

**aprilia**

**1306 5**

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**TUONO 1000**

www.serviceaprilia.com

# workshop manual



8104982

## INTRODUCTION

0

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## 0.1. FOREWORD

### 0.1.1. FOREWORD

- This manual provides the information required for normal servicing.
- This publication is intended for use by **aprilia** Dealers and their qualified mechanics; certain information has been omitted intentionally, as this manual does not purport to provide a comprehensive treatise on mechanics. Since complete mechanical explanations have not been included in this manual, the reader must be familiar with basic notions of mechanics, as well as with basic repair procedures. Repairing or inspecting a motorcycle when one does not possess such basic knowledge or training could result in improper servicing and make the motorcycle unsafe to ride. For the same reason, certain basic precautions have been omitted in the descriptions of repair and inspection procedures; you are therefore invited to take special care to avoid damage to motorcycle components or injury to persons. **aprilia s.p.a.** undertakes to constantly improve the design of its products and the relevant literature to ensure maximum customer satisfaction. The main technical modifications and changes in repair procedures are communicated to all **aprilia** dealers and agencies world-wide. Such modifications will be included in subsequent editions of the manual. Should you require assistance or clarifications regarding inspection and repair procedures, please contact the **aprilia** SERVICE DEPT., which will be pleased to help, as well as providing you with updates and technical modifications regarding the vehicle.

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## 0.1.2. REFERENCE MANUALS

## PARTS CATALOGUES

aprilvia part# (description)					
3985	I	F	D	E	UK

## SPECIAL TOOLS MANUALS

aprilvia part# (description)					
001A00	I	F	D	E	UK

## OWNER'S MANUALS

aprilvia part# (description)			
8104927	I	F	D
8104928	NL	E	UK
8104929	SF	RR	J
8104930	USA	CAN	

## CHASSIS WORKSHOP MANUAL

aprilvia part# (description)	
8104978	I
8104981	E
8104979	F
8104980	D
8104982	UK
8104983	USA

## ENGINE TECHNICAL MANUAL

aprilvia part# (description)	
8140743	I
8140744	E
8140745	F
8140746	D
8140747	UK
8140748	USA

**0.1.3. ABBREVIATIONS / SYMBOLS**

#	= number
<	= less than
>	= greater than
≤	= less than or equal to
≥	= greater than or equal to
~	= approximately
∞	= infinity
°C	= degrees Celsius (centigrade)
°F	= degrees Fahrenheit
±	= plus or minus
A.C.	= alternating current
A	= Ampere
Ah	= Ampere per hour
API	= American Petroleum Institute
AT	= high voltage
AV/DC	= Anti-Vibration Double Countershaft
bar	= pressure measurement unit (1 bar = 100 kPa)
D.C.	= direct current
cc	= cubic centimetres
CO	= carbon monoxide
CPU	= Central Processing Unit
DIN	= German industrial standards (Deutsche Industrie Norm)
DOHC	= Double Overhead Camshaft
ECU	= Electronic Control Unit
rpm	= revolutions per minute
HC	= unburnt hydrocarbons
ISC	= Idle Speed Control
ISO	= International Standardisation Organisation
kg	= kilograms
kgm	= kilograms per metre (1 kgm = 10 Nm)
km	= kilometres
km/h	= kilometres per hour
kΩ	= kilo Ohm
kPa	= kiloPascal (1 kPa = 0.01 bar)
KS	= clutch side (from the German "Kupplungsseite")
kW	= kilowatt
ℓ	= litres
LAP	= racetrack lap
LED	= Light Emitting Diode
LEFT	
SIDE	= left side
m/s	= metres per second
max	= maximum
mbar	= millibar (1 mbar = 0.1 kPa)
mi	= miles
MIN	= minimum
MPH	= miles per hour
MS	= flywheel side (from the German "Magnetoseite")
MΩ	= MegaOhm
N.A.	= Not Available
N.O.M.M.	= Motor Octane Number
N.O.R.M.	= Research Octane Number
Nm	= Newton metre (1 Nm = 0.1 kgm)
Ω	= ohm
PICK-UP	= pick-up
BDC	= Bottom Dead Centre
TDC	= Top Dead Centre
PPC	= Pneumatic Power Clutch

<b>RIGHT</b>	
<b>SIDE</b>	= right side
<b>SAE</b>	= Society of Automotive Engineers
<b>TEST</b>	= diagnostic check
<b>T.B.E.I.</b>	= crown-head Allen screw
<b>T.C.E.I.</b>	= cheese-head Allen screw
<b>T.E.</b>	= hexagonal head
<b>T.P.</b>	= flat head screw
<b>TSI</b>	= Twin Spark Ignition
<b>UPSIDE-</b>	
<b>DOWN</b>	= inverted fork
<b>V</b>	= volt
<b>W</b>	= watt
<b>Ø</b>	= <b>diameter</b>

GENERAL INFORMATION

1

**SUMMARY**



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## 1.1. STRUCTURE OF THE MANUAL







### 1.1.1. CONVENTIONS USED IN THE MANUAL

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

In this manual any variants are identified with these symbols:

	optional
	catalytic version
-	all versions
MP	national certification
SF	European certification (EURO 1 limits)

#### VERSION:

	Italy		Greece		Malaysia
	United Kingdom		Holland		Chile
	Austria		Switzerland		Croatia
	Portugal		Denmark		Australia
	Finland		Japan		United States of America
	Belgium		Singapore		Brazil
	Germany		Slovenia		South Africa
	France		Israel		New Zealand
	Spain		South Korea		Canada

**1.1.2. SAFETY WARNINGS**

The symbols and warnings used throughout this manual have the following meanings:



**Safety warning.** When you find this symbol on the vehicle or in the manual, be careful of the potential risk of personal injury. Disregarding the instructions identified by this symbol may compromise the safety of the user, the motorcycle and third parties.

**DANGER**

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

**WARNING**

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.

## 1.2. GENERAL RULES

### 1.2.1. BASIC SAFETY RULES

#### CARBON MONOXIDE

When an operation must be performed with the engine running, position the motorcycle outdoors in a well-ventilated area.

Avoid starting the engine indoors.

Use an exhaust emission extraction system when working indoors.



#### **DANGER**

Exhaust gases contain carbon monoxide, a poisonous gas which, if inhaled, may cause loss of consciousness or even death.

#### FUEL



#### **DANGER**

The fuel used in internal combustion engines is highly flammable and can become explosive under particular conditions.

Refuelling and maintenance operations should be carried out in a well-ventilated area, with the engine off.

Do not smoke when refuelling or in the proximity of sources of fuel vapours. Avoid contact with bare flames, sources of sparks or any other source which may ignite the fuel or lead to explosion.

**DO NOT DISPOSE OF FUEL IN THE ENVIRONMENT.**

**KEEP AWAY FROM CHILDREN.**

#### HOT COMPONENT PARTS

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

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

#### USED GEARBOX AND FORK FLUIDS



#### **DANGER**

Wear latex gloves when servicing.

Prolonged or repeated contact with gear fluid may cause severe skin damage.

Wash your hands thoroughly after use.

For disposal, contact the nearest waste oil reclamation firm or the supplier.

Wear latex gloves when servicing.

**DO NOT DISPOSE OF OIL IN THE ENVIRONMENT.**

**KEEP AWAY FROM CHILDREN.**

#### BRAKE FLUID



#### **WARNING**

Brake fluid can damage plastic, rubber or painted parts. When servicing the brake system, protect all such parts with a clean cloth.

Always wear safety glasses when servicing the brake system.

Brake fluid is highly irritant. Avoid contact with the eyes.

In case of contact with the eyes, rinse thoroughly with cool, clean water and immediately seek medical attention.

**KEEP AWAY FROM CHILDREN.**

#### COOLANT

Coolant contains ethylene glycol which can be flammable under certain conditions. When ignited, ethylene glycol produces invisible flames that can cause burns.



**DANGER**

Avoid spilling coolant on hot engine parts and the exhaust system, as it may ignite and produce invisible flames.

Wear latex gloves when servicing.

Though toxic, its sweet taste might attract animals. Never leave coolant in an open container or in a position easily accessible to animals.

**KEEP AWAY FROM CHILDREN.**

Never remove the radiator cap while the engine is still hot. Coolant is under pressure and can cause burns.

**HYDROGEN GAS AND BATTERY ELECTROLYTE****DANGER**

The battery electrolyte is a toxic, caustic substance containing sulphuric acid and thus able to cause severe burns in case of contact with the skin.

Wear close-fitting gloves and protective clothing when handling this fluid.

In case of contact with the skin, rinse thoroughly with fresh water.

Always use eye protection as even a very small amount of the battery fluid can cause blindness. If battery fluid comes in contact with the eyes, flush thoroughly with water for fifteen minutes and contact an eye specialist immediately.

If battery fluid is swallowed accidentally, drink plenty of water or milk. Seek medical attention immediately and keep drinking milk of magnesia or vegetable oil in the meantime.

The battery gives off explosive gases. Keep the battery well away from any sources of ignition, such as flames, sparks, or any heat sources; do not smoke near the battery.

Make sure the area is well ventilated when servicing or refilling the battery.

**KEEP AWAY FROM CHILDREN.**

Battery fluid is corrosive.

Do not spill it, especially on plastic parts.

Make sure that the electrolyte acid is suitable for the type of battery used.

**GENERAL PRECAUTIONS AND INFORMATION**

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

**DANGER**

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

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

Unless expressly indicated otherwise, reassemble the units by repeating the disassembly operations in reverse order. Where a procedure is cross-referred to relevant sections in the manual, proceed sensibly to avoid disturbing any parts unless strictly necessary. Do not use polishing pastes on matt paints.

Never use fuel instead of solvent to clean the motorcycle.

Do not clean rubber or plastic parts or the seat with alcohol, petrol or solvents. Use only water and mild detergent.

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

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

**BEFORE REMOVING THE COMPONENTS**

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

**DISASSEMBLING THE COMPONENTS**

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

**REASSEMBLING THE COMPONENTS****DANGER**

**Never reuse a circlip or snap ring. These parts must always be replaced with new ones once they have been removed.**

**When fitting a new circlip or snap ring, open the ends just enough to allow fitting to the shaft.**

**Make a rule to check that a newly fitted circlip or snap ring is fully housed in its groove.**

**Never use compressed air to clean bearings.**

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

- Use ORIGINAL **aprilia** SPARE PARTS only.
- Use the specified lubricants and consumables.
- Where possible, lubricate a part before assembly.
- When tightening nuts and bolts, start with the largest or innermost nut/bolt and observe a cross pattern. Tighten evenly, in subsequent steps until achieving the specified torque.
- Replace any self-locking nuts, gaskets, seals, circlips or snap rings, O-rings, split pins, bolts and screws which have a damaged thread.
- Lubricate the bearings abundantly before assembly.
- Make it a rule to check that all components you have fitted are correctly in place.
- After repairing the motorcycle and after each service inspection, perform the preliminary checks, and then test ride the motorcycle in a private estate area or in a safe area away from traffic.
- Clean all mating surfaces, oil seal edges and gaskets before assembly. Apply a thin layer of lithium grease along the edges of oil seals. Fit oil seals and bearings with the marking or serial number facing outward (in view).

**ELECTRICAL CONNECTORS**

Disconnect electrical connectors as follows: failure to follow these instructions can seriously damage the connectors and the wiring.

Press the special safety hooks, where fitted.

**WARNING**

**Never separate two connectors by pulling on the wiring.**

- Grasp both connectors and pull them in opposite directions until they become separated.
- Remove dirt, rust, moisture, etc., from inside the connectors with compressed air.
- Ensure that the wires are securely crimped to the terminals inside each connector.

**NOTE** A connector will fit properly only in the matching connector and when inserted in the correct fitting position.

- Reconnect the two connectors. Ensure that they are correctly coupled (if fitted with hooks, they should click audibly into place).

**TIGHTENING TORQUES****DANGER**

**Always remember that the tightening torque settings of all wheel, brake, wheel shaft and other suspension parts play a fundamental role to ensure vehicle safety. Ensure that these values are always within the specified limits.**

**Check the tightening torque settings of fastening parts at regular intervals. Always use a torque spanner when reassembling.**

**Failure to observe these instructions can result in parts loosening or coming away, thus jamming a wheel or creating other problems which would affect the handling of the motorcycle, potentially resulting in serious injury or death.**

### 1.3. DANGEROUS ELEMENTS

#### 1.3.1. WARNINGS

##### FUEL

**DANGER**

The fuel used in internal combustion engines is highly flammable and can become explosive under particular conditions.

Refuelling and maintenance operations should be carried out in a well-ventilated area, with the engine off.

Do not smoke when refuelling or in the proximity of sources of fuel vapours. Avoid contact with bare flames, sources of sparks or any other source which may ignite the fuel or lead to explosion.

Avoid spilling fuel out of the filler, as it may ignite when in contact with hot engine parts.

In the event of accidental fuel spillage, ensure that the affected area is fully dry before starting the engine. Fuel expands from heat and when left under direct sunlight.

Never fill the fuel tank up to the rim. Tighten the filler cap securely after each refuelling.

Avoid contact with skin. Do not inhale vapours. Do not swallow fuel. Do not transfer fuel between different containers using a hose.

**DO NOT DISPOSE OF FUEL IN THE ENVIRONMENT.**

**KEEP AWAY FROM CHILDREN.**

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

##### LUBRICANTS

**DANGER**

Correct lubrication is essential to the safety of the motorcycle.

Failure to maintain the lubricant level or the use of incorrect, old or dirty lubricant can cause the engine or transmission to seize, resulting in accident, serious injury or death.

Prolonged or repeated contact with gear fluid may cause severe skin damage.

Wash your hands thoroughly after use.

Do not dispose of oil in the environment.

For disposal, contact the nearest waste oil reclamation firm or the supplier.

**WARNING**

Avoid spillage when filling the vehicle with oil. Immediately clean up any spilt oil, as it can damage painted parts.

Oil on the tyres can make them very slippery and dangerous to use.

In case of leaks, do not use the motorcycle. Identify the cause of the leak and repair it.

##### ENGINE OIL

**DANGER**

Prolonged or repeated contact with engine oil may cause severe skin damage.

Wash your hands thoroughly after handling.

Do not dispose of oil in the environment.

For disposal, contact the nearest waste oil reclamation firm or the supplier.

Wear latex gloves when servicing.

##### FRONT FORK FLUID

**DANGER**

Front suspension response can be modified to a certain extent by changing damping settings and/or selecting a particular grade of oil. Standard oil viscosity: SAE 20 W. Different oil grades can be selected to obtain a particular suspension response (choose SAE 5W for a softer suspension, 20W for a stiffer suspension).

The two grades can also be mixed in varying solutions to obtain the desired response.

**BRAKE FLUID**

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

**DANGER**

Do not drive the vehicle if the brakes are worn or not operating correctly. The brakes are the vehicle's most important safety component and using the vehicle with the brakes in less than perfect operating condition comprises a high probability of traffic accident, which can result in serious injury or death. The brakes are significantly less effective on a wet road surface.

**DANGER**

If the road surface is wet, maintain a double braking distance, as both the brakes and the grip of the tyres are significantly less effective in such conditions.

Water on brakes, whether due to a recent wash or picked up from a wet road surface, puddles or drains, can result in significantly reduced brake efficiency.

Failure to observe these instructions can result in serious accidents, with the risk of serious personal injury or death.

The brakes are essential to your safety. Do not drive the vehicle if the brakes are not in perfect operating condition.

Always check the brakes before riding the motorcycle.

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

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

**DO NOT DISPOSE OF BRAKE FLUID IN THE ENVIRONMENT.**

**KEEP AWAY FROM CHILDREN.**

Avoid spillage. Brake fluid can damage plastic or painted parts.

**DANGER**

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

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

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

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

Ensure that the brake lines are not twisted or worn.

Avoid accidental entry of water or dust into the circuit.

Wear latex gloves when servicing the hydraulic circuit.

**DISC BRAKES****DANGER**

The brakes are the vehicle's most important safety component.

To ensure your personal safety, they must be in perfect working order and should be checked before every ride.

A dirty disc soils the pads.

Dirty pads must be replaced. Dirty or oily discs must be cleaned with a high-quality degreasing product.

If the vehicle is often used on wet road surfaces or on dusty or rough tracks, or if used in competition, reduce the service intervals by half.

Check brake pads for wear.

When the brake pads are worn, the fluid level lowers to compensate for the wear.

The front brake fluid reservoir is on the right-hand side of the handlebar, next to the front brake lever.

The rear brake fluid reservoir is located under the right fairing.

Do not use the vehicle if the brake system leaks fluid.

**COOLANT****DANGER**

Coolant is toxic when swallowed; contact with the eyes or skin can cause irritation.

In the event of contact with the skin or eyes, rinse thoroughly and repeatedly with water and seek medical attention. If swallowed, induce vomiting, thoroughly rinse mouth and throat with water and seek medical attention immediately.

**DO NOT DISPOSE OF IN THE ENVIRONMENT.**

**KEEP AWAY FROM CHILDREN.**

**DANGER**

Avoid spilling coolant on hot engine parts, as it may ignite and produce invisible flames. Wear latex gloves when servicing.

Do not use the vehicle when the coolant is below the minimum level.

The coolant mixture is a 50% solution of water and antifreeze. This solution is ideal for most operating temperatures and provides good corrosion protection.

This solution is also suitable during the warm season, as it is less likely to evaporate and will reduce the need for frequent top-ups.

In addition, less water evaporation means fewer mineral salt deposits in the radiator, which helps preserve the efficiency of the cooling system.

When the temperature drops below 0°C check the cooling system frequently and add more antifreeze (up to 60% maximum) to the solution, if needed.

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

Refer to the chart given below and add the indicated quantity of antifreeze to the water to obtain a solution with the desired freezing point:

Freezing point °C (°F)	Coolant % of volume
-20° (-4 °F)	35
-30° (-22 °F)	45
-40° (-40 °F)	55

**NOTE** Coolants have different specifications. The protection degree is written on the label.

**WARNING**

Use nitrite-free and anticorrosion coolant only to ensure protection at least at -35°C (-31 °F).

**DRIVE CHAIN**

Check drive chain operation, wear, slack and lubrication at regular intervals.

The vehicle is equipped with an endless chain with master link.

**WARNING**

If too slack, the chain can come off the front or rear sprocket thus resulting in serious accidents and damage to the vehicle, with consequent serious personal injury or death.

Do not use the vehicle if the chain slack has not been correctly adjusted.

To check the chain, hold it where it turns on the rear sprocket and pull it as if to separate it from the sprocket itself.

If you can move it more than 3 mm (0.125 in) from the front sprocket, it is worn; replace the chain, and the front and rear sprocket.

**DANGER**

Improper maintenance can cause premature wear of the chain and result in damage to both the front and rear sprocket.

Perform chain maintenance operations more frequently if the vehicle is used on dusty roads or in muddy areas.

**TYRES****WARNING**

An over-inflated tyre results in a hard, uncomfortable and less secure ride.

Over inflation also affects grip, especially on curves and wet surfaces.

An under-inflated tyre (insufficient pressure) can slip on the wheel rim, resulting in loss of control.

Under inflation also affects grip and handling, as well as braking efficiency.

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

When new, tyres can have a thin slippery protective coating. Drive carefully for the first few kilometres (miles).

Never use rubber treatment products on the tyres.

In particular, do not allow the tyre to come in contact with liquid fuel, which rapidly deteriorates the tyre rubber.

In case of contact with oil or fuel, do not clean but change the tyres.

**DANGER**

Some of the factory-assembled tyres of this vehicle are provided with wear indicators.

There are various types of wear indicators.

For more information on how to check the wear, contact your Dealer.

Check wear visually and have the tyres replaced when they are worn.

If a tyre deflates during a ride, do not attempt to continue the trip.

Avoid sudden braking or steering manoeuvres, and do not decelerate abruptly.

Slowly decelerate and move to the edge of the road braking with the engine until you come to a standstill.

Failure to observe these instructions can result in accidents, with the risk of serious personal injury or death.

Never use tube tyres on tubeless tyre rims, or vice versa.

## 1.4. RUNNING-IN

### 1.4.1. RUNNING-IN

Correct engine running-in is essential to ensuring proper performance and durability.

Twisty, hilly roads are ideal for an effective running-in of engine, suspension and brakes.

Varying speed frequently is also recommended.

This will vary the amount of stress placed on vehicle components continuously, allowing engine parts to cool down when less stressed.

While it is important to put a certain amount of stress on engine components during the running-in period, it is equally important to spare the engine at this stage in the vehicle's life.



#### **WARNING**

**Top acceleration performance is obtained only after covering the first 1500 km (932 mi).**

Follow these recommendations:

- Do not open the throttle completely when the engine is running at low speed, both during and after the running-in period.
- Until you have covered the first 100 km (62 mi), use the brakes gently and avoid harsh, prolonged braking. This will help the brake pads bed in properly against the brake disc.
- During the first 1000 km (621 mi), never exceed 6000 rpm (see table).



#### **WARNING**

**After covering the first 1000 km (621 mi), perform the checks listed in the "After running-in" column (see REGULAR SERVICE INTERVALS CHART) to avoid personal injury to yourself or third persons, or vehicle damage.**

- Between the first 1000 km (621 mi) and 1500 km (932 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 (932 mi) you may run the engine harder, however, without exceeding the maximum rpm allowed (11000 rpm).

Recommended maximum rpm	
Mileage km (mi)	rpm
0-1000 (621)	6000
1000-1500 (621-932)	7500
Over 1500 (932)	11000

## 1.5. VEHICLE IDENTIFICATION

### 1.5.1. POSITION OF THE SERIAL NUMBERS

These numbers are necessary for vehicle registration.

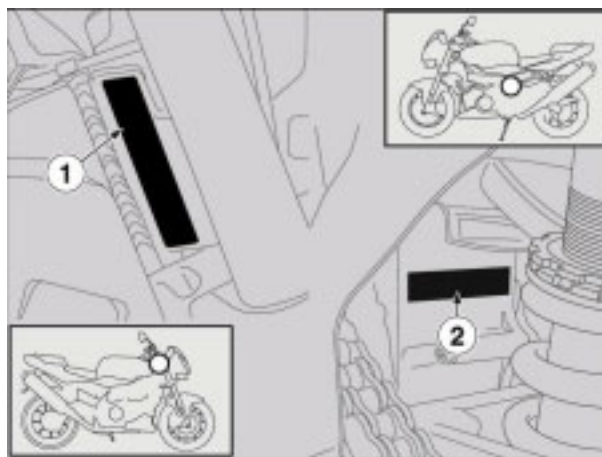
**NOTE** *Altering the vehicle's identification numbers is punishable by law with heavy fines and penalties. Altering the frame number voids the warranty.*

#### FRAME NUMBER

The frame number (1) is stamped on the right-hand side of the headstock.

#### ENGINE NUMBER

The engine number (2) is stamped on the rear, near the sprocket.



PERIODIC MAINTENANCE

2



**SUMMARY**

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## 2.1. GENERAL TECHNICAL INFORMATION

## 2.1.1. TECHNICAL DATA

DIMENSIONS	
Max length	2025 mm (79.75 in)
Max width	830 mm (36.78 in)
Max height (at headlight fairing)	1100 mm (43.31 in)
Seat height	820 mm (32.28 in)
Wheelbase	1410 mm (55.51 in)
Minimum ground clearance	130 mm (5.12 in)
Weight in running order	209 kg (460.8 lb)

ENGINE	
Model	V990 NG
Type	Longitudinal 60° V twin-cylinder, four-stroke, four valves per cylinder, 2 overhead camshafts
Number of cylinders	2
Total displacement	997.6 cu cm (60.87 cu in)
Bore/stroke	97 mm/67.5 mm (3.81 in/2.65 in)
Compression ratio	11.8 ± 0.5: 1
Starting	Electric starter
Engine idle rpm	1250 ± 100 rpm
Clutch	Wet multi-plate clutch with hydraulic control on left handlebar and PPC system
Lubrication system	Dry sump with separate oil reservoir and oil cooler
Air filter	Dry cartridge filter
Cooling	Liquid cooling

GEARBOX	
Type	mechanical, 6-speed, with control pedal on left side of engine

CAPACITIES	
Fuel (including reserve)	18 l (4.76 gal)
Fuel reserve	4 ± 1 l (1.06 ± 0.26 l)
Engine oil	gearbox 3700 cu cm (225.8 cu in) – gearbox and oil filter 3900 cu cm (238.9 cu in)
Fork fluid	505 ± 2.5 cu cm (30.81 ± 0.15 cu in) (each leg)
Coolant	2.2 l (0.58 gal) (50% water + 50% ethylene-glycol-based antifreeze)
Seat	twin seat
Max carrying load	192 kg (423.2 lb) (rider + passenger + luggage)

TRANSMISSION RATIOS				
Ratio	Primary drive ratio	Gear ratios	Final drive ratio	Total gear ratio
1st	31/60 = 1: 1.935	15/34 = 1: 2.267	16/40 = 1: 2.500	1:10.968
2nd		19/31 = 1: 1.632		1:7.895
3rd		20/26 = 1: 1.300		1:6.290
4th		22/24 = 1: 1.091		1:5.279
5th		25/24 = 1: 0.960		1:4.645
6th		26/23 = 1: 0.885		1:4.280

DRIVE CHAIN	
Type	endless chain (without master link) with sealed links
Model	525

FUEL SYSTEM	
Type	Multipoint electronic injection
Throttle	Ø 57 mm (2.24 in)

FUEL SYSTEM	
Fuel	premium grade unleaded petrol, min. O.N. 95 (RON) and 85 (MON)

<b>FRAME</b>	
Type	twin-spar frame with light-alloy cast elements and formed extruded elements
Steering head angle	25°
Trail	100 mm (3.93 in) (with 120/70 front tyre)

<b>SUSPENSION</b>	
Front	adjustable hydraulic upside-down telescopic fork, 43-mm Ø (1.69 in) legs
Travel	127 mm (5.00 in)
Rear	light-alloy swingarm with arms having different profiles and adjustable hydropneumatic monoshock
Wheel travel	135 mm (5.31 in)

<b>BRAKES</b>	
Front	twin floating disc – Ø 320 mm (Ø 12.60 in), four-piston callipers – Ø 34 mm (Ø 1.34 in)
Rear	single disc – Ø 220 mm (Ø 8.66 in), two-piston calliper – Ø 32 mm (Ø 1.26 in)

<b>WHEEL RIMS</b>	
Type	light alloy, removable wheel shaft
Front	3.50 x 17"
Rear	6.00 x 17"

<b>TYRES</b>							<b>Pressure kPa (bar)</b>	
Wheel	Make	Model	Type	Size	Recommen- ded		#	
							Front	Rear
** Front	PIRELLI	DIABLO	CORSA	120/70– ZR 17"	#	\$	250 (2.5) (36.25 PSI)	-
** Rear	PIRELLI	DIABLO	CORSA	190/50– ZR 17"	#	\$	-	280 (2.8) (40.61 PSI)
** Front	METZELER	SPORTTEC	M1	120/70– ZR 17"	#	\$	250 (2.5) (36.25 PSI)	-
** Rear	METZELER	SPORTTEC	M1	190/50– ZR 17"	#	\$	-	280 (2.8) (40.61 PSI)
** Front	MICHELIN	PILOT SPORT	E	120/70– ZR 17" TL	#	-	250 (2.5) (36.25 PSI)	-
** Rear	MICHELIN	PILOT SPORT	E	190/50– ZR 17" TL	#	-	-	280 (2.8) (40.61 PSI)
** Front	DUNLOP	SPORTMA X	D 208 RR	120/70– ZR 17"	#	-	250 (2.5) (36.25 PSI)	-
** Rear	DUNLOP	SPORTMA X	D 208 RR	190/50– ZR 17"	#	-	-	280 (2.8) (40.61 PSI)
* Front	PIRELLI	DRAGON SUPERCO RSA	-	120/70– ZR 17"	#	\$	250 (2.5) (36.25 PSI)	-
* Rear	PIRELLI	DRAGON SUPERCO RSA	-	180/55– ZR 17"	#	\$	-	280 (2.8) (40.61 PSI)
Rear	METZELER	SPORTTEC	M1	180/55– ZR 17"	#	\$	-	280 (2.8) (40.61 PSI)
Front	METZELER	RENNSPOR T	-	120/70– ZR 17"	-	\$	250 (2.5) (36.25 PSI)	-
Rear	METZELER	RENNSPOR T	-	180/55– ZR 17"	-	\$	-	280 (2.8) (40.61 PSI)
Front	MICHELIN	PILOT POWER RACING		120/70– ZR 17"	-	\$	250 (2.5) (36.25 PSI)	-
Rear	MICHELIN	PILOT POWER RACING		180/55– ZR 17"	-	\$	-	280 (2.8) (40.61 PSI)
Rear	MICHELIN	PILOT POWER RACING	-	190/50– ZR 17"	-	\$	-	280 (2.8) (40.61 PSI)
* = Original equipment			** = Alternative		# = Road use		\$ = Racing	

<b>SPARK PLUGS</b>	
Standard	NGK R DCPR9E
Electrode gap	0.6 - 0.7 mm (0.023 - 0.028 in)
Resistance	5 kΩ

<b>ELECTRIC SYSTEM</b>	
Battery	12 V – 10 Ah
Main fuses	30 A
Auxiliary fuses	5 A, 15 A, 20 A
Generator (permanent magnet)	12 V – 500 W

<b>BULBS</b>	
Low beam (halogen)	12 V – 55 W H11 x 2
High beam (halogen)	12 V – 55 W H11 x 2
Front parking light	12 V – 5 W x 2
Turn indicators	12 V – 10 W (USA version 12V – 10W)
Number plate light	12 V – 5 W
Rear parking/stop lights	LED
Rev counter light	LED
Left multi-function display light	LED

<b>WARNING LIGHTS</b>	
Gearbox in neutral	LED
Turn indicators	LED
Fuel reserve	LED
High beam light	LED
Stand light	LED
WARNING light	LED
Red line	LED
Immobilizer	LED

### 2.1.2. SCHEDULED MAINTENANCE CHART

MAINTENANCE OPERATIONS TO BE PERFORMED BY **aprilia** Authorised Dealers (MAY ALSO BE PERFORMED BY OWNER).

**Key**

1 = Check and clean, set or adjust, lubricate, change or replace as required;


2 = Clean;

3 = Change or replace;

4 = Set or adjust.

(\*) = Check every two weeks or at the specified intervals.

**NOTE** Perform maintenance operations at half the specified intervals if the vehicle is used in rainy and dusty areas, on uneven ground, or for racing.

Components	End of running-in period [1000 Km (625 mi)]	Every 5000 Km (3125 mi) (only for intensive racetrack use)	Every 10000 Km (6250 mi) or 12 months	Every 20000 Km (12500 mi) or 24 months
Spark plug		3	1	3
Air filter		3	1	3
Engine oil filter	3	3	3	
Engine oil filter (on oil tank)	2	2		2
Operating/setting of lights			1	
Light system	1		1	
Safety switches	1		1	
Clutch fluid	1	1	1	
Brake fluid	1	1	1	
Coolant	1	1		1
Engine oil	3	3	3	
Tyres	1		1	
Tyre pressure *	4		4	
Error light (on instrument panel) 	upon starting: 1			
Drive chain tension and lubrication	Every 1000 Km (625 mi): 1			
Brake pad wear	1	Every 1000 Km (625 mi): 1	Before each ride and every 2000 Km (1250 mi): 1	

MAINTENANCE OPERATIONS TO BE PERFORMED BY **aprilia** Authorised Dealers.

**Key**





























- 1 = Check and clean, set or adjust, lubricate, change or replace as required (as specified in the Workshop Manual);  
 2 = Clean;  
 3 = Change or replace;  
 4 = Set or adjust.

(\*) = Only for versions with Magnesium wheels: check to ensure that wheel rim paintwork is in perfect condition.

**NOTE** Perform maintenance operations at half the specified intervals if the vehicle is used in rainy and dusty areas, on uneven ground, or for racing.

Components	End of running-in period [1000 Km (625 mi)]	Every 5000 Km (3125 mi) (only for intensive racetrack use)	Every 10000 Km (6250 mi) or 12 months	Every 20000 Km (12500 mi) or 24 months
Rear shock absorber		1		1
Gearbox		Every 10000 Km (6250 mi): 1		
Bowden cables and controls	1	1	1	
Rear suspension connecting rod bearings				1
Steering bearings and steering play:	1	1	1	
Wheel bearings		1	1	
Brake discs	1	1	1	
Overall operation of vehicle	1	1	1	
Valve clearance adjustment		4		4
Braking systems	1	1	1	
Cooling system		1	1	
Clutch fluid		every 12 months: 3	every 24 months: 3	
Brake fluid		every 12 months: 3	every 24 months: 3	
Coolant			every 24 months: 3	
Front fork fluid			After the first 10000 Km (6250 mi) and every 20000 Km (12500 mi) afterwards: 3	
Front fork oil seals			After the first 30000 Km (18650 mi) and every 20000 Km (12500 mi) afterwards: 1	
Brake pads	If worn: 3			
Wheels/tyres (*)	1	1	1	
Tightness of fasteners	1	1	1	
Cylinders synchronisation	1		1	
Suspension and track alignment	1	1		1
Final drive (chain and chain sprockets)		1	1	
Fuel lines			1	every 4 years: 3
Clutch wear		1		
Pistons		1		

## 2.1.3. LUBRICANT TABLE

LUBRICANT	PRODUCT
Engine oil	<p>RECOMMENDED:  EXTRA RAID 4, SAE 15W – 50 or  Agip TEC 4T SAE 15W – 50.</p> <p>As an alternative to recommended oils, top brand oils meeting or exceeding CCMC G-4, A.P.I. SG specifications can be used.</p>
Front fork fluid	<p>RECOMMENDED: F.A. 5W or  F.A. 20W or  Agip FORK 5W or  Agip FORK 20W.</p> <p>When you wish to obtain an intermediate response between those offered by  F.A. 5W and  F.A. 20W or  Agip FORK 5W or  Agip FORK 20W oils, you may mix the different products as follows:</p> <p>SAE 10W =  F.A. 5W 67% of volume +  F.A. 20W 33% of volume or  Agip FORK 5W 67% of volume +  Agip FORK 20W 33% of volume.</p> <p>SAE 15W =  F.A. 5W 33% of volume +  F.A. 20W 67% of volume or  Agip FORK 5W 33% of volume +  Agip FORK 20W 67% of volume.</p>
Bearings and other lubrication points	<p>RECOMMENDED:  Bimol Grease 481,  AUTOGREASE MP or  Agip Grease 30.</p> <p>As an alternative to recommended grease, use top brand rolling bearing grease that will resist a temperature range of -30 °C ... +140 °C (-22 °F....+284 °F) , with dropping point 150 °C ...230 °C (+302 °F....+446 °F), high corrosion protection, good resistance to water and oxidation.</p>
Battery terminals	Neutral grease or Vaseline.
Chains	RECOMMENDED aerosol chain lubricant:  CHAIN SPRAY or  Agip CHAIN LUBE.
Brake fluid	<p>RECOMMENDED:  Autofluid FR. DOT 4 (braking system is also DOT 5 compatible) or  Agip BRAKE 5.1 DOT 4 (braking system is also DOT 5 compatible).</p> <p><b>NOTE</b> Use only new brake fluid. Never mix different brands or types of brake fluid unless you have determined that bases are compatible.</p>
Clutch fluid	<p> Autofluid FR. DOT 4 (clutch system is also DOT 5 compatible) or  Agip BRAKE 5.1 DOT 4 (braking system is also DOT 5 compatible).</p> <p><b>NOTE</b> Use only new clutch fluid.</p>
Engine coolant	<p>RECOMMENDED:  ECOBLU – 40°C or  Agip COOL.</p> <p><b>NOTE</b> Use nitrite-free and anticorrosion coolant only to ensure protection at at least 35°C (-31 °F).</p>

## 2.1.4. TIGHTENING TORQUES

**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	Note
<b>ENGINE TO FRAME</b>					
Front engine mount	2+2	M10	50		
Upper and lower rear engine mount, LH side	2	M10	50		
Upper and lower rear engine mount, RH side - adjust. bushing	2	M20x1.5	12		
Upper and lower rear engine mount, RH side - counter nut	2	M20x1.5	50		
Upper and lower rear engine mount, RH side	2	M10	50		
<b>PARTS MOUNTED ON ENGINE</b>					
Engine oil inlet flange	2	M6	10		
Engine oil outlet flange	2	M6	10		
Rear brake lever bracket	1	M6	10		
	1	M8	25		
Rear brake master cylinder bracket	2	M8	25		
Sprocket fastener	1	M10	50		Loctite 243
Clutch slave cylinder fastener	3	M6	10		
Sprocket cover fastener	3	M6	10		
Fuel delivery line to throttle body	1	M12x1.5	22		
72/78Kw reduction bushing	1	M5	3		(shear bolt) Loctite 243
<b>SWINGARM</b>					
Swingarm pivot ring nut	1	M30x1.5	60		
Swingarm pivot adjustment bushing	1	M30x1.5	12		
Swingarm pivot nut	1	M20x1.5	90		
Calliper carrier retaining pin	1	M12	50		Loctite 243
Chain tightener screw and nut	1+1	M8	Man.		
Rear brake line guide	3	M5	4		
Chain guard upper fixing screw	1	M5	4		
Chain guard and chain guide mount lower fixing screw	1	M5	5		
Chain slider	2	M5	3		
Chain guide to chain guide mount upper fixing nut	1	M5(nut)	5		
Rear stand bushing	2	M6	10		
Chain guide fixing nut	1	M6(nut)	10		
<b>SIDE STAND</b>					
Stand bracket to frame	1	M10	50		
Side stand fixing pin	1	M10x1.25	10	-	
Stand switch fixing screw	1	M6	10		Loctite 243
Lock nut	1	M10x1.25	30		
<b>FRONT FORK</b>					
Fork leg to top fork yoke	1+1	M8	25		
Fork leg to bottom fork yoke	2+2	M8	25		
Headstock ring nut	1	M35x1	40		
Headstock counter nut	1	M35x1	Man.		Manual + 90°
Top yoke fixing plug	1	M29x1	100		Use a torque wrench
Front fork clamps (Showa)	2+2	M8	22		
Front fork clamps (Öhlins)	2+2	M6	12		



DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	NOTE
<b>STEERING DAMPER</b>					
Steering damper to frame	1	M6	10		Loctite 243
Steering damper to bottom fork yoke	1	M6	10		
<b>FOOTRESTS</b>					
Rider footrests	4	M8	2.5		
Passenger footrests	4	M8	2.5		
<b>REAR SHOCK ABSORBER</b>					
Shock absorber to frame	1	M10	50		
<b>REAR SUSPENSION CONNECTING RODS</b>					
Single connecting rod to frame	1	M10	50		
Single to double connecting rod	1	M10	50	-	
Double connecting rod to swingarm	1	M10	50		
Double connecting rod to shock absorber	1	M10	50		
<b>ELECTRIC SYSTEM</b>					
Battery bracket	2	M5	2		
Horn	1	M8	15		
Odometer sensor to rear brake calliper carrier	1	M6	12		
Voltage regulator mount	2	M6	10		
Voltage regulator to mount	2	M6	10		
Coil mount to frame	2	M6	10		
Coil to coil mount	1	M6	10		
ECU	3	M6	10		
Starter relay mount to seat frame	1	M6	10		
Relay carrier bracket to seat frame	2	M6	3		
Atmospheric pressure sensor to seat frame cover	1	M5	1		
Wire to starter motor	1	M6	5		
Wires to starter relay	2	M6	4		
Engine ground wire	2	M6	5		
Main wiring harness plate to air intake	1	SWP 3.9	1		
<b>LIGHTS / INSTRUMENT PANEL</b>					
Rear turn indicators	2	M4	1	-	
Front turn indicators	2	M6	4	-	
Tail light to tail guard	4	M5	2	±20%	
Headlight to conveyor	2	M5	2	-	
Headlight to fairing front piece	4	M5	2		
Instrument panel	3	SWP5x14	3		
<b>AIR BOX</b>					
Air box cover	7	SWP5x20	3	±20%	
Air box to throttle body	6	M6	5	±20%	
Intake funnels	4	SWP 3.9	1	±20%	
MAP sensor mount	1	SWP5x20	2	±20%	
Filter frame	2	SWP5x20	2	-	
Conveyor to frame	4	M6	10		

Description	Qty	Type of fastener	Torque (Nm)	Tol.	Note
<b>FRONT WHEEL</b>					
Wheel shaft nut	1	M25x1.5	80		
<b>REAR WHEEL</b>					
Rear chain sprocket to sprocket holder	5	M10	50		
Rear wheel shaft nut	1	M25x1.5	120		
<b>COOLING SYSTEM</b>					
Coolant radiator upper bracket to frame	2	M6	10		
Electric fans to coolant radiator	2+2	M6	6	±20%	
Coolant radiator to upper bracket	2	M6	10	-	
Filler neck to coolant radiator	1	M6	-	±20%	See RH spoiler front fixing
Coolant radiator side brackets to engine mount spacers	2+2	M6	10	±20%	
Coolant radiator to side brackets	2	M6	6		
Oil cooler bracket to engine	4	M6	10		
Oil coolers to bracket	4	M6	10		
Expansion tank to frame	2	M6	10		
Expansion tank cap	1	M28x3	6		
Tube clamps no. 8104097	-	-	4		
<b>FRONT BRAKING SYSTEM</b>					
RH and LH front brake callipers	2+2	M10x1.25	50	-	
Front brake fluid reservoir to bracket	1	M6	7	-	
Front brake and clutch fluid reservoir bracket	1	M6	10	-	
Clutch fluid reservoir to bracket	1	M5	3		
Front brake line guide to bottom fork yoke	1	M5	4		
Brake disc	6+6	M8	30		Loctite 243
<b>REAR BRAKING SYSTEM</b>					
Rear brake calliper	2	M8	25	±20%	
Rear brake lever pin	1	M8	15	±20%	Loctite 243
Rear brake fluid reservoir	1	M5	3	±20%	
Rear brake rod counter nut	1	M6	Man.	±20%	
Brake disc	5	M8	30	±20%	Loctite 243
<b>EXHAUST SYSTEM</b>					
Front exhaust pipe to engine	4	M6	12		
Rear exhaust pipe to engine (upper screws)	2	M6	/		Tighten manually
Rear exhaust pipe to engine (lower screws)	2	M6	12		
Lambda sensor	1	M18x1.5	38		
Rear manifold guard	2	M4	2,5		
Silencers to mount	2	M8	25		
Guards to silencer	2	M4	2,5		

Description	Qty	Type of fastener	Torque (Nm)	Tol.	Note
<b>FUEL PUMP</b>					
Fuel return fitting (for workshop manual only)	1	M6	6	±20%	Loctite 243
Pump mount to flange (for workshop manual only)	3	M5	4	±20%	
Lead terminals to flange (for workshop manual only)	2	M5	5	±20%	
Fuel return cover (for workshop manual only)	1	M6	10		Loctite 243
Fuel delivery line to flange	1	M12x1.5	22		
Fuel level sensor to pump mount (for workshop manual only)	2	SWP 2.9x12	1		
Fuel pump wiring harness to flange (for workshop manual only)	2	M6	10		
<b>FUEL TANK</b>					
Filler neck to tank	4	M5	5	±20%	
Fuel pump flange to tank	8	M5	6	±20%	
<b>ENGINE OIL TANK</b>					
Oil tank nuts	3	M6	10	-	
Oil filter connection	1	M20x1.5	30	-	
Oil drain cap	1	M8	15	-	
Oil sight glass	2	M10x1	20		
<b>SEAT FRAME LOWER COVER</b>					
Lower cover to seat frame	3	M6	5	±20%	
Seat frame lower cover to frame	2	M5	4	±20%	
Rear stand bushing securing lower cover to seat frame	2	M6	12	±20%	
<b>NUMBER PLATE HOLDER</b>					
Number plate holder to seat frame lower cover	4	M6	3	±20%	
Cat's eye to number plate holder	2	M4	1	±20%	
<b>MUDGUARDS</b>					
Front mudguard	4	M5	5		
Rear mudguard	4	M5	5		
<b>TAIL GUARD</b>					
Tail guard to seat frame	2	M5	5		
Tail guard cover to seat frame	2	M6	7		
<b>RIGHT / LEFT SIDE PANELS</b>					
Side panels to tail guard	2	M5	2		
Side panels to tank	2	M5	5		
<b>COWLING</b>					
Complete cowling to oil cooler bracket and engine spacers	3	M6	7		
<b>RIGHT / LEFT SIDE COVERS</b>					
Side covers, rear end	2	M6	7		
Side covers, front end (with spoiler spacers)	2	M6	10		
Right side cover to voltage regulator mount	1	M6	5		
<b>RIGHT / LEFT RADIATOR FAIRING</b>					
RH-LH radiator fairing to fan peg	2	SWP 3.9	1		

Description	Qty	Type of fastener	Torque (Nm)	Tol.	Note
<b>RIGHT / LEFT SPOILER</b>					
Spoiler rear end to spacer	2	M6	7		
Spoiler front end to coolant radiator	2	M6	7		
<b>OIL TANK COVER</b>					
Cover to oil tank	2	M5	5		
<b>FRONT PIECE</b>					
Front piece to light units and conveyor	6	M5	3		
<b>HEADLIGHT FAIRING</b>					
Headlight fairing to fairing front piece	5	M4	1		
<b>RADIATOR SPOILER</b>					
Spoiler to coolant radiator lower brackets	2	M5	3		
<b>FRONT FORK LOWER COVER</b>					
Cover to bottom fork yoke	2	M6	3		
Cover to bottom fork yoke with steering damper	1	M6	10		
<b>SEAT COVER</b>					
Cover to cover base	7	SWP 3.9	1		
<b>HANDLEBAR AND CONTROLS</b>					
Upper U-bolt to handlebar mounts	4	M8	25		
Handlebar mounts to fork top yoke (for workshop manual only)	2	M10	30		Loctite 243
Anti-vibration weights	2	M6	10		
Anti-vibration weight end caps	2	M18x1	35		
LH dimmer switch	1	M5x1	1,5		
RH dimmer switch	1	M4	1,5		
Front brake master cylinder	2	M6	8		
Clutch master cylinder	2	M6	8		
<b>LOCKS</b>					
Ignition switch to yoke	2	M8	25		
Rear lock to tail guard	1	M22x1.5	10		Nylon nut
<b>FRAME</b>					
Lower chain slider	2	M6	10		
Seat frame	4	M10	50		

### 2.1.5. SPECIAL TOOLS

Suitable tools are required for correct disassembly and reassembly and a good tune-up.

The use of special tools avoids the potential risk of damage as a result of inappropriate tools and/or improvised methods.

Following is a list of special tools designed specifically for this vehicle

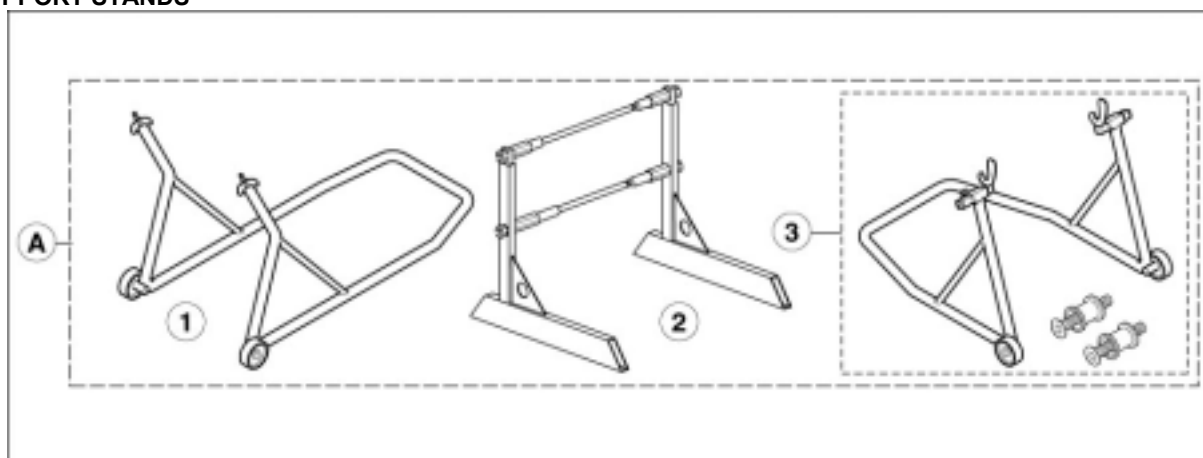
If necessary, request generic special tools.



#### WARNING

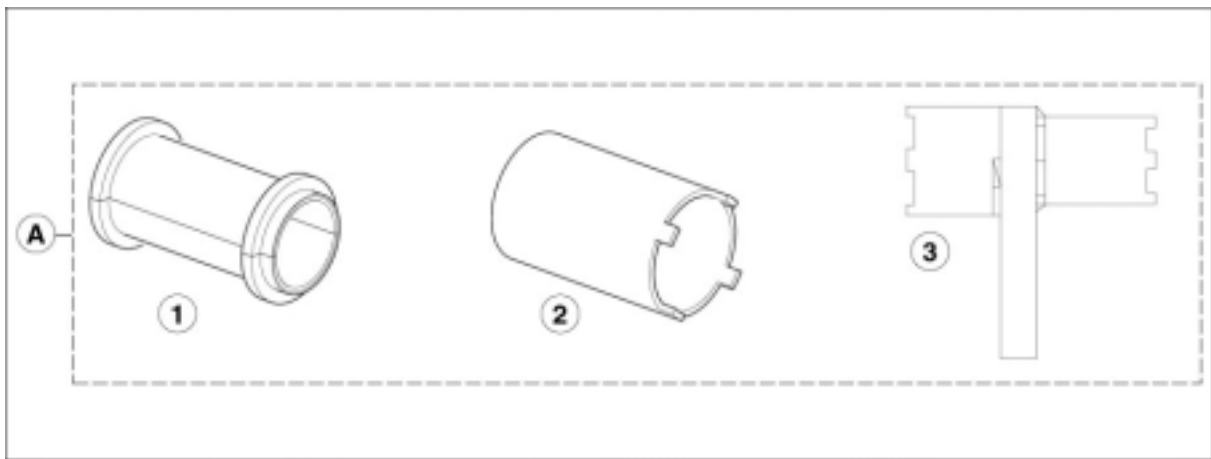
Before using the special tools consult the provided documentation.

### SUPPORT STANDS



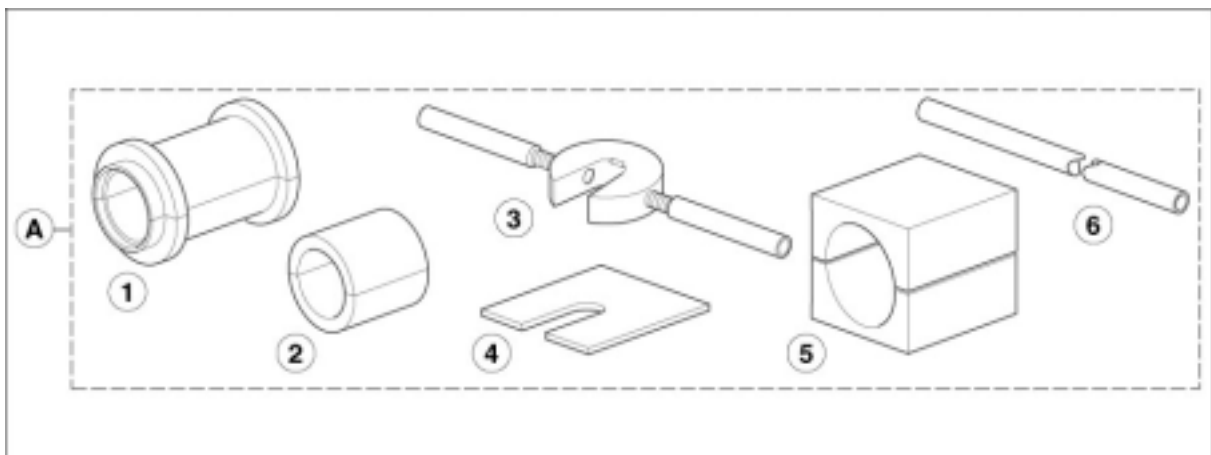
Pos.	aprilia part# (tool name and purpose)
A	<b>8140176</b> (complete support stands kit)
1	<b>8146486</b> (front support stand)
2	xxxxxxx N.A. [central support stand]
3	<b>8705021</b> (rear support stand)

xxxxxxx N.A. = supplied only with kit aprilia part# 8140176 (complete support stand kit)



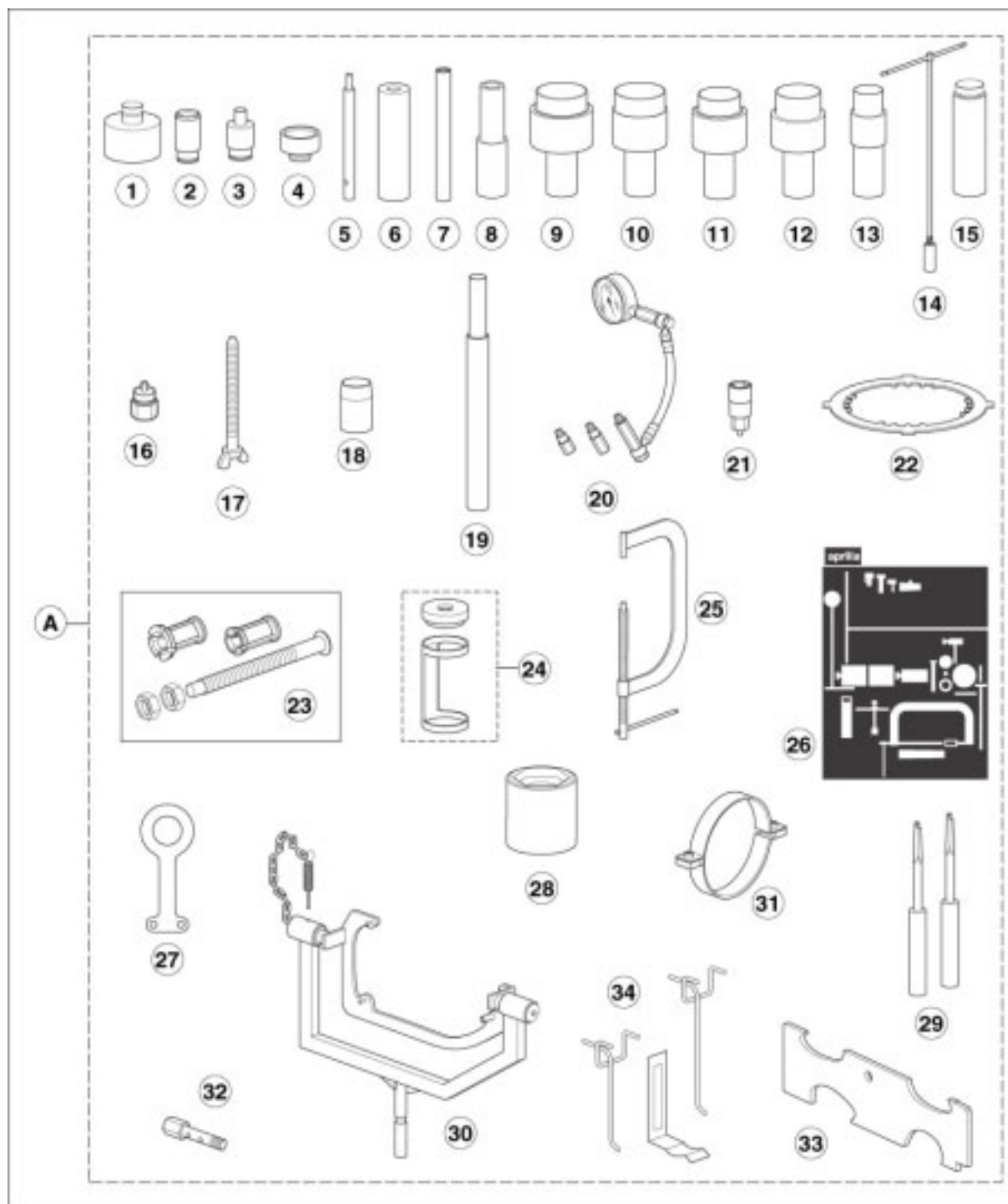
Pos.	aprilia part# (tool name and purpose)
A	<b>8140203</b> (complete tool kit for frame components)
1	<b>8140189</b> [tool for fitting oil seal for Ø 43 mm (Ø 1.70 in). Completes kit <b>aprilia</b> part# 8140151 (complete fork tool kit)]
2	<b>8140190</b> (tool for tightening steering head)
3	<b>8140191</b> (tool for tightening swingarm pivot and engine bracket)

## FORK TOOLS



Pos.	aprilia part# (tool name and purpose)
A	<b>8140151</b> (complete fork tool kit)
1	<b>8140145</b> (tool for fitting Ø 41 mm seal)
2	<b>8140146</b> {Weight to apply to tool: <b>aprilia</b> part# 8140145 [tool for fitting Ø 41 mm (Ø 1.61 in) seal] and <b>aprilia</b> part# 8140189 [tool for fitting oil seal for Ø 43 mm (Ø 1.70 in) hole. Completes kit <b>aprilia</b> part# 8140151 (complete fork tool kit)]}
3	<b>8140147</b> (tool for holding spacer)
4	<b>8140148</b> (spacer/damper rod separator plate)
5	<b>8140149</b> (guard for disassembly operations)
6	<b>8140150</b> (perforated rod for bleeding air from damper rod)

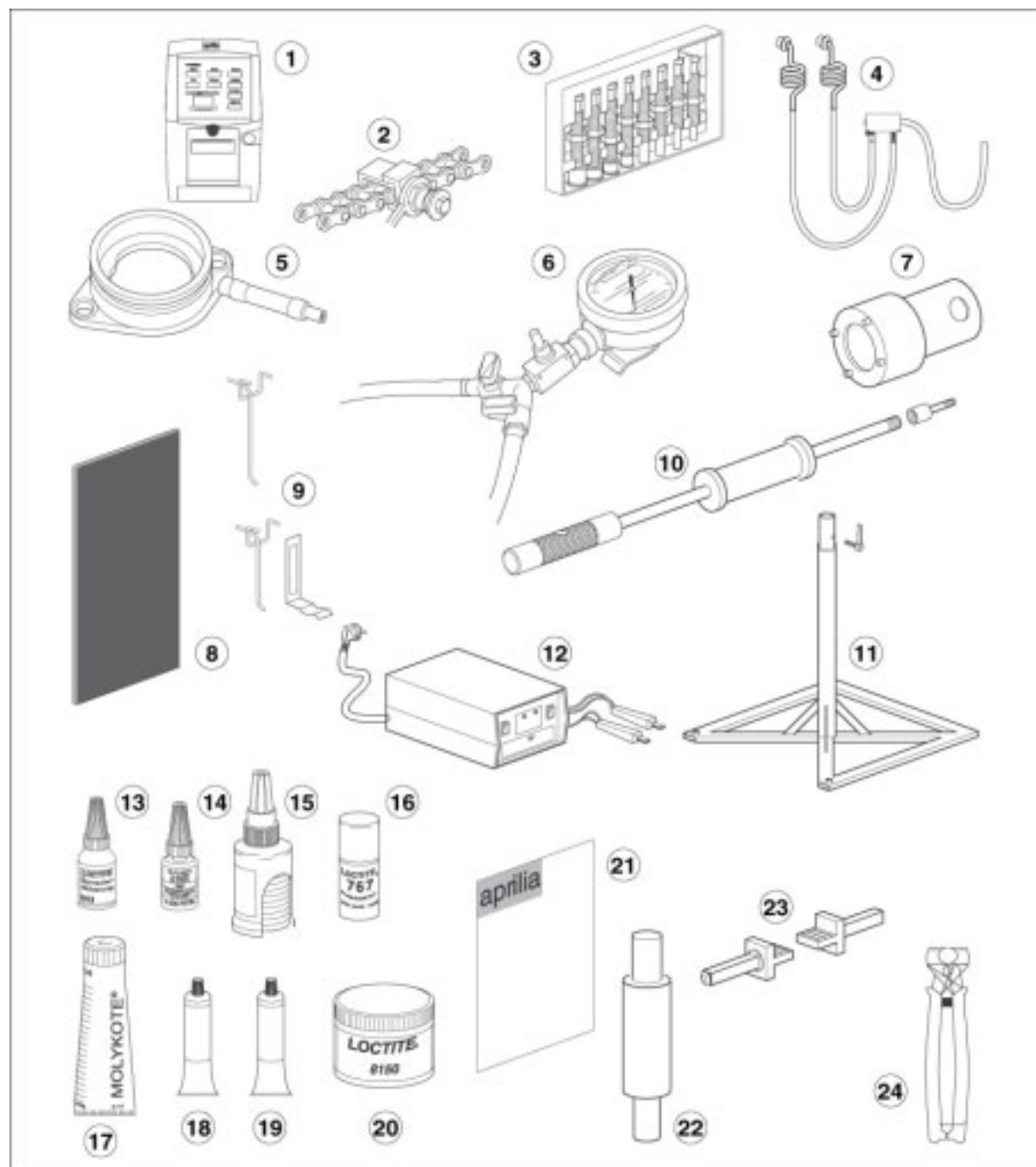
ENGINE TOOLS



Pos.	aprilia part# (tool name and purpose)
A	<b>8140175</b> (complete engine tool kit)
1	<b>0277680</b> (drift for fitting gearbox secondary shaft oil seal)
2	<b>0277660</b> (drift for fitting upper counter shaft oil seal)
3	<b>0277670</b> (drift for fitting coolant pump shaft housing oil seal)
4	<b>0877257</b> (drift for fitting water pump shaft housing sliding ring)
5	<b>0277510</b> (drift for valve guide disassembly)
6	<b>0277210</b> (drift for valve guide assembly)
7	<b>0277695</b> (drift for fitting valve guide oil seal)
8	<b>8140155</b> (drift for fitting gearbox shaft oil seal-clutch shaft oil seal)
9	<b>0277725</b> (drift for fitting crankshaft brass bushings)
10	<b>0277720</b> (drift for extracting crankshaft brass bushings)
11	<b>0277537</b> (drift for fitting lower counter shaft brass bushings)
12	<b>0277727</b> (drift for inserting clutch cover-crankshaft brass bushings)
13	<b>0277729</b> (drift for inserting lower counter shaft clutch cover brass bushings)
14	<b>8140177</b> (spark plug spanner)
15	<b>0277252</b> (tool for removing ignition cover)
16	<b>0277730</b> (hexagonal bolt for extracting flywheel)
17	<b>0240880</b> (threaded bolt for locking crankshaft at TDC)
18	<b>0277308</b> (guide bushing for gearbox secondary shaft)
19	<b>8140178</b> (drift for fitting and removing gudgeon pin)
20	<b>8140181</b> (fuel-oil-compression pressure gauge)
21	<b>8140182</b> (bushing for rotor bolt)
22	<b>0277881</b> (tool for locking clutch)
23	<b>8140156 + 8140157 + 0276377</b> (extractor for clutch cover brass bushings)
24	<b>0276479</b> (tool for valve spring spacer)
25	<b>8140179</b> (arc for valve disassembly and reassembly)
26	<b>8157143</b> (RSV/mille tool box compartment decal)
27	<b>8140183</b> (hook for lifting engine)
28	<b>8140184</b> (bushing for primary gear disassembly)
29	<b>8140185</b> (hooked levers for extracting clutch plates)
30	<b>8140188</b> (engine bracket)
31	<b>8140186</b> (tool for compressing piston rings)
32	<b>8140197</b> (drilled bolt for fuel pressure check)
33	<b>8140205</b> (tool for camshaft template)
34	<b>8140426</b> (panel hooks)

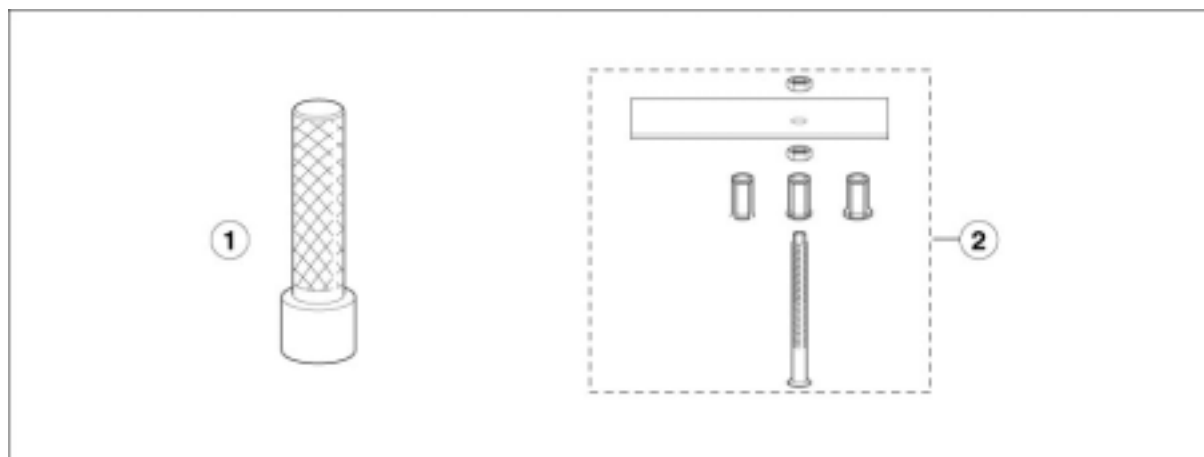


## MISCELLANEOUS TOOLS



Pos.	aprilia part# (tool name and purpose)
1	<b>8140196</b> [Plurigas (Italian )]
1	<b>8140578</b> [Plurigas (English)]
2	<b>8140192</b> (chain assembly kit)
3	<b>8140180</b> (bearing extractor)
4	<b>8140202</b> (exhaust gas test probes)
5	<b>8140267</b> (vacuum gauge sleeve)
6	<b>8140256</b> (vacuum gauge)
7	<b>8140424</b> (spanner for OHLINS forks)
8	<b>8140199</b> (tool holder panel)
9	<b>8140426</b> (panel hooks)
10	<b>8140432</b> (impact puller)
11	<b>8140187</b> (engine stand)
12	<b>8124838</b> (M.F. battery charger)
13	<b>0897651</b> [LOCTITE® 243 blue (10 cu cm) (0.61 cu in)]
14	<b>0899788</b> [LOCTITE® 648 green (5 g) (0.011 lb)]
15	<b>0899784</b> (LOCTITE® 574 orange)
16	<b>0297434</b> (LOCTITE® 767 Anti-Seize 15378)
17	<b>0297433</b> [MOLYKOTE® G-N (50 g) (0.11 lb)]
18	<b>0897330</b> (bp lz multipurpose grease)
19	<b>0297386</b> [SILASTIC 732 RTV (100 g) (0.22 lb)]
20	<b>8116067</b> (LOCTITE® 8150)
21	<b>8202222</b> (generic adhesive sheet for panel)
22	<b>8140074</b> (drift for extracting lower countershaft brass bushings)
23	<b>8140204</b> (rear support stand brackets)
24	<b>0277295</b> (clic clamps pliers)

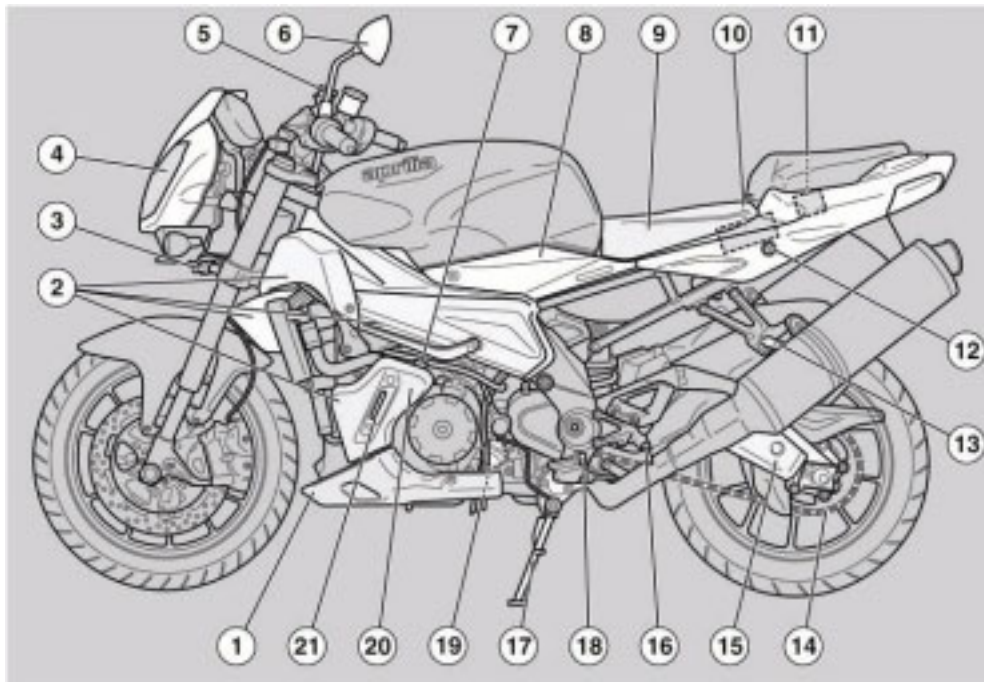
## TOOLS FOR OTHER aprilia VEHICLES



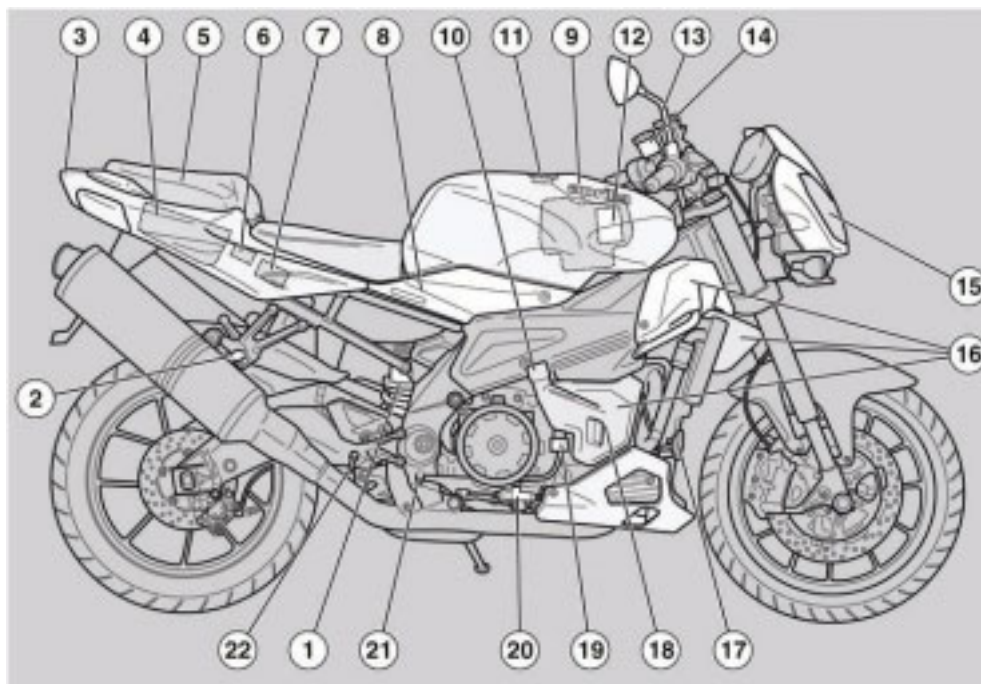
Pos.	aprilias part# (tool name and purpose)
1	<b>0877650</b> (drift grip)
2	<b>0277265</b> (extractor for counter shaft, primary shaft and secondary shaft bearing)
–	<b>8116050</b> (engine oil)
–	<b>8116053</b> (Bimol Grease 481 grease)
–	<b>8116038</b> (LUBERING ST grease)
–	xxxxxxx N.A. (AP-LUBE temporary lubricant)
–	xxxxxxx N.A. (DID CHAIN LUBE grease)
–	<b>8116031</b> (“double solvent” frame washing liquid )
–	<b>8116945</b> (“ACRILICON 28” cyanoacrylic glue)
–	xxxxxxx N.A. (MOTUL MOTOWASH degreaser)
–	<b>8116043</b> (ANTI-SEIZE MOTAGEPASTE AS 1800 anti-seize paste)
–	xxxxxxx N.A. (alcohol)
–	<b>0898011</b> (LOCTITE® 275 fluorescent green)
–	xxxxxxx N.A. (LOCTITE® 572)

xxxxxxx N.A. = not available

## 2.1.6. LOCATION OF KEY COMPONENTS

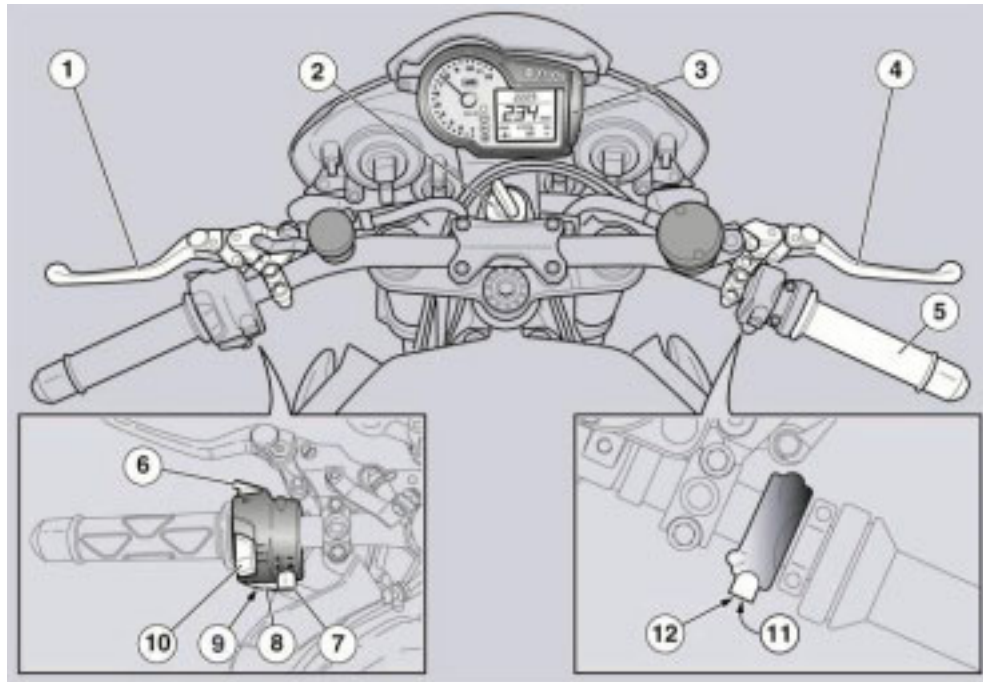
**Key:**

1. Cowling
2. Side fairings
3. Adjustable steering damper
4. Left headlight
5. Clutch fluid reservoir
6. Left rear-view mirror
7. Engine oil tank cap
8. Left side panel
9. Rider seat
10. Battery
11. Main fuse carrier (30A)
12. Passenger seat lock – glove / tool kit compartment
13. Passenger left footrest (Snaps closed/open)
14. Drive chain
15. Rear swingarm
16. Rider left footrest
17. Side stand
18. Gear change lever
19. Engine oil filter
20. Engine oil tank
21. Engine oil level

**Key:**

1. Rear shock absorber
2. Passenger right footrest (snaps closed/open)
3. Tail light
4. Glove / tool kit compartment
5. Passenger seat / seat cover
6. Control unit
7. Auxiliary fuse carrier (15A)
8. Right side panel
9. Fuel tank
10. Coolant expansion tank cap
11. Fuel tank filler cap
12. Air filter
13. Right rear-view mirror
14. Front brake fluid reservoir
15. Right headlight
16. Right side fairings
17. Horn
18. Expansion tank
19. Rear brake fluid reservoir
20. Rear brake master cylinder
21. Rear brake lever
22. Rider right footrest

## 2.1.7. LOCATION OF INSTRUMENTS / CONTROLS

**Key:**

1. Clutch lever
2. Ignition / steering lock switch (( - - ))
3. Instruments and indicators
4. Front brake lever
5. Throttle twistgrip
6. High beam flasher button ()
7. Light dimmer switch ( - )
8. Turn indicator switches ( - )
9. Horn button ()
10. TRIP1 / TRIP2 / MODE switch
11. Engine kill switch ( - )
12. Starter button ()

**Key:**

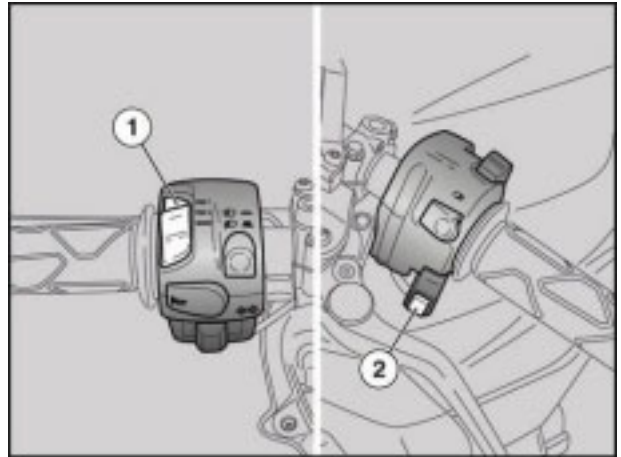
1. Rev counter
2. Green neutral light (N)
3. Amber "stand down" light (I)
4. Red general warning light (Δ)
5. Multifunction digital display (coolant temperature – clock - battery voltage – lap time - engine oil pressure diagnostics (⚠️))
6. Blue high beam light (⚡)
7. Amber low fuel light (⛽)
8. Green turn indicator light (↔️)
9. Red line light (red)



### 2.1.8. INSTRUMENT PANEL OPERATION

#### CONTROLS

Three-position selector (1) : TRIP1 / TRIP2 / ODO  
 SET button (2) : press briefly to scroll menu functions, hold down to confirm selection.



When the ignition key is turned to "I", the following instrument panel lights come on for two seconds:

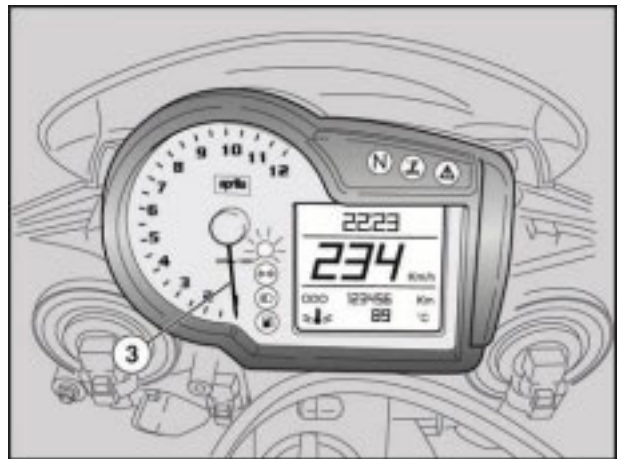
- All warning lights
- Backlighting
- The Tuono 1000 logo appears on the display.

The rev counter pointer (3) moves to the maximum rpm value set and then returns to its initial position.

During the initial check-up, all instruments will briefly show the current values of the corresponding parameters.

With the ignition key in position "I", standard display readouts are as follows:

- CLOCK
- CURRENT SPEED
- ODOMETER
- ENGINE TEMPERATURE



#### TRIP 1 AND 2

TRIP 1 and 2 modes display trip meter readouts 1 and 2. Trip meter reading is displayed at the side of the measurement unit indication.

To select TRIP 1 or TRIP 2 mode, set selector (1) to the TRIP mode you want displayed.

The following indications are displayed in the lower portion (C) of the display:

- TRIP METER 1/2
- RIDING TIME 1/2
- TOP SPEED 1/2
- AVERAGE SPEED 1/2



Press the SET button (2) briefly to cycle through the different indications. Hold down the SET button to reset all readings of the selected TRIP meter.





## ODO

The MODE configuration includes all user interface functions. To select the MODE configuration, set the selector (1) to MODE.

With the vehicle stopped, at each short press of the SET button (2), the display cycles through the following readings:

- CURRENT SPEED
- BATTERY VOLTAGE

Holding down the SET button (2) gives access to the configuration menu:

- MENU

When activated, "distance to empty" indication will be displayed in place of odometer reading.

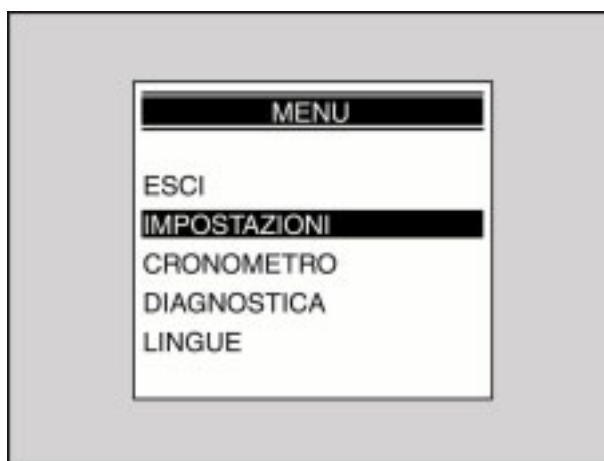


## MENU

The MENU screen configuration menu can be accessed when the vehicle is stopped and the selector is set to MODE. To open this menu, select MENU and hold down the SET button (2) to confirm.

The configuration menu holds the following options:

- EXIT
- SETTINGS
- LAP TIMER
- DIAGNOSIS
- LANGUAGE



## SETTINGS

When you select SETTINGS and hold down the SET button (2) to confirm, a screen with the following options will appear:

- EXIT
- TIME SETTINGS
- GEAR SHIFT INDICATOR
- BACKLIGHTING
- CHANGE THE CODE
- CODE RECOVERY
- °C / °F

## TIME SETTINGS

This option is used to set clock time. At each press of the

SET button (2), hour setting will increase by one unit from 1 to 12 and then will start over again from 1.

The transition from AM to PM and vice versa coincides with the transition from 11:59 to 12:00.

Holding down the SET button (2) stores current setting and gives access to the minutes setting mode. At each press of the SET button (3), minutes increase by one unit up to 59 and then go back to 0. Holding down the SET button (2) terminates the procedure and the instrument panel returns to the SETTINGS menu.

## GEAR SHIFT INDICATOR

This mode is used to set gear change threshold. When this mode is selected, the

## TUONO 1000

wording "GEAR SHIFT INDICATOR" in the current display language is displayed and the rev counter pointer points to the current threshold setting. At each short press of the SET button (2), threshold setting increases by 100 RPM. Upon reaching the upper limit, at the next press of the button the setting will decrease by 100 RPM and vice versa.

Holding down the SET button (2) terminates the procedure and the instrument panel returns to the SETTINGS menu.

Upon first power-up, the instrument panel defaults to the preset RUNNING-IN RPM; the next time the instrument panel is powered on, it will use the last set value.

- RUNNING-IN RPM 6000
- IDLE RPM 5000
- MAX RPM 12000

When the set threshold is exceeded, the warning light (4) on the instrument panel begins to flash and will keep flashing until speed drops back below the threshold.

**BACKLIGHTING**

Backlighting brightness can be set at one of three preset levels. When this option is selected, the wording BACKLIGHTING appears on the display; at each short press of the SET button (2), the display cycles through the following symbols:

LOW  
MEAN  
HIGH

After choosing the desired brightness, hold down the SET button (2) and the instrument panel returns to the SETTINGS menu.

**CHANGE THE CODE AND CODE RECOVERY**

This function can be used to change code, provided that the old code is known.

Upon accessing this function, the following message is displayed:

"INSERT THE OLD CODE"

After the old code has been recognised, a new code can be entered when the following prompt is displayed:

"INSERT THE NEW CODE"

When finished, the display returns to the DIAGNOSIS menu.

If you used the code to access the menu, this operation is not allowed.

When finished, the instrument panel returns to the SETTINGS menu.

**CODE RECOVERY**

This function is used to change the existing code when it is unknown; in this case, you will need

at least a second ignition key in addition to the one you will have inserted into the ignition.

The system will prompt you to insert a second key with this message:

"INSERT THE 2ND KEY"

The instrument panel stays on after the first key is removed; the second key must be inserted within 20 seconds of removing the first, otherwise the procedure is aborted.

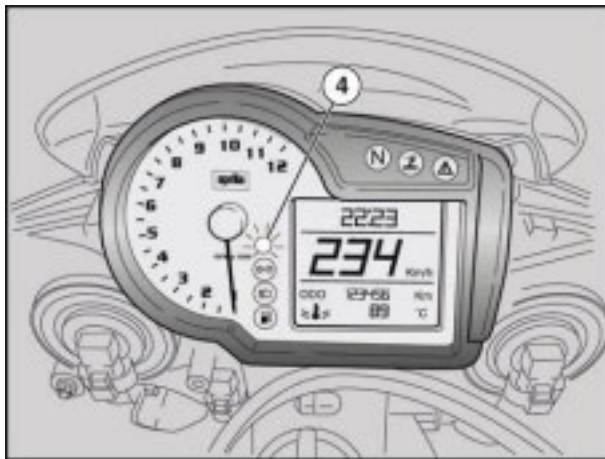
When the second key has been recognised, the system prompts for a new code with this message:

"INSERT THE NEW CODE"

When finished, the display returns to the DIAGNOSIS menu.

If you used the code to access the menu, this operation is not allowed.

When finished, the instrument panel returns to the SETTINGS menu.



**°C / °F**

This function is used to select the desired measurement unit for ambient temperature. When this function is selected, at each short press of the SET button (2), the display cycles through the two measurement units:

°C / °F

After choosing the desired unit, hold down the SET button (2) to store the setting and the instrument panel returns to the SETTINGS menu.

**LAP TIMER**

When you select LAP TIMER and hold down the SET button (2) to confirm, a screen with the following options will appear:

- EXIT
- LAP TIME ON
- VIEW TIMES
- DELETE TIMES

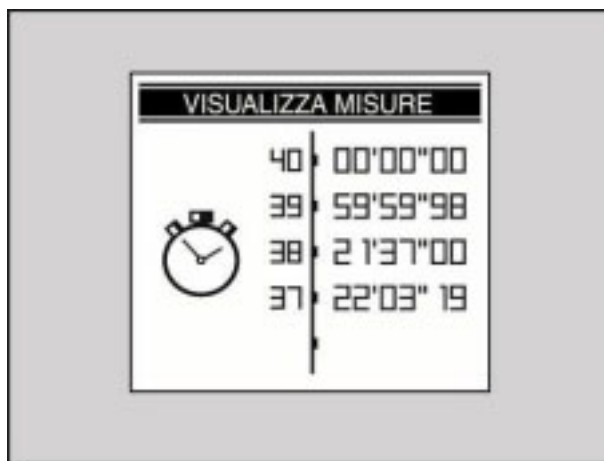
**LAP TIME ON**

This function turns on Lap Timer display in place of the clock in the upper portion of the display.

When set to on, Lap Timer display is retained after a Key off, Key on sequence.

**VIEW TIMES**

This function displays recorded lap times.



Short-press the SET button (2) to scroll lap time screens, hold down the button to return to the LAP TIMER menu. Recorded lap times will be lost if the battery is disconnected.

**DELETE TIMES**

This function is used to delete recorded lap times.

You will be asked to confirm whether you intend to proceed before data is deleted. When finished, the display returns to the LAP TIMER menu.

**Lap timer operation**

To use the lap timer, select LAP TIME ON and hold down the SET button (2) to confirm; the upper portion of the display (A) goes into

time acquisition mode. Briefly press the SET button (2) to start the lap timer.

Press the SET button (2) again within 10 seconds of timer starting to cancel count and restart the timer. Pressing the SET button (2) again after the timer has been running for over 10 seconds stops and stores current count and starts a new count. Holding down the SET button (2) stops the lap timing session.

When 40 lap times have been recorded, the word "FULL" is displayed and acquisition is terminated. To view recorded lap times, stop the motorcycle, see (STOP) and use the VIEW TIMES function available in the LAP TIMER menu.

## DIAGNOSIS

This function interfaces with and diagnoses the motorcycle's on-board systems. It is password-protected and the appropriate password is made available to Aprilia service centres only.

## LANGUAGE

This function is used to select display language.

Available options are listed below:

- ITALIANO
- ENGLISH
- FRANCAIS
- DEUTSCH
- ESPAGNOL

When finished, the display returns to the LANGUAGE menu.

## SERVICE WARNING

At the preset service intervals, a spanner symbol is displayed to serve as a service reminder.

First reminder: 1,000 Km (621.4 mi):

Afterwards: every 10,000 Km (6213.7 mi)

## ALARM DISPLAY

If a severe failure such to lead to serious damage or affect safety is detected, a symbol signifying its cause is shown in the lower portion of the display (D).

Alarms are grouped into two priority classes:

High priority: Engine overtemperature, Engine oil pressure, ECU errors, Instrument panel errors;



Low priority: Turn indicators and ECU disconnected.

When two or more alarms from the same priority class occur at the same time, the appropriate symbols are shown in a sequence.

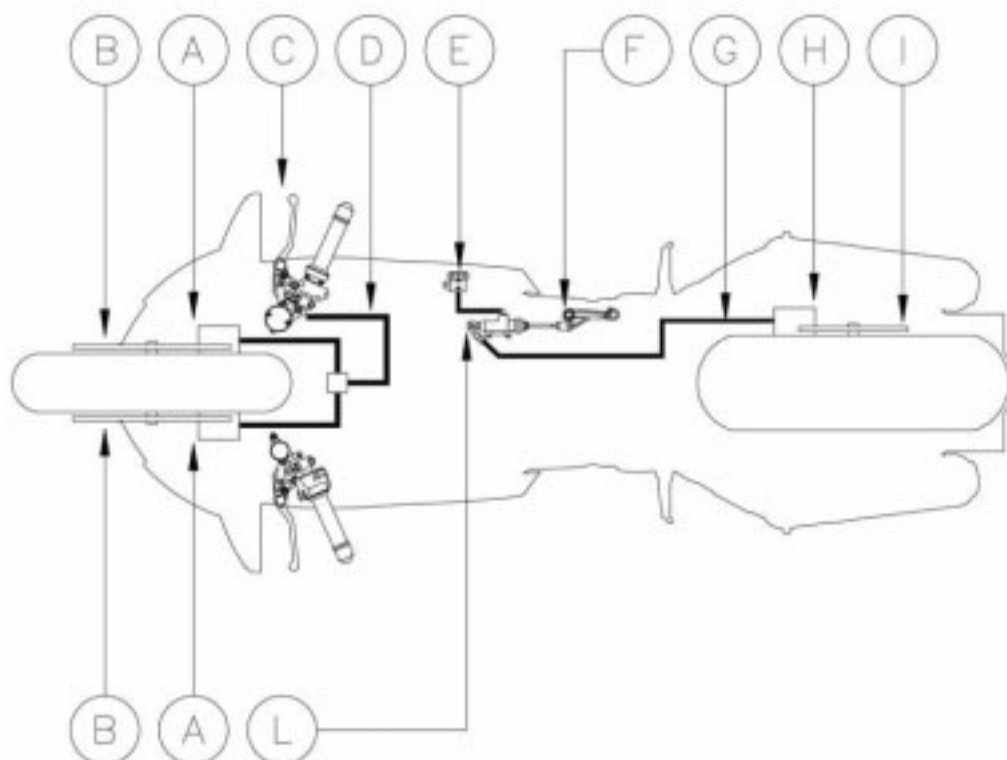
When high and low priority alarms occur at the same time, only high-priority alarms are displayed.

Warning light and SERVICE symbol may come on briefly at any given time; this does not indicate a malfunction.



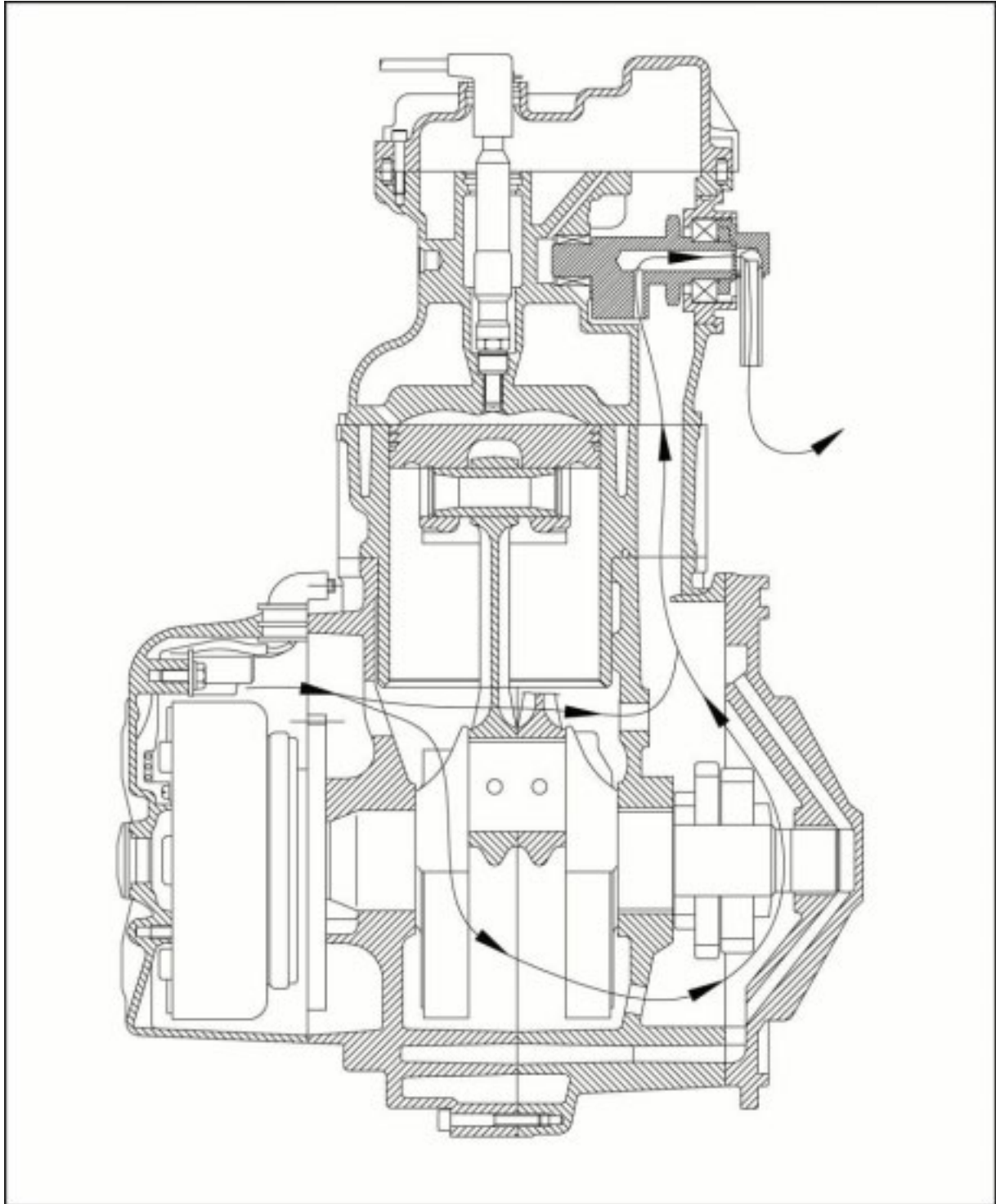
## 2.1.9. SYSTEMS DIAGRAM

## BRAKES



POS.	DESCRIPTION
A	FRONT BRAKE CALIPER (ONE FOR EACH SIDE)
B	FRONT BRAKE DISK (ONE FOR EACH SIDE)
C	FRONT BRAKE PUMP WITH LEVER AND OIL SUPP LY TANK
D	FRONT BRAKE OIL PIPE
E	REAR BRAKE OIL SUPP LY TANK
F	REAR BRAKE LEVER
G	REAR BRAKE OIL PIPE
H	REAR BRAKE CALIPER
I	REAR BRAKE DISK
L	REAR BRAKE PUMP

## EXHAUST GAS RECOVERY



FUEL SYSTEM

3

**SUMMARY**

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### 3.1. POWER SUPPLY

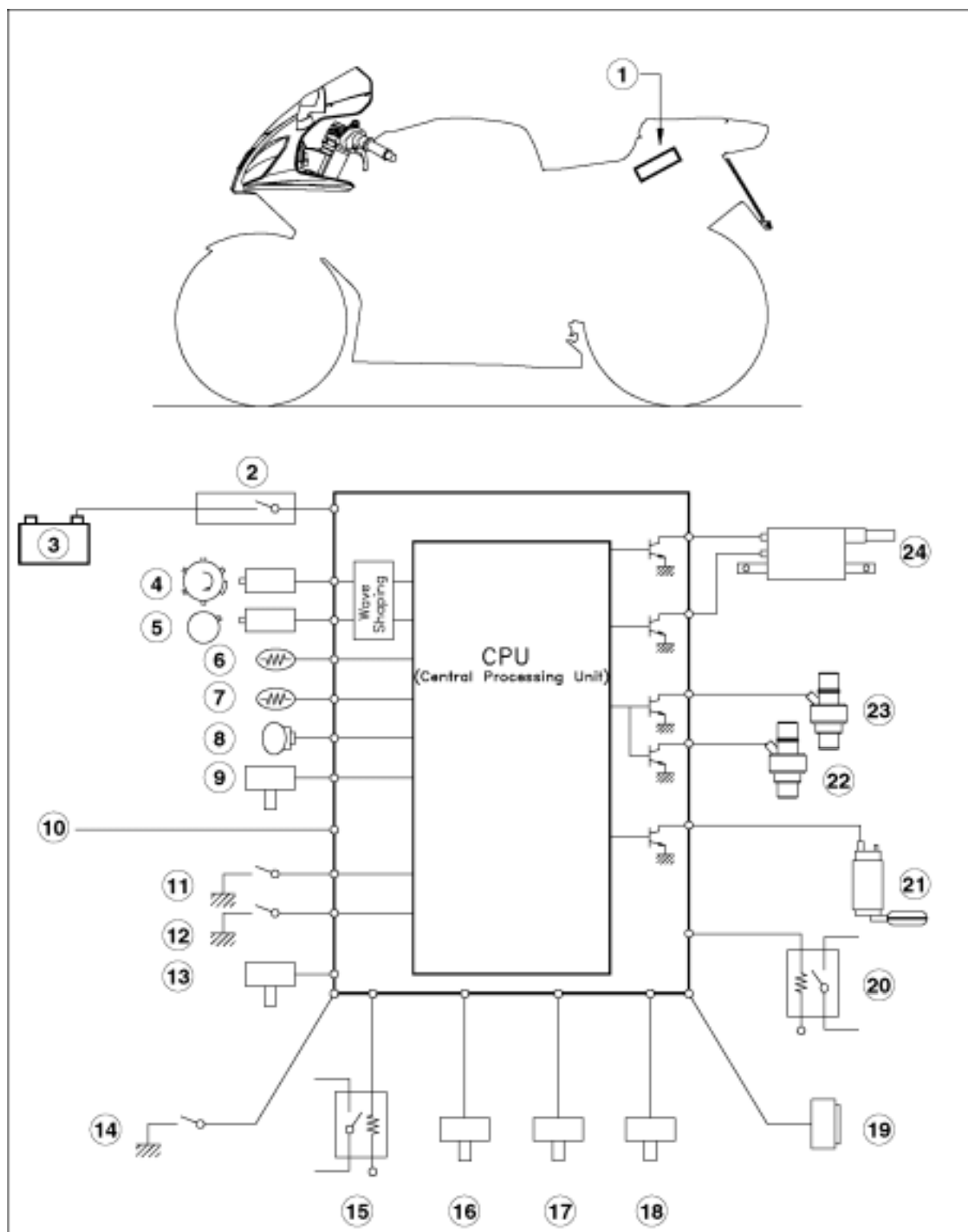
#### 3.1.1. DIAGRAM



#### Key

1. Fuel tank
2. Filler cap
3. Fuel pump unit
4. Breather tube for fuel vapours (caused by tank overpressure)
5. Excess fuel draining tube
6. Fuel level sensor
7. Delivered fuel filter
8. Fuel pump
9. Fuel delivery line
10. Fuel return line

## 3.1.2. INJECTION SYSTEM DIAGRAM



**Key:**

1. Position of ECU
2. Ignition switch
3. Battery
4. Crankshaft position sensor
5. Camshaft position sensor
6. Engine temperature sensor
7. Air temperature sensor
8. Throttle position sensor
9. Intake pressure sensor
10. Safety system: side stand, neutral sensor
11. Test switch
12. Bank angle sensor
13. Atmospheric pressure sensor
14. Oil pressure sensor
15. Electric fan
16. Automatic choke
17. Intake flap
18. Lambda sensor
19. Diagnosis connector
20. Starter relay
21. Fuel pump
22. Injector 1
23. Injector 2
24. Coil

### 3.1.3. CYLINDER SYNCHRONISATION AND CO LEVEL ADJUSTMENT

- With the engine off, connect Axone 2000 to the diagnosis socket and to the vehicle battery.
- Switch the tester on.
- Connect the gas analyser tubes to the relevant fittings.



- Start the setting with both throttle body bypass screws closed.
- Carry out the following procedure when the engine temperature is above 75°C (167°F).



#### VARIANT 1 (version with standard exhaust pipes)

- Using AXONE, check the "front cylinder pressure" and "rear cylinder pressure" parameters; ensure that they read:

**front cylinder pressure = rear cylinder pressure – (50 ± 10) mbar**

- Should the FRONT CYLINDER PRESSURE value be incorrect, turn the FRONT CYLINDER bypass screw.
- Read the residual CO value while alternatively opening the analyser valves. Turn the bypass screws if the value does not stay between 0.7 and 1.2 % and if the difference between the two readings is greater than 0.5 %.
- Once the CO test is completed, ensure that the FRONT CYLINDER PRESSURE and REAR CYLINDER PRESSURE parameter values are approximately within the specified range.



#### VARIANT 2 (version with open exhaust pipes)



#### DANGER

**It is strictly prohibited to make racing adjustments and ride the vehicle with said setting on roads and motorways**

**CAUTION** The following settings only apply to ECUs with racing mapping for open pipes.

- Using AXONE, check the "front cylinder pressure" and "rear cylinder pressure" parameters; ensure that they read:

**front cylinder pressure = rear cylinder pressure – (50 ± 10) mbar**









- Should the FRONT CYLINDER PRESSURE value be incorrect, turn the FRONT CYLINDER bypass screw.
- Read the residual CO value while alternatively opening the analyser valves. Turn the bypass screws if the value is not between **2** and **4** % and if the difference between the two readings is greater than 0.5 %.
- Once the CO test is completed, ensure that the FRONT CYLINDER PRESSURE and REAR CYLINDER PRESSURE parameter values are approximately within the specified range.

**WARNING**

Should the bike be fitted with an Akrapovic complete exhaust system, please note that the CO reading obtained with the approved exhaust system is lower once the Akrapovic system is installed.

## 3.1.4. AXONE

SYMBOL	SCREEN
	ISO
	ENGINE PARAMETER READING
	DEVICE STATUS (in general they are "On – Off" values)
	ENABLE DEVICES
	DETECTED FAULTS
	ENGINE PARAMETER ADJUSTMENT
	FREEZE FRAME

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
ISO				
	Aprilia hardware	485466000	-	Mapping code with reversed figures. If all figures are nought, it means the ECU is empty (not mapped): it is necessary to upload the suitable mapping (see note concerning mapping parameter)
	Aprilia software		-	Meaningless field
	Revision number	47	-	
	Engine	V2 – 60° 990	-	Twin-cylinder engine, 60° V, 990 cc
	Manufactured on	dd/mm/yy	-	ECU date of manufacture
	Mapping	664584	-	Mapping code stored in ECU.
	Programming date	dd/mm/yy	-	Date last mapping was loaded: day/month/year
	Last programmer	85456	-	ID code for the PC or Axone tester that loaded the latest mapping. In this 5.0.2 version, the code shown is not correct: to see it correctly, go to the ISO page that appears when selecting REPROGRAM

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
<b>ENGINE PARAMETER READING</b>				
	Water temperature	-	°C	The fans are activated at about 100°C. If the signal is lost, the ECU sets linear output for the value at 88°C (190 °F), starting from the air temperature at start-up (1° every 3 seconds) and activation of the cooling fans
	Air temperature	-	°C	If the signal is lost, the ECU sets the value at 18°C (64.4 °F)
	Engine rpm	-	rpm	
	Target idle speed	1200	rpm	The ECU attempts to bring the engine to this target speed (depending on coolant temperature).
	Engine load	-	-	Parameter linked to injection time (which in turn depends on the air flow intake determined by the throttle opening and intake pressure). The ECU uses this parameter to take different mapping steps, also.
	Intake pressure	650	hPa	Average value measured by the sensor connected to the two intake channels
	Total throttle opening	2.7	°	Parameter that considers throttle opening and stepper motor position
	Spark advance	-	°	
	Throttle position sensor	0	°	Parameter that reads the throttle opening degrees. If the signal is lost, the ECU sets the value at 9.8° and uses the intake pressure values
	Throttle offset	-	V	After the "Initialisation" or "Throttle Pos. Self-Learn" parameter is activated, this value (closed throttle position) is stored in the ECU: based on this reference value the control unit will know the position of the throttle at that moment
	Stepper motor	-	-	Stepper (idle) motor steps (if the signal is missing, the ECU sets value 21)
	Battery voltage	-	V	
	Vehicle speed	-	km/h	
	Front cylinder pressure	680	hPa	Pressure detected in the intake channel by the pressure sensor. If the signal is lost, the ECU uses the throttle position sensor values to operate the engine. The value for the front cylinder pressure must be 50 hPa higher than the rear cylinder pressure
	Rear cylinder pressure	630	hPa	Pressure detected in the intake channel by the pressure sensor. If the signal is lost, the ECU uses the throttle position sensor values to operate the engine. The value for the front cylinder pressure must be 50 hPa higher than the rear cylinder pressure
	Lambda correction	1	-	The value must vary around 1 when the ECU uses the oxygen sensor signal to keep combustion close to the stoichiometric value
	Lambda sensor	100-900	mV	Lambda sensor signal voltage; the value remains fixed if the circuit is broken
	Injection time	-	ms	
	Atmospheric pressure	1000	hPa	Sensor located under the seat. In case the signal is lost, the ECU sets value at 980 hPa

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
DEVICE STATUS				
	Bank angle sensor	normal/tip over	-	The ECU manages it like a status (therefore it is not stored in the memory): but if the circuit is broken (sensor disconnected) the instrument panel signals a fault, while Axone reads "Normal" (because when correctly connected the circuit is open) and the engine starts
	Control unit	Valid combin/Invalid combin		If the instrument panel is disconnected or the CAN connection is faulty, the ECU does not receive the code it was expecting from the instrument panel and therefore sets itself on "Invalid combin". With Axone it is in any case possible to connect to the ECU
	Oil pressure	normal/low	-	In case of low pressure, it limits engine rpm (if the wire is disconnected, it indicates "Normal": this is noticed only because, when the key is turned to "ON", both the warning light and the oil light on the instrument panel stay off)
	Idle speed	on/off	-	Engine operating conditions at idle speed (can be seen also with engine off)
	Full load	on/off	-	Engine operating conditions at full load (engine should be running)
	Engine stop push-button	on/off	-	Engine kill push-button status and immobilizer enable: if "OFF", one or both devices are faulty
	Ignition request	on/off	-	Correct operation can be tested with the gear engaged and by pressing the starter button: under these conditions, the ECU detects the start enable (the Axone display will read "on") but will not start the engine, as a safety precaution. The Axone tester could read "off" if the right dimmer switch circuit is broken.
	Lambda sensor active	on/off	-	"ON" if the ECU is using the lambda sensor signal to maintain stoichiometric combustion
	Cut off	on/off	-	Is activated under certain conditions of engine speed/ throttle position/ ....etc.
	Throttle learning completed	on/off	-	If the throttle position self-learning is unsuccessful, for any reason whatsoever, it switches to "OFF"
	Engine warming up	on/off	-	When the engine is warming up, it is on
	Power latch over	on/off	-	When turning the key from "ON" to "OFF", before the ECU is disabled, during the power latch it stores a series of parameters (e.g. stepper motor position)
	Limited operation	on/off	-	In case a serious fault is detected, engine rpm is limited to a certain value
	Gearbox in neutral	yes/no	-	
	Selector	on/off	-	Parameter currently not used
	Side stand	up/down	-	Stand position
	Clutch pulled	yes/no	-	If the clutch lever is pulled, it reads "YES"



SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
	Initialisation fault	no/engine speed>0/ vehicle speed>0/ stepper error/ throttle position / battery voltage/ water temperature / stepper motor off		Possible factors that may have caused unsuccessful Throttle position learning or Initialisation, in this order: Engine speed>0/Vehicle speed>0/stepper motor error/Incorrect throttle position/Incorrect battery voltage /Water temperature /Stepper motor disconnected
	Lambda control	initializ./Wait.after start/Ric.st.lambda/Att.after ric/Dis.for rid./Dis. for err/Att.after int/Lambda act/Saturat.		Current lambda sensor conditions
	Engine variant	1/2	-	1 if standard mapping is active, 2 if Racing mapping is active -necessary when using non-approved exhaust pipes
	Injectors per cylinder	1cyl	-	ECU status that cannot be changed: should read "1cyl"
	Knock sensor	No	-	ECU status that cannot be changed: should read "no"
	Boost adjustment	No	-	ECU status that cannot be changed: should read "no"
	Lambda sensor	Yes	-	ECU status that can be changed with password authority only; should usually read "YES", i.e. lambda sensor available
	Water injection	No	-	ECU status that cannot be changed: should read "no"
	Idling mot. fitted	Yes	-	ECU status that can be changed with password authority only; should usually read "YES", i.e. stepper motor available
	Purge valve	yes/no	-	Parameter not active (mechanical purge valve)
	Electronic reverse	No	-	ECU status that cannot be changed: should read "no"
	Electric starting	Yes	-	ECU status that cannot be changed: should read "yes"
	Initialised ECU	yes/no		If status is "yes", it indicates that the parameter "Initialised ECU" was activated. If the ECU needs replacing, this parameter should be activated or the engine rpm will be limited
<b>ENABLE DEVICES</b>				
	Delete errors	-	-	Press ENTER to switch error status from memorised (MEM) to deleted (STO). The next time Axone is connected to the ECU, the deleted errors (STO) will no longer be displayed
	Fuel pump	-	-	The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
	Lambda sensor heating	-	-	The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
	Fan	-	-	The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
<b>ENABLE DEVICES</b>				
	Front injector	-	-	The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
	Rear injector			The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
	Front coil			The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
	Rear coil			The device is activated: if not correctly activated, the tester will NOT show failed activation immediately; it is necessary to check the detected faults page
<b>DETECTED FAULTS</b>				
	?P0106?	-	-	
	Atm.press.signal low	-	-	It is displayed in case of low or zero voltage (e.g. broken circuit).
	Atm.press.signal high	-	-	It is displayed when excessive voltage is detected in the sensor circuit
	Air temperature sensor	-	-	
	Air temp.signal low	-	-	It is displayed when low voltage is detected in the sensor circuit
	Air temp.signal high	-	-	It is displayed in case of excessive voltage (e.g. broken circuit, but freeze frame reads -40° maximum ohm resistance)
	Water temper.sensor	-	-	
	Water temp.signal low	-	-	It is displayed when low voltage is detected in the sensor circuit
	Water temp.signal high	-	-	It is displayed in case of excessive voltage (e.g. broken circuit, but freeze frame reads -40° maximum ohm resistance)
	TPS low	-	-	It is displayed when low voltage is detected in the sensor circuit
	TPS high	-	-	It is displayed in case of excessive voltage (e.g. broken circuit).
	Lambda sensor	-	-	It is displayed if the sensor signal circuit is broken or faulty while the sensor is operating; it switches to STO without reconnecting, so it does not stay in the memory; also note that on page 3-DEVICE STATUS the parameter "Lambda correction" stays Disabled

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
	Lambda sensor heat.	-	-	It is displayed if the feeding circuit is broken or short-circuited; it switches from ACT to STO without reconnecting if the engine is off, otherwise it stays ACT, but not memorised (also note fixed mV signal)
	Lambda sensor adaptive ability	-	-	Lambda sensor operation outside standard operating conditions, in both the short and the long term.
	Fuel pump o/c	-	-	Open circuit or earthed
	Fuel pump short-c	-	-	Short circuit
	Front cyl.inj.open	-	-	It is a signal that can also be displayed by chance and with no actual part fault
	Front cyl.inj.short-c	-	-	Short circuit
	Rear cyl.inj.open	-	-	It is a signal that can also be displayed by chance and with no actual part fault
	Rear cyl.inj.short-c	-	-	Short circuit
	?P0336?	-	-	
	Engine rpm signal missing	-	-	
	Engine rpm signal	-	-	It is displayed after a few minutes if the engine is running (the ECU compares it to the camshaft signal) or after several starting attempts (the engine does not start if an error is present). It switches to MEM when the engine is switched off, so it can be deleted even if the fault persists
	Camshaft signal missing	-	-	It is displayed almost immediately (the engine starts even if the signal is missing). It switches to MEM when the engine is switched off, so it can be deleted even if the fault persists
	Front coil	-	-	
	Rear coil	-	-	
	Fan	-	-	Error is detected based on relay state (open or short circuit). As a result, a disconnected fan connector will not be detected
	Stepper control	-	-	Detects stepper motor control missing
	Oil pressure gauge	-	-	
	Battery voltage low	-	-	
	Battery voltage high	-	-	
	CAN line	-	-	It is displayed if the CAN line is faulty or the signal is missing: e.g. when the instrument panel is disconnected
	Control unit	-	-	
	ECU not initialised	-	-	It is necessary to execute the control: CPU initialised on the "Adjustable parameters" page
	RAM error	-	-	
	Control unit	-	-	
	?P0608?	-	-	
	Starter relay open	-	-	Rear right position
	Starter relay short-c	-	-	Short circuit
	?P0704?	-	-	
	TPS	-	-	The engine runs because it uses intake pressure values.
	TPS align.interrupted	-	-	It is displayed if "Throttle pos.self-learn." or "initialisation" were not successful due to a failure in the throttle position sensor signal

SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
	Int.press.signal low	-	-	
	Int.press.signal high	-	-	
	Cut off time excess.	-	-	
	Water temperature too high (limit exceeded)			This is a first in our injection systems: error detection is based on a critical threshold (115°C) (239 °F) rather than an electric fault (short or open circuit)
	Low oil pressure			In the design used so far, the ECU would only indicate an oil pressure switch fault if a malfunction was detected before engine starting. A malfunction occurring after start-up would be displayed on the instrument panel but not stored in the ECU. In the current design, the error is detected and stored in the ECU
	?P1611?	-	-	
	?P1683?	-	-	
<b>ADJUSTABLE PARAMETERS</b>				
	Initialisation	-	-	To reset adaptive parameters when changing the ECU, throttle body or injectors (it may happen that in the first seconds after start-up it stays at 5000 rpm). The engine starting attempts count that appears in the error frozen parameters is reset
	Throttle position self-learning	-	-	The ECU self-learning procedure for the throttle sensor position and the stepper motor (in case the TPS or the stepper motor are changed)
	CO adjustment 1	-	-	Adjustment is possible only with PASSWORD authority, whenever it is not possible to balance the CO rate using the bypass screws
	CO adjustment 2	-	-	Adjustment is possible only with PASSWORD authority, whenever it is not possible to balance the CO rate using the bypass screws
	Engine variant	-	-	Set 1 to activate standard mapping, 2 to activate Racing mapping (with open pipes only! e.g. Akrapovic)
	Lambda sensor	-	-	Adjustment is possible only with PASSWORD authority: to disable the lambda sensor, regardless of the type of mapping
	Idling mot. fitted	-	-	Adjustment is possible only with PASSWORD authority: to disable the stepper motor
	Initialised ECU	-	-	Enabling necessary when installing a new ECU (enables a set of parameters): see the same parameter in the DEVICE PAGE


SCREEN	DESCRIPTION	APPROXIMATE VALUES	UNIT OF MEASURE	NOTE
<b>FROZEN PARAMETERS</b>				
	Engine load		%	Same as the engine parameters page, but expressed in %
	Water temperature	-	°C	
	Air temperature	-	°C	
	Battery voltage	-	V	
	Intake pressure	64	kPa	Caution: measured in kPa so, for example, 62 kPa correspond to 620 hPa (unit of measure used in the engine parameters reading)
	Vehicle speed	-	km/h	
	Engine rpm	-	rpm	
	Throttle position	-	%	
	Dwell point cyl 1	-	°	Spark advance
	Engine in VL mode	No	-	
	Cut off active	-	-	
	Frequency	2	-	Number of times an error is detected by the ECU (including the checks performed by the ECU when it switches on, for certain types of errors)
	Time since start-up	3	min	Time elapsed since starting referred to the last time the error in question was detected, for example, detected in the 3rd minute
	Riding cycles	8	-	Number of times the engine was started when the error in question was last detected. The count resets if the "Initialisation" parameter is enabled
	Operating time	72	min	Total number of minutes of engine operation when the error in question was last detected. It cannot be reset (data stored in the ECU)

From the adjustable parameters page it is possible to:

- align the throttle position sensor
- initialise the ECU, i.e. align the throttle, reset the stepper motor and reset the lambda control adaptive parameters.
- initialise the ECU, necessary when installing a new ECU

#### Throttle position sensor alignment


TPS alignment should be carried out when the throttle body and/or the ECU are changed.

- Select: "throttle pos. self-learning".
- Ensure that the throttle is fully home
- Press ENTER .
- Turn the key to "OFF" and leave it for at least 30 seconds.

#### ECU initialisation

ECU initialisation is carried out in case important parts of the engine (valves, cylinder, camshaft), exhaust system, ECU, fuel feeding system, or the lambda sensor are changed.

The three correction factors for the lambda control concerning injection time are electronically reset.

- Select: "initialisation".
- Ensure that the throttle is fully home
- Press ENTER .
- Turn the key to "OFF" and leave it for at least 30 seconds.

Initialisation allows activation of the new ECU

- Select: "initializ.complete".
- Follow the instructions given to activate the ECU
- Turn the key to "OFF" and leave it for at least 30 seconds.

### 3.2. FUEL PUMP

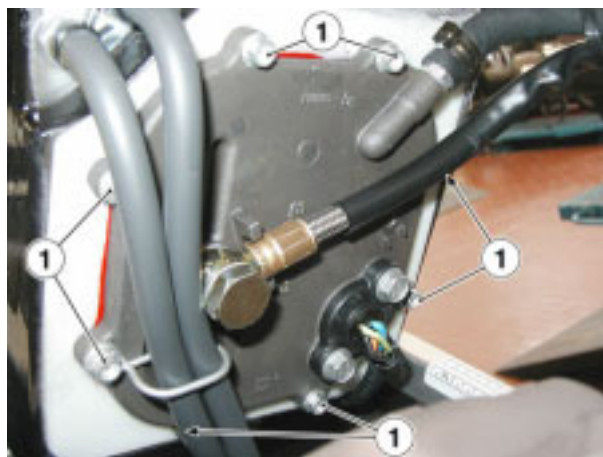
#### 3.2.1. REMOVING THE PUMP UNIT

- Completely remove the fuel tank.

**NOTE** Place the tank on a clean surface with the pump unit facing upward.

- Loosen and remove the eight screws (1).

**NOTE** When reassembling, tighten all the screws (1) finger tight, observing a cross-pattern.



**WARNING**

When removing the pump unit take care not to damage the tubing and the fuel level sensor.

- Remove the complete pump unit.

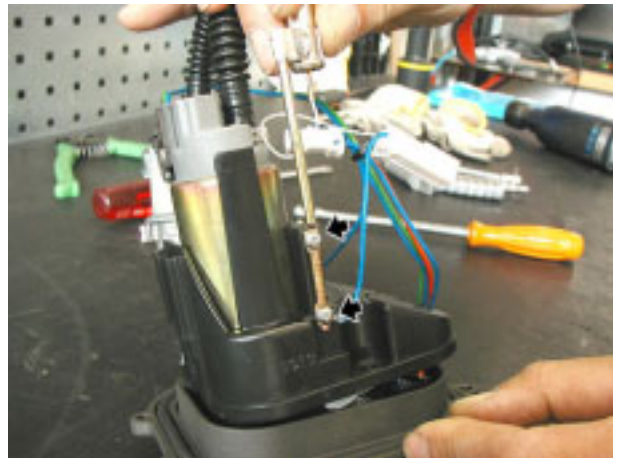


**3.2.2. REMOVING THE FUEL LEVEL SENSOR**

- Remove the complete fuel unit.
- Disconnect the connector.



- Loosen and remove the two screws.
- Remove the fuel level sensor.



### 3.2.3. REMOVING THE DELIVERY FUEL FILTER

- Remove the complete fuel pump unit.

**NOTE** Use the special tool **OPT:**  
- *aprilia* part# 0277295 (pliers for fitting ties).

**WARNING**

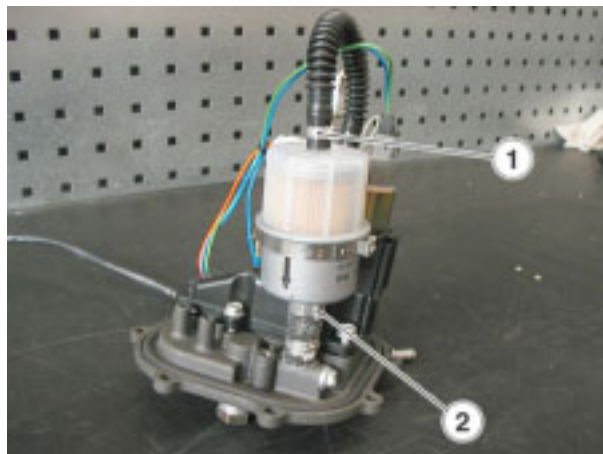
When reassembling, replace the tie with a new one of the same size.  
Do not refit the old tie; it is no longer useable.  
Do not replace the tie with a screw tie or other type of tie.

- Unfasten the tie (1).
- Slide the tube out of the filter.
- Unfasten the tie (2).
- Slide the filter out of the tube.

**WARNING**

Do not use filters that have already been used.

- Replace the filter with a new one of the same kind.





### 3.2.4. REMOVING THE FUEL PUMP

- Remove the complete fuel pump unit.

**NOTE** Use the special tool **OPT:**  
- *aprilia* part# 0277295 (pliers for fitting ties).



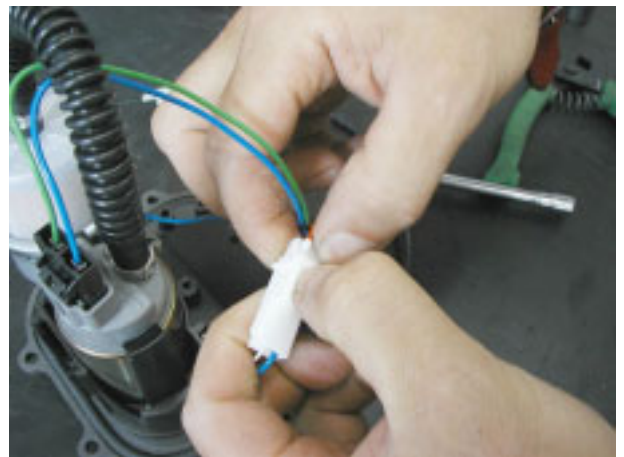
#### WARNING

When reassembling, replace the tie with a new one of the same size.  
Do not refit the old tie; it is no longer useable.  
Do not replace the tie with a screw tie or other type of tie.

- Unfasten the tie (1).
- Slide the fuel tube out of the pump



- Disconnect the electrical connector.



- Disconnect the electrical connector.



- Loosen and remove the three screws.



- Bend the side of the fuel filter and hold it in position.

**NOTE** Use compressed air to clean any sediments in the filter mesh; direct the jet of air so that the impurities do not penetrate inward.

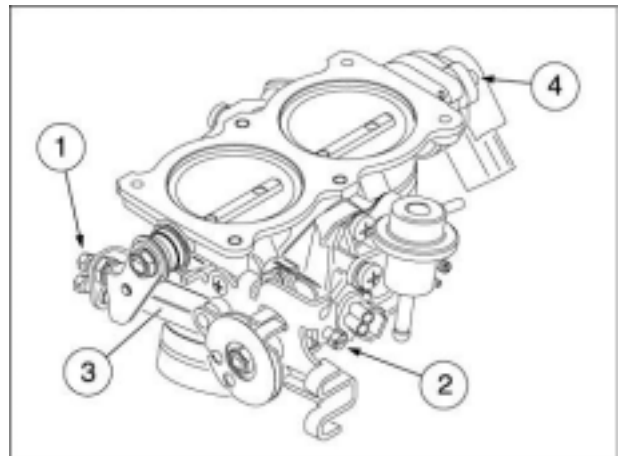


### 3.3. THROTTLE BODY UNIT

#### 3.3.1. REMOVING THE THROTTLE BODY UNIT

**WARNING**

The screws for the basic adjustment of the throttle valve (1) are painted and cannot be set. The adjustment screws can be set only when replacing the wire securing bracket (2) completely. The two M4x12 screws (3) for securing the throttle valve potentiometer are painted and can be removed only when replacing the sensor.



- Partially remove the fuel tank.
- Remove the air box.
- Disconnect the electrical connectors:
  - right injector;



- left injector;



- throttle valve potentiometer.



**NOTE** Use the special tool **OPT**:

aprilia part# 0277295 (pliers for fitting ties).

- Unfasten the tie (4).
- Unfasten the tie (5).
- Slide the tubes out of the throttle unit.



- Disconnect the two accelerator control wires.



**WARNING**

When reassembling, ensure that the two accelerator control wire adjusters are correctly secured to their links and adjust play, if necessary





- Slide the airbox flap tube out of the throttle unit.



- Loosen the two ties

**WARNING**

Be very careful when removing the throttle unit, as it is connected to the fuel tank by means of the fuel line.

- Firmly grasp the throttle unit ; wriggle and slide it out of the intake flanges.
- Place the complete throttle unit and the connected fuel tank on a clean surface.



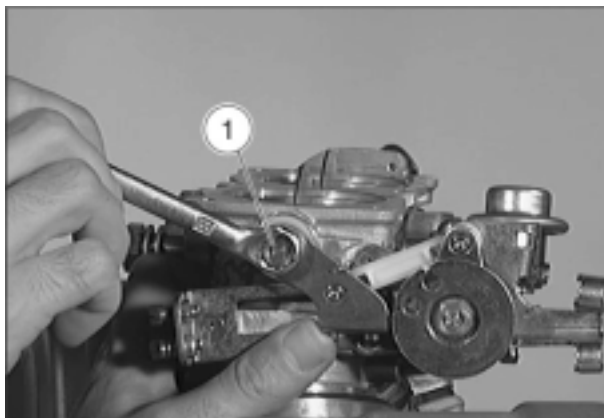
When reassembling ensure that:

- the delivery fuel line is neither twisted nor in a position in which it can be crushed by other components; if damaged or worn it must be replaced;
- the delivery fuel line is positioned so that it reaches the right-hand side of the throttle unit, passing under it, between the two intake flanges;
- the throttle unit is perfectly positioned on the intake flanges;
- The ties must be correctly fastened.

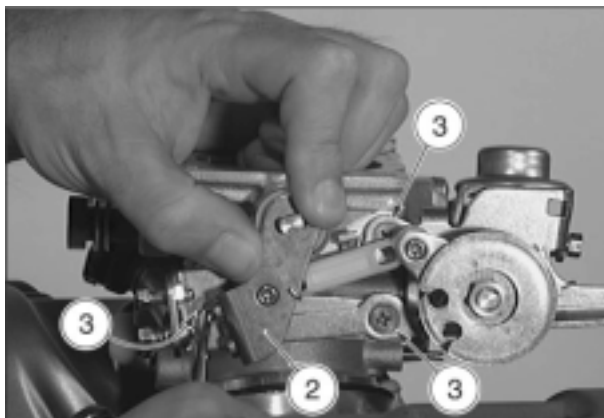


### 3.3.2. DISASSEMBLING THE THROTTLE UNIT

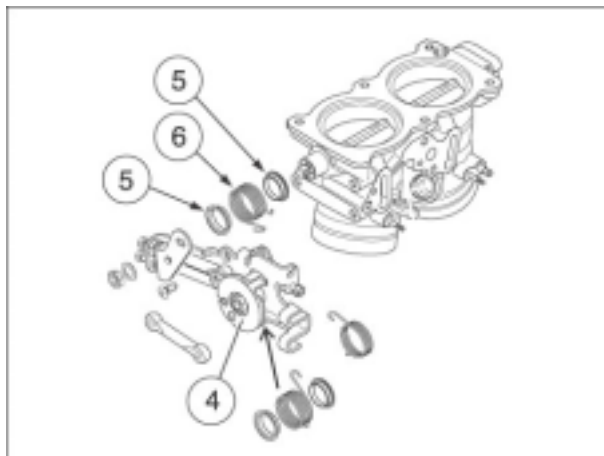
- Loosen and remove the M8x1 nut (1) and remove the spring washer.



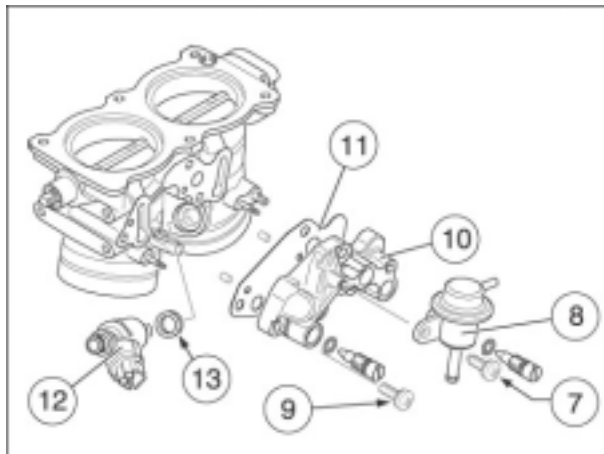
- Slightly turn the throttle valve control lever (2), loosen and remove the three T.E. M5x12 screws (3).

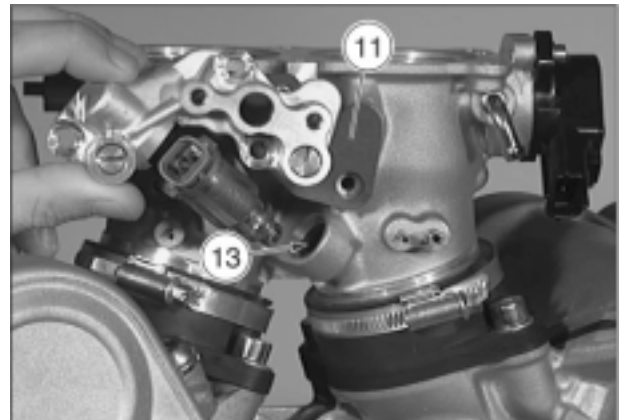
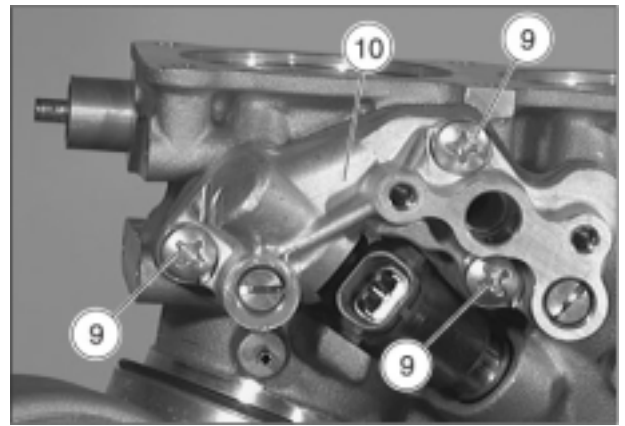


- Slide the complete accelerator wire securing bracket (4) along with the two bushings (5) and the torsion spring (6) out of the throttle unit.



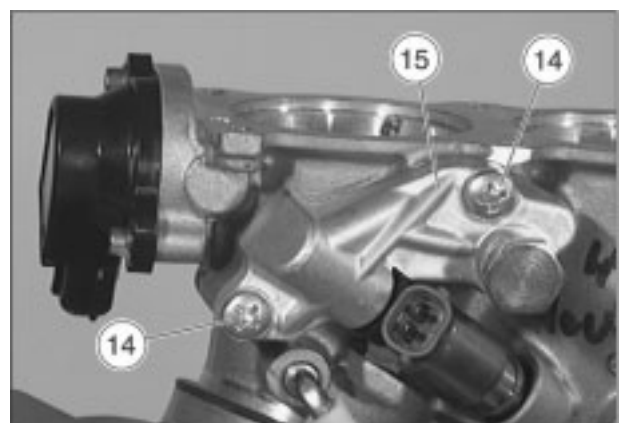
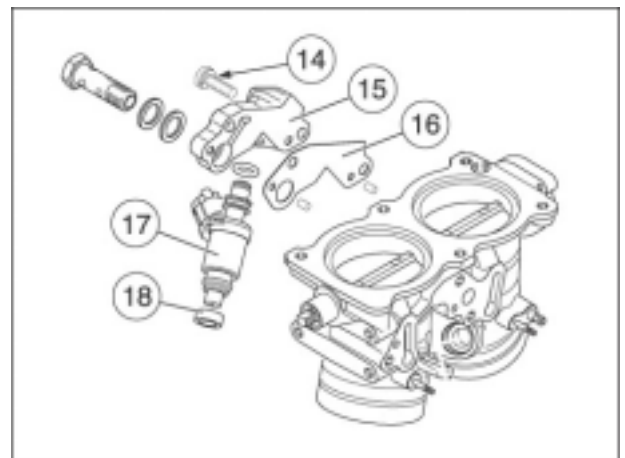
- Loosen and remove the two M6x16 screws (7) and remove the fuel pressure regulator (8) complete with the O-ring.
- Loosen and remove the three M6x25 screws (9) and remove the left injector bracket (10) together with the gasket (11), injector (12) and seal (13) from the throttle unit.



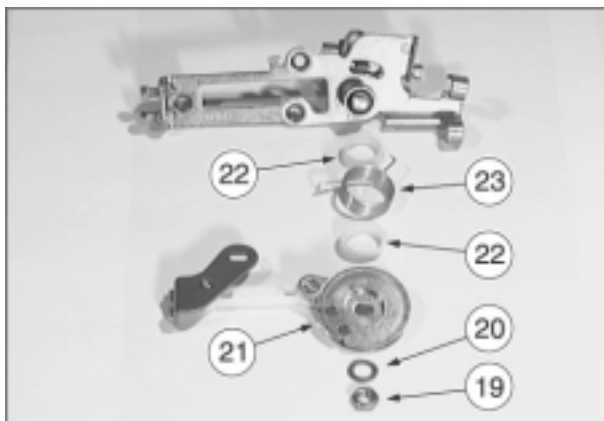
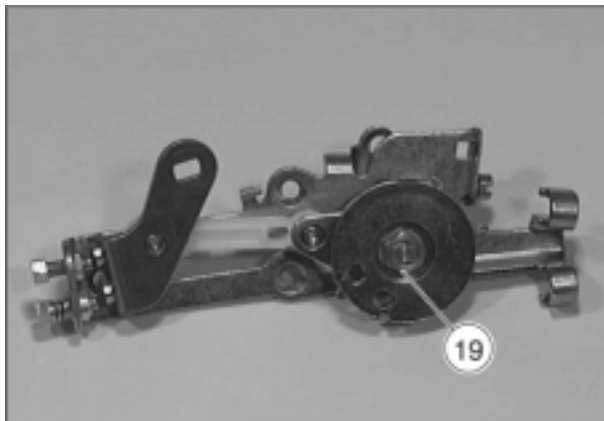


- Loosen and remove the two M6x25 screws (14); remove the right injector bracket (15) together with the gasket (16), injector (17) and seal (18).

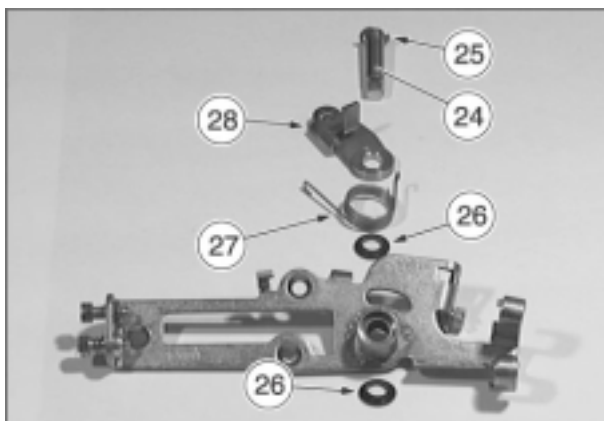
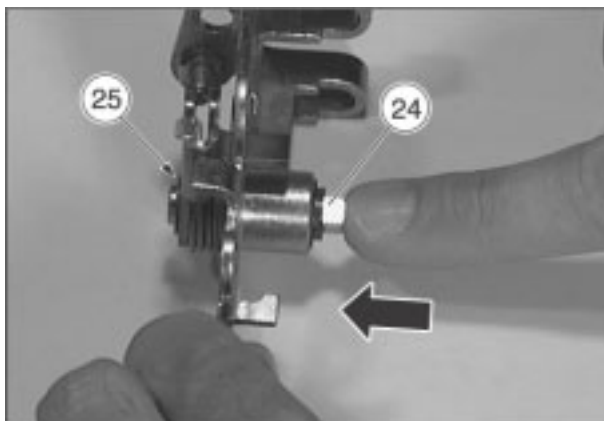
**NOTE** The injector seal (18) can be left in the throttle unit hole.



- Loosen and remove the M8x1 nut (19); remove the spring washer (20), the belt roller (21), the two bushings (22) and the torsion spring (23).



- Slide the fulcrum pin (24) together with the safety washer (25) out of the hole of the accelerator wire securing bracket and remove the two shaft gaskets (26) together with the torsion spring (27) and the cold starting lever (28).



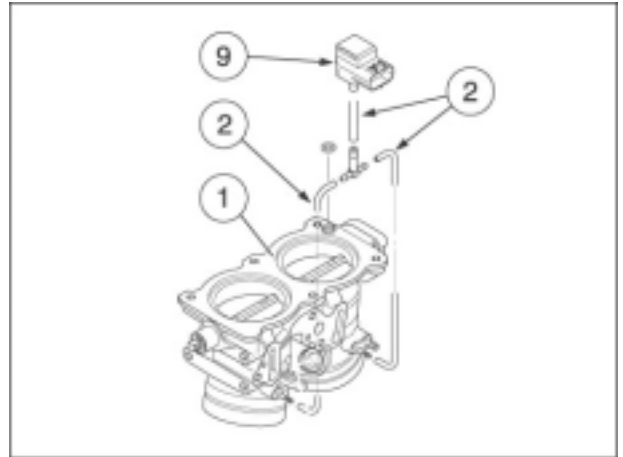


### 3.3.3. INSPECTING THE THROTTLE UNIT

#### INJECTOR OPERATION TEST

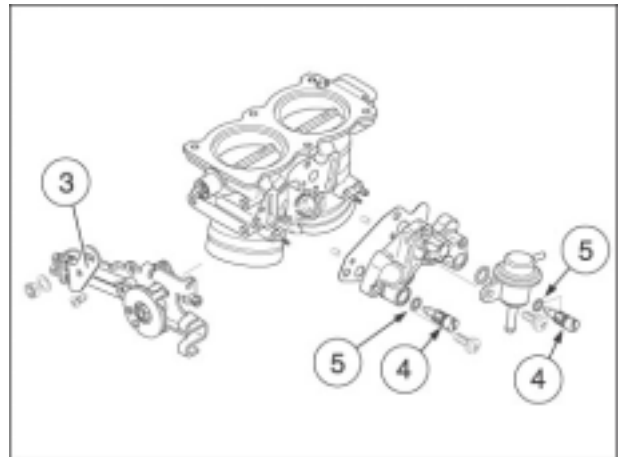
**NOTE** The injectors can be tested electrically.

- Check the following components:
  - electrical wiring and connections;
  - injector or ECU injection signal.



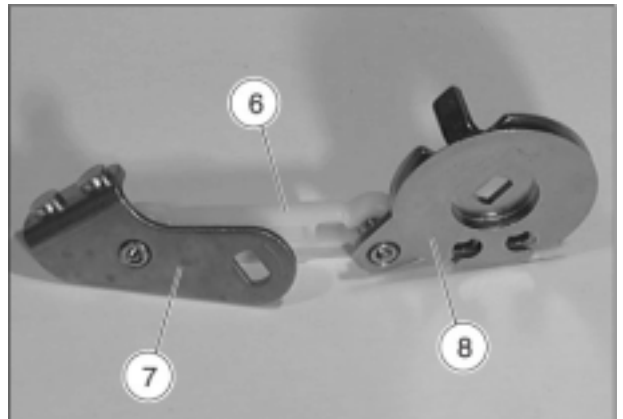
#### Throttle body

- Clean all throttle body (1) openings and ducts using compressed air.
- Check the intake pressure sensor tubes (2) for clogging.
- Check the throttle valve unit and the wire securing mechanism (3) for any mechanical damage.



**NOTE** Synchronise the cylinders when replacing the synchronisation screws (4) or the O-rings (5).

- Loosen the two cylinder synchronisation screws (4) only if there is an air leak.
- When replacing the ball joint linkage (6), unfasten the linkage from the throttle valve control lever (7) and from the accelerator belt roller (8).
- After having fitted a new ball joint linkage (6) ensure that it moves freely.

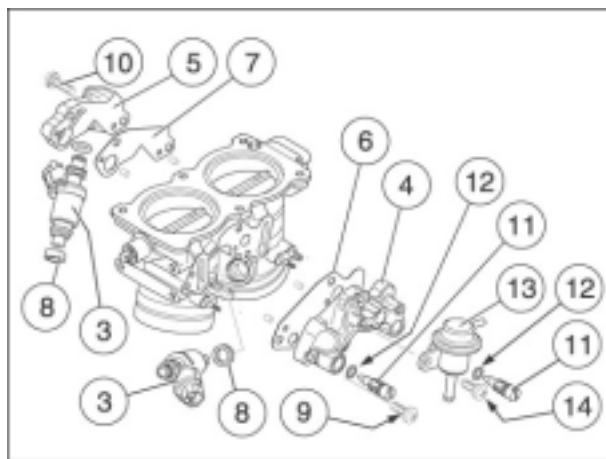
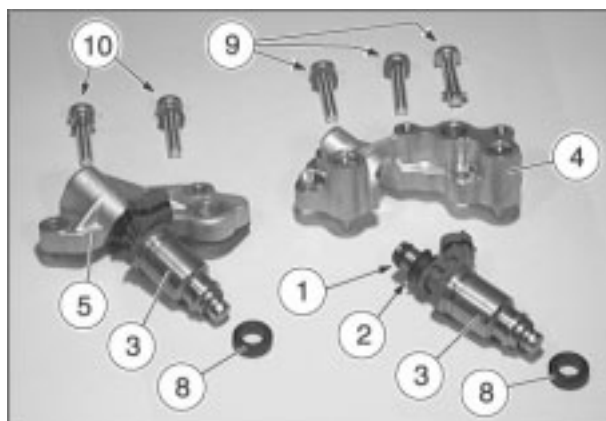


## 3.3.4. REFITTING THE THROTTLE UNIT

**WARNING**

After having disassembled the throttle unit, replace all gaskets, O-rings, torsion springs, bushings and seals. These components are supplied with the repair kit.

- Fit the new O-rings (1) and seals (2) on both injectors.
- Fit the injectors (3) in the left injector bracket (4) and right injector bracket (5).
- Fit the left injector bracket gasket (6), the right injector bracket gasket (7) and the two seals (8) on the throttle unit.
- Fit the complete left injector bracket (4) and the right injector bracket (5) on the throttle body and secure them with the new M6x25 screws (9) (10).
- If the synchronisation screws (11) and their O-rings (12) have been replaced, moderately tighten the screws (11) until they are flush with the surface and then loosen by one turn.



**Synchronisation screw pre-adjustment (11) : 1 turn.**

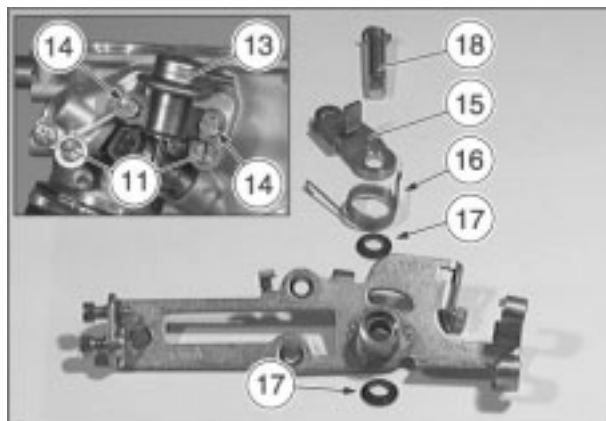
**WARNING**

Precise screw adjustment (11) must be performed with a vacuum gauge.

- Secure the fuel pressure regulator (13) with the two M6x16 screws (14).

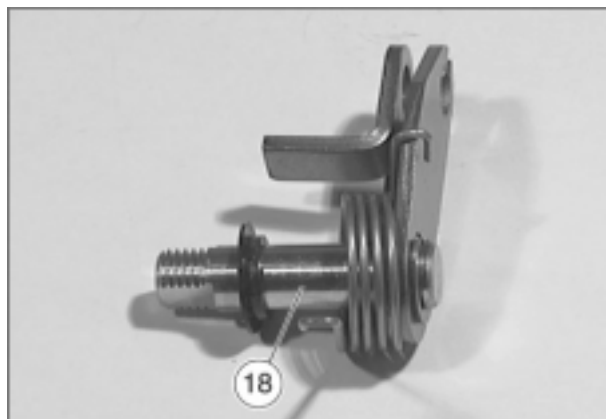
**NOTE** Spread a thin layer of grease over the surface of the fulcrum pin (18).

- Fit the cold starting lever (15), the torsion spring (16) and the shaft gasket (17) in the fulcrum pin (18).
- Fit the complete fulcrum pin (18) on the accelerator wire securing bracket.



**NOTE** Ensure that the torsion spring is hooked to the cold starting lever (15) and to the wire securing bracket.

- Spray the spring (16) with chain grease.
- Fit the shaft gasket (17) on the fulcrum pin (18).
- Fit the two bushings (19) and the torsion spring (20).
- Fit the belt roller (21) on the accelerator wire securing bracket.



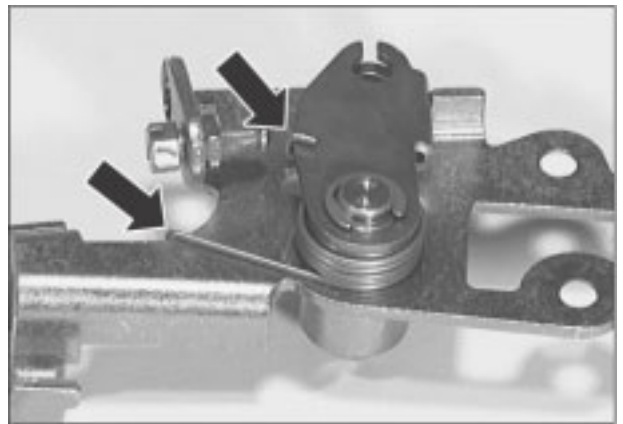
**WARNING**

Ensure that the ends of the torsion spring (20) are hooked to the accelerator wire securing staff and belt roller (21).

**NOTE** Spray the spring (20) with temporary lubricant.

- Fit the spring washer (22).

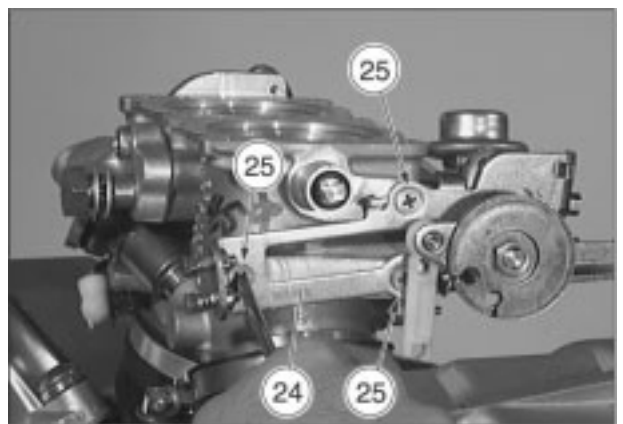
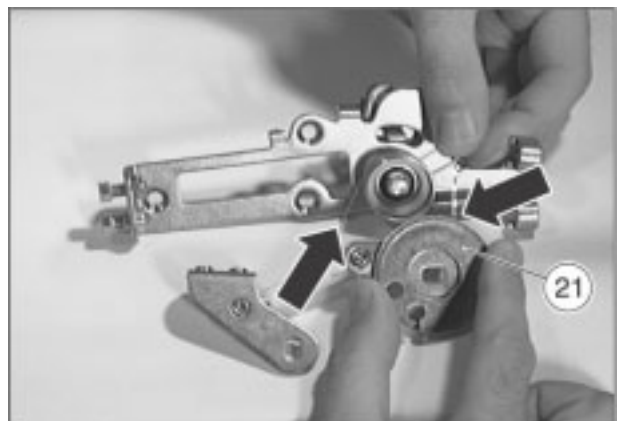
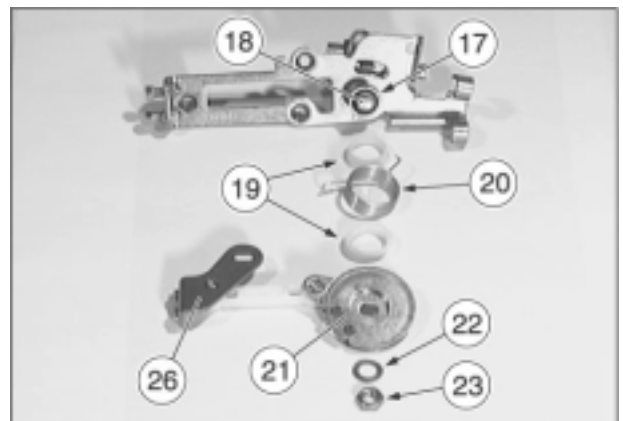
**NOTE** Apply LOCTITE® 243 to the nut threading (23).



- Tighten the M8x1 nut (23).

**NOTE** Apply LOCTITE® 243 to the screw threading (25).

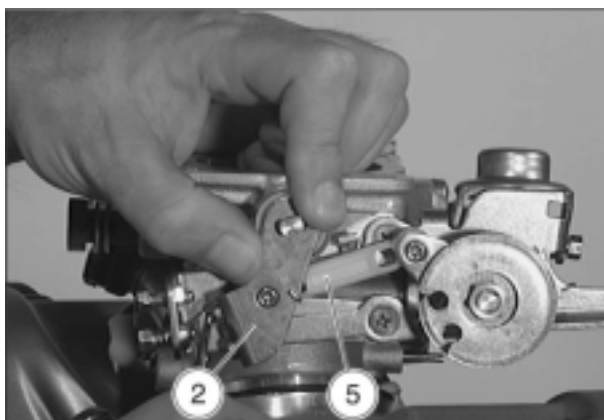
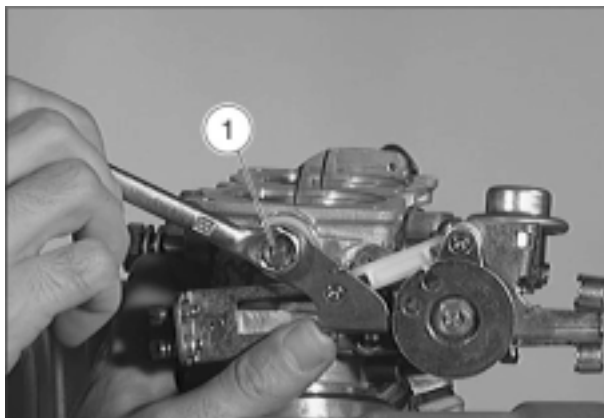
- Secure the accelerator wire securing bracket (24) with the three T.E M5x12 screws (25).
- Fit the throttle valve control lever (26).



### 3.3.5. REPLACING THE THROTTLE VALVE CONTROL LEVER

#### REMOVAL

- Partially remove the fuel tank.
- Remove the air box.
- Loosen and remove the M8x1 nut (1) and remove the spring washer.
- Slide out the control lever (2) and set aside the two bushings (3) and the torsion spring (4).
- Remove the control lever (2) from the ball joint linkage (5).



#### ASSEMBLY

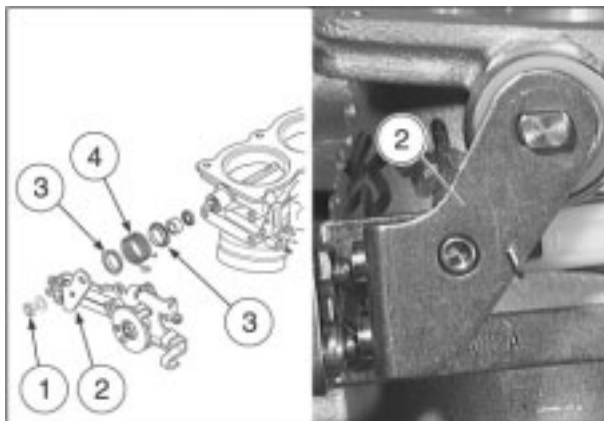
- Fit the two bushings (3) and the torsion spring (4) on the throttle body.
- Fit the throttle valve control lever (2) on the throttle valve axis.

**NOTE** Spray the spring (4) with temporary lubricant.



#### WARNING

Ensure that the ends of the torsion spring (4) are fastened to the throttle body and to the throttle valve control (2).



- Fit the spring washer.

**NOTE** Apply LOCTITE 243® to the nut threading (1) .

- Tighten the M8x1 nut (1).

**NOTE** When reassembly is completed, ensure that the levers turn freely.

The torsion spring must return the throttle valve control lever (2) to its original position.

Check for axial play on the throttle valve control shaft



### 3.3.6. CHECKING AXIAL PLAY ON THE THROTTLE VALVE CONTROL SHAFT

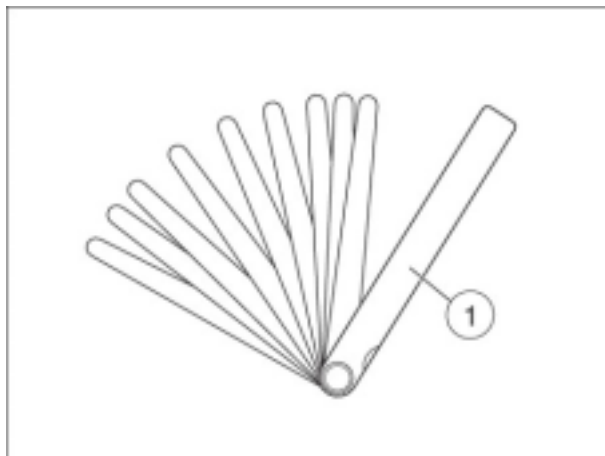
- Partially remove the fuel tank.
- Remove the air box.

**NOTE** Use a thickness gauge (1) with a 0.05 mm (0.00197 in) scale.

**With the throttle valves closed:**

- Using the thickness gauge (1), measure the minimum value of play between the lever (2) and the contact surface (3) in various points of the throttle body.

**Axial play: 0.1 mm (0.0039 in).**



**WARNING**

If the minimum value measured is less than 0.1 mm (0.0039 in), replace the entire throttle body.

**With the throttle valves open:**

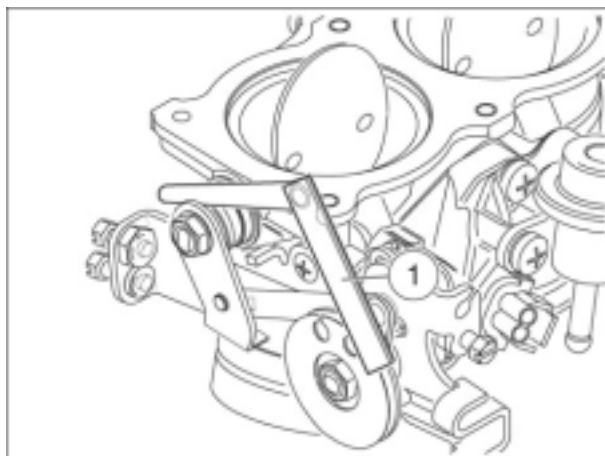
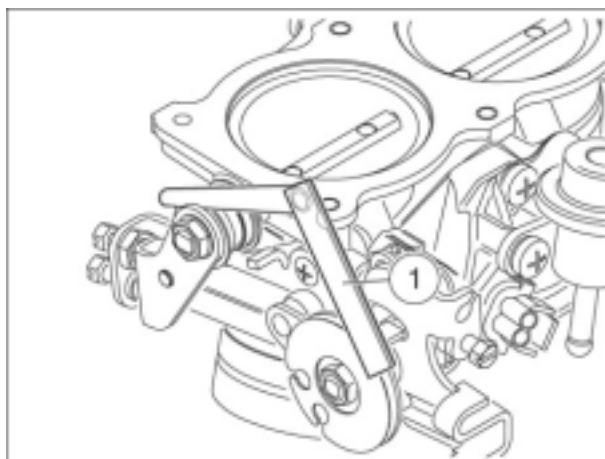
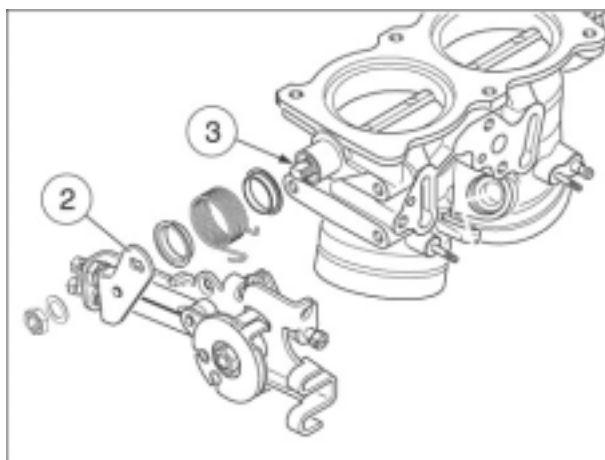
- Repeat the procedure above.

**Axial play: 0.15 mm (0.0059 in).**



**WARNING**

If the minimum value measured is less than 0.15 mm (0.0059 in), replace the entire throttle body.



ENGINE

4

**SUMMARY**

4.1.	ENGINE.....	3
4.1.1.	REMOVING THE ENGINE.....	3
4.1.2.	INSTALLING THE ENGINE.....	26
4.1.3.	TIGHTENING TORQUES.....	51



## 4.1. ENGINE

### 4.1.1. REMOVING THE ENGINE

- To remove the engine, you will have to remove seat, fuel tank and battery first.
- Remove the airbox cover.



- Remove the screws fixing the airbox to the frame.



- Remove the six screws fixing then throttle body to the airbox.







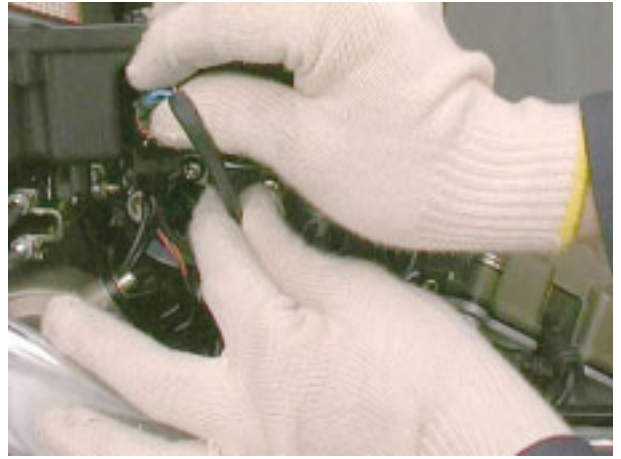
- Disconnect the bypass tubes to the throttle body and the stepper motor connection.



- Disconnect the oil recovery tank tube.



- Disconnect the manifold pressure sensor and tubes coming from the throttle body.



- Remove the airbox.



- Disconnect the coil wiring.



- Disconnect the accelerator control wires.



- Disconnect the throttle potentiometer.



- Disconnect the vacuum tubes on the throttle body.







- Disconnect the injector connectors.



- Loosen the ties on the intake manifolds.





- Disconnect the throttle body.



- Plug all openings to avoid entry of impurities.



- Unfasten the ties of the lubrication circuit tubes coming from the oil tank.



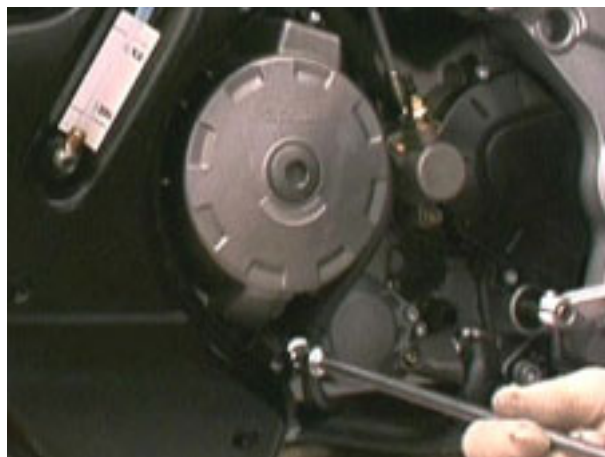


- Disconnect the oil tubes on the crankcase.





- Loosen the three fixing screws on the oil tank.



- Remove the oil tank along with the tube coming from the oil cooler.



- Slide the breather tubes out of their housing.



- Remove the oil tube on the crankcase.



- Loosen and remove the rear brake fluid reservoir fixing screw and move the reservoir downward keeping it vertical.



- Remove the clamp.



- Remove the coolant breather tube.



- Loosen and remove the two expansion tank fixing screws and remove the expansion tank.





- Disconnect the connectors.



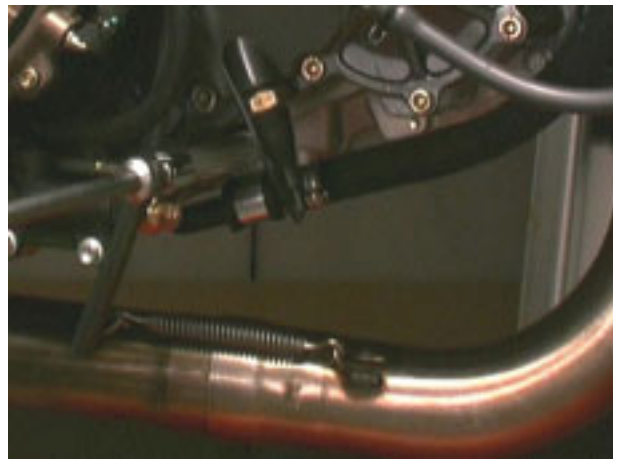
- Loosen and remove the two fixing screws and remove the voltage regulator.



- Loosen and remove the two fixing screws and remove the voltage regulator mounting plate.



- Unscrew the stud bolt that secures the oil tube clamp to the crankcase.
- Disconnect the oil tube from the right-hand side.
- Loosen and remove the four oil cooler subframe fixing screws.



**NOTE** For the screw on the upper left-hand side, tighten the internal nut with a spanner.



- Remove the subframe complete with oil coolers.



- Remove the rear brake master cylinder fixing screws.



- Unfasten the clip fixing the master cylinder to the brake lever.



- Disconnect the engine oil pressure sensor.





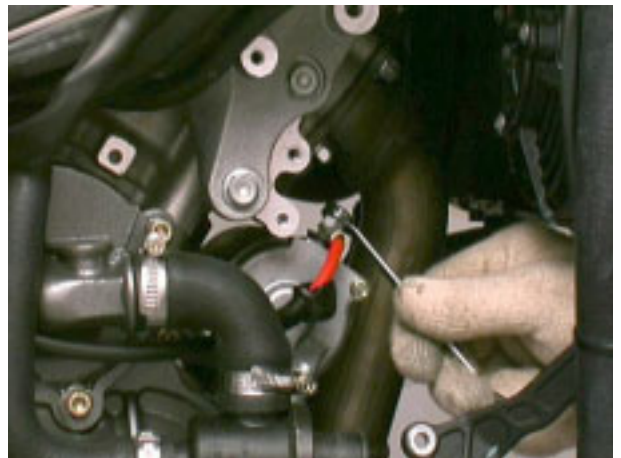
- Disconnect the vehicle speed sensor, the stop light switch and the lambda sensor connectors.



- Remove the oil cooler lower brackets and move it keeping it vertical.



- Unscrew the starter motor connection.



- Unhook the silencer fixing springs.



- Loosen the silencer clamp fixing screws.



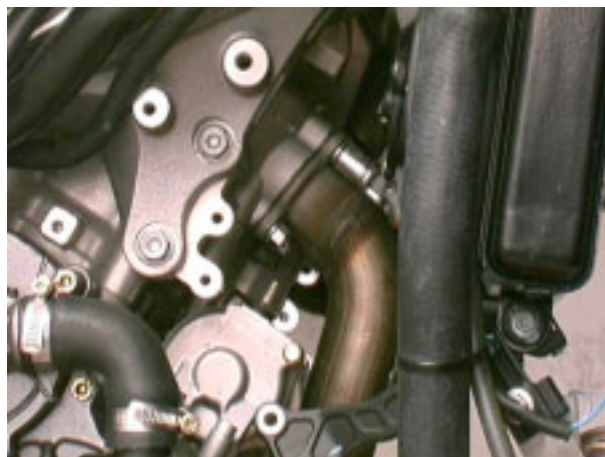
- Remove the silencers.



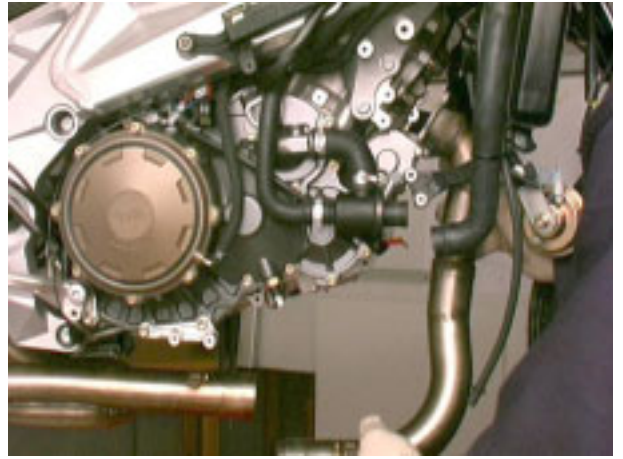
- Unhook the fixing spring located between the front cylinder manifold and the exhaust.



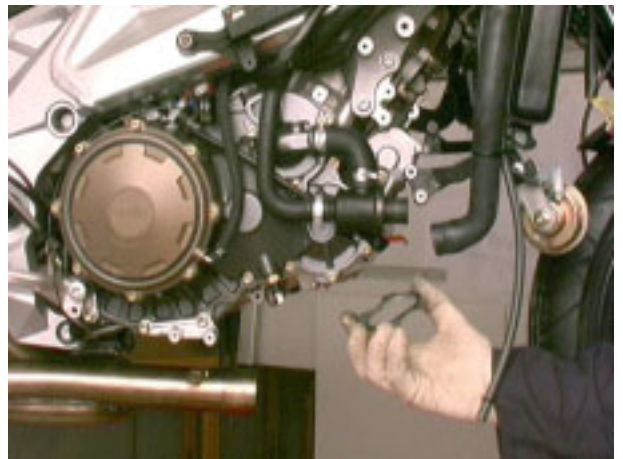
- Loosen the four nuts fixing the manifold to the front cylinder.



- Remove the manifold.



- Remove the seal.



- Unhook the fixing spring located between the rear manifold and the exhaust.

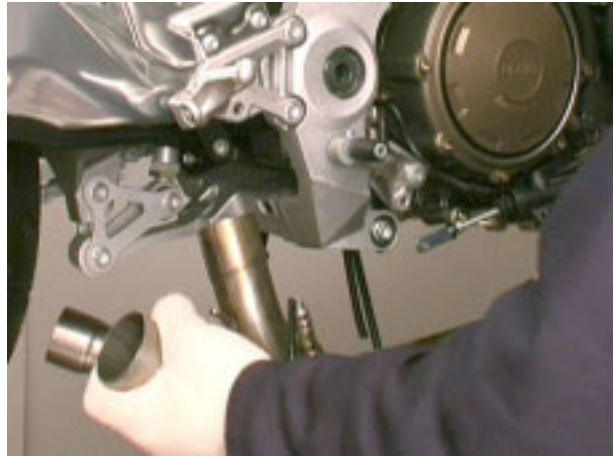


- Slide the lambda sensor wiring out of the frame.





- Remove the exhaust complete with lambda sensor.



- Loosen the four nuts fixing the manifold to the rear cylinder.



- Remove the exhaust manifold; remove the seal.



- Disconnect the engine temperature sensor, the timing sensor, the rpm sensor, the side stand safety switch and the generator connectors.







- Disconnect the spark plug caps.



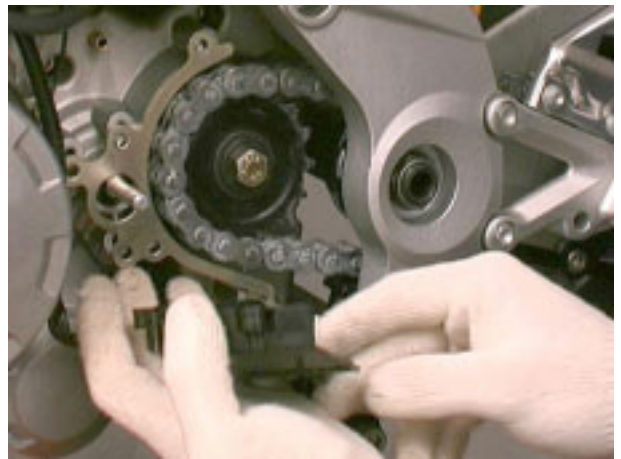
- Remove the gear lever.



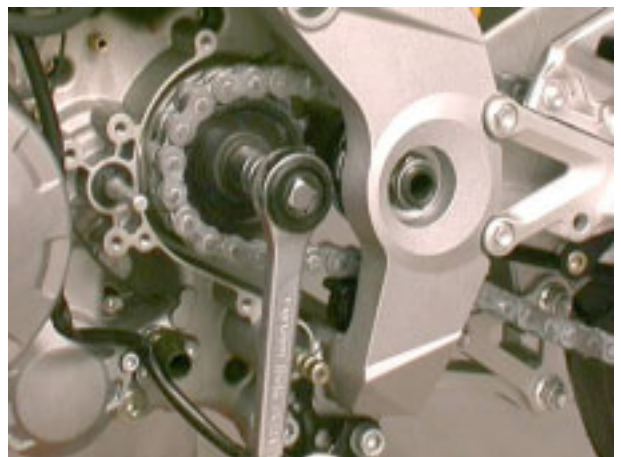
- Remove the clutch actuator complete with flange.



- Remove the sprocket cover and the crankcase guide plate.



- Unscrew the sprocket fixing bolt and set aside the seal washer.



- Remove the sprocket.



- Unfasten the ties and disconnect the coolant tubes on the oil cooler.



- Unscrew the earth connections on the crankcase.



- Unscrew the neutral sensor connection.





- Remove the rear brake lever.



- Remove the lever bracket and the rear brake master cylinder.
- Remove the brake master cylinder bracket.



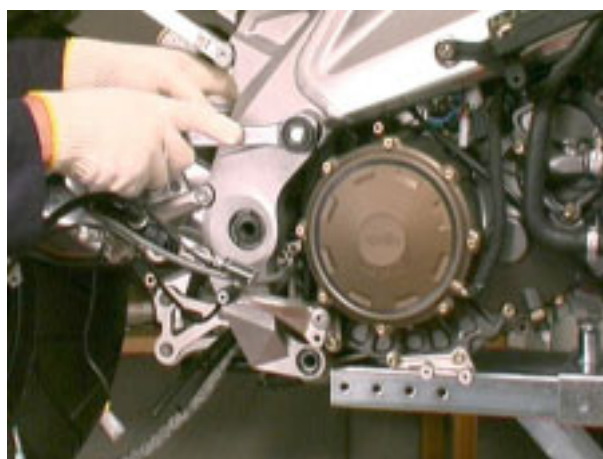
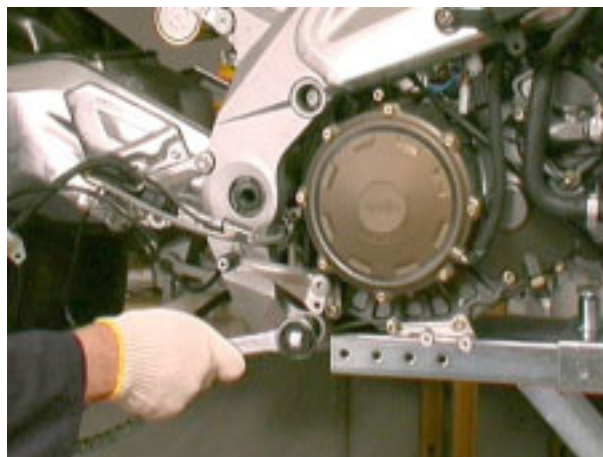
- Disconnect the vacuum tube on the clutch pneumatic actuator.



- Hold up the engine with an adequate support.



- Remove the rear screws fixing the engine to the frame.



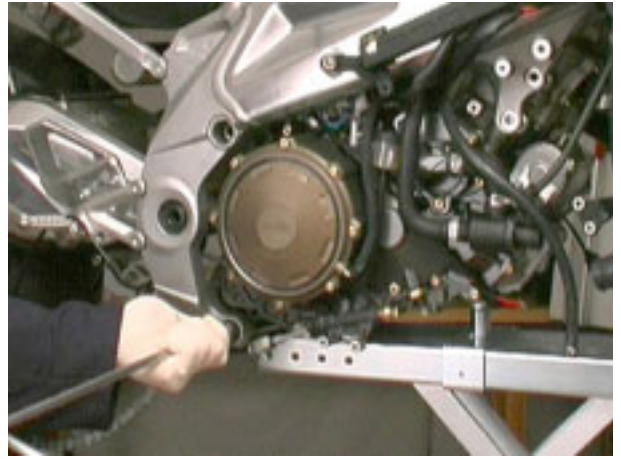
- Loosen the four screws of the engine front mounts.



- Remove the screws and the spacers located between the frame and the engine.



- Pull back the adjustment bushings between the engine and the frame.



- Completely lower the engine.





#### 4.1.2. INSTALLING THE ENGINE

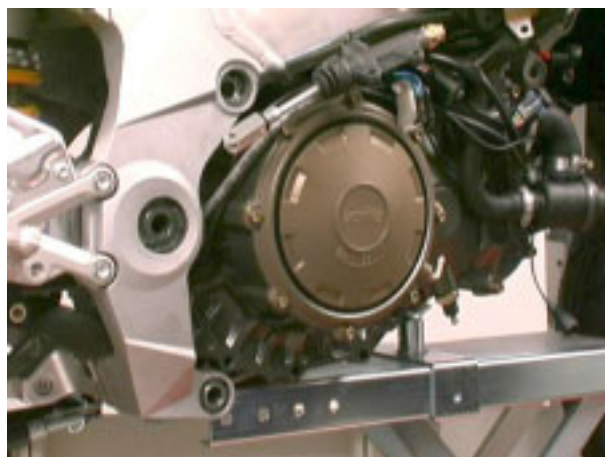
- Place the engine on a suitable lower support.



- Lift the engine.



- Position the engine so as to align the rear mounts on the frame.

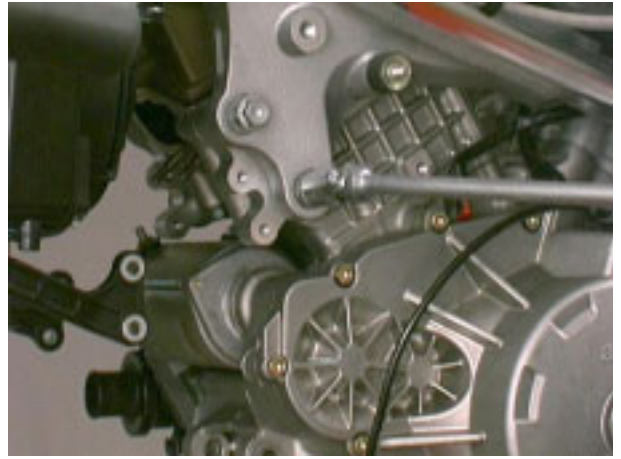


- Fit the front left spacer.

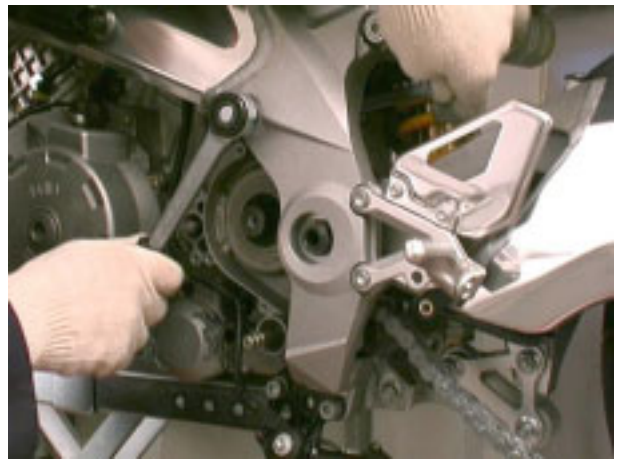




- Tighten the two screws in the front left engine mount.



- Fit the left rear spacer and tighten the screws to the specified torque.



- Tighten the left rear screw.



- Fit the front right spacer



- Tighten the two screws in the front right mount.
- Tighten the four screws on the left-hand side.



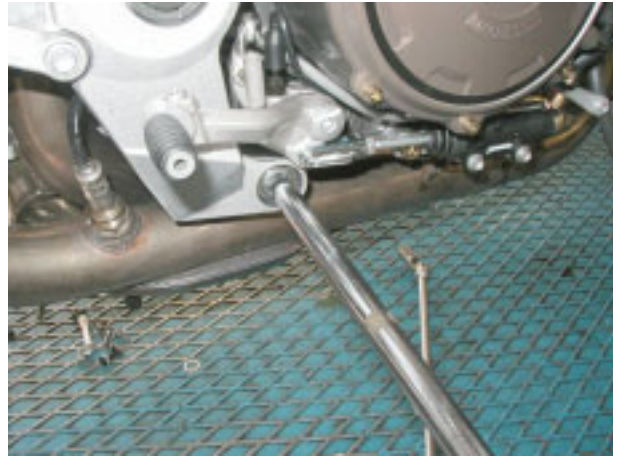
- Tighten the upper right bushing to the specified torque.



- Tighten the upper right ring nut to the specified torque.



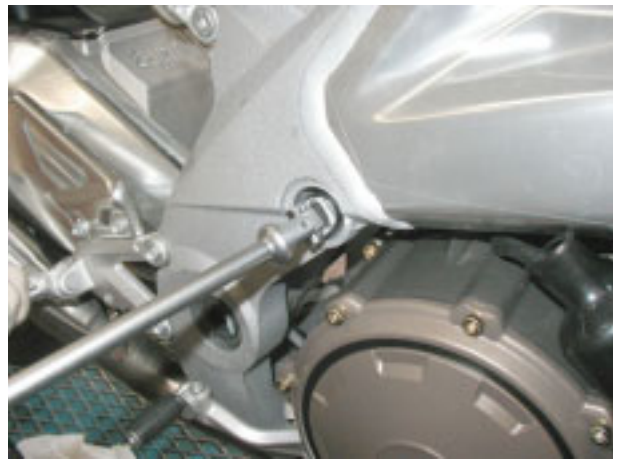
- Tighten the lower right bushing to the specified torque.



- Tighten the lower right ring nut to the specified torque.



- Tighten the upper right screw.



- Tighten the lower right screw.
- Tighten the four screws on the right-hand side.





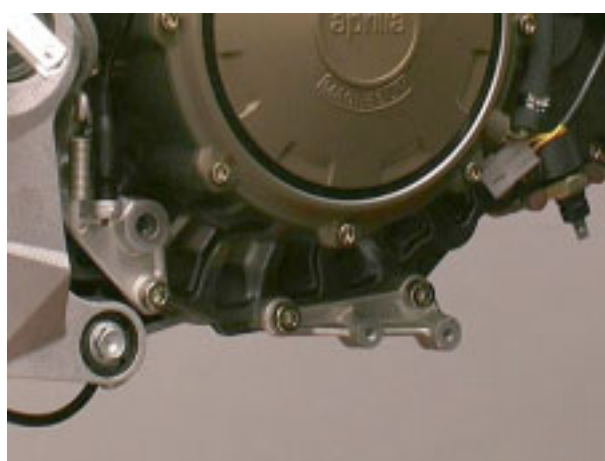
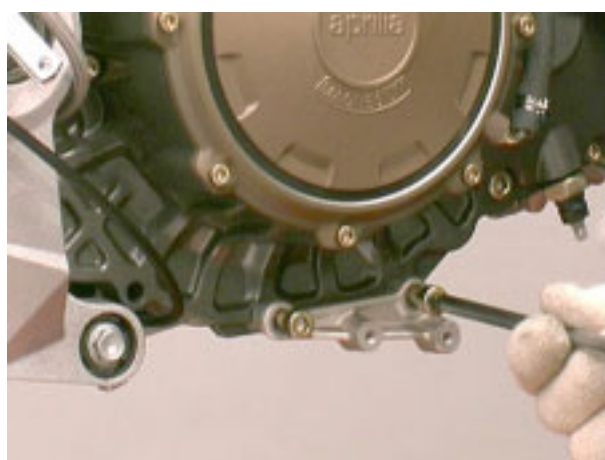
- Remove the engine lower support.



- Reconnect the vacuum tube to the clutch pneumatic actuator and fasten it with a tie.



- Fit the lever and the rear brake master cylinder bracket and tighten the screws to the specified torque.



- Fit the rear brake lever and tighten the screws to the specified torque.



- Fit the rear brake master cylinder and connect it to the brake lever.



- Tighten the neutral sensor connection.



- Reconnect the earth connection to the crankcase and tighten the screws to the specified torque.

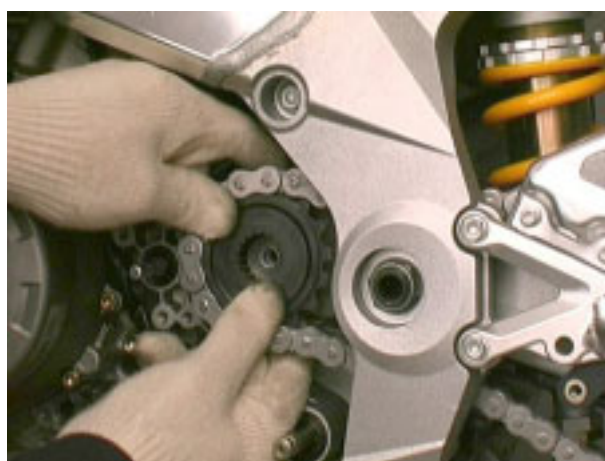




- Use ties to fasten the coolant tubes to the oil cooler

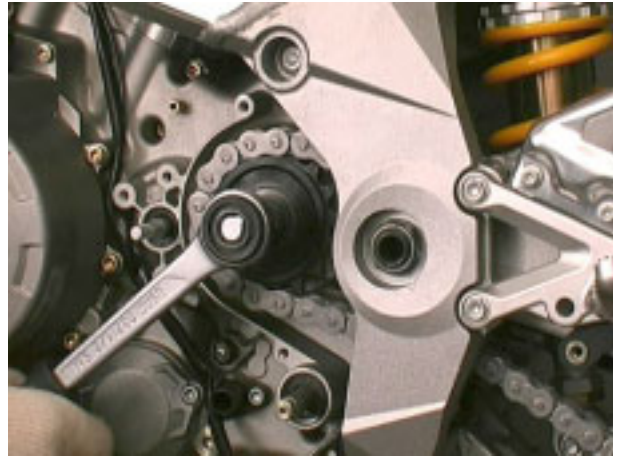


- Place the sprocket in the correct position.

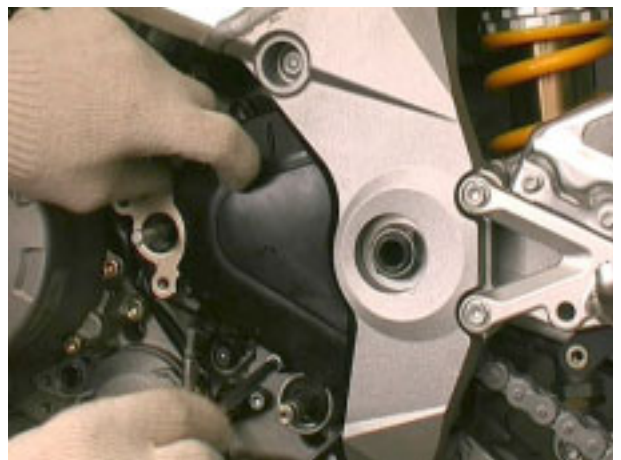
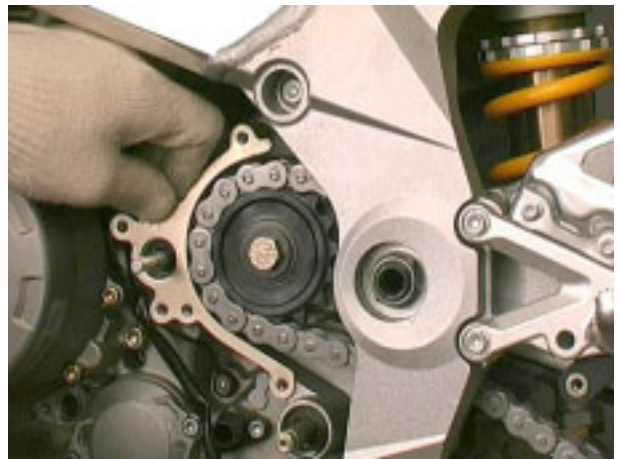




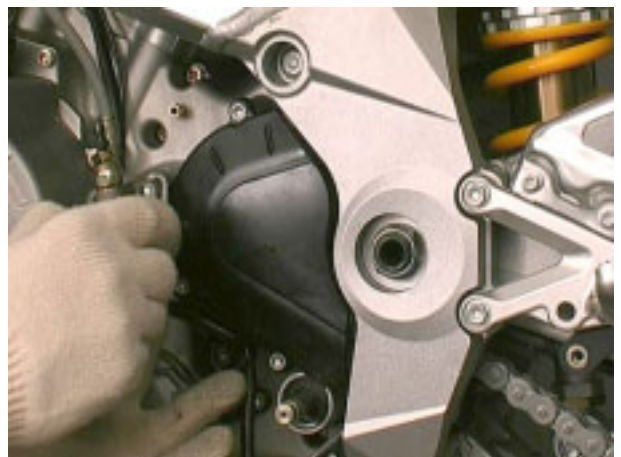
- Tighten the fixing bolt to the specified torque to secure the sprocket in place.



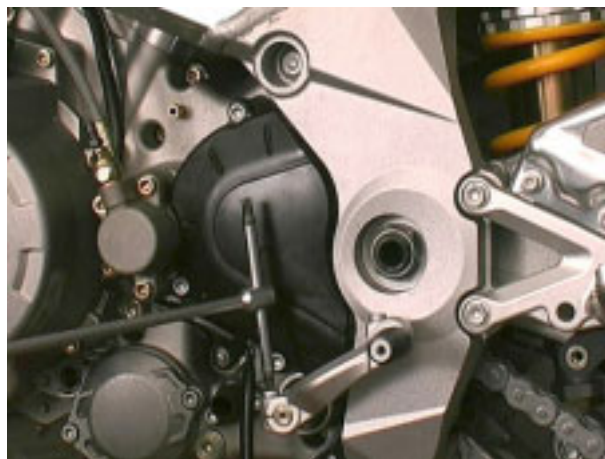
- Fit the sprocket cover and the guide plate and tighten the screws to the specified torque.



- Fit the clutch actuator complete with flange.



- Fit the gear lever.

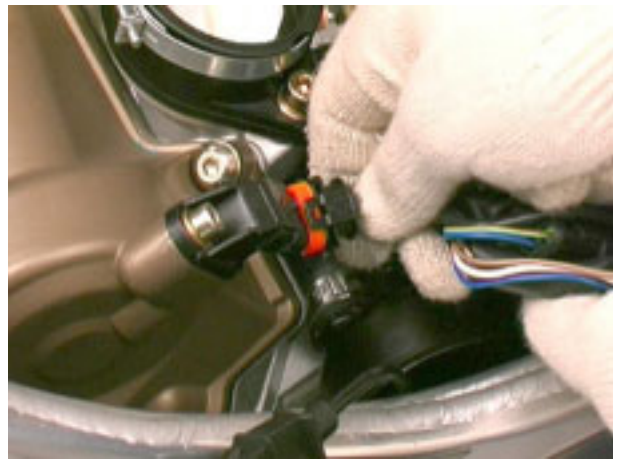


- Insert the spark plug caps in their housing.



- Connect the engine temperature sensor, the timing sensor, the rpm sensor, the side stand safety switch and the generator connectors.







- Fit the rear cylinder exhaust manifold with the washer.



- Tighten the nuts and stud bolts to the specified torque.



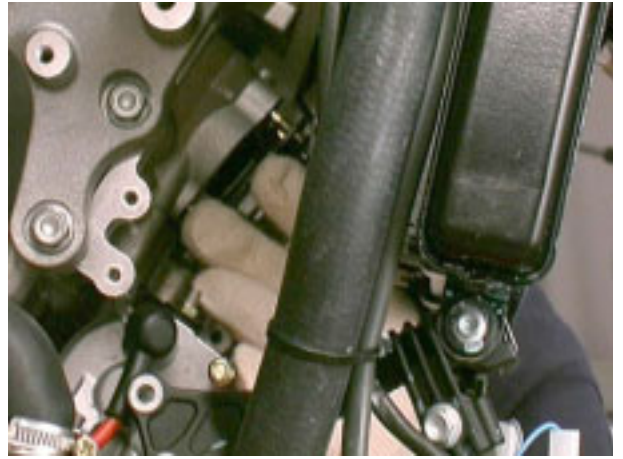
- Fit the exhaust complete with lambda sensor.



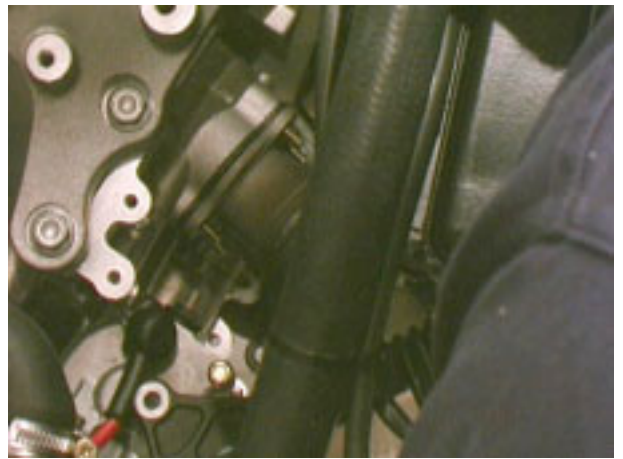
- Hook the fixing spring located between the rear manifold and the exhaust.
- Place the lambda sensor wiring on the frame.



- Place the exhaust gasket on the front cylinder.



- Fit the manifold on the cylinder stud bolts and on the exhaust.



- Tighten the four nuts fixing the manifold to the cylinder to the specified torque.



- Hook the fixing spring between the front cylinder manifold and the exhaust.



- Fit the silencers.



- Tighten the silencer clamp fixing screws.

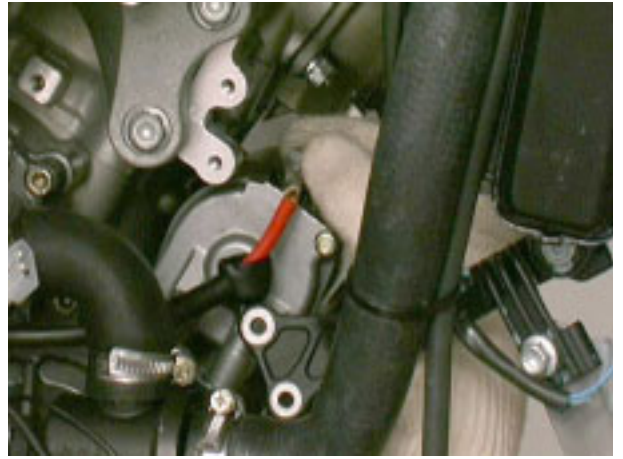


- Hook the silencer fixing springs.





- Tighten the starter motor connection.



- Move the oil cooler toward the engine and secure the lower supports.



- Refit the lambda sensor, stop light switch and speed sensor connectors.



- Connect the engine oil pressure sensor.



- Fasten the clip fixing the master cylinder to the brake lever.



- Tighten the rear brake master cylinder fixing screws.



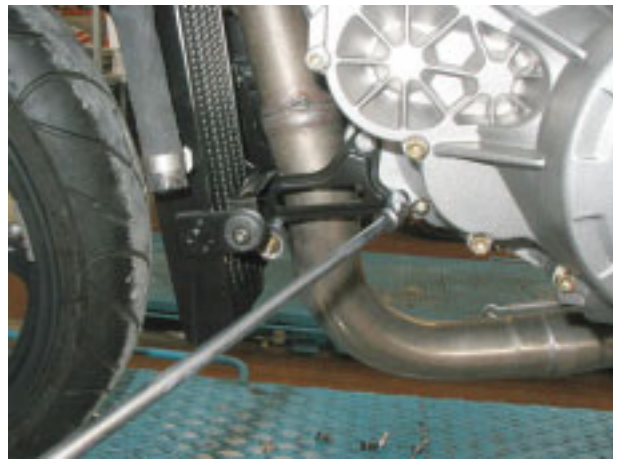
- Fit the subframe complete with oil coolers.



- Tighten the four screws to the specified torque.



**NOTE** For the screw on the upper left-hand side, tighten the internal nut with a spanner.



- Connect the oil tube from the right-hand side.



- Tighten the stud bolt that secures the oil tube clamp to the crankcase.



- Fit the voltage regulator mounting plate and tighten the two fixing screws.





- Fit the voltage regulator and tighten the two fixing screws.



- Restore all connections.



- Fit the expansion tank and tighten the two fixing screws.



- Fit the coolant breather tube.



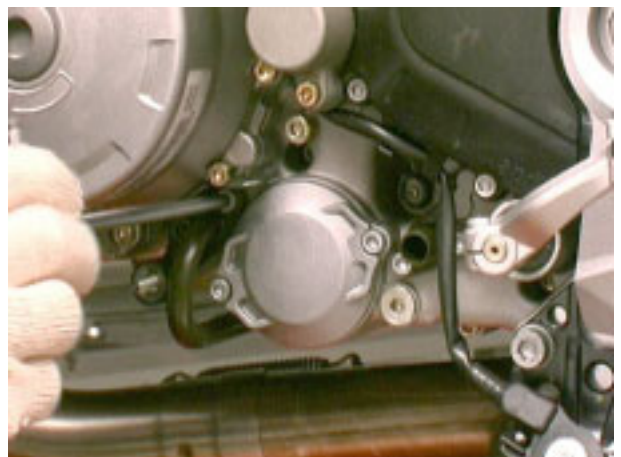
- Fit the clamp.



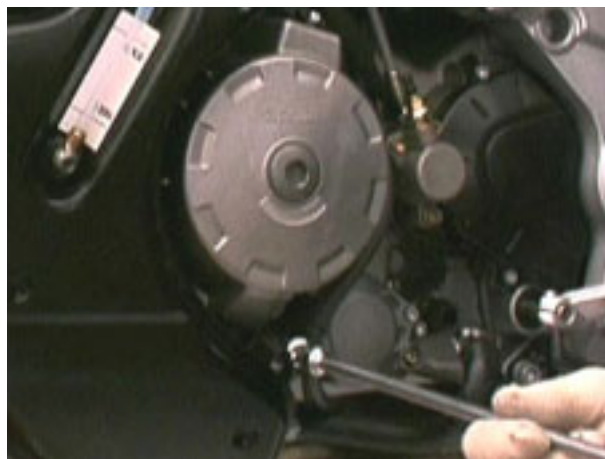
- Fit the rear brake fluid reservoir and tighten the fixing screw.



- Fit the oil tube on the crankcase.



- Fit the oil tank.
- Tighten the three oil tank fixing screws.



- Fit a new clamp to the tube coming from the oil cooler and fit the tube into place in the housing.



- Insert the breather tubes in their housing.



- Fit the oil tubes to the engine crankcase and secure in place with new clamps.







- Remove the plugs from the ducts.



- Fit the throttle body.



- Fasten the ties on the intake manifolds.



- Connect the injector connectors.



- Insert the vacuum tubes in the throttle body.





- Connect the throttle position sensor.



- Fit the throttle control wires and adjust play.





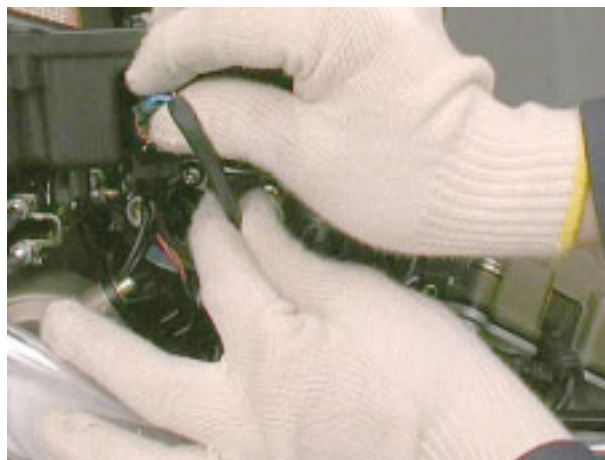
- Connect the coil wiring.

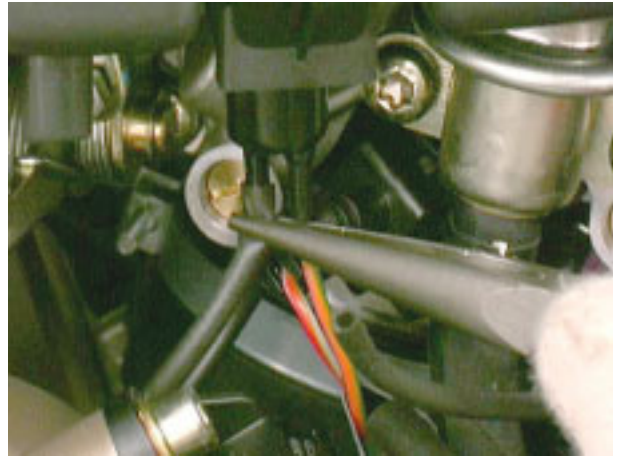


- Fit the airbox.

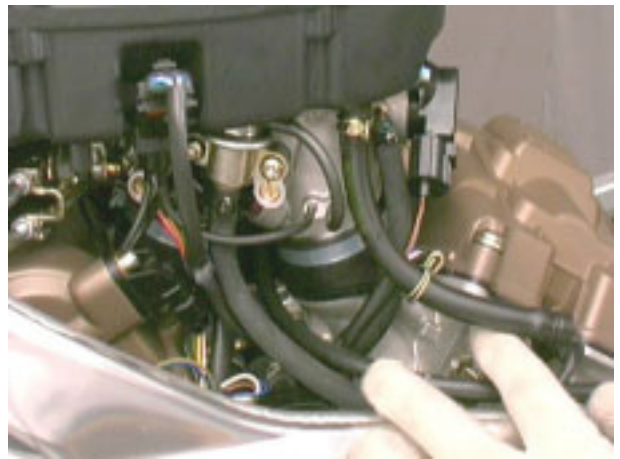


- Reconnect the manifold pressure sensor and tubes coming from the throttle body.





- Disconnect the oil recovery tank tube.



- Disconnect the by-pass tubes to the throttle body and the stepper motor connection.



- Tighten the six screws fixing the throttle body to the airbox.







- Fit the airbox cover.



- Fit the battery, the fuel tank and the seat.

## 4.1.3. TIGHTENING TORQUES

**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	Note
<b>ENGINE TO FRAME</b>					
Front engine mount	2+2	M10	50		
Upper and lower rear engine mount, LH side	2	M10	50		
Upper and lower rear engine mount, RH side of adjustment bushing	2	M20x1.5	12		
Upper and lower rear engine mount, RH side of counter nut	2	M20x1.5	50		
Upper and lower rear engine mount, RH side	2	M10	50		
<b>PARTS MOUNTED ON ENGINE</b>					
Engine oil inlet flange	2	M6	10		
Engine oil outlet flange	2	M6	10		
Rear brake lever bracket	1	M6	10		
	1	M8	25		
Rear brake master cylinder bracket	2	M8	25		
Sprocket	1	M10	50		Loctite 243
Clutch slave cylinder	3	M6	10		
Sprocket cover	3	M6	10		
Fuel delivery line to throttle body	1	M12x1.5	22		
72/78Kw reduction bushing	1	M5	3		(shear bolt) Loctite 243
<b>SWINGARM</b>					
Swingarm pivot ring nut	1	M30x1.5	60		
Swingarm pivot adjustment bushing	1	M30x1.5	12		
Swingarm pivot nut	1	M20x1.5	90		
Calliper carrier retaining pin	1	M12	50		Loctite 243
Chain tightener screw and nut	1+1	M8	Man.		
Rear brake line guide	3	M5	4		
Chain guard upper fixing screw	1	M5	4		
Chain guard and chain eye mount lower fixing screw	1	M5	5		
Chain slider	2	M5	3		
Chain eye to chain eye mount upper fixing nut	1	M5(nut)	5		
Rear stand bushing	2	M6	10		
Chain eye fixing nut	1	M6(nut)	10		
<b>Side stand</b>					
Stand bracket to frame	1	M10	50		
Side stand fixing pin	1	M10x1.25	10	-	
Stand switch fixing screw	1	M6	10		Loctite 243
Counter nut	1	M10x1.25	30		
<b>FOOTRESTS</b>					
Rider footrests	4	M8	2.5		
Passenger footrests	4	M8	2,5		
<b>REAR SHOCK ABSORBER</b>					
Shock absorber to frame	1	M10	50		
<b>REAR SUSPENSION CONNECTING RODS</b>					
Single connecting rod to frame	1	M10	50		
Single to double connecting rod	1	M10	50	-	
Double connecting rod to swingarm	1	M10	50		
Double connecting rod to shock absorber	1	M10	50		
<b>ELECTRIC SYSTEM</b>					
Battery bracket	2	M5	2		
Horn	1	M8	15		
Odometer sensor to rear brake calliper carrier	1	M6	12		
Voltage regulator mount	2	M6	10		

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	Note
<b>ELECTRIC SYSTEM</b>					
Voltage regulator to mount	2	M6	10		
Coil mount to frame	2	M6	10		
Coil to coil mount	1	M6	10		
ECU	3	M6	10		
Starter relay mount to seat frame	1	M6	10		
Relay carrier bracket to seat frame	2	M6	3		
Atmospheric pressure sensor to seat frame cover	1	M5	1		
Wire to starter motor	1	M6	5		
Wires to starter relay	2	M6	4		
Engine ground wire	2	M6	5		
Main wiring harness plate to air intake	1	SWP 3.9	1		
<b>AIR BOX</b>					
Air box cover	7	SWP5x20	3	±20%	
Air box to throttle body	6	M6	5	±20%	
Intake funnels	4	SWP 3.9	1	±20%	
MAP sensor mount	1	SWP5x20	2	±20%	
Filter frame	2	SWP5x20	2	-	
Conveyor to frame	4	M6	10		
<b>REAR WHEEL</b>					
Rear chain sprocket to sprocket carrier	5	M10	50		
Rear wheel shaft nut	1	M25x1.5	120		
<b>COOLING SYSTEM</b>					
Coolant radiator upper bracket to frame	2	M6	10		
Electric fans to coolant radiator	2+2	M6	6	±20%	
Coolant radiator to upper bracket	2	M6	10	-	
Filler neck to coolant radiator	1	M6	-	±20%	See RH spoiler front fixing
Coolant radiator side brackets to engine mount spacers	2+2	M6	10	±20%	
Coolant radiator to side brackets	2	M6	6		
Oil cooler bracket to engine	4	M6	10		
Oil coolers to bracket	4	M6	10		
Expansion tank to frame	2	M6	10		
Expansion tank cap	1	M28x3	6		
Tube clamps no. 8104097	-	-	4		
<b>REAR BRAKING SYSTEM</b>					
Rear brake calliper	2	M8	25	±20%	
Rear brake lever pin	1	M8	15	±20%	Loctite 243
Rear brake fluid reservoir	1	M5	3	±20%	
Rear brake rod counter nut	1	M6	Man.	±20%	
Brake disc	5	M8	30	±20%	Loctite 243
<b>EXHAUST SYSTEM</b>					
Front exhaust pipe to engine	4	M6	12		
Rear exhaust pipe to engine (upper screws)	2	M6	/		Tighten manually
Rear exhaust pipe to engine (lower screws)	2	M6	12		
Lambda sensor	1	M18x1.5	38		
Rear manifold guard	2	M4	2,5		
Silencers to mount	2	M8	25		
Guards to silencer	2	M4	2,5		
<b>FUEL PUMP</b>					
Fuel return fitting (for workshop manual only)	1	M6	6	±20%	Loctite 243
Pump mount to flange (for workshop manual only)	3	M5	4	±20%	
Lead terminals to flange (for workshop manual only)	2	M5	5	±20%	
Fuel return cover (for workshop manual only)	1	M6	10		Loctite 243

Description	Qty	Type of fastener	Torque (Nm)	Tol.	Note
<b>FUEL PUMP</b>					
Fuel return line to flange	1	M12x1.5	22		
Fuel level sensor to pump mount (for workshop manual only)	2	SWP 2.9x12	1		
Fuel pump wiring harness to flange (for workshop manual only)	2	M6	10		
<b>FUEL TANK</b>					
Filler neck to tank	4	M5	5	±20%	
Fuel pump flange to tank	8	M5	6	±20%	
<b>ENGINE OIL TANK</b>					
Oil tank nuts	3	M6	10	-	
Oil filter connection	1	M20x1.5	30	-	
Oil drain plug	1	M8	15	-	
Oil sight glass	2	M10x1	20		
<b>SEAT FRAME LOWER COVER</b>					
Lower cover to seat frame	3	M6	5	±20%	
Seat frame lower cover to frame	2	M5	4	±20%	
Rear stand bushing securing lower cover to seat frame	2	M6	12	±20%	
<b>MUDGUARDS</b>					
Rear mudguard	4	M5	5		
<b>TAIL GUARD</b>					
Tail guard to seat frame	2	M5	5		
Tail guard cover to seat frame	2	M6	7		
<b>RIGHT / LEFT SIDE PANELS</b>					
Side panels to tail guard	2	M5	2		
Side panels to tank	2	M5	5		
<b>BELLY PAN</b>					
Complete belly pan to oil cooler bracket and engine spacers	3	M6	7		
<b>RIGHT / LEFT SIDE COVERS</b>					
Side covers, rear end	2	M6	7		
Side covers, front end (with spoiler spacers)	2	M6	10		
Right side cover to voltage regulator mount	1	M6	5		
<b>RIGHT / LEFT RADIATOR FAIRING</b>					
RH-LH radiator fairing to fan peg	2	SWp 3.9	1		
<b>RIGHT / LEFT SPOILER</b>					
Spoiler rear end to spacer	2	M6	7		
Spoiler front end to coolant radiator	2	M6	7		
<b>OIL TANK COVER</b>					
Cover to oil tank	2	M5	5		
<b>FRONT PIECE</b>					
Front piece to light units and conveyor	6	M5	3		
<b>HEADLIGHT FAIRING</b>					
Headlight fairing to fairing front piece	5	M4	1		
<b>RADIATOR SPOILER</b>					
Spoiler to coolant radiator lower brackets	2	M5	3		
<b>SEAT COVER</b>					
Cover to cover base	7	SWP 3.9	1		
<b>LOCKS</b>					
Ignition switch to yoke	2	M8	25		
Rear lock to tail guard	1	M22x1.5	10		Nylon nut
<b>FRAME</b>					
Lower chain slider	2	M6	10		
Seat frame	4	M10	50		

**CYCLE PARTS**

**5**



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## 5.1. DISASSEMBLING THE UPPERWORKS

### 5.1.1. DISASSEMBLING THE UPPERWORKS

- Loosen and remove the two fixing screws (1) and set aside the washers.
- Remove the fairing (2).



- Unscrew and remove the fixing pin (3).
- Loosen and remove the fixing screw (4) and set aside the washer.



- Release the quick-release fitting (5) and free the tube.
- Remove the fairing (6).



- Loosen and remove the fixing screw (7).
- Remove the fairing (8).



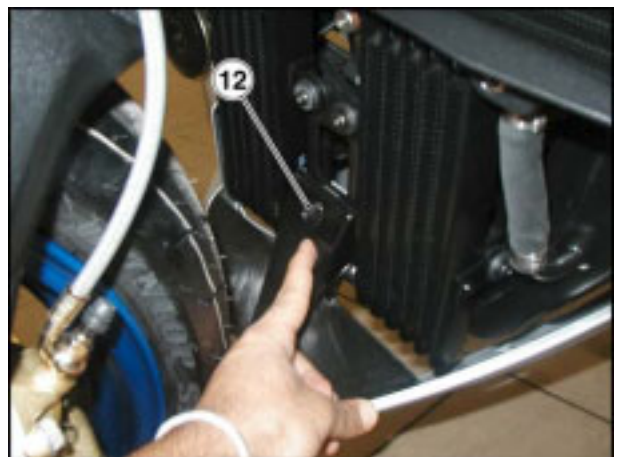
- Loosen and remove the two fixing screws (9) and set aside the washers.
- Remove the fairing (10).



- Loosen and remove the left fixing screw and set aside the washer (11).



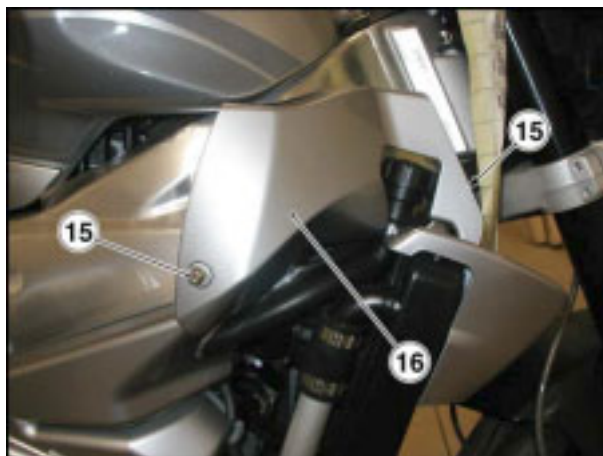
- Loosen and remove the front fixing screw and set aside the washer (12).



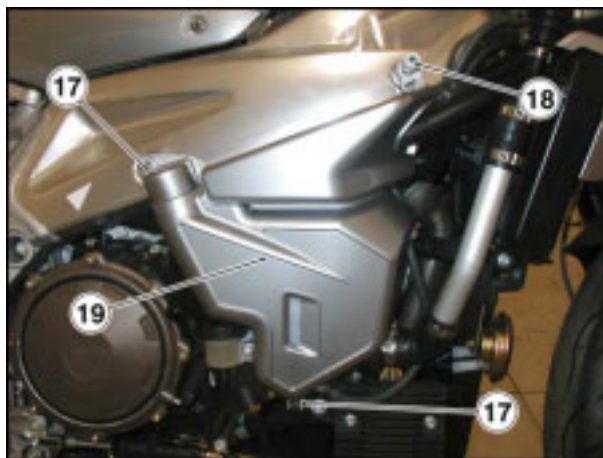
- Loosen and remove the right fixing screw and set aside the washer (13) .
- Remove the fairing (14).



- Loosen and remove the two fixing screws and set aside the washers (15) .
- Remove the fairing (16).



- Loosen and remove the two fixing screws (17) and set aside the washers.
- Unscrew and remove the fixing pin (18).
- Remove the fairing (19).



- Loosen and remove the fixing screw (20).
- Remove the fairing (21).



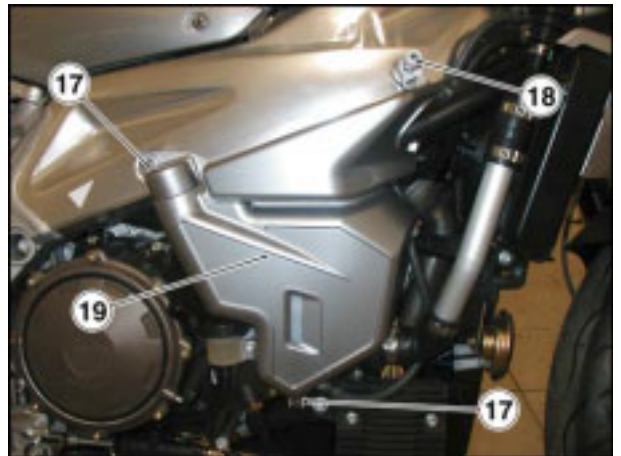


**5.1.2. REASSEMBLING THE UPPERWORKS**

- Fit the fairing (21).
- Tighten the fixing screw (20).



- Fit the fairing (19).
- Insert and tighten the fixing pin (18).
- Tighten the two fixing screws (17).



- Fit the fairing (16).
- Tighten the two fixing screws (15).



- Fit the fairing (14).
- Tighten the right fixing screw (13).



- Tighten the front fixing screw (12).



- Tighten the left fixing screw (11).



- Fit the fairing (10).
- Tighten the two fixing screws (9).



- Fit the fairing (8).
- Tighten the fixing screw (7).



- Fit the fairing (6).
- Fit the tube in the quick-fitting coupling (5).



- Tighten the fixing screw (4).
- Tighten the fixing pin (3).



- Fit the fairing (2).
- Tighten the two fixing screws (1).



## 5.1.3. TIGHTENING TORQUES

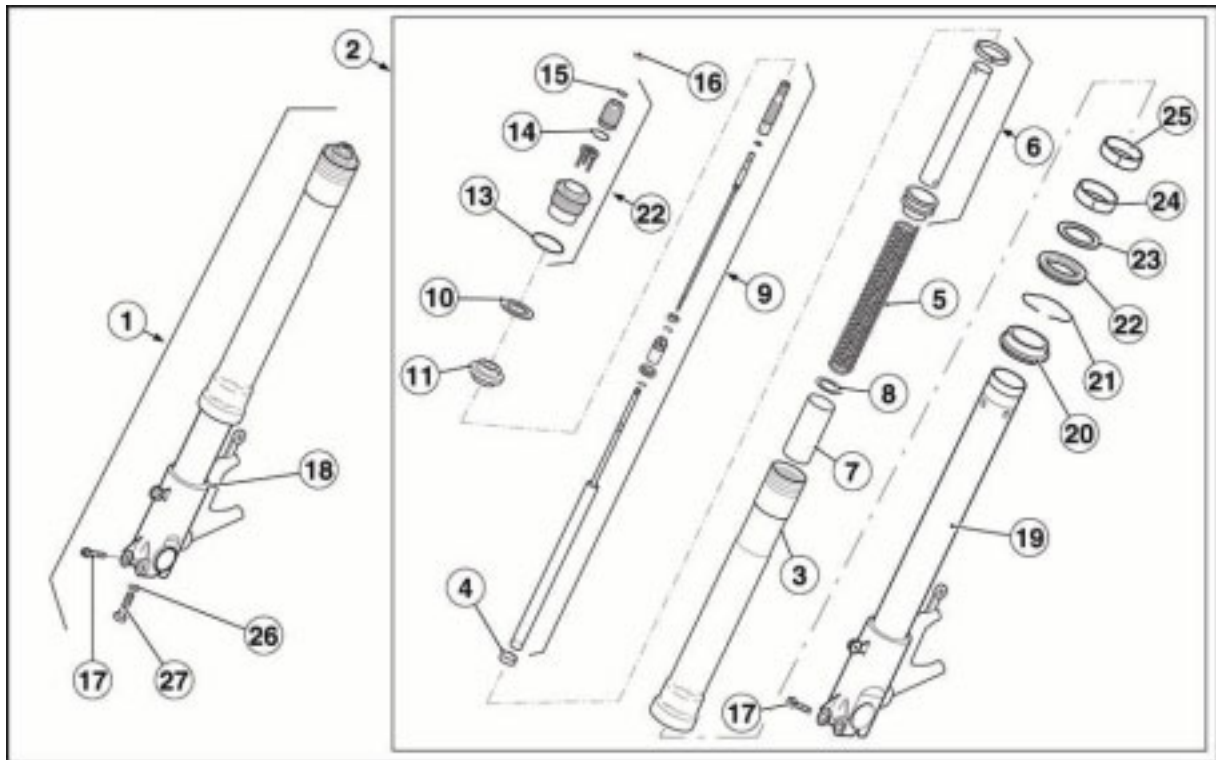
**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

Description	Qty	Type of fastener	Torque (Nm)	Tol.	Note
<b>RIGHT / LEFT SIDE PANELS</b>					
Side panels to tail guard	2	M5	2		
Side panels to tank	2	M5	5		
<b>BELLY PAN</b>					
Complete belly pan to oil cooler bracket and engine spacers	3	M6	7		
<b>RIGHT / LEFT SIDE COVERS</b>					
Side covers, rear end	2	M6	7		
Side covers, front end (with spoiler spacers)	2	M6	10		
Right side cover to voltage regulator mount	1	M6	5		
<b>RIGHT / LEFT RADIATOR FAIRING</b>					
RH-LH radiator fairing to fan peg	2	SWp 3.9	1		
<b>RIGHT / LEFT SPOILER</b>					
Spoiler rear end to spacer	2	M6	7		
Spoiler front end to coolant radiator	2	M6	7		
<b>OIL TANK COVER</b>					
Cover to oil tank	2	M5	5		
<b>FRONT PIECE</b>					
Front piece to light units and conveyor	6	M5	3		
<b>RADIATOR SPOILER</b>					
Spoiler to coolant radiator lower brackets	2	M5	3		

## 5.2. FRONT FORK

### 5.2.1. FRONT FORK DIAGRAM



#### Key:

1. Right radial fork leg
2. Left radial fork leg
3. Sleeve
4. Damper rod bushing
5. Spring
6. Complete preload tube.
7. Spacer
8. Washer
9. Complete damper rod.
10. Washer
11. Ring
12. Complete sleeve plug.
13. O-ring
14. O-ring
15. O-ring
16. Stop ring
17. M8x40 flanged screw
18. Right leg + wheel carrier
19. Left leg + wheel carrier
20. Dust seal
21. Circlip
22. Oil seal
23. Ring
24. Bushing
25. Sliding bushing
26. Special washer
27. M10x1.5 screw

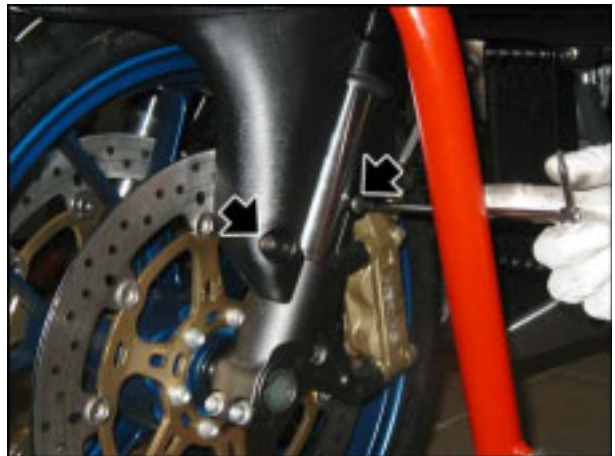


**5.2.2. REMOVING THE FORK LEGS**

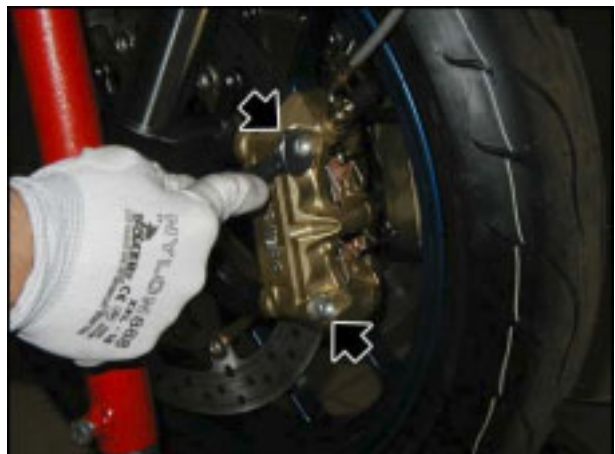
- Support the front end of the vehicle.

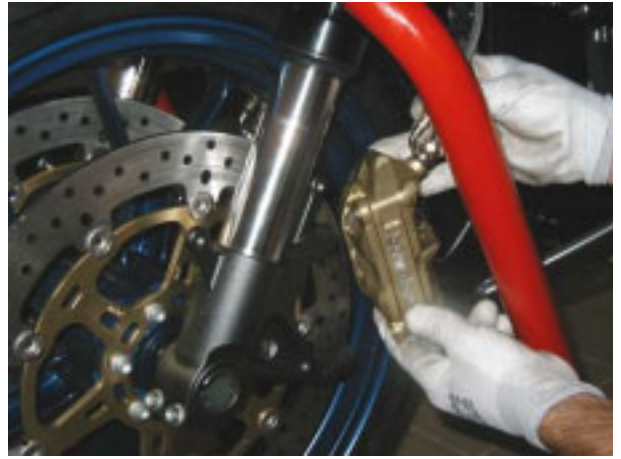


- Loosen the front mudguard screws and remove it.



- Loosen the front callipers fixing screws and slide them out of the disc.





- Remove the wheel shaft nut.



- Set aside the washer.



- Loosen the wheel shaft pinch bolts.



- Lightly tap the wheel shaft with a rubber mallet until the holes on the opposite side are uncovered.



- Remove the wheel shaft using a screwdriver inside the shaft holes.



- During this operation, support and remove the wheel.



- Support the fork and loosen the top and bottom yoke screws.
- Fit the fork leg.





**5.2.3. FITTING THE FORK LEGS**

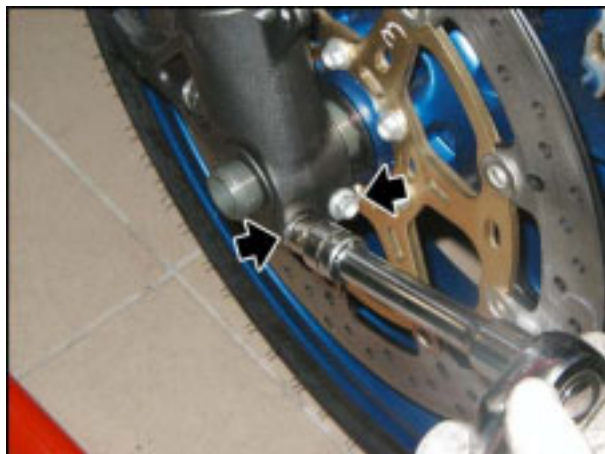
- Fit the fork leg.
- Adjust sleeve sliding and tighten the screws on the fork yokes to the specified torque.



- Fit the front wheel and insert the wheel shaft in its housing.



- Tighten the clamp screws (nut side) to secure the wheel shaft.





- Fit the washer and tighten the wheel shaft nut to the specified torque.
- Work the fork to ensure that the fork legs are aligned.



- Working on both sides, tighten the clamp screws securing the wheel shaft to the specified torque.



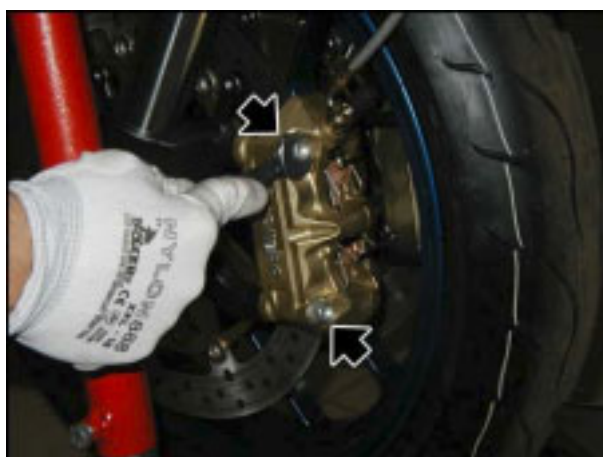
- Fit the callipers on the disc.



- Fit the brake callipers and tighten the screws to the specified torque.

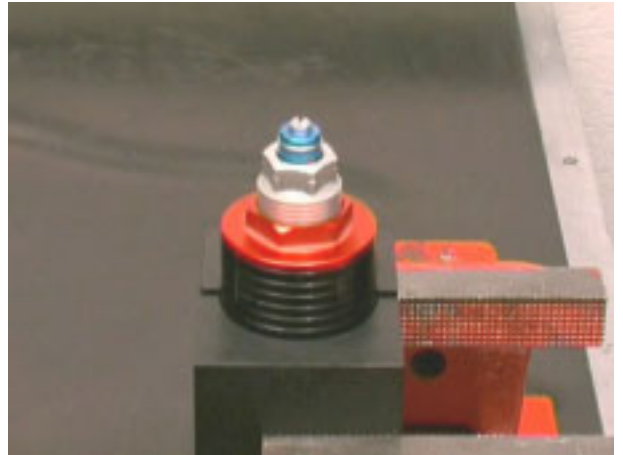
**WARNING**

After installing the brake callipers, pull the front brake lever a few times

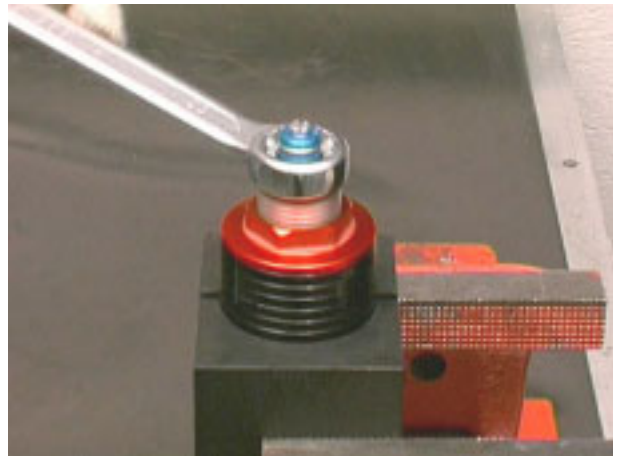


**5.2.4. REPLACING FORK FLUID**

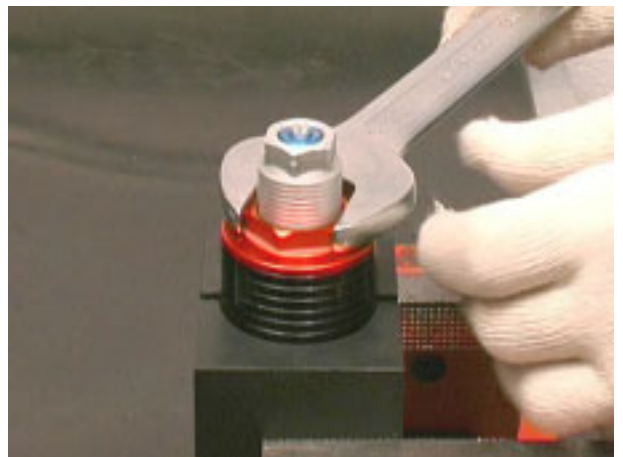
- Clamp the sleeve in a vice with the specified tool.



- Set the spring preload to its minimum.



- Unscrew the sleeve upper plug.



- Clamp the fork foot with care to avoid damaging it.



- Fit the specified tool on the spring joint.



- Push the tool downward to compress the spring and then fit the tool spacer under the cartridge lock nut.



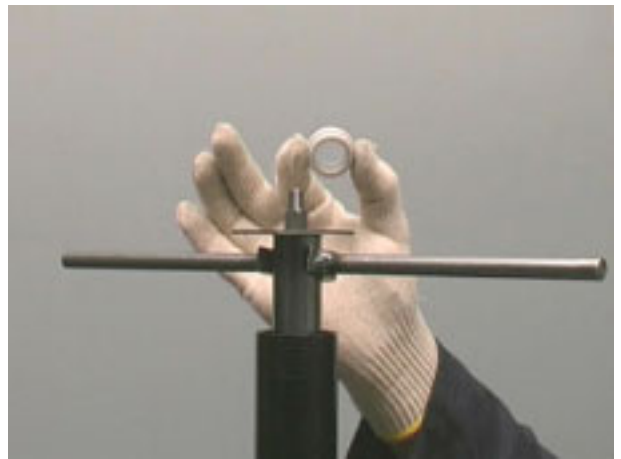
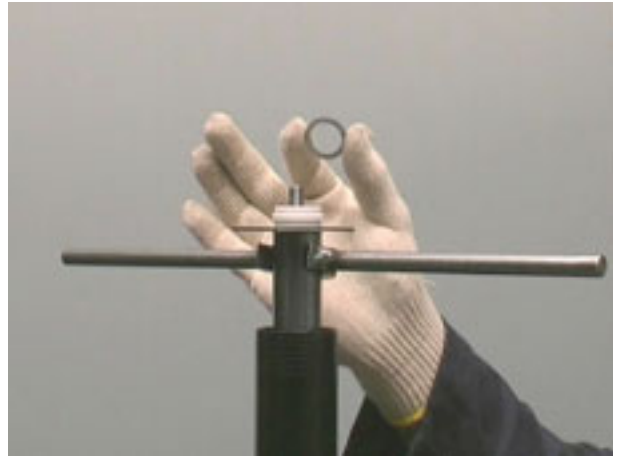
- Loosen the plug by placing the key in the provided opening and loosening the nut.



- Remove the complete plug.



- Remove the spacer and the washer.
- Press downward against spring force and slide out the spacer.



- Slide out the spring joint.



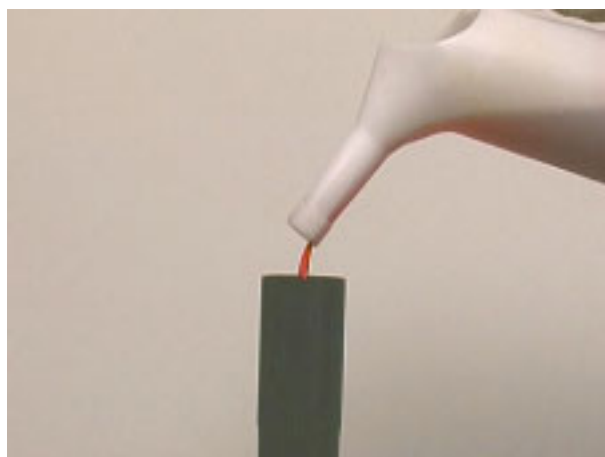
- Empty the oil into a container and remove the spring.





**5.2.5. FILLING THE FRONT FORK FLUID**

- Fill the fork so the air bubbles trapped inside are released.



- Fit the spring joint.



- Fit the specific tool on the spring joint so the cartridge rod is secured in position.



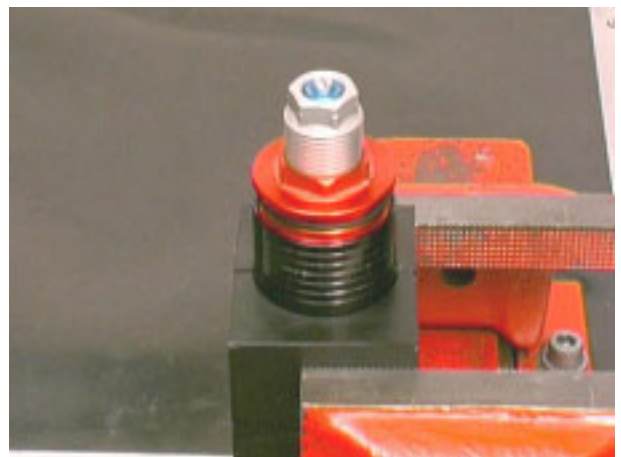
- Fit the spacer and the washer.



- Tighten the upper plug on the cartridge rod.



- Clamp the sleeve in a vice with the specified tool.



- Tighten the upper plug to the specified torque.



**5.2.6. REPLACING THE OIL SEAL/DUST SEAL**

- Clamp the sleeve in a vice with the specified tool.



- Set the spring preload to its minimum.



- Unscrew the sleeve upper plug.



- Clamp the fork foot with care to avoid damaging it.



- Fit the specified tool on the spring joint.



- Push the tool downward to compress the spring and then fit the tool spacer under the cartridge lock nut.



- Loosen the plug by placing the key in the provided opening and loosening the nut.

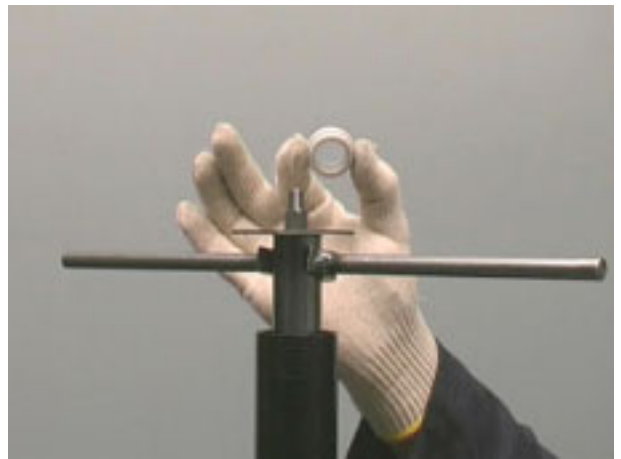
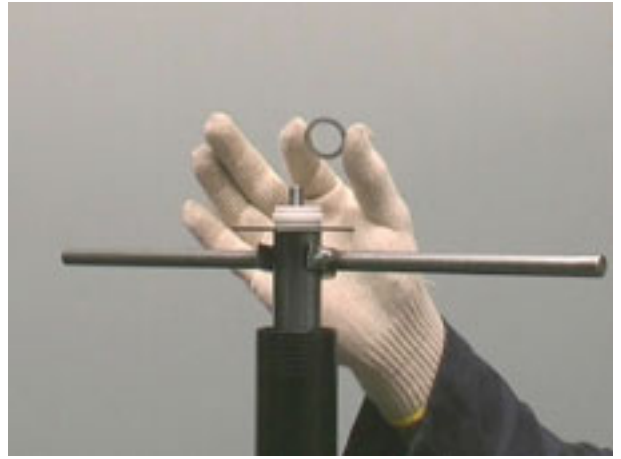


- Remove the complete plug.





- Remove the spacer and the washer.
- Press downward against spring force and slide out the spacer.



- Slide out the spring joint.



- Empty the oil into a container and remove the spring.



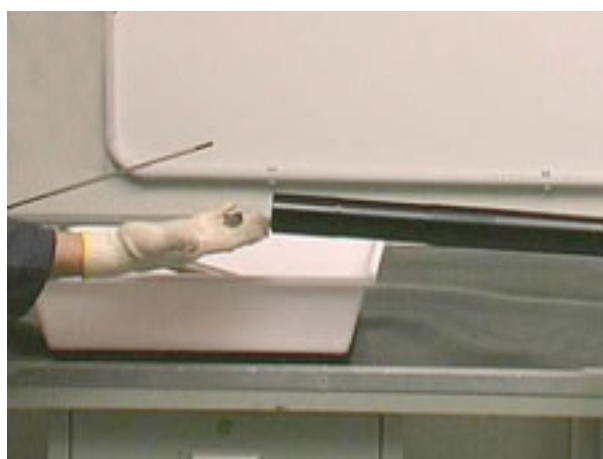
- Remove the spacer and the washer.



- Loosen the cartridge fixing screw on the fork foot.



- Set aside the centring bushing.



- Slide out the sleeve dust seal using a screwdriver for leverage.
- When doing this, take care not to damage the edge of the sleeve.



- Remove the circlip.

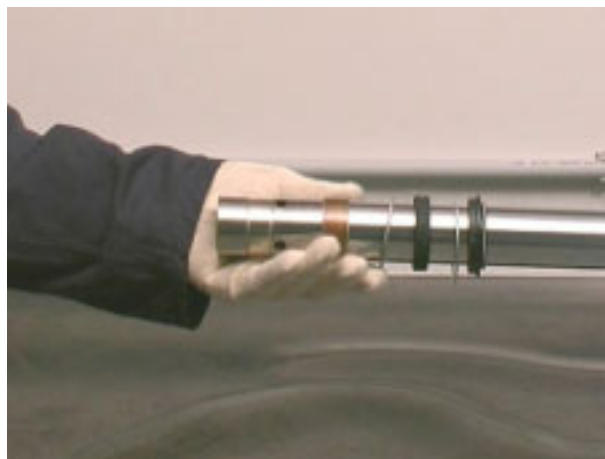


- Remove the sleeve from the slider using the sleeve as a stop.



- Remove the bushing, the movable bushing, the ring and the oil seal from the slider.





- Remove the ring and the dust seal.







**5.2.7. REFITTING THE OIL SEAL/DUST SEAL**

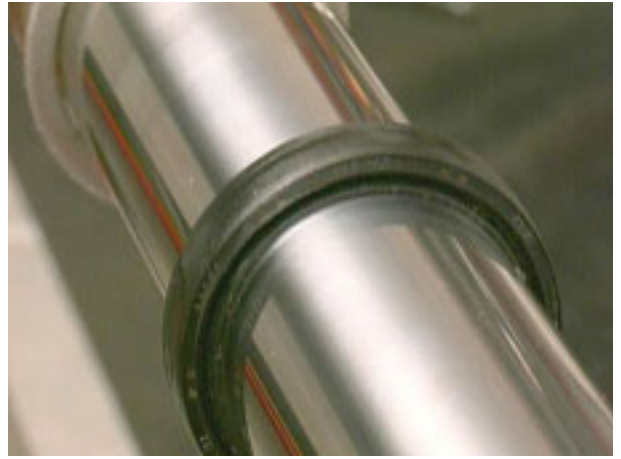
- Clamp the leg in a vice with care to avoid damaging its surfaces.
- Protect the ends of the leg with adhesive tape.
- Lubricate the sliding edges with fork fluid or seal grease.



- Fit the dust seal, the stop ring and the sealer ring on the slider.



- Ensure that the stamped side of the sealer ring is facing the dust seal.



- Proceed to fit the ring, the movable bushing and, after having removed the tape, the fixed bushing.



- Fit the sleeve on the leg and, using the specific tool, fit the oil seal in position.



- Insert the stop ring in its housing.



- Fit the dust seal with the specific tool.



- Fit the centring bushing on the cartridge and place the complete assembly in the fork.



- Tighten the cartridge fixing screw on the fork foot to the specified torque.



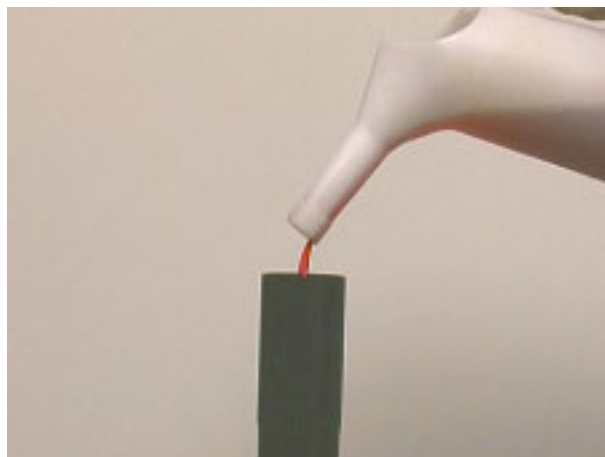
- Fit the lower spacer and the washer.



- Fit the fork spring.



- Fill the fork so the air bubbles trapped inside are released.



- Fit the spring joint.



- Fit the specific tool on the spring joint so the cartridge rod is secured in position.



- Fit the spacer and the washer.

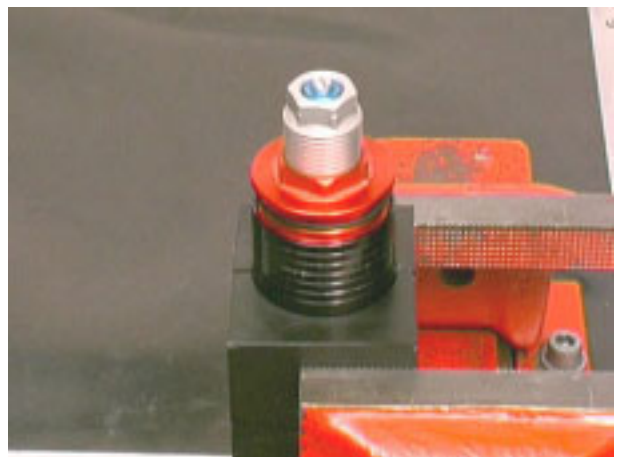




- Tighten the upper plug on the cartridge rod.



- Clamp the sleeve in a vice with the specified tool.



- Tighten the upper plug to the specified torque.

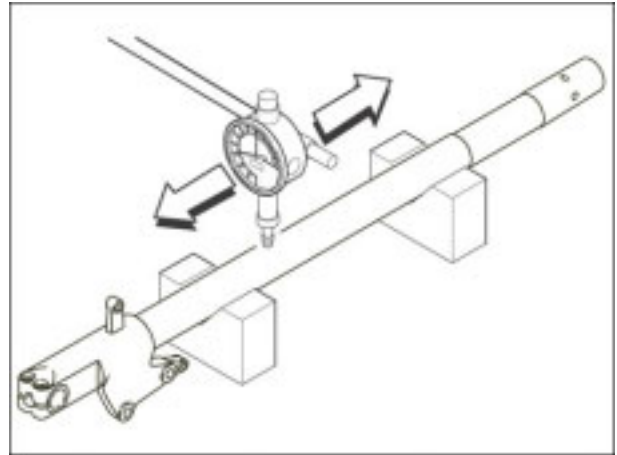


### 5.2.8. CHECKING THE COMPONENTS

#### WHEEL STANCHION

Inspect the sliding surface for scoring and/or scratching.  
Eliminate minor scoring with wet sand paper (grain size 1).  
Replace the stanchion if badly scored.  
Check for stanchion buckling using a dial gauge.  
Replace the stanchion if buckled beyond the service limit.

**Buckling limit: 0.2 mm (0.008 in).**



#### DANGER

**NEVER** attempt to straighten a buckled stanchion as this would weaken the overall structure leading to a dangerous riding condition.

#### SLEEVE

Inspect for damage and/or cracking. Replace if damaged.

#### SPRING

Check spring condition and ensure that the length is within the specified limits.  
If the length does not correspond, replace the spring.

**Minimum length of the free spring: 284 mm (11.18 in)**



Check conditions of the following components:

- sliding bushing;
- guide bushing;



– damper rod.

Change any component which is badly worn or damaged.

**WARNING**

Remove any impurities from the bushing; be careful not to damage the surface.

When reassembling, replace the following components with new ones:

- gasket;
- dust seal;

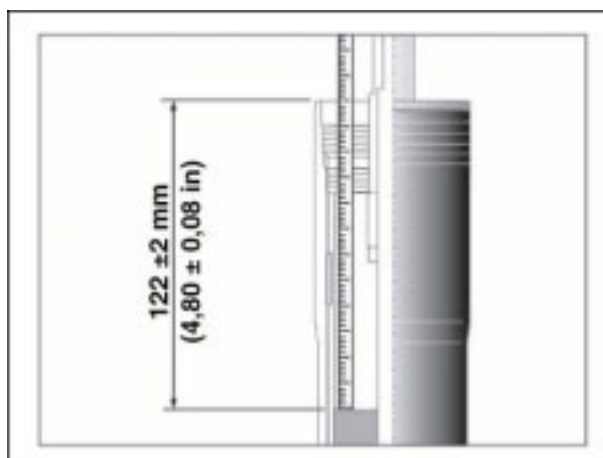


– the two O-rings on the regulator.

Oil quantity:  $(505 \pm 2.5)$  cu cm ( $30.81 \pm 0.15$  in.

Oil level:  $122 \pm 2$  mm ( $4.80 \pm 0.08$  in); (from edge of sleeve)

**NOTE** To correctly measure the oil level the sleeve must be perfectly vertical. The oil level must be the same in both legs.

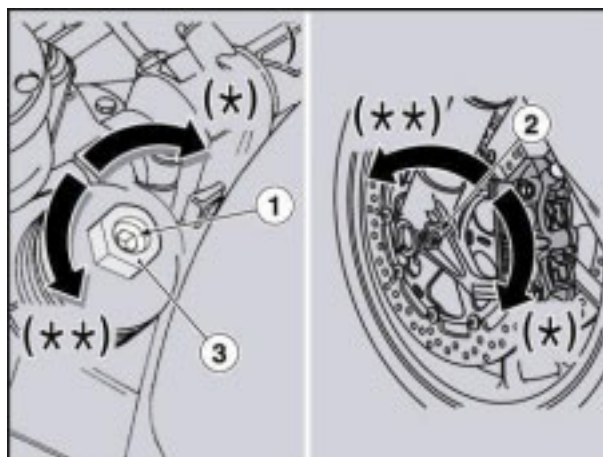


The standard adjustment of the fork meets most conditions of high and low speed riding, whether the vehicle is travelling with a full load or not.

It is however possible to customise the adjustment, depending on how the vehicle is used.

**WARNING**

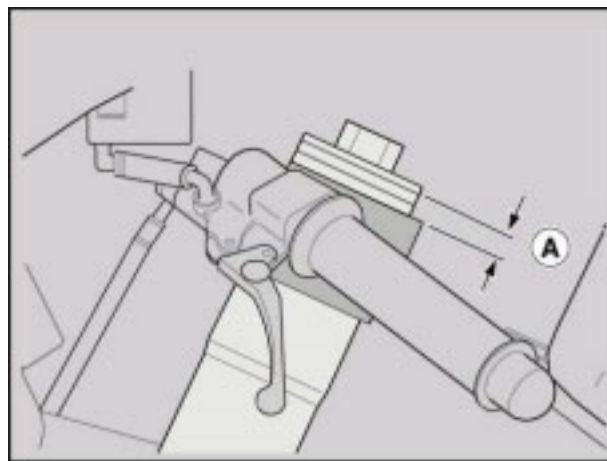
When proceeding with the adjustment, always start from the stiffest setting (adjusters 1 and 2 turned completely clockwise). As a reference for adjusting compression and rebound damping, use the marks on the adjusters (1-2). Gradually turn the adjusters (1-2) by 1/8 of a turn each time.



**DANGER**

Racing adjustments must be made exclusively during organised races or sporting events held on tracks far from road circulation and with the authorisation of the proper authorities.

It is strictly prohibited to make racing adjustments and ride the vehicle with said setting on roads and motorways



Front suspension	Standard adjustment
Rebound damping adjustment, screw (1)	from completely closed (*) open (**) 1.5 turns
Compression damping adjustment, screw (2)	from completely closed (*) open (**) 1 turn
Spring preload, nut (3)	from completely closed (*) open (**) 5 projection notches
Leg projection (A) (***) from upper yoke (excluding plug)	1 projection notch

(\*) clockwise

(\*\*) anticlockwise

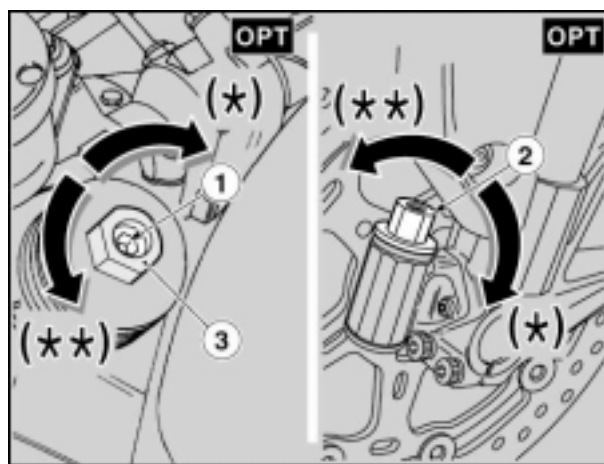
(\*\*\*) For this type of adjustment please contact exclusively an **aprilia** Authorised Dealer.

**NOTE** Öhlins forks available on request (OPT).

**Öhlins front fork (OPT)**

The standard adjustment of the fork meets most conditions of high and low speed riding, whether the vehicle is travelling with a full load or not.

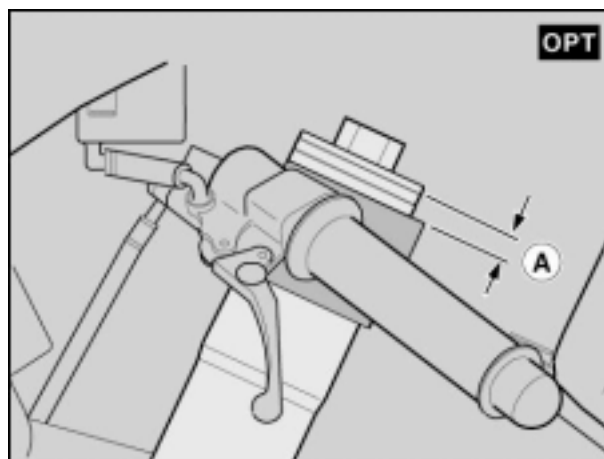
It is however possible to customise the adjustment, depending on how the vehicle is used.

**WARNING**

To count the number of adjusters (1-2) clicks always start from the stiffest setting (adjuster turned completely clockwise).

As a reference for adjusting hydraulic braking compression and rebound damping, use the adjusters (1-2).

Gradually turn the adjusters (1-2) 1 mark at a time.





Front suspension	Standard adjustment
Rebound damping adjustment, screw (1)	from completely closed (*) open (**) 12 turns
Compression damping adjustment, screw (2)	
Spring preload, nut (3)	from completely open (*) close (**) 8 turns
Leg projection (A) (***) from upper yoke (excluding plug)	4 projection notches

(\*) clockwise

(\*\*) anticlockwise

(\*\*\*) For this type of adjustment please contact exclusively an **aprilia** Authorised Dealer.

## 5.2.9. TIGHTENING TORQUES

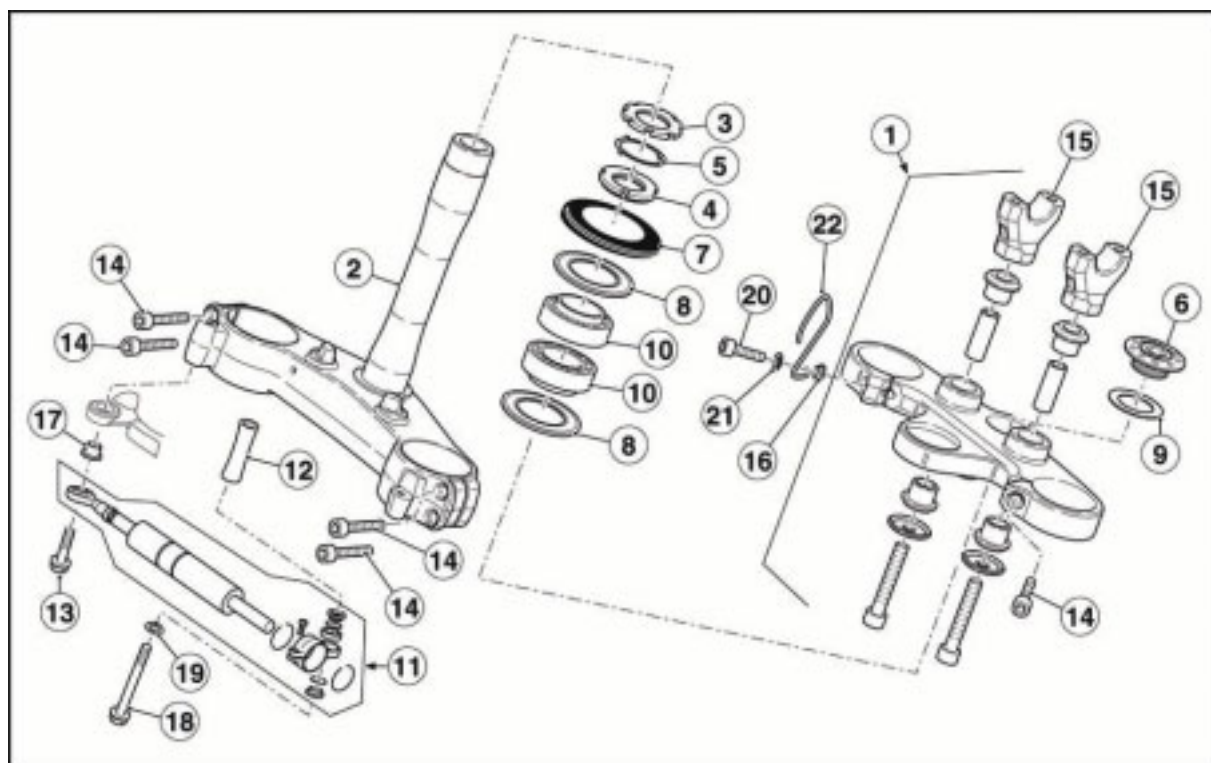
**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE<sup>®</sup> where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	NOTE
<b>FRONT FORK</b>					
Fork leg to top fork yoke	1+1	M8	25		
Fork leg to bottom fork yoke	2+2	M8	25		
Headstock ring nut	1	M35x1	40		
Headstock counter nut	1	M35x1	Man.		Manual + 90°
Top yoke fixing plug	1	M29x1	100		Use a torque wrench
Front fork clamps (Showa)	2+2	M8	22		
Front fork clamps (Öhlins)	2+2	M6	12		
<b>STEERING DAMPER</b>					
Steering damper to frame	1	M6	10		Loctite 243
Steering damper to bottom fork yoke	1	M6	10		
<b>LIGHTS / INSTRUMENT PANEL</b>					
Rear turn indicators	2	M4	1	-	
Front turn indicators	2	M6	4	-	
Tail light to tail guard	4	M5	2	±20%	
Headlight to conveyor	2	M5	2	-	
Headlight to fairing front piece	4	M5	2		
Instrument panel	3	SWP5x14	3		
<b>AIR BOX</b>					
Air box cover	7	SWP5x20	3	±20%	
Air box to throttle body	6	M6	5	±20%	
Intake funnels	4	SWP 3.9	1	±20%	
MAP sensor mount	1	SWP5x20	2	±20%	
Filter frame	2	SWP5x20	2	-	
Conveyor to frame	4	M6	10		
Carbon filter to seat frame lower cover	1	M6	4		
<b>FRONT WHEEL</b>					
Wheel shaft nut	1	M25x1.5	80		
<b>FRONT BRAKING SYSTEM</b>					
RH and LH front brake callipers	2+2	M10x1.25	50	-	
Front brake fluid reservoir to bracket	1	M6	7	-	
Front brake and clutch fluid reservoir bracket	1	M6	10	-	
Clutch fluid reservoir to bracket	1	M5	3		
Front brake line guide to bottom fork yoke	1	M5	4		
Brake disc	6+6	M8	30		Loctite 243
<b>MUDGUARDS</b>					
Front mudguard	4	M5	5		

## 5.3. STEERING BEARINGS

## 5.3.1. DIAGRAM

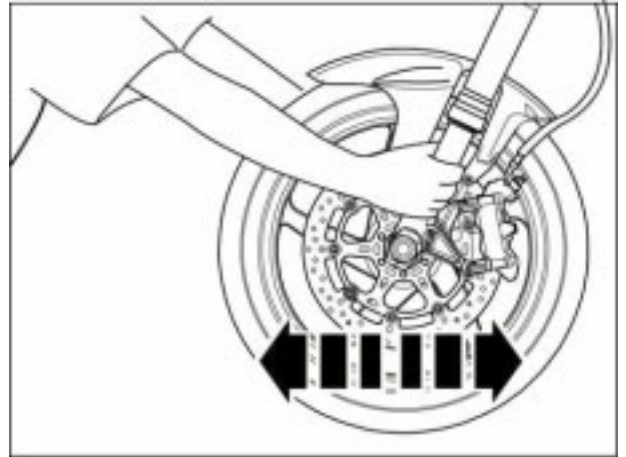


## Key:

1. Top yoke
2. Bottom yoke
3. Counter nut
4. Ring nut
5. Steering safety plate
6. Top yoke fixing bushing
7. Dust seal
8. Dust seal
9. Headstock plug washer
10. Axial ball bearing
11. Steering damper
12. Front damper mount
13. M6x25 flanged screw
14. M8x35 TCEI screw
15. Handlebar lower U-bolt
16. Bushing
17. Bushing
18. TE pf M6x80 screw
19. Curved spring washer
20. M8x45 TCEI screw
21. Washer
22. Wire guide

**5.3.2. CHECKING PLAY****Steering bearings and steering play:**

- Place the vehicle on the central support stand.
- Shake the fork in the direction of travel.
- If play is noticed, proceed with adjustment



**5.3.3. ADJUSTING BEARING PLAY**

- Loosen and remove the four U-bolt fixing screws.
- Remove the stand.
- Remove the handlebar taking special care not to spill oil from the clutch reservoir or from the front brake fluid reservoir.



- Loosen and remove the headstock upper nut and set aside the washer.



- Loosen the fork leg fixing screws on the upper yoke.



- Slide out the fork upper yoke moving it toward the instrument panel.

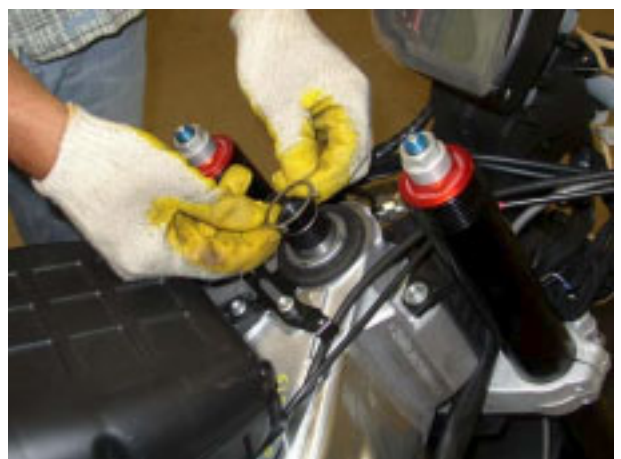




- Straighten the safety washer on the headstock.



- Loosen the upper ring nut and remove the safety washer.



- Adjust the steering bearing preload by tightening the lower ring nut to the specified torque.



- Fit the safety washer.



- Fit the upper ring nut and tighten so the grooves correspond to the safety washer tabs.



- Rivet the tabs on the upper ring nut.



- Fit the upper fork yoke.



- Tighten the upper bolt on the headstock to the specified torque.



- Tighten the fork leg fixing screws on the upper yoke to the specified torque.



- Fit the handlebar.
- Fit the U-bolt.
- Tighten the four U-bolt fixing screws to the specified torque.





## 5.3.4. TIGHTENING TORQUES

**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

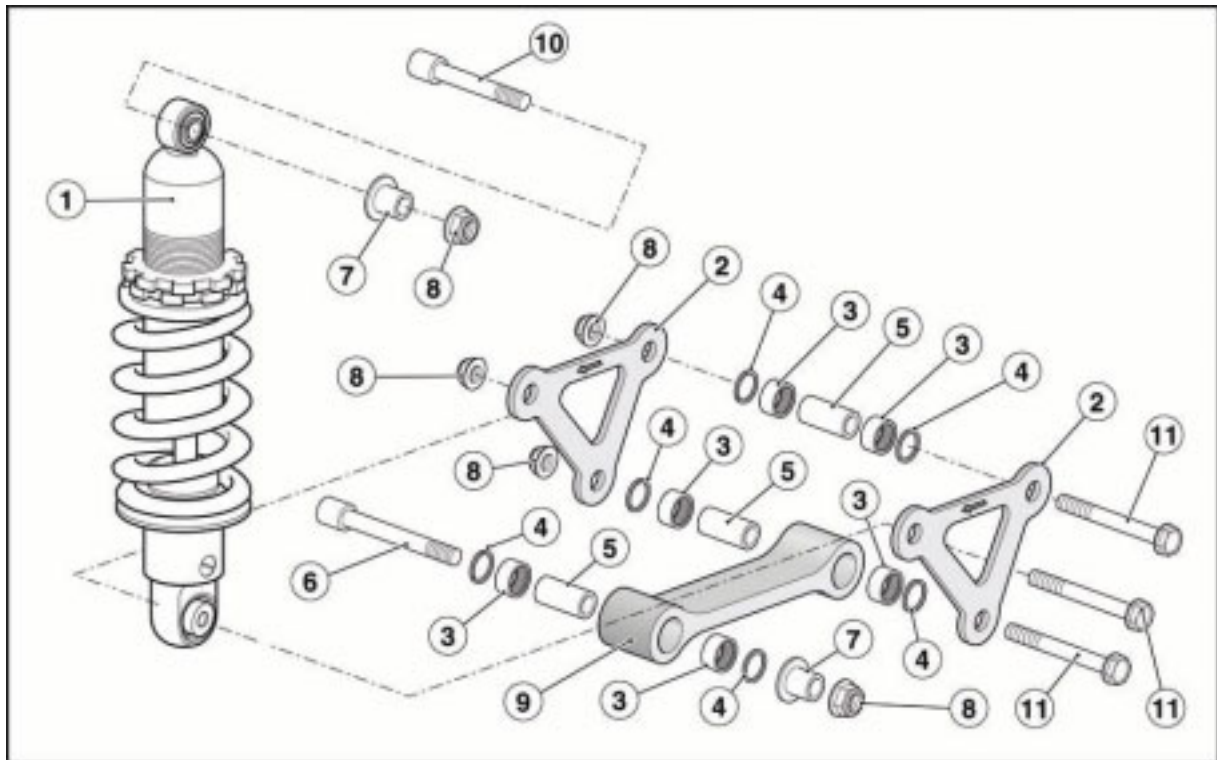
DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	NOTE
<b>ENGINE TO FRAME</b>					
Front engine mount	2+2	M10	50		
Upper and lower rear engine mount, LH side	2	M10	50		
Upper and lower rear engine mount, RH side of adjustment bushing	2	M20x1.5	12		
Upper and lower rear engine mount, RH side of counter nut	2	M20x1.5	50		
Upper and lower rear engine mount, RH side	2	M10	50		
<b>FRONT FORK</b>					
Fork leg to upper fork yoke	1+1	M8	25		
Fork leg to lower fork yoke	2+2	M8	25		
Headstock ring nut	1	M35x1	40		
Headstock counter nut	1	M35x1	Man.		Manual + 90°
Upper yoke fixing plug	1	M29x1	100		Use a torque wrench
Front fork clamps (Showa)	2+2	M8	22		
Front fork clamps (Öhlins)	2+2	M6	12		
<b>STEERING DAMPER</b>					
Steering damper to frame	1	M6	10		Loctite 243
Steering damper to lower fork yoke	1	M6	10		
<b>HEADLIGHTS / INSTRUMENT PANEL</b>					
Rear turn indicators	2	M4	1	-	
Front turn indicators	2	M6	4	-	
Tail light to tail guard	4	M5	2	±20%	
Headlight to conveyor	2	M5	2	-	
Headlight to fairing front piece	4	M5	2		
Instrument panel	3	SWP5x14	3		
<b>AIR BOX</b>					
Air box cover	7	SWP5x20	3	±20%	
Air box to throttle body	6	M6	5	±20%	
Intake funnels	4	SWP 3.9	1	±20%	
MAP sensor mount	1	SWP5x20	2	±20%	
Filter frame	2	SWP5x20	2	-	
Conveyor to frame	4	M6	10		
Carbon filter to seat frame lower cover	1	M6	4		California version only
<b>FRONT WHEEL</b>					
Wheel shaft nut	1	M25x1.5	80		
<b>FRONT BRAKING SYSTEM</b>					
RH and LH front brake callipers	2+2	M10x1.25	50	-	
Front brake fluid reservoir to bracket	1	M6	7	-	
Front brake and clutch fluid reservoir bracket	1	M6	10	-	
Clutch fluid reservoir to bracket	1	M5	3		
Front brake line guide to lower fork yoke	1	M5	4		
Brake disc	6+6	M8	30		Loctite 243



Description	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	NOTE
<b>FRONT FORK LOWER COVER</b>					
Cover to lower fork yoke	2	M6	3		
Cover to lower fork yoke with steering damper	1	M6	10		
<b>HANDLEBAR AND CONTROLS</b>					
Upper U-bolt to handlebar mounts	4	M8	25		
Handlebar mounts to fork upper yoke (for workshop manual only)	2	M10	30		Loctite 243
Anti-vibration weights	2	M6	10		
Anti-vibration weight end caps	2	M18x1	35		
LH dimmer switch	1	M5x1	1,5		
RH dimmer switch	1	M4	1,5		
Front brake master cylinder	2	M6	8		
Clutch master cylinder	2	M6	8		
<b>MUDGUARDS</b>					
Front mudguard	4	M5	5		

## 5.4. REAR SUSPENSION

### 5.4.1. DIAGRAM



#### Key:

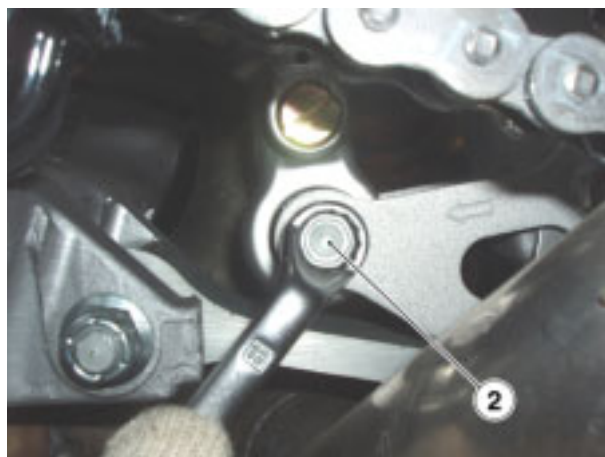
1. Shock absorber
2. Double connecting rod
3. Roller case
4. D18x24x3 oil seal
5. Pin L=36
6. Screw
7. T-bushing
8. M10 flanged self-locking nut
9. Complete single connecting rod
10. M10x59 TCEI screw
11. M10x61 flanged screw

**5.4.2. DISASSEMBLING THE REAR SUSPENSION**

- Secure the motorcycle using slings and an A-frame.
- Working from the right-hand side of the vehicle, loosen the upper screw (1) but do not remove it and remove the nut.



- Working from the left-hand side of the vehicle, loosen the lower screw (2) but do not remove it and remove the nut.



- Operate the A-frame to raise the motorcycle just enough to remove load from the swingarm, but do not lift the motorcycle off the ground.
- Remove the upper screw (1).



- Remove the lower screw (2).



- Remove the rear shock absorber (3) from between swingarm and rear subframe.



## 5.4.3. CHECKING THE COMPONENTS

**WARNING**

Check that the components are not deformed, broken, cracked and/or dented.  
Replace any damaged components

**BEARINGS**

Manually turn the rollers; they must turn smoothly, freely and without noise.

No axial play should be noticed.

Faulty bearings should be replaced.

**WARNING**

Apply grease to the rollers

**SEALS**

Check that all seals are intact; replace them if they are damaged or worn.

**SHOCK ABSORBER**

Check that the shock absorber shows no signs of oil leaks and that its stroke is smooth and progressive. Replace if necessary.

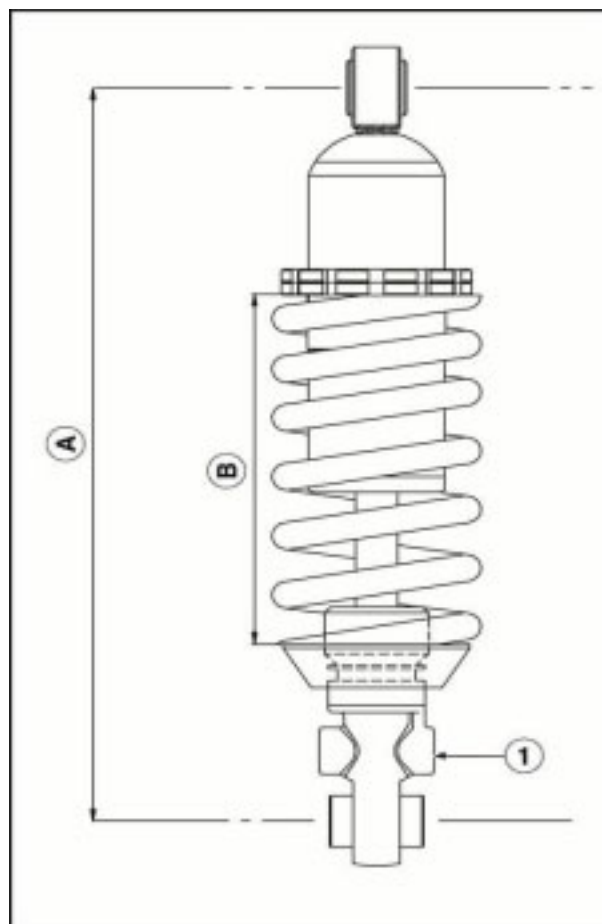
REAR SUSPENSION	Standard adjustment
Spring length (preloaded) (B)	147 mm (5.79 in)
Rebound adjustment, screw (1)	from completely closed (*) open (**) 25 clicks

**CHECK ADJUSTMENTS**

(\*) clockwise

(\*\*) anticlockwise

**NOTE** Öhlins shock absorbers available on request (OPT).





## Öhlins shock absorber (OPT)

**WARNING**

Adjust shock absorber spring preload and rebound damping to suit motorcycle usage conditions.

When you increase spring preload, you should also increase rebound damping to avoid sudden jerks when riding.

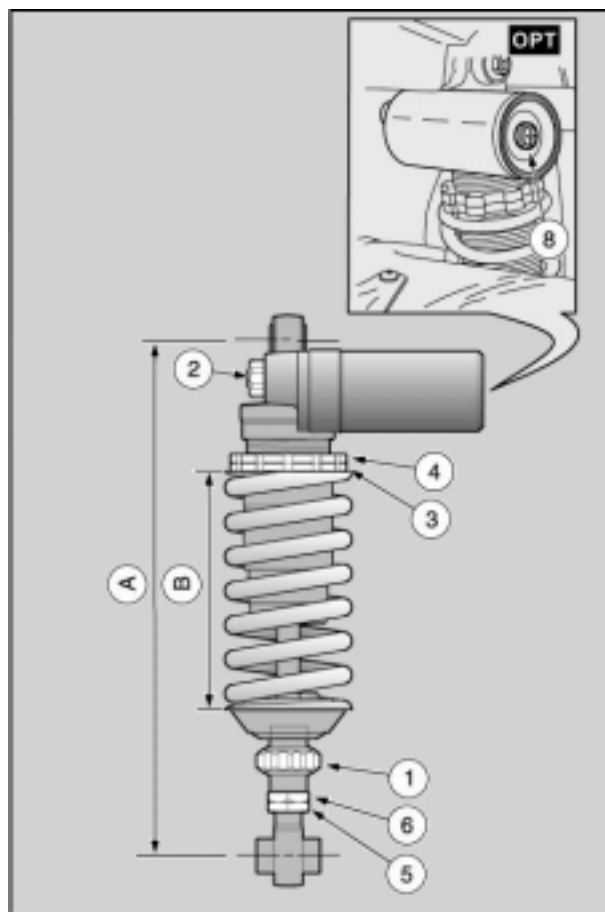
**DANGER**

Racing adjustments must be made exclusively during organised races or sporting events held on tracks far from road circulation and with the authorisation of the proper authorities.

It is strictly prohibited to make racing adjustments and ride the vehicle with said setting on roads and motorways

**WARNING**

(OPT) Do not loosen the screw (8) or disturb the membrane located underneath or the resulting nitrogen loss will impair shock absorber operation making the motorcycle unsafe to ride.



## Öhlins shock absorber

Rear suspension	Standard adjustment
Shock absorber centre distance (A)	312 ±1.5 mm (12.28 ± 0.59 in)
Spring length (preloaded) (B)	145 mm (5.71 in)
Rebound adjustment, ring nut (1)	from completely closed (*) open (**) 20 clicks
Compression adjustment, knob (2)	from completely closed (*) open (**) 12 clicks

**CHECK ADJUSTMENTS**

(\*) clockwise

(\*\*) anticlockwise

**5.4.4. REASSEMBLING THE REAR SUSPENSION**

- Fit the rear shock absorber (3) between swingarm and rear subframe.



- Fit the lower screw (2).



- Operate the A-frame until aligning the frame hole with the rear suspension upper mounting point.
- Fit the upper screw (1).



- Working from the right-hand side of the vehicle, fit the nut (2) to the lower screw and tighten.



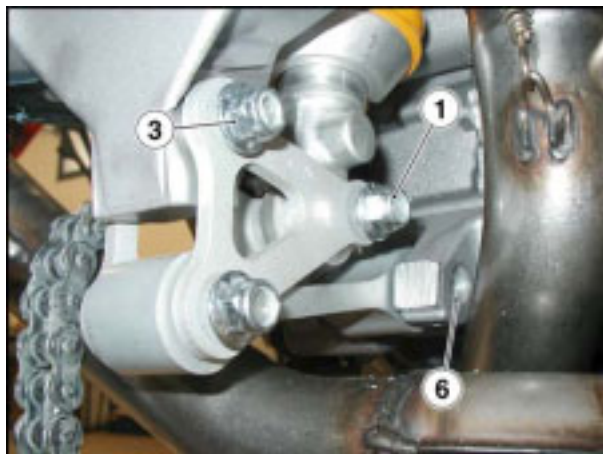
**TUONO 1000**

- Working from the left-hand side of the vehicle, fit the nut (1) to the upper screw and tighten.
- Release the motorcycle from the A-frame and remove the slings.

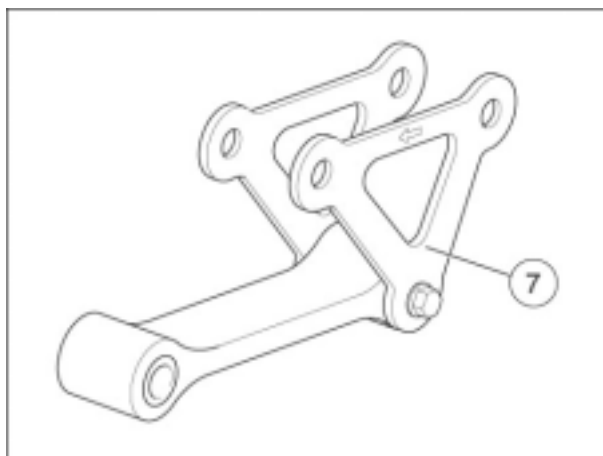


**5.4.5. REMOVING THE REAR SUSPENSION CONNECTING RODS**

- Working from the right-hand side of the vehicle, loosen and remove the nut (1).
- Remove the screw from the opposite side (2).
- Loosen and remove the nut (3).
- Remove the screw from the opposite side (4).
- Loosen and remove the nut (5).
- Remove the screw from the opposite side (6).
- Remove the complete suspension connecting rod unit (7).



**NOTE** When reassembling, grease the connecting rod pivot points; ensure that all the parts are correctly positioned and check repeatedly that all joints move freely.



## 5.4.6. TIGHTENING TORQUES

**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE<sup>®</sup> where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	NOTE
<b>REAR SHOCK ABSORBER</b>					
Shock absorber to frame	1	M10	50		
<b>REAR SUSPENSION CONNECTING RODS</b>					
Single connecting rod to frame	1	M10	50		
Single to double connecting rod	1	M10	50	-	
Double connecting rod to swingarm	1	M10	50		
Double connecting rod to shock absorber	1	M10	50		



## 5.5. SWINGARM

### 5.5.1. REMOVING THE SWINGARM

- Place the vehicle on the central support stand (OPT).
- Remove the rear wheel.

**NOTE** Though not necessary for removing the rear wheel, the rear support stand (OPT) is essential for keeping the swingarm without the wheel in place.

Shim the resting surface of the rear support stand (OPT) so it is in work position (fastened to the two swingarm pegs).



- Remove the exhaust system.
- Loosen and remove the three guard fixing screws and set aside the washers.

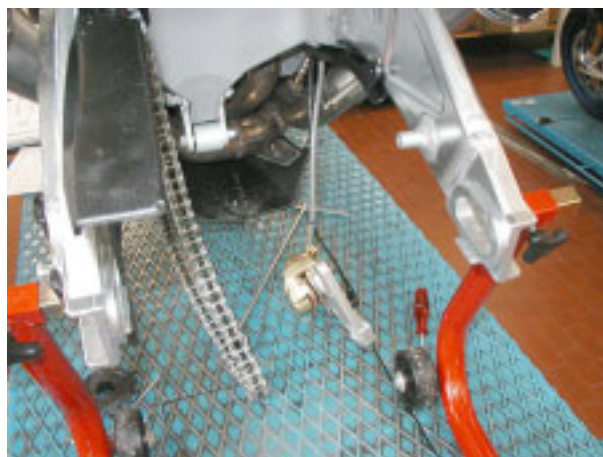


- Carefully rest the support plate on the ground on its side complete with the brake calliper and the speed sensor, connected to the tube and to the wire, respectively.



#### **WARNING**

Do not pull the rear brake lever when the calliper has been removed as this could cause the piston to come out of its housing and determine brake fluid leakage.



- Working on the left-hand side, loosen and remove the double-connecting rod/swingarm nut.
- Remove the screw from the opposite side.



- Working on the left-hand side, loosen and remove the shock absorber lower nut.
- Remove the screw from the opposite side.



- Loosen and remove the nut and set aside the washer.



**NOTE** Use the special tool (**OPT**):

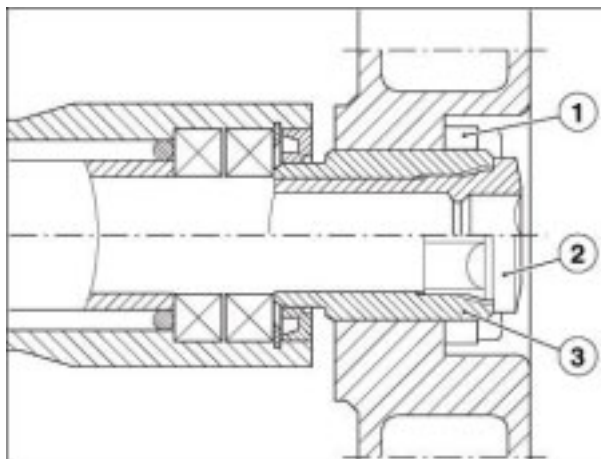
- **aprilia** part# 8140191 (tool for tightening swingarm pivot and supporting engine).
- Use the box spanner to loosen and remove the ring nut (1) on the right-hand side of the vehicle.



- Turn the swingarm pivot anticlockwise (2); this will turn and drag the adjustment bushing (3) loosening it completely.

**WARNING**

Removal must be carried out with utmost care. Support the front end of the swingarm to avoid accidental falling. Place a wooden support under the front end of the swingarm to prevent it from lowering and keep it in position.

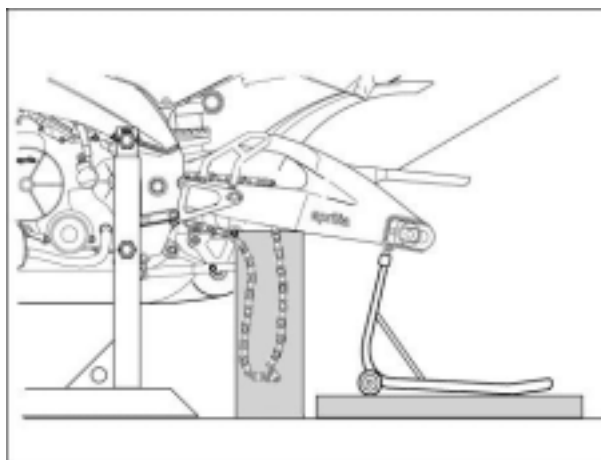


- Place the support under the front end of the swingarm.
- Support the front end of the swingarm.
- Slide the swingarm pivot (2) out from the right-hand side.

**WARNING**

When removing the swingarm ensure that the drive chain does not tangle up.

- Support the front of the swingarm and be prepared to guide its movement.
- Using the rear support stand, slide the swingarm out from the rear until it is out of the way of the vehicle.
- Slide the adjustment bushing (3) out of the swingarm pivot (2)



### 5.5.2. CHECKING THE COMPONENTS

**WARNING**

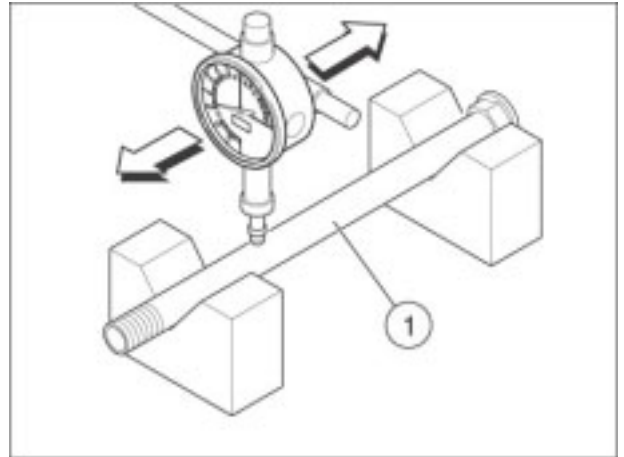
Check that all components are intact, especially those listed below.

**SWINGARM BEARINGS**

Perform the check with the bearings fitted on the swingarm.

**ROTATION CHECK**

- Manually turn the inner ring of each bearing. Rotation must be continuous, smooth and silent.



If one or both bearings do not meet the specifications:

- replace both swingarm bearings.

**DANGER**

Always replace both bearings.

Always replace bearings with bearings of the same type.

**RADIAL AND AXIAL PLAY CHECK**

- Check radial and axial play.

**Axial play: minimum axial play is accepted.**

**Radial play: none.**

If one or both bearings do not meet the specifications:

- replace both swingarm bearings.

**DANGER**

Always replace both bearings.

Always replace bearings with bearings of the same type.

**SWINGARM SEALS**

- Check that all seals are intact; replace them if they are damaged or worn.

**DANGER**

Always replace both seals.

Always replace seals with seals of the same type.

**SWINGARM PIVOT**

- Using a dial gauge, check the eccentricity of the swingarm pivot (1). If eccentricity exceeds the specified limits, replace the swingarm pivot (1).

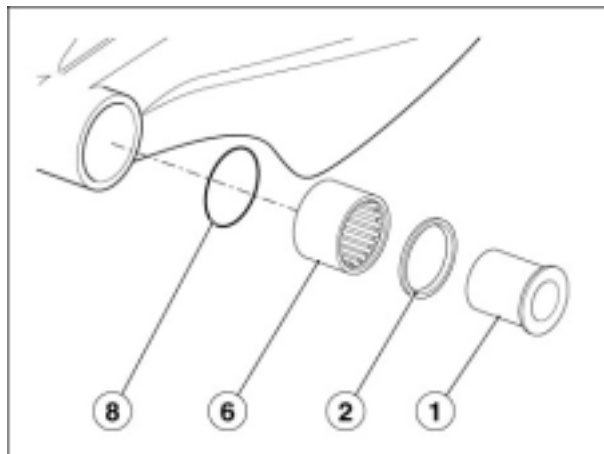
**Maximum eccentricity: 0.3 mm (0.012 in).**

## 5.5.3. REMOVING THE SWINGARM BEARINGS

- Remove the swingarm.
- Clean the two sides of the bearing housings with a cloth.
- Remove the bushing (1).
- Remove the seal (2).
- Remove the seal (3).
- Remove the circlip (4).

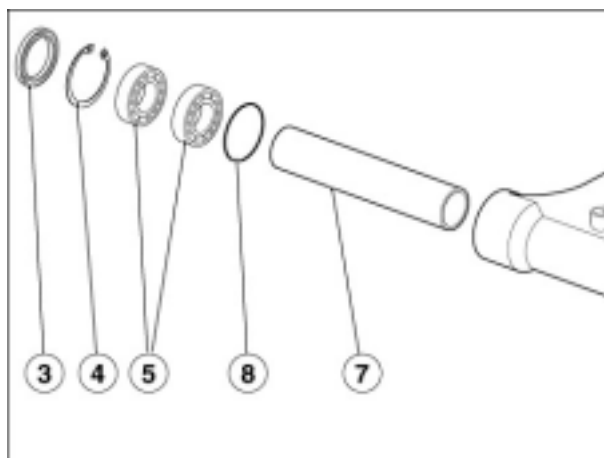
**NOTE** Use the special tool **OPT:**  
- *aprilia part# 8140180 (bearing extractor)*

- Remove the two bearings (5) and the roller bearing (6) with the extractor.

**WARNING**

After removing the bearings, check to see if they should be replaced.

- Remove the inner spacer (7) and set aside the two O-rings (8).
- Remove the inner spacer (9).
- Remove the gaskets (10).
- Remove the two roller bearings with an extractor (11).

**WARNING**

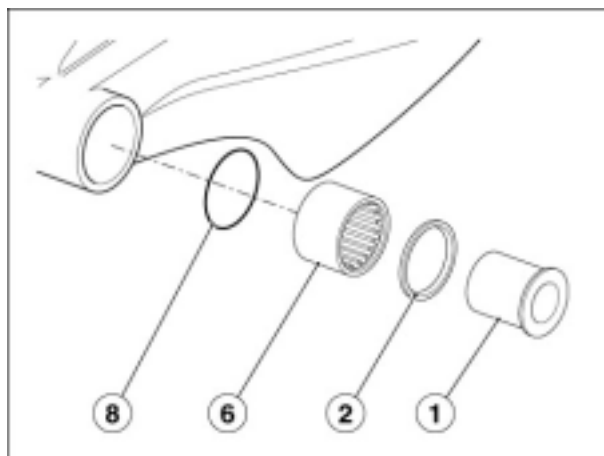
After removing the bearings, check to see if they should be replaced.

- Clean the bearing housing thoroughly.

**NOTE** Wash all components with clean detergent.

**WARNING**

When reassembling, to insert the bearings, use a drift with the same diameter as the outer ring of the bearing.  
Do not hammer the rollers and/or the inner ring.

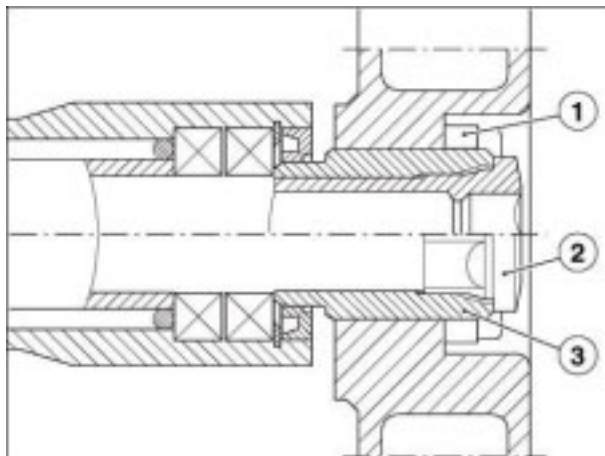




#### 5.5.4. REFITTING THE SWINGARM

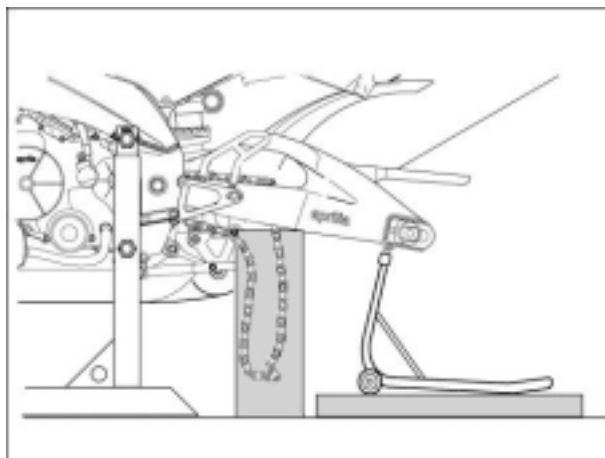
- Smear some grease all along the swingarm pivot.
- Fit the adjustment bushing (3) in its housing and tighten it manually.

**NOTE** Ensure that the adjustment bushing (3) does not protrude from the inner edge of the frame.



- Fit the drive chain on the front part (left) of the swingarm and secure it with adhesive tape.
- Place a wooden support under the front end of the swingarm to prevent it from lowering and keep it in position.
- Support the rear end of the swingarm using the rear support stand (OPT).

**NOTE** Shim the resting surface of the rear support stand (OPT) so it is in work position (fastened to the two swingarm pegs).).



- Support the front end of the swingarm; position it so that the holes are aligned and simultaneously insert the pivot completely (2).

**NOTE** Ensure that the hexagonal area of the pivot head (2) is correctly inserted in the hexagonal housing inside the adjustment bushing (3).

- Fit and manually tighten the counter nut a few turns (1).
- Fit the washer and the swingarm pivot nut on the pivot and tighten manually.



- Working on the right-hand side of the vehicle, turn the swingarm pivot (2) clockwise so it turns the adjustment bushing (3) which will push the swingarm fully home.



**NOTE** Use the special tool (**OPT**):

- **april**ia part# 8140191 (tool for tightening swingarm pivot and supporting engine).
- Tighten the locking ring nut with a box spanner (1).



- Tighten the nut.



- Remove the adhesive tape and free the chain.
- Fit the chain on the transmission sprocket.

**NOTE** Apply **LOCTITE**® Anti-Seize to the inner teeth of the transmission sprocket.

- Fit the sprocket complete with chain on the shaft.



**NOTE** Apply **LOCTITE**® 243 to the screw threading.

- Insert the washer on the screw.
- Tighten the screw.

- Working on the right-hand side, insert the shock absorber lower screw.
- Tighten the nut on the opposite side.



- Working on the right-hand side, insert the double-connecting rod/swingarm screw.
- Tighten the nut on the opposite side.



- Fit the support plate complete with brake calliper and speed sensor.
- Tighten the three guard fixing screws complete with washers.



- Fit the sprocket cover and tighten the three screws.
- Fit the rear wheel and the exhaust system.
- Adjust the drive chain tension.



## 5.5.5. TIGHTENING TORQUES

**WARNING**

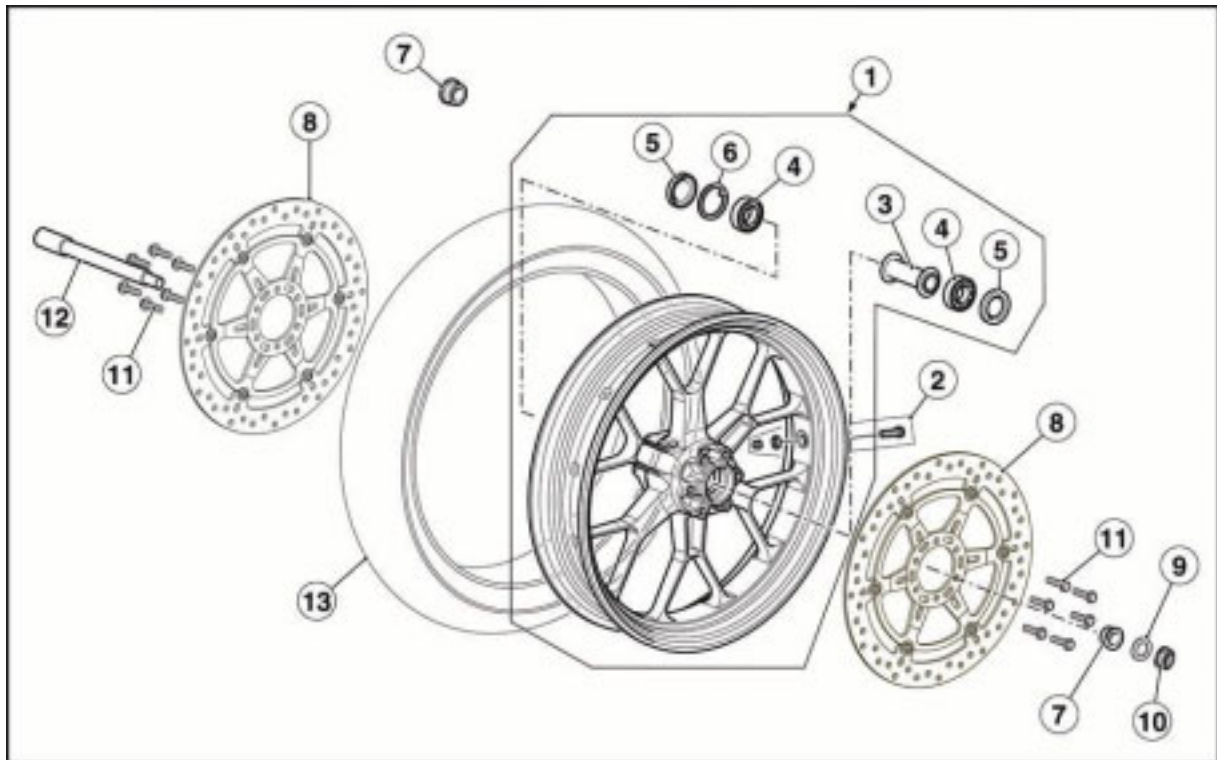
All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	Note
<b>ENGINE TO FRAME</b>					
Front engine mount	2+2	M10	50		
Upper and lower rear engine mount, LH side	2	M10	50		
Upper and lower rear engine mount, RH side of adjustment bushing	2	M20x1.5	12		
Upper and lower rear engine mount, RH side of counter nut	2	M20x1.5	50		
Upper and lower rear engine mount, RH side	2	M10	50		
<b>SWINGARM</b>					
Swingarm pivot ring nut	1	M30x1.5	60		
Swingarm pivot adjustment bushing	1	M30x1.5	12		
Swingarm pivot nut	1	M20x1.5	90		
Calliper carrier retaining pin	1	M12	50		Loctite 243
Chain tightener screw and nut	1+1	M8	Man.		
Rear brake line guide	3	M5	4		
Chain guard upper fixing screw	1	M5	4		
Chain guard and chain eye mount lower fixing screw	1	M5	5		
Chain slider	2	M5	3		
Chain eye to chain eye mount upper fixing nut	1	M5(nut)	5		
Rear stand bushing	2	M6	10		
Chain eye fixing nut	1	M6(nut)	10		
<b>REAR SHOCK ABSORBER</b>					
Shock absorber to frame	1	M10	50		
<b>REAR SUSPENSION CONNECTING RODS</b>					
Single connecting rod to frame	1	M10	50		
Single to double connecting rod	1	M10	50	-	
Double connecting rod to swingarm	1	M10	50		
Double connecting rod to shock absorber	1	M10	50		
<b>REAR WHEEL</b>					
Rear chain sprocket to sprocket carrier	5	M10	50		
Rear wheel shaft nut	1	M25x1.5	120		
<b>REAR BRAKING SYSTEM</b>					
Rear brake calliper	2	M8	25	±20%	
Rear brake lever pin	1	M8	15	±20%	Loctite 243
Rear brake fluid reservoir	1	M5	3	±20%	
Rear brake rod counter nut	1	M6	Man.	±20%	
Brake disc	5	M8	30	±20%	Loctite 243
<b>MUDGUARDS</b>					
Rear mudguard	4	M5	5		
<b>FRAME</b>					
Lower chain slider	2	M6	10		
<b>EXHAUST SYSTEM</b>					
Front exhaust pipe to engine	4	M6	12		
Rear exhaust pipe to engine (upper screws)	2	M6	/		Tighten manually
Rear exhaust pipe to engine (lower screws)	2	M6	12		
Lambda sensor	1	M18x1.5	38		
Rear manifold guard	2	M4	2,5		
Silencers to mount	2	M8	25		
Guards to silencer	2	M4	2,5		



## 5.6. FRONT WHEEL

### 5.6.1. DIAGRAM



#### Key:

1. Naked blue front wheel
2. Tubeless tyre valve
3. Internal spacer
4. 6005-2rs1 bearing
5. 30x47x7 seal
6. Circlip
7. External spacer
8. Front brake disc
9. 25.2x36x1 washer
10. Wheel shaft nut
11. M8x20 flanged screw
12. Front wheel shaft
13. 120/70 ZR17 front tyre

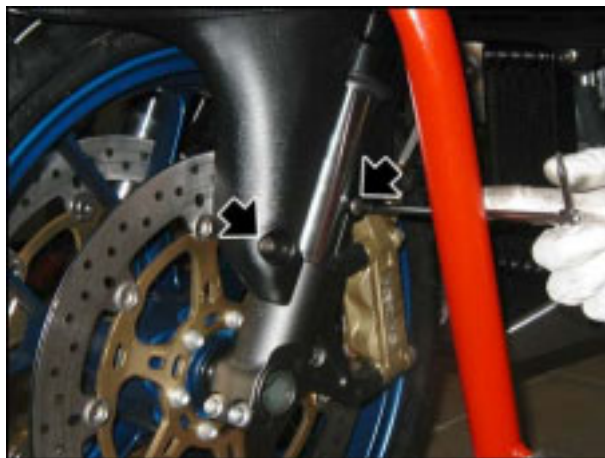


**5.6.2. REMOVING THE FRONT WHEEL**

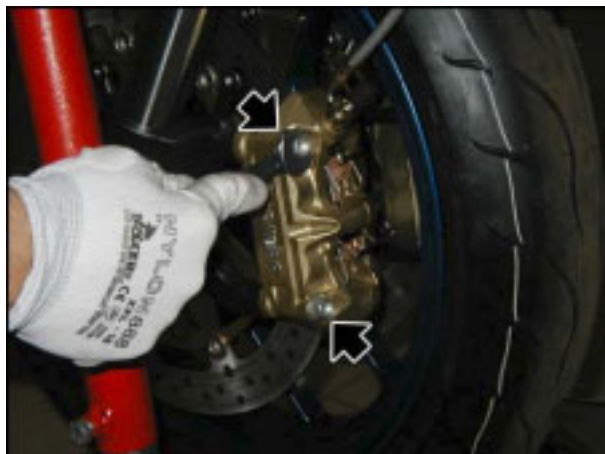
- Support the front end of the vehicle.

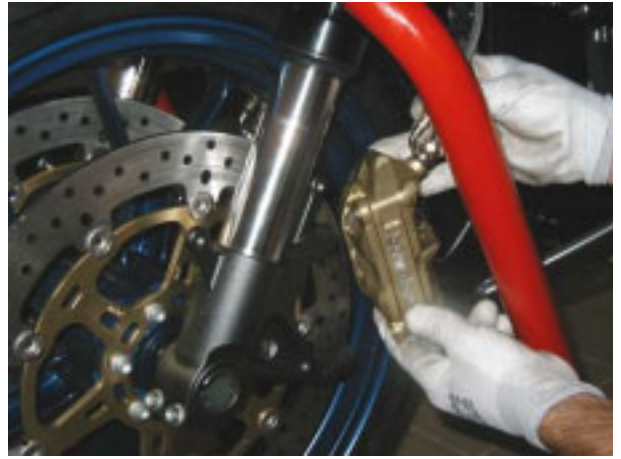


- Loosen the front mudguard screws and remove it.



- Loosen the front calliper fixing screws and slide them out of the disc.





- Remove the wheel shaft nut.



- Set aside the washer.



- Loosen the wheel shaft pinch bolts.



- Lightly tap the wheel shaft with a rubber mallet until the holes on the opposite side are uncovered.



- Remove the wheel shaft using a screwdriver inside the shaft holes.



- During this operation, support and remove the wheel.



### 5.6.3. CHECKING THE FRONT WHEEL COMPONENTS

**WARNING**

Check that all components are intact, especially those listed below.

**FRONT WHEEL BEARINGS**

Check with the bearings fitted on the wheel.

**ROTATION CHECK**

- Manually turn the inner ring of each bearing. Rotation must be continuous, smooth and silent.

If one or both bearings do not meet the specifications:

- replace both wheel bearings.

**DANGER**

Always replace both bearings.

Always replace bearings with bearings of the same type.

**RADIAL AND AXIAL PLAY CHECK**

- Check radial and axial play.

**Axial play: minimum axial play is accepted.**

**Radial play: none.**

If one or both bearings do not meet the specifications:

- replace both wheel bearings.

**DANGER**

Always replace both bearings.

Always replace bearings with bearings of the same type.

**FRONT WHEEL SEALS**

- Check that all seals are intact; replace them if they are damaged or worn.

**DANGER**

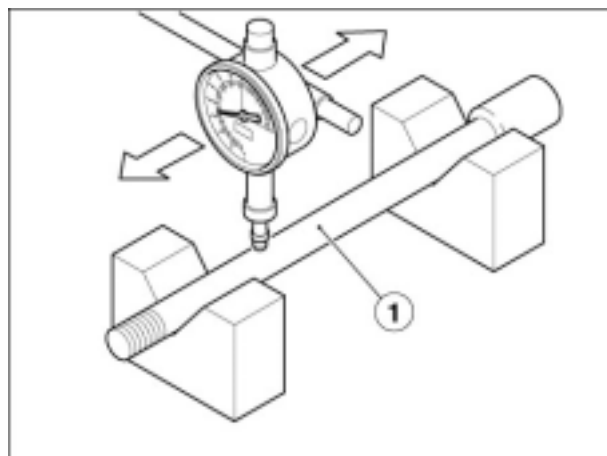
Always replace both seals.

Always replace seals with seals of the same type.

**FRONT WHEEL SHAFT**

- Using a dial gauge, check the eccentricity of the wheel shaft (1). If eccentricity exceeds the specified limits, replace the wheel shaft (1).

**Maximum eccentricity: 0.25 mm (0.0098 in).**



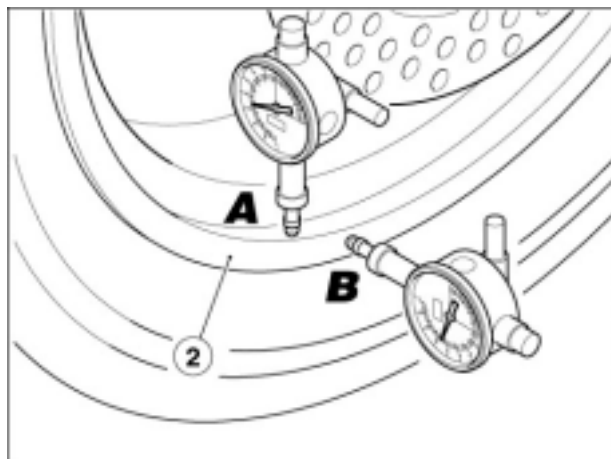
**FRONT WHEEL RIM**

- Using a dial gauge, check that the radial (A) and axial (B) eccentricity of the rim (2) does not exceed the specified limit.

Excess eccentricity is usually caused by worn or damaged bearings.

If after the bearings have been replaced the value is not within the specified limit, replace the rim (2).

**Maximum radial and axial eccentricity: 2 mm (0.0079 in).**





#### 5.6.4. REMOVING THE FRONT WHEEL BEARINGS

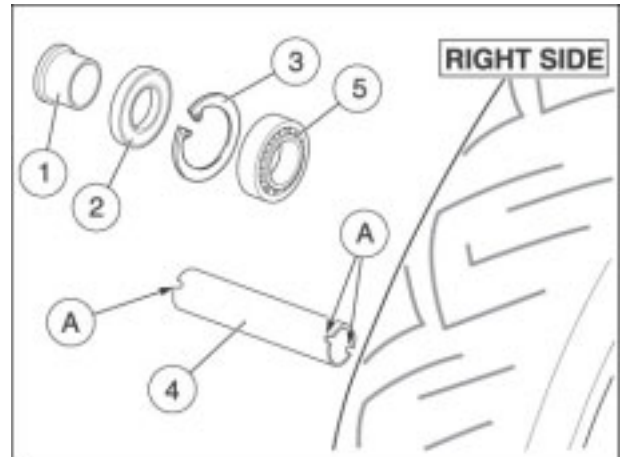
- Remove the front wheel.
- Clean the two sides of the hub with a cloth.

##### Work on the right-hand side of the wheel:

- Remove the right spacer (1).
- Remove the seal (2).
- Remove the circlip (3).

**NOTE** The circlip (3) is fitted only on the right-hand side of the wheel.

The edges of the spacer (4) feature slots (A) to allow the passage of the extractor teeth.



**NOTE** Use the special tool - **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Remove the right bearing with the extractor (5).
- Set aside the inner spacer (4).

##### Work on the left-hand side of the wheel:

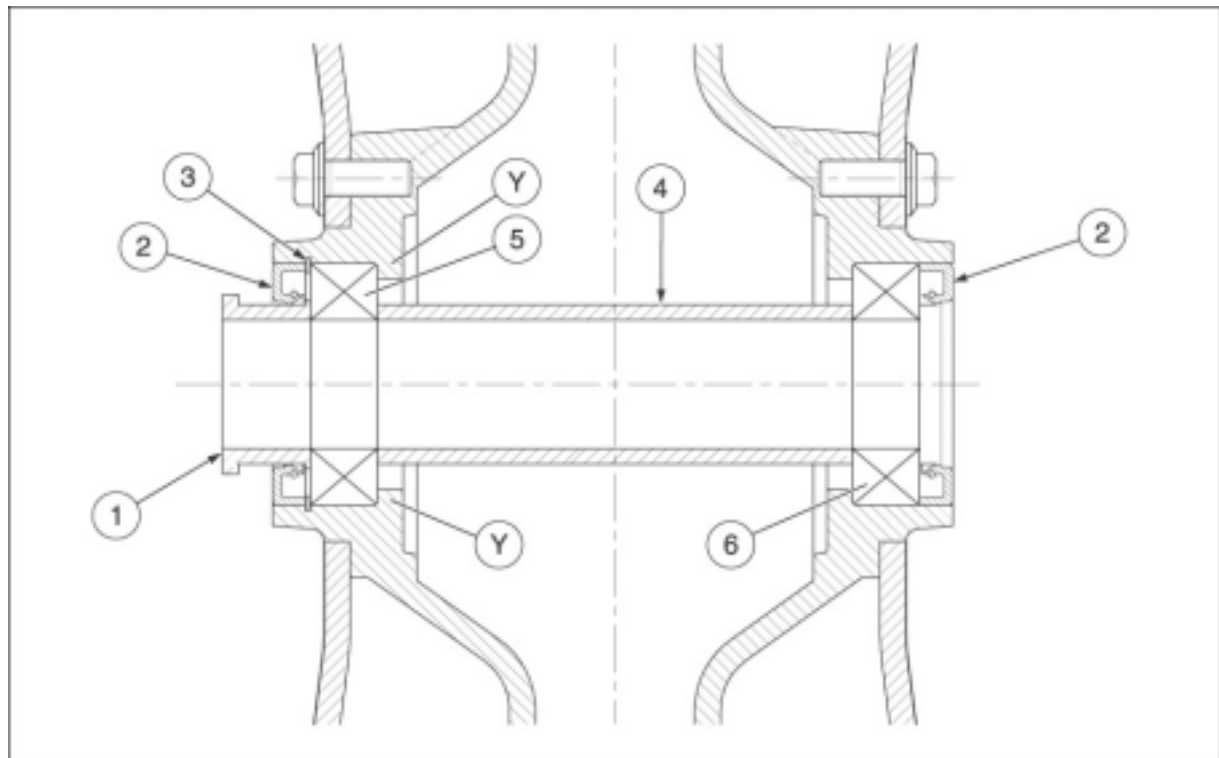
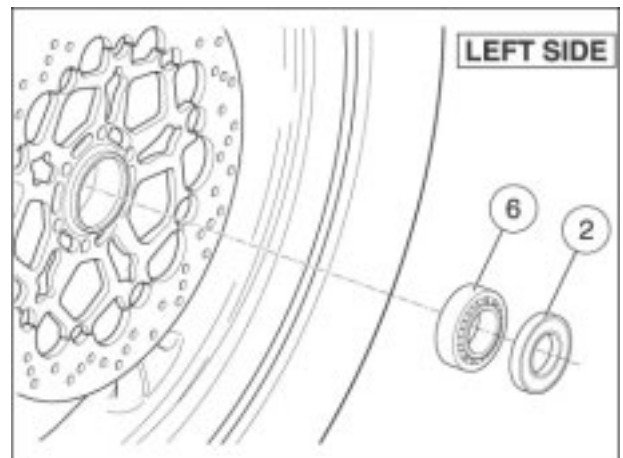
- Remove the seal (2).

**NOTE** Use the special tool - **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Remove the left bearing with the extractor (6).
- Clean the inner part of the hub thoroughly.

**NOTE** Wash all components with clean detergent.



### 5.6.5. REFITTING THE FRONT WHEEL BEARINGS

#### If fitted:

- Remove the front wheel bearings.

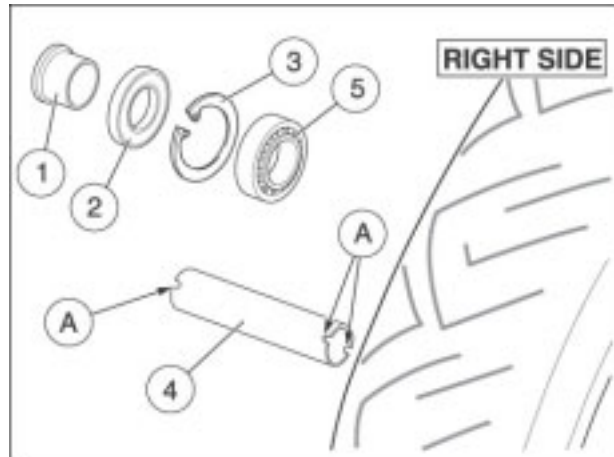
#### Work on the right-hand side of the wheel:

**NOTE** Use the special tool  
- **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Insert the right bearing (5) completely, using the drift.

**NOTE** The bearing must be inserted until it is fully home against the abutment (Y).



- Fit the circlip (3).

**NOTE** The circlip (3) is fitted only on the right side of the wheel.

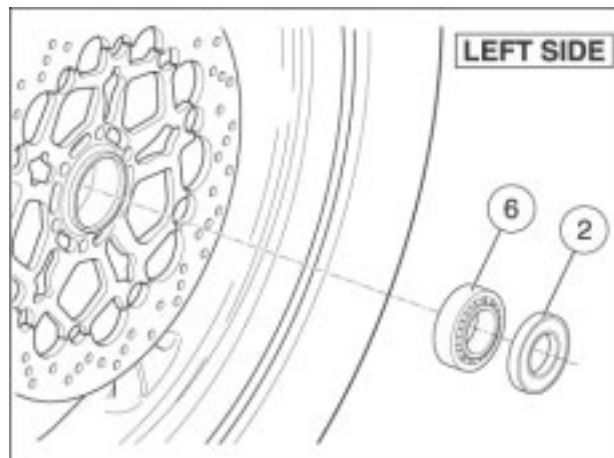
#### Work on the left-hand side of the wheel:

- Fit the spacer (4).

**NOTE** Use the special tool  
- **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Insert the left bearing (6), using the drift.



**NOTE** Complete insertion of the left bearing (6) will couple the following components:

- right bearing (5);
- spacer (4);
- left bearing (6).



#### WARNING

Once it is home against the right bearing (5) do not push further to avoid forcing the circlip (3).

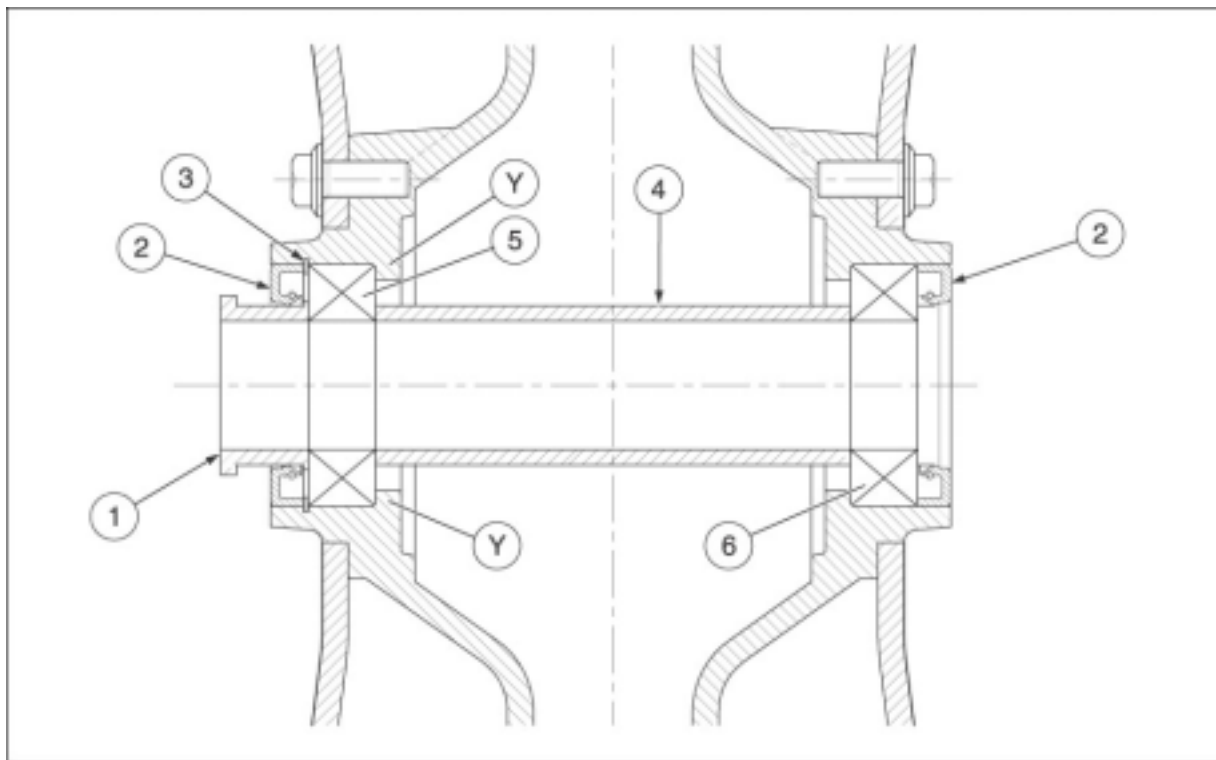
**NOTE** Once the left bearing has been fitted (6), check that the following components are coaxial:

- right bearing (5);
- spacer (4);
- left bearing (6).

- Fit a new seal (2).

#### Work on the right-hand side of the wheel:

- Fit a new seal (2).
- Fit the spacer (1) with the larger diameter facing the vehicle exterior.

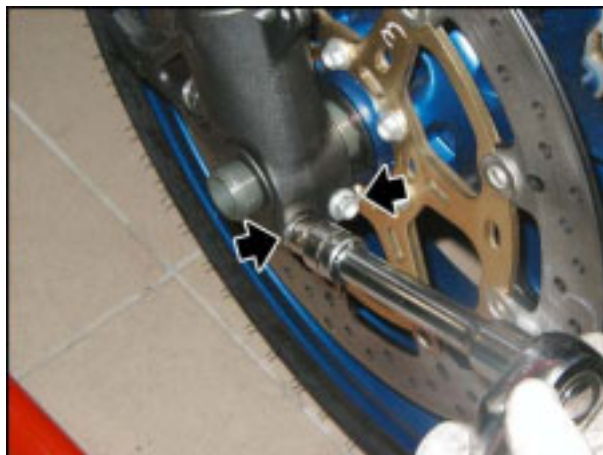


**5.6.6. FITTING THE WHEEL**

- Fit the front wheel and insert the wheel shaft in its housing.



- Tighten the clamp screws (nut side) to secure the wheel shaft.



- Fit the washer and tighten the wheel shaft nut to the specified torque.
- Work the fork to ensure that the fork legs are aligned.





- Working on both sides, tighten the clamp screws securing the wheel shaft to the specified torque.



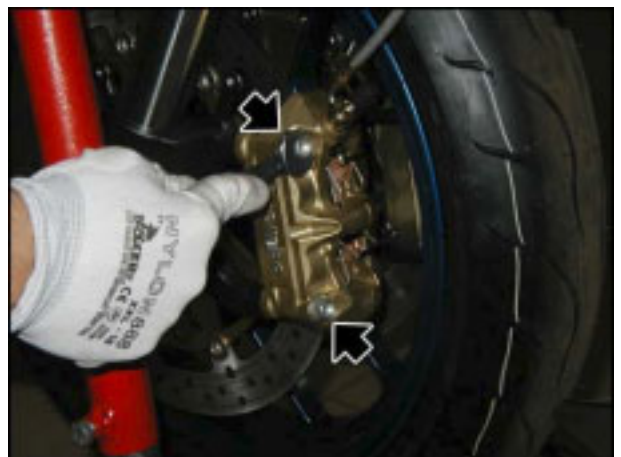
- Fit the callipers on the disc.



- Fit the brake callipers and tighten the screws to the specified torque.

**WARNING**

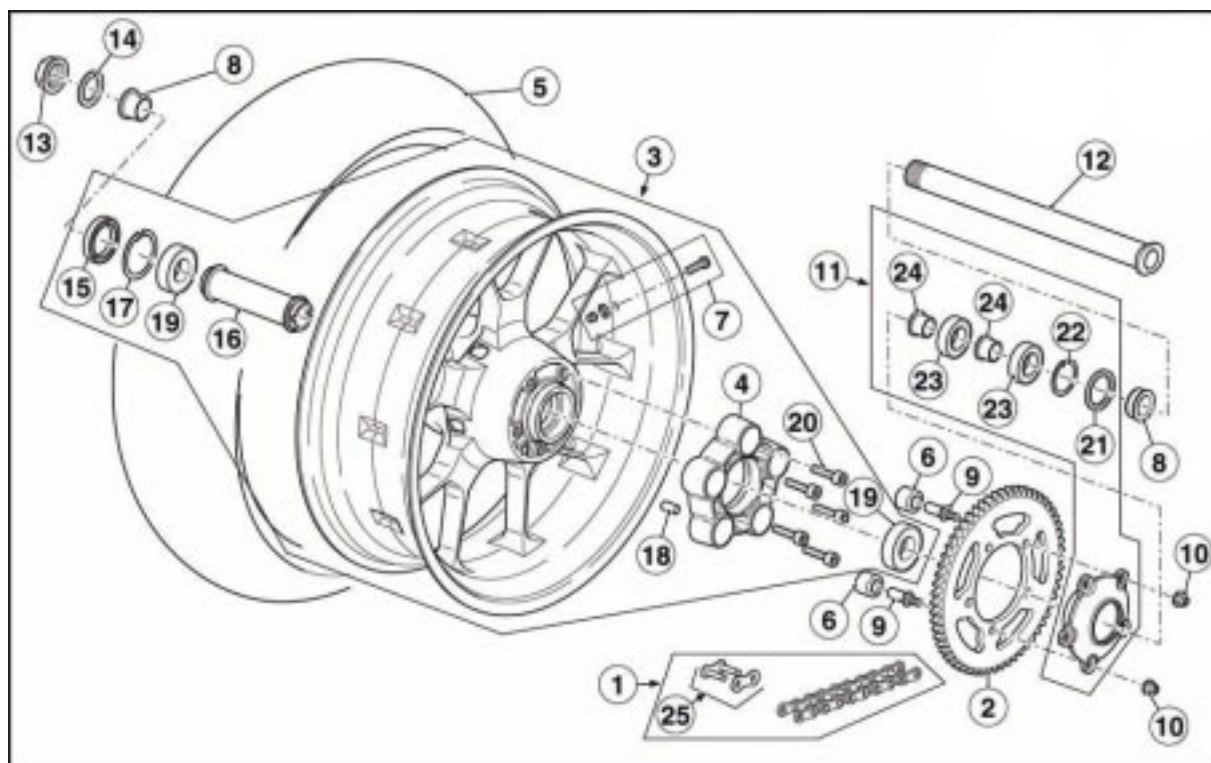
After fitting the brake callipers, pull the front brake lever repeatedly





## 5.7. REAR WHEEL

## 5.7.1. DIAGRAM



## Key:

1. Complete chain, with master link
2. Rear sprocket z=40
3. Naked blue rear wheel
4. Rear wheel vibration damper holder
5. 190/50-ZR 17" TL rear tyre
6. Vibration damper seal
7. Tubeless tyre valve
8. Rear wheel spacer
9. Retainer
10. M10 self-locking nut
11. Complete rear chain sprocket holder
12. Rear wheel shaft
13. M25x1.5 wheel shaft nut
14. 25.2x36x1 washer
15. 30x52x7 seal
16. Internal spacer
17. Circlip
18. 10x20 pin
19. 6205-2rs1 bearing
20. M10x30 TCEI screw
21. 38x52x7 seal
22. Retaining ring for 55Ø hole
23. 30x55x13 bearing
24. Vibration damper spacer
25. Master link

**5.7.2. REMOVING THE REAR WHEEL**

- Place the vehicle on the rear support stand.
- Loosen and remove the wheel shaft nut.
- Set aside the abutment washer and the left chain tightener slider.



- Lightly tap on the wheel shaft so the head comes out of its housing.



- Bring the wheel forward and free the drive chain from the rear sprocket.



- Slide the wheel shaft out together with the right chain tightener slider.



- Remove the complete wheel freeing the disc from the brake calliper.



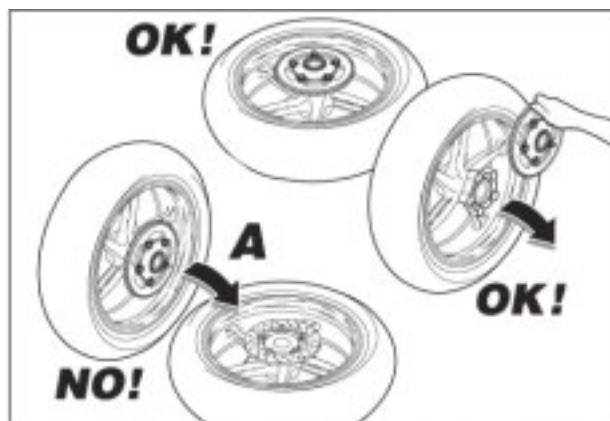


## 5.7.3. REMOVING THE FINAL DRIVE UNIT

- Remove the rear wheel.

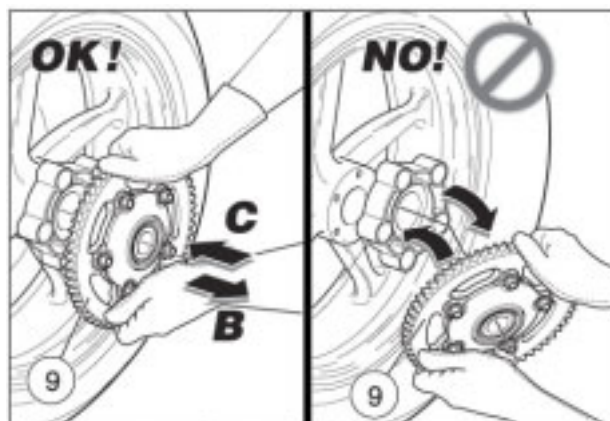
**WARNING**

Proceed with care. If the final drive unit (1) is fitted on the vibration damper holder (2) do not turn the rear wheel upside down or horizontally (A) on the rear sprocket side; the final drive unit could fall out and damage the sprocket (3).



**NOTE** Do not loosen the five nuts (4). The final drive unit comes out of the vibration damper holder as a single unit.

- Use both hands (B) to remove the final drive unit, parallel to the wheel shaft, working from the external diameter of the sprocket (3).

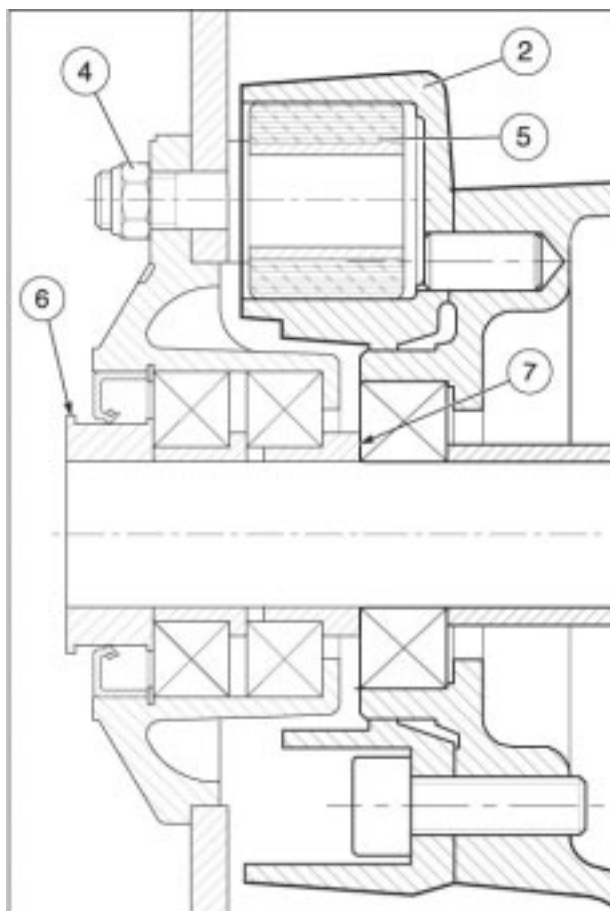
**REASSEMBLY**

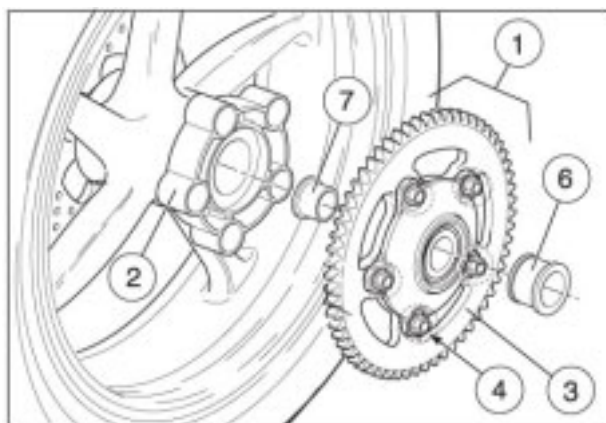
**NOTE** Fit the final drive unit parallel to the wheel shaft and place the vibration damper seals (5) in their housing on the vibration damper holder (2).

- Use both hands (C) to fit the final drive unit in the vibration damper holder, from the external diameter of the sprocket (3).

**NOTE** Do the following only if the left spacer (6) and/or the right spacer (7) have come out of their housing.

- Fit the left spacer (6) and/or the right spacer (7) in their housings with the larger diameter facing the vehicle exterior.







#### 5.7.4. CHECKING THE REAR WHEEL COMPONENTS



##### WARNING

Check that all components are intact, especially those listed below.

##### REAR WHEEL BEARINGS

Check with the bearings fitted on the wheel.

##### ROTATION CHECK

- Manually turn the inner ring of each bearing. Rotation must be continuous, smooth and silent.

If one or both bearings do not meet the specifications:

- replace both wheel bearings.



##### DANGER

Always replace both bearings.  
Always replace bearings with bearings of the same type.

##### RADIAL AND AXIAL PLAY CHECK

- Check radial and axial play.

**Axial play: minimum axial play is accepted.**

**Radial play: none.**

If one or both bearings do not meet the specifications:

- replace both wheel bearings.



##### DANGER

Always replace both bearings.  
Always replace bearings with bearings of the same type.

##### REAR WHEEL SEALS

- Check that all seals are intact; replace them if they are damaged or worn.



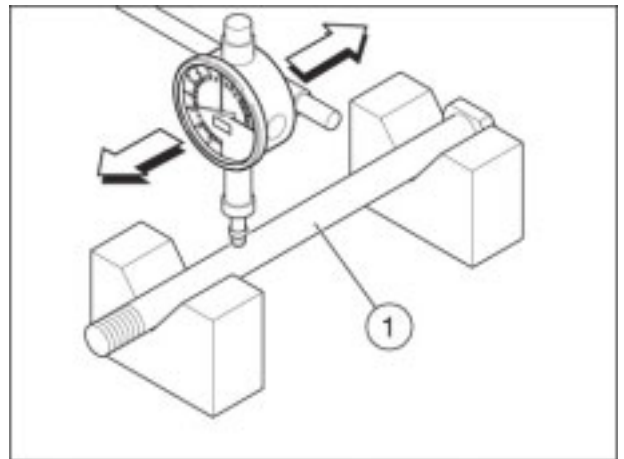
##### DANGER

Always replace both seals.  
Always replace seals with seals of the same type.

##### REAR WHEEL SHAFT

- Using a dial gauge, check the eccentricity of the wheel shaft (1). If eccentricity exceeds the specified limit, replace the wheel shaft (1).

**Maximum eccentricity: 0.25 mm (0.0098 in).**



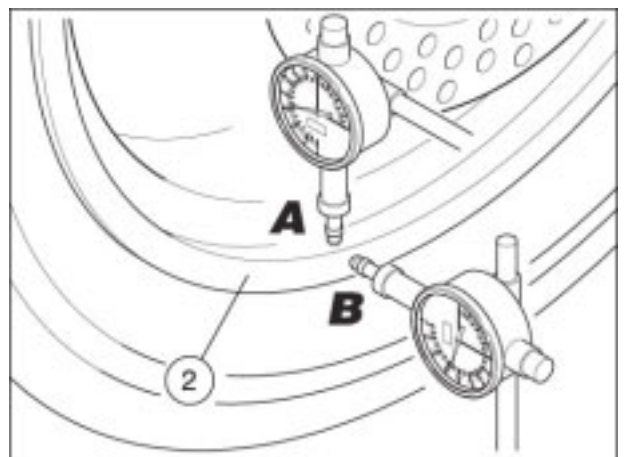
##### REAR WHEEL RIM

- Using a dial gauge, check that the radial (A) and axial (B) eccentricity of the rim (2) does not exceed the specified limit.

Excess eccentricity is usually caused by worn or damaged bearings.

If after the bearings have been replaced the value is not within the specified limit, replace the rim (2).

**Maximum radial and axial eccentricity: 2 mm (0.0079 in).**



**FINAL DRIVE UNIT BEARINGS**

Check with the bearings fitted on the final drive unit.

**ROTATION CHECK**

- Remove the left spacer (3).
- Remove the right spacer (4).
- Manually turn the inner ring of each bearing. Rotation must be continuous, smooth and silent.

If one or both bearings do not meet the specifications:

- Replace both final drive unit bearings.

**DANGER**

**Always replace both bearings.**

**Always replace bearings with bearings of the same type.**

**RADIAL AND AXIAL PLAY CHECK**

- Check radial and axial play.  
**Axial play: minimum axial play is accepted.**  
**Radial play: none.**

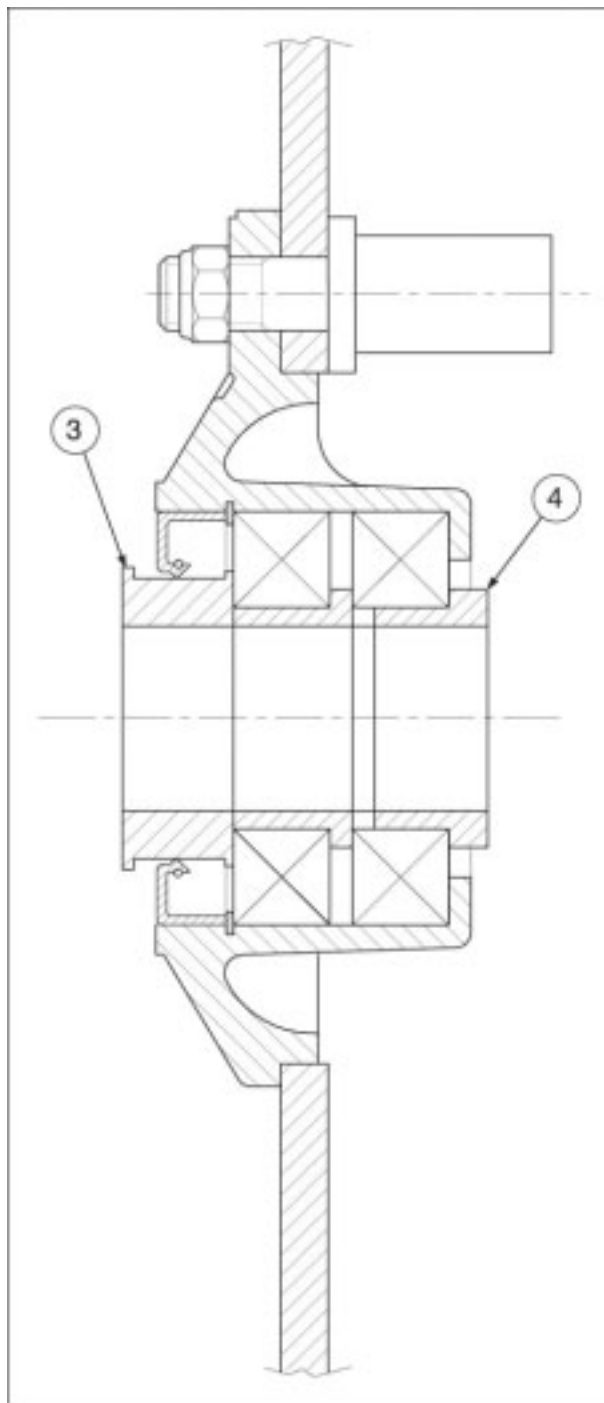
If one or both bearings do not meet the specifications:

- Replace both final drive unit bearings.

**DANGER**

**Always replace both bearings.**

**Always replace bearings with bearings of the same type.**

**VIBRATION DAMPER**

- Check that the vibration damper seals (5) are not damaged and/or excessively worn.

**To perform the check:**

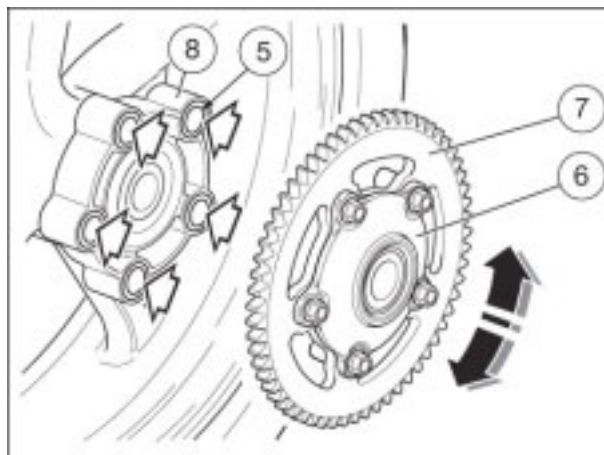
- Fit the complete final drive unit on the wheel (6).
- Manually turn the sprocket (7) in both directions and check play between the vibration damper seals (5) and the vibration damper holder (8).

**If excessive play is noticed:**

- Replace all vibration damper seals (5).

**DANGER**

**Always replace all vibration damper seals with seals of the same type.**



**REAR SPROCKET**

- Check the condition of the sprocket teeth (7).

In case of excessive wear:

- replace the rear sprocket.

**WARNING**

To avoid premature wear of new components, the rear sprocket, the front sprocket and the drive chain must be replaced as a group.



## 5.7.5. REMOVING THE REAR WHEEL BEARINGS

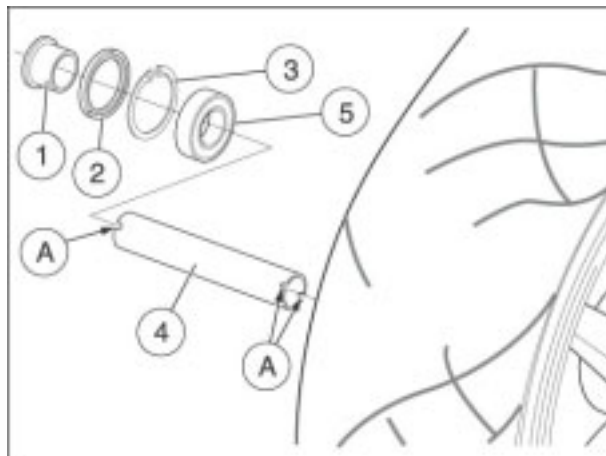
- Remove the rear wheel.
- Clean the two sides of the hub with a cloth.

**Work on the right-hand side of the wheel:**

- Remove the right spacer (1).
- Remove the seal (2).
- Remove the circlip (3).

**NOTE** The circlip (3) is fitted only on the right side of the wheel.

The edges of the spacer (4) feature slots (A) to allow the passage of the extractor teeth.



**NOTE** Use the special tool - **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Remove the right bearing with the extractor (5).
- Set aside the inner spacer (4).

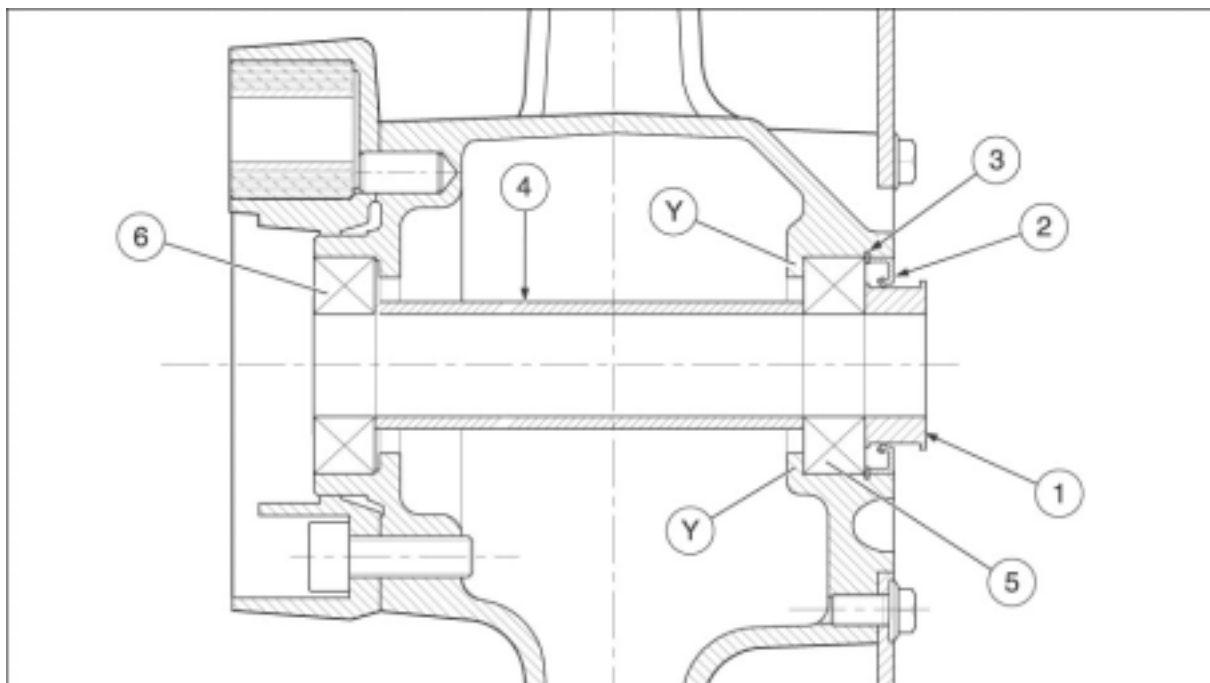
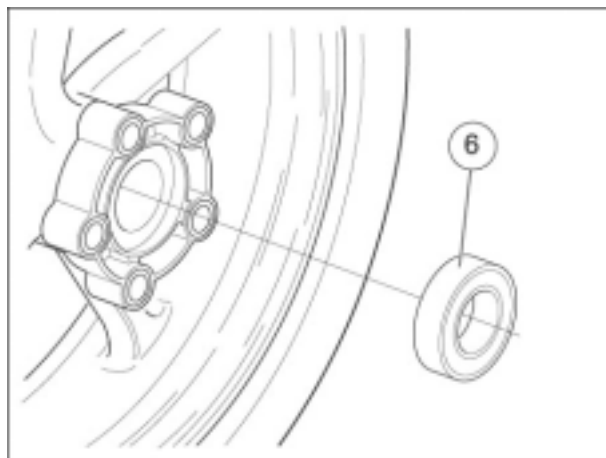
**Work on the left-hand side of the wheel:**

**NOTE** Use the special tool - **aprilia** part# 8140180 (bearing extractor)

**OPT:**

- Remove the left bearing with the extractor (6).
- Clean the inner part of the hub thoroughly.

**NOTE** Wash all components with clean detergent.



### 5.7.6. REFITTING THE REAR WHEEL BEARINGS

#### If fitted:

- Remove the rear wheel bearings.

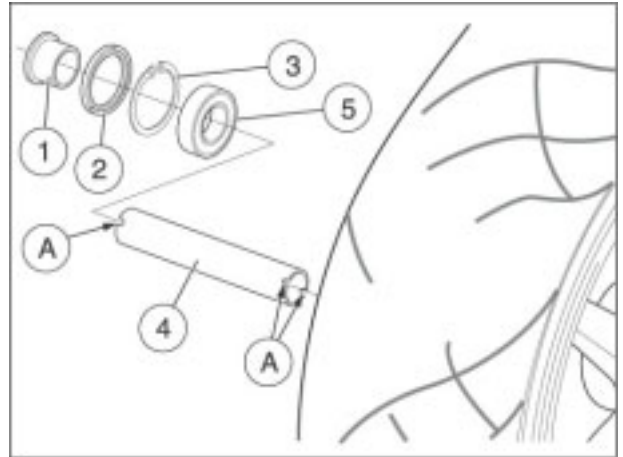
#### Work on the right-hand side of the wheel:

**NOTE** Use the special tool  
- *aprilia* part# 8140180 (bearing extractor)

**OPT:**

- Insert the right bearing (5) completely, using the drift.

**NOTE** The right bearing must be inserted until it is fully home against the abutment (Y).



- Fit the circlip (3).

**NOTE** The circlip (3) is fitted only on the right side of the wheel.

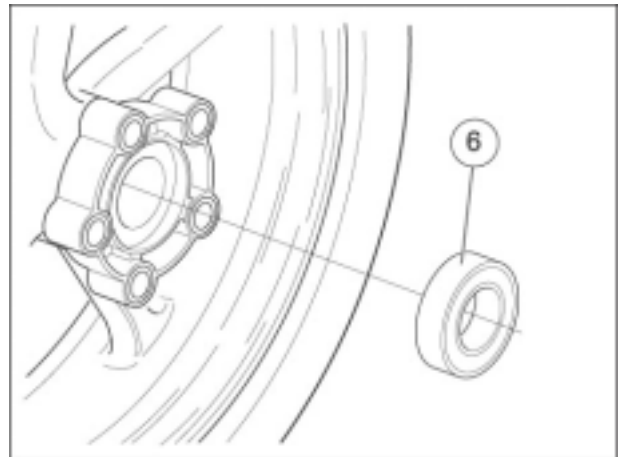
#### Work on the left-hand side of the wheel:

- Fit the spacer (4).

**NOTE** Use the special tool  
- *aprilia* part# 8140180 (bearing extractor)

**OPT:**

- Insert the left bearing (6), using the drift.



**NOTE** Complete insertion of the left bearing (6) will couple the following components:

- right bearing (5);
- spacer (4);
- left bearing (6).



#### WARNING

Once it is against the right bearing (5) do not push further to avoid forcing the circlip (3).

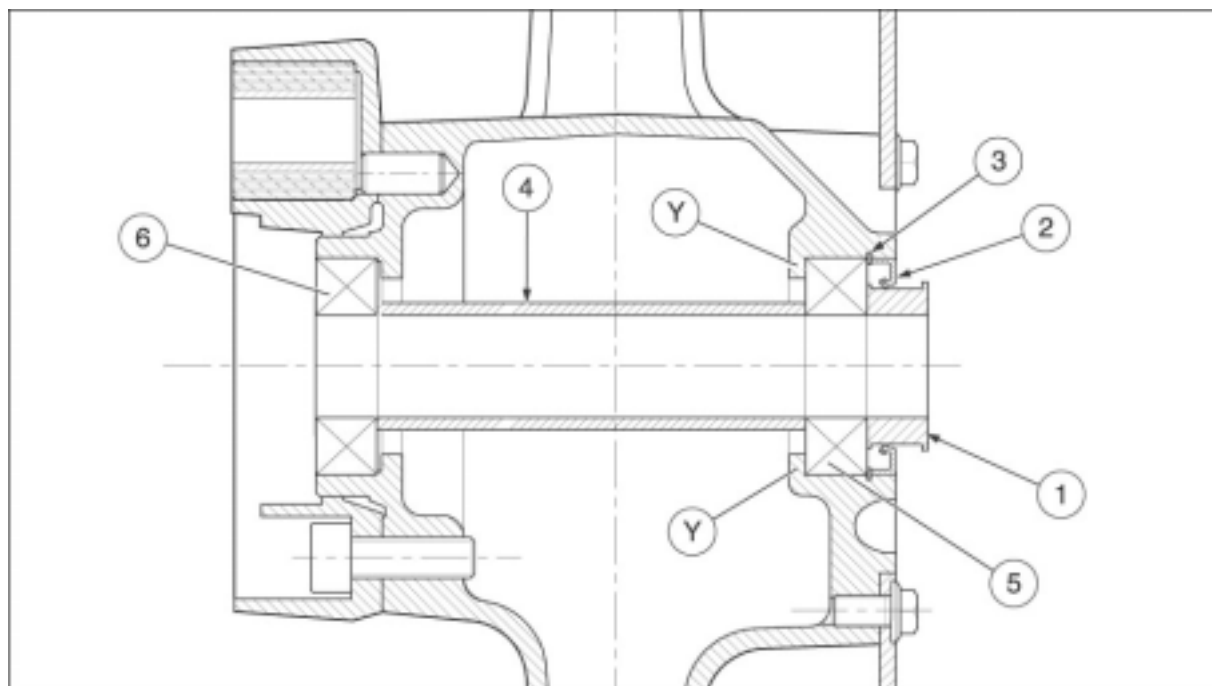
**NOTE** Once the left bearing has been fitted (6), check that the following components are coaxial:

- right bearing (5);
- spacer (4);
- left bearing (6).

#### Work on the right-hand side:

- Fit a new seal (2).
- Fit the spacer (1) with the larger diameter facing the vehicle exterior.

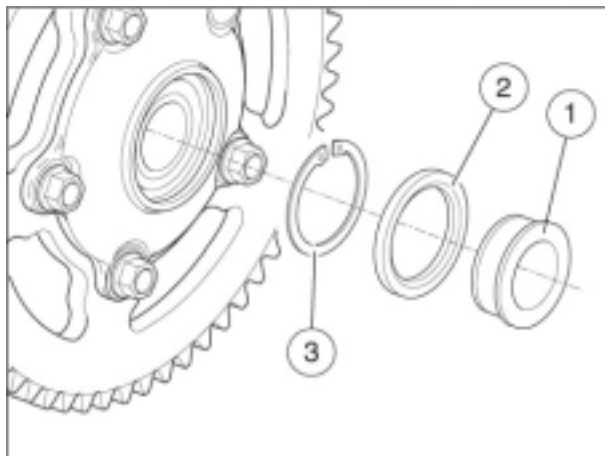




### 5.7.7. REMOVING THE FINAL DRIVE UNIT BEARINGS

- Remove the final drive unit.
- Clean the two sides of the hub with a cloth.
- Remove the left spacer (1).
- Remove the seal (2).
- Remove the circlip (3).

**NOTE** The circlip (3) is fitted only on the left side of the final drive unit.

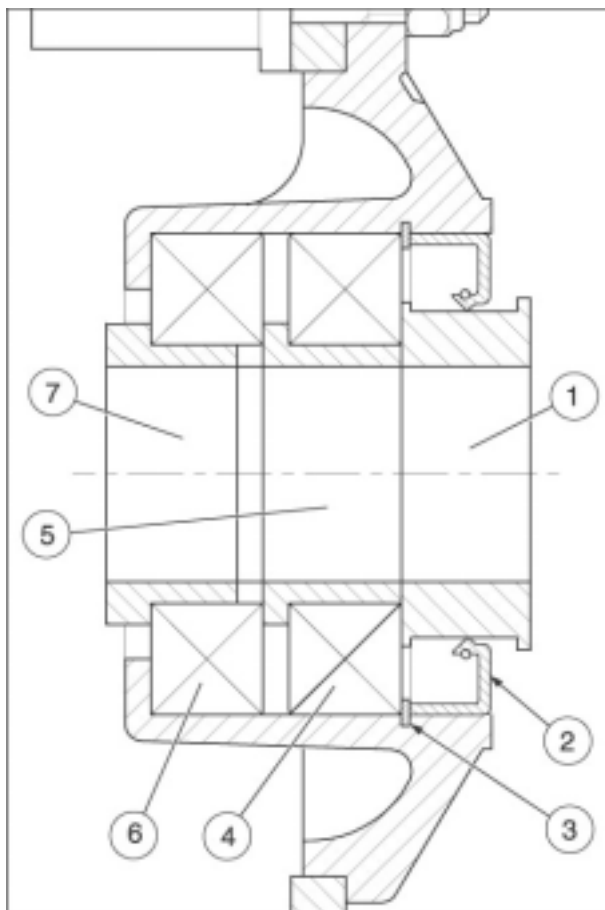
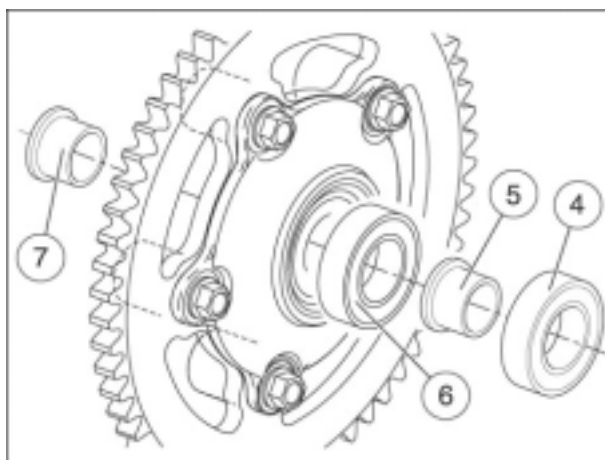


**NOTE** Use the special tool - *aprilia* part# 8140180 (bearing extractor)

**OPT:**

- Remove the left bearing with the extractor (4).
- Set aside the inner spacer (5).
- Remove the right bearing with the extractor (6).
- Set aside the right spacer (7).
- Clean the inner part of the hub thoroughly.

**NOTE** Wash all components with clean detergent.



## 5.7.8. REFITTING THE FINAL DRIVE UNIT BEARINGS

If fitted:

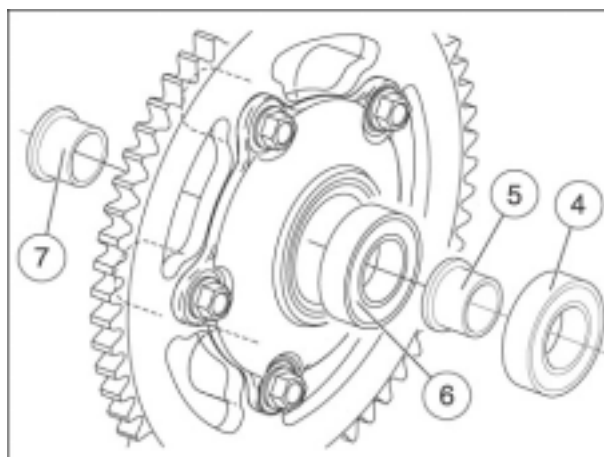
- Remove the final drive unit bearings.

Work on the left-hand side:

**NOTE** Use the special tool  
- *aprilia* part# 8140180 (bearing extractor)

**OPT:**

- Insert the right bearing (6) completely, using the drift.

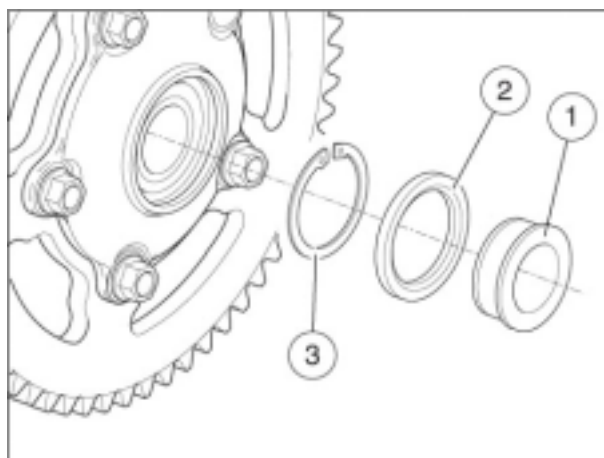


**NOTE** The right bearing must be inserted until it is fully home against the abutment (Y).

- Fit the inner spacer (5).
- Insert the left bearing (4), using the drift.

**NOTE** Complete insertion of the left bearing (4) will couple the following components:

- right bearing (6);
- inner spacer (5);
- left bearing (4).



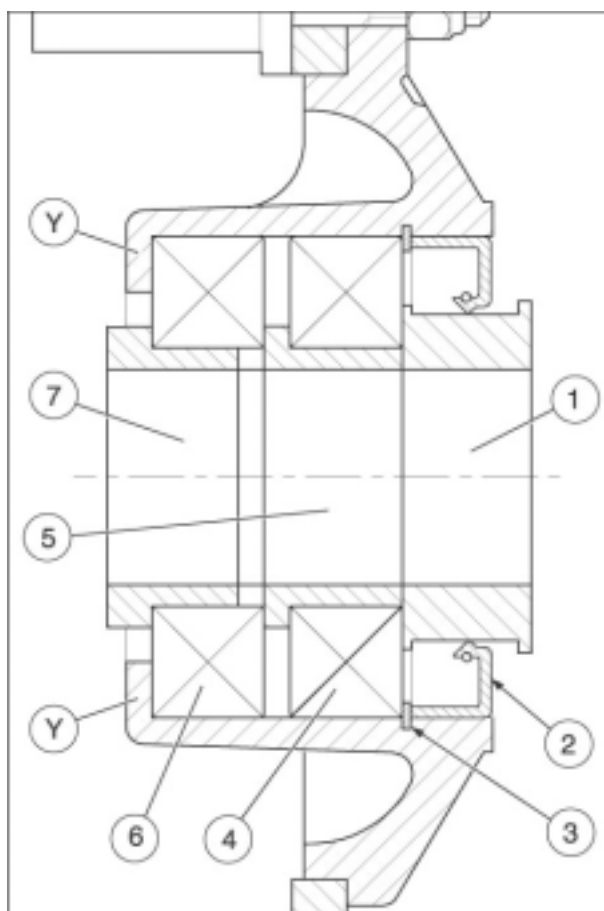
- Fit the circlip (3).

**NOTE** The circlip (3) is fitted only on the left side of the final drive unit.

- Fit a new seal (2).
- Fit the left spacer (1) with the larger diameter facing the vehicle exterior.

Work on the right-hand side:

- Fit the right spacer (7) with the larger diameter facing the vehicle exterior.



**5.7.9. REMOVING THE VIBRATION DAMPER SEALS**

- Remove the final drive unit.

**NOTE** *The vibration damper seals are fitted on the vibration damper holder.*

- Remove all vibration damper seals.



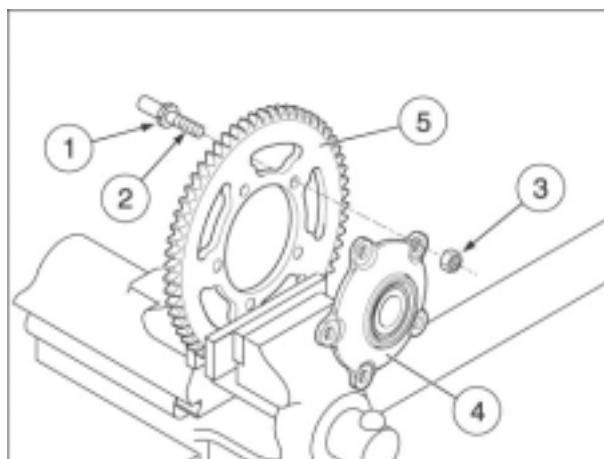
## 5.7.10. REMOVING THE REAR SPROCKET

- Using a setscrew wrench (1), lock threaded pin rotation (2), loosen and remove the self-locking nut (3) and the threaded pin (2).

**WARNING**

Replace the self-locking nuts (3) every three times the rear sprocket is removed.

Replace the self-locking nuts (3) with nuts of the same type.



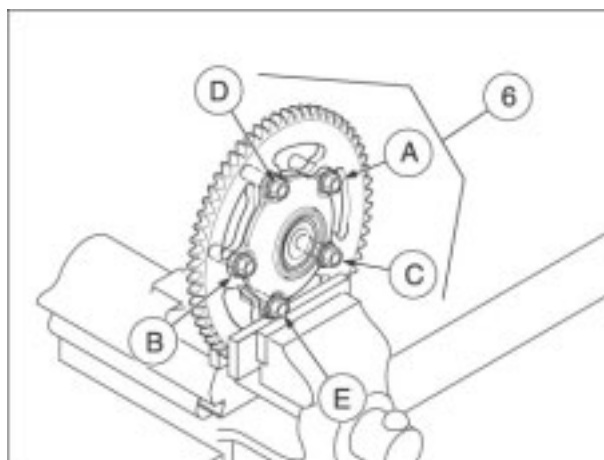
- Remove the rear sprocket holder (4).
- Clean the rear sprocket (5) and the holder (4) with clean detergent.

**Reassembly:**

- Fit the five threaded pins (2) on the rear sprocket (5).
- Assemble the rear sprocket holder and the rear sprocket complete with threaded pins.
- Manually tighten the self-locking nuts (3).

**WARNING**

Do not fit the final drive unit (6) on the wheel to tighten the self-locking nuts.

**WARNING**

To protect the rear sprocket, fit (wooden or aluminium) protections on the vice grips. Clamp only the rear sprocket in the vice; do not clamp any other components of the final drive group.

- Clamp the rear sprocket in the vice.

**NOTE** To avoid possible deformation and/or imperfect mating, tighten according to the instructions below:

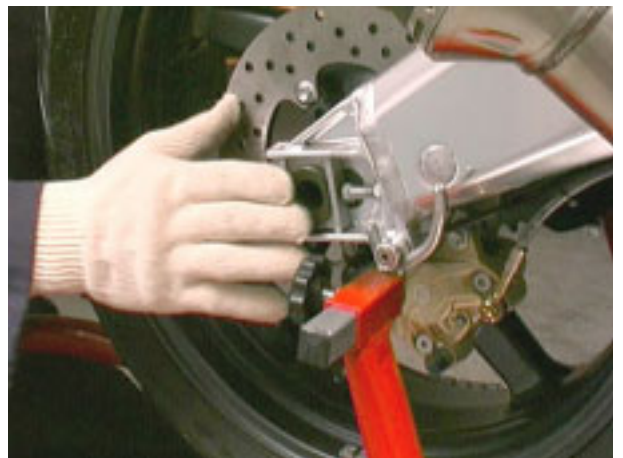
- Using a setscrew wrench (1) lock the rotation of the threaded pin (2) and apply half the specified torque; tighten the elements opposite each other in the following order: (A) (B) (C) (D) (E).
- Repeat the above procedure applying the specified tightening torque.

**NOTE** In this way the stress applied by the fixing elements will be evenly distributed over the joint surface.



**5.7.11. REFITTING THE REAR WHEEL**

- Fit the wheel shaft, together with the right chain guide slider, on the swingarm.
- Fit the rear wheel and insert the wheel shaft in its housing.
- Bring the wheel forward and fit the drive chain on the rear sprocket.
- Fit the left chain tightener slider and the abutment washer on the shaft.





- Manually tighten the nut.
- Check the chain tension.



- Tighten the fixing nut to the specified torque.



## 5.7.12. TIGHTENING TORQUES

**WARNING**

All fasteners listed in the table must be tightened to the specified torque using a torque wrench and LOCTITE® where specified.

DESCRIPTION	QUANTITY	NUT/BOLT	TORQUE (Nm)	TOL.	Note
<b>SWINGARM</b>					
Swingarm pivot ring nut	1	M30x1.5	60		
Swingarm pivot adjustment bushing	1	M30x1.5	12		
Swingarm pivot nut	1	M20x1.5	90		
Calliper carrier retaining pin	1	M12	50		Loctite 243
Chain tightener screw and nut	1+1	M8	Man.		
Rear brake line guide	3	M5	4		
Chain guard upper fixing screw	1	M5	4		
Chain guard and chain eye mount lower fixing screw	1	M5	5		
Chain slider	2	M5	3		
Chain eye to chain eye mount upper fixing nut	1	M5(nut)	5		
Rear stand bushing	2	M6	10		
Chain eye fixing nut	1	M6(nut)	10		
<b>REAR WHEEL</b>					
Rear chain sprocket to sprocket carrier	5	M10	50		
Rear wheel shaft nut	1	M25x1.5	120		
<b>REAR BRAKING SYSTEM</b>					
Rear brake calliper	2	M8	25	±20%	
Rear brake lever pin	1	M8	15	±20%	Loctite 243
Rear brake fluid reservoir	1	M5	3	±20%	
Rear brake rod counter nut	1	M6	Man.	±20%	
Brake disc	5	M8	30	±20%	Loctite 243
<b>MUDGUARDS</b>					
Rear mudguard	4	M5	5		
<b>FRAME</b>					
Lower chain slider	2	M6	10		
Seat frame	4	M10	50		

## 5.8. FRONT BRAKE

### 5.8.1. CHANGING THE PADS

#### TIGHTENING TORQUES

Brake calliper screws (1) 50 Nm (5 kgm)



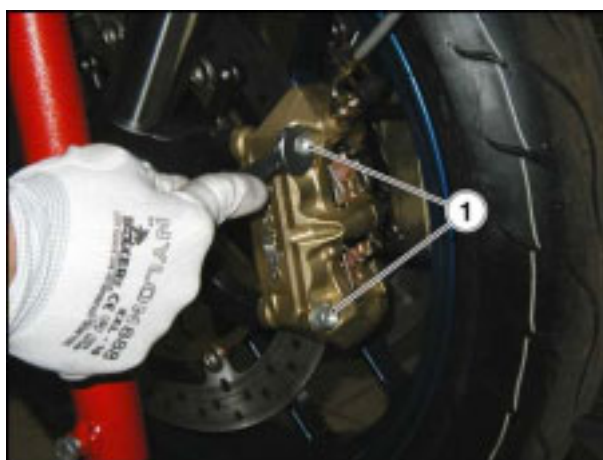
#### WARNING

This vehicle is equipped with a double-disc front brake system (right and left side). Always replace all the pads of both front brake callipers.

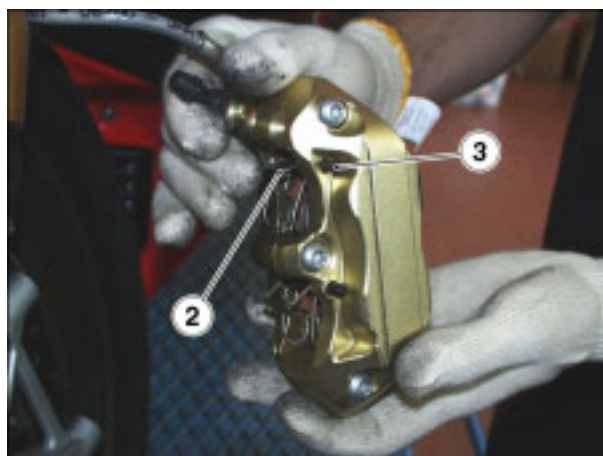
Replacing the pads of only one front calliper would compromise the stability and safety of the vehicle, potentially resulting in danger for people, things and the vehicle itself.

**NOTE** The following procedure refers to a single calliper but applies to both.

- Loosen and remove the two brake calliper fixing screws (1).
- Remove the front brake calliper from the disc.



- Press on the safety spring (2) and simultaneously slide the pin out (3).
- Remove the safety spring (2).





- Remove the two pads (4).

**WARNING**

Do not pull the brake lever when the pads are not in place or the calliper pistons might come out of their housing, thus causing brake fluid leakage.

- Fit two new pads and position them correctly.

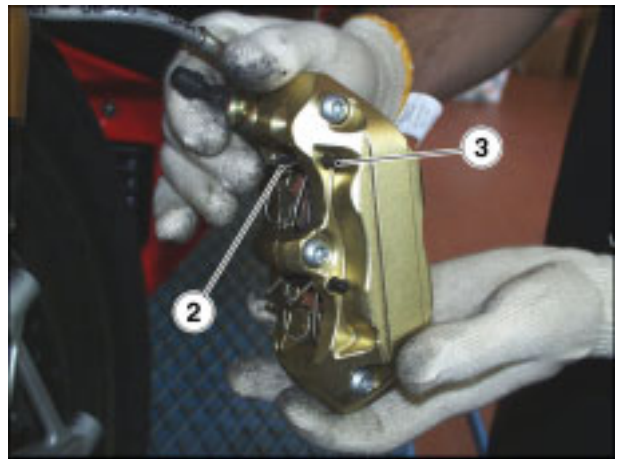
**WARNING**

Always replace all four pads and ensure they are correctly in place inside the calliper.

- Fit the safety spring (2).
- Press on the safety spring (2) and simultaneously insert the pin from the inside (3).
- Release the safety spring (2) and hook it correctly on the pin (3).

**DANGER**

When it is released, the safety spring (2) must secure the pin (3) by entering the housings. If positioned correctly the pin (3) will not slip out; check this condition.



- Fit the front brake calliper on the disc.
- Manually tighten the two screws completely (1).
- Pull the front brake lever to allow the brake calliper to bed correctly.
- Keeping the brake lever pulled, tighten the two screws (1).
- Check the front brake fluid level.



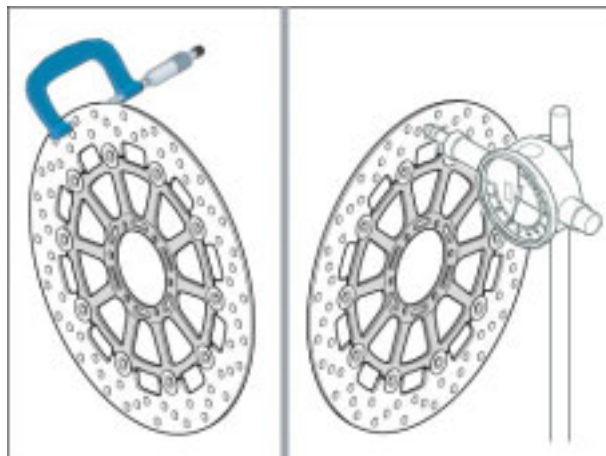


**5.8.2. CHECK****Brake discs:**

**NOTE** Perform the following operations with the brake discs fitted on the wheel, the information provided below refers to one disc but applies to both.

- Check disc wear by measuring the minimum thickness in various points with a micrometer.  
If the minimum thickness is lower than the minimum value, even if only in one point, replace the disc.

**Minimum disc thickness value: 4 mm (0.16 in)**



- Using a dial gauge, check that the disc maximum oscillation does not exceed tolerance; if so, replace it.

**Disc oscillation tolerance: 0.3 mm (0.012 in).**

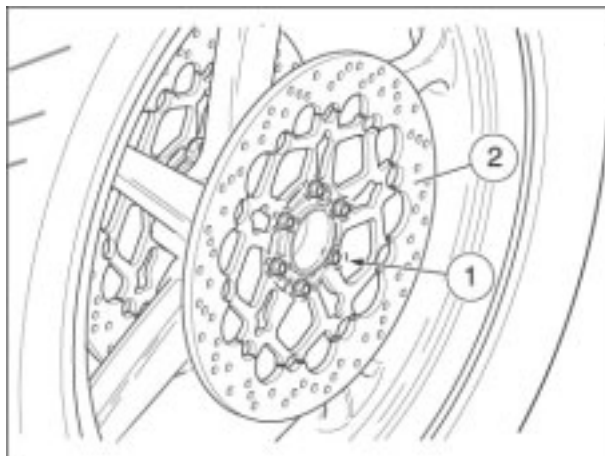
### 5.8.3. REMOVING THE DISCS

- Remove the front wheel.

**NOTE** The information provided below refers to one disc but applies to both.

To loosen the screws (1) we recommend the use of a pneumatic screw gun which will resist the strength of the LOCTITE® 243.

- Loosen and remove the six brake disc screws (1).

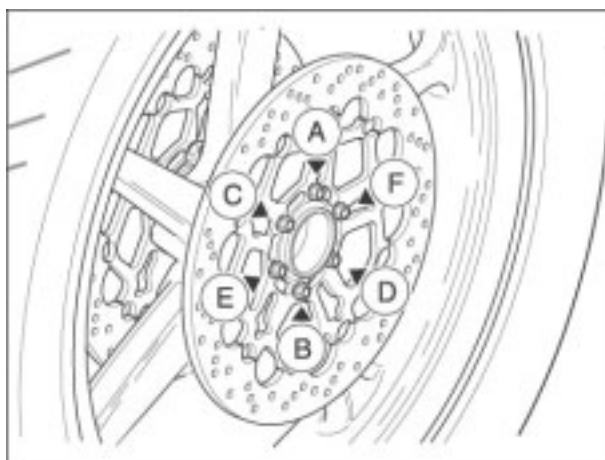


**WARNING**

When refitting, apply LOCTITE® 243 to the thread of the brake disc screw (1).

**NOTE** When refitting, fit all the screws (1) manually and tighten them observing a cross pattern in the following order: A-B-C-D-E-F.

- Remove the brake disc (2).



#### 5.8.4. BLEEDING THE BRAKE SYSTEM

##### FRONT BRAKE

**NOTE** Make sure to have a flexible tube and a container of adequate size ready at hand before beginning the bleeding procedure.

- Connect the tube to the brake master cylinder bleed valve.



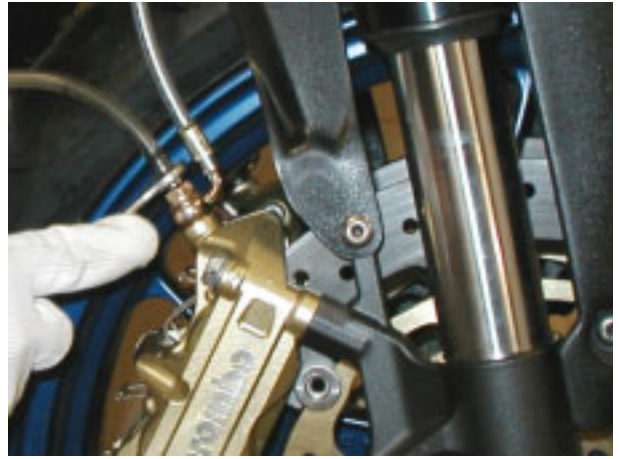
- Pull the lever and slightly open the bleed valve on the master cylinder to release the air.
- Close the bleed valve before reaching the end of stroke with the lever and repeat the procedure until all the air is released.



- Working from both sides, connect the tube to the brake calliper bleed valve.



- Pull the brake lever and slightly open the bleed valve on the calliper you wish to bleed to release the air.
- Close the bleed valve before reaching the end of stroke with the lever and repeat the procedure until all the air is released.
- As a precaution repeat the bleed procedure on the brake master cylinder.



## REAR BRAKE

**NOTE** Make sure to have a flexible tube and a container of adequate size ready at hand before beginning the bleeding procedure.

- Remove the fairing, see (DISASSEMBLING THE UPPERWORKS).
  - Connect the tube to the brake master cylinder bleed valve.
- 
- Pull the lever and slightly open the bleed valve on the master cylinder to release the air.
  - Close the bleed valve before reaching the end of stroke with the lever and repeat the procedure until all the air is released.
- 
- Connect the tube to the brake calliper bleed valve.



- Pull the brake lever and slightly open the bleed valve on the calliper you wish to bleed to release the air.
- Close the bleed valve before reaching the end of stroke with the lever and repeat the procedure until all the air is released.
- As a precaution repeat the bleed procedure on the brake master cylinder.





## 5.9. REAR BRAKE PADS

### 5.9.1. REPLACING THE REAR BRAKE PADS

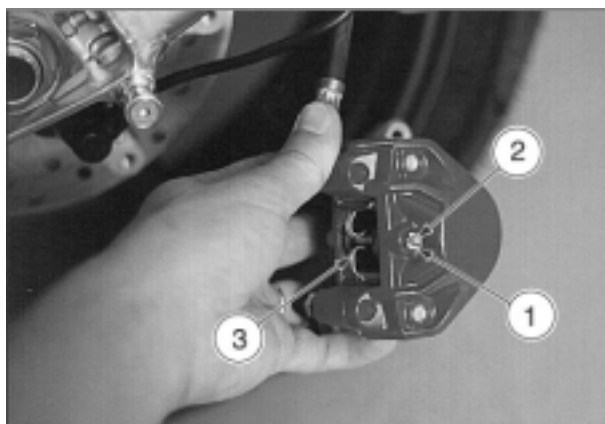
- Place the vehicle on the stand.
- Remove the rear brake calliper.



#### WARNING

Do not pull the rear brake lever when the calliper has been removed as this could cause the piston to come out of its housing and determine brake fluid leakage.

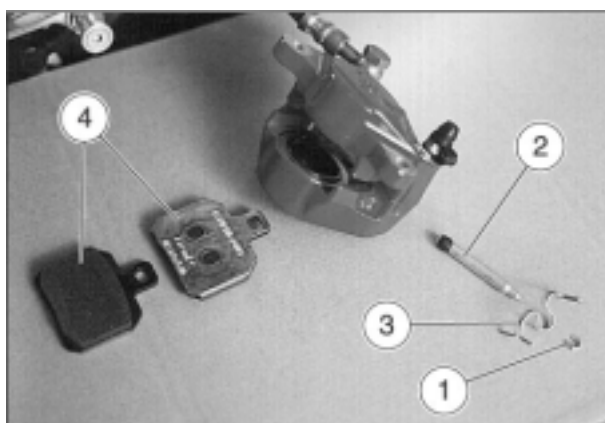
- Remove the stop ring (1).



#### WARNING

Before removing the pin (2), check the position of the safety spring (3); refit in the same position.

- Remove the pin (2) and collect the safety spring (3).
- Remove the two pads (4) and collect the noise dampening plates.



#### WARNING

Do not pull the brake lever when the pads are not in place or the calliper pistons might come out of their housing, thus causing brake fluid leakage.

- Replace the anti-vibration plates if worn.



#### WARNING

When refitting the anti-vibration plates, make sure the arrows point in the direction of travel.

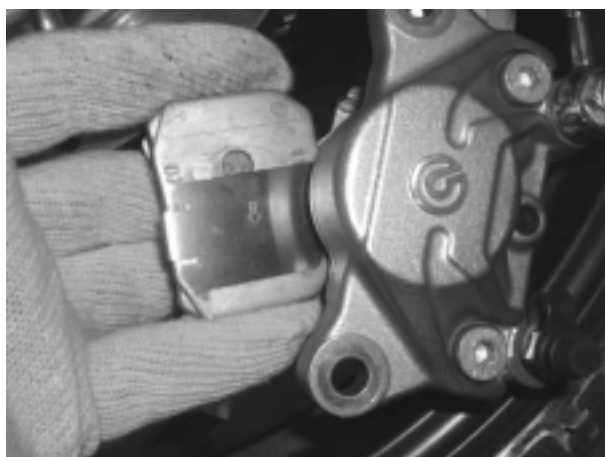
- Fit the two new pads together with the anti-vibration plates, fit them so the holes match those on the calliper.



#### WARNING

Always change both pads and ensure they are correctly in place inside the calliper.

- Fit the safety spring (3).
- Keeping the centre of the safety spring (3) pressed, insert the pin (2) so it passes over it.
- Fit the stop ring (1).
- Check the brake fluid level



**5.9.2. CHECKING THE REAR BRAKE DISC**

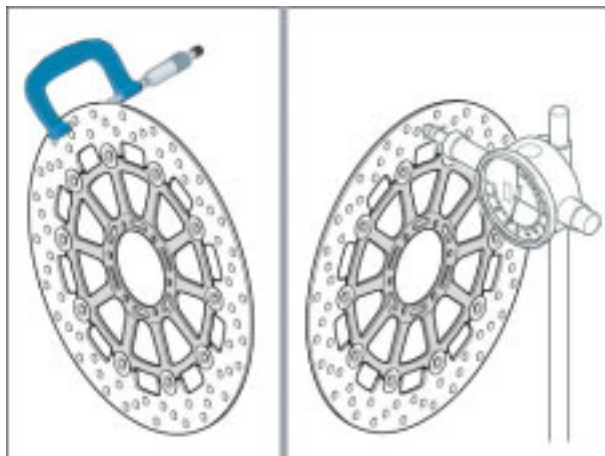
**NOTE** Perform this operation with the brake disc fitted on the wheel.

- Check disc wear by measuring the minimum thickness in various points with a micrometer.
- If the minimum thickness is lower than the minimum value, even if only in one point, replace the disc.

**Minimum disc thickness value: 4 mm (0.16 in)**

- Using a dial gauge, check that the disc maximum oscillation does not exceed tolerance; if so, replace it.

**Disc oscillation tolerance: 0.3 mm (0.012 in)**



### 5.9.3. REMOVING THE REAR BRAKE DISC

- Remove the rear wheel.

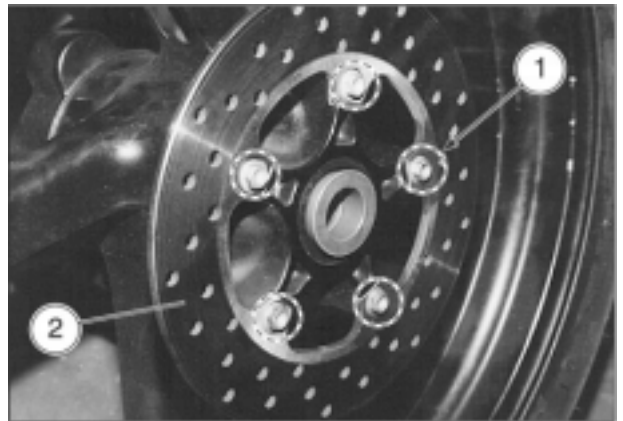
**NOTE** To loosen the screws (1) we recommend the use of a pneumatic screw gun which will resist the strength of the LOCTITE® 243.

- Loosen and remove the five brake disc screws (1).



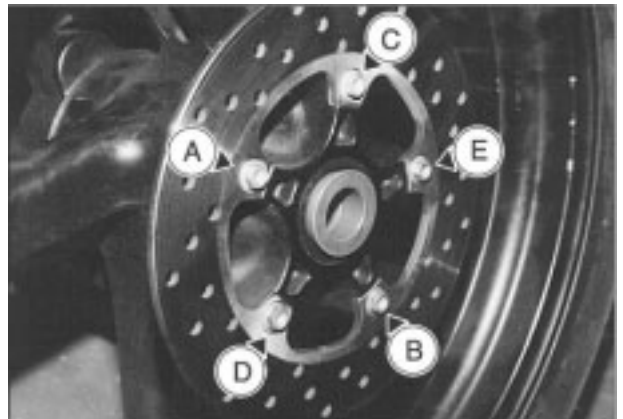
**WARNING**

When refitting, apply LOCTITE® 243 to the thread of the brake disc screw.



**NOTE** When refitting, fit all the screws manually and tighten them observing a cross pattern in the following order: A-B-C-D-E.

- Remove the brake disc (2).

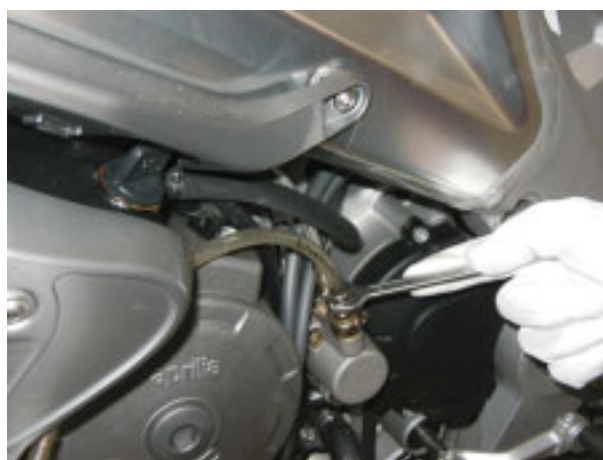


## 5.10. CLUTCH

### 5.10.1. BLEEDING THE CLUTCH SYSTEM

**NOTE** Make sure to have a flexible tube and a container of adequate size ready at hand before beginning the bleeding procedure.

- Connect the tube to the clutch control cylinder bleed valve.
- Pull the lever and slightly open the bleed valve on the slave cylinder to release the air.
- Close the bleed valve before reaching the end of stroke with the lever and repeat the procedure until all the air is released.

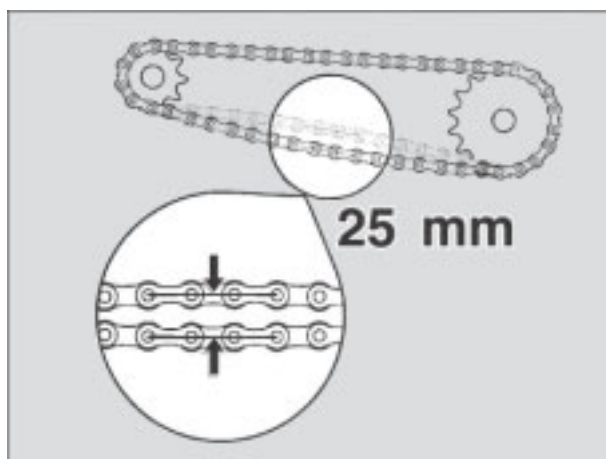


## 5.11. CHAIN

### 5.11.1. DRIVE CHAIN

The vehicle is equipped with an endless chain that does not contain a master link.

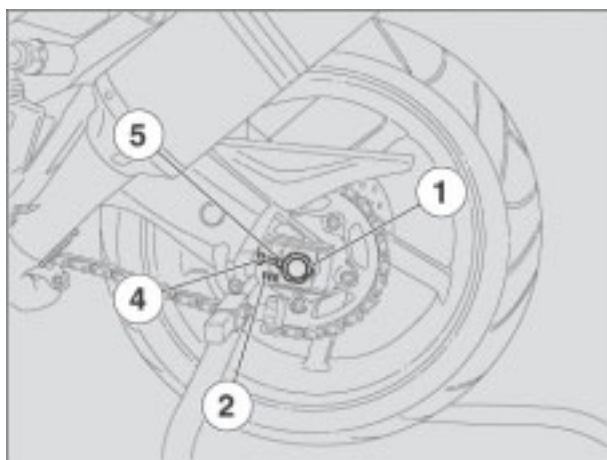
**NOTE** Halve maintenance intervals if you are riding in rainy or dusty conditions, on rough road surfaces or when the vehicle is used in competitions.



### CHECKING PLAY

To check play:

- Stop the engine.
- Place the vehicle on the stand.
- Set the gear in neutral.
- Ensure that vertical oscillation, in an intermediate point of the lower length of chain between the front and rear sprockets, is about **25 mm (0.98 in)**.
- Move the vehicle forward to check vertical oscillation of the chain in other positions; play must remain constant in all phases of wheel rotation.



### ADJUSTMENT

**NOTE** To adjust the chain use the rear support stand OPT.

If the check determines that chain tension adjustment is necessary:

- Place the vehicle on the rear support stand.
- Loosen the nut completely (1).

**NOTE** When centring the wheel, there are fixed references (2-3) located in the chain tightening slider housings on the swingarm arms, in front of the wheel shaft.





- Loosen the two lock nuts (4).
- Adjust chain play by means of the adjusters (5) ensuring that the references match on both sides of the vehicle (2-3).
- Tighten the two lock nuts (4).
- Tighten the nut (1).
- Check chain slack.

#### CHECKING CHAIN, FRONT AND REAR SPROCKET FOR WEAR

Every 10000 km (6250 mi) check also the following parts and ensure that the chain, front and rear sprockets show no signs of:

- damaged rollers;
- loose pins;
- dry, rusty, flattened or seized links;
- excessive wear;
- missing seals;
- excessively worn or damaged front and rear sprocket teeth.



#### WARNING

If the chain rollers are damaged, the pins are loose and/or the seals are damaged or missing, replace the entire chain assembly (front and rear sprockets and chain).

Lubricate the chain frequently, especially dry or rusty parts.

Flattened or seized links must be lubricated and restored to working condition.

#### CLEANING AND LUBRICATION



#### WARNING

The drive chain is fitted with seals between the links to prevent grease from coming out.

Take special care when adjusting, lubricating, washing and replacing the chain.

Never wash the chain with jets of water, jets of steam, jets of high pressure water and with high-flammability solvents.

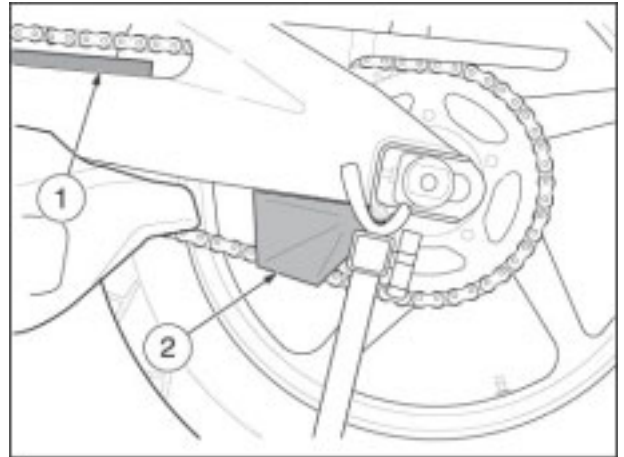
- Wash the chain with naphtha or kerosene. If it tends to rust rapidly, perform maintenance more frequently.

Lubricate the chain every 1000 km (625 mi) and each time it is necessary.

- After having washed the chain, let it dry and lubricate it with spray grease for sealed chains.

**5.11.2. INSPECTING THE DRIVE CHAIN SLIDER**

- Place the vehicle on the stand.
- Ensure that the slider (1) is not worn or damaged; replace it with a new one if necessary.
- Check for chain guide wear (2).



**5.11.3. REMOVING THE CHAIN SLIDER**

- Place the vehicle on the rear support stand (OPT).
- Loosen and remove the three screws.
- Remove the sprocket cover.
- Slacken chain tension.



- Loosen and remove the sprocket fixing screw and set aside the washers.

**NOTE** When reassembling apply **LOCTITE® Anti-Seize** to the inner teeth of the drive sprocket and **LOCTITE® 243** to the screw threading.



- Loosen and remove the two screws from the rider left footpeg guard.



- Loosen and remove the chain slider upper fixing screw and set aside the washer.



- Loosen and remove the chain slider lower fixing screw and set aside the washer.



- Slide the lower part of the chain slider out from the front.



- Remove the chain slider by sliding it out from the rear.



**5.11.4. LOWER CHAIN SLIDER**

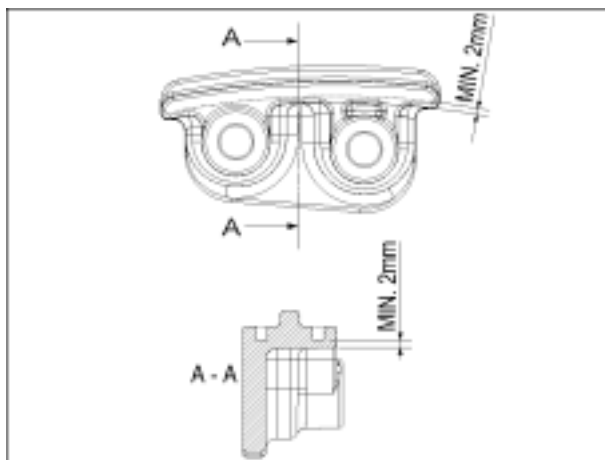
**NOTE** When checking for wear the slider must be removed.

- Loosen and remove the two screws.
- Remove the lower chain slider.

**CHECKING WEAR**

Check the wear of the chain slider.

**Minimum thickness: 2 mm (0.079 in).**



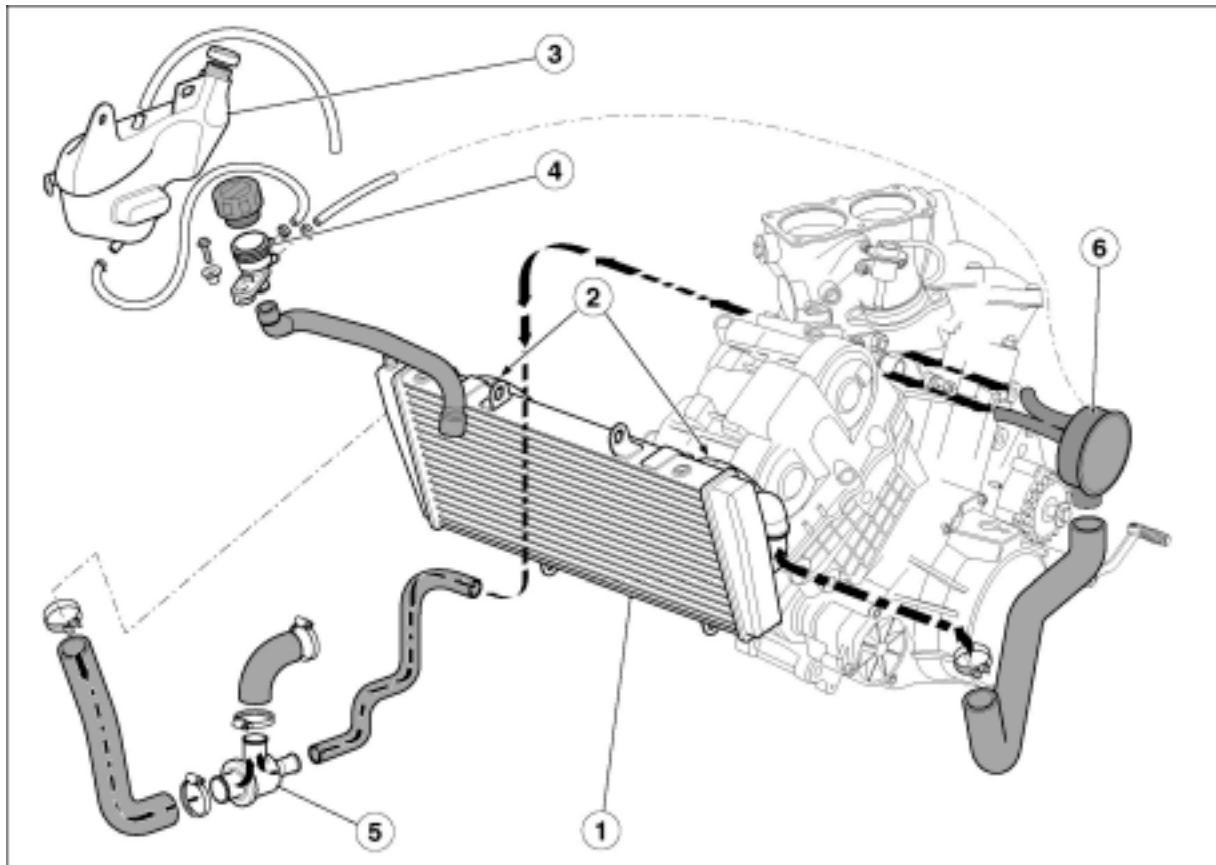


COOLING SYSTEM

6

**SUMMARY**

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**6.1. COOLING SYSTEM****6.1.1. DIAGRAM****Key:**

1. Cooler
2. Solenoid valves
3. Expansion tank
4. Oil filler
5. Three-way thermostatic valve
6. Three-way manifold

**6.1.2. FILLING THE COOLING SYSTEM**

- The cooling system is filled with approximately 2.2 litres (4 pt) of fluid.
- Place the vehicle on the rear stand **OPT.**
- Loosen the radiator breather screw.



- Unscrew the oil filler plug.
- Pour approximately 2 litres (3.6 pt) of coolant in the filler.



- When the coolant starts to come out of the breather screw on the radiator, tighten the plug to the specified torque.
- To complete the system filling procedure, continue to pour the fluid until it reaches the upper rim of the oil filler.



- Unscrew the expansion tank plug and pour the remaining 0.2 litres (0.36 pt) of fluid until the level is between the **MIN** and **MAX** marks.



- Tighten the filler and the expansion tank plugs.
- If fluid does not come out of the radiator breather screw, before filling the system completely (approximately 2 litres) (approximately 3.63 in) reach the level in the expansion tank
- Start the engine for approximately 30 seconds with the filler plug open.
- Turn off the engine and pour some coolant in the filler.
- To complete the system filling procedure, continue to pour the fluid until it reaches the upper rim of the filler.



- Start the engine and bring it to operating temperature (the electric fans must run at least 2 times), turn it off and wait for it to cool down (approximately 12 hours).
- Check that the coolant level is between the **MIN** and **MAX** marks.



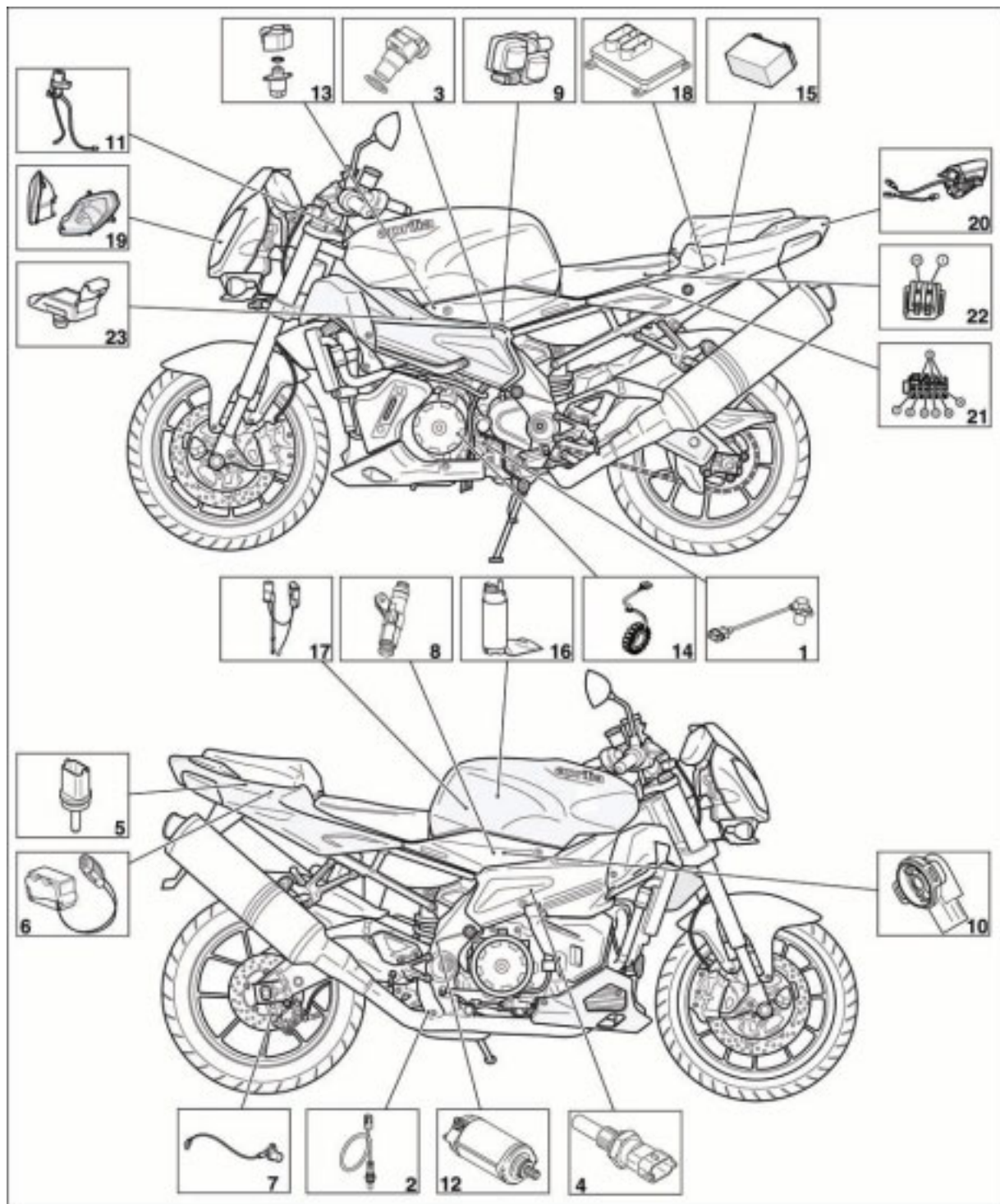


CYCLE PARTS

7

**SUMMARY**

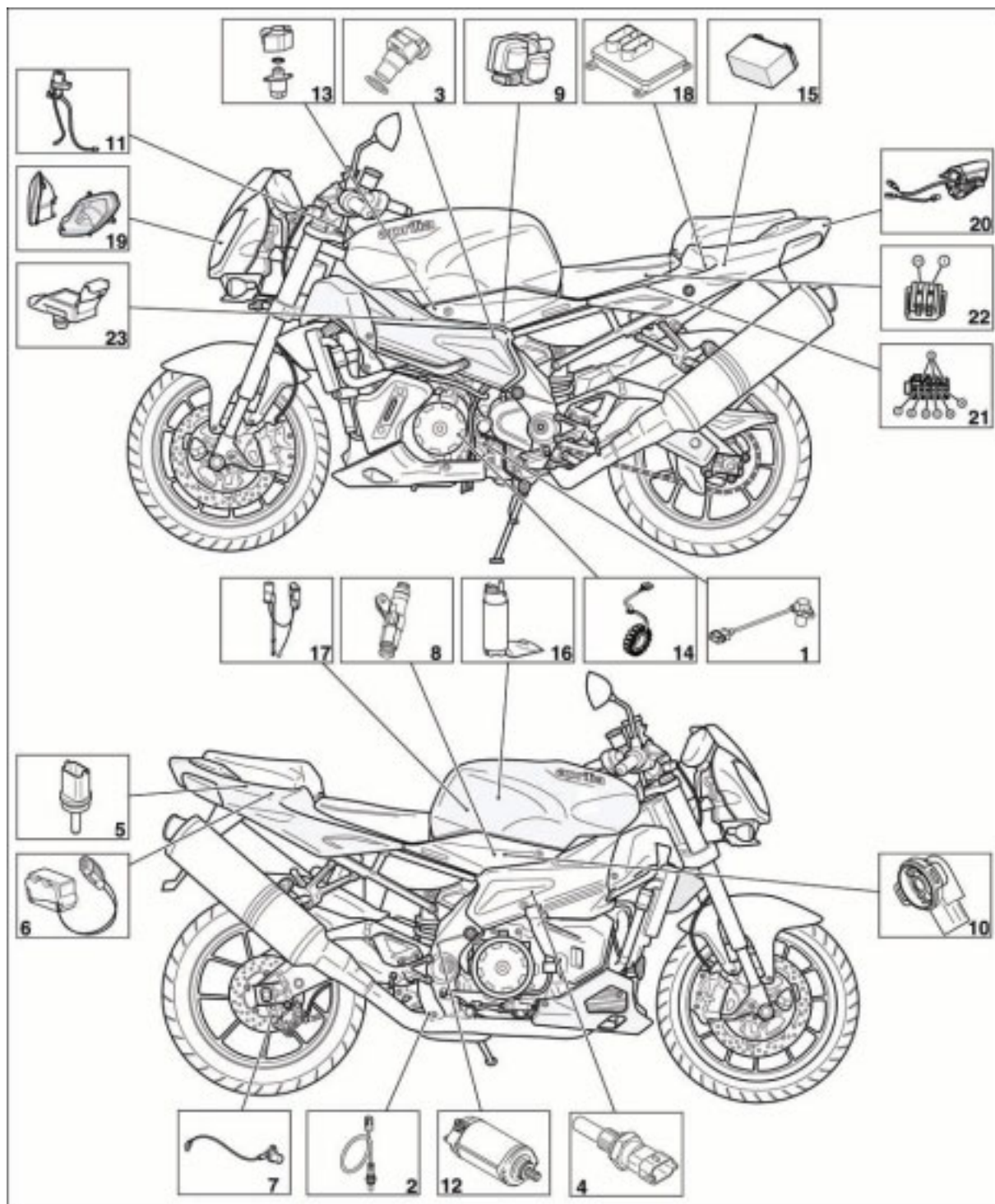
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**7.1. ELECTRIC SYSTEM****7.1.1. LOCATION OF THE COMPONENTS**

Key:

1. RPM sensor
2. Lambda sensor
3. Camshaft sensor
4. Coolant temperature sensor
5. Intake air temperature sensor
6. Bank angle sensor
7. Vehicle speed sensor
8. Injector
9. Ignition coils
10. Throttle position sensor (TPS)
11. Immobilizer antenna
12. Starter motor
13. Stepper motor
14. Generator
15. Recharge voltage
16. Fuel pump
17. Fuel reserve sensor
18. Control unit
19. Headlight
20. Tail light
21. Auxiliary fuses
22. Main fuses
23. Intake pressure sensor

## 7.1.2. ELECTRIC PARTS INSPECTION TABLE





**1 RPM SENSOR**

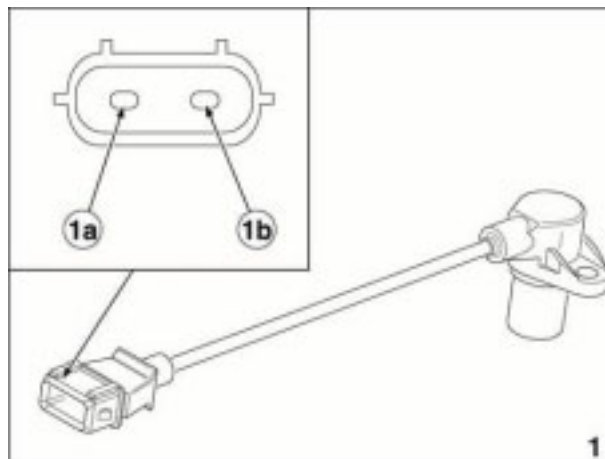
induction sensor

It consists of a 36-tooth phonic wheel

The sensor outputs a voltage pulse every 10° of rotation to allow the control unit to calculate engine rpm and crankshaft position

Coil resistance 0.7 – 1.1 K $\Omega$  (measured across pins 1a and 1b)

Alternated current at output 1 – 2 V (measured across pins 1a and 1b)

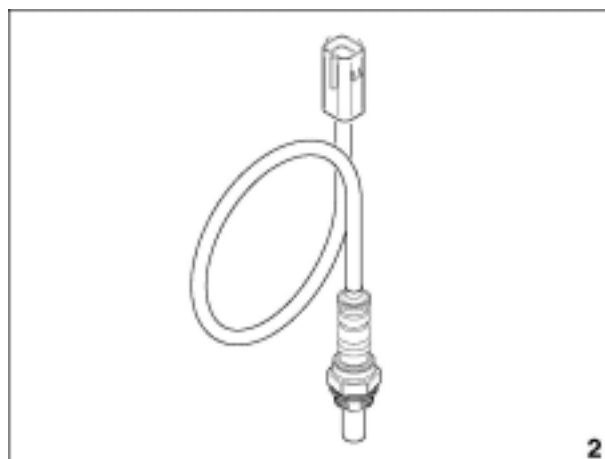
**2 LAMBDA SENSOR**

oxygen sensor with heater

sensor tension between 0 and 0.9 V (measured across pins 3 and 4)

heater resistance between 12.8 and 14.2  $\Omega$  (measured across pins 1 and 2 at 20°C – 68°F)

Power voltage 12 V.

**3 CAMSHAFT SENSOR**

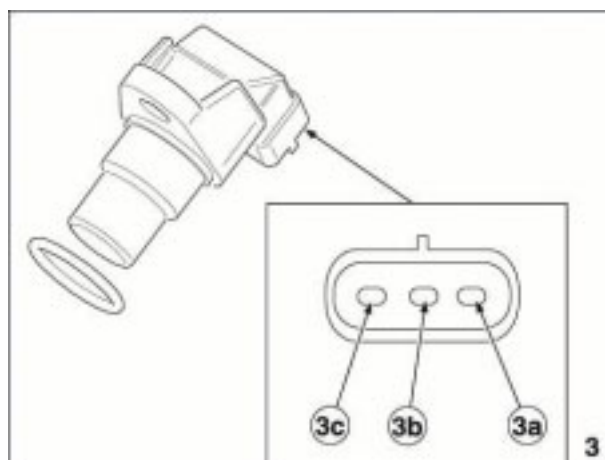
Hall sensor

Fitted in the front cylinder head.

The sensor allows the control unit to recognise the precise sequence of each cylinder by resetting the inner counter during the ignition asynchronous stage.

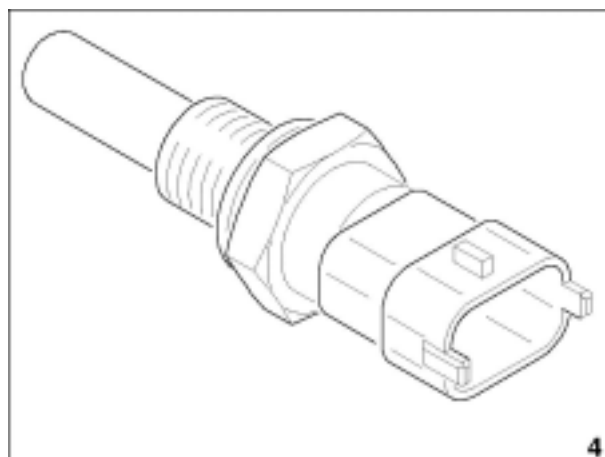
12V power across pins 3c and 3a.

Square wave output with a pulse every two rpm (measured across pins 3b and 3a)

**4 COOLANT TEMPERATURE SENSOR**

NTC sensor (variable resistance, the value decreases as the temperature increases)

Temperature °C (°F)	Resistance average value $\Omega$
-30 (-22 °F)	28000
-20 (-4 °F)	14500
0 (32 °F)	5500
20 (68 °F)	2500
40 (104 °F)	1200
60 (140 °F)	600
80 (176 °F)	320
100 (212 °F)	180
130 (266 °F)	90

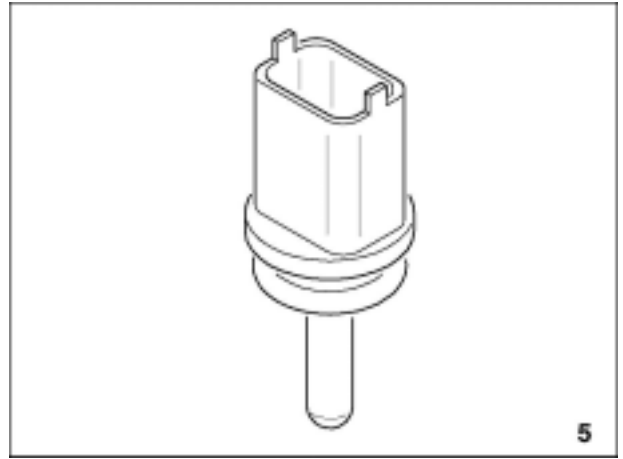


**5 INTAKE AIR TEMPERATURE SENSOR**

NTC sensor (variable resistance, the value decreases as the temperature increases)

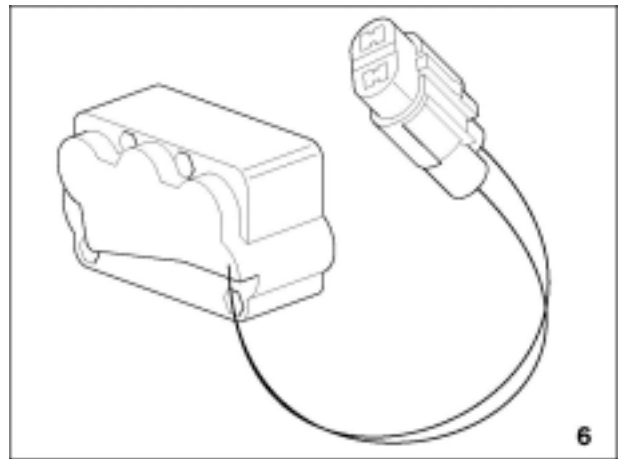
resistance 2.5 K $\Omega$  (temperature 20°C – 68°F)

Power supply: 5 V

**6 BANK ANGLE SENSOR**

resistance of 62 K $\Omega$  with sensor in its position of assembly

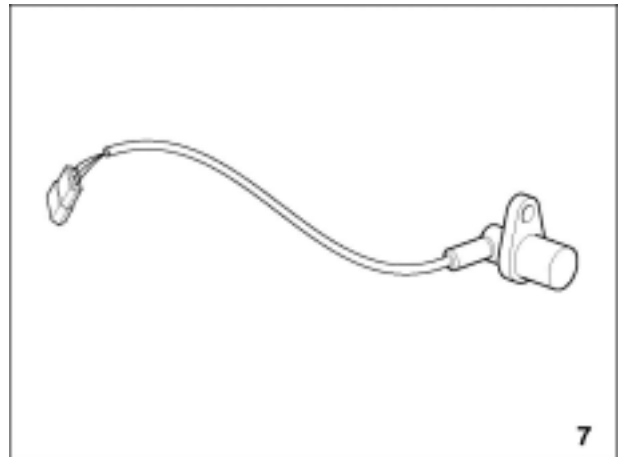
resistance 0  $\Omega$  when sensor is turned by 90° with respect to position of assembly.

**7 VEHICLE SPEED SENSOR**

Hall sensor with square wave output at 5 pulses/rev

power voltage: 11-12V (measured across pins 1 and 3)

low signal when sensor is facing screw head (measured across pins 2 and 3)

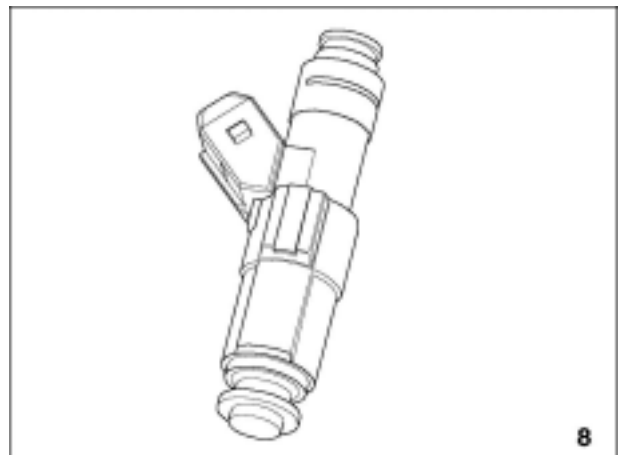
**8 INJECTOR**

resistance between 13.8 and 15.2  $\Omega$

Power supply: 12 V

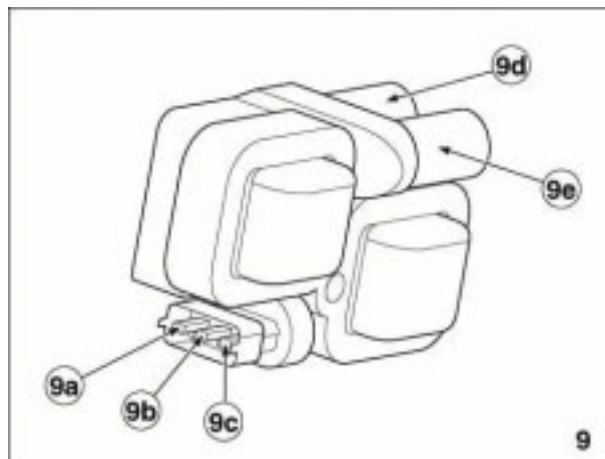
The push-button signal output by the ECU activates an electromagnet attracting an armature and causing fuel injection by opening the injector calibrated nozzles

Assuming that fuel properties as well as the injector 3.5 bar pressure do not change over time, the amount of injected fuel depends on the injectors opening time



**9 IGNITION COILS**

rear cylinder primary winding resistance between 0.40 and 1.15  $\Omega$  (measured across pins 9c and 9b)  
front cylinder primary winding resistance between 0.40 and 1.15  $\Omega$  (measured across pins 9a and 9b)  
resistance of secondary winding: between 0.40 and 1.15  $\Omega$  (measured across pins 9d and 9e)

**10 THROTTLE POSITION SENSOR (TPS)**

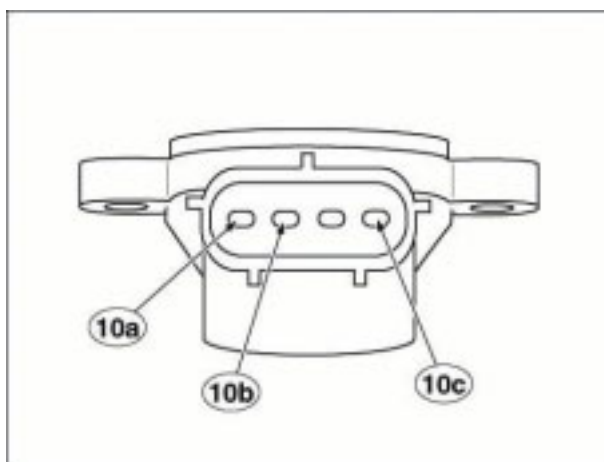
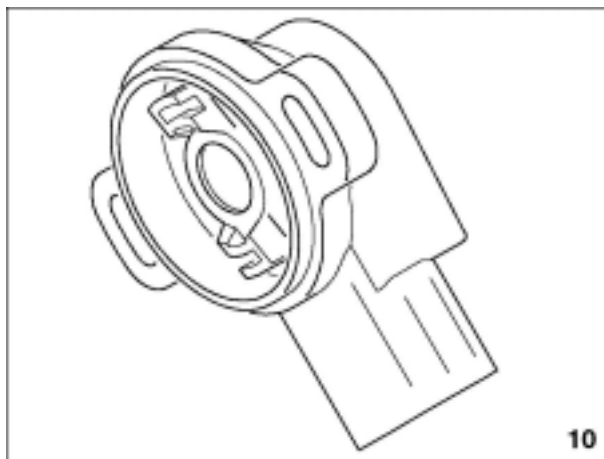
mechanically coupled to the throttle so that its output voltage depends on throttle position.

4.5 to 5.5V power measured across pins 10a and 10c

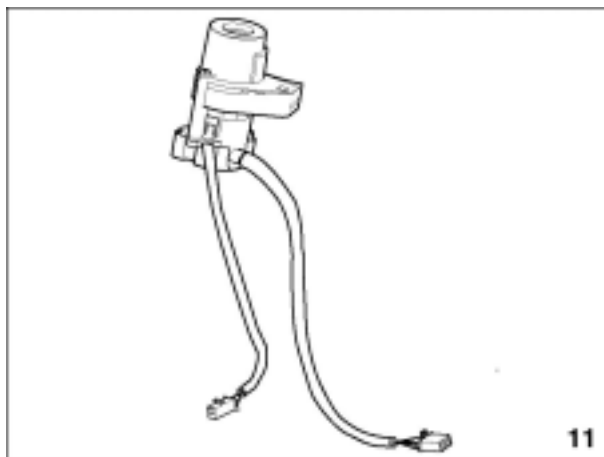
Resistance across VC (10a) and E2 (10c) = 2.87 – 5.33 K $\Omega$

Resistance across VTA (10b) and E2 (10c) throttle open = 2.87 – 8.41 K $\Omega$

Resistance across VTA (10b) and E2 (10c) throttle closed = 0.34 – 5.69 K $\Omega$ .

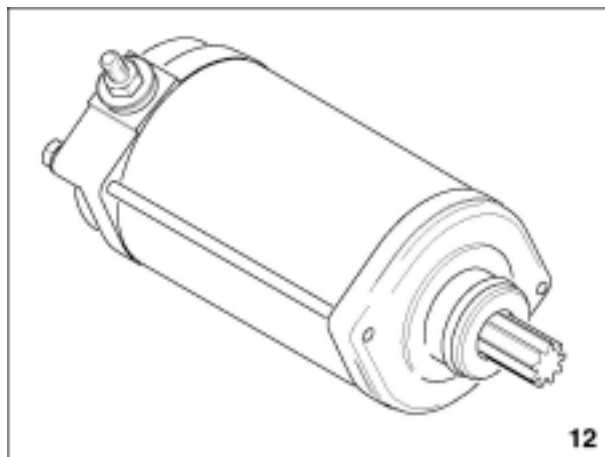
**11 IMMOBILIZER ANTENNA**

winding resistance: 14  $\Omega$



**12 STARTER MOTOR**

input at start-up: 120 A

**13 STEPPER MOTOR**

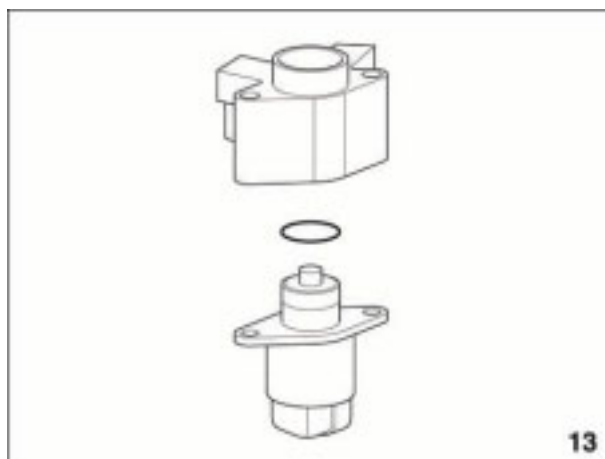
phase resistance: 50  $\Omega$

The stepper motor is powered by the ECU

Its rotation is divided in "steps".

By changing the opening steps it is possible to suitably power the engine to help start-up procedure and correct fuel feeding with cold engine

When the engine has reached operating temperature, the stepper motor will be partially closed

**14 GENERATOR**

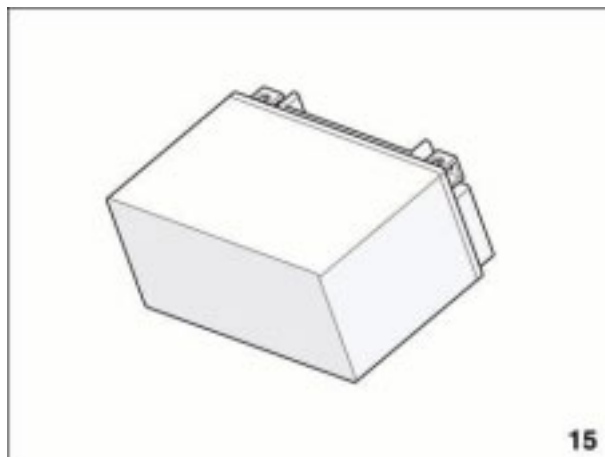
three-phase generator

winding resistance: 0.4  $\Omega$

output voltage: 75 VAC (measured with the generator disconnected from the electric system and the engine at 4000 rpm)

**15 RECHARGE VOLTAGE**

13.8 V measured at battery terminals (with the engine at 4000 rpm)

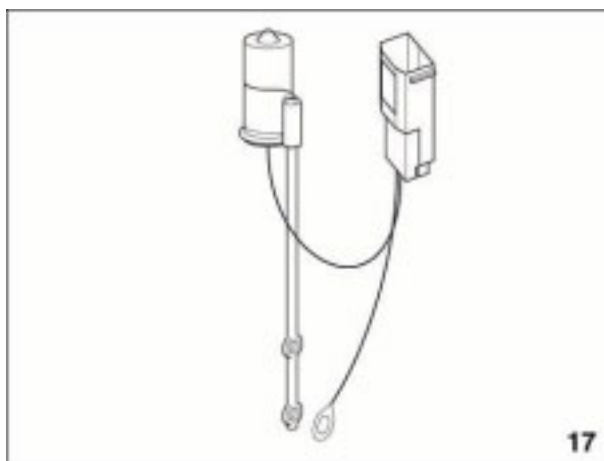


**16 FUEL PUMP**

input: 3.9 A

**17 FUEL RESERVE SENSOR**

There is no fuel level indicator; it is simply a reserve warning light that comes on when level goes below 3.7 litres: 30 seconds after fuel is no longer reaching the sensor, it starts conducting (and the light comes on).



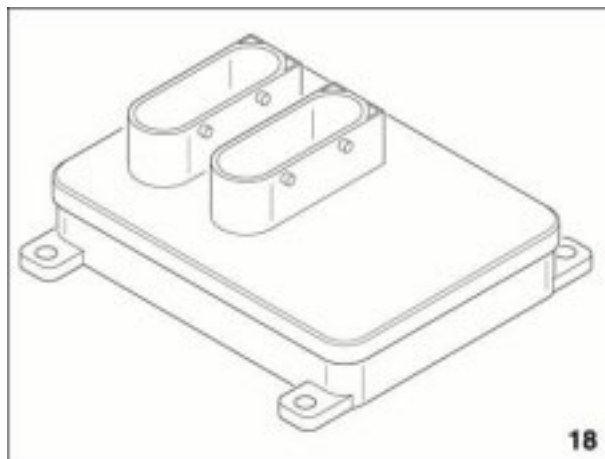


**18 ECU**

ECU Pinout

Connector A

Pin	Description	Type of signal
1	Rear cylinder coil control	Power output
2	n.a.	
3	Atmospheric pressure sensor power supply (5V)	Power supply
4	Atmospheric pressure sensor power supply (earth)	Power supply
5	Rpm sensor signal	Frequency input
6	n.a.	
7	Air temperature sensor signal	Analogue input
8	n.a.	
9	n.a.	
10	Minimum oil pressure sensor signal	Digital input
11	Water temperature sensor signal	Analogue input
12	Manifold pressure sensor signal	Analogue input
13	n.a.	
14	Purge valve control	Power output
15	Front cylinder 2 injector control	Power output
16	n.a.	
17	n.a.	
18	Atmospheric pressure sensor signal	Analogue input
19	Rpm sensor signal (earth)	Power supply
20	Timing sensor (earth)	Power supply
21	Air temperature sensor signal	Power supply
22	n.a.	
23	n.a.	
24	Throttle Position Sensor signal	Analogue input
25	Throttle Position Sensor power supply (earth)	Power supply
26	n.a.	
27	Water temperature sensor signal (earth)	Power supply
28	Manifolds pressure sensor power supply (earth)	Power supply
29	n.a.	
30	n.a.	
31	n.a.	
32	n.a.	
33	Rear cylinder 1 injector control	Power output
34	Timing sensor	Analogue input
35	Stepper stage D	Power output
36	Stepper stage A	Power output
37	Stepper stage C	Power output
38	Stepper stage B	Power output
39	Throttle position sensor power supply (5V)	Power supply
40	Manifolds pressure sensor power supply (5V)	Power supply
41	Front cylinder coil control	Power output

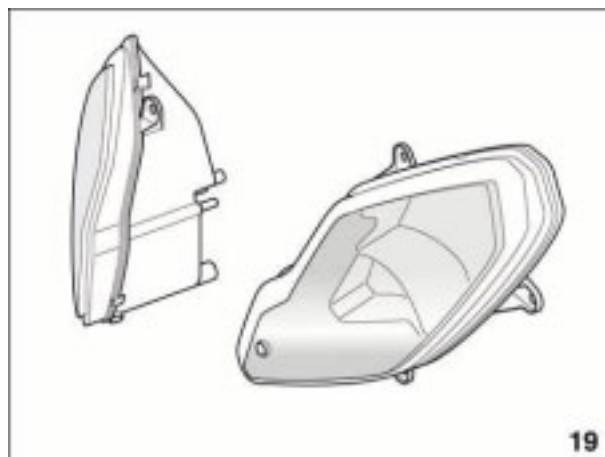


## Connector B

Pin	Description	Type of signal
1	ECU power supply (earth)	Power supply
2	ECU power supply (earth)	Power supply
3	Fan	Power output
4	n.a.	
5	Lambda sensor heater control	Power output
6	Vehicle speed sensor signal	Frequency input
7	n.a.	
8	n.a.	
9	Bank angle sensor signal	Digital input
10	n.a.	
11	ECU power supply (15)	Power supply
12	Lambda sensor signal (earth)	Power supply
13	ECU power supply (earth)	Power supply
14	n.a.	
15	Intake flap control	Power output
16	n.a.	
17	Injection relay control	Digital output
18	n.a.	
19	n.a.	
20	Vehicle speed sensor power supply (earth)	Power supply
21	Ignition request	Digital input
22	n.a.	
23	Side stand switch	Digital input
24	Diagnostics line (K)	Communication line
25	Clutch switch	Digital input
26	Stop switch	Digital input
27	CAN line (L)	Communication line
28	CAN line (H)	Communication line
29	Fuel pump control	Power output
30	n.a.	
31	Starter relay control	Digital output
32	ECU power supply (earth)	Power input
33	n.a.	
34	n.a.	
35	n.a.	
36	12 V Power supply	Power supply
37	Lambda sensor signal	Analogue input
38	n.a.	
39	n.a.	
40	Neutral switch	Digital input
41	ECU power supply (earth)	Power supply

**19 HEADLIGHT**

Low beam (halogen) 12 V – 55 W H11 x 2  
 High beam (halogen) 12 V – 55 W H11 x 2  
 Front parking light 12 V – 5 W

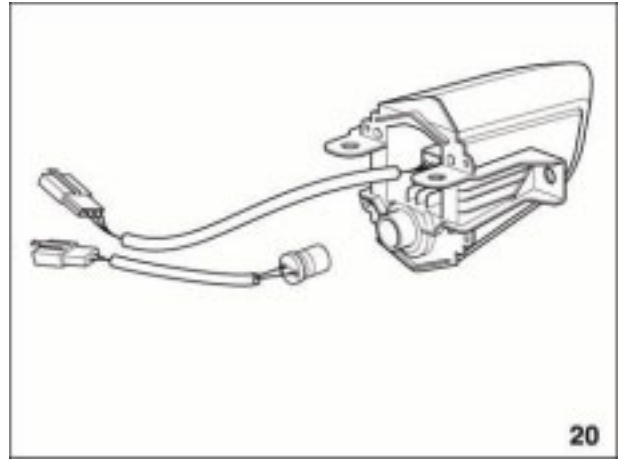


19

**20 TAIL LIGHT**

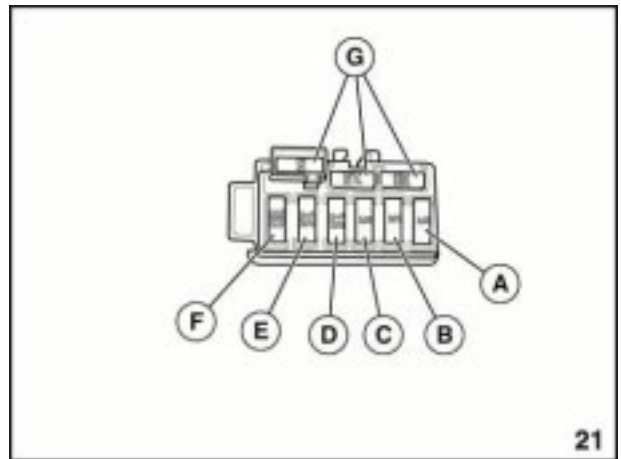
Number plate light

12 V – 5 W

**21 AUXILIARY FUSES**

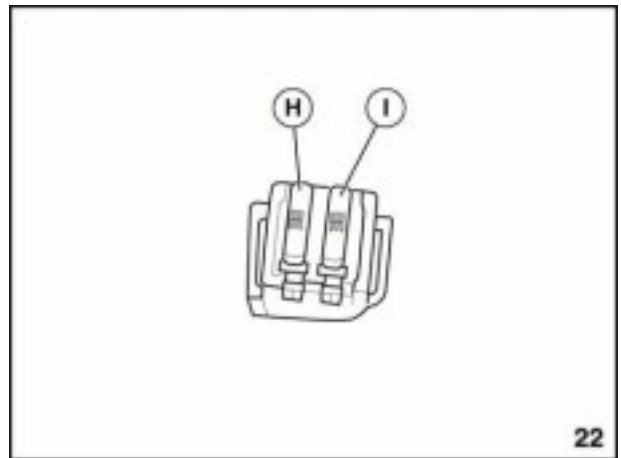
- A - From key to: light relay, stop, horn, parking lights (5 A).
- B - From key to: turn indicators, instrument panel (5 A).
- C - From battery to: key-operated positive to E.C.U. (5 A).
- D - From battery to: speed sensor, fuel pump, relay, starter, oxygen sensor (15 A).
- E - From battery to: fan relay, coils, injectors, air flaps, camshaft position sensor (15 A).
- F - From ignition switch to: high beam, low beam (20 A).

**NOTE** There are three spare fuses (G).

**22 MAIN FUSES**

- H - Battery charge and vehicle electric loads (red and red/white wires) + immobilizer (30 A).
- I - injection loads (red and red/black wires) (30 A).

**NOTE** There is one spare fuse.

**23 INTAKE PRESSURE SENSOR**

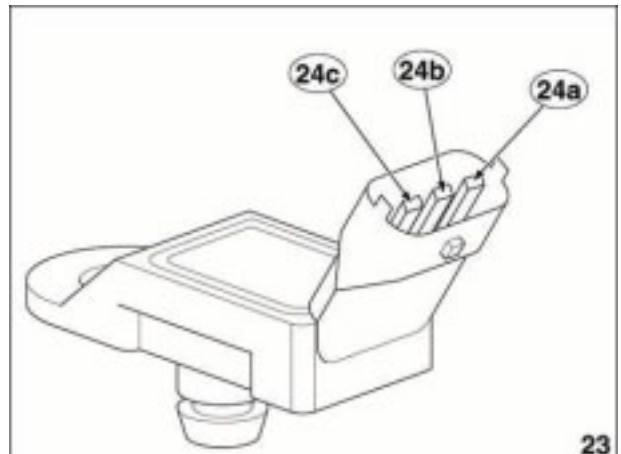
Membrane sensor, in which the deformation of a membrane is transformed in an electric signal.

It is located under the air box.

The sensor is connected with the throttle body via two lines.

Power supply 5V measured across pins 24a and 24b and 24a and 24c.

Output voltage: at 350 mbar = 1.07V, at 950mbar = 3.76V



### 7.1.3. CAN LINE

CAN line technology (Controller Area Network) is used to connect the different electronic devices of the vehicle, so they operate like a network of computers (Internet).

The use of a CAN line made it possible to significantly simplify the layout of the electric system and reduce the bulk of the wiring harness.

In addition, the CAN line avoids the duplication of sensors because both processing units installed on the vehicle (instrument panel and ECU) use the inputs from the same sensors.

### BENEFITS OFFERED BY CAN TECHNOLOGY

- Less wires: the CAN line uses a pair of wires to transmit information between the different nodes.
- Faults Confinement: nodes are capable of isolating faults and avoid system breakdown.
- Noise immunity: this is achieved through differential signalling. Information is transmitted over the pair of wires and the receiving device reads the difference between the signals on the two wires. Any interference due to external sources will affect both signal equally and the difference between their voltages remains constant.
- Transfer Rate: messages are transferred at a bit rate of about 250 kbps (the nodes receive data every 20 ms, i.e. 50 times per second).

### CAN PROTOCOL (CONTROLLER AREA NETWORK)

The CAN line uses the CSMA/CD communications protocol (Carrier Sense Multiple Access /w Collision Detection)

"Carrier Sense" means that a node will determine whether the BUS link shared by all connected devices is busy before using the link to transmit a message. When the BUS link is idle, multiple nodes are allowed access at the same time (Multiple Access). When two nodes start transmission at the same time, a collision occurs. The nodes sense a collision (Collision Detection) and begin a process of arbitration to determine which message has higher priority (messages are unaffected by arbitration and the higher priority message is given priority so there is no delay).

The CAN protocol is based on messages rather than addresses. Messages are divided into several portions (frames), and each frame carries different information: message priority, data, error detection, acknowledgement of receipt, etc. All nodes in the network receive all messages sent over the BUS (with acknowledge or error frames) and each node determines whether a given message is to be processed or discarded. In addition, any node can request information from other nodes (RTR = Remote Transmit Request).

## STARTING

The ECU will only enable starting when it recognises V990 engine model based on a CAN acknowledge message from the instrument panel (model information is located in the instrument panel).

Only the fuel reserve sensor is connected directly to the instrument panel. All other sensors/switches are connected to the ECU and the instrument panel reads relevant information in the ECU through the CAN line.

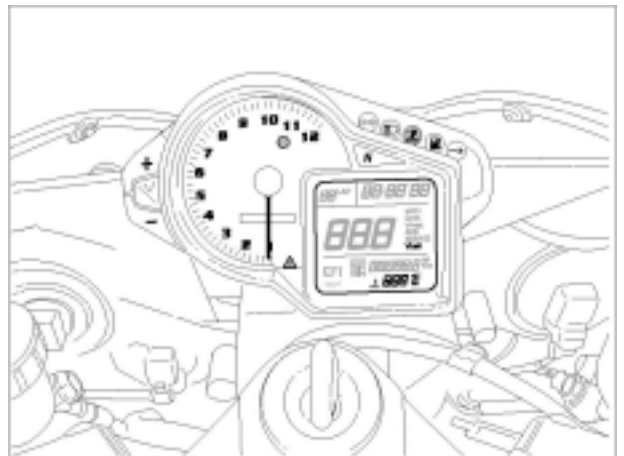
### OPERATION OF INSTRUMENT PANEL WARNING LIGHTS:

Warning light	LED	Operated by
Neutral	Green, SMD	ECU through CAN line
Side stand	Amber, SMD	
EFI	Red, SMD	
Oil pressure	Red, SMD	

### CAN-BUS LINE SIGNALS:

Transmitted signal	Frequency [Hz]
Engine rpm	50
Vehicle speed	
Diagnostics	
Neutral (warning light)	
Side stand (warning light)	
Oil pressure (warning light)	
Water temperature	
Sent signal	Frequency [Hz]
Odometer (stored in injection ECU for future implementations)	50
Model identifier	

When data transmission fails (CAN line damaged and/or disconnected), the Red Line, Warning and Side Stand lights come on steady, the Neutral light stays off, RPM and speed read zero, battery voltage indication reads "9.0V" and coolant temperature readout shows a flashing "Err" message.





#### 7.1.4. IMMOBILIZER

##### IMMOBILIZER

The motorcycle is equipped with an immobilizer system that inhibits engine start-up unless it receives the correct identification code. This code is stored in a transponder incorporated in the ignition keys supplied with the motorcycle. Transponder data is read by an antenna mounted on the ignition switch and connected directly to the ECU.

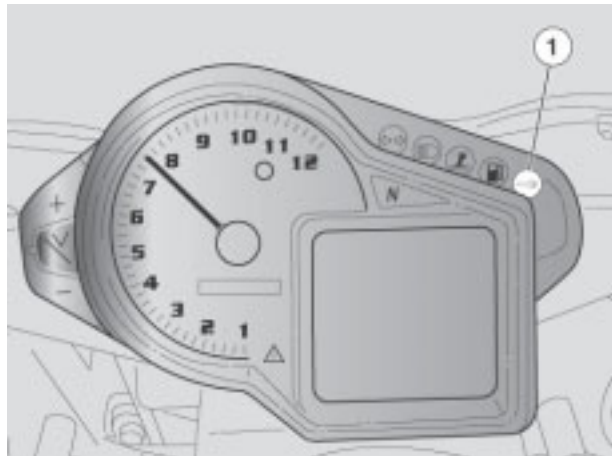
The immobilizer operates independently of the CAN line.



A warning light on the instrument panel indicates the current mode of operation of the immobilizer:

- immobilizer off - light off
- immobilizer on - light blinks every 3 seconds approximately to act as a theft deterrent
- key not recognised - light blinks every second

A power-save feature turns off the light when it has been blinking for 240 hours



##### STORING KEY CODES AT FIRST POWER-UP

At first power-up, the immobilizer control unit is blank and the LED comes on steady. To store the key codes of the two keys supplied as standard:

- Insert the first key and turn the ignition switch to ON: the LED goes out for 0.5 seconds and comes back on again. When the LED comes on, turn the key to OFF.
- Insert the second key within the next 20 seconds and turn the key to ON: the LED goes out and then blinks 4 times.

When you turn the key to OFF, the key codes are stored and the immobilizer is switched on (the LED will blink every 3 seconds as a theft deterrent)

The key codes are now stored in the memory and the immobilizer is switched on upon key-off (the LED will blink every 3 seconds as a theft deterrent)

If power supply fails after storing the first key, the system is reset (and will not retain the first key code). All vehicle and instrument panel functions are enabled when the first key code is stored, but the memory will not retain the code unless the second key is recognised within the next 20 seconds.

**STORING KEY CODES - NEW KEYS**

The immobilizer system can store up to 4 key codes. The procedure requires a Master Key, and can only be performed by Authorised Dealers.

Storing a new key code deletes all existing codes; this means the Owner must bring in all keys (new and old) he wants enabled. The procedure is as follows:

- 1) Insert an enabled key and turn the key to ON and back to OFF
- 2) Insert the Master Key within 20 seconds to enable the procedure; this is indicated by the immobilizer light coming on steady
- 3) Insert and turn to ON all keys to be enabled. To confirm each key code has been stored successfully, the immobilizer LED goes out for 0.5 sec.
- 4) After storing each key code, the system will wait for the next key for 20 seconds (immobilizer LED steady on) and then automatically terminates the procedure (the LED blinks as many times as are the enabled keys and then goes out).



### 7.1.5. LAMBDA SENSOR

It measures oxygen content in the exhaust gas and provides indirect information on combustion.

The oxygen sensor signal allows the ECU to continuously correct the mixture strength in case it is not ideal or stoichiometric (lambda setting).

To obtain an optimum mixture and a stoichiometric ratio it is necessary for the quantity of air taken in by the engine to be equal to the theoretical amount needed to burn all the injected fuel.



In this case, the lambda factor is 1, i.e. the ratio between air taken in by the engine and theoretical air necessary to burn all the injected fuel.

$\lambda = 1$  ideal mixture

$\lambda > 1$  lean/weak mixture

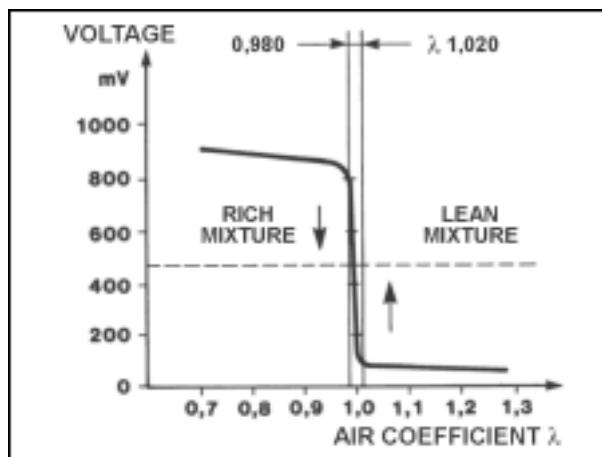
$\lambda < 1$  rich mixture

Oxygen sensor with heater

Power supply: 12V.

Sensor tension between 0 and 1 V (measured across pins 3 and 4).

Heater resistance between 12.5 and 14.2 ohm (measured across pins 1 and 2 at 20°C – 68°F)



**7.1.6. RECOVERY FUNCTION**

In case the signal of the following sensors is interrupted, the control unit either sets a series of values to let the engine work anyway or uses a different parameter. In any case, the instrument panel highlights that there is a fault.

Air temperature	<b>18°C (64.4 °F)</b>
Water temperature	<b>88°C (190.4 °F)</b> In case the signal is lost the ECU sets the value of 88°C (190.4 °F), with linear increase by 0.33°C/sec (32.6°F/sec) starting from air temperature upon start-up. On the instrument panel <b>135 (°C)</b> flashes and the <b>WARNING</b> light turns on.
Barometric pressure	<b>980 hPa</b>
TPS	<b>9.8°</b> Uses the value from the intake pressure sensor.
Intake pressure	Values according to engine rpm and TPS are set (front and rear cylinder intake pressure values are fixed and are not used for engine operation)
Stepper motor	<b>21</b>

**7.1.7. ENGINE RPM LIMITATION CONDITION**

The control unit limits engine rpm in case one of the following events occurs:

- TPS signal missing.
- stepper motor signal missing.
- low oil pressure.
- On the Axone DEVICES STATUS page, the parameter INITIALISED ECU is "NO".
- water temperature above 120 °C (248 °F).
- if the ECU detects a failure of a set of signals that might compromise safe use of the vehicle. For example: TPS and intake pressure signals missing at the same time.



### 7.1.8. NEW MAPPING

On vehicles manufactured before February 2004 and up to frame no. **ZD4RR00004S003947**, the ECU needs to be reprogrammed with the revised mapping that ensures improved idle stability and engine performance at 2000 - 3000 rpm.

ECUs with the **664582** mapping must be reprogrammed with the **664584 (VD5G684\$.BIX)** mapping using Axone 5.0.2. The CO must be balanced after reprogramming the ECU, see 3.1.3 (CYLINDER SYNCHRONISATION AND CO LEVEL ADJUSTMENT).

Vehicles produced after frame no. **ZD4RR00004S003947** are equipped with a new ECU and mapping; new mapping designation is: **664583 (VD5L683\$.BI)**. CO level adjustment and cylinder synchronisation to match the new mapping are performed at the factory.

Vehicles produced after frame no. **ZD4RR00004S003947** feature a modified wiring harness because the pick-up sensor now uses a two-pin connector (instead of the three-pin connector used in the past).

The new ECUs can be retrofitted to motorcycles manufactured before frame no. **ZD4RR00004S003947**.

### SPARE ECU'S

**NOTE** Spare ECUs must be programmed before use; look up correct mapping in the following table:

NEW ECU		MAPPING	
CODE	NOTE	664584 (VD5G684\$.BIX)	664583 (VD5L683\$.BIX)
664980	blank	x	
664581		x	
664582		x	
664981	blank		x

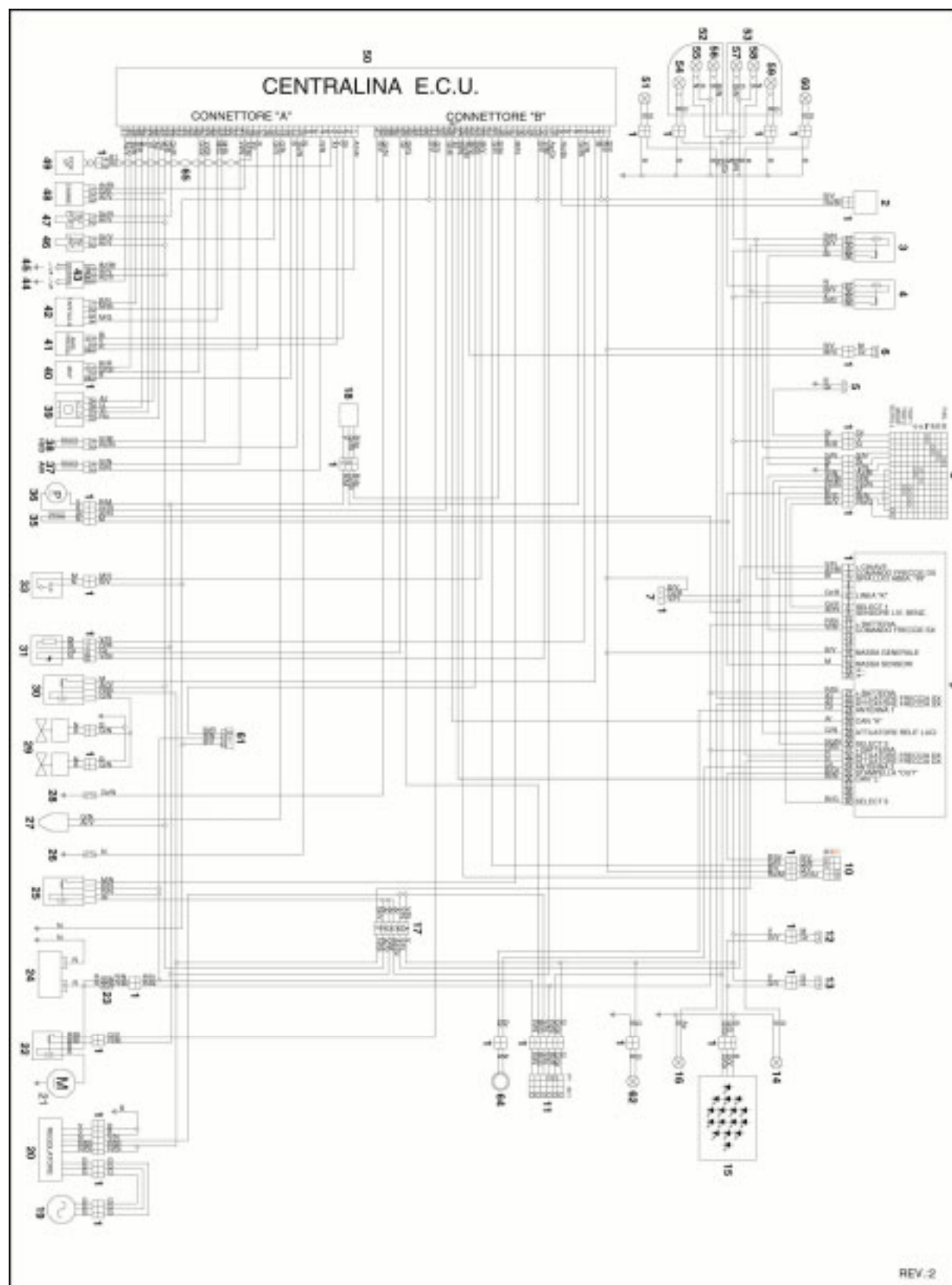
**NOTE** Axone automatically detects the mapping stored in the ECU and will only allow reprogramming if the correct mapping is selected.

When the "Enter" key is pressed in the Adjustable Parameters screen to start ECU reprogramming, the system prompts for the current date (dd/mm/yy); enter the current date:

When the reprogramming procedure is completed, the Axone ISO screen offers the following information for your review:

- mapping code;
- uploading date;
- serial number of Axone unit used for upload procedure;

## 7.1.9. WIRING DIAGRAM



## Key:

1. Multiple connectors
2. Bank angle sensors
3. High beam relay
4. Low beam relay
5. Horn
6. Clutch switch
7. Instrument panel diagnostics
8. LH dimmer switch
9. Instrument panel
10. RH dimmer switch
11. Ignition switch
12. Front stop light switch
13. Rear stop light switch
14. Rear RH turn indicator
15. Tail light (LED)
16. Rear LH turn indicator
17. Auxiliary fuses
18. Speed sensor
19. Flywheel
20. Voltage regulator
21. Starter motor
22. Starter relay
23. Main fuses
24. Battery
25. Injection relay
26. Oil pressure sensor
27. Purge valve (California only)
28. Neutral light switch
29. Fans
30. Fan relay
31. Lambda sensor
32. –
33. Side stand switch
34. –
35. Fuel level sensor
36. Fuel pump
37. Air thermistor
38. Coolant thermistor
39. Automatic choke
40. Intake pressure sensor
41. Ambient pressure sensor
42. Throttle sensor
43. Double coil
44. Front cyl. spark plug
45. Rear cyl. spark plug
46. Front cyl. injector
47. Rear cyl. injector
48. Camshaft sensor
49. Pick up
50. ECU
51. Front LH turn indicator
52. LH headlight
53. RH headlight
54. LH headlight parking light
55. LH headlight low beam bulb
56. LH headlight high beam bulb
57. RH headlight high beam bulb
58. RH headlight low beam bulb
59. RH headlight parking light
60. Front RH turn indicator
61. ECU diagnostics
62. Number plate light
63. –
64. Immobilizer antenna
65. Twisted wire for pick up

## AUXILIARY FUSES:

- |          |     |   |
|----------|-----|---|
| <b>A</b> | 5A  | NUMBER PLATE, STOP, HORN, PARKING LIGHTS                    |
| <b>B</b> | 5A  | INST. PANEL DIAGNOSTICS, INSTRUMENT PANEL                   |
| <b>C</b> | 5A  | KEY-OPERATED POSITIVE, TO ECU                               |
| <b>D</b> | 15A | SPEED SENSOR, FUEL PUMP, STARTER RELAY, LAMBDA SENSOR       |
| <b>E</b> | 15A | FAN RELAY, COILS, INJECTORS, INTAKE FLAP, CAMS, PURGE VALVE |
| <b>F</b> | 20A | LOW/HIGH BEAM LIGHTS  |

## WIRE COLOUR CODING

- |    |            |
|----|------------|
| 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     |



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