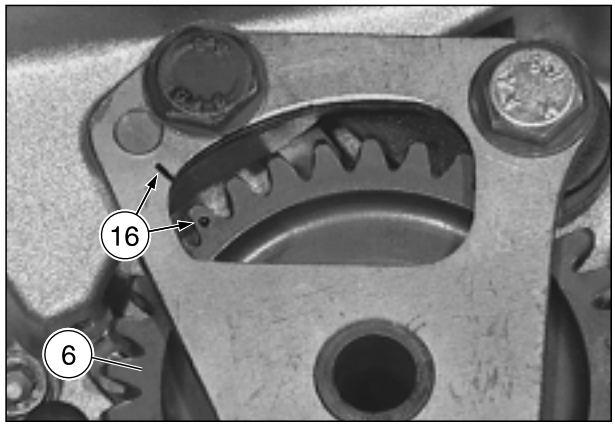








◆ Rotate the intermediate drive gear (6) so that the two reference marks (16) are lined up with each other.



◆ Place the counterweight (17) on the countershaft.
◆ Insert the key (18) in the countershaft.
◆ Push in the drive pinion (19) and counterweight (20).

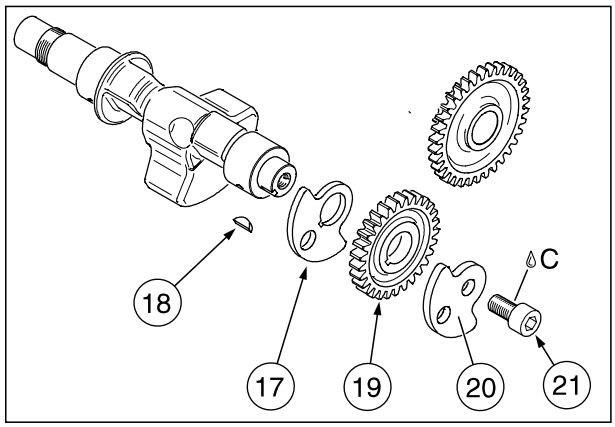
NOTE The half-moon shaped key (18) must be inserted in the upper counterweight slot.
Make sure the reference mark on the intermediate drive gear coincides with the reference mark (16) on the bearing flange.

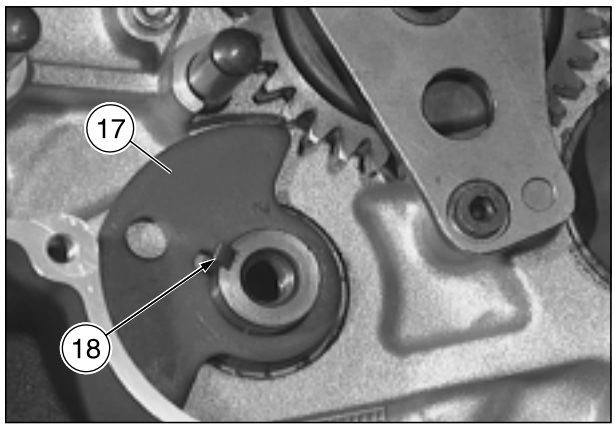
◆ Fasten the M10 T.C.E.I. screw (21) with a coat of LOCTITE® 648 and screw it on to the countershaft.

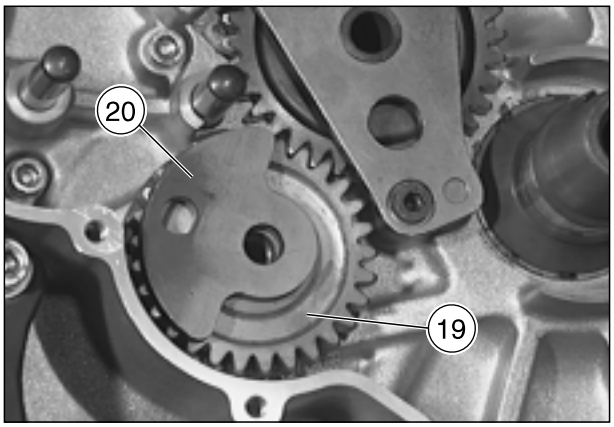
Driving torque of screw (21): 50 Nm (5.0 kgm).

C = LOCTITE® 648.

NOTE The countershaft is timed by timing cylinder “2”.



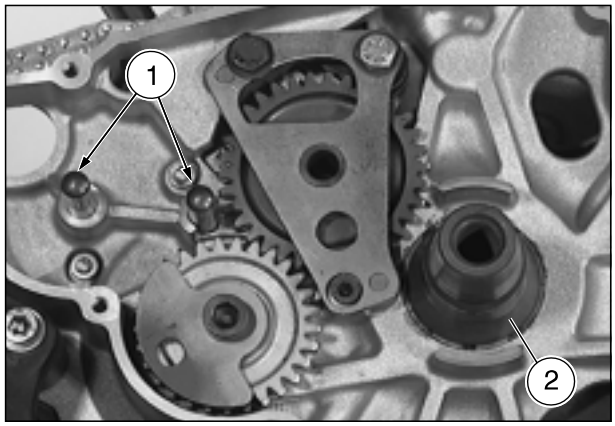


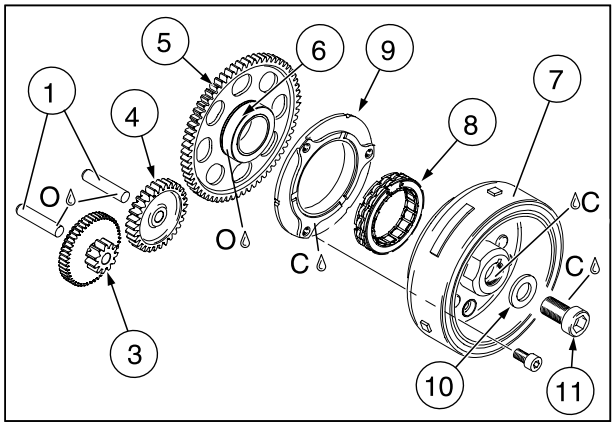


3.7.15 ASSEMBLING THE STARTER MOTOR DRIVE ASSEMBLY AND IGNITION SYSTEM

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Oil the two pins (1) and coat the housing (2) of the freewheel gear on the driving shaft with MOLYKOTE® G-N.
- Insert the double starter gear (3), idler gear (4) and freewheel gear (5).
- Oil the surface (6) on the freewheel gear (5).
- Grease the cone of the driving shaft and rotor (7).
- Oil the freewheel (8) inside the relevant casing (9).
- Coat the cone of the rotor (7) with LOCTITE® 648.
- Push the complete rotor (7) onto the driving shaft so that the driving shaft key coincides with the slot on the flywheel hub.





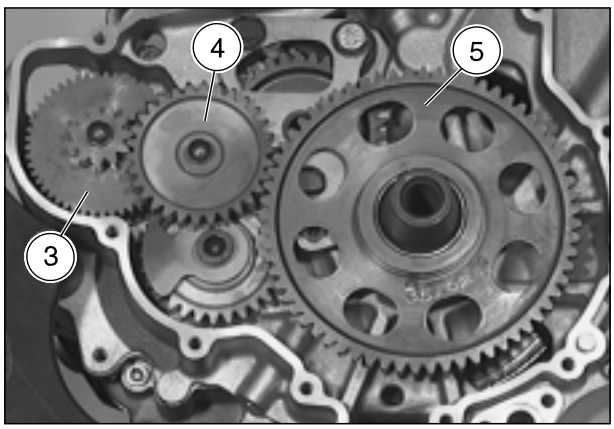
NOTE The double starter gear (3) must be rotated clockwise so that the freewheel can slide over the freewheel gear (5).
During assembly, be careful not to let any LOCTITE® product get inside the sleeve of the freewheel gear (5).

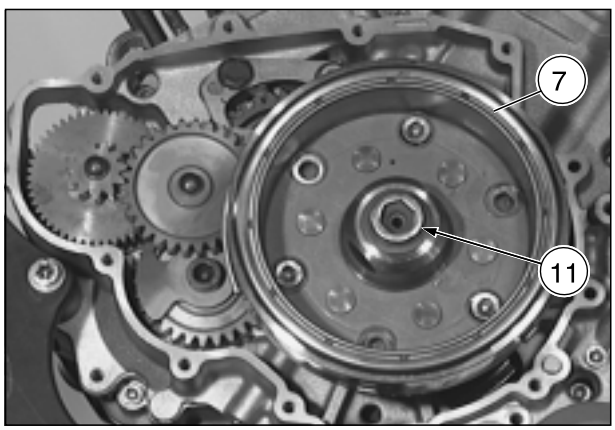
NOTE Complete the rotor (7) with the casing of the freewheel mechanism (9), see 3.6.33 (IGNITION GENERATOR).

- Fit the washer (10), fasten the M16 T.C.E.I. screw (11), applying a coat of LOCTITE® 648, and tighten it.

Driving torque of screw (11): 130 Nm (13.0 kgm).

C = LOCTITE® 648.
O = Motor oil.



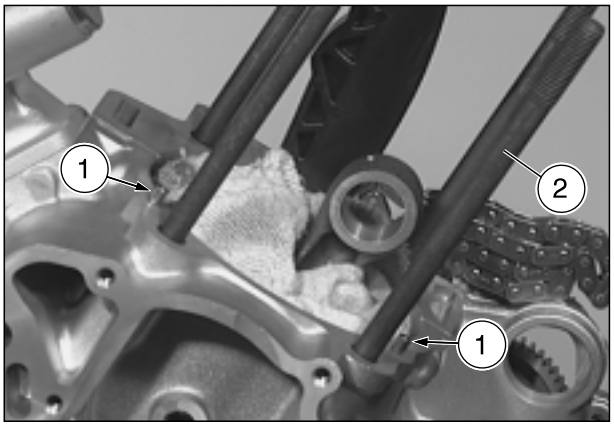


3.7.16 ASSEMBLING THE PISTON AND CYLINDER "1" (FRONT)

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Cover the engine compartment with a cloth.
- ◆ Insert the two locating dowels (1).
- ◆ Coat the four M10 stud bolts (2) with LOCTITE® 243 and screw them onto the engine casing.

Driving torque of stud bolts (2): 15 Nm (1.5 Kgm).



- ◆ Coat the connecting rod small end and the hole of the gudgeon pin inside the piston with MOLYKOTE® G-N.
- ◆ Install the piston (3) on the connecting rod and push the gudgeon pin (4) in, using a punch suitable for the job.

⚠ CAUTION

Observe the assembly direction indicated by the previously applied reference mark.

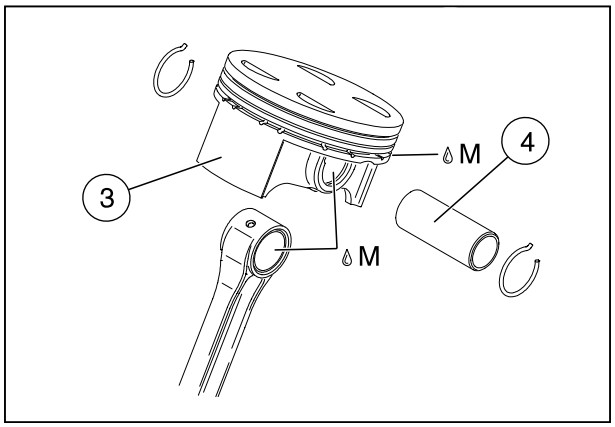
If a new piston is used, the "red" or "green" reference point (5) on the piston crown must face in the direction of the intake (6).

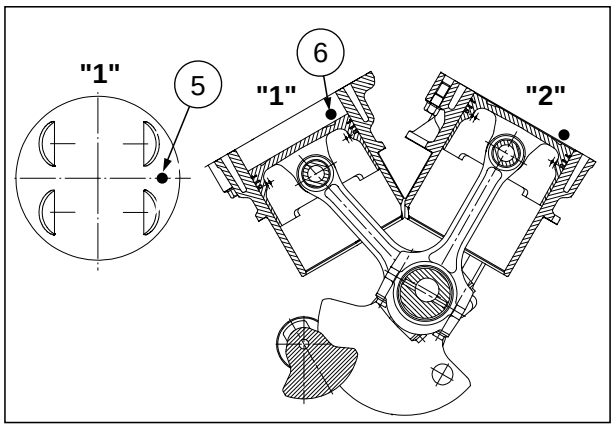
- ◆ Take special care when matching the cylinder - piston:

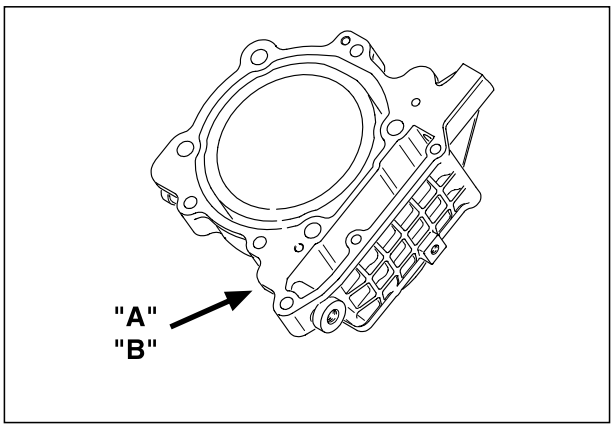
– "Red" piston - cylinder "A";
– "Green" piston - cylinder "B".

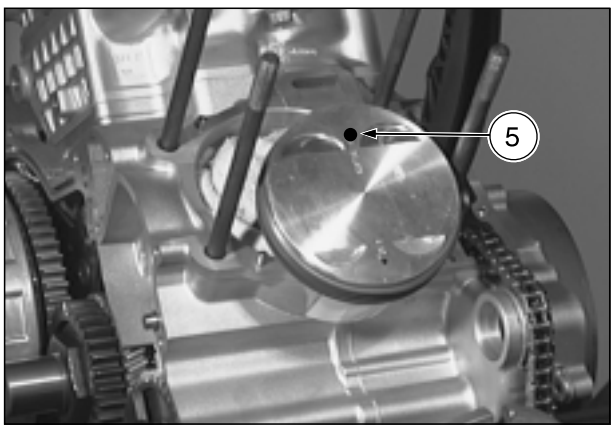
NOTE The cylinders size group "A" or "B" is stamped onto the lower side of the actual cylinder in the timing chain compartment area.

M = MOLYKOTE® G-N.





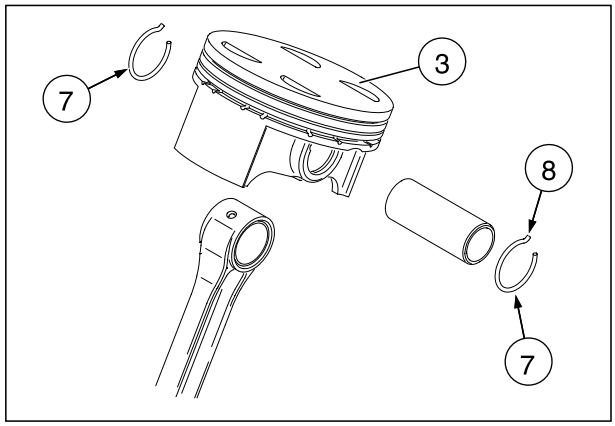




⚠ CAUTION

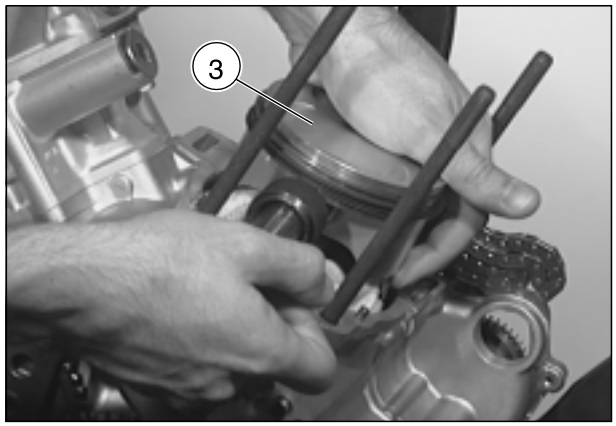
Use new bent-end gudgeon pin seeger rings (7) only.

◆ Insert the gudgeon pin seeger ring (7) in the piston, pushing down hard.

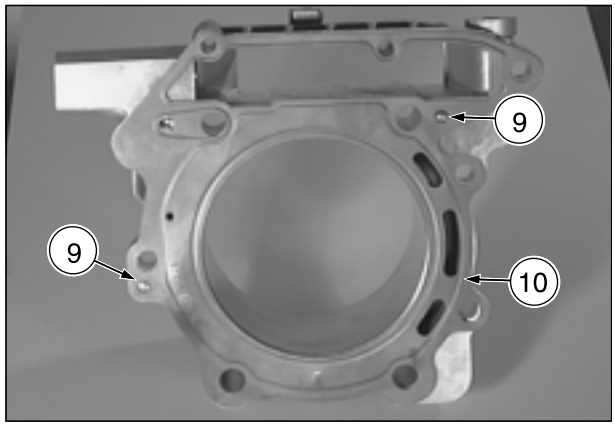


NOTE Support the piston (3).
Make sure the two gudgeon pin seeger rings are inserted perfectly in the groove of the piston and that the hook (8) is inserted in the slot of the actual piston.

◆ Where necessary, fit the second gudgeon pin seeger ring (7), repeating the same procedure as described above.



◆ Insert the two locating dowels (9) in the cylinder.



⚠ CAUTION

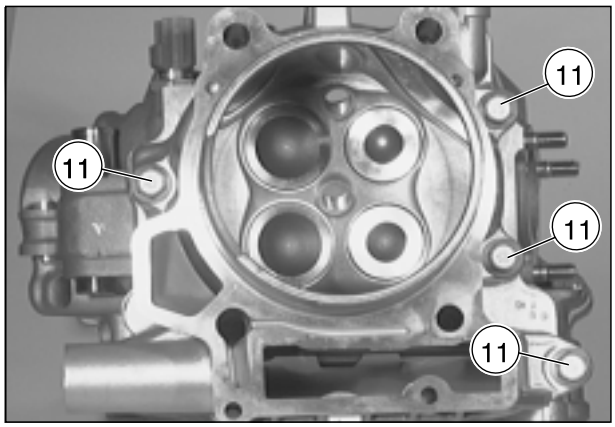
Use a new head gasket.

◆ Fit the head gasket (10) in place.
◆ Place the preassembled head in the cylinder and tighten it on with the four shouldered T.E. screws (11).

– Non-painted cylinder version:
Driving torque of screws (11): 29 Nm (2.9 kgm).

– Painted cylinder version:
Driving torque of screws (11): 27 Nm (2.7 kgm).

◆ Apply a coat of LOCTITE® 574 on the casing around the gasket surface of the cylinder base gasket in the area of the line separating the two sections of the casing.
◆ Apply the cylinder base gasket on the casing.
◆ Oil the piston and the respective piston rings.
◆ Turn the piston rings so that the meeting ends of the three rings are staggered by approx. 120°.

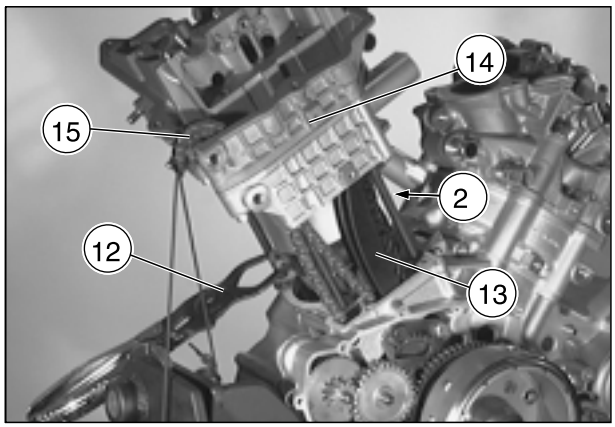


NOTE Have the appropriate special tool OPT (12) to hand cod. 8140186 (piston ring compression tool).

◆ Lower the ring compressor (12) or piston ring pliers over the piston to preload the piston rings.
◆ Place the chain tightener shoe (13) in the chain compartment of the cylinder (14) and push the cylinder over the piston so that the ring compressor is pushed down.
◆ Remove the ring compressor (12).
◆ Insert the timing chain (15) through the cylinders chain compartment.

NOTE The timing chain can be guided inside using an O-ring or similar device to aid assembly.

◆ Place the cylinder (14) on the engine casing, pushing it in all the way.
◆ Oil the thread of the stud bolts (2) and the contact surfaces.



NOTE Screw on the M10 T.E. nuts (16) and M6 T.C.E.I. screws (17) evenly and gradually, working in a crisscross pattern.

◆ Secure the cylinder together with the head with the four M10 T.E. nuts (16) and two M6 T.C.E.I. screws (17).

Non-painted head version:

– four M10 T.E. nuts (16), driving torque 58 Nm (5.8 kgm);

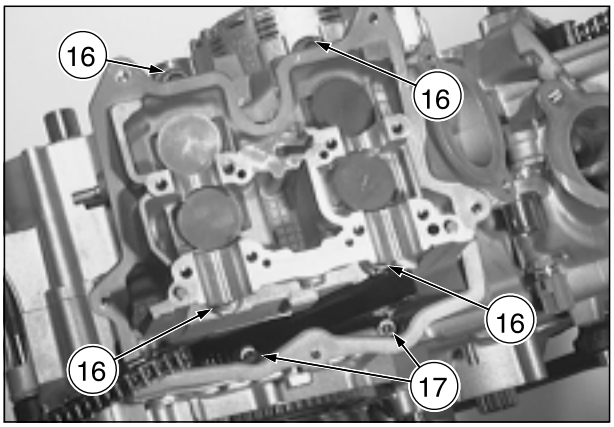
– two M6 T.C.E.I. screws (17), driving torque 12 Nm (1.2 kgm).

Painted head version:

– two M10 T.E. nuts (16), external, driving torque 53 Nm (5.3 kgm);

– two M10 T.E. nuts (16), chain compartment side, driving torque 58 Nm (5.8 kgm);

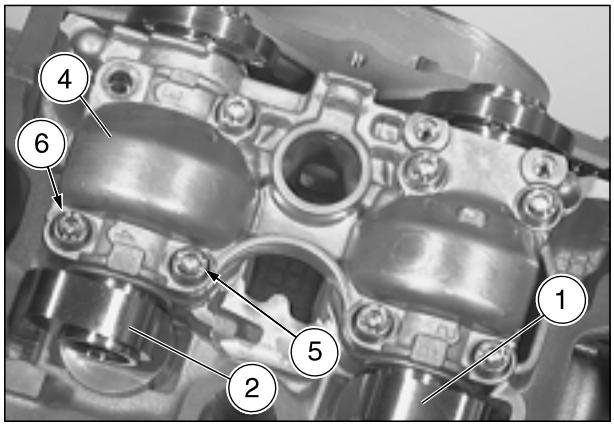
– two M6 T.C.E.I. screws (17), driving torque 12 Nm (1.2 kgm).



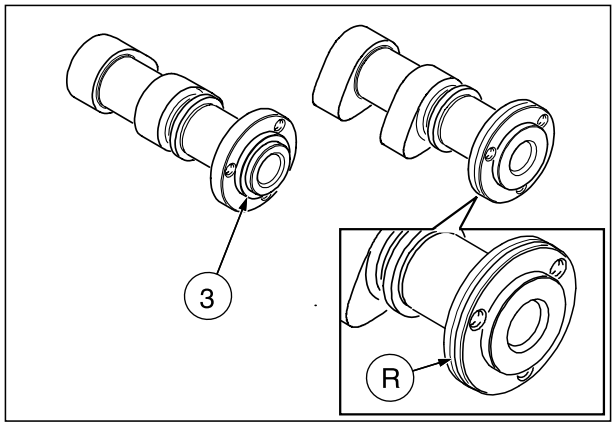
3.7.17 ASSEMBLING HEAD "1" (FRONT) CAMSHAFT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Adjust the valve clearance, see 3.7.11 (ADJUSTING VALVE CLEARANCE).
- Oil the housings of the exhaust camshaft (1) and intake camshaft (2).
- Coat the cams with MOLYKOTE® G-N and insert the camshafts in the head.



NOTE Difference on exhaust and intake camshafts:
– up to engine # 524 388, the exhaust camshaft features a double shoulder (3);
– as of engine # 524 389, the intake camshaft features a distinguishing groove (R).



NOTE Tighten the camshaft U bolt gradually, starting from the inside and working in a crisscross pattern.

- Fasten the U bolt of the camshaft (4) with the seven washers (5) and seven M6x30 T.C.E.I. screws (6).

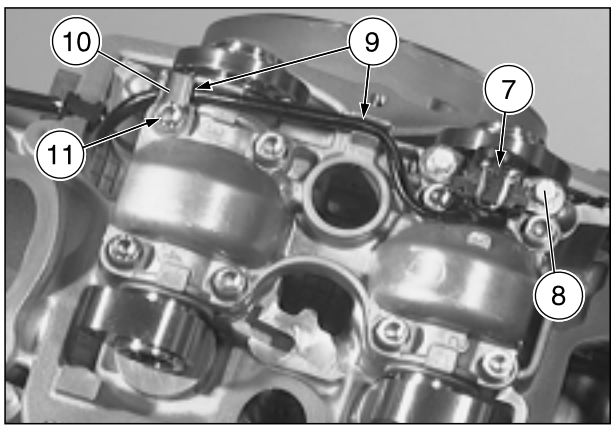
  Driving torque of screws (6): 11 Nm (1.1 kgm).

- Fit the camshaft sensor (7) and secure it in place with two M5 Taptite screws (8), fastening them with a coat of LOCTITE® 243.

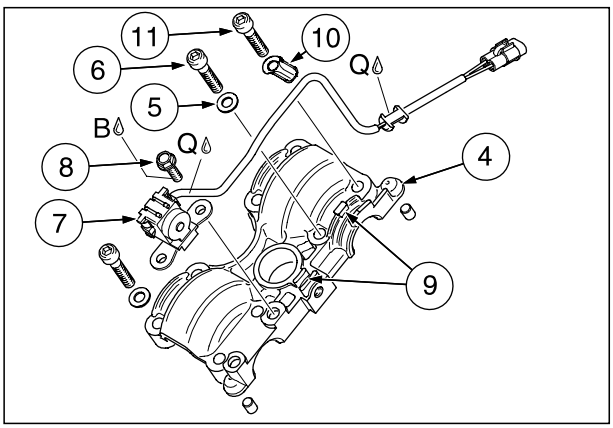
  Driving torque of screws (8): 4 Nm (0.4 kgm).

- Insert the camshaft sensor cable in the guide race (9) and fasten it with the cable clamp (10) and M6X30 T.C.E.I. screw (11).

  Driving torque of screw (11): 11 Nm (1.1 kgm).



B = LOCTITE® 243.
Q = SILASTIC 732 RTV.



3.7.18 ASSEMBLING HEAD "1" (FRONT) TIMING DRIVE ASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The driving shaft must be retained at TDC of cylinder "1" (front), see 3.5.6 [DISASSEMBLING CYLINDER "1" (FRONT) TIMING DRIVE ASSEMBLY].

- Turn the camshafts so that the cam lobes (1) point away from each other.
- Fit the drive gear (2) in the exhaust camshaft (3) and line up the holes.

NOTE The drive gear of the exhaust camshaft has a transducer (4) for the camshaft sensor.

- Turn the timing gear (2) with the exhaust camshaft until the "**EX**" reference mark (5) faces the centre of the intake camshaft.
- Place the timing chain (6) over the timing gear (2).

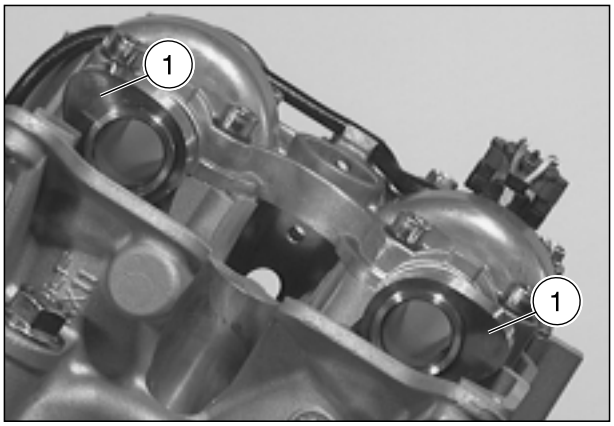
NOTE The timing chain must be taught on the traction side (7).

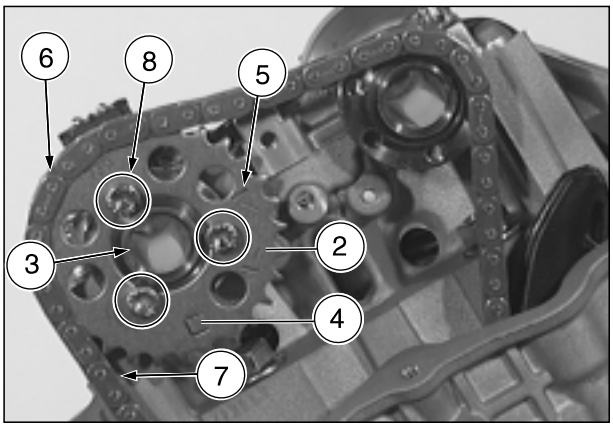
- Secure the timing gear with the three M6 T.C.E.I. screws (8), coating them with LOCTITE® 243.

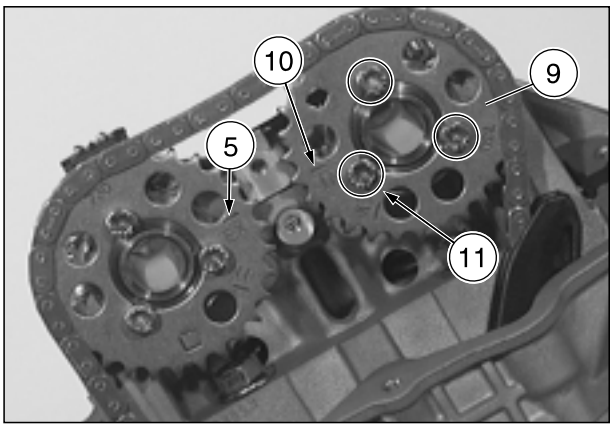
Driving torque of screws (8): 11 Nm (1.1 kgm).

- Engage the second timing gear (9) in the timing chain so that the "**IN**" reference mark (10) faces the "**EX**" reference mark (5) on the timing gear of the exhaust camshaft.
- In this position, push the timing gear (9) onto the intake camshaft and line up the holes of the timing gear with those on the camshaft.
- Secure the timing gear (9) with the three M6 T.C.E.I. screws (11), coating them with LOCTITE® 243.

Driving torque of screws (11): 11 Nm (1.1 kgm).





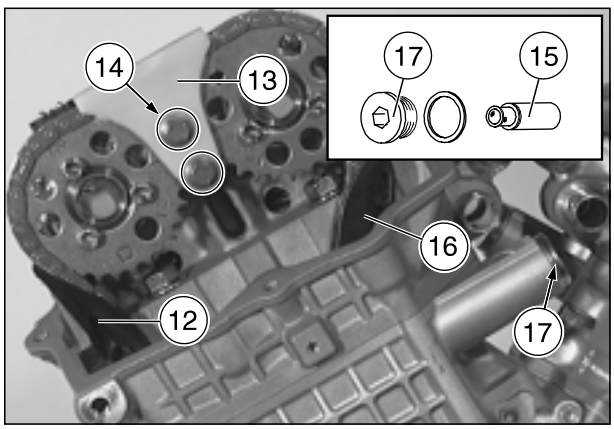


- Insert the chain guide shoe (12) as far as it will go.
- Fit the chain guide bracket (13) and secure it with the two M6 spacer screws (14).

Driving torque of screws (14): 11 Nm (1.1 kgm).

- Oil the chain tightener (15) and fit it in the cylinder with the closed end facing the chain tightener shoe (16).
- Screw on the M18x1 T.E. screw (17) complete with seal.

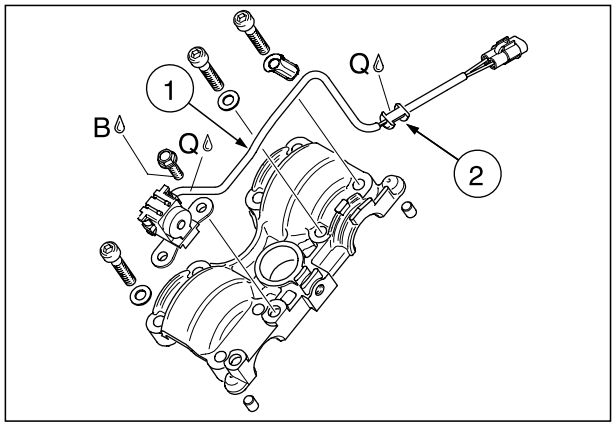
Driving torque of screws (17): 20 Nm (2.0 kgm).



3.7.19 ASSEMBLING THE VALVE COVER

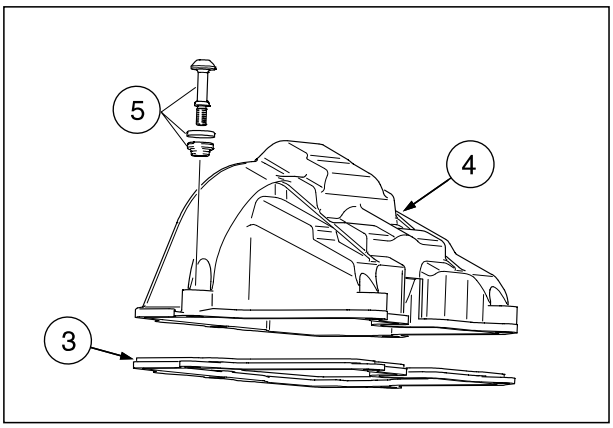
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Coat the cable (1) of the camshaft sensor and rubber element (2) with SILASTIC 732 RTV.



◆ Grease the head cover gasket (3) and insert it in the groove on the head cover (4).
◆ Place the head cover on head “1” (front) and on head “2” (rear), securing it with the five M6 spacer screws (5).

Driving torque of screws (5): 9 Nm (0.9 kgm).



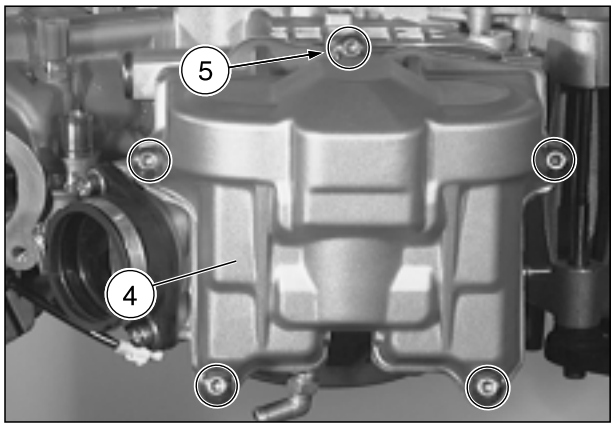
◆ Secure the intake flange (6) with the two M8 T.C.E.I. screws (7) and respective washers.

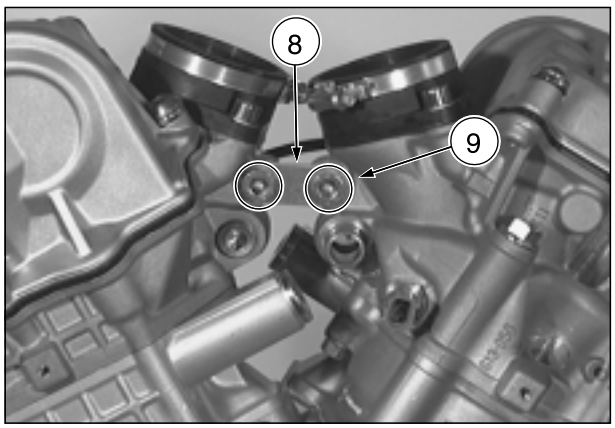
Driving torque of screws (7): 19 Nm (1.9 kgm).

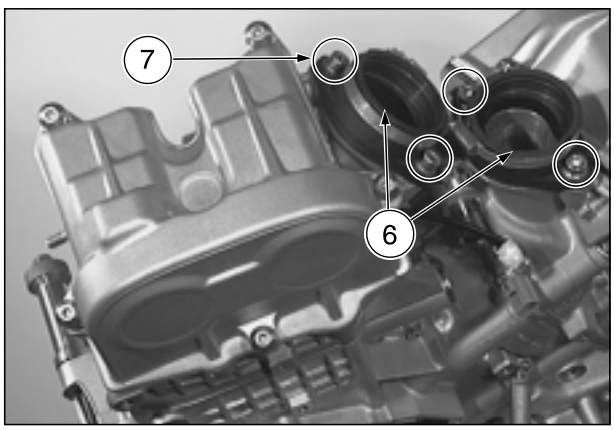
◆ Secure the support bracket (8) with the two M10 T.C.E.I. screws (9), fasten the two M10 nuts and apply LOCTITE® 243**.**

Driving torque of screws (9): 40 Nm (4.0 kgm).

B = LOCTITE® 243.
Q = SILASTIC 732 RTV.







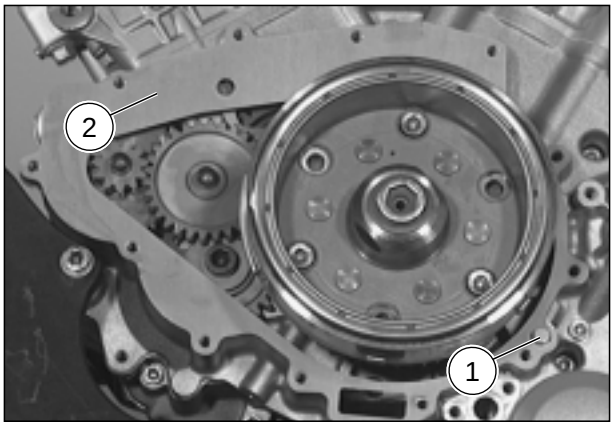
3.7.20 ASSEMBLING THE IGNITION COVER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

◆ Where necessary, insert the locating dowel (1).

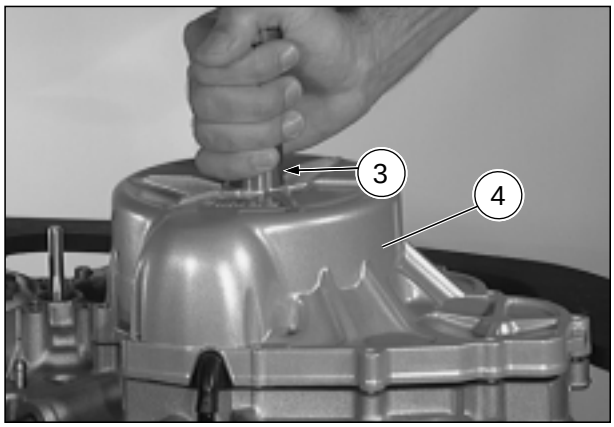
NOTE Use a new gasket (2).

◆ Apply the gasket (2).



NOTE Have the appropriate special tool OPT (3) to hand cod. 0277252 flywheel cover removal tool).

◆ Screw the tool (3) onto the ignition cover.

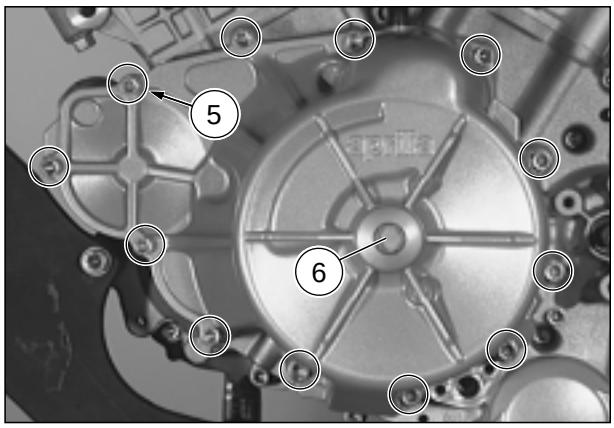


◆ Fit the ignition cover on the casing and screw it on with the twelve M6 T.C.E.I. screws (5).

Driving torque of screws (5): 11 Nm (1.1 kgm).

◆ Remove the tool (3) and tighten the plastic closing screw (6) complete with O-ring.
◆ Screw on the four spark plugs inside the two heads using the special spanner.

Driving torque of spark plugs: 18 Nm (1.8 kgm) (with head cold and thread not lubricated).



3.7.21 ASSEMBLING THE CLUTCH HOUSING

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- ◆ Remove the threaded bolt (1) for retaining the shaft at TDC.
- ◆ Insert the two locating dowels (2).
- ◆ Fit the gasket (3) in place.

NOTE Use a new gasket.

- ◆ Coat the end of the driving shaft (4) and end of the countershaft (5) with MOLYKOTE® G-N.
- ◆ Fit the clutch cover (6), complete with coolant pump, on the casing.

NOTE Turn the impeller (8) to enable the toothing of the pump gear (7) to mate with the toothing of the coolant pump idler gear (9).

- ◆ Screw on the clutch cover (6) using the eleven M6 T.C.E.I. screws (10) and four M8 T.C.E.I. screws (11, 12):
  - – eleven M6 x 35 screws (10);
  - – three M8 x 55 screws (11);
  - – one M8 x 65 screw (12).

Driving torque:

- **– M6 T.C.E.I. screws (10) 11 Nm (1.1 kgm);**
- **– M8 T.C.E.I. screws (11 - 12) 19 Nm (1.9 kgm).**

NOTE Fit the seal (13) on the M8x65 T.C.E.I. screw (12).

NOTE Fit the seal (18) on the M6x25 T.C.E.I. screw (17) (coolant drain plug).

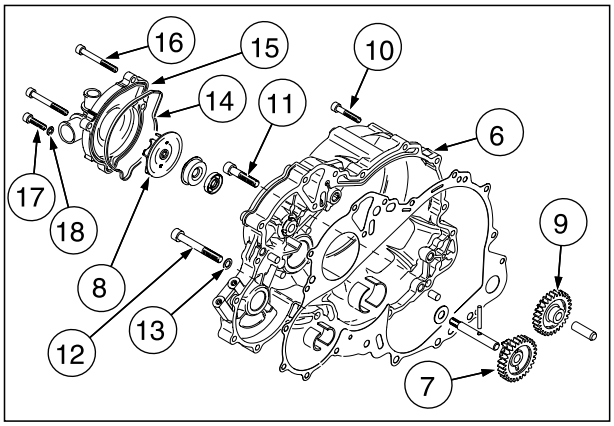
- ◆ Insert the shaped seal (14) in the coolant pump casing (15) and fit it together with the clutch cover, securing it with the four M6 T.C.E.I. screws (16 - 17).

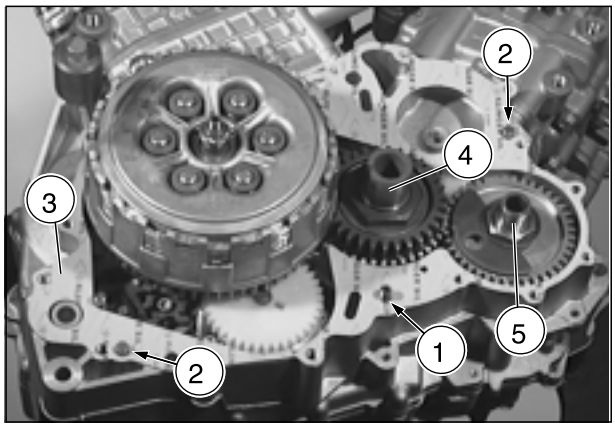
Coat the M6 x 55 T.C.E.I. screw in the centre of the cover with LOCTITE® 243.

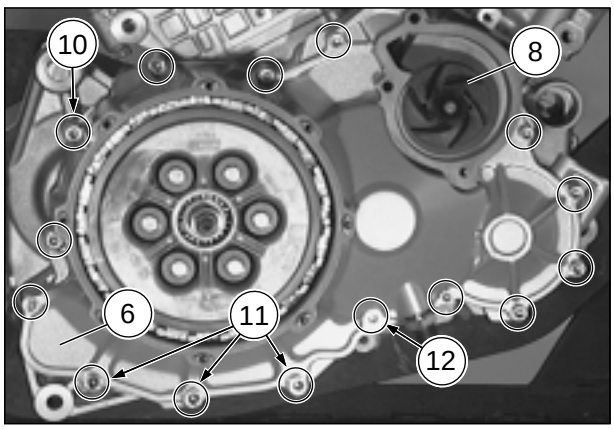
- – three M6 x 55 screws (16);
- – one M6 x 25 screw (17).

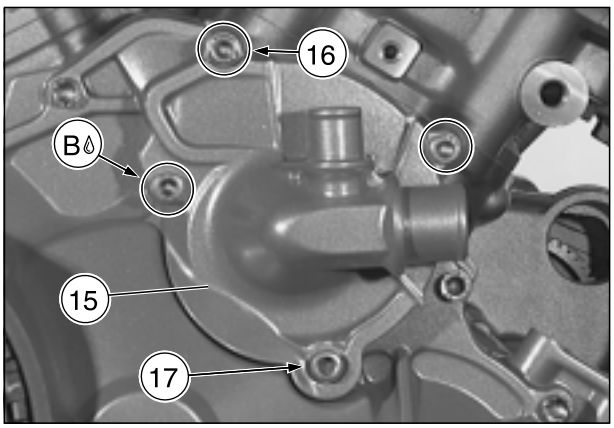
Driving torque of screws (16-17): 11 Nm (1.1 kgm).

B = LOCTITE® 243.



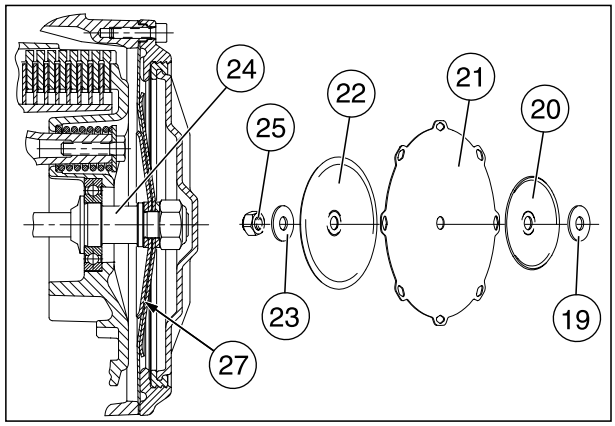






◆ Fit the washer (19), support cup (20), diaphragm (21), cup (22) and spring washer (23) on the clutch disengaging shaft (24) and secure them with an M12 stop nut (25) previously coated with LOCTITE® 648.

Driving torque of nut (25): 30 Nm (3.0 kgm).

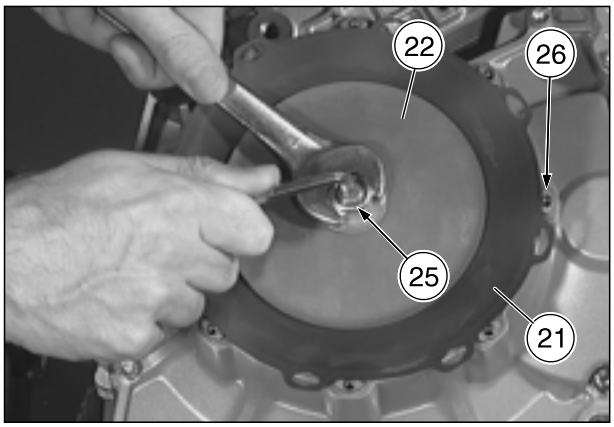


⚠ CAUTION

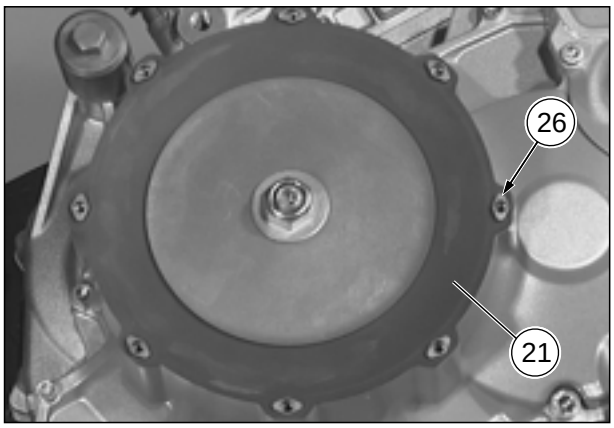
In order to tighten the stop nut, the diaphragm (21) must not be fixed in the clutch cover retainers (26).

NOTE Fit the support cup (20) and cup (22) on the clutch disengaging shaft with the rounded edge (27) facing out.

NOTE Hold the diaphragm (21) still on the clutch disengaging shaft (24), using a bent hexagon-head driver.

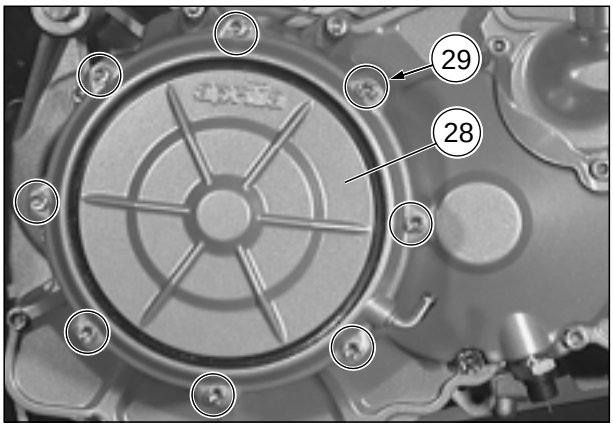


◆ Rotate the complete clutch disengaging shaft (24) and fasten the diaphragm (21) in the clutch cover retainers (26).



◆ Insert the preassembled diaphragm disc (28) and secure it with the eight M5 T.C.E.I. screws (29).

Driving torque of screws (29): 5 Nm (0.5 kgm).

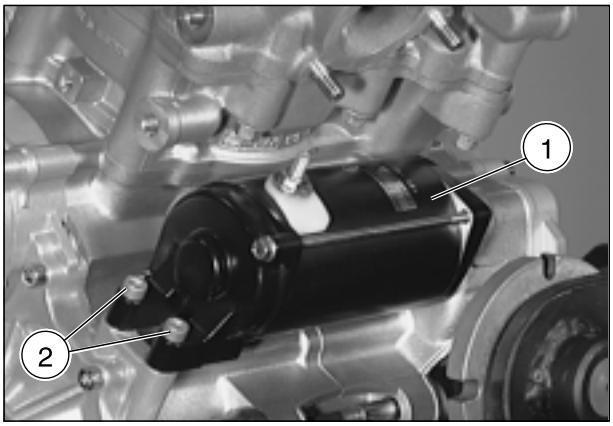


3.7.22 ASSEMBLING THE STARTER MOTOR

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Grease the starter motor gear.
- Coat the starter motor flanged housing with MOLYKOTE® G-N.
- Centre the starter motor (1) in the casing, pushing it all the way in and securing it with the two M6 T.C.E.I. screws (2).

Driving torque of screws (2): 11 Nm (1.1 kgm).



3.7.23 ASSEMBLING THE DRIVING CHAIN PINION

- Coat the toothing of the secondary shaft with LOCTITE® Anti Seize.
- Push in the chain pinion (3) with the collar facing in, and secure it with the spring washer (4), washer (5) and M10 T.E. screw (6).

Driving torque of screw (6): 50 Nm (5.0 kgm).

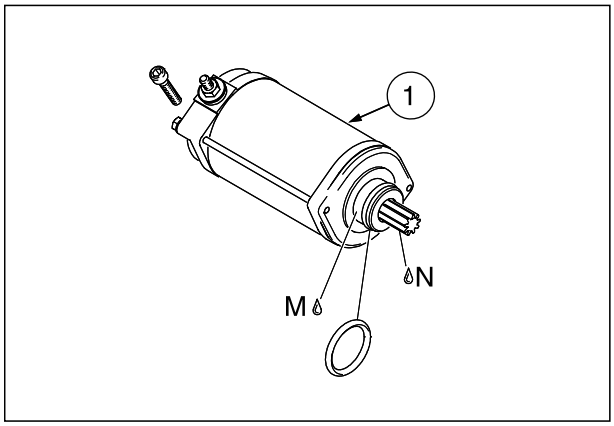
- Fit a new oil filter (7) in the engine compartment.
- Fasten the oil filter cover (8) and O-ring (9) with two M6 T.C.E.I. screws (10).

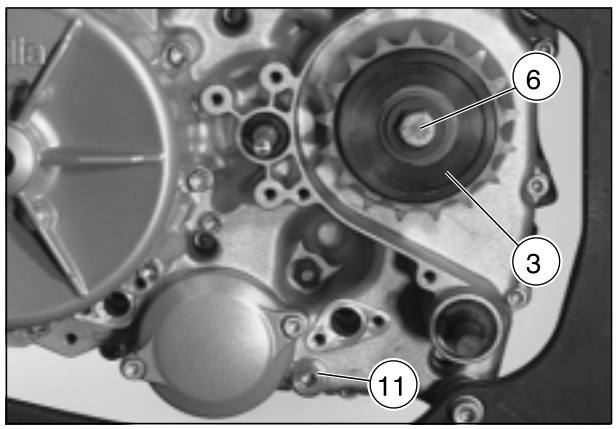
Driving torque of screws (10): 11 Nm (1.1 kgm).

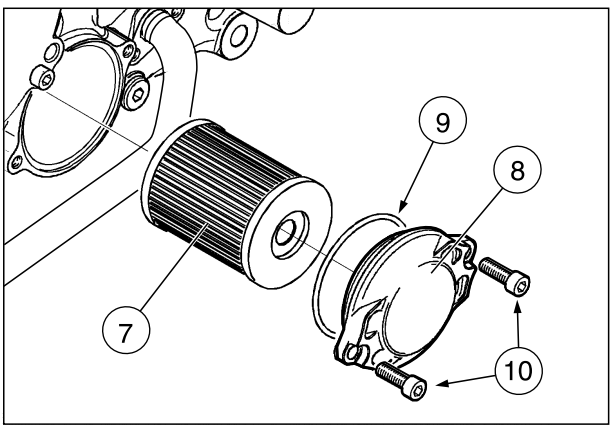
- Clean the magnetic screw (11) of any deposits.
- Screw on and tighten the magnetic screw (11).

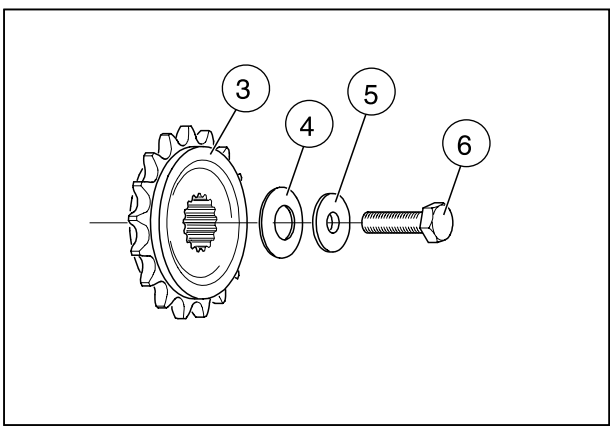
Driving torque of screw (11): 20 Nm (2.0 kgm).

M = MOLYKOTE® G-N.
N = Lubricating grease.







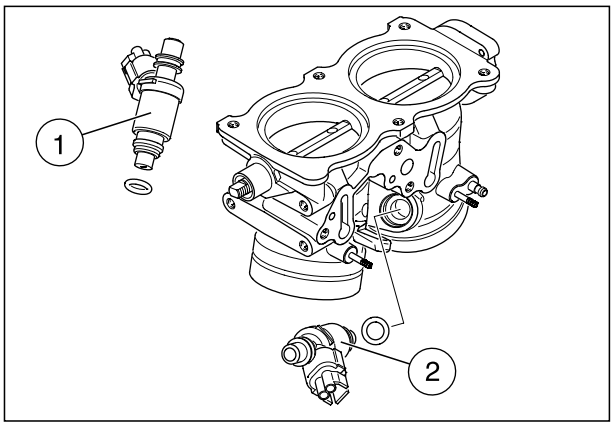


3.8 ENGINE CHECKS SUBSEQUENT TO REASSEMBLY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

3.8.1 BLEEDING THE ENGINE OIL CIRCUIT

- Refill the engine with motor oil, see 2.14 (CHANGING THE ENGINE OIL AND THE OIL FILTER).
- Slip the two electric connectors off the two injectors (1-2).
- Start the engine for a moment until the engine oil pressure LED goes off.
- Insert the two electric connectors on the two injectors (1-2).
- Top up with motor oil until the tank level reaches the prescribed limit, see 2.13 (CHECKING THE ENGINE OIL LEVEL AND TOPPING UP).
- Start the engine and let it idle for approx. 10 minutes.
- Check the oil level again and, where necessary, top up.



3.8.2 CHECKING THE ENGINE OIL PRESSURE

NOTE Have the appropriate special tool OPT (3) to hand cod. 8140181 (fuel-oil pressure gauge).

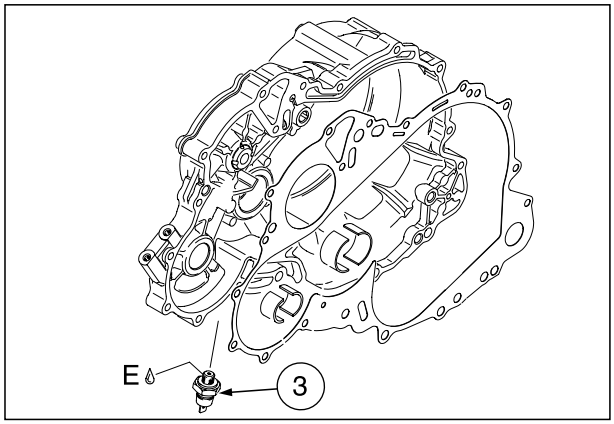
- Connect the oil pressure gauge (4) in place of the engine oil pressure sensor (3).

Engine oil pressure: min. 50 kPa (0.5 bar).

NOTE Check the oil pressure at a temperature of 80 °C (176 °F) and at a speed of at least 1200 rpm.

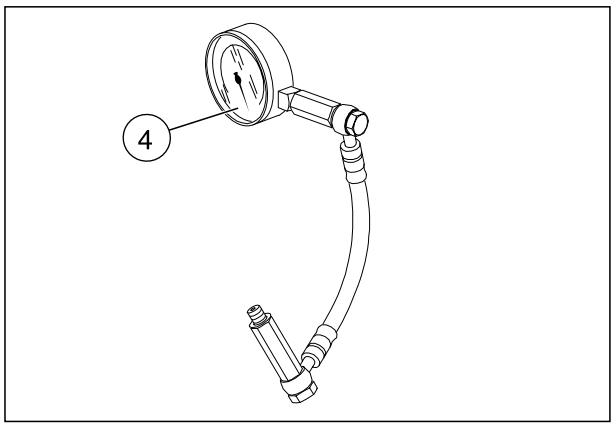
⚠ CAUTION

If the oil pressure is below the minimum limit, check the oil pump and relevant drive assembly.



- During reassembly, coat the thread of the engine oil pressure sensor (3) with LOCTITE® 243.

Driving torque of sensor (3): 15 Nm (1.5 kgm).



3.8.3 SYNCHRONIZING CYLINDERS

See 4.8.10 (CYLINDER SYNCHRONIZATION).

FUEL SUPPLY SYSTEM 4

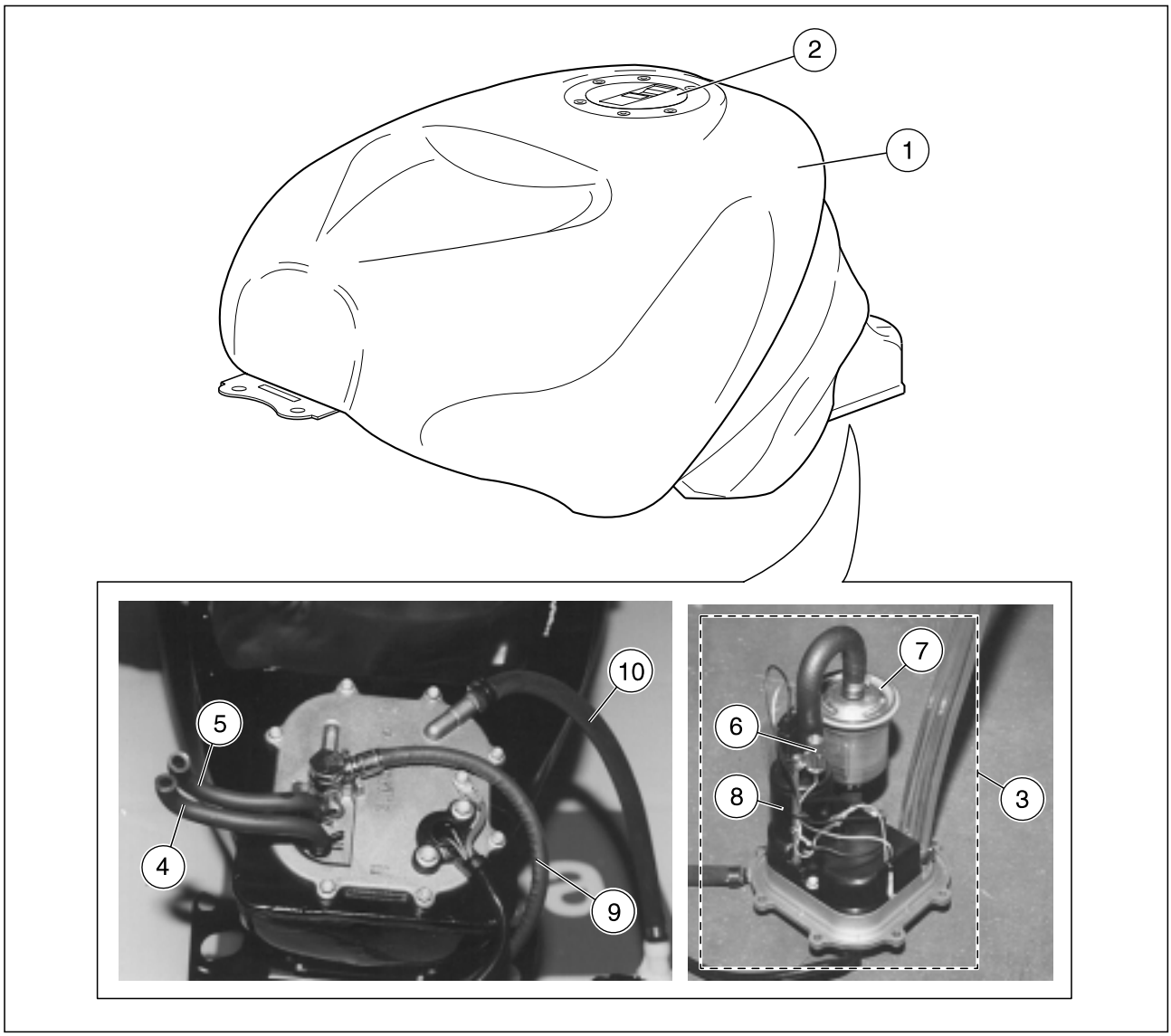
FUEL SUPPLY SYSTEM

TABLE OF CONTENTS

4.1 FUEL TANK

The filler cap is to be found on the top of the tank, whilst the bottom part houses:

– the fuel supply pump unit;
– a pipe for draining water from the filler cap in the event of rain or during washing;
– a pipe for draining off petrol in the event the tank is overfilled.



Key

1) Fuel tank
2) Filler cap
3) Fuel supply pump unit
4) Filler cap water drainage pipe
5) Fuel “overflow” drainage pipe
6) Fuel level sensor
7) Fuel delivery filter
8) Fuel supply pump
9) Fuel delivery pipe
10) Fuel return pipe

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.1 (FUEL).

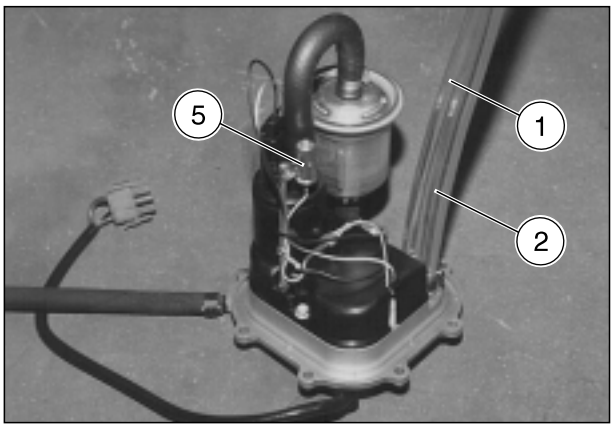
⚠ WARNING

Fuel vapours are noxious for the health.
Before proceeding, make sure that the room in which you are working is properly ventilated.
Do not inhale fuel vapours.

Avoid any contact of the fuel with the skin.
Do not smoke, nor use naked flames.
Do not dispose of fuel in the environment.

4.1.1 MAINTENANCE

◆ When the fuel supply pump is to be removed, see 4.3 (REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT), it is advisable to make sure the pipes (1 - 2 - 3 - 4) are intact and that the following are working properly:
– fuel level sensor (5), see 6.10.2 (LOW FUEL WARNING LIGHT);
– fuel supply pump (6), see 6.5.2 (CHECKING THE FUEL PUMP).
◆ Change the delivery filter (7).



NOTE During this procedure, it is also advisable to wash the tank completely.

4.1.2 CHECKING THE FUEL SUPPLY

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

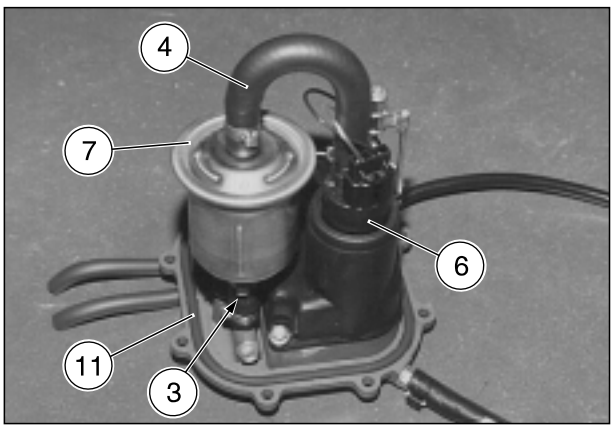
⚠ WARNING

Check the delivery pipe (8), return pipe (9) and relevant connections extremely carefully: the operating pressure of the delivery pipe (8) is approx. 450 kPa (4.5 bar).

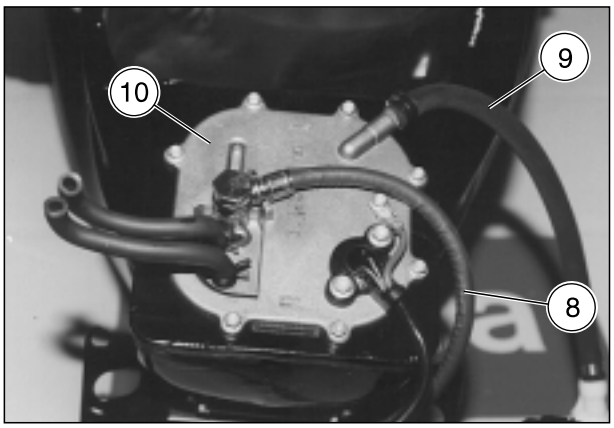
Any fuel pipes featuring cracks or cuts must be replaced, without exception.

Fuel leaking from the flange (10) might be due to a damaged O-ring (11), consequently:

◆ Remove the whole fuel supply pump unit, see 4.3 (REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT), check its state of repair and, where necessary, replace it.
◆ Open the filler cap and make sure the vent on the tank is not clogged. Where necessary, unclog it using a compressed air jet.



NOTE For further details see 6.5.2 (CHECKING THE FUEL PUMP).



4.2 DRAINING THE FUEL TANK

See 2.9 (DRAINING THE FUEL TANK) for the fuel tank draining procedure.

4.3 REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS), 1.2.1 (FUEL) and 4.1.1 (MAINTENANCE).

◆ Remove the fuel tank completely, see 7.1.5 (COMPLETE REMOVAL OF THE FUEL TANK).

⚠ CAUTION

Handle the fuel tank with care and avoid scraping or damaging them.

NOTE Set the tank on a clean surface with the pump unit facing up.

◆ Unscrew and remove the screws (1).

NOTE When reassembling, screw all the screws on manually and tighten them in a crisscross pattern in the following order: A-B-C-D-E-F-G-H.

Driving torque of screws (1): 7 Nm (0.7 kgm).

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Lift the pump unit (2) just enough to be able to get at the pipe clamps (3 - 4).
◆ Release the head off the pipe clamps (3 - 4).

⚠ CAUTION

When removing the pump unit (2), take care not to damage the pipes and the fuel level sensor (5).

◆ Remove the whole pump unit (2).

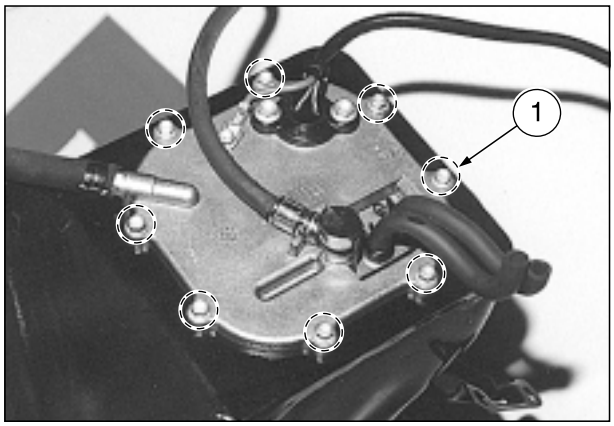
4.4 REMOVING THE FUEL LEVEL SENSOR

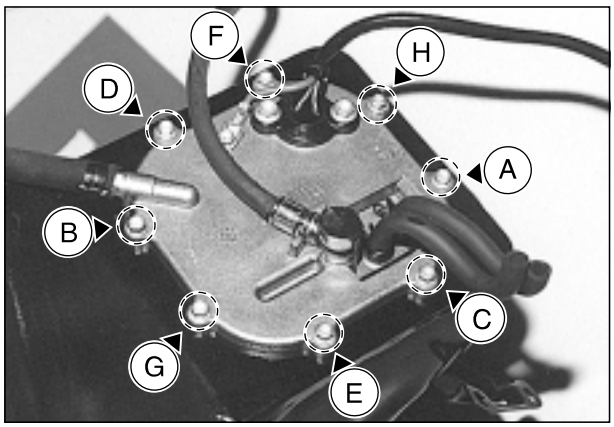
◆ Remove the whole fuel supply pump unit, see 4.3 (REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT).
◆ Release and remove the clamp (6).

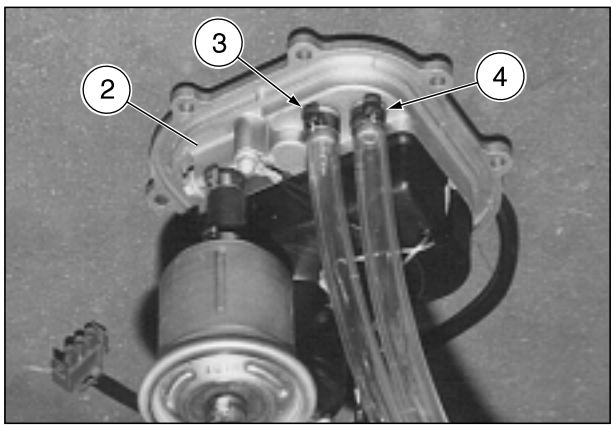
Before removing the screws (7 - 8), make sure the relevant electric terminals fastened on them are positioned correctly.

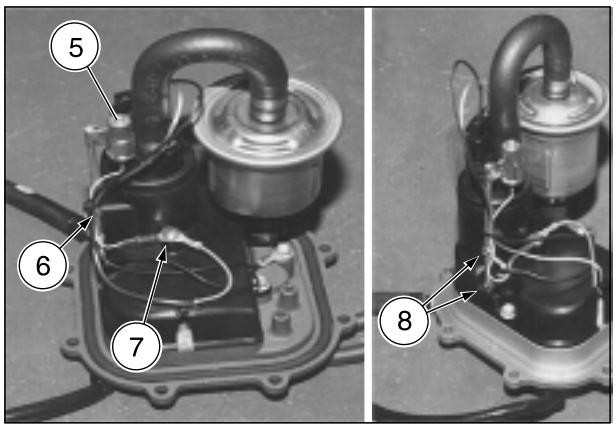
◆ Unscrew and remove the screw (7).
◆ Unscrew and remove the screws (8).
◆ Remove the sensor (5).

NOTE When reassembling, position the terminals of the electric cables correctly, in the relevant fastening positions, using the screws (7 - 8).







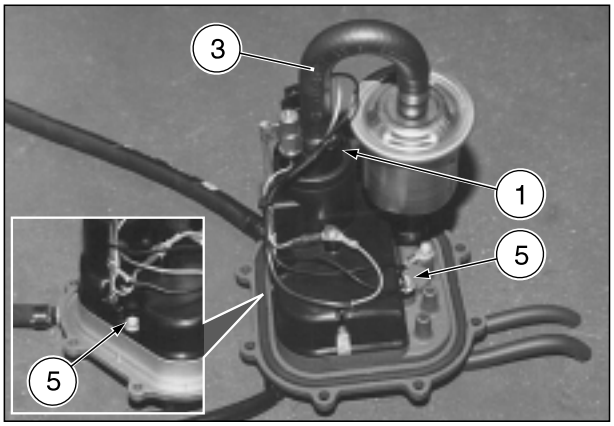


4.5 REMOVING THE FUEL SUPPLY PUMP

◆ Remove the whole fuel supply pump unit, see 4.3 (REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT).

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Release the head off the pipe clamp (1).
◆ Pull the fuel pipe (3) off the pump (2).
◆ Disconnect the electric connector (4).



⚠ CAUTION

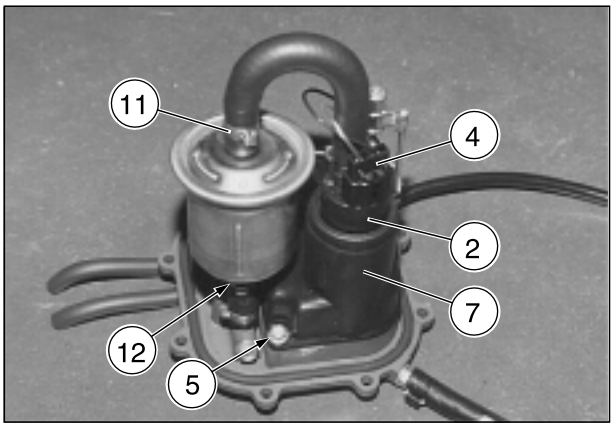
When reassembling, make sure the electric connector (4) is plugged in properly.

◆ Unscrew and remove the screws (5).

⚠ CAUTION

When performing the operations below, take care not to entangle the electric cables.

◆ Bend the fuel filter (6) over sideways and keep it held down.
◆ Lift the pump mount (7) just enough to be able to slide out the fuel pump (2).
◆ Slide the fuel pump (2) off the mount (7) and recover the O-ring (8).



⚠ CAUTION

If the rubber element (9) supporting the pump proves damaged, replace it.

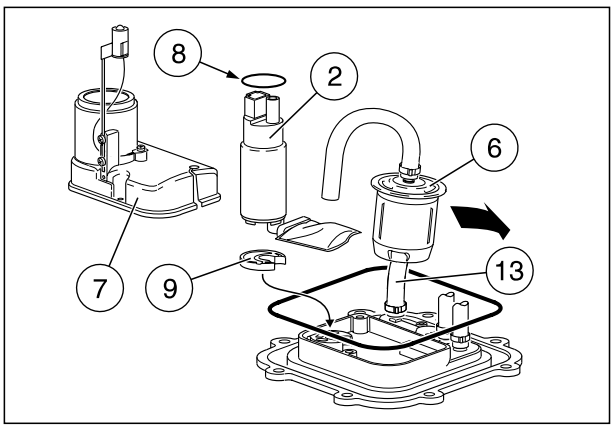
If the filtering mesh (10) features traces of sediments, clean it using a compressed air jet directed so that the impurities do not get inside.

4.6 REMOVING THE DELIVERY FILTER

◆ Remove the whole fuel supply pump unit, see 4.3 (REMOVING THE WHOLE FUEL SUPPLY PUMP UNIT).

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

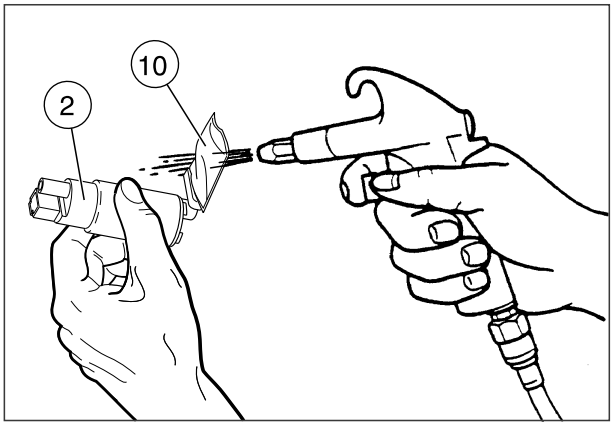
◆ Release the head off the pipe clamps (11-12).
◆ Slip the pipe (3) off the filter (6).
◆ Slip the filter (6) off the pipe (13).



⚠ CAUTION

Do not reuse a previously used filter.

◆ Replace the filter (6) with a new one of the same type.



4.7 ENGINE MANAGEMENT

4.7.1 FOREWORD

The “heart” of the engine’s management consists in the electronic Engine Control Unit which manages and optimizes the ignition and injection of the fuel.

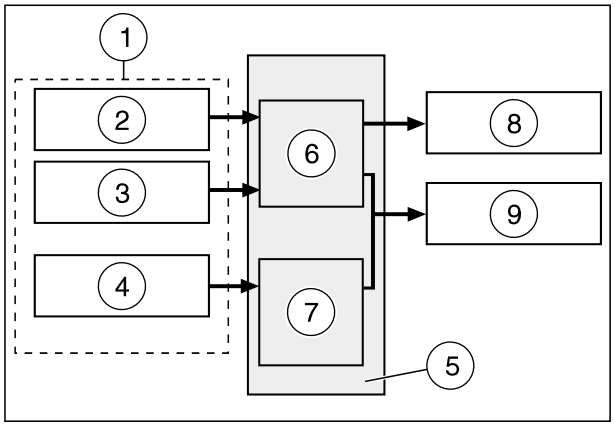
– The ignition management depends on the specific consumption levels.
  The engine control unit measures the exact ignition angle based on the engine rpm signals and on the position of the throttle valves (quantity of air).
– The engine control unit manages the injection time (quantity of fuel) based on the rpm signal, the throttle valve signal (quantity of air, pressure of induction pipe) and correction factors of the various sensors.
– Every time the engine is switched on, the engine control unit checks the sensors and ignition coils, making sure they are working correctly.
  If any anomalies are encountered, the message “ EFI ” flashes on the display.
– The safety devices inside the engine control unit stop ignition and the injection of the fuel when the speed exceeds the permissible peak rpm, which is 10500 rpm, or if the vehicle falls over.
  When the vehicle is set on the side stand and a gear is engaged, ignition is stopped, preventing the vehicle from starting.

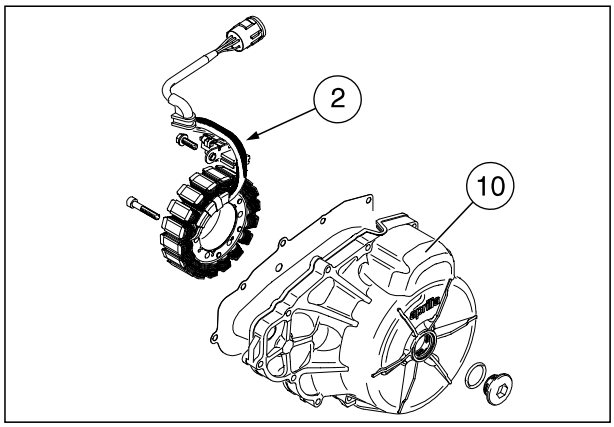
⚠ CAUTION

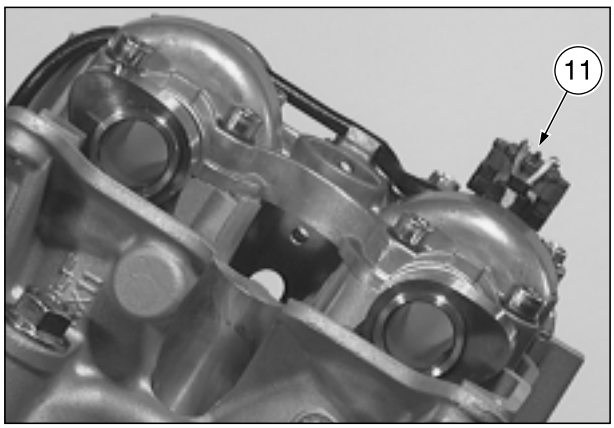
Any modifications or variations made to the exhaust system, intake system or the engine control unit may result in serious damage to the engine.
The assembly, modification or use of non-original parts shall cause any warranty to become void and shall exempt the manufacturer from any liability.

Key

1) Signals
2) Driving shaft position sensor (engine rpm)
3) Throttle valve potentiometer (position of the throttle valves)
4) Other sensors
5) Engine control unit
6) Standard data
7) Correction factors
8) Ignition coil (ignition angle)
9) Injector (injection time)







4.7.2 SENSORS

Driving shaft position sensor (2)

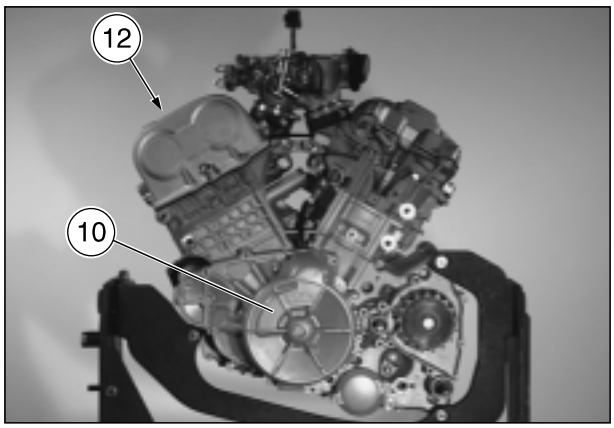
Location: in the flywheel cover (10)

The signals are emitted by the transducers located on the rotor.
The engine speed and the position of the driving shaft are calculated based on the signals emitted.

Camshaft position sensor (11)

Location: in head “1” (12) (front).

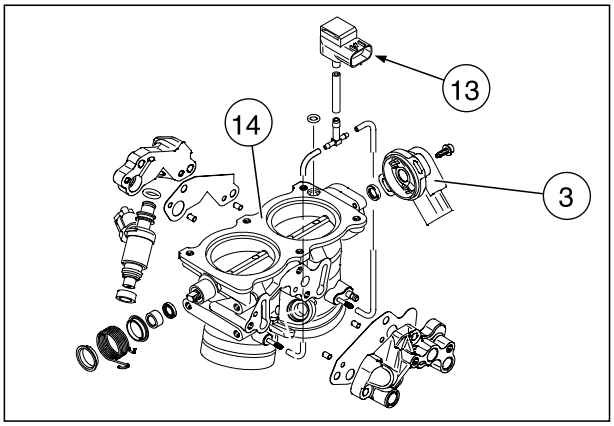
The signal is emitted by a transducer located on the control gear of the output camshaft.
Based on this signal, the engine control unit calculates the position of cylinder “1” (front) and “2” (rear) during the work cycle.



Intake pressure sensor (13)

Location: in the intake manifold.

The pressure measured in the induction pipe is converted into a voltage signal.
Moreover, the injection time also depends on the induction pipe pressure, especially when the throttle valve opening angle is limited (during idling).



Throttle valve potentiometer (3)

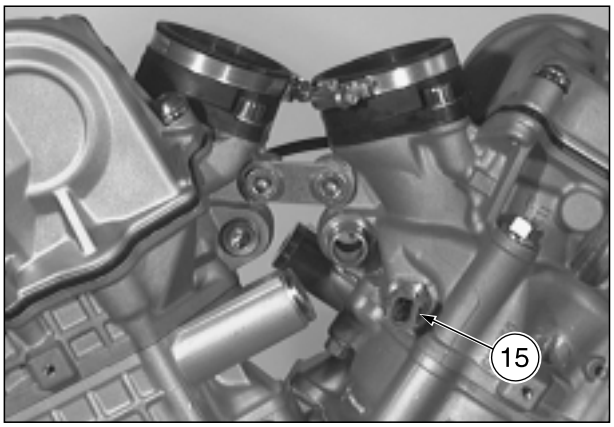
Location: on the throttle body (14).

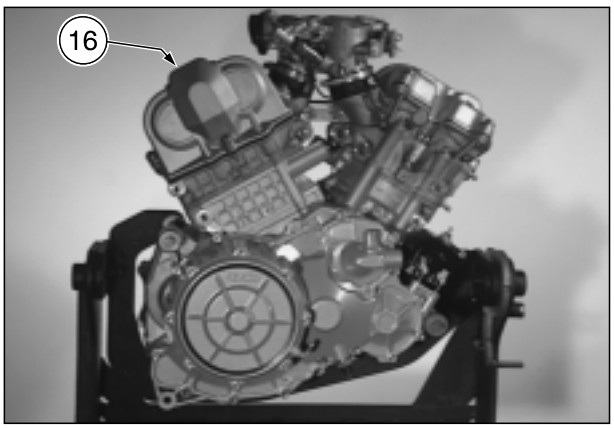
The throttle valve potentiometer measures the position of said valves and acts as the main parameter in determining the injection time and ignition angle.

Coolant thermistor (15)

Location: on head “2” (16) (rear cylinder).

The temperature sensor detects the coolant temperature and is required to correct the injection time.
The injection time is increased if the coolant has not yet reached the working temperature.





Atmospheric pressure sensor

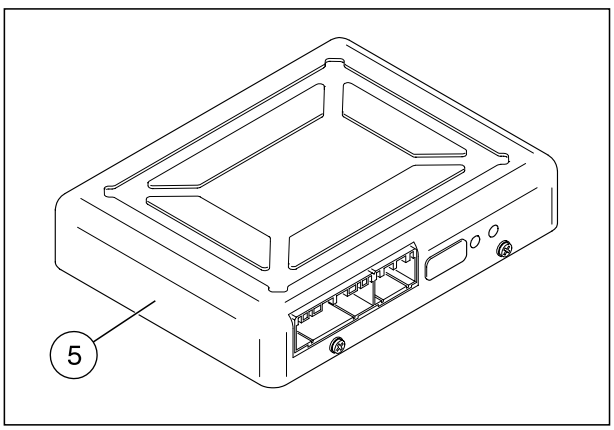
Location: inside the engine control unit (5).

The intake pressure measured by the sensor is converted into a voltage signal and is required by the engine control unit to correct the injection time.

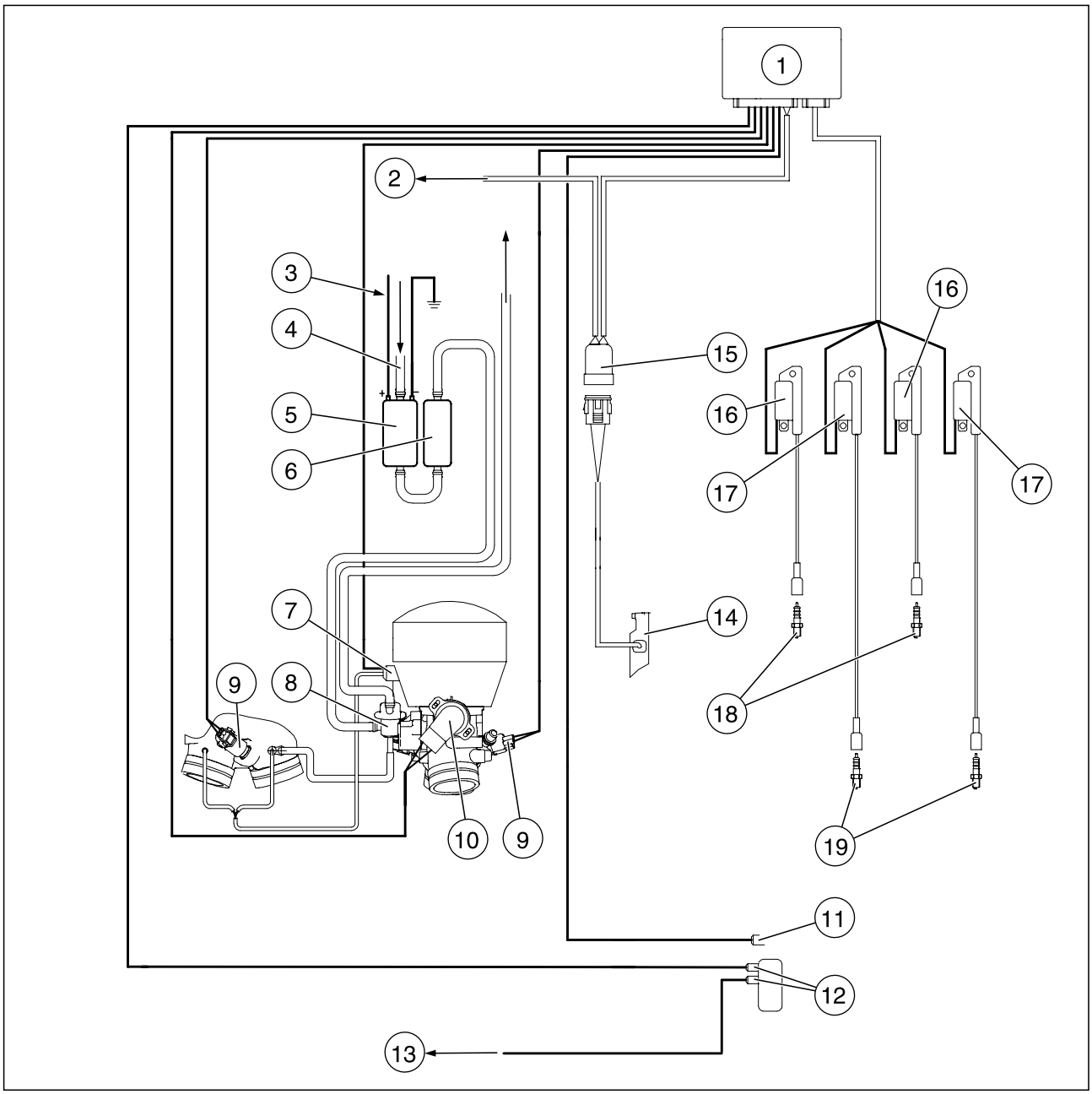
Air thermistor

Location: in the intake pipe of the left-hand air conveyor.

The resistance measured by the thermistor is converted into a voltage signal and is required by the engine control unit to correct the injection time.



4.7.3 INJECTION SYSTEM DIAGRAM

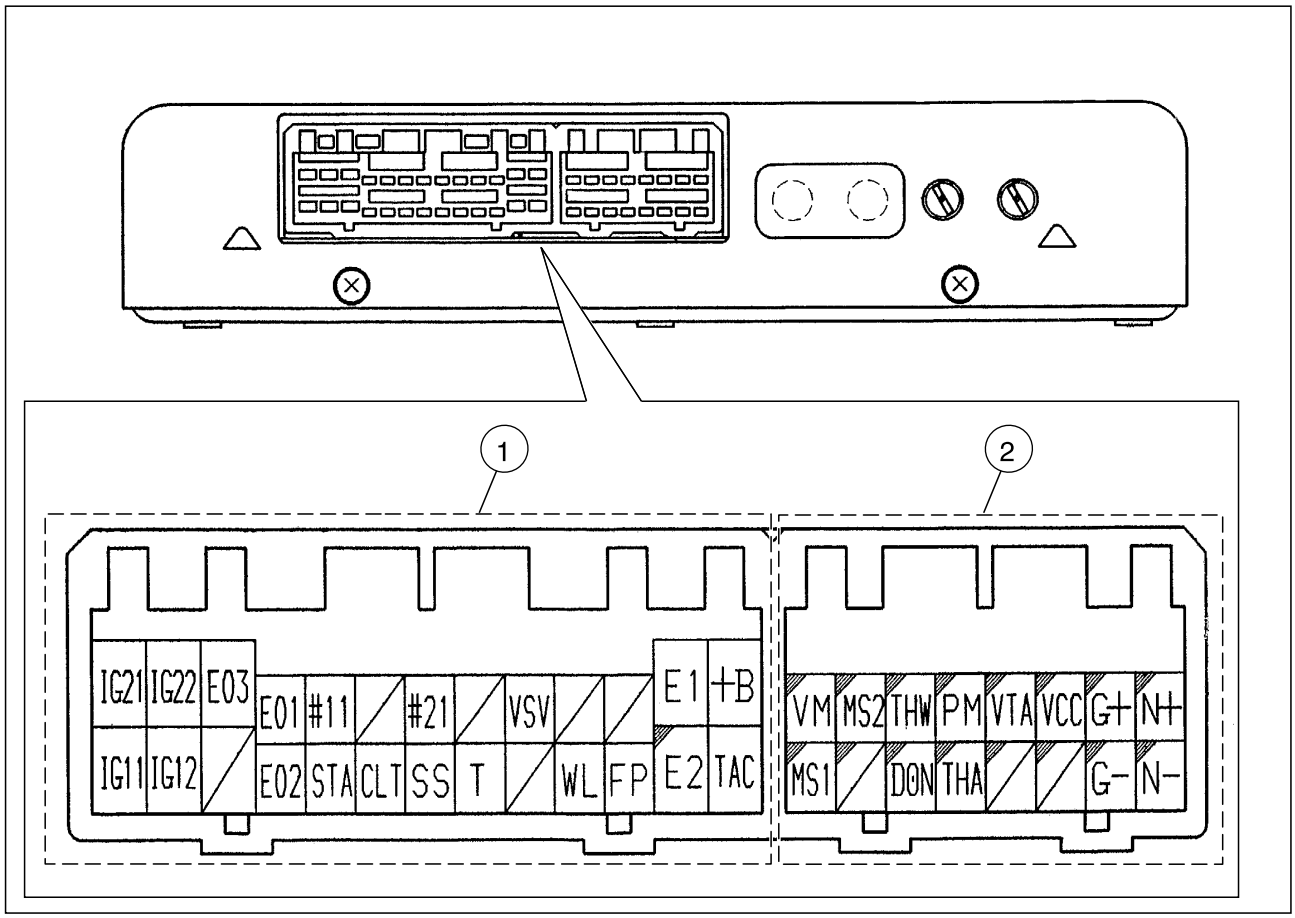


Key

1) Engine control unit
2) To voltage regulator
3) Supply voltage
4) Fuel suction from tank
5) Fuel pump
6) Fuel filter
7) Intake pressure sensor
8) Fuel pressure regulator
9) Injectors
10) Throttle valve potentiometer
11) Camshaft position sensor
12) Thermistors
13) To multifunction display, right-hand side
14) Driving shaft position sensor and generator
15) Driving shaft position sensor and generator connector
16) HV ignition coil cylinder “1” (front)
17) HV ignition coil cylinder “2” (rear)
18) Spark plug cylinder “1” (front)
19) Spark plug cylinder “2” (rear)

4.7.4 ENGINE CONTROL UNIT CONNECTORS

For further details see 6.17 (CONNECTIONS TO THE ENGINE CONTROL UNIT).



26-pin connector (1)	
Terminal labelling	**Connections**
+ B	Battery connection positive pole **"+"**
E 1	Earth (for control circuit)
VSV	Empty
# 21	Injector cylinder **"2"** (rear)
# 11	Injector cylinder **"1""** (front)
E 01	Earth
E 03	Earth
IG 22	HV ignition coil cylinder **"2"** (rear)
IG 21	HV ignition coil cylinder **"2"** (rear)
TAC	Revolution counter
E 2	Sensor earth
FP	Fuel pump relay
WL	Multifunction display
T	Test (automatic fault search, dealer mode)
SS	Side stand switch
CLT	Clutch control lever switch
STA	Starter motor relay
E 02	Earth
IG 12	HV ignition coil cylinder **"1"** (front)
IG 11	HV ignition coil cylinder **"1"** (front)

16-pin connector (2)	
Terminal labelling	**Connections**
N +	Driving shaft position sensor **"+"**
G +	Camshaft position sensor
VCC	Intake pressure sensor and throttle valve potentiometer
VTA	Throttle valve potentiometer
PM	Intake pressure sensor
THW	Coolant thermistor
MS 2	Earth
VM	Fuel pump
N -	Driving shaft position sensor **"–"**
G -	Camshaft position sensor
THA	Air thermistor - Intake pressure sensor
DON	Fall sensor
MS 1	Earth

4.7.5 AUTOMATIC TESTING

See 6.4 (IGNITION SYSTEM).

4.7.6 ELIMINATING ELECTRONIC SYSTEM FAULTS ACCORDING TO THE INFORMATION SENT UP ON THE DISPLAY

⚠ WARNING

Take care around the high voltage in the ignition system.

Never disconnect connections with the engine running.

Whenever work is performed in the ignition system, always make sure the ignition switch is set to "⊠" and the battery disconnected, unless otherwise indicated (when disconnecting the battery, disconnect the negative pole "–" first).

⚠ CAUTION

All measurements must be taken with the components at a temperature of 20°C (68°F).

General instructions regarding the elimination of faults: as soon as the fault has been located, remove the defective component.

4.7.7 CAMSHAFT POSITION SENSOR

Fault code "11"

See 6.4.6 (CHECKING THE CAMSHAFT POSITION SENSOR).

4.7.8 DRIVING SHAFT POSITION SENSOR

Fault code "12"

See 6.4.5 (CHECKING THE PICK-UP).

4.7.9 INTAKE PRESSURE SENSOR

Fault code "13"

See 6.4.11 (CHECKING THE INTAKE PRESSURE SENSOR).

4.7.10 INTAKE PRESSURE SENSOR

Fault code "14"

- Check for pressure loss in the connection pipes (1-2-3) and make sure the flow is regular.
- Check the wiring and connections of the pressure sensor.

NOTE Where necessary, replace the pressure sensor or engine control unit.

4.7.11 THROTTLE VALVE POTENTIOMETER

Fault code "15"

See 6.4.10 (CHECKING THE THROTTLE VALVE POTENTIOMETER).

4.7.12 COOLANT THERMISTORS

Fault code "21"

See 6.4.8 (CHECKING THE COOLANT THERMISTOR OPERATION).

4.7.13 AIR THERMISTORS

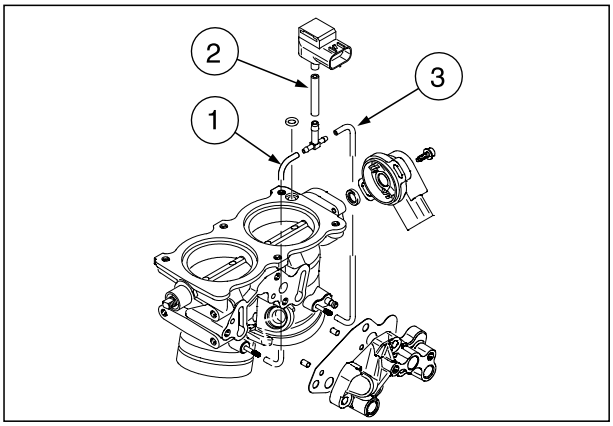
Fault code "22"

See 6.4.9 (CHECKING THE AIR THERMISTOR OPERATION).

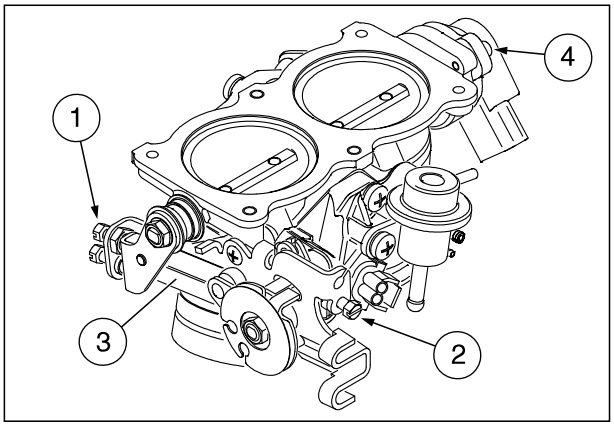
4.7.14 IGNITION COILS

Fault code "33", "34", "35", "36"

See 6.4.4 (CHECKING THE IGNITION COILS).



4.8 THROTTLE BODY



⚠ CAUTION

The screws (1) for the standard adjustment of the throttle valves and for increasing idling (2) are painted and cannot be adjusted.

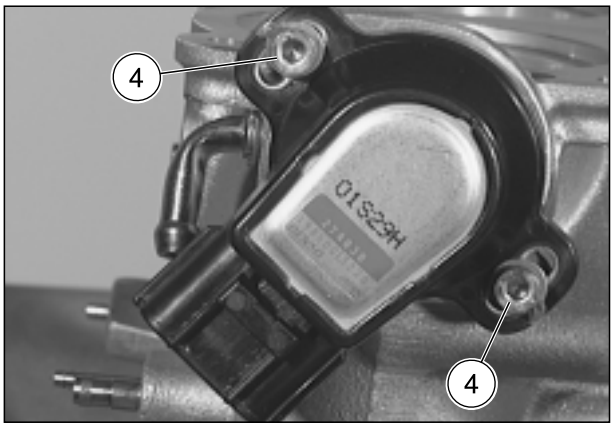
Only when the whole cable support bracket (3) is replaced can the two adjusting screws be turned.

The two M4x12 screws (4) fastening the throttle valve potentiometer are painted and can only be removed in the event the actual sensor is replaced.

4.8.1 REMOVING THE INJECTORS

See 4.8.2 (REMOVING THE THROTTLE BODY).

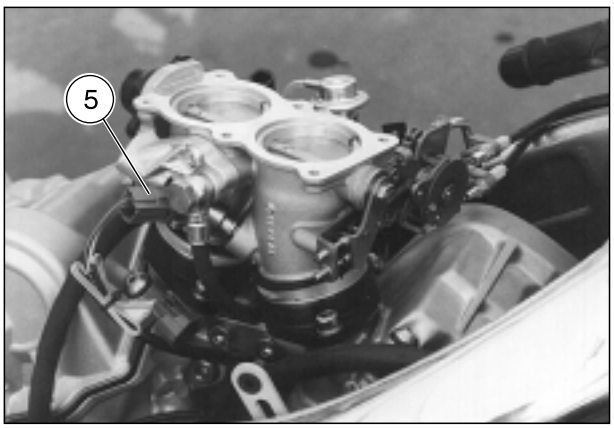
See 6.4.12 (CHECKING THE INJECTORS) for the checking procedure.



4.8.2 REMOVING THE THROTTLE BODY

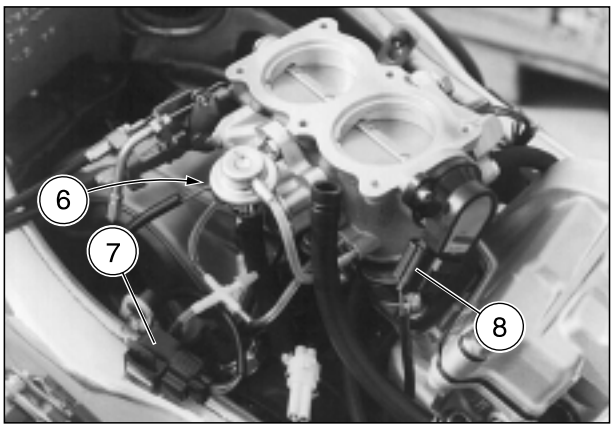
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

- Partially remove the fuel tank, see 7.1.4 (PARTIAL REMOVAL OF THE FUEL TANK).
- Remove the air filter casing, see 7.1.7 (REMOVING THE AIR CLEANER CASE).
- Disconnect the electric connectors:
  - right injector (5);
  - left injector (6);
  - intake pressure sensor (7);
  - throttle valve potentiometer (8).



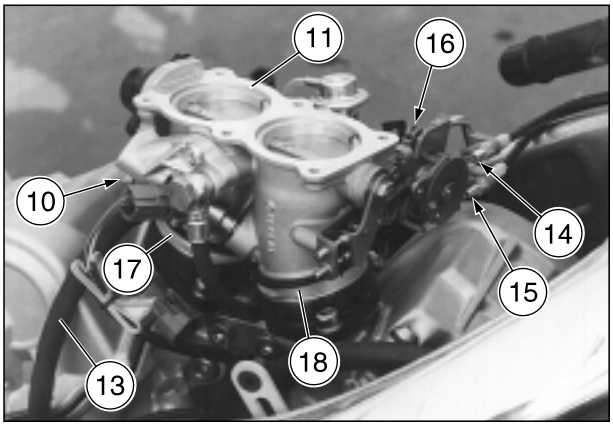
⚠ CAUTION

When reassembling, make sure the electric connectors are plugged in properly.



NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Release the head off the pipe clamps (9 - 10).
◆ Pull the pipes (12 - 13) off the throttle body (11).
◆ Disconnect the two throttle cables (14 - 15).



⚠ CAUTION

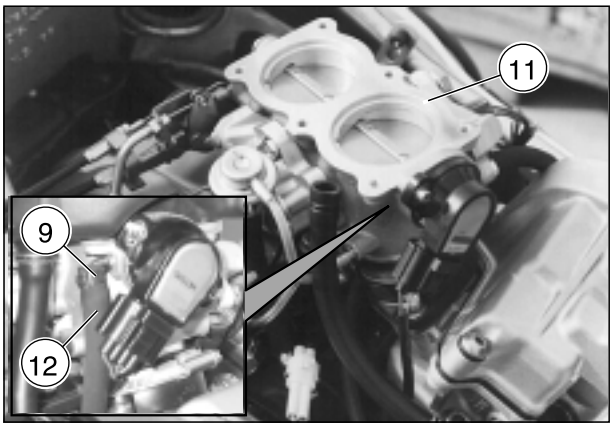
When reassembling, make sure the two throttle cable adjusters are properly fastened to the respective couplings and check and, where necessary, restore the correct freeplay, see 2.11.3 (ADJUSTING THE ACCELERATOR CONTROL).

◆ Disconnect the cold-start control cable (16).

⚠ CAUTION

When reassembling, make sure the cold-start control cable adjuster is properly fastened to the respective coupling and check and, where necessary, restore the correct freeplay, see 2.12 (COLD START CABLE).

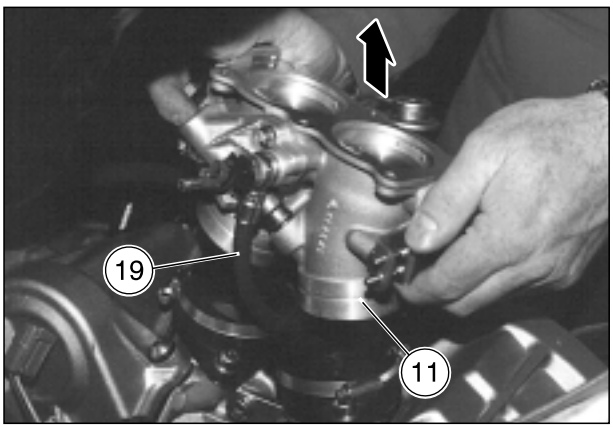
◆ Loosen the two clamps (17 - 18).



⚠ CAUTION

When removing the throttle body (11), be careful to make sure it remains connected to the fuel tank (20) by means of the fuel pipe (19).

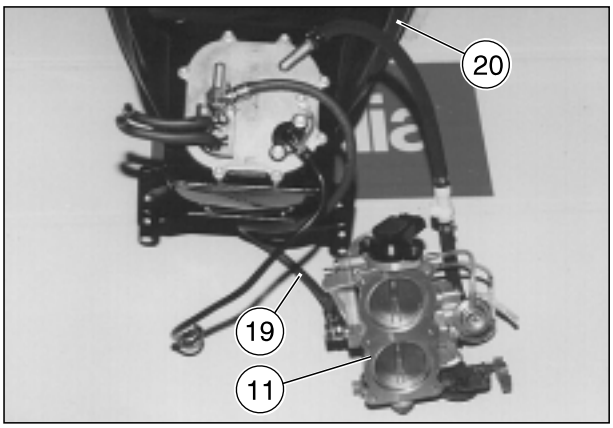
◆ Grip the throttle body (11) firmly and hitch it one way and the other to lift it and slide it off the intake flanges.
◆ Place the whole throttle body (11) and fuel tank (20), still connected together, on a clean surface.



⚠ CAUTION

When reassembling:

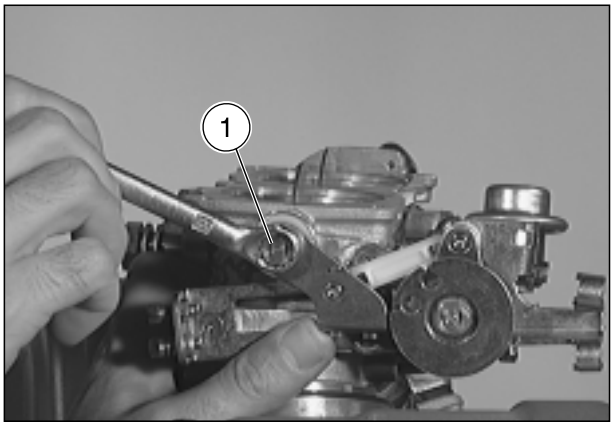
- **the fuel delivery pipe (19) must not be entangled or positioned where it is likely to be squashed by other components; should it appear damaged or deteriorated, it must be replaced;**
- **the fuel delivery pipe (19) must be placed so that it reaches the right-hand side of the throttle body (11), passing under said body between the two intake flanges;**
- **the throttle body (11) must be fitted perfectly on the intake flanges;**
- **the clamps (17 - 18) must be properly tightened.**



4.8.3 DISASSEMBLING THE THROTTLE BODY

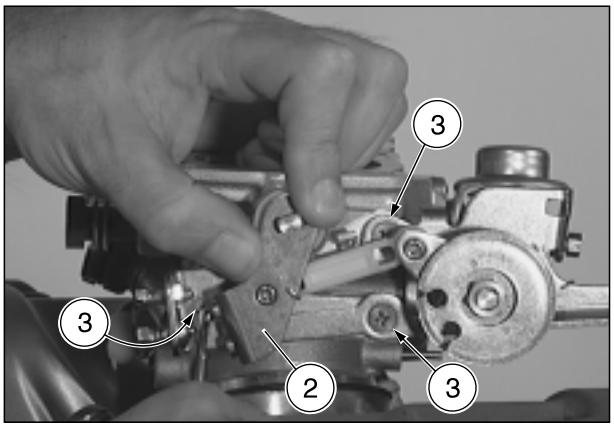
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

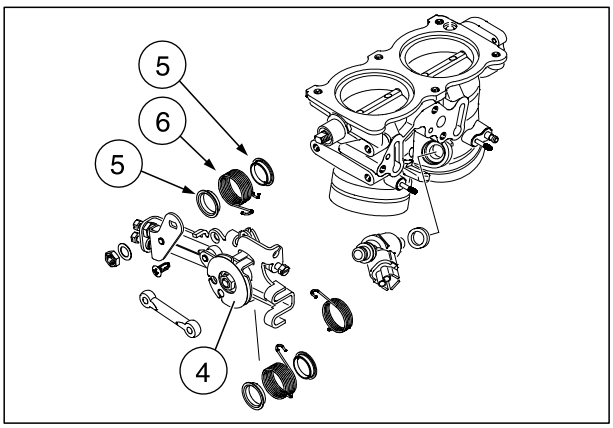
◆ Unscrew and remove the M8x1 nut (1) and remove the spring washer.

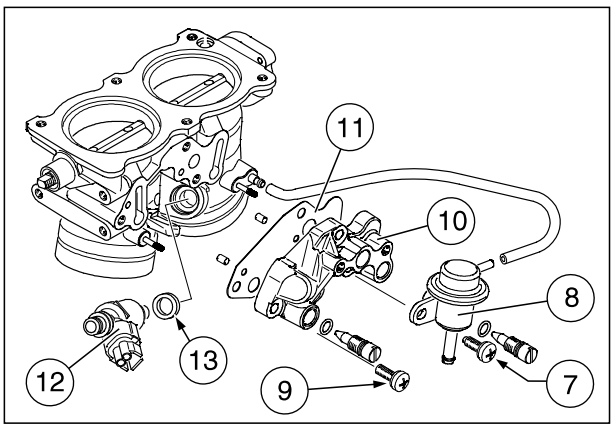


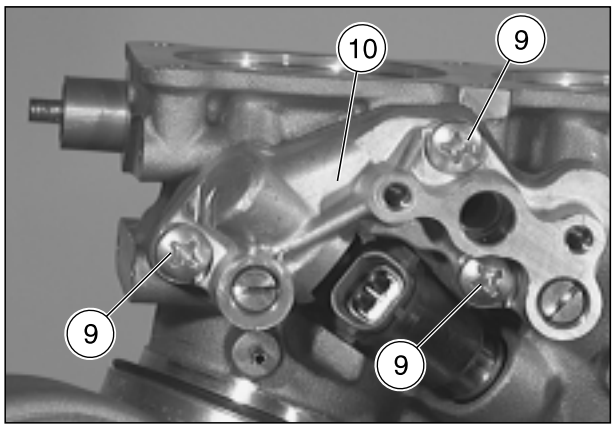
◆ Turn the throttle valve control lever (2) slightly, unscrew and remove three hex-head M5x12 screws (3).
◆ Slip the whole support bracket (4) securing the throttle cables, with the two bushes (5) and the torsion spring (6), off the throttle body.
◆ Unscrew and remove the two M 6x16 screws (7) and remove the fuel pressure regulator (8) complete with O-ring.
◆ Unscrew and remove the three M6x25 screws (9) and remove the left injector support (10) - together with the relevant gasket (11), injector (12) and sealing ring (13) - from the throttle body.

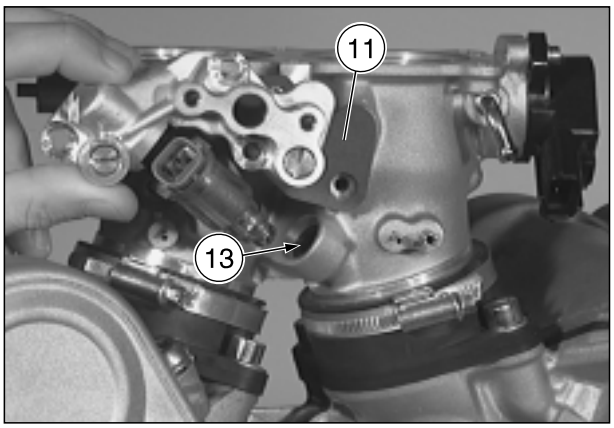
NOTE The injector's sealing ring (13) may be kept inserted in the slot on the throttle body.





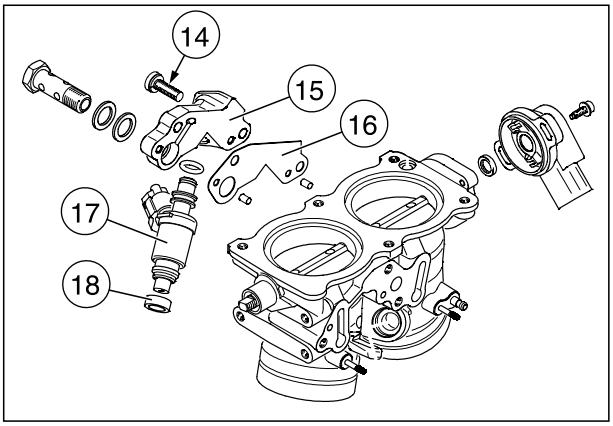




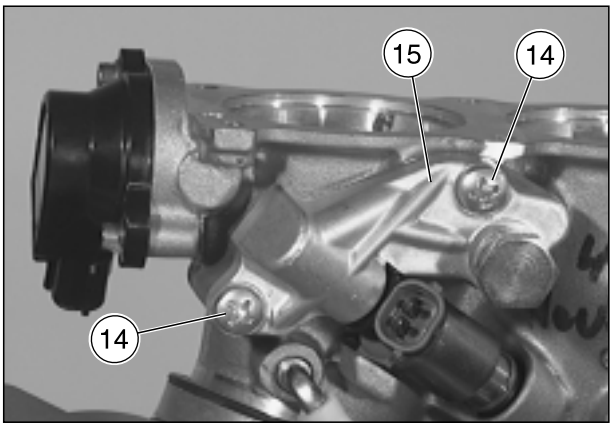


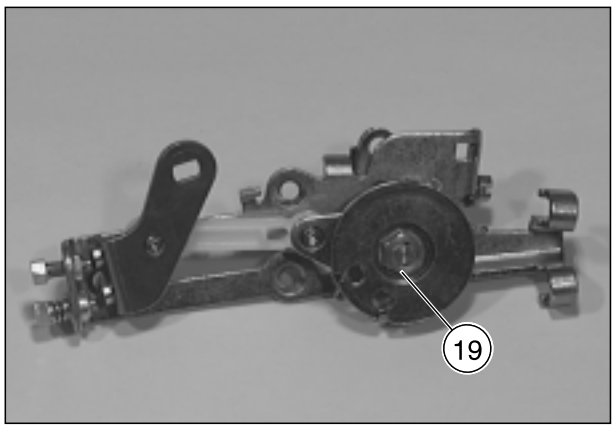
◆ Unscrew and remove the two M6x25 screws (14) and the right injector support (15), together with the relevant gasket (16), injector (17) and sealing ring (18).

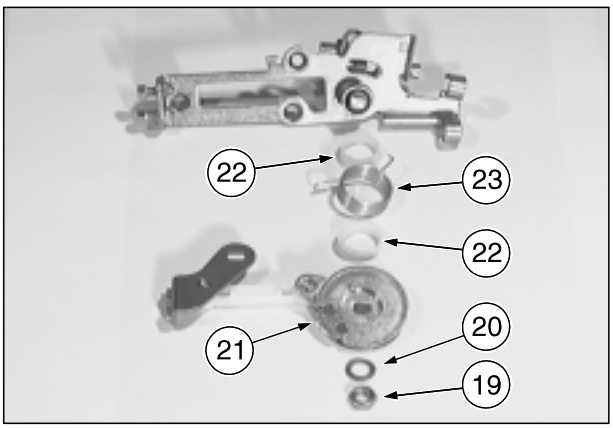
NOTE The injector's sealing ring (18) may be kept inserted in the slot on the throttle body.

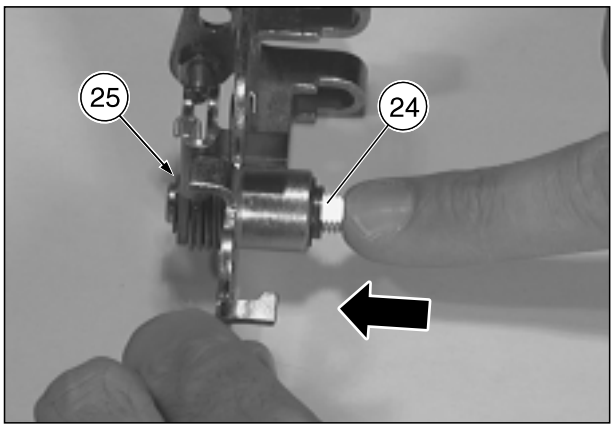


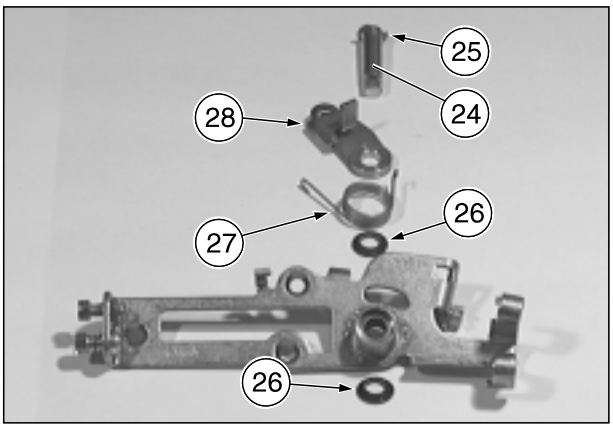
◆ Unscrew and remove the M8x1 nut (19) and remove the spring washer (20), the pulley (21), the two bushes (22) and torsion spring (23).
◆ Slide the fulcrum pin (24), together with the lock washer (25), out of the hole on the throttle cable support bracket and remove the two shaft sealing rings (26) with the torsion spring (27) and cold-start lever (28).











4.8.4 INSPECTING THE THROTTLE BODY

TESTING THE INJECTOR

⚠ WARNING

The fuel is explosive and highly inflammable. Keep fuel away from ignition sparks, heat and flames.

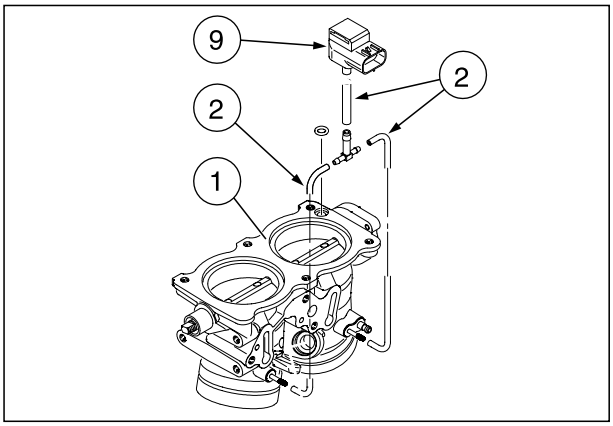
NOTE The injection valves may also be checked whilst fitted.

◆ Check the following components:

– wiring and connections;
– injector or injection signal of the engine control unit, see 6.4 (IGNITION SYSTEM).

Checking injector resistance:

See 6.4.12 (CHECKING THE INJECTORS).

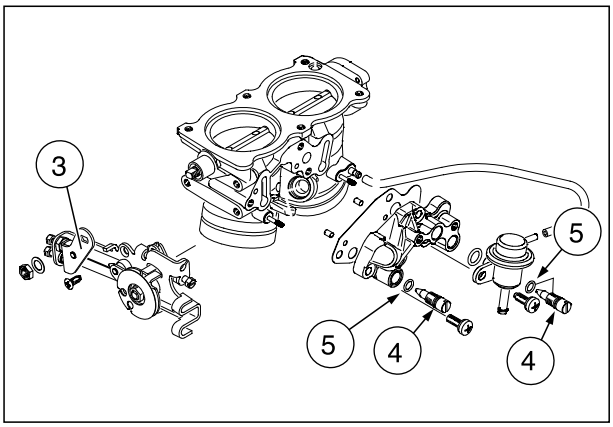


THROTTLE BODY

⚠ CAUTION

Use neutral detergents only.
For cleaning, use a product for removing sealing, a degreasing product or a detergent for cleaning when cold.

◆ Clean all the openings and pipes of the throttle body (1) using compressed air.



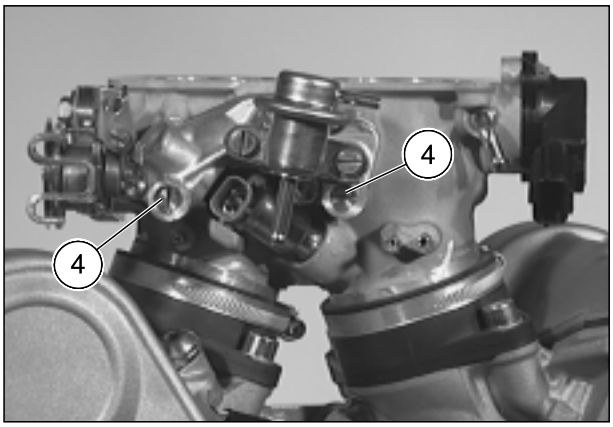
⚠ CAUTION

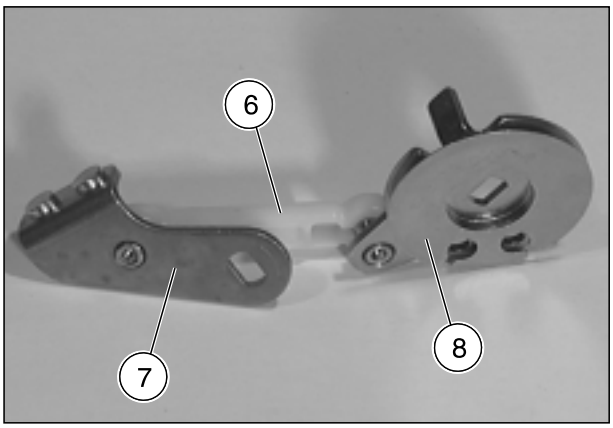
Once the intake pressure sensor (9) its installed, not utilice the compressed air for the pipes cleaning; danger for damages.

◆ Check the pipes of the intake pressure sensor (2), watching out for any clogging.
◆ Check the throttle valves unit and the cable fastening mechanism (3), watching out for any signs of mechanical damage.

NOTE In the event the synchronization screws (4) or O-rings (5) are replaced, synchronize the cylinders, see 4.8.10 (CYLINDER SYNCHRONIZATION).

◆ Only unscrew the two cylinder synchronizing screws (4) when there are leaks.
◆ When replacing the tie rod of the ball joint (6), disengage the tie rod from the throttle valve control lever (7) and throttle cable pulley (8).
◆ Once a new ball joint tie rod (6) has been fitted, make sure it moves freely.





4.8.5 REFITTING THE THROTTLE BODY

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

After disassembling the throttle body, replace all the gaskets, O-rings, torsion springs, bushes and seals. These components are supplied with the repair kit.

- ◆ Fit the new O-rings (1) and seals (2) on both injector.
- ◆ Insert the injector (3) in the left injector support (4) and in the right injector support (5).
- ◆ Fit the left injector support gasket (6), right injector support gasket (7) and the two seals (8) on the throttle body.
- ◆ Install the complete left injector support (4) and right injector support (5) in the throttle body, fastening them with the new M6x25 screws respectively (9 - 10).

Driving torque of screws (9 - 10): 9 Nm (0.9 kgm).

- ◆ If the synchronizing screws (11) and respective O-rings (12) have been replaced, screw on the screws (11) fairly tight until they touch the stop and then unscrew them a single turn.

Presetting of synchronizing screws (11): 1 turn.

⚠ CAUTION

The precise adjustment of the screws (11) must be performed using a vacuum gauge, see 4.8.10 (CYLINDER SYNCHRONIZATION).

- ◆ Fasten the fuel pressure regulator (13) using the two M6x16 screws (14).

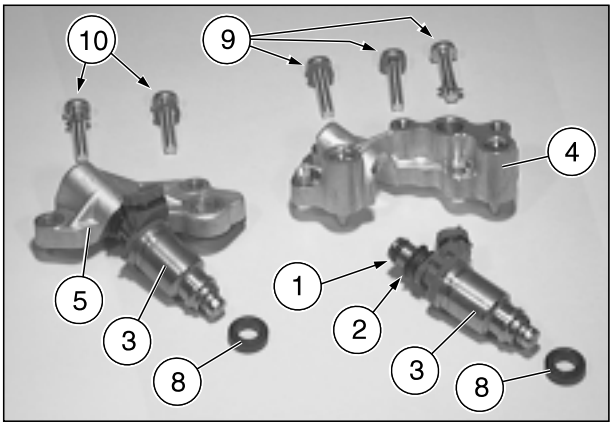
Driving torque of screws (14): 3.5 Nm (0.35 kgm).

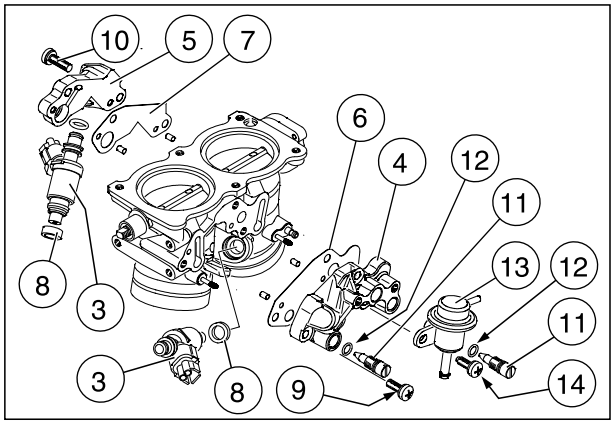
NOTE Smear a film of grease over the surfaces of the fulcrum pin (18), see 1.6 (LUBRICANT CHART).

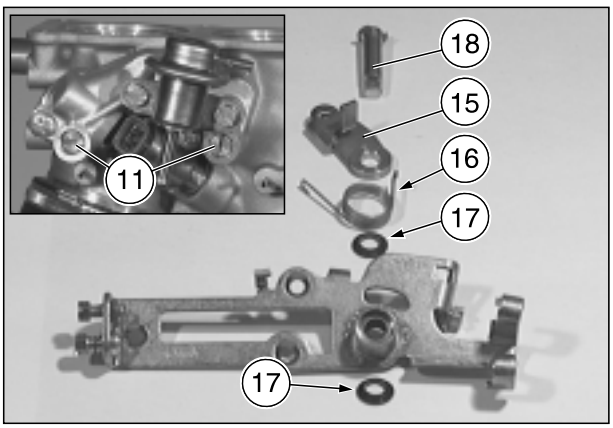
- ◆ Insert the cold-start lever (15), torsion spring (16) and shaft sealing ring (17) on the fulcrum pin (18).
- ◆ Insert the complete fulcrum pin (18) in the throttle cable support bracket.

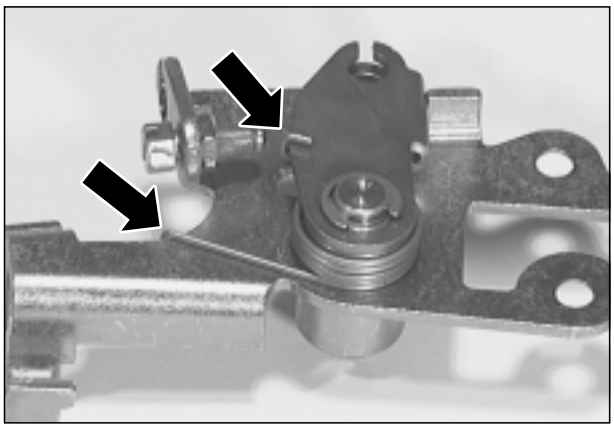
NOTE Make sure the torsion spring is hooked to the cold-start lever (15) and cable support bracket.

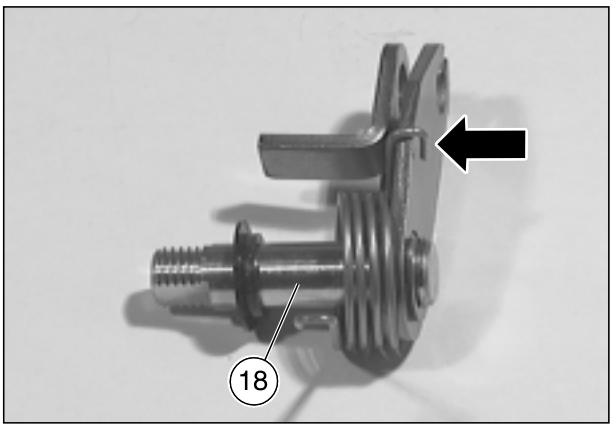
- ◆ Spray chain grease onto the spring (16), see 1.6 (LUBRICANT CHART).



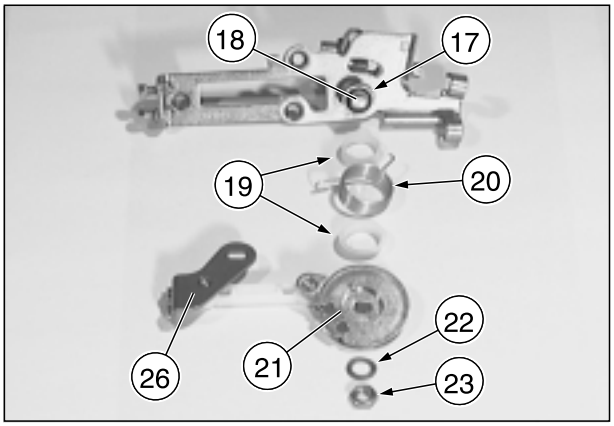








◆ Insert the shaft sealing ring (17) on the fulcrum pin (18).
◆ Fit the two bushes (19) and torsion spring (20).
◆ Fit the pulley (21) on the throttle cable support bracket.



⚠ CAUTION

Make sure that the ends of the torsion spring (20) are hooked onto the throttle cable support bracket and pulley (21).

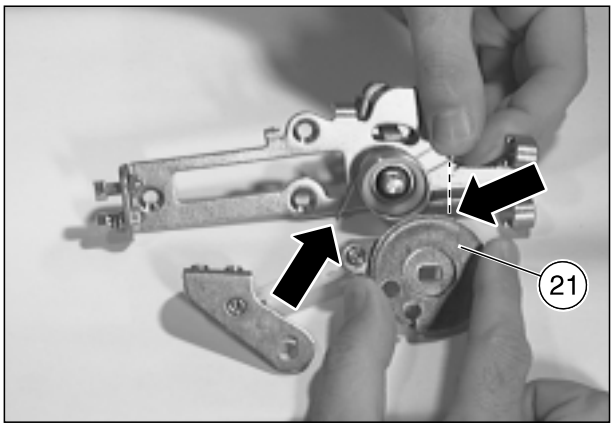
NOTE Spray a temporary lubricant AP-LUBE on the spring (20), see 1.7.2 (USE OF CONSUMABLES).

◆ Fit the spring washer (22).

NOTE Apply LOCTITE® 243 on the thread of the nut (23).

◆ Screw on nut M8x1 (23) and tighten it.

Driving torque of nut (23): 3 Nm (0,3 kgm).

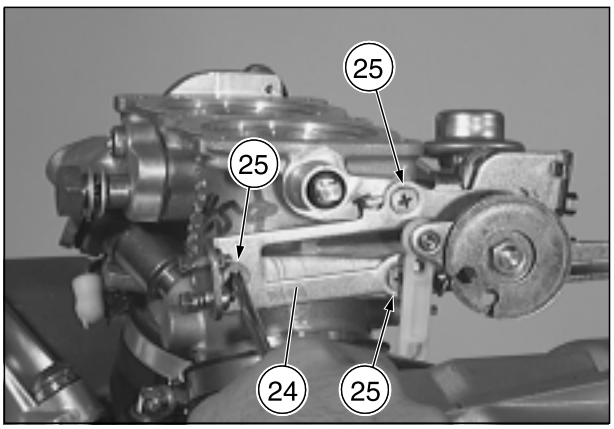


NOTE Apply LOCTITE® 243 on the thread of the screws (25).

◆ Fasten the throttle cable support bracket (24) using the three M5x12 hex-head screws (25).

Driving torque of screws (25): 3 Nm (0.3 kgm).

◆ Fit the throttle valve control lever (26), see 4.8.6 (REPLACING THE THROTTLE VALVE CONTROL LEVER).

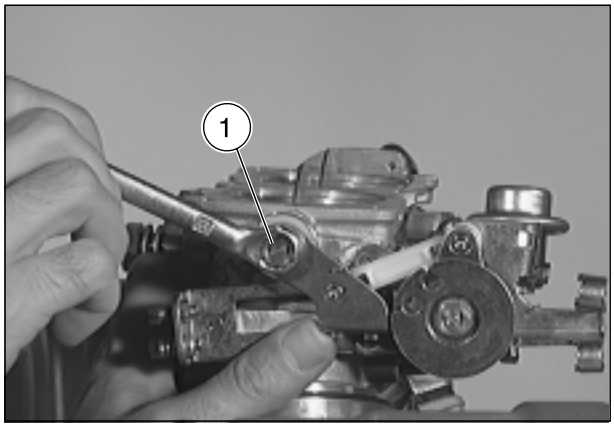


4.8.6 REPLACING THE THROTTLE VALVE CONTROL LEVER

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

DISASSEMBLY

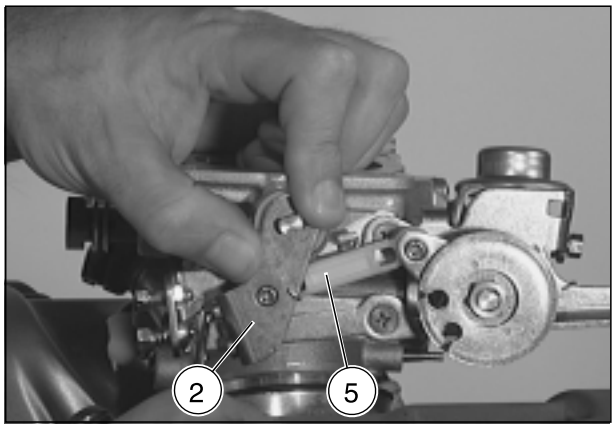
- Remove the fuel tank partially, see 7.1.4 (PARTIAL REMOVAL OF THE FUEL TANK).
- Remove the air filter casing, see 7.1.7 (REMOVING THE AIR CLEANER CASE).
- Unscrew and remove the M8x1 nut (1) and remove the spring washer.
- Slide out the control lever (2) and retrieve the two bushes (3) and torsion spring (4).
- Remove the control lever (2) from the tie rod of the ball joint (5).



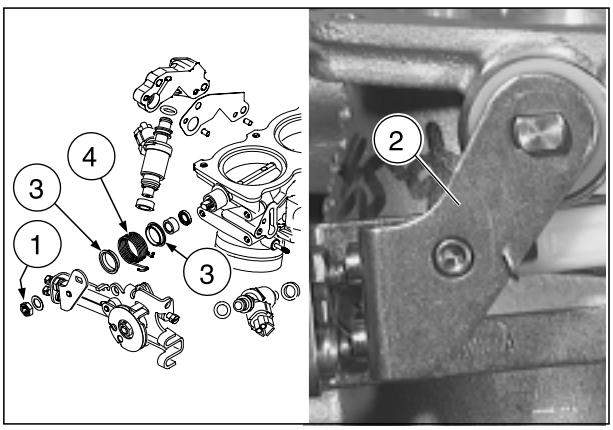
ASSEMBLY

⚠ CAUTION

For the vehicles with the following engine numbers, the throttle valve control lever (2) must be replaced with the new grey-coloured lever.



523579	525113 - 525118	525443 - 525597
523582	525120 - 525124	525605
523587	525126 - 525139	525609
523590 - 523592	525141 - 525148	525621
523594 - 523602	525150 - 525236	525629 - 525631
523604	525238 - 525275	525633 - 525635
523607 - 523609	525277 - 525278	525639
523612 - 523618	525280 - 525295	525641 - 525645
523621	525300 - 525302	525647 - 525648
523623 - 523624	525306 - 525321	525651
523626 - 523635	525324 - 525327	525653 - 525654
523637 - 523640	525329 - 525331	525657
523643	525344	525659
523645	525346 - 525347	525662
523648 - 523651	525350 - 525351	525665
523654 - 523656	525356 - 525358	525667
523658 - 523660	525365	525676 - 525681
523662 - 523673	525368 - 525371	525684
523675 - 523676	525373 - 525374	525686 - 525687
523678 - 523691	525376	525689 - 525690
523693 - 523698	525378	525699
523700 - 523713	525382 - 525387	525704
523715 - 523752	525389	525713
523754 - 523778	525392 - 525404	525731
523780 - 523793	525406	525750
523795 - 523892	525408	525765
523894 - 523948	525410 - 525412	525767
523950 - 523966	525414 - 525420	525883
523970 - 524610	525422	526070
524612 - 524679	525424 - 525427	526075
524683 - 524686	525430	526235 - 526237
524688 - 524999	525432 - 525435	526246 - 526249
525001 - 525007	525439	526254 - 526265
525009 - 525111	525441	



◆ Fit the two bushes (3) and torsion spring (4) on the throttle body.
◆ Fit the throttle valve control lever (2) on the throttle valve spindle.

NOTE Spray a temporary lubricant AP-LUBE on the spring (4), see 1.7.2 (USE OF CONSUMABLES).

⚠ CAUTION

Make sure the ends of the torsion spring (4) are hooked onto the throttle body and throttle valve control lever (2).

◆ Fit the spring washer.

NOTE Apply LOCTITE® 243 on the thread of the nut (1).

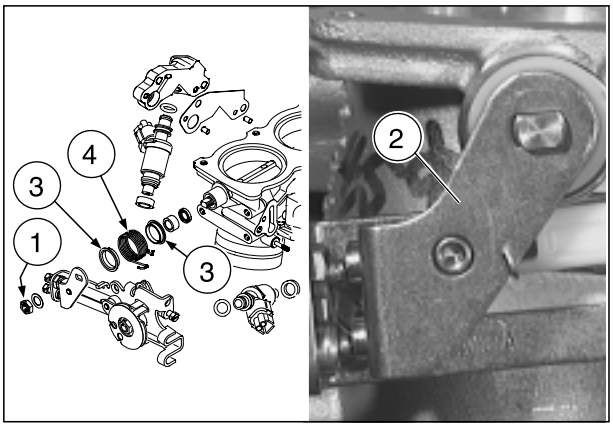
◆ Screw on the M8x1 nut (1) and tighten it.

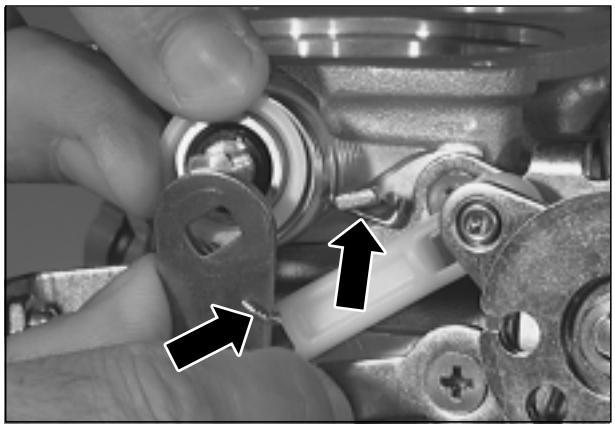
Driving torque (1): 3 Nm (0.3 kgm).

NOTE Once assembly is complete, make sure the levers rotate freely.

The throttle valve control lever (2) must be returned to its original position by the torsion spring.

Check for end play on the throttle valve control shaft, see 4.8.7 (CHECKING THROTTLE VALVE CONTROL SHAFT END PLAY) and adjust as necessary, see 4.8.8 (ADJUSTING THE THROTTLE BODY).

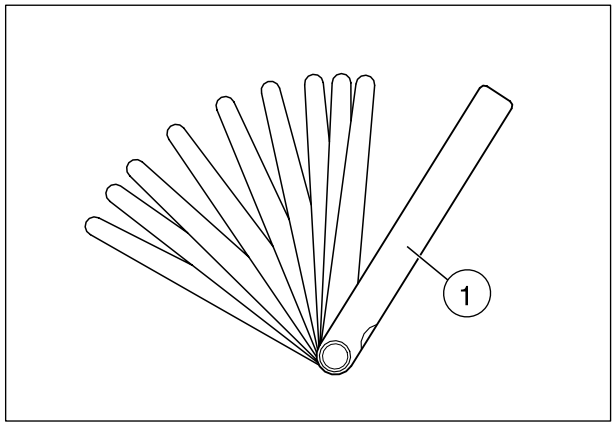




4.8.7 CHECKING THROTTLE VALVE CONTROL SHAFT END PLAY

◆ Remove the fuel tank partially, see 7.1.4 (PARTIAL REMOVAL OF THE FUEL TANK).
◆ Remove the air filter casing, see 7.1.7 (REMOVING THE AIR CLEANER CASE).

NOTE Have an appropriate thickness gauge (1) to hand with a 0.05 mm scale.



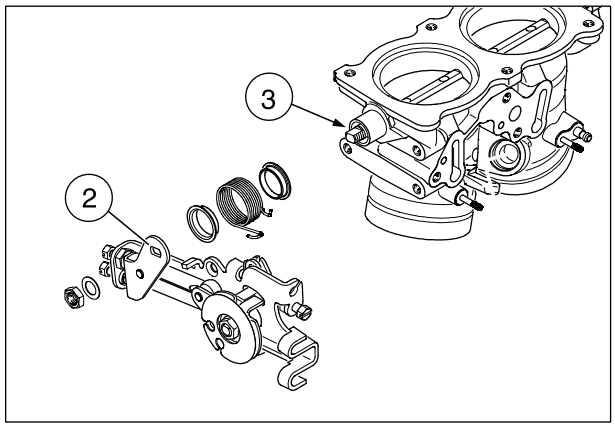
With throttle valves closed:

◆ Use the thickness gauge (1) to measure the minimum play between the lever (2) and the contact surface (3) on the throttle body in a number of points.

End play: min. 0.1 mm.

⚠ CAUTION

If the minimum value measured is less than 0.1 mm, the whole throttle body (cod. 295690) must be replaced.



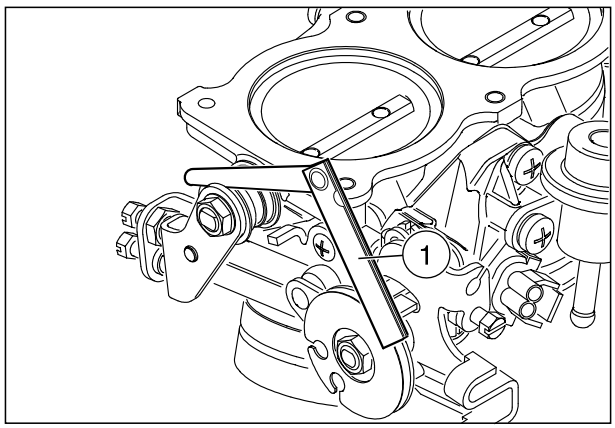
With throttle valves open:

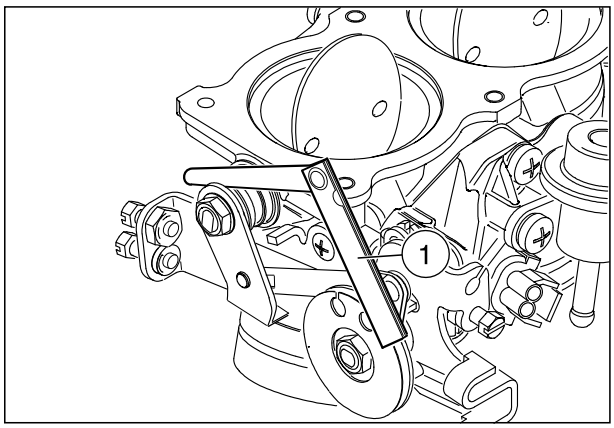
◆ Repeat the above procedure.

End play: min. 0.15 mm.

⚠ CAUTION

If the minimum value measured is less than 0.15 mm, the whole throttle body (cod. 295690) must be replaced.





4.8.8 ADJUSTING THE THROTTLE BODY

- Partially remove the fuel tank, see 7.1.4 (PARTIAL REMOVAL OF THE FUEL TANK).
- Remove the air filter casing, see 7.1.7 (REMOVING THE AIR CLEANER CASE).

SETTING IDLING

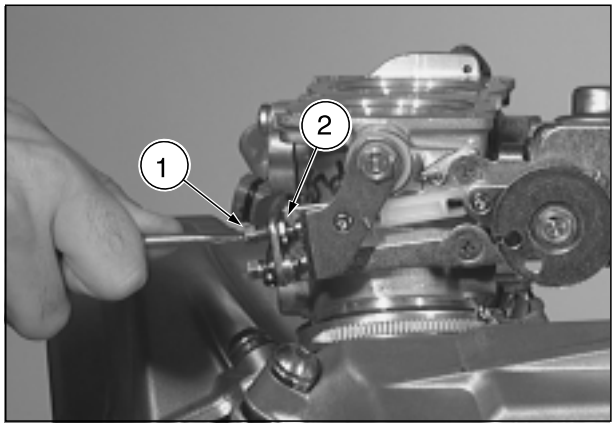
⚠ CAUTION

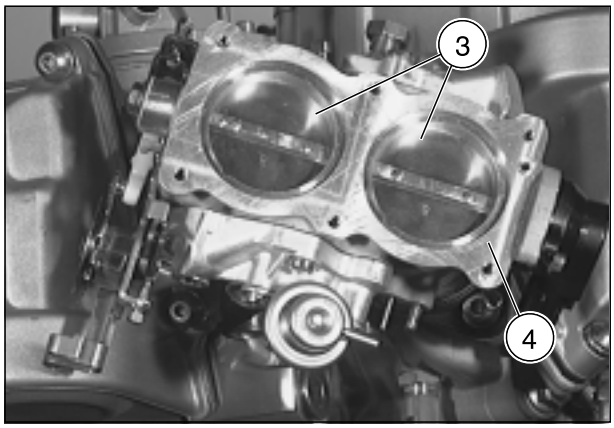
The idling adjusting screw (1) is painted and cannot be adjusted.

Only when the whole throttle cable support bracket is replaced can the adjusting screw (1) be turned again.

- Loosen the M5x0.5 nut (2).
- Unscrew the adjusting screw (1) until the throttle valves (3) are pressed up against the throttle body (4).
- Screw the adjusting screw (1) until it touches the stop onto the throttle valve control lever (5), and turn it another 1/2 - 3/4 turn before tightening the M5x0.5 nut (2).

Idling setting: 1/2 – 3/4 turn.





SETTING THE COLD-START DEVICE

⚠ CAUTION

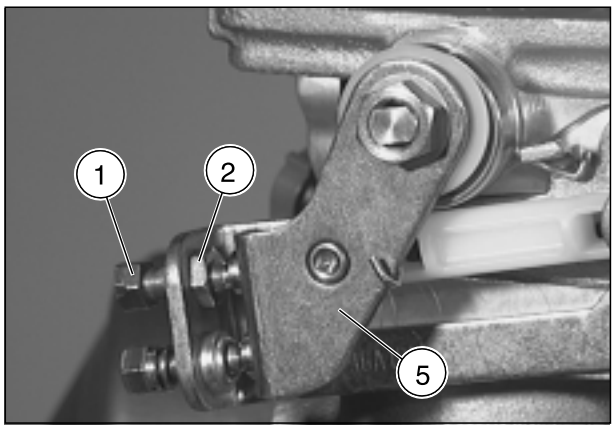
Whenever the whole throttle cable support bracket is replaced, the cold-start control adjusting screw (6) must be adjusted again once the idling adjusting screw (1) has been set.

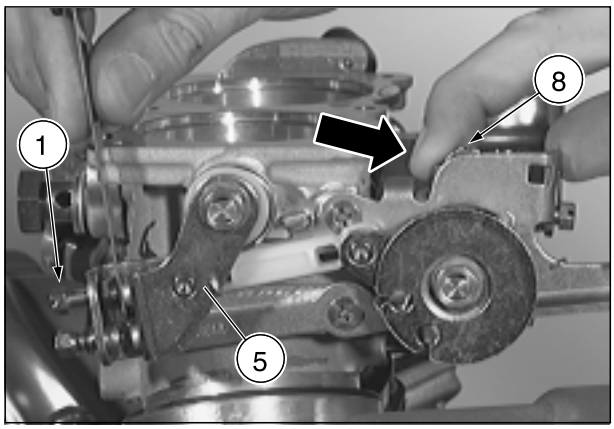
NOTE Have an appropriate thickness gauge.

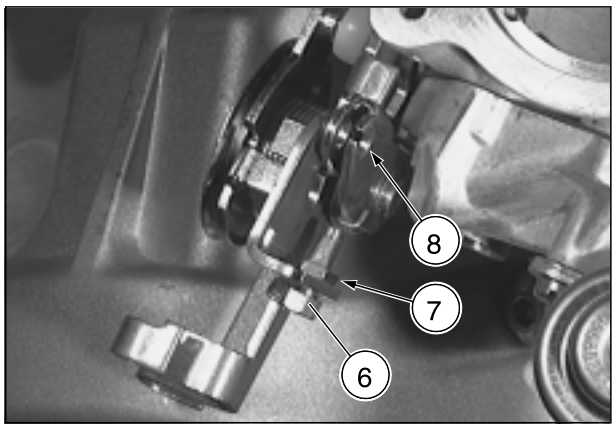
- Loosen the M5x0.5 nut (7).
- Pull back the cold-start lever (8) until it touches the screw (6).
- Adjust the screw (6) so that the clearance between the idling adjusting screw (1) and the throttle valve control lever (5) is in the range 1.6 to 1.8 mm.

Adjustment: 1.6 – 1.8 mm.

- Secure the screw (6) by tightening the M5x0.5 nut (7).



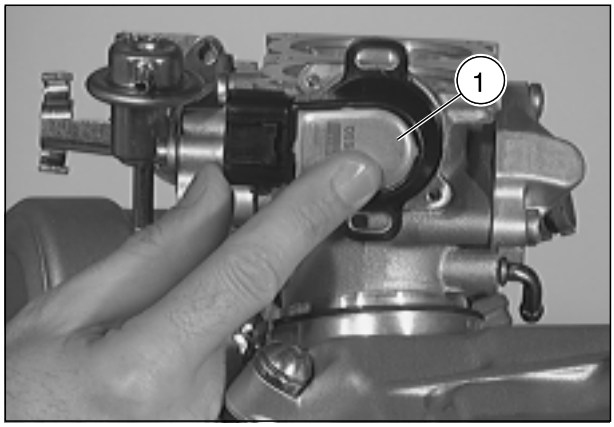




4.8.9 ADJUSTING THE THROTTLE VALVE POTENTIOMETER

⚠ CAUTION

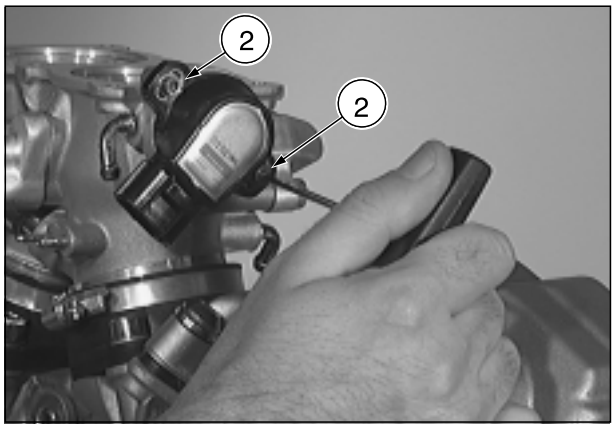
The two sunk hexagon cheese-head screws fastening the throttle valve potentiometer (1) are painted during production and cannot be loosened.
The throttle valve potentiometer can only be adjusted in the event of replacement.



◆ Place the throttle valve potentiometer (1) in a horizontal position on the throttle valve shaft and rotate it downwards.

NOTE Apply LOCTITE® 243 on the thread of the screws (2).

◆ Screw on the two M4x12 T.C.E.I. sunk hexagon cheese-head screws (2) and tighten the throttle valve potentiometer quite firmly, but so that the screws can still be turned further.
◆ Turn the ignition switch to position "○".
◆ To connect the TEST connectors (3).
◆ Turn the throttle valve potentiometer until the display longer reads "0" .



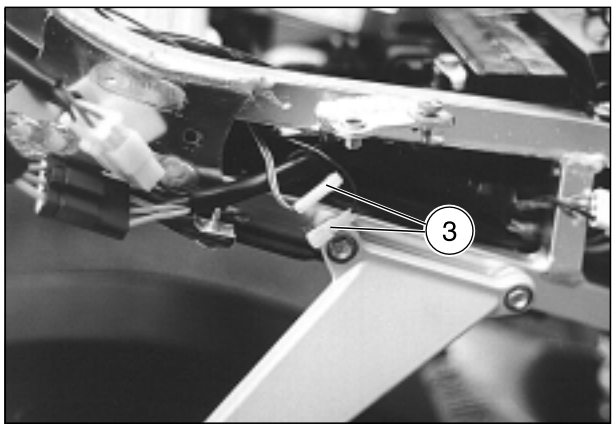
⚠ CAUTION

Any adjustment of the position sensor must be performed with the valves closed, meaning the throttle valve control lever (4) must touch the adjusting screw (5).

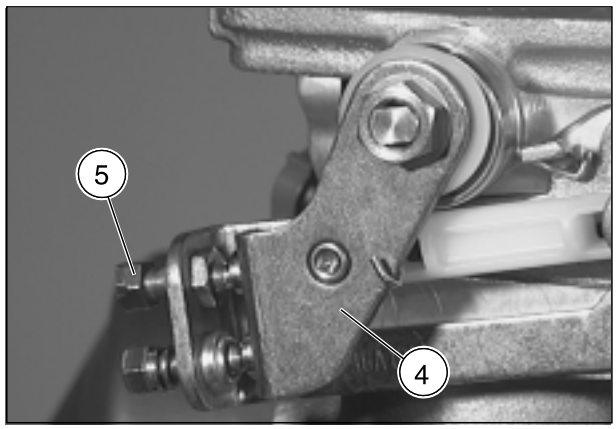
◆ Tighten the two M4x12 T.C.E.I. sunk hexagon cheese-head screws (2).

Driving torque of screws (2): 1.6 Nm (0.16 kgm).

◆ Turn the ignition switch to position "⊗".



For further details see 6.4.11 (CHECKING THE INTAKE PRESSURE SENSOR).

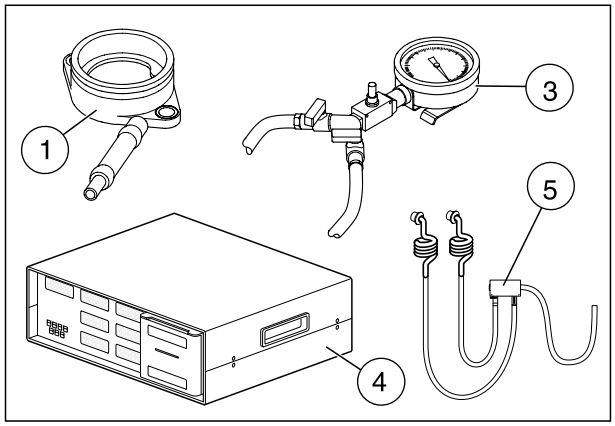


4.8.10 CYLINDER SYNCHRONIZATION

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.1 (FUEL).

The cylinders must be synchronized whenever the engine runs smoothly no longer when idling.

◆ Run a few kilometres until reaching the regular working temperature.



⚠ CAUTION

The cylinder syncronization must be carried out with the engine warmed up:
– coolant temperature 80-100°C (176-212°F);
– room temperature 20-30°C (68-86°F).

NOTE Have the following special tools OPT at hand:
– intake flange for vacuometer (1) (cod. 8140267);
– vacuometer (3) (cod. 8140256);
– exhaust gas tester (4) (cod. 8140196);
– set of pipes for exhaust gas tester (5) (cod. 8140202).

⚠ WARNING

Fuel vapours are harmful for health.
Before proceeding, make sure that the room in which you are working is properly ventilated.
Do not inhale fuel vapours.

Avoid contact of fuel with the skin.
Do not smoke or use naked flames.
Do not pollute the environment with the incorrect disposal of fuel.

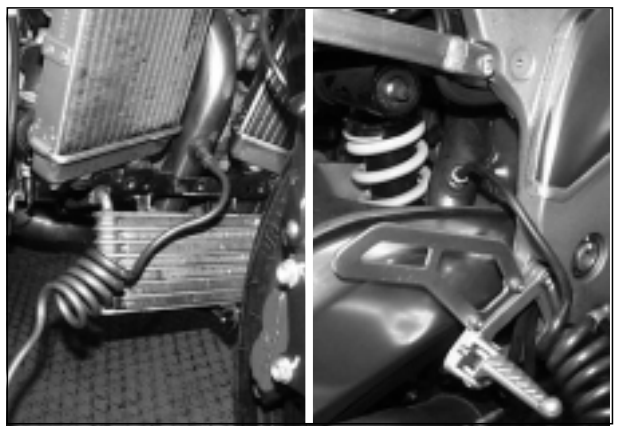
◆ Lift the petrol tank, see 2.8 (LIFTING THE FUEL TANK).
◆ Loosen and remove the two front and rear exhaust pipe plugs (6-7).

NOTE Upon reassembly, apply LOCTITE® 8150 on the threaded of the plugs (6-7)

◆ Connect the exhaust gas tester pipes (5):
– connect the two rigid pipes to the appropriate exhaust pipe outlets;
– connect the other pipe to the exhaust gas tester (4).
◆ Start the engine and make sure the idling rpm is 1250 ± 100 rpm. If this is not the case, adjust accordingly, see 2.11.2 (IDLING ADJUSTMENT).
◆ Check the tester (5) for the CO values.
They should correspond to the values indicated and be the same for both cylinders.

CO values for both cylinders:
0.8-1.3% at 1250 ± 100 rpm.

◆ If the CO value measured in one or both of the cylinders is different from the value indicated, adjust one or both of the screws (8-9) accordingly to restore the correct value.
◆ Check the idling rpm and, if it does not correspond to 1250 ± 100 rpm, adjust accordingly, see 2.11.2 (IDLING ADJUSTMENT) and then check the CO values again and, where necessary, repeat the sychronization procedure.



NOTE If it is not possible to obtain the preset CO values, the sparking plugs must be replaced, see 2.7 (SPARK PLUGS).

CHECKING THE CYLINDER VACUUM VALUES

NOTE The checking of the cylinder vacuum values on the new models no longer requires the intake flange to be replaced with the vacuometer attachment (1) since the throttle body is already fitted with the suitable connector (2).

◆ Loosen the two clamps (10-11).

⚠ WARNING

Take extreme care when removing the throttle body (12) as it remains connected to cables and pipes.

◆ Grip the throttle body firmly (12), complete with air filter casing (13), and shift it slightly one way and the other, lifting and sliding it off the intake flanges.
◆ Move the throttle body off to the left-hand side of the vehicle.
◆ Unscrew and remove the two screws (14) fastening the intake flange (15) to the front cylinder and recover the washers.
◆ Remove the intake flange (15) of cylinder “1” (front).
◆ Fit the vacuometer intake flange (1) in place, and position it so that the connector (16) is on the right-hand side of the vehicle.
◆ Fit the two screws (14) back in place with their respective washers and tighten them.

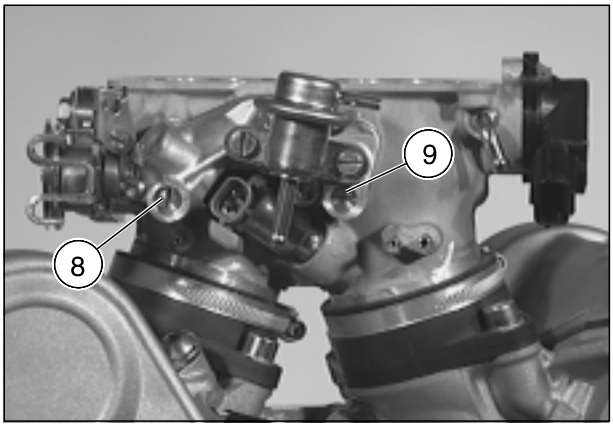
Torque settings of screws (14): 19 Nm (1.9 kgm).

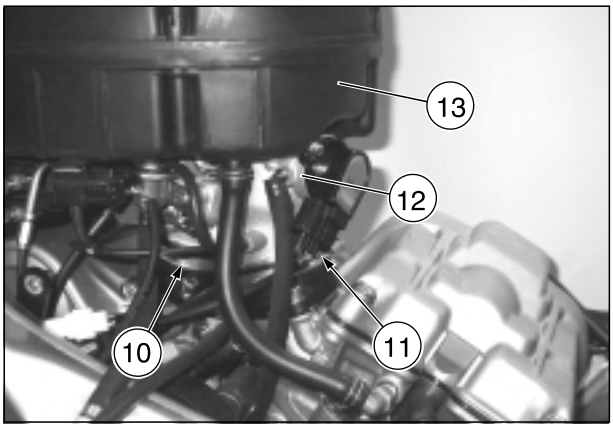
⚠ WARNING

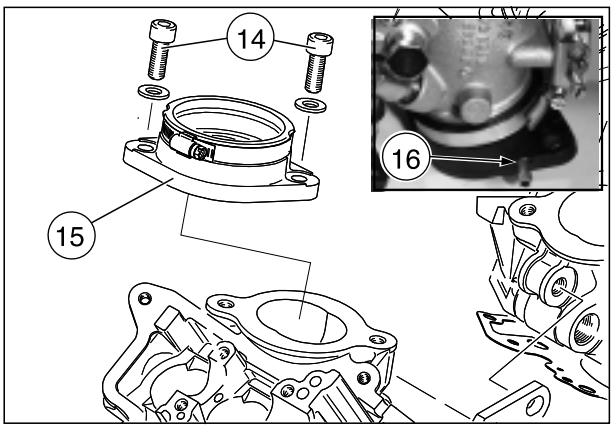
The throttle body (12) must be fitted perfectly to the intake flanges.

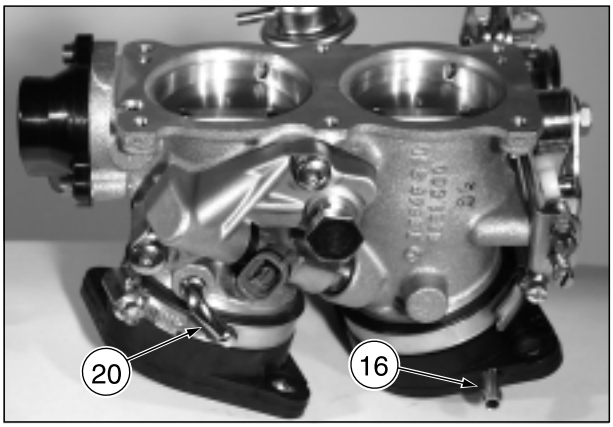
The clamps (10-11) must be properly tightened.

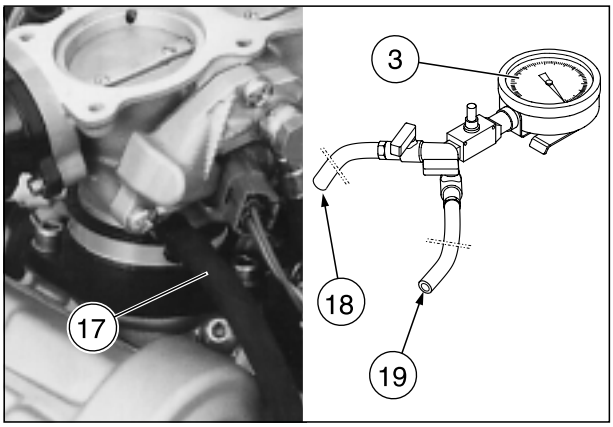
◆ Fit the throttle body (12) again, complete with air filter casing (13), to the two intake flanges.
◆ Tighten the two clamps (10-11).
◆ Slide the pipe (17) off the vacuum connector.
◆ Hang the vacuometer (3) on the handlebars.
◆ Insert the two ends of the vacuometer pipes (18-19) in the connectors (16-20).









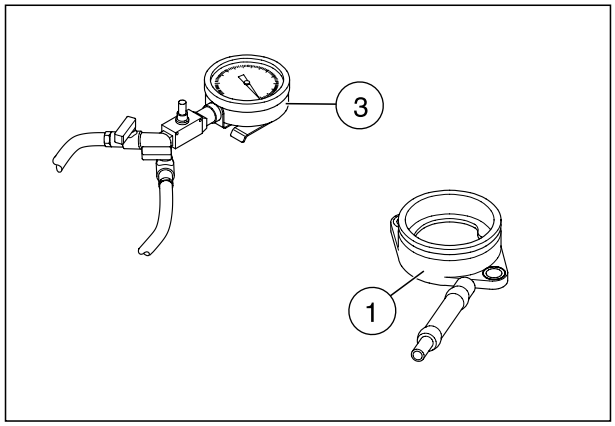


◆ Check the vacuometer (3) for the vacuum value of a cylinder and then of the other one.

NOTE The vacuum value reading should be the same for both cylinders.

Vacuum values for both cylinders:
300 ± 30 mbar at 1250 ± 100 rpm.

◆ Once the cylinders have been synchronized correctly and the idling rpm adjusted, remove the vacuometer attachment (1) and fit the intake flange (15).



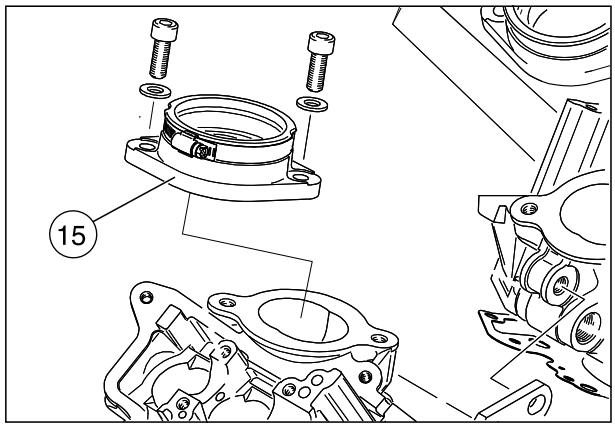
⚠ WARNING

It is vital that the vacuometer intake flange (1) be replaced with the original intake flange (15).

⚠ WARNING

Slight differences in the vacuum values between the two cylinders are acceptable only if the CO values fall within the range of the preset parameters (from 0.8 to 1.3%).

If the CO values and/or the vacuum values do not fall within the range of the preset parameters, the adjusting procedures must be repeated to restore the correct values.



COOLING SYSTEM 5

COOLING SYSTEM

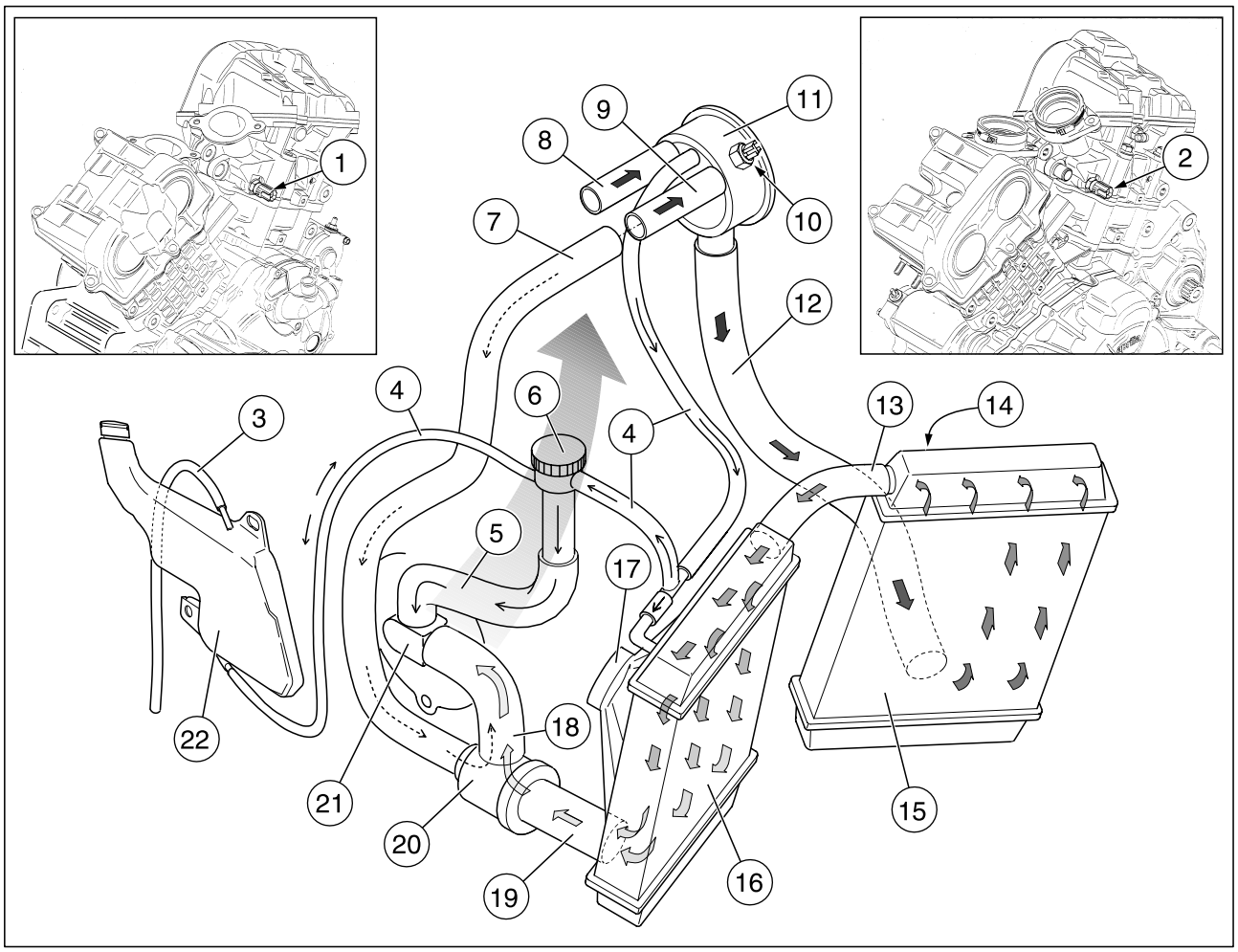
TABLE OF CONTENTS

5.1 DESCRIPTION

The centrifugal pump (positioned inside the engine and driven by the latter) draws coolant and distributes it to the galleries in the cylinders and in the heads in order to cool the internal parts of the engine.
The path of the coolant on leaving the engine varies depending on the temperature of the actual coolant, and is illustrated below.
The coolant volume increase (caused by the temperature increase) is compensated for in the expansion tank.

To check and top up the coolant, refer to the “LOW” and “FULL” reference marks, see 2.15 (CHECKING AND TOPPING UP COOLANT).

For any information regarding the coolant, see 1.2.5 (COOLANT).



Key

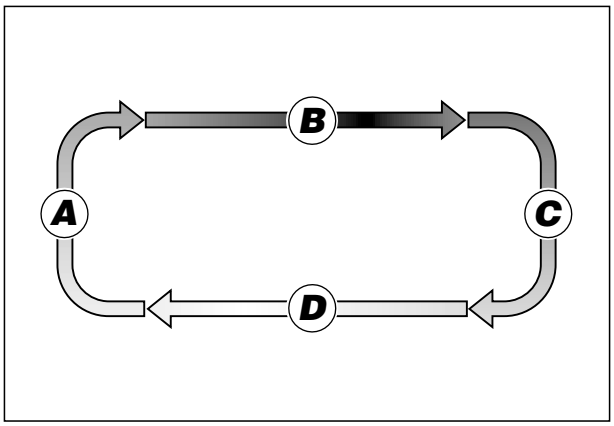
1) Front cylinder thermistor
2) Rear cylinder thermistor
3) Breather pipe
4) Coolant compensation pipes
5) Filler hose
6) Filler neck
7) Engine hose (right side) - thermal expansion valve
8) Rear cylinder hose - three-way manifold
9) Front cylinder hose - three-way manifold
10) Thermal switch
11) Three-way manifold
12) Three-way manifold hose - left radiator
13) Radiator link hose
14) Left radiator electrofan
15) Left radiator (vertical flow)
16) Right radiator (vertical flow)
17) Right radiator electrofan
18) Thermal expansion valve hose - pump
19) Right radiator hose - thermal expansion valve
20) Three-way thermal expansion valve (type with heat-sensitive wax)
21) Centrifugal pump
22) Expansion tank

⟶ = Direction of flow with thermal expansion valve open

- - - - → = Direction of flow with thermal expansion valve shut

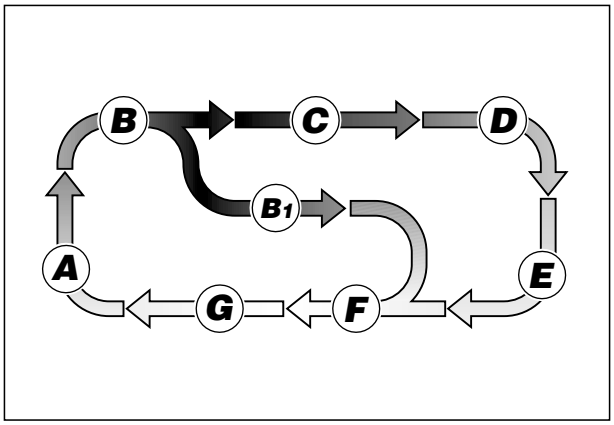
Path with coolant temperature below 65°C (149°F).

Pump ➡Ⓐ➡ coolant enters the galleries (temperature taken by thermistors and sent up on the right-hand display on the dashboard) ➡Ⓑ➡ coolant leaves the gallery (right-hand side of engine) ➡Ⓒ➡ thermal expansion valve (completely shut) ➡Ⓓ➡ pump.



Path with coolant temperature in the range 65°C (149°F) to 80°C (176°F).

Pump ➡Ⓐ➡ coolant enters the galleries (temperature taken by thermistors and sent up on the right-hand display on the dashboard) ➡Ⓑ➡ coolant leaves the galleries (at the same time, ➡Ⓑ1➡ coolant leaves the gallery, right-hand side of engine, and is conveyed directly to the thermal expansion valve) ➡Ⓒ➡ three-way manifold➡Ⓓ➡ left radiator ➡Ⓔ➡ right radiator ➡Ⓕ➡ thermal expansion valve (gradually opening) ➡Ⓖ➡ pump.

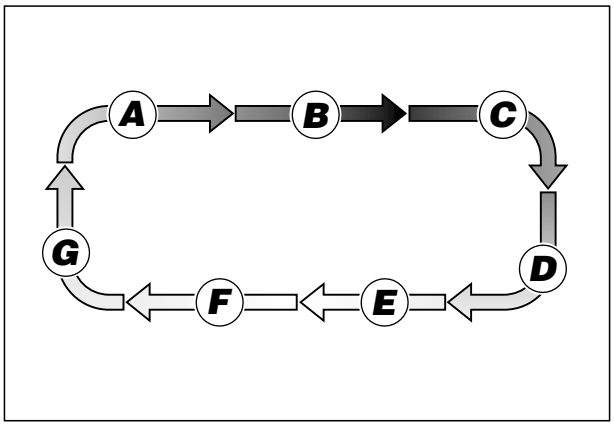


Path with coolant temperature over 80°C (176°F).

Pump ➡Ⓐ➡ coolant enters the galleries (temperature taken by thermistors and sent up on the right-hand display on the dashboard) ➡Ⓑ➡ coolant leaves the galleries ➡Ⓒ➡ three-way manifold (temperature taken by thermal switch: if over 100°C (212°F), the operation of the electrofans is enabled; when it drops below 85°C (185°F), the electrofans are switched off) ➡Ⓓ➡ radiatore sinistro ➡Ⓔ➡ left radiator ➡Ⓕ➡ thermal expansion valve (completely open) ➡Ⓖ➡ pump.

⚠ CAUTION

When the ignition switch is set to "⚿" the electrofans switch off regardless of the coolant temperature.

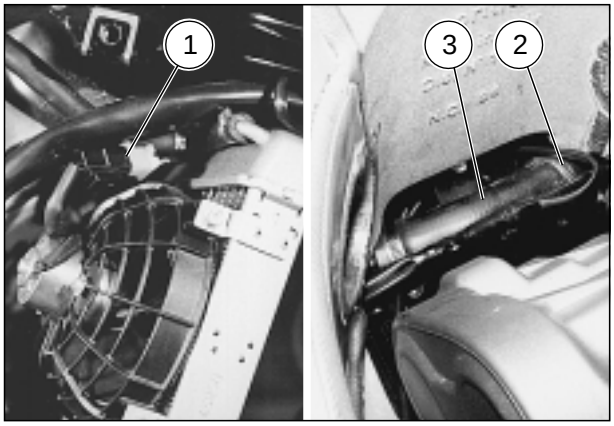


5.2 REMOVING THE RADIATORS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

NOTE The following procedure refers to a single radiator, though it is applicable to both.

- Turn the ignition switch to position "⊠" .
- Drain the cooling circuit completely, see 2.16 (CHANGING THE COOLANT).
- Disconnect the electric connector (1).

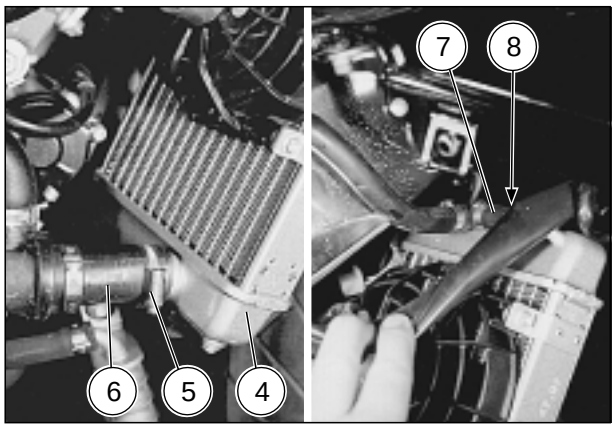


⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Remove the radiator spoiler, see 7.1.33 (REMOVING THE RADIATOR SPOILER).
- Loosen and move the clamp (2).
- Pull the coupling (3) off the radiator (4).
- Loosen and move the clamp (5).
- Pull the coupling (6) off the radiator (4).

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).



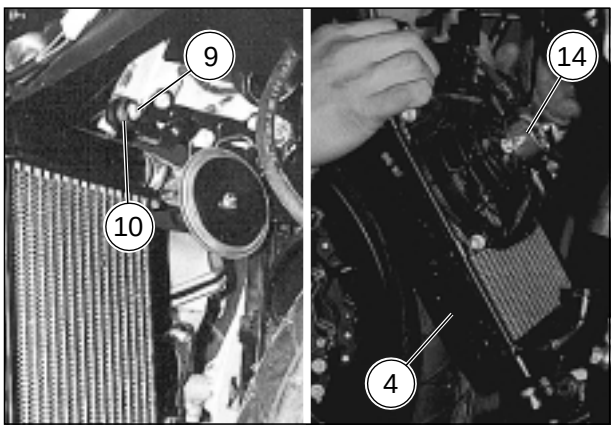
- Release the head off the pipe clamp (7).
- Pull the pipe (8) off the radiator (4).
- Unscrew and remove the screw (9), retrieving the bush and the rubber element (10) if necessary.

NOTE If the rubber element (10) is damaged, replace it.

⚠ CAUTION

Proceed with care. Do not damage the radiator fins.

- Tilt the radiator (4) slightly forwards and at the same time lift it, sliding the two lower anchorage pins (12-13) from their slot on the radiator mount (11).
- Remove the radiator (4) complete with the electrofan (14).



⚠ CAUTION

Plug the coupling openings so as to prevent any foreign bodies from falling in.

NOTE If the rubber elements (15) are damaged, replace them.

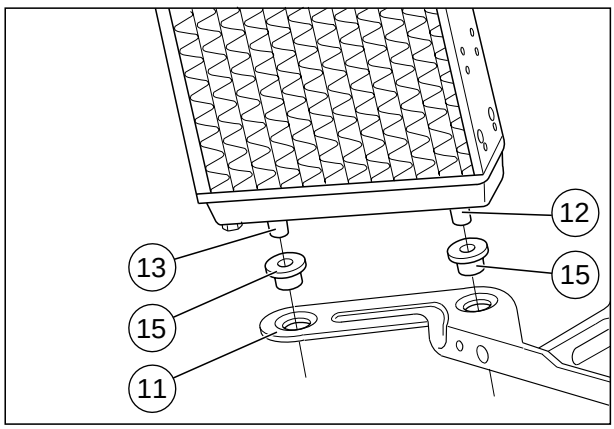
If necessary:

- Remove the cooling electrofan, see 5.3 (REMOVING THE COOLING ELECTROFANS).

⚠ CAUTION

Foreign bodies, filth, etc. sticking to the radiator fins must be removed by means of a jet of compressed air.
Any bent fins are to be straightened using a small flat-tip screwdriver.
If the couplings (3-6) feature cuts and/or cracks, they must be replaced.
Before reassembly, thoroughly wash the inside of the radiator with clean water only.

NOTE Where necessary, remove the other radiator.

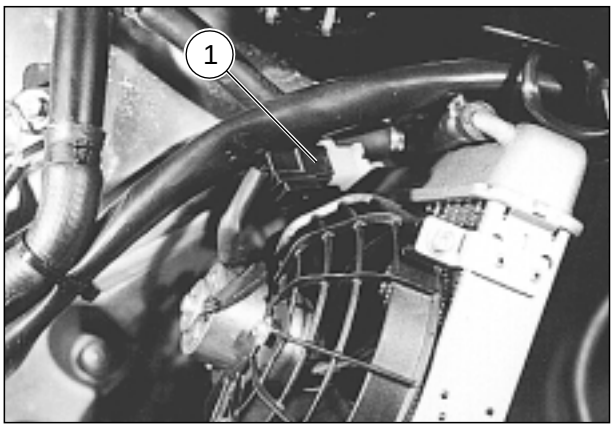


5.3 REMOVING THE COOLING ELECTROFANS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

NOTE The following procedure refers to a single electrofan, though it is applicable to both.

- Turn the ignition switch to position“ ” .
- Remove the relevant side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Disconnect the electric connector (1).



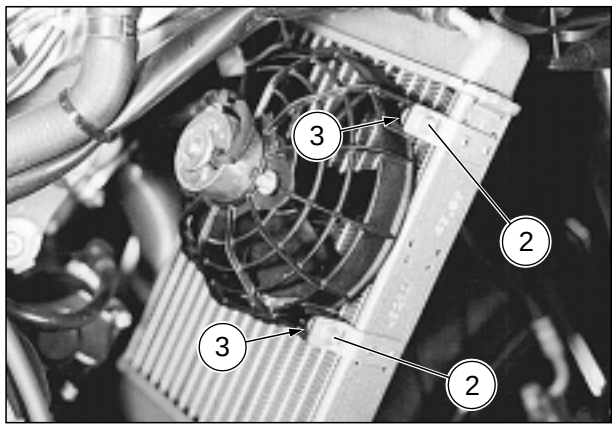
⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Unscrew and remove the two screws (2).

Driving torque of screws (2): 6 Nm (0.6 kgm).

- Retrieve the two nuts (3).
- Tilt the whole electrofan (4) slightly forwards, at the same time moving it outwards, pulling the internal anchorage pin out of its slot on the radiator (5).
- Remove the electrofan (4).



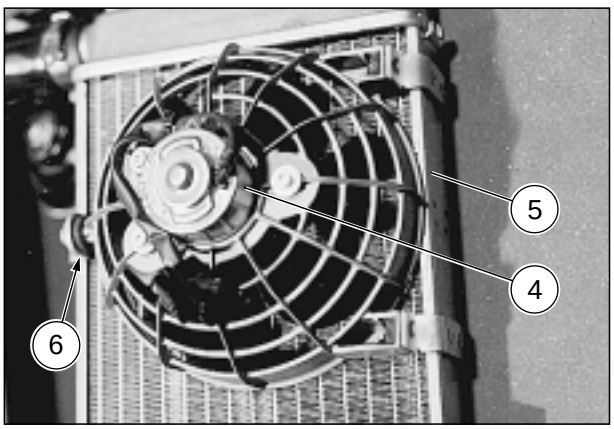
NOTE If the rubber element (6) is damaged, replace it.

Where necessary:

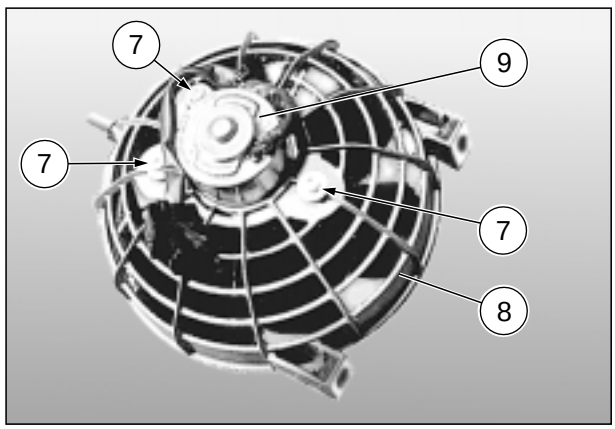
- Unscrew and remove the three screws (7) and retrieve the washers.

Driving torque of screws (7): 2 Nm (0.2 kgm).

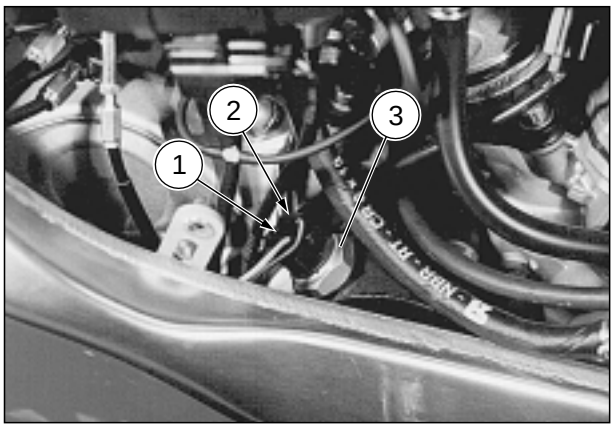
- Slide out the grating (8) protecting the electrofan motor (9).



NOTE Where necessary, remove the other electrofan. See 6.9 (COOLING ELECTROFAN) for further details.



5.4 REMOVING THE COOLANT THERMAL SWITCH



Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

- Turn the ignition switch to position "⊗" .
- Remove the left side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Disconnect the electric connectors (1-2) from the thermal switch (3).

⚠ CAUTION

When reassembling, make sure the electric connectors (1-2) are plugged in properly.

- Prepare a new thermal switch and apply LOCTITE® 572 on its thread.
- Unscrew and remove the thermal switch (3) and retrieve the gasket.
- Insert the gasket on the new thermal switch.
- Screw the thermal switch (3) on by hand before tightening it.

Driving torque of thermal switch (3): 30 Nm (3.0 kgm).

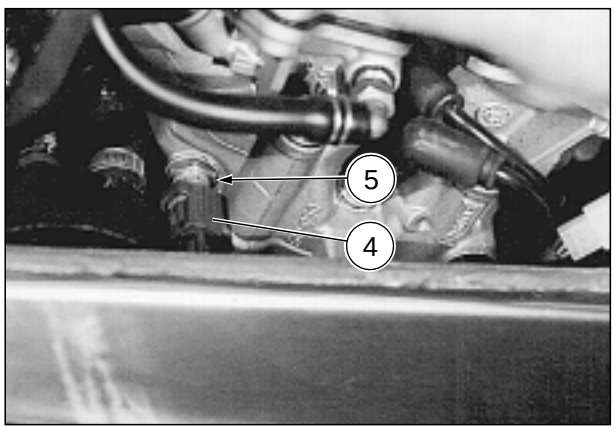
- If any coolant spilled during removal, once the operation is complete, top up the coolant, see 2.15 (CHECKING AND TOPPING UP COOLANT).

NOTE See 6.9.3 (CHECKING THE THERMAL SWITCH OPERATION) for further details on the thermal switch.

⚠ CAUTION

Plug the hole on the three-way manifold so as to prevent any foreign bodies from falling in.

5.5 REMOVING THE COOLANT THERMISTORS



Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

NOTE The following procedure refers to a single thermistor, though it is applicable to both.

- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Disconnect the electric connector (4).

⚠ CAUTION

When reassembling, make sure the electric connector (4) is plugged in properly.

- Prepare a new thermistor and apply LOCTITE® 574 on its thread.
- Unscrew and remove the thermistor (5).
- Screw the thermistor (5) on by hand before tightening it.

Driving torque of thermistor (5): 30 Nm (3.0 kgm).

- If any coolant spilled during removal, once the operation is complete, top up the coolant, see 2.15 (CHECKING AND TOPPING UP COOLANT).

NOTE Where necessary, remove the other thermistor. See 6.4.8 (CHECKING THE COOLANT THERMISTOR OPERATION) for further details on the thermistors.

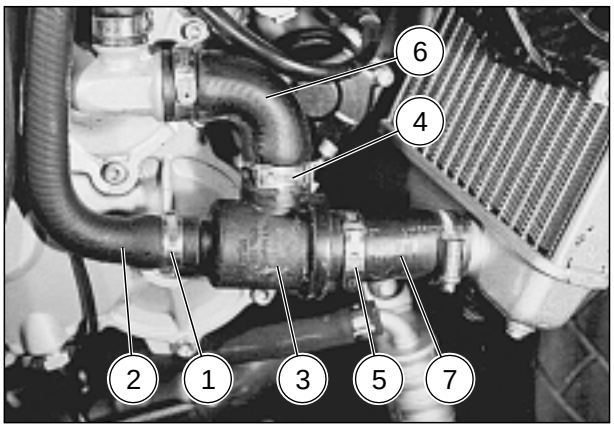
5.6 REMOVING THE THERMAL EXPANSION VALVE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

◆ Drain the cooling circuit completely, see 2.16 (CHANGING THE COOLANT).

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Release the head off the pipe clamp (1).
◆ Pull the pipe (2) off the thermal expansion valve (3).
◆ Loosen the clamps (4-5).
◆ Grip the thermal expansion valve (3) and pull it free of the two couplings (6-7) one small step at a time.



⚠ CAUTION

Plug the coupling openings so as to prevent any foreign bodies falling in.

5.6.1 CHECKING THE THERMAL EXPANSION VALVE

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

◆ Remove the thermal expansion valve, see 5.6 (REMOVING THE THERMAL EXPANSION VALVE).
◆ Check the heat-sensitive wax for signs of cracking or excessive wear: in this case, replace the whole valve (3).

Check the valve (3) is working properly as follows:

◆ Tie a piece of string around the valve (3).
◆ Place a container (8) holding coolant on a burner (9).
◆ Immerse the valve (3) in the container.

NOTE The valve (3) must be fully submersed without allowing it to touch the walls or bottom of the container (8).

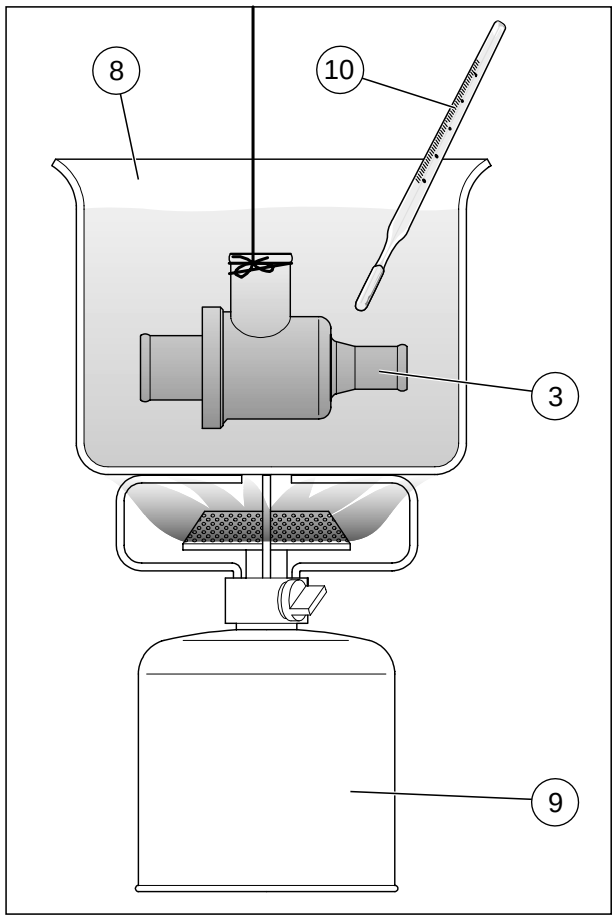
◆ Secure the string so that the valve (3) remains in place.
◆ Heat the coolant, using a thermometer (10) with a 0 to 150 °C (32 to 302 °F) range to check the rise in temperature.
◆ Take note of the temperature reading when the valve (3) starts to open.

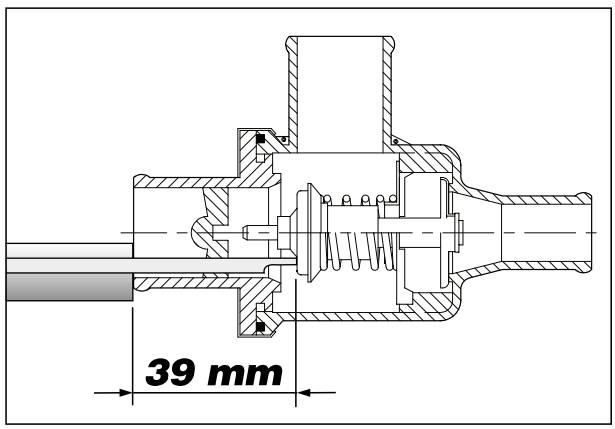
Valve (3) opening temperature: 65 ± 2 °C (149 ± 3.6 °F).

◆ Continue heating the coolant.
◆ When the temperature of the coolant reaches 80 °C (176 °F), the valve (3) should have opened by at least 7 mm (39 mm measured from the edge).

Valve (3) opening: ≥ 7 mm at 80 °C (176 °F).

NOTE If the valve does not meet both conditions (initial opening temperature and maximum opening), it must be replaced.





5.7 REMOVING THE FILLER NECK

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

◆ Drain the cooling circuit completely, see 2.16 (CHANGING THE COOLANT).

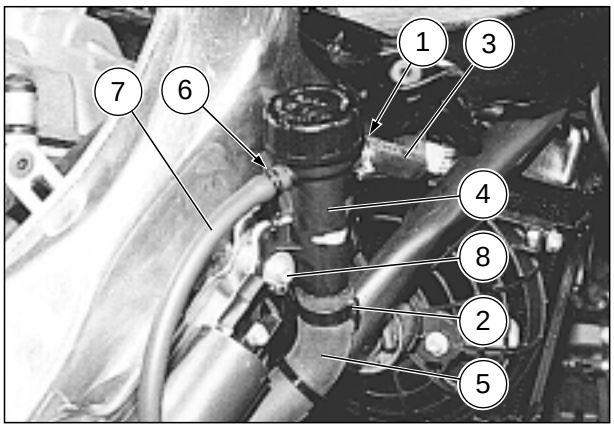
NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Release the head off the pipe clamps (1-2).
◆ Pull the pipe (3) off the neck (4).
◆ Pull the coupling (5) off the neck (4).

⚠ CAUTION

Plug the coupling openings so as to prevent any foreign bodies falling in.

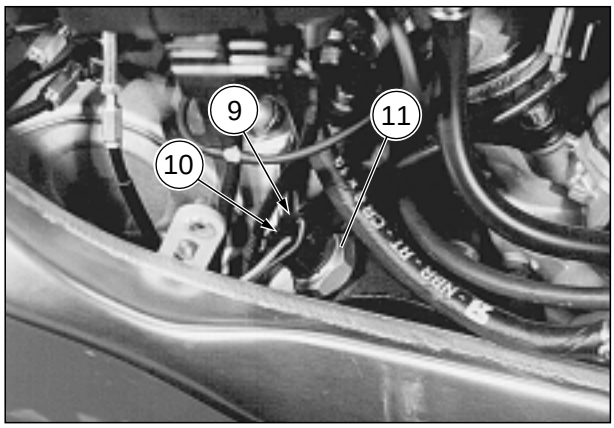
◆ Move the pipe clamp (6).
◆ Pull the pipe (7) off the neck (4).
◆ Unscrew and remove the screw (8) and retrieve the bush.
◆ Remove the filler neck (4).



5.8 REMOVING THE THREE-WAY MANIFOLD

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

◆ Turn the ignition switch to position "⚿" .
◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
◆ Remove the engine oil tank, see 7.1.49 (REMOVING THE ENGINE OIL TANK).
◆ Drain the cooling circuit completely, see 2.16 (CHANGING THE COOLANT).
◆ Disconnect the electric connectors (9-10) from the thermal switch (11).



⚠ CAUTION

When reassembling, make sure the electric connectors (9-10) are plugged in properly.

NOTE Obtain appropriate pliers to attach the clamps, or screwdriver-type pipe clamps to replace the original ones (special type without screw).

◆ Release the head off the pipe clamps (12-13-14).
◆ Pull the three pipes (15-16-17) off the manifold (18).
◆ Loosen the pipe clamp (19) and move it downwards.
◆ Grip the manifold (18) and slide it up off the coupling (20) one small step at a time.

⚠ CAUTION

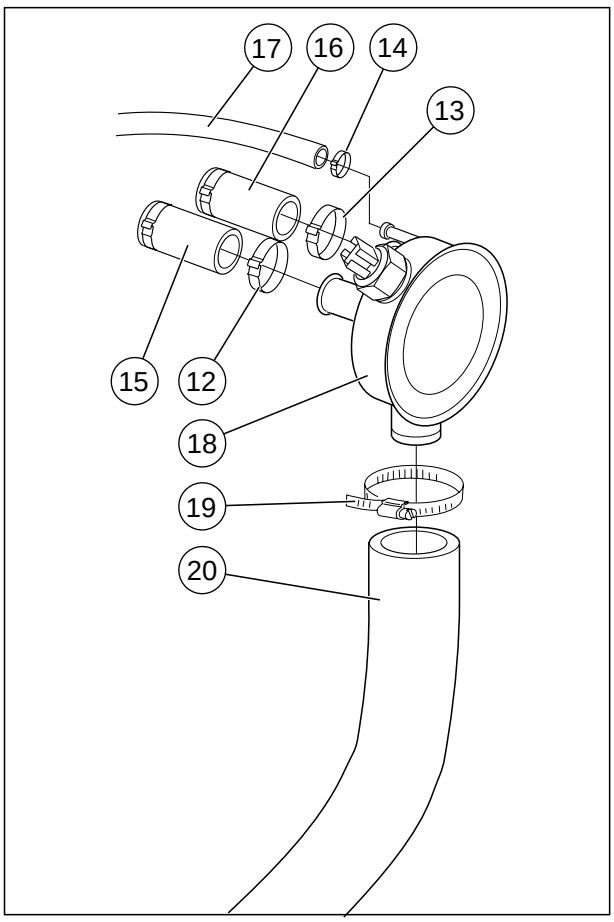
Plug the coupling openings so as to prevent any foreign bodies falling in.

Where necessary:

◆ Unscrew and remove the thermal switch (11) and retrieve the gasket.

NOTE When reassembling, apply LOCTITE® 572 on the thread of the thermal switch.

Driving torque of thermal switch (11): 30 Nm (3.0 kgm).



5.9 REMOVING THE EXPANSION TANK

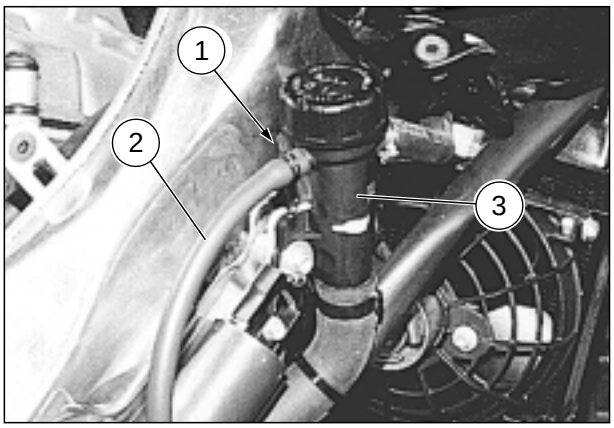
Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS) and 1.2.5 (COOLANT).

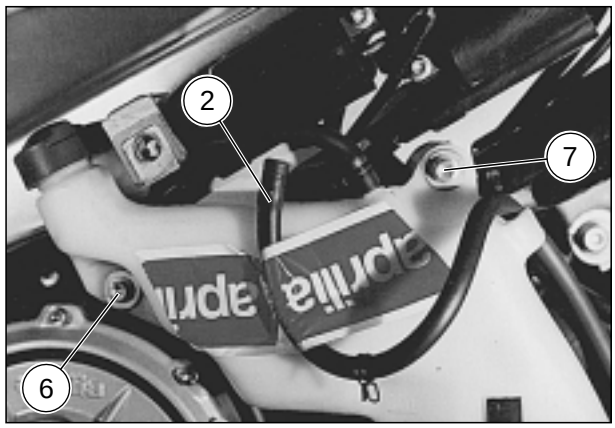
- ◆ Remove the right side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- ◆ Move the pipe clamp (1).
- ◆ Pull the pipe (2) off the filler neck (3).
- ◆ Bend the pipe (2) back on itself and secure it in place on the top of the expansion tank with adhesive tape.
- ◆ Unscrew and remove the fastening screw (4), keeping the rear brake fluid tank (5) in place.
- ◆ Move the rear brake fluid tank (5) and secure it in place with adhesive tape.
- ◆ Unscrew and remove the two fastening screws (6-7) and retrieve the two bushes.
- ◆ Remove the expansion tank (8), keeping it the right way up.
- ◆ If the inner and outer foam edging is damaged, replace it.

⚠ WARNING

The coolant is noxious.
Put the expansion tank (8) in a safe place.

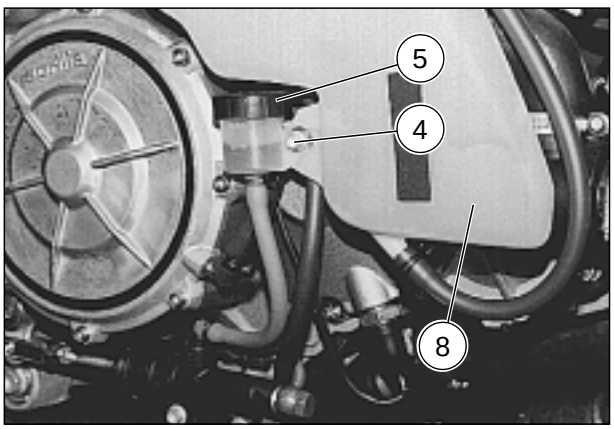
KEEP OUT OF THE REACH OF CHILDREN.

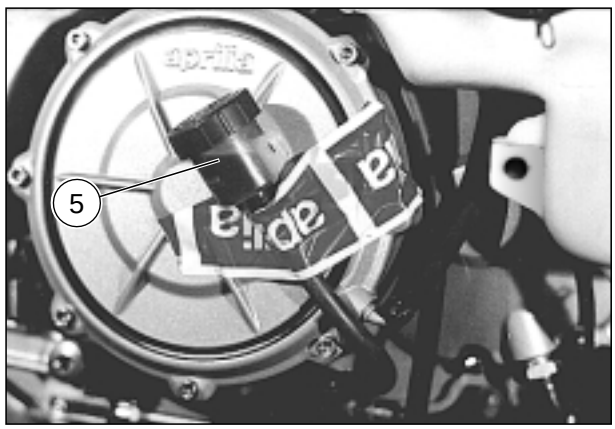




5.10 COOLANT PUMP

See 3.6.21 (COOLANT PUMP) for information on the coolant pump.





ELECTRICAL SYSTEM 6

ELECTRICAL SYSTEM

TABLE OF CONTENTS

6.1 INTRODUCTION

The following key will be useful in consulting this section.

NOTE The numbering to be found on the specific wiring diagrams corresponds to that on the general wiring diagram.

6.1.1 CABLE COLOURS

Ar Orange
Az Light blue
B Blue
Bi White
G Yellow
Gr Grey
M Brown
N Black
R Red
Ro Pink
V Green
Vi Violet

6.1.2 ELECTRICAL CONNECTORS

The disconnection of two electrical connectors must be carried out by proceeding as follows:

◆ Press the appropriate safety couplings, if provided.

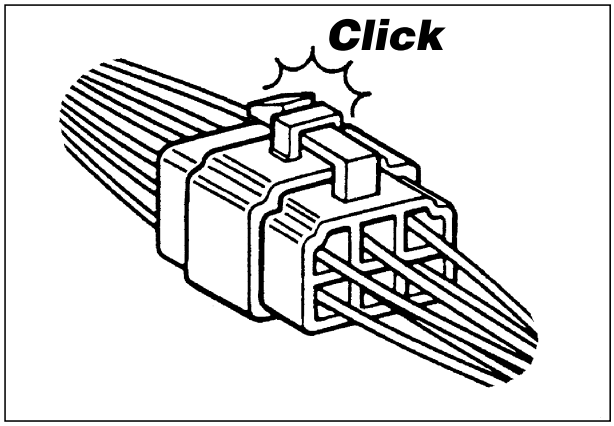
⚠ CAUTION

Do not pull the cables to disconnect the two connectors.

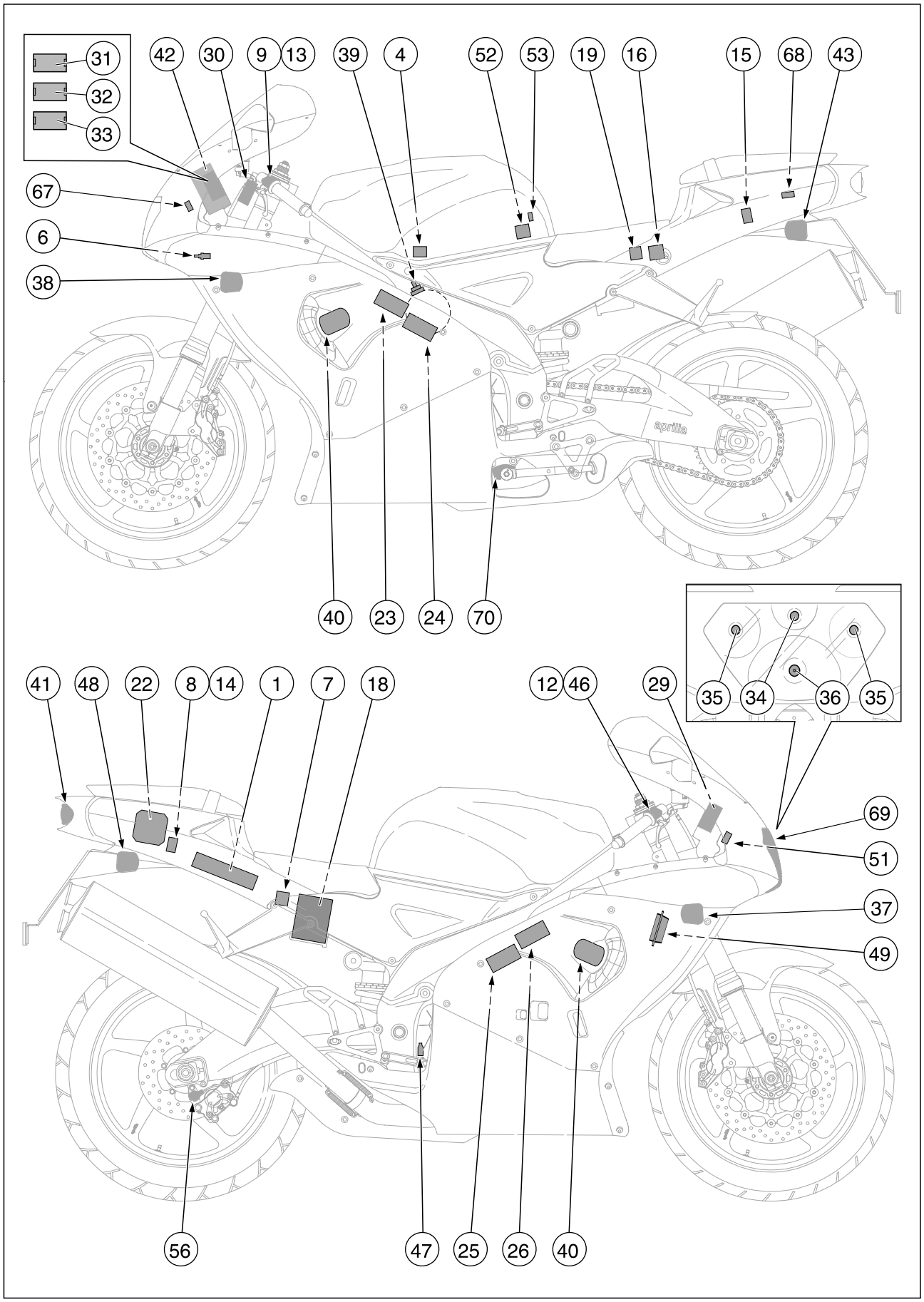
◆ Grasp the two connectors and disconnect them by pulling in opposite directions.
◆ If dirt, rust, dampness, etc. can be noticed, carefully clean the inside of the connector by means of a pressurized air jet.
◆ Make sure that the cables are correctly crimped to the terminals positioned inside the connectors.

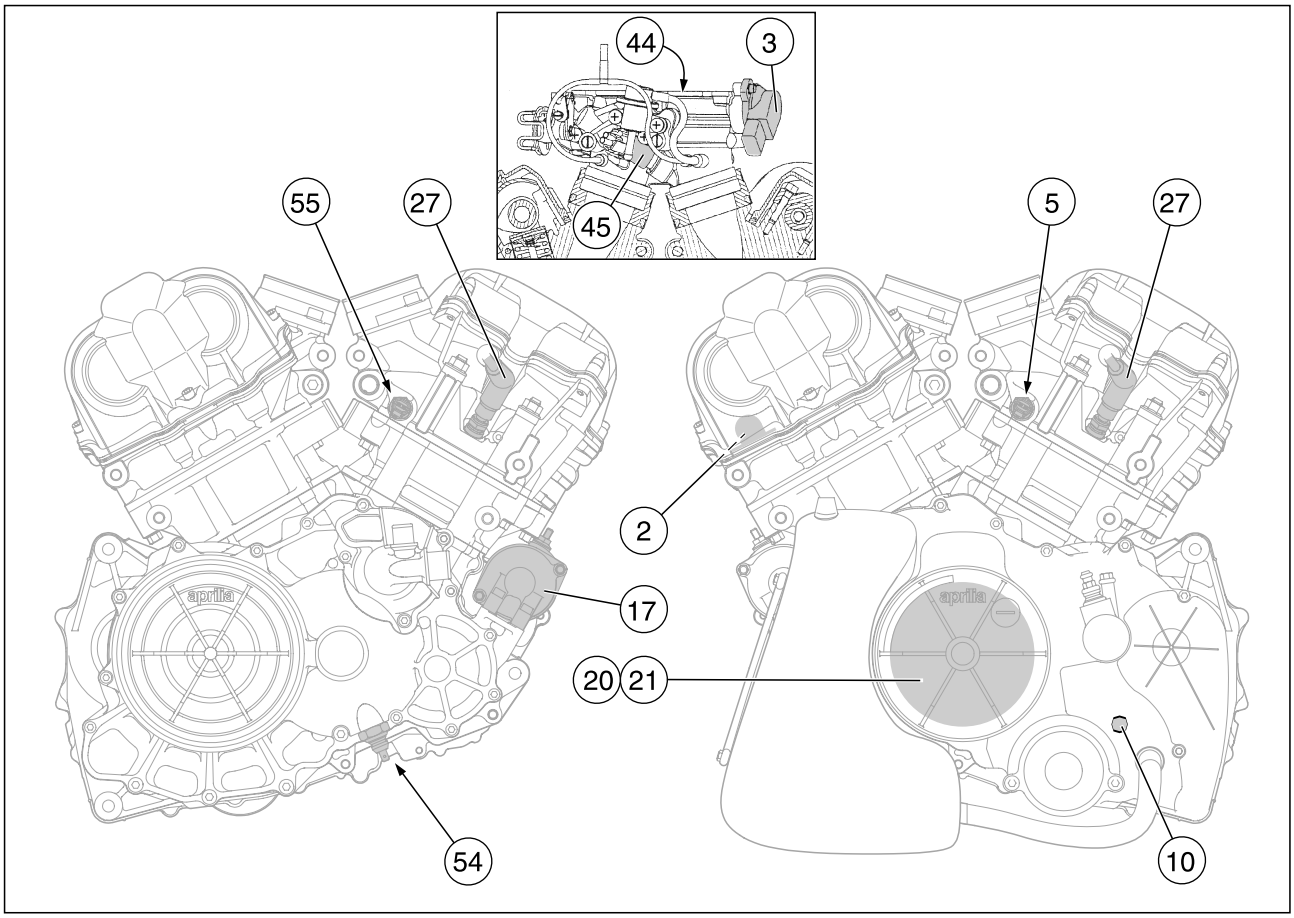
NOTE The two connectors have one insertion direction only, therefore it is important to couple them in the correct direction.

◆ Insert the two connectors, making sure that the coupling direction is correct (if the appropriate safety couplings are provided, the typical “click” sound will be heard).



6.2 ELECTRIC COMPONENTS LAYOUT





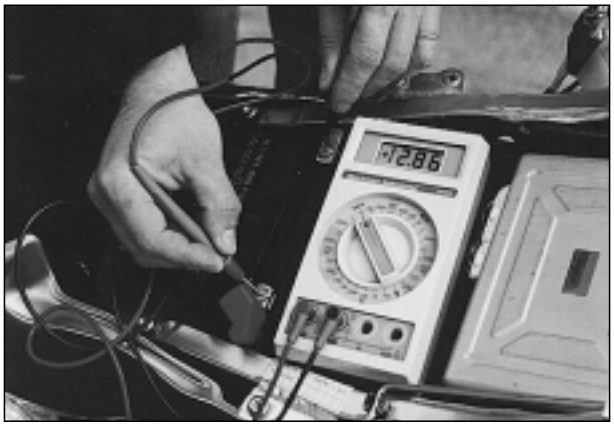
Key

NOTE The numbering corresponds to that on the general wiring diagram.

1) Electronic unit
2) Cam position sensor
3) Throttle valve potentiometer
4) Suction pressure sensor
5) Coolant temperature thermistor
6) Air thermistor
7) Fall sensor
8) Diode module
9) Clutch control lever switch
10) Neutral switch
12) Right dimmer switch
13) Left dimmer switch
14) Engine stop relay
15) Fuel pump relay
16) Start relay
17) Starter
18) Battery
19) Main fuses (30A) (ignition)
20) Generator
21) Pick up
22) Voltage regulator
23) Rear cylinder coil “1”
24) Rear cylinder coil “2”
25) Front cylinder coil “1”
26) Front cylinder coil “2”
27) Spark plugs
29) Secondary fuses (15A)
30) Ignition switch
31) Low beam relay
32) High beam relay
33) Cooling fan relay
34) Front parking light bulb
35) High beam bulbs
36) Low beam bulb
37) Front right direction indicator
38) Front left direction indicator
39) Thermal switch
40) Cooling fans
41) Rear light
42) Dashboard
43) Rear left direction indicator
44) Front cylinder injector
45) Rear cylinder injector
46) Front stoplight switch
47) Rear stoplight switch
48) Rear right direction indicator
49) Horn
51) Blinking
52) Fuel pump
53) Low fuel sensor
54) Engine oil pressure switch
55) Coolant temperature thermistor
56) Speed sensor
67) Light diode / LAP
68) TEST connectors
69) Headlight
70) Side stand switch

6.3 CHECKING THE RECHARGING SYSTEM

6.3.1 CHECKING THE RECHARGING VOLTAGE



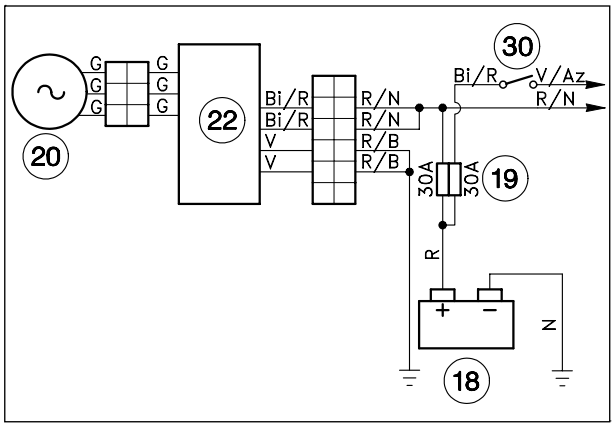
- Check battery voltage, see 2.4.2 (RECHARGING THE BATTERY).
- Start the engine and let it run until it reaches 4000 rpm.
- Set the light switch to "☼" and dimmer switch to "≡D".
- ASD Set the dimmer switch to "≡D".
- Using a pocket tester, measure the direct voltage between the positive (**+**) and negative (**–**) terminals.

If the tester indicates voltage values lower than 13V or higher than 15V:

- Check the loadless operation and the continuity of the alternator, see 6.3.2 (CHECKING THE ALTERNATOR LOADLESS OPERATION) and 6.3.3 (CHECKING THE ALTERNATOR CONTINUITY). Also check the voltage regulator, see 6.3.4 (CHECKING THE VOLTAGE REGULATOR).

Wiring diagram key

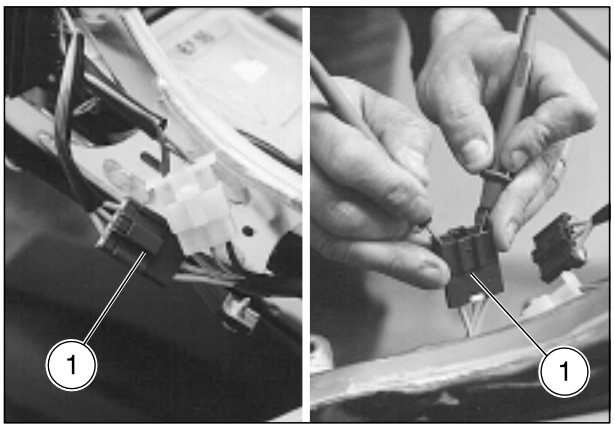
NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



18) Battery
19) Main fuse (30A)
20) Generator
22) Voltage regulator
30) Ignition switch (○ - ⚷ - 🔒)

Standard charging voltage:
13 to 15 V (d.c.) at 4000 rpm.

6.3.2 CHECKING THE ALTERNATOR LOADLESS OPERATION



- Remove the rear fairing, see 7.1.36 (REMOVING THE REAR FAIRING).
- Disconnect the voltage regulator three-way cable connector (1) (coloured brown).

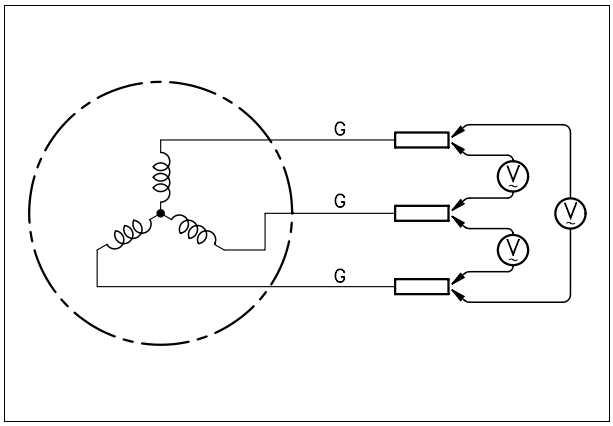
⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Start the engine and let it run until it reaches 4000 rpm.
- Using a pocket tester, measure the voltage (a.c.) from the three internal male terminals [yellow cables (G)] in rotation.

If the value indicated by the tester is lower than 60 V, the alternator is faulty and needs replacing.

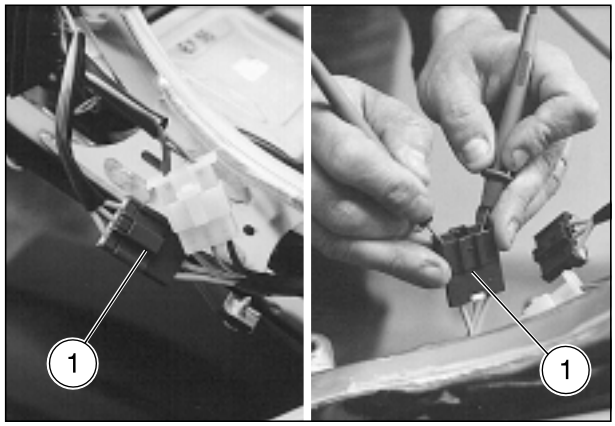
Standard loadless voltage:
more than 60 V (a.c.) at 4000 rpm.



6.3.3 CHECKING THE ALTERNATOR CONTINUITY

When the engine is switched off:

- Remove the rear fairing, see 7.1.36 (REMOVING THE REAR FAIRING).
- Disconnect the voltage regulator three-way cable connector (1) (coloured brown).



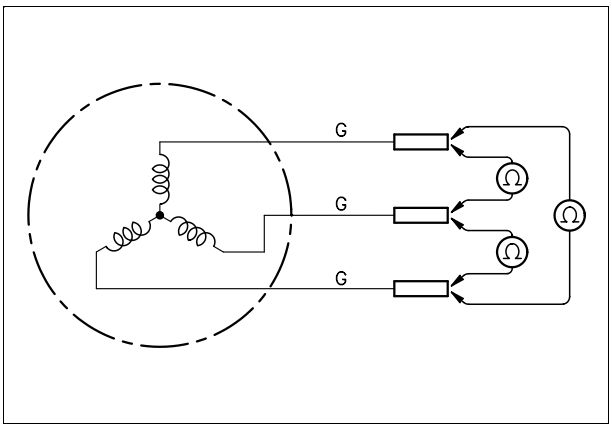
⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Using a pocket tester (Ω scale), check for breaks between the cables of the stator [on the internal female terminals, yellow cables (G)].
  Also check the isolation of the stator mount.

Standard resistance value: 0.1 - 1Ω.

Standard resistance value (between cables and stator mount): ∞.



6.3.4 CHECKING THE VOLTAGE REGULATOR

- Remove the rear fairing, see 7.1.36 (REMOVING THE REAR FAIRING).
- Disconnect the three-way connector (1) (coloured brown).
- Disconnect the six-way connector (2) (coloured white).

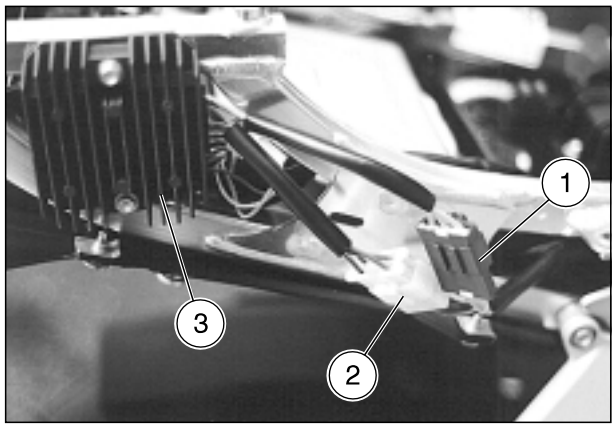
⚠ CAUTION

When reassembling, make sure the electric connectors (1-2) are plugged in properly.

- Using a pocket tester (scale x 1MΩ), measure the resistance between the cables indicated in the table below from the regulator side (internal male terminals).

NOTE The green (V) and white/red (Bi/R) cables are double, though connected together.
Take the measurements on either of the two.

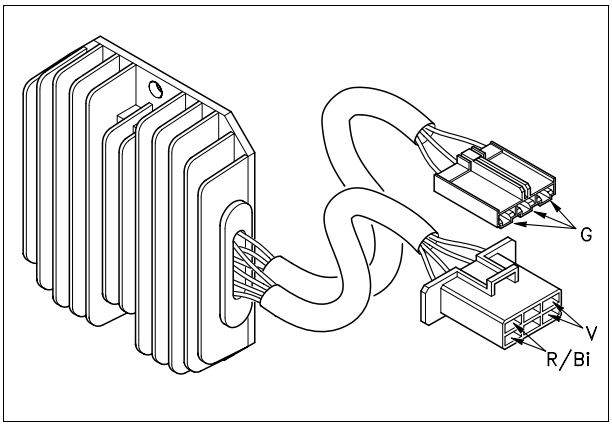
		Positive terminal (+) of the tester on:				
		G	G	G	V	R/Bi
Negative terminal (–) of the tester on:	G		∞	∞	2 - ∞	∞
	G	∞		∞	2 - ∞	∞
	G	∞	∞		2 - ∞	∞
	V	∞	∞	∞		∞
	R/Bi	2 - ∞	2 - ∞	2 - ∞	3 - ∞	



⚠ CAUTION

This measuring method is approximate; if possible, check the correct operation of the recharging system using another regulator in perfect condition.

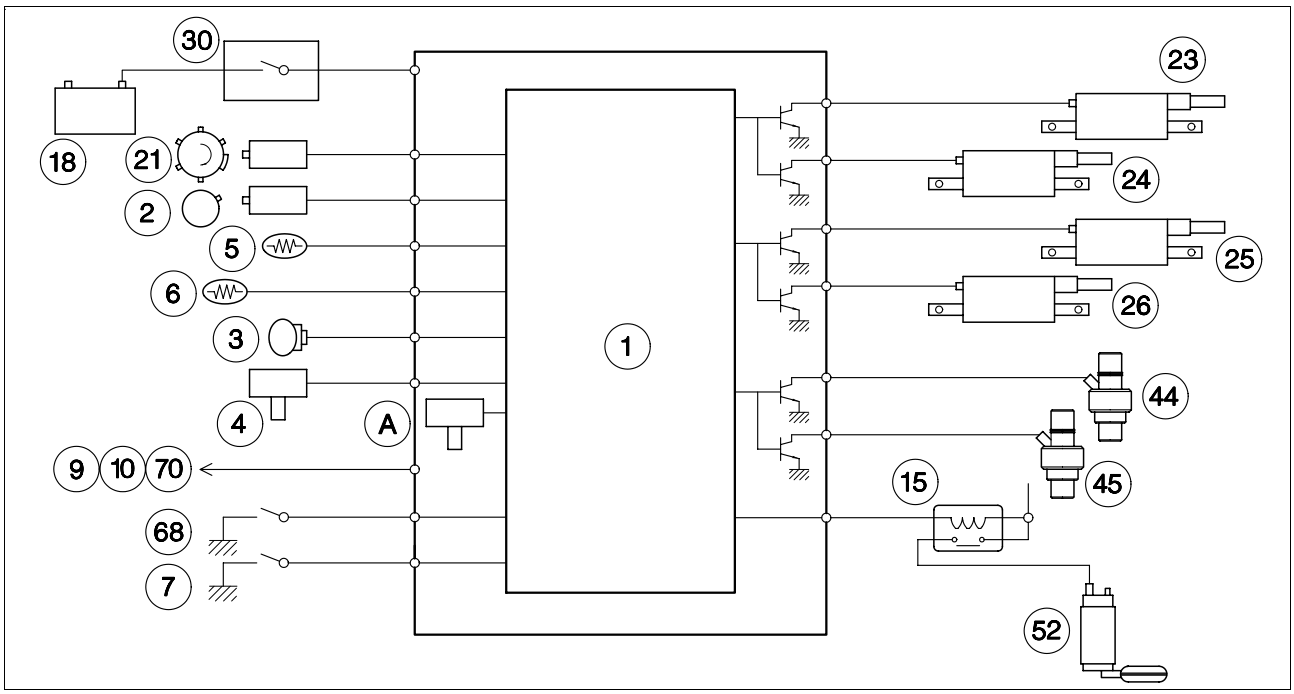
If the resistance measured is incorrect, replace the voltage regulator (3).



6.4 IGNITION SYSTEM

6.4.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



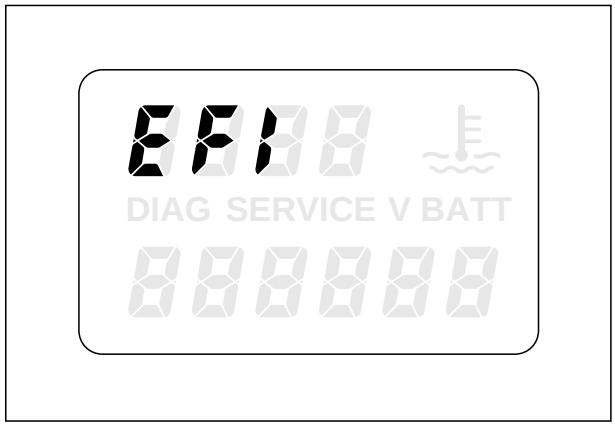
Wiring diagram key

A) Intake pressure sensor (inside electronic unit)
1) Electronic unit
2) Cam position sensor
3) Throttle valve potentiometer
4) Suction pressure sensor
5) Coolant thermistor
6) Air thermistor
7) Fall sensor
9) Clutch control lever switch
10) Neutral switch
15) Fuel pump relay
18) Battery
21) Pick up
23) Rear cylinder coil “1”
24) Rear cylinder coil “2”
25) Front cylinder coil “1”
26) Front cylinder coil “2”
30) Ignition switch
44) Front cylinder injector
45) Rear cylinder injector
52) Fuel pump
68) TEST connectors
70) Side stand switch

6.4.2 TROUBLESHOOTING (IF THE ENGINE DOES NOT START)

Locating a fault in the electrical system

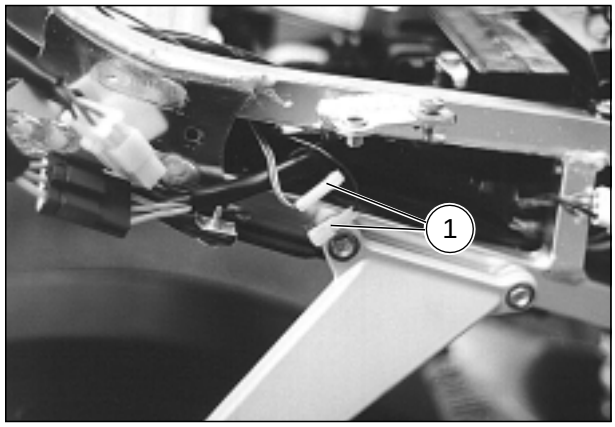
- Position the vehicle on the stand.
- Turn the ignition switch to position "○".
  The message "EFI" comes up on the right-hand display for approx. three seconds.
- Press the start pushbutton "⊛"for more than four seconds.
  If the ignition system is malfunctioning, the message "EFI"reappears.



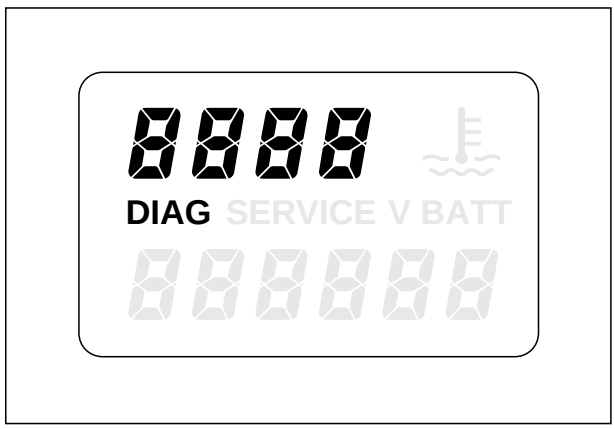
NOTE If a fault is detected in the electronic system or if the "EFI" message flashes on the multifunction display, do not start the vehicle so as to avoid secondary damage.

If the ignition system is malfunctioning and the message "EFI", fails to reappear, make sure there are no breaks in the white/purple (Bi/Vi) cable between the electronic unit and the display.

- Remove the right side panel, see 7.1.3 (REMOVING THE SIDE COVERS).
- Connect the two one-way TEST connectors (1).
- Turn the ignition switch to position "○".
- Start the engine or attempt to start it.



The message "DIAG" comes up on the left display along with a number corresponding to the reference code relating to the fault (see table); the fault detected may be caused by breaks in the cables and/or connections not made properly.



Checking an electric system fault:

⚠ CAUTION

Before commencing the automatic search for a fault, stop the engine.

NOTE When a fault comes up on the display, it is possible that the fault may also be attributable to the engine control unit.

The ECU may only be tested by connecting a new ECU. Should the engine control unit work properly, remember to refit the previous unit.

The ECU features an anti-breakdown device which, where necessary, means the engine can be started and run despite there being a fault on the display.

Component	Fault code	Cause	To view "EFI" on the display	Components to be checked	Starting motor running	Engine runs	Engine runs (emergency conditions)
Camshaft position sensor	11	Sensor not connected. Sensor broken. Wiring faulty.	Press the starter button for more than four seconds.	Connector, sensor cable and sensor.	Yes	No (the cylinder cannot be identified)	No
Driving shaft position sensor	12				Yes	No	
Intake pressure sensor	13				Yes	Yes	Yes (irregular running for throttle valves rotation insufficient)
Intake pressure sensor	14	Excessive difference between the sensor signals.	Engine shut off.	Sensor pipes (air pipe)			
Throttle valve potentiometer	15	Sensor not connected. Sensor broken. Wiring faulty.	Engine running or engine shut off.	Connector, sensor cable and sensor.			Yes
Coolant thermistor	21					Yes (cold-starting difficult)	
Air thermistor	22						
Atmospheric pressure sensor (ECU inside)	23	Sensor faulty.		Cannot be checked: replace the ECU.		Yes	Yes (altimetrical compensation lack)
Ignition coil "1" of front cylinder	33	Ignition coil faulty or wiring not connected.	Engine running.	Connector, ignition cable.		Yes (power loss)	Yes (power loss)
Ignition coil "2" of front cylinder	34						
Ignition coils "1" and "2" of front cylinder	33, 34					Yes (only one cylinder, power loss)	Yes (only one cylinder, power loss)
Ignition coil "1" of rear cylinder	35					Yes (power loss)	Yes (power loss)
Ignition coil "2" of rear cylinder	36				Yes		
Ignition coils "1" and "2" of rear cylinder	35, 36				Yes	Yes (only one cylinder, power loss)	Yes (only one cylinder, power loss)
Fall sensor	41	Sensor not connected. Sensor broken. Wiring faulty.	Engine running or engine shut off.	Connector, sensor cable and sensor.	Yes	No	No

6.4.3 ELIMINATING ELECTRONIC SYSTEM FAULTS ACCORDING TO THE INFORMATION SENT UP ON THE DISPLAY

⚠ WARNING

Take care around the high voltage in the ignition system.

Never disconnect connections with the engine running.

Whenever work is performed in the ignition system, always make sure the ignition switch is set to "⊗" and the battery disconnected, unless otherwise indicated (when disconnecting the battery, disconnect the negative pole "–" first).

⚠ CAUTION

All measurements must be taken with the components at a temperature of 20°C (68°F).
General instructions regarding the elimination of faults: as soon as the fault has been located, remove the defective component.

◆ Perform the checks indicated in the following chapters:
- 6.4.6 (CHECKING THE CAMSHAFT POSITION SENSOR);
- 6.4.5 (CHECKING THE PICK-UP);
- 6.4.11 (CHECKING THE INTAKE PRESSURE SENSOR);
- 6.4.10 (CHECKING THE THROTTLE VALVE POTENTIOMETER);
- 6.4.8 (CHECKING THE COOLANT THERMISTOR OPERATION).

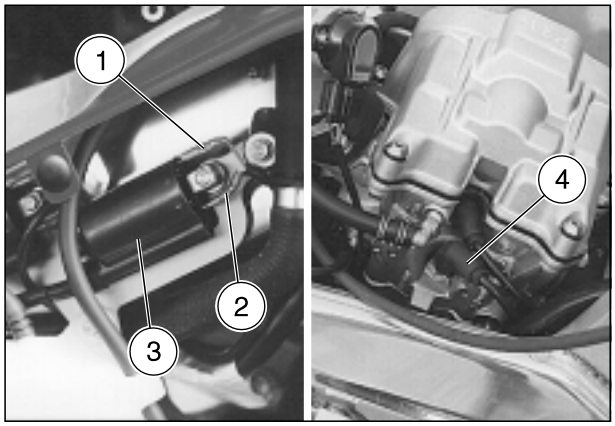
If the engine does not start and the diagnostics fail to detect any fault, check (in the given order) whether:
- The fuel pump is working properly, see 6.5.2 (CHECKING THE FUEL PUMP);
- The injectors are working properly, see 6.4.12 (CHECKING THE INJECTORS);
- The connector for the antitheft device fitting is connected properly (located under the passenger seat and coloured white);
- The ignition switch is working properly, see 6.7 (SWITCHES);
- The engine shutoff switch is working properly, see 6.7 (SWITCHES);
- The main 30A fuses and secondary 15A fuses have blown, see 6.15 (CHANGING THE FUSES);
- The engine shutoff relay is working properly, see 6.5.4 (CHECKING THE ENGINE SHUTOFF RELAY);
- The battery is working properly, see 2.4 (BATTERY) and 6.11 (BATTERY);
- The safety logic is working properly, see 6.6 (IGNITION SAFETY SYSTEM);
- The fall sensor is working properly, see 6.4.7 (CHECKING THE FALL SENSOR).

6.4.4 CHECKING THE IGNITION COILS

◆ Remove both side fairings, see 7.1.26 (REMOVING THE SIDE FAIRINGS).

NOTE The following procedure refers to a single coil, though it is applicable to both.

◆ Disconnect the terminals (1-2) from the ignition coil (3).



⚠ CAUTION

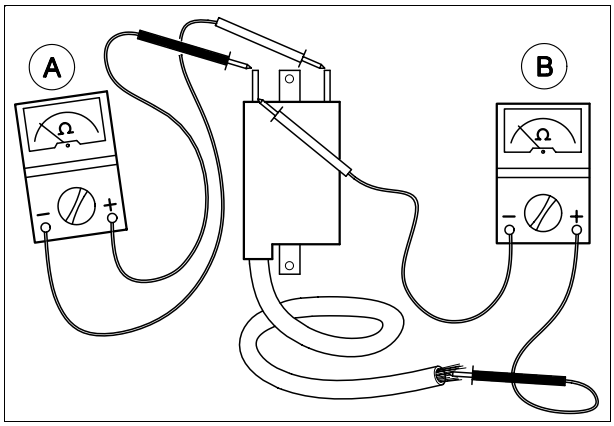
When reassembling, make sure the electric terminals (1-2) are connected up properly.

◆ Slip off the spark plug cap (4) (belonging to the coil of interest) and disconnect it from the cable.
◆ Measure the values of (A) and (B) indicated in the figure by means of a pocket tester.

It is important to check the continuity of the primary and secondary windings.
The reading in Ohms does not necessarily have to be exact but if the windings are sound, the resistance values must correspond approximately to those indicated.

Standard values:

Measurement (A): 2.8 – 5.2 Ω;
Measurement (B): 9.1 – 16.5 kΩ.



⚠ CAUTION

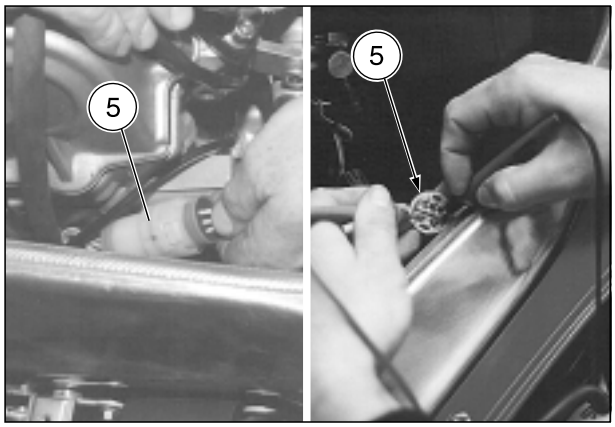
This measuring method is approximate; if possible, check the correct operation of the coil by replacing it with another one in perfect condition.

◆ Repeat the procedure for the other coils.

6.4.5 CHECKING THE PICK-UP

With the engine switched off:

◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
◆ Disconnect the two-way connector (5) (coloured white) and take the measurements (on the engine-side terminals).



⚠ CAUTION

When reassembling, make sure the electric connector (5) is plugged in properly.

◆ Using a pocket tester (scale x 100 Ω), measure the resistance between the terminals of the blue/yellow (B/G) and white/yellow (Bi/G) cables.

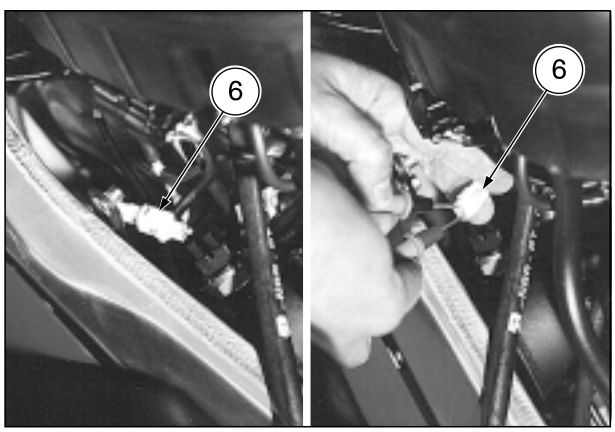
Standard value: 150 – 350 Ω.

If the resistance is infinite (∞) or lower than the prescribed level, the sensor must be changed.

6.4.6 CHECKING THE CAMSHAFT POSITION SENSOR

With the engine switched off:

◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
◆ Disconnect the two-way connector (6) (coloured white) and take the measurements (on the engine-side terminals).



⚠ CAUTION

When reassembling, make sure the electric connector (6) is plugged in properly.

◆ Using a pocket tester (scale x 100 Ω), measure the resistance between the terminals of the blue/yellow (B/G) and white/yellow (Bi/G) cables.

Standard value: 150 – 350 Ω.

If the resistance is infinite (∞) or lower than the prescribed level, the sensor must be changed.

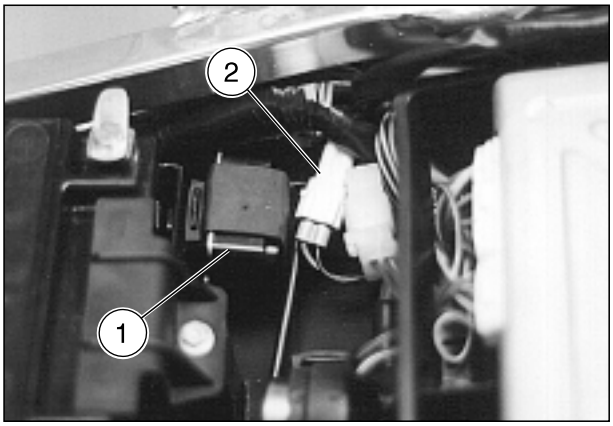
6.4.7 CHECKING THE FALL SENSOR

With the engine switched off:

◆ Remove the riders saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).

Check whether the sensor (1) is fitted correctly (with the arrow inscribed on the rubber element pointing up).

◆ Disconnect the two-way connector (2) (coloured white/grey) and take the measurements (on the sensor-side terminals).



⚠ CAUTION

When reassembling, make sure the electric connector (2) is plugged in properly.

◆ Using a pocket tester (scale x 100 kΩ), measure the resistance between the terminals of the black and white/black (N - Bi/N) cables.

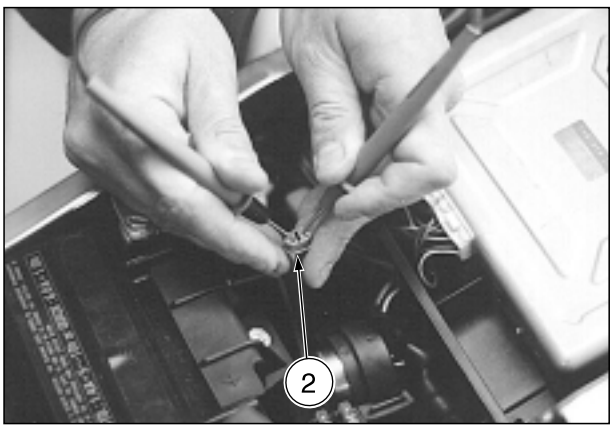
Standard value: resistance 62 kΩ ± 15 %.

◆ Remove the sensor (1) complete with rubber element from its housing and tilt it sideways at an angle of over 45° (simulating the condition of a vehicle resting on the ground).

Standard value: 0 – 1 Ω.

If the resistance is any value other than that prescribed, the sensor (1) must be changed.

◆ Repeat the procedure, tilting the sensor in the opposite direction.

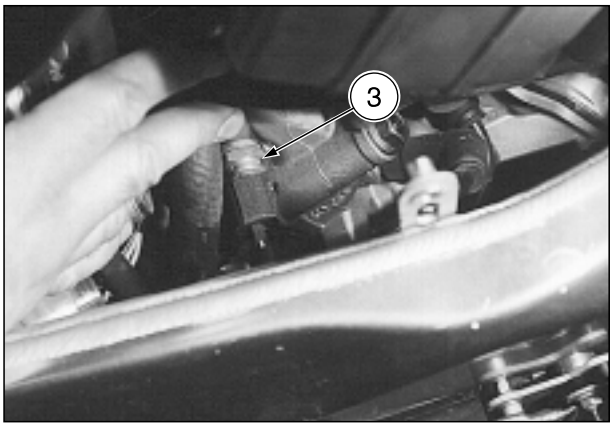


6.4.8 CHECKING THE COOLANT THERMISTOR OPERATION

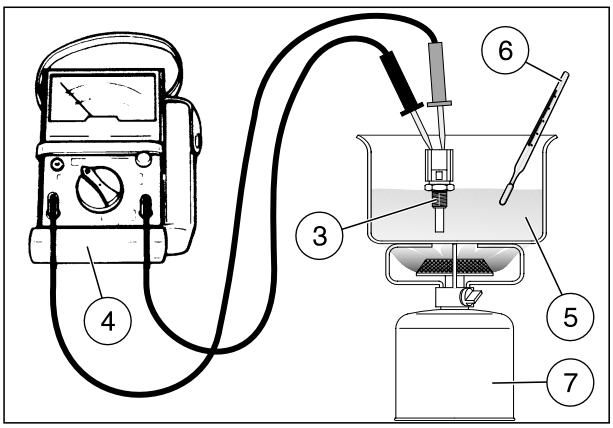
NOTE The value of the temperature measured by the front cylinder thermistor (right-hand side) is sent up on the right-hand display; that measured by the rear cylinder thermistor (left-hand side) is sent to the electronic unit.

◆ Remove the thermistor (3), see 5.5 (REMOVING THE COOLANT THERMISTORS).
◆ Connect a tester (4) (set as an ohmmeter) to the thermistor (3), as illustrated in the figure.
◆ Immerse the thermistor (3) in a container (5) holding coolant.
◆ Immerse a thermometer (6) with a 0 to 150 °C (32 to 302 °F) range in the same container.
◆ Place the container on a burner (7) and slowly warm up the coolant.
◆ Check the temperature indicated on the thermometer (6) and the thermistor (3) value indicated by the tester.

Make sure that the value varies according to the temperature, as indicated.



Coolant temperature (°C)	Coolant temperature (°F)	Standard values (Ω) (± 10%)
20	68	1960 - 2940
40	104	800 - 1200
60	140	400 - 700
80	176	200 - 400
100	212	120 - 250

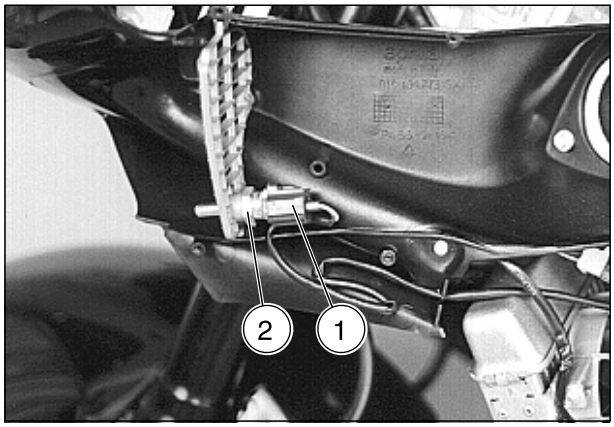


If values do not vary, or if they depart excessively from those indicated in the table, change the thermistor (3).

◆ Repeat the procedure for the other thermistor.

6.4.9 CHECKING THE AIR THERMISTOR OPERATION

- Remove the left-hand conveyor cover, see 7.1.29 (REMOVING THE AIR CONVEYOR).
- Disconnect the two-way connector (1) (coloured green).

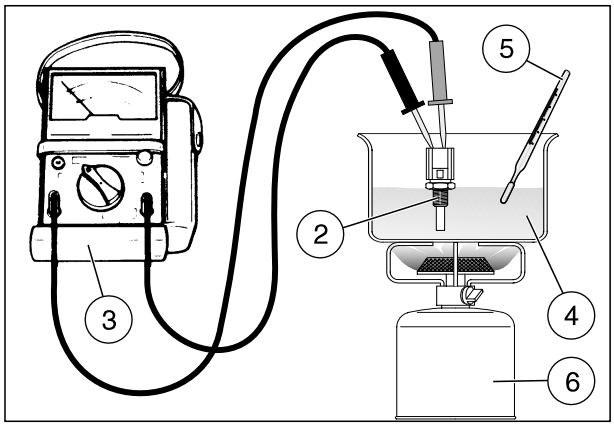


⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Remove the thermistor (2).
- Connect a tester (3) (set as an ohmmeter) to the thermistor (2) as illustrated in the figure.
- Immerse the thermistor in a container (4) holding water.
- Immerse a thermometer (5) with a 0 to 150 °C (32 to 302 °F) range in the same container.
- Place the container on a burner (6) and slowly warm up the liquid.
- Check the temperature indicated on the thermometer (5) and the thermistor value indicated by the tester.

Make sure that the value varies according to the temperature, as indicated.



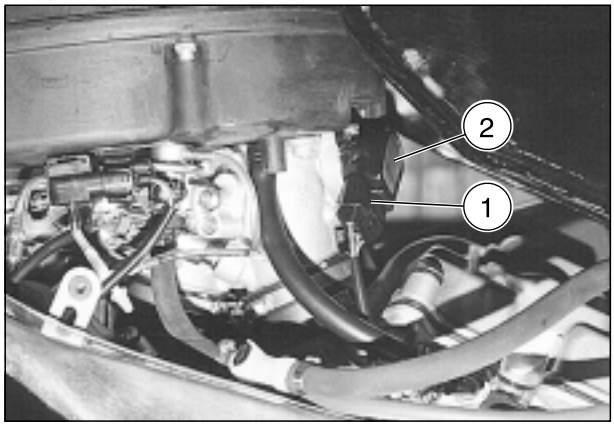
Water temperature (°C)	Water temperature (°F)	Standard values (Ω) (± 10%)
20	68	1960 - 2940
40	104	800 - 1200
60	140	400 - 700
80	176	200 - 400
100	212	120 - 250

If values do not vary, or if they depart excessively from those indicated in the table, change the thermistor (2).

6.4.10 CHECKING THE THROTTLE VALVE POTENTIOMETER

With the engine switched off:

- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Disconnect the four-way connector (coloured black) (1).



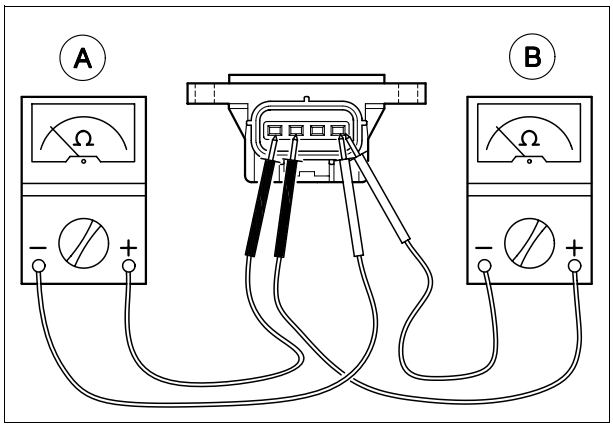
⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Turn the ignition switch to position "○".
- Using a pocket tester, measure the supply voltage between the terminals of the potentiometer (2); measurement (A).

Standard value: 4.5 - 5.5 V.

- Turn the ignition switch to position "⊠".
- Using a pocket tester (scale kΩ), measure the resistance between the terminals of the potentiometer (2).



MEASUREMENT (A)

Resistance between the two terminals whatever the position of the throttle valves:

Standard value: 2.87 – 5.33 kΩ.

MEASUREMENT (B)

Starting with the throttle valve fully closed, accelerating progressively until completely open, the resistance should vary as follows;

standard value:

- **with throttle valves closed 0.34 - 5.69 kΩ;**
- **with throttle valves open 2.87 - 8.41 kΩ.**

NOTE In order to make it easier to unscrew the screws (3) secured using LOCTITE® 243, heat them first with a hot air blower.

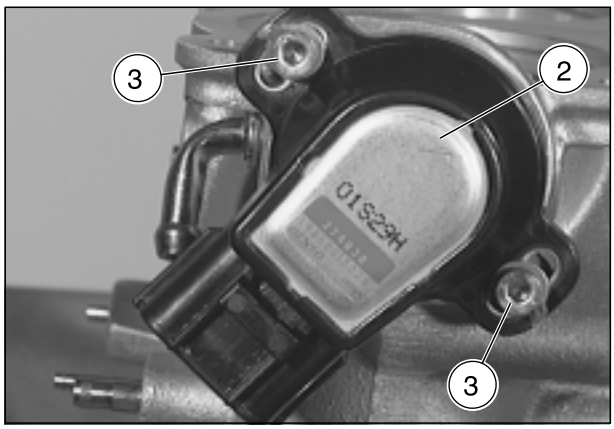
- Unscrew and remove the screws (3).
- Remove the potentiometer (2).
- Using a tester (kΩ scale), measure the resistance between the potentiometer terminals (2); measurement (B).

Standard value:

– with throttle valves closed < 5.2 kΩ;
– with throttle valves open 3.34 – 8.88 kΩ.

If the measurements result in any resistance values other than those given, replace the potentiometer (2).

- With the throttle valves in the closed position, place the potentiometer in its housing (2).



NOTE Apply LOCTITE® 243 on the thread of the screws (3).

- Screw the screws (3) on by hand so that they hold the potentiometer (2) in place but do not prevent it from rotating.
- Connect the TEST connectors.
- Turn the ignition switch to position "○".
- Turn the potentiometer (2) until the display reads "0".
- Tighten the screws (3).

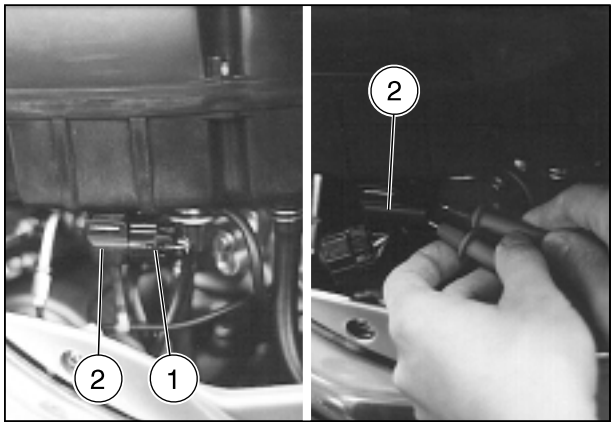
Driving torque of screws (3): 1.6 Nm (0.16 kgm).

- Turn the ignition switch to position "⊠".
- Disconnect the TEST connectors.

6.4.11 CHECKING THE INTAKE PRESSURE SENSOR

With the engine switched off:

◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
◆ Disconnect the three-way connector (1) (coloured black).



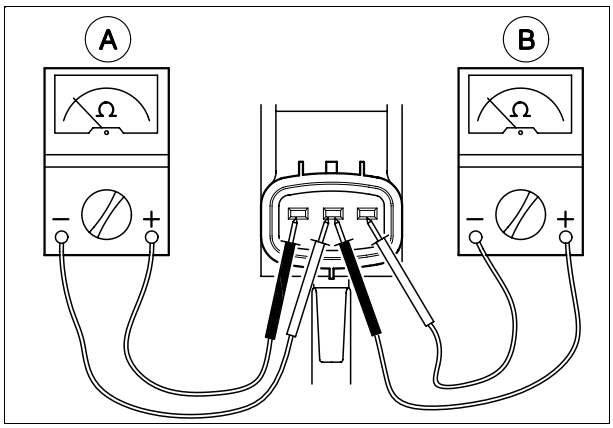
⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

◆ Turn the ignition switch to position "○".
◆ Using a pocket tester, measure the supply voltage between the terminals of the sensor (2): measurement (A).

Standard value: 4.5 – 5.5 V.

◆ Turn the ignition switch to position "⊠".
◆ Using a pocket tester (scale kΩ), measure the resistance between the terminals of the sensor (2).



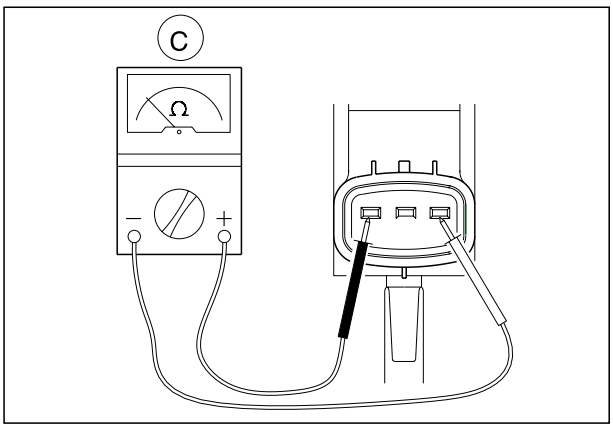
NOTE Measurements (A), (B) and (C) must be taken individually, not at the same time.

Measurements (A), (B) and (C) must produce the following values:

Standard values:

– **measurement (A) 12 kΩ;**
– **measurement (B) 11.50 kΩ;**
– **measurement (C) 4 kΩ.**

If the resistance proves to be any value other than that prescribed, the sensor (2) must be changed.



6.4.12 CHECKING THE INJECTORS

With the engine switched off:

◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).

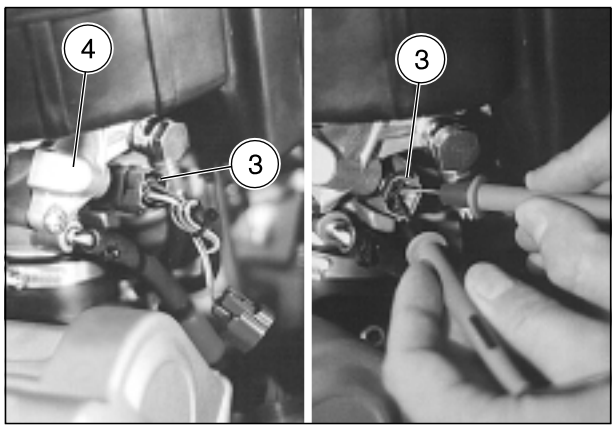
NOTE The following procedure refers to a single injector, though it is applicable to both.

◆ Disconnect the two-way connector (3) (coloured grey) and take the measurements (on the injector-side terminals).
◆ Using a pocket tester (scale 100 Ω), measure the resistance between the terminals of the injector.

Standard value: 11 – 17 Ω a 20 °C (68 °F).

If the resistance is infinite (∞) or lower than the prescribed level, the injector (4) must be changed.

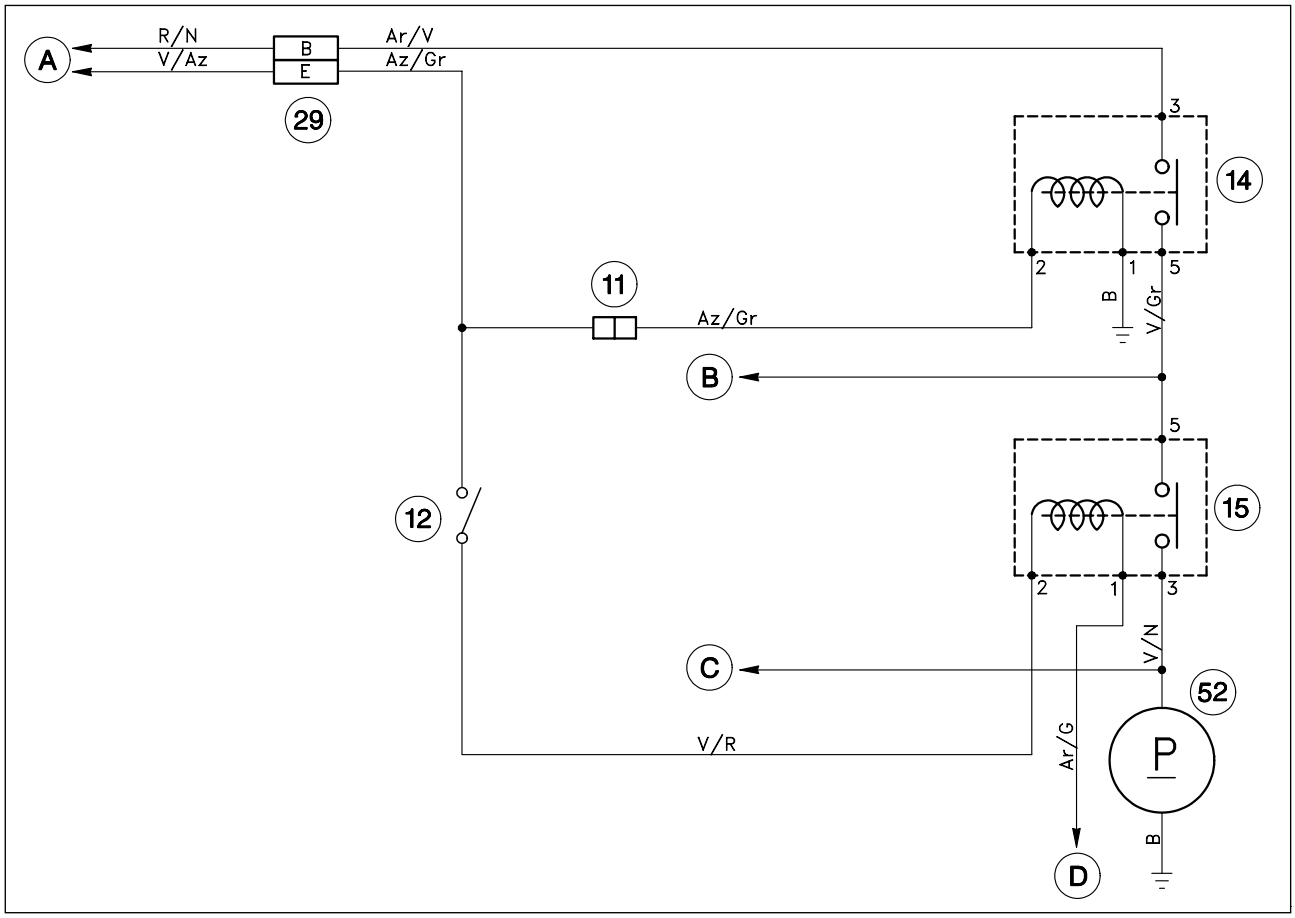
◆ Repeat the procedure for the other injector.



6.5 FUEL PUMP SYSTEM

6.5.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



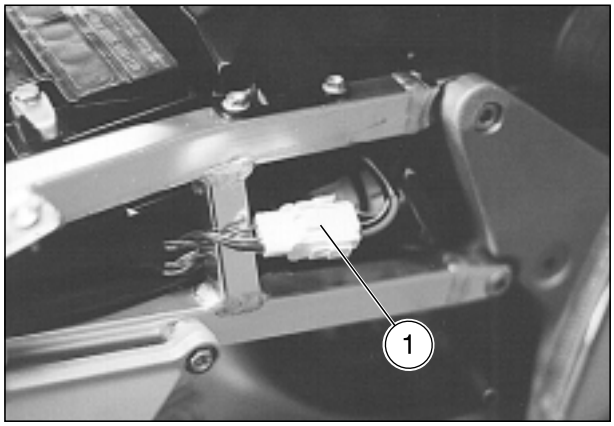
Wiring diagram key

11) Arrangement for the installation of the anti-theft device
12) Right dimmer switch
14) Engine stop relay
15) Fuel pump relay
29) Secondary fuses (15 A)
52) Fuel pump
A) To the battery / ignition switch
B) To the HV coil
C) To the injectors / electronic unit
D) To the electronic unit

6.5.2 CHECKING THE FUEL PUMP

In order to check the pump is operating properly:

- ◆ Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- ◆ Disconnect the pump units three-way connector (1) (coloured white).



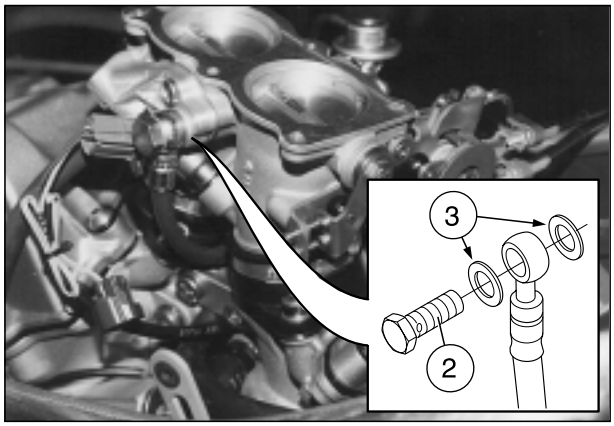
⚠ CAUTION

When refitting, make sure the electric connector (1) is plugged in properly.

Place a cloth under the perforated screw (2) to catch any fuel spills.

- ◆ Loosen the perforated screw (2) by approx. half a turn and wait a few seconds to allow the system to depressurize.
- ◆ Unscrew and remove the perforated screw (2) and retrieve the two gaskets (3).

Driving torque of perforated screw (2):
22 Nm (2.2 kgm).

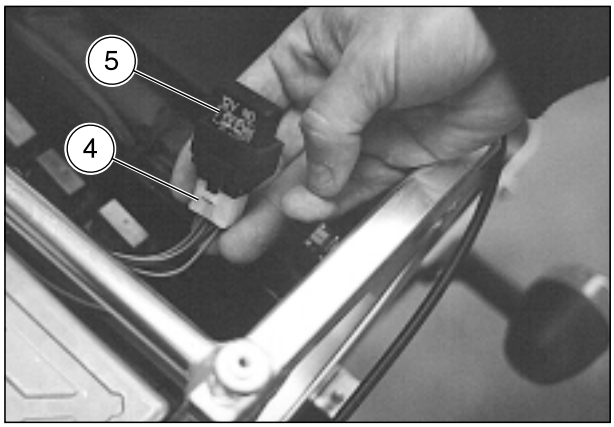


⚠ WARNING

When reassembling, use two new gaskets (3) and torque the perforated screw (2) to specification in order to ensure the tank is perfectly hermetic.
This is essential as the injection pressure is approx. 450 kPa (4.5 bar) and any fuel leakage would prove highly dangerous as the leaking oil might end up on high-temperature parts of the engine.

NOTE Have the appropriate special tool OPT cod. 8140181 (fuel-oil pressure gauge) to hand .

- ◆ Fit the appropriate special tool.
- ◆ Insert the free end of the pipe inside a container.
- ◆ Power the positive (**+**) green (V) and negative (**–**) blue (B) cables with a voltage of 12 V (d.c.) (from the pump unit side).
- ◆ Make sure the pump is working and produces the characteristic humming sound and check the pressure gauge gives a supply pressure reading of at least 350 kPa (3.5 bar).



6.5.3 CHECKING THE FUEL PUMP RELAY

- ◆ Remove the passenger seat, see 7.1.2 (UNLOCKING / LOCKING THE PASSENGER SEAT).

In order to check the operation of the relay:

- ◆ Disconnect the four-way connector (4) (coloured white) from the relay (5).

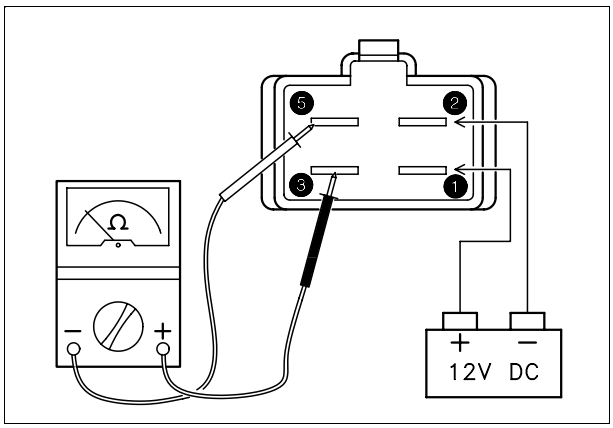
⚠ CAUTION

When reassembling, make sure the electric connector (4) is plugged in properly.

- ◆ Power the two internal male terminals (❶ - ❷) at 12 V.
- ◆ Using a tester (set as an ohmmeter), check for breaks between the other two terminals (❸ - ❺).

Correct value with relay powered: 0Ω.
Correct value with relay not powered: ∞ Ω.

If the resulting values do not correspond to those featured, change the relay (5).



6.5.4 CHECKING THE ENGINE SHUTOFF RELAY

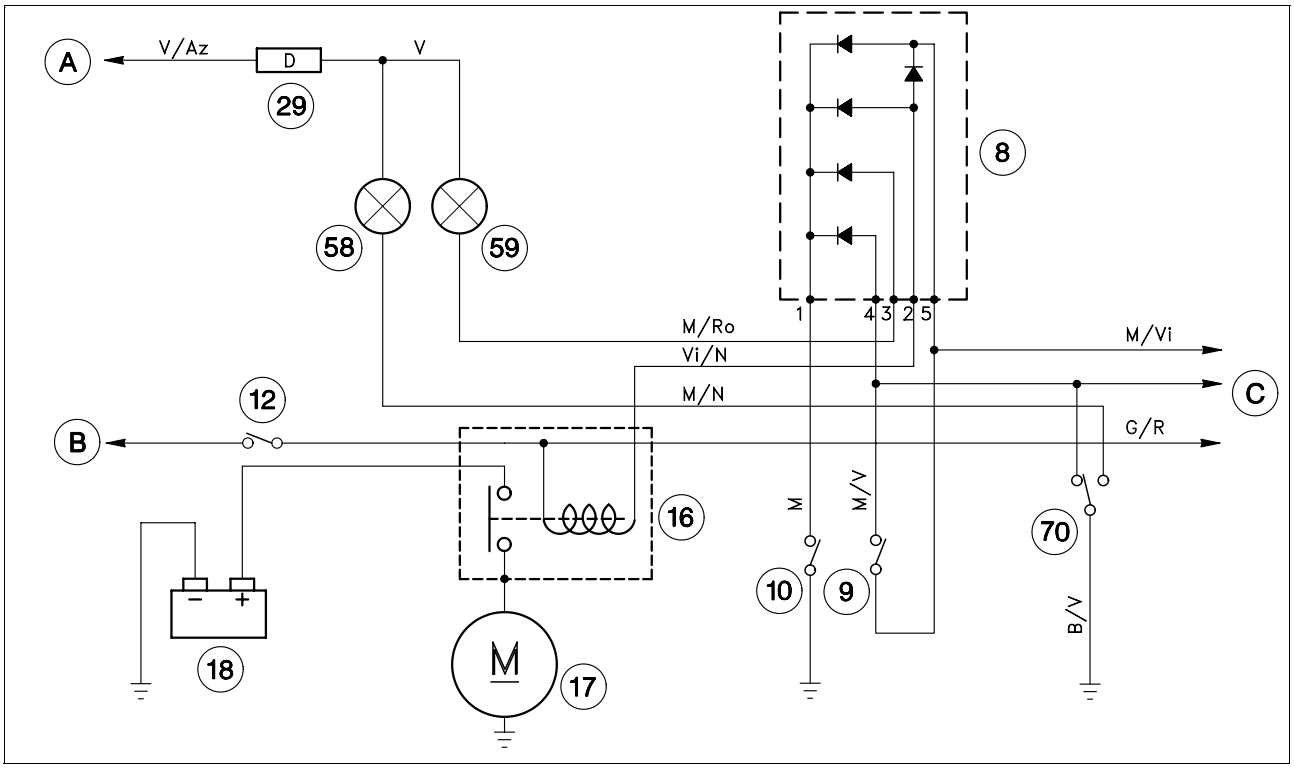
The procedure is exactly the same as that used to check the fuel pump relay, see 6.5.3 (CHECKING THE FUEL PUMP RELAY).

6.6 IGNITION SAFETY SYSTEM

6.6.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.

Wiring diagram key



8) Diode module
9) Clutch control lever switch
10) Neutral switch
12) Right dimmer switch
16) Start relay
17) Starter
18) Battery
29) Secondary fuses (15 A)
58) Side stand down warning light
59) Neutral warning light
70) Side stand switch
A) To the battery / ignition switch
B) To the secondary fuses (15 A)
C) To the electronic unit

6.6.2 STARTING SAFETY OPERATING LOGIC

NOTE With the engine shutoff switch in position "⊗" the starter motor does not turn over.

GEAR POSITION	STAND POSITION	CLUTCH LEVER	STAND WARNING LIGHT	ENGINE IGNITION	STARTER MOTOR
IN NEUTRAL	LIFTED	PULLED UP	OFF	WORKING	TURNING OVER
		RELEASED			
	LOWERED	PULLED UP	ON		
		RELEASED			
GEAR ENGAGED	LIFTED	PULLED UP	OFF		
		RELEASED			
	LOWERED	PULLED UP	ON	NOT WORKING	NOT TURNING OVER
		RELEASED			

6.6.3 CHECKING THE STARTING RELAY

To check operation of the relay:

- Remove the rider's saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).
- Disconnect the two-way connector (1) (coloured white).

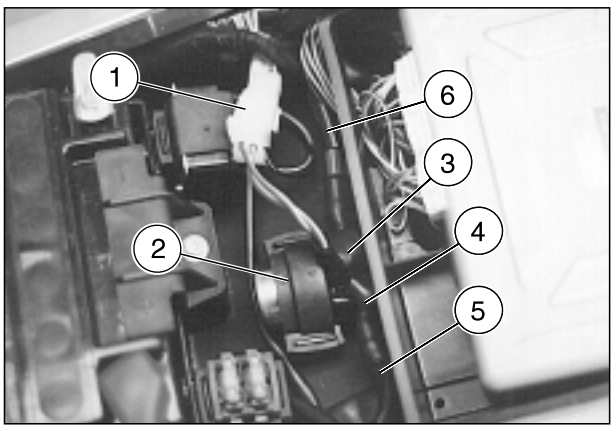
⚠ CAUTION

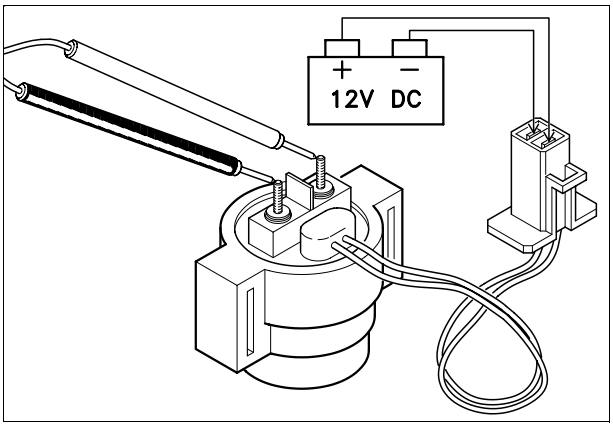
When reassembling, make sure the electric connector (1) is plugged in properly.

- Lift the relay and slip it off the relevant couplings (2).
- Slip off the two rubber protections (3-4).
- Disconnect the cables (5-6) from the relevant terminals on the relay (2).
- From the relay side, power the two internal terminals of connector (1) at 12V.
- Using a tester (acting as ohmmeter), check the for breaks between the two screw contacts on the relay (2).

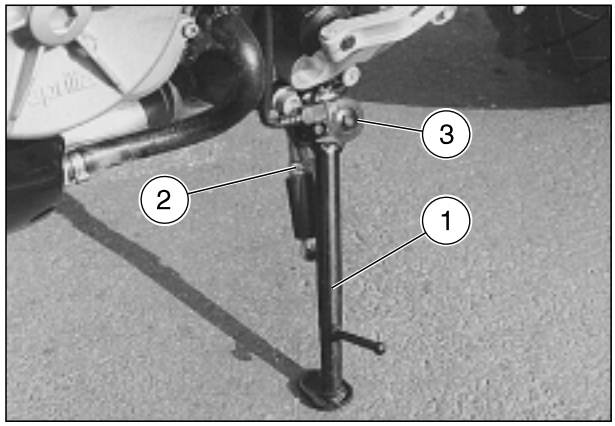
Correct value with relay powered: 0Ω.
Correct value with relay not powered: ∞ Ω.

If the values do not correspond to those indicated, change the relay (2).





6.6.4 CHECKING THE SIDE STAND AND THE SAFETY SWITCH



The side stand (1) must rotate without hindrances.

Carry out the following checks:

- ◆ The springs (2) must not be damaged, worn, rusty or weakened.
- ◆ The side stand must rotate freely, if necessary grease the joint, see 1.6 (LUBRICANT CHART).

The side stand (1) is provided with a safety switch (3) that has the function to prevent or interrupt the operation of the engine with the gears on and the side stand (1) down.

To check the proper functioning of the safety switch (3), proceed as follows:

- ◆ Seat on the vehicle in driving position.
- ◆ Fold the side stand (1).
- ◆ Start the engine.
- ◆ With released throttle grip and engine idling, pull the clutch lever completely.
- ◆ Engage the first gear, pushing the shifting lever downwards.
- ◆ Lower the side stand (1), thus operating the safety switch (3).

At this point:

– the engine must stop;
– the "side stand down" warning light "" must come on.

Should this fail to happen, replace the switch (3).

6.6.5 CHECKING THE DIODE MODULE

- ◆ Remove the passenger seat, see 7.1.2 (UNLOCKING / LOCKING THE PASSENGER SEAT).
- ◆ Disconnect the five-way connector (4) (coloured white) from the module (5).

⚠ CAUTION

When reassembling, make sure the electric connector (4) is plugged in properly.

- ◆ Power the various terminals at 12 V, placing a 12V - 2W bulb on the positive cable (+), as indicated.

⚠ CAUTION

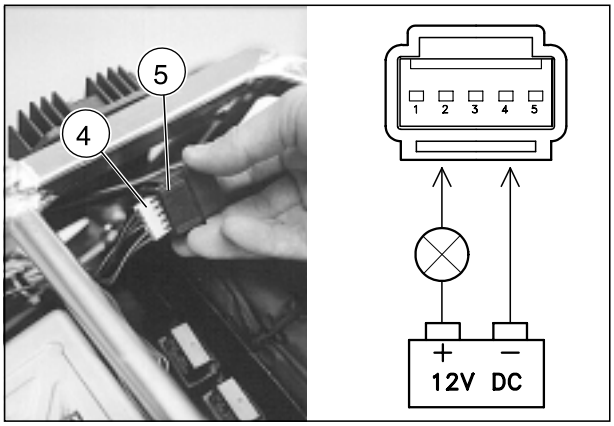
Do not use bulbs over 2W, since the module may be damaged.

– \ +	1	2	3	4	5
1		☼	☼	☼	☼
2	●		●	●	●
3	●	●		●	●
4	●	●	●		●
5	●	☼	●	●	

⚠ CAUTION

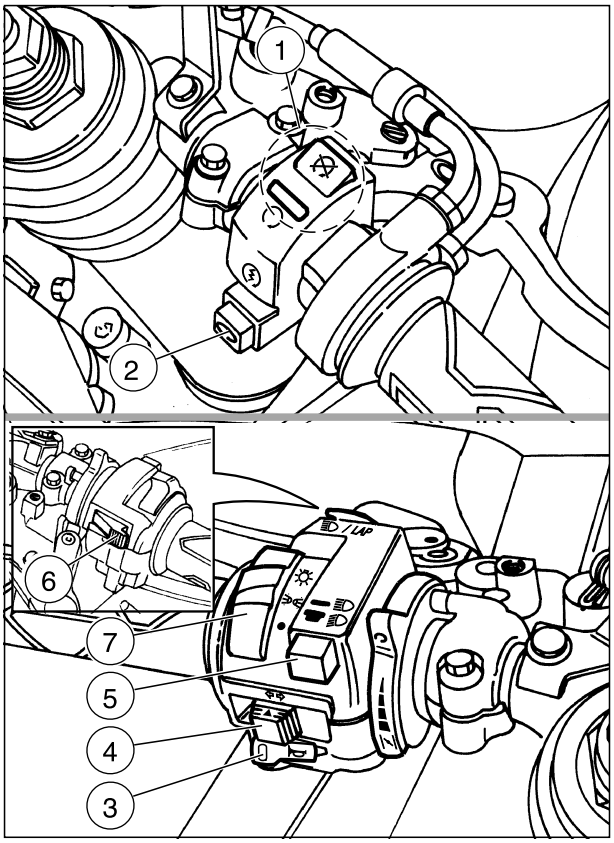
The bulb should only light up in the positions indicated.

If this is not the case, replace the module (5).



6.7 SWITCHES

Using a tester, check the continuity of the switches, referring to the specific diagram below.
Should any anomalies be encountered, change the corresponding switch set.



RIGHT SIDE SWITCH SET

1) Engine stop switch
2) Start push button

Pos.	Cables			
	Ar/Gr	V/R	G/R	V/R
⊛			○—○	
○ RUN	○—○			
○ OFF				

LEFT SIDE SWITCH SET

3) Horn push button
4) Direction indicator switch
5) Dimmer switch
6) High beam signaller push button / LAP push button (multifunction)
7) Light switch (not provided for ASD)

Pos.	Cables									
	Gr	V	G	N	Bi	Bi/B	R	Az	B/N	
≣D / LAP		○—	—	—	—	—○				
⊂	○—	—○								
•										
≣D⊂		○—	—○							
☼		○—	—○	—	—	—	—	—	—	—○
≣D				○—	—	—	—	—	—	—○
≣D					○—	—	—	—	—	—○
⇨							○—	—	—○	
⇦								○—	—○	

LEFT SIDE SWITCH SET ASD

3) Horn push button
4) Direction indicator switch
5) Dimmer switchi
6) High beam signaller push button / LAP push button (multifunction)

Pos.	Cables								
	Gr	V	G	N	Bi	Bi/B	R	Az	B/N
≣D / LAP		○—	—	—	—	—○			
⊂	○—	—○							
≣D		○—	—○	—○					
≣D		○—	—○	—	—○				
⇨							○—	—	—○
⇦								○—	—○

8) IGNITION SWITCH

Pos.	Cables			
	R	V/Gr	V	Bi/R
○	○	○	○	○
⊠				
🔒				

8) IGNITION SWITCH ASD

Pos.	Cables			
	R	V/Gr	V	Bi/R
○	○	○		
⊠			○	○
🔒			○	○

9) FRONT BRAKE STOPLIGHT SWITCH

Pos.	Cables	
	Gr	M
Operating	○	○

10) REAR BRAKE STOPLIGHT SWITCH

Pos.	Cables	
	G	G
Operating	○	○

11) NEUTRAL GEAR SWITCH

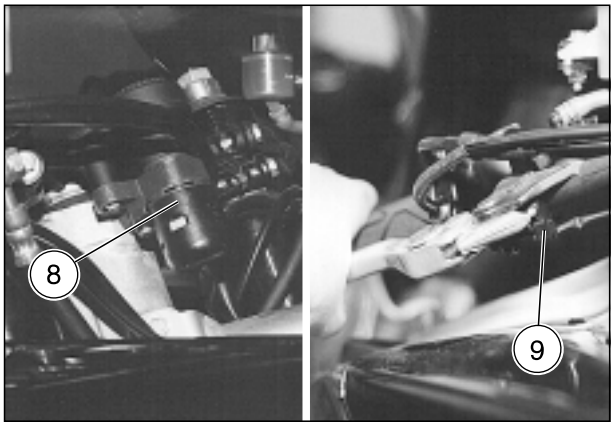
Pos.	Cables	
	Screw	⏚
Neutral	○	○

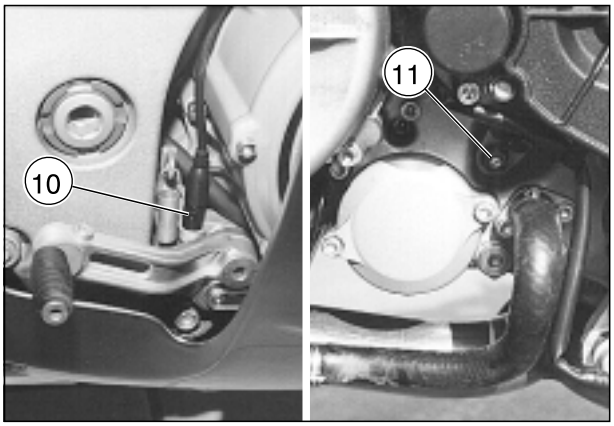
12) STAND SWITCH

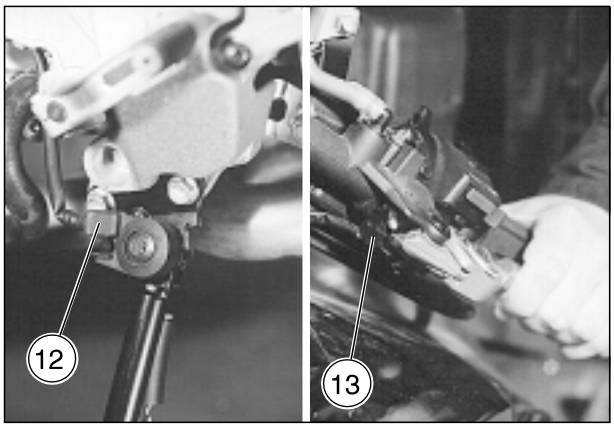
Stand	Cables		
	M	V	N
Down	○		○
Up		○	○

13) CLUTCH LEVER SWITCH

Pos.	Cables	
	Gr	M
Operating	○	○



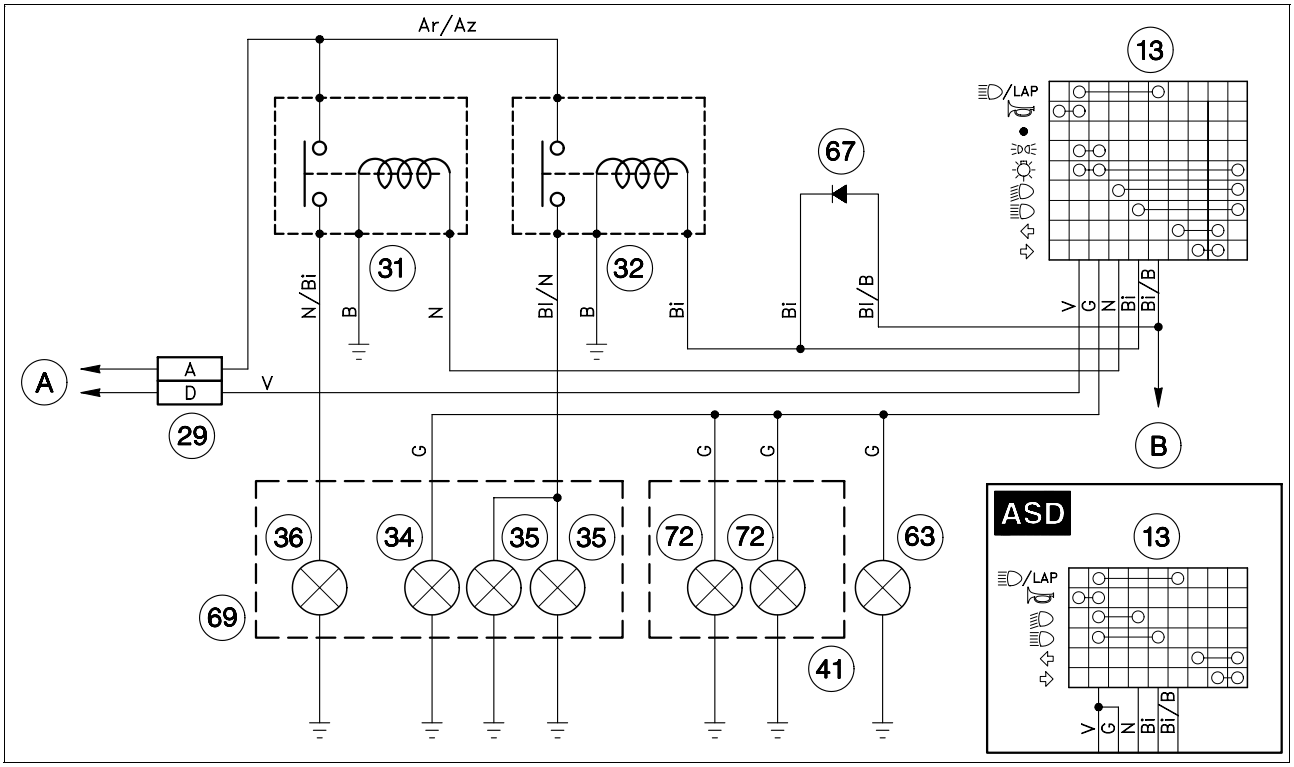




6.8 LIGHTS SYSTEM

6.8.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



Wiring diagram key

13) Left dimmer switch
29) Secondary fuses(15 A)
31) Low beam relay
32) High beam relay
34) Front parking light bulb
35) High beam bulbs
36) Low beam bulb
41) Rear light
63) Dashboard bulbs
67) Dimmer switch diode / LAP (multifunction)
69) Headlight
72) Rear parking light / stoplight bulbs
A) To the battery / ignition switch
B) To the right display / chronometer

6.8.2 CHECKING THE LIGHTS RELAY

To check operation of relay:

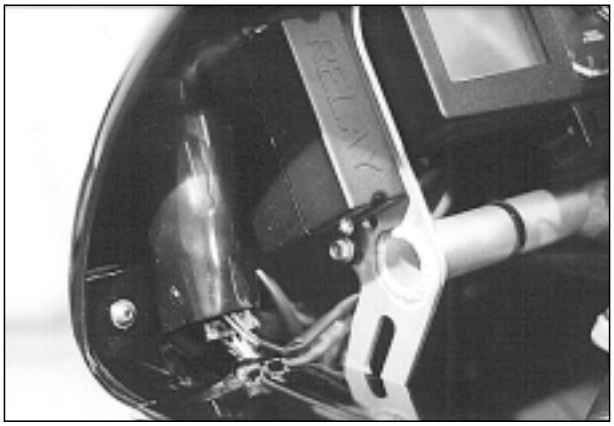
- ◆ Remove the relay box lid located on the left next to the dashboard.
- ◆ Remove the relevant relay (identifiable thanks to the label on the lid):

– high beam light relay (1);
– dimmers relay (2).

- ◆ Power the two internal male terminals (85 - 86) at 12V.
- ◆ Using a tester (acting as ohmmeter), check for breaks between the other two terminals (87 - 30).

Correct value with relay powered: 0Ω.
Correct value with relay not powered: ∞ Ω.

If the values do not correspond to those indicated, change the relevant relay.



6.8.3 CHECKING THE LIGHTS / LAP DIODE (multifunction)

To check operation of diode:

- ◆ Disconnect the three-way connector (3) (coloured white) (under the rubber protection cap) to the left of the handlebar.

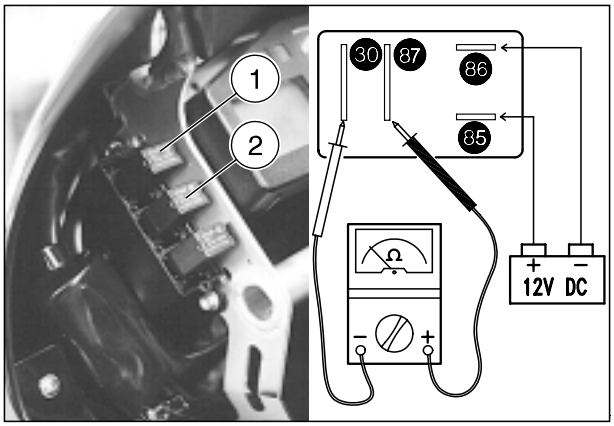
⚠ CAUTION

When reassembling, make sure the electric connector (3) is plugged in properly.

- ◆ Using a tester (in diode test mode), check the values between the two male terminals in the diode, as illustrated in the figure.

Correct value (measurement A): 0 – 1Ω.
Correct value (measurement B): ∞ .

In the event the tester does not feature the diode test mode, power with a voltage of 12 V, placing a 12V - 2W bulb on the positive cable and connecting the diode as illustrated in the figure.

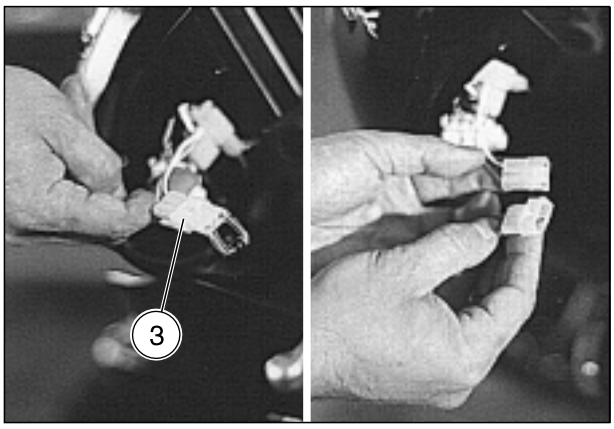


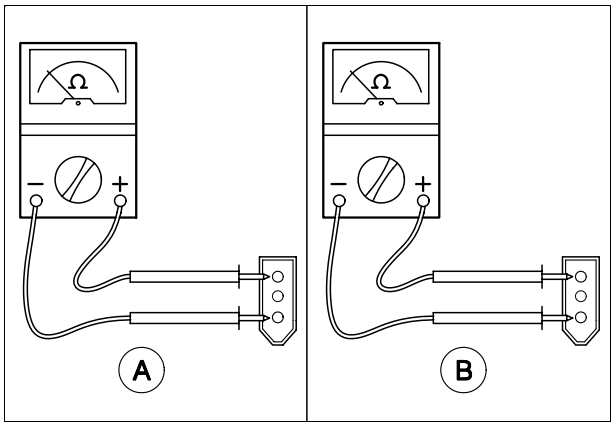
⚠ CAUTION

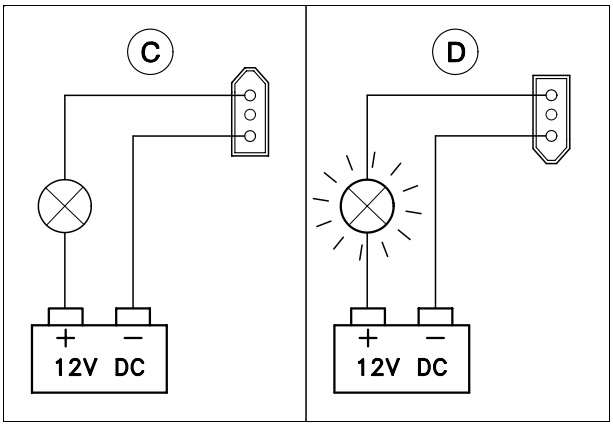
Do not use bulbs over 2W, since the diode may be damaged.

Test (C): the bulb does not light up.

Test (D): the bulb lights.



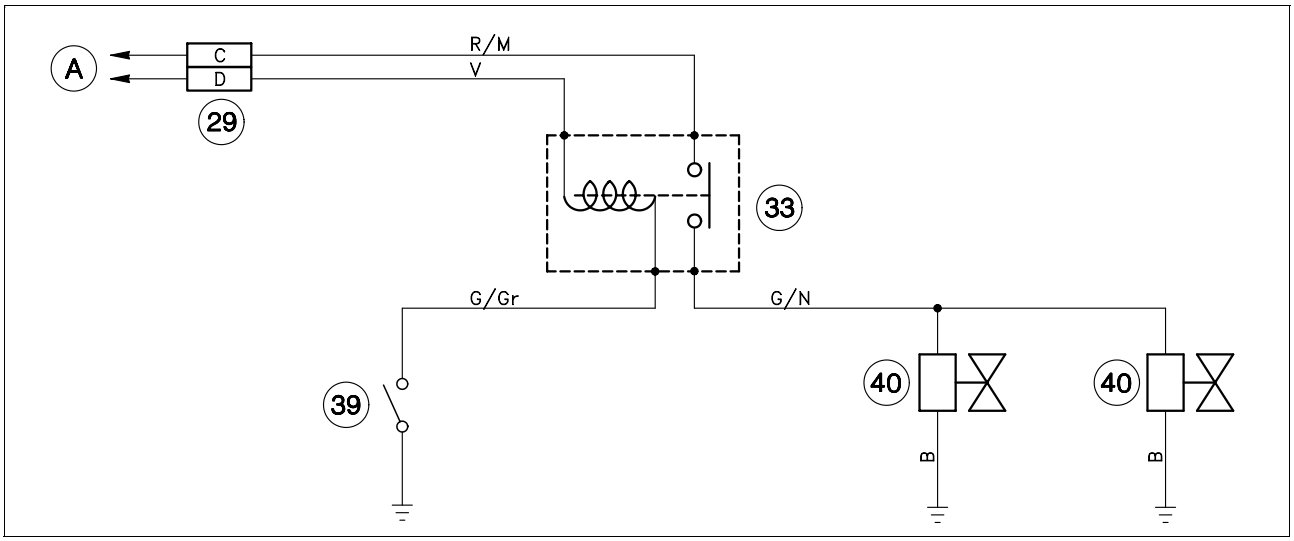




6.9 COOLING ELECTROFAN

6.9.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



Wiring diagram key

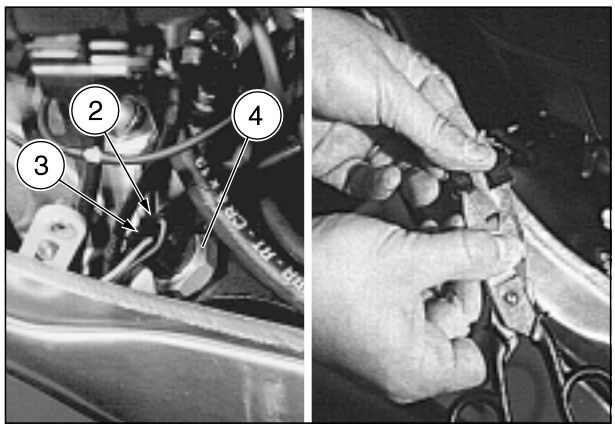
29) Secondary fuses (15A)
33) Cooling fan relay
39) Thermal switch
40) Cooling fans
A) To the battery / ignition switch

6.9.2 CHECKING THE ELECTROFAN OPERATION

NOTE The following procedure refers to a single electrofan, though it is applicable to both.

To check operation of electrofan (1):

- Remove the left-hand side fairing, see 7.1.26 (REMOVING THE SIDE FAIRINGS).
- Disconnect the two electric terminals (2-3) from the thermal switch (4) and connect them together.
- Turn the ignition switch to position "○".

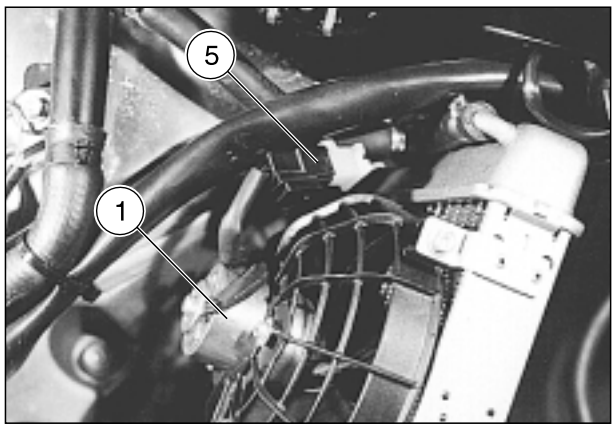


⚠ CAUTION

Then reassembling, make sure the electric terminals (2-3) are connected properly.

If the electrofan does not work:

- Turn the ignition switch to position "⚿".
- Make sure the connector (5) is correctly inserted.
- Rotate the fan manually, making sure the blades do not touch the mount.
- Check the recharging system, see 6.3 (CHECKING THE RECHARGING SYSTEM) and the secondary fuses (15A).
- Repeat the procedure for the other electrofan.

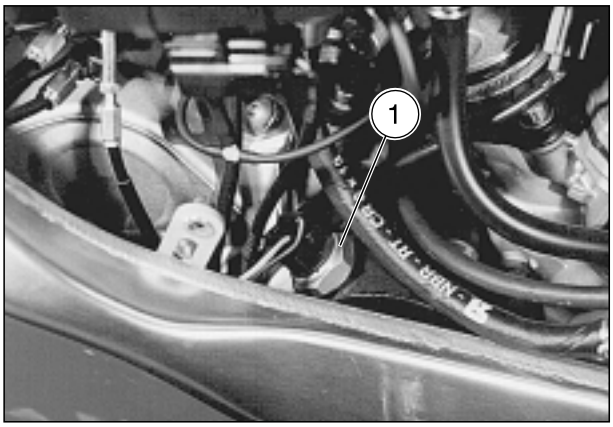


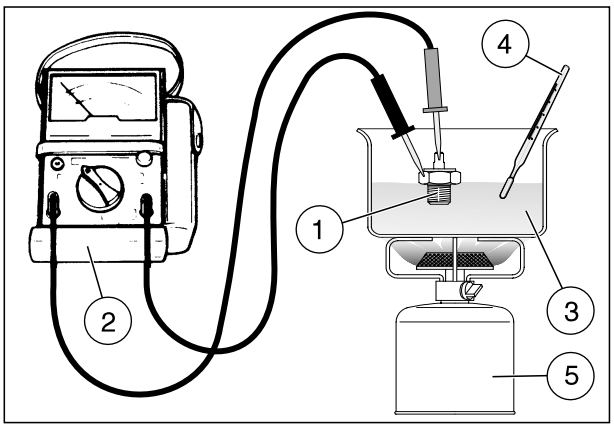
6.9.3 CHECKING THE THERMAL SWITCH OPERATION

Thermal switch	Temperature
switch on	~ 100° C (212°F)
switch off	~ 85° C (185°F)

NOTE The thermal switch switches to on at a temperature of ~ 100°C (212°F) and to off at ~ 85°C (185°F); within this range of values, it may switch to on or off indifferently.

- Remove the thermal switch (1), see 5.4 (REMOVING THE COOLANT THERMAL SWITCH).
- Connect a tester (2) (set as an ohmmeter) to the thermal switch (1) as illustrated in the diagram.
- Immerse the thermal switch (1) in a container (3) holding coolant.
- Immerse a thermometer (4) with a 0 – 150 °C (32 – 302 °F) range in the same container.
- Place the container on a burner (5) and slowly warm up the coolant.
- Check that the temperature reading on the thermometer (4) and the value indicated by the tester (2) correspond to the data in the table.





Coolant temperature (°C)	(°F)	Standard values (Ω) (± 10%)
> 100	> 212	0
< 85	< 185	∞

If the values depart excessively from those indicated in the table, change the thermal switch (1).

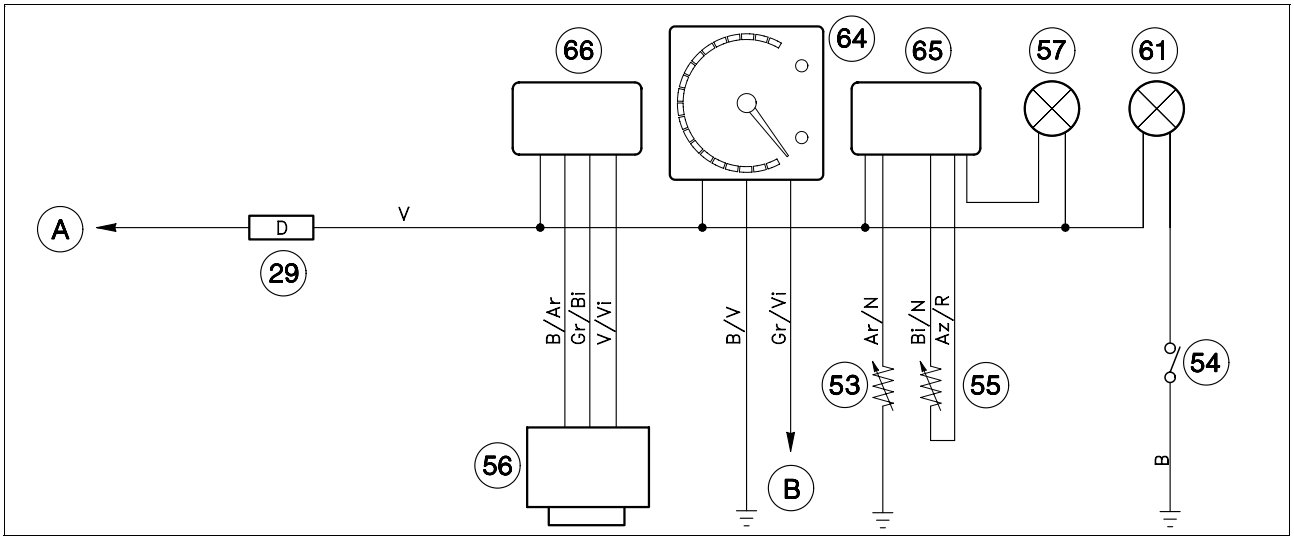
6.9.4 CHECKING THE ELECTROFAN RELAY

The procedure is the same as that required to check the lights relay, see 6.8.2 (CHECKING THE LIGHTS RELAY).

6.10 INDICATORS ON THE DASHBOARD

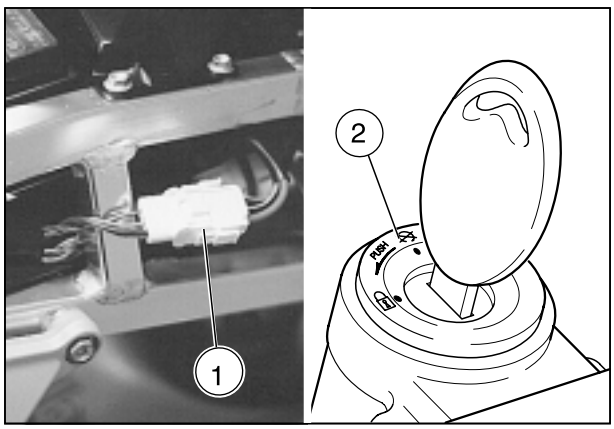
6.10.1 WIRING DIAGRAM

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.



Wiring diagram key

29) Secondary fuses (D) (15 A)
53) Low fuel sensor
54) Engine oil pressure switch
55) Coolant temperature thermistor
56) Speed sensor
57) Low fuel warning light
61) Engine oil pressure warning light LED
64) Revolution counter
65) Multifunction display (right side)
66) Multifunction display (left side)
A) To the ignition switch
B) To the electronic unit



6.10.2 LOW FUEL WARNING LIGHT

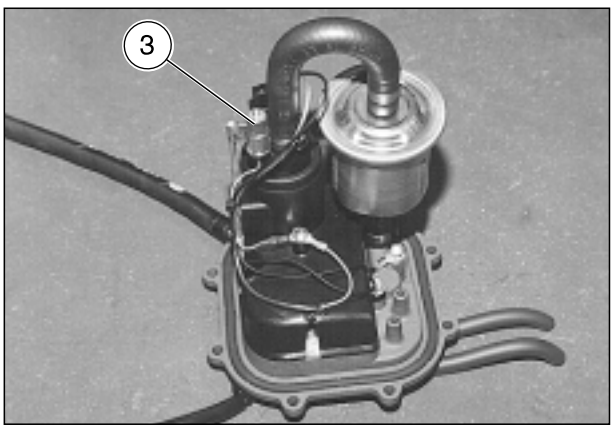
- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Disconnect the three-way electric connector (1) (coloured white) of the fuel pump unit.

⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Connect together the orange black (Ar/N) and blue (B) cables from the system side.
- With the ignition switch (2) set to "○" the "⛽" low fuel warning light should come on after a second.
- If the"⛽" light does not come on as expected, make sure the sensor (3) is working properly:
- Fill the tank with petrol.
  – With the sensor (3) fully submersed by petrol: the "⛽" light remains unlit.
- Drain the fuel tank completely, see 4.2 (DRAINING THE FUEL TANK).
  – With the sensor (3) fully submersed by petrol: the"⛽" light comes on after 30 to 60 seconds.

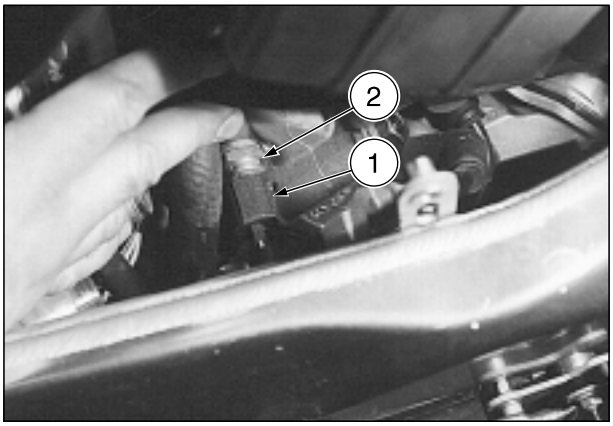
If these conditions are not achieved, replace the sensor, see 4.4 (REMOVING THE FUEL LEVEL SENSOR).



6.10.3 COOLANT TEMPERATURE DISPLAY

NOTE In the event the message "LLL", appears on the right-hand display, with a temperature below 130 °C (266 °F), there might be a problem with the wiring or the coolant thermistor might have short-circuited (right-hand side of engine, see 6.4.8 (CHECKING THE COOLANT THERMISTOR OPERATION).

- Lift the fuel tank, see 2.8 (LIFTING THE FUEL TANK).
- Disconnect the two-way connector (1) (coloured green) from the thermistor (2) (right-hand side of the engine).

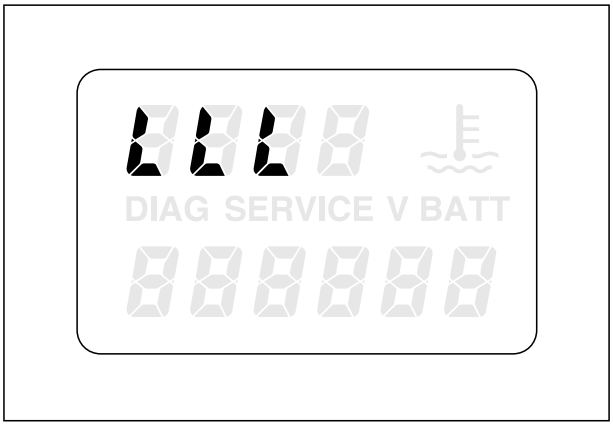


⚠ CAUTION

When reassembling, make sure the electric connector (1) is plugged in properly.

- Connect the following resistors to the connector (1) and check the message sent up on the right-hand display.

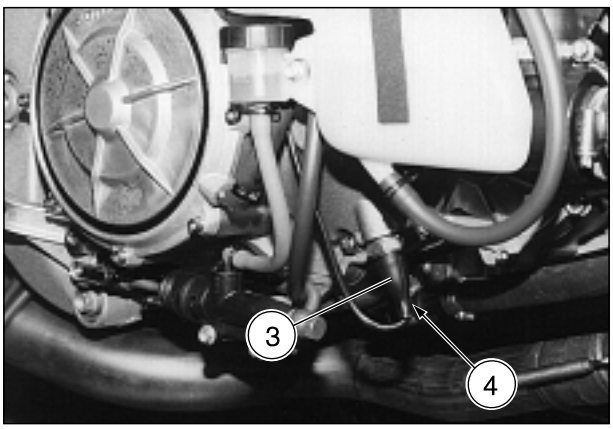
Resistance (Ω)	Message on right display	
	°C (±10%)	°F (±10%)
> 1400	cold	cold
580	60	140
245	90	194
115	120	248
< 90	LLL	LLL



- If the messages are correct, check the coolant thermistor on the right-hand side of the engine, see 6.4.8 (CHECKING THE COOLANT THERMISTOR OPERATION).

6.10.4 CHECKING THE ENGINE OIL LOW PRESSURE SENSOR

- Remove the lower fairing, see 7.1.32 (REMOVING THE LOWER FAIRING).
- Slip off the rubber protection (3).
- Disconnect the electric terminal (4) from the sensor (5) and earth it.



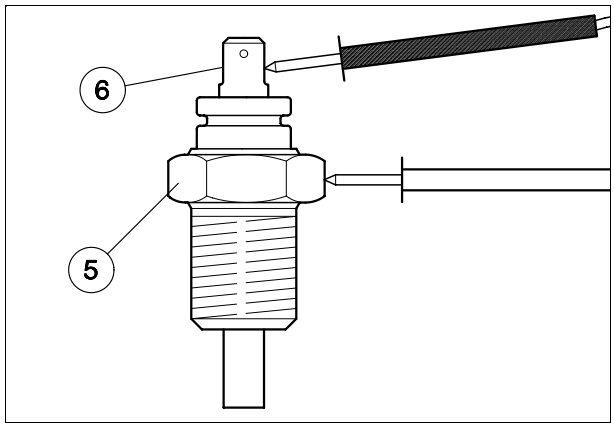
⚠ CAUTION

When reassembling, make sure the electric terminal (4) is connected properly.

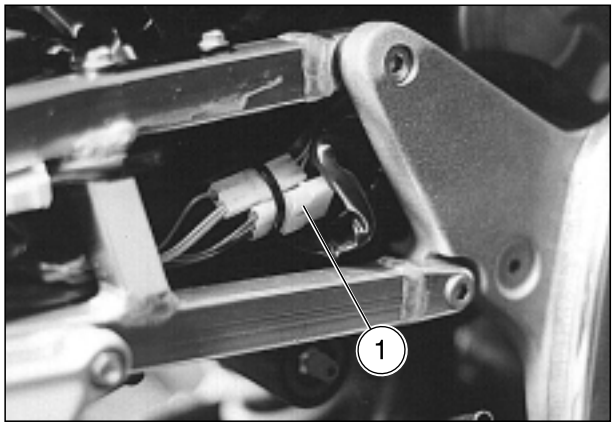
- With the ignition switch set to "○", the red low engine oil pressure "🛢" LED should come on.
- If the "🛢" LED comes on as expected, check the sensor is working properly.
- With a tester (scale x 100 Ω) check for breaks between the tongued terminal (6) and the casing of the sensor (5) (see figure).

Correct value with engine off: 0 Ω.
Correct value with engine running: ∞ Ω.

If the values do not correspond to those indicated, check that the engine oil level is correct, see 2.13 (CHECKING THE ENGINE OIL LEVEL AND TOPPING UP) and change the sensor (5), if necessary.



6.10.5 SPEEDOMETER

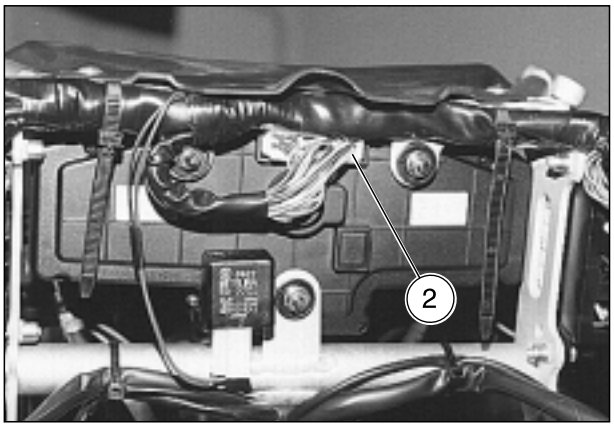


- Position the vehicle on the special rear support stand OPT.
- Place the clutch lever in neutral.
- Check the electric connections are plugged in properly: three-way connector (1) (coloured white) of the speed sensor and (2) of the dashboard.
- Check the distance between the speed sensor (3) and the five screws (4) securing the rear brake disc.

Distance between sensor (3) and screws (4): 1.5 ±1 mm.

- Make sure all five screws are present (4).

With the engine off and the ignition switch set to "❍", perform the following tests:



Test 1st

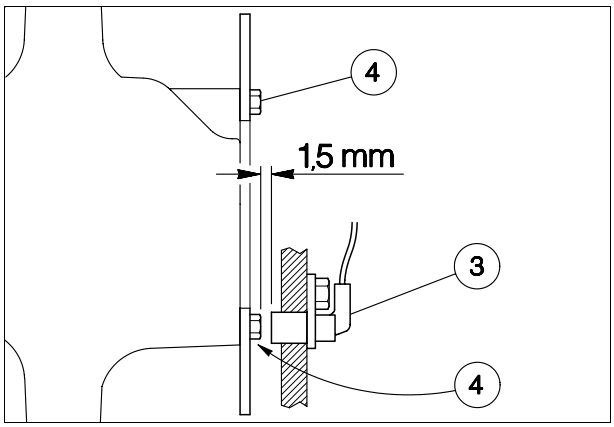
- Without disconnecting the electric connectors, connect a tester and measure the voltage between the green/purple (V/Vi) and blue/orange (B/Ar) cables.

Correct value:> 9V (d.c.).

Test 2nd

- Without disconnecting the electric connectors, connect a tester and measure the voltage between the grey/white (Gr/Bi) and blue/orange (B/Ar) cables.

Correct value: > 6V (d.c.).

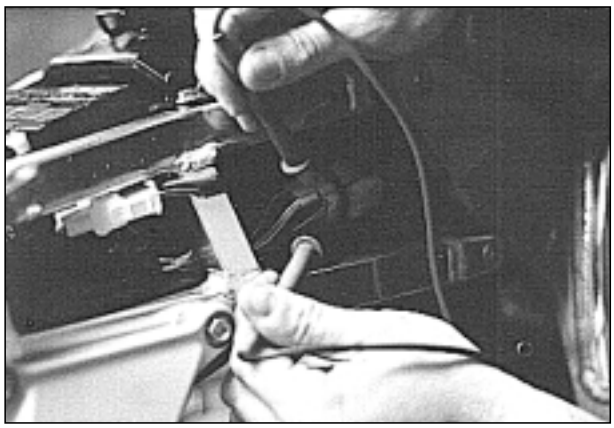


Test 3rd

- Perform test second.
- Spin the rear wheel by hand until one of the five screws (4) is in line with the sensor (3). The tester should read **zero V** for approx. two seconds before returning to **> 6 V**.

– If test 1st gives an incorrect result, disconnect the sensor (3) and repeat test 1st. If the wrong value persists, the dashboard is faulty and must be replaced with one in perfect condition.
– If test 1st gives a correct result and test 2nd an incorrect value, the sensor (3) is faulty and must be replaced.
– If both tests 1st and 2nd give a correct result and test 3rd an incorrect value, the sensor (3) is faulty and must be replaced.
– If all three tests give a correct result and no speed comes up on the left-hand display, the dashboard is faulty and must be replaced with one in perfect condition.

6.10.6 REV COUNTER



- Remove the right side panel, see 7.1.3 (REMOVING THE SIDE COVERS).
- Turn the ignition switch to position "❍".
- Use a tester to check for voltage between the green (V) and blue/green (B/V) cables powering the rev counter.
- Use a tester in ohmmeter mode to check for any breaks on the grey/purple cable (Gr/Vi) between the dashboard and the electronic unit; otherwise try replacing the dashboard with one in perfect condition.
- If the rev counter still does not work even after the dashboard is replaced, the fault is to be found in the electronic unit.

6.11 BATTERY

NOTE This vehicle is provided with a maintenance-free battery and no operation is necessary, excepting occasional checks and the recharge when required.

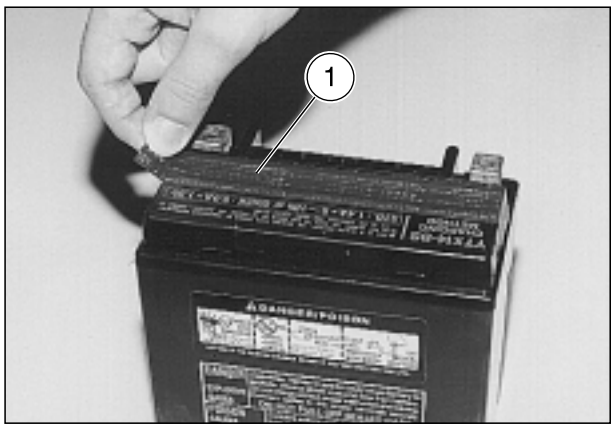
When changing batteries, replace with a battery of the same type.

Type: 12V - 12 Ah

Carefully read 2.4 (BATTERY).

6.11.1 ACTIVATING THE BATTERY

◆ Remove the battery, see 7.1.8 (REMOVING THE BATTERY).



⚠ WARNING

The electrolyte in the battery is toxic and caustic and may cause burns on contact with the skin as it contains sulphuric acid.
Wear protective clothing, a face mask and/or goggles during service operations.

If electrolyte liquid comes in contact with the skin, wash with large quantities of running water.

In case of contact with the eyes, wash with large quantities of water for fifteen minutes and consult an oculist without delay.

If the liquid is accidentally swallowed, drink large amounts of water or milk, then continue drinking milk of magnesia or vegetable oil and promptly call a doctor.

The battery gives off explosive gases, particularly during the phase of starting and/or recharging; keep it away from flames, sparks, cigarettes and any other source of heat.
During recharging or using, make sure the room is properly ventilated and avoid inhaling the gases released during recharging.

KEEP AWAY FROM CHILDREN.

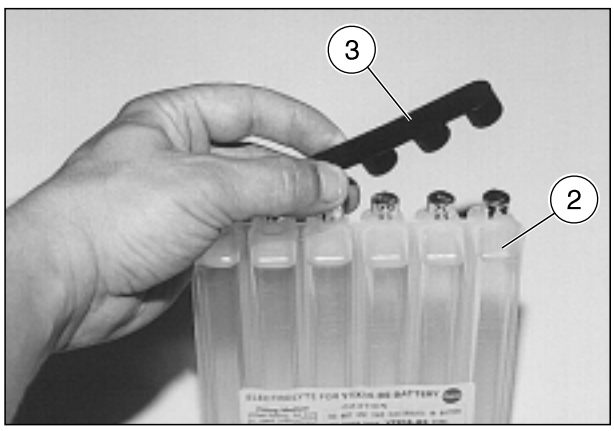
The battery fluid which is very corrosive.

Do not pour or spill it, especially on the plastic parts.

⚠ CAUTION

Make sure the electrolyte liquid is specific for the battery to be activated.

◆ Place the battery on a flat surface.
◆ Remove the adhesive sealing label (1).
◆ Remove the sealed bag from the cardboard container containing the relevant six reservoirs (2).
◆ Take the reservoirs (2) out of the bag.



NOTE Keep the row of stoppers (3) handy as you will need them later to plug the battery cells.

◆ Disconnect the row of stoppers (3) from the top of the reservoirs (2).

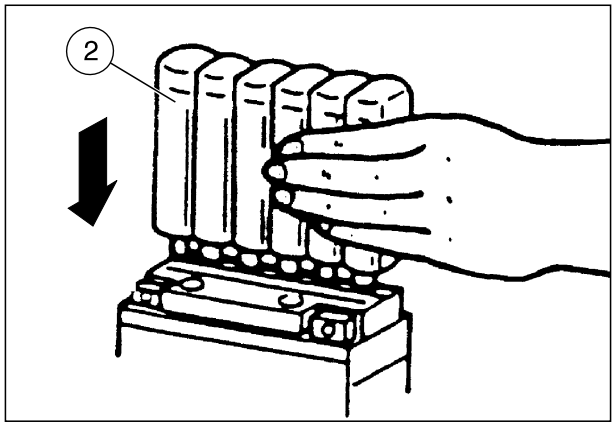
⚠ CAUTION

Do not cut or make holes in the sealed parts on the reservoirs (2).

- Turn the reservoirs (2) upside down and place them so that the sealed parts are over the openings of the battery cells.
- Press on the reservoirs (2) so that the seals break and the acid is allowed to pour into the battery cells.

NOTE Make sure the reservoirs (2) are positioned above the battery as vertically as possible to enable the liquid to flow out.

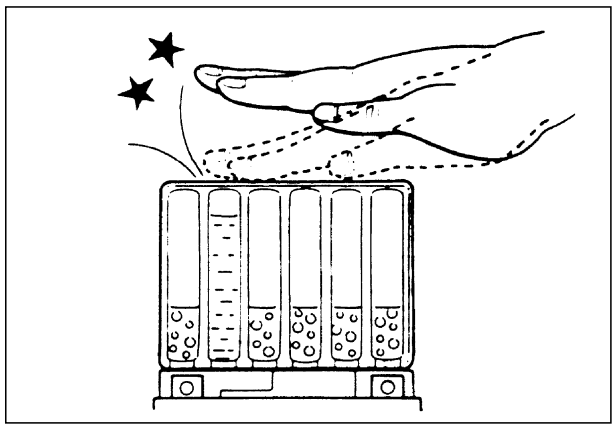
- Leave the reservoirs (2) in place on the battery for approx. twenty minutes, checking the liquid flows out properly.



⚠ CAUTION

Do not remove the reservoirs (2) from the battery until all the liquid has poured out.

- Should any liquid still be left in the reservoirs (2) once the twenty minutes are up, tap your fingers on the top of the reservoirs to help the remaining liquid out.
- Lift the reservoirs (2) with care, disengaging them from the battery.
- Place the row of stoppers (3) over the battery cell openings.
- Press down firmly until the tops of the stoppers (3) are flush with the top of the battery.



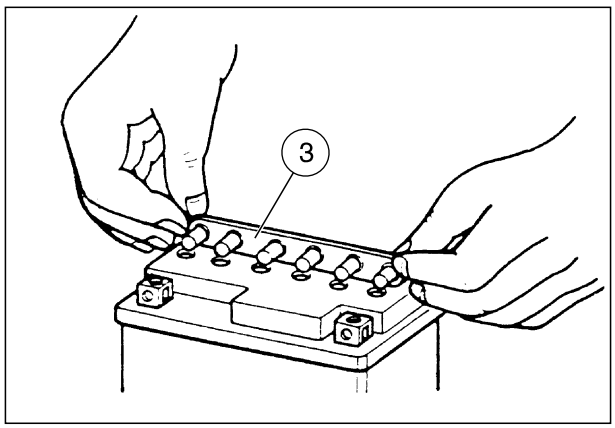
⚠ CAUTION

The row of stoppers (3) must NEVER be removed.

- Connect the battery to a battery charger.
- Subject the battery to a normal charge cycle (see table).

Charge	Voltage (Amperes)	Time (hours)
Normal	1.2	8 ÷ 10
Fast	12	0.5

- Refit the battery on the vehicle on being returned to the customer.



6.11.2 MAINTENANCE

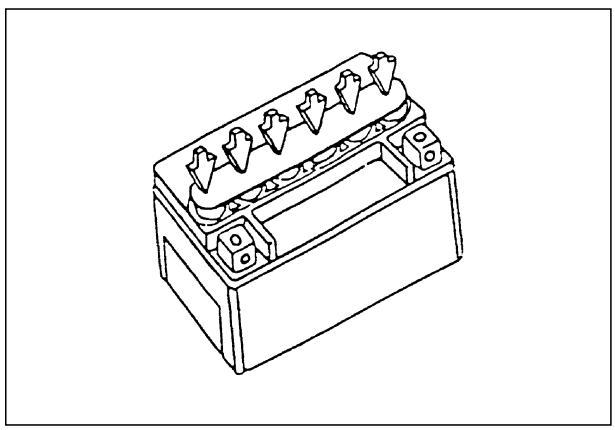
- If the vehicle remains unused for more than fifteen days, the battery must be recharged to prevent sulphation, recharge the battery using a normal charge, see 2.4.2 (RECHARGING THE BATTERY).
- Smear a film of neutral grease or Vaseline on the terminals.

6.11.3 CHECKING

Should any anomalies be encountered, first check the recharging circuit, making sure that it is working correctly, see 6.3 (CHECKING THE RECHARGING SYSTEM).

In addition, make sure that:

- There are no signs of damage (external case cracked) and no electrolyte leak.
- The cables are firmly connected to the terminals.
- Proceed with the normal charge for at least 10 hours.



⚠ CAUTION

After recharging, check the no-load voltage; if it is lower than 12 V, it is absolutely necessary to change the battery.

6.11.4 RETURN UNDER GUARANTEE

The guarantee is not valid if the battery features:

- Damage (dented box, bent poles, etc.).
- Widespread sulphation (incorrect activation and/or use of the battery).

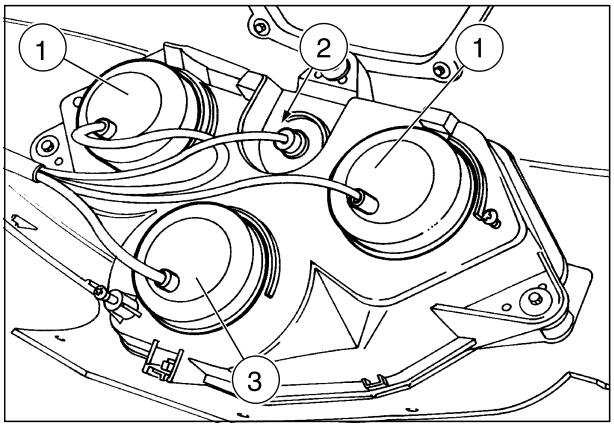
6.12 CHANGING THE BULBS

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Before changing a bulb, move the ignition switch to position "⊠".
Change the bulb wearing clean gloves or using a clean and dry cloth.
Do not leave fingerprints on the bulb, since these may cause its overheating and consequent breakage. If you touch the bulb with bare hands, remove any fingerprint with alcohol, in order to avoid any damage.

DO NOT FORCE THE ELECTRIC CABLES.



6.12.1 CHANGING THE HEADLIGHT BULBS

◆ Position the vehicle on the stand.

NOTE Before changing a bulb, check the fuses, see 6.15 (CHANGING THE FUSES).

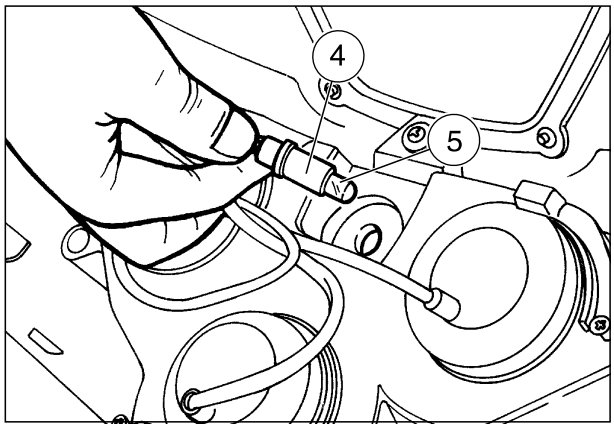
The headlight contains:
– two high beam bulbs (1) (side);
– one parking light bulb (2) (upper);
– one low beam bulb (3) (lower).

NOTE The removal of the front part of the fairing is necessary when the parking light bulb and the high beam bulbs must be changed.

To change the bulbs, proceed as follows:

PARKING LIGHT BULB

◆ Remove the front part of the fairing, see 7.1.20 (REMOVING THE FRONT PART OF THE FAIRING).



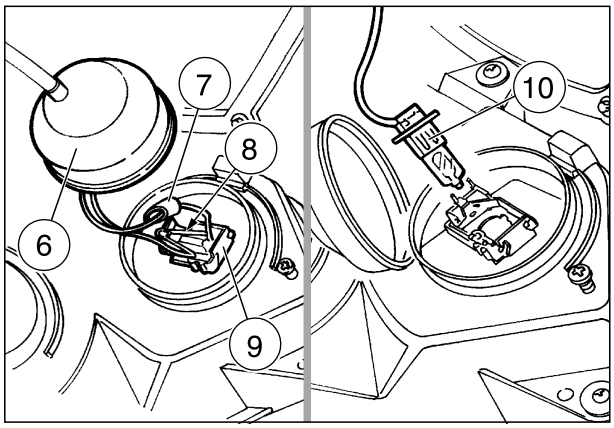
⚠ CAUTION

To extract the bulb socket, do not pull the electric wires.

◆ Grasp the parking light bulb socket (4), pull it and remove it from its seat.
◆ Withdraw the bulb (5) and replace it with one of the same type.

HIGH BEAM BULBS

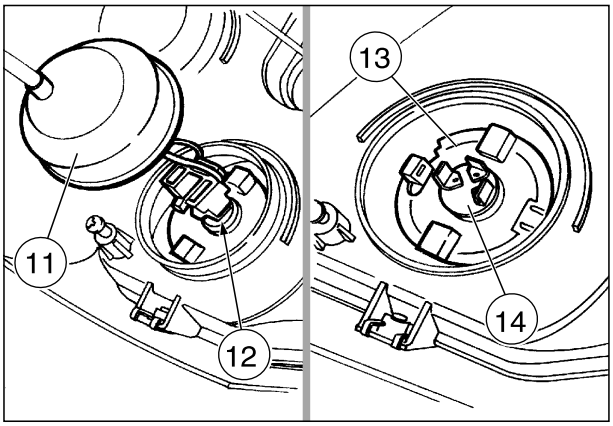
◆ Remove the front part of the fairing, see 7.1.20 (REMOVING THE FRONT PART OF THE FAIRING).
◆ Move the protection element (6) of the bulb to be changed with your hands.
◆ Withdraw the electric terminal (7).
◆ Release the check spring (8) positioned at the rear of the bulb socket (9).
◆ Extract the bulb (10) from its seat and replace it with a new one of the same type.



NOTE Insert the bulb in the bulb socket, making the relevant positioning seats coincide.

LOW BEAM BULBS

◆ Move the protection element (11) with your hands.
◆ Withdraw the bulb electric connector (12).
◆ Rotate the bulb socket (13) anticlockwise and extract it from its seat.
◆ Extract the bulb (14) from its seat and replace it with a new one of the same type.



NOTE Insert the bulb in the bulb socket, making the relevant positioning seats coincide.

6.12.2 CHANGING THE FRONT AND REAR DIRECTION INDICATOR BULBS

◆ Position the vehicle on the stand.

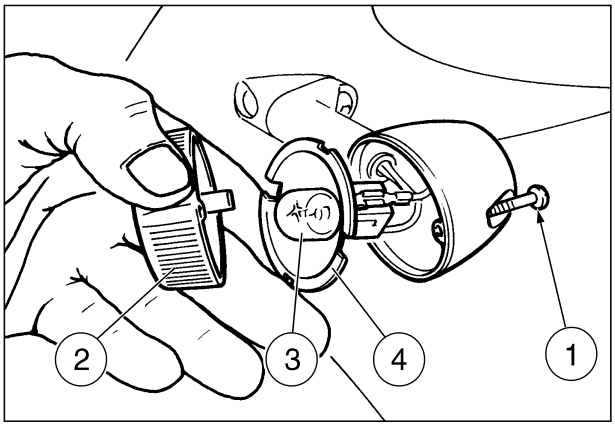
NOTE Before changing a bulb, check the fuses, see 6.15 (CHANGING THE FUSES).

◆ Unscrew and remove the screw (1).

⚠ CAUTION

While removing the protection screen, proceed carefully in order not to break the lug.

◆ Remove the protection screen (2).



⚠ CAUTION

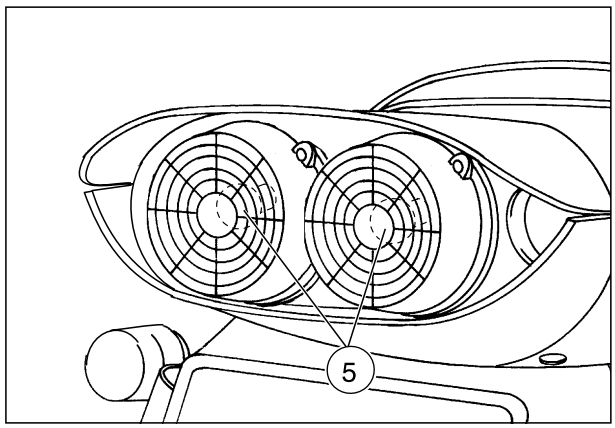
Upon reassembly, correctly position the protection screen in its seat.
Tighten the screw (1) moderately and carefully, to avoid damaging the protection screen.

◆ Press the bulb (3) slightly and rotate it anticlockwise.
◆ Extract the bulb (3) from its seat.

NOTE Insert the bulb in the bulb socket, making the two bulb pins coincide with the relevant guides on the socket.

◆ Correctly install a new bulb of the same type.

NOTE If the bulb socket (4) goes out of its seat, insert it correctly, making the bulb socket opening coincide with the screw seat.



6.12.3 CHANGING THE REAR LIGHT BULB

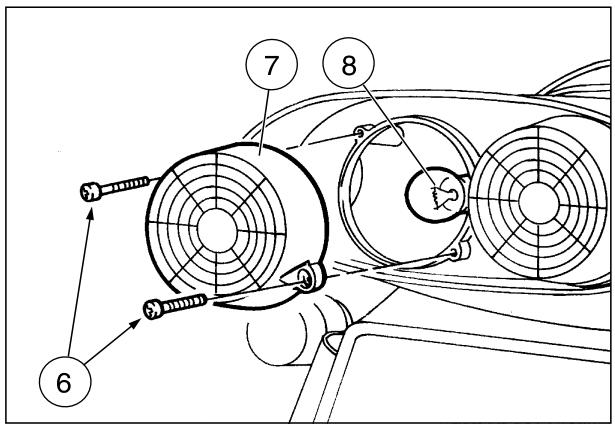
NOTE The rear light houses two parking light/stoplight bulbs (5).

The following operations refer to a single bulb, but are valid for both.

◆ Position the vehicle on the stand.

NOTE Before changing a bulb, check the fuses, see 6.15 (CHANGING THE FUSES) and the efficiency of the stoplight switches, see 6.16 (CHECKING THE SWITCHES).

◆ Unscrew and remove the two screws (6).
◆ Remove the protection screen (7).



⚠ CAUTION

Upon reassembly, correctly position the protection screen in its seat.
Tighten the screw (6) carefully, without exerting too much pressure, in order to avoid damaging the protection screen.

◆ Press the bulb (8) slightly and rotate it anticlockwise.
◆ Extract the bulb (8) from its seat.

NOTE Insert the bulb in the bulb socket, making the two bulb pins coincide with the relevant guides on the socket.

◆ Correctly install a new bulb of the same type.

6.12.4 CHANGING THE DASHBOARD BULBS / LIGHTS

NOTE Before replacing a bulb/light, check the fuses, see 6.15 (CHANGING THE FUSES).

To change the bulb/light:

- ◆ Remove the dashboard, see 7.1.23 (REMOVING THE DASHBOARD).
- ◆ Unscrew and remove the eight fastening screws (1).
- ◆ Remove the rear cover (2).
- ◆ Slide out the relevant bulb holder and, where necessary, replace the bulb:

Pos.	Description
3	Bulbs for right-hand display lighting
4	Bulbs for left-hand display lighting
5	Bulbs for rev counter lighting

Pos.	Warning light	Description
6		Side stand down
7		Low fuel
8		High beam
9		Direction indicator
10		Neutral

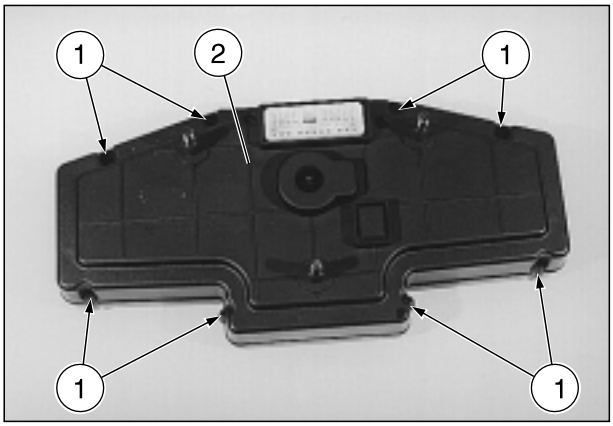
⚠ CAUTION

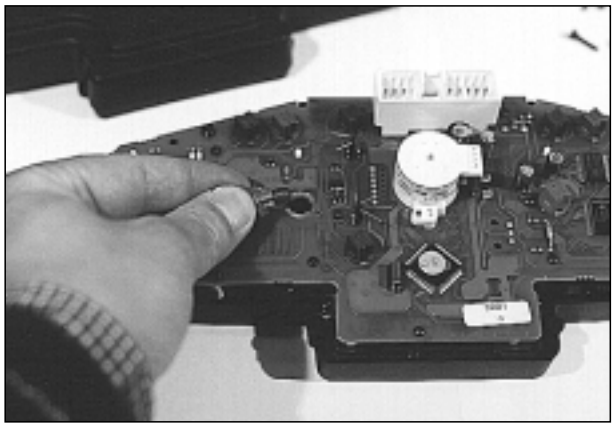
If the defect persists even after the bulb/light has been changed, check the relevant sensor/switch, see:

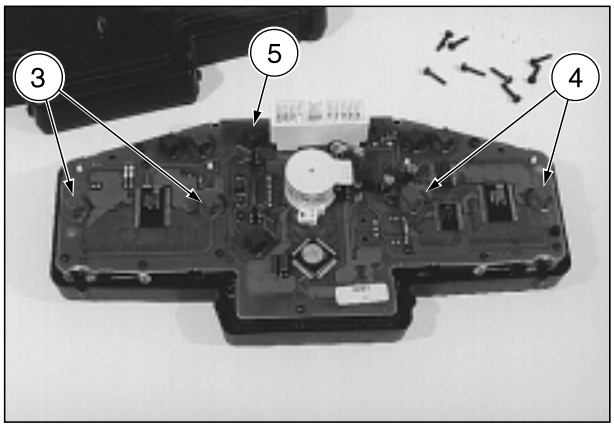
- **– 6.6.4 (CHECKING THE SIDE STAND AND THE SAFETY SWITCH);**
- **– 6.10.2 (LOW FUEL WARNING LIGHT);**
- **– 6.10.4 (CHECKING THE ENGINE OIL LOW PRESSURE SENSOR).**

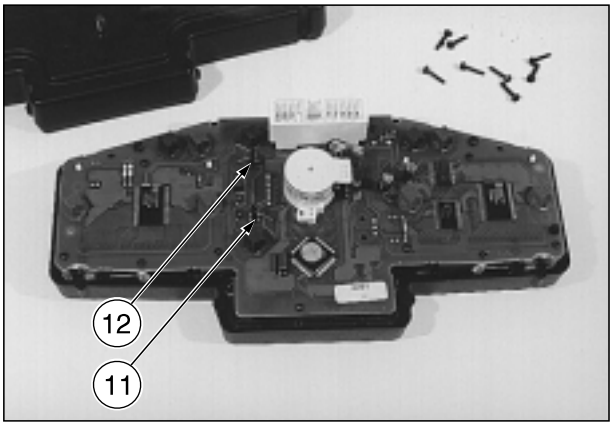
NOTE The two LEDs (11) and (12) cannot be removed.

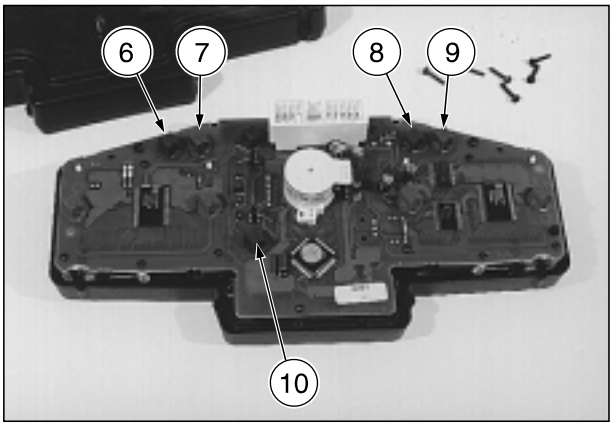
Pos.	LED	Description
11		Engine oil pressure
12	***max***	Red line











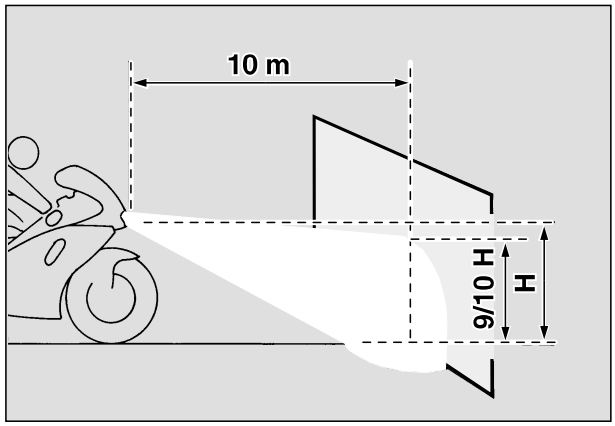
6.13 ADJUSTING THE VERTICAL HEADLIGHT BEAM

NOTE To check the direction of the headlight beam, specific procedures must be adopted, in accordance with the regulations in force in the country where the vehicle is used.

I

To rapidly check the correct direction of the beam, place the vehicle on flat ground, 10 m away from a wall.

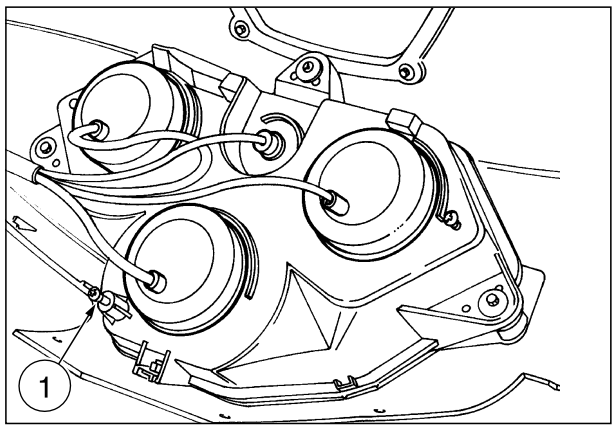
Turn on the low beam, sit on the vehicle and make sure that the beam projected on the wall is slightly under the horizontal line of the headlight (about 9/10th of the total height).



To adjust the headlight beam:

◆ Working on the rear left side of the front part of the fairing, adjust the apposite screw (1) by means of a short cross-tip screwdriver.

By SCREWING IT (clockwise), you set the beam upwards.
By UNSCREWING IT (anticlockwise), you set the beam downwards.



6.14 ADJUSTING THE HORIZONTAL HEADLIGHT BEAM USA

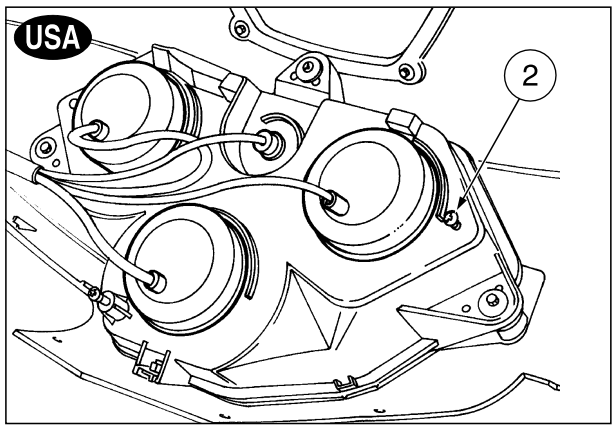
NOTE To check the direction of the headlight beam, specific procedures must be adopted, in accordance with the regulations in force in the country where the vehicle is used.

NOTE Before proceeding with the horizontal adjustment of the high beam, the vertical adjustment of the headlight beam must be performed, see 6.13 (ADJUSTING THE VERTICAL HEADLIGHT BEAM).

◆ Working from the right-hand side of the vehicle, adjust the relevant screw (2) by means of a short Phillips screwdriver.

By SCREWING IT (clockwise) moves the beam to the left.

By UNSCREWING IT (anticlockwise) moves the beam to the right.



6.15 CHANGING THE FUSES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

⚠ CAUTION

Do not repair faulty fuses.
Never use fuses different from the recommended ones.
The use of unsuitable fuses may cause damages to the electric system or, in case of short circuit, even a fire.

NOTE If a fuse blows frequently, there probably is a short circuit or an overload in the electric system.

If an electric component does not work or works irregularly, or if the vehicle fails to start, it is necessary to check the fuses.
Check first the 15A secondary fuses and then the 30A primary fuses.

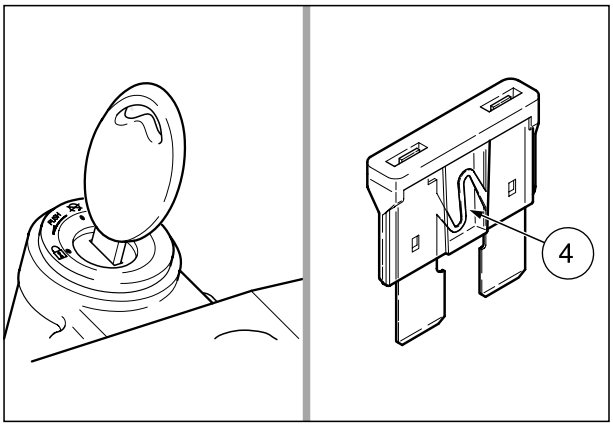
For the check:

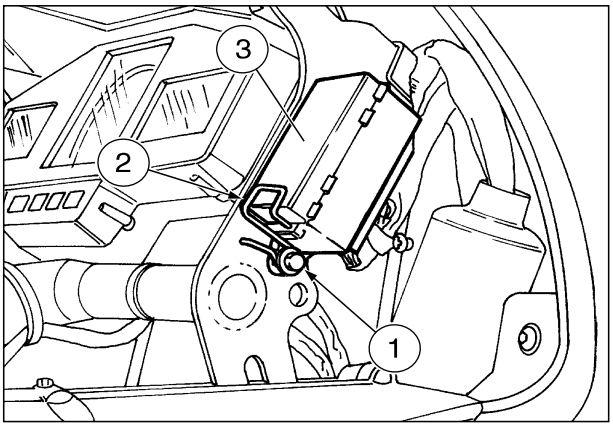
- ◆ Turn the ignition switch to position "⊠", to avoid any accidental short circuit.
- ◆ Remove the rider saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).
- ◆ Loosen the screw (1).
- ◆ Move the safety clip (2).
- ◆ Open the cover of the box (3) containing the secondary fuses.
- ◆ Extract the fuses one by one and check if the filament (4) is broken.
- ◆ Before replacing a fuse, try to find out the cause of the trouble, if possible.
- ◆ Replace the damaged fuse with a new one having the same amperage.

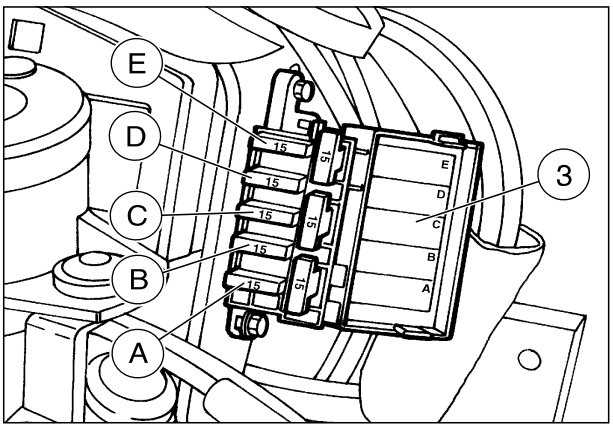
NOTE If you use one of the spare fuses, put a new fuse in the proper seat.

- ◆ Remove the rider saddle, see 7.1.1 (REMOVING THE RIDER SADDLE).
- ◆ Carry out the operations previously described for the secondary fuses also for the main fuses.

NOTE By removing the 30A fuse, you set the digital clock and the red line to zero. To reset these functions, see 2.3 (MULTIFUNCTION COMPUTER).







ARRANGEMENT OF THE 15A SECONDARY FUSES

A) From voltage regulator to:
high beam relay, low beam relay.

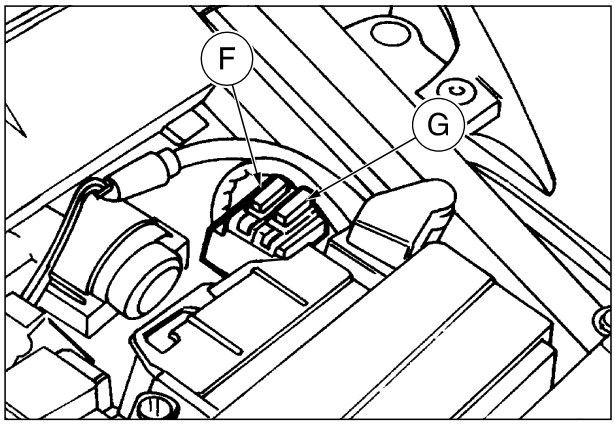
B) From voltage regulator to:
coils, engine stop relay, fuel pump.

C) From ignition switch to:
electric fans, clock.

D) From ignition switch to:
parking lights, rear stoplights, horn, dashboard lights, direction indicators.

E) From ignition switch to:
electronic unit, fuel pump relay, engine stop relay.

NOTE Three fuses are spare fuses.



ARRANGEMENT OF THE 30A MAIN FUSES

F) From battery to: ignition.
G) From battery to: ignition.

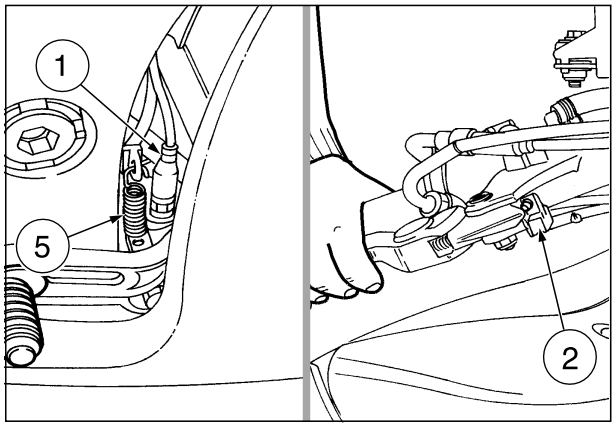
NOTE One fuse is a spare fuse.

6.16 CHECKING THE SWITCHES

Carefully read 0.2.1 (PRECAUTIONS AND GENERAL INFORMATIONS).

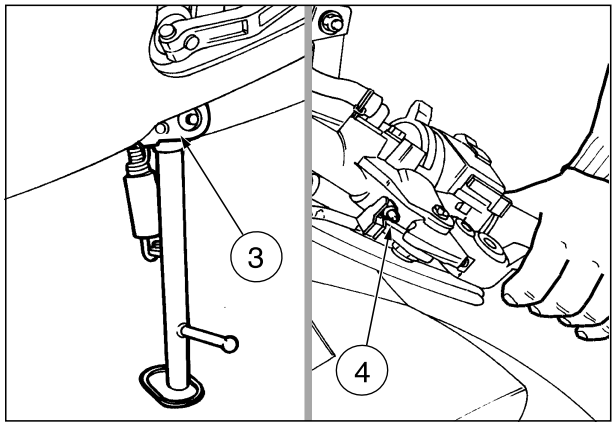
The vehicle is provided with four switches:

1) **Stoplight switch on the rear brake control lever.**
2) **Stoplight switch on the front brake control lever.**



3) **Safety switch on the side stand.**
4) **Switch on the clutch control lever.**

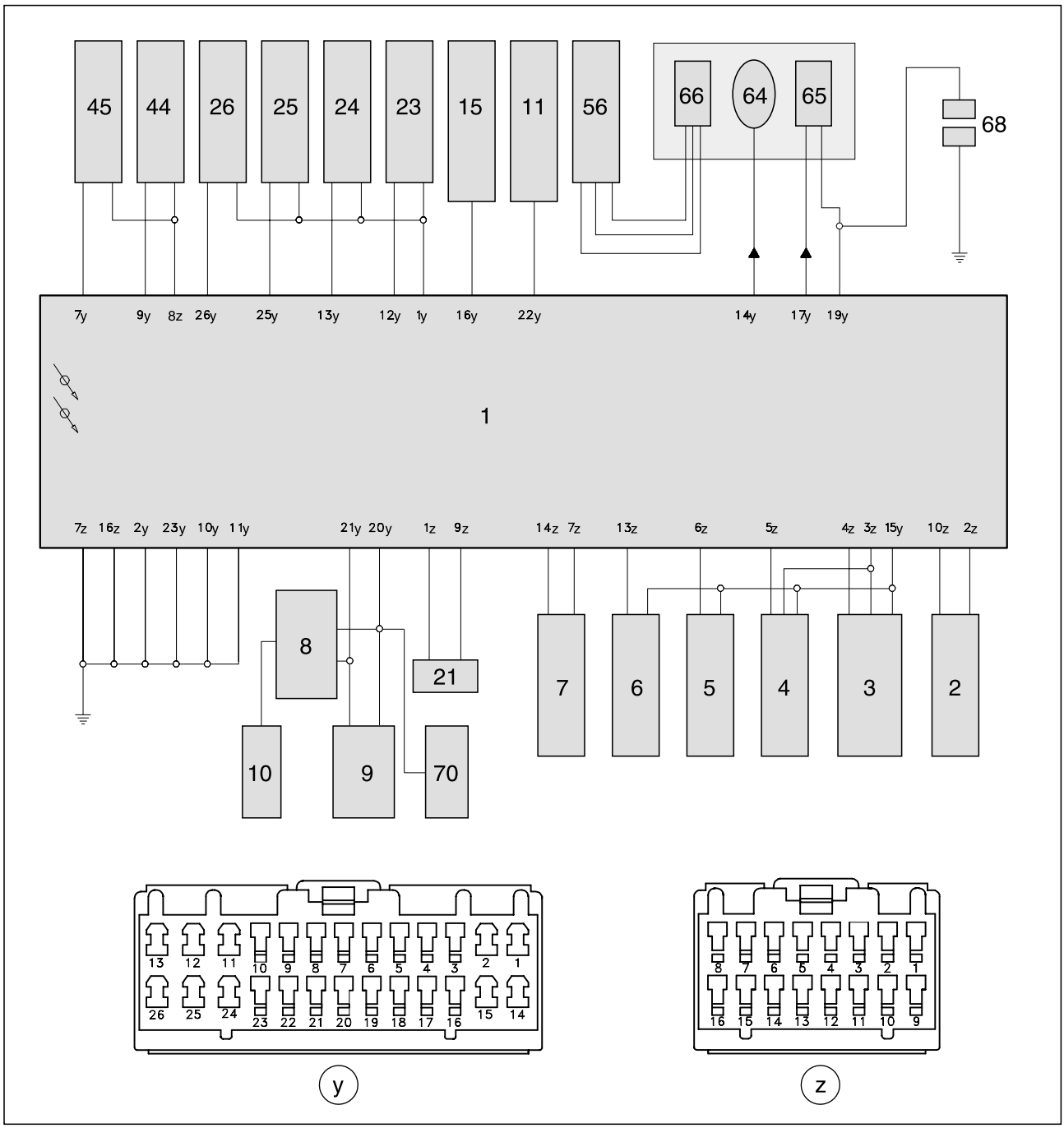
- ◆ Make sure that there are no dirt or mud deposits on the switch; the pin must be able to move without interferences, returning automatically to its initial position.
- ◆ Make sure that the cables are connected correctly.
- ◆ Check the spring (5): it must not be damaged, worn or weakened.



6.17 CONNECTIONS TO THE ENGINE CONTROL UNIT

NOTE See 6.2 (ELECTRIC COMPONENTS LAYOUT) for the positioning of the components.

See 4.7.4 (ENGINE CONTROL UNIT CONNECTORS), for further details.

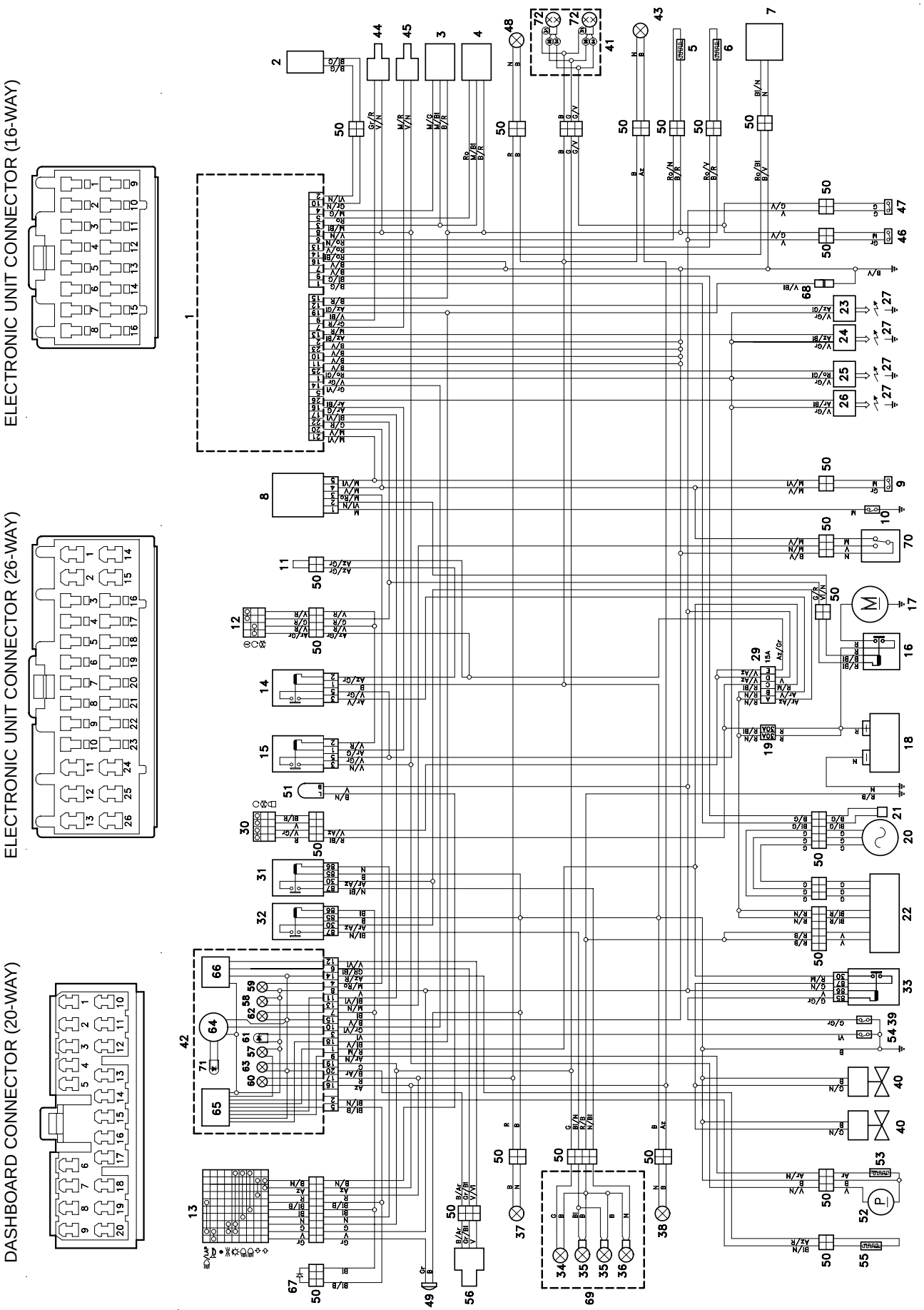


NOTE The initials (y) and (z) appearing in the diagram, next to the relevant numbers, mark the respective terminals on both connectors.

Y) Electronic unit connector (26-way).
Z) Electronic unit connector (16-way).

Pos.	Component	Connector	Terminal #	Nominal value	Cable colours
2	Cam position sensor	Z	2	150 - 300 Ω	Vi /N
		Z	10		Gr/N
3	Throttle valve potentiometer	y	15	2.8 - 3.4 kΩ (Angle variable)	B/R
		Z	3		M/Bi
		Z	4		M/G
4	Suction pressure sensor	y	15	10 - 15 kΩ	B/R
		Z	3		M/Bi
		Z	5		Ro
5	Coolant thermistor	y	15	1:9 - 2:9 kΩ	B/R
		Z	6		Ro/N
6	Air thermistor	y	15	–	B/R
		Z	13		Ro/V
7	Fall sensor	Z	7	> 10 kΩ	Earth
		Z	14		Ro/Bi
9	Clutch control lever switch	y	20	–	M/V
		y	21		M/Vi
11	Starting relay	y	22	–	G/R
15	Fuel pump relay	y	16	–	Ar/G
21	Pick up	Z	9	150 - 300 Ω	Bi/G
		Z	1		B/G
–	Earth	y	2-10-11-23	–	B/V
		Z	7 - 16		
42	Diagnostics	y	17		B/Vi
42	Rev.counter	y	14		Gr/Vi
23	Rear cylinder coil	y	1	4 - 5 Ω	V/Gr
		y	12		Az/G
24	Rear cylinder coil	y	1	4 - 5 Ω	V/Gr
		y	13		Ro/G
25	Front cylinder coil	y	1	4 - 5 Ω	V/Gr
		y	25		Ro/G
26	Front cylinder coil	y	1	4 - 5 Ω	V/Gr
		y	26		Ar/Bi
44	Front cylinder injector	Z	8	11 -17 Ω	V/N
		y	9		Gr/R
45	Rear cylinder injector	Z	8	11 - 17 Ω	V/N
		y	7		M/R
68	TEST connectors	y	19	–	V/Bi

6.18 WIRING DIAGRAM - RSV mille



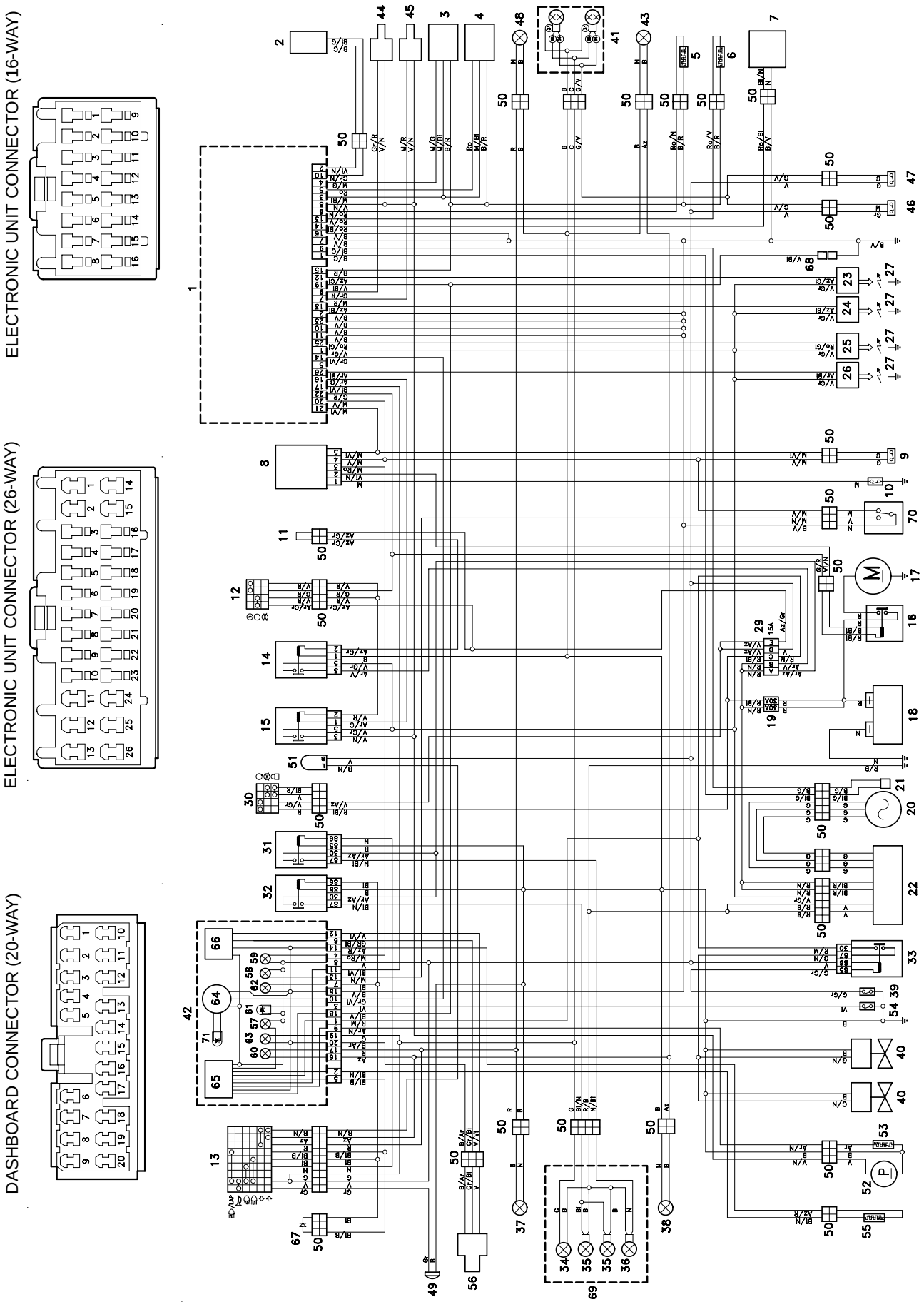
WIRING DIAGRAM KEY - RSV mille

1) Electronic unit
2) Cam position sensor
3) Throttle valve potentiometer
4) Suction pressure sensor
5) Coolant thermistor
6) Air thermistor
7) Fall sensor
8) Diode module
9) Clutch control lever switch
10) Neutral switch
11) Arrangement for the installation of the anti-theft device
12) Right dimmer switch
13) Left dimmer switch
14) Engine stop relay
15) Fuel pump relay
16) Start relay
17) Starter
18) Battery
19) Main fuses (30A) (ignition)
20) Generator
21) Pick up
22) Voltage regulator
23) Rear cylinder coil “1”
24) Rear cylinder coil “2”
25) Front cylinder coil “1”
26) Front cylinder coil “2”
27) Spark plugs
28) –
29) Secondary fuses (15A)
    A - High beam, low beam.
    B - ISC, coils, fuel pump.
    C - Electric fans, clock.
    D - Parking lights, stoplights, horn, dashboard lights, direction indicators.
    E - Electronic unit, fuel pump relay engine stop relay.
30) Ignition switch
31) Low beam relay
32) High beam relay
33) Cooling fan relay
34) Front parking light bulb
35) High beam bulbs
36) Low beam bulb
37) Front right direction indicator
38) Front left direction indicator
39) Thermal switch
40) Cooling fans
41) Rear light
42) Dashboard
43) Rear left direction indicator
44) Front cylinder injector
45) Rear cylinder injector
46) Front stoplight switch
47) Rear stoplight switch
48) Rear right direction indicator
49) Horn
50) Multiple connectors
51) Blinking
52) Fuel pump
53) Low fuel sensor
54) Engine oil pressure switch
55) Coolant temperature thermistor
56) Speed sensor
57) Low fuel warning light
58) Side stand down warning light
59) Neutral warning light
60) Direction indicator warning light
61) Engine oil pressure warning light LED
62) High beam warning light
63) Dashboard bulbs
64) Revolution counter
65) Multifunction display (right side)
66) Multifunction display (left side)
67) Light diode / LAP
68) TEST connectors
69) Headlight
70) Side stand switch
71) Red line warning light LED
72) Rear parking light/stoplight bulbs

CABLE COLOURS

Ar	Orange
Az	Light blue
B	blue
Bi	White
G	Yellow
Gr	Grey
M	Brown
N	Black
R	Red
Ro	Pink
V	Green
Vi	Violet

6.19 WIRING DIAGRAM - RSV mille ASD



WIRING DIAGRAM KEY - RSV mille ASD

1) Electronic unit
2) Cam position sensor
3) Throttle valve potentiometer
4) Suction pressure sensor
5) Coolant thermistor
6) Air thermistor
7) Fall sensor
8) Diode module
9) Clutch control lever switch
10) Neutral switch
11) Arrangement for the installation of the anti-theft device
12) Right dimmer switch
13) Left dimmer switch
14) Engine stop relay
15) Fuel pump relay
16) Start relay
17) Starter
18) Battery
19) Main fuses (30A) (ignition)
20) Generator
21) Pick up
22) Voltage regulator
23) Rear cylinder coil “1”
24) Rear cylinder coil “2”
25) Front cylinder coil “1”
26) Front cylinder coil “2”
27) Spark plugs
28) –
29) Secondary fuses (15A)
    A - High beam, low beam.
    B - ISC, coils, fuel pump.
    C - Electric fans, clock.
    D - Parking lights, stoplights, horn, dashboard lights, direction indicators.
    E - Electronic unit, fuel pump relay engine stop relay.
30) Ignition switch
31) Low beam relay
32) High beam relay
33) Cooling fan relay
34) Front parking light bulb
35) High beam bulbs
36) Low beam bulb
37) Front right direction indicator
38) Front left direction indicator
39) Thermal switch
40) Cooling fans
41) Rear light
42) Dashboard
43) Rear left direction indicator
44) Front cylinder injector
45) Rear cylinder injector
46) Front stoplight switch
47) Rear stoplight switch
48) Rear right direction indicator
49) Horn
50) Multiple connectors
51) Blinking
52) Fuel pump
53) Low fuel sensor
54) Engine oil pressure switch
55) Coolant temperature thermistor
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57) Low fuel warning light
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65) Multifunction display (right side)
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68) TEST connectors
69) Headlight
70) Side stand switch
71) Red line warning light LED
72) Rear parking light/stoplight bulbs

CABLE COLOURS

Ar	Orange
Az	Light blue
B	blue
Bi	White
G	Yellow
Gr	Grey
M	Brown
N	Black
R	Red
Ro	Pink
V	Green
Vi	Violet

NOTE